

ARCHITECTURE PORTFOLIO

Caining Gu

*Columbia University
Graduate School of Architecture, Planning and Preservation
Master of Architecture | 2021-2024*

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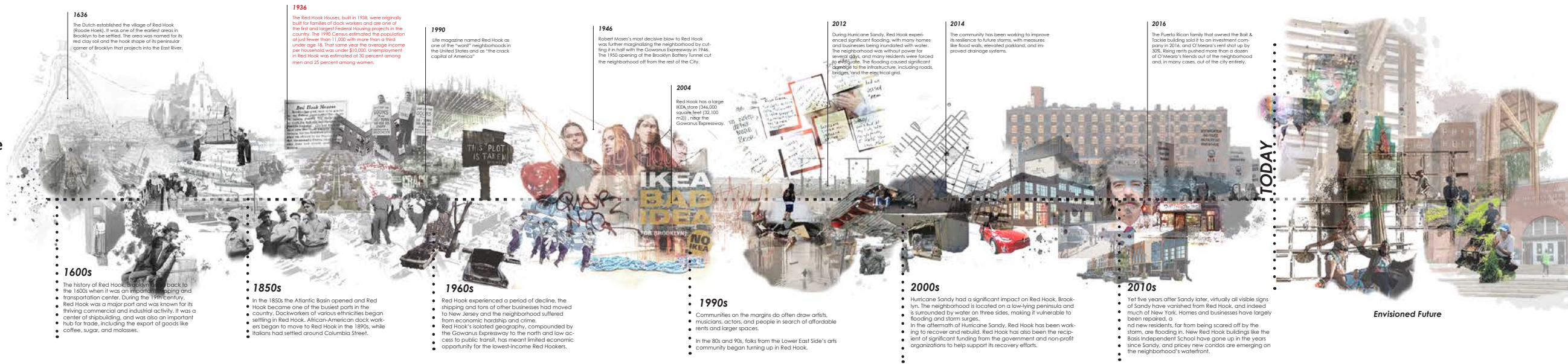
DENSITY AND WEAVING

ADV V Studio

*Instructor: Marc Tsurumaki
Fall 2023 | Collaborate with Shiyu Lyu
Site: Red Hook, Brooklyn*

Site Historical Timeline

Thrive, Depression, Art, Hurricane Sandy, Gentrification, Future Envision



1600s

The history of Red Hook, Brooklyn, goes back to the 1600s when it was an important shipping and transportation center. During the 17th century, Red Hook was a major port and was known for its thriving commercial and industrial activity. It was a center of shipbuilding, and was also an important hub for trade, including the export of goods like coffee, sugar, and molasses.

1850s

In the 1850s the Atlantic Basin opened and Red Hook became one of the busiest ports in the country. Dockworkers of various ethnicities began settling in Red Hook. African-American dock workers began to move to Red Hook in the 1890s, while Italians had settled around Columbia Street.

1960s

Red Hook experienced a period of decline, the shipping and tons of other businesses had moved to New Jersey and the neighborhood suffered from economic hardship and crime. Red Hook's isolated geography, compounded by the Gowanus Expressway to the north and low access to public transit, has meant limited economic opportunity for the lowest-income Red Hookers.

1990s

Communities on the margins do often draw artists, musicians, actors, and people in search of affordable rents and larger spaces. In the 80s and 90s, folks from the Lower East Side's arts community began turning up in Red Hook.

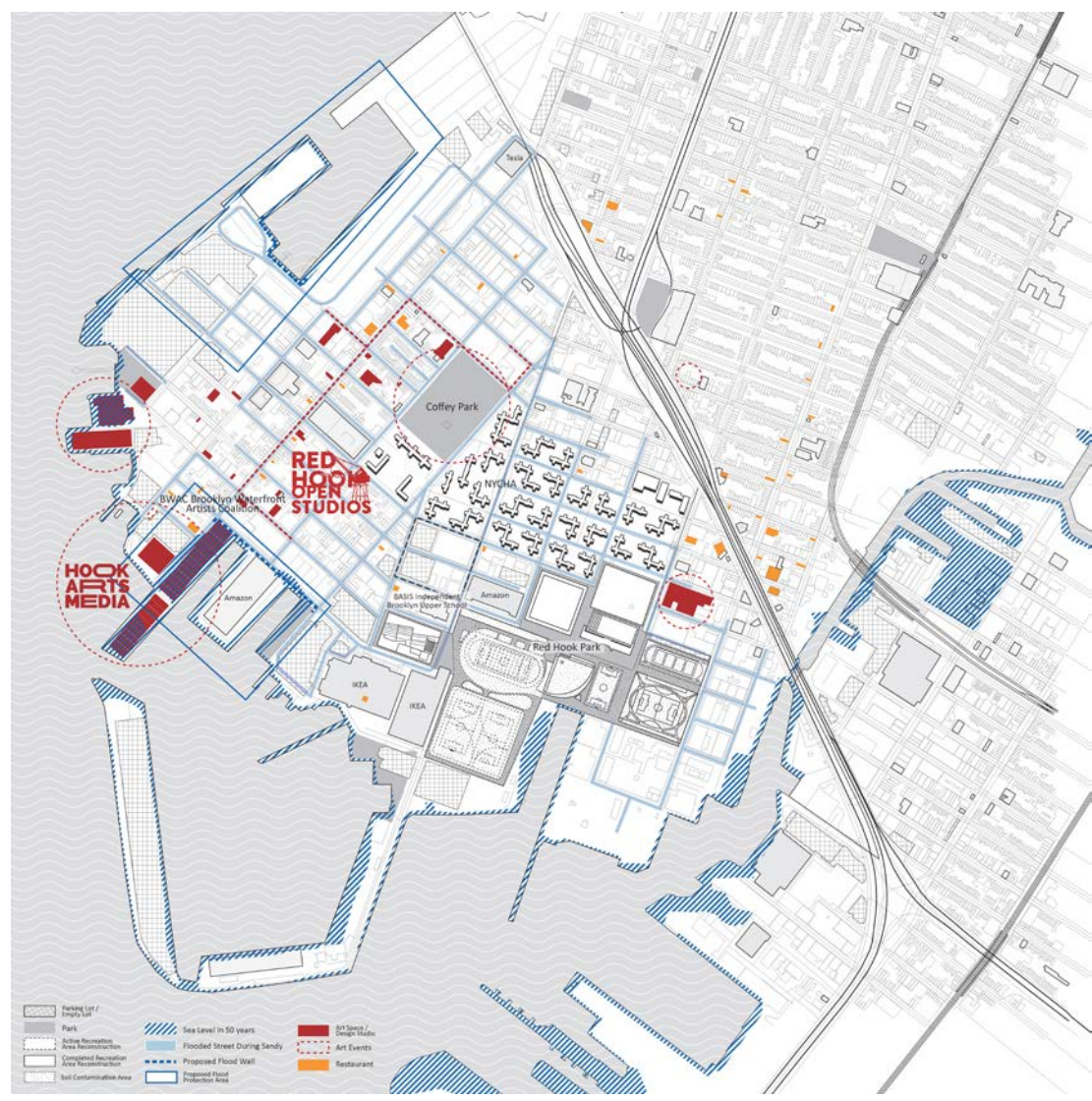
2000s

Hurricane Sandy had a significant impact on Red Hook, Brooklyn. The neighborhood is located on a low-lying peninsula and is surrounded by water on three sides, making it vulnerable to flooding and storm surges. In the aftermath of Hurricane Sandy, Red Hook has been working to recover and rebuild. Red Hook has also been the recipient of significant funding from the government and non-profit organizations to help support its recovery efforts.

2010s

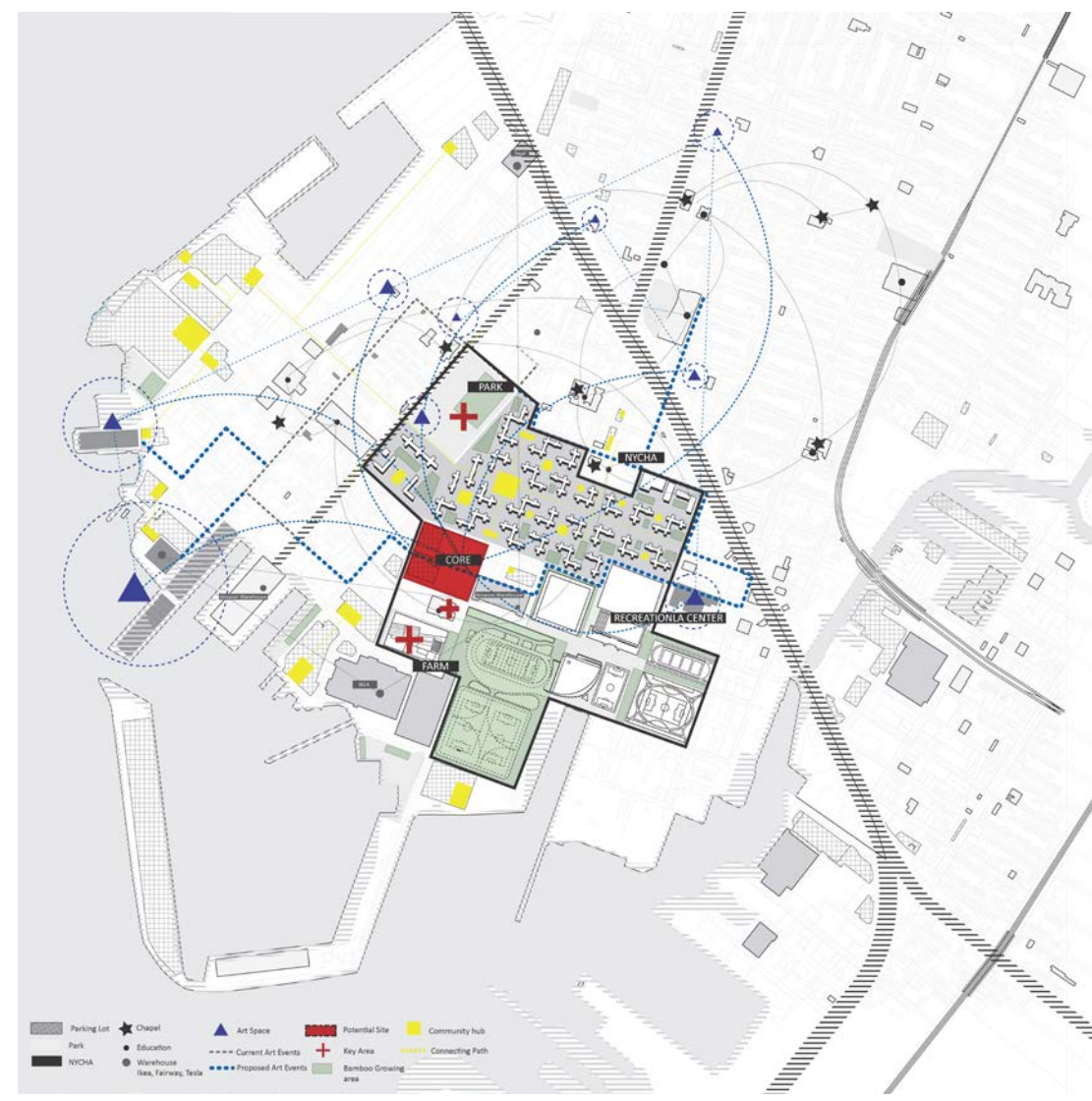
Yet five years after Sandy later, virtually all visible signs of Sandy have vanished from Red Hook, and indeed much of New York. Homes and businesses have largely been repaired, and new residents, far from being scared off by the storm, are flooding in. New Red Hook buildings like the Boas Independent School have gone up in the years since Sandy, and pricey new condos are emerging on the neighborhood's waterfront.

Envisioned Future



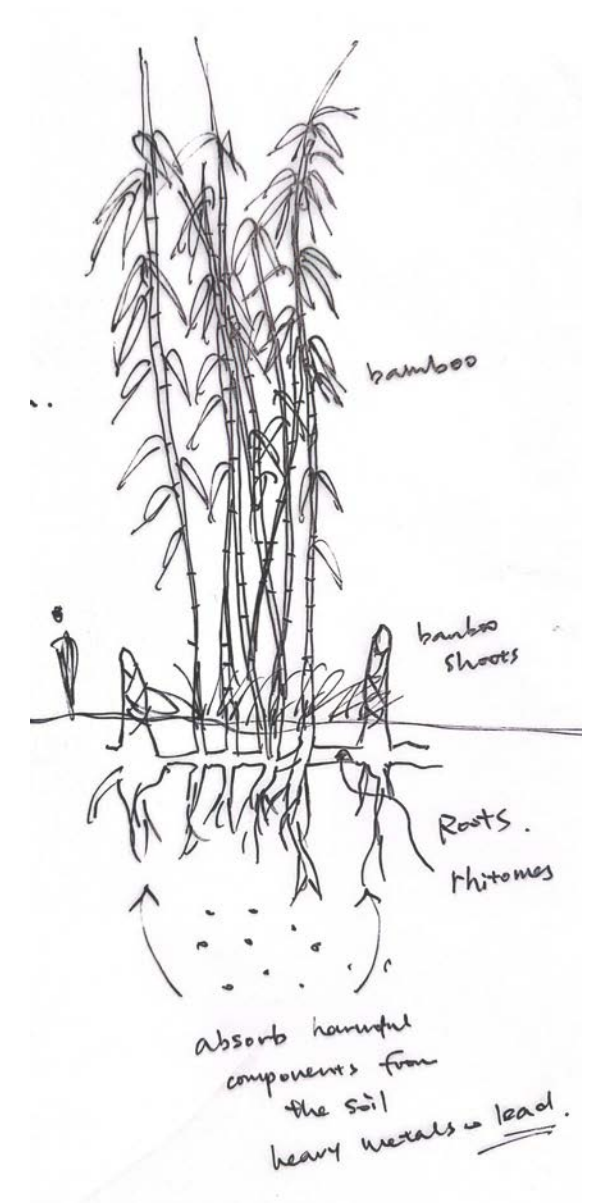
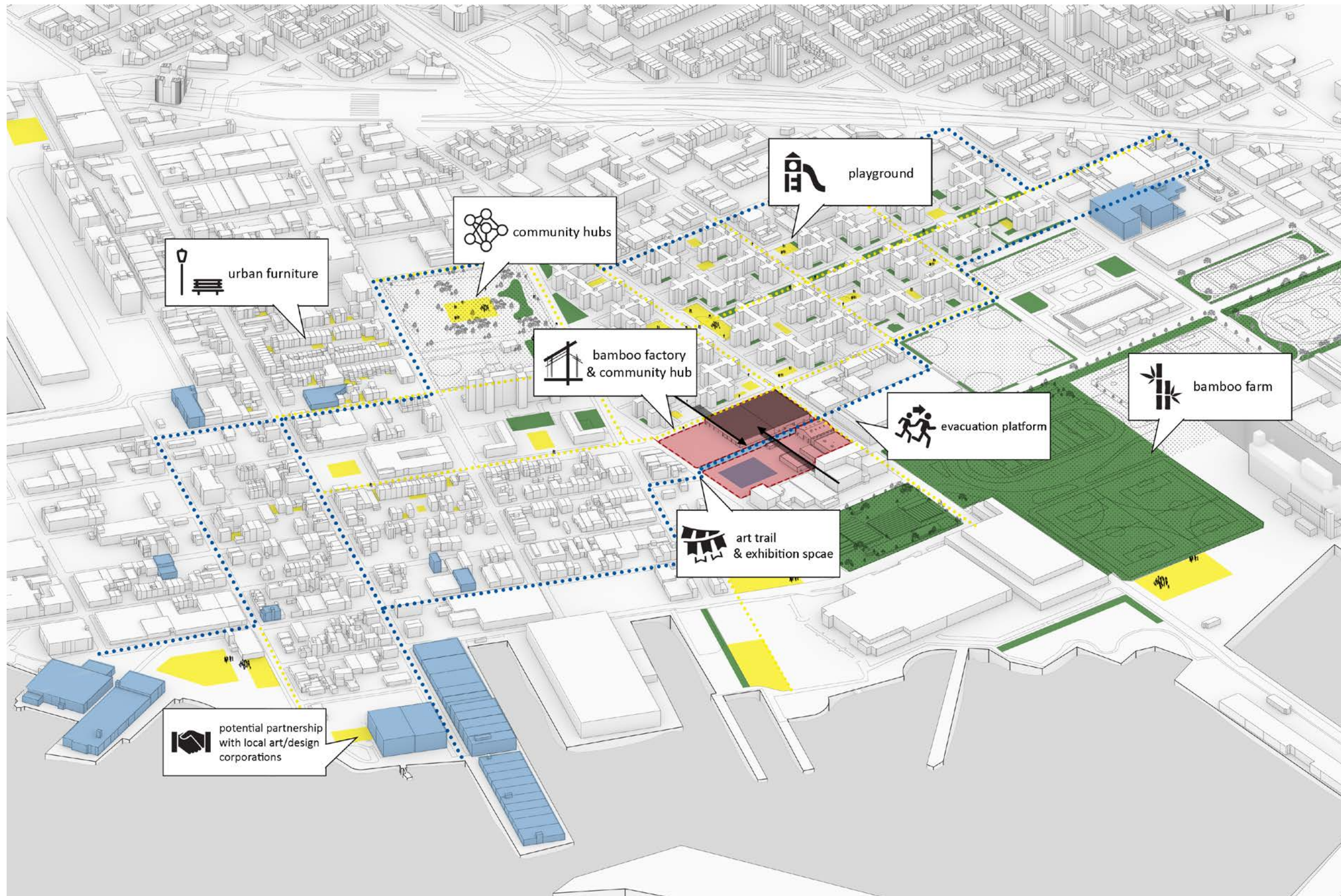
Red Hook Map

Existing Conditions and Concerns:
Urban Segregation, Food Desert, Soil Contamination, Flooding Zone



Analytical Map

Our Planning to mediate problems:
Building extension and Urban Connection, Farm-to-Table, Bamboo Phytoremediation, Evacuation Platform and shelter



Planning for Solution

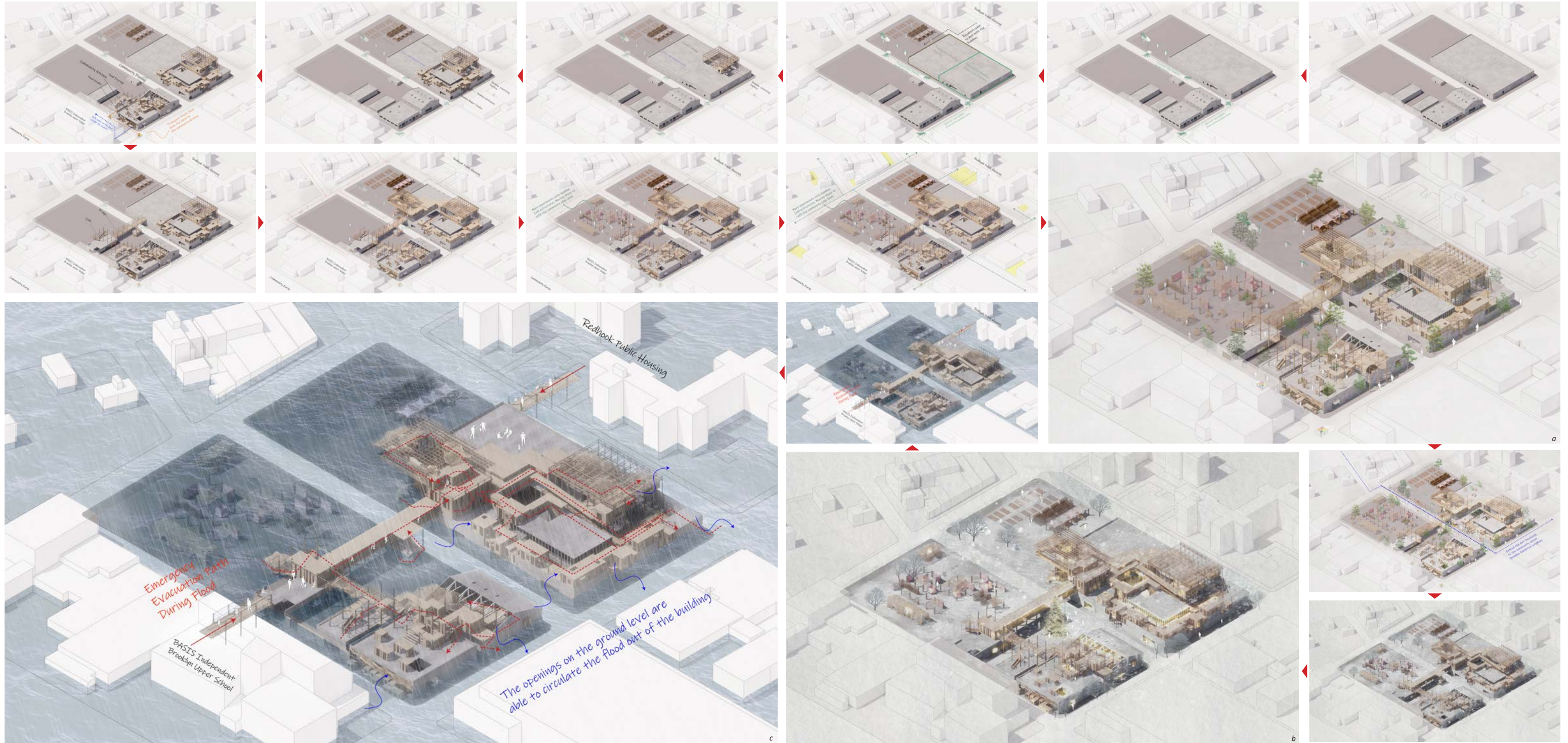
Considering the prevalent challenges, the proposal involves utilizing bamboo as a phytoremediation plant to initially cleanse the recreational park, followed by the local community members to harvest the bamboo to construct a community center in the central red core area, atop an underused garbage collecting center.

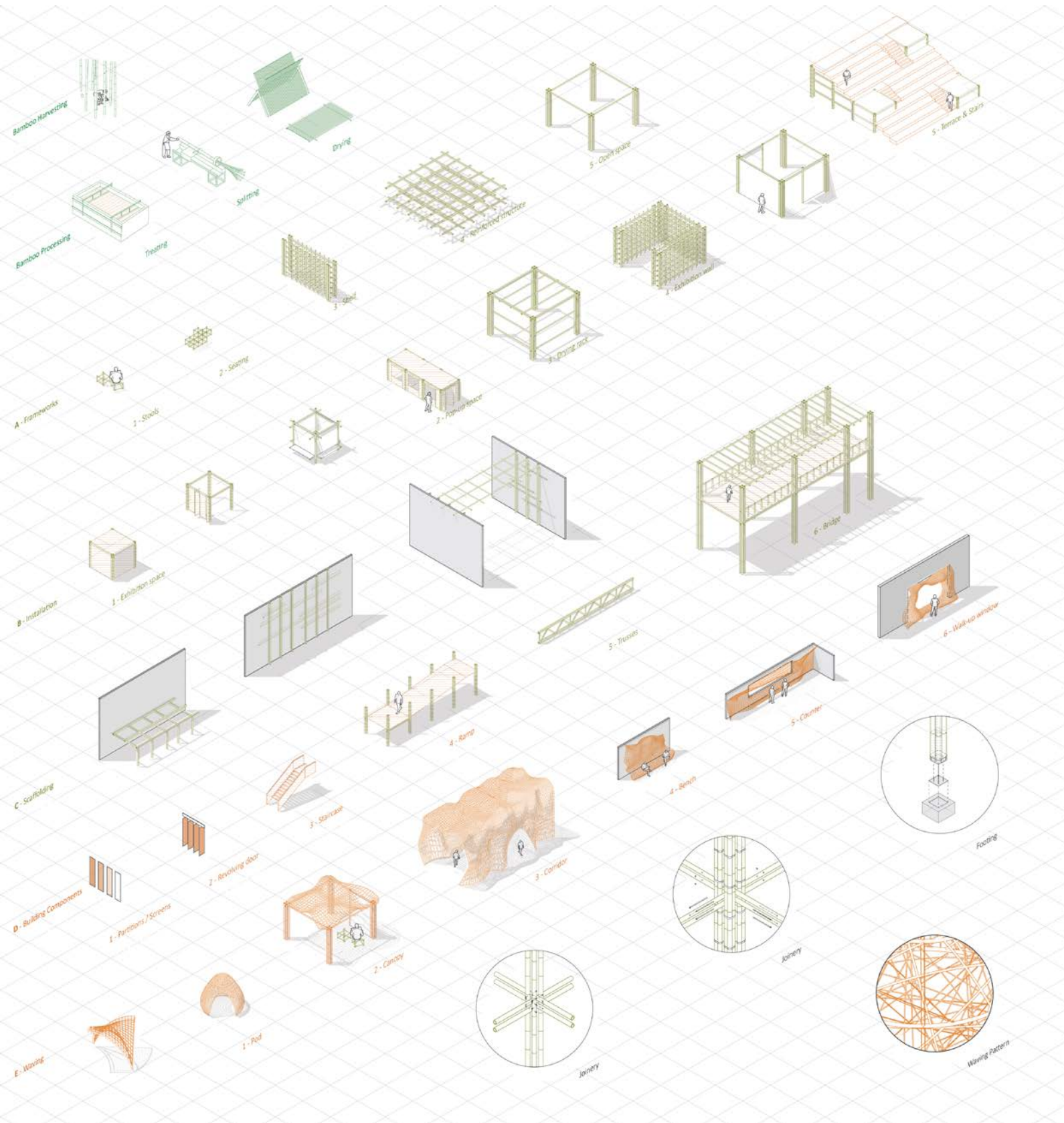
Storyline

This is a close-up view of the central construction site, showcasing the community's active involvement in creating the core community center using bamboo. Initially, existing facilities are repurposed into a bamboo processing facility, with plans for expansion, including a bamboo workshop, artist studios, and a communal kitchen. As self-sufficiency grows, commercial structures attract residents and corporations for collaborations. The micro-system evolves into experimenting with bamboo infrastructures and furniture, benefiting Red Hook. During art festivals, the expanded art trail fosters unity, and in flood seasons, temporary bamboo bridges serve as evacuation routes and shelters. Our bamboo grid system prioritizes flexibility for diverse weather patterns in New York City.

- a. *Summer Scene_ During the summer, we enhance community engagement by adding outdoor urban furniture and installations.*
- b. *Winter Scene_ In winter, most structures are enclosed, and extra insulation layers on wall panels ensure optimal indoor warmth.*
- c. *Flood Scene_ During flood seasons, our elevated ground circulation system effectively controls potential inundation risks.*

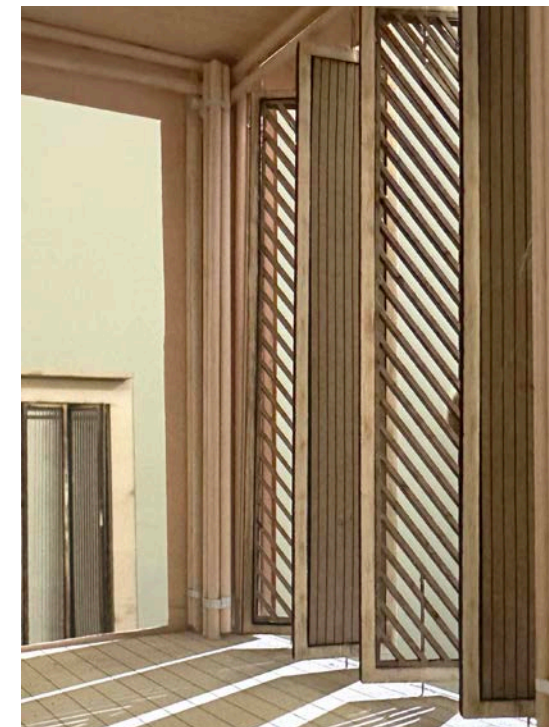
Start





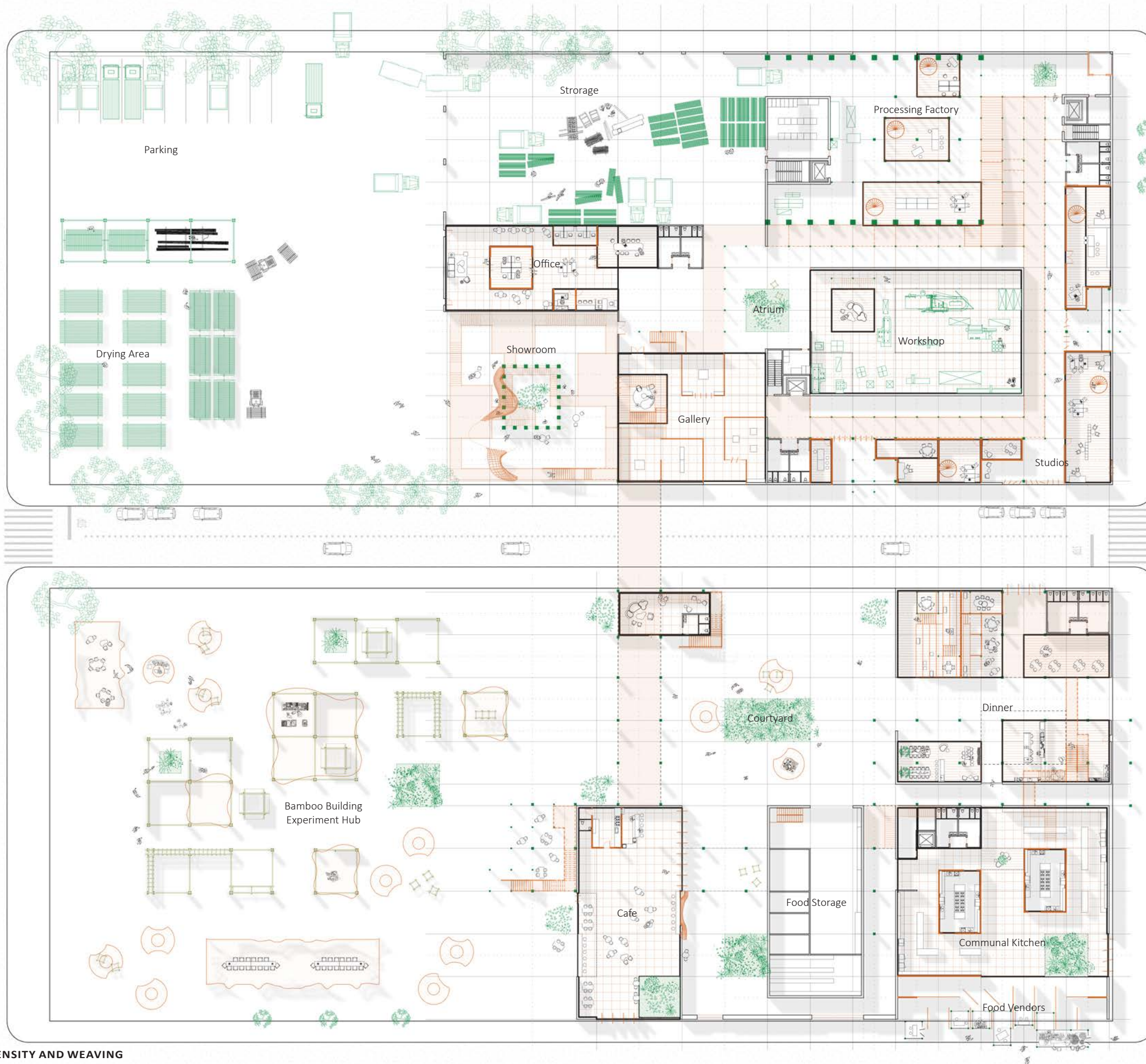
Kit-of-Parts

This diagram serves as a visual representation of our bamboo construction methods, emphasizing the material's flexibility and user-friendly assembly features. By highlighting these attributes, we aim to encourage community members, even those without professional building expertise, to actively participate in the construction of their community hub.



Sketch of Key Moment & Physical Model 1'=1/2"

This collection delves into the nuanced process of forming columns through the strategic arrangement of bamboo clusters of varying scales. Additionally, it explores the innovative utilization of revolving panels to enhance the aesthetic and functional aspects of the facade. It highlights the versatility of bamboo as a construction material.



Ground Floor Plan

Built upon existing structures, our design employs a 20x20 feet grid as the primary column system for innovative bamboo construction. Within this extensive grid, smaller grid spaces are seamlessly connected using bamboo, allowing for flexibility. The ground floor intentionally remains open to cater to bamboo processing, public gatherings, and flood treatment, with circulation elevated to the upper level.

The core design is intentionally porous, featuring partitions and enclosures strategically placed based on programmatic needs. This results in a diverse array of smaller box spaces across the floor plan, promoting density and adaptability.

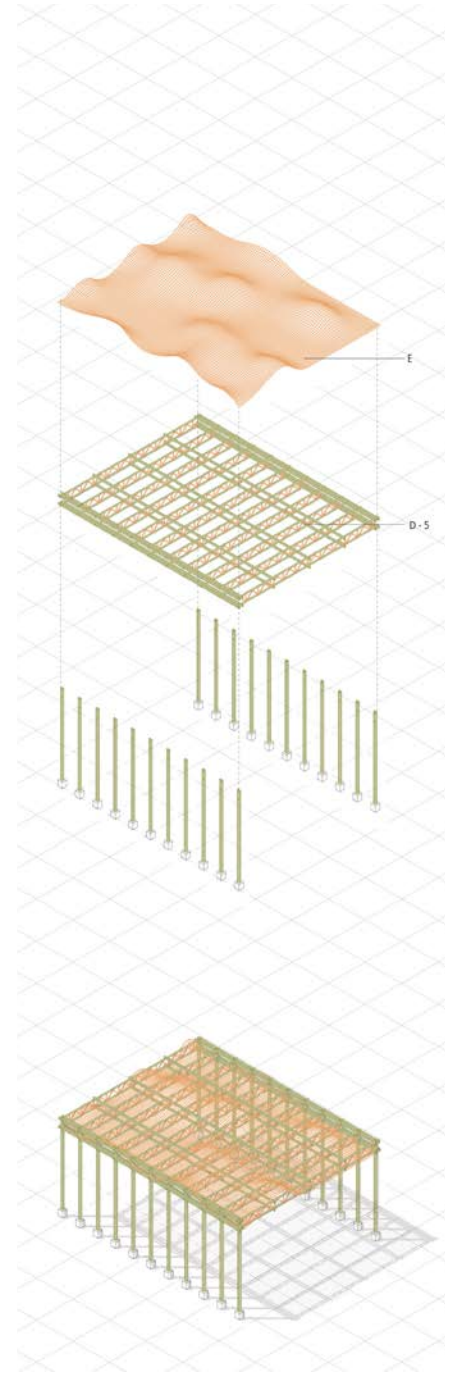
This plan showcases our approach, utilizing bamboo elements of varying scales. It stands as a testament to our dedication to activating underutilized spaces in Red Hook. We envision replicating these elements and interventions across the urban landscape, addressing a spectrum of community needs, fostering inclusivity, and enhancing the social fabric of neighborhoods.

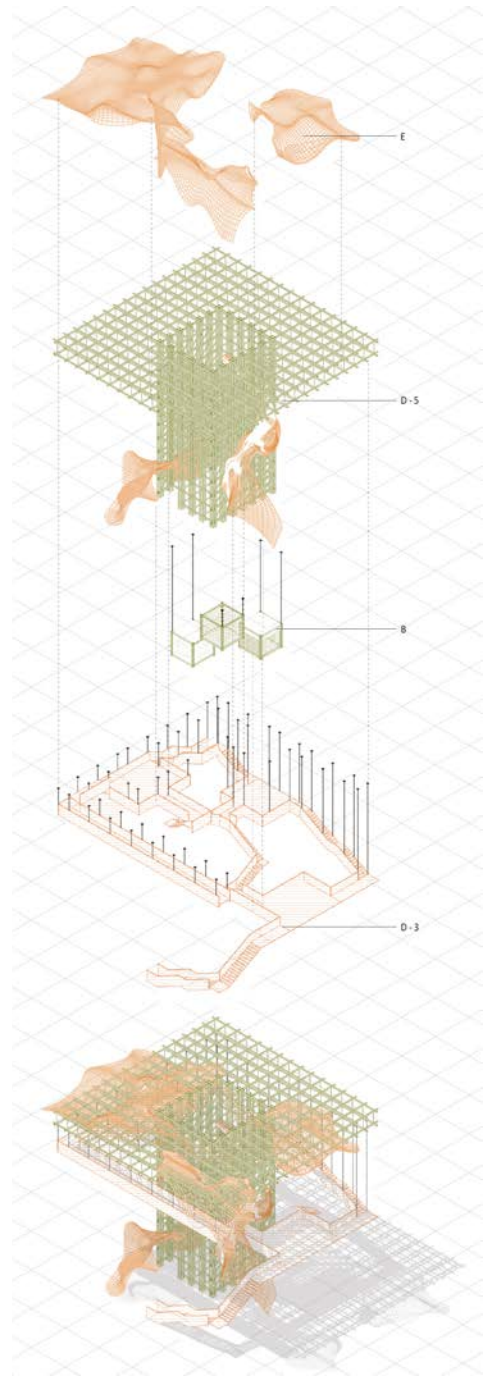


FACTORY
 Hanging box to free up the ground level for circulation and bamboo processing workflow
 Exposed structure with weaving canopy for better air circulation
 Makerspace with replaceable partitions to adapt different seasons

Scene I Workshop

Section Perspective I
 1' = 1/8"
 Factory and Work Spaces





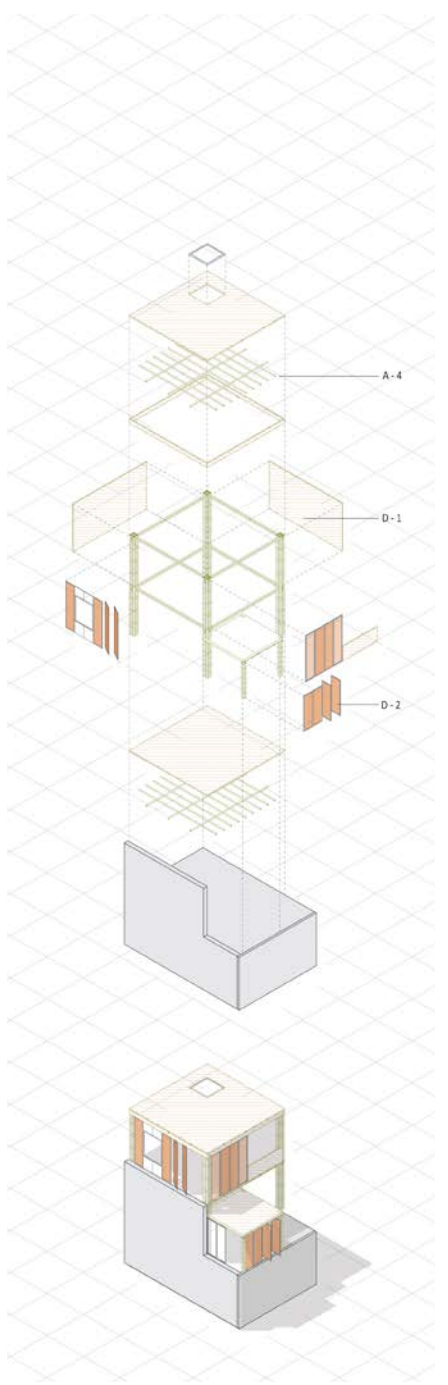
SHOWROOM
Organic weaving skin provides enclosures and becomes an artwork itself.



Scene II Exhibition

Section Perspective III
1' = 1/8"



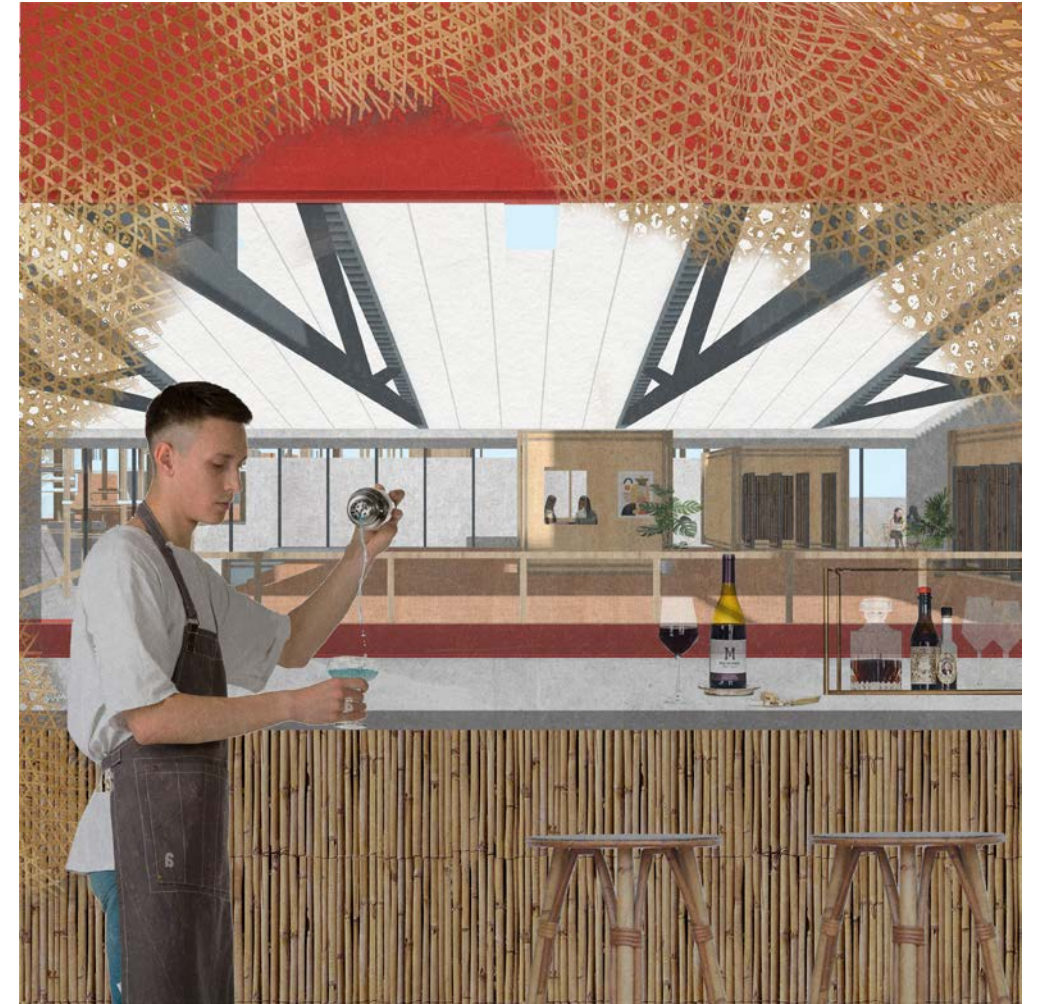




Scene I
Workshop



Scene II
Showroom



Scene III
Hidden Bar

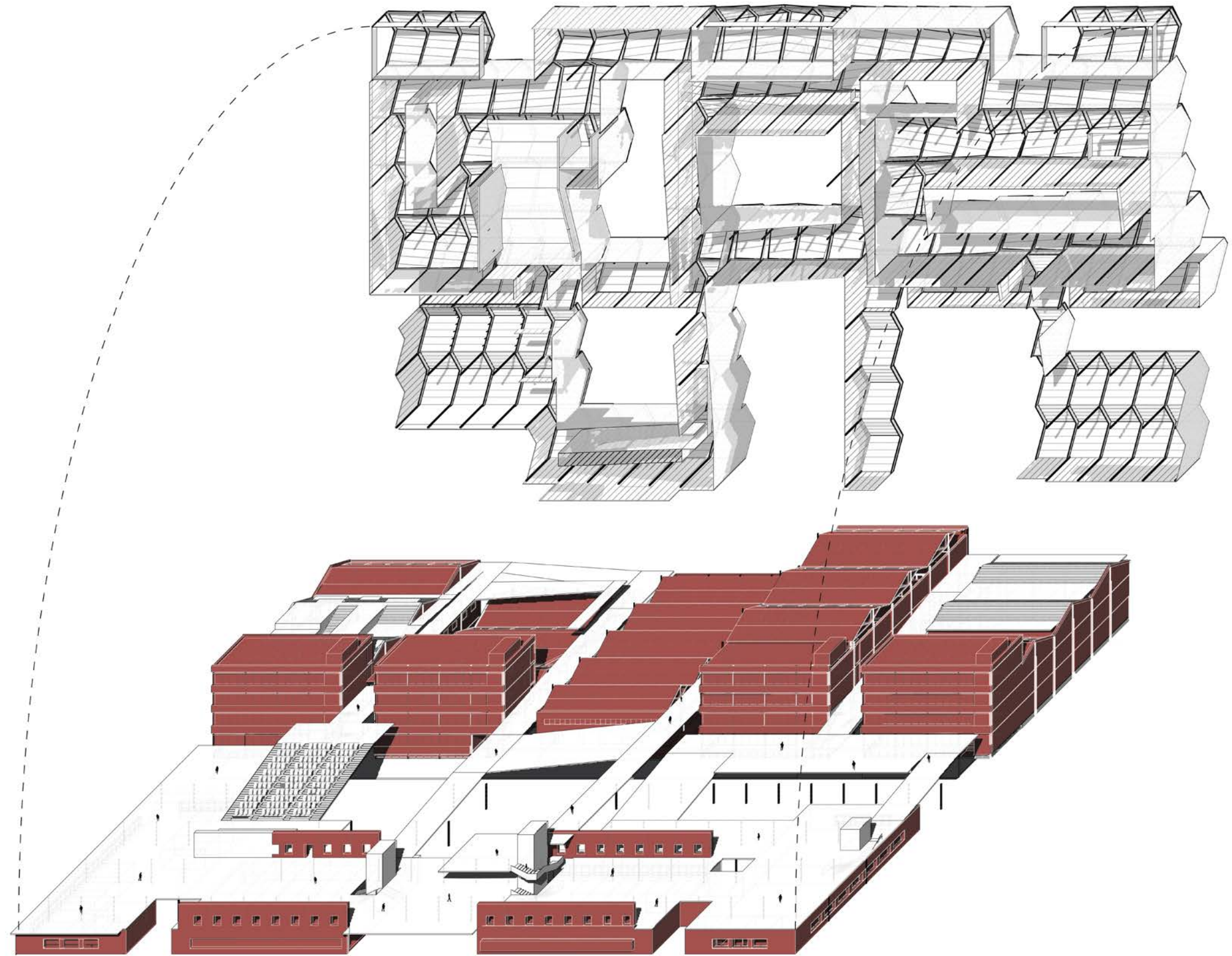
WELD

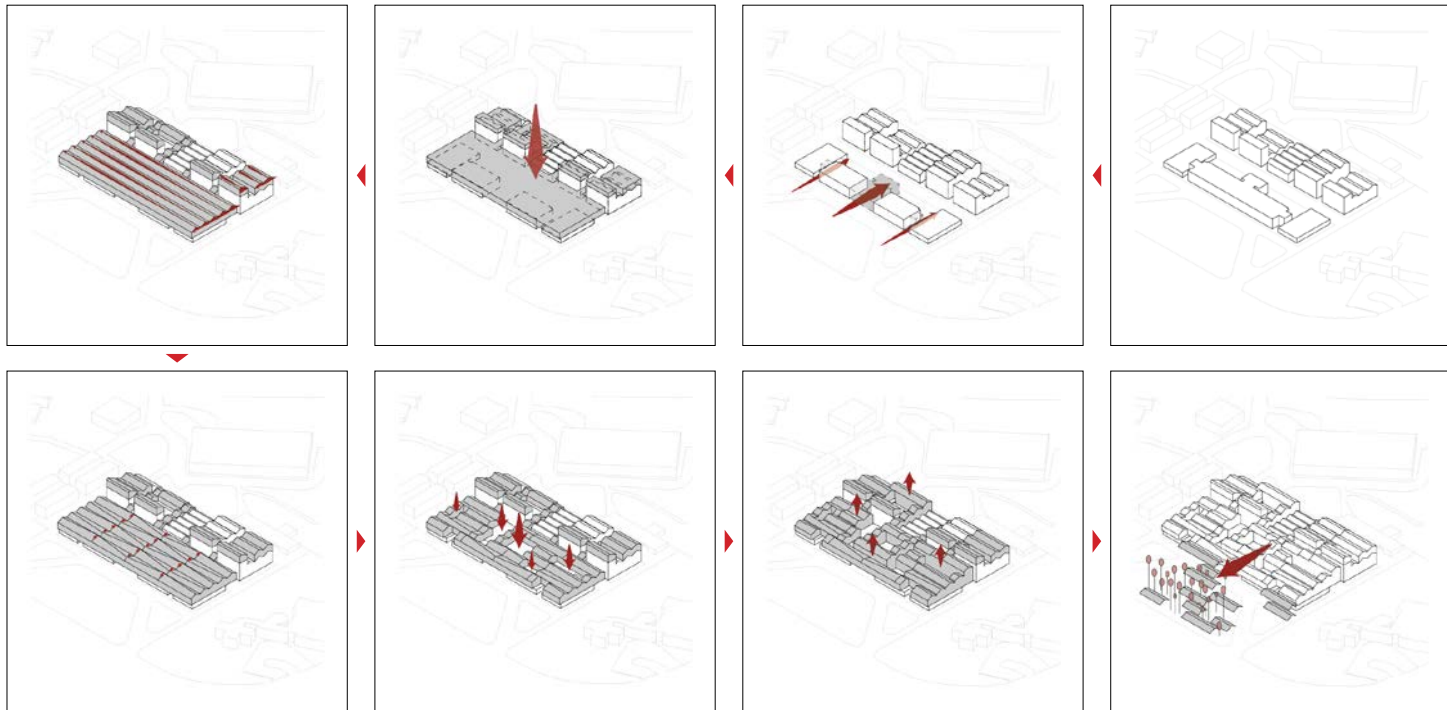
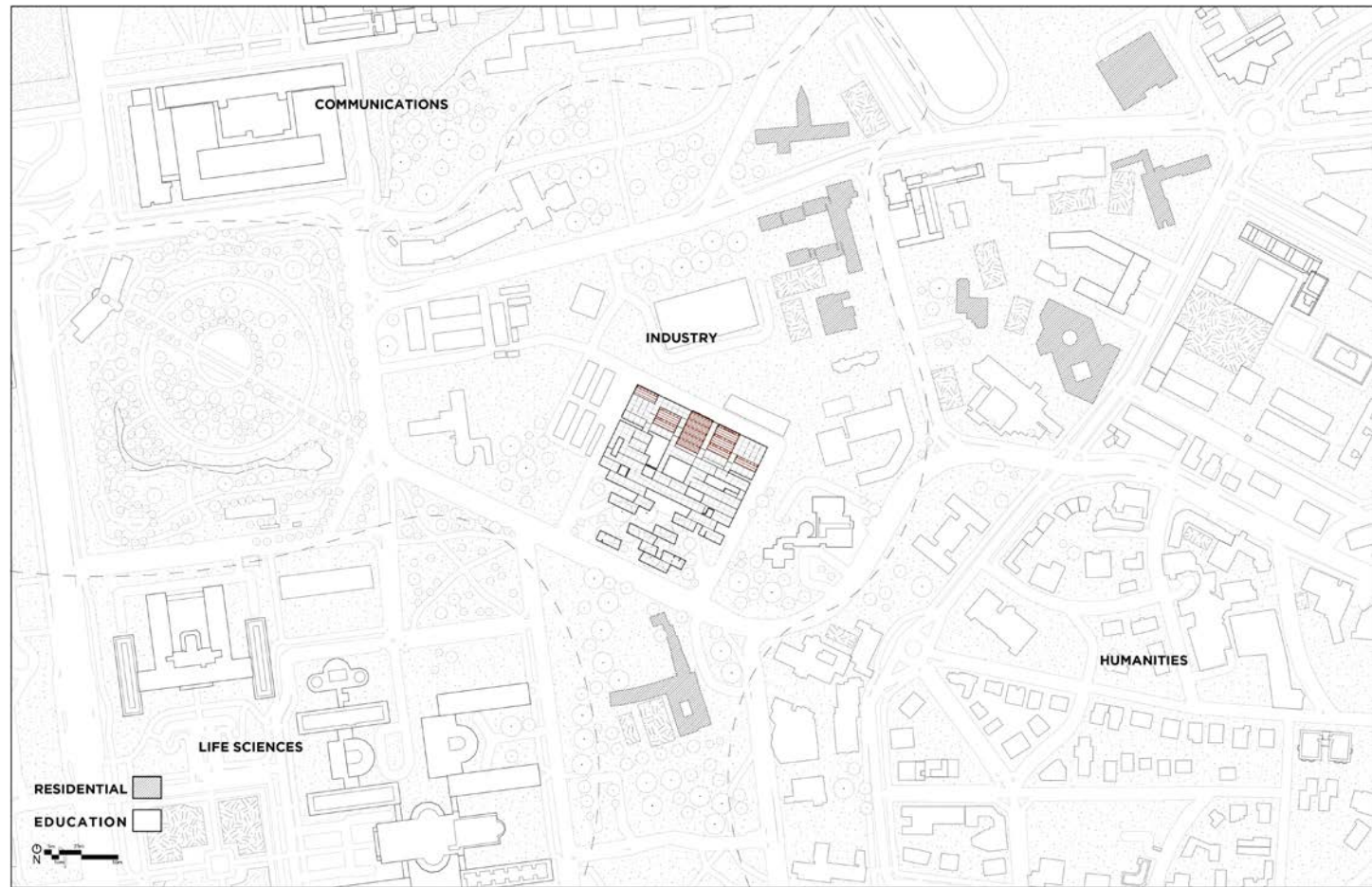
ADV VI Studio

Instructor: Juan Herreros

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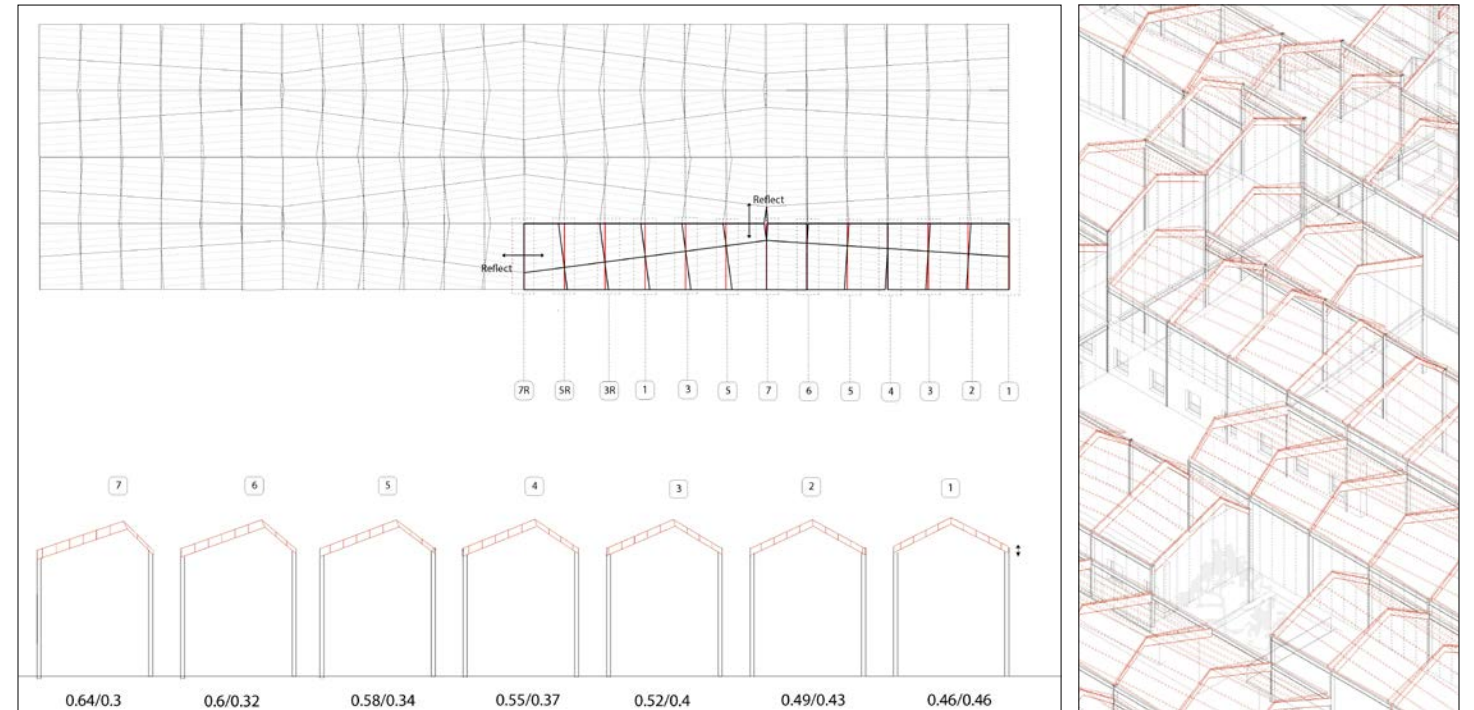
*Site: Av. de Gregorio del Amo, 8, Moncloa - Aravaca,
28040 Madrid, Spain*





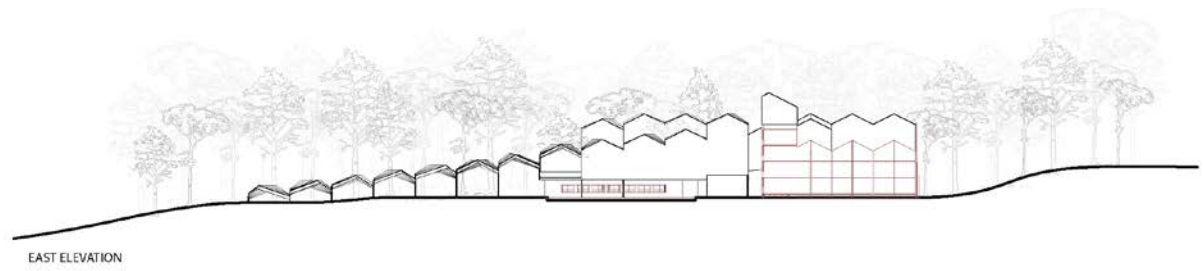
Site Analysis

These photos provide a glimpse into the current state of the building, showcasing its unique features. The exposed steel beams and brick wall infill are emblematic of Alejandro de la Sota's architectural philosophy, emphasizing material authenticity. Outside, the building boasts a front garden adorned with a Roman Pine forest, adding a touch of natural beauty to the surroundings. Stepping inside, the spacious areas on the left are dedicated to housing equipment and facilitating experimental activities, while offices are thoughtfully arranged on the right, promoting efficiency and enabling administrative staff to oversee workshop operations effectively. This thoughtful layout seamlessly blends functionality with architectural design, creating a space that is both aesthetically pleasing and conducive to productive work.

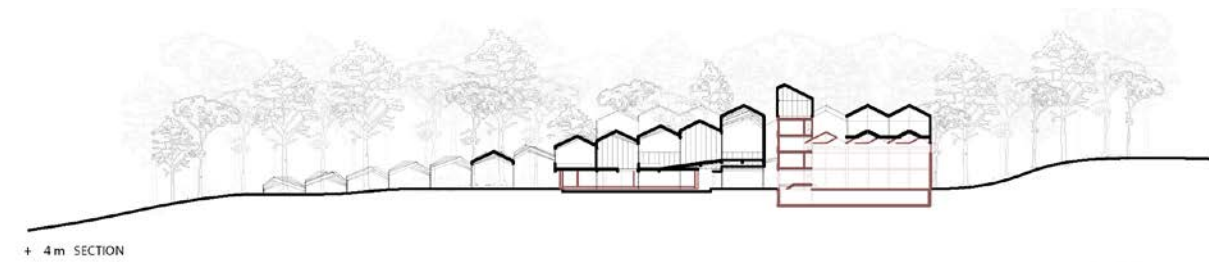


Design Strategy

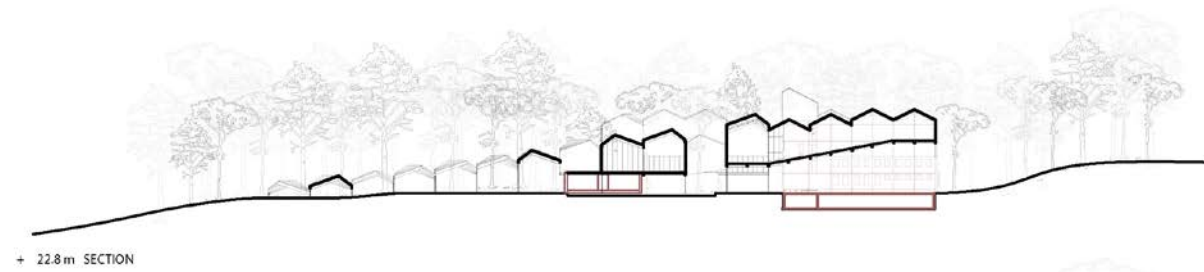
Our design intricately weaves together elements of tradition and innovation, paying homage to the legacy of the sawtooth roof while introducing new dimensions of elegance and functionality. Each frame of our roof design forms a captivating sequence, with gentle sways and rhythmic patterns crafting a vivid spatial experience. To distinguish our approach from De la Sota's emphasis on material genuineness, we incorporate translucent panels that soften the industrial essence and infuse the interior with cleanliness and elegance. Detailed drawings reveal the geometric intricacies of our roof weave and frame types, while an oblique overview showcases the majestic transition from the classical building to our vibrant creation, symbolizing the passage from old to new. Inspired by De la Sota's Maravillas School Gymnasium, we incorporate a forum space atop our factory structure, paying homage to his iconic idea and further enriching our design narrative.



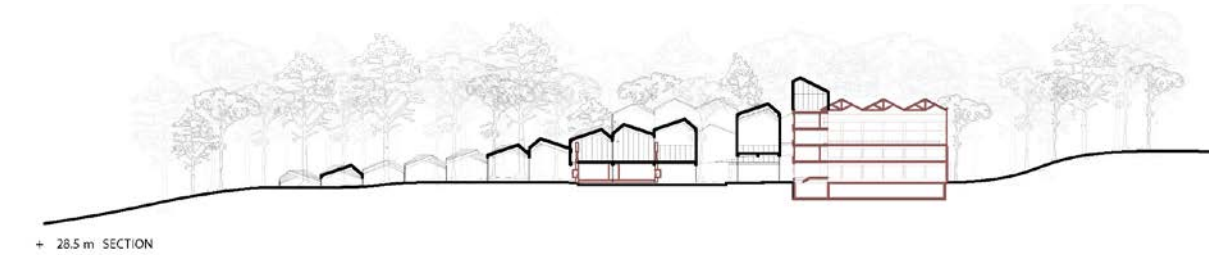
EAST ELEVATION



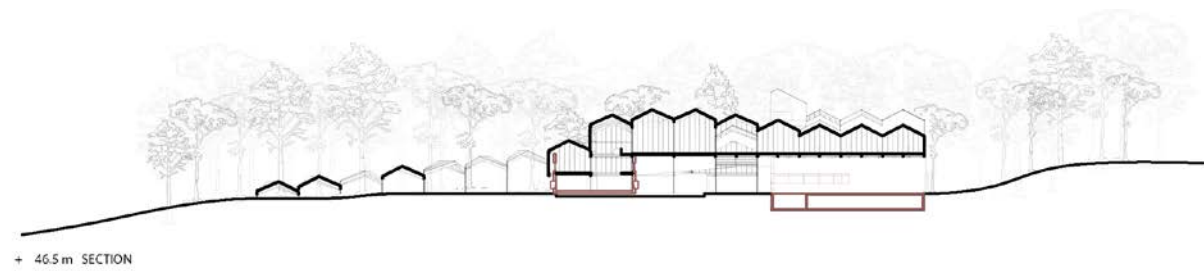
+ 4m SECTION



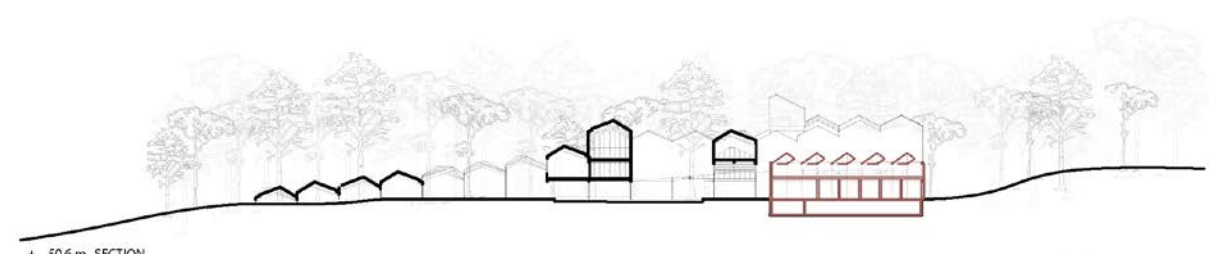
+ 22.8m SECTION



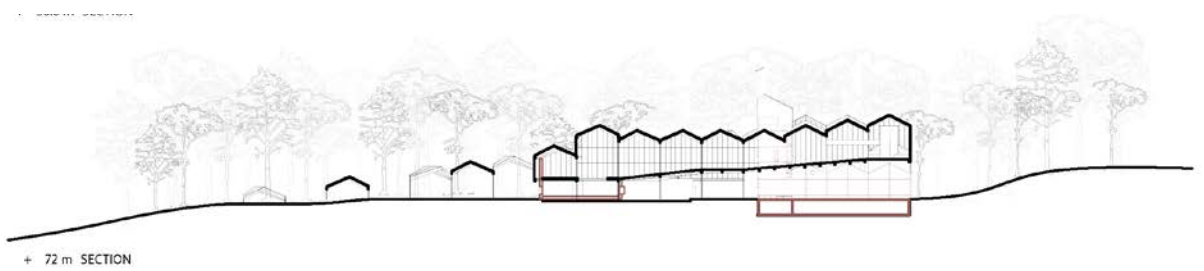
+ 28.5m SECTION



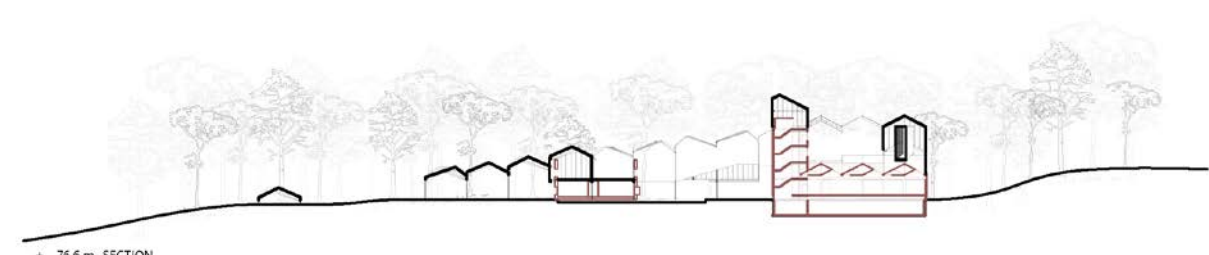
+ 46.5m SECTION



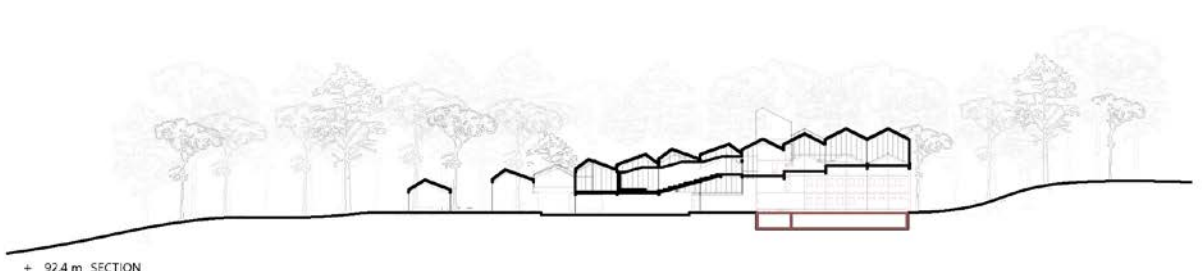
+ 50.6m SECTION



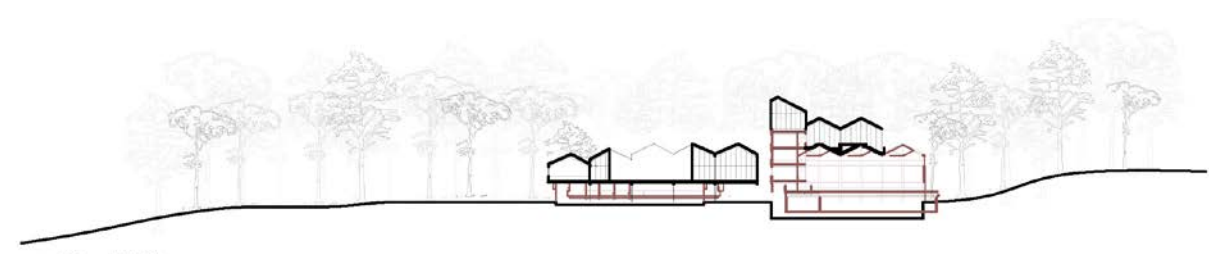
+ 72m SECTION



+ 76.6m SECTION



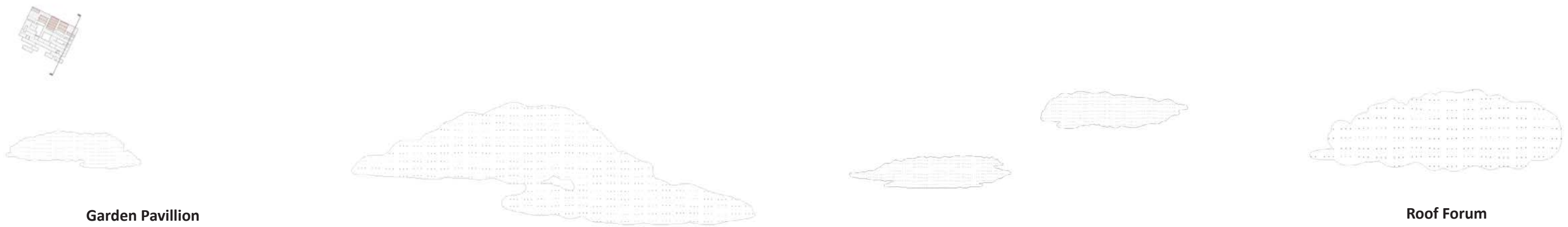
+ 92.4m SECTION



+ 113.8m SECTION

Sectional Sequence

By keeping the majority of the current built environment and building on top and in between of the existing, we carefully maintained a balance between the old and the new. Paying homage at the same time rendering a contemporary reading of the originally industrial buildings, we kept the workshops as making studios with heavy machinery and furthered the sawtooth-roof language and brought dynamic manipulations into the form and space. Maximizing the uses of the making workshops and the gathering spaces, this project welds different student bodies and activities together, and produces flexible potential for future adaptations.



Garden Pavillion

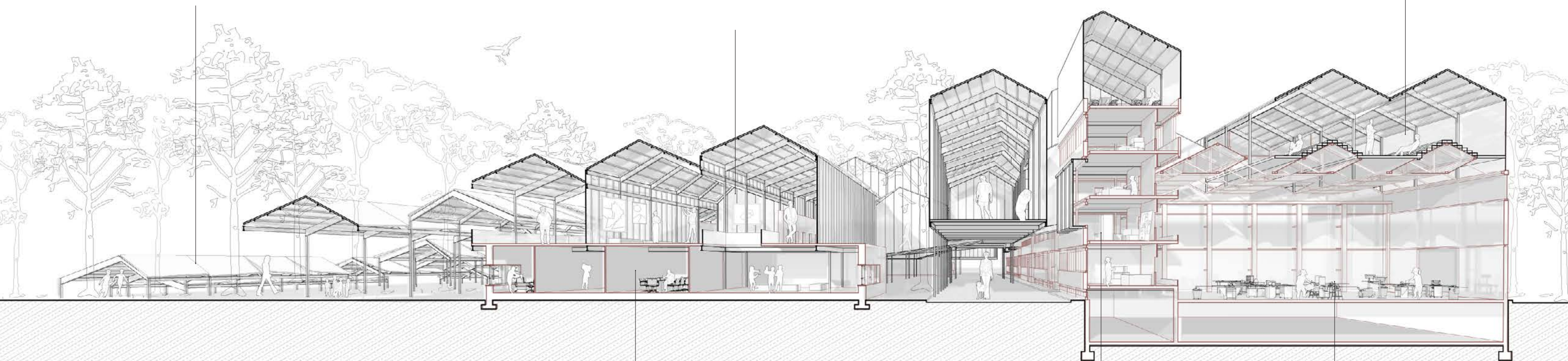
Extending beyond the building's original construction, we have added additional pavilion spaces that incorporate the sawtooth design language, varying in height to offer diverse and engaging entertainment options.

Free-Planed Gallery

We provide a versatile second-floor gallery space for students and faculty to host a diverse range of events and exhibitions.

Roof Forum

In homage to de la Sota's design essence seen in the Maravillas School Gymnasium, our creation features a forum space atop the roof structure as its signature touch.



East Section Perspective

This section perspective showcases the varying heights of our newly constructed structure, providing a gradient that emphasizes its architectural dynamics. Additionally, it highlights different instances of people interacting with both the new and old elements of the environment, capturing the blend of tradition and innovation within our design.

Administrative

We preserve the old building and maintain its purpose as research and administrative usage.

Visible Art Storage

The compact tower serves as storage space for artworks, with its glazed glass walls providing visibility for passersby on the adjacent walkway, effectively turning it into an alternative venue for exhibiting artworks.

Maker Space

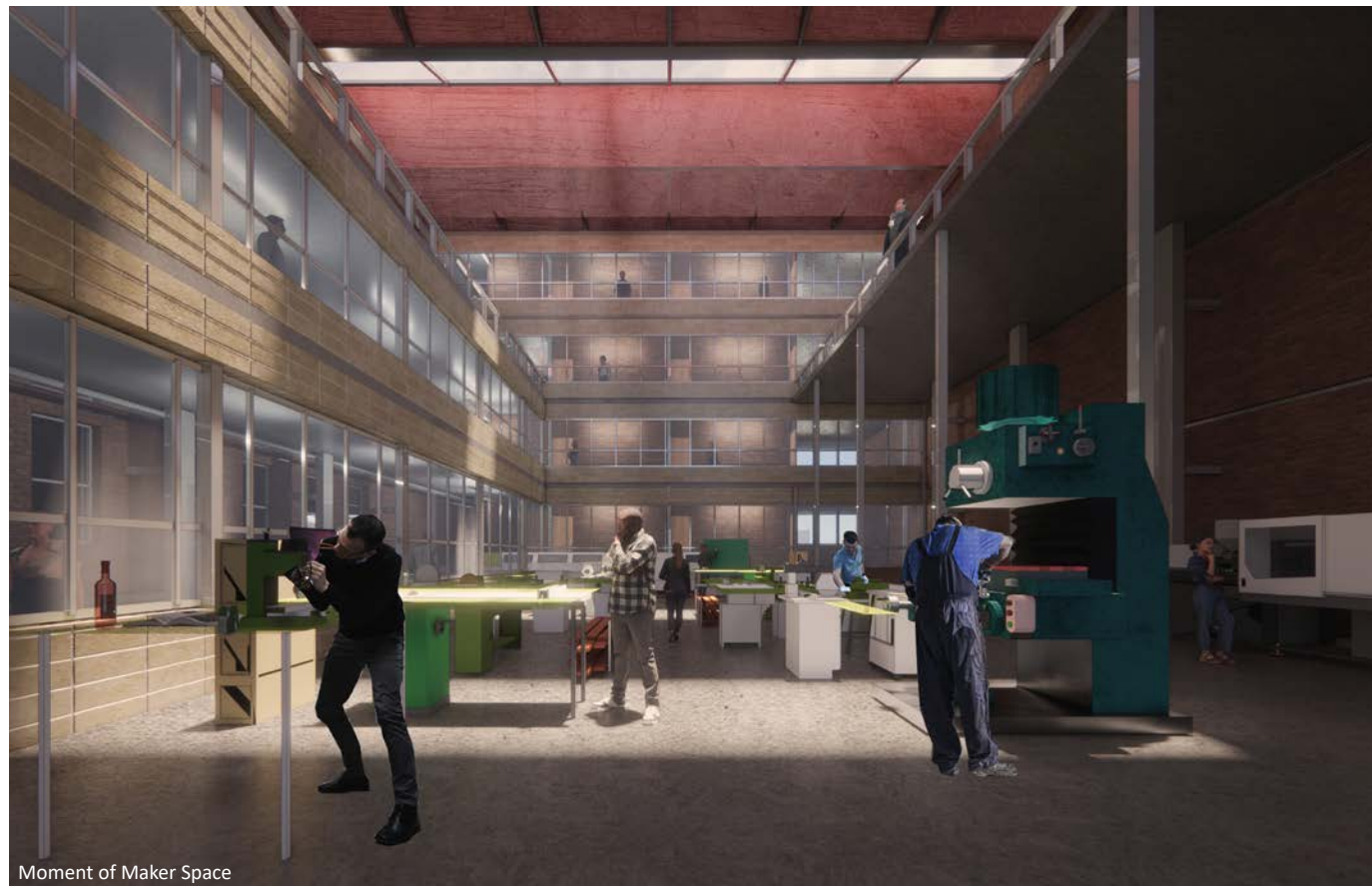
We preserve the old building and maintain its purpose as a maker space for student creations.



Moment of Roof Forum



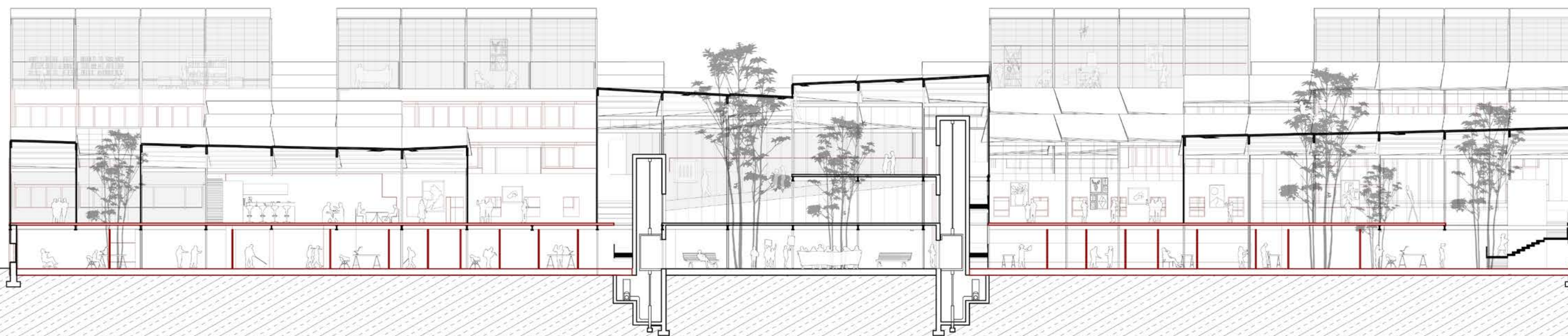
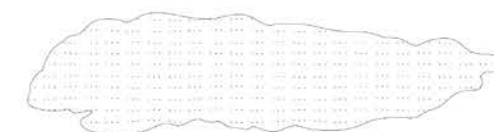
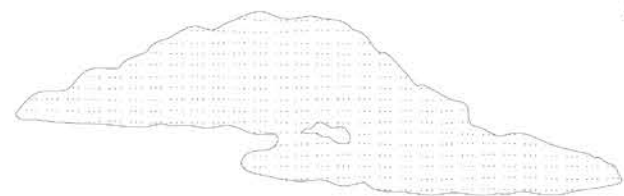
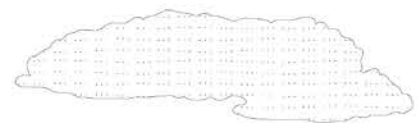
Moment of Gallery



Moment of Maker Space

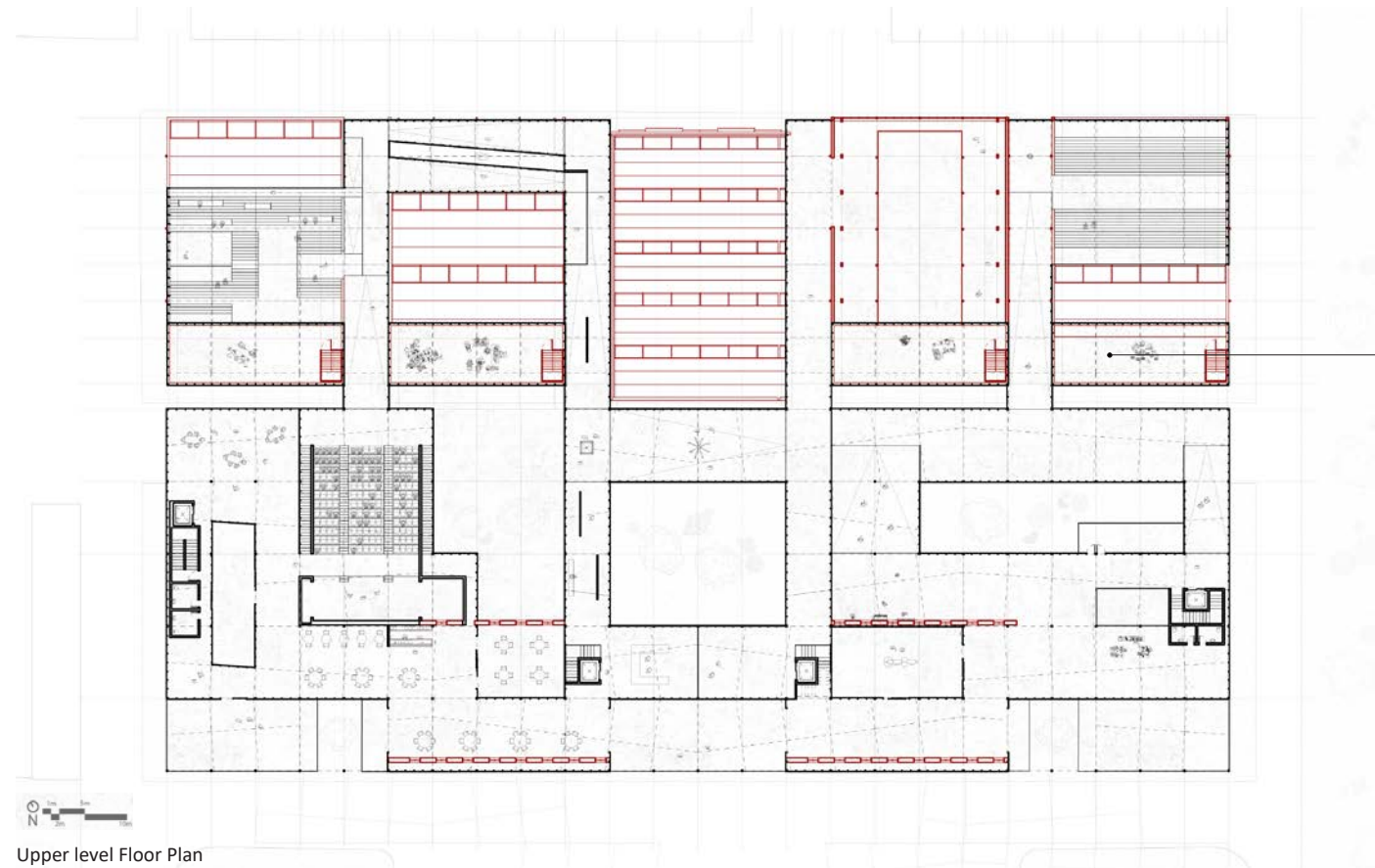


Moment of Garden Terrace



South Section Perspective

This section perspective showcases the basic layout of our structure: the second floor houses gallery spaces, while the first floor contains research and administrative areas. Additionally, it highlights the varying heights of courtyard spaces within the complex and captures different instances of people interacting with both new and old elements of the environment, illustrating the blend of tradition and innovation in our design.







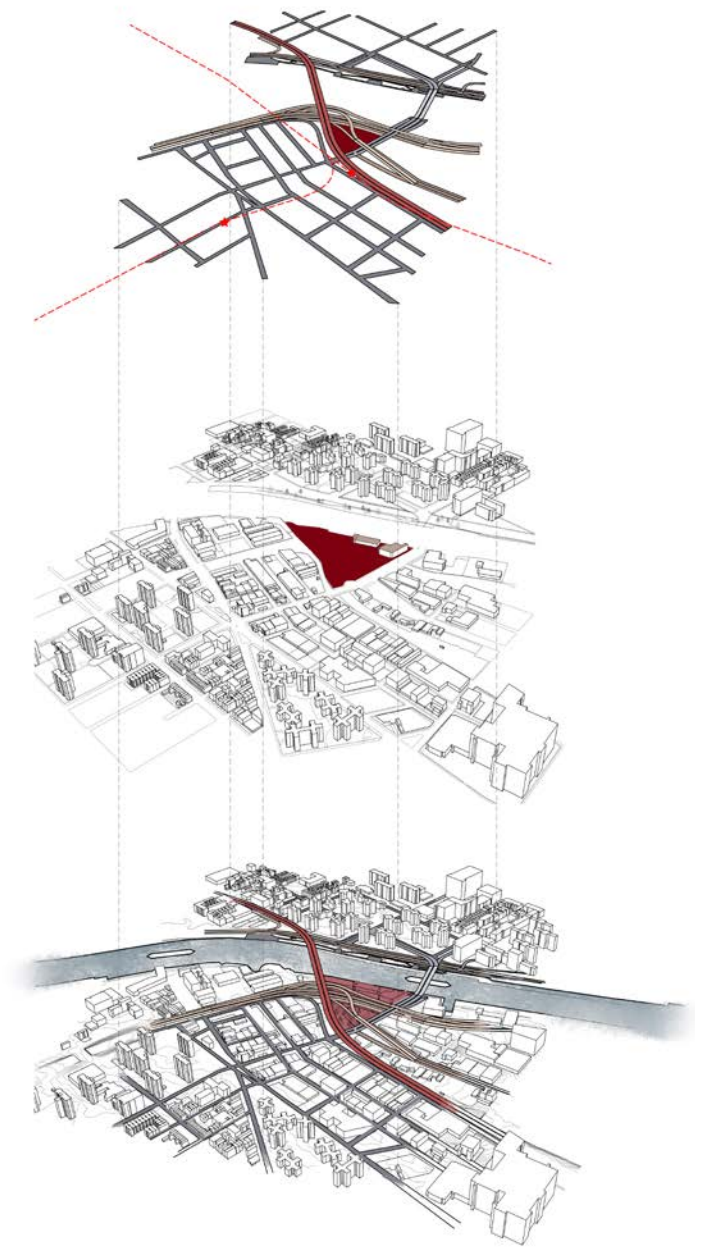
SPECTRUM RESIDENCES

Core III Studio

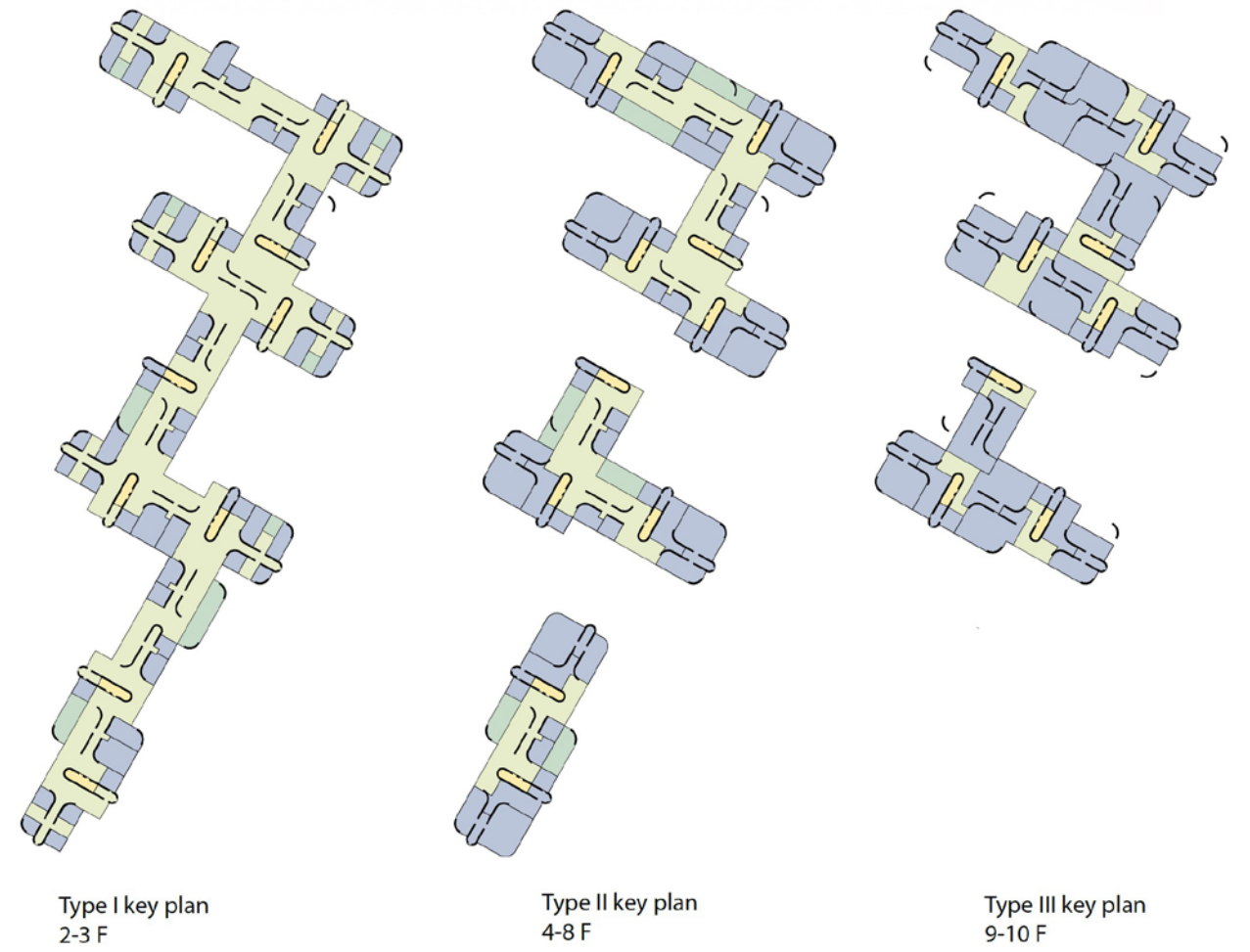
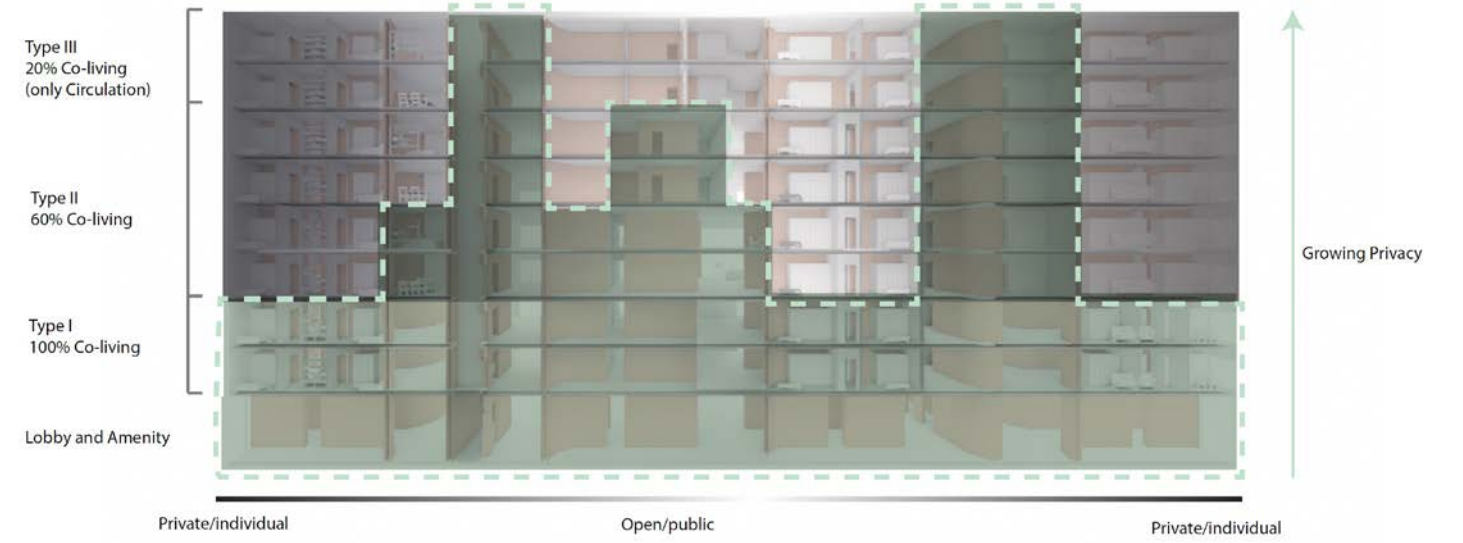
*Instructor: Benjamin Cadena
Fall 2022 | Collaborate with Yichun Liu
Site: East 138th St, the Bronx*

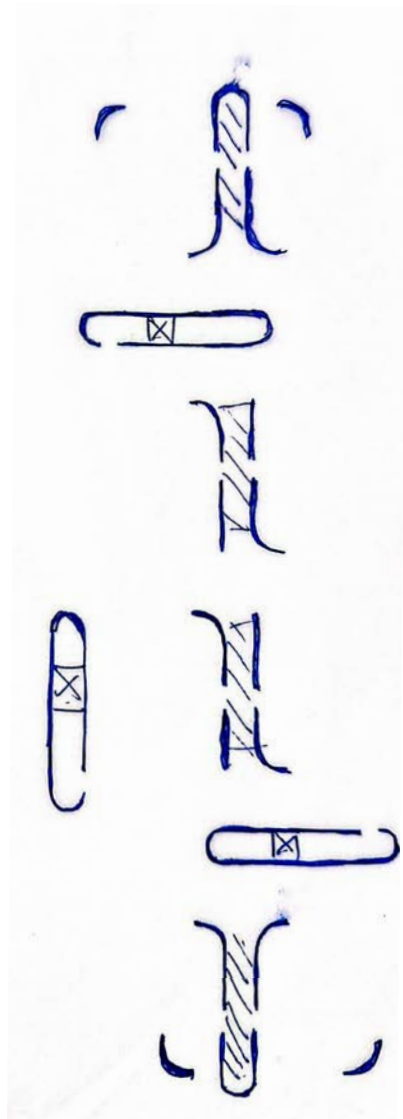


Arial Building Axon





Site Analysis Sketch



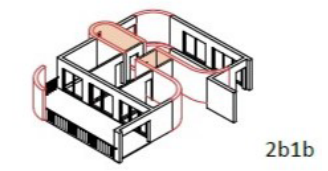
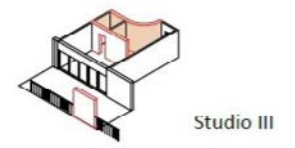
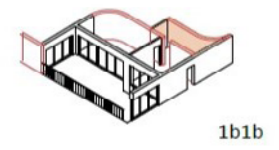
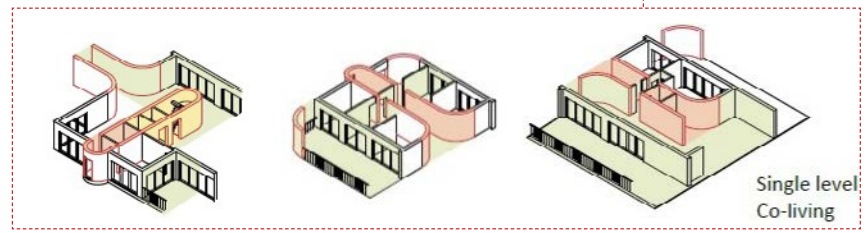
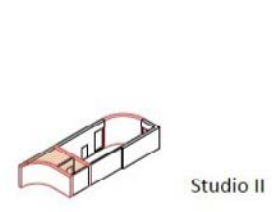
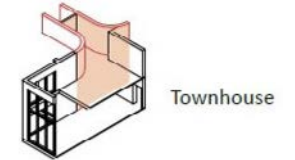
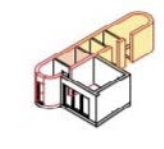
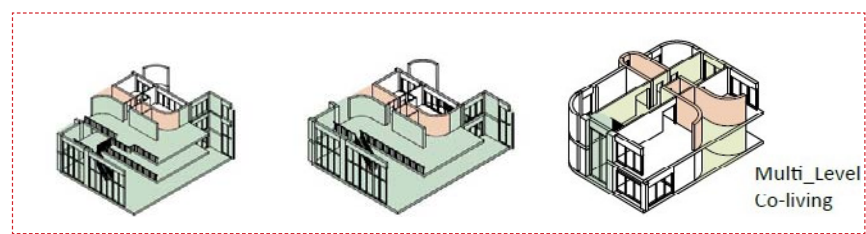
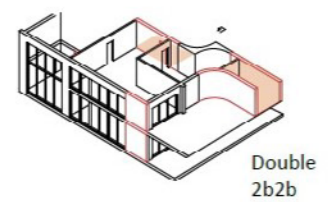
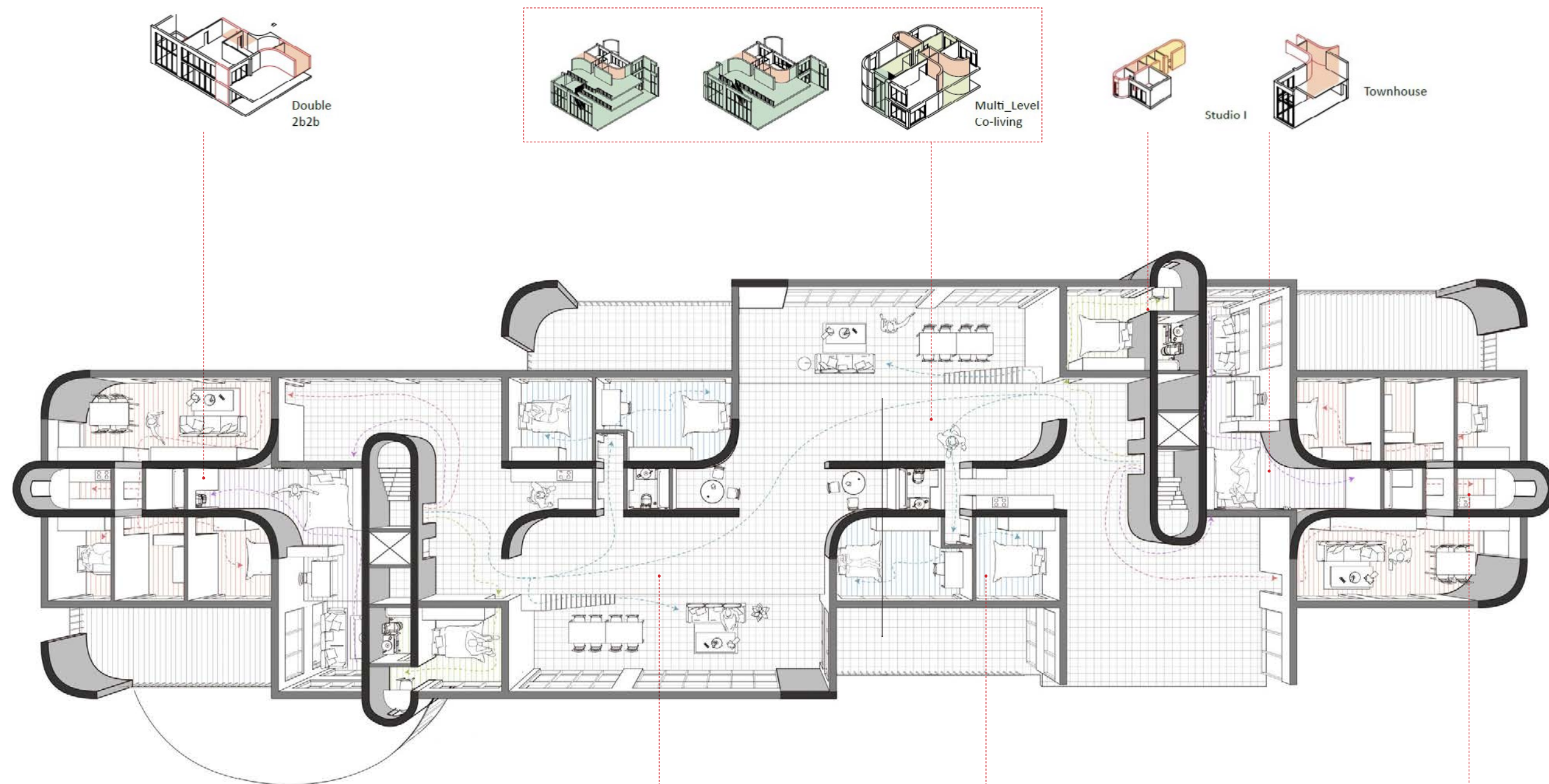


Structural Core.

-  Kitchen
bathroom
-  Circulation
elevator.



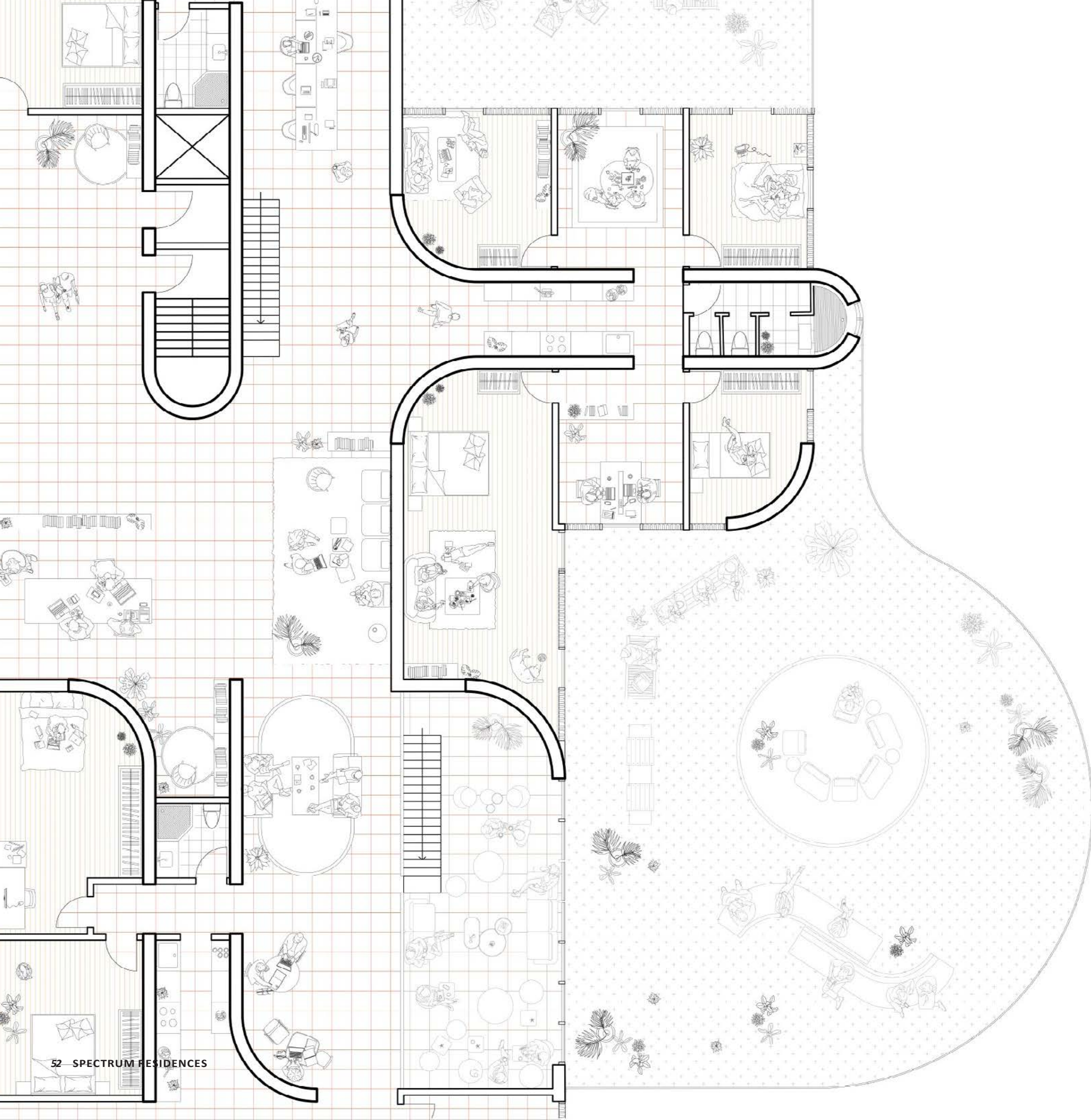
- Co-living Area
- Co-living Area Multi-level
- Structure Wall/Infrastructure Unite
- Private Area
- Circulation Core





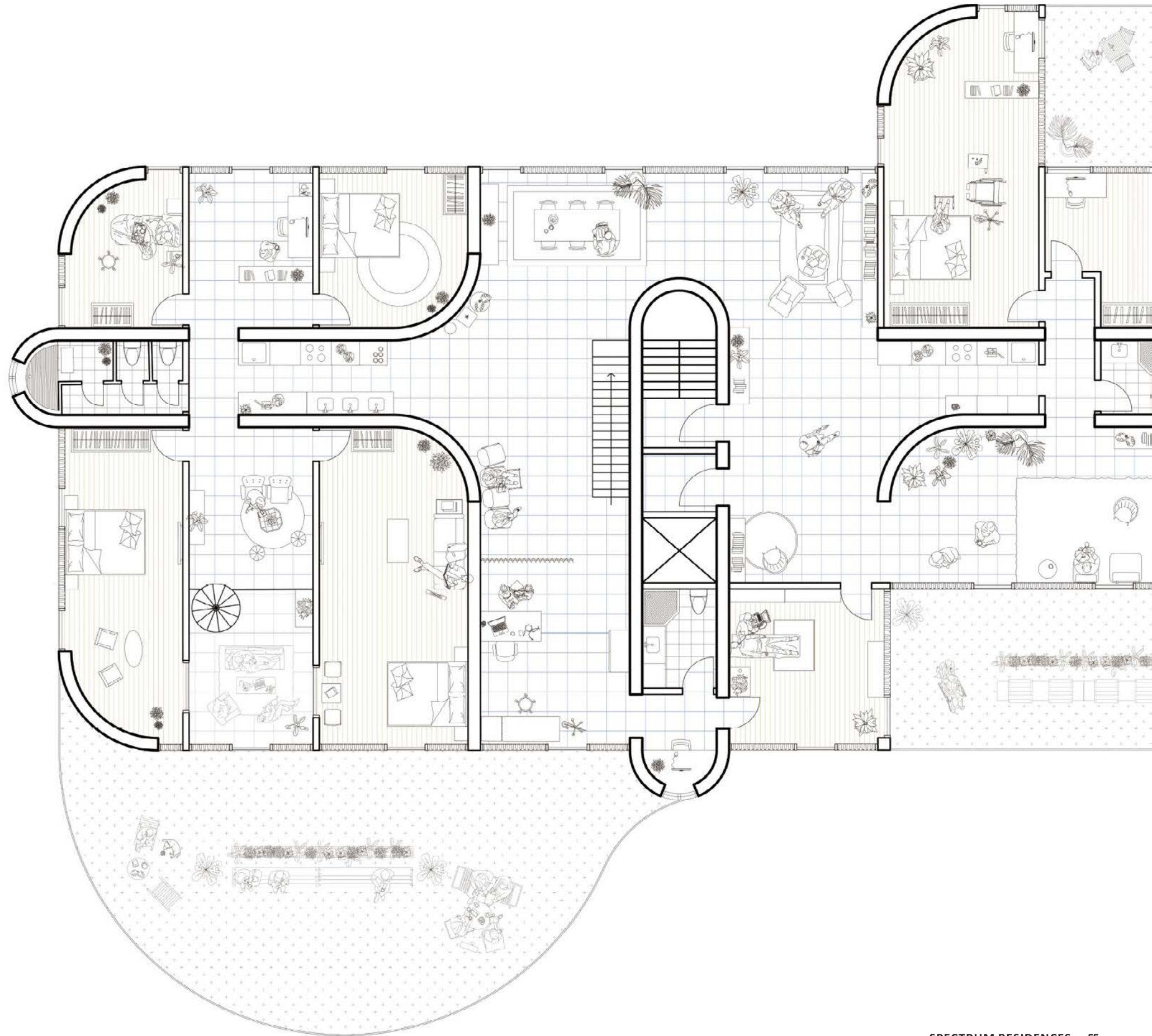
Offering various co-living arrangements tailored to meet the diverse needs of distinct groups, encompassing families with children, young individuals, whether single or married, and the elderly.

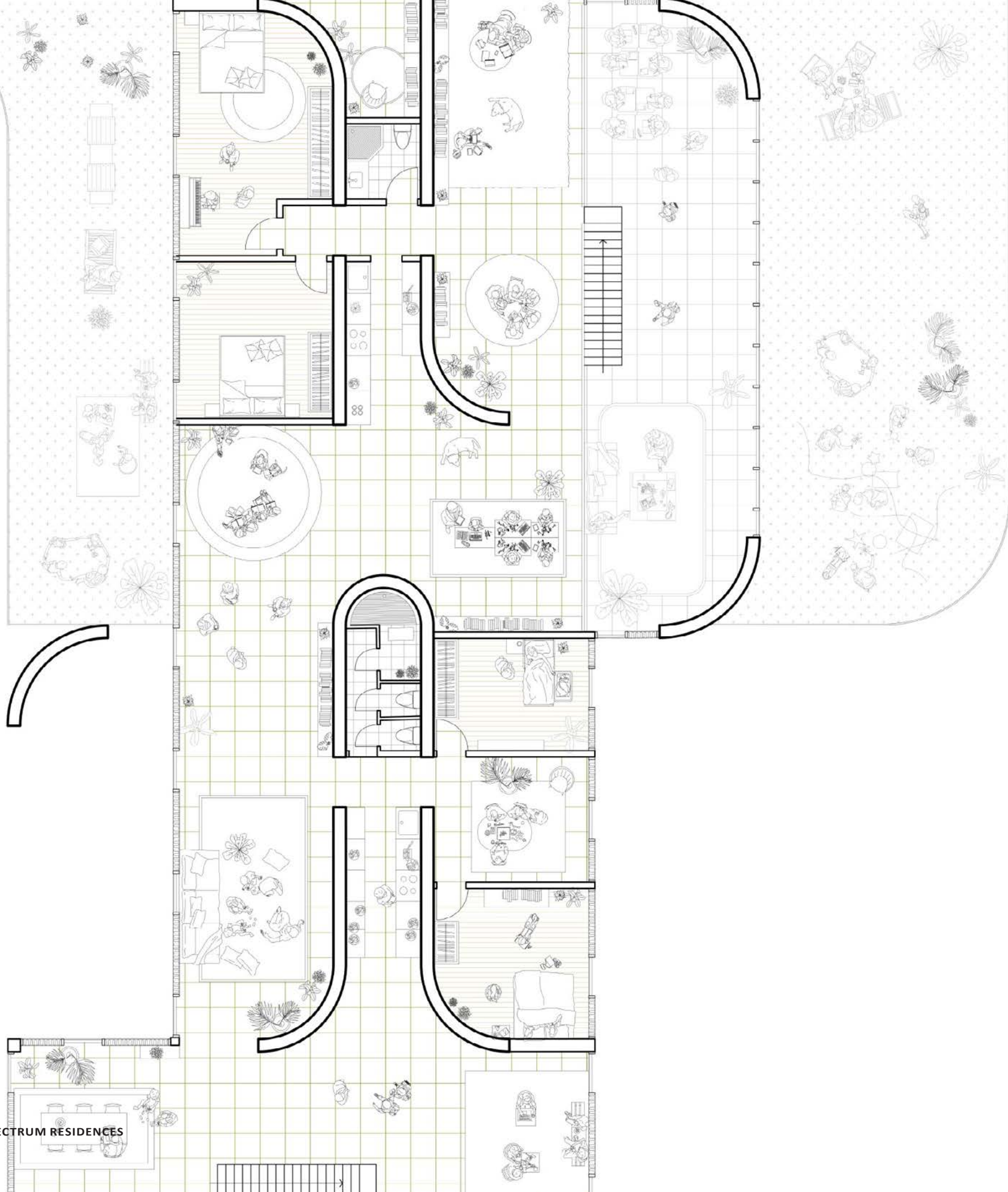
Section Perspective
Scale: 1'-0" = 0'-1/8"





Co-living for Elderly





Co-living for Families

An architectural rendering of a coastal structure. The structure consists of several tall, cylindrical concrete pillars of varying heights, some with perforated surfaces. Two larger, rounded concrete structures are integrated into the design, one on the left and one on the right, both featuring vertical slits and small square openings. The pillars are situated in a shallow, marshy area with tall grasses. In the foreground, a small wooden boat with a person inside is on the water. The sky is a mix of soft pinks, oranges, and blues, suggesting a sunset or sunrise, with numerous birds flying around. The overall style is a detailed architectural illustration.

ADAPTABLE SHORES: A TIMELESS COASTAL ODYSSEY

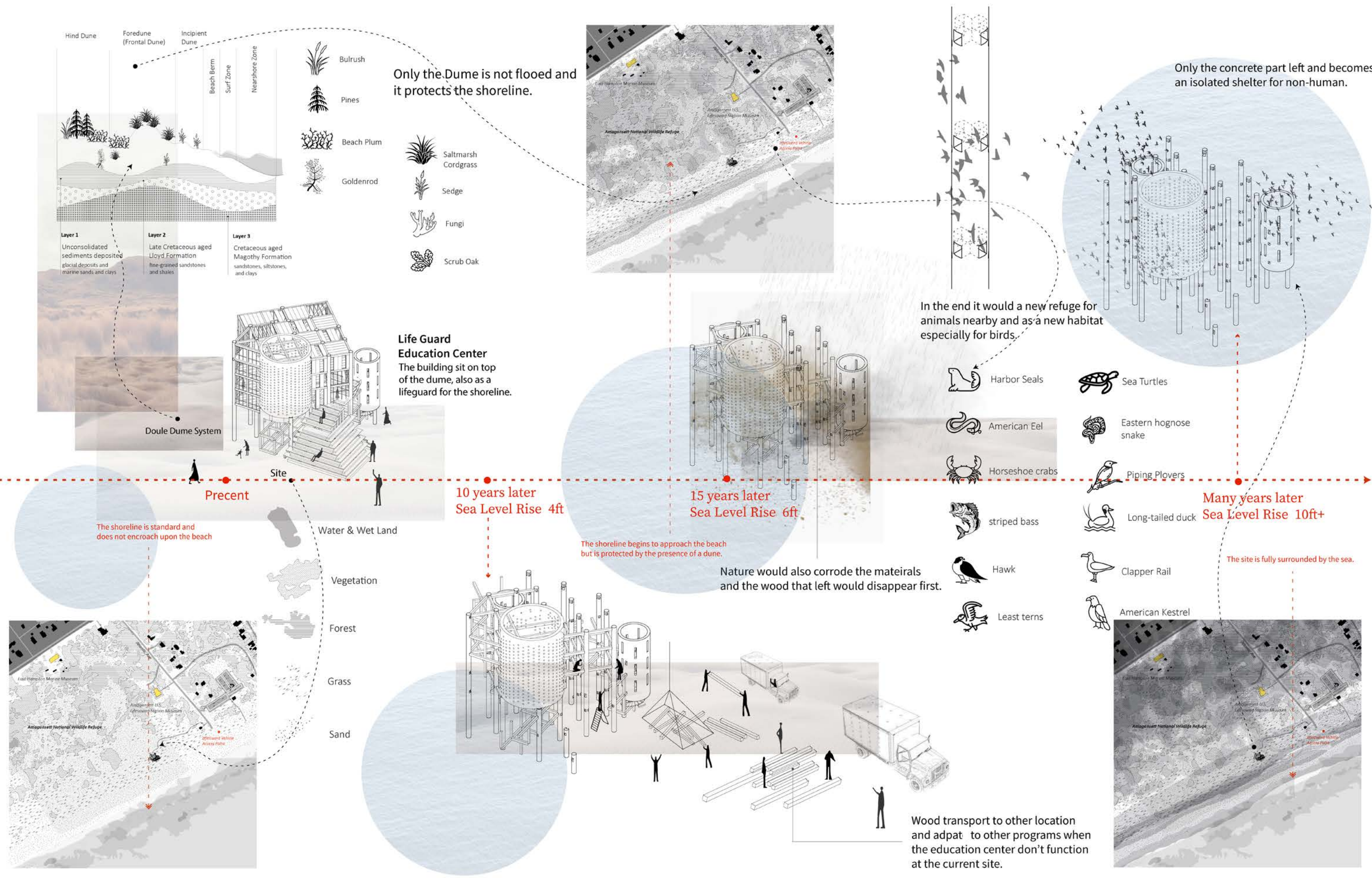
ADV IV Studio

Instructor: Robert Marino

Spring 2023

Individual Work

Site: Atlantic Avenue Beach, Amagansett, NY

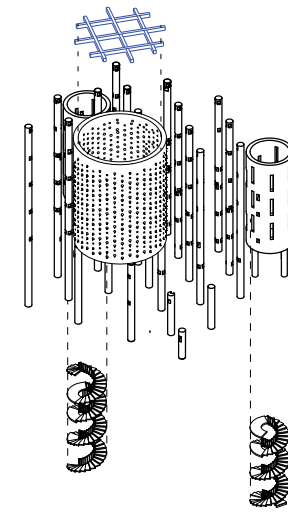




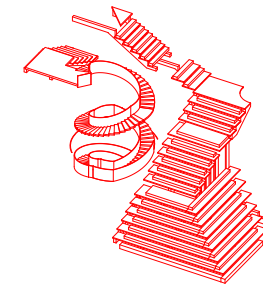
TIMELESS

+

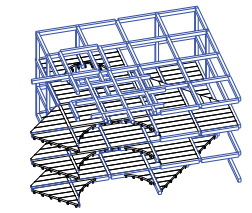
EPHEMERAL



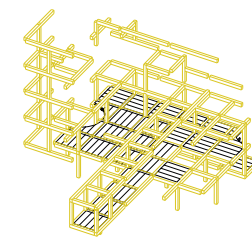
Concrete Support +
Secondary Circulation



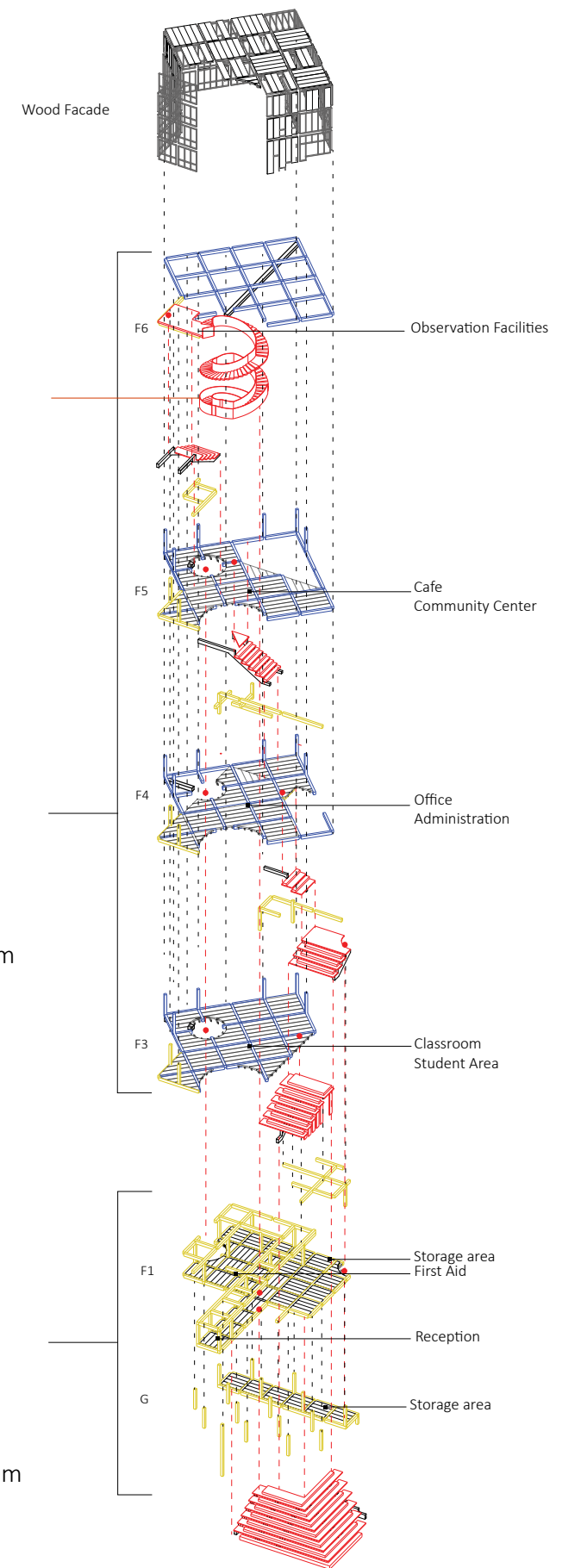
Wood Circulation

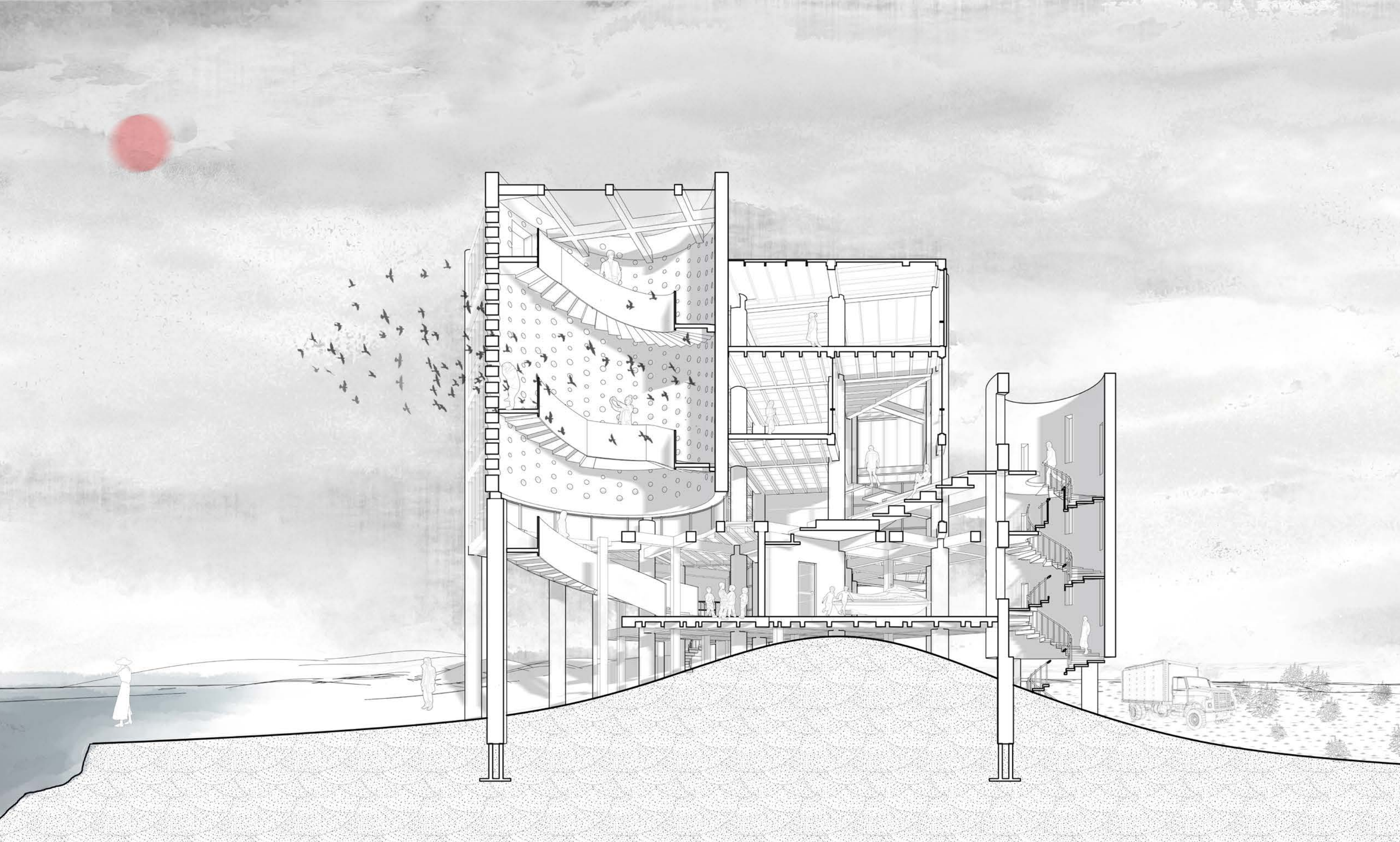


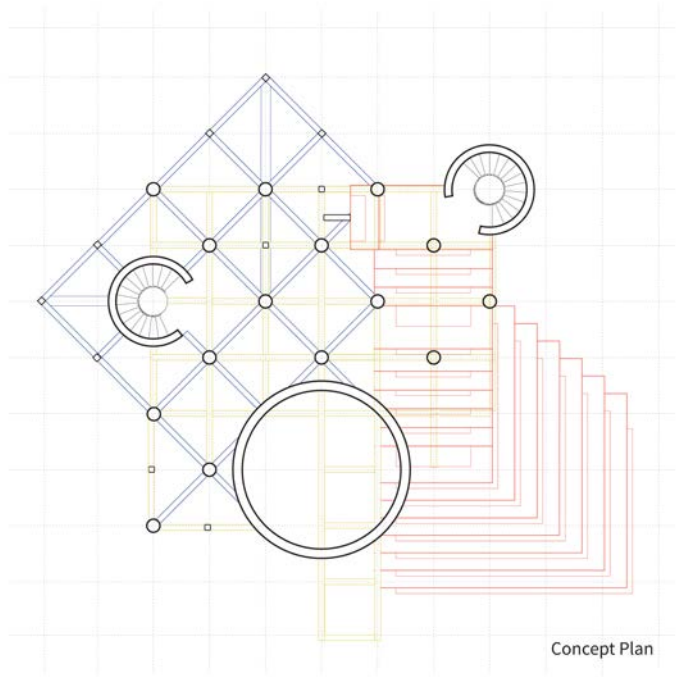
Wood Beam System
Diagonal



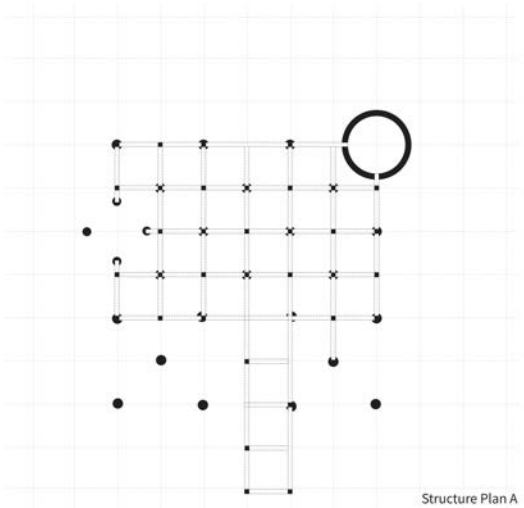
Wood Beam System
Grid



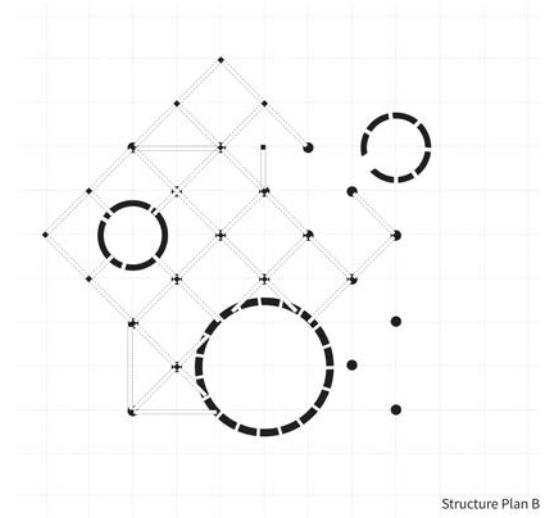




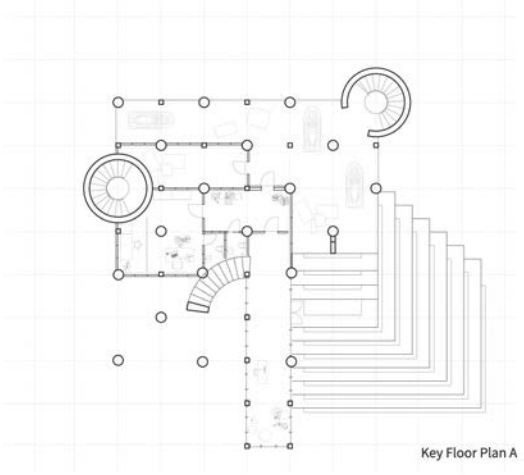
Concept Plan



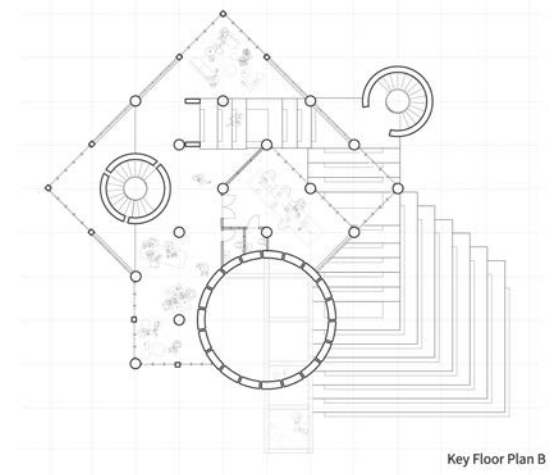
Structure Plan A



Structure Plan B



Key Floor Plan A



Key Floor Plan B





TENSILE ACADEMY

CORE II Studio

Instructor: Karla Rothstein

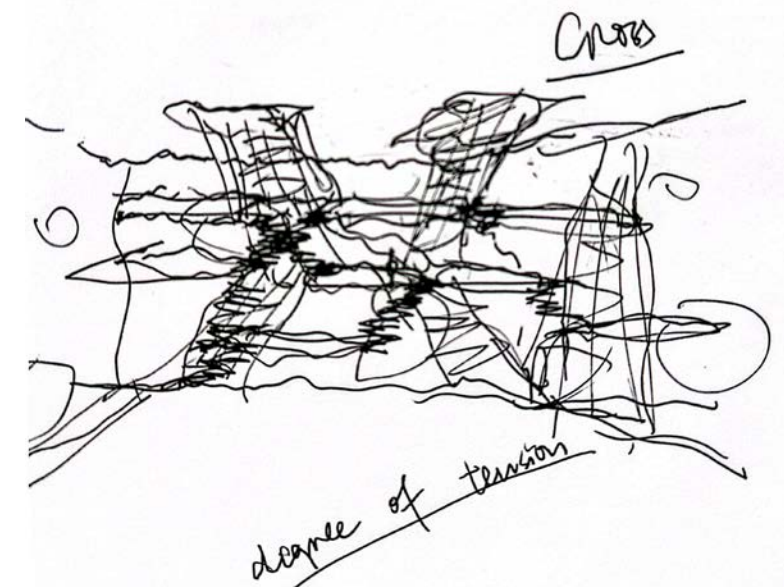
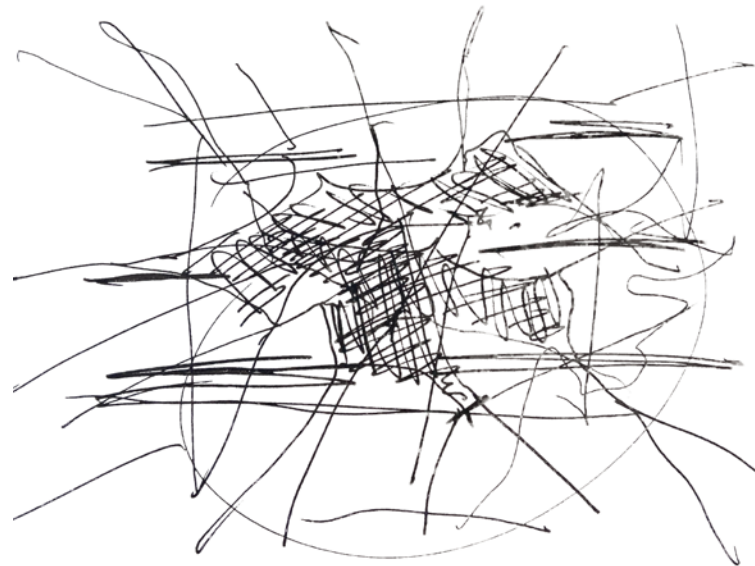
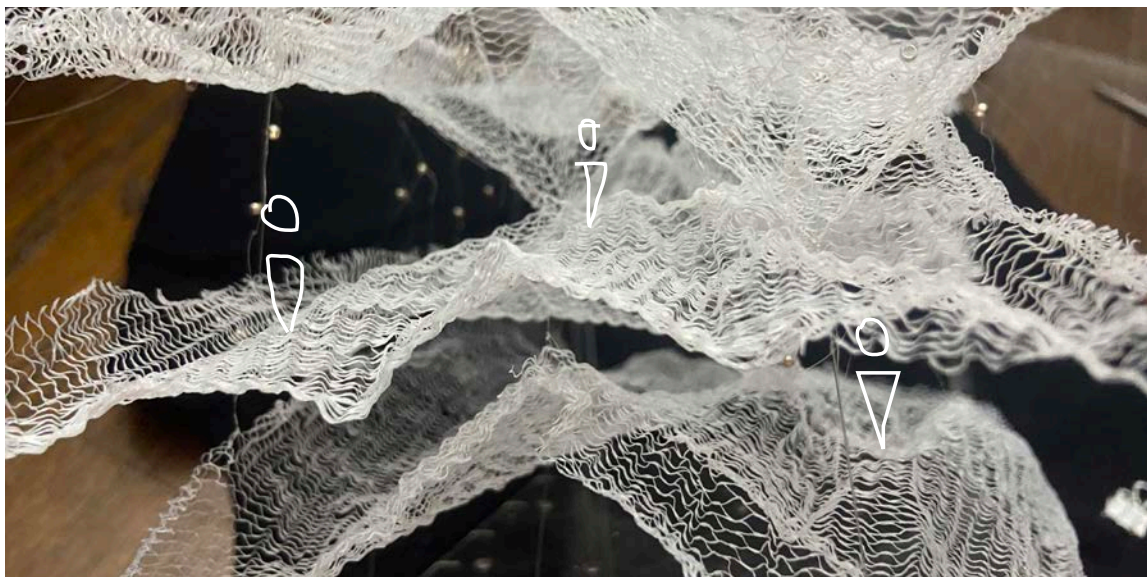
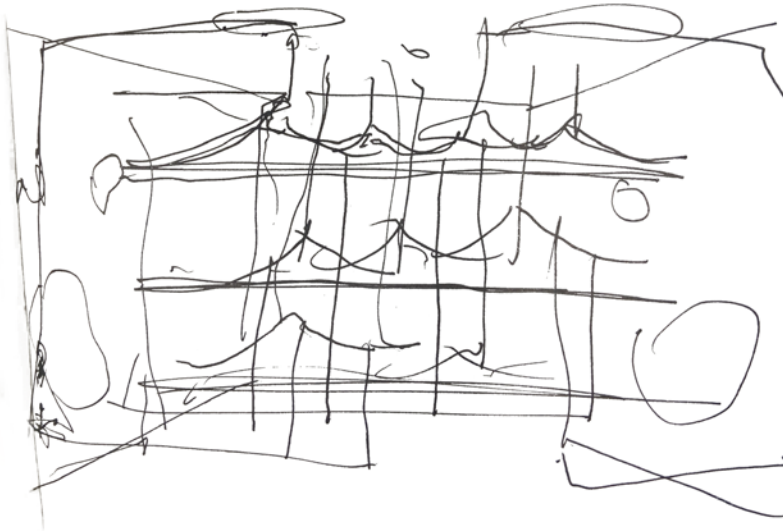
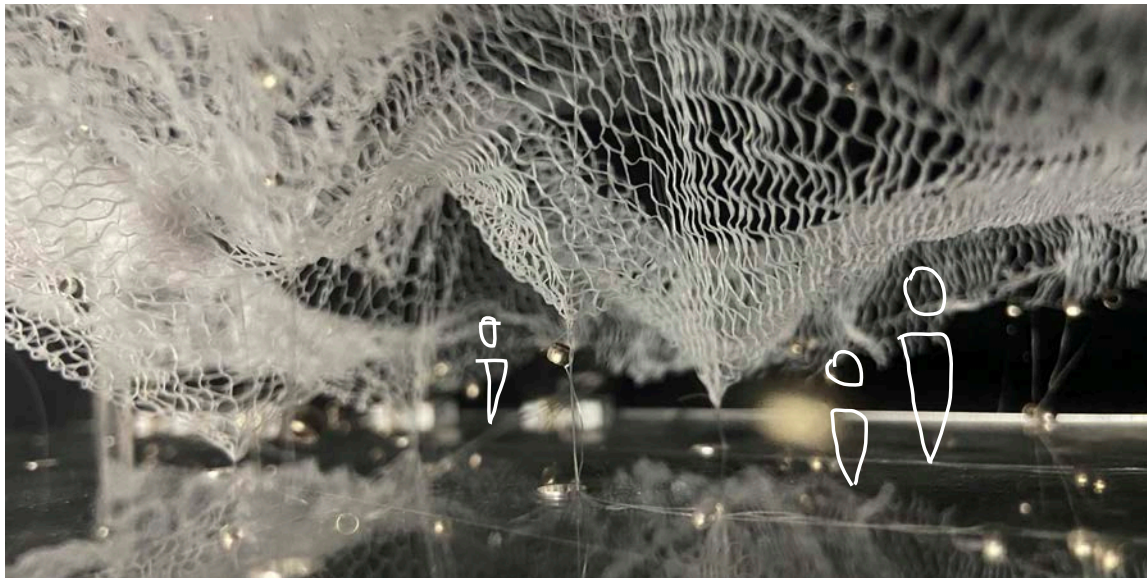
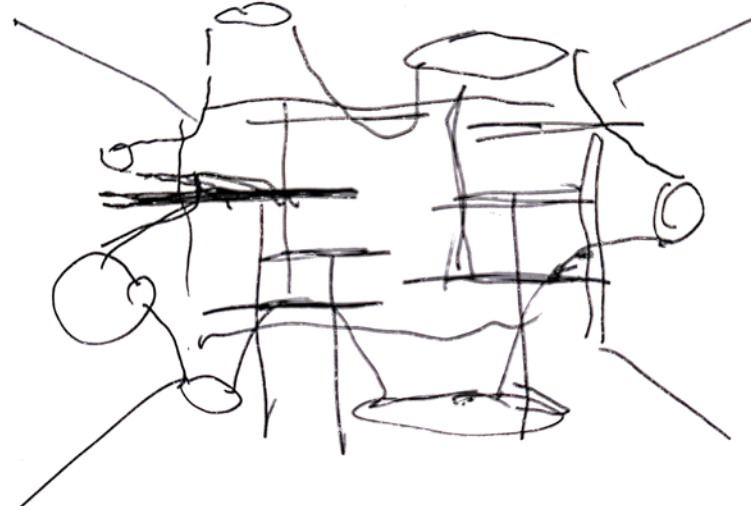
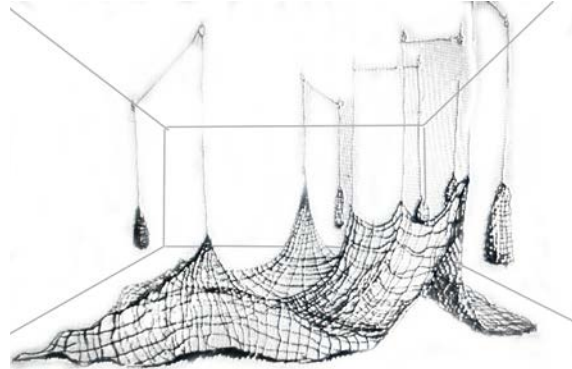
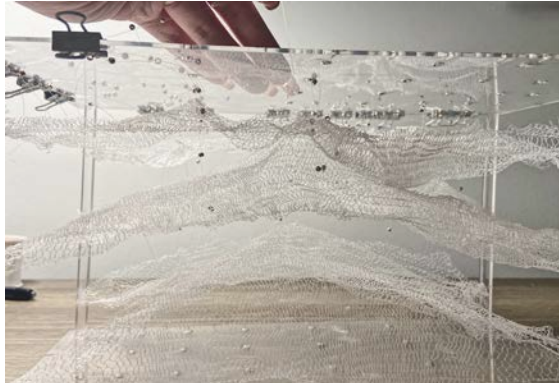
Spring 2022

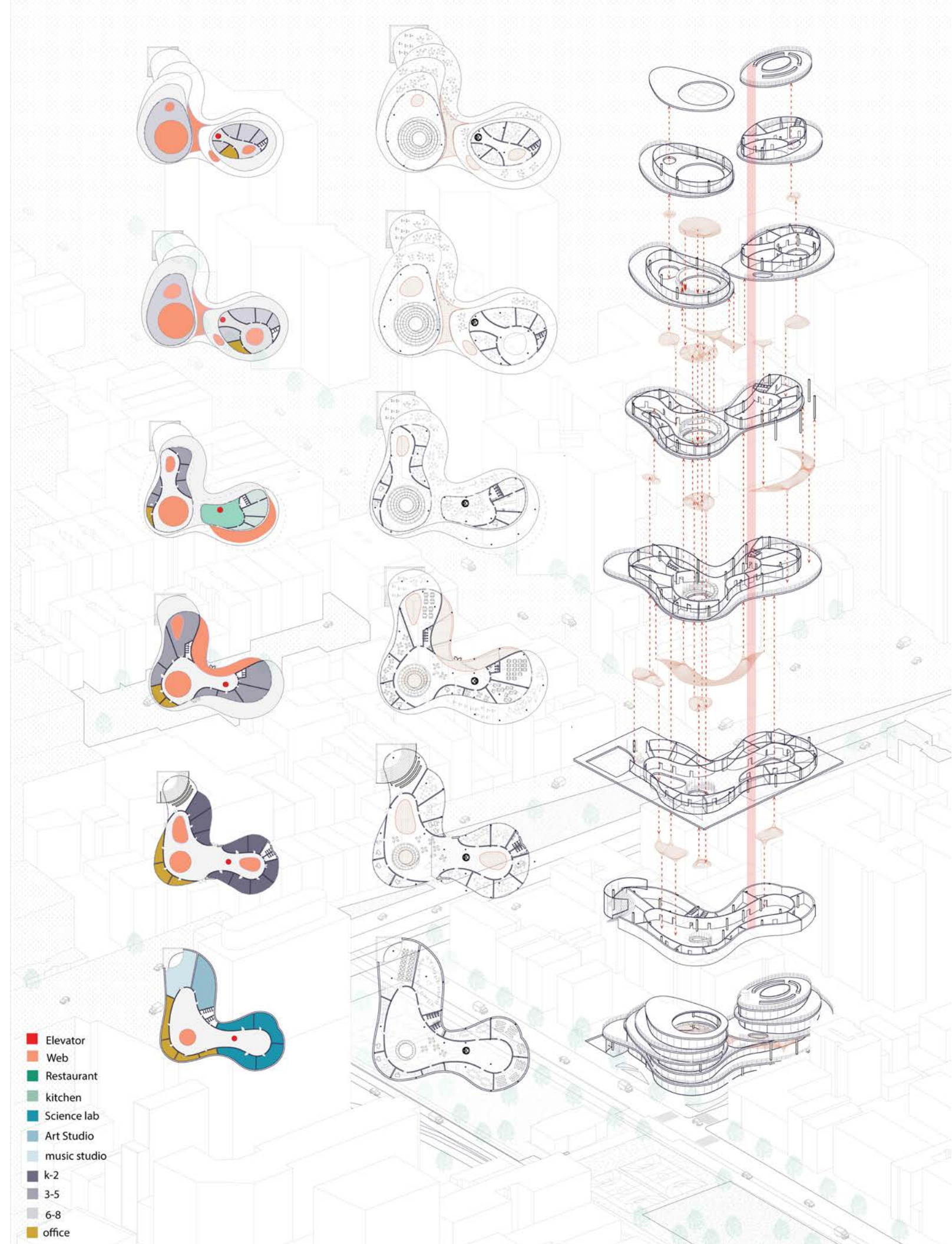
Individual Work

Site: 198 Forsyth Street, New York, NYC

Tensile Studies

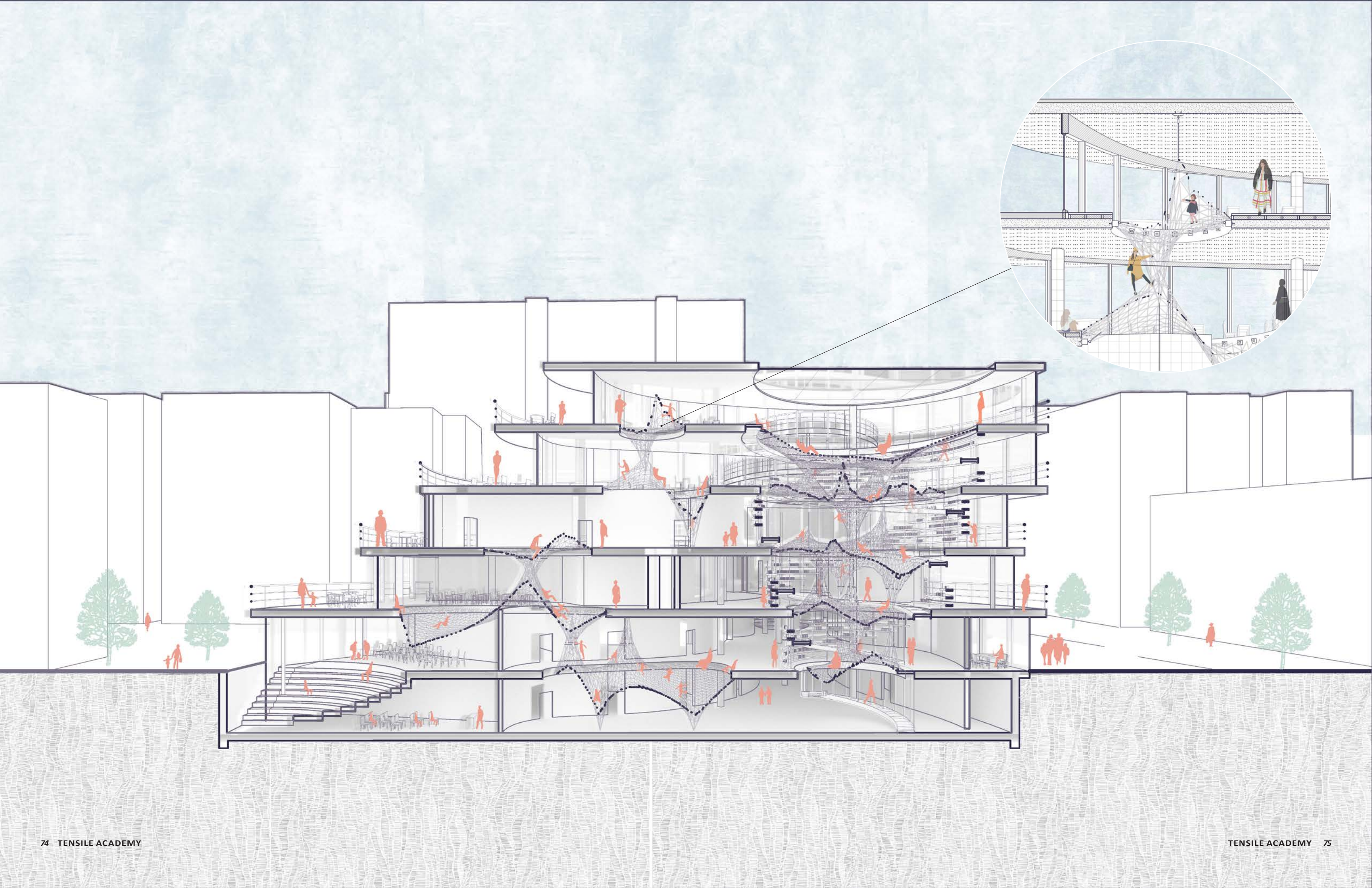
This study delves into the exploration of diverse tensile spatial possibilities by employing loofa as the flexible tensile material. To comprehensively investigate the material's potential, an interactive instrument was devised. This tool allows for the application of varying scales of forces to layers of meshes, thereby forming a spectrum of spatial possibilities. The study aims to unravel the unique characteristics and adaptability of tensile material in creating dynamic and interactive environments, offering insights into its feasibility as a versatile material for architectural applications.

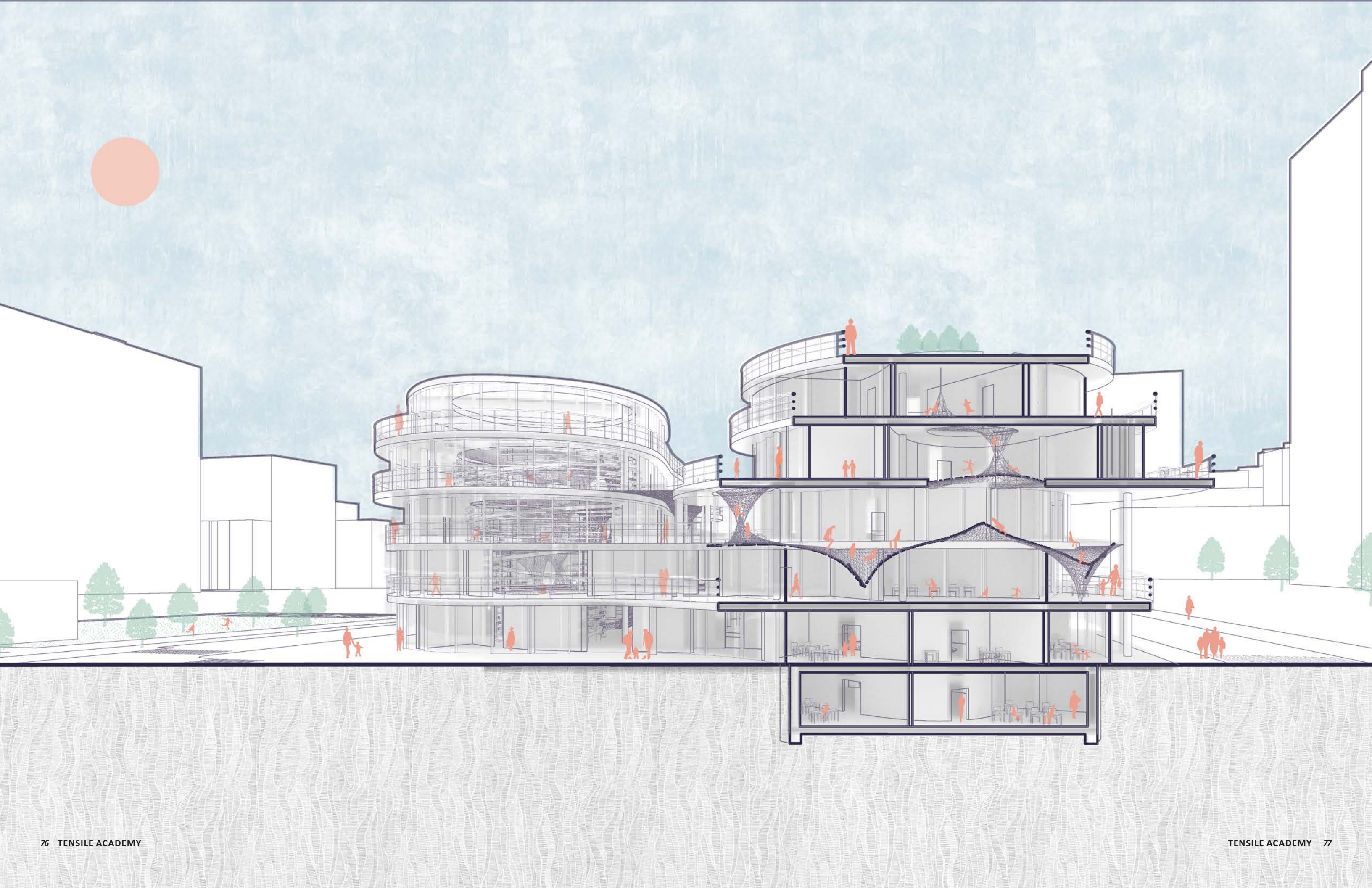




Dynamic Spaces for Playful Minds

This architectural design features a grand spiral staircase that not only serves the functional purpose of a library but also plays a pivotal role in shaping the atrium space. To enhance the interactive and dynamic elements, I incorporated a tensile structure within the atrium, transforming it into a central playground. The spiral staircase, in conjunction with the tensile structure, creates a harmonious blend of utility and aesthetic appeal, fostering a multi-functional environment that encourages learning, social interaction, and imaginative play within a visually striking architectural setting.





THE ARTISAN STROLL OF FREEMAN

CORE I Studio

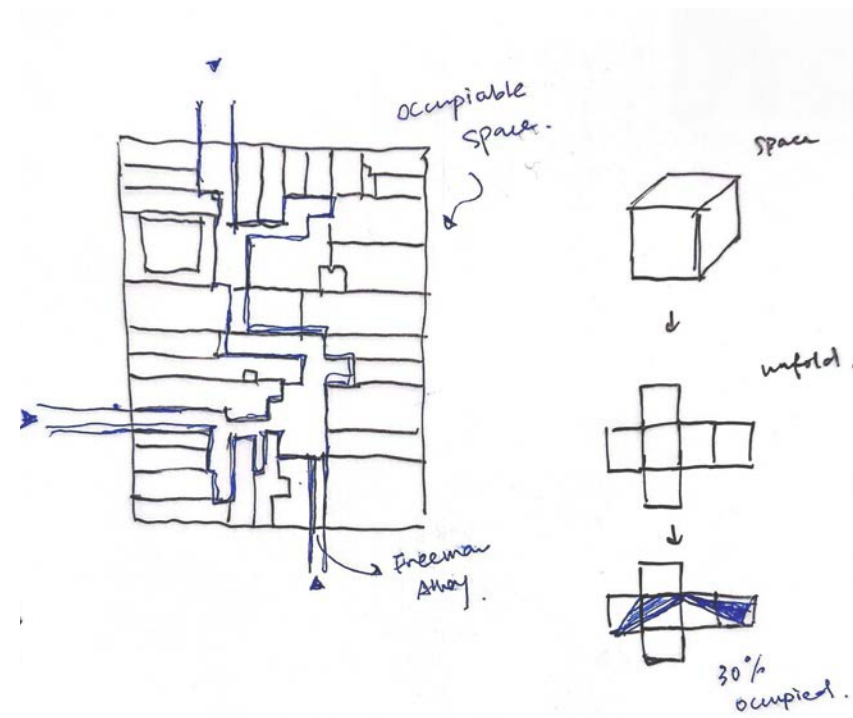
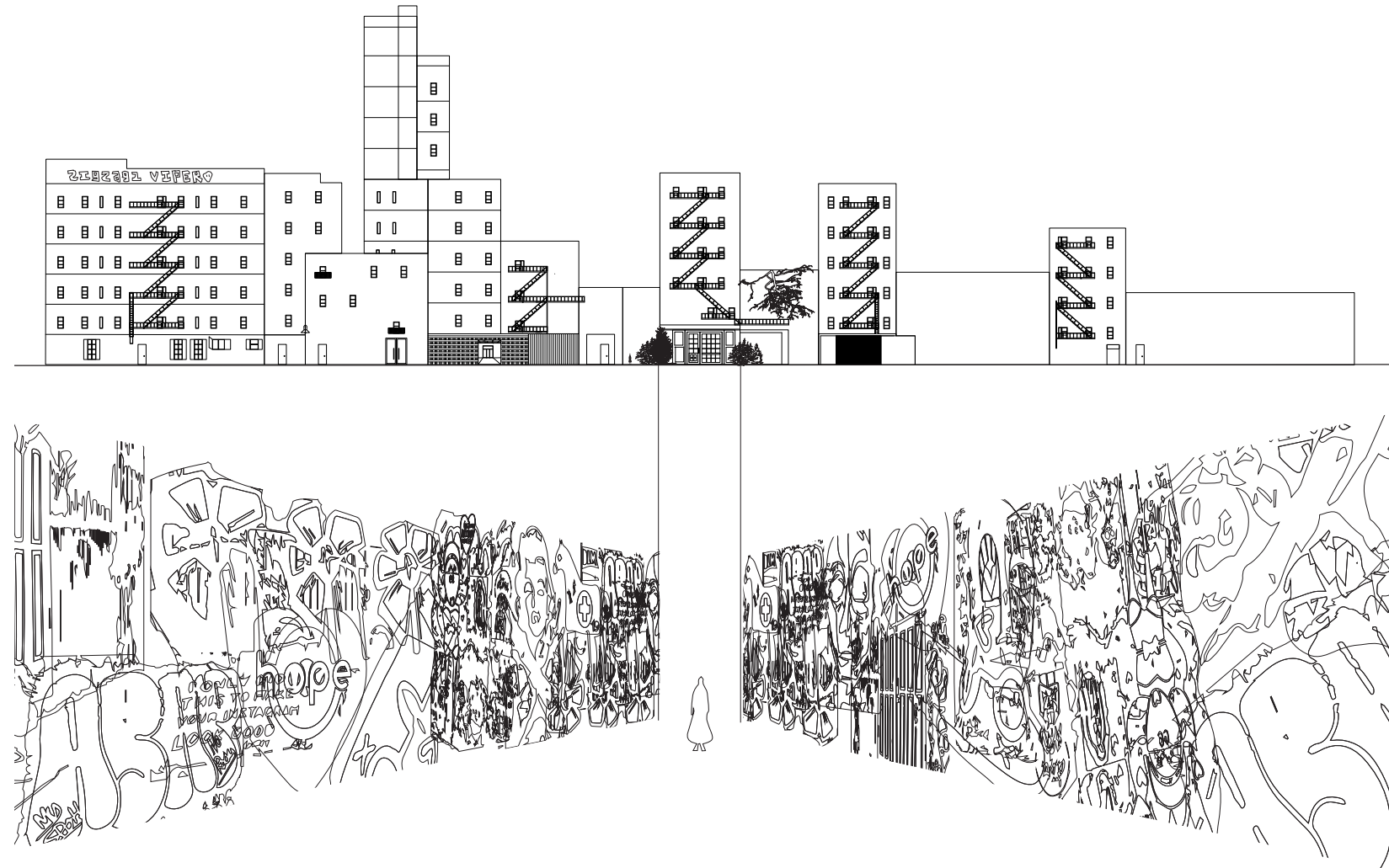
Instructor: Amina Blacksher
Fall 2021

Individual Work
Site: 12 Rivington St, New York, NY



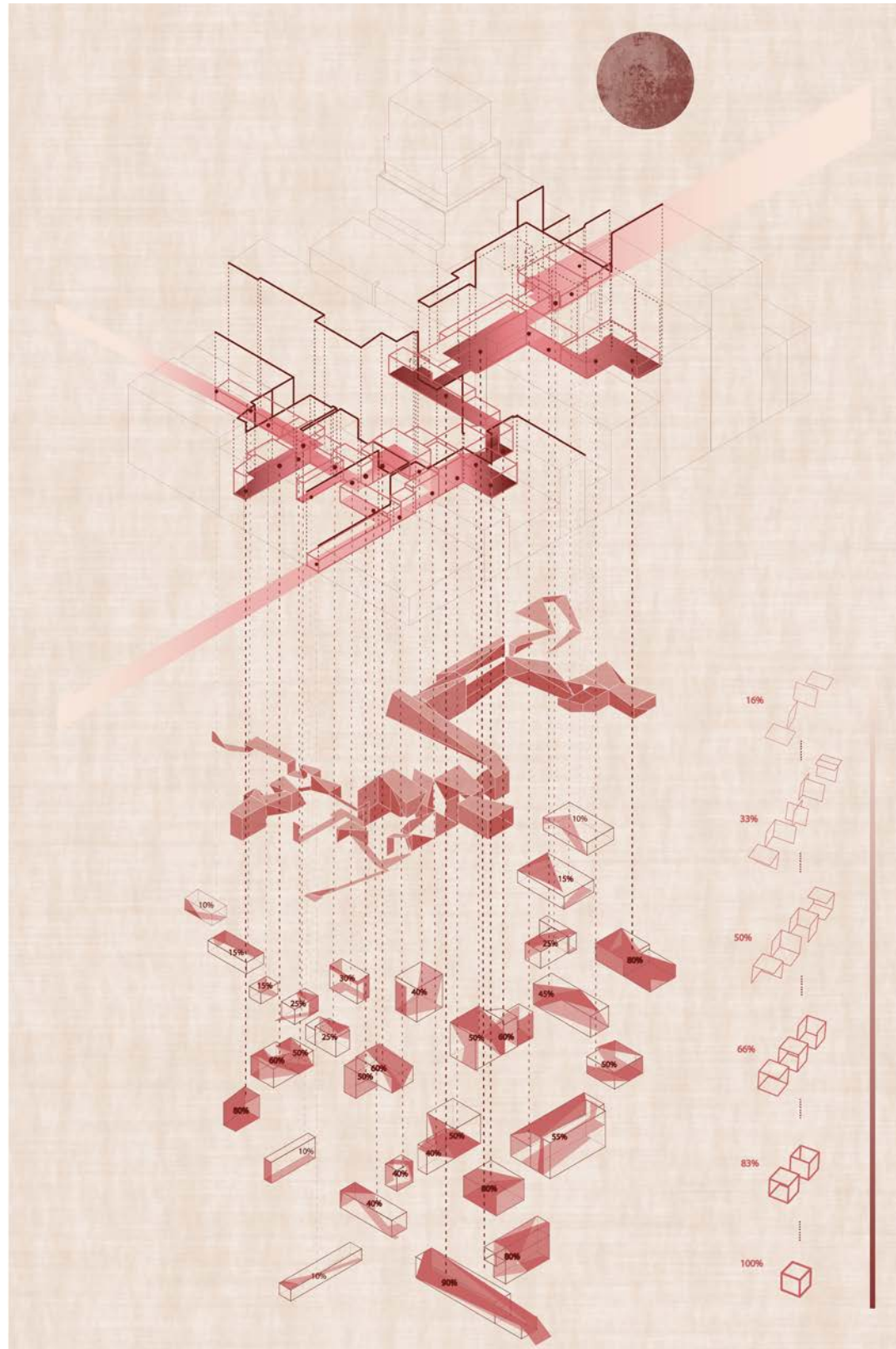
Jimmy Wright's Residence





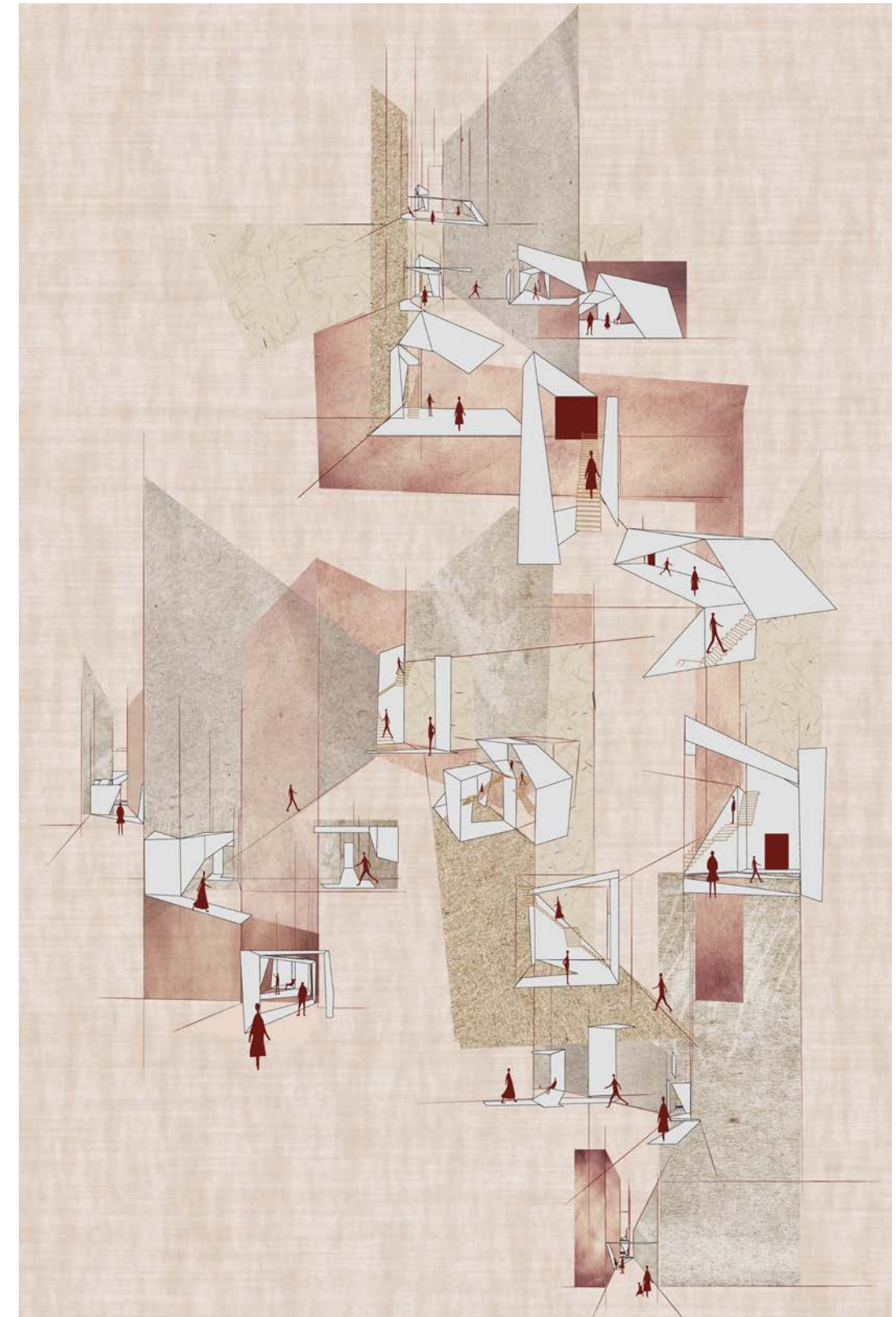
Freeman Art Trial

The alley is adorned with street art, creating an ever-evolving atmosphere. The project aims to emphasize the artistic aspect of the alley and its urban context, particularly within this block, which includes the New Museum, galleries, and three alleys that, though disjointed, can form a consistent journey.



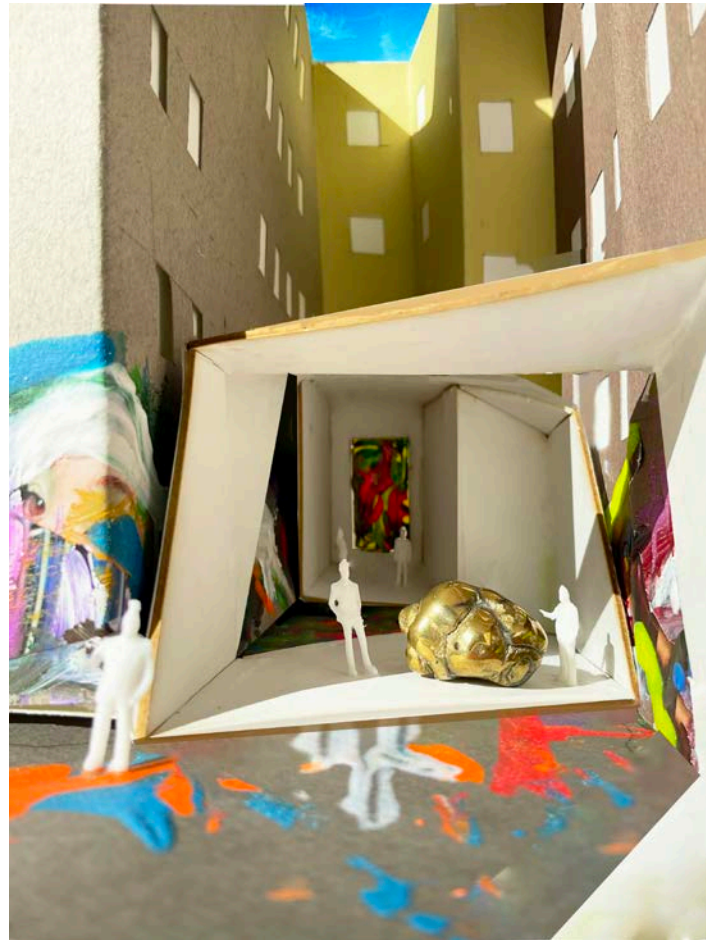
Dynamic Transitional Strategy

The fundamental concept at the core of this intervention is to artfully manipulate coverage and exposure within the alley. This is achieved by skillfully partitioning the alley void into a series of continuous rectangular geometries, each characterized by unique coverage percentages. Through this deliberate play with spatial dynamics, the intervention aims to create a visually engaging and dynamically evolving environment.



Harmony in Between

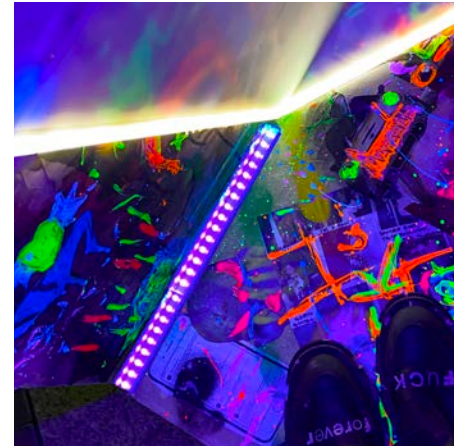
The proposed intervention envisions a connecting structure in the Freeman Alley block, fostering an artists' community and serving as an extended exhibition space. This structure links three alleys, enhancing cohesion and offering a transitional spatial experience that spans from open to enclosed, public to private, scattered to gathering, and isolated to intimate.



LEFT_top. Day Time Scene_Art Trail and Public Space

LEFT_below. Night TIME Scene_1:1 Physical model with light

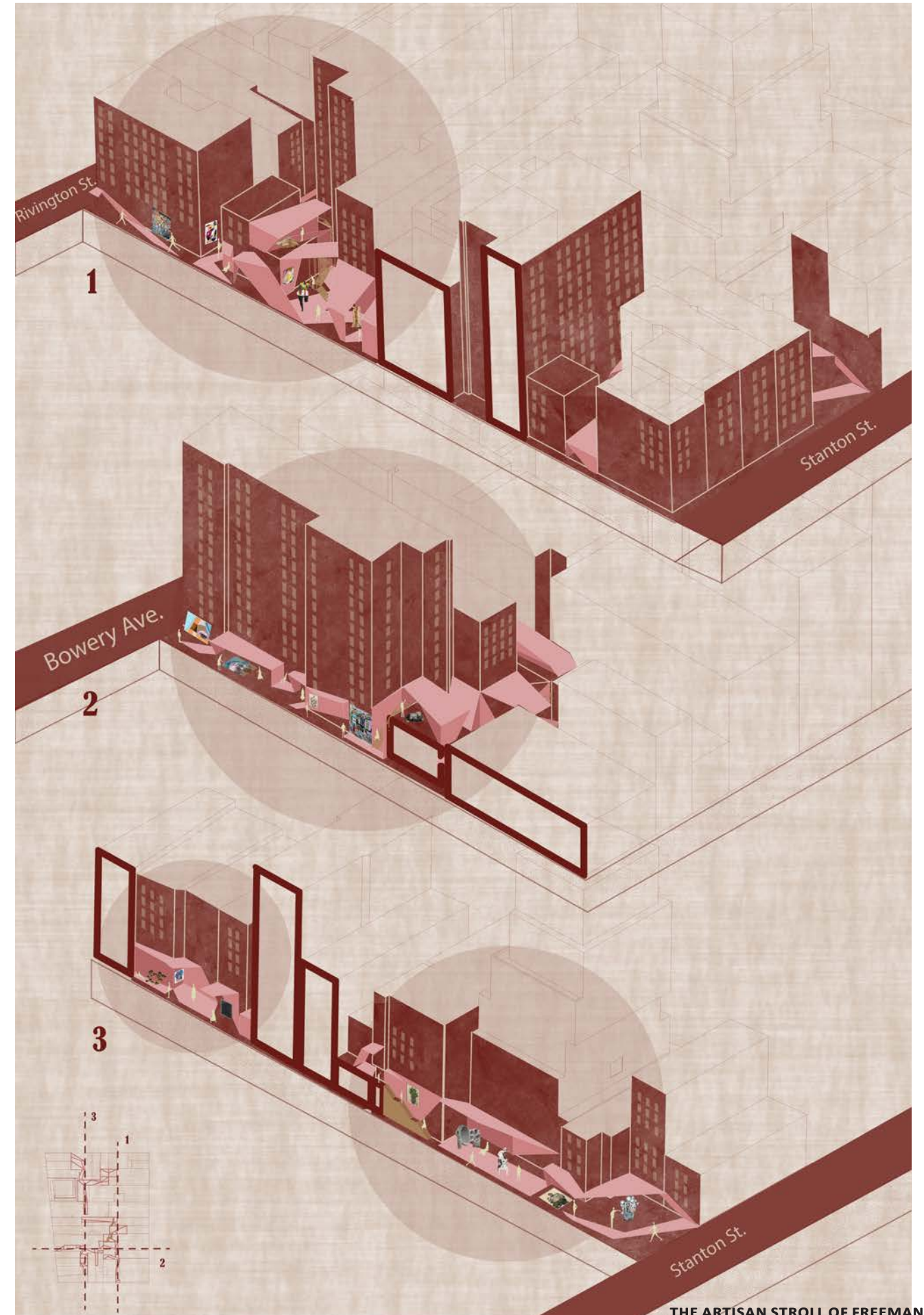
RIGHT. Night TIME Scene_24/7 Event Venue



Canvas for Community Expressions

Inspired by the vibrant street art within Freeman Alley, the intervention takes form as a pristine white structure, providing a backdrop for communal art pieces contributed by local communities. This transformative intervention not only showcases the work of individual artists but also serves as a canvas for the broader creative expressions of the entire community, fostering a dynamic and inclusive environment.

Additionally, to enhance community engagement, the intervention goes beyond being a daytime art trail. By incorporating light strips along its edges, the structure transforms into an event space during the night—a versatile venue for raving, outdoor bars, and various community events. This dual-purpose design aims to further enliven the alley, creating a 24/7 cultural hub for artistic and social experiences.





BUILDING TECH IV

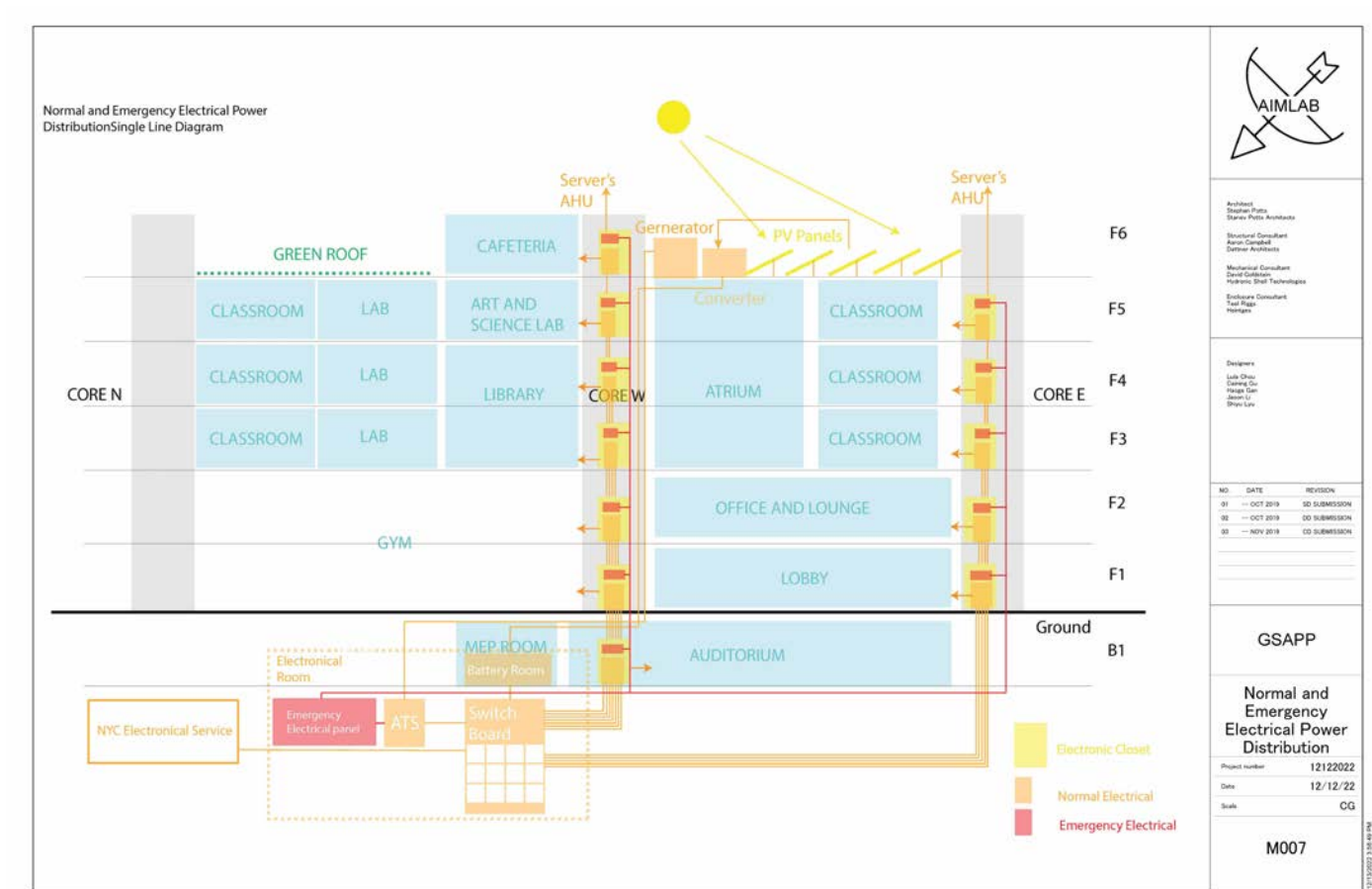
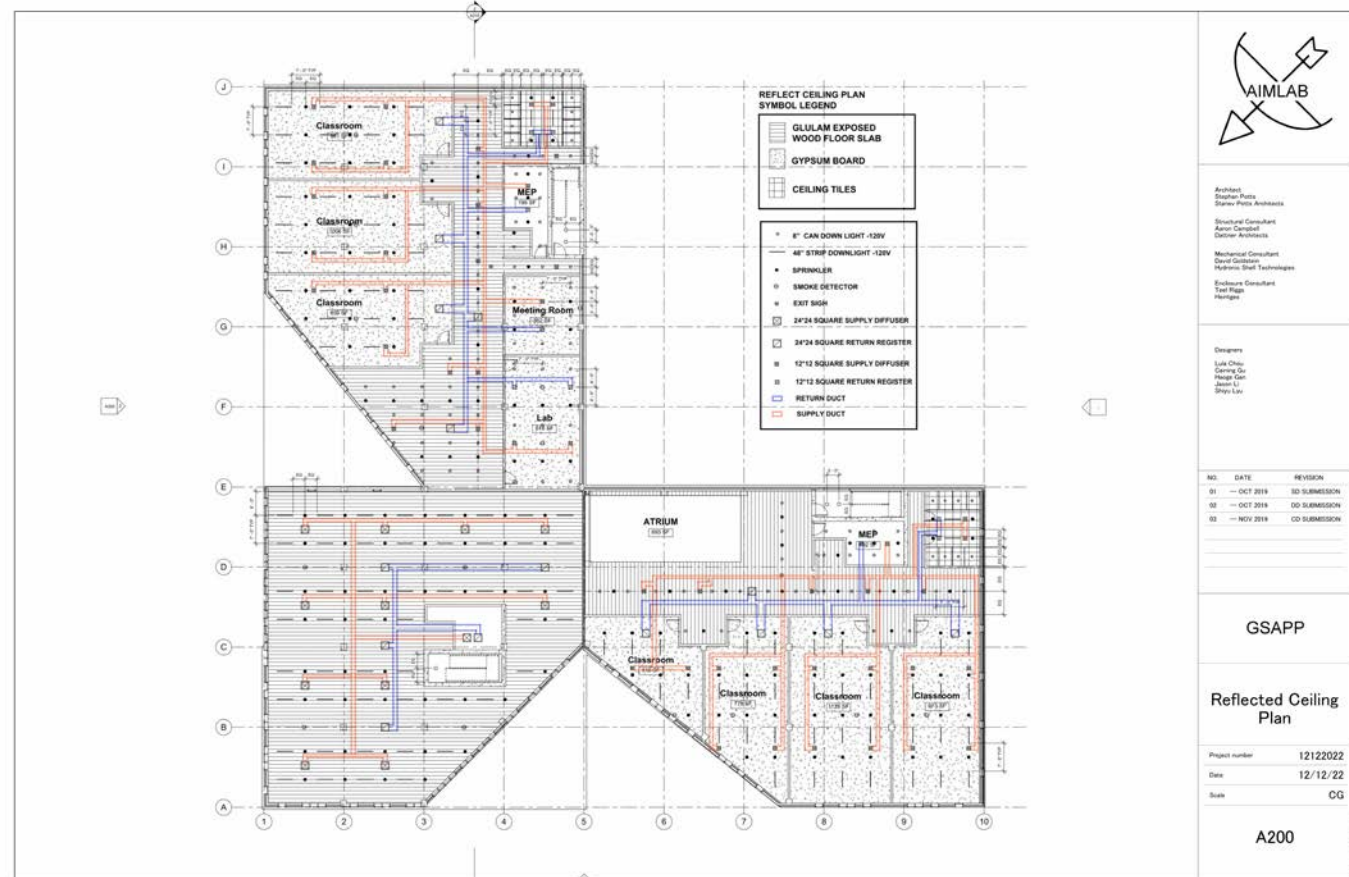
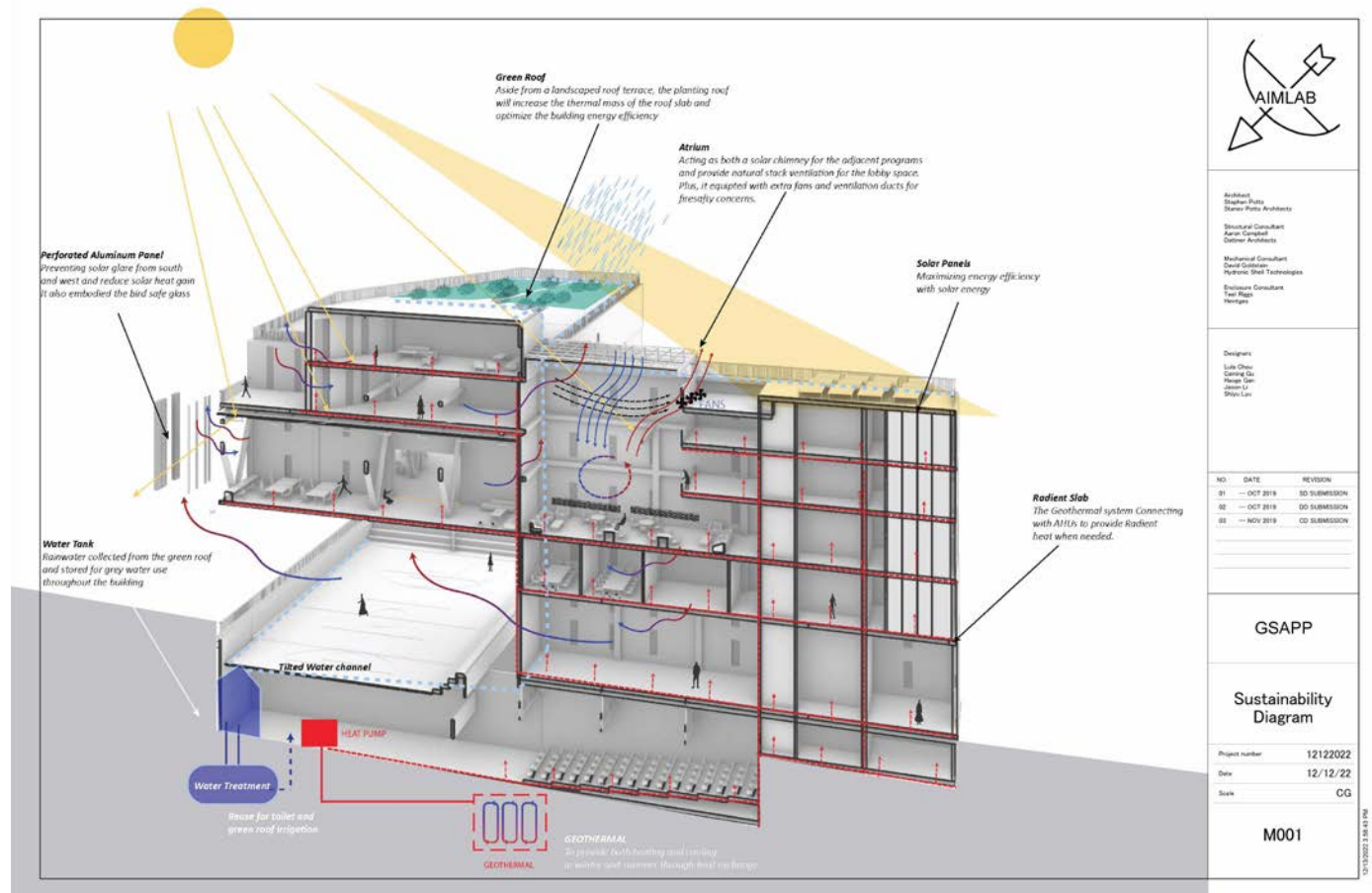
BUILDING SCIENCE & TECHNOLOGY SEQUENCE

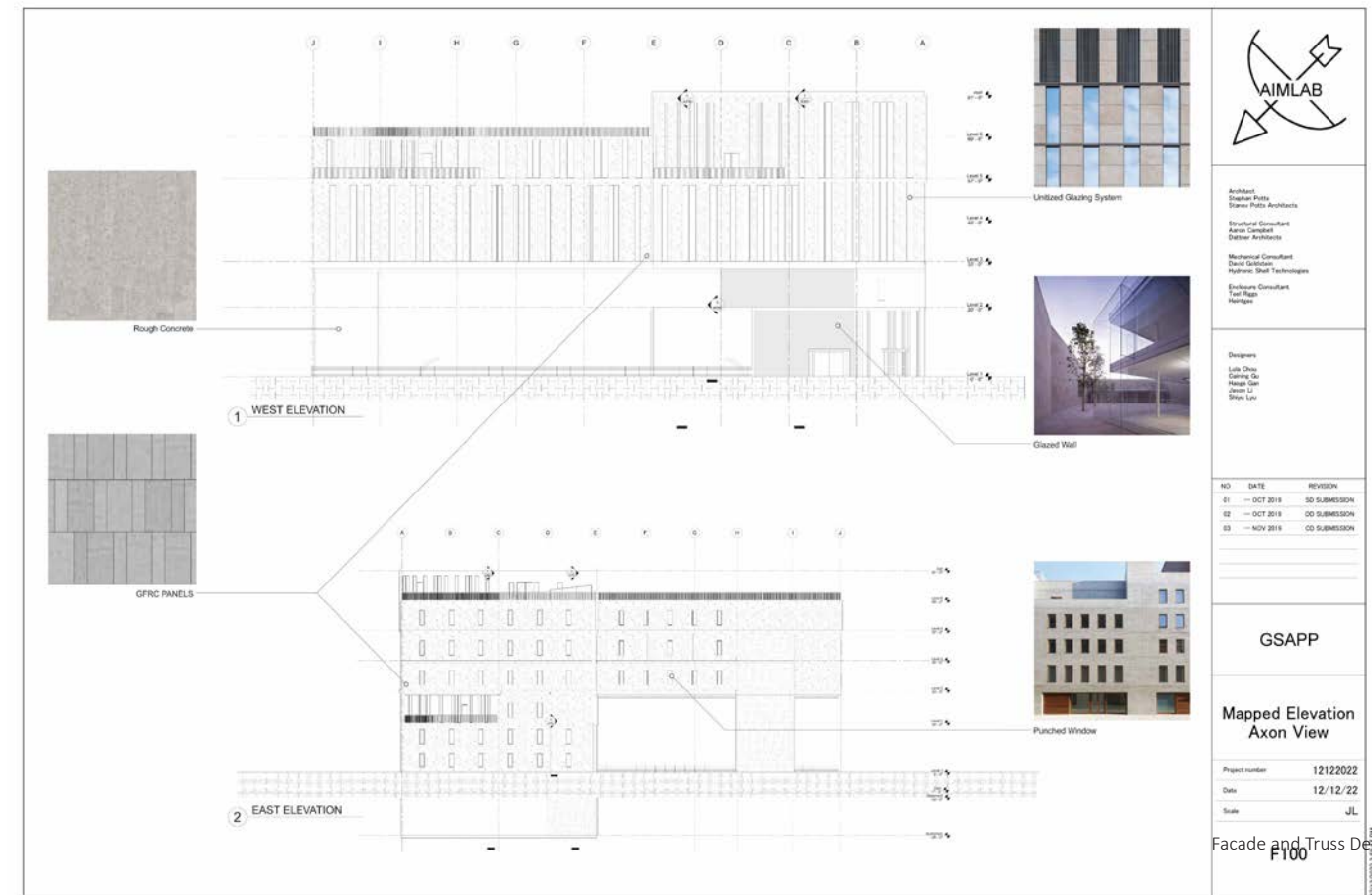
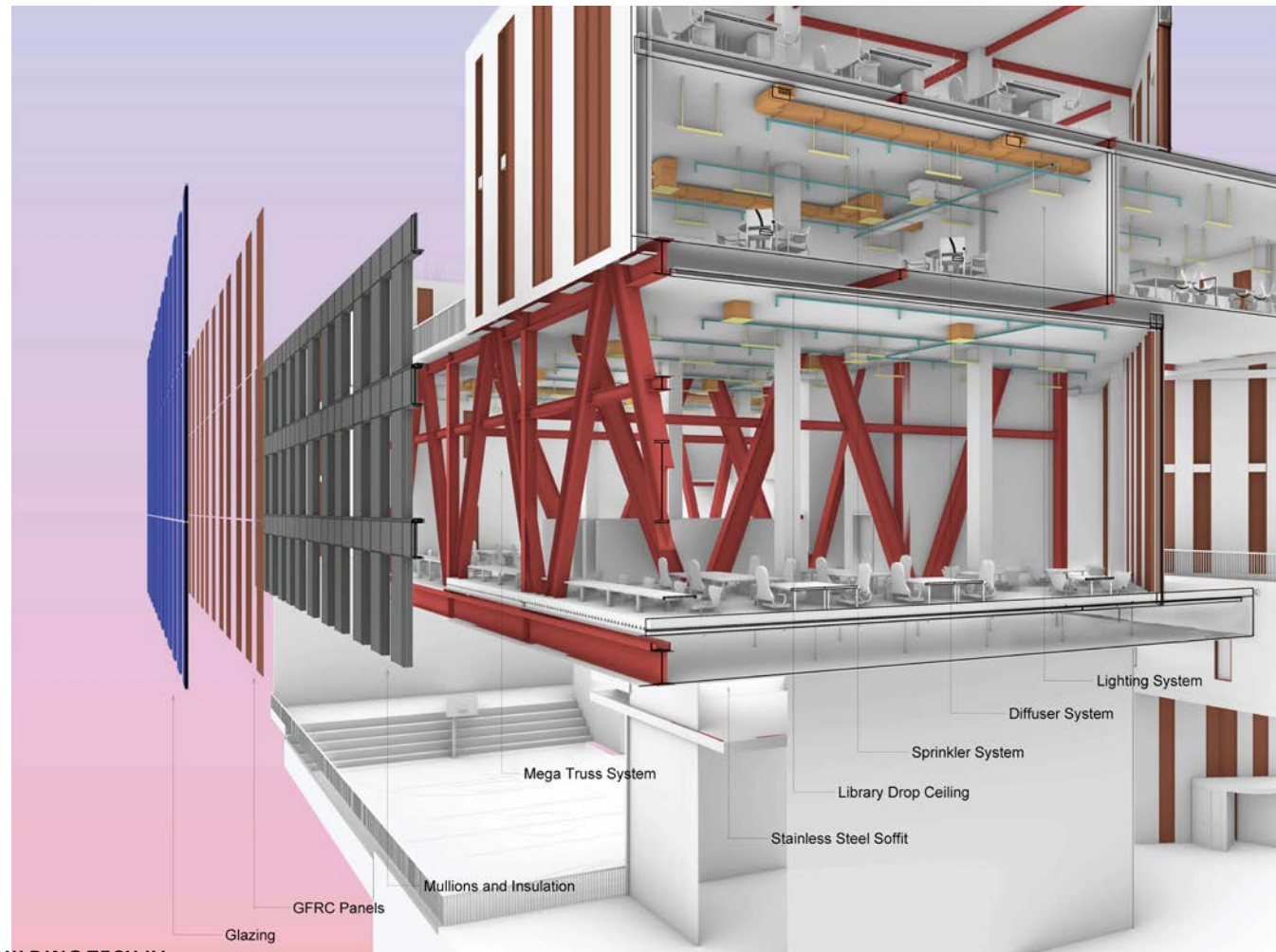
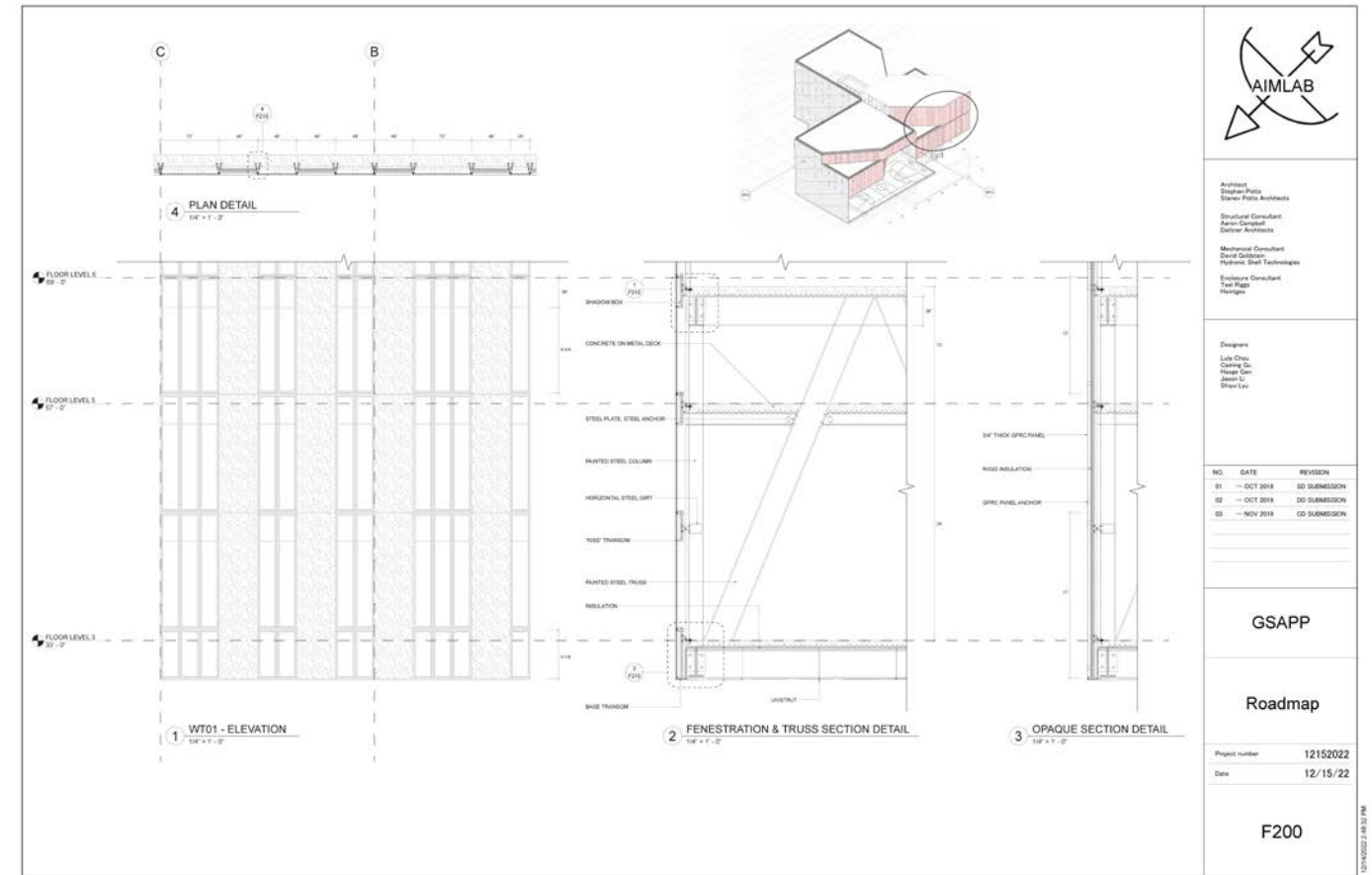
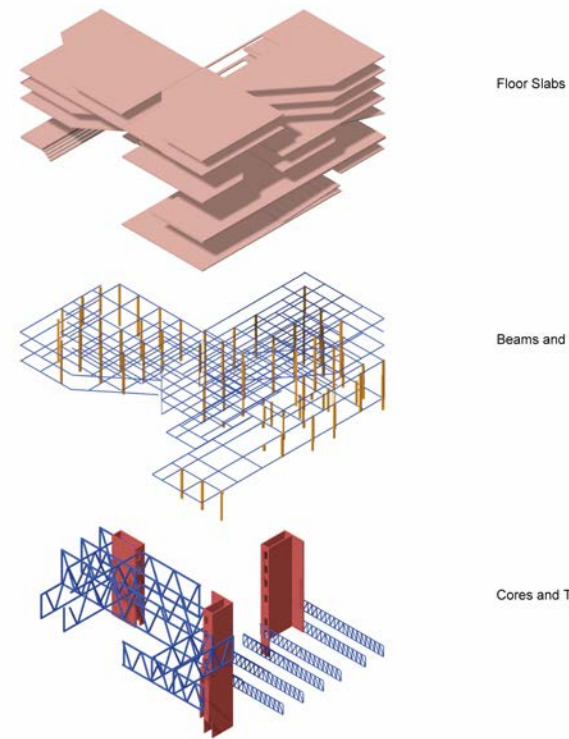
Instructor: LOLA BEN-ALON

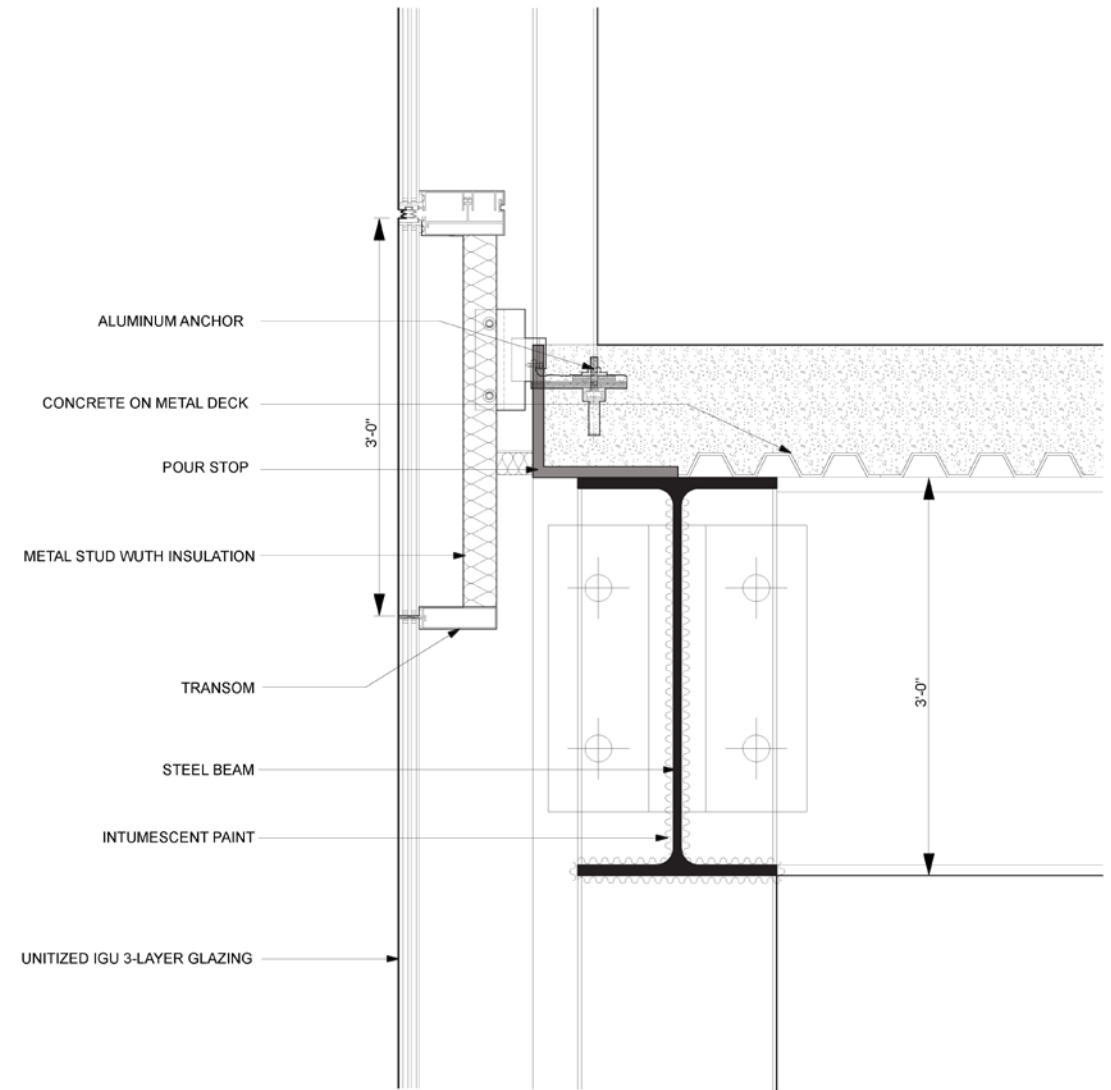
Fall 2022

Collaborate with Shiyu Lyu, Lula Chou, Steven Gan, Jason Li

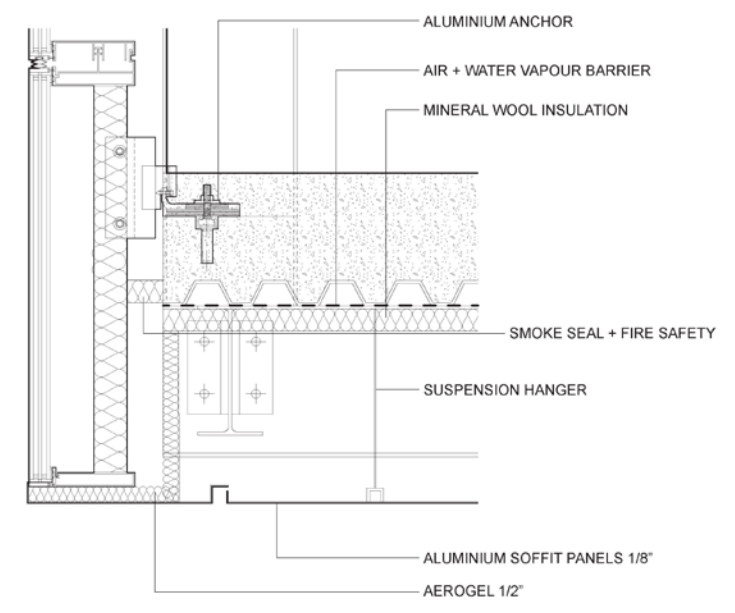
Software: Autodesk Revit



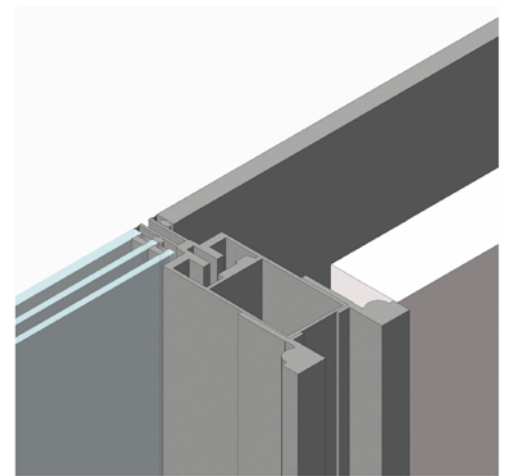




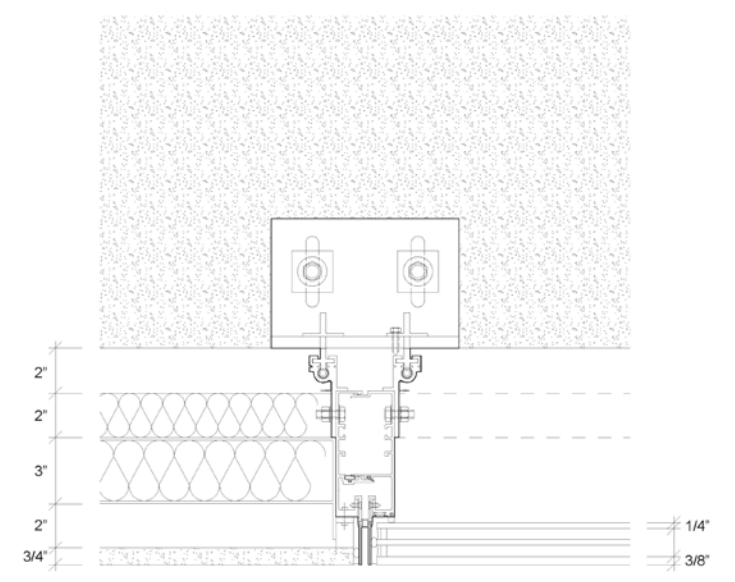
1 WT01 - TRUSS DETAIL
1-1/2" = 1' - 0"



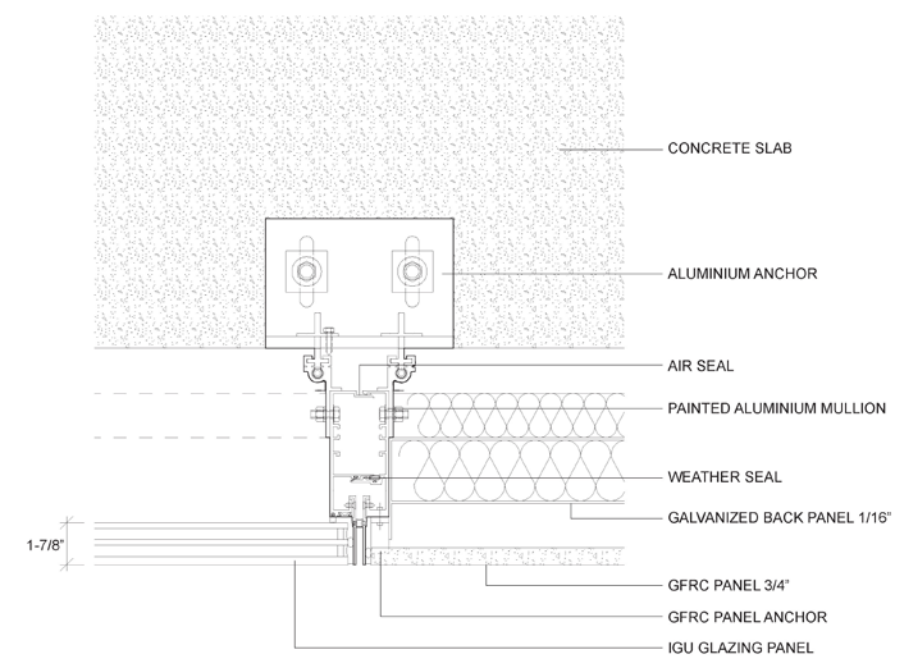
2 WT01 - SOFFIT SECTION
1-1/2" = 1' - 0"

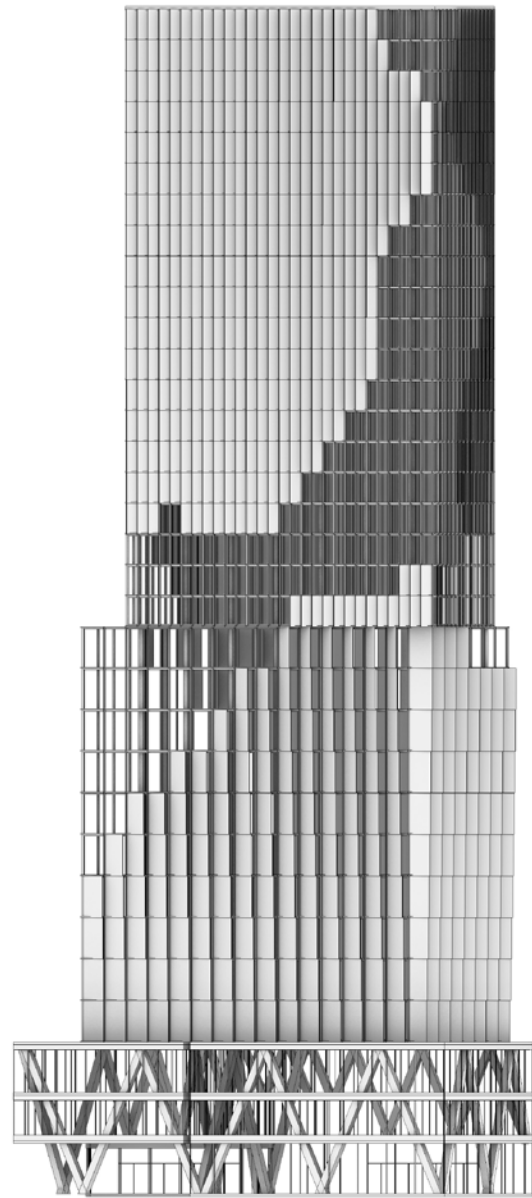


3 WT01 - DETAIL AXON

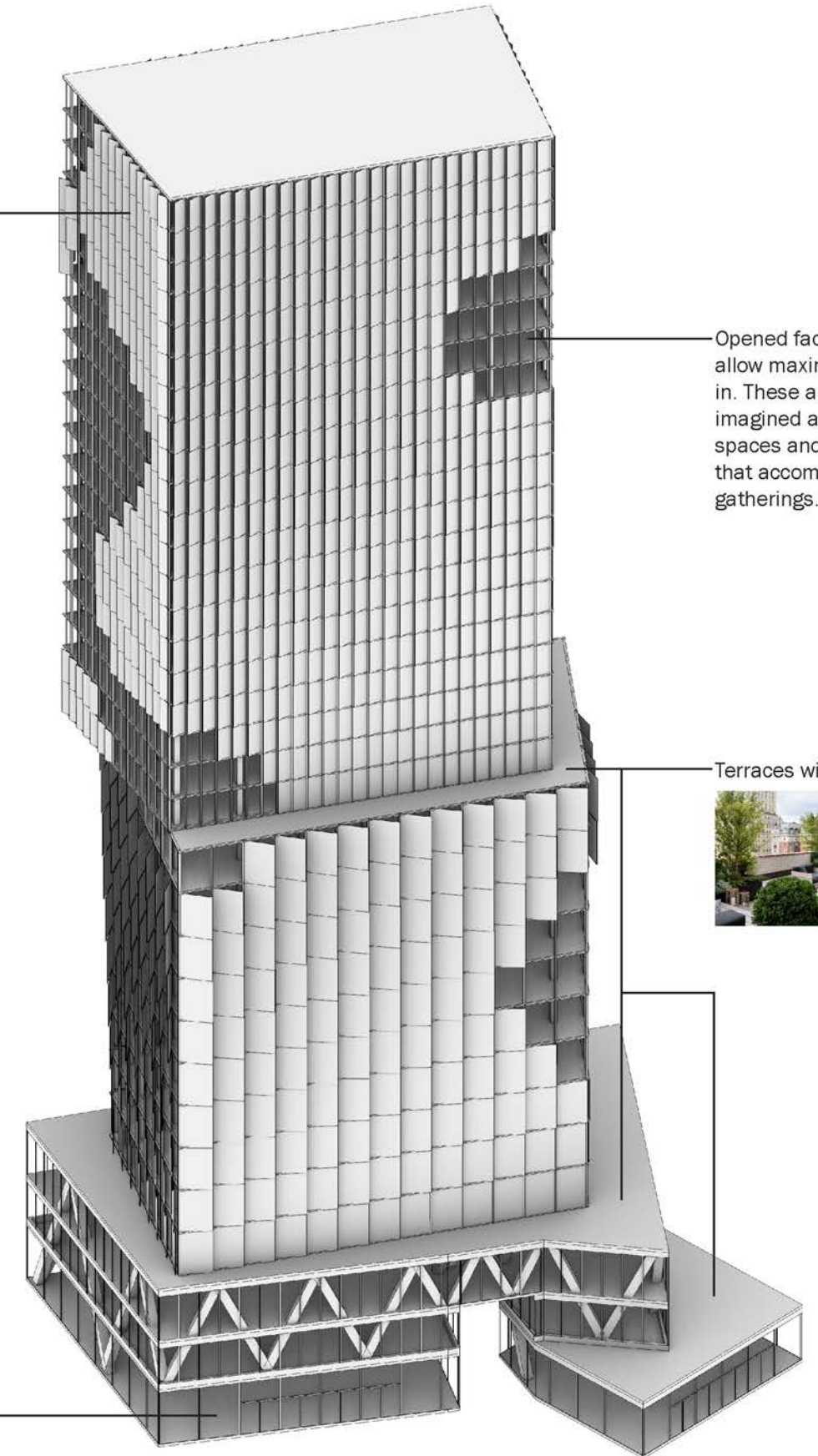
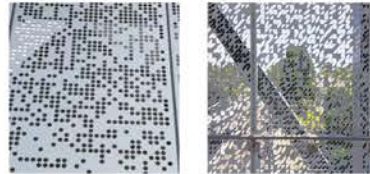


4 WT01 - DETAIL PLAN
3' = 1' - 0"





Perforated panel louvers for sun shading and light control. The panels are rotated outwards with relations to an attractor which depends on the sun orientation. The north facade has a bigger rotation which will let in more light. In contrast, the southern light is more controlled since our sun analysis suggested that there will be an abundance.



Opened facades that allow maximum light in. These areas are imagined as shared spaces and amenities that accompanied large gatherings.

Terraces with green space



The ground floor retail has been treated with a lot of visual and physical porosity, to embrace the public movement through the plaza as well as into the commercial flagship store space. The large truss gestures create a more dramatic experience for the users but also opens up the floor areas for more flexible occupation.



RETHINKING BIM

BUILDING SCIENCE & TECHNOLOGY SEQUENCE

Instructor: Joseph Brennan
Spring 2024

Collaborate with Shiyu Lyu, Jason Li, Yichun Liu
Software: Rhino Grasshopper

Site Analysis



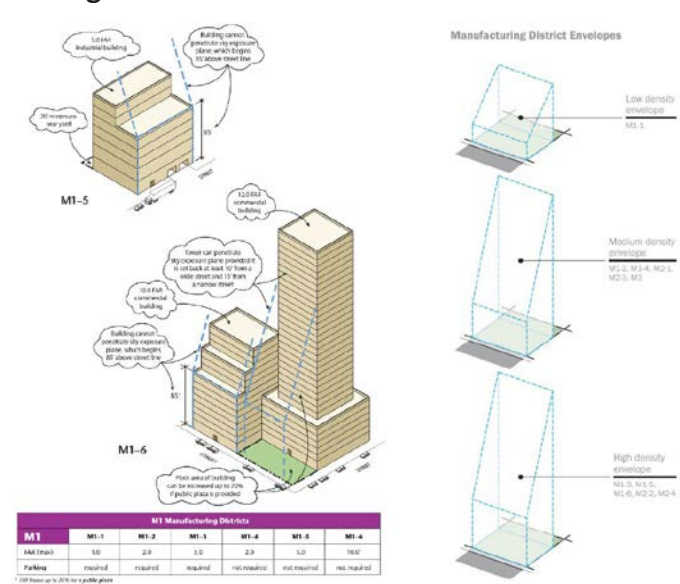
Owner
 JLAM MANAGEMENT LLC
Land Use
 Commercial & Office Buildings
Lot Area
 29,990 sq ft
Lot Frontage
 211.5 ft
Lot Depth
 164.35 ft
Year Built
 2017
Year Altered
 2017
Building Class
 Hotels - Full Service Hotel (H2)
Number of Buildings
 1
Number of Floors
 38
Gross Floor Area
 412,612 sq ft

Surrounding Context

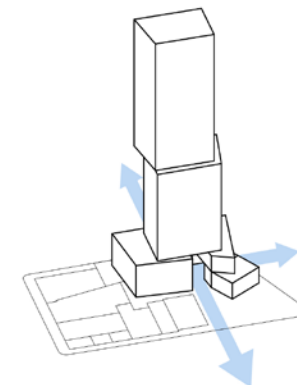
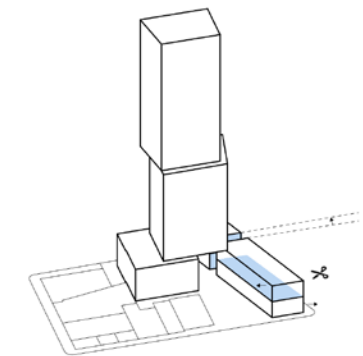
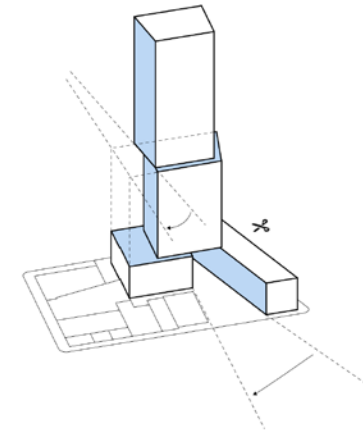
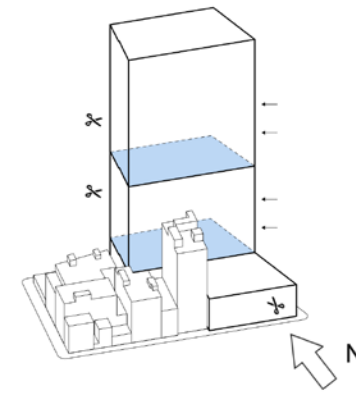


Commercial & Office | 65.51%
 Mixed Res. & Commercial | 14.50%
 Public Facilities & Institutions | 6.49%
 Multifamily Elevator | 5.33%
 Transportation & Utility | 3.14%
 Open Space & Outdoor Recreation | 1.59%
 Vacant Land | 0.96%

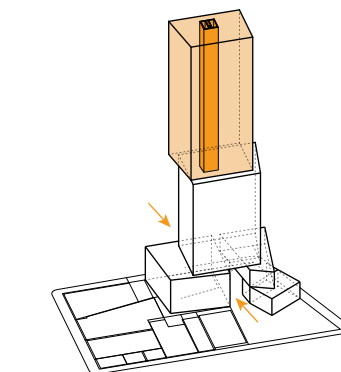
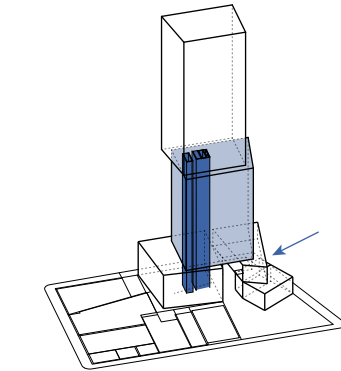
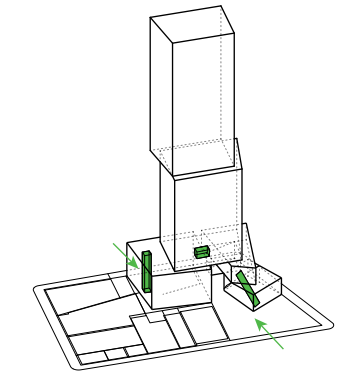
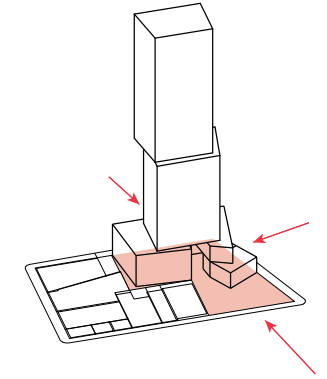
Zoning



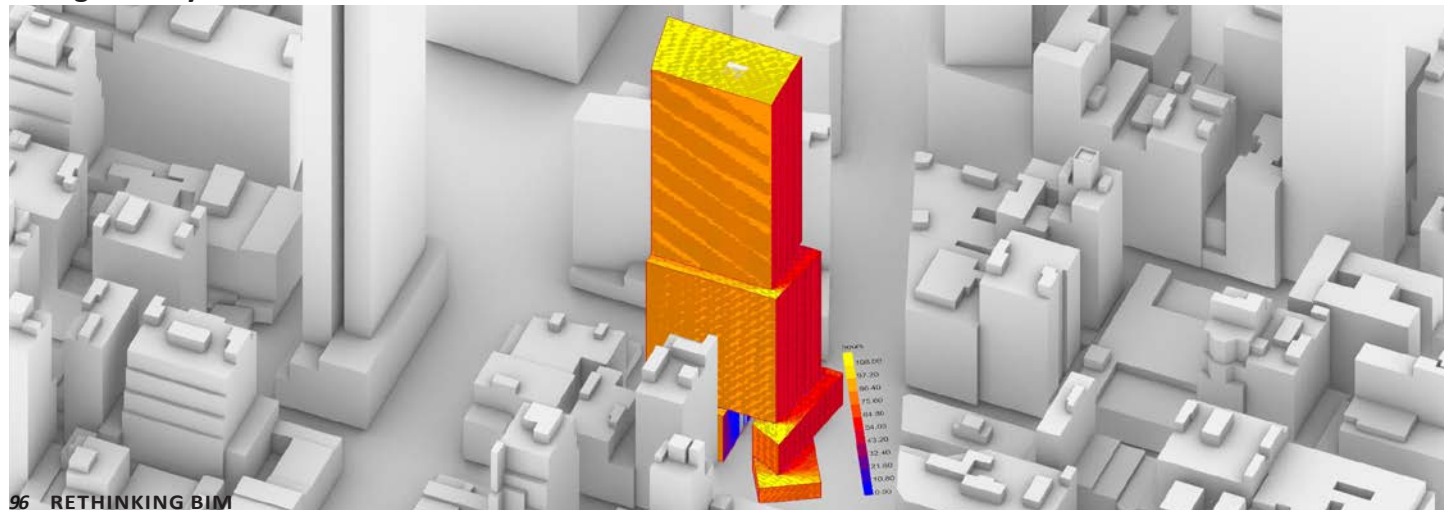
Design Progress



Programs

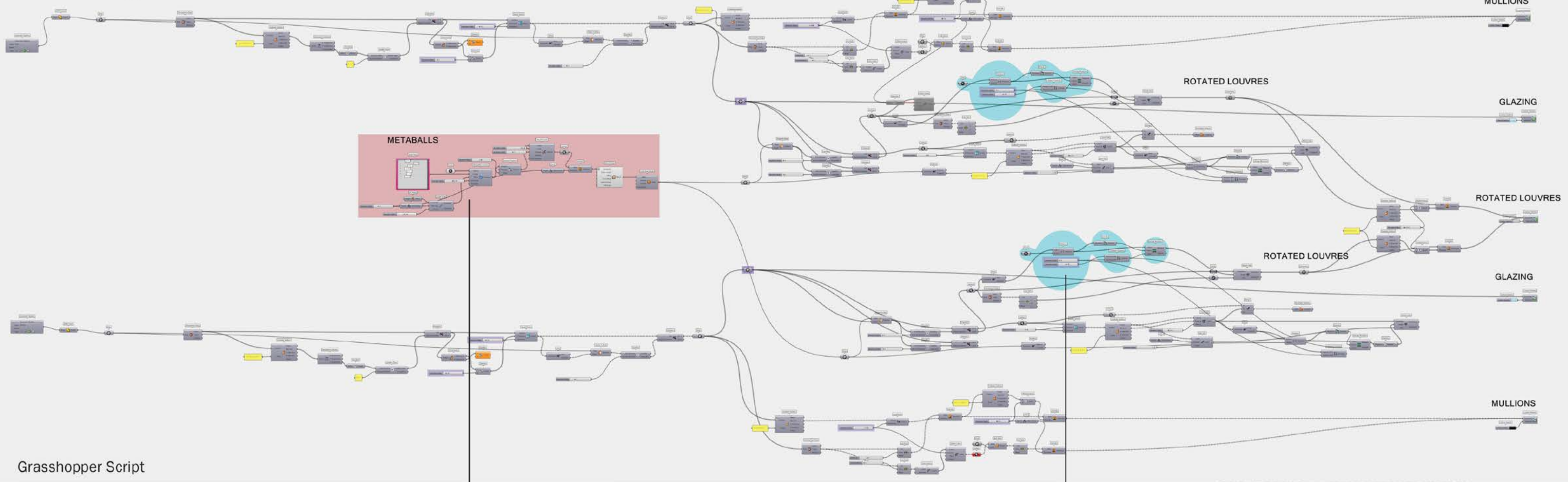


Sunlight Analysis

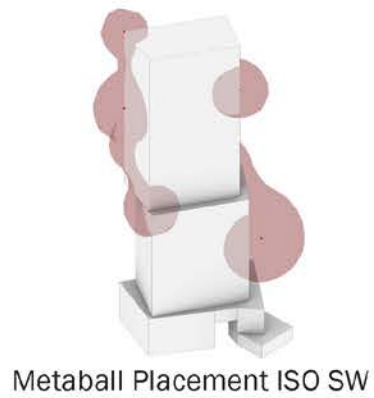


Parametric Design Workflow

TEAM PENDING



Grasshopper Script



Metaball Placement ISO SW



Metaball Placement ISO SE



Metaball Placement ISO NE



Metaball Placement ISO NW

The facade patterns are created with the use of Metaballs, of whose size gradually decreases from the office portion towards the residential portion. This is mainly due to the different need for intimacy and associated programs. These openings, that accompanies gatherings and amenities, are the portals that bring people together through an experiential sequence that gently wraps around the building.



Facade ISO SW



Facade ISO SE

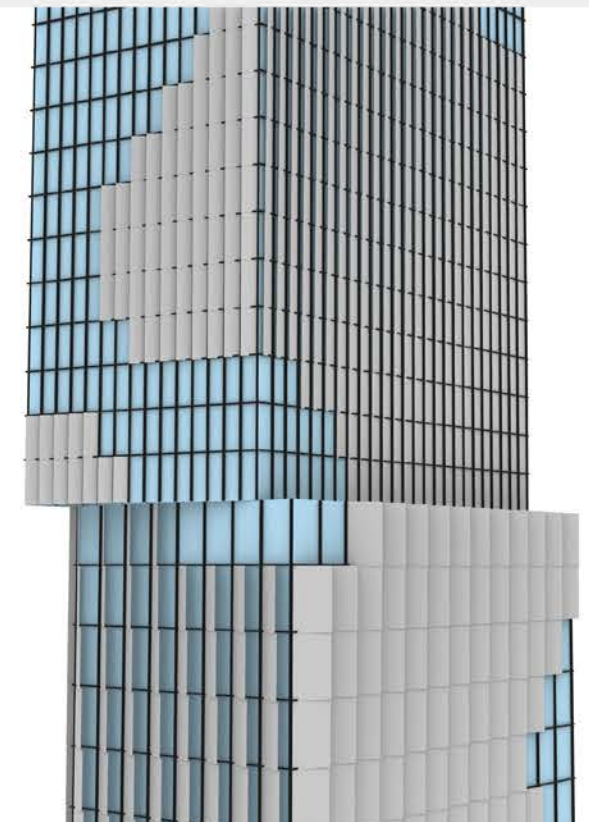


Facade ISO NE



Facade ISO NW

The gradient rotated facade louvers are created with the use of an attractor that is placed toward the north of the building for natural light control.



Facade Close-up

RENDERING SYSTEM

VISUAL STUDIES SEQUENCE

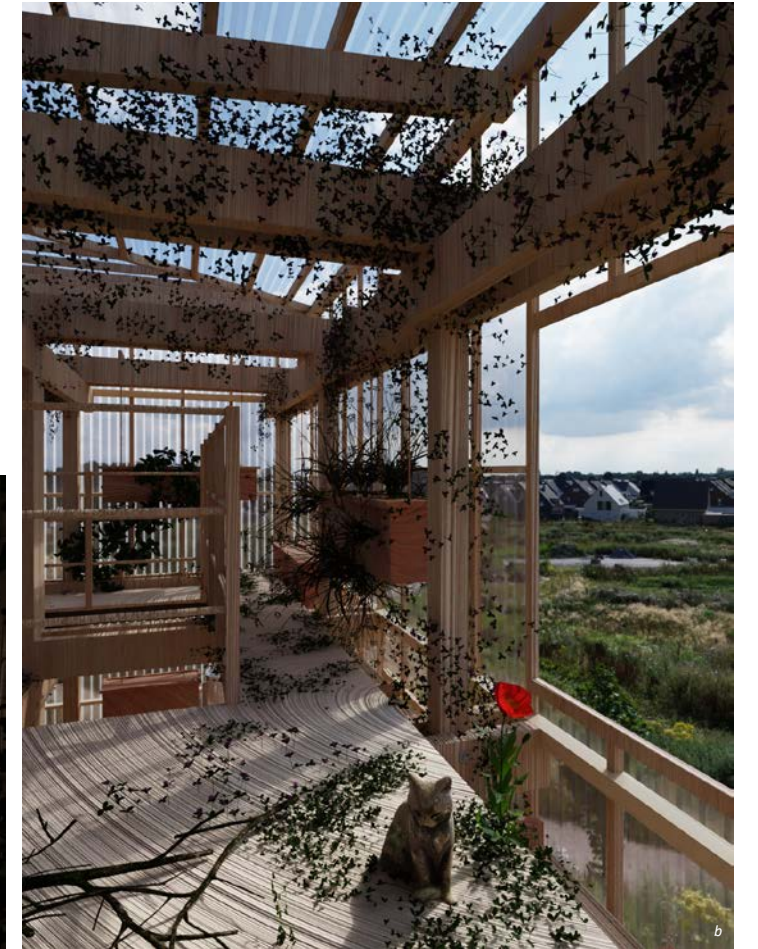
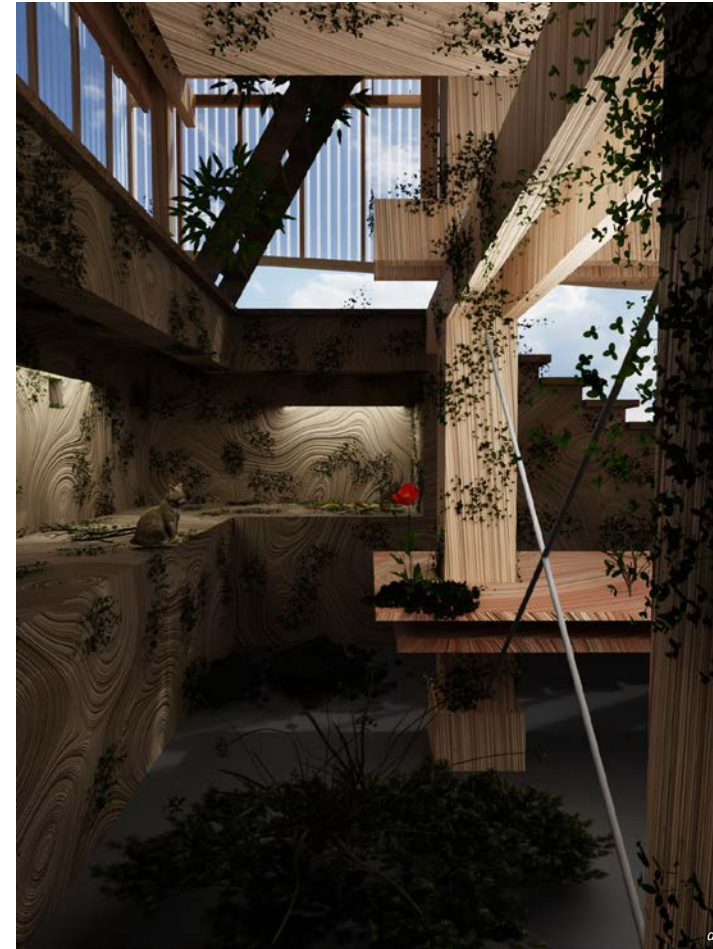
Instructor: Seth Thompson
Fall 2023
Software: Blender



LEFT_whole page. Nest That We Grow_Scene I_Tea Room

RIGHT a. Nest That We Grow_Scene II_Basement

RIGHT b. Nest That We Grow_Scene III_Terrace



*In shadows deep, where roses sigh,
A stone cat guards beneath the sky.
Abandoned Home, wood whispers past,
Doomy air, but hope holds fast.*



Left, TECH 1:1 Model, connecting point of roof glazing and roof garden

Right, Tadao Ando, Water Chaple model and variation experiment