BASEL INNOVATION CENTER

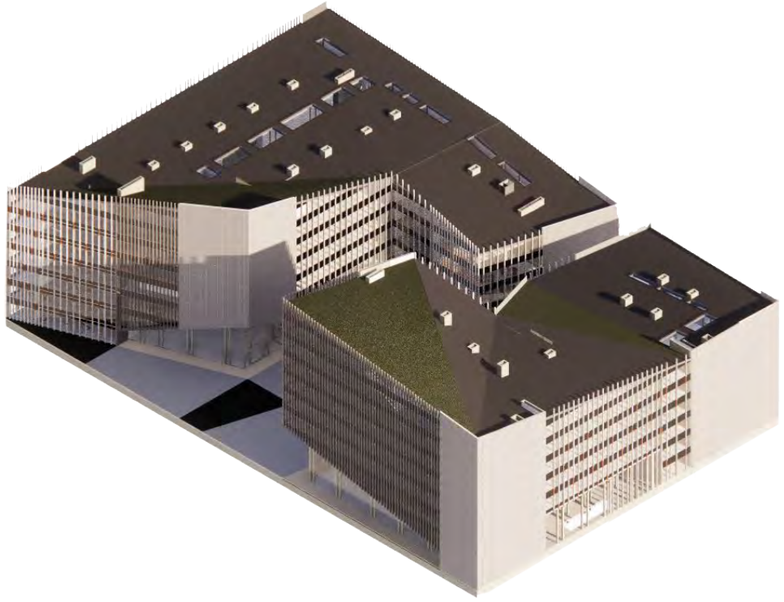
BASEL SCIENCE CAMPUS

'INNOVATIVE HUB FOR CREATIVE MINDS'

BOOK V.1

POLITECNICO DI MILANO

MARY LYNN AL HADDAD NANCY EL ASMAR



BASEL SCIENCE CAMPUS

INNOVATIVE HUB FOR CREATIVE MINDS

Politecnico di Milano

School of Architecture Urban Planning Construction Engineering

Academic Year 2019/2020

Laurea Magistrale (equivalent to Master of Science) Thesis
Architecture Study Programme-**Building Architecture**

Born and raised in Lebanon, a country whose capital has been demolished and rebuilt over 7 times, I grew a passion for architecture and learned to see art in everything. The experiences I lived in my country made me realize that an architect can save lives; therefore, designing for the people and their needs became my top priority. I am always eager to learn more about different cultures and expand my knowledge on architecture and design every day. This led me to pursue my Master's Degree at Politecnico di Milano after earning my BArch from the Lebanese American University. On a social level, I dedicated my time for community services, scouting and volunteering which brought me an extensive experience in leadership, communication, adaptability, and perseverance.

My teammate Nancy and I formed a group (Grp 5) known as the 'power team' by some of our classmates and mentors. I am particularly grateful for my teammate without whom I would not have been able to complete this project. I would also like to thank my thesis advisor, Professor Francesca Battisti, and all the professors, and mentors, for their guidance, encouragement and useful critiques of this thesis project. To all my classmates, flat mates and friends, thank you for making my experience abroad exceptional and unforgettable and for always motivating me along the journey. Finally, the biggest thank you goes to my supportive parents and siblings that made all of this possible.

MARY LYNN AL HADDAD

I am a Lebanese, born and raised in Kuwait, and attended an international British school that shaped me into the culturally diverse individual that I am today. My architectural journey initiated when I became bewildered with the richness of my country's history and the fact that most areas in Lebanon are post-war zones, and countless ones rebuilt from scratch. This is when my passion to continue my higher studies in Architecture was born. My objective was to tackle the complexity of problems tied to design and construction. As a citizen of a "resilient country", I was driven to extend my knowledge in all aspects of architecture including the environment, technology and structure.

However, I would not have produced this thesis without the love, dedication, and support that my team mate, Mary Lynn Al Haddad, has showed me, not only throughout our past couple of years in Politecnico di Milano, but also throughout our BArch in the Lebanese American University. I would also like to thank the countless mentors, teachers and professors that pushed me to the limits and brought out the best in me throughout my academic career. Finally, and above all, I would like to thank my parents for their selfless support that bought me here today. "Mama" & "Baba", all that I am, or hope to be, I owe to you.

NANCY EL ASMAR

ABSTRACT

Basel has been a prominent city in the pharmaceutical and biochemistry industries since the 20th century, and the chronicles of the "Innovative Hub for Creative Minds" started when the decision was made to reinvent the 70-year-old Schällemätteli Campus, as per the request of the University of Basel, in order to become a prominent Life Science Campus. This is an innovative turning point for the Dreiland region, and Switzerland as a whole. This was not only a challenging task because the site, Plot n.4, was considered the heart of the campus accommodating the Chemistry, Physics, and Anatomy Departments, but also because it lies in between the actual campus and the residential district.

Therefore, the main aim was to design innovative laboratories with maximum efficiency, within a complex geometry reflecting the "Reimagined Urban Area" concept of an innovation center, and to restitch the urban fabrics of both the campus and the residential district by designing buildings that serve as a transition between the two scales.

'Basel Science Campus – Innovative Hub for Creative Minds' is based on a "3-belt" concept, which allows the new complex to act as a connector between different spaces, districts, and piazzas.

Conceived as a two-phase construction process, the architectural ensemble consists of two main buildings, connected underground, which provides two "urban layers". Both buildings allow for multi-use and interactive spaces, maximizing work performance as well as providing leisure and communication hubs. The building is accessible from every corner, and the porosity and ease of pedestrian accessibility facilitates circulation around the campus, and from one facility to the other.

Just as Plot n.4 is the heart of the Campus, a Forum extending from the second basement up to the roof is the heart of the complex; a contemporary "Lichthof" acting as a communication hub. The Forum substantiates the idea of a clear functional and spatial organization of the building, amidst its complexity. The Forum provides a powerful spatial experience by means of an architectural promenade throughout the building, in order to break the conventional perception of 'scientific laboratories' and *reveal the "unexpected".*

SOMMARIO

La città di Basel riveste un ruolo di importanza nell'industria farmaceutica e biochimica sin dal XX secolo e le cronache del "Innovative Hub for Creative Minds" sono iniziate quando è stata presa la decisione di reinventare il campus "Schällemätteli", vecchio ormai di 70 anni, per richiesta dell'Università di Basel, al fine di diventare un importante campus di "Life Science". Si tratta di una svolta innovativa per la regione del Dreiland e per la Svizzera nel suo complesso. Questo è stato un compito impegnativo non solo perché il sito Plot n.4 era considerato il cuore del campus, ospitante i dipartimenti di Chimica, Fisica e Anatomia, ma anche perché si trova tra il campus vero e proprio e il quartiere residenziale.

Pertanto l'obiettivo principale era quello di progettare con la massima efficienza laboratori innovativi, all'interno di una geometria complessa che riflettesse il concetto di "area urbana reimmaginata" di un centro di innovazione, e di ricucire i tessuti urbani sia del campus che del quartiere residenziale progettando edifici che fungessero da transizione tra le due scale.

Il **"Basel Science Campus - Innovative Hub for Creative Minds"** si basa sul concetto a 3 cinture ("3-belt"), che consente al nuovo complesso di funzionare da connettore tra diversi spazi, quartieri e piazze.

Concepito come un processo di costruzione in due fasi, l'insieme architettonico è costituito da due edifici principali, collegati sottoterra, che forniscono due "strati urbani". Entrambi gli edifici consentono spazi multiuso e interattivi, massimizzando l'efficienza lavorativa e fornendo centri di svago e comunicazione. L'edificio è accessibile da ogni angolo, la porosità e la facilità di accesso pedonale facilitano la circolazione all'interno del campus e tra le varie strutture.

Così come il Plot n.4 è il cuore del Campus, un Forum che si estende dal secondo seminterrato fino al tetto è il cuore del complesso; un "Lichthof" contemporaneo che funge da hub di comunicazione. Il Forum concretizza l'idea di una chiara organizzazione funzionale e spaziale dell'edificio, nella sua complessità. Il Forum offre una potente esperienza spaziale attraverso una passeggiata architettonica lungo tutto l'edificio, al fine di rompere la percezione convenzionale dei "laboratori scientifici" e *rivelare l'"inaspettato".*

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TABLE OF CONTENT

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Giovanni Dotelli | *Innovative Materials for Architecture*
Francesco Romano | *Building Services Design*
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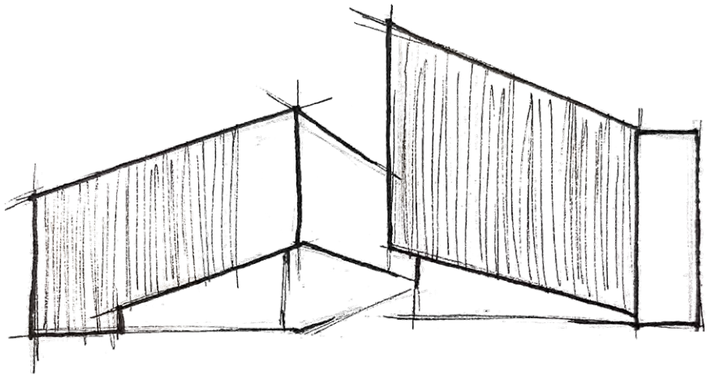
Matteo Pigni

INTRODUCTION

...WHERE THE STORY BEGAN



TO BEGIN WITH...

The 70-year-old Schällemätteli Campus will be reinvented, as per the request of the University of Basel, to become a prominent Life Science Campus. This is not only a groundbreaking turning point for Switzerland, but also for the Dreiland region, which is where Germany, France and Switzerland border each other. It is a stone's throw to the neighbors, so you can easily visit three countries in one day. This makes our research institution's location an extraordinary and strategic urban area. Basel is one of the major pharmaceutical hubs of the world, hosting centers as eminent as Novartis and Roche. This strengthens the bond between the university campuses which are now undergoing further development, and the key industries and companies, allowing the city of Basel to prosper in terms of innovation.

It is rational that as innovation progresses, so does the demand for scientists and researchers along with their required workspaces. Nowadays, society lives by the rule that a workspace is a second home, and researchers do not consider their workplaces to be merely their laboratories. On the contrary, the entire building, and even urban context in which the campus exists, are involved in a typical workday. If a space is designed in a way to integrate work and leisure moderately within a building, researchers are more likely to be psychologically and physically more efficient and comfortable in their work environment, in which they spend most of their day. Therefore, this task involves a collaboration between scientists and designers in order to merge conventional laboratory requirements and an 'innovative hub for creative minds', as we have mentioned earlier, creating a social hub in the heart of the campus itself.

This is where the story begins. This building has a storyline itself, our one-year long story. Just like a human being develops starting from birth, baby steps, first words, and eventually blooming, as does this project. The concept was born ensuing thorough research, followed by design, and the different technical parts that are integrated into the building such as structural concept, choice of material, and building efficiency in terms of energy-saving and performance. This chronological order of the building development facilitates the comprehension of the project, and its story, through this book. But before we explore our building, let us explore Basel to understand the role that our building plays in the urban context.

URBAN HISTORY

INTRODUCTION

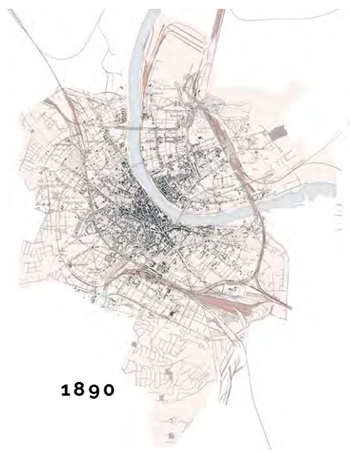
BASEL HISTORY

In order to understand the chief role that our project plays in the Schällemätteli campus, one must comprehend the context in which it was born. Basel is a city in northwestern Switzerland by the Rhine river. It is Switzerland's third most populated city, after Zurich and Geneva, reaching around 180,000 inhabitants. Basel is known as the cultural capital of Switzerland, as it contains many museums in relation to its size and population. It is one of the largest cultural centers in Europe as it has museums ranging from the Kunstmuseum, the largest museum of art in Switzerland, to the Fondation Beyeler. The city has not only been a commercial and cultural hub since the Renaissance period, but it has also emerged as a center for the chemical and pharmaceutical industries in the 20th century. Hence, an innovation center in the heart of Basel is, in some way, conventional and quite convenient to say the least, for many motives including enhancing the economic, social, and educational aspects of the city.

Following a revolution in Basel, the Helvetic Revolution, in which the French stole properties and politically reorganized the occupied areas, a "Continental System" was formed. This system is merely the splitting of the canton into Basel-Stadt and Basel-Landschaft as a result of political and financial disagreements, and sometimes violent clashes. Simultaneously, the birth of influential institutions initiated. From then on, traffic and industrialization transformed Basel. After numerous pivotal steps towards industrial production, Basel ultimately became the largest industrial city in Switzerland in the late 19th century.

The campus is located in an area with great historical significance and a storyline which evolved into what we know as the innovation hub today. It is evident through the urban morphology and the historical maps that the site acts as an urban edge, not only because it is a plot dividing the residential district from the campus, but also because it was previously a French railway station, which was adjacent to the historic walls. The railway station was demolished in 1859 in order to build a prison, but the plans have altered rendering the site an empty plot.

Despite the evolution of the urban morphology, we can still observe the remains of the most significant historic monuments in the city. The University of Basel pays tribute to the city's history by staying linked with its past. However, the genuine urban growth spread when the complex historical walls that once surrounded the central part of the city started vanishing, leaving only part of them preserved today serving as part of the city's heritage. Subsequently, the city expanded starting from the center, and branching out reaching the newly constructed rail stations, just like a pebble in a pond.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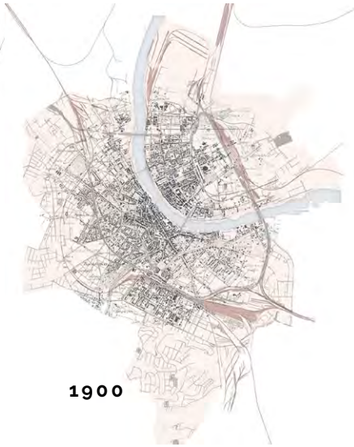
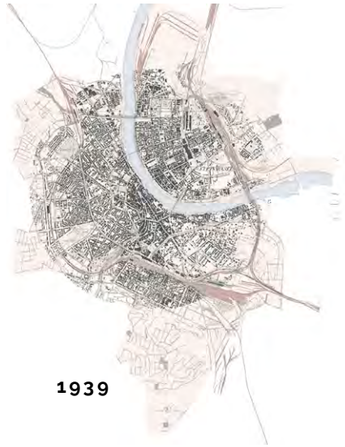

1900


1928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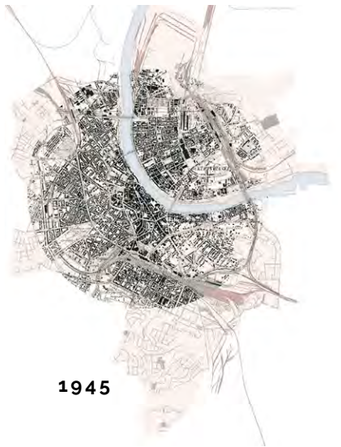

1945


2000

RHINE RIVER

Rhine River

The Rhine River plays a very important role in the evolution of the Swiss city of Basel. Amid the splitting of the cantons and the outburst of the WWI, Basel developed from a small-scale fortified town to a medium-scale industrial city, and the Rhine was the main means of transportation. The products, mainly grain and dry goods, were eventually transported, handled and stored in the building of the St. Johann Rhine harbour (refer to Rhine River timeline on page.) and the two docks in Kleinhüningen. At the time, commerce and trade were the main source of job opportunities in Basel. However, in 2010, the port was demolished in order to make room for the Novartis Campus. Hence, it is evident once again that the spotlight shifted from the industry that was once prominent prior to the Reformation, to the chemical-pharmaceutical industry. Due to the presence of these technologically advanced industries, the complications that hydro-electric dams and excessive freight traffic create are tackled by solid anti-pollution measures, making the river safe enough even to swim. To sum up, although the river might be interpreted as an urban edge in the city splitting Basel into two, it is in fact a main connector in the city, along with its multiple forms of links formed from one side to the other such as taxi boats, ferries, and bridges for vehicles, pedestrians, and bicycles. As an experimentation, we assumed that the river is nonexistent, merged both sides of the river together, and it was evident that the river has no impact that segregates the city; on the contrary, the city remained as one entity, with the historical center remaining as the beating heart of the city with and without the river.

RHINE RIVER HISTORY

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

1960's water purification plans and agriculture flourished

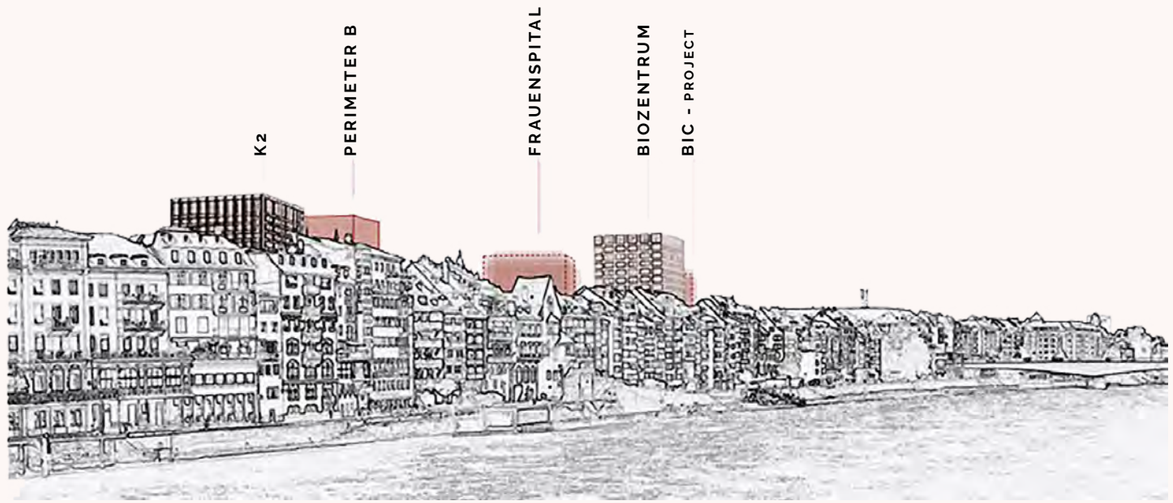
1986 fire at a Sandoz Ltd. storehouse at Schweizerhalle, an industrial area near Basel, resulted in chemical contamination of the environment. Rhine river didn't recover until the late 90s.

2019 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.

UNIVERSITY OF BASEL

INTRODUCTION

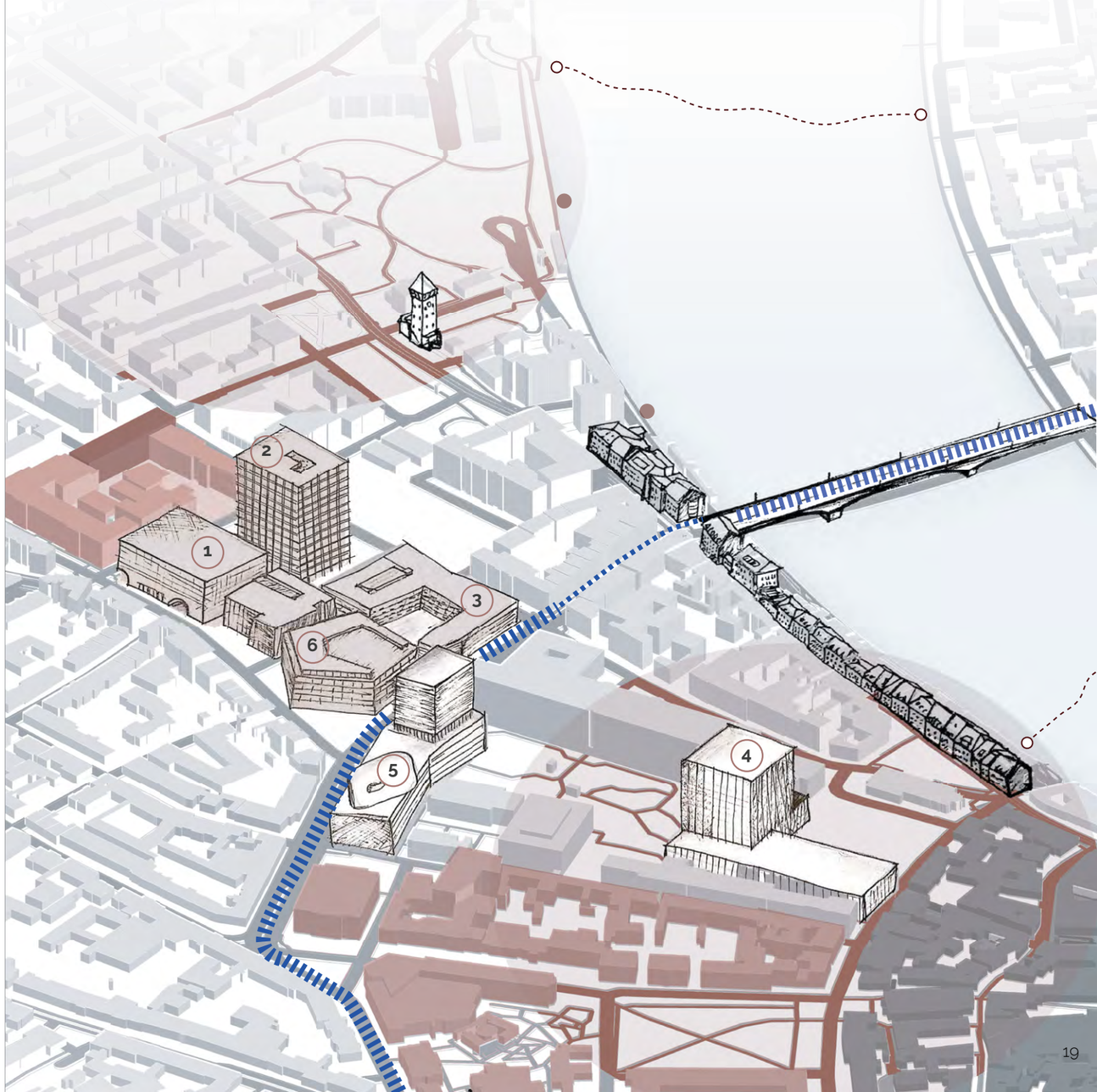
Universität Basel



It is a fact commonly acknowledged that an urban scale project such as the Schällemätteli campus creates a unique and distinct urban character for the city. The type of urban environment in Basel is an experience in Architecture that is unlike any other due to the constant vibrancy combined with the massive collection of buildings. Although each city is exceptional in its own way, one main factor differentiates Basel, and it is that the public realm and the private developments have not been totally approached as separate entities. This urban unity of public and private results in an architectural approach that comprises of both sectors that make up the city which the residents call home, despite the high-rise buildings that are usually famous for segregating private and public spaces. This thesis explores how our project further elaborates on the collective design that is formed due to the fact that it is a transitional project that stitches both urban contexts together, allowing both realms to coexist in the campus as one entity. Our building is designed primarily based on the new existing projects, as a complementary extension of the campus, including its permeability and ease of access.

"Cities have the capability of providing something for everybody, only because, and only when, they are created by everybody"
– Jane Jacobs.

This collaboration of specialists, stakeholders, and students, is the future of the University of Basel, and the main source of innovation. Hence our title, **'Basel Science Campus – Innovative Hub for Creative Minds'.**



1

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.

2

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.

3

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.

4

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.

5

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.

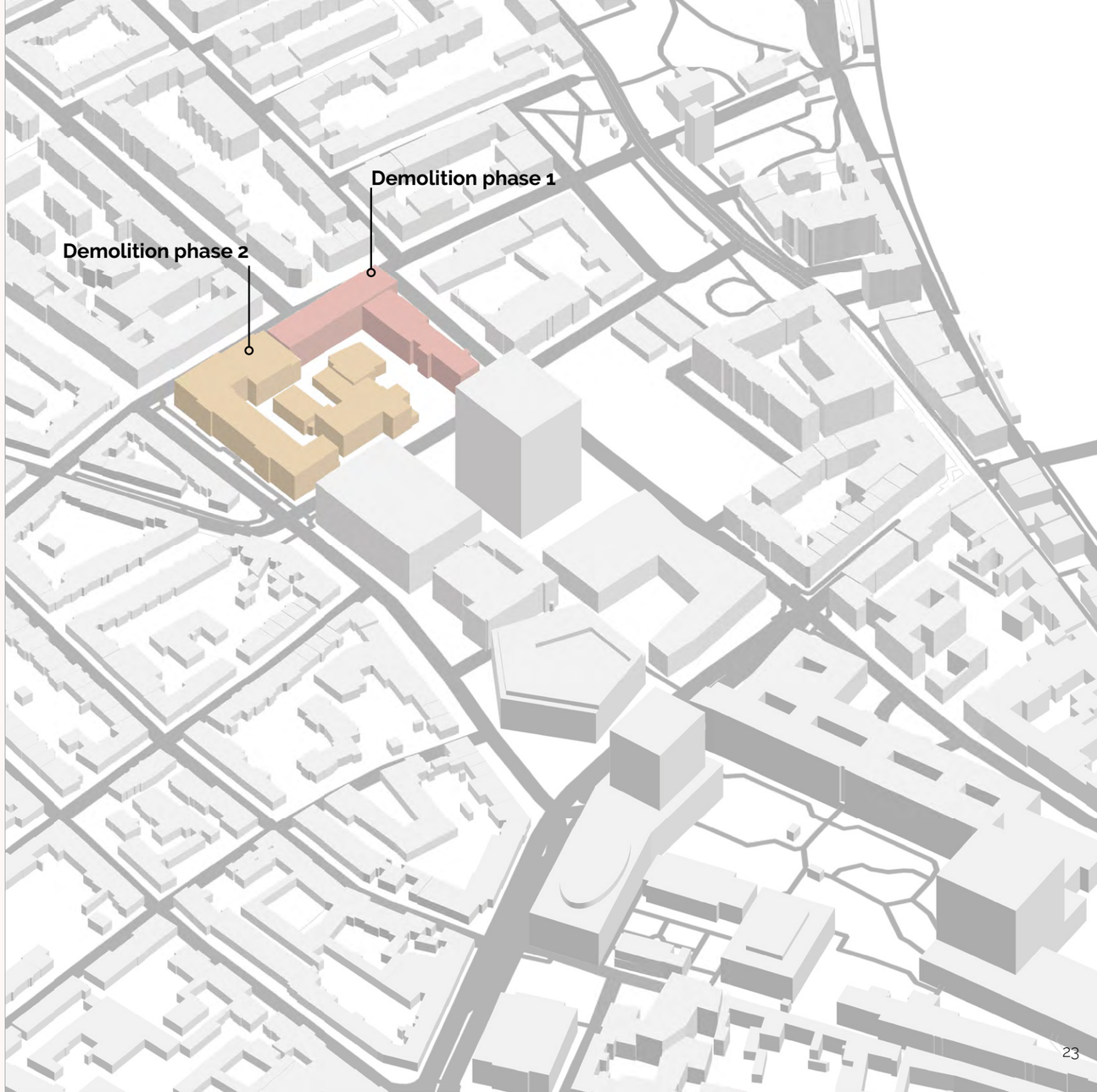
6

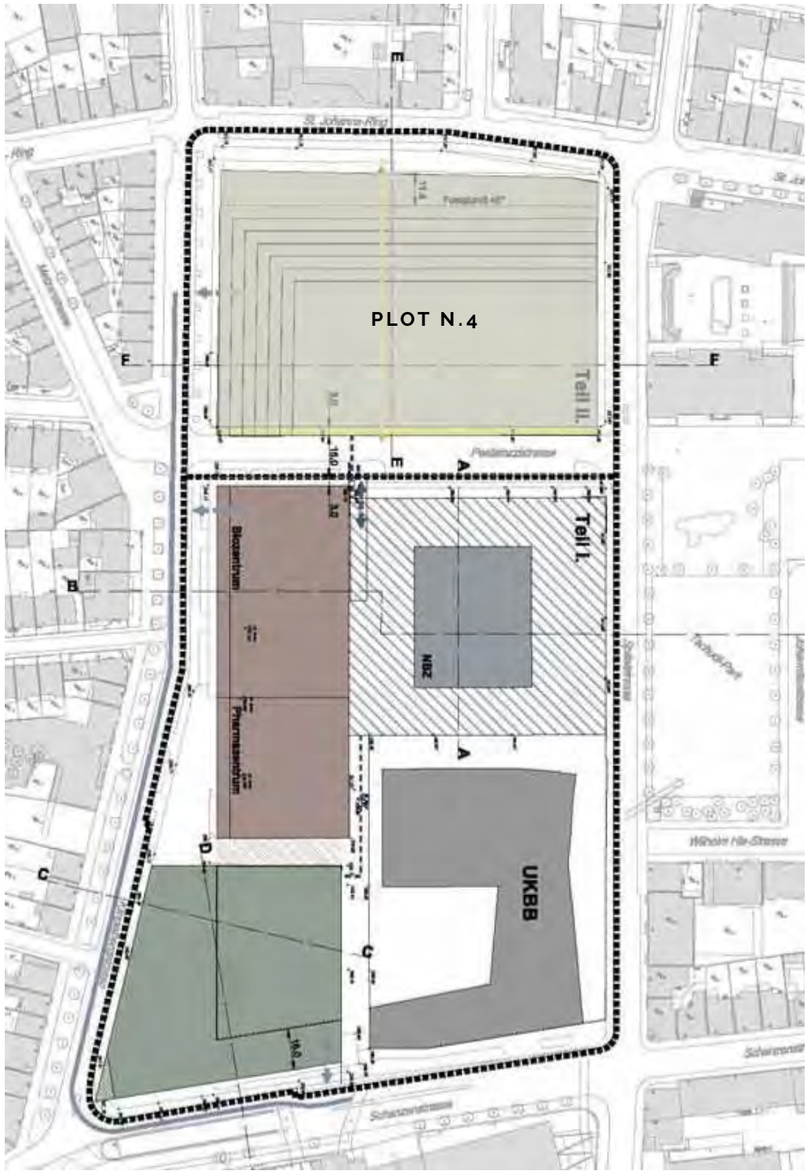
ETHZ D-BSSE Lab and Research Bldg

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.

COMPETITION BRIEF

INTRODUCTION





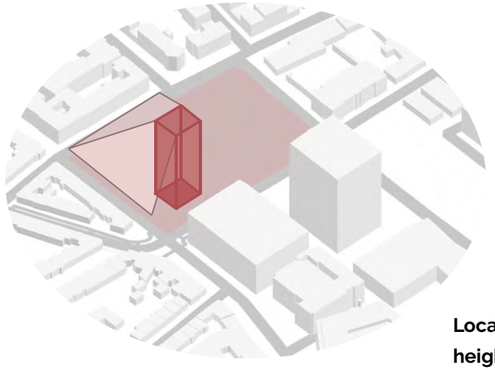
Parcels number Owner 0240
Address Kanton BaselStadt
St.Johanns Ring 19, 25, 27
Klingelbergstrasse 80, 82
Pestalozzistrasse 20, 22
Spitalstrasse 51

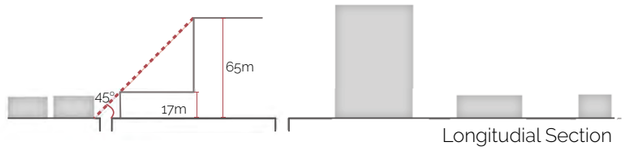
Buildable area acc. Zoning 12,239 m²
Zone for public interest uses
Building height 50.5 m max
Max. angle of incidence 45 (Zone edge)
Noise sensitivity level ES III

REGULATIONS

The initiative to transform the existing buildings on Plot N.4 took place in parallel with the revitalization of the Schällemätteli Campus. Following the same approach as the Novartis Campus, the University of Basel's main objective involved campus diversity including assigning each site to different teams of architects, or architectural firms. This dynamic process enhances the development of the town and thrives on innovative design. However, this sort of approach may develop complications due to the stringent competition, creating a clash between the different architectural designs proposed for each site. Therefore, the University of Basel had to impose rules and regulations in order to eliminate the issues that were inevitably arising.

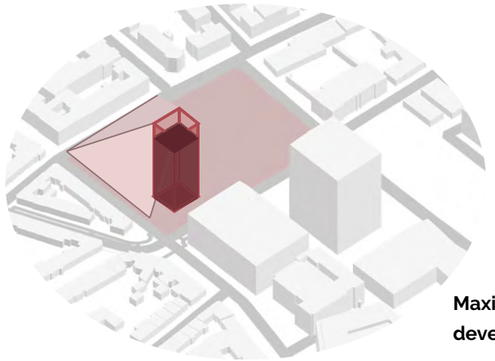
Our project was gradually molded, initially based on the restrictions imposed by the new campus development master plan which involves two main demolition phases. Plot N.4, our site of intervention, is an essential constituent of the campus because it includes most of the lecture rooms which the rest of the campus buildings lack. Due to the fact that the demolition process is divided into two phases, our construction process is divided into two phases accordingly, resulting in a set of two buildings mainly categorized as Chemistry and Physics respectively. Thus, further shedding light on the fact that site limitations and conditions often shape the building, allowing it to blend into the surrounding context, and they are the starting point of a multifaceted project development.

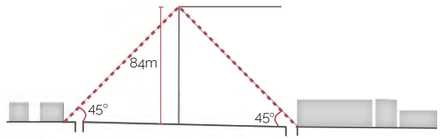




Longitudial Section

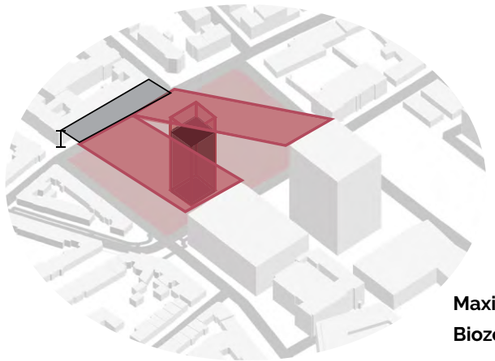
Location of maximum allowable height 64m





Transversal Section

Maximum height according to the development plan is 50.5m



Maximum height altered following the extension from the Biozentrum & the caruso St john to lowest point allowable is 40m

CONTEXT & GROUND FLOOR PLANS

ANALYSIS & STRATEGY

URBAN ANALYSIS

ANALYSIS & STRATEGY


Linear Grid


Organic Grid


Organic/Radial Grid


Organic/Industrial Grid


Linear/Radial Grid

"One cannot make architecture without studying the condition of life in the city" – Aldo Rossi.

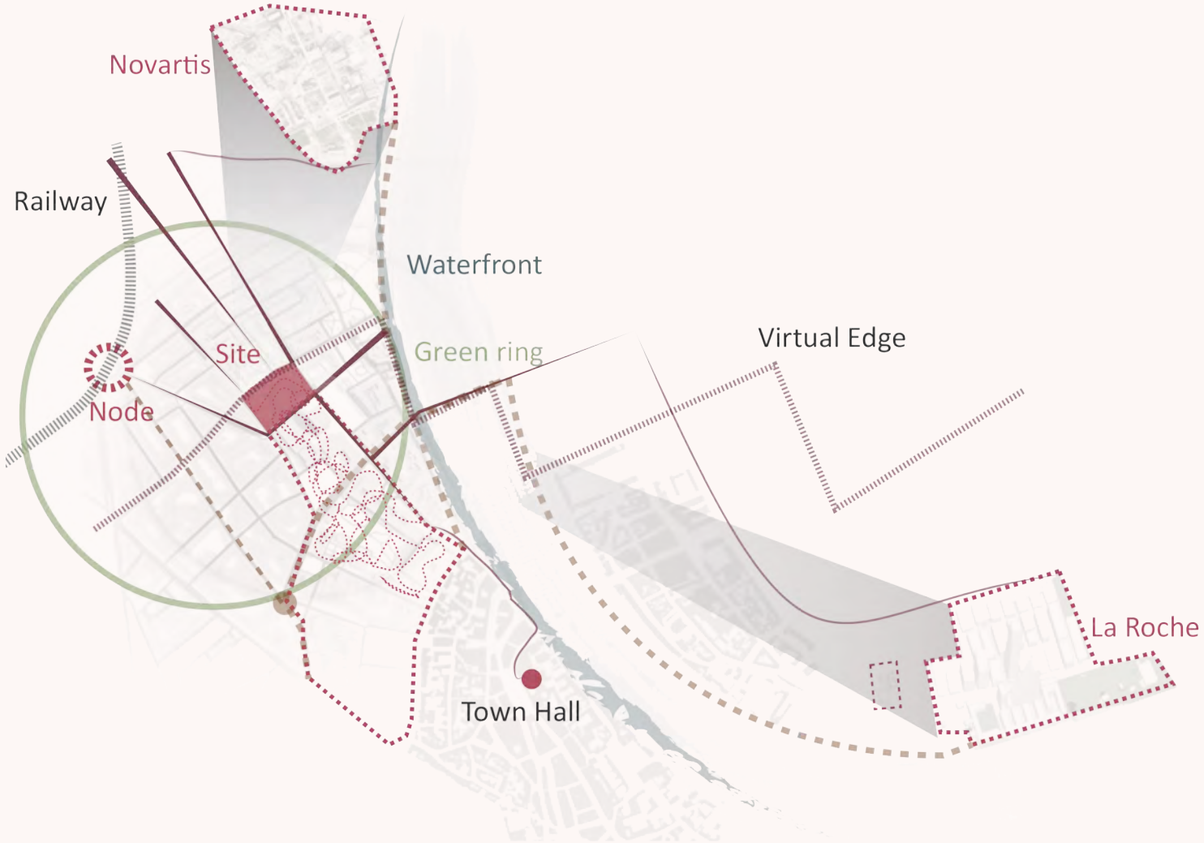
The diversity of urban fabrics formed by the urban morphology range from old towns, to newly constructed high-rise building districts. For instance, to the north and west of the campus, there exists old residential towns with a pattern of residual spaces and voids that act as either courtyards or public open areas. In addition, the site is at an advantage because it gradually became connected to three principal routes that lead to the train stations. Although this sort of morphology forms an urban pattern, it is interrupted by the industrial influence and rapid infrastructure development. This makes Basel a melting pot of different urban typologies and it is able to accommodate each and every one creating a heterogenous system.

Due to the fact that the city of Basel is complex in its diversity of urban fabrics and typologies, so is the urban strategy carried out in order to embark upon the project. This strategy begins with the scale of the entire city, and gradually zooming into the campus, eventually shedding light on the site itself. The widespread industrialization in the field of biochemistry and research boosted the city's development economically, socially and at an urban level. However, not only industrialization has affected the city's urban configuration, but also the current infrastructure and different urban fabrics of varying areas. Therefore, we analyzed that there is a linear grid configuration on the north-eastern part of the river where the urban sprawl started branching out of the old city center, which is defined by an organic radial grid. As we move further towards the peripheral areas and approaching the railways, an organic industrial and more widespread grid is found. In newly developed areas, that are still undergoing development, the radial linear grid is found, forming nodes and facilitating connections between towns and cities. The study of different urban fabrics allowed us to determine Basel's distinctiveness in Switzerland, and therefore it became possible to identify the possible development opportunities in the detached areas that need innovation, and our site is amongst those areas.

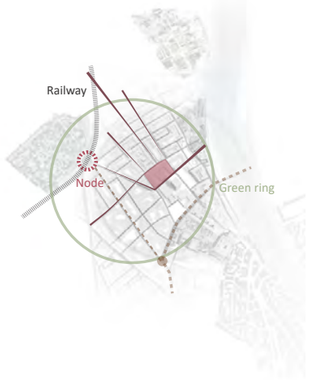
This is when we determined that our site is located in a 'Reimagined Urban Area'.

STRATEGY

ANALYSIS & STRATEGY



THE 5 POINTS

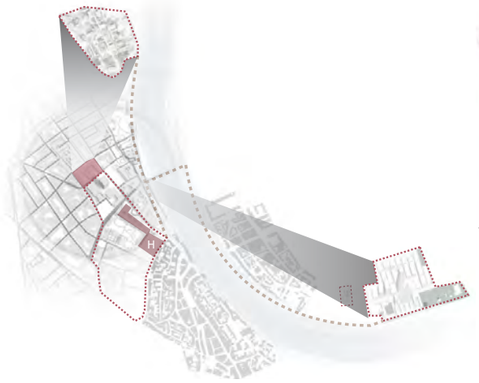


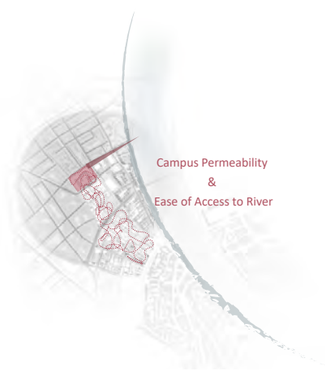
I-Collaborative Leadership Network

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 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.

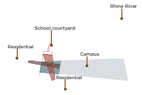
V-Enhance Access to Capital

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. (Campus Permeability & Ease of Access to River)

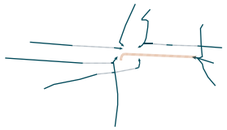
SITE ANALYSIS

ANALYSIS & STRATEGY

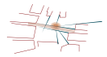
3- belt concept



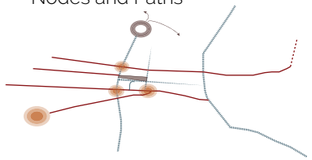
Accessibility



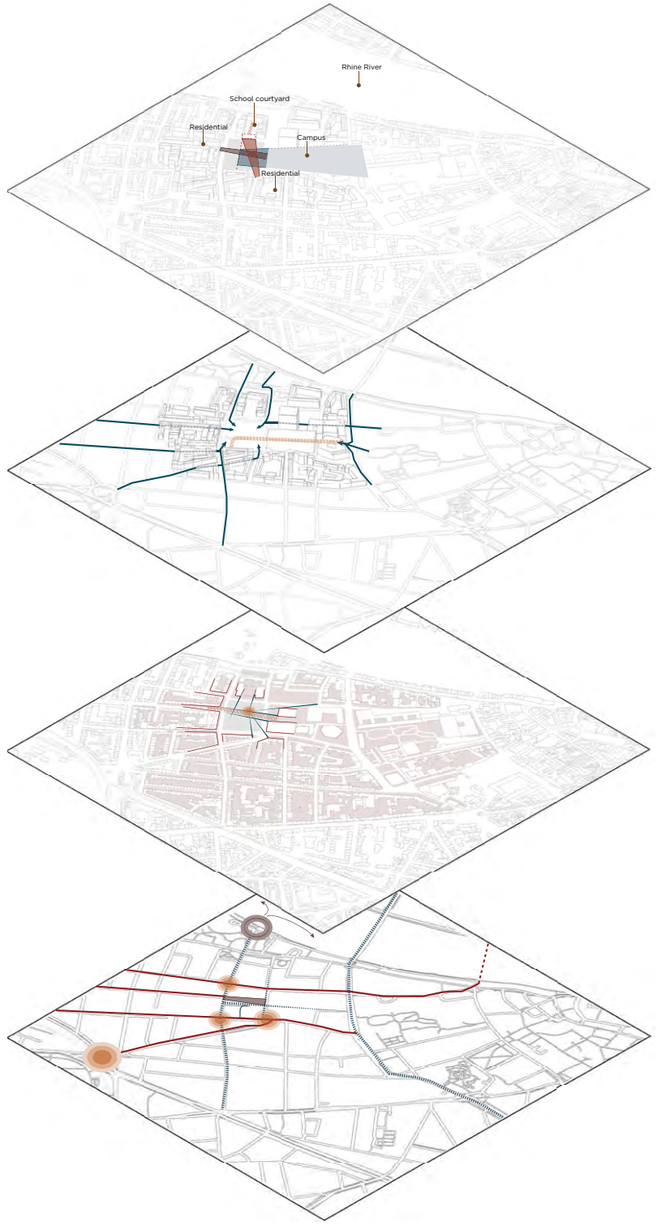
Voids and boundaries



Nodes and Paths



- Site accessibility
- Campus underground tunnel
- Voids
  -grow larger the closer they are to the river, and smaller in the residential district-
- Connection of void to site
- Block's Boudaries
- Project's courtyard location
- Primary Vehicular Network
- Secondary Vehicular Network
- Fairy Taxi
- River Network
- Nodes



Our urban strategy is ultimately finalized through the justification that our site is a 'Reimagined Urban Area'. It is found in close proximity to Basel's historic river waterfront, 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.

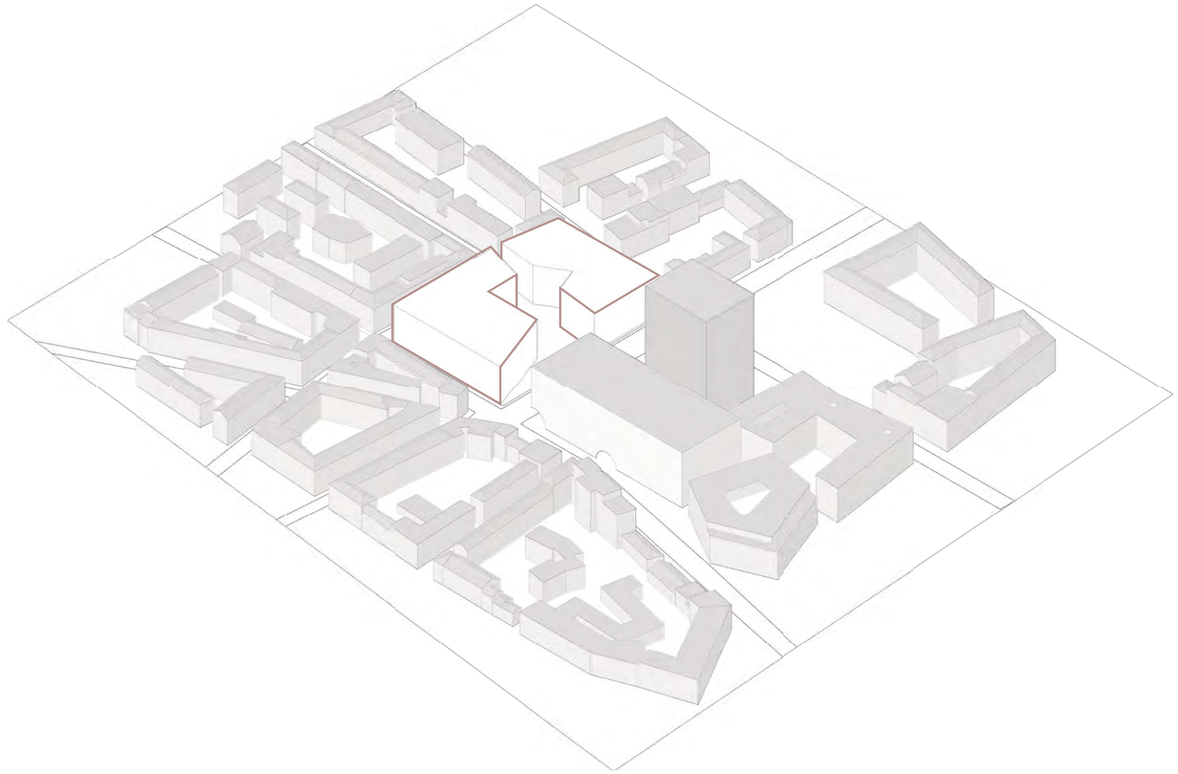
A **3-belt concept** is generated in order to connect the open public spaces/green areas/piazzas that are surrounding the campus. The first belt branches out of the residential district with an access that widens towards the campus. The second is an extension of the school courtyard, with an axis extending, serving as a connector to the river. The third highlights the end point of the campus, having a sort of U-shape that allows for the 'belt' to wrap around the project and mark the campus boundaries. The site is accessible from every angle, and the porosity and ease of pedestrian accessibility facilitates circulation around the campus, and from one facility to the other.

Residual spaces, courtyards, and setbacks form voids that are noticed to grow larger the closer they are to the river, and smaller in the residential district. The intersection of their boundaries forms a node on the site, where the courtyard will be located. The project is advantageous due to the ease of circulation for pedestrians, vehicles, and bikes. It is surrounded by nodes where most intersections occur, and is in close proximity to the river, linking it to the other side of Basel.

refer to page 46 for an elaboration on the 3-belt concept

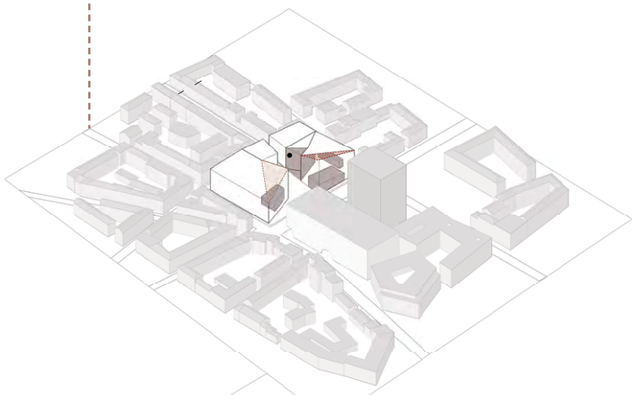
INTERVENTION

ANALYSIS & STRATEGY



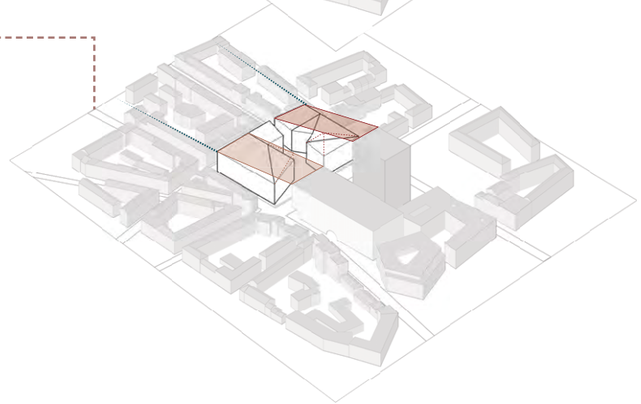
BUILDING'S VOIDS: ATRIUMS & FORUM

A forum/excavated area is created in the 1st basement to allow for light penetration and ventilation, along with a central area/communication hub that is semi-private, as opposed to the public open space/node that has been created in between the two buildings on the ground floor.



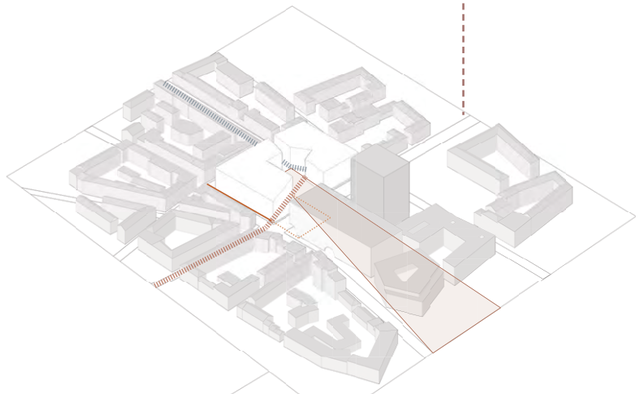
HEIGHTS

The slopes of the roofs and entrances are derived from both the Biozentrum, and Biomedical center, along with the restrictions imposed on the site due to the height limits near the residential buildings, resulting in a minimum of 28m and a maximum of 50m. The entrances are designed in a manner that physically and visually connect to both the Biozentrum and Biomedical Center.



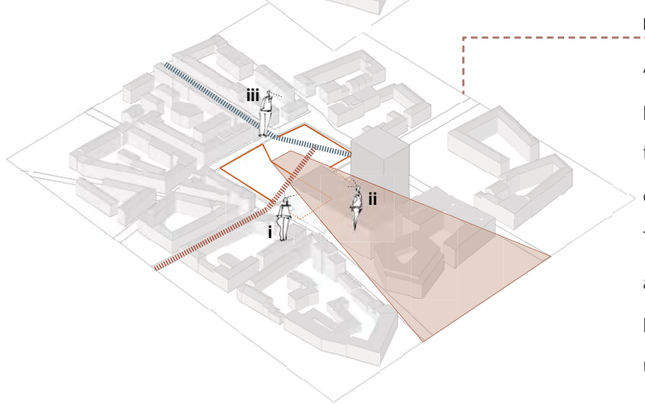
VOLUME

One building is mainly Chemistry and the other is mainly Physics. Both buildings allow for multi-use and interactive spaces, maximizing work performance as well as providing leisure and communication hubs. The project is sliced into two buildings due to the demolition process and the two phases of development, and are connected underground. The belt creates a courtyard that is the node of the project, and the main access to the rest of the campus. The dimensions are extensions of the surrounding context.



BOUNDARIES

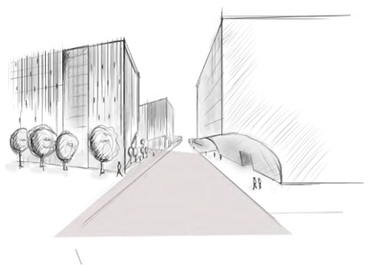
A 3-belt concept is generated in order to connect the open public spaces/green areas/piazzas that are surrounding the campus. The first belt branches out of the residential district with an access that widens towards the campus. The second is an extension of the school courtyard, with an axis extending, serving as a connector to the river. The third highlights the end point of the campus, having a sort of U-shape that allows for the 'belt' to wrap around the project and mark the campus boundaries.



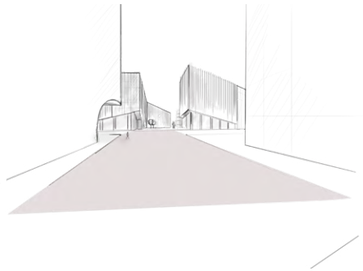
THE 3-BELT CONCEPT

The main goal was to create the standard laboratories with maximum efficiency that are required, within a complex geometry that reflects the "Reimagined Urban Area" concept of an innovation center. The atriums at the entrances and forum allow for a collaborative workspace that allows for some leisure time in between work hours. The slopes of the roofs and entrances are derived from both the Biozentrum, and Biomedical center, along with the restrictions imposed on the site due to the height limits near the residential buildings, resulting in a minimum of 28m and a maximum of 50m. The entrances are designed in a manner that physically and visually connect to both the Biozentrum and Biomedical Center. One building is mainly Chemistry and the other is mainly Physics. Both buildings allow for multi-use and interactive spaces, maximizing work performance as well as providing leisure and communication hubs. The project is sliced into two buildings due to the demolition process and the phase I and phase II development, and are connected underground. An underground tunnel serves as service truck route and extends into the project, and out to the exit. The belt creates a courtyard that is the node of the project, and the main access to the rest of the campus. The dimensions are extensions of the surrounding context.

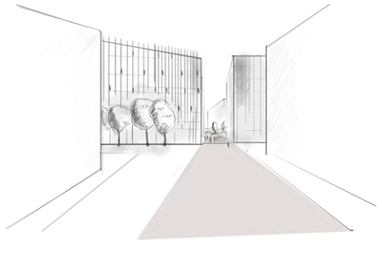
View **i**



View **ii**



View **iii**



MASS PLAN

This social hub we speak of is created by stitching the parts of the city that the campus divides. Not only does the interior accommodate the work-leisure concept, but also the form of the building tackles the urban aspect of creating continuity and porosity throughout the campus, linking the residential districts to the campus through our central pathway, without necessarily accessing the building itself, but granting access to the ground floor of the building that is semi-public, containing a library and a multi-purpose space. In addition, the building contains many elements that make the program almost tangible to by passers, such as voids along the main pathway, the main transparent façade of the forum, and the transparency of the entire building envelope as a whole. These glimpses of this architectural promenade are imprinted in one's memory, further endorsing this field and encouraging students to take part in it, feeding their thirst for curiosity and knowledge. However, despite this 'architectural promenade', the program is still the prominent part of the design.

BUILDING PROGRAM

CASE STUDY

BUILDING PROGRAM

The swiss architecture firm Herzog & de Meuron won the competition to construct an education and research center for the University of Zurich (UZH). Architects has released details of their proposed Forum UZH, the second project in the city, following a Children's Hospital featured in 2012. As with the 'Kinderspital', the university building is a publicly significant project, located at the historical heart of Zurich.

The scheme, known as 'Forum UZH', consists of three primary components: a 'topographical plinth' for teaching; a stand-alone building for research; and a unifying forum that continues outdoors as a garden. It is expected to be completed in 2027. "Space is at a premium around the university, more and more area is required for diverse institutions to guarantee a future for their research and teaching missions. How, then, can spaces be created for people and nature?

From "Enclosed Campus" to "Inner city Campus"

The generation project "Hochschulgebiet Zürich Zentrum" (HGZZ) will improve the infrastructure of USZ, UZH and ETH Zurich, thereby strengthening the leading position of the institutions and strengthening their excellent performance for the city, the canton and Switzerland. In the future, green spaces and public spaces will invite you to linger and thus contribute to the appreciation of the entire district.

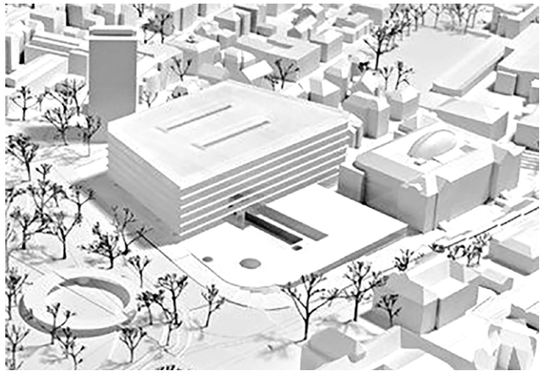
Usability and accessibility of the Gloria farms must be guaranteed. New large specimen trees of different species, found both on public and on private land, form the glue of the quarter and are important for the urban climate. In size they are in dialogue with the building volume and its facades. Thus, the preservation of existing and the planting of new trees in solitary in the public and private space are top priorities.

The Central Forum

The Continuous Garden

The Library

The “Lichthof” Forum



The Forum

The forum determines the idea of a clear functional and spatial organization of the building. Teaching and study areas are situated in a part extending towards the Rämistrasse. The back of the building contains areas dedicated to research. The open, centrally located Forum is placed on an even topography and can be accessed from various sides. The Forum extends across a multi-storey circular atrium containing a study center with library. The auditoriums situated below are accessible directly from the Forum. Inside this forum is the central location of this building. It is the counterpart of the Lichthof in the UZH main building.

The Plinth

The Forum’s “topographical plinth” serves as a primary teaching hub, while terraces built into the slope are stepped around a central forum. The plateaus form places for students and the public to congregate, access lecture halls, classrooms, cafes, shops, gyms, and sports facilities. A flowing transition between inside and outside is paramount with the below-ground plinth interacting with surrounding urban spaces, and entrances to the building on all sides. Our central courtyard resembles the plinth, overlooking the underground forum and seating steps, as well as the basements through the voids carved in the main pathway.

“Only by placing many of the uses in an elevated building have we been able to bring daylight into the terraced plinth and make room for the public space that we were aiming for. The inviting atmosphere and the numerous trees will make the large plaza in front of the new building and also the Forum itself a new focal point of university and urban life.”

COMPARISON

Location

The “re-imagined urban area” model: Both sites are found near a historic waterfront (river), therefore they are located where the innovation districts are undergoing a physical and economic transformation.

Parcel Voids

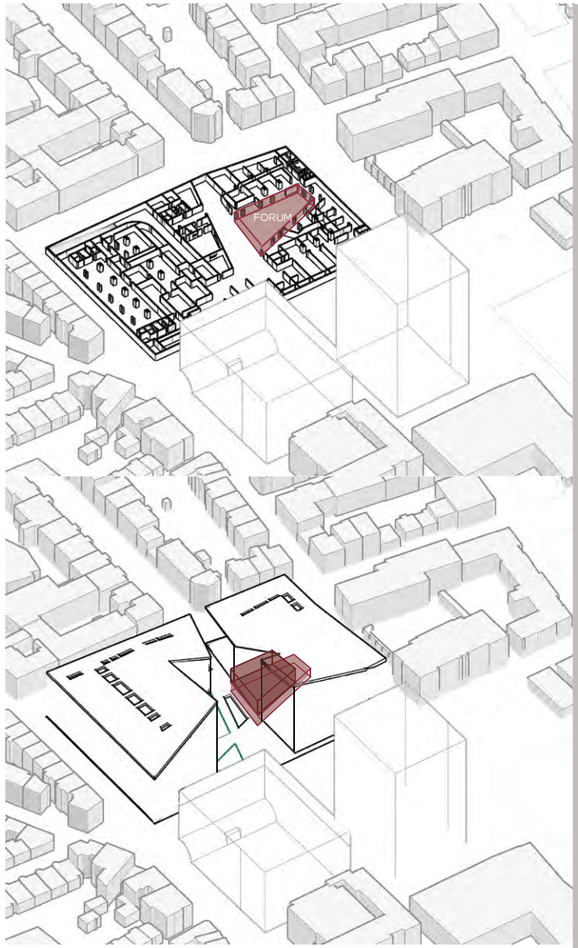
The voids in these parcels grow bigger in scale as they go further towards the waterfront, while it is clear that they densify and are smaller in scale towards the residential buildings. Therefore, it was important to note the varying open spaces found available in both areas.

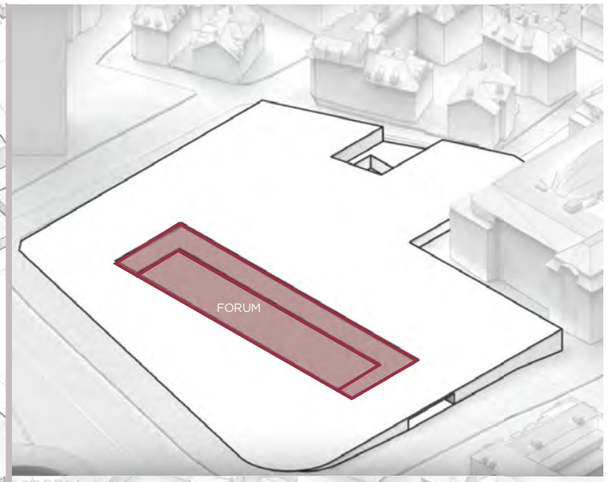
Networking

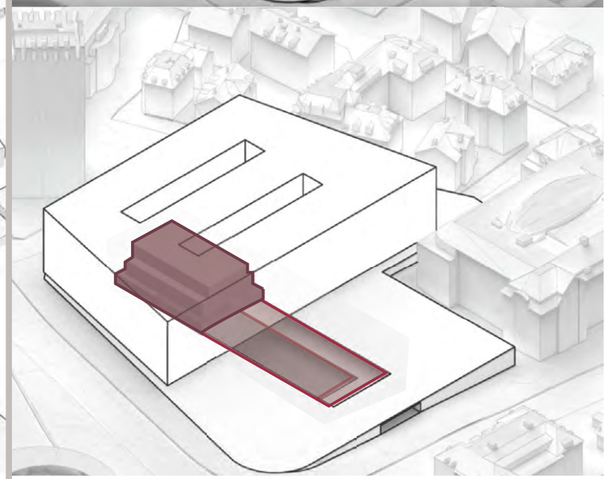
The urban porosity is seen as the ability of an project to accommodate public spaces, uses and flows that affect a territory beyond the building itself. In both projects, there are no boundaries that are impenetrable urban features that segregate the entire area within the city. Our project design is an outcome of the 3-belt concept that is generated in order to connect the open public spaces/green areas/piazzas that are surrounding the campus. The first belt branches out of the residential district with an access that widens towards the campus. The second is an extension of the school courtyard, with an axis extending, serving as a connector to the river. The third highlights the end point of the campus, having a sort of U-shape that allows for the ‘belt’ to wrap around the project and mark the campus boundaries.

Phases of Construction

Our project is sliced into two buildings due to the demolition process and the phase I and phase II development, and are connected underground. One building is mainly Chemistry and the other is mainly Physics. Both buildings allow for multi-use and interactive spaces, maximizing work performance as well as providing leisure and communication hubs. The UZH has three-stage construction / reformation phases. The first construction phase will be realized in 2028.

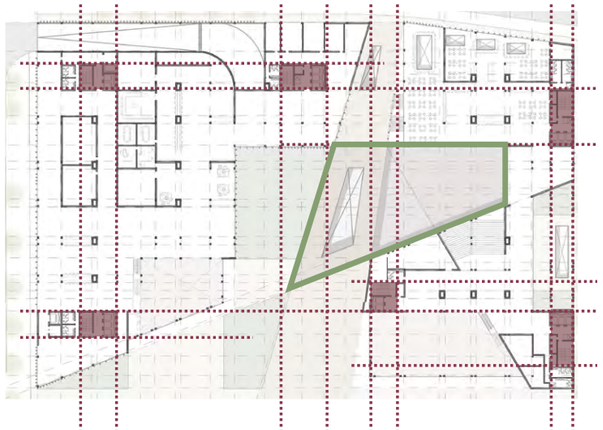




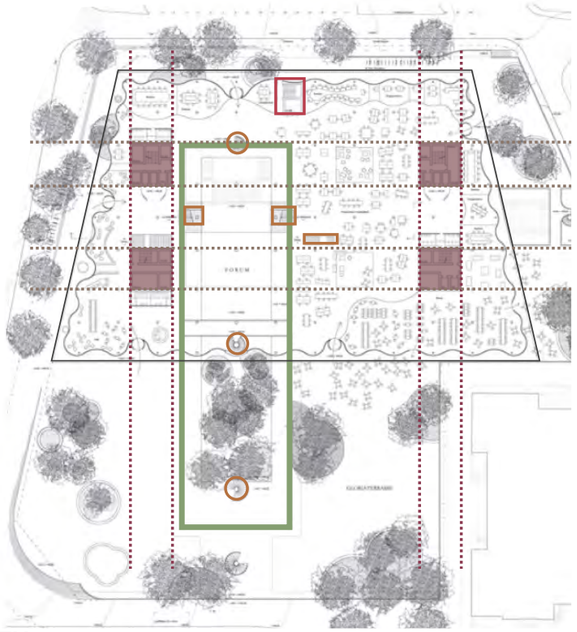


Basel Innovative center BIC

University Zurich Hospital UZH



BIC



UZH

Circulation and Floor plan

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.

Facade

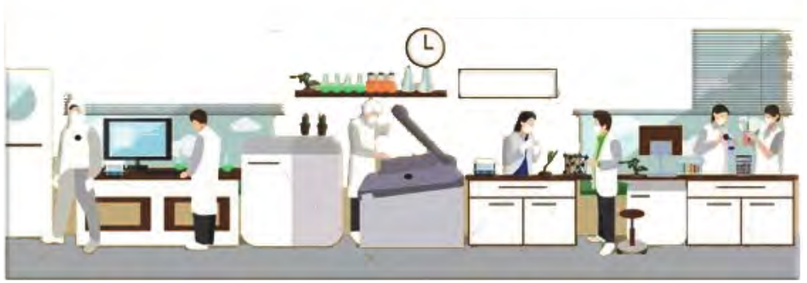
Cantilevered floors and brise-soleils of varying sizes structure the façade and lend it spatial depth. Depending on one's vantage point, the building may appear weighty, as if it were of solid stone, or transparent and light. The play of horizontal and vertical lines and the curved motif of the brise-soleils enter into a dialogue with the historicizing Palazzo architecture of the neighboring institutions. The colors and forms of the parasols are adapted to the surroundings. They are high-tech and provide the adequate amount of shade without blocking the views throughout the building so that the 'open feel' remains. Just as UZH's facade design was inspired by the Italian Palazzo adapted in the surroundings, our project was designed with respect to the context including Caruso St. John and the Biozentrum, with similar building materials and highlighting the verticality of the building with respect to the scale.

"We are building here the house for the medicine of tomorrow and the people of today."

-Martin Waser, Hospital President of the University Hospital Zurich

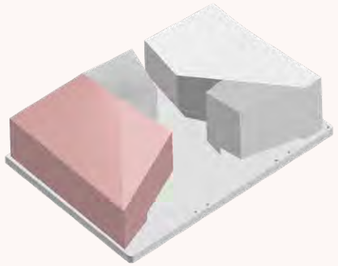
PROGRAM

BUILDING PROGRAM

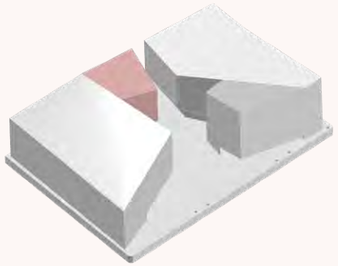


BUILDING PROGRAM

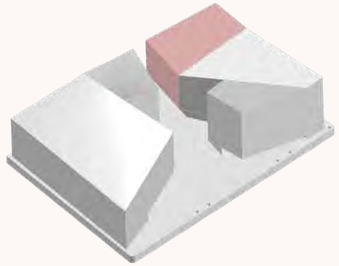
Building I
Floor Area: 4,100 sqm
Number of floors: 6
Total Area: 24,600 sqm
Function: Chemistry

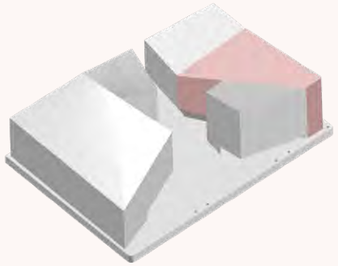


Building II
Floor Area: 910 sqm
Number of floors: 5-6
Total Area: 4,550 sqm
Function: Library & Chemistry

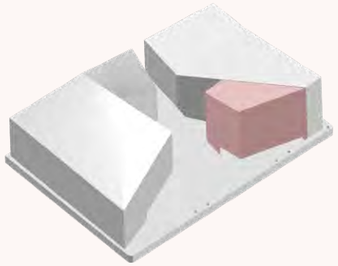


Building III
Floor Area: 1,285 sqm
Number of floors: 5
Total Area: 6,425 sqm
Function: SNI

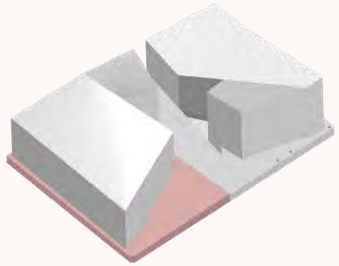




Building IV
Floor Area: 1,170 sqm
Number of floors: 6
Total Area: 10,620 sqm
Funticon: Physics



Building VI
Floor Area: 1,170 sqm
Number of floors: 8
Total Area: 9,375 sqm
Function: Anatomy

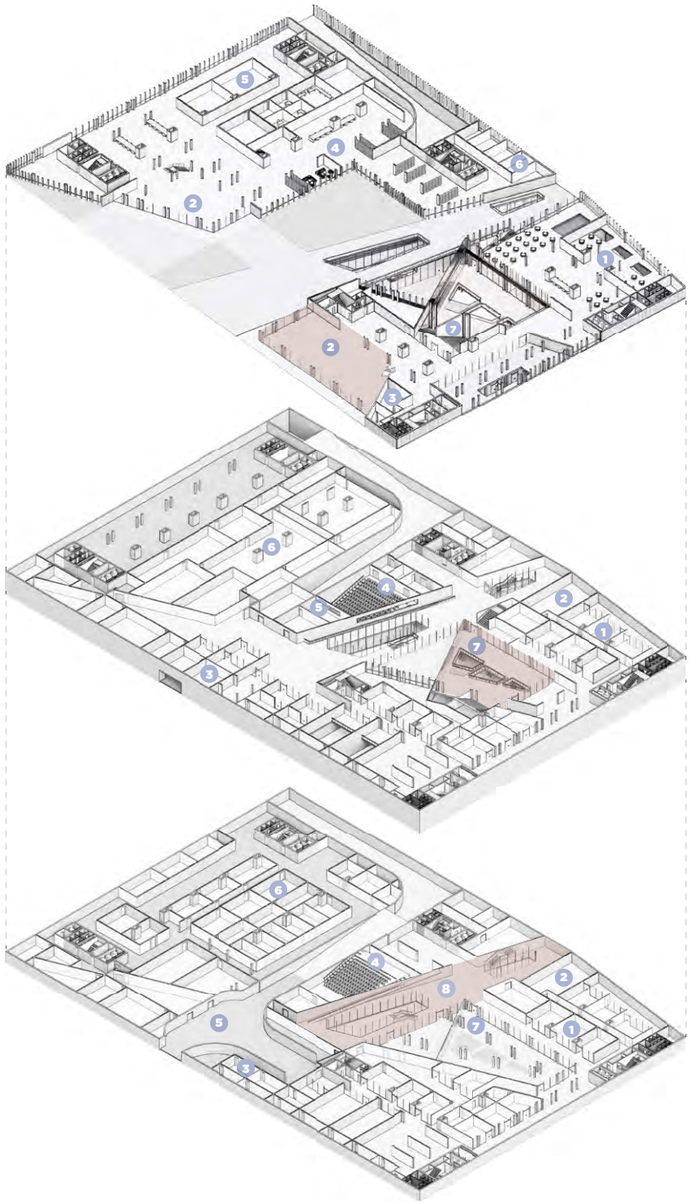


Basement 1
Total Area: 9,000 sqm
Function: Animal Station

To sum up, the starting point is now understood in order to proceed with embarking upon the design that houses the requirements University of Basel campus. The focal point of this campus is the fact that it is an innovative campus and our innovation center is the dominant part of this focal point. Subsequent to various thorough case studies and research regarding the role of campuses in a city's masterplan, along with the interplay of their function with the surrounding urban environment, it was possible to follow a functional and innovative strategy that paved the way to the building design that we envisioned.

There is a timeline of architectural and urban evolution that we cannot control. As a human goes forward, so should architecture. Therefore, despite the fact that the implementation of the campus strategy that dates back to 2007 contributed greatly to the current state of the University, the strategy planned from 2022 to 2030 is the one which sets the course for the campus's successful development.

'Basel Science Campus – Innovative Hub for Creative Minds' which is divided into two developing buildings connected underground, as previously mentioned, are occupied by two buildings, each following a specific and independent program defined by the campus. Despite the fact that the buildings have different functions, they are complementary to each other and follow the same architectonic language. On one hand, a building's design is not just what it looks like and feels like; design is how a building works. The content precedes the design because design in the absence of content is merely decoration. On the other hand, it is not enough to just have the right building that works well, it also ought to be a delight to the eye, and it has to stand out while simultaneously blending into the urban environment. It ought to create an element of surprise in the city, and surprise is the main thing in a work of art.



GF

1- Cantine
2- Entrance atriums
3- Storage room
4- Library
5- Meeting rooms
6- 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
8- Double Connector

5TH

1- Standard Labs
2- Dark room
3- Storage room
4- Common Space
5- Offices

3RD

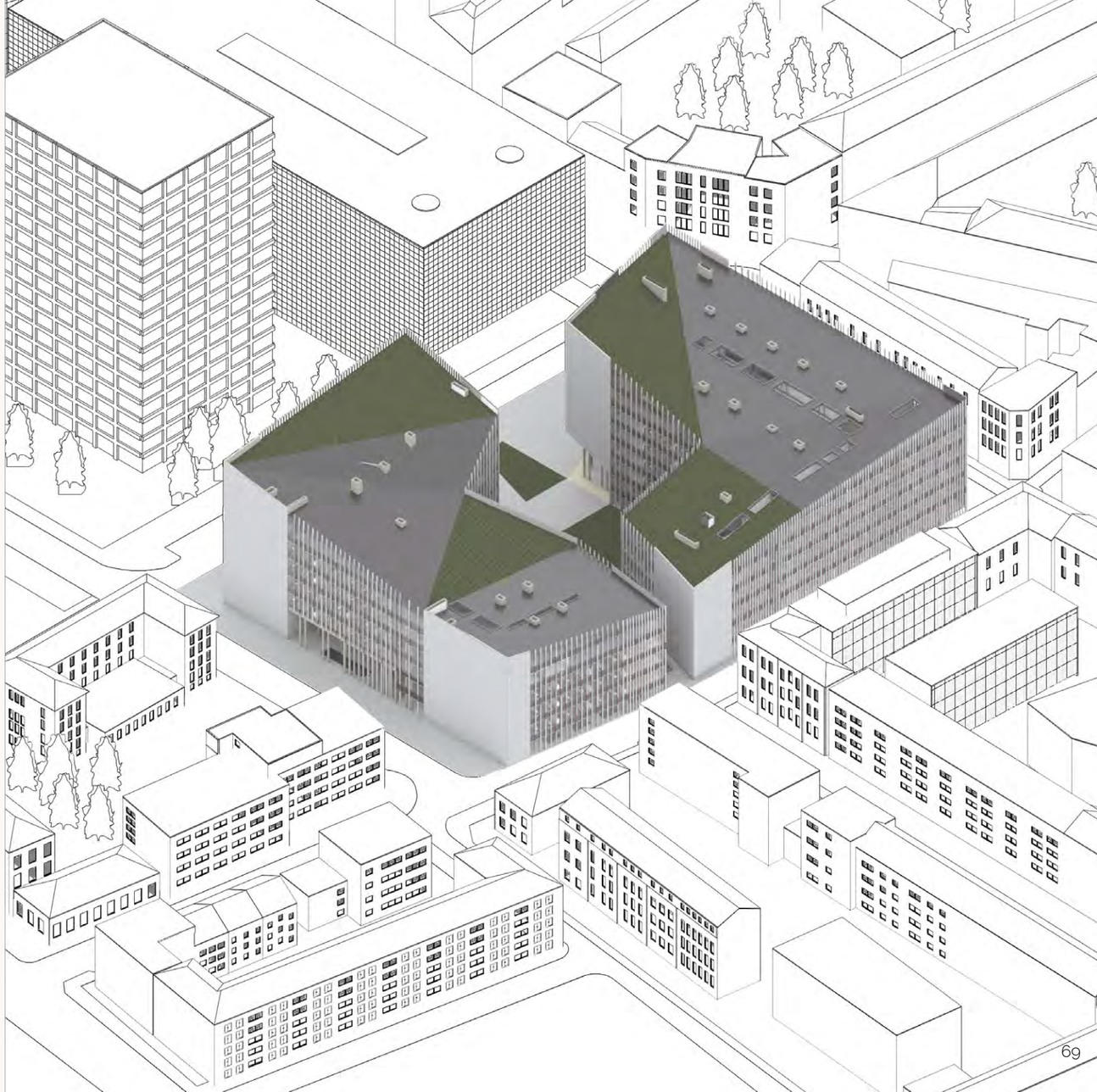
1- Standard Labs
2- Dark room
3- Storage room
4- Common Space
5- Offices
6- Lecture halls
7- Research and development

1ST

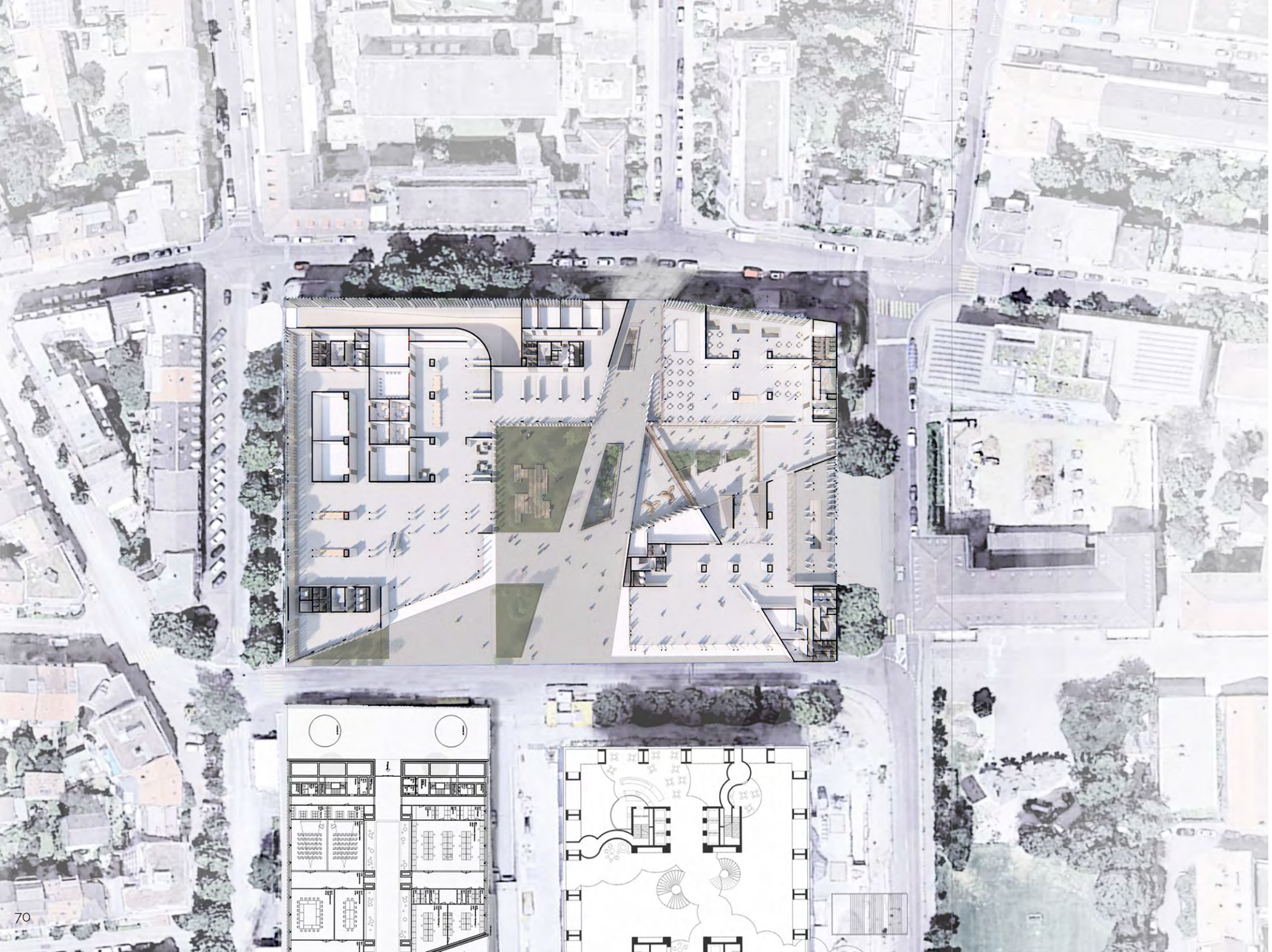
1- Standard Labs
2- Dark room
3- Storage room
4- Common Space
5- Offices
6- Lecture halls

ARCHITECTURAL DRAWINGS

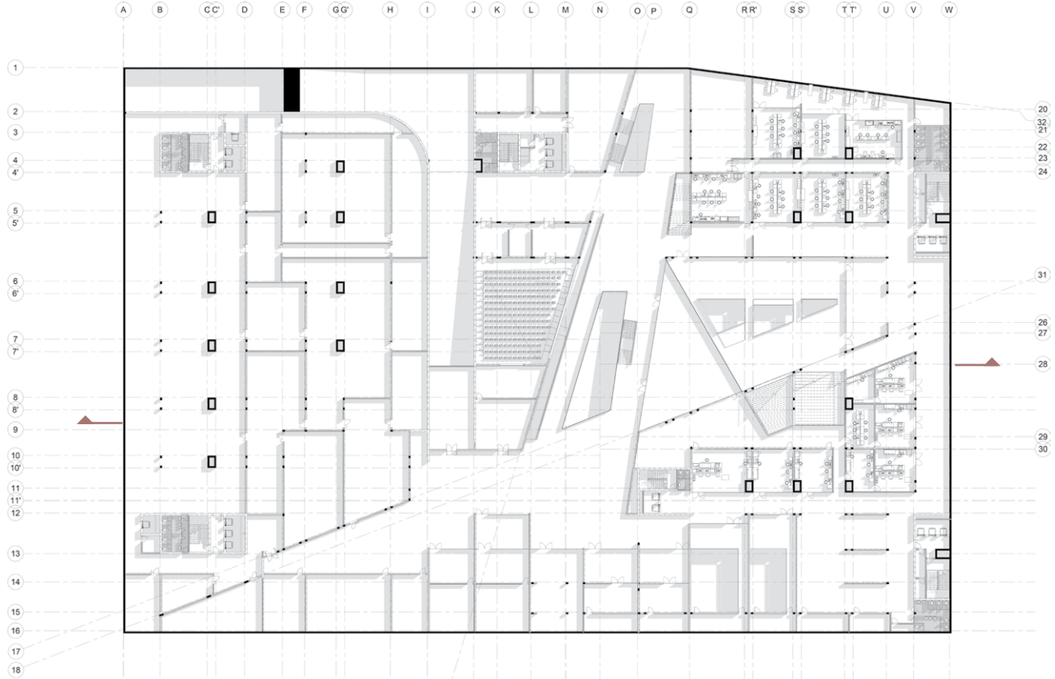
BUILDING PROGRAM



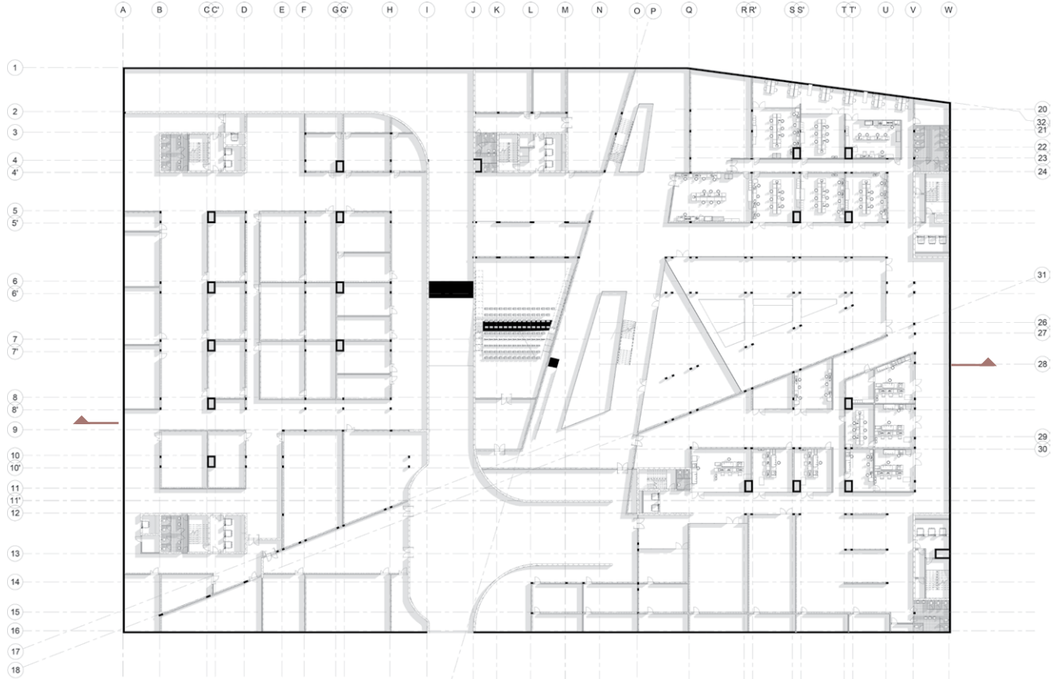
GROUND FLOOR PLAN



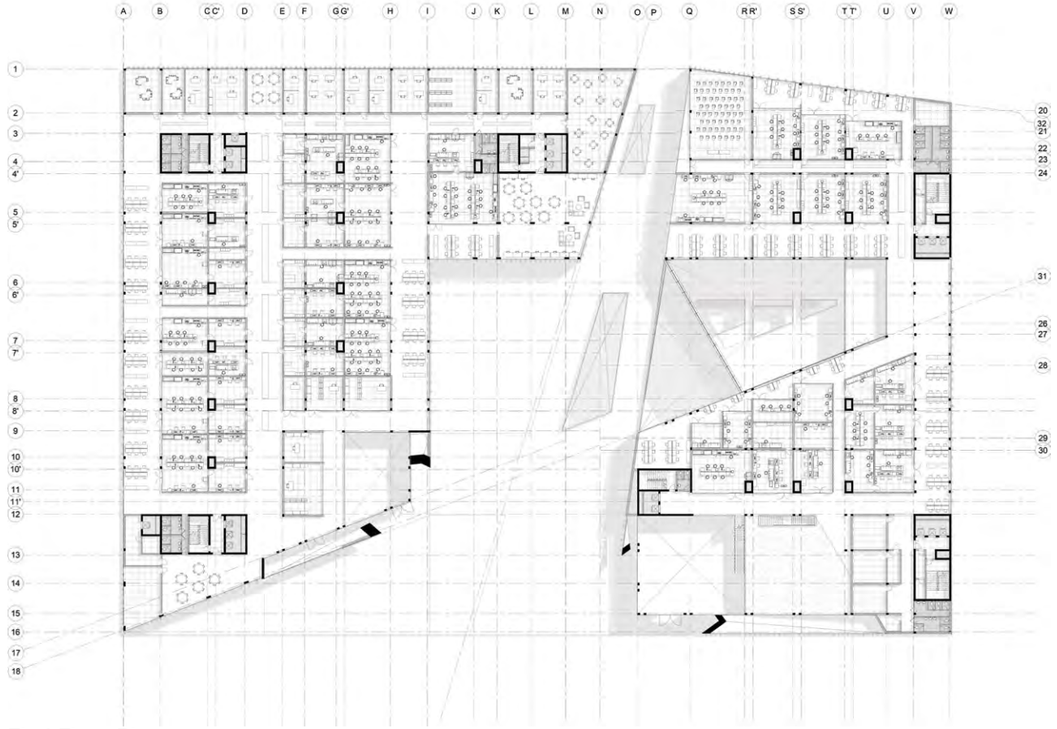
Our ground floor is our project gateway, and the semi-public inviting spaces are part of the bypassers' experience in the campus. The hierarchy of the entrances are defined by both the size and the assigned materials such as chrome-colored fins rather than off-white on the south elevation, which is the main façade. The secondary access to the ground floor is on the eastern façade facing the primary school, and the tertiary access is found en route to the campus from the residential district, along the main pathway. The secondary and tertiary accesses both lead to the social hub of our project, and maybe even the entire campus or city itself. This social hub is our multi-purpose 'forum' which we will elaborate on later in terms of its use of space according to its materiality and the required function. The access to the forum from the main atrium of the Physics building is a combination of a conventional staircase which serves merely as vertical circulation, and seating steps which add dynamism to the space and its function as a communication hub. The ground floor embodies a sort of free circulation plan, as opposed to the complex upper floor plans that are considerably dense in order to accommodate all the required laboratories and their equipment. The use of a coupled columns system is adapted for both structural and aesthetical reasons. On one hand the coupled columns follow the grid of the structural shafts. On the other hand, they are used in the facades, and areas emphasizing the hierarchy of the spaces such as the entrances and the forum. Despite the duality in the plan typology, all floors are visually connected through continuous atriums, and voids that allow light to penetrate the corridors throughout the entire building. In addition, through this partial open plan, the location of the cores are evident, and this facilitates circulation for the user upon entry, even though the scale of the project is relatively large.



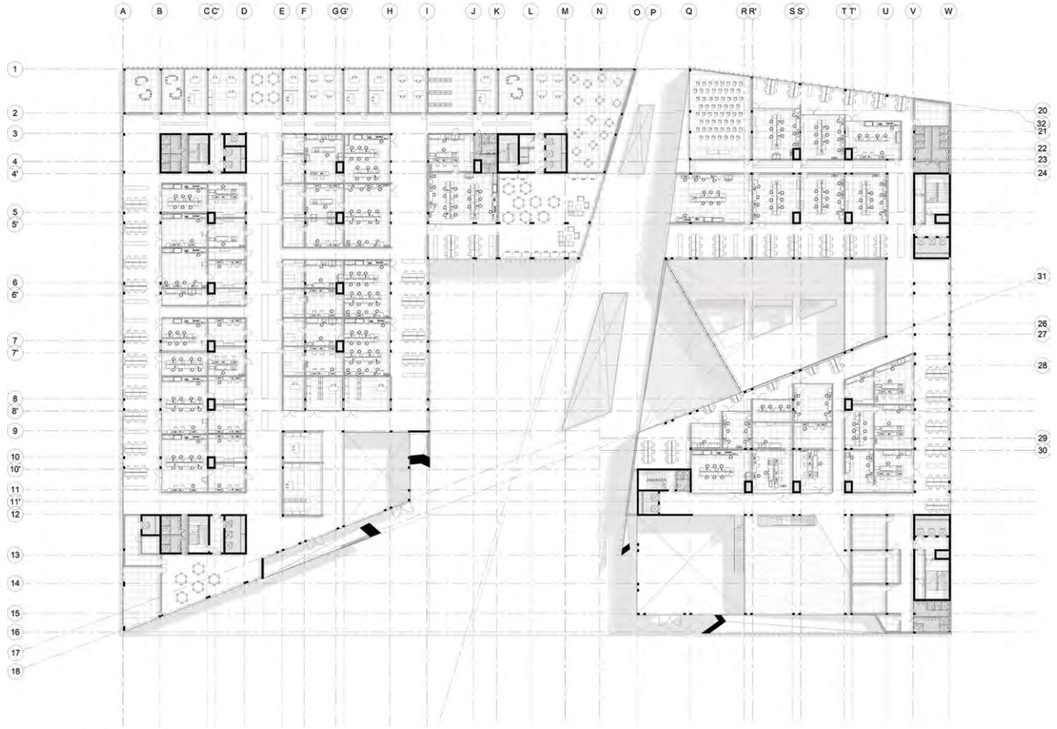
Basement -1 Floor Plan



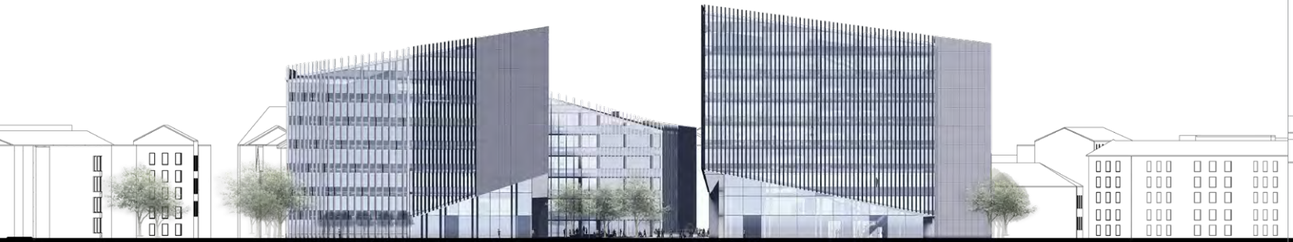
Basement -2 Floor Plan



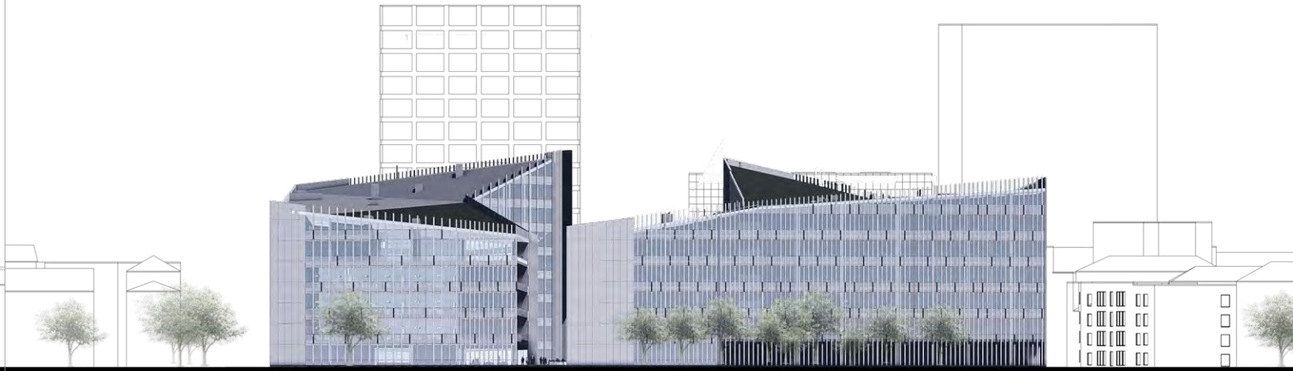
First Floor Plan



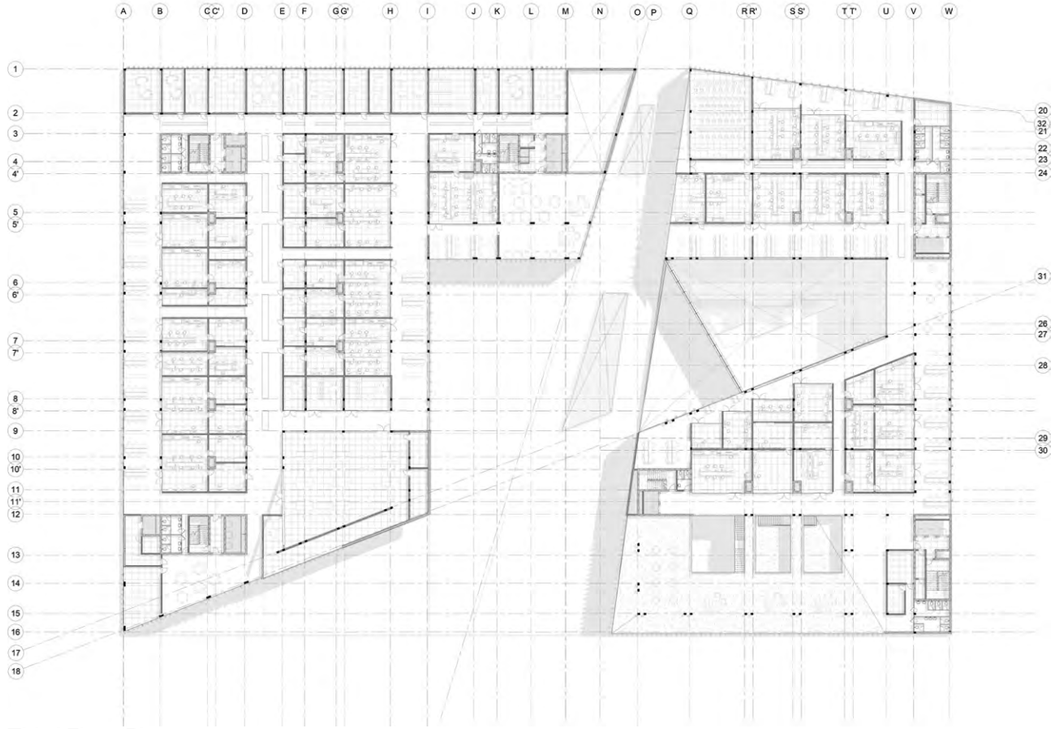
Second Floor Plan



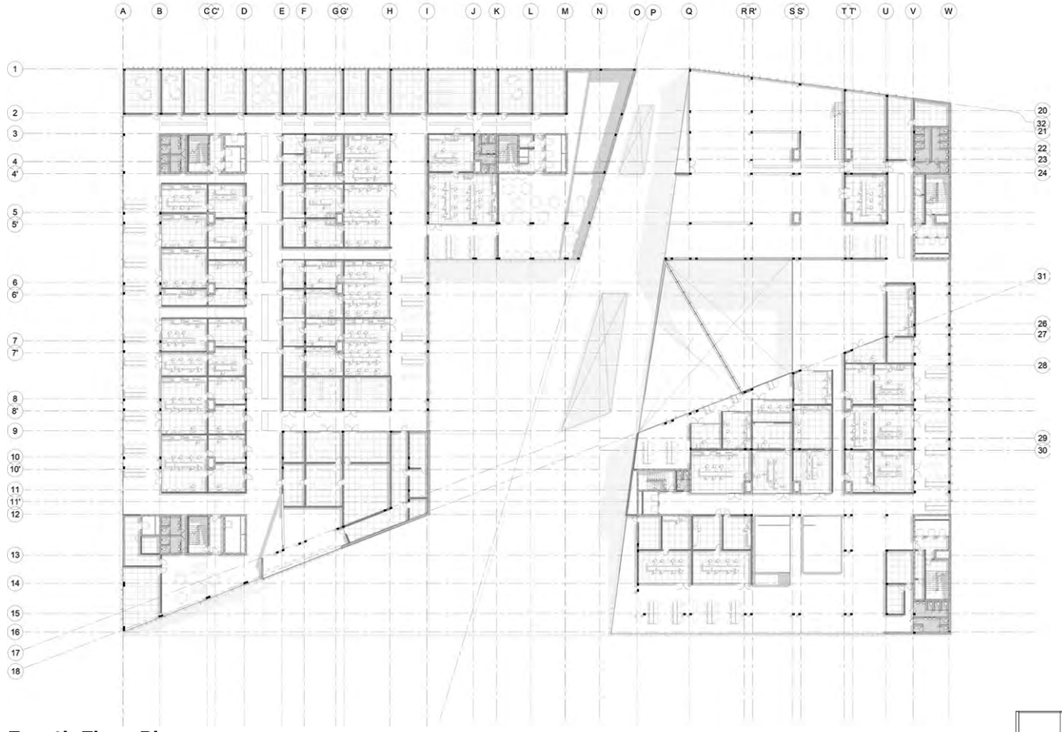
South Elevation



North Elevation



Third Floor Plan



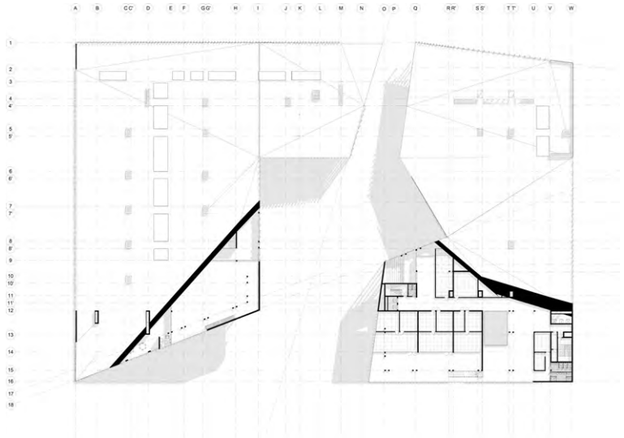
Fourth Floor Plan

East Elevation

West Elevation

Fifth Floor Plan

Sixth Floor Plan



Seventh Floor Plan

As we approach the upper floors, and starting at the fifth floor, the roofs start sloping up extending from the residential buildings' height towards the Biozentrum and Caruso St. John. This creates mezzanines, double heighted spaces, and some technical rooms where there isn't enough clear height for a standard laboratory space. These mezzanines create panoramic views over the levels below and overlooking the entire project as a whole, further strengthening the visual connection established throughout the entire building, which was one of the main concepts of this work/leisure experience. As we start losing spaces as a result of the sloped roofs, we start gaining others at the atriums which become enclosed spaces inhabiting research spaces and common rooms, and creating shelters over the entrance atriums. Although the upper floors follow a typical floor plan, each has a unique element that distinguishes it from the other. For instance, the Chemistry building has a linear reading space on the southern façade, as a light-infused quiet space, overlooking Caruso St.John. The Physics building has a panoramic view simultaneously overseeing the cantilevered floor supported by the steel space frames below, and the forum all the way down to the second basement. On the sixth floor, the spaces are illuminated by the mechanical skylights above, which follow the same pattern as the glazed voids throughout the entire building, but wider in order to maximize light penetration. On the seventh floor, the users gain access to the last floors which are mezzanines concluding the architectural promenade.

"Design is where science and art break even" – Mieke Gerritzen. **We decided to create this type of experience by means of the architectural promenade throughout the building in order to break the conventional impression that people have of 'scientific laboratories'. We created a filmstrip of different space experiences, forming a photographic memory from the distinctiveness of each space. This is the art of design, and how we gradually sculpted our project. In architecture, these small changes change everything, and the entire conception of the building.**

BUILDING DESIGN

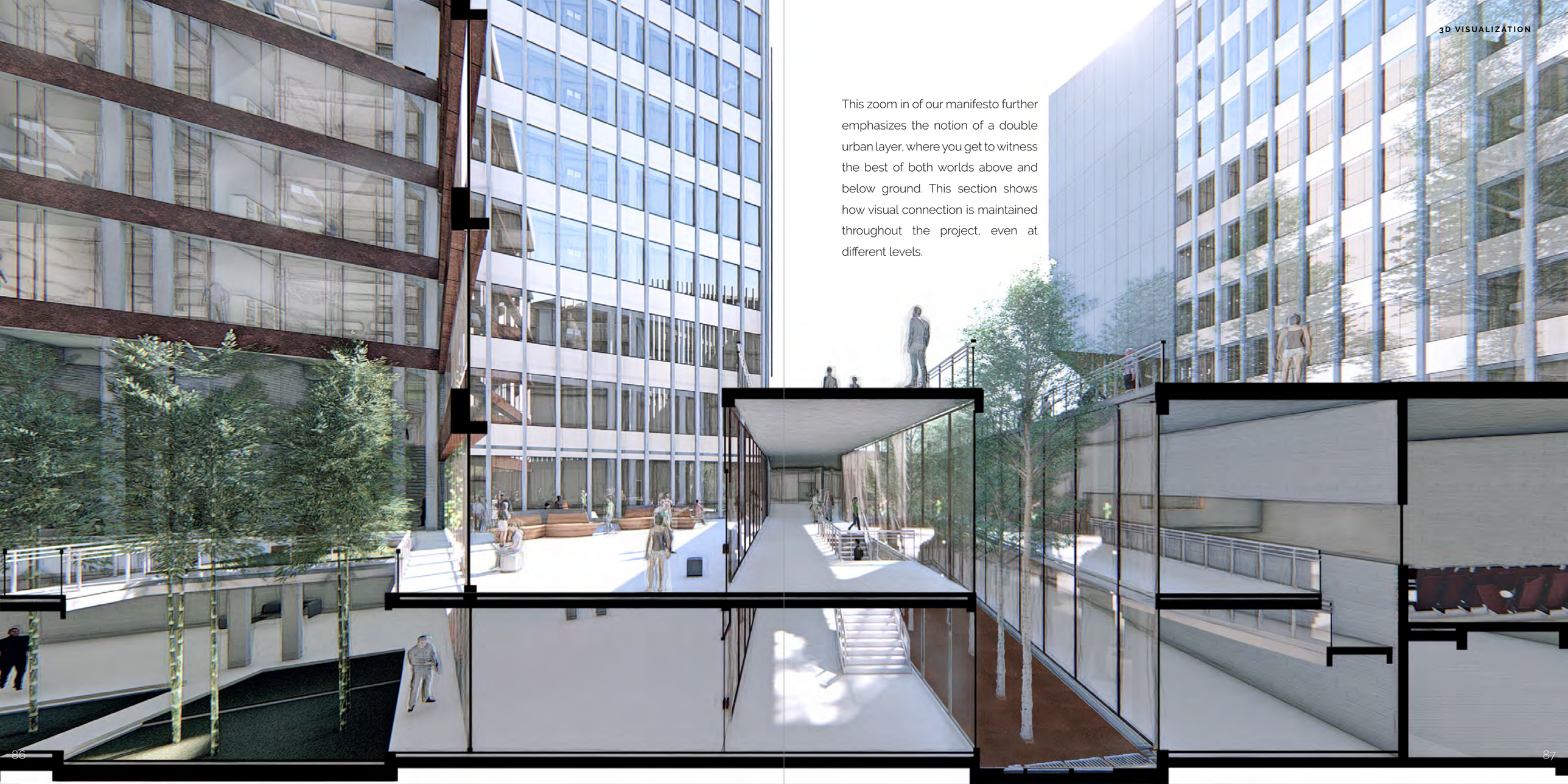
MANIFESTO

To manifest means to basically display a clear representation of a project, and our manifesto was chosen to be this section that cuts through every key component of our building: the forum, the voids protruding from the ground floor to the second basement allowing for water management and light penetration, the green roofs that are also water collectors, the auditorium, the different lab spaces, and the glazed voids in the corridors along with the mechanical skylights on the roof.

3D VISUALIZATION

BUILDING DESIGN

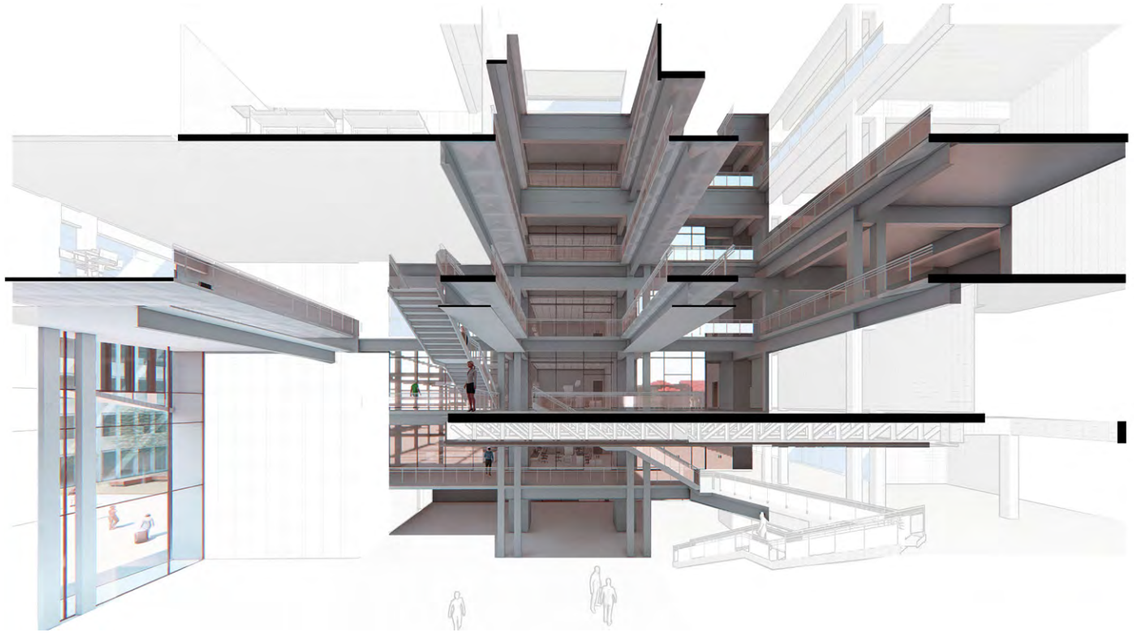
This zoom in of our manifesto further emphasizes the notion of a double urban layer, where you get to witness the best of both worlds above and below ground. This section shows how visual connection is maintained throughout the project, even at different levels.



“SPACE IS THE BREATH OF ART”

-FRANK LLOYD WRIGHT

Our filmstrip of photographic memories of our innovative hub for creative minds.



ARCHITECTURAL PROMENADE

This is where our architectural promenade begins. Every road often leads to a beautiful destination. The pathway that splits the building into two, is a main connection, rather than a segregation, stretching out from the residential district and opening up to the rest of the campus, creating an inviting sense for the visitor. Just as Dorothy and her friends from the Wizard of Oz follow the 'Yellow Brick Road' to reach the Emerald City, our 'Grey Brick Road' leads to the "cluster" of innovative research centers in the Life Science Campus. This path is a transition from the small urban scale of the old town houses, to the buildings of today, and the future; it is a transition from convention to evolution.

"I believe that the way people live can be directed a little by architecture"

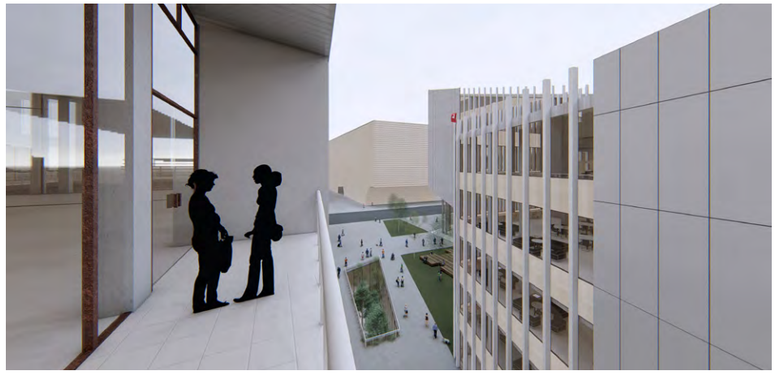
– Tadao Ando.

This pathway contains many elements that direct the visitors, such as the perspective it creates forming a specific directionality, the voids in the pavement the guide the users in the basements through light, and the main transparent façade of the forum. These guiding instances are perceived upon entry of the central space of the project, in addition to the different façade materials that spike peoples' curiosity about what is happening on the interior, because the power to question is the foundation of all human advancement. This curiosity is based on the fact that the functions are evidently reflected to the exterior through the use of blind walls, densely placed fins, and widely spread fins.

The “Grey Brick Road” as a ‘connecting segregation’

“Plants give us oxygen for the lungs and for the soul” – Linda Solegato

“Architecture is really about well-being. I think that people want to feel good in a space…On one hand it’s about shelter, but it’s also about pleasure” – Zaha Hadid



A tertiary access from the ground floor leading to the first basement is found as the campus is approached from the residential district. This further sheds light on the fact that this **pathway serves as a ‘connecting segregation’** that functions not only horizontally and on one level, but also vertically between different levels. The exterior and interior are also both physically and visually connected through interior greenery, and voids that create light-infused spaces to maximize daylight efficiency in the basement levels.

The relationship of the exterior with the interior creates different **spatial layers** in the architectural design of our building and generates spaces that can’t be defined as either inner or outer spaces, but rather spaces which have the characteristics of both. The incorporation of greenery inside the project is not only an aesthetics choice, or merely a decision taken to further strengthen the bond between the exterior and interior, but also their benefits are much greater nowadays. Firstly, plants have a major psychological impact in any space, making it more relaxing and stimulating. In addition, they tend to aid in increasing our self-confidence, well-being and they make us more optimistic, reducing stress, anxiety and depression, which is what scientific researchers experience in a badly designed workspace. Greenery also has a cognitive impact on humans, possibly increasing mental abilities, improving concentration and memory; hence leading to a more efficient work environment. The combination of these different elements result in a type of design that distinguishes itself from the generic approach by its specific architecture that presents richness, variety, complexity and unique perception of space, thus increasing its value.

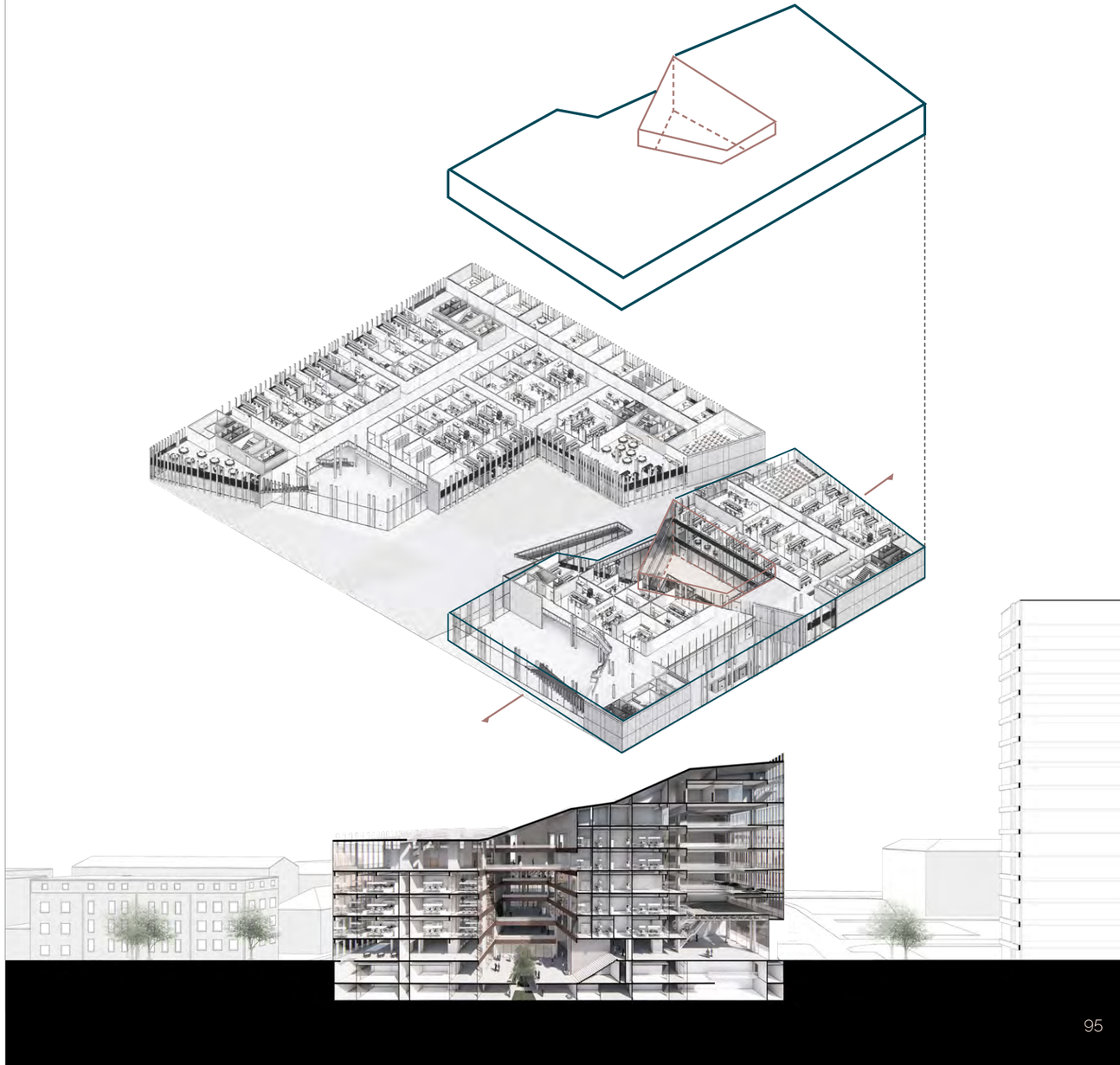
Now let us guide you all the way to the top level in the Physics building, to our **balconies that overlook the entire building**, the central pathway, the Biozentrum, and Caruso St. John. Try to picture it- you are a researcher. You are responsible for collecting, organizing, and analyzing opinions and data to solve problems, explore issues, and predict trends in medicine. Let us assume you are currently researching the side effects of the possible COVID-19 vaccine, so it is only normal that you have had a long rough day at work, and it is time for a cigarette break, or a cup of coffee.

What sight would be better than a panoramic view for your sore eyes, right outside your lab?

BOX INSIDE A BIGGER BOX

The “in between spaces” appeared as the result of our specific design concept in which the architectural composition is created by gradually inserting volumes one inside another, like a box that is placed inside a box; i.e: the forum is metaphorically a box inside the bigger box which is the Physics building. This integration of multiple layers in the spatial arrangement of the ‘volumes’ in our architectural composition is perceived as an approach in linking the interior and exterior.

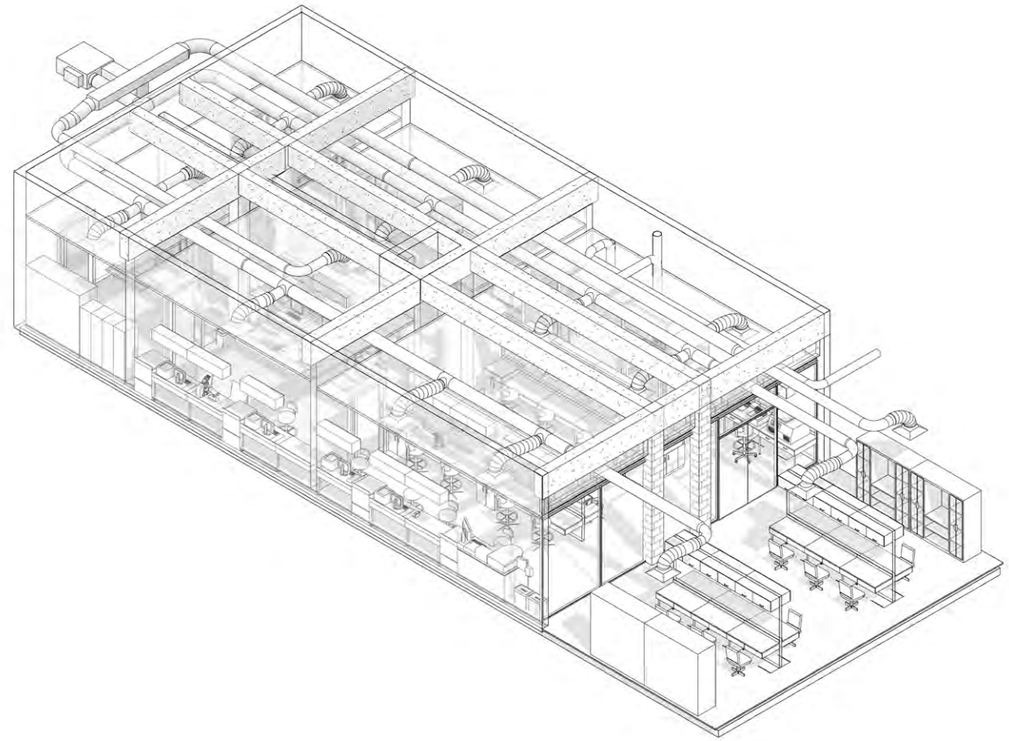
Thinking outside the box is a renowned metaphor that means to think differently, unconventionally, or from a new perspective. This phrase often refers to creative or innovative thinking. In our project, you get to **think ‘inside’ this specific box**, our forum. In the forum, users collaborate and come together to reach a consensus in considering different solutions and methods to achieve the desired outcome in science and technology. If everyone just accepted things the way they are, then there would never be any innovation or improvement in the world. If Thomas Edison had shrugged and figured things were good enough the way they were with gas lamps, light bulbs and the electricity to power them might never have been developed. If you view things as unchangeable, then nothing will ever change for the better. ***By ‘thinking outside the box’, but inside this box, our ‘Innovative Hub for Creative Minds’ will keep growing, and can lead to intelligent and forward-thinking decisions in the Life Science Campus.***

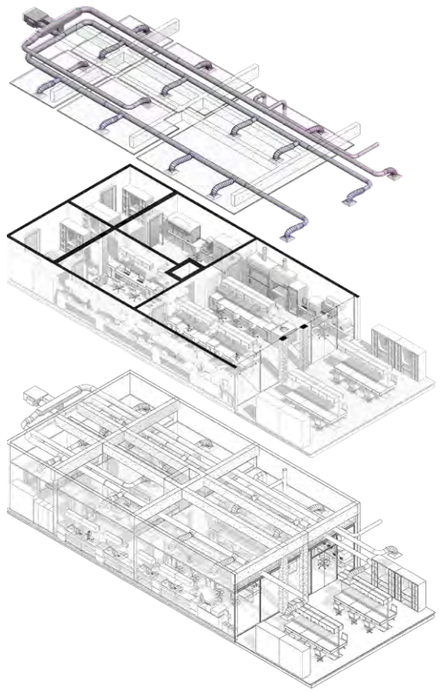


A forum extends from the 2nd basement to the top to allow for light penetration and ventilation, along with a central area/ communication hub that is semi-private, as opposed to the public open space/node that has been created in between the two buildings on the ground floor. The forum determines the idea of a clear functional and spatial organization of the building. The open, centrally located Forum is placed on an even topography and can be accessed from various sides. The Forum extends across a multi-storey circular atrium containing a study center with library. The auditoriums situated below are accessible directly from the Forum.

LAB MODULE

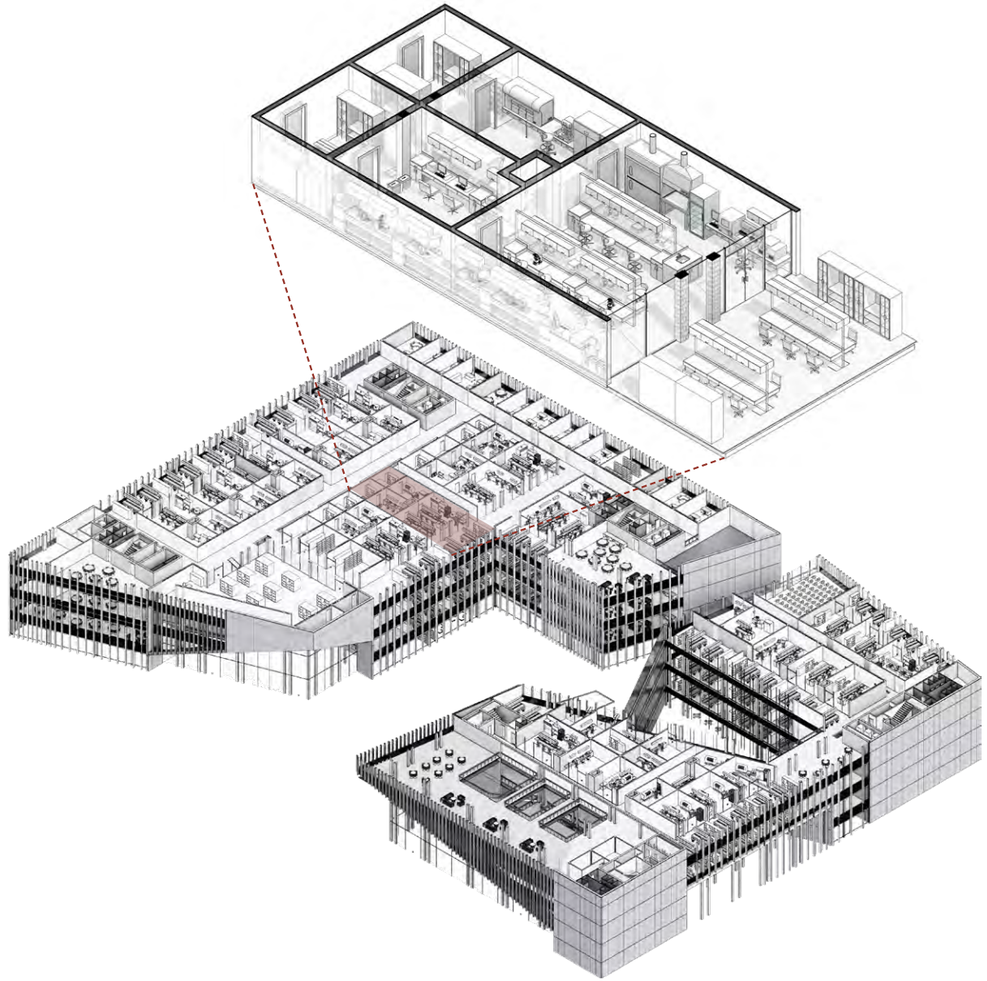
BUILDING DESIGN

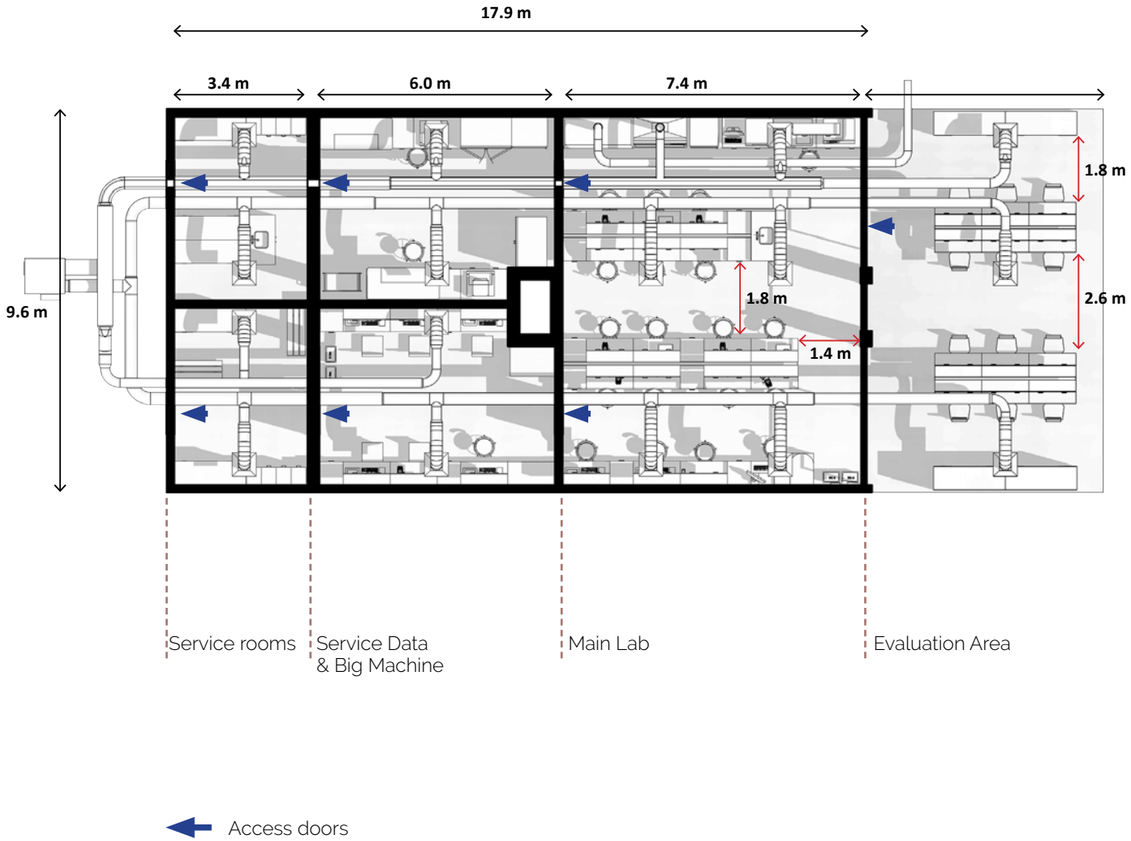




Now that we have generally explored our building together, it is time to visit one of our standard laboratories. **Innovation and renewal are required to keep a laboratory on the frontiers of science.** Therefore, the conventional requirements are met, but originality and innovation are supplementary to the design to 'add a little spice' to the experience. Our laboratories are oriented in a manner to maximize daylight in the evaluation spaces where light is most needed, and allowing for light penetration in the standard laboratory space where minimal light is required. Our circulation is a double loaded circulation in order to follow this concept of placing the evaluation spaces at the glazed façades. The service labs that operate the big machinery and the data rooms do not necessarily require natural daylight, and neither do the storage and locker rooms in the rear end of each laboratory unit.

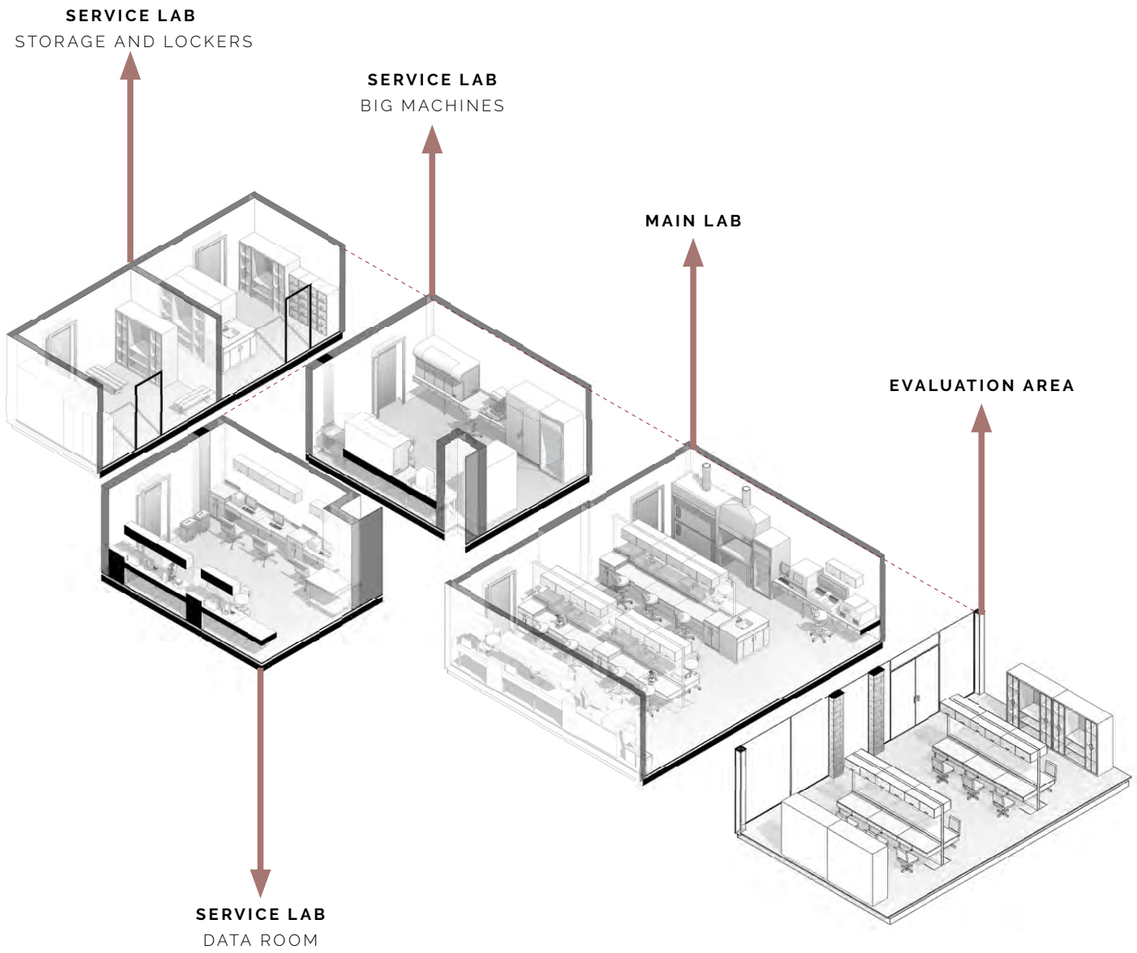
Science has great beauty. A scientist in his or her laboratory is not only a technician, but also a child facing a natural miracle which astonishes him or her like a fairy tale. We should not think of it as merely a scientific progress that is reduced to solely mechanisms and machines, despite the fact that such machinery has its own beauty. Although people are living in a scientific age, they tend to assume that knowledge of science is the involves only a small number of human beings, isolated and introverted in their laboratories. As we have proven through our research and our innovative design, this is not necessarily true. The materials of science are the materials of life itself. Science is part of the actuality of life, and it is the way, the how and the why for everything in our experience.





As mentioned, our building accommodates three main faculties: Chemistry, Physics, and Anatomy, and there are several types of labs within these faculties, each having its own requirements: analytical and quality laboratories, biosafety laboratories, cleanrooms, clinical and medical laboratories, incubator laboratories, production laboratories, and research & development (R&D) laboratories. However, ironically, there is much more physics in a chemistry lab than there is chemistry in a physics lab. In other words, in a chemistry lab experiment, an experimenter usually analyses the "physical properties" of the chemical being analyzed, alongside the chemical properties. For instance, the chemical's melting and boiling points, its density, color, odor and transparency. The electron (a particle that is particularly fundamental to the science of chemistry) is essentially a physical entity and its mass, charge and energy that define its existence are all physical properties. Generally, all instruments that are essential for a chemistry lab are physics instruments such as voltmeters, ammeters, magnetic spinners, mass-spectroscopes, spectrometers, microscopes, Geiger counters, and cloud chambers. Therefore, although the building is segregated into these three different faculties, the Chemistry and Physics laboratories are almost quite the same, and very interrelated in terms of their equipment and function. The different laboratory spaces ranging from service labs to main labs vary in size, from small "closets" to well-equipped work areas of 17 m^2 or more. The basic needs for a laboratory include sinks, benchtop areas, utilities (gas, tap and distilled water, electrical power, and vacuum), storage (dry, refrigerated, chemical, media, and glassware), and space for equipment like an autoclave, hoods (fume and/or laminar flow), and incubators.

Our laboratory fume hood is a type of ventilation system that mainly functions protect the scientists or users against toxic fumes, vapors and dust, and its secondary function includes protection against chemical spills, runaway reactions and fires by acting as a physical barrier. The incubators installed in our laboratories are devices used to grow and maintain microbiological cultures or cell cultures, and they maintain optimal temperature, humidity and other conditions such as the CO_2 and oxygen content of the atmosphere inside. There are four key elements that we considered in the process of designing our laboratories. Firstly, flexibility is one of the key components in maneuvering inside the laboratory, and our design incorporates features that are ideal for hands-on experiences and theoretical practice as well as both solo and group work. Second, the environmental factors such as the use of natural light, acoustics, storage and the choice of colors greatly affect work performance and progress. Thirdly, sufficient circulation space is imperative when sustaining a safe working environment. This freedom of movement can aid in improving the collaboration and teamwork between the scientists, and ensures a safer and more accessible lab which helps to promote inspiration. Lastly, science laboratories are a great investment, and a poorly designed lab will tremendously impact the technicians, researchers, and scientists negatively. Therefore, using the adequate materials reduces maintenance costs and adds great value to the overall experience. For example, durable and chemical-resistant surfaces are important when selecting the right laboratory worktop.



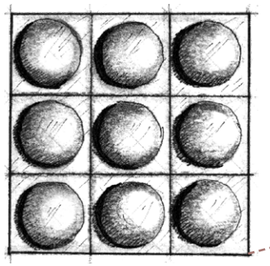
FACADE

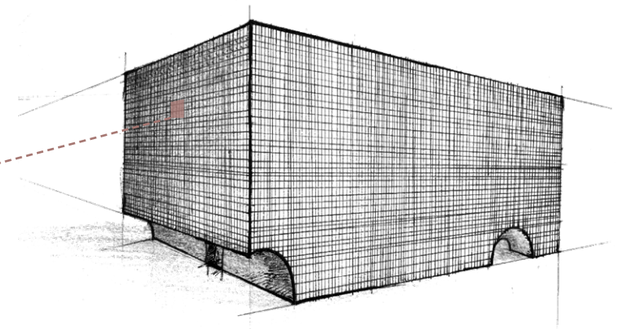
BUILDING DESIGN

"I think space, architectural space, is my thing. It's not about the façade, elevation, making image, making money. My passion is creating space" – Peter Zumthor.

Our façade is simultaneously a reflection of what is happening behind the curtains, and what is happening outside the stage with the audience. It was all about 'creating the space' that Peter Zumthor spoke of. In this particular situation, **form followed function**. Our initial idea was to have a glazed façade. Transparency is an element that establishes exterior-interior relationships, as well as the ability to transmit light and contribute to visual interiors. In addition, it allows buildings to be an urban element, delivering the message that everything is clear and it grants the opportunity to blend in with other urban elements. Therefore, transparency is viewed as a reinventing element of public space, along with its capacity to attach the interior space to urban life. Based on the concept of transparency throughout almost the entire building, our façade design was further developed and elaborated on. In order for the project to fit into the urban context without imposing itself on the surroundings, our chief references were the Biozentrum, and the Caruso St. John, and our main aim was to create a façade pattern that was a sort of 'middle-ground' between the referenced buildings and the residential old town houses. We concluded that they both had one thing in common, and it is that regardless of the complexity in the interior, the exterior is geometrically refined and based on a unified grid. Accordingly, we decided to clad our facades with glassfibre reinforced concrete (GFRC) fins and panels, following a certain grid, but simultaneously reflecting the interior functions.

Caruso St. John Biomedical Center

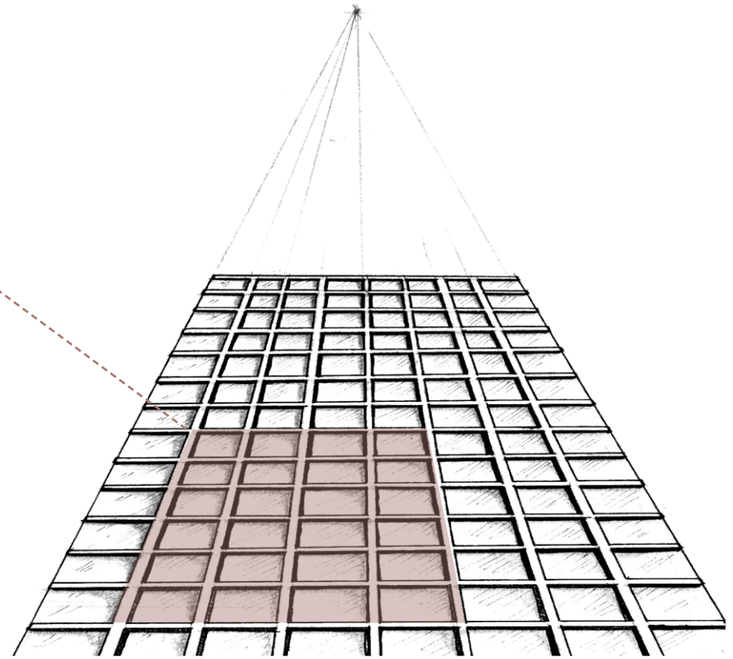




The Caruso St. John Biomedical Center features a gridded façade of panes of glass measuring 80 by 80 centimeters, providing views into the laboratories.

The Biozentrum Science Tower

The Biozentrum is a tower of chrome steel and glass, also following a unified grid



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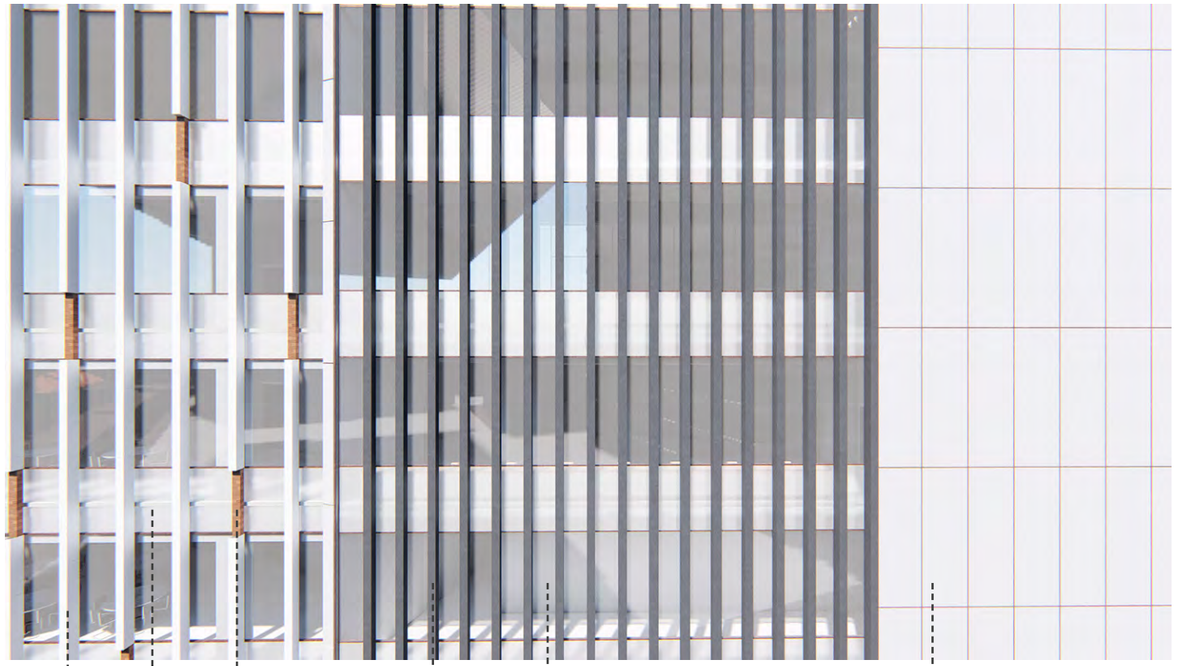
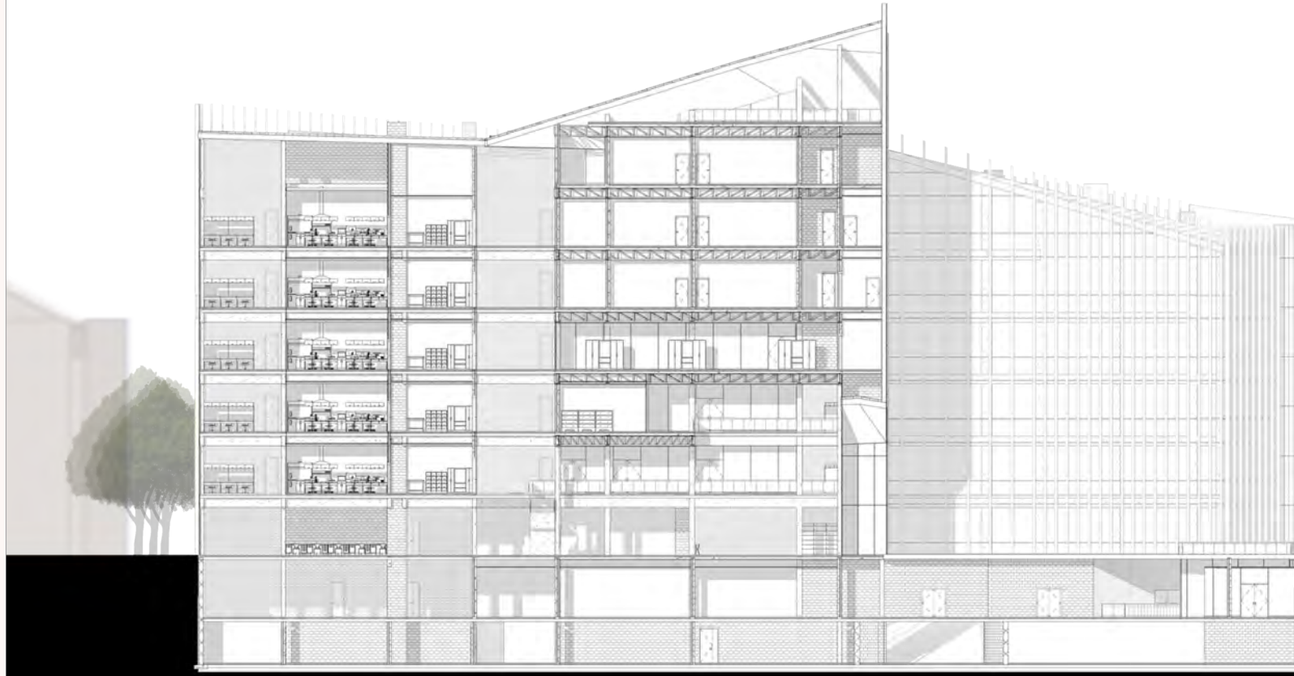


refer to page 146 for the material specifications

The blind walls are cladded with GFRC panels of 3.6m by 1.2m, and they implicate that the function is either vertical circulation, or a private space that does not require natural daylight. The curtain glass is cladded with U-shaped GFRC fins of 30cm by 20m, and are placed at distances ranging from 0.6m to 2m, depending on the function of the space in the interior and the amount of light penetration it requires.
A special feature in the field of architecture is the use of optical illusions in order to make buildings appear different from what they actually are. In other words, if a person stands directly at the foot of a building, they will perceive it differently than if they look at it from a distance. Hence, in order to display the hierarchy of the entrances on the southern façade, the GFRC fins are chrome in color, while the rest are off-white. This strategy explicitly places the main entrances under the spotlight, making them easy to perceive from afar, and as they are being approached.
Our project is large scale architecture which investigates the relationship between the building and the city. This includes our complex building design and urban strategy, and involves many actors, and have a public presence that requires a high level of precision in argumentation and execution. One of the main actors is the residential district; therefore, we ought to pay tribute to the scale of the old town houses. Hence, wooden planks were placed as fin separators at the spandrels in between floors in order to clearly identify each floor as a separate entity rather than an immense mass looming over the small-scaled houses. Stay tuned in the next chapter to find out more about the role that these representative materials play in our design.

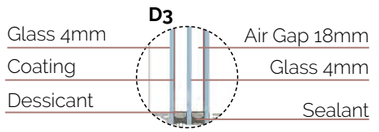
DETAILS

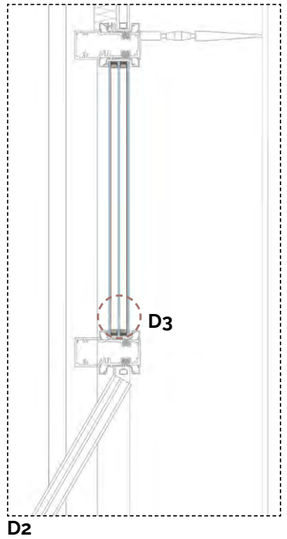
BUILDING DESIGN

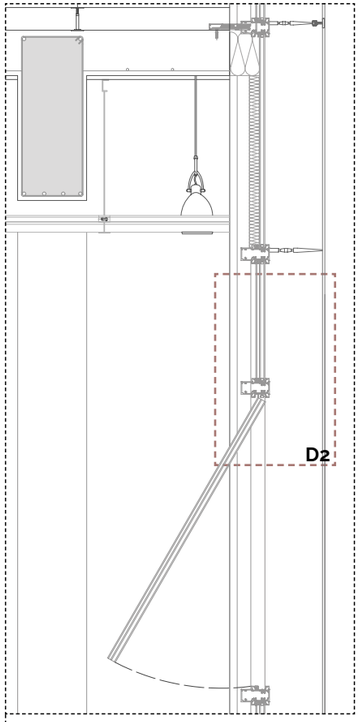


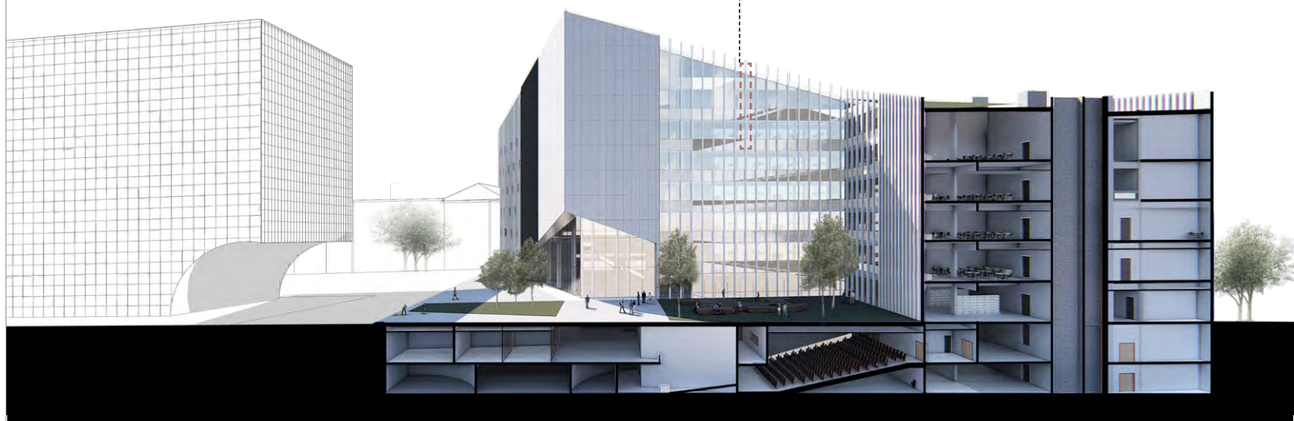
Basel is considered a quiet city, even during rush hour. Therefore, our urban layer that is below ground is not perceived as an escape from the city life's noise pollution and congestion. Alternatively, it is considered our hidden treasure, but it is our easily accessible treasure once the building is approached and unrevealed. Think of it as a tree for instance; even though trees are a beautiful sight, we cannot see what is happening underground, as the roots are growing. In the 'Innovative Hub for Creative Minds', our 'roots' are accessed by the users of the building, but other residents and by passers are also given the opportunity to experience these 'roots' through the multiple voids along the main pathway on the ground floor. However, despite the fact that people can get glimpses of what is happening below, some spaces remain completely reserved for private use, such as the auditorium. An auditorium is defined as a room built to enable an audience to hear and watch performances. Nevertheless, our auditorium is not a conventional, ordinary auditorium designed for the sole purpose of observing. Just like most of our building's innovative spaces, our auditorium is a type of large-scale collaborative lecture hall or a 'questions and answers hub'. It does not make any sense to pack an auditorium with five hundred people, and then ask them to stay quiet. Participation, collaboration, and teamwork are a must.

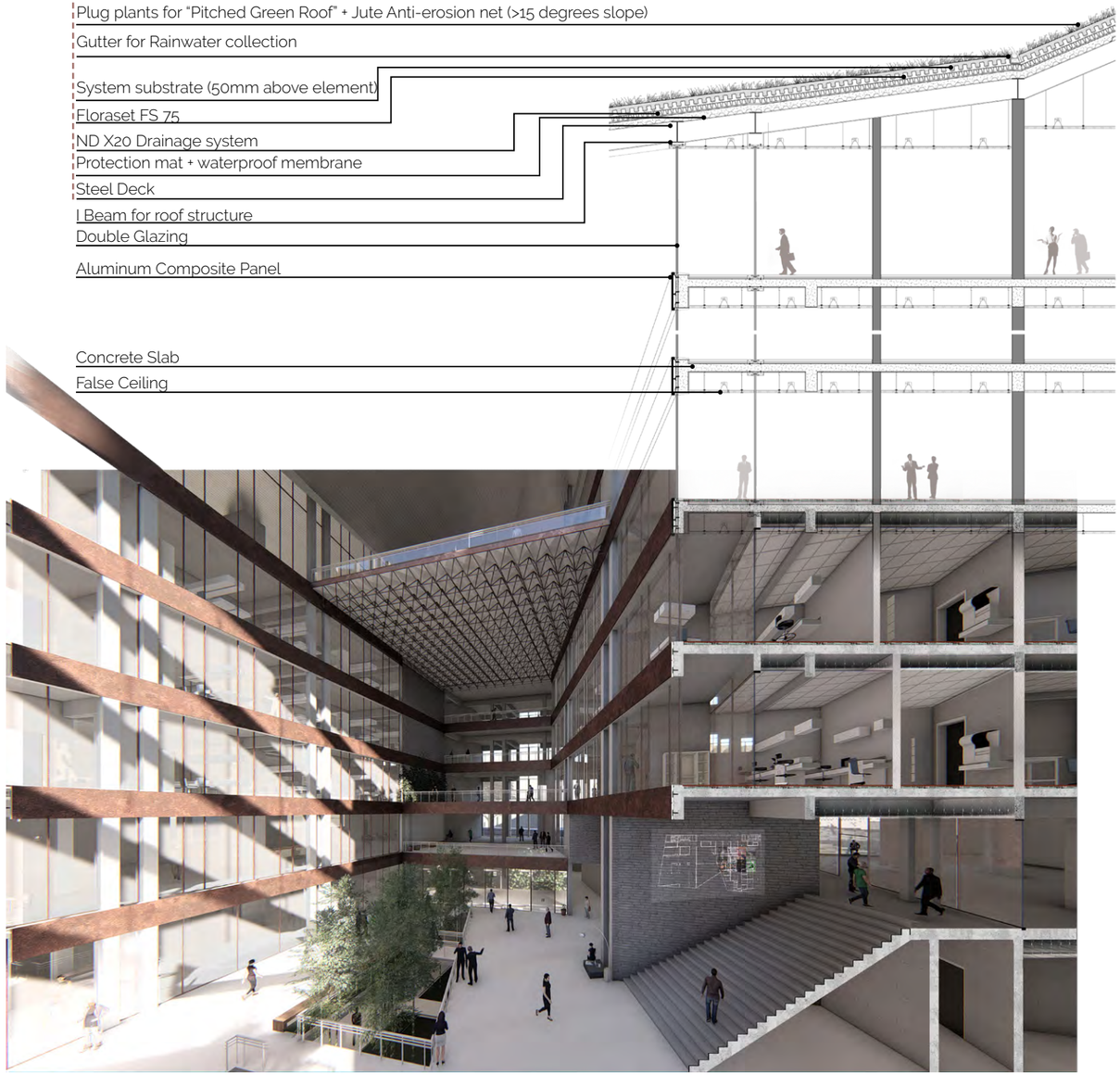
"Coming together is a beginning, staying together is progress, and working together is success" – Henry Ford







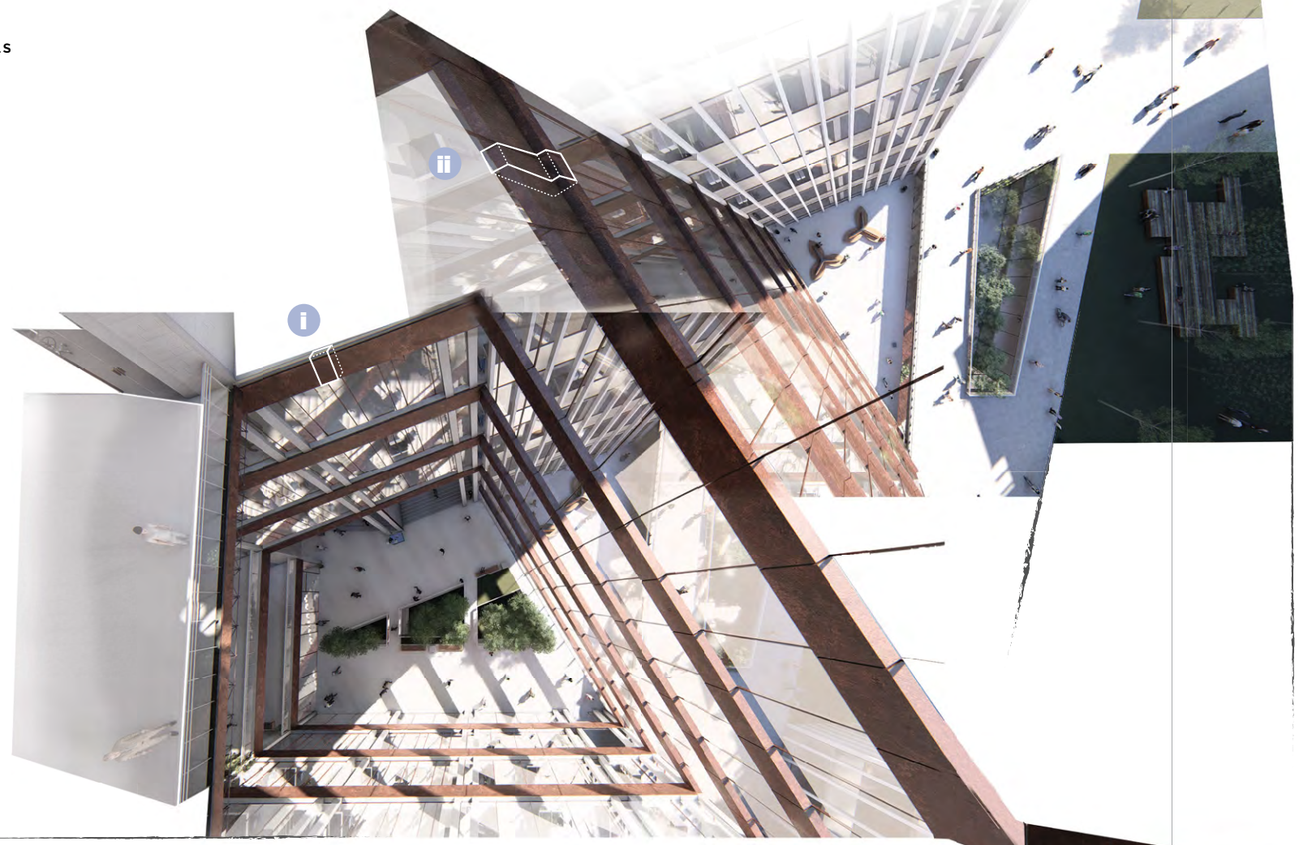


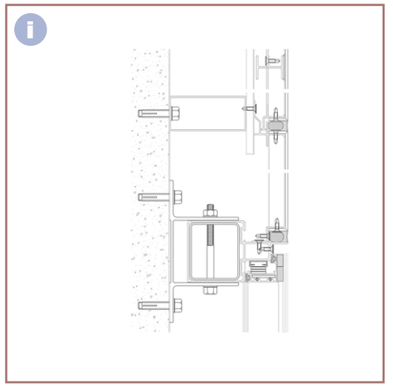


Behold, the **heart of 'Innovative Hub for Creative Minds'**. This sectional manifesto of our contemporary "Lichthof", the forum, is an architectural visual art piece, and this gem speaks for itself. It is an innovative urban space that will capture the aspirations of the University of Basel due to the fact that it emphasizes sustainability, and exceeds accessibility standards. Driven by our mission to serve the scientists, researches, and all the users of the building, we dedicated a space extending from the lowest basement level to the roof, that holds meetings and events that all levels can overlook. Our forum garden is partially open to the public, depending on the function that alters according to the switchable glass. Correspondingly, the workspaces that were formed are collaborative, open, and green.

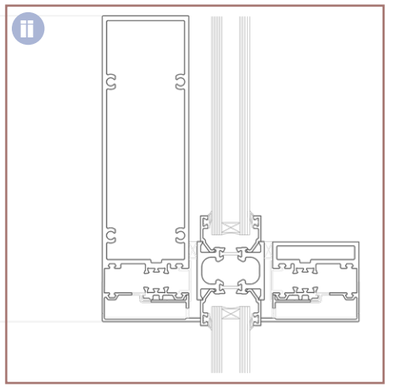
Staircases are highly functional elements in the internal circulation of a building, but in our forum, they are also granted communication, collaboration, and leisure significance. We may live in the age of lifts and escalators, but this should not stop architects from treating the staircase as a means of adding value to spaces, whether it was through their aesthetic aspects or through their engineering virtuosity. It is not the destination that counts, but it is actually getting there. Our seating steps are multifunctional, auditorium-style, co-working spaces that are used for meetings, lectures, breaks, and seminars when the forum is closed off for guest spokespeople.

refer to page 150 for detail layering of the green roof

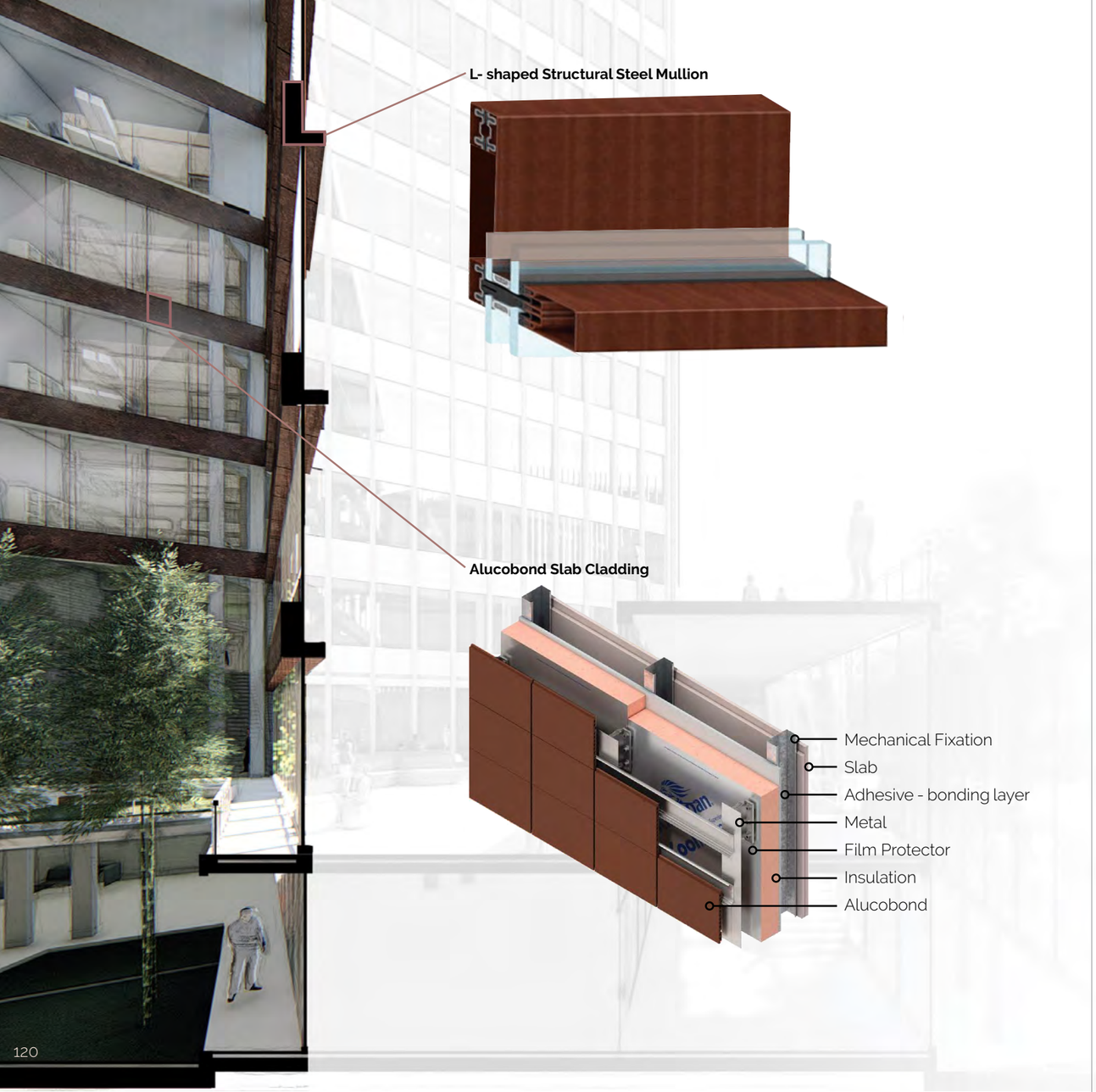




Alucobond Slab Cladding



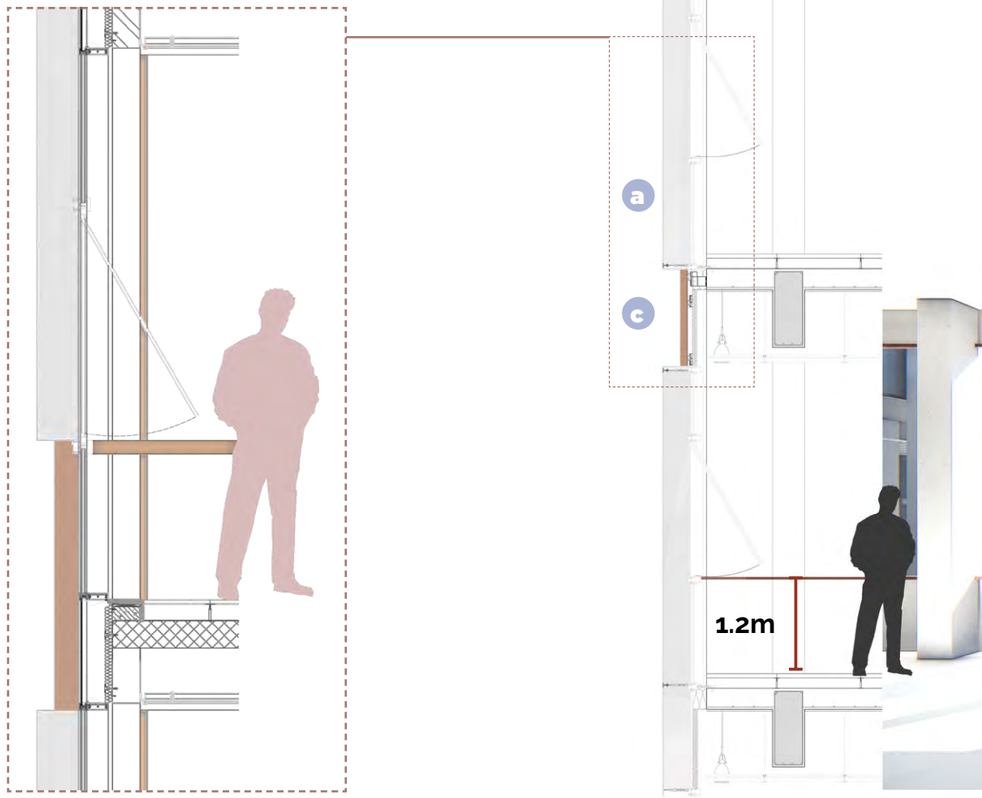
L- shaped Structural Steel Mullion

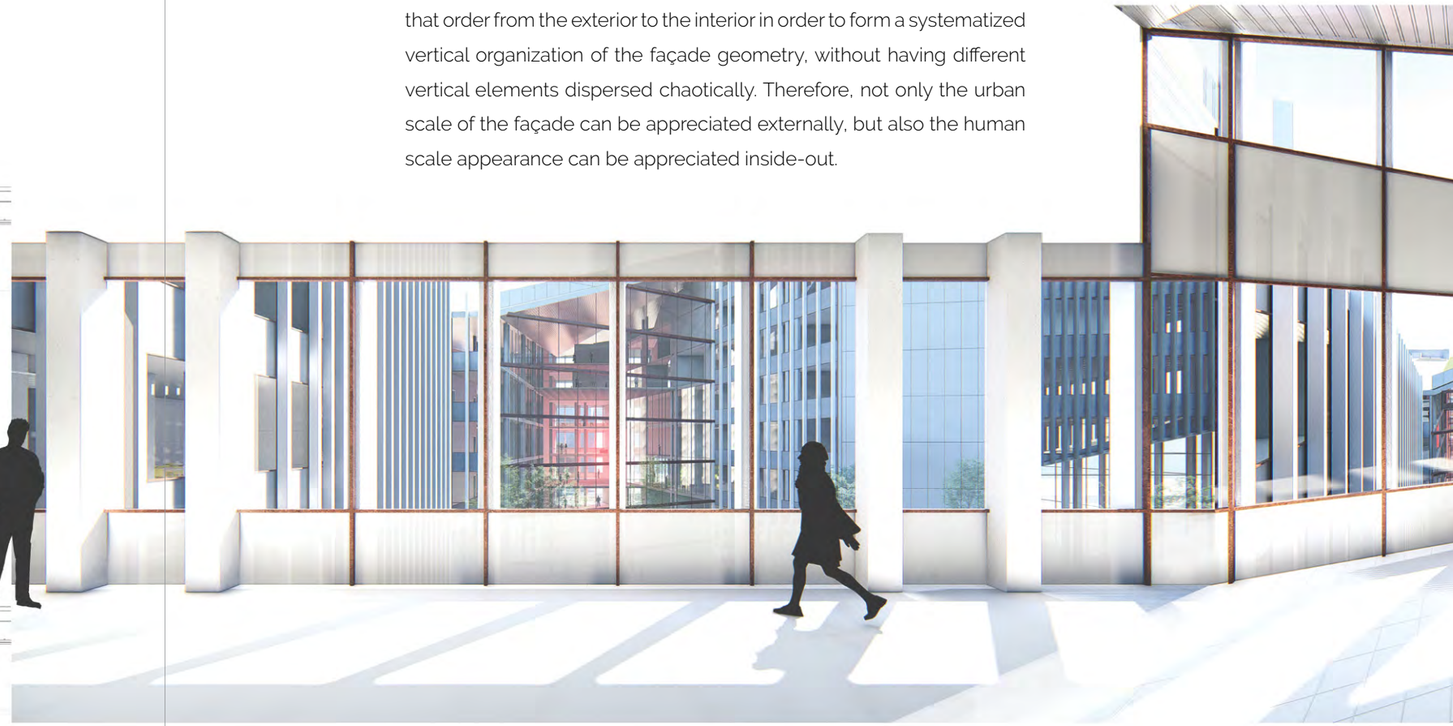


Our forum is the heart of our project, and it is designed, along with its assigned materials, in a way to stand out more vividly in its uniqueness and prominent function with respect to the entire building. Therefore, the slabs are cladded with aluminum composite panels (Aluminum Cladding larson pe®-larson fr®) 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) alucubond is also resistant to fading or bleaching from the sun. It is typically coated with a tinted weatherproof topcoat that is very durable and should last for many years. The composite panels or sandwich panels of various dimensions are made of two aluminum sheets, which are joined together by a thermoplastic resin polyethylene (PE) core or a mineral (FR) core. Both sides require anticorrosion pretreatment to facilitate the adherence and a primer layer. The aluminum back sheet is treated to provide the product with a regular and well attached layer which will protect it against corrosion and increase the adherence of the core.

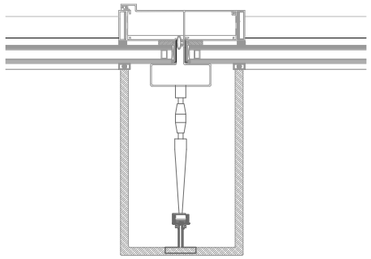
The façade of the forum that extends from the second basement to the sloped roof adds up to a total height of 39.5m, and is not interrupted by any structural columns along its span. Therefore, a structural steel mullion is a necessity to substantially support its self-weight. It was a design decision to have a continuous 'ribbon' wrapping around the forum and its envelope to signify its individuality as a 'box inside a bigger box'. Therefore, the 0.8m height of the aluminum composite cladding of the slabs is continuous to the structural steel mullion profile in the interior. However, in order not to inflict a bulky perception of the forum's glass façade from the exterior with a mullion height equal to 0.8m, an L-shaped profile of the hot rolled structural steel was designed and customized according to our design preferences, with an exterior height of 0.3m.

An architectural sectional detail is a small piece of the building, yet it has the power to characterize and define the entire building. Details inform us of what the building is, and they are fundamental to the life and character of a space. In pure architecture, the slightest detail should have a meaning or serve a purpose. Yes, our mullions are the vertical and horizontal bars between the panes of our curtain glass, but no their purpose are not solely technical. The translucent glass spandrel is dimensioned in a manner to conceal the false ceilings, and rise 1.2m above the floor finish level in order for the horizontal mullion to serve as a handrail on the façade in the double loaded corridors, and to minimize the height of the glass panes to protect them from wind loads. The wooden plank fin separators are the same height as the glass spandrels. The fins, vertical mullions, and columns coincide in that order from the exterior to the interior in order to form a systematized vertical organization of the façade geometry, without having different vertical elements dispersed chaotically. Therefore, not only the urban scale of the façade can be appreciated externally, but also the human scale appearance can be appreciated inside-out.

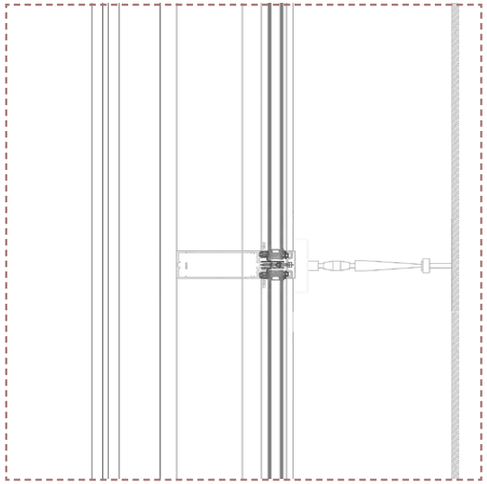




a

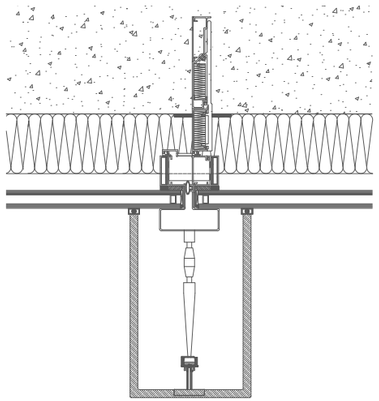


GFRC fin connection on curtain glass



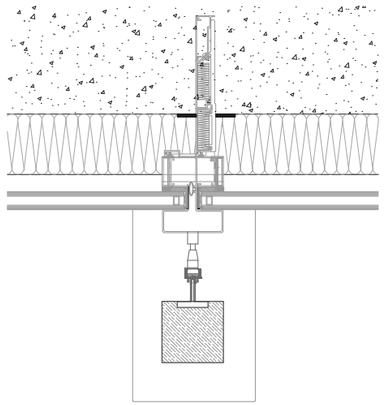
Curtain glass section detail- Fin in projection

b



GFRC fin connection at spandrel

c



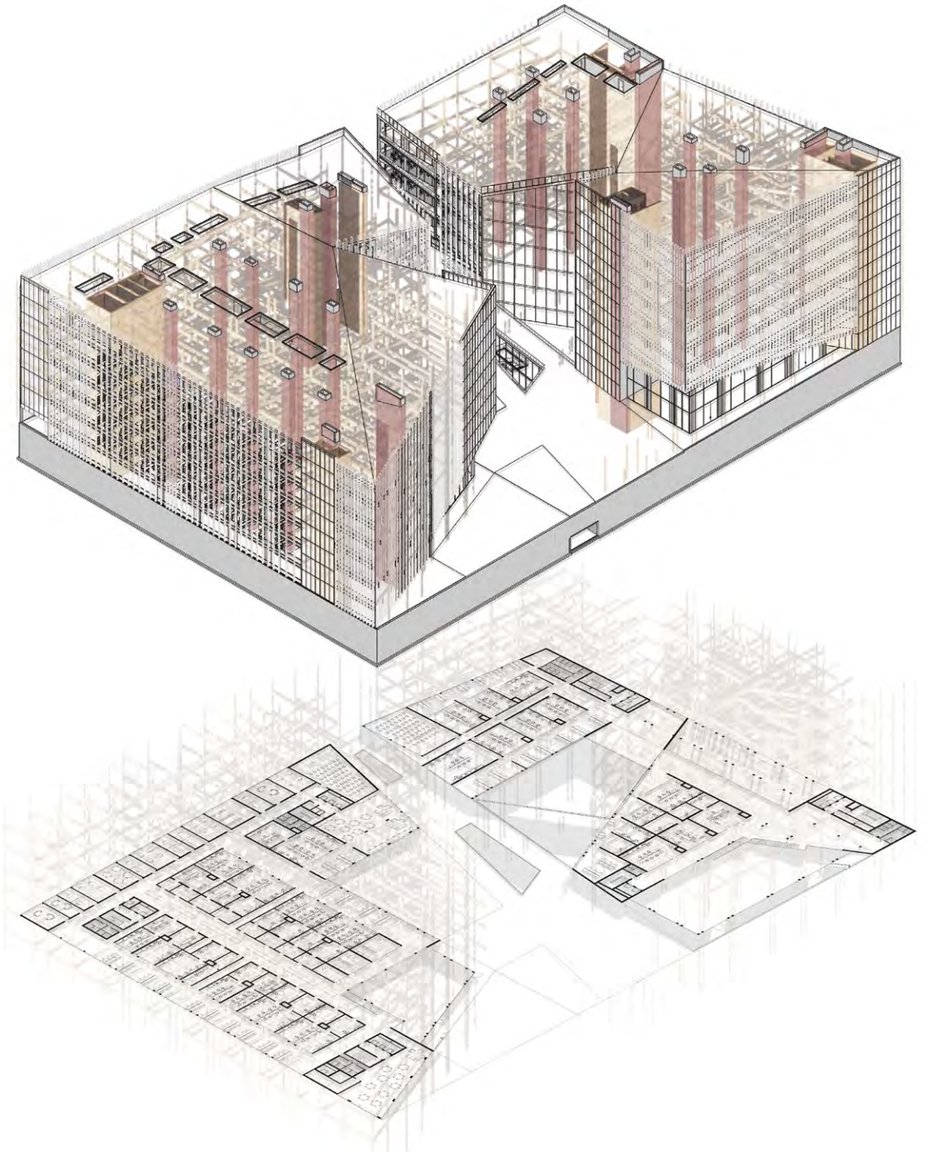
Wood plank connection at spandrel

SCAN FOR BOOK V.2
-TECHNICAL REPORT-

TECHNICAL DESIGN

STRUCTURAL DESIGN

TECHNICAL DESIGN



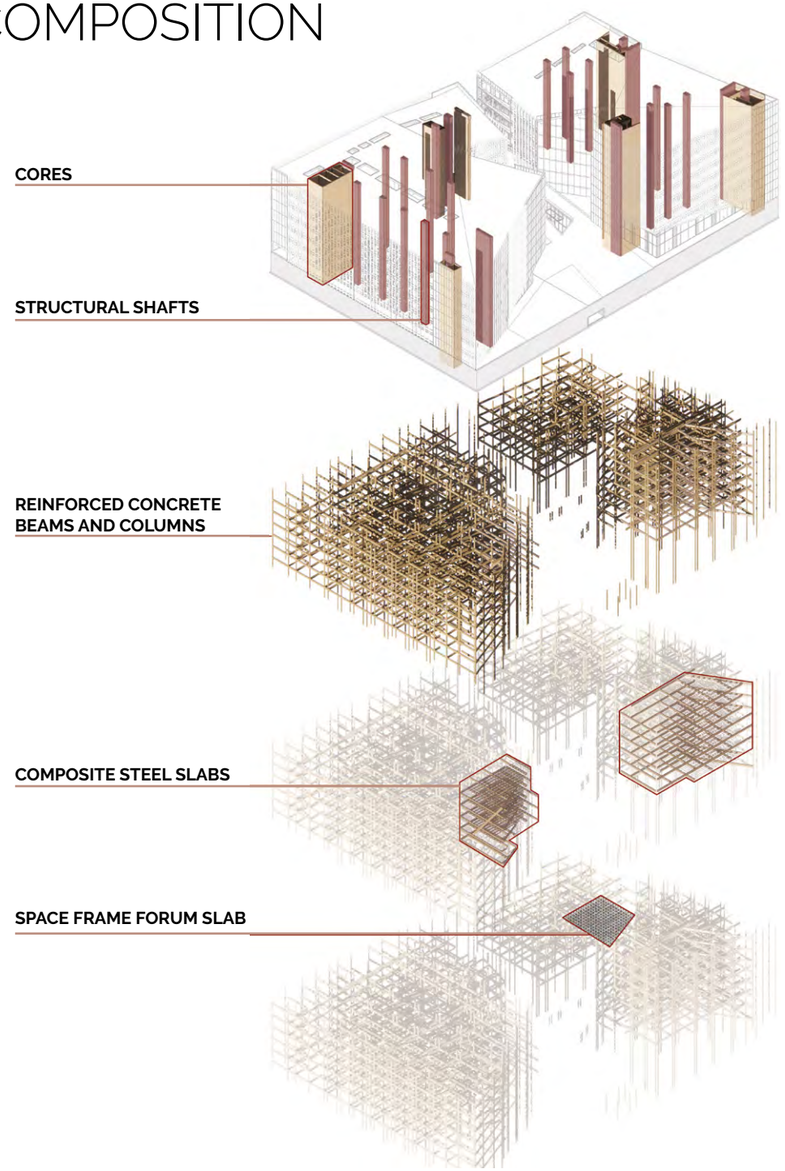
Cores and Shafts: functioning as structural walls, cores serving as bracing elements for wind and earthquake loads, and for circulation.

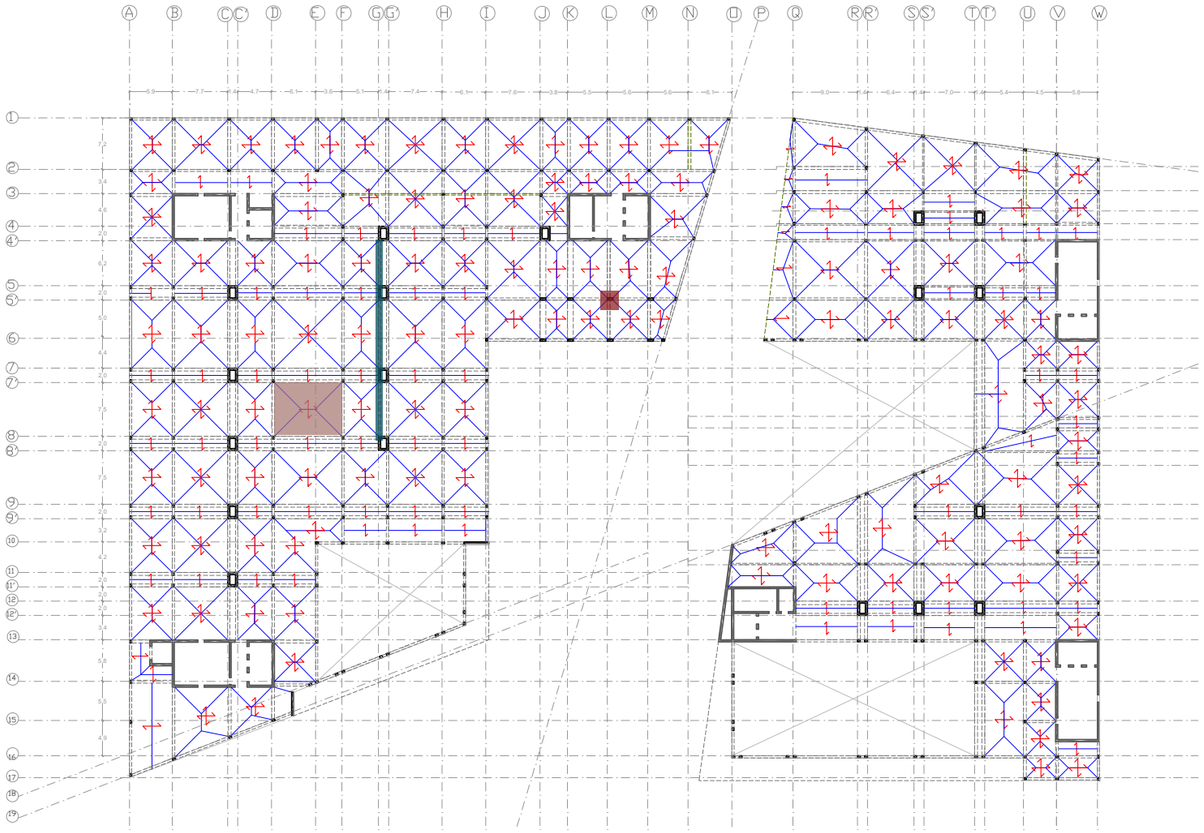
Reinforced Concerete Columns and Beams: the use of a coupled columns system is adapted for both structural and aesthetical reasons. On one hand the coupled columns follow the grid of the structural shafts. On the other hand, they are used in the facades, and areas emphasizing the hierarchy of the spaces such as the entrances and the forum.

Composite Slabs: using steel decking and truss beams were adapted for the design of the slabs at the atriums. In this case, the floor slab comprises shallow steel decking and a concrete topping, which act together compositely. Mesh reinforcement is placed in the slab to enhance the fire resistance of the slab, to distribute localized loads, to act as transverse reinforcement around the shear connectors and to reduce cracking in the slab.

Space Frame Slab: or Space Structure is a type of two way truss system constructed from lightweight inlerlocking struts following a geometric pattern. Space Frames can be use to span large areas with few interior supports. The structures strength is due to the rigidity of the triangle and flexing loads that are transmitted as tension and compression loads along the length of each rod.

STRUCTURAL COMPOSITION





Structural Map with Tributary Areas

Two-way slab

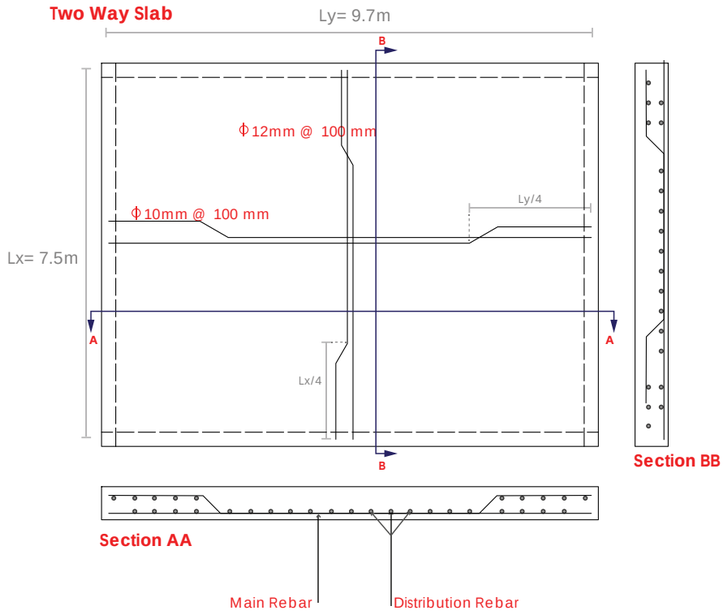
Beam

Column

Distributed loads on two-way slabs, unlike one way slabs, do not have obvious tributary “widths”. The distribution is modeled using a 45 degree tributary “boundary” in addition to the tributary boundary that is half way between supporting elements, in this case, edge beams.

The eurocode series of European standards (EN) related to construction is the basis of structural design (informally Eurocode 0; abbreviated EN 1990). It establishes the basis that sets out the way to use Eurocodes for structural design. Eurocode 0 establishes Principles and requirements for the safety, serviceability and durability of structures, describes the basis for their design and verification and gives guidelines for related aspects of structural reliability. Eurocode 0 is intended to be used in conjunction with EN 1991 to EN 1999 for the structural design of buildings and civil engineering works, including geotechnical aspects, structural fire design, situations involving earthquakes, execution and temporary structures.

Following the standard sizes of the different spaces in a laboratory, and fitting the complex configuration of the design, the outcome was an irregular structural grid ranging from a span of 4m up to a span of 9m. This resulted in both a one-way slab and two-way slab systems in both buildings.

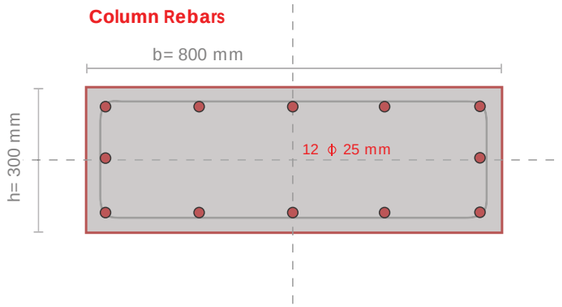


Two-way slab: Minimum reinforcement is 0.12% for high yield strength deformed bars (HYSD) and 0.15% for mild steel bars. The diameter of bar generally used in slabs are: 6 mm, 8 mm, 10 mm, 12mm and 16mm.

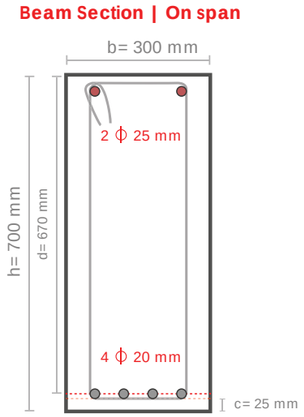
The maximum diameter of bar used in slab should not exceed 1/8 of the total thickness of slab. Maximum spacing of main bar is restricted to 3 times effective depth or 300 mm whichever is less. For distribution bars the maximum spacing is specified as 5 times the effective depth or 450 mm whichever is less.

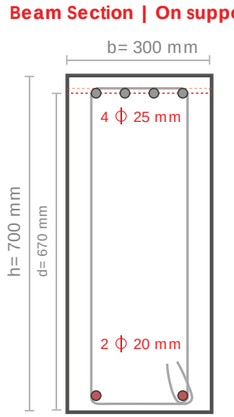
Minimum clear cover to reinforcements in slab depends on the durability criteria and this is specified in the code. Generally 15mm to 30mm cover is provided for the main reinforcements.

refer to V.2 'Technical Report' for the complete computation



Single Column: We can establish that the double column design system works both aesthetiCly and structurally in this building design. The same design of the column was studied but in its singular function rather than a double column system, with a higher design strength and a maximum coefficient. However, it was only sufficient to hold the load of the desired area, when its length was doubled. Therefore, the single columns should have a bigger area in order to carry the load.





Beams: The trapezoidal load of each beam is calculated by adding the tributary areas on both sides of the beam and multiplying the value by both the dead load and the live load determined.

The linear loads are then computed for each span by multiplying the floor loads obtained above by the coefficients of the dead load and the live load respectively. The values are then plugged into the wxCBA software in order to obtain the bending moments.

LOAD ANALYSIS

DEAD LOADS

In short, the dead load of a structure comprises its completed weight, before it goes into service. The floors, walls, roof, columns, stairs, permanent equipment and any fixed decor constitute a static load that normally doesn't change over the life of the building.

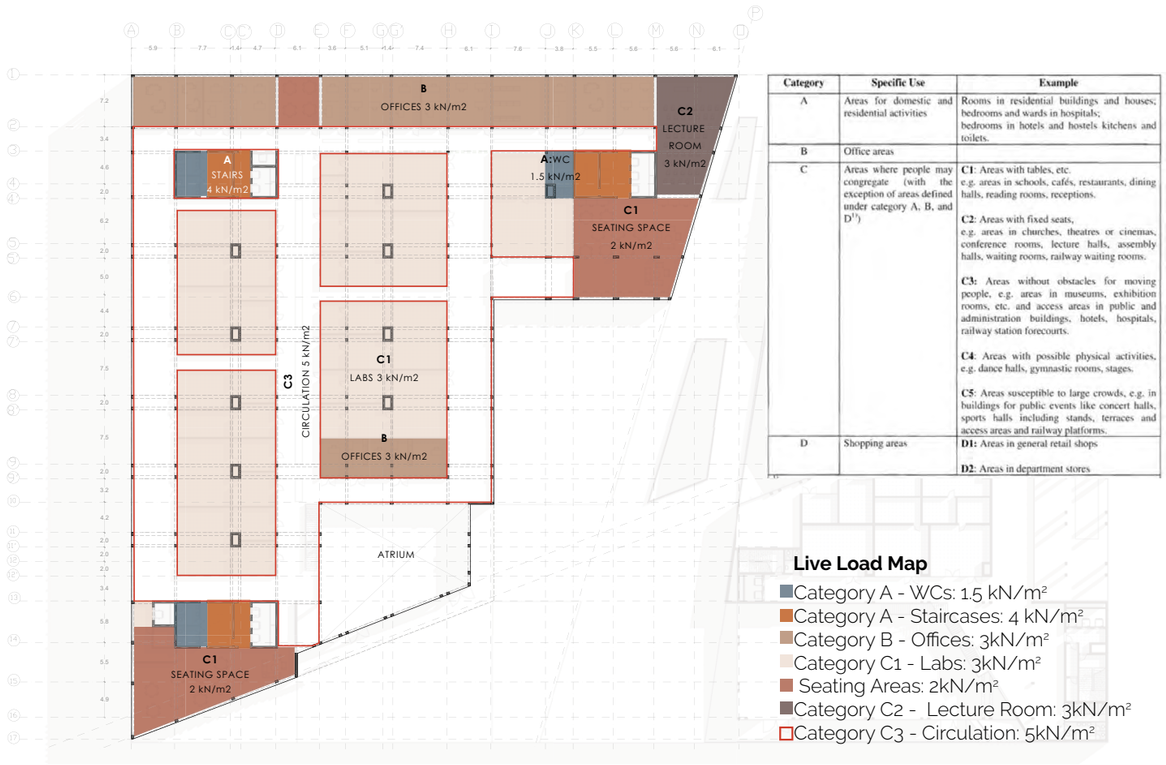
Therefore, calculations for the dead load before a building takes on the additional loads from occupancy or use, must include the concrete for the foundation system, planned building materials plus any service equipment such as elevators, HVAC units and ductwork, plumbing, fixed manufacturing equipment, and so on.

LIVE LOADS

Live loads refer to the dynamic forces from occupancy and intended use. They represent the temporary forces that can be moved through the building or act on any particular structural element; such as, the anticipated weight of people, furniture, appliances, automobiles, moveable equipment ...

Reinforced concrete creates the heaviest dead loads but also supports the most weight with its compressive strength. Structural steel offers much less of a dead load and provides superior support for live loads in multi-story buildings.

The load path is transferred from slab to beams by distributing the load over the beam. The slab rests on the beam that carries its weight. In this case, the area weight is distributed along the beam by both a one-way slab and a two way slab system. In a one-way slab, the slab load is divided equally between adjacent beams. For an interior beam, the slab areas of both sides are divided by the corresponding width to obtain the lineal load of the beam. In a two-way slab, each direction of reinforcement is supposed to carry and transfer a portion of the slab load to the adjacent beam.



Category	Specific Use	Example
A	Areas for domestic and residential activities	Rooms in residential buildings and houses; bedrooms and wards in hospitals; bedrooms in hotels and hostels kitchens and toilets.
B	Office areas	
C	Areas where people may congregate (with the exception of areas defined under category A, B, and D[1])	**C1**: Areas with tables, etc. e.g. areas in schools, cafés, restaurants, dining halls, reading rooms, receptions. **C2**: Areas with fixed seats, e.g. areas in churches, theatres or cinemas, conference rooms, lecture halls, assembly halls, waiting rooms, railway waiting rooms. **C3**: Areas without obstacles for moving people, e.g. areas in museums, exhibition rooms, etc. and access areas in public and administration buildings, hotels, hospitals, railway station forecourts. **C4**: Areas with possible physical activities, e.g. dance halls, gymnastic rooms, stages. **C5**: Areas susceptible to large crowds, e.g. in buildings for public events like concert halls, sports halls including stands, terraces and access areas and railway platforms.
D	Shopping areas	**D1**: Areas in general retail shops **D2**: Areas in department stores

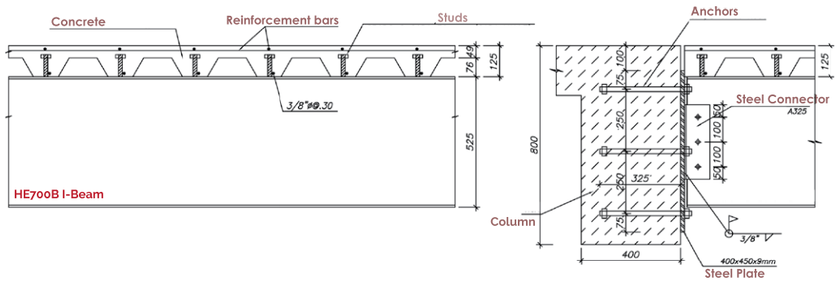
Live Load Map

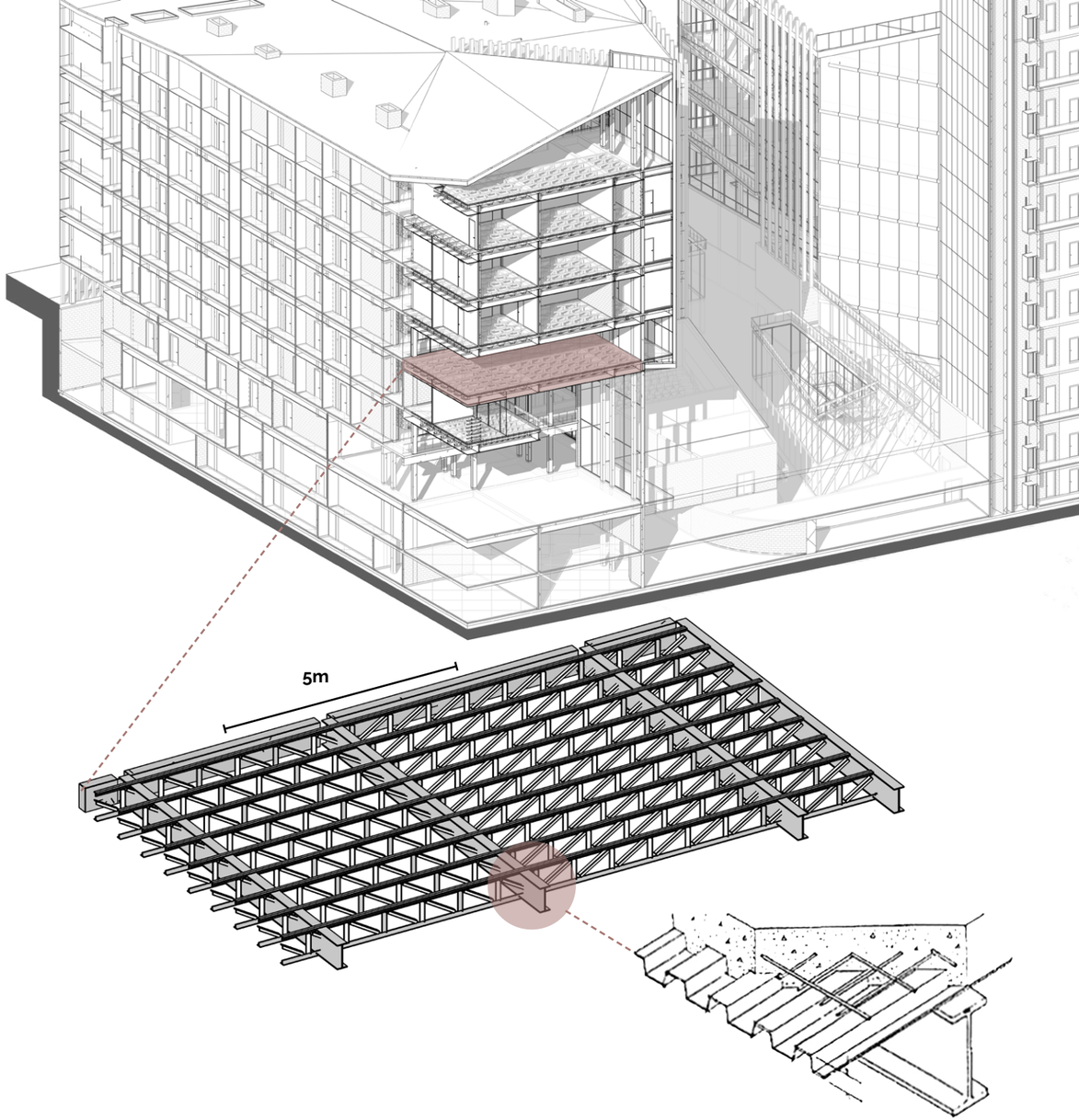
- Category A - WCs: 1.5 kN/m²
- Category A - Staircases: 4 kN/m²
- Category B - Offices: 3kN/m²
- Category C1 - Labs: 3kN/m²
- Seating Areas: 2kN/m²
- Category C2 - Lecture Room: 3kN/m²
- Category C3 - Circulation: 5kN/m²

COMPOSITE STEEL SLAB

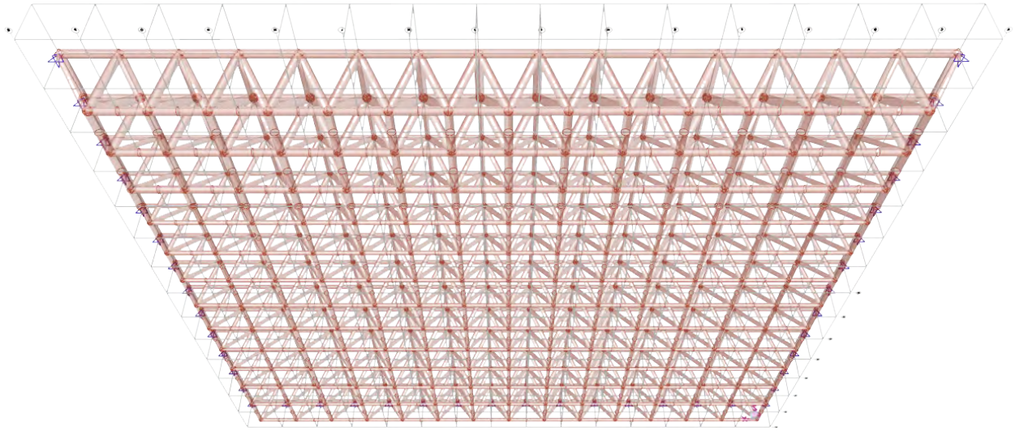
The Composite Floor System provides innovative, results-driven building solutions that provide efficiency, safety, sound and fire ratings and economical design flexibility. Ideally suited for multistory buildings. It also allows for installation flexibility of HVAC and Electrical systems. The Composite Floor System provides innovative, results-driven building solutions that provide efficiency, safety, sound and fire ratings and economical design flexibility. Ideally suited for multistory buildings. It also allows for installation flexibility of HVAC and Electrical systems. Open web floor trusses are growing in popularity over engineered joist systems. Their superior span capability allows them to create more spacious rooms free of awkward columns. Rooms over structure can be built without the need for support beams and columns. This system will help us having the idea of an open space and cantilevered slabs to have the architectural initiative while staying efficient and functional. As spans between bearing walls increase, open web floor system can often be the more cost effective approach to building a floor system.

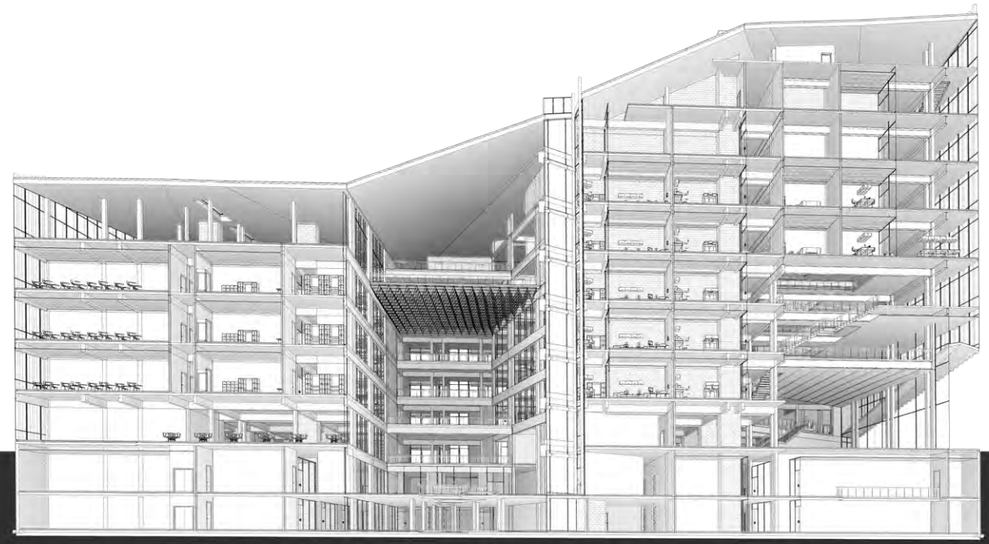
Tata Steel Galvatite®, hot dip zinc coated steel to BS EN 10346 S280GD+Z275, with guaranteed minmum proof strength of 280N/mm2 and zinc coating of total mass 275g/m2 (including both sides). This is sufficient for internal floors in a non-aggressive environment, which satisfies the requirement in Clause 4.2 BS EN 1994-1-1 - the exposed surfaces of the steel decking shall be adequately protected to resist the particular atmospheric conditions. A zinc coating, if specified, should conform to the requirements of BS EN 10346. The specification may be varied, depending on service conditions.





SPACE FRAME SLAB





In a very broad sense, the definition of the space frame is literally a three-dimensional structure. However, in a more specific sense, a **space frame** or space structure is a structure system assembled of linear elements so arranged that forces are transferred in a three-dimensional manner. With the growth of new building techniques and construction materials, space frames frequently provide the right answer and satisfy the requirements
for lightness, economy, and speedy construction. It is a type of two-way truss system constructed from lightweight interlocking struts following a geometric pattern. Space Frames can be used to span large areas with few interior supports. The structures strength is due to the rigidity of the triangle and flexing loads that are transmitted as tension and compression loads along the length of each rod.

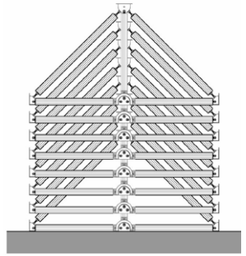
TYPES OF SPACE FRAMES

Classified into two categories, namely, Curvature Classification and Classification by the arrangement. In our case, we are using the structure on a flat slab, thus we will be using the Classification by Arrangement that can be classified as follows:

-Single-layer grid: All elements are located on the surface to be approximated.

-Double layer grid: Elements are organized in two layers parallel to each other at a certain distance apart. Each of the layers forms a lattice of triangles, squares or hexagons in which the projection of the nodes in a layer may overlap or be displaced relative to each other. In this type of meshes, the elements are associated into three groups: upper cordon, cordon and cordon lower diagonal.

-Triple-layer grid: Elements are placed in three parallel layers, linked by the diagonals. They are almost always flat. Hanging cover



Stocked modules

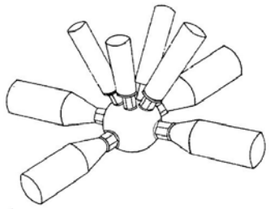
The efficiency of a timber truss solution depends, to a great extent, on the load transmitted to the bars then to the node. Resin epoxy is easy to join bars together using threaded steel rods inserted in timber. This is a highly efficient system which is can be stackable. Joining them together with glued bars gives great stiffness and strength, in addition to their ductile joints design. Pipes and ducts can also be installed in between the rods.

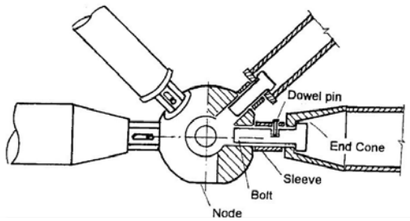
ADVANTAGES

1. These three-dimensional structures aid load sharing with maximum precision.
2. Portable, lightweight, and their assembly is modular, secure and efficient.
3. It is capable of bearing heavy loadings with minimum deflections.
4. The cost of transportation is less as compared to conventional steel structures.
5. Space frame also allows odd placement of columns, along with integral cladding and glazing. Therefore, modularity is achieved with these structures.
6. They allow hassle free erection and a geometric balance, boosting the aesthetics of the construction and offers flexibility.
7. Easily expandable and are built following assembly line approaches with a very minimum amount of seismic resistance.

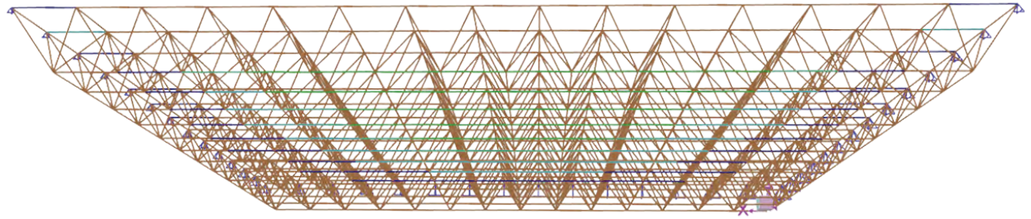
Software SAP 2000 used:

SAP2000 is general-purpose civil-engineering software ideal for the analysis and design of any type of structural system. Basic and advanced systems, ranging from 2D to 3D, of simple geometry to complex, may be modeled, analyzed, designed, and optimized using a practical and intuitive object-based modeling environment that simplifies and streamlines the engineering process. This software was used for the structural analysis procedure of the space frame. An additional suite of advanced analysis features are available to users engaging state-of-the-art practice with nonlinear and dynamic consideration. Created by engineers for effective engineering, SAP2000 is the ideal software tool for users of any experience level, designing any structural system. Using SAP we were able to identify the dimension needed for the space frame elements to hold the forum slab.

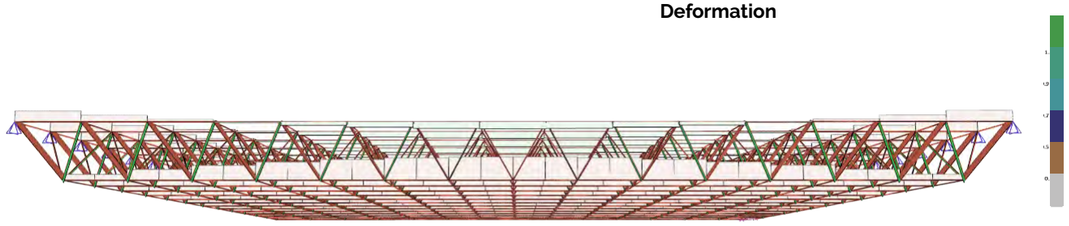




space frame's node connection

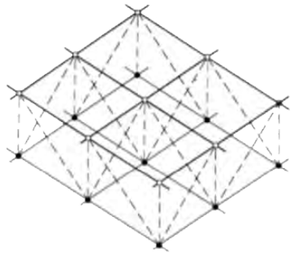


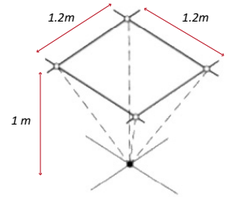
Deformation

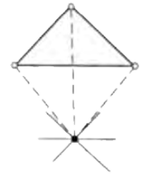


Axial Forces

Deformation





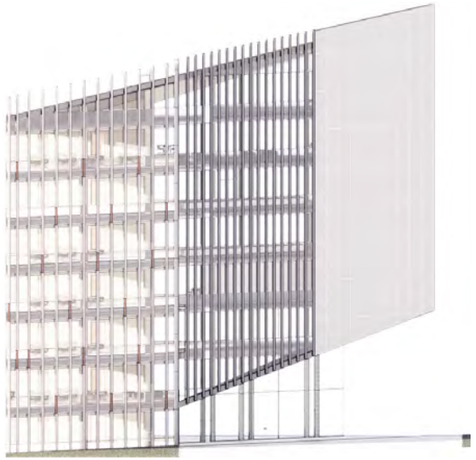


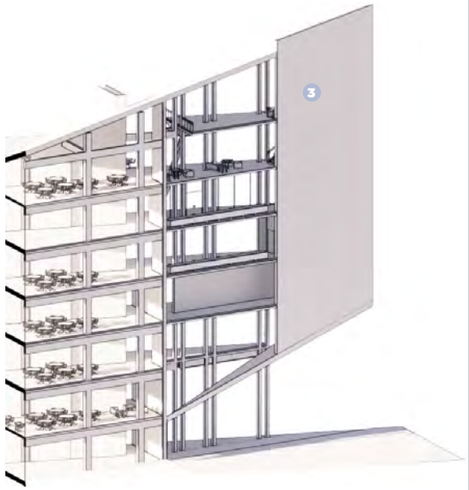
INNOVATIVE MATERIALS

TECHNICAL DESIGN

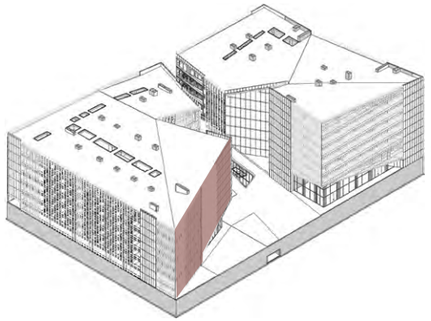
FACADE COMPONENTS

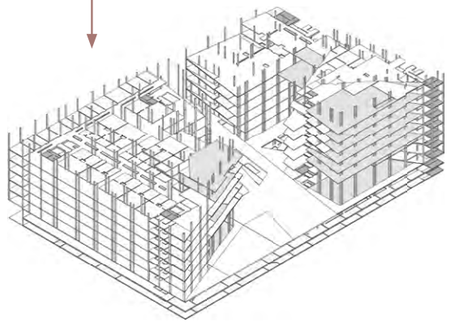
1. GFRC Cladding - Rieder® 3,600/1,200/13 mm
2. GFRC fibreC fins - Rieder® U-shape 300/200/13 mm
3. Concrete - FINJA® PreFab
4. Wooden Plank Fin Separators - HPL Board Parklex® 1,700/200/200 mm
5. Reflective Glass - Reflectasol® Ultra Grey 10 mm Triple Glazing
6. Translucent Spandrel Glass - EMALIT®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

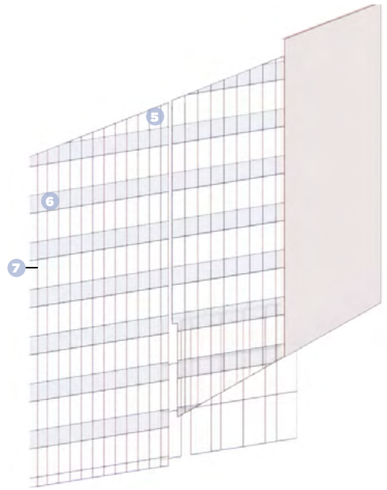




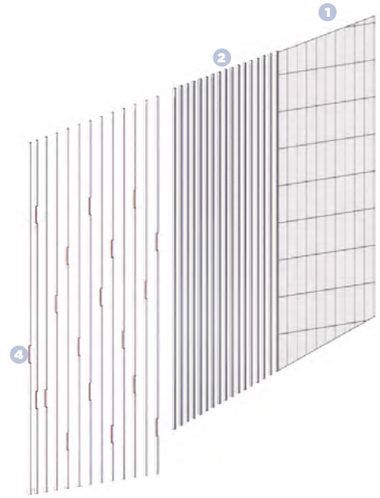
Structural Layer



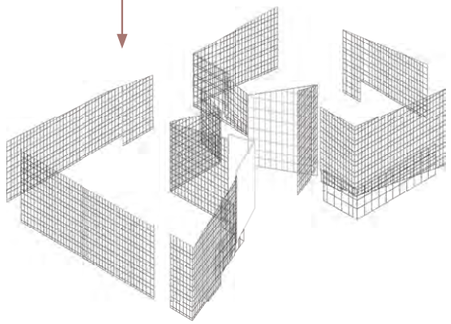


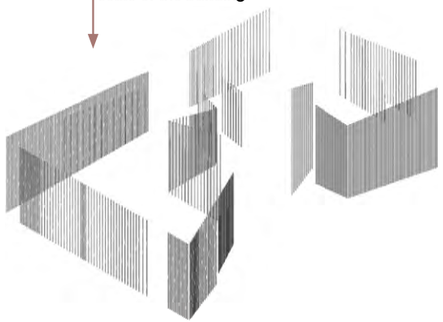


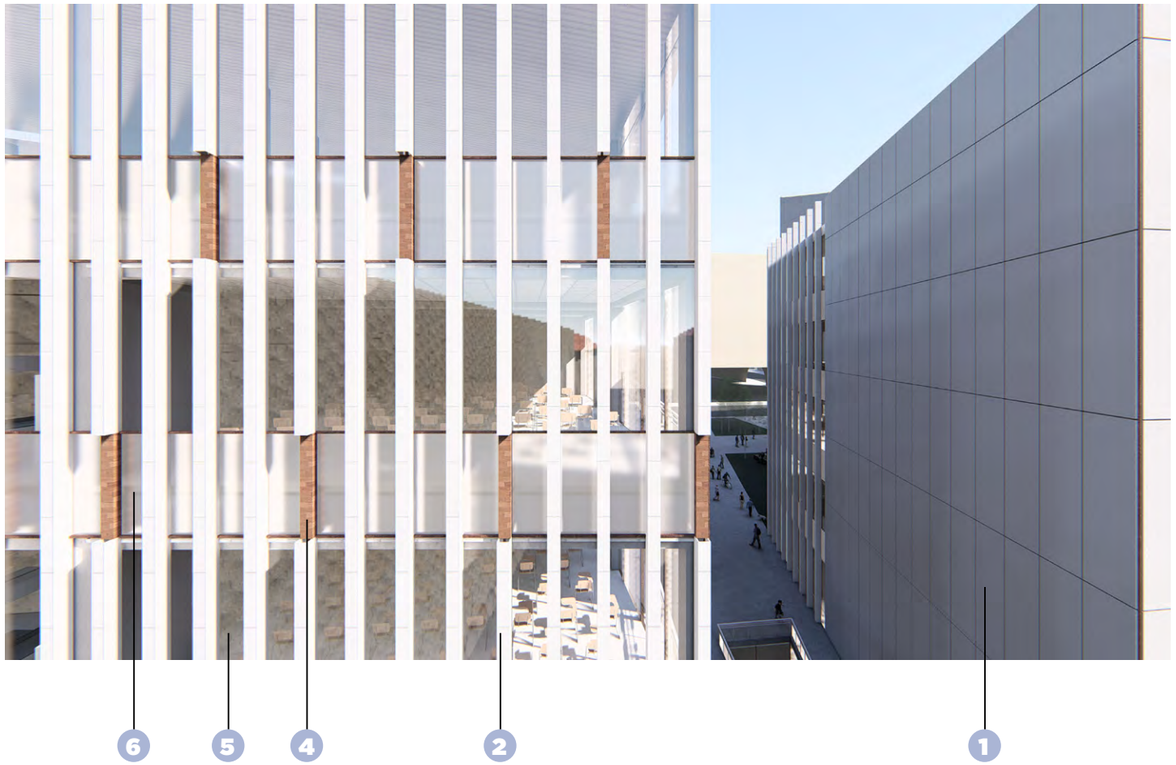
Curtain Glass System Layer



Glassfibre Reinforced Concrete Fins & Wood planks atspandrels to further define the scale of the building







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

4 **Wooden Planks**

The Parklex wooden planks are formed of a high density bakelite core, coated with a natural wood treated with synthetic resin, and an additional film improves the durability of the panels, conferring anti-adherent properties protecting against of solar radiation, atmospheric agents, dirt and chemical attacks.

5 **Reflective Glass**

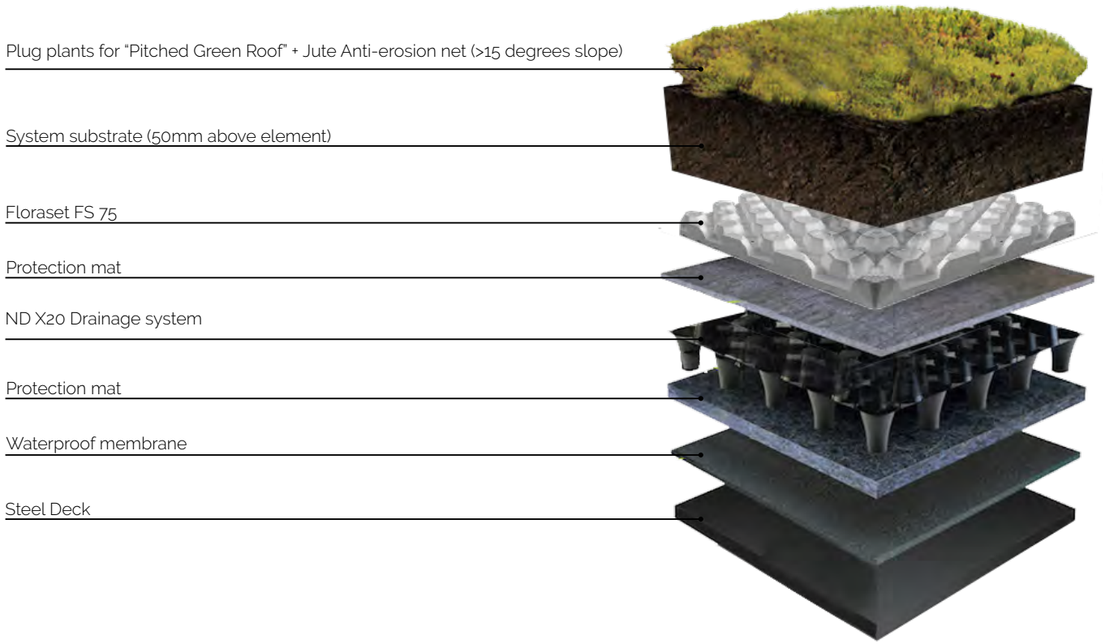
The curtain glass is manufactured by Reflectasol, and it is reflective, solar control glass. The soda-lime silicate glass is produced using the float procedure, on which a CVD coating has been applied, and it is manufactured by a process known as 'on-line pyrolitic coating' (or Pyrolytic Chemical Vapor Deposition) wherein a coating is applied to the glass surface by means of pyrolysis. Also known as hard coating, the process fuses precious metal oxides on the surface of the float at high temperature while the glass is in formation. This gives it a number of properties including the total integration with the surface of the glass, strength and stability over time, and solar control properties and a reflective appearance.

6 **Translucent Spandrel**

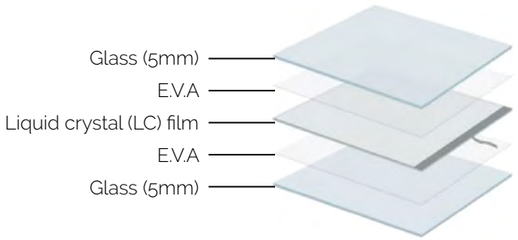
As mentioned before, the translucent glass spandrel is dimensioned in a manner to conceal the false ceilings, and rise 1.2m above the floor finish level in order for the horizontal mullion to serve as a handrail to the interior double loaded corridors on the facade, and to minimize the height of the glass panes to protect them from wind loads.

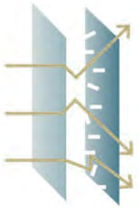
GREEN ROOF

Now that you have been introduced to our façade's components, it is time to meet our fifth façade. According to general regulations for roofs with waterproofing, flat roofs should have a fall of at least 2 %. The substrate layer has to be protected against erosion. Plant selection and planting methods are to be adjusted to the relevant slope and exposure. The future is green energy, sustainability, and renewable energy. Our roofs are designed in a manner to accommodate the hybrid photovoltaic/solar panels on the shallow slope, and the green roofs on the other steeper slopes. The green roofs have a layer of Floraset FS 75 that keep the soil intact and slide-resistant on the slopes that exceed 15°, and they are one of our water management systems, collecting rainwater that goes through a purification process in order to be reusable.

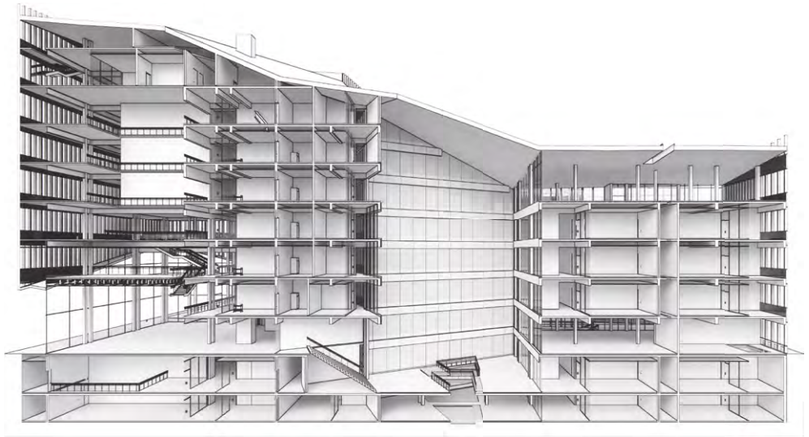


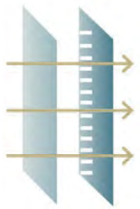
A forum is originally defined as a place or opportunity for discussing a subject or a large public place in an ancient Roman city that was used as the center of business. In our project, the forum is a contemporary embodiment of urban and interior features that connect the building's interior with its exterior and serves as a space where students, researchers and the public can interact. However, our forum is also designed and customized in a manner to accommodate both semi-public and private events in our 'Innovative Hub for Creative Minds'. This is achieved via our **PRIVA-LITE® transparent/translucent switchable glass façade** that is structurally supported by the L-shaped structural steel mullions discussed earlier. It is a thermal and sound-insulating laminated glazing solution incorporating a liquid crystal film that can manage transparency on demand, changing instantly from clear state to translucent, and vice versa. The liquid crystals align when the electrical current is switched on, causing the glass to turn transparent instantly, and transparency is needed when the forum is acting as a communication hub, and the two buildings are in visual connection as well. When the power is switched off, the glass has a naturally opaque appearance, blocking vision (total privacy), yet permitting light to pass through (translucent), and this is needed when the forum is closed off for seminars, guest spokespeople, etc; hence, serving as a hall like the renowned Patio in Politecnico di Milano.



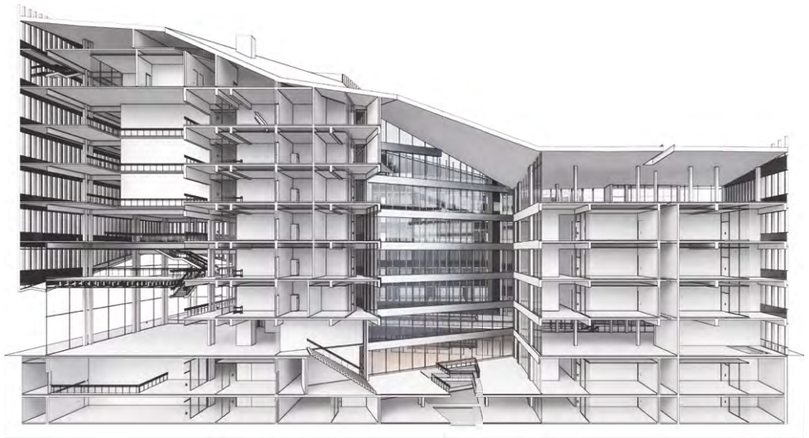


Power **OFF**





Power **ON**

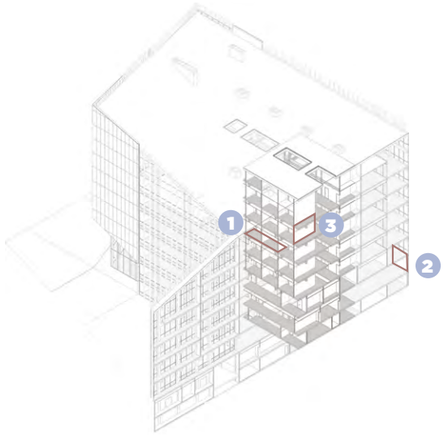


Wall & Slab Stratigraphy

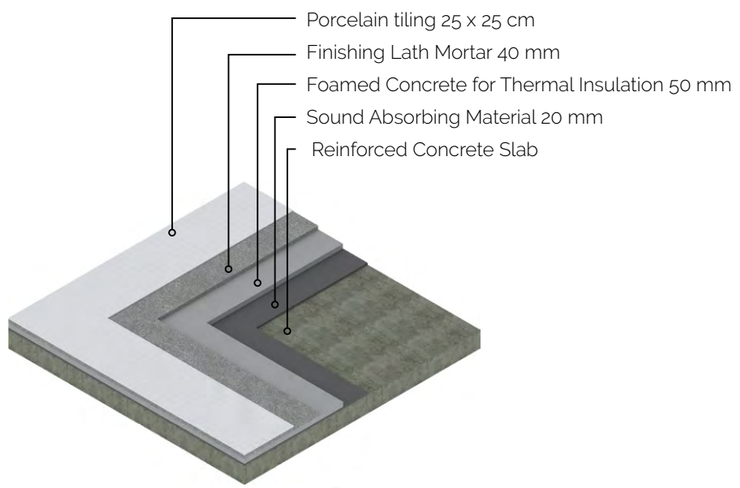
The Egyptians started using basic masonry to build one of the most impressive structures ever created in 2600BC, and from then on, masonry has been the material mostly used in building construction. Masonry walls typically increase the fire resistance of the wall system or structural elements. Concrete masonry units (CMU) are made from a mixture of portland cement and aggregates under controlled conditions. These units are used in our interior partitions between spaces within the building since they are typically larger than brick units, and the construction time required is typically less than that for brick.

The foundation walls are cast-in-place concrete retaining walls, selected for their strength and versatility due to the high level of technicality. Poured concrete retaining walls are also more flexible design-wise as they can be colored, textured, accented with embedded objects, in addition to multiple other options. If it is installed correctly, concrete allows for more customization than any other retaining wall material.

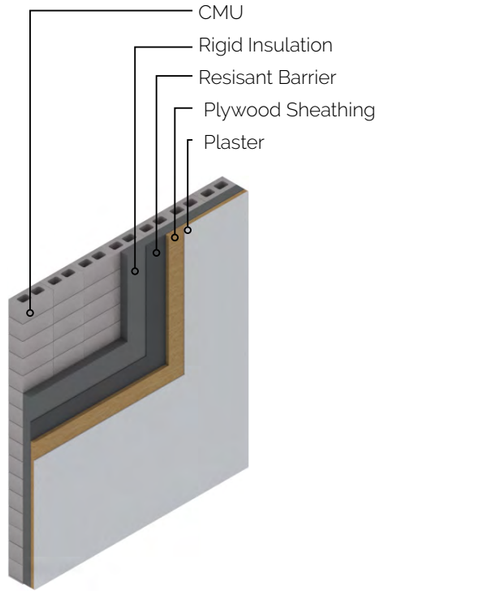
The flooring is made of concrete slabs with porcelain finishing, and sound-insulating barrier in between due to the use of heavy and sometimes loud machinery and equipment in the laboratories. If it is properly installed, a concrete slab has an almost unlimited lifespan and will most likely outlive all other components of the building. Fire resistance is another advantage of concrete slabs, and because of this, they are ideal fire prone areas such as a laboratory building. As for the environmental aspect, concrete can be recycled; therefore, if the slab is ever demolished, it will not end up in landfill.



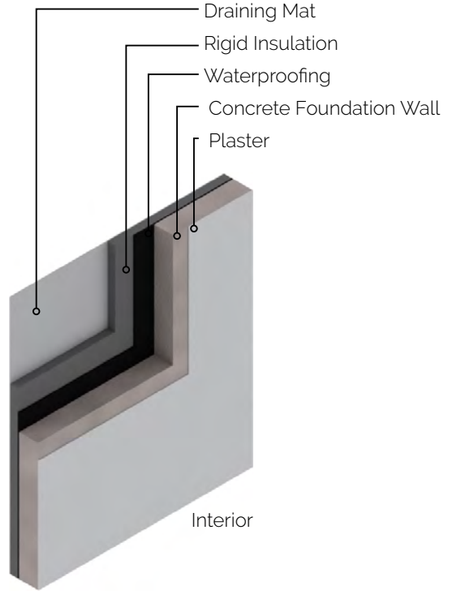
1- Slab stratigraphy



2- Basement wall stratigraphy

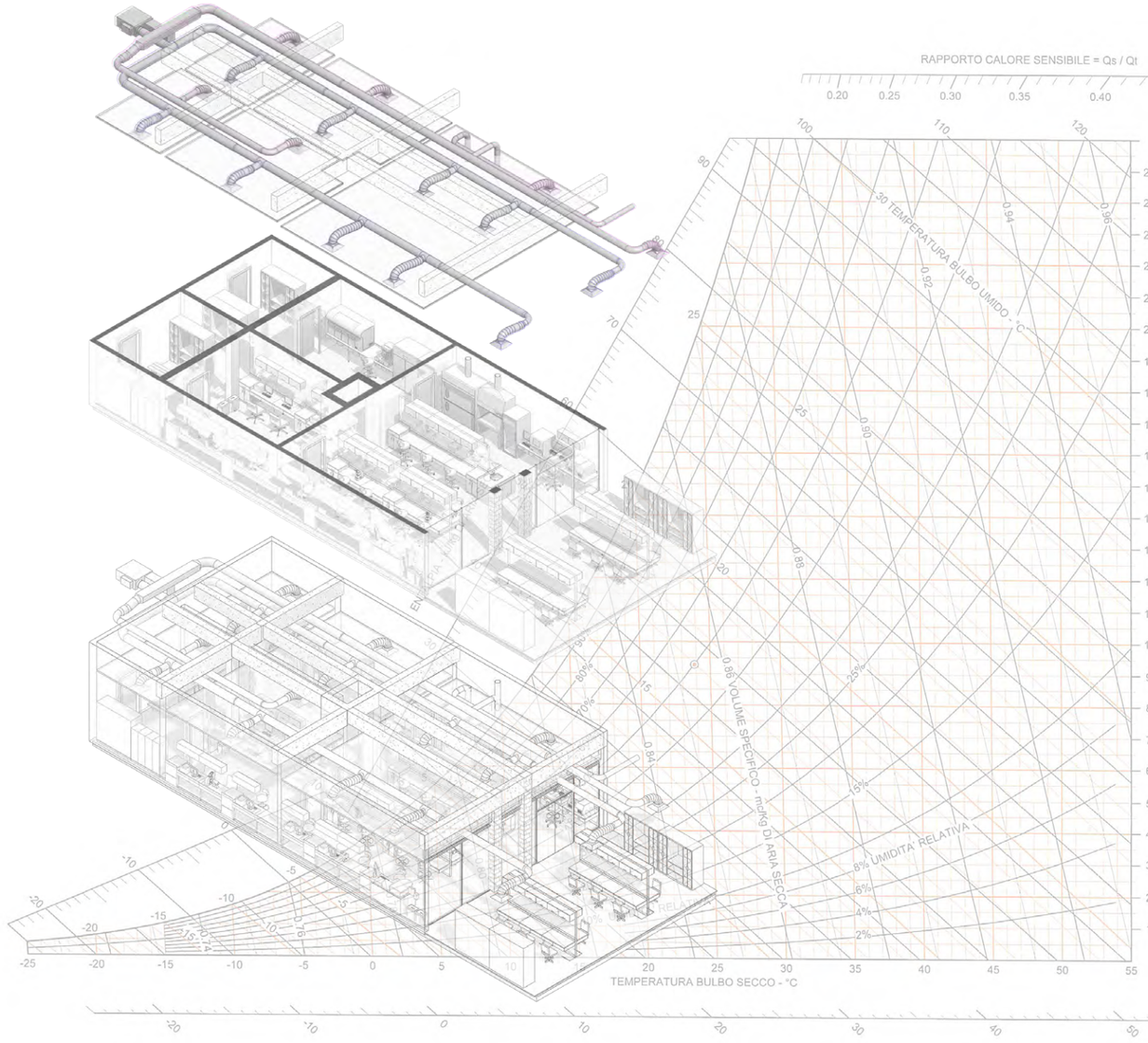


3- Wall stratigraphy



BUILDING SERVICES

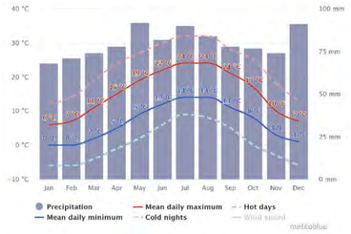
TECHNICAL DESIGN



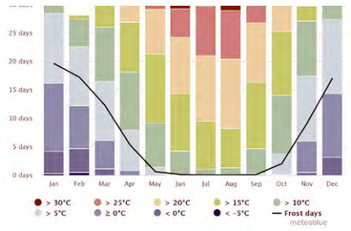
GENERAL DATA TAKEN FROM MONTHLY CLIMATE INFORMATION

Location 55.0˚ 33˚47˚N 46.8˚34˚7˚E

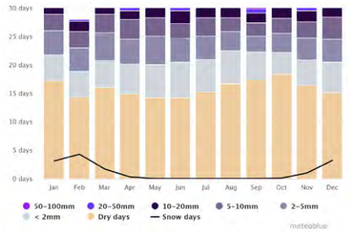
- The warmest month (with the highest maximum temperature) is July (32˚C). The month with the lowest average high temperature is January (-5˚C).
- The warmest month (with the highest average high temperature) is July (25.3˚C). The month with the lowest average high temperature is January (4.5˚C).
- The month with the highest average low temperature is July (14.5˚C). The coldest month (with the lowest average low temperature) is January (-1.1˚C).
- Months with the highest relative humidity are November and December (82%). The month with the lowest relative humidity is April (68%).
- The wettest month (with the highest rainfall) is May (99mm). The driest month (with the lowest rainfall) is February (45mm).
- The month with the highest number of rainy days is May (12.4 days). The month with the lowest number of rainy days is February (8.4 days).
- The month with the highest number of snowfall days is January (3 days). Months with the lowest number of snowfall days are May, June, July, August and September (0 days).
- The month with the longest days is June (Average daylight: 15.9h). The month with shortest days is December (Average daylight: 8.5h).
- The month with most sunshine is July (Average sunshine: 7.2h). The month with least sunshine is December (Average sunshine: 1.7h).
- Months with the highest UV index are June and July (UV index 7). Months with the lowest UV index are January, November and December (UV index 1).



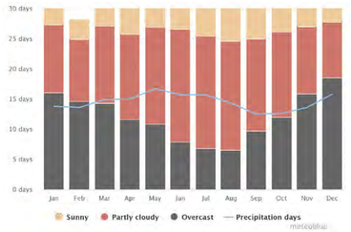
Average temperature and precipitation



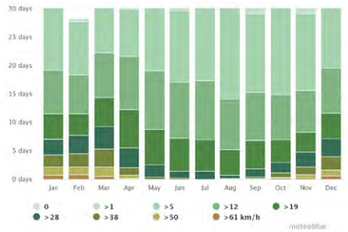
Maximum Temperature



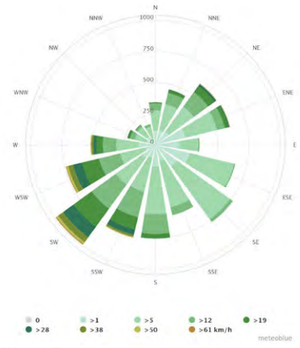
Precipitation amount



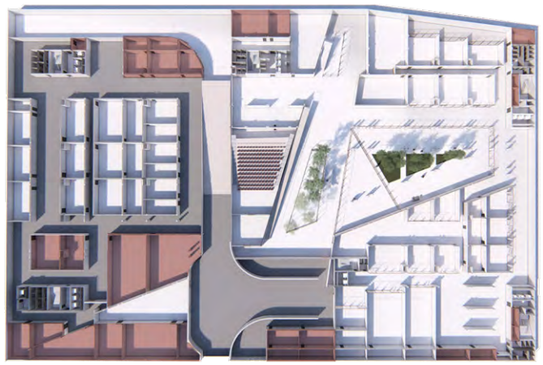
Cloudy, Sunny and precipitation days

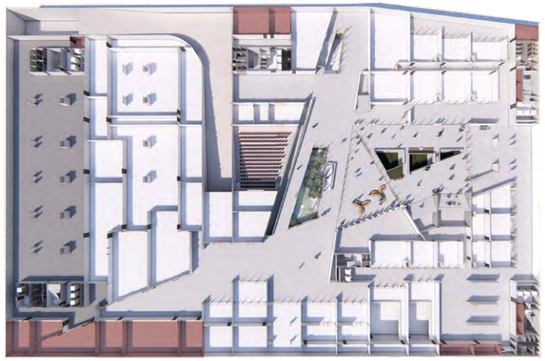


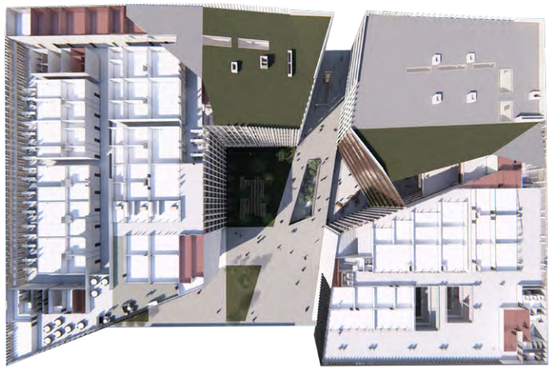
Wind Speed



Wind Rose







TECHNICAL ROOMS

Technical rooms are mainly allocated in the Basement 1 and 2 levels, and in the upper floors where the roof starts sloping with inadequate clear height for normal functions. Those rooms and spaces are used for technical, mechanical, storage, and electrical rooms. Mechanical rooms 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

Equipment in mechanical rooms is often operated and maintained by a stationary engineer or a maintenance technician. Modern buildings use control systems to manage HVAC cycles, lighting, communications, and life safety equipment. Often, the control system hardware is located in the mechanical room and monitored or accessed remotely. Rooms with only electrical or electronic equipment are not considered mechanical rooms but are instead called electrical rooms.

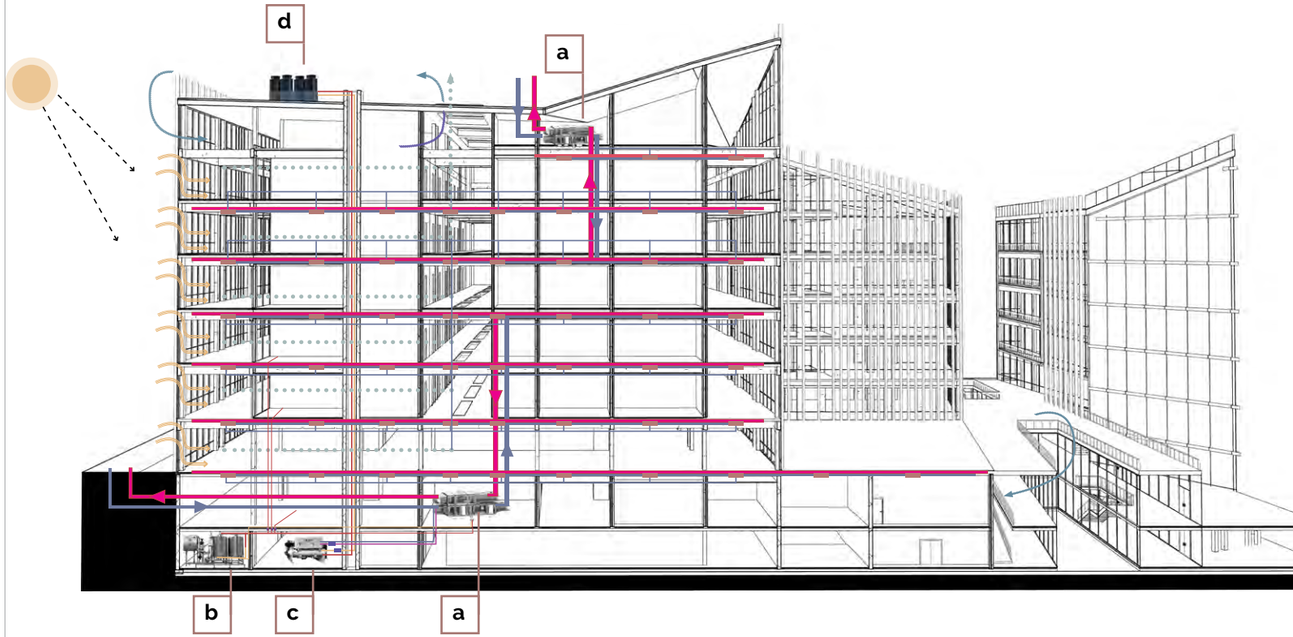
ALL AIR HVAC SYSTEM

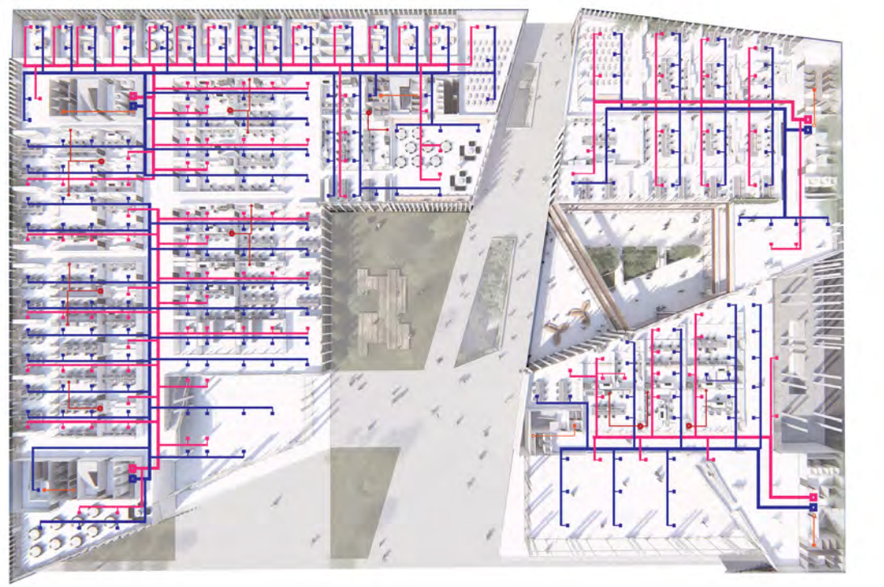
An 'All-Air Central System' supply the latent and sensible cooling and heating with the same airstream, either placed in the central system or separated by zones controlled by a thermostat. All-air systems fall into two classes - constant volume and variable air volume (VAV). This system is advantageous when it comes to maintenance, since the main equipment are centrally located.

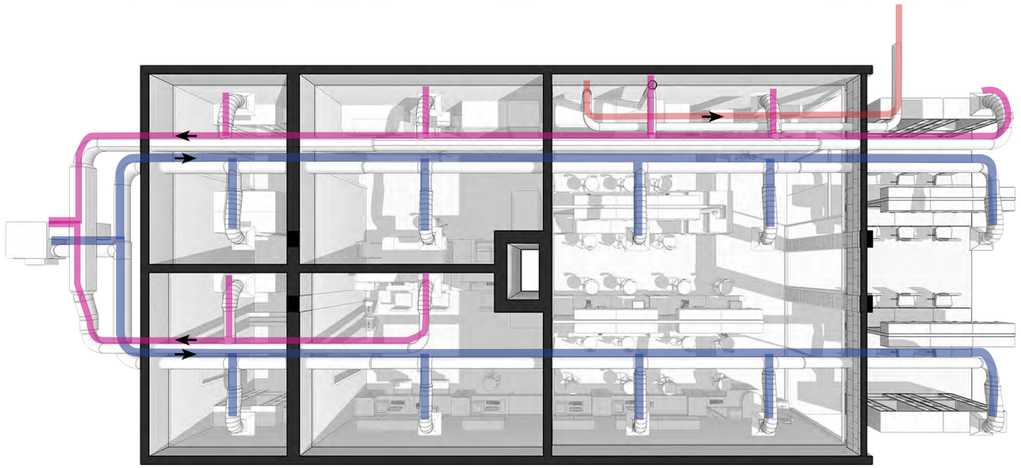
The HVAC equipment are mainly placed in the basement level's technical rooms. On the roof, the cooling towers and the hybrid solar panels are positioned. The **cooling towers** are designed to remove heat from a building or facility by spraying water down through the tower to exchange heat into the inside of the building. Those towers are connected to the chiller in the basement level, through the shaft. Typically in heating, ventilation and air conditioning systems, **chiller units** produce chilled water that is piped to air handling units (AHU) or fan coil units where it is used to cool the air that ventilates the building. Simultaneously, the warmed water is then returned to the chiller unit to be re-cooled. AHUs are located in the basement levels and in the last floor where the roof starts sloping and creating spaces with inadequate clear height for a commercial function. **Air Handling units** are used to recondition and circulate air as part of a heating, ventilating and air-conditioning system. The basic function of the AHU is taking outside air into the unit, recondition it and supply it as fresh air to the different spaces of the building. In addition to supply ducts, exhaust air ducts return air to the AHU to be partially reconditioned and recirculated again , which creates an acceptable indoor air quality. In each lab fume hoods carries the contaminated air in a separate exhaust duct to be treated and thrown outside. Some recirculated air could also be contaminated; therefore, using filtering and natural ventilation is key to avoid toxins.

- Exhaust
- Supply
- Terminal units
- Fresh air, natural ventilation
- **a** Air Handling Units
- **b** Boiler
- **c** Chiller
- **d** Cooling Towers

refer to V.2 'Technical Report' for the complete computation







Supply Return Fume Hood Exhaust

ALL AIR HVAC SYSTEM

Safety is key when designing laboratories. "In laboratories where hazardous substances are handled, the design of the HVAC system has to focus on the protection of staff and of the environment." Matthias Olders of Trox.

Planning a laboratory layout from an HVAC design viewpoint should be done with the objective of making each room and set up in the laboratory as safe as possible. Air quality must be tightly controlled to avoid contaminants, fire risks, recirculation of toxic air, and various other hazards that might affects workers. Also, carrying toxins directly outside can cause the contamination of external air. Labs are classified based on the type of materials and contaminants handled and the hazards posed. Laboratory classifications can be classified by industry and type. Following our program, the building includes the following types of labs:

Animal Station

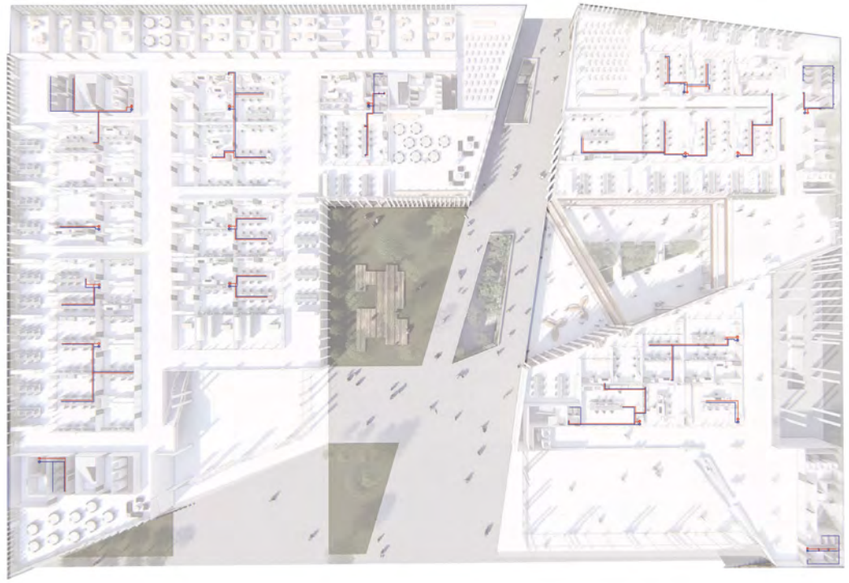
The animal station is located in the basement level and demands similar requirements to those of biological labs, with extra attention for temperature and humidity control. Air change rates must be fairly high and airflow must be sufficient to keep animals healthy and comfortable. Contamination control should also be taken into consideration whether in the air or in the water pipes.

Chemistry labs

Chemical laboratories require both careful planning and execution to avoid contamination of air from the workspace to the other rooms (offices, lecture halls, common spaces, even other labs) or from the exhaust system to unpolluted parts of the facility. These type of labs are more complex and require several different types of filtration to reduce risk. Fume hoods will require regular testing to ensure the HVAC system and VAV are operating at optimum efficiency. This is particularly important in large facilities, such as in our case, with multiple fume hoods simultaneously running.

Physics labs

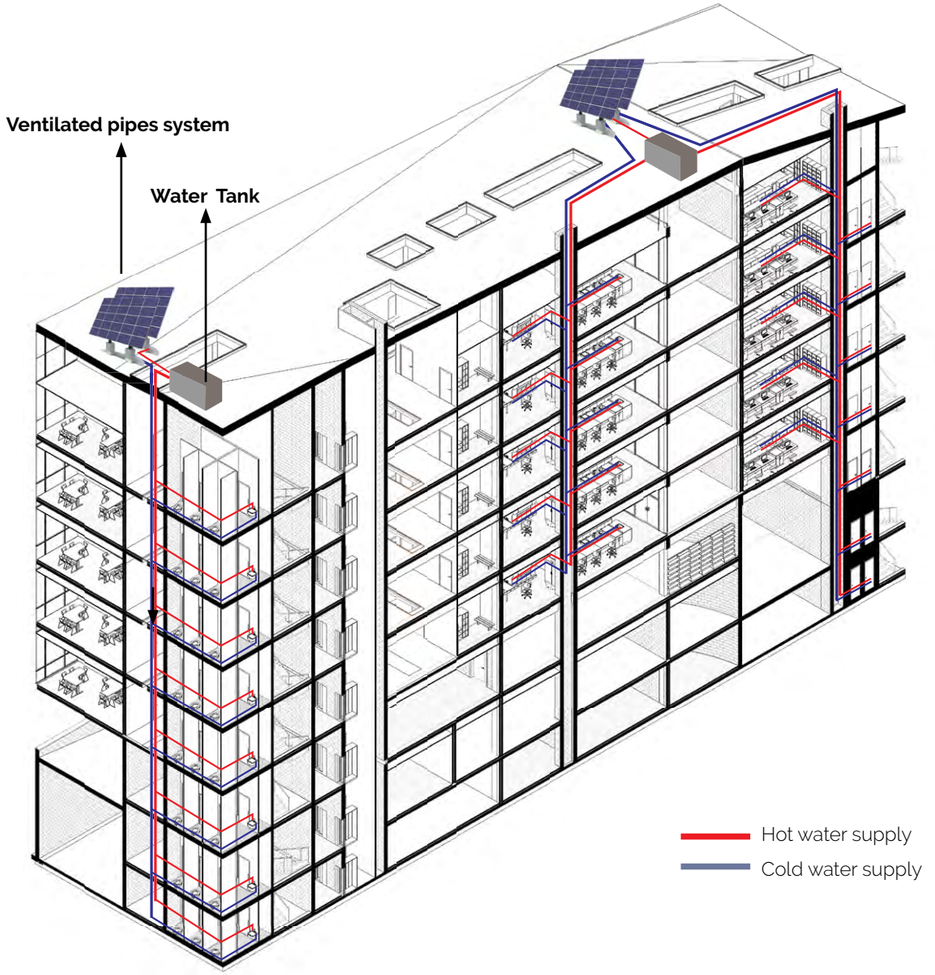
Physics or research and design labs may be more concerned with particulates from dust, mists and aerosols that require filtering out of the air than gaseous chemicals or biological substances. In open-floor workspaces, safety precautions should be followed strictly to avoid polluted spaces while profiting from the open common spaces and hubs. Personal protective equipment such as goggles, face shields, gloves and suits combined with an HVAC system that delivers strong filtration and high air change rates may be sufficient.



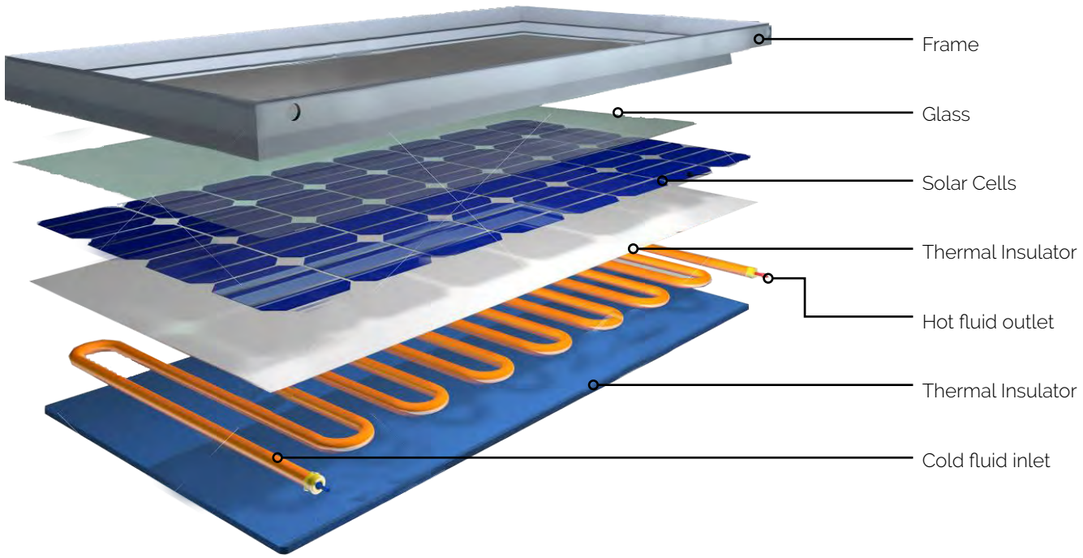
Water supply is always driven by pressure and we chose to have a top down water supply system with the use of solar panels to heat up the water for a more sustainable result

A lab water system (or laboratory water purification system) provides a consistent, pure, and adjustable source of water essential for many laboratory experiments. There are a variety of laboratory water systems, including deionized water systems, high flow lab water systems, reagent grade water systems, reverse osmosis water purification systems, and ultrapure water systems. Laboratory water purification systems can use ultra-violate radiation to eliminate microorganisms. A laboratory water system can either draw water directly from the tap or from an accompanying reservoir. Hot water is provided from two sources in our building; from the hybrid solar panels placed on the roof that heats water and uses it for the different purposes, or from the boiler that heats the water to generate steam. Steam produced in a boiler can be used for a variety of purposes other than hot water supply, including space heating, sterilisation, drying, humidification and power generation.

TOP DOWN WATER SYSTEM

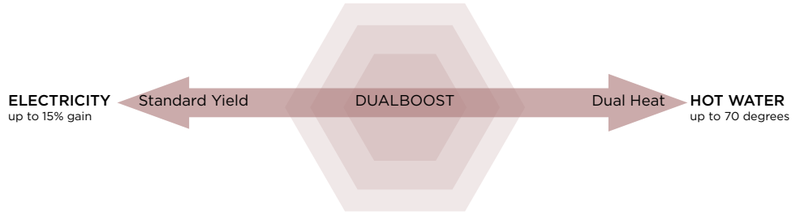


refer to V.2 'Technical Report' for the complete computation



HYBRID SOLAR PANELS

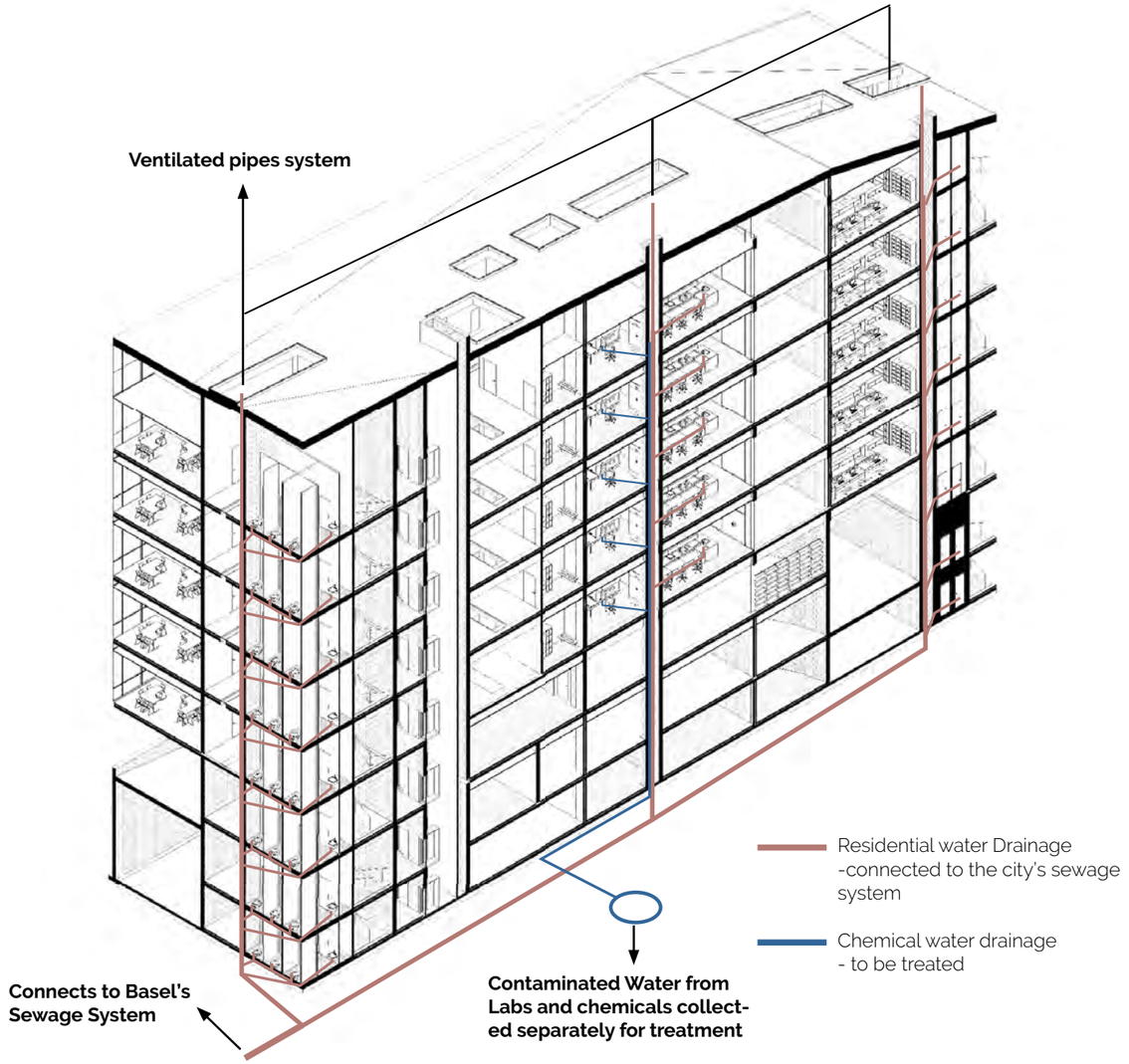
The hybrid soalr panel fulfills two functions at the same time; a double boost, it generates electricity and heats water given its combination of a photovoltaic module for generating electric power and a solar thermal collector. The front of the PVT panel absorbs solar radiation and generates electricity 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 integration of heat, the photovoltaic cells are constantly cooling, increase their productivity and operate with optimal efficiency. This system not only helped in generating electricity and hot water in one panel, but also increased the energy efficiency and saving on both bills.



refer to V.2 'Technical Report' for the Building Optimization

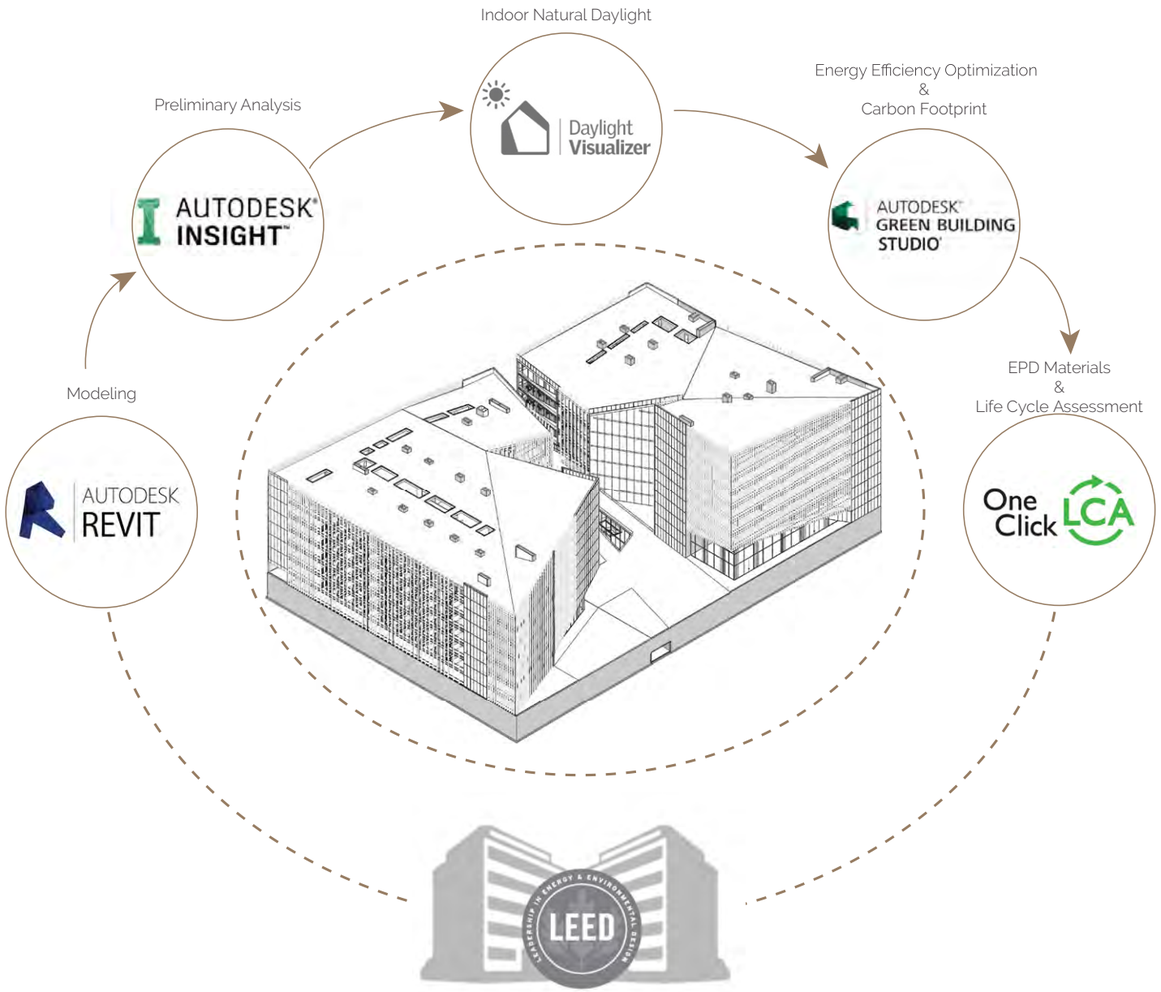
Sewage system pipes are driven by gravity thus their dimensions are bigger than the water pipes and they require to have a slope. The project has enough clear height provided for the technical ducts and pipes and for the sloping of the drainage pipes, a floor height of 4.5m and a false ceiling that can reach 1m. Waste is produced at fixtures such as toilets, sinks, and showers, laboratory sinks. A ventilated pipe avoids a vacuum from being created inside the pipes. As the water runs down air must be allowed into the waste pipe either through a roof vent, or the "drain waste. This allows neutral air pressure in the drains and free flow of water and sewage down the drains. It is critical that a sufficient downward slope be maintained throughout, to keep liquids and solids flowing freely towards the municipal drain. In some situations, "sewage ejector" pumps are needed. Traps are used for every fixture to avoid sewer gases from leaking and causing bad odor. Through traps, all fixtures are connected to waste lines, which in turn take the waste to a "soil stack", or "soil vent pipe". At the building drain system's lowest point, the drain-waste vent is attached, and rises (usually inside a wall) to and out of the roof. Waste exits from the building through the building's main drain and flows through a sewage line. In our building drained water is either connected directly to Basel's sewage system or treated firstly is it generated from chemical based water and waste. (refer to V.2 'Technical Report')

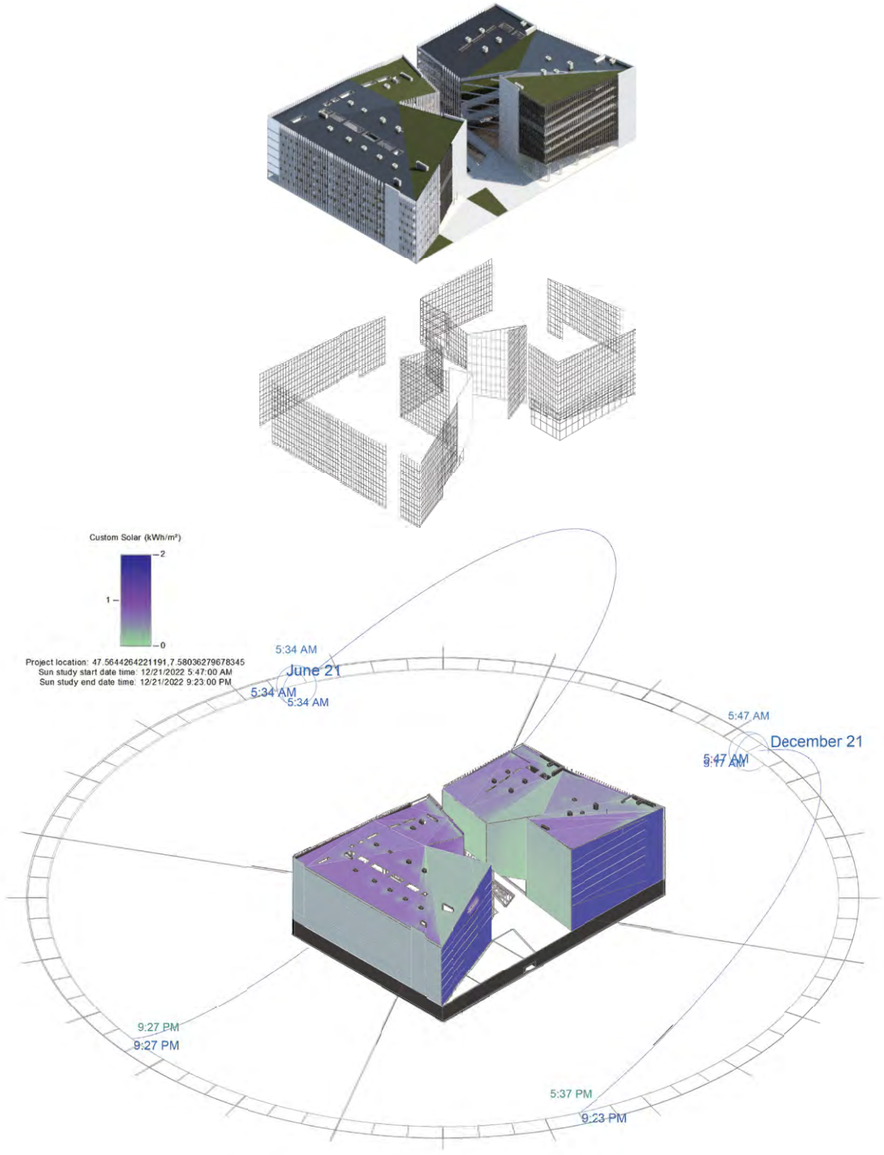
VENTILATED DRAINAGE SYSTEM



Building Information Modeling

TECHNICAL DESIGN

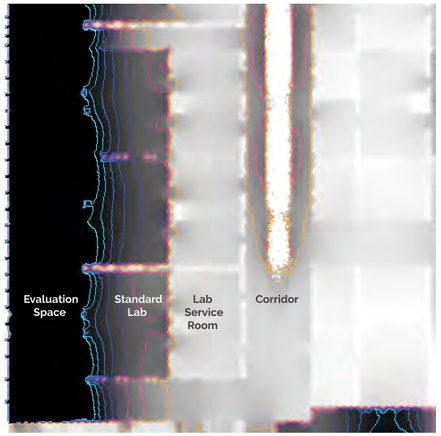




INSIGHT - SOLAR ANALYSIS & FACADE DESIGN SOLUTION

Building Information Modeling (BIM) is an intelligent 3D model-based process that gives architecture, engineering, and construction (AEC) professionals the insight and tools to more efficiently plan, design, construct, and manage buildings and infrastructure. Our workflow includes modeling our building on Revit, then using Autodesk Insight for the preliminary analysis. Insight empowers architects and engineers to design more energy-efficient buildings with advanced simulation engines and building performance analysis data integrated in Revit. Subsequently, we used Velux Daylight Visualizer to analyze the indoor natural daylight penetration, and we integrated glazed voids and skylights into our project accordingly. Next came Autodesk Green Building Studio for the optimization of energy efficiency and the assessment of carbon footprint. Once the building was roughly completed, we incorporated EPD materials to enhance our life cycle assessment using OneClick LCA. Following all of these steps, and based on the results, we were able to conclude the points we gathered for the LEED certification.

To begin with, **Insight** focuses on the energy use intensity, or EUI. The EUI is a key metric in benchmarking buildings. It is essentially a building's annual energy use divided by the total area. The resulting calculation gives you the energy use per area per year. Depending on the building type, the EUI should be within a certain range. In this case, the value we obtained is very close to the ASHRAE 90.1 benchmark, which is a good start for our preliminary analysis. The Benchmark Comparison shows how the design's current performance stacks up against industry benchmarks such as ASHRAE 90.1 and Architecture 2030. It assigns a cost for energy use euros per square meter per year. Window to wall ratio is one of the big factors that relate to daylighting in Insight. It does it for each elevation for the building - North, South, East & West. The graph represents energy performance in terms of either energy use intensity or euros per square meter per year of energy use, with a range of different options. If it is a steep line on the graph, it means that this factor has a big impact on the energy use of the building. On the contrary, the shallow lines mean that this factor does not have as big of an impact as other factors on this building, which is the case in all of our facades. It is the same procedure for window glass. We can find the mean value and the different range of values when we change the type of glass to see how glazing type affects performance.



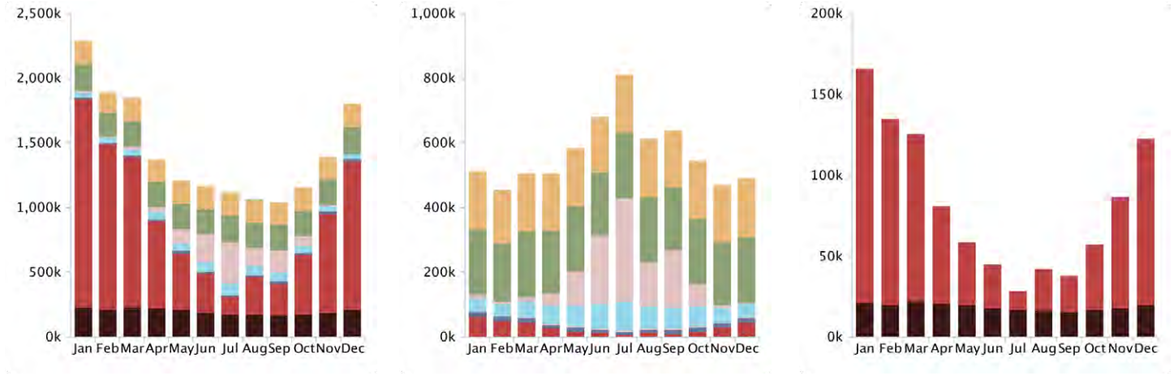
VELUX DAYLIGHT VISUALIZER - NATURAL INDOOR LIGHTING

The project **location is 55.0' 33'47"N 46.8'34'7"E**, and a solar analysis was conducted on Revit with the sun path, and a daylight study on Velux Daylight Visualizer. **Velux Daylight Visualizer** is a professional lighting simulation tool for the analysis of daylight conditions in buildings. It is intended to promote the use of daylight and to aid professionals by predicting and documenting daylight levels and appearance of a space prior to realization of the building design. Daylight factor is the most commonly used performance indicator for the evaluation and specification of daylight conditions in buildings. It evaluates the amount and distribution of diffuse light in the building in relation to the amount of diffuse light available outside under cloudy sky conditions, and is expressed as a percentage. Daylight factor levels are usually determined on a plan view and at work-plane height. Ultimately, we concluded that the highest insolation values are on the South facade, which is the main facade of the building, and that further explains our design solution which is partially integrating blind walls cladded with GFRC panels, and partially GFRC fins serving as a type of brises-soleil for our glazed facades, providing shade in the interior while maximizing natural daylight. 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 on our roofs and glazed voids in our corridors following the preliminary daylighting analysis in which the daylight factor was quite low.

Scan for the indoor daylight analysis video on lux

GREEN BUILDING STUDIO - ANNUAL DATA

Subsequently, Autodesk Green Building Studio (GBS) was used to optimize the energy efficiency and carbon footprint of the building design. It is a flexible cloud-based service that allows you to run building performance simulations to optimize energy efficiency and to work toward carbon neutrality earlier in the design process. Green Building Studio helped in extending the ability to design a considerably high-performance building, taking into consideration that most of the building envelope is glass. The BIM data was imported directly from the Revit model, providing a fast and efficient workflow for energy analysis.



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%

Total Electricity

= 6,811,247 kWh -> 100 kWh/m2

-Space Heat = 5%

-Pumps = 2%

-Vent Fans = 11%

-Space Cooling = 16%

-Equipment = 35%

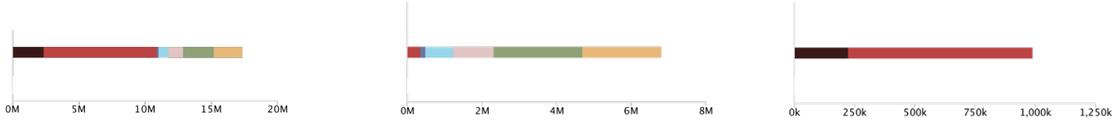
-Area Lights = 31%

Fuel (Natural Gas)

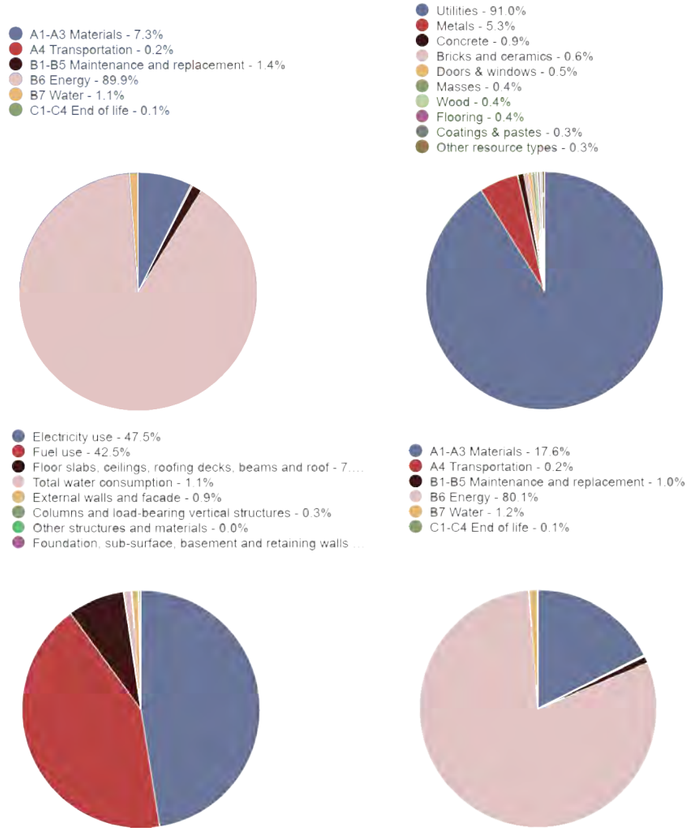
= 987,037 m3

-Hot Water = 22%

-Space Heat = 78%



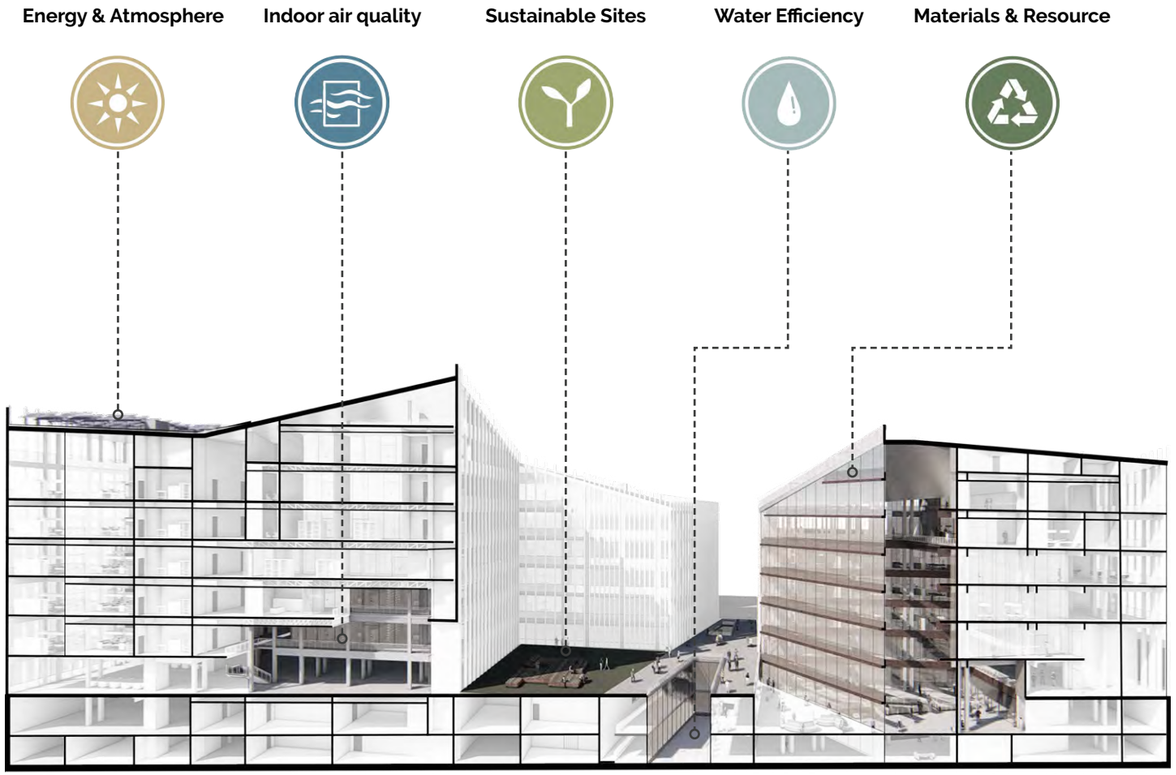
ONECLICK LCA - TOTAL USE OF PRIMARY ENERGY

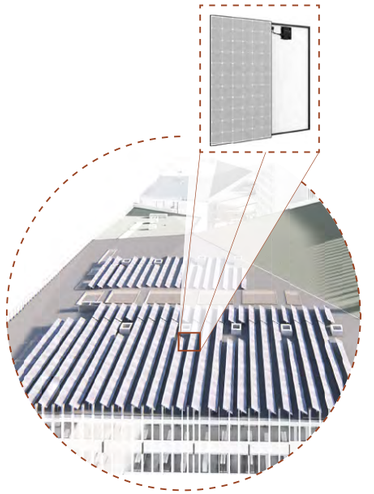


LEED CERTIFICATION -

SECTIONS OF THE RATING SYSTEM

LEED, which stands for Leadership in Energy and Environmental Design, is a certification program focused primarily on new, commercial-building projects and based upon a points system. The more points you earn, the higher your rating. This process is aimed at rewarding sustainable and environmentally friendly decisions that are part of the construction process. It is a way to demonstrate that certain environmental goals have been achieved during the design and construction of the structure or facility that is being certified. To be certified, the building project needs to obtain certain points and meet green building standards that will, later on, be validated during the certification process. When LEED-certified buildings are well maintained, they produce less waste products and are more energy efficient.





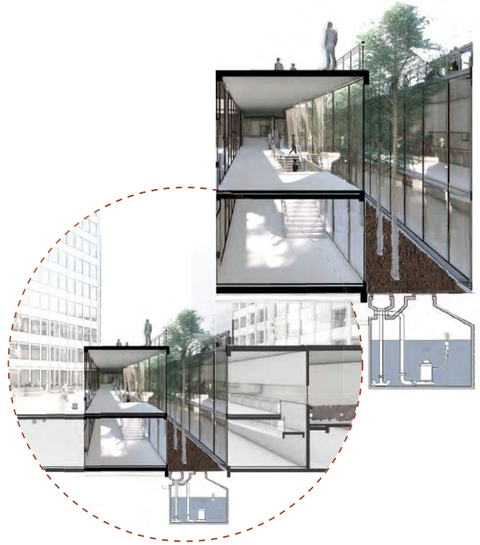
Hybrid Solar Panels

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.

Following the Green Building Studio Analysis, we determined the total annual electricity consumption and we needed to take further measures to optimize our building's energy efficiency, hence, we installed **Hybrid Solar Panels**. The term "hybrid solar panels" refers to solar and battery storage which unlike off-grid systems is connected to the electricity grid. The best thing about hybrid solar systems is that they store solar energy and low-cost electricity, they can be used for advanced energy management, and they are a great way to reduce power consumption from the grid. (refer back to page 164-165)



Rainwater Management

We conducted a rainwater management method through the water collection system in the void. It is used to mitigate extreme rainfall events without increasing the capacity of existing sewer system, and to mitigate urban heat island problems. Rainwater is collected from the roof and voids on the ground floor. On the roof, the rain will collect in gutters that channel the water into downspouts and then redirected to a tank or cistern. As for the water collection in the ground, water can be obtained by drilling or digging wells. A well is usually a pipe in the ground that fills with ground water. This water can then be brought to the land surface by a pump. It undergoes water treatment and a purification process before it is re-used.

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

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	**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	**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

LEED Gold

NEW CONSTRUCTION PROJECT CHECKLIST

The ratings system by which buildings can achieve certification, however, has come under scrutiny as well as criticism for granting points that require little effort on behalf of the builder. Points are easily granted for check-list items such as proximity to public transportation or location within a densely populated area, and this can mean the difference between silver, gold or platinum certification. Nevertheless, we followed the LEED project checklist in order to determine whether or not our building is LEED certified, and if yes, what is its rating level.

We evaluated whether our building abides by the rules of the sections of the rating system, and established that five of them apply:
1-Enery and Atmosphere: : Hybrid Solar Panels to optimize building energy efficiency
2- Indoor Air Quality: The atriums and forum allow for natural ventilation, in addition to the all-air HVAC system
3- Sustainable Sites: Open space availability, dealing with rainwater, and heat island and light pollution reduction.
4- Water Efficiency: Rainwater management through the water collection system in the void. It is used to mitigate extreme rainfall events without increasing the capacity of existing sewer system, and to mitigate urban heat island problems. Rainwater is collected from the roof and voids on the ground floor, and redirected to a tank or cistern. It undergoes water treatment and a purification process before it is re-used.
5- Materials & Resources: Green roof & low CO_2 emitting EPD materials for building optimization
There are 93 LEED either certified or registered buildings in Switzerland, 1 LEED silver certification in Basel-Landschaft, and 1 LEED silver certification in Basel-Stadt. *Innovative Hub for Creative Minds is Basel's 3rd LEED certified building, and its rating level is Gold.*

BIC's Possible Points = 77, resulting in a Gold LEED certification

CONCLUSION

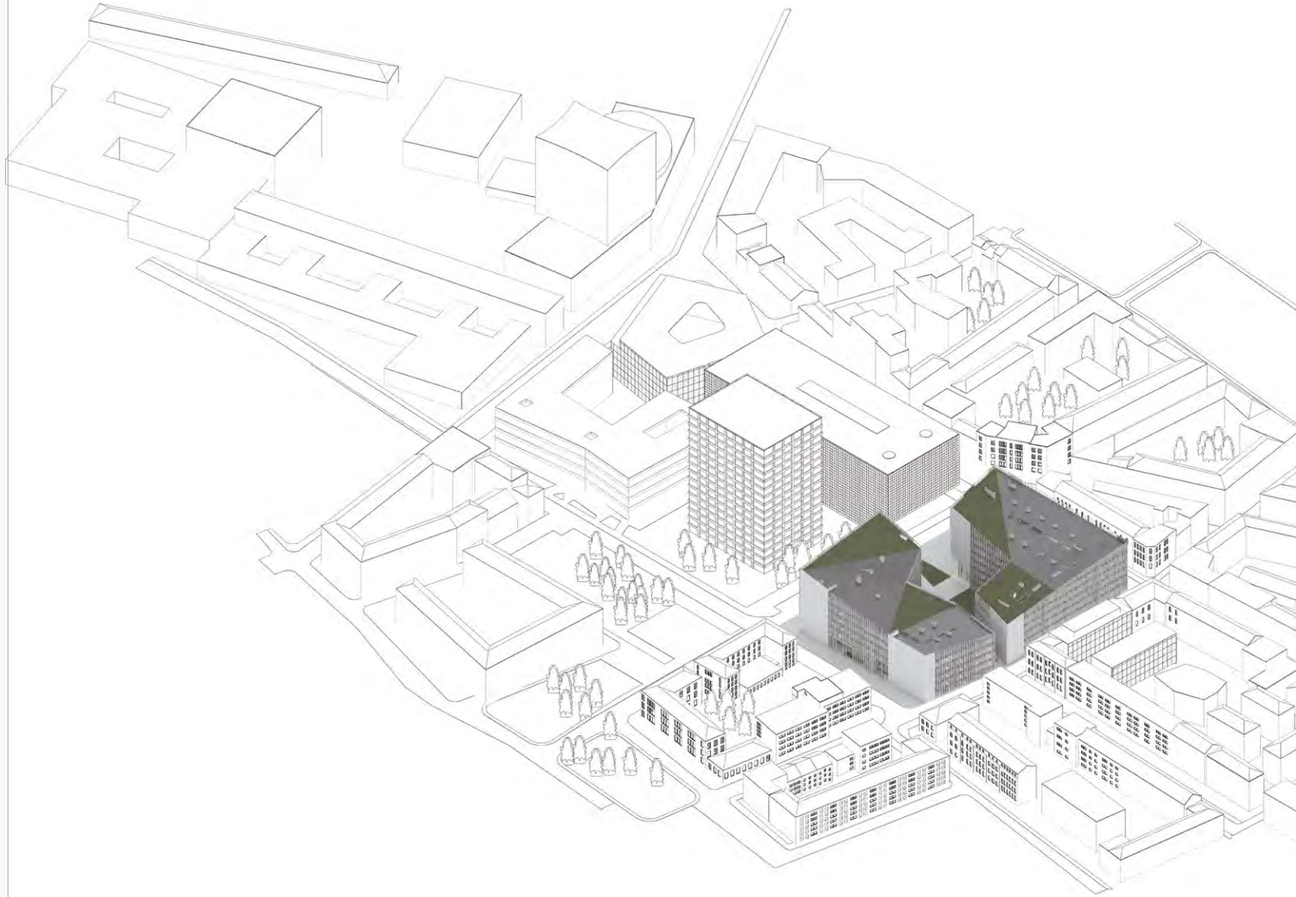
BUILDING IMPACT

CONCLUSION

‘INNOVATIVE HUB FOR CREATIVE MINDS’ IS A COMPLEX BUILDING, IN A COMPLEX SETTING, AND WITH COMPLEX REQUIREMENTS, BUT THE IMPACT IS EXPLICIT, EFFECTIVE, ELOQUENT, AND A CONTEMPORARY ‘LICHTHOF’ -AN INNOVATIVE URBAN SPACE...

FUTURE OF THE CAMPUS

CONCLUSION



We have ultimately reached the final curtain for 'Innovative Hub for Creative Minds'. The collaboration that includes specialists, stakeholders, and students, is the future of the University of Basel, and the main source of innovation; and the social hub that we have created left behind a great impact on the city of Basel by stitching the parts of the city that the campus divides. We tackled the university program requirements while simultaneously integrating a continuous 'architectural promenade' throughout our building, forming a duality of contemporary yet conventionally designed laboratories. This complex geometry, in due course, reflected the "Reimagined Urban Area" concept of an innovation center.
The heart of our building and our forum, the contemporary "Lichthof", is our communication hub that eventually displayed our intentions of having a clear, functional and spatial organization of the building. Our goal was to provide a powerful spatial experience by means of an architectural promenade throughout the building, and our forum, in order to break the conventional perception of 'scientific laboratories' and disclose the 'unexpected'.

"People make cities; it is to them, not buildings, that we must fit our plans"
– Jane Jacobs.

Our plans were made according to the booming innovation in the development of the pharmaceutical and bio-chemical industries in Basel, and our task was to provide the increasing number of scientists and researchers with adequate workspaces. Our design thrived in combining work and leisure moderately within our architectural building ensemble.
The end product of the one-year development project is not merely Plot n.4, it is the heart of the Life Science Campus, and the main linkage that allows for the continuous network throughout the porous campus. And our forum is the box, inside a bigger box (Physics department), which is inside the biggest box which is the University of Basel, all co-existing together as one entity, and significantly impacting the city of Basel, the Dreiland region, and Switzerland as a whole.

SCAN TO ENTER THE WORLD OF INNOVATION AND TAKE PART OF OUR HUB FOR CREATIVE MINDS

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