The Wall of Porta Romana

The BEIC Library of Milan

Thesis Project Booklet

Politecnico Di Milano_ AUIC School
Architecture: Building Architecture_**Thesis**

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Abstract

The thesis addresses the project of The Wall of Porta Romana in the complex context of Milan. It investigates the history, present, and future of Milan. This investigation is crucial because the project aims to revitalize not only Porta Romana as an independent entity but also the entire perimeter of Milan.

Libraries have evolved with time. They no longer solely serve the individual reader but also cater to the vast range of tools associated with the future library, serving the entire community.

Combining the important role libraries serve in the community as a knowledge hub and public space, witht the prominent historical location of Porta Romana, a landmark is born in Milan.

The development of the Wall of Porta Romana needed to embrace the idea of a long journey of a user inside the building, where the user would be captivated the not just architecture, but sculptural piece. This sculptural piece evolved through organic experimentation to achieve the flow and flexibility of a user, not just circulation or spaces, but visually as well.

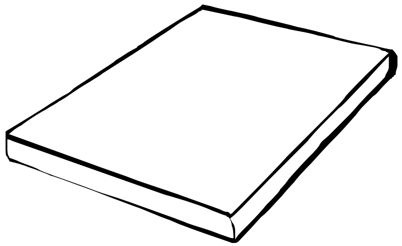
Beyond the sharpness and formailtiy of the Wall is designed with organic forms that are inclusive, extending as far as the eye can see, resembling a canyon.

Through this studio and project, we achieved coherence by integrating design, structure, and technology while always keeping in mind that we are constructing a library meant to endure for future generations. We made functional, technological, and even atmospheric choices for the library of the future. These choices were sometimes driven by the needs of the structure, sometimes by the needs of the users, and at other times by the needs of the city. We modernized the building technically for the “21st-century library” by implementing structural innovations, automation systems, and utilizing alternative sustainable materials.

We invite you to embark on a journey into The Wall of Porta Romana.

NF JDG ES

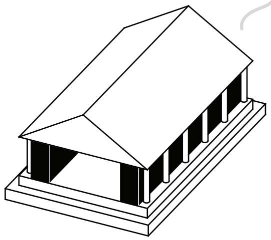
Theme



History of Libraries

Monastic Libraries
Middle Ages

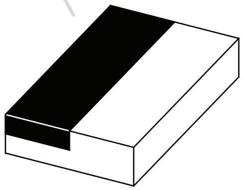
Dual purpose of storing manuscripts and were often integrated into monasteries.



Temple + Storage

Renaissance Libraries
16th Century

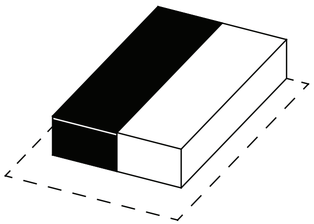
Private collections belonging to wealthy patrons or institutions and emphasized the display of rare manu-scripts and book.



Instituation + Private Storage

Early Modern Libraries
17th Century

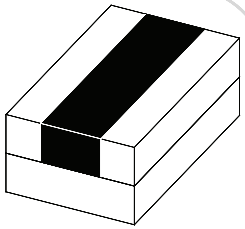
Serving scholars and became more accessible to the educated public.



Private Storage

Enlightenment Libraries
18th Century

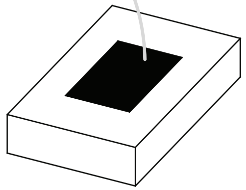
Expanded their services, catering to both scholars and a public audience. Layout emphasized functionality, with reading desks surrounded by bookshelves, representing the Enlightenment ideals of knowledge.



Public Storage + Reading Spaces

Academic Libraries
19th Century

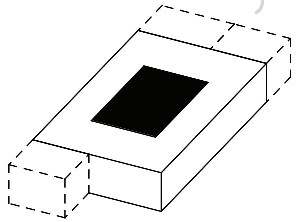
The 19th century saw the rise of public libraries and academic libraries, often featuring separate reading spaces and storage areas.



Classical Typology Expanded

Modernism and Functionalism
20th Century

Libraries continued to expand, often incorpo-rating separate spaces for reading, storage, and administrative functions.



Functions Addition (Expandture)

Going from a storage space to a whole cultural instituation and community figure.

Community Based Library

21st Century Library

Emphasize sustainability, accessibility, and integration with the community.

Evolved into multifunctional spaces, incorporating reading areas, digital resources, collaborative spaces, and sustainable features.

Library Functional Needs

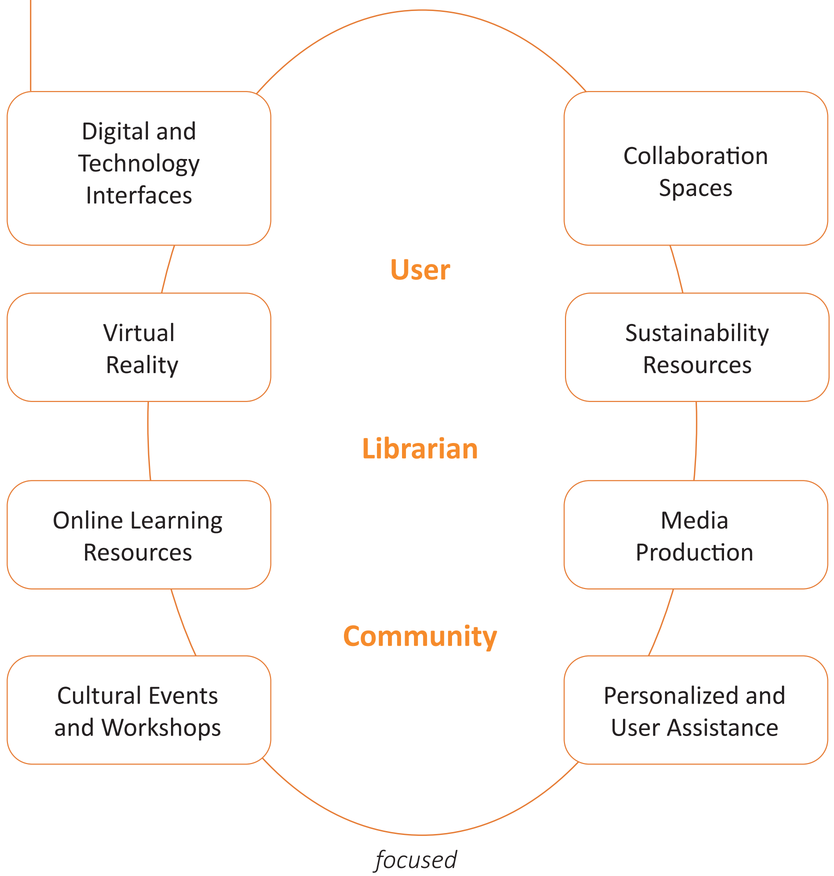
20th Century

Static Functions

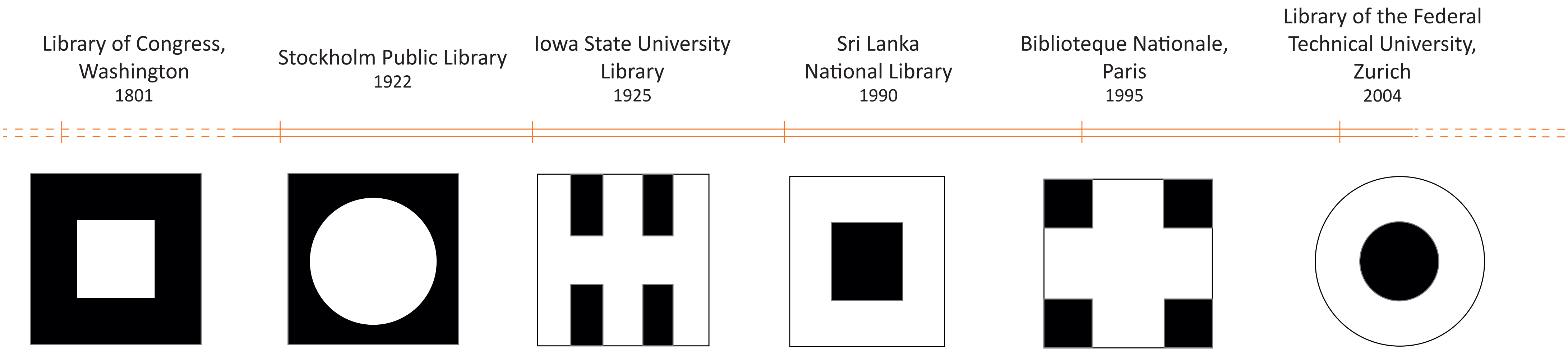
Focusing on printed materials, quiet study environments, and the central role of librarians in assisting users manually.

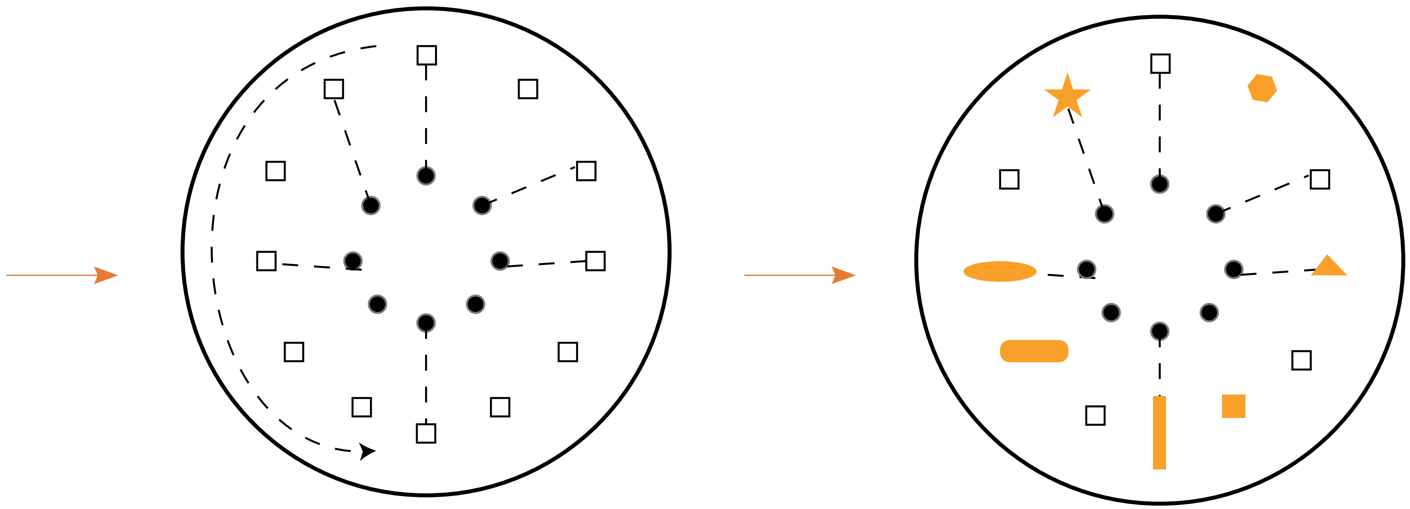
21st Century

Dynamic Functions



Typology Evolvment



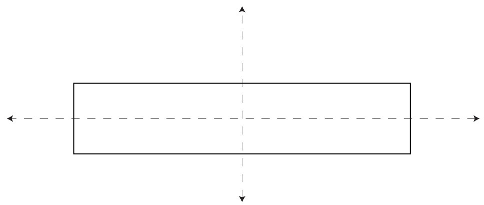


From the beginning of the 19th century to the current 21st century, library typologies have focused on concentrated radiality as a form of distributing Reading Spaces and Book Shelving spaces. As shown previously, library functions have expanded beyond the mere need for reading spaces and book storage, which encourages the experimentation of potential library typologies.

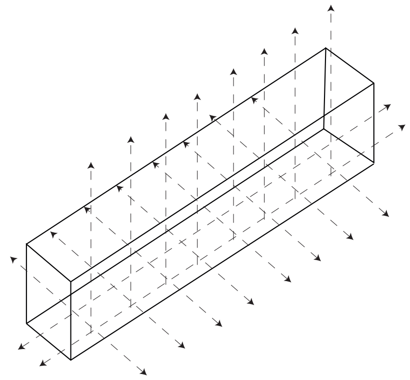
Book Stack areas Reading Areas New Functions

Re-Intrepretation of the 21st Library

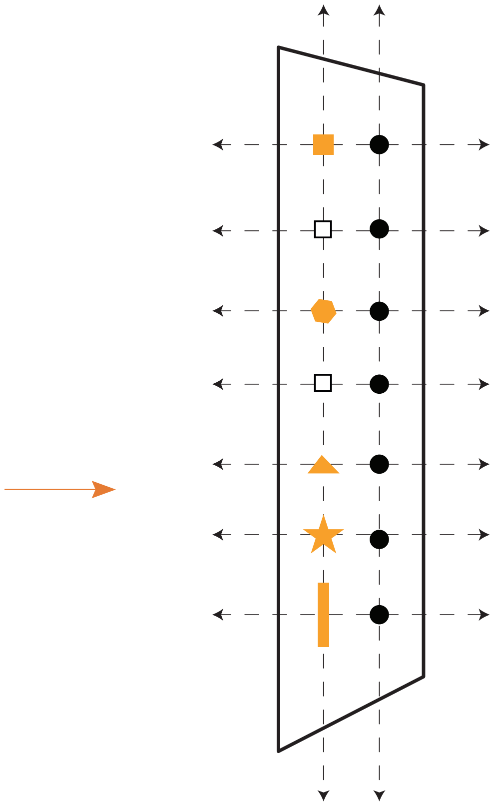
21st Library Functions



Horizontal Flow through the Library



Vertical Flow through the Library



A horizontal line signifies a journey that guides a person from one function to another, providing a linear distribution for the library's updated functions. This horizontal flow transforms within a volumetric form into a vertical flow as well. Both vertical and horizontal flows should be observed not only in circulation but also visually.

This **flow** isn't confined to the interior alone, but extends to the exterior as well. Flow occurs from within to the outside, establishing connections between the interior and the exterior, achieving permeability with the surroundings and the user inside.

The Future: BEIC - European Library of Information and Culture in Milan, Italy Competition

BEIC
BIBLIOTECA EUROPEA
DI INFORMAZIONE E CULTURA

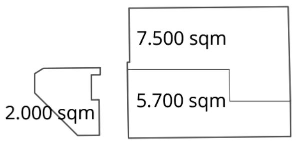
Figure 2.6, 2023 Competition Poster

Aims to go beyond the traditional functions of a library to become a laboratory for the tools necessary to create contemporary culture.

Tools

- Auditorium
- Imaginarium
- Forum
- Digital Deparments
- Deparments
- Automated Central Stroage

A commission of five members, representatives of the Municipality of Milan, the BEIC Foundation, the Orders of Architects and Engineers of Milan.

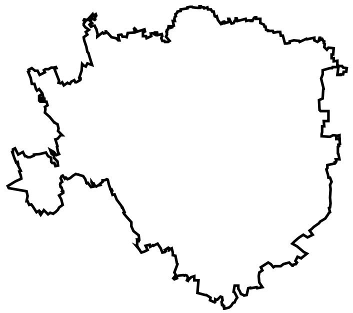


The BEIC library competition began in 2020 with the aim of selecting a winning architectural proposal for the upcoming European library in Milan.

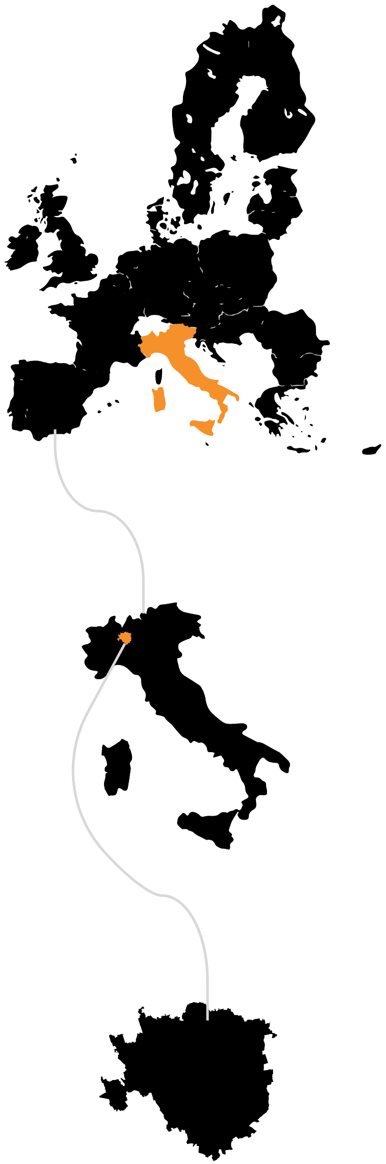
The guidelines and criteria for winning involve presenting innovative architectural and functional solutions that blend traditional library services with contemporary digital resources.

Throughout the project's development in designing the Wall of Porta Romana, the BEIC Library's guidelines and vision were consistently considered as guiding principles. These principles mirror the future library's functionalities and tools in today's digital age.

Milan



"There are cities of evident beauty that give themselves to everyone, and secret ones that like to be discovered. Milan is one of those (...)" - Carlo Castellaneta



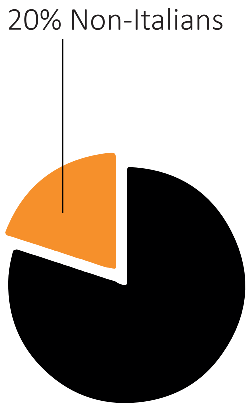
Why in Milan?

Milan’s international prominence also positions it as a prime candidate to represent Europe in the establishment of future advanced academic and cultural institutions. Given its current status as a hub for finance, culture, and education, Milan stands as a compelling example of Europe’s commitment to pioneering institutions that drive societal progress.

Milan’s proven track record as a home to renowned universities, research centers, and artistic hubs underscores its capacity to nurture innovation and academic excellence. The city’s vibrant cultural landscape, coupled with its rich historical context, provides an ideal backdrop for the development of advanced cultural and intellectual establishments that can leave an indelible mark on the global stage.

Capitalizing on its strategic location and cosmopolitan ambiance, Milan has the potential to serve as a blueprint for Europe’s aspirations in establishing cutting-edge academic and cultural spaces. The city’s seamless fusion of tradition and modernity further solidifies its suitability to embody Europe’s vision for the future of learning and creativity.

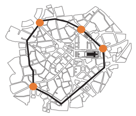
With Milan’s ongoing attraction of a diverse community of scholars, artists, and professionals from around the world, its capacity to symbolize Europe in constructing advanced academic and cultural institutions becomes even more evident. This representation not only aligns with Milan’s current role as a global hub but also bolsters Europe’s stature as a leader in intellectual and cultural pursuits.



Morphology and Urban Rings

3rd Century

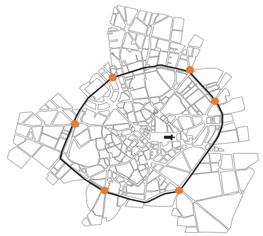
Roman Walls



The Roman walls portrays the Mediolanum Wall, a defensive fortification that encircled the ancient city. This wall, built during the reign of Emperor Maximian, delineates the boundaries of the Roman settlement and offers insight into the strategic layout of the city during that era.

12th Century

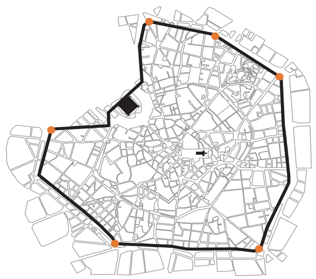
Medival Walls



These walls were constructed to safeguard the city from potential threats, offering a snapshot of how Milan was fortified in the past.

16th Century

Spanish Walls



The Spanish walls of Milan, created between 1546 and 1560, are shown on maps as a defensive structure encircling the city. Built during the Spanish rule, these walls demonstrate how Milan was fortified in the 16th century for protection and control.

20th Century

Beruito's Plan Layout

Known as the "Piano Regolatore Generale di Milano" was an urban plan developed for the city of Milan, in the early 20th century. Created by the architect and urban planner Piero Portaluppi under the direction of Giuseppe Beruto, the plan aimed to modernize and reorganize the city's urban infrastructure and layout.

Gates — Wall

The Existing

The Walls and Gates

Roman Walls

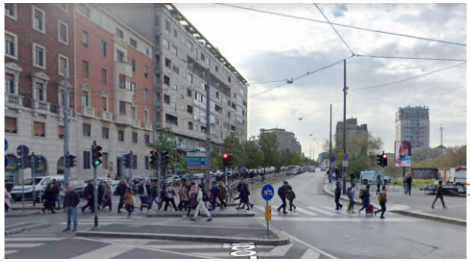
Via Medici

Medival Walls

Pusterla di Sant'Ambrogio

Spanish Walls

Porta Romana



Beruto's Plan

Viale Lodi

The traces of Milan's protective gates and borders have profoundly influenced the city's present-day layout. Over the years, it has been a customary practice to mark and conserve these traces, notably by incorporating the existing walls into new constructions and designating the gates with twin buildings (which will be further elaborated upon in the subsequent sections of this paper).

Exceptionally, Beruto's plan is merely an urban development plan which covers an infradtructural layout rather than a wall layout. Previouly shown in the Beruto's Plan, Piero Portaluppi has aimed to reorganize the urban infrastructure within the city and beyond the city limits.. The relation to the outside has created these gates and primary roads connecting to neighboring cities and countries, such as Rome, Genoa, Venice, Turin, Switzerland, and France.

Viale Lodi has shown to be the main road that connects Milan to the outer city, Rome. Highlighting this road plays a crucial role in the city's overall planning, aiming to underscore and extend its historical significance.

Throughout this paper, Viale Lodi, which serves as the border road to the Porta Romana Site, will be a key element in marking the placement, architecture, and community role of future european library of Milan.

Milanese Architecture - Twin Buildings

Twin Buildings represent a Milanese architectural style evident in various historical and modern landmarks across the city. These structures consist of mirrored buildings placed on either side of a road, often resembling towers with the road acting as a gateway. Delving into history, as previously mentioned, Milan has a historical connection with old urban rings ranging from Roman to Medieval to Spanish eras. These rings have been historically represented by walls, featuring only a few entrances.

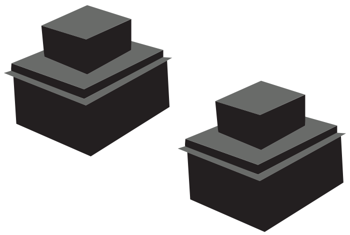
In the contemporary context, these entrances or “Portas” are embodied in architecture through twin buildings. These dual structures are frequently located where historical “Portas” once stood. Their grand entrances are flanked by identical edifices, inviting visitors to explore the elegance within.

This architectural style has spread extensively, to the point where twin buildings are now associated with Milan’s cultural identity. This trend has become so ingrained that at times, a “Porta” isn’t a prerequisite for twin buildings, as demonstrated in Piazza Piemonte 1923. **While some entrances themselves do not have twin buildings representations, shown in Porta Romana.**

Milanese Architecture - Twin Buildings Typologies

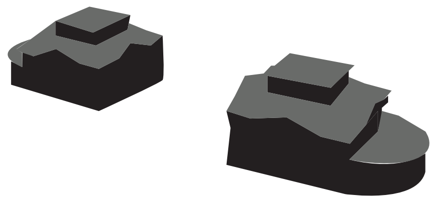
1810

Caselli di Porta Sempione



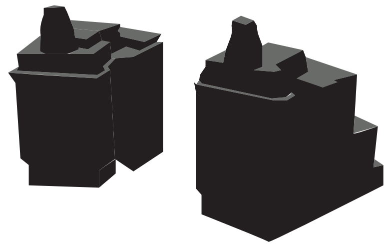
1815

Caselli di Porta Sempione



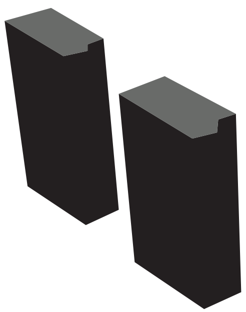
1923

Porta Piemonte



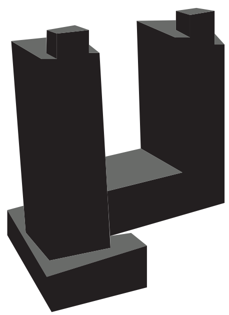
1960

Largo Quinto Alpini, 13



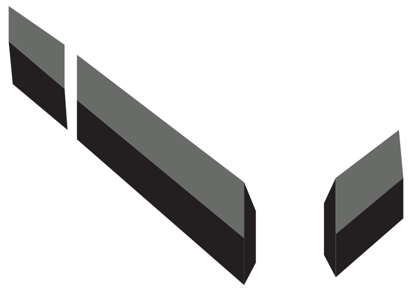
1992

Torri Garibaldi - Porta Garibaldi



2016

Feltrenelli - Porta Volta



Transporation System Connectivity

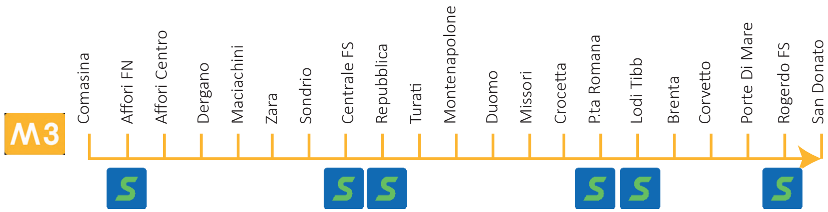


Figure 3.5, Milan metro and train station around Milan with an emphasis on Lodi Metro Station in Porta Romana. Lodi also included a train station.

City Connectivity and Landmarks

Transporation Method to

Foundazione Prada	2m Walk
Linate Airport	7m Train + 7m Bus
Central District	14m Metro
Citylife	25m Metro
Monumentale	23m Metro
Centrale Station	12m Metro
San Siro Stadium	32m Metro
Politecnico Di Milano	14m Bus

Figure 3.6, Landmarks and Main institutions around in Milan distribution with respect to Porta Romana.

Present Milan

Academic Institutions

Public/National Libraries

1 Oglio
2 Calvairate
3 Tibaldi
4 Sormani
5 Fra Cristoforo
6 Chiesa Rossa
7 Valvassori
8 Venezia
9 Sant Amborgio
10 Sicilia
11 Lorenteggio
12 Harar
13 Zara
14 Accursio
15 Villapizzone
16 Baggio
17 Gallaratese
18 Dergano Bovisa
19 Crescnzago
20 Niguarda
21 Affori

Bibliobus Stop

University Libraries

1 University Bocconi Library
2 University of Milano Library
3 The Philosophy Library of the University of Milan
4 Library of Polo di Lingue e Letterature
5 University of Milano: Library of Political Science
6 Biblioteca del Dipartimento di Scienze della Terra Ardito Desio.
7 Biblioteca di Scienze Agrarie e Alimentari
8 Polimi- Leonardo Campus Library
9 Biblioteca di Scienze del Farmaco
10 Istituto Lombardo Accademia Di Scienze E Lettere
11 Polimi- Bovisa Candiani Library

Libraries and Cultural Institutions

Distance

10 IED
3 Bocconi University
8 University of of Milano Educational
4 University of Milano
11 NABA
9 Collegio Di Milano
6 IULM University
5 Catholic University of the Sacred Heart
1 Politecnico Di Milano- Leonardo
2 Politecnico Di Milano- Bovisa Campus
7 University of Studenti of Milano Biocca

University Residences

Transporation System Connectivity

Lambrate 70,000 m2

Farini-Lugano 620,000 m2

Porta Romana 210,000 m2

San Cristoforo 159,000 m2

These areas, once abandoned industrial sites in Milan, require rejuvenation.

The city aims to transform these spaces, particularly the disused railway yards, into vibrant hubs. The goal is twofold: restore the environment's quality and revitalize Milan's urban fabric.

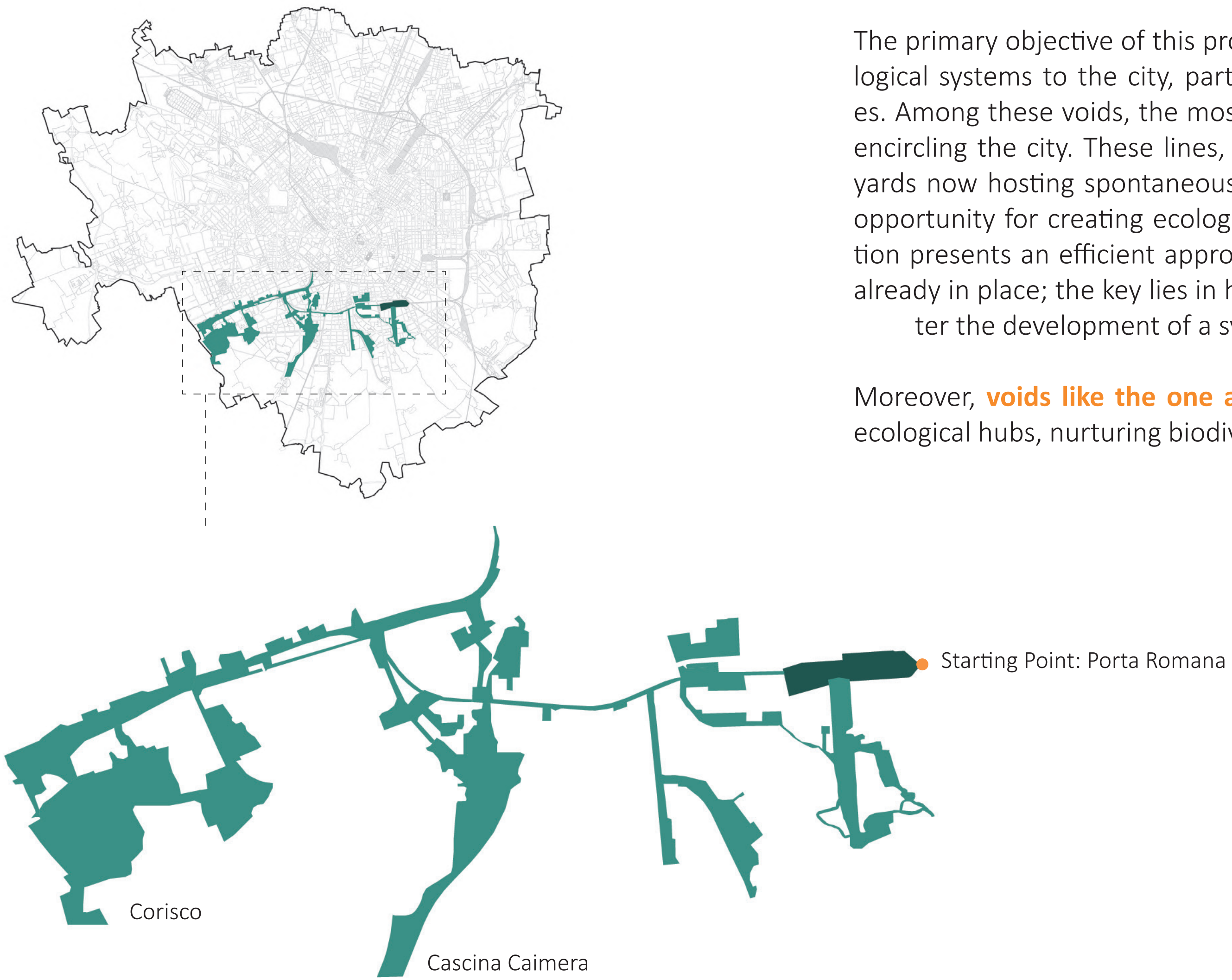
The project spans various city zones, focusing on creating green spaces, enhancing the railway system, and establishing new public areas.

Ultimately, this initiative aims to meet housing needs, foster social diversity, and contribute to Milan's sustainable growth.

PGT Piano di Governo del Territorio

The "Piano di Governo del Territorio" (PGT), translated as the "Territorial Government Plan," is a comprehensive urban planning document that outlines the vision, strategies, and regulations for the development and management of a specific area within a city. In the context of Milan, the PGT Milano 2030 is a significant urban planning initiative that lays out the city's developmental framework up to the year 2030.

Green Rail Project



The primary objective of this project is to introduce green ecological systems to the city, particularly within its empty spaces. Among these voids, the most promising is the railway lines encircling the city. These lines, along with abandoned railway yards now hosting spontaneous vegetation, offer an excellent opportunity for creating ecological corridors. This transformation presents an efficient approach as the circular structure is already in place; the key lies in harnessing this potential to foster the development of a synanthropic environment.

Moreover, **voids like the one at Porta Romana** can serve as ecological hubs, nurturing biodiversity and allowing it to thrive.

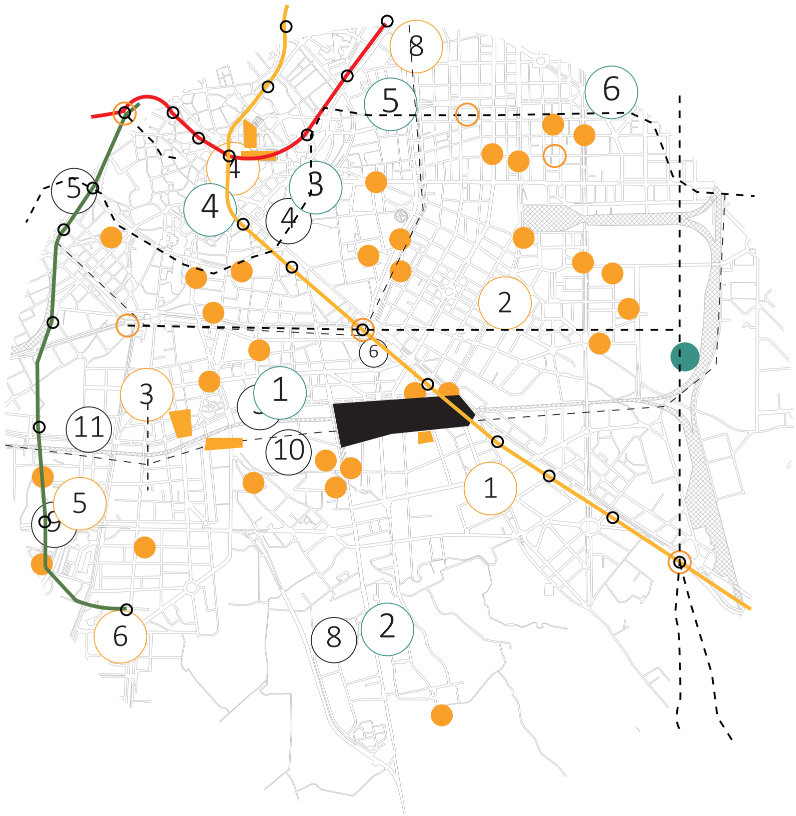
Overall Connectivity and Regeneration of Abandoned Plot

Present Railway Situation

Future Regeneration of Plots into Public Spaces and Green Areas

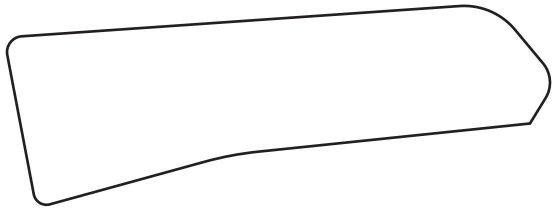
Currently the rail yards have created a gap in the urban fabric of Milan, turning its perimeter into a series of abandoned islands. This created a somekind of fragmentation in the city of milan. Future Milan proposes a regeneration of these rail yards into public spaces and green areas, uniting the different zones together and creating a green perimeter.

Porta Romana



Why in Porta Romana?

1. Situated in historically significant locations in Milan, specifically within Beruto's Plan's Urban Ring.
2. Well-connected areas through transportation in Milan include the yellow line of the Lodi Stop and the Porta Romana train station, primarily.
3. In close proximity to the landmarks around Milan, offering easy transportation between them.
4. Highlighted in the PGT as an area with high development potential, the Porta Romana program is founded on principles of temporality, flexibility, and sustainability, derived from the new PGT Milano 2030.
5. The future starting point of the Green Rail Project.
6. In close proximity of the academic and cultural institutions around Milan.

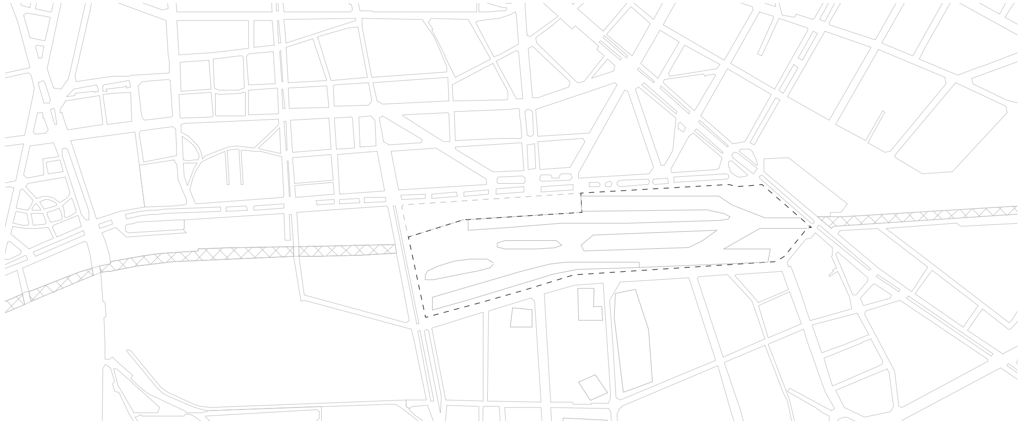


Masterplan

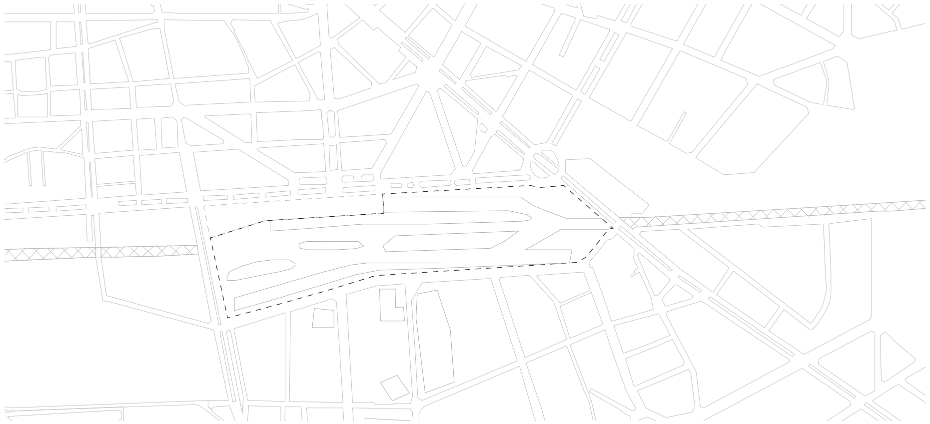
Site Evolution

1900

1945



2000

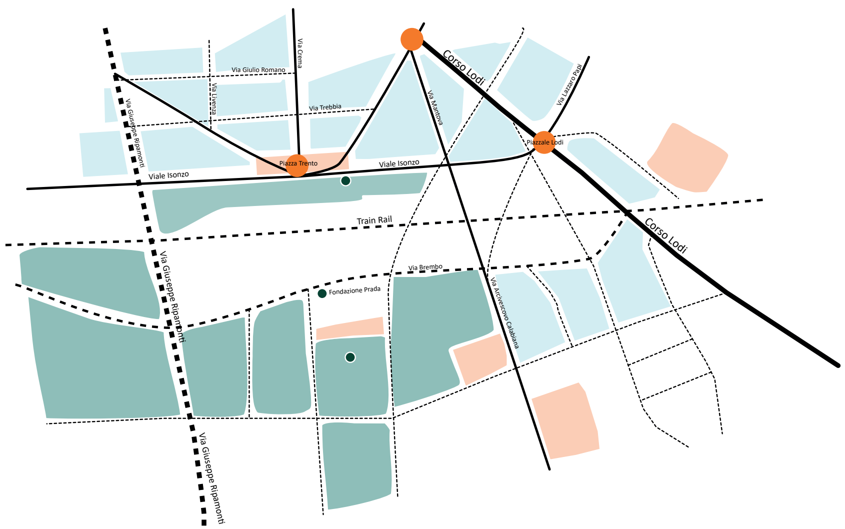


2020

Shown in the morphology study of porta romana in the last decade that this plot has always been concieved as a railway yard. The site is 200,000 m2, an abandoned island in the urban fabric of milan. Being the element which seperates the old residential zone of milan with the new industrial zone, porta romana is the gap which is found on the perimeter of Milan.

Figure Ground

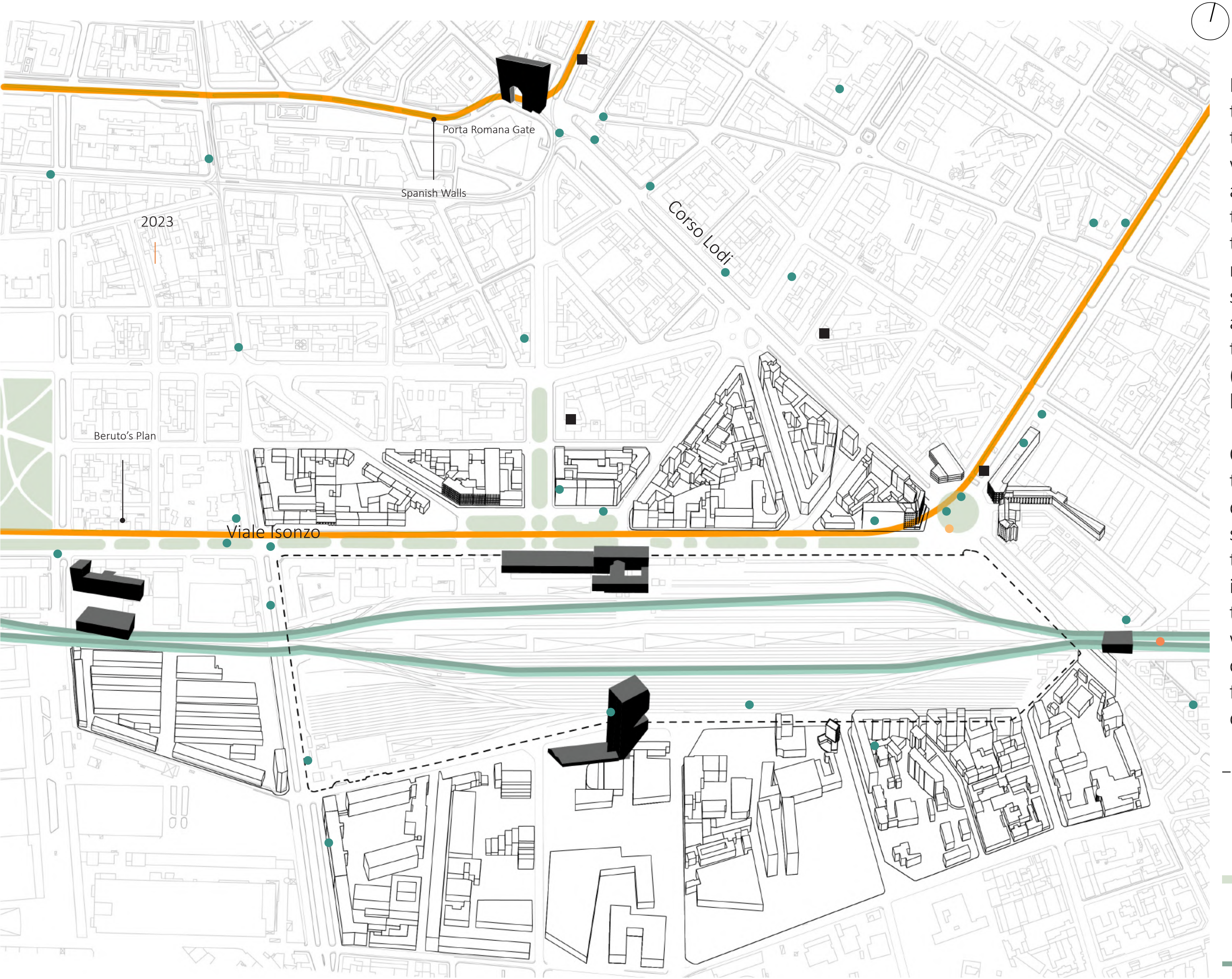
In order to harmonize with the rhythm of occupancy and voids in the Porta Romana area, the Library and the entire Masterplan were designed to fit the void left by the train station. Objectives such as filling the void to the southwest of Piazzale Lodi, maintaining the facade continuity along Viale Isonzo, and continuing the axis created by the historic buildings at Piazza Trento were identified through this analysis.



Kevin Lynch Study

After the Figure Ground analysis, regions on the map were delineated with colors to understand the functions of the building stock surrounding the workspace (differentiating between residential and industrial areas). The roads defining the city's main arteries were further emphasized, and how the Masterplan could complement these routes was determined on this map. Interesting areas around the workspace and major public transportation points were highlighted.

- Nodes
- Train Trail
- Site Limit
- Low Frequent Circulation
- Medium Frequen Circulation
- High Frequent Circulation
- Green Areas
- Offices/Industrial
- Residental



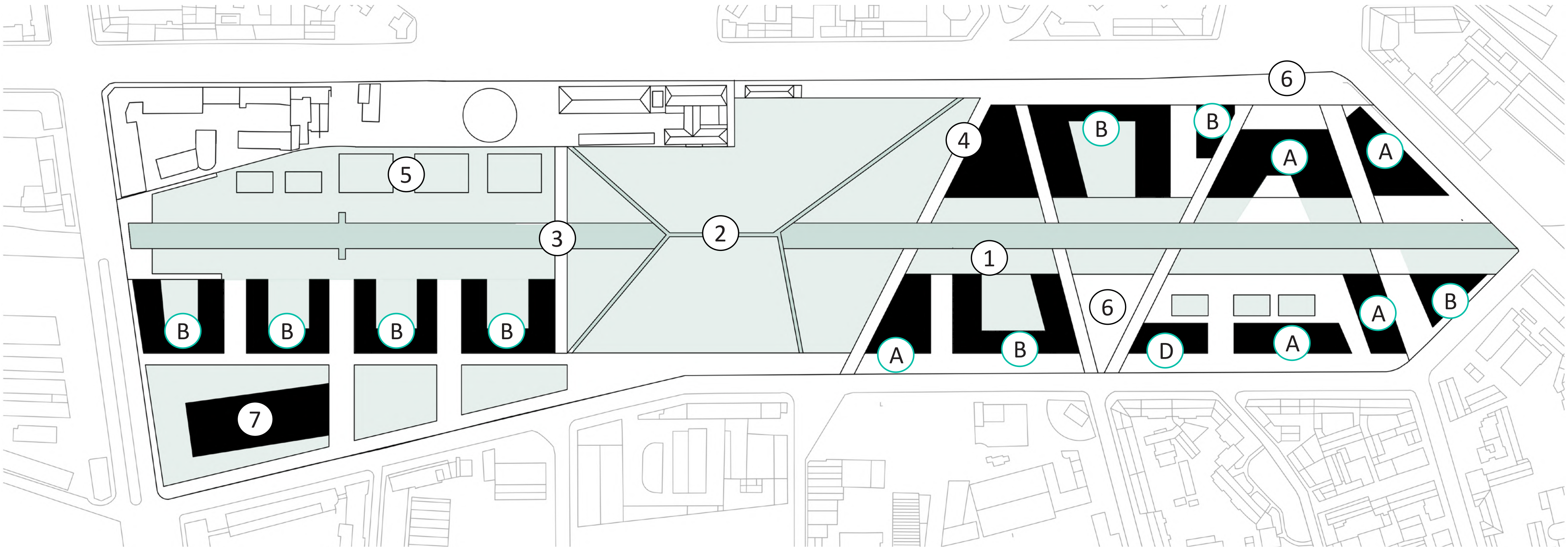
From the twentieth century to the present, a train station with the same name was established in this area, accompanied by a substantial space designated for train parking and interconnections. Currently, the train station faces low foot traffic and considerable deterioration due to external factors (climatic and natural) and human activities.

Owing to its strategic location, the area hosts various distinctive uses and spaces, such as the Prada Foundation area. Moreover, there is a Metro station and multiple streetcar and bus lines, which, together with its central city position, have fueled extensive real estate development in the site.

- - - Site Limit
Bus Stops
Metro Stops
Train Stops
Vigitation
Significant Places
Bike Sharing Points
Train Track

Regeneration of the Porta Romana Railway Area in Milan Competition Masterplan

The international competition for the preparation of the regeneration masterplan of the Porta Romana Railway Yard is part of the Program Agreement signed by the Municipality of Milan, the Lombardy Region, the Italian State Railways (with the Italian Railway Network and FS Sistemi Urbani) for the redevelopment of the seven disused railway stations (Farini, Porta Romana, Porta Genova, Greco-Breda, Lambrate, Rogoredo, San Cristoforo) in Milan. This is one of the largest urban regeneration plans that will affect Milan and stands as one of the largest projects to mend and enhance the territory in Italy and Europe. **Winners include Diller Scofidio + Renfro, PLP, Carlo Ratti, Arup, and OUTCOMIST.** This group reanimates the area with contemporary programs centered on an ethos of sustainability, rethinking a large railway yard and stitching together a fragmented urban realm.



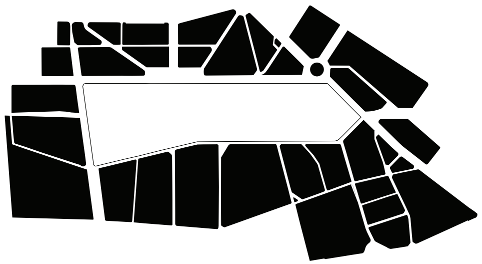
Public Space

1 Eco-Zone
2 Campo Selvatico
3 Highline
4 Floating Bridges
5 Sports Camp
6 Public Piazza
7 Olympic Villiage

Private Spaces

A Office
B Residential / Social Housing
C Commercial
D Incubator
E Multi-Functional

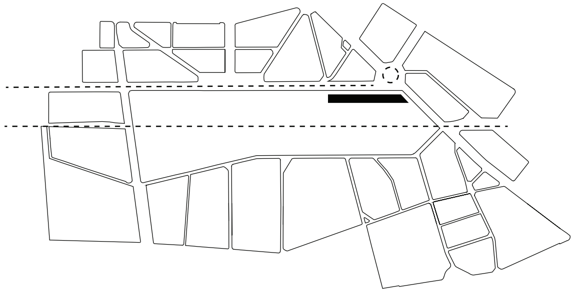
Masterplan Interpretation and Aim



The Porta Romana site has been perceived as an abandoned island, creating a void in Milan's urban fabric.
On an urban scale, it functions as a separating gap between the two sides of the plot.

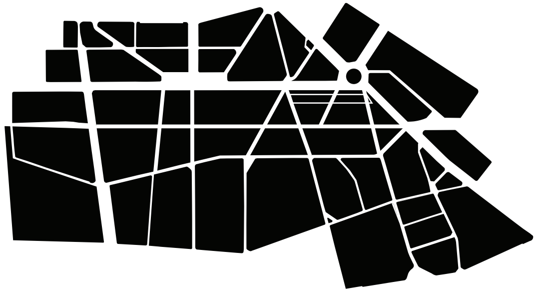
Regenerating the site presents an opportunity to unify the urban surroundings and leverage its extensive scale to return it to the community.

1



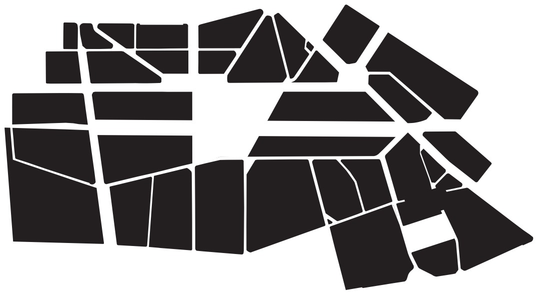
Honoring the condition and horizontality of the site, ranging from the railway line passage to the geometry of the site.

2



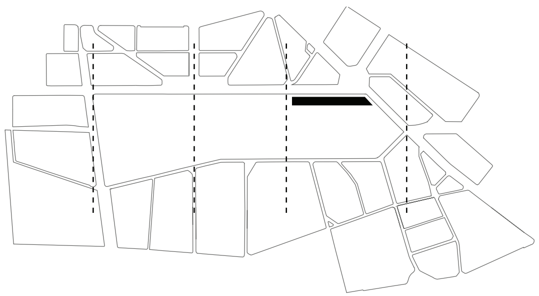
Establish permeability across the site to create a distinct pathway that connects various nodes and axes around the site.

3



Creating a clear boundary for open green spaces vs built area spaces.

4



Segmenting site functions to establish separate zones that can accommodate diverse audiences.

Legend

Functions

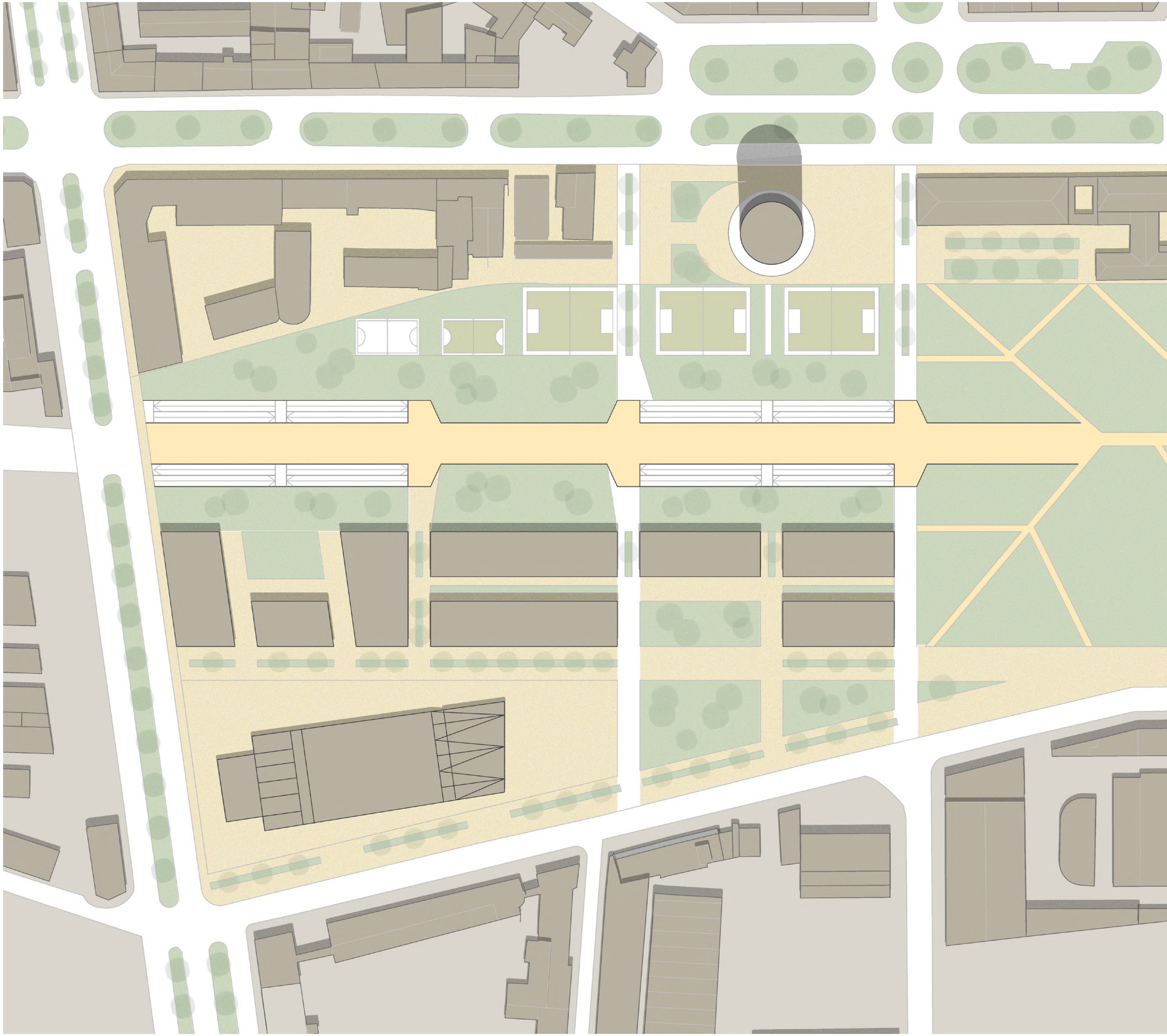
1. Residential
2. Offices
3. Commercial
4. Incubator
5. BEIC Library

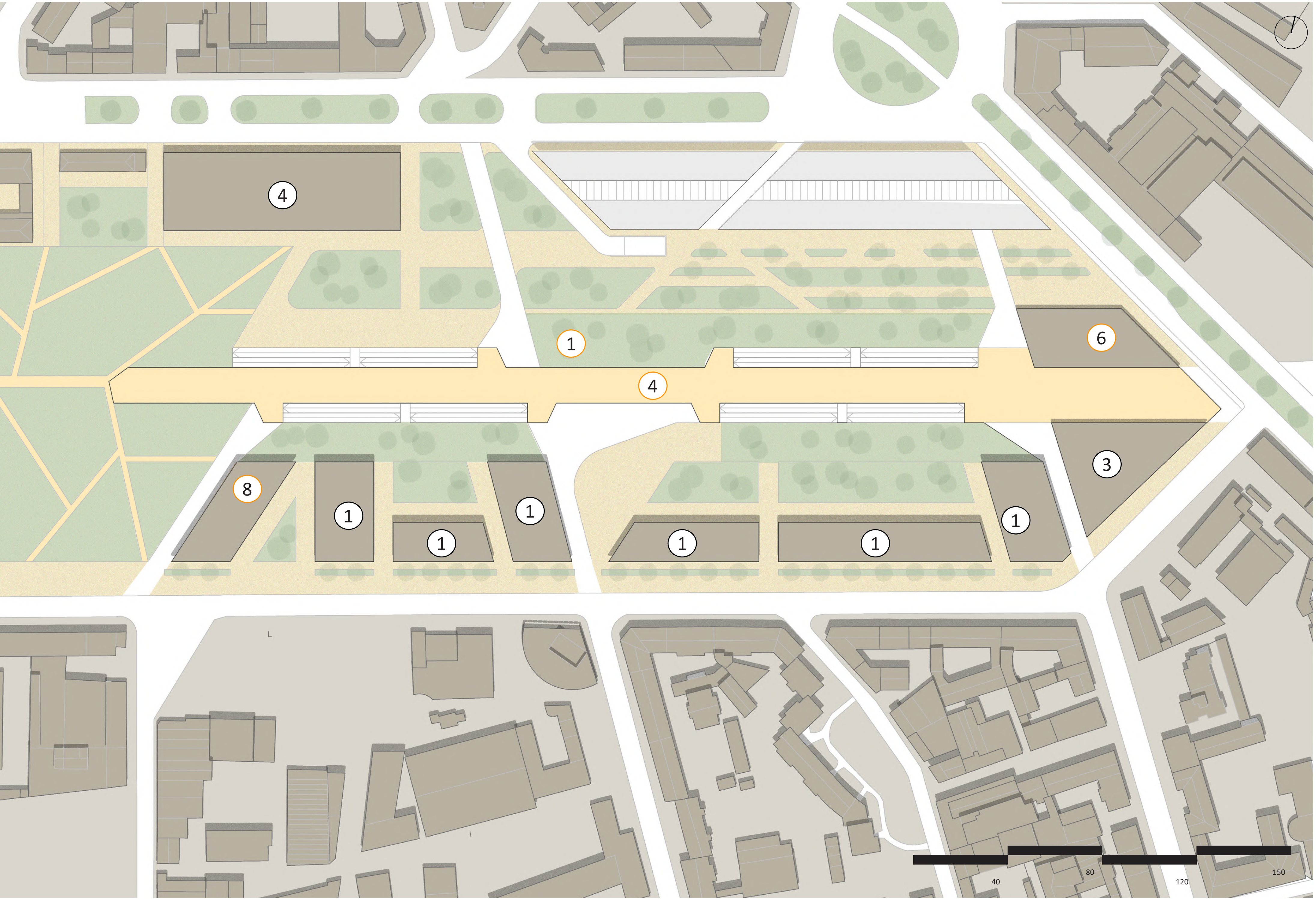
Existing

1. Ex-Industrial Building
2. Foundazione Prada
3. Residentail Blocks
4. A2A Skyscrapper
5. Piazza Lodi
6. Piazza Trento

New

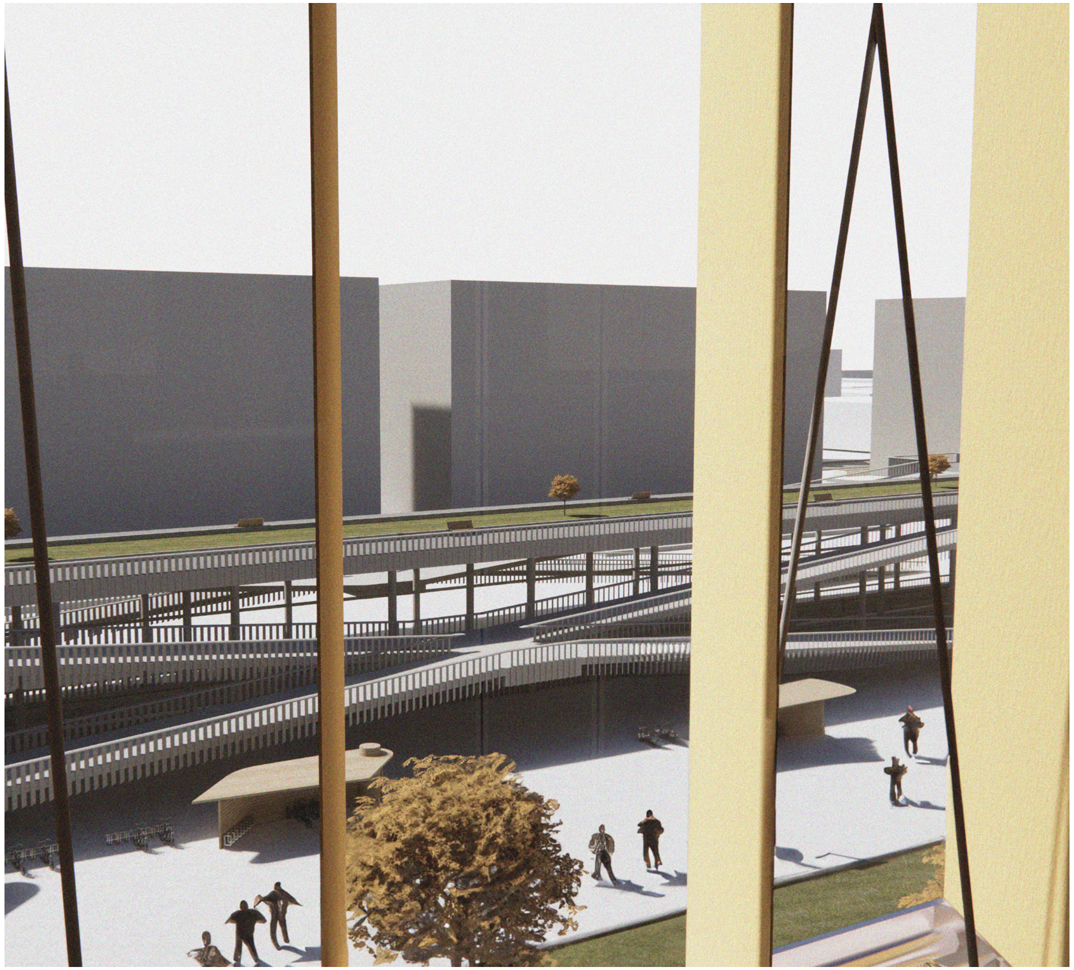
1. Eco-Zone
2. Public-Park Hill
3. Sports Camp
4. Highline Park
5. Railway
6. Porta Romana Train Station
7. Olympic Village
8. Prada Offices




4
1
6
4
3
8
1
1
1
1
1
1
40
80
120
150

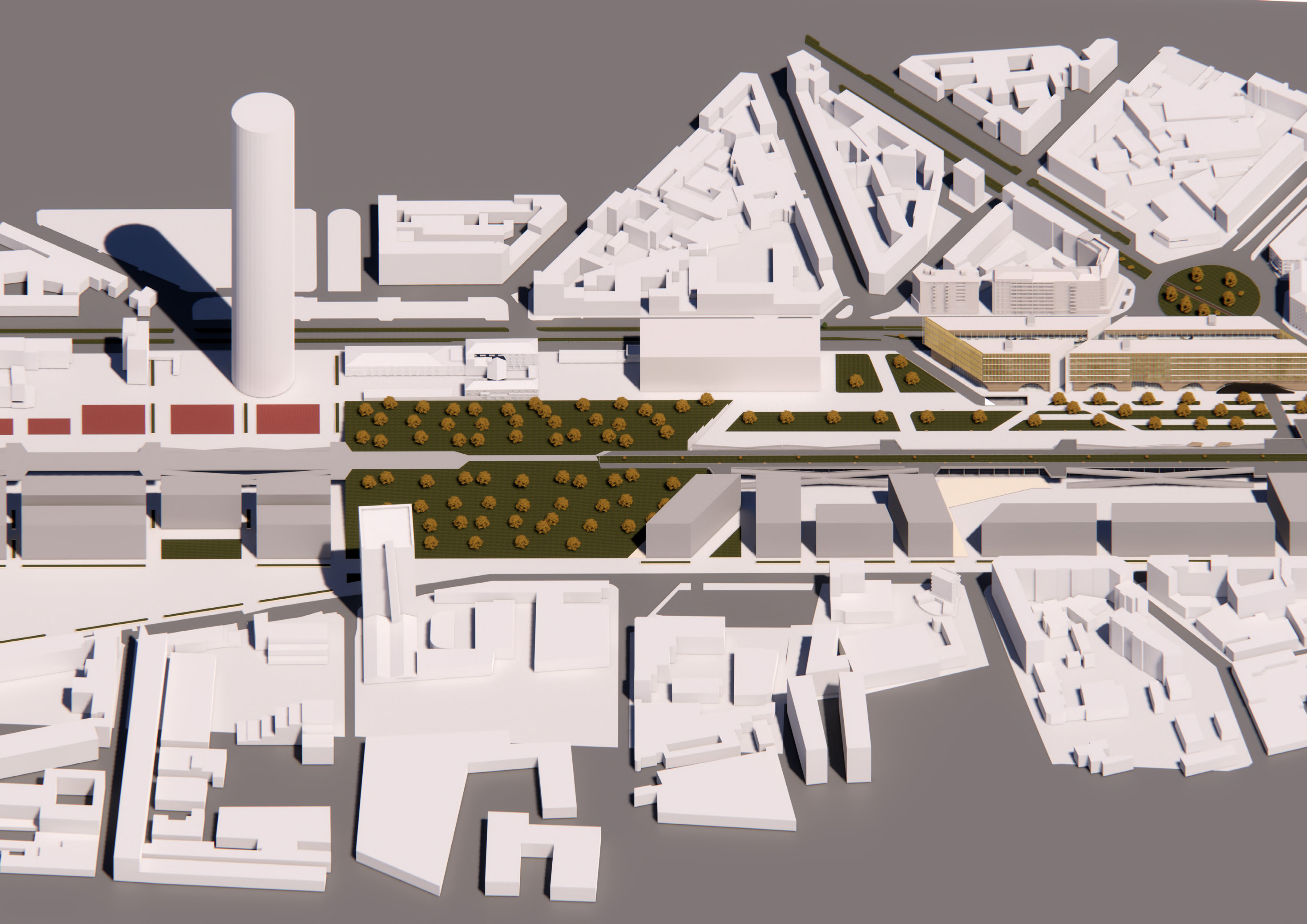
BEIC Library Backside

Porta Romana Train Station

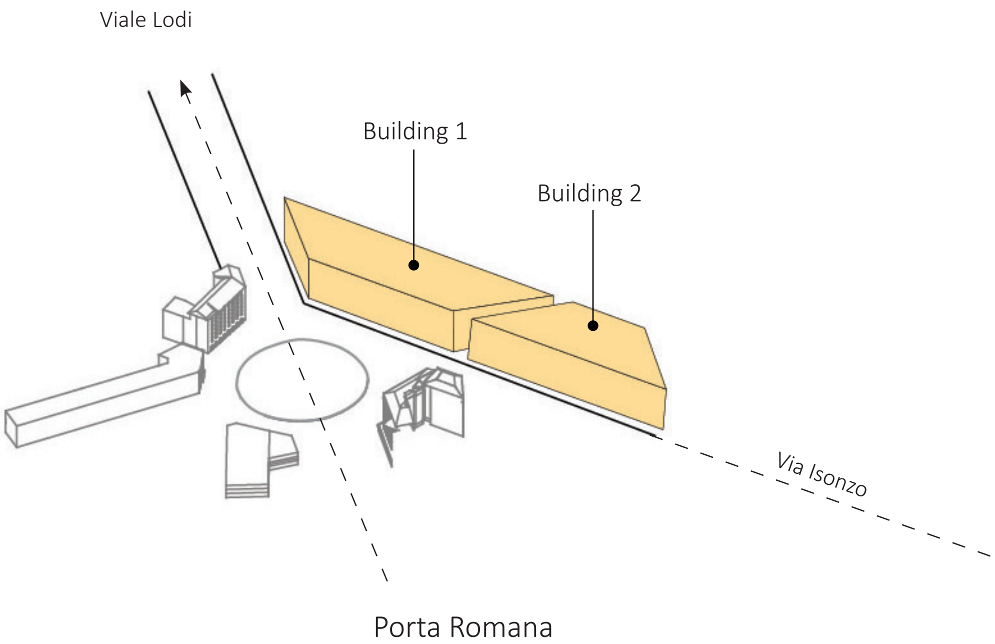


The Highline Park of Milan

This bridge, which runs parallel to the train tracks and was present in the previous masterplan, offers green spaces, pedestrian areas, and bicycle lanes on top of it. Starting from Porta Romana, one can walk along this bridge to various points in the city without the hassle of vehicle traffic, enjoying a tree-lined green path. Our library is strategically located at the beginning (and end) point of this route.the structure to charge the bicycles. This design takes advantage of the extensive park pathways that extend to the center of Milan, thanks to the Highline in the Masterplan. With an electric bicycle, one can access a third of the city, including the Duomo Square, within 15 minutes. These stations also offer the option to rent electric transportation vehicles, in addition to books, through a system like "Borrow Urban Transportation" from the Library.



General Placement

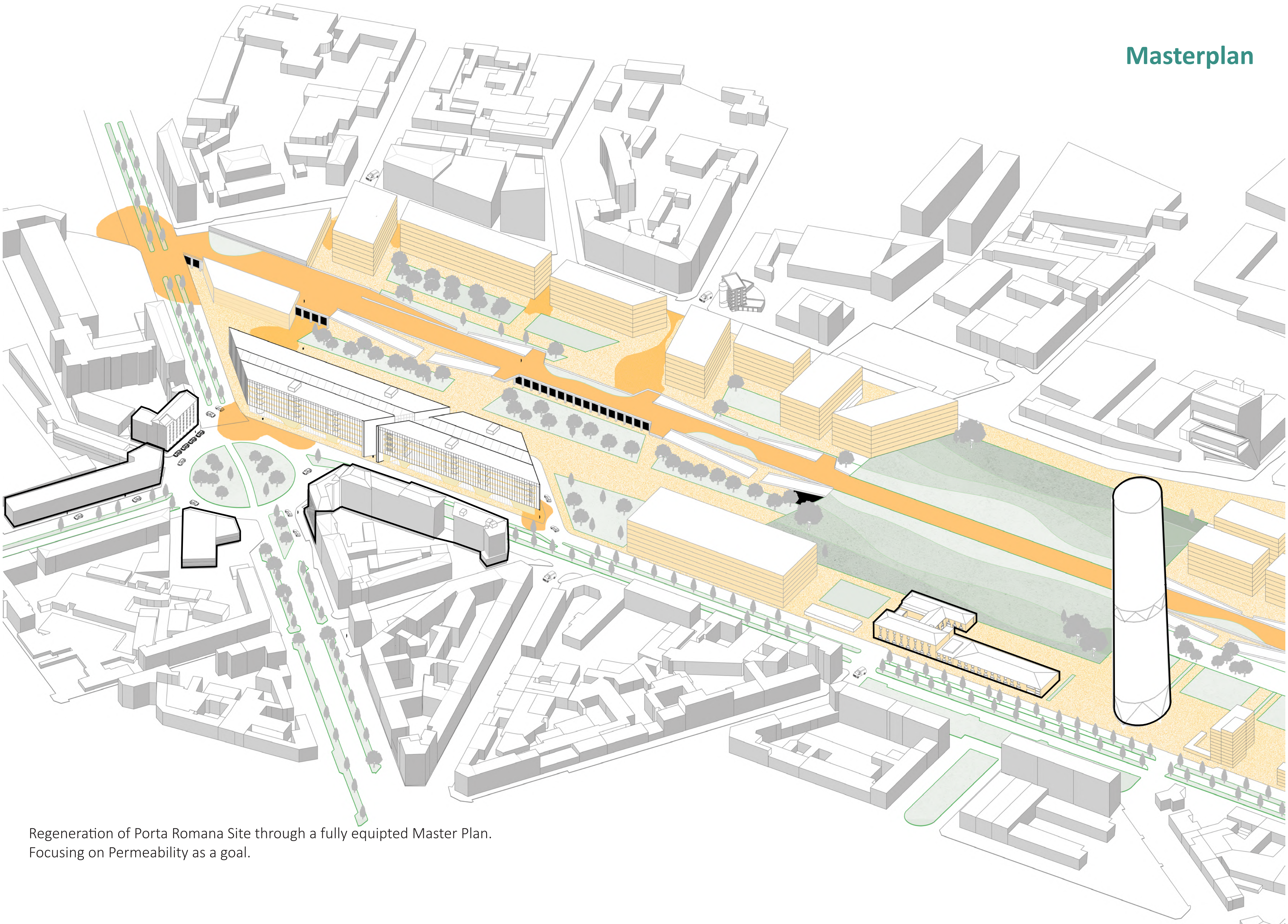


By merging the masterplan strategy of establishing total permeability at the Porta Romana site with its historical significance, the volume undergoes a transformation, resulting in twin buildings.

Twin buildings symbolize Milan's collective urban and volumetric entrance. They depict the gateway not only from Viale Lodi to Rome but also from the Porta Romana site to the masterplan itself.

This approach encompasses Milan's historical narrative through strategic placement and architectural language.

Masterplan

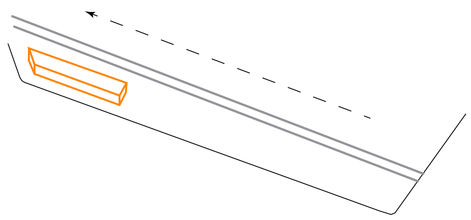


Regeneration of Porta Romana Site through a fully equipted Master Plan.
Focusing on Permeability as a goal.

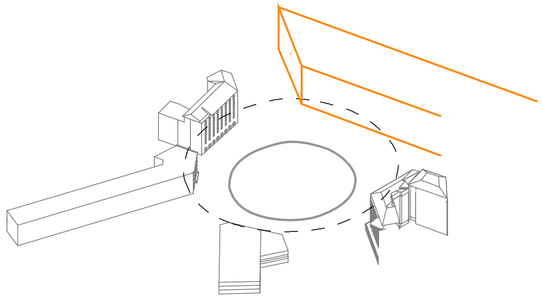
The building is situated at the crossroads of Viale Isonzo and Corso Lodi, facing the traffic circle and Piazzale Lodi. Besides its role as a road-facing wall and its corner development in alignment with the existing and proposed urban layout, this site serves to enclose Piazzale Lodi, regenerating the area.

This position aims to harmonize the project and master plan with the city through numerous axes aligned with the roads aside from the direct connection with piazza lodi.

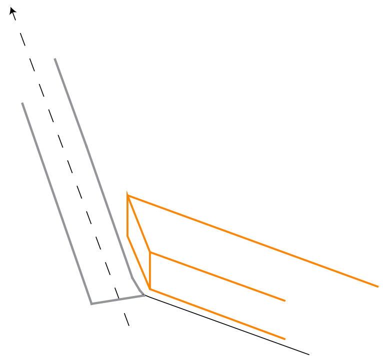
In implementing the building within this sector, diverse strategies were formulated, gradually altering the structure's form, typology, purpose, and positioning. Following an extensive examination of site conditions and potential project locations, the current placement was reached. This proposal represents a comprehensive response to the various elements and requisites involved.



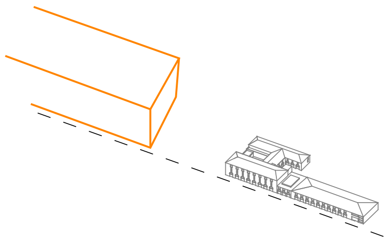
1 Adapting to Site Horizontality



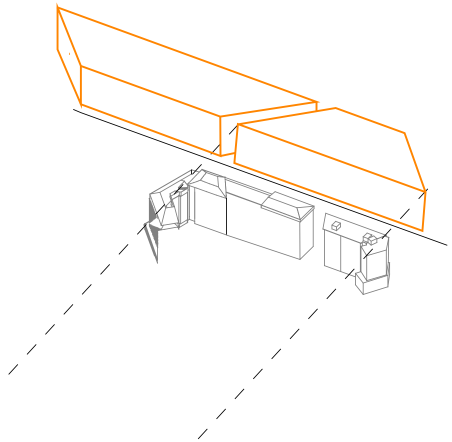
2 Continuation of Piazza Lodi



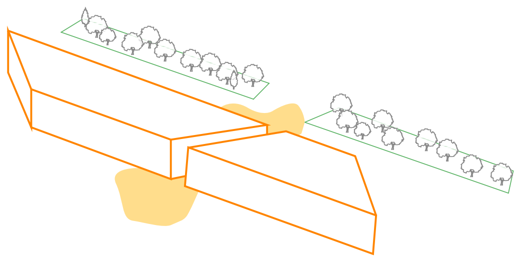
3 Continuation of Corso Lodi



4 Respecting exisitng historical buildings on Site



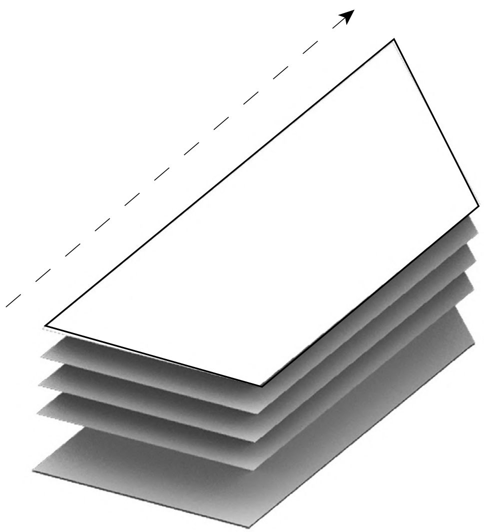
5 Continuation of Exisiting Street Facades



6 Permeable Site passage to the other side of the Area creating a pair of twin buildings

The Wall of Porta Romana Composition

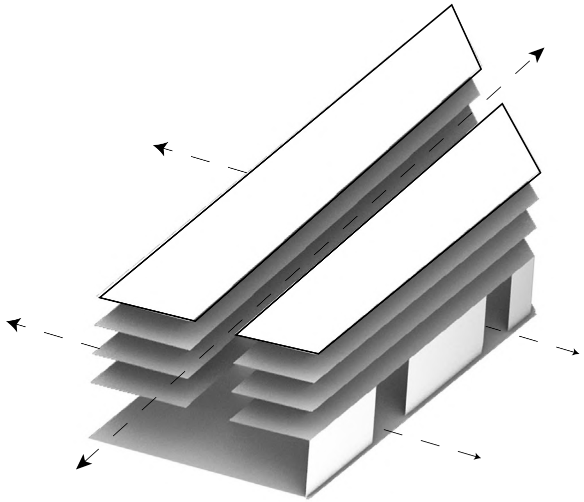
The Wall of Porta Romana Composition



1

General Typology

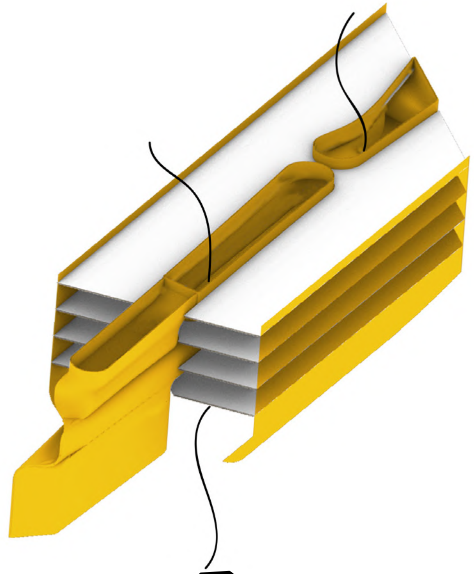
Adapting to Height and
Floors Needed



2

Horizontal Flow

Adapting Horizontal Flow in the Middle Void
and an open ground floor



3

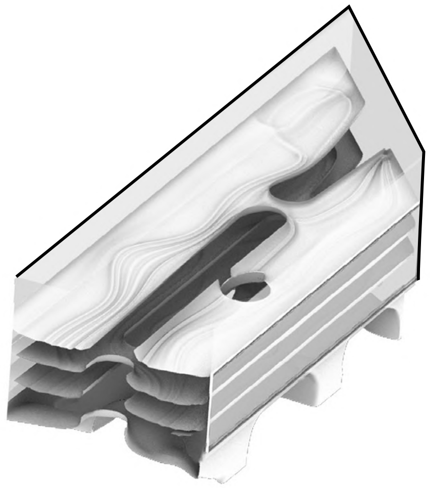
Vertical Flow

Adapting Vertical flow through a continuous
inner void and floors walls being embraced
vertically

4

Sculpture

Vertical and Horizontal Flow adapting to each other creating a sculpture of organic movement

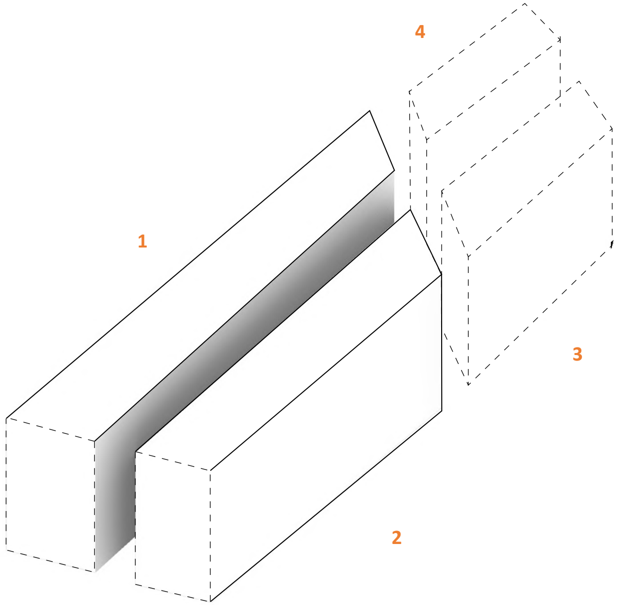


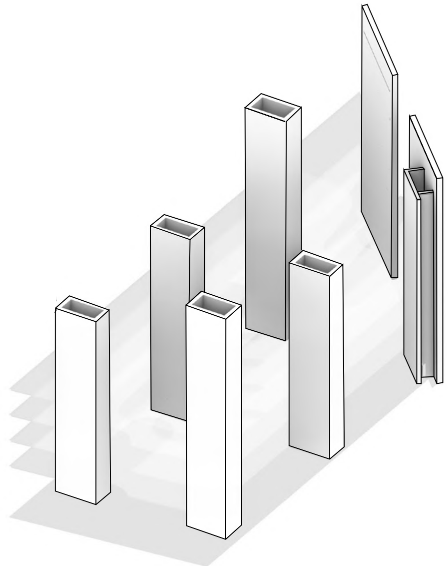
5

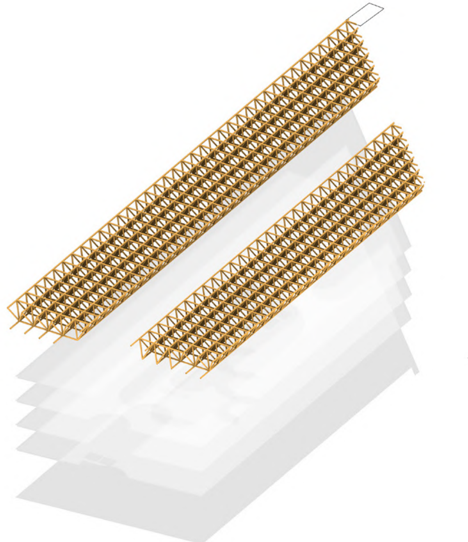
Box

Facade taking a role of a calm element of a box which is adapting to it's presence in the surrounding

The architectural concept of the structure achieves the contrast between its versatile and complex function as a Library and its simple form through the theme of "Sculpture within a box." The "Wall" simultaneously serves as a "Container," organizing circulation and functions organically.







❶

Structural Configuration Division

Building Configuration follows four different parts

❷

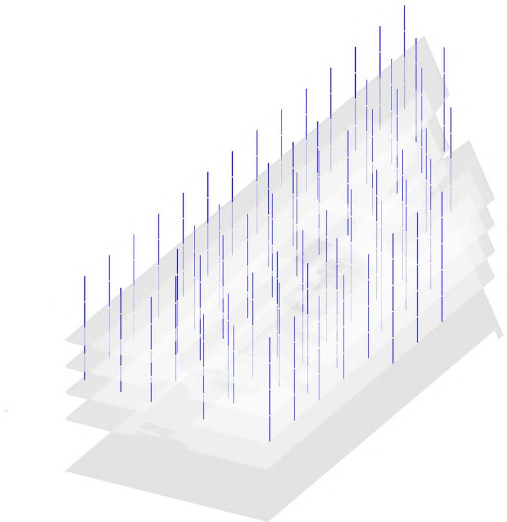
Core and Shear Wall Distribution

Shear and Cores heavily distributed around the edges of the building

❸

Vertical Flow

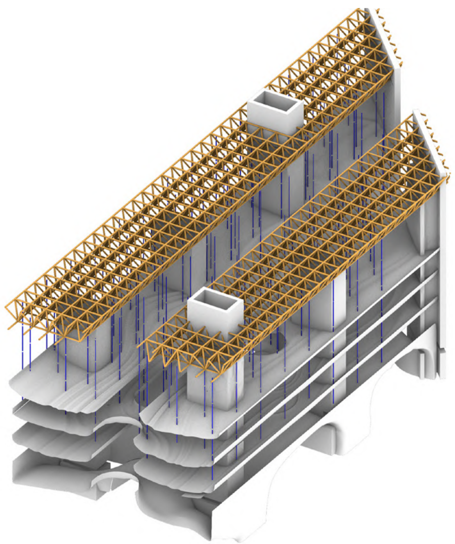
Adapting Vertical flow through a continuous inner void and floors walls being embraced vertically



4

Cables Suspended From Truss

Narrow cables suspended from the trusses

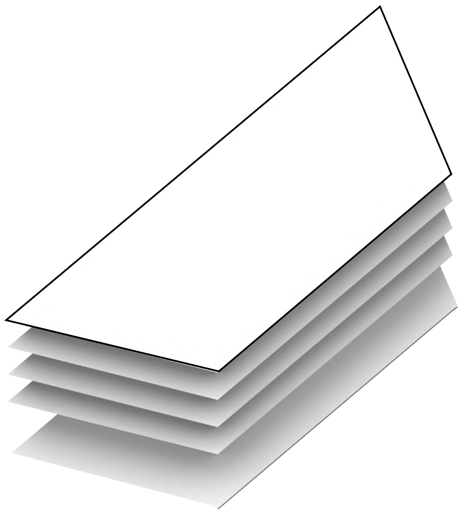


5

Structural System Carries Building Sculpture

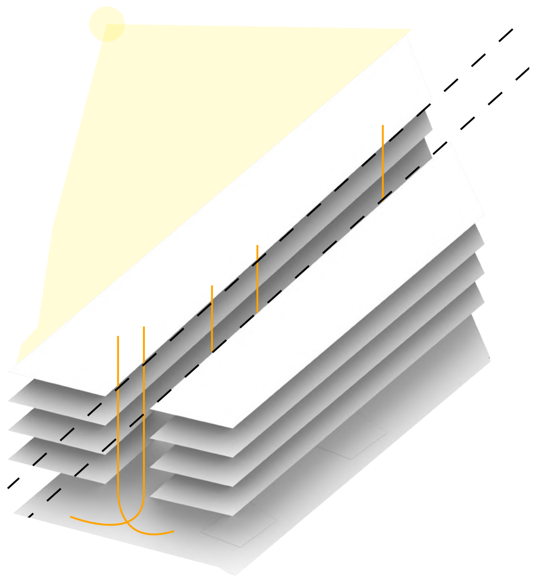
This structural configuration allowed a light and organic flow inside the wall of porta romana.

The concept of the structure began with the aim of "open plan, free form," emphasizing organic forms within. The system, summarized as a combination of pushing and pulling forces, where the concrete cores support the upper lattice structure and all the floor slabs are suspended from this lattice system, takes the library beyond conventional systems.



❶

Understanding of Typology



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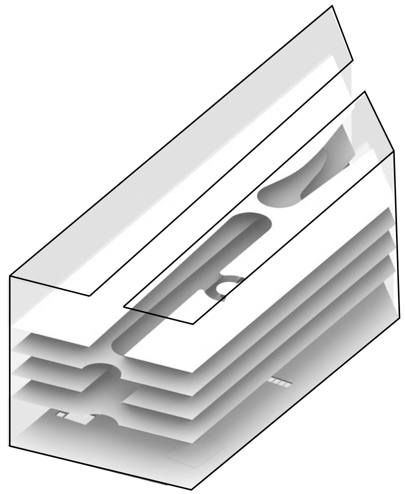
Inner Void Division

Adapting to Ventilation and Light conditions



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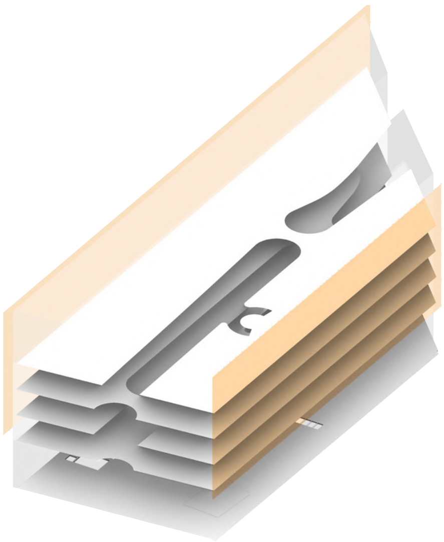
Facade Envelope

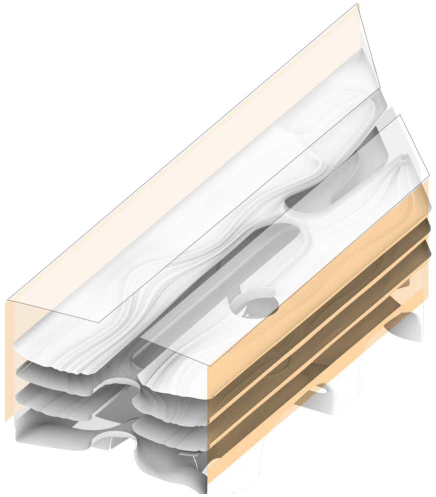
Facade Envelope to accomodate building conditions



4

Design of Facade System

Adapting to inner functions and exterior conditions



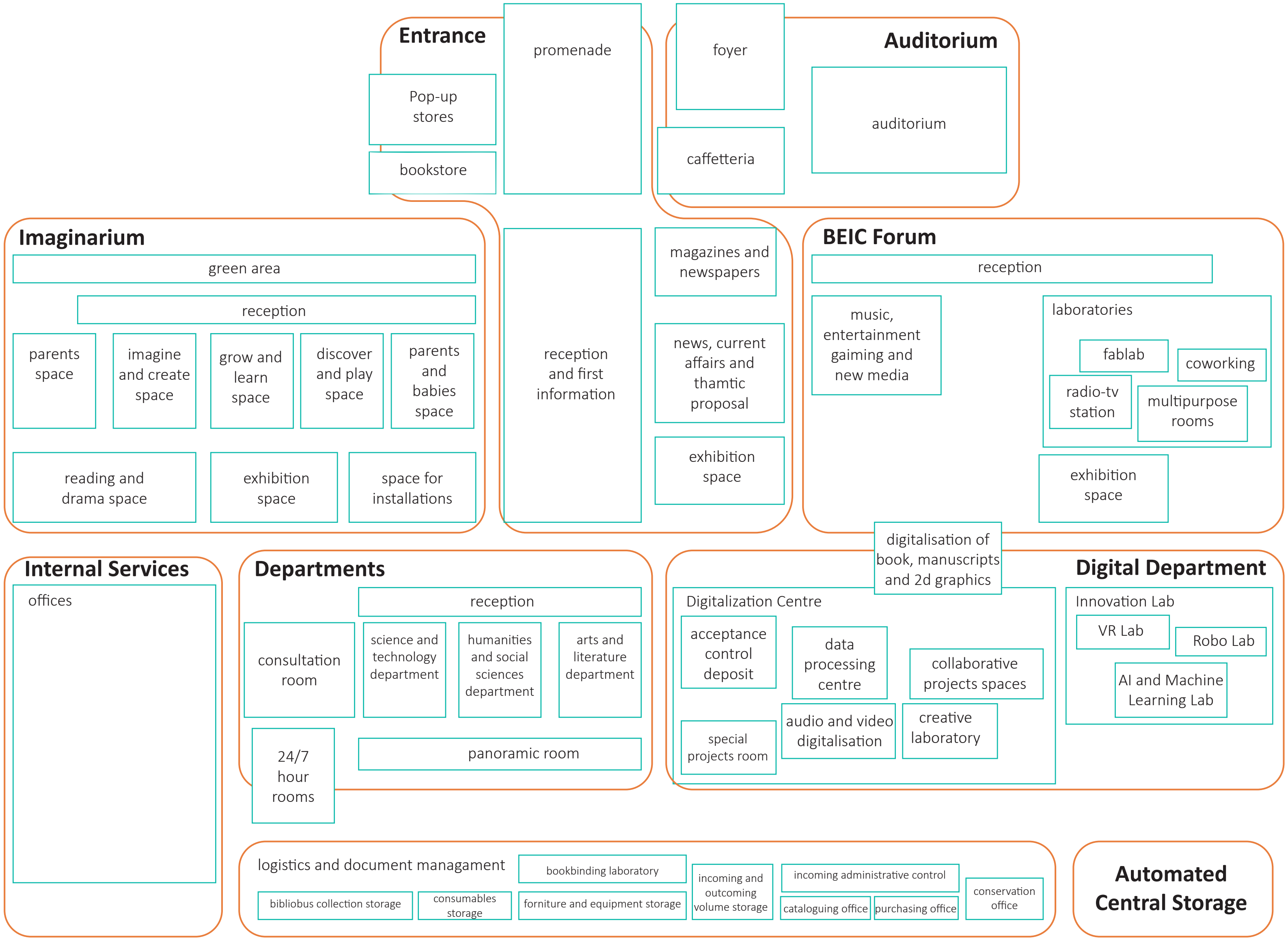
5

The possibility of creation of the flow

Flow is created in a form of organic form through developed procedures of construction.

The technological solutions for the structure emerged through the analysis of various problems and opportunities. Initially focused on increasing the use of natural light in a 40-meter-wide building, this system integrates various components such as ventilation, solar panels, natural light, and shade control.

Function



During the early reasearch stages of the project, the goal was to build the ideal future library of milan with the future tools of a library.

The BEIC Library aimed **to go beyond the traditional functions of a library to become a laboratory for the tools necessary to create contemporary culture.**

From developed technology, ai systems, fablabs, lecture areas, private and public meeting spaces, and entertainment areas.

The Wall of Porta Romana + BEIC Library Functions

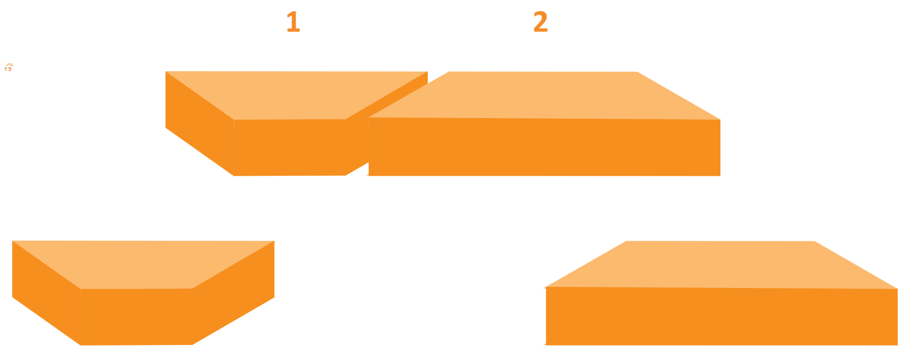
Functions	Area (BEIC)	Area (TWOP)
Departments	7700	7300
Auditorium	1300	1550
Digital Deparmtent	1350	1200
Automated Central Storage	6000	6200
Forum	4300	3150
Imaginarium	1800	2000
Internal Services	4600	3000
Entrance	1600	4500
Total	28560	29100

Library functions were constantly compared between the our aim of space distribution and user journey to those of the BEIC Library.

The Wall of Porta Romana Function Details

Floors	Function	Area	Books	Shelves	Users
Basement Floor	Storage Space	6200	5,840,000	14600	-
	Internal Services	1200	-	-	-
Ground Floor	Entrance	4500	-	-	108
Mezzanine	Departments	350	-	-	-
First Floor	Digital Department	1750	180000	1000	311
	Auditorium	1200	-	-	300
	Imaginarium	650	-	-	56
	Forum	450	-	-	16
Second Floor	Departments	2000	90000	5000	430
	Auditorium	350	-	-	-
	Imaginarium	600	-	-	60
	Forum	700	-	-	23
Third Floor	Departments	2000	190000	5000	430
	Imaginarium	900	-	-	21
	Forum	650	-	-	78
Fourth Floor	Departments	2000	19000	5000	430
	Auditorium	1200	-	-	45
	Internal Services	800	-	-	46
Total		33700 m2	6,959,600 Books	30600 Shelves	2354 Users

Building Overall Function Division

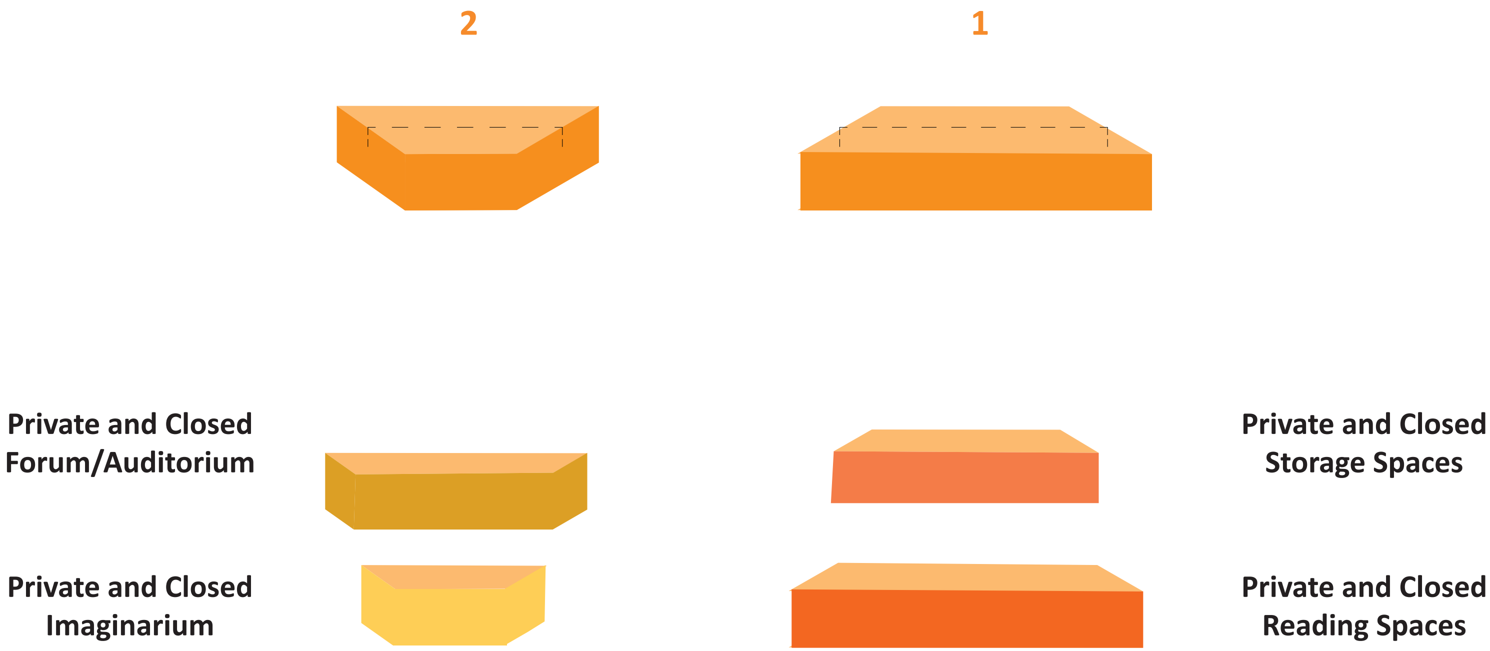


Community-Based Functions

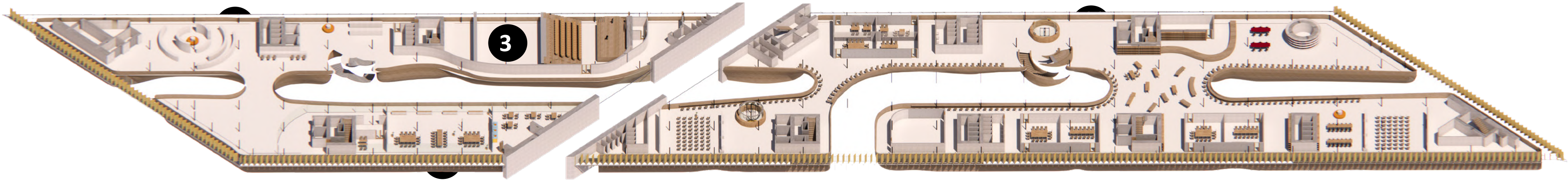
Auditorium
Imaginarium
Forum

Compressed Library for Direct Urban Entry and Circulation

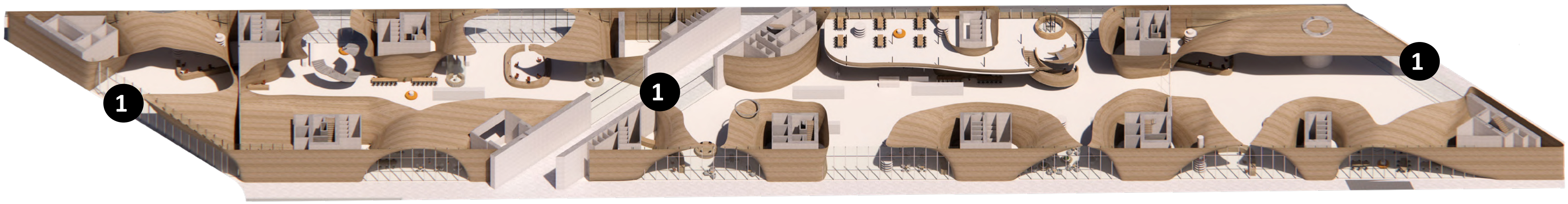
Building Overall Function Division



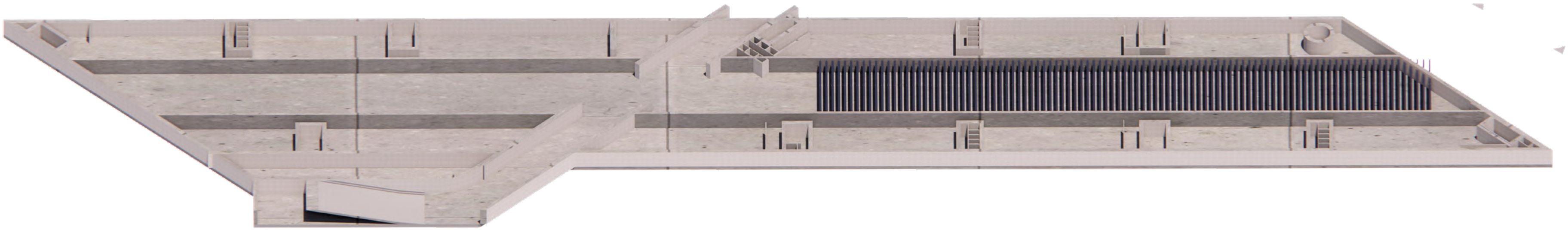
Function



First Floor



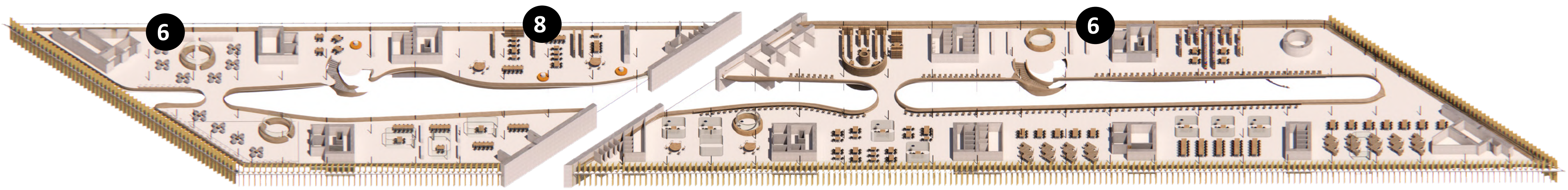
Ground Floor



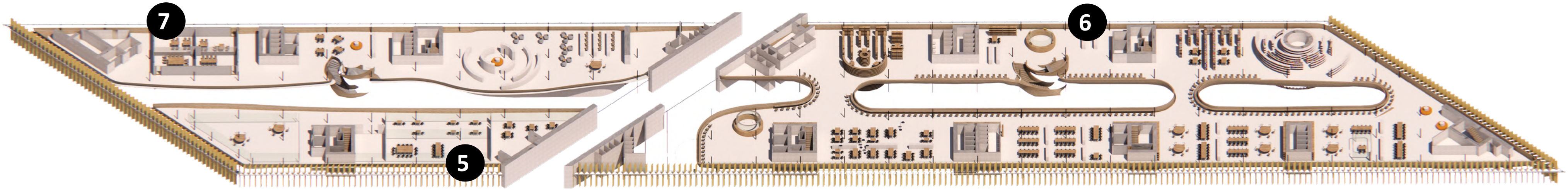
Basement Floor

1 Entrance 2 Automated Central Storage 3 Auditorium 4 Digital Department

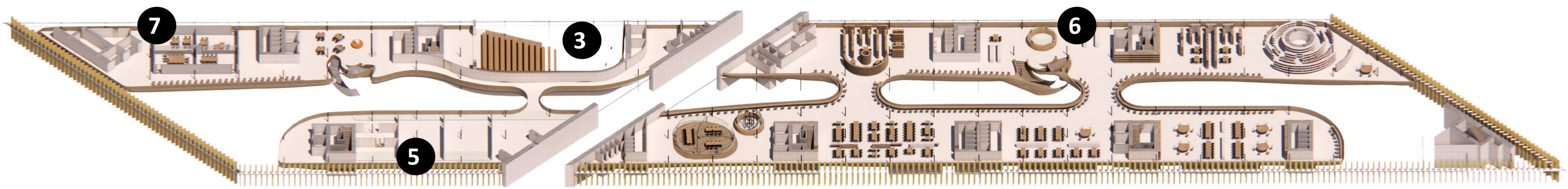
Function



Fourth Floor



Third Floor



Second Floor

5 Imaginarium
6 Departments
7 Forum
8 Internal Services

Sculpture

General Concept

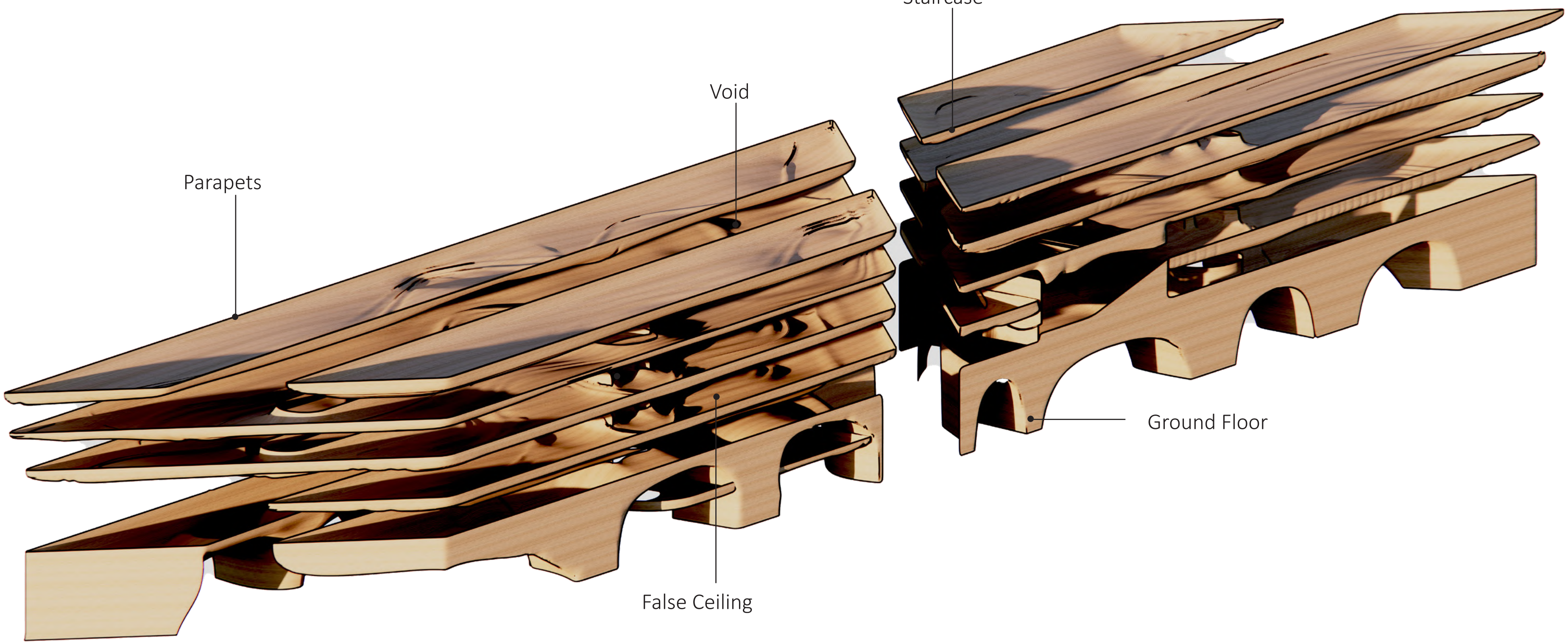
Our library stands out from the outside with its geometric form, designed as a wall, serving as both a separator and a boundary. It's a long rectangle with its short sides intersecting the long side at a 45-degree angle. Apart from the cut in the middle of this rectangle, it presents a rigid, solid appearance that characterizes it as a wall.

However, for us, a library is a place that enables us to see beyond the wall. That's why the interior of the structure greets us with entirely organic, warm colors. The wall, divided in half along its axis, creates a central opening, and wooden spaces following this opening from both sides form a "valley," showcasing the contrast between the interior and the exterior.

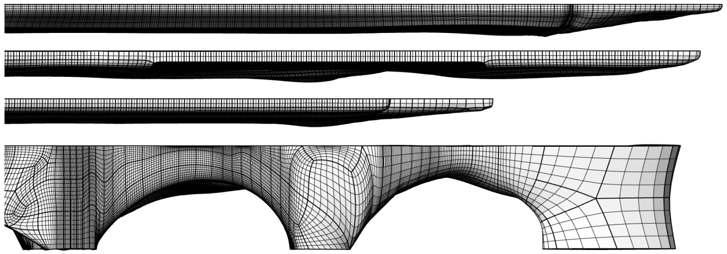
Sculpture

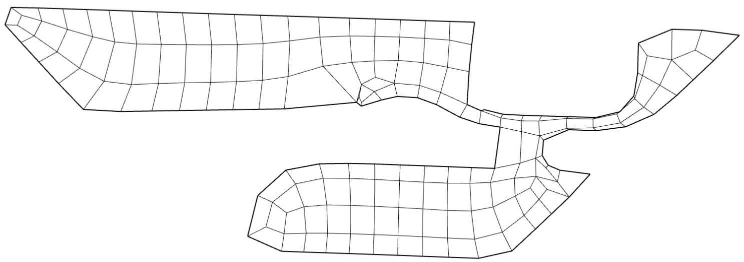
The Sculpture Composition

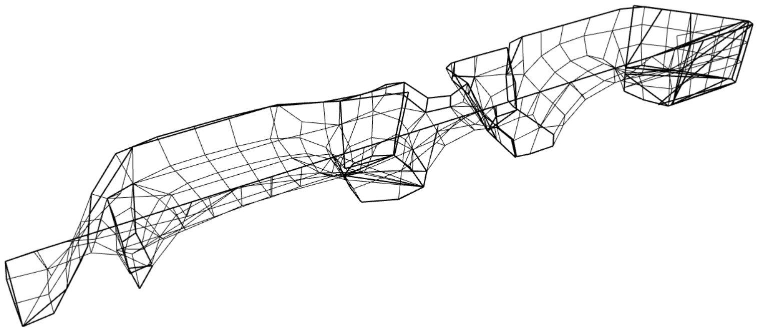
Sections with organic forms were designed to create a contrast to the geometric shape of the "wall," both physically and metaphorically. The wall, with its sharp edges and substantial size, stands out distinctly as a defined boundary, while Beyond the Wall is designed with organic forms that are inclusive, extending as far as the eye can see, resembling a valley. The organic form is constructed from recycled wood material, allowing for formal flexibility and providing positive acoustic performance where needed. This design choice serves to contrast the bold and imposing nature of the wall, creating a harmonious interplay between different architectural elements such as the ground floor entry, parapettes, void, and false ceiling; all connected into one sculpture piece.

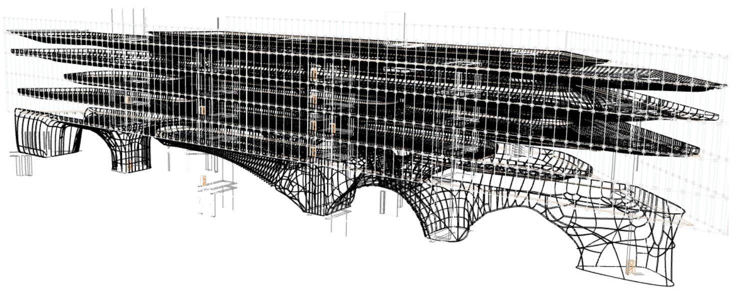


Sculpture









Sections with organic forms were designed to create a contrast to the geometric shape of the “wall,” both physically and metaphorically.

The wall, with its sharp edges and substantial size, distinctly stands out as a defined boundary. In contrast, **Beyond the Wall is designed with organic forms that are inclusive, extending as far as the eye can see, resembling a canyon.** The organic form is constructed from recycled wood material, allowing for formal flexibility and providing positive acoustic performance where needed.

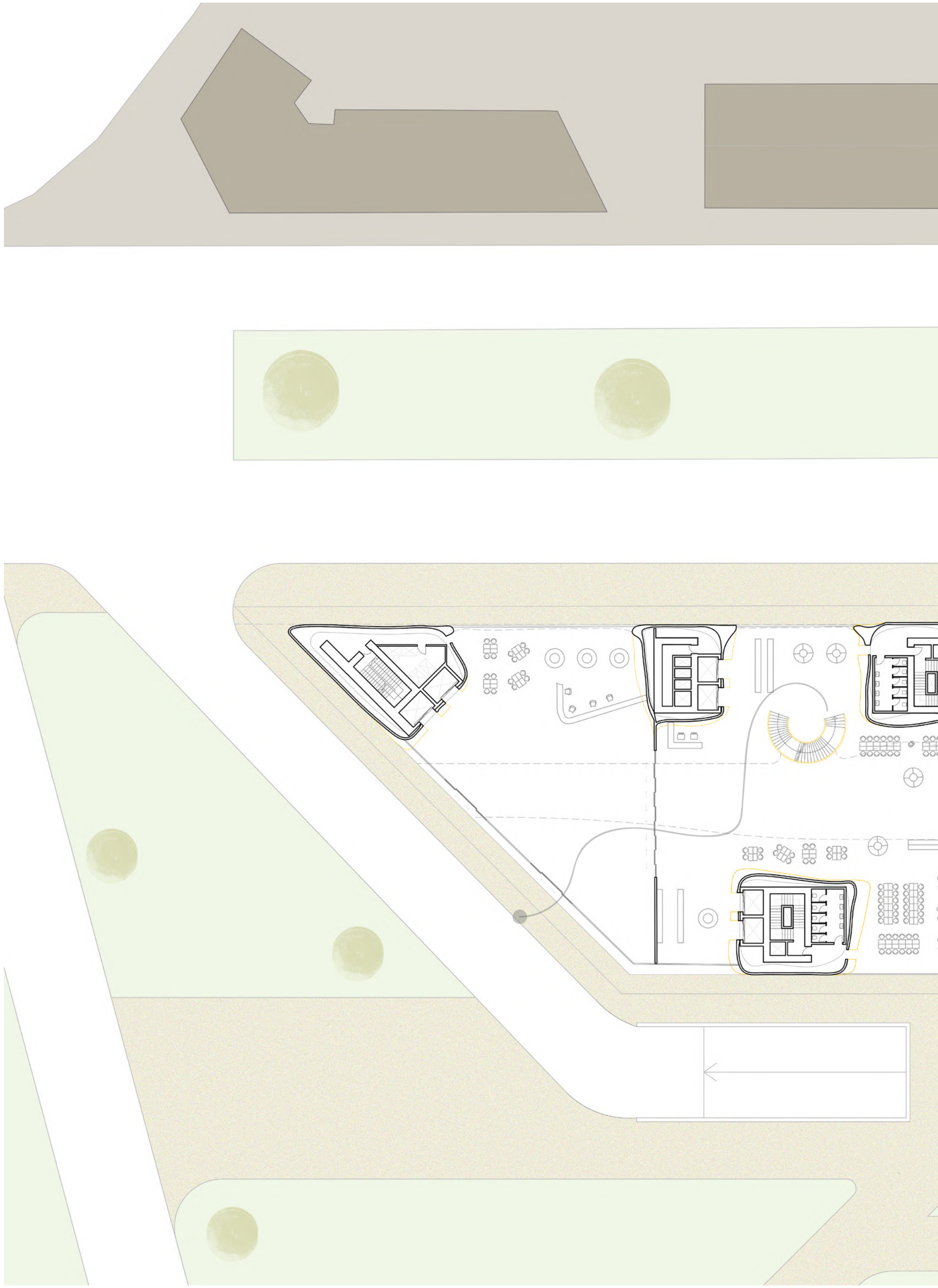
This design choice serves to contrast the bold and imposing nature of the wall, resulting in a harmonious interplay between various architectural elements.

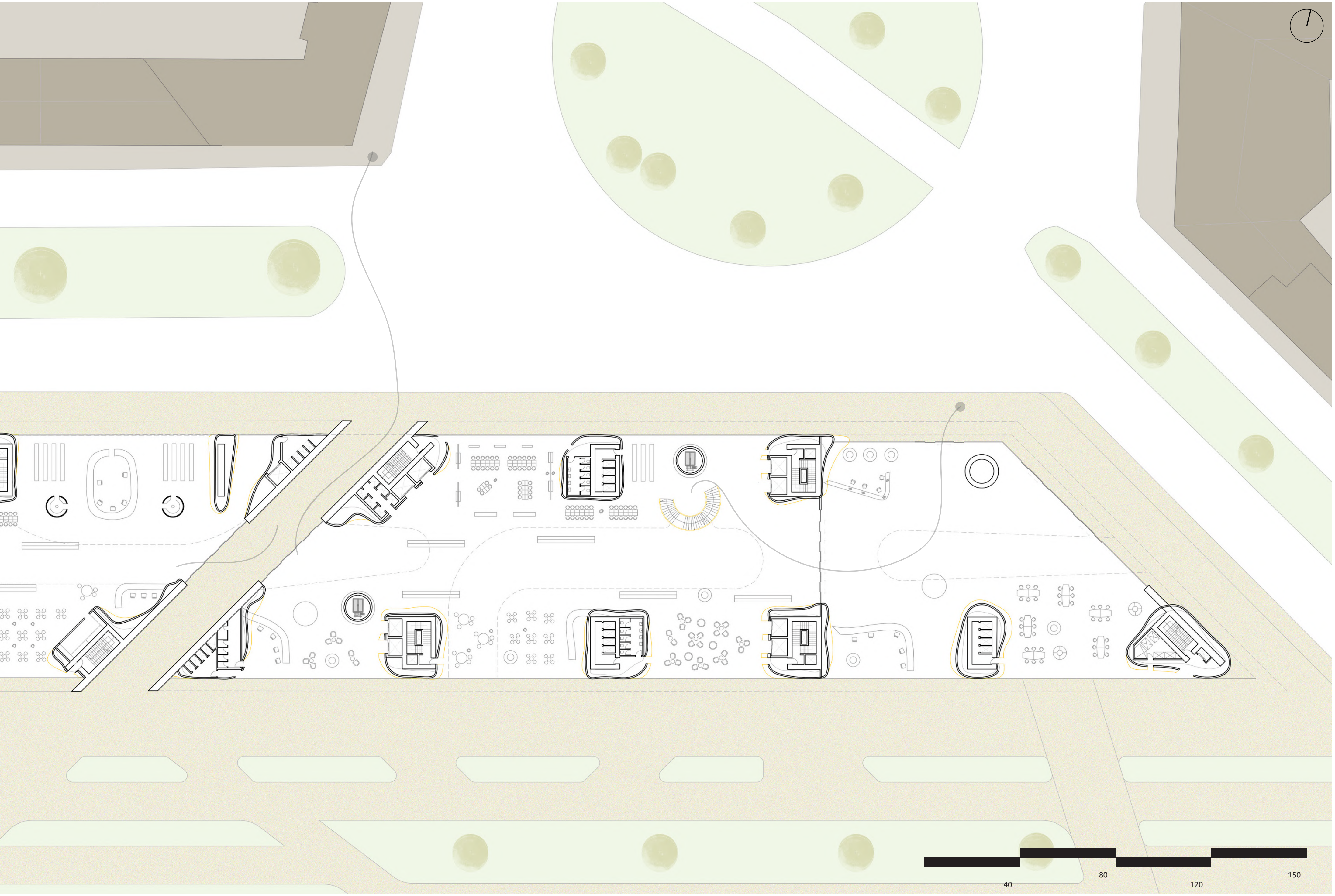
The fusion of staircase railings with the “Sculpture” and the expression of vertical circulation between the floors in the design language.

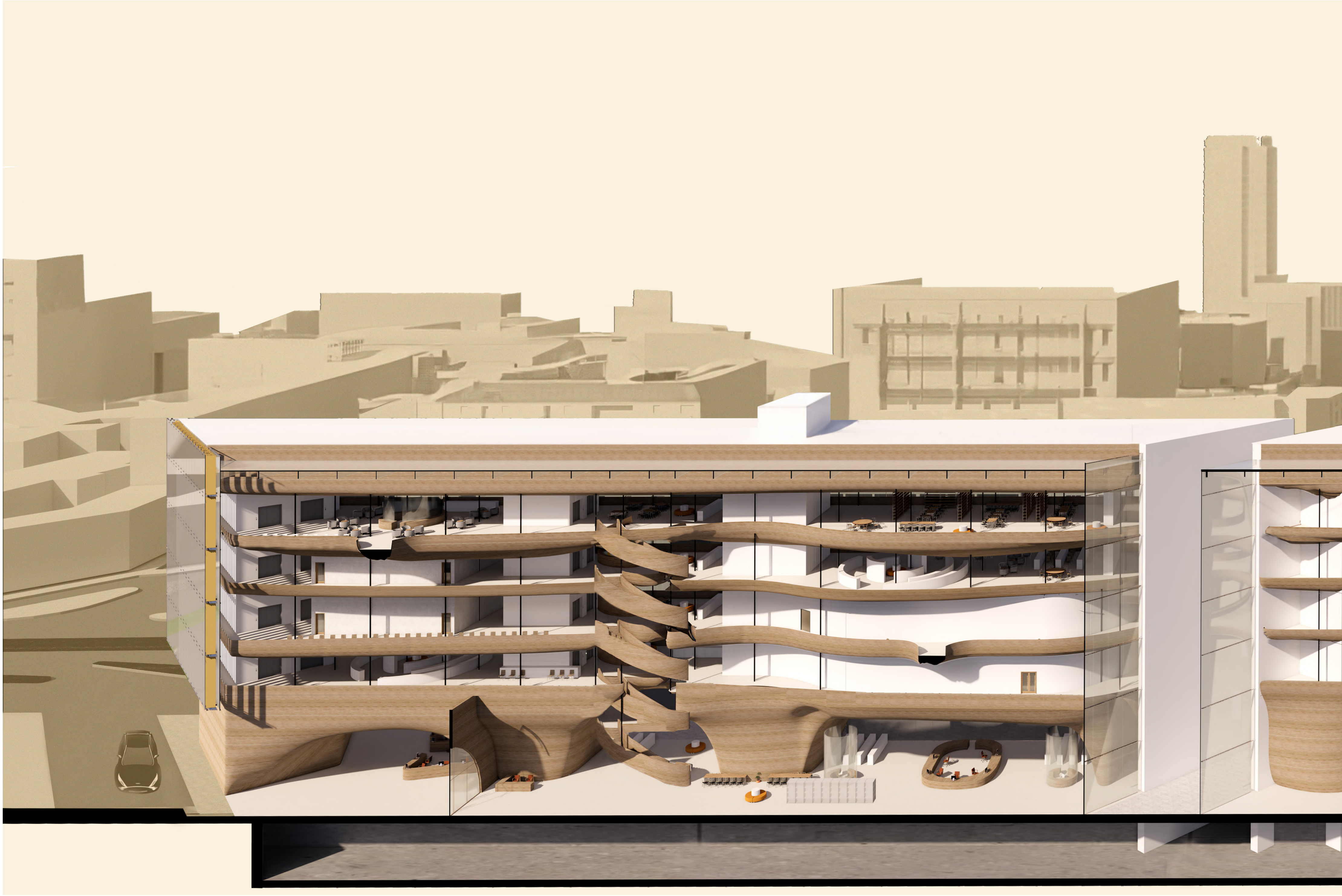
The relationship between the staircase and the naturally lit interior space. Sunlight received from the central void varies in quantity on each floor, and the floorings have been arranged accordingly.

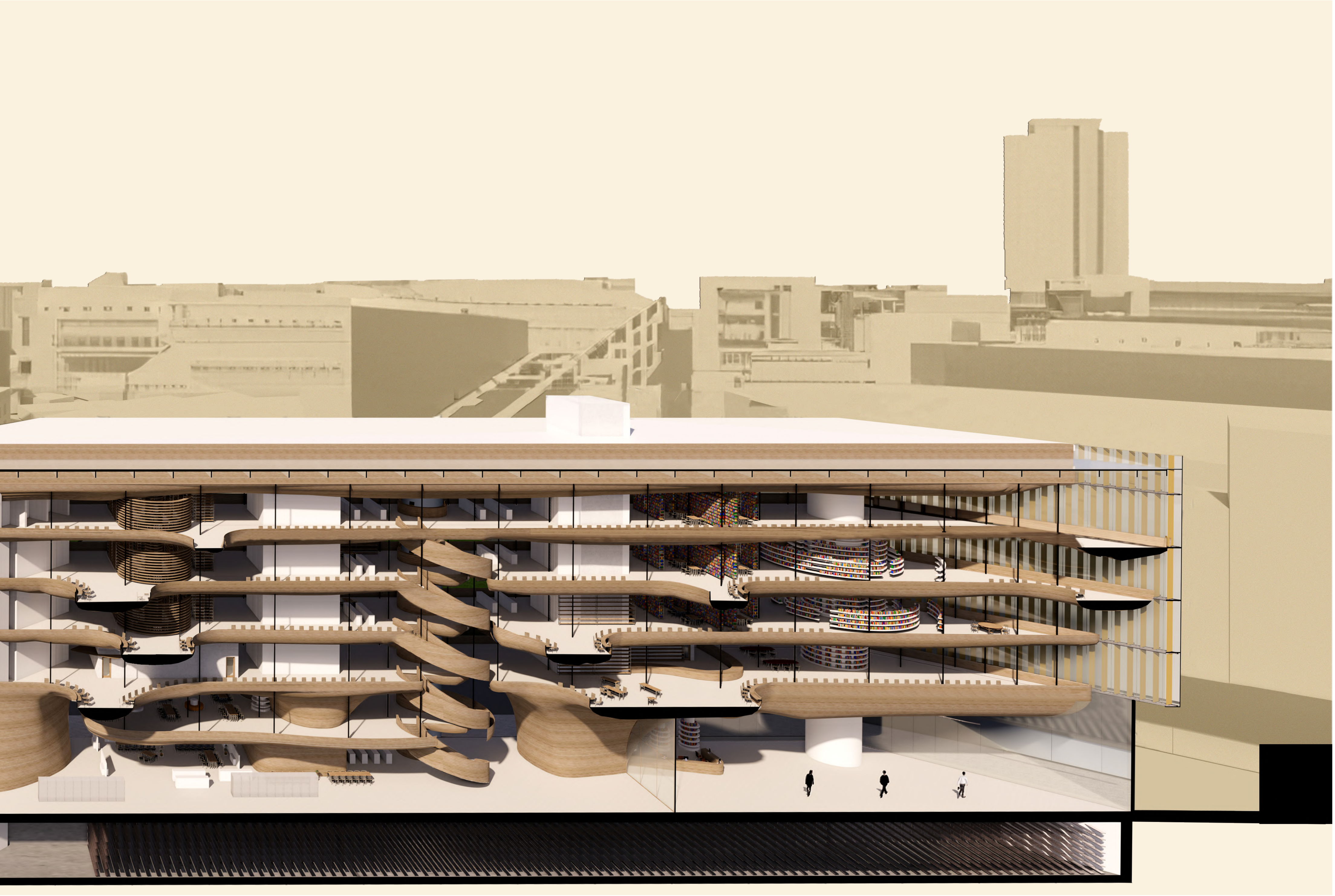
The Sculpture Diffused: Ground Floor

There are a total of four entrances, one on Piazzale Lodi, one facing Piazza Trento, and two on either side of "The Cuct." The entrance on Piazzale Lodi is considered the main entrance to the building and is defined by the "curving" of the wooden panel section. The entrances at "The Cut" are aligned with the circulation parts of the Library and Imaginarium buildings. These openings are in line with the "Void" and will be used for continued circulation. The entrance to the Imaginarium section (Piazza Trento) is designed for children and parents, and it is oriented towards users coming from the Trento direction.

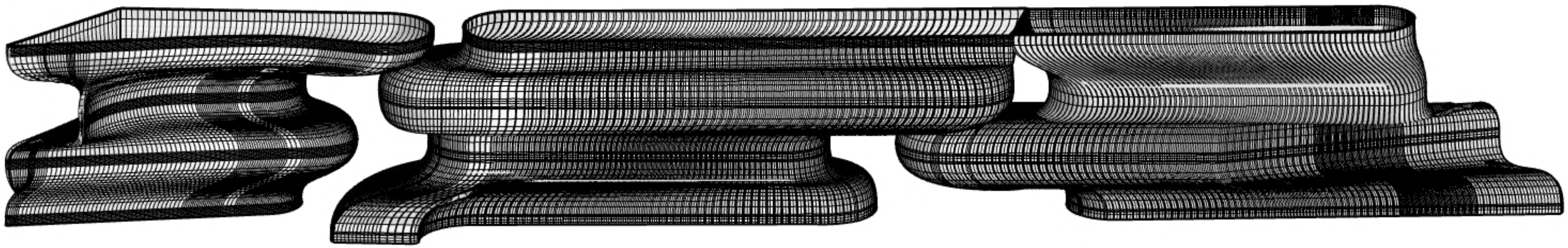



40
80
120
150

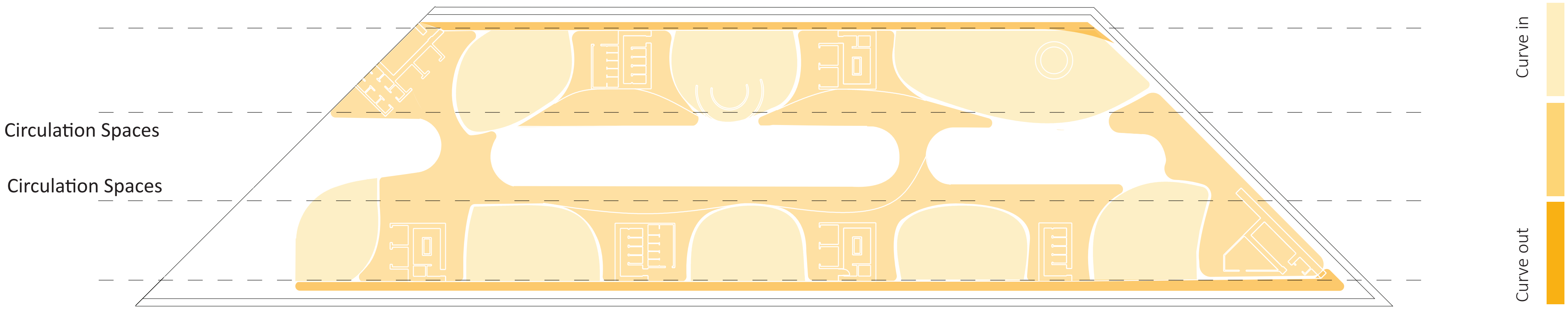




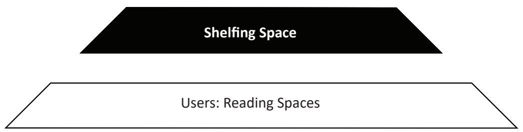
The Sculpture Diffused: Voids and Bridges



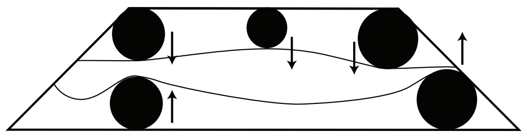
Typical Floor Plan



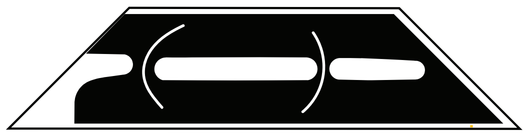
Horizontal Flexible



Highlighting Functions



Flexibility

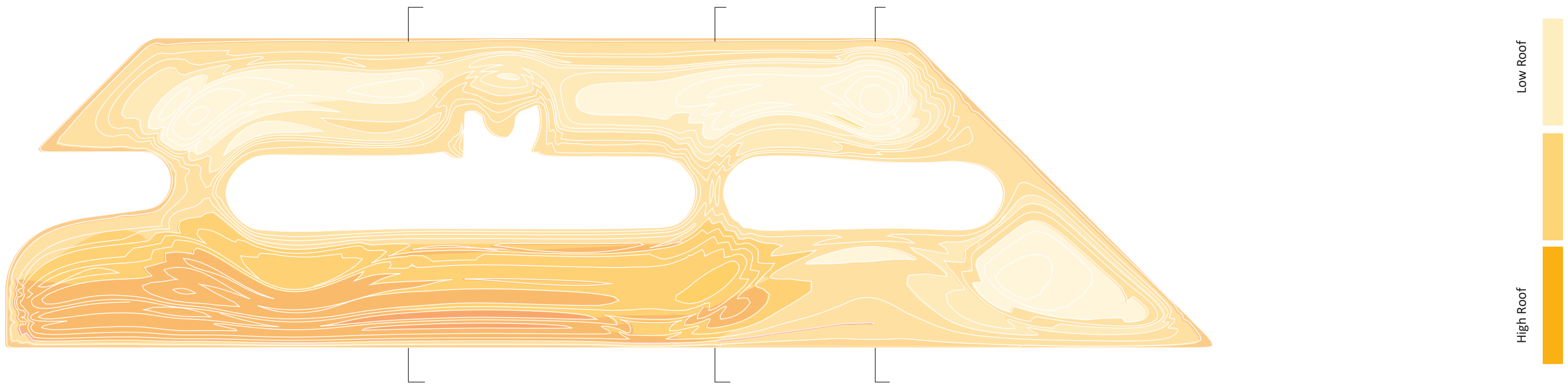


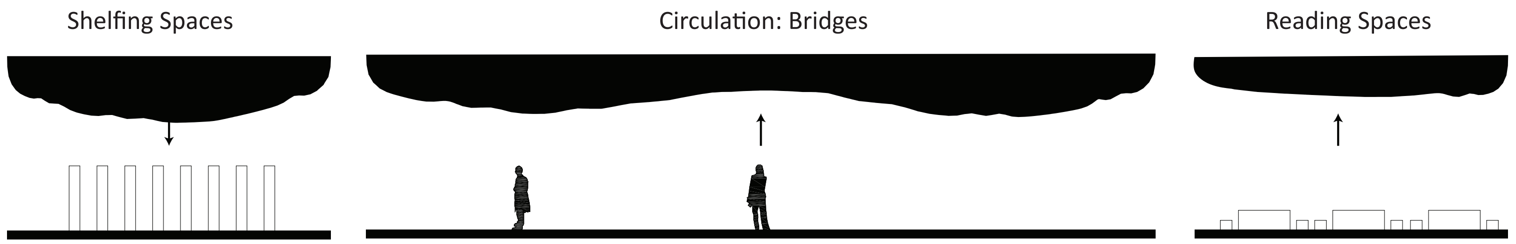
● Special spaces

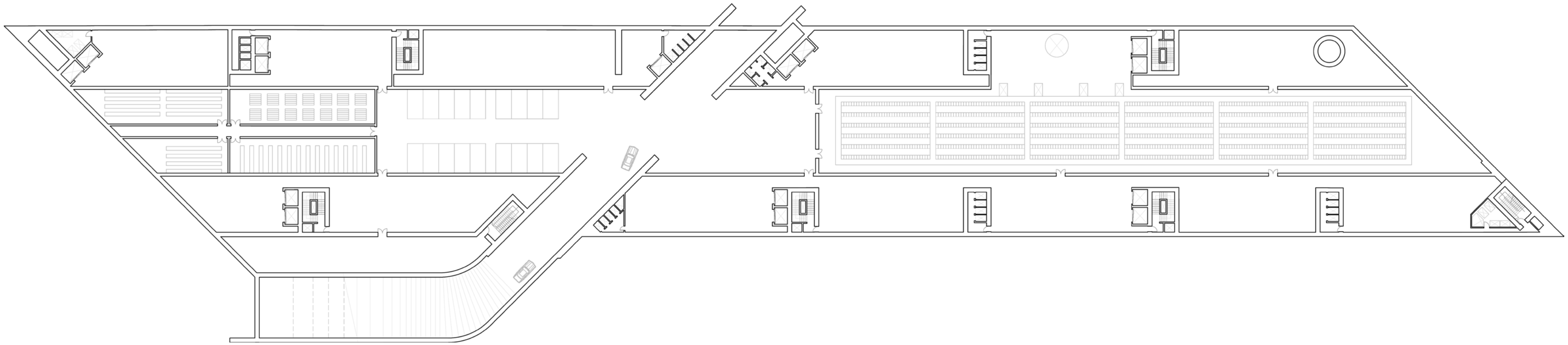
The Sculpture Diffused: False Ceiling

The suspended ceiling is constructed from wood in two different forms. The first form involves creating wooden panels on a profile skeleton to achieve flat surfaces. In this manner, holes need to be made on the wooden panels for light and ventilation. The second form, on the other hand, is composed of rows of voids left for acoustic performance, illumination, and ventilation. This approach is implemented by suspending curved wooden profiles from steel profiles using cables of the required length.

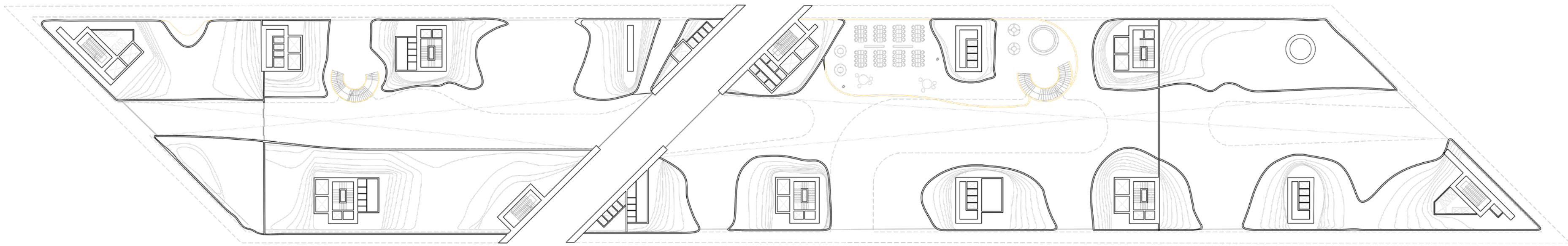
Typical False Ceiling Plan



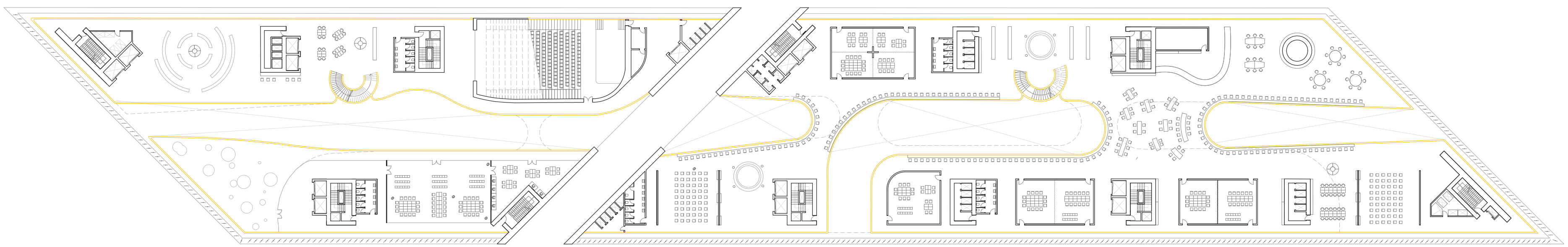




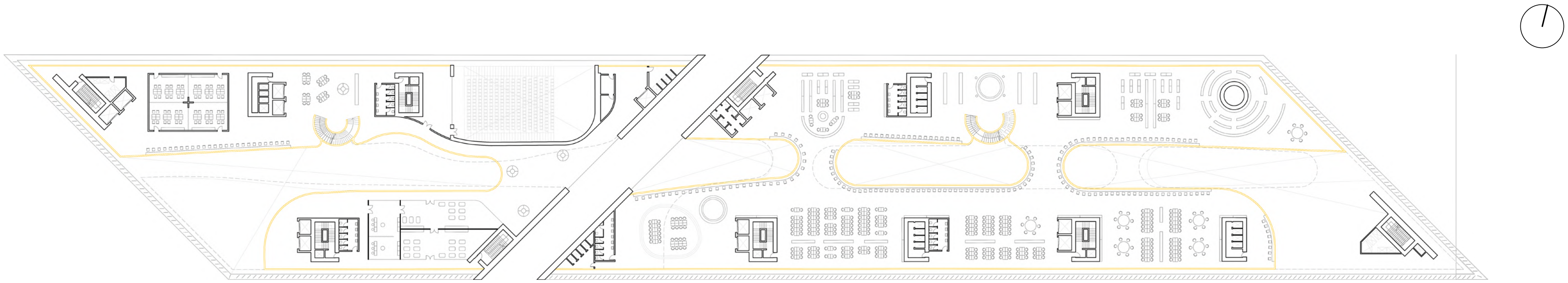
Basement Floor Plan - 07.00



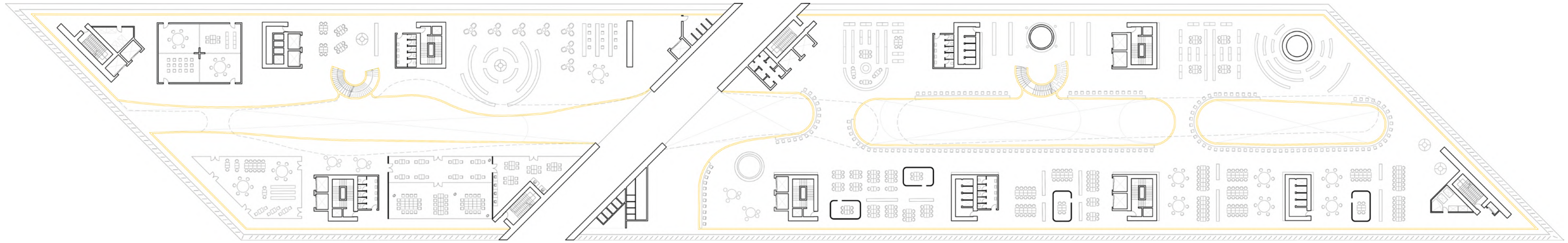
Mezzanine Floor Plan + 05.00



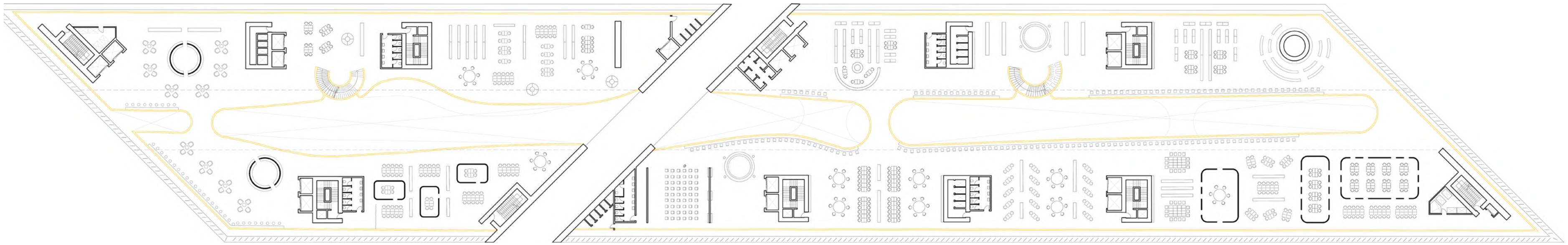
First Floor Plan +10.00

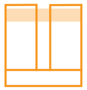


Second Floor Plan +15.00

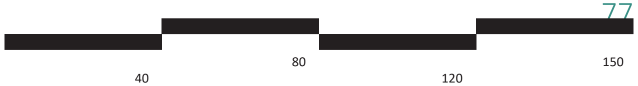


Third Floor Plan +20.00





Fourth Floor Plan +25.00



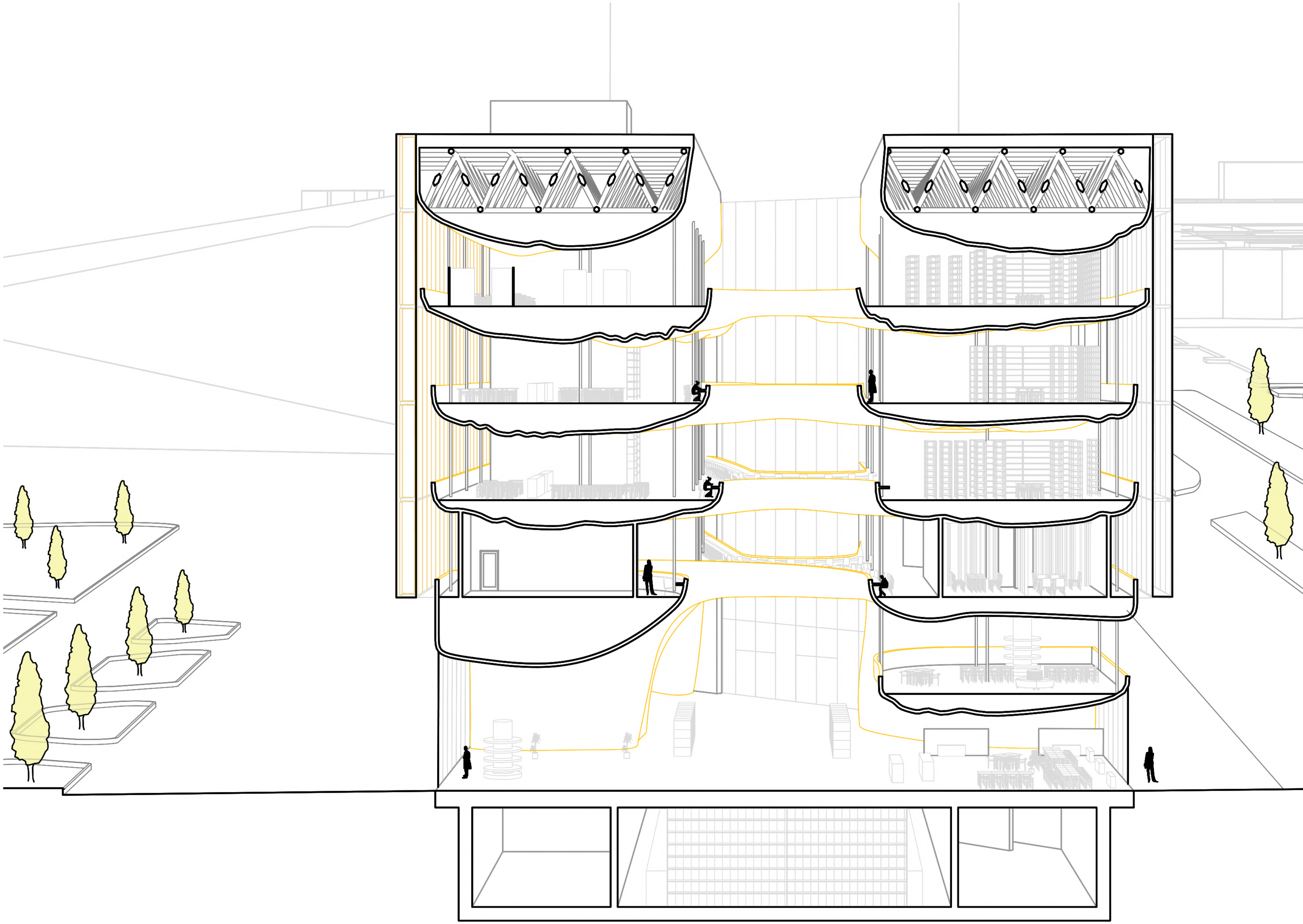
Shelving Spaces

The spaces are characterized by a mixture of thermal, spatial and visual sensations, where natural light plays as another element inside the project, generating different relationships between the building and its user.

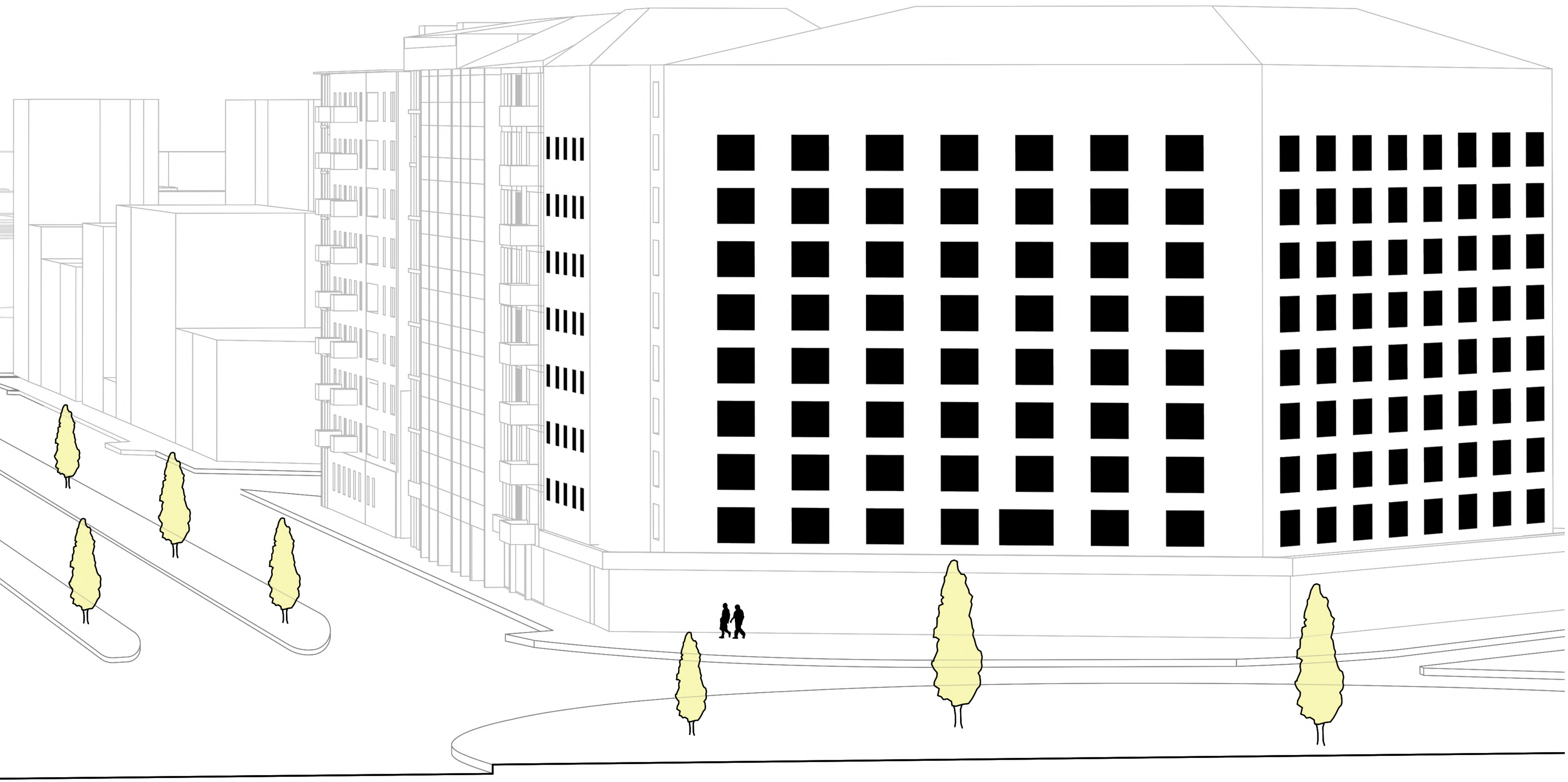
Reading Spaces

Reading areas and the transformation of 'sculpture' into acoustic panels. Holes can be created in wooden panels to obtain acoustic absorbers and light/ventilation gaps.

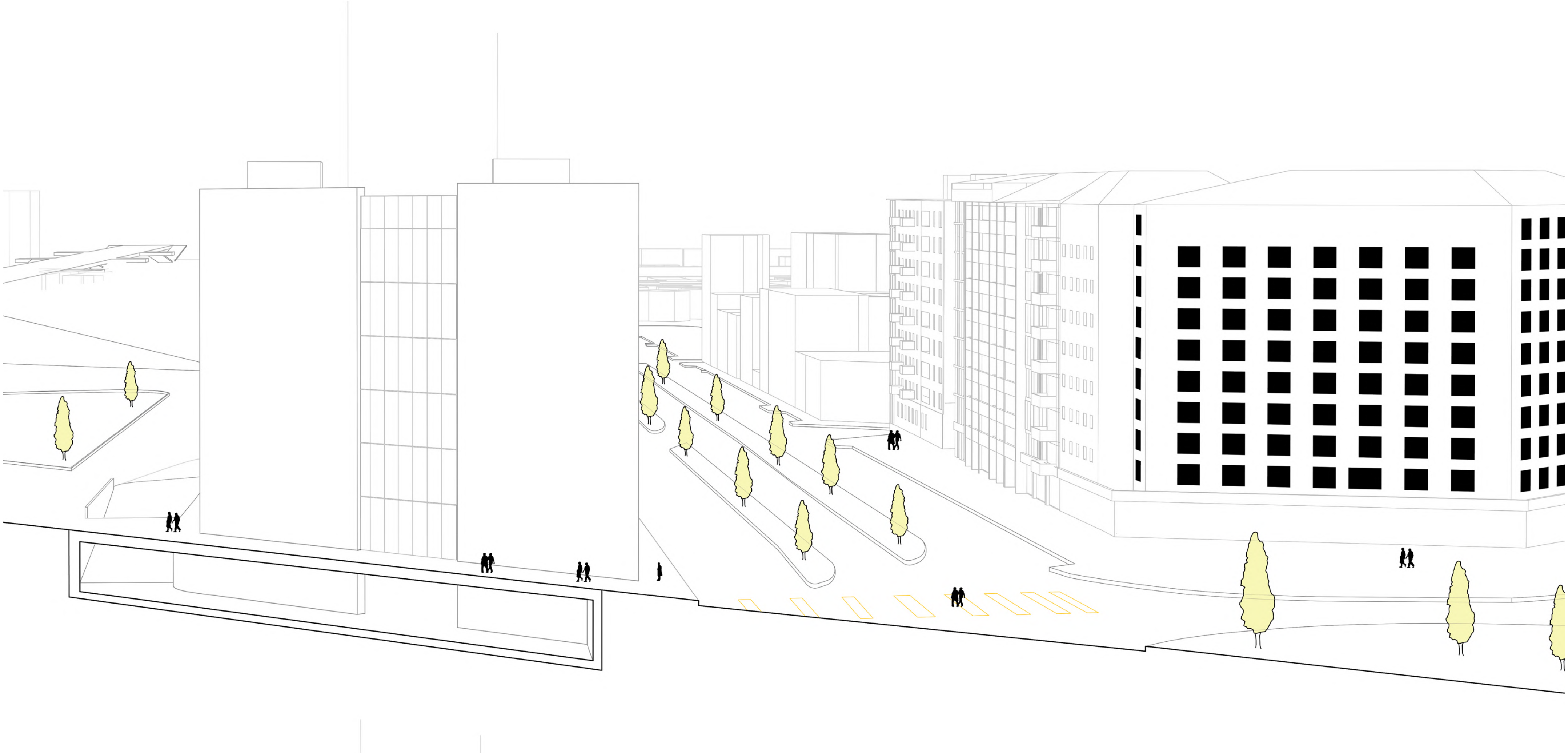
- Journey throughout the Building



Journey throughout the Building



- Journey throughout the Building



- Journey throughout the Building

Structure

The concept started as the need to use a simple structure made by mixing steel columns and beams with reinforced concrete cores in order to generate stability in the building. The main problem was the lack of flexibility of this structural configuration, as well as the lack of space for its conjugation and finally the repetition of these elements.

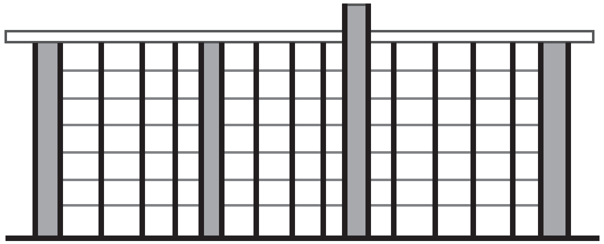
Subsequently, it was decided to remove the columns and leave a more open system, trying to reduce the use of steel elements that affect the visual appearance of the interior of the project. In this case, the use of reinforced concrete cores is maintained, but due to the lack of vertical support, the floor slabs and beams begin to present bending problems.

To the problem of this system, a spatial truss system is created, which is a three-dimensional structure used to build large support systems. These structures are characterized by their ability to resist loads and distribute them efficiently along their elements.

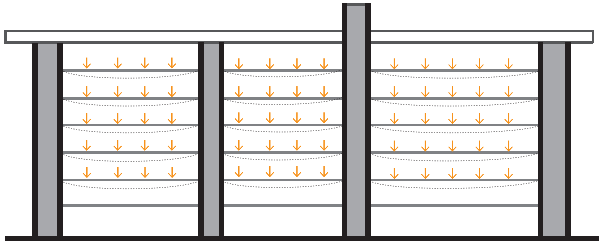
This type of truss also includes the use of tension cables, which are connected to both the truss and the steel beams, in order to reduce the dimension of these elements, as well as the distance between one and the other. This type of configuration benefits the project, since it allows greater flexibility in terms of cable locations, double height configuration, gaps and openings, among others.

This type of structure provides us with endless possibilities at the architectural level, which also allows the building to have flexibility with the spaces according to the dynamics that begin to be generated. For example, the possibility of changing the type of configuration of the interior spaces without the requirement or need to design new structural elements.

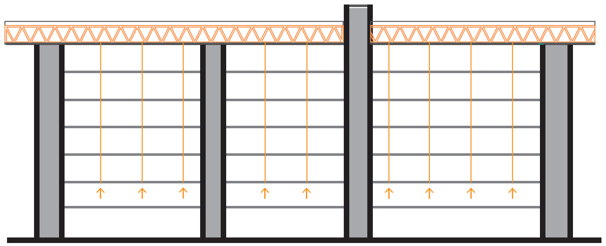
Structural Design Process



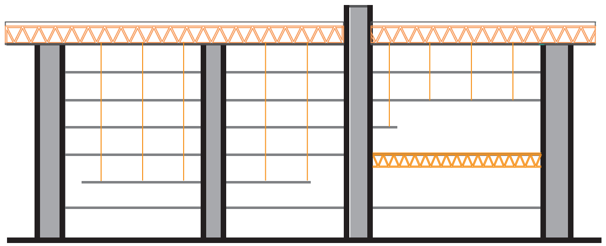
The use of columns and cores to organize the structural configuration of the project. Lack of flexibility inside the proyect due to its composition.



Remove columns to make a flexible floor. This configuration generates large deformations in the beams by bending, due to the lack of vertical support.

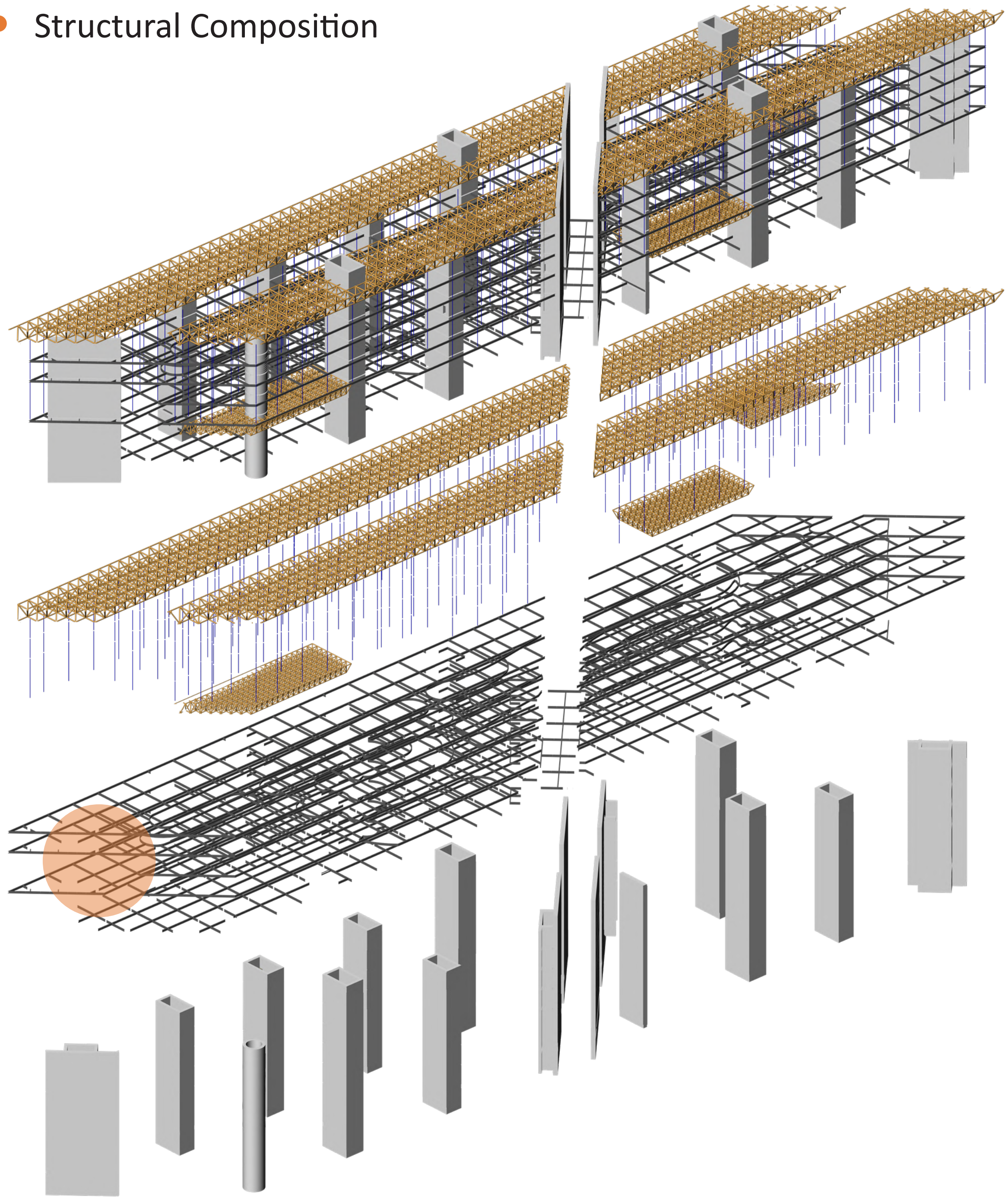


We created a spatial truss on the roof and from there we used tension cables to counteract the load of the structure and the slabs.



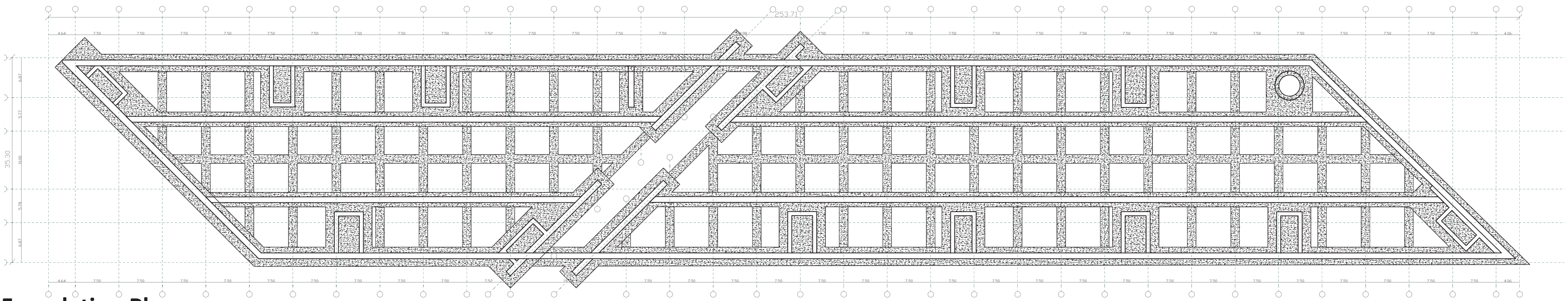
With this distribution and system, new forms of spatial configuration are generated which project different spaces with specific characteristics.

Structural Composition

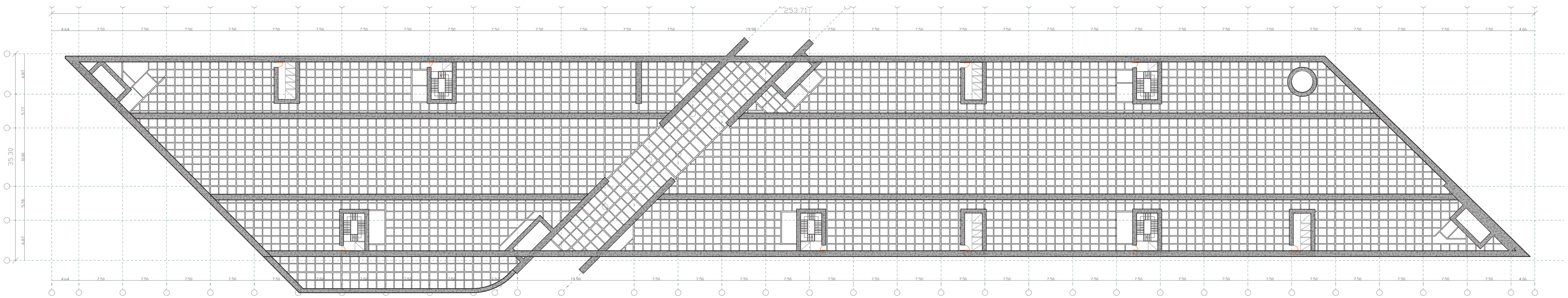


By putting all the elements together, we can see how the project, despite developing a complex structural system, manages to generate a spatial flexibility within the project, which allows us to integrate the uses and activities according to the spaces, which are also flexible enough to change their use without modifying their morphology.

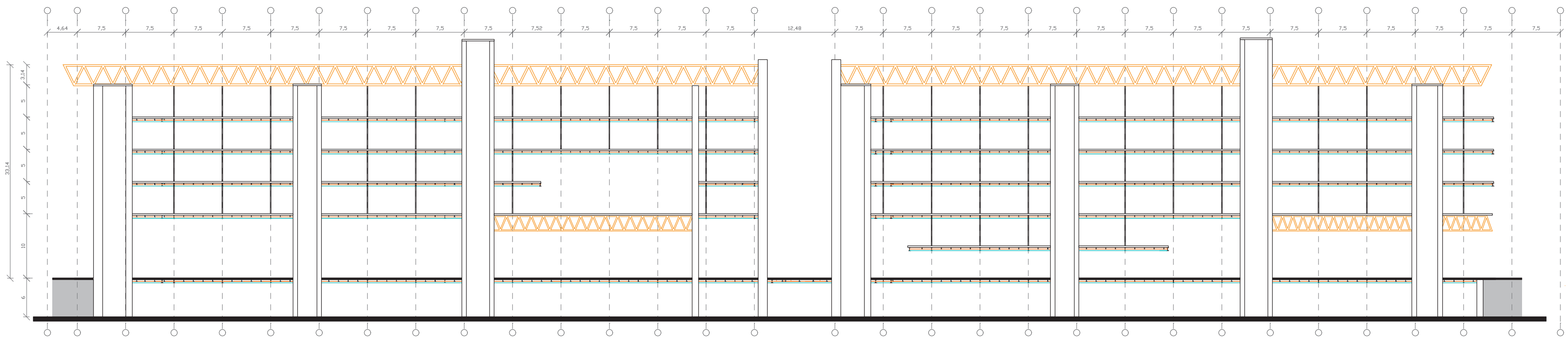
The main materials used for this structural project are reinforced concrete for the cores, steel for the main and secondary beams, as well as tubular steel profiles for all the spatial trusses and finally tubular steel profiles for the cable.



Foundation Plan

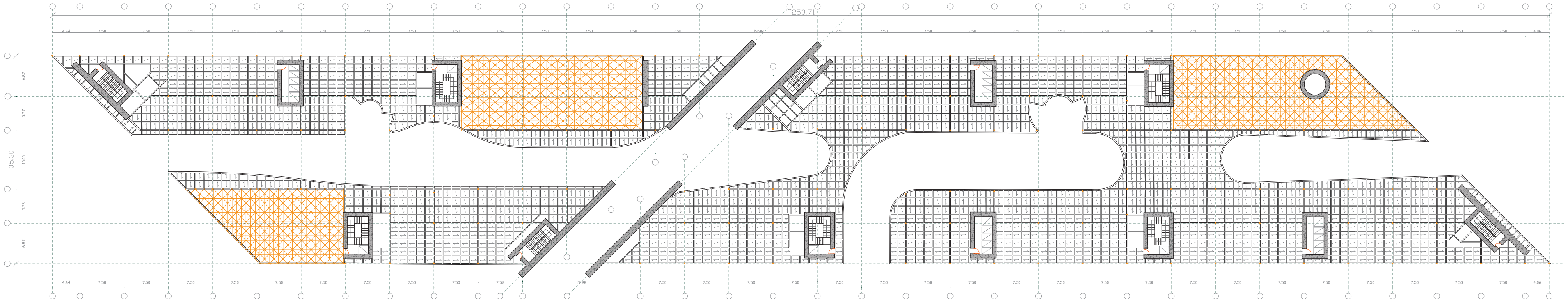


Basement Structural Plan



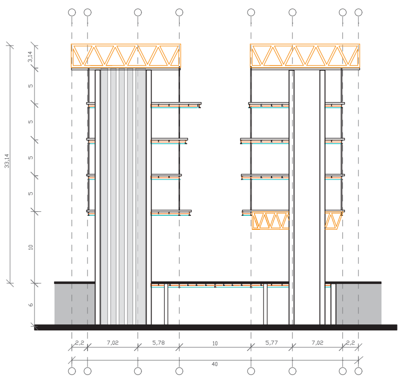
Transversal Structural Sections

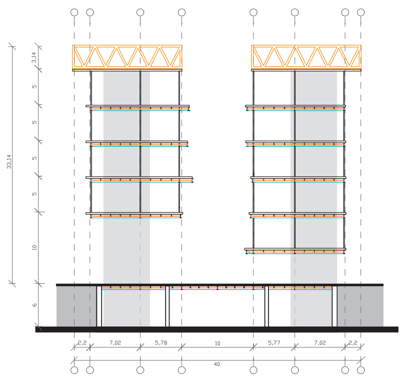
Structural Documentation

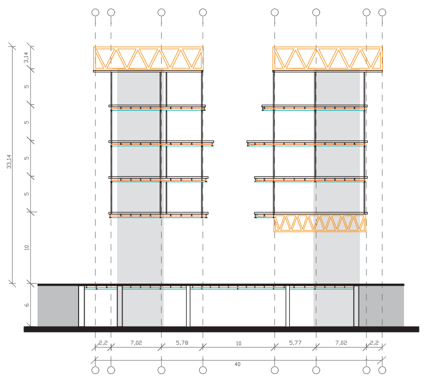


Second floor plan of the project where we see the 3 singularities in the structure present in the building. The first two located at each end of the building towards the east and west end, and the last one located in the auditorium area. These have similar characteristics to those of the roof with the difference of dimension and profile used.

Subsequently, there is a typical floor plan of the building showing the different connections both vertically and horizontally by means of the bridges of each of the spaces. These are also located and organized according to a structural behavior, as well as an architectural organization.







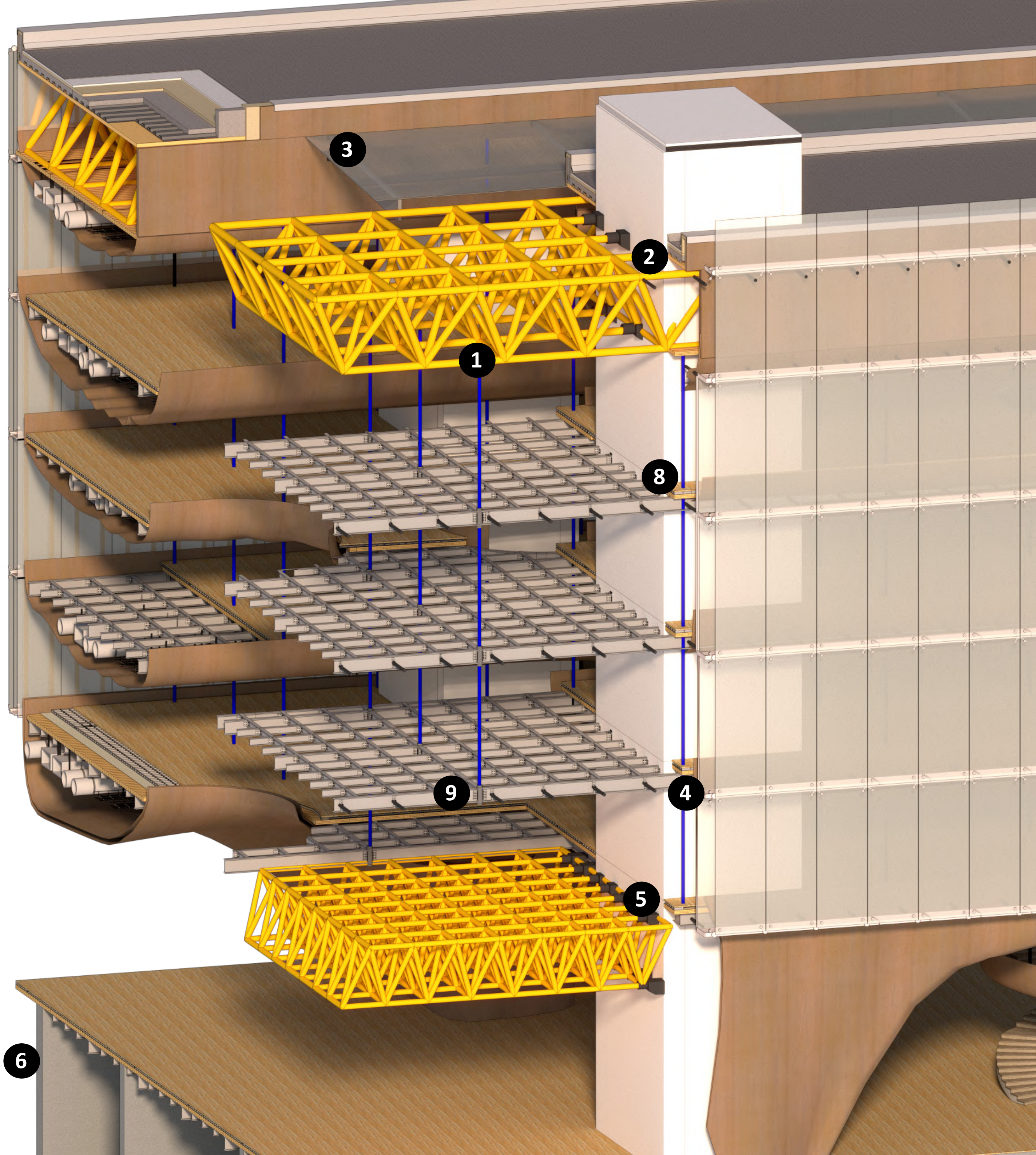
Structural Components Details

1. Rooftop Truss - Cable Connection
2. Rooftop Truss - Core Connection
3. Structural Glass Detail Rooftop
4. Primary Beam - Cable - Facade Profile
5. Core - Secondary Truss Connection
6. Basement Shear Wall - Primary Beam
7. Foundation Detail
8. Core - Primary Beam Connection
9. Primary Beam - Cable Connection

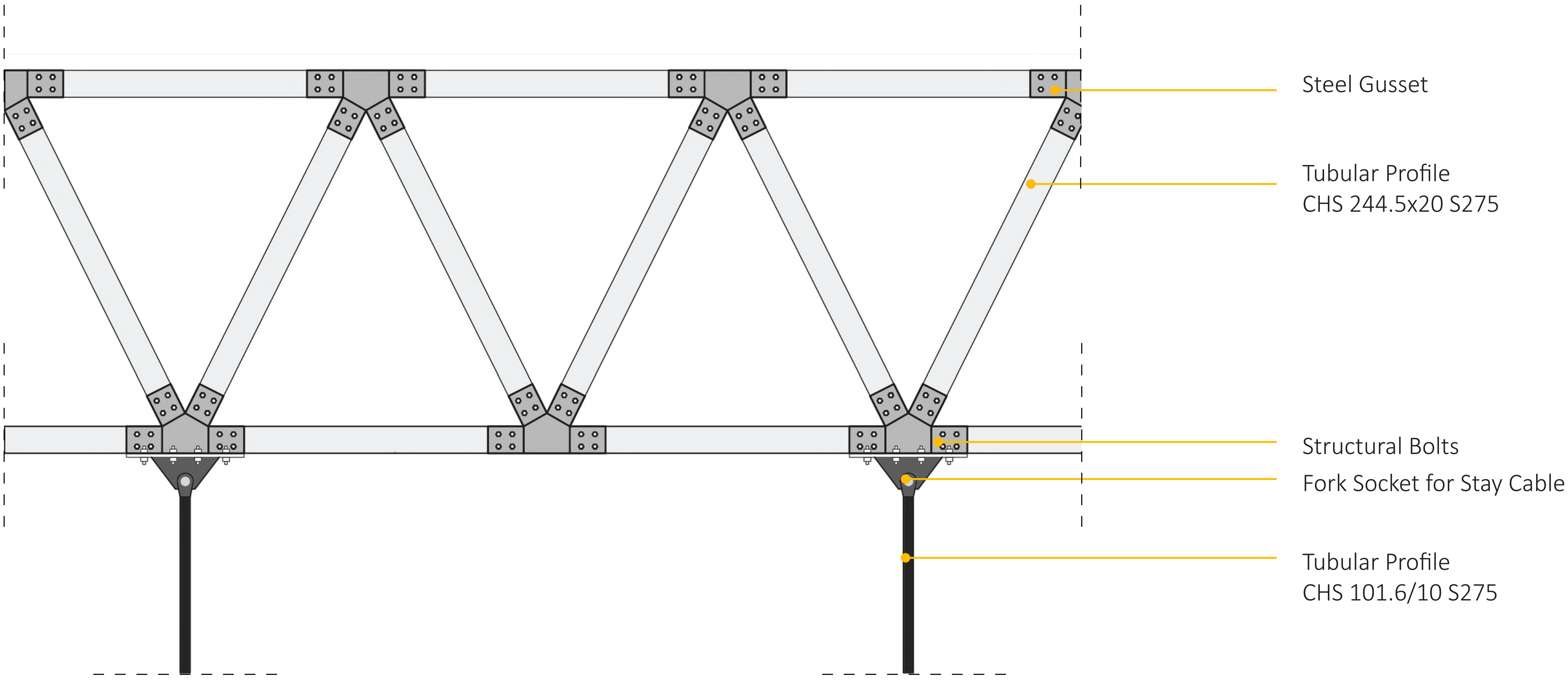
It can be seen how the structure is hidden within the ceiling finishes and the wood sculpture, so the only visible elements are the steel cables.

This image reflects both the conjugation of the structure within the architecture as a primordial part, as well as the stratification of the different layers of the mezzanine plate, to finally realize the level of integration of the different structural elements with the MEP elements that are also a primordial part of the buildings.

Within the project there are multiple structural configurations, each one with singularities now of developing the finishes.

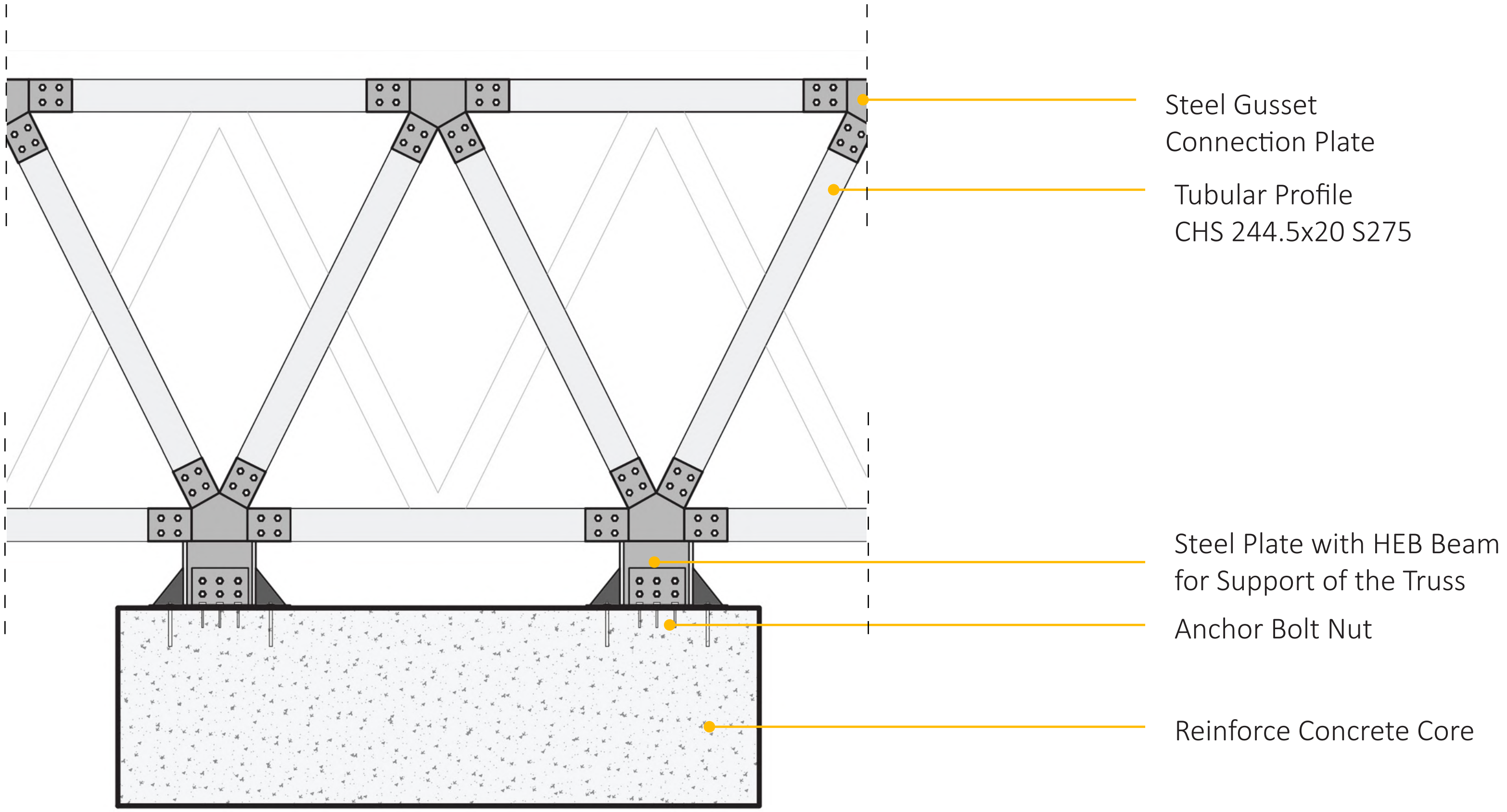


Structural Components Details



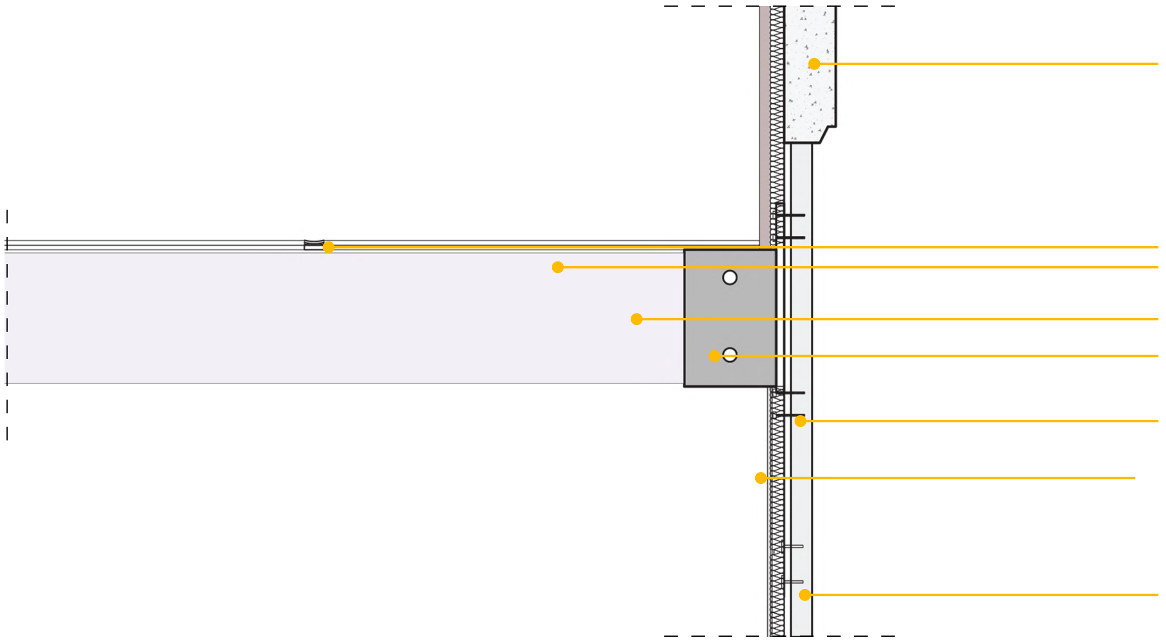
1 Rooftop Truss - Cable Connection

Structural Components Details



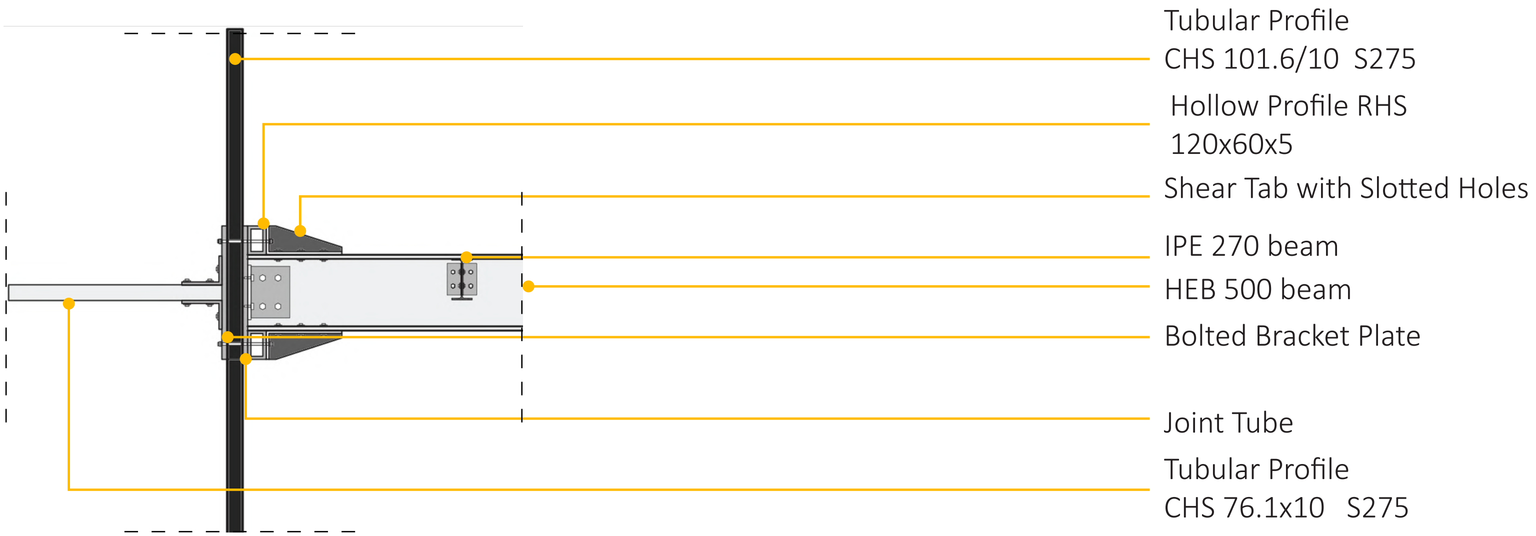
2 Rooftop Truss - Core Connection

Structural Components Details



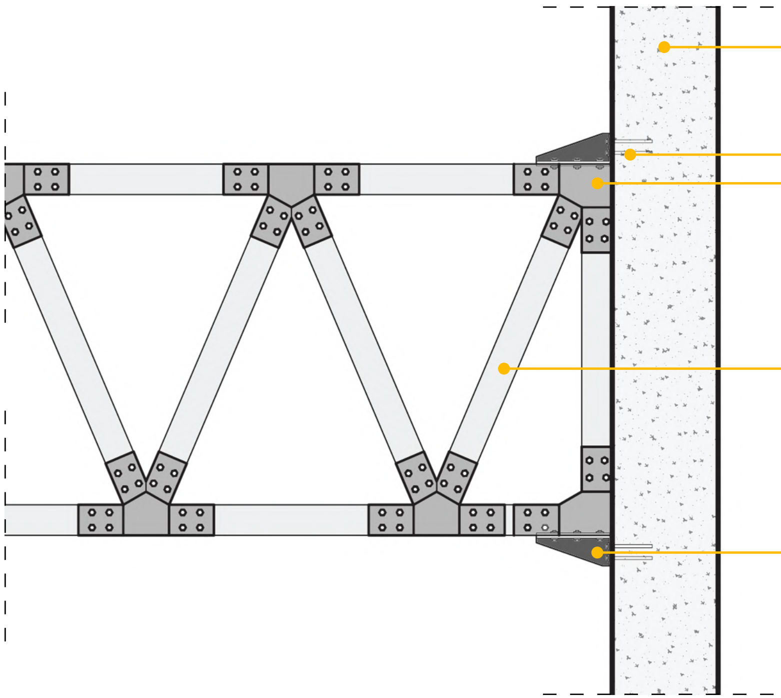
3 Structural Glass Detail Rooftop

Structural Components Details



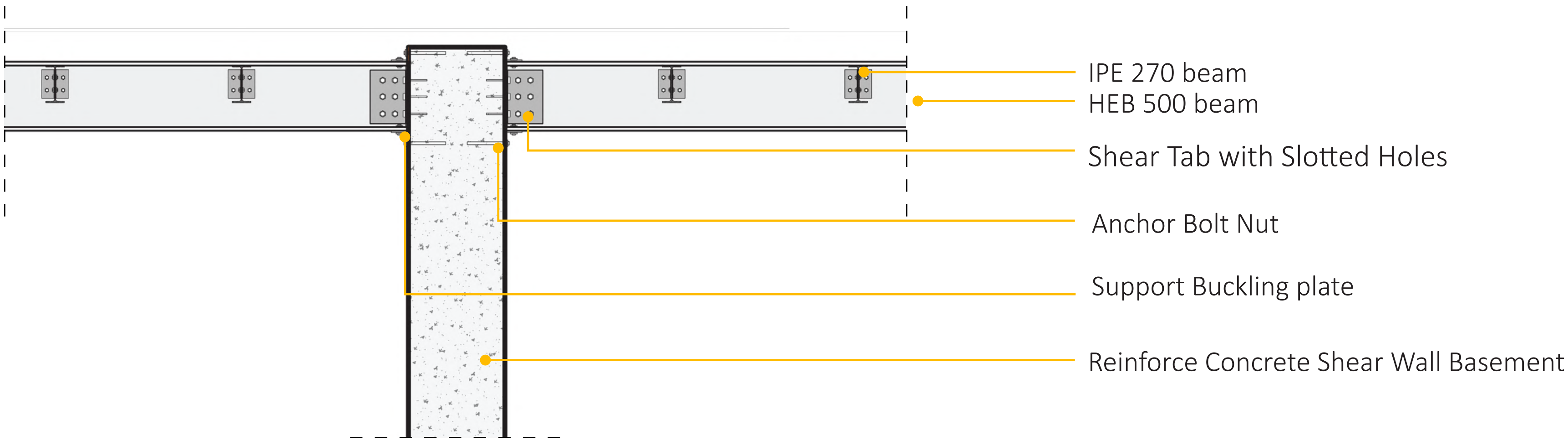
4 Primary Beam - Cable - Facade Profile Connection

Structural Components Details



5 Core - Secondary Truss Connection

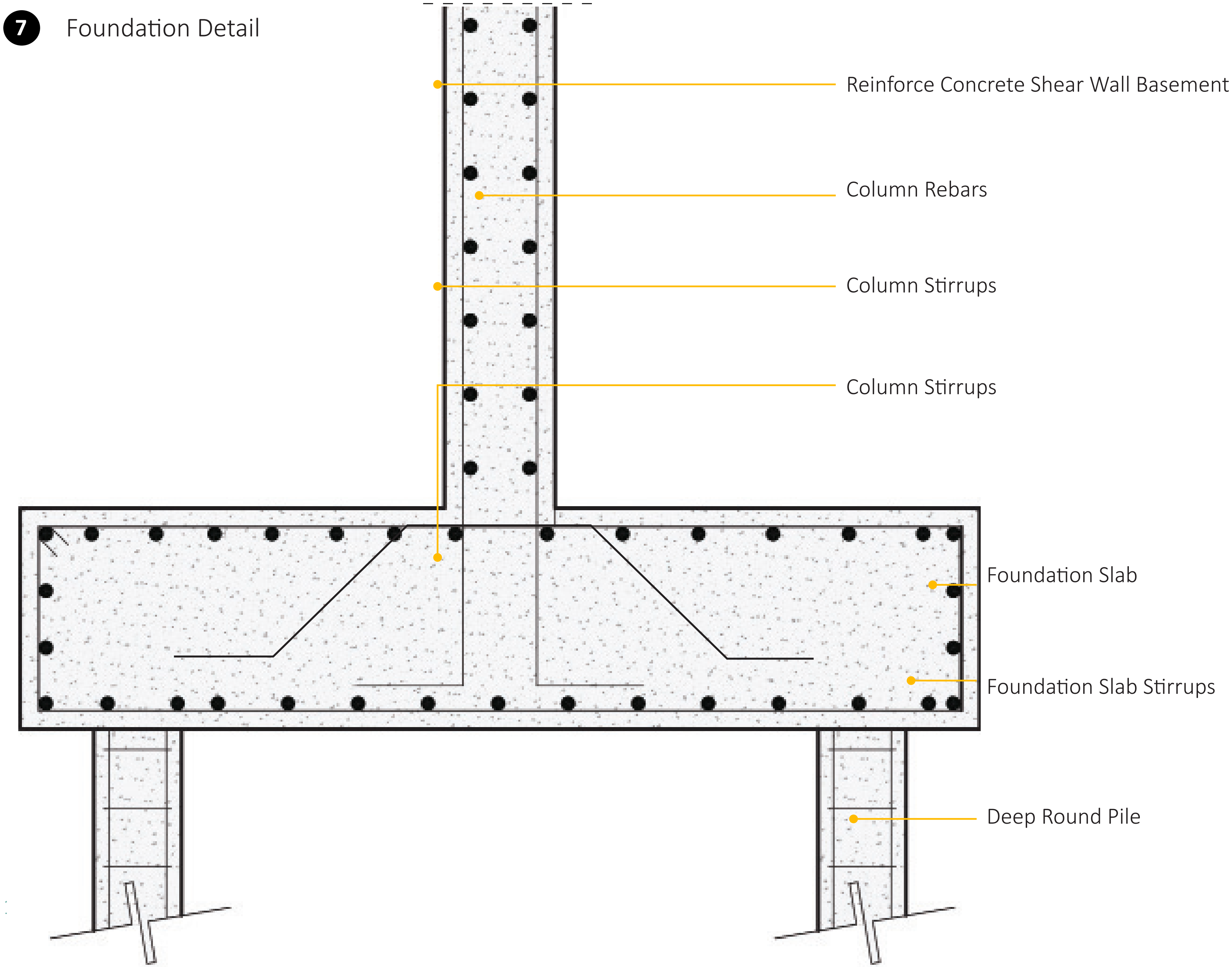
Structural Components Details



6 Basement Shear Wall - Primary Beam Connection

Structural Components Details

7 Foundation Detail

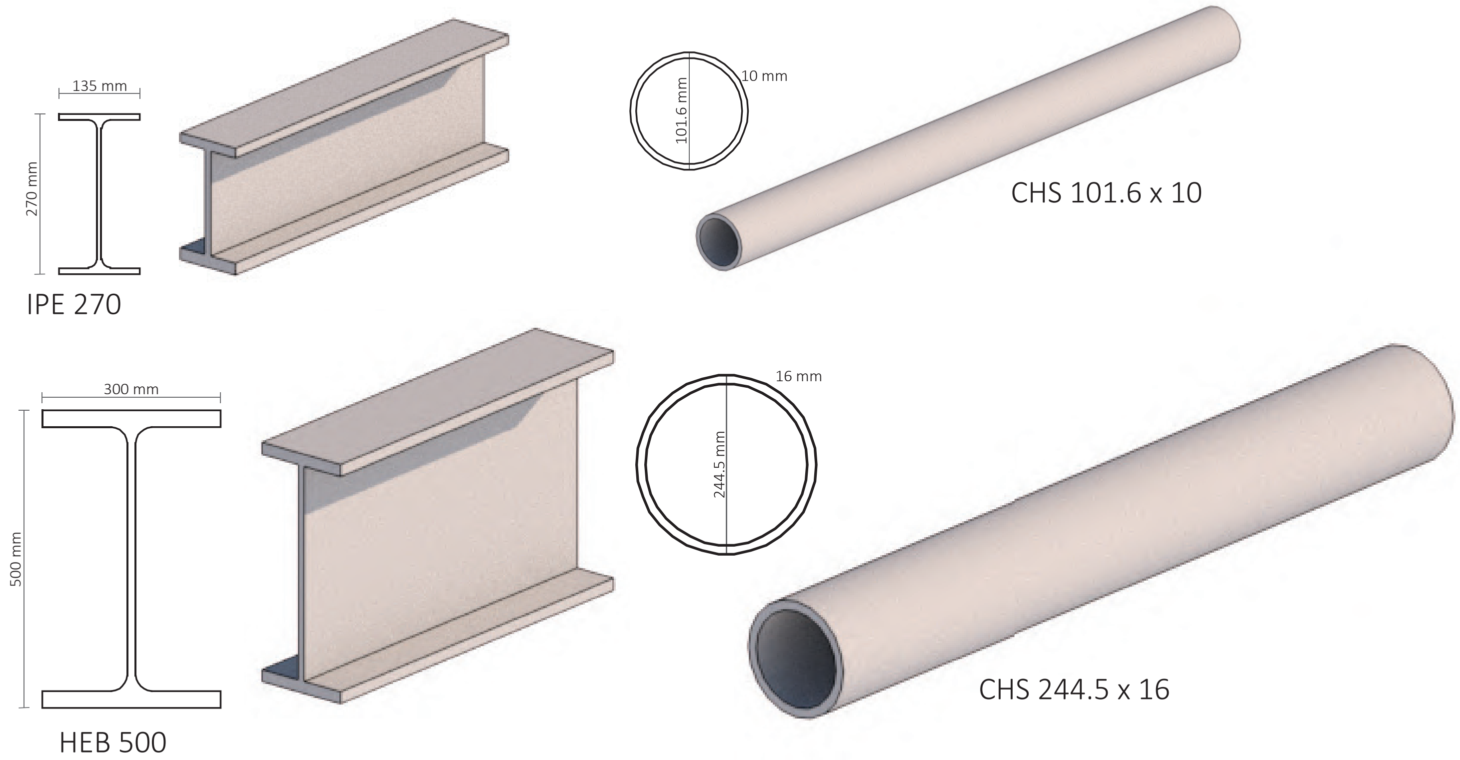


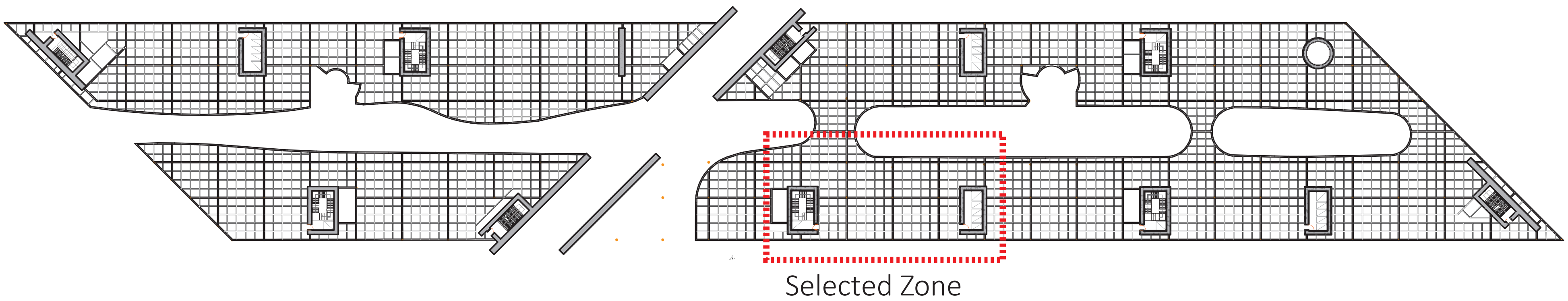
Structural Calcaulations and Verifications

Beam Calcaulation

The structural elements used in the project are composed of primary and secondary beams with HEB 500 and IPE 270 respectively. The slabs in order to make them lighter, we use CLT for it characteristics and behavior.

Also, in the decisions of the materials, we use steel tubular profiles CHS 219.1x10 for the space truss.

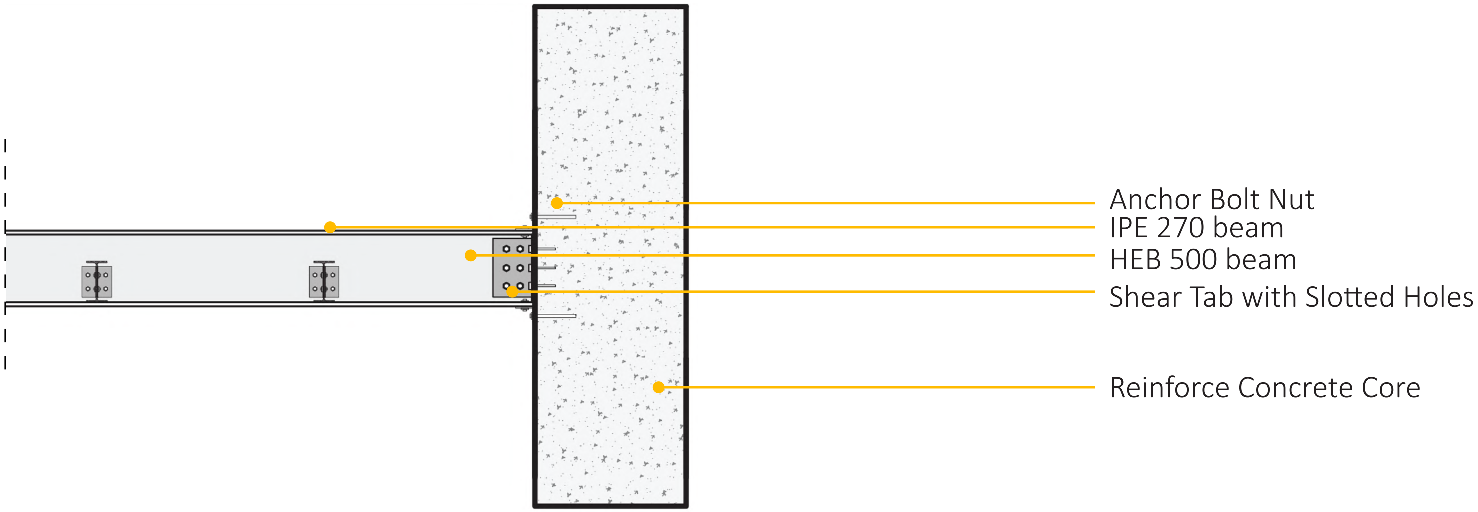




The selected zone for the calculation is a sample of the common construction distribution.

Structural Calcaulations and Verifications

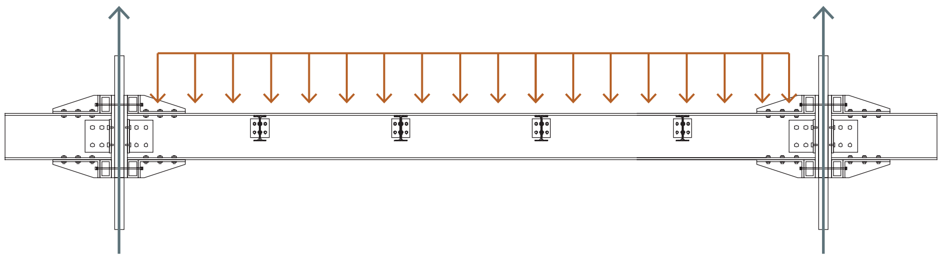
Beam Calcaulation



8 Core - Primary Beam Connection

		S235	S275	S375	1887	1939
f_{yk}	N/mm^2	2352	75	3751	50	190
E	$\times 10^3$ N/mm	2002	00	2002	00	200

Beam Calcaulation



HEB 500		
Primary Beam ULS & SLS		
Beam		
Beam span	7.5	[m]
Interaxis distance	8.3	[m]
Wpl	0.004815	[m3]
Fy	275000	[kN/m2]
ɣMo	1.05	
Av	0.008982	[m2]
E	200000000	[kN/m2]
Ly	0.001072	[m4]

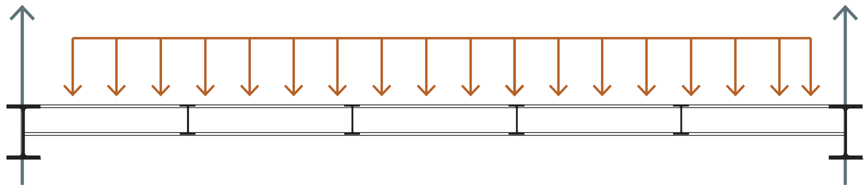
ULS		
q = G1*1,3 + G2*1,3 + Q*1,5		
G1	G2	Q
2.90	17.94	45
q	65.84	[kN/m]
Mmax	1/8 * q * L^2	
Mmax	463	[kNm]
Mpl	Wpl * (Fy/ɣMo)	
Mpl	1261.07	
Mpl > Mmax		
TRUE		
Resistance Verified		
Vmax	5/8 * q * L	
Vmax	341.57	[kNm]
Va	Av * Fy / Raíz3 · ɣMo	
Va	1358.18	[kNm]
Va > Vmax		
TRUE		
Resistance Verified		

SLS		
q = G1 + G2 + Q		
G1	G2	Q
2.23	13.80	30.0
q	46.03	[kN/m]
∂max/ ∂min < 1		
∂min=	(5/384 * q * L^4) / E * Ly	
∂min=	**0.00885**	[m]
	0.88	[cm]
∂max=	1/250 * L	
∂max=	**0.03000**	[m]
	3.00	[cm]
Wmax/ Wmin < 1	0.29	<1
Resistance Verified		

When verifying the loads and weights on the HEB 500 main beam, we can demonstrate how the beam, in spite of its low size and characteristics, resists the loads of. Its arrangement is given with an interval of 7.5 meters between each one, thus generating an organized grid.

Structural Calcaulations and Verifications

Beam Calcaulation



IPE 270		
Secondary Beam ULS & SLS		
Beam		
Beam span	1.38	[m]
Interaxis distance	1.5	[m]
Wpl	0.000484	[m3]
Fy	275000	[kN/m2]
γMo	1.05	
Av	0.002754	[m2]
E	200000000	[kN/m2]
Ly	0.0001177	[m4]

ULS		
q = G1*1,3 + G2*1,3 + Q*1,5		
G1	G2	Q
0.47	17.94	45.0
q	63.41	[kN/m]
Mmax	1/8 * q * L^2	
Mmax	15.09	[kNm]
Mpl	Wpl * (Fy/σMo)	
Mpl	126.76	
Mpl > Mmax		
TRUE		
Resistance Verified		
Vmax	5/8 * q * L	
Vmax	54.69	[kNm]
Va	Av * Fy / Rad3 · σMo	
Va	416.43	[kNm]
Va > Vmax		
TRUE		
Resistance Verified		

SLS		
q = G1 + G2 + Q		
G1	G2	Q
0.36	13.80	30.0
q	44.16	[kN/m]
∂max/ ∂min < 1		
∂min=	(5/384 * q * L^4) / E * Ly	
∂min=	0.000089	[m]
	0.01	[cm]
∂max=	1/250 * L	
∂max=	0.005520	[m]
	0.55	[cm]
Wmax/ Wmin < 1	0.02	<1
Resistance Verified		

Likewise, the verification for the secondary beam, which is an IPE270 and its location is done every 1.75 meters. This in order to make a layout that allows the use of a smaller CLT plate, allowing to reduce the size of the plate.

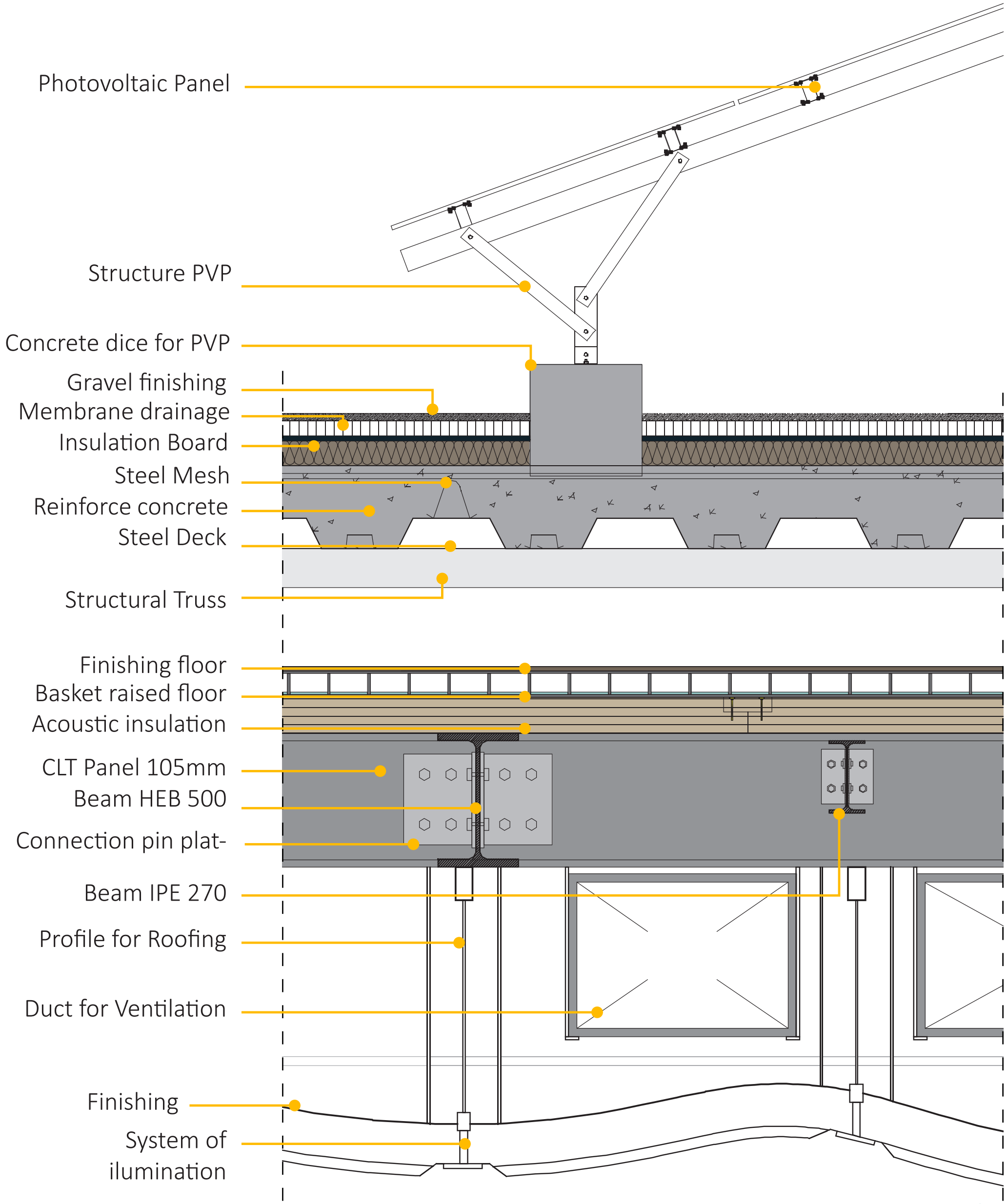
Structural Calcaulations and Verifications

Slab Calcaulation

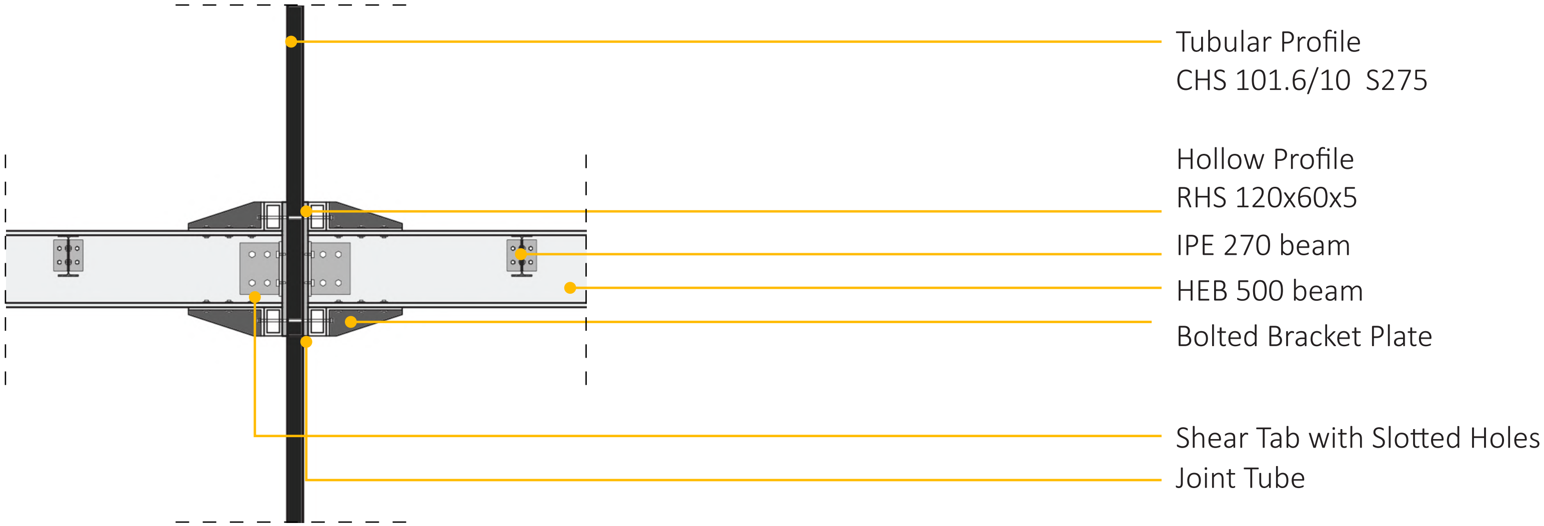
In the calculation of the weight of the slabs, we can appreciate the use of the CLT and the only slab that have different characteristics is the rooftop, in which we use a reinforce concrete slab, this due the behave of the CLT slabs in outside conditions like rain, ice and sun. Also, the idea is to create light structure with the same concept for the slabs to control the dimension of the elements, in order to reduce costs have a better composition in the project.

Rooftop Slab				
Dead Loads				
G1	Space truss	Circular Hollow section 139,7 mm Diameter 10 mm thickness	0.294	[kN/m]
G1			**0.294**	**[kN/m]**
G2	Slab Distribution			
		PVP with structure (aprox)	0.50	[kN/m2]
		Gravel Finishing 2 cm deep	0.34	[kN/m2]
		Waterproof membrane	0.00	[kN/m2]
		Insulation Board	0.10	[kN/m2]
		Reinforce concrete deck	4.80	[kN/m2]
		Steel Deck	0.16	[kN/m2]
		Insulation board	0.10	[kN/m2]
	Total		6.00	
G2 Principal Beam			44.978	[kN/m]
G2 Secondary Beam			8.276	[kN/m]
Q	Live Loads Library			
		Linear Load Library	4.0	[kN/m]
		Snow Load Library	1.3	[kN/m]
	Total		5.30	
G2			39.8	[kN/m]

Typical Slab				
Dead Loads				
G1	Primary Beams	HEB 500	1.873	[kN/m]
	Secondary Beams	IPE 270	0.361	[kN/m]
G1			2.234	[kN/m]
G2	Slab Distribution			
		PVC floor panel + System	0.26	[kN/m2]
		Impact insulation layer	0.09	[kN/m2]
		Acoustic insulation x2	0.06	[kN/m2]
		CLT panel	0.44	[kN/m2]
		AC system	0.39	[kN/m2]
		Finishing - Wood Element	0.60	[kN/m2]
	Total		1.84	
G2 Principal Beam			13.800	[kN/m]
G2 Secondary Beam			2.539	[kN/m]
Q	Live Loads Library			
		Linear Load Library	4.0	[kN/m]
				[kN/m]
	Total		4.00	
G2			30.0	[kN/m]



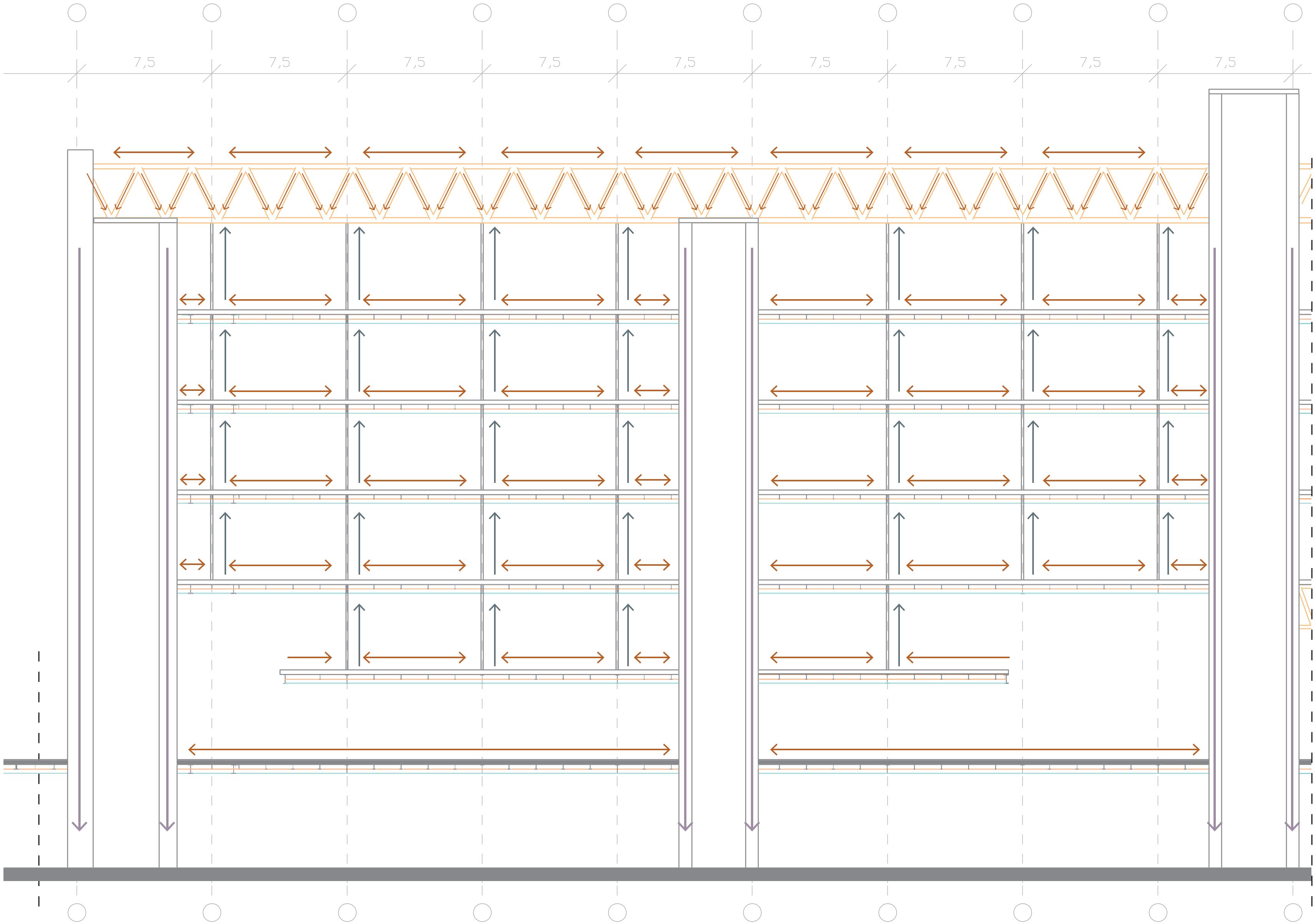
Cable Calcaulation



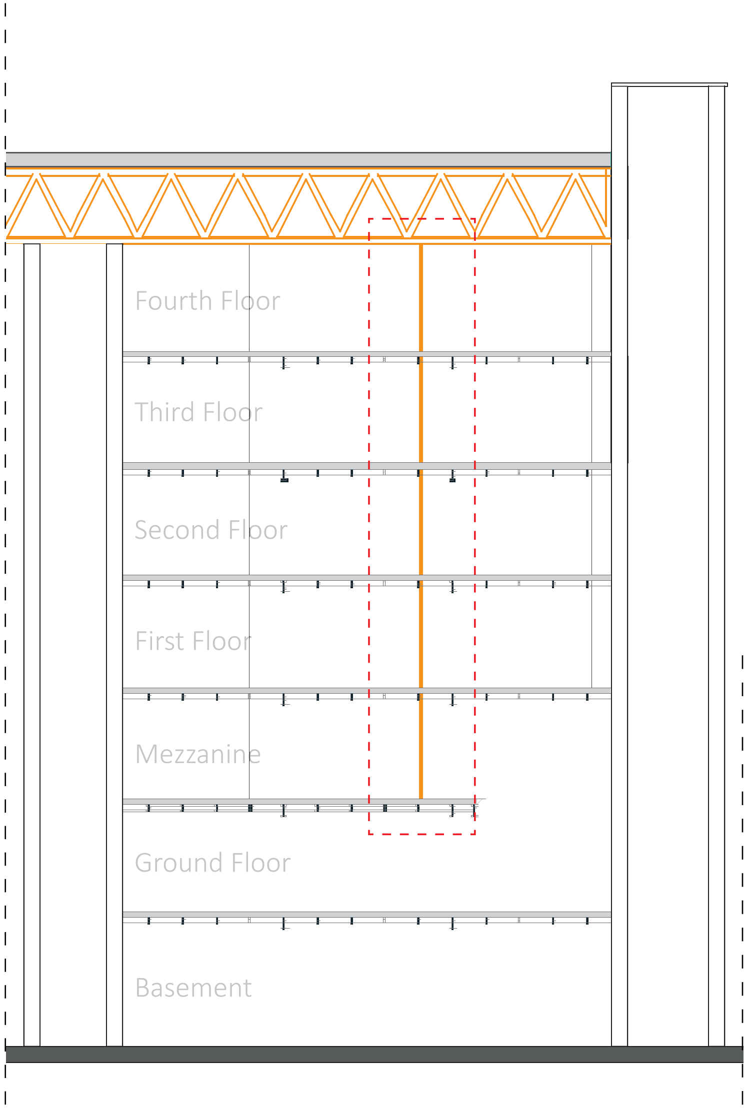
9 Primary Beam - Cable Connection

Cable Calcaulation

In the scheme of loads, we explain how the slabs working are compression and at the same time we use the cable that works in tension to behave as organize structural elements that support the structural behave of the building. Also the space truss helps in order to reach big distances without structure when at the same time carry the load of the beams and transfer it into the cores.



Cable Calcaulation

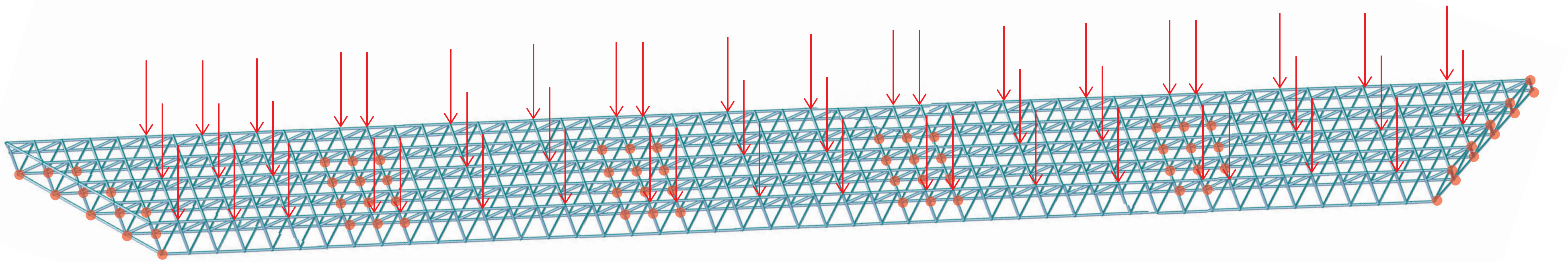


SECTION OF THE PIPE		
CHS 101,6/10		
ΔL = NL/EA		
E	210000000	[kN/m2]
L	5.0	m
A	0.001517	m2
N	1118.21	kN
ΔL	2 or 3	cm
	0.02 or 0.03	m
ΔL	1.755E-02	
	0.0177	**m**
	1.77	**cm**

CHS 101,6/10		
Cables		
Area of Slab	31.31	m2
# slabs	5	Und
Weight of the slab	1.84	[kN/m2]
Total	288.05	kN
Principal beam	11.44	ml
Weight PB	1.8730	[kN/m]
Total	107.14	kN
Secondary beam	53.64	ml
Weight PB	0.3610	[kN/m]
Total	96.82	kN
Q live laod	31.31	m2
Weight	4.00	[kN/m]
Total	626.20	kN
Nd total	1118.21	kN
γMo	1.05	
γ_m =	275000	[kN/m2]
$f_{yd} = f_{yk}/\gamma_m$ =	261905	[kN/m2]
fyd > Nd		
TRUE		
Resistance Verified		

Structural Calcaulations and Verifications

Structure Overall Verification



In the first part of the analysis made by MIDAS, we evaluated all the structural elements of the space truss located in the rooftop of the building. The model was imported from Archicad to Autocad and then to MIDAS.

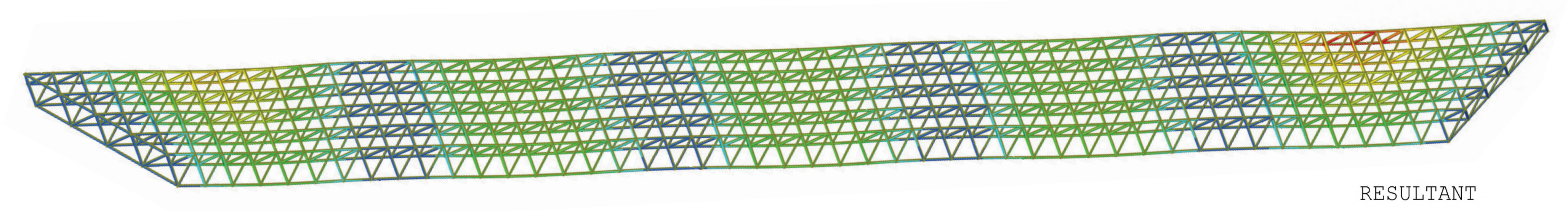
With this configuration we also include the distributed load of the rooftop that included the dead load of 6 kN/m²(DL) where is the structure and the slab . Also we included the snow load (SL) that have a load of 1.5 kN/m².

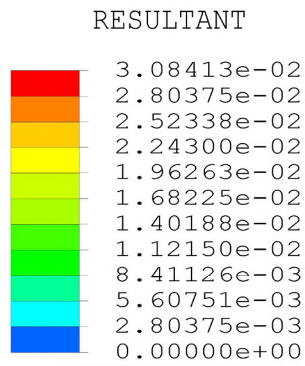
Puntual Load- 1118.21 kN/m²

Restrains- Connection Truss / Cores

ULS
Ultimate Limit State
1.3 x (DL) + 1.5 x (LL)

SLS
Serviceability Limit State
1.0 x (DL) + 1.0 x (LL)

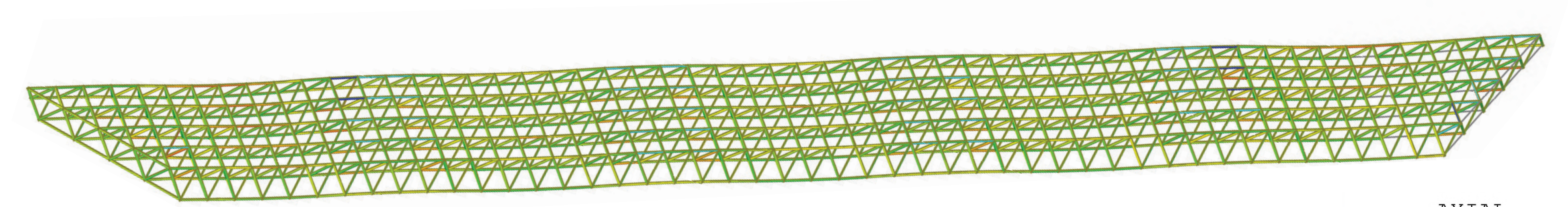


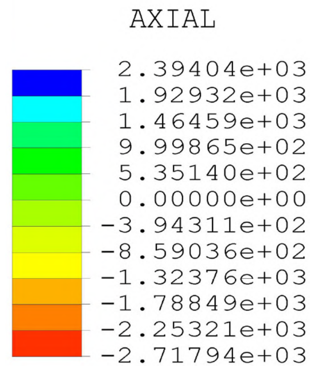


Displacement - SLS

1.0 x (DL) + 1.0 x (LL)

CHS 244.5 x 20



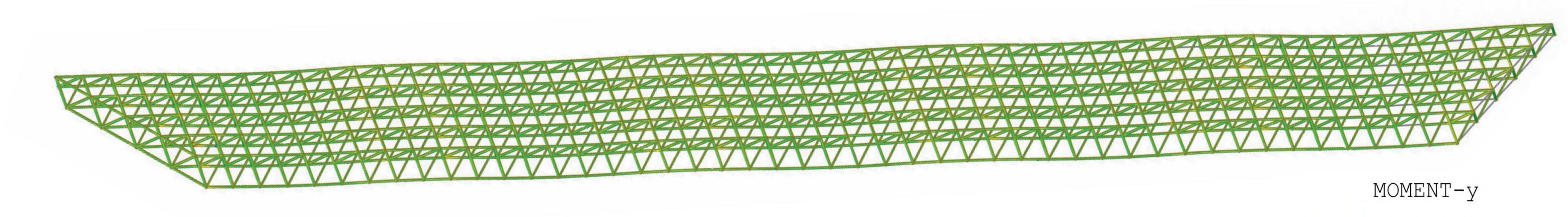


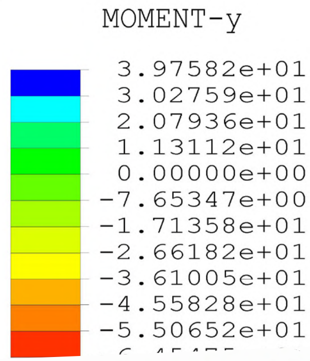
AXIAL FORCE - ULS

1.3 x (DL) + 1.5 x (LL)

CHS 244.5 x 20

- Structural Calcaulations and Verifications

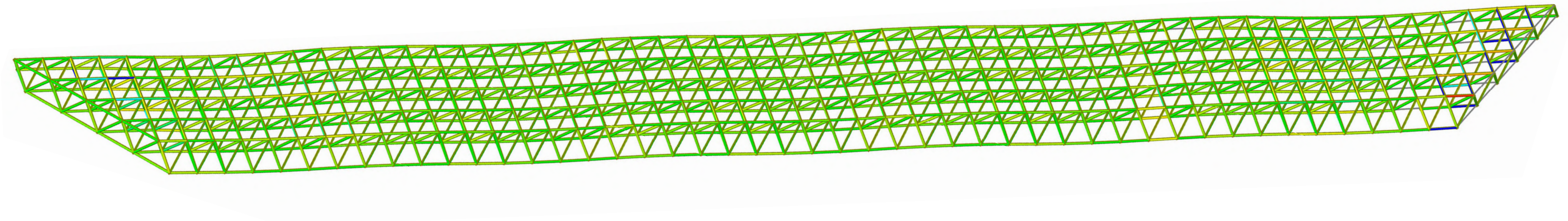


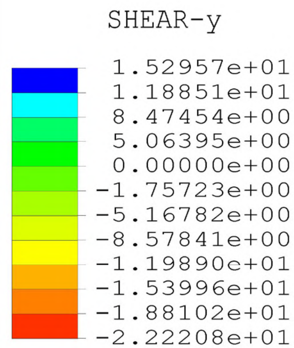


MOMENT in Y - ULS

1.3 x (DL) + 1.5 x (LL)

CHS 244.5 x 20

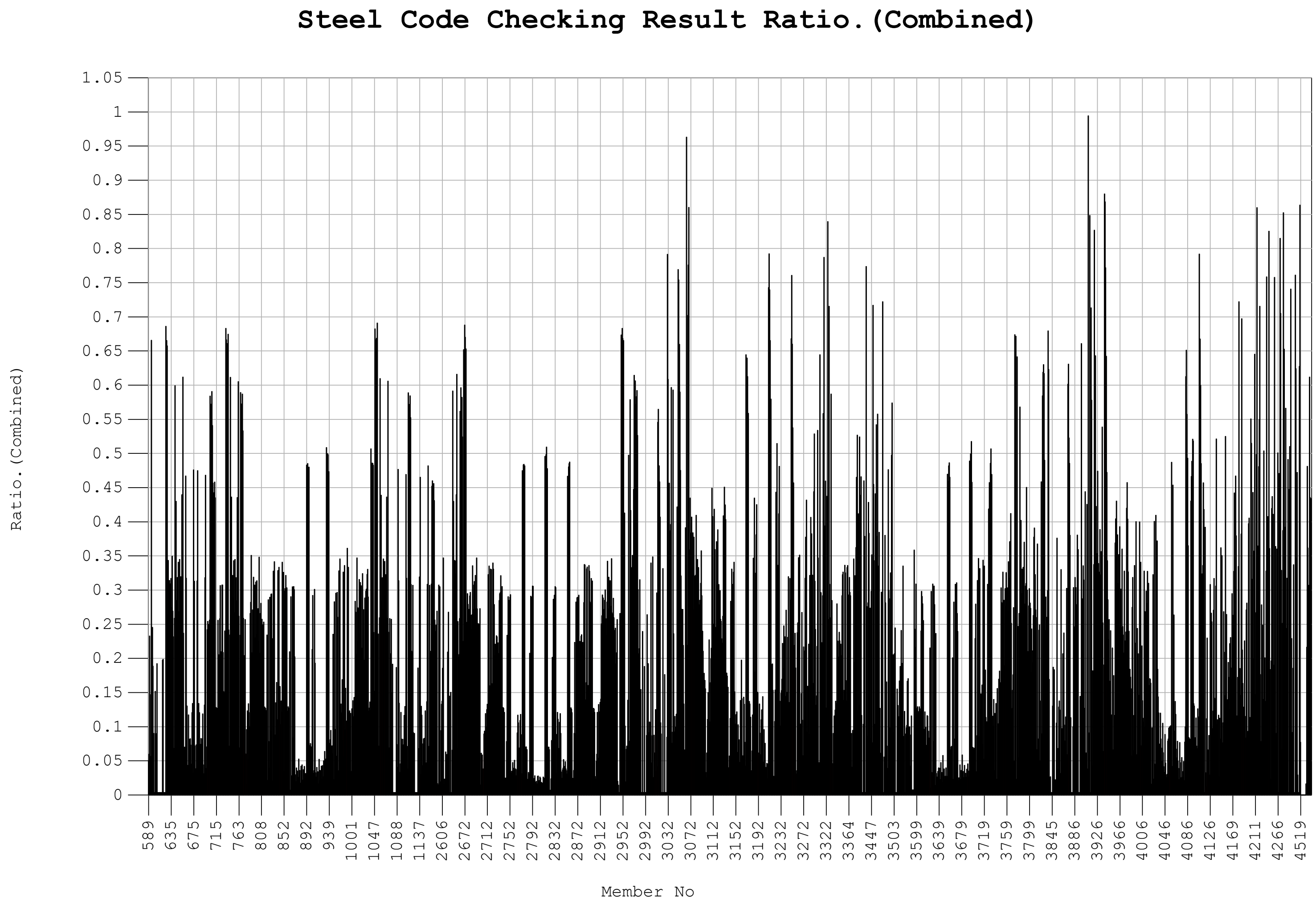




SHEAR in Y - ULS

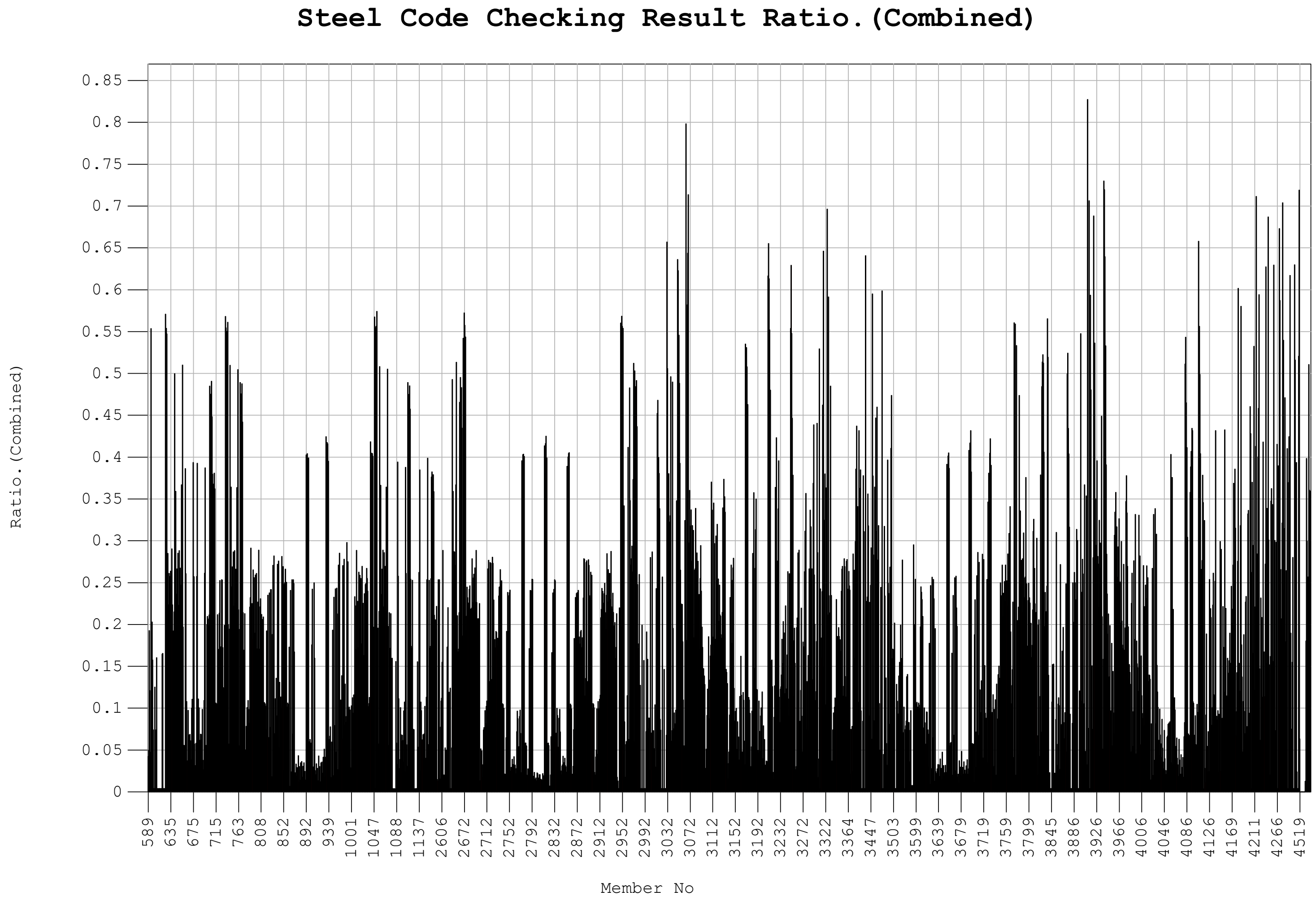
1.3 x (DL) + 1.5 x (LL)

CHS 244.5 x 20



CHS 244.5 x 16

In this analysis we see how this section (CHS2445x16) despite having a larger size, still presents failures in the steel code checking. This can also be seen in the deformation and displacament found in the analysis. By examining the options according to the need, we can see that even by increasing the section diameter, the result does not vary in comparison to the option of increasing the thickness.



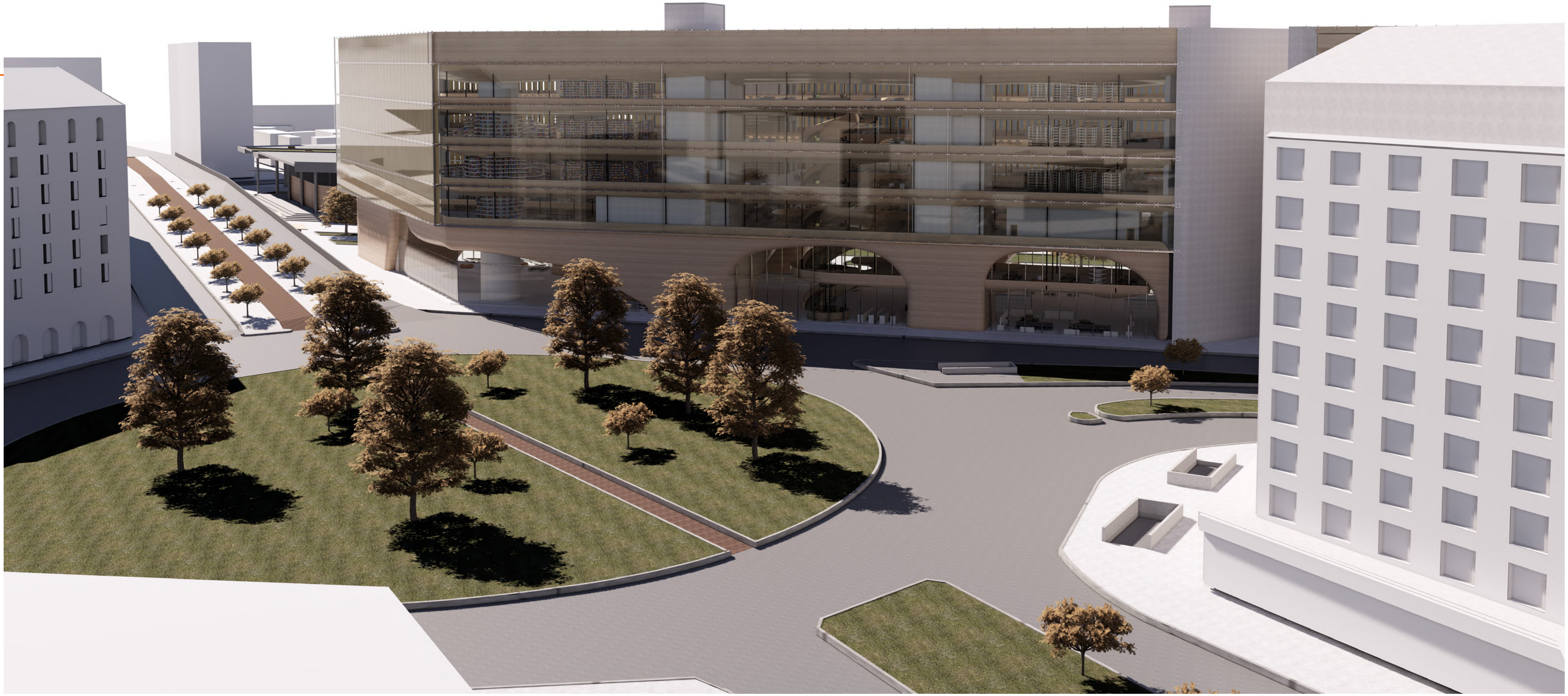
CHS 244.5 x 20

The steel code checking shows how all the sections are below 1.0 and only a few are close to 0.85. The great majority is below 6 which gives us to understand how the structure, in spite of the section and the multiple loads it is subjected to, manages to resist. This also demonstrates how in the end, despite having a 3.0 cm deflection in the SLS, the structure performs adequately for the need.

Technology and Detail

Entrance I ***"La Fuga"***

On the eastern and western facades, a uniform appearance above the ground floor level has been pursued. The ground floor showcases organic-shaped interior wooden panels towards the exterior. On the entrance facades, which are the eastern and western facades, this organic covering delineates the entrances through a "folded" configuration.

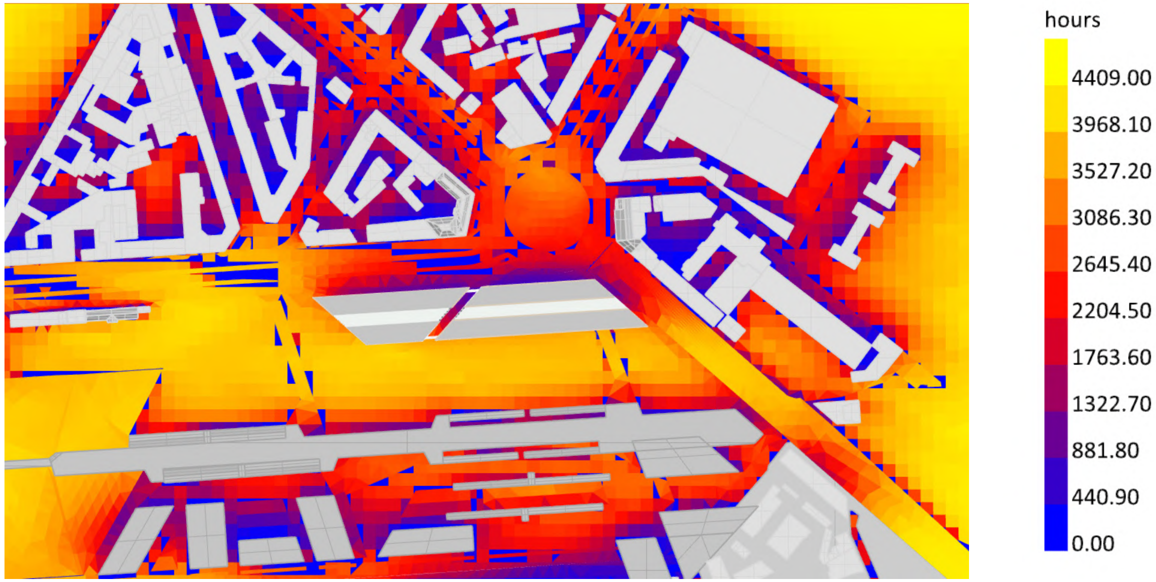


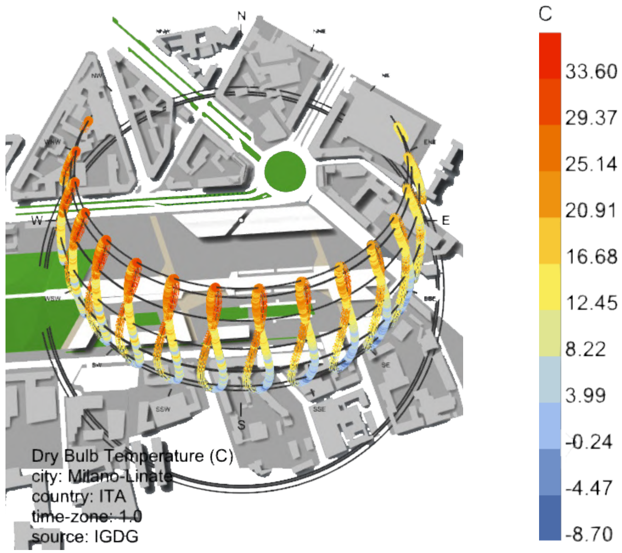
BIM Study of
The Wall of Porta Romana

In the project, we obtained environmental analyses using different programs, taking into consideration the physical requirements of a library. These analyses guided the design based on crucial factors such as daylight, shadows, direct sunlight, and interior illumination factors. During the design phase, programs like Ladybug and Velux Daylight were employed for this analysis stage.

In addition to environmental factors, programs that aided in visualizing and improving aspects such as construction processes and sustainability were utilized. The Synchro 4D program allowed us to think about how the structure could be constructed and put it on a timeline. The Active House system was used to highlight deficiencies in terms of sustainability and LEED certification adequacy.

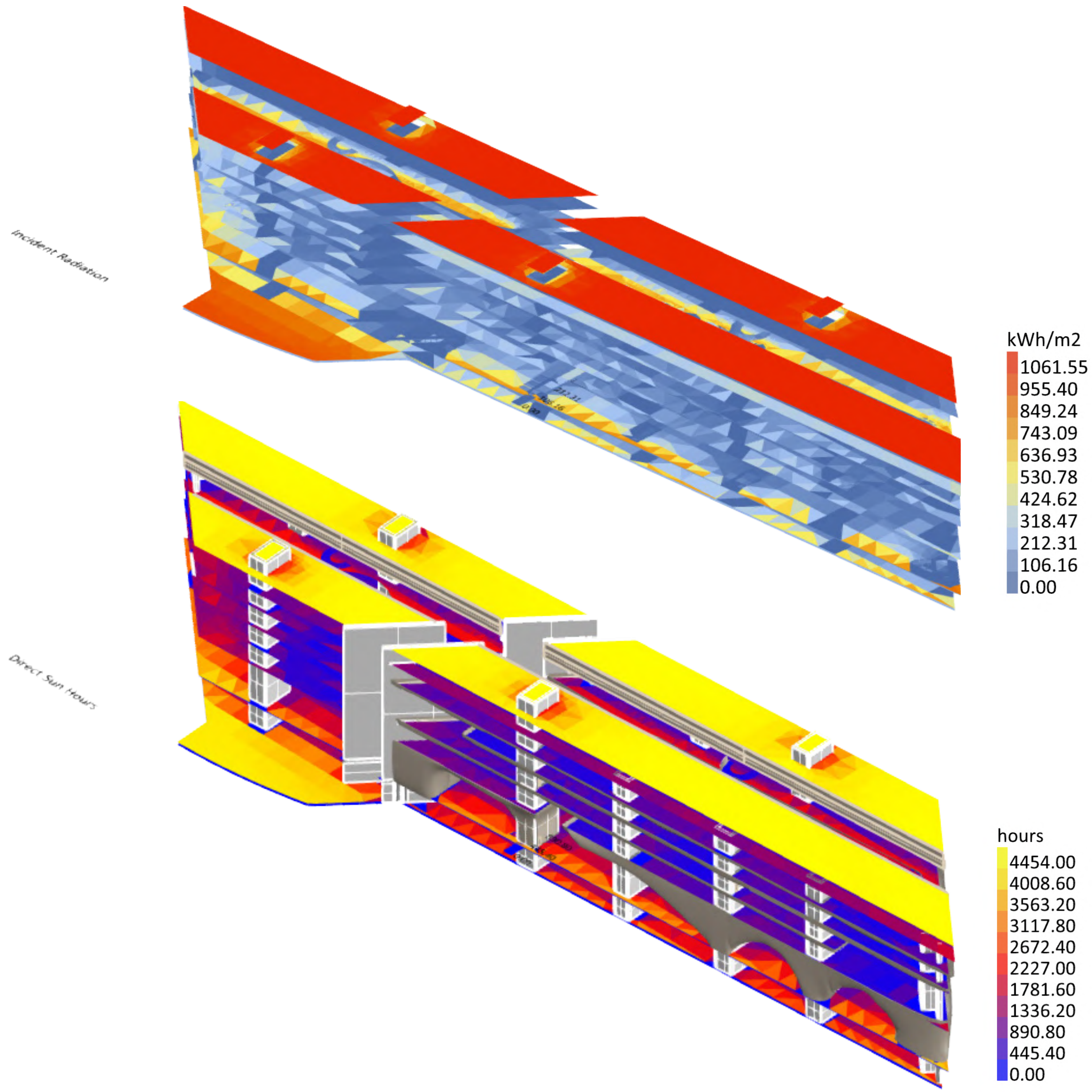
To continuously monitor errors in the 3D model of this project and adjust the BIM modeling, we relied on the Solibri program.



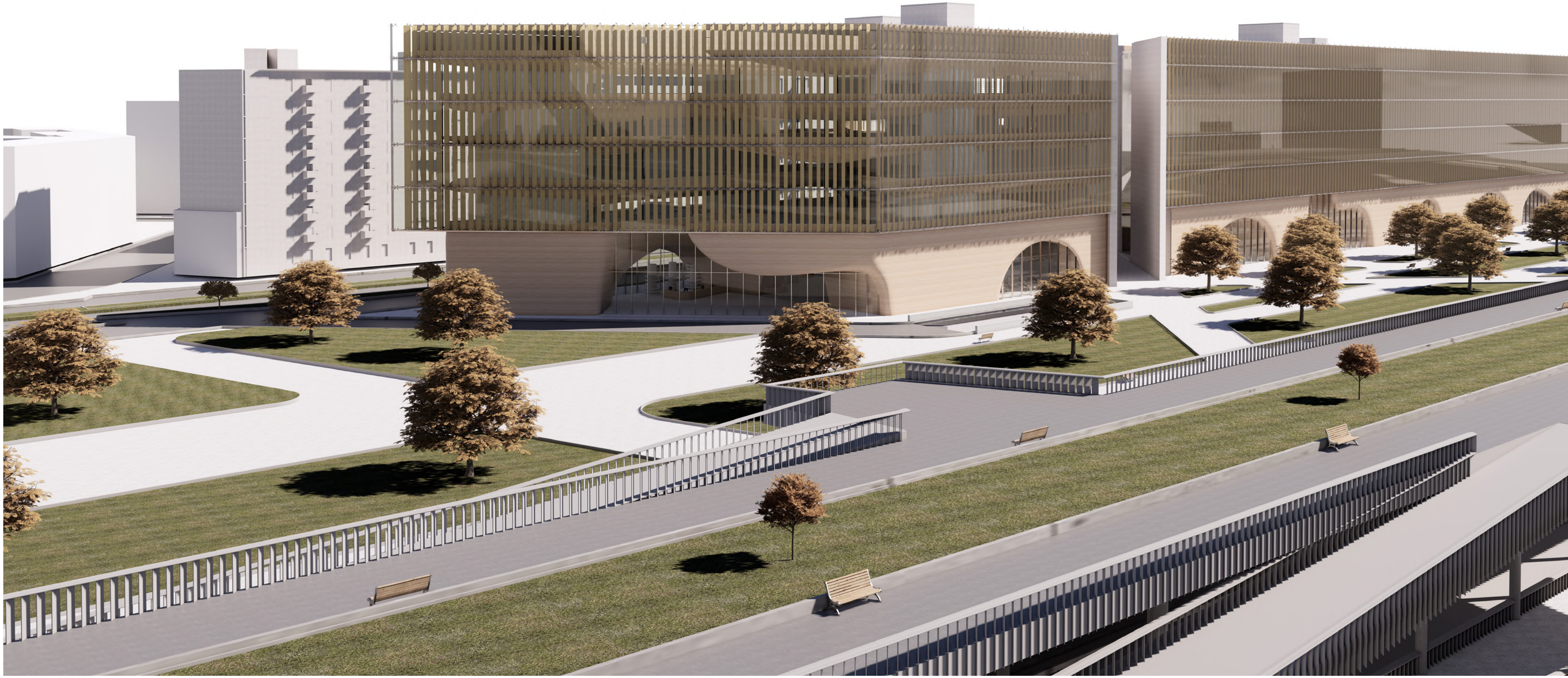


Building Facade: Preliminary Study

Before the facade design, we measured radiation exposure and daylight hours on the facade to determine which areas should be shaded as a priority and to analyze advantageous zones for energy collection using Ladybug. With daylight analysis, we measured the amount of sunlight that was shaded after the addition of our facade (as shown in the diagram above).



Building Facade Composition



Entrance I ***"La Fuga"***

The entrance of Piazza Trento, facing the park, serves as a facade that provides a homogeneous appearance for Highline users while also emphasizing the entrance. This entrance is specifically oriented towards Imaginarium users and those coming from the Trento direction.

Facade System

"The Wall of Porta Romana" façade design was guided by the need for a homogeneous appearance due to it being a wall, as well as consideration of four important physical factors:

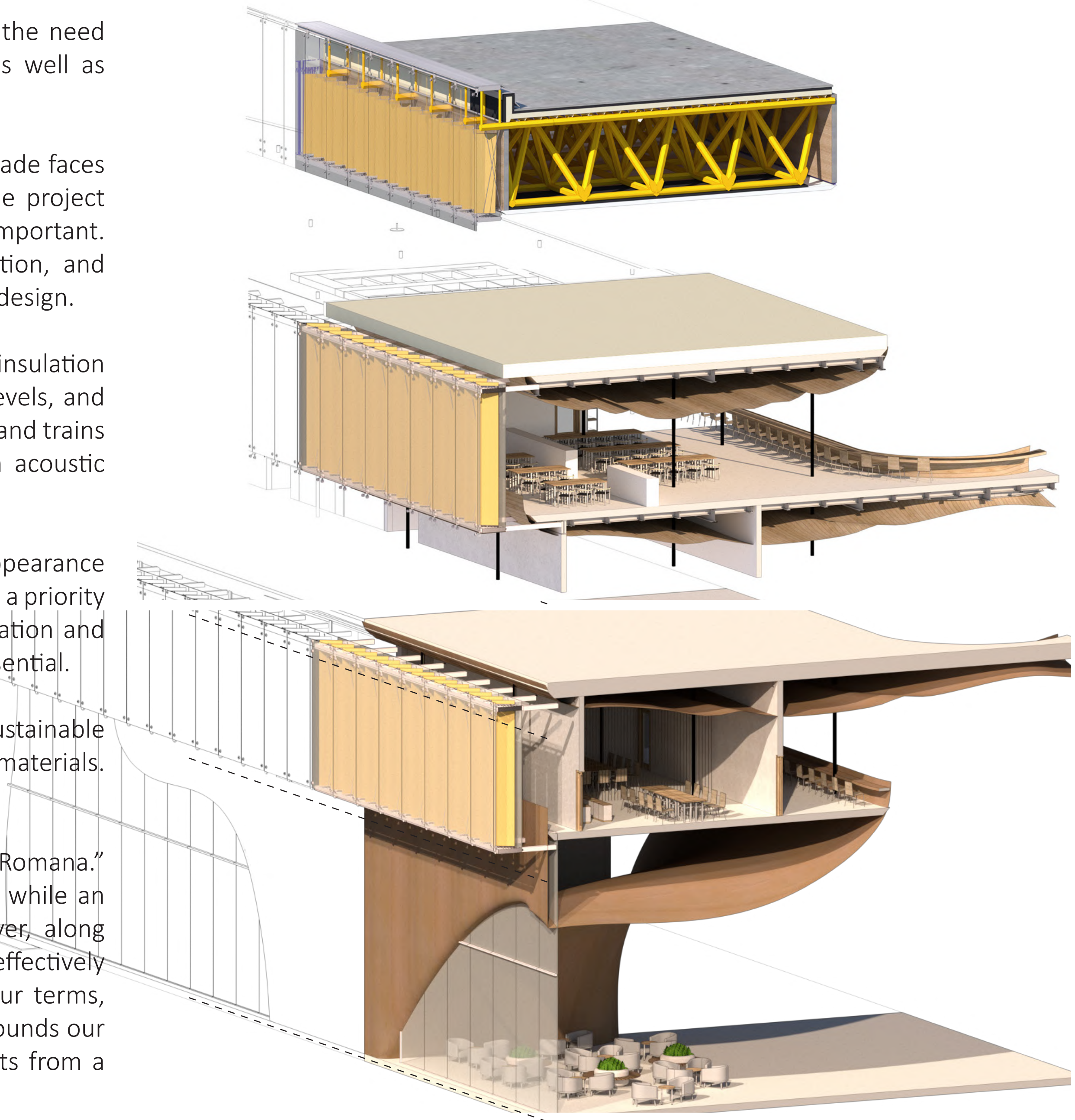
1. Sun Control: Given that approximately 5400 m^2 of the façade faces directly south, and a significant part of the activities in the project involve reading, utilizing sunlight to our advantage was important. Factors such as daylight, direct sunlight, internal illumination, and optional use and automation were taken into account in the design.

2. Acoustic Performance: As a library requires high sound insulation and minimal contrast between interior and exterior noise levels, and considering the location's exposure to urban sounds like cars and trains at Porta Romana, the façade needed to serve as both an acoustic reflector and insulator.

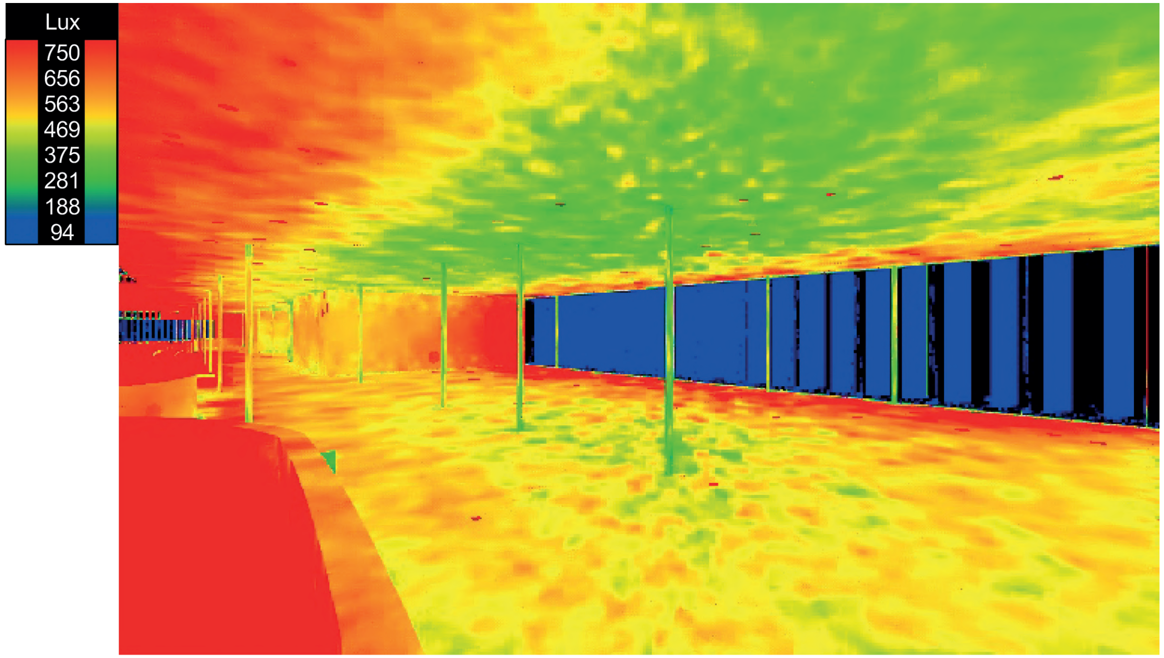
3. Climate Control: Balancing the need for a transparent appearance with the ability to maintain and control the indoor climate was a priority in the design process. Creating opportunities for heat insulation and ventilation in the façade to achieve this dual purpose was essential.

4. Sustainability: The extensive façades needed to be sustainable and contribute to other aspects of the building besides just materials. Integrating systems beyond materials was necessary.

These four factors led to the design of "The Wall of Porta Romana." Its outermost layer collects energy with photovoltaic glass, while an automated, sun-tracking shading system in the middle layer, along with an inner glass layer, encapsulates all these systems, effectively creating an air duct and providing acoustic insulation. In our terms, it's our "Box." This façade system not only conceptually surrounds our structure but also provides solutions to all our requirements from a systemic perspective.



Facade System Mechanisim

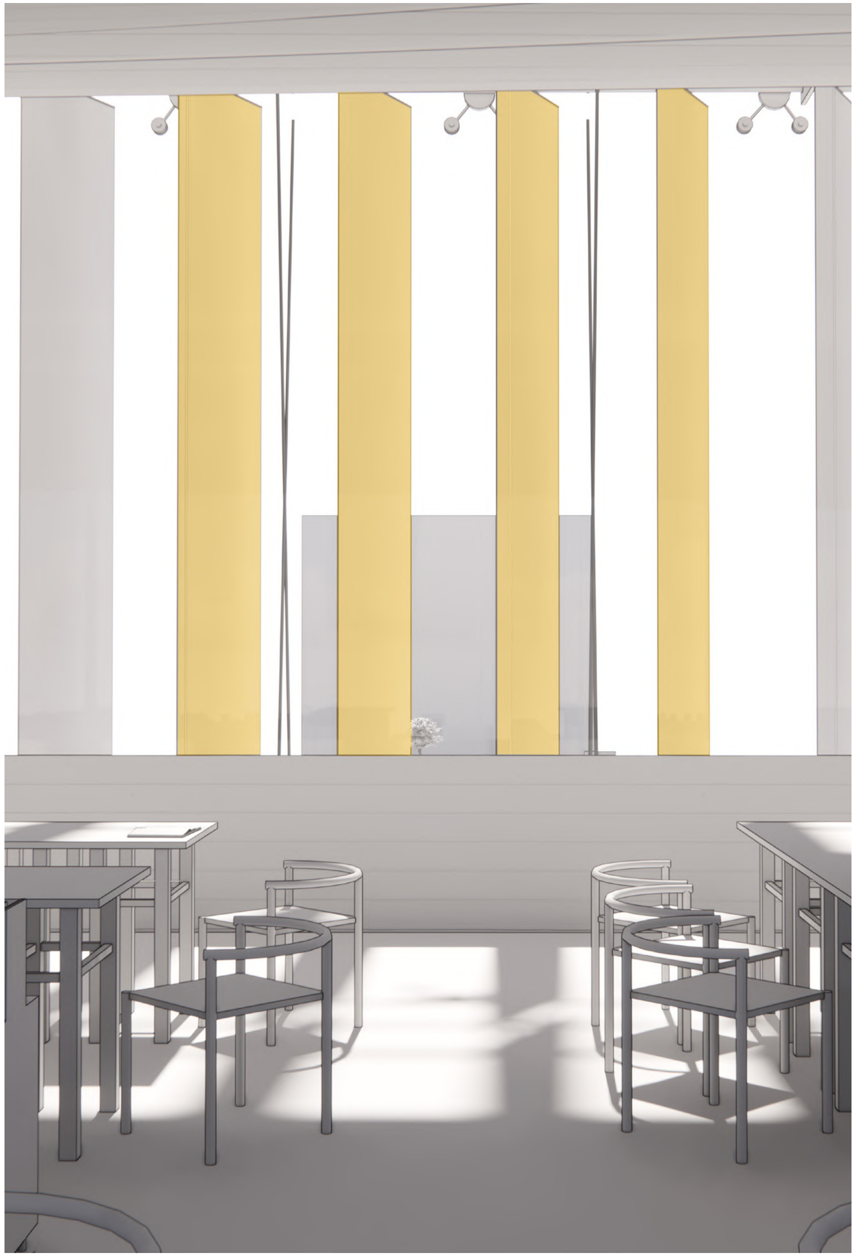


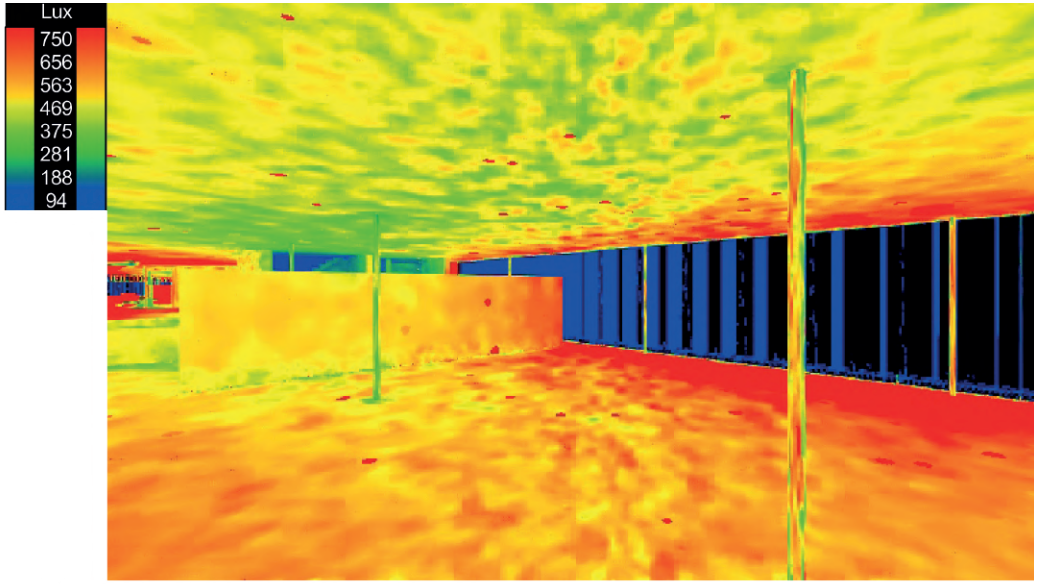
Location	**Milan, latitude 45.3 N, longitude 9.1 E**
Time	**March at 12:00**
Orientation	**0.0 CW**
Sky condition	**Intermediate (7)**
Ext. illuminance	**24,777.2 lux**

The Energy Saving Mode, which is the most closed among the facade modes, is designed to prevent energy loss inside the building when there are no occupants (to prevent overheating inside during summer) and to prevent unnecessary exposure of bookshelves to sunlight. The curtains align parallel to the facade and allow only enough sunlight to enter to illuminate the interior dimly.

Daylight Goal 6%

Facade System Mechanisim



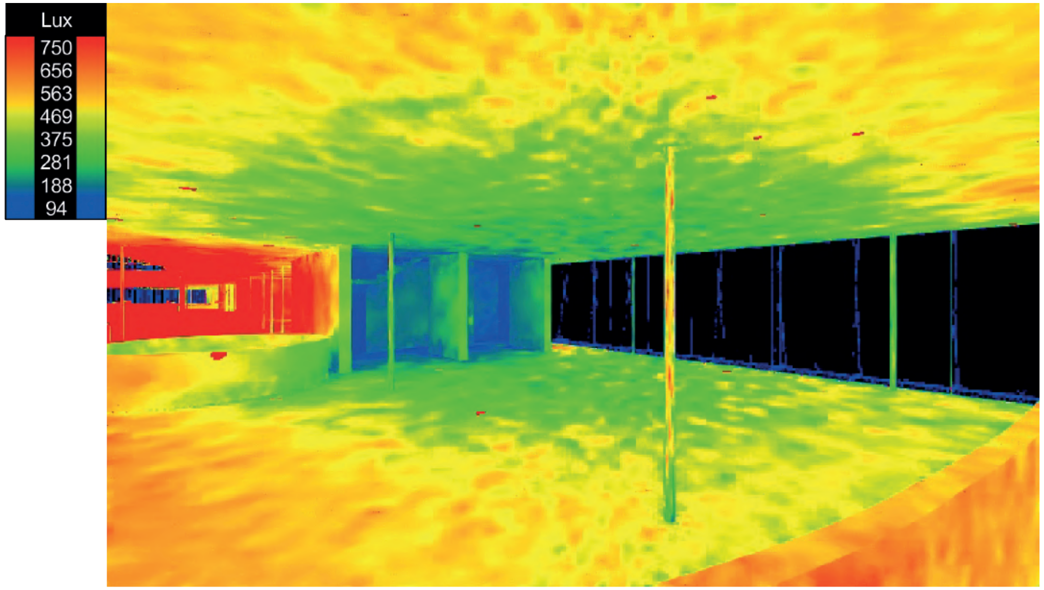


Location	Milan, latitude 45.3 N, longitude 9.1 E
Time	March at 12:00
Orientation	0.0 CW
Sky condition	Intermediate (7)
Ext. illuminance	24,777.2 lux

The Semi- Open Mode, mode among the facade modes is designed to allow daylight inside while blocking direct sunlight during the hours when the sun is perpendicular to the facade, ensuring that the view from inside remains unobstructed. This mode, which will be used most frequently during a typical day, follows the sun thanks to sensors on the facade and utilizes the angles of this mode to adjust the amount of incoming light to the desired level.

Daylight Goal 10%

- Facade System Mechanisim



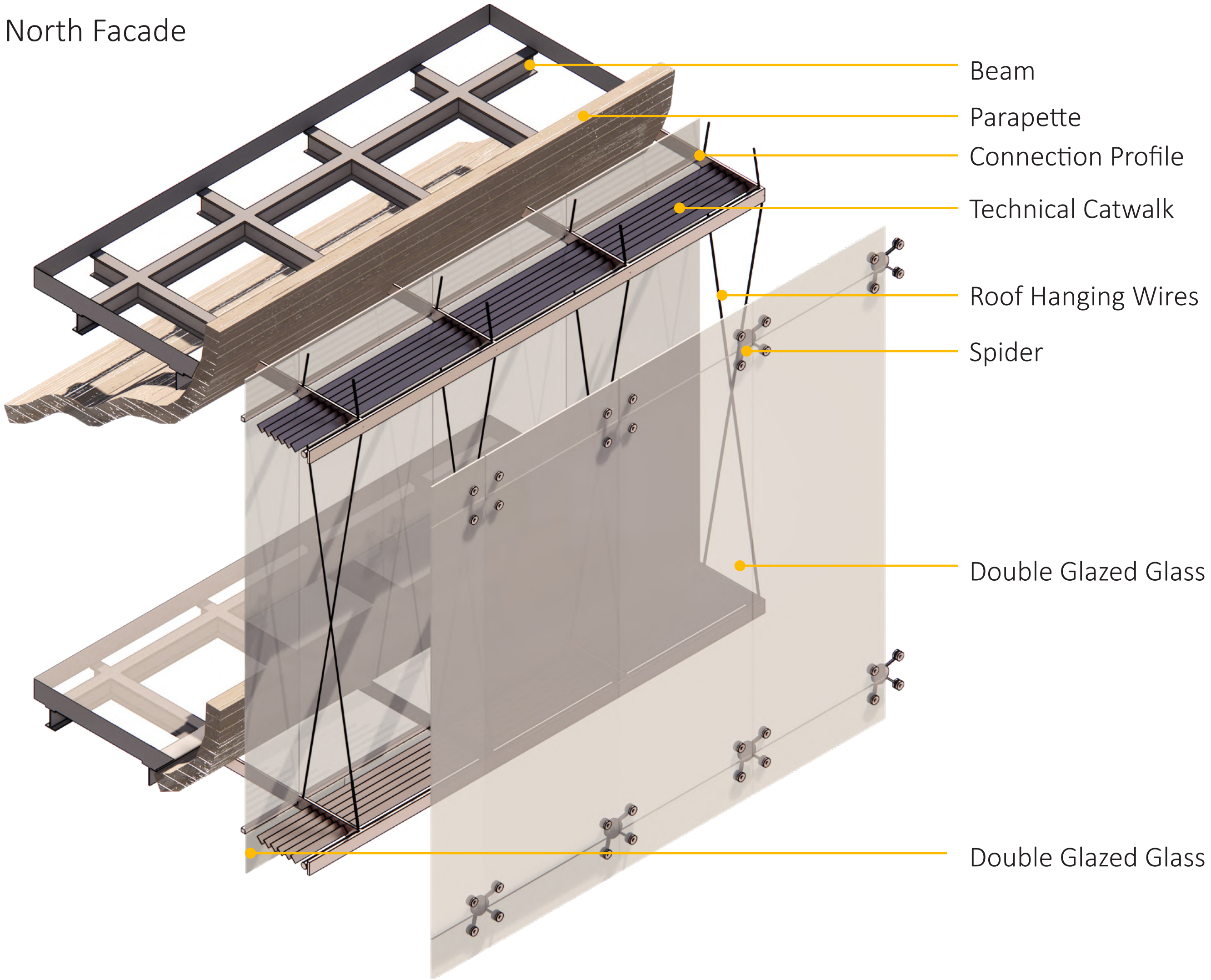
Location	Milan, latitude 45.3 N, longitude 9.1 E
Time	March at 12:00
Orientation	0.0 CW
Sky condition	Intermediate (7)
Ext. illuminance	24,777.2 lux

The Open Mode, generally used during the hours when the sun is at an oblique angle to the facade (morning and evening), this mode prevents direct sunlight from entering while providing a clear view from the inside. This mode, which can be adjusted if needed, can provide high daylight intake if used during noon hours.

Daylight Goal 13%

Facade Technology

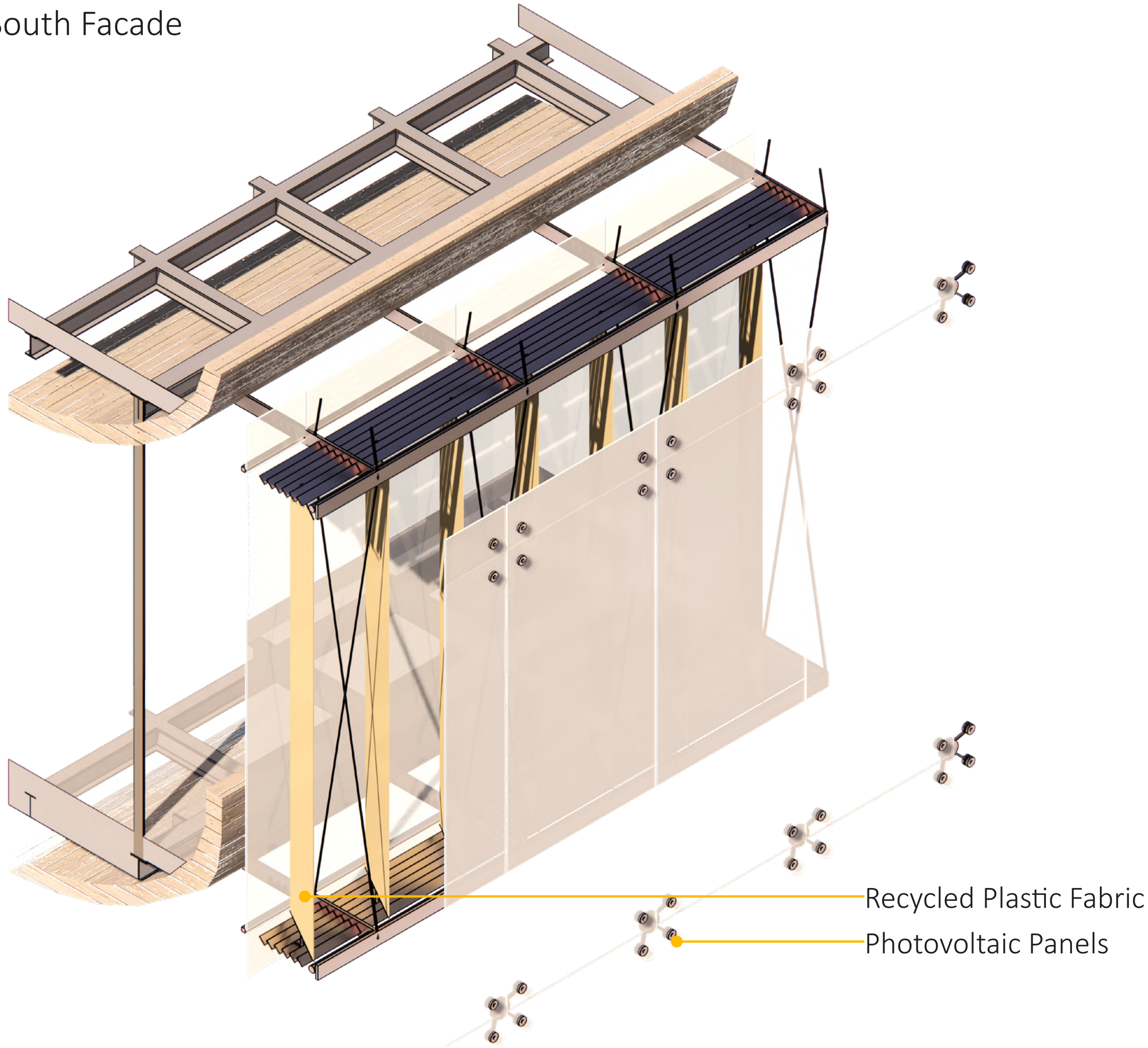
North Facade

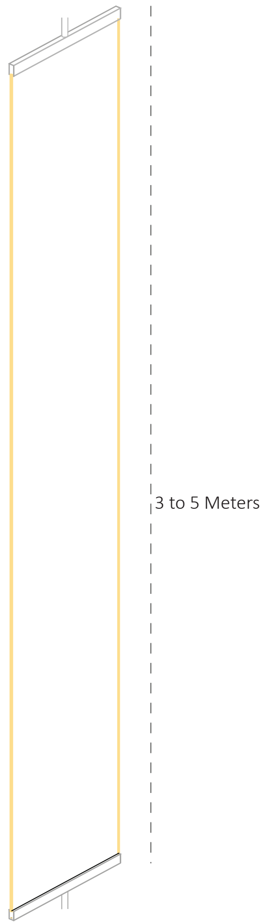


The northern facade faces Piazzale Lodi and Viale Isonzo. The facade system consists of two layers, with the first layer being a three-layered standard windows and the second (outer) layer being a single-layer glass suspended with a spider system. There is no sun control system on the facade, the reason being the lack of necessity due to the minimal solar exposure of the facade. This design choice aims to enhance the visual connection of the library with the street and the neighborhood.

Facade Technology

South Facade

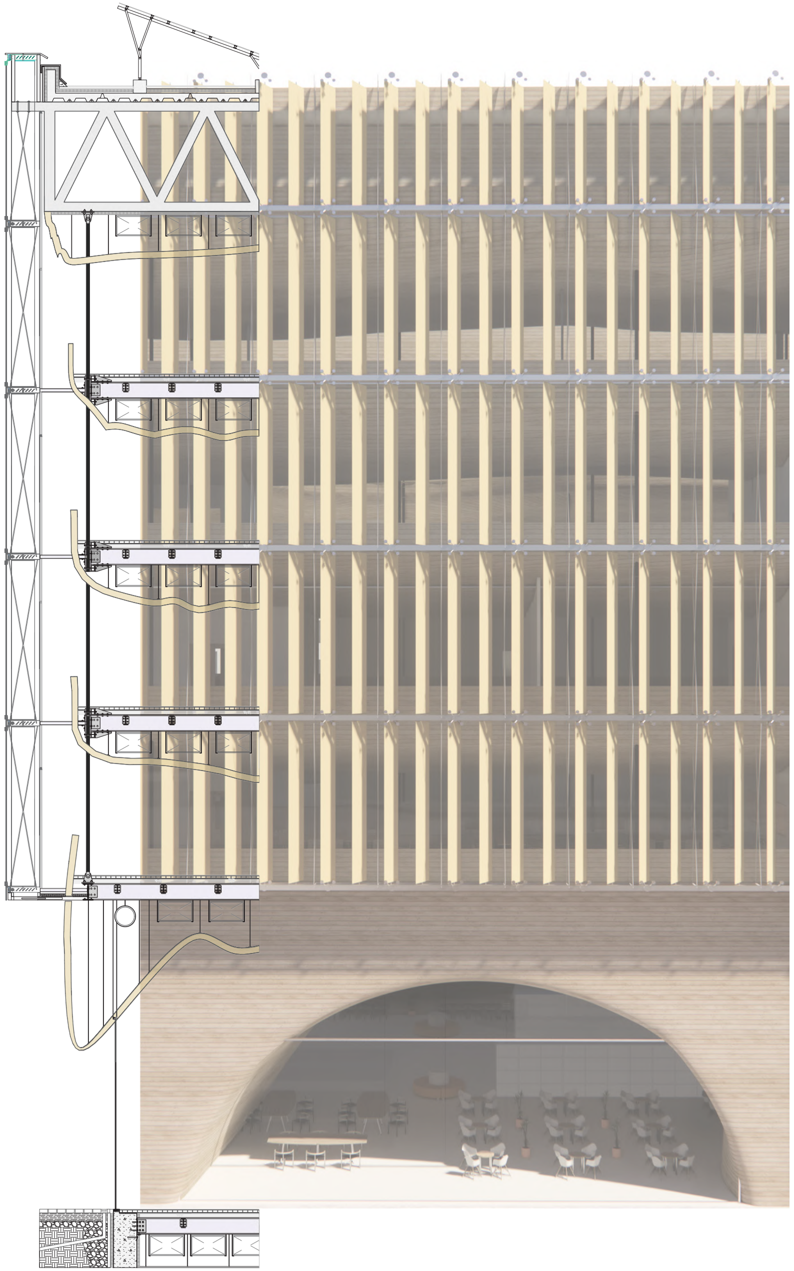




Recycled Plastic Fabric

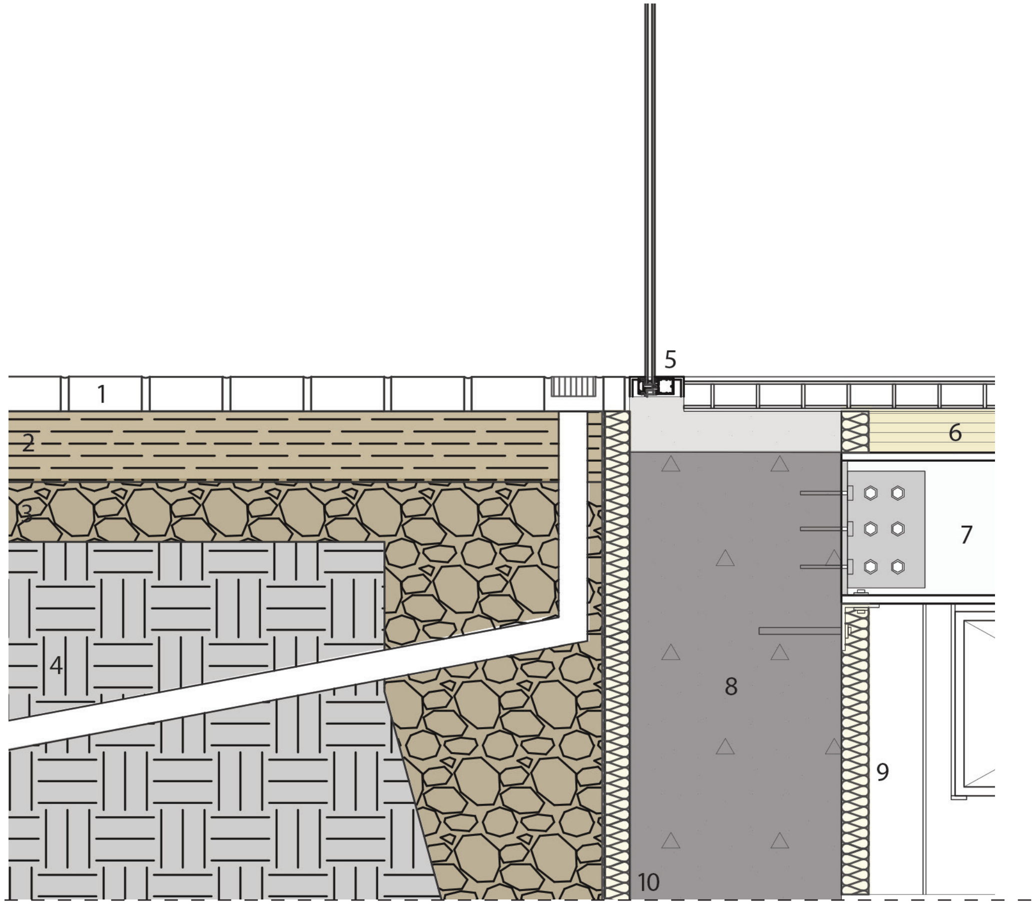
The southern facade, on the other hand, is composed of a primary system consisting of three elements. The first layer (innermost) is a full-height window system with three tiers of glass, similar to the northern facade. The second layer comprises automatic louvers spanning the entire facade. The outermost layer features photovoltaic panels suspended by spider connections. As these panels are positioned on the outermost layer, they are exposed to direct sunlight. However, the control of direct sunlight and daylight within the interior is facilitated by the louvers positioned between the two glass layers.

Facade and Sculpture Dialogue Detail



The relationship between the facade and the wooden panels is that the facade, in line with the "box" concept, is suspended on the outside without touching the "sculpture." The structural system of the facade is inspired by the word "tensegrity" and relies on the upper cage system for vertical loads, while horizontal loads are supported by suspended floor slabs and concrete cores. Thanks to this system, our facade design shares the same design language as our overall structural system, combining tension and compression elements effectively.

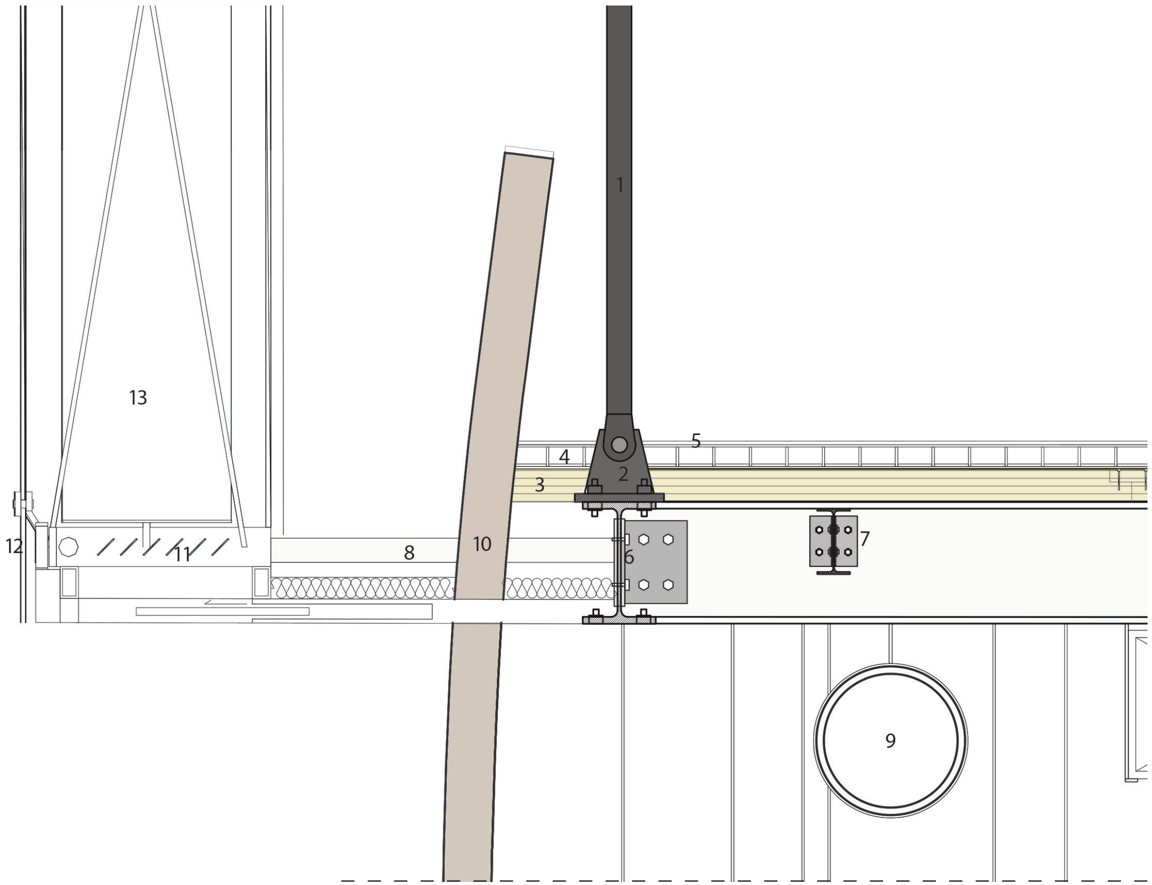
Facade Angles: Transitions



In the detail where the façade connects to the ground, an integrated water drainage system was chosen to manage rainwater. The goal was to have the ground and the ground floor's flooring at the same level.

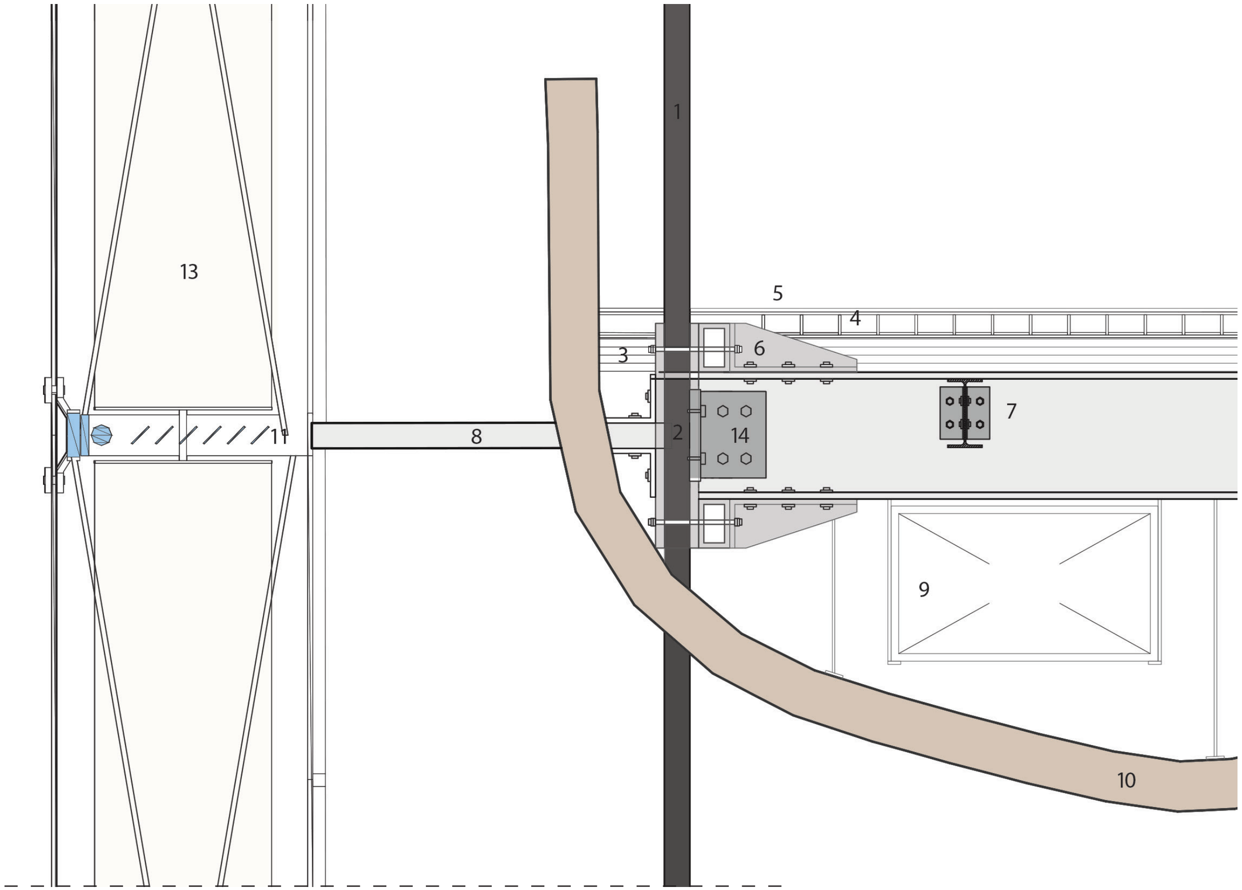
01 Aco Brick Slot
02 Minimun Sub Base
03 Smoothing Aggregate
04 Ground Soil
05 Curtain Wall Frame
06 CLT Panel 105 mm
07 Beam HEB 500
08 Reinforce Concrete Shear Wall
09 Waterproof Membrane
10 Drainage Membrane

Facade Angles: Transitions



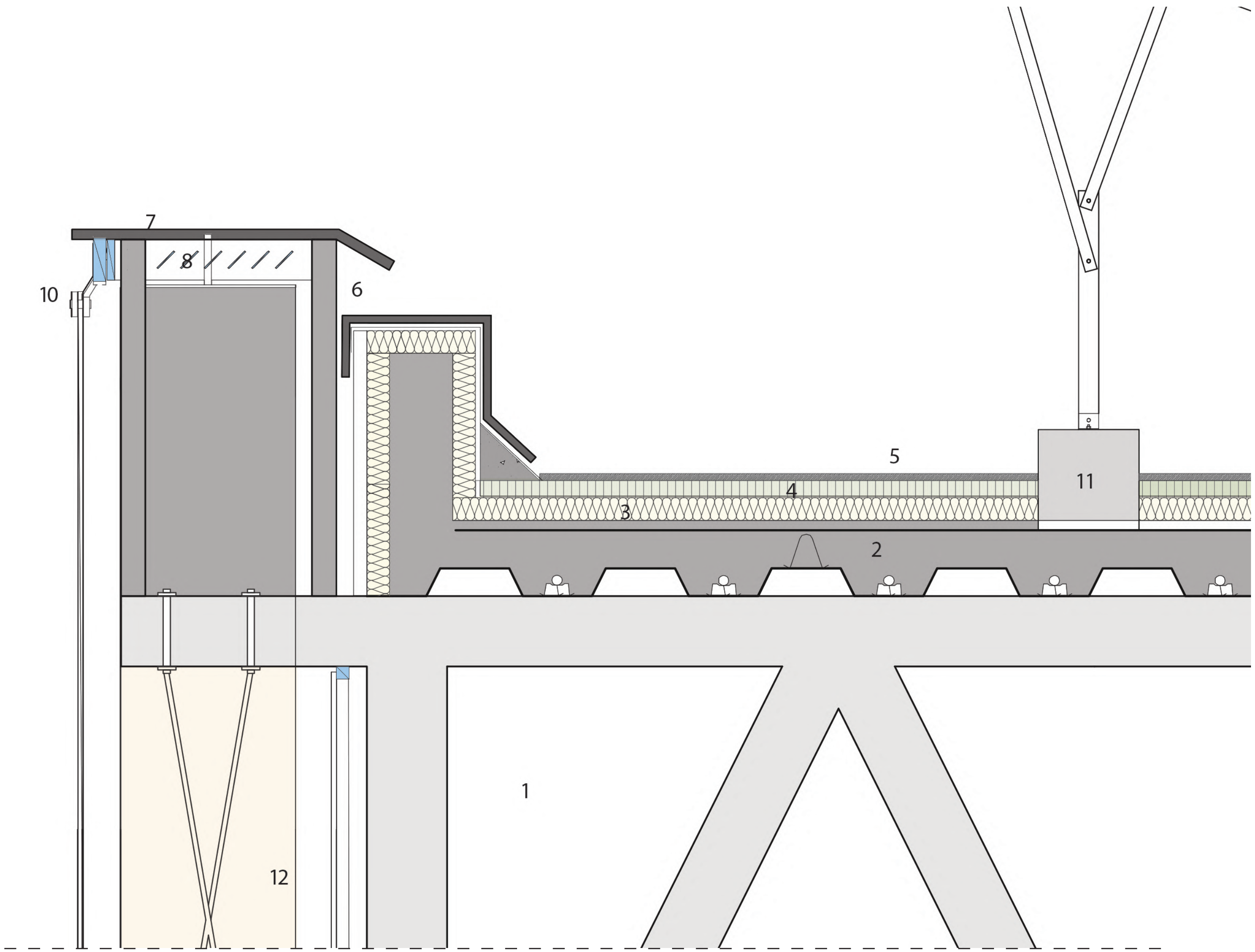
At the joint detail between the plastered reinforced concrete wall and the glass facade system, insulation has been applied where the glass facade makes contact with the wall. This insulation also enables the movement of the glass facade, which is conveyed through cables. The internal and external sections separated by the glass facade system on the wall have been insulated with mineral wool, preventing thermal bridging.

01 Tubular profile CHS 101.6/10 S275
02 Fork Socket for Stay Cable
03 CLT Panel 105 mm
04 Basket Raised Floor
05 Finishing Floor
06 Beam HEB 500
07 Beam IPE 270
08 Tubular Profile CHS 76.1x10 S275
09 Ducts For Ventilation and MEP
10 False Cealing Spruce Wood
11 Maintenance Catwalk
12. Spider Connection
13. Technical Fabric



At the lower part of the glass facade system (at the level of the ground floor's ceiling), a controllable flap has been placed between the two layers of glass for ventilation purposes. This flap can be used to refresh the air circulating within the facade system. Wooden panels extend behind this double-wall system, leaving a minimum gap of 1 meter between the panels and the system. In this joint detail, the gap has been covered with weather-resistant gypsum panels insulated with mineral wool and supported by a steel profile carrier system. Suitable insulation silicones have been used for material-appropriate insulation in the joint details.

01 Tubular profile CHS 101.6/10 S275
02 Joint Tube
03 CLT Panel 105 mm
04 Basket Raised Floor
05 Finishing Floor
06 Bolted Bracker Plate
07 Beam IPE 270
08 Tubular Profile CHS 76.1x10 S275
09 Ducts For Ventilation and MEP
10 False Cealing Spruce Wood
11 Maintenance Catwalk
12 Spider Connection
13 Technical Fabric
14 Shear Tab with Slotted Holes



At the joint detail between the facade system and the roof, a gap of 1 meter in height has been left starting from the end of the louvers. This gap contains the necessary systems for connecting the facade system's supporting cables to the roof's space frame system. Additionally, it includes covers to allow the release of accumulated air within the double-layered facade system to the outside.

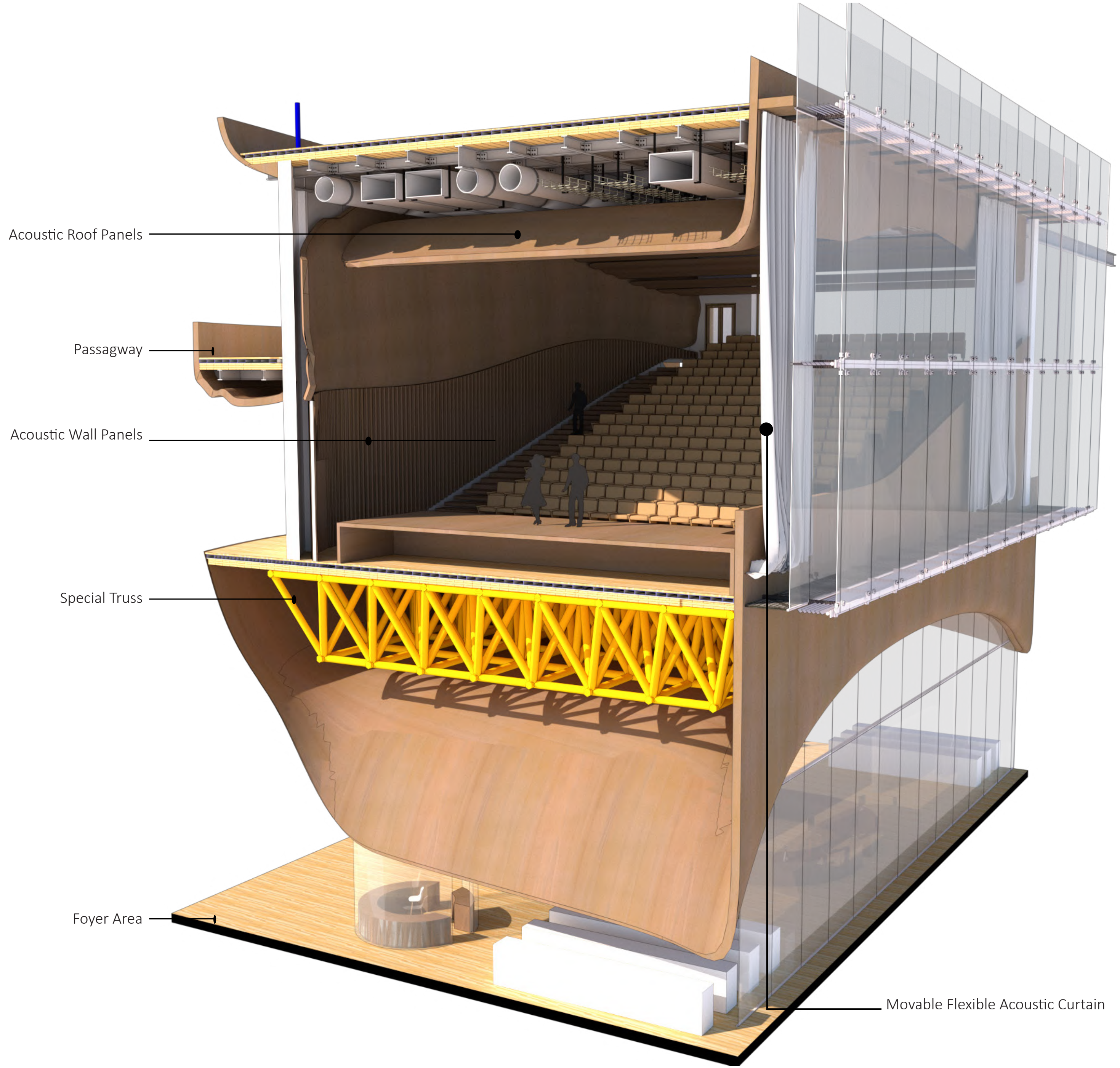
01 Tubular profile CHS 219.1x10 S275
02 Reinforce Concrete Slab
03 Insulation Board
04 Membrane Drainage
05 Gravel Finishing
06 Metal Profile Formed
07 Metal Profile Formed
08 Maintenance Catwalk
09 Double Layer Glass
10 Spider Connection
11 Concrete Dice
12 Technical Fabric

The Sculpture Technology

The sculpture consists of a suspended wooden framework densely arranged to capture the contours of its curves, with panels attached to this framework. With this system, both flat and curved forms can be applied in sections. To use it as a suspended ceiling, after suspending the framework from the floor structure and placing the panels on it, the space between the floor structure and the framework can be utilized for MEP and other technical systems.

Furthermore, the panels to be applied to the framework are designed to be spaced apart, allowing for the creation of gaps that can accommodate acoustic absorbers and lighting systems. The suspended ceilings above the reading rooms, for instance, have been designed with perforations to accommodate acoustic absorbers and lighting fixtures.

Technology and Detail

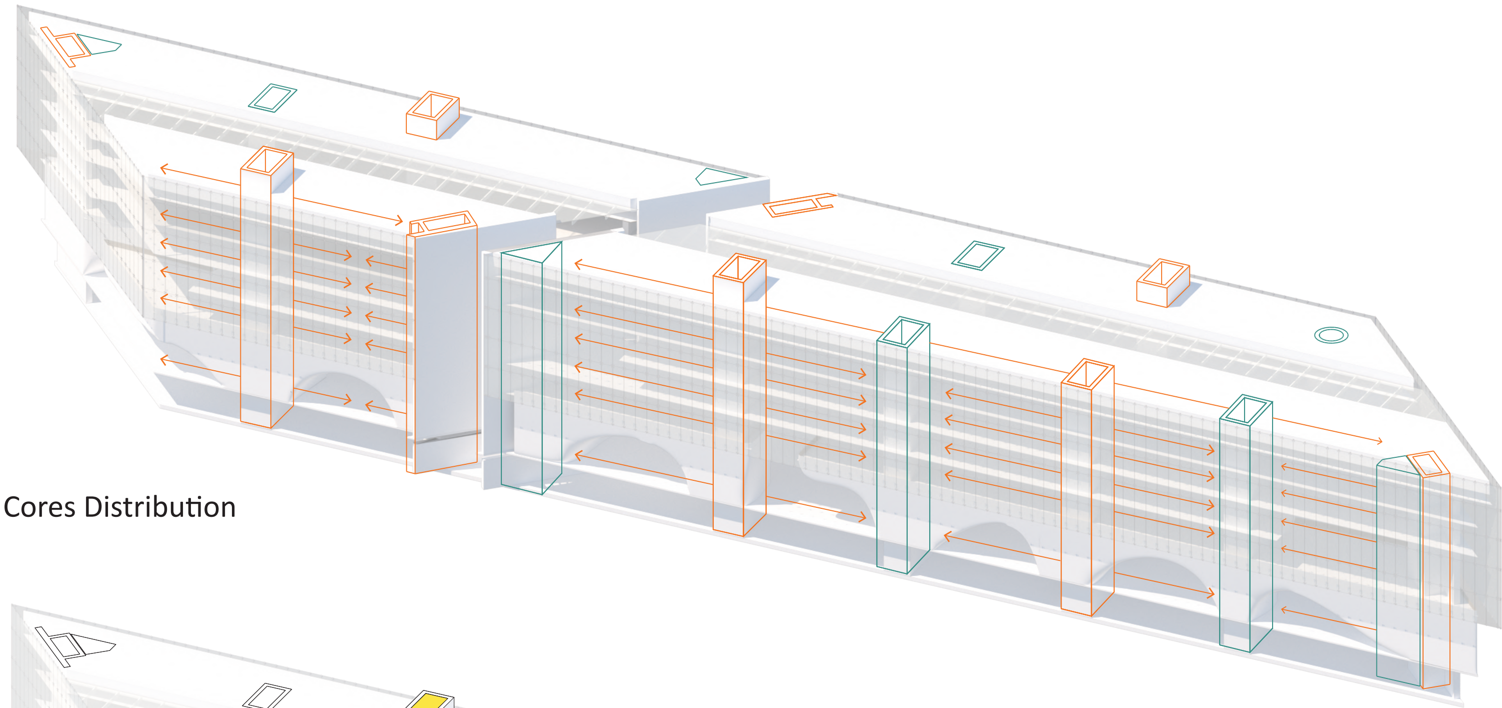


The design of the auditorium has been planned with taking into consideration an organic design language for the interior and acoustic conditions. Wooden panels have been strategically placed on the walls to cater to the appropriateness of low-frequency (bass) and high-frequency (treble) sounds, using wide panels for bass sounds and thinner panels for treble sounds, with the purpose of sound diffusion.

On the ceiling, wooden panels have been arranged at angled positions to facilitate even sound reflection, while also concealing lighting and ventilation systems effectively.

The facade of the auditorium has not been altered, maintaining a double-glazed window system. This allows for natural light to enter the auditorium, making it suitable for daytime activities such as lectures or presentations. If needed, acoustic curtains suspended between the glass and wooden forms can be used to control the light, transforming the space into a conventional auditorium settingW. We implemented this system in a way that does not disrupt the overall facade design of the building, achieving a simple yet effective integration of the auditorium into the design system.

Building Services

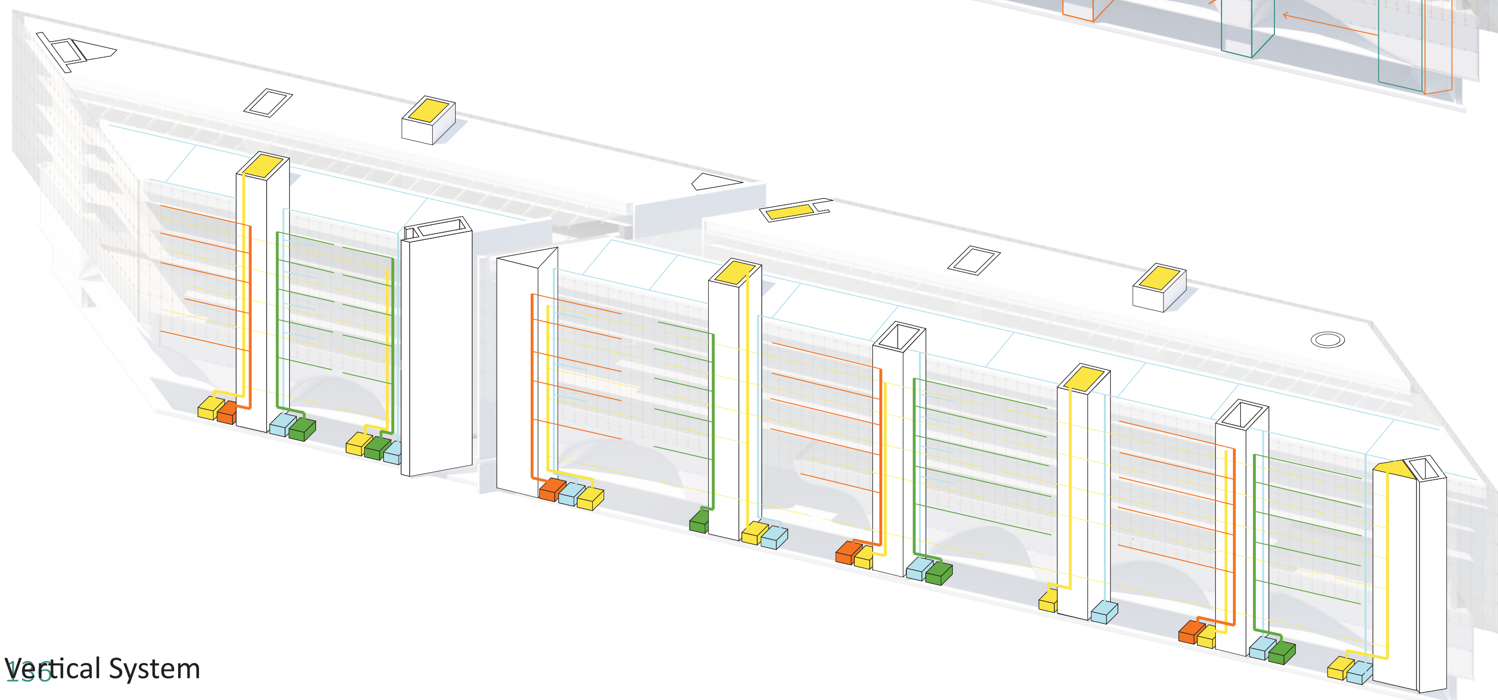


Vertical Circulation
MEP Cores

Cores Distribution

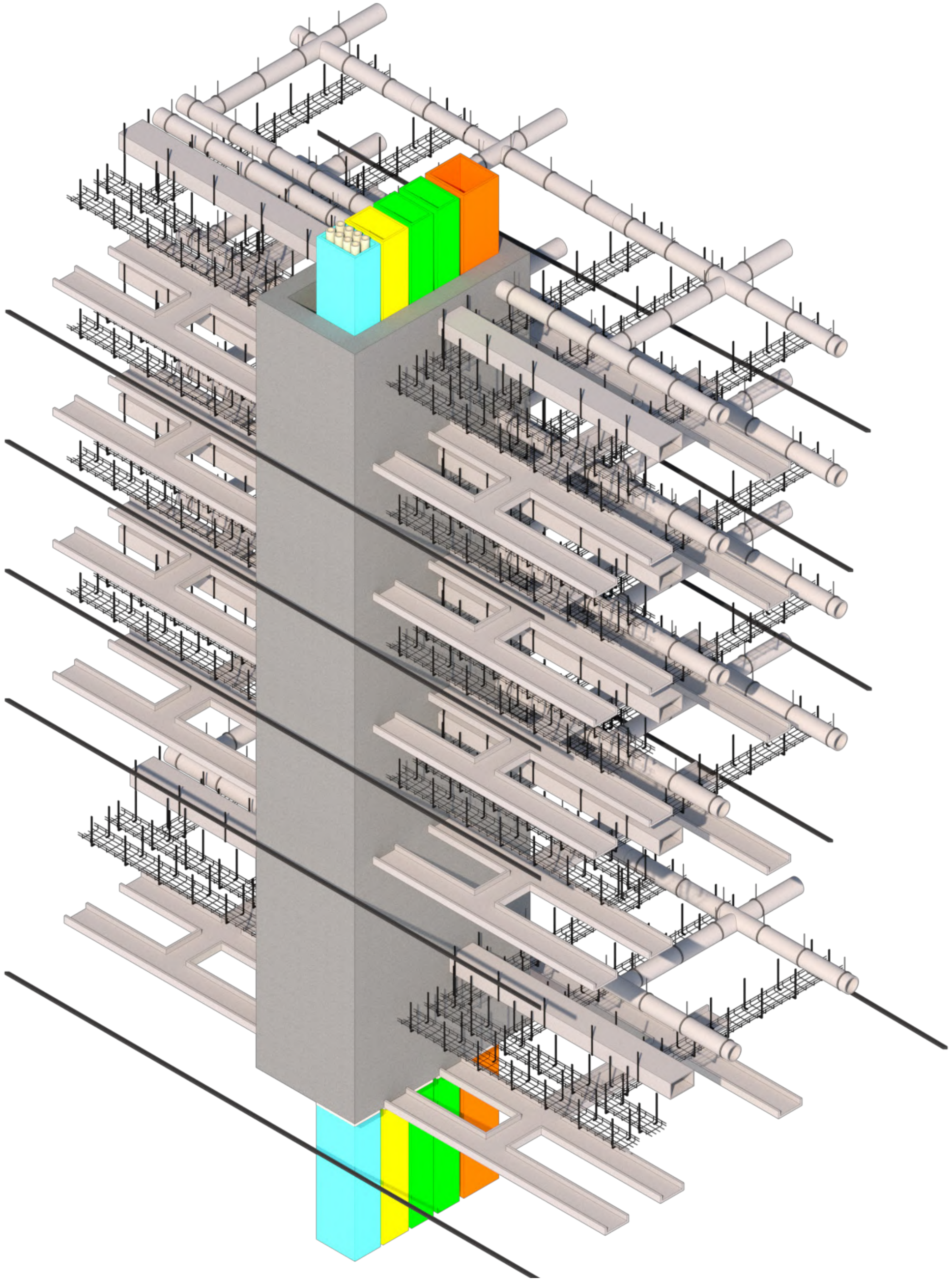
Structural cores are developed inside the project, which oversees receiving the load of the space fence and therefore also the load exerted by the plates, beams, and cables.

These cores function not only as structural elements, but also as vertical circulation elements in the building. This circulation includes personnel, users, and workers, as well as all hydraulic, electrical, air supply and reception, data and other systems. Within the project we separated some of the cores so that they would be exclusively for the vertical movement of the building's central systems that are connected from basements and roofs.



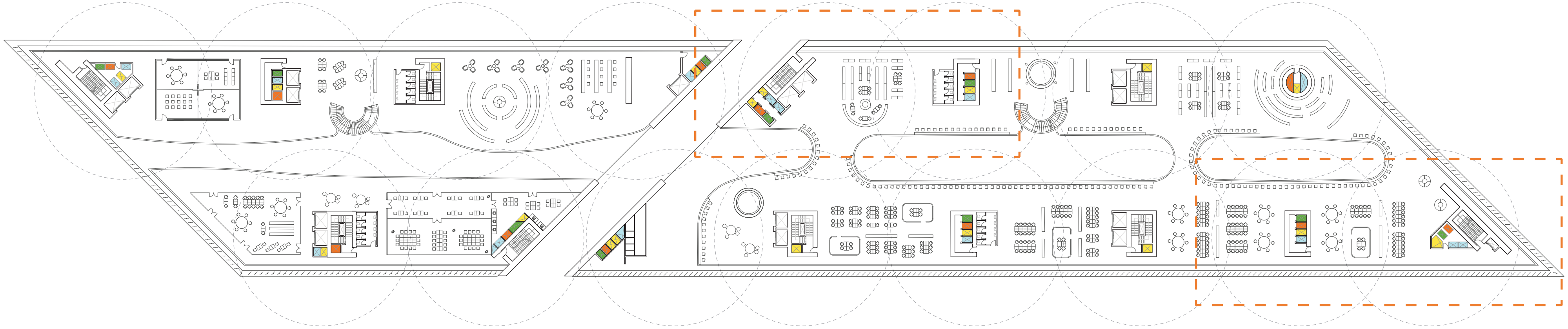
Cooling System
Water System
Heating System
Electricity

Vertical System

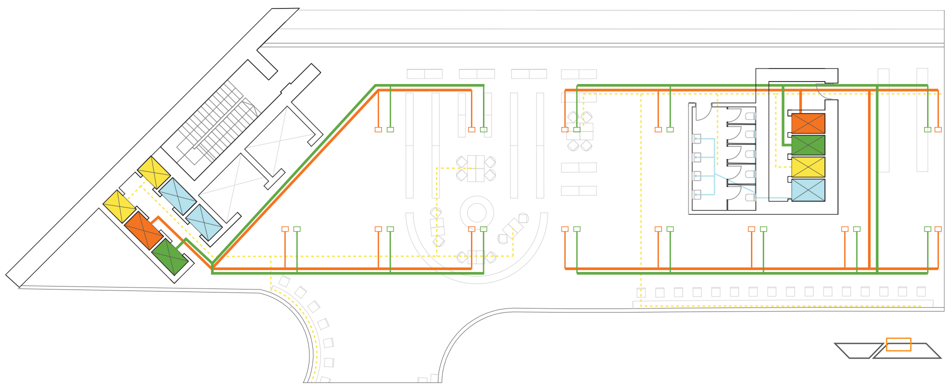


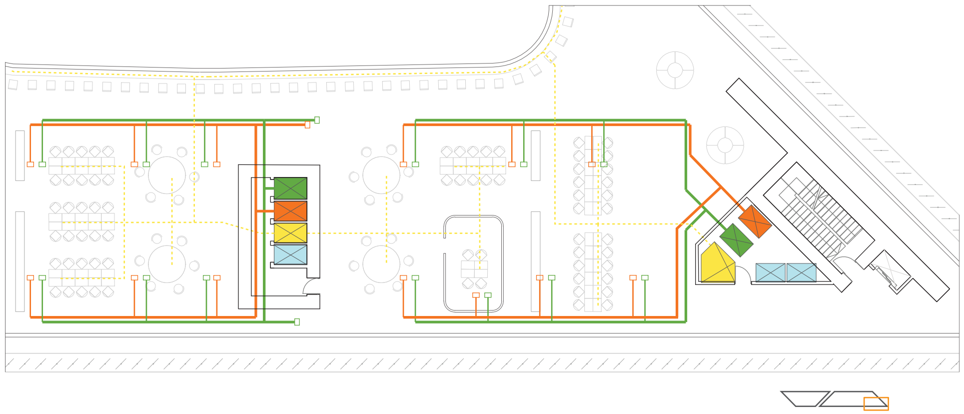
These systems communicate centrally through the cores and are distributed on the different floors according to requirements, where ducts are used for the distribution of space conditioning systems, while metallic trays are used for electricity, lighting and data systems.

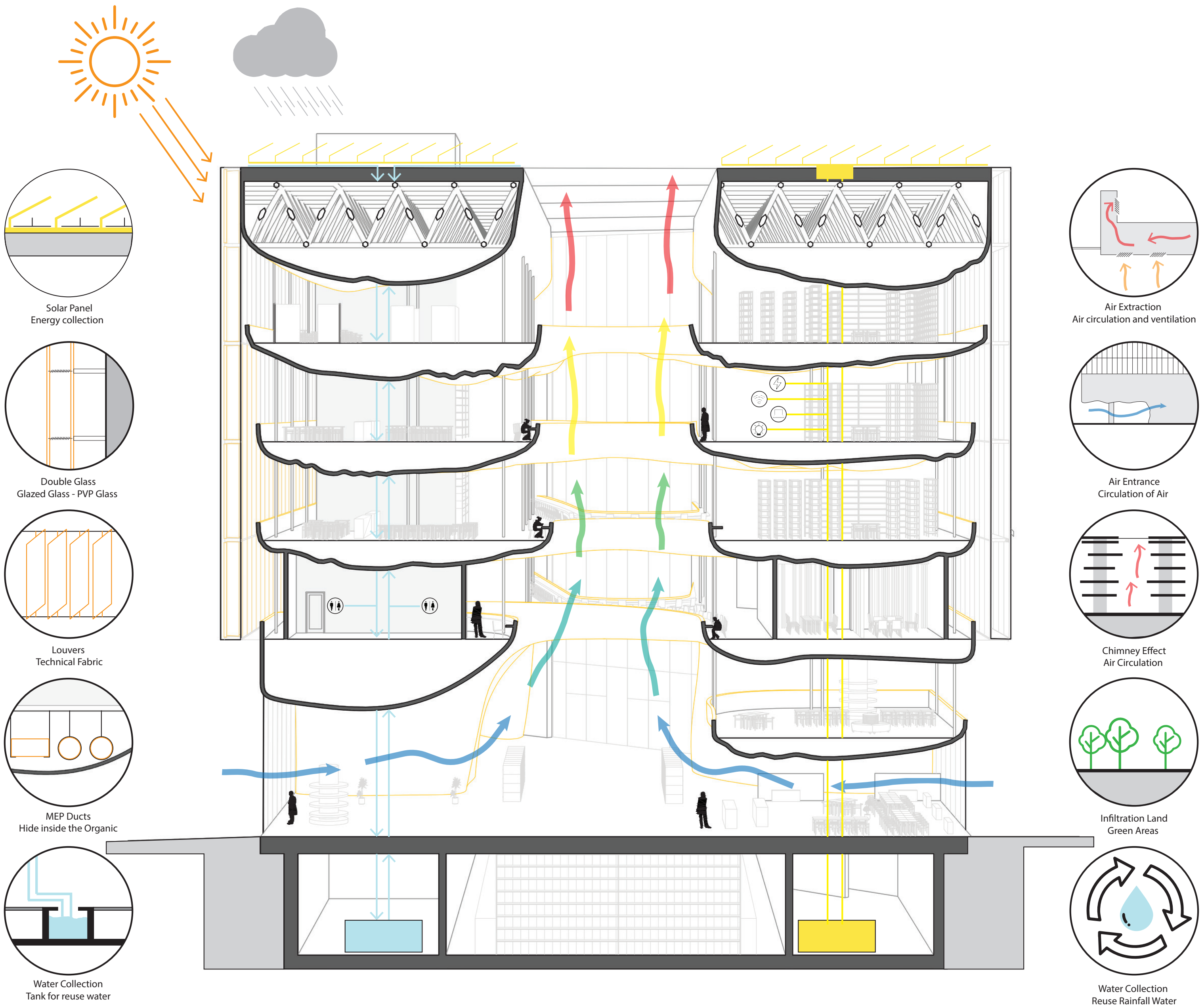
Building Services



Within the proposed distribution of the duct cores, we propose an organized distribution inside the building, reaching every corner of it. We can see the different distributions that are executed in the spaces according to the uses and activities, while we see how all the elements are able to reach every corner of the building avoiding unnecessary or too long journeys due to costs.







Technology and Detail

Several of the concepts used within the project involve sustainability issues such as: the use of solar panels, rainwater harvesting, natural cross ventilation, automated systems to control the entry of light, among others. All these aspects are developed in order to facilitate and improve the conditions and use of the building, not only as a container, but also as a self-sustainable building.

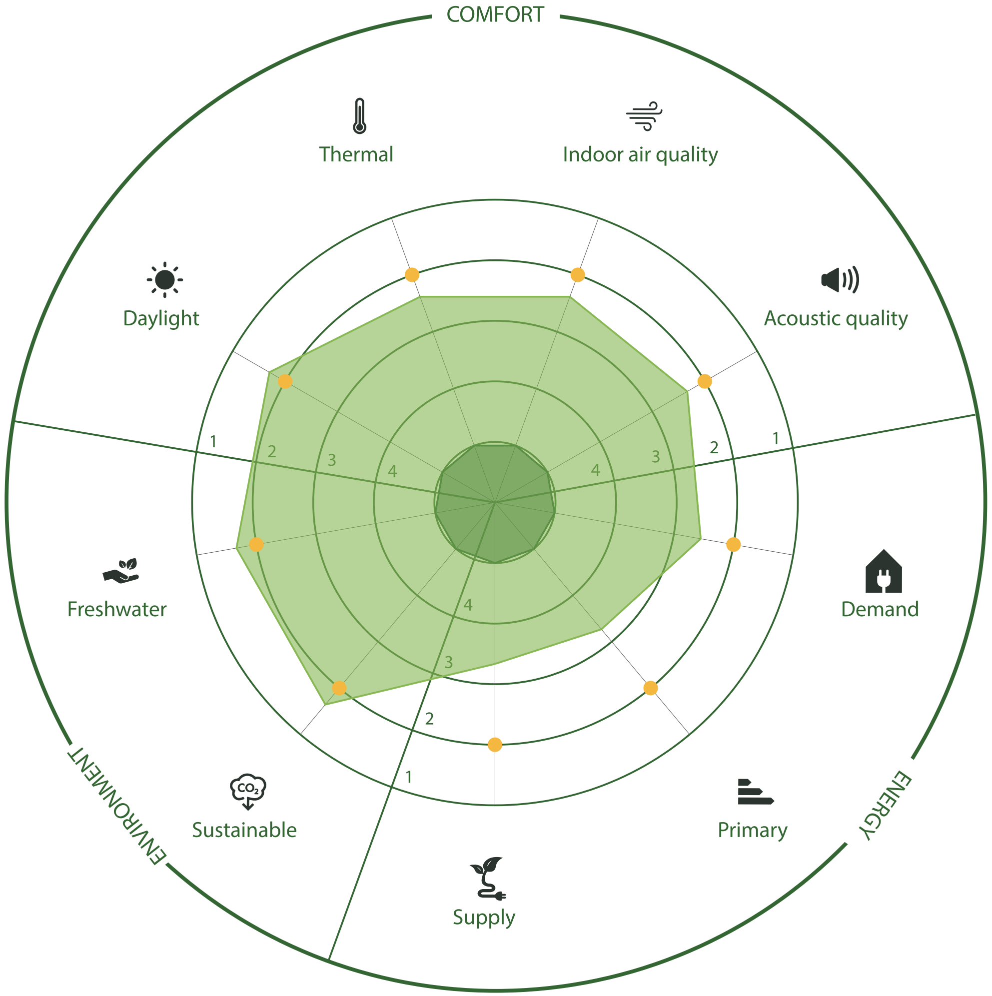
Materiality and Fabrication

Sustainability

“The Wall of Porta Romana” project was designed with the sustainability goals set by Milan for 2030 as a guiding principle. Factors such as carbon emissions and energy usage were addressed by integrating recycled materials, recyclable materials, and systems like photovoltaic energy collection from the facade and roof.

Factors such as water usage and gas emissions were considered in the project under the guidance of the Active House and LEED certification programs. Additionally, to make “The Wall of Porta Romana” and the Masterplan a successful point in the transformation of the Porta Romana area from its industrial past to a green space, projects such as integrated bike paths, electric bike charging stations, and the Highline project, which provides a green pedestrian walkway throughout the city, were included.

Following the principle of social sustainability for the Porta Romana area, functions such as the Library and the Incubator were designed to meet the needs of the local population, particularly the increasing student residents. Structures designated for conversion into student dormitories after the Winter Olympics were also identified.



Taking into account all the decisions that were made in our designs, calcaulations were made for a scoring based on the ActiveHouse and LEED systems.

Based on these scores, a draft roadmap was created on what we need to focus on during of the development process of the building.

Using the Active House analysis, Analysis was conducted of the building components based on energy and sustainability criteria, and generated a radar chart.

This chart revealed the areas where the design lacked sustainability considerations and highlighted the elements that required attention throughout the process.

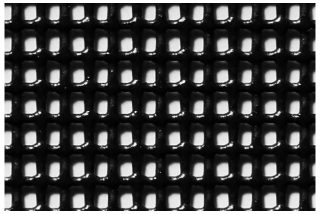
Material Palette

Pura NFC Spruce PlyWood

1

Spruce PlyWood

2



TF | ECO 400 F1
Technical Fabric

3

Double Glazed Glass
(FWS 50 S.SI and FWS 35 S.SI)

4

Photovoltaic Panels

5

The two types of wood materials used were selected to convey the inviting and warm theme of the Library in both interior and exterior design. The fragmented nature of the wood material in the interior allowed it to be applied in organic forms. The use of recycled materials prevented uniformity in the wood's colors, thus avoiding repetitive patterns.

For the exterior, the wood was chemically treated to provide protection against weather conditions and exposure to the sun due to its vulnerability.
Another material widely used in large quantities due to the size of the structure besides wood is the plastic of the sun shading system. This plastic is produced from recycled PET bottles and results in a material that remains uncontaminated through chemical additives.
Double-glazed windows have been chosen for both acoustic and thermal insulation purposes. Photovoltaic panels, on the other hand, come in two different types: those with low opacity will be used on the facade, while those for the roof will be selected for high efficiency.

1 Pura NFC Spruce PlyWood

Producers

TRESPA®

Trespa

Rome, Italia

High Pressure Laminated Wood

For Outdoor Use

Needs fewer replacements, long-lasting products entails less use of resources, lower emissions of pollutants and a smaller amount of waste than short-lifespan goods.

Sustainability of Material

Their sustainability policy is based on a deeply felt motivation to shift from 'being less bad' for the environment to being good and creating new value.

They comply with safety, product and sustainability regulations and guidelines set by the countries in which we operate. We are focused on materialising opportunities that minimise the environmental impact of our operations and products.

They support our suppliers and customers in meeting their sustainability challenges. The environmental properties of Trespa® products are mentioned in the EPDs available to the market. We will continue to look for opportunities and initiatives to support and promote longer-term sustainability beyond the direct scope of our current operations.

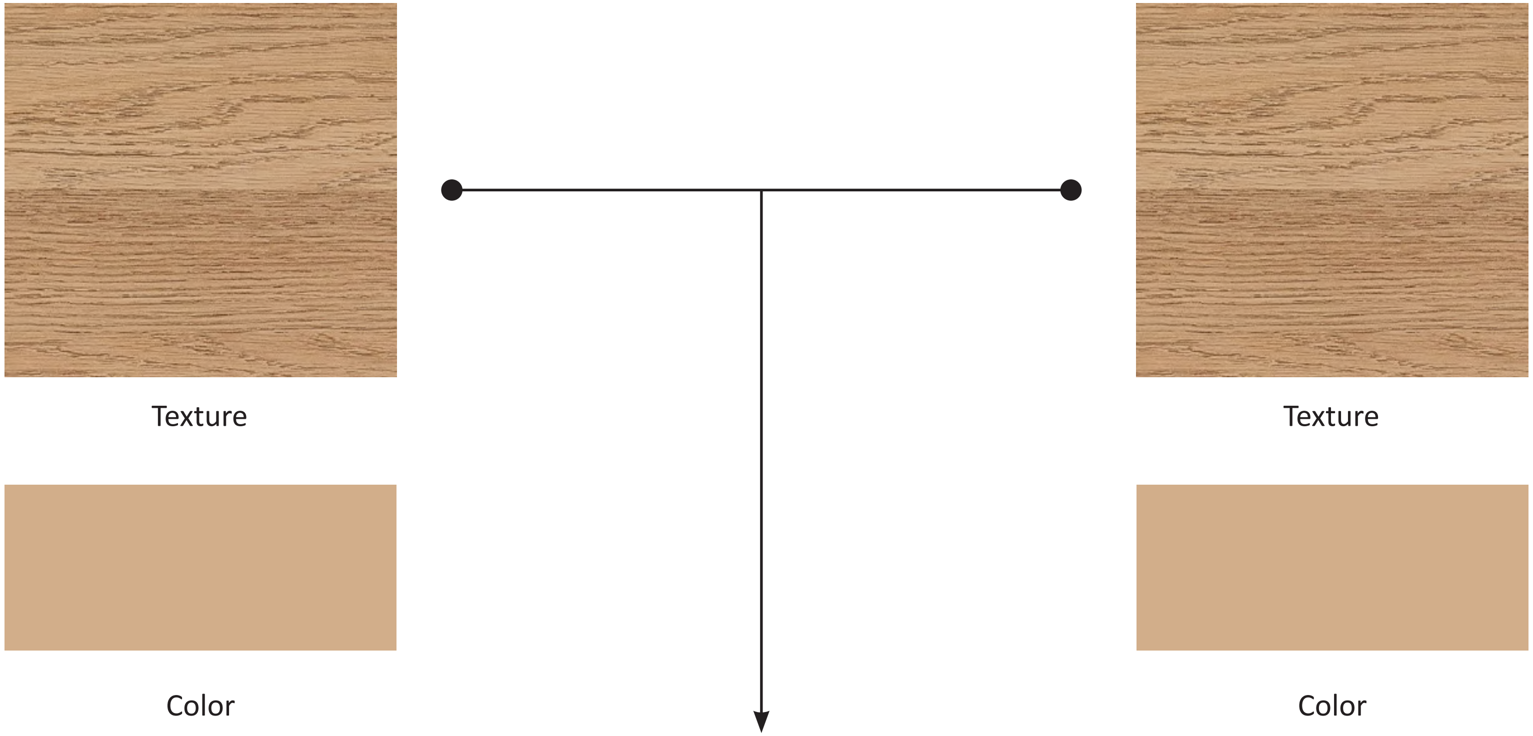
They believe that investing in sustainability should be beneficial to the long-term position of the company. Many sustainability challenges constitute good business opportunities that will allow the company to continue to grow.

1 Pura NFC Spruce PlyWood

Fact Sheet

Properties	Test Methods	Property or Attribute	Unit	Result
				Grade: EDF **Standard: EN 438-6** **Colour/Decor**
Surface quality				
Surface quality	EN 438-2 : 4	Spots, dirt, similar surface defects	mm²/m²	≤ 2
		Fibres, hairs & scratches	mm/m²	≤ 20
Dimensional tolerances				
Dimensional tolerances	EN 438-2 : 5	Thickness	mm	+/- 0.50
	EN 438-2 : 9	Flatness	mm/m	≤ 2
	EN 438-2 : 6	Length & width	mm	+ 5 / - 0
	EN 438-2 : 7	Straightness of edges	mm/m	≤ 1
Physical properties				
Resistance to impact by large diameter ball	EN 438-2 : 21	Indentation diameter - 6 ≤ t mm with drop height 1.8 m	mm	≤ 10
Dimensional stability at elevated temperature	EN 438-2 : 17	Cumulative dimensional change	Longitudinal %	≤ 0.25
			Transversal %	≤ 0.25
Resistance to wet conditions	EN 438-2 : 15	Mass increase	%	≤ 3
		Appearance	Rating	≥ 4
Modulus of elasticity	EN ISO 178	Stress	MPa	≥ 9000
Flexural strength	EN ISO 178	Stress	MPa	≥ 120
Tensile strength	EN ISO 527-2	Stress	MPa	≥ 70
Density	EN ISO 1183	Density	g/cm^3	≥ 1.35
Resistance to fixings	ISO 13894-1	Pull out strength	N	≥ 3000
Weather resistance properties				
Resistance to climatic shock	EN 438-2 : 19	Flexural strength index (Ds)	Index	≥ 0.95
		Flexural modulus index (Dm)	Index	≥ 0.95
		Appearance	Rating	≥ 4
Resistance to artificial weathering	EN 438-2 : 29	Contrast	Grey scale ISO 105 A02	4-5
		Contrast	Grey scale ISO 105 A03	4-5
		Appearance	Rating	≥ 4
Resistance to artificial weathering	Trespa Standard	Contrast	Grey scale ISO 105 A02	4-5
		Contrast	Grey scale ISO 105 A03	4-5
		Appearance	Rating	≥ 4
Resistance to SO_2	DIN 50018	Contrast	Grey scale ISO 105 A02	4-5
		Contrast	Grey scale ISO 105 A03	4-5
		Appearance	Rating	≥ 4
Fire performance				
Reaction to Fire	EN 438-7	Classification	Euroclass	B-s2,d0
Surface burning characteristics	ASTM E84	Classification	Class	A

Pura NFC Spruce PlyWood Vs Spruce PlyWood For Versitile Construction



Outdoor Use: Durable to weather conditions while Spruce Plywood for Versitile Construction is more flexible for the interior sculpture to be built. Both have same texture and color.

2 Spruce PlyWood

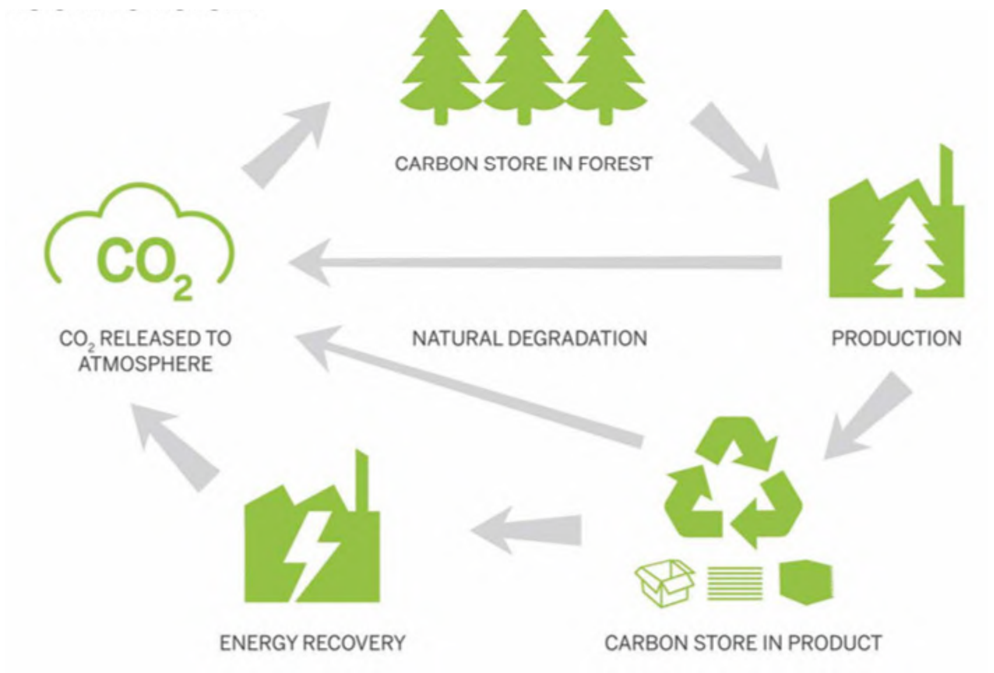
Producers

Metsa Wood

Milano, Italia

Wood raw material for premium-quality Metsä Wood plywood is sourced from PEFC-certified forests belonging to Metsä Group's Finnish forest owner members, ensuring that the origin of the material conforms to the principles of sustainable forestry.

Sustainability of Material



Carbon dioxide (CO2) emissions are the main cause of the green- house effect and global warming. Carbon footprint shows carbon dioxide emissions of the process behind the product. Carbon footprint shows the magnitude of the environmental effect caused by a certain activity. Forests and forestry are involved in the natural circulation of carbon. Sustainably managed forests can act as carbon sinks. The climate change mitigation ef- fect can also be reached by using forest residuals and by-products in energy production

2 Spruce PlyWood

Fact Sheet

Gluing

Metsä Wood spruce plywood panels are bonded with a weather andboil-resistant phenolic resin adhesive.
The gluing meets the requirements of the following international standards:
• EN 314-2 / Class 3 (exterior)
• JAS / Structural plywood / Class 2
• DIN 68705-3 / BFU 100 (former class)
• BS 6566 Part 8 / WBP (former class)

Panel Tolerances

Measured in accordance with standard EN 324, the plywood size and squareness tolerances meet EN 315 requirements.

Lenght/Width	Tolerance
< 1000	+ 1 mm
1000-2000	+ 2 mm
> 2000	= 3 mm
Squareness of the panel	+ 0,1% or + 1 mm/m
Straightness of the panel	+ 0,1% or + 1 mm/m

Sound Absorbtion

Sound absorption coefficient of spruce plywood is:
• α = 0,10 in frequency range 250 – 500 Hz
• α = 0,30 in frequency range 1000 – 2000 Hz

Structural Values

The given strength and elasticity values are design values according to EN 789, EN 1058 and EN 13986 and they are to be used for structural calculations with EN 1995 (Eurocode 5). The values are based on tested veneer values and they are given for the full cross-section of the panel in relative humidity 65 % and temperature of 20 °C corresponding to moisture content of 10±2 %.
Mean density ρmean = 460 kg/m^3
Characteristic density ρk = 400 kg/m^3

Thermal Conductivity

Thermal conductivity of spruce plywood through the thickness of the panel is:
• λ = 0,11 W/(m K) for dry panels (MC 10 %)
• λ = 0,13 W/(m K) for wet panels (MC 25 %)

Water Vapour Permeability

Vapour resistance factor of spruce plywood is:
• μ = 190 dry cup value
- apply when the mean relative humidity across the panel < 70 %
- panel inside of an insulation layer in heated buildings
• μ = 66 wet cup value
- apply when the mean relative humidity across the panel ≥ 70 %
- panel outside of an insulation layer in heated buildings

2 Spruce PlyWood

Pre- Fabrication

Process

1. Detailed parametric design was created using CAD-CAM software, taking advantage of the CNC machine's ability to handle complex forms.

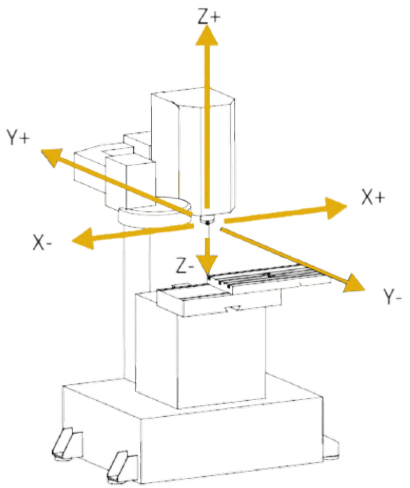
2. Automated Algorithms for Milling Files: Developing of automated algorithms to generate milling files from the design, ensuring a seamless transition from design to fabrication. These algorithms created precise tool paths for the CNC machine to follow.

3. Nesting and Milling: A small 3-axis CNC router was used for milling, effortlessly carving the ply sections according to the prescribed tool paths.

4. Custom ventilation grilles are embedded into the milling process.

5. Functional and Focal Elements: The fabrication process addressed both functional needs and focal elements. Ventilation grilles and shrouds were designed with detail finesse, while focal elements like the conference table and directors' desks were plastically formed to incorporate electrical data outlets and embellished mathematically based on parameters of "tension" and "irony."

6. Material Coherence and Sustainability: The use of sustainably forested plywood and water-based glue contributed to the project's reduced carbon footprint and sustainability.

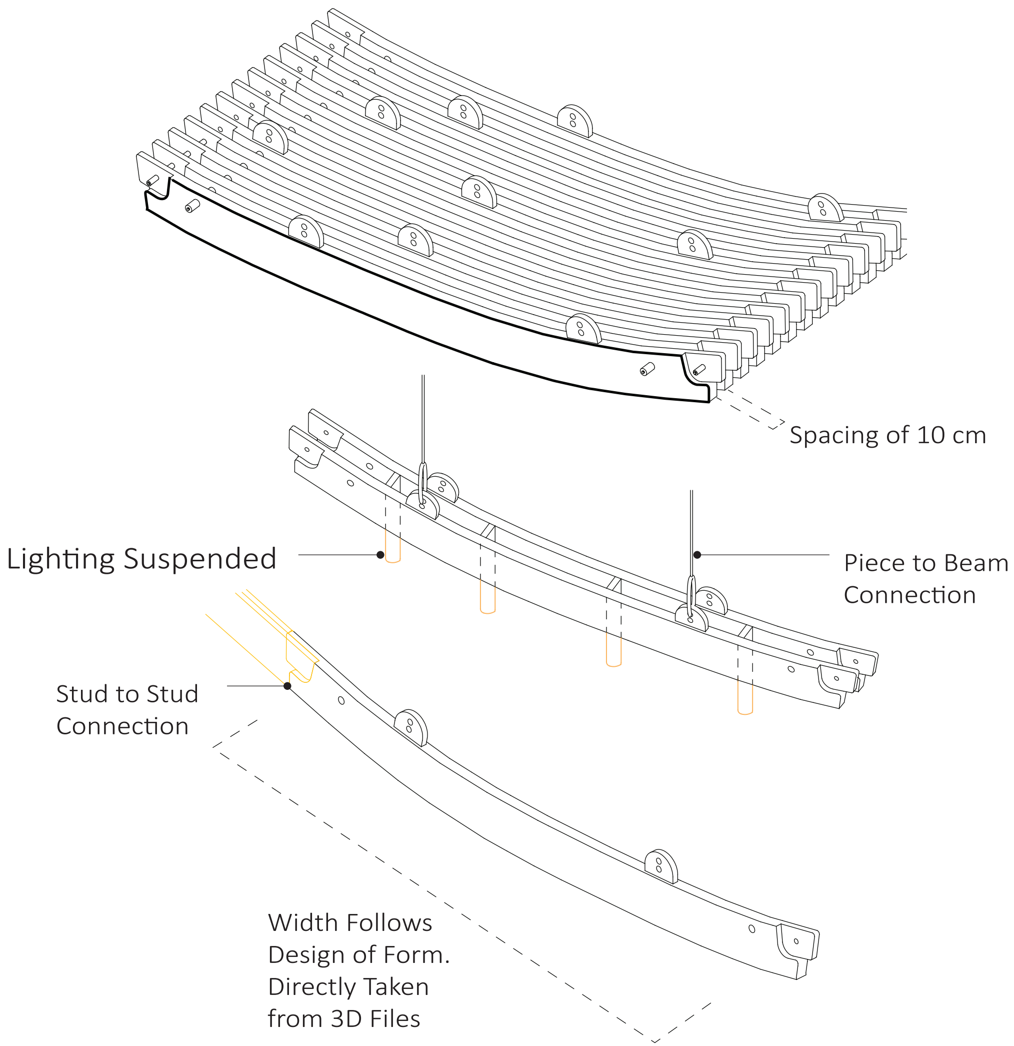


Material Palette

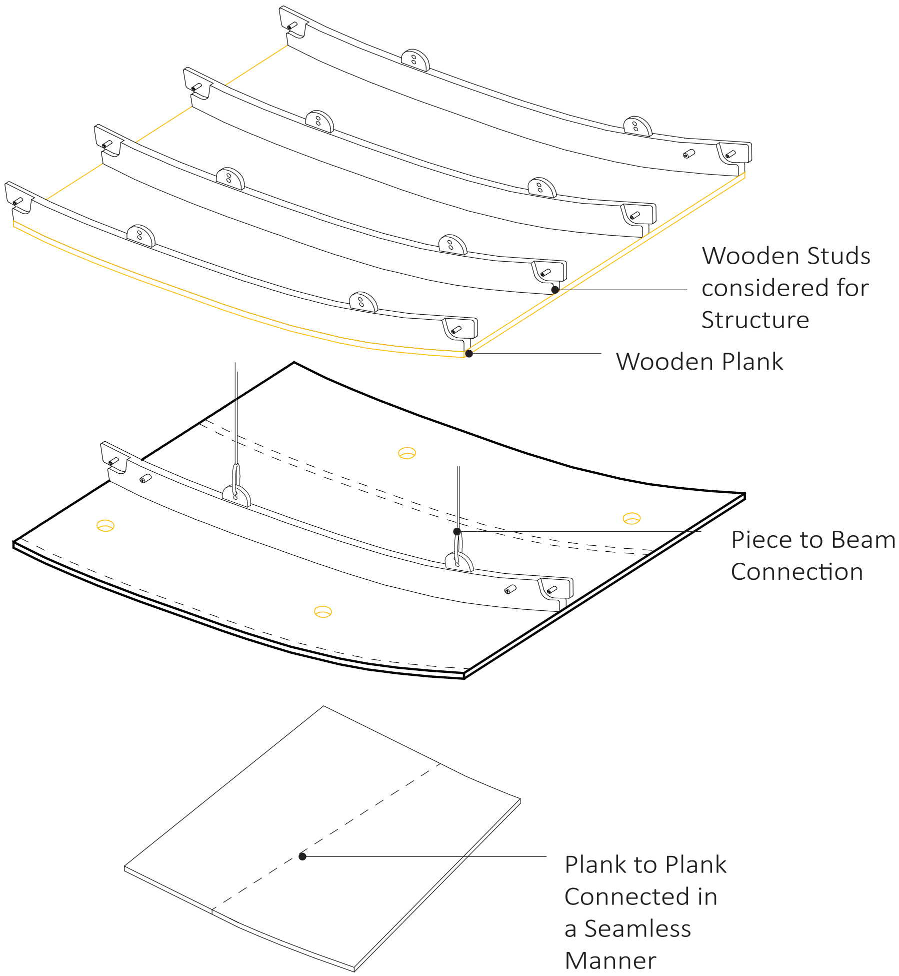
2 Spruce PlyWood

Fabrication

Gapped Spacing for Reading Rooms: Acoustic and Ventilation Purposes



Smooth Wooden Surfaces



3 TF | ECO 400 F1 Technical Fabric

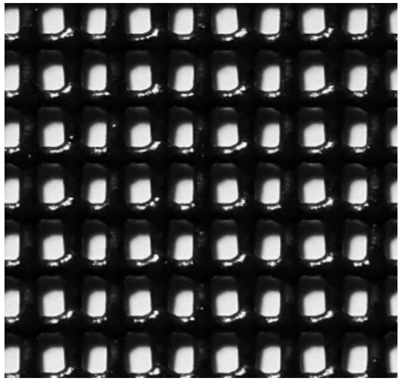
Producers

MEHLER TEXNOLOGIES

Mehler Technologies

Germany

Texture



Color

Sustainability of Material

100% up-cycled PET Bottles

The TF 400 Eco F fabric comprises 100 % upcycled PET bottles. At the same time, the properties are very similar to those of conventional mesh fabrics.

Stand out thanks to their weather resistance, UV resistance and durability, among other things.

Weatherproof
Hardly Inflammable
UV-Resistant
Anti-microbial
Stain Resistant
Dimensionally Stable

3 TF | ECO 400 F1 Technical Fabric

Fact Sheet

VALMEX	TF 300				TF 400	TF 500	TF 600
Product No.	7283 5246				7280 5246	7285 5246	7286 5246
			Material composition				
Multi-composed lacquering with highly concentrated PVDF mixture on both sides, weldable without grinding, protected against microbial and fungal attack, UV-protected							
	Measurement methods/ Classifications	Unit					
Base fabric	DIN ISO 2076			Polyester	Polyester	Polyester	Polyester
Yarn count	DIN ISO 2060	dtex		1100	3300 / 2200	1670 / 8800	2200 / 2200
Low-wick yarn treat-ment	Methylenblue liquid method	mm		<5	<5	<5	<5
Total weight	EN ISO 2286-2	g/m²		700	420	500	1050
	ASTM D-751.10	oz./sq.yd.		20.7	12.4	14.7	31
Fabric thickness		mm		approx. 0,95 mm	approx. 0,75 mm	approx. 1,25 mm	approx. 1,45 mm
Fabric openness	PA 12.03	%		approx. 18 %	approx. 34 %	approx. 50 %	approx. 24%
			Mechanical properties				
Tensile strength | Strip Tensile (warp/weft)	DIN EN ISO 1421/V1 ASTM D-751 Procedure B	N/50 mm lbs./in.		4200 / 3000 370 / 280	4000 / 3000 370 / 280	4000 / 3200 350 / 300	6000 / 5500 680 / 680
Tear strength | Tongue Tear	DIN EN 17679	N	800 / 650		800 / 550	1000 / 600	1800 / 1800
(warp/weft)	ASTM D-751 (8" x 10") Specimen	lbs.	150 / 120		160 / 140	110 / 110	330 / 330
Elongation at break (warp/weft)	DIN EN ISO 1421/V1	%		approx. 23 / 23	approx. 24 / 26	approx. 22 / 32	approx. 24 / 24
			Physical properties				
Adhesion	PA 09.03 (intern) ASTM D-751 RF Weld	N/cm lbs. / in.		20 11	20 11	15 8.5	20 11
Light fastness	DIN EN ISO 105 B02	>6	>6	>6			
Seam strength	DIN 53354	N/50 mm		1400	1400	1000	4000
	ASTM D-751 Procedure B	lbs. / in.		160	160	130	450
Air permeability	EN ISO 9237	l/m²*sec	approx. 2000	approx. 6000			
Cold resistance	DIN EN 1876-1	°C		-20	-20	-20	-20
Low Temperature	ASTM D-2136	°F		-4	-4	-4	-4
Heat resistance	PA 07.04 (intern)	°C		+70	+70	+70	+70
High Temperature		°F		+158	+158	+158	+158
Fire resistance	Classification			DIN 4102: B1 (white) NFP 92507: M2 (Coloris blanc)	DIN 4102: B1 BS 7837 EN 13501-1: B-s2-d0 NFP 92507: M1 VKF Richtlinie 5.2 California T19 NFPA 701 Test 2 ASTM E84: Class A CAN ULC S109 AS 1530 part 2 AS 1530 part 3	EN 13501-1: C-s3-d0 California T 19 NFPA 701 Test 2 ASTM E84: Class A	DIN 4102: B1 (White) BS 7837 EN 13501-1: C-s2-d0 California T 19 NFPA 701 Test 2 ASTM E84: Class A

4 Photovoltaic Panels

Producers

Onyx Solar

Avila, Spain

Sustainability of Material

In Onyx Solar they believe in a better future. Their aim is to enable the buildings to be self-sufficient from an energy point of view, a key factor in the struggle against climate change. Their see our environmental-friendly solutions as a small contribution to create a meaningful change, needed to secure a sustainable legacy for generations to come.

Onyx Solar commitment to sustainability has an impact on your company's Corporate Social Responsibility policy and its performance in three dimensions: economic, environmental and social.

Economic

Sustainability is becoming core to business practice on corporate strategies. Proved to be embedded in customer expectations, improves company's reputation, drives sales and turns the company more competitive in its market. Fitting premises with photovoltaic cells has been shown as one of the most powerful measures to achieve it.

Enviromental

We collaborate with local partners and organizations to enhance our ability to do business responsibly in the communities where we operate. From developed countries to developing ones, we try to set more sustainable patterns to grow.

Social

Adopting Onyx Solar innovative solutions, and combining them with other environmental-friendly practices is the best contribution a company can make to build a greener future for people and our planet.

Material Palette

3 Photovoltaic Panels

PHOTOVOLTAIC GLASS					
Electrical data test conditions (STC)		DARK (0%)	M VISION (10%)	L VISION (20%)	XL VISION (30%)
Nominal peak power	P_{mpp} (Wp)	177	123	104	86
Open-circuit voltage	V_{oc} (V)	191	191	191	191
Short-circuit current	I_{sc} (A)	1,50	1,15	0,97	0,77
Voltage at nominal power	V_{mpp} (V)	132	132	132	132
Current at nominal power	I_{mpp} (A)	1,34	0,93	0,79	0,65
Power tolerance not to exceed %		±5	±5	±5	±5

Fact Sheet

Mechanical Description		
Length	mm	1245
Width	mm	2456
Thickness	mm	16,72 / 14.72 / 12,72
Surface area	sqm	3,06
Weight	Kg	116,3 / 101,0 / 85,7
Cell type		a-Si Thin Film
Front Glass		6 / 5 / 4 mm Tempered Glass
PV Glass		3,2 mm Float Glass
Rear Glass		6 / 5 / 4 mm Tempered Glass
Thickness encapsulation	ref. A	EVA Foils (not available)
	ref. B	1,52 mm PVB Foils

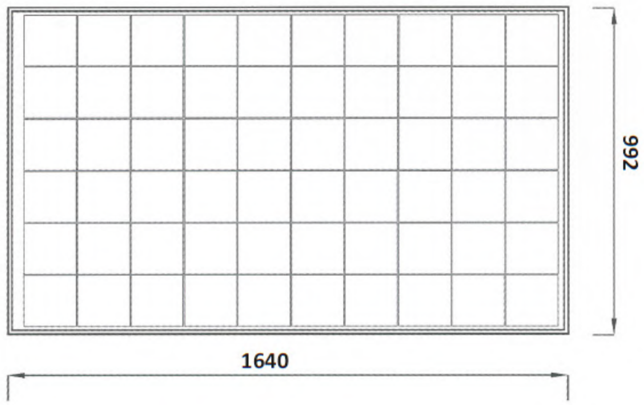
Junction Box		
Protection		IP65
Wiring Section		2,5 mm² / 4,0 mm²
Limits		
Maximum system	V_{sys} (V)	1.000
Operating module temperature	°C	-40…+85
Temperature Coefficients		
Temperature Coefficient of P	%/°C	-0,19
Temperature Coefficient of V..	%/°C	-0,28
Temperature Coefficient of	%/°C	+0,09

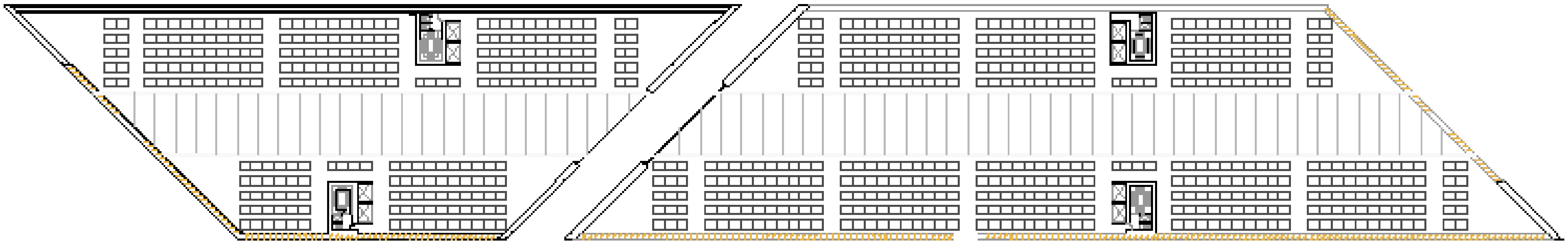
3 Photovoltaic Panels

Placement: Roof

Area: 6000 m^2 approx.
PV Panel PMax: 310 Wp
Total Yearly Energy Production: 1,843,716.87 kWh

Electricity Generated in 35 Years: 53,559,975 KWh
Total Lighting Points Operating 4 Hours Per Day: 105,092 Lights
Avoided CO2 Emissions in 35 Years: 13,711
Barrels of Oil Saved in 35 Years: 31,517 Barrels
Liters of Oil Saved in 35 Years: 5,011,184 Liters
Electric Car Mileage in 35 Years thanks to the Energy Generated: 307,969,857 Km





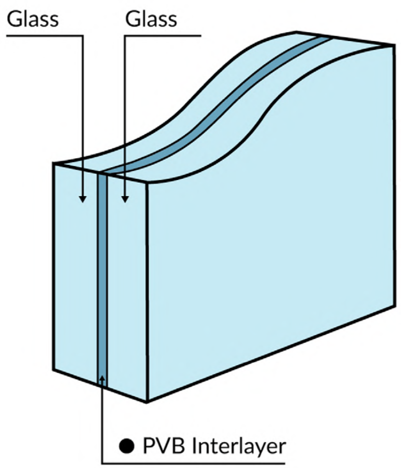
Roof Plan + 35.00

3 Photovoltaic Panels

Placement: South Facade

Area: 5375 m² approx.
Photovoltaic Panel Type: Morphous PV Glass Curtain Wall High Transparency
PV Panel PMax: 28 Wp/sqm

Electricity Generated in 35 Years: 4.523,545 KWh
Total Lighting Points Operating 4 Hours Per Day: 8,876 Lights
Avoided CO2 Emissions in 35 Years: 1,158
Barrels of Oil Saved in 35 Years: 2,662 Barrels
Liters of Oil Saved in 35 Years: 423,232 Liters
Electric Car Mileage in 35 Years thanks to the Energy Generated: 26,010,381 Km



Photovoltaic panels have been used on both the southern façade and the roof. With sustainability principles in mind, the aim was to reduce the electrical energy drawn from the city grid by using photovoltaics in the building.

On the southern façade, an area of approximately 5375 m² has been integrated with OnyxSolar's Amorphous PV Glass system. This system, with its high light transmittance, looks different from regular glass on the façade, with a 20% difference of transparency, and it can also serve as the outer layer of our double-glazed window system.

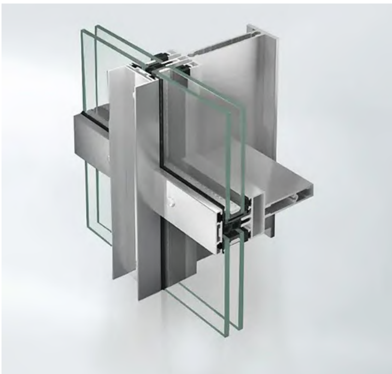
The panels used on the roof are designed with Eclipse Italia's Monocrystal Black PV system, which is produced by an Italian manufacturer called Eclipse Italia. This system covers an area of approximately 6000 m² and, when combined with the system on the southern façade, can generate a total annual output of 1,843,716.87 kWh.

5 Double Glazed Glass (FWS 50 S.SI and FWS 35 PD.HI)

Producers

Schuco Italia

Avila, Spain



High performance mullion and transom facade for a variety of solutions with steel aesthetics

Sustainability of Material

Certification

Cradle to Cradle

The approach of this certification is to follow all phases of the product's life with the aim of leaving as little waste as possible to future generations.

The Environmental Product Declarations (EPD) for all the systems used are important for all-round sustainability. At Schüco, their creation for aluminum manufacturing systems is integrated into the SchüCal calculation software.

Material Palette

3 TF | ECO 400 F1 Technical Fabric

Fact Sheet

Valore Uf telaio ≥	0,7 W/(m²·K)
Sezione in vista min.	50 mm
Profondità di sistema min. - max.	6...255 mm
Spessore vetro/pannello max.	86 mm
Peso max.	1080 kg
Finiture superficiali	polvere, Anodizzazione, Lacca
Permeabilità all'aria	AE
Misura dell'abbattimento acustico RwP max.	48 dB(A)
Impermeabilità alla pioggia battente	RE 1200
Resistenza agli urti	I5/E5
Antieffrazione	fino a RC 3
Sicurezza contro la caduta nel vuoto	Sì
Antiproiettile	fino a FB4
Profondità di sistema min.	6 mm
Profondità di sistema max.	255 mm
Profondità costruttiva del montante min.	50 mm
Profondità costruttiva del montante max.	250 mm
Profondità costruttiva del montante min.-max.	1080 kg
Sezione in vista min.-max.	50 mm
Sezione in vista sottocopertina/copertura	50 mm
Sezione in vista esterna	50 mm
Sezione in vista interna	50 mm
Sezione in vista del montante	50 mm
Sezione in vista telaio	50 mm
Sezione in vista traverso	50 mm

Spessore vetro/pannello min.	22 mm
Spessore vetro/pannello min.-max.	22...86 mm
Peso vetro/tamponamento max.	1080 kg
Angolo di montaggio	2-105 °
Angolo facciata poligonale	45 °
Costruzione per falde vetrate inclinate ir	2 °
Costruzione per falde vetrate inclinate ir	90 °
Costruzione per falde vetrate inclinate ir	2...90 °
Costruzione per falde vetrate inclinate	Sì
Conchiglia per drenaggio	Sì
Piani di drenaggio	3
Protezione dai fulmini DIN EN 62561	Sì
Resistenza all'azione sismica	Sì
Tenuta al vento	2,0/3,0 [kN/m²]
Staffa di fissaggio per elementi frangisol	Sì
Schermatura solare integrata	Sì
Sicurezza contro la caduta nel vuoto	Integrate
Sicurezza contro la caduta nel vuoto inte	Sì
Certificati	Certificazione Passivhaus, cradle2cradle SILVER
Marchio CE	Sì
Compatibile con Passivhaus	Sì
Classe Passivhaus	phA
Riciclabile	Sì
Norme	DIN EN 1627, EN ISO 10077, DIN EN 13830, Autorizzazione generale di controllo della costruzione (AbZ)
Certificato AAMA	Sì
Certificato CWCT	Sì
Autorizzazione di controllo della costruz	Sì
Valutazione tecnica europea	Sì

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