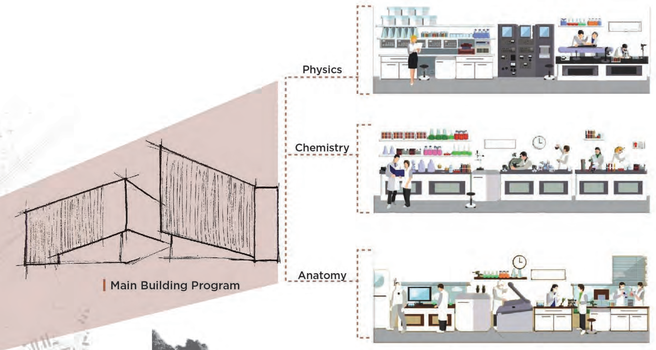
BASEL SCIENCE CAMPUS | Innovation Hub for Creative Minds



1800's: the river was an immense network of interconnecting streams. But the swampy water was a breeding ground for malaria & other diseases, making the riverside an unpleasant and sometimes deadly place to be.
1817: hydraulic engineer, Johann Gottfried Tulla, began to shape and control the river by narrowing and shortening it. The construction work made the Rhine navigable by boat.

1906-1911: The Port of St. Johann was built - mainly grain and dry goods were handled and stored. In 2010, the port was demolished in order to make room for the Novartis Campus.
1917 - 1926: Port facilities in Basel were used, projected, built and extended. Around 30-40% of mineral oil reaches Switzerland via the Rhine ports.

1944: American and British planes bombed Switzerland about seventy times during WWII.

1950: formation of ICPR
1960s: water purification plans - agriculture flourished.

1986: fire at a Sandoz Ltd. storehouse at Schweizerhalle, an industrial area near Basel, resulted in chemical contamination of the environment. Rhine river didn't recover until the late 90s.

Present: Heavy industry, hydro-electric dams, and excessive freight traffic, but anti-pollution measures were taken to return the river to health with 60 fish species. Also safe to swim.

Rhine River's story throughout History

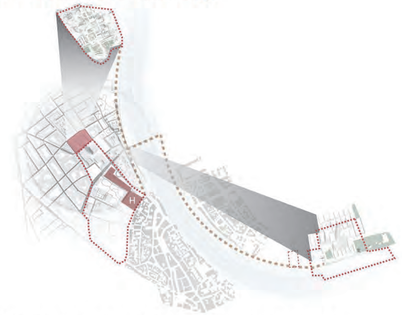
I- Collaborative Leadership Network

The site is a strategical location for the network of the pharmaceutical and chemical industries and research centers, and the higher authority or government. The site is where the "Triple Helix" is formed.

II- Vision for Growth

The site's physical location has advantages because it allows for the growth since it is enveloped by the railway, the green ring (the 3 largest parks surrounding the campus), and the node connecting all axes to the main road linking both sides of the river.

III- Pursue Talent & Technology

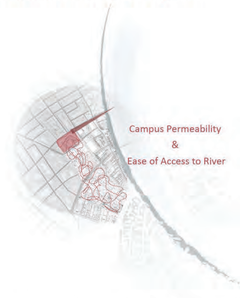


Skilled workers and sophisticated infrastructure are the twin drivers of innovation. Technology in Basel requires a commitment to specialized laboratory facilities to create a high quality platform for innovative firms. The site is located midway between novartis and the campus.

IV- Promote Inclusive Growth

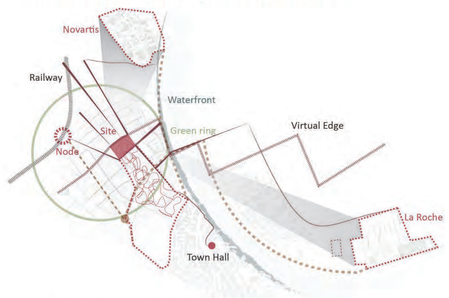
The innovation district is used as a platform to regenerate adjoining distressed neighborhoods as well as creating job opportunities for low-income residents of the city. The highlighted district is the working quarter, and the site is on the edge of it.

V- Enhance Access to Capital



Enhance access to capital to support science and research, resulting in the commercialization of innovation, entrepreneurial start-ups, new collaborative spaces, place-based infrastructure, and intermediaries to steward the innovation ecosystem.

VI-Formation of a Reimagined Urban Area



This "re-imagined urban area" found in close proximity to Basel's historic river waterfront is where the chemical and pharmaceutical industries are booming and undergoing a physical and economic transformation. This change is powered by transit access, the historic building stock, and its proximity to the high rent downtown.

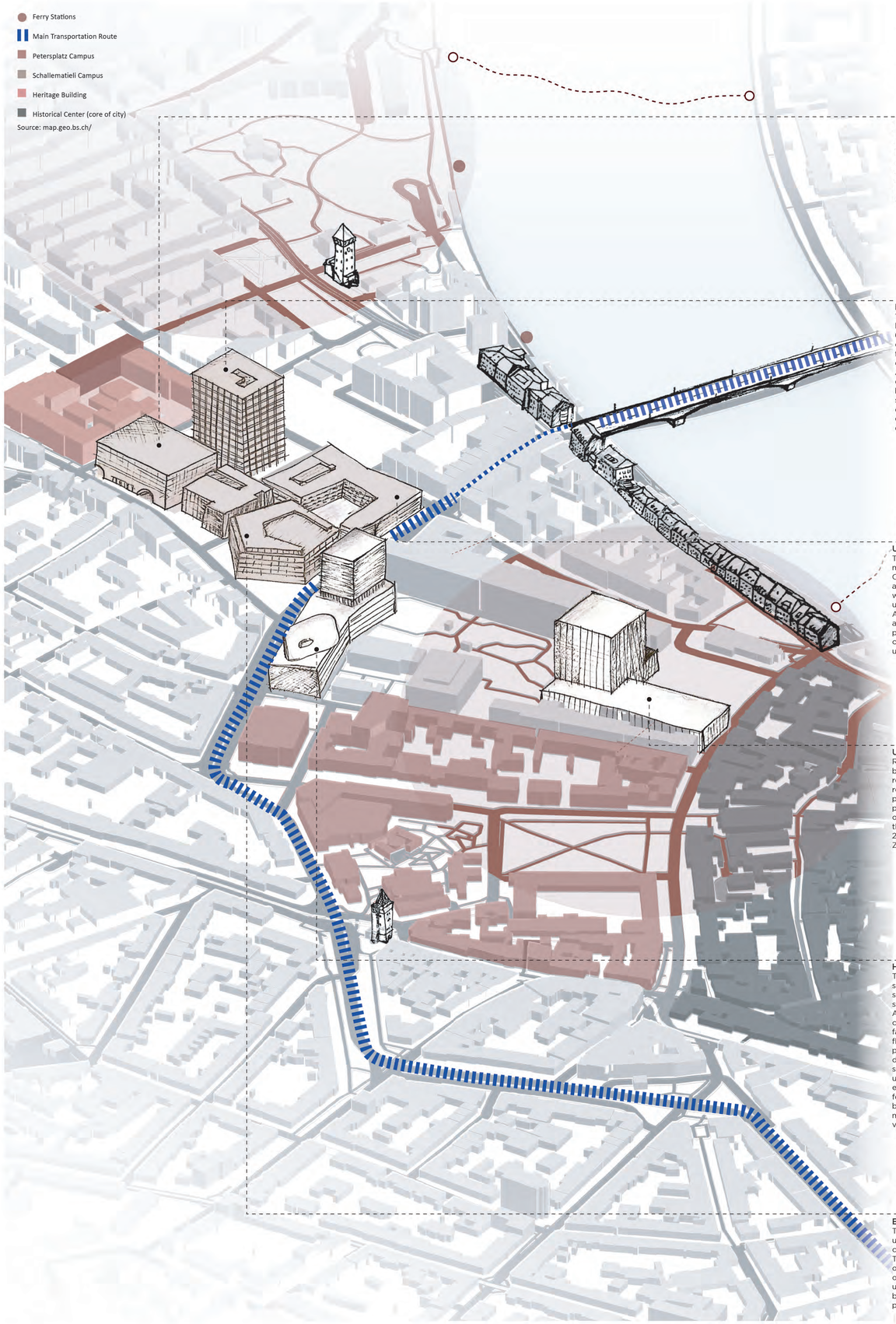
Politecnico Di Milano
School of Architecture Urban Planning and Construction Engineering
Laurea Magistrale Thesis | Study Program Architecture-Building Architecture
Academic Year 2019|2020

MSc Authors
Mary Lynn Al Haddad
Nancy El Asmar

Supervisor
Prof. Francesca Battisti | Architectural Design

Professors
Grigor Angjeliu | Structural Design
Giovanni Dotelli | Innovative Materials for Architecture
Francesco Romano | Building Services Design
Lavinia Chiara Tagliabue | Technology and Design in BIM Environment

Assistant Professors
Roberta Contrino | Studio Assistant
Denise Houx | Studio Assistant
Lorenzo Castellani Lovati | Studio Assistant



New Department of Biomedicine
The competition to design a laboratory building for the Department of Biomedicine was won by Caruso St John architecture firm, three years ago. Once the new Biozentrum has been moved, the old one will be demolished. A new laboratory construction is to be created on the vacant area.

New Biozentrum Building
The 19 storey building (3 basement levels) of 23'400 sqm is occupied by 600 researchers and 800 students. 40% of the total volume lies underground. Ten floors are available for research; each can accommodate four research groups. Adjacent floors are joined through an open staircase and a meeting zone benefiting scientific exchange. Also the shared technology platorms are distributed over all the floors, encouraging encounters and informal dialogue.

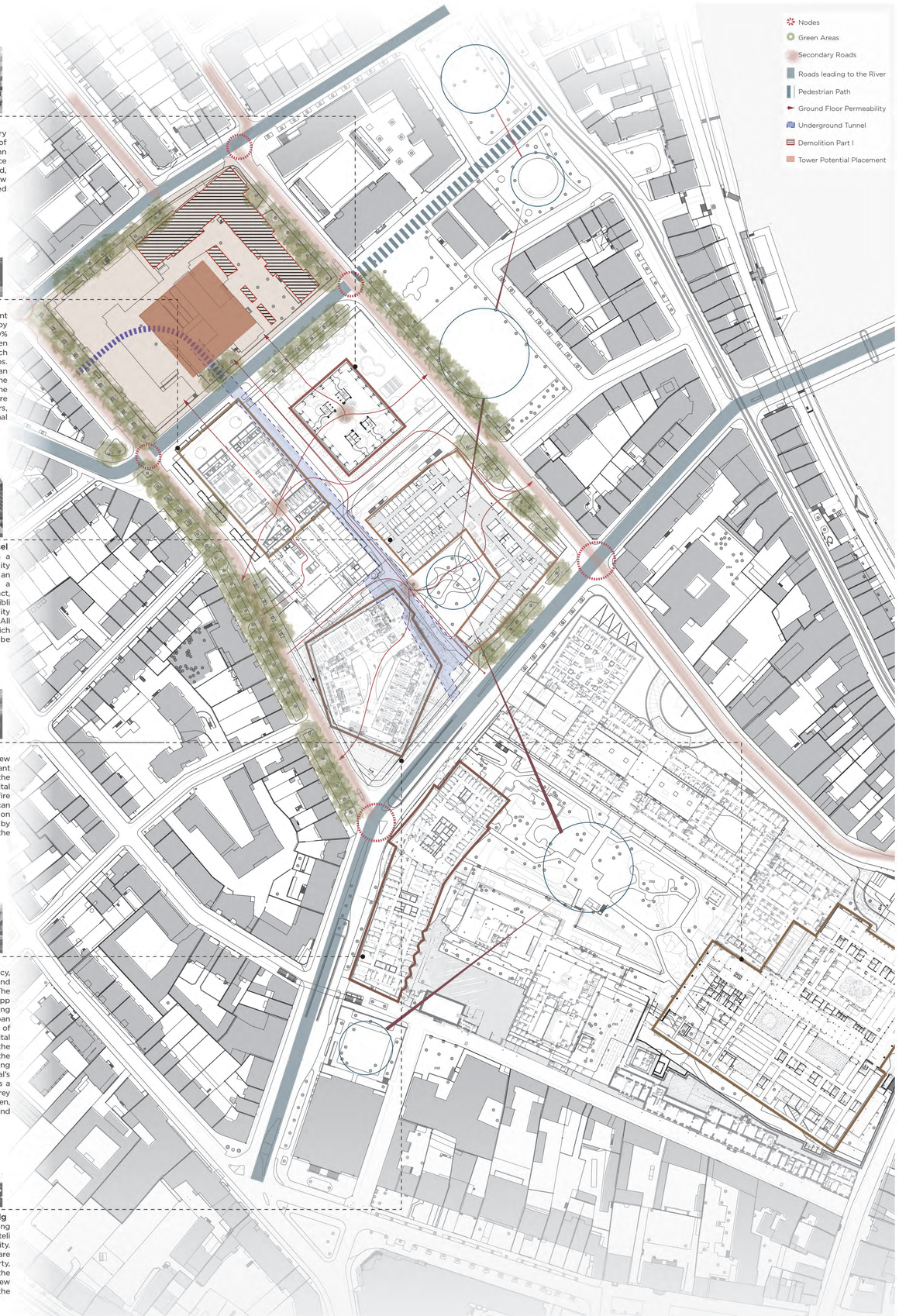
Universitäts-Kinderspital Beider Basel
The 5-storey building is gleaming in a multitude of colours, the University Children's Hospital Basel UKBB is an architectural masterpiece as well as a working clinic. It appears as a compact, unique unit; however Stump & Schibli Architects BSA retained the permeability and transparency of the urban spaces.All patients' rooms face the yard, which creates a peaceful green oasis that can be used for convalescence.

University Hospital Renewal
Renovation is as expensive as a new building and would entail significant restrictions during and after the refurbishment. Optimized hospital procedures, earthquake safety, fire protection and comfort for patients can only be achieved with a new building on the campus. This will be completed by 2032 with the project "Arcadia" of the Zurich team of architects

Herzog & De Meuron Perimeter B.
The plans are aimed to increase efficiency, simplify the work of employees, and shorten waiting times for patients. The scheme by Herzog & De Meuron and Rapp Architekten seeks to make a strong contribution to the site's existing urban fabric, while maintaining a high degree of flexibility. By dividing the hospital program among three structures, the design team was able to reference the scale and atmosphere of the surrounding urban environment and the hospital's existing public garden, which serves as a focal point. The horizontal four-storey building wraps around the garden, maximizing light penetration and ventilation.

ETHZ D-BSSE Lab and Research Bldg
The design makes it related to the existing urban de velopment of the Schallemätteli campus while keeping its own identity. The research and laboratory buildings are on the southern side of the property, occupying an urban corner of the university area of St. Johann. The new building adapts to the given shape of the property and the surroundings.

ampus Study and A



Politecnico Di Milano
School of Architecture Urban Planning and Construction Engineering
Laurea Magistrale Thesis | Study Program Architecture-Building Architecture
Academic Year 2019|2020

MSc Authors
Mary Lynn Al Haddad
Nancy El Asmar
Rhine Taxi Points

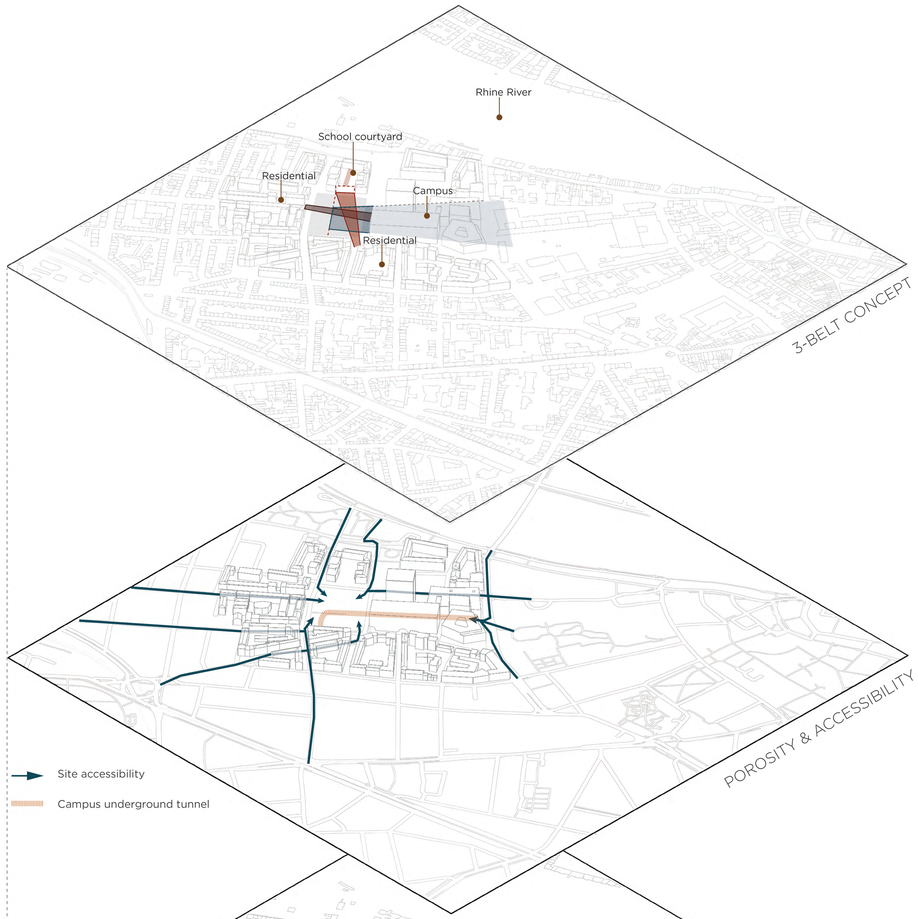
Supervisor
Prof. Francesca Battisti | Architectural Design

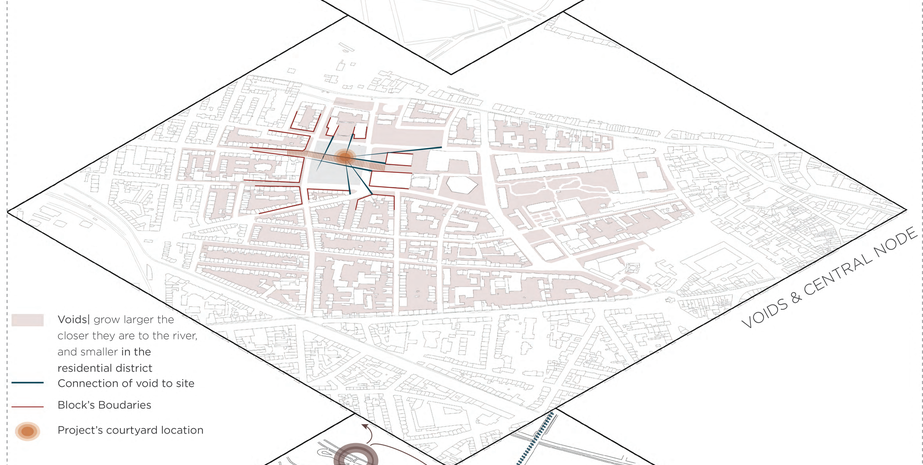
Professors
Grigor Angjeliu | Structural Design
Giovanni Dotelli | Innovative Materials for Architecture
Francesco Romano | Building Services Design
Lavinia Chiara Tagliabue | Technology and Design in BIM Environment

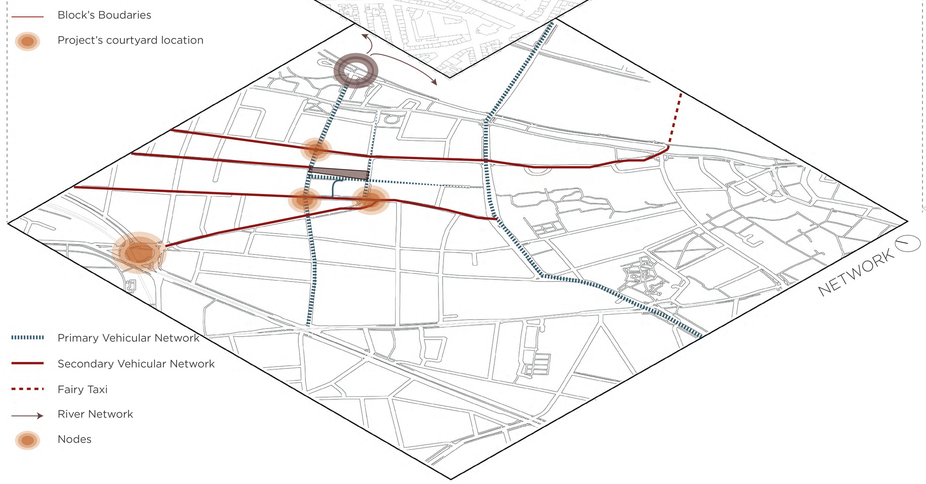
Assistant Professors
Roberta Contrino | Studio Assistant
Denise Houx | Studio Assistant
Lorenzo Castellani Lovati | Studio Assistant

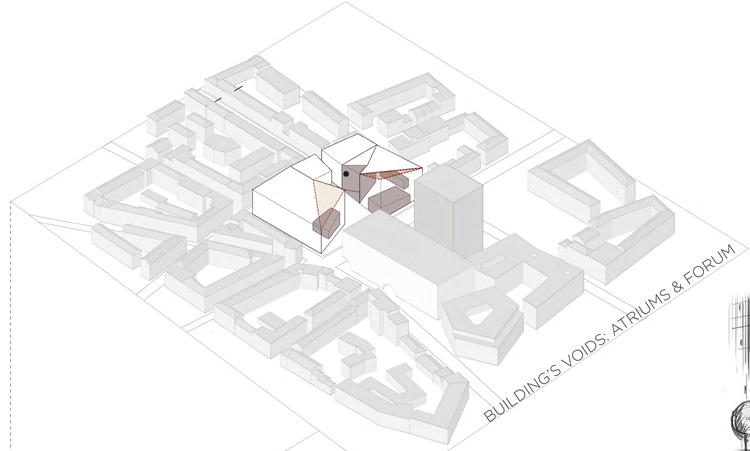
Urban and Site Analysis

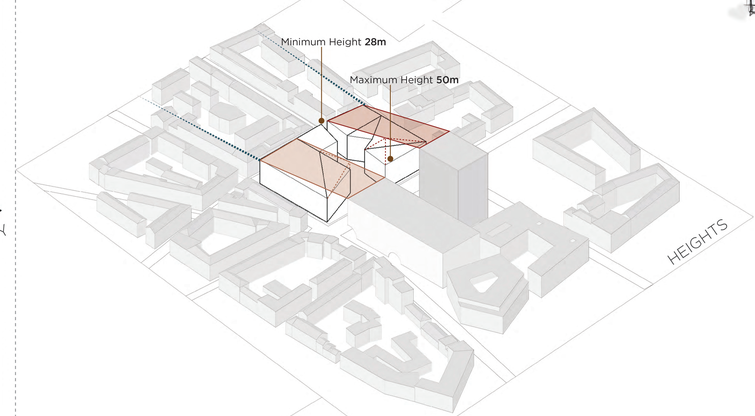
Scale
1/5000

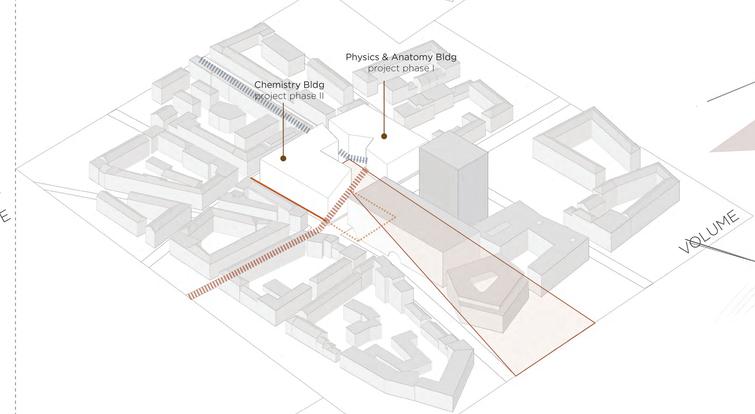


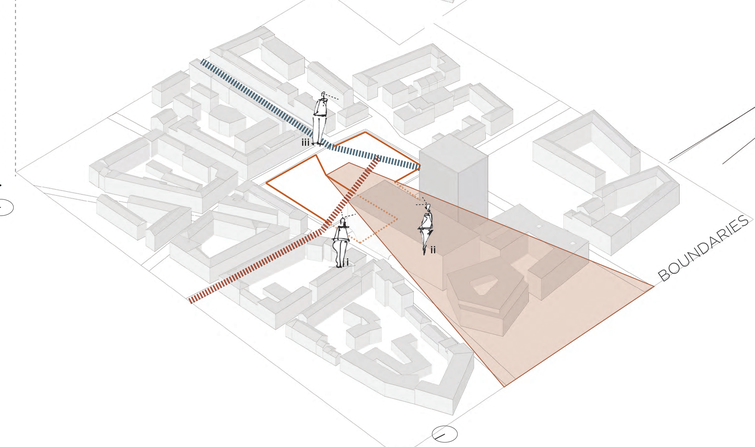


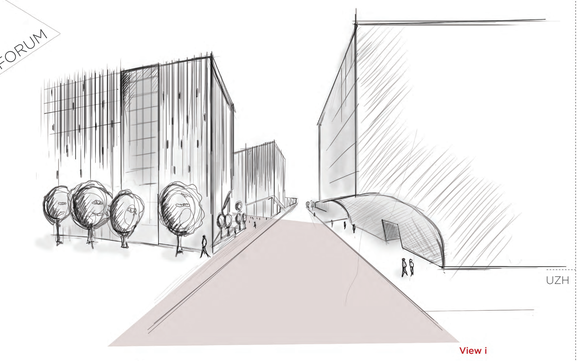


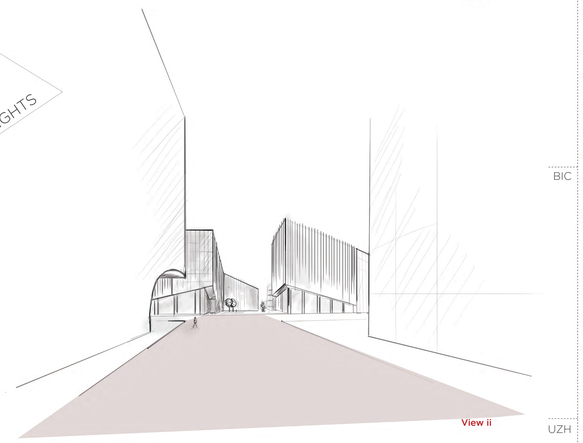


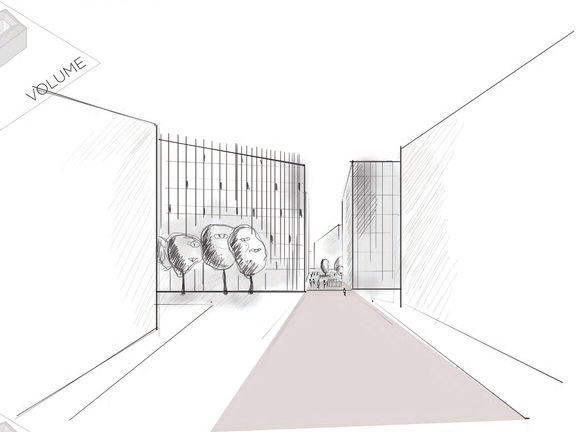




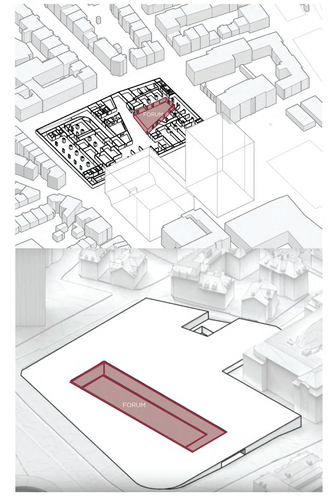


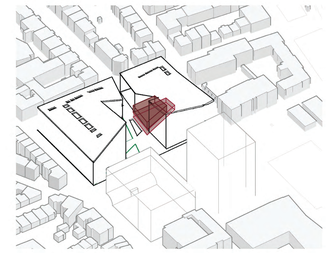


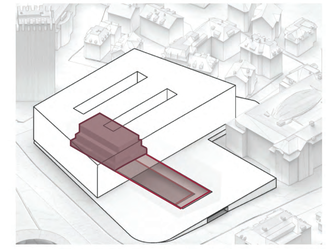


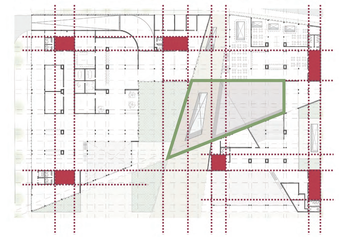


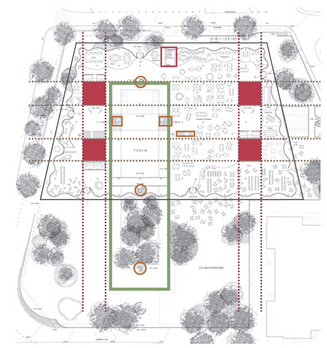
PRECEDENT - UZH











BIC

UZH

The Gross Floor Area (GFA) of UZH is 68,800 sqm, and it has 4 main cores, and the user does not travel a distance more than 31m to reach vertical circulation. Similarly, in our project, the GFA is around 63,000 sqm therefore we have 6 cores, for both safety and structural reasons due to the complex design of the two separate buildings. In addition, there are other staircases in different locations on every floor, depending on the different mezzanines, and atriums.

Politecnico Di Milano
School of Architecture Urban Planning and Construction Engineering
Laurea Magistrale Thesis | Study Program Architecture Building Architecture
Academic Year 2019|2020

MSc Authors
Mary Lynn Al Haddad
Nancy El Asmar

Supervisor
Prof. Francesca Battisti | Architectural Design

Professors
Gregor Angielini | Urban Design
Giovanni Dotelli | Urban Design

Assistant Professors
Roberta Cassano
Denise Houx
Lorenzo Castellani Lovati | Urban Design

Scale

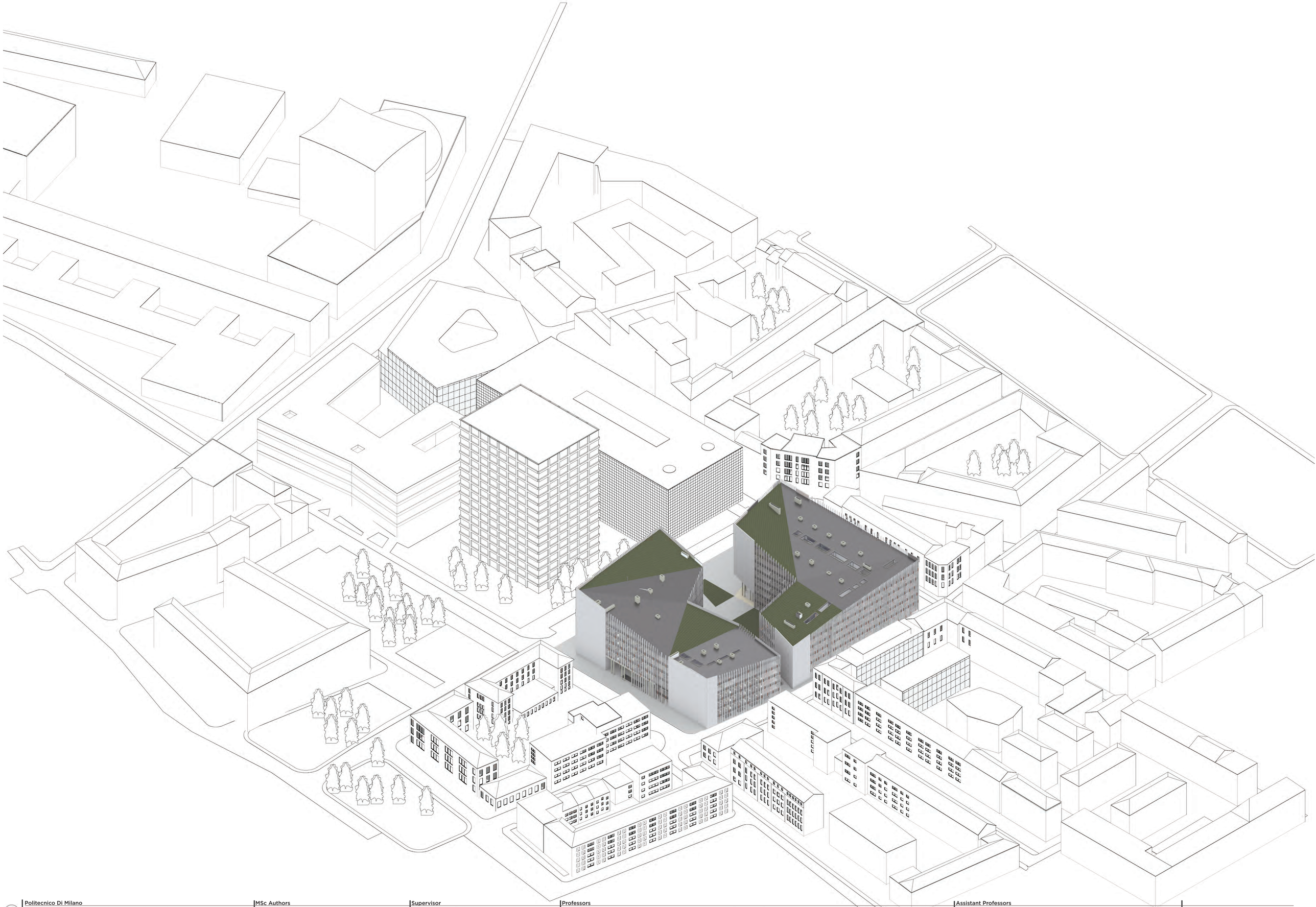
Politecnico Di Milano
School of Architecture Urban Planning and Construction Engineering
Laurea Magistrale Thesis | Study Program Architecture-Building Architecture
Academic Year 2019|2020

MSc Authors
Mary Lynn Al Haddad
Nancy El Asmar

Supervisor
Prof. Francesca Battisti | Architectural Design

Professors
Grigor Angjeliu | Structural Design
Giovanni Dotelli | Innovative Materials for Architecture
Francesco Romano | Building Services Design
Lavinia Chiara Tagliabue | Technology and Design in BIM Environment

Assistant Professors
Roberta Contrino | Studio Assistant
Denise Houx | Studio Assistant
Lorenzo Castellani Lovati | Studio Assistant



Politecnico Di Milano
School of Architecture Urban Planning and Construction Engineering
Laurea Magistrale Thesis | Study Program Architecture-Building Architecture
Academic Year 2019|2020

MSc Authors
Mary Lynn Al Haddad
Nancy El Asmar

Supervisor
Prof. Francesca Battisti | Architectural Design

Professors
Grigor Angjeliu | Structural Design
Giovanni Dotelli | Innovative Materials for Architecture
Francesco Romano | Building Services Design
Lavinia Chiara Tagliabue | Technology and Design in BIM Environment

Assistant Professors
Roberta Contrino | Studio Assistant
Denise Houx | Studio Assistant
Lorenzo Castellani Lovati | Studio Assistant

Politecnico Di Milano
School of Architecture Urban Planning and Construction Engineering
Laurea Magistrale Thesis | Study Program Architecture-Building Architecture
Academic Year 2019|2020

MSc Authors
Mary Lynn Al Haddad
Nancy El Asmar

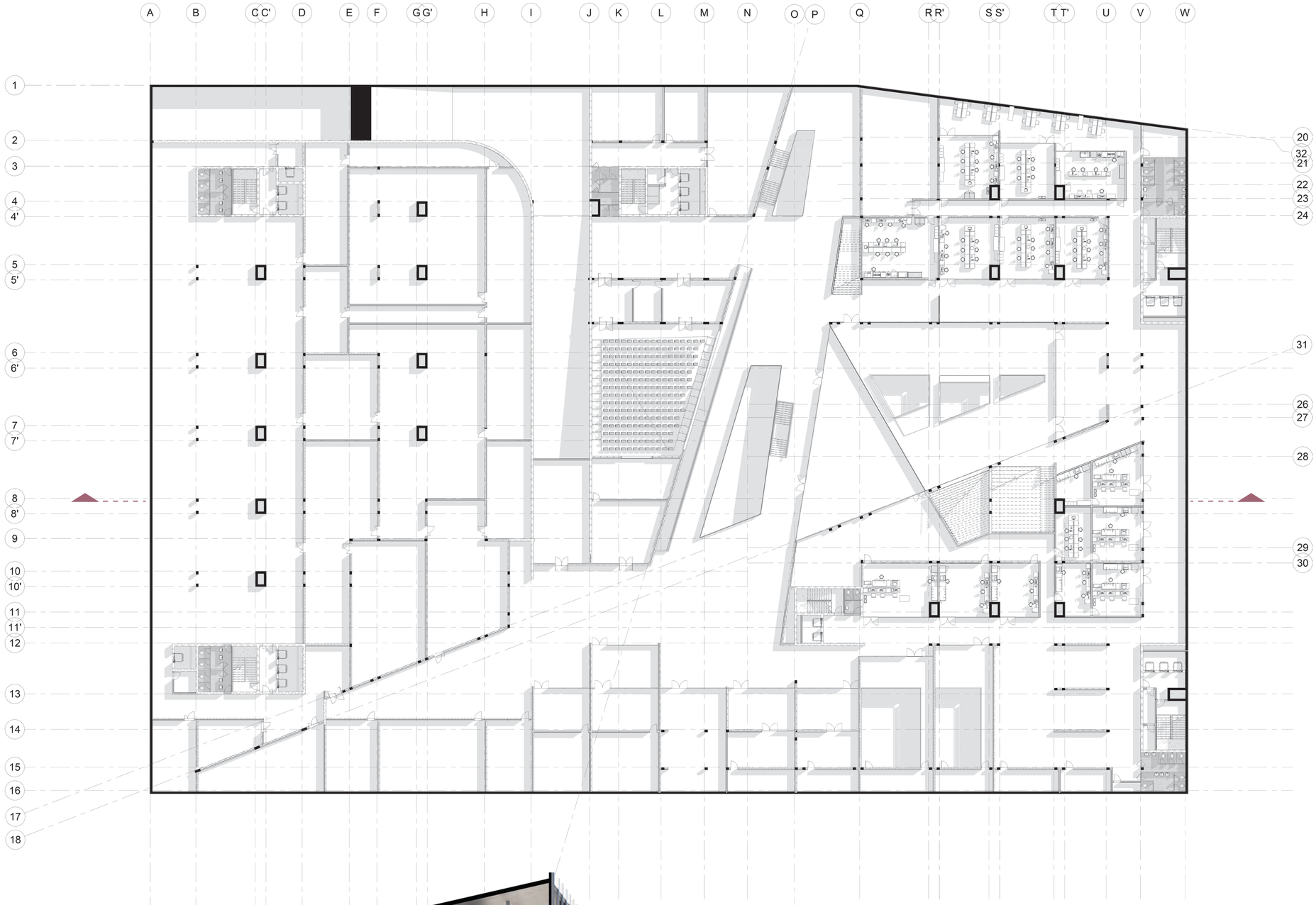
Supervisor
Prof. Francesca Battisti | Architectural Design

Professors
Grigor Angjeliu | Structural Design
Giovanni Dotelli | Innovative Materials for Architecture
Francesco Romano | Building Services Design
Lavinia Chiara Tagliabue | Technology and Design in BIM Environment

Assistant Professors
Roberta Contrino | Studio Assistant
Denise Houx | Studio Assistant
Lorenzo Castellani Lovati | Studio Assistant

Ground Floor Plan

Scale
1/400



Politecnico Di Milano
School of Architecture Urban Planning and Construction Engineering
Laurea Magistrale Thesis | Study Program Architecture-Building Architecture
Academic Year 2019|2020

MSc Authors
Mary Lynn Al Haddad
Nancy El Asmar

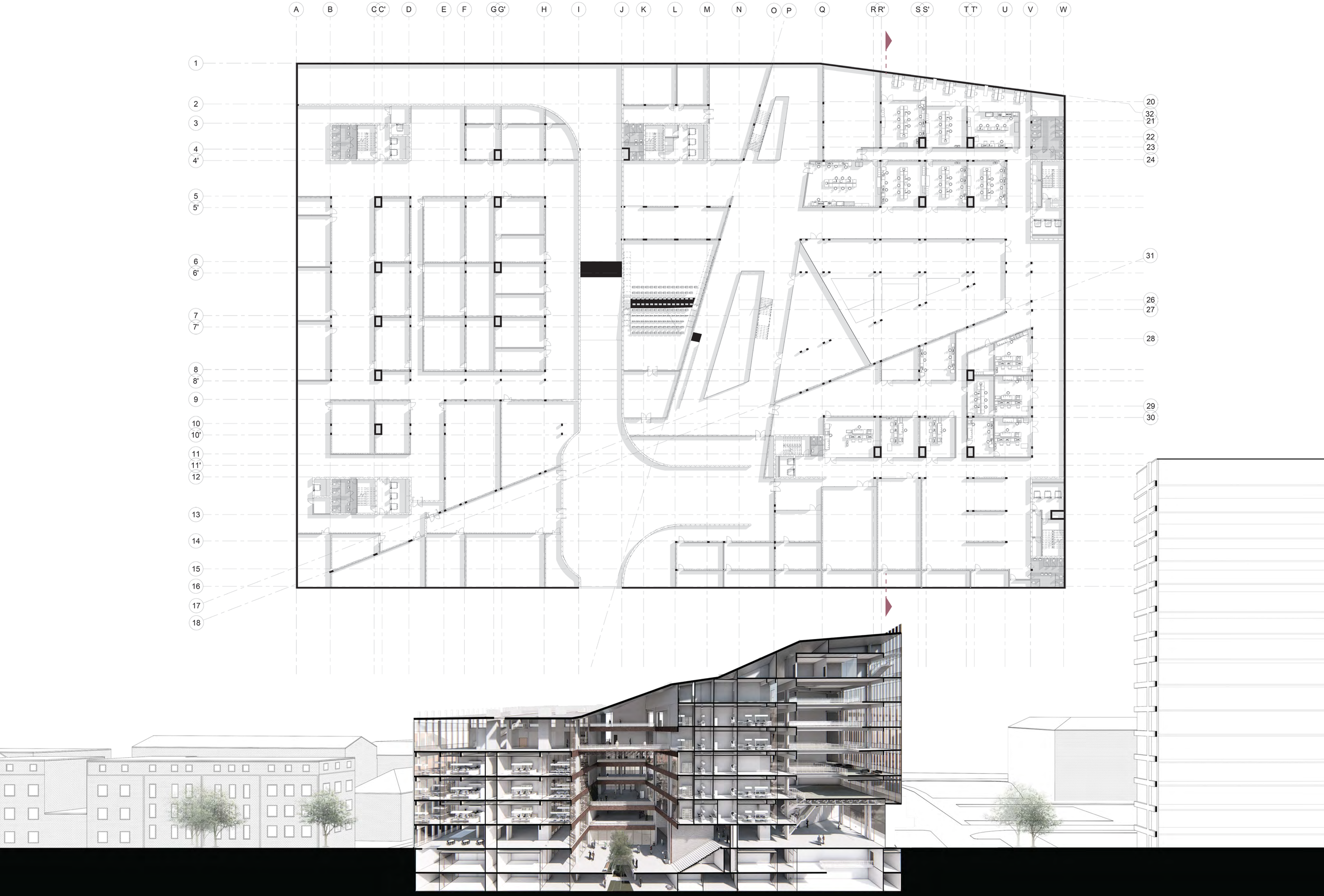
Supervisor
Prof. Francesca Battisti | Architectural Design

Professors
Grigor Angjeliu | Structural Design
Giovanni Dotelli | Innovative Materials for Architecture
Francesco Romano | Building Services Design
Lavinia Chiara Tagliabue | Technology and Design in BIM Environment

Studio Assistants
Roberta Contrino
Denise Houx
Lorenzo Castellani Lovati

B1 Floor Plan
South Elevation

Scale
1/200



Politecnico Di Milano
School of Architecture Urban Planning and Construction Engineering
Laurea Magistrale Thesis | Study Program Architecture-Building Architecture
Academic Year 2019|2020

MSc Authors
Mary Lynn Al Haddad
Nancy El Asmar

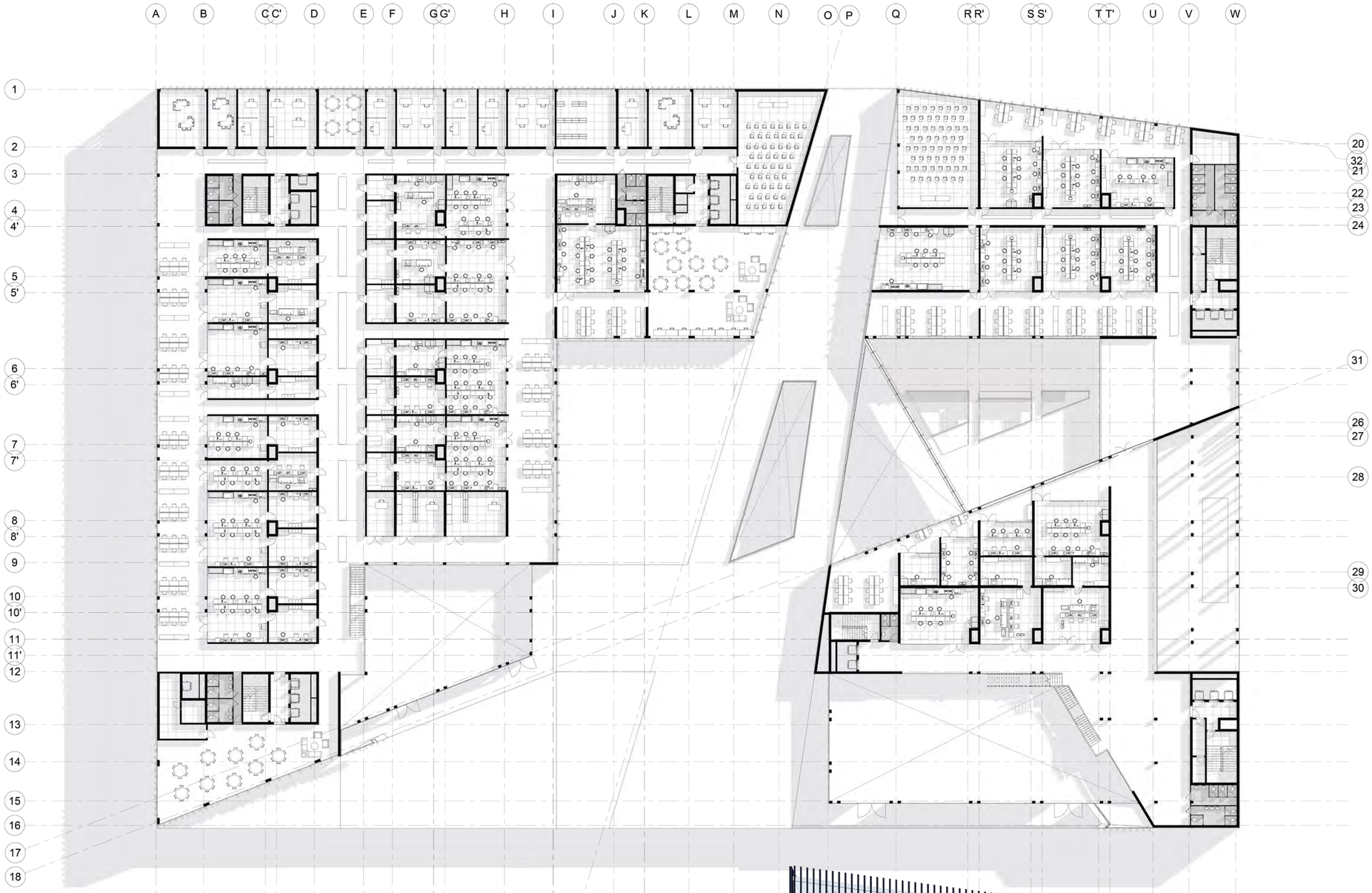
Supervisor
Prof. Francesca Battisti | Architectural Design

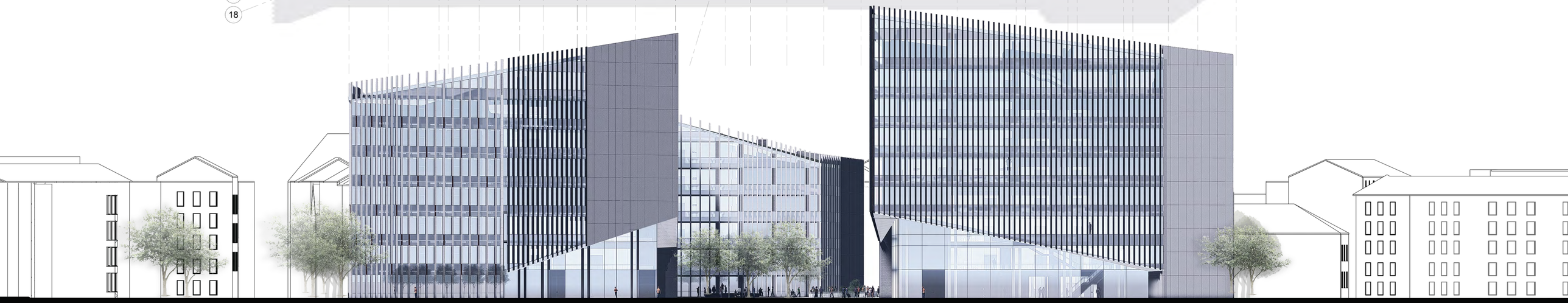
Professors
Grigor Angjeliu | Structural Design
Giovanni Dotelli | Innovative Materials for Architecture
Francesco Romano | Building Services Design
Lavinia Chiara Tagliabue | Technology and Design in BIM Environment

Studio Assistants
Roberta Contrino
Denise Houx
Lorenzo Castellani Lovati

B2 Floor Plan
North Elevation

Scale
1/200





Politecnico Di Milano
School of Architecture Urban Planning and Construction Engineering
Laurea Magistrale Thesis | Study Program Architecture-Building Architecture
Academic Year 2019|2020

MSc Authors
Mary Lynn Al Haddad
Nancy El Asmar

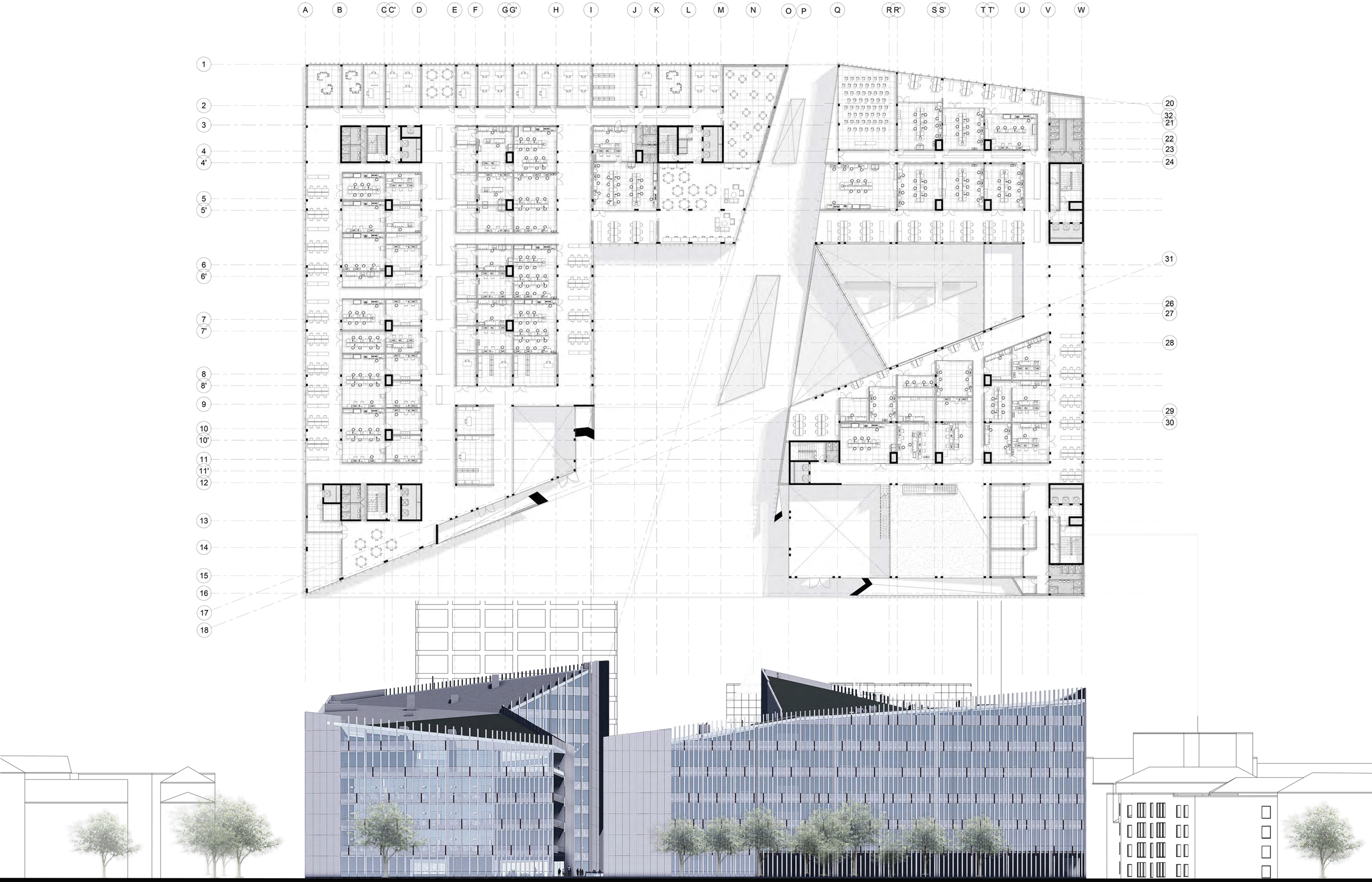
Supervisor
Prof. Francesca Battisti | Architectural Design

Professors
Grigor Angjeliu | Structural Design
Giovanni Dotelli | Innovative Materials for Architecture
Francesco Romano | Building Services Design
Lavinia Chiara Tagliabue | Technology and Design in BIM Environment

Studio Assistants
Roberta Contrino
Denise Houx
Lorenzo Castellani Lovati

First Floor Plan
South Elevation

Scale
1:200



Politecnico Di Milano
School of Architecture Urban Planning and Construction Engineering
Laurea Magistrale Thesis | Study Program Architecture-Building Architecture
Academic Year 2019|2020

MSc Authors
Mary Lynn Al Haddad
Nancy El Asmar

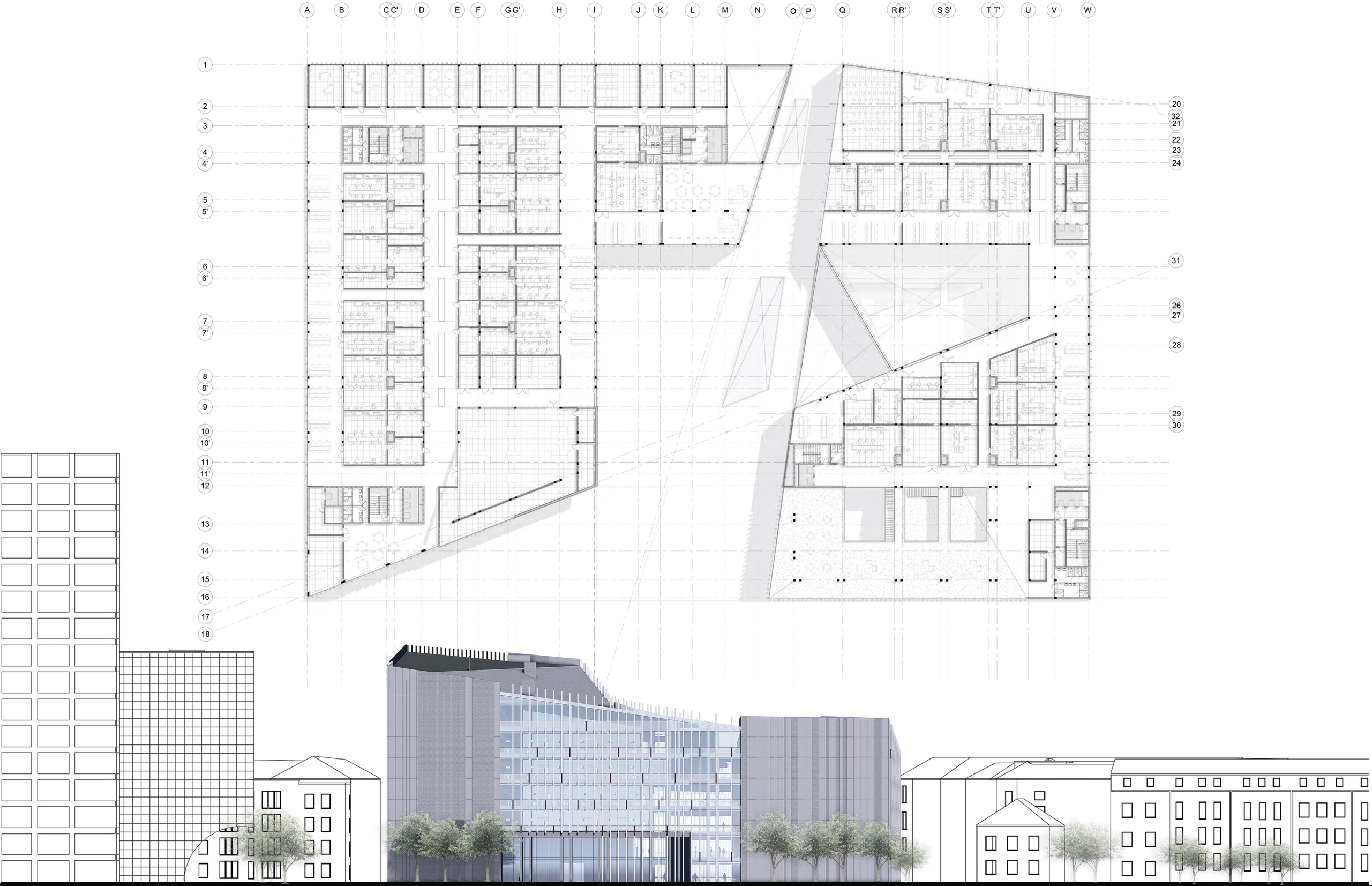
Supervisor
Prof. Francesca Battisti | Architectural Design

Professors
Grigor Angjeliu | Structural Design
Giovanni Dotelli | Innovative Materials for Architecture
Francesco Romano | Building Services Design
Lavinia Chiara Tagliabue | Technology and Design in BIM Environment

Studio Assistants
Roberta Contrino
Denise Houx
Lorenzo Castellani Lovati

Second Floor Plan
North Elevation

Scale
1/200



Politecnico Di Milano
School of Architecture Urban Planning and Construction Engineering
Laurea Magistrale Thesis | Study Program Architecture-Building Architecture
Academic Year 2019|2020

MSc Authors
Mary Lynn Al Haddad
Nancy El Asmar

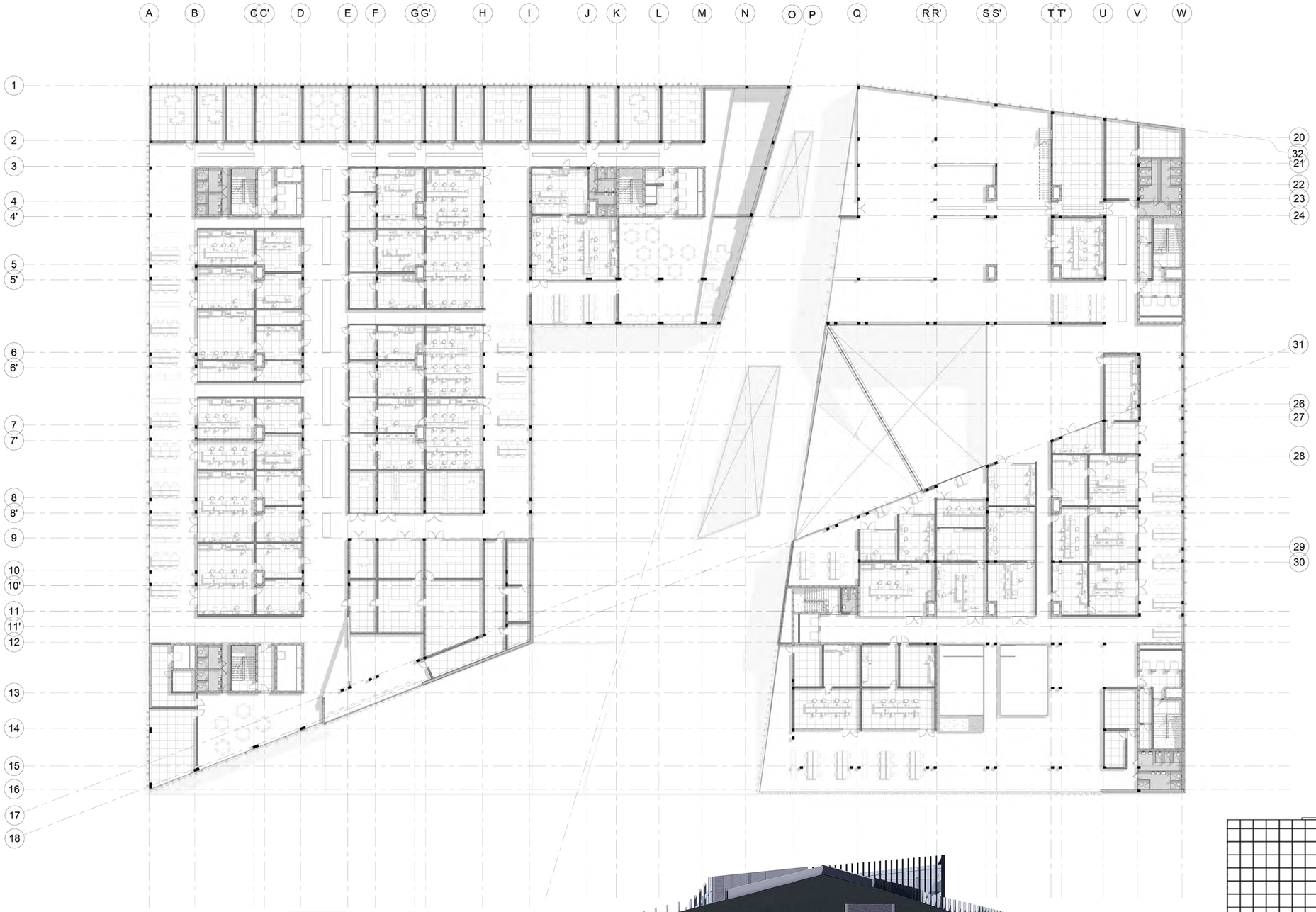
Supervisor
Prof. Francesca Battisti | Architectural Design

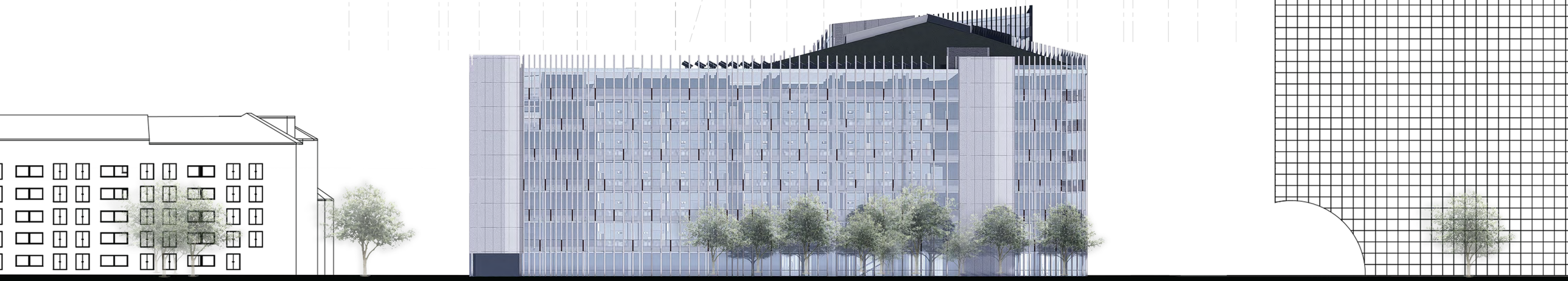
Professors
Grigor Angjeliu | Structural Design
Giovanni Dotelli | Innovative Materials for Architecture
Francesco Romano | Building Services Design
Lavinia Chiara Tagliabue | Technology and Design in BIM Environment

Studio Assistants
Roberta Contrino
Denise Houx
Lorenzo Castellani Lovati

Third Floor Plan
East Elevation

Scale
1/200





Politecnico Di Milano
School of Architecture Urban Planning and Construction Engineering
Laurea Magistrale Thesis | Study Program Architecture-Building Architecture
Academic Year 2019|2020

MSc Authors
Mary Lynn Al Haddad
Nancy El Asmar

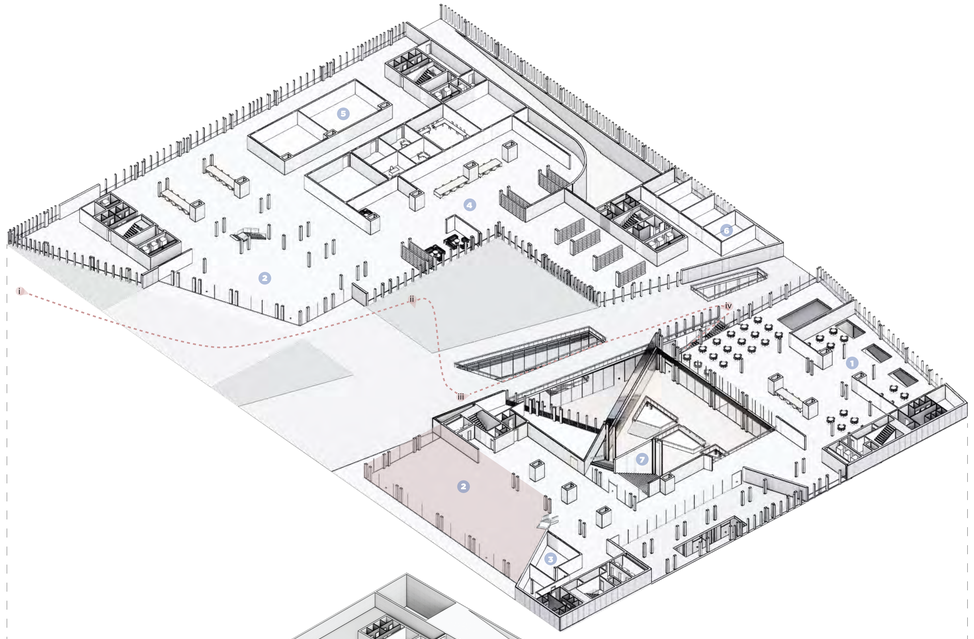
Supervisor
Prof. Francesca Battisti | Architectural Design

Professors
Grigor Angjeliu | Structural Design
Giovanni Dotelli | Innovative Materials for Architecture
Francesco Romano | Building Services Design
Lavinia Chiara Tagliabue | Technology and Design in BIM Environment

Studio Assistants
Roberta Contrino
Denise Houx
Lorenzo Castellani Lovati

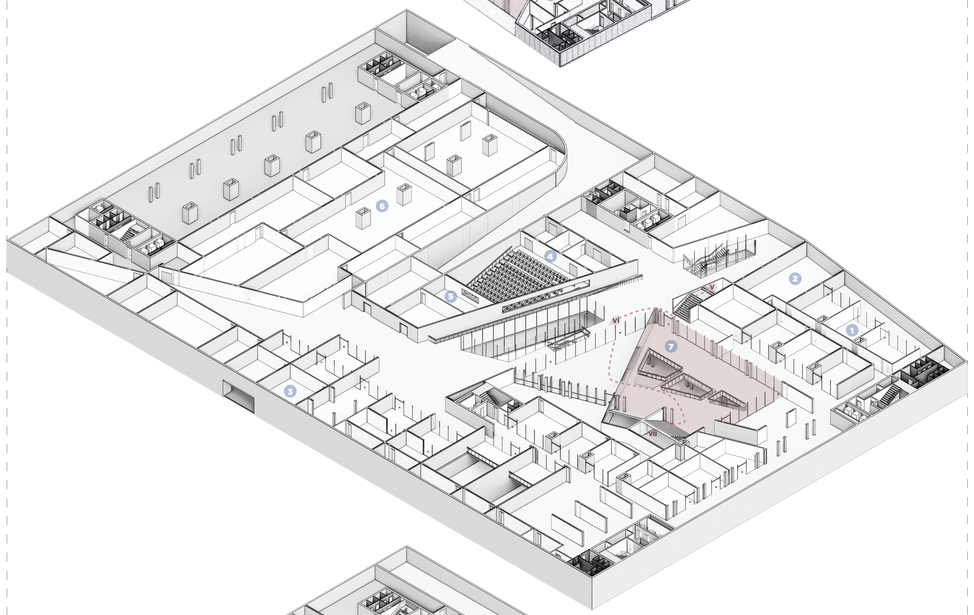
Fourth Floor Plan
West Elevation

Scale
1/200



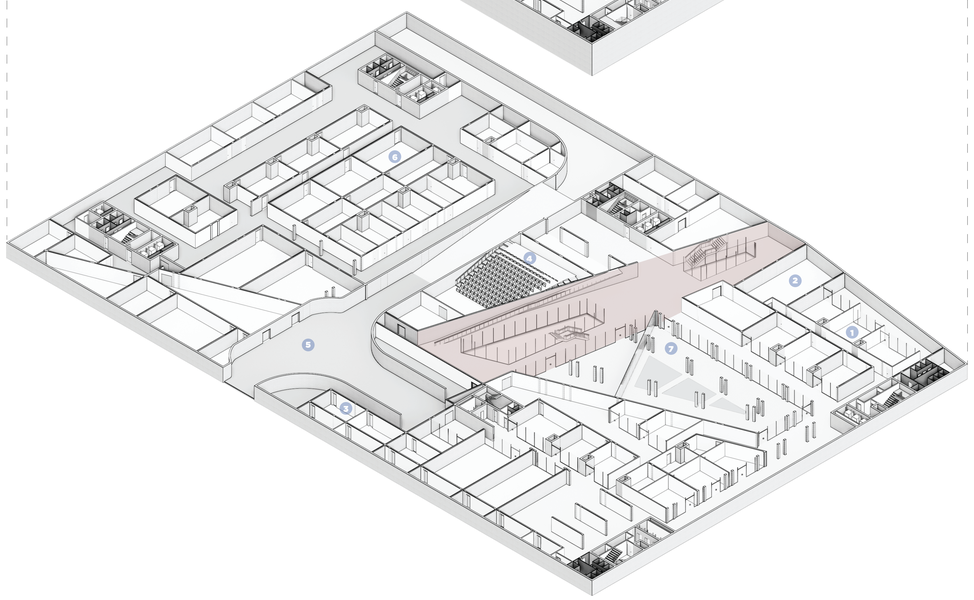
GF

1- Cantine
2- Entrance atriums
3- Storage room
4- Library
5- Meeting rooms
6- Offices
7- Forum seating steps



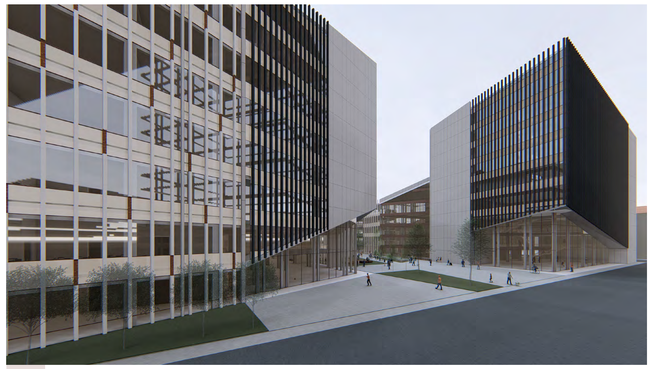
B1

1- Standard labs
2- Dark room
3- Storage room
4- Theatre
5- Monitoring room
6- Animal Station
7- Forum



B2

1- Standard labs
2- Dark room
3- Storage room
4- Theatre
5- Service truck access
6- Technical rooms
7- Forum



i

ii

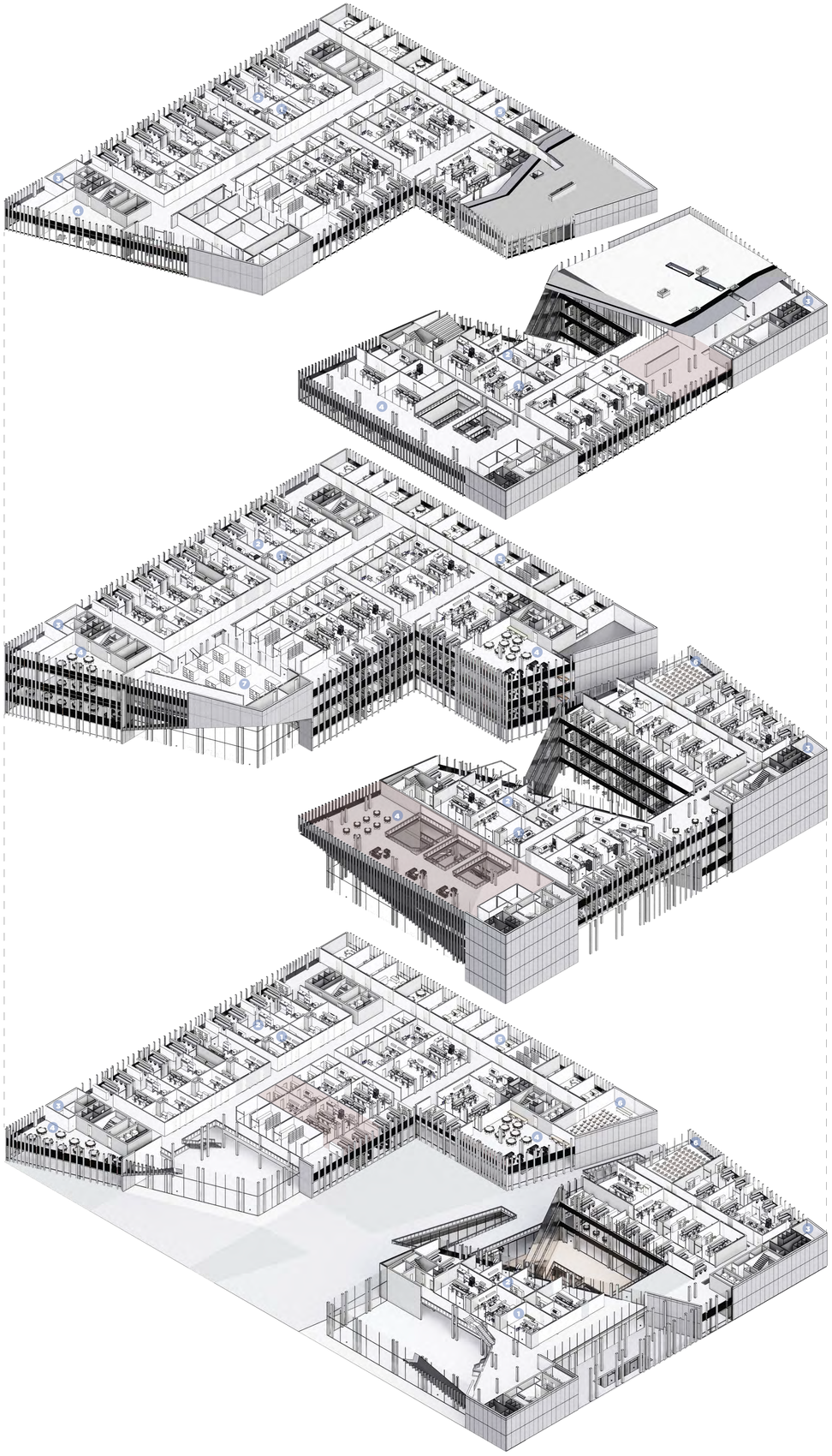
iii

iv

v

vi

vii



5th

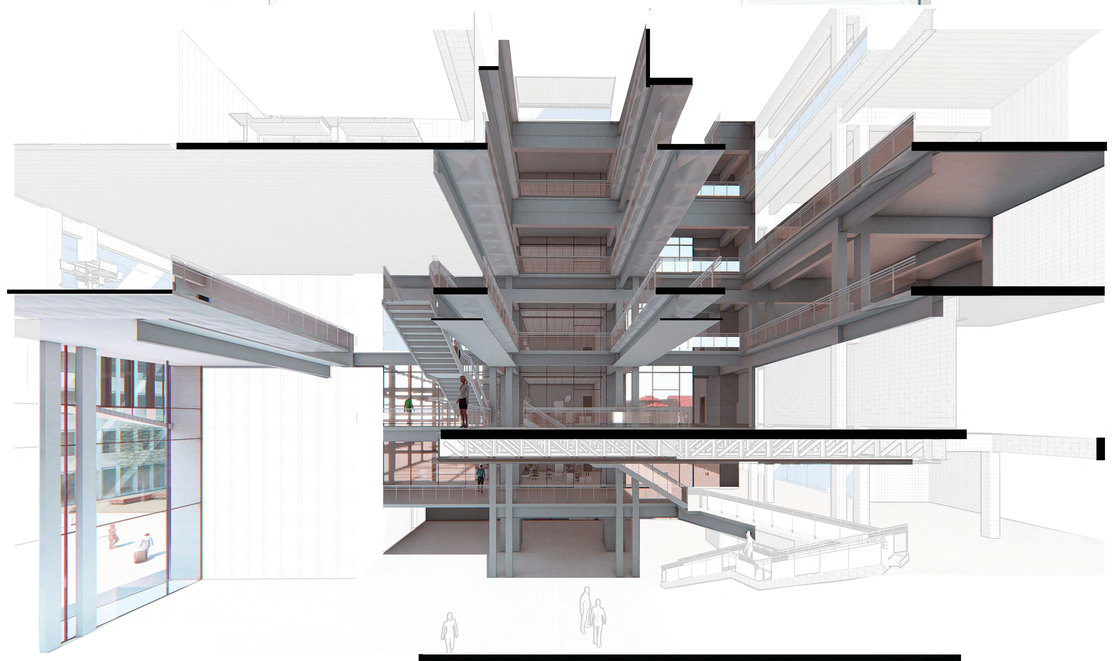
1- Standard labs
2- Dark room
3- Storage room
4- Common space
5- Offices

3rd

1- Standard labs
2- Dark room
3- Storage room
4- Common spac
5- Offices
6- Lecture halls
7- Research & de

1st

1- Standard labs
2- Dark room
3- Storage room
4- Common space
5- Offices
6- Lecture halls



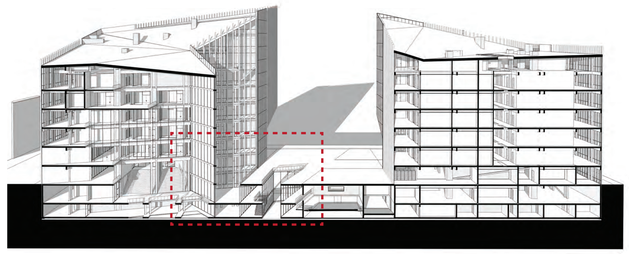
Politecnico Di Milano
School of Architecture Urban Planning and Construction Engineering
Laurea Magistrale Thesis | Study Program Architecture-Building Architecture
Academic Year 2019|2020

MSc Authors
Mary Lynn Al Haddad
Nancy El Asmar

Supervisor
Prof. Francesca Battisti | Architectural Design

Professors
Grigor Angjeliu | Structural Design
Giovanni Dotelli | Innovative Materials for Architecture
Francesco Romano | Building Services Design
Lavinia Chiara Tagliabue | Technology and Design in BIM Environment

Studio Assistants
Roberta Contrino
Denise Houx
Lorenzo Castellani Lovati



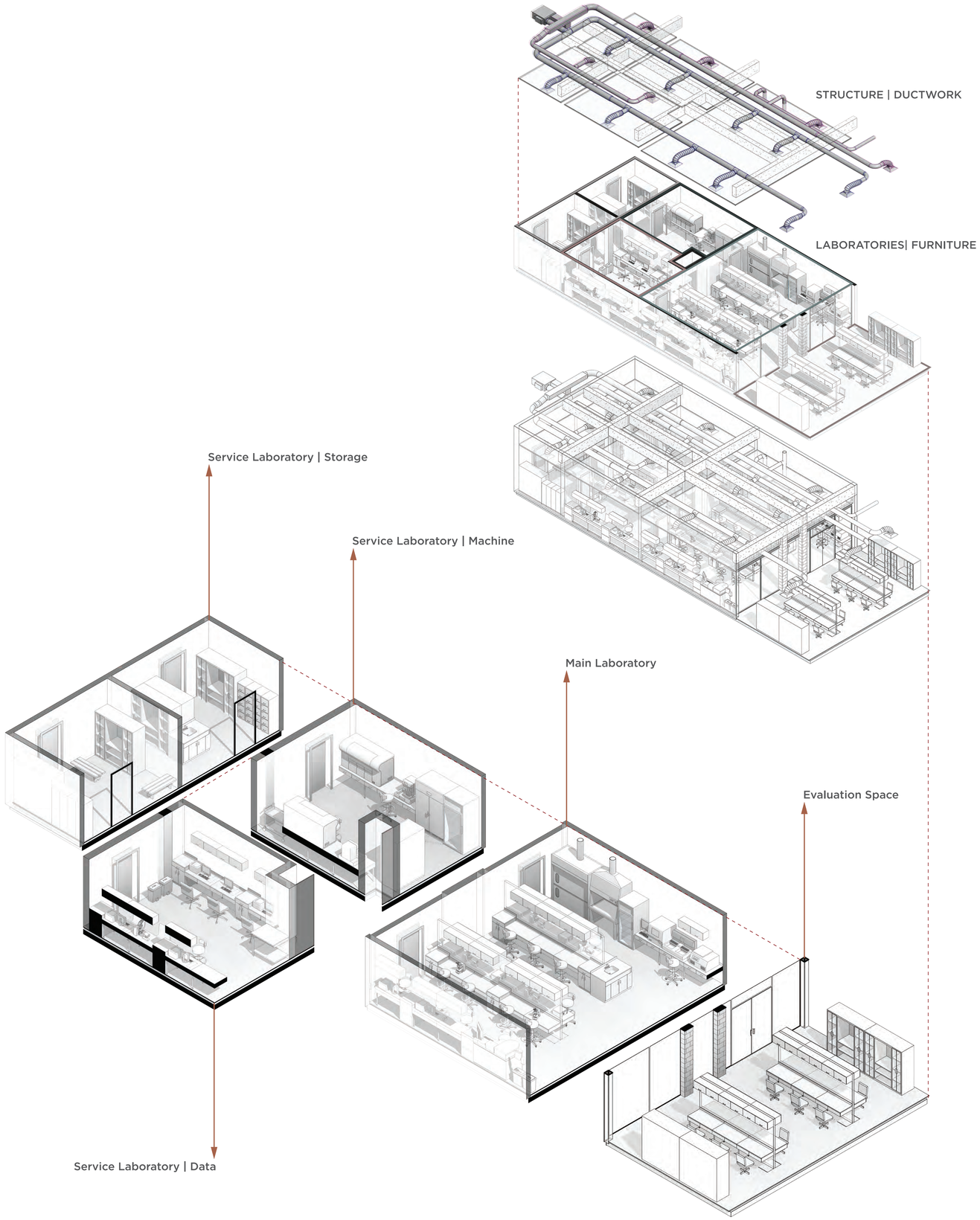
Politecnico Di Milano
School of Architecture Urban Planning and Construction Engineering
Laurea Magistrale Thesis | Study Program Architecture-Building Architecture
Academic Year 2019|2020

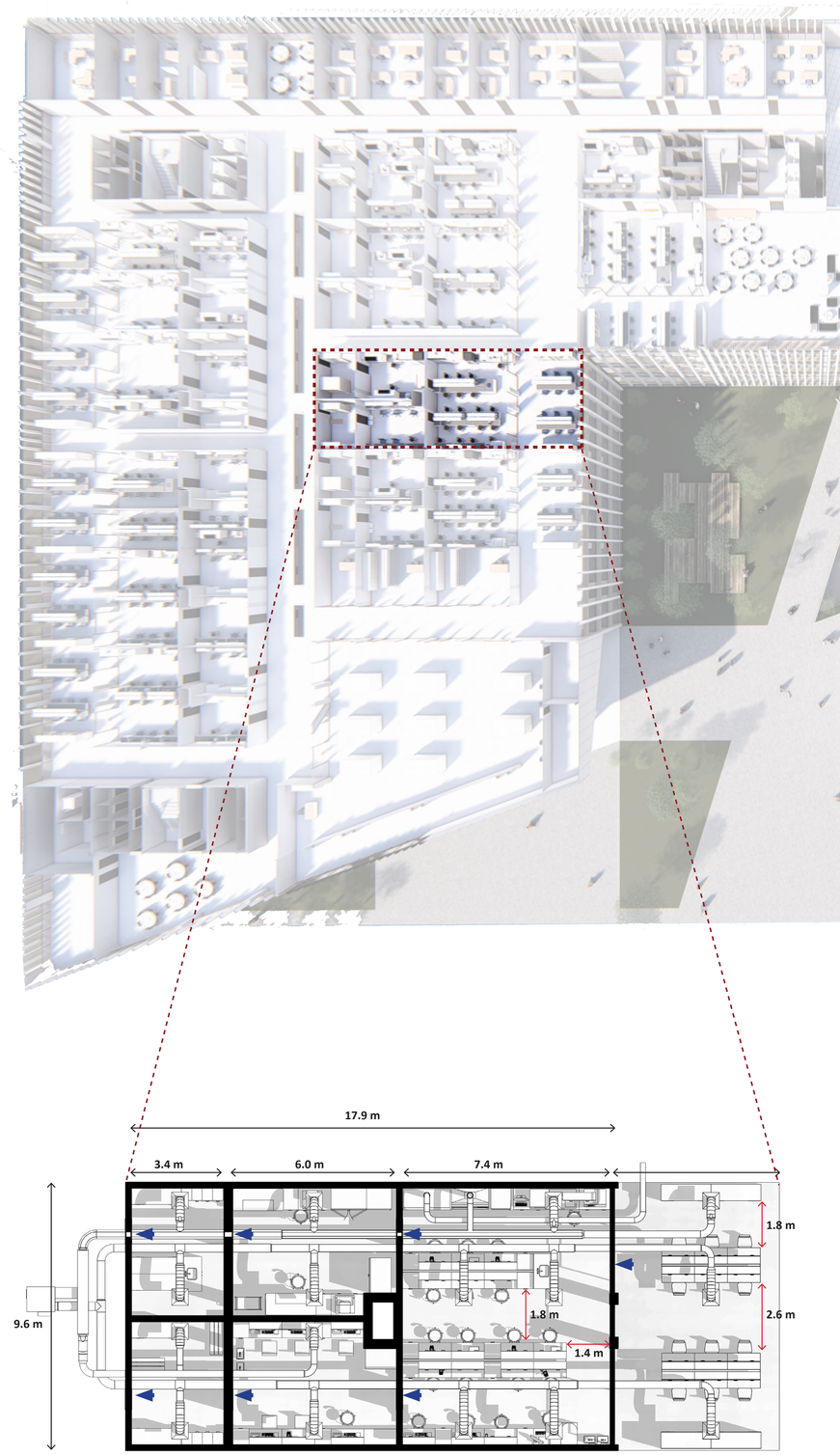
MSc Authors
Mary Lynn Al Haddad
Nancy El Asmar

Supervisor
Prof. Francesca Battisti | Architectural Design

Professors
Grigor Angjeliu | Structural Design
Giovanni Dotelli | Innovative Materials for Architecture
Francesco Romano | Building Services Design
Lavinia Chiara Tagliabue | Technology and Design in BIM Environment

Assistant Professors
Roberta Contrino | Studio Assistant
Denise Houx | Studio Assistant
Lorenzo Castellani Lovati | Studio Assistant





Lab Module Plan | Standard Dimensions

Politecnico Di Milano
School of Architecture Urban Planning and Construction Engineering
Laurea Magistrale Thesis | Study Program Architecture-Building Architecture
Academic Year 2019|2020

MSc Authors
Mary Lynn Al Haddad
Nancy El Asmar

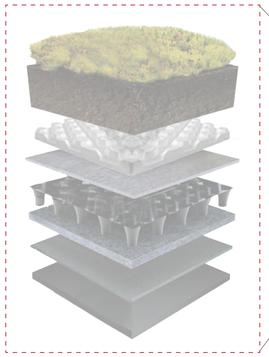
Supervisor
Prof. Francesca Battisti | Architectural Design

Professors
Grigor Angjeliu | Structural Design
Giovanni Dotelli | Innovative Materials for Architecture
Francesco Romano | Building Services Design
Lavinia Chiara Tagliabue | Technology and Design in BIM Environment

Assistant Professors
Roberta Contrino | Studio Assistant
Denise Houx | Studio Assistant
Lorenzo Castellani Lovati | Studio Assistant

Interior Lab Module

Scale 1/10



Politecnico Di Milano
School of Architecture Urban Planning and Construction Engineering
Laurea Magistrale Thesis | Study Program Architecture-Building Architecture
Academic Year 2019|2020

MSc Authors
Mary Lynn Al Haddad
Nancy El Asmar

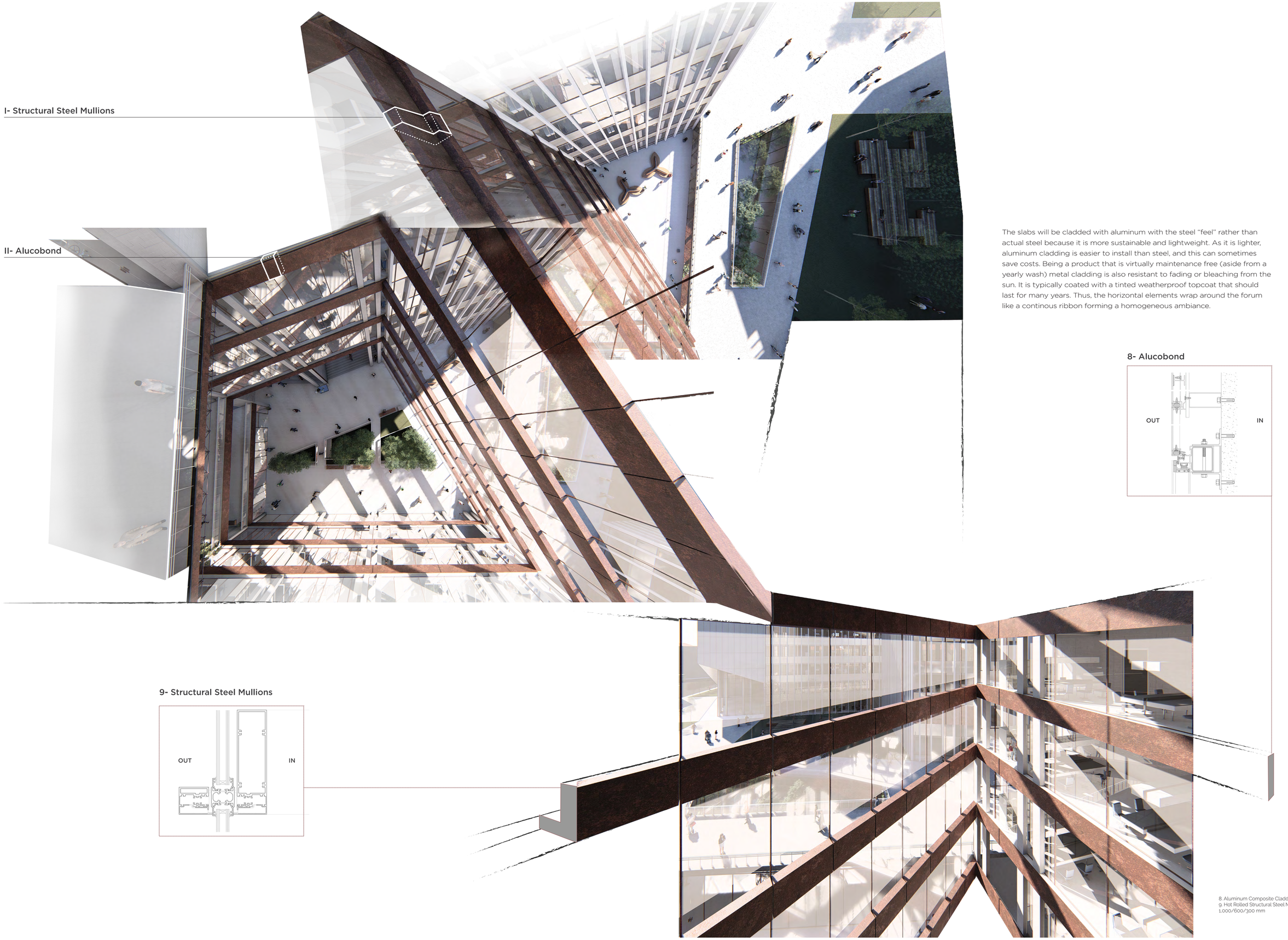
Supervisor
Prof. Francesca Battisti | Architectural Design

Professors
Grigor Angjeliu | Structural Design
Giovanni Dotelli | Innovative Materials for Architecture
Francesco Romano | Building Services Design
Lavinia Chiara Tagliabue | Technology and Design in BIM Environment

Assistant Professors
Roberta Contrino | Studio Assistant
Denise Houx | Studio Assistant
Lorenzo Castellani Lovati | Studio Assistant

Forum

Scale
1/40

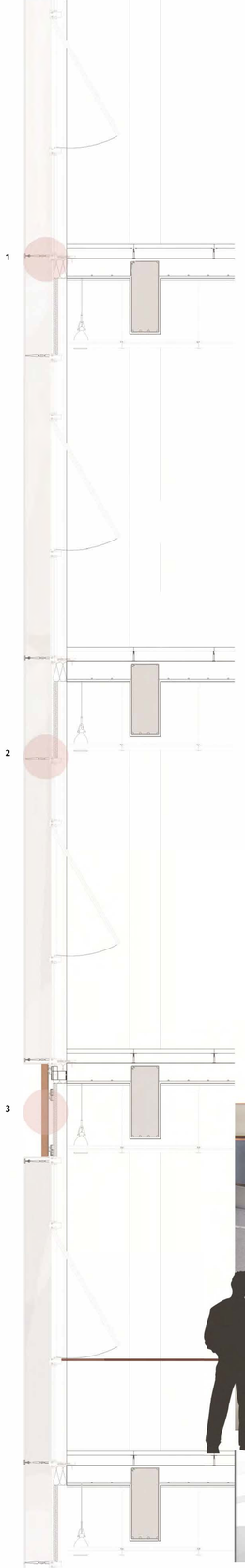


The slabs will be cladded with aluminum with the steel "feel" rather than actual steel because it is more sustainable and lightweight. As it is lighter, aluminum cladding is easier to install than steel, and this can sometimes save costs. Being a product that is virtually maintenance free (aside from a yearly wash) metal cladding is also resistant to fading or bleaching from the sun. It is typically coated with a tinted weatherproof topcoat that should last for many years. Thus, the horizontal elements wrap around the forum like a continous ribbon forming a homogeneous ambiance.

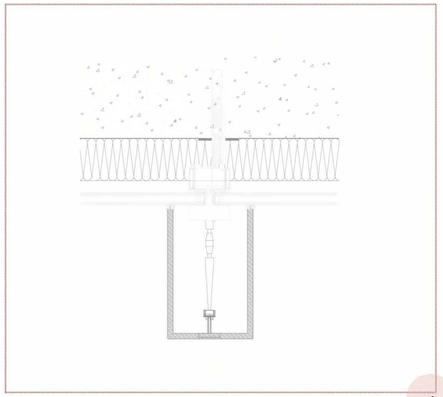
8- Alucobond

9- Structural Steel Mullions

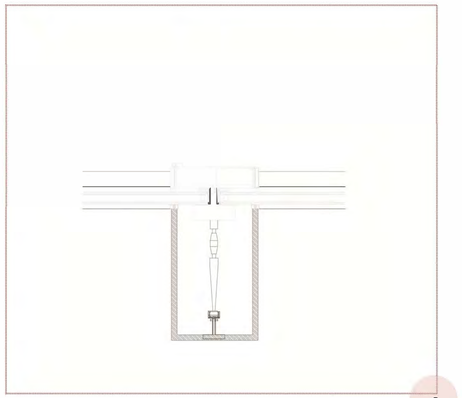
8. Aluminum Composite Cladding - larson pe®-larson fr®
9. Hot Rolled Structural Steel Mullion - OneSteel® L-profile 1.000/600/300 mm



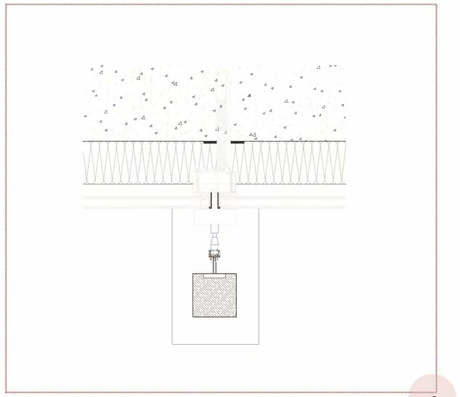
GFRC Fin Connection at Spandrel



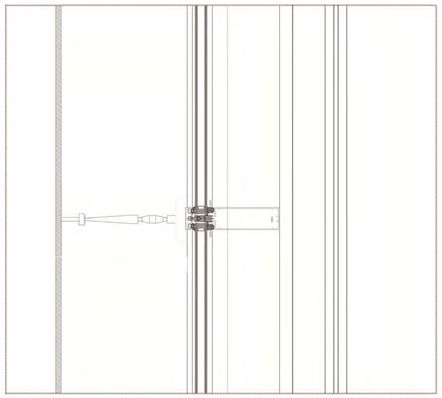
GFRC Fin Connection on Curtainn Glass



Wood Plank Connection at Spandrel



Curtain Glass Section Detail - Fin in Projection



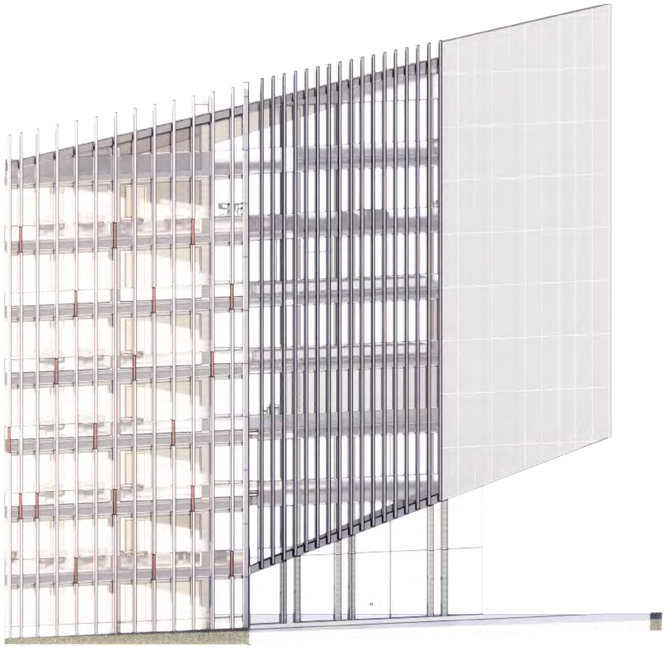
The fins are at distances ranging from 0.6m to 1.2m, depending on the function on the interior based on typical laboratory standards and whether or not it requires additional shading. The blind walls are cladded with the gfrc panels, and both fins and cladding are continuous to the roof serving as parapets, and hiding shafts and other technical elements.

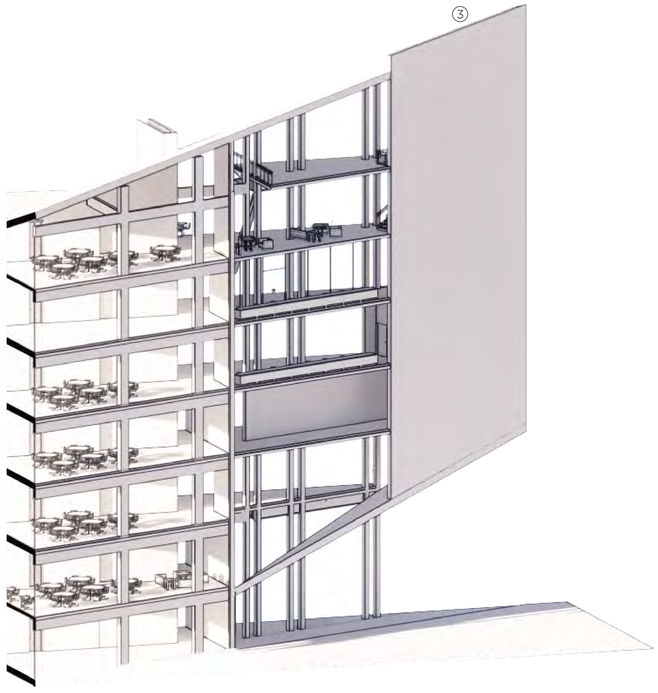
Facade Components

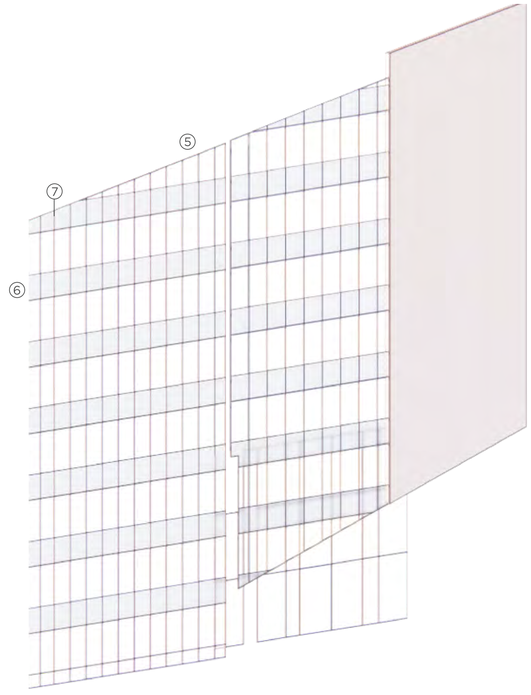
Layer 1: Structure

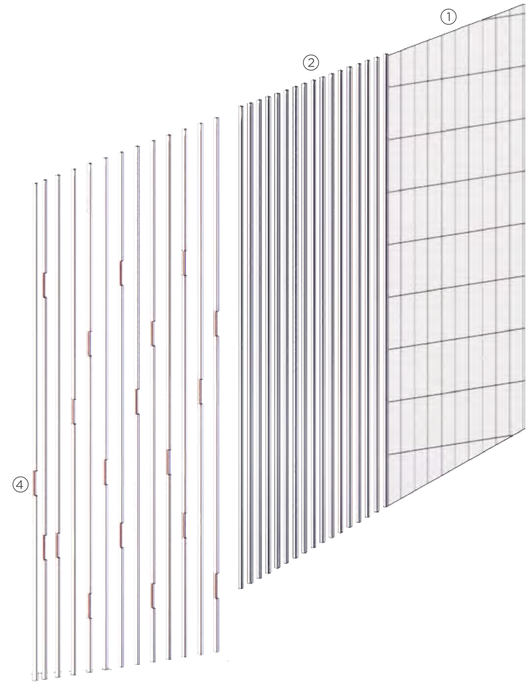
Layer 2: Curtain Glass System

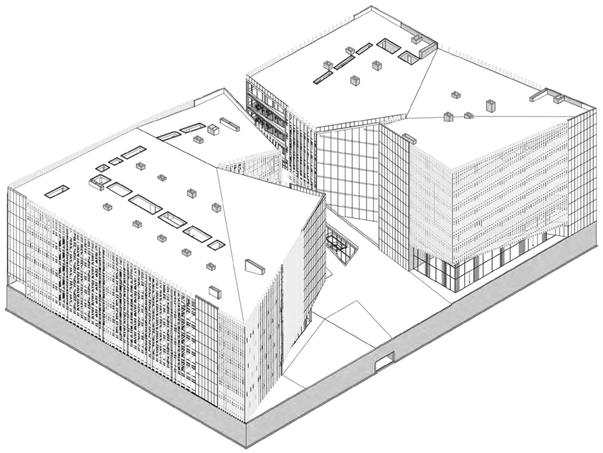
Layer 3: Glassfibre Reinforced Concrete Fins & Wood planks at spandrels to further define the scale of the building

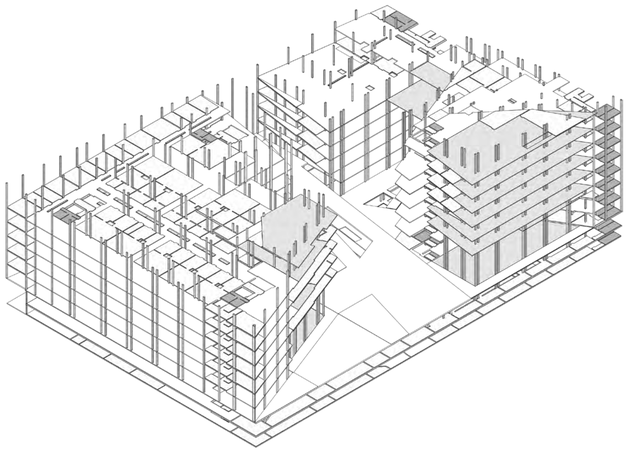


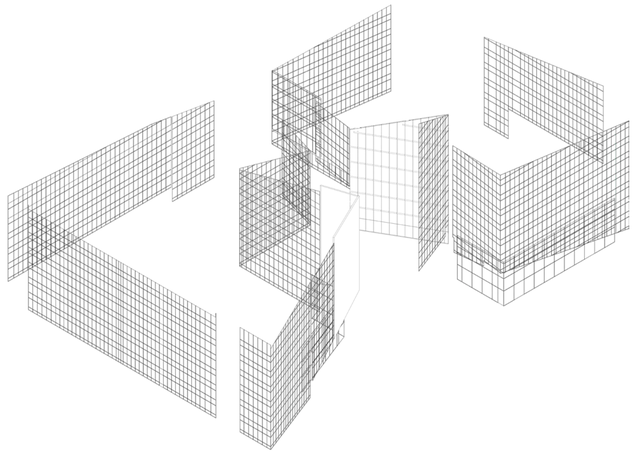


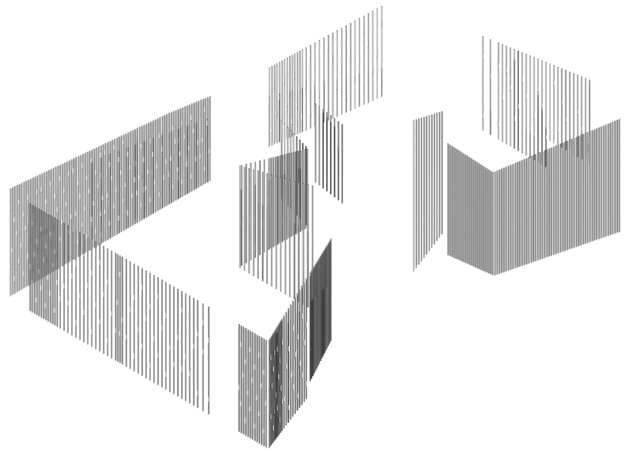












1. GFRC Cladding - Rieder® 3,600/1,200/13 mm
2. GFRC fibreC fins - Rieder® U-shape 300/200/13 mm
3. Concrete - FINJA® PreFab
4. Wooden Plank Fin Separators - HPL Board Parklex® 1,700/200/200 mm
5. Reflective Glass - Reflectasol® Ultra Grey 10 mm Triple Glazing
6. Translucent Spandrel Glass - EMALIT® 8 mm Enameled glass
7. Mullions - ETEM GESTAMP® Aluminium Extrusions S.A. 95/50 mm

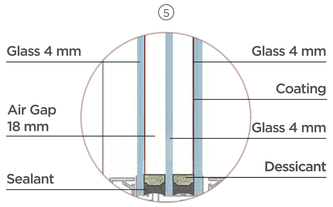
Politecnico Di Milano
School of Architecture Urban Planning and Construction Engineering
Laurea Magistrale Thesis | Study Program Architecture-Building Architecture
Academic Year 2019|2020

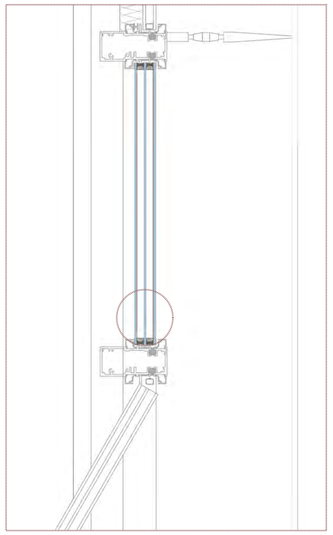
MSc Authors
Mary Lynn Al Haddad
Nancy El Asmar

Supervisor
Prof. Francesca Battisti | Architectural Design

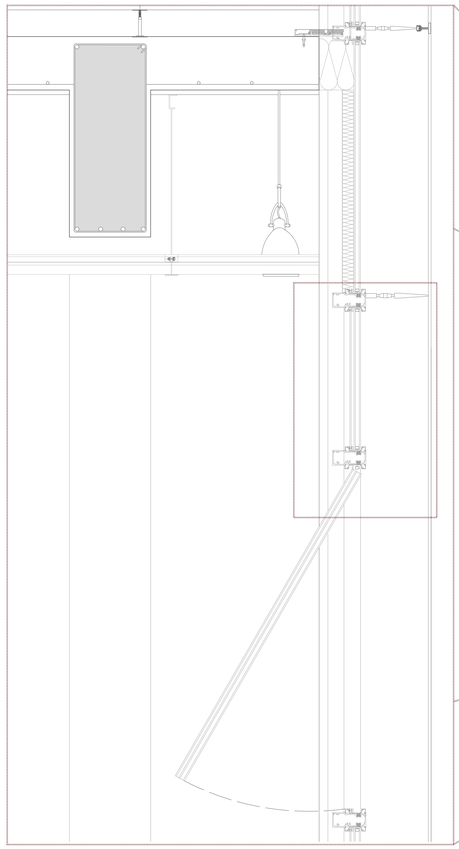
Professors
Grigor Angjeliu | Structural Design
Giovanni Dotelli | Innovative Materials for Architecture
Francesco Romano | Building Services Design
Lavinia Chiara Tagliabue | Technology and Design in BIM Environment

Assistant Professors
Roberta Contrino | Studio Assistant
Denise Houx | Studio Assistant
Lorenzo Castellani Lovati | Studio Assistant

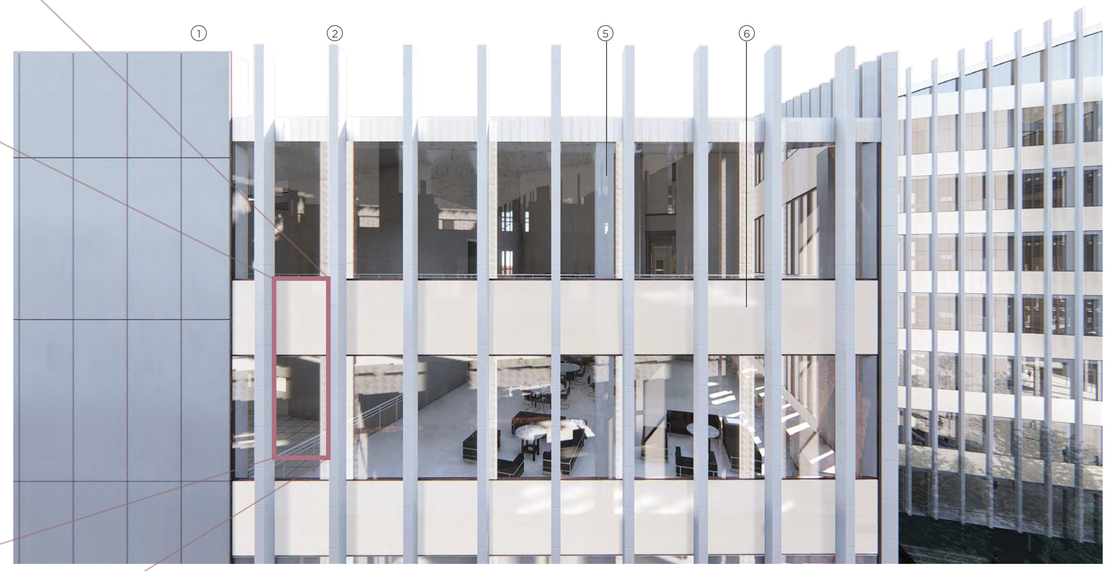




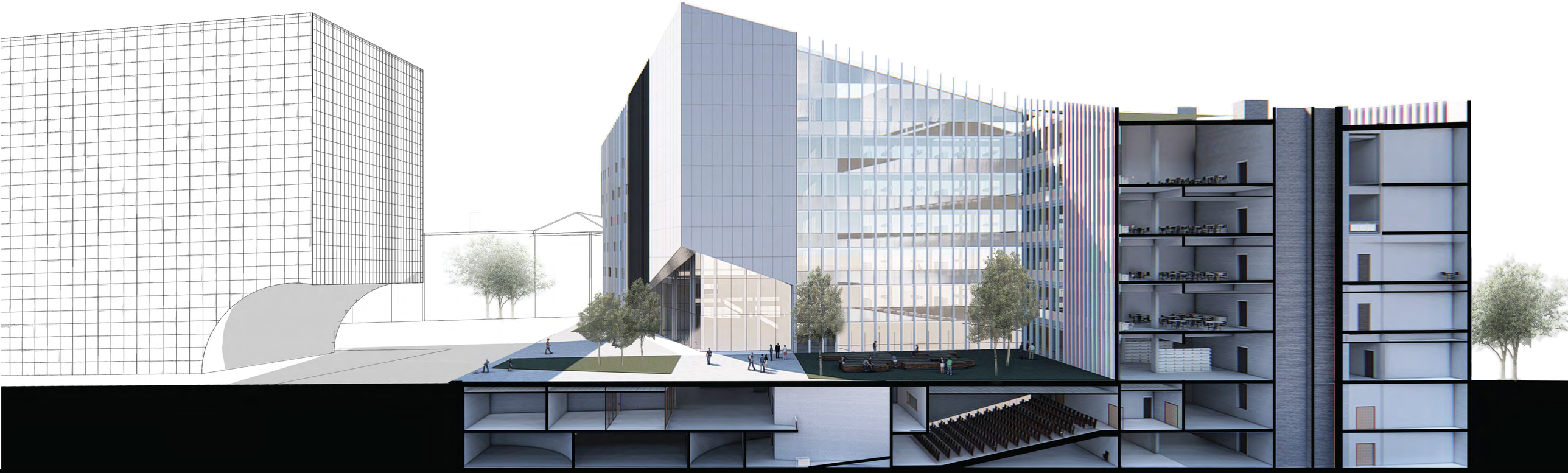
Scale 1:5



Scale 1:10



1. GFRC Cladding - Rieder® 3,600/1,200/13 mm
2. GFRC fibreC fins - Rieder® U-shape 300/200/13 mm
5. Reflective Glass - Reflectasol® Ultra Grey 10 mm Triple Glazing
6. Translucent Spandrel Glass - EMALIT® 8 mm Enameled glass



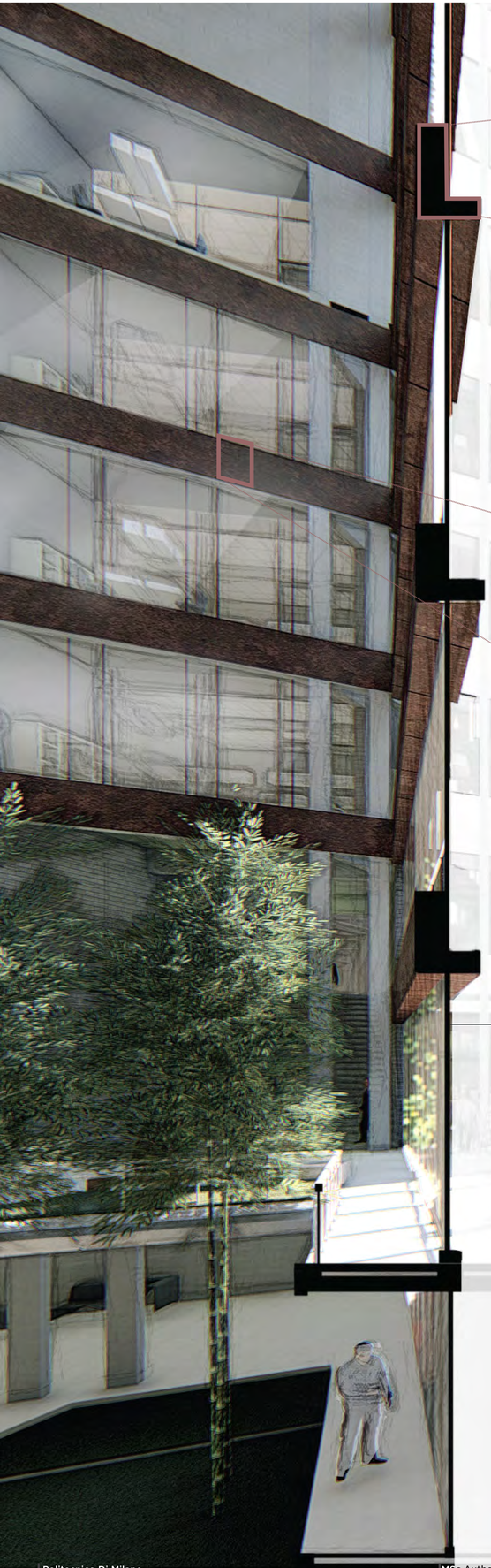
Politecnico Di Milano
School of Architecture Urban Planning and Construction Engineering
Laurea Magistrale Thesis | Study Program Architecture-Building Architecture
Academic Year 2019|2020

MSc Authors
Mary Lynn Al Haddad
Nancy El Asmar

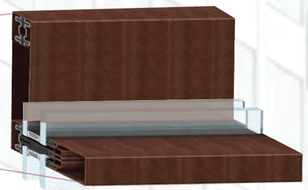
Supervisor
Prof. Francesca Battisti | Architectural Design

Professors
Grigor Angjeliu | Structural Design
Giovanni Dotelli | Innovative Materials for Architecture
Francesco Romano | Building Services Design
Lavinia Chiara Tagliabue | Technology and Design in BIM Environment

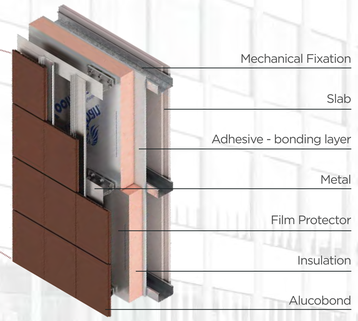
Studio Assistants
Roberta Contrino
Denise Houx
Lorenzo Castellani Lovati



⑨ Structural Steel Mullion



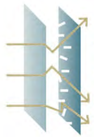
⑧ Alucobond Slab Cladding

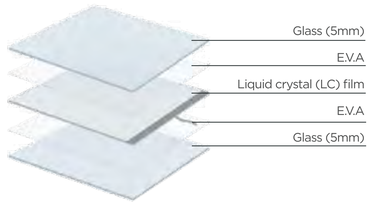


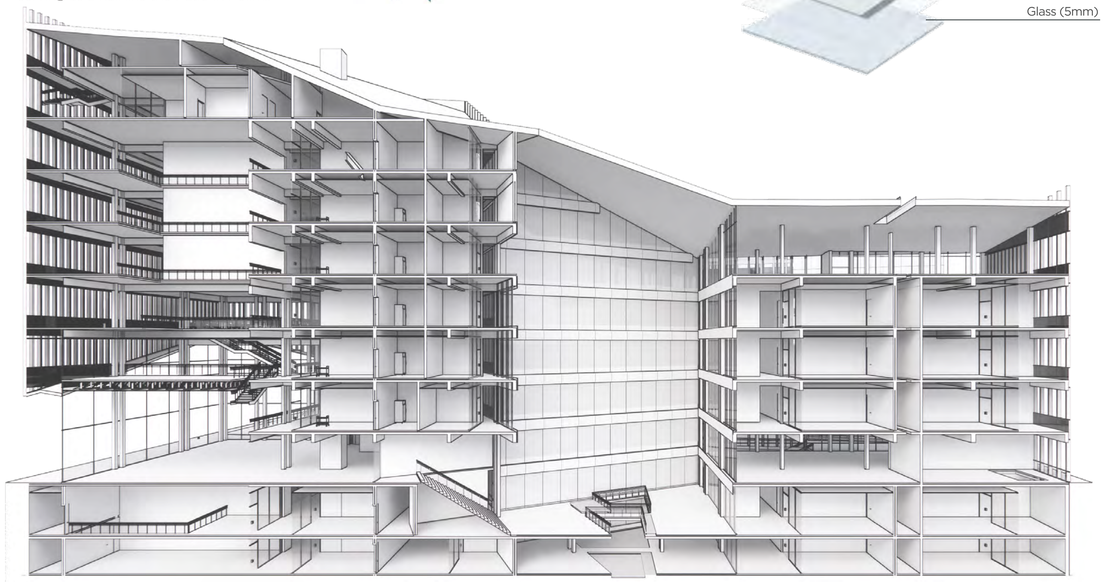
⑩ Switchable Glass

Switchable Glass

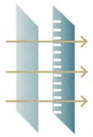
Power off: the glass has a naturally opaque appearance, blocking vision (total privacy), yet permitting light to pass through (translucent). This is needed when the forum is closed off for seminars, guest spokespeople, etc; hence, serving as a hall like the Patio in Polimi.

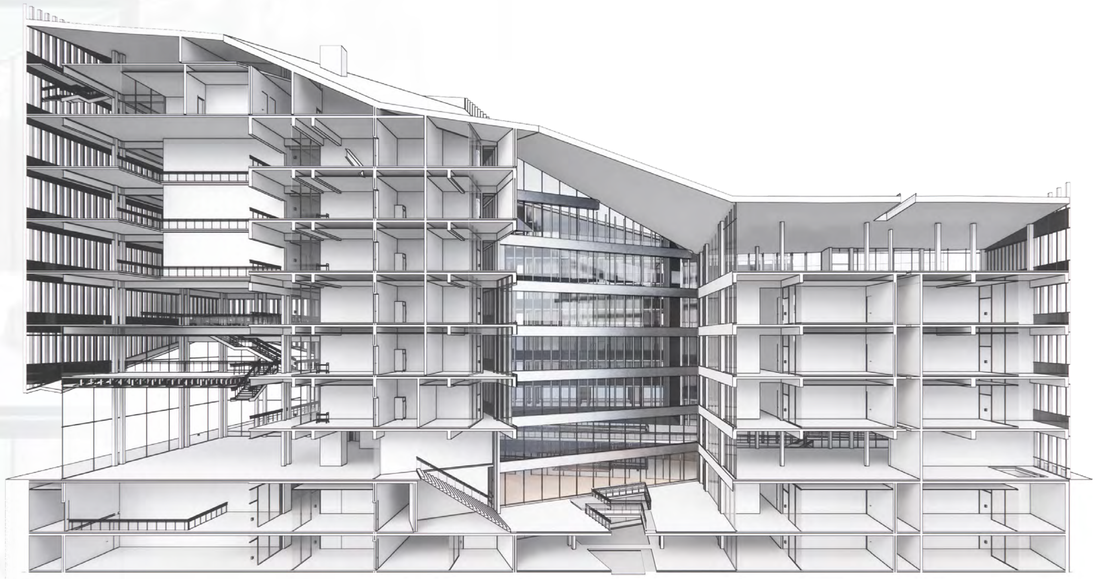




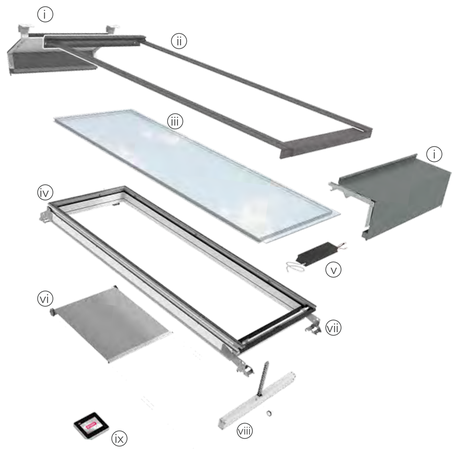


Power on: The liquid crystals are aligned when the electrical current is switched on, causing the glass to turn transparent instantly. Transparency is needed when the forum is acting as a communication hub, and the two buildings are in visual connection as well.





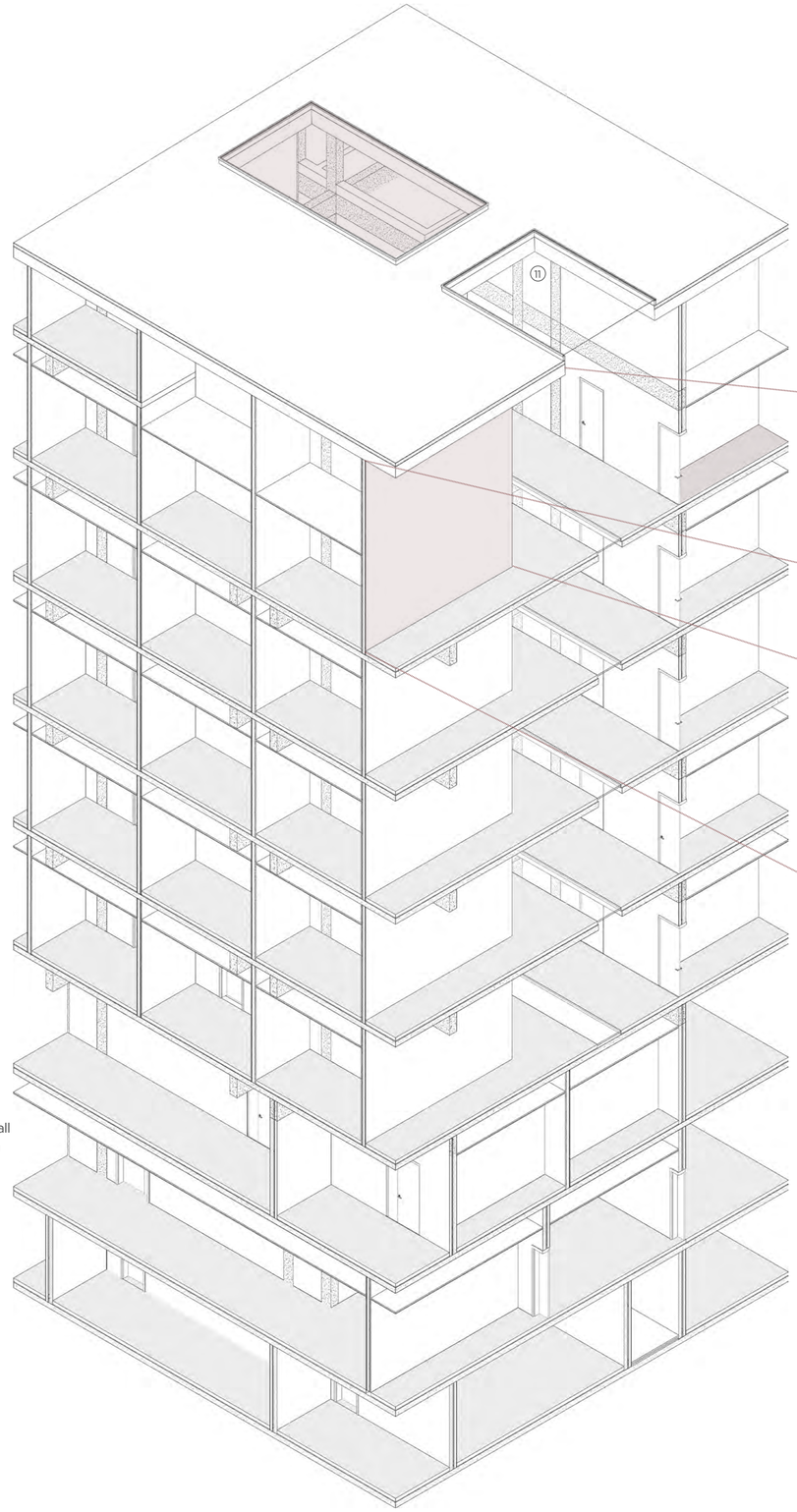
8. Aluminum Composite Cladding - larson pe®-larson fr®
9. Hot Rolled Structural Steel Mullion - OneSteel® L-profile 1,000/600/300 mm
10. Switchable Glass - PRIVA-LITE® 15 mm

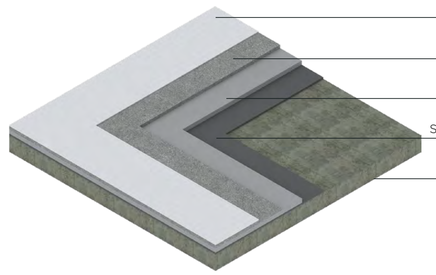


i. Flashing
ii. Cladding
iii. Glazing Unit
iv. Frame
v. Power Supply & Control Unit
vi. Roller Blind
vii. Mounting Bracket
viii. Chain Actuator
ix. Remote Control

Motorized comfort venting skylight module - Opening up to 410 mm

Concrete Basement Wall with Exterior Insulation
(Figure 2.0)





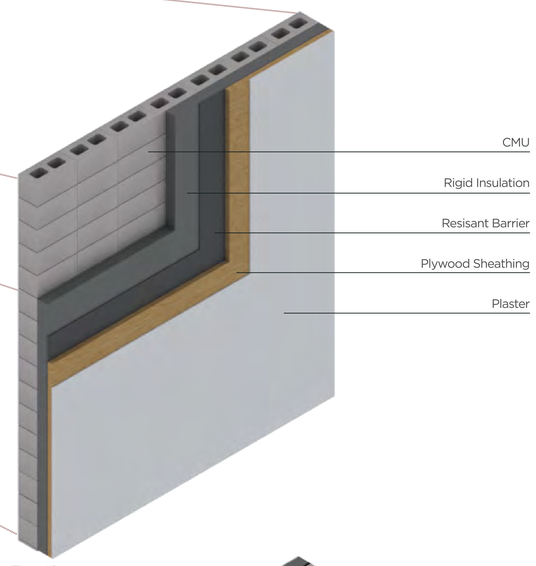


Figure 1.0

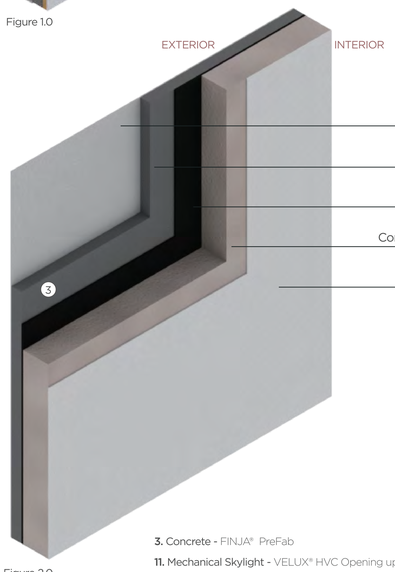
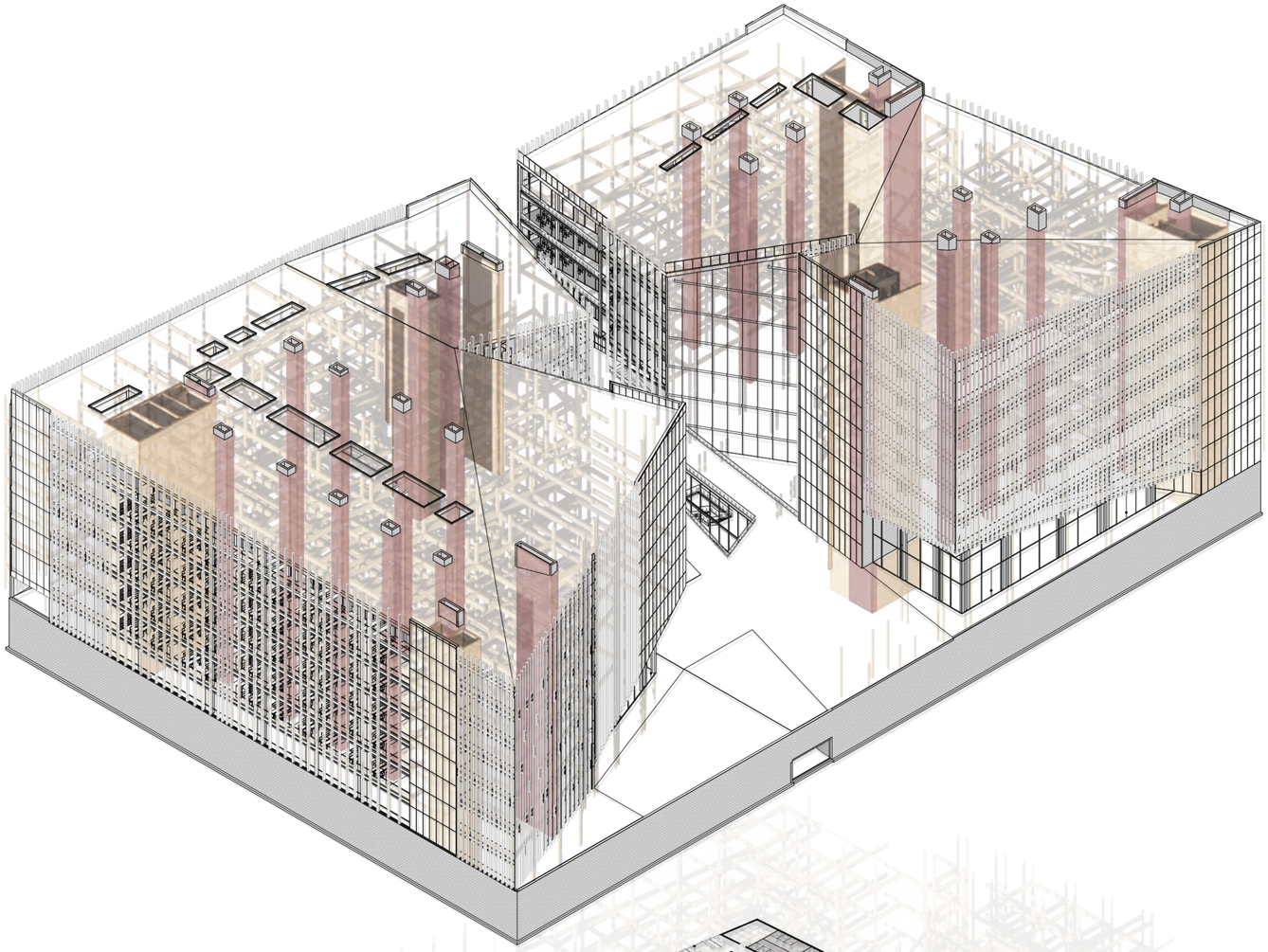
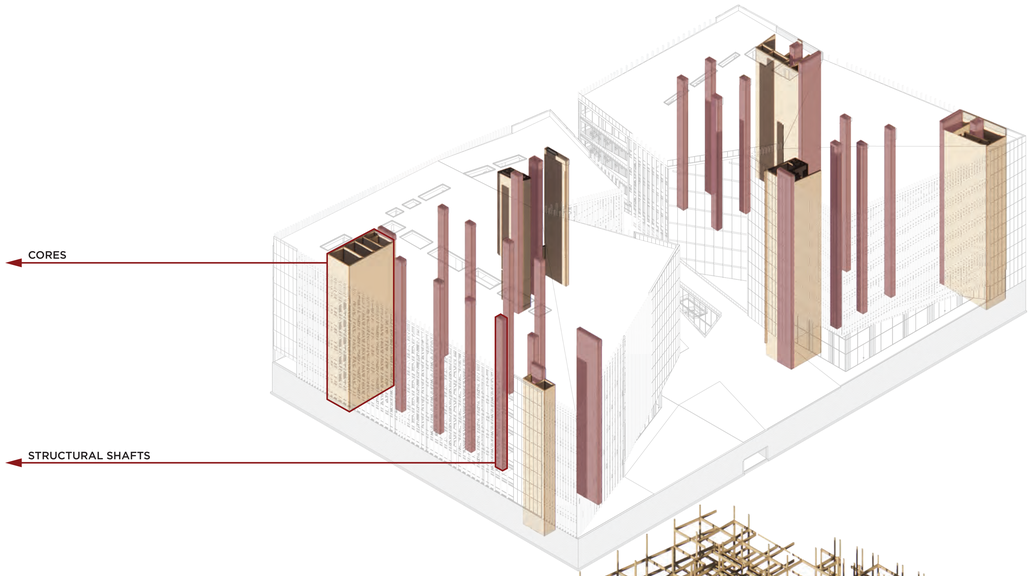


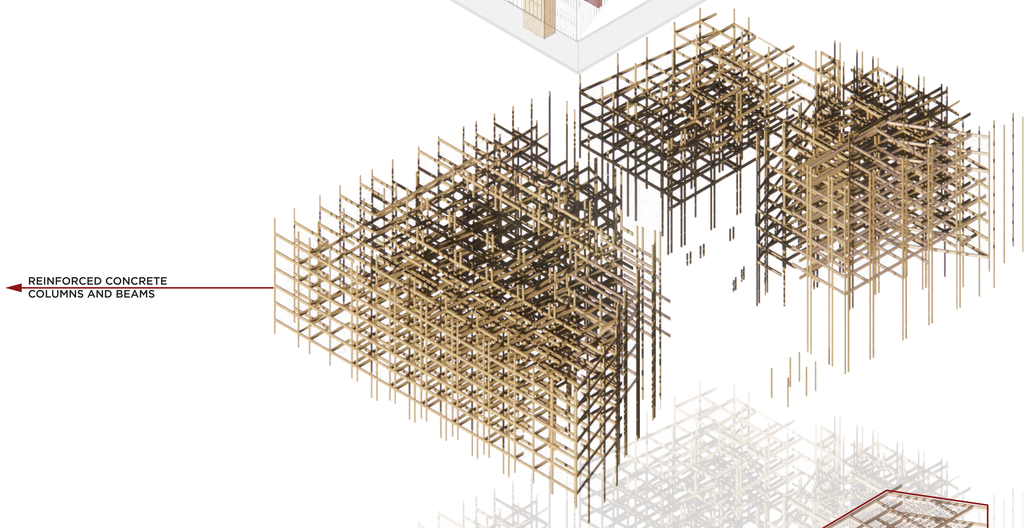
Figure 2.0

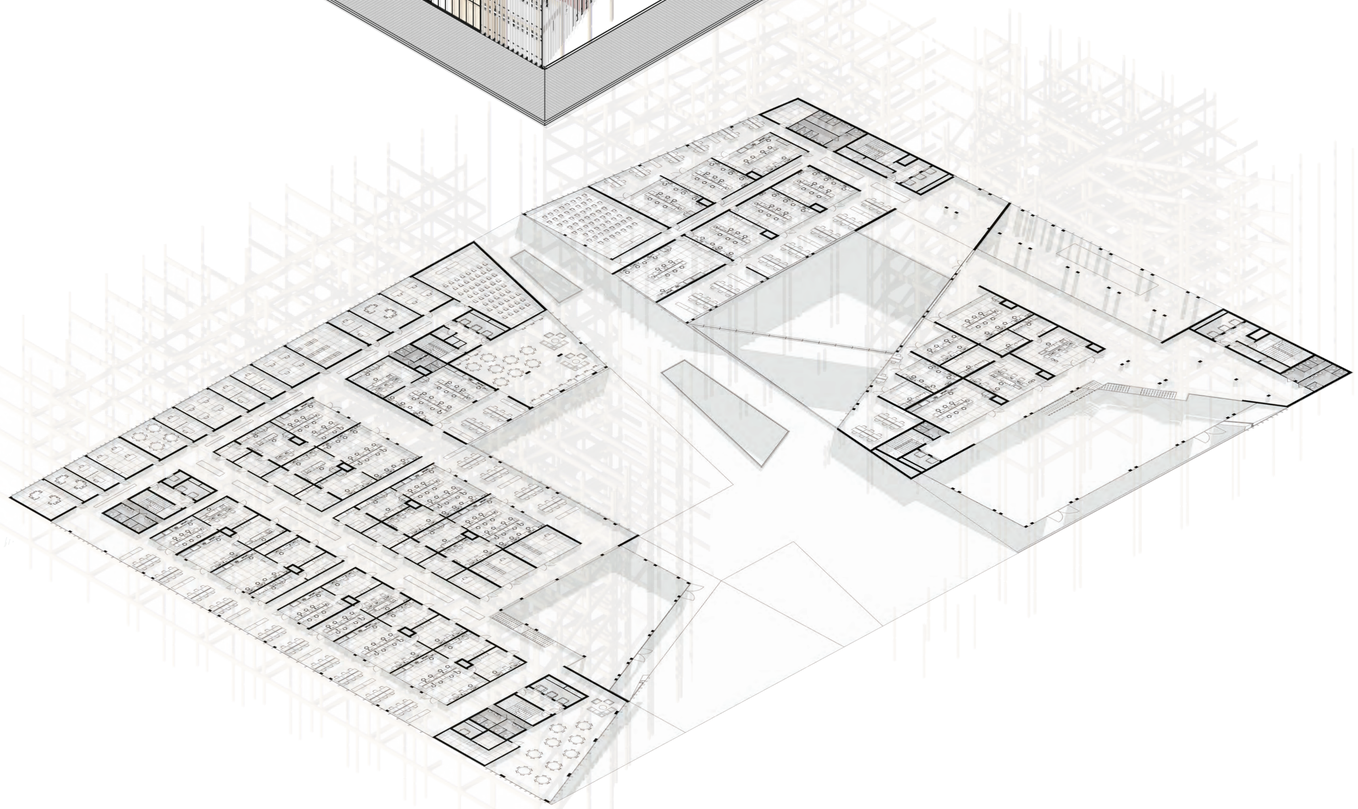
3. Concrete - FINJA® PreFab

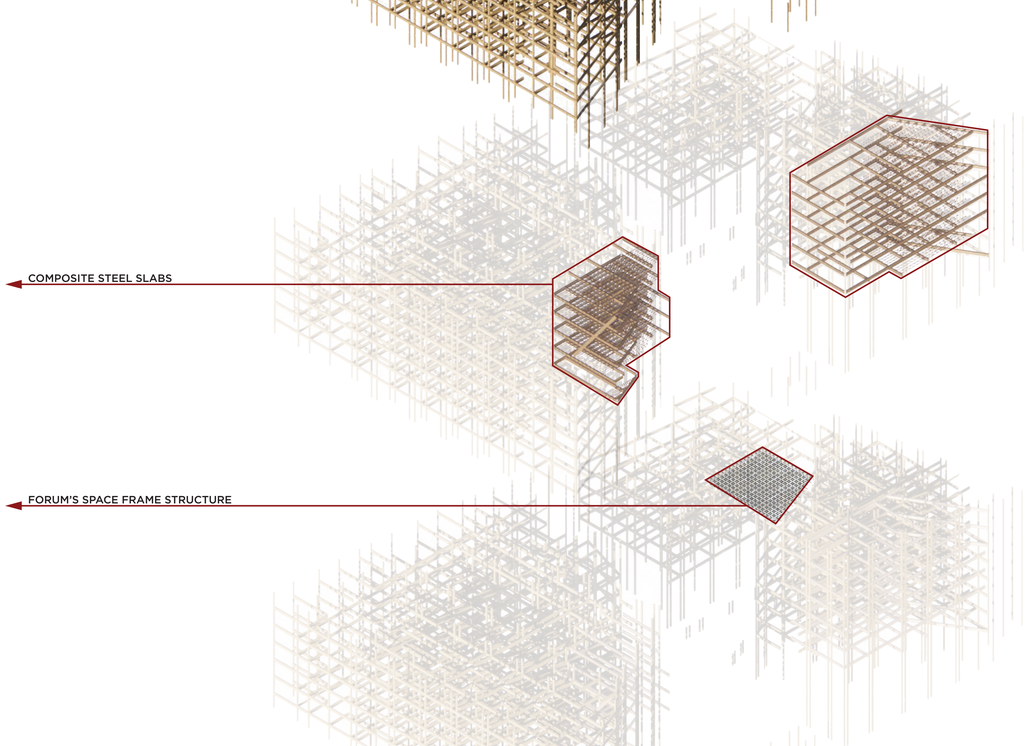
11. Mechanical Skylight - VELUX® HVC Opening up to 410 mm, double-glazed

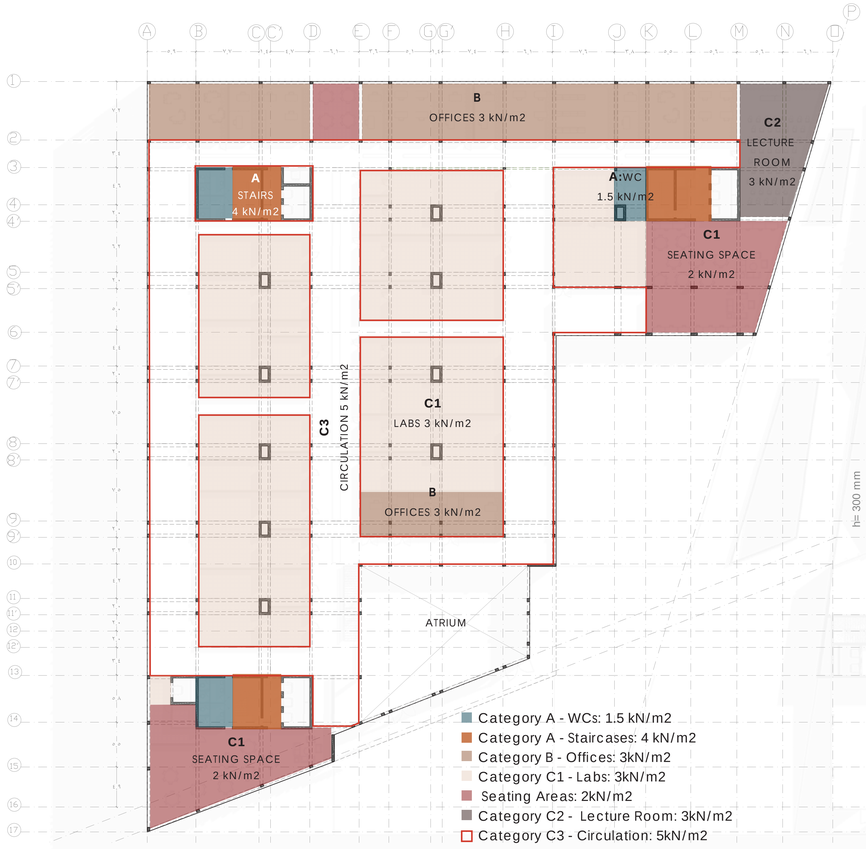



CORES
STRUCTURAL SHAFTS

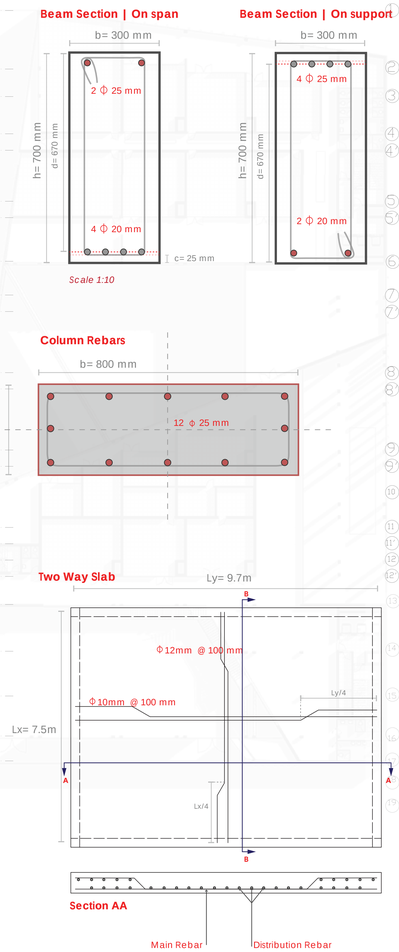

REINFORCED CONCRETE
COLUMNS AND BEAMS

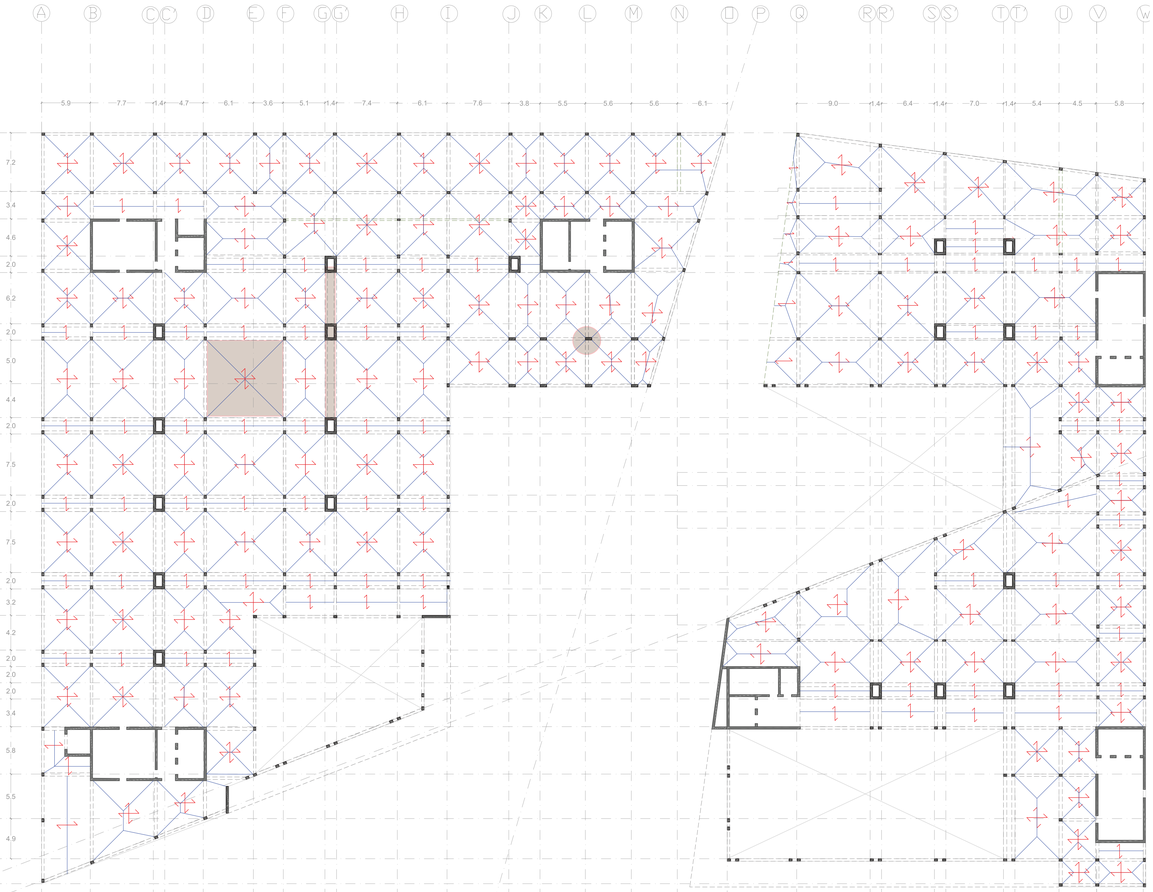



COMPOSITE STEEL SLABS
FORUM'S SPACE FRAME STRUCTURE

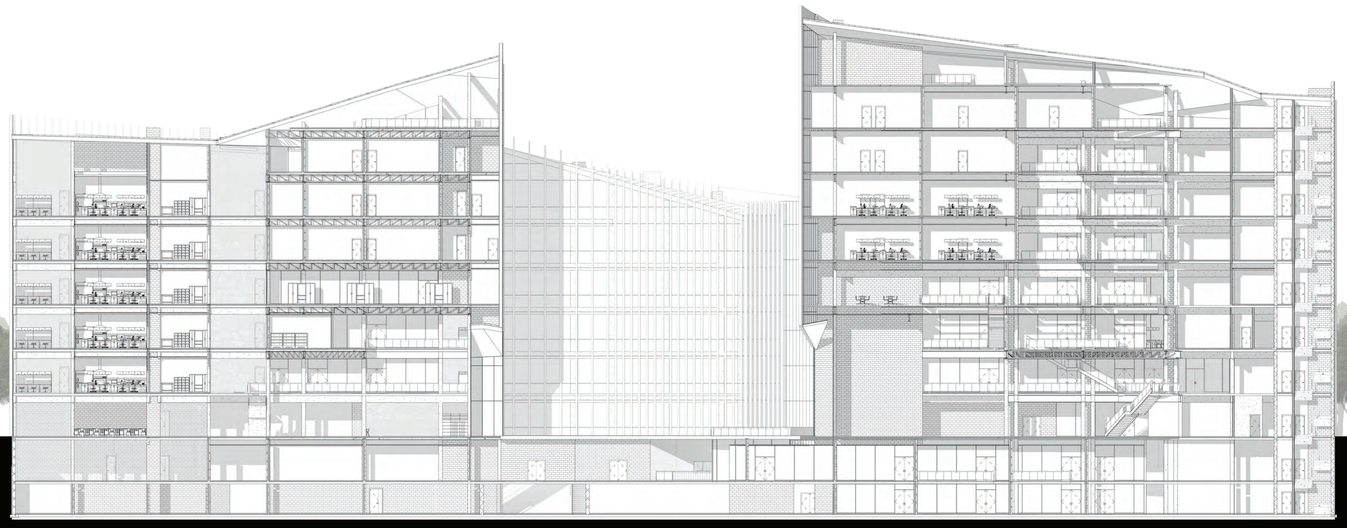


Structural Plan | Live Load Distribution





Structural Plan | Tributary Area on typical floor



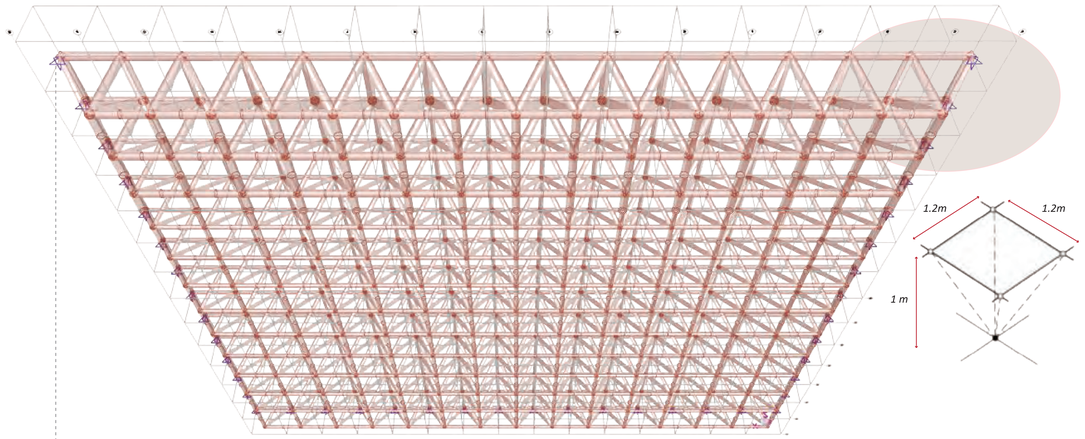
Politecnico Di Milano
School of Architecture Urban Planning and Construction Engineering
Laurea Magistrale Thesis | Study Program Architecture-Building Architecture
Academic Year 2019|2020

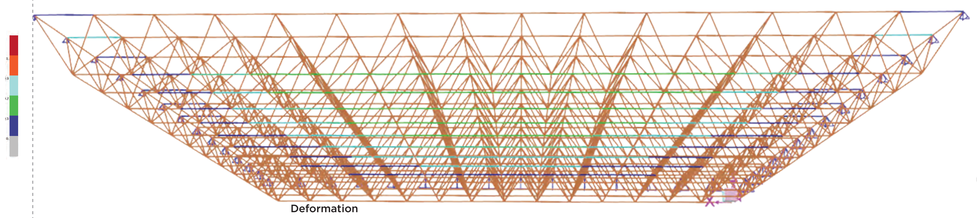
MSc Authors
Mary Lynn Al Haddad
Nancy El Asmar

Supervisor
Prof. Francesca Battisti | Architectural Design

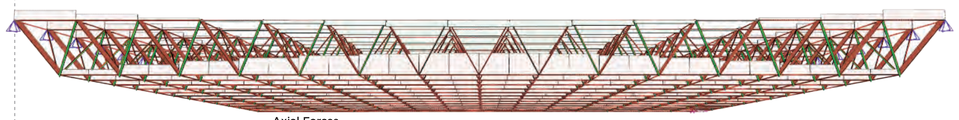
Professors
Grigor Angjeliu | Structural Design
Giovanni Dotelli | Innovative Materials for Architecture
Francesco Romano | Building Services Design
Lavinia Chiara Tagliabue | Technology and Design in BIM Environment

Studio Assistants
Roberta Contrino
Denise Houx
Lorenzo Castellani Lovati



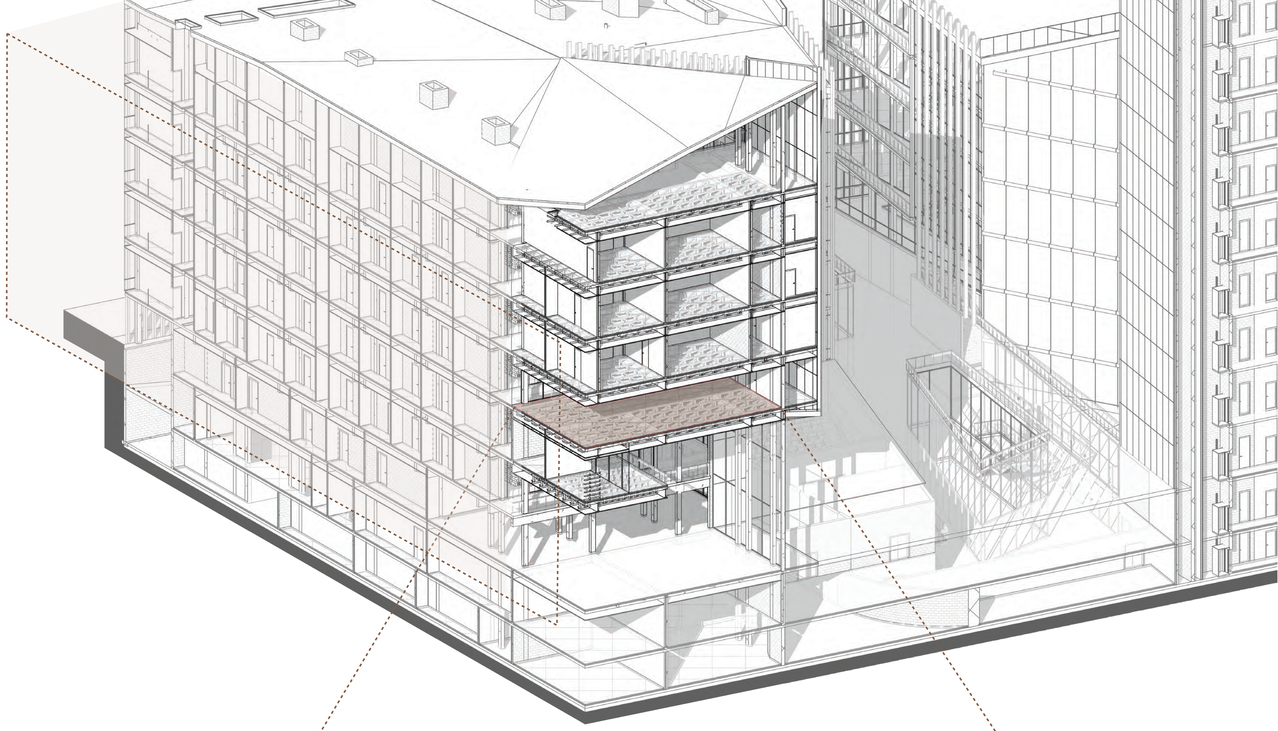


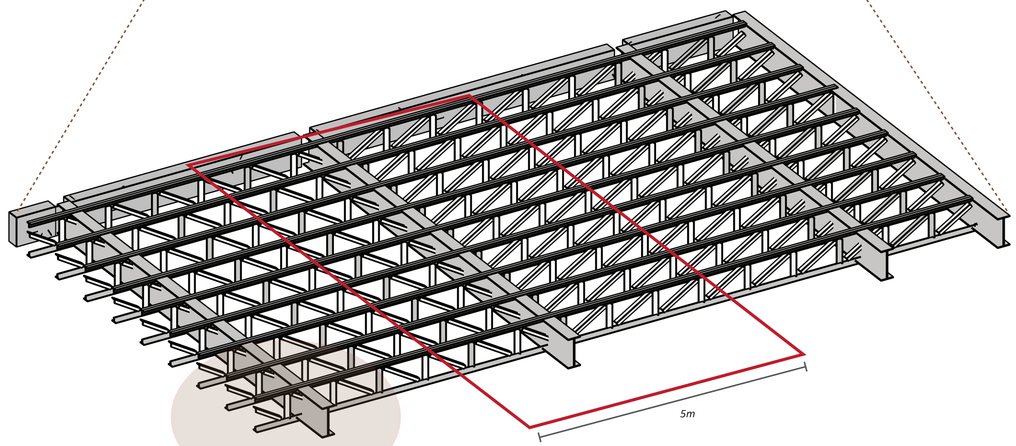
Deformation

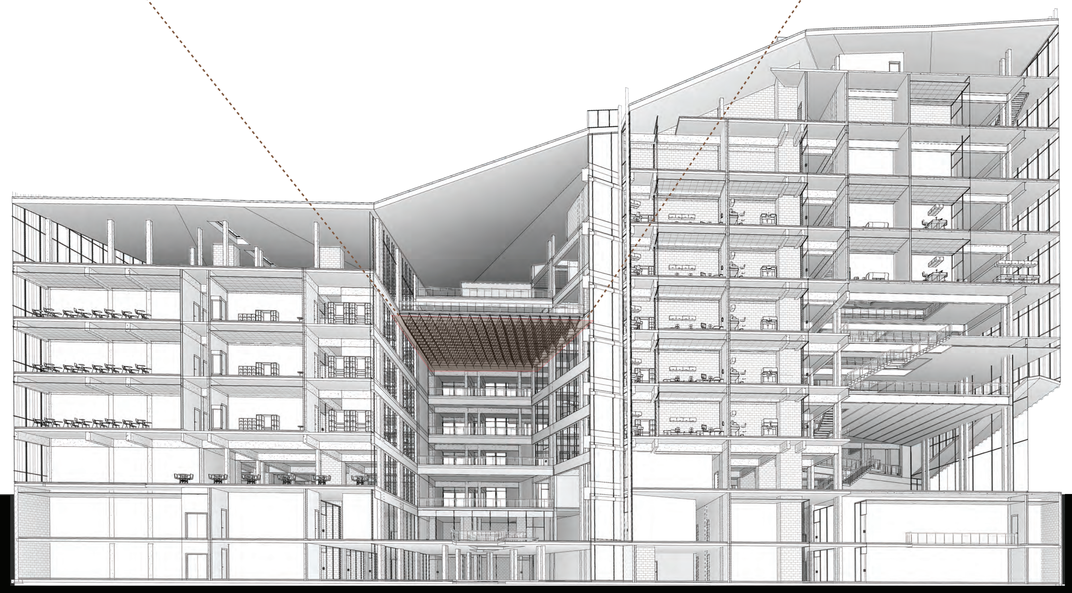


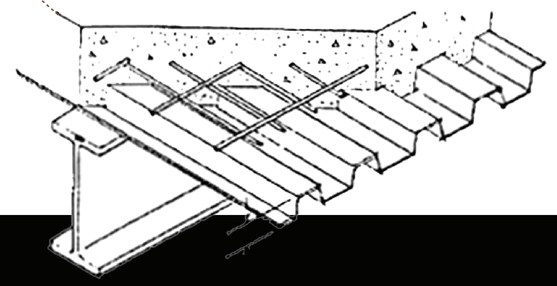
Axial Forces

Deformation









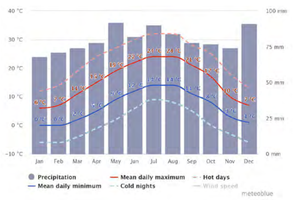
Politecnico Di Milano
School of Architecture Urban Planning and Construction Engineering
Laurea Magistrale Thesis | Study Program Architecture-Building Architecture
Academic Year 2019|2020

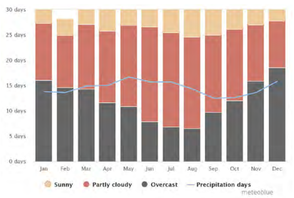
MSc Authors
Mary Lynn Al Haddad
Nancy El Asmar

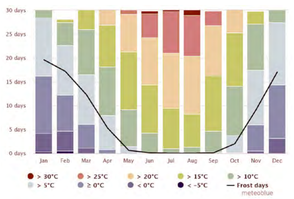
Supervisor
Prof. Francesca Battisti | Architectural Design

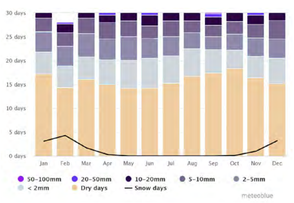
Professors
Grigor Angjeliu | Structural Design
Giovanni Dotelli | Innovative Materials for Architecture
Francesco Romano | Building Services Design
Lavinia Chiara Tagliabue | Technology and Design in BIM Environment

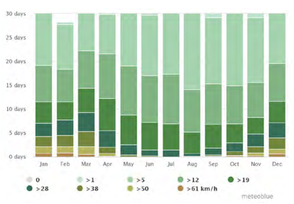
Studio Assistants
Roberta Contrino
Denise Houx
Lorenzo Castellani Lovati

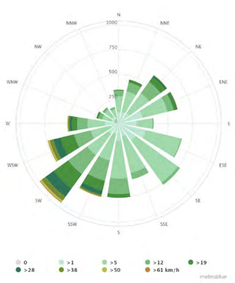




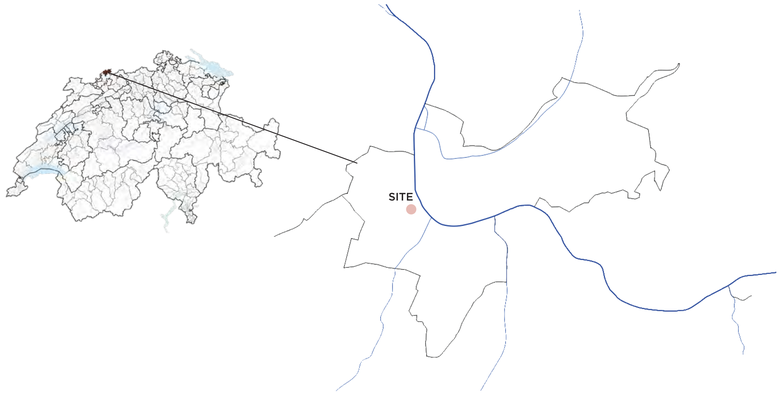








Wind rose

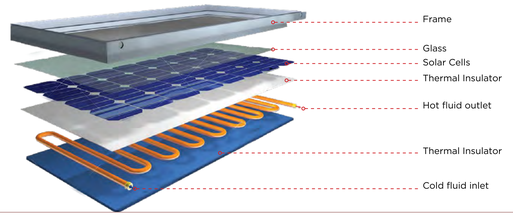


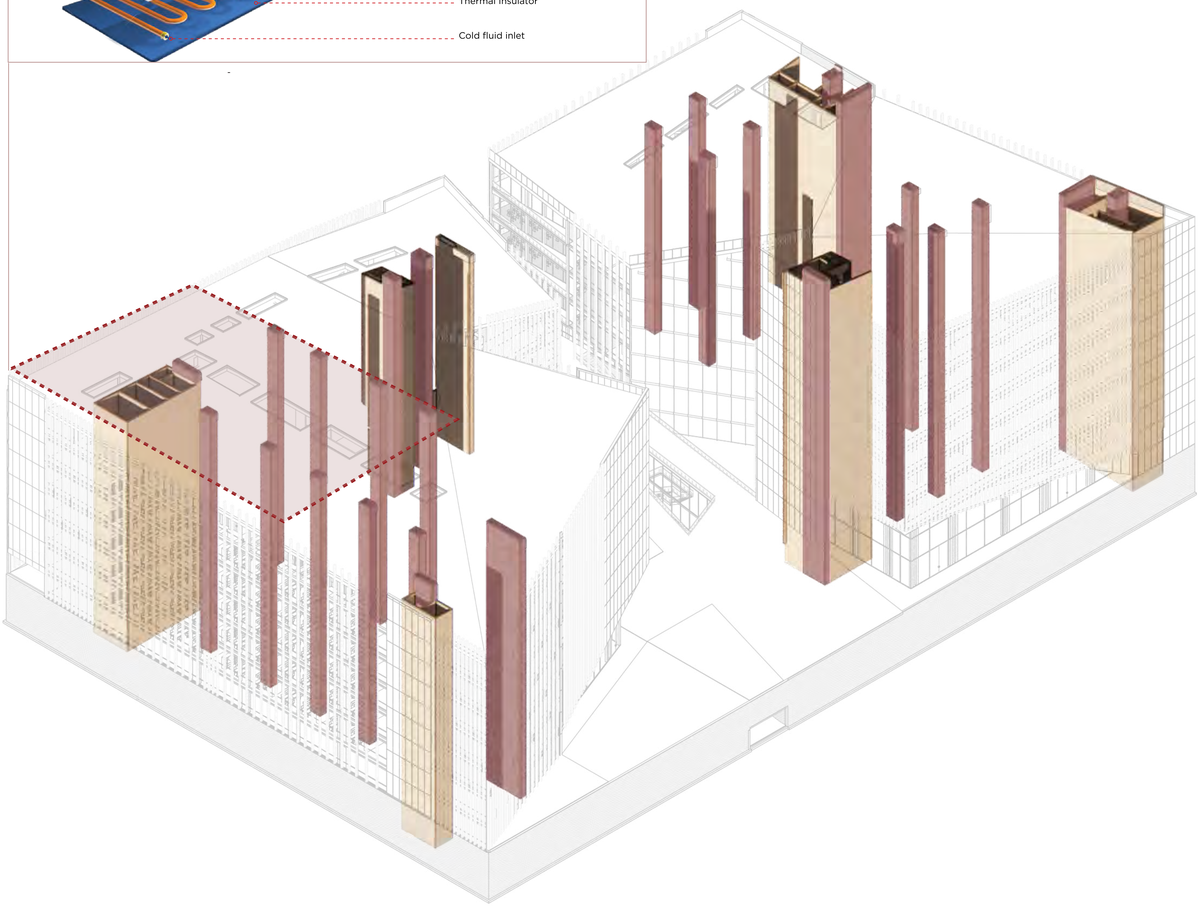
Location	Basel, Switzerland
Latitude	47.55°
Longtitude	7.58°

Heating Degree Days (HDD)	2617°C
Winter lowest Design External Temperature (Te,min)	-5°C
Summer highest Design External Temperature (Te,max)	32°C
Average Humidity	70%
Average Seasonal External Temperature (Tavg,e)	12°C
Design Internal Temperature (Tint,e)	20°C

The **hybrid soalr panel** fulfills two functions at the same time; a doubleboost, it generates electricity and heats water given its combination of a photovoltaic module for generating electric power and a solar thermal collector.

The front of the PVT panel absorbs solar radiation and generates electricity and heat. A high efficiency absorber, integrated in the upper part of the solar cells, assimilates the heat and by means of a propylene glycol heats the water. Thanks to the assimilation of heat, the photovoltaic cells are constantly cooling, increase their productivity and operate with optimum efficiency.
You can now have electricity and hot water in one panel increased efficiency and saving on both bills.





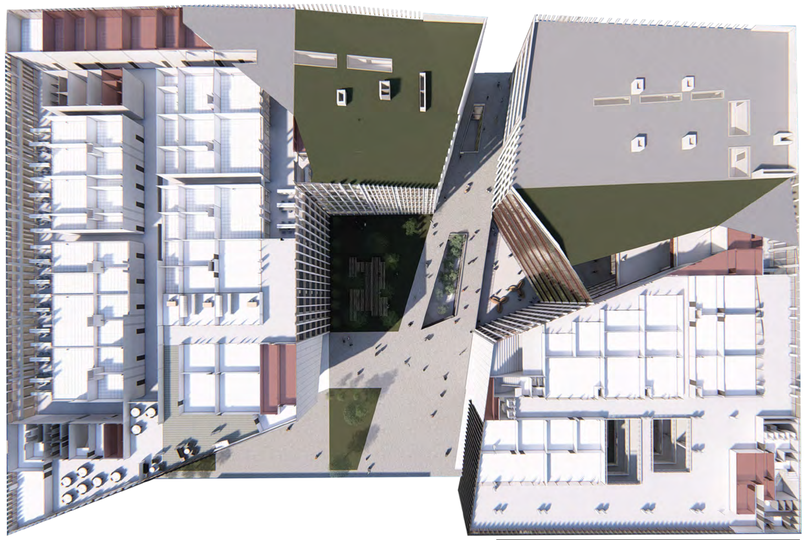
Structural / Circulation Cores/ WCs

Shafts

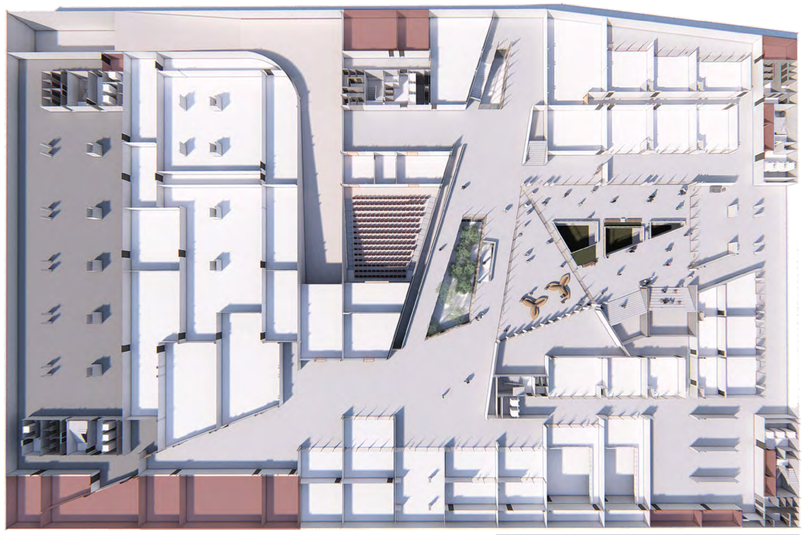
Hybrid Solar Panels area on roof

Technical rooms
Mechanical rooms will typically house the following equipment:
-Air handlers
-Boilers
-Chillers
-Heat exchangers
-Water heaters and tanks
-Water pumps (for domestic, heating/cooling, and firefighting water)
-Main distribution piping and valves
-Sprinkler distribution piping and pumps
-Back-up electrical generators
-Elevator machinery
-Other HVAC (heating, ventilation and air-conditioning) equipment

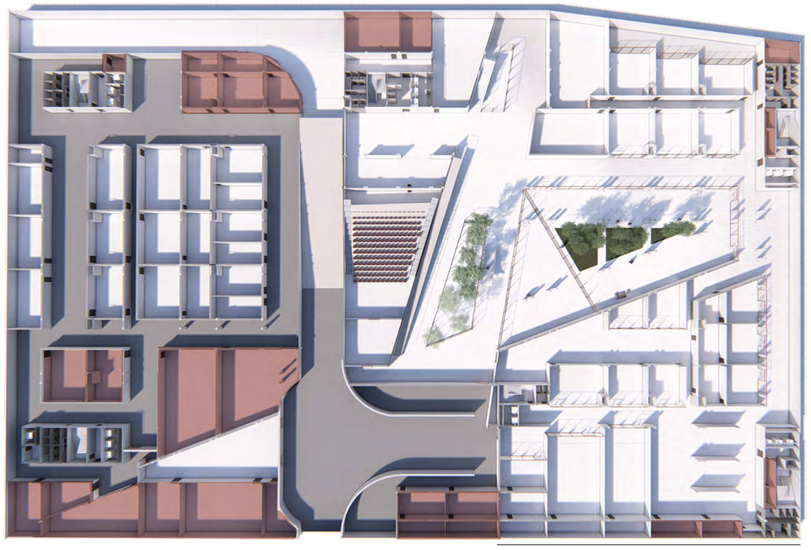
TECHNICAL ROOMS



Sixth Floor Plan



-1 Basement Plan



-2 Basement Plan

Politecnico Di Milano
School of Architecture Urban Planning and Construction Engineering
Laurea Magistrale Thesis | Study Program Architecture-Building Architecture
Academic Year 2019|2020

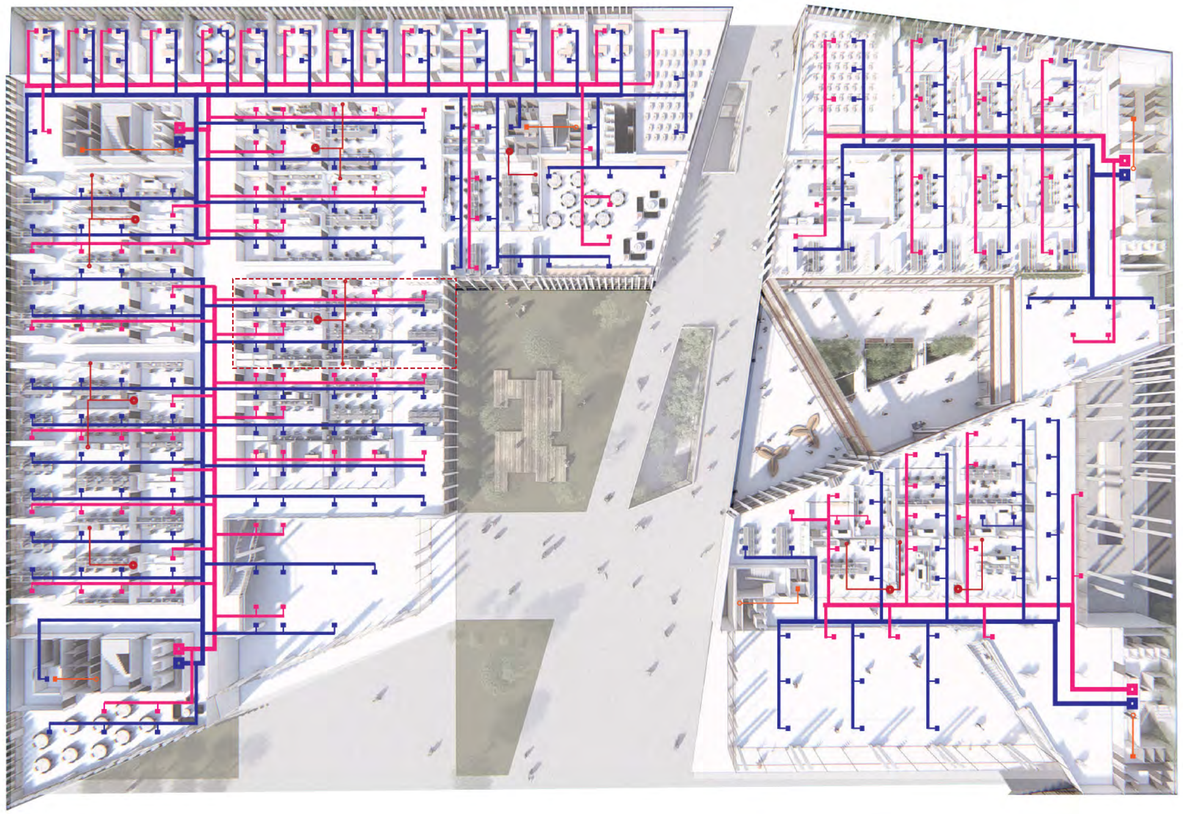
MSc Authors
Mary Lynn Al Haddad
Nancy El Asmar

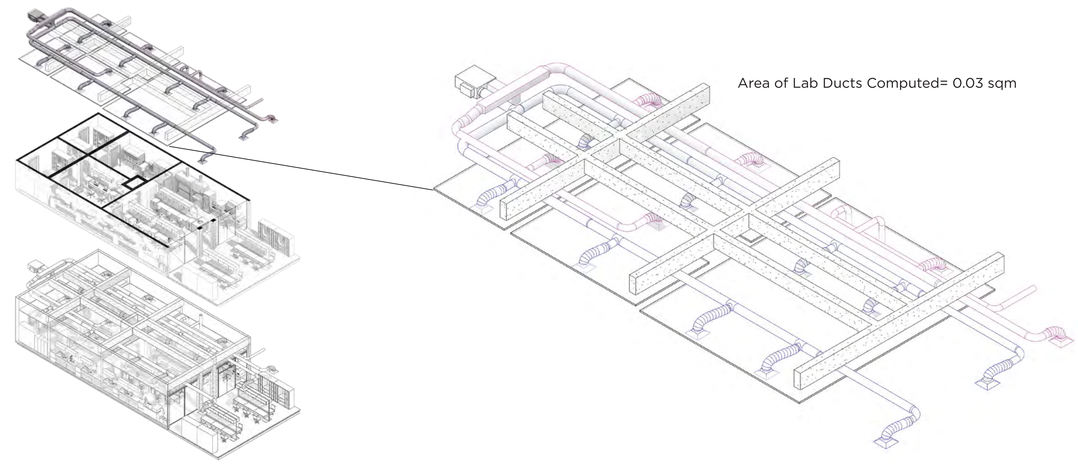
Supervisor
Prof. Francesca Battisti | Architectural Design

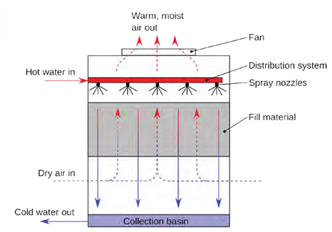
Professors
Grigor Angjeliu | Structural Design
Giovanni Dotelli | Innovative Materials for Architecture
Francesco Romano | Building Services Design
Lavinia Chiara Tagliabue | Technology and Design in BIM Environment

Assistant Professors
Roberta Contrino | Studio Assistant
Denise Houx | Studio Assistant
Lorenzo Castellani Lovati | Studio Assistant

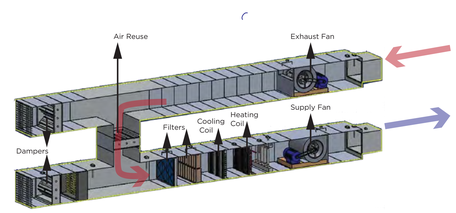
ALL AIR HVAC SYSTEM



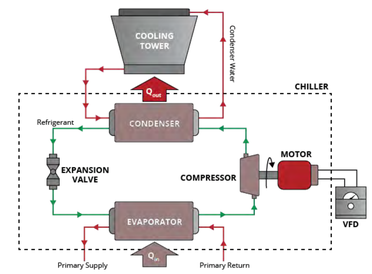




A- Cooling Tower on Roof
A cooling tower is designed to remove heat from a building or facility by spraying water down through the tower to exchange heat into the inside of the building.

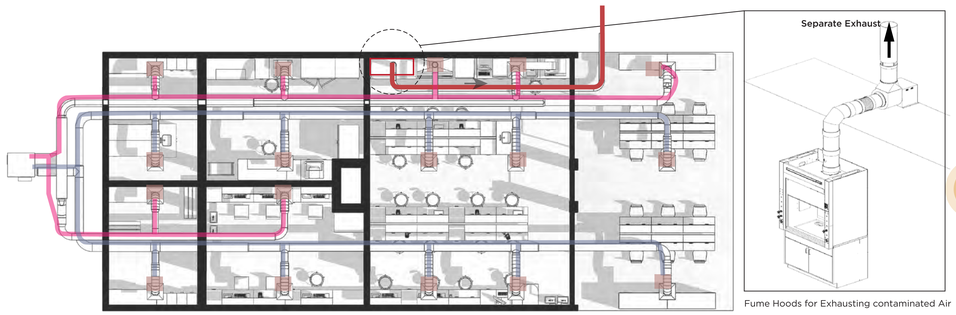


B- Air Handling Unit (AHU)
is used to re-condition and circulate air as part of a heating, ventilating and air-conditioning system. The basic function of the AHU is take in outside air, re-condition it and supply it as fresh air to a building. All exhaust air is removed, which creates an acceptable indoor air quality.

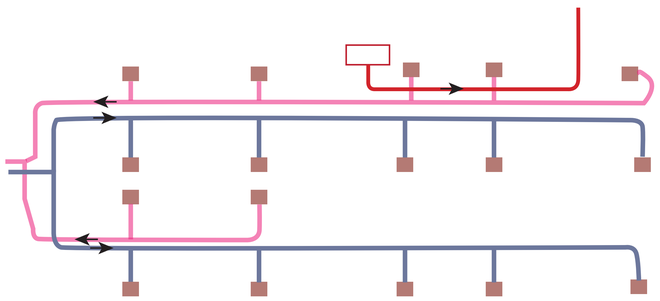


C- Chiller
Typically in heating, ventilation and air conditioning systems, chiller units produce chilled water that is piped to air handling units (or fan coil units) where it is used to cool the air that ventilates the building. The 'warmed' water is then returned to the chiller unit to be re-cooled.

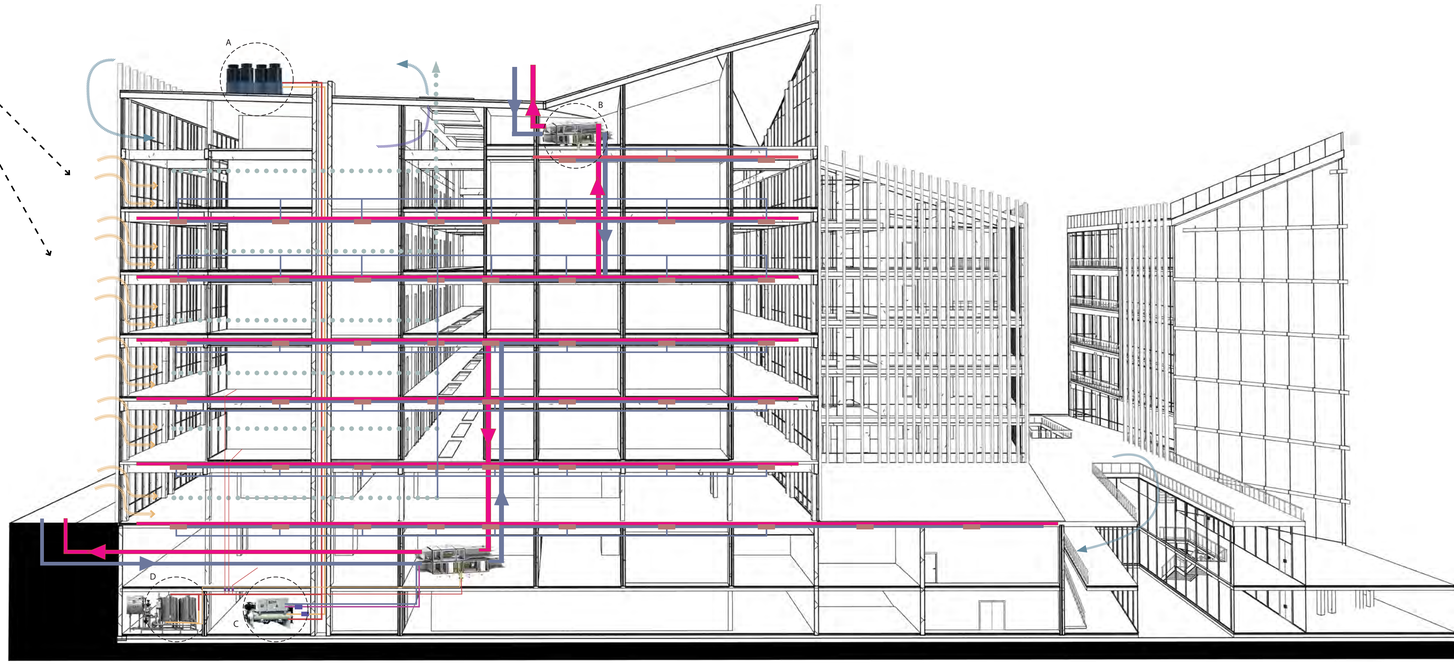
D- Boiler
The main function of a boiler is to heat water to generate steam. Steam produced in a boiler can be used for a variety of purposes including space heating, sterilisation, drying, humidification and power generation.



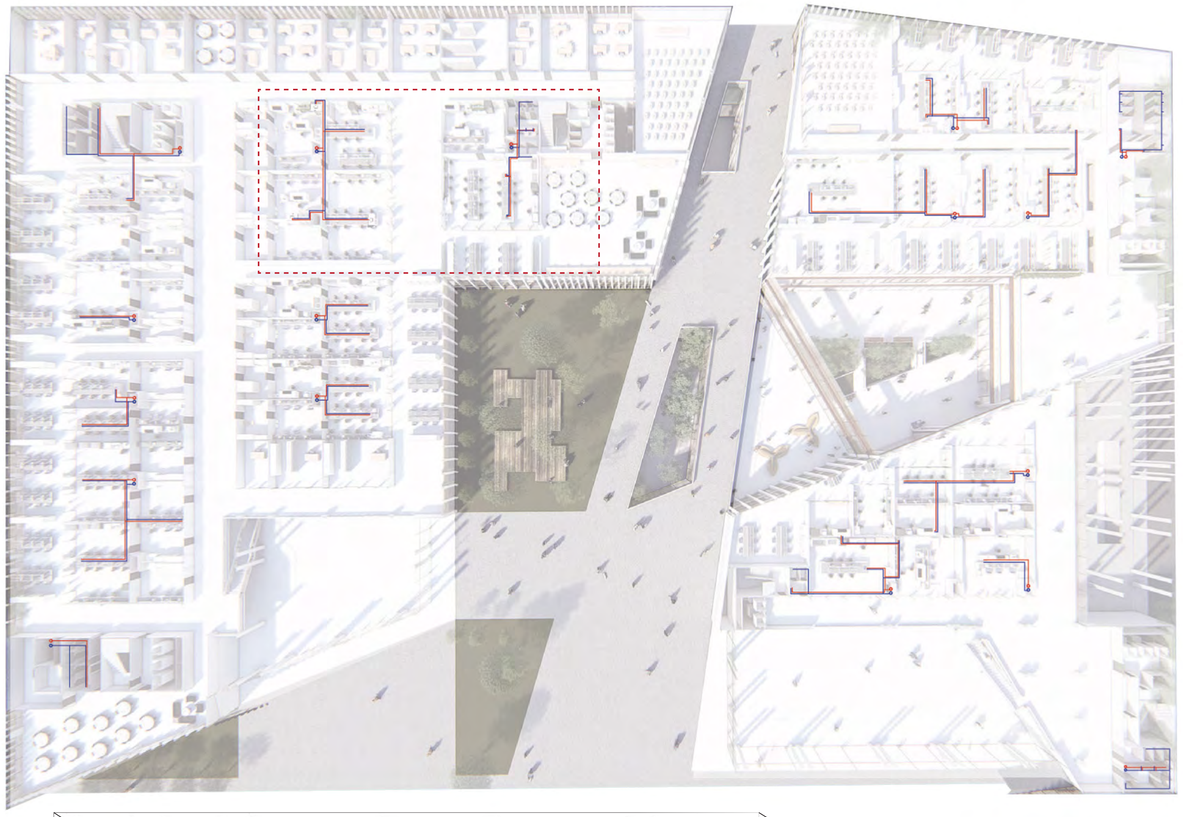
Fume Hoods for Exhausting contaminated Air

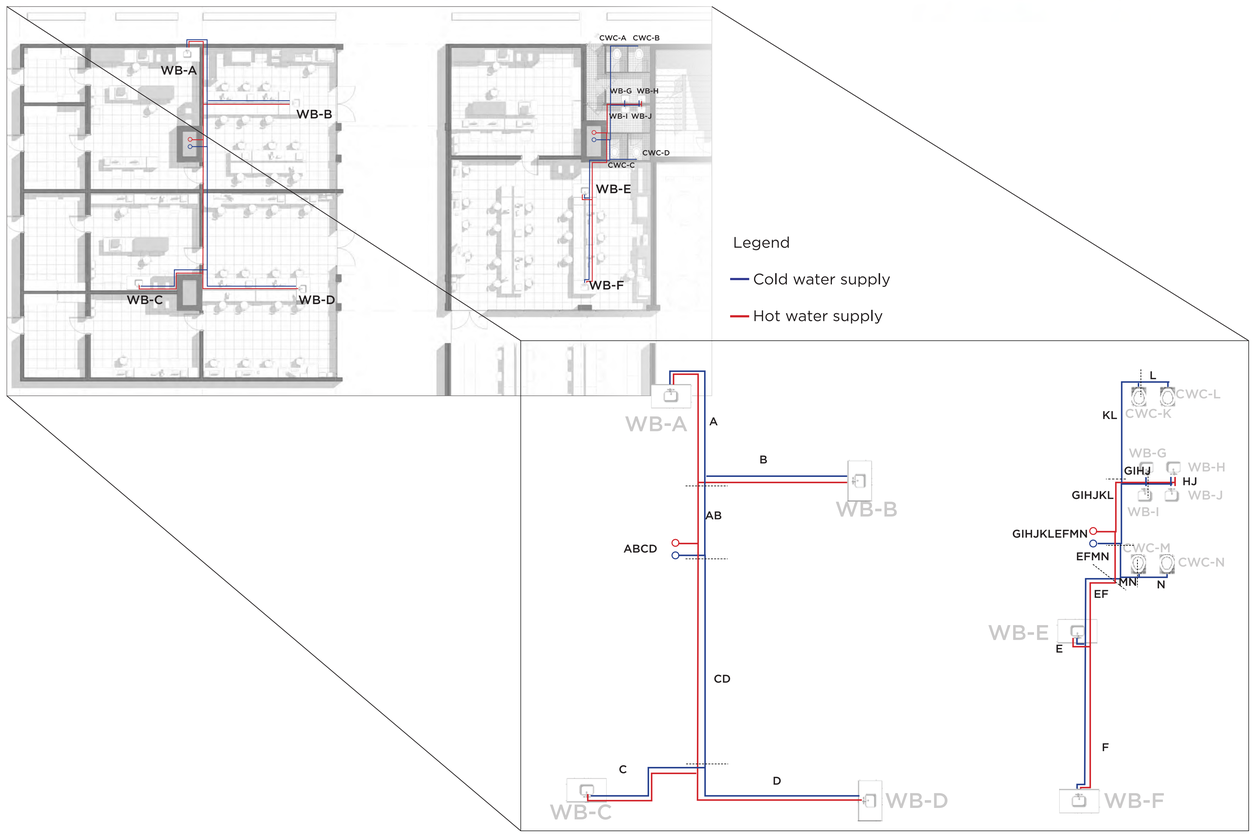


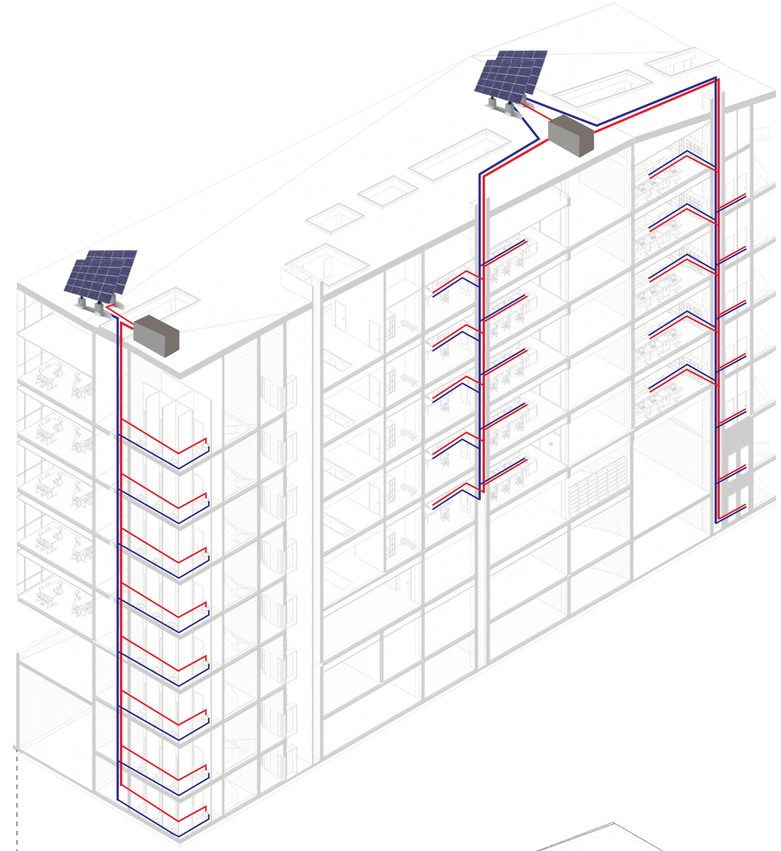
Supply Ducts Return Ducts Exhaust Ducts for Fume Hoods

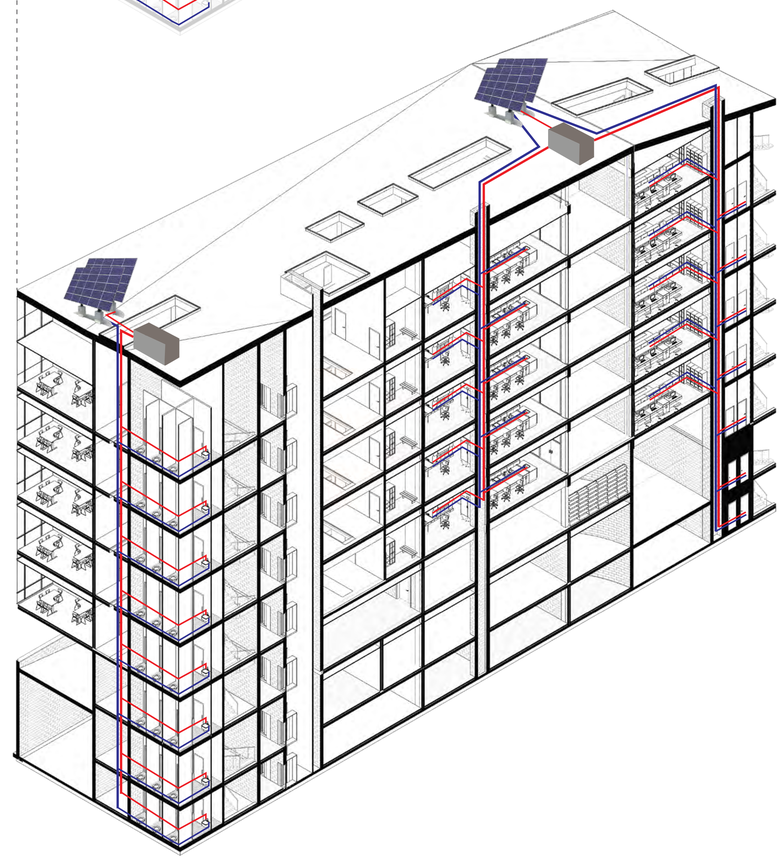


TOP DOWN WATER SYSTEM

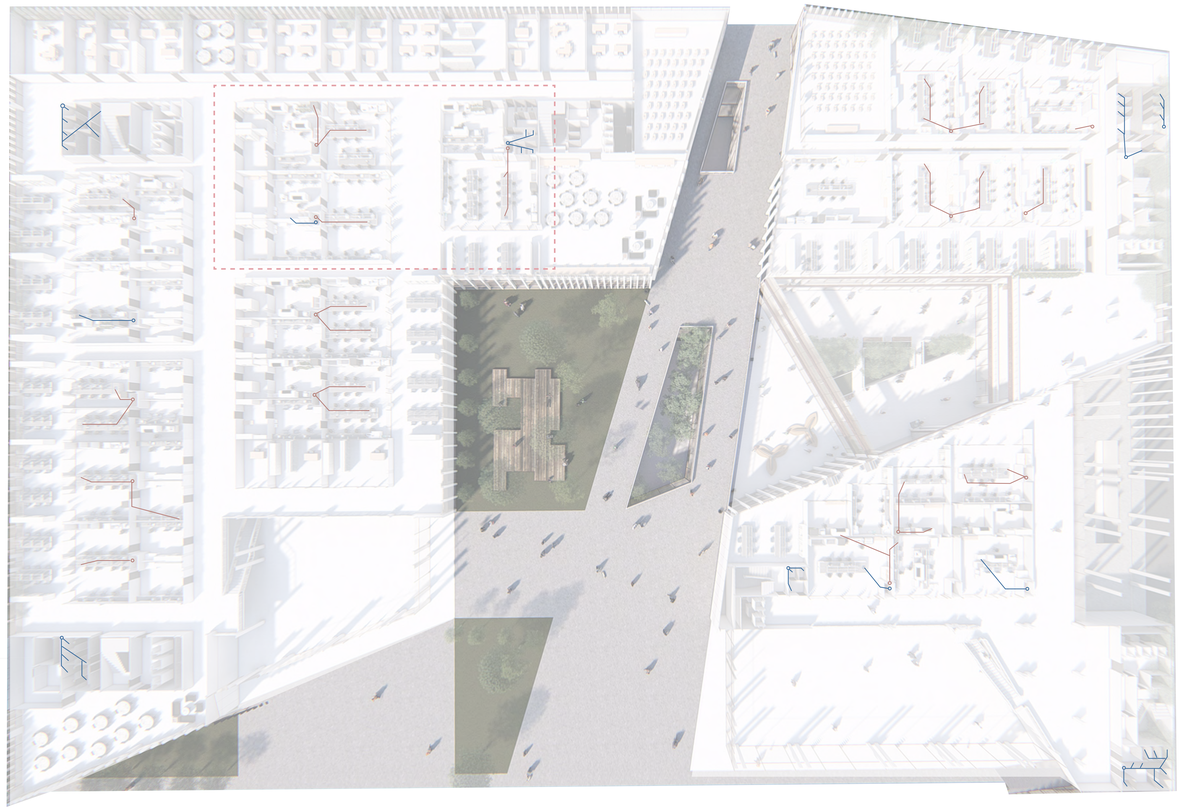


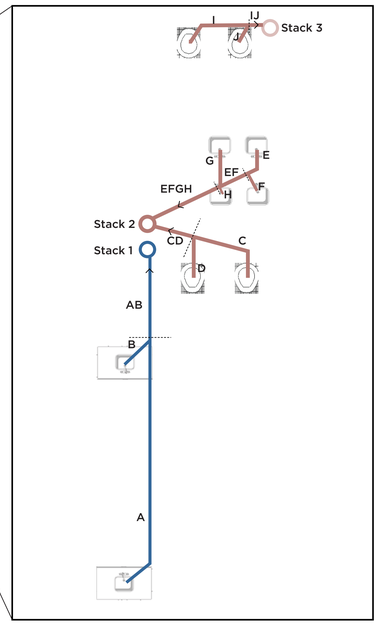






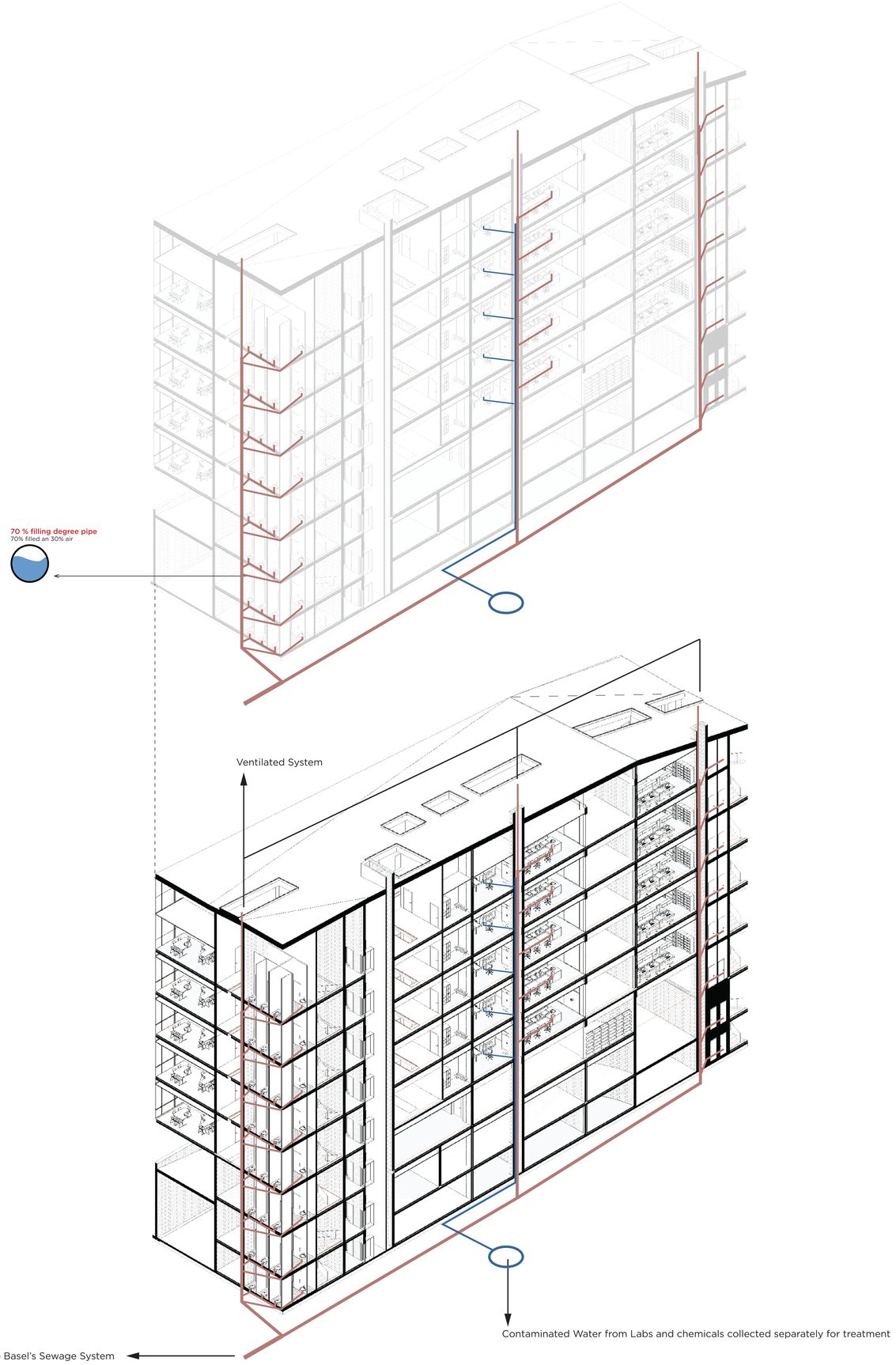
VENTILATED DRAINAGE SYSTEM



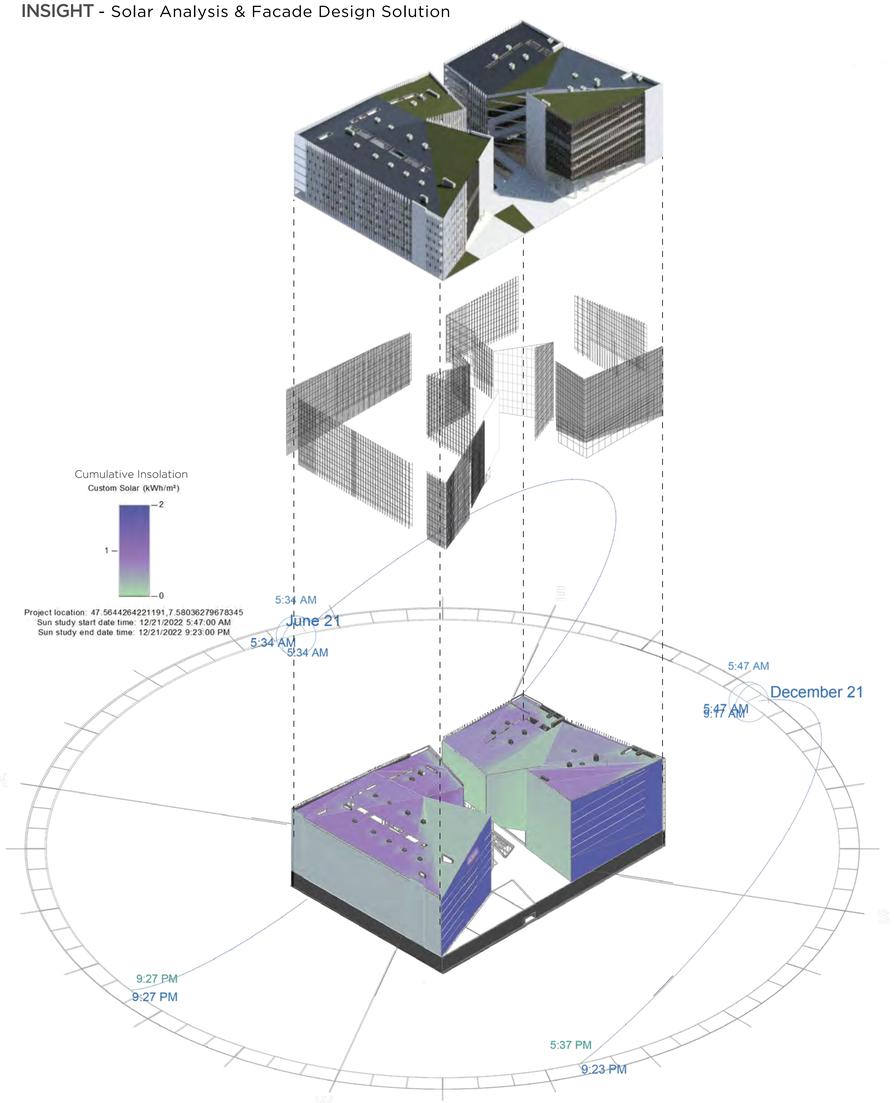


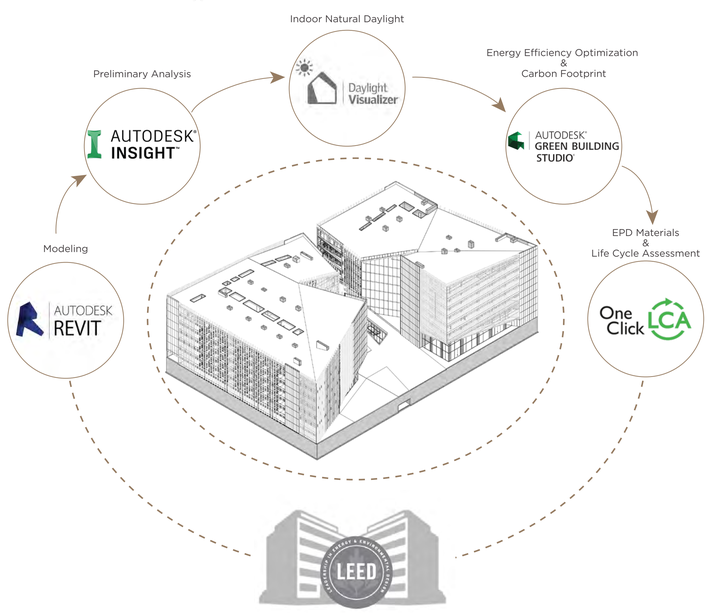
Chemical water Drainage (to be treated)

Residential water Drainage (connected to the city's sewage system)

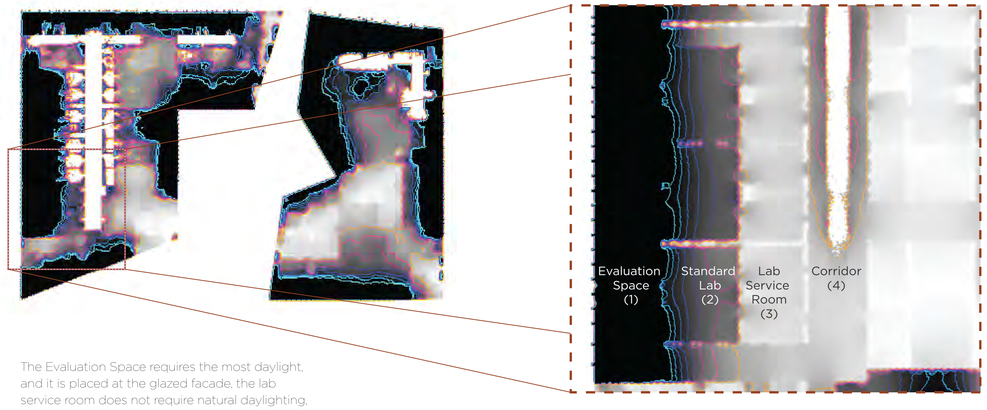


INSIGHT - Solar Analysis & Facade Design Solution

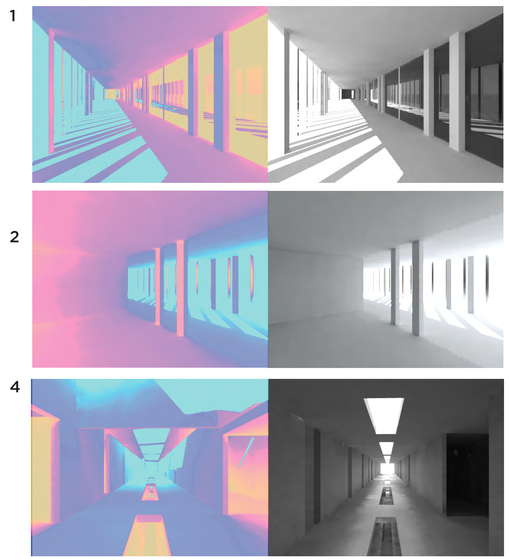




VELUX DAYLIGHT VISUALIZER - Natural Indoor Lighting

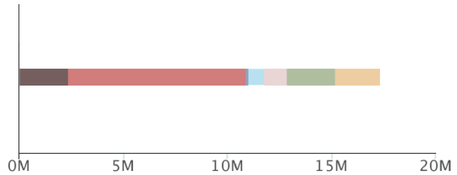


The Evaluation Space requires the most daylight, and it is placed at the glazed facade, the lab service room does not require natural daylighting, and we integrated skylights in our corridors following the preliminary daylighting analysis in which the daylight factor was quite low.



GREEN BUILDING STUDIO - Annual Data

Total Energy (kWh)

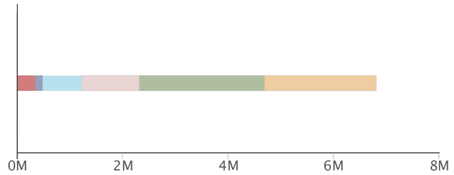


Total Energy = 17,343,056 kWh

255 kWh/m²

Hot Water = 14%
Space Heat = 49%
Pumps = 1%
Vent Fans = 4%
Space Cooling = 6%
Equipment = 14%
Area Lights = 12%

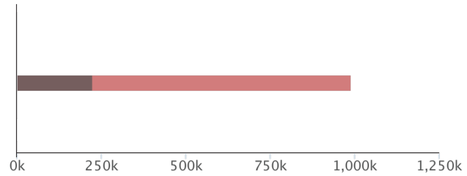
Electricity (kWh)



Total Electricity= 6,811,247 kWh

Space Heat = 5%
Pumps = 2%
Vent Fans = 11%
Space Cooling = 16%
Equipment = 35%
Area Lights = 31%

Fuel -Natural Gas (m³)

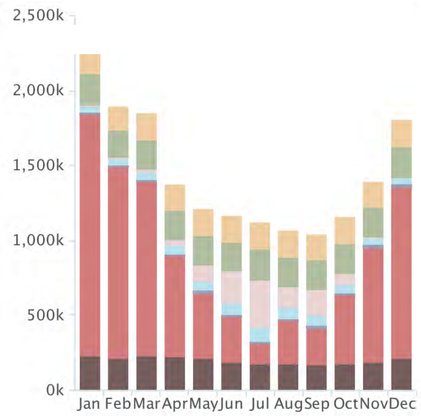


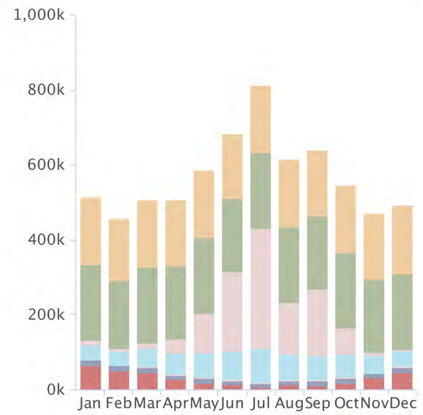
Fuel (Natural Gas) = 987,037 m³

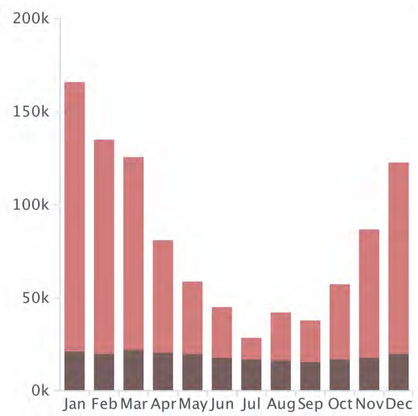
Hot Water = 22%
Space Heat = 78%

Area Lights
Misc Equip
Space Cooling
Vent Fans
Pump Aux
Space Heat
Hot Water

Monthly Data



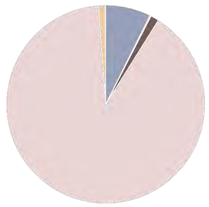




OneClick LCA - Total use of primary energy ex. raw materials, MJ

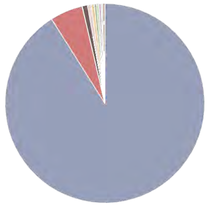
Life-cycle stages

- A1 - A3 Materials - 7.3%
- A4 Transportation - 0.2%
- B1 - B5 Maintenance & replacement - 1.4%
- B6 Energy - 89.9%
- B7 Water - 1.1%
- C1 - C4 End of life - 0.1%



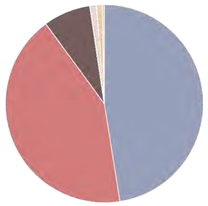
Resource types

- Utilities - 91.0%
- Metals - 5.3%
- Concrete - 0.9%
- Bricks & ceramics- 0.6%
- Doors & windows - 0.5%
- Masses - 0.4%
- Wood - 0.4%
- Flooring - 0.4%
- Coatings & pastes - 0.3%
- Other resource types - 0.3%



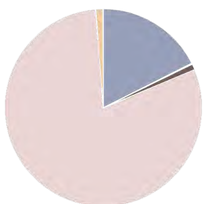
Classifications

- Electricity use - 47.5%
- Fuel use - 42.5%
- Floor slabs, ceilings, roofing decks, beams & roof - 7%
- Total water consumption - 1.1%
- External walls & facade - 0.9%
- Columns & load-bearing vertical structures - 0.3%
- Other structures & materials - 0.0%
- Foundation, sub-surface, basement & retaining walls - 0.0%



Global warming, kg CO2e - Life-cycle stages

- A1 - A3 Materials - 7.3%
- A4 Transportation - 0.2%
- B1 - B5 Maintenance & replacement - 1.4%
- B6 Energy - 89.9%
- B7 Water - 1.1%
- C1 - C4 End of life - 0.1%



LEED certification - sections of the rating system

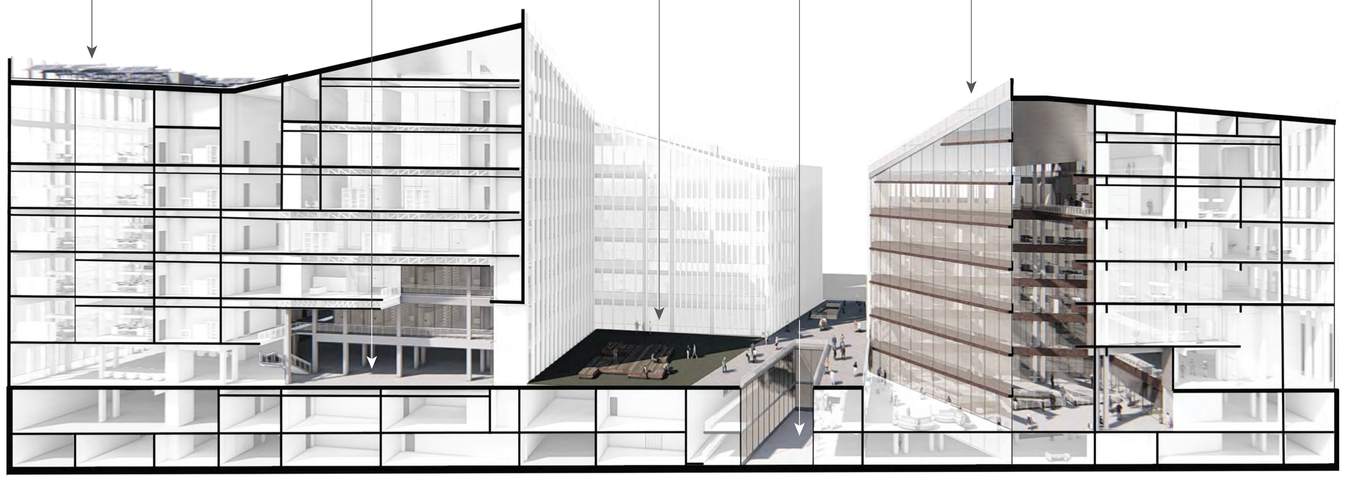
Energy & Atmosphere
Photovoltaic Panels to optimize building energy efficiency

Indoor Air Quality
The atriums and forum allow for natural ventilation, in addition to all-air HVAC system

Sustainable Sites
Open space availability, dealing with rainwater, and heat island and light pollution reduction.

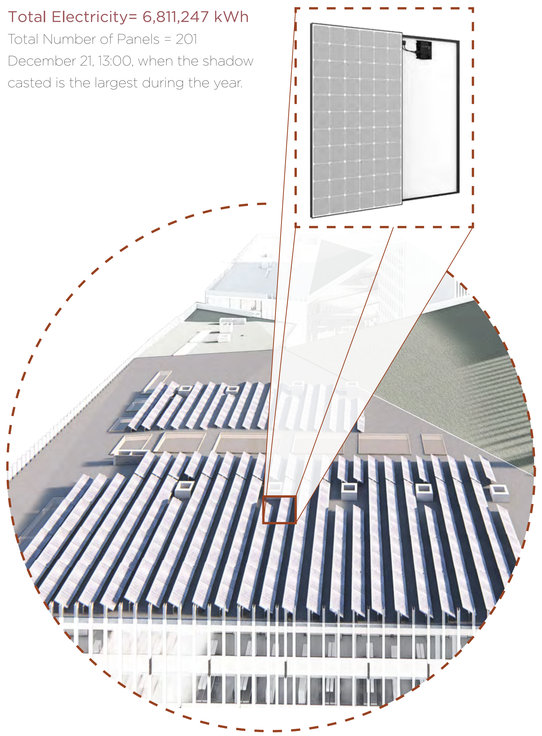
Water Efficiency
Rainwater management through water collection system in void

Materials & Resources
Green Roof & low CO2 emitting EPD materials for building optimization

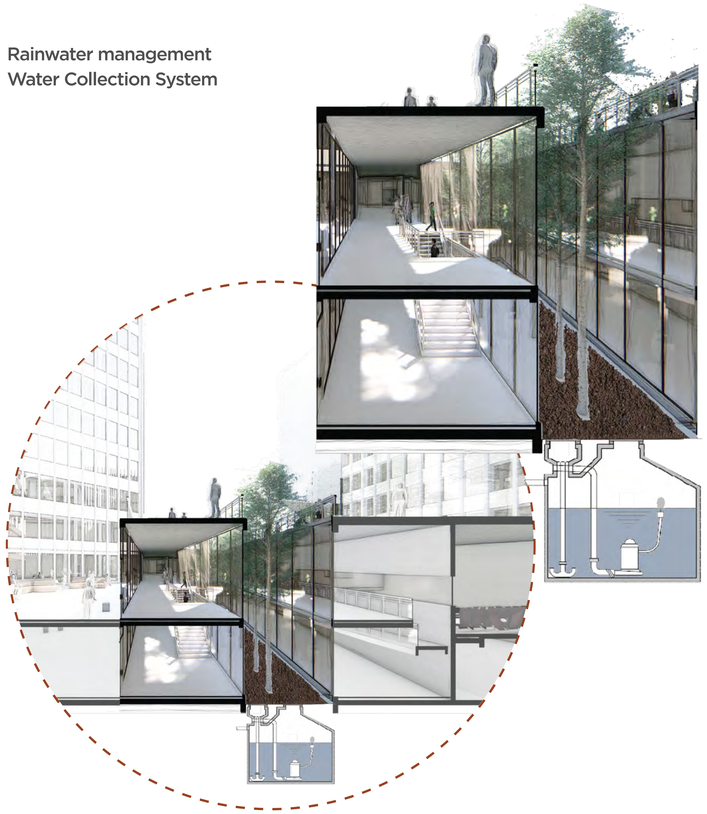


Hybrid Solar Panels

Total Electricity= 6,811,247 kWh
Total Number of Panels = 201
December 21, 13:00, when the shadow casted is the largest during the year.



Rainwater management Water Collection System



LEED v4 for BD+C: New Construction & Major Renovation Project Checklist

Certified: 40 to 49 points,
Silver: 50 to 59 points,
Gold: 60 to 79 points,
Platinum: 80 to 110

0	0	0			**Location and Transportation**	**16**
•				Credit	LEED for Neighborhood Development Location	1
	•			Credit	Sensitive Land Protection	1
		•		Credit	High Priority Site	0
•				Credit	Surrounding Density and Diverse Uses	4
•				Credit	Access to Quality Transit	5
•				Credit	Bicycle Facilities	5
•				Credit	Reduced Parking Footprint	1
		•		Credit	Green Vehicles	0

0	0	0			**Sustainable Sites**	**16**
Y				Prereq	Construction Activity Pollution Prevention	Required
•				Credit	Site Assessment	5
	•			Credit	Site Development - Protect or Restore Habitat	2
•				Credit	Open Space	5
•				Credit	Rainwater Management	3
		•		Credit	Heat Island Reduction	0
	•			Credit	Light Pollution Reduction	1

0	0	0			**Water Efficiency**	**8**
Y				Prereq	Outdoor Water Use Reduction	Required
Y				Prereq	Indoor Water Use Reduction	Required
Y				Prereq	Building-Level Water Metering	Required
•				Credit	Outdoor Water Use Reduction	1
•				Credit	Indoor Water Use Reduction	1
•				Credit	Cooling Tower Water Use	5
	•			Credit	Water Metering	1

0	0	0			**Energy and Atmosphere**	**10**
Y				Prereq	Fundamental Commissioning and Verification	Required
Y				Prereq	Minimum Energy Performance	Required
Y				Prereq	Building-Level Energy Metering	Required
Y				Prereq	Fundamental Refrigerant Management	Required
	•			Credit	Enhanced Commissioning	0
•				Credit	Optimize Energy Performance	6
		•		Credit	Advanced Energy Metering	0
		•		Credit	Demand Response	0
•				Credit	Renewable Energy Production	3
		•		Credit	Enhanced Refrigerant Management	0
	•			Credit	Green Power and Carbon Offsets	1

0	0	0			**Materials and Resources**	**10**
Y				Prereq	Storage and Collection of Recyclables	Required
Y				Prereq	Construction and Demolition Waste Management Planning	Required
•				Credit	Building Life-Cycle Impact Reduction	3
•				Credit	Building Product Disclosure and Optimization - Environmental Product Declarations	2
•				Credit	Building Product Disclosure and Optimization - Sourcing of Raw Materials	1
•				Credit	Building Product Disclosure and Optimization - Material Ingredients	2
•				Credit	Construction and Demolition Waste Management	2

0	0	0			**Indoor Environmental Quality**	**16**
Y				Prereq	Minimum Indoor Air Quality Performance	Required
Y				Prereq	Environmental Tobacco Smoke Control	Required
•				Credit	Enhanced Indoor Air Quality Strategies	4
•				Credit	Low-Emitting Materials	3
•				Credit	Construction Indoor Air Quality Management Plan	1
	•			Credit	Indoor Air Quality Assessment	1
•				Credit	Thermal Comfort	1
	•			Credit	Interior Lighting	1
•				Credit	Daylight	4
•				Credit	Quality Views	1
		•		Credit	Acoustic Performance	0

0	0	0			**Innovation**	**0**
		•		Credit	Innovation	0
		•		Credit	LEED Accredited Professional	0

0	0	0			**Regional Priority**	**0**
		•		Credit	Regional Priority: Specific Credit	0
		•		Credit	Regional Priority: Specific Credit	0
		•		Credit	Regional Priority: Specific Credit	0
		•		Credit	Regional Priority: Specific Credit	0

Possible Points = 77

Politecnico Di Milano
School of Architecture Urban Planning and Construction Engineering
Laurea Magistrale Thesis | Study Program Architecture-Building Architecture
Academic Year 2019|2020

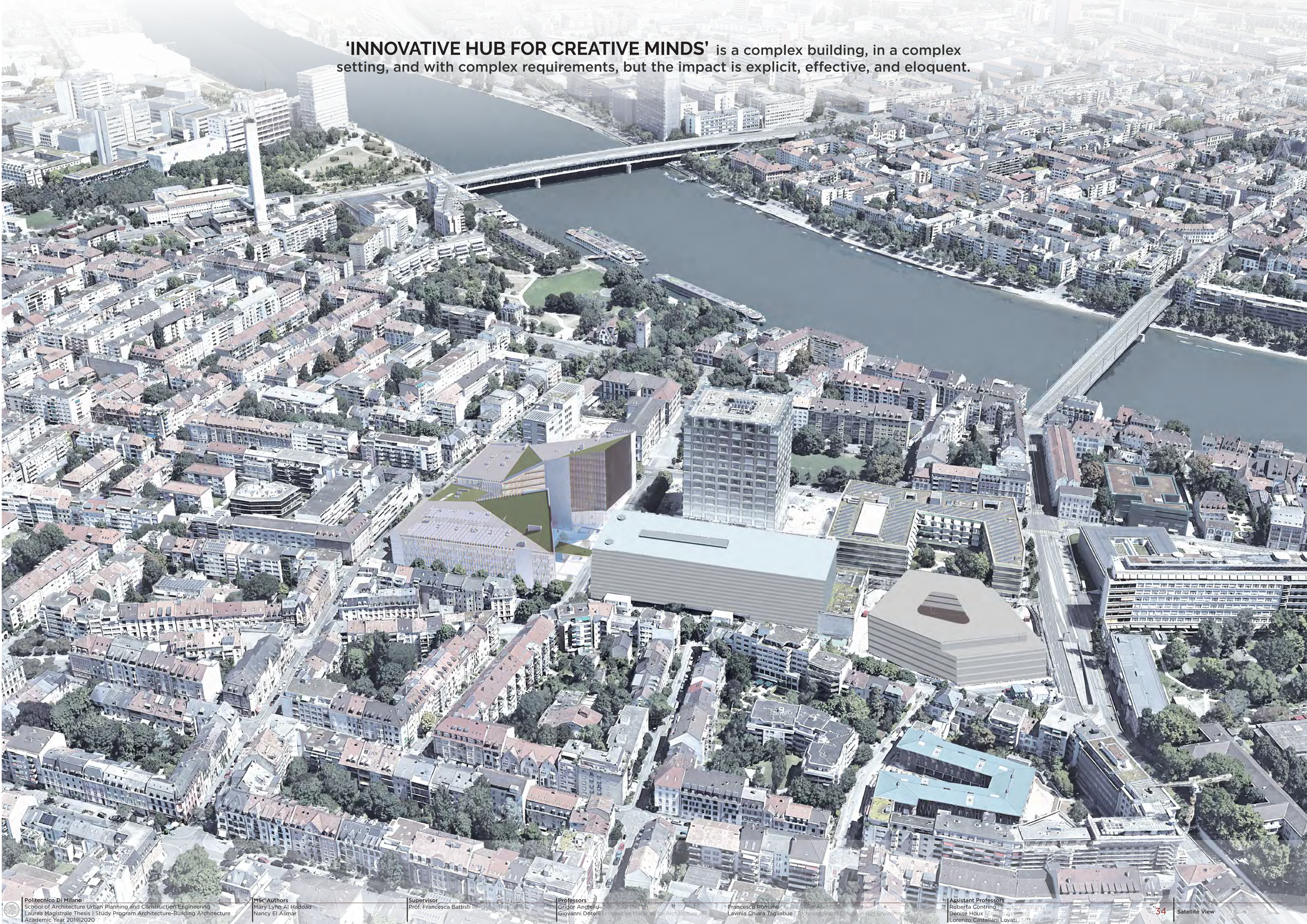
MSc Authors
Mary Lynn Al Haddad
Nancy El Asmar

Supervisor
Prof. Francesca Battisti | Architectural Design

Professors
Grigor Angjeliu | Structural Design
Giovanni Dotelli | Innovative Materials for Architecture
Francesco Romano | Building Services Design
Lavinia Chiara Tagliabue | Technology and Design in BIM Environment

Assistant Professors
Roberta Contrino | Studio Assistant
Denise Houx | Studio Assistant
Lorenzo Castellani Lovati | Studio Assistant

'INNOVATIVE HUB FOR CREATIVE MINDS' is a complex building, in a complex setting, and with complex requirements, but the impact is explicit, effective, and eloquent.



Politecnico Di Milano
School of Architecture Urban Planning and Construction Engineering
Laurea Magistrale Thesis | Study Program Architecture-Building Architecture
Academic Year 2019|2020

MSc Authors
Mary Lynn Al Haddad
Nancy El Asmar

Supervisor
Prof. Francesca Battisti | Architectural Design

Professors
Gridor Angelini | Structural Design
Giovanni Detelli | Innovative Materials for Architecture
Francesco Romano | Building Services Design
Lavinia Chiara Tagliabue | Technology and Design in BIM Environment

Assistant Professors
Roberta Contrino | Studio Assistant
Denise Houx | Studio Assistant
Lorenzo Castellani Lovati | Studio Assistant