

SKY SCRAPER IN ROYAL SEA PORT OF STOCKHOLM



Scuola di Architettura, Urbanistica e Ingegneria delle Costruzioni

Royal Skyline - A multi functional tower for Royal Seaport

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WHERE TO BUILD? AND WHY?

sweden - stockholm - royal seaport

Sweden is widely recognized for its strong commitment to sustainability, and the country has implemented various initiatives and policies that reflect this dedication. The relationship between Sweden and sustainability is multifaceted, encompassing environmental, social, and economic dimensions.

SWEDEN

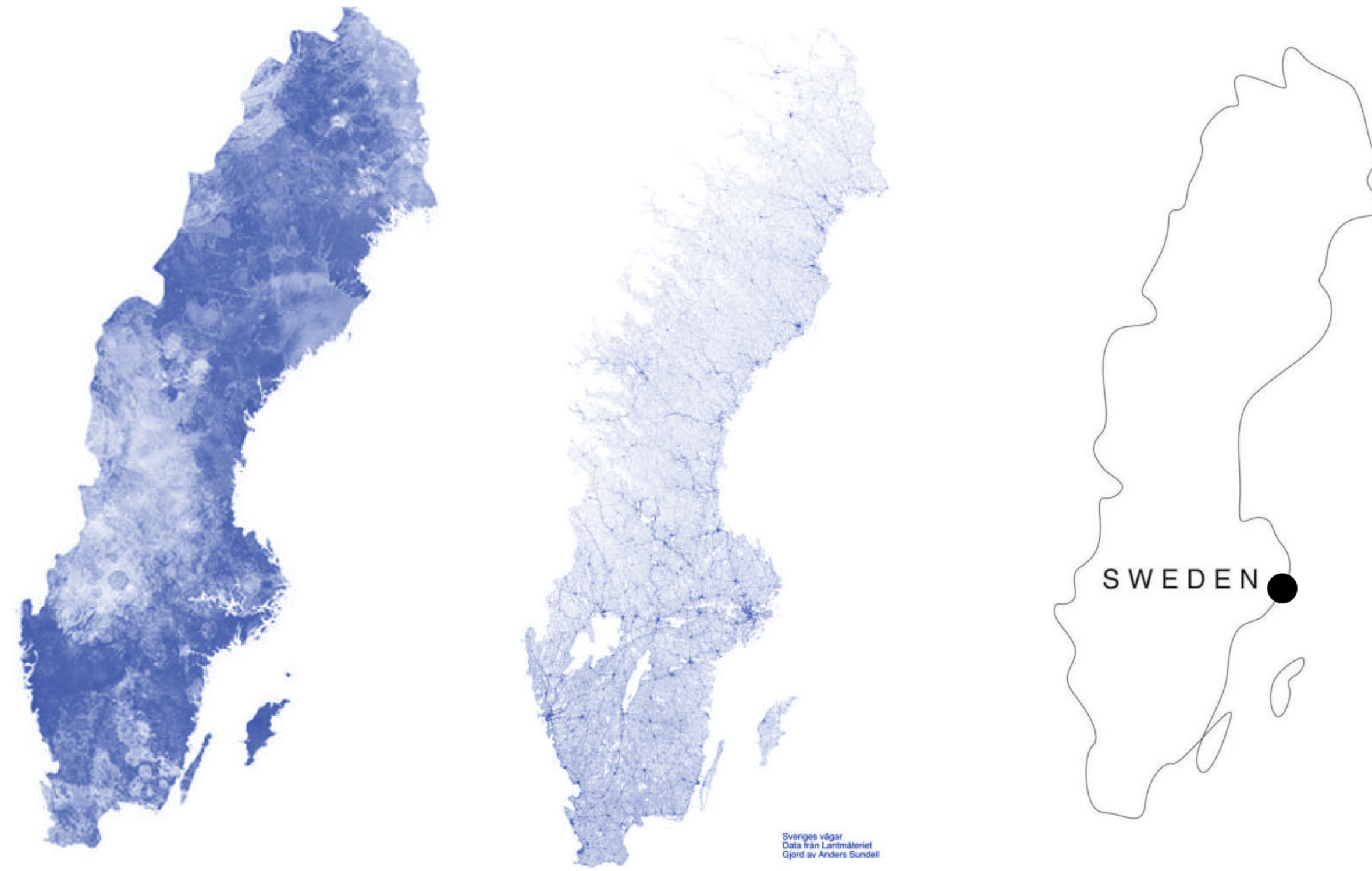
- LOCATION**
Northern Europe
Scandinavian Peninsula
- KEY FEATURES**
Capital: Stockholm
Varied landscapes (forests, lakes, coastline)
Rich cultural heritage
Socially progressive policies

FEATURES

- CULTURAL HERITAGE**
Home to the Vikings with a rich historical and cultural legacy.
UNESCO World Heritage Sites like the Royal Palace of Stockholm and the Skogskyrkogården cemetery.
- SOCIAL POLICIES**
Progressive social policies, including gender equality and comprehensive welfare programs.
High emphasis on education and healthcare.
- NATURAL BEAUTY**
Diverse landscapes ranging from dense forests and pristine lakes to a picturesque coastline.

ARCHITECTURAL CHARACTERISTIC

- HISTORICAL ARCHITECTURE**
Preservation of medieval structures in cities like Stockholm's Gamla Stan.
Gustavian style architecture from the 18th century.
Traditional wooden stave churches in rural areas.
- MODERN DESIGN**
Internationally acclaimed contemporary architects contributing to modern cityscapes.
Emphasis on functional, minimalist design.
- INNOVATIVE SUSTAINABLE ARCHITECTURE**
Growing trend towards environmentally conscious design.
Integration of green roofs and energy-efficient technologies.



Sweden: original Data från Lantmäteriet. Öppna av Anders Sundell

URBAN CHARACTERISTIC

- URBAN PLANNING**
Mix of modern and traditional urban planning strategies.
Integration of green spaces in urban environments.
Emphasis on sustainable city development.
- CHARACTERISTIC FEATURES**
Varied architectural styles from historical to contemporary.
Efficient public transportation systems.
Preservation of historical sites and buildings.
- CULTURAL INTEGRATION**
Promotion of cultural events and festivals.
Inclusive urban spaces that celebrate diversity.

CULTURAL ASPECTS

- CULTURAL HERITAGE**
Rich history of Viking culture and medieval traditions.
Preservation of historic sites, museums, and artifacts.
Celebrations of national events and traditions.
- CONTEMPORARY CULTURE**
Vibrant arts scene with theaters, galleries, and music festivals.
Embrace of modern design and innovation.
Inclusivity and diversity in cultural expressions.
- SOCIAL VALUES**
Emphasis on equality, social justice, and human rights.
High value placed on education and intellectual pursuits.
Thriving literary and artistic traditions.

PEOPLE CHARACTERISTIC

- SOCIAL EQUALITY**
Strong emphasis on social equality and inclusivity.
Comprehensive welfare programs supporting citizens.
Progressive policies promoting gender equality.
- EDUCATED POPULATION**
Focus on research, innovation, and intellectual pursuits.
Accessible and quality education systems.
Cultural Diversity.

STOCKHOLM IN SWEDEN

STOCKHOLM

- LOCATION**
Eastern coast of Sweden
Archipelago of interconnected islands
- KEY FEATURES**
Capital city
Historical landmarks (Gamla Stan, Royal Palace)
Modern architecture (Vasamuseet, ABBA Museum)
Green spaces (Djurgården)
Cultural Aspects:
Nobel Prize ceremonies held in Stockholm
Vibrant arts and music scene

FEATURES

- ISLAND ARCHITECTURE**
Spread across 14 islands, connected by bridges and ferries.
Unique architectural blend of medieval and modern structures.
- CULTURAL SCENE**
Hub for the arts, with numerous museums, theaters, and galleries.
Annual events like the Nobel Prize ceremonies and Stockholm Film Festival.
- INNOVATION HUB**
Booming tech and startup scene.
Home to major tech companies and research institutions.

ARCHITECTURAL CHARACTERISTIC

- HISTORIC CHARM**
Gamla Stan's narrow cobblestone streets and colorful buildings.
The Royal Palace showcasing Baroque and Rococo styles.
- MODERN SKYLINE**
Contemporary structures like the Ericsson Globe and Kista Science Tower.
Innovative designs in residential and commercial spaces.
- ARCHIPELAGO INFLUENCE**
Waterfront architecture influenced by the city's island setting.
Modern developments blending with historical maritime elements.



URBAN CHARACTERISTIC

- URBAN PLANNING**
Archipelago-inspired urban layout with interconnected islands.
Zoning that balances historical preservation with modern development.
Pedestrian-friendly areas in the city center.
- CHARACTERISTIC FEATURES**
Historical landmarks like Gamla Stan and modern structures like the City Hall.
Waterfront architecture and promenades.
Integration of smart city technologies.
- CULTURAL INTEGRATION**
Diverse neighborhoods with unique cultural identities.
Cultural institutions and events contributing to city life.

CULTURAL ASPECTS

- HISTORICAL AND MODERN BLEND**
Preservation of Gamla Stan's medieval architecture.
Modern cultural hubs like the ABBA Museum and Fotografiska.
Fusion of historical events with contemporary cultural expressions.
- CULTURAL EVENTS**
Hosting of international events like the Nobel Prize ceremonies.
Film festivals, fashion weeks, and music events.
Local festivals celebrating Swedish traditions.
- CULTURAL DIVERSITY**
Neighborhoods with distinct cultural identities.
Museums and cultural institutions representing various art forms.
Inclusive cultural policies promoting diversity.

PEOPLE CHARACTERISTIC

- URBAN DIVERSITY**
Diverse neighborhoods reflecting various socio-economic backgrounds.
Inclusive policies fostering a sense of belonging for all residents.
Social programs and initiatives for community well-being.
- TECH-SAVVY POPULATION**
Focus on research, innovation, and intellectual pursuits.
Accessible and quality education systems.
Cultural Diversity.
- ACTIVE COMMUNITY ENGAGEMENT**
Participation in cultural and social events.
Strong community ties and neighborhood engagement.

ROYAL SEAPORT IN STOCKHOLM

ROYAL SEAPORT

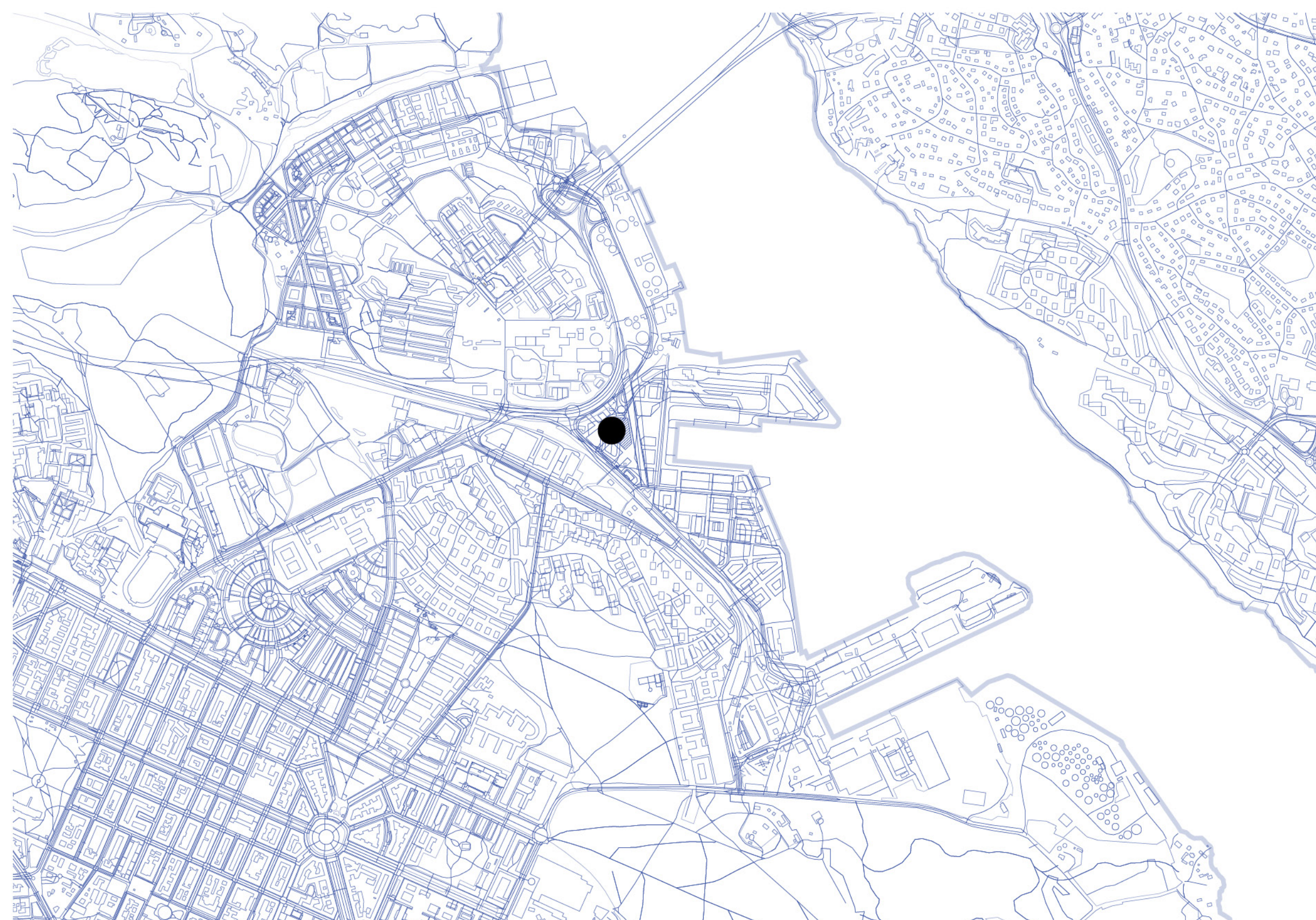
- LOCATION**
Northeastern part of Stockholm
- KEY FEATURES**
Waterfront district
Sustainable urban development
Mix of residential and commercial spaces
Innovation in green infrastructure
Sustainability initiatives.
Environmental design and planning
Green roofs and sustainable architecture
Focus on renewable energy sources
Efficient waste management systems

FEATURES

- Cutting-edge environmental design and green infrastructure.**
Integration of renewable energy sources and eco-friendly construction.
- MIXED USE SPACES**
Blend of residential, commercial, and recreational areas.
Emphasis on creating a balanced and livable urban environment.
- WATERFRONT LIVING**
Proximity to the waterfront, providing scenic views and recreational opportunities.
Sustainable transportation options, including waterfront promenades and bike paths.

ARCHITECTURAL CHARACTERISTIC

- SUSTAINABLE ARCHITECTURE**
Green building practices and sustainable urban planning.
Emphasis on eco-friendly materials and energy-efficient design.
- MIXED-USE SPACES**
Varied architectural styles in residential and commercial buildings.
Integration of public spaces and parks into the urban fabric.
- WATERFRONT DESIGN**
Buildings designed to take advantage of waterfront views.
Sustainable transportation infrastructure along the waterfront.



URBAN CHARACTERISTIC

- URBAN PLANNING**
Sustainable urban development with green building practices.
Mixed-use spaces, combining residential and commercial areas.
Waterfront-focused planning for a cohesive district.
- CHARACTERISTIC FEATURES**
Sustainable architecture with green roofs and energy-efficient design.
Public spaces, parks, and recreational areas for community engagement.
Efficient waste management and eco-friendly infrastructure.
- CULTURAL INTEGRATION**
Integration of cultural spaces and community facilities.
Emphasis on a sense of community and well-being.
Events and initiatives promoting sustainable living.

CULTURAL ASPECTS

- SUSTAINABLE CULTURAL INITIATIVES**
Integration of sustainability into cultural practices.
Cultural events promoting environmental awareness.
Sustainable living as a cultural value.
- COMMUNITY ENGAGEMENT**
Local cultural events and festivals fostering a sense of community.
Art installations and cultural spaces within the district.
Integration of cultural elements into public spaces.
- INNOVATION IN THE ARTS**
Embrace of technology and innovation in artistic expressions.
Promotion of eco-friendly and sustainable art projects.
Cultural initiatives aligning with the district's sustainable ethos.

PEOPLE CHARACTERISTIC

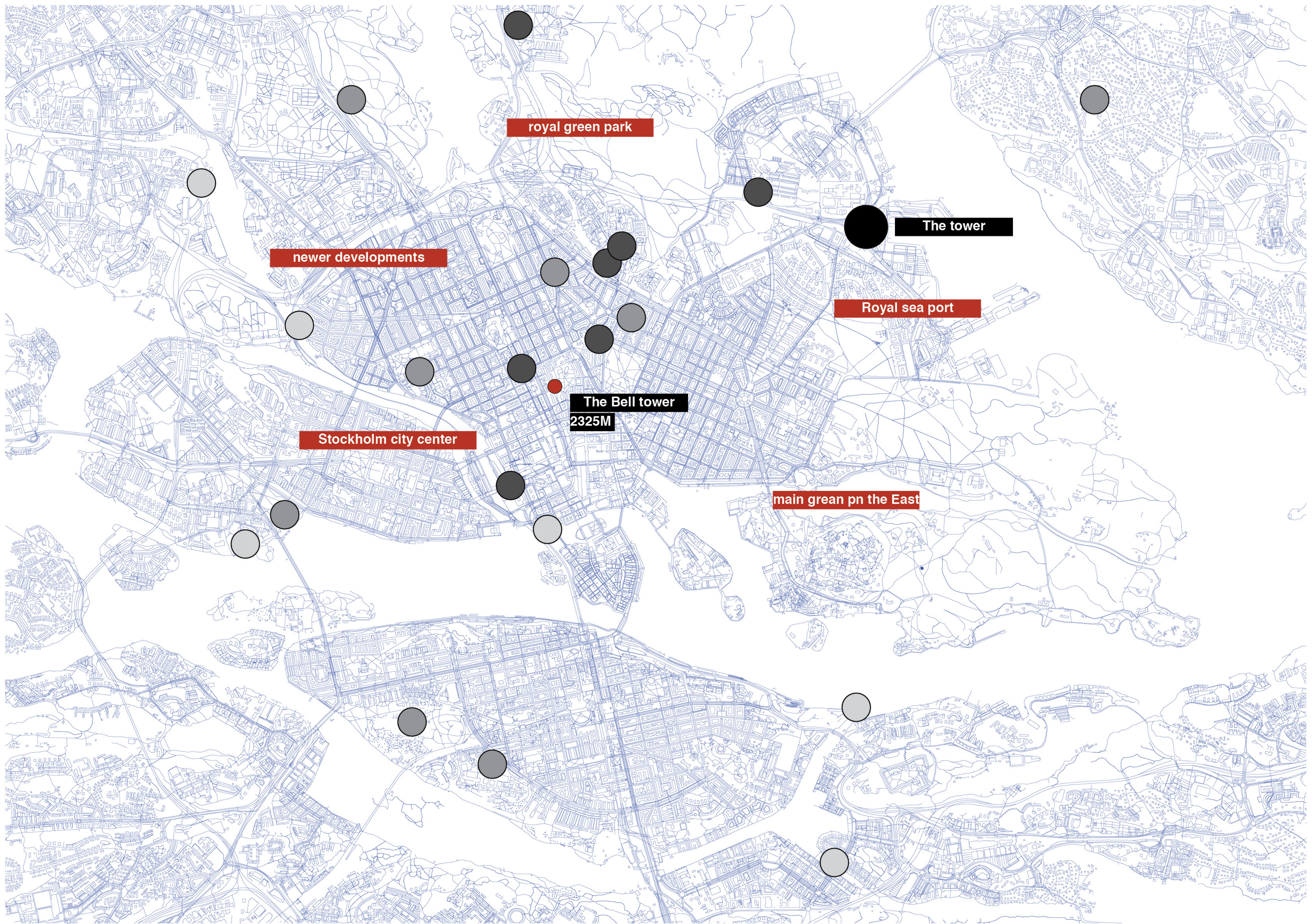
- Sustainable Living Community**
Residents committed to sustainable living practices.
Community initiatives for environmental conservation.
Collaboration on green projects for a shared vision.
- Mixed-Use Spaces for Interaction**
Design of spaces encouraging social interaction.
Shared facilities and communal areas fostering a sense of community.
Involvement in cultural and environmental events within the district.

STOCKHOLM URBANISM

nodes , places , locations

The city's skyline showcases a harmonious fusion of medieval structures, such as Gamla Stan, with contemporary landmarks, reflecting a commitment to sustainable urban planning and technological advancement. Vibrant public spaces, waterfront promenades, and cultural hubs contribute to Stockholm's dynamic and inclusive urban experience.

LOCATIONS AND DISTRICTS



NOLLI PLANS OF SOME DISTRICTS



STOCKHOLM

Stockholm's city center, particularly the district of Norrmalm, is a bustling urban core known for its high population density. Home to major landmarks, shopping districts, and cultural institutions, it represents a vibrant hub of activity. The area combines historical charm, modern architecture, and efficient transportation, creating a dynamic and lively urban center in the heart of the city.



NORRMALM

Norrmalm is Stockholm's central business and shopping district, known for its high population density and vibrant urban atmosphere. It features iconic landmarks like Sergels Torg, Stockholm Concert Hall, and the bustling shopping street Drottninggatan. Norrmalm is a cultural and commercial hub, with a mix of historical and contemporary architecture, making it a dynamic and lively part of Stockholm's city center.



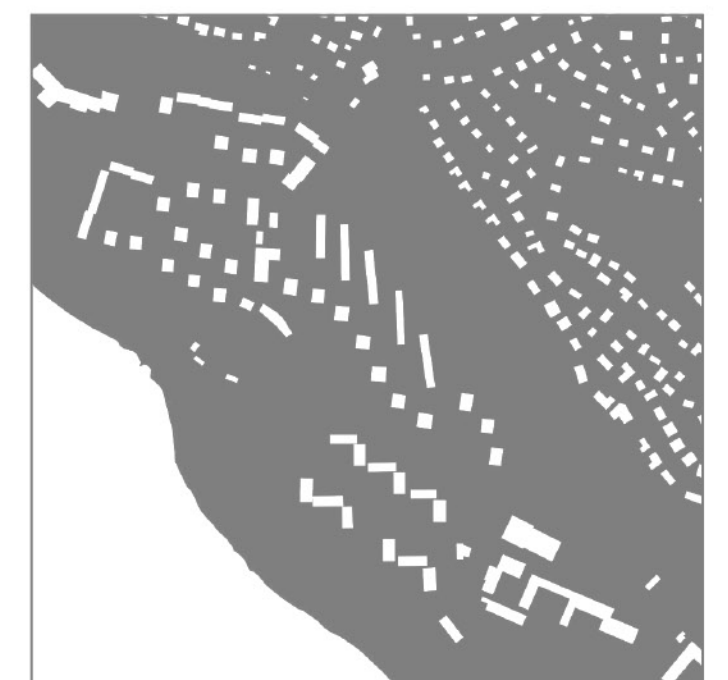
ÖSTERMALM

Östermalm is a prestigious district in central Stockholm, characterized by a mix of upscale residential areas, commercial spaces, and cultural attractions. Known for its affluent atmosphere, Östermalm features exclusive shops, fine dining, and elegant architecture. This district combines a sense of luxury with green spaces like Djurgården, making it a sought-after and sophisticated part of Stockholm.



ROYAL SEAPORT
"SITE LOCATION"

The Royal Seaport (Kungliga Sjöporten) in Stockholm is an innovative and sustainable urban development project. This waterfront district focuses on green living, featuring eco-friendly architecture, green roofs, and renewable energy sources. With a mix of residential and commercial spaces, the Royal Seaport exemplifies modern urban planning, emphasizing environmental consciousness and creating a livable, forward-thinking community.

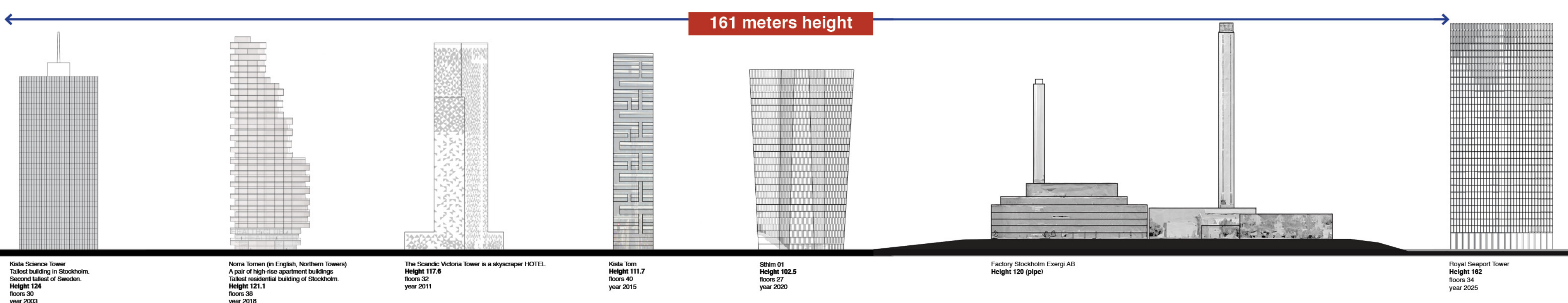


HERASERUD
LIDINGÖ

As of my last knowledge update in January 2022, Heraserud is a residential area on the island of Lidingö in Stockholm County, Sweden. Lidingö is known for its suburban character, and Heraserud is likely a neighborhood or district within this larger area. Specific details about Heraserud, such as its amenities or notable features, may not be readily available in my training data.

For the most accurate and up-to-date information about Heraserud, especially if there have been changes or developments since my last update, I recommend checking with local sources, municipality records, or community websites associated with Lidingö.

HEIGHT OF IMPORTANT TOWERS



161 meters height

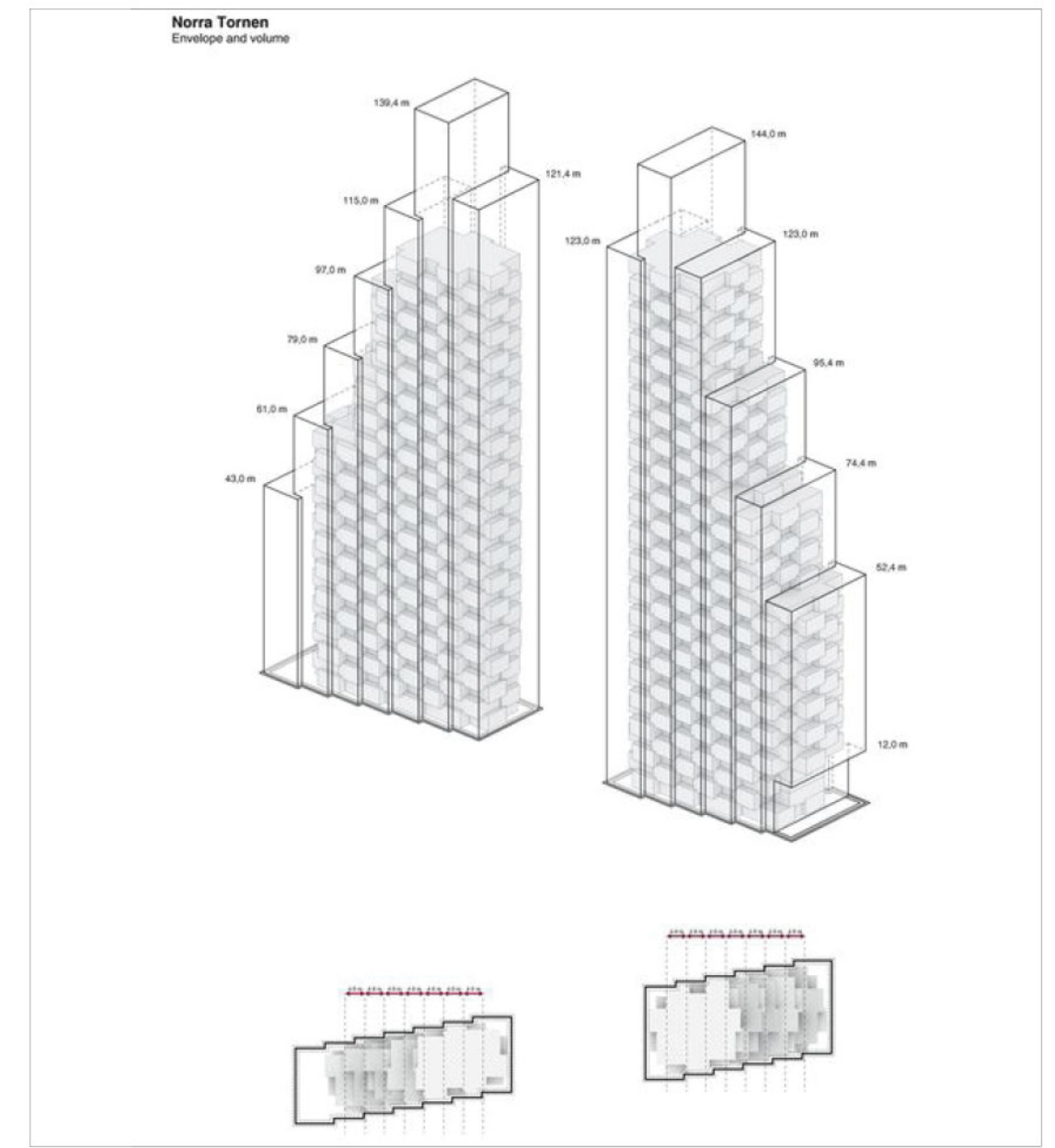
NORDIC ARCHITECTURE important towers in the two cities

characteristic of Nordic architecture will play an important role in designing a new important element "The tower" and knowing the last recent and important similar building in this area is a must do.

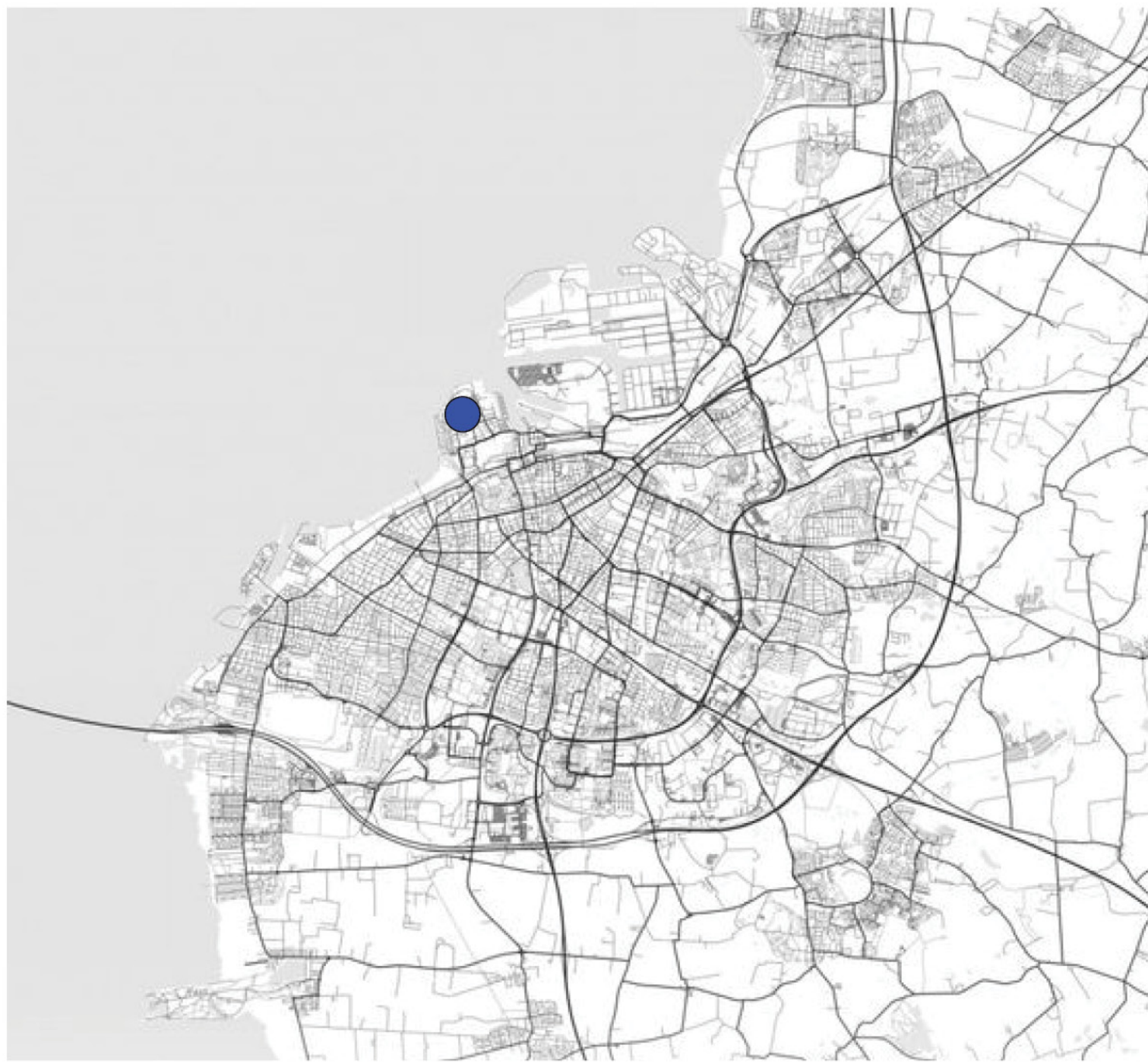
REM KOOLHAAS RESIDENTIAL BUILDING IN STOCKHOLM



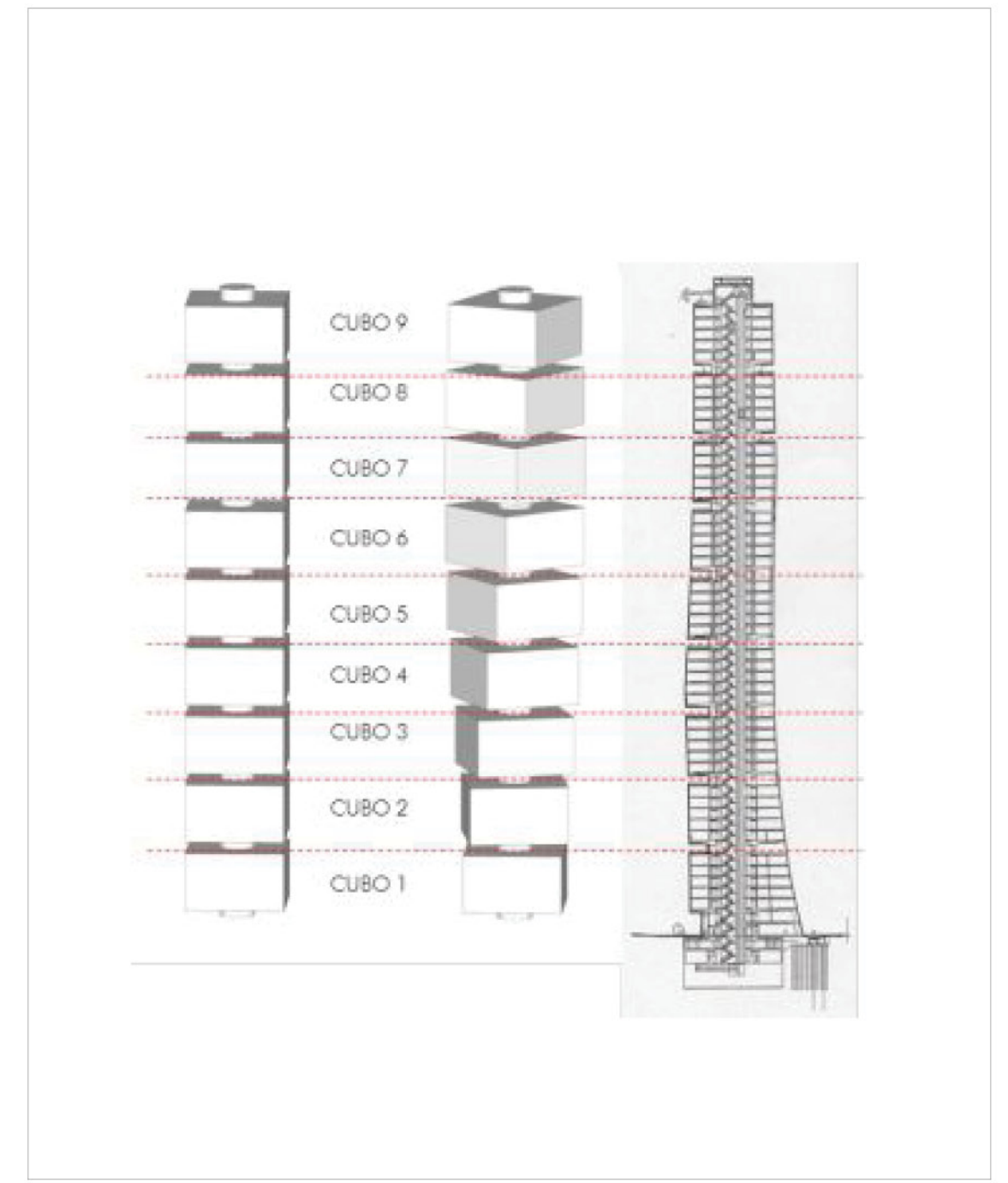
Stockholm's skyline is a captivating blend of historic and modern architecture, characterized by a mix of spires, towers, and contemporary structures. Key landmarks include the iconic City Hall with its distinctive silhouette, the Kaknäs Tower offering panoramic views, and modern skyscrapers like the Kista Science Tower. This skyline reflects the city's commitment to preserving its historic charm while embracing innovation in urban design.



TURNING TORSI IN MALMO

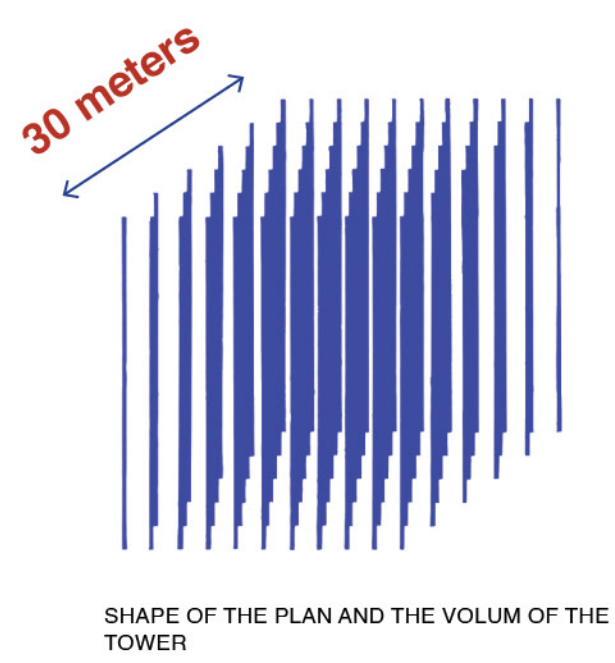


The Turning Torso is an iconic skyscraper located in Malmö, Sweden, and it was designed by the Spanish architect Santiago Calatrava. Completed in 2005, the tower is known for its distinctive twisting form, reaching a height of 190 meters (623 feet). The Turning Torso is a residential building and stands as a landmark in the city, showcasing Calatrava's innovative architectural design.



ARCHITECTURE CHARACTERISTICS

PURE VOLUMES



PURE VOLUMES IN STOCKHOLM ARCHITECTURE

Contemporary Designs: In newer developments and modern architecture, Stockholm has seen the incorporation of pure volumes. This involves the use of clean lines, simple geometric shapes, and a focus on the overall mass of the building.

SUSTAINABLE ARCHITECTURE: SUSTAINABLE ARCHITECTURE

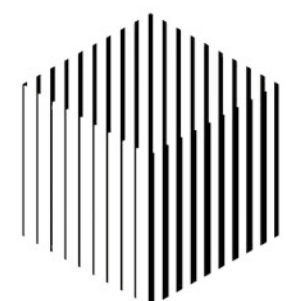
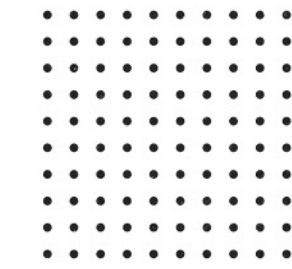
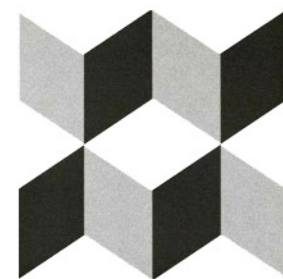
Buildings in Stockholm with pure volumes may also incorporate sustainable design principles, showcasing a commitment to both aesthetics and environmental responsibility.

MODERNIST INFLUENCES

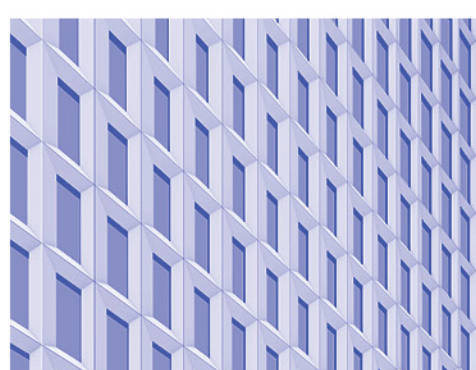
Modern residential buildings, commercial spaces, or cultural institutions where architects have embraced a minimalist and pure volume approach.

EXAMPLES

Stockholm, like many European cities, has been influenced by modernist architecture. Certain neighborhoods or developments may showcase buildings with pure volumes and grid-based layouts.



USE OF THE GRIDS



USE OF GRID IN THE DESIGN OF THE FACADE

URBAN PLANNING

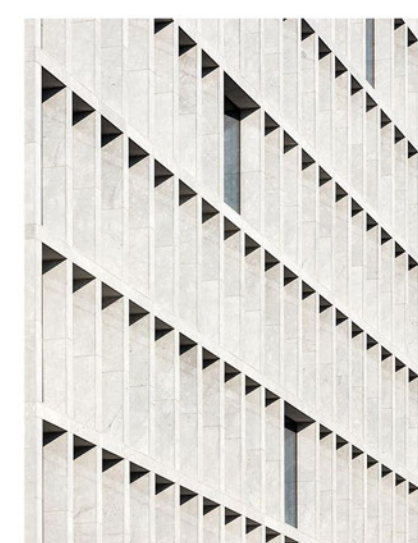
The use of a grid layout is evident in certain areas of Stockholm, especially in the planning of streets and city blocks. This grid-based urban planning can be seen in both historical neighborhoods and newer developments.

STRUCTURAL ELEMENTS

Modern buildings may feature grid-like patterns in their facades, windows, or structural elements. This approach contributes to visual coherence and can be a nod to contemporary design principles.

HARMONIOUS STREETSCAPES

The grid layout contributes to the creation of harmonious streetscapes, providing a sense of order and regularity to the urban environment.



THE ROYAL SEAPORT functions and locations

Transition of a brown field into a multi functional area with the name of royal sea port was one of the important decision in early years of 21st century. This district is known as one of the most important areas that has been designed for sustainable life.

ROYAL SEAPORT MASTER PLAN 2000

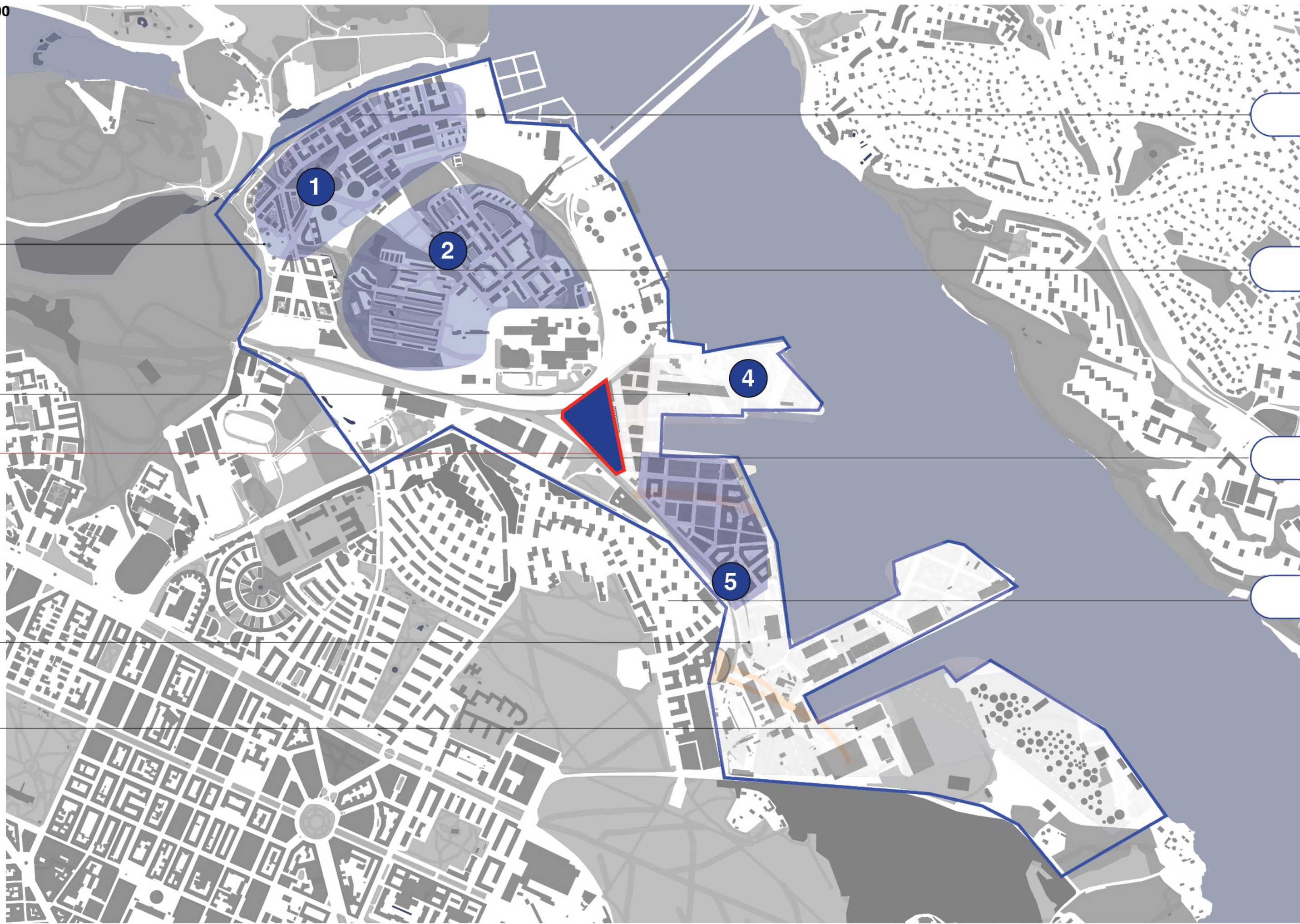
GASKLOCKAB TOWER
(90 meter height,
In Construction)
Herzog & de Meuron

**VÄRTATERMINALEN
FERRY TERMINAL**
C.F. Møller Architects

PROJECT AREA
Team Anomaly
The site locates in Valparaiso (Port & City District) and aimed to link the northern and southern part of the masterplan.

MAGASIN I, II, III, 9
Modern Art&Design Museum

NASDAQ STOCKHOLM
Stock Exchange Centre



GASVERKET

Preservation,
Public Sectors of the Area,
Old/New Interaction

HJORTHAGEN

Mid-rise residence,
Small-scale Services,
the Ring of Greenery

PORT & CITY

SÖDRA VÄRTAN

Up to 600,000 sqm
Commercial Space
Starting 2022

ARERIAL VIEW OF CURRENT SITUATION

**LOW DENSITY RESIDEN-
RIAL**
the view from the other side
of the sea

GREEN IN THE MIDDLE
hub of events
commercial
open spaces
social area

**SUSTAINABLE RESIDEN-
TIAL**
Equipped with all kind of
transportation
connectivity
events

ROYAL PARK
the biggest greenery on the
north side of the royal sea-
port



SÖDRA VÄRTAN

Up to 600,000 sqm
Commercial Space
Starting 2022

PORT & CITY

Connection, Visual Entry,
Tourism, Terminal Support,
High-Rise Buildings

HJORTHAGEN

Mid-rise residence,
Small-scale Services,
the Ring of Greenery

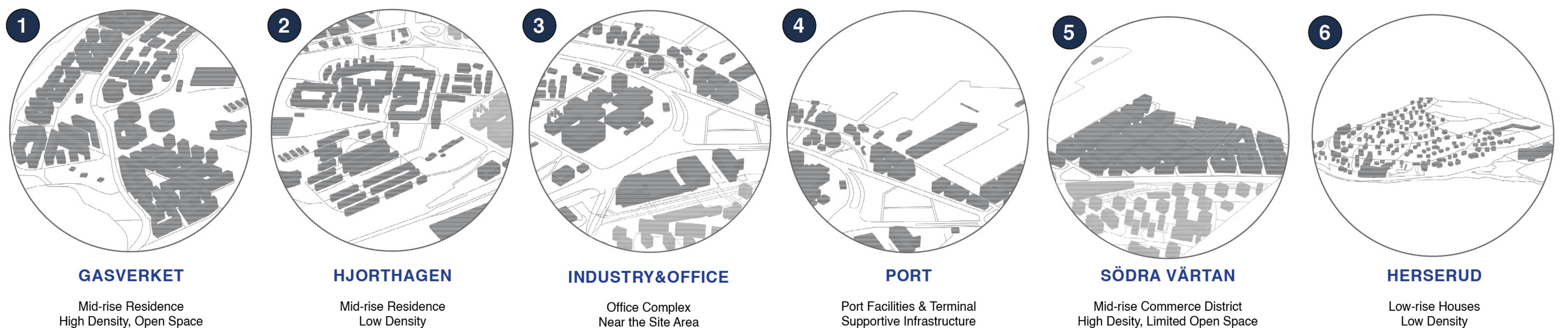
GASVERKET

Preservation,
Public Sectors of the Area,
Old/New Interaction

DESIGNING A TOWER?

- ICONIC LANDMARK**
A well-designed tower can serve as an iconic landmark, contributing to the identity and recognition of the Royal Seaport.
- SKYLINE ENHANCEMENT**
Adding a tower to the skyline can enhance the aesthetic appeal of the area, creating visual interest and a sense of modernity.
- MIXED-USE OPPORTUNITIES**
The tower could offer mixed-use spaces, incorporating residential, commercial, or cultural elements, providing a dynamic and vibrant environment.
- INCREASED DENSITY**
Vertical construction allows for increased density without sprawling horizontally, contributing to sustainable urban development.
- SUSTAINABLE DESIGN**
Embracing sustainable architectural principles in the tower's design can set a positive example for environmentally conscious construction in the Royal Seaport.
- ECONOMIC STIMULUS**
The construction and operation of a tower can stimulate the local economy, providing job opportunities and attracting businesses to the area.
- COMMUNITY SPACE**
Incorporating communal spaces within the tower or its vicinity can encourage community engagement and foster a sense of belonging. Smart Technologies:
- CULTURAL CONTRIBUTION**
A tower with unique architectural features or cultural significance can contribute to the cultural identity of the Royal Seaport, becoming a source of pride for residents.
- SMART TECHNOLOGIES**
Integrating smart city technologies into the tower's infrastructure can enhance efficiency, resource management, and overall sustainability.
- INNOVATION SHOWCASE**
If the tower incorporates innovative design, materials, or construction methods, it can serve as a showcase for architectural and technological advancements.

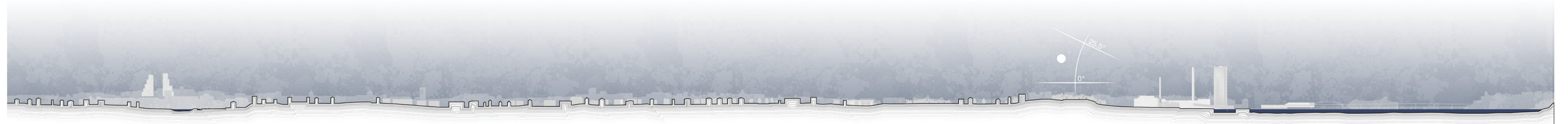
ROYAL SEAPORT DISTRICTS



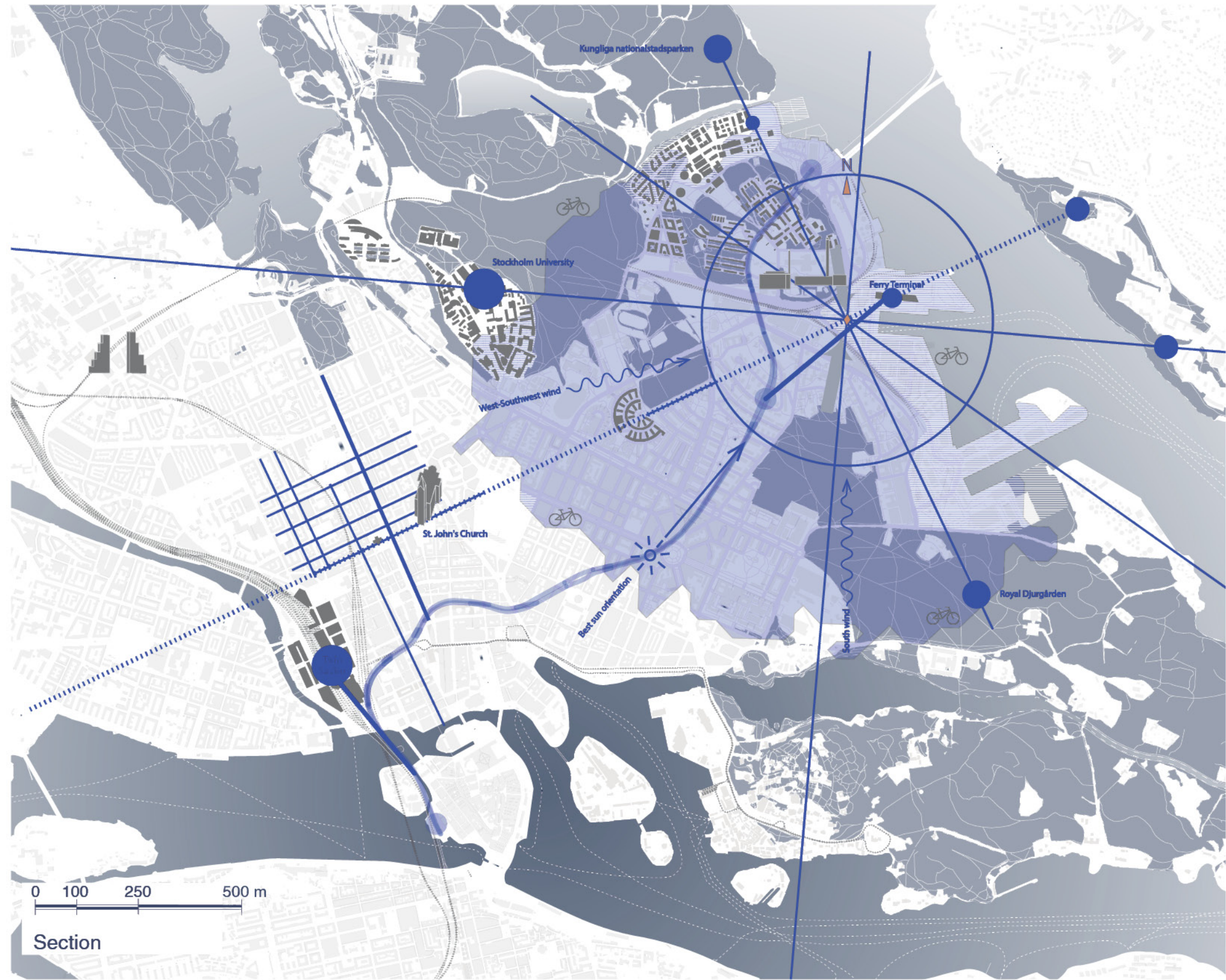
URBAN FABRIC
location of the tower towards the city

How the most important nodes of the city may effect the tower is important to be analysed. the connection of the tower with royal sea port and the city, important elements of the city are point of vies in designing the spaces and functions.



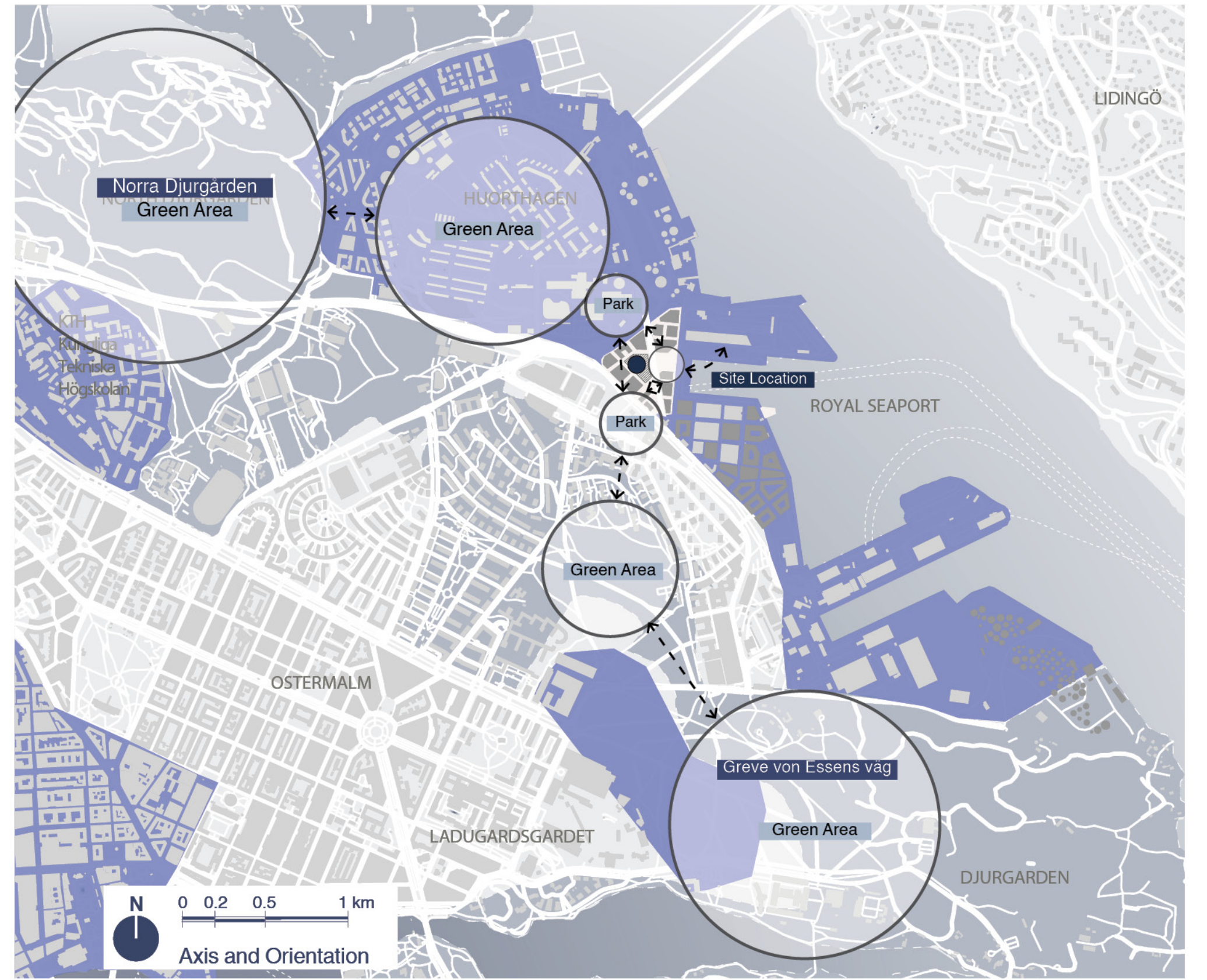


ANALYSIS OF THE CITY CONNECTIONS AND AXIS



CONNECTION OF GREEN AREA

As a purpose we linked our project with other greenery near by



ECOLOGICAL LINKAGE



FLOWS & CONNECTION



ACTIVITIES NODES



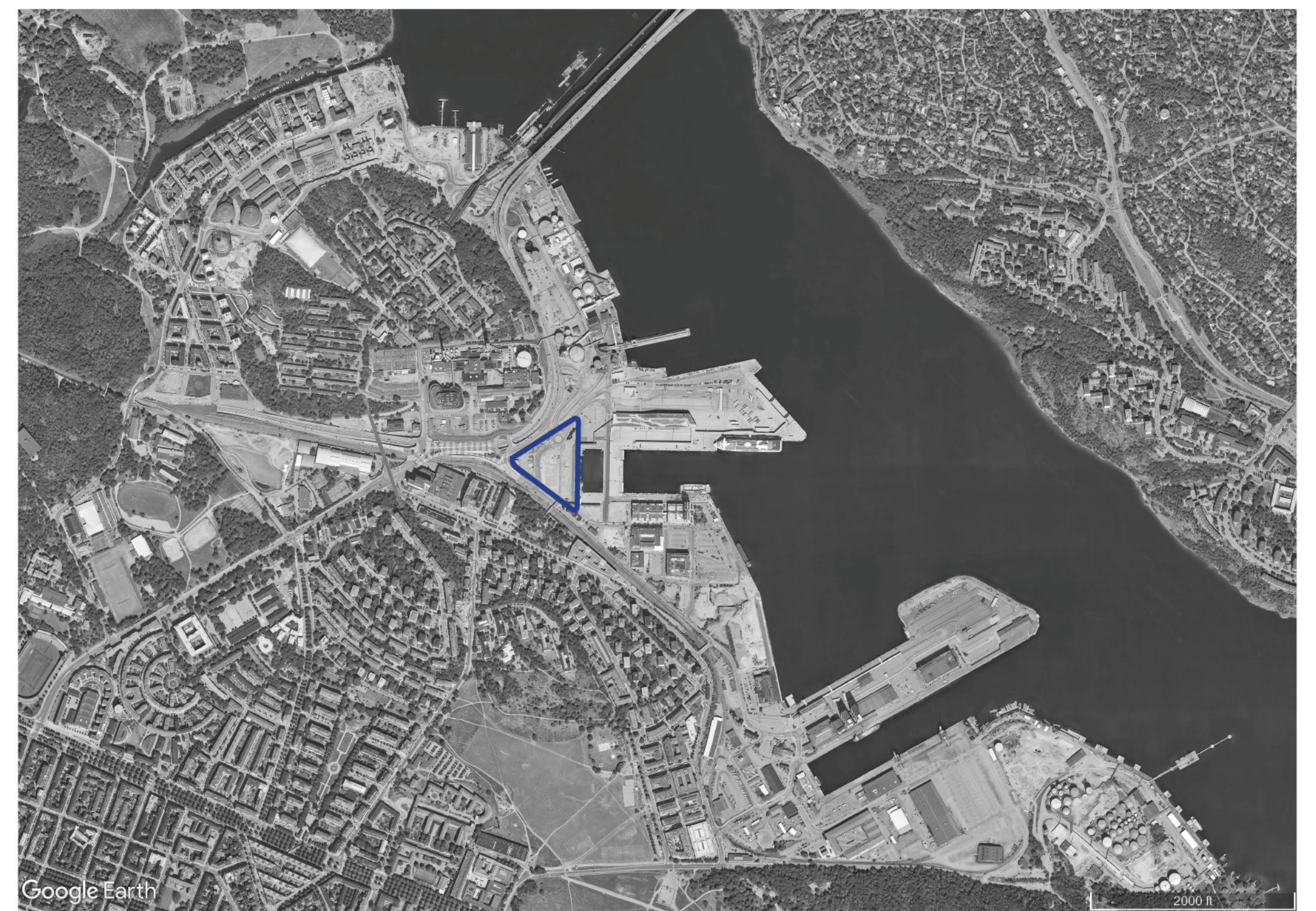
HOTSPOTS & TRANSPORTATION



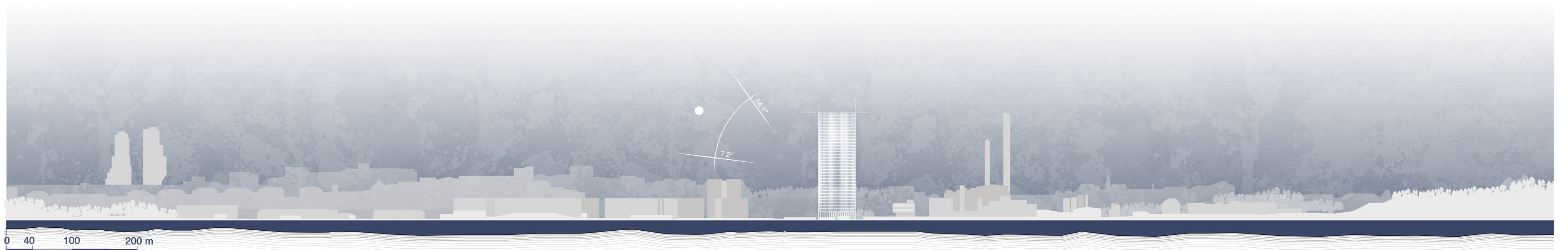
THE AREA FOR SELECTING THE SITE CHANGING THE MASTER PLAN



THE STOCKHOLM ROYAL SEAPORT A brownfield project launched in 2000



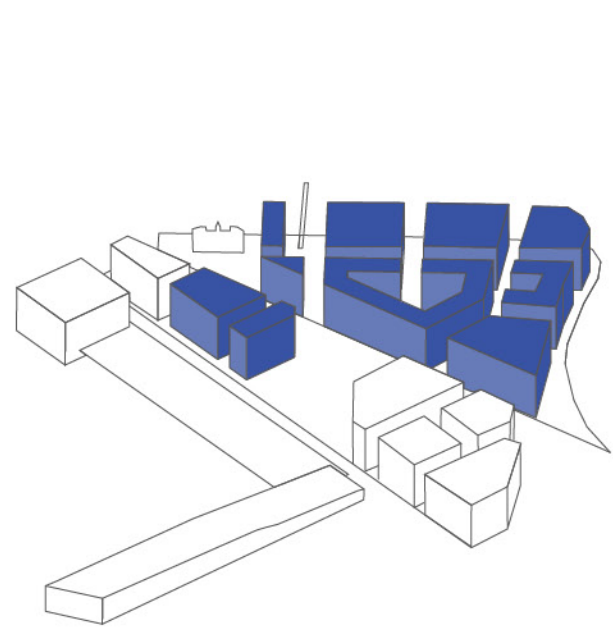
Density & Building Height



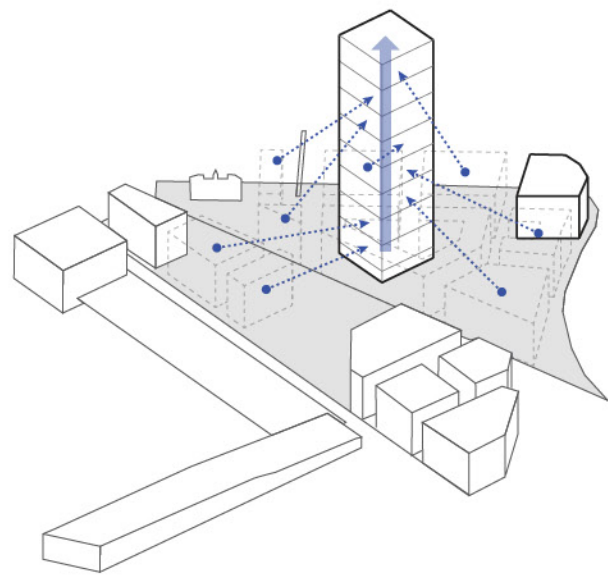
DESIGN PROCESS

Concept Diagram: How to Arrive the Shape&Volume (architectural)

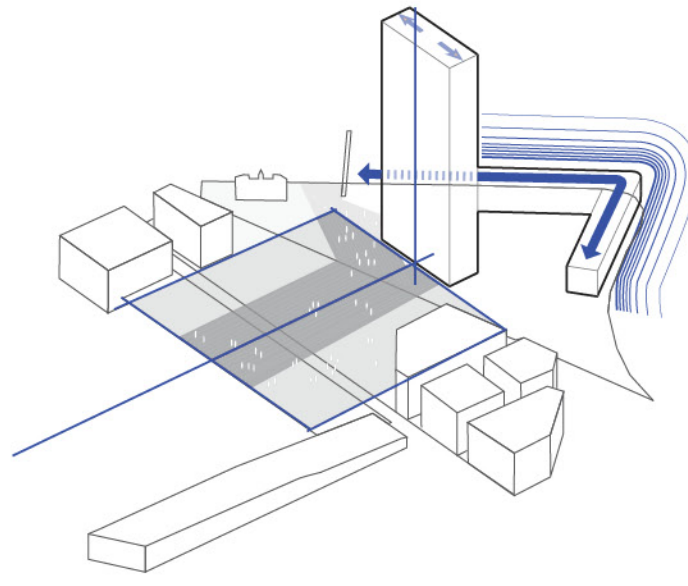
Future Fabric
(Understand the site)



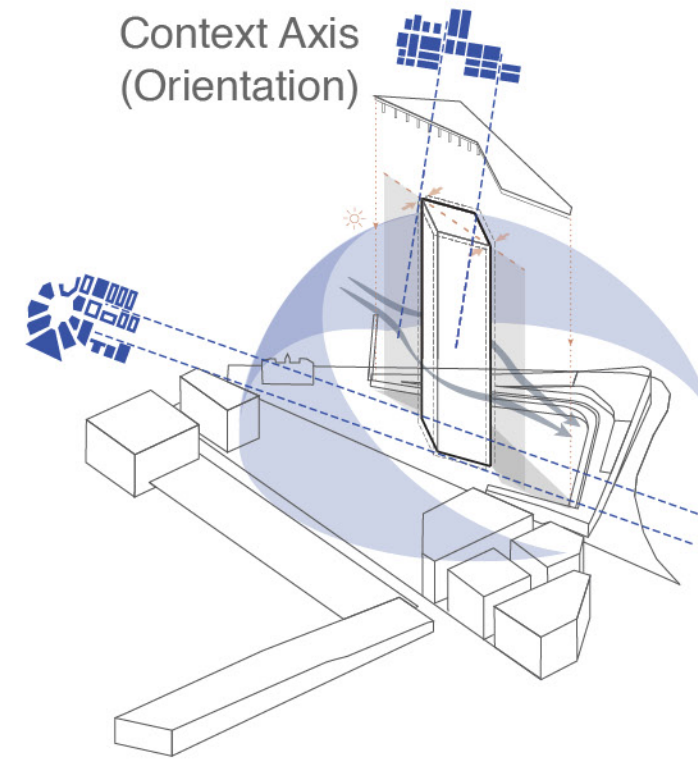
Clear the Ground Floor
(Concentration)



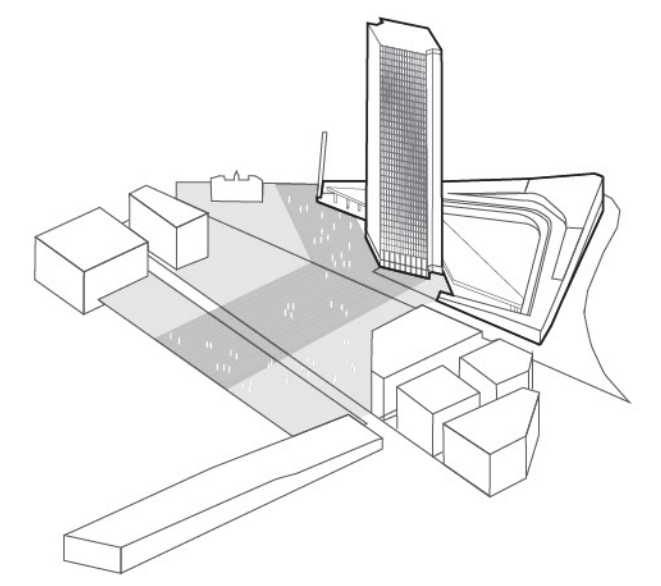
Urban Connection
(Stretch the volume)



Context Axis
(Orientation)

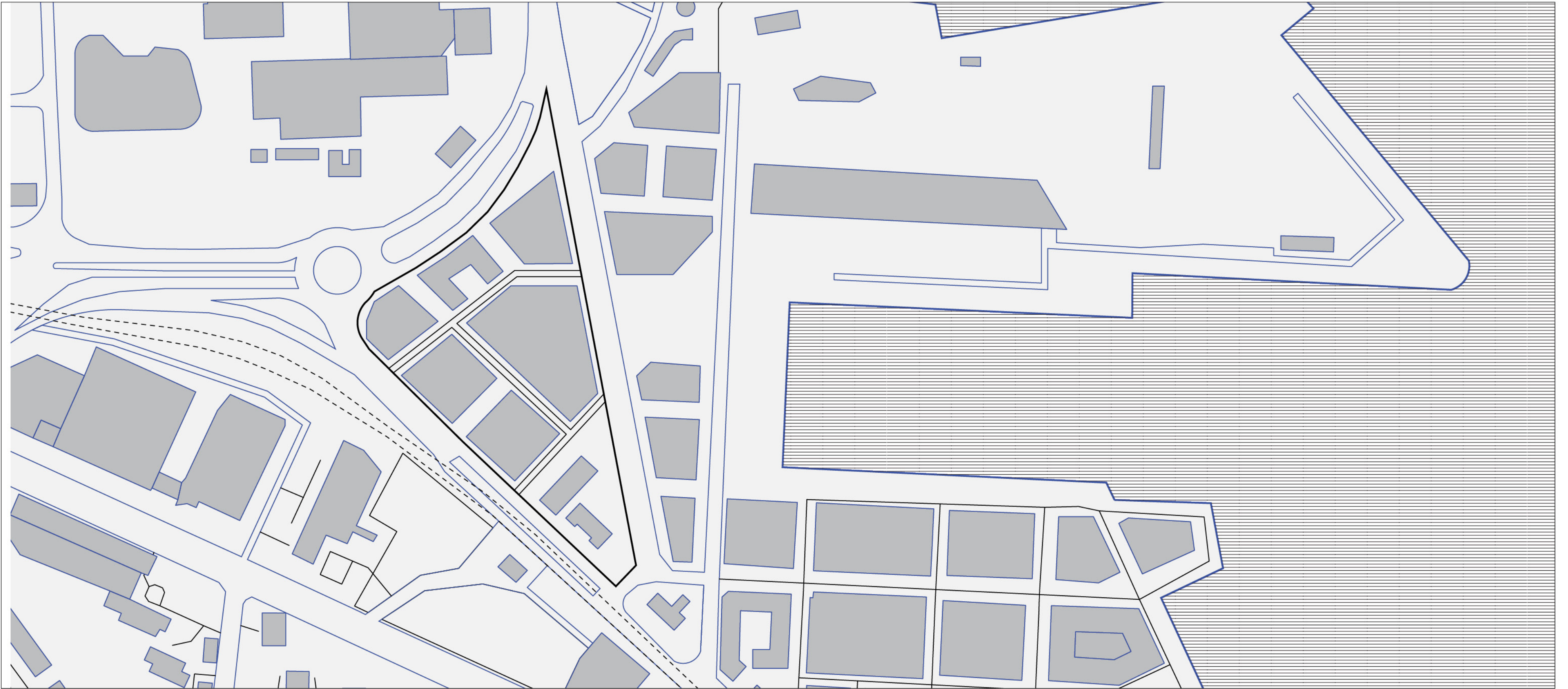


Connection to the seaport
(Facade & Landscape)



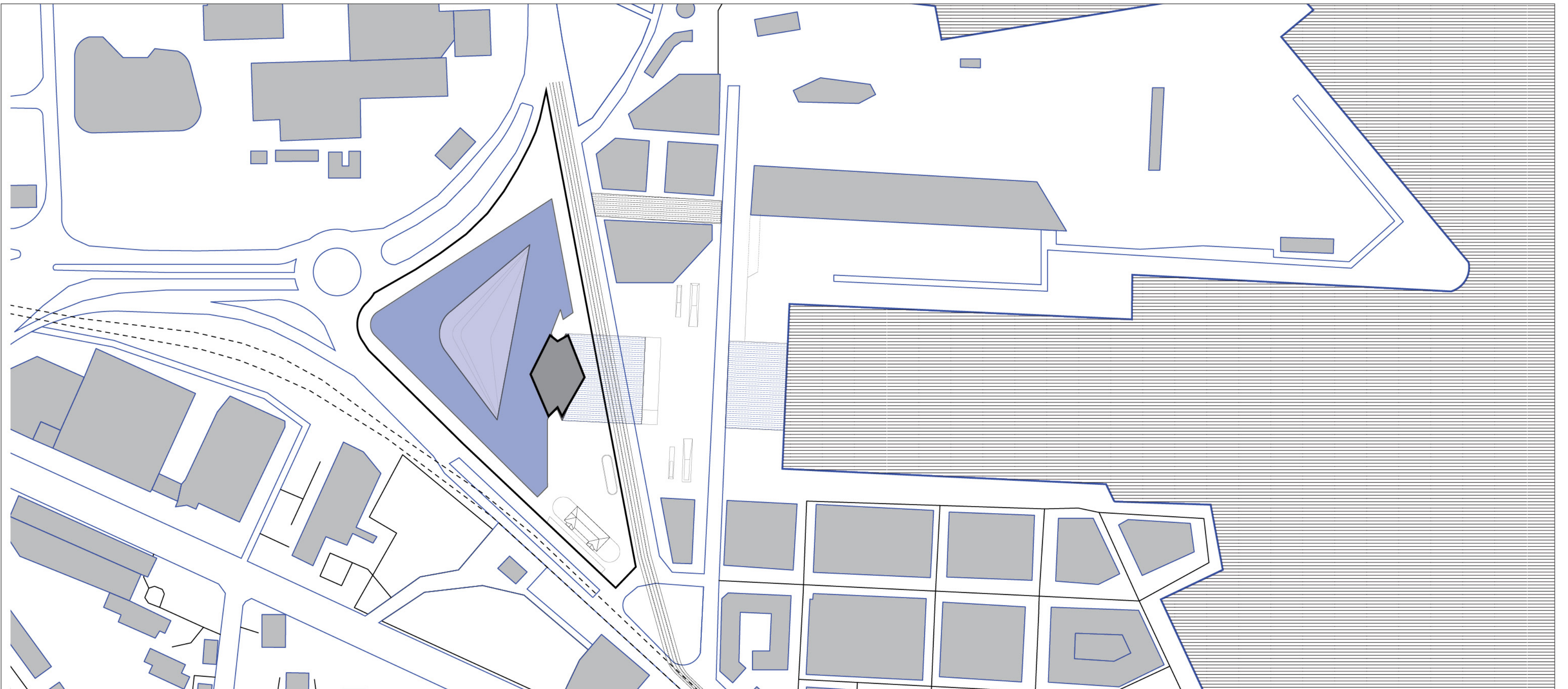
FUTURE MASTER PLAN 2000

Concept: mixed use of commercial and residential on dense blocks



SUGGESTED DESIGNED MASTERPLAN

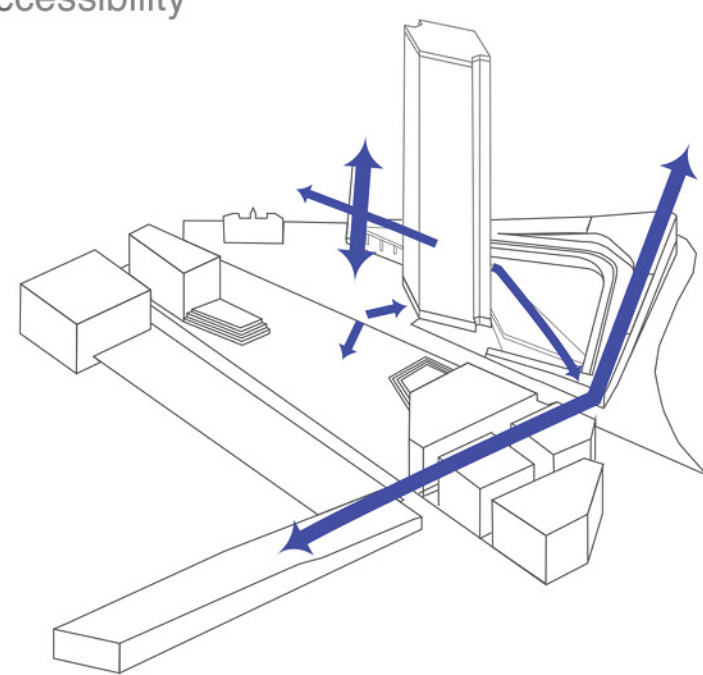
Concept: replacing with tower gives more free space and diverse functions



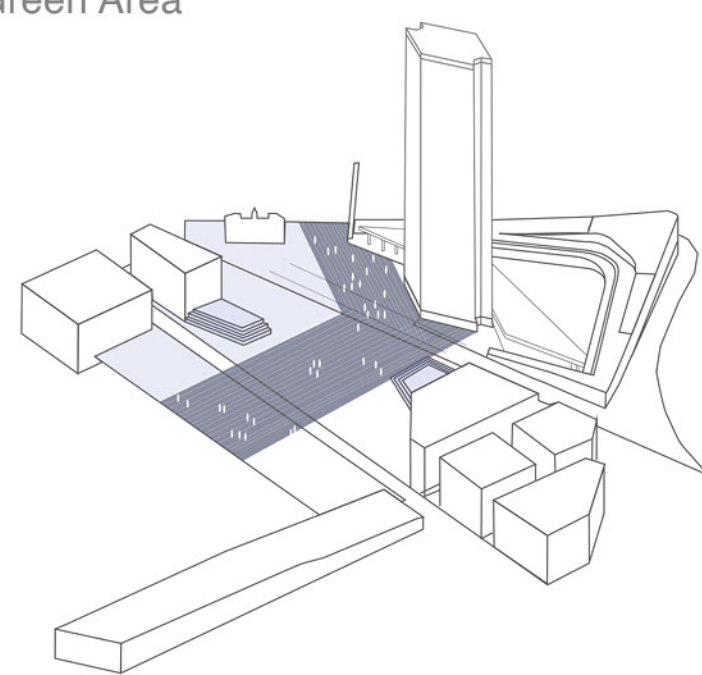
DESIGN STRATEGY

Concept Diagram: The things that are considered for the design and the shape

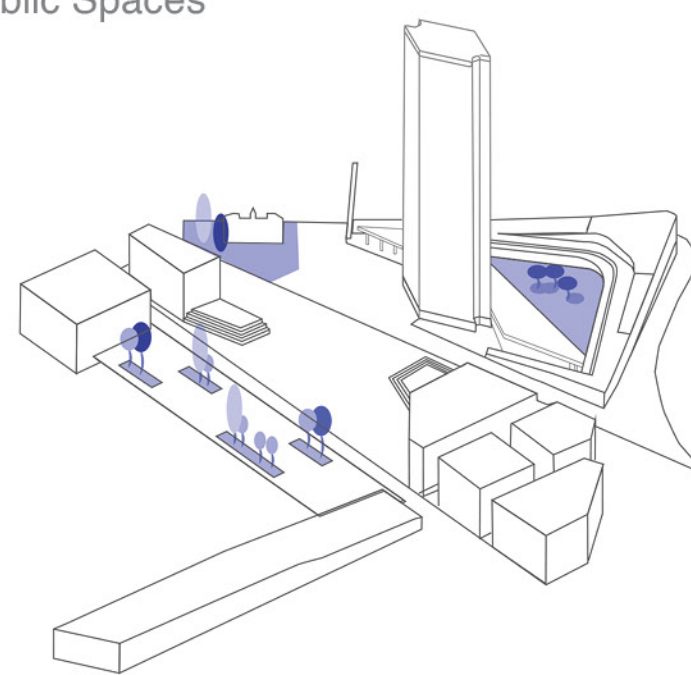
Accessibility



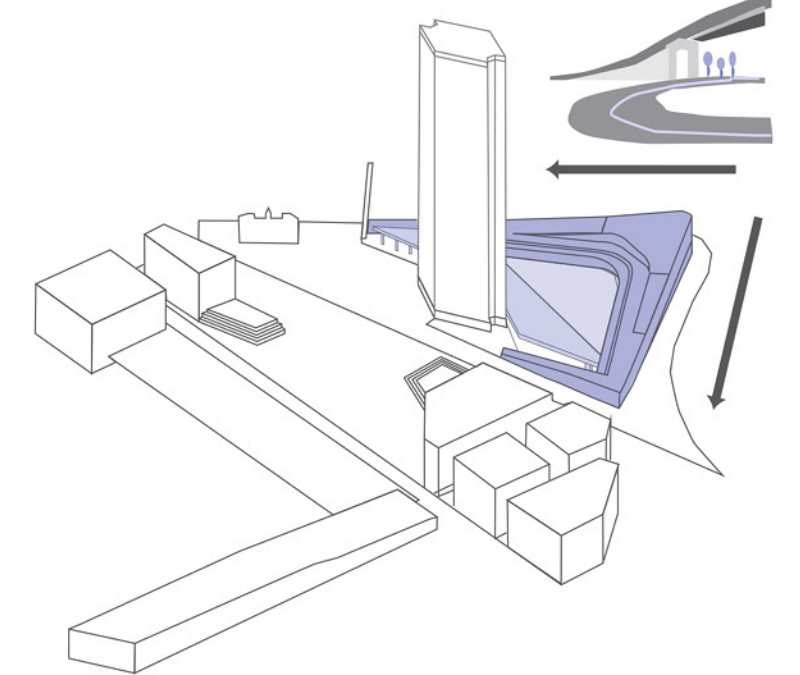
Green Area



Public Spaces



Podium



POSITION OF THE ATRIUMS

Proposal of Function and locations

The tower in Royal Seaport, Stockholm, offers a multifunctional space with entrances, a library, co-working areas, an institute of sustainability, residential floors, and an infinity view restaurant. It caters to diverse needs, providing a dynamic and vibrant hub in the heart of the city.

How Far Can the Human Eye See?

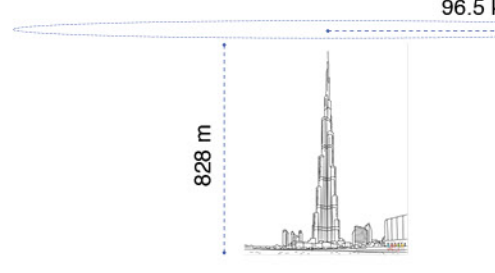
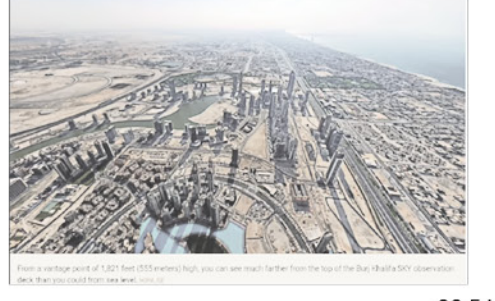
In the day
If you're a person with normal vision acuity — a rating of 20/20 — and you gaze horizontally from around 5 feet (152.4 centimeters) above the ground, you can see about 3 miles (5 kilometers) into the distance, which is the point at which the Earth's curvature bends away so that the surface is no longer in view.

In the night
And while your ability to discern objects depends upon their size and the how much light the distant object emits, on a dark night it's possible to see a candle flame from about a 1.5 miles (2.4 kilometers).

How Far You Can See Depends on Your Vantage Point

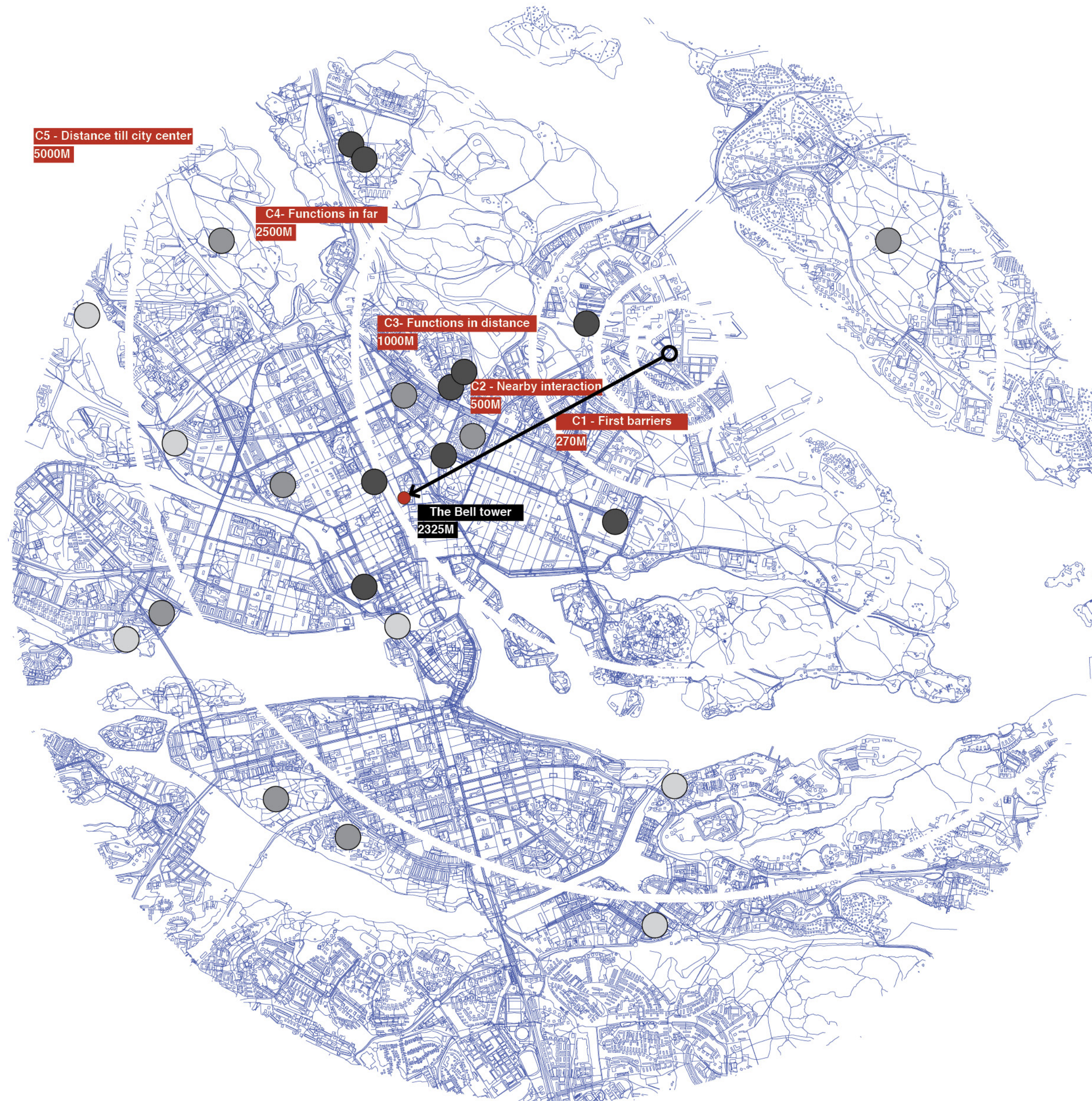
without obstructions in the way, you can see about 3 miles (4.8 kilometers) into the distance from ground level, before you reach the point where Earth curves enough to block your view of what's on the ground. That's based on an imaginary person who is 5 feet (1.5 meters) tall.

"If I was 6 feet (1.8 meters) tall, I could see farther," Singman says. The higher you go in elevation, the further into the distance you can see. A person looking out from the observation deck of Burj Khalifa, a 2,716.5-foot (828-meter) skyscraper in Dubai that is the world's tallest building, reportedly can see for 60 miles (96.5 kilometers), according to a 2010 New York Times article.



THE MOST IMPORTANT TALL BUILDINGS

- Kista Science Tower**
Located in the Kista Science City, this tower serves as a hub for technology and innovation companies, particularly in the fields of information technology, telecommunications, and research and development.
- Nordea Bank Headquarters**
Nordea Bank's headquarters, situated in Stockholm's financial district, is a modern office tower that houses the bank's operations and administrative functions.
- Skrapan**
also known as the "Scrapers," is a high-rise office and commercial building located in Södermalm. It offers a mix of office spaces, retail establishments, and restaurants.
- World Trade Center Stockholm**
Situated in the heart of the city, the World Trade Center Stockholm is a multi-purpose complex that includes office spaces, conference facilities, and various business services.
- Kungsbrohuset**
Located near Stockholm Central Station, Kungsbrohuset is an office tower with a distinctive design. It houses offices for various companies and organizations.
- Sergelhuset**
is a modern office tower situated in Sergels Torg, one of Stockholm's central squares. It provides office spaces for various businesses and commercial establishments.



THE MOST IMPORTANT GREENS

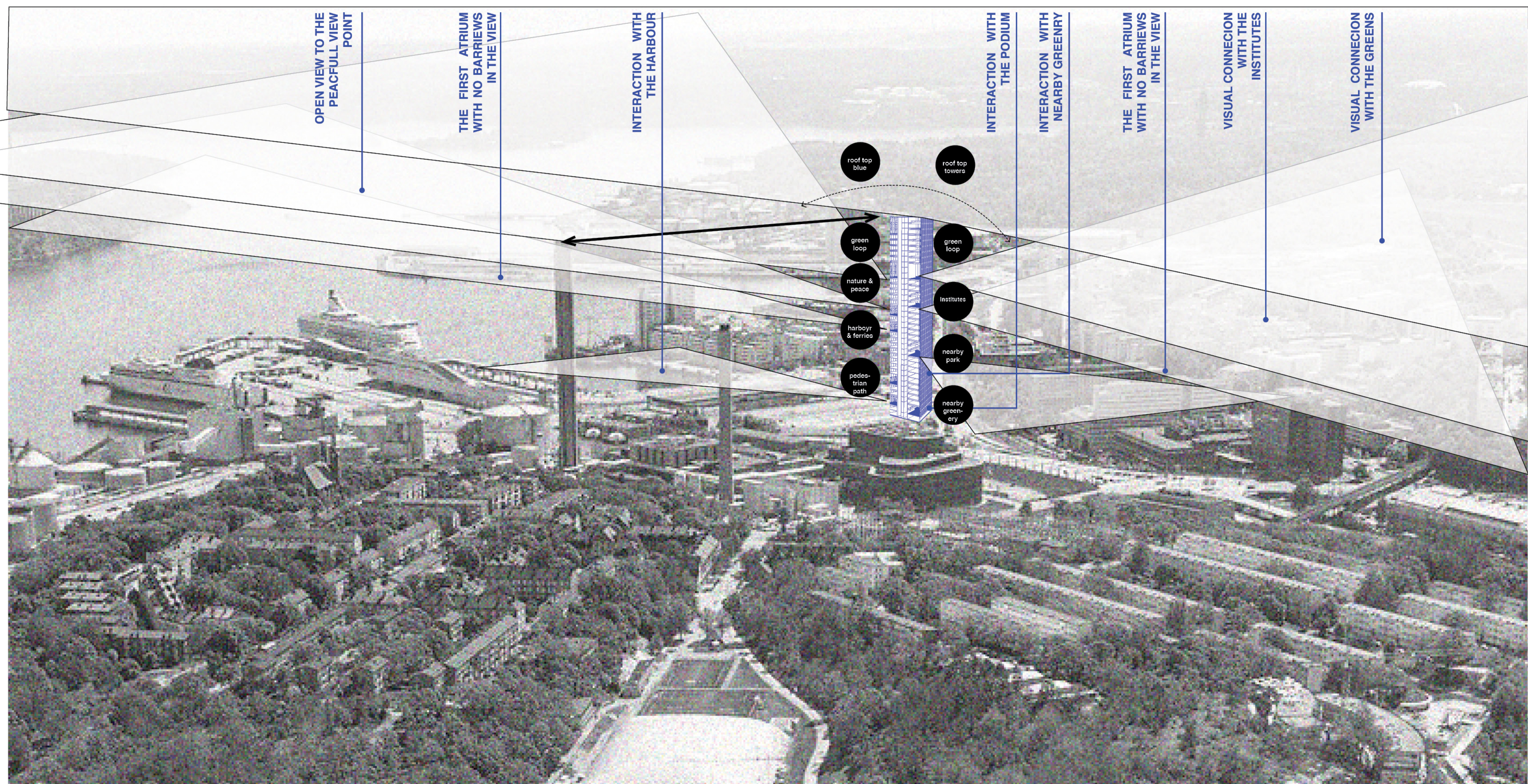
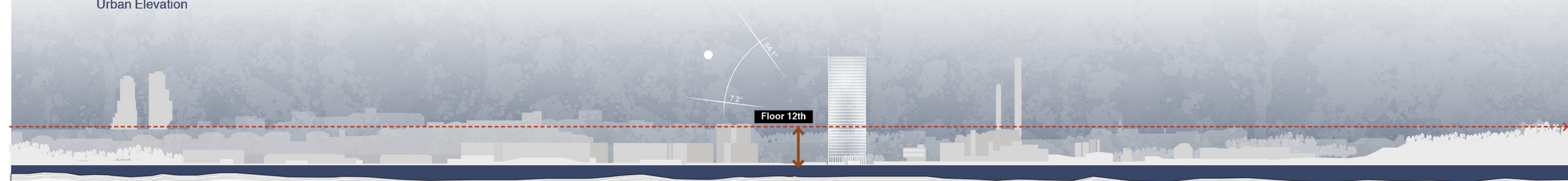
- Haga Park**
part of Sweden's first national urban park beautiful buildings, including Gustav III's Pavilion, Turkish Kiosk, Copper Tents, and Chinese Pavilion.
- Humlegården**
There is a playground for kids at one end, the Royal Library at the other located in Stockholm's tony Östermalm district means it attracts one of the city's more posh crowds.
- KUNGSTRÄDGÅRDEN**
A lot of concerts and events take place here during the weekends but on a weekday, there are few better spots to sit in the sun (during summer) the city's oldest preserved park.
- VASAPARKEN**
mini-golf in summer or ice-skating in the winter. It's not a massively big park but it packs a punch.
- TANTOLUNDEN**
greenery but you can also swim and picnic, or maybe try mini-golf, frisbee golf, or volleyball mini-golf in summer or ice-skating in the winter. It's not a massively big park but it packs a punch.
- OBSERVATORIELUNDEN**
offers the chance to quickly escape the pulse of Drottninggatan. Climb up the hill and find your spot (more for local district).
- DJURGÅRDEN**
27 square kilometers of wide-open green spaces, culture to die for, and plenty of activities. There are plenty of museums and other tourist attractions located on the island, but the real treat for many is simply exploring the less busy parts of the park. Here you'll find amazing nature.
- RÅLAMBSHOVSPARKEN**
can be described as a playground for everyone. With a skatepark, a boule court, an outdoor gym, and space for volleyball.

THE MOST IMPORTANT INSTITUTES

- Stockholm Environment Institute (SEI)**
an international research organization that conducts interdisciplinary research and provides policy support on sustainable development. It focuses on issues such as climate change, energy, water resources, biodiversity, and sustainable urban development.
- Stockholm Resilience Centre**
is a research institute dedicated to advancing the understanding of complex social-ecological systems and promoting sustainable development. It focuses on research related to resilience, biodiversity, ecosystem services, and governance for sustainability.
- KTH Royal Institute of Technology**
is one of Europe's leading technical universities and has several research centers and initiatives focused on sustainability, including the KTH Sustainability Office. They conduct research and provide education on sustainable energy systems, urban planning, sustainable transport, and more.
- IVL Swedish Environmental Research Institute**
is an independent research institute that works on environmental issues, including sustainability. They conduct research and provide expertise in areas such as climate change, air quality, waste management, and sustainable production and consumption.
- Stockholm International Water Institute (SIWI)**
is a policy institute that focuses on water-related issues, including water governance, water management, and sustainable water use. They organize the annual World Water Week, which brings together experts and practitioners from around the world to discuss water-related challenges and solutions.

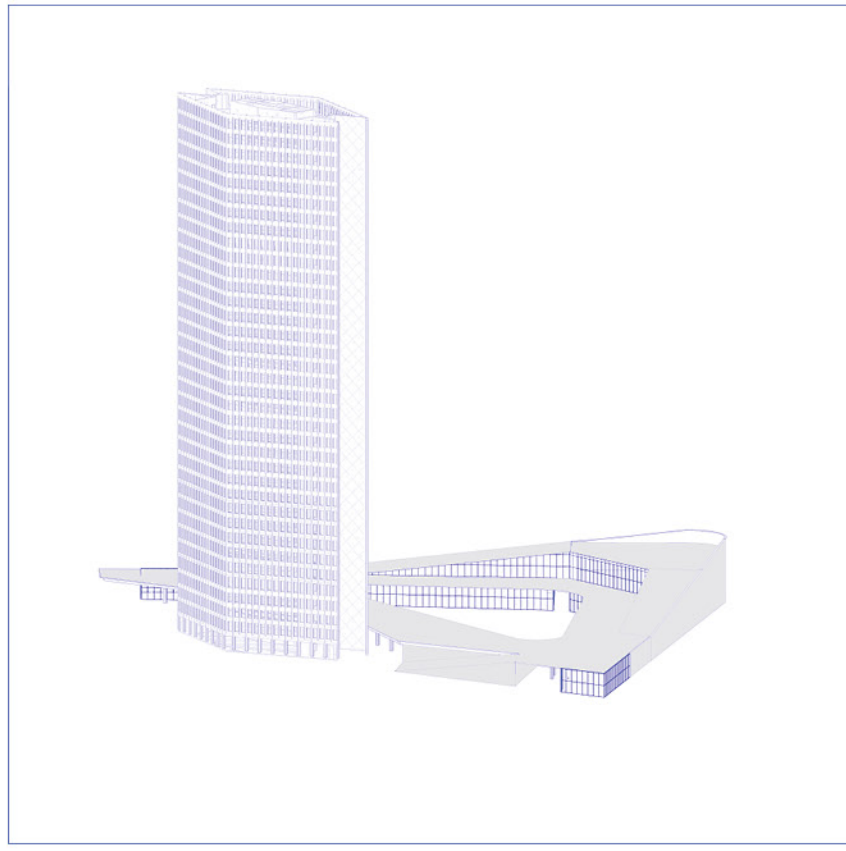


Urban Elevation



CITY AND TOWER connection to the fabric

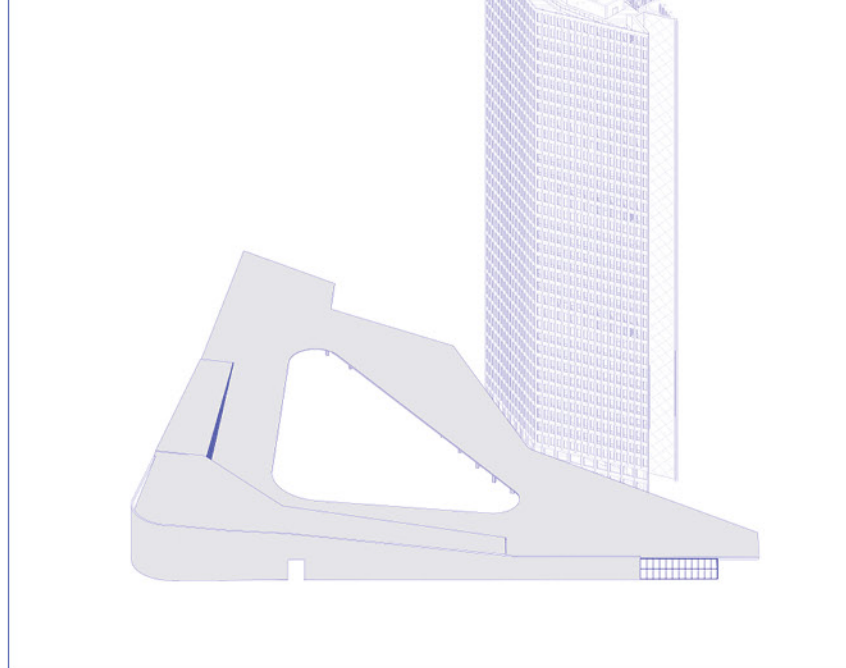
Connection of the tower with the immediate fabric around is one of the crucial part of the design. the master plan of the tower works with the ferry terminal, the harbour, the industrial area and the residential fabric. also joints the pedestrian path which has been interfered with the roads.



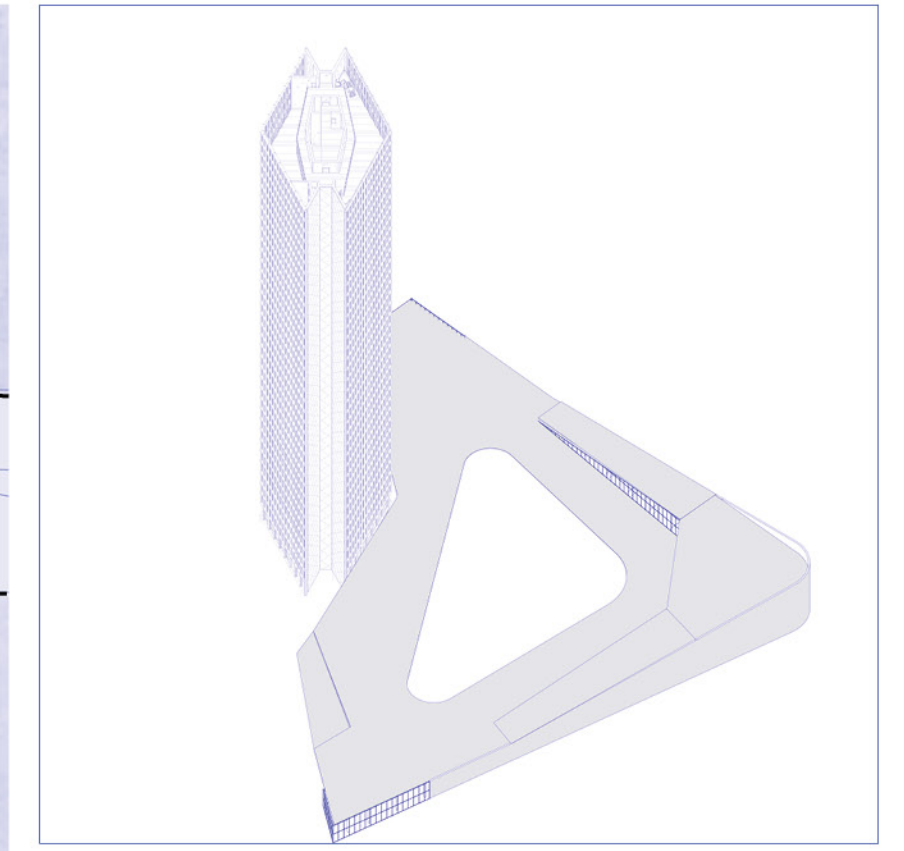
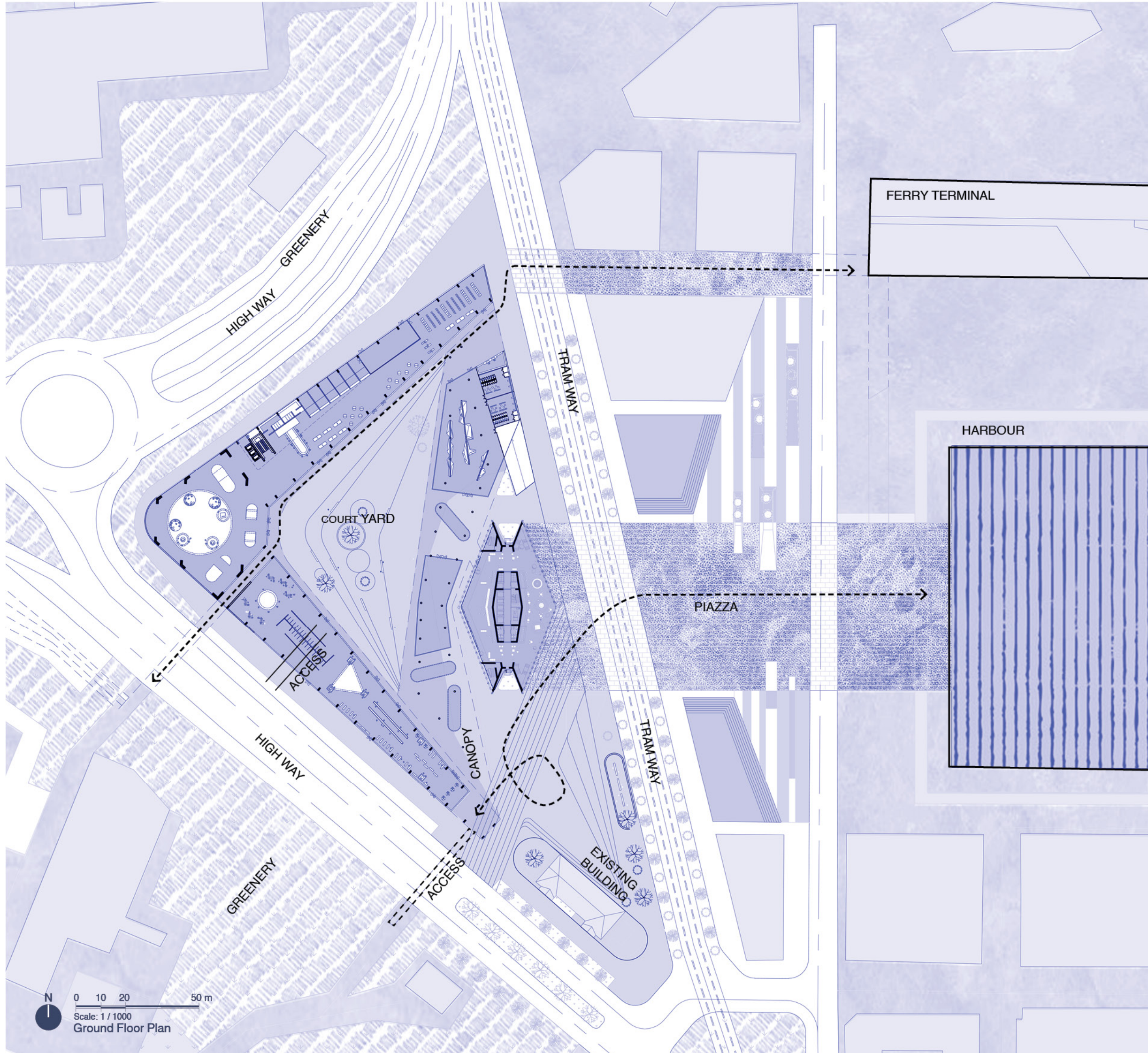
Seamless Transition: The walkable roof serves as a seamless transition between the podium and the tower, providing a direct pathway for people to move from the city level to the 3rd floor of the tower. This design approach ensures a smooth and uninterrupted flow, allowing visitors or occupants to easily access the tower without the need for additional entrances or elevators.

Elevated Experience: By elevating the pedestrian pathway to a roof level, the design offers an elevated experience for individuals walking from the city towards the tower. This vantage point provides unique views and perspectives, enhancing the overall journey and creating a sense of anticipation as visitors approach the tower.

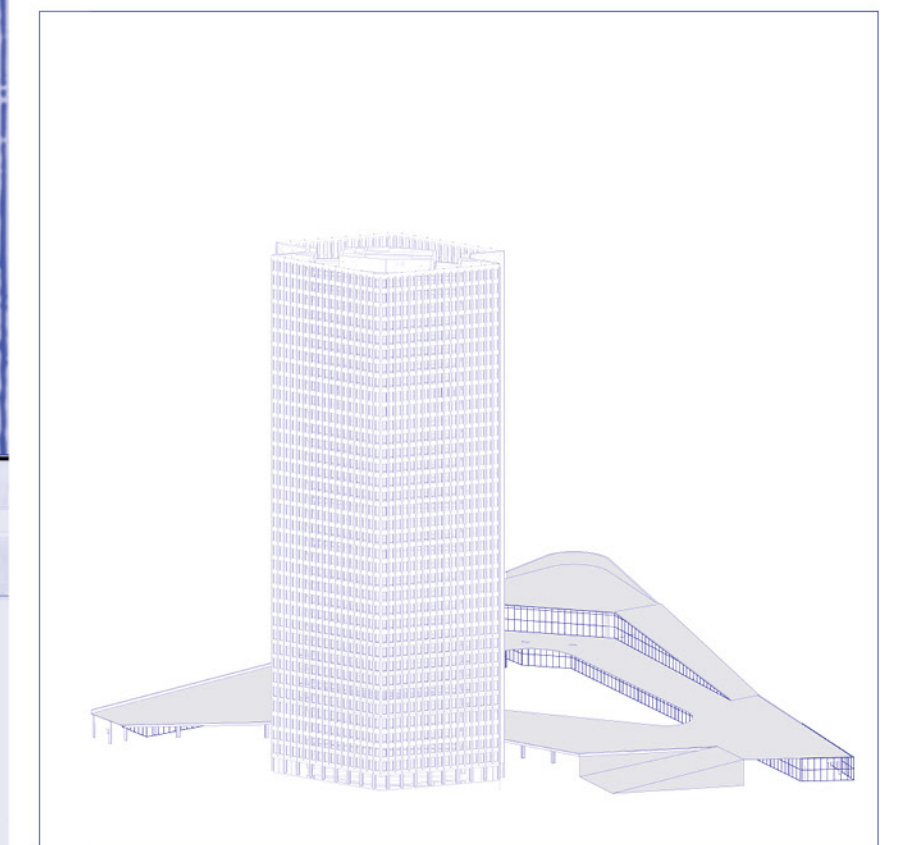
THE MOST IMPORTANT TALL BUILDINGS



Urban Integration: The walkable roof contributes to the urban integration of the building by extending the public realm and creating an inviting space that connects with the surrounding cityscape. It becomes a public amenity, encouraging people to explore and engage with the building beyond its immediate boundaries.

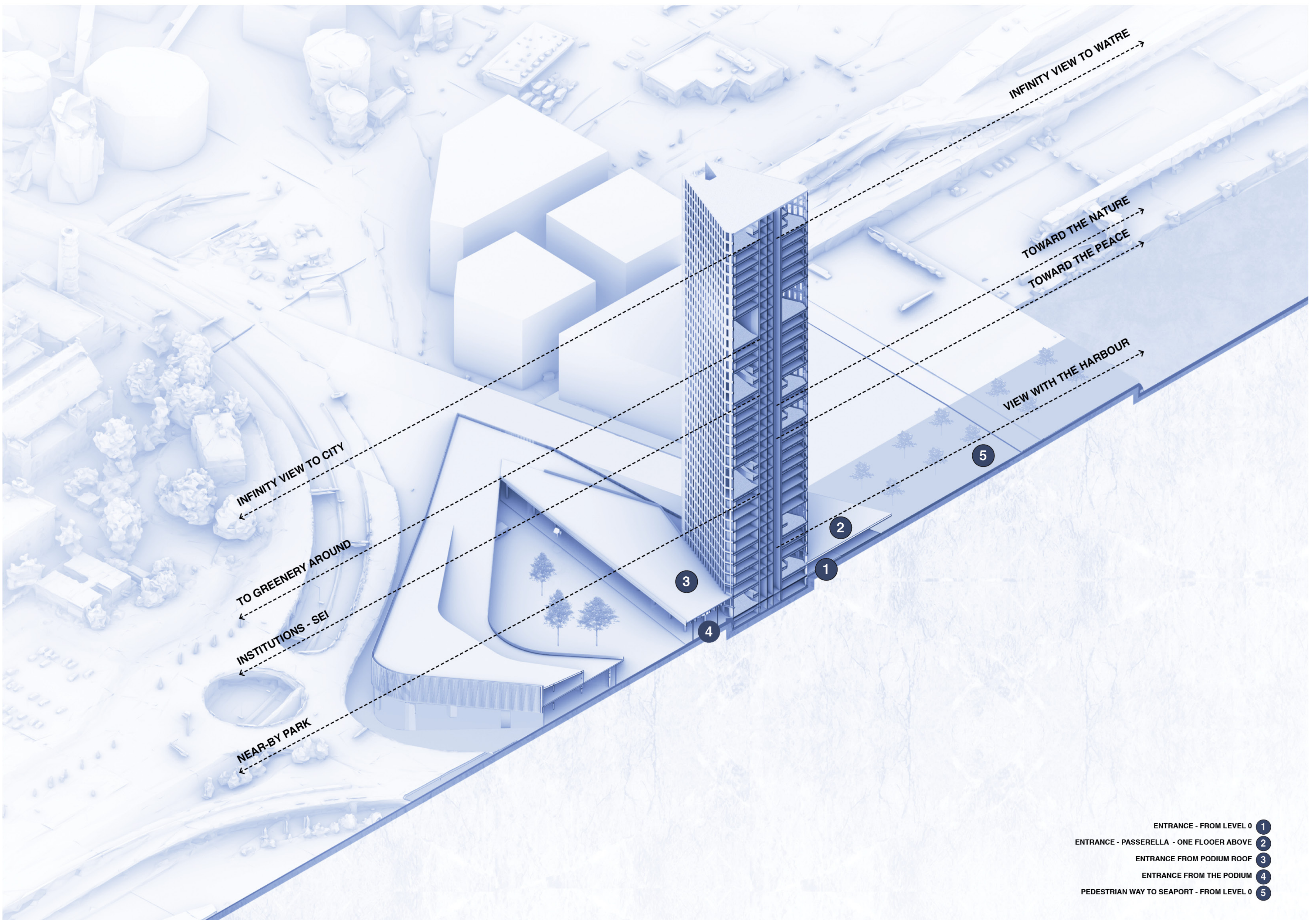


Multi-functional Space: The walkable roof can serve multiple functions beyond its role as a pedestrian pathway. It can be designed as a flexible public space, accommodating activities such as outdoor seating areas, gathering spaces, or even events. This adds value to the building by providing an additional amenity for both tower occupants and the wider community.



Architectural Expression: The design of the walkable roof offers an opportunity to express the architectural identity of the building. Consider incorporating design elements, materials, or landscaping features that reflect the overall design language or theme of the skyscraper. This helps create a cohesive visual experience and reinforces the building's identity.

URBAN SECTION OF THE TOWER ^ SOROUNDINGS



- 1 ENTRANCE - FROM LEVEL 0
- 2 ENTRANCE - PASSERELLA - ONE FLOOR ABOVE
- 3 ENTRANCE FROM PODIUM ROOF
- 4 ENTRANCE FROM THE PODIUM
- 5 PEDESTRIAN WAY TO SEAPORT - FROM LEVEL 0

FUNCTIONALITY OF THE TOWER

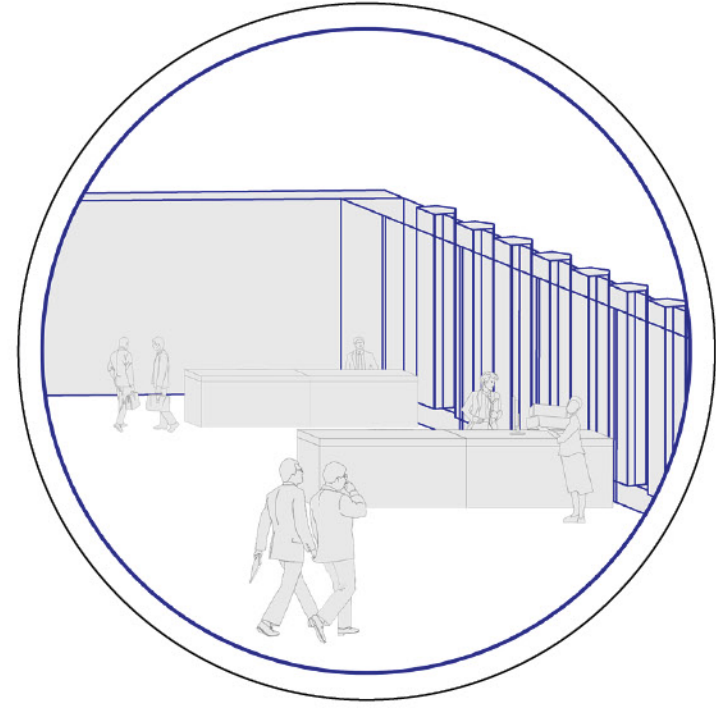
Proposal of Function and Activities

The tower in Royal Seaport, Stockholm, offers a multifunctional space with entrances, a library, co-working areas, an institute of sustainability, residential floors, and an infinity view restaurant. It caters to diverse needs, providing a dynamic and vibrant hub in the heart of the city.

Infinity view Restaurant

31-33 F
Information
wait area
sittin area
kitchen
lounge

Finally, at the pinnacle of the tower, a breathtaking infinity view restaurant awaits. Offering panoramic views of the city and beyond, this gastronomic delight serves as a captivating destination for fine dining, special occasions, and unforgettable experiences.

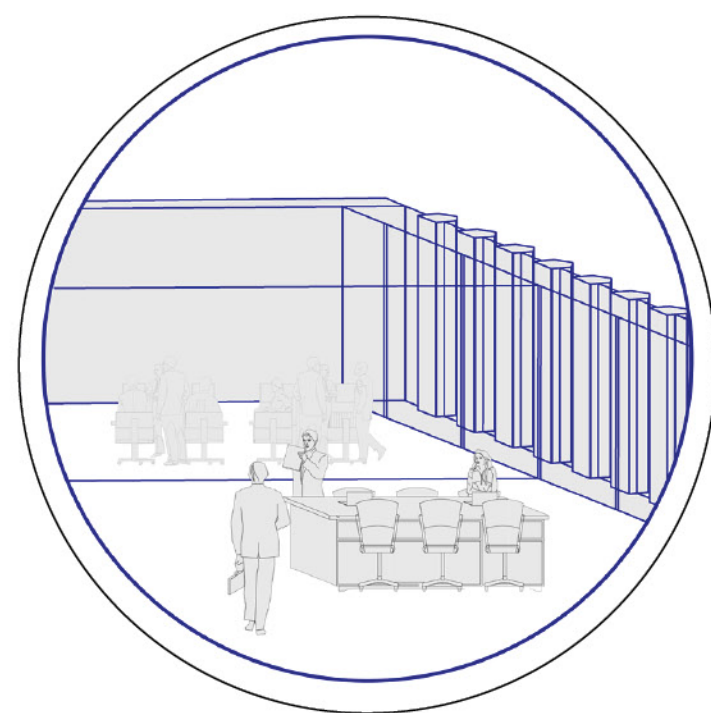


Third Zone: Coworking

15-25F
For SEI (Stokholm Invinroment Institute): 10 floors
- Office and Long-term Users
- Reception/ Postal services
- Laboratories
- Experimental zones
- Classes
- Meeting rooms, Calling rooms
- Registered office
- Makerspace, Seminar

Moving further up, the tower transitions into an institute of sustainability, showcasing a commitment to environmental consciousness and responsible practices. Here, the office spaces are designed to promote sustainable living and working, incorporating features like energy-efficient systems, green infrastructure, and innovative technologies for waste management and resource conservation.

PRIVATE OFFICES
shared conference rooms
INDIVIDUAL OFFICES
small private offices
DAILY SPOTS - GROUP TABLES
most popular area of the section



First Zone: Library

4-5 floor
- Lobby
- Book shelves, Printing service
- Meeting rooms, Reading area

Upon entering, one is greeted by a grand library spanning two floors, providing a serene and intellectual atmosphere for knowledge seekers and book lovers. Adjacent to the library, a spacious co-working area takes center stage, catering to the needs of entrepreneurs, freelancers, and creative minds. This co-working space is equipped with state-of-the-art facilities, including shared workstations, meeting rooms, collaboration areas, and cutting-edge technology to foster innovation and productivity.

Entrance : to the podium

2nd floor
- Lobby
- connections

The tower design in Royal Seaport, Stockholm, offers a seamless integration of various functions from the ground to the top. Starting with multiple entrances at different sizes and levels, the tower welcomes visitors and occupants into its vibrant and dynamic space.

Restaurant

Blending with the work

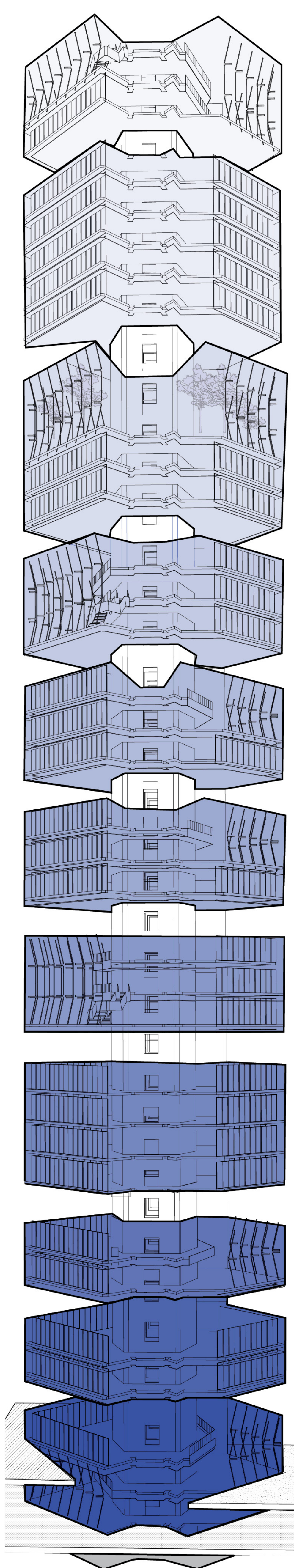
in both ways

Institute of sustainable activities

different kind of work environment from for individual or groups

Library

Entrance from podium



Infinity view

Short -stay residential

Indoor Green

Facilities for optimizing the sustainability

Co-working spaces

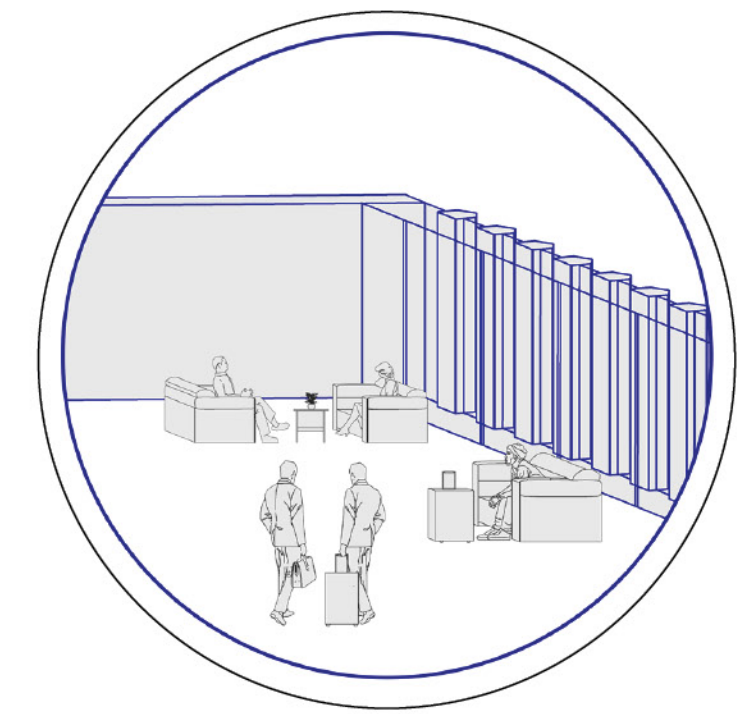
small scale

Entrance in two levels

Fourth Zone: Short Stay

26F-31F
Hostel rooms: 5 floors
- Shared social space
- Working area
- Social Area
- lounge and cafe

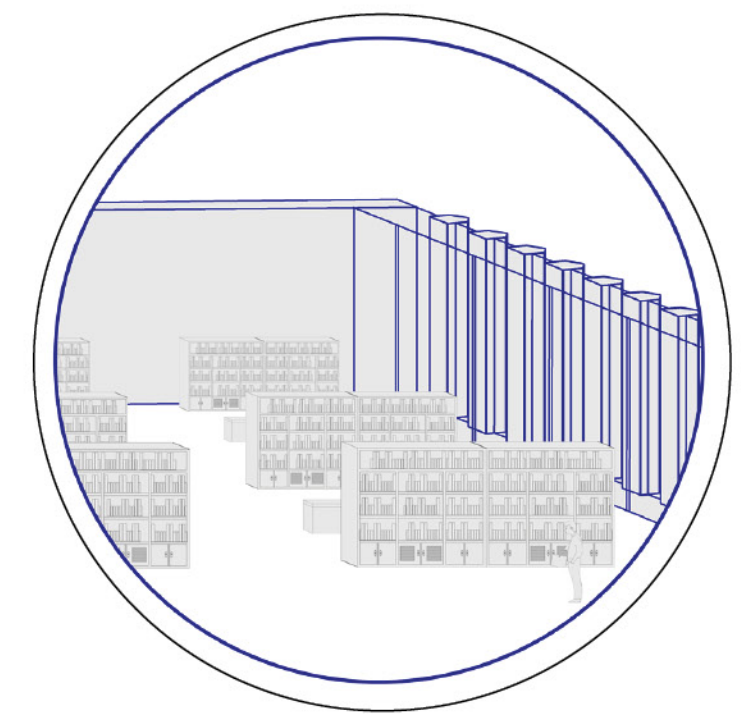
As the tower continues to ascend, it seamlessly blends with residential floors, offering a harmonious living environment. The residential units provide a balance of comfort, style, and functionality, designed to meet the diverse needs and preferences of residents. These floors offer a range of amenities and services to enhance the quality of life, including communal spaces, fitness facilities, and social gathering areas.



Second Zone: Coworking

6-15F
For Public users: 10 floors
- Reception/ Postal services
- Meeting rooms, Calling rooms
- Registered office
- Makerspace, Seminar

the co-working area in the tower offers a variety of spaces including shared workstations, private offices, meeting rooms, breakout areas, flexible lounges, and amenities. This variety allows individuals and teams to choose the most suitable environment based on their specific work requirements, promoting productivity, collaboration, and a sense of community.



Entrances : to the sea port

0-1
- Lobby
- Entrance
- Dropp off area
- Information

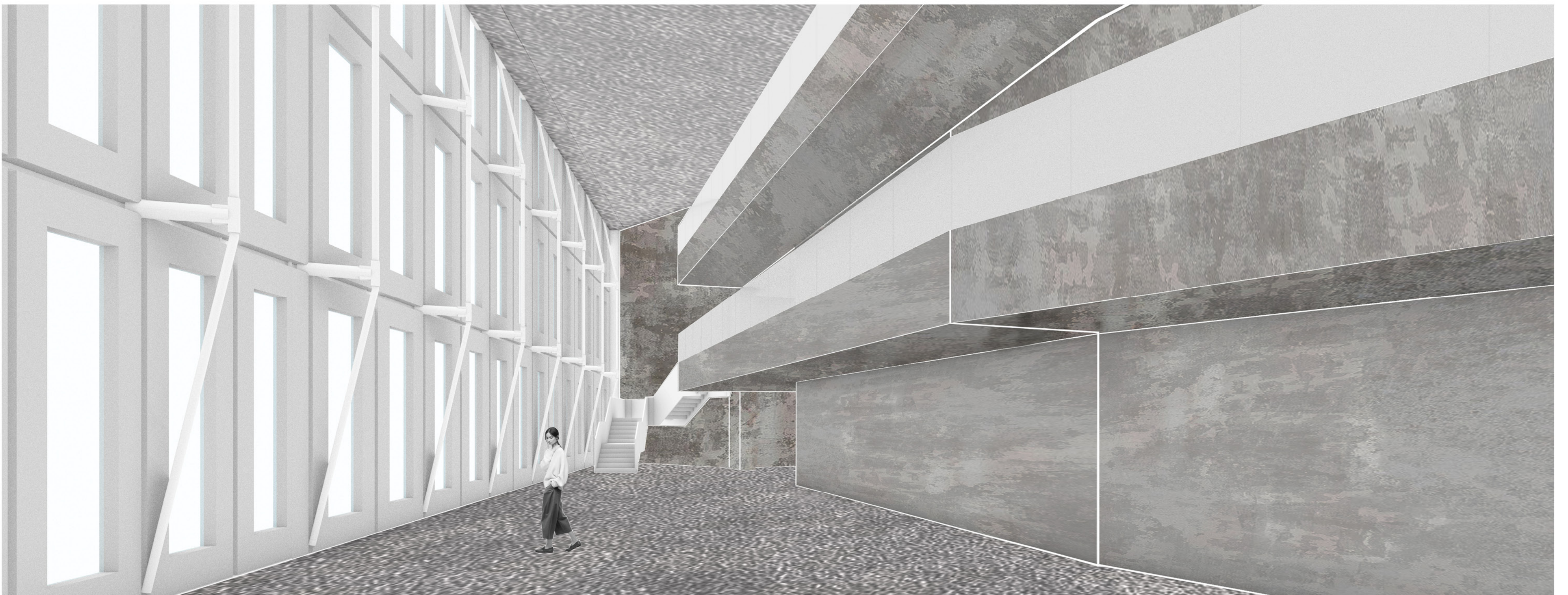
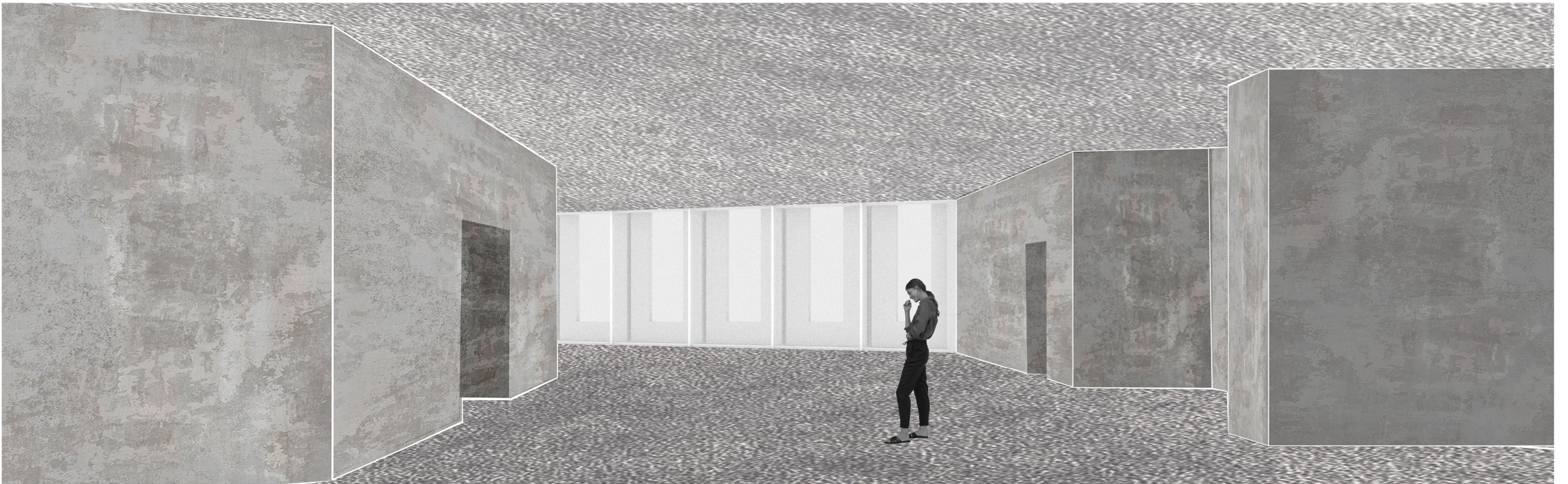
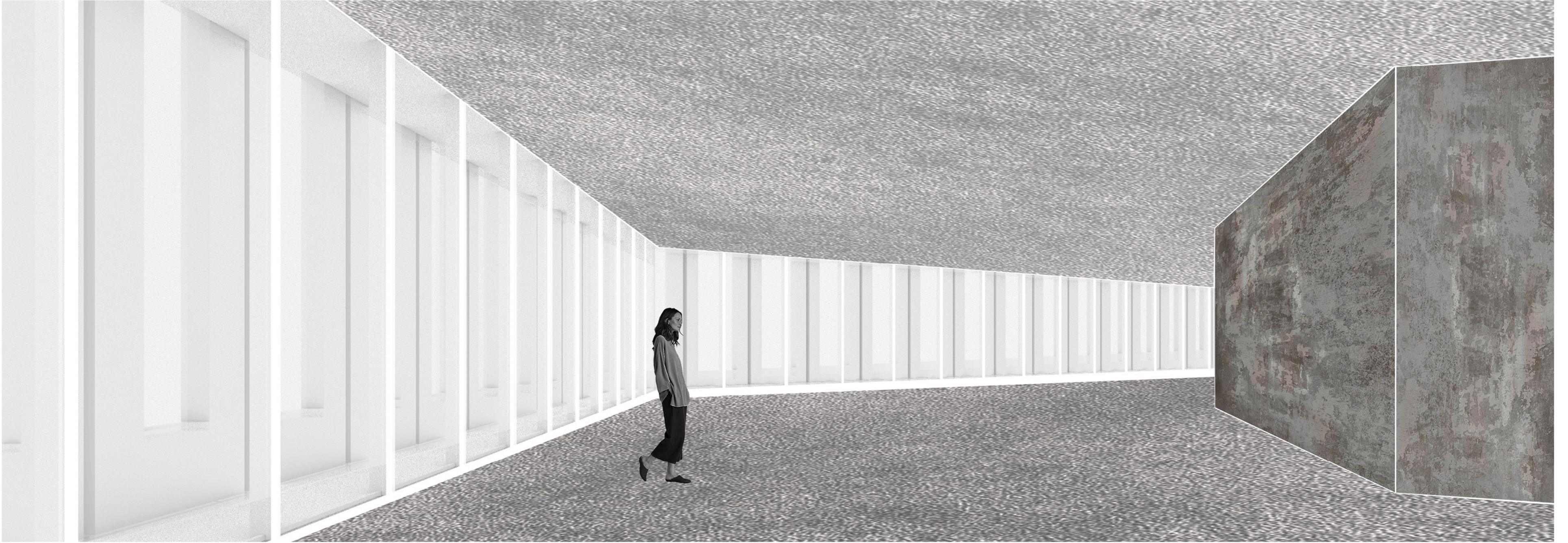
two-level entrances, one from the pedestrian area and another on the ground floor for tram arrivals and access from different parts of the city. These entrances prioritize convenience and connectivity, providing easy access for pedestrians and commuters. They contribute to the tower's architectural design and enhance its integration within the surrounding urban environment

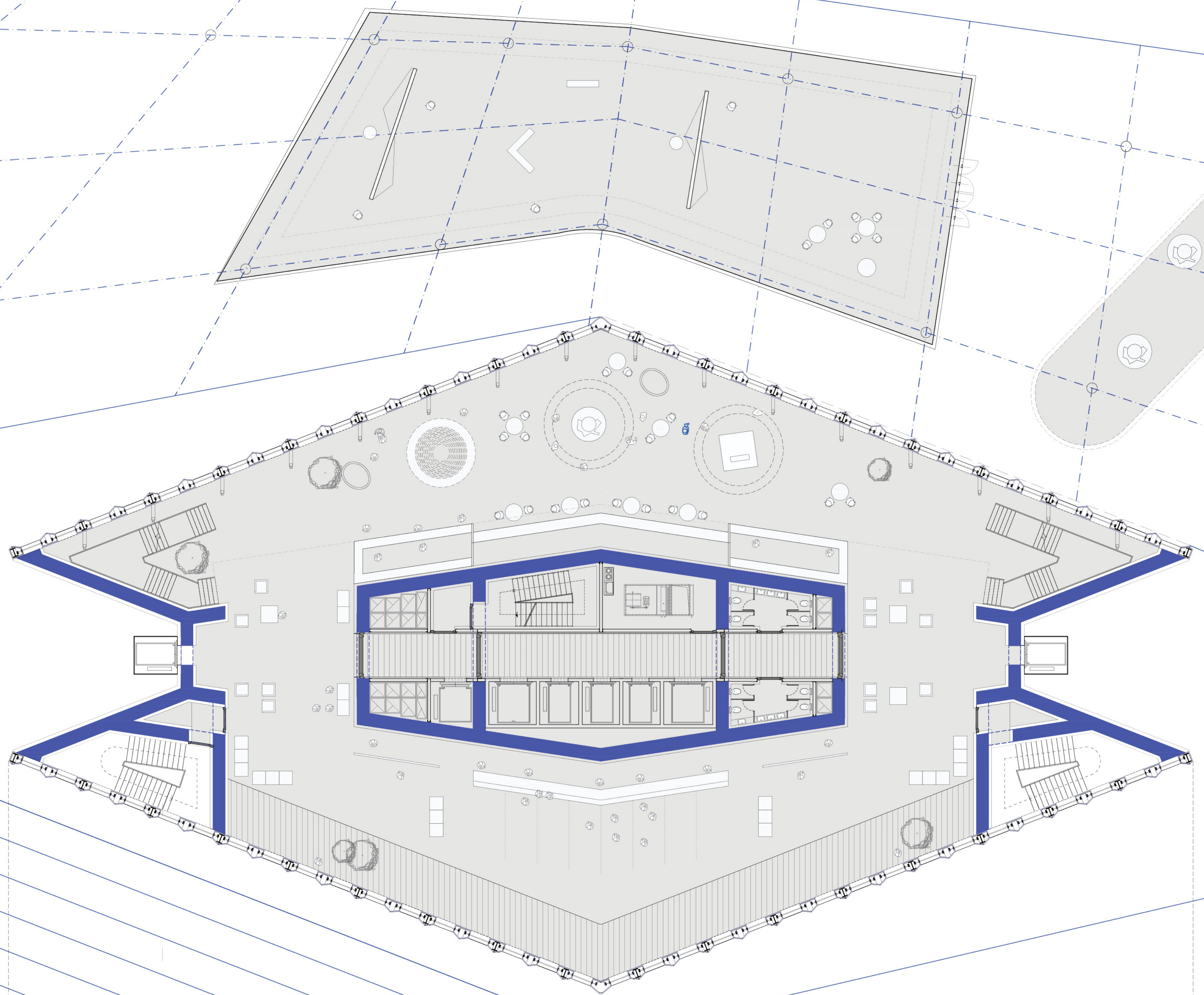
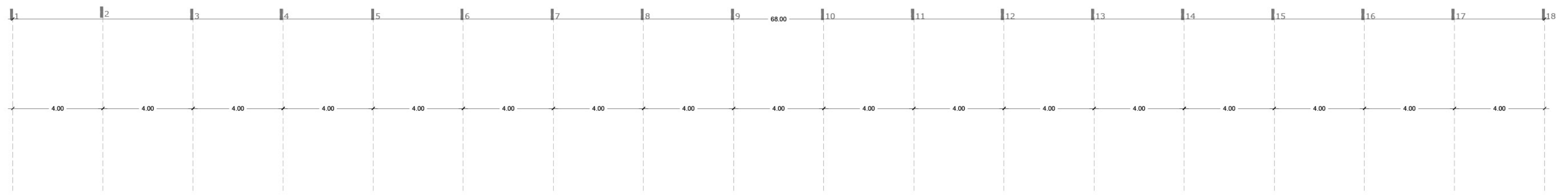
Mechanical and Technical rooms

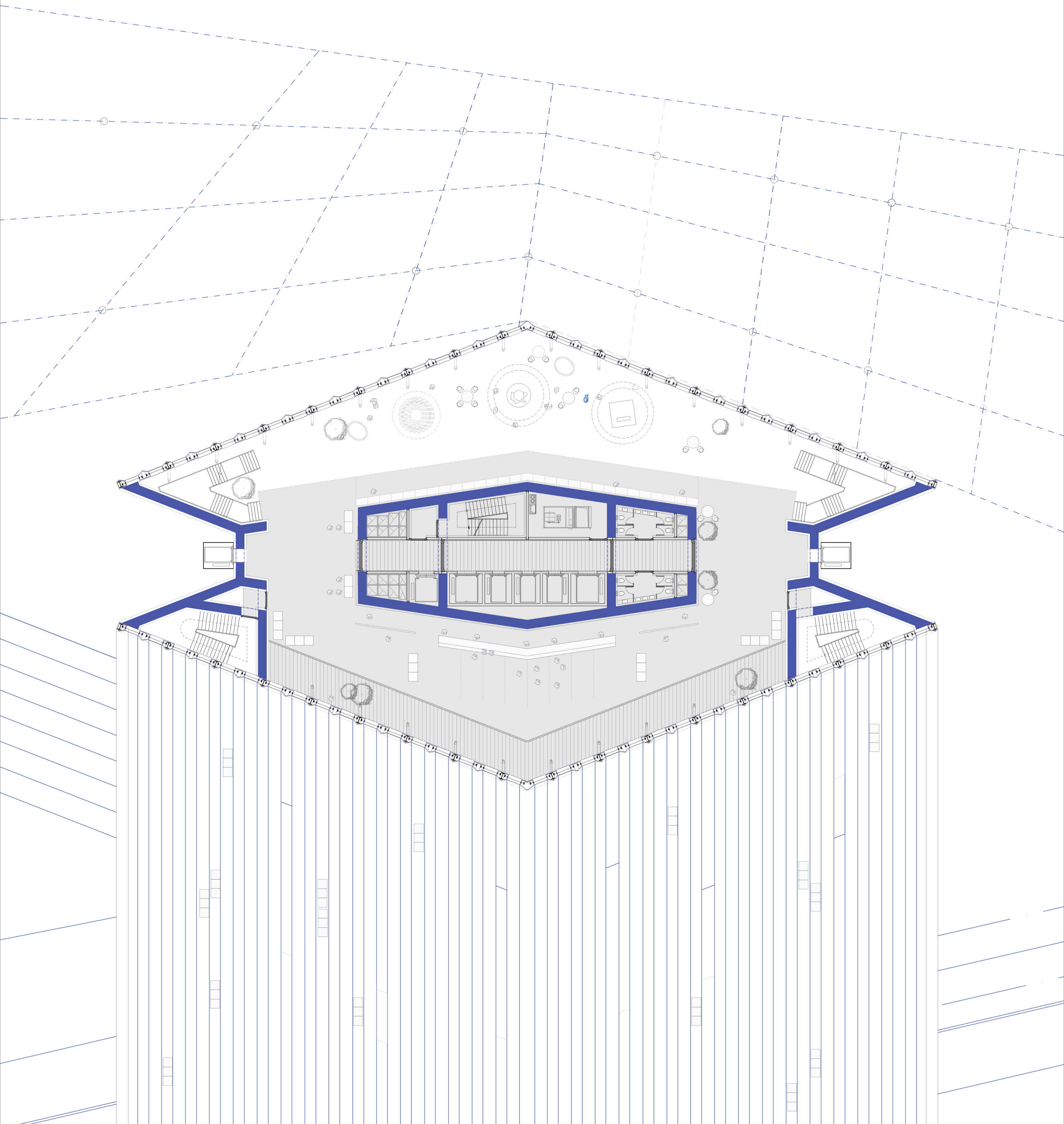
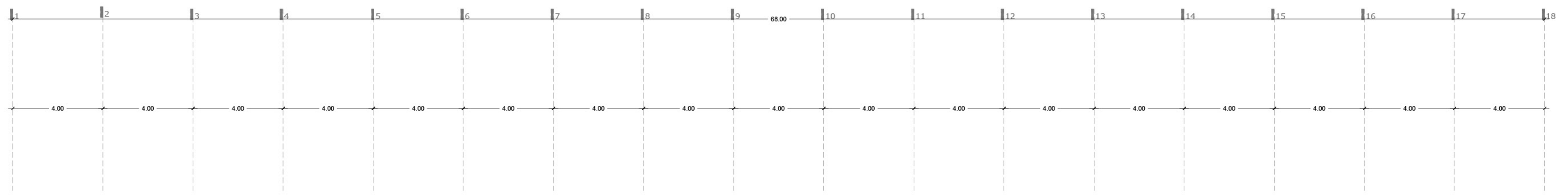
-1F
For Mechanical and Technical rooms: 1 floor
- The services rooms

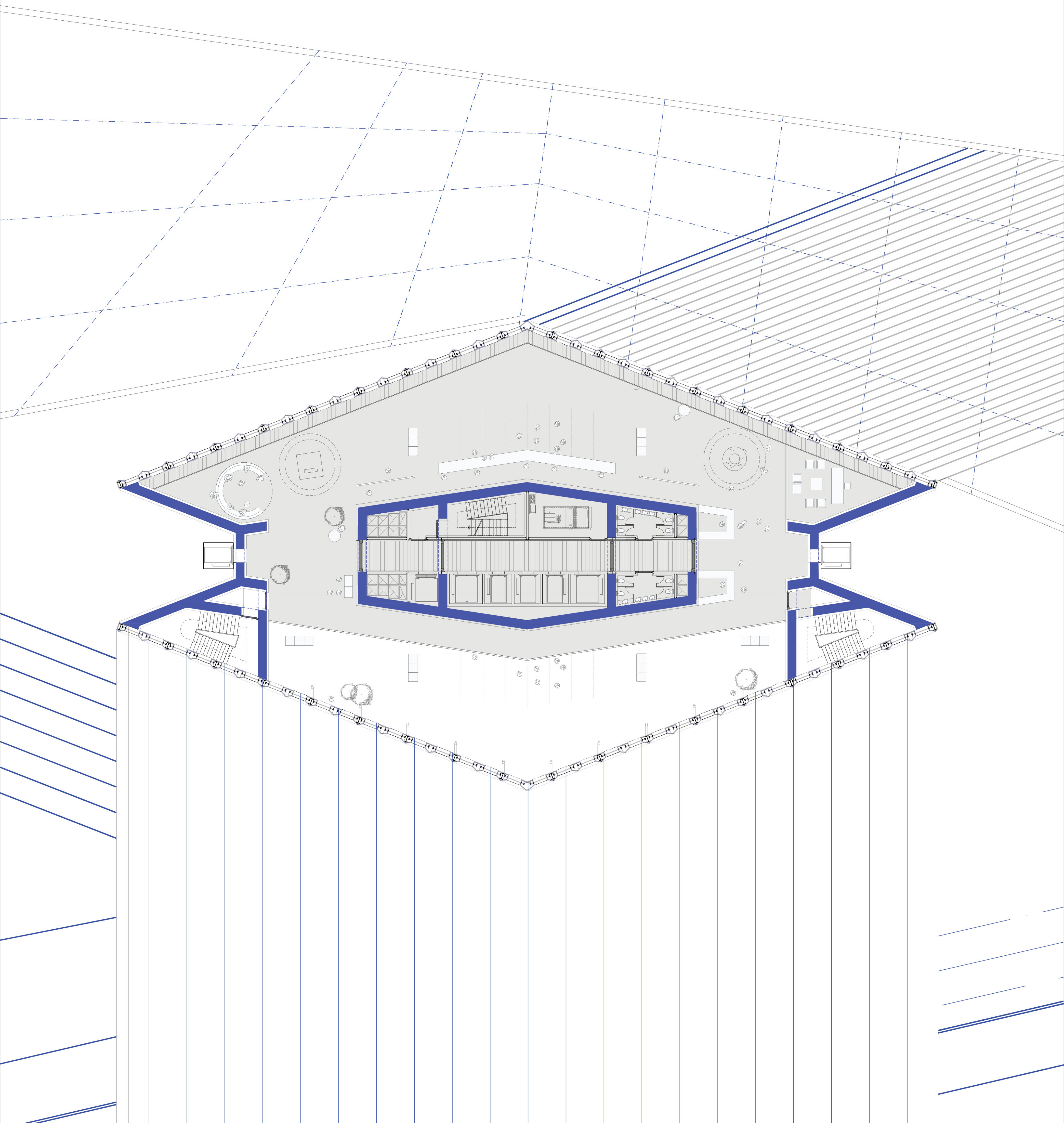
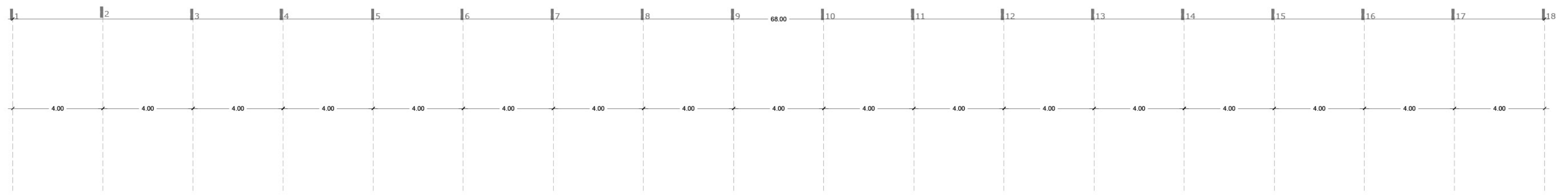
INTERIOR THEME
layouts of different levels

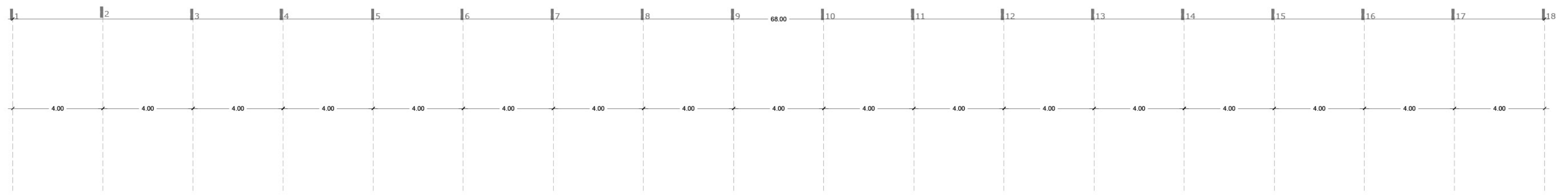
The tower in Royal Seaport also has a modern theme interior. materials and structure and details are designed with aim of simplicity and being hidden. mostly the interior follows the purity of the Nordic architectural character.



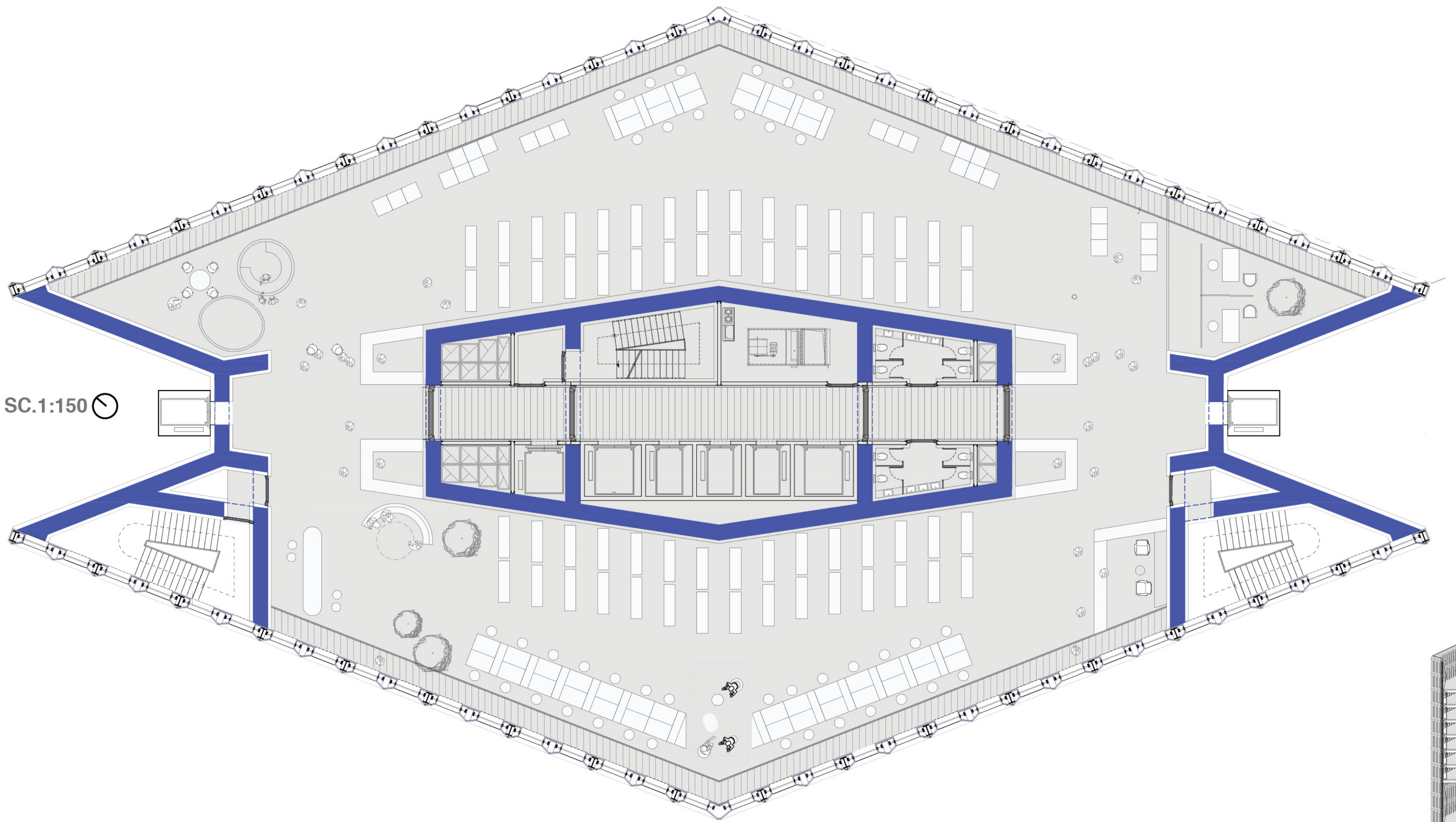




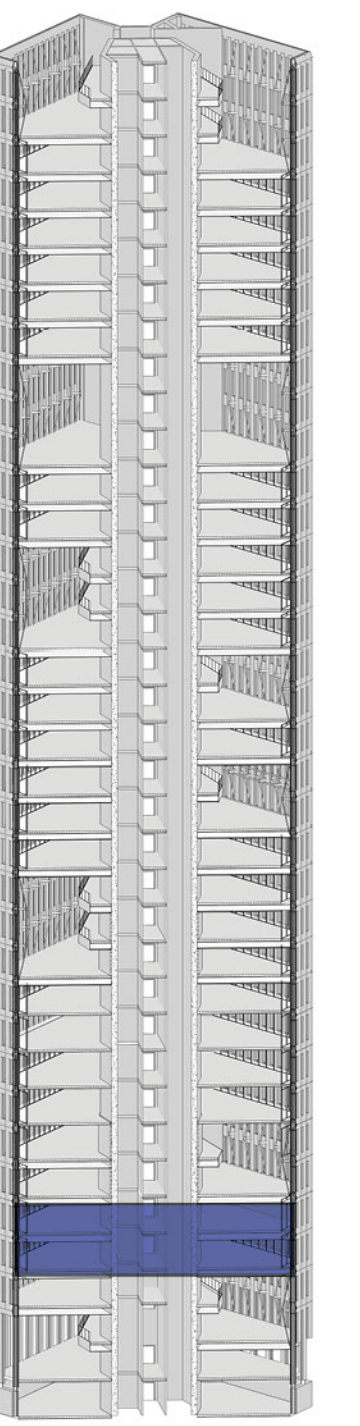
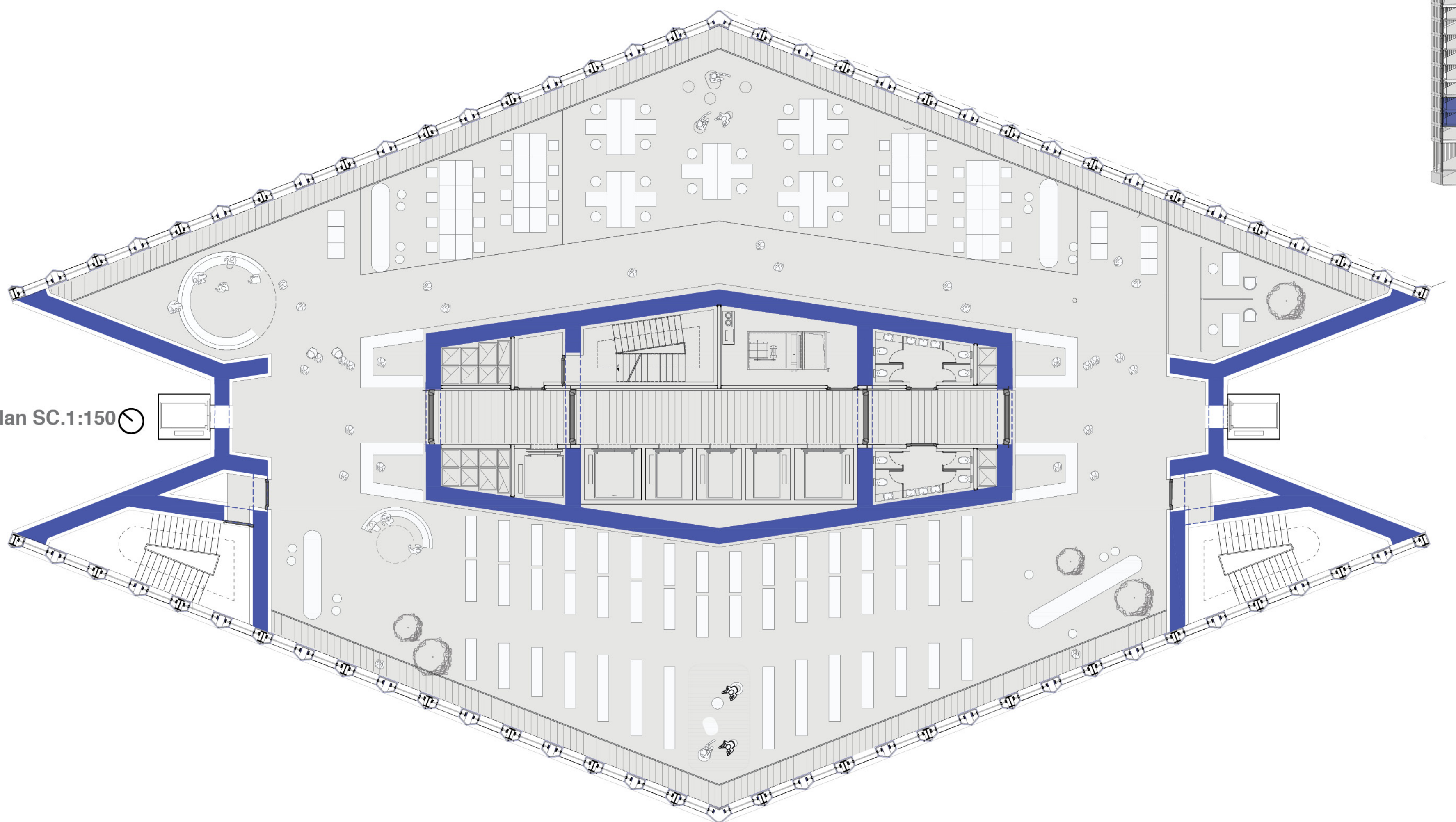


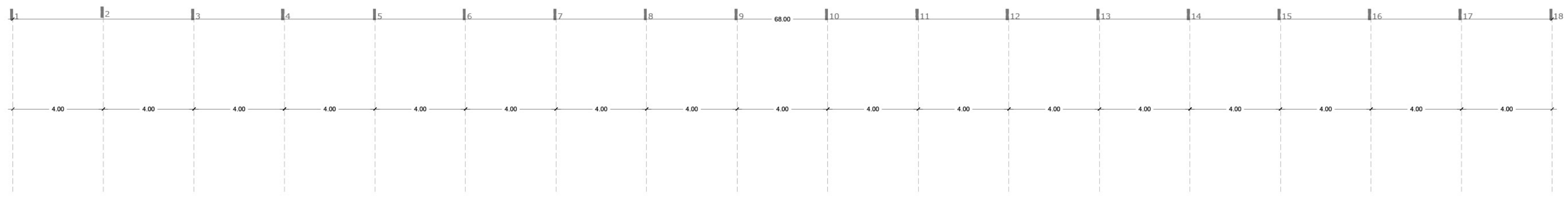


First Floor Plan SC.1:150

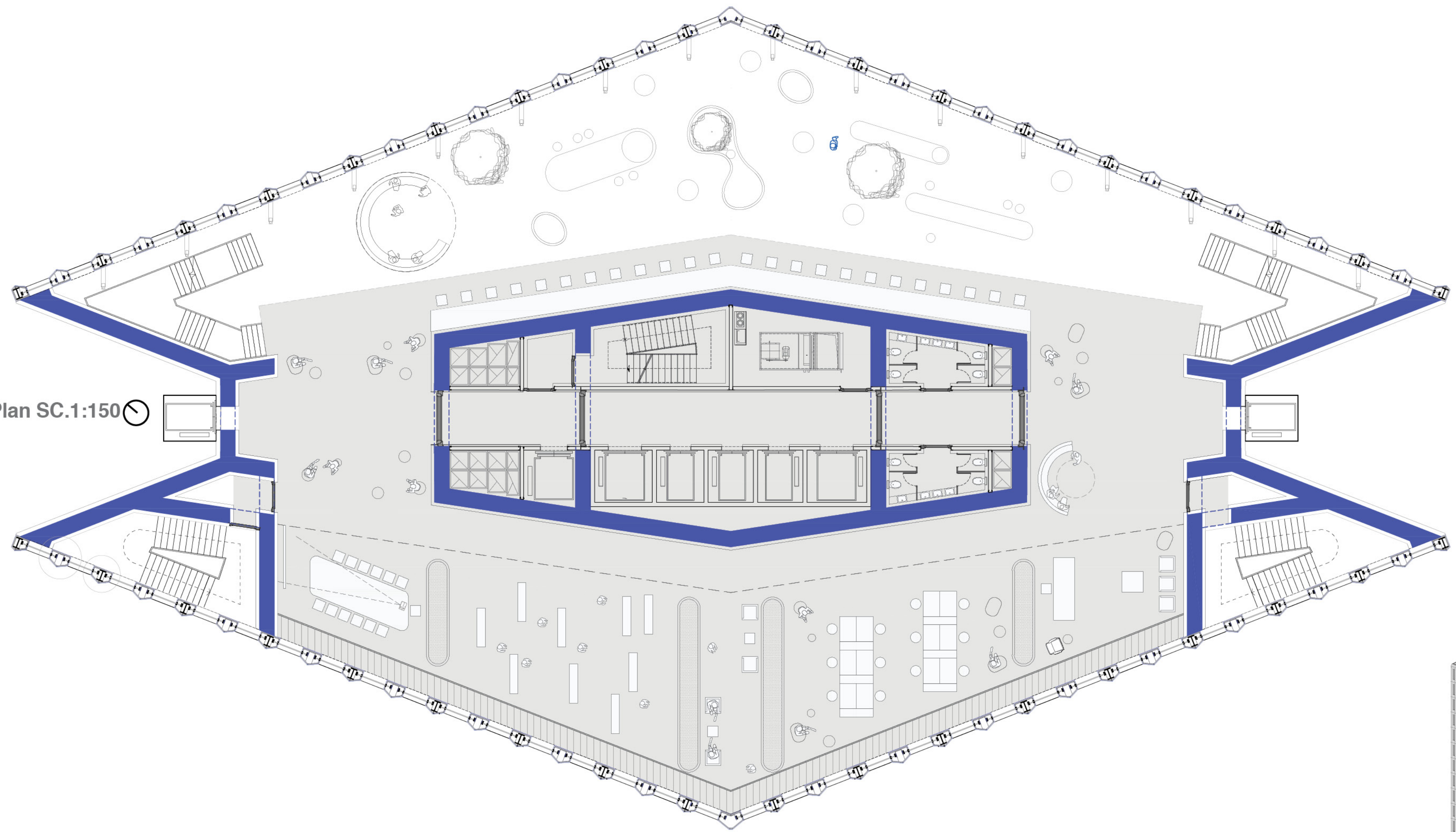


Second Floor Plan SC.1:150

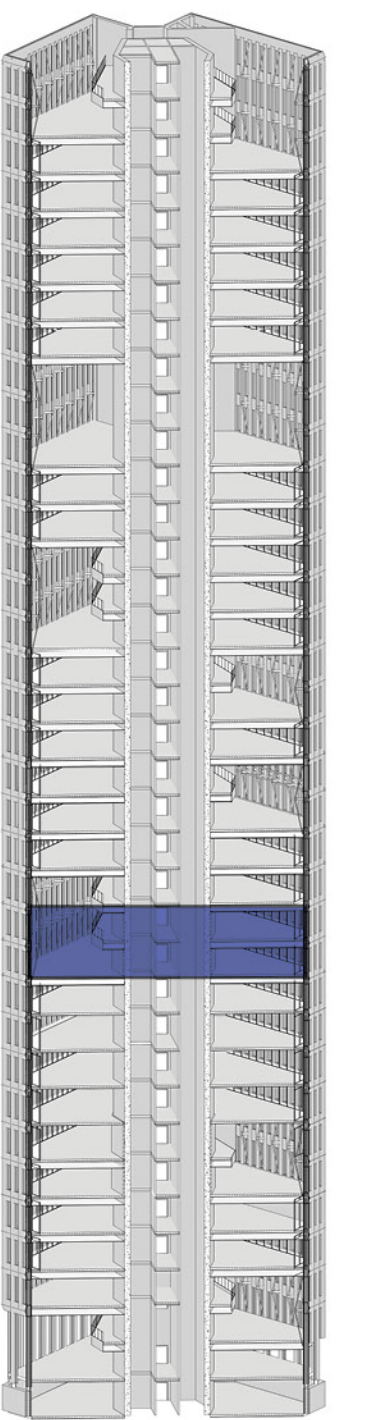
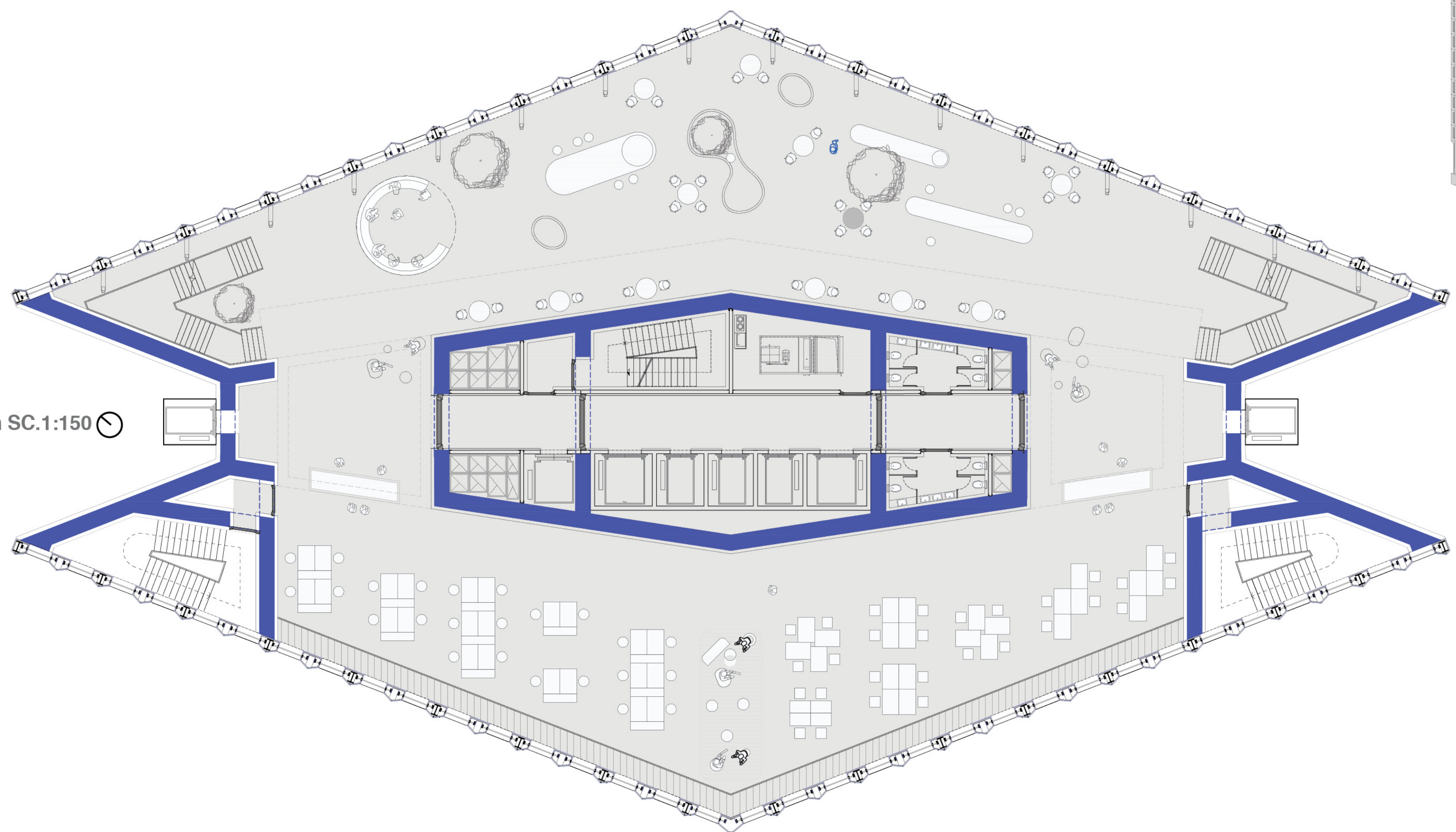


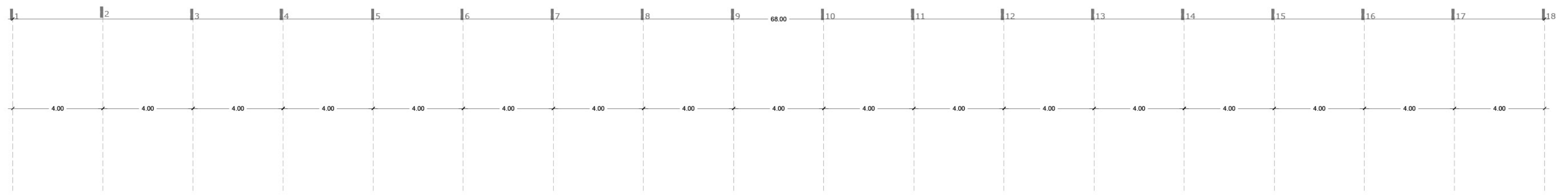


Second Floor Plan SC.1:150

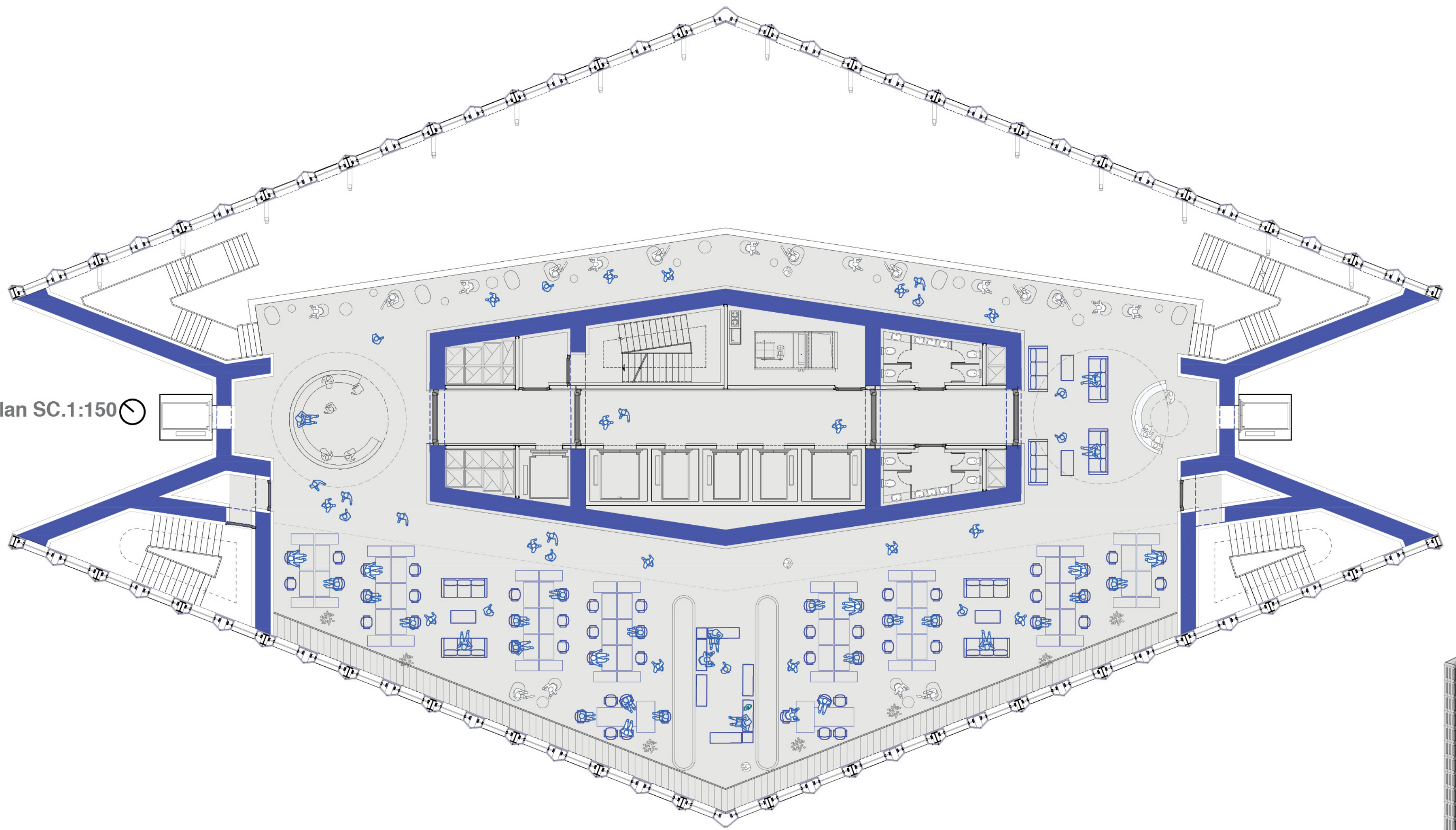


First Floor Plan SC.1:150

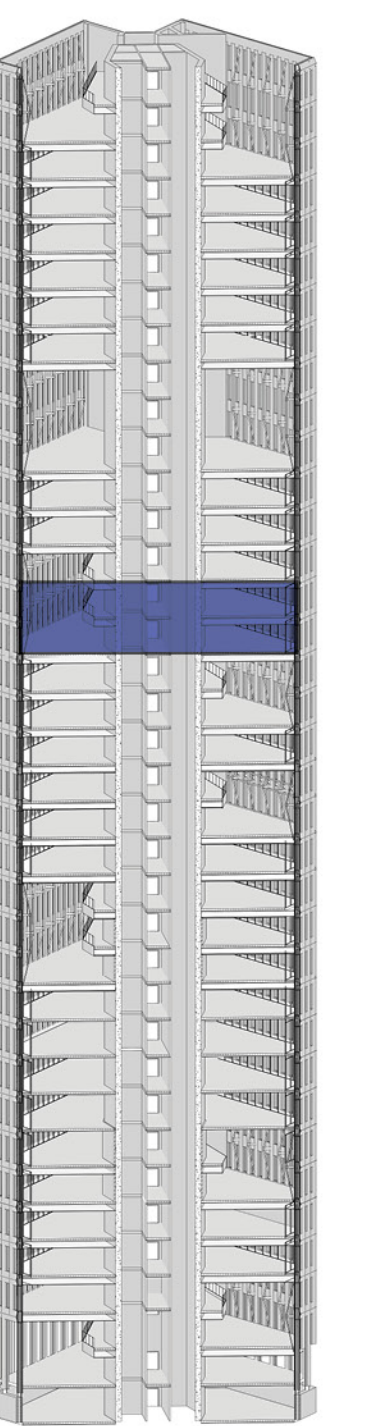
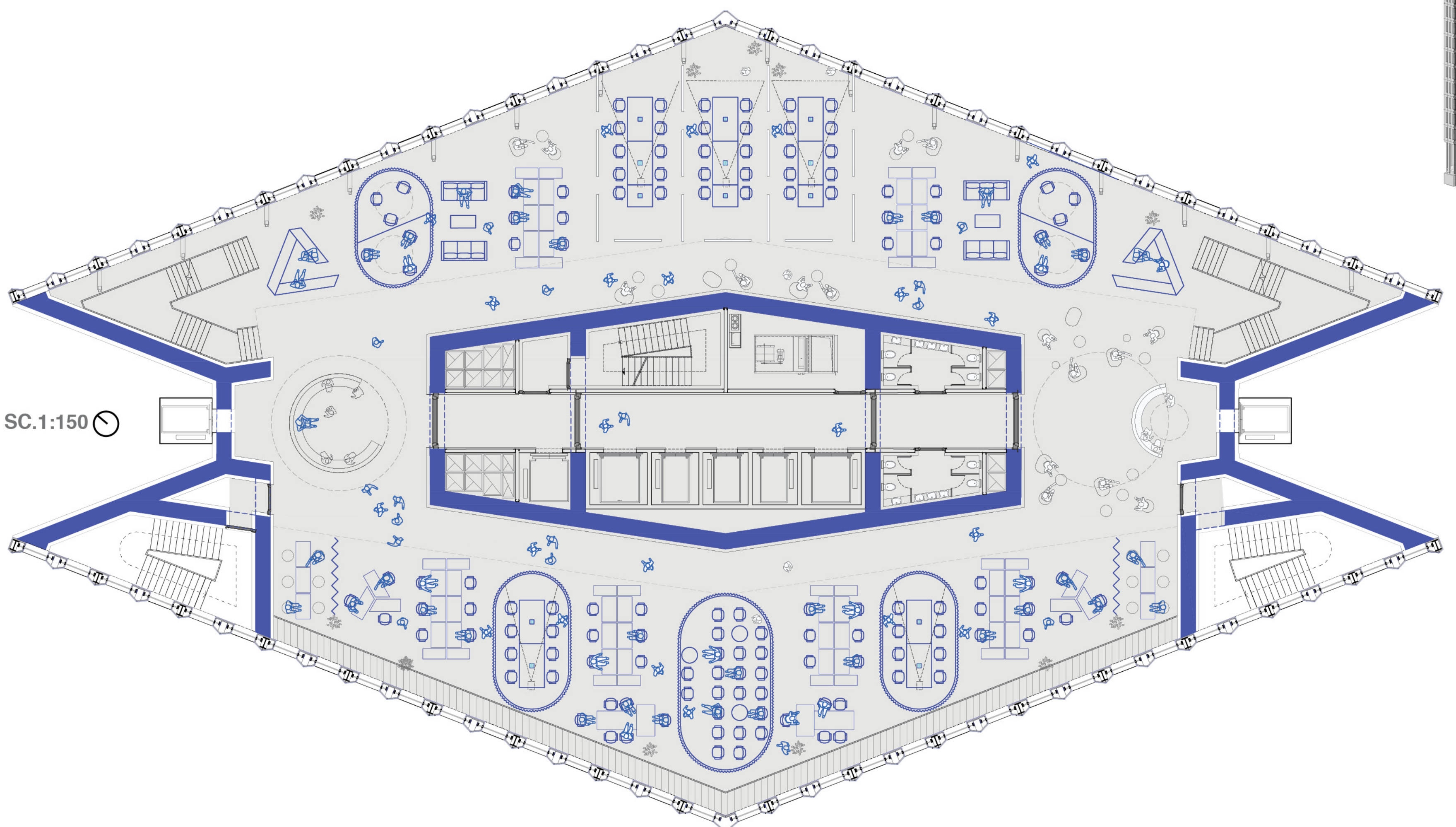


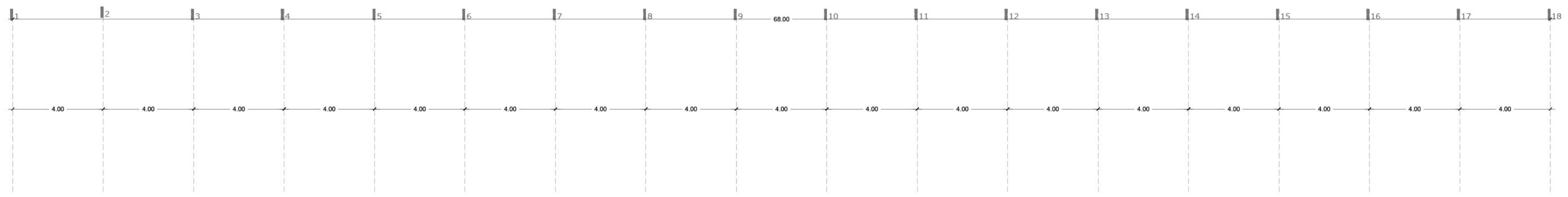


Second Floor Plan SC.1:150

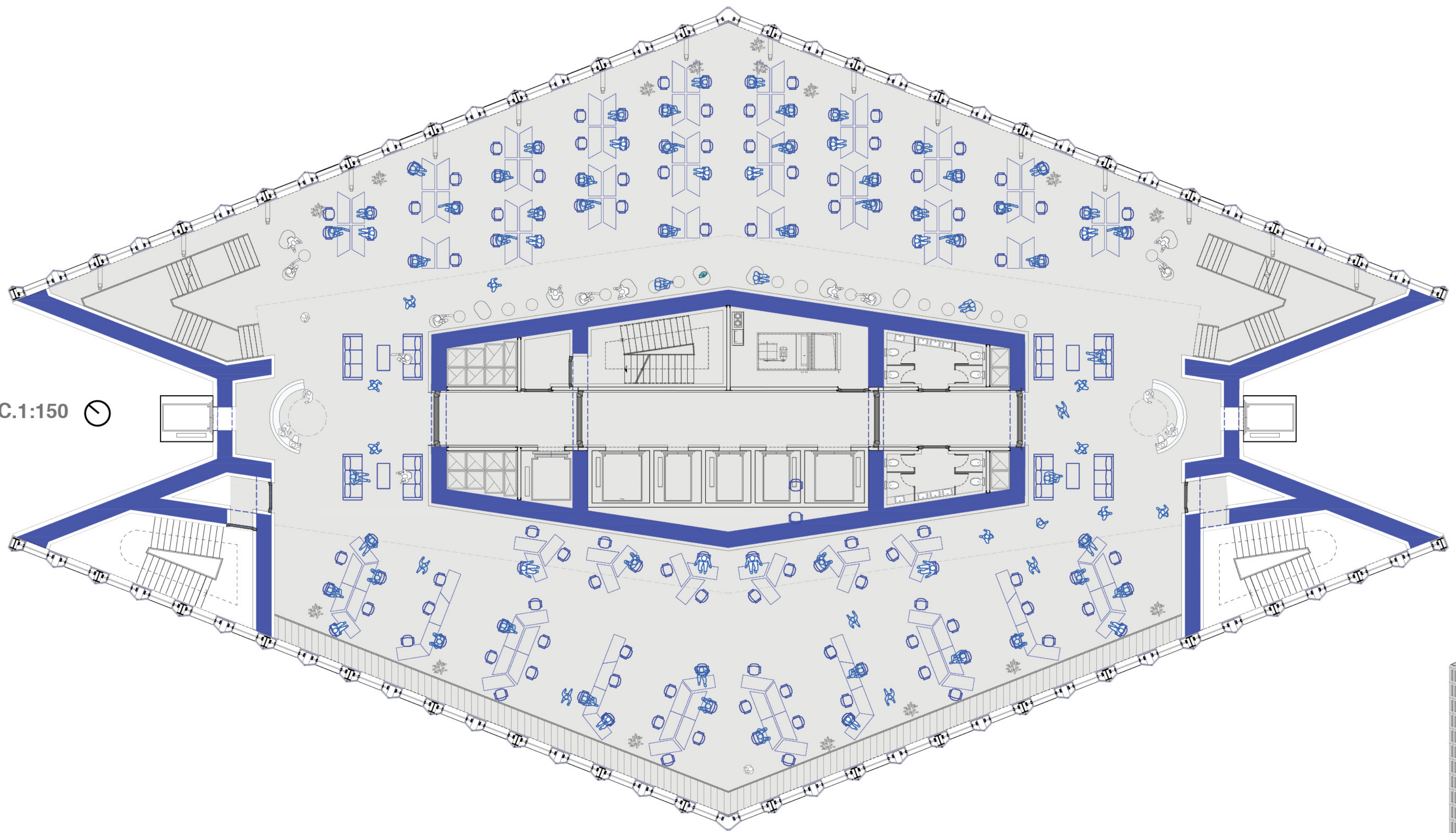


First Floor Plan SC.1:150

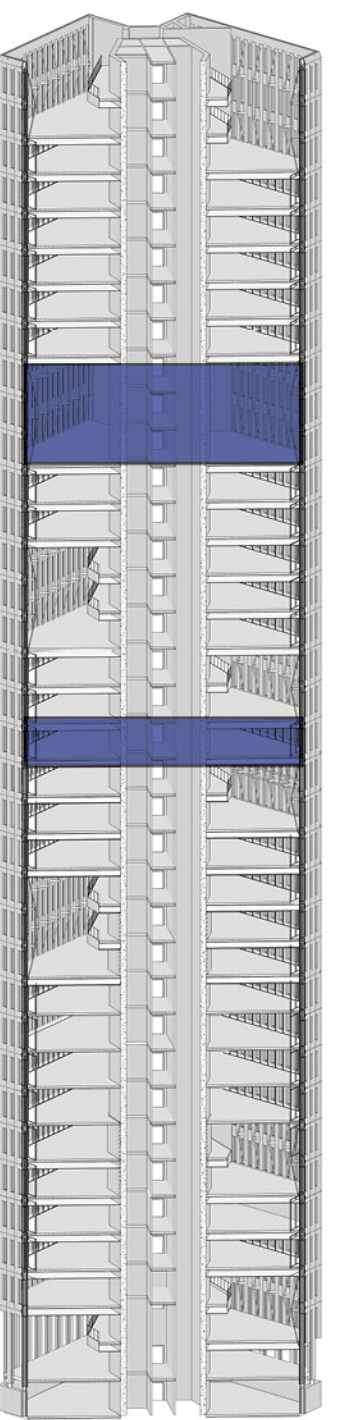
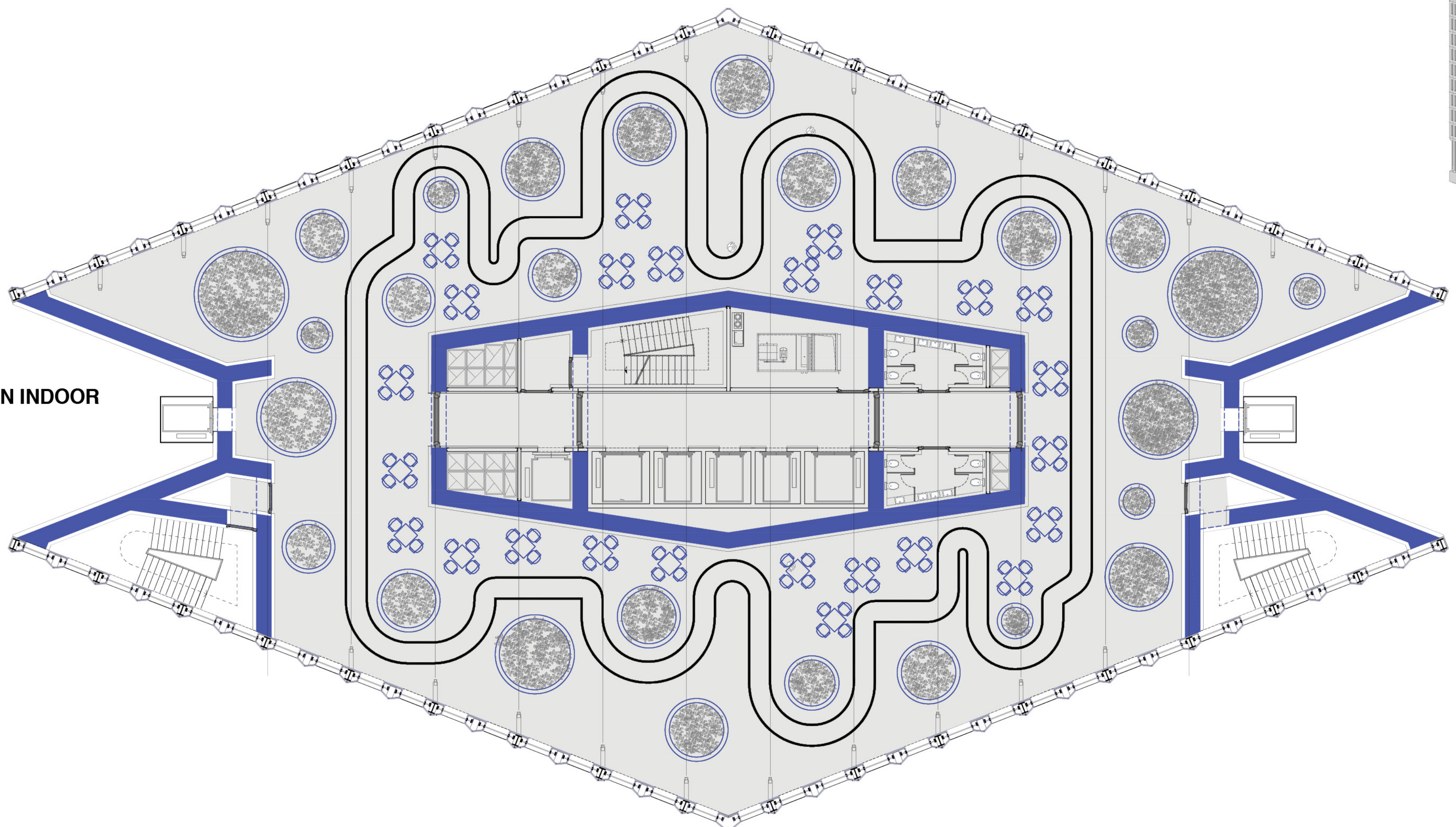


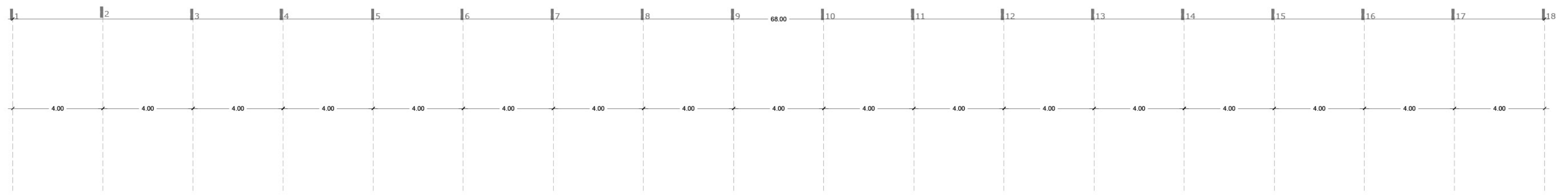


Working area SC.1:150

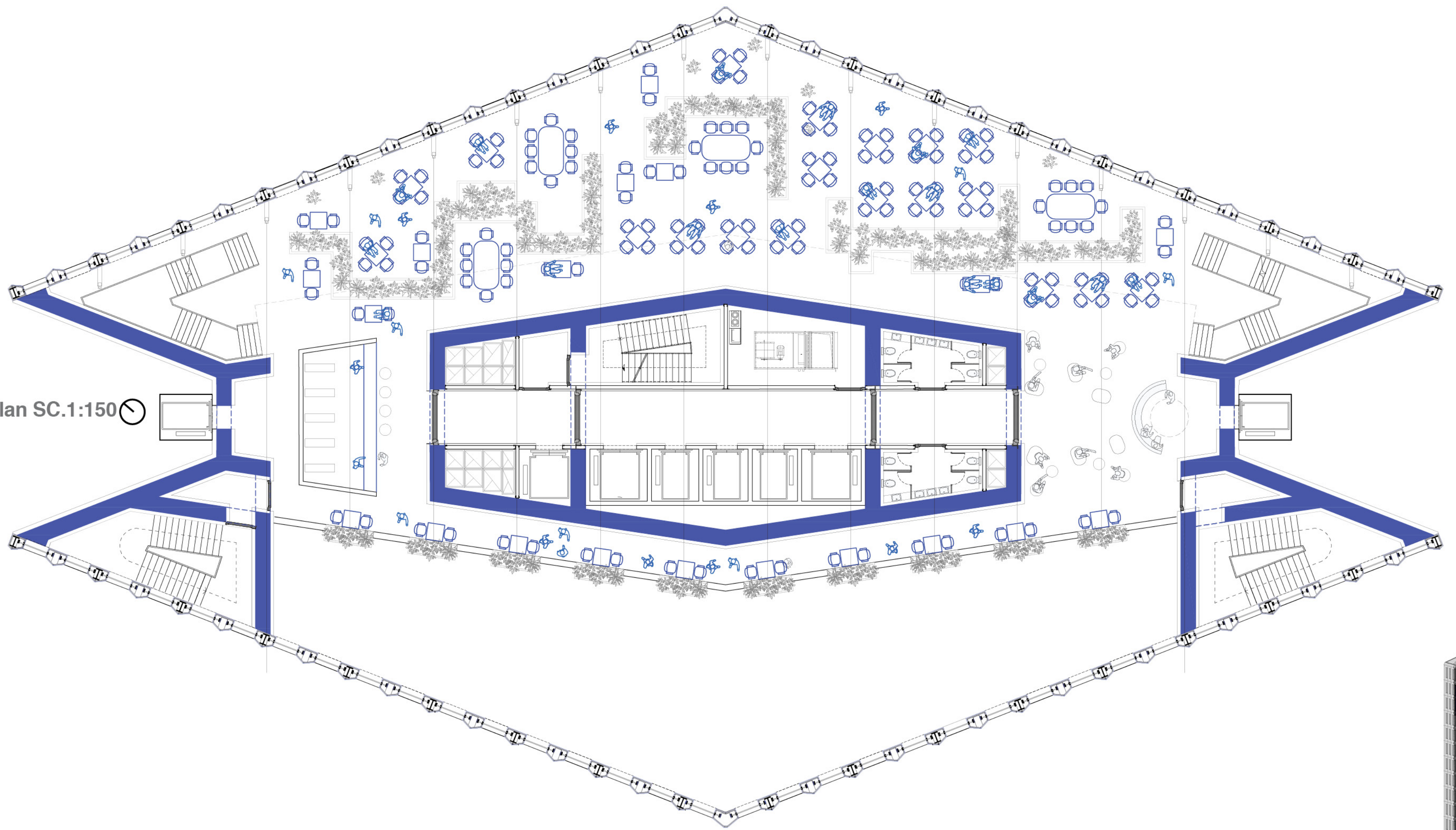


TRIPLE GREEN INDOOR
SC.1:150

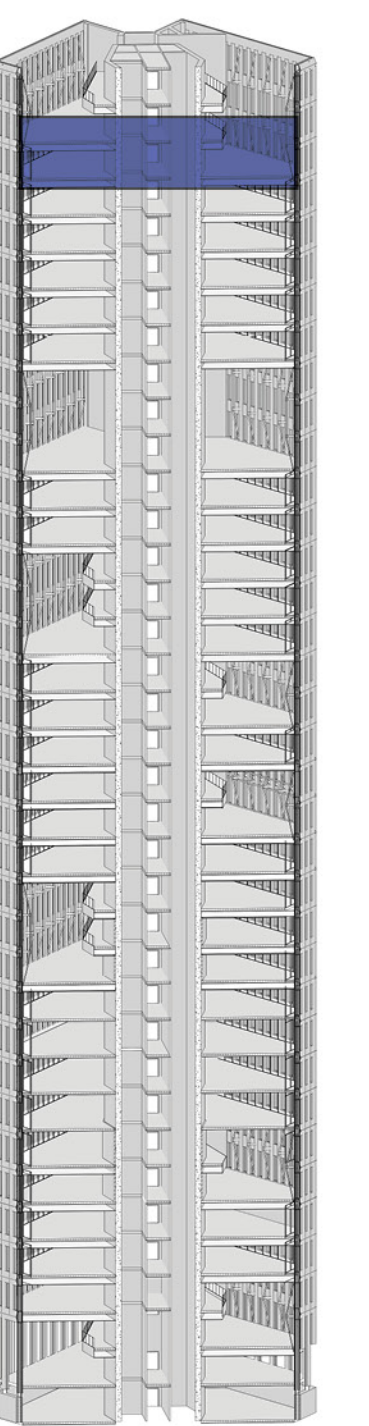
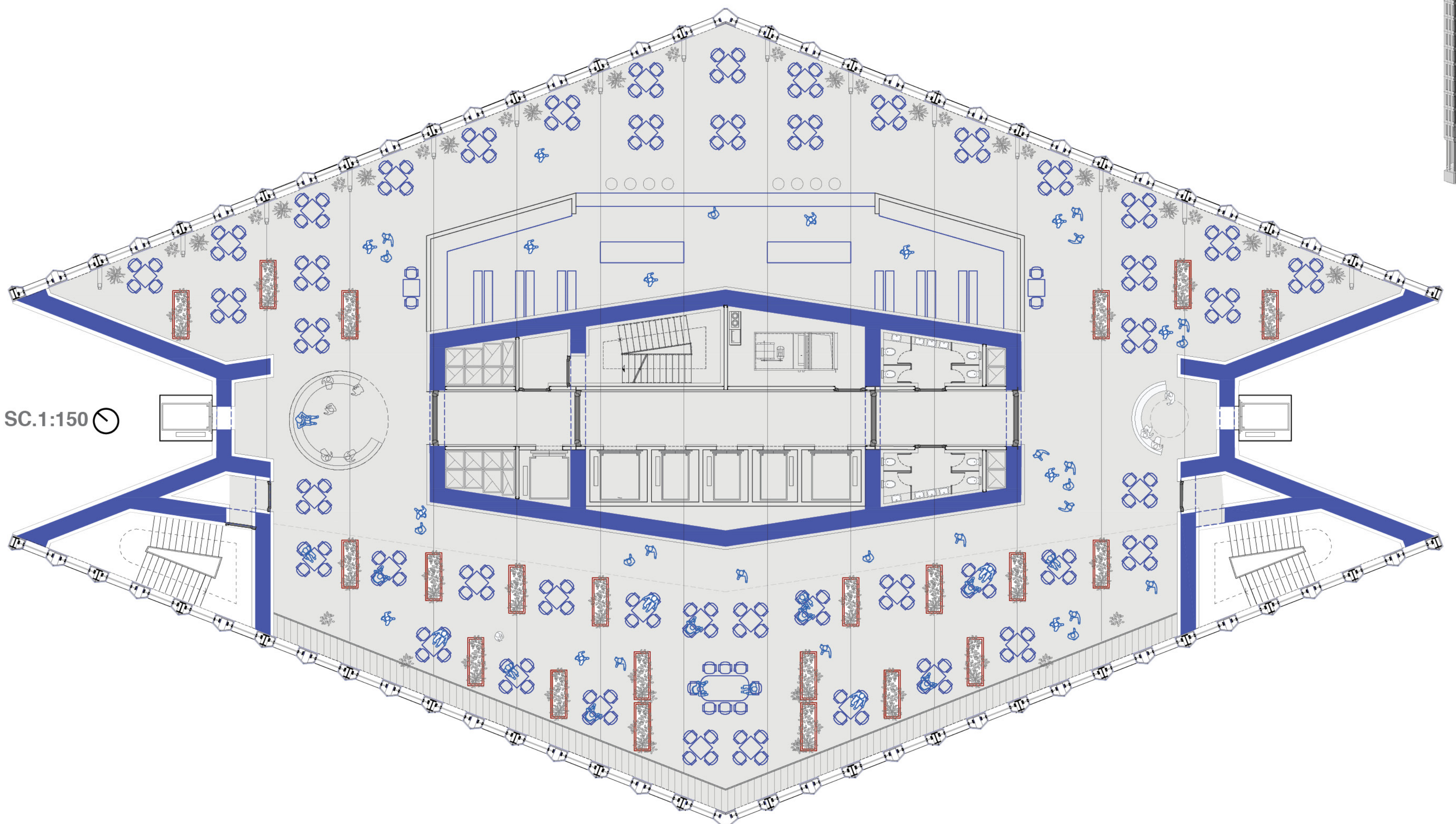




Second Floor Plan SC.1:150

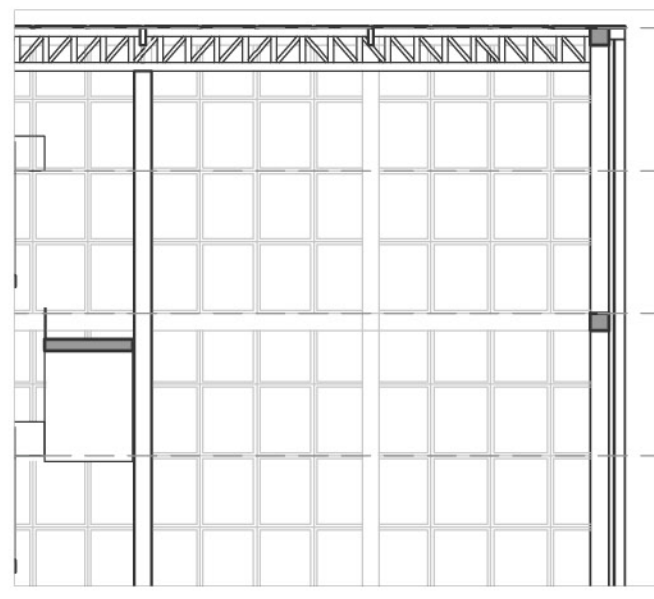


First Floor Plan SC.1:150



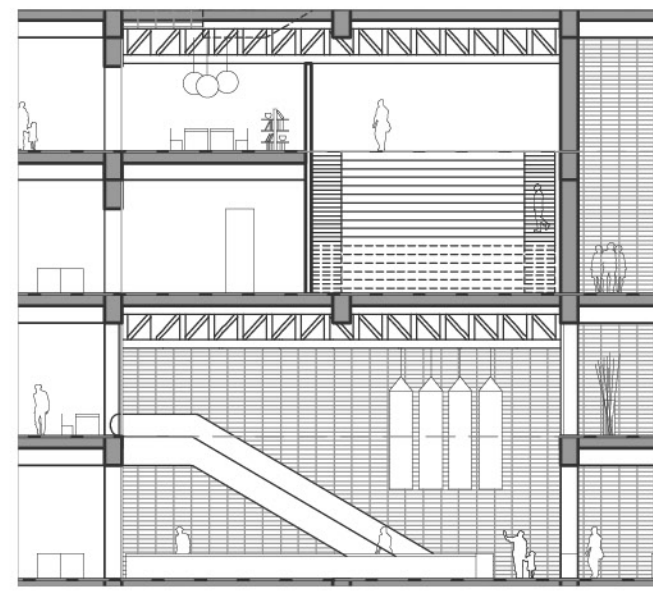
OVERAL SECTION
layouts of spaces and dimensions

This tower has many complicated spaces in different levels and the section below shows the differences of the quality of the different spaces and how the functions are related vertically



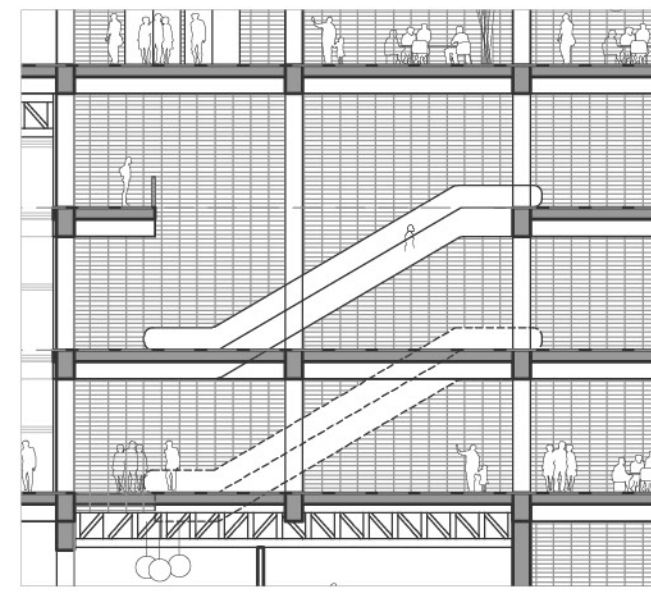
MAIN ENTRANCE

THIS SPACE WORKS AS A COMPLEMENTARY ELEMENT WHICH GIVES SERVICES TO THE ALL BLOCKS.



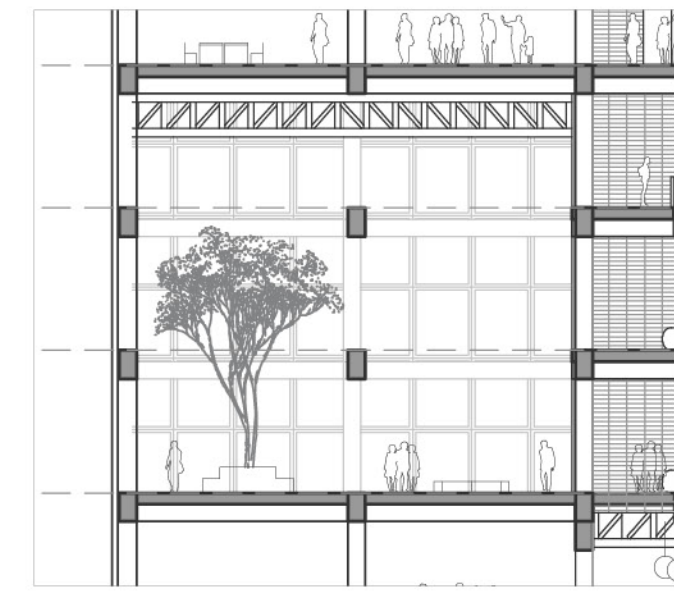
ATRIUM DPUBLE

THE AUDITORIUM WORKS AS AN INDIVIDUAL BOX THAT IS COMPLETELY SOUND ISOLATED



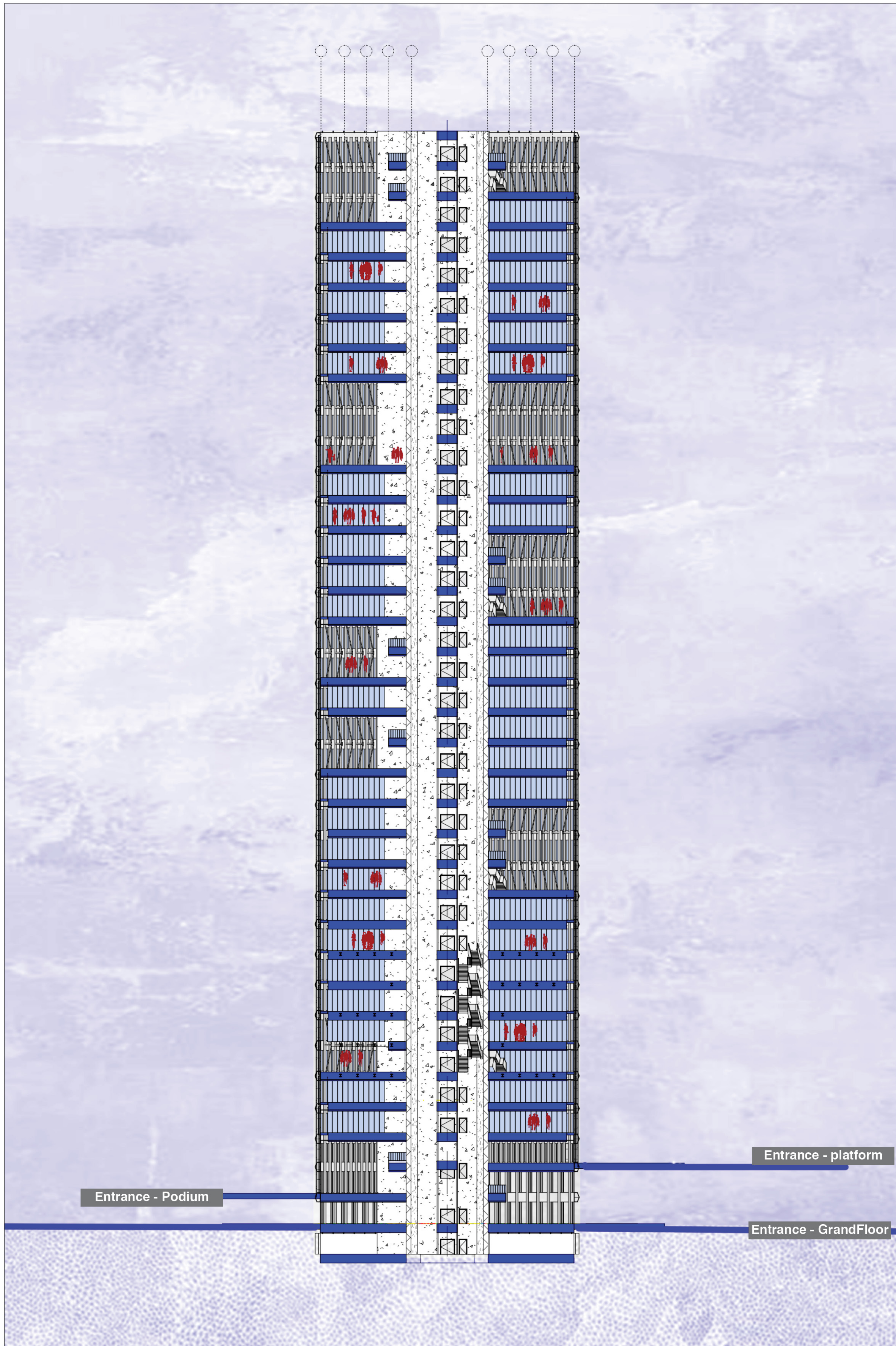
CONNECTION OF SOME FLOORS

EACH BLOCK HAS CONNECTIONS ACCORDING TO ITS NEEDS AND CIRCULATION

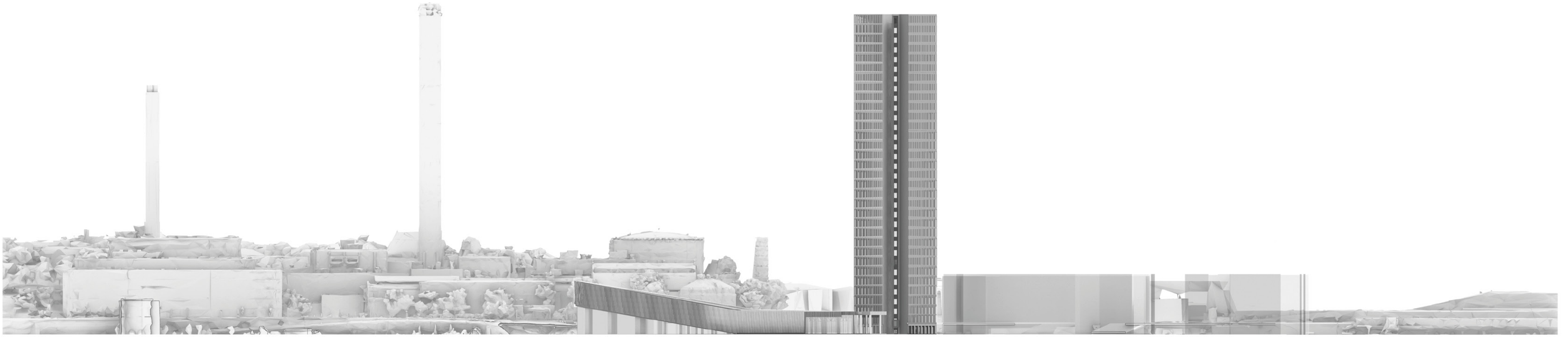


GREEN ATRIUMS

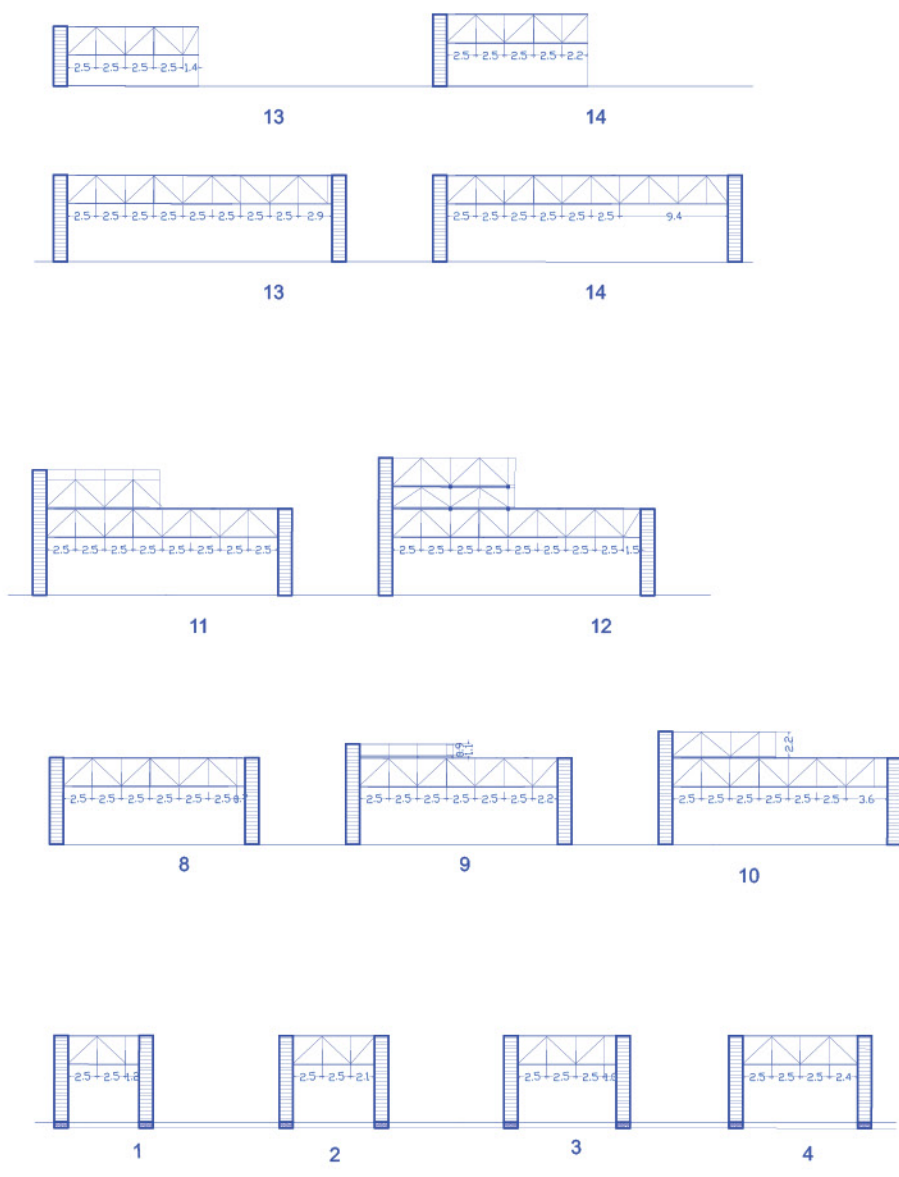
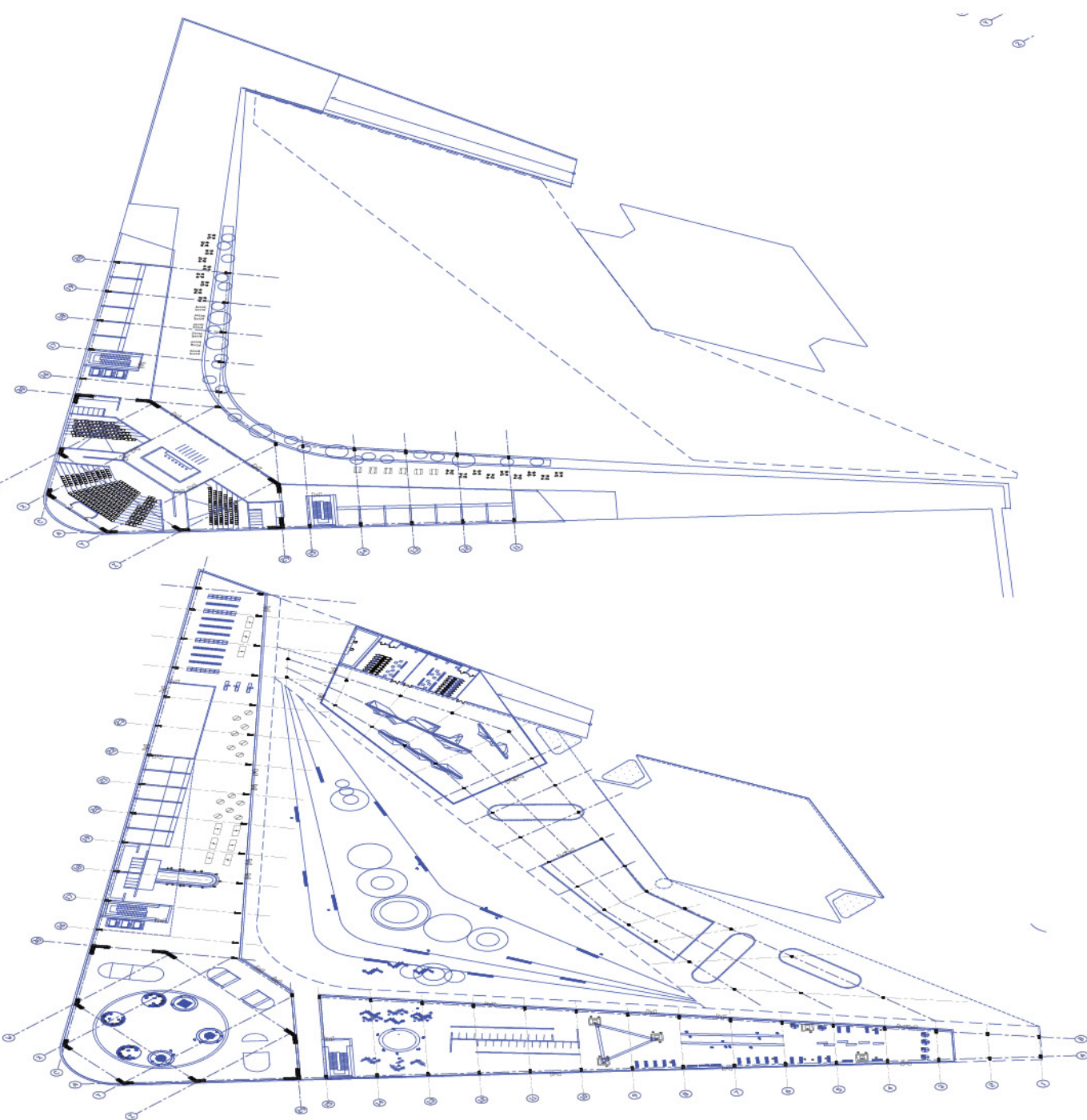
WORKS AS A CENTRAL FOCAL POIT OF THE LIBRARY. IN THE DEPARTMENT SECTION



URBAN SECTION
Relation of the tower and podium with the city

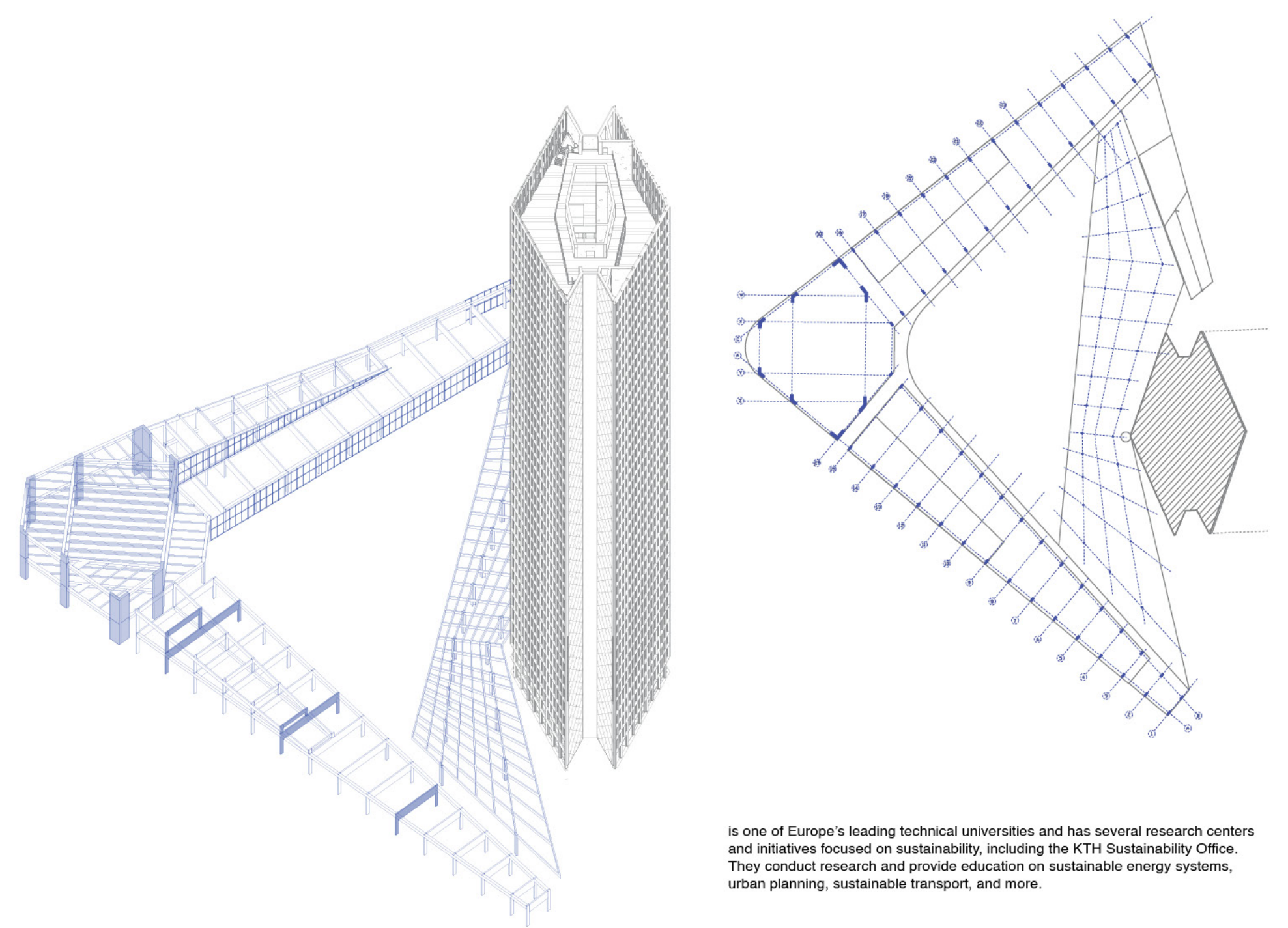


PLAN OF PODIUM
In two levels containing the needs of the context



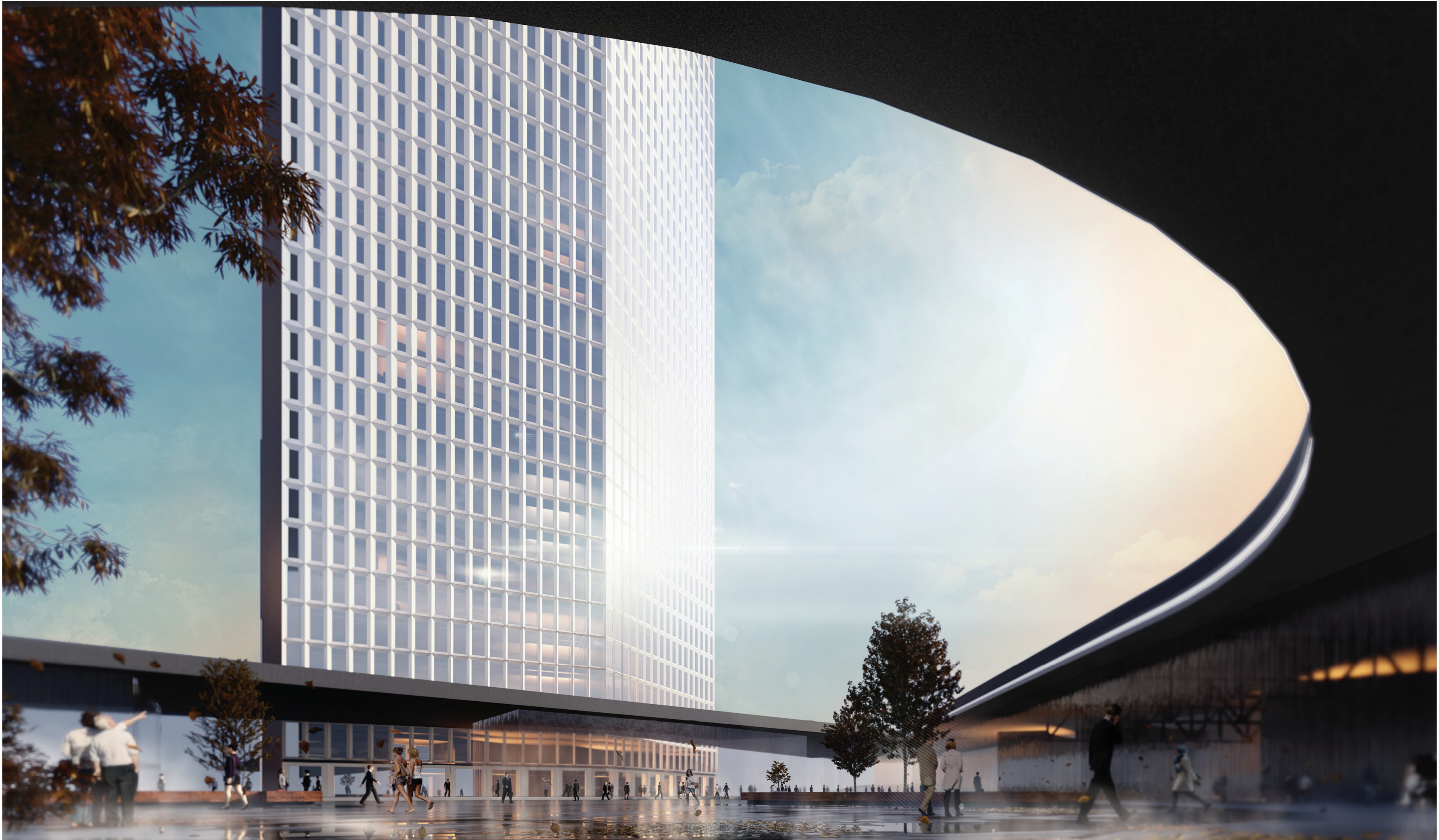
is one of Europe's leading technical universities and has several research centers and initiatives focused on sustainability, including the KTH Sustainability Office. They conduct research and provide education on sustainable energy systems, urban planning, sustainable transport, and more.

STRUCTURE OF THE PODIUM
Steel trusses that in some parts are doubled



is one of Europe's leading technical universities and has several research centers and initiatives focused on sustainability, including the KTH Sustainability Office. They conduct research and provide education on sustainable energy systems, urban planning, sustainable transport, and more.

VIEW OF THE TOWER FROM INNER COUR

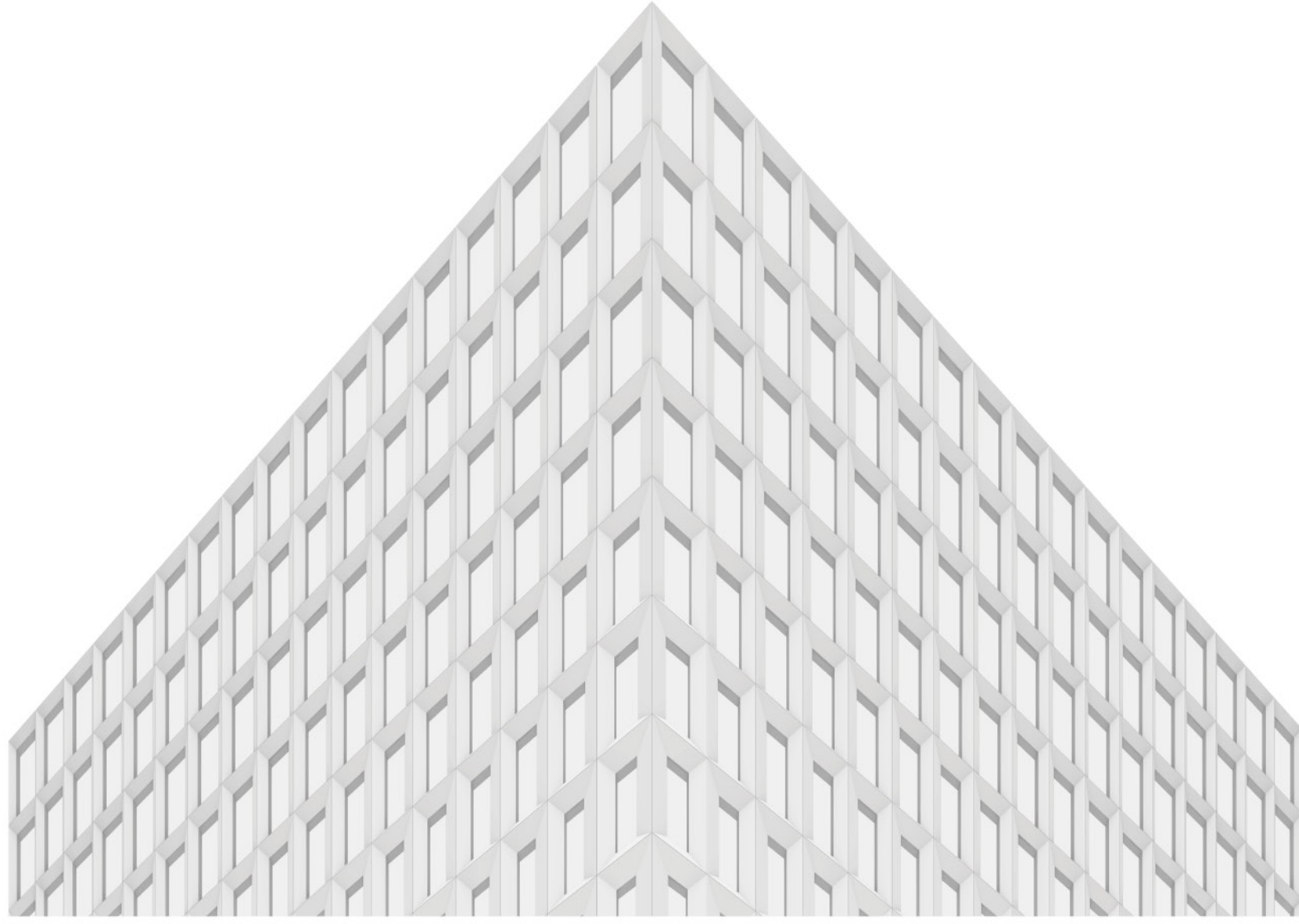


PARAMETRIC FACADE DESIGN

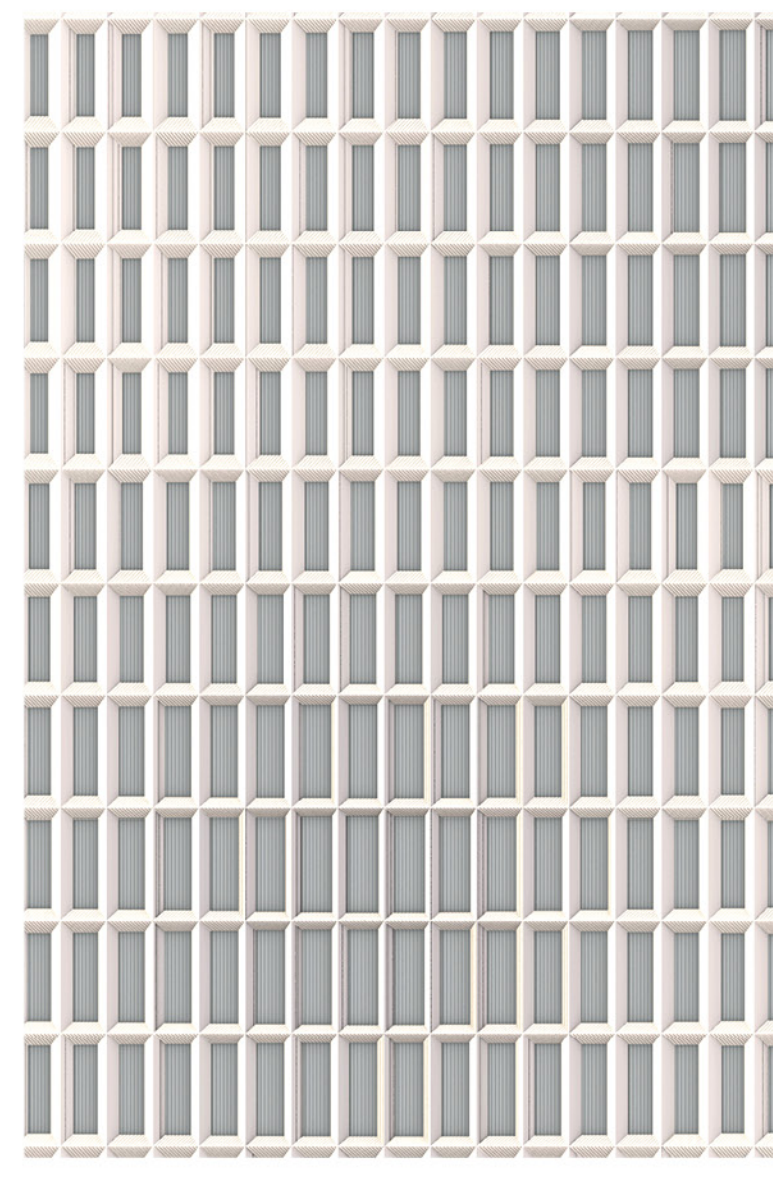
strategies, layout, details

parametric facades represent a cutting-edge approach to architectural design, providing adaptability, aesthetic innovation, and environmental responsiveness in building exteriors.

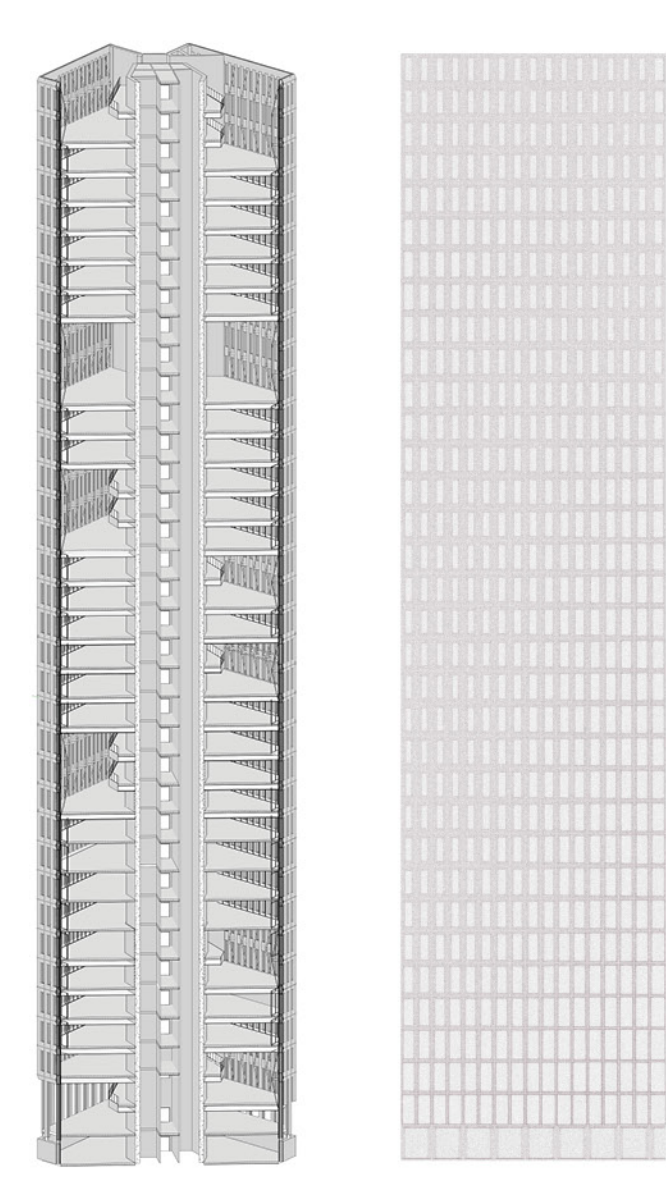
THE DESIGN OF THE JOINTS



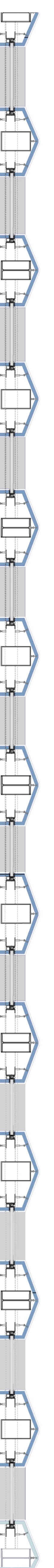
PARAMETRIC FACADE - OPENING SIZES



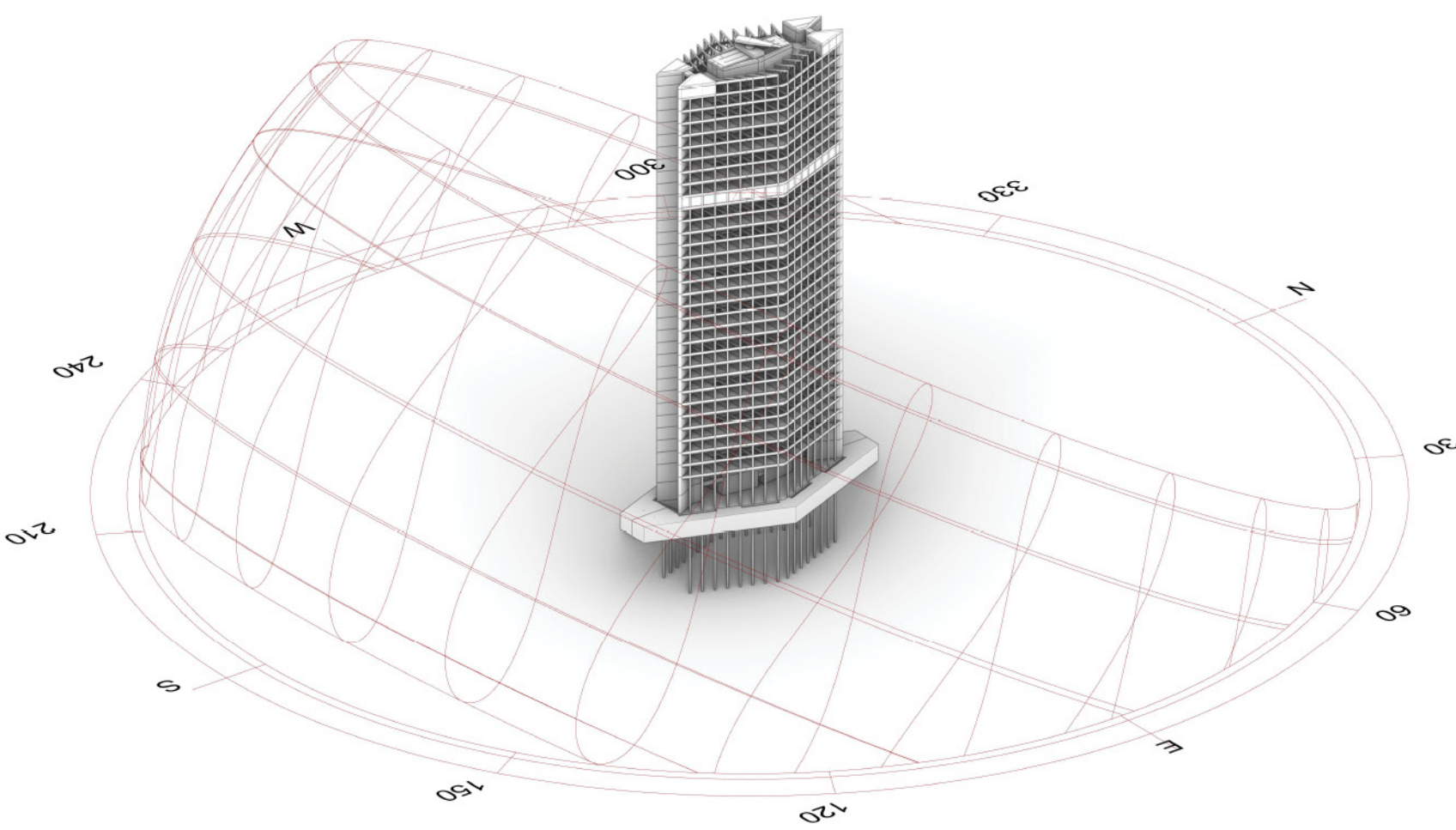
STRATEGIE BASE ON THE FUNCTIONS



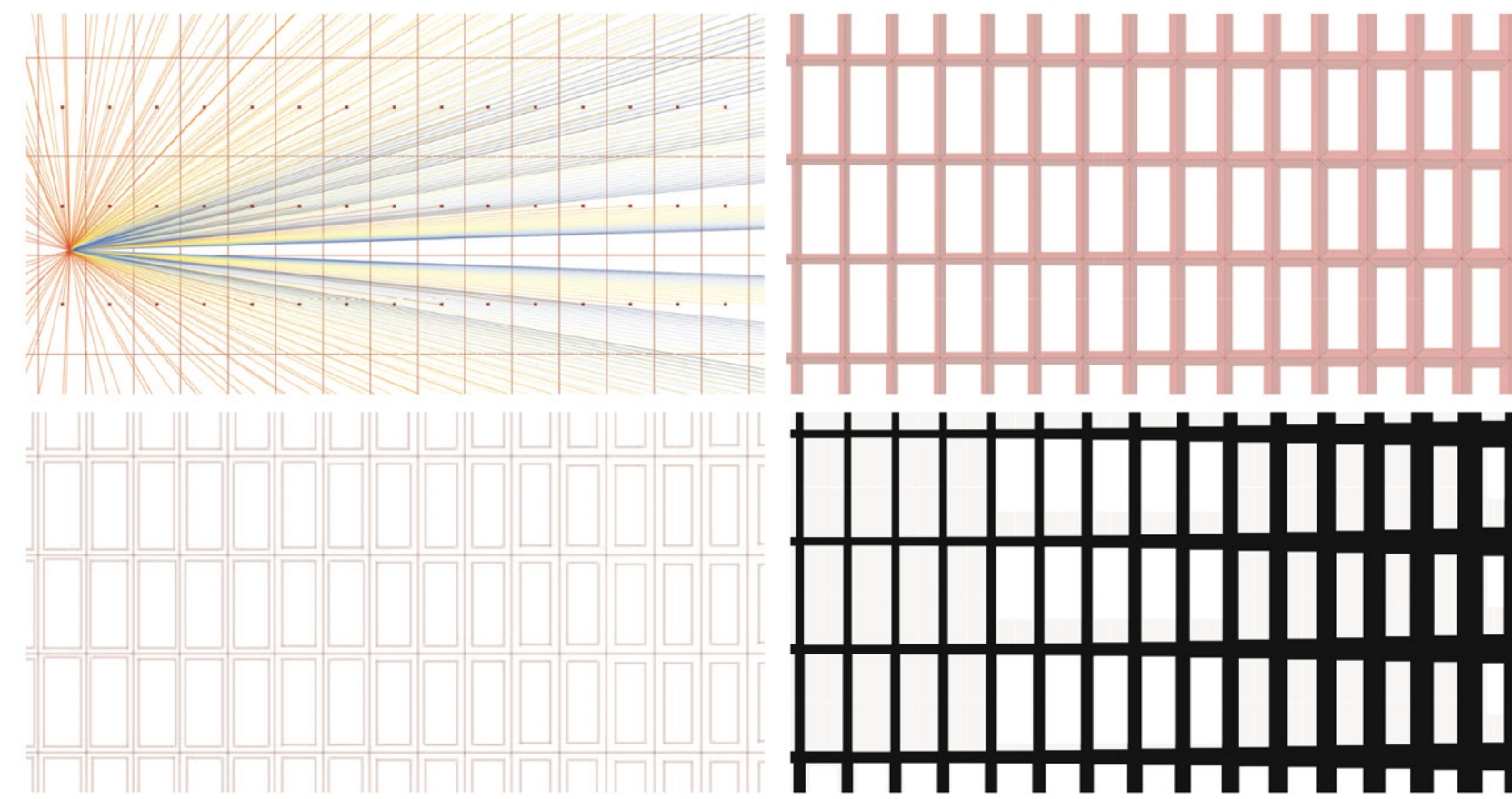
PARAMETRIC DETAIL PLAN



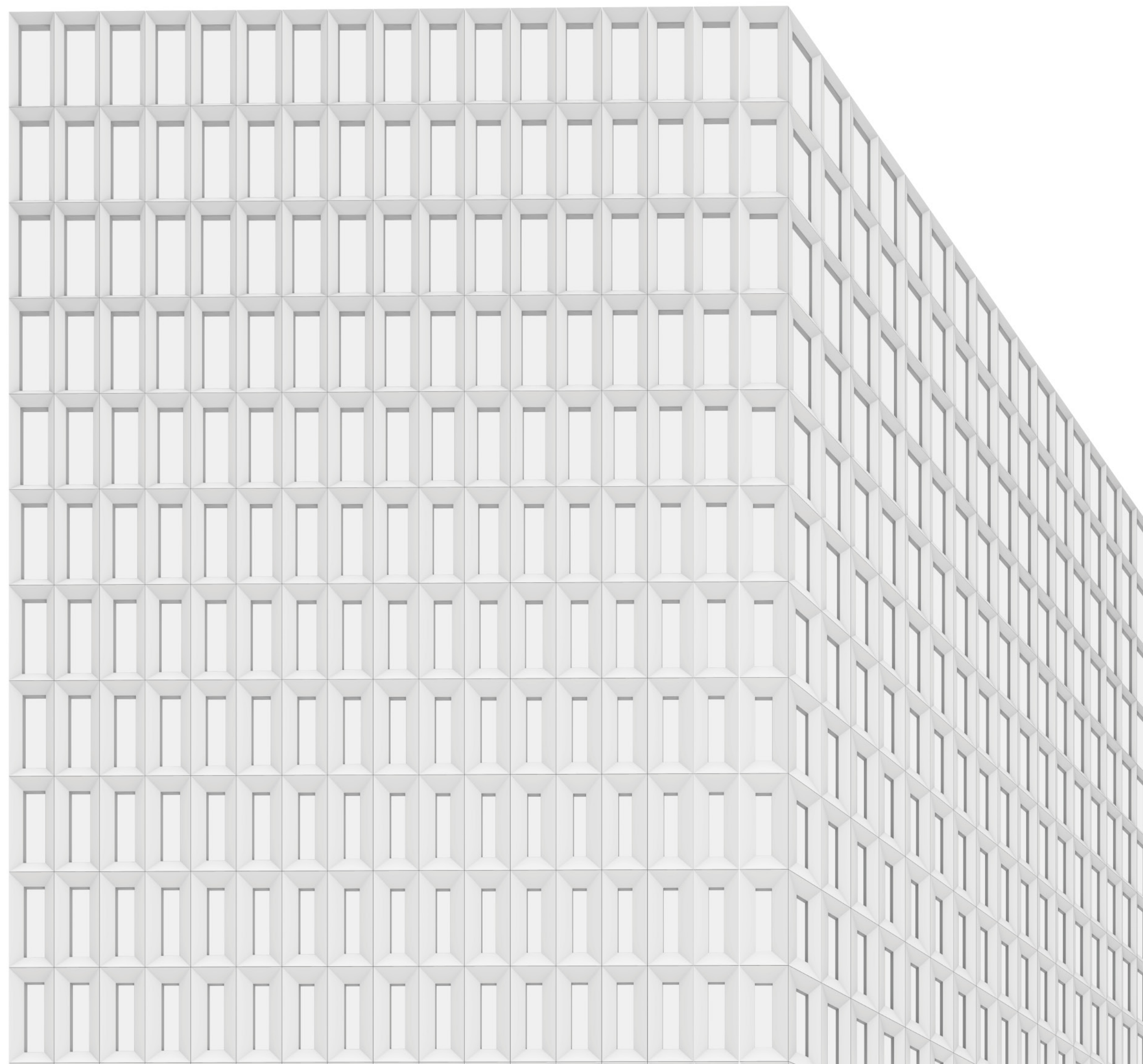
STRATEGIE BASED ON THE LIGHT CHANGE



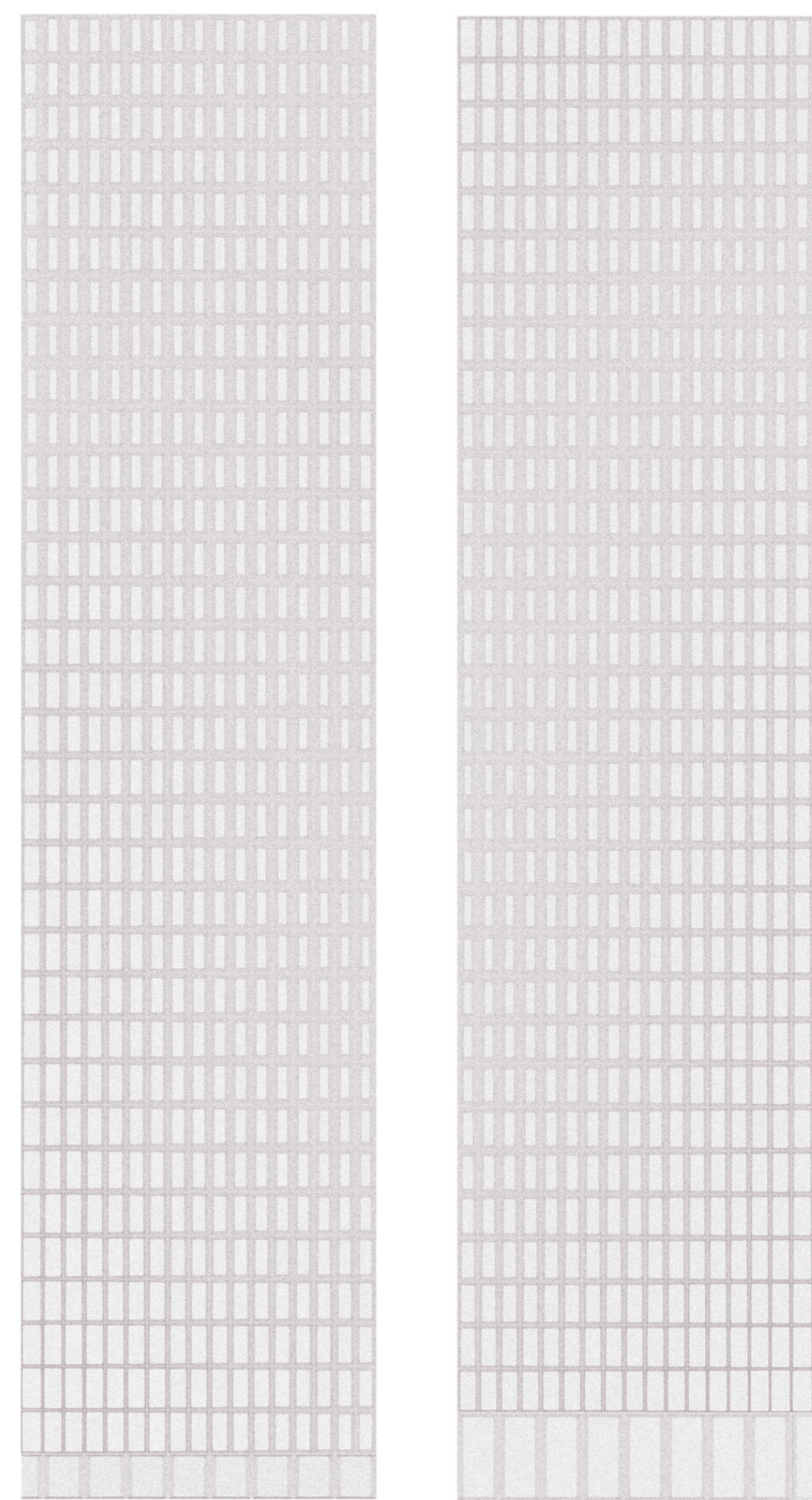
Due to the analysis that we could get from Ladybug and Honeybee we understood that we have different radiations for all the facades of the tower. Each facade has a different orientation according to the sun therefore has different amount of sun and light. On the other hand, because of the functions that we have for the tower, we can say we need different amount of light for each space.



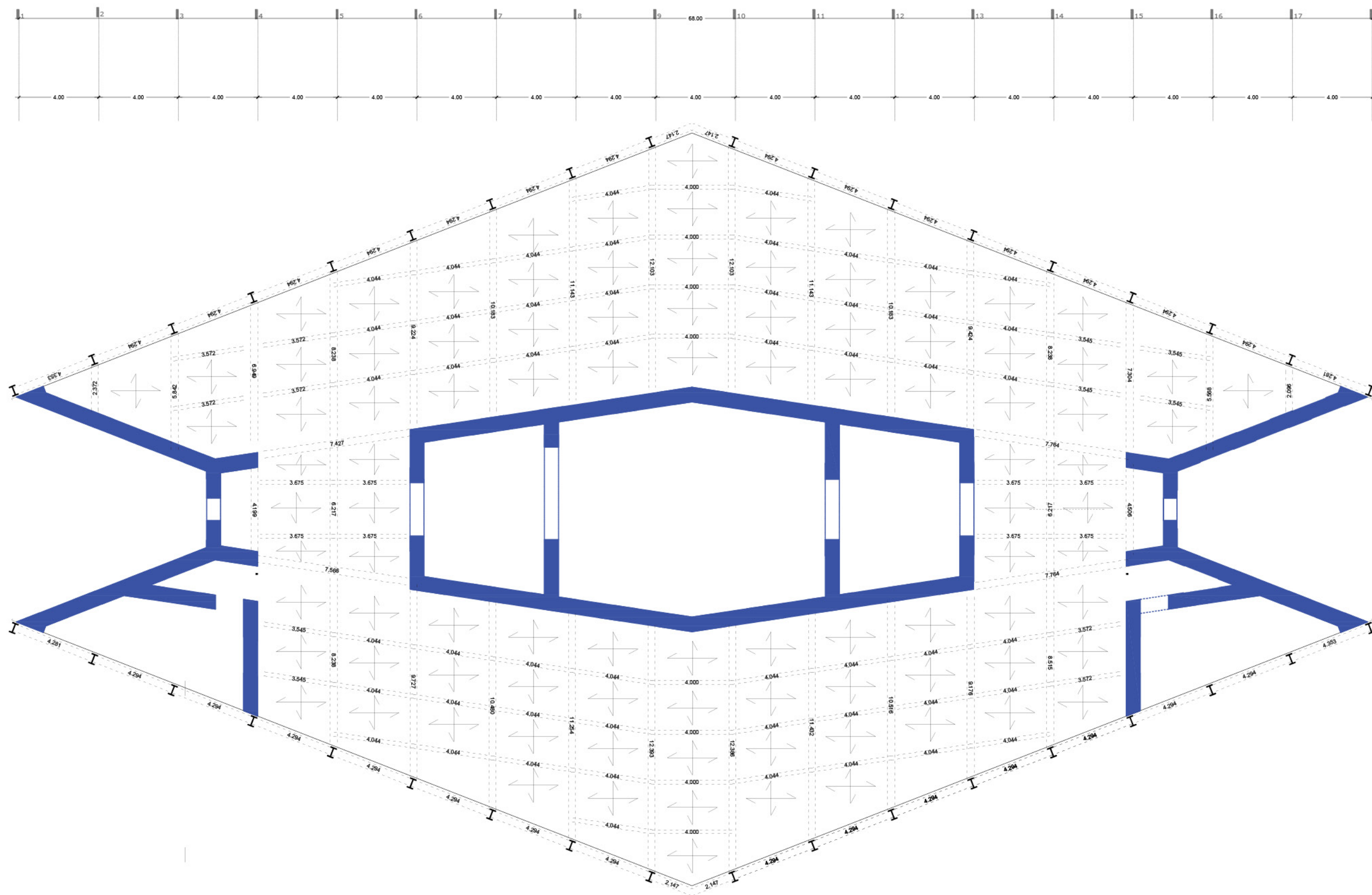
ONE SCOPE OF THE FACADES



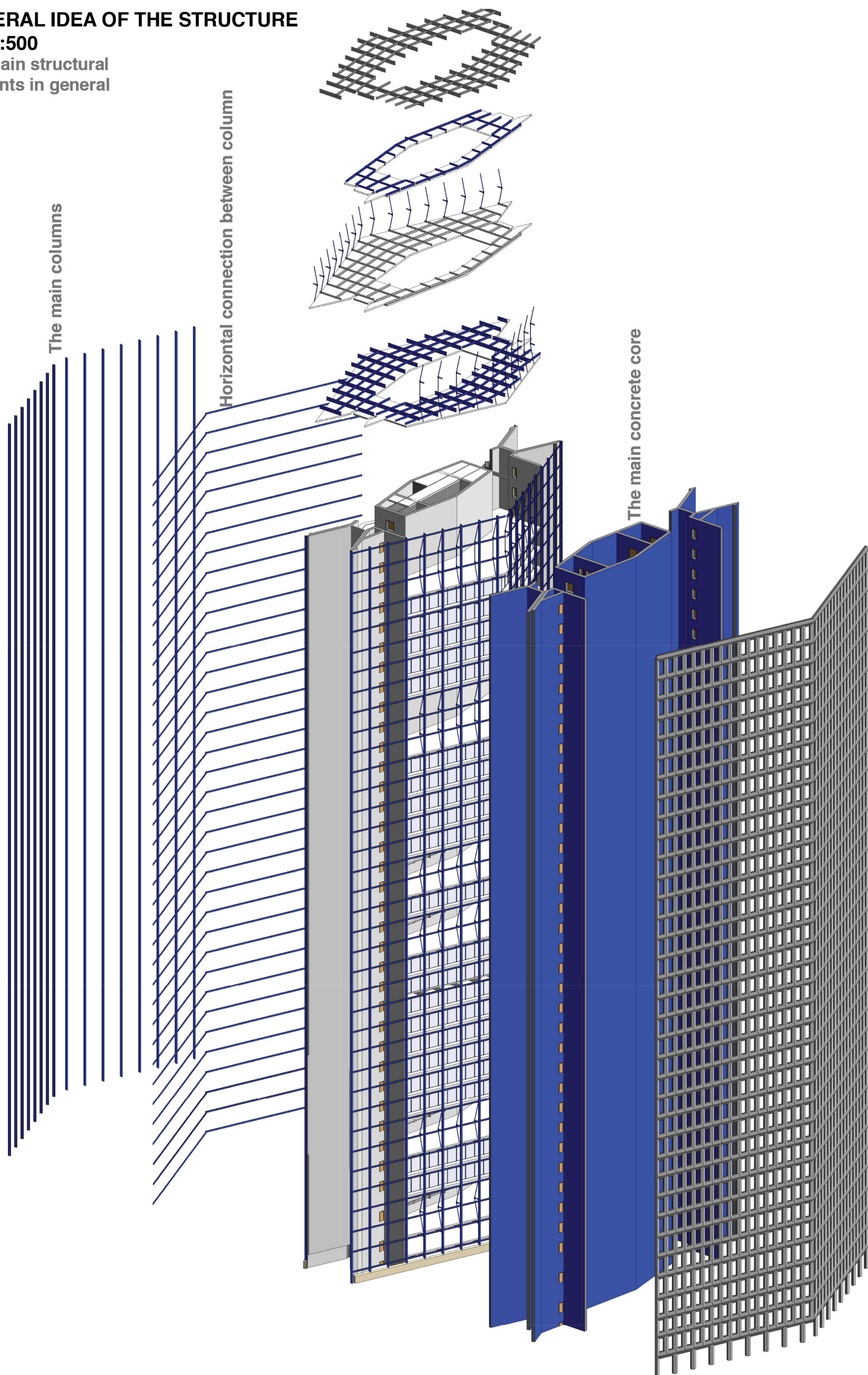
EASTERN FACADES



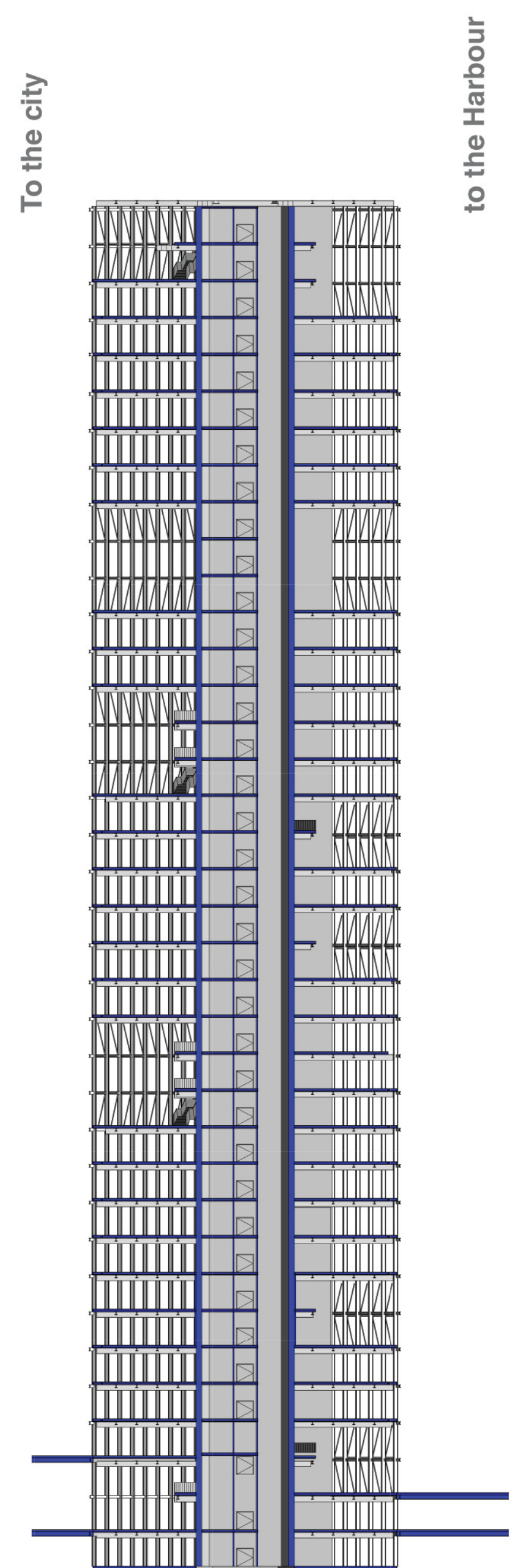
STRUCTURAL PLAN SC.1:200
The main floor structure plan with out any casting



GENERAL IDEA OF THE STRUCTURE SC.1:500
The main structural elements in general



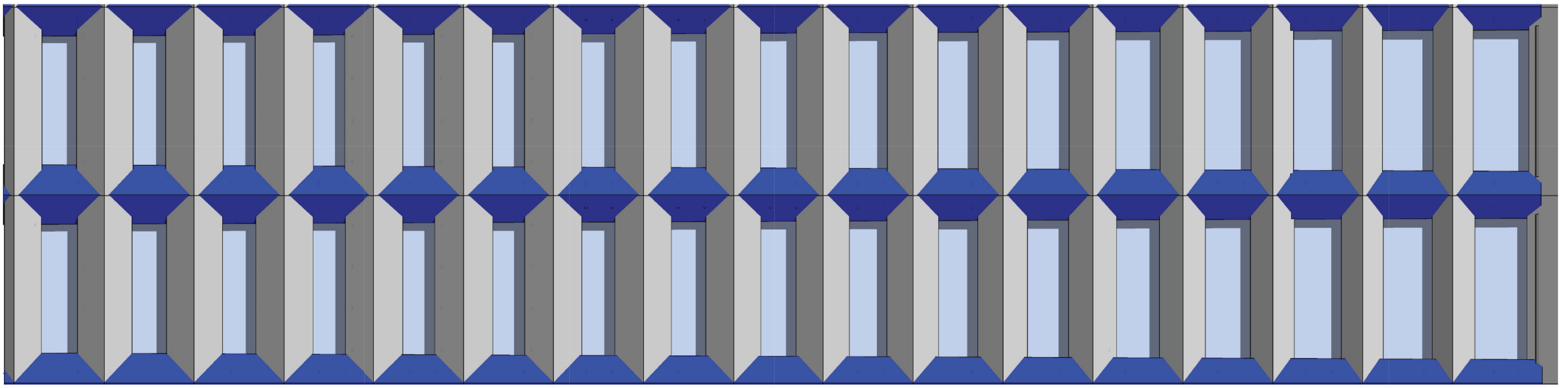
STRUCTURAL SECTION SC.1:500
The main structural elements in general



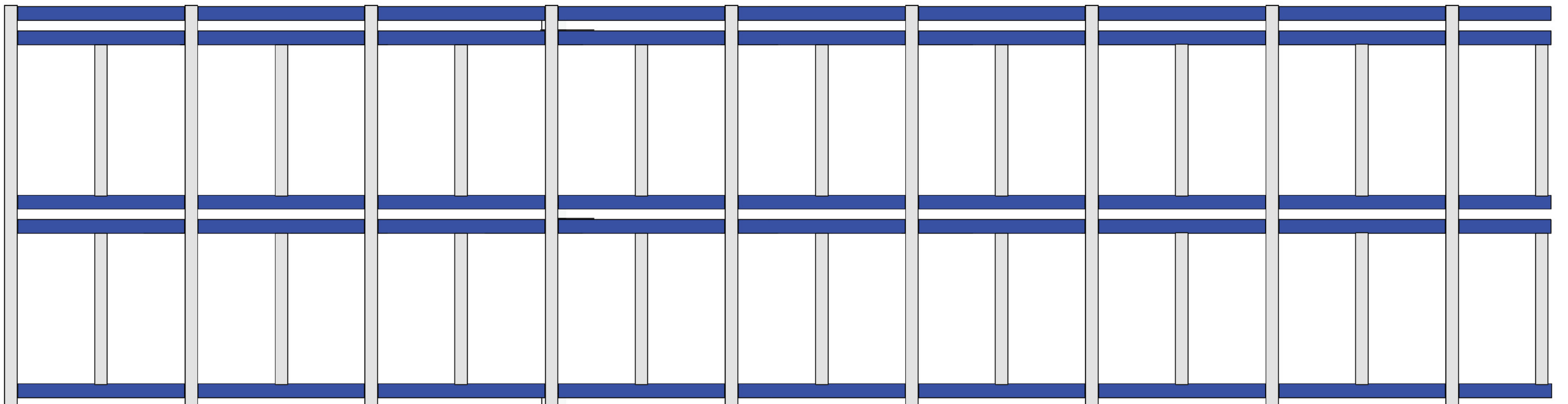
LAYERS OF THE FACADE

how the connections works in parametric

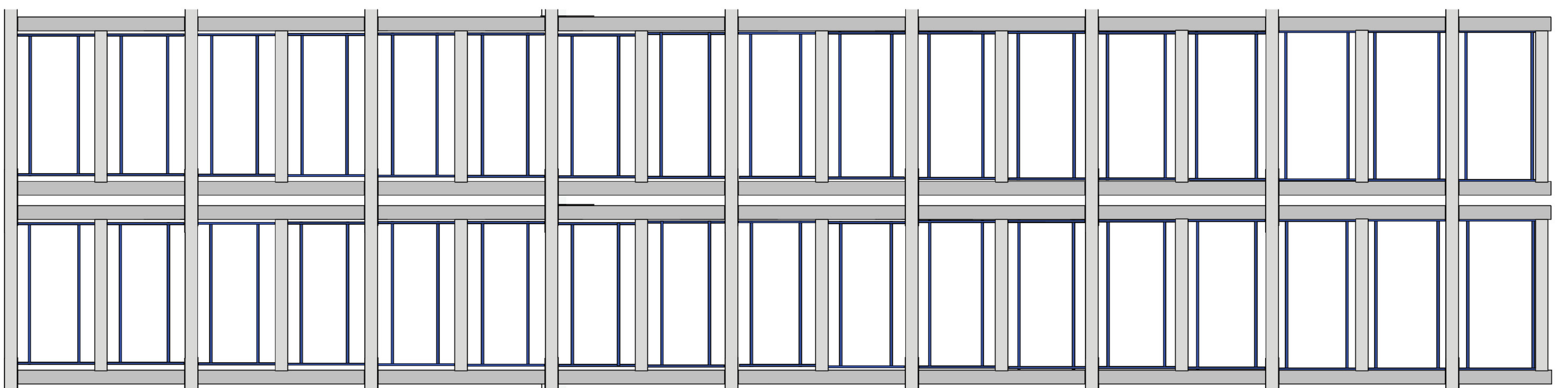
CONFIGURATION OF THE PANELS



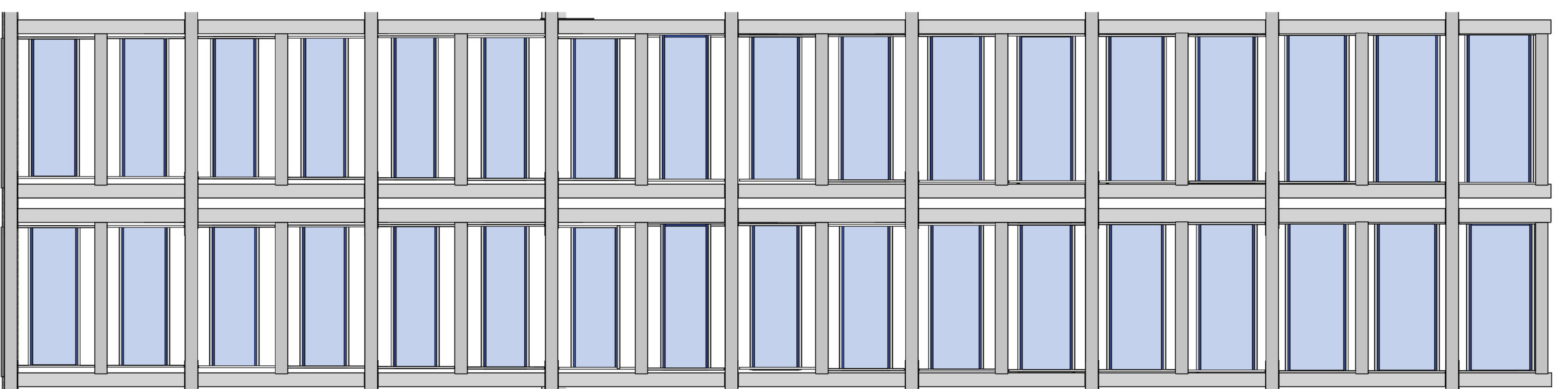
STRUCTURAL CONNECTIONS



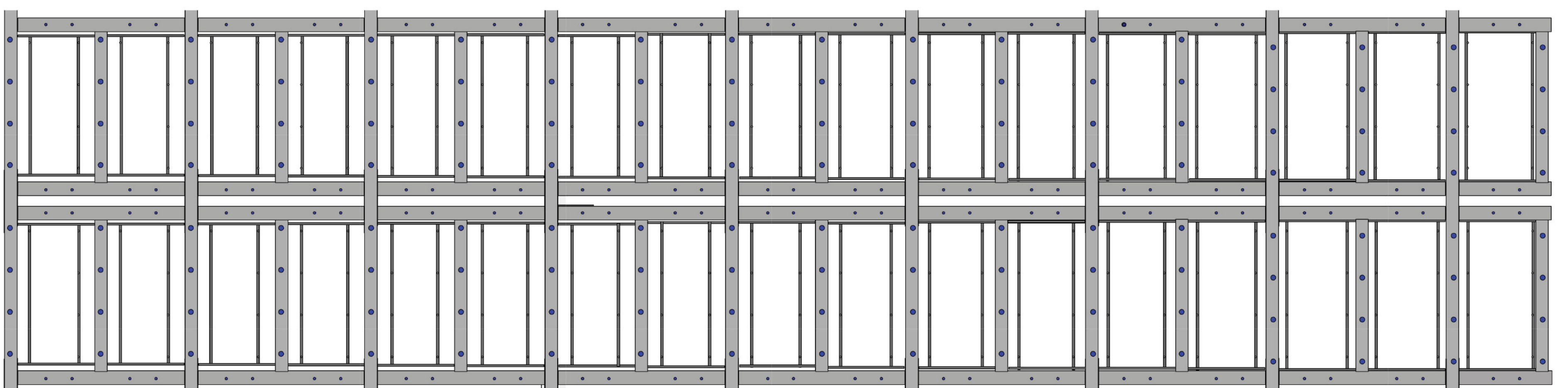
STRUCTURE OF WINDOWS



WINDOWS FRAME WITHIN THE STRUCTURE

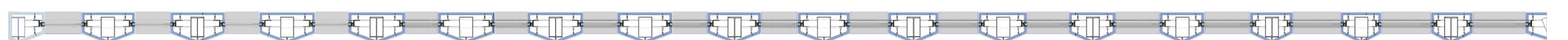


POSITION OF CONNECTION FOR PANELS ACCORDING TO THEIR LOCATIONS

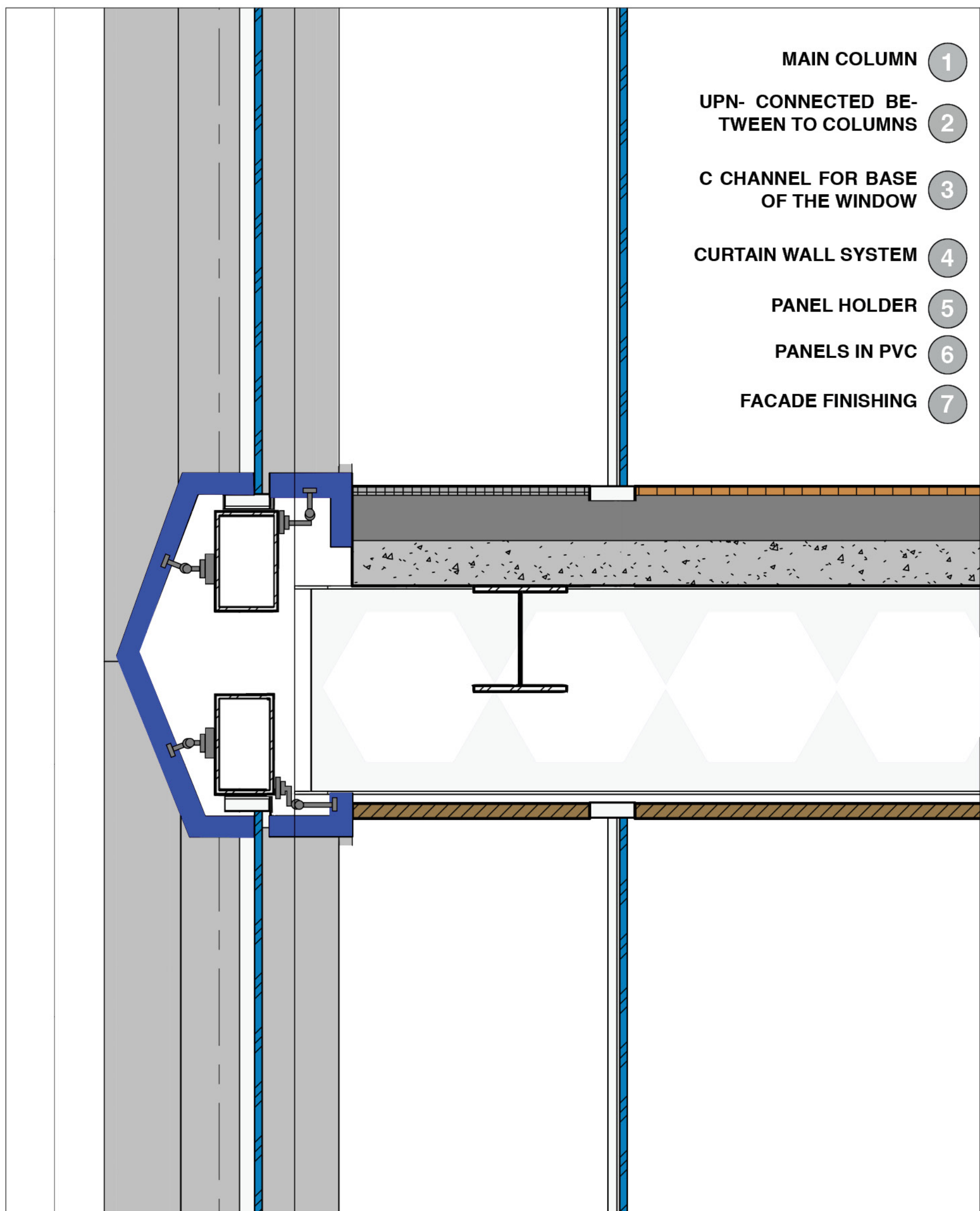


PLANS ACCORDINGLY TO THE PARAMETRIC DIMENSIONS

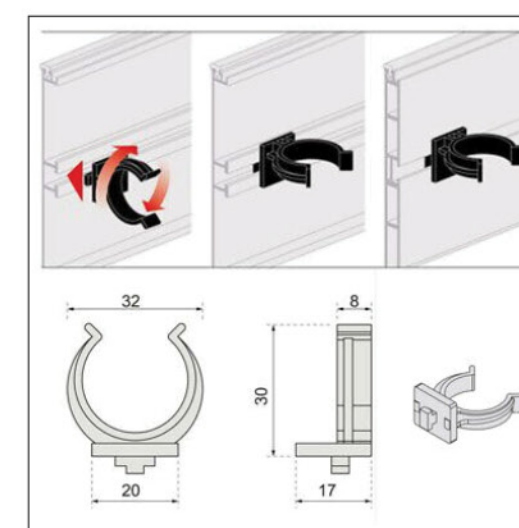
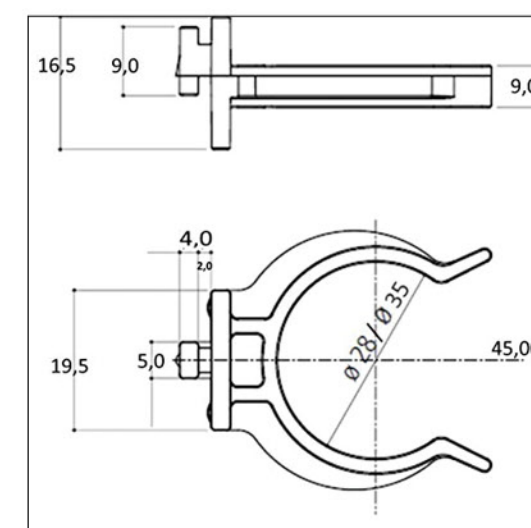
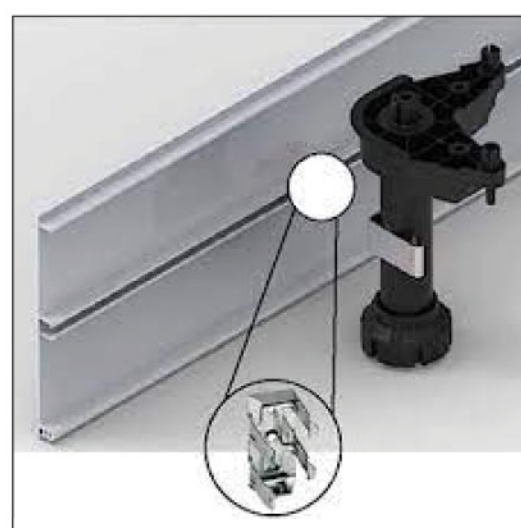
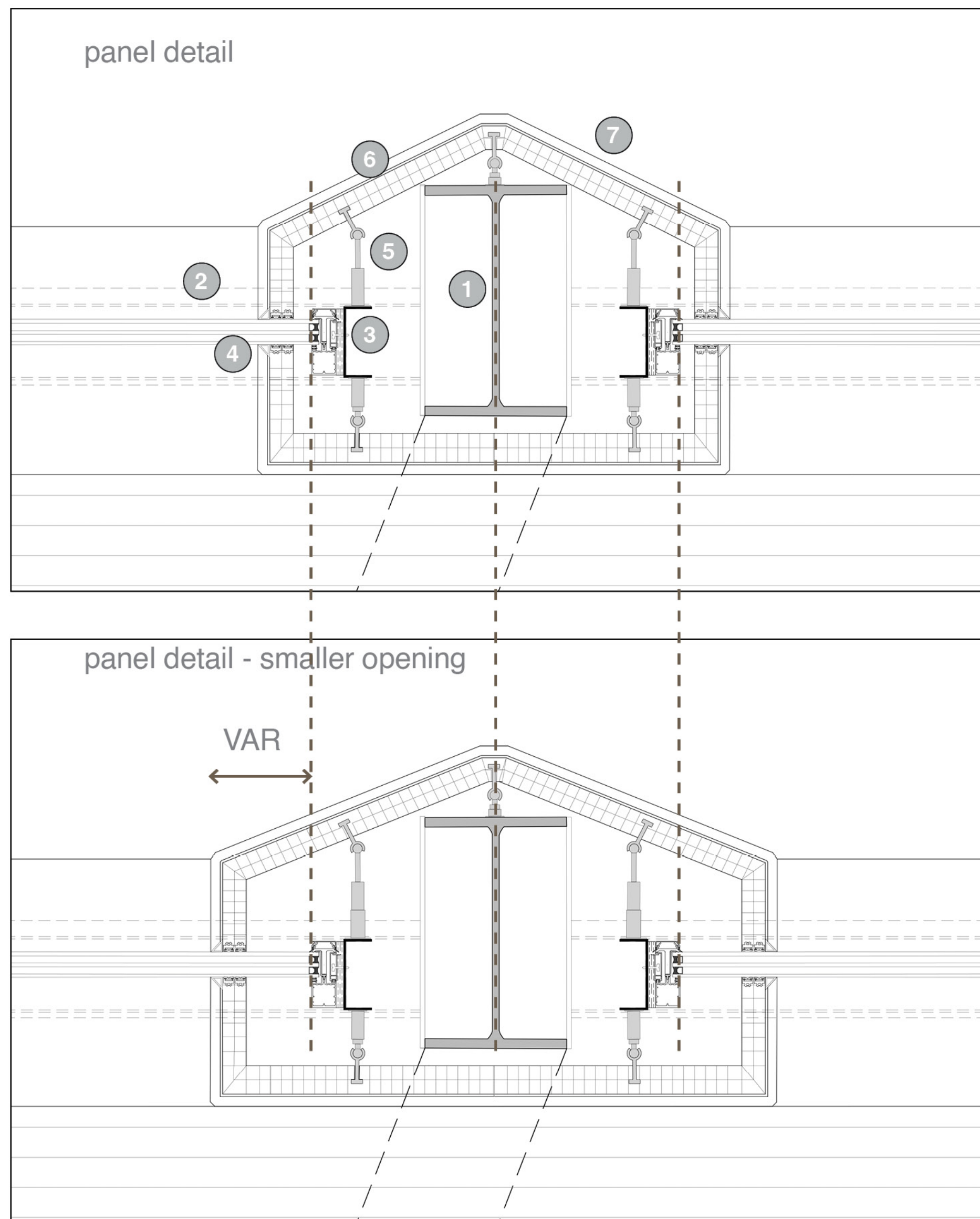
THE SCALE: 1:75



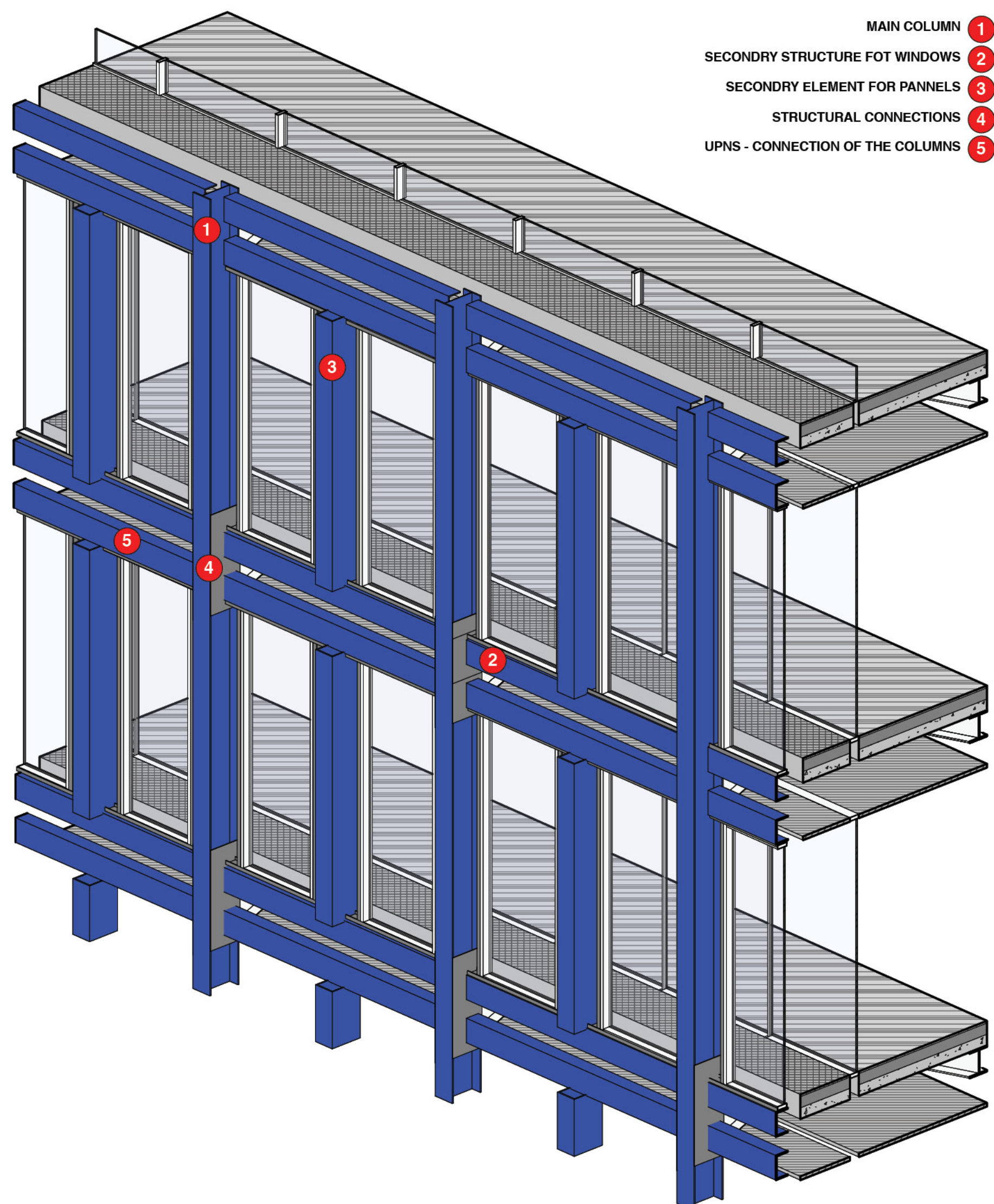
DETAIL OF THE PANELS
vertical section of connection of the panels



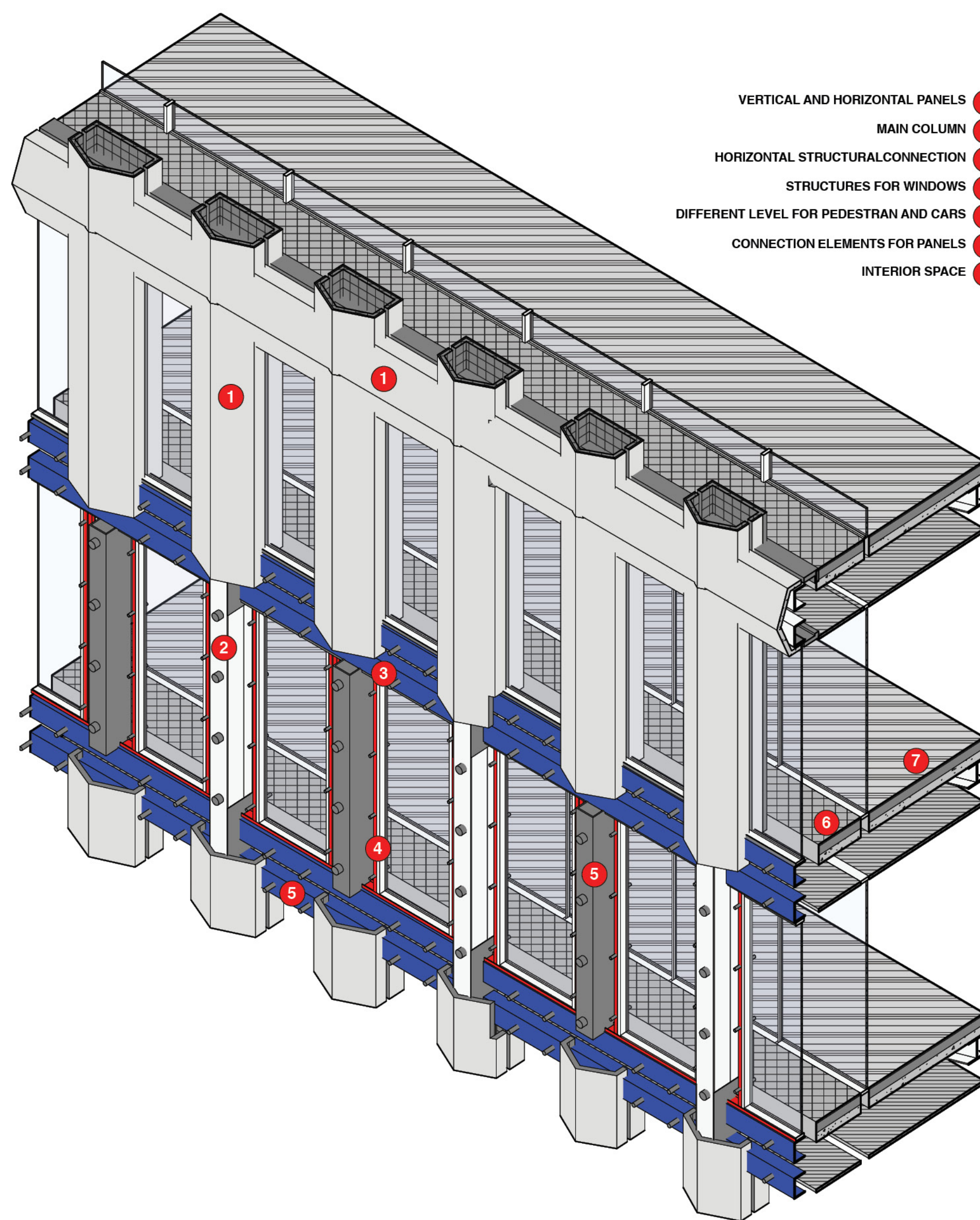
DETAIL OF THE PANELS
how it changes with dimension



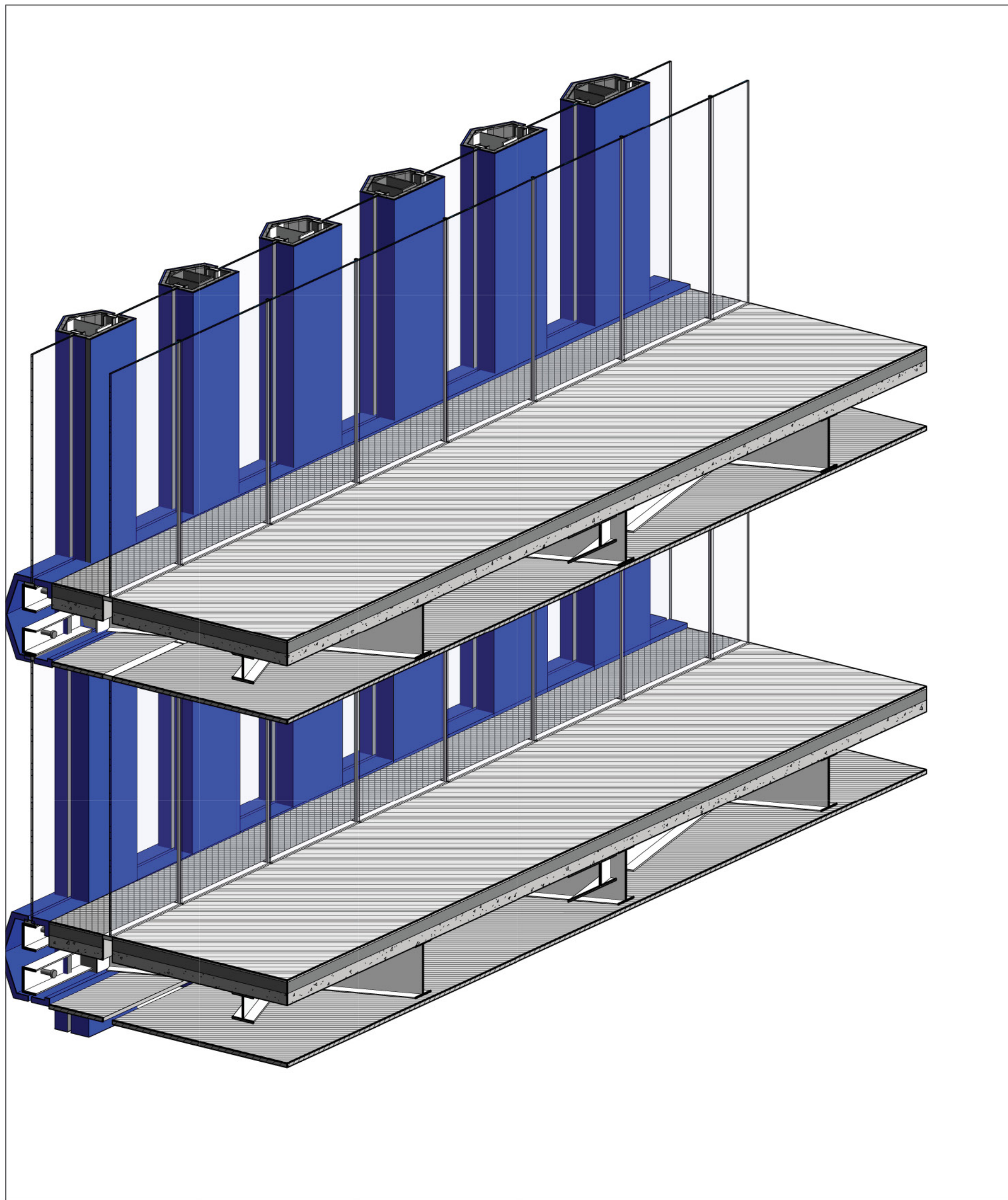
DETAIL OF THE PANELS SC: 1.50
The main structure for facade



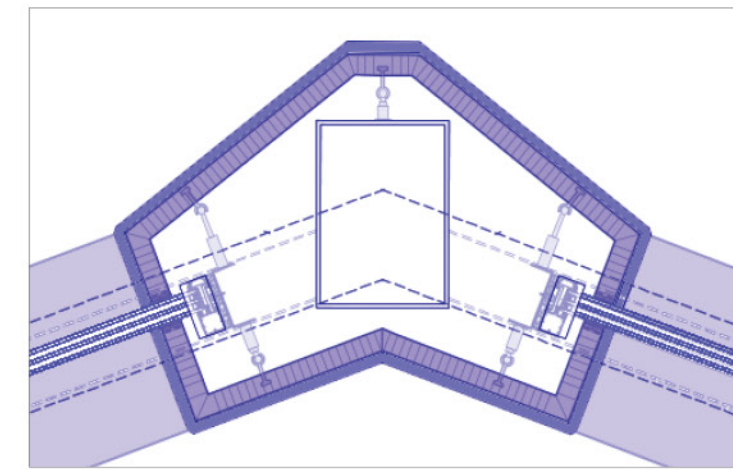
DETAIL OF THE PANELS SC: 1.50
Connection of the panels to the structure



DETAIL OF THE PANELS SC.1:50
how it is connected to the structure and space

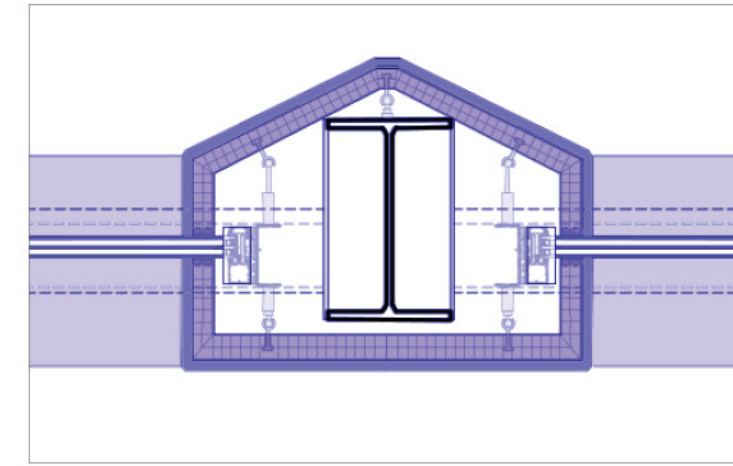


ARCHITECTURAL DETAIL
Joints, curtain walls , balcony



DETAIL OF THE JOINT - TWO FACADES

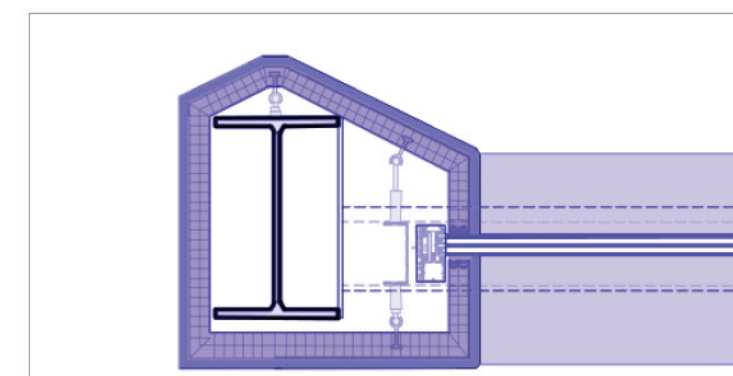
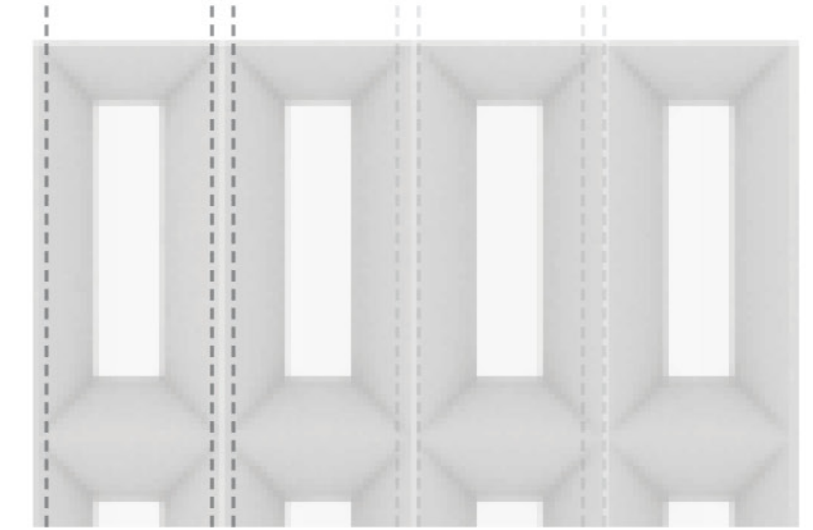
detachable panels in order to be able having a better maintenance.
inside of the panel as a wrap for the package of architecture, structure and insulations.



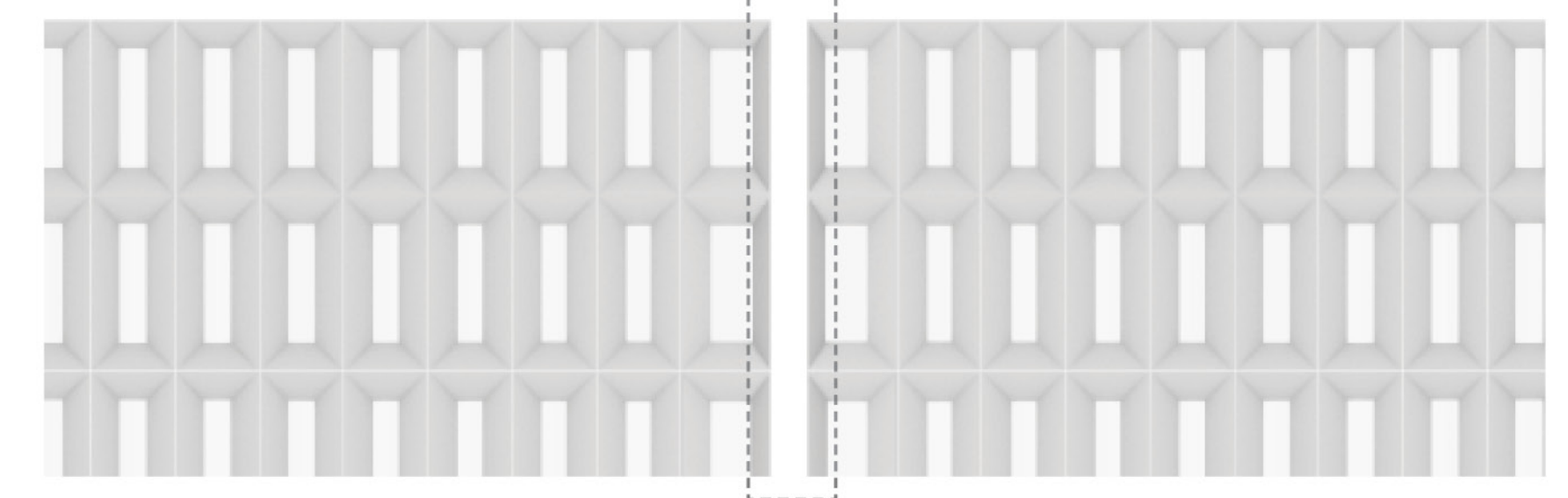
NO COLOUMN VISIBLE

no window frame visible
the less dimension for insulation due to the choice of the material for the panels

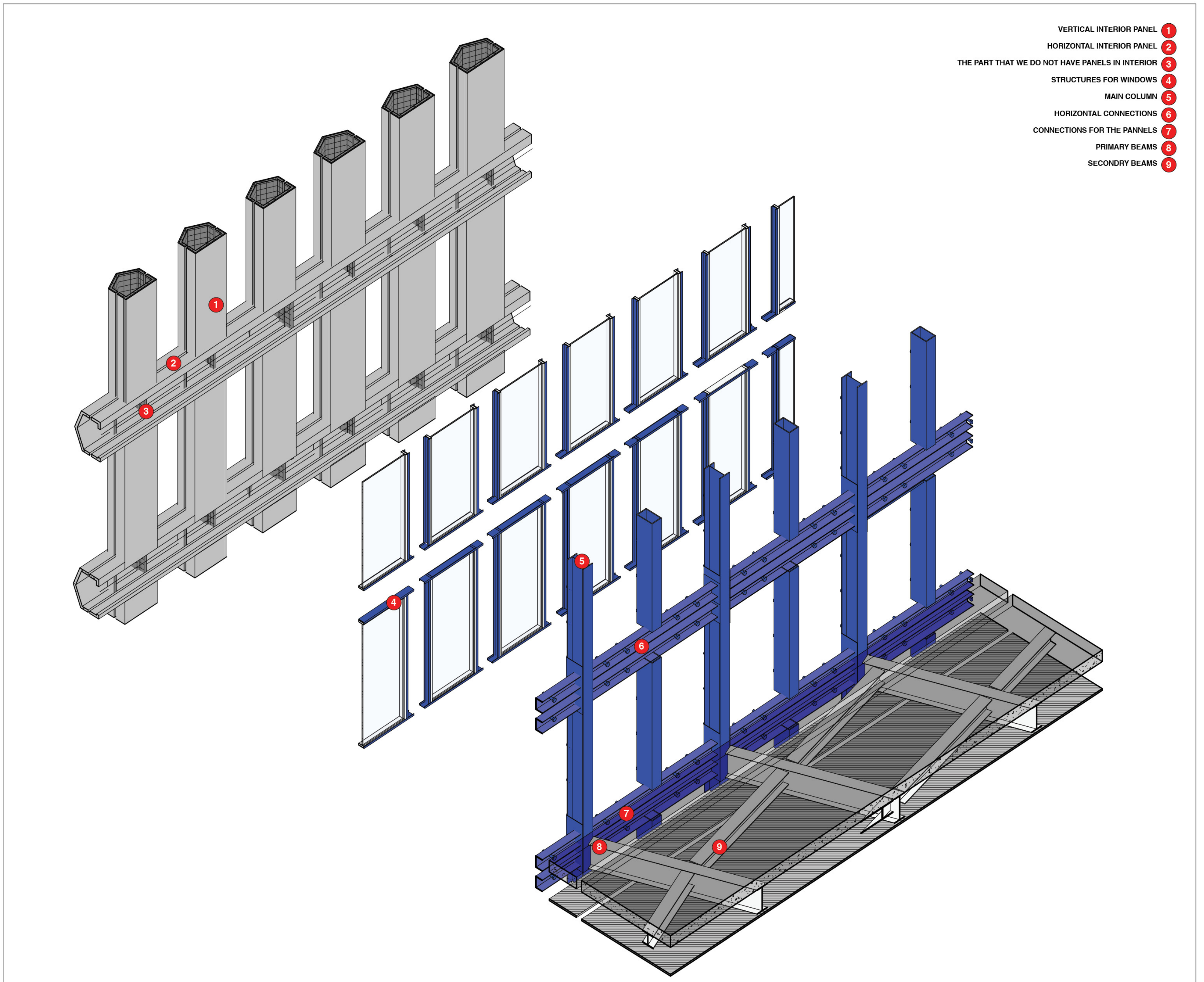
the corner regulars



location of the joint



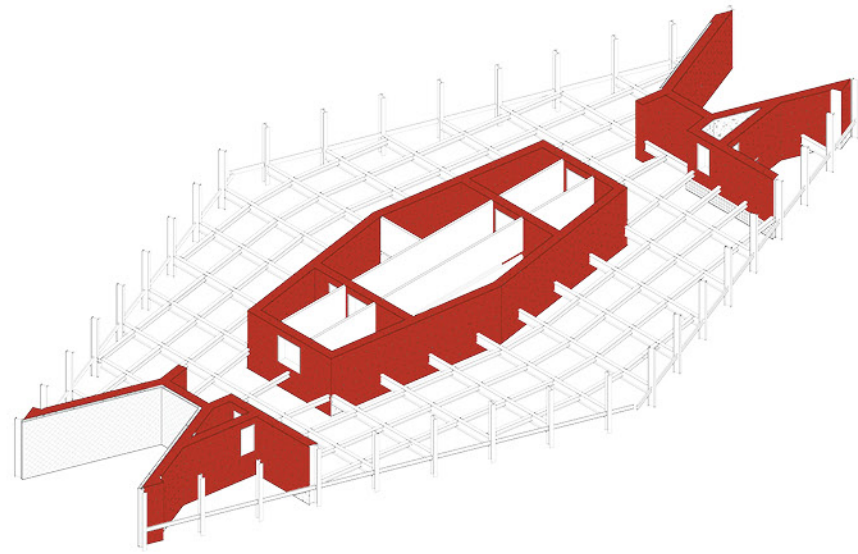
DETAIL OF THE PANEL SC.1:50
how it is connected to the structure and space



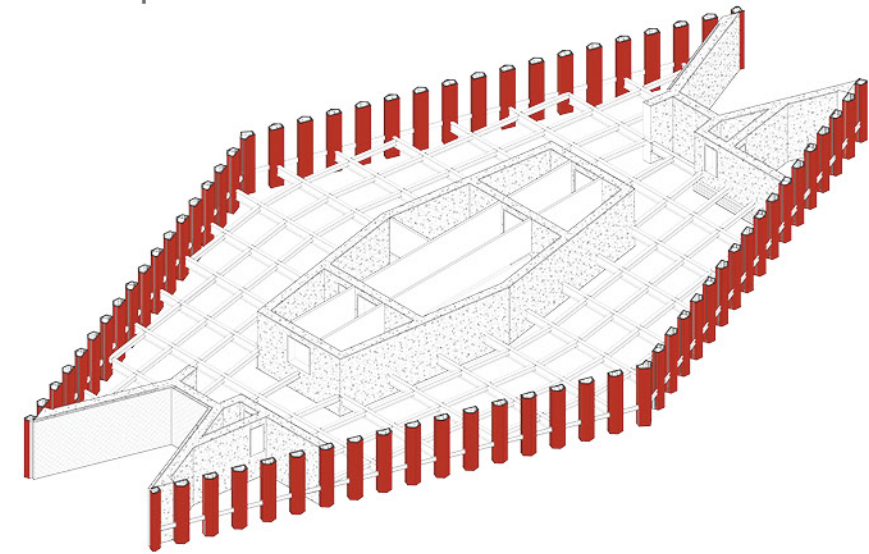
DETAIL OF THE PANELS AND STRUCTURE

The general idea of the panels and layout of the regular floors

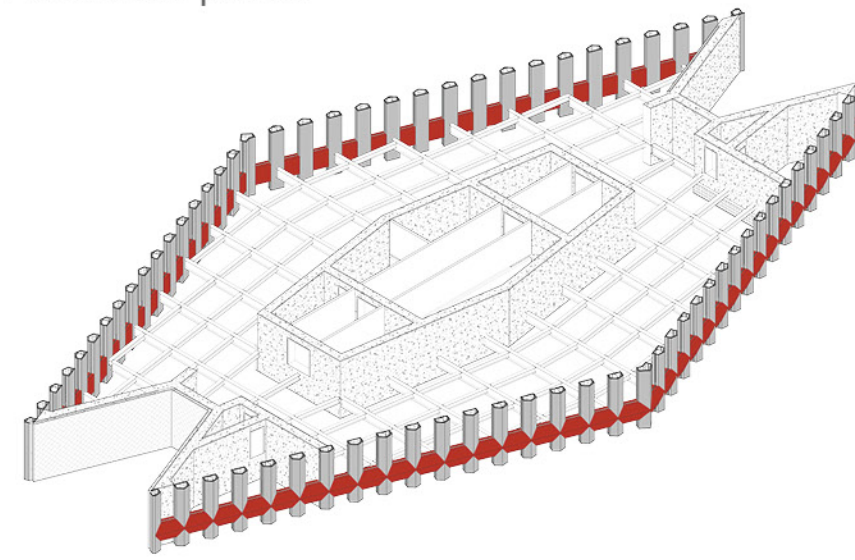
the main core in concrete



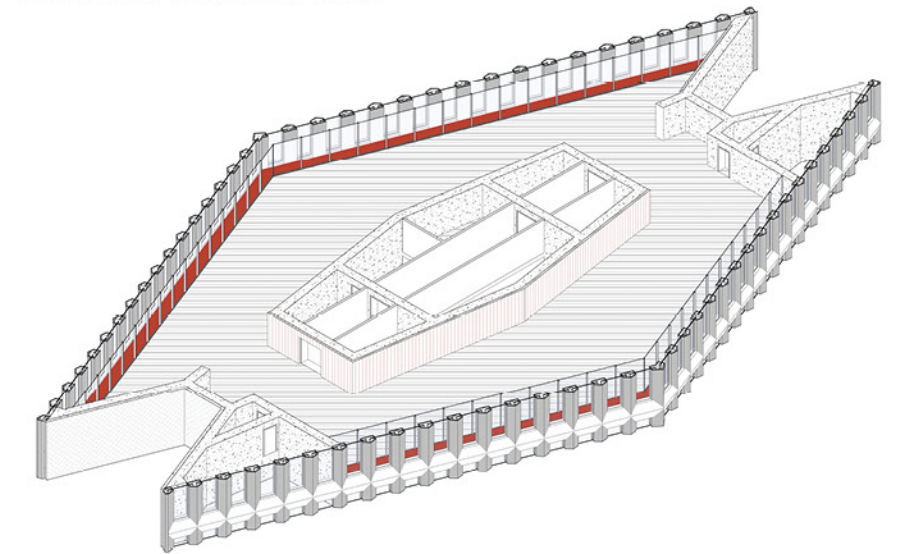
Vertical panels



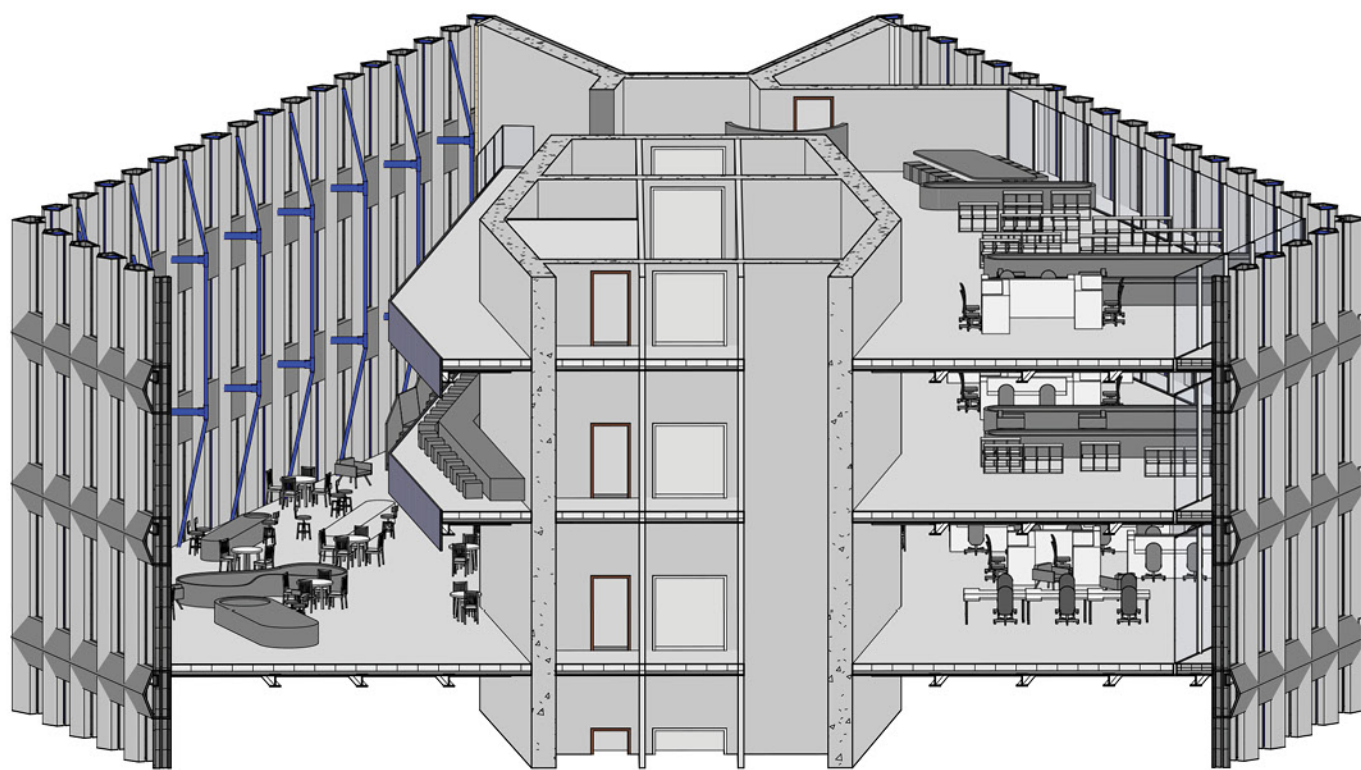
Horizontal panels



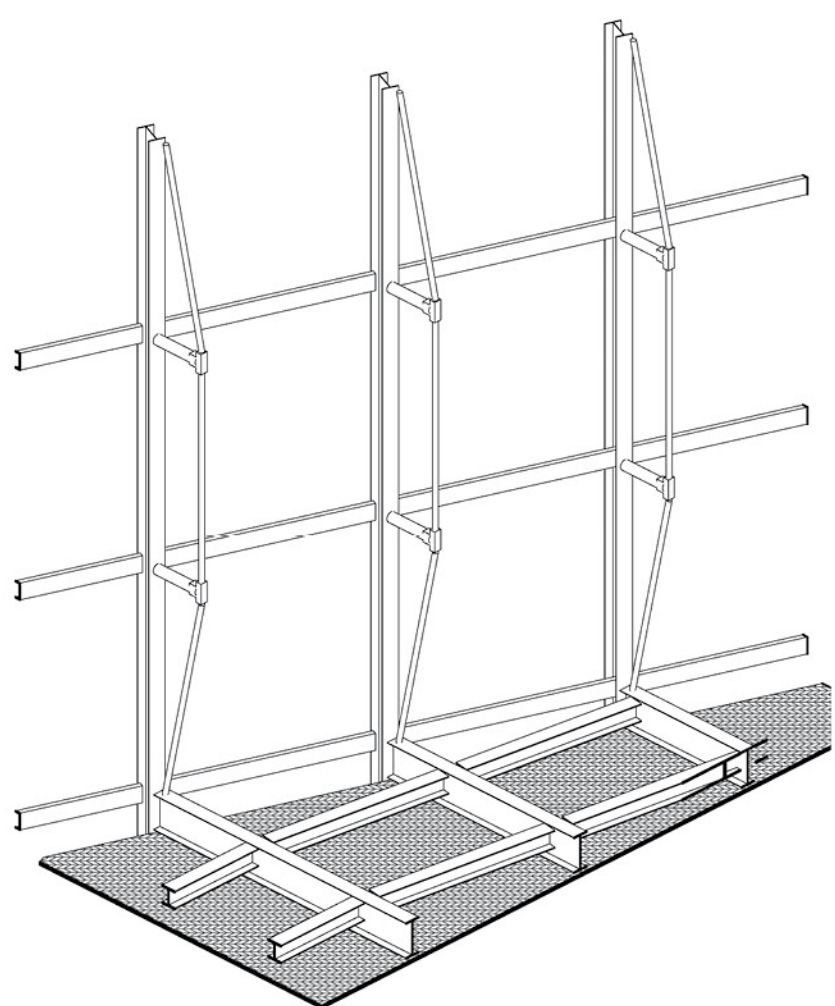
Doubled facaded floor



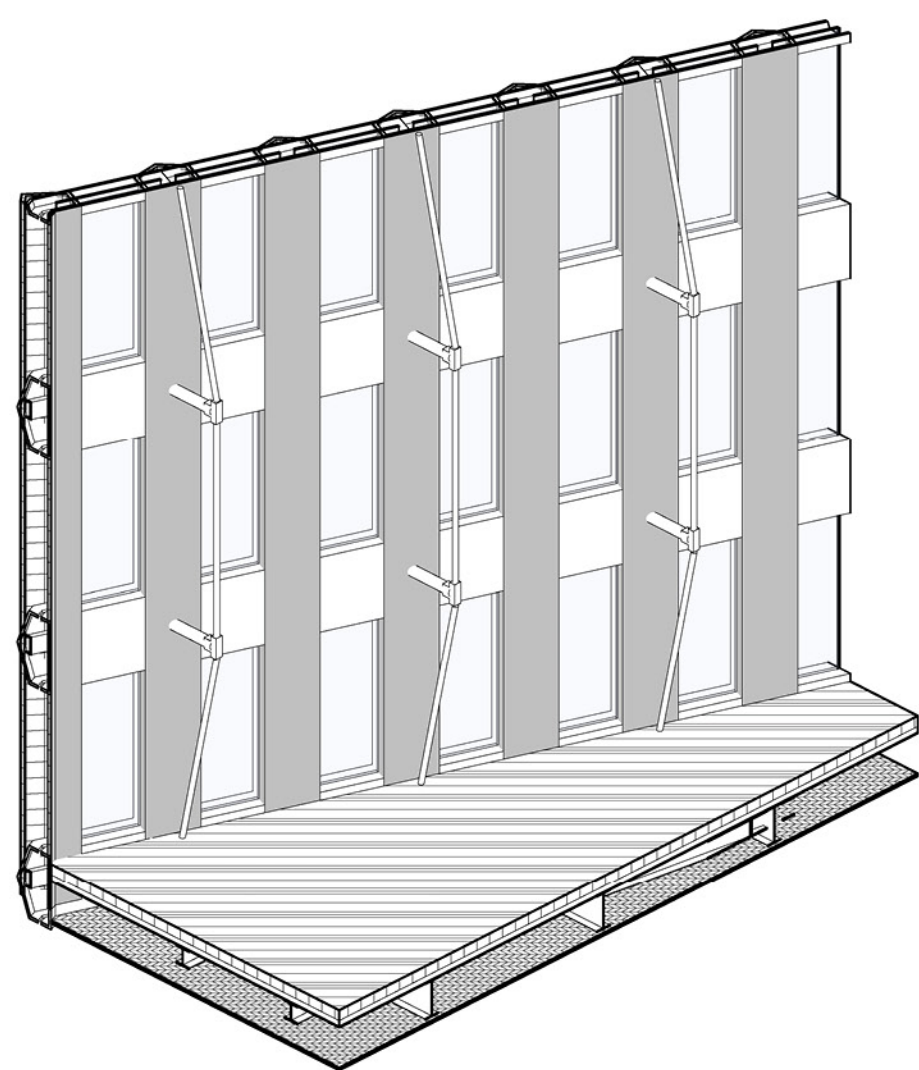
Triple height structural element in the interior



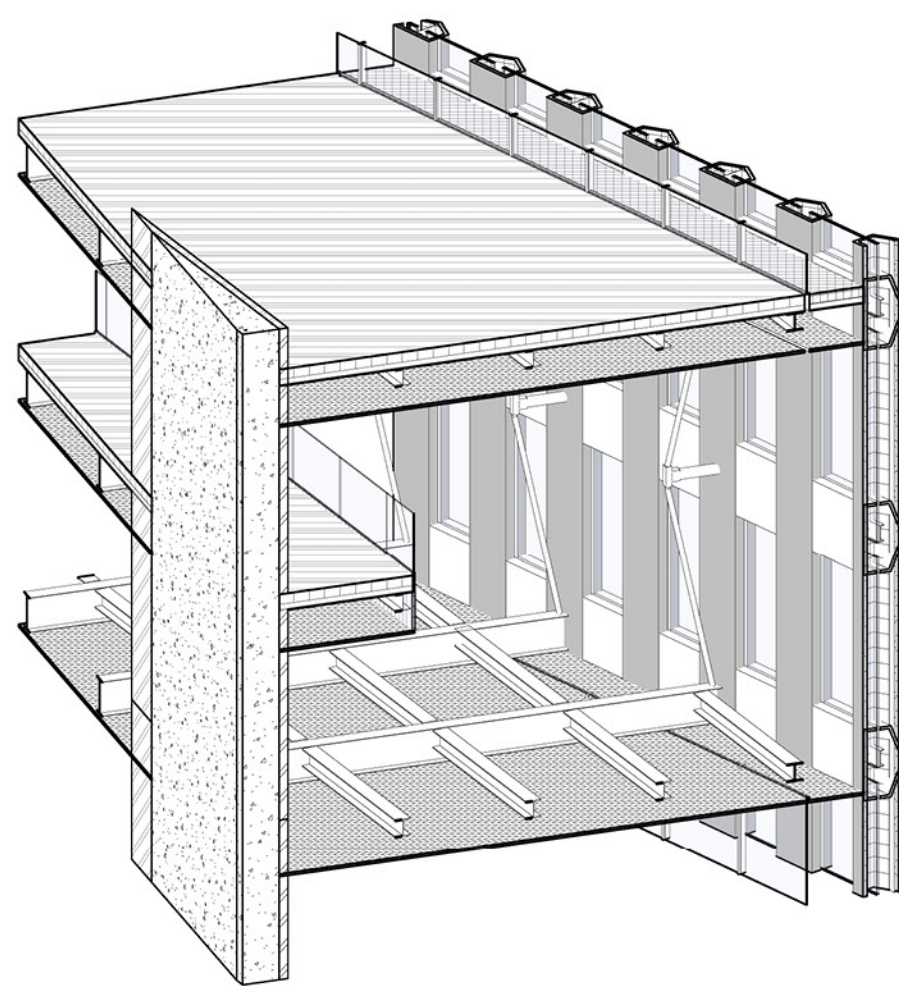
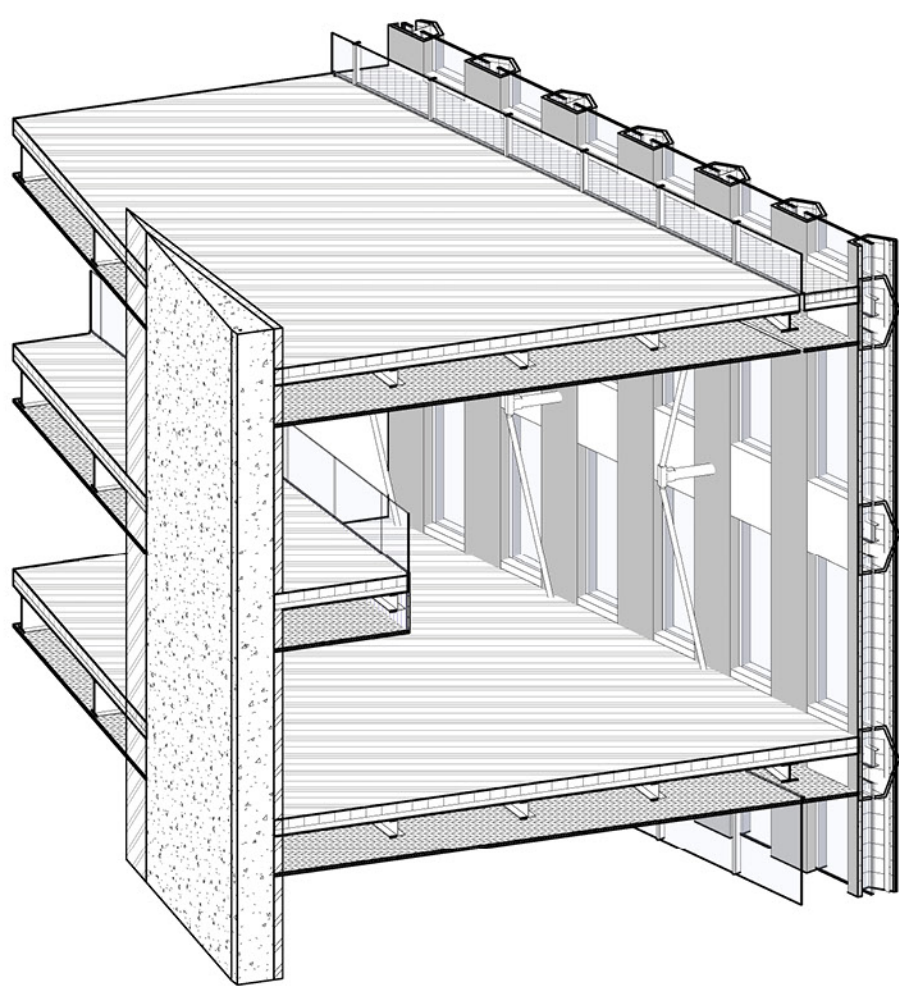
connection of vertical cables with structure
Section axonometric of floors



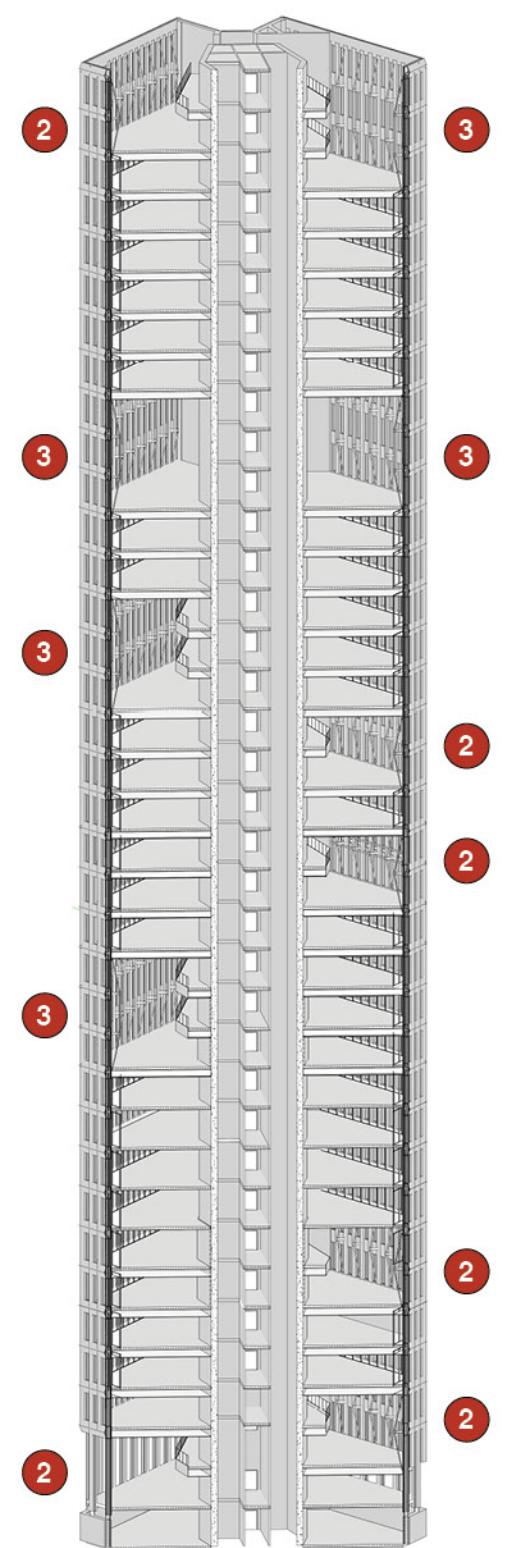
relation of facade and interior space
in triple height atriums



Double height atriums - detail



the city harbour - sea port



3D wall section

main column

column and their horizontal connections are hidden in the facade panels

main core

in regular floors we have double facade with possibility of having access and use it as a balconies

PV glasses

aside from pv glasses on the roof and some part of the facade we have them also in these parts

slabs structure

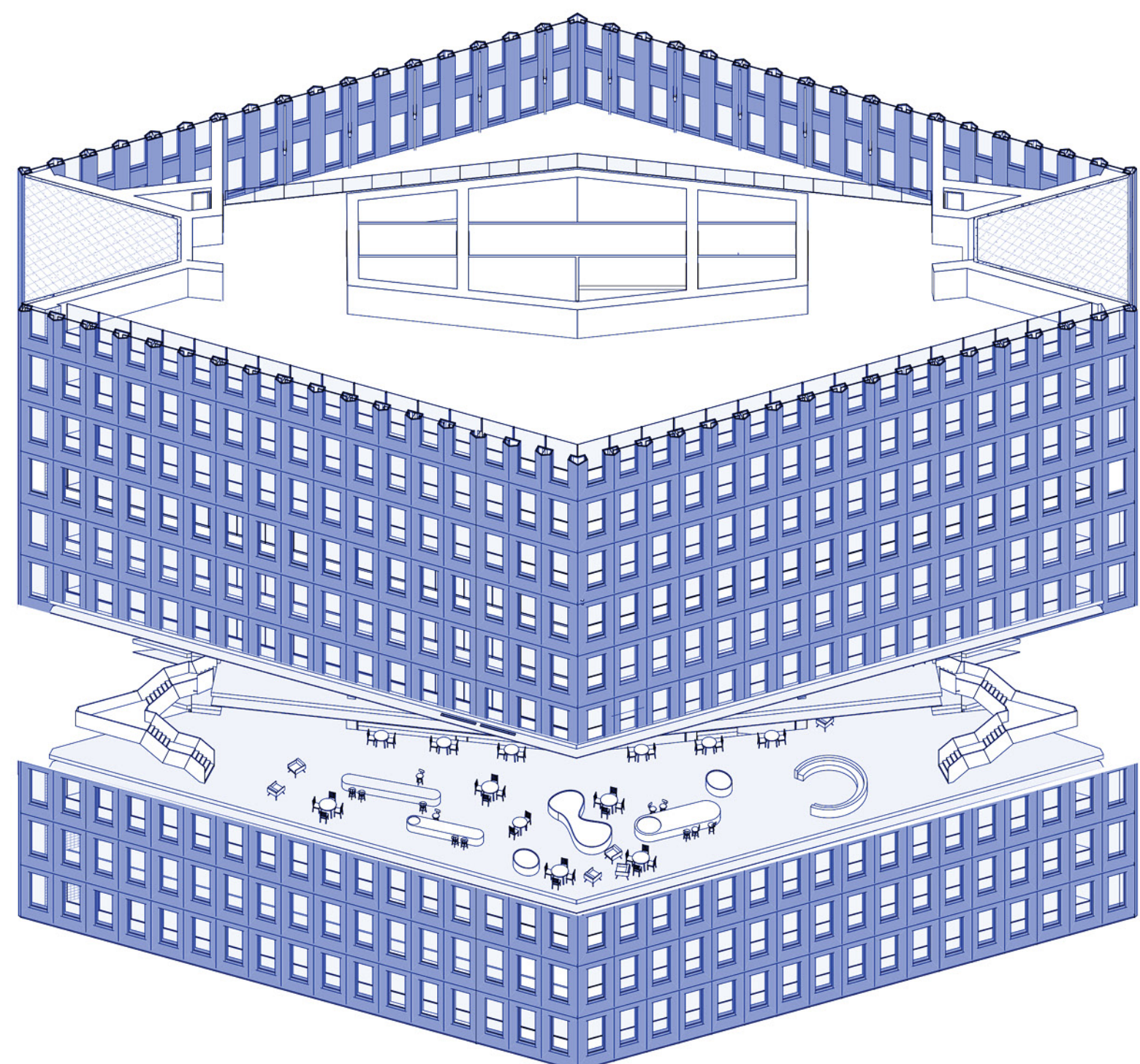
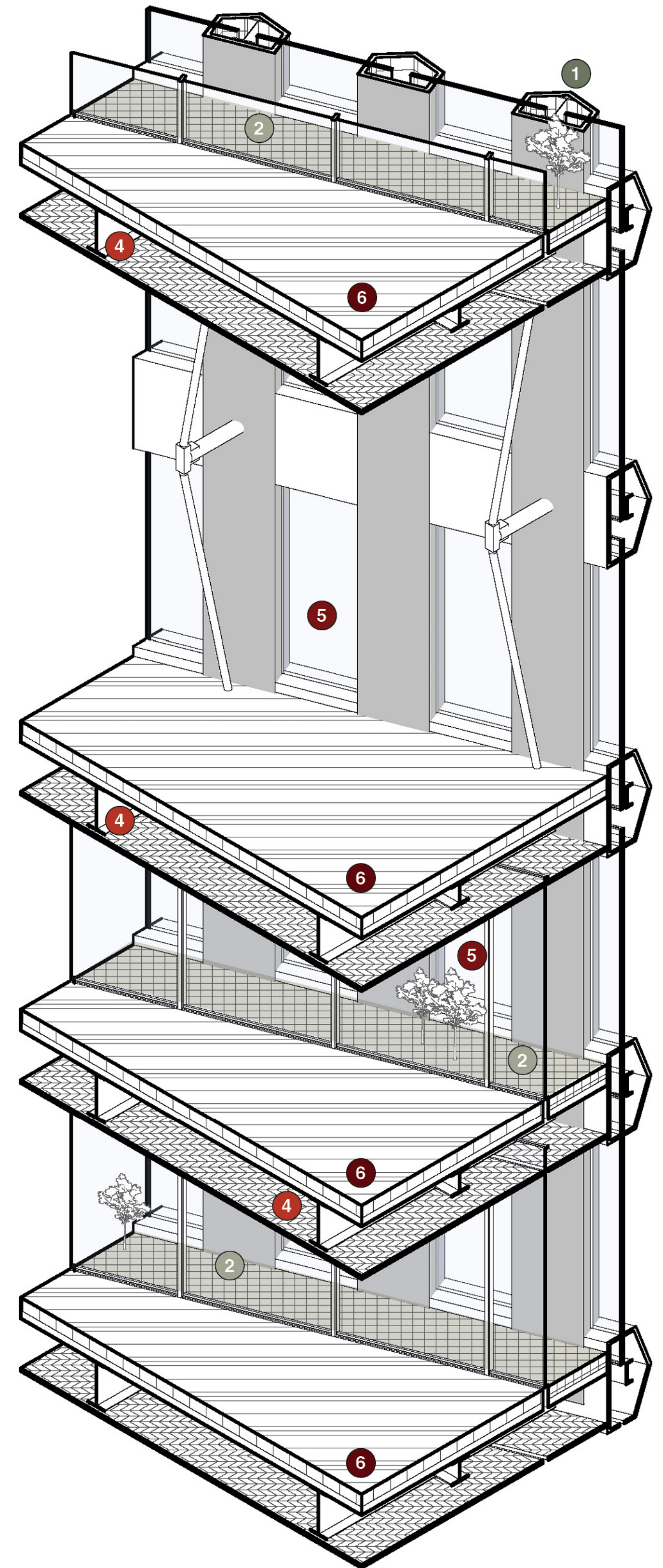
contains honeycomb beam that has the capacity to contain mechanical and electrical features

facade glasses

three layered high performance glass for the better thermal insulation

layers of the floors

we have acoustic insulation and CLT panels and honeycomb beam



STRUCTURAL COLCULATIONS

LOADS

CHARACTERISTICS OF BEAM

Beam span: 11,75 m
Competence distance: 4,0 m

DEAD LOADS

G1 Dead Load (structure): 3,57 kN/m
HEA700 - HEA300
2,04kN/m + 1,52kN/m

G2 Dead Load (slab): 12,23 kN/m
CLT slab: 0,771kN/m2
Materials x 4,0 m
3,06kN/m2 x 4,0 m

LIVE LOADS

Q Live load (office): 12,0 kN/m
Category B
3,0 kN/m2 x 4,0 m

PRINCIPAL BEAMS ULS

$q = (G1x1,3) + (G2x1,3) + (Qx1,5)$
 $q = (3,56kN/m \times 1,3) + (12,23kN/m \times 1,3) + (12kN/m \times 1,5)$
 $q = 38,54kN/m$

$M_{max} = 1/8 \times q \times L^2$
 $M_{max} = 1/8 \times 38,54 \text{ kN/m} \times (11,75 \text{ m})^2$
 $M_{max} = 665 \text{ kNm}$

$M_{pl} = W_{pl} \times (F_y/M_0)$
 $M_{pl} = 0,007032 \text{ m}^3 \times (275000 \text{ kN/m}^2 / 1,05)$
 $M_{pl} = 1841,71 \text{ kNm}$

$M_{pl} > M_{max}$
 $1841,71 \text{ kNm} > 665 \text{ kNm}$
Resistance check

LOADS

CHARACTERISTICS OF BEAM

Beam span: 3,7 m
Competence distance: 2,3 m

DEAD LOADS

G1 Dead Load (structure): 1,12 kN/m
HEA300
1,12 kN/m

G2 Dead Load (slab): 7,04 kN/m
CLT slab: 0,771kN/m2
Materials x 2,3 m
3,06kN/m2 x 2,3 m

LIVE LOADS

Q Live load (office): 6,9 kN/m
Category B
3,0 kN/m2 x 4,0 m

SECONDARY BEAMS ULS

$q = (G1x1,3) + (G2x1,3) + (Qx1,5)$
 $q = (1,12kN/m \times 1,3) + (7,04kN/m \times 1,3) + (6,9kN/m \times 1,5)$
 $q = 20,96 \text{ kN/m}$

$M_{max} = 1/8 \times q \times L^2$
 $M_{max} = 1/8 \times 20,96 \text{ kN/m} \times (3,7 \text{ m})^2$
 $M_{max} = 35,86 \text{ kNm}$

$M_{pl} = W_{pl} \times (F_y/M_0)$
 $M_{pl} = 0,002088 \text{ m}^3 \times (275000 \text{ kN/m}^2 / 1,05)$
 $M_{pl} = 546,85 \text{ kNm}$

$M_{pl} > M_{max}$
 $546,85 \text{ kNm} > 35,86 \text{ kNm}$
Resistance check

LOADS

CHARACTERISTICS OF THE COLUMN

Column span: 4,50 m
Area of influence: 21,99 m

DEAD LOADS

G1 Dead Load (structure): 3,57 kN/m
HEA700 - HEA300
2,04kN/m + 1,52kN/m

G2 Dead Load (slab): 6,67 kN/m
CLT slab + pvc + glazing
3,06 kN/m + 1,91 kN/m + 1,70 kN/m

LIVE LOADS

Q Live load (office): 12,0 kN/m
Category B
3,0 kN/m2 x 4,0 m

COLUMN

$q = (G1x1,3) + (G2x1,3) + (Qx1,5)$
 $q = (3,56kN/m \times 1,3) + (6,67kN/m \times 1,3) + (12kN/m \times 1,5)$
 $q = 31,31kN/m$

$l_{max/min} = \sqrt{l/A}$
 $l_{max/min} = \sqrt{0,000869 \text{ m}^4 / 0,0197 \text{ m}^2}$
 $l_{max/min} = 0,210 \text{ m}$

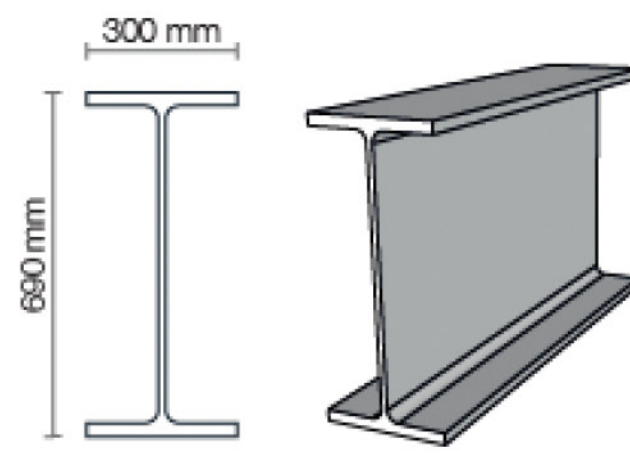
$\lambda = l_0 / i_{min}$
 $\lambda = 4,50 \text{ m} / 0,210 \text{ m}$
 $\lambda = 21,42$

$\lambda_p = \pi \times \sqrt{E} / f_y$
 $\lambda_p = 93,91$

$\lambda_{ref} = \lambda / \lambda_p$
 $\lambda_{ref} = 21,42 \text{ m} / 93,91$
 $\lambda_{ref} = 0,23$

PRINCIPAL BEAM HEA700

$h = 690 \text{ mm}$
 $b = 300 \text{ mm}$
 $t_w = 14,5 \text{ mm}$
 $G = 204 \text{ kg/m}$
 $I_y = 0,002153 \text{ m}^4$
 $W_{ply} = 0,007032 \text{ m}^3$
 $I_y = 28,75 \times 10^8 \text{ mm}^4$
 $E = 200000000 \text{ kN/m}^2$



PRINCIPAL BEAMS SLS

$q = G1 + G2 + Q$
 $q = 3,56 \text{ kN/m} + 12,23 \text{ kN/m} + 12,0 \text{ kN/m}$
 $q = 27,80 \text{ kN/m}$

$W_{max} / W_{min} < 1$

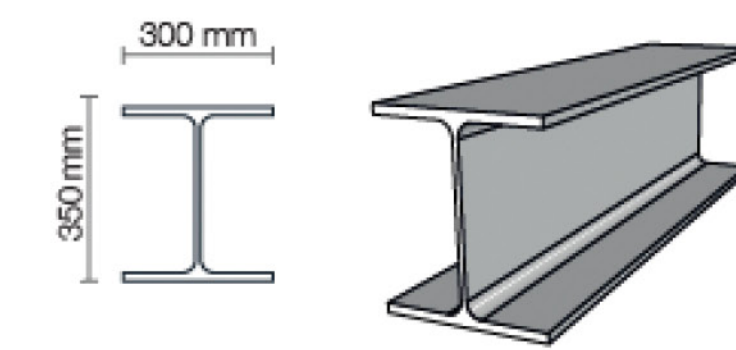
$W_{max} = (5/384) \times q \times L^4 / E \times I_y$
 $W_{max} = (5/384) \times 27,80 \text{ kN/m} \times 11,75 \text{ m}^4 / 200000000 \text{ kN/m}^2 \times 0,002153 \text{ m}^4$
 $W_{max} = 0,016$

$W_{min} = 1/250 \times L$
 $W_{min} = 1/250 \times 11,75 \text{ m}$
 $W_{min} = 0,047$

$W_{max} / W_{min} < 1$
 $0,016 / 0,047$
 $0,34 < 1$
Resistance check

SECONDARY BEAM HEA300

$h = 350 \text{ mm}$
 $b = 300 \text{ mm}$
 $t_w = 10,0 \text{ mm}$
 $G = 112 \text{ kg/m}$
 $I_y = 0,0003309 \text{ m}^4$
 $W_{ply} = 0,002088 \text{ m}^3$
 $I_y = 15,22 \times 10^8 \text{ mm}^4$
 $E = 200000000 \text{ kN/m}^2$



SECONDARY BEAMS SLS

$q = G1 + G2 + Q$
 $q = 1,12 \text{ kN/m} + 7,04 \text{ kN/m} + 6,9 \text{ kN/m}$
 $q = 15,06 \text{ kN/m}$

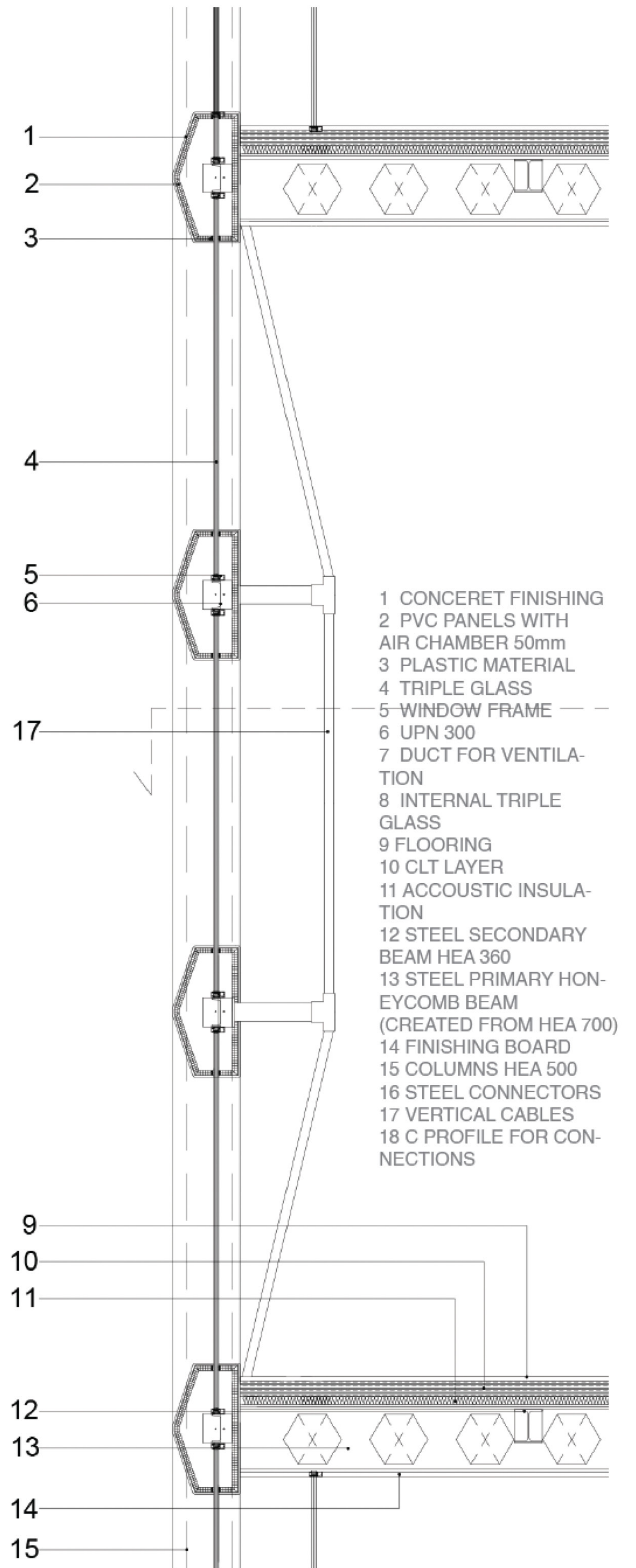
$W_{max} / W_{min} < 1$

$W_{max} = (5/384) \times q \times L^4 / E \times I_y$
 $W_{max} = (5/384) \times 15,06 \text{ kN/m} \times 3,7 \text{ m}^4 / 200000000 \text{ kN/m}^2 \times 0,0003309 \text{ m}^4$
 $W_{max} = 0,000555$

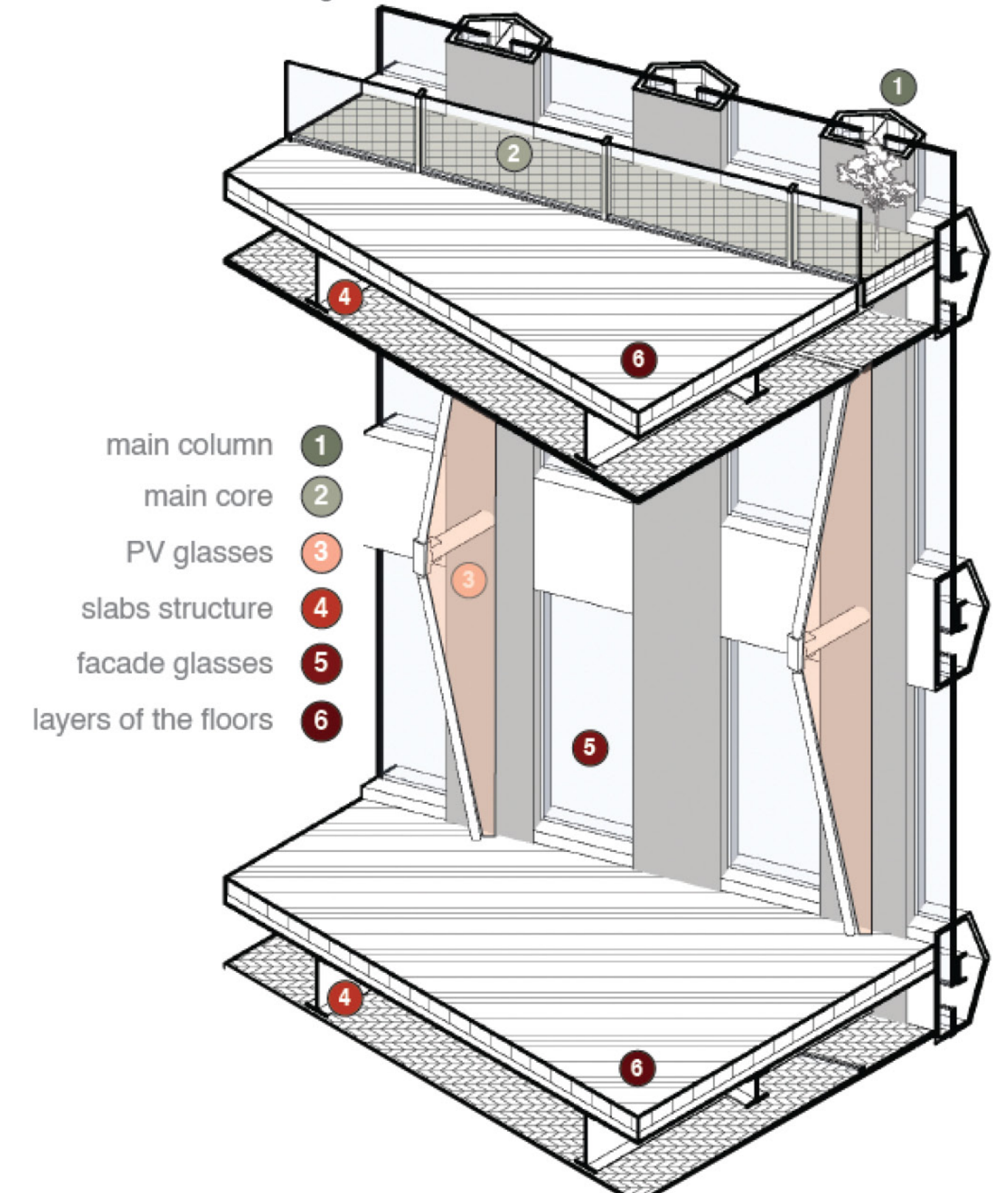
$W_{min} = 1/250 \times L$
 $W_{min} = 1/250 \times 3,7 \text{ m}$
 $W_{min} = 0,0148$

$W_{max} / W_{min} < 1$
 $0,000555 / 0,0148$
 $0,04 < 1$
Resistance check

Section of triple height atriums



Section axonometric of double height atriums



MIDAS CALCULATIONS
displacement , stress, buckling

MIDAS refers to a suite of software tools for civil and structural engineering analysis and design. MIDAS software is widely used for various engineering applications, including structural analysis, design, and optimization.

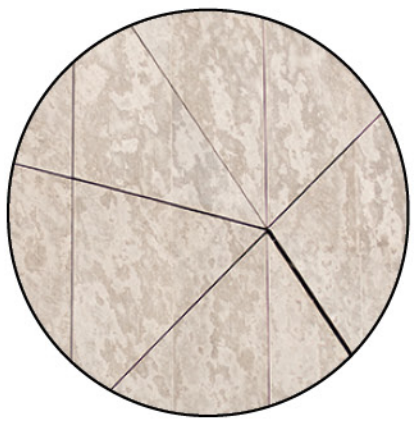
MIDAS CALCULATIONS
displacement , stress, buckling

MIDAS refers to a suite of software tools for civil and structural engineering analysis and design. MIDAS software is widely used for various engineering applications, including structural analysis, design, and optimization.

MATERIALS

Facade and material

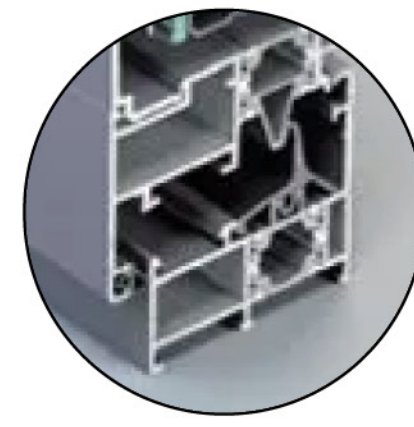
With an increasing focus on sustainability, architects and developers are choosing materials with a lower environmental impact. This includes considering the ecological footprint of raw material extraction, manufacturing processes, and the potential for recycling or reuse.



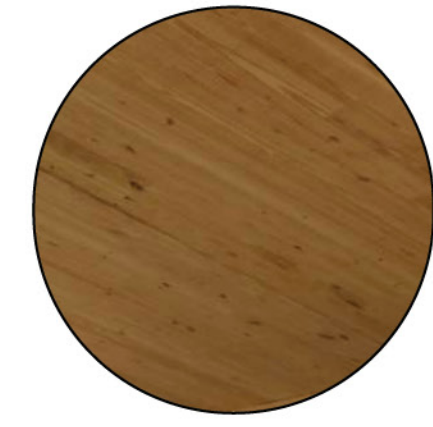
1. Fibre Cement
Facade finishing
Type: Finishing
Producer: SVK
Characteristic: light weight, natural beauty and texture of cement, easy clean, ventilated rainscreen cladding solution, Resistant to mould and bacteria
Website: <https://svk.global/en/blog/architect-talks-renovation-cavoe-zoe-seaside-hotel-cyprus>



2. Glass
Facade window
Type: Triple glazing
Producer: FinestreNurith
Characteristic: Transparent, high performance, $U_g = 0.7 \text{ W/m}^2\text{K}$, $\psi = 0.039 \text{ W/mK}$
Website: <https://www.nurith.it/en/products/pvc-windows/more/glass/triple-glazing>



3. Aluminium
Facade panels
Type: aluminium air chamber
Producer: Serr blind
Characteristic: light weight, prefabricated, thermal isolated, acoustic isolated
Website: <http://www.serrblind.com/serr-blind--serramenti-in-alluminio.html>



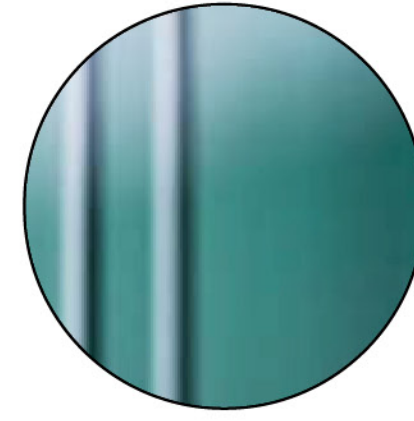
4. CLT
Internal pavement
Type: CLT pavement
Producer: Swedish wood
Characteristic: High strength in relation to the self-weight, Small manufacturing tolerances, Good load-bearing capacity in fire, Good thermal insulation capacity, Low self-weight.
Website: <https://www.swedishwood.com>



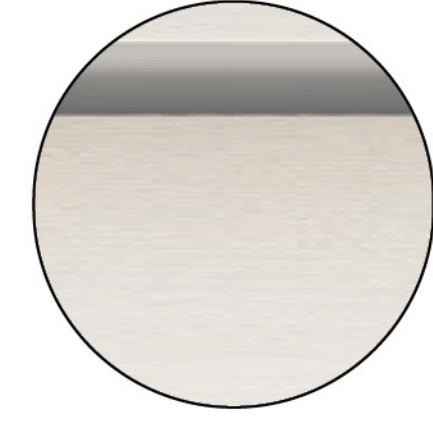
5. Stainless Steel Water Ripple Sheet
The core finishing
Type: Finishing
Producer: ISteel Color S.p.A.
Location: Italy
EPD no.: S-P-00690
Website: <https://www.integra-groep.com/wp-content/uploads/2020/01/Integra-wood-ceiling-wall-system.pdf>



6. Clay Stoneware Tiles
Floor finishing
Type: Finishing
Producer: Gruppo Ceramiche GRESMALT
Location: Italy
EPD no.: EPDITALY0080
Website: <https://www.gresmalt.it/wp-content/uploads/2021/05/EPD-GRESMALT-0001-20.pdf>



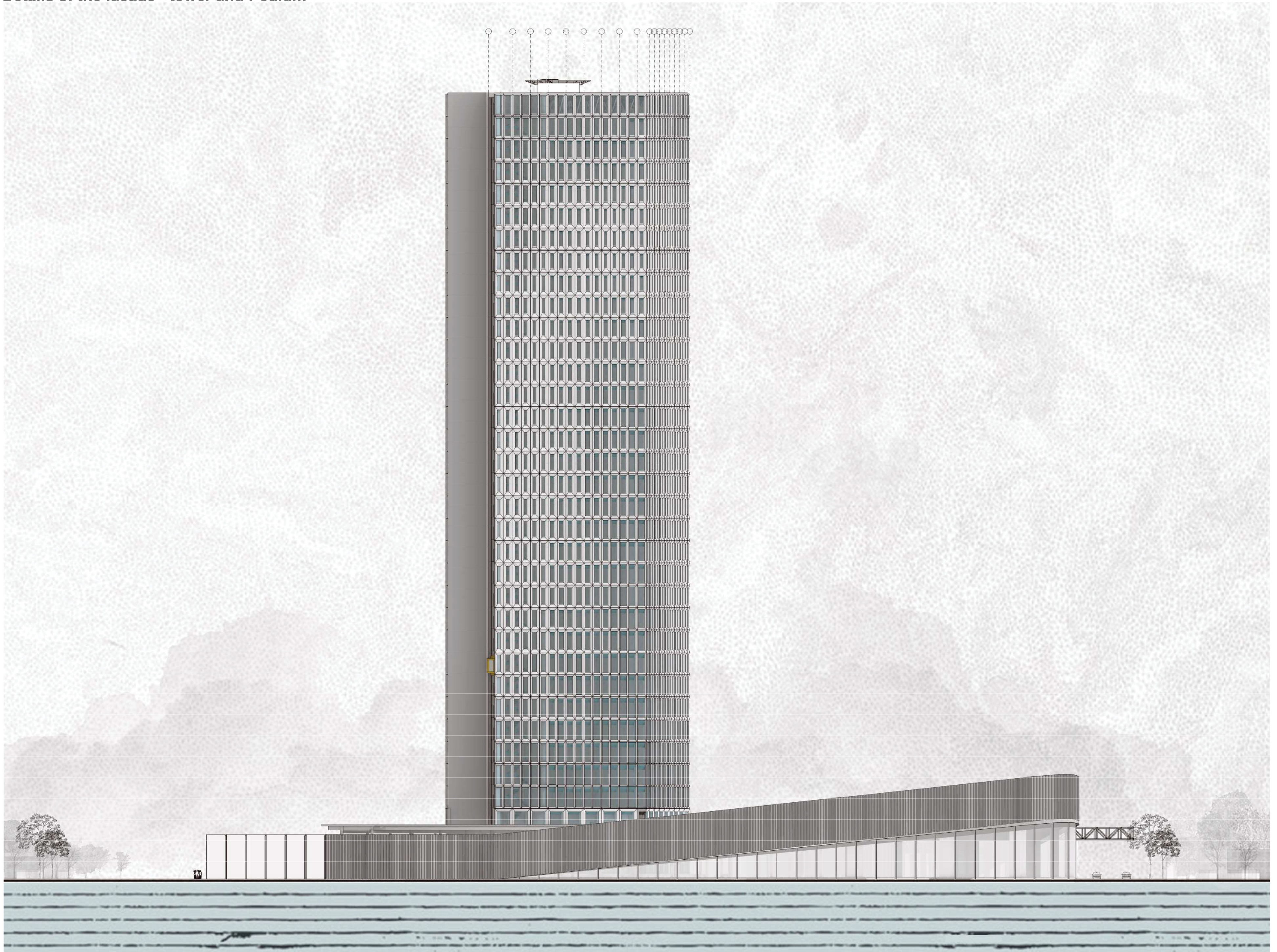
7. Double/ Triple Insulation
Podium glazing
Type: Glazing
Producer: Okalux Glastechnik
Location: Sweden
EPD no.: M-EPD-MIG-GB-002029
Website: <https://www.glastroesch.com/ch/de/>



8. Suspended Ceiling with Mineral Binder
Type: Finishing
Producer: Knauf Ceiling Solutions
Location: France
<https://www.knaufceilingsolutions.com/en/products/adagio-acoustic-plus/>

PARAMETRIC FACADE

Details of the facade - tower and Podium

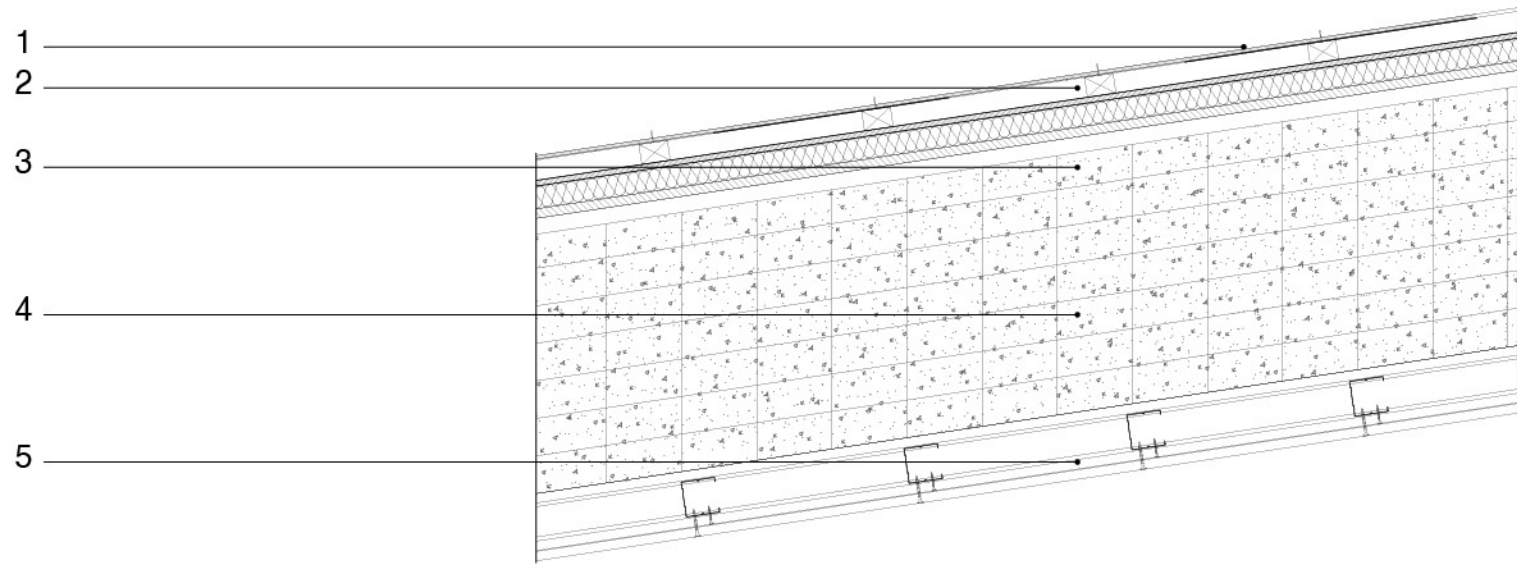


MATERIALS detail of the parts i material

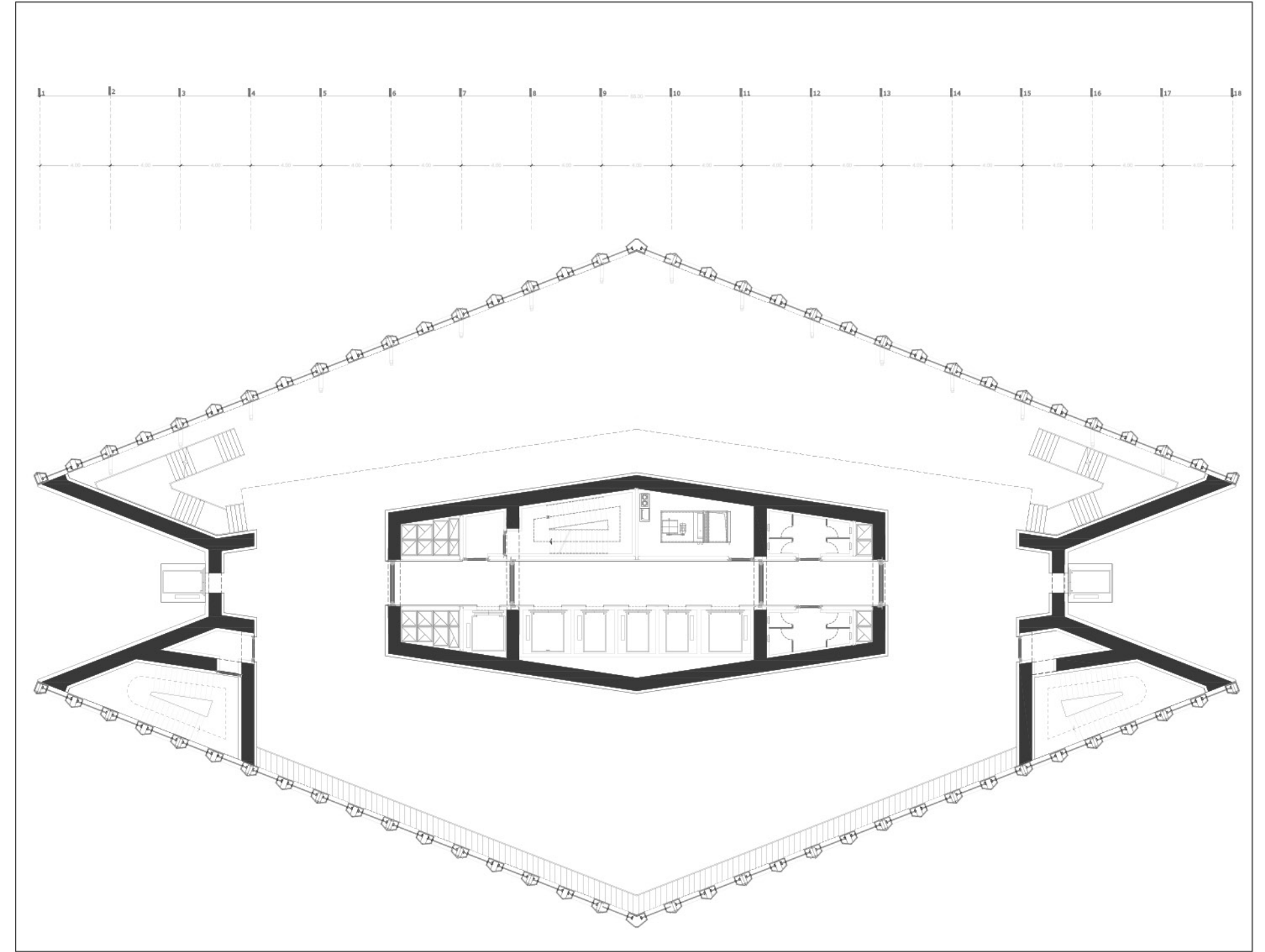
material selection in tower architecture influences not only the structural and safety aspects but also plays a key role in the aesthetic, environmental, and economic considerations of the construction project.

THE MAIN CORE

Technical details - stratigraphy

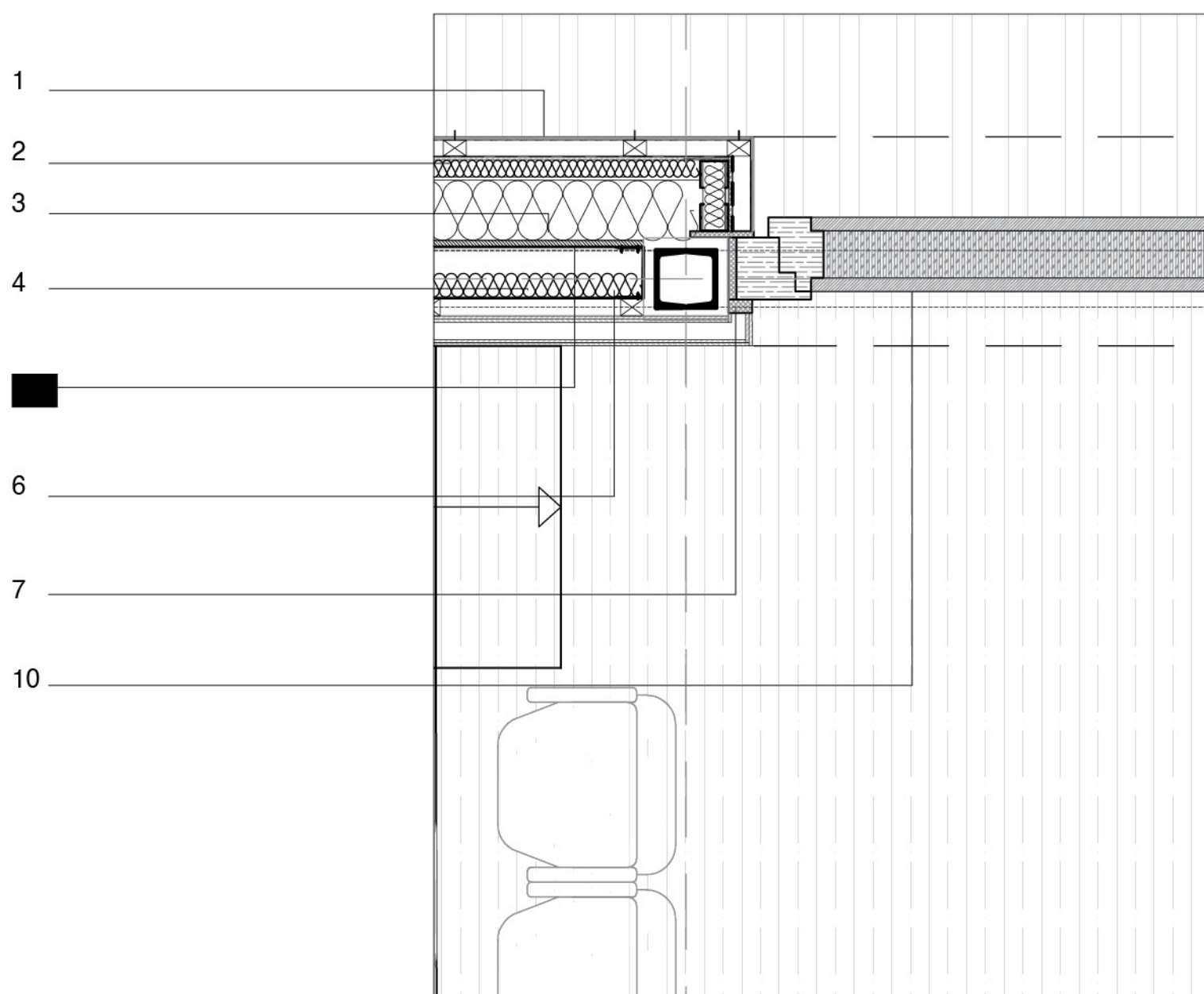


- 1 STAINLESS STEEL WATER RIPPLE SHEET
- 2 STUD AND RUNNER FOR THE FINISHING IN STAINLESS STEEL
- 3 KNAUF INSULATION BODEN-DÄMMPLATTE TPD (60 MM)
- 4 REINFORCEMENT CONCRETET C25/30
- 5 CLAY STONEWARE TILES (20MM)

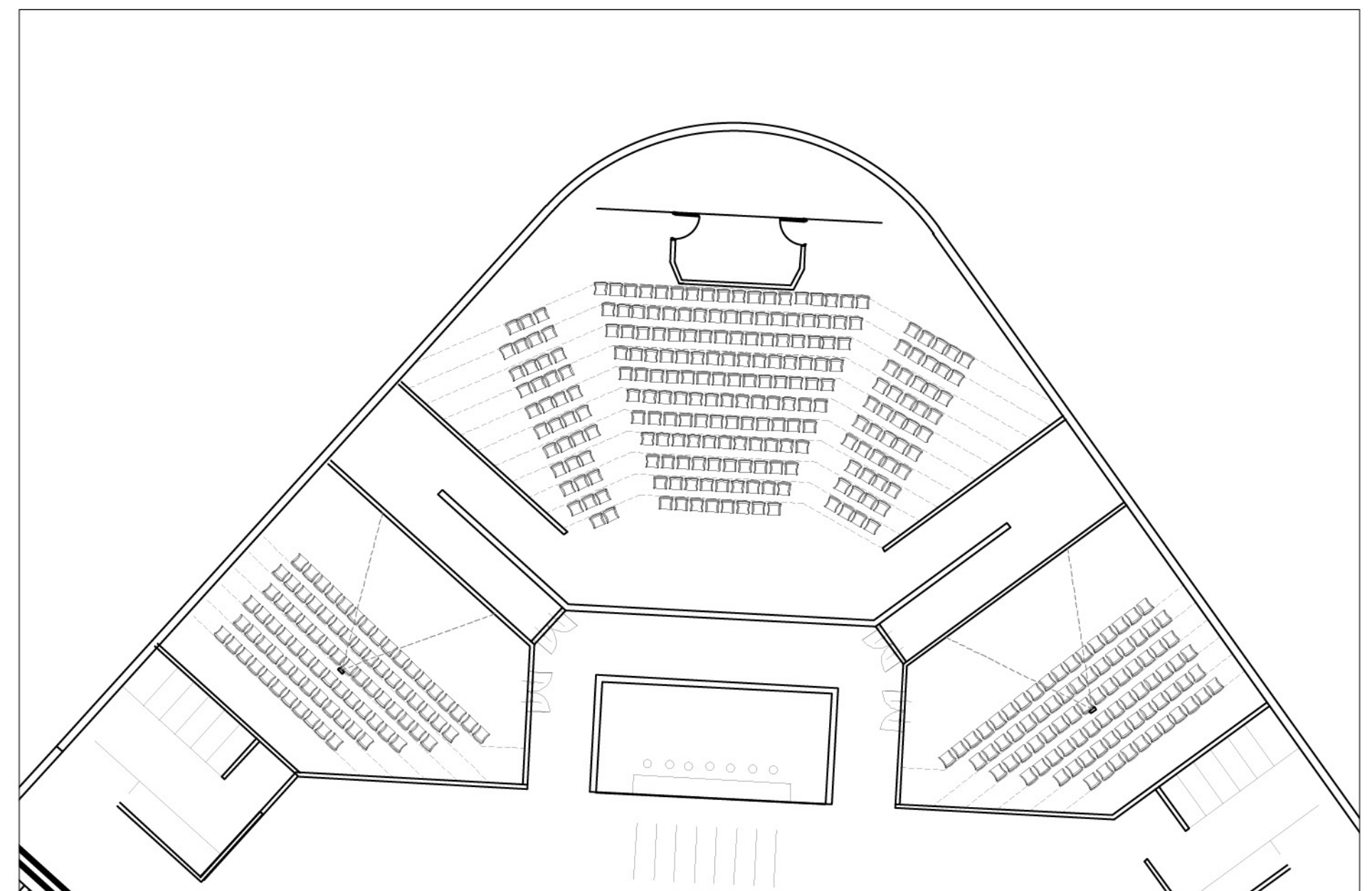


PODIUM MATERIALS

Technical details - Auditorium

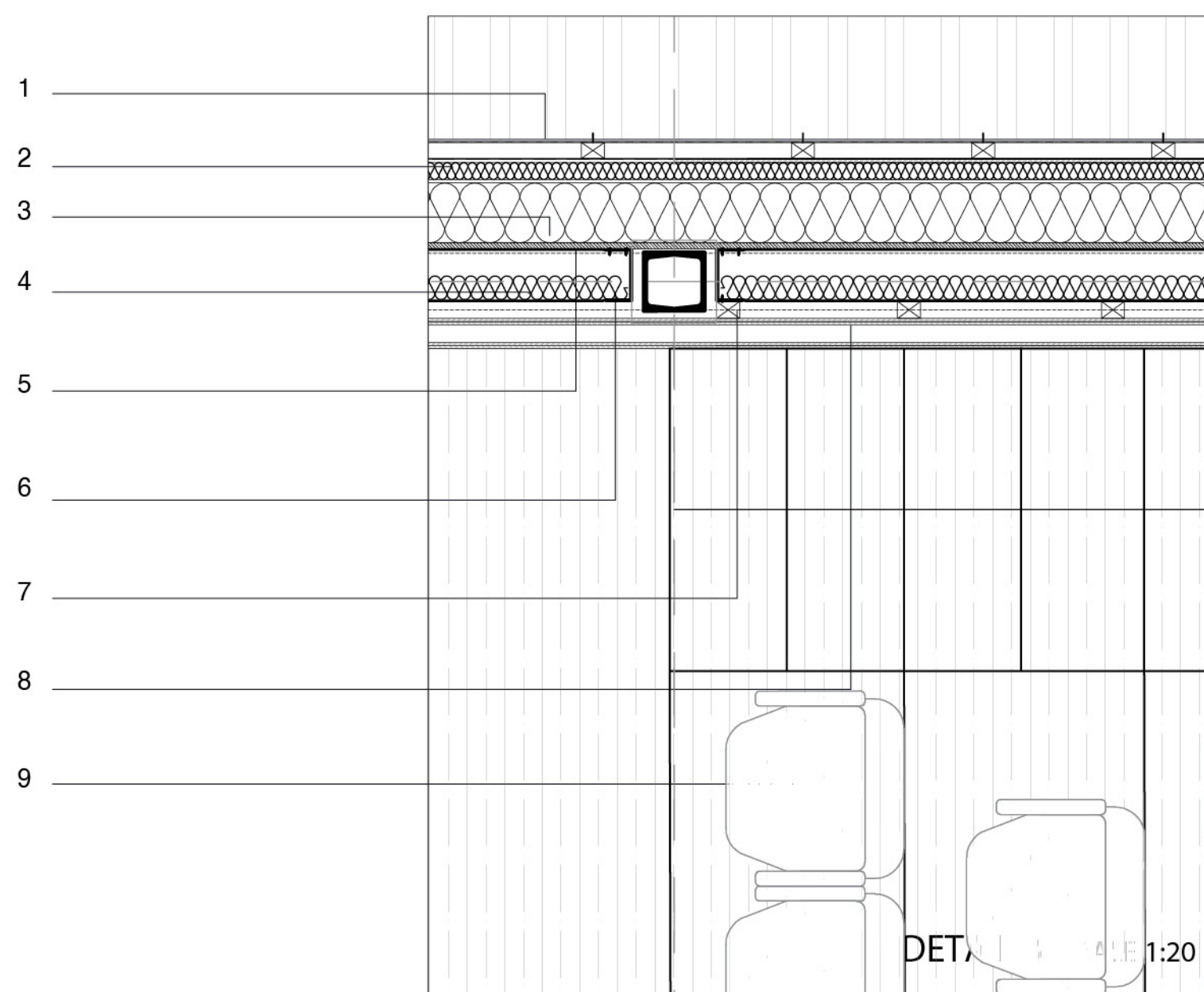


AUDITORIUM DOOR DETAIL SCALE 1:20

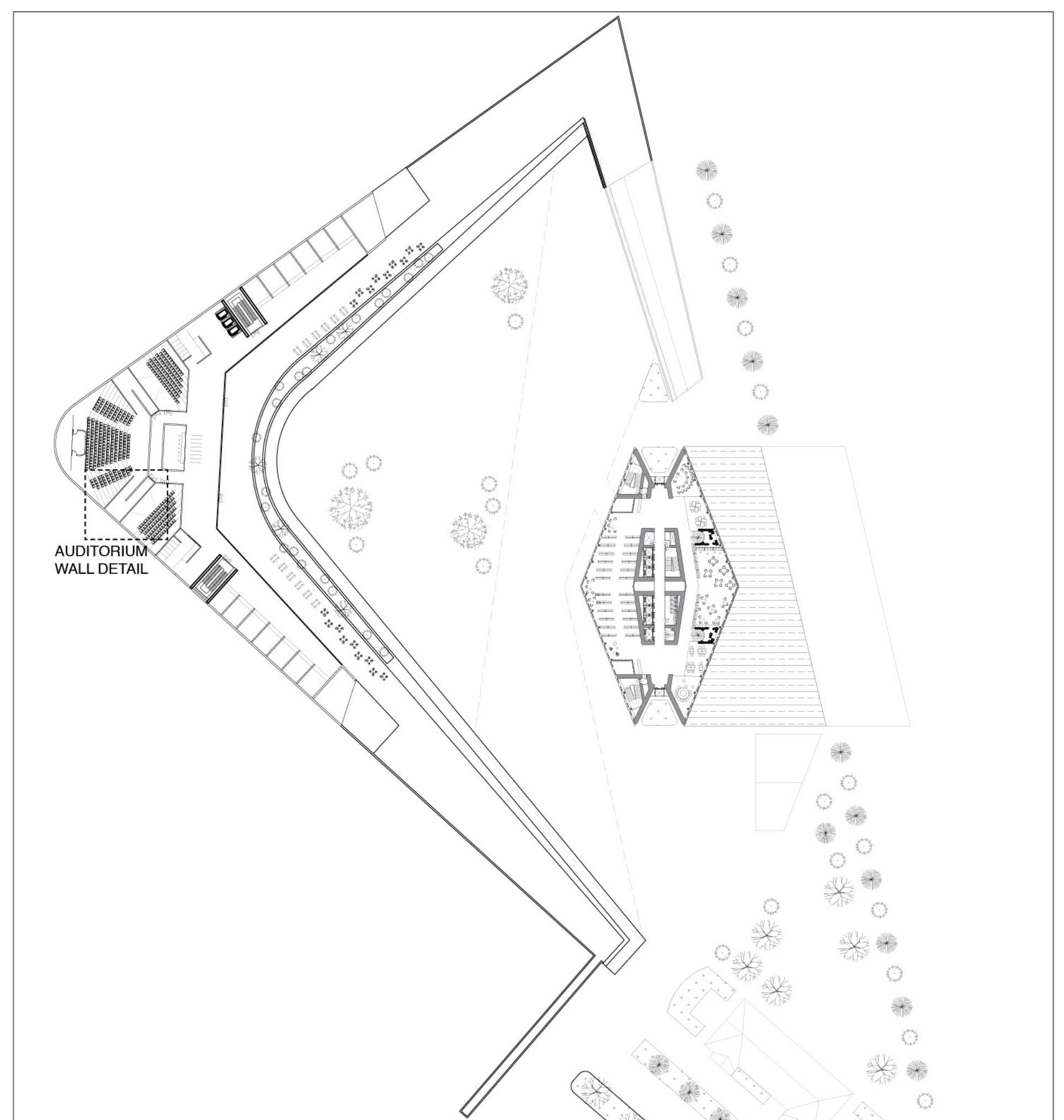


PODIUM AUDITORIUM FLOOR PLAN SCALE 1:500

- | | |
|--------------------------------------|--------------------------------|
| 1 EXTERIOR WOODEN PANEL | 6 DRYWALL |
| 2 FIRST LAYER OF INSULATION | 7 28mm TIMBER BATTEN |
| 3 SECOND LAYER OF INSULATION | 8 INTERIOR AUDITORIUM CLADDING |
| 4 ACCOUSTIC DRY WALL WITH INSULATION | 9 AUDITORIUM SEATING |
| 5 BREATHABLE MEMBRANE | 10 ACCOUSTIC DOOR |



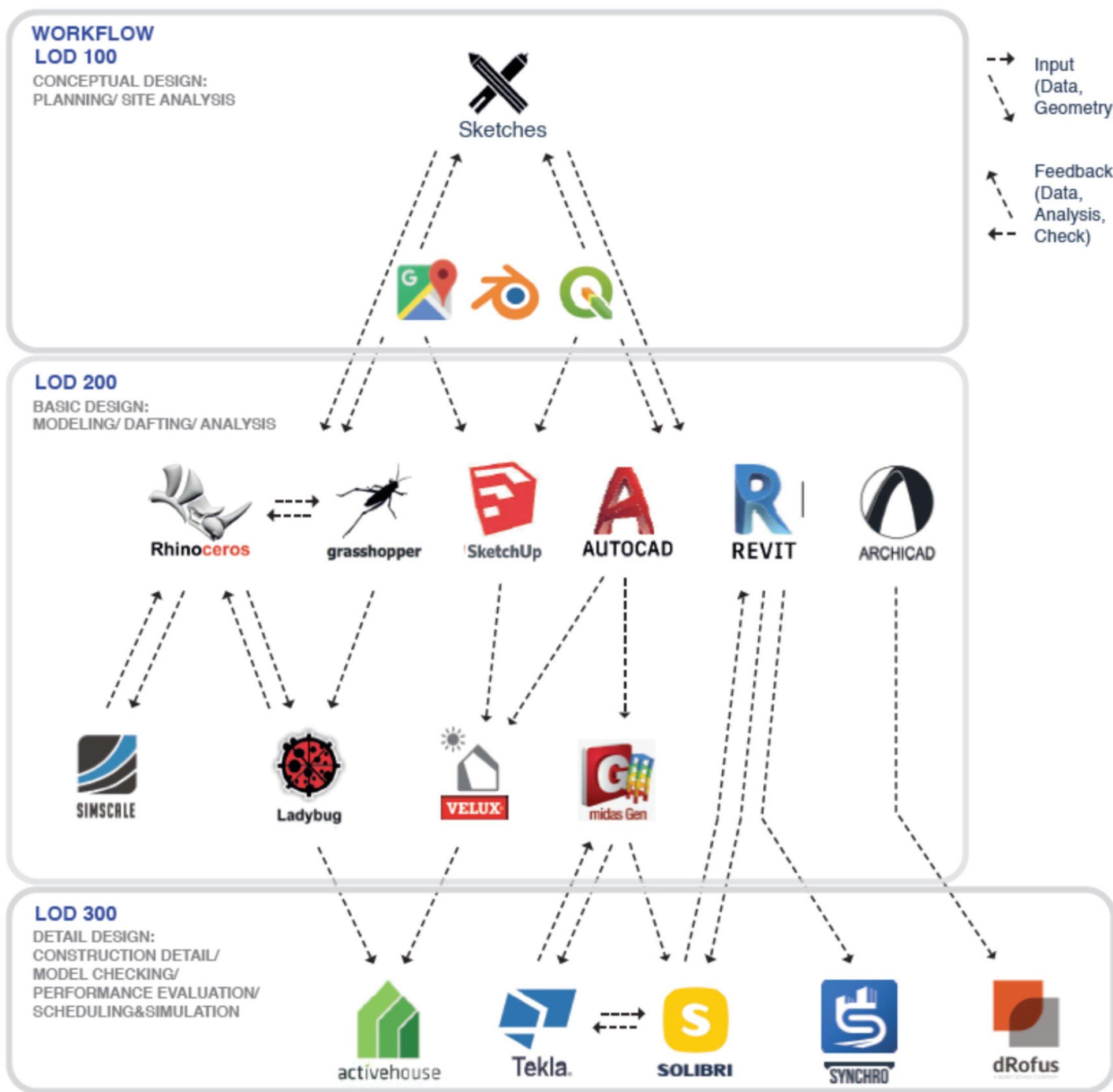
AUDITORIUM WALL DETAIL SCALE 1:20



PODIUM FIRST FLOOR PLAN SCALE 1:1000

BIM ANALYSIS from concept to delivery

BIM is employed to analyze factors such as structural integrity, energy efficiency, spatial coordination, and construction sequencing. In the context of towers, BIM helps streamline the design and construction process, enhance collaboration among different stakeholders, and improve overall project efficiency. The analysis can include simulations for energy performance, structural integrity, and other critical aspects, providing valuable insights for architects, engineers, and project managers in the design and management of tall buildings.



LEVEL OF DESIGN

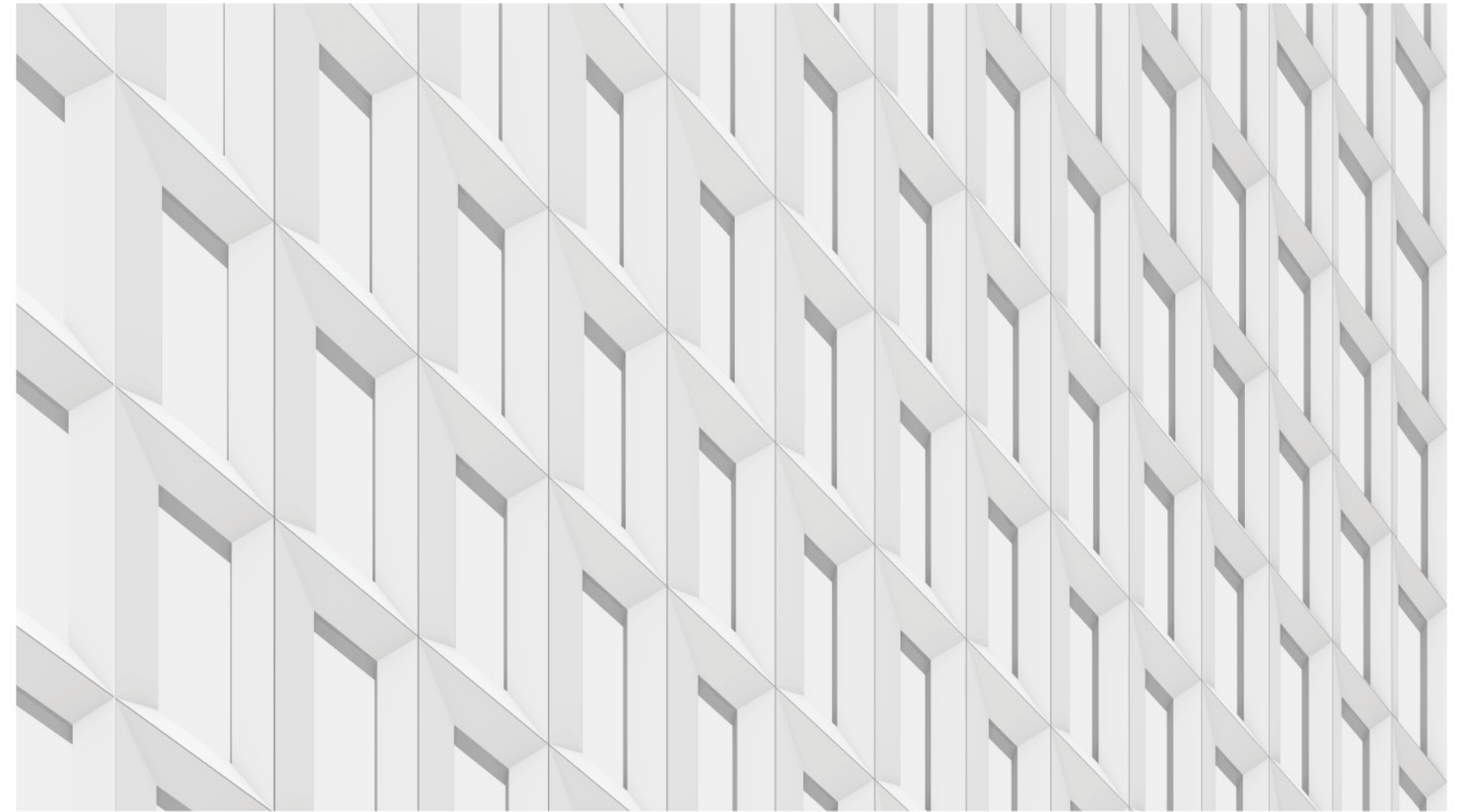
LOD 100
CONCEPT OF THE PROJECT.
It is the symbolic representation of the building in a model that responds to the first approximation of the design with an environment, landscape, history, needs, and orientation. This representation is schematic and is based on the analysis of the project site.

LOD 200
APPROXIMATE GEOMETRY.
The project is represented graphically in the model as a generic object, where a more detailed approximation of size, shape, position and orientation is already available. At this point we start to develop modifications and changes according to the detail that we will find as we progress with the model.

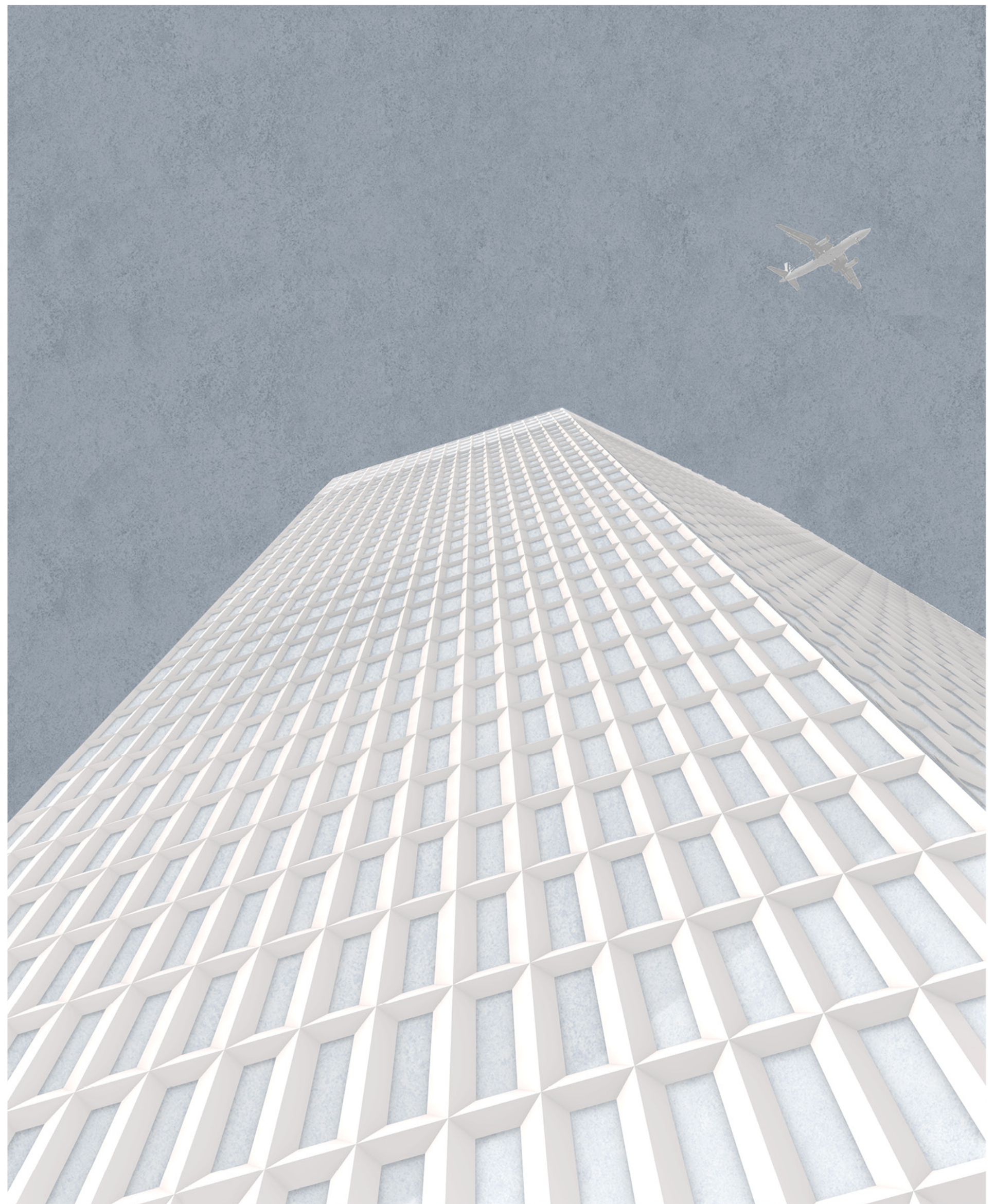
LOD 300
PRECISE GEOMETRY.
The design is shown as a model that represents graphically as a system, where the quantities, size, shape, location and orientation is specific. Likewise, the elements are also linked to a system of analysis of different variables that come to affect the project.

LOD 400
FABRICATION.
The model is represented with graphical detail and detailed definitions. Shapes, arrangements, dimensions and orientations are specific to the point where fabrication, assembly or installation is possible. The elements are linked to more in-depth non-graphical

PARAMETRIC FACADE



PARAMETRIC FACADE FROM THE GROUND FLOOR



BIM 7D

SUSTAINABILITY PERFORMANCE

Active House: Building performance

BIM 6D

MANAGEMENT

Solibri: Model checking

BIM 5D

COST

Tekla: Construction detail
Quantity take-off

Synchro: Budgeted direct cost
Resource cost

BIM 4D

TIME SCHEDULING & FUTURE SIMULATION

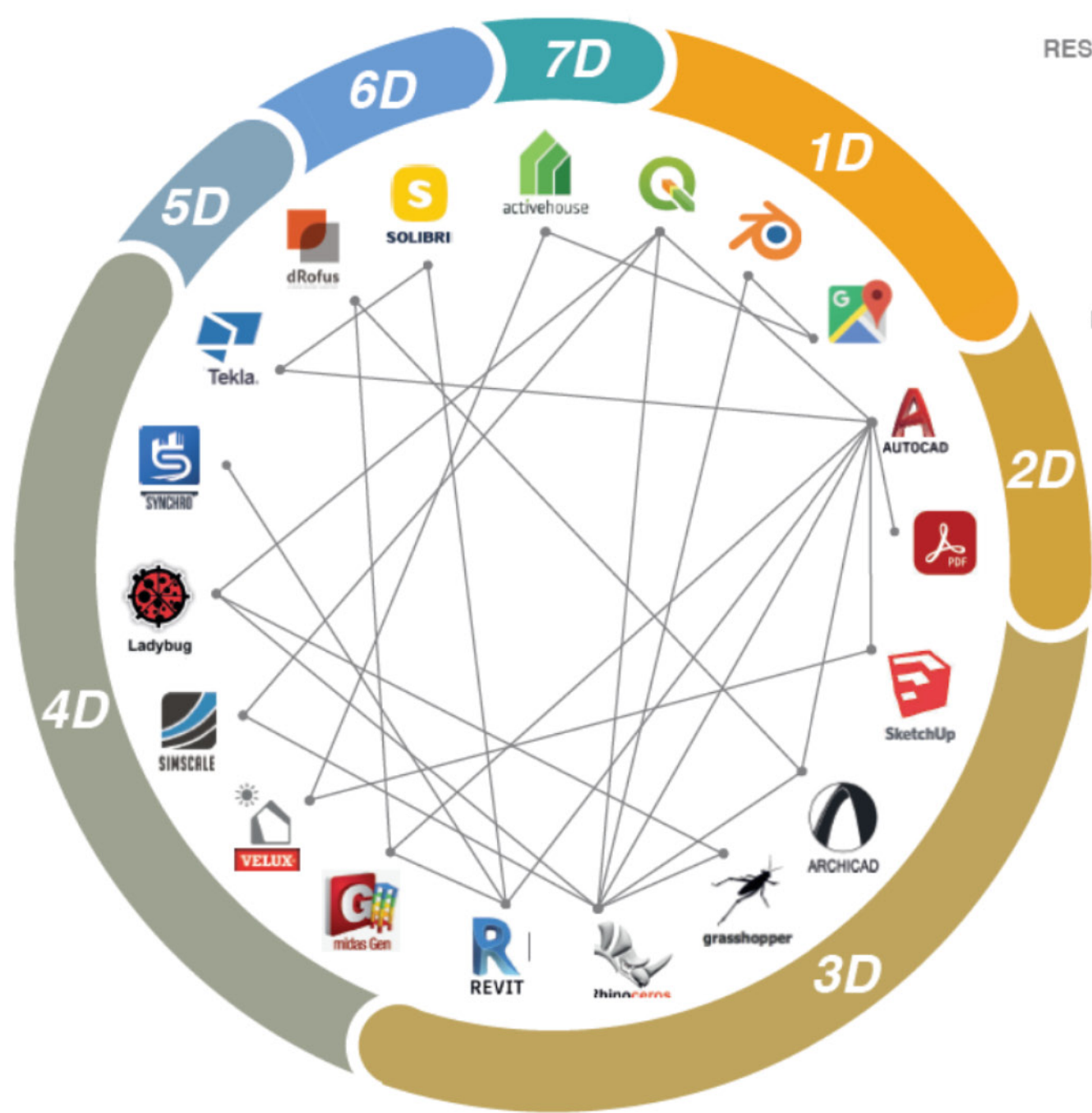
Synchro: Scheduling
Logic network
Construction Simulation

Ladybug: Wind simulation
Sun simulation
Shading simulation
View simulation

Simscale: Wind simulation

Dalux: Artificial lighting simulation

Velux: Daylight simulation



BIM 1D

SCRATCH POINT RESEARCH/ EXISTING CONDITION

QGIS: GIS opendata
Blender: Satellite mesh model
Google Map: Location, Satellite image

BIM 2D

VECTOR DRAWINGS/ DOCUMENTATION

AutoCad: Drafting, mapping
Adobe PDF: Plotting, documentation

BIM 3D

SHAPE & GEOMETRY MODEL REPRESENTATION/ VISUAL PROGRAMMING

Sketchup: Concept modeling
Light analysis model (with VELUX & DALUX)

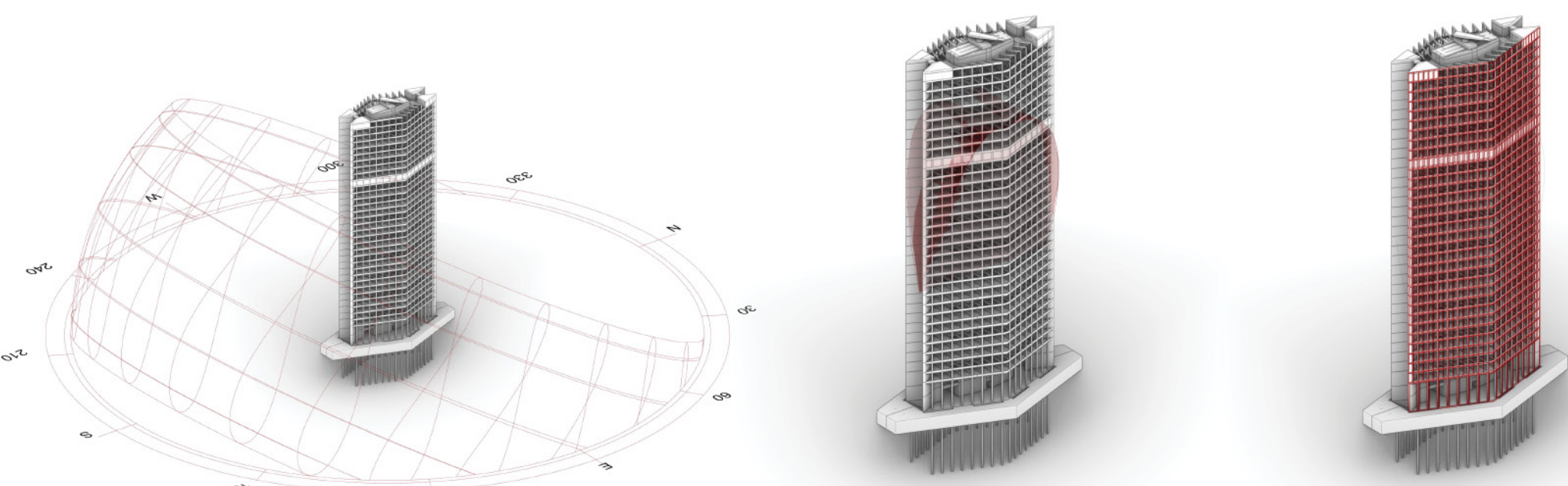
Archicad: Interior organization (podium part)

Grasshopper: Facade design
Visual programming
Environmental analysis (with Ladybug & Honeybee)

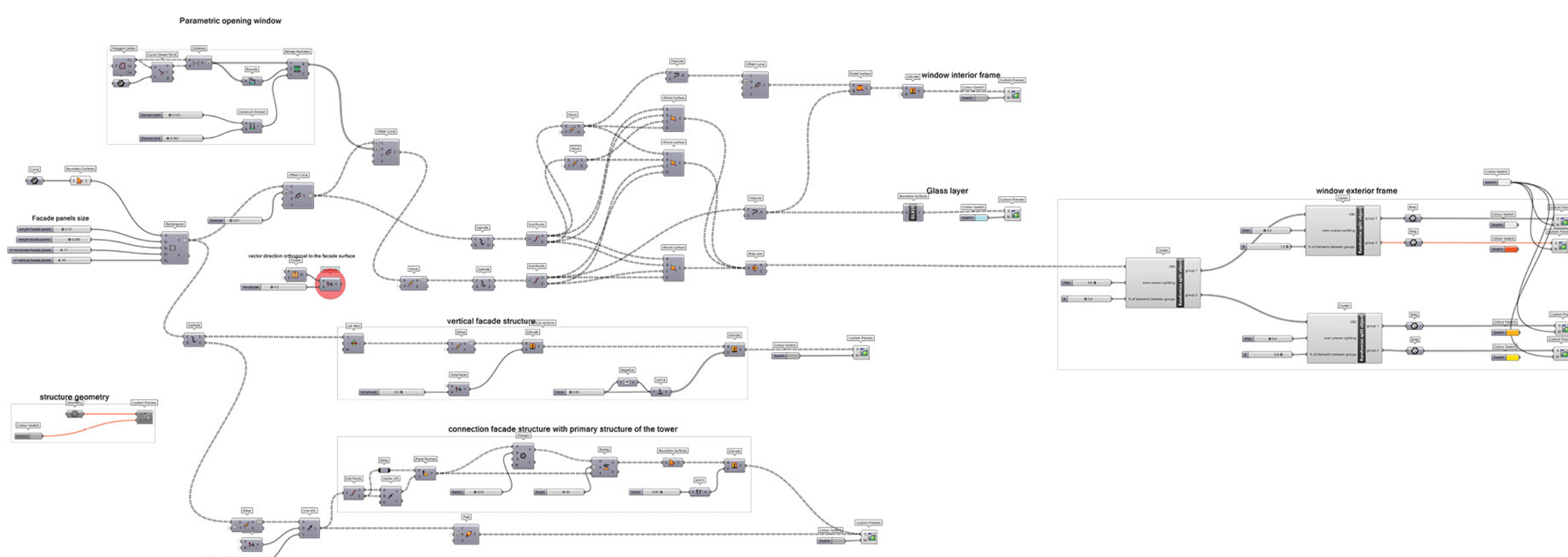
Rhino: Context model
Architectural model
Rendering model (with Enscape & 3ds Max)
Sun&Wind analysis model (With Simscale&Ladybug)

Revit: Structure Model
Time&Cost Simulation Model

PARAMETRIC FACADE FACADE- RESPOND TO LIGHT / INTERIOR FUNCTIONS



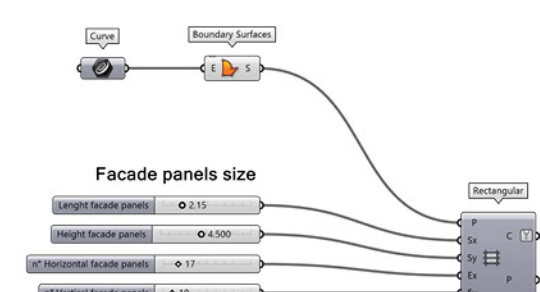
GRASSHOPPER CODES



For achieving our façade goal, we used Grasshopper associated with Rhinoceros as a mean for having a parametric design and to be able to control on real time the parts that we wanted to give more light.

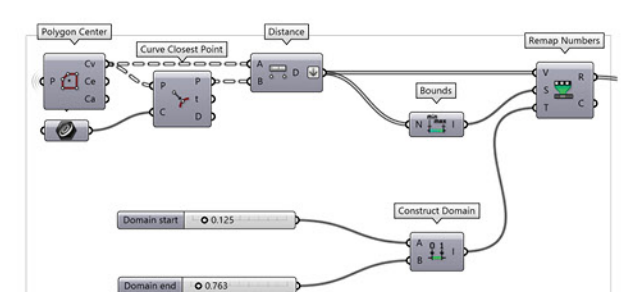
PARAMETER PANELS

Parametric panel size by using sliders for height and length dimensions as well as the number of elements we want in a grid plane.

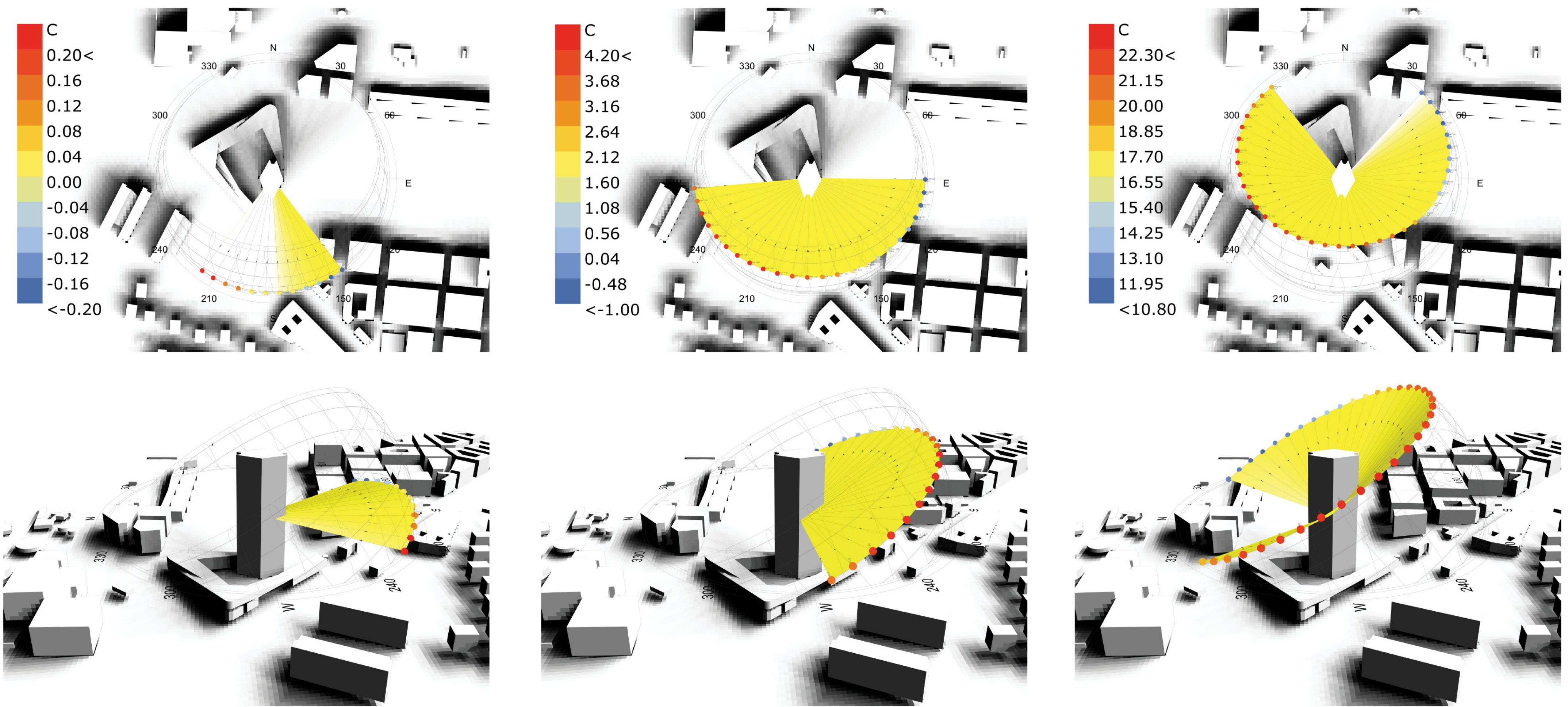


PARAMETER FACTOR

Parameter that allowed to determine the opening dimension of the panels in respect to our façade principle.



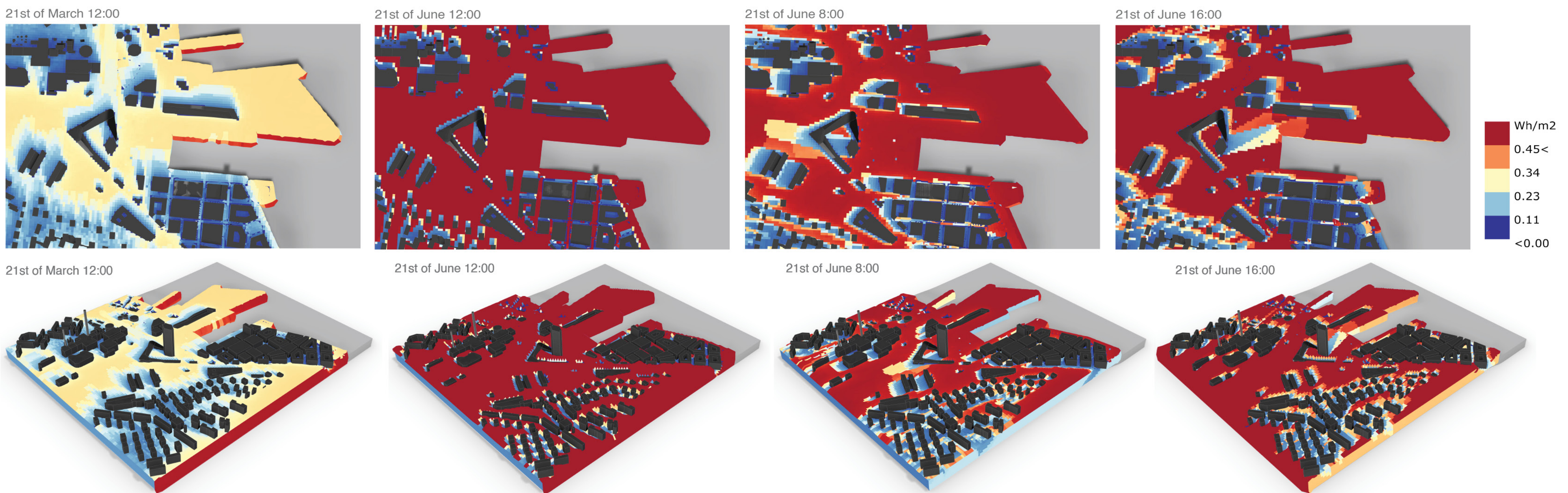
DIRECT SUN SEASON ANALYSIS



DIRECT SUN ANALYSIS
 We decided to analyse the sun direction in different periods of the year in relation with the building shape, by using the Grasshopper plug-in Ladybug.
WINTER SIMULATION
 In winter (21st December) the sun is low in Latitude. Having a high building is efficient to receive more Sun rays because we avoid the shades generated by the surrounding buildings.

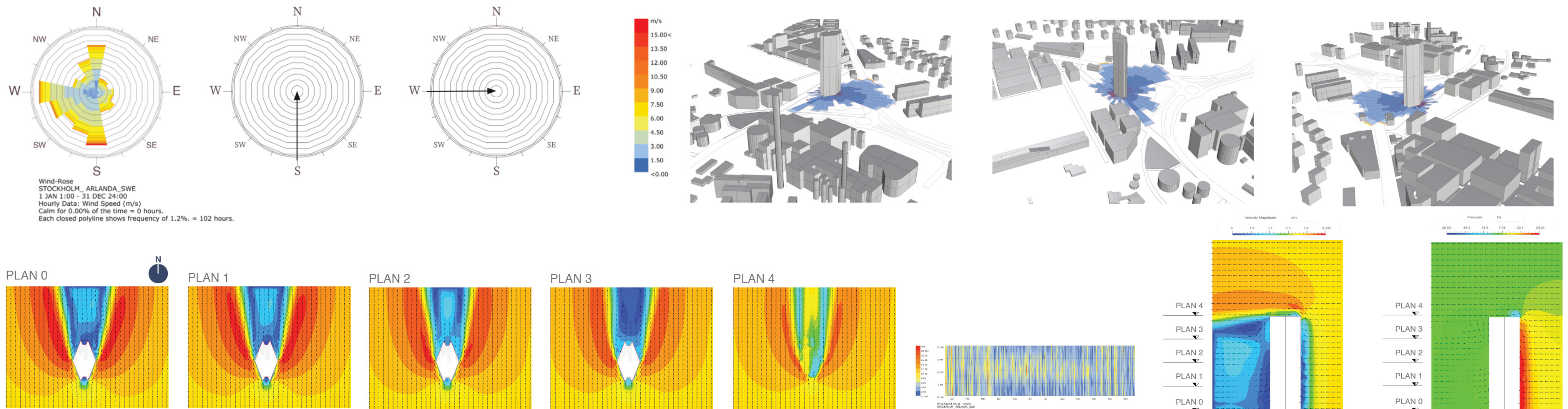
MIDDLE SEASON SIMULATION
 In Middle-season (21st March-September) the sun is still grazing and re- mains present for 12h. The West-East Facade receive constant and equal sunlight.
SUMMER SIMULATION
 In Summer (21st March-September) the sun comes from almost all di- rections. The position of the building allows to catch equal sunlight from WestEast directions the shape wants to reduce the northern façade di- mension which is the most challenging one.

OUTDOOR RADIATION



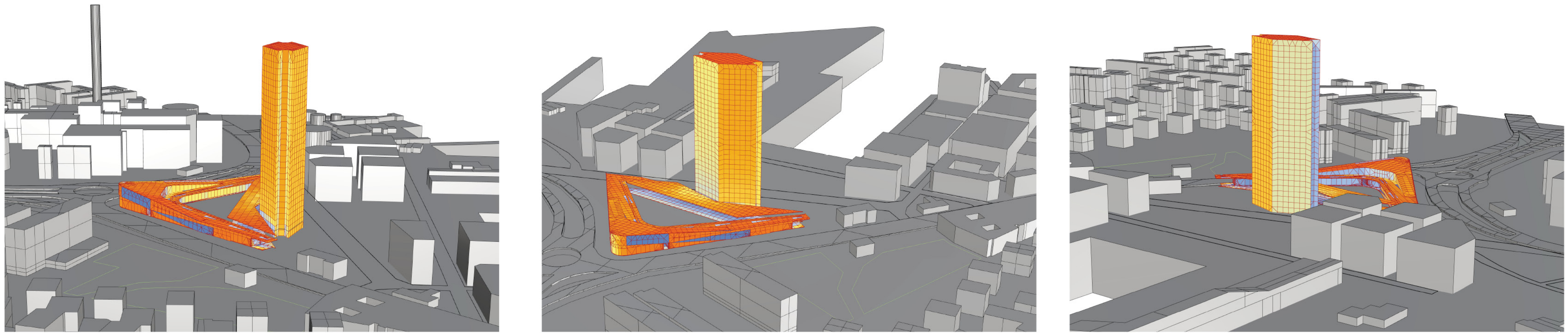
OUTDOOR RADIATION
 During the early stages of site selection and site analysis, we performed a Grasshopper plug-in Ladybug run of the outdoor radiation of the Royal Seaport area. Having comfortable and warm spaces of interaction as well as usage was one of our primary goals while we began this project and at every step, we have accounted on how we could accommodate maximum potential radiation.
 From the results we observe that the winter months are cold as expected in Stockholm so hence to provide people with an ambient atmosphere, we created closed and semi-open spaces in the podium but in a more thermally controlled environment.
 From March onwards the sunlight is pretty good and to make use of it we have courtyards and Piazzas which also respects the urban context of the site.

WIND ANALYSIS



WIND SIMULATION: The rhombus shape of the building positioned along the North-South offers advantages with the Sun path, wind aerodynamic from the most important wind direction, the relations with surrounding elements and urban connections.
 We used SimScale software to generate a wind tunnel fluid simulation to verify how the building volume is interacting with the wind.
SIMSCALE WORKFLOW: To use SimScale we had to create the volume shape with Rhino as OBJ file. After that we had to reverse the solid/void space to create a volume for the air. We generated a wind flow of 6.2m/s (22km/h) coming from the south.
RESULT COMMENTS: This software gave us the reasons to implement a rotation of our first building design idea.
 We decided to show create some plan views from different altitudes as well as sections in the middle of our building.
WIND GRAPH: The wind graph has been generated using the Grasshopper plug-in Ladybug and it was interesting in order to understand the precise power of wind for all year time period.

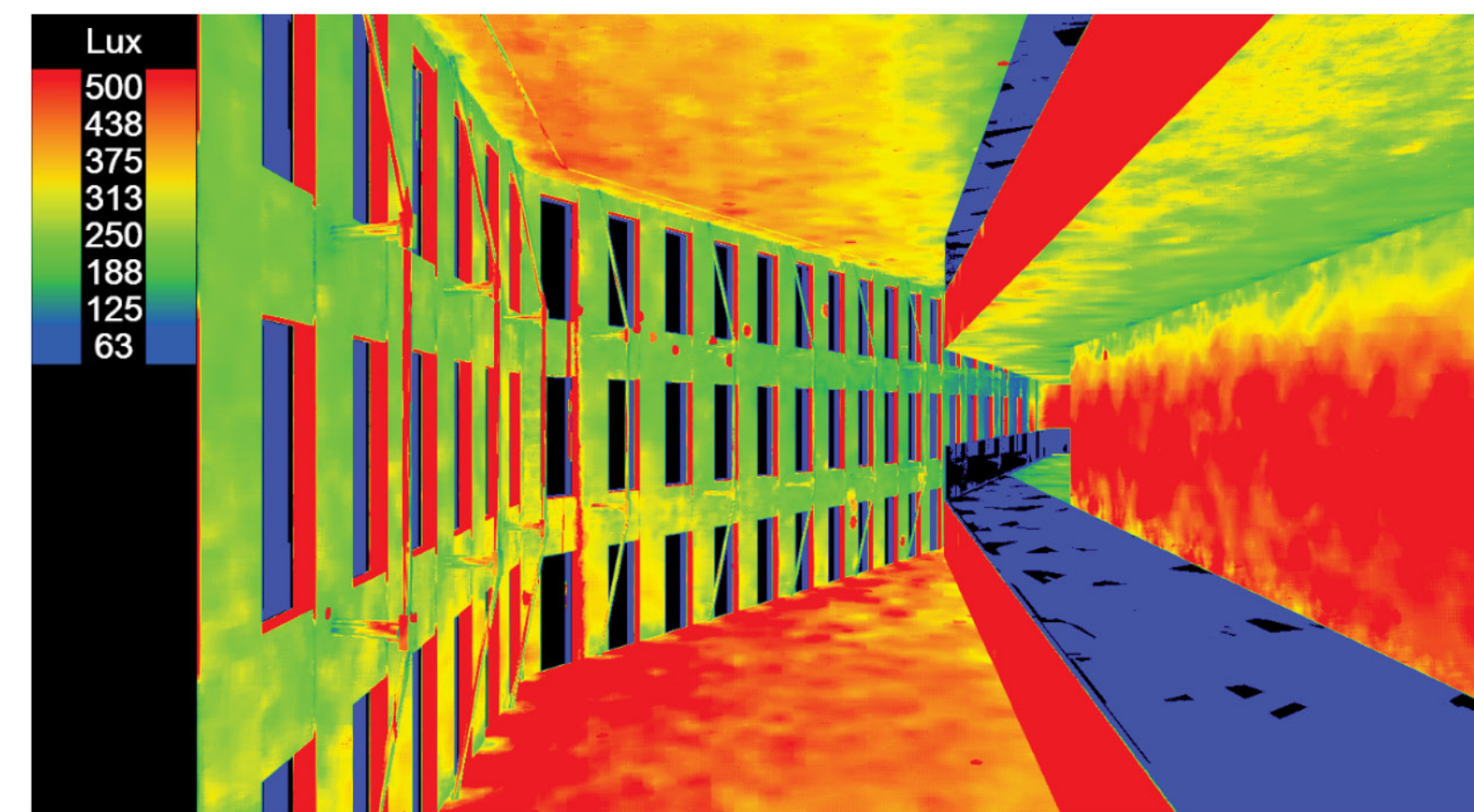
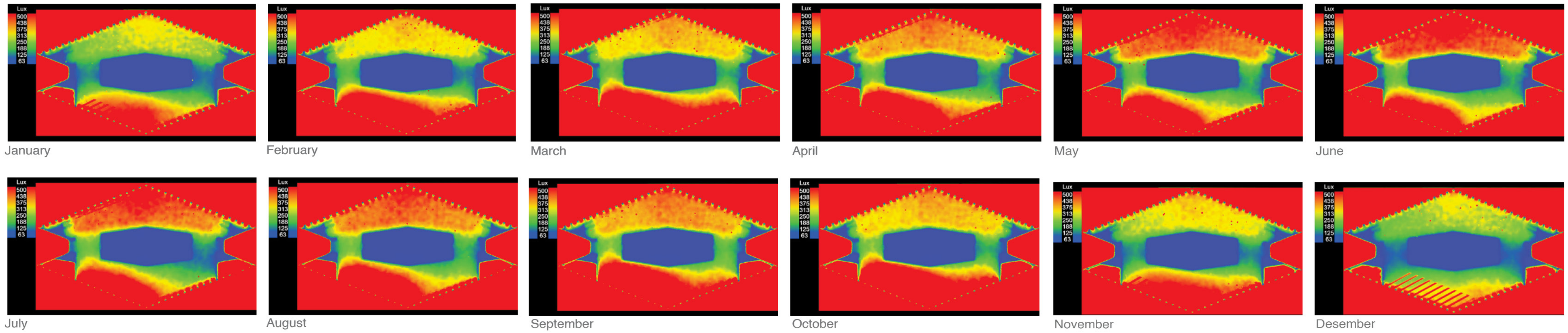
RADIATION OF THE FACADE



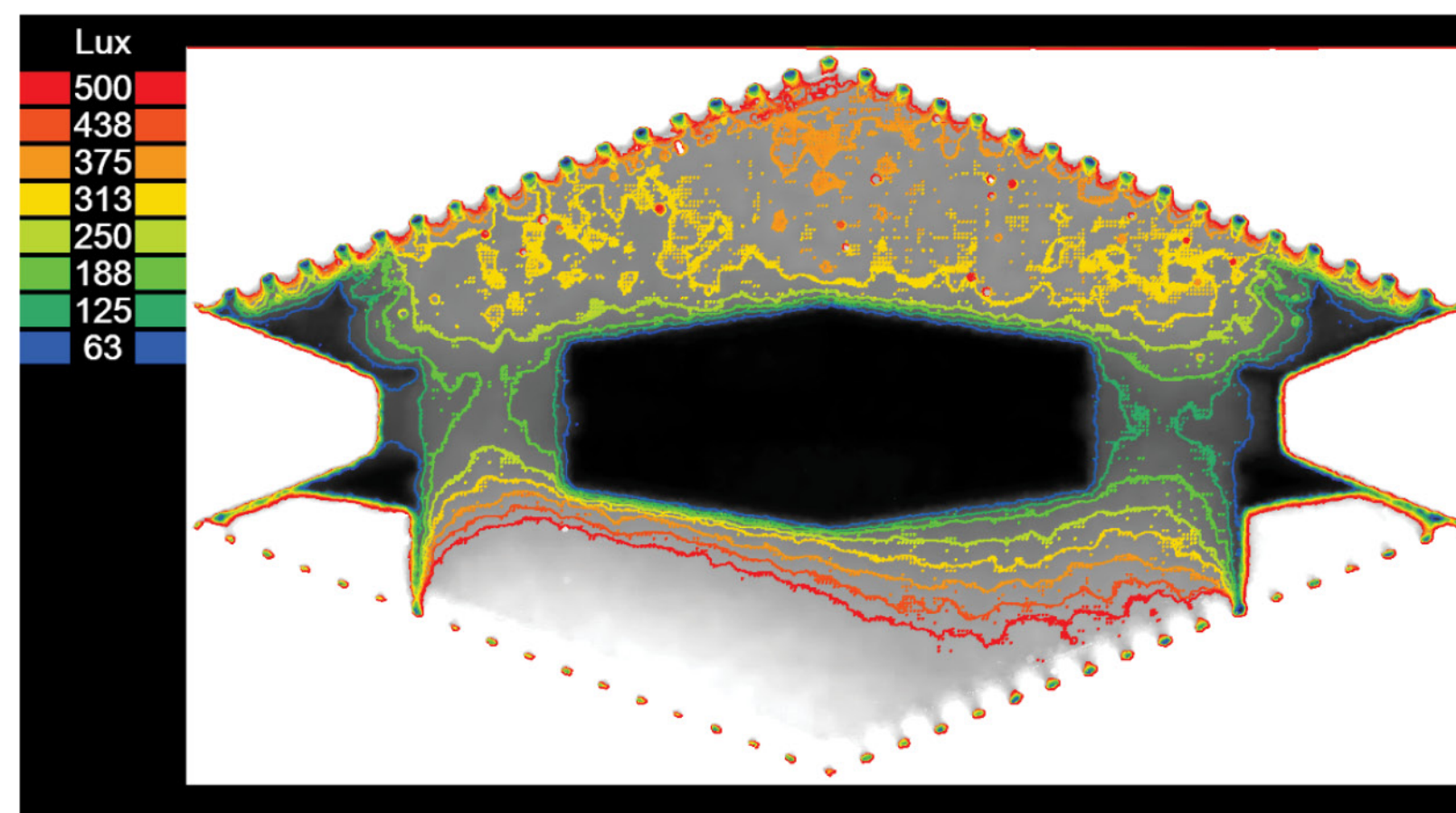
SUN RADIATION SIMULATION

We generated sun radiation analysis on the surfaces of the project volumes in early stages with Grasshopper plug-in Ladybug. This allowed us to verify the sun radiation in different time periods.

**INDOOR DAYLIGHT FACTOR
VIZ - SOFTWARE**



Day light in triple atriums

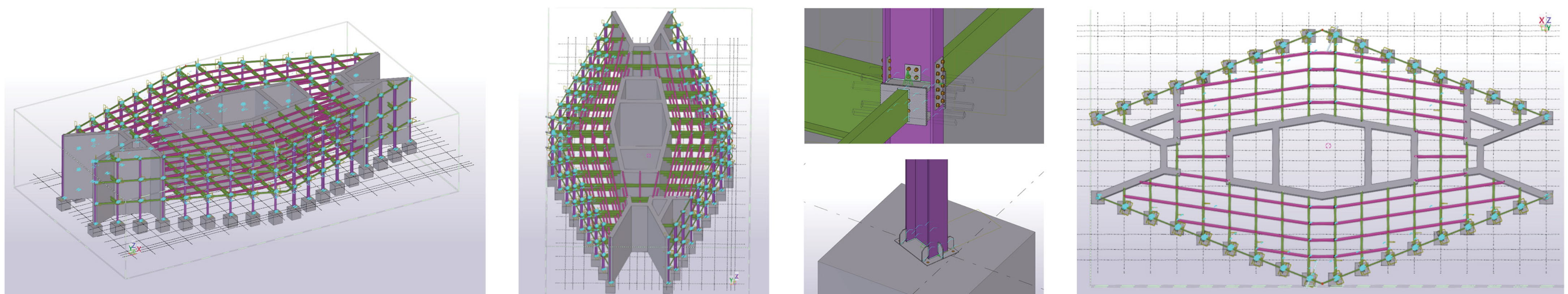


VIZ SIMULATION

We have visualised luminance, illuminance and daylight factor levels to explore daylight conditions with plan views, section views and perspective renderings.

From study, the recommended requirements for daylight in commercial buildings is a daylight factor of 2% on the work plane, and an average daylight factor in the room of 3%. In the months during summer we have a good 2-4% achieved in our interior spaces followed by 1-3% in the winter season.

**STRUCTURE MODEL
TEKLA - STRUCTURE MODELLING**



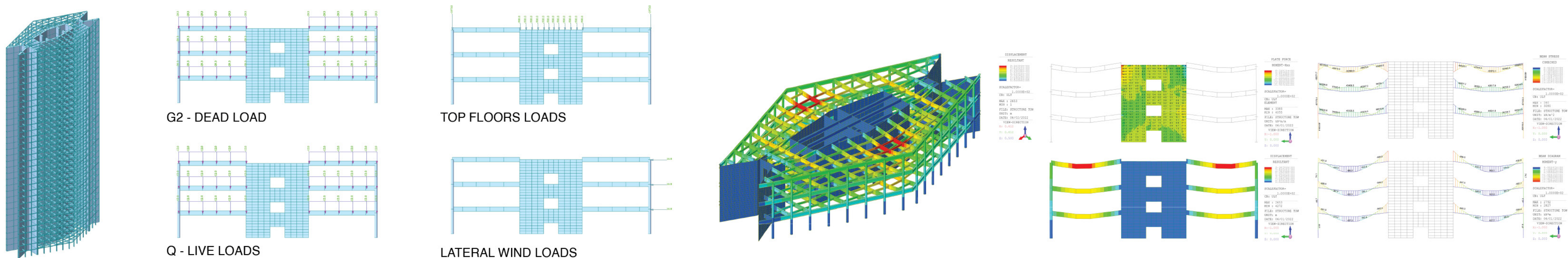
URBAN REDEVELOPMENT PROJECT

The use of TEKLA allows us to perform in a 3D model an analysis of structural loads, technical details and connections, as well as a wide variety of connections, details and solutions to structural and architectural elements of the project. This program also allows us to understand the complexity of the construction and the implications in terms of dimensions and organization.

With the use of TEKLA we can understand the complexity of construction and the various problems that may arise at the time of construction. For example, in the case of joints between primary and secondary beams with angles other than 90°. This demonstrates the complexity of the different joints and the material and time implications for the project.

The project has a central concrete core and 2 other cores of smaller size and different configuration to the lateral ones. The structure used is a combined system of main beams in HEA700 and secondary beams in HEA360, and the columns in HEA500.

MIDAS



MIDAS SOFTWARE

The application of the MIDAS program allows us to have a better understanding of the behaviour of the structure and the different profiles, elements, and connections necessary for the implementation of the structure.

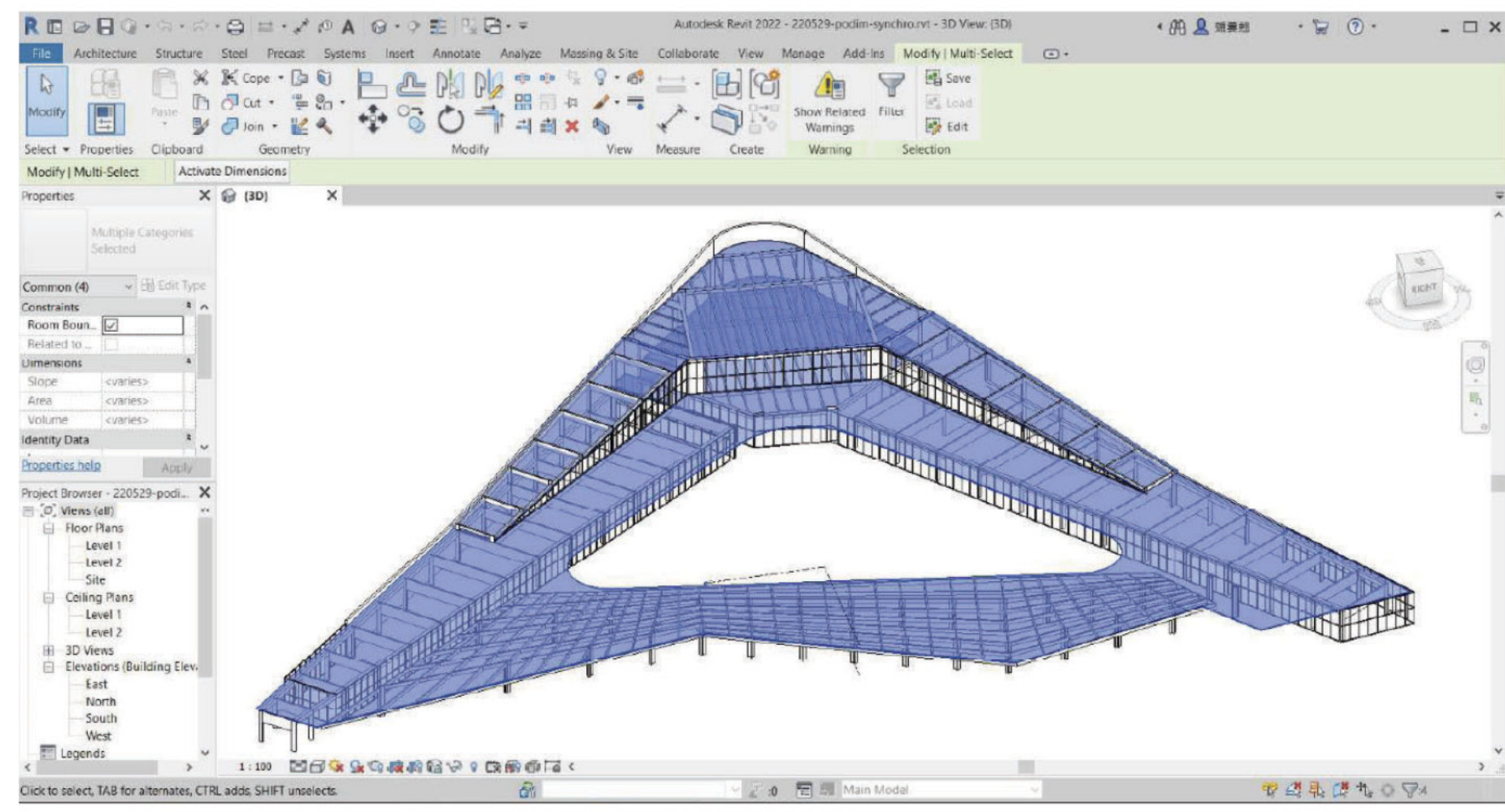
MODELLING PROCESS

After performing this step, it is required to perform an analysis of the loads that the building has, such as LIVE LOADS, DEAD LOAD and WIND LOAD. After having this information, these loads are applied to the different profiles and configurations to perform a detailed analysis. A combination of loads is made to understand how they affect the building and the consequences.

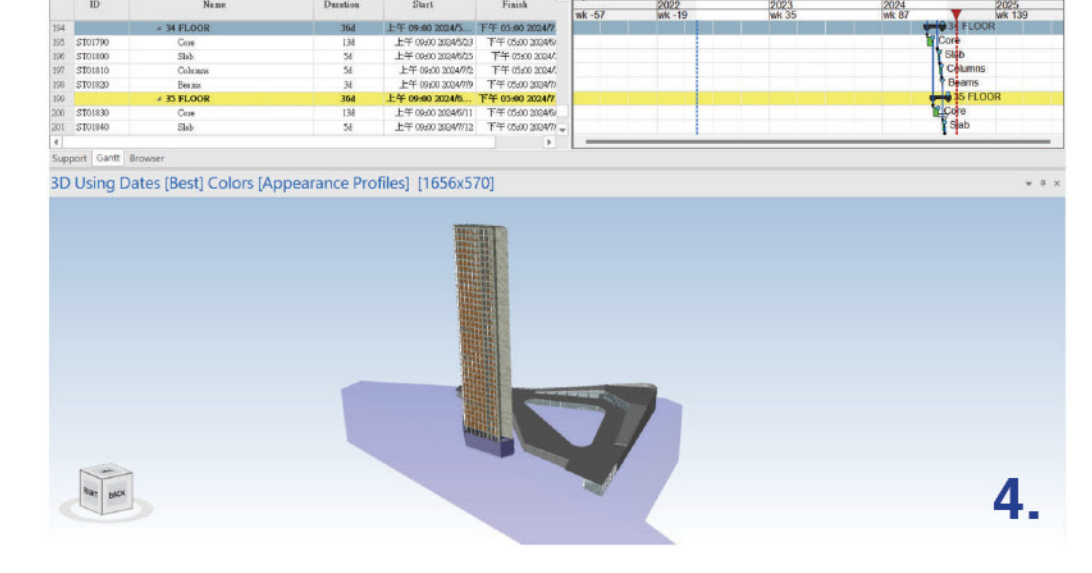
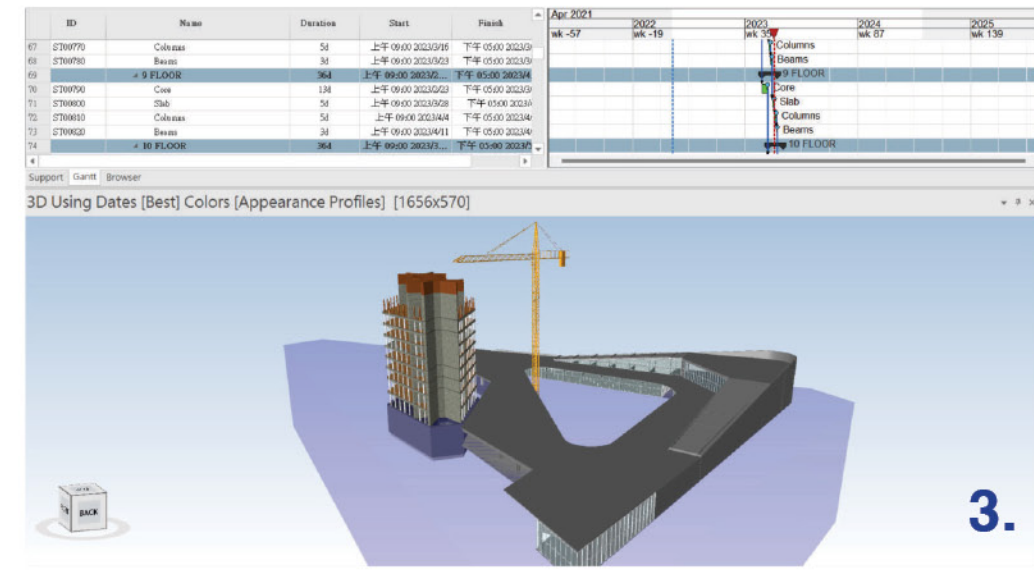
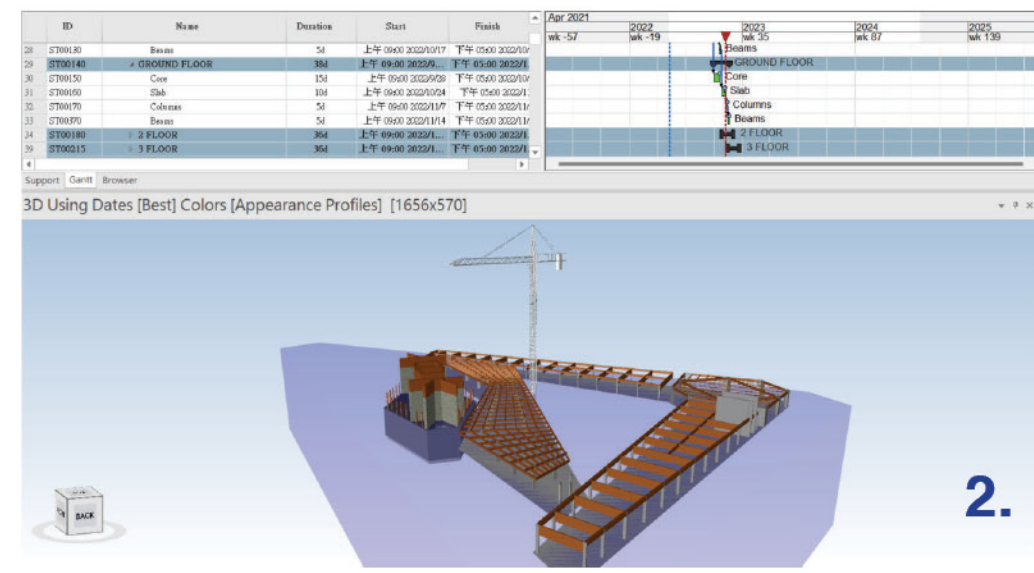
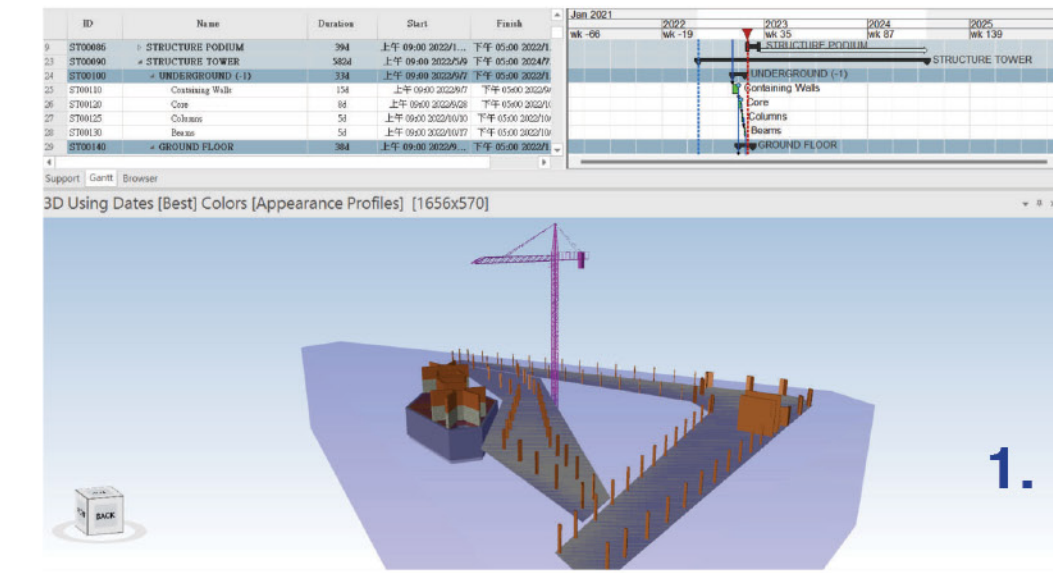
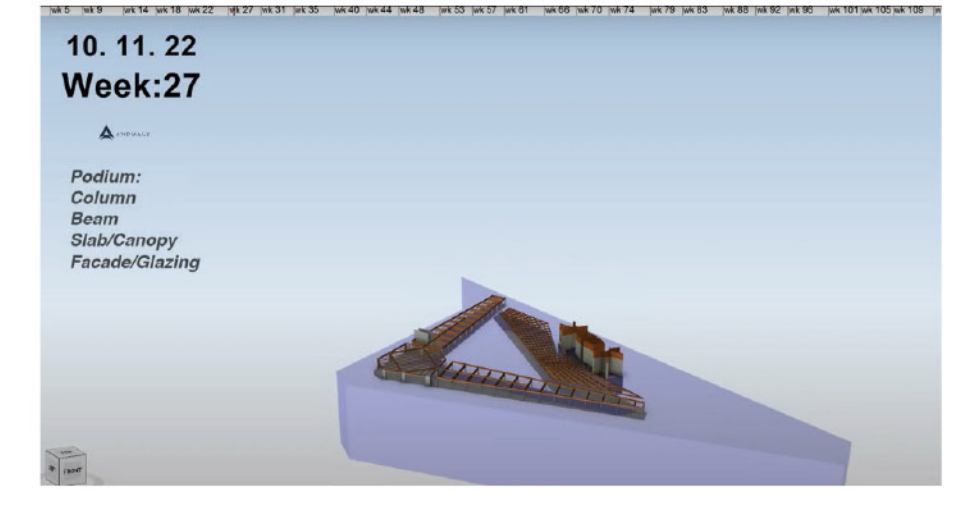
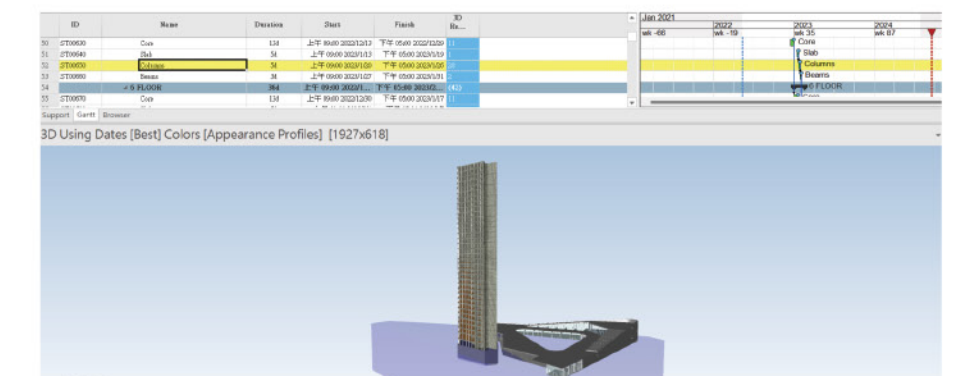
MIDAS WORKFLOW

In the end, the use of midas is related to a structural analysis and a check of the different loads and their effect on the sections. The modelling process consists of generating a template in AUTOCAD to import it into MIDAS and start generating the assignment of the sections in the project. Additionally start modelling the structural elements such as concrete screens and others. The steel sections are assigned, and the model is reviewed.

**CONSTRUCTION SITE MANAGEMENT
SYNCR0 SOFTWARE**



ID	Name	Duration	Start	Finish	AP
1366	Structure	5d	27 Nov 2023	1 Dec 2023	1366
1367	Columns	5d	27 Nov 2023	1 Dec 2023	1367
1368	Beams	3d	27 Nov 2023	29 Nov 2023	1368
1369	23 FLOOR	36d	27 Nov 2023	3 Dec 2023	1369
140	Core	13d	27 Nov 2023	10 Dec 2023	140
141	Slab	5d	27 Nov 2023	2 Dec 2023	141
142	Columns	5d	27 Nov 2023	2 Dec 2023	142
143	Beams	3d	27 Nov 2023	29 Nov 2023	143
144	24 FLOOR	36d	27 Nov 2023	3 Dec 2023	144
145	Core	13d	27 Nov 2023	10 Dec 2023	145
146	Slab	5d	27 Nov 2023	2 Dec 2023	146
147	Columns	5d	27 Nov 2023	2 Dec 2023	147
148	Beams	3d	27 Nov 2023	29 Nov 2023	148
149	25 FLOOR	36d	27 Nov 2023	3 Dec 2023	149
150	Core	13d	27 Nov 2023	10 Dec 2023	150
151	Slab	5d	27 Nov 2023	2 Dec 2023	151
152	Columns	5d	27 Nov 2023	2 Dec 2023	152
153	Beams	3d	27 Nov 2023	29 Nov 2023	153
154	26 FLOOR	36d	27 Nov 2023	3 Dec 2023	154
155	Core	13d	27 Nov 2023	10 Dec 2023	155
156	Slab	5d	27 Nov 2023	2 Dec 2023	156
157	Columns	5d	27 Nov 2023	2 Dec 2023	157
158	Beams	3d	27 Nov 2023	29 Nov 2023	158
159	27 FLOOR	36d	27 Nov 2023	3 Dec 2023	159
160	Core	13d	27 Nov 2023	10 Dec 2023	160
161	Slab	5d	27 Nov 2023	2 Dec 2023	161
162	Columns	5d	27 Nov 2023	2 Dec 2023	162
163	Beams	3d	27 Nov 2023	29 Nov 2023	163
164	28 FLOOR	36d	27 Nov 2023	3 Dec 2023	164
165	Core	13d	27 Nov 2023	10 Dec 2023	165
166	Slab	5d	27 Nov 2023	2 Dec 2023	166
167	Columns	5d	27 Nov 2023	2 Dec 2023	167

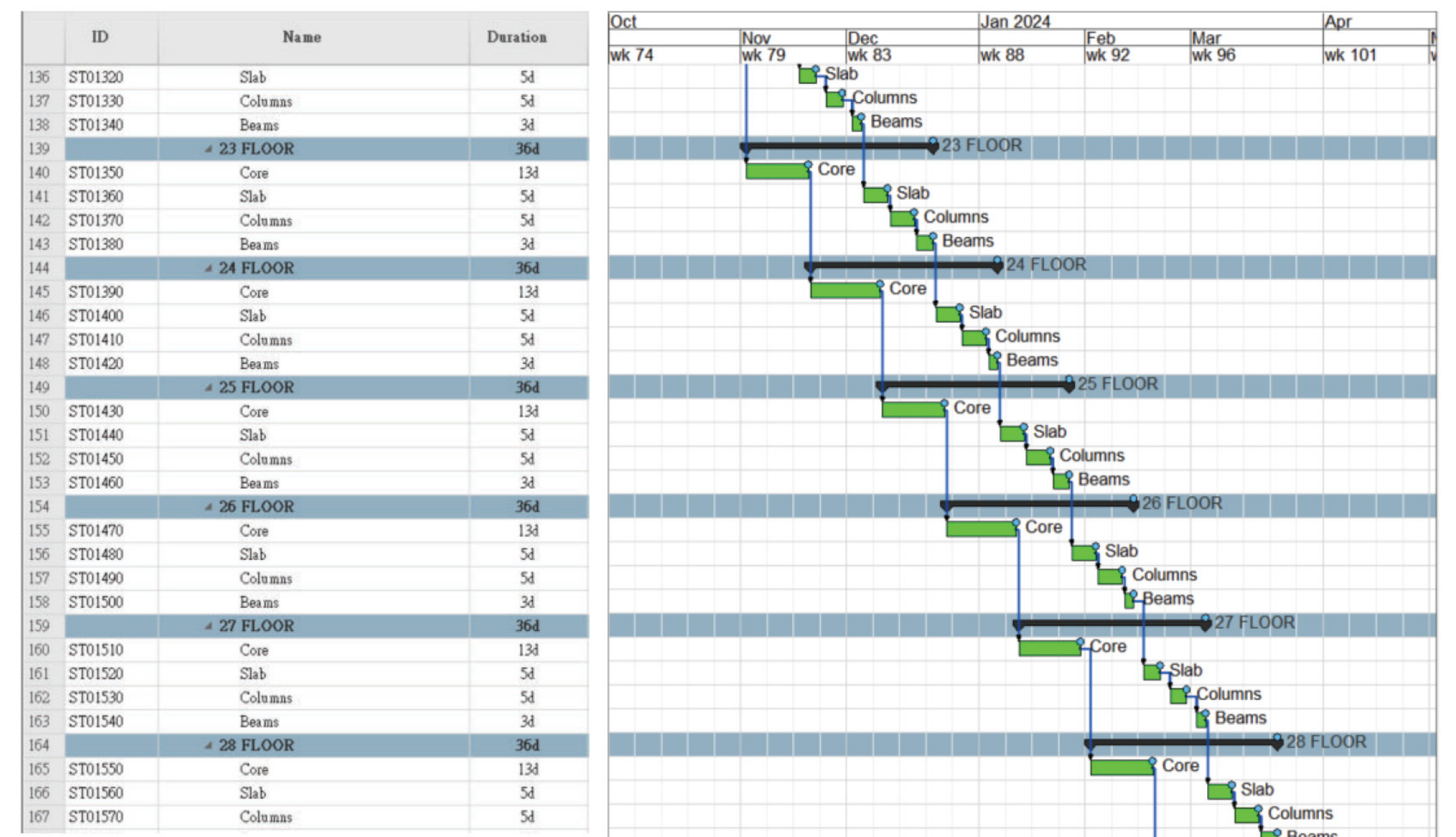


Synchro 4D as a powerful software in BIM 4D also 5D, is very useful for tower to understand the construction schedule and costs. We decide to use Revit as the input model, since it is already built with structural system and other components.

1. Apply timeline
2. Apply construction machinery
3. Create 3D path
4. Examine the sequence and linked work
5. Examine the tasks and the objects assigned
6. Explain the works along with simulation phases

The structure of the tower is formed by three main materials: Reinforced concrete cores and shear walls, steel columns and beams, and CLT timber slab. Hence in the time scheduling we linked the work of cores together, and the other structure elements linked in the sequence of slab-column-beam. In this way we see also in the video how the cores will be accomplished first.

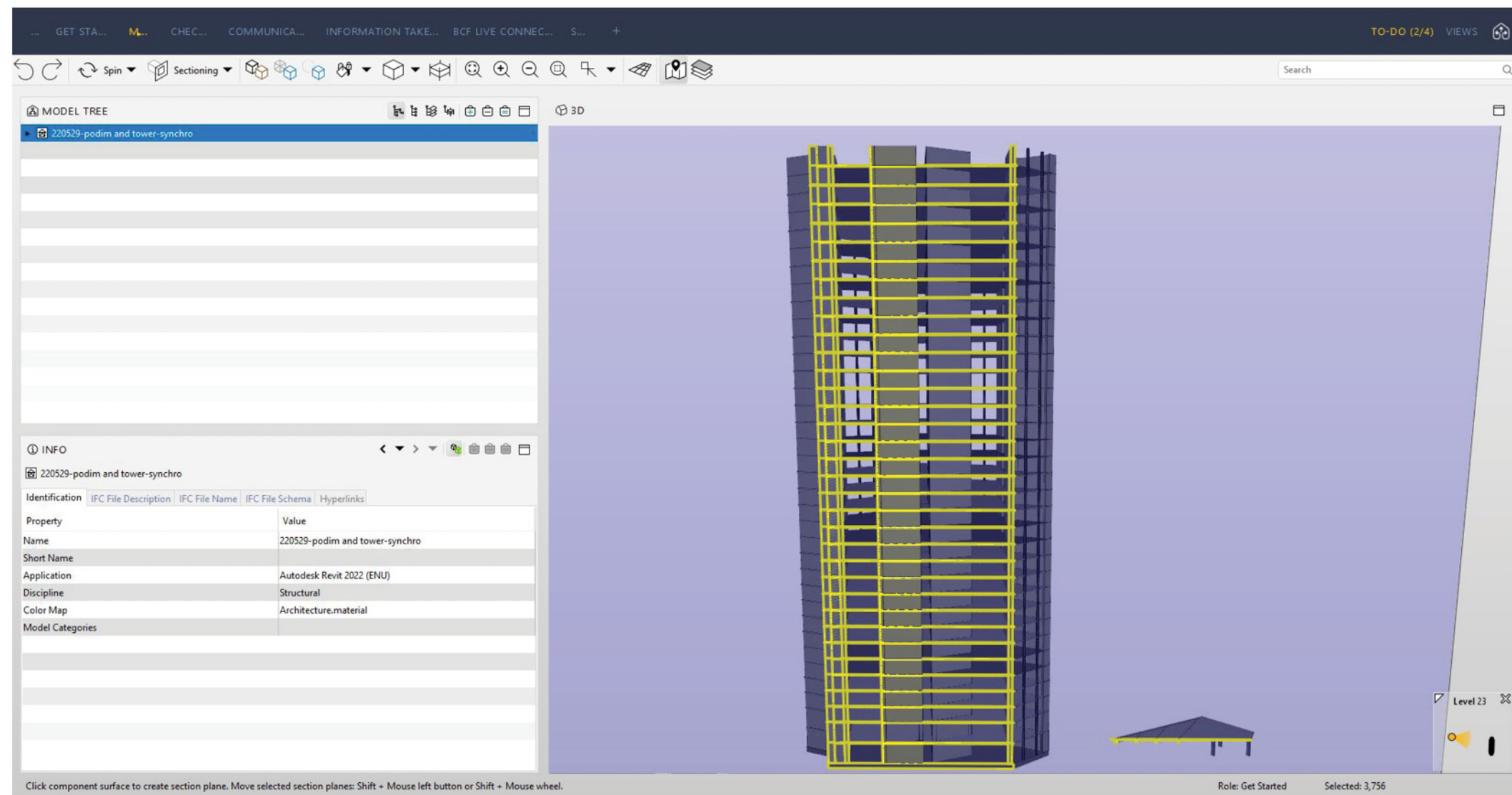
1. After the earthwork and underground structure, establish the ground floor of the tower as well as the podium.
2. Finish the ground floor beams and also the canopy waffle beams.
3. Introduce of tower crane or even other equipments when it proceeds exceeding 10 floors or taller.
4. Finish the building constructions. Start with the landscape and recovery.



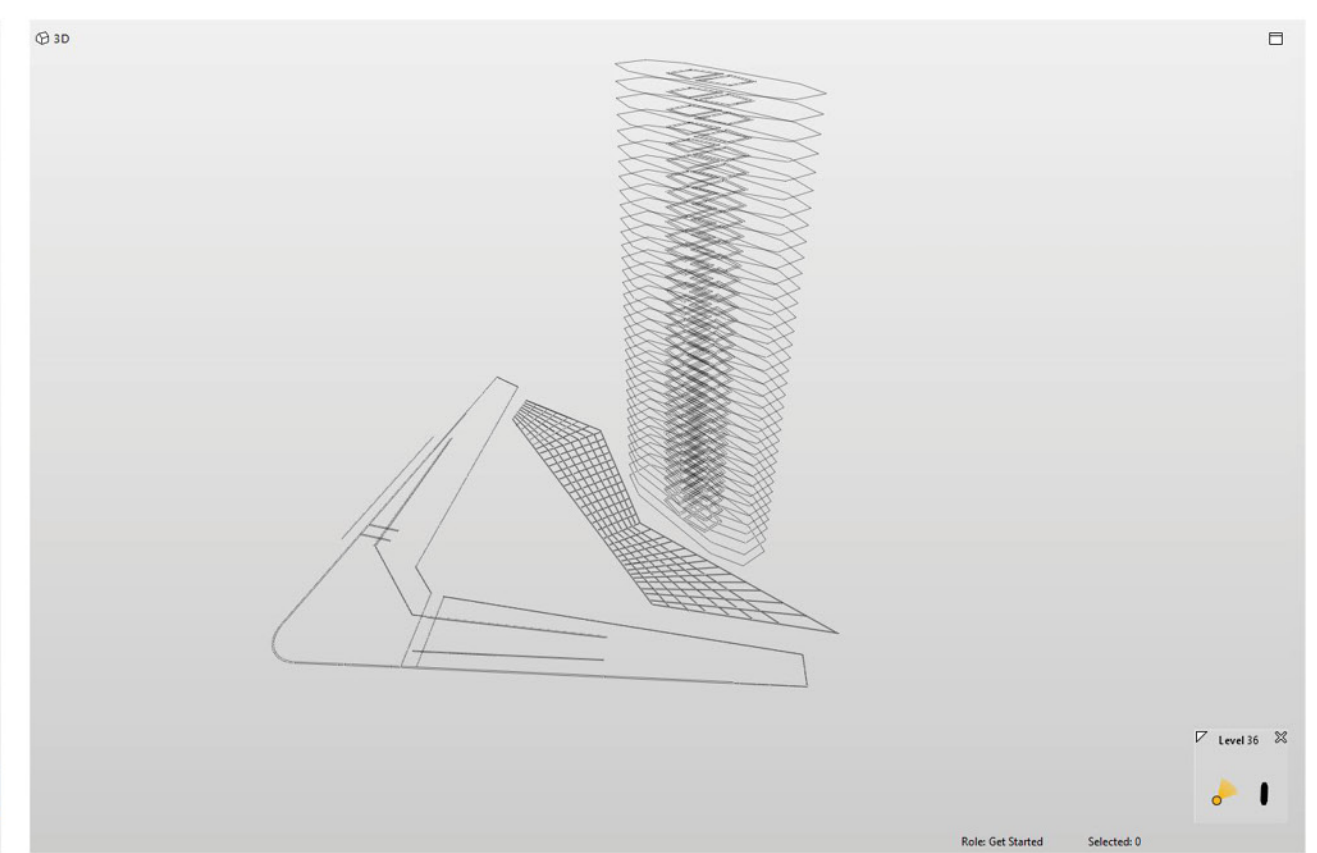
THE QR CODE OF THE SYNCHRO SIMULATION FOR THIS PROJECT.
OR VISIT: [HTTPS://WWW.YOUTUBE.COM/WATCH?V=XXFVQ3G1EM](https://www.youtube.com/watch?v=XXFVQ3G1EM)



**MODEL SHECKER
SOLIBRI SOFTWARE**

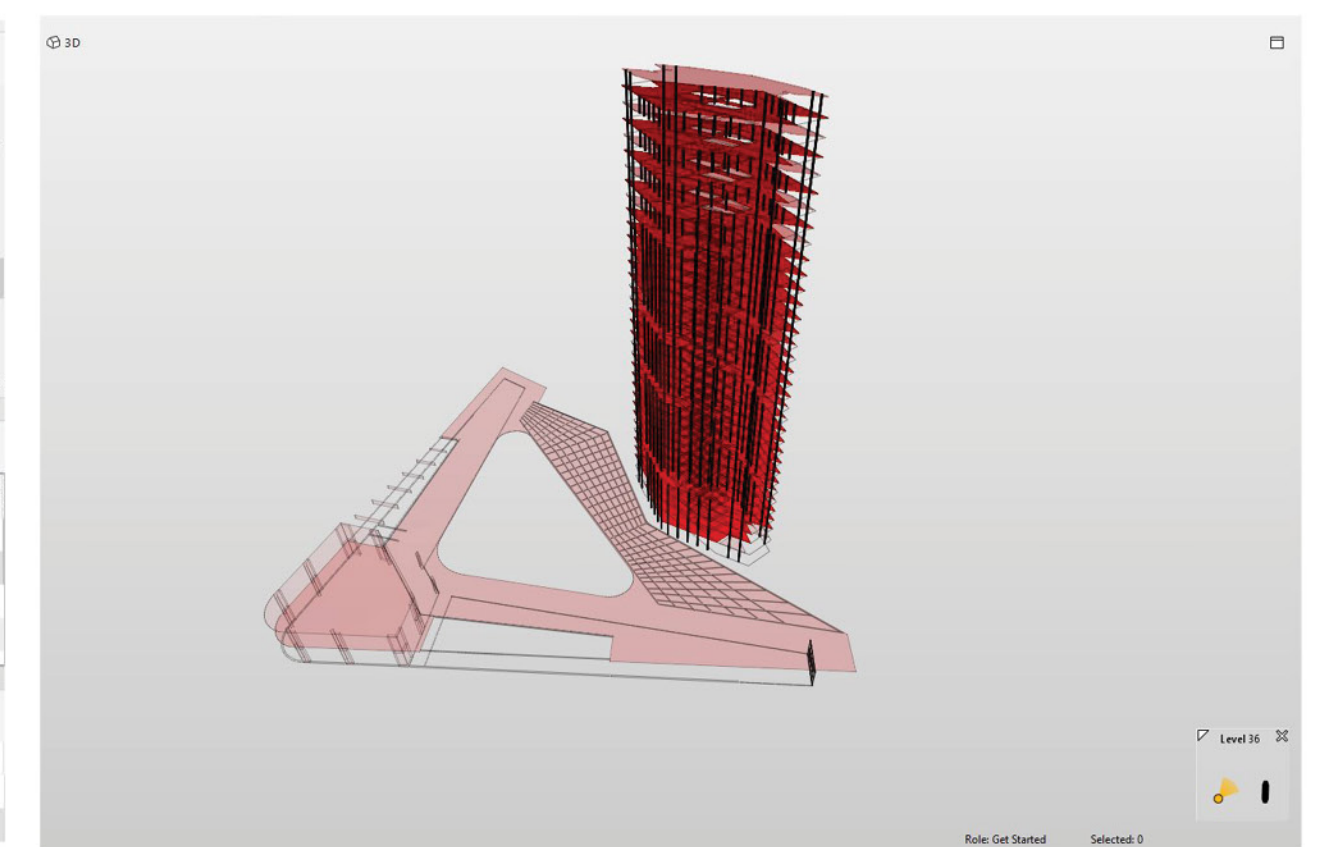


RuleSet	Checked Model	Issue Count	Issue Density
Intersections - Different Kind of Components	OK	0	0
Intersections - Same Kind of Components	OK	0	0
Wall - Wall Intersections	OK	0	0
Slab - Slab Intersections	OK	0	0
Roof - Roof Intersections	OK	0	0
Beam - Beam Intersections	OK	0	0
Column - Column Intersections	OK	0	0
Footing - Footing Intersections	OK	0	0



RuleSet	Checked Model	Issue Count	Issue Density
Intersections - Different Kind of Components	OK	0	0
Intersections - Same Kind of Components	OK	0	0
Wall Intersections	OK	0	0
Slab Intersections	OK	0	0
Roof Intersections	OK	0	0
Beam Intersections	OK	0	0
Column Intersections	OK	0	0
Footing Intersections	OK	0	0
Pile Intersections	OK	0	0

RuleSet	Checked Model	Issue Count	Issue Density
Assembly - Assembly Intersections	OK	0	0
Object - Object Intersections	OK	0	0
Intersections - Different Kind of Components	OK	0	0
Wall Intersections	OK	0	0
Slab Intersections	OK	0	0
Roof Intersections	OK	0	0
Beam Intersections	OK	0	0
Column Intersections	OK	0	0



SOLIBRI WORKFLOW

All the parts are modeled and assembled in Revit as the main software. We modeled every part in the proper category. Then we exported them in four different IFC files in order to have a clean model in Solibri. Then we imported all the files in Solibri.

SIMULATION

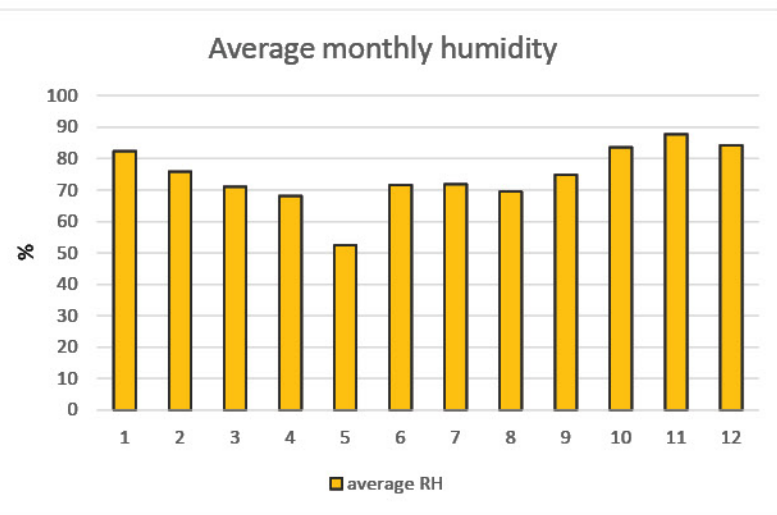
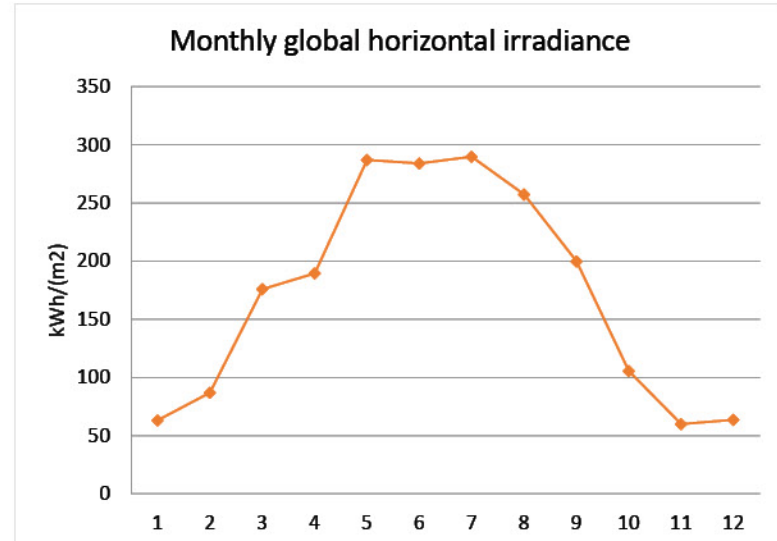
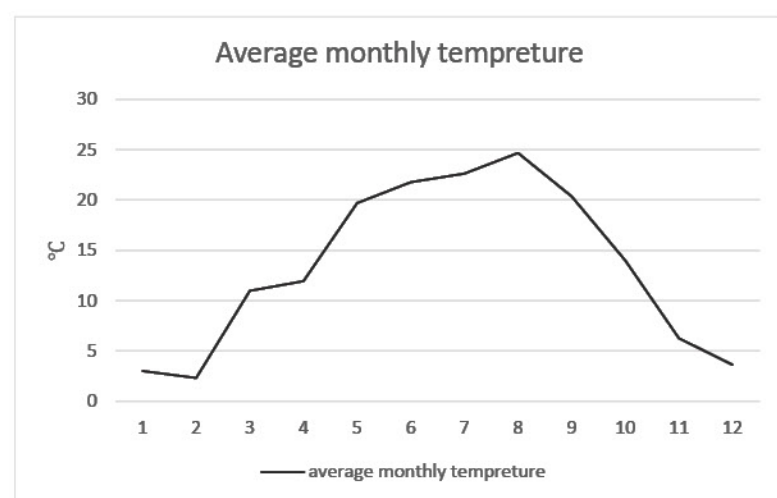
With Solibri we had the chance to be able to find the errors of our model. And we tried to solve them in the intersection of the structural elements. We had some clashes for overlapping some elements. And there are some errors with connection on architectural walls with structural columns. For the slab intersection and roof intersection there was no error hopefully. With this software we were able to check all the elements of the structural model. Besides that we needed to change some of the modelings for the base of the software in order to have a more precise results.

SERVICES

wethear and U-value calculations

Design of the technical and mechanical systems are based on weather analysis and the site situation, with calculating the U-value for the elements of the building we can make sure if we have designed based on the sustainable materials which save the energy as much as possible.

SWEDEN WWATHER ANALYSIS



Climate chart - Stockholm (Sweden)

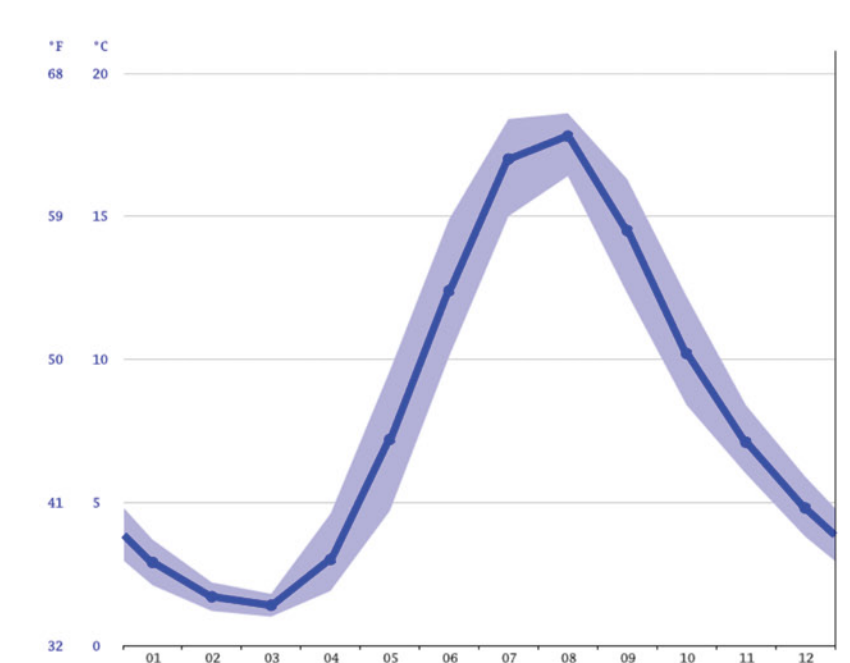
In Stockholm, the capital of Sweden, the climate is Baltic, that is, moderately continental, with cold winters, during which the average temperature is a few degrees below freezing, and mild to pleasantly warm summers. The city is located in south-central Sweden, a short distance from the Baltic coast, but is surrounded by water, as it is located in an area of fjords, islands and lakes.

The climatic conditions prevailing in Stockholm are characterized by a warm and moderate temperature. It is noteworthy that Stockholm experiences a considerable volume of precipitation throughout the year, including its least humid month. As per the Köppen-Geiger classification, the prevailing weather conditions in this region are categorized under Cfb. The average annual temperature in Stockholm is 7.3 °C | 45.1 °F. The annual rainfall is 619 mm | 24.4 inch. Stockholm is located in the northern hemisphere. The commencement of summer is observed at the conclusion of June and its culmination takes place in September. The months that constitute this season are known as June, July, August, September.

There exists a variation of 39 mm | 2 inch in precipitation levels between the month with the least rainfall and that which experiences maximum downpour. Throughout the course of a year, there is an observable fluctuation in average temperatures by 19.8 °C | 35.6 °F.

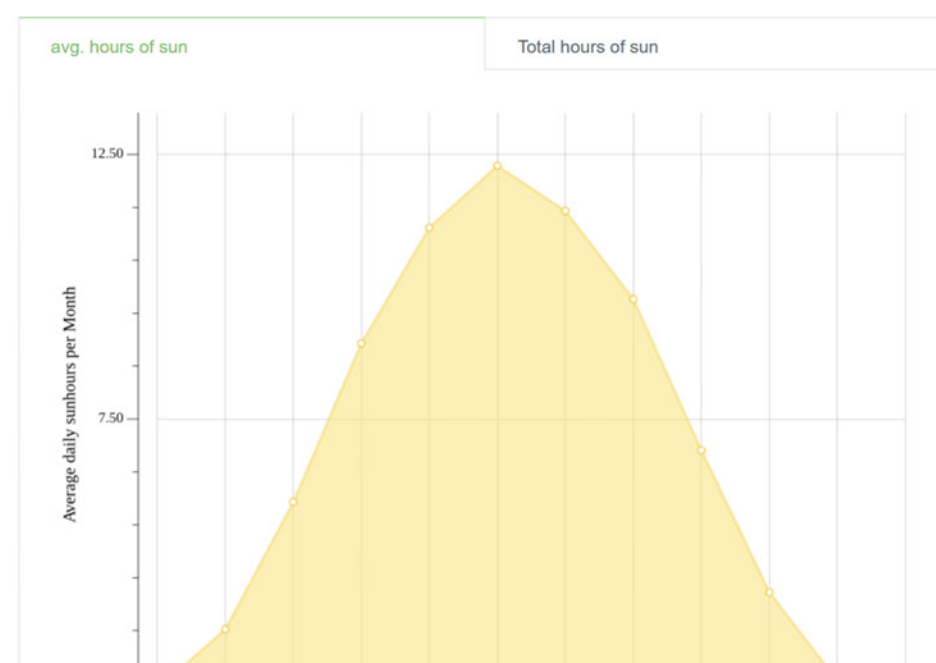
It is observed that November (86.61) has the highest relative humidity, whereas May (69.05) experiences the lowest. The month with the highest precipitation is August (12.00 days), whereas the one with the lowest amount of rainfall is April (8.50).

WATER TEMPERATURE STOCKHOLM(BALTIC SEA)



On average, the yearly water temperature in Baltic Sea at Stockholm is recorded as approximately 8.40°C | 47.12°F. When the water temperature is at 18.60°C | 65.48°F, it attains its peak value on a monthly basis in August. Conversely, during March, the lowest reading of about 1.00°C | 33.80°F is recorded.

HOURS OF SUNSHINE IN STOCKHOLM



At Stockholm, the month that boasts the highest number of daily sunshine hours is June with an average duration of 12.29. The total count for this period accumulates to a staggering sum of 368.65 sunlight hours. The location of Stockholm experiences the least number of daily hours with sunshine during January, wherein an average of only 2.28 hours is recorded. The total count for this month's sunlight duration accumulates to a sum value equivalent to 70.61.

WEATHER BY MONTH // WEATHER AVERAGES STOCKHOLM

	January	February	March	April	May	June	July	August	September	October	November	December
Avg. Temperature °C (°F)	-1.8 (28.8)	-1.7 (29.0)	0.5 (33.0)	5.4 (41.7)	10.6 (51.1)	14.8 (58.7)	17.7 (64.0)	18.6 (65.5)	13.1 (55.5)	7.6 (45.6)	3.6 (38.4)	0.2 (32.4)
Min. Temperature °C (°F)	-3.7 (25.4)	-3.9 (25.0)	-2.3 (27.9)	2 (35.7)	7 (44.6)	11.4 (52.5)	14.8 (58.6)	14.2 (57.6)	10.6 (51.1)	5.7 (42.2)	2 (35.6)	-1.6 (29.2)
Max. Temperature °C (°F)	-0.1 (31.8)	0.4 (32.7)	3.5 (38.2)	9 (48.3)	14 (57.3)	18.1 (64.5)	21 (69.9)	19.9 (67.8)	15.8 (60.4)	9.5 (49.2)	5 (35.2)	1.8 (35.2)
Precipitation / Rainfall mm (in)	44 (1.7)	37 (1.5)	34 (1.3)	36 (1.4)	45 (1.8)	67 (2.6)	72 (2.8)	73 (2.9)	56 (2.2)	52 (2.0)	53 (2.1)	50 (2.0)
Humidity (%)	84%	83%	78%	73%	69%	70%	74%	76%	79%	84%	87%	85%
Rainy days (d)	7	7	7	6	7	8	9	9	7	8	8	8
avg. Sun hours (hours)	2.4	3.5	5.9	8.9	11.1	12.3	11.4	9.8	6.9	4.2	2.5	2.3

Data: 1991 - 2021 Min. Temperature °C (°F), Max. Temperature °C (°F), Precipitation / Rainfall mm (in), Humidity, Rainy days. Data: 1999 - 2019: avg. Sun hours

There exists a variation of 39 mm | 2 inch in precipitation levels between the month with the least rainfall and that which experiences maximum downpour. Throughout the course of a year, there is an observable fluctuation in average temperatures by 19.8 °C | 35.6 °F.

It is observed that November (86.61) has the highest relative humidity, whereas May (69.05) experiences the lowest. The month with the highest precipitation is August (12.00 days), whereas the one with the lowest amount of rainfall is April (8.50).

CALCULATION OF U VALUE

The U-value, or thermal transmittance, is a measure of the heat transfer through a structure, such as a wall, roof, or window. It quantifies how well a building element conducts heat. A lower U-value indicates better insulation and reduced heat loss. The U-value is expressed in watts per square meter per degree Celsius (W/(m²·°C)).

Outside wall insulation (wood fibre), U=0.24 W/(m²K)

Temperature profile

Layers (from inside to outside)

#	Material	A [m]	R [m²K/W]	Temperature [°C]	Weight [kg/m²]
1	Thermal contact resistance*	0.130	18.5	20.0	-
2	1 cm HASTI 150 Filzputz	0.330	0.030	18.4	12.0
3	1.5 cm Cement plaster	1.400	0.011	18.3	39.0
4	2 cm Light weight concrete	1.300	0.154	17.4	360.0
5	1 cm Gypsum plaster	0.350	0.026	17.2	10.0
6	2 cm Lime cement plaster	1.000	0.020	17.1	17.2
7	14 cm Extruded polystyrene (XPS 035)	0.540	0.009	17.1	17.2
8	0.5 cm Bitumen membranes	0.042	3.233	2.5	17.1
9	0.5 cm Bitumen membranes	0.042	3.233	2.5	17.1
10	5 cm OSB/3	0.130	0.385	-4.8	31.0
11	Thermal contact resistance*	0.130	18.5	-4.8	-
12	Whole component	4.150	-	-	512.6

Surface temperature inside (min / average / max): 18.5°C / 18.5°C / 18.5°C
Surface temperature outside (min / average / max): -4.8°C / -4.8°C / -4.8°C

Floor heating, U=0.26 W/(m²K)

Temperature profile

Layers (from inside to outside)

#	Material	A [m]	R [m²K/W]	Temperature [°C]	Weight [kg/m²]
1	Thermal contact resistance*	0.100	20.0	20.2	-
2	1 cm Tiles (ceramic)	1.200	0.008	20.2	20.2
3	0.14 cm Foil, PE	0.400	0.005	20.2	1.7
4	8 cm purem FAL	0.023	3.478	20.2	22.4
5	0.4 cm BITUMAT PVC Waterproofing Membrane	0.170	0.029	22.4	2.4
6	50 cm Reinforced concrete (1%)	2.300	0.217	22.4	22.6
7	10 cm gravel	0.400	0.009	22.5	23.6
8	4 cm Cement screed	2.000	0.050	21.1	24.4
9	Thermal contact resistance*	1.400	0.028	18.0	20.0
10	Whole component	0.900	5.0	20.0	1.479.4

Surface temperature inside (min / average / max): 20.2°C / 20.2°C / 20.2°C
Surface temperature outside (min / average / max): 15.9°C / 20.5°C / 30.0°C

Outside wall insulation (wood fibre)

Thermal protection: U = 0.24 W/(m²K)
Moisture proofing: Dries 44 days, Condensate 51 g/m², Wood moisture: +0.1%
Heat protection: Temperature amplitude damping: >100 phase shift: non relevant, Thermal capacity inside: 443 kJ/m²K

Impact of each layer and comparison to reference values

Inside air: 20.0°C / 50%
Outside air: -5.0°C / 80%
Surface temperature: 18.5°C / -4.8°C

Floor heating, U=0.26 W/(m²K)

Moisture proofing

Humidity

Notes: Calculation using the Ubakus 2D-FE method. Convection and the capillarity of the building materials were not considered. The drying time may take longer under unfavorable conditions (shading, damp / cool summers) than calculated here.

Flat roof with sloped insulation

Thermal protection: U = 0.19 W/(m²K)
Moisture proofing: Dries 81 days, Condensate: 8.3 g/m²
Heat protection: Temperature amplitude damping: >100 phase shift: non relevant, Thermal capacity inside: 377 kJ/m²K

Impact of each layer and comparison to reference values

Inside air: 20.0°C / 50%
Outside air: -5.0°C / 80%
Surface temperature: 18.7°C / -4.8°C

Flat roof with sloped insulation, U=0.19 W/(m²K)

Moisture proofing

Humidity

Notes: Calculation using the Ubakus 2D-FE method. Convection and the capillarity of the building materials were not considered. The drying time may take longer under unfavorable conditions (shading, damp / cool summers) than calculated here.

Flat roof with sloped insulation, U=0.19 W/(m²K)

Heat protection

Temperature profile

Surface temperature during the day

Phase shift: 10.3h
Heat capacity (whole component): 487 kJ/m²K
Thermal capacity of inner layers: 377 kJ/m²K

Flat roof with sloped insulation, U=0.19 W/(m²K)

Temperature profile

Layers (from inside to outside)

#	Material	A [m]	R [m²K/W]	Temperature [°C]	Weight [kg/m²]
1	Thermal contact resistance*	0.250	0.100	18.7	20.0
2	1.25 cm Gypsum board	0.350	0.050	18.4	18.8
3	4 cm Installation level	0.250	0.160	17.5	18.5
4	4 cm Lathing (0.6%)	0.100	0.208	17.5	18.6
5	20 cm Reinforced concrete (1%)	2.200	0.087	17.1	17.8
6	0.05 cm Vapor barrier sd=100m	0.020	0.022	17.0	17.1
7	14 cm Extruded polystyrene (XPS 035)	0.005	4.000	-4.1	17.0
8	0.5 cm Bitumen membranes	0.020	0.222	-4.3	-4.1
9	75 cm Plain tiles and battens	0.100	-4.8	-4.3	70.0
10	Thermal contact resistance*	0.400	-4.8	-4.8	550.0
11	Whole component	4.570	-	-	-

Surface temperature inside (min / average / max): 18.7°C / 18.7°C / 18.8°C
Surface temperature outside (min / average / max): -4.8°C / -4.8°C / -4.8°C

SERVICES

Heat pumps - how they work

A method of heating first developed in the USA in the 1940s, the technology has slowly spread across the world and in some countries, notably Sweden, is now the main form of home heating in rural areas. In Germany and Austria it has also gained in popularity.

WINTER HEATING AND MECHANICAL VENTILATION WITH HEAT RECOVERY

IN GENERAL

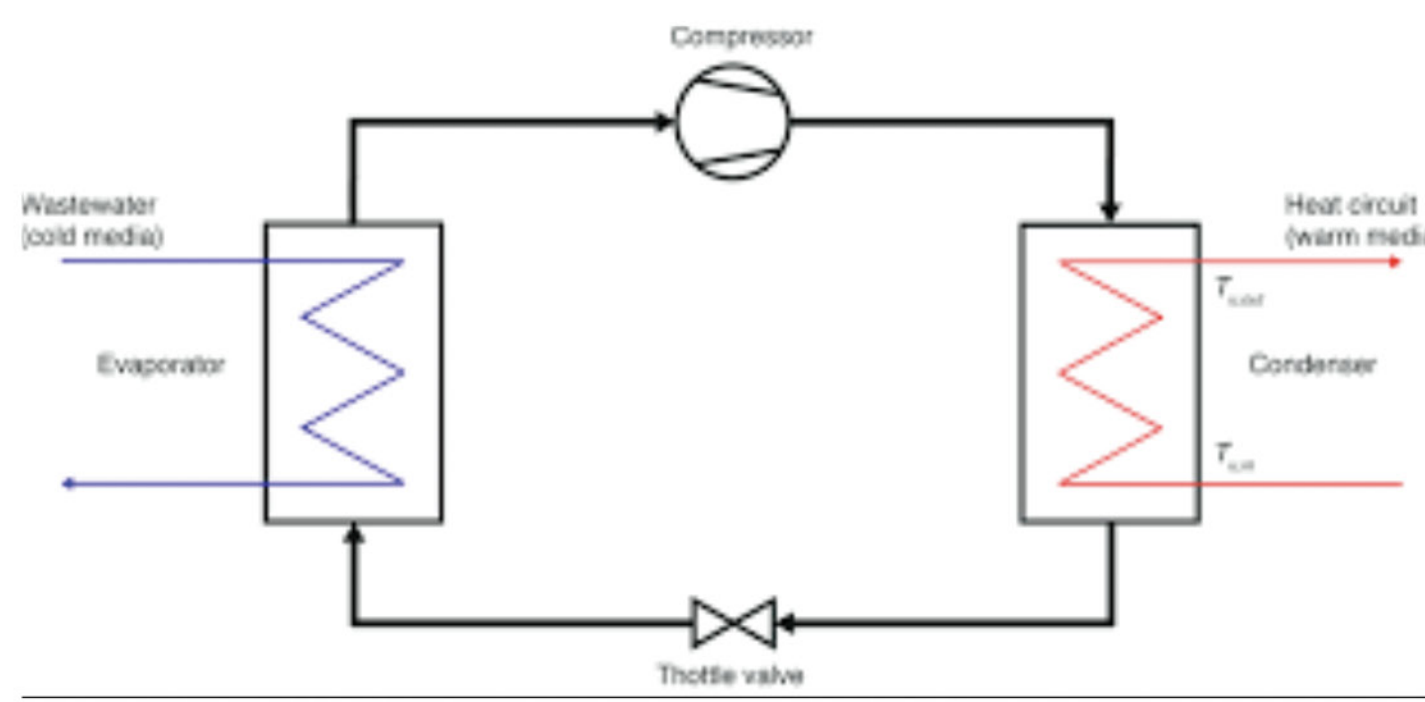
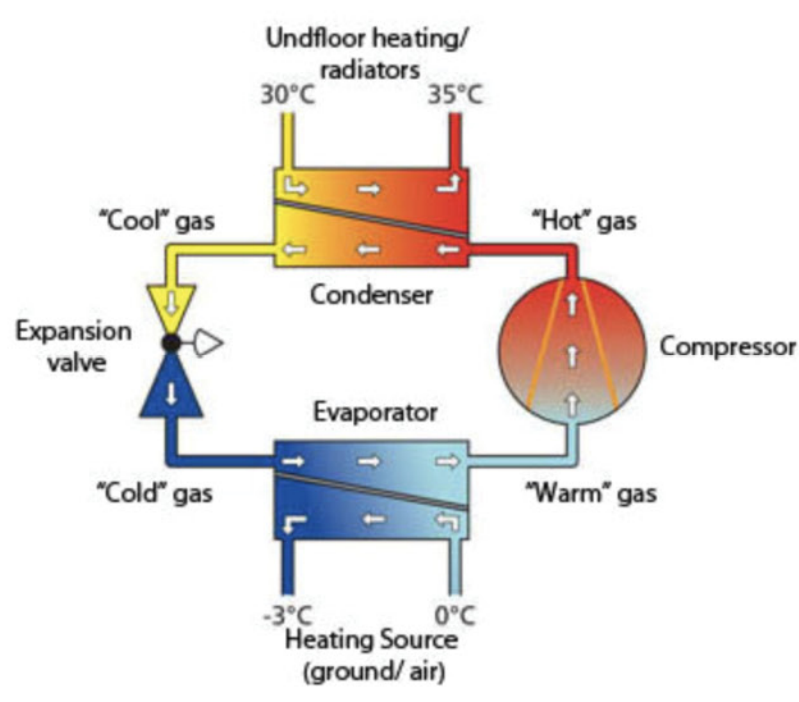
The average temperature drops below freezing (0 °C or 32 °F) from December to February, and it typically exceeds the freezing point in March. However, the weather varies greatly depending on weather situation: when mild currents from the Atlantic Ocean prevail, the temperature can exceed freezing by a few degrees even in winter, and rain can fall instead of snow. In other periods, when an anticyclone of polar or Siberian origin moves over the city, the temperature sinks below freezing, down to -20 °C (-4 °F) and more. The coldest record is -29.1 °C (-20.4 °F) and was set in January 1979. In the short spring, in April and May, the weather is variable, and there can be the first mild days, but also the return of cold weather. It can still snow in late April, and it can still get cold in May, but at other times, it can already get warm, sometimes in late April, but more often in the second half of May, when an anticyclone can move over Scandinavia, bringing a few early summery days.

THE SOLUTION

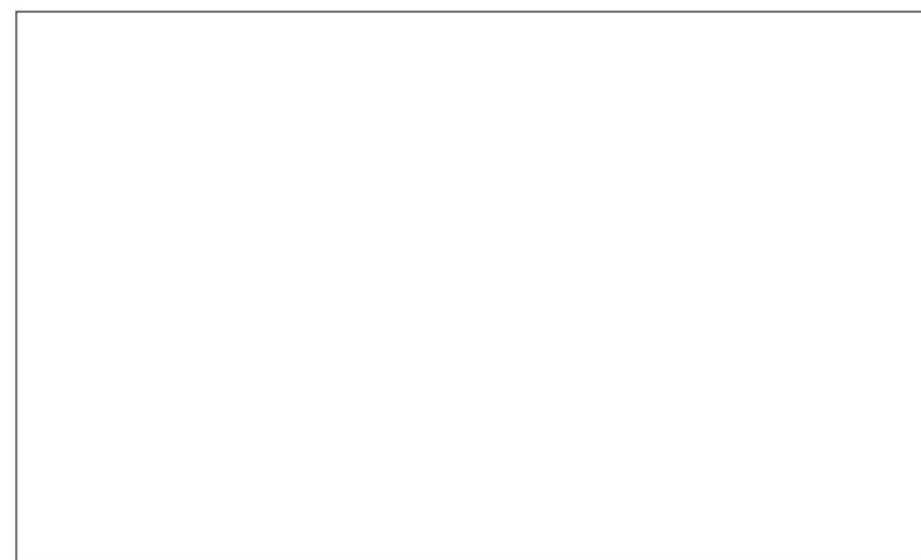
Heat pumps: the heating source would be the sea water (and it will not be at 0 C, but 10 may be, we put the average temperature at 10 m depth of the harbour in Stockholm, and the HP will deliver warm water at 35 C to the underfloor heating

PERFORMANCE

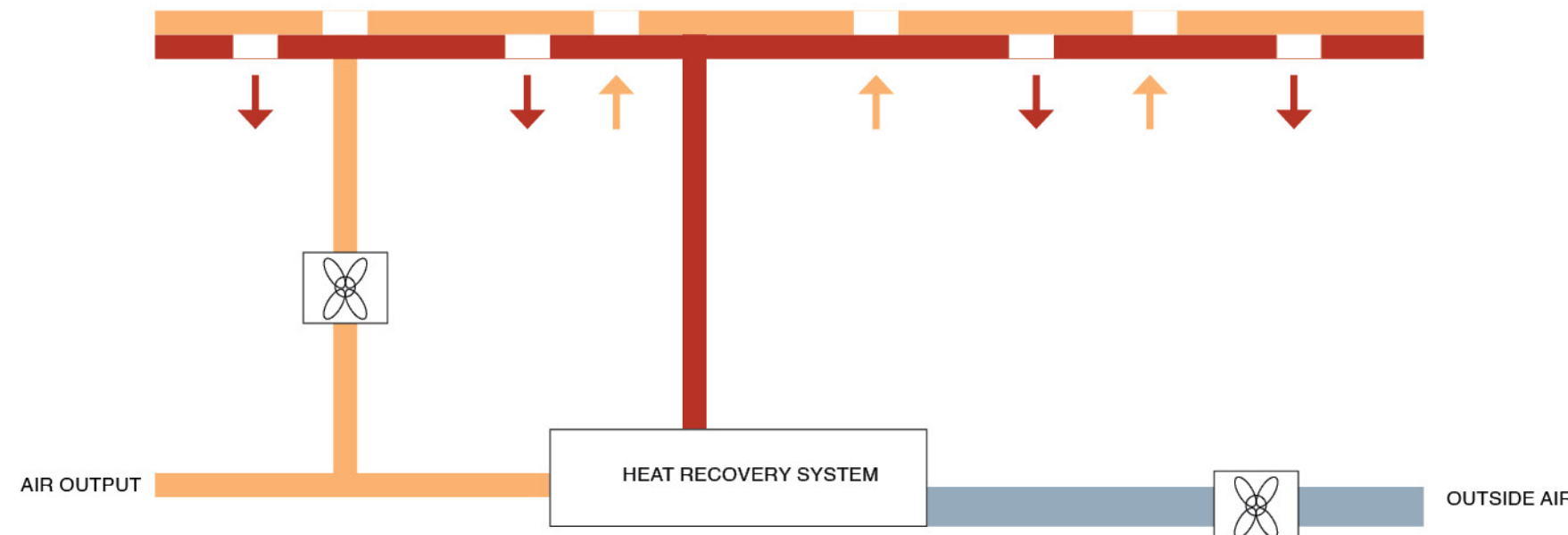
For ground and water source heat pumps there are two circuits: the external 'collector' circuit that pumps a liquid around a piped circuit in the soil or water to collect the heat, and the internal heat pump circuit, filled with refrigerant, that 'moves' the heat. In place of the external circuit, air source heat pumps simply blow the air across a heat exchanger filled with refrigerant using a big fan. The internal circuit absorbs the collected heat from the external circuit in an evaporator. As the refrigerant has a low temperature boiling point, it can evaporate into a gas when it is not under pressure. As it evaporates, it absorbs energy in the form of heat (in a similar way to the water in your kettle, which absorbs electrical energy as heat to boil and produce steam). The refrigerant is now pressurised in an electrical compressor (this is where most of the electrical energy is used). Under pressure, the refrigerant condenses, turns into liquid and releases heat energy. The released heat is normally transferred to water and pumped around the house for space heating and hot water. The final stage of the internal heat pump circuit is for the refrigerant to pass through an expansion valve, releasing the pressure, allowing it to evaporate again and continue the cycle.



HOW THE PIPES ARE PLACED IN THE FLOOR PLAN LAYERS



MECHANICAL VENTILATION WITH HEAT RECOVERY WORKING SCHEME



SUMMER HEATING AND MECHANICAL VENTILATION WITH HEAT RECOVERY

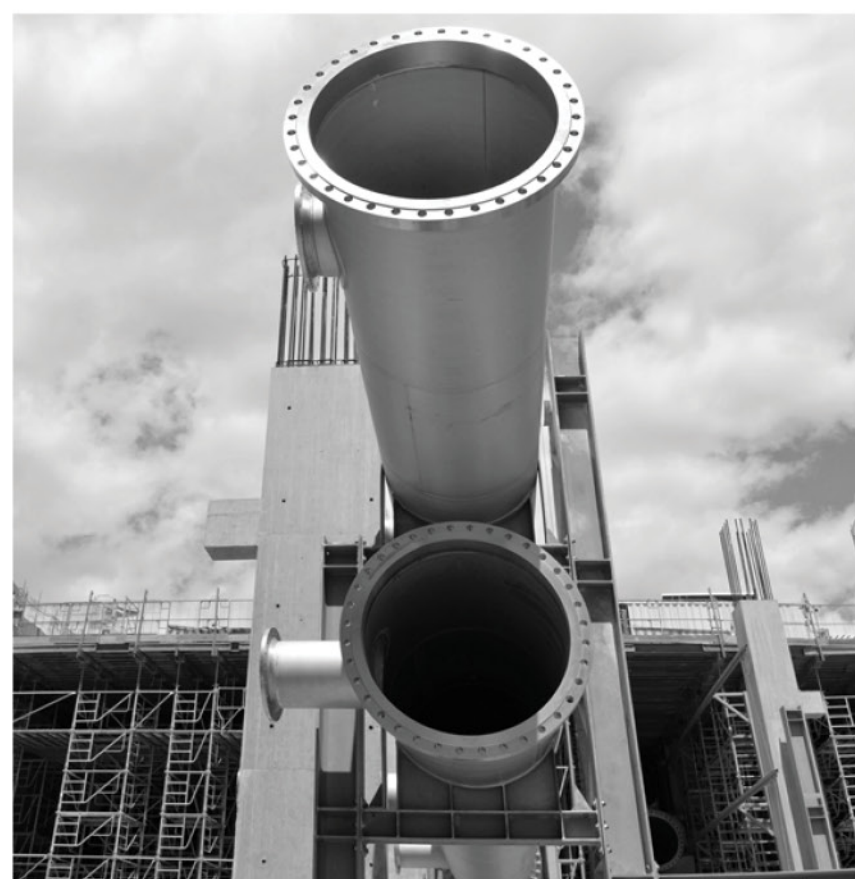
IN GENERAL

Summer, from June to August, is a mild or pleasantly warm season, with highs around 22/23 °C (72/73 °F) in July and August, and very long days. June is a bit cooler, but it has the longest days of the year. Sometimes there can be hot periods, usually of short duration, in which the temperature reaches 28/30 °C (82/86 °F). The highest record is 35.1 °C (95.2 °F) and was set in August 1975. Due to global warming, hot periods are becoming more frequent. In July 2018, there were 16 days with a maximum equal to or above 28 °C (82.5 °C), and it reached 32 °C (89.5 °C). However, sometimes at night, it can be very cool, or even cold, since the temperature can drop below 10 °C (50 °F) even in this season. Autumn, from September to November, is cool and quite rainy as early as in September, and then gradually becomes more cold and gray; also, the days shorten rapidly. In November, the temperature is just above freezing, and in this month, typically the first snowfalls occur.

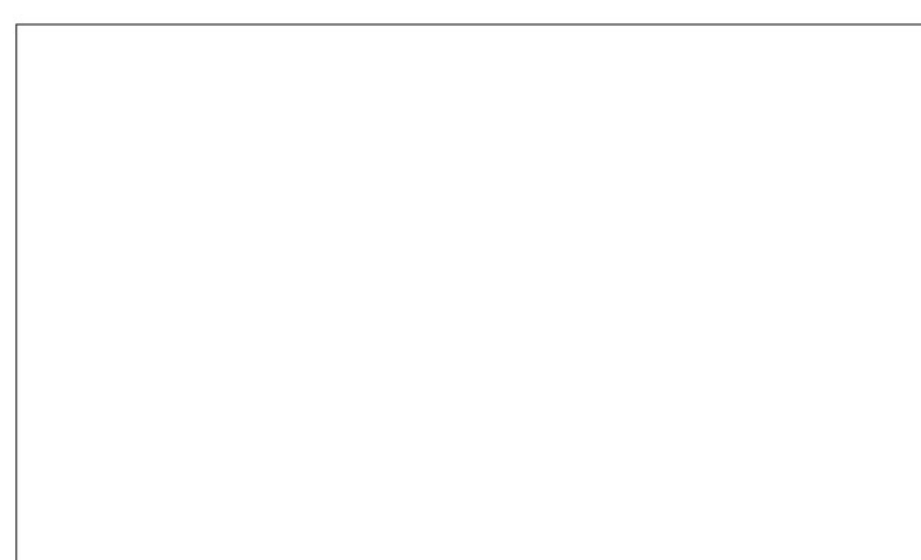
HOW EFFECTIVE ARE HEAT PUMPS 'ON THE GROUND'?

An extensive study by the Energy Savings Trust, which ran from 200g to 2012, was undertaken to find out how heat pumps installed in UK homes were actually performing. It first evaluated 83 sites and then monitored how heat pump performance changed after various degrees of system upgrades were performed on 32 of the units. On average they found ground source performed better than air source, and in general the measured COPs stood in and around the 3 mark although in the first phase of the study one site did come in at 1.2!

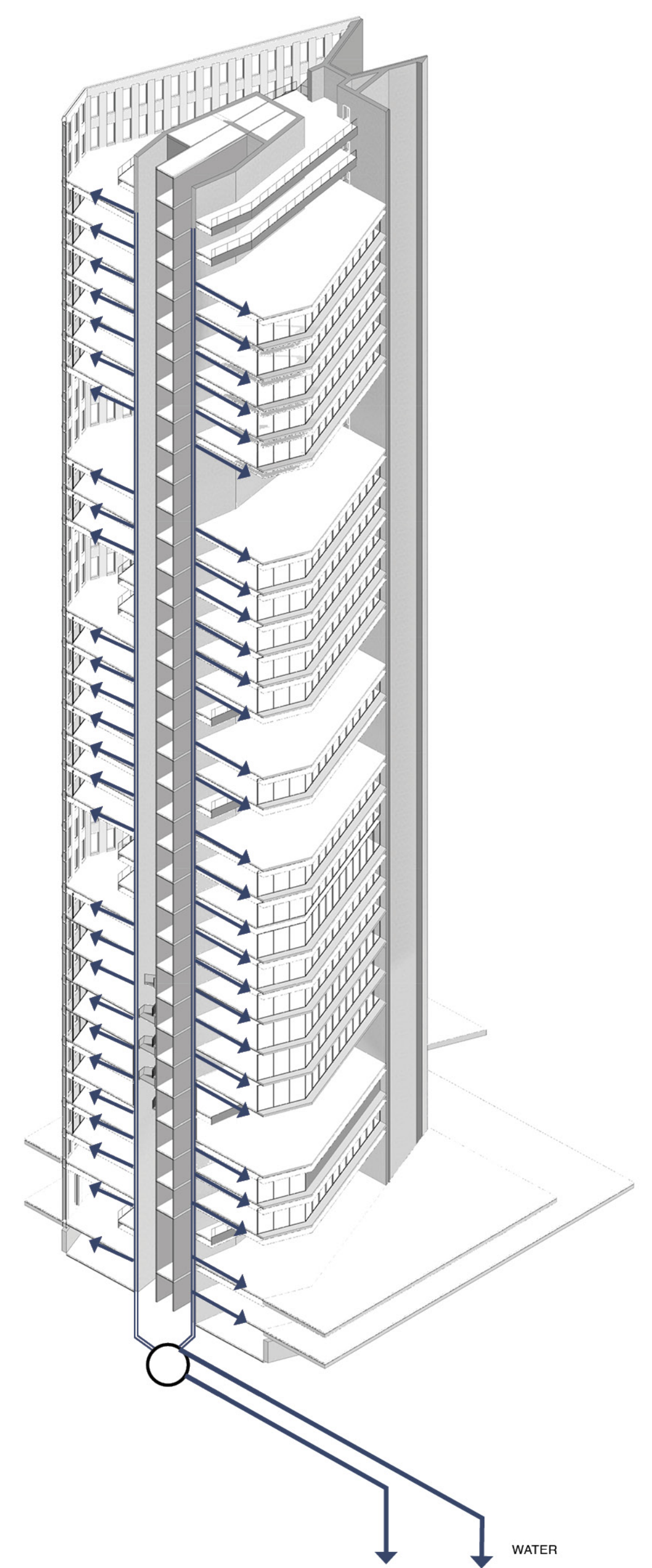
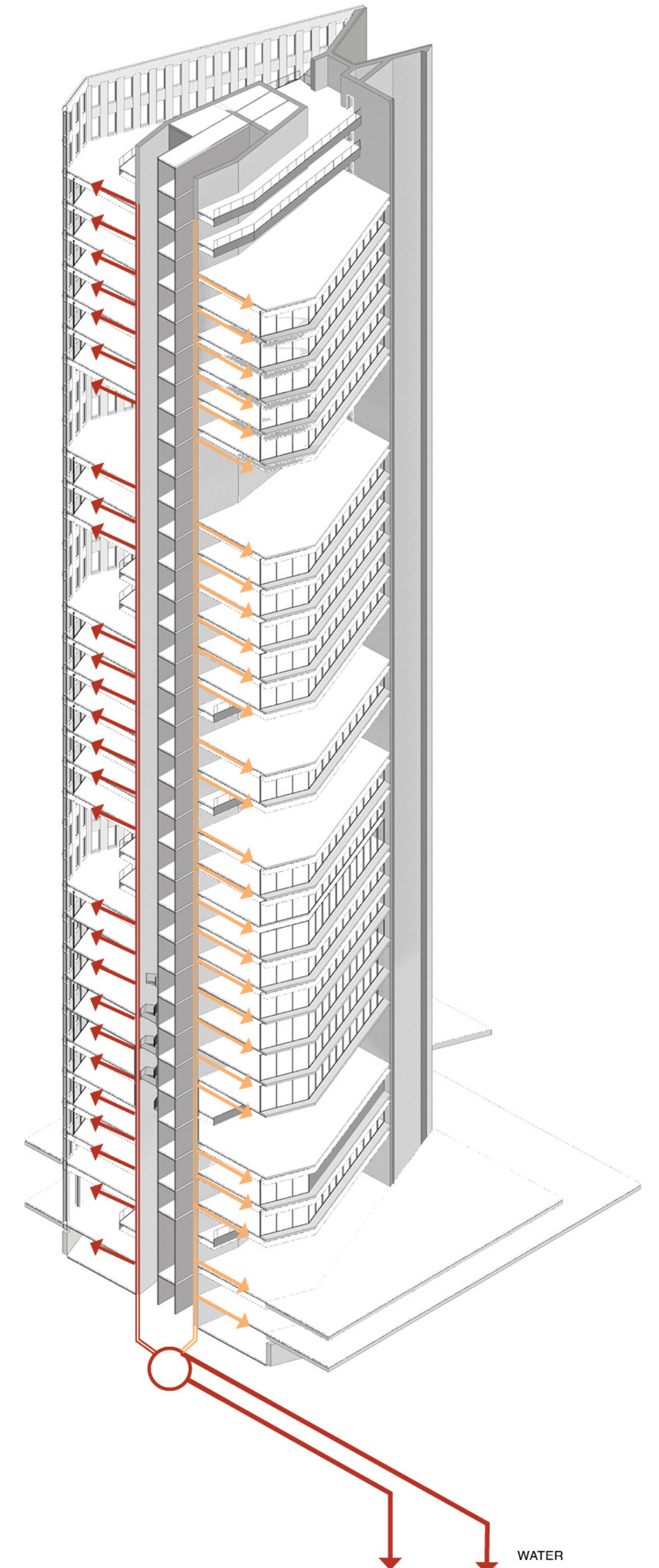
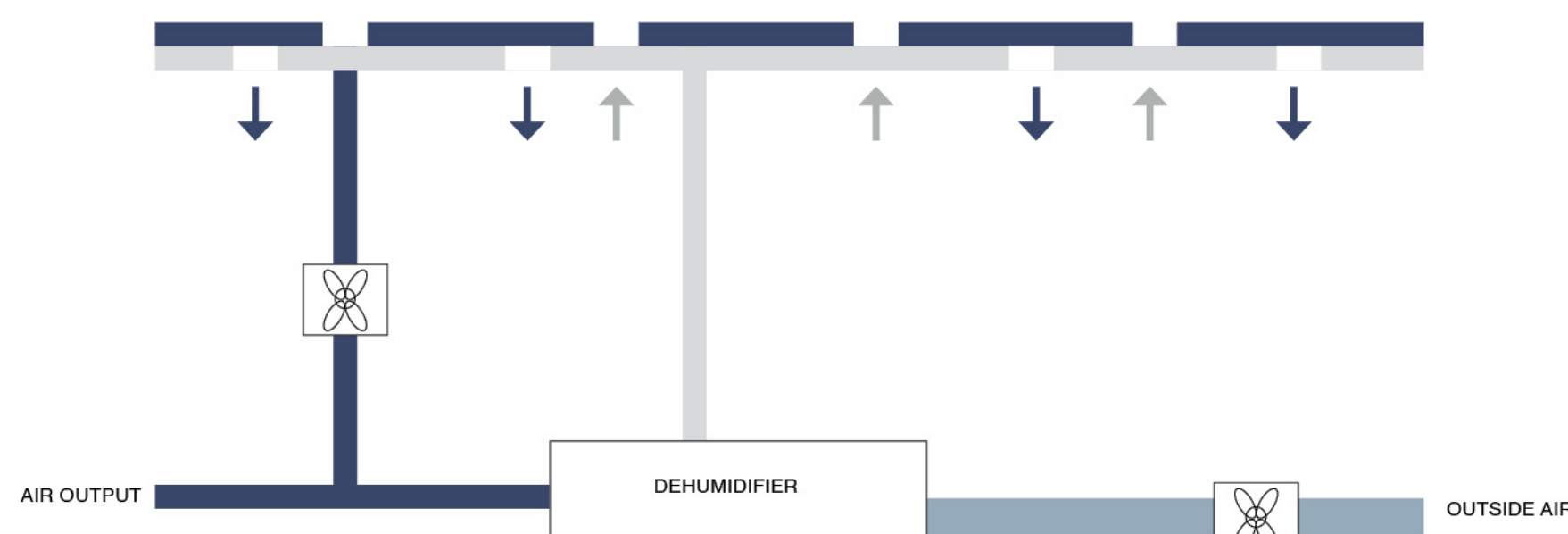
Keeping the system and the controls simple was an important variable in determining which ones performed better than the rest, as was system sizing, which was especially evident in the second phase of the study, the findings of which were recently published. In five cases they had to replace the heat pump with a smaller one to increase efficiency, in another significant gains were made by altering the software to reduce the use of the auxiliary heater (COP increased from 2.31 to 3.29). This highlights the absolute necessity to get a system that is both correctly designed and installed.



HOW THE PIPES ARE PLACED IN THE FLOOR PLAN LAYERS



DEHUMIDIFIER WORKING SCHEME



SERVICES

Mechanical spaces , elevators , pipes

Mechanical spaces in towers refer to dedicated areas within tall buildings that house the mechanical, electrical, and plumbing (MEP) systems essential for the building's functionality. These spaces accommodate equipment such as heating, ventilation, and air conditioning (HVAC) systems, elevators, electrical panels, plumbing, and other utilities. Efficient design and organization of mechanical spaces are crucial for ensuring optimal building performance, safety, and maintenance accessibility.

TECHNICAL DETAILS, MATERIALS PALET

Orientation of main plan and core, position of technical services areas (technical and mechanical)

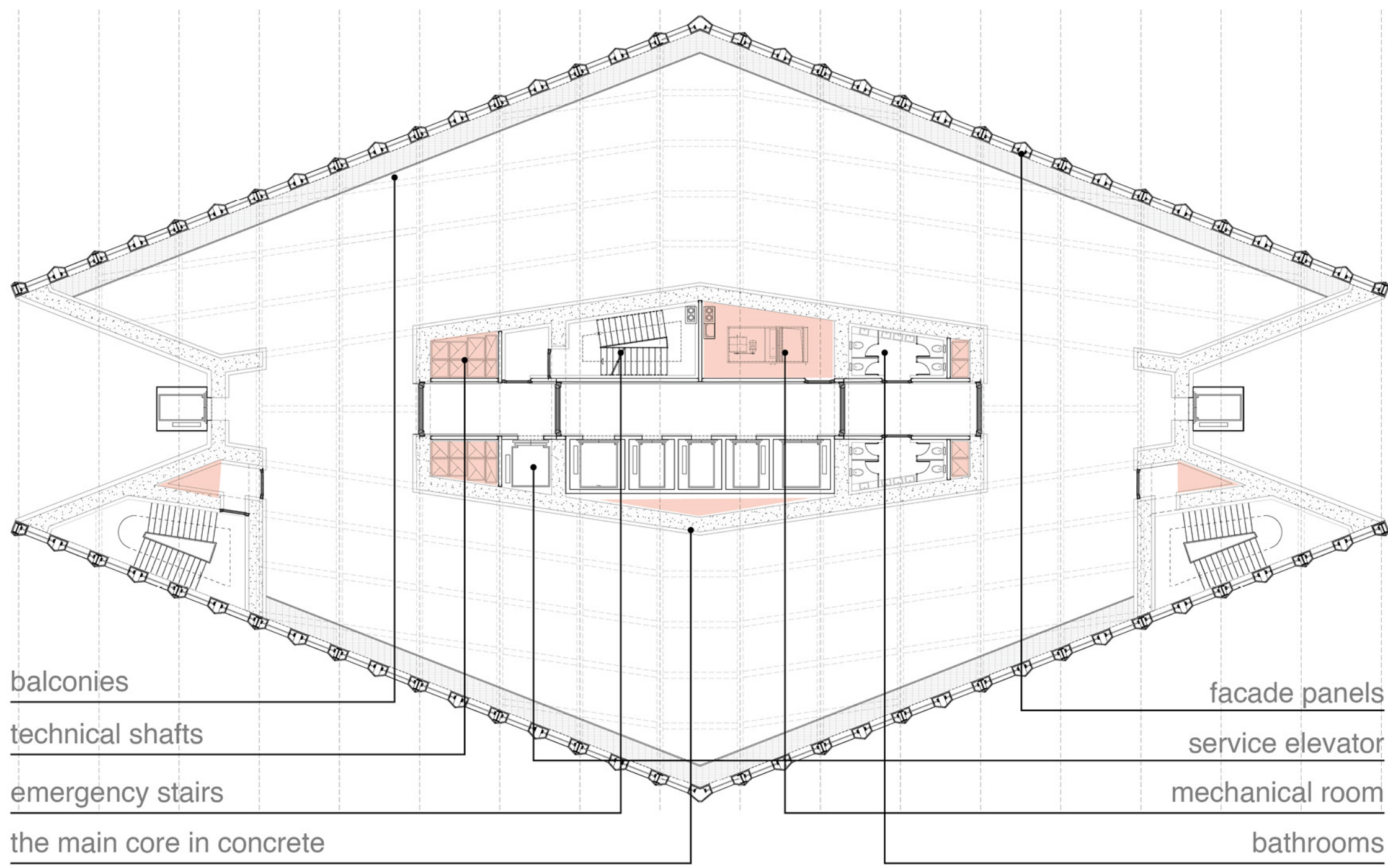
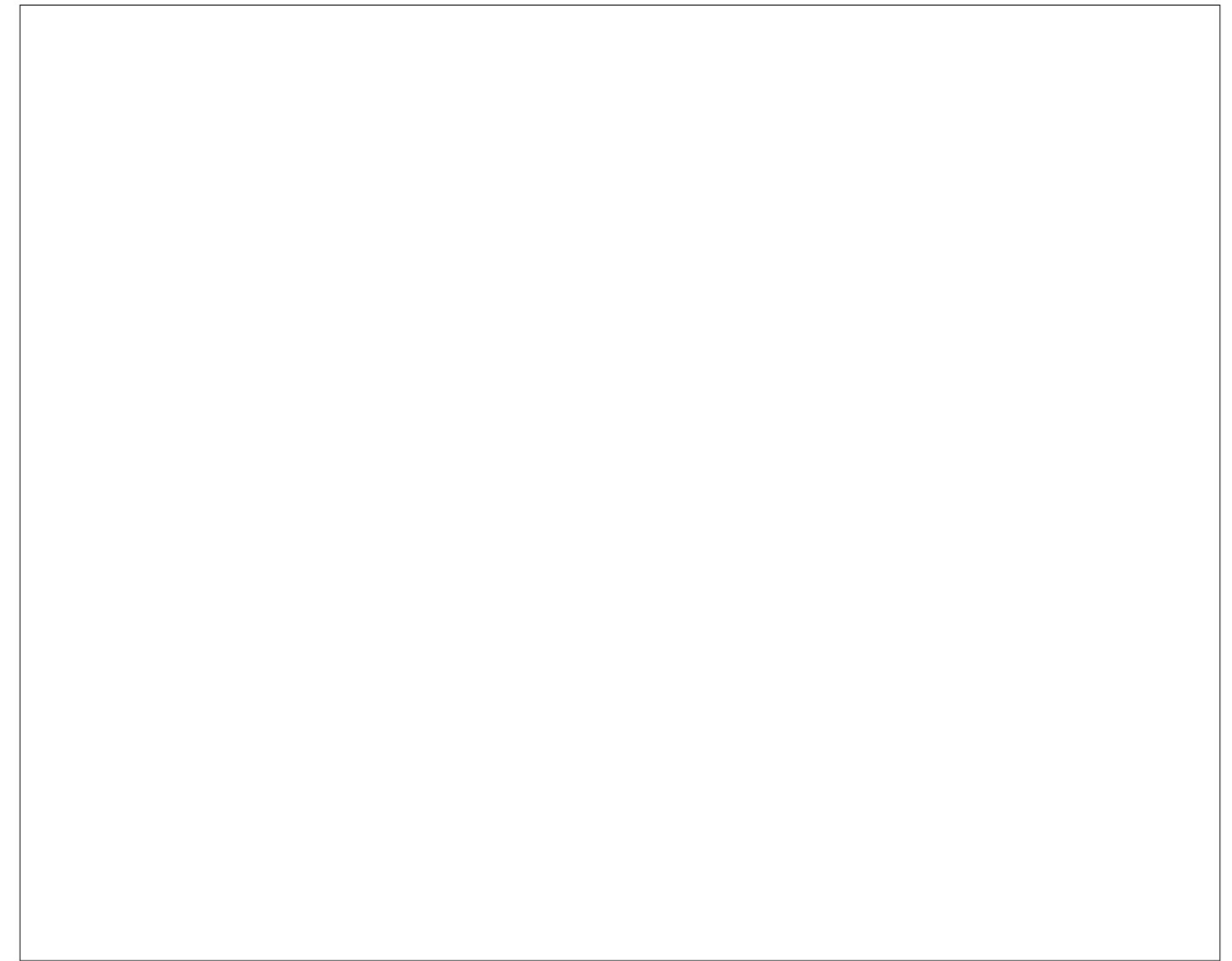
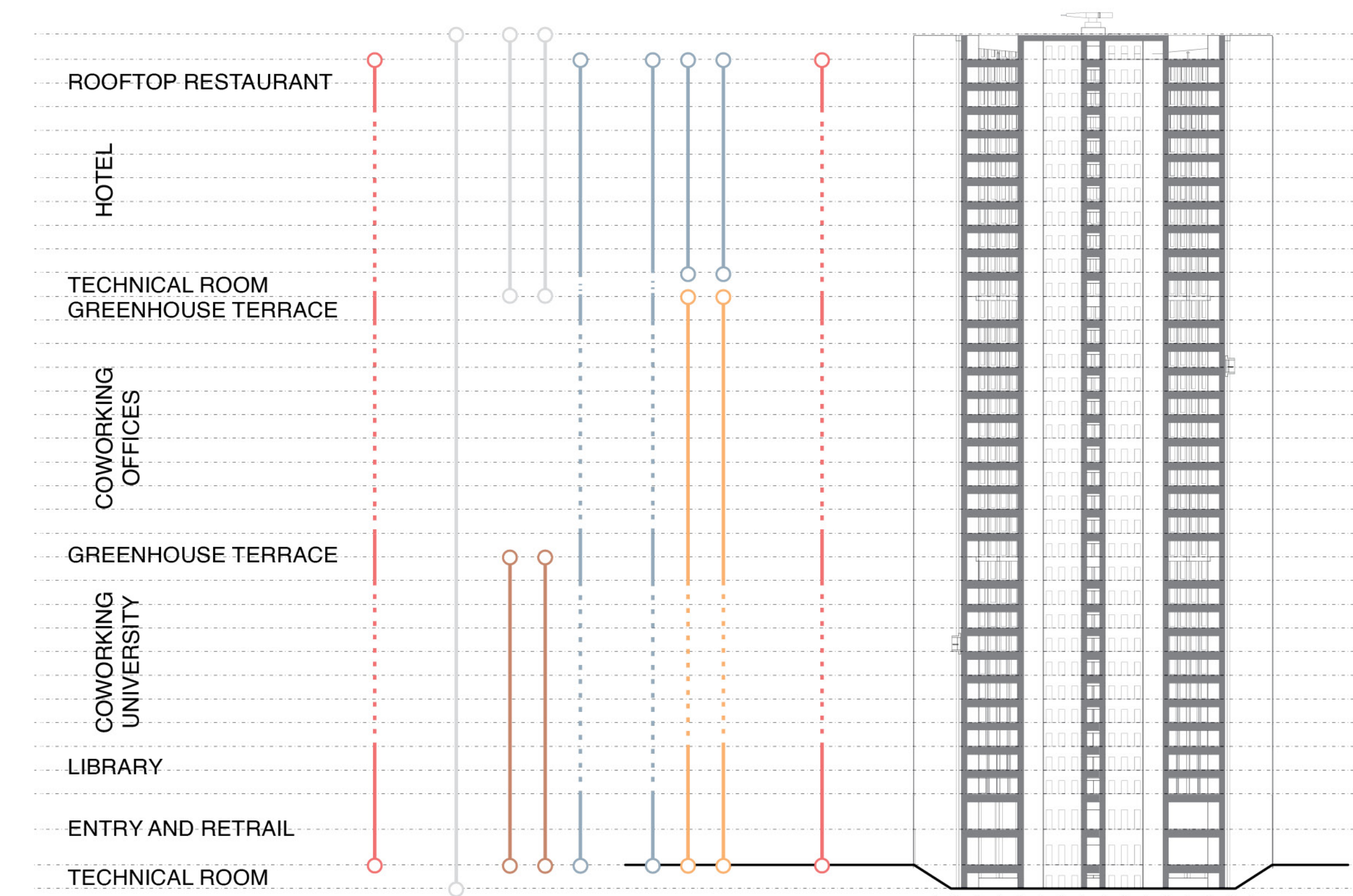


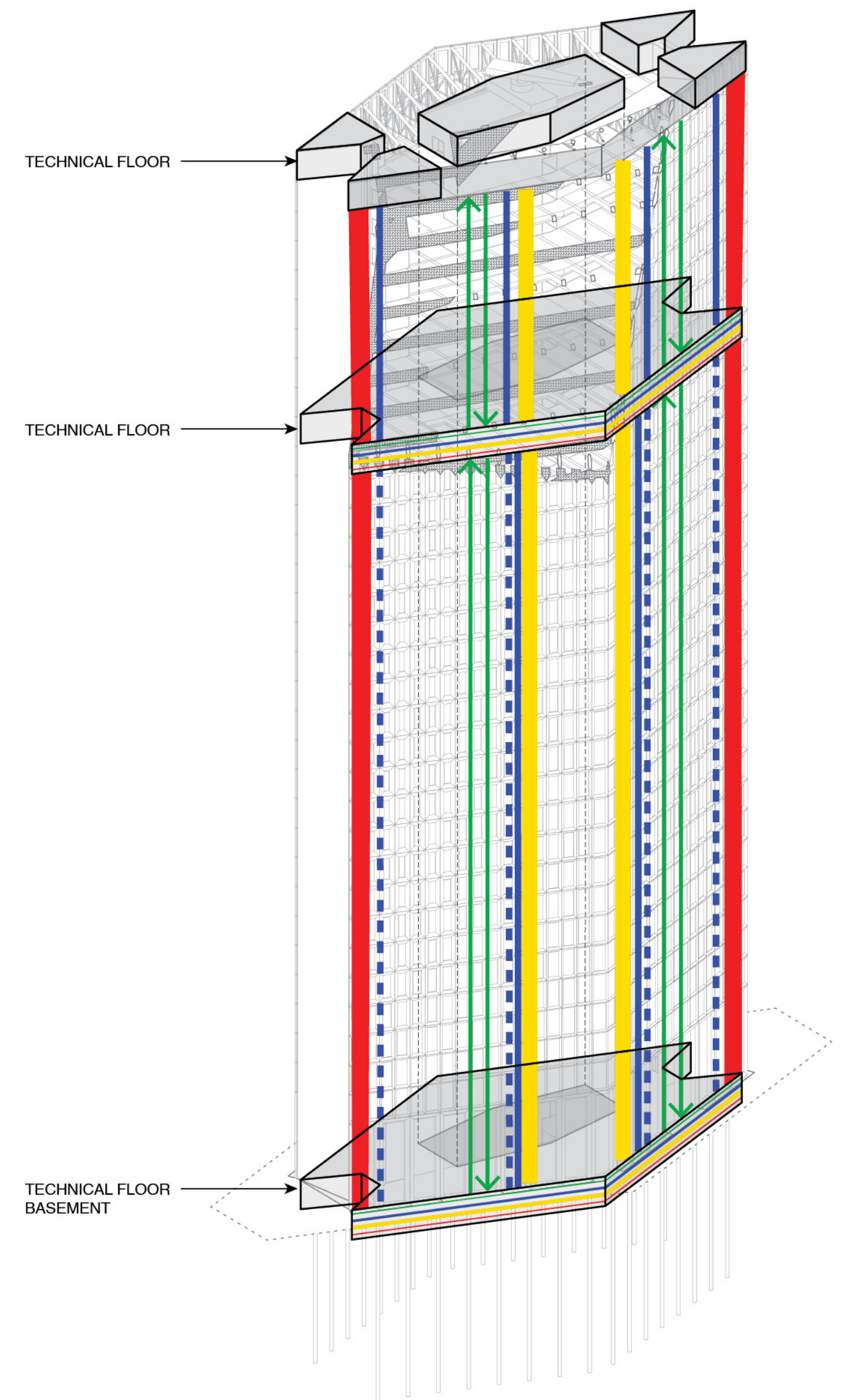
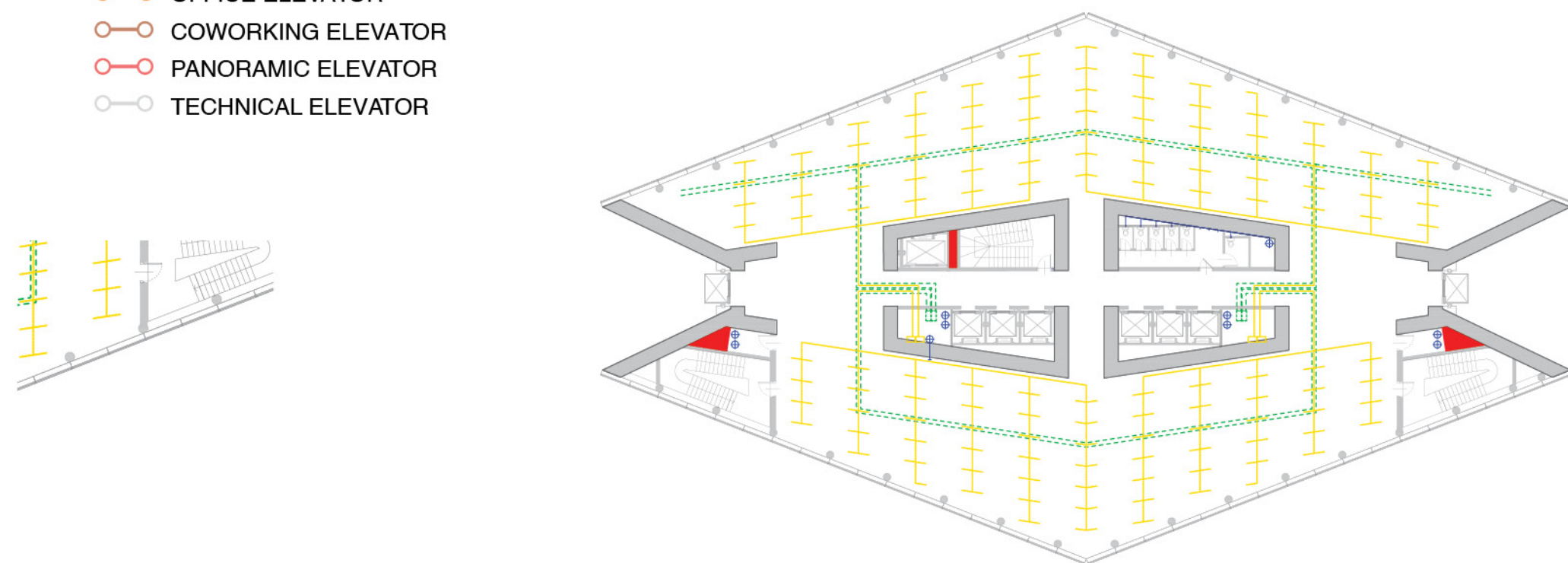
TABLE OF MECHANICAL AREAS



MEP ORIENTATION DETAILS



- HOTEL ELEVATOR
- OFFICE ELEVATOR
- COWORKING ELEVATOR
- PANORAMIC ELEVATOR
- TECHNICAL ELEVATOR



- WATER DISTRIBUTED IN THE FLOORS
- VERTICAL WATER DISTRIBUTION