POLITECNICO DI MILANO 1863
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TRANSFORMING THE CONVITTO

A NEW PERSPECTIVE FOR VIA DAVERIO

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Abstract

Milan is a dynamic and modern city, contemporary and rich in history, intrinsic in all its parts.
A city that is not limited to its own borders, but goes beyond becoming a model and myth for the entire Italian, European and international society.
It is difficult to understand its peculiarities since it is so varied, complex and extensive.
It is from this richness that this study begins, starting from the solid foundations of the Società Umanitaria, the Milanese model of social reality that later developed around the world.
Like all great legends, they have a beginning, a growth and sooner or later they meet a decline.
This is the goal of this thesis: to bring back the Umanitaria complex to its primary vocation.
For this reason, the architectural project aims to restore to its greatness a constituent block of the complex, the Convitto.
It was built in the 1950s, from a typological point of view it is a pure rationalist architecture, created to house the medical staff of the Ospedale Maggiore of Milan, the current Polyclinic. It was abandoned to its fate and ended up hosting the offices and archives of the Milan Public Prosecutor's Office.
The project, therefore, aims to reconstitute its primary vocation as a hospice for university students, enriching this property with new receptive and valuable functions including exhibition space and a library.
The path that has seen the project development has touched many disciplines including in the first place the subject of restoration, also passing through the study of systems, technologies and structures, coexisting with the pre-existing lot, its criticalities and its points of strength.
The keyword of this development proposal is therefore transformation which is divided into demolition, addition and recovery.

CHAPTER 1
Introduction

1.1 Urban framework

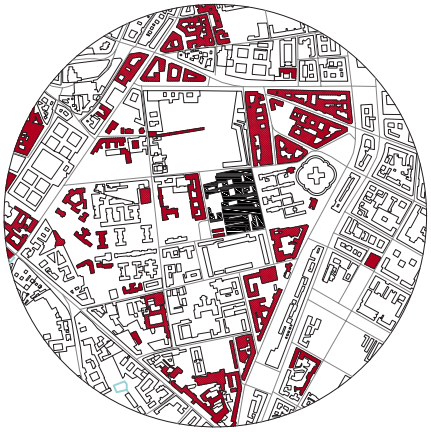
The case study of this thesis is a complex of buildings located in Milan in the Guastalla district, more precisely it is surrounded by via Manfredo Fanti to the south and via Francesco Daverio to the west.
The complex is the Società Umanitaria, located in the urban heart of Milan, facing the seat of the court, halfway between the Ca 'Granda building and the Rotonda Della Besana.
Thanks to the following framing, it is possible to understand the peculiarities of the lot from the year 2004, the year in which the photo-plan still presented its historical integrity, before changing. The historical evolution of the urban space was subsequently represented.

Fig. xx: Orthophoto

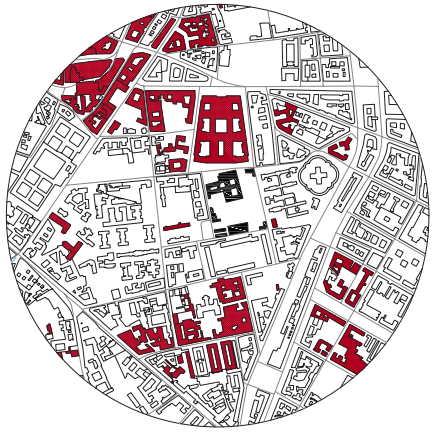
First half of XVIII century

Year 1807

Year



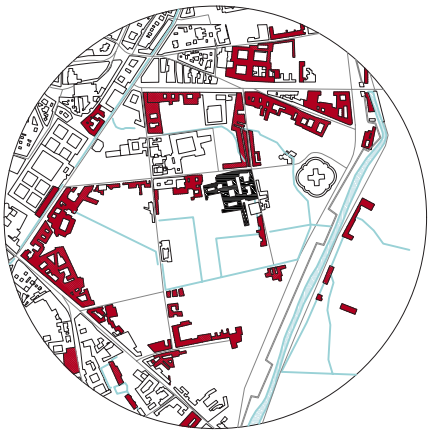
Year 1930



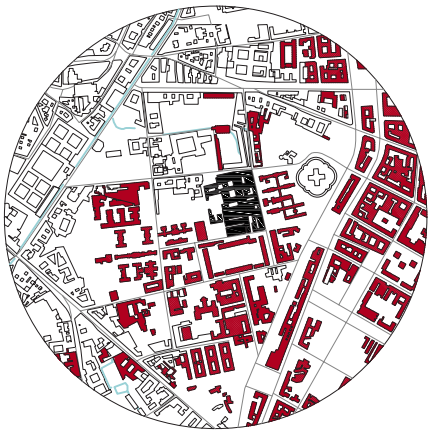
Year 1946

Year

1856



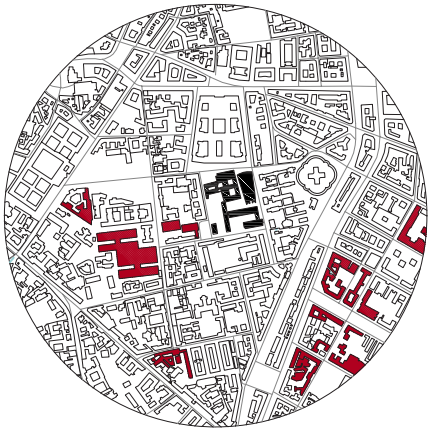
Year 1884



Year 1910

1965

Year 1990



Year 2021

Fig. xx: Historical development

1.1 Società Umanitaria

1.1.1 Birth

The Società Umanitaria was constituted on June 29, 1893, thanks to Prospero Moisè Loria a patron that left his legacy and wanted to create a new society for helping the lower classes to be independent giving them support, work and instruction.
The keyword of the Society has always been Modernity, this view is applied in different fields, in works method (researching and analysing in a rational and scientific way); for the people that represent the society, (politics, entrepreneurs, scholars etc..) and for the nature of the society (a moral entity in the assistance field).
As it's possible to read in "Educazione e Lavoro: sapere, fare e saper fare" different author wrote about Umanitaria, two of them were Carlo Emilio Gadda and Luciano Bianciardi.

"In his Novel, Gadda deepens a lot the Umanitaria initiatives, knowing that every intervention has to be sustained by the knowledge and every thought have to conclude into concrete action, and in this way, he ends up considering the Society as an expression of modernity for Milan, his capability

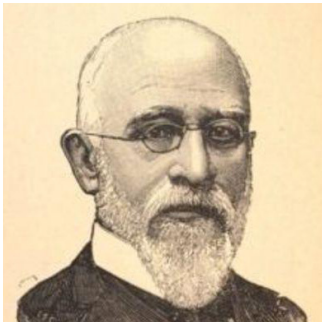


Fig. xx: Prospero Moisè Loria

of giving supportive and civil responses to lower classes necessity. "Evidently the city was on the way to becoming a metropole." Gadda said."
Biancardi, thirty years later wrote into a reportage for the Touring Club:
"The revolutionary character of the Humanitarian, its modernity, its Italian primacy, and in certain European sectors, were clear from the very beginning", immediately writes the Author of Vita Agra. And then it continues. "Schools we have seen above all: classrooms, laboratories, teachers and children. A population of about three thousand young people who give life to this Milanese citadel for at least six to seven hours a day. Here we insist above all on the didactic importance of teamwork. The idea, in short, and that we learn better by collaborating and discussing all together, pupils and teachers. (...)

Fig. xx: The Book Lab

"This is a pilot school", one tells us. Another would have said "model school" but it is more correct in the other way, it gives the sense of forwarding movement, of progress ".

The society role was, first, about establishing relations with public entities, industries, cooperatives, entrepreneurs. Secondly providing schools, primary, secondary, and professionalizing, all for free, where people could improve their skills and their knowledge for defending themselves from unemployment.

Society has always been dynamic, the different courses increase in number and in quality over years, following the different trends of that time and was always updated.

An interesting testimony of students it's written in "Educazione e Lavoro: sapere, fare e saper fare": "We entered the refectory and wore the overalls all day long. The vigilante, Mr Grandi, was stationed outside, with a black coat and a hammer always in hand to keep discipline. The school was very hard, but those who came out of the 'Humanitarian did not stay at home. He found work immediately. The theorem was easy: education, training, placement "(ANTONIO BORNACIN, enrolled in the secondary school for guidance and vocational training). "I have to say thanks to Umanitaria who gave me an instruction to secure my job. I thought I was stupid, but, Instead, I was just ignorant and Umanitaria helped me a lot. I became an appreciated tailor in an important tailor's shop in the centre of Milan "(ERMELNIDA PARENTI, enrolled in the secondary school for women with a vocational-industrial orientation).

The Umanitaria Society introduced the "Teatro del Popolo", a place where all lower classes and workers could participate to high levels show for few sums of money. This introduction changed the normal artistic routine of Milan, and convinced different artists to show for free, they were capable of opening The Teatro Della Scala to people, giving them the possibility to live an unthinkable experience.

Furthermore, the society helped people with houses, in fact in 1905 they built up two different social houses complex in via Solari and in Viale Lombardia, providing more than 450 apartments

with all the main services for the private citizen. These buildings were provided with common services, as a library, restaurant, schools, nursery schools and the conference hall.

1.1.2 Advent of Fascism

In 1924 the "camicie nere" took control of the society, they closed all the decentralized offices and stopped most of the social activities, the only exception was for "Teatro del Popolo", which continued to be used but just for musical shows. School courses were maintained but changed the method, it had to be aligned to the rules given by "Carta Della Scuola", imposed by fascists.
All the activities were interrupted after the bombing of August 1943 that partially destroyed the headquarter of Umanitaria. In Autumn 1945 they organised a course for the propaganda of cooperation, as a sign of continuity between before and after the war.
In 1946 Bauer become the president of the society, he wanted to rise from the rubble, he restarted in an updated way all the social programs that were already there before fascism and focused all his affords on educating people to democracy. All the school's courses were subdivided into practical and theoretical classes, it was necessary for educating people about their rights and duties.

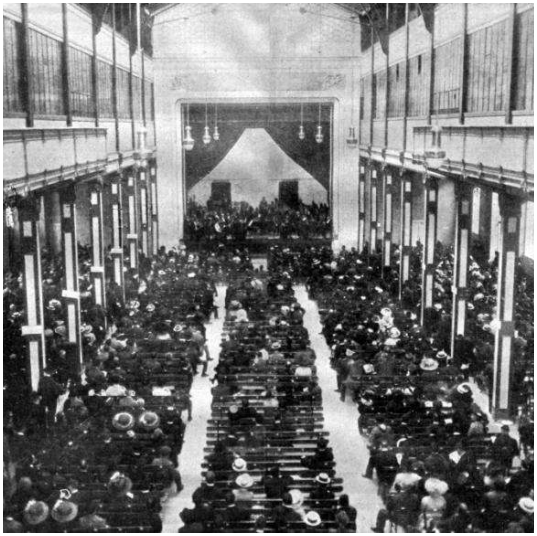


Fig. xx: Teatro del Popolo

1.1.3 Reconstruction

After the Marshall plan, in 1947 a competition for the reconstruction of the lot was held, it was won by Giovanni Romano and Ignazio Gardella as we can read in an extract of Casabella n.214 of February- March of 1957

"In Italy's post-war reconstruction period, the rebuilding of the Società Umanitaria - a heap of rubble - is of special interest. It resulted in the rebirth of one of the most typical and progressive social institutions, linked to the history of the

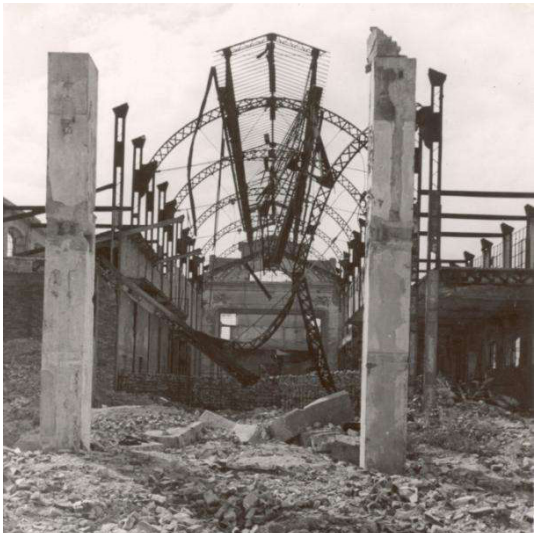


Fig. xx: Bombing of 1943, World War II

modernisation of Italy. The difficult process is an example of the problems relating to the rebuilding of our country, with not enough means available but a lot of determination, hampered by a slow and uncomprehending bureaucracy.

The Società Umanitaria drew up a programme and towards the end of 1946 requested tender. I put forward a project and outlined a proposal, expressing an idea that I had been considering for some time, not only for the reconstruction project of the buildings but for the reorganisation of the schools, which I saw as a modern centre for the vocational preparation of young people, particularly craftsmen, combining this experience with the legacy of the Istituto Superiore di Monza, further enhanced by recent influences from elsewhere in Europe.

The reconstruction project had to be adapted to the limitations of State funding. The initial amount of 1,085 million liras gradually decreased to 900, to 700 to 500 liras, which meant that whole buildings would be demolished, others would be modified with materials of lower quality. The final result of the project was as follows:

- buildings for the teaching of cultural, scientific and technological subjects and drawing;
- light workshops;
- heavy workshops;
- Scuola del Libro and graphic design workshops;
- directors' offices;
- accommodation with one hundred twin-bedded rooms;
- the historic buildings for administration offices, library and research centre.

This was the start of what the Società Umanitaria has become through further modifications, projects and decrees. For my part, involved in these developments, I felt that the formal architectural problems were of marginal importance, the focus being on the most important aspects of the work, the outcome of this singular experience."

After the reconstruction, it was held an experiment called "Scuola preparatoria di avviamento e orientamento professionale" that after three years of experimentation became the "Scuola Media" that everybody knows and joined.
In the following years the Society opened "La Casa dell' Artigianato Italiano" in New York, where they promote Italian products, joined a program for developing Iraq and they organised a professional school in Bassora (Iraq) and in 1954 they opened, with "Cassa del Mezzogiorno" financing, two cultural centres in Puglia and Sardinia.
Umanitaria became excellence of multidisciplinary activities and in 1949 Bauer organised the first "Corso residenziale per insegnanti" were, for eight days before starting schools, teachers were gathered and prepared for the beginning of the school.

1.1.4 Decline

Unfortunately, in 1968 for economic problems, they were obliged to drastically reduce the scholar program. Different protests and riots happened after this decision, they ended with the occupation of the headquarter of the Society and in 1969 the board of directors met and decided to step down, since that day Umanitaria continued with courses, conferences, and publications but without recovering at all.
In 1981 a state law decree that all the educational apparatus had to be transferred to the Lombardy region, and with an expropriation for public utility all the buildings were transferred to the Region.
Since that day Umanitaria rethink his operation, and nowadays they educate adults, promotes students with scholarships, fights against school dropout and sustains intense cultural programming.

Fig. xx: Stdents protesting, 1968

1.2.1 Geometrical survey

For what concern the geometrical survey was conducted starting from the drawings in the archive, then it was continued on-site, where we verified the different measures.

First, it was developed an eidotype of all the lot, considering the public street, the pedestrian roads, the pre-existing vegetation and green areas and the private spaces. The Survey was subdivided into different levels, a general one that considered all the macro areas and the border measures of the building, and a more detailed one, where it was taken all the measures about the typical span, and the details that are repeated into the elevation/plan.

To lead the survey, it was used the trilateration method, starting from the perimetral measures, and connecting them with diagonals. The main instrument used were a ribbon, measuring tape and a laser distance meter.

For supporting the geometrical survey, it was done a photographic survey, and furthermore, it was taken notes about the organisation of the buildings, construction details, structural characteristics and about the condition of use and conservation.

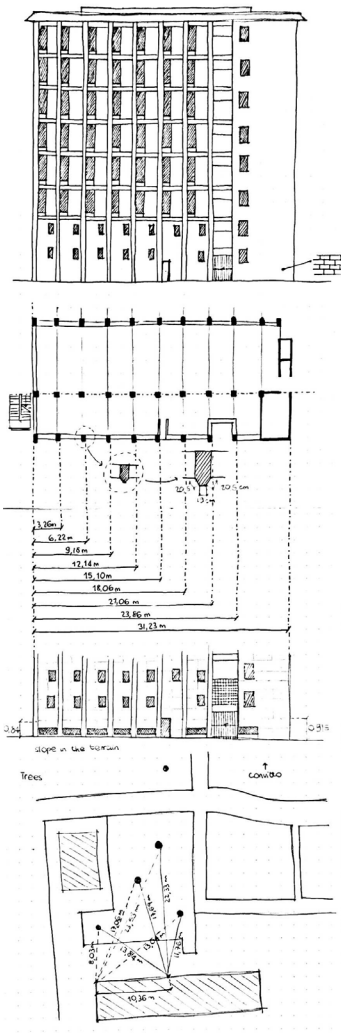


Fig. xx: Sketches and measurements of the Convitto

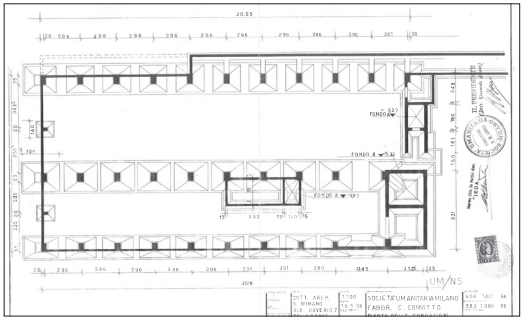


Fig. xx: Foundation Floor, from the archives

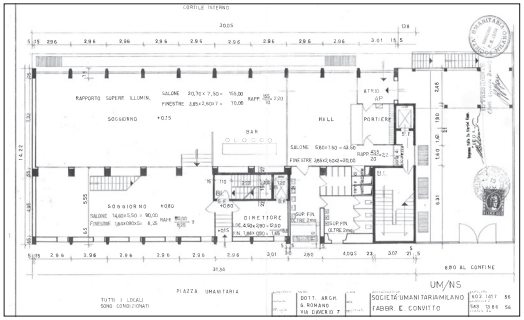


Fig. xx: Ground Floor, from the archives

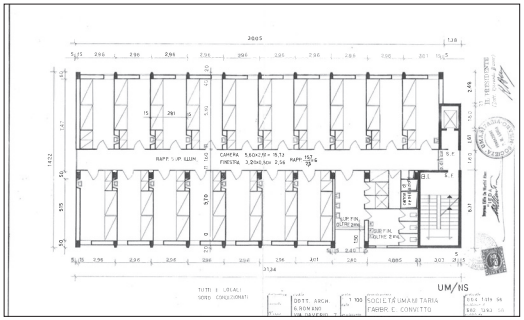


Fig. xx: Typical Floor, from the archives

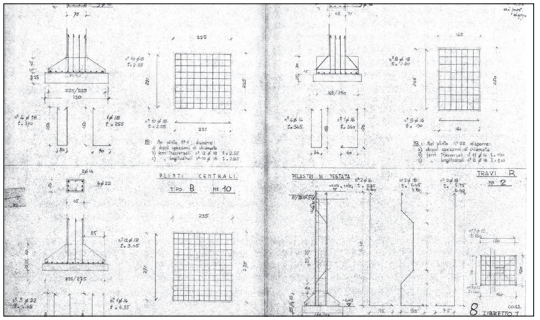


Fig. xx: Details of the foundations, from the archives

Fig. xx: Close-up of the RC columns

Fig. xx: Picture from the North-West angle

Fig. xx: East facade

Fig. xx: North facade

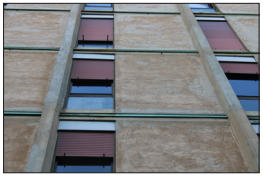


Fig. xx: West facade

Fig. xx: Interior picture showing *vetrocemento*

1.2.2 Materials and Decay

The survey of materials and decay is focused on Convitto Tower, the following mapping was possible thanks to a combined approach between direct observation and drawings (plans, elevation, section, and technical details) found in the archive's drawings.
For what concerned the material mapping, it was done with photo documentation of the different materials and direct analysis in the site. The materials were subdivided into concrete, glass part, plastic element, finishing and metal carpentry, each macro group is subdivided into subgroups according to the different characteristics of materials.
For what concern the deterioration mapping, it was done photo documentation of the different decays on site. Following the ICOMOS glossary, the decays were ctalougued, following the different definitions of Blistering, Flacking, Encrustation, Oxidation process, moist areas, Missing parts, deposits, hair cracking and detachments the mapping and the following catalogues were created. In the end, the causes that induced the decays were hypothized.
Particular attention was given to reinforced concrete, as it is the material that according to composition analysis is the most relevant for what concern the character of the building. According to this premise, information from original drawings, archives, books and articles about the construction time, the techniques, the characteristics of the concrete, the exposure condition, the history of the buildings and other works or restoration done on it in the past were collected. After that, the mapping of the level of decays and the place for diagnostic examinations was carried out. In the end, the residual service life diagram allowed the classification of the condition of Convitto's concrete into a field delimited by "Formation of cracks in concrete" and "concrete cover detachment", therefore in a non-serious situation.

Necessary investigations

A. Sclerometry
B. Magnetometry
C. Ultrasounds
D. Infrared thermography
E. Electrochemistry
F. Map cracking (on the whole structure)
G. Core drilling
H. Compression tests
I. Colorimetric analysis
L. Physical and microstructural tests

Level of decay

Level 1: detachment of plaster

Level 2 : presence of cracks

Level 3 : presence of exposed rebars

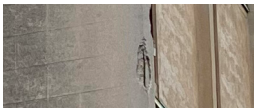


Fig. xx: Mapping of the decays of RC

CONCRETE

_C1
Reinforced concrete

_C2
Vibrated concrete curb

The reinforced concrete elements constitute the loadbearing structure of the Convitto. The vibrated concrete curb is used in the opaque walls and placed under the window frames.

GLASS

_G1
Glass panels

The windows have one single panel of glass, creating thermal breaks and not allowing a good performance.

PLASTIC

_PL1
Plastic elements (polycarbonate)

The shelters covering the entrances of the Convitto on the ground floor are entirely made of polycarbonate materials.

FINISHINGS

_P1
Rustic plaster with common mortar for exteriors

_P3
Graniglia martellinata

_P2
Vetro-cemento

_P4
Cement mortar integrations

There are different typologies of finishing related to the function behind the walls. The rustic plaster is used to cover the mortar of the walls in the areas dedicated to housing function. The graniglia martellinata can be found on the short sides of the Convitto and partially on the West and East facdes (indicating also the presence of common spaces), together with the Vetro-cemento which is only present on the facade facing West.

METAL CARPENTRY

_M1
Copper

_M3
Generic metal elements

_M2
Galvanized steel

_M4
Aluminum (Frames and flashings)

Copper elements are used to protect the walls from rainwater. All the elements related to windows and doors are made of metallic elements, in order to have the cleanest appearance. The external emergency stair is also made of galvanized steel.

Fig. xx: List of materials

	DEFINITION	CAUSES
 _De1 Blistering	Separated, air-filled, raised hemispherical elevations on the face of the surface resulting from the detachment of an outer layer. This detachment is not related to the structure of the material.	• Exposure to atmospheric agents • Lack of correct maintenance • Problems with the drainage system
 _De2 Flaking	Detachment of plaster as a scale or a stack of scales. The thickness of a scale is generally of millimetric to centimetric scale, and is negligeable compared to its surface dimension.	• Exposure to atmospheric agents • Lack of correct maintenance • Problems with the drainage system
 _De3 Encrustation	Compact, hard, outer layer adhering to the surface. Surface morphology and colour are usually different from those of the original appearance.	• Exposure to atmospheric agents • Lack of correct maintenance
 _De4 Oxidation process	Spontaneous process leading to the loss of electrons.	• Exposure to atmospheric agents
 _De5 Moist area	Corresponds to the darkening (lower hue) of a surface due to dampness.	• Exposure to atmospheric agents • Lack of correct maintenance • Problems with the drainage system

Fig. xx: List of decays

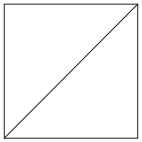
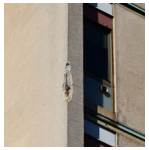
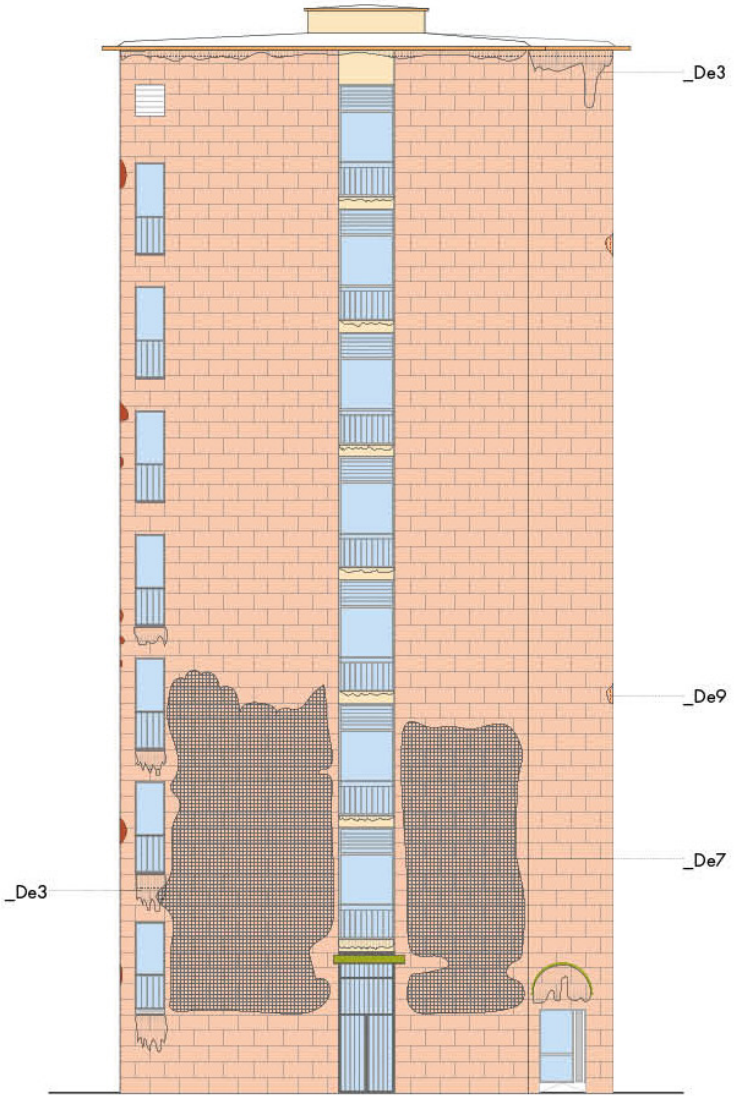
	DEFINITION	CAUSES
 _De6 Missing part	Empty space, obviously located in the place of some formerly existing part. Protruding and particularly exposed parts are typical locations for material loss resulting in missing parts.	• Exposure to atmospheric agents • Lack of correct maintenance
 _De7 Deposit	Consists of an accumulation of exogenic material, such as dust, droppings, on the surface.	• Exposure to atmospheric agents • Lack of correct maintenance • Problems with the drainage system
 _De8 Hair cracking	Minor crack with width dimension < 0.1 mm.	• Exposure to atmospheric agents • Lack of correct maintenance • Problems with the drainage system
 _De9 Detachment	Material loss due to the carbonation process of the rebars in the concrete	• Exposure to atmospheric agents • Lack of correct maintenance

Fig. xx: List of decays

Fig. xx: Mapping of materials and decays



South elevation
SCALE 1:100

CONCRETE

_C1
Reinforced concrete

_C2
Vibrated concrete curb

GLASS

_G1
Glass panels

PLASTIC ELEMENTS

_PL1
Plastic elements (polycarbonate)

FINISHINGS

_P1
Rustic plaster with common mortar for exteriors

_P2
Vetro-cemento

_P3
Hammered grit work in artificial stone in cement smoothed with marble grit. Graniglia martellinata

_P4
Cement mortar integrations

DECAYS

_De1
Blistering

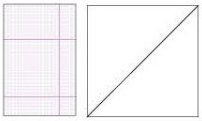
_De2
Flacking

_De3
Encrustation (due to water leaking)

_De4
Oxidation process (presence of rust)

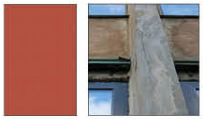
_De5
Moist area (as result of a concentrated discharge of rain water from a broken down-pipe)

_De6
Missing part



_De7
Deposit

_De8
Hair cracking



_De9
Detachment (material loss due to the carbonation process of the rebars in the concrete)

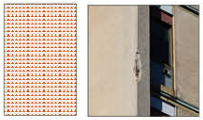
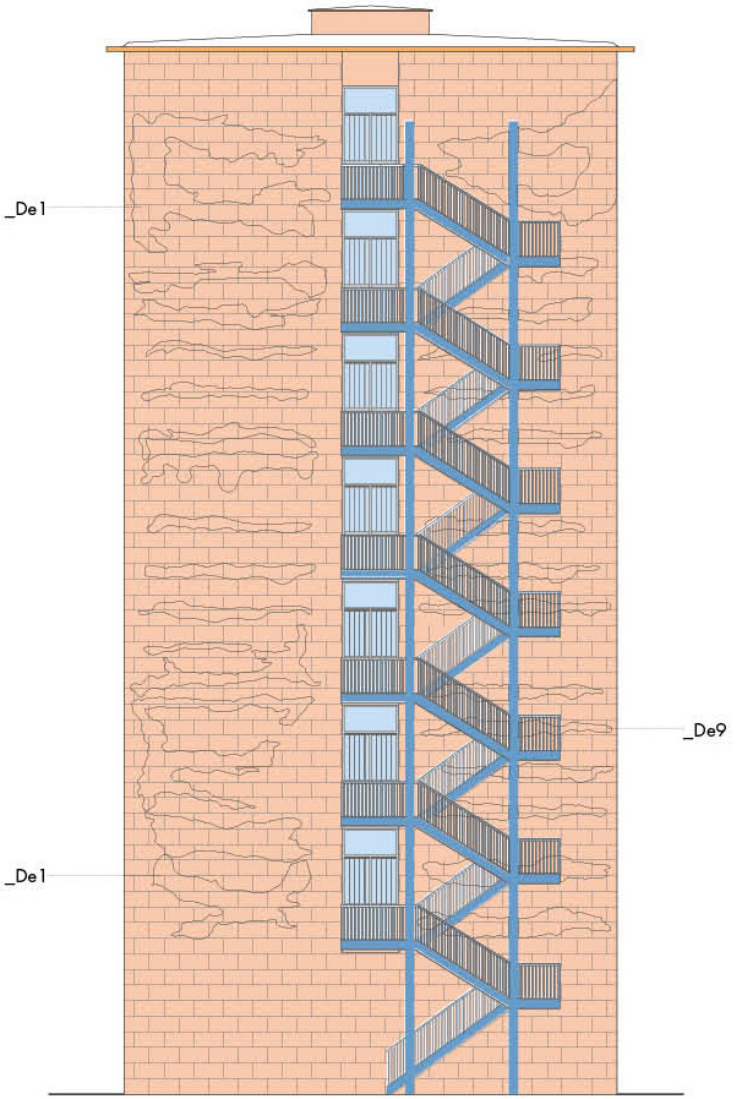


Fig. xx: Mapping of materials and decays

Fig. xx: Mapping of materials and decays



North elevation
SCALE 1:100

CONCRETE

_C1
Reinforced concrete

_C2
Vibrated concrete curb

GLASS

_G1
Glass panels

PLASTIC ELEMENTS

_PL1
Plastic elements (polycarbonate)

FINISHINGS

_P1
Rustic plaster with common mortar for exteriors

_P2
Vetro-cemento

_P3
Hammered grit work in artificial stone in cement smoothed with marble grit. Graniglia martellinata

_P4
Cement mortar integrations

DECAYS

_De1
Blistering

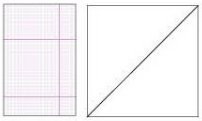
_De2
Flacking

_De3
Encrustation (due to water leaking)

_De4
Oxidation process (presence of rust)

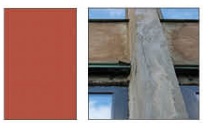
_De5
Moist area (as result of a concentrated discharge of rain water from a broken down-pipe)

_De6
Missing part



_De7
Deposit

_De8
Hair cracking



_De9
Detachment (material loss due to the carbonation process of the rebars in the concrete)

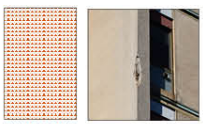


Fig. xx: Mapping of materials and decays

1.2.3 Architectural analysis

Giovanni Romano and Ignazio Gardella won the competition of 1947 for the reconstruction of the Società Umanitaria lot. The project considered all the pre-existing buildings left intact by the bombing.

As we can read in "Nuove architecture in Milano", Roberto Aloi descript the functional and compositional organisation of the intervention, giving attention to the rational subdivision of the spaces according to different necessity.

"The newly constructed part includes six volumes, all but one with an orthogonal layout, plus a seventh – not yet completed - set aside for the "Teatro del Popolo"."

"The program also called for the construction of a new gymnasium, a swimming pool, an infirmary, a centre for vocational orientation and a level for offices.

The functional organization of the complex is based on the program of professional courses, calling for equal emphasis on cultural studies, drawing and work, while covering experimental applications in three categories: a) heavy workmanship, b) light workmanship, c) graphic arts.

According to these programmatic tenets, the functions of the various volumes were assigned:

1) Classroom building (cultural, scientific, technological and drafting); 2) Heavy workshops; 3) Light workshops; 4) Literature and Graphic Design workshops; 5) Administration.

The various basements were set aside for dressing rooms, dining halls, kitchens, showers, storage, maintenance, and general services.

The classrooms have a height of 3.25 meters, a length of 6 - 7 - 8 meters and can have 18 - 24 - 30 seats.

All the external walls are glazed, using metal frames. For the heavy workshops (four-story building) it was necessary to consider extraordinary loads, up to 1200 kg/m? for the slabs of the ground floor and 800 kg/m? for those of the upper levels.

The roofing of the buildings is in clamped aluminium sheets with a thickness of 0.8 mm.

Clinker brick was used for the paving of the porticos, the outdoor sidewalks, and the workshops, while all the other spaces are paved in vitrified tile.

The parts in iron and sheet metal and all the metal frames were made in the workshops of the Umanitaria."

The "Teatro del Popolo" was never built, and at the beginning of the new millennium the area occupied by the Heavy machinery lab (that had been demolished), and the never-built "Teatro del Popolo" had been occupied by a massive building that saturates the lot, used by the court.

1.2.4 Functional Analysis of the Convitto tower

The Convitto Tower nowadays is used as offices, but in its origin, it was used as a residential building, and it was organised in this way.
The basement was used as services spaces, in fact, it was presented as a warehouse a personal refectory, food storage, cold rooms and a laundry.
The ground floor level was a place where inhabitants could stay together and share spaces, at this floor, there was the direction of the Convitto, the common living room and a bar.
The first-floor level, as the ground floor had a relational vocation, in fact at this floor there was the restaurant.
From the second up to the seventh floor, there were the most private spaces for each inhabitant, at these floors, there were single rooms that follows the typical span of the structure of the building.

CHAPTER 2
Conservation and transformation

Design for the existing built environment means taking care of the heritage, recognizing it as a resource and acting to promote the preservation and transformation.
This requires the refinement of a new listening and vision skills in order to develop a deep and necessary knowledge process in order to operate in a conscious way.
Works of art, and of course architecture as well, are (among many other things) pieces of material testimony. They are fragments of the puzzle that is art history, and actors as much as witnesses.
To fight against artworks' inevitable material degradation, preservation science, through conservation and restoration, is in charge of their upkeep. Conservation aims to prevent damage to a piece, and to reinforce it for the future; it safeguards the object in its current state by stabilizing it and preserving its integrity. Restoration actually alters the physical state of a work by rebuilding, repairing, repainting, or generally re-perfecting it, the main ambition being to restore the piece to its ideal state.
Restoration is thus much more controversial than conservation, since it's almost impossible to understand which is the ideal state of an artwork. The complexity of the matter explains why an all-embracing definition of restoration has not yet been reached.

What does it mean to preserve today?

Preservation is a methodological approach, which means that is not a standard repetitive and automatic process.
To preserve means to develop an architectural project, which is focused on existing built and to develop techniques aimed for the care and the preservation of the substance. However the main goal of preservation nowadays is to allow the use through a conscious and respectful intervention.

"The shift from original state to historical palimpsest reinforces the entire record of the changes the structure has endured and many forms of intervention are likely to have impacts upon the authenticity and integrity of the building, both of which are particularly important issues in the broader ethical discussions."

What does it mean to design for the existing built?

Despite all the doubts and contradictions concerning the correct way to intervene, some concepts are fundamental; indeed respect must be paid for existing built as a collective resource and we must accept the stratification that the past has given to the present, cherishing the signs of time.

Furthermore, considering that the existing city is in continuous change, the existing built takes part in the transformation process. Consequently the investigation of the history is the starting point of the design process.

2.1 Respect of the Authenticity

Authenticity is the principle that lies at the base of all modern doctrines that deal with the conservation and restoration of monuments and is a central concept of the cultural heritage field.
The importance and significance of the concept of the authenticity is reinforced in "The Nara Document on Authenticity" (ICOMOS, 1994).
In a wider sense, authenticity guarantee the true in opposition to the false, the original against a copy.
This conviction was for Ruskin at the core of "The Seven Lamps of Architecture", in which he declared that a restoration of a building would delete the "golden stain of time", at which point its authenticity would be lost, like a simple reproduction or an imitation, and the building would become an historical-counterfeit.
This concept has not a single meaning, in fact, for Viollet Le Duc all the restoration works should re-establish the building to a finished state which may have never actually existed at any given time, the idea to restore the building as it was.
This approach may appear inappropriate in the conservation field for many researchers. However, these diametrically opposed positions continue also today, and this contradiction is the most important idea that every restorer must consider.
In general, this decision can be affected by previous modifications, or works like repair, protection or even restoration, which altered the original state, for this reason, the problem for practitioners may be compounded as they are often faced with making decisions on previously executed.
The original purpose of the designer for the building is a transient condition that exists only for a short period of time after completion of the work.
Thus, if a building is left to decay through wilful neglect, a lack of proper care, or intransigence, how authentic will it is at the point when the designer is engaged to address the problems?
The question is understanding how authentic will be a project when the designer starts to reason about the problems and the nature of a building.

"We can consider the conservation work an ethical need, but at the same time an opportunity to capture with a project capable of combining the charm of the matter and of the ancient spaces with the necessary transformations to new uses

suggested by the traditional building techniques and a sophisticated contemporary design culture. [...] This result is favoured by a design philosophy whose main principle is constituted by a sophisticated search for new distribution strategies, which must be clear, rational and capable of enhancing the spatial qualities of the existing building while preserving them in the most rigorous way." Massimo Carmassi

"Possiamo considerare l'opera di conservazione una necessità etica, ma nello stesso tempo una opportunità da cogliere con un progetto capace di combinare la sottile e indefinibile suggestione della materia e degli spazi antichi, con le trasformazioni necessarie ai nuovi usi suggerite da una profonda consuetudine delle tecniche costruttive tradizionali e una sofisticata cultura progettuale contemporanea. ... questo risultato è favorito da una filosofia progettuale il cui principio portante è costituito da una sofisticata ricerca di nuove strategie distributive, chiare, razionali e capaci di esaltare le qualità spaziali dell'edificio esistente conservandole nel modo più rigoroso." Massimo Carmassi

"It is a question of trying to grasp [...] a reflection on the disciplinary foundations of one's doing, [...] a duty of care, an ethic of therapy to be applied both to the space intended as a common good, and to comparisons with other resources, including socially relevant ones, first of all, avoiding waste.

[...]

Rediscovering this ethical soul of the disciplines of construction and snatching it from oblivion can be useful, while not ignoring great epochal changes, to recharge the culture of design with a critical sense and purpose.

[...]

And to firmly reject the interpretations of the contemporary expressed in terms of the "post-architectural" era, against the backdrop of an alleged and global junk-space against which it would seem vain to fight.

But it is precisely in contrast to these visions, cynically accomplices of degradation, that we need to remember the building-care, in view of its renewed application and realization." (Emery)

2.1.1. Compatibility

The concept of compatibility in restoration is fourfold: chemical, physical, mechanical, and architectural.
From a mechanical and chemical-physical point of view, the choice of materials for the restoration work can only be carried out by the architect after a study and analysis phase that leads him to have a deep knowledge of the building and its characteristics.
The materials chosen must have homogeneous characteristics to the ancient ones: presenting similar thermal expansions and states of restraint, therefore having the same compositions much as possible.
This choice, therefore, determines the duration of the intervention, a wrong choice could rend the intervention vain or damage the product irreparably.
Furthermore, the architect needs to analyze and consider the functions of the spaces and the respective load conditions of the structures to study and design the most appropriate uses, allowing the future possibility of other interventions.
"Any work done on the art or to its surroundings [...] must be executed in such way and with such techniques and materials that will not obstruct or prevent preservation or restoration work in the future." art. 8 Venice Restoration Chapter, 1972.

2.1.1.1 Eraclea Minoa Theatre by Minissi

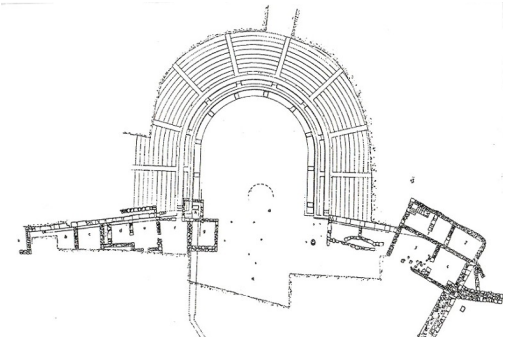


Fig. xx: The plan of theatre Eraclea Minoa

The theatre can be assigned to the IV-III century BC, then re-modelled in the third century. to. C. and finally abandoned around the II, I sec. B.C.
It is located in the city of Cattolica Eraclea (AG) in the hollow of the hill to the north of the town, the koilon, which opens south towards the sea as in the theatres of Athens and Syracuse.
It is built in ashlars of arenaceous marl for most of the orders of the seats, while the underlying part is located in the rock.
The Archaeological Superintendency of Agrigento entrusts Minissi with the task of studying how to isolate the monument from the attack of atmospheric agents, fully covering the cavea with a sort of colourless and transparent display case on site.

Fig. xx: The plan of theatre Eraclea Minoa

Fig. xx: Particular of the theatre of first row seats with backrest and armrests immediately after excavation (from Grifo 1966)

Fig. xx: Reconstruction of the seats according to Minissi's project

The objective of Minissi of representing the original model was carried out in the most complete way, the drawing of the shapes reached here the maximum precision, in a real recomposition.
The reconstruction is perfectly colourless and transparent. His original architectural forms have been rigorously modelled on the drawings of precise reliefs, in printed and then welded plates. In this work, all possible measures were taken to ensure that the instances of this brand new conservation procedure were adequately resolved: from the perfect seal of the welds of the slabs to the thermal insulation and ventilation of the resulting air chamber between the surfaces of the monument and the perspex roofing, from systems to avoid any infiltration of water and wind to those to prevent deformation or breakage of the slabs depending on climatic variations, up to the practicability of the steps by visitors.
By the way, this purpose to protect and defend the theatre was discarded, because many phenomena of degradation were increasing, like erosion, pulverization or disintegration, scaling, gaps, exfoliation, separation, biological patina and efflorescences.
Many causes were hypothesized, the most consistent are of course the exposure to the eolian winds and the meteoric action. But also another cause, generated by the covering system, is the greenhouse effect, that favours the gouth of

Fig. xx: The plan of theatre Eraclea Minoa

Fig. xx: Picture showing the condition of the cover: yellowing and spontaneous growth of vegetation

Fig. xx: Auditorium of the theater with paneled roof to protect the seats

infesting vegetation. The last problem is due to the corrosion of the metallic structure causing the fissure of the stone.
Another problem does not affect the theatre, but the intervention, infact the covering with the time had lost the original and beautiful transparency becoming more and more yellow, then many panels or pieces were broken.
From this example, it is possible to understand that when speaking about compatibility it is necessary to take into account not only functional compatibility, but also mechanical and physical compatibility. In fact, this conservation project presents a perfect functional compatibility, maintaining the layering of the original seats and the stratification, but also has side-effects related to the mechanical joints which are irreversible and which damaged the heritage.

2.1.1.2. Compatibility in Società Umanitaria

The project has been taken into account the compatibility under all its aspects.
First of all, the original functions are restored and the new ones are strictly related and complementary with the vocation of the Umanitaria complex.
Those aggregation of functions allow the site to be a significant attractive point for the neighbourhood.
The materials used in the project are compatible with the existing ones, in fact, they are homogeneous and they will not present any chemical or mechanical issues especially in the connection joints, because the new materials are either the same ones used in the Convitto, or materials totally compatible to those ones.

2.1.2. Recognizability

Recognizability must be tangible to the observer to distinguish the intervention from the artefact, avoiding the creation of historical fakes and thus allowing the reading of the stratification and the layering, in fact, any completion or addition must highlight the sign of its time.
This is technically possible, for example, by using materials that are aesthetically different in terms of shape, size or colour, or by using the same elements by laying them on a different plane.
"Replacements of missing parts must integrate harmoniously with the whole, but at the same time must be distinguishable from the original so that restoration does not falsify the artistic or historic evidence." art. 12 Venice Restoration Chapter, 1972.
"Additions cannot be allowed except in so far as they do not detract from the interesting parts of the building, its traditional setting, the balance of its composition and its relation with its surroundings." art. 13 Venice Restoration Chapter, 1972.

2.1.2.1. Youth Hostel Basel

The building is located in St. Alban Kirchrain, Basel, Switzerland and was built in 1851 as a silk ribbon manufacture factory. In 1979 it was converted to a youth hostel with a project of Buchner Bründler Architekten (Daniel Buchner and Andreas Bründler).
For what concerns the interior of the original factory, it was almost entirely removed, with the exception of the dye cellar, while the outer original façade remained almost totally unchanged.
The guiding idea of the architectural intervention includes, in addition to the required expansion of the space, the redefining of the context and a clarification of the relations of the inner spaces and their interactions.
The new expansion from Maja-Sacherplatz square changes the urban contextualization of the Hostel. The main entrance is emphasized by a bridge that passes across St. Alban pond, that follows as a wooden walkway, following the longitudinal side of the Hostel to end in the new, semi-public area where the terrace can be found.
An open structure made of oak vertical lamellas surrounds the bridge, the walkway, and extension building forming a wooden bracket around the old grey stone structure creating a strong connection between the building itself and the forest next to it.
Through a process of re-orientation of the ground level, the space reappropriates its original vastness becoming in this way a vast meeting area.
In allusion to the building's industrial past, the concept of robust, direct, and tactile

Fig. xx: Auditorium of the theater with paneled roof to protect the seats

Fig. xx: View of the wodden lamellae frames

Fig. xx: View of the walkway

Fig. xx: View of the expansion

Fig. xx: View of the project from the forest

materialization is at the base of all interventions in the project.

The original structure of the building, with its vaults coming from the dye cellar and the later-inserted supports, is completely exposed leaving the construction naked.

The dominant materials used in the addition are exposed concrete and oak. The intervention provides twenty-one rooms with bathrooms. Floor-to-ceiling windows inside of the rooms offer a direct relation with the outside space, in particular with the forest, which, in turn, influences the interior atmosphere and light.

The vertical wooden lamellae on the facade provide privacy for the balconies.

It is clear that one of the main principles followed in this restoration project is the recognizability. It is very visible from the eyes of the spectator which are the parts of the building which were kept from the original silk ribbon manufacture and which are the parts that are constituting the new addition. The architects made this distinction very clear; the material used for the addition as already mentioned is wood, which thanks to the strong contrast with the concrete, make the whole project very comprehensible. The recognizability is not only visible from the contrast of materials but also from the architectonical elements used, in this specific case, the lamellas, which are a recurrent element in the addition.

This distinction between the two structure is necessary to allow the readability of the entire project, making visible all the historical layers and the different interventions, which is a fundamental concept to keep in mind during a preservation and transformation project.

2.1.2.2. Società Umanitaria

The intervention is highly recognizable to avoid false histories or fake emulations.
Considering the urban complex, the important elements and historical memory of the identity and character of the building were considered, for this reason where modifications or demolitions were planned, the authenticity was maintained and respected, underlining the features of the form with a different compositional language.
The additions, on the other hand, are quite distinct from the artifact through the use of punctual and visible connections, also for mechanical reasons, allowing independence between the different structures.
In addition, materials and finishes different from those already present were used to further underline this distinction and thus allow clear recognition.

2.1.3. Juxtaposition

The concept of juxtaposition is broad, because it embraces many factors of each architecture.
Starting from the design of the shapes and passing through the choice of the materials, this concept may be strictly related to the design stage, but is very relevant also for the restoration in case of addiction or replacements, to do not overwhelm the buildings and keep the whole homogenous and well balanced.

2.1.3.1. Church of Brigittine Bruxelles

The Brigittines Chapel was built in 1663 in Brussels. The chapel was designed by the architect Léon Van Heil in Renaissance style.
The building was only slightly damaged during the bombardment of 1695, which destroyed most of the city.
In 1920, the Chapel was put up for auction and bought two years later by the municipality of Brussels, which restored very well the church.
The City of Brussels and the Alderman of Fine Arts and Culture decided to support the creative turn that the chapel was taking with the performing arts.
In 1982, new improvement works were undertaken and the Chapel's space was made available to emerging dance companies. The Brigittines Chapel has refined its ambition to support and participate in the new forms of expression emerging at both the national and international level.
The city of Brussels decided to expand the volume of the church, to increase the available space for the cultural associations of dance and art by building on an extension.
The goal was to provide more appropriate space and accommodation, a better environment for the artists and for the public.
The Italian architect Andrea Bruno won the competition instituted by the municipality to build the expansion in 2005.
The intervention of addition consisted in the creation of a clone chapel, identical in terms of the footprint and the volumes but different, therefore presenting a contemporary language.
The idea of using the same volume is justified by the necessity of space, satisfied with a similar quantity of area, and also to add functions to the existing church and converting it into an auditorium.
The architectural cloning is able to change not only the perception of the chapel itself but also the significance of the space around.
The entire layout of the lot of course changed completely, because first it was a church and the layout was the chapel with a square as sacre entity, for this reason the project allows to make

this square a public spacemgiving to the chapel a new meaning for the society.
The external part were of course designed too to develop better the lot.
The image of the double volumes permit to understand the juxtaposition between the original

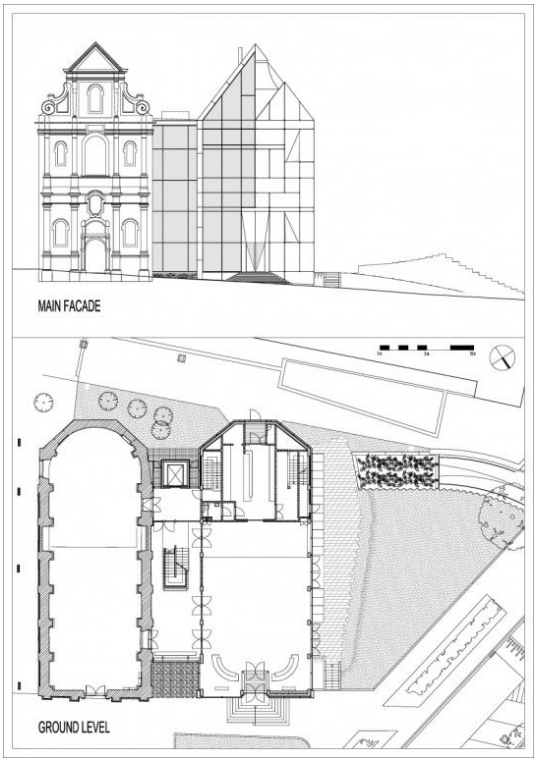


Fig. xx: Ground level and main facade of the addition

Fig. xx: Drawing of the main facade showing the intervention

Fig. xx: Detail of the roof of the intervention

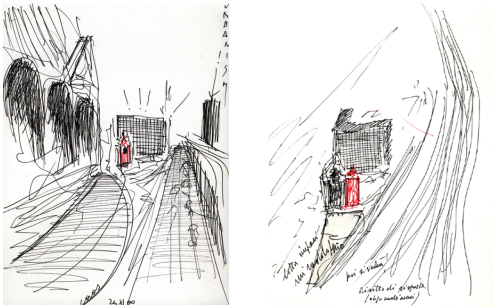


Fig. xx: Sketches of the project by Andrea Bruno

and the new volume, this is readable looking to the façade, where the masses are counterposes between the heavy existing and the new light structure.

The opposition between the original materiality of the church and the modern reproduction generate a sort of new sculptural element as union and negation of the two facades.

This opposition find place also in the vertical distribution of the functions in the seven floors: a 100 persons performing room, a restaurant, practice rooms, spaces for offices, technical plants and facilities.

Also the loadbearing structure is the reproduction of the existing one, but it's built with steel elements, following the axis and the grid of the original one.

This reproduction continues in the façade, the cladding with contemporary materials, glass and steel, reproduce the darkness of the brown bricks, while the glass planes on the left hand of the entrance elevation provide a literal reflection of the chapel and open up the new area.

Corten steel sheets start on the right-hand corner and complete the perimeter of the building.

Fig. xx: View of the main facade showing the juxtaposition of volumes

An important role is also played by the shadow and light effect, generated by the several cut-outs on the metal surface.
The reproduction allow also to change the identity of the block, by forgetting the sacre vocation and opening it to the city.

2.1.3.2. Società Umanitaria

Designing a building that seems born to be where it is, in an ideal lot to accommodate it, in a context in which it identifies is certainly the goal of any architectural project.
This uniqueness of architecture takes place precisely in the juxtaposition of masses, bodies, colours.
The Umanitaria is characterized by a heterogeneous set of buildings historically built in different eras, therefore the search for dialogue with the complex is very sophisticated in order not to overlook the existing one; to do this, in-depth studies and analyzes are necessary relating to the geometry of the complex, its linearity and its compositional grid.
The project must therefore take these elements into account to fit in as best as possible to improve the usability of the lot and at the same time be complementary to the Convitto. This research is evident in the various views that can be seen of the project, from above or from the side, where this juxtaposition is tangible in heights, extensions and proportions.

2.1.4. Continuity of history

History is the binder of every monument, every artefact is inserted in a more or less certain historical period, it can influence the present but must also transmit its memory and knowledge to the future.
This is the fundamental point of the restoration work and perhaps the paradigm of architecture, as it was built in the past, it's living in the present and it will be present in the future.
Obviously, the restoration may seem like an upheaval of this nature, therefore it is necessary to take advantage of this action to glorify the monument and give it the opportunity to transmit knowledge and testimony to the future.
And also it's important to do not forget that the built architecture has been built first of all for a determined function, to be used and lived by users
"We will talk about the restoration of buildings. We start by saying that there is no fixed rule in the restoration...
I don't believe in the sacredness of the existing built, in the preservation at all costs because the history is quite the opposite. The history of architecture is the story of the reuse of buildings. The city is the collage of all these stratification. Quoting Aldo Rossi, the beauty of the city lies in the overlapping of the fabric and image. Over the years I realized that the building is a living animal, changed over time, sometimes good, sometimes bad. If today we have the technology, we have to apply it, and do it well, because these are the possibilities that we have. The problem is to choose the figure that we want to obtain, if it has to contrast with the old or if it should belong to the same family..." Eduardo Souto de Moura [05/05/2015 Mantova Architettura speech]

"Art is the supreme manifestation of the power of man; it is granted to a select few, and raises the elect to a height where man is overcome by vertigo and it is difficult to maintain sanity. In art, as in every struggle, some heroes dedicate themselves entirely to their mission, and who perish without reaching the goal ", moreover" art is a human activity whose end is the transmission to others of the most eligible and better feelings to which men have been able to rise "Lev Nikolaevic Tolstoy, What is art

2.1.4.1. Rivoli Castle

The Castle of Rivoli is a museum of contemporary art in the province of Turin, Italy. It is one of the most significant international recovery and re-functionalizing projects.
The first renovation works on the Castle of Rivoli were carried out by the architect Andrea Bruno.
The size of this intervention was not so relevant because of a very limited budget, enough only to repair and fix the main structural damages on the castle.
In 1967, new funds were available, for this reason Bruno had the opportunity to demolish the decaying parts of the atrium, built at the beginning of the 20th century. The castle was by the way exposed to terrible decaying conditions of the building: the water infiltration had damaged the walls, ceilings, frescos, and stuccos, causing the first failures of the structure. For this reason since 1979 to 1984 many works to restore the building and to open it to the public were carried out.
The architect decided to keep the historical traces and to make them much visible, giving lot of importance to all the moments in the life cycle of the castle, avoiding completions and falsification, respecting the originality of the architecture, which became a true image of the history of the building and the transformation of the structure. Also, Bruno preserved all the internal

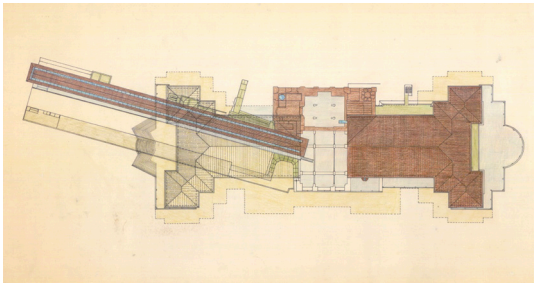


Fig. xx: Plan of the intervention

Fig. xx: View on the Manica Lunga, tranformed into an exhibition space

Fig. xx: Space between the Castel and the Manica Lunga

Fig. xx: View of the old part of the Castle of Rivoli

Fig. xx: View of the Manica Lunga

and external decorations, stuccos and paintings harmed by the passing of time and the inattention of men.

Following this idea of reading the stratification of the history, Bruno decided to show many periods of the castle by restoring rooms to their gold period: on the first floor the Juvarra's period, and the second in the Duke of Aosta's apartment. He enhanced the unfinished atrium, installed the glazed observatory point that emerges from the great brick wall of the Castle, and conceived the suspended staircase, together with the walkway, making the present in dialogue with the past.

Other works started later on the Manica Lunga, to become an exhibition space, here were added a staircases and the elevator completely external from the block; they are made in steel and glass to allow visitors to observe the whole unfinished process of the structure and to appreciate the layering of time.

In this way Bruno, with the use of modern materials, like glass and steel, for new structures, became a pioneer of the concept of reversibility, stressing the relationship between present and past emphasizing the transformations.

In Rivoli, the historic building and contemporary forms interact together creating in this way a continuity in time; the re-use of buildings which otherwise would be, if not necessarily abandoned, neglected is the best approach

to provide continuity for a built heritage. The continuous adaptation of a building (through a re-functionalizing restoration) reflecting the necessity of contemporary society is the only way in which a monument can be preserved.
The history of the place at this point becomes a tool for the designer and for the restorer and can help in identifying the way to approach the building.

2.1.4.2. Società Umanitaria

Restoring the Convitto does not only mean taking care of the building itself, as a curative or palliative treatment to restore it to a healthy and not decadent state of health.
But restoring it also means giving the guarantee of historical continuity, allowing it to be experienced by users, so that it is a reference and attractive point for the city.
Do not guarantee this condition to an immediate monumentalization, but to a subsequent and progressive abandonment as well as to an irremediable loss of collective historical memory.
Therefore, only through the receptivity of the place, it is possible to guarantee its historical continuity, so that it continues to be loved and appreciated.

2.2 Fear insertion in the present

"You can't think of architecture without thinking of people."
"Non si può pensare un'architettura senza pensare alla gente." Richard Rogers

2.2.1. Monumentality and characterizing elements in Società Umanitaria

What is a monument? What was the meaning of this word in the past?
.... even a literature monument of second rank, as for example a torn piece of paper reporting an unimportant brief news, contains - beside its historical value for the fabrication of paper, writing and materials suitable to writing and so on - a series of artistic elements.
... a monument (...) is every realization of man, which has at least 60 years...
"In accordance to contemporary concepts, it does not exist an absolute artistic value, but just a relative one.
the safeguard of monuments is subjected to this decisive influence.... the definition of "monuments" ..... can be intended not in an objective way, but only in a subjective way*
.... nowadays should rarely happen that a monument would be destroyed just for its "relative artistic value" (or better, of its "non artistic value") Alois Riegl, Modern cult of monuments: its character and its origin, 1903

"The concept of a historic monument embraces not only the single architectural work but also the urban or rural setting in which is found the evidence of a particular civilization, a significant development or a historic event. This applies not only to great works of art but also to more modest works of the past which have acquired cultural significance with the passing of time." Art.1, The Venice Charter 1964

Franceschini Committee (1964-1966)
(The Italian cultural heritage has)'"' preeminent value of civilization, absolute, universal and not transitory, so as to it is characterized as world heritage, of which every single owner, every Nation, every generation must consider itself only as guardian and so responsible in front of society, of the whole civilized world and of future generations"

Document/Monument of the Einaudi encyclopedia (Jacques Le Goff, 1978)
Being knowledge of the past, history would not be possible if the past had not left some traces, monuments, as supports to collective memory.
Before today, the historian has made a choice

between traces, favoring some monuments, especially the written ones.
Nowadays this method has been subjected to a change. It is not more making a choice between monuments, but to considering documents as monuments, so as to put them in a row and treat them in a quantitative way. Furthermore, they should be inserted in sets of other monuments: rests of material culture, collections, housing typologies, landscape, fossils, and in particular, bone rests of men and animals. Finally, taking into account the fact that every document is at the same time true and false, it is important to show the production conditions, and to show in which way this is a powerful tool.

"It is not the restoration of the image but of the materiality of heritage, restoration is at first place conservation of the authenticity of a building"
Cesare Brandi, Teoria del Restauro, 1963

Monumentality of Società Umanitaria

Generally, we are inclined to think of the concept of monument as a significant and extraordinary event, with a unique identity, linked to the world of the past.
However, this concept is wrong as each entity belongs to a historical and cultural context that characterizes it.

Considering the entire complex of the Società Umanitaria, there are many monumental elements, starting from the ancient fifteenth-century cloisters, the floorings, the buildings of the 1950s, the more modern and rational types including the Convitto.

"The challenge that their conservation can generate lies in the comparison with their status of heritage, that is of an asset to be transmitted, in a society that has changed its scale of values [...] and in a physical, economic and functional context very quickly transformation. Retaining means acknowledging these changes. Rather than attempting to restore all that is a modern heritage to its original state, the goal must be to develop a grid of criteria that takes into account the state of knowledge of the artefact, through which to evaluate what are the significant characteristics of an architecture: with respect to the personality of the designer and his language, the place and time, the materials, the client, the collective memory. The challenge lies in designing change without betraying the legacy that the architects of the twentieth century have left us." Conservare l'architettura. Conservazione programmata per il patrimonio del XX secolo, pag16-17.

From a deep analysis of the Convitto, it is evident which are the main features that characterize the building which allows us to identify the

"grid of criteria". The structural elements have a fundamental role in the characterization of the Convitto; in fact, they form a grid that is extruded from the facade and which is also able to create a module that will be repeated on the whole building. The vertical elements are composed of 11 and 9 reinforced concrete pillars, respectively on the east and west elevation, while the horizontal ones are composed by a horizontal slab. The whole load-bearing structure is therefore totally visible and becoming in this way one of the main characters of the Convitto.

As already mentioned, the module is another important aspect; while the first two levels are different from the rest of the building due to the presence of public functions inside, from the third floor to the last one it is evident the repetition of the module which is again representing and following the function inside, in this case being rooms for students.

The frames of the windows are also a characterizing element for the Convitto since their shape and aesthetic is typical of their time and therefore must be preserved.

2.2.2. Transformation and addition of new functions for the Convitto

In a preservation and transformation project, it can happen that the function inside the built heritage might vary with the passing of time.

For example, as in the previous case study showed before, the Church of Brigittines, the religious vocation of building was forgotten to become an art centre. This new function required more space than the one that the building could offer. This is the reason why many restoration projects deal with additions, when the surrounding space can allow it. In the case of the Church of Brigittines the architect chose a strong way, using the juxtaposition of volumes and materials, therefore making it very recognizable, and at the same time he was able to provide the space needed by the artists and the people that are now the users of that building.

In the case of Società Umanitaria the original function of the Convitto tower, designed to be a housing, is kept, but the necessity of the society and the needs of the students that will be the real users of the building did not remain the same. In order to provide a more comfortable and functional space, two volumes attached to the tower were added; their goal is to provide functions that can be used by both the inhabitants of the Convitto and the people from the city.

The approach in this case is a little bit different from the one described above. The design of the addition is still connected to the concept of juxtaposition but in a more gentle way, without overwhelming the building. The two volumes

are moreover positioned in a strategic point following the traces of the past and the memory of the history.

2.2.3. Structures in reinforced concrete in the XX century

Research and innovation in the field of building materials have always distinguished and influenced architecture.
An iconic material, perhaps the most revolutionary in history, is certainly concrete.
In ancient times, cement-based materials were obtained through the crushing and subsequent combustion of raw materials such as gypsum and limestone.
Originally this mixture, similar to mortar, was obtained by adding variable proportions of water and sand; the main use was to hold together the different pieces of stone in horizontal constructions.
For many years these materials have been combined with others to improve their capabilities and performance. An example of this aggregation is modern concrete.
The modern concept of concrete is instead radically different, this is obtained by mixing cement mostly Portland type, with fine or coarse aggregates of stone and sand and water. The process is therefore absolutely industrialized to obtain a maximally homogeneous material and with a consequent optimal stress behaviour. Furthermore, today there are additives of chemical origin, which are added to the concrete mix to control its setting or hardening properties, allowing applications in extreme environments exposed to saltwater or extreme environmental conditions in terms of temperature or wind.
Throughout history, reinforced concrete architecture has always been covered with plaster until the 19th century, except for industrial buildings, because the concrete was considered socially unacceptable as a building material for aesthetic reasons and its rough appearance.
By the way, structurally it is not strong enough using only structural concrete, in fact, concrete is a rigid material, very resistant to compression, but it does not work well in the presence of bending, traction or torsion. For this reason, it has been perfected with the use of steel rods as a complementary resistance.
In the architectural field, during the late nineteenth century, the use of concrete and then reinforced concrete was developed in particular by Francois Hennebique, and by Ernest L. Ransome.
Ransome began building with reinforced concrete in 1877, the year in which he patented a reinforcement system with twisted square bars; his projects, however, were mainly in the industrial field.

The first to build residences was Hennebique, he began building steel houses in France, receiving patents for his system, but those works were mainly industrial.
In 1902, however, the French August Perret built a multi-storey residential building in Paris using reinforced concrete for the entire load-bearing structure. The architect, fearing possible cracks or cracks, decided to refine and colour this mixture, thus building an elegant facade. Perret thus managed to make a raw material such as concrete a more socially acceptable material even in the city. This design was influential in the design of reinforced concrete buildings in subsequent years and still today, for residential and industrial buildings, allowing thousands of architects to develop new technologies, structures and forms.

Problems and decays

The main causes of damage and degradation for reinforced concrete are consequences of the typical conditions of urban exposure, the most common being carbonation and corrosion of steel.
One of the main causes of steel is corrosion of the rebars.
Generally, this phenomenon begins with the superficial cracking and is then followed by the chipping of the concrete cover, which leads to the subsequent possible structural failure.
This phenomenon is also visible aesthetically as it affects the external surface vulnerable to exposure to external agents with cracks or rust spots.
Furthermore, carbonation or the penetration of chlorides (salts) or stray electric currents can accelerate or induce the degradation process.
Carbonation occurs when atmospheric carbon dioxide reacts with alkaline parts of the cement. This results from a progressive pH, which thus approaches neutral values close to pH 7. Therefore a general attack on the steel can occur, increasing oxidative phenomena, such as rust, generating tensile stresses in the concrete cover towards the outside, which will eventually lead to cracking or chipping.
The phenomenon, therefore, begins with corrosion due to carbonation, then continues spreading until it reaches the reinforcement bars, and thus has led the concrete to crack.
The main impediment factors are three: the thickness of the concrete cover in the first place, the humidity of the concrete in the second place and finally the ratio of water and cement.
The corrosion rate is high when the risk is exposed to external conditions, in equilibrium with a relative humidity of around 80-95%.

2.2.3.1. Torre Velasca

The analysis of the conservative restoration of Torre Velasca is useful since it presents characteristics which are compatible, from a structural point of view, with the Convitto.

Torre Velasca was designed by the B.B.P.R. studio (Banfi, Belgioioso, Peressuti, Rogers), structurally checked by eng. Danusso and built in 1956-1958.
The tower is 106 m high and has 29 floors. It can be divided in three main zones: the lower part un, from the ground level to the 15th floor, the intermediate part from the 16th to 18th floor, and the upper part till the 26th floor.
The external perimeter is characterised by projecting load-bearing pillars, beams, struts and T-beams, which are both a structural component but also they define the character of the facades and the whole building. The first works on the facades had been carried out in 1978-1979, than in 1995 because of evident deterioration on reinforced concrete parts.
The reinforced concrete elements that compose the tower can be considered separately in structural and decorative elements. The structural elements are the struts, the tie-beams and the pillars; while the decorative elements are the parapets, the window ledges and newels and

Fig. xx: View of Torre Velasca

Fig. xx: View of the top part of Torre Velasca

panels.
An accurate evaluation and diagnosis of causes of deterioration was carried out both on the structural and decorative reinforced concrete elements.
From the detailed visual inspection of the structural elements, several observations were captured: the presence of sealed cracks on the plaster, existing repairs over large surfaces on the struts, no clear sign of corrosion-induced damage.
For the decorative elements, it has detected the presence of sealed cracks, evidence of corrosion on newels, parapets and window ledges and no corrosion-related phenomena on the panels.
The first step is characterizing the type of materials for each element of the tower and its relative chemical composition, to understand the iteration between different materials.
For the structural elements, another important factor is understanding the thickness of the concrete cover over the rebars to analyze the severity level of carbonation phenomena. In the case of Velasca tower, the analysis shows that most of the steel reinforcement is in passive condition, this means that there's no structural danger, but if ignored it could lead even to failure; for this reason a conservation project must be carried out.
The analyses showed that the cracks in the plaster of structural elements cannot be attributed to

Fig. xx: Pictures showing some dected decays on the structure and elements made of reinforced concrete

reinforcement corrosion. Different results were obtained for structural and decorative elements, which had relevant consequences on the restoration strategy.
This analysis also shows that the presence of a thick and dense layer of plaster on the structural elements prevented carbonation of the concrete cover and prove also to be able to keep dry the concrete cover and prevent corrosion of steel bars already reached by carbonation. As a consequence, the risk of corrosion-induced cracking is low on these elements, as long as the

plaster is maintained or replaced.
The choice of the restoration technique should then be aimed either at preventing wetting of concrete, thus keeping low the corrosion rate of steel, or at the re-passivation of the concrete cover.
Where the concrete does not present passive protection in the reinforcement, it is necessary to intervene promptly on the areas involved by replacing the concrete, this intervention is however very invasive. Otherwise, other repair methods can be considered thus avoiding the removal of the concrete lining, thus making the work less invasive.
In Torre Velasca it was estimated that about 20% of the reinforcement bars were no longer passive, and it was expected that this percentage would not increase significantly in the future.
Assuming that this effect can continue, conventional repair limited to the few local cracked areas could prove effective, allowing for extensive retention of the materials in their original look and texture.
Thanks to the coring, however, it is noted that the layers of plaster and mortar are often detached from the underlying concrete, probably this is also favoured by the vibrating stresses of the coring due to the rotation and friction of the instrument. It is therefore clear that the weak point is the interface between the layer of mortar and that of concrete is a weak point, therefore it requires careful investigation, in fact, during the inspection, this aspect had not emerged.
In fact, in the absence of good adhesion, the concrete does not benefit from protection from water and the corrosion of the reinforcements immersed in the carbonated concrete could propagate proportionally to the level of humidity.
According to the visual inspection and the preliminary analysis, which allowed the mapping of the deterioration on the facade of the Convitto and the analysis of the Velasca tower, it emerged that the general condition of the Convitto does not show significant signs of deterioration that would lead to serious safety consequences.
The presence of a thick layer of plaster allows widespread protection from humidity which is the primary cause of carbonation in reinforced concrete. This condition presents only superficial hair-cracks and fessurations, and only in some points moderate detachment with consequent partial exposure of the reinforcement bars.
Therefore, this condition allows a less invasive and more precise intervention compared to that of Torre Velasca, where instead a complete coating of plaster and cathodic protection has been proposed on the entire structure. However, this type of intervention is extremely expensive, although effective and not necessary in any case of carbonation.

2.2.3.2. Brazilian museum of sculpture Paulo Mendes da Rocha

The Brazilian Museum of Sculpture was designed by Paulo Mendes da Rocha.
It is built on a triangular site in São Paulo, Brazil.
The museum and the landscape are treated as a whole, avoiding the creation a free-standing building as icon of itself.
Underground internal spaces are created by large slabs, which are also creating an exterior square with pools and an esplanade. An immense beam (97-foot long, 39-foot wide) frames the museum, satisfying the need for shade and shelter for the external plaza. In this way the focus is put on the visitors who are the real users of the plaza and that can they can take advantage of it for appreciating some time of relax, relief and even to attend performances.
The raised concrete beam becomes the framing of the surroundings.
Depending on the proximity of the visitor to the structure, a short, wide sliver of space is visible between the beam and the surface of the square, and with the dull grey of both the view beyond is emphasized, which acquires importance through the visitor's experience.
As the sculpture changes in relation to the viewer, the context is in this case changed by the building's presence and the visitor's relation to it.

The materiality and the architectural composition are two of the main characteristics of this project.

This architectural concept can also be re-proposed in the Società Umanitaria; in this way it is possible to create different spaces that are able to respond to the needs of the lot and at the same time make it a unique space which is capable of changing appearance to the position of the viewer.
In addition, the use of reinforced concrete in relation to the Convitto allows to create not only a material continuity but also an historical one, as it becomes a link between what already exists and what is added.

Fig. xx: Picture of the reinforced concrete slab of the Brazilian museum of Sculpture

Fig. xx: Picture of the reinforced concrete slab of the Brazilian museum of Sculpture

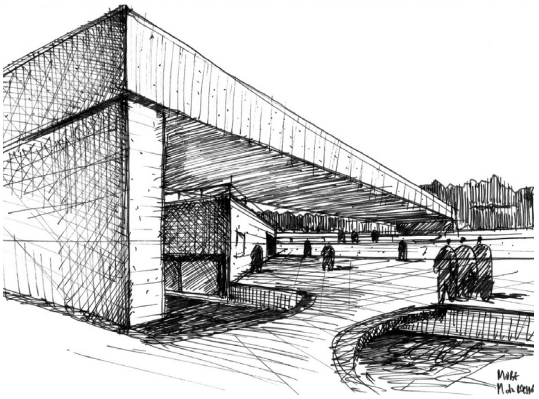


Fig. xx: Sketch of the reinforced concrete slab of the Brazilian museum of Sculpture

Fig. xx: Picture of the reinforced concrete stairs

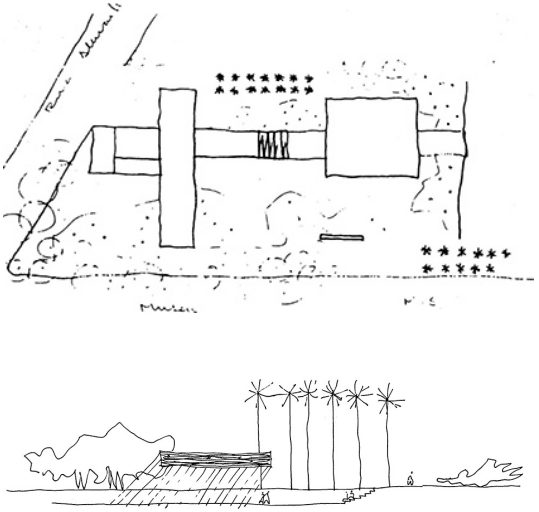


Fig. xx: Sketches of the project by Mendes da Rocha

2.2.4. Relationships between different materials

"Each material has a formal language that belongs to it and no material can claim forms that correspond to another material..."
"Ogni materiale possiede un linguaggio formale che gli appartiene e nessun materiale può avocare a sé le forme che corrispondono ad un altro materiale..." Adolf Loos

The combination of different materials in an architecture represents not only the figurative composition, but can also identify the function itself of the architecture.
In the projects, the choice of materials derives from a functional need.
For this reason, in the restoration and transformation project of the Convitto, different materials were used to mark the difference from the existing ones.
In this way it is possible to read a stratification from an altimetric point of view, understanding who supports what also from a structural point of view.
Furthermore, this choice derives from the desire to show the lower materials as heavier to support slender materials lighter in the highest part of the project.

2.2.4.1. Cross Laminated Timber

Remise Immanuelkirchstrasse (https://jwa.berlin/en/immanuelkirchstrasse/)
"Cross laminated timber" is a structural two-way spanning timber panel that can be used to form walls, roof and floor panels as well as shear walls. The high versatility of this system allows the design of the most diverse architectural solutions.The Xlam construction system allows excellent thermal insulation and guarantees high fire resistance, a fast drying process and good sound insulation; these are some of the reasons why it is an excellent material in the construction of residential spaces. Its great flexibility is a fundamental characteristic that was taken in consideration while deciding the materials for the project.

2.2.4.2. Steel and glass architecture

Pac – padiglione d'arte contemporanea by Gardella
Il padiglione d'arte contemporanea fu progettato dall'architetto Ignazio Gardella, per contenere le collezioni d'arte contemporanea del XX secolo.
Lo spazio interno è estremamente flessibile, un ambiente continuo articolato da piccole variazioni di quota, tramezzature mobili e diversi tipi di illuminazione. Lo spazio principale è una sala di 600 metri quadrati, soprelevata di un

metro rispetto all'ingresso, che mediante pareti mobili può essere frammentata in cinque sale esagonali. Questi ambienti sono destinati a esporre opere pittoriche e sono illuminati dall'alto da lucernari schermati da un controsoffitto di lamelle metalliche bianche.
La struttura portante è in ferro e la copertura con capriate. I serramenti sono anch'essi in ferro, con serrande a contrappeso scorrevoli verticalmente.

CHAPTER 3
Active intervention

3.1 General architectural concept

The project consists in the addition of two volumes and the transformation of the Convitto tower.
The tray is the connection element between the old and the new. The huge horizontal slab starts from the inside of the Convitto and act as already mentioned as a "tray", supporting the two volumes which are the gallery and the guest building.
The tower becomes a student housing and the additions are its auxiliary functions.

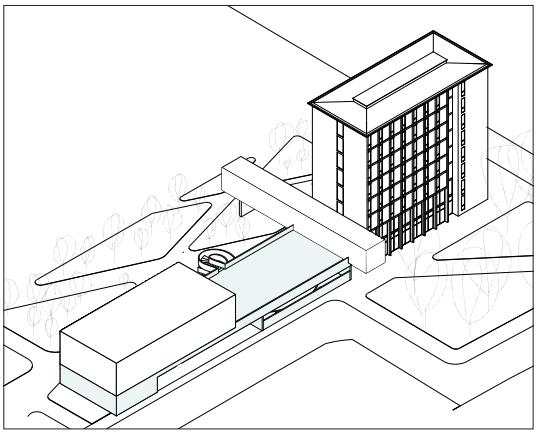


Fig. xx: Diagram of the project showing the addition of the tray

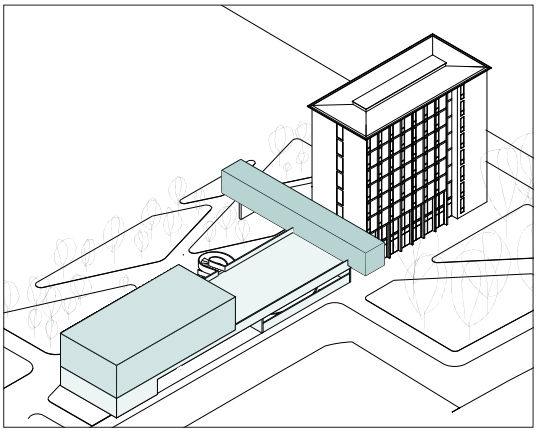


Fig. xx: Diagram of the project showing the addition of the guest building

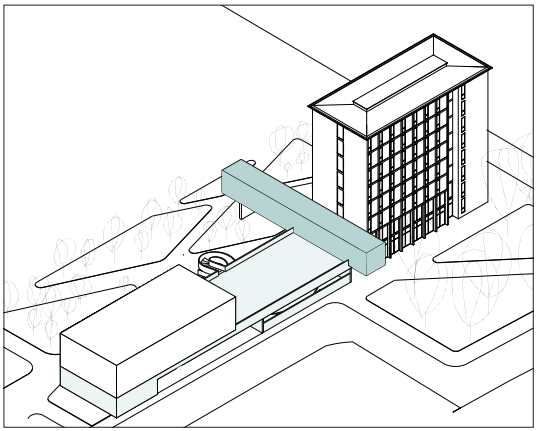


Fig. xx: Diagram of the project showing the addition of the gallery

ASSONOMETRIA
MANIFESTO CON
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3.1.1. Axis based construction

The addition is based on the alignment of the axes. The project by Gardella and Romano follows a grid that is slightly different and tilted from the ones of the original cloisters, however, dealing with the Convitto, and considering the extremely close proximity to the tower, the choice of following Gardella and Romano's grid is clear.

Fig. xx: Diagram showing the alignments of the buildings

Fig. xx: Axial diagram of the current situation

Fig. xx: Axial diagram of the design proposal

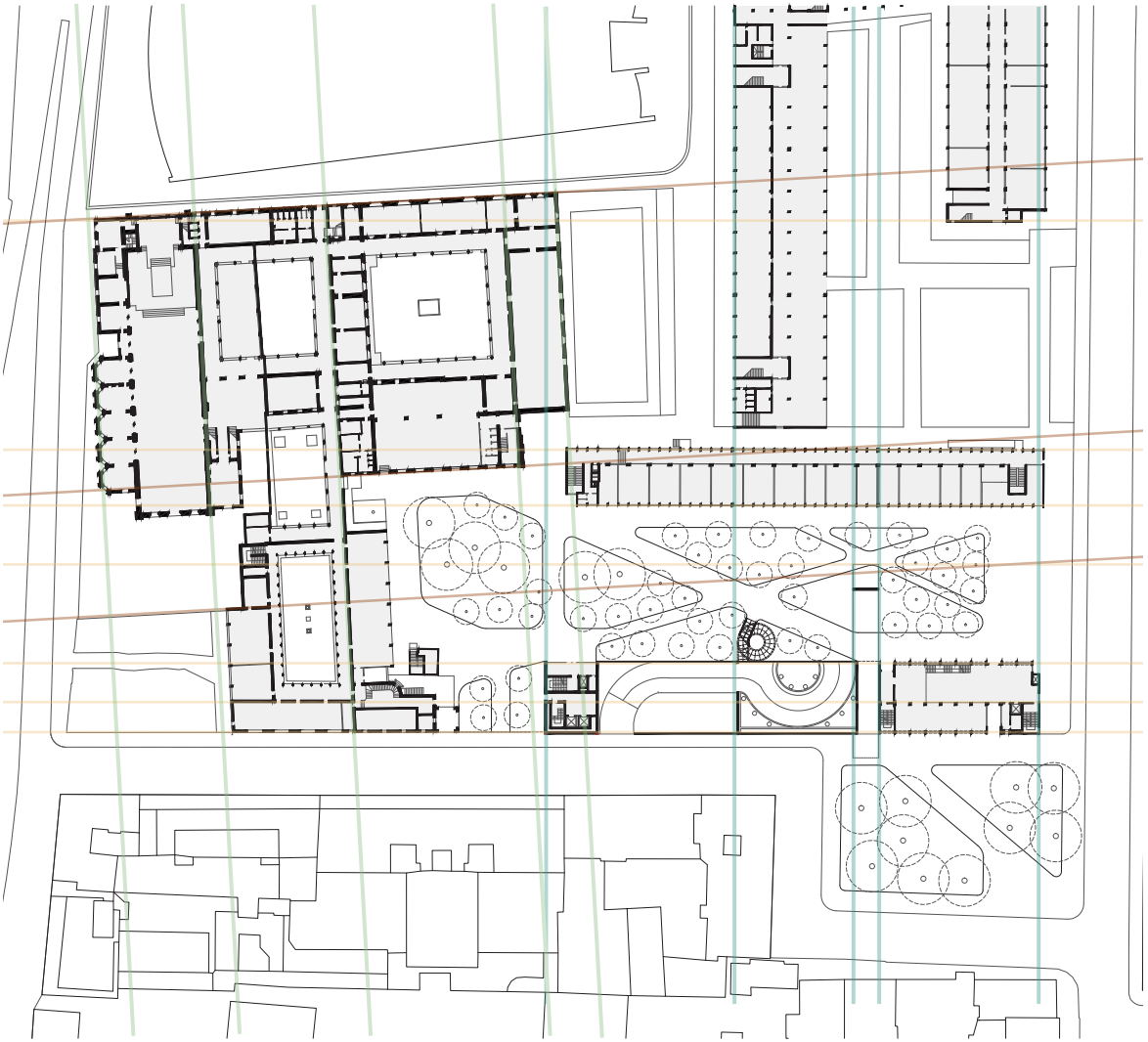


Fig. xx: Ground floor plan showing the alignments between the design proposal and the existing built

Fig. xx: Masterplan

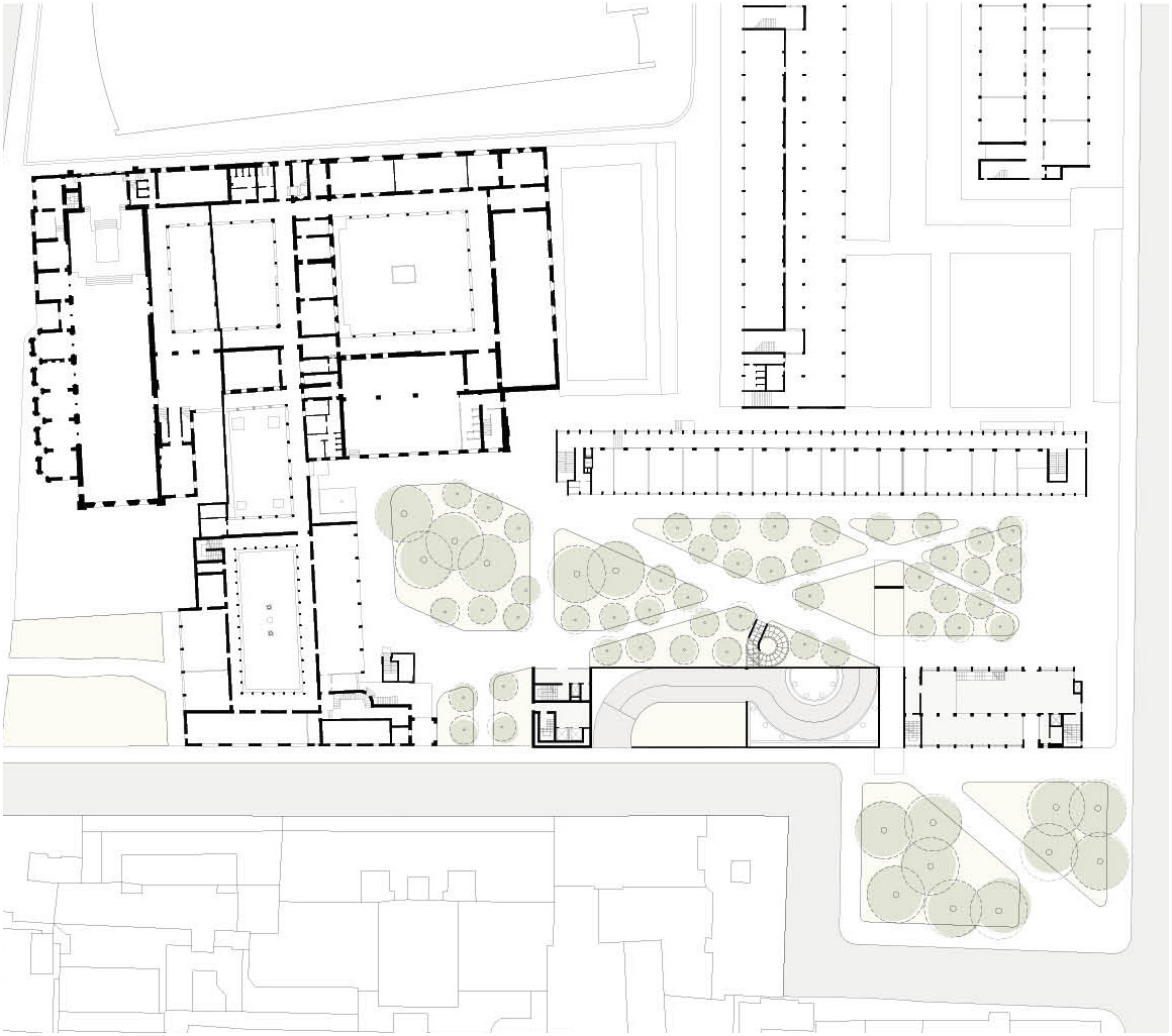


Fig. xx: Ground floor plan

3.1.2. Relation between volumes and voids

"The architectural work is not only the object, but also what surrounds it and the voids, the spaces."
"L'opera architettonica non è soltanto l'oggetto, ma anche quello che lo circonda e i vuoti, gli spazi." Oscar Niemeyer
The void is defined as "the free space in which no solid body stands, cavity" (Vuoto, in Devoto G., Oli G.C., Dizionario della lingua italiana, Le Monnier, Firenze, 1979). ["lo spazio libero nel quale nessun corpo solido si frappone, cavità"]
However, emptiness is not the opposite of fullness, and it is worth no less. The void is richer, as a place of infinite possibilities, therefore, designing in architecture means being aware of the value of space as a place, which is why the project is not only the building, but also the design of the urban space.
Therefore, the analysis of the bodies and masses led the project to a progressive balance, to identify a suitable proportion, thus finding the right scale of the project.

3.1.3. Public and private spaces

One of the great dichotomies in the design of space is identified in the oppositional definition of public and private. A definition that develops by negation through that "non-public" for which tertium non datur (latin: "a third possibility is not allowed")
Public and private, understood as ecclesia and oikos, must be understood as complementary and synergistic, that is, as two very spheres of the polis.
In today's world, the politics of conformity, unfortunately, make public/private spaces rare and too often empty.
The project, therefore, sets itself the goal of creating a liveable and lived-in space, ideally recreating a controlled public square, maintaining the distinction from the private domestic sphere, but allowing contamination.
For this reason, it presents a sequence of spaces connecting the inner semi-public spaces to the public ones belonging to the city.

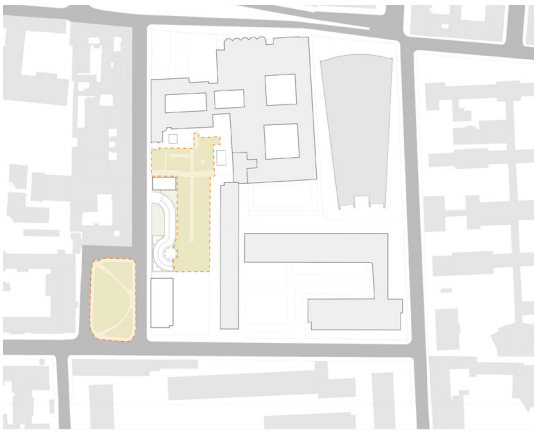


Fig. xx: Diagram showing the green spaces at the current situation

Fig. xx: Diagram showing the road path at the current situation

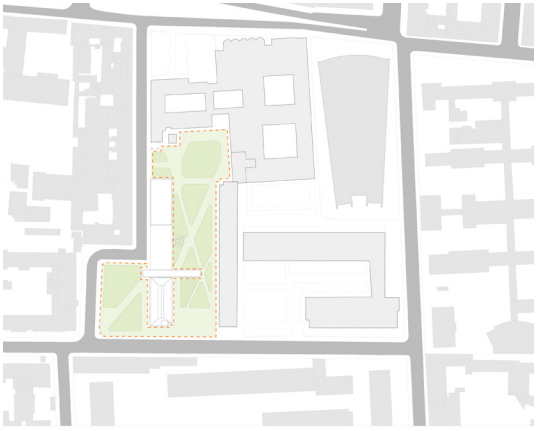


Fig. xx: Diagram showing the green spaces for the design proposal

Fig. xx: Diagram showing the road path and the road interruption for the design proposal

3.2. Transformation

3.2.1. Relation between current state and design proposal

The complexity of the Umanitaria lot is given by the planimetric density of the urban agglomeration, but at the same time by the multi-planarity due to the presence of underground car parks.
Therefore, given the nature of the pre-existing buildings of the Convitto, a detailed analysis of the changes is essential to better understand the changes in the site. This analysis is only possible through a graphical representation in yellow-red that clearly shows the demolition and reconstruction proposals.
Specifically, the structural interaction with the car parks on one side and the changes in the plan on the tower on the other.

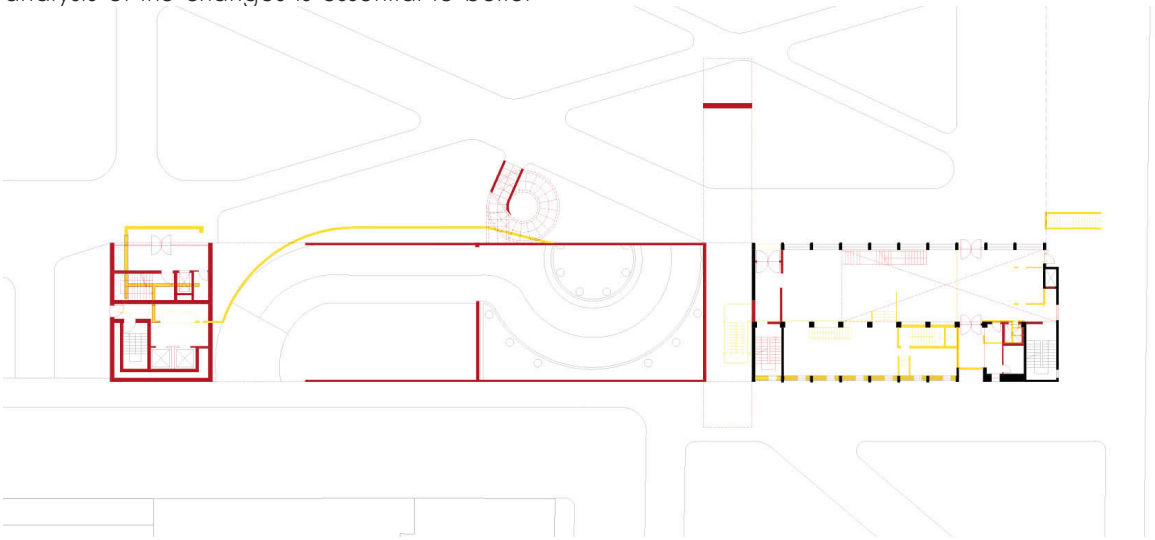


Fig. xx: Demolition and reconstruction plan of the ground floor

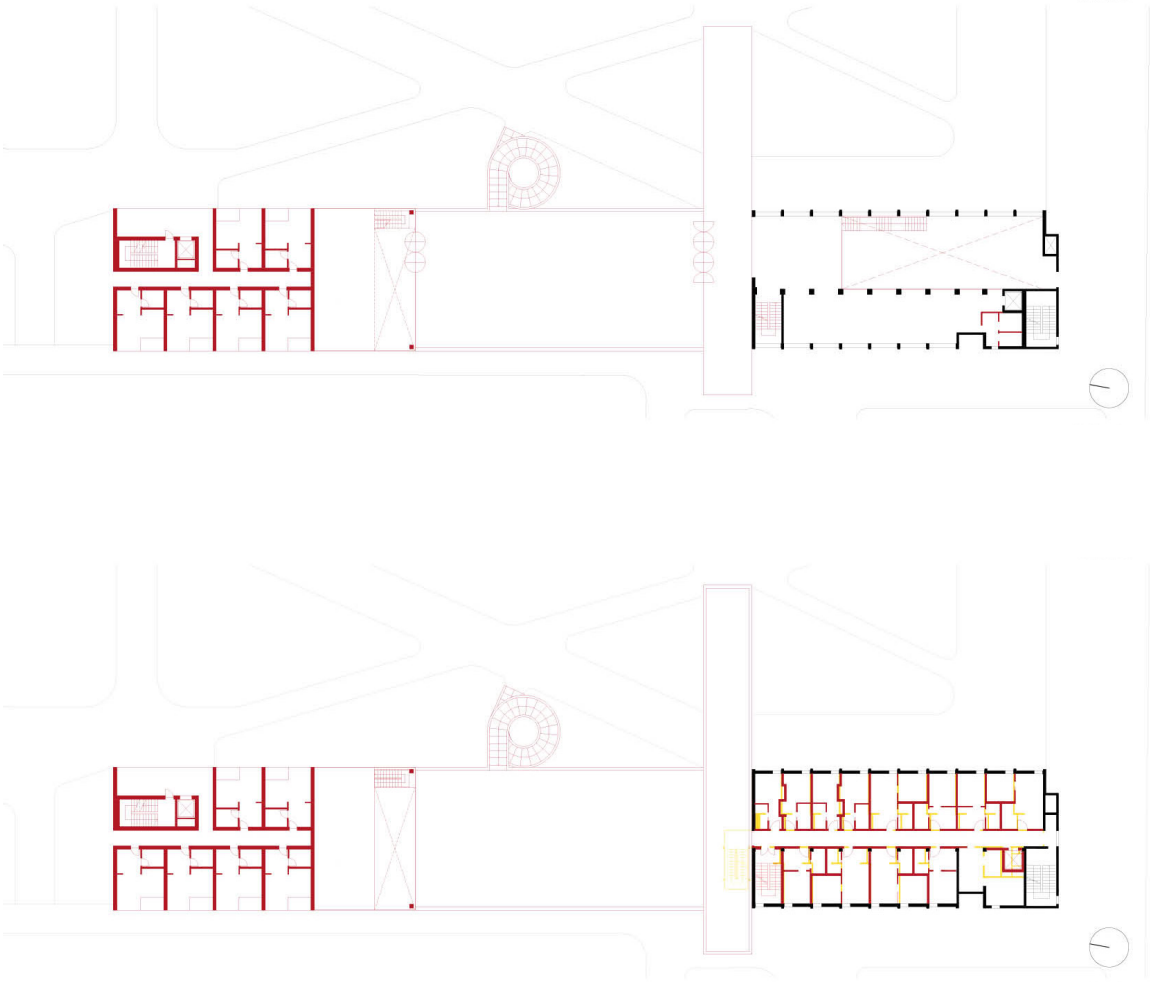


Fig. xx: Demolition and reconstruction plan of the first floor plan and of the typical floor plan

3.2.2. Pemeability and connection with the city

Considering the partial state of neglect due to the non-use of the public space around the Umanitaria, the project aims to enhance this place to make it integrated and allow the user to enjoy all its qualities, from greenery to paved spaces.
In this way, the building is an integral part of the lot and becomes a reason for visiting passage as it is a direct entrance to the lot itself.
The course of via Daverio was also diverted, integrating the park facing the tower, thus making the entrance more attractive and permeable.
Furthermore this new green and pedestrian space isolate the tower from the heavy vehicle traffic of the city. The Convitto in this way is protected and is protecting its users creating a series of spaces.

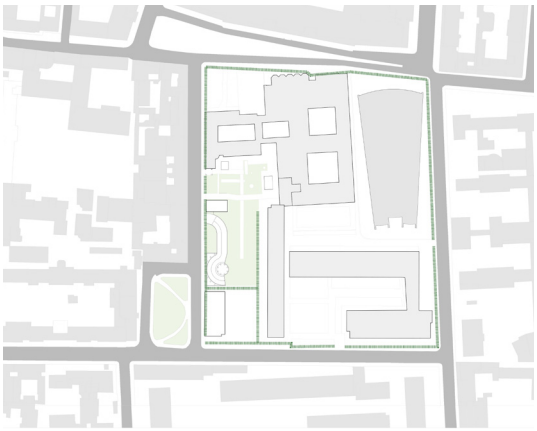


Fig. xx: Diagram showing the scarce permeability of the current situation

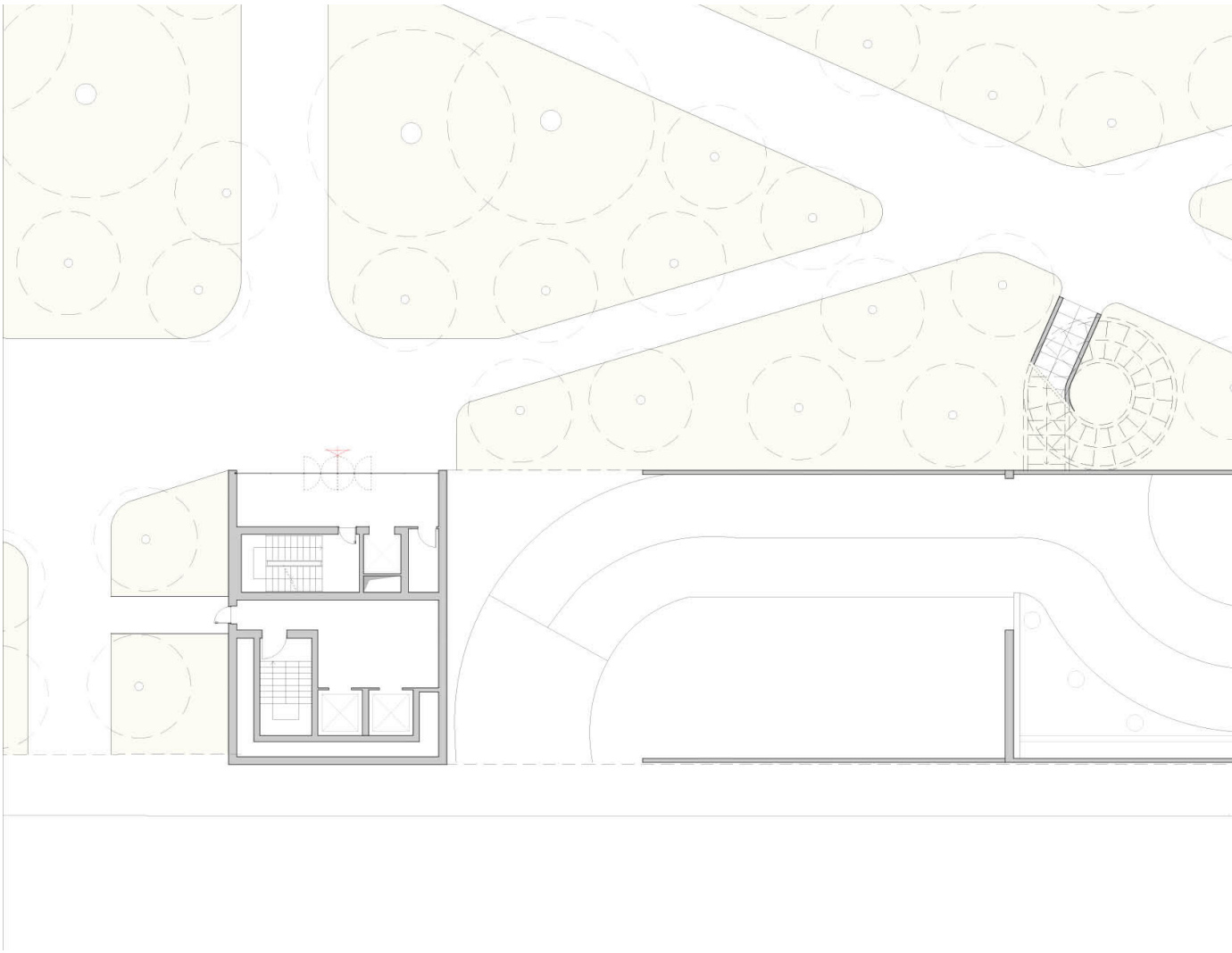
Fig. xx: Diagram showing the permeability of the proposal

3.2.3. Horizontal and vertical circulation

The project being characterized by a multiplicity of related functions, requires a strong connection and reachability.
Therefore all the spaces are designed to be reachable from every point in the space through effective pedestrian paths that make this circulation pleasant, through a continuous different mixture of spaces.

Fig. xx: Diagram showing the horizontal circulation

Fig. xx: Diagram showing the vertical circulation



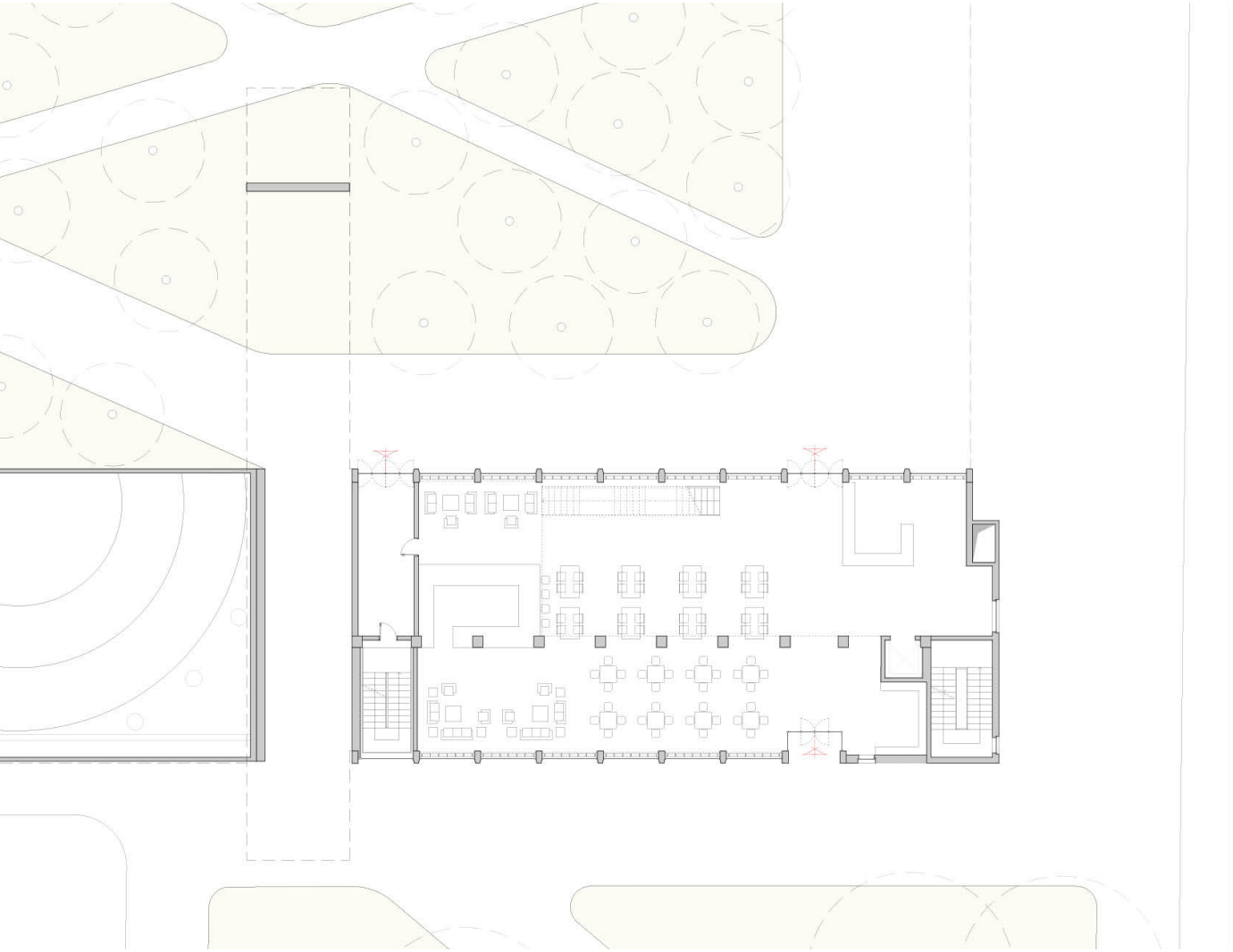


Fig. xx: Ground floor plan

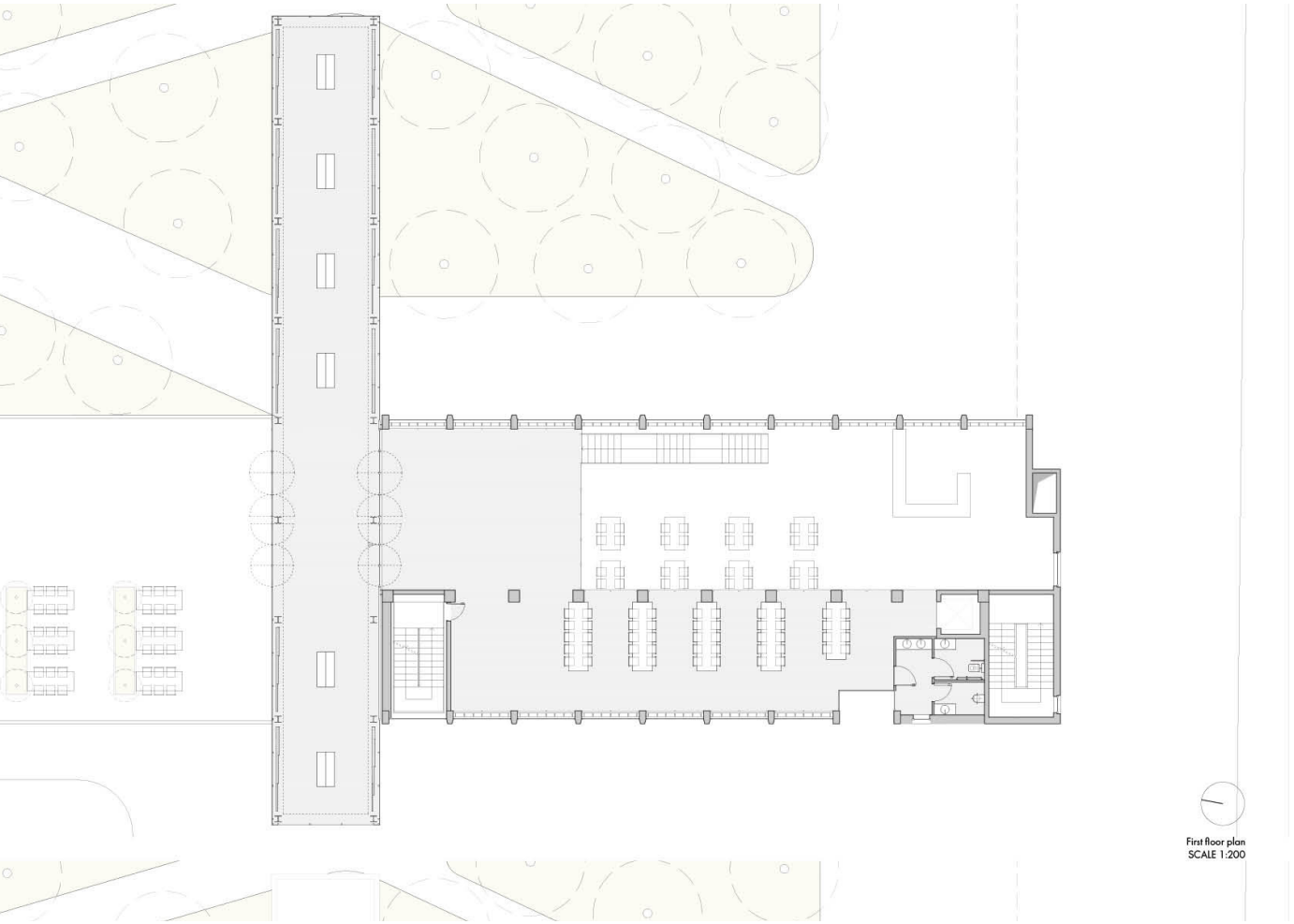


Fig. xx: First floor plan

Fig. xx: Second floor plan

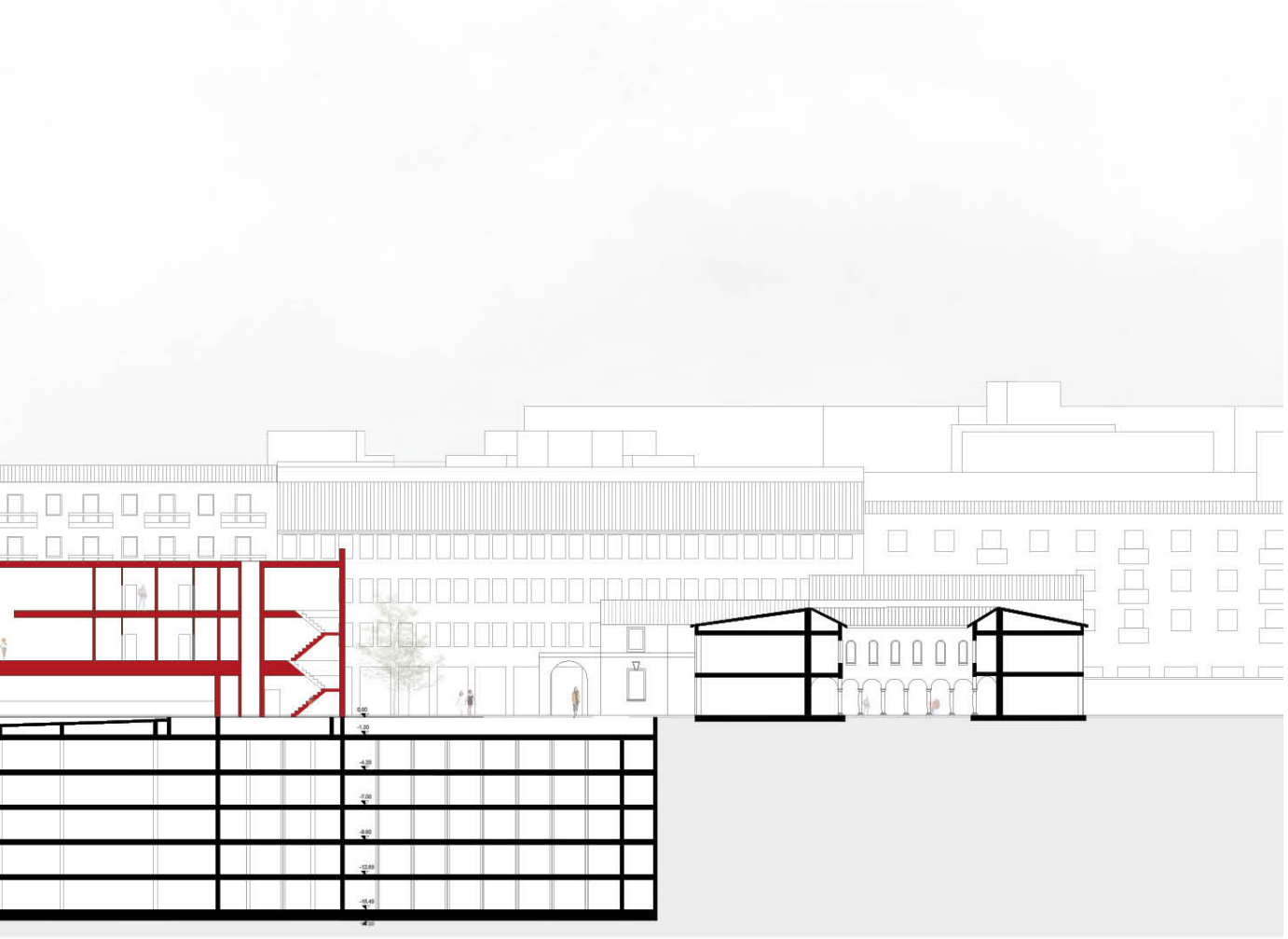


Fig. xx: Longitudinal section

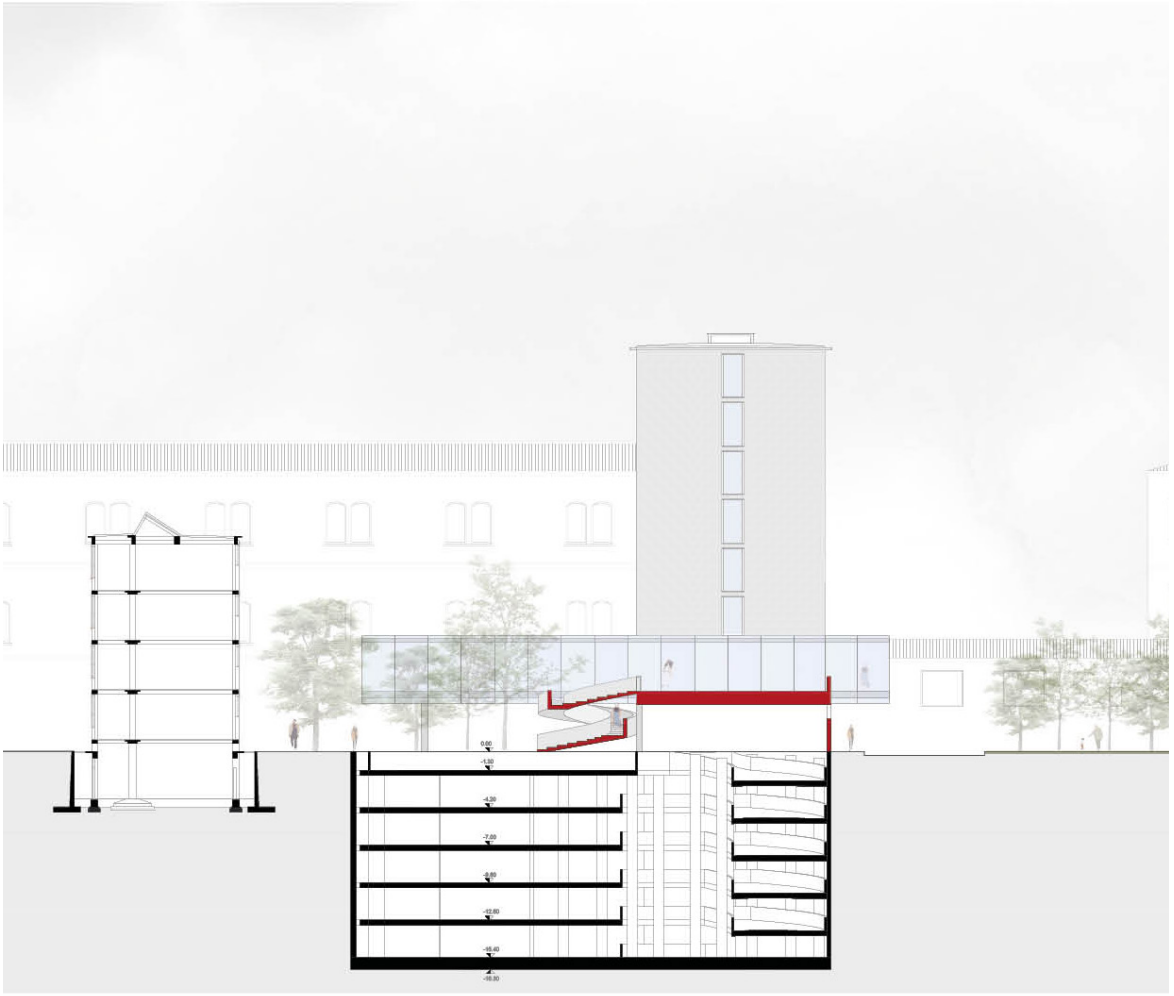


Fig. xx: Cross section

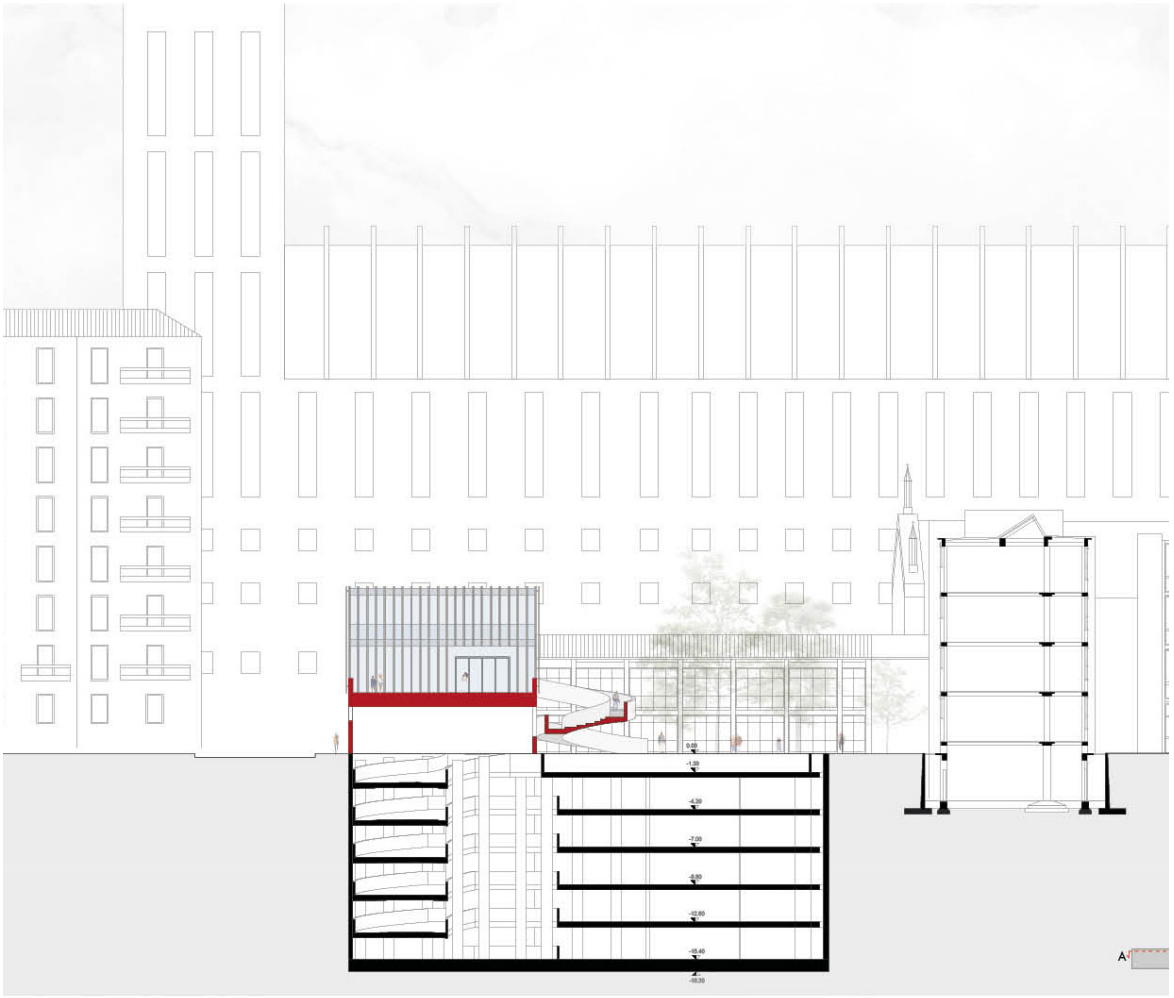


Fig. xx: Cross section

Fig. xx: East elevation

Fig. xx: West elevation

Fig. xx: North elevation

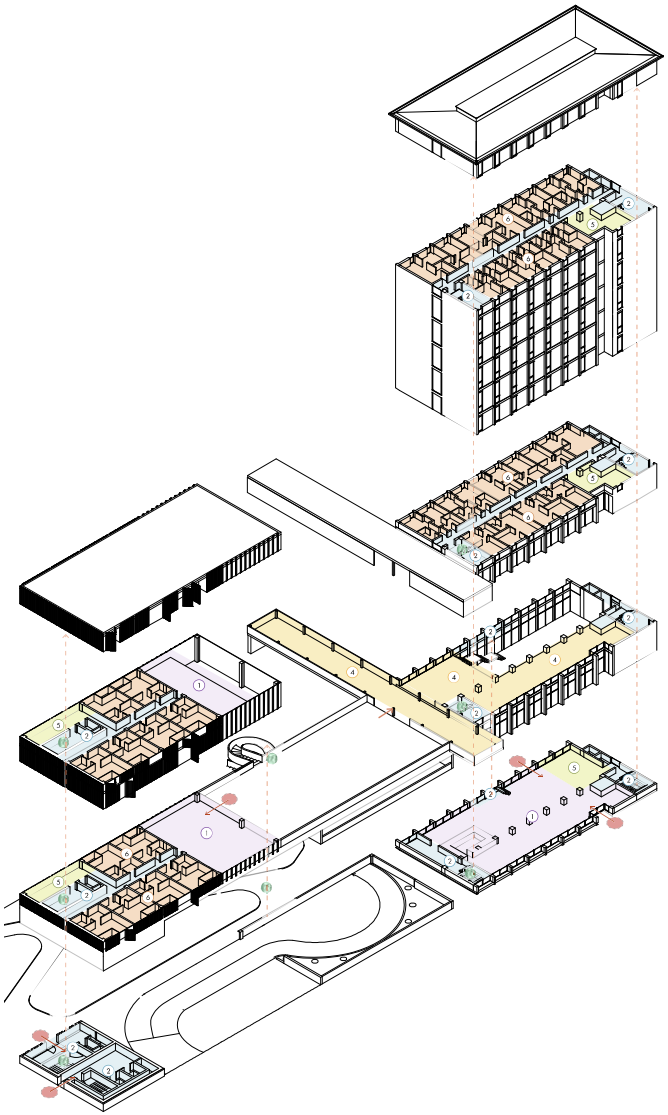
Fig. xx: South elevation

3.3. Functional brief

The Convitto has various functions, it is complete as being mainly intended for residence for students and teachers, it has private residence spaces, but also common reception areas with a bar and waiting lounge areas with chairs and tables for study.
Continuing the description, passing to the exhibition gallery, a neutral and dynamic space for temporary exhibitions and easily equipped.
Going out then, you arrive at the open terrace characterized by spaces for recreation and rest, continuing you arrive at the library overlooking the terrace inside the guest building, this space on two levels is useful for students to read and study, it can also host events of modest size.
Finally, the remaining part of the building is designed for the residence of academic guests for short or long periods, thus also varying the type and size of the residences themselves.
Returning to the garden inside the lot, there are seats and green spaces, with paved areas suitable for temporary exhibitions or outdoor events.

Building	Level	Function	Area (sqm)
Convitto			
	3rd-7th floor		
		Common spaces	29,6
		Distribution	89,6
		Dwellings	264
	2nd floor		
		Common spaces	29,6
		Distribution	89,6
		Dwellings	264
	1st floor		
		Distribution	52,9
		Public spaces	197,6
	Groundfloor		
		Services	233
		Distribution	75,4
		Common spaces	42,5
	Underground floor		
		Services	312
		Distribution	99
Building	Level	Function	Area (sqm)
Guest's building			
	2nd floor		
		Services	91
		Distribution	65,3
		Dwellings	182
		Common spaces	29
	1st floor		
		Services	147,8
		Distribution	65,3
		Common spaces	29
		Dwellings	182
	Groundfloor		
		Distribution	120,9
Building	Level	Function	Area (sqm)
Gallery			
	1st floor		
		Public spaces	179

Fig. xx: Table showing the function and respective m^2



3RD-7TH FLOOR

- (2) Distribution.....89,6 sqm
- (5) Common spaces.....29,6 sqm
- (6) Dwellings.....264 sqm

2ND FLOOR

- (1) Services.....91 sqm
- (2) Distribution.....154,9 sqm
- (5) Common spaces.....58,6 sqm
- (6) Dwellings.....446 sqm

1ST FLOOR

- (1) Services.....147,8 sqm
- (2) Distribution.....118,2 sqm
- (4) Public spaces.....376,6 sqm
- (5) Common spaces.....29 sqm
- (6) Dwellings.....182 sqm

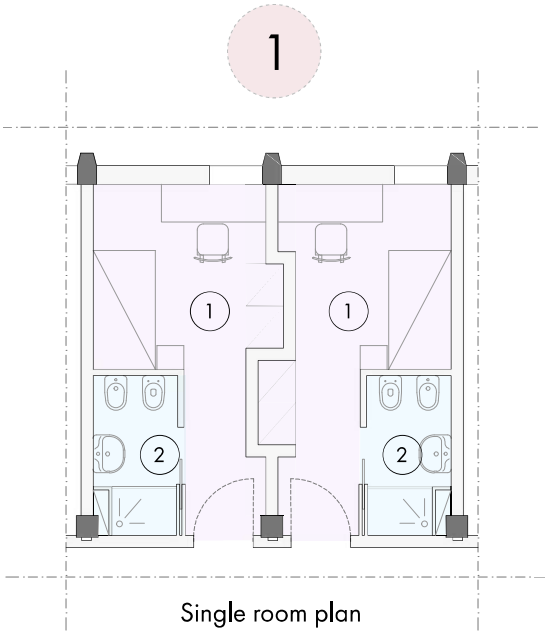
GROUNDFLOOR

- (1) Services.....233 sqm
- (2) Distribution.....196,3 sqm
- (5) Common spaces.....42,5 sqm

Fig. xx: Functional brief

3.3.1. Typological rooms

In the Convitto tower, three typologies of module were created in order to satify the needs of the students and to offer different options.
The first module is composed by two identical single rooms which were mirrored in order to use at best the available space. This is why the wall dividing the two rooms is shaped to host the wardrobes.
The second typology is composed by a single room and a double room with one kitchenette each.
The third and last module is composed by a single room and a room for disabled people.

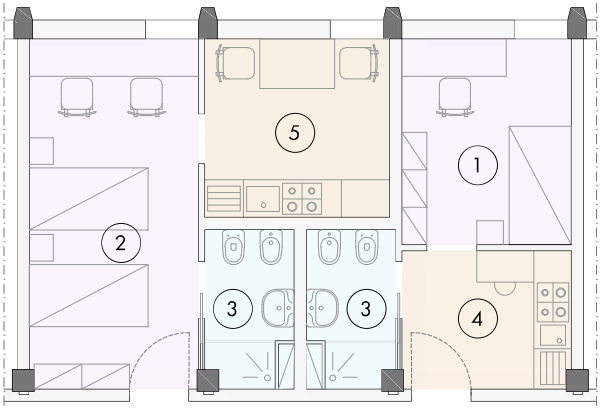


Single room plan

1.Sleeping+studying area - 11.43 sqm

2.Bathroom - 3,45 sqm

2



Single room with kitchenette + double room with kitchenette

1.Sleeping+studying area (single) - 9 sqm

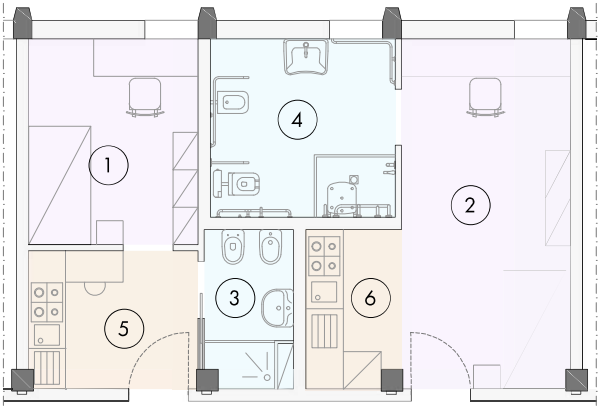
2.Sleeping+studying area (double) - 15,2 sqm

3.Bathroom - 3,65 sqm

4.Kitchen for one people - 6 sqm

5.Kitchen for 2 people - 8,46 sqm

3



Single room with kitchenette + room for disabled people with kitchenette

1.Sleeping+studying area (single) - 9 sqm

2.Sleeping+studying area (single) - 15 sqm

3.Bathroom - 3,65 sqm

4.Bathroom - 8,75 sqm

5.Kitchen for 1 person - 6 sqm

6.Kitchenette for 1 person - 6 sqm

Fig. xx: Typological rooms

3.4. Plan of interventions on the Convitto

3.4.1. Intervention on the reinforced concrete structure

3.4.1.1. Residual service life

According to the previous analyses, to the mapping of the levels of decay on the facade of the Convitto and to the diagnostic examinations the evolution of degradation, i.e. the residual service life of the building, was predicted.
Four stages of corrosion penetration were identified: the first is the corrosion onset, the second one the formation of cracks in concrete, the third the concrete cover detachment and the fourth and last one is the total collapse of the

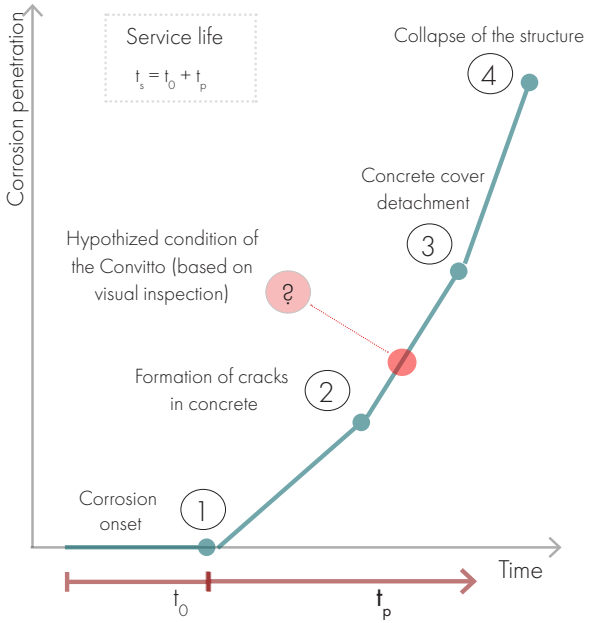
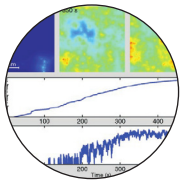
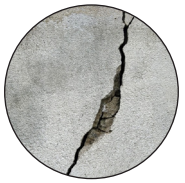


Fig. xx: Diagram of the service life of the Convitto



1 Corrosion onset



2 Formation of cracks in concrete

3 Concrete cover detachment

4 Collapse of the structure

Fig. xx: Phases of service life

structure.
In the graph is possible to understand the condition of the tower at the time of the analysis. From the visual inspection the hypothized condition stands between the second and third step, therefore the state of the building is not critical but needs some intervention.

3.4.1.2. Decision support about restoration strategies

Considering the case study previously analyzed of Torre Velasca and the comparison with the condition of the Convitto, two steps were identified in order to carry out a conventional repair.
The first step is the preservation: it consists in the removal of the carbonated concrete and the consequent application of an hydrophobic film in order to protect the alcaline concrete and the inner rebers.
The second step is the consolidation: a new layer of concrete is placed above the hydrophobic film together with plaster to protect the whole structure.

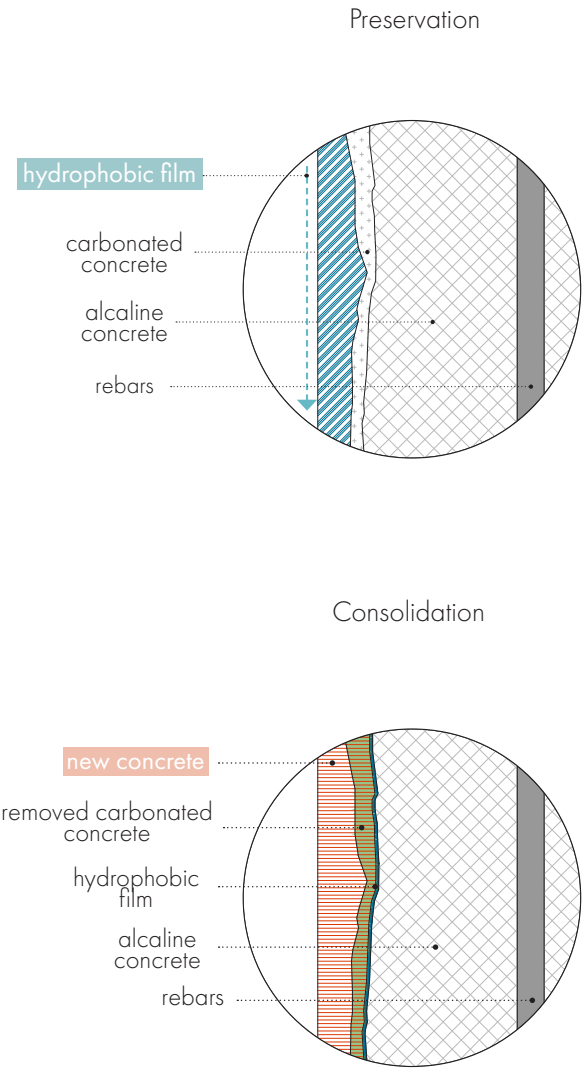
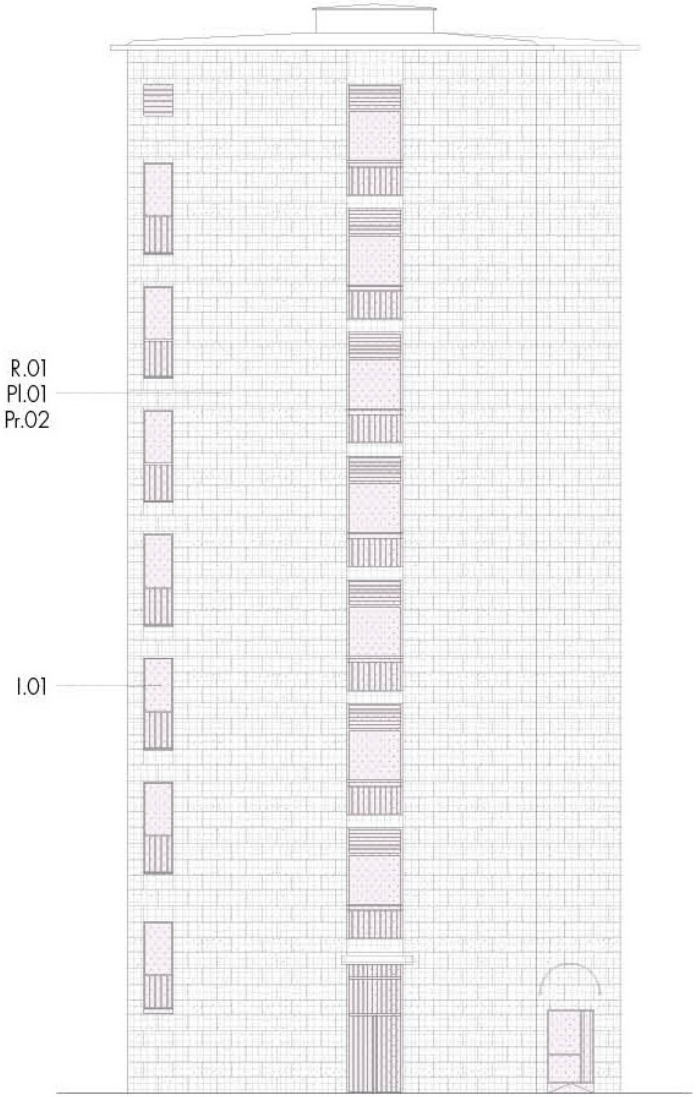


Fig. xx: Restoration strategies in detail

Fig. xx: Mapping of the interventions



REMOVAL WORKS

R.01
Controlled removal of light detached plaster with brushes and solvents.

CLEANING WORKS

Pl.01
Hydro cleaning with deionized and nebulized water (by spray).

Pl.02
Cleaning of copper elements by brushes with chemical products.

Pl.03
Cleaning of existing flashings.

CONSOLIDATION WORKS

Co.01
Sealing borders of light plaster.

Co.02
Application of fillers and masking primers (silicate finishing).

Co.03
Sealing of the micro cracks with adequant sealants. (RC)

Co.04
Consolidation of the pillars. (RC)

PUNCTUAL INTERVENTION

I.01
Replacement of existing window frames.

PROTECTION WORKS

Pr.01
Application of water repellent treatements.

Pr.02
Consolidation of the meteoric water disposal system.

DESIGN CHOICES

Dm.01
Demolished and re-built areas.

Dm.02
Demolished elements.

Fig. xx: Mapping of the interventions

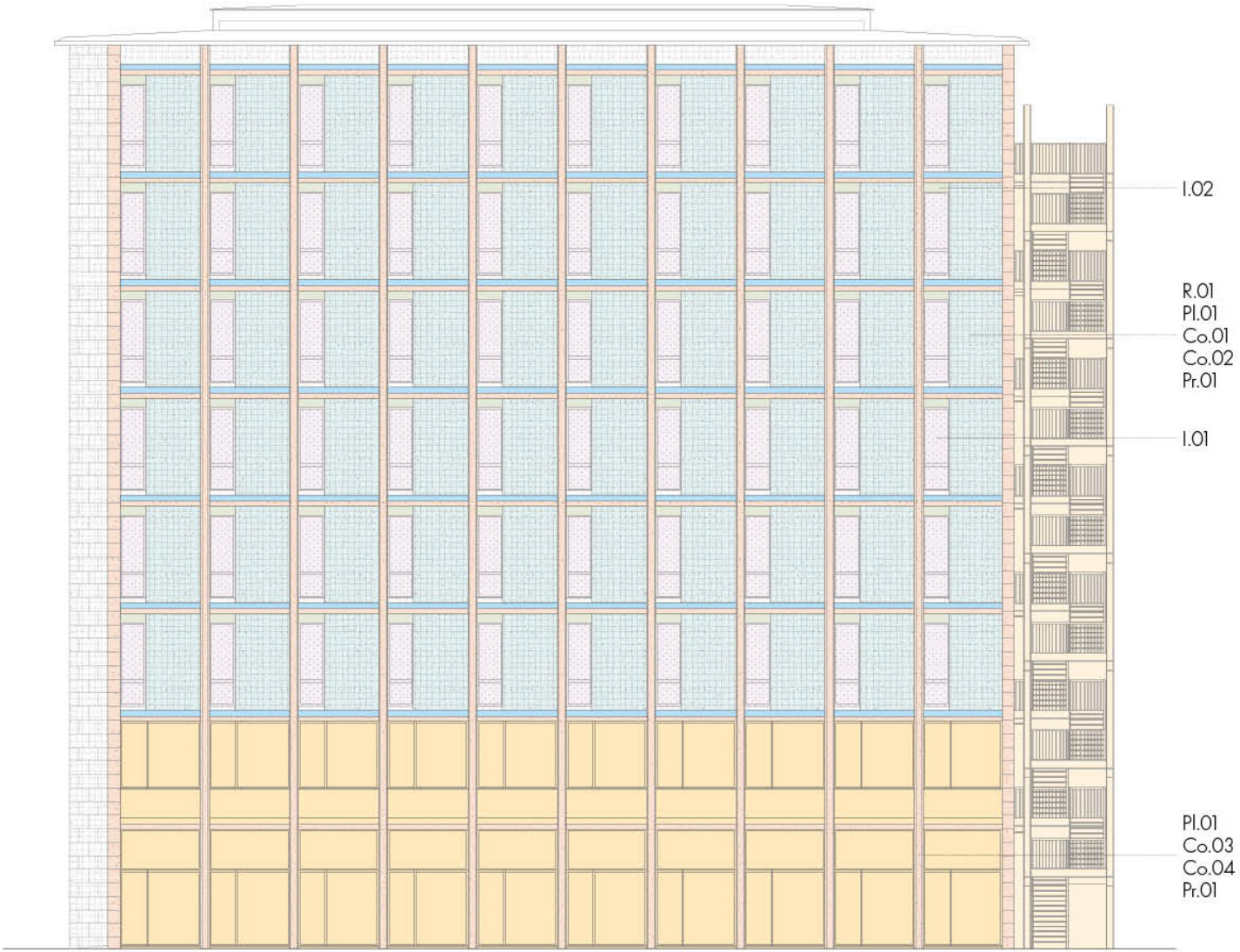
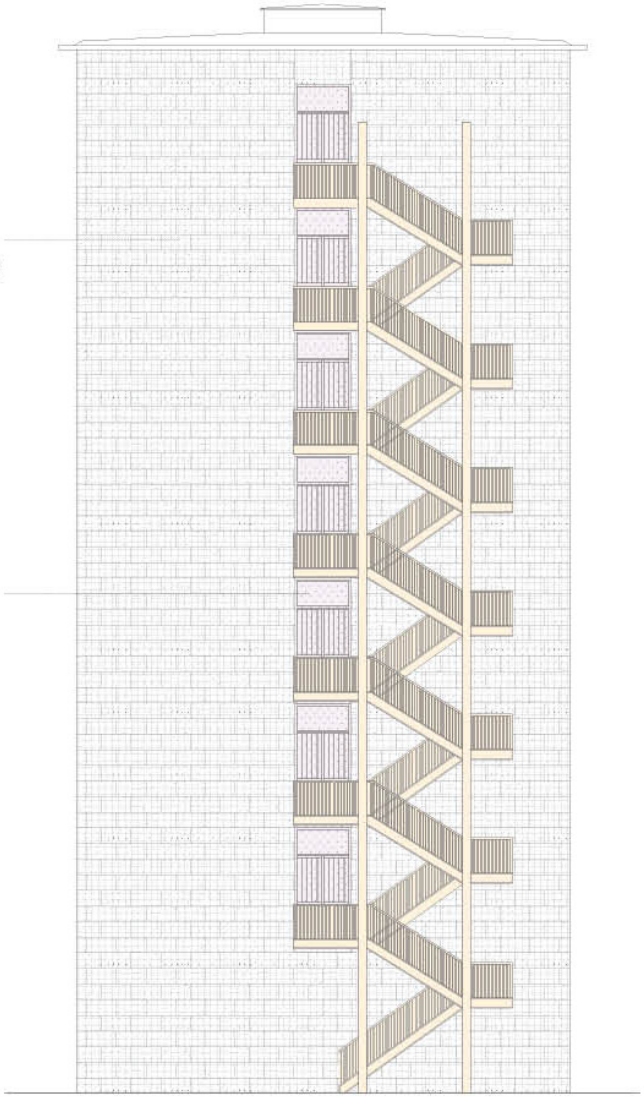


Fig. xx: Mapping of the interventions



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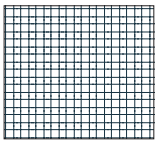


3.4.2. Interventions in chronological order

R.01 Controlled removal of light detached plaster with brushes and solvents

- Removal of the superficial painting by dry brushing. Proceed for horizontal sectors from top to bottom. In the areas where the dry brushing is inadequate to remove the superficial painting film, it is possible to use water by spray to soften the part that must be removed and then repeat the brushing operation.

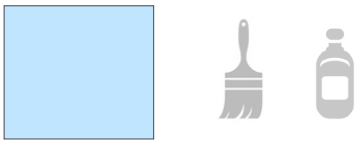
- If the brushing is not enough to remove the superficial painting film, it is possible to use an appropriate paint remover to facilitate the detachment of the acrylic paint. Before using the product, the worker shall carry out one or more tests on small areas, in order to define the timing and mode of application, removal and cleaning of surfaces, taking care not to damage the underlying brick wall.

- Cleaning of the surface.

Pl.01 Hydro cleaning with deionized and nebulized water (by spray).

- Removal of consistent deposits and dry cleaning by manual instruments (such as scrapers, brushes) and with the help of extractor fan, to obtain a surface completely free of dust and rubble.
- Repeated washes until the complete extraction of dust and rubble by cycles of water by spray with brushing.
- Final drying of the surface by soft brushes.
- After the cleaning, the Work Director will estimate the necessity of grouting of the joints before the next step.

Pl.02 Cleaning of copper elements by brushes with chemical products.

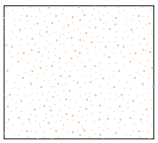


- Cleaning with water with a medium jet for the removal of the debris and dirt from the surfaces.
- Application of acetone with the use of a woolen cloth or a not very abrasive sponge to avoid scratching the surfaces.

Pl.03 Cleaning of existing flashings

- Cleaning with water with a medium jet for the removal of the debris and dirt from the surfaces.
- Application of Key3003 (alkaline cleaner) with the use of a woolen cloth or a not very abrasive sponge to avoid scratching the surfaces.

Co.01 Sealing borders of light plaster.

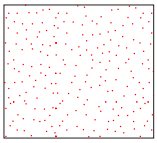


- Protection of surface by masking tape.
- After cleaning in accord to the fact sheet Pl.01 and possible intervention with compressed air, removal of incoherent materials by small instruments, taking care not to damage the surface beneath.
- Sealing borders of plaster with hydraulic lime mortar. The mortar must be free of soluble salts, with mechanical strength and with physical characteristics similar to the pre-existing mortar (pigment, grain, texture, clasts-aggregate relation). The mixture of aggregates must be similar to the existing mortar for grain and color. The seals should be accurately sponged before becoming hard.
- The final color of the seal will be verified from Work Director in relation to the sealed area.

Co.02 Application of fillers and masking primers (silicate finishing).

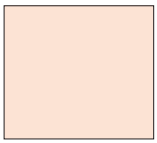
- The portions in which there has been a clear detachment of the plaster need to be filled with antishrinkage mortar (PAULINPLASTER K638).
- When the surface is dry in order to consolidate apply a silicate primer (SILK PRIMER).
- After 12-24 hours cross-brush application of one or two coats of uniforming mineral connection filler for silicate paints (SILK PF523) with average consumption of 0.3 / 0.5 Kg / m^2 per coat.
- Application of MINERAL FINISH paint based on modified potassium silicate with a minimum consumption of 0.3 kg / m^2 in two coats.

Co.03 Sealing of the micro cracks with adequant sealants. (RC)



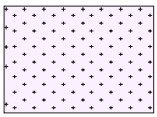
- Cleaning with water with a medium jet for the removal of the debris and dirt from the surfaces.
- Application of acetone with the use of a woolen cloth or a not very abrasive sponge to avoid scratching the surfaces.

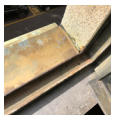
Co.04 Consolidation of the pillars. (RC)



- Removal of the carbonated concrete.
- Apply a layer of hydrophobic film.
- Apply a layer of new concrete.

I.01 Replacement of existing window frames.

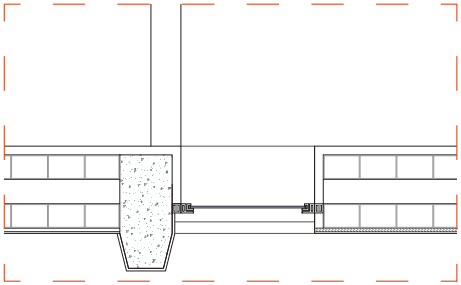




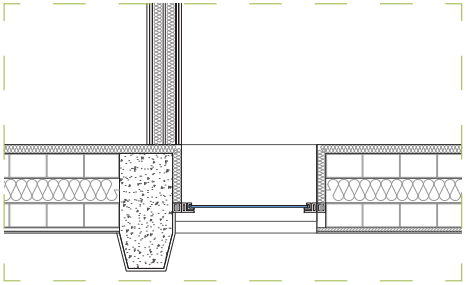
The minimalistic aesthetics of solid hot rolled steel profiles and their ability to shape windows is unique. Their slender lines appear to loose weight and give lightness to the frames, emphasizing the transparency of the facade. This elegance which was well known in the past, nowadays is often affected by the need of thermal performances imposed by modern comfort or regulations. Contemporary architecture requires a new generation of steel profiles that combines steel windows uniqueness and modern comfort. The company FerroFinestra Taglio Termico is able to preserve the character of heritage buildings. FerroFinestra Taglio Termico by Mogs is a thermal barrier steel window system, which combines the essence of the original steel window design with modern manifacturing technology.
Windows are among the most vulnerable elements to renovate in historical buildings. If windows are important in establishing the historical character of the building, replacing them with non-coherent profiles can change or destroy the historical character of the building. Sash type, depth of reveal and mounting configuration must be identical for the most part. Sightlines, shapes, materials, finishes, colours and quality of the glass should be as close as possible to the original, allowing a philological deployment that does not change the overall picture of the architecture.

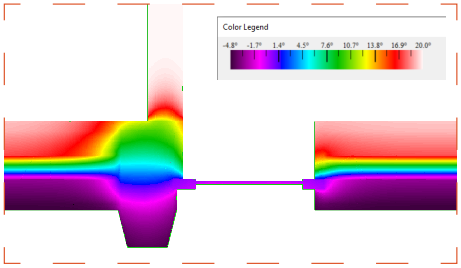
CURRENT SITUATION

DESIGN PROPOSAL

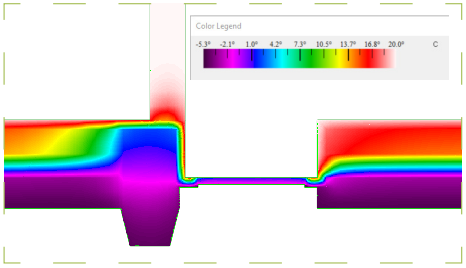


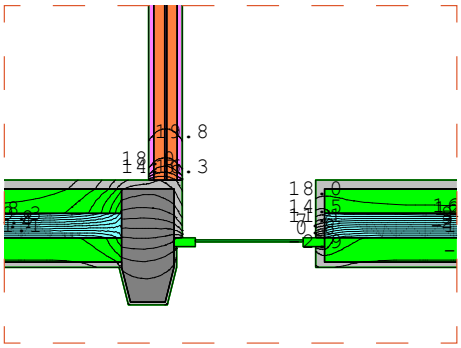
Typological plan



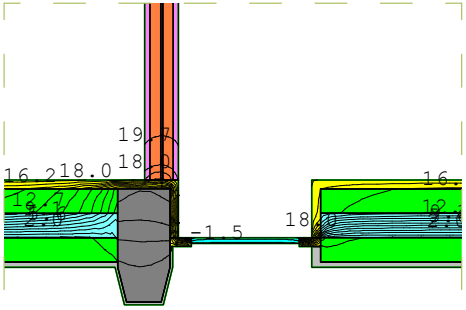


Infrared analysis





Isotherm analysis



Current condition

Design proposal

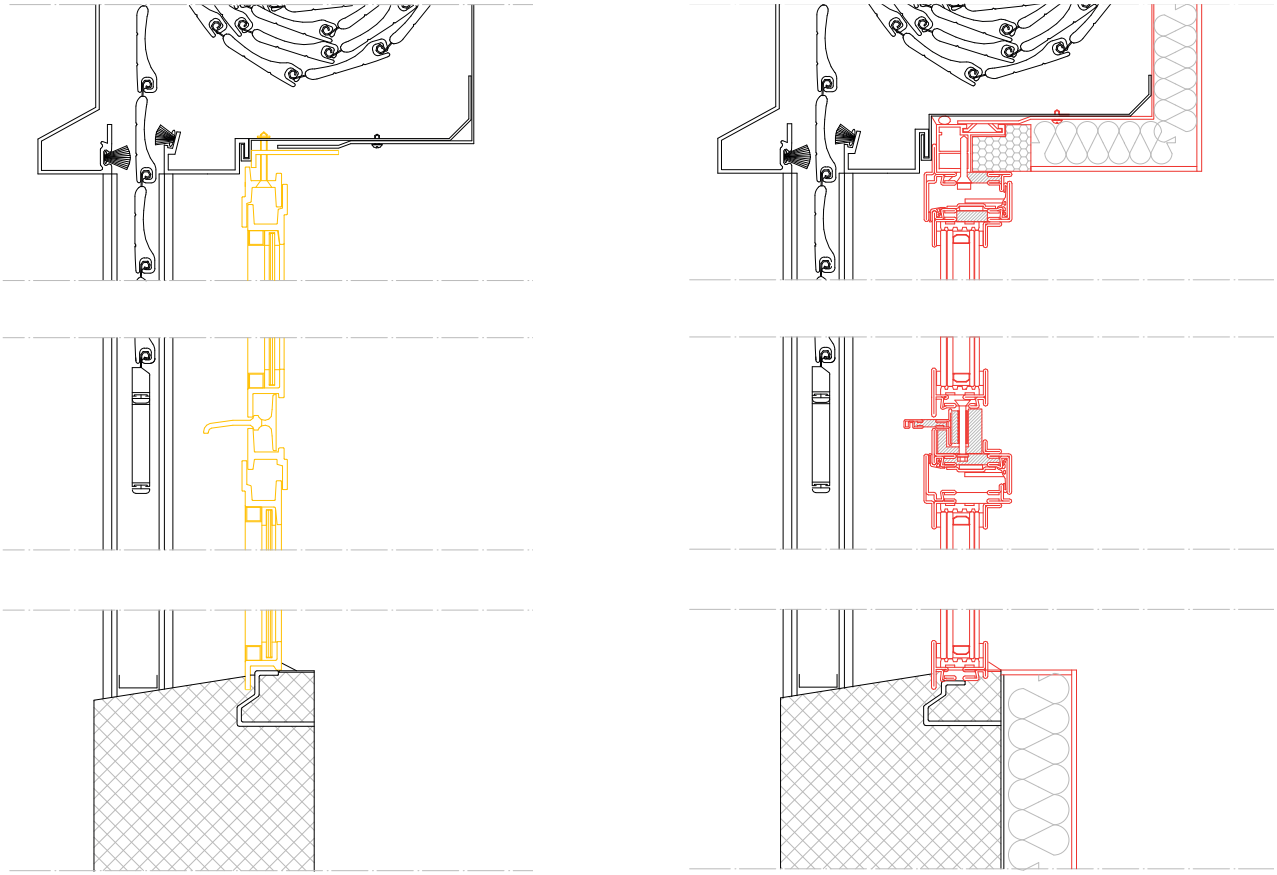
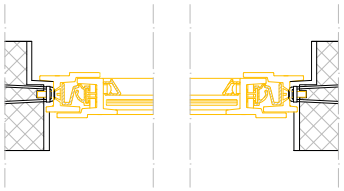
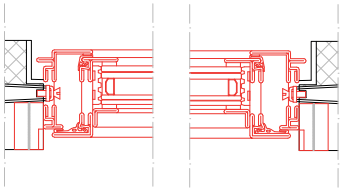


Fig. xx: Sections of the frames of the windows





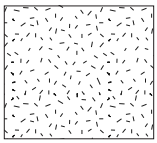
Existing frames

Addition (new frames)

Fig. xx: Plan view of the frames of the windows

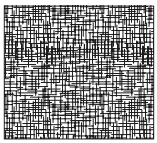
Pr.01 Application of water repellent treatments.

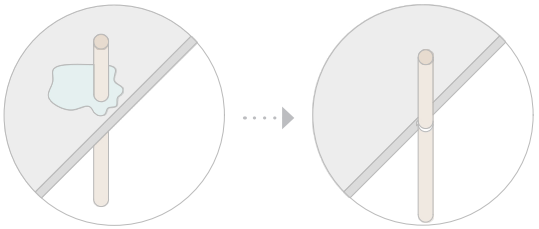
- Apply transparent coating solvent, siloxane based, ideal to protect porous walls made of tiles, stones or concrete from rainwater. It doesn't alter the wall color, protecting from ice and blocking dampness infiltrations. It allows the water inside the wall to evaporate, and it makes possible deep impregnations into the wall, even onto slighty humid surfaces.



Pr.01 Application of water repellent treatments.

- Relocation of the systems
- Substitute the damaged systems and improving them.





3.5. Structural analysis

3.5.1. Convitto structure

The structure of Convitto is a reinforced concrete frame, made of squared columns in the middle row and geometrical tapered columns in the perimeter.
The slabs are unconventional because their technology was innovative for their construction time, they are realized with dense rows of secondary RC beams and only one primary beam in the middle of the transversal span. Nowadays their size and construction technique is no more reproducible because of their consistent displacement and no more checkable with current codes.
For this reason, we decided to improve the resistant part of those slabs adding a reinforced concrete curb including a floor heating system, to improving also thermic performances.
By the way, because of architectural decisions, it has been decided to demolish a part of the first-floor slab to create a double-height space at the ground level. In this case, the design will introduce a new slab with a corrugated steel sheet.
This technology makes the intervention more recognizable from the conservation project point of view. Also, this slab technology allows the presence of a more dense number of people, which is very important considering its public function, avoiding cracks and failures, guaranteeing a high safety level.

3.5.2. Iteration with the underground structural grid

A factor of extreme rigidity and difficulty was the underground presence of the car parks. The void they created imposed a considerable constraint from the design point of view. This constraint is both functional as parking spaces could not be lost and structural as it is necessary to respect the parking grid in the vertical supports. For this reason, it was a comprehensive solution of these constraints to optimize the parking space by minimizing the loss and to have a rigid and precise supporting structure, obtaining regular supports, with balanced spans.

3.5.3. Iteration between structures

The particularity of the structure is the dependence grade of the different structures and bodies, in fact two building bodies, the gallery and the guest building are both supported by the reinforced concrete terrace.
The terrace's supports are very rare: there are only three connection points to the ground, but the structure allows us to use a free plan system

in order to be freer to place the supports of the other structures.
The design of those supports was influenced a lot by the presence of an underground parking lot above the ground, for this reason, we had to manage the existing presence of the parking structure, considering the position of the supports avoiding the loss of parking places and avoiding the overlapping of the structures.
While, the gallery for an architectural choice, is supported at one side with a shear wall, located in the middle of the parking road, for this reason, two beams at the underground level are designed to support it without interrupting the road path.
The existing structure of the Convitto tower is detached from the gallery one of 10 cm, but physically connected with a seismic joint that allows the passage of people.

3.5.4. Model of calculation

The structures are studied following a precise order: first the gallery and the guest's building, then considering those outcoming loads, also the reinforced concrete terrace.
The calculation has been done first by hand, then using MidasGen, innovative software to check those also at the finite element verification, to better understand the general behaviour with a more detailed analysis about the loads combination.
The pre-sizing and related calculations were carried out considering the current Italian legislation: the Technical Standards for Construction of 2018 (NTC - Norme Tecniche per le Costruzioni 2018) in general, but also were considered about the cross-laminated timber also the "Eurocode 5: Design of timber structures" (EN 1995-1-2:2004) and the CNR-DT 206/2007 "Instructions for the Design, Execution and Control of Wooden Structures", while for the steel structure "Eurocode 3: Design of steel structures" (EN 1993-1-6:2005-2007), in the end for the reinforced concrete "Eurocode 2: Design of concrete structures" (EN 1992-1-3:2004-2006).

3.5.4.1 The terrace: Reinforced Concrete structure

The terrace is a continuous reinforced concrete slab with three supports, it presents particular dimensional characteristics as it is 64.80 meters long with a maximum span of 27,50 m, and the short side measures 13,37 m.
It works as a plate allowing us the possibility to design a free plan, positioning columns and shear walls ovf the upper floor in a freeway without respecting the structural grid of the ground floor.
Of course, this structure can be considered as

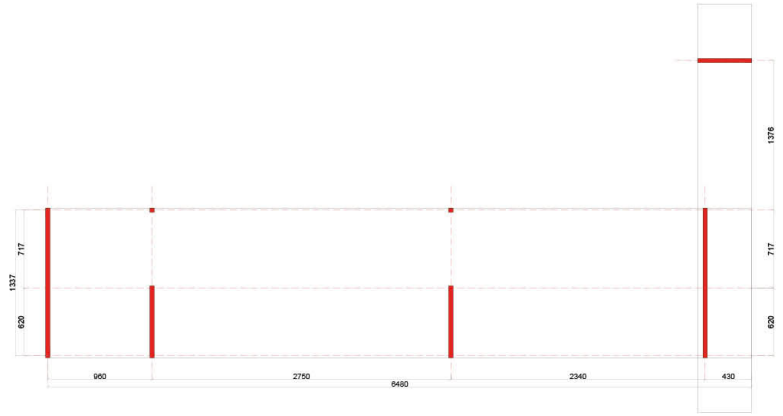
a bidirectional slab, but considering the relation between the long side and the short one, we have considered it as a one-way slab.
First of all, we have considered the loads of the guest's building and the gallery, then we did the loads analysis.
Simplifications have been adopted to calculate this structure, in fact, instead of considering the structure as a single tray, it was decided to consider it as a set of beams with a width of one meter and a length equal to the entire length of the terrace.
This simplification made it possible to more easily identify the ideal pre-sizing of the reinforcement bars and the geometry of the resistant section.

3.5.4.2 Guest Building: Cross-laminated timber structure

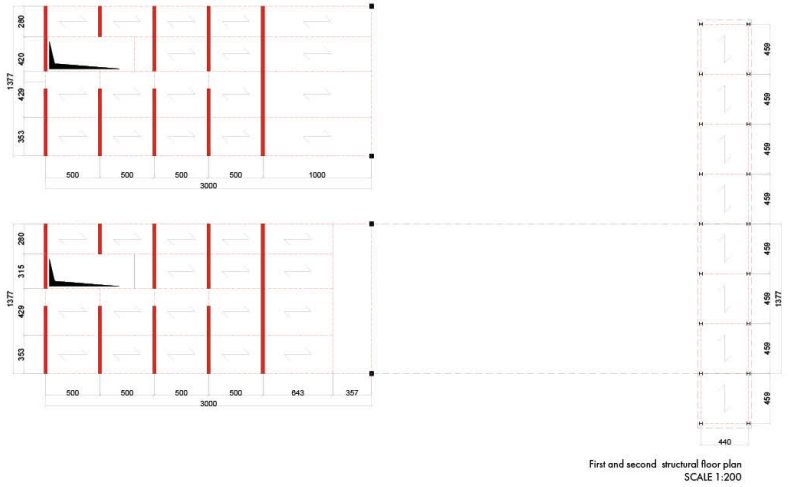
The structure for the guest building was instead designed in cross-laminated timber for two reasons: to be light and have a lower environmental impact, and to be modifiable and extendable.
For this reason, the structure was designed on a rigid grid to create a longitudinal module of 10 meters. In this way, the transverse vertical partitions were fixed, allowing the plan to develop different types of residences.
The structure is on two levels where both the horizontals and the vertical partitions are in XLAM.

3.5.4.3 Galleria: Steel reticular structure

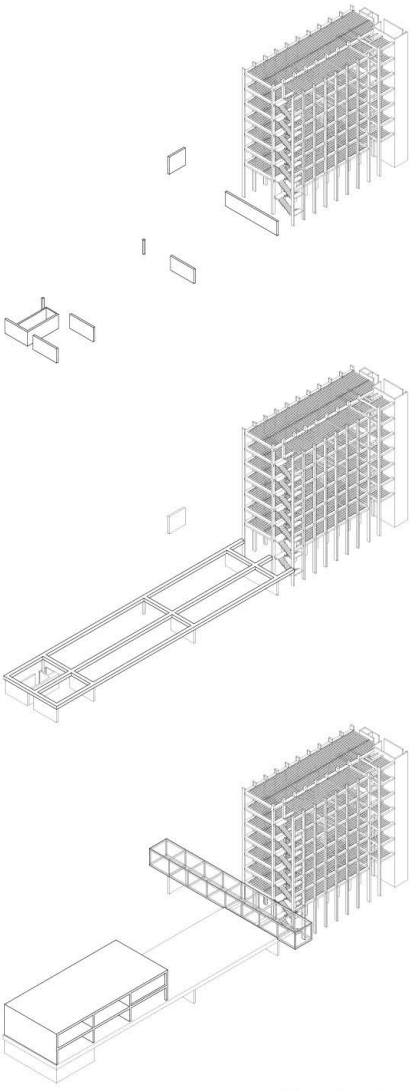
The gallery has been designed as a reticular steel structure supported by a shear wall and the RC structure of the terrace.
This steel structure can be considered as a double Vierendeel beam.
We decided to focus more on the material choice, for this reason, we chose a very light slab: the NPSAir produced by TecnoStrutture, this slab is very innovative because of its very low weight and low environmental impact.
The structure has been studied starting from the slab loads and considering the curtain walls as distributed loads on the façade.
Considering the complexity of the structure, the structure has been modelled in detail on MidasGen to calculate understand better the behaviour of each element thanks to the finite elements.



Ground structural floor plan
SCALE 1:200

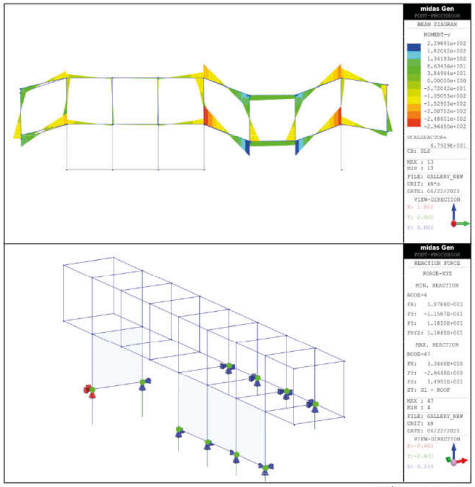


First and second structural floor plan
SCALE 1:200

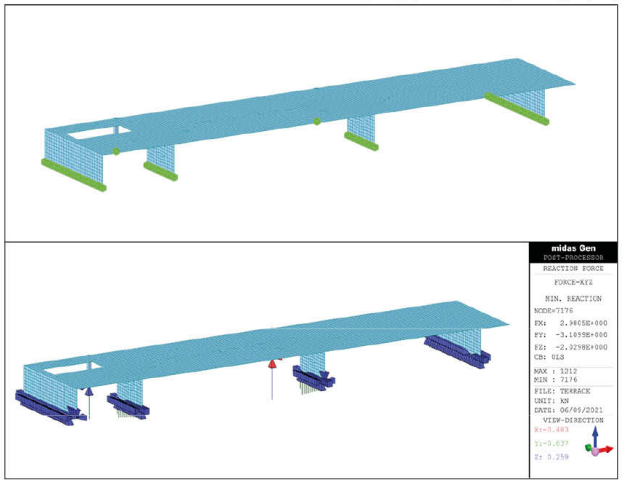


Axonometric view of the structural proposal

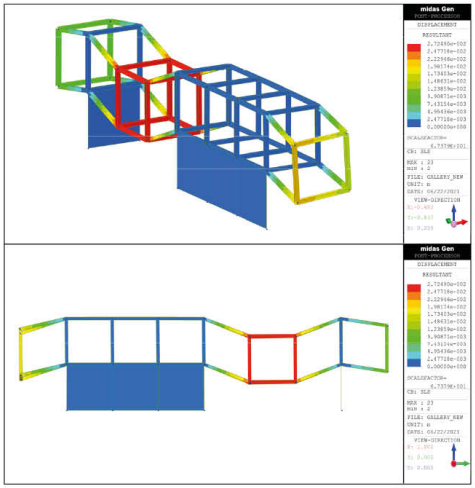
Fig. xx: Isometric view and plans of the structure



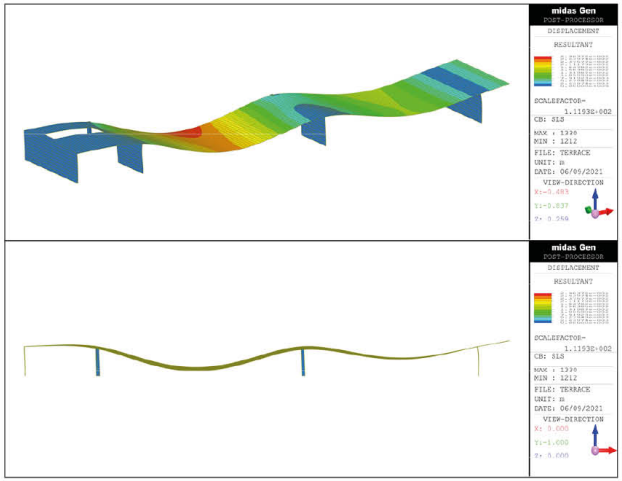
Bending moment stresses
Reaction forces on the supports



Axonometry of the supports and of the type of plate
Reaction forces on the supports



Displacements results in axonometry and elevation (south side)



Displacements results in axonometry and elevation (west side)

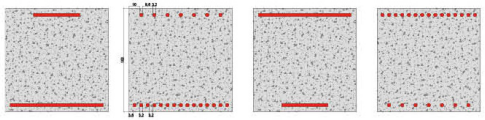


Fig. xx: Structural behaviour diagrams

3.6. Technology

The project has different buildings, so the solutions adopted from building to building are also different.
The common goal was to ensure comfortable spaces, thermally insulated from the outside, and designed in the best way, from soundproofing to waterproofing to the brightness of the rooms.

3.6.1. Connections points

As these buildings are different, they have different mechanical characteristics due to the materials and geometry of the bodies. To avoid rigid cores or worse to weaken the pre-existing ones, it was decided to use seismic joints.

3.6.2. Convitto-Galleria connection

In particular, these connections were used in the connection between the Convitto building and the gallery, positioning a continuous horizontal nitrile expansion joint connecting the two floors on the walkable level and at the level of the roof. This joint consists of an interchangeable flexible section capable of absorbing the movements of expansion and contraction, supported by two rolling mills in aluminium or strips in galvanized steel or stainless steel. In this way, the two building blocks are detached by 10 cm but at the same accessible thanks to this particular joint.

3.6.3. Gallery-Terrace connection

Furthermore, another particular connection used is that between the reticular structure of the tunnel and the concrete one of the terrace. Structurally, this connection is considerably important, the support points are considered as simple carriage supports, thus having a degree of constraint on the vertical axis but allowing vertical displacements in both directions. For this reason, an elastic damper was used, positioned between the reticular structure and the reinforced concrete one.

3.6.4. Convitto daylight analysis

The most consistent transformative process is that which took place in the Convitto, where the external opaque vertical partitions were demolished, maintaining the strong morphological character given by the design and shape of the modular windows, and a portion of the attic was demolished.
This intervention, which appears extremely invasive, however, takes into account the future function envisaged by the project on the building, which, being suitable for hospitality, needs to be a very bright environment, making full use of the contri-

bution of natural light.
Justification of this design will be appreciable in the study of daylight analysis, where comparing existing and project situations, it becomes clear how the environments are much brighter, reducing dark areas and making the internal ambient lighting homogeneous and well distributed.

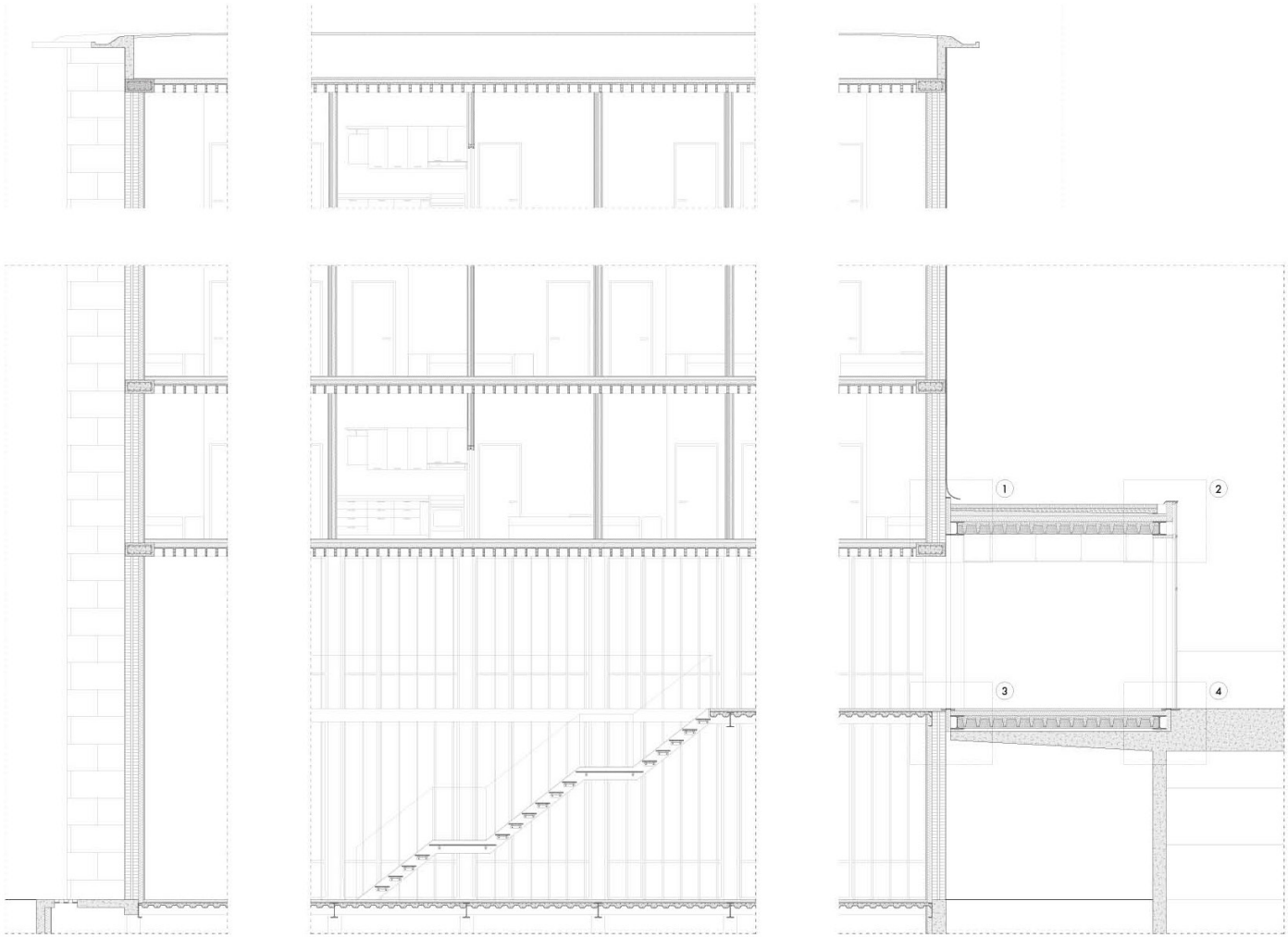
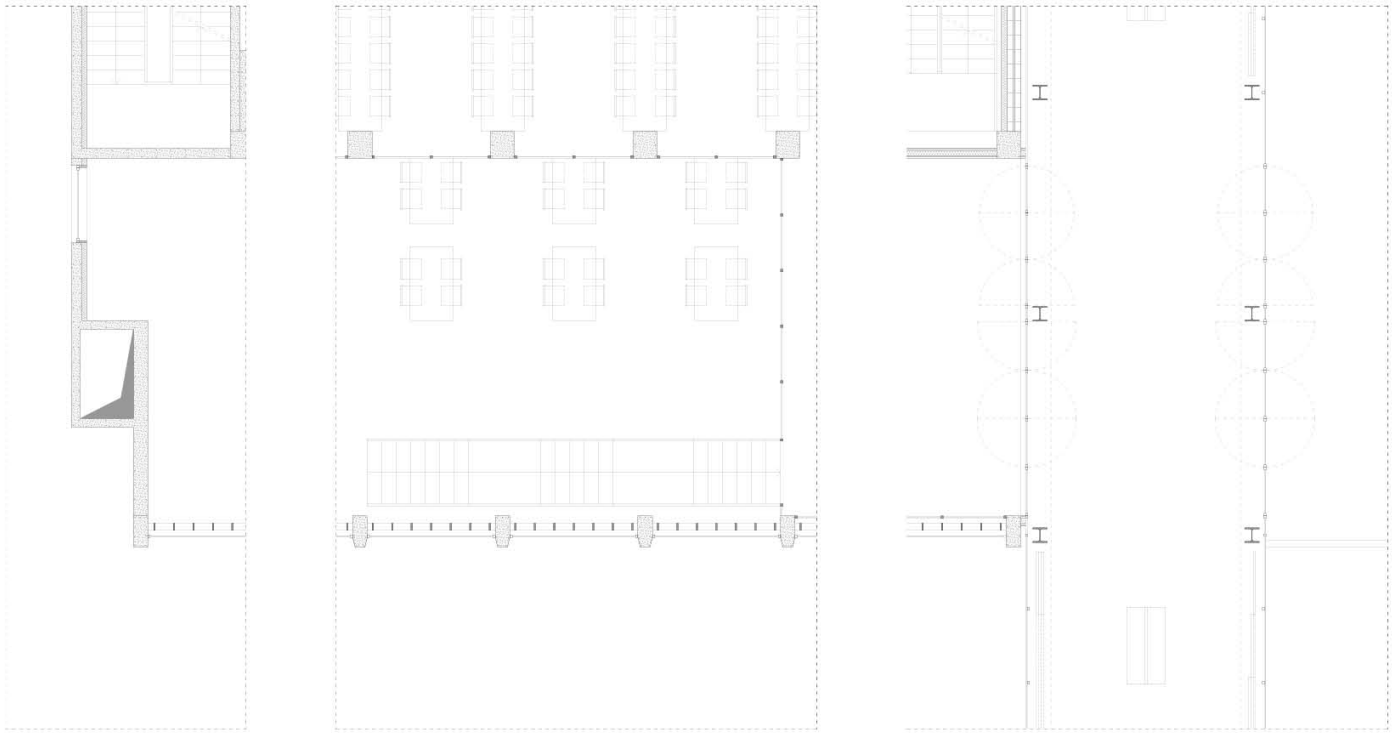

1
2
3
4

Fig. xx: Detailed longitudinal section of the Convitto



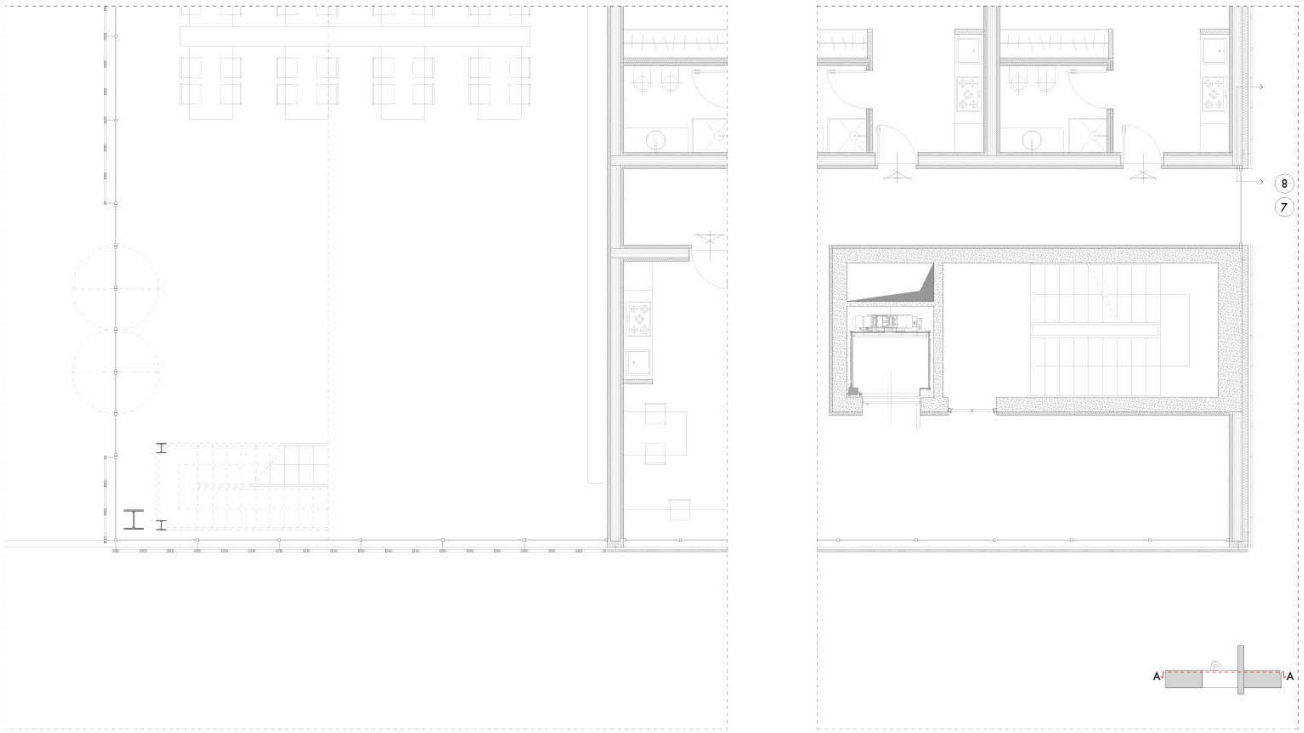
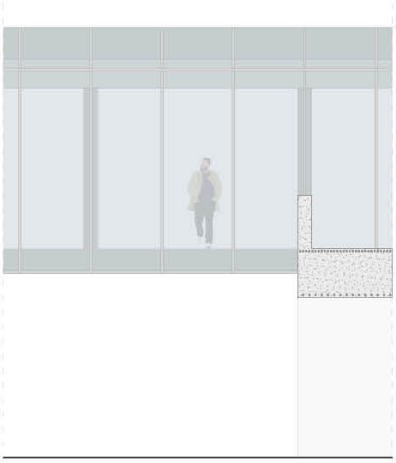
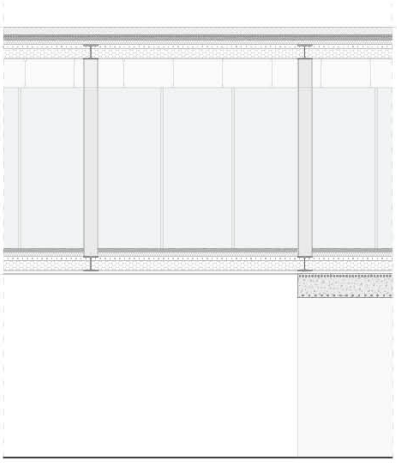


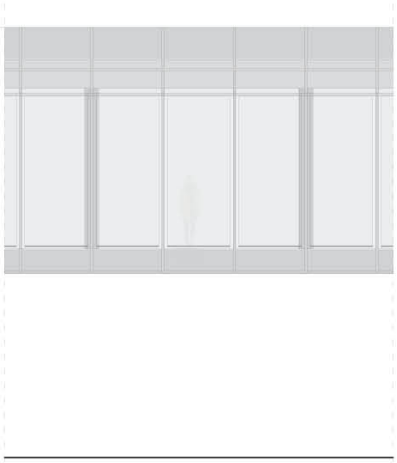
Fig. xx: Detailed groud floot plan of the Convitto



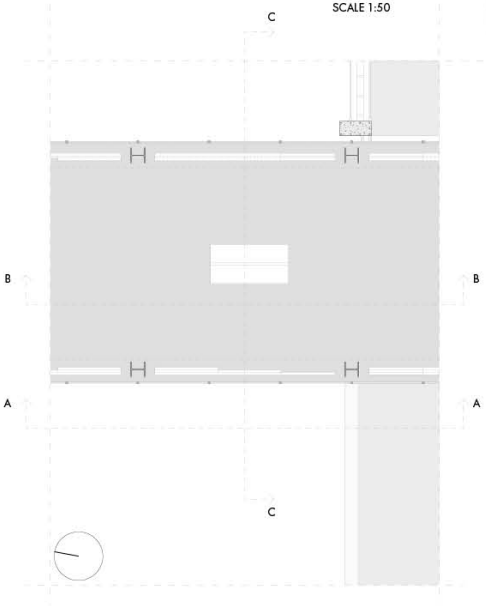
Cross section AA
SCALE 1:50



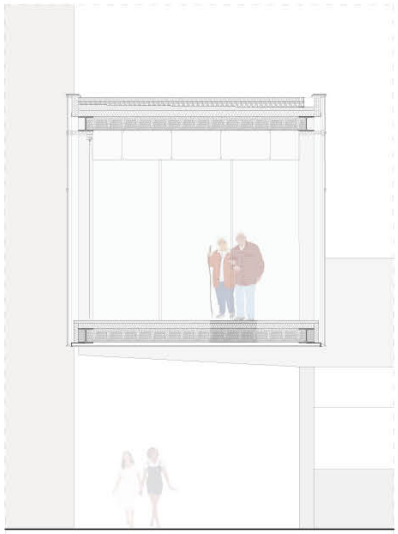
Cross section BB
SCALE 1:50



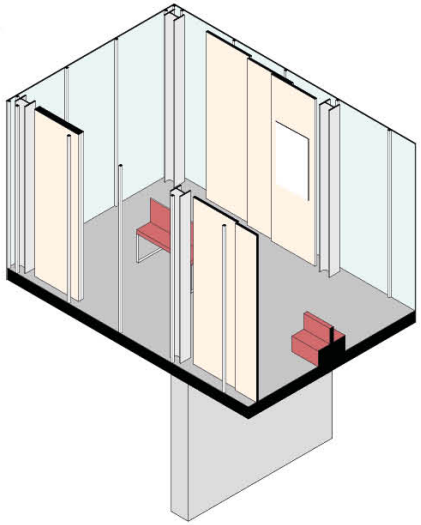
South elevation of the typical span
SCALE 1:50



Gallery detailed floor plan
SCALE 1:50

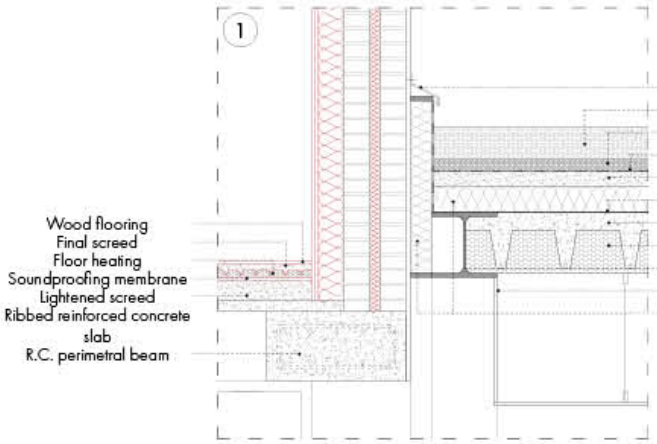


Cross section CC
SCALE 1:50

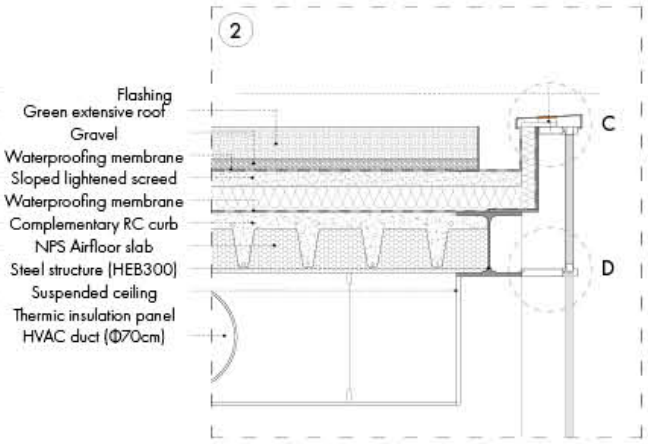


Isometric view of the typical span of the gallery

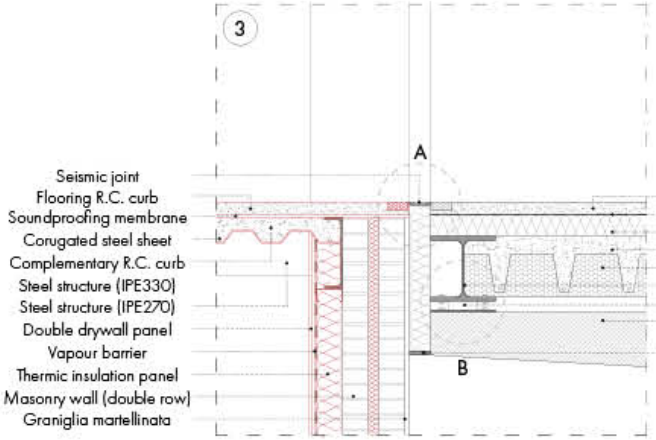
Fig. xx: Typical span of the gallery



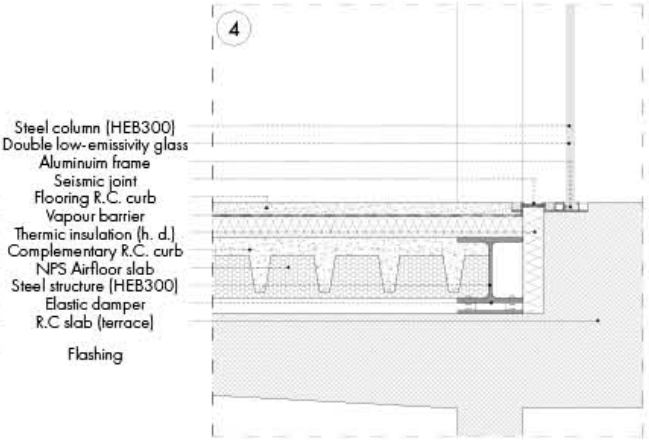
Detail of the connection between gallery and Convitto tower
SCALE 1:20



Detail of the gallery's roof
SCALE 1:20



Detail of the connection between gallery and Convitto tower
SCALE 1:20



Detail of the connection between gallery and open terrace
SCALE 1:20

Fig. xx: Details of the connections between gallery and tray

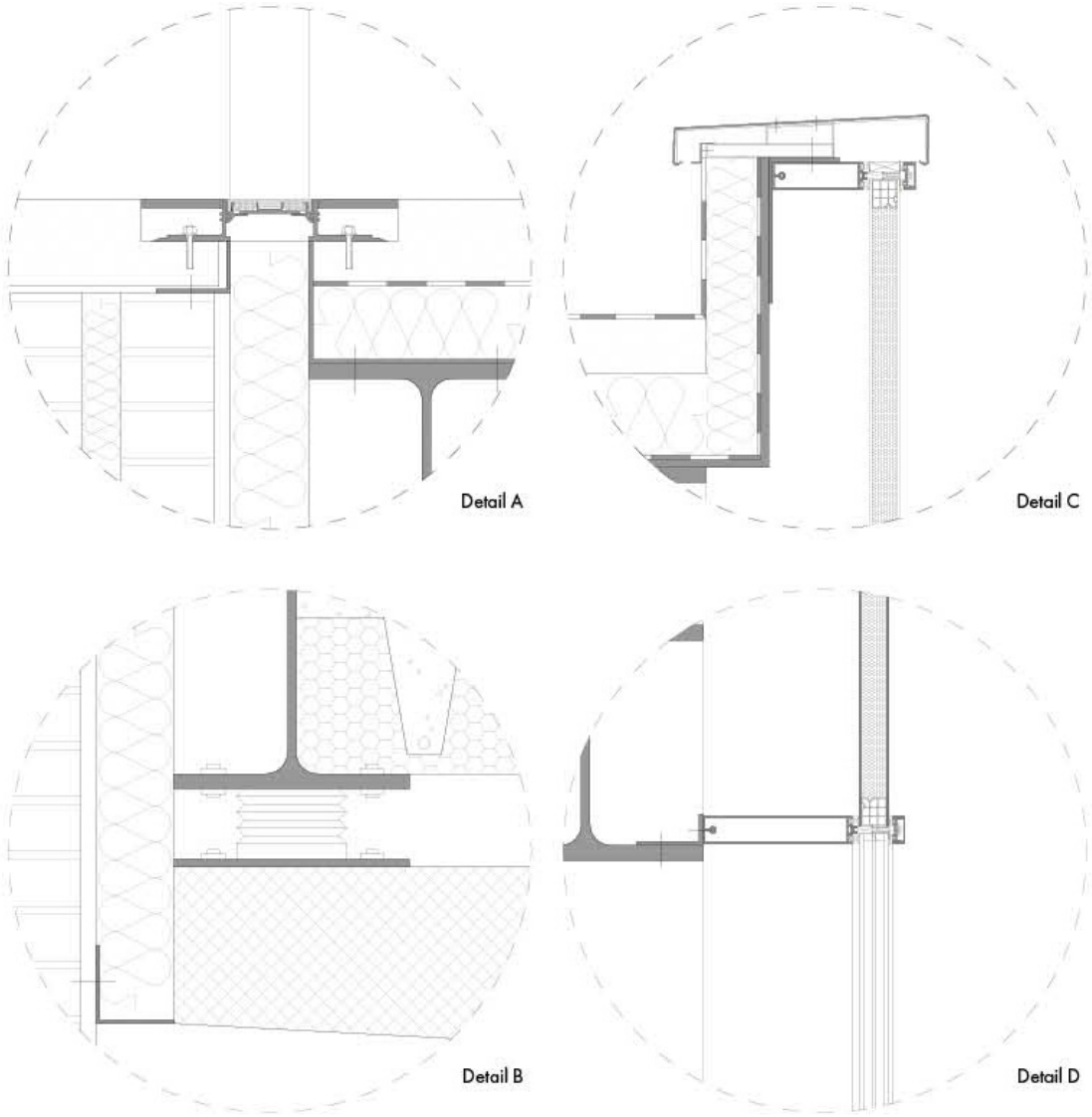
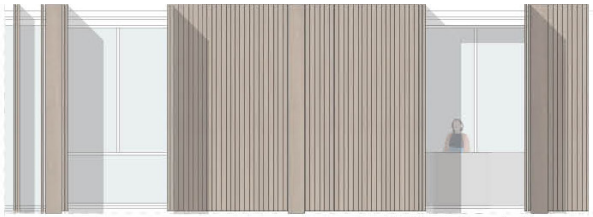
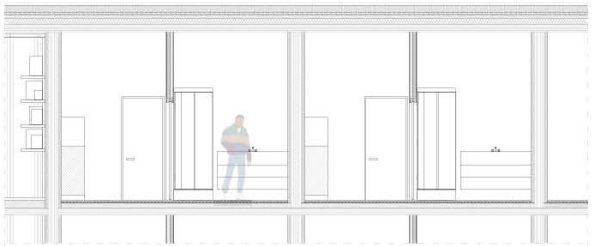


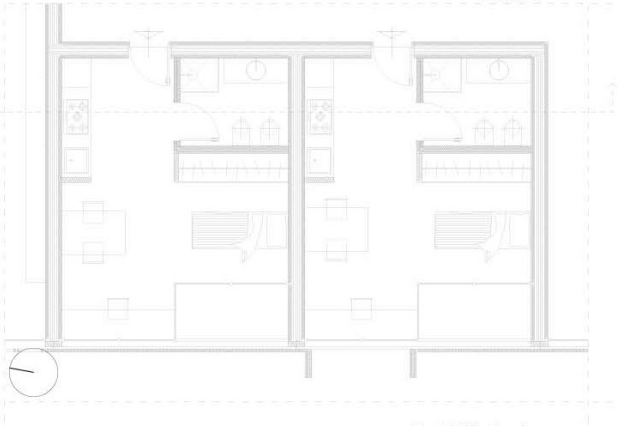
Fig. xx: Blow up details of the gallery



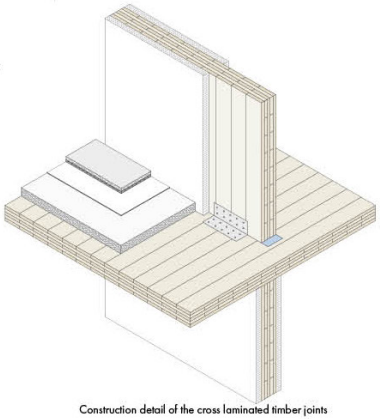
Guest's building typical span elevation
SCALE 1:50



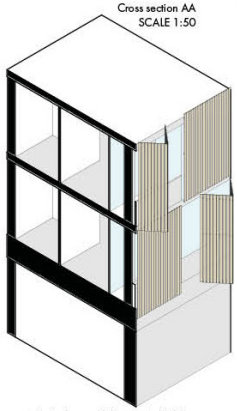
Cross section AA
SCALE 1:50



Guest's building floor plan
SCALE 1:50

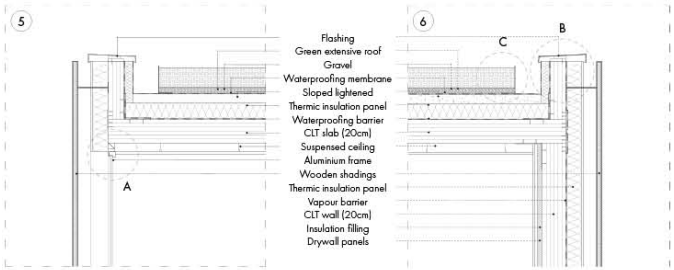


Construction detail of the cross laminated timber joints



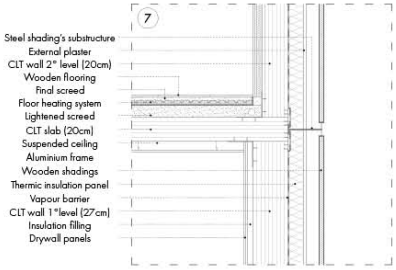
Typical span of the guest's building

Fig. xx: Typical span of the guest building

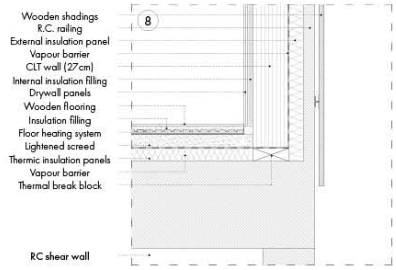


Detail of the roof of the guest's building
SCALE 1:20

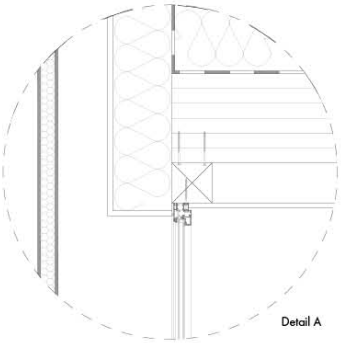
Detail of the roof of the guest's building
SCALE 1:20



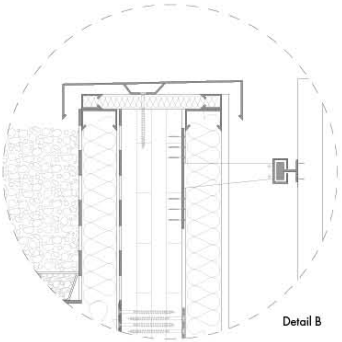
Detail of the internal slab connection in the guest's building
SCALE 1:20



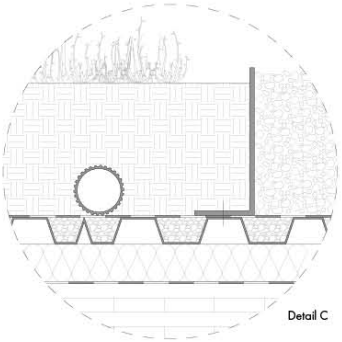
Detail of the connection of the guest's building with the terrace
SCALE 1:20



Detail A



Detail B



Detail C

Fig. xx: Blow up details of the guest building

3.7. Building service design

Convitto's systems
The Convitto tower already presents a rude floor heating system.
Thanks to the original technical drawings it is possible to understand the layout of the water pipes (supply and discharge), those are distributed on each internal column, this option allowed the designers to reduce the size of the vertical pipes simply by increasing their number.
The design approach takes care of the surfaces to understand the quantities of energy needed and the relative carbon footprint.

Energy loads
First of all, it has been estimated the overall energy loads using the method of the Rules of Thumbs, obtaining the building occupancy and the airflow rate.

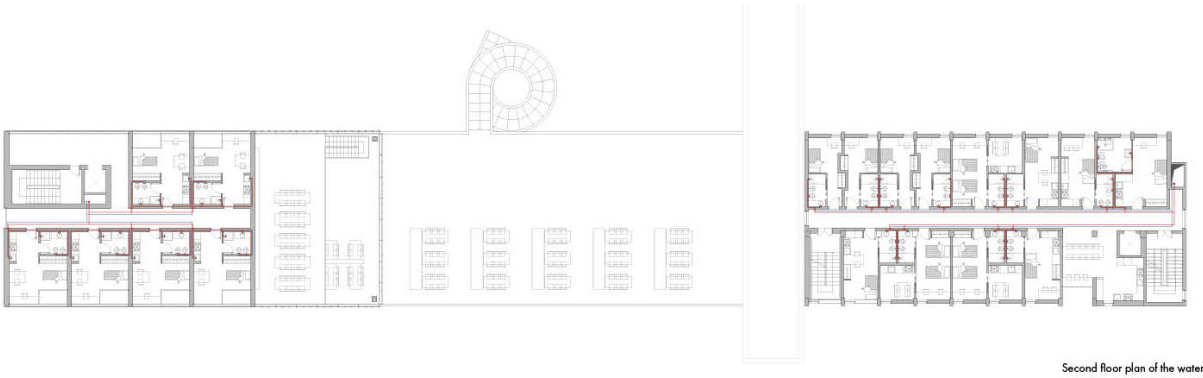
HVAC
To calculate the size of HVAC ducts, the internal surface of every single space and its internal volume was considered, assuming an air change rate equal to 5,00, while for the air velocity the values depend on the single function of each room.
The airflow rate is obtained as a product of the internal volume for the air change rate.
Then, the value of the minimum duct was obtained by dividing the airflow rate over the air velocity, gaining the minimum area of duct needed, and then the value of the diameter of the circular section or the value of base and height for rectangular or squared sections.

Water supply and discharge
First, it's studied the supply system, considering the single loading units (LU) of the single elements in one single dwelling and obtaining the total number of loading units for each room (kitchen and bathroom), and the total value for a single dwelling.
In the end, with a technical tabulation, it was possible to translate those loading units into sized ducts.
While, for the discharge system, it's considered the single discharge loading units (US) of the single elements in one single dwelling.
Then obtaining the total number of loading units for each room (kitchen and bathroom), and the total value for a single dwelling.
Finally, calculating the value of the water flow (Q) in l / s, and using an axial graph it is possible to read the corresponding value of Q to find the correct diameter for the pipe.

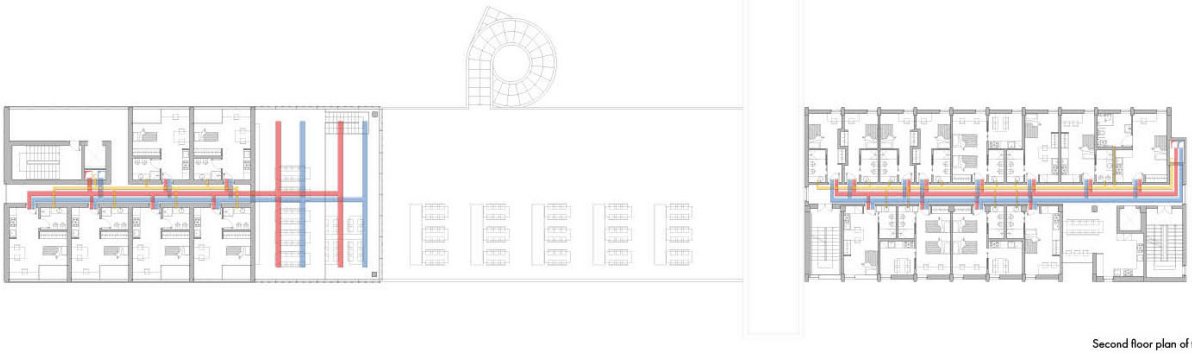
Floor heating system
Measuring the gross internal area of each room

of a dwelling, it is possible to calculate the heat load value by multiplying the area for the heat load, a standard value considered equal to 60 W/m2GIA.
Then, thanks to a tabulation the heat load values are translated into a double pipe size, obtaining also the internal speed of the water.

Standards used
- Energy consumption: Glenn, Rules of Thumbs, BSRIA 2011.
- HVAC: BS EN 12831 1-3 2018 "Energy performance of buildings. Method for calculation of the design heat load. "
- Water supply & discharge: B S EN 12056 1-5 2000 "Gravity drainage systems inside buildings"
- Floor heating: BS EN 12831 1-3 2018 "Energy performance of buildings. Method for calculation of the design heat load. "



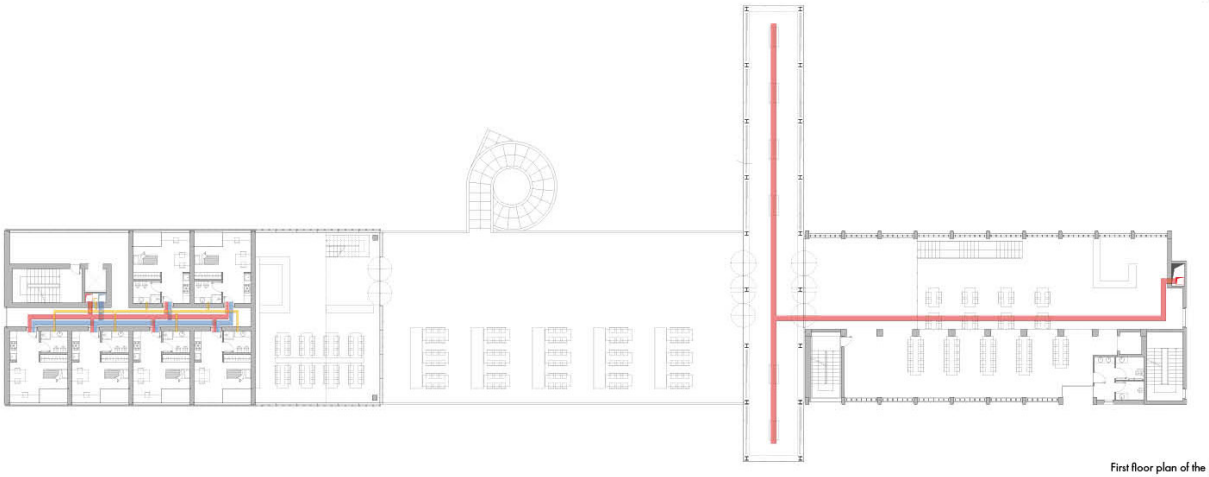
Second floor plan of the water supply system
SCALE 1:200



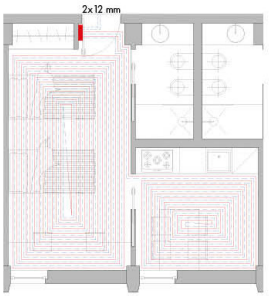
Second floor plan of the HVAC system
SCALE 1:200

Fig. xx: Plans of the water supply and HVAC system

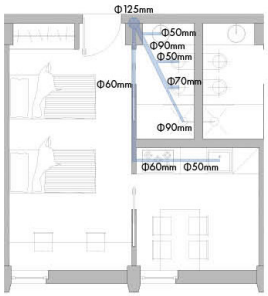
SCALE 1:200



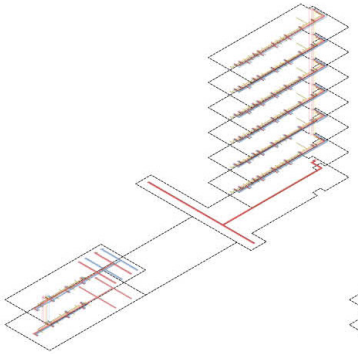
First floor plan of the HVAC system
SCALE 1:200



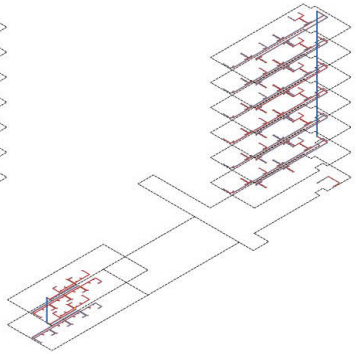
Plan of the floor heating system for a typical span of the Convitto
SCALE 1:50



Plan of the water discharge system for a typical span of the Convitto
SCALE 1:50



Axonometry of the HVAC system



Axonometry of the water supply system

Fig. xx: HVAC and water discharge system