Research by Design

A Graduation Report up to P4

Jing Han 5768764

Abstract

Campus as a Community in the 21st Century

In the 21st century, a campus functions as a learning community where individuals with shared attitudes and interests come together. Defined by the commonality of values, this community serves as a central hub for the exchange of knowledge, inspiration, and innovation. Individuals of all age groups, representing diverse characteristics, converge around these shared values and interests in pursuit of learning. While maintaining its traditional role as a learning space, the modern campus places increased importance on cultivating social values. This shift is especially notable as online learning continues to evolve, accentuating the significance of the social dimension within the physical campus experience.

My vision extends to creating a dedicated learning community in the city of The Hague, with a focused emphasis on two pillars: enriching the learning experience and cultivating a vibrant social space. This community aims to facilitate interactions among people of all age groups, fostering the exchange of ideas and providing inspiration.

To bring this vision to life, I plan to design an improved learning environment informed by scientific research, particularly in the realm of environmental psychology. This approach ensures that the physical space itself contributes to a positive and conducive learning atmosphere. Additionally, the community programs will cater to all age groups, promoting a culture of lifelong learning.

Graduation Plan

Graduation Plan: All tracks

Submit your Graduation Plan to the Board of Examiners (Examencommissie-BK@tudelft.nl), Mentors and Delegate of the Board of Examiners one week before P2 at the latest.

The graduation plan consists of at least the following data/segments:

Personal information	
Name	Jing Han
Student number	5768764

Studio		
Name / Theme	Public Building	
Main mentor	Stefano Corbo	Project Design
Second mentor	Florian Eckardt	Technical Building Design
Third mentor	Sang Lee	Theory & Delineation
Argumentation of choice of the studio	The core value of architectural design to me is its human-centered approach. Public spaces and buildings are crucial as they can revitalize a city and enhance the quality of life for people. I am fascinated by public buildings because they are designed for people and allow for multiplicity as architectural design elements. I would like to explore the topic of the vertical campus, as it offers opportunities to envision a typology of university space in the 21st century that is not only functional but also integral with social values.	

Graduation project	
Title of the graduation project	Verticalizing Public Space: Campus as a learning community
Goal	
Location:	The Hague, Netherlands
The posed problem,	The majority of theories related to public space are deeply rooted in the concept of horizontalism. Traditionally, perceptions have been predominantly confined to horizontal landscapes and flat surfaces. However, with global cities experiencing vertical growth due to increased population density and urbanization, **the notion of ungrounded public space requires reassessment.** In the context of the campus, **the functions and value of the campus need to be reevaluated.** In the 21st century, the role of the campus extends beyond its primary function as a space for learning; it plays a crucial role in nurturing social values. It epitomizes the essence of community. Within this communal

	setting, individuals with diverse characteristics converge around shared values and common interests. It functions as a dynamic hub for the exchange of ideas and serves as a wellspring of inspiration.
research questions and	In the domain of public space design: How can the foundational principles of horizontal public space design be utilized to shape and influence the evolution of vertical public spaces? In other words, what valuable insights can be drawn from the design of horizontal public spaces and adapted to their vertical counterparts? Revisiting the context of campus design: How do functions, learning experiences, and public spaces harmonize within the structure of a vertical campus? Moreover, in exploring the application of the community concept in vertical campus design, how might it contribute to enhancing the overall learning experience?
design assignment in which these result.	The discoveries will set the theoretical groundwork and be experimentally applied in my graduation project. The primary aim is to create a design in line with my vision for a 21st-century vertical campus. This vision encompasses establishing a specialized learning community in The Hague. Anchored by two crucial pillars—enhancing the learning experience and fostering a dynamic vertical social public space—this community seeks to encourage interactions among diverse age groups, promoting the exchange of ideas, and acting as a source of inspiration. It not only prioritizes education but also nurtures meaningful connections and supports continuous learning throughout life.

Process

Method description

In the endeavor to enhance vertical public space, I intend to accomplish my goal through a detailed exploration of three critical aspects: boundary, threshold, and hierarchy. Specific methods will be applied to each aspect, as outlined below (the list of literature reviews for each aspect are in the next section):
Boundary: Qualitative analysis through literature reviews and case study
Threshold: Qualitative analysis through literature reviews and observation
Hierarchy: Qualitative analysis through literature reviews and case study
These research efforts aim to enhance our understanding of defining private and public spaces, fostering social interactions, and establishing varying degrees of privacy within learning spaces associated with the program within the design.

Concurrently, while delving into the concept of a 21st-century campus as a community, the research will employ the methodology of literature review and case study. The plan involves crafting an enhanced learning environment guided by a thorough literature review of scientific research in the field of environmental psychology, with a particular focus on how spatial proportions impact the learning experience. This approach ensures that the physical space itself contributes to a positive and conducive learning atmosphere. Additionally, the community programs will be tailored to encompass all age groups, fostering a culture of lifelong learning. The programs within the design should be designed to cater to different age groups, and their configurations should enhance the learning experience and promote social interactions.

Literature and general practical references

Campus as a community
Literature review: Patrick Geddes, Team X and John Turner, *Community and Architecture Treble*
Oshin Vartanian, Gorka Navarrete, Anjan Chatterjee, Lars Brorson Fich, Jose Luis Gonzalez-Mora, Helmut Leder, Cristián Modroño, Marcos Nadal, Nicolai Rostrup, Martin Skov, *Architectural design and the brain: Effects of ceiling height and perceived enclosure on beauty judgments and approach-avoidance decisions*, Journal of Environmental Psychology,Volume 41, 2015, Pages 10-18
Avishag Shemesh, Gerry Leisman, Moshe Bar, Yasha Jacob Grobman, *The emotional influence of different geometries in virtual spaces: A neurocognitive examination*, Journal of Environmental Psychology, Volume 81, 2022
Potential case study: Nanyang Learning Hub, Roy and Diana Vagelos Education Center, Stavros Niarchos Foundation Cultural Center

Boundary, hierarchy, and threshold
Boundary: Jan Gehl's studies, including *Life Between Buildings*(concentrated on street-level experiences, reinforcing the prevailing emphasis on flat public spaces.) Herman Hertzberger *Space and Learning* (investigate threshold, hierarchy, and boundary in educational settings)
Kevin Lynch *The Image of the City* (examined cities from the perspective of a pedestrian, discussing the concept of boundaries in shaping our understanding of cities.)
Potential case study: Parc de la Villette (analyze boundaries in terms of physical, spatial, functional, and spiritual)

Threshold: Herman Hertzberger *Space and Learning* (investigate threshold, hierarchy, and boundary in educational settings.)
Potential Observation Method: List and sketch thresholds for at least one public space and one campus. Compare the similarities and differences within these thresholds, explore their duality, and analyze how vertical campuses can benefit from the findings.

Hierarchy: Richard Sennett, *Together: The Rituals, Pleasures and Politics of Co-operation* (explore hierarchy through the social, political, and cultural dimensions.) Herman Hertzberger *Space and Learning* (investigate threshold, hierarchy, and boundary in educational settings)
Potential case study:
The Edge (analyze hierarchy in terms of materiality, sustainability, and interconnected programs)
50 Hybrid Buildings (Study the spatial and functional hierarchy within mixed-use buildings.)

Reflection

1.What is the relation between your graduation project topic, your master track (A, U, BT, LA,MBE), and your master programme (MSc AUBS)?

The studio topic, "The Vertical Campus: A Public Hub of the Future in The Hague," sets the stage for my graduation project, allowing for an in-depth exploration of the campus as a learning community. Both public space and campus design are of paramount importance in the realm of architecture. The courses I've undertaken during my master's program have prepared me for the graduation studio, and completing this design will deepen my understanding of public building dynamics, enhancing my sensitivity as a future architect. The CommuVersity serves a dual purpose as both a public space and a campus, seamlessly integrating into The Hague's urban fabric. My graduation design aims to create a vertical campus for the 21st century, serving as a vessel for a learning community to form.

2. How did your research influence your design/recommendations and how did the design/recommendations influence your research?

In the development of this design, research and design processes inform each other iteratively.

From research, I get better understanding of what spaces need to be designed and how can I design the space to achieve specific goal, research provide the theriotical and scientific backup for my design decision. in my project CommuVersity, Research highlights the increasing recognition of lifelong learning as a necessity. Consequently, it's clear that 21st-century campuses must adapt to meet this demand. This raises the pivotal question: How can we design campuses to enhance the learning experience? Addressing this inquiry, my research delves into environmental psychology, emphasizing the roles of spatial configuration and color in facilitating learning. The design of future learning spaces should prioritize flexibility, allowing for the creation of diverse spatial configurations over time. In line with this principle, CommuVersity adopts a modular shelf-like structure, enabling the adaptation of spaces to suit specific learning activities. Additionally, my research underscores the importance of social interaction in learning. To promote this, I've reconfigured circulation within the building to encourage encounters between individuals. Together with ample informal study spaces, this fosters an environment conducive to organic social interactions. Extensive research has also been conducted on color, alongside spatial configuration and materiality, to create versatile spaces tailored to different learning styles and activities.

In addressing the public aspect, I analyzed the interaction between the chosen site and the urban landscape through literature review and observation. This assessment considered factors such as traffic flow, nearby public spaces, and surrounding buildings to enhance city identity and accessibility. Insights from this analysis guided decisions on entrance, orientation, and programming. Additionally, background research on Terminal Zuid was conducted using Dutch archives to better understand its historical significance. This informed the decision to repurpose rather than demolish it

3. How do you assess the value of your way of working (your approach, your used methods, used methodology)?

I utilized three primary research methods—literature review, case studies, and observations—to address two key aspects of this project: the enhancement of public space and the optimization of the campus environment to facilitate effective learning. I assess the value of my approach, methods, and methodology as effective in addressing the project's objectives. By integrating a combination of literature review, case studies, and observations, I was able to develop a comprehensive understanding of the subject matter and apply this knowledge to the design process in public aspect and campus aspect. The research result will inform my design and help to make design decisions.

4.What is the relevance of your graduation work in the larger social, professional and scientific framework.

This graduation project seeks to address identified design challenges and propose an innovative approach to vertical campus design. Utilizing the research-informed design method, the outcomes of the research will establish theoretical foundations, forming the basis for shaping in my graduation project. This process allows for a comprehensive exploration and critical reflection on the concept of the 21st-century campus, contributing to the future realm of campus design. The collaborative synergy between research and design is focused on developing a campus typology that prioritizes the learning experience while integrating social values. The goal is to create a holistic environment that transcends traditional educational paradigms within the urban fabric. From an academic standpoint, the CommuVersity project holds value due to its innovative approach to addressing the challenges of urban density and the need for adaptable learning environments. Moreover, the societal implications of the project are considerable, as it offers a tangible response to the growing demand for lifelong learning spaces within densely populated urban areas. Ethically, the project prioritizes sustainability from the perspective of reuse instead of demolishing.

5. Why and how should horizontal public space be reoriented in a vertical direction in your design?

Given The Hague's high population density and limited ground-level space, there's a growing need for vertical urban living. The CommuVersity serves as an extension of the city's horizontal public spaces, addressing the challenge of space scarcity. To justify vertical public space, I identified key attributes of horizontal public spaces, emphasizing social interaction, and integrated them into the design. The CommuVersity features three major public spaces—the Botanic Garden, Playground, and Plaza—strategically placed throughout the building and connected by internal public spaces on each floor, fostering social interaction and community engagement.

6. How does your project help to form a community of learning?

For a community, there are two aspects: tangible and intangible. The intangible aspect pertains to the spirit of community, characterized by shared values, a sense of belonging, and a collective identity. In the context of a learning community, individuals share the common value of learning.

The tangible aspect refers to the physical spaces that allows the intangible spirt to happen and enhance and assist on the goal of this community, in this case, is to help people learn better. Informed by research in environmental psychology and campus design, CommuVersity creates spaces that facilitate social interaction, thereby aiding learning. Public spaces with diverse atmospheres foster diverse preferences, allowing individuals to choose learning environments that suit their preferences and learning tasks. CommuVersity also offers programs for multi-generational learning, promoting lifelong learning. All these elements collectively provide the foundation and conditions necessary for a learning community to flourish.

Design Brief

Hybrid Building on Education
approx.27165m2

Entrance(500 m2)

Reception, information counter, lounge, elevator lobby, security center, informal study space and event space

Cafe & Lounge(500m2)

A space with different zoning, including cafe, space for different activities, reading, studying, gathering space and quiet space

Library(575 m2)

Reception, information counter, lounge, elevator lobby, security center, informal study space and event space

Bar(110m2)

A place that is a canteen during day time and in the evening transform into a bar. It can also be use to host event.

Sports (1100m2)

Including open exercise space, playground, meditation room, dance studio, and sports hall

Interaction space(1200m2)

These spaces are in front of lobby, which integrate with informal study space and exhibition space. Furnitures can be rearrange response to different events and activities. Here people from different groups encounters, they can interact with each other, study and discuss, or having a interesting conversation while waiting for the class to be start

Research and Media Center(1500m2)

Research center is a secured place for authorized people to conduct research. Media center contains digital collections.

Sky Garden(1800m2)

Outdoor sky gardens are located at different levels through out the two buildings. It is a multi-purpose space for socializing, enjoying the view of the city, or hold event.

Office Space(7300m2)

Work space with support staff and associated facilities such as file storage, meeting rooms, and reception

Flexible Classroom(9150m2)

Including classroom for early learning, adult, and elderly. There classrooms are flexible and can be separated into 2 smaller. The room can be converted into meeting room or quiet study room according to needs.

Lecture Theater(1000m2)

Including a large lecture theater for 300 people, two medium theaters each seating 120 people, two small theaters each seating 50 people.

Daycare(1000m2)

A safe space for youngest to play and learn. Including indoor playground and staff office

Computer Lab(680m2)

A secure working environment with computers. Only authorized people can use this space for individual work or group project.

Studio(750m2)

Including art & craft studio, photography studio, music studio,etc. Related class will be held in here and serve as a practice space in the free time.

Process Documentation

Theory & Delineation <>Project Design

Oxford assignment

Psycho-geographical Map

Design Thinking Workshop assignment

TD workshop Diagram

Performative Conceptual Model

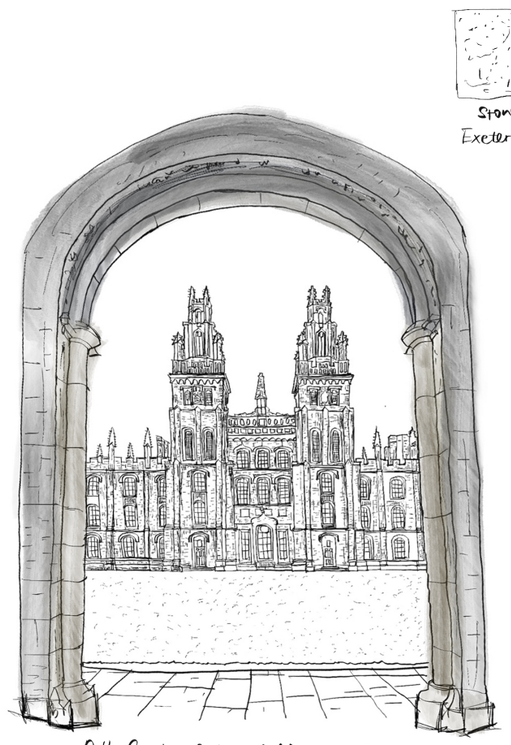
Sustainability Diagram

Collage & Montage

Personalized and Revised P1 Material

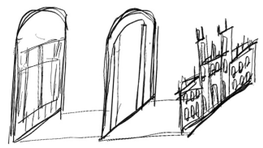
Oxford assignment

Analysis of threshold and circulation



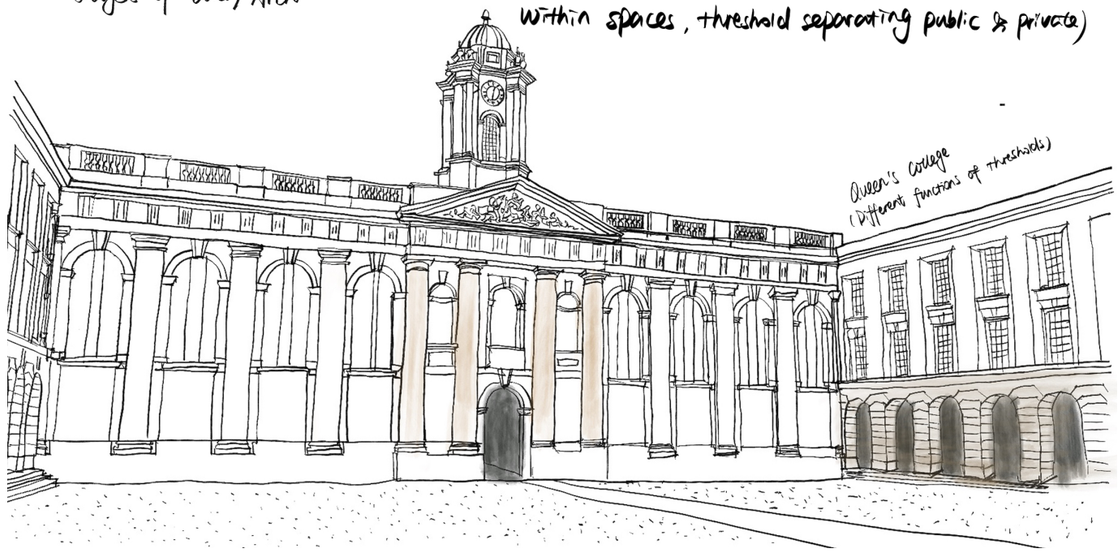
All Souls College (After gate)

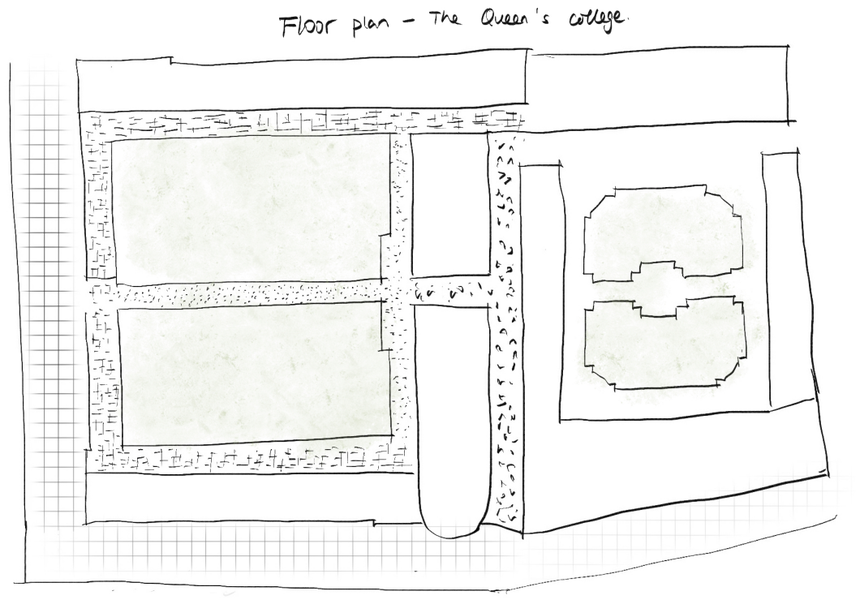
All Soul College (Street view)



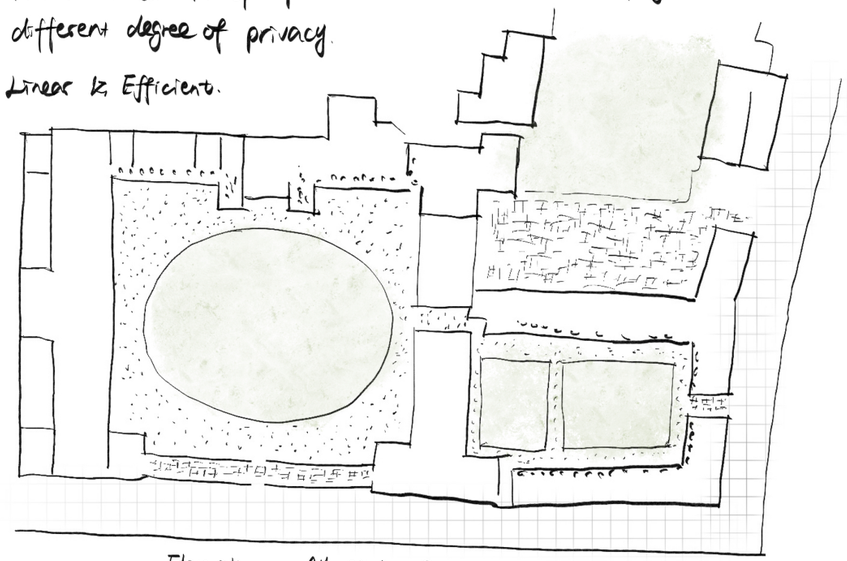
Layers of Gate / Arch

- Gate and arch as an architectural element that signifies a transition from one space to another.
- Different types of threshold are identified based on functions (entrance threshold, transitional threshold within spaces, threshold separating public & private)





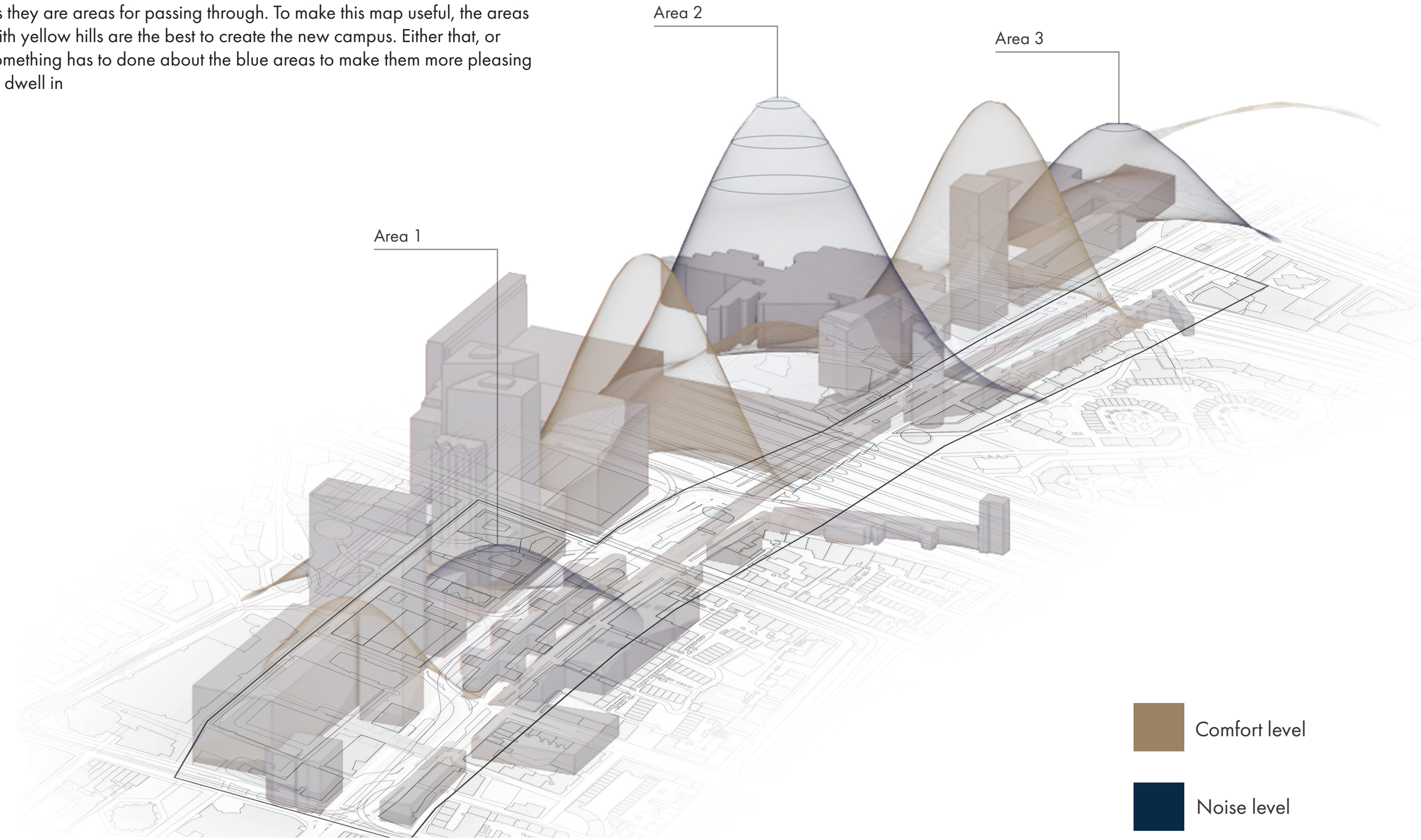
- Circulate around court / quadrangle
- Paths cater to specific needs and connects to program with different degree of privacy.
- Linear & Efficient.



Floor plan - All souls College

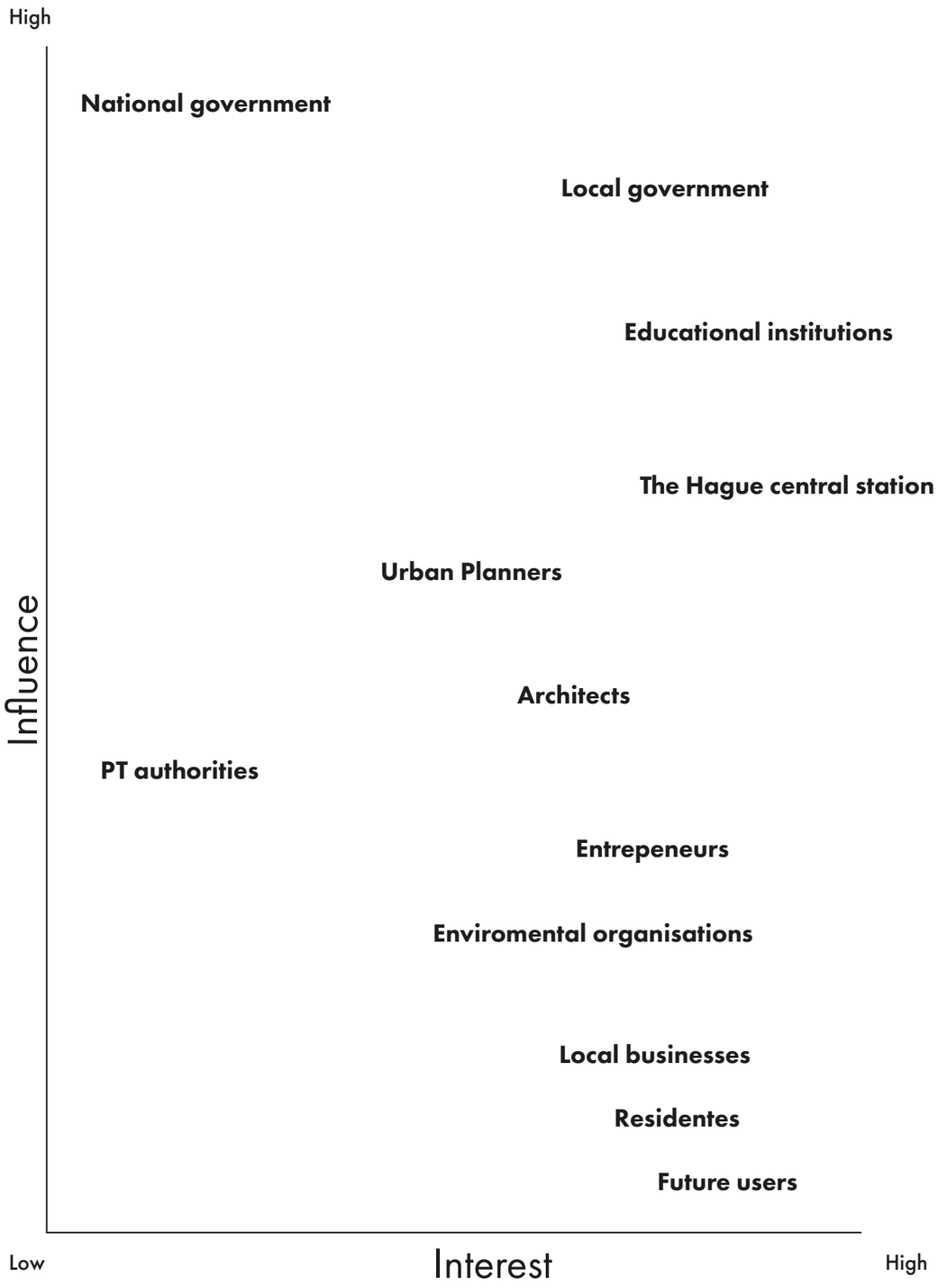
Psycho-geographical Map (Group work)

In this map we investigated as a group what the level of noise and comfort are in our determined site area. As is seen, comfort goes where noise comes as the yellow and blue hills switch with each other along the way. The three blue hills are at crucial traffic points in the area. This, in turn, does mean that they are not places where people want to dwell to long, as they are areas for passing through. To make this map useful, the areas with yellow hills are the best to create the new campus. Either that, or something has to done about the blue areas to make them more pleasing to dwell in



Design Thinking Workshop assignment (Group Work)

Stakeholder Map



Problem Statements

Local Business owners and Local Residence

The main concern for both local business owners and local residents is the congestion that a big scale project like constructing a public college building could cause. Local business owners are deeply concerned that the congestion caused by construction will negatively impact their bottom line, making it challenging to sustain their businesses during and after the project. They fear that their businesses' long-term viability and the livelihoods of their employees are at stake. With their main concern being: reduced foot traffic, limited parking availability, decreased visibility, extended construction timeliness and potential business relocation. Local residents are concerned that the congestion and disruption caused by construction will disrupt their peaceful city center living experience. They fear that the noise, inconvenience, and safety risks associated with the construction project will diminish the quality of life they value in their neighborhood. Additionally, they worry about the potential long-term changes to the aesthetics and atmosphere of the city center. With their main concerns being: noise and disruption, limited access to homes due to blocked roads, parking challenges, safety concerns and negative aesthetic changes.

Future Users

In the heart of The Hague, both students and university staff face a critical challenge: the severe shortage of accessible public study spaces on campus. This pressing issue stems from the rapid surge in student enrollment and escalating academic demands, overwhelming the existing infrastructure. Scholars, encompassing students and professors alike, are confronted with limited options for collaborative learning, research, and intellectual exchange. The campus, from libraries to open study areas and amenities like the university canteen, remains perennially overcrowded. This scarcity not only hampers students' academic progress but also impedes professors' ability to cultivate an enriching learning environment. Additionally, the limited campus space constrains the scope of events that can be organized for networking and collaboration, further hindering the development of a vibrant academic community. Urgent attention is essential to address this shortage, ensuring an optimal learning atmosphere and fostering meaningful academic interactions for all.

Professionals and Governmental Institutions

The main concern of the government would be the efficiency of utilizing an urban space that is already quite dense and keeping the residents surrounding it and its future users content. A concern that the government has is if the building can meet with their regulations and if the design will be taking their guidelines and plans into consideration. The congestion is a concern that is very valid as the government wants to offer the residents and users of The Hague easy accessibility going away

and coming to this area. Construction of a high rise building can take up to months if not years, which needs to be considered when thinking about the daily user flows and all other stakeholders. On the other hand, the professionals might worry more about having an easier accessible high-quality education center where they are able to network and share knowledge with fellow professionals and students in the field, as there is less space for these activities to happen now. While mentor-ships would be harder to find back in the day the introduction of such a vertical campus would increase interaction between the different groups of experts which could be leading to more innovation in the field.

TU Delft and Leiden University

For the two universities the problem statement comes along quite narrowly, as the only difference between the two is that the universities give different studies in different locations. Stakeholder management or expectations would be the pain point here for both parties, as both the universities have quite some stakeholders within their own entity that they have to uphold which include students, teachers, alumni, parents, donors, local communities, governmental bodies and external partners. These partners can be seemingly difficult to get right as some of them have different interests. External parties can consist of research companies and other universities. These parties can have different interests than what students or teachers would want, only a lot of money comes from these external parties. It is crucial to get the stakeholder management right as universities have an enormous amount of credibility that is at stake, which in turn answers to their educational mission and funding they receive from this credibility.

Persona (Group Work)

Maria van der Meer

Age: 38

Occupation: Owner of "Maria's Boutique" a family-run clothing store

Location: The Hague, Netherlands

Education: Bachelor's degree in Business Management

Bio

Maria van der Meer is a dynamic and determined businesswoman who was born and raised in The Hague. She comes from a family of entrepreneurs, and she decided to continue the tradition by opening her own clothing store in the city center. Her boutique, "Maria's Boutique," specializes in unique, locally-made fashion pieces and accessories. Maria is a dedicated mother of two young children and is actively involved in the local business community.

Statement

Maria is deeply concerned about the proposed construction of a large new public educational building in The Hague's city center, as it could have significant implications for her boutique's future and the character of the area.

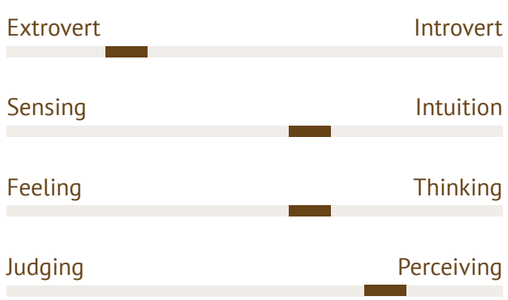
Quote

"I believe in the strength of our local businesses and the unique character of our city. Let's build a future that respects our history and values our community."

Behavior

Maria is proactive and community-driven. She regularly attends local business association meetings and actively participates in initiatives aimed at enhancing the city center's appeal. She is known for her strong work ethic and commitment to her boutique.

Personality



Motivations

- **Business Success:** Maria is motivated by the success and growth of her boutique. She wants to provide for her family and create job opportunities for locals.
- **Preserving Local Culture:** She is passionate about preserving the unique culture and character of The Hague's city center.

Challenges

- **Financial Stability:** Like many small business owners, Maria faces financial challenges, especially during economic downturns and uncertainties.
- **Competition:** Staying competitive in the fashion industry requires constant innovation and adaptation.

Pain points

- **Impact on Foot Traffic:** Maria is worried that the construction of a new educational building could deter potential customers from visiting her boutique due to congestion and construction-related disruptions.
- **Uncertainty:** She is concerned about the uncertainty surrounding the project's timeline and potential effects on her business's future.

Gain points

- **Collaboration Opportunities:** Maria sees the potential for collaboration with the educational institution to showcase local fashion and support young talent.
- **Preserving Heritage:** If the project respects the heritage and character of the city center, Maria may see it as an opportunity to attract a broader customer base interested in the area's culture and history.

Sarah Jensen

Age: 49

Occupation: University Lecturer

Location: The Hague, Netherlands

Education: Ph.D. in Education and Social Sciences from Leiden University

Bio

Sarah is a passionate and dedicated university lecturer based in The Hague. With a strong background in education and social sciences, she has been teaching at a local university for the past seven years. Sarah is deeply committed to creating an engaging and innovative learning environment for her students, encouraging critical thinking and fostering a sense of community within her classes.

Statement

She believes in the transformative power of education, and she is committed to shaping the future by empowering her students with knowledge and critical skills.

Quote

"Education is the most powerful weapon which you can use to change the world." - Nelson Mandela

Behavior

Sarah is open-minded. She actively engages with her students, encouraging discussions and embracing diverse perspectives. She is also a strong advocate for community involvement and believes in the importance of education beyond the classroom.

Personality

Extrovert — Introvert

Sensing — Intuition

Feeling — Thinking

Judging — Perceiving

Motivations

- **Sustainability:** Emma is motivated by a desire to create a sustainable future and make a positive impact on her community.
- **Environmental conversation:** She is driven by her passion for environmental conservation and hopes to inspire others to join her in making a difference.

Challenges

- **Community Engagement:** Finding effective ways to engage with the local community and bridge the gap between academia and society.
- **Resource Constraints:** Limited access to resources and funding for innovative teaching methods and research projects.

Pain points

- **Overcrowded Classes:** Large class sizes can hinder personalized interaction and student engagement.
- **Technologies:** Increasing demand for online education and technological integration poses a learning curve for him.

Gain points

- **Professional Development:** Access to workshops, conferences, and collaborations that enhance Sarah's teaching methods and research opportunities.
- **Collaborative Partnership:** Engaging in collaborative partnerships with like-minded individuals and organizations.

Emma de Vries

Age: 21

Occupation: University Student

Location: The Hague, Netherlands

Education: Pursuing a Bachelor's degree in Environmental Science

Bio

Emma is a second-year student at University, majoring in Environmental Science. Originally from Rotterdam, she moved to The Hague to pursue her higher education. She is passionate about environmental issues and is deeply involved in various student-led initiatives related to sustainability. Emma enjoys exploring the city's cultural offerings and is actively engaged in community service projects.

Statement

Emma sees the potential of the new public educational building as a hub for innovative ideas and collaborative efforts among students, fostering a sense of community and shared purpose.

Quote

"The purpose of education is to replace an empty mind with an open one." - Malcolm Forbes

Behavior

Emma is proactive and outgoing, often participating in student protests and community clean-up events. She is tech-savvy, relying heavily on social media platforms to stay informed about local events and environmental issues.

Personality

Extrovert — Introvert

Sensing — Intuition

Feeling — Thinking

Judging — Perceiving

Motivations

- **Sustainability:** Emma is motivated by a desire to create a sustainable future and make a positive impact on her community.
- **Environmental conversation:** She is driven by her passion for environmental conservation and hopes to inspire others to join her in making a difference.

Challenges

- **Study-life balance:** The challenge of balancing her academic responsibilities with her active participation in various extracurricular activities.
- **Shortage of space on campus:** Lack of suitable spaces on campus to conduct group meetings and collaborate with fellow students.

Pain points

- **Bureaucratic Hurdles:** Emma feels frustrated when she encounters bureaucratic obstacles in organizing events or implementing eco-friendly initiatives on campus.
- **Limited Amenities:** She finds it challenging to find affordable and healthy food options near the university.

Gain points

- **Community-Centered:** Emma seeks a sense of belonging and purpose through connections with like-minded peers and collaborative initiatives.
- **Holistic Experience:** Emma desires a well-rounded university experience that includes hands-on learning, creativity, and improved campus amenities like affordable, healthy food options and convenient meeting spaces.

Sara De Boer

Age: 35

Occupation: Urban planner for the municipality of The Hague

Location: The Hague, Netherlands

Education: Master's degree in Urbanism

Bio

Sara De Boer is an accomplished urban planner with a passion for sustainable and community-focused development. She has spent the last 11 years working in various cities, with a particular interest in restoring urban centers. Sara is a resident of The Hague and has researched the city's rich history and vibrant culture. She believes in the power of education and infrastructure to transform communities and improve the quality of life for residents.

Statement

Sara is excited about building a new public educational facility in the heart of The Hague's center. There is a unique opportunity to enhance our city's cultural and intellectual life.

Quote

"The city should not be a concrete jungle, it should be designed with great care of the people using it."

Behavior

Sara is known for her attention to detail and her ability to balance the needs of the community with the demands of urban development. She is a proactive advocate for sustainable and inclusive design, often collaborating with local stakeholders to allign values and needs.

Personality

Extrovert — Introvert

Sensing — Intuition

Feeling — Thinking

Judging — Perceiving

Motivations

- **Growth and prosperity:** Sara is motivated by her love for The Hague and her desire to contribute to its continued growth and prosperity. She is driven by the belief that thoughtful urban planning can create a more livable, sustainable, and culturally vibrant city.

Challenges

- **Preservation and balance:** the challenge of balancing the need for new development with the preservation of historical and cultural landmarks.
- **Regulation and stakeholders:** navigating public opinion and address concerns while staying true to the city's vision.

Pain points

- **Limited space:** a suitable place in the dense city center for a new educational facility.
- **Community Concerns:** from residents about increased traffic and congestion.
- **Funding constraints:** financial support for ambitious urban projects.
- **Balancing modernization:** with preserving The Hague's rich history and culture.

Gain points

- **Access to education:** the opportunity to enhance access to quality education for residents within their own city.
- **Infrastructural benefits:** the chance to improve transportation infrastructure in the city center, contributing to the growth of the city.
- **Preservation:** the satisfaction of preserving The Hague's historical and cultural heritage while embracing modernization.

Dr. Ir. Maria van der Voort

Age: 58

Occupation: Chairperson of the Board of Directors, Technical University Delft

University: TU Delft

Education: Ph.D. in Engineering Management

Bio

Dr. Maria van der Voort is a highly respected academic and administrator with a distinguished career in engineering and higher education. She has held various leadership positions within the university and is known for her strategic vision and commitment to innovation in education and research. Maria is deeply connected to the university's mission and its role in shaping the future of technology and society.

Personality

Extrovert — Introvert

Sensing — Intuition

Feeling — Thinking

Judging — Perceiving

Goals

- Academic Excellence
- Communal Engagement
- Creating an Innovation Hub

Challenges

- Funding and Budget: Securing the necessary funding for a large-scale construction project can be a complex and time-consuming process, involving negotiations with government bodies, donors, and investors.
- Strategic Alignment: Ensuring that the new building aligns with the university's long-term strategic goals while meeting immediate needs can be a delicate balancing act.Limited access to tech-relat-ed events as do not have enough opportunities to build a network with professions
- Stakeholder Management: Managing the diverse interests and expectations of faculty, students, alumni, and external partners can be challenging, especially when they have varying opinions on the project's scope and design.

Needs and Preferences

- A building that fits in the urban and cultural fabric of the Hague, as that is where she is from.
- Flexibility and Adaptability of the building
- As an environmentally conscious individual, Maria prefers that the construction project adheres to sustainable and eco-friendly practices.

Anna Peters

Age: 32

Occupation: Graphic Designer

Location: The Hague, Netherlands

Education: Bachelor's degree in Graphic Design

Bio

Anna Peters is a young professional who moved to The Hague city center a few years ago to be closer to her workplace and enjoy the vibrant urban lifestyle. She's passionate about design and creativity, which led her to pursue a career as a graphic designer. Anna is known in her neighborhood for her active involvement in community events and her love for local art and culture.

Statement

Anna is intrigued by the idea of a new public educational building in the city center but is also concerned about how it might affect the charm and livability of her neighborhood.

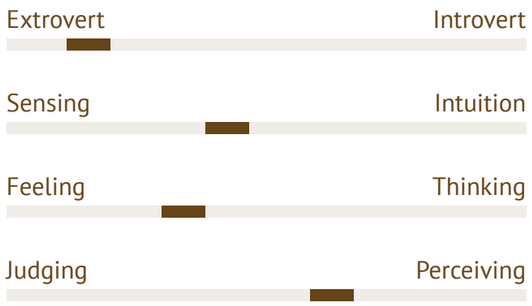
Quote

"Change can be exciting, but it's essential to ensure that it enhances the character of our city center rather than diminishes it."

Behavior

Anna is an engaged and socially conscious resident. She often participates in neighborhood meetings, art exhibitions, and cultural events. She's active on social media, sharing updates and insights about her city center experiences.

Personality



Motivations

- **City Center Living:** Anna chose to live in the city center to be part of its vibrant atmosphere and enjoy its rich cultural offerings.
- **Preservation:** She's motivated to preserve the unique character and history of the city center for future generations.

Challenges

- **Cost of Living:** Anna faces the challenge of managing the higher cost of living in the city center, including rent and daily expenses.
- **Noise and Congestion:** The city center can get noisy and congested, which can disrupt Anna's work and daily life.

Pain points

- **Quality of Life:** Anna is concerned that the construction and increased activity around the new educational building might affect her quality of life and the tranquility she values in her neighborhood.
- **Cultural Impact:** She worries that the development could alter the cultural and artistic fabric of the city center, potentially displacing local artists.

Gain points

- **Educational** Opportunities: Anna sees the potential for enhanced educational and cultural opportunities in the city center with the presence of the new building, potentially benefiting her creative pursuits and networking.
- **Improved Infrastructure:** If the project includes improvements to public spaces and transportation in the city center, Anna may view it as an enhancement to her urban living experience.

Olivier Hansen

Age: 46

Occupation: Financial Analyst

Location: The Hague, Netherlands

Education: Master's degree in Finance

Bio

Olivier Hansen is an experienced financial analyst with over two decades of expertise in the financial field. He has been living and working in The Hague for the past 12 years. Olivier values education and lifelong learning, not only for himself but also for the younger generation. He believes that access to quality education is essential for personal and professional growth.

Statement

Olivier sees the potential of a new public educational building in The Hague's center to provide access to finance and business-related courses.

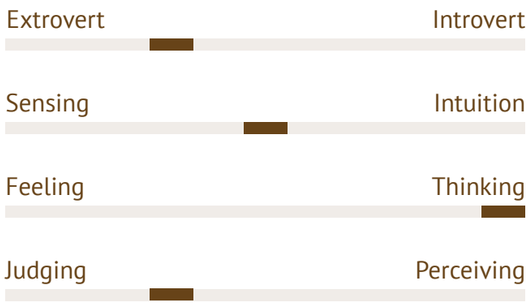
Quote

"Easier access to high-quality education will open oppurtunities to share knowledge with students as well as other professionals."

Behavior

Olivier is known for his analytical mindset. He is a responsible and methodical professional who enjoys mentoring younger colleagues and sharing his knowledge with other people in the field.

Personality



Motivations

- **Community:** Olivier is motivated by the opportunity to give back to the community by sharing his financial expertise and knowledge with younger professionals.
- **Ambition:** Olivier is also driven by his commitment to staying updated with the latest financial innovations.

Challenges

- **Access to Quality Education:** Olivier faced challenges accessing quality finance and business when he was looking to study.
- **Mentorship Opportunities:** he struggled to find effective mentorship opportunities in his early career.

Pain points

- **Access to high-quality education:** limited access to affordable, high-quality finance and business education in the city center.
- **Mentorship gaps:** scarcity of mentorship programs for aspiring financial professionals.
- **Continuing education demands:** difficulty balancing professional commitments with ongoing education.

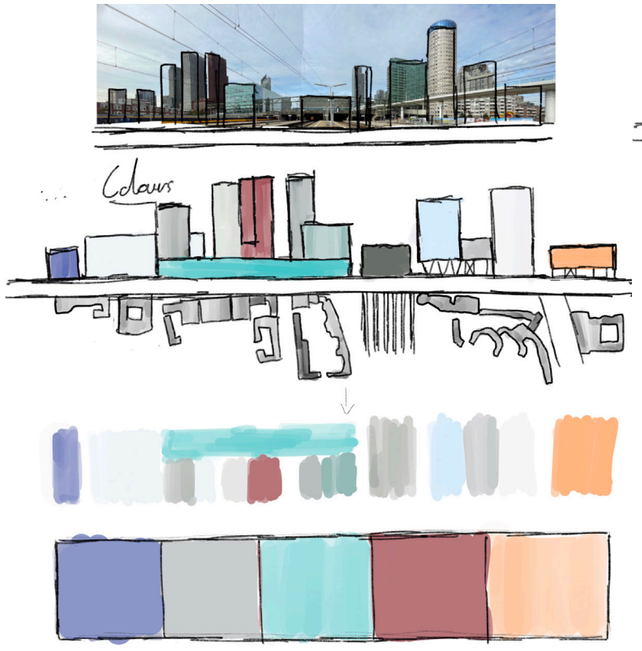
Gain points

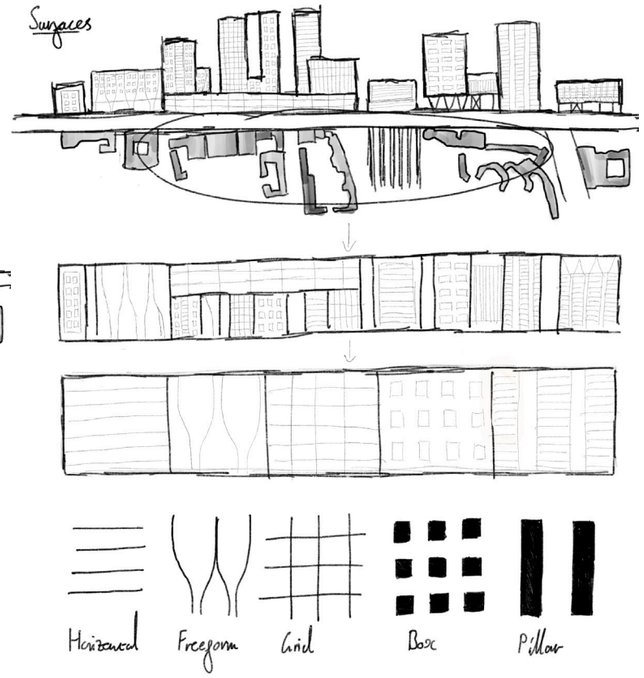
- **Enhancing lifelong learning:** the new public educational building in The Hague's city center will allow him to stay updated with the latest industry trends.
- **Convenient Resources:** the building offers easy access to resources, making it more convenient for Olivier to conduct research and analysis for his work.
- **Networking:** Olivier can expand his professional network by interacting with fellow finance professionals.

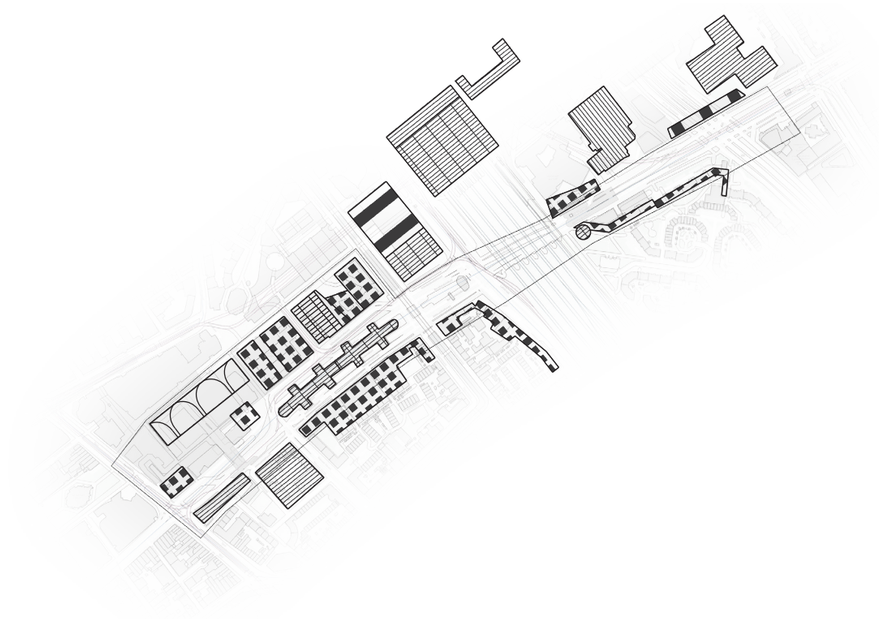
TD workshop Diagram (Group Work)

Diagrams

Underneath here are two sketch analyses that revolve around the colour and surface of the buildings that are either in or near area 3, depending on how relevant they are for the design area. For both aspects the buildings have been put in a side view and traced according to their colour or surface. For the colour they have been simplified to a scheme where they are seen how much of certain colours exist, whereafter they have been simplified again into a pallette of 5. For the surfaces the same technique has been used, and following this there were 5 categories where each building could be placed in.

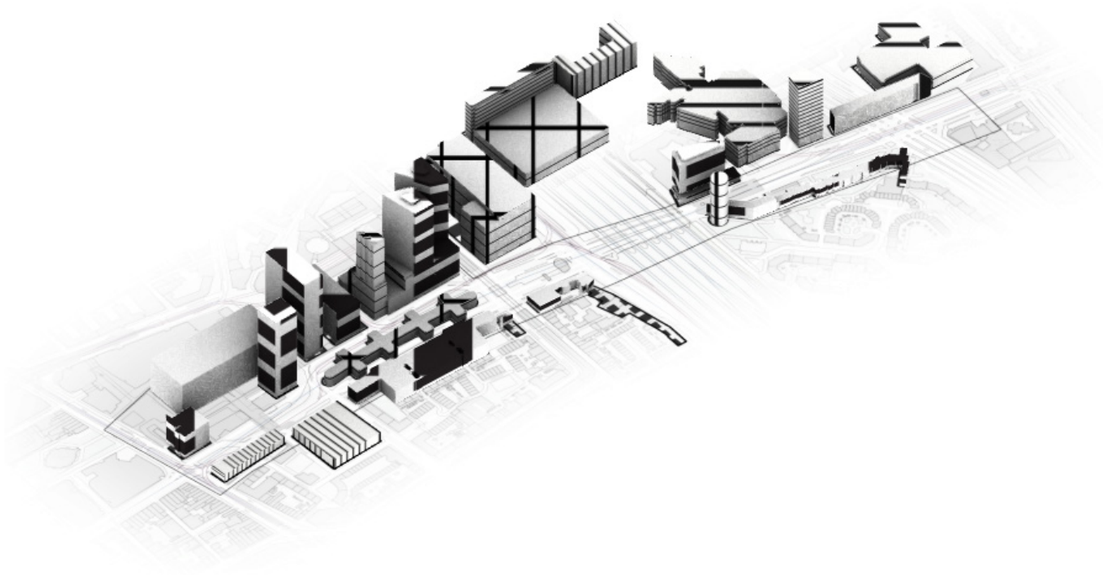






2D

In this 2D map all of the symbols for surace types have been put on the plots where the buildings are situated, and this shows certain clustering of different types of surfaces. From this map you can tell what kind of surface could be usefull to be used in the design project, be it that you want to mingle in the contextual buildings or stand out compared to the rest of the neighbours.



3D

Why this 3D map is an addition to the 2D map is because it shows the height of each building which is only shown in a planar view in the 2D map. These height differences can tell you which type of surface is more present in the verticality of the city, which could make a difference when looking from a far.

Performative Conceptual Model

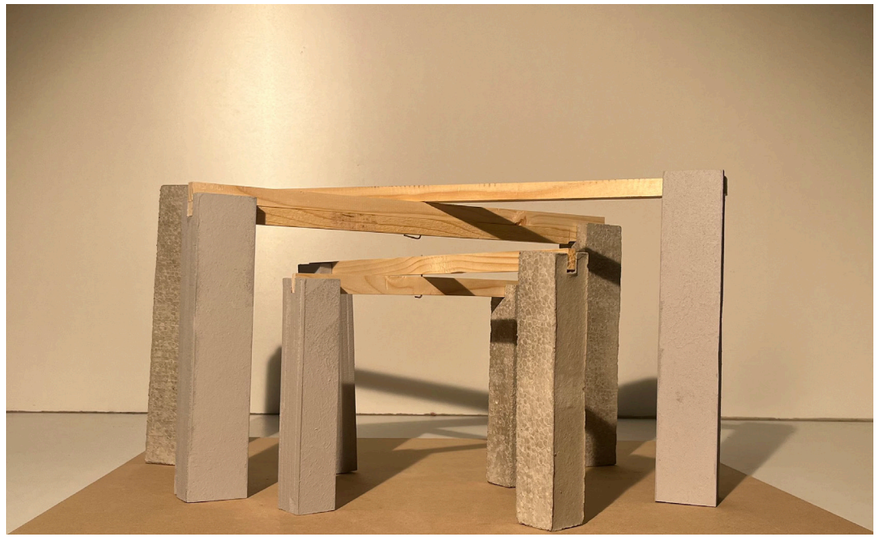
Materiality & Adaptability

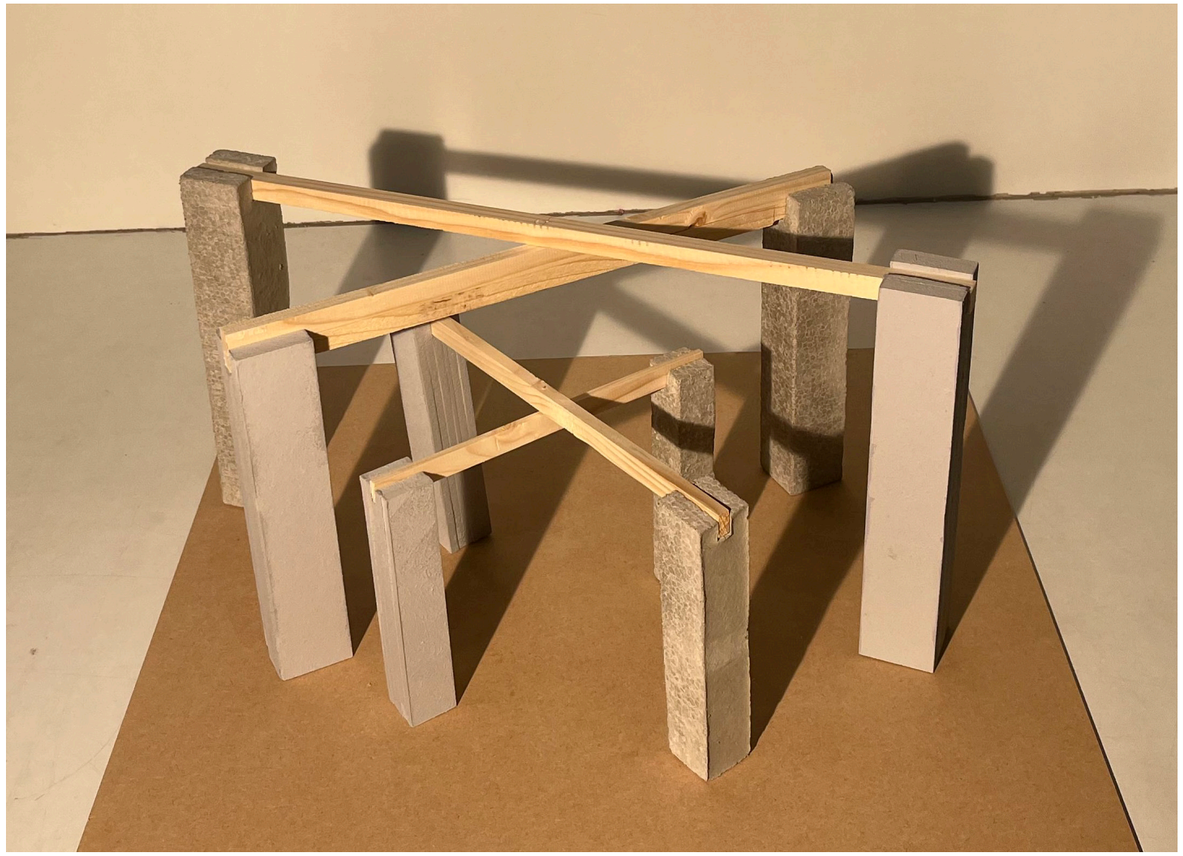
Jing Han (5768764)

This model is composed of two fundamental building elements: columns and beams. It encapsulates the inherent material properties wherein columns, constructed from concrete, bear compression forces, whereas beams, made from wood, endure tension forces. The model intricately illustrates the synergy between these materials.

The varying heights of the frame symbolize distinct urban layers within the site, interconnected through a pivotal rotation point. This design approach signifies that the combination and layout are not fixed but rather adaptable and somewhat "fluid." The tight connection between wood and concrete is facilitated by the high coefficient of static friction (0.6), ensuring a secure grip by default.

The interplay between the weighty materials and the adaptable structure creates a striking contrast, exemplifying the harmonious balance between robustness and flexibility.

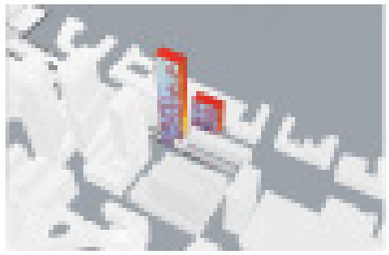


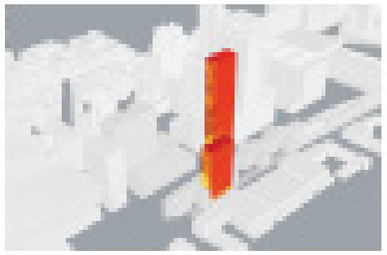


Sustainability Diagram

Facade System

Large glazing on NW improve benifical heat gain and daylight
adjustable solar shutters and blinds on the SE controls the transmission of heat and light





Materials

CLT floorslab

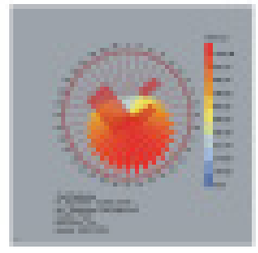
Hybrid structural elements with steel and wood

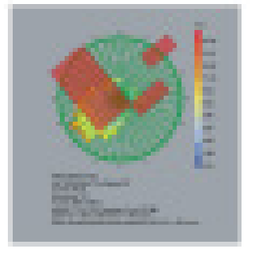
Water Management

Green roof capture and slowing rainwater
Water reuse from irrigation and flushing
Grey water and black water reuse system

Energy Strategies

Natural ventilation through the building
Solar energy collection
Efficient cooling and heating system



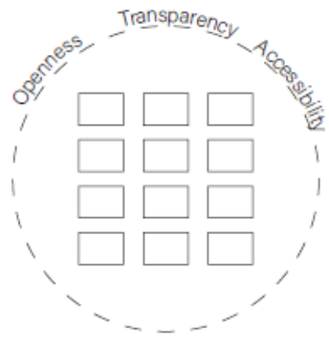


Collage & Montage

Fit In

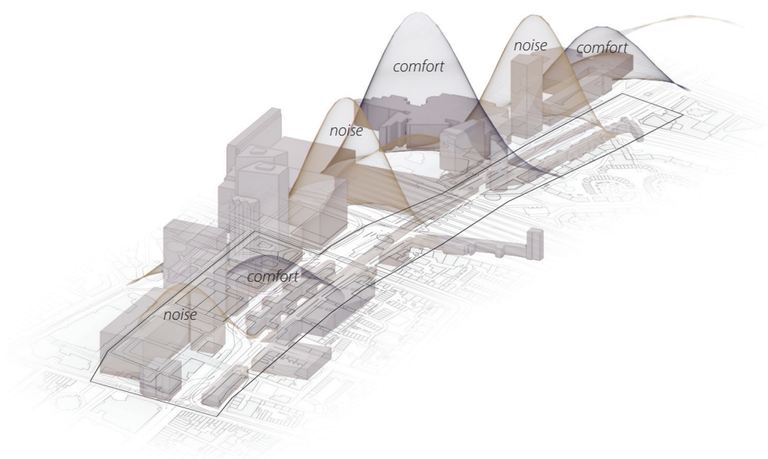
Plant & Harvest

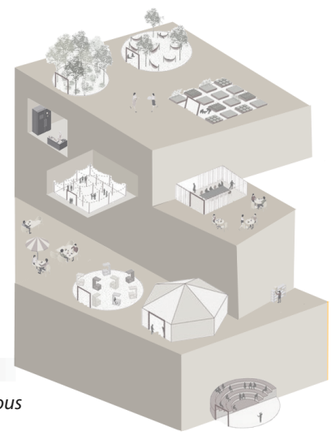
On site



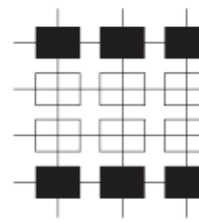
Plant & Harvest

Current

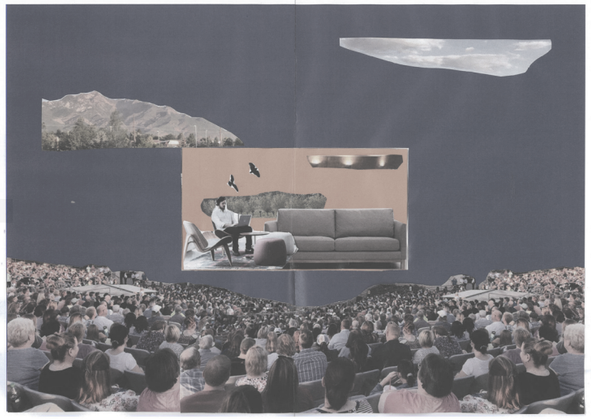




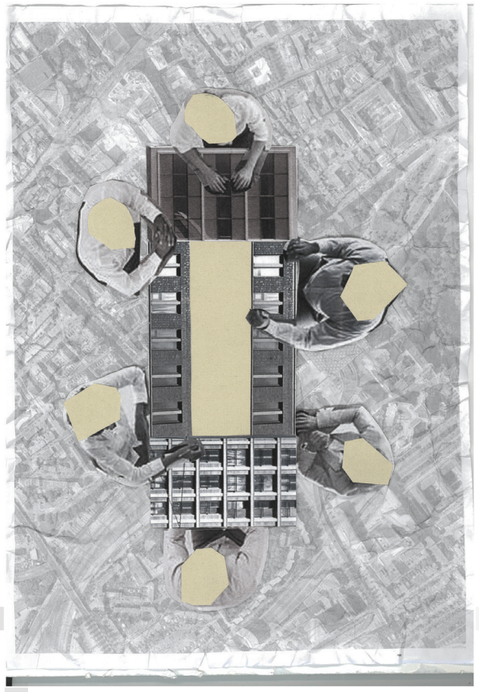
Simultaneous



Connectivity



Space for people



Materiality

Programs

Public

Entrance

Cafe and Lounge

Exhibition Space

Play and Learn

Studio

Residential

Private

Theatres

Workshops

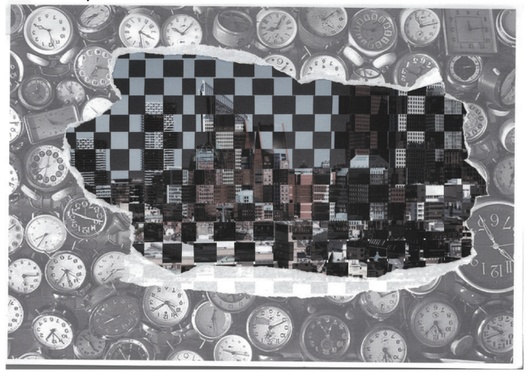
Classrooms

Offices

Commertical Space

Library

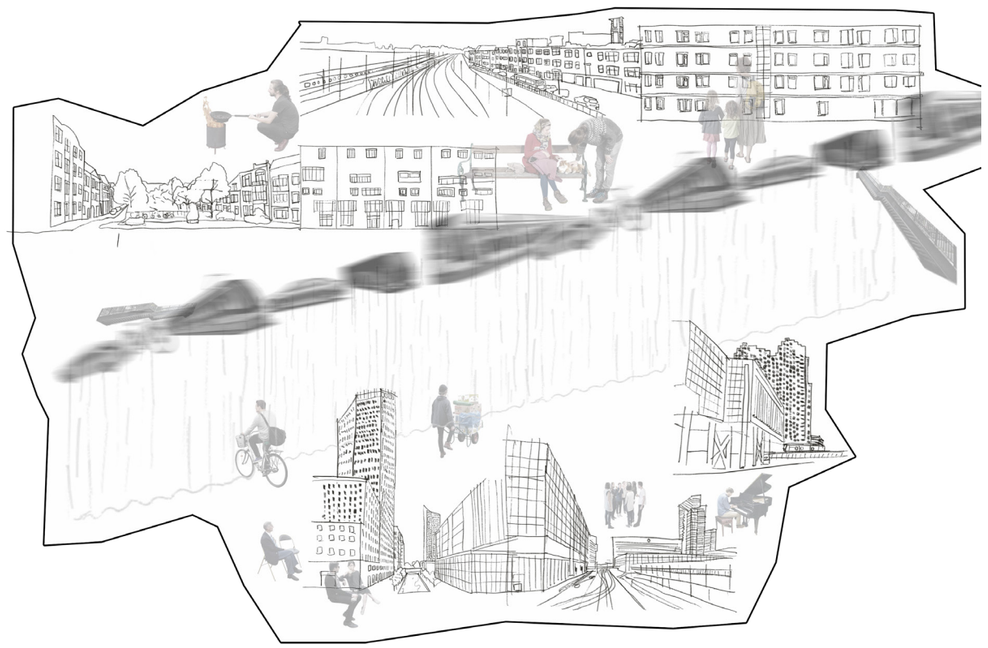
Concept of Time



Personalized and Revised P1 Material

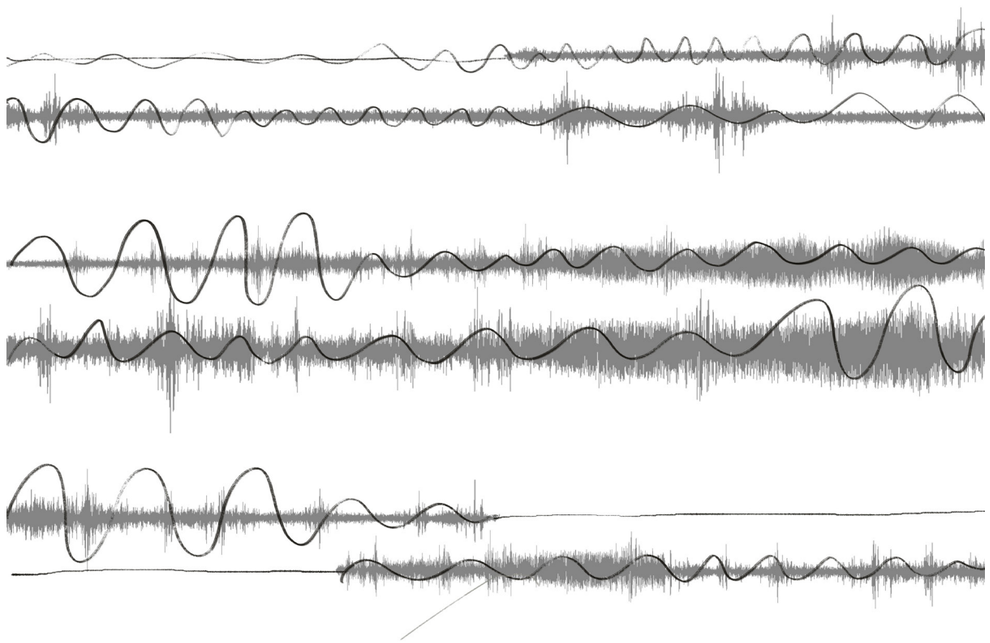
Personal Psycho-geographical Map

Patch



Identical

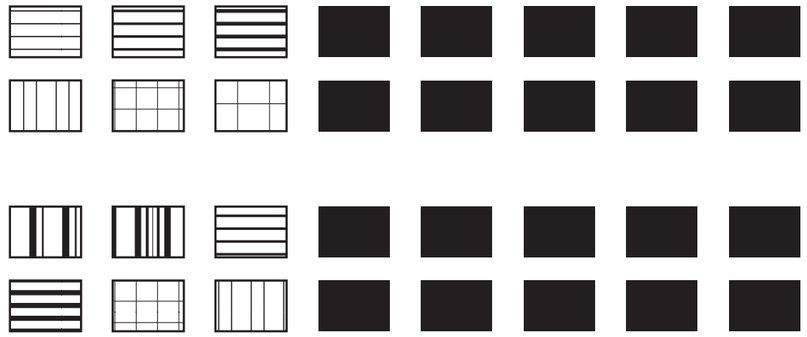
Senses

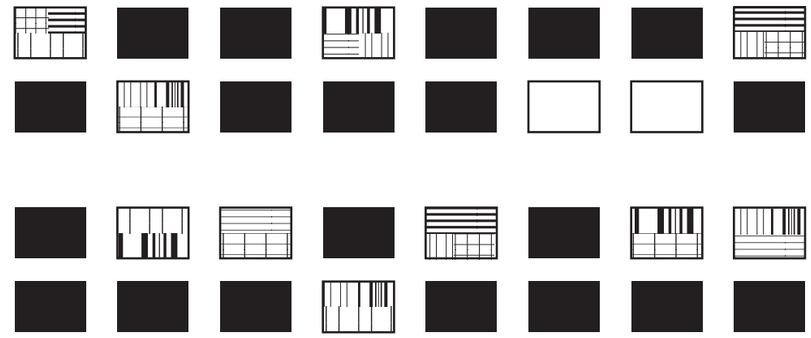


Flows

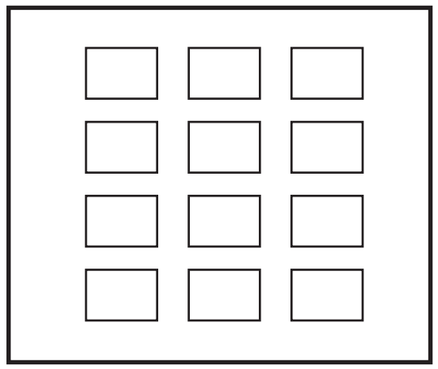
Personalized and Revised P1 Material
Personal vision of campus in the 21st century

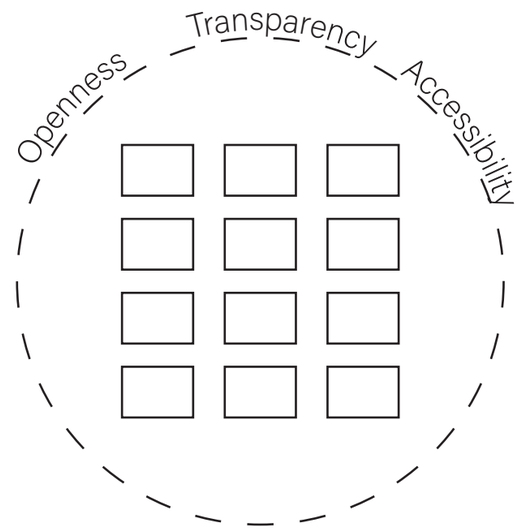
Scatter & Concentrate



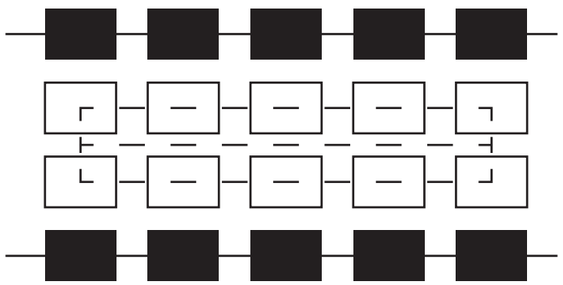


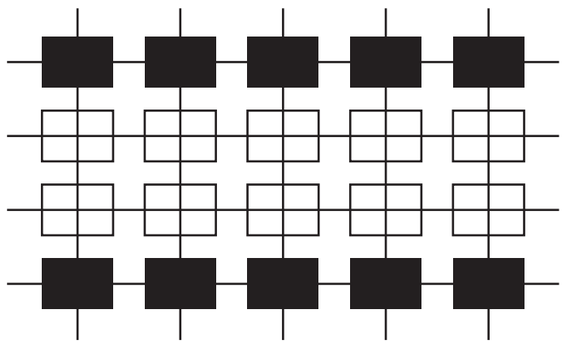
Open & Close





Separate & integrate





Integrated Design Proposal

A vertical campus in the 21st century

Where

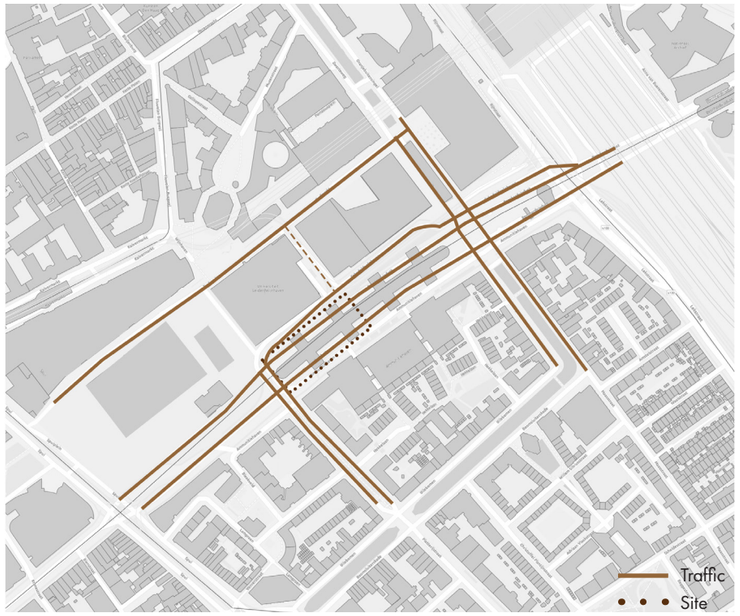
What

Why

How

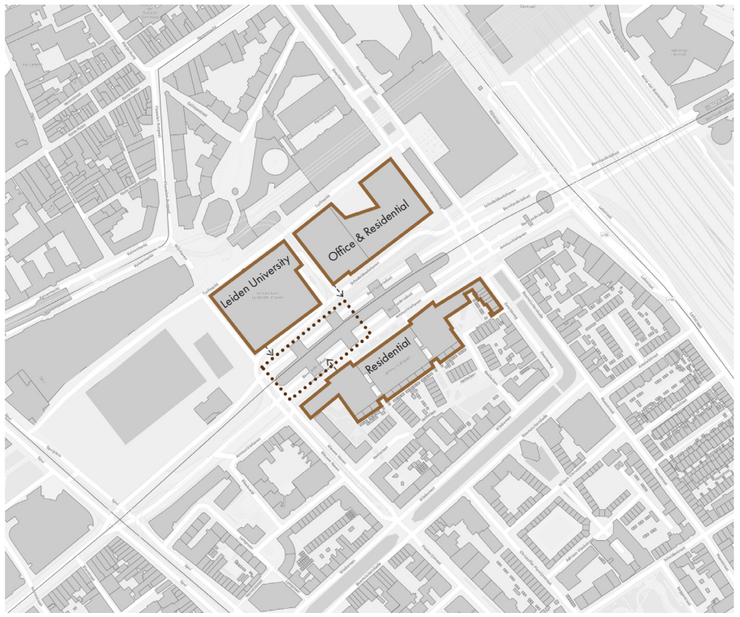
Where

The site I have chosen is within the flyover infrastructure area, presenting both challenges and considerable potential. Specifically, my focus lies in the space situated between Leiden University and the residential area, where an existing governmental building occupies the plot. This area currently lacks public space. Through my design, I aim to not only address this deficiency by creating public spaces but also to position the building as a transitional element between the city and the residential zone.



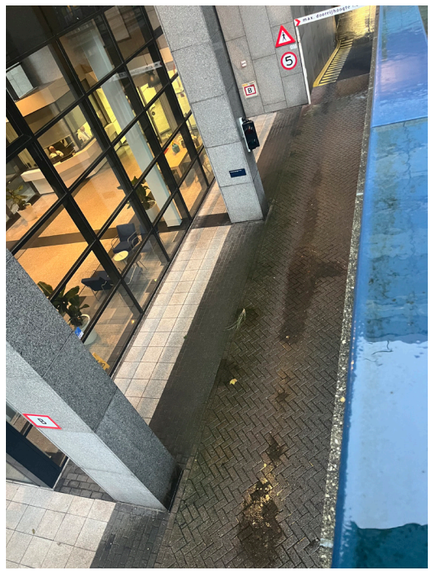
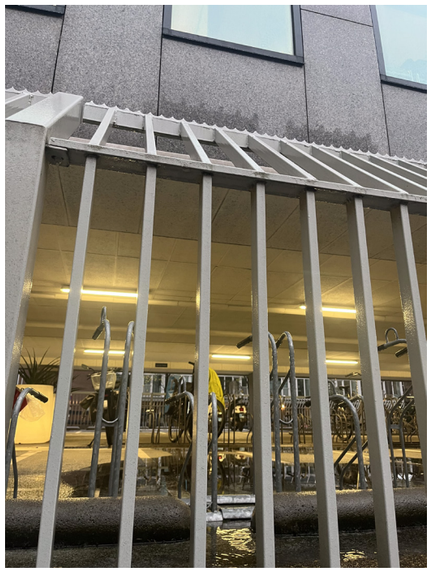
Transform: Traffic dominate

Improve: Lack of qualitative public space



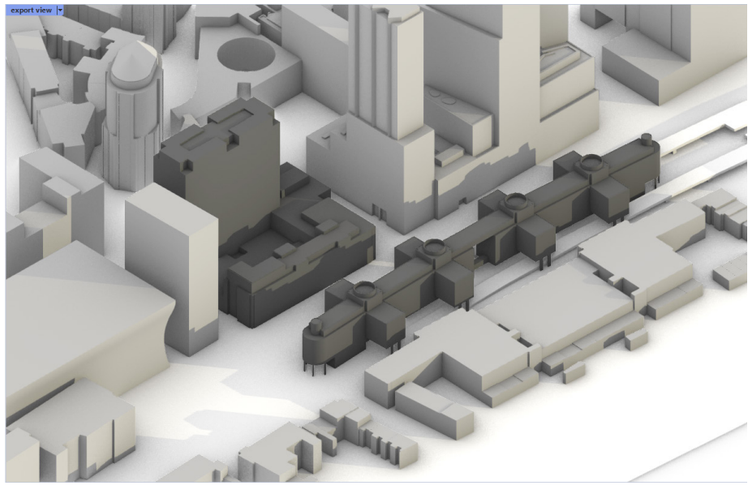
Merge: Connection with surroundings

Site Information
Location: Opposite Leiden University
Site Area:4620 m² (can be extend)

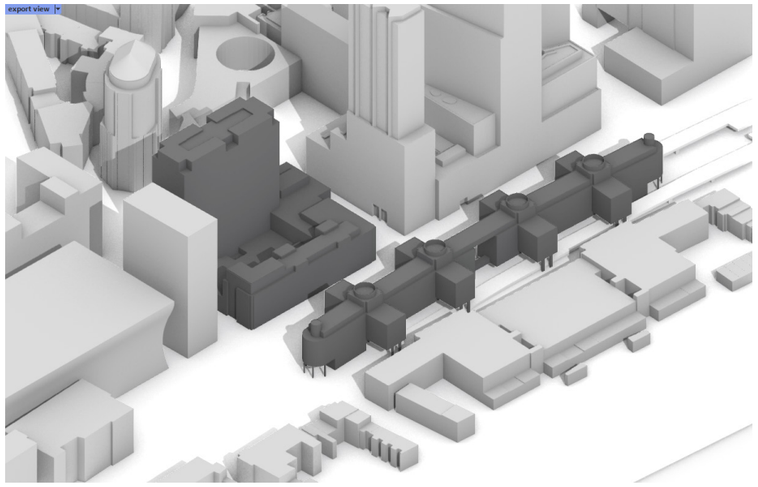





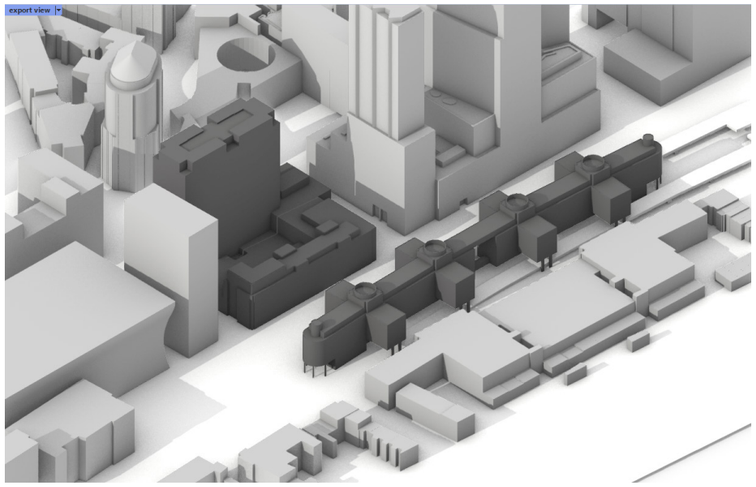

Shadow Study



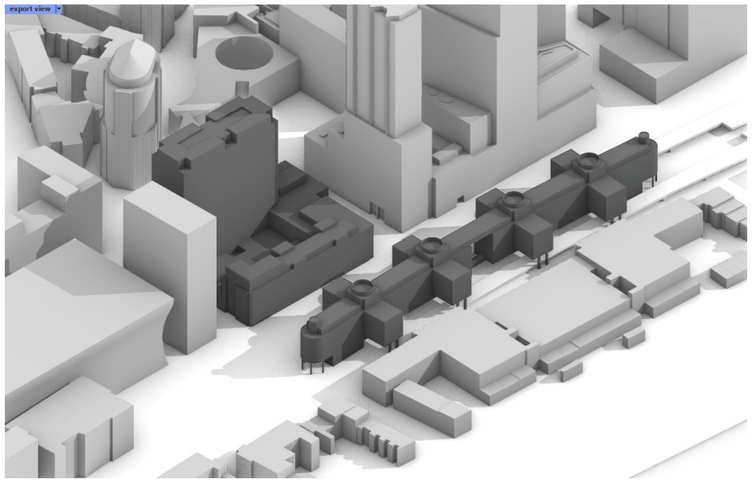
March 21 8AM



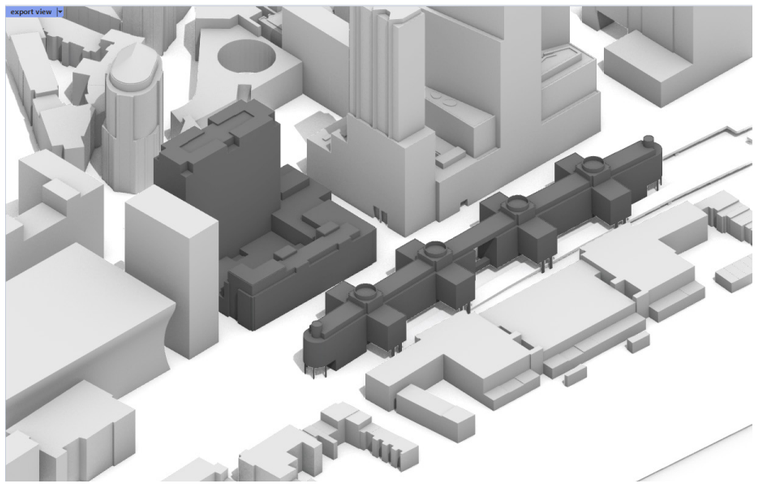
March 21 12 noon



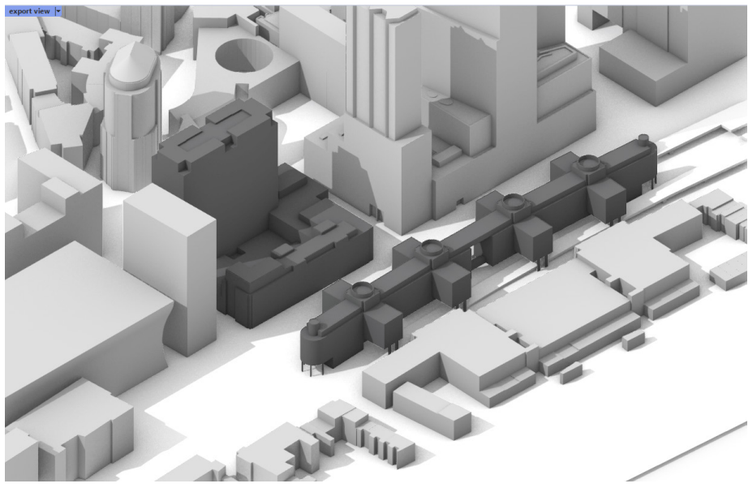
March 21 4PM



June 21 8AM

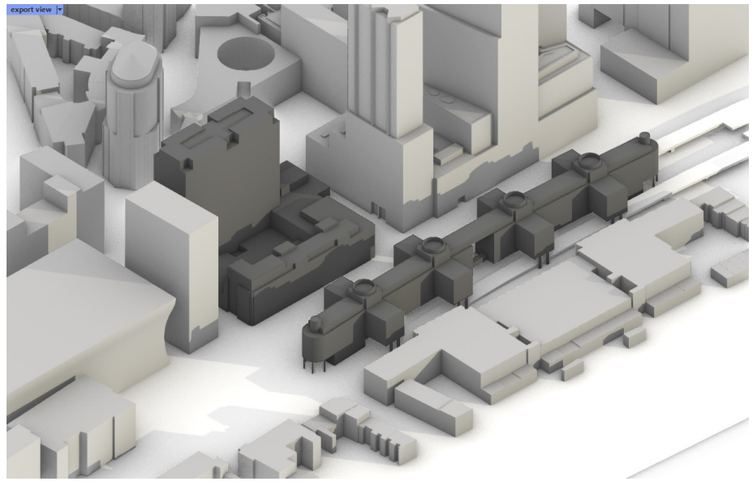


June 21 12 noon

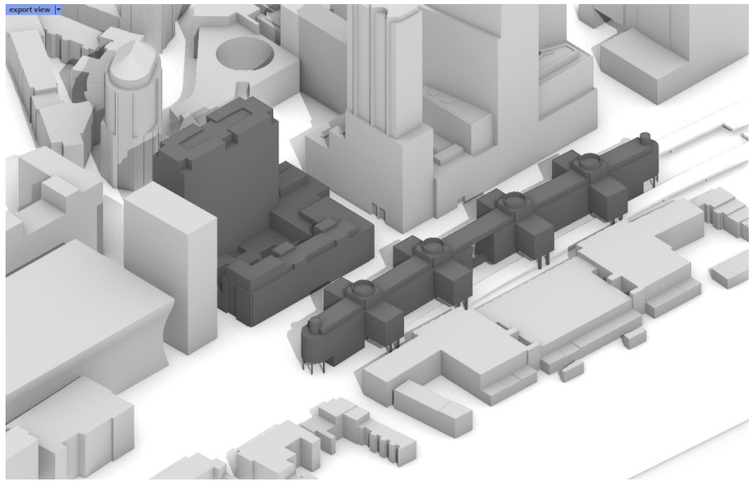


June 21 4PM

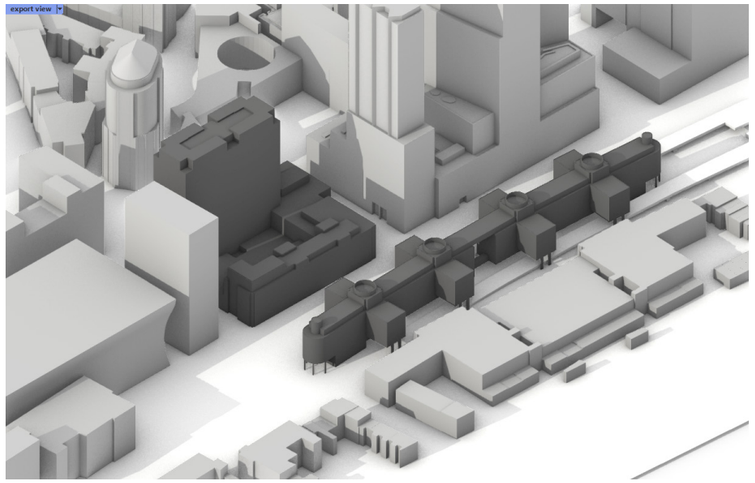
Shadow Study



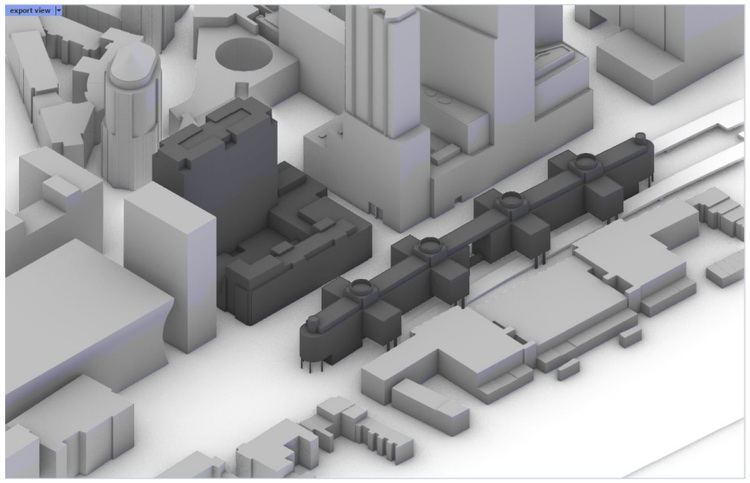
September 21 8AM



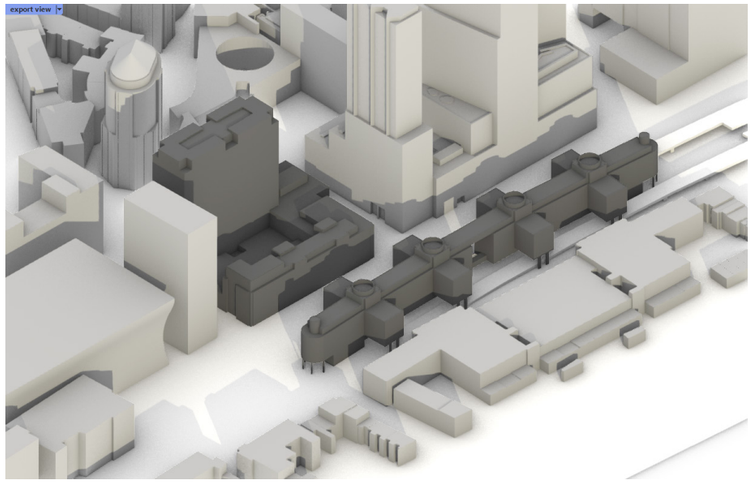
September 21 12 noon



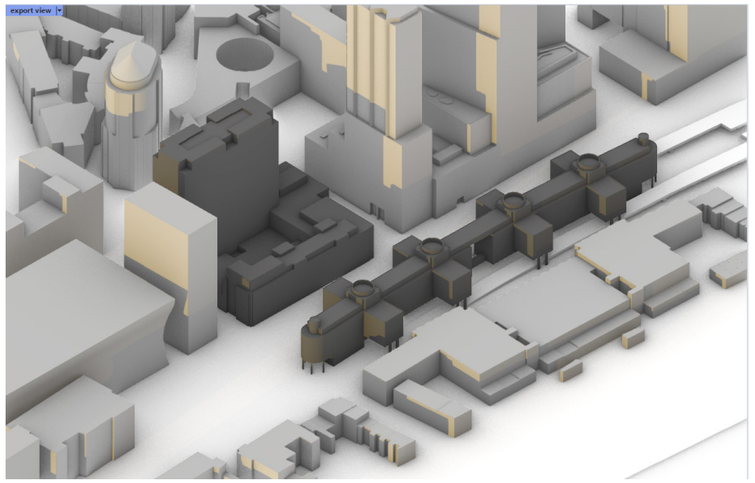
September 21 4PM



December 21 8AM



December 21 12 noon

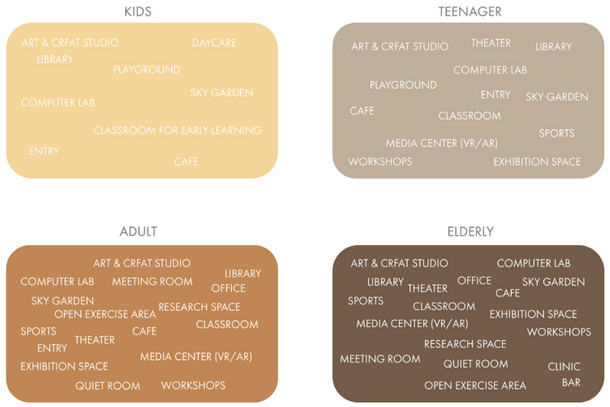


December 21 4PM

What

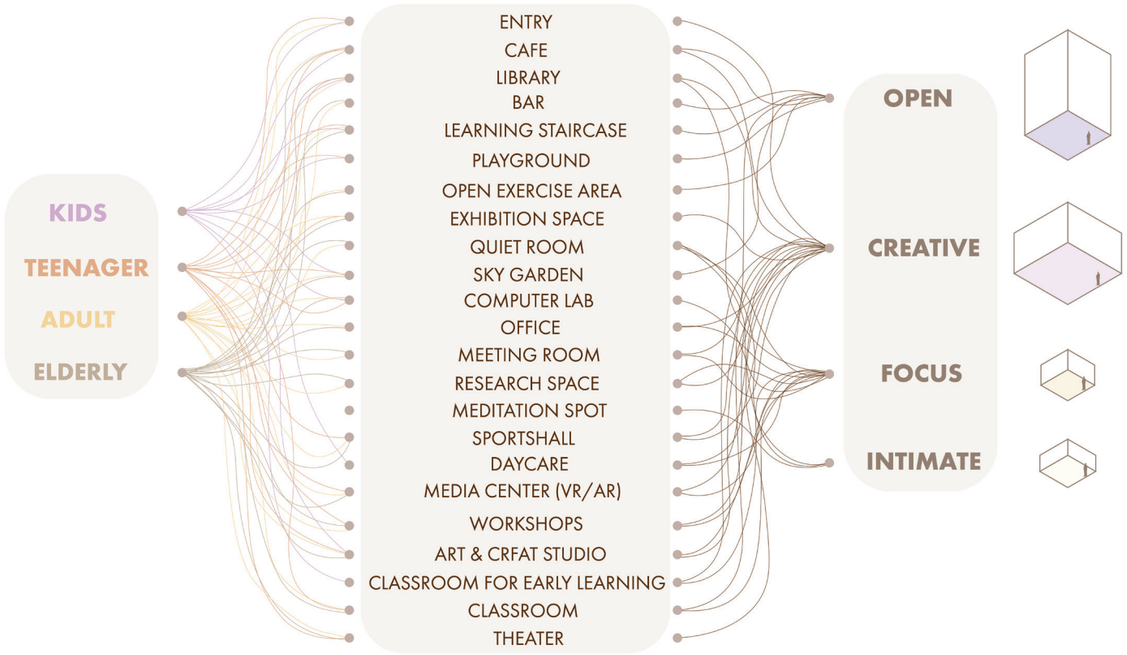
Campus in the 21st century is a community for learning. My vision extends to establishing a dedicated learning community in The Hague, emphasizing two key pillars: enhancing the learning experience and cultivating a vibrant social space. This community aims to facilitate interactions across all age groups, fostering idea exchange and inspiration. To realize this vision, I plan to design an improved learning environment based on scientific research, particularly in environmental psychology, ensuring that the physical space contributes to a positive learning atmosphere. Additionally, tailored community programs will promote a culture of lifelong learning, aiming to establish a thriving community that prioritizes education while nurturing meaningful connections throughout individuals' lives.

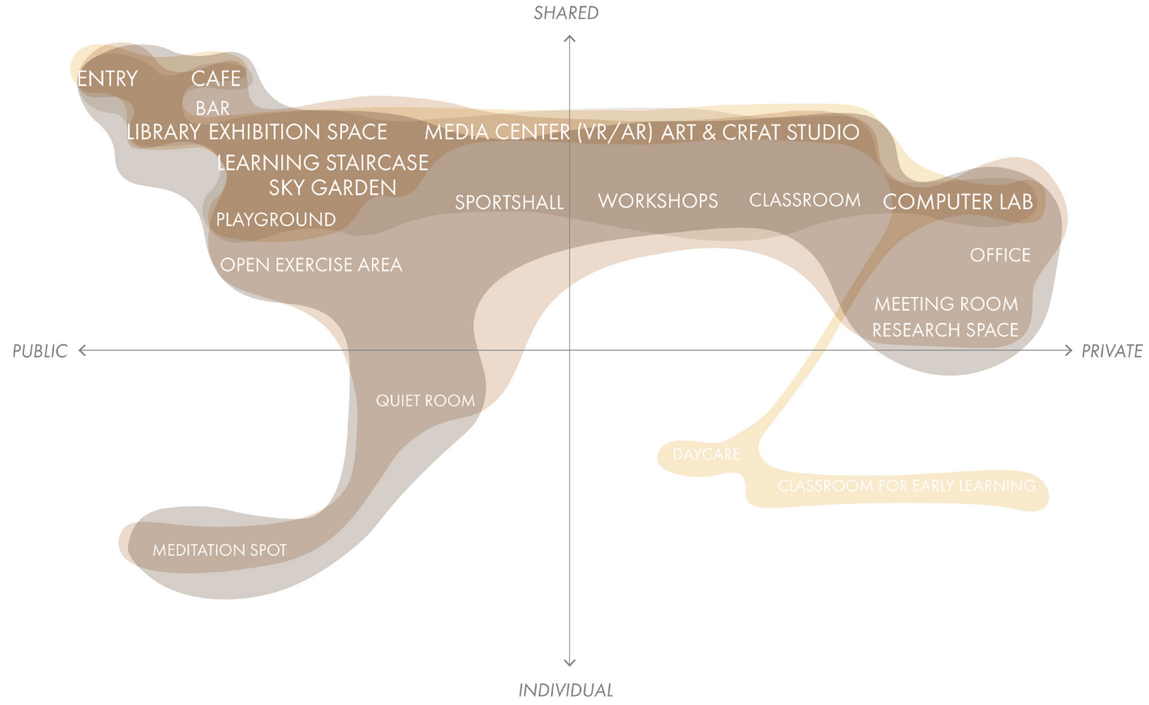
Program by hierarchy , threshold and degree of privacy



Program by age group

The programs within the building are tailored to specific age groups, encompassing children, teenagers, adults, and the elderly. The locations of these programs are strategically distributed throughout the building, taking into consideration varying degrees of privacy and accessibility.





Research about spatial proportion and emotion

Avishag Shemesh, Gerry Leisman, Moshe Bar, Yasha Jacob Grobman, The emotional influence of different geometries in virtual spaces: A neurocognitive examination, Journal of Environmental Psychology, Volume 81,2022,101802,ISSN 0272-4944, https://doi.org/10.1016/j.jenvp.2022.101802.

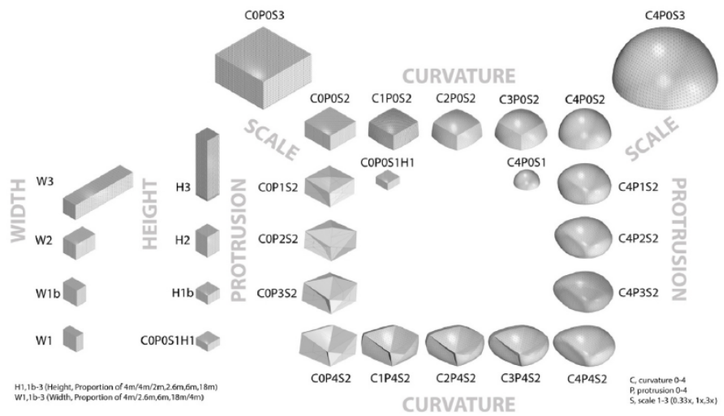


Fig. 4. Virtual spaces that were exported from the Grasshopper + Rhino programs that examined the various criteria measured, that included curvature, protrusion, scale, height, and width in VR (from Shemesh et al., 2021).

Table 1
Analysis of emotional response upon recognition of a VS..

VS of significance		Human Centered Measurable Variables											Emotional Response	
		Physiological measures							High+ dominant Physiological measures type	Amount of dominant measures	Behavioral measure	Self-reported measures	X= Arousal score	Interest polarity (negative/ positive)
		βBPR*	PD*	MPD*	ROF*	FD*	GSRR*	MGSR*			PIS*	LS**	Use given***		
	C0+P0+S2	high	high	high	-	-	low	low	MPD	1	-	-	positive	2	-
	C0+P4+S2	-	high	high	low	low	-	-	MPD	1	high	high	positive	3	positive
	C4+P0+S2	low	low	low	-	-	-	high	-	-	-	-	positive	-2	-
	C4+P4+S2	-	-	low	-	high	-	-	-	-	-	-	positive	0	-
	C3+P0+S2	-	-	-	-	-	-	-	NA	-	high	high	positive	0	-
	C2+P4+S2	-	high	high	low	low	-	-	NA	-	high	high	positive	2	positive
	C0+P0+S1	high	low	-	-	high	-	low	GSR FD βBPR	2	low	low	negative	2	negative
	C0+P0+S3	low	high	high	-	low	-	low	MPD GSR	1	high	high	positive	0	-
	C4+P0+S1	high	low	-	-	high	-	-	GSR FD βBPR	2	low	low	negative	3	negative
	C4+P0+S3	low	-	-	low	low	high	high	MPD GSR	1	high	high	positive	2	positive
	W1	high	high	high	high	high	high	-	FD	1	low	low	negative	5	negative
	W3	high	low	low	low	low	high	high	βBPR	1	high	low	negative	2	-
	H1	-	high	high	high	-	-	-	FD	-	low	low	negative	1	negative
	H3	-	low	low	low	low	high	high	-	-	-	-	negative	0	-

Research Information

A proportional change in height P(H) was defined based on the following criteria: changes in ceiling height:
low = 4 m × 4 m x 2 m (C0P0S1H1),
medium = 4 m × 4 m x 2.6 m (H1b),
high = 4 m × 4m x6m (H2),
very high = 4 m × 4 m x 18 m (H3).

Changes in virtual room width:
narrow =2 m × 4 m x 4 m (W1),
standard = 2.6 m × 4 m x 4 m (W1b),
wide = 6 m× 4 m x 4 m (W2)
and very wide = 18 m × 4 m x 4 m (W3)

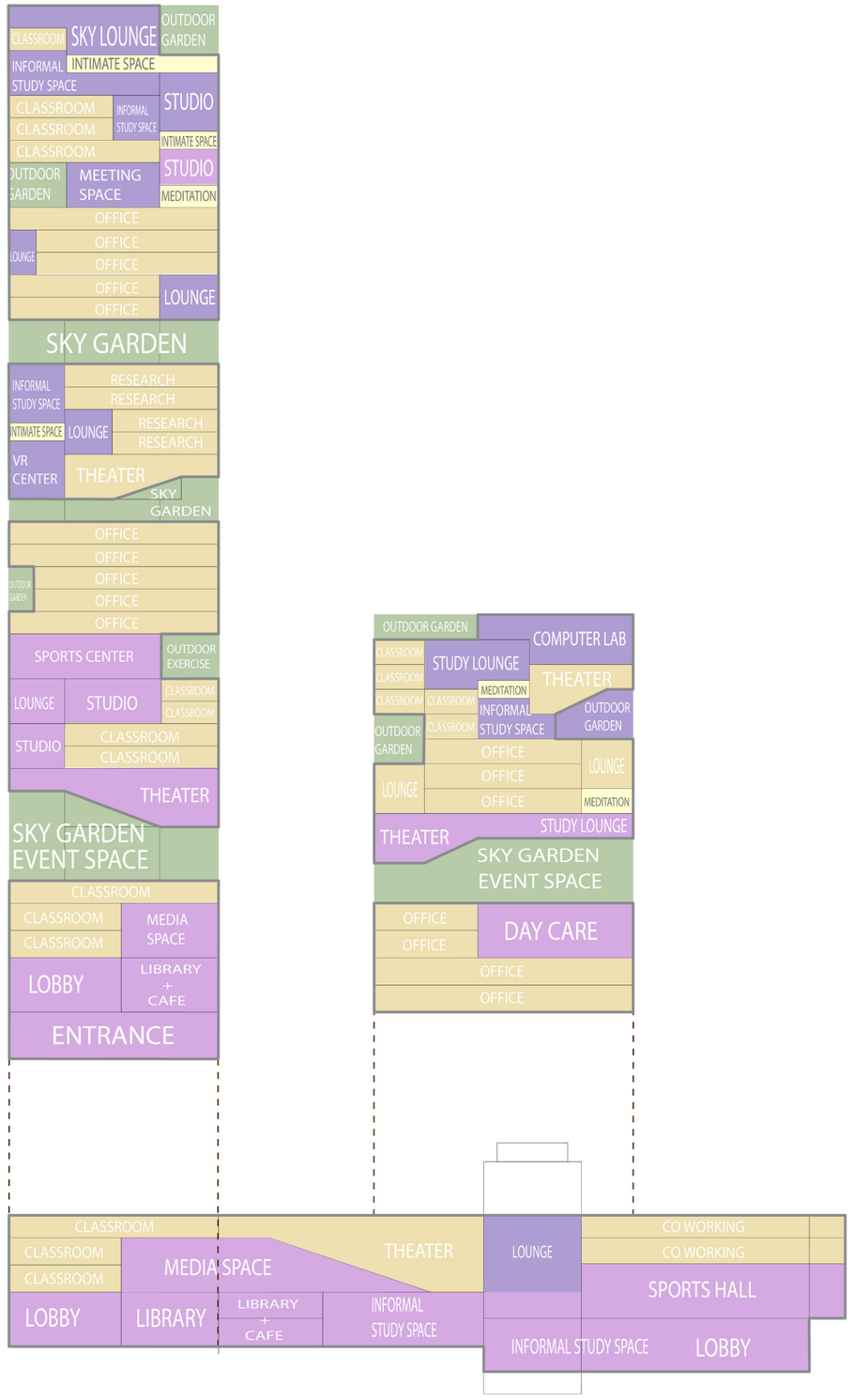
The larger the simple and symmetric VS, the more positive the response (the limit is unknown), and the smaller the symmetric VS, the more negative the emotional response. A curved, large-scale VS is associated with a more positive emotional response than a large square VS.

There exists an inverse relationship between the proportion of the VS and emotional responsivity. Changes in proportions were expected to be influential (Franz net al., 2005) as extreme proportions of spaces (rectangular and very close/far from the perceiver's body in either one facet-ceiling or sides, or all facets relative to the human body (scale)) have the potential to negatively influence wellbeing (Lara-Moreno, Lara, & Godoy-Izquierdo, 2021). If we wish to design spaces which create a high level of excitement, we may use extreme proportions or scale.

In contrast to ceiling height, perceived enclosure affected both beauty judgments and approach-avoidance decisions: participants were more likely to judge as beautiful open than enclosed spaces, and also more likely to decide to avoid enclosed than open spaces. Interestingly, Stamps (2005) has demonstrated that impressions of enclosure are more strongly influenced by visual permeability than by locomotive permeability, whereas impressions of safety are more strongly influenced by locomotive permeability than by visual permeability. Although we did not distinguish between visual and locomotive permeability in our stimuli, the behavioral results suggest that participants might have attended to different aspects of perceived enclosure (i.e., visual or locomotive) when making choices in the beauty and approach-avoidance conditions. Specifically, impressions of visual and locomotive permeability might have had a greater impact on beauty judgments and approach-avoidance decisions, respectively. Future studies on the effect of perceived enclosure on beauty judgments and approach-avoidance decisions would benefit by distinguishing between stimuli that signal different types of permeability.

Why

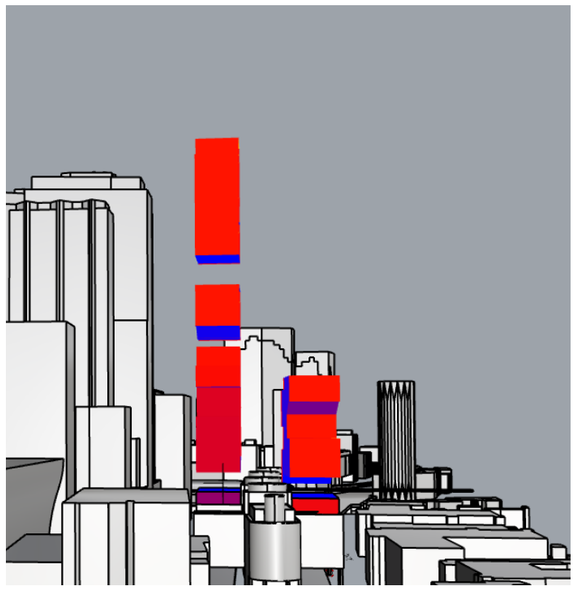
In the 21st century, a campus has evolved into a vibrant learning community, uniting individuals with shared attitudes and interests. This community, founded on common values, serves as a central hub for the dynamic exchange of knowledge, inspiration, and innovation. People of all age groups, reflecting diverse characteristics, converge around these shared values in their pursuit of learning. While preserving its traditional role as a learning space, the modern campus places heightened emphasis on fostering social values. This adjustment becomes particularly significant as online learning continues to evolve, underscoring the importance of the social dimension within the physical campus experience. With ample public space and intentional planning designed to encourage interpersonal connections, this environment promises a novel learning experience for individuals of all ages.

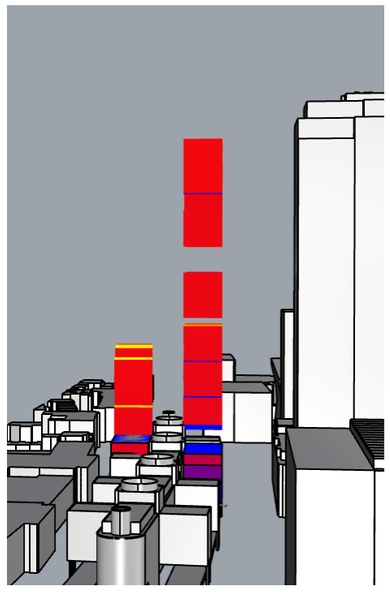


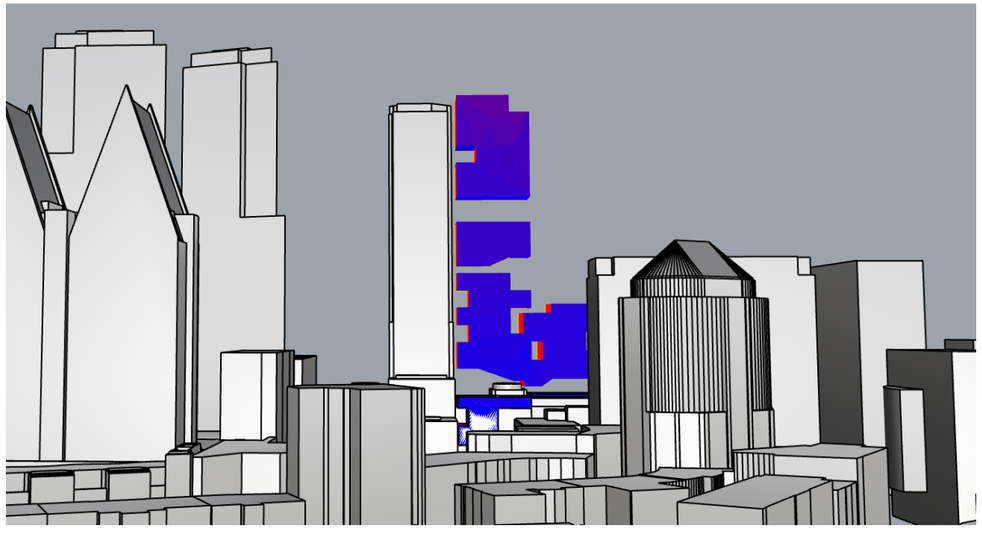
Campus as a learning community and future

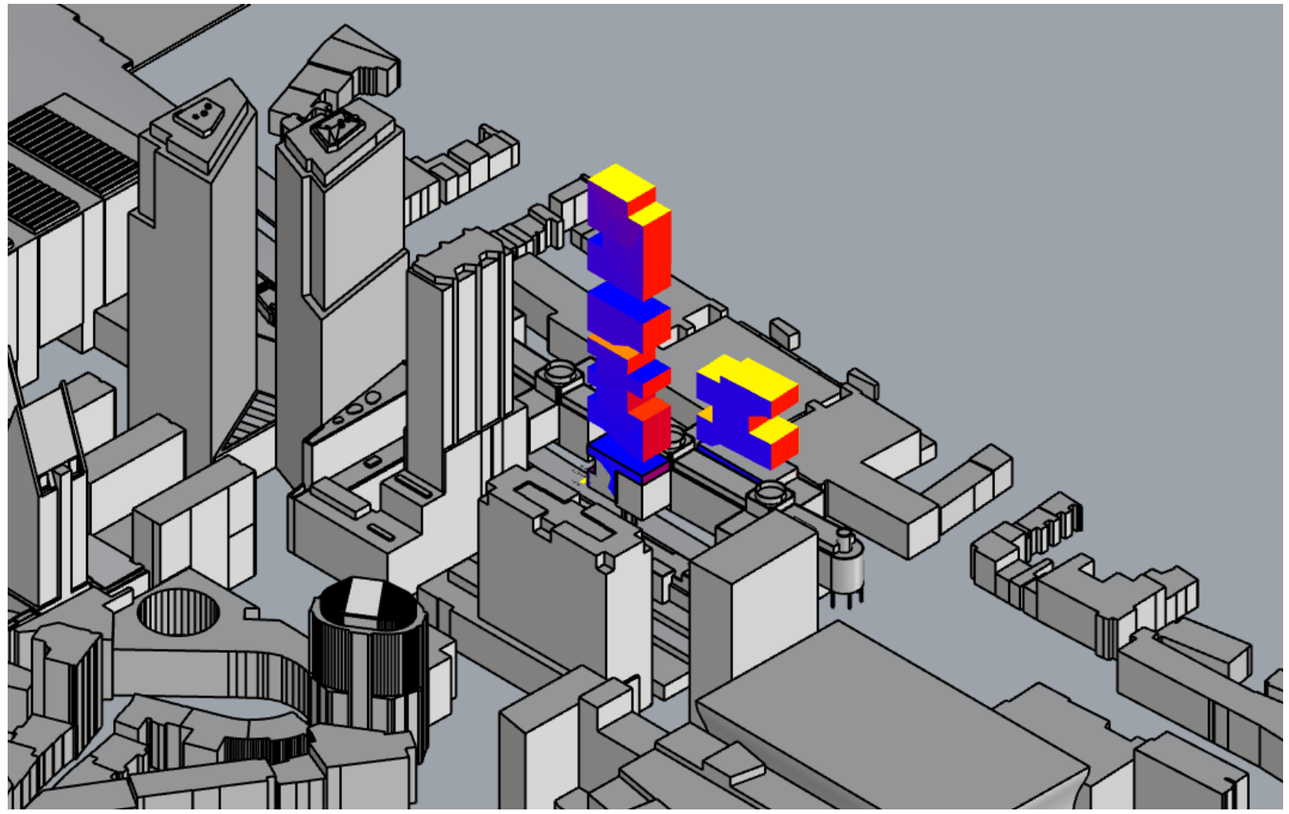
In the era of pervasive digital learning resources such as recorded courses and AI chatbots, the question arises regarding the necessity of physical gatherings for educational purposes, except in the most practical scenarios like surgeon or firefighter training. The primary function of nowadays campus shifted from traditional education space into a space for social interactions. In the 21st century, a campus embodies the essence of community for me. Within this community, individuals with diverse characteristics converge around shared values and common interests. It serves as a hub for the exchange of ideas and a source of inspiration. Beyond its primary role as a learning space, the campus fosters social values. The experience within the community cannot duplicate from online learning platform, with that being said, makes this concept future proof. My vision extends to creating a dedicated learning community in the city of The Hague, with a focused emphasis on two pillars: enriching the learning experience and cultivating a vibrant social space. This community aims to facilitate interactions among people of all age groups, fostering the exchange of ideas and providing inspiration. To bring this vision to life, I plan to design an improved learning environment informed by scientific research, particularly in the realm of environmental psychology. This approach ensures that the physical space itself contributes to a positive and conducive learning atmosphere. Additionally, the community programs will cater to all age groups, promoting a culture of lifelong learning. By combining these elements—innovative learning spaces, social interaction, and evidence-based design—I aim to establish a thriving community in The Hague that not only prioritizes education but also nurtures meaningful connections and continuous learning throughout life.

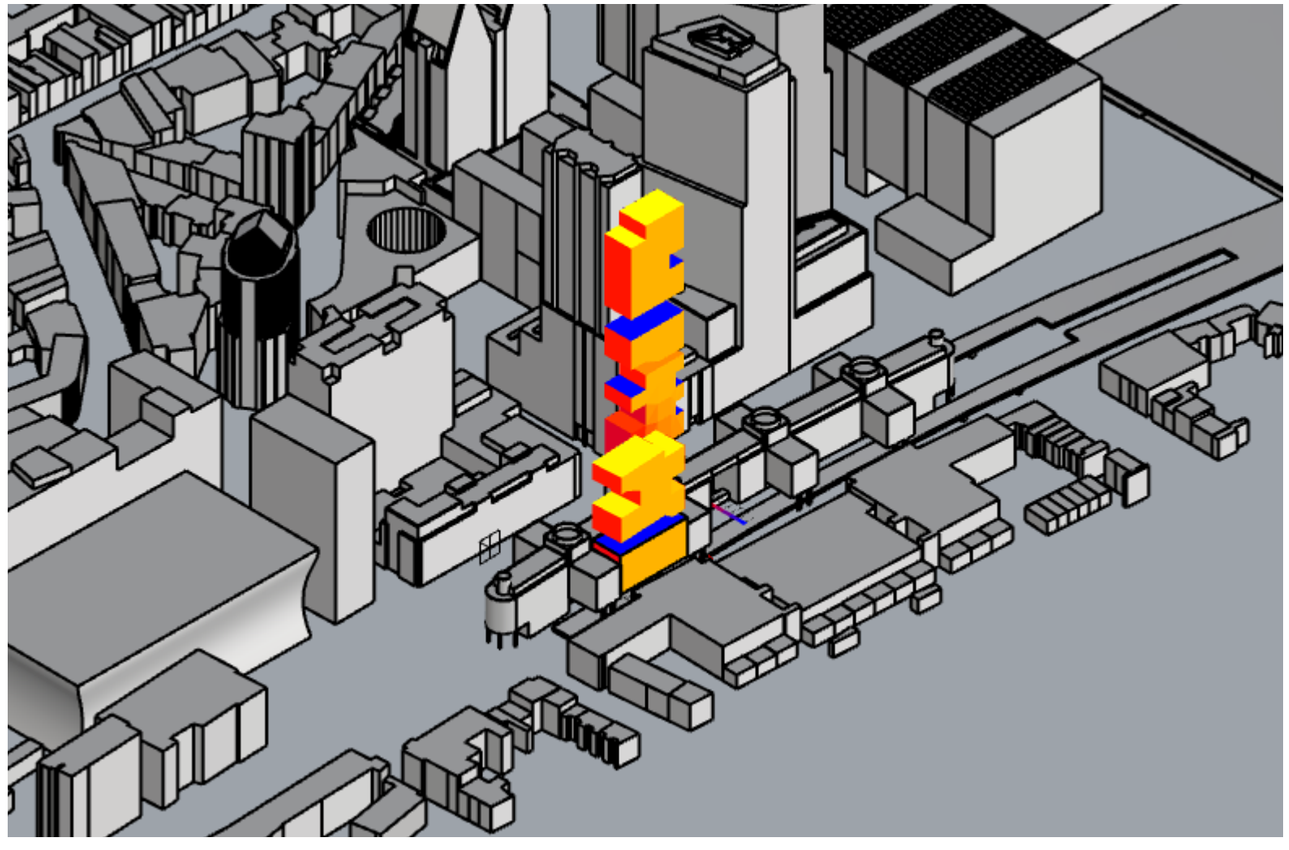
Heat analysis



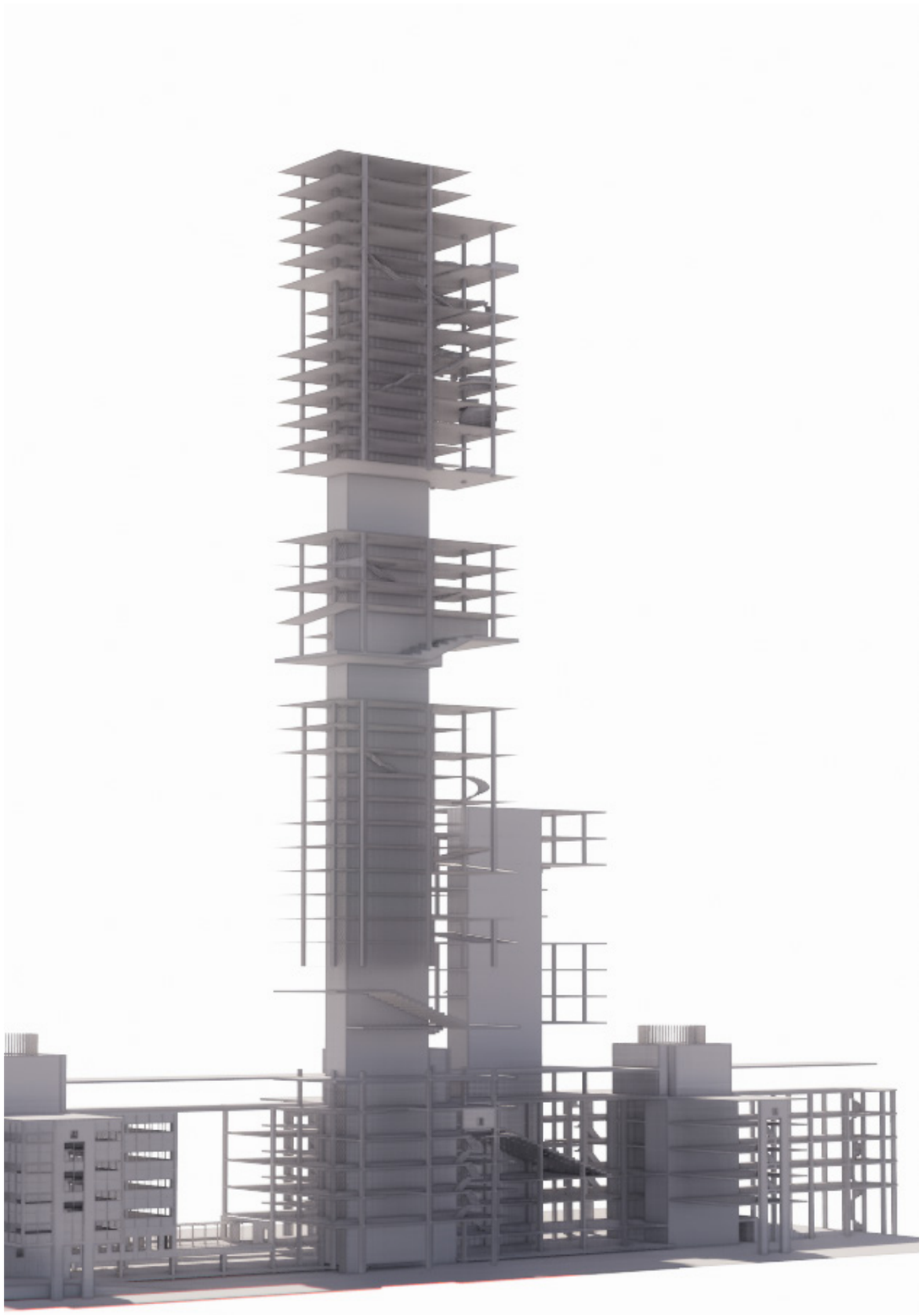


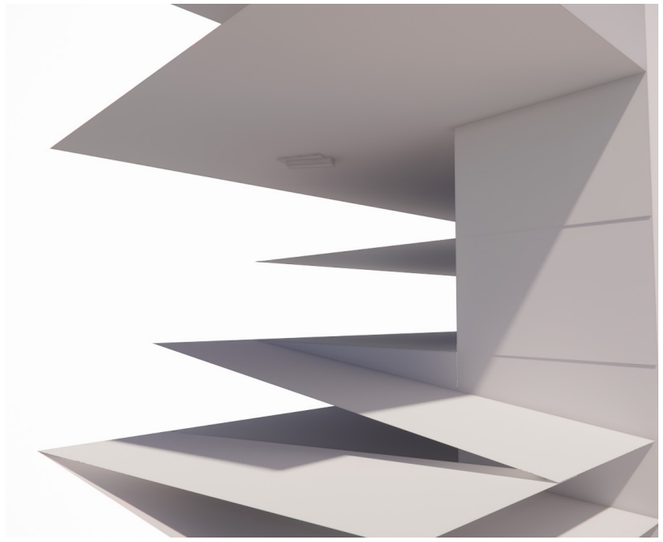


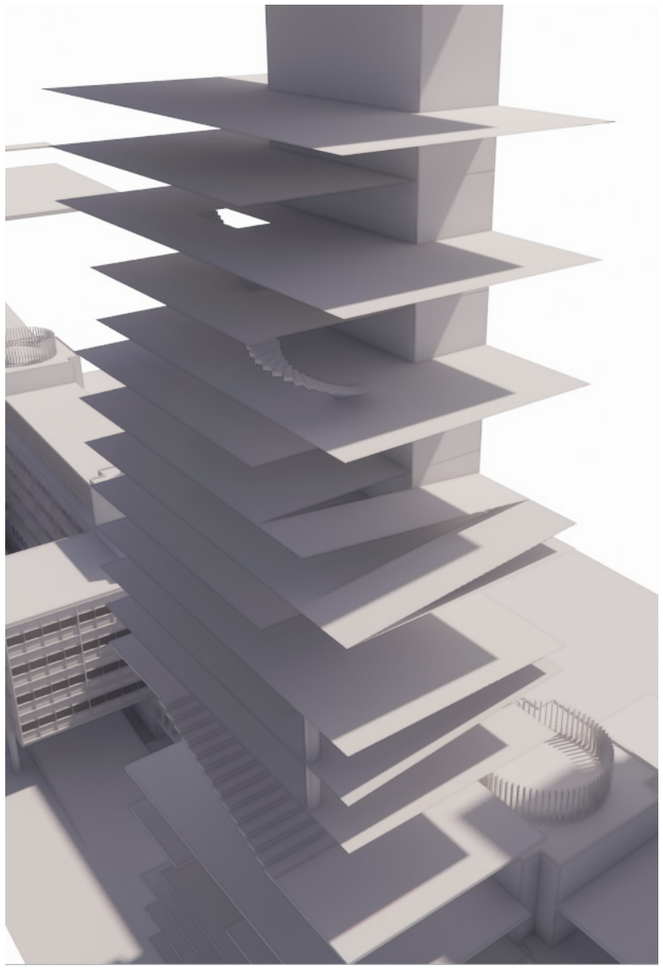




Spatial Quality exploration



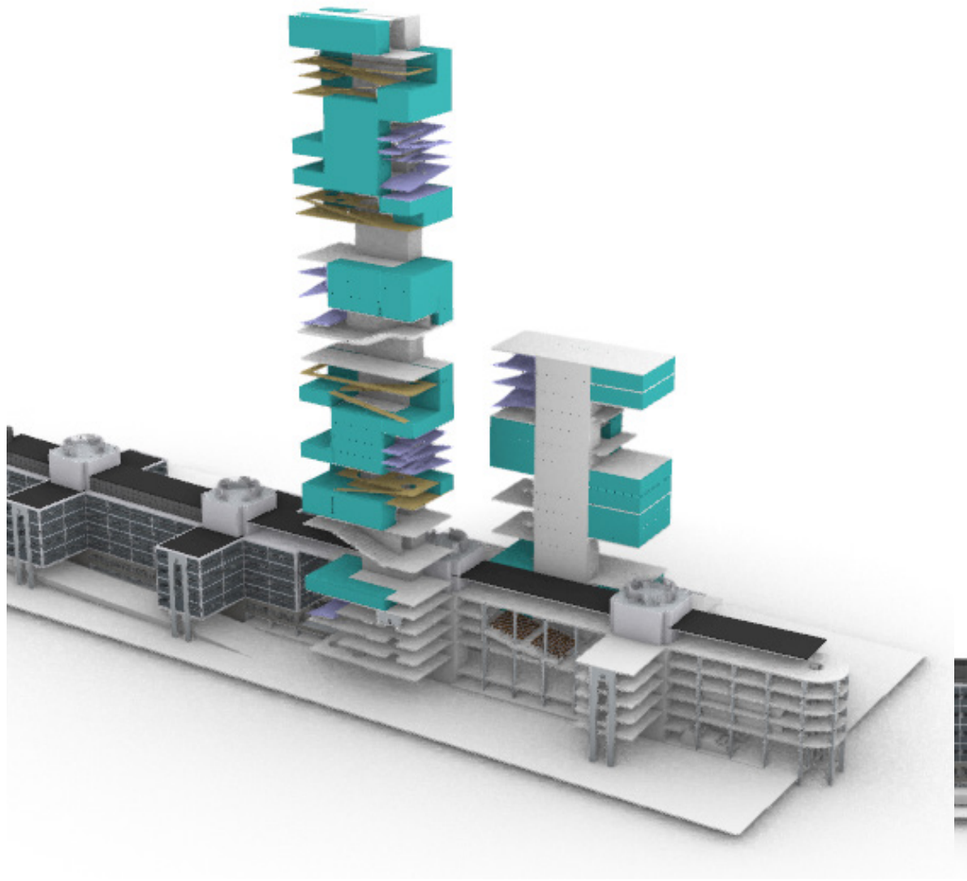


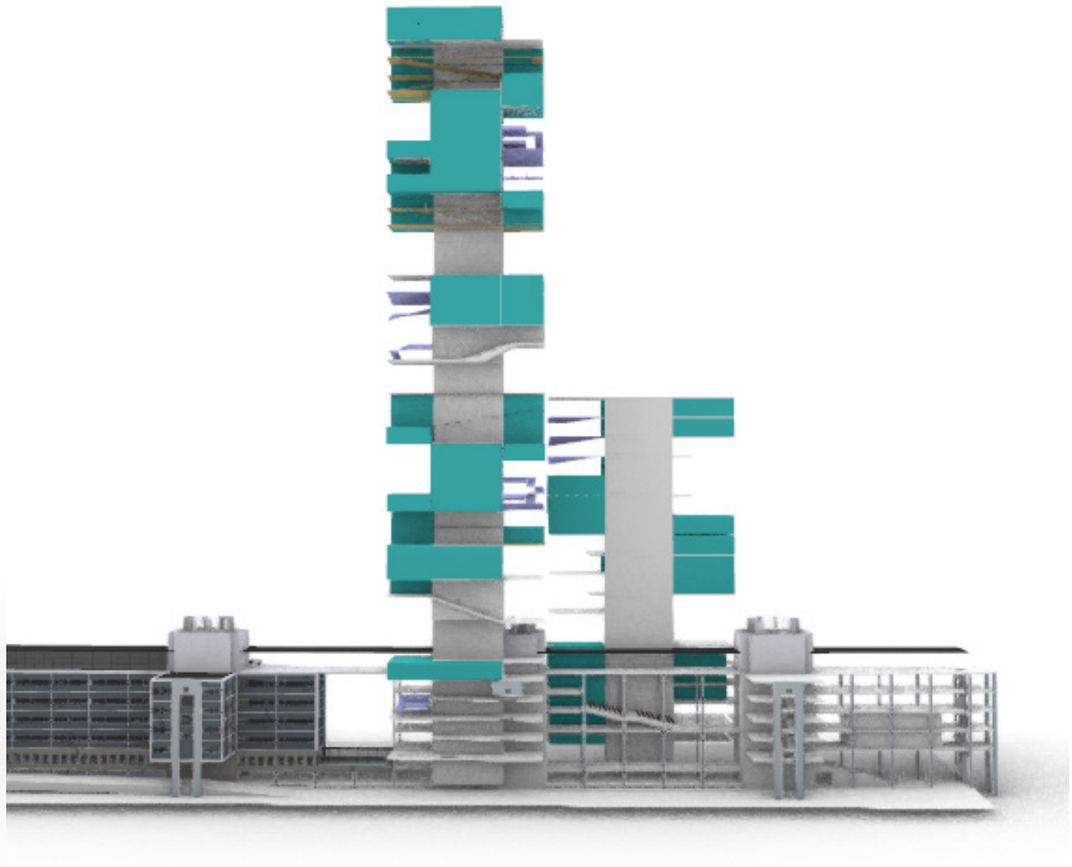


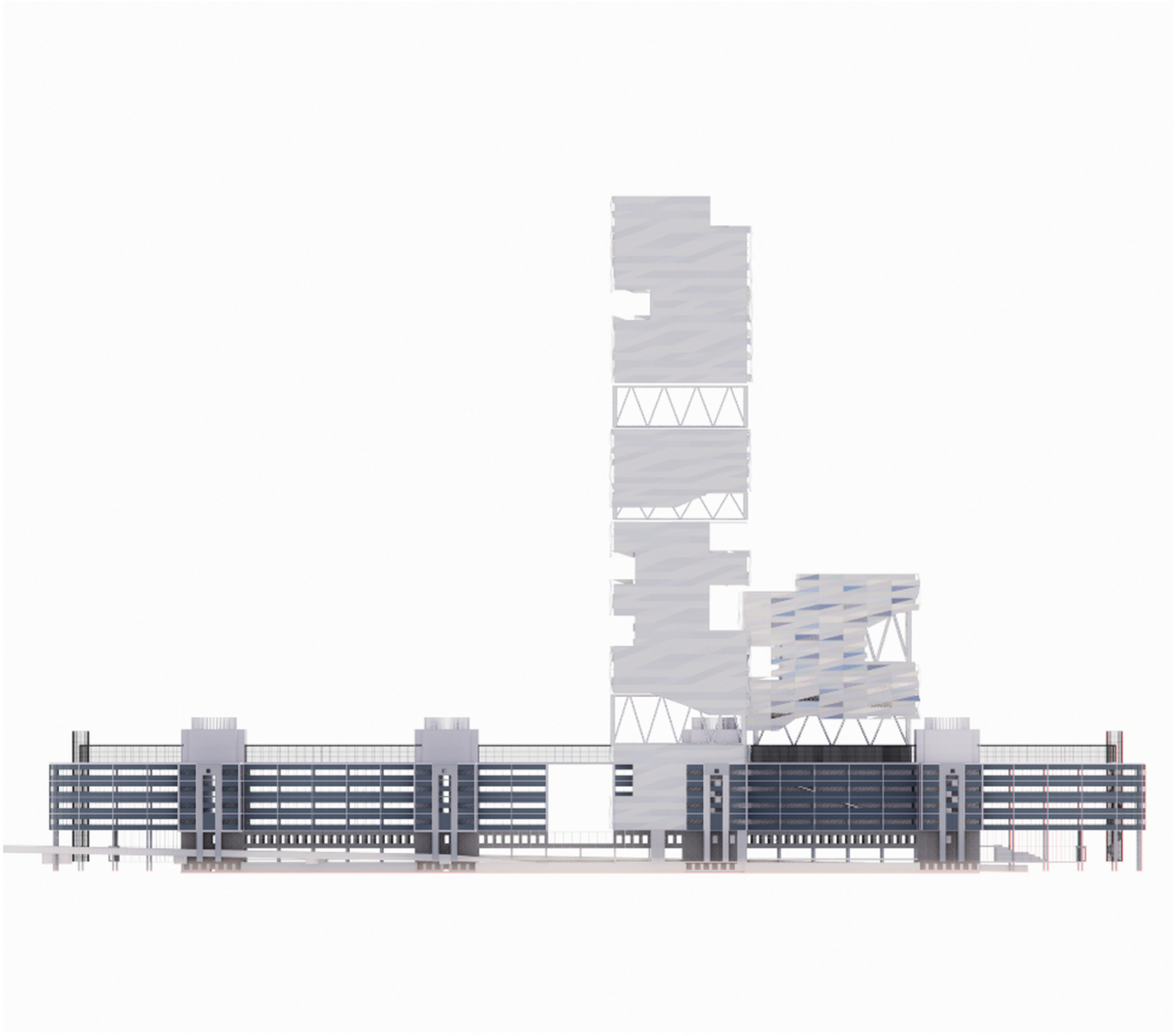
Facade exploration

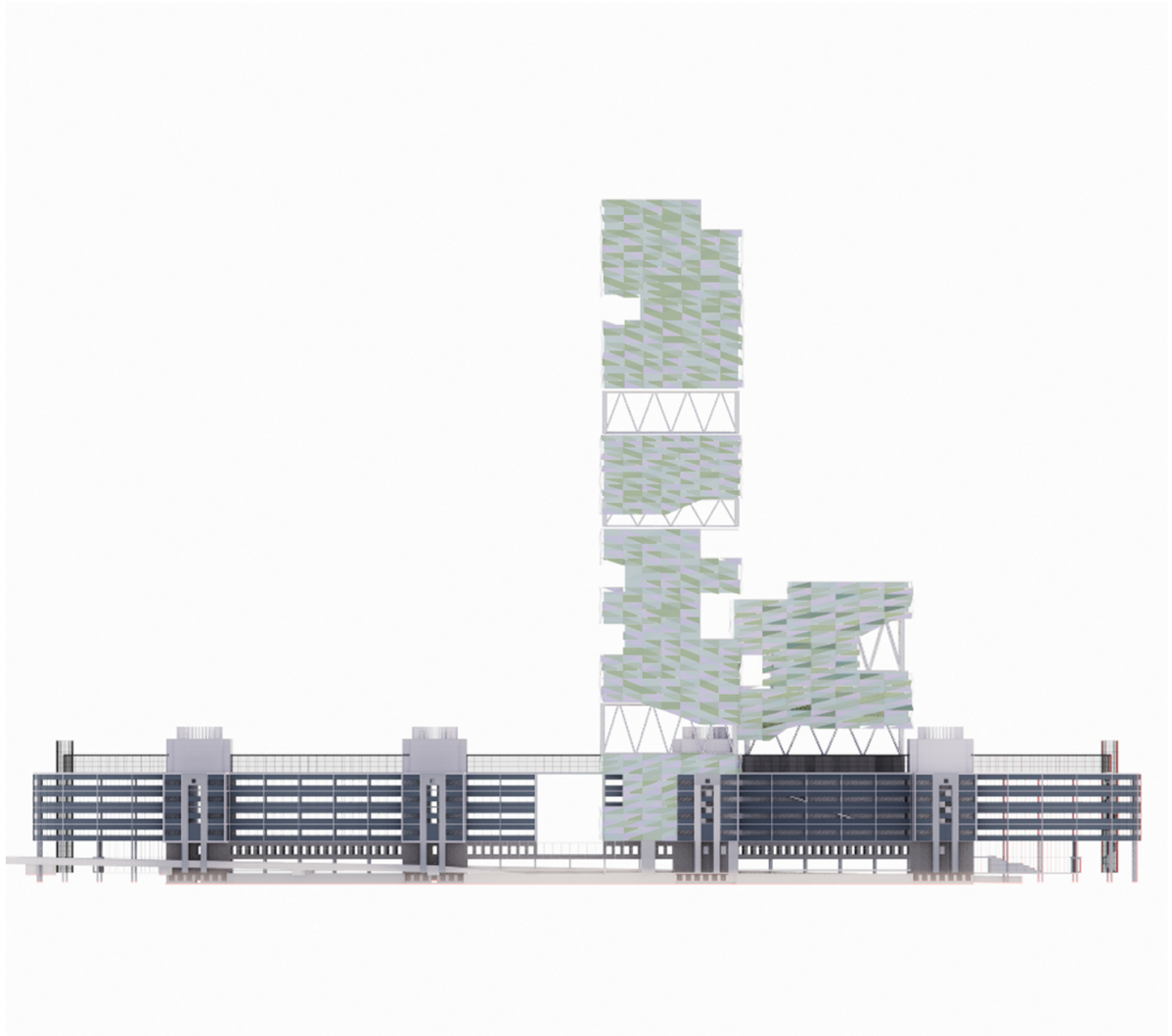
idea 1: public spine

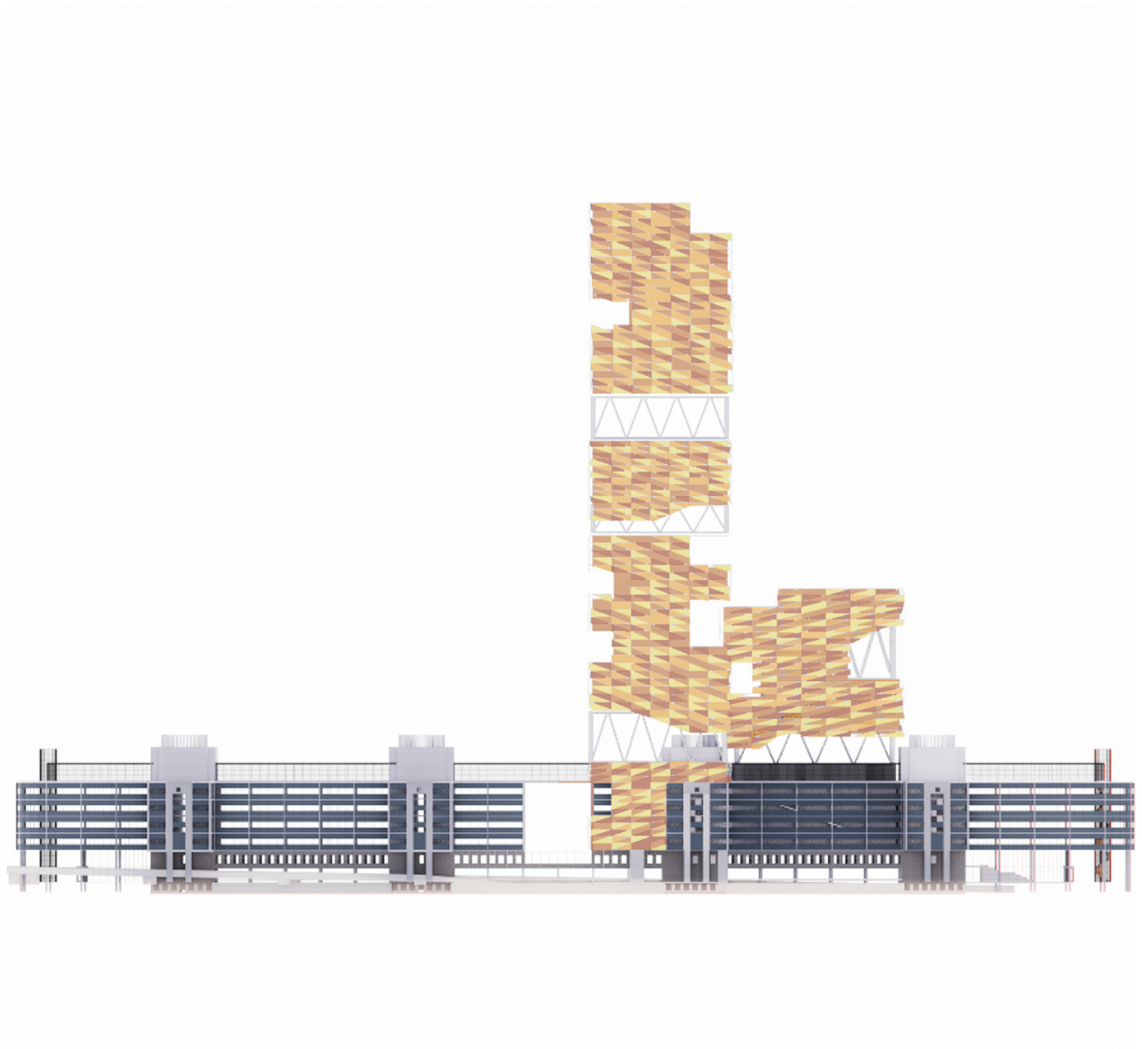
idea 2: education space

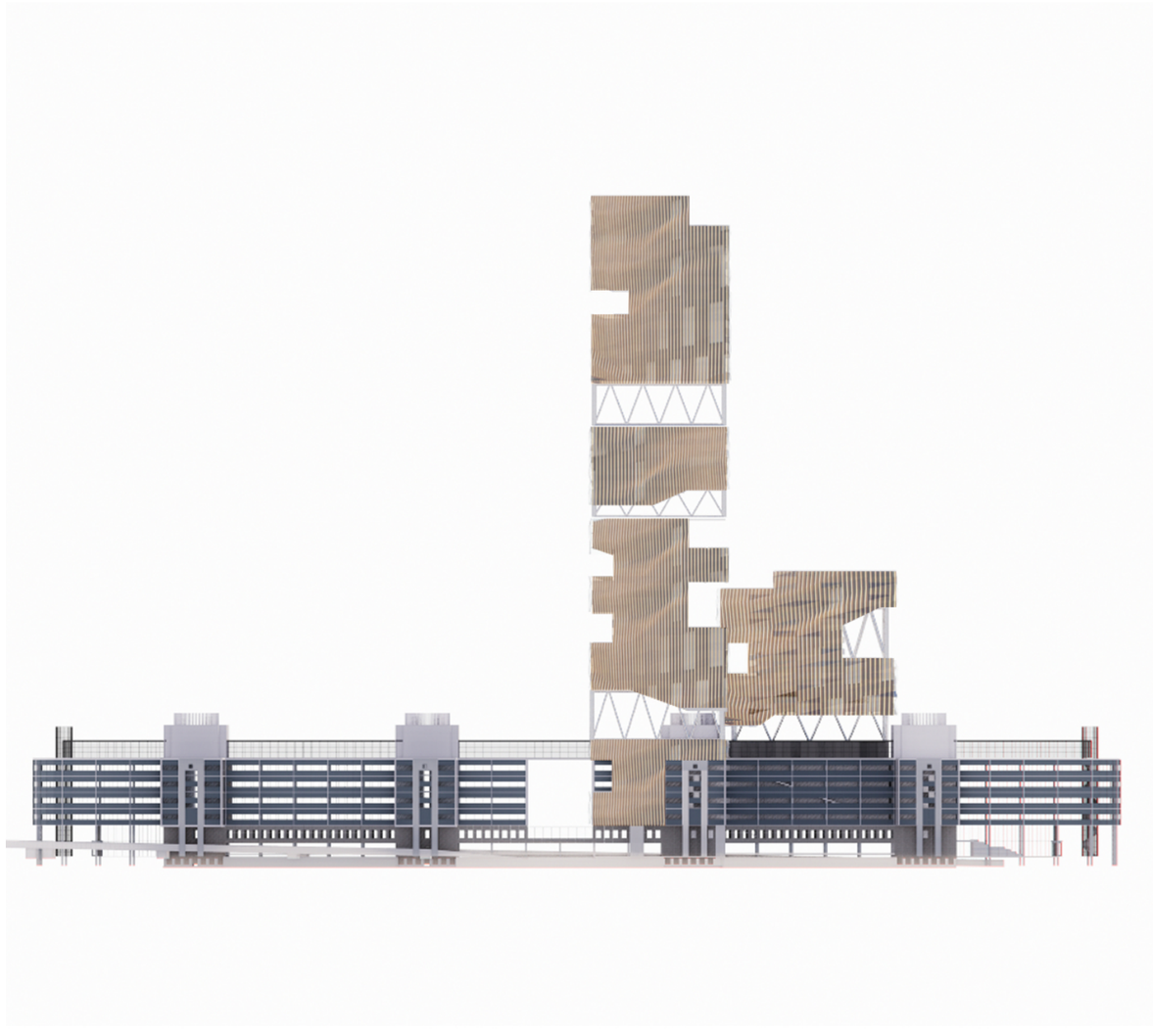


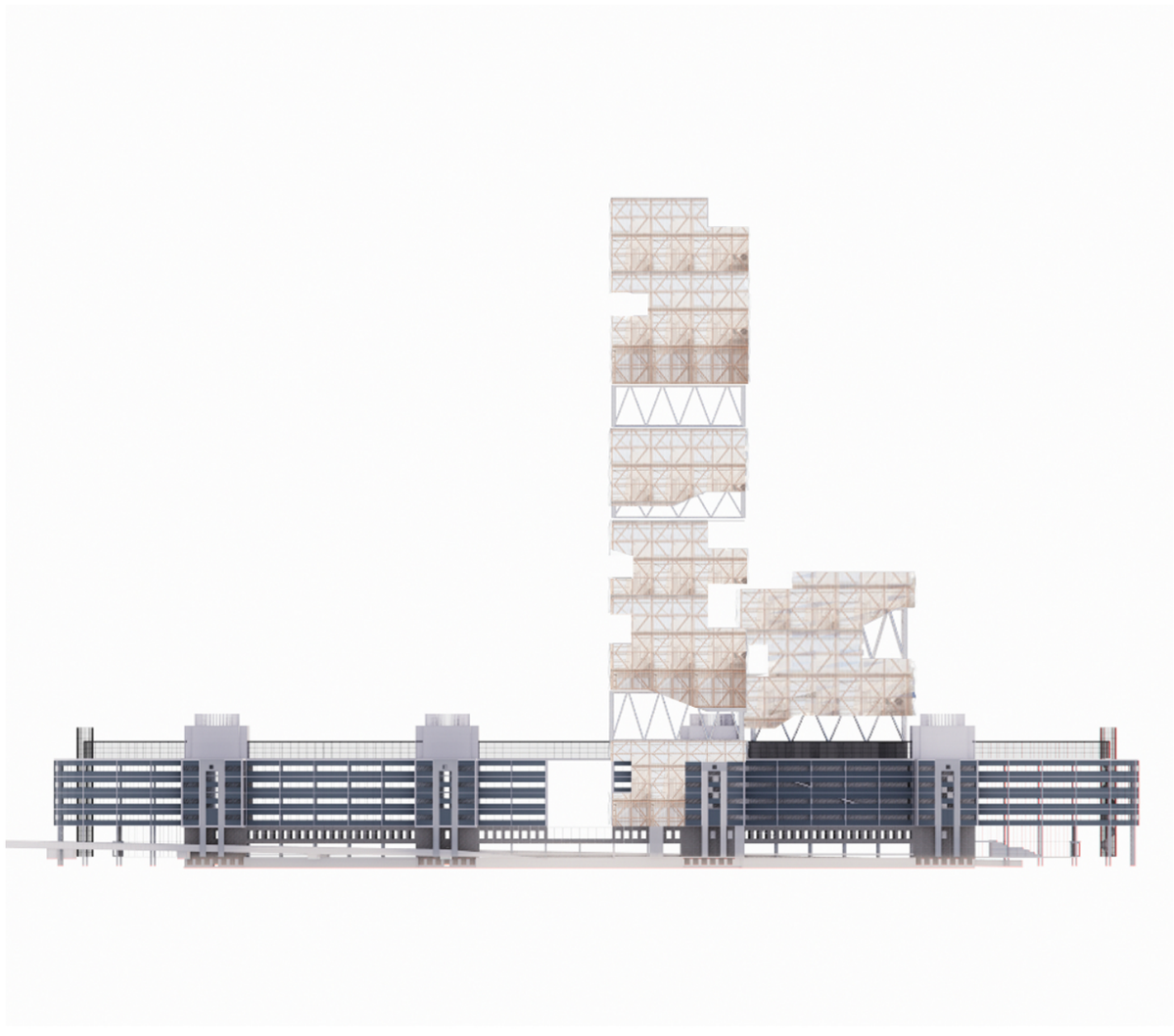


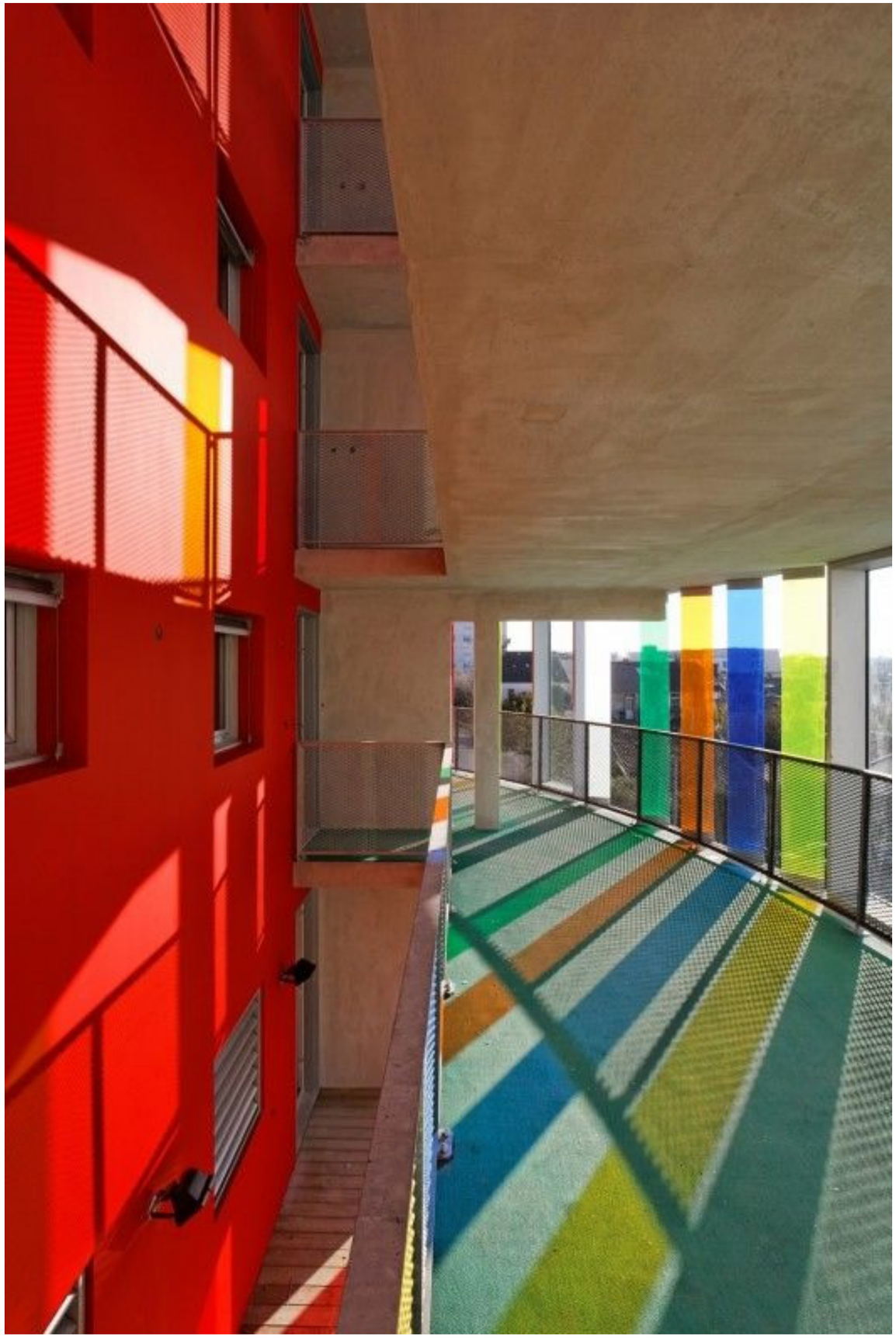


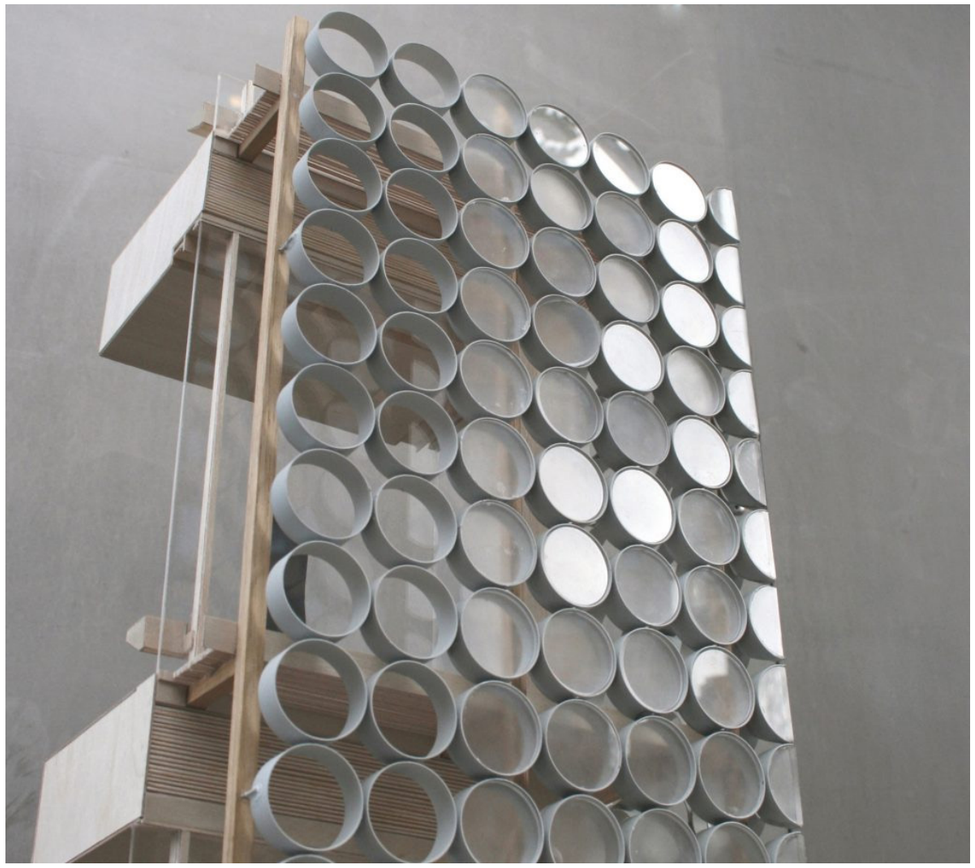




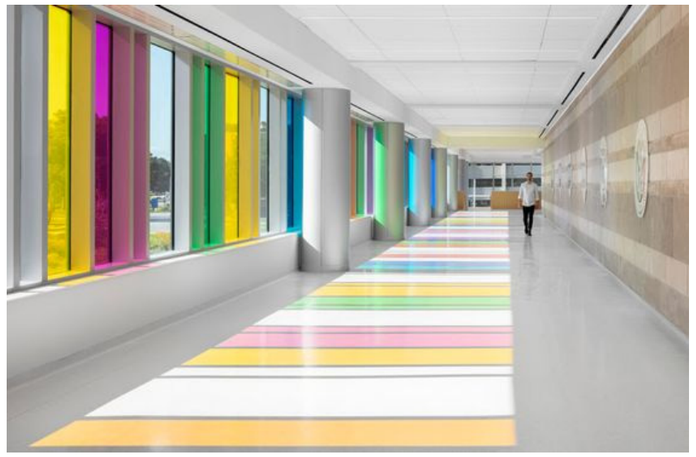


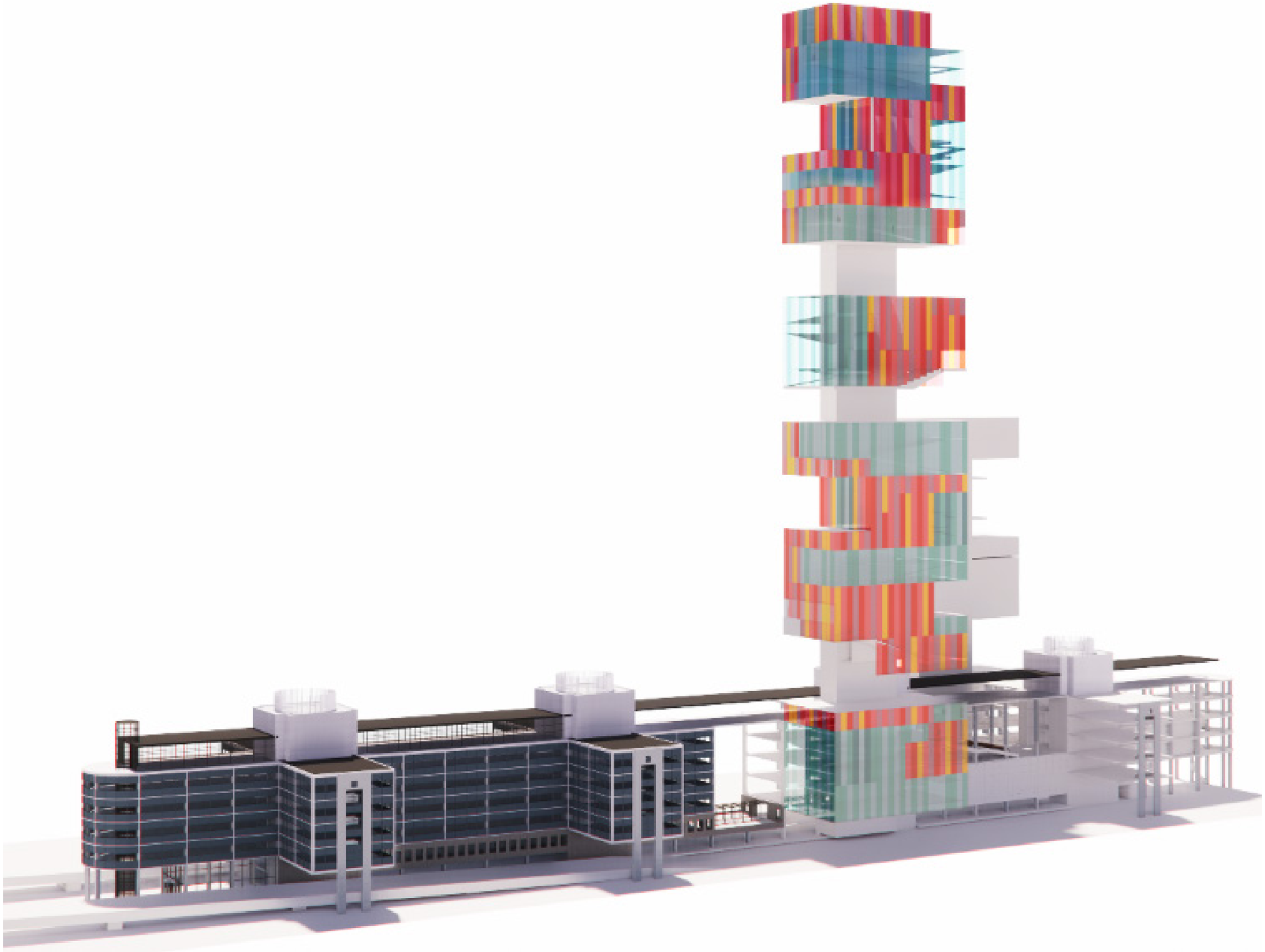


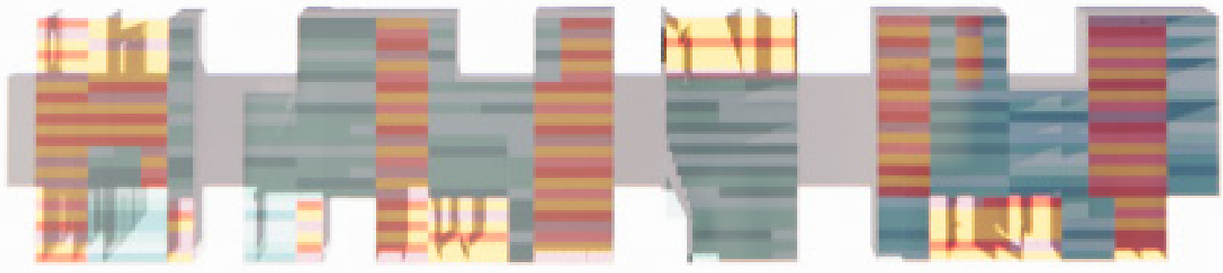


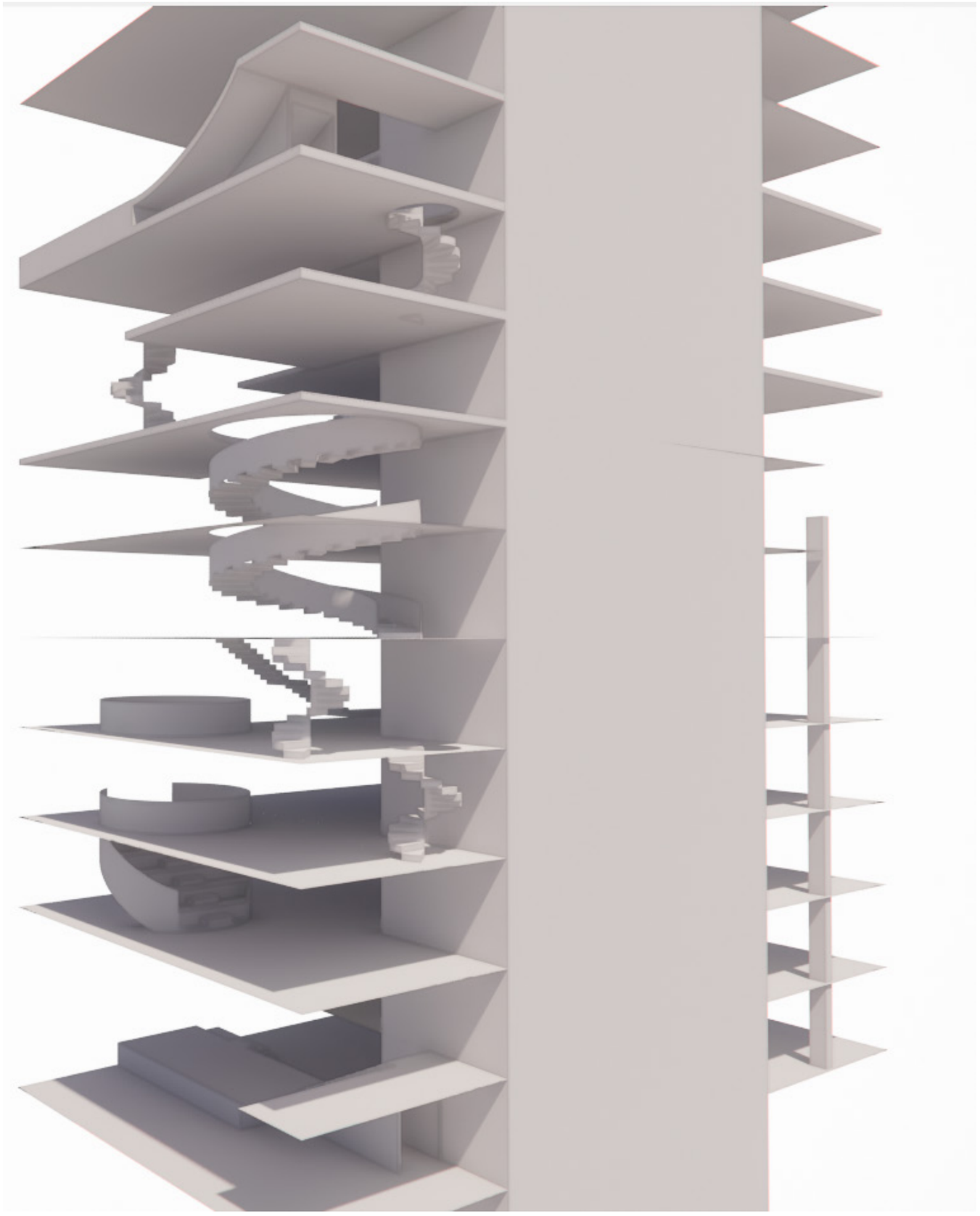


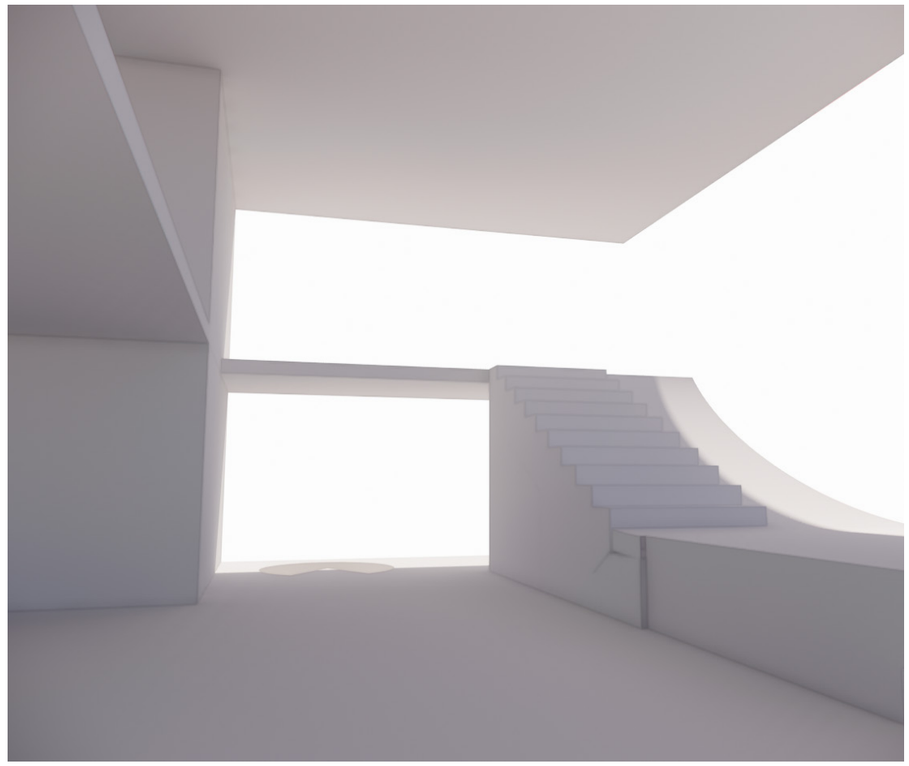
The façade comprises a specifically detailed double glazed inner skin on each face of the building and an automated operable second skin shading device. The second skin shading device surrounds the entire building, from the ground floor to the roof plant level. It is made up of nominally 600 mm diameter sandblasted glass disks, which are fixed to either a horizontal or vertical aluminium axel. Each axel is fixed to the outer face of a galvanised steel cylinder of a slightly greater diameter and nominally 130 mm in depth.

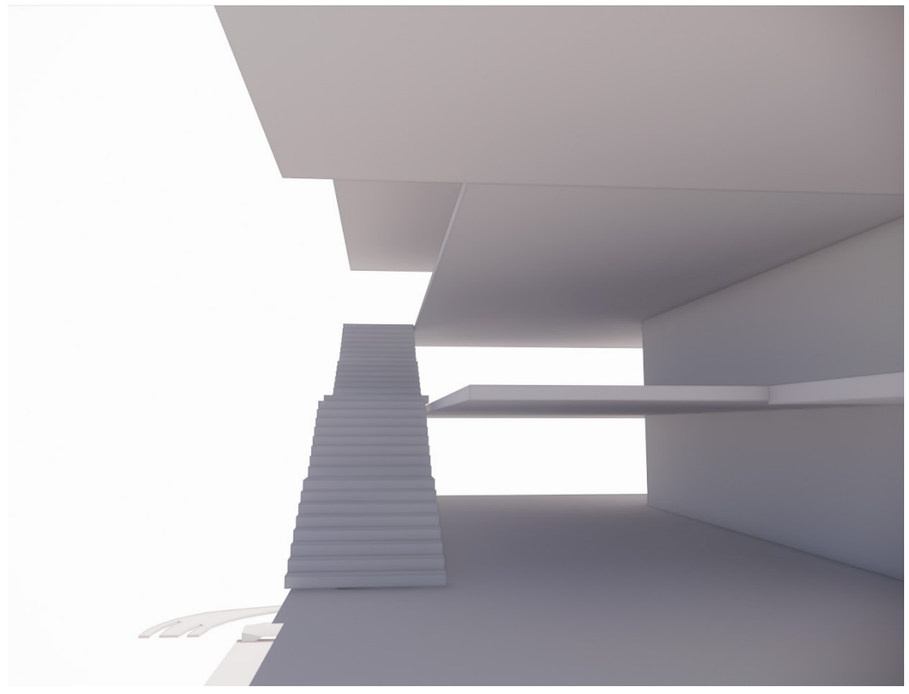


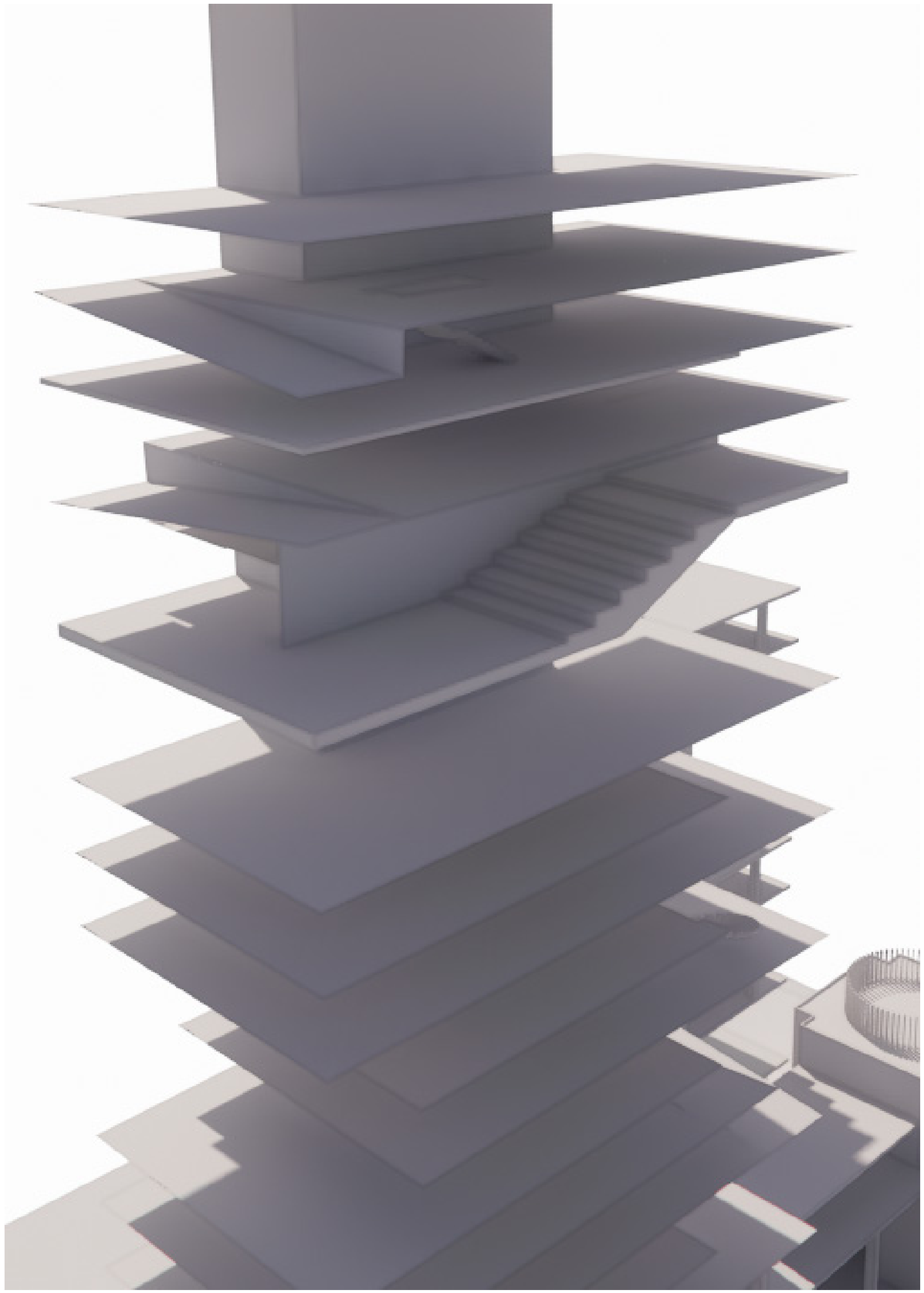


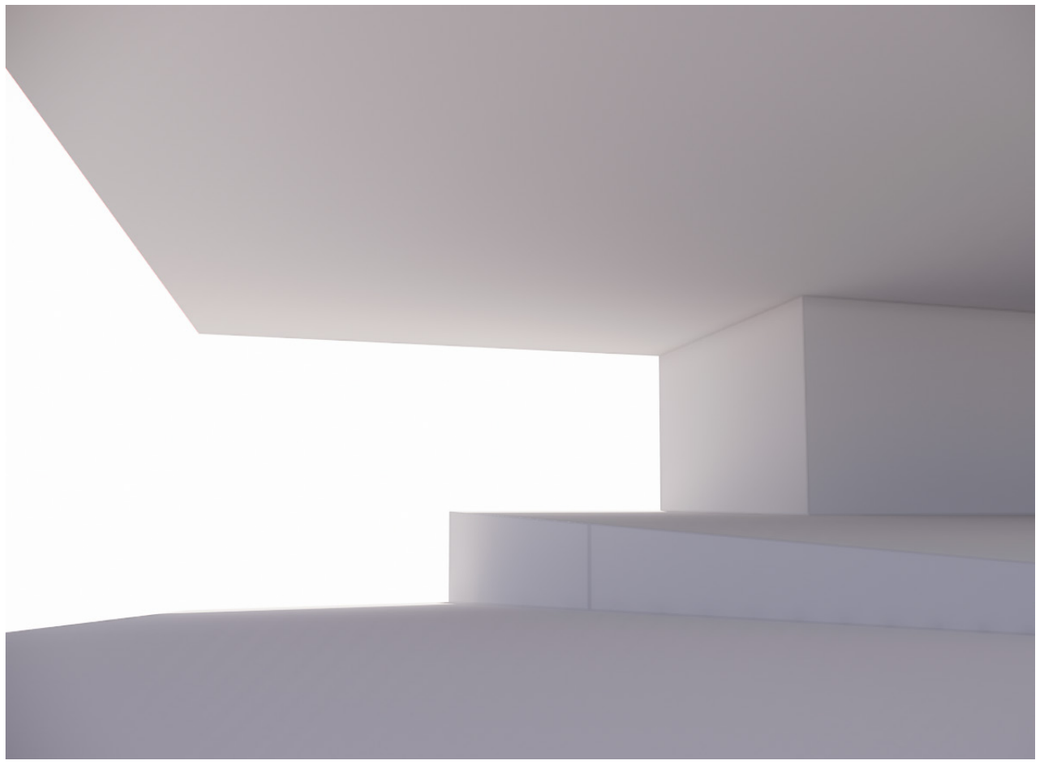


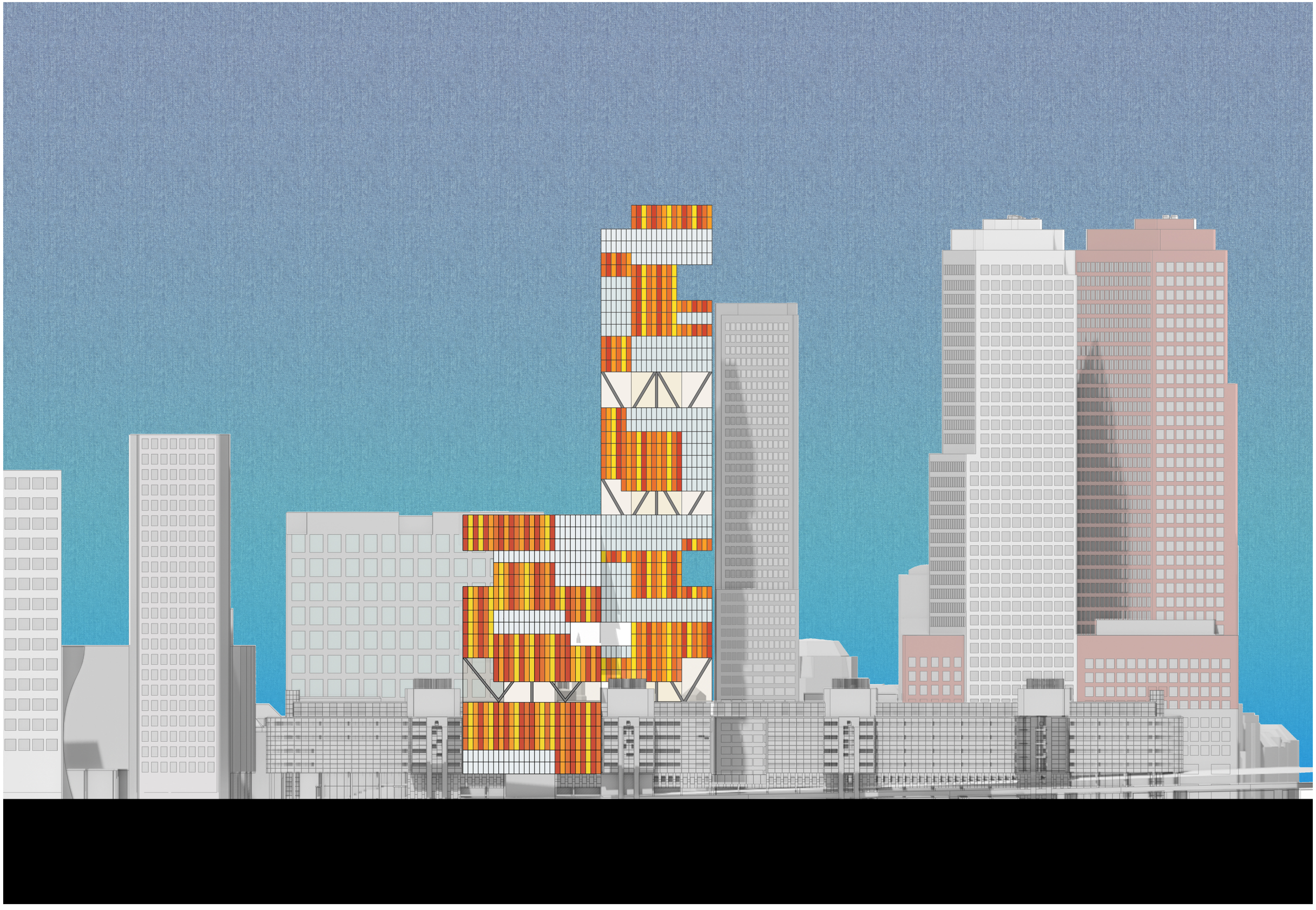




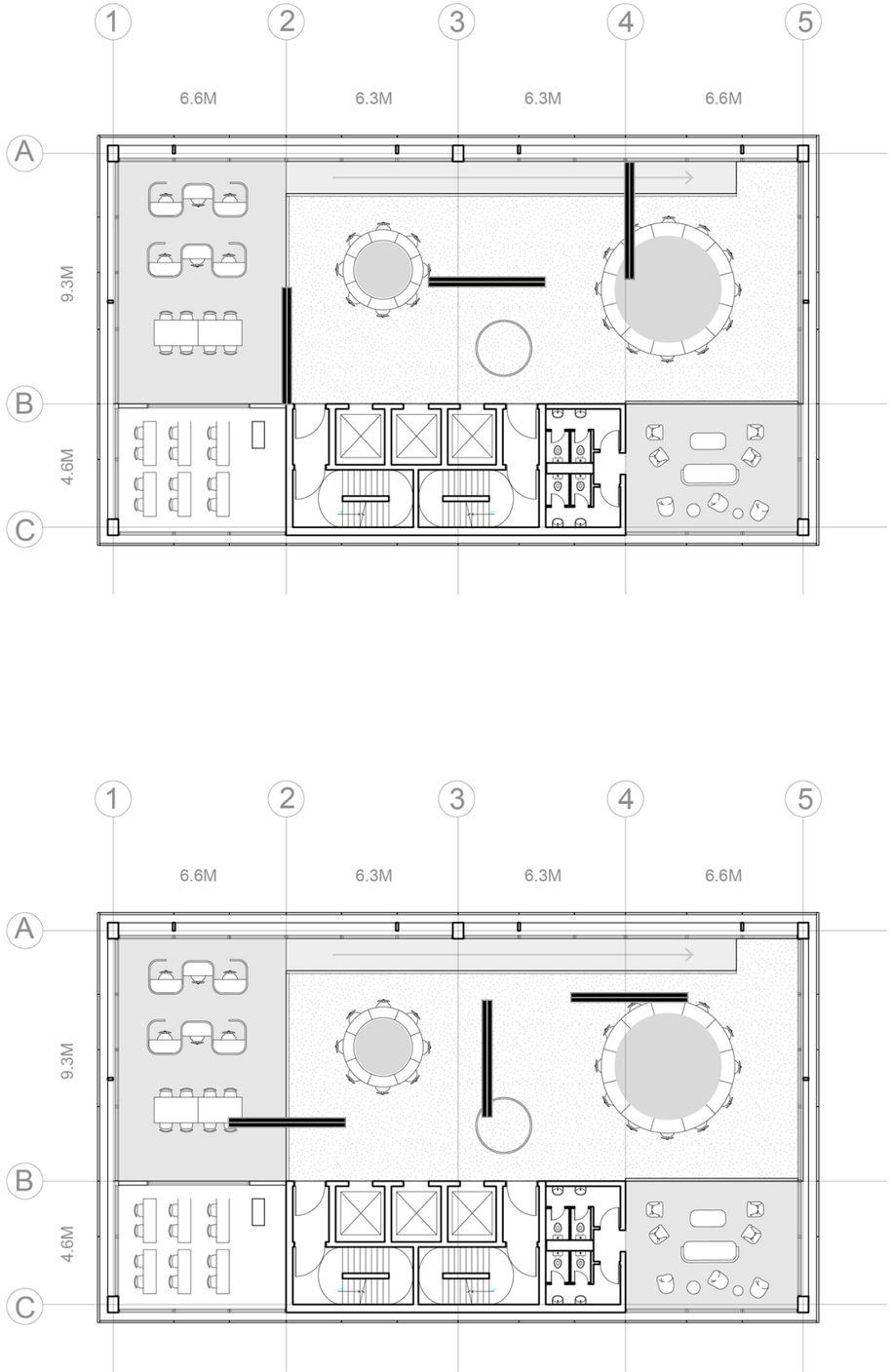


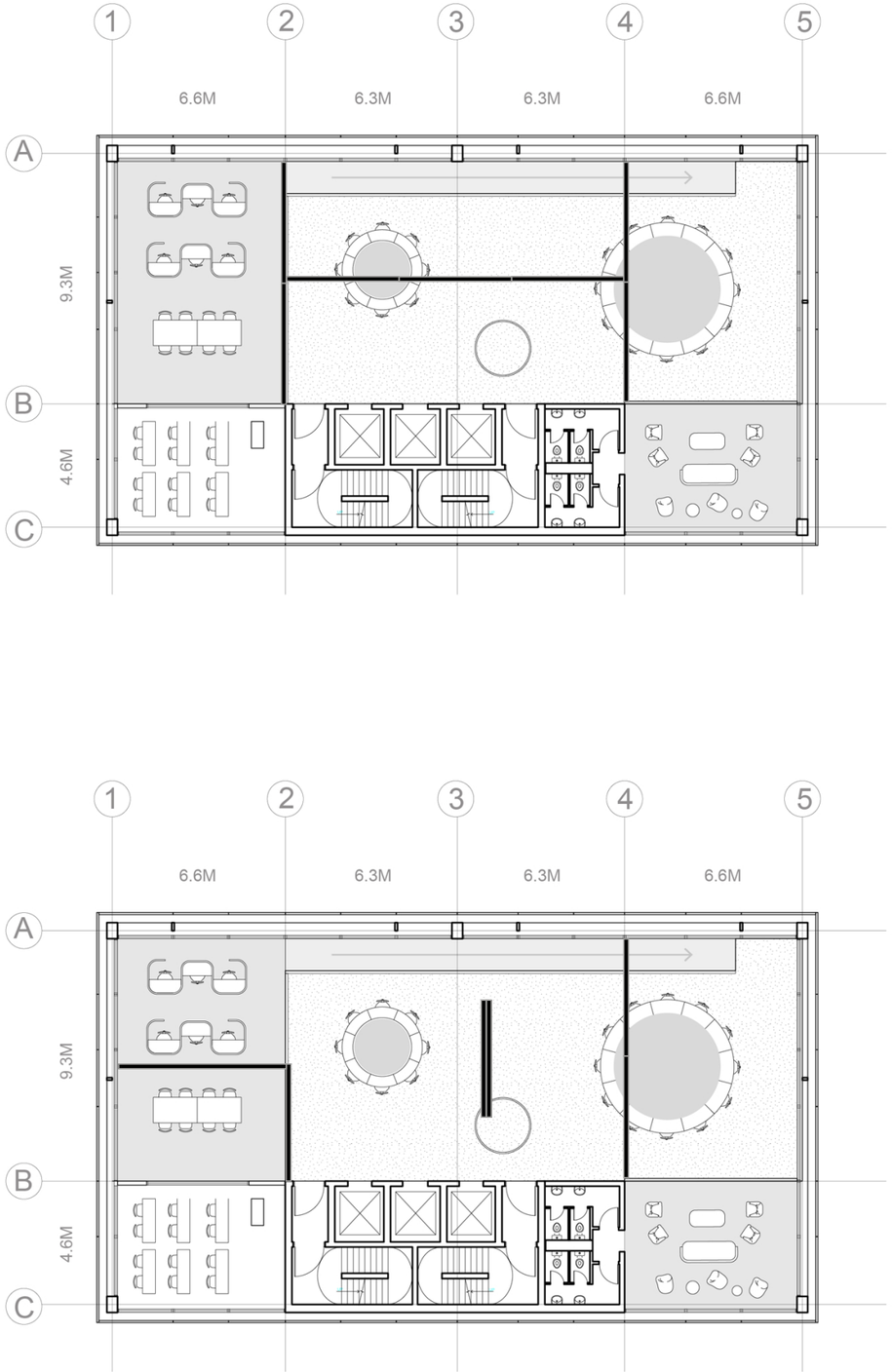




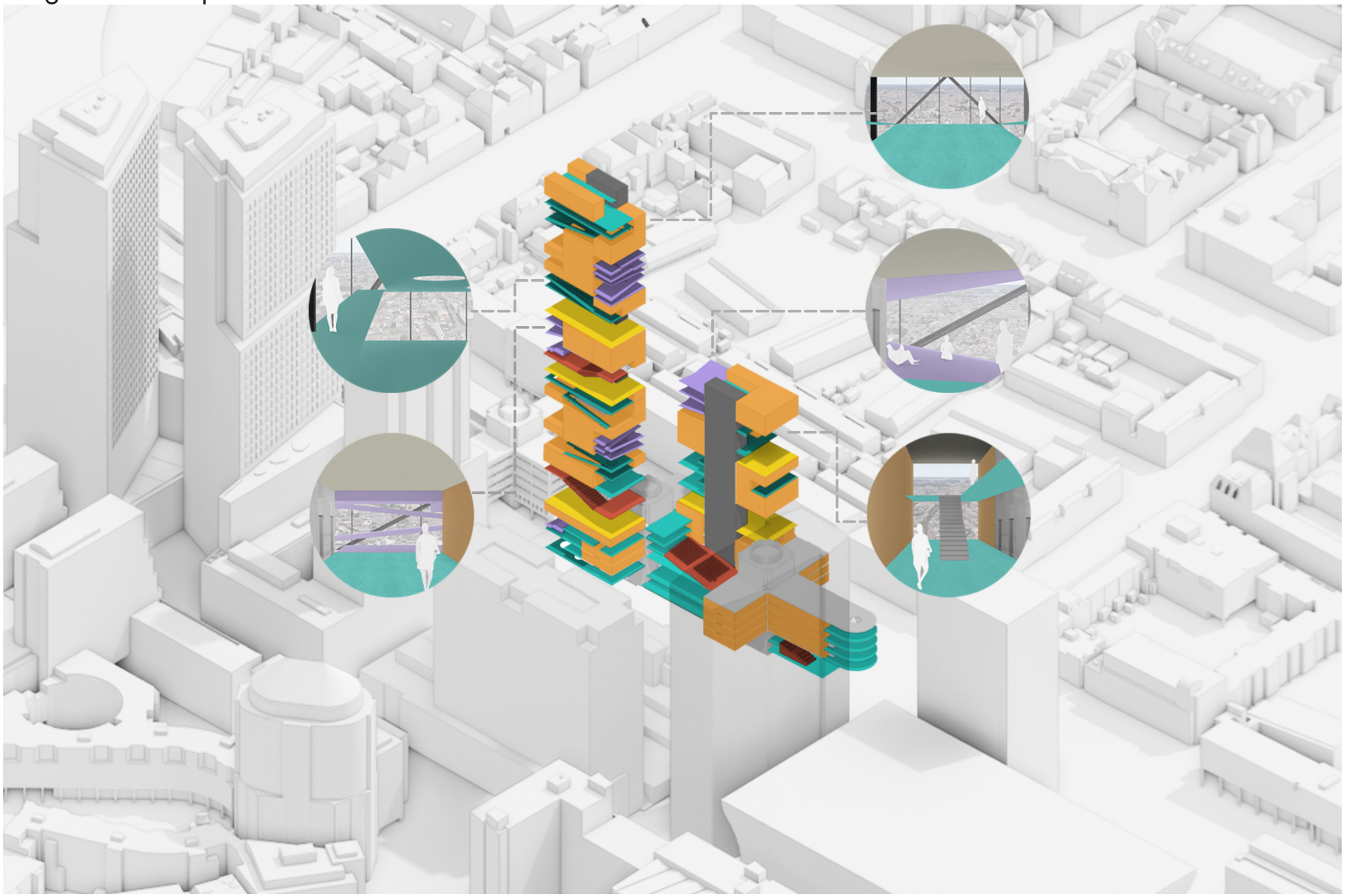


Floor Plan Arrangement Exploration

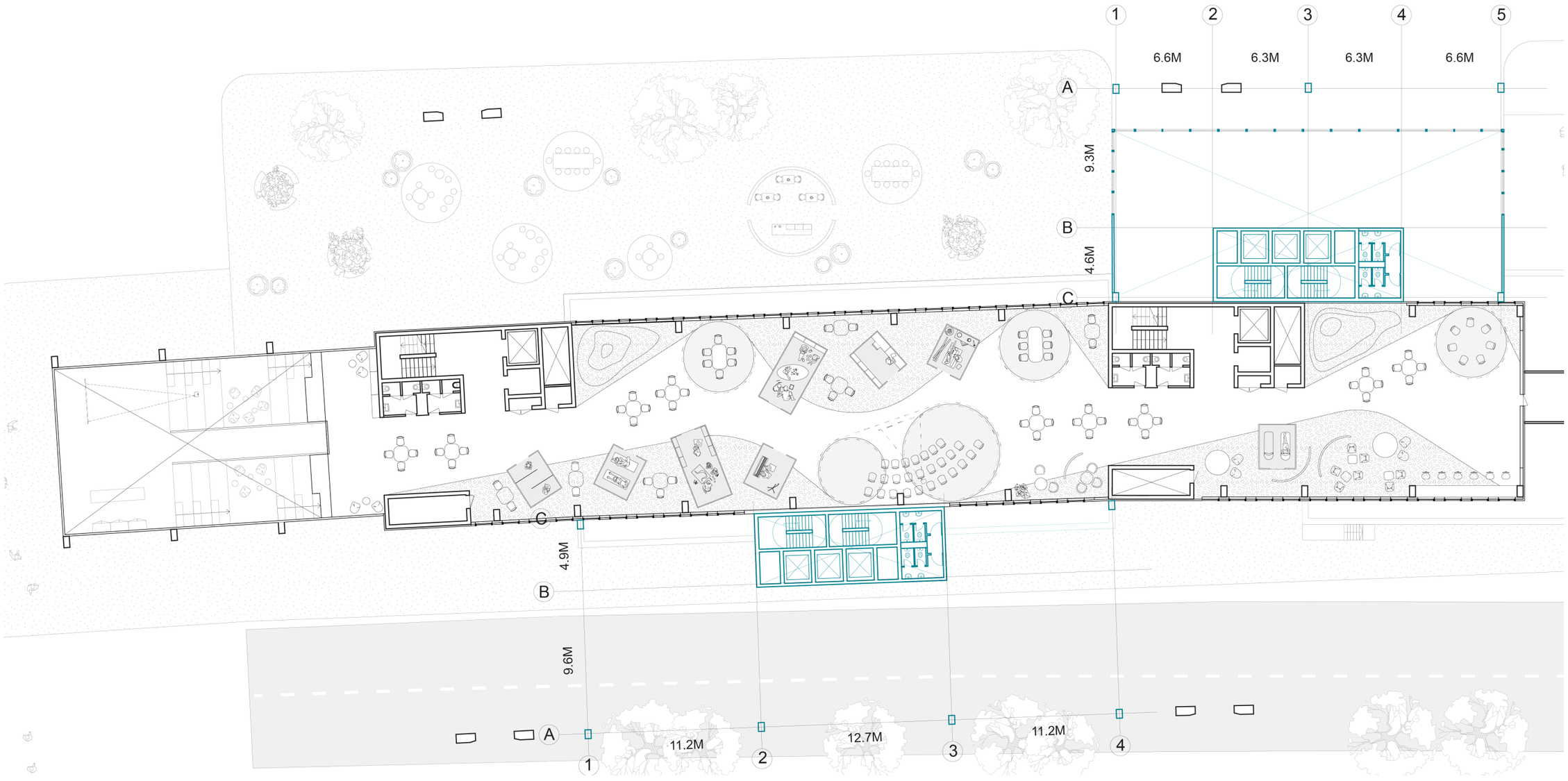


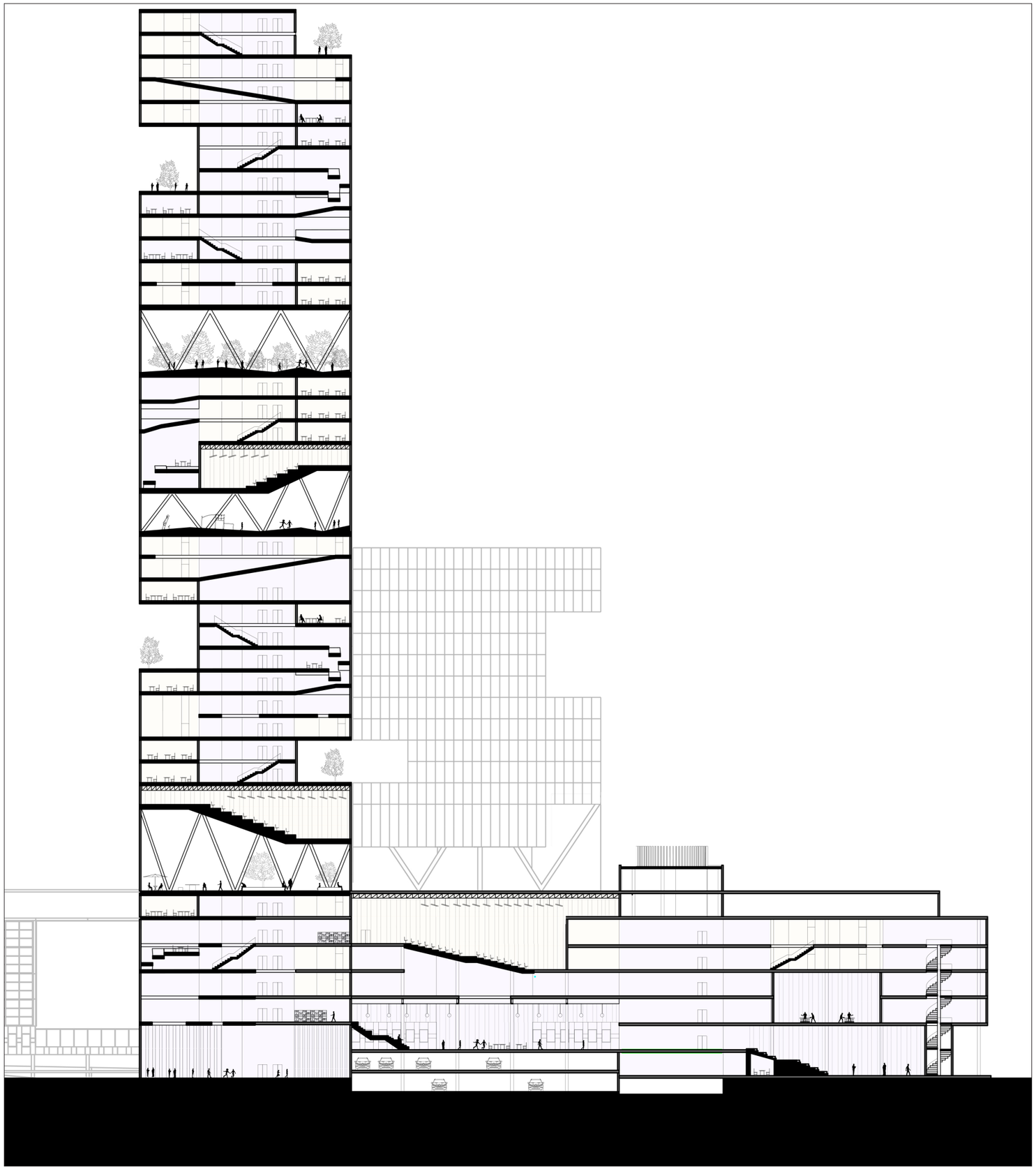


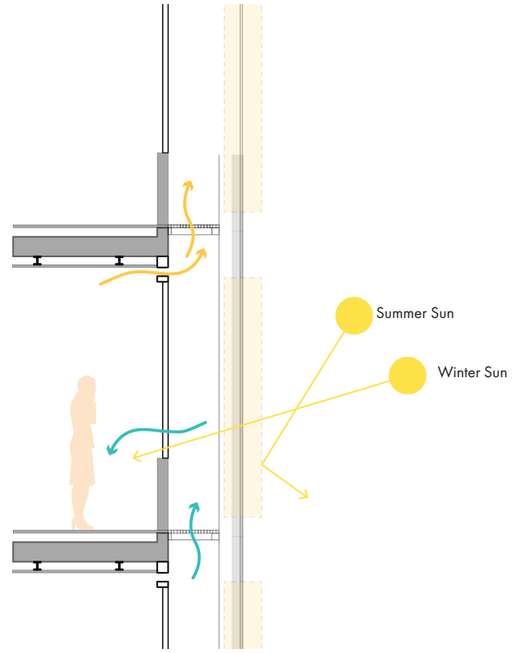
Programs and Spatial Qualities



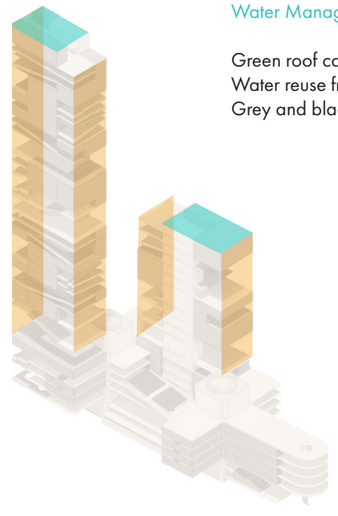
First Floor Plan: The Community Street







Adjustable facade and ventilation corridor



Water Management

Green roof capture and slowing rainwater
Water reuse from irrigation and flushing
Grey and black water reuse system

Facade System and Solar Energy

Large glazing on NW improve beneficial heat gain and daylight
Adjustable solar shading on the SE controls the transmission of heat and light.
Solar panel integrated within SE

Reflection

The CommuVersity serves a dual purpose as both a public space and a campus, blending seamlessly into the urban fabric of The Hague. My graduation design aims to create a vertical campus for the 21st century, serving as a vessel for a learning community to form while extending the city's horizontal public space.

In the development of this design, research and design processes inform each other iteratively. I utilized three primary research methods—literature review, case studies, and observations—to address two key aspects of this project: the enhancement of public space and the optimization of the campus environment to facilitate effective learning.

In the publicness aspect, I conducted analysis of the interplay between the selected site and the urban landscape through literature study and observation. This analysis encompassed factors such as traffic flow, nearby public spaces, and surrounding building structures to determine how my design could enhance city identity and accessibility. The insights gained from this analysis informed decisions regarding the entrance, orientation, and programming of the design. Moreover, I conducted background research on Terminal Zuid, the adjacent building, utilizing Dutch archives. This aimed for me to have a better understanding of the building's historical usage and significance, informing the decision to repurpose and refine it rather than demolish it.

The Hague, as the city which has highest density of population in the Netherlands and limited ground-level space, necessitates a shift towards vertical urban living. This necessitates reimagining public space in a vertical context. The CommuVersity thus acts as an extension of the city's horizontal public spaces, offering a solution to the challenge of space scarcity. To justify vertical public space, I identified key attributes of horizontal public spaces, particularly spaces conducive to social interactions, and integrated them into the design. Within the CommuVersity, three major public spaces—the Botanic Garden, Playground, and Plaza—are strategically placed throughout the building. These spaces are interconnected by internal local public spaces on each floor, creating a vertical network that facilitates social interaction and community engagement.

Aside from the public aspect, research shows the growing awareness and necessity of lifelong learning. Consequently, it has become evident that 21st-century campuses must accommodate the demand for spaces conducive to lifelong learning. This realization leads to another crucial question: How can we design a campus that enhances the learning experience? To address this inquiry, I conduct research through literature review.

Campus design is closely linked with environmental psychology, where spatial configuration and color play crucial roles in facilitating the learning process. To accommodate future learning activities, buildings should feature a flexible system that can adapt and create various spatial configurations as needed over time. With this principle in mind, CommuVersity adopts a structure similar to a modular shelf system. The primary structural system acts as a frame, allowing for the removal of floorplates to create different spatial configurations tailored to specific learning activities. Another important finding from my research is the significant role that social interaction plays in the learning process. In alignment with the secondary objective of creating a public space, I have decided to modify the circulation throughout the building to enhance opportunities for people to

encounter one another. Coupled with ample informal study spaces, this design approach fosters an environment where social interactions can occur organically.
Extensive research has been undertaken regarding color, in conjunction with spatial configuration and materiality, to create diverse spaces that cater to various learning habits and activities.

Questions from Graduation Plan

1. What is the relation between your graduation project topic, your master track (A, U, BT, LA,MBE), and your master programme (MSc AUBS)?

The studio topic, "The Vertical Campus: A Public Hub of the Future in The Hague," sets the stage for my graduation project, allowing for an in-depth exploration of the campus as a learning community. Both public space and campus design are of paramount importance in the realm of architecture. The courses I've undertaken during my master's program have prepared me for the graduation studio, and completing this design will deepen my understanding of public building dynamics, enhancing my sensitivity as a future architect. The CommuVersity serves a dual purpose as both a public space and a campus, seamlessly integrating into The Hague's urban fabric. My graduation design aims to create a vertical campus for the 21st century, serving as a vessel for a learning community to form

2. How did your research influence your design/recommendations and how did the design/recommendations influence your research?

In the development of this design, research and design processes inform each other iteratively.
From research, I get better understanding of what spaces need to be designed and how can I design the space to achieve specific goal, research provide the theoretical and scientific backup for my design decision. in my project CommuVersity, Research highlights

the increasing recognition of lifelong learning as a necessity. Consequently, it's clear that 21st-century campuses must adapt to meet this demand. This raises the pivotal question: How can we design campuses to enhance the learning experience? Addressing this inquiry, my research delves into environmental psychology, emphasizing the roles of spatial configuration and color in facilitating learning. The design of future learning spaces should prioritize flexibility, allowing for the creation of diverse spatial configurations over time. In line with this principle, CommuVersity adopts a modular shelf-like structure, enabling the adaptation of spaces to suit specific learning activities. Additionally, my research underscores the importance of social interaction in learning. To promote this, I've reconfigured circulation within the building to encourage encounters between individuals. Together with ample informal study spaces, this fosters an environment conducive to organic social interactions. Extensive research has also been conducted on color, alongside spatial configuration and materiality, to create versatile spaces tailored to different learning styles and activities.
In addressing the public aspect, I analyzed the interaction between the chosen site and the urban landscape through literature review and observation. This assessment considered factors such as traffic flow, nearby public spaces, and surrounding buildings to enhance city identity and accessibility. Insights from this analysis guided decisions on entrance, orientation, and programming. Additionally, background research on Terminal Zuid was conducted using Dutch archives to better understand its historical significance. This informed the decision to repurpose rather than demolish it

3. How do you assess the value of your way of working (your approach, your used methods, used methodology)?

I utilized three primary research methods—literature review, case studies, and observations—to address two key aspects of this project: the enhancement of public space and the optimization of the campus environment to facilitate effective learning.
I assess the value of my approach, methods, and methodology as effective in addressing the project's objectives. By integrating a combination of literature review, case studies, and observations, I was able to develop a comprehensive understanding of the subject matter and apply this knowledge to the design process in public aspect and campus aspect. The research result will inform my design and help to make design decisions.

4. What is the relevance of your graduation work in the larger social, professional and scientific framework.

This graduation project seeks to address identified design challenges and propose an innovative approach to vertical campus design. Utilizing the research-informed design method, the outcomes of the research will establish theoretical foundations, forming the basis for shaping in my graduation project. This process allows for a comprehensive exploration and critical reflection on the concept of the 21st-century campus, contributing to the future realm of campus design. The collaborative synergy between research and design is focused on developing a campus typology that prioritizes the learning experience while integrating social values. The ultimate goal is to create a holistic environment that transcends traditional educational paradigms within the urban fabric.
From an academic standpoint, the CommuVersity project holds value due to its innovative approach to addressing the challenges of urban density and the need for adaptable learning environments. Moreover, the societal implications of the project are considerable, as it offers a tangible response to the growing demand for lifelong learning spaces within densely populated urban areas. Ethically, the project prioritizes sustainability from the perspective of reuse instead of demolish.

5. Why and how should horizontal public space be reoriented in a vertical direction in your design?

Given The Hague's high population density and limited ground-level space, there's a growing need for vertical urban living. The CommuVersity serves as an extension of the city's horizontal public spaces, addressing the challenge of space scarcity. To justify

vertical public space, I identified key attributes of horizontal public spaces, emphasizing social interaction, and integrated them into the design. The CommuVersity features three major public spaces—the Botanic Garden, Playground, and Plaza—strategically placed throughout the building and connected by internal public spaces on each floor, fostering social interaction and community engagement.

6. How does your project help to form a community of learning?

For a community, there are two aspects: tangible and intangible. The intangible aspect pertains to the spirit of community, characterized by shared values, a sense of belonging, and a collective identity. In the context of a learning community, individuals share the common value of learning.

The tangible aspect refers to the physical spaces that allows the intangible spirt to happen and enhance and assist on the goal of this community, in this case, is to help people learn better. Informed by research in environmental psychology and campus design, CommuVersity creates spaces that facilitate social interaction, thereby aiding learning. Public spaces with diverse atmospheres foster diverse preferences, allowing individuals to choose learning environments that suit their preferences and learning tasks. CommuVersity also offers programs for multi-generational learning, promoting lifelong

learning. All these elements collectively provide the foundation and conditions necessary for a learning community to flourish.

Research on Color and Material in learning Space

Essential part of my vertical campus project is the prevalence of the flexible free-usage public spaces, where students, professors, staff or any other visitor can find the most optimal setting for their particular mood and activity. Therefore, it is important to create a set of rules that would help to cover possible human states of mind. While it is impossible to fit everyone's tastes, some universal behavioristic patterns could be extracted from the literature, providing the guideline for spatial characteristics, colors choices and visual arrangements. In this catalog I will try to illustrate a few examples of these "science-driven" designs and show the general logic of public space classification.

Within the framework of my project I specify 4 principal features that help to make a decision about the conceptual purpose of public space, calling them 4W-rule:

WhoIs? ---> Cooperative or Individual?
WhatFor? ---> Creative or Focused?
WhichWay? ---> Static or Dynamic?
WhySo? ---> Intellectual or Emotional?

Being quite self-explanatory, those simple questions define the core task that should be addressed by the environment. Should it help to reach out your nearest one or help to establish an inner dialogue? Should it broaden or confine your attention lens? Incentivize leaving a chair or distract from being stuck in a chair? And, finally, are we seeking for Truth or for Happiness?

This is, obviously, not an exhaustive level of purpose division, however, I believe that it captures quite well the major pattern of educational and social activities. In the following sections I will discuss how modern understanding of color- and space-related psychology aligns with this proposed approach.

It is important to note that the recent progress in technologies, such as VR, compact EEG or prompt image generation, enriched available tools for both studying and analyzing the human perception of space, accelerating the field expansion. Therefore, with a higher quantification and reproducibility we can rely more on the external research not only as a support for the common sense assumptions but also as the provider of the unique insights. With this knowledge, let's deconvolute the logic of choosing the public space parameters for two specific and polar examples: Individual-Focused-Static-Intellectual and Cooperative-Creative-Dynamic-Emotional. Ideal representations of those functions would be a "quiet spot" in a library for student's work and a communal space for the organized exhibitions.

Initially, let's refer to the static vs. dynamic tasks. In a situation when a person has to face a tedious (or even boring) task requiring high concentration it is necessary to "lose the track of time". Recent study has shown that people have statistically notable distortion of time perception regarding different colors, tending to overestimate the duration of blue light

exposure [1]. This means that with a high chance a person doing a non-arousing task in a blue room would subjectively feel that he has spent more time there, which would be a negative reinforcement. In contrast, a false sense of longer exposure can be more likely a positive stimuli for the art perception. Alignment also sustains for the creative vs. focused, as study [2], based on the depersonalized experiment, suggests that the prevalence of red colors better activates the detail-oriented cognitive abilities while blue hue promotes creative task solving.

Emotional vs. intellectual refers to the guiding mechanism and the final purpose of use. Aesthetic enhancement of exhibition properties can be achieved by purposefully raising the ceiling height and giving it an open composition, which was studied by [3] using highly reproducible variations of the same room in VR. At the same time, the goal of the studying process is the opposite: it is to eliminate distraction and spectrum of the potential perceptions. Visual arrangement can achieve that by creating subtle guiding patterns towards the confined configuration of the workspace. In [4] it was noted that the combination of the color and oriented shape is perceived more strongly rather than isolated examples of both while [5] illustrated the power of color gradient applications showing that the directed change of shade can distort the sense of physical parameters such as e.g. weight. Therefore, it can be used to create the visual “rails” helping to fixate the attention span in a certain area of the studying cell.

Talking of which we come to the individual vs. cooperative aspect and, less obviously, to the use of varying materials and their shapes. The key to the successful individual studying space is a quick establishment of a comfortable microcosm, isolated bubble, where a person can sustain an uninterrupted focus on his inner thoughts for a few hours. Studying space adapts to the user, not the subject he studies. Oppositely, exhibition space adapts to the subject it shows, sustaining the dynamic of the content consumption for the user. How does this translate to the materials and shapes? First, acoustically. If quiet libraries with thick carpets do not need additional comments, for the exhibitions the primarily use of resonating materials such as a marble floor creates halls full of whispers and echoes, resulting in a subconscious sense of a vast space to explore. Second, via spatial complexity and visual depth. Libraries usually have permanent and simple global configuration (e.g. equidistant rows of cubicles or shelfs) without a distinct direction vector. The space is semi-transparent, open in general but isolated in cells, where the configuration can be complex and flexible, to ensure the best adaptation to the user. Warm wooden tables of curved shape, free arrangement of writing boards in subspaces, rotating chairs, etc. Exhibitions, on the other hand, are organized with a certain narrative, and the user is expected to follow the specific path prescribed by the authors. With globally complex and non-transparent configurations, made of installable pseudo-walls, the spots of user interaction with the subjects are usually simple and strictly regulated via glass or other type borders. Those narratives, however, are temporal and vary from time to time, so the permanent type of the area is robust and modular, with a dominance of metal and operational constructions. Support for these considerations can be found in [6-8].

With the decision-making logic being described above, in this section I provide the compressed representation of main features for other potential uses of public space.

Individual-Creative-Static-Intellectual
examples: a spot in a library to think of the problem solving
core task: helping person to see the task from different angles and establish a conversation with himself
color: wide palette
materials: writable surfaces
ceiling: usual
shapes: linear but flexible
Ref. [9]

Individual-Creative-Static-Emotional
examples: a spot in a campus to get some inspiration
core task: giving moral support, appeal to high values and sense of belonging
color: high-contrast bright combinations
materials: poster sheets, monumental elements
ceiling: high
shapes: straight and directed
Ref. [9]

Individual-Creative-Dynamic-Intellectual
examples: digital learning facilities and workshops
core task: provide an access to different solutions, show that different methods can be used for applied tasks
color: black/white and light blue
materials: plastics
ceiling: usual
shapes: minimalist and industrial
Ref. [9]

Individual-Creative-Dynamic-Emotional
examples: office chill spots
core task: helping person to refresh a view, remove the accumulated tiredness
color: soft yellow and orange
materials: wood and ceramics
ceiling: usual
shapes: curved and localized
Ref. [9]

Individual-Focused-Static-Intellectual
examples: a spot in a library to practice or drill

core task: distribute the workload from the attention, channel it to the subject
color: soft red gradient
materials: carpet, light wood
ceiling: usual
shapes: curved and wrapping
Ref. [9]

Individual-Focused-Static-Emotional
examples: canteen
core task: make the best environment for efficient resource restoration
color: soft red gradient
materials: carpet, light wood
ceiling: high
shapes: curved and wrapping
Ref. [9]

Individual-Focused-Dynamic-Intellectual
examples: lab
core task: sustain the integrity and precision, channeling attention as well
color: metallic white
materials: metal and ceramic
ceiling: usual
shapes: curved and wrapping
Ref. [9]

Individual-Focused-Dynamic-Emotional
examples: classic gym
core task:
color: metallic black
materials: carpet, metal
ceiling: high
shapes: industrial
Ref. [9]

Cooperative-Creative-Static-Intellectual
examples: a spot in a library to discuss
core task: help all members of the group to establish communication
color: soft red gradient
materials: carpet, light wood
ceiling: usual
shapes: curved and wrapping
Ref. [9]

Cooperative-Creative-Static-Emotional
examples: watching media or smth
core task: methods of expression
color: soft red gradient
materials: carpet, light wood
ceiling: usual
shapes: curved and wrapping
Ref. [9]

Cooperative-Creative-Dynamic-Intellectual
examples: conference space
core task: efficient subgrouping and remixing
color: soft red gradient
materials: carpet, light wood
ceiling: usual
shapes: curved and wrapping
Ref. [9]

Cooperative-Creative-Dynamic-Emotional
examples: exhibition
core task: flexibility in reorganization
color: soft red gradient
materials: carpet, light wood
ceiling: usual
shapes: curved and wrapping
Ref. [9]

Cooperative-Focused-Static-Intellectual
examples: presentation/defense rooms
core task: hierarchy melting and distance shortening
color: soft red gradient
materials: carpet, light wood
ceiling: usual
shapes: curved and wrapping
Ref. [9]

Cooperative-Focused-Static-Emotional
examples: well being and meditation facilities
core task: provide a comfortable environment for everyone
color: soft red gradient
materials: carpet, light wood
ceiling: usual
shapes: curved and wrapping

Ref. [9]

Cooperative-Focused-Dynamic-Intellectual
examples:
core task: provide a comfortable environment for everyone
color: soft red gradient
materials: carpet, light wood
ceiling: usual
shapes: curved and wrapping
Ref. [9]

Cooperative-Focused-Dynamic-Emotional
examples: group sports
core task: healthy competition and union
color: soft red gradient
materials: carpet, light wood
ceiling: usual
shapes: curved and wrapping
Ref. [9]

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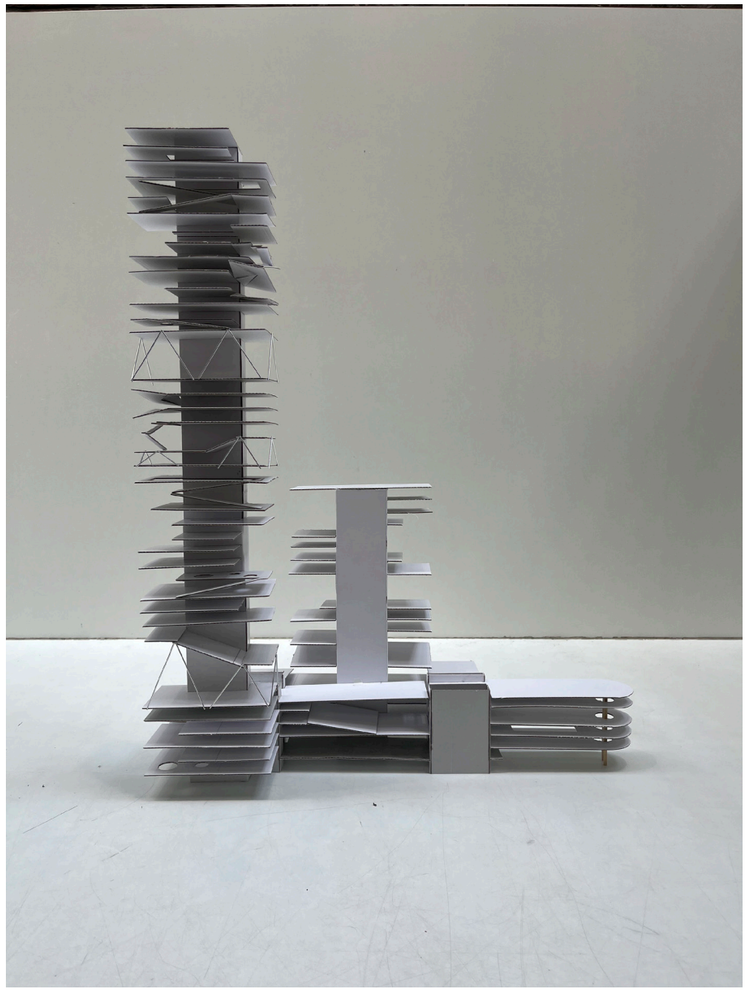
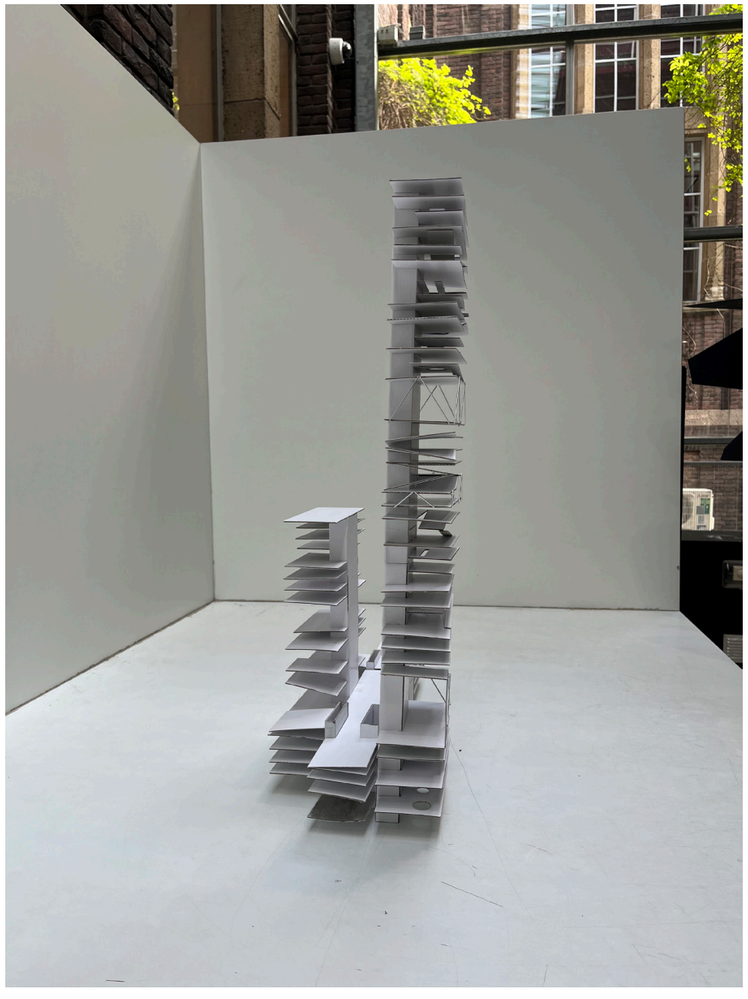
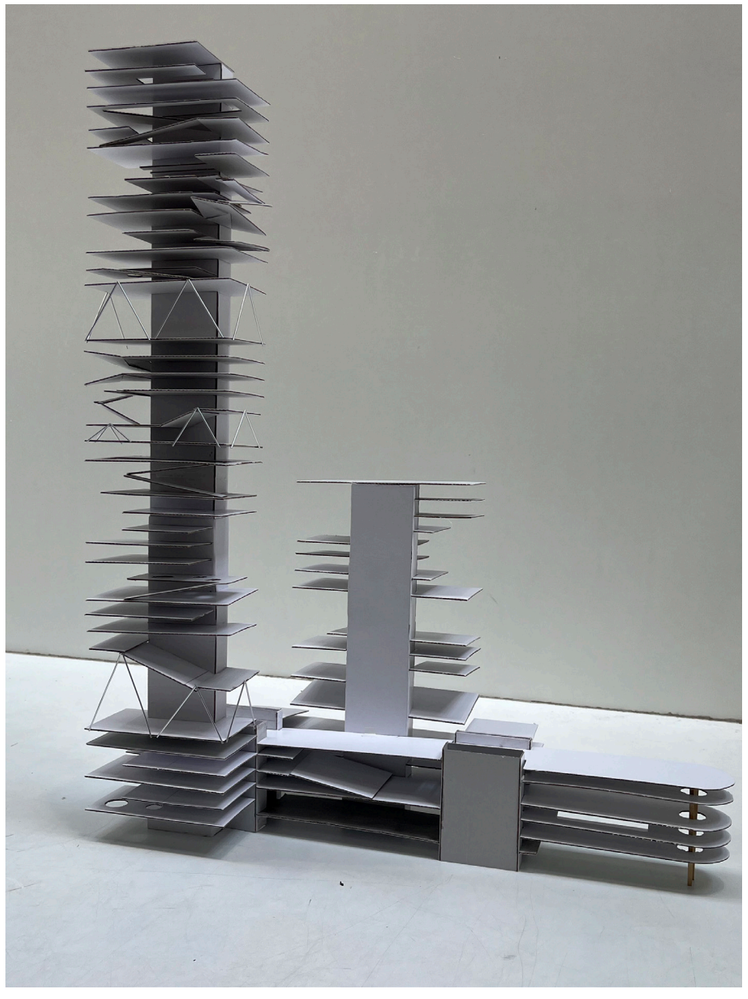
Physical Model Study







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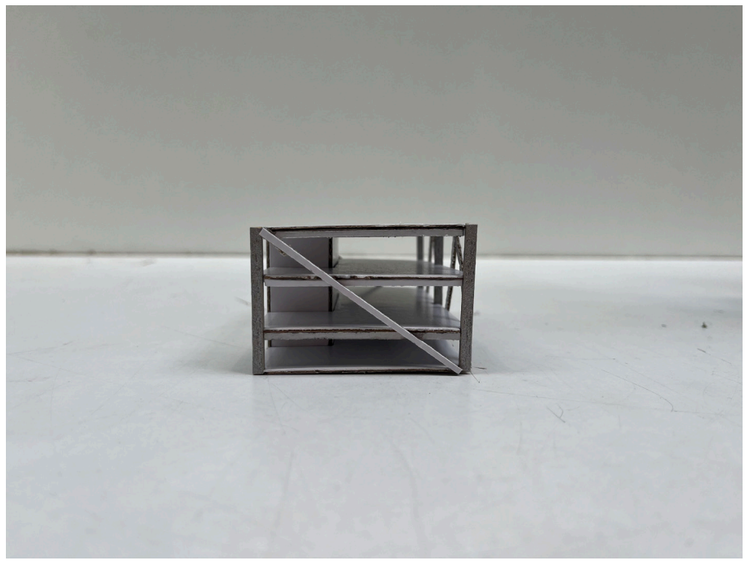

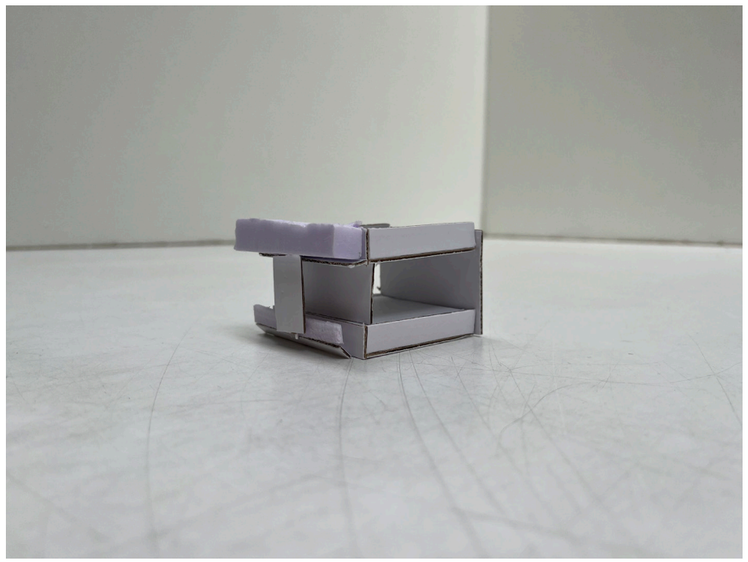

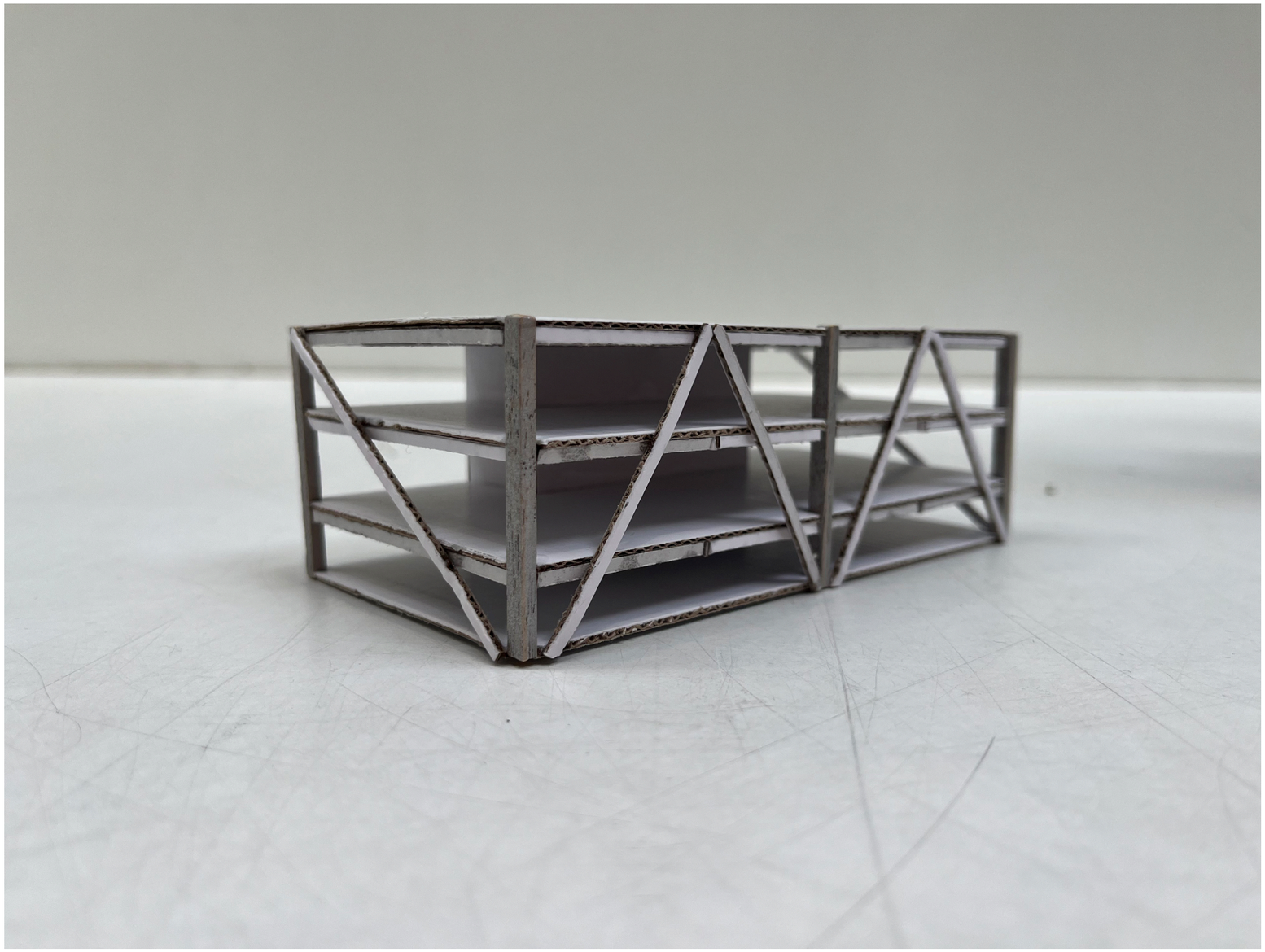

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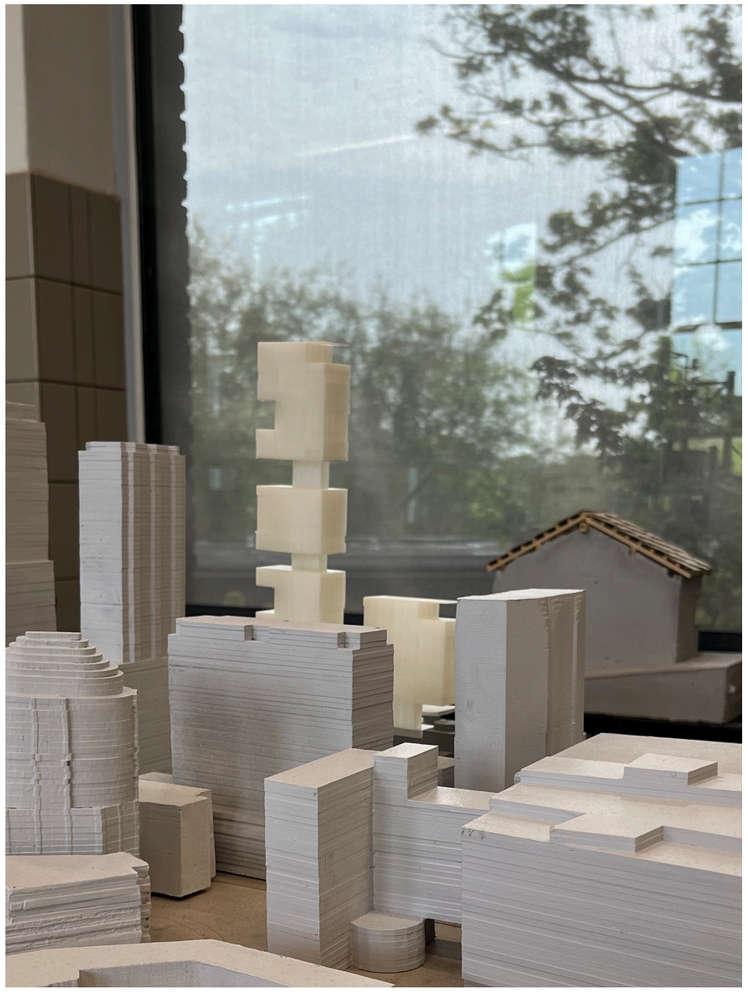

Exploring the Use of Color in Architecture

An Analysis of Luis Barragan and Le Corbusier's Design Approaches and Their Influence on Educational Spaces

ABSTRACT

This paper studies the color application in architecture during the 20th century by Le Corbusier and Luis Barragan through a thorough analysis of case studies such as Cité Frugès, Unité d'Habitation, Casa Gilardi, and the Chapel for the Capuchinas, as well as relevant literature reviews. It then explores how color affects users' perception of a space from a psychological aspect through Goethe's color theory (1810) and the Ecological Valence Theory (2010). Factors that affect how people perceive color are also discussed. Finally, the paper focuses on the application of color in educational settings and discusses the impact of color. This paper aims to analyze and draw inspiration from Le Corbusier and Luis Barragan's color application approaches to apply them in educational spaces and emphasize the importance of color in educational settings.

Keywords: *architecture, color psychology, color in education space*

INTRODUCTION

Color holds an important position in architectural design and often has a great influence on the design decisions made by architects. Le Corbusier believed that color was an essential design element in architecture, not only for aesthetic purposes but also for its ability to modify the spatial perception of architecture [1]. His projects, Cité Frugès(1931) and Unité d'Habitation(1952) demonstrate how he used color to mitigate the starkness of concrete exteriors and create a sense of hierarchy within interior spaces. On the other hand, Luis Barragan used color as a way to create emotional responses and convey cultural meanings through his projects such as Casa Gilardi (1976) and Chapel for the Capuchinas (1952)[2].

The different approaches of these two architects in using color in architecture can inspire and be applied to designing educational spaces. Color can be used in architecture to modify spatial perception and create emotional responses because color affects people psychologically in general. In educational settings, colors are used to guide students' concentration and maintain class collective engagement. The findings from environmental psychology show that choosing the appropriate colors in educational spaces creates a vibrant atmosphere that encourages students to learn and promotes their results [3].

This paper contains three chapters. The first chapter will discuss the use of color in architecture by Le Corbusier and Luis Barragan through case studies and explore how it can be applied in educational spaces. The second chapter will analyze the color schemes chosen by Le Corbusier and Luis Barragan in their projects from a psychological perspective, exploring why those colors were effective in achieving the desired results. Factors like culture and personal experience, which affect how people perceive color, will also be discussed in this chapter. Lastly, as a student with a keen interest in the use of color in educational spaces, I conducted a small-scale photo-based interview with five of my peers in a campus space that I frequently use as a student. The purpose of this experiment was to explore the application of color in educational spaces. Despite its limited scope and methodology, the findings of this interview suggest that educational spaces with a limited number of dominant colors are preferred by students, as they promote increased focus and better academic performance(T.Arends, A.de Souza Mello, N.Gemiei, M.Cheung, E.Kooij, personal communication, March 20, 2023). This chapter also discusses how this interview should be properly conducted in the future.

CHAPTER 1: LE CORBUSIER & LUIS BARRAGAN: ARCHITECTS WHO ARE “GOOD” AT USING COLOR

In the 20th century, Le Corbusier considered color as an important design element in architecture as he believed “Each shade has its relevance and embodies specific spatial and human effects” (para.1) [4]. In his essay, “Architectural Polychromy” (1931), Le Corbusier states that “Man needs colors to live, it is an element as necessary as water and fire” (para.1) [5].

The practical appliance of color theory has successfully illustrated the synergy between spatial and chromatic dimensions in his project Cité Frugès in Pessac (1931). A set of contrasts has been applied on the façade: the clash of dark brown with green or white at the visual edge “amplifies the deployment of surface and causes a suppression of volume” (para.13) [6]. Here, colors were employed by Le Corbusier to mitigate the starkness of the exposed concrete exteriors. In addition, Le Corbusier describes that the use of color can drastically change the spatial perception of architecture [1]. He claims that color did not simply alter how we perceive space in architecture, but created a new, fundamentally rational phenomenon, which he has called polychromy, that introduces to the architectural symphony elements of extreme physiological power.

Figure 1: Cité Frugès, Pessac Photo : Paul kozlowski 1995 © FLC/ADAGP

The Unité d Habitation (1952) is another project in which Le Corbusier incorporated color in his architectural design. This project is commonly seen as an “unprecedented spate of new housing that was urgently required for several decades” in the post-Second World War period (p.40) [7]. Built as a prototype, it is the result of an experimental collective housing solution that contains all the facilities needed for 1,200 people to live in a community. Le Corbusier claimed that color was introduced to the façade as an afterthought to fix structural errors such as the mistake of proportions where the Modular was not in use and problems related to structural frames of the loggias caused by a careless engineer.

Despite the reasons why colors were applied to facades, the color scheme of red, yellow, blue, and green established a strong accent and made the facades more pronounced compared to the bare concrete building skin. The use of yellow can be interpreted as Le Corbusier’s concealed desire to spark happiness in inhabitants, while the use of blue and green was meant to express people’s connection with nature [8]. The contrast of balconies, painted with a wide choice of specters, with the raw concrete of side walls and finished façade, ensures the balance between the stonelike reliability of living-machine and freedom of self-expression for those who use it.

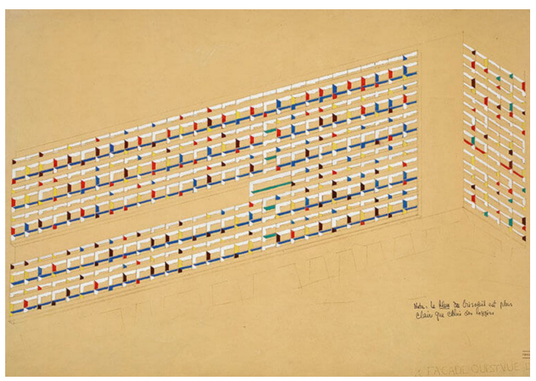

Figure 2: Unité d'Habitation, Marseille, France, 1945 © FLC/ADAGP

In addition to aesthetics, the color on the façade of Unité d Habitation was implemented with a product called “Maitrol” to resist ultraviolet rays. Compared to Cité Frugès, where color was directly applied to the concrete facing, the effect of bouncing off light from the concrete surface is stronger as the color was applied to recesses [7]. Moreover, Le Corbusier employed color as a means to substantially transform the architecture. Color can be used to organize and create a sense of hierarchy in space as he wrote that by using color “You can bring forward a wall (black), push it back (pale blue), and even destroy it (a yellow wall)” (p.94). The decision of applying a color scheme to the apartment interior was made intentionally, and there is a nice interaction between exterior and interior outlook. The arrangement of color from facades was the same order as the color for the apartment doors. Unfortunately, there is no documentation that clearly states the original color within the apartment. Since Unité d Habitation was constructed more than seventy years ago, the interior of apartments has been repainted by the inhabitants. In the book Le Corbusier: The Unité d Habitation in Marseilles, the color scheme within the apartment was documented by comparing two apartments 215 - repainted according to the original color scheme, and 725 – the color scheme within this apartment has been discussed in a written commentary. There are eight colors within the color scheme: black, iron grey, pearl grey, whitewash, pale yellow, red-brown, clear blue, and medium green. What noteworthy is that colors within the apartment were not assigned based on the function of rooms; instead, they are distributed based on how the space is constructed. Stated differently, “planar surfaces delineated by their edges instead of prismatic structures” (p.97). In this way, color has been utilized as a means of modifying space, thus possessing the power to shape and transform people’s perceptions of it.

Generally speaking, Le Corbusier used color as a way to alter architecture. As mentioned previously, he indicated that color can be used to drastically change the spatial perception of architecture [1]. A similar approach can be applied when designing educational space. Color can be used to strengthen spatial hierarchy and create wayfinding cues for students. It can also be used to create a visual difference to improve the limitation within the interior of the built environment. For example, as mentioned in the previous paragraph, black can be used to bring forward a wall while pale color helps to push it back visually. In this way, an educational space can be enlarged or shrunk according to the design principle and program for the space.

Luis Barragan is another architect who is famous for combining color with architectural design. While Le Corbusier’s use of color is primarily technical, using color to visually alter the architecture, Barragan’s approach to color application is more sensational, utilizing colour to help “architecture evoke pure aesthetic emotion” (p.25) [2]. The purpose of using color in his design is not to convey meaning, but simply because he liked it. Colors are added to give dimensions to a space or, in his phrase, to add a “touch of magic” to it.

Figure 3,4,5: Chapel for the Capuchinas View of the freestanding cross and the quilla Source: Armando Salas Portugal

His work shows a significant connection with his predecessors and fits seamlessly into its chronological and geographical context. Many of his projects feature colors such as pink, yellow, purple, and red, which are inspired by the vivid variety of hues found in Mexican culture and the local environment. His core idea was to use multiple shades to create a sense of hierarchy and apply

color to important minor elements such as windows, lattice screens, and balustrades to help express the spirit of the place [9]. In his design, color normally works in combination with natural elements such as light and shadow to convey spatial sensations. For example, the Chapel for the Capuchinas (1952), also known as “a space blessed by light” (p.127) [2], successfully expressed Barragan’s design philosophy of color integrated with natural elements in architecture. Within the chapel, his use of light as a fundamental component of architecture, which was strained, colored, and diffused through yellow stained-glass windows and lattices, falls on a free-standing cross in Mexican pink and extends further into the confession space. With the use of color and light, Barragan achieved an unexpected level of poetry and sophistication in the space.

In Casa Gilardi (1976), Barragan also played with the sense of light together with color, to create illusions and tensions within the mind of an observer. With the combination of light, he induces a sense of serenity, while building perception gradually transforms into a narrated journey from one reflection to another. The pronounced purple wall color in the courtyard next to the jacaranda tree mimics the shade of jacaranda flowers. The tinted window illuminates the white walls with a natural yellow hue, evoking a sense of ascended spirituality along the corridor path that leads to the pool. The artful combination of light, form, and color in the space creates an exquisite composition that frames the blue-colored pool wall [10]. A curious red wall stands in the pool which supports the skylight. According to Barragan, the column in the pool is necessary as he indicated that “the column in the middle of the pool goes against all the rules… but it needed to be there to bring another color into the composition” (p.198) [2]. The scene undergoes a transformation throughout the day as the red wall sinks into the water, echoing the patterns created by the changing angles of sunlight.

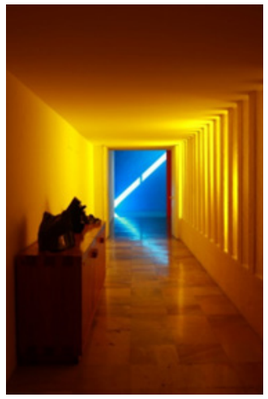

Figure 6:Corridor Space_© Eduardo Luque

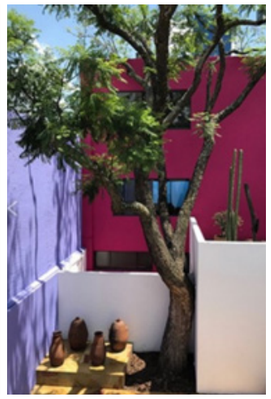

Figure 7: View of the first-floor courtyard and jacaranda tree, as seen from above_© Mark English

Generally speaking, Barragan used color together with natural elements like light to create an emotionally engaging space. By contrasting color, light, and shadow, he imbued spaces with a poetic and sophisticated character and the ability to elicit strong feelings.

Drawing inspiration from Luis Barragan’s use of color theory in his architectural design can be highly beneficial in the design of educational spaces. Following Barragan’s color philosophy, color can be used as a way to create joy and a comfortable atmosphere within an educational space which may help to encourage academic activities. Barragan used color to highlight minor elements within the space to create focal points in his project. Similarly, in the educational setting, color can be used to draw attention to important features such as whiteboards and screens, thus creating focal points that enhance the learning experience.

CHAPTER 2: COLOR AND PSYCOLOGY – HOW DOES COLOR WORKS IN ARCHITECTRAL SPACE

Le Corbusier and Luis Barragan both utilized color in their architectural designs but in different ways. Le Corbusier approached color from a functional standpoint, using it to visually transform constructed spaces. On the other hand, Barragan employed color in conjunction with natural elements to create a poetic atmosphere and emotionally engaging space. Despite their divergent approaches to color, the underlying question remains: why do these colors work? To answer this question, one should explore the fundamental matter of how color affects people psychologically.

The linkage between a visible spectrum and human emotions has been a subject of scientific study for centuries. Isaac Newton’s decomposition of white light and his creation of the color wheel provided a foundation for subsequent research into the psychological impact of different colors on the human mind. This was the first step in the quantitative discovery of spectrum’s impact on humans. Later, in 1810, Johann Wolfgang von Goethe published his theory that color is linked to emotions and moods from a psychological point of view [11]. He argues that colors are a complex subjective experience perceived by people, rather than a simple scientific measurement, and that it is difficult to draw general conclusions about these links. The Ecological Valence Theory (2010), proposed by Stephen E. Palmer and Karen B. Schloss, indicates that color preferences arise from people’s average affective responses to color-associated objects [12]. This theory is supported by an empirical evidence: people‘s preferences for color are strongly associated with things and notions they like (e.g. blues with clear skies and clean water). Conversely, people dislike colors that are associated with concepts they dislike (e.g browns with feces and rotten food). We can see that people tend to like color if they have experienced positive emotions with an object in that color.

With these in mind, let’s take a closer look at the color schemes developed by Le Corbusier and Barragan. Architectural Polychromy is a 43-color palette and a 63-color palette created by Le Corbusier in 1931 and 1956 [13]. In the 43-color collection, he categorized the colors into 12 charts, known as “claviers”. Each clavier is composed of three background colors, referred to as “valeurs de fond” in Le Corbusier’s naming convention, and two horizontal strips of color tones arranged in a keyboard-like sequence. The twelve claviers are Space; Sky; Velvet I and II; Masonry I and II; Sand I and II; Landscape; and Checkered I, II, and III. Each clavier was named after color schemes associated with a concept from nature. For example, “sky” and “space” are associated with blue, “Sand” is associated with yellow, “Masonry” is associated with red, and “Landscape” is associated with green[14]. These colors associated with nature have been successfully implemented into his design. For example in his project Cité Frugès in Pessac, the color green is connected with the concept of a far-off forest or rooftop garden, blue with the background sky, and red is used to “anchor” the façade as a solid masonry and to enhance its visual impact.

We can argue that Le Corbusier drew inspiration from nature to incorporate colors into his designs. As nature is often associated with pleasant feelings, the color schemes he created are also pleasing to people. Therefore, it can be said that to some extent, Le Corbusier’s color choices are derived from nature, making them attractive to people.

However, in reality, the linkage between humans and color is not that simple. The previous explanations regarding the appeal of Le Corbusier’s nature-inspired colour scheme can only be valid if natural elements are universally pleasing. In ither words, if a person does not find nature appealing, the connection between their preferred colors and their desired emotions may not exist. For instance, an individual who dislikes the sky and sea may not find blue as interesting as someone who finds these elements pleasing. Another example, some people consider brown as the color that is associated with unpleasant situations such as decay and rotting processes. In this case, these unpleasant feelings will trigger negative emotions towards this color, like the feeling of heaviness, dullness, or disgust. On the other hand, brown can also be the color that represents earth and

nature. Wood is a natural brown-colored material commonly used in interior spaces to create a cozy and warm atmosphere. Brown can also be associated with coffee and chocolates, which can trigger positive emotions in some people. The linkage between an individual's preferences and emotions is complex. There are no universal solutions to apply for regulating people's impression of a certain color. Thus, when designing education space architects must be aware of the context of the building. It is important to conduct interviews or questionnaires to get users' preferences. It is possible to achieve color harmonization within a space, for example using the color palette from Le Corbusier, however, it is generally hard to control individual preference towards the designed education space with an assigned color scheme.

Culture is another factor that affects how people perceive color. With knowledge being more accessible globally, we can refer to the result from The International Colour-Emotion Association Survey (2020), which shows that participants found it easy to visually refer emotions to certain shades. This varies according to socio-cultural contexts. One color can convey different meanings in a different region. For example, red is associated with joy and prosperity in Chinese culture while Nigerian consider red as a color representing fear. Another example, in Greek, purple is considered a color of sadness whereas purple is recognized as a positive color with no exact emotional association in most countries in the world[15].

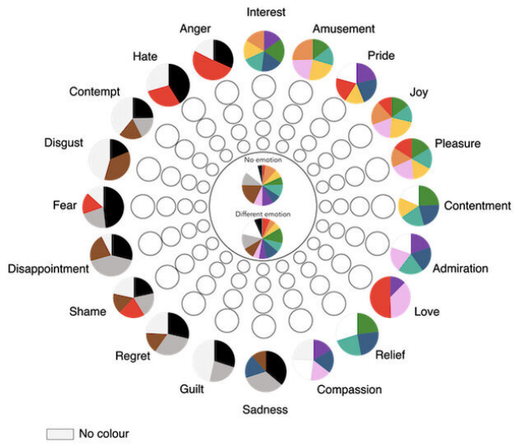

Figure 8: Source: Figure by Alessia Garzilli for Domicele Jonauskaite and Christine Mohr Eduardo

Color term	Cross-cultural similarity 0 = no similarity 1 = identical associations
Red	.89
Orange	.92
Yellow	.85
Green	.90
Blue	.86
Turquoise	.91
Pink	.93
Purple	.66
White	.86
Grey	.91
Brown	.87
Black	.91
All colors together	.88

Figure 9: Source: Domicele Jonauskaite and Christine Mohr

With this knowledge as background, cultural relations can also be one of the reasons why Luis Barragan's color scheme is successful. The color scheme within his design is heavily influenced by Mexican culture. Mexican pink frequently appears in Barragan's work, for example, a large area of this color was applied in Casa Luis Barragan (1948), Gálvez House (1954), and Lover's Fountain (1968). This color is considered an element of national identity and a symbol of Mexican charisma [16]. However, the same color holds different values in another country, for example, Switzerland. Pink is considered a color that helps to tranquilize feelings of anger and perform a calming effect on nerves for a certain period in Switzerland. Thus, pink is used in Switzerland's prison system to confine aggressive inmates to pink jail cells [17]. The color pink, in this case, can be less favorable compares to Mexico in an architectural context, as one is normally associated with a jail cell, and the other represents national charisma. Similarly, the pink color in Luis Barragan's design can be less poetic and popular in a different cultural context. Thus, people's preference for color is also heavily affected by cultural influence. Apply to the educational context, apart from personal preference, color is also embodied with certain meanings. When choosing a color scheme for educational space, architects need to be aware of cultural differences. Thus, to design a successful architectural space, the cultural background needs to be taken into consideration before curated colors for the designated site.

Another aspect that can affect the choice of color scheme is light. Normally, light defines how we perceive color in architectural space, we cannot simply focus on one aspect and ignore the other. Generally speaking, color and light work hand in hand when creating the desired atmosphere in architecture. In Casa Gilardi, apart from colors inspired by local culture and nature, Luis Barragan also placed architectural elements like screened windows intentionally to alter the light within the space. Together with color, light imposes a sense of tranquillity. In the corridor, bright daylight was filtered through yellow opaque glass which tinted and soften the light when shines into the interior space. Without the colored glass and the yellow wall, this space may be less poetic. The pool area of Casa Gilardi is illuminated by natural daylight that enters through the skylight, interacting with the red wall and water to create a dynamic scene with colour changes that evolve throughout the day with the changing angle of the sun. Without light, there would be no color transformation within the space. When designing a color scheme, architects cannot simply consider the color in isolation; it must be evaluated in a particular context, taking into account both natural daylight and artificial light sources.

Although color and emotions relate to individual factors like culture, personal experience, and natural elements, many color-emotion associations are still universal. This is shown in the experiment result below. Thus, some common colors can be suggested for classroom design. Depending on individual visual experience, color can stimulate different emotions and affect people's behavior and mood naturally. Therefore, in the context of education space, color is an important aspect of visual experience that influence students' behavior.

Figure 10: Lecture Hall in SUTD Source: SUTD

Figure 11: Orange Hall in TU Delft

Research from the Qingdao University of Technology concludes that classrooms with warm-colored walls were more effective at improving students' self-rated ability to pay attention whereas cold-colored walls were associated with higher ratings of pleasure and relaxation. [18] My experience of using the education space in TU Delft and Singapore University of Technology and Design (SUTD) for my master's and bachelor's degrees respectively can also verify this conclusion. In SUTD, the wall color of the lecture hall is purple, which makes me feel calm. On the other hand, the dominant orange color in the architecture building in TU Delft makes me more excited but the large area of orange can be interrupting the focus during the lecture.

Generally speaking, is also important to consider the number of colors and the area applied within a space. Colorfulness to create a sensory-enriched environment can be found to distract attention and impair performance [19]. The number of colors and the area where they are applied should be in moderation. Two to three colors are considered optimal for classroom environments to promote effective learning [20]. Research showed that type and difficulty of the task together modulate the effect of color on cognitive performance. For example, red links with danger and mistake, which makes individuals pay more attention to prevent error and falling into danger. Therefore, red as a color should enhance performance on detail-oriented tasks. Blue, however, should induce an

approach motivation as it is a color usually associates with openness and peace. In this case, blue encourages individuals to be creative and exploitative [21]. We can conclude that study spaces with different purposes normally should associate with different dominant colors. Thus, based on the studies mentioned above and my own experience, library or reading space should be dominated by cold colors like green and blue whereas classroom or lecture space requires warm colors like yellow, orange, or red.

When designing a color scheme for educational spaces, architects need to consider various factors, including cultural background, lighting, and psychological aspects. Additionally, it is important to consider the potential physiological reactions that may be induced in the human psyche. In most cases, surface colors are used to create an overall “room experience,” incorporating a variety of design elements. However, simply relying on generalizations such as “red excites” or “blue calms” without understanding the psychological interconnections at play will normally lead to an inability to achieve the desired effect [22]. To effectively design with color in an educational context, it is necessary to consider it within the context of the overall design and not apply generalizations across the board. While some generalities may be effective in certain situations, it is crucial to analyze each case individually to determine their applicability to the specific design.

CHAPTER3: COLOUR IN EDUCATION SPACE ANALYSIS THROUGH INTERVIEW

In the previous chapter, we explored the significance of color in architecture and drew inspiration from the approaches of Le Corbusier and Luis Barragan when designing educational spaces. It is essential to conduct background research when designing an effective educational space, as color preference can be influenced by various factors such as culture, personal experience, and geographic location.

This chapter aims to illustrate how the impact of color on students’ academic performance can be investigated in an educational context. An interview was planned to gather data on the color scheme of two classrooms in TU Delft and investigate the relationship between color in the classroom and students’ performance. However, due to time constraints, the experiment remained incomplete. The interview was designed to demonstrate the approach and its potential for future development.

In this interview, students were only asked to select the classroom they preferred based on two photos. However, the atmosphere of a classroom is influenced by numerous factors such as lighting, building location, noise level, and room size, among others. Additionally, to fully experience these spaces, students should perform academic activities within them. While selecting a preferred classroom from a picture provides some insight into student preferences, the results may be limited to some extent.

In order to obtain more comprehensive data in the future, the two sample classrooms should be in the same condition, with the color scheme being the only variable. The experiment should be conducted within the same room and lighting conditions to control for external factors that may affect the results. To further improve the accuracy of the collected data, VR technology and physiological measurements should be implemented in the experiment. Additionally, to ensure consistency, the same academic activity should be performed in both classrooms. This will provide more accurate data and enable us to draw more meaningful conclusions regarding the impact of color on students’ performance in educational spaces.

Figure 12:Lecture Hall R Source: TU Delft

Figure 13:Instruction Room B2.100 in Applied Sciences Source: TU Delft

For this interview, I selected five participants who are all students from TU Delft. Four of them are master’s students from the Architecture faculty, while the other one is a master’s student from the Applied Science department. I presented the participants with two classroom options shown in Figure 12 and Figure 13. Figure 13 depicts a classroom located in the Applied Sciences building that is dominated by white color, while Figure 12 shows a more colorful classroom located in BK City, with red as the dominant color on the carpet and chairs of three different colors - orange, black, and grey. The participants were asked to choose their preferred classroom, and all of them indicated

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that they prefer the classroom with colors over the white-dominated classroom. One participant commented, “I prefer the red one. I think it gives a more interesting feeling than some plain boring color, this will help me to focus during class” (T.Arends, personal communication, March 20, 2023). Generally speaking, a colorful classroom makes students feel more excited, ultimately improving their study interest and enhancing their performance during class. In contrast, a colorless classroom makes participants feel dull within the space and leads to problems such as a decrease in study motivation and difficulty concentrating during class.

Moreover, most of the participants also indicated that the dominant color within the classroom should not be too intense, and large areas of color should be avoided. One participant commented, “For the classroom, I would prefer less intense colors. I think it is easier to pay attention to a class if you are not analyzing the room itself. I prefer a plain floor and chairs with a single color” (A. de, personal communication, March 20, 2023). Another participant agreed, stating, “Strong and large areas of color within a classroom are more distracting. For me, chairs with colors add personality, making me feel more comfortable, so I prefer colored chairs and a plain floor within the classroom” (E. Kooij, personal communication, March 20, 2023). Based on the result of this interview, we can conclude that students prefer moderate colors applied in the classroom over a colorless educational space. This is because visual stimulation rewires the brain and creates stronger connections while enhancing learning and behaviors, which also verifies theories between color and student performance in chapter two to some extent.

However, it is important to note that the results obtained from this interview may be limited, as the atmosphere of a classroom is influenced by numerous factors, as mentioned earlier. Further experimentation and research are necessary to draw meaningful conclusions regarding the impact of color on students’ performance in educational spaces. Due to the limited time and scope of this interview, the number of participants involved was small. In the future, I aim to conduct a more extensive study on how color affects students’ emotions by implementing the experimental framework mentioned above.

CONCLUSION

Generally, we can draw inspiration from Le Corbusier and Luis Barragan’s approaches to color application and apply them in educational spaces.

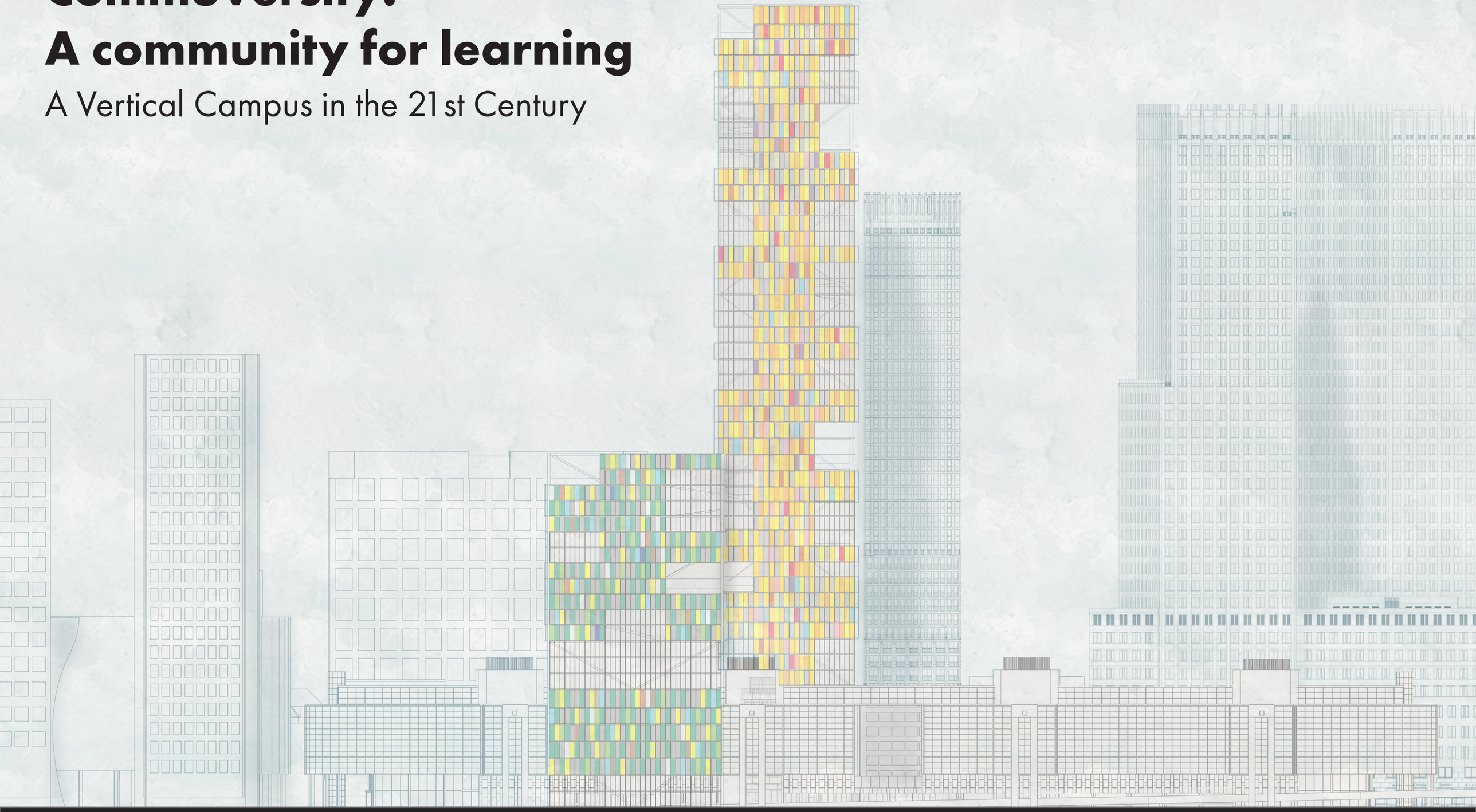
Le Corbusier employed the color to transform the perception of architecture, and a similar approach can be taken in designing educational spaces. Color can be utilized to reinforce spatial hierarchy and provide wayfinding cues for students. Moreover, it can help overcome limitations within the built environment’s interior by creating visual contrasts. For instance, black can accentuate a wall while a pale color can visually push it back. Thus, an educational space can be expanded or contracted as per the design principles and the program’s needs.

Applying Luis Barragan’s color theory to educational space design can be highly advantageous. By following his color philosophy, color can be utilized to create a comfortable and joyful atmosphere that promotes academic activities. In his projects, Barragan used color to accentuate minor elements and create focal points. Similarly, in educational settings, color can be utilized to draw attention to important features like whiteboards and screens.

However, due to the influence of factors like culture and personal experience on how people perceive color, there is no universal color palette that can be applied to all educational settings. Therefore, the color scheme in educational spaces should take into consideration various factors, including cultural background, lighting, and psychological impact. It is crucial to understand the potential physiological reactions that may be induced in the human psyche when considering color in architectural design. To effectively design with color in educational settings, it is necessary to consider it within the context of the overall design, rather than applying generalizations across the board. Although some generalities may be useful in certain situations, analyzing each case individually is critical to determine their applicability to the specific design in question.

CommuVersity:
A community for learning

A Vertical Campus in the 21st Century



Jing Han 5768764

Learning in Modern Society

Develop a Life Long Learning Scheme in The Netherlands

keep learning

Agree

Uncertain

Disagree

Learning is exaggerated

Agree

Uncertain

Disagree

Learn to keep up with changes

Agree

Uncertain

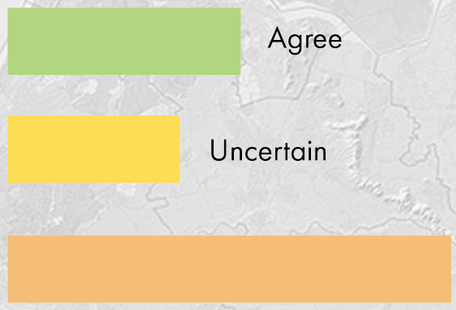
Disagree

Learning in Modern Society

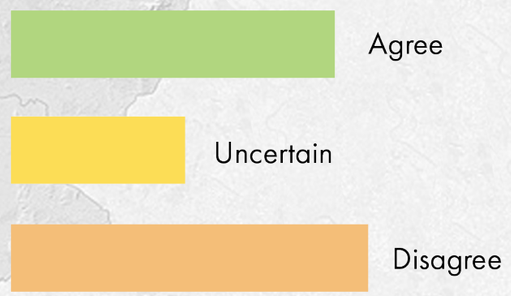
Physical Learning Space & Flexible Learning

Course in a group with teacher

Online Learning



Self-directed study with a computer



Learning in Modern Society

Enhancing Learning Through Social Interaction

For Children & Teenager

"Social interaction is crucial for optimal cognitive and brain development"

For Adult & Elderly

"Social interaction is a booster in adult human learning"

De Felice S, Hamilton AFC, Ponari M, Vigliocco G. Learning from others is good, with others is better: the role of social interaction in human acquisition of new knowledge. Philos Trans R Soc Lond B Biol Sci. 2023 Feb 13;378(1870):20210357. doi: 10.1098/rstb.2021.0357. Epub 2022 Dec 26. PMID: 36571126; PMCID: PMC9791495.

Vertical Campus in the 21st Century

A Learning Community that for Better Learning

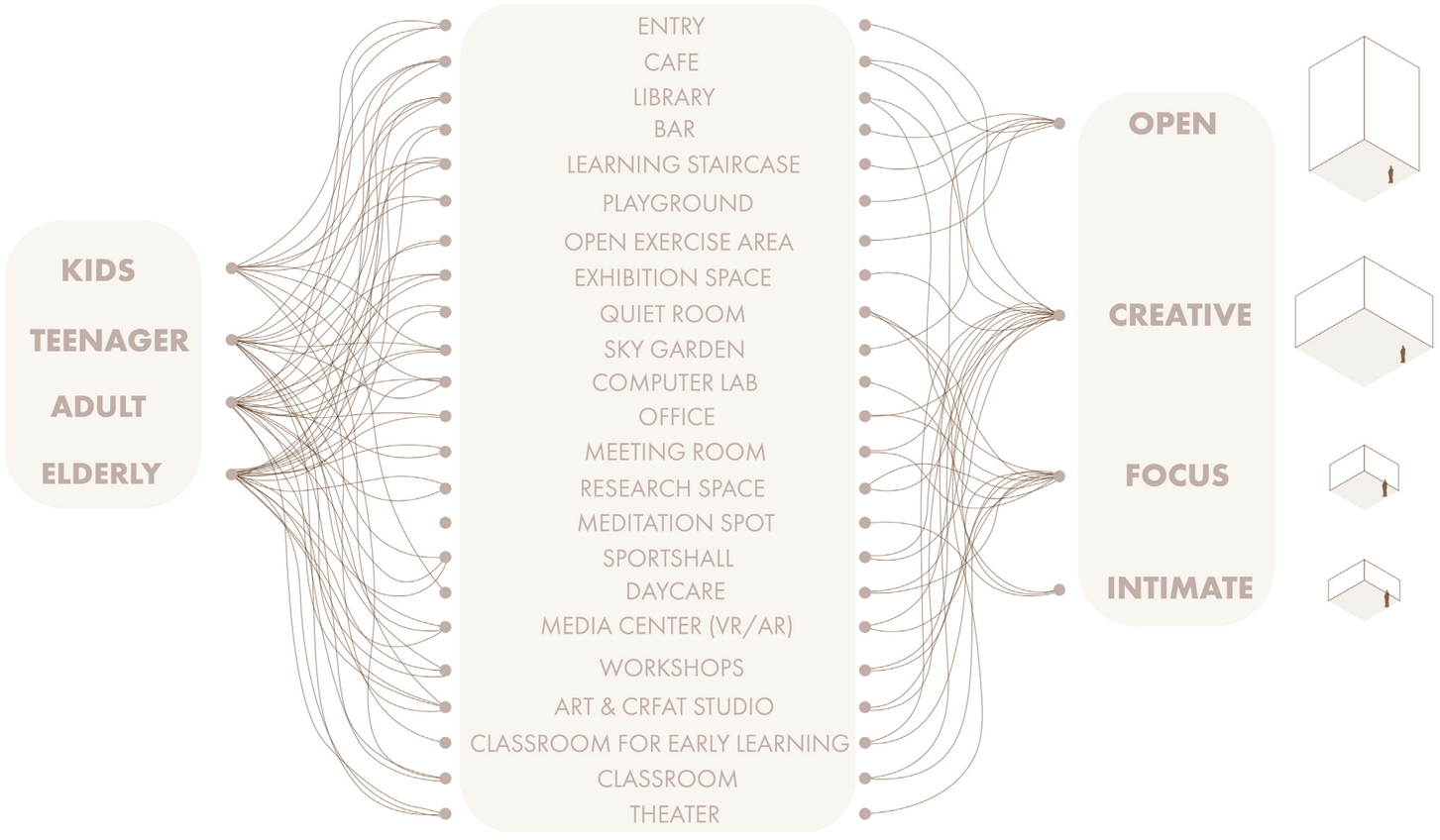
Programs & Configuration

Sort by hierarchy, threshold, and multi-generation learning

Clusters

Separate

Blend in



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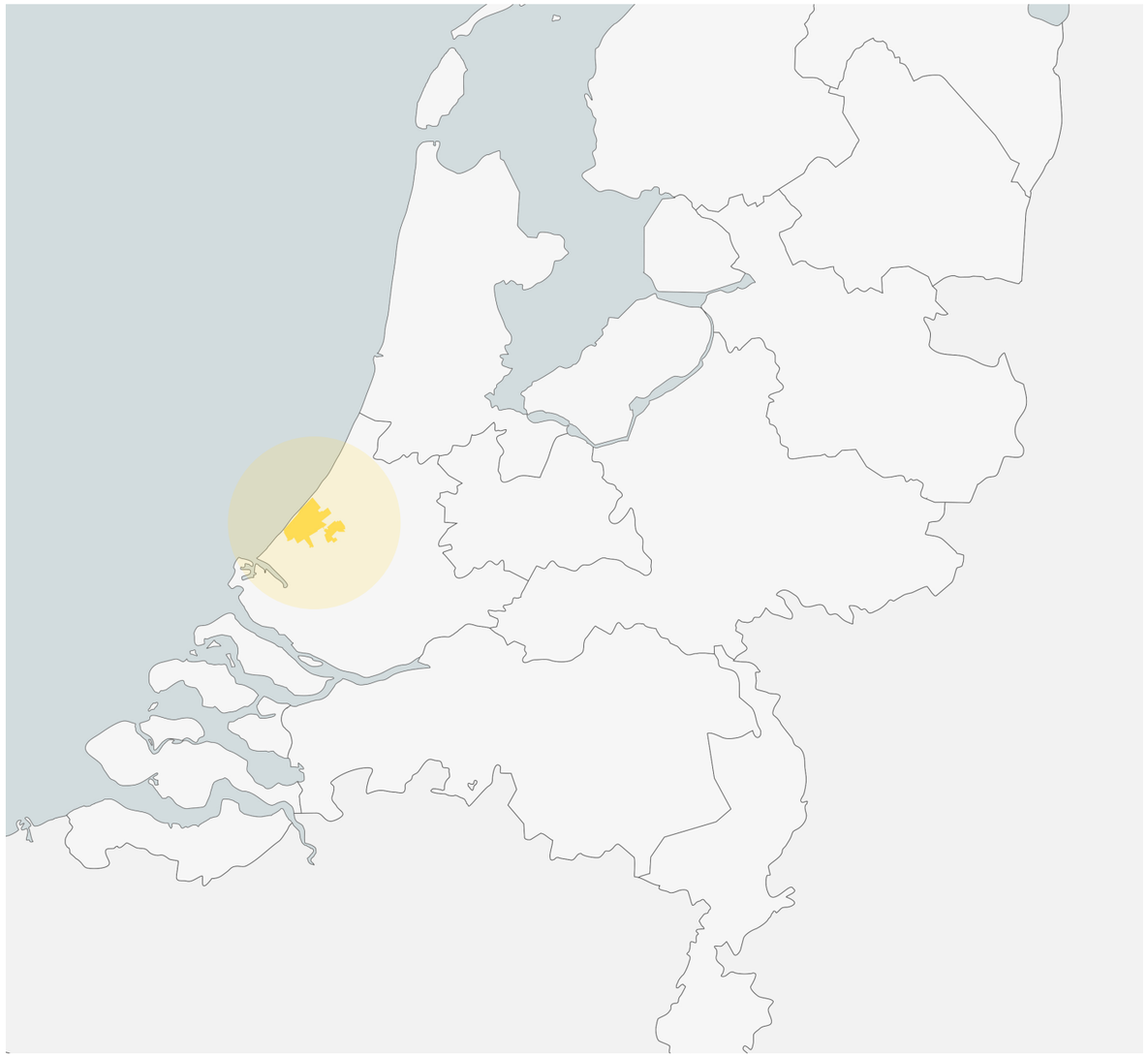
The Hague, Netherlands



Site Information

Central area in The Hague

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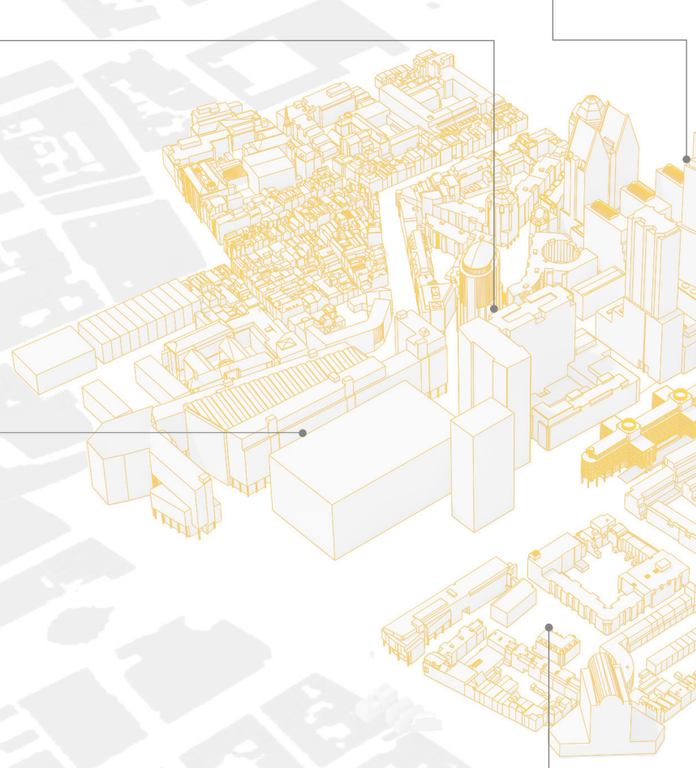
Surrounding buildings

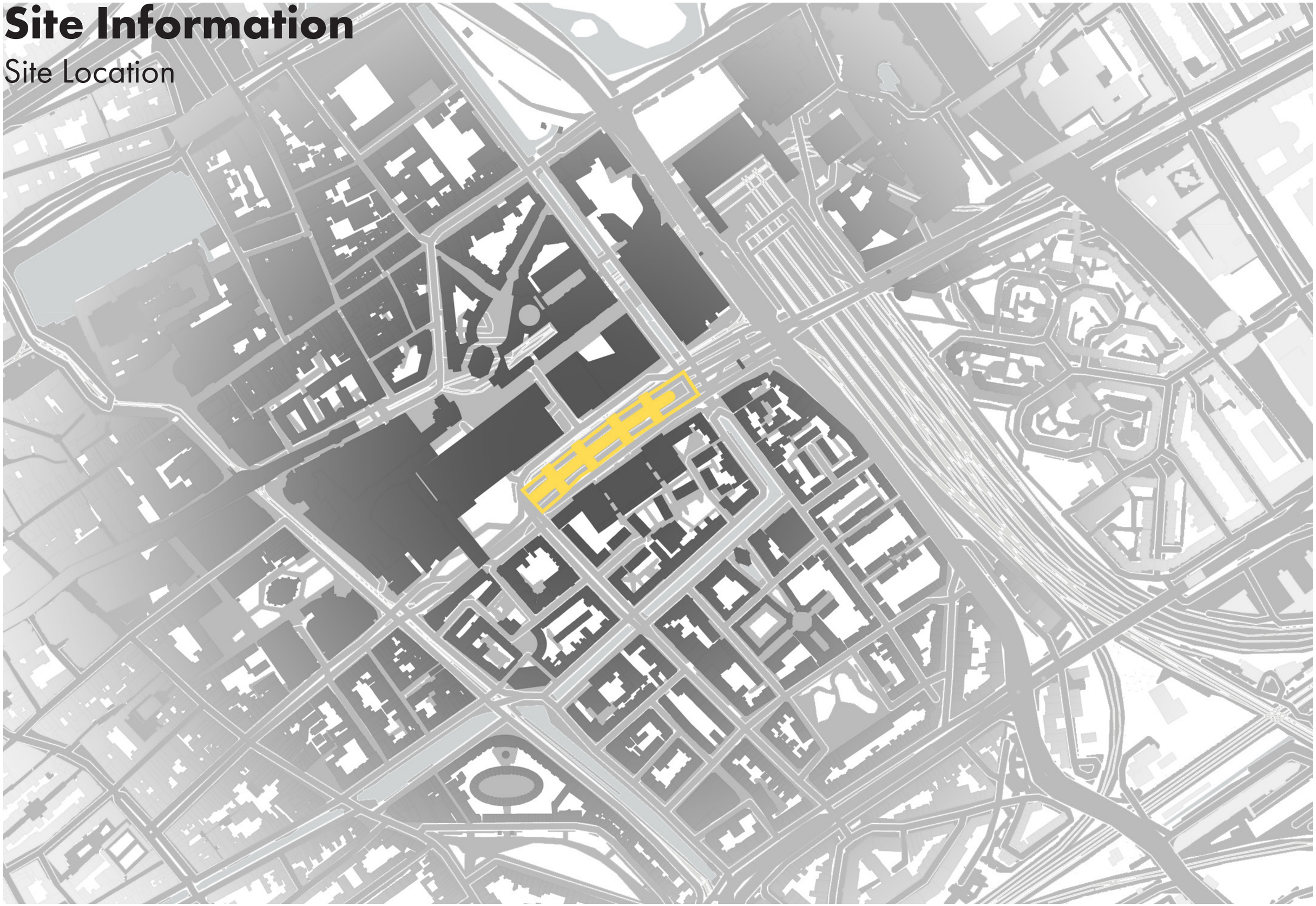


Capacity Plan

Envision a Green and Accessible Future

Site Information

Site Location



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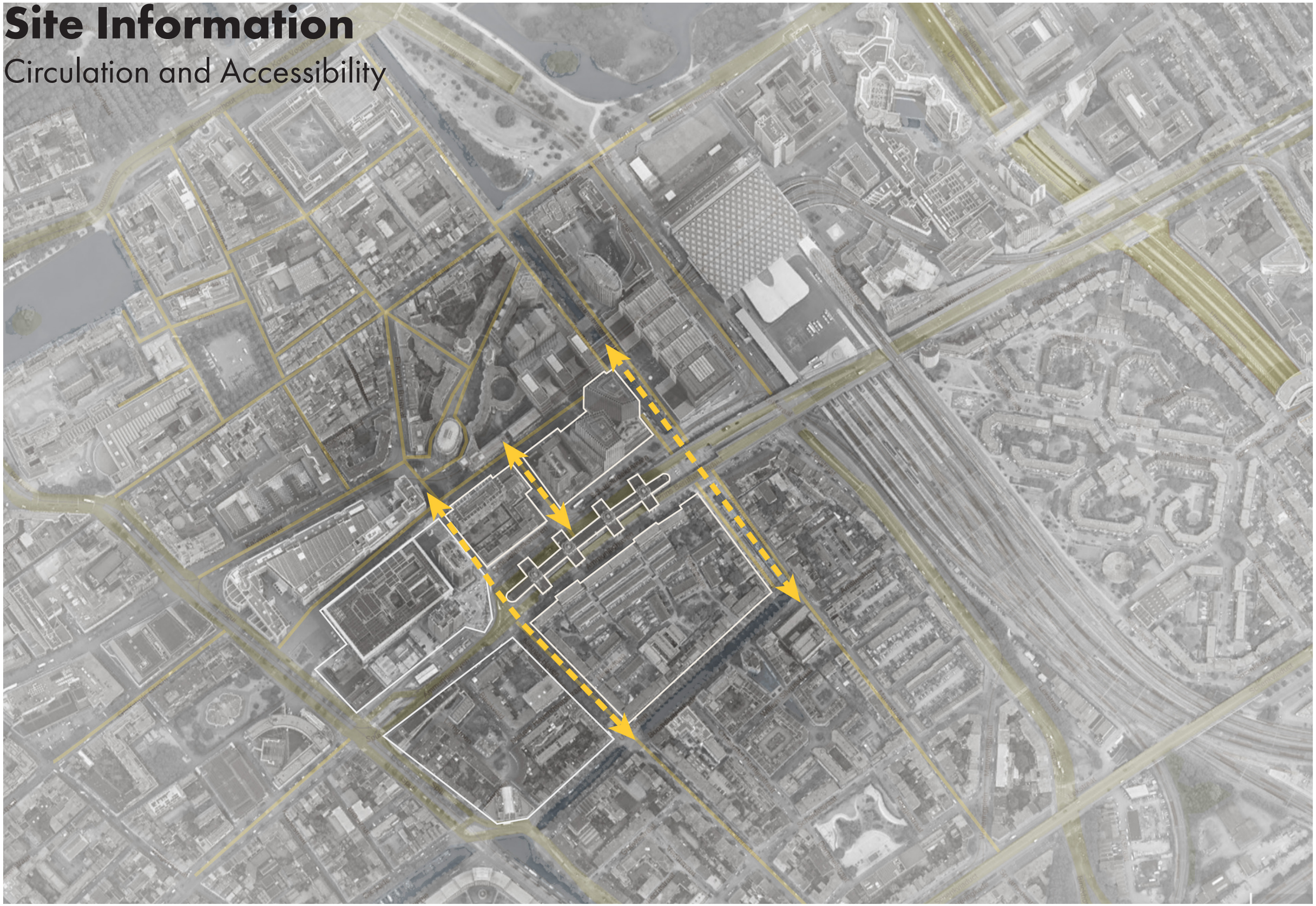


Site Alternation

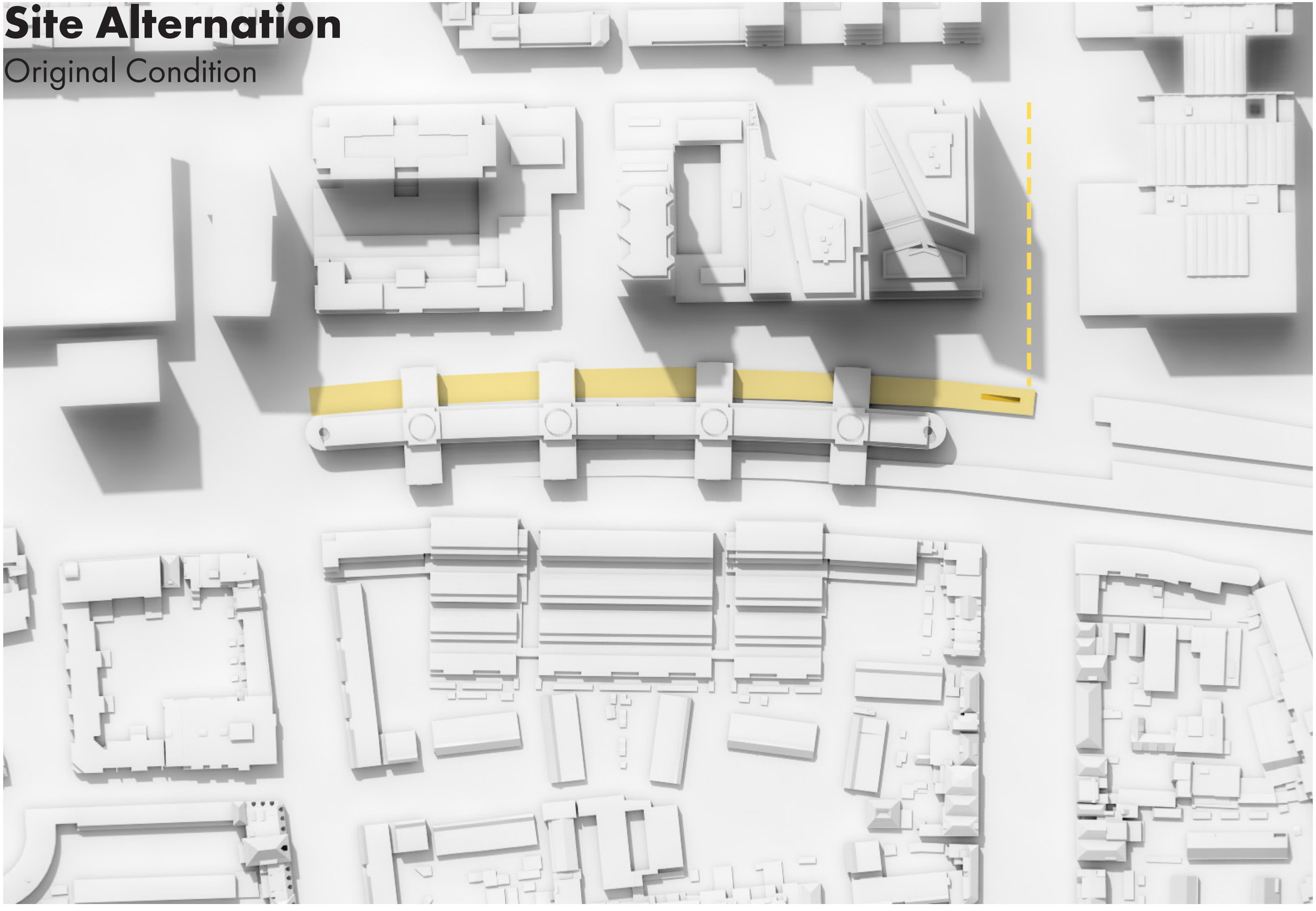
Original Condition

Site Information

Push traffic to one side

Site Alternation

Original Condition



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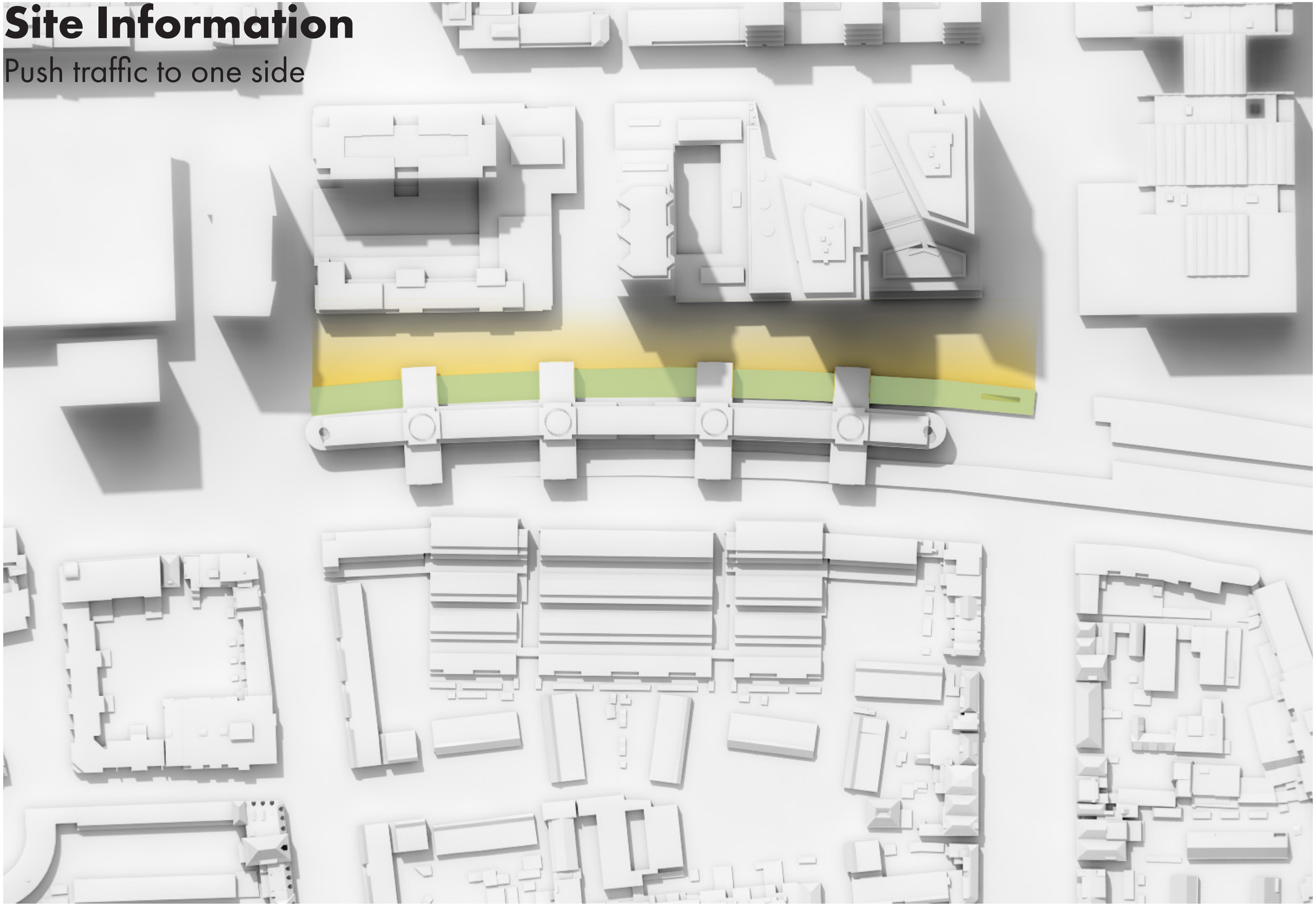
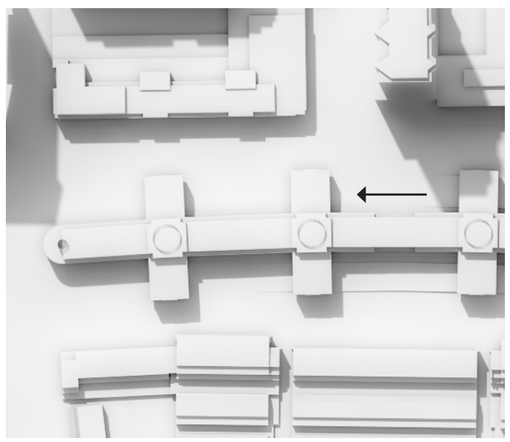
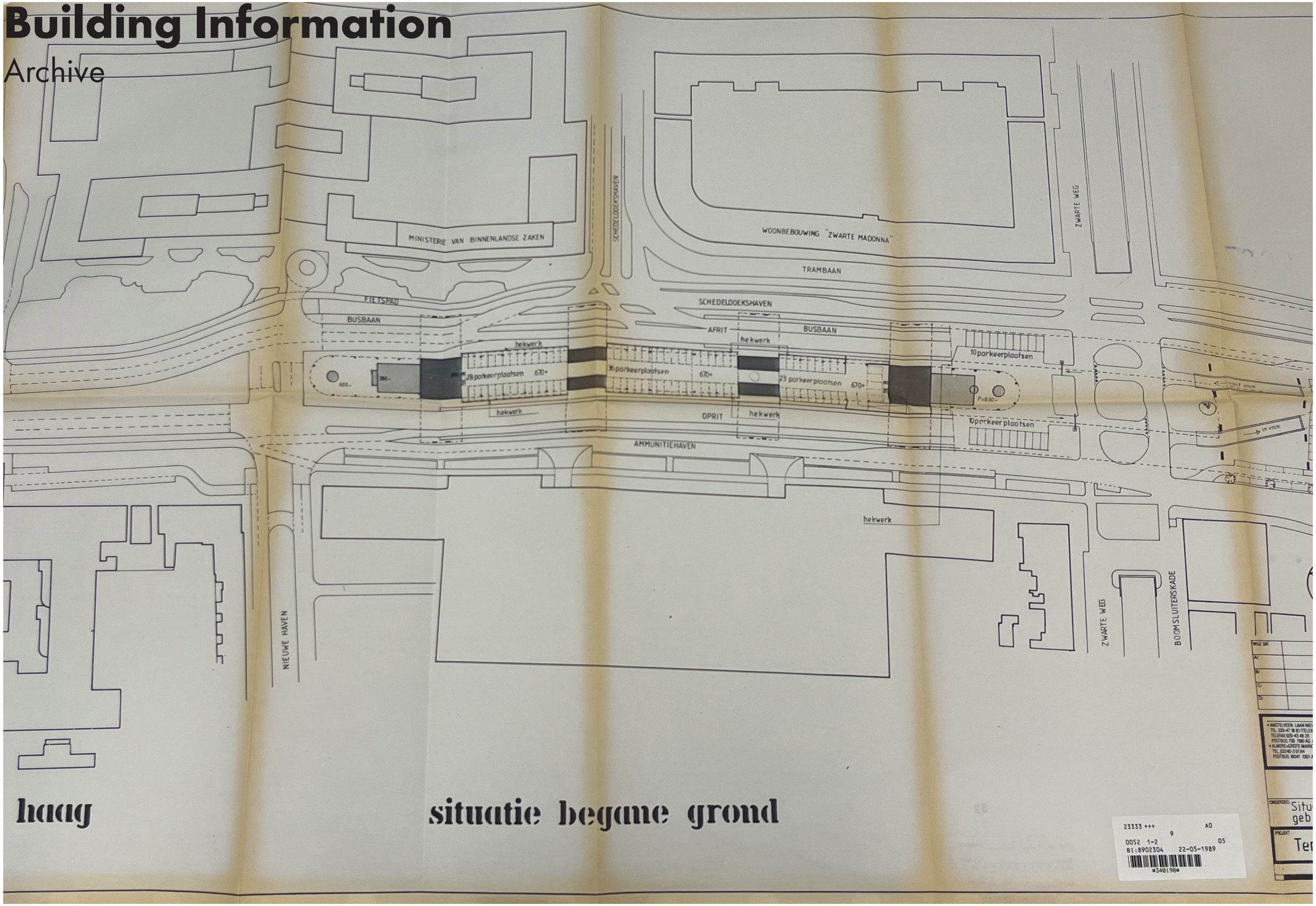




Building Information

Archive



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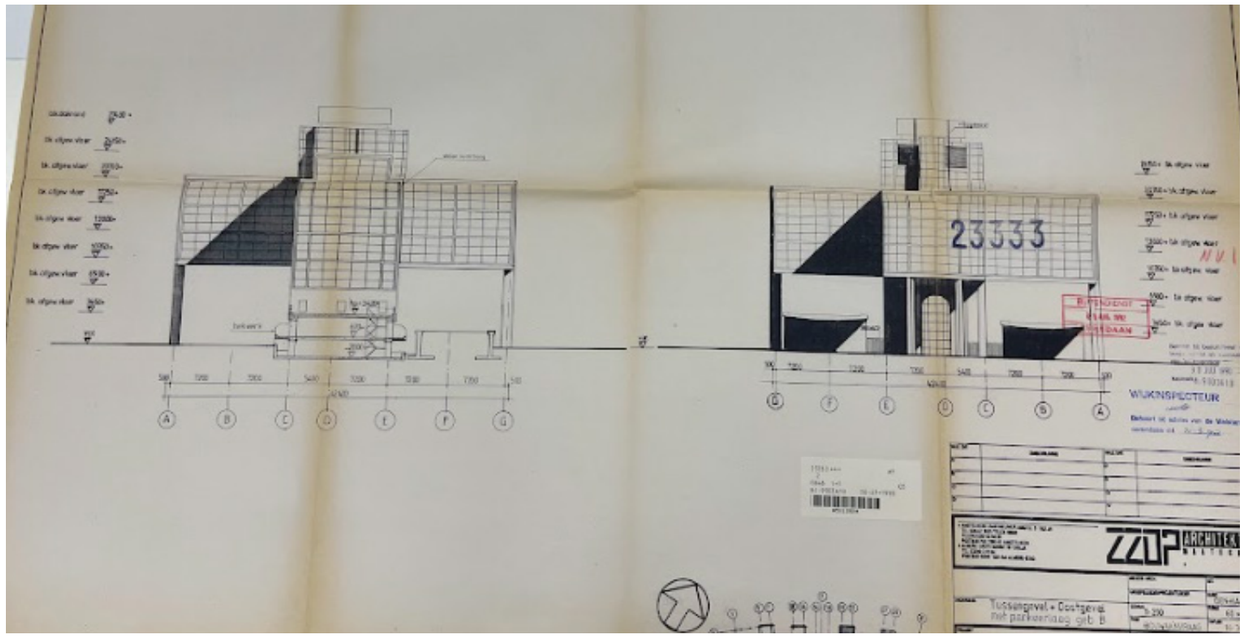
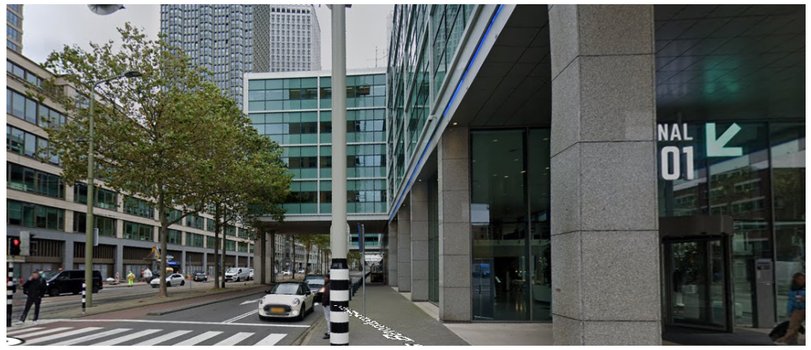
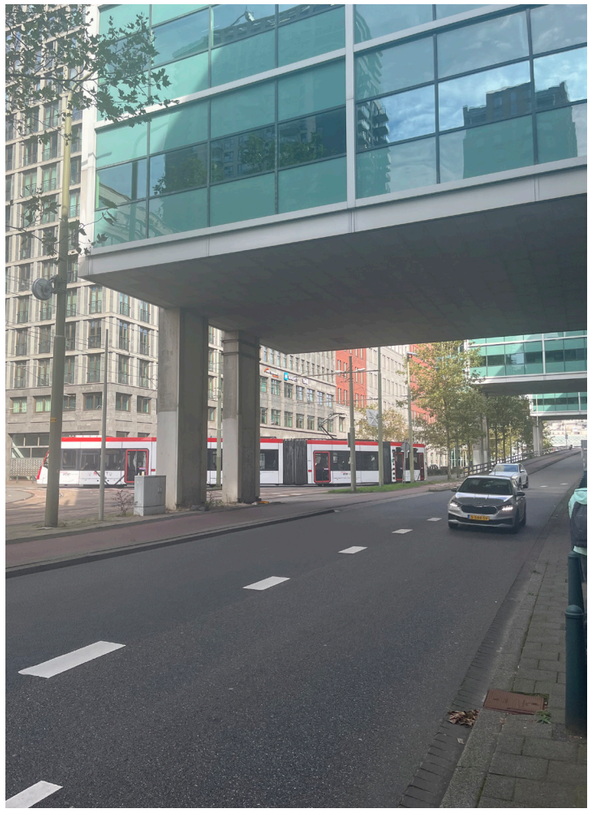


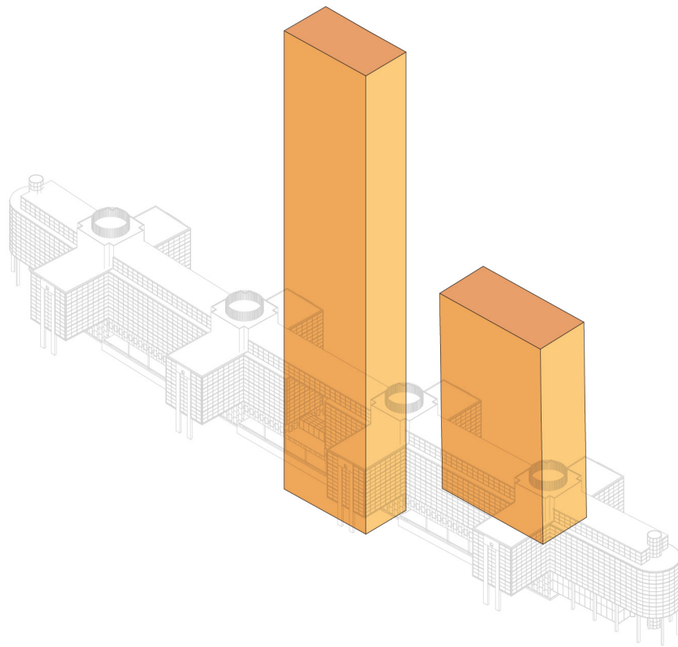




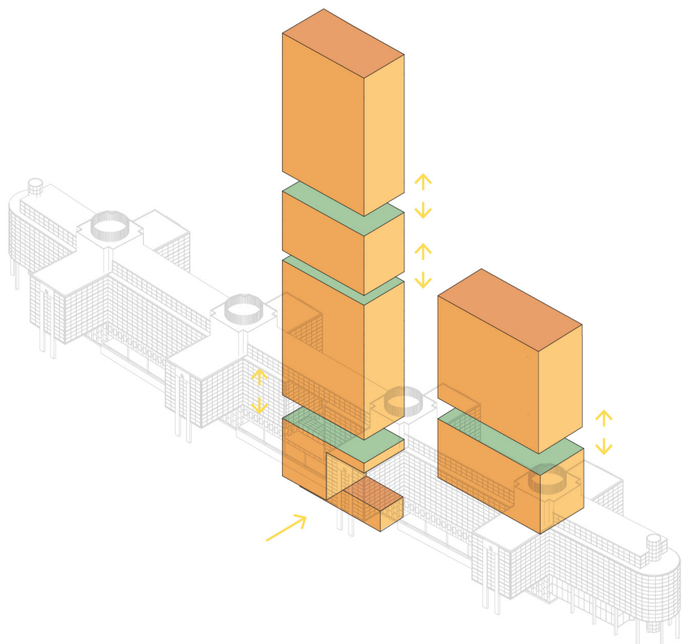
Massing Diagram

Step by step massing decisions

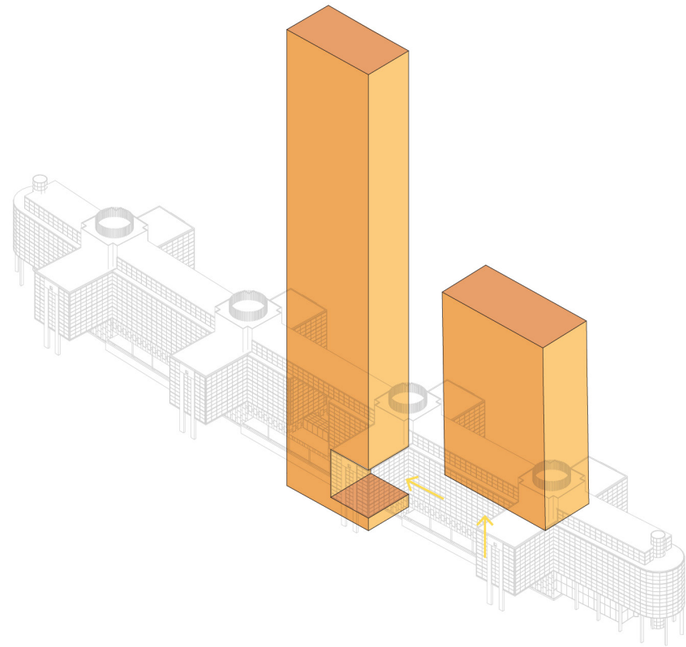
1.
Blocks Extrusion



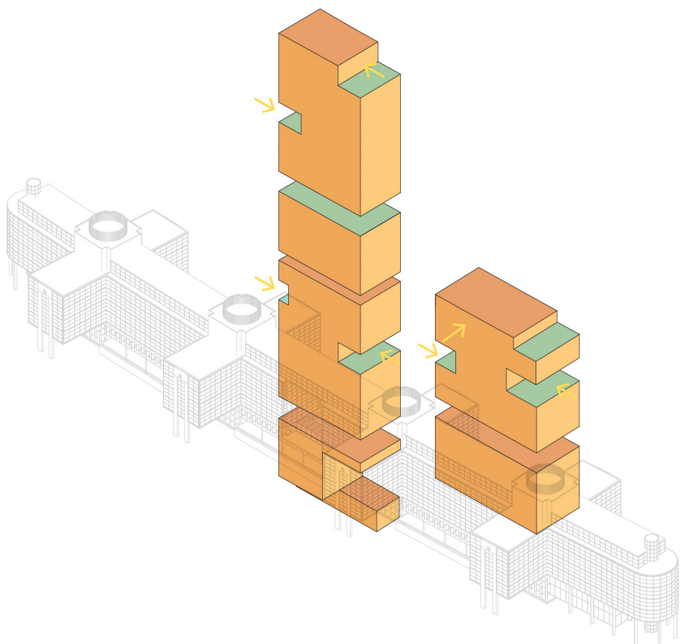
2.
Fit into existing building



3.
Cut for entrance and sky garden

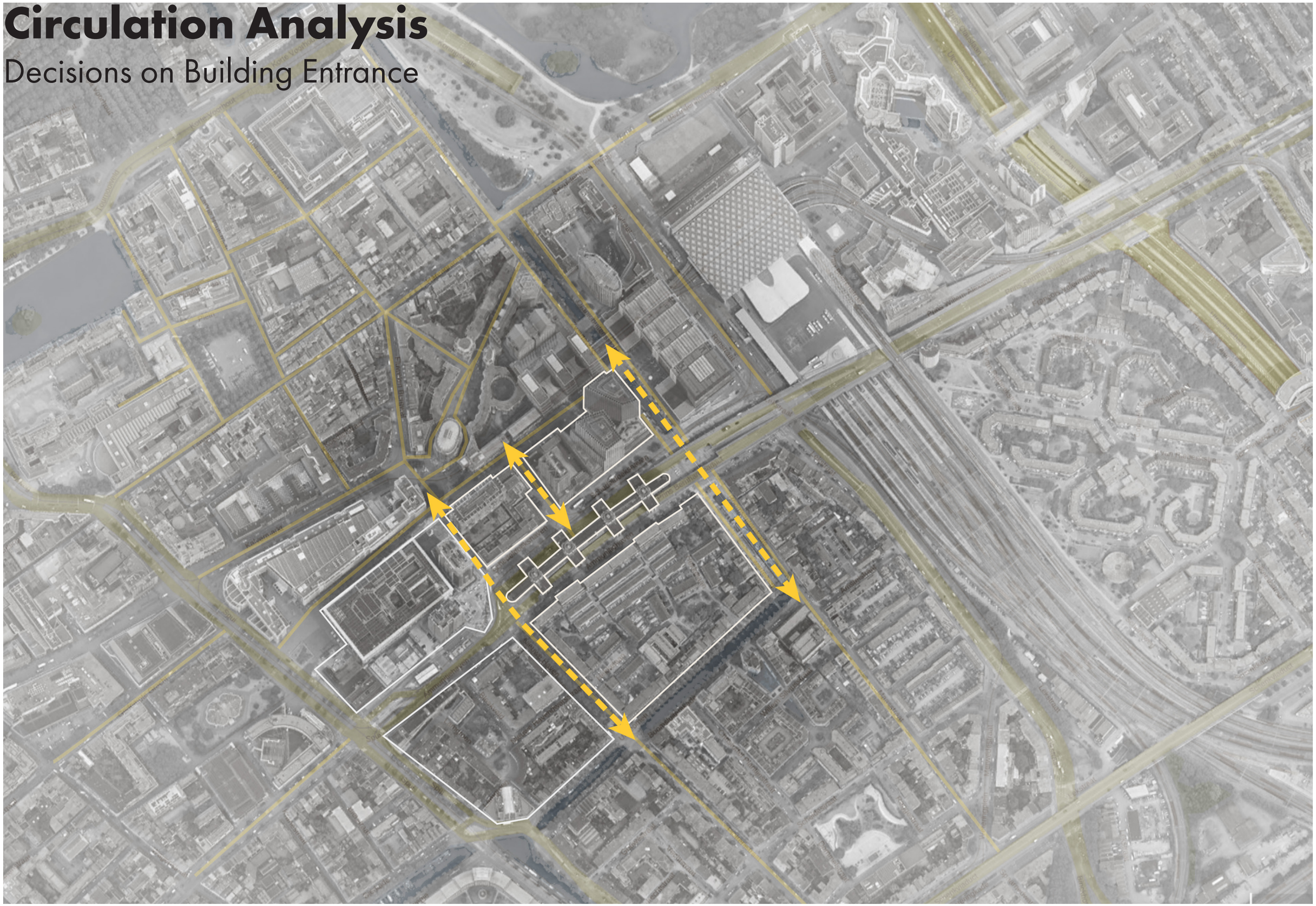


4.
Open for views and visual connections to the city



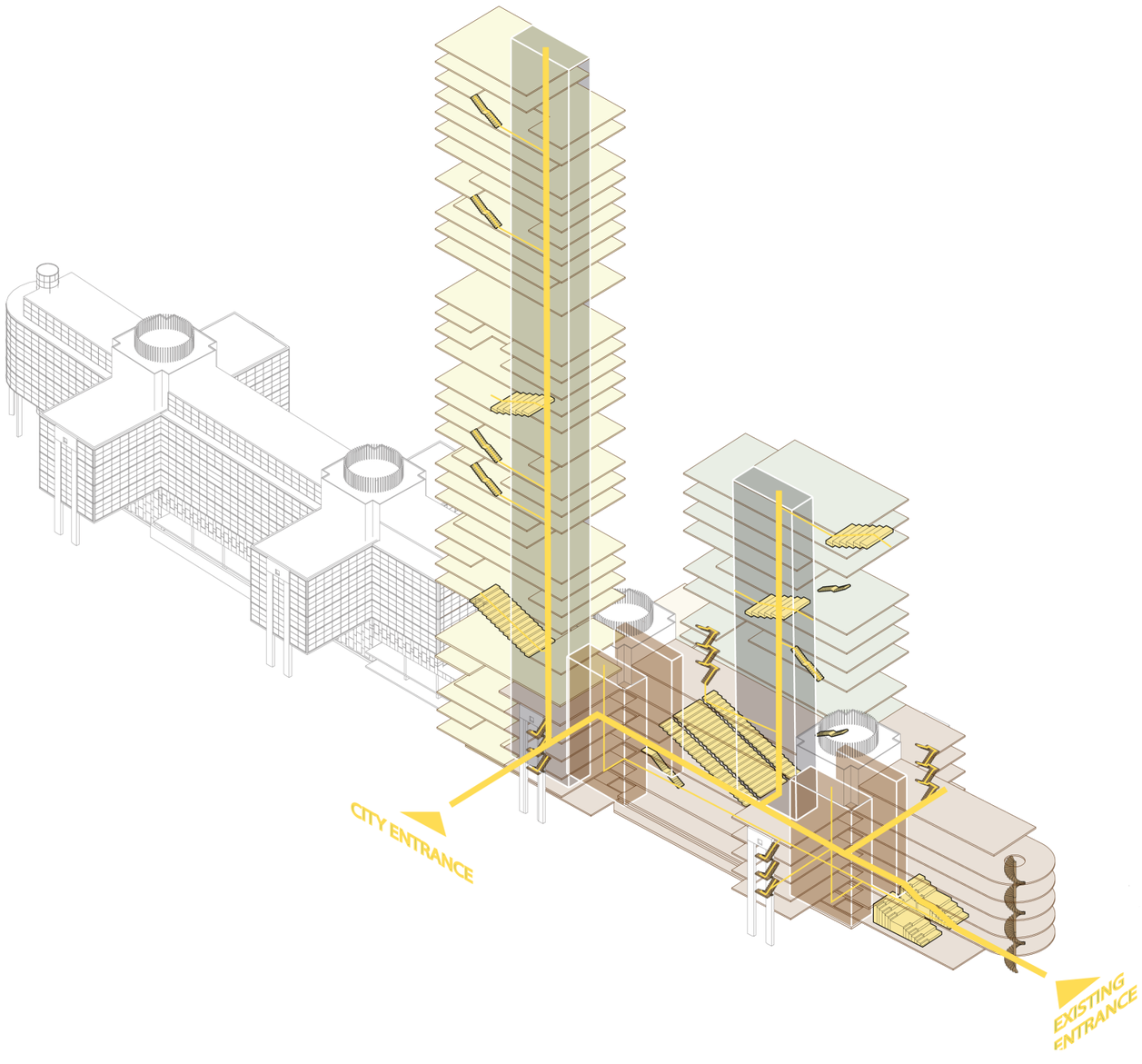
Circulation Analysis

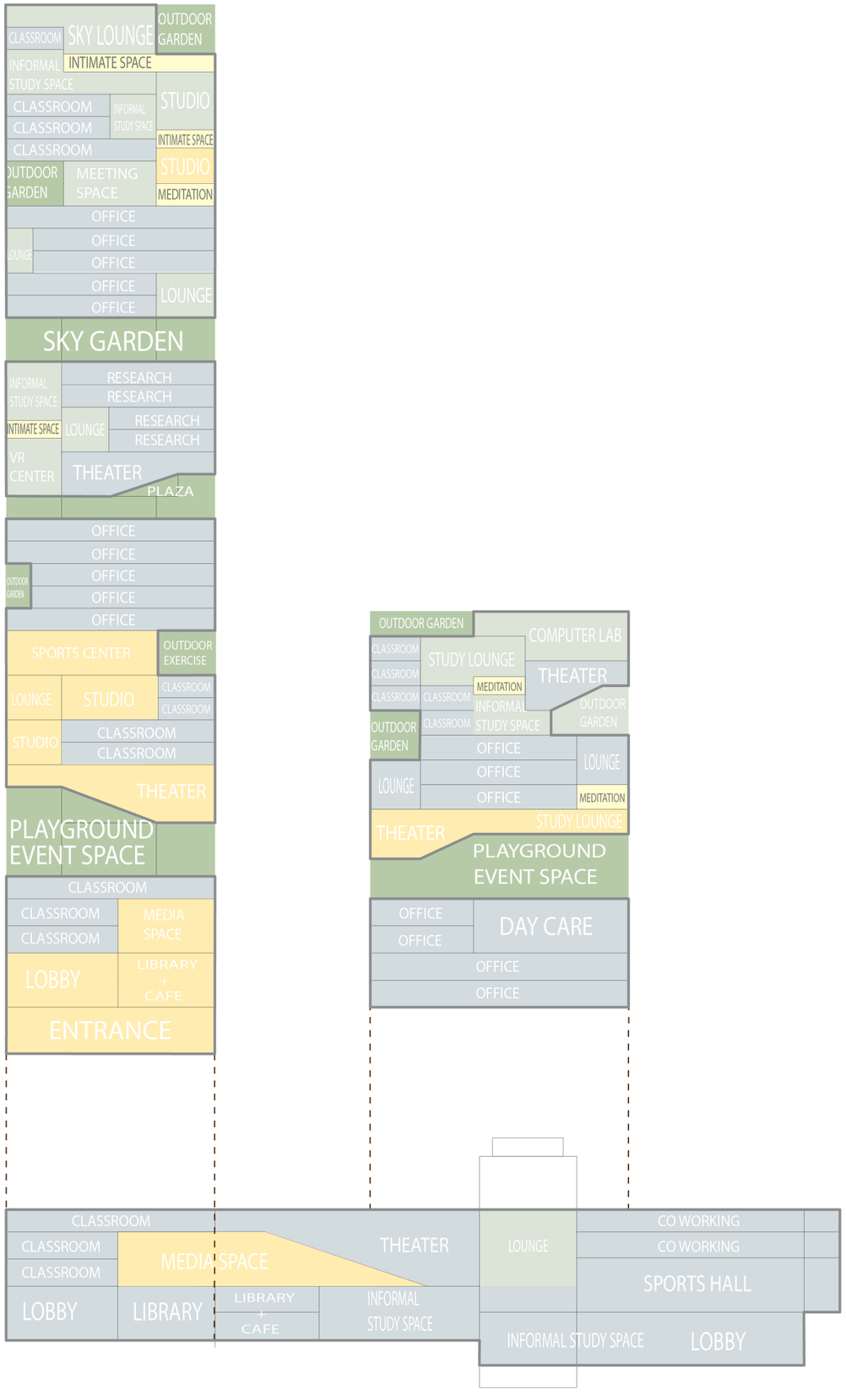
Decisions on Building Entrance



Circulation & Programs

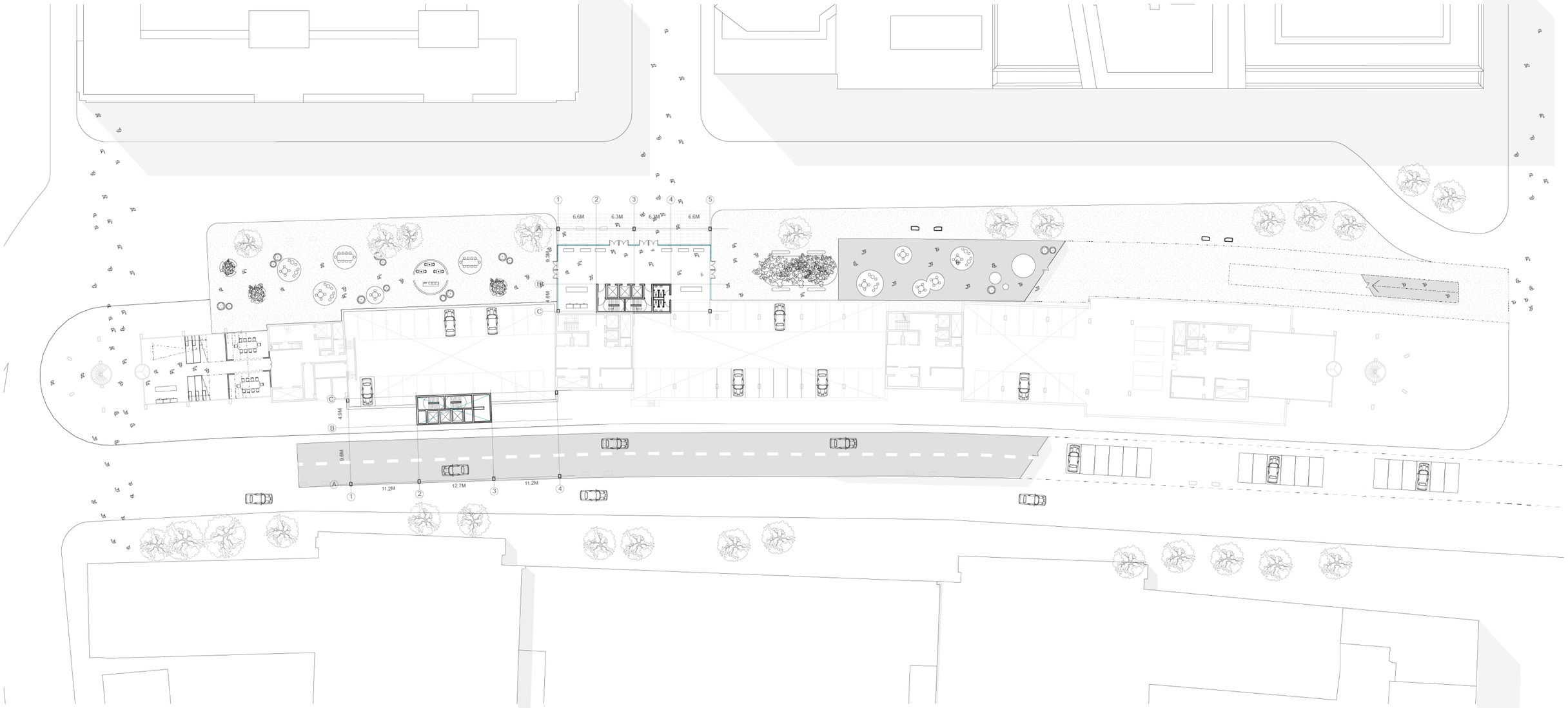
Main entrances to campus and program allocation





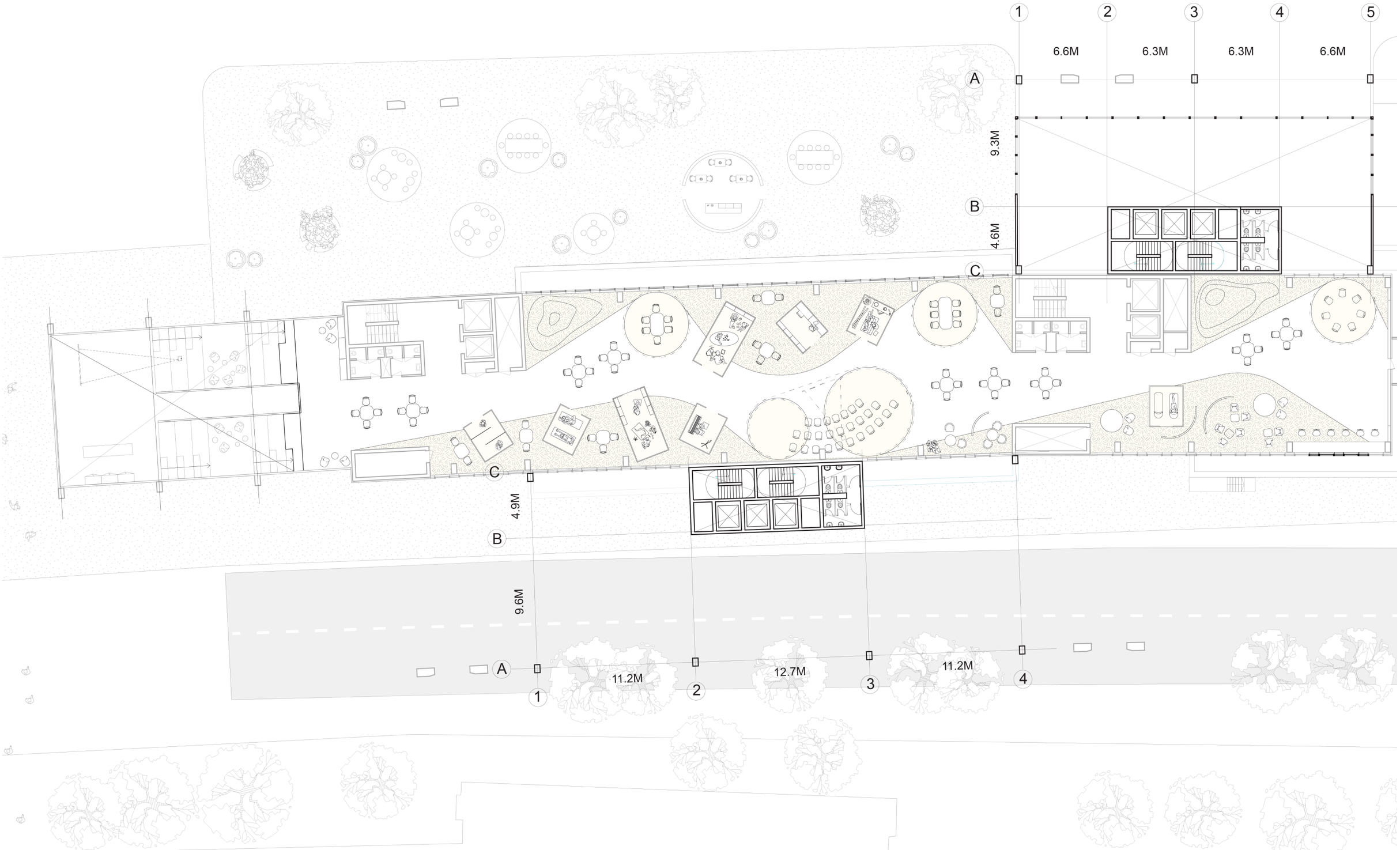
Ground Floor Plan

Three axes for accessibility



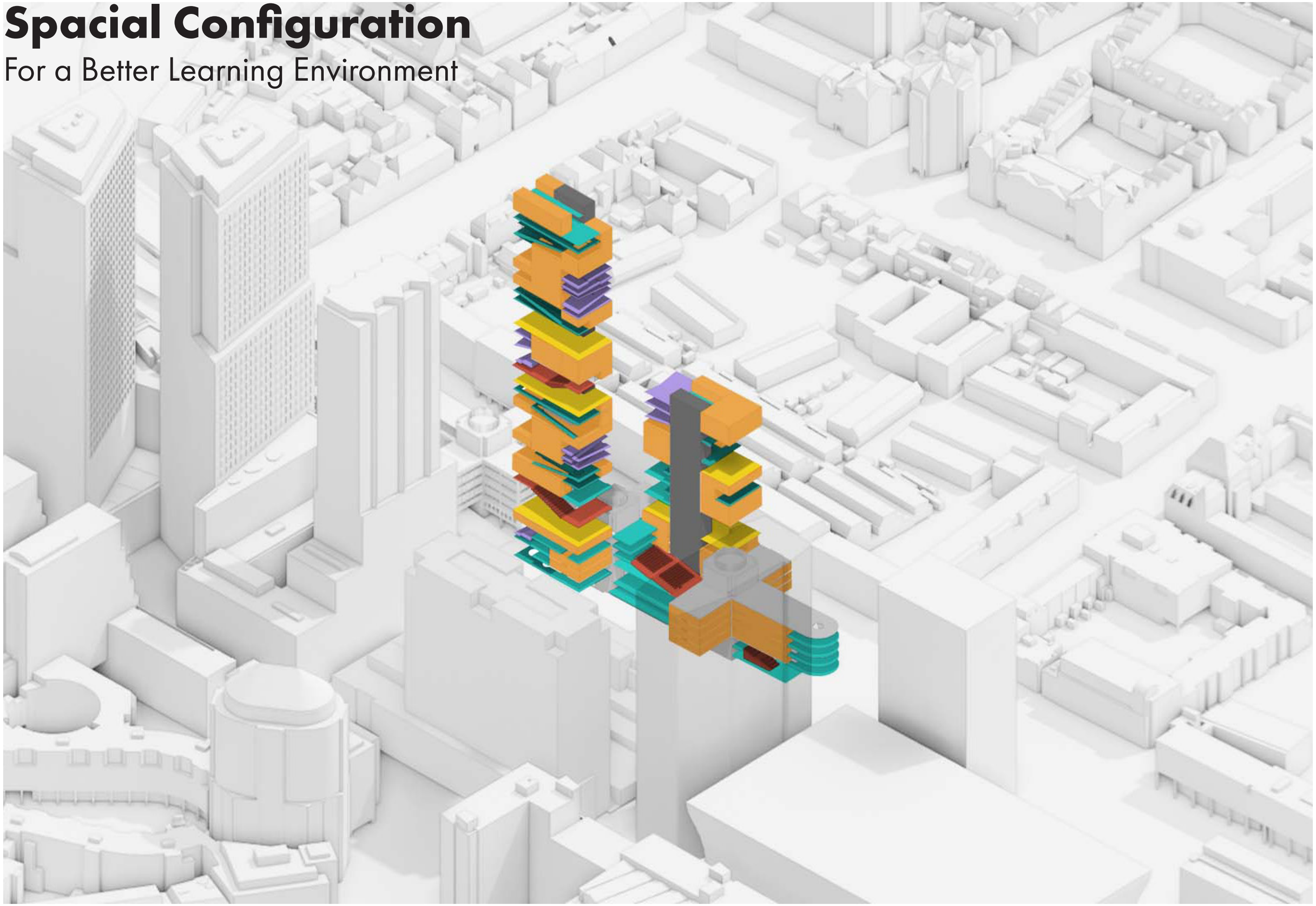
Second Floor Plan

The Avenue with Informal Learning and Activity Spaces



Spacial Configuration

For a Better Learning Environment

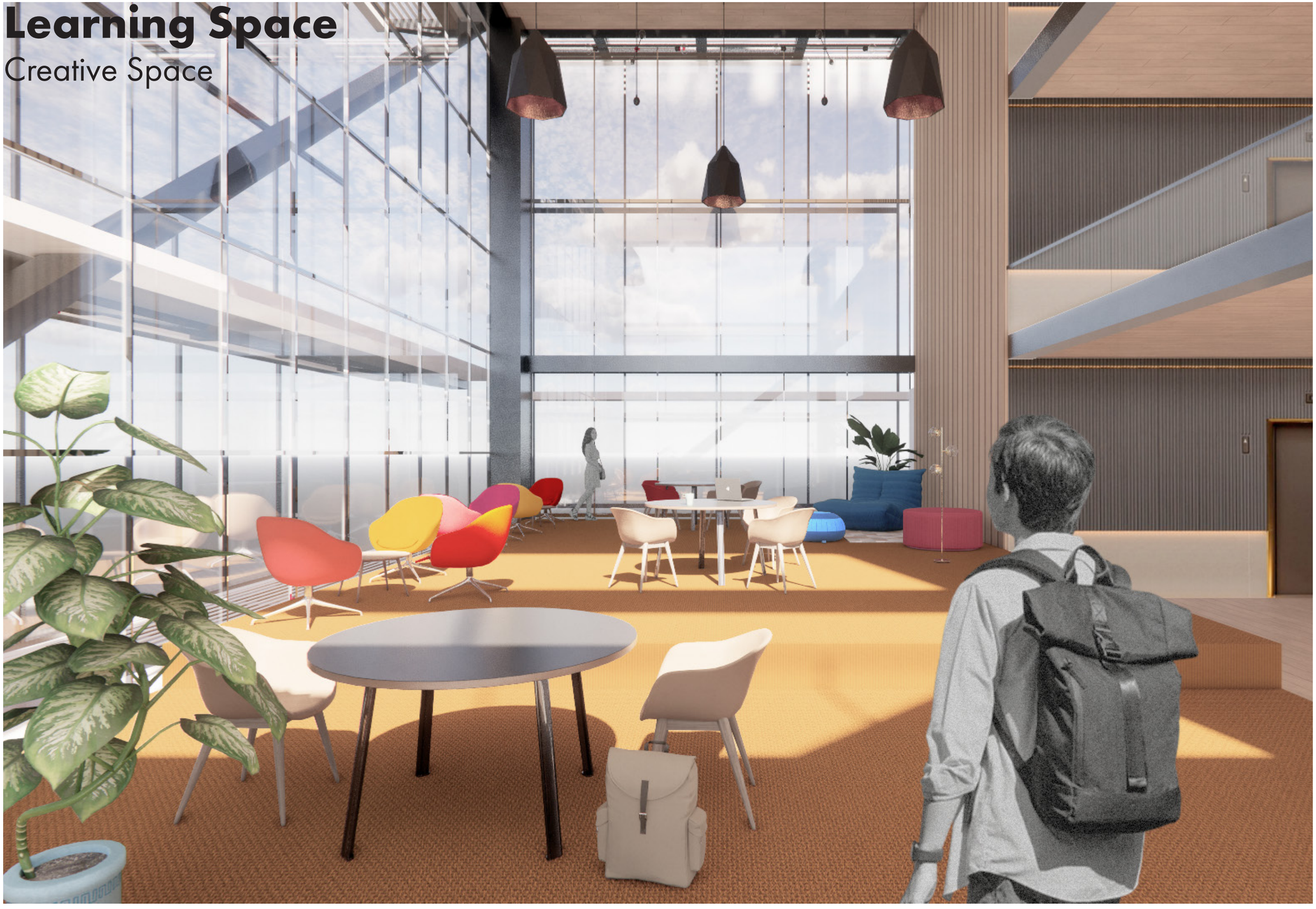


Learning Space

Focus Zone

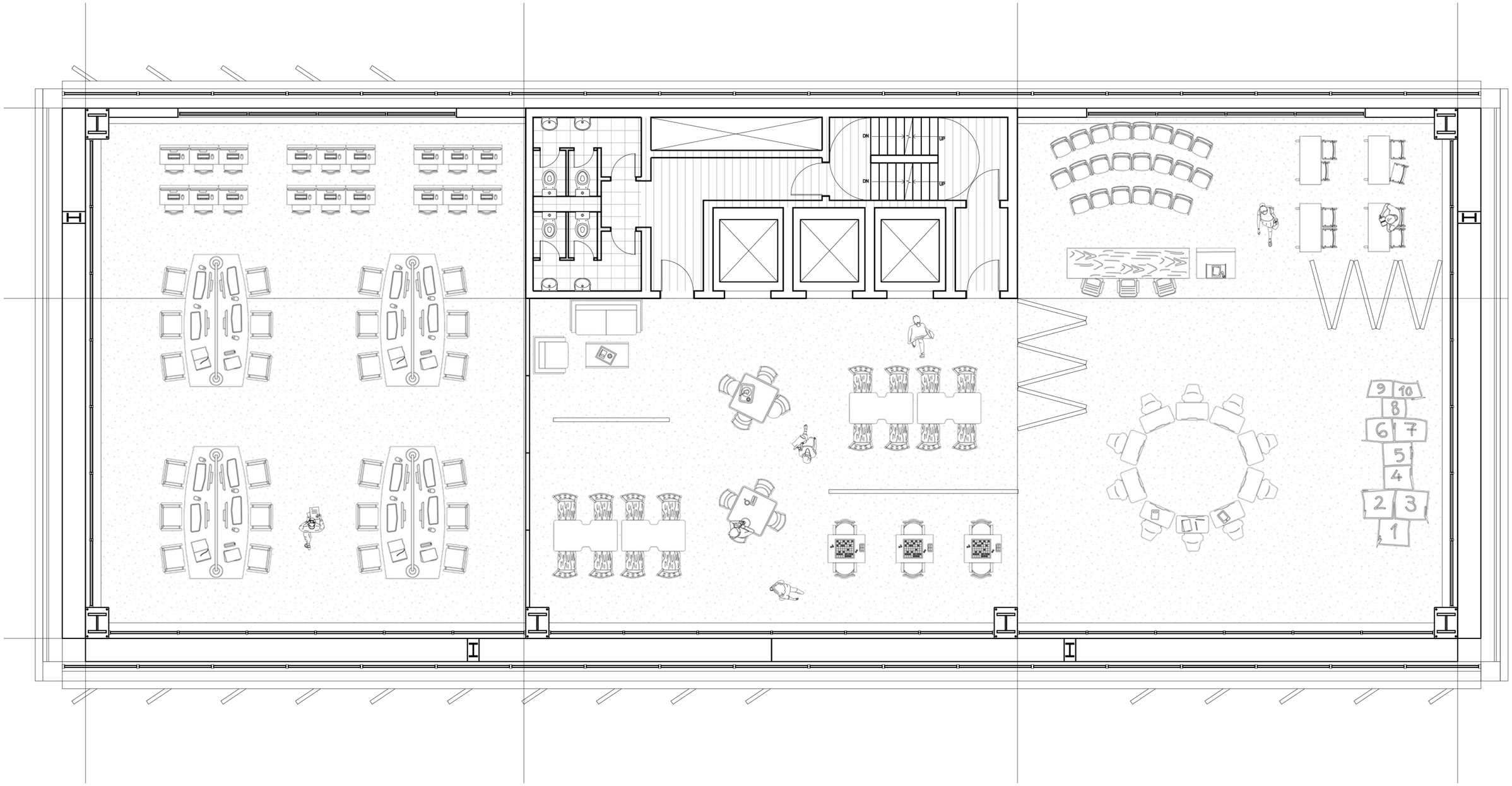
Learning Space

Creative Space



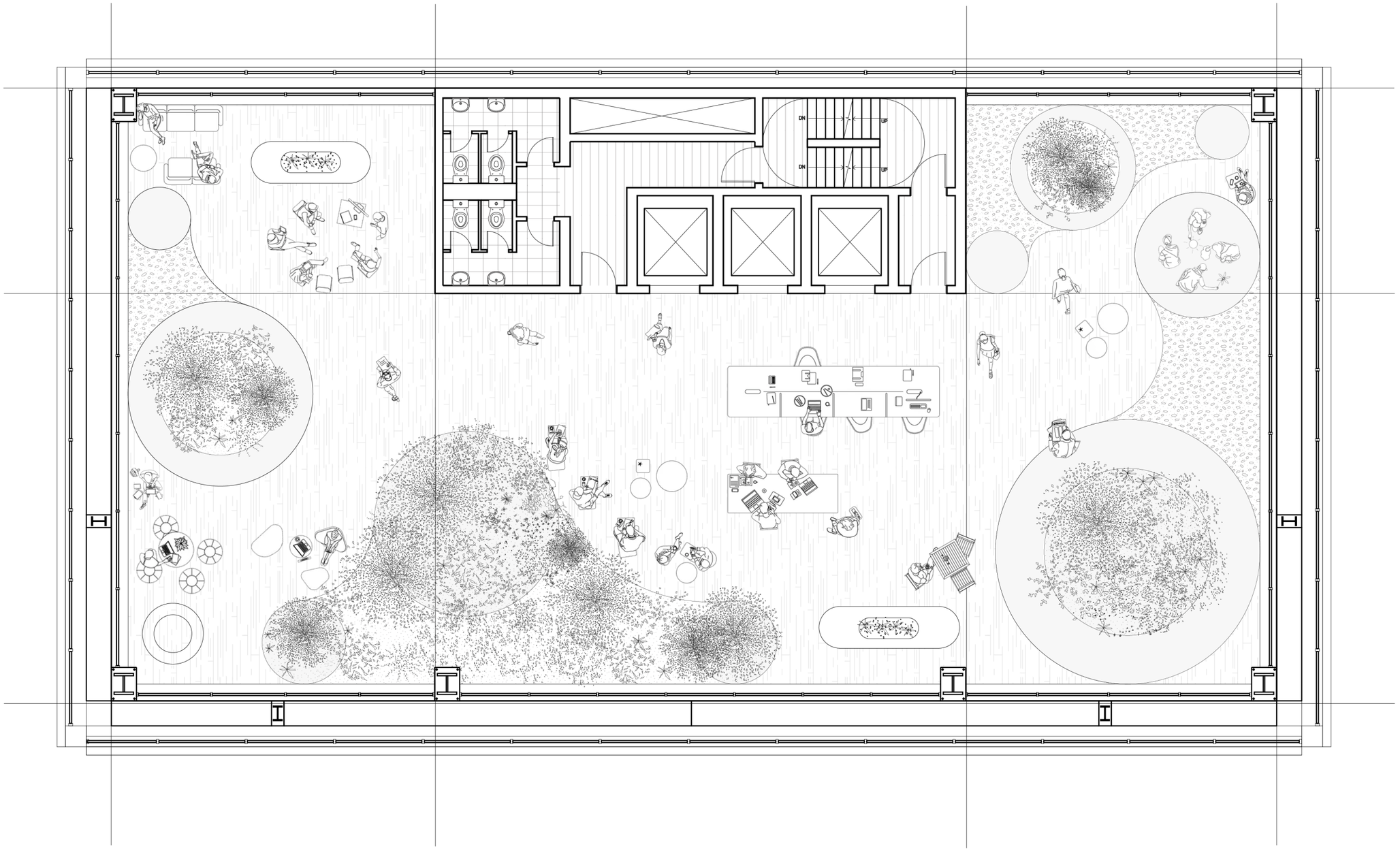
Floor Plan

Research Center



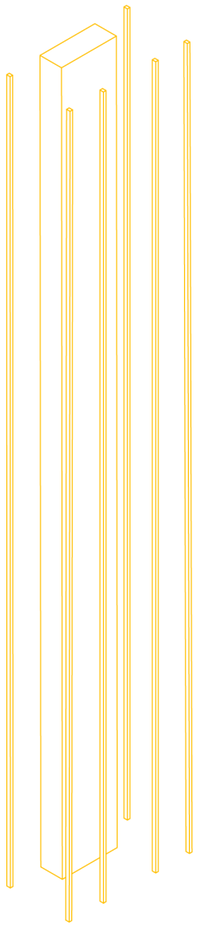
Floor Plan

Botanic Garden with Informal Learning Space

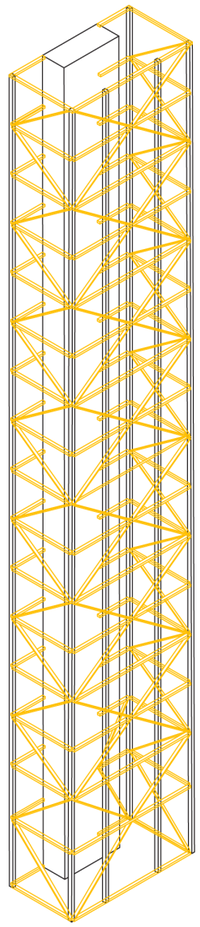


Structural Diagram

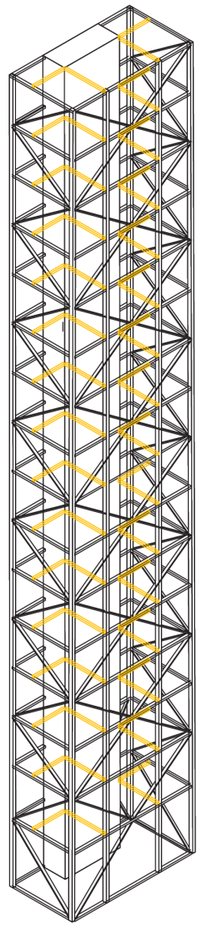
Construction Sequence



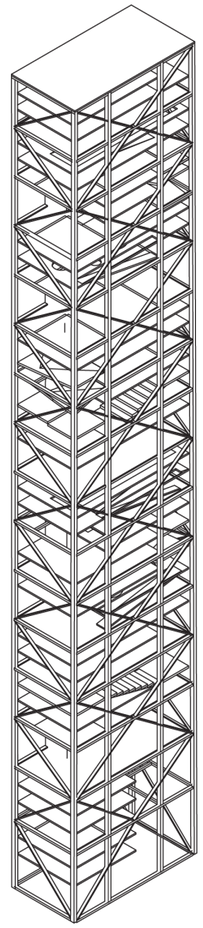
Column and Core



Bracing

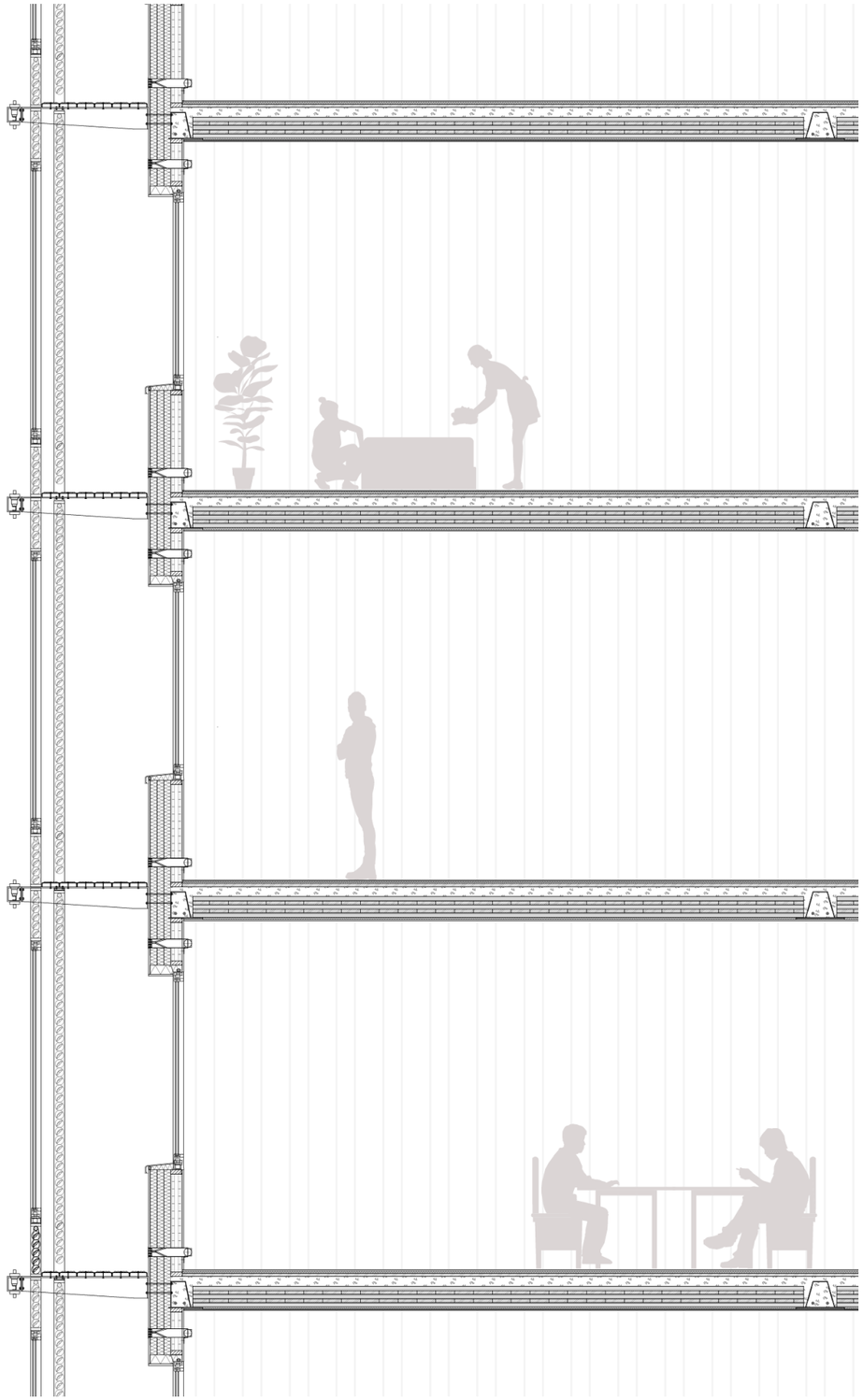


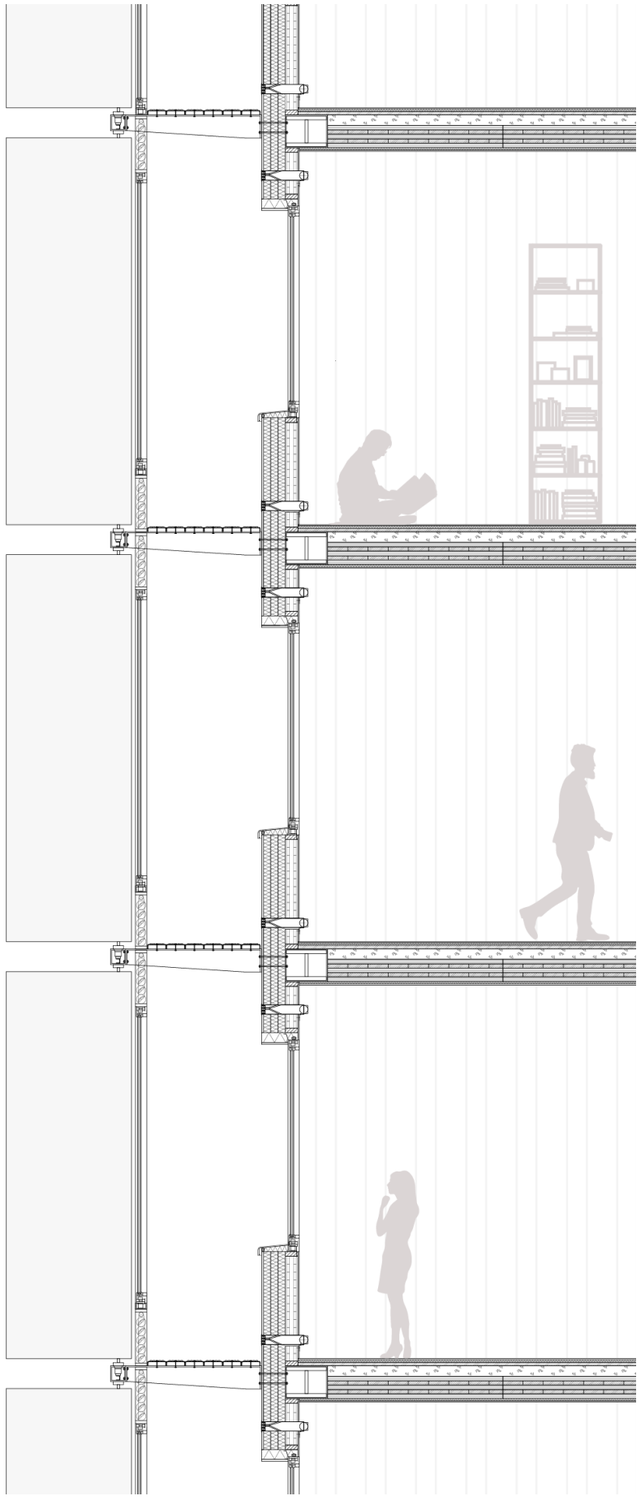
Beam



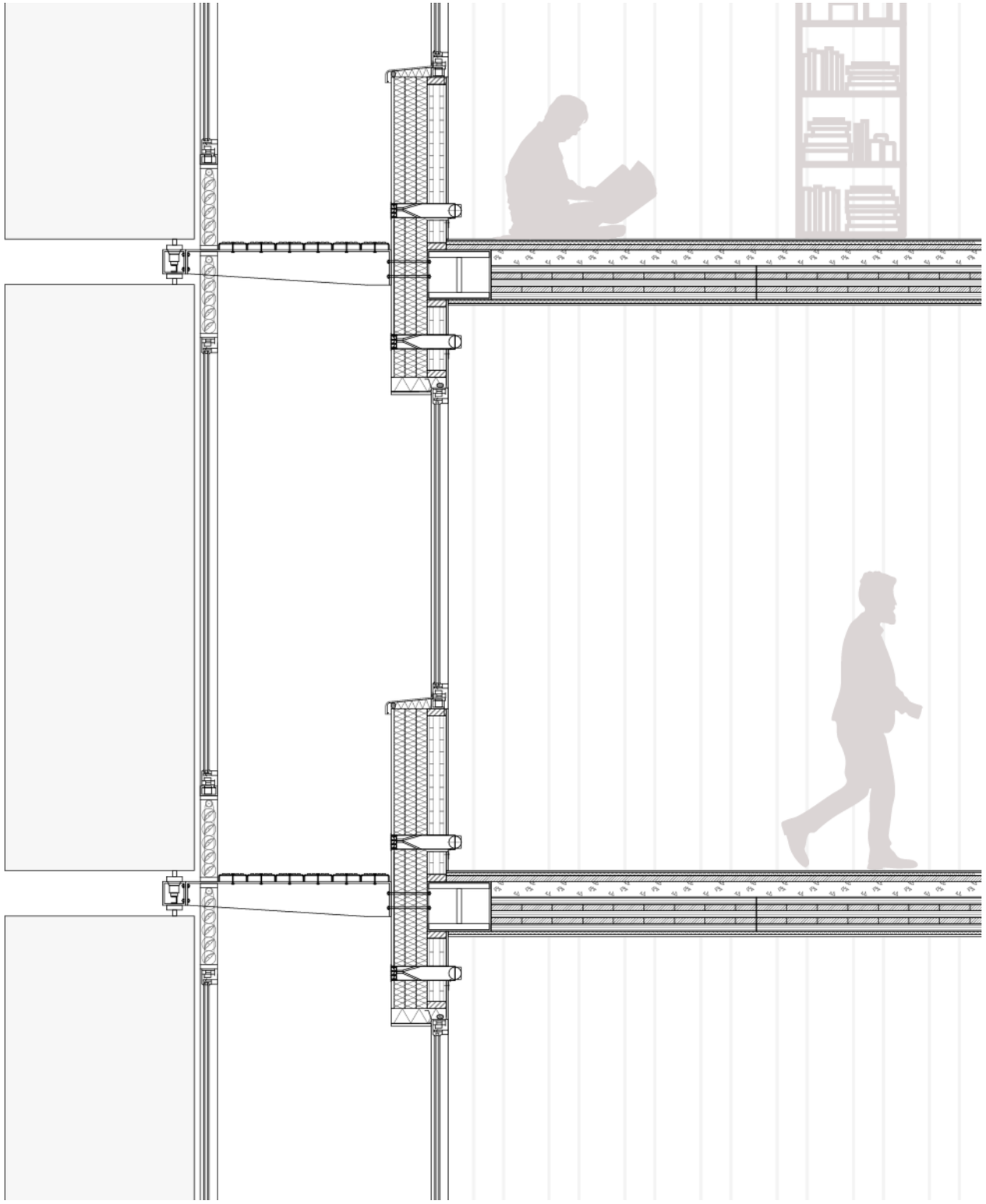
Floor

Facade Fragment

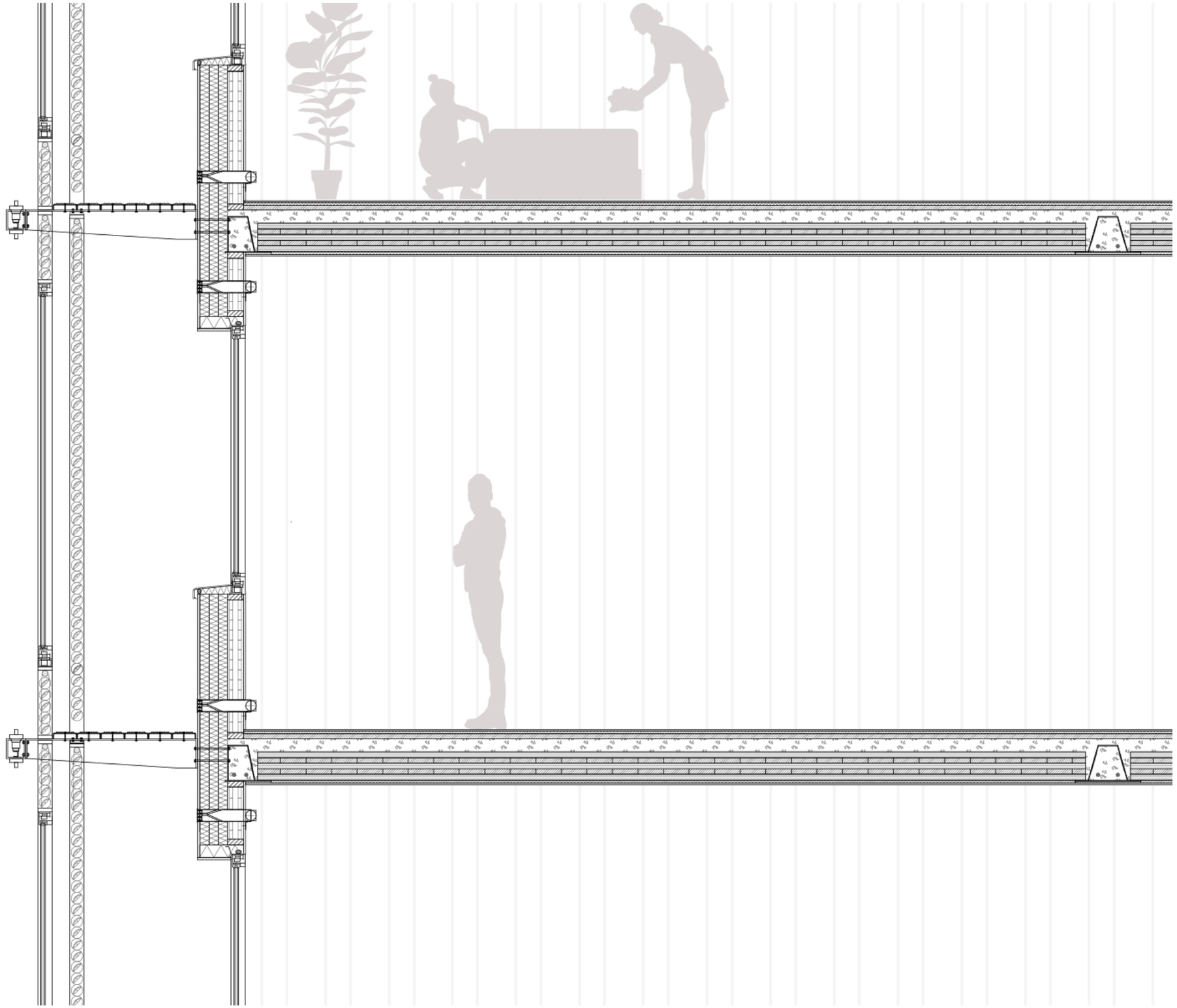




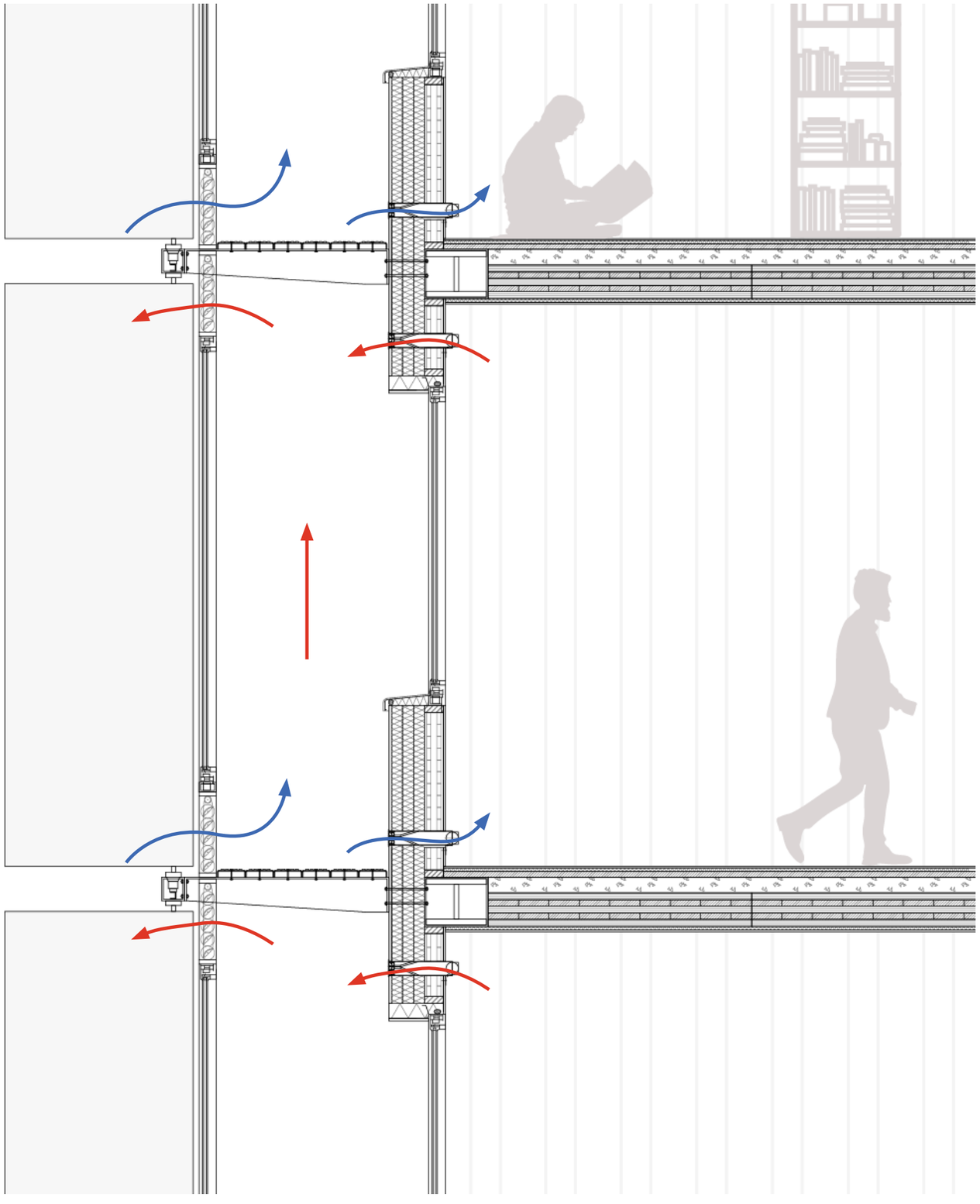
Sectional Detail

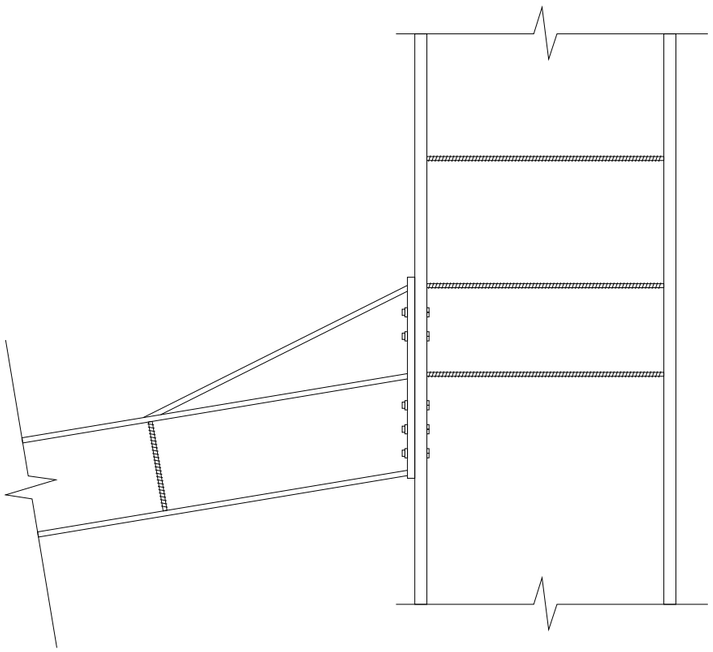


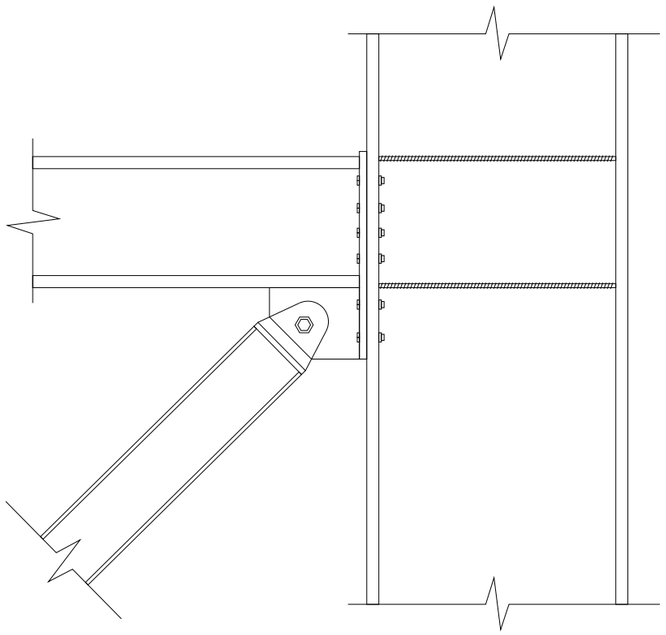
Sectional Detail

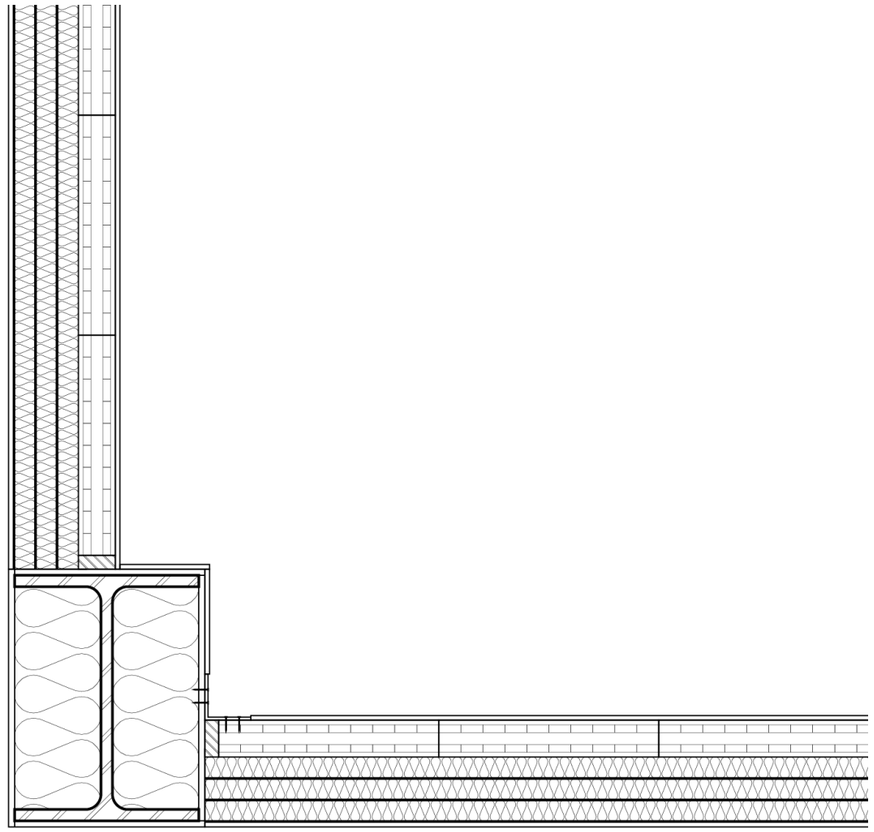


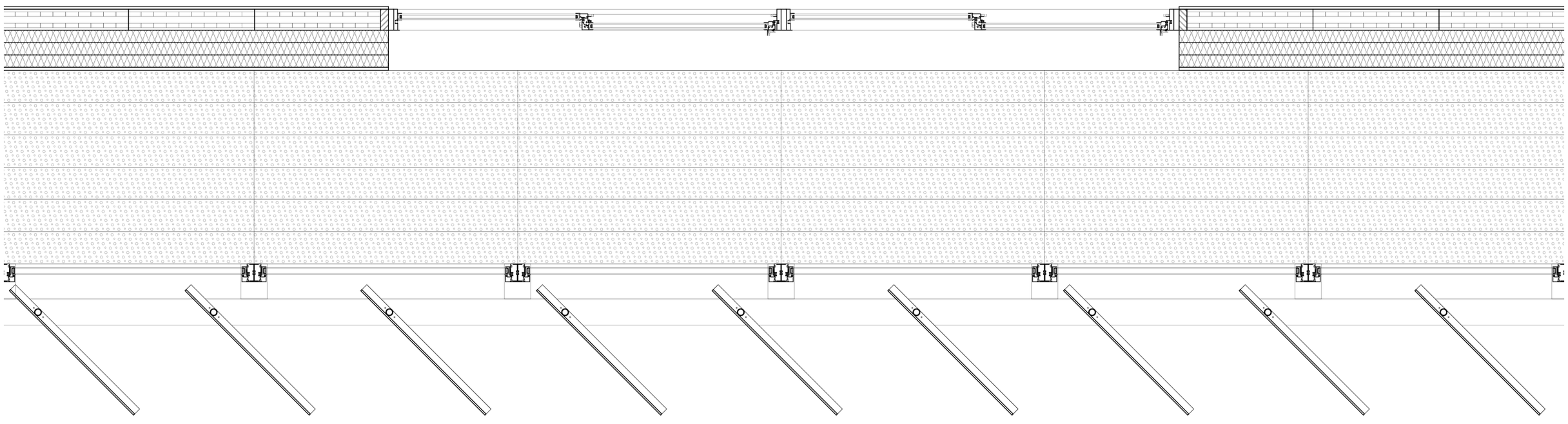
Double Facade











CommuVersity:
A community for learning

A Vertical Campus in the 21st Century