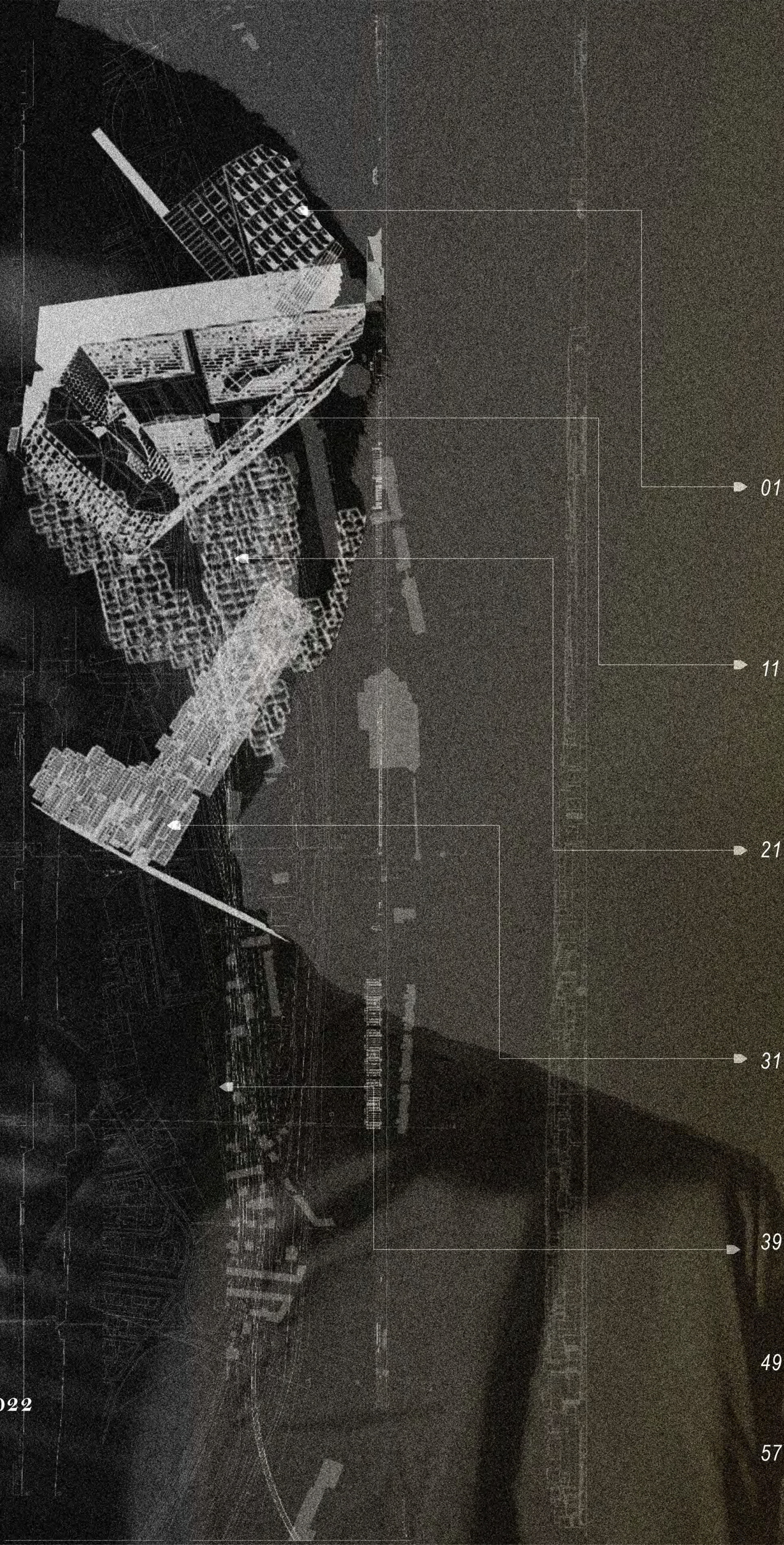


“Atypia” is not the antonym of “Typical”, but an extension. The prerequisite of “Typical” is “Known”, while the “Atypia” brackets both “Known” and “Unknown”.

# “An Atypia Architect”

Individual Architectural Design Portfolio 2022

by **Yilin Wang**



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# OUTLINED TREES

Installation Method in Architectural Typology and Morphology  
Design of Campus Apartment in Wuhan University, China

Individual academic work

July-November 2021

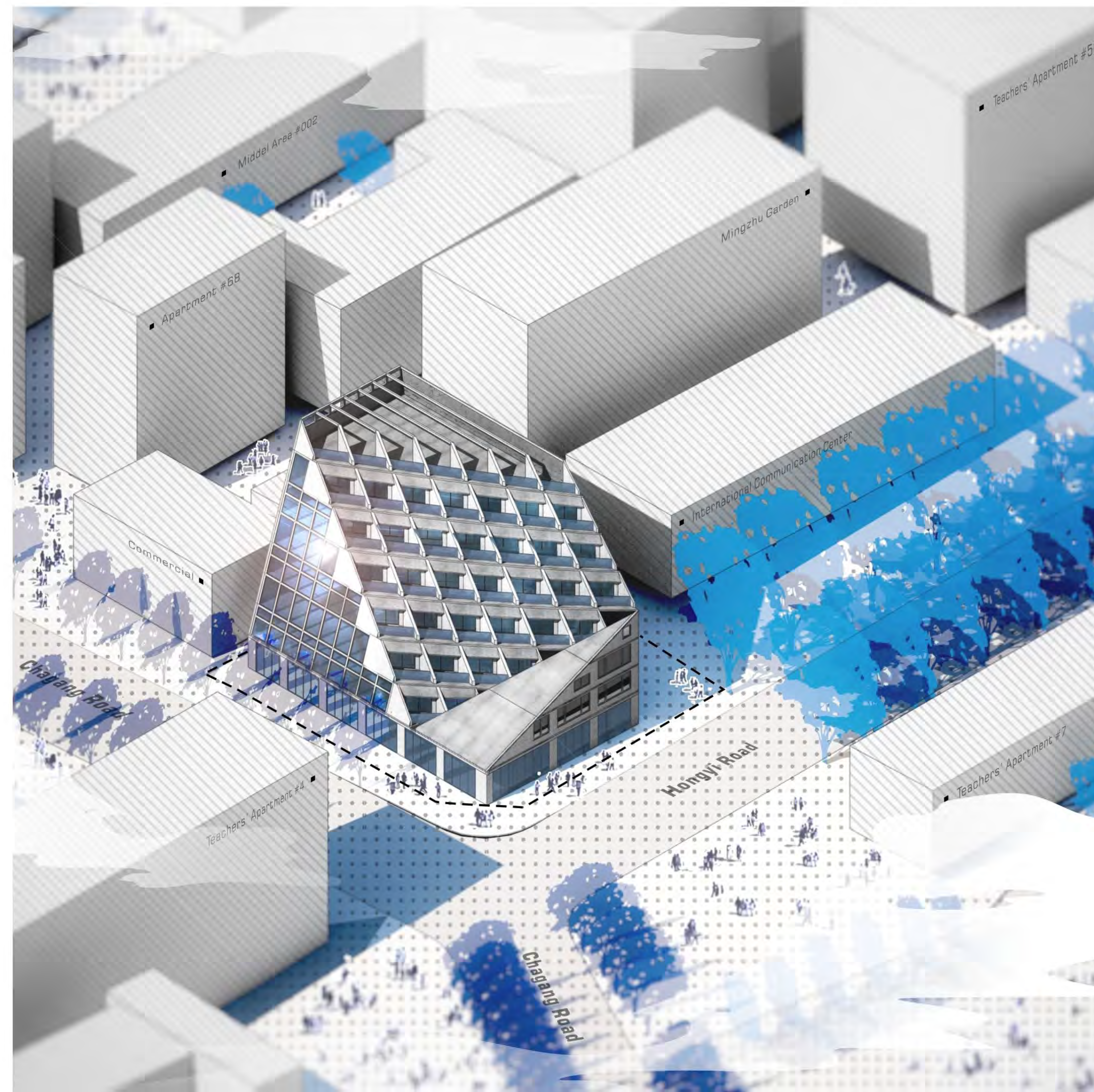
## SYNOPSIS

This is **NOT** a purely conventional architecture design project. It is an installation experiment that can be applied to the real site so as to guide the subsequent architecture design.

China's college campuses are often located in the places with lush trees and surrounded by mountains and rivers. Moreover, at the beginning of the construction of campus environment, most of them were designed and planned based on the theory of traditional Chinese landscape gardens. However, during the transformation and expansion process of modern colleges and universities, the new architectural forms and styles are rarely combined with the original design intentions, which makes the

architectures on campus are getting rid of hybridity or genealogy of historical architecture styles.

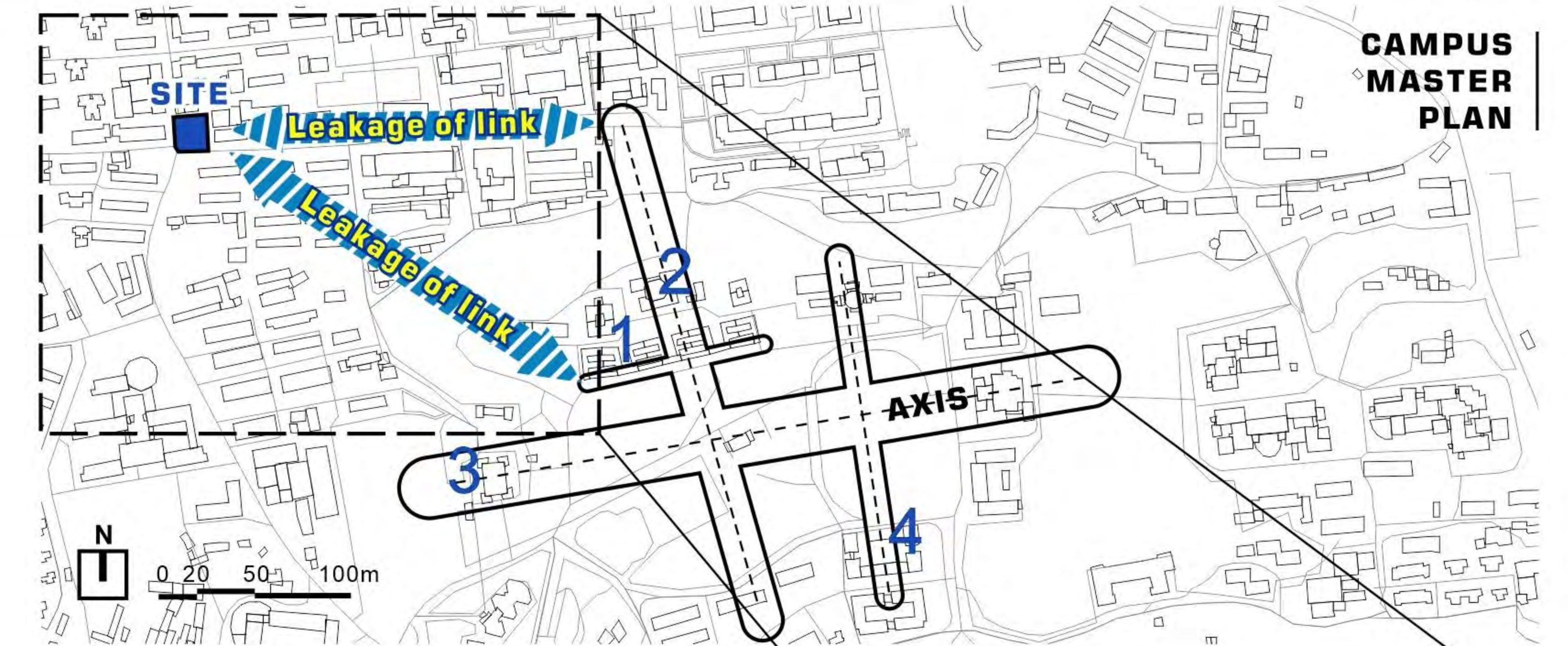
The campus architectural typology in Wuhan University was derived from the modern improvement of Chinese traditional architectural style. My obsession is: **How can the high-rise campus apartment architecture design inherit the existing modern architectural typology?** This project attempts to decode the types of campus buildings through a suit of **INSTALLATIONAL DESIGN**, and henceforth applies the research results of this installation to the preliminary architectural morphology design of the campus high-rise apartment.



## EXISTING PREMISE 1

**Long Distance** from the Main Axis of the Whole Campus Planning Structure

The location of the site is far from the main structure of the campus planning, and it is basically in a marginalized state. The buildings around the site are recognized as a blind area of the campus plan and design.

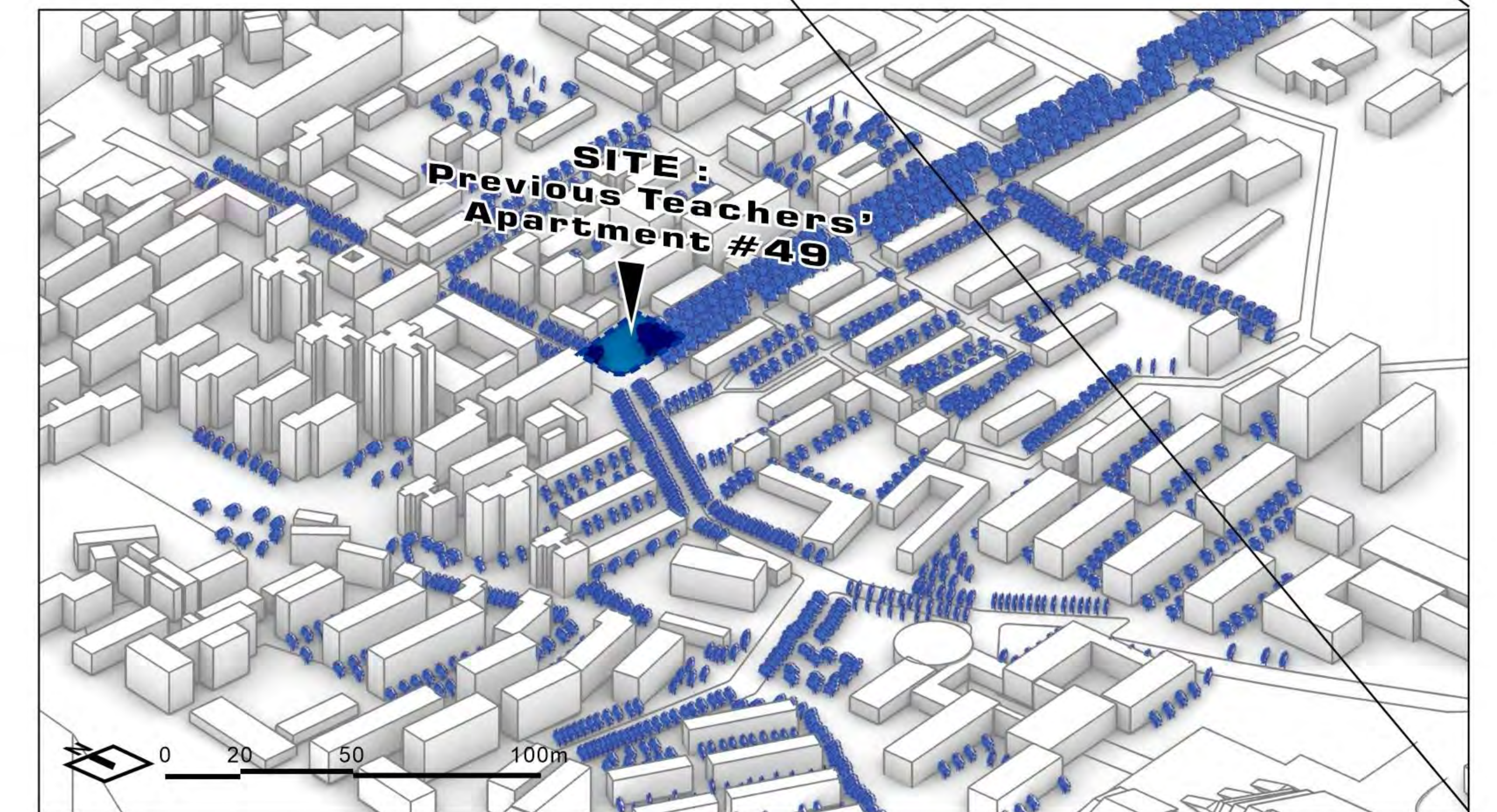


CAMPUS MASTER PLAN

## EXISTING PREMISE 2

Remarkable **Tree Arrays**

The trees along paths around the site are the only group of elements derived from the original campus planning. However, most trees are aligned along certain tracks rather than the surrounding buildings. As a consequence, there is little relevance between trees and the surrounding buildings within the scope of my site.

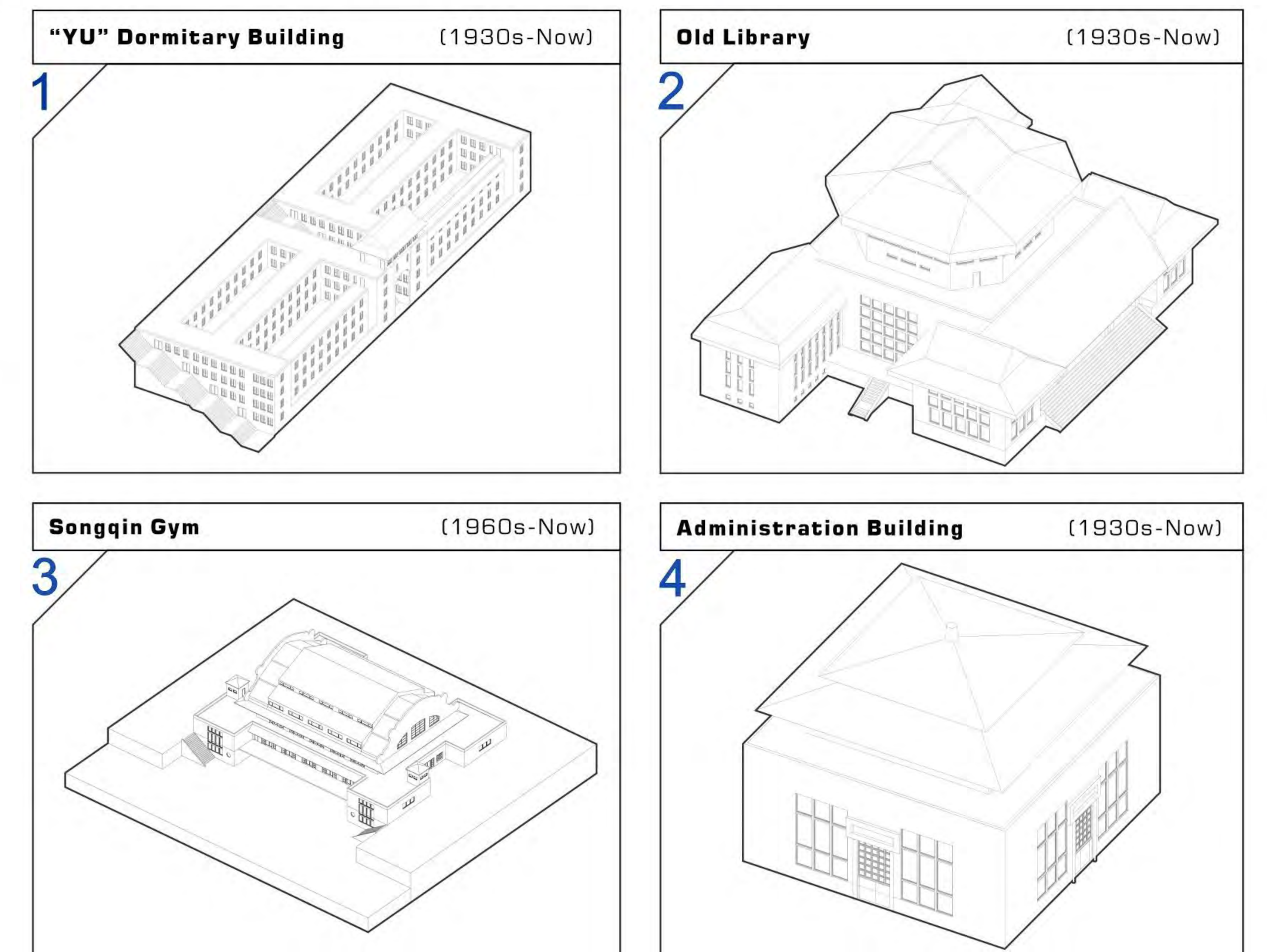


## EXISTING PREMISE 3

Succession from the **Architectural Typology of the Landmarks & the Building Heritages**

The historical architectural heritages in Wuhan University are very unique, which makes the campus a famous scenic spot in Wuhan City. Originally, the style setting of the old buildings had fully taken the characteristics of trees and traditional Chinese landscape garden buildings into account already.

The relationships between historical architectural heritages and the existing trees is of reference value, hence the relationships can be integrated as an academic example for the subsequent new architectural design.



### ARCHITECTURE HERITAGE SAMPLES WITH TREES

Further Research Sample:

**Old library**  
 Function: A library for storing, studying and borrowing; also used as lecture room  
 Built time: 1933-1935  
 Area: 4767sqm  
 Material: reinforced concrete, steel, tile, glass  
 Openness: for students and all staff

**Lao Zhai Dormitory**  
 Function: dormitory for guys  
 Built time: 1931-09  
 Area: 10000 sqm  
 Material: concrete, steel, tile, timber, glass  
 Openness: only for students living here

### DYNAMIC PHOTOGRAPHIC METHOD in the Old Library

+ Lao Zhai Dormitory (with Sakura Avenue, a scenic path)

Among these building samples, Lao Zhai Dormitory is selected for further analysis, and the aesthetic principles of the campus buildings and scenery in the plan composition is analyzed through the superposition of transport, medium and close range photos.

The preliminary research of the project is to analyze the typology of the classical buildings on campus, that is, to combine the axonometric and section drawings of the buildings with the surrounding scenery such as trees. It is my first step to explore the relationships between static heritage buildings with the dynamic natural elements.

**Legend**

- Camera Position
- Front Building
- Back Building
- Tree
- Flower
- Path

**1 View from Top to Bottom**

Shooting Spot | Photo | Photo Coincidence | Element Extraction

Old Library

**2 View Between Building Wings**

Shooting Spot | Photo | Photo Coincidence | Element Extraction

Lao Zhai Dormitory

**3 View of Different Plants & Seasons**

Shooting Spot | Photo | Photo Coincidence | Element Extraction

Lao Zhai Dormitory

Flowering season "Wuhan University Sakura Festival"

Summer Foliage period

Winter Withered period

OUTLINED TREES

Installational Method in Architectural Morphology Design of Campus Apartment in Wuhan University

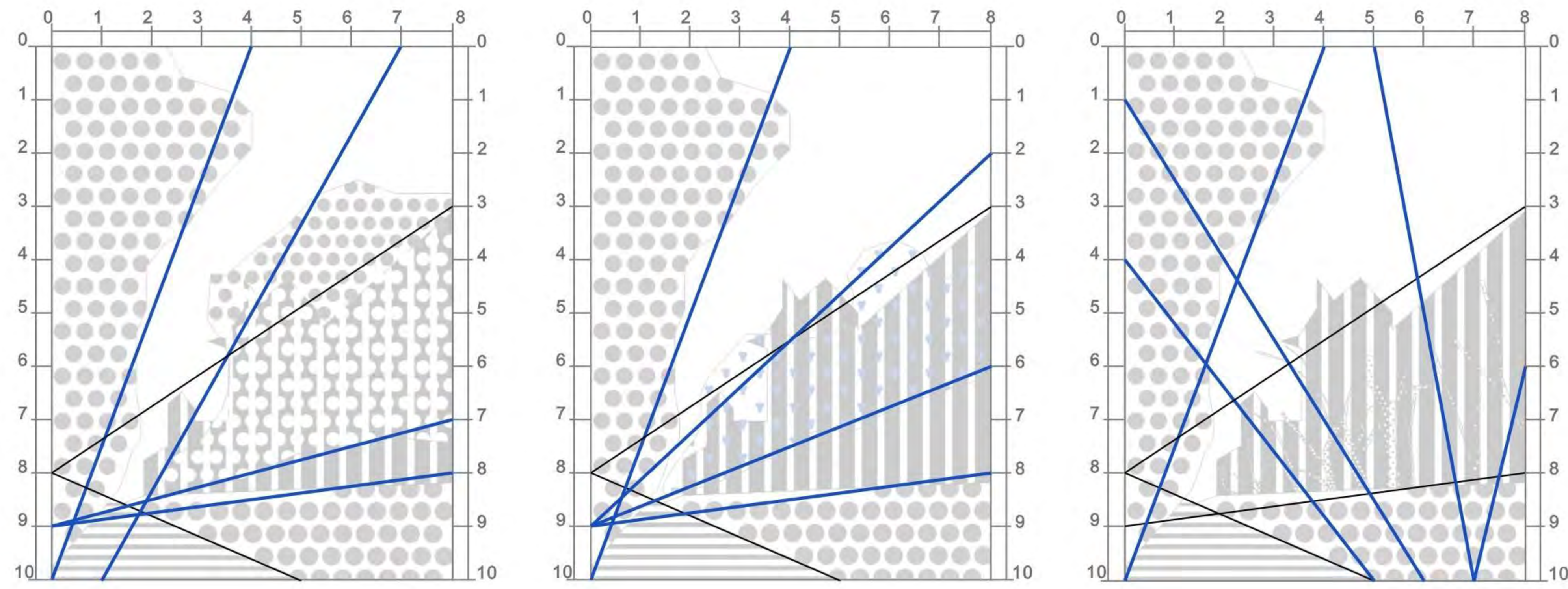
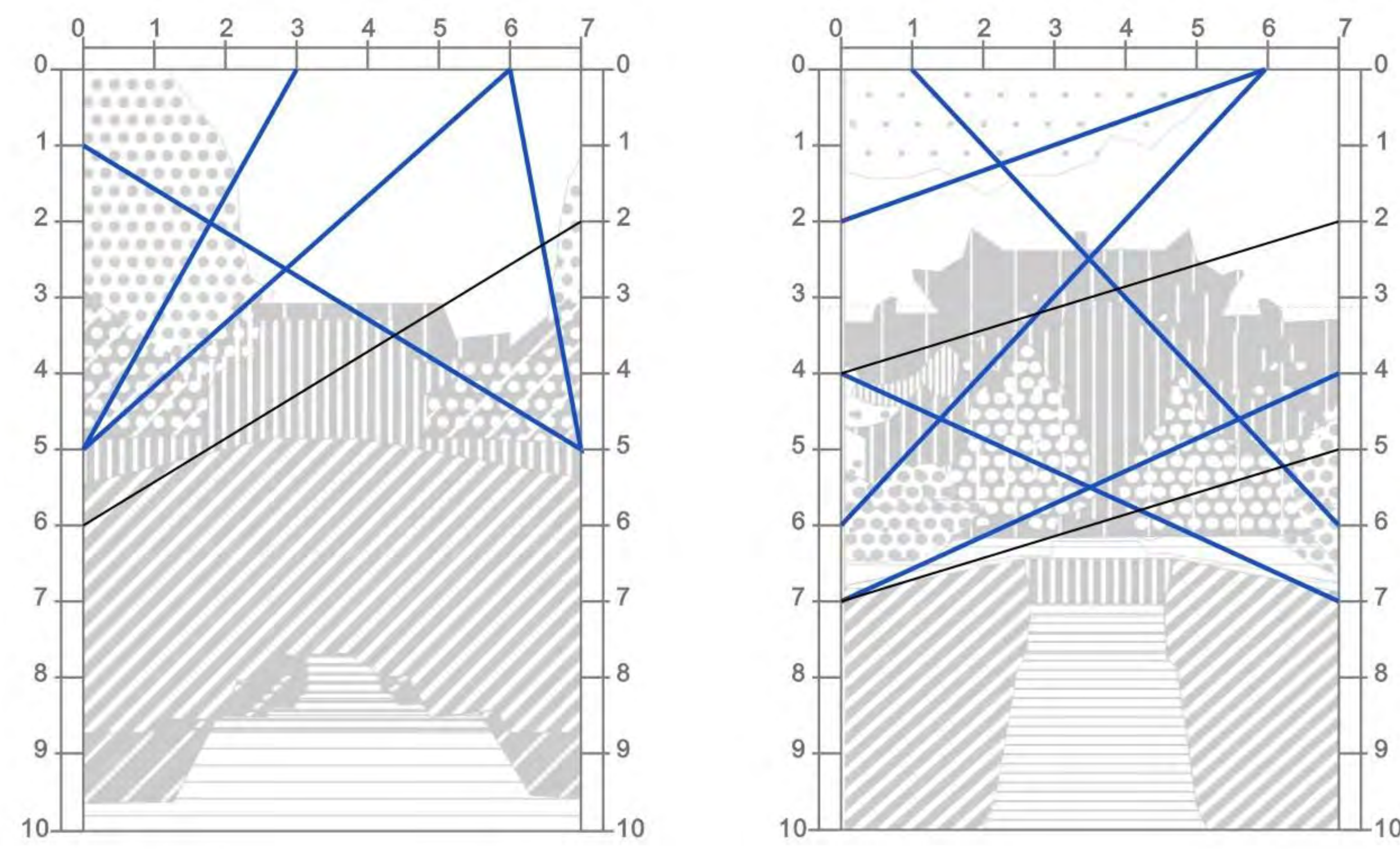
OUTLINED TREES

Installational Method in Architectural Morphology Design of Campus Apartment in Wuhan University

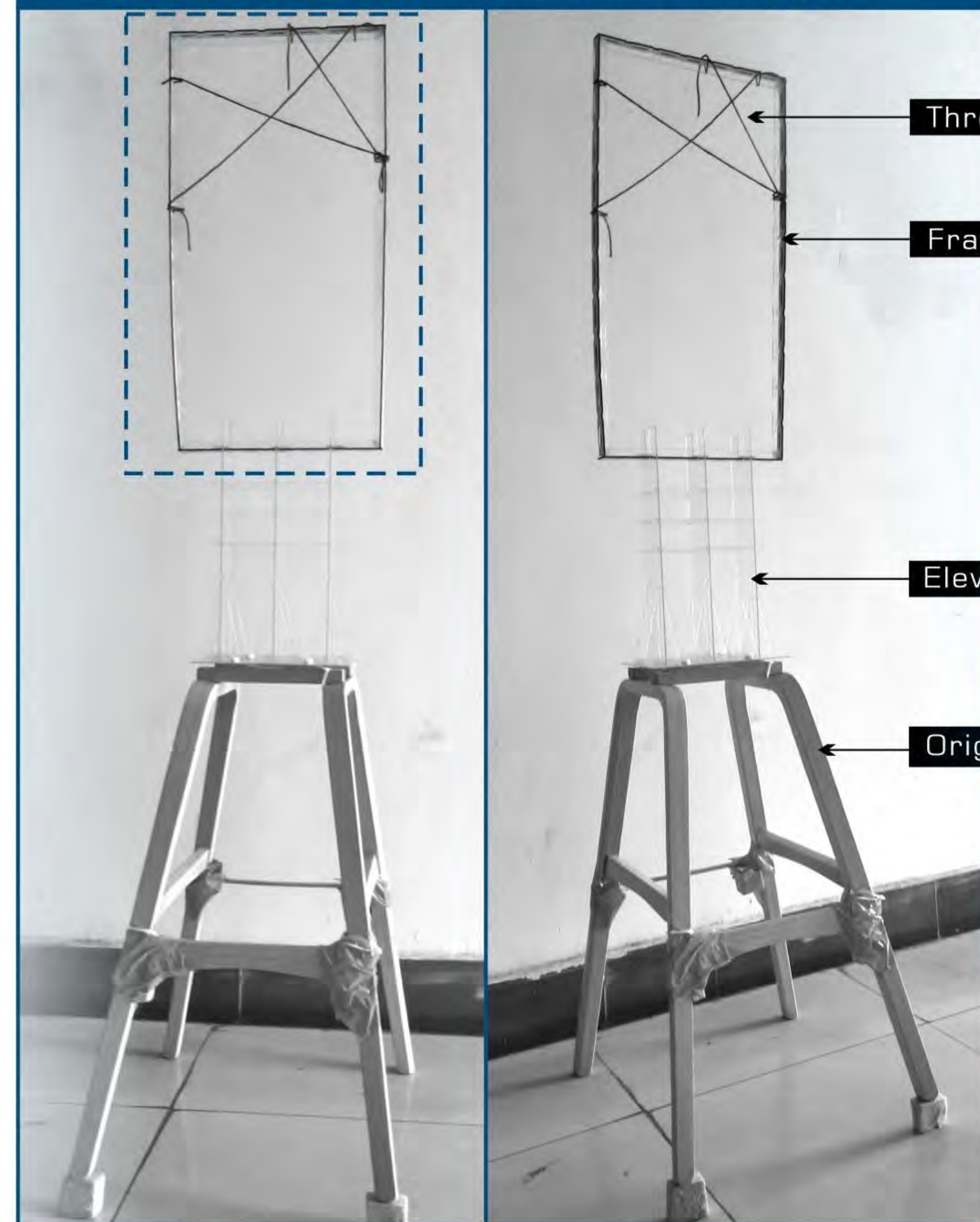
**FRAME AND OUTLINES OF TREES WITH BUILDINGS**

— Tree outline — Existing building outline

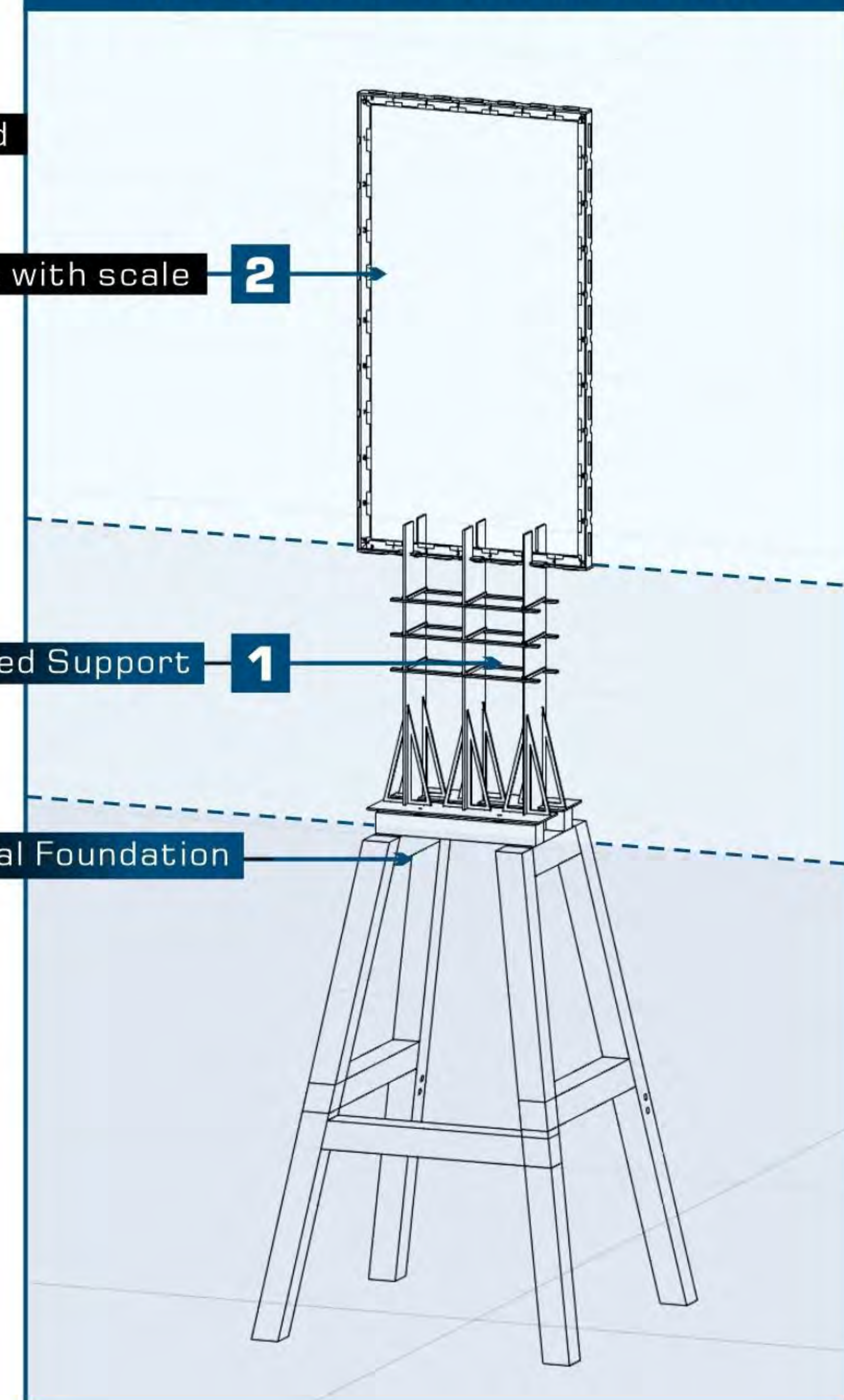
Based on the photography and abstract composition methods, this group of degree scale pictures analyzes the relationship between trees and heritage buildings. It is acknowledged that trees will change with time, and in the proportion of the pictures, the proportion of tree growth had been integrated into the arrangement of architectural elements among classic heritage buildings. In order to apply the typological principle of graphic compositions between heritage buildings and trees to the following architecture design in my site, it is necessary to make a set of material installation model.



**THE WHOLE INSTALLATION STRUCTURE**



**INSTALLATION AXONOMETRICS**



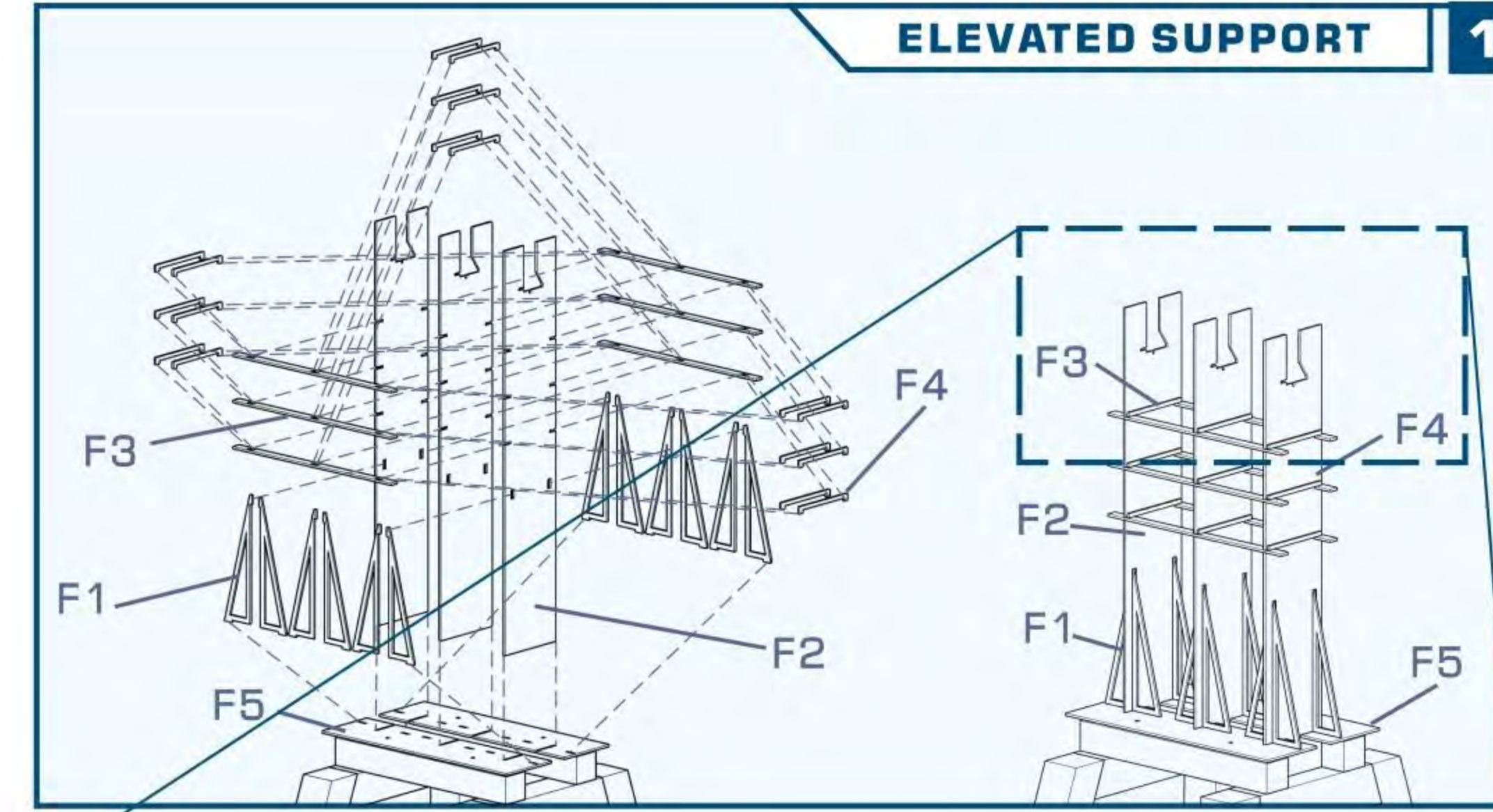
**TOP VIEW SIDE VIEW FRONT VIEW**

**INSTRUCTION** Media: Transparent acrylic (A3 size/10mm thickness), Wooden board (A3 size/10mm thickness), Wooden legs of finished chairs as a foundation

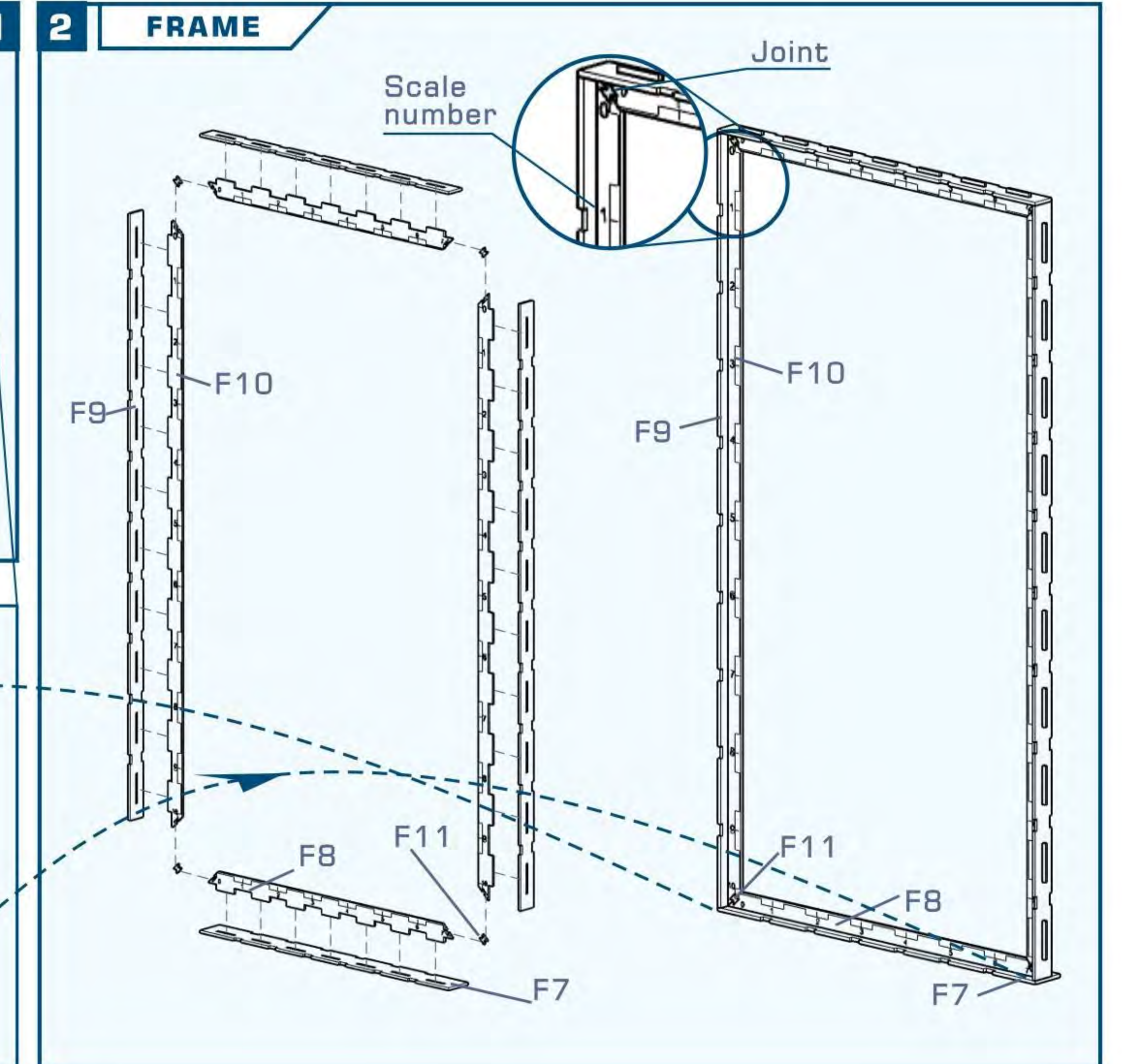
**SEPARATE COMPONENT**

F1	[Component]	X12
F2	[Component]	X3
F3	[Component]	X6
F4	[Component]	X18
F5	[Component]	X2
F6	[Component]	X3
F7	[Component]	X2
F8	[Component]	X2
F9	[Component]	X2
F10	[Component]	X2
F11	[Component]	X4

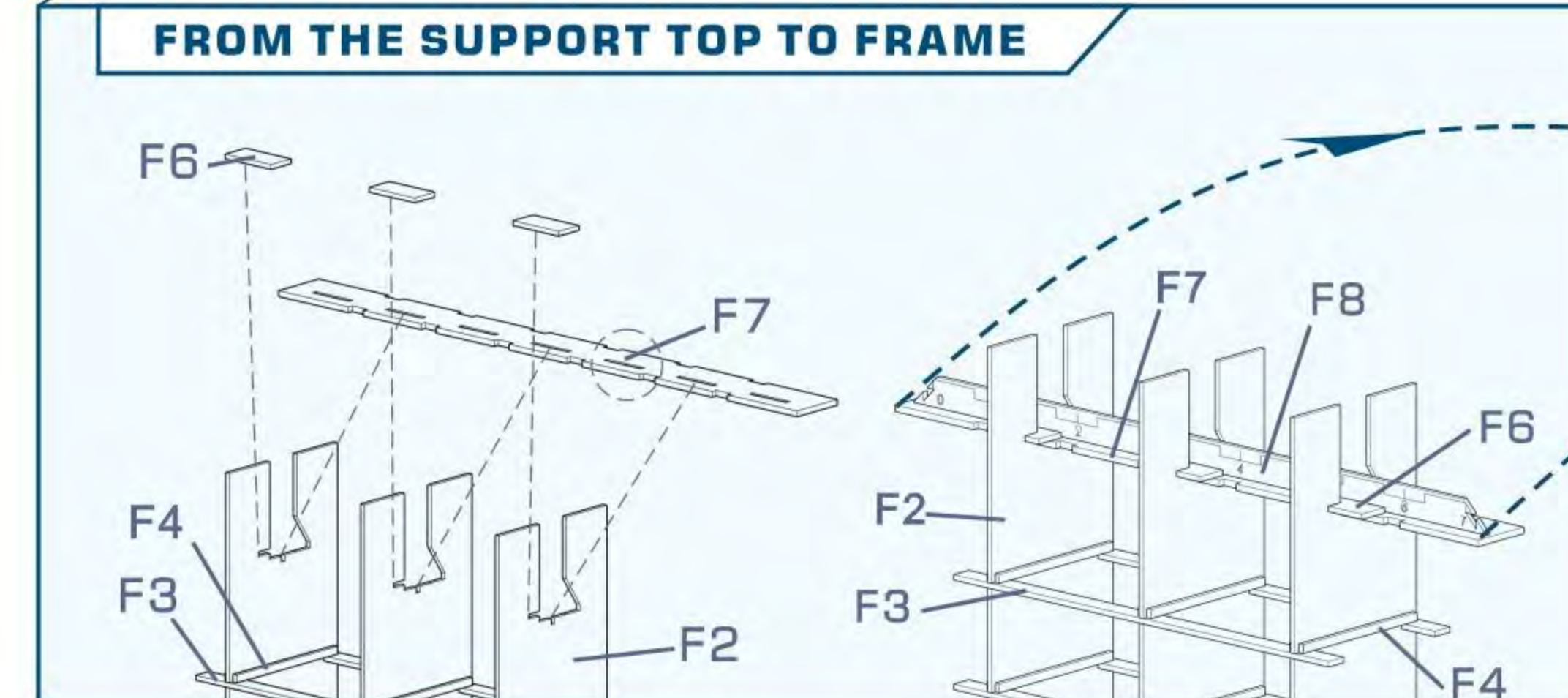
**ELEVATED SUPPORT 1**



**FRAME**



**FROM THE SUPPORT TOP TO FRAME**

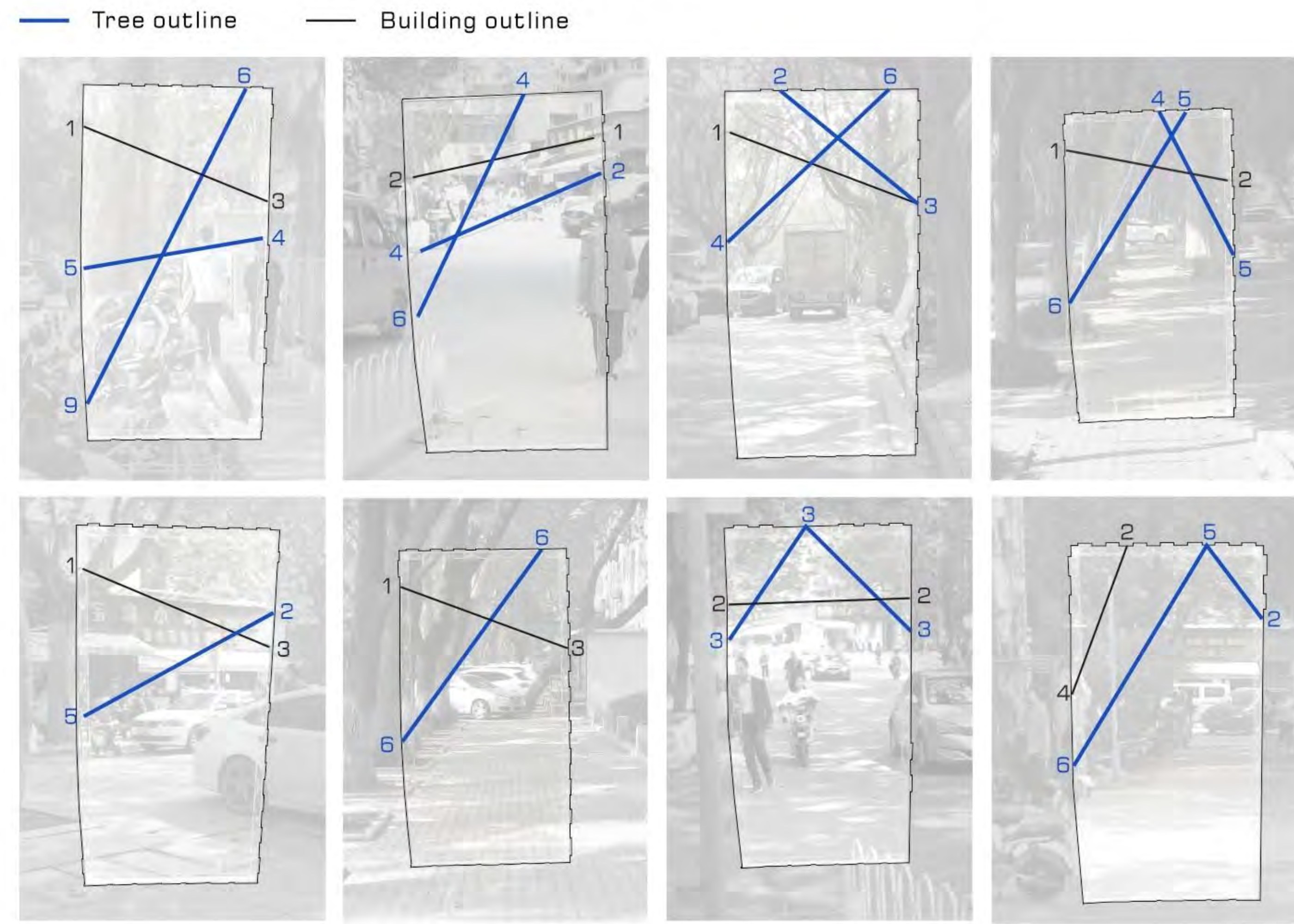


**APPLICATION IN REAL FIELDS AWAY FROM THE SITE**

After the model is completed, the model needs to be moved to the site around the site (especially outside the site, not within the site or adjacent to the site range) to draw the outlines of the real street view with tremendous existing trees.



### OUTLINE ANALYSIS OF STREET-SCAPE

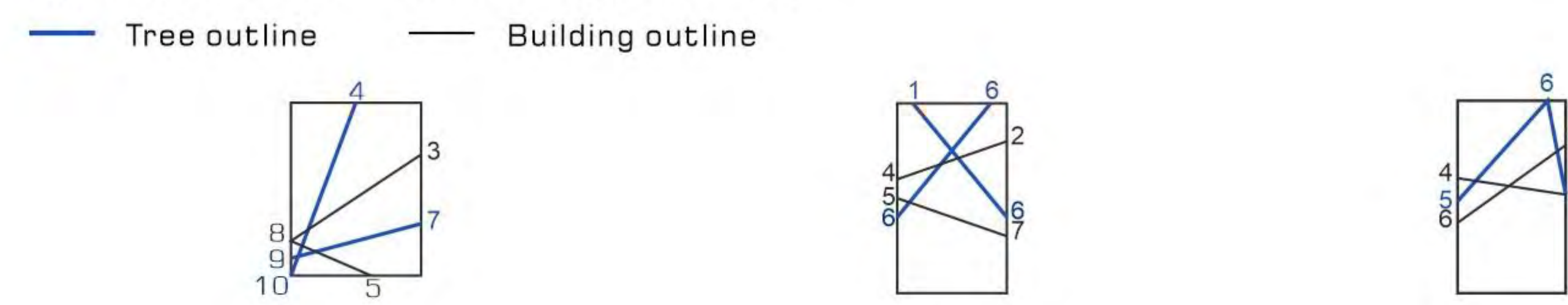


### SUPERPOSITION METHOD:

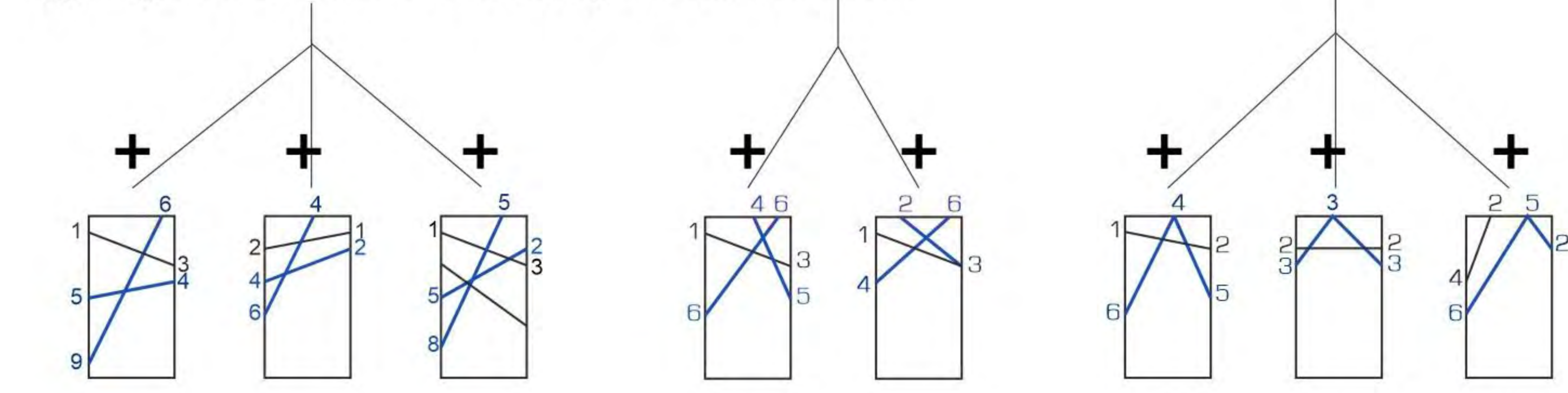
**HERITAGE TYPOLOGY ± STREET-SCAPE = NEW BUILDING OUTLINE**

Using the typological results of heritage buildings to supplement or delete the current typological results of street-scapes around the site, and then the classical typological results can be applied to the preliminary design of the site.

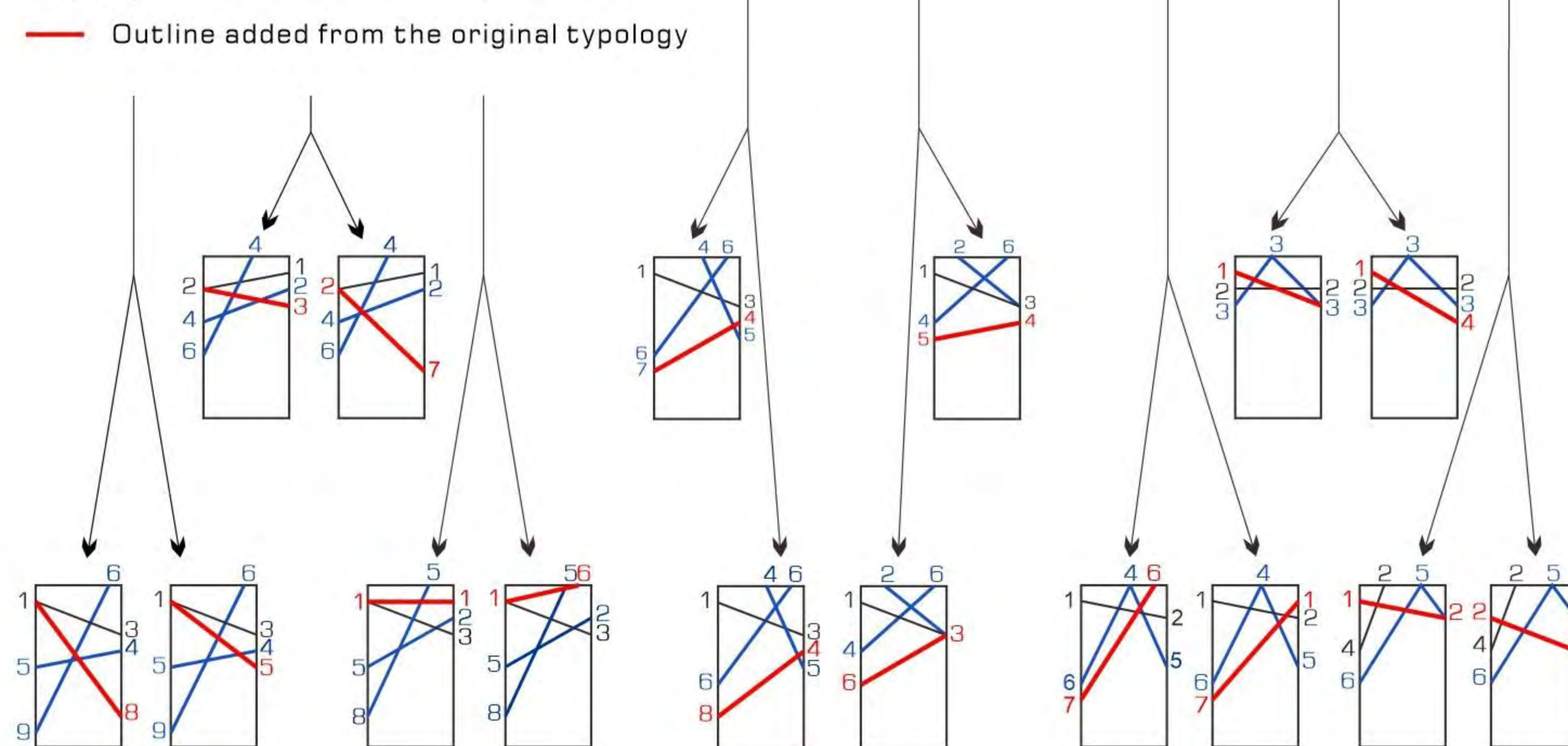
### Typological Result of Heritage Buildings



### Typological Result of Street-scapes around the Site

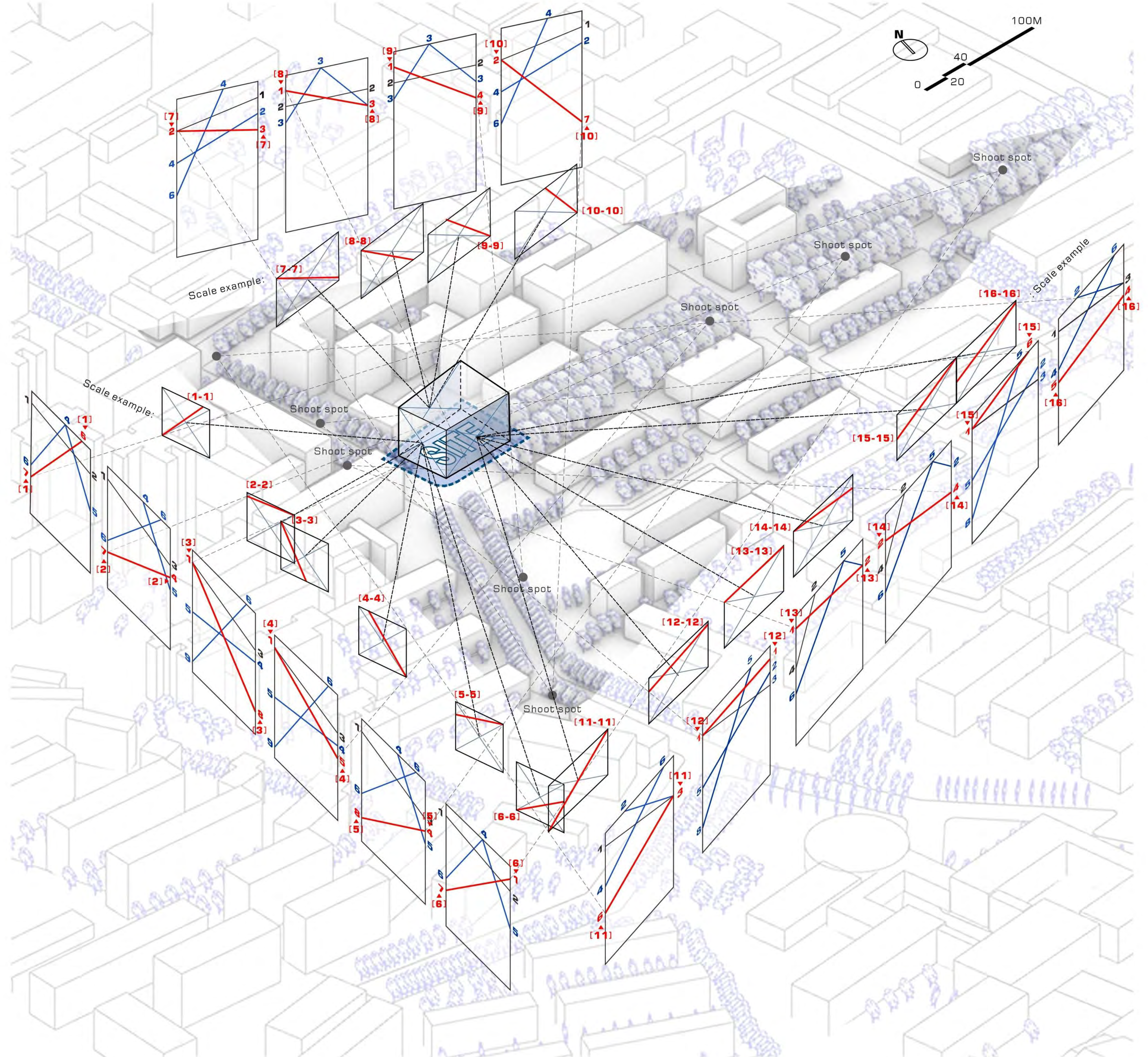


### Superposition



### COMPREHENSIVE OUTLINE ARRANGEMENT AND THE OUTLINE TRANSLATION TO THE ARCHITECTURAL BLOCK IN THE SITE ( 2D LINE - 3D LINE )

The superposition results will be horizontally panned and scaled from the respective shooting spots. Various graphic results will be translated to the scope of the site. Through the outlines extracted from the graphic results, the spatial lines of the preliminary architectural block can be obtained.



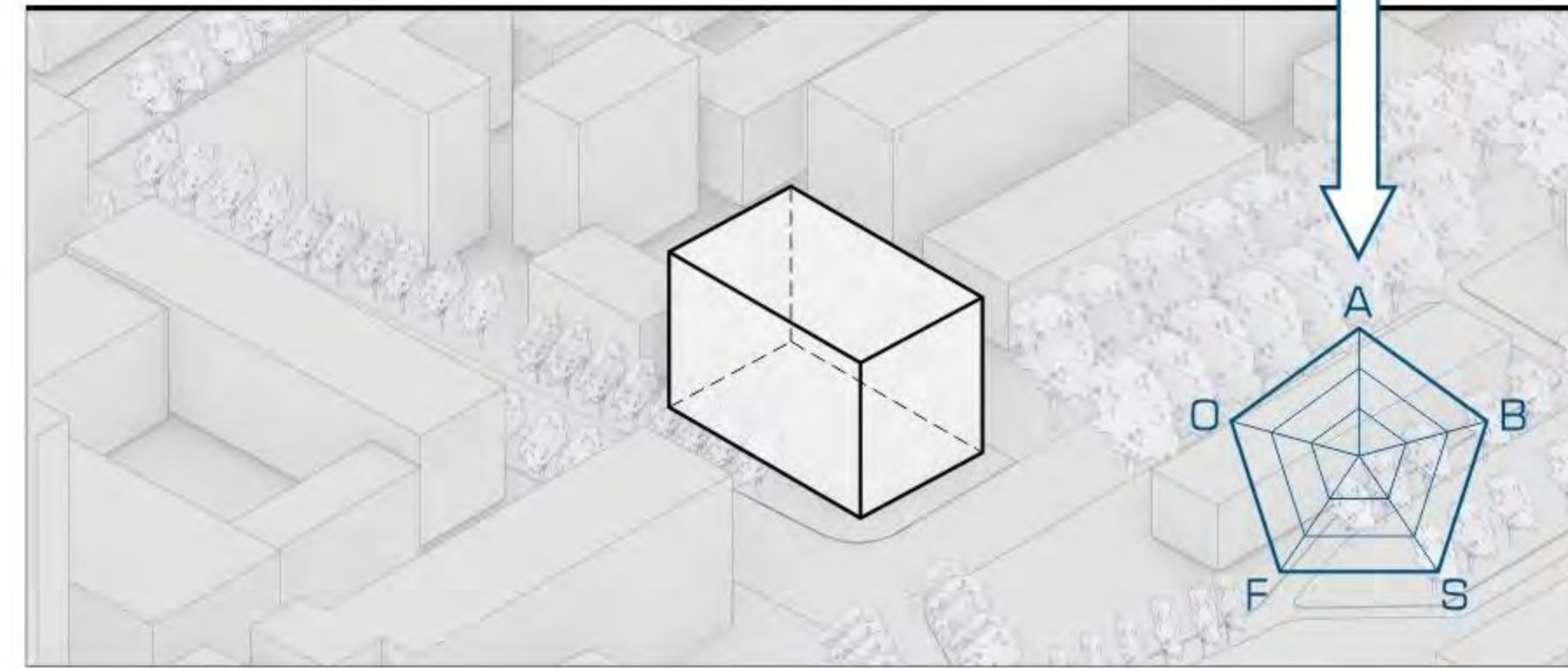
### OUTLINE COMBINATION RESULT ( 3D LINE - 3D BLOCK )

After the groups of outline combinations are displayed below, the pure 3 dimensional models can be generated which is out of any considerations about architectural construction technologies, cost or using eligibility, so that the "Assessment of Architectural Bias" are given to decide the most suitable architectural form result.

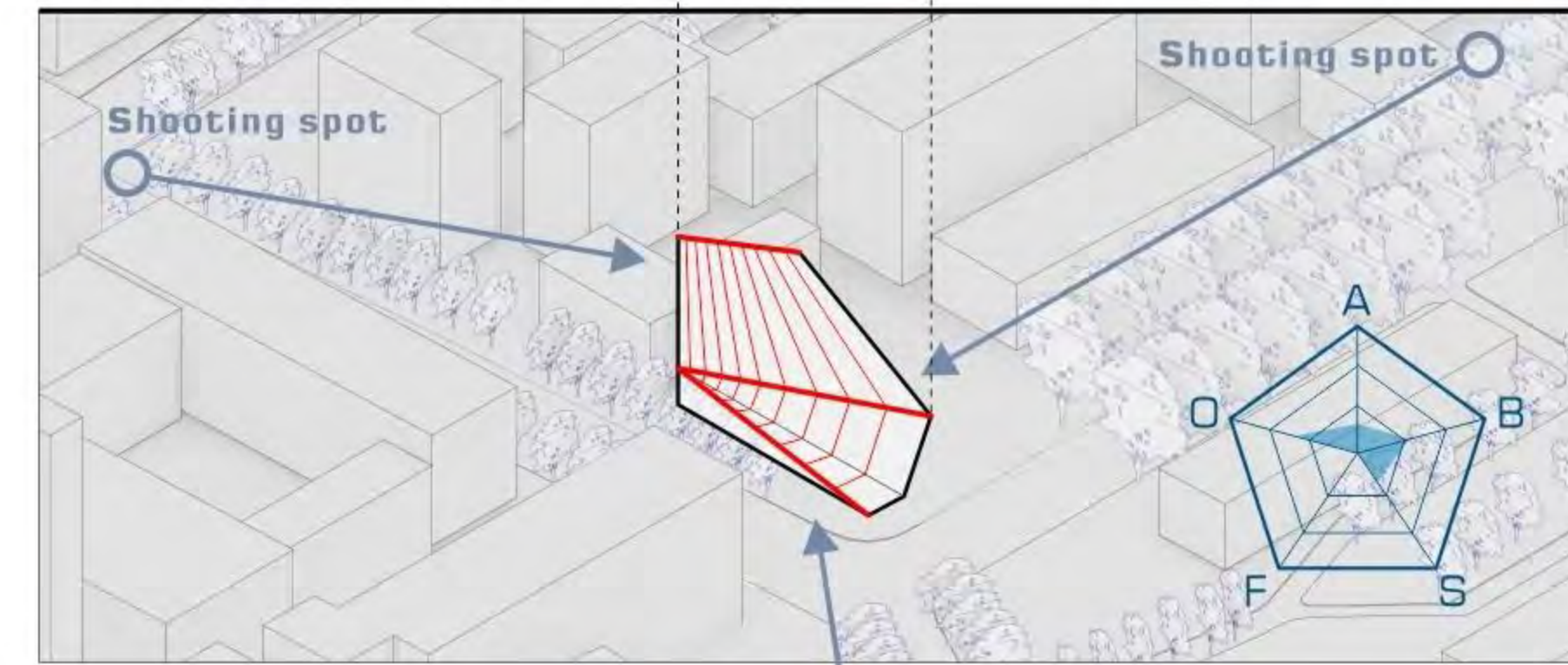
#### Assessment of Architectural Bias

- A: Amount of acute angle ( less=better )
- O: Amount of obtuse angle ( less=better )
- F: Falling gradient ( less=better )
- S: Slope area ( less=better )
- B: Block volume ( more=better )

Original Block



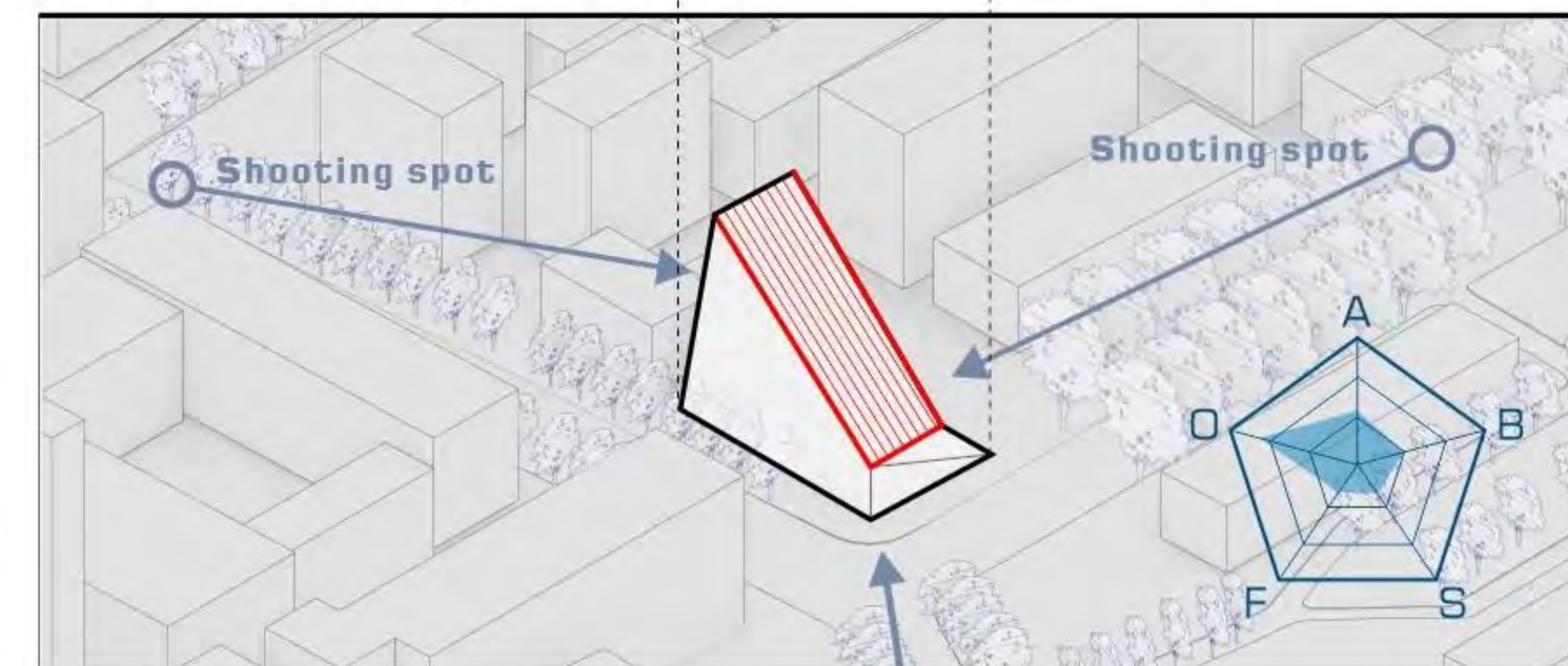
Combination Sample 1



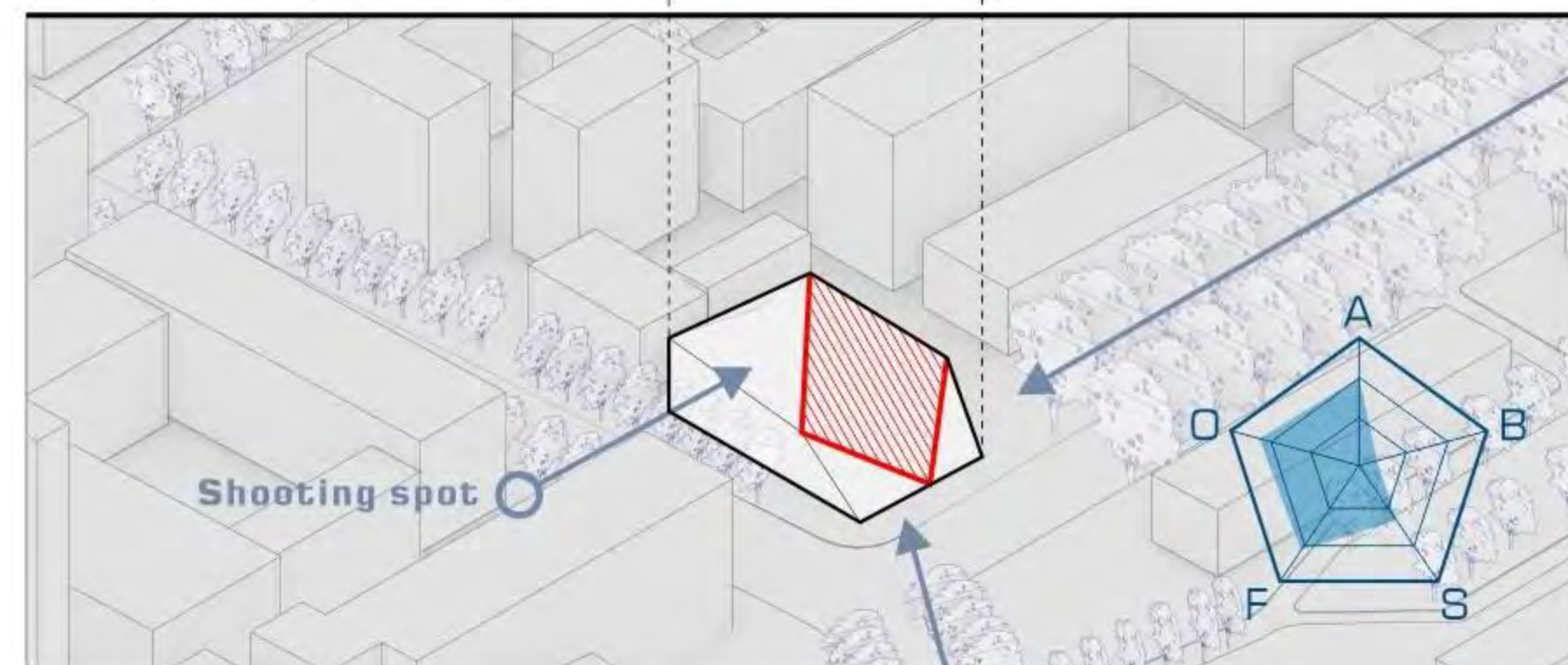
Combination Sample 2



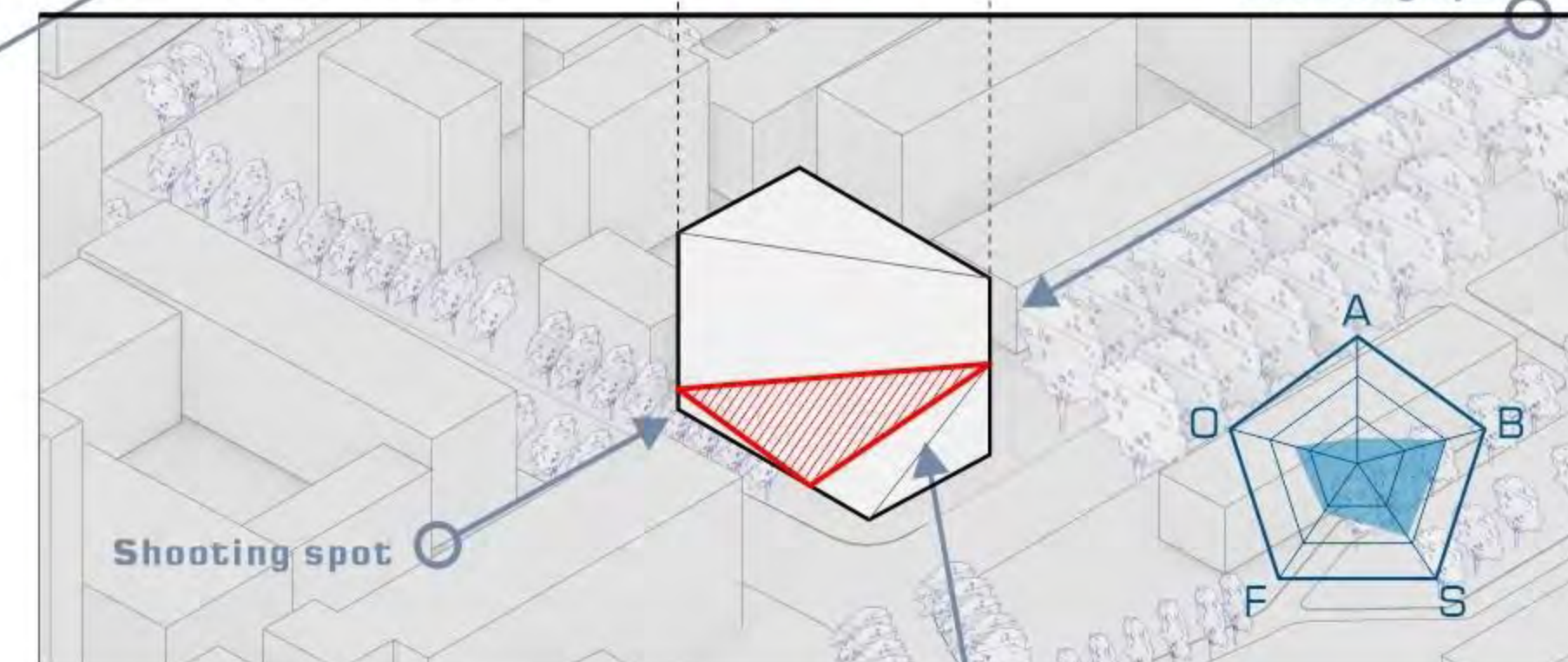
Combination Sample 3



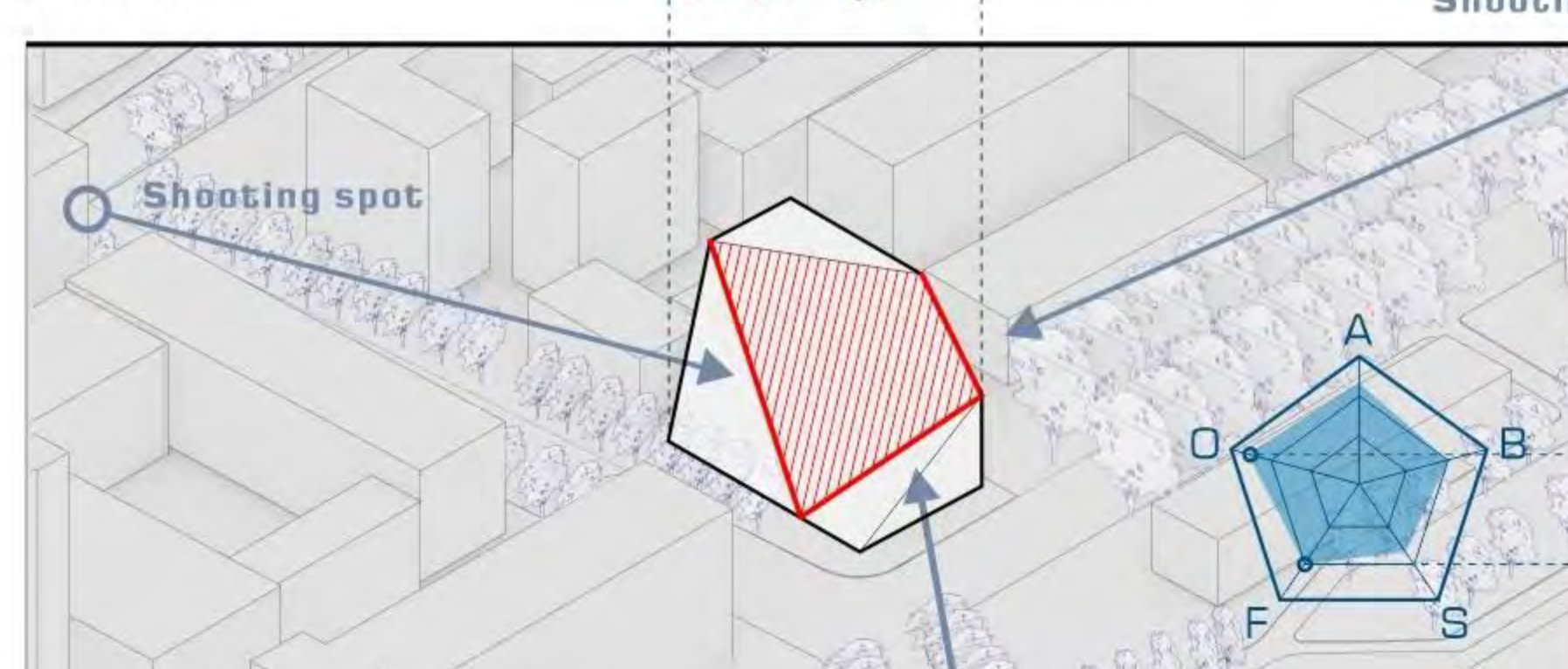
Combination Sample 4



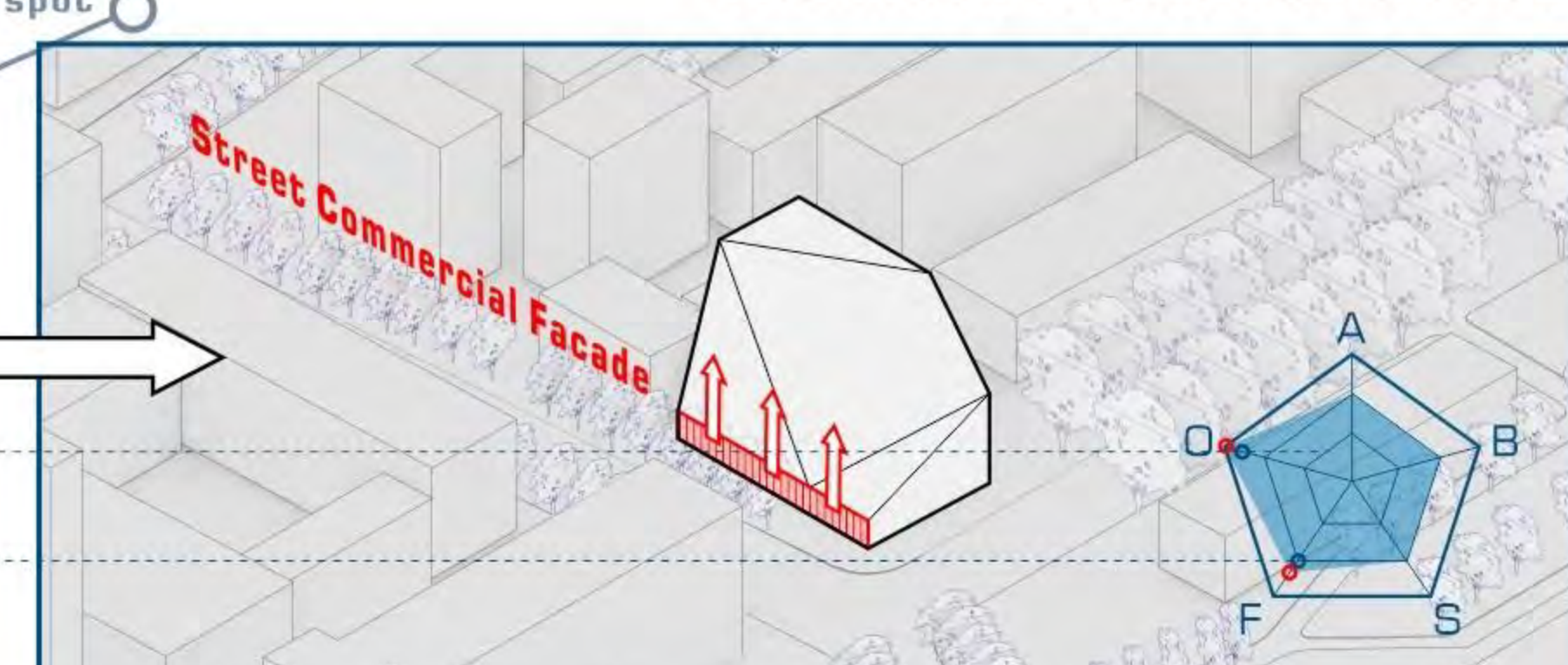
Combination Sample 5



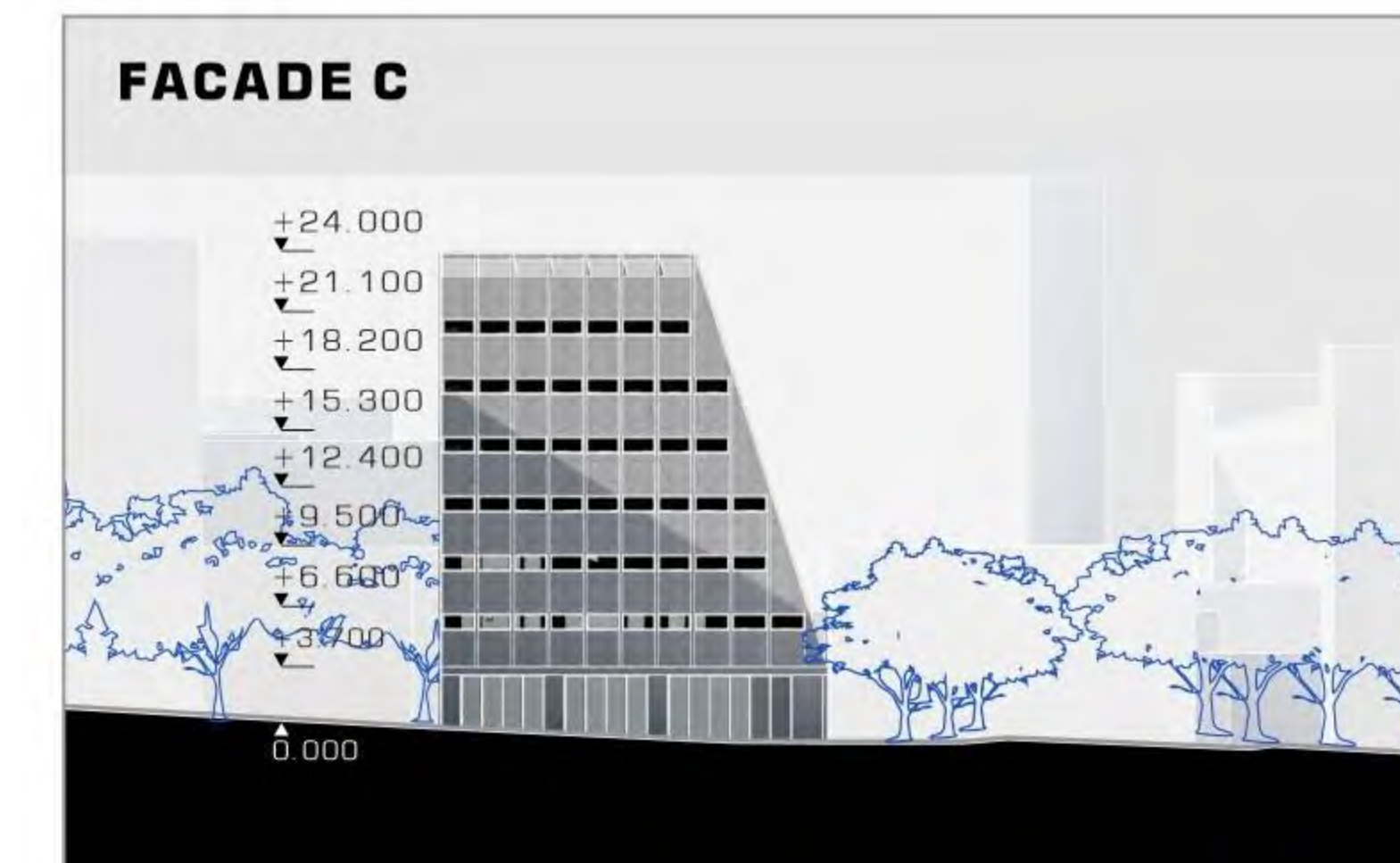
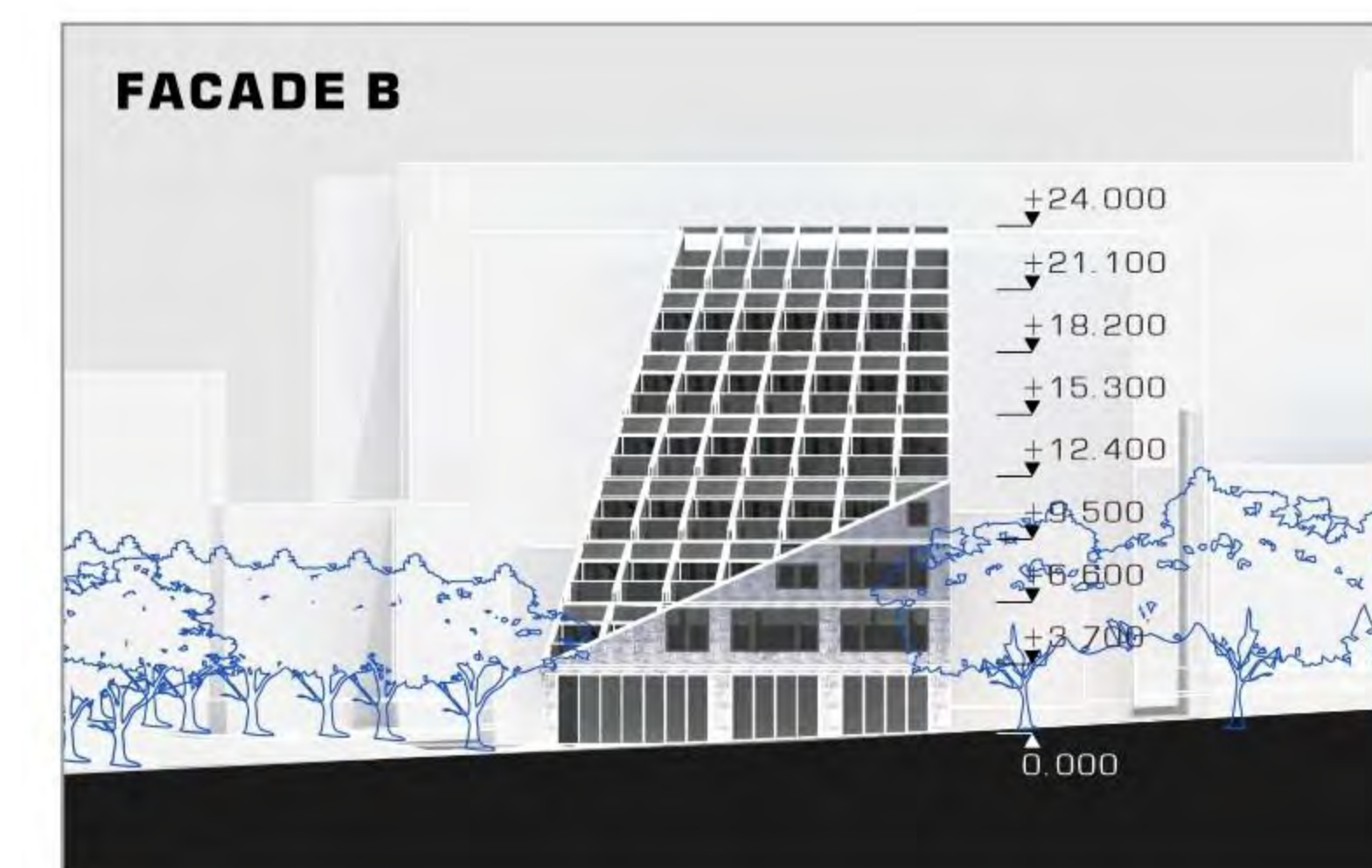
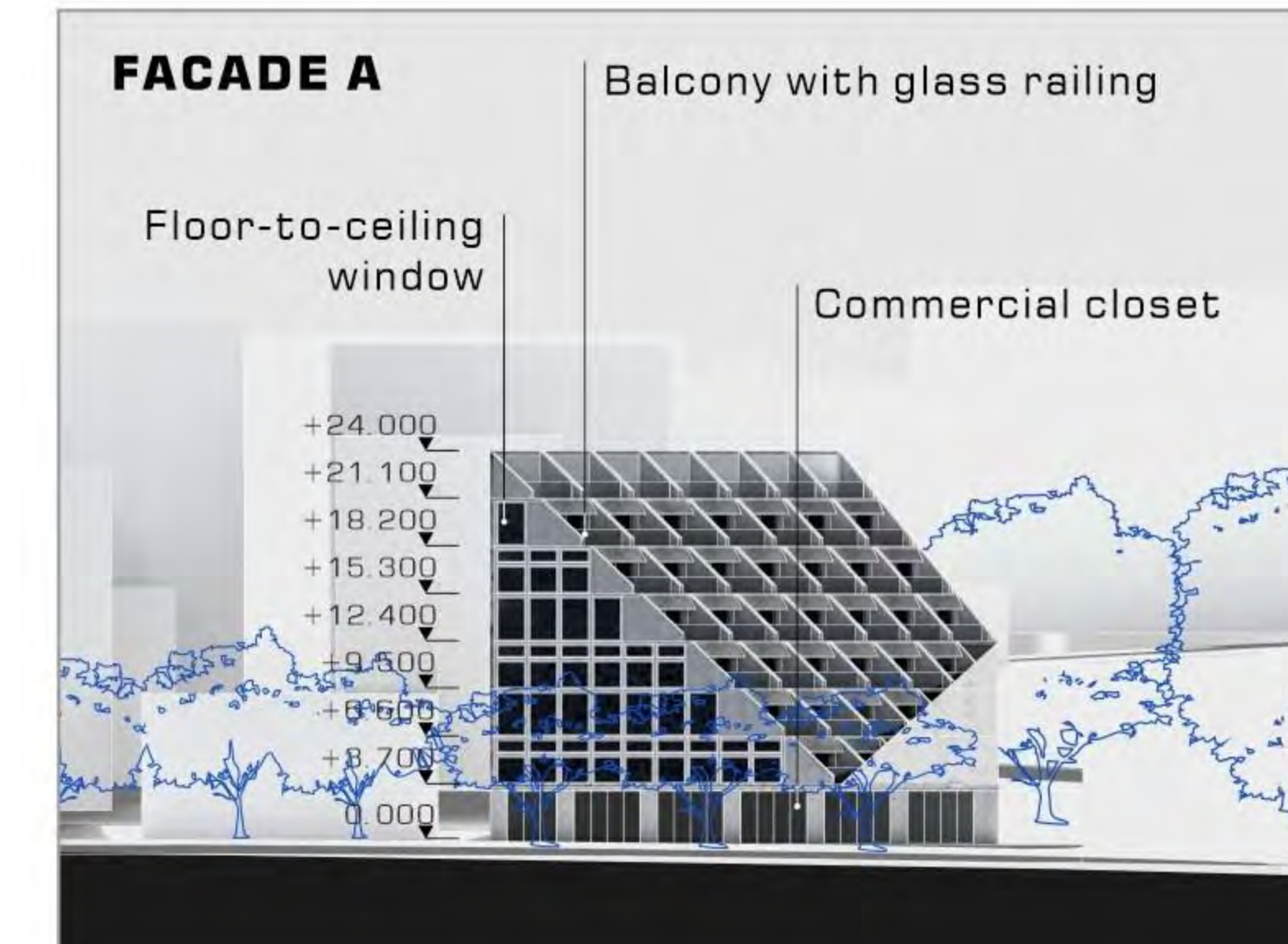
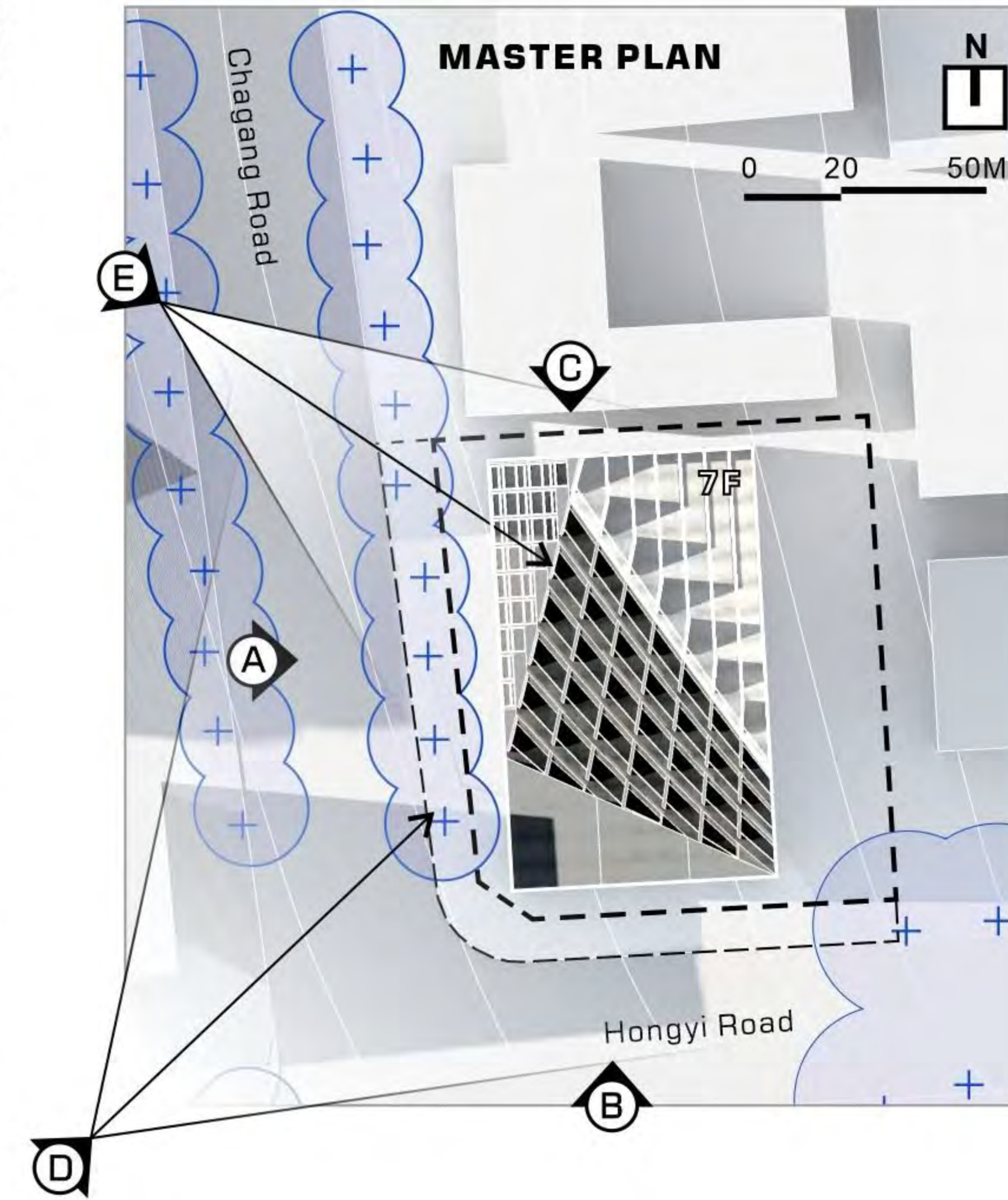
FINAL



THE MOST BALANCED RESULT



# ARCHITECTURAL MORPHOLOGY RESULT PREVIEW



### ARCHITECTURAL TECHNICAL ECONOMY EXPONENT

Lot Area: 805sqm  
 Gross Floor Area: 2932sqm  
 Plot Ratio: 3.6  
 Ground Floor Area: 589sqm

Building Density: 0.75  
 Floor: 7  
 Ground Floor Height: 1 x 3.7m  
 Standard Floor Height: 6 x 2.9m

# HYBRID OF "CONTRAST"

## Modern Architecture Design with Mixed Functions of Business and Commerce over the Historic Building of Bagong House

Individual academic work

January-April 2022

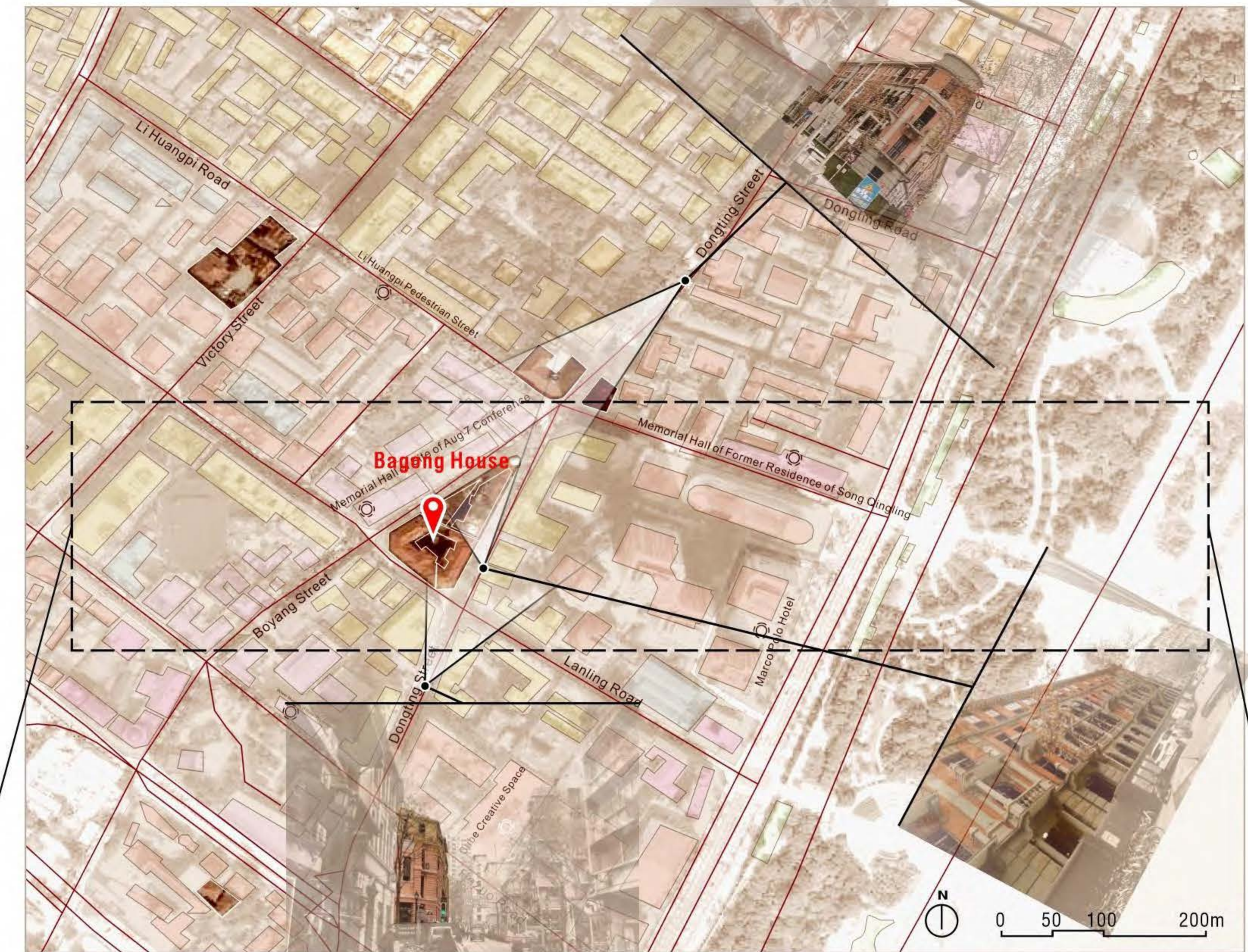
### BRIEF

The conventional renovation design of historical buildings usually begins with repairing of the interior of the historical buildings, so as to ensure the stability of the buildings and try to ensure that "repair as old as possible". However, Aldo Rossi's (1984) viewpoint to the permanent characteristics of urban architecture heritages are dynamic in his book "The Architecture of the City": the functions of a sprawling city are changing so that the positioning of historical buildings naturally needs to change accordingly. At my project site - Bagong House - in the past, as an example of collective housing type within the concession area of Wuhan, it is the structure and room scale of the typical apartment building typology that makes the internal transformation extremely difficult. At present, the historical blocks around the Bagong house are gradually being replaced by modern retail and service shops. Therefore, it is more necessary to take the most advantages of the particularity of these existing conditions because of the conspicuous architectural volume of the Bagong house and the special spatial location at the remarkable triangular traffic fork.

Adding new modern commercial building upon the historical building of Bagong House is the most direct design method in this project. The vertically extending building volume integrates the overall layout of the existing building heights, and the most economical support system is generated according to the existing building atrium scale.

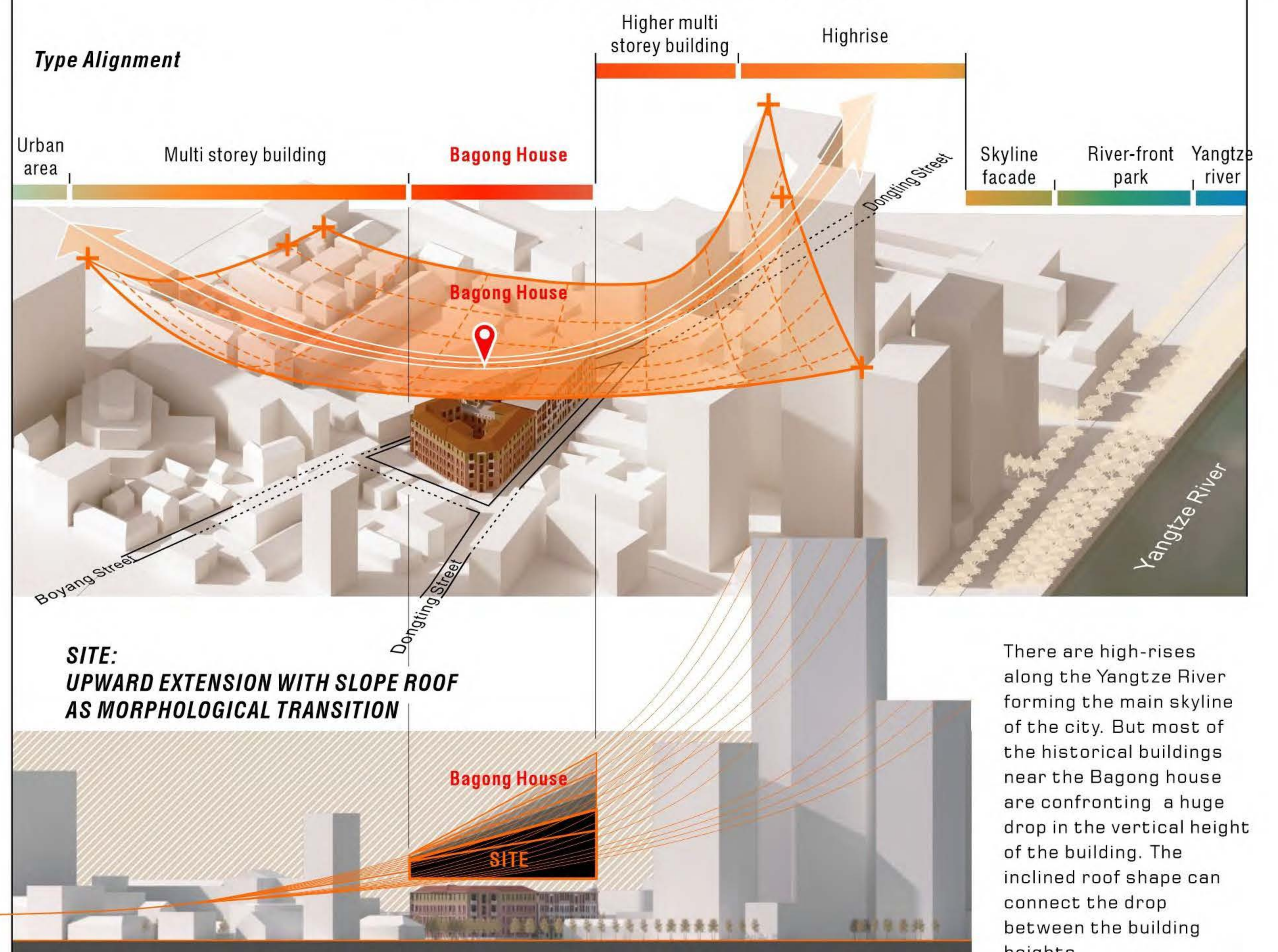


### PRESENT BUSINESS FORMATS AROUND BAGONG HOUSE



Legend Residential Historic Synthesis Education Public Park Facility

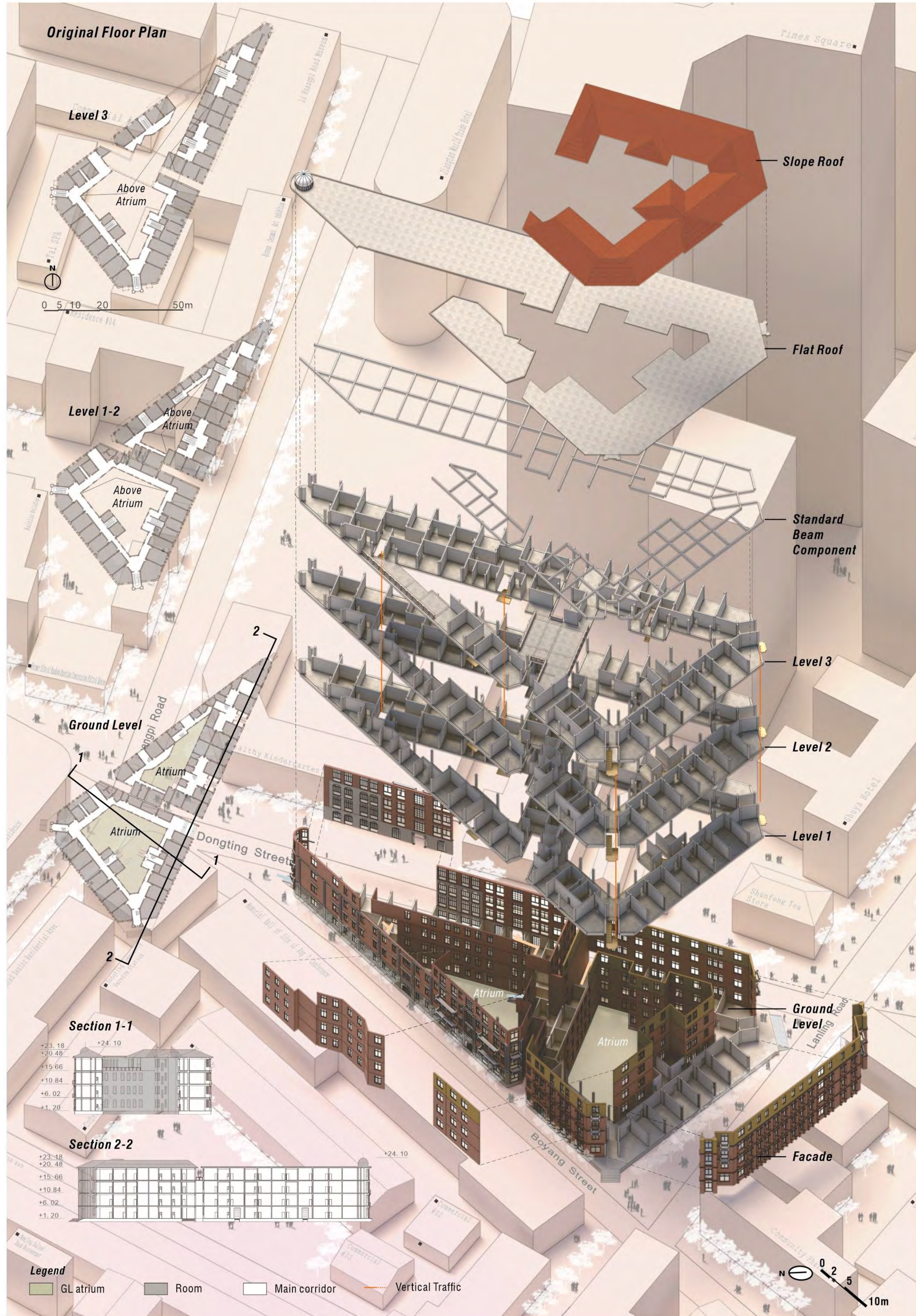
### ARCHITECTURAL TYPE OF HEIGHTS ALIGNED TREND



**SITE: UPWARD EXTENSION WITH SLOPE ROOF AS MORPHOLOGICAL TRANSITION**

There are high-rises along the Yangtze River forming the main skyline of the city. But most of the historical buildings near the Bagong house are confronting a huge drop in the vertical height of the building. The inclined roof shape can connect the drop between the building heights.

EXPLOSION OF THE ORIGINAL BAGONG HOUSE

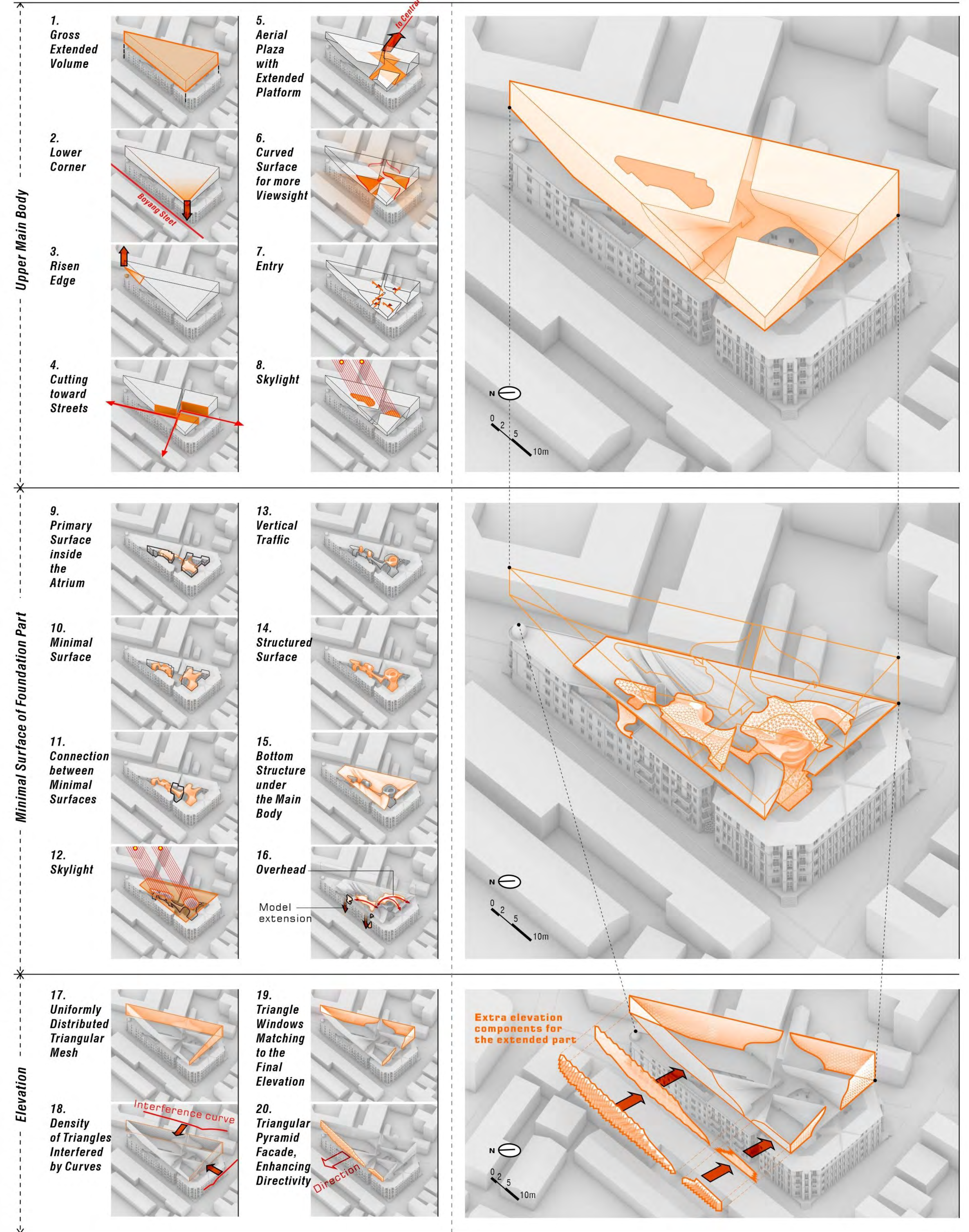


ERA TRANSITION

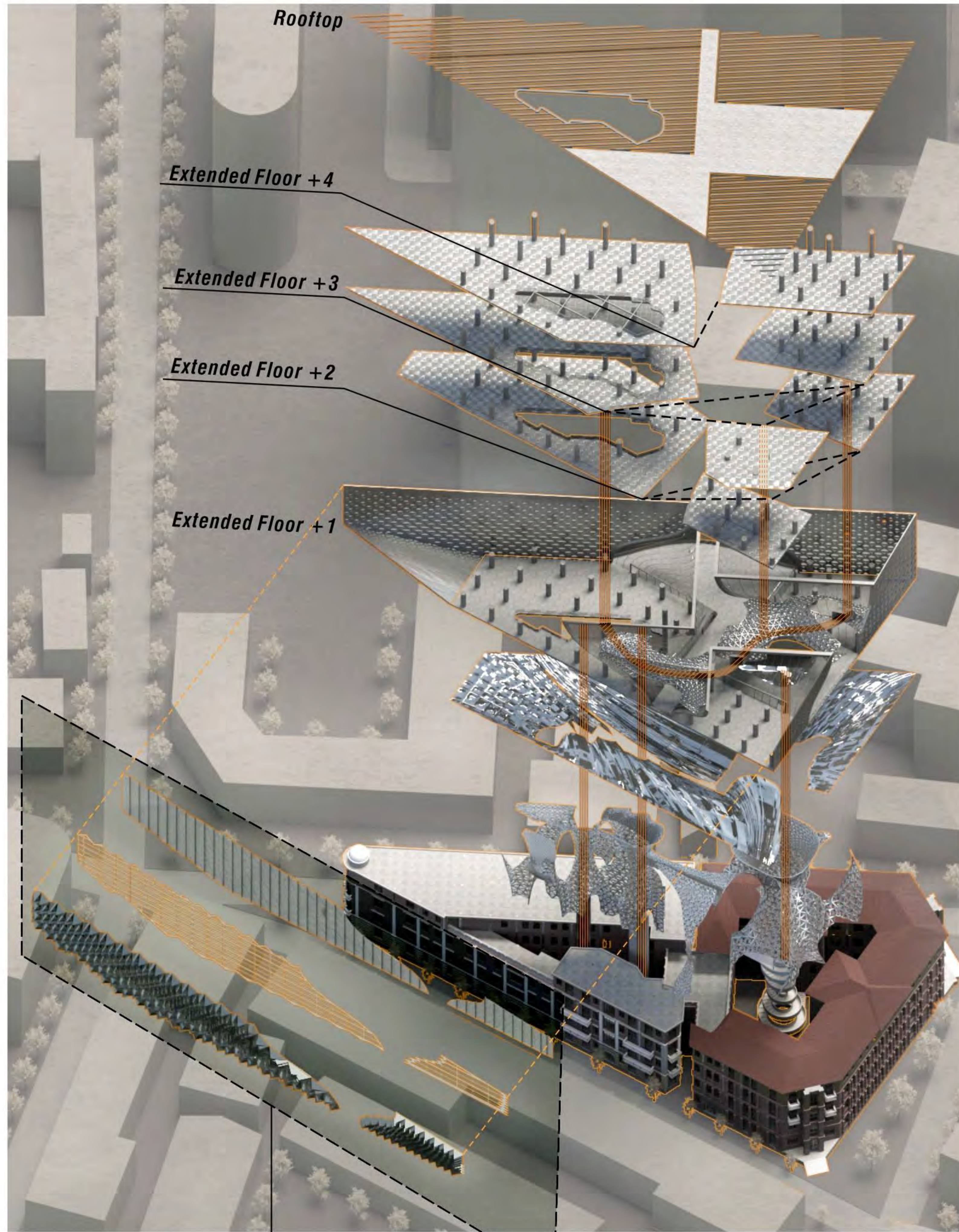
Historic Architecture Extension into the Mixed Functions of Business and Commerce

GENERATION PROCESS

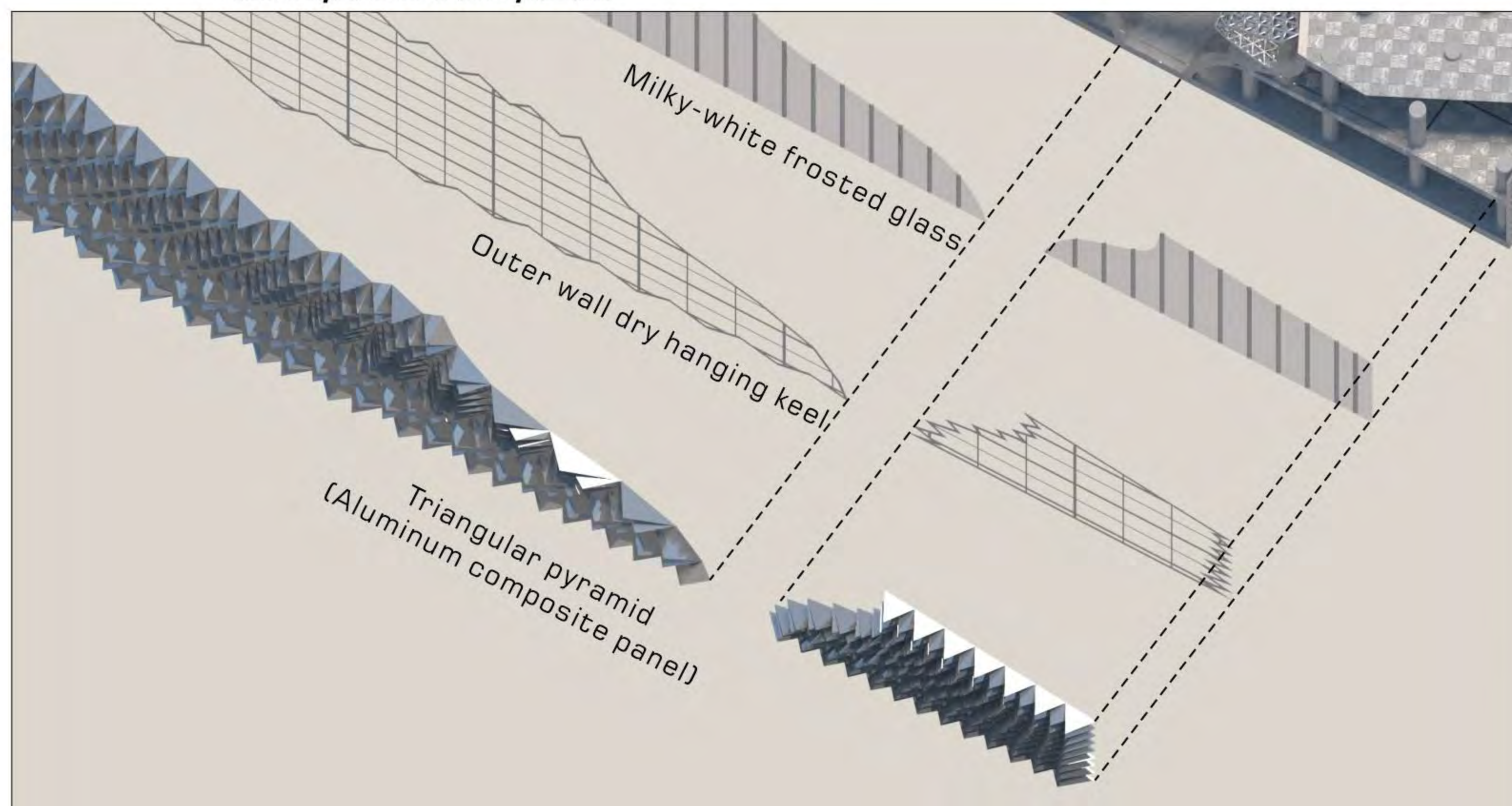
FINAL RESULT



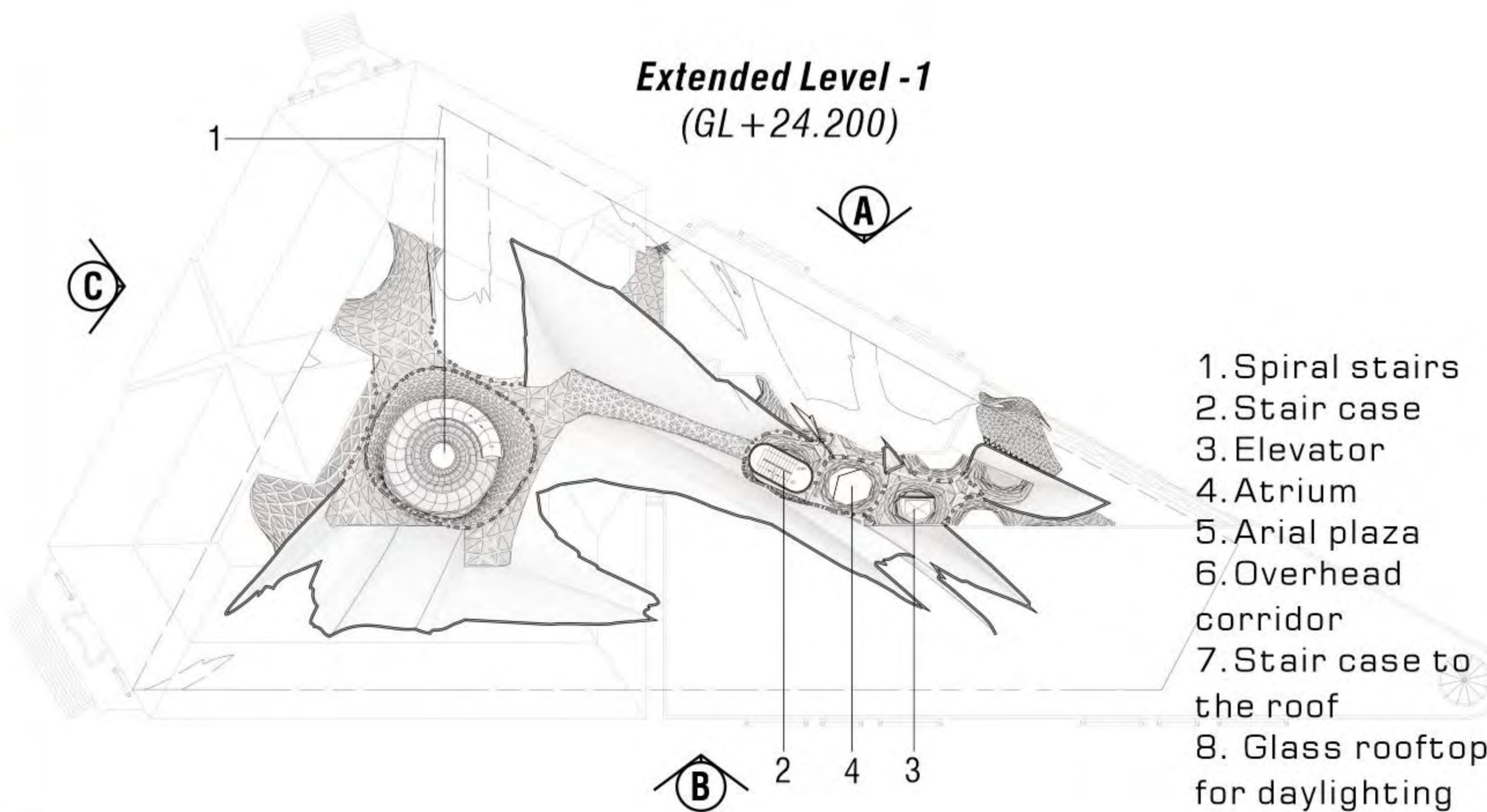
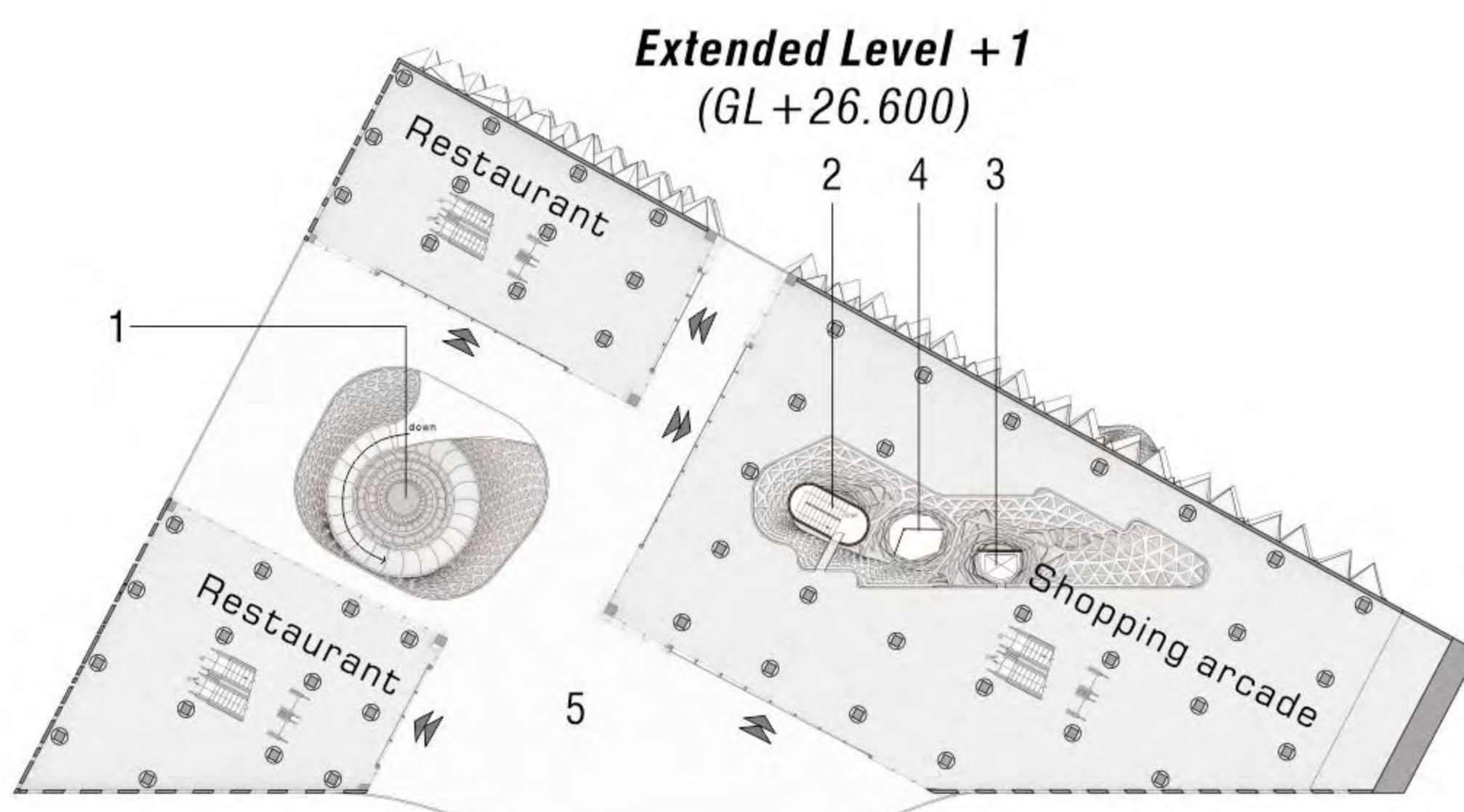
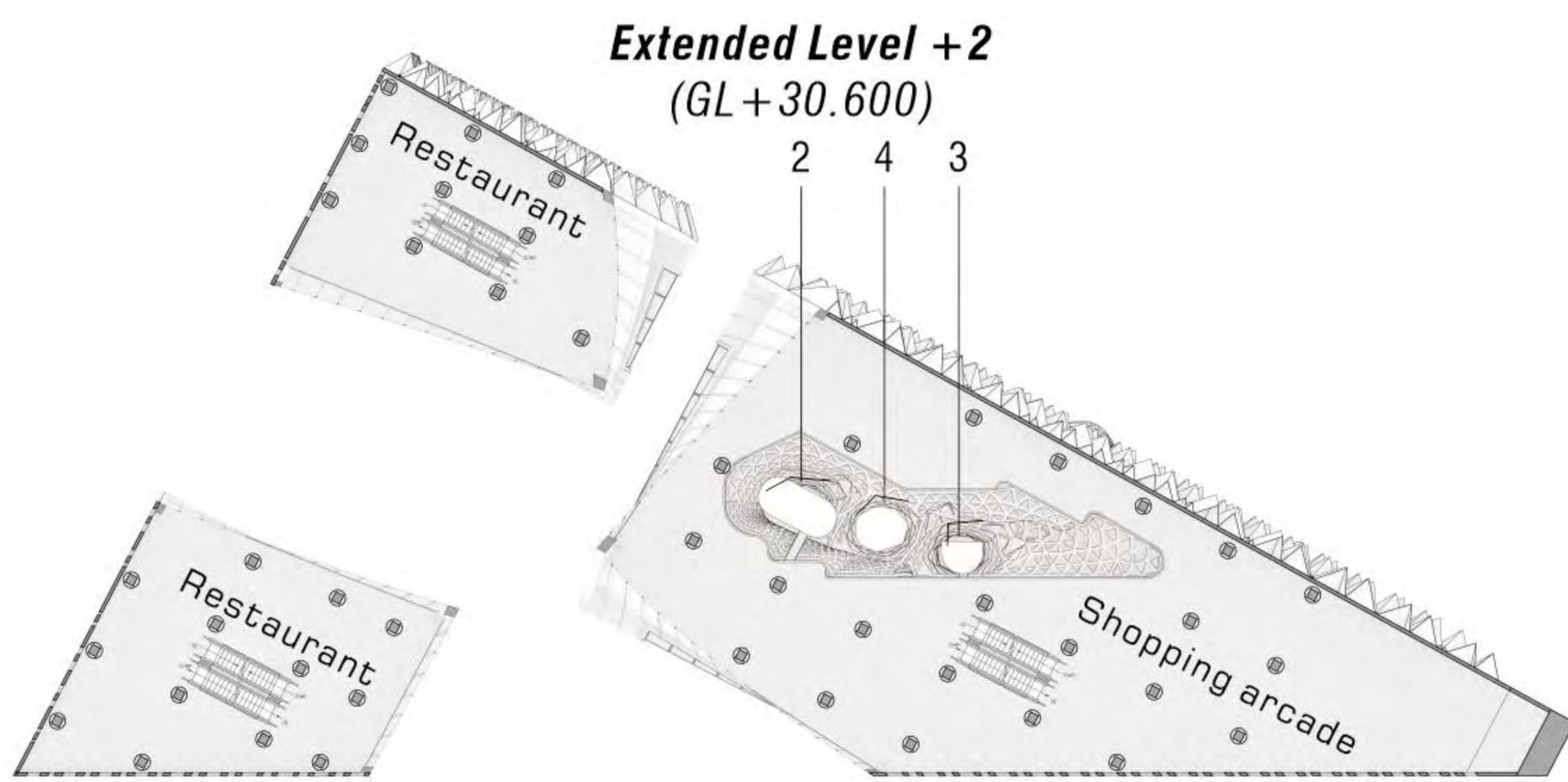
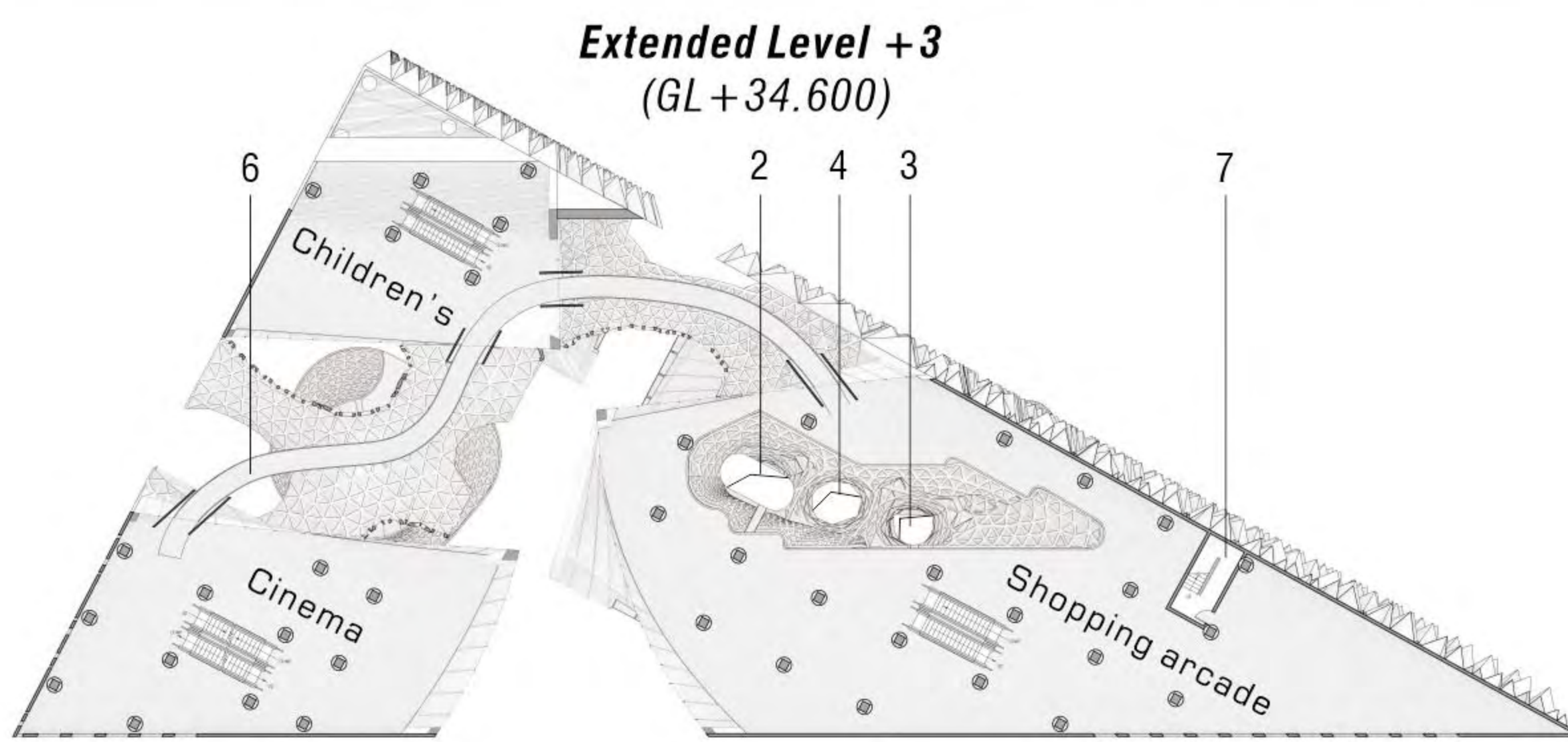
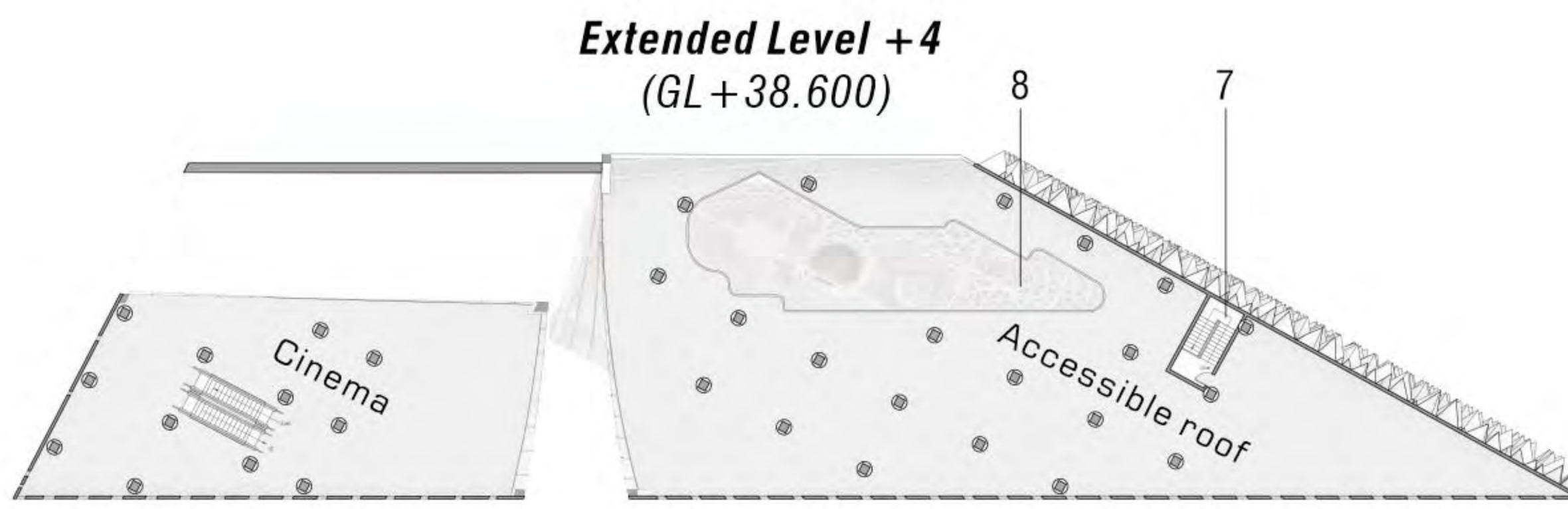
EXPLODED DIAGRAM



Basic Epidermis Component



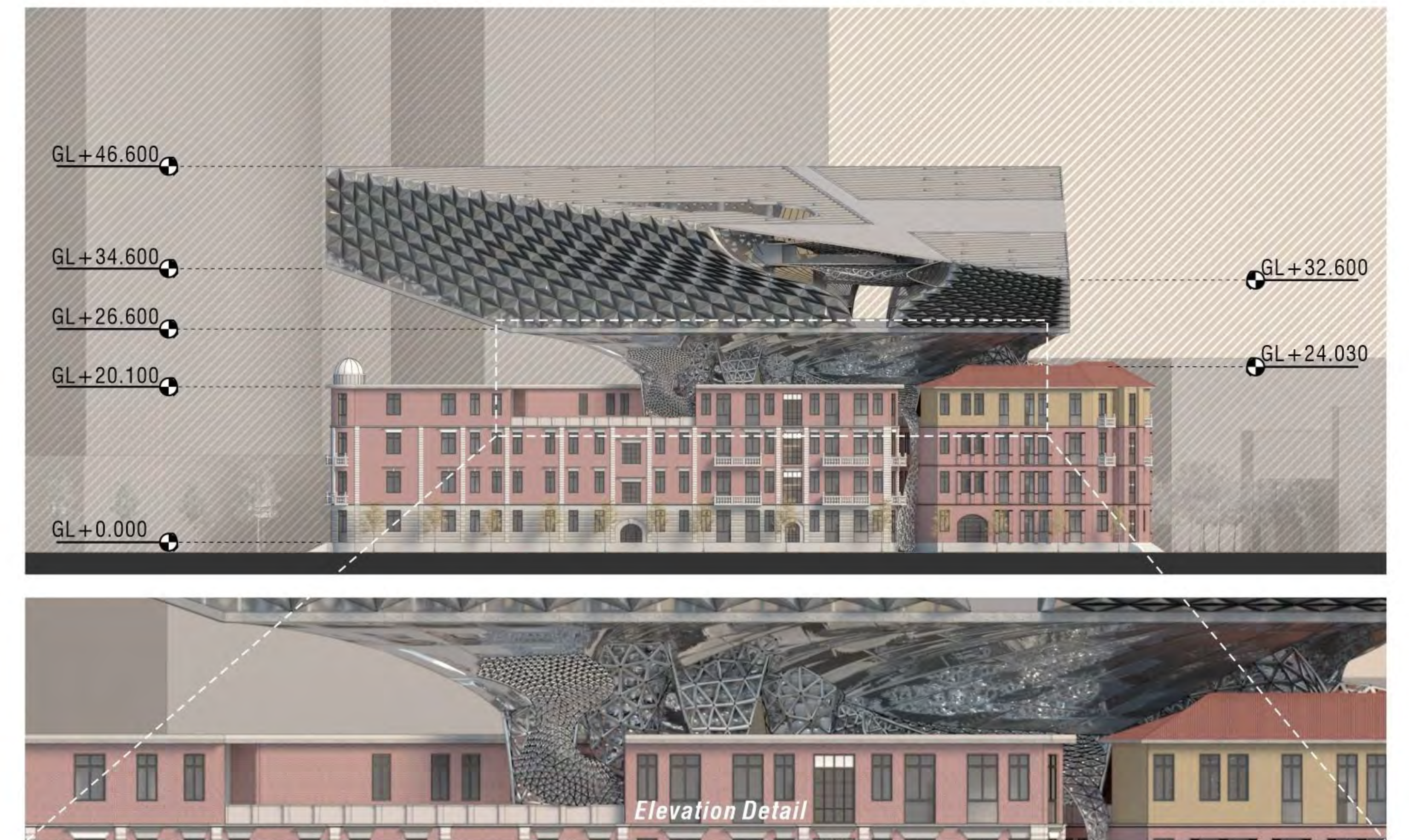
FLOOR PLAN



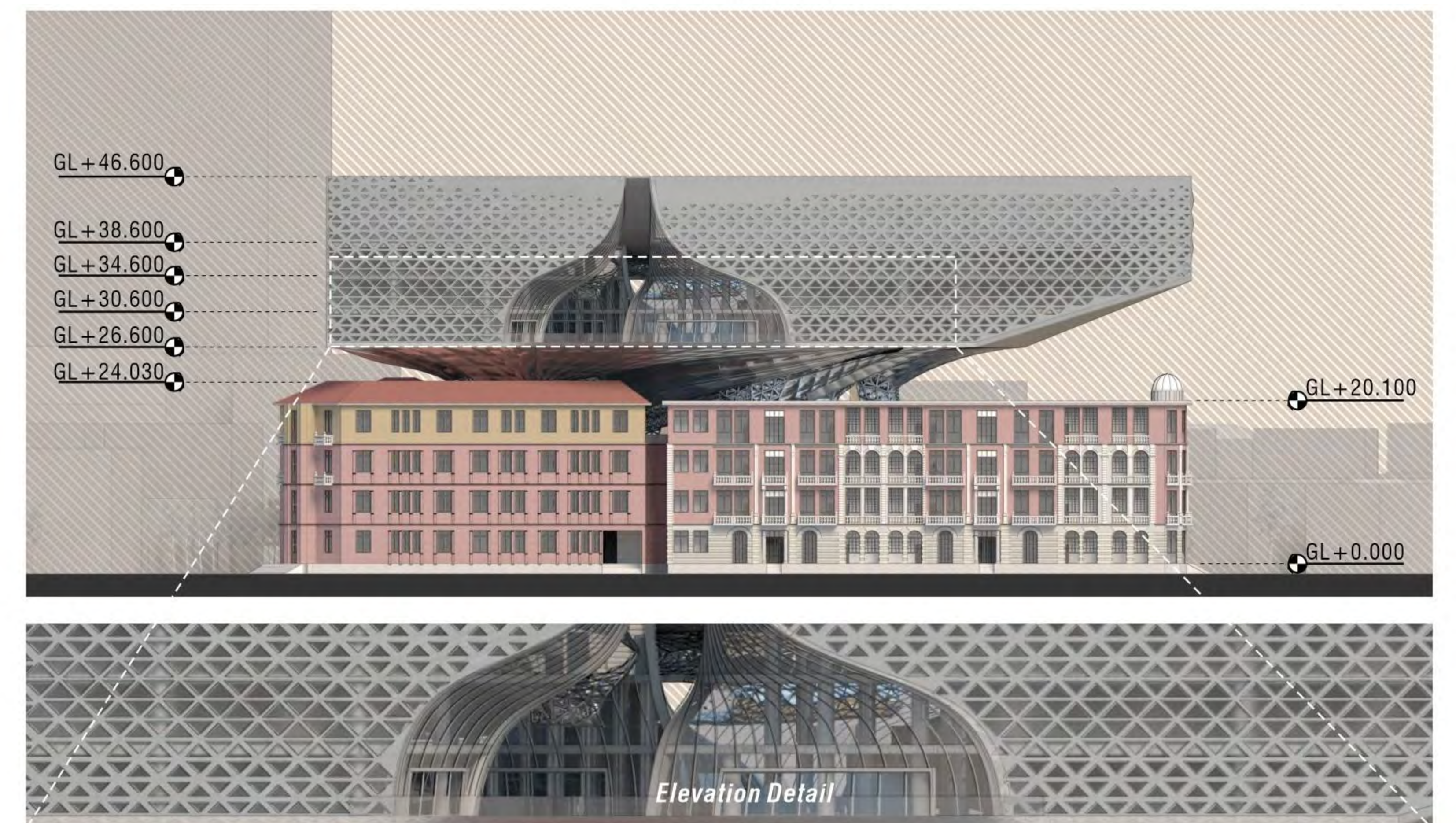
1. Spiral stairs
2. Stair case
3. Elevator
4. Atrium
5. Aerial plaza
6. Overhead corridor
7. Stair case to the roof
8. Glass rooftop for daylighting

ELEVATION

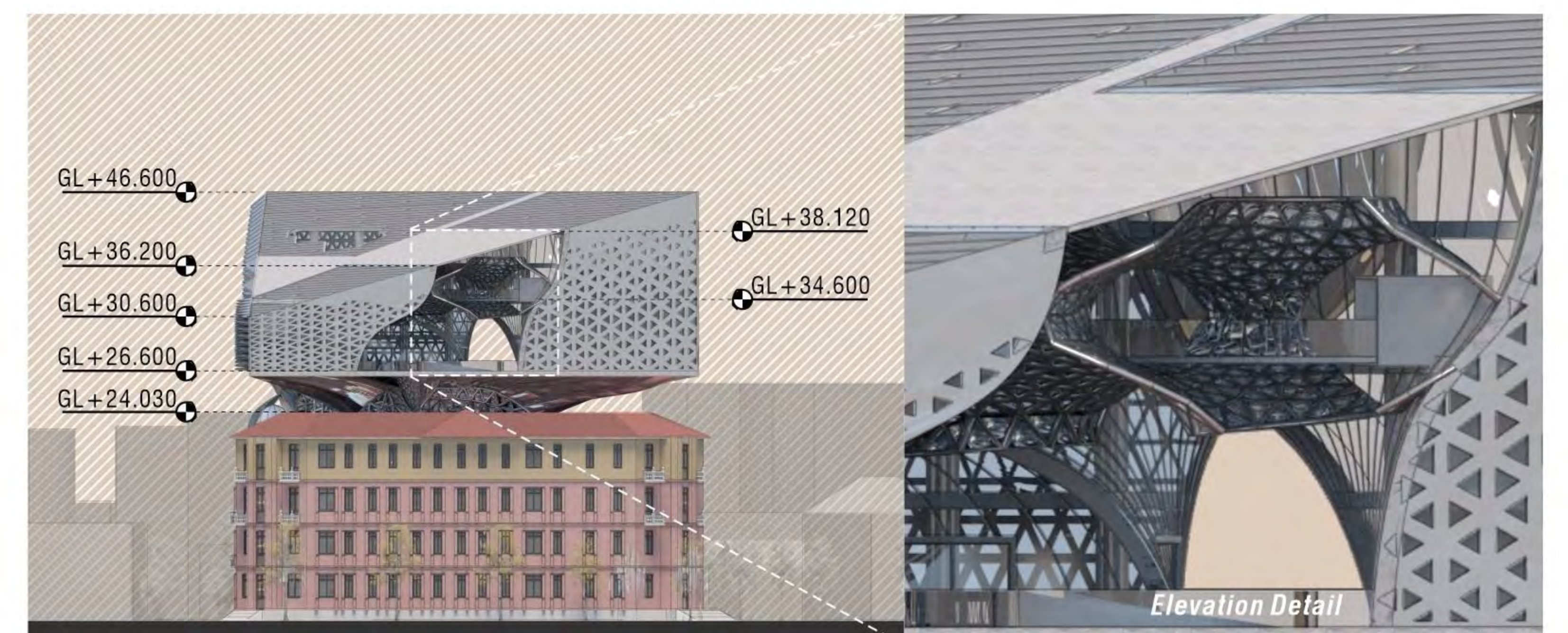
Elevation A



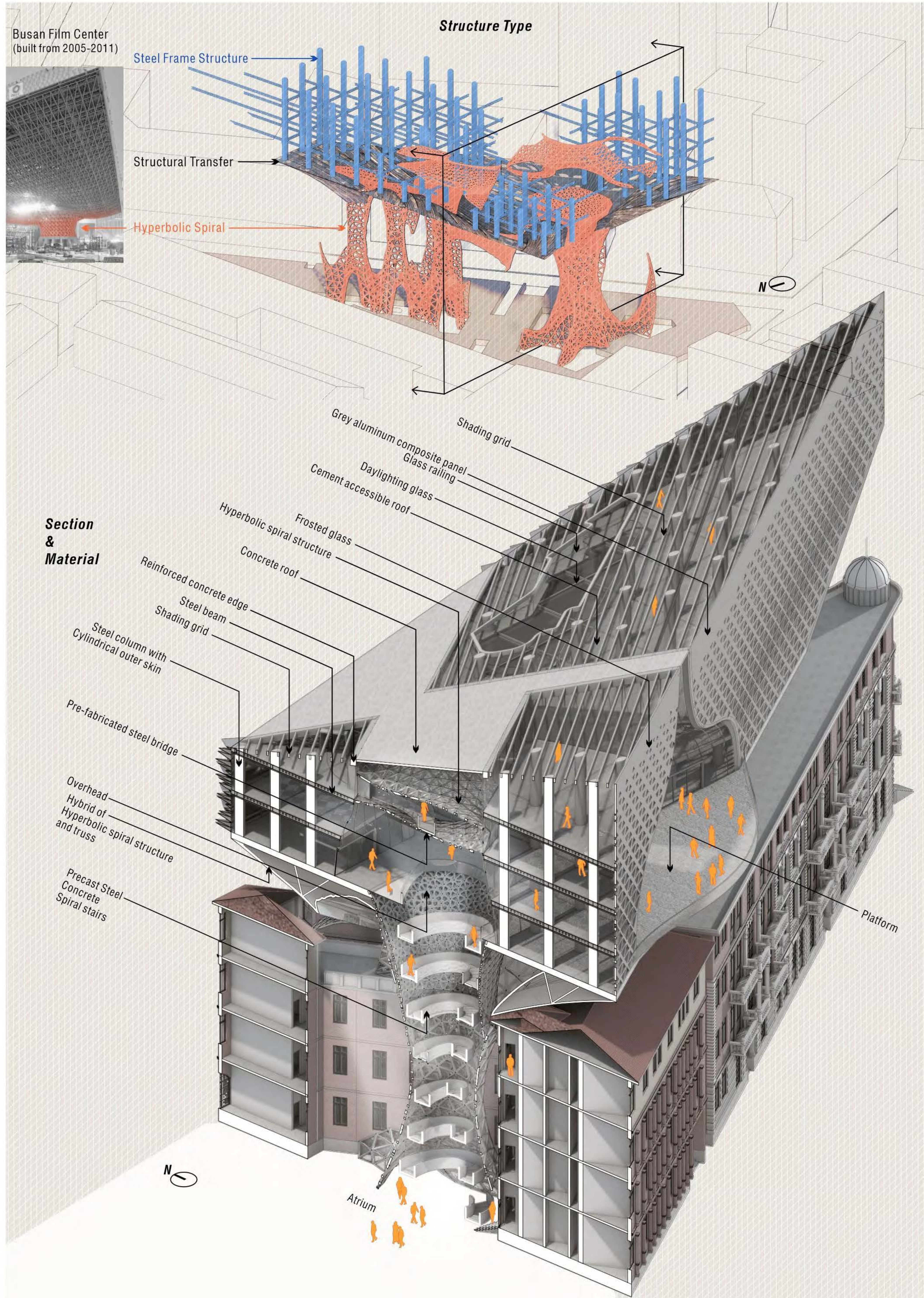
Elevation B



Elevation C

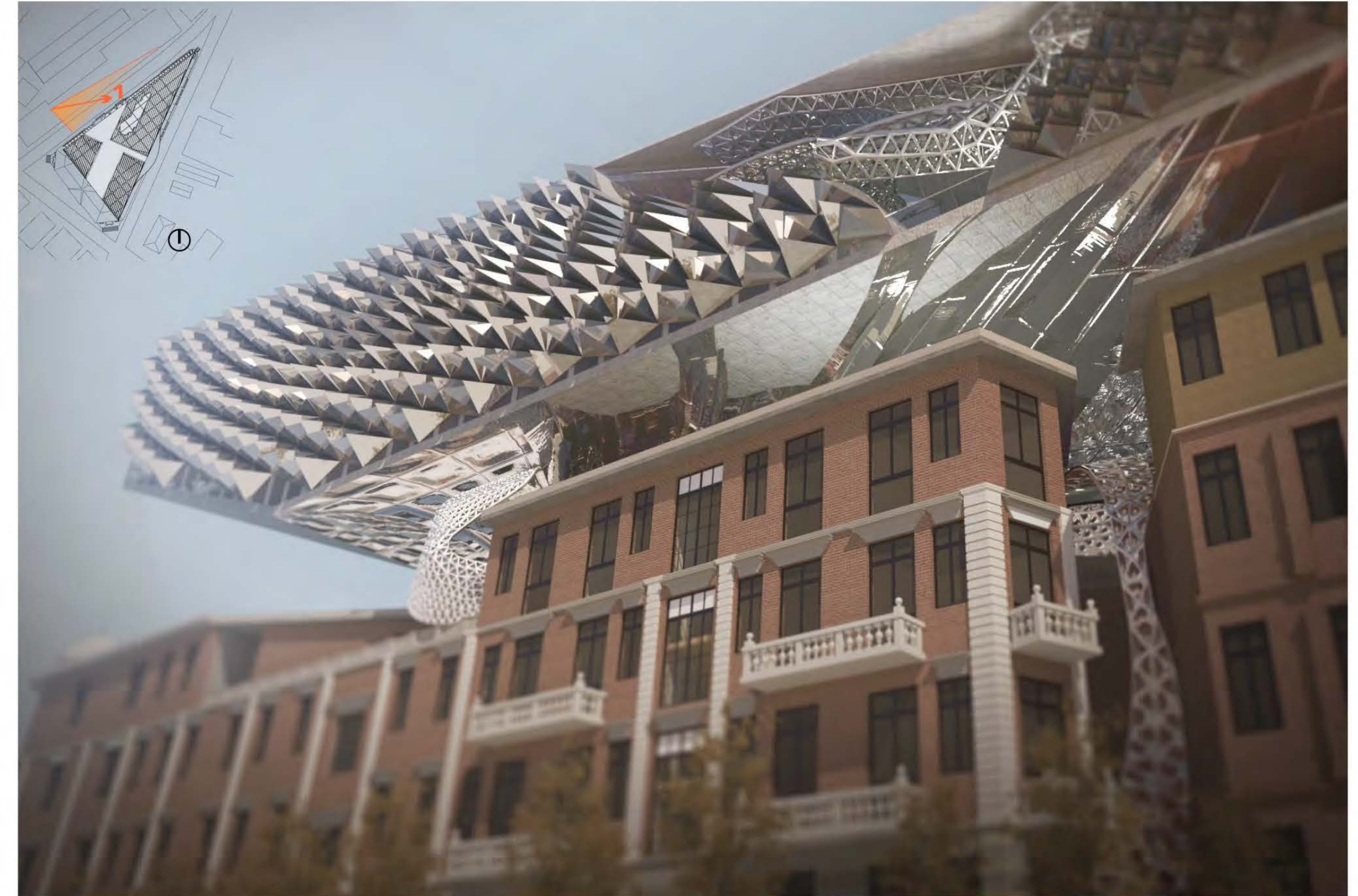


STRUCTURE



RENDERING

View 1: Outdoor



View 2: Atrium Interior





View 3: Street Scene

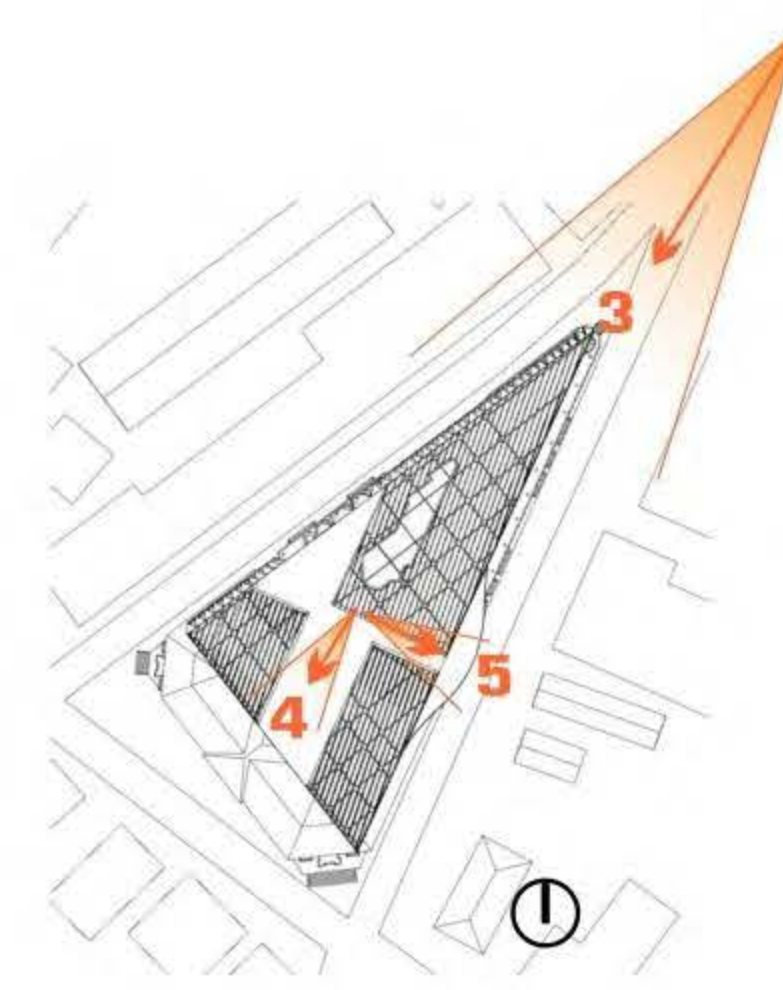
ERA TRANSITION

Historic Architecture Extension into the Mixed Functions of Business and Commerce

**CONCLUSION**

This project does not adopt conventional strategies of interior architectural renovation, but consequently it completes the following advantages through the addition of new architecture:

1. The original building was preserved.
2. Using the innovative structure of Busan Film Center ( built from 2005-2011) by Coop Himmelblau and Christoph Gengnagel, the vacant space of the atrium can be used as the base of the main supporting structure.
3. The interior of the additional building is compatible with a small indoor square.
4. Elevation surfaces differ according to different directions, which echoes to the different urban rooftop landscapes from bigger scope.



View 4: Downward view of the Atrium



View 5: Interior and Platform



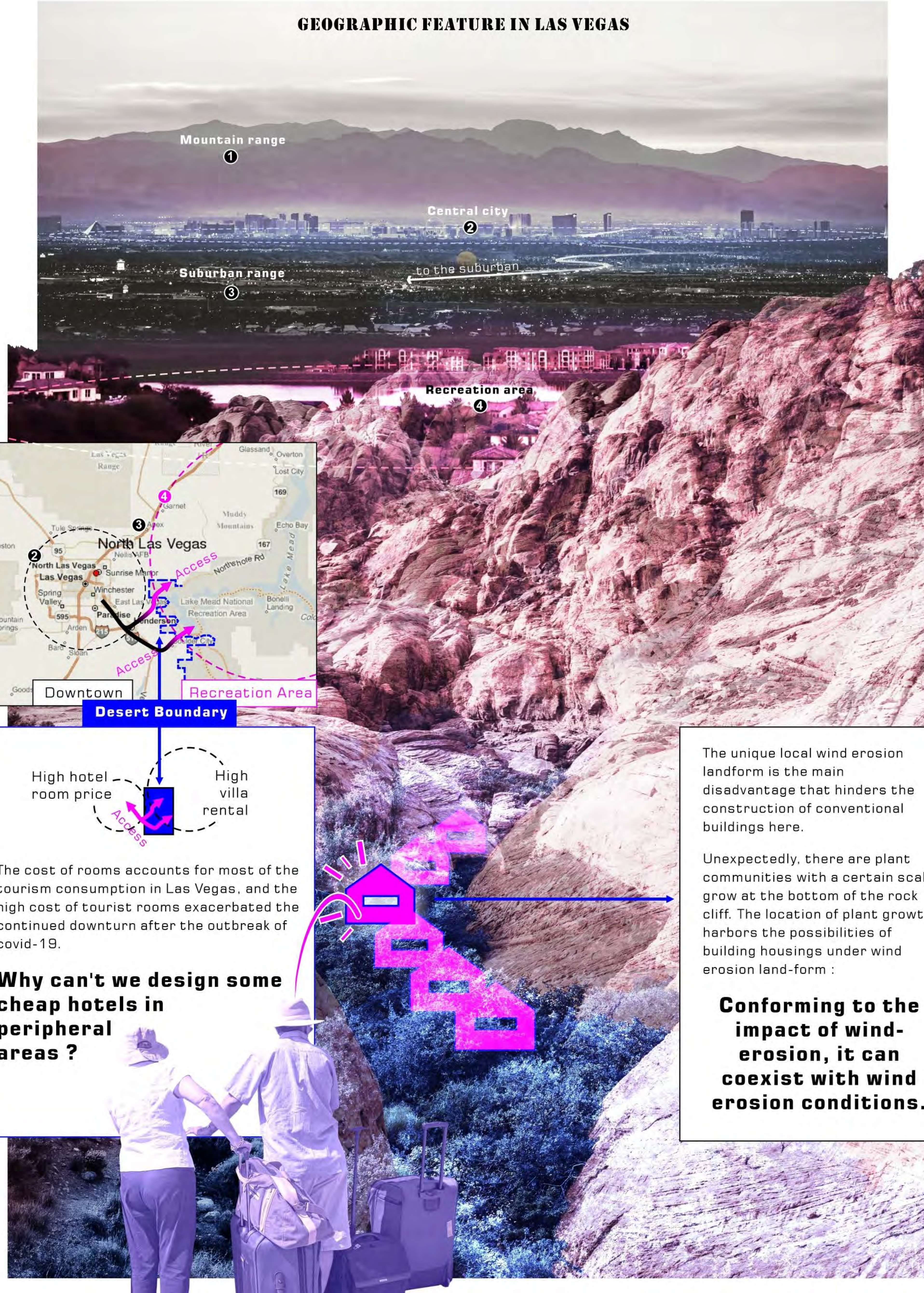
# EROSION & RECONCILING

Economical Tourist Hotel Architecture Design  
Based on the Simulation of Wind-erosion Land-form  
and WFC Algorithm in Las Vegas

Individual academic work

June-September 2022

## GEOGRAPHIC FEATURE IN LAS VEGAS



The cost of rooms accounts for most of the tourism consumption in Las Vegas, and the high cost of tourist rooms exacerbated the continued downturn after the outbreak of covid-19.

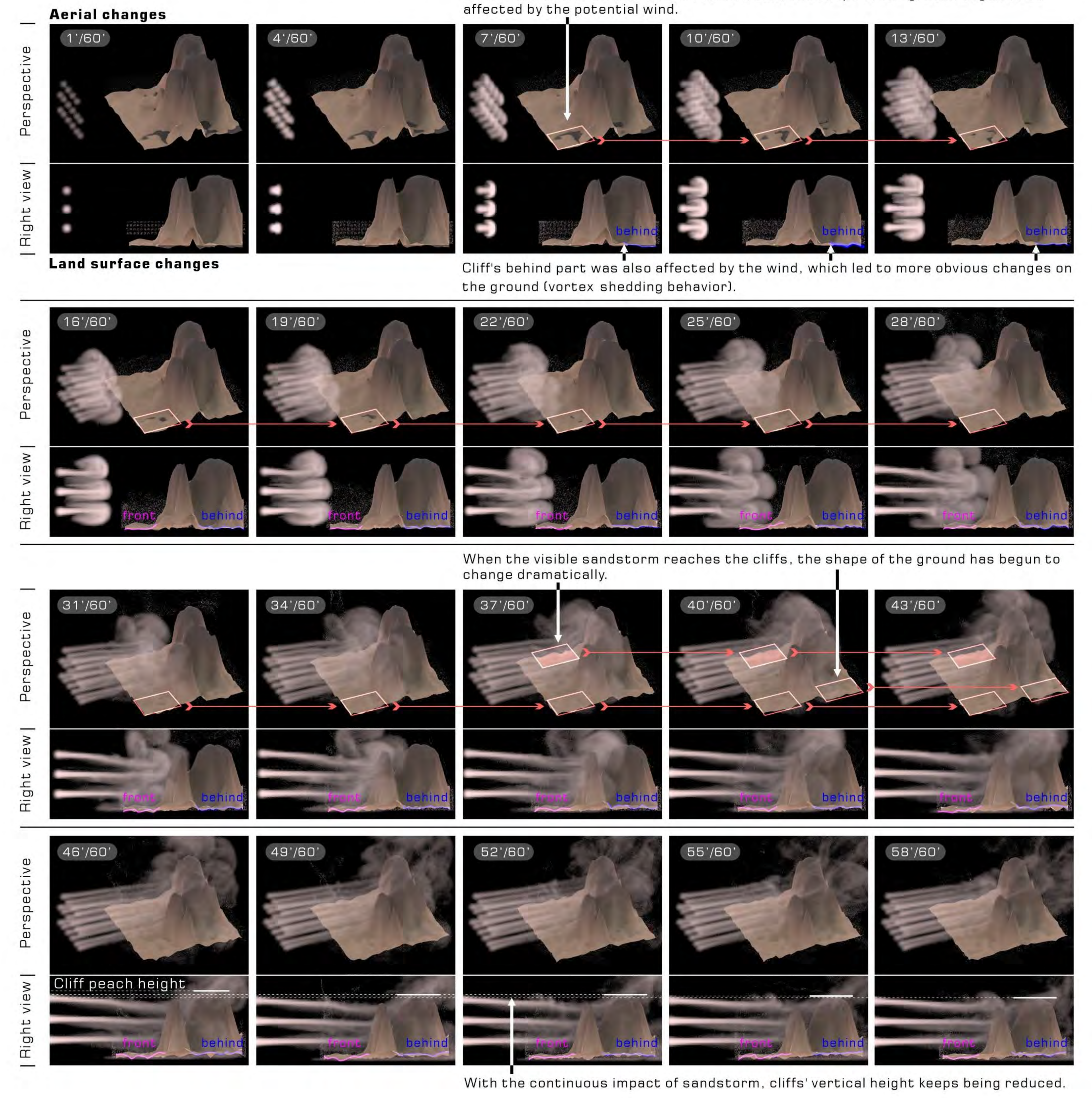
**Why can't we design some cheap hotels in peripheral areas ?**

The unique local wind erosion landform is the main disadvantage that hinders the construction of conventional buildings here.

Unexpectedly, there are plant communities with a certain scale grow at the bottom of the rock cliff. The location of plant growth harbors the possibilities of building housings under wind erosion land-form :

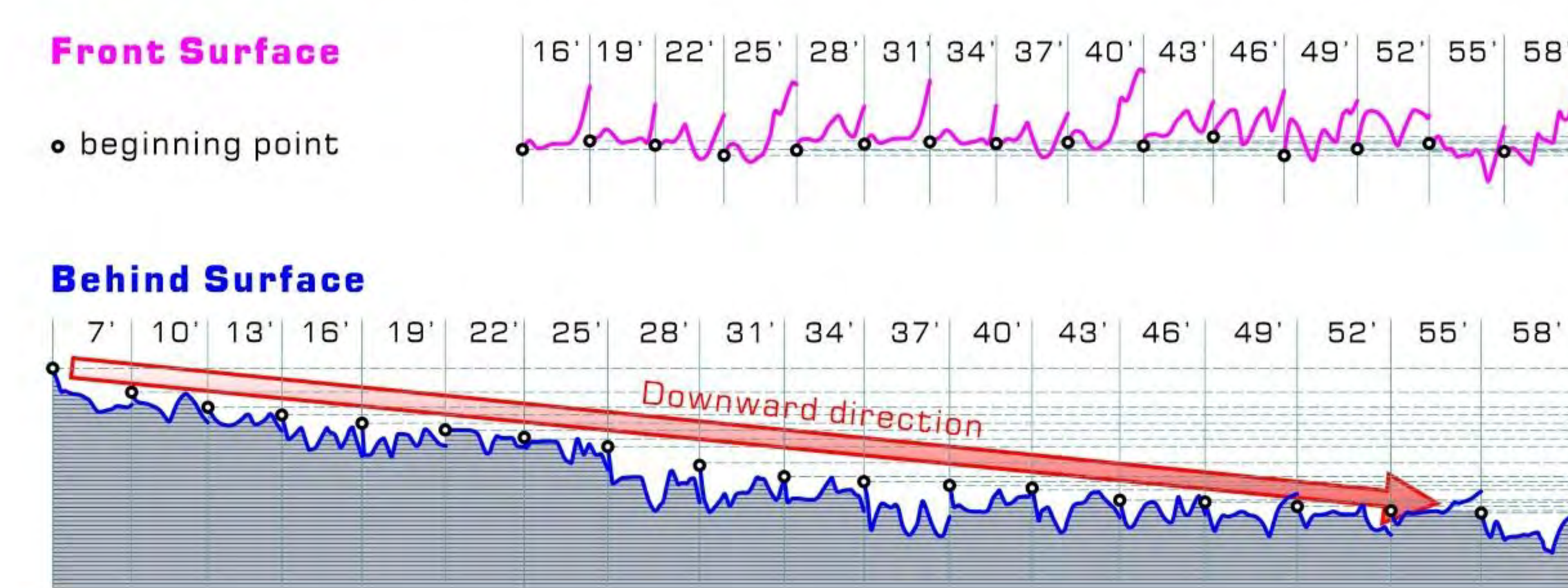
**Conforming to the impact of wind-erosion, it can coexist with wind erosion conditions.**

## WIND-EROSION PROCESS SIMULATION (HDA)



### MAIN FEATURE OF THE LAND-FORM TRANSFORMATION TREND

When I compare the curves of the front surface and the behind surface before and after the tested cliff, it is manifested: the front surface presents unpredictable and irregular changes; The behind surface shows a gradual downward collapse along the wind direction.

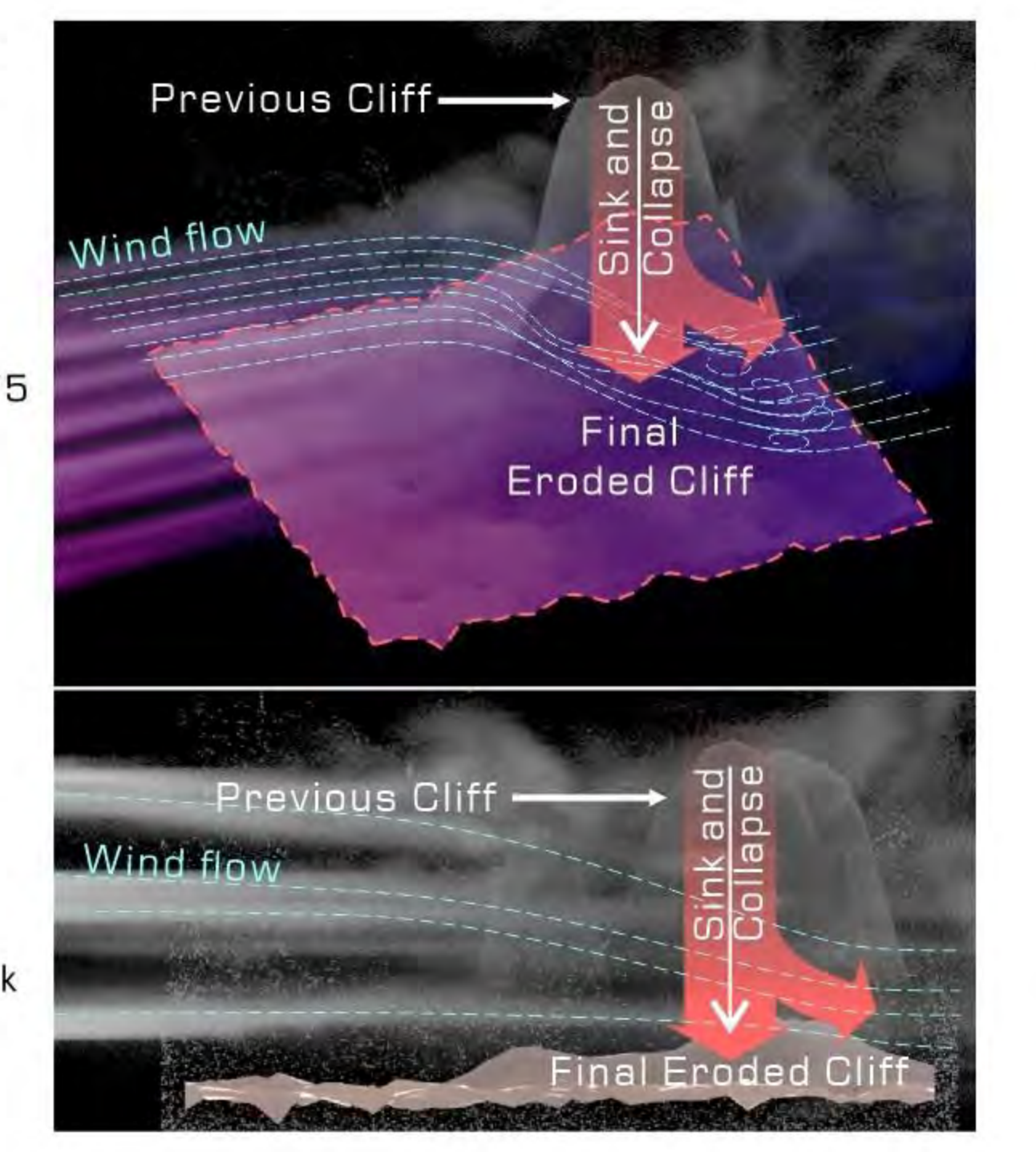


### FINAL EROSION

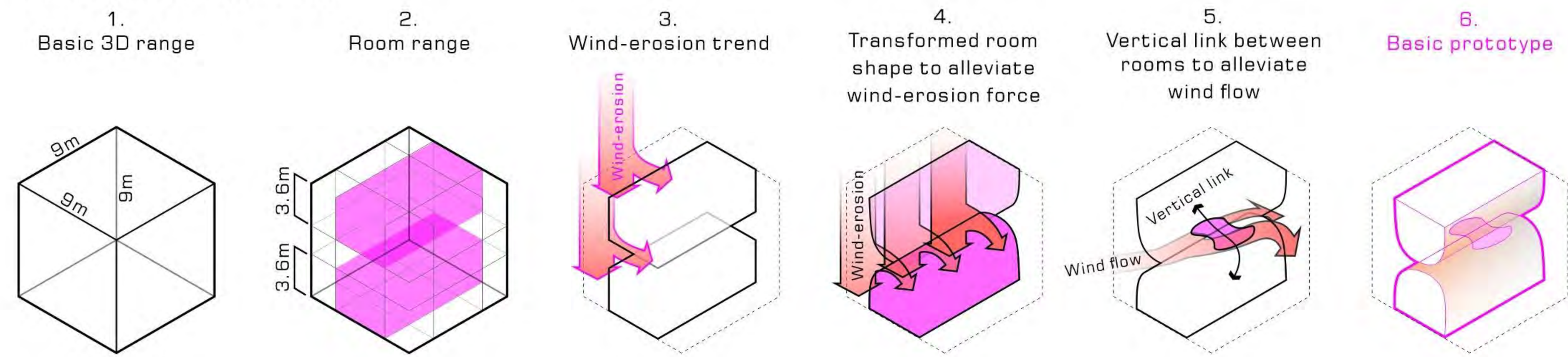
**Parameter:**  
Rasterization  
Filter: Gaussian  
Voxel Size: 0.1  
Particle Scale: 1  
Minimum Filter Size: 0.75  
Coverage Attribute: density  
Coverage Scale: 1

**Hydro**  
Erodability: 0  
Erosion Rate: 0.3  
Bank Angle: 70  
Spread Iterations: 40

**Thermal**  
Erodability: 0.6  
Thermal erodability mask  
Erosion Rate: 0.03  
Cut Angle: 35  
Cut angle mask

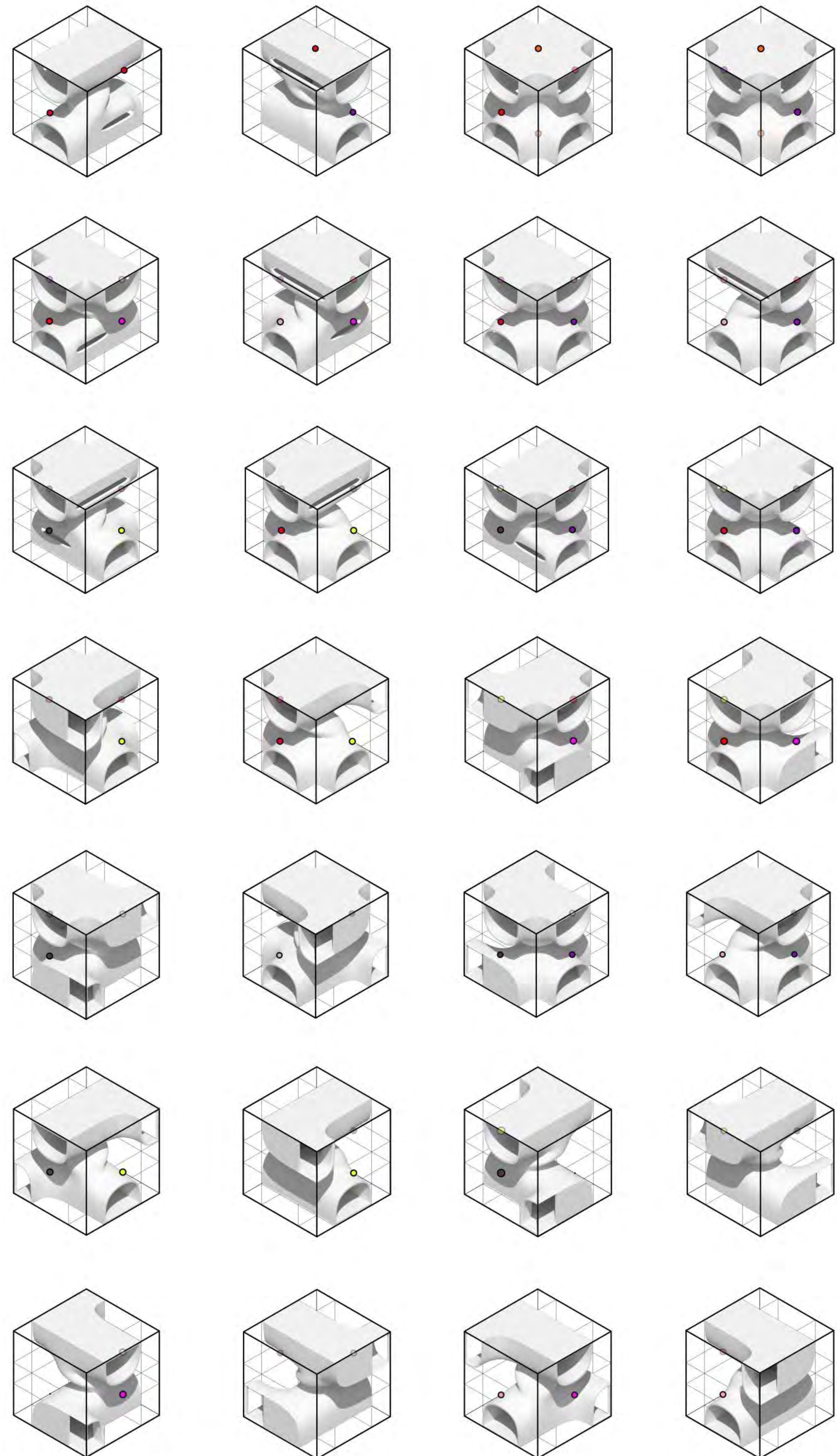


UNIT TYPE GENERATION



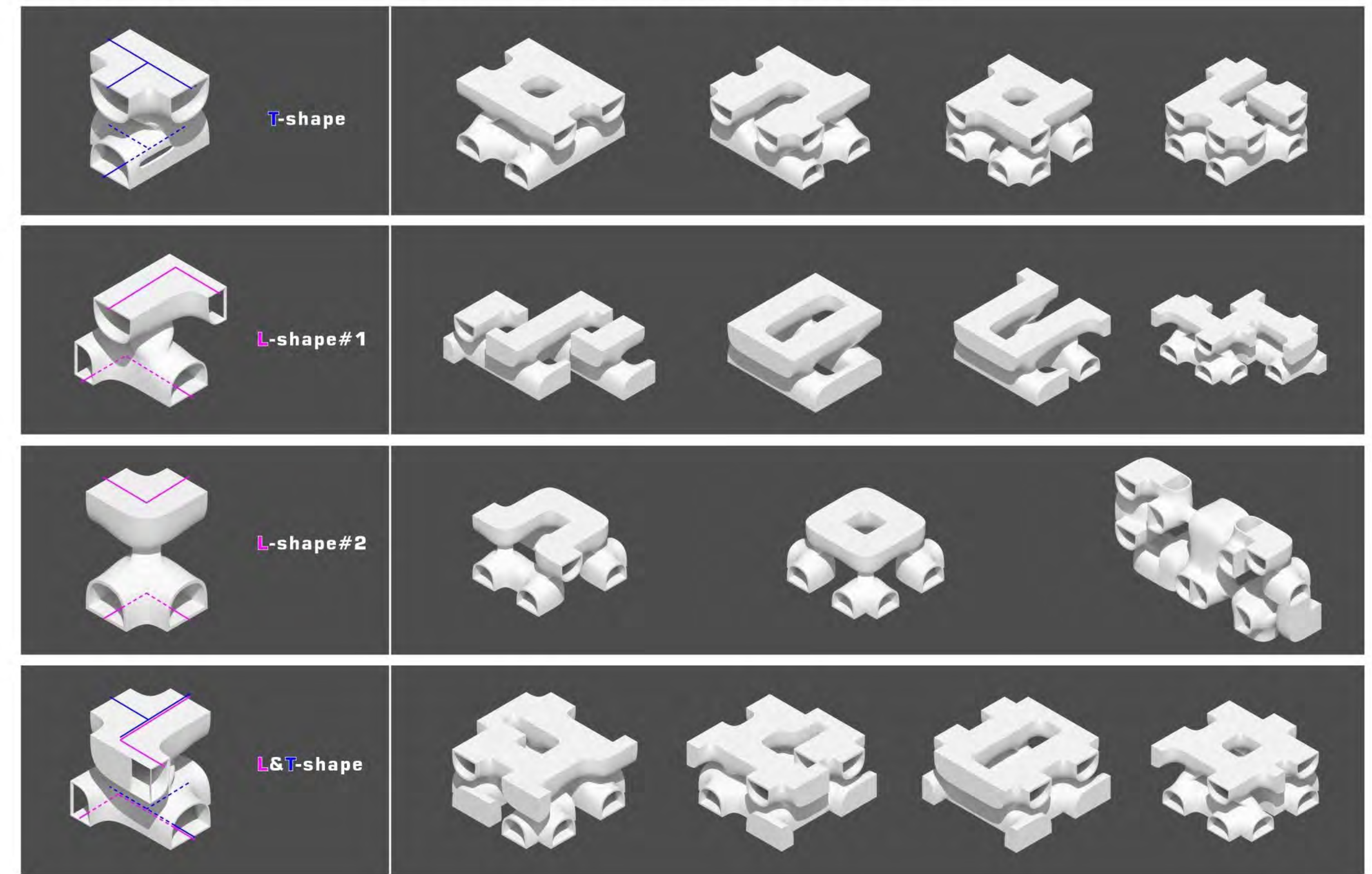
TILE CATALOGUE

- Connection\_X-up and down
- Connection\_X-up only
- Connection\_X-down only
- Connection\_Y-up and down
- Connection\_Y-up only
- Connection\_Y-down only
- Connection\_Z-Core Unit First

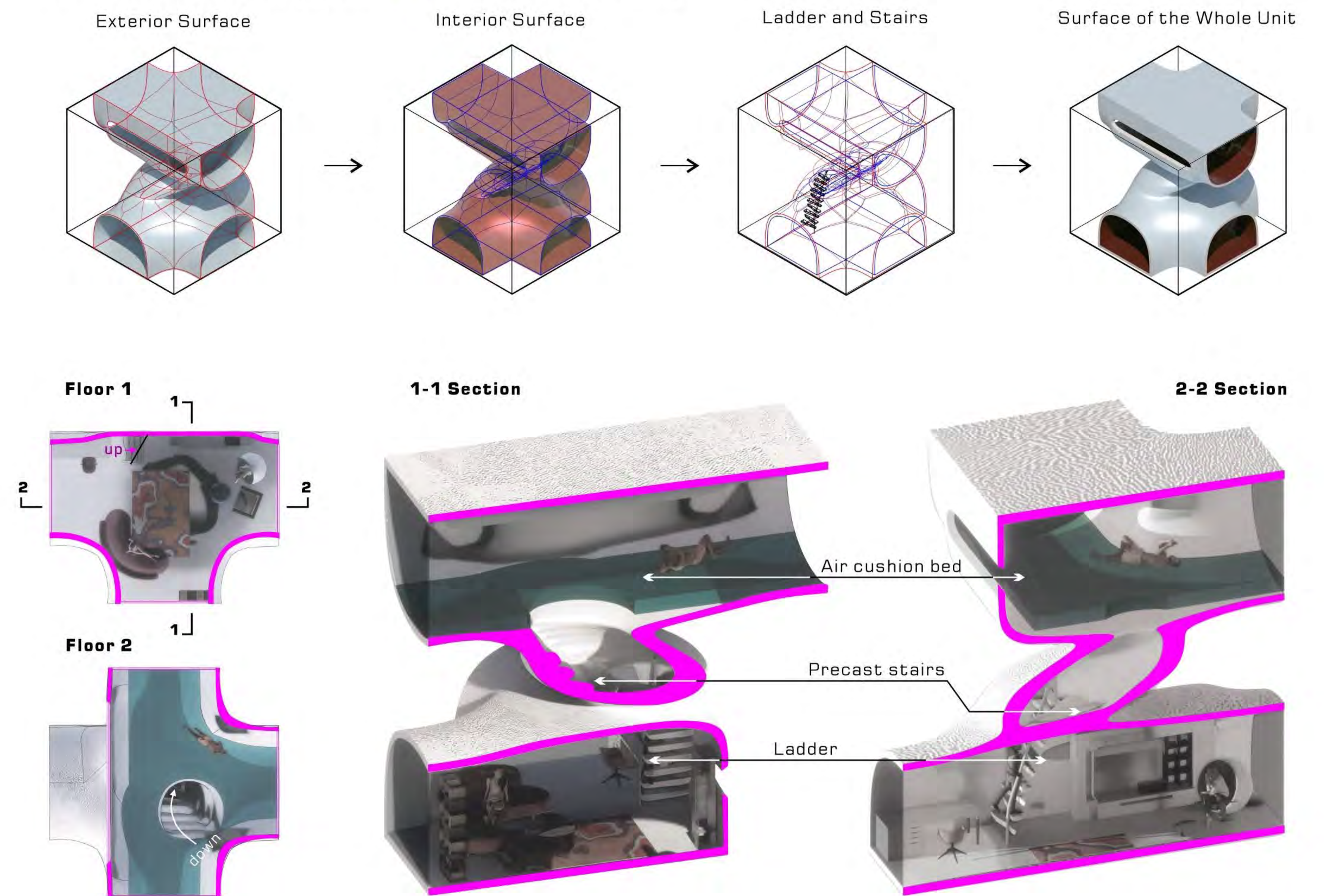


VOXEL PROTOTYPE

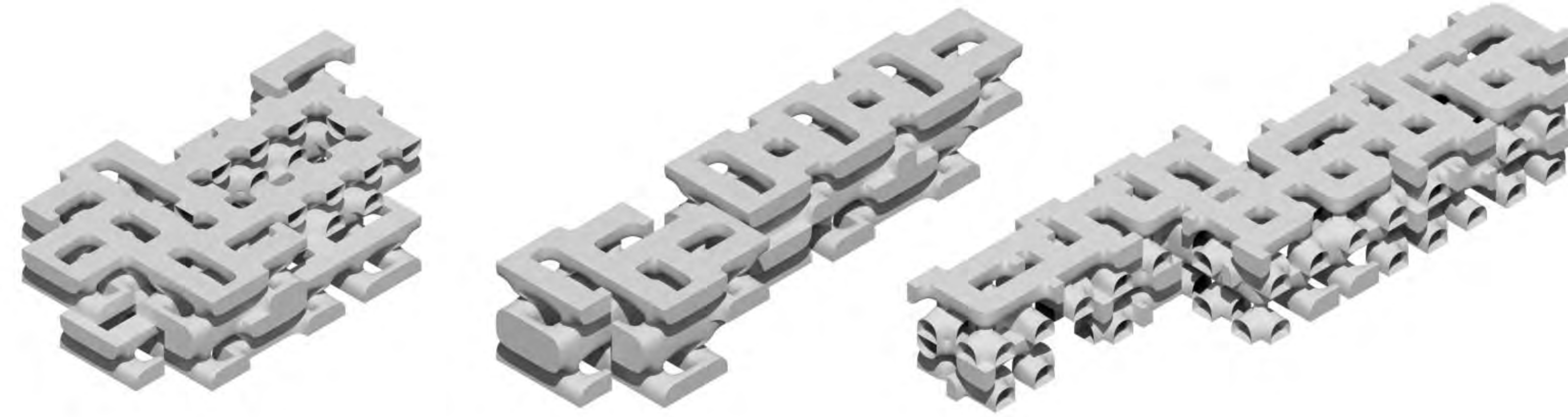
MANUAL ASSEMBLY AND SIMPLE COMBINATION



HOTEL ROOM DESIGN (TAKING T-SHAPE AS AN EXAMPLE)



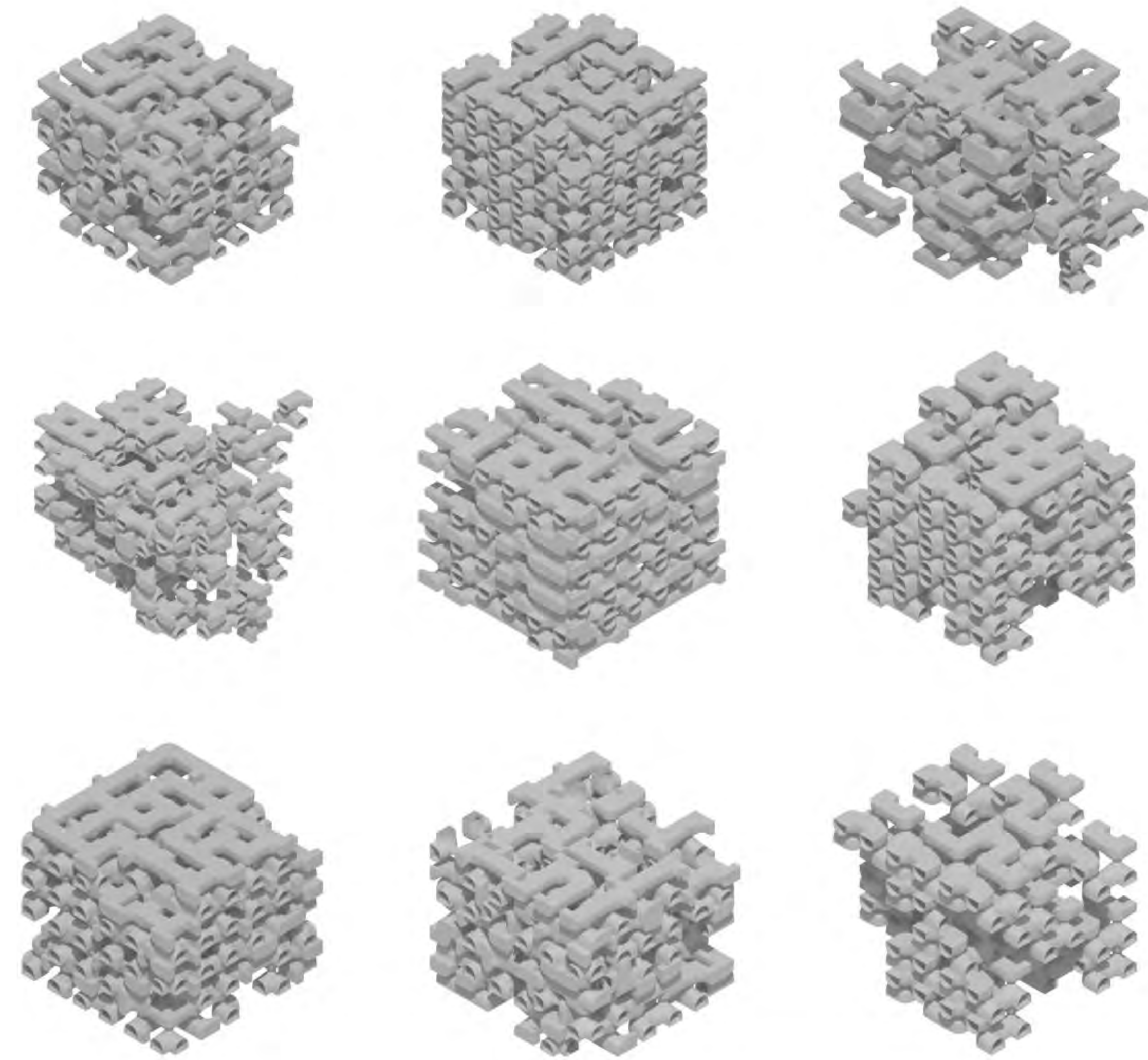
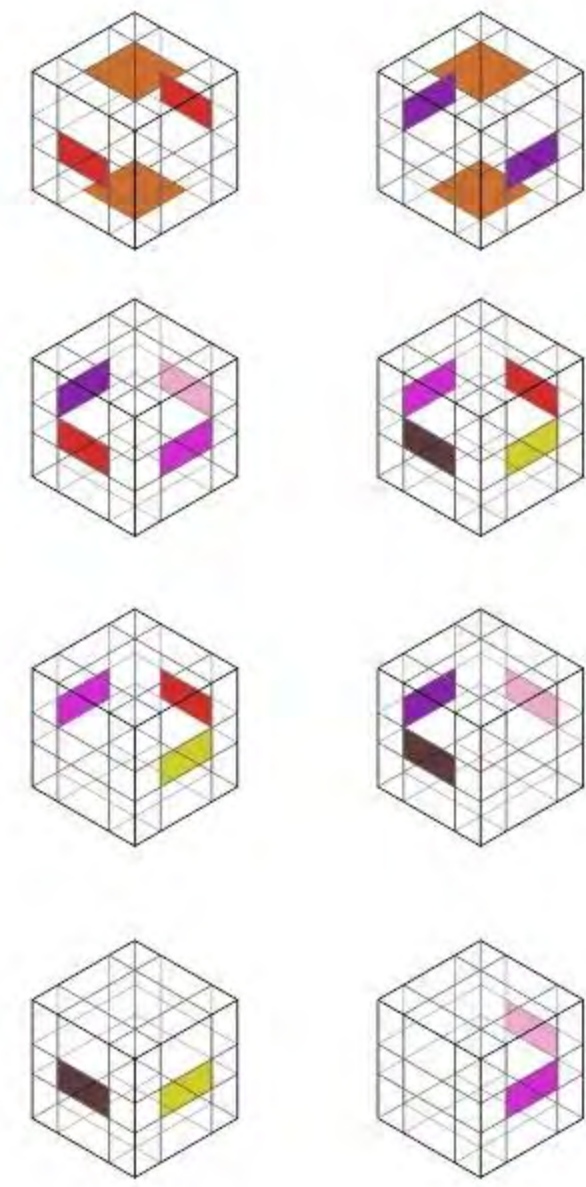
**MANUAL COMBINATION TRIAL AS PROTOTYPES**



**8\*8 BOX AGGREGATION FOR RULES TRIAL**

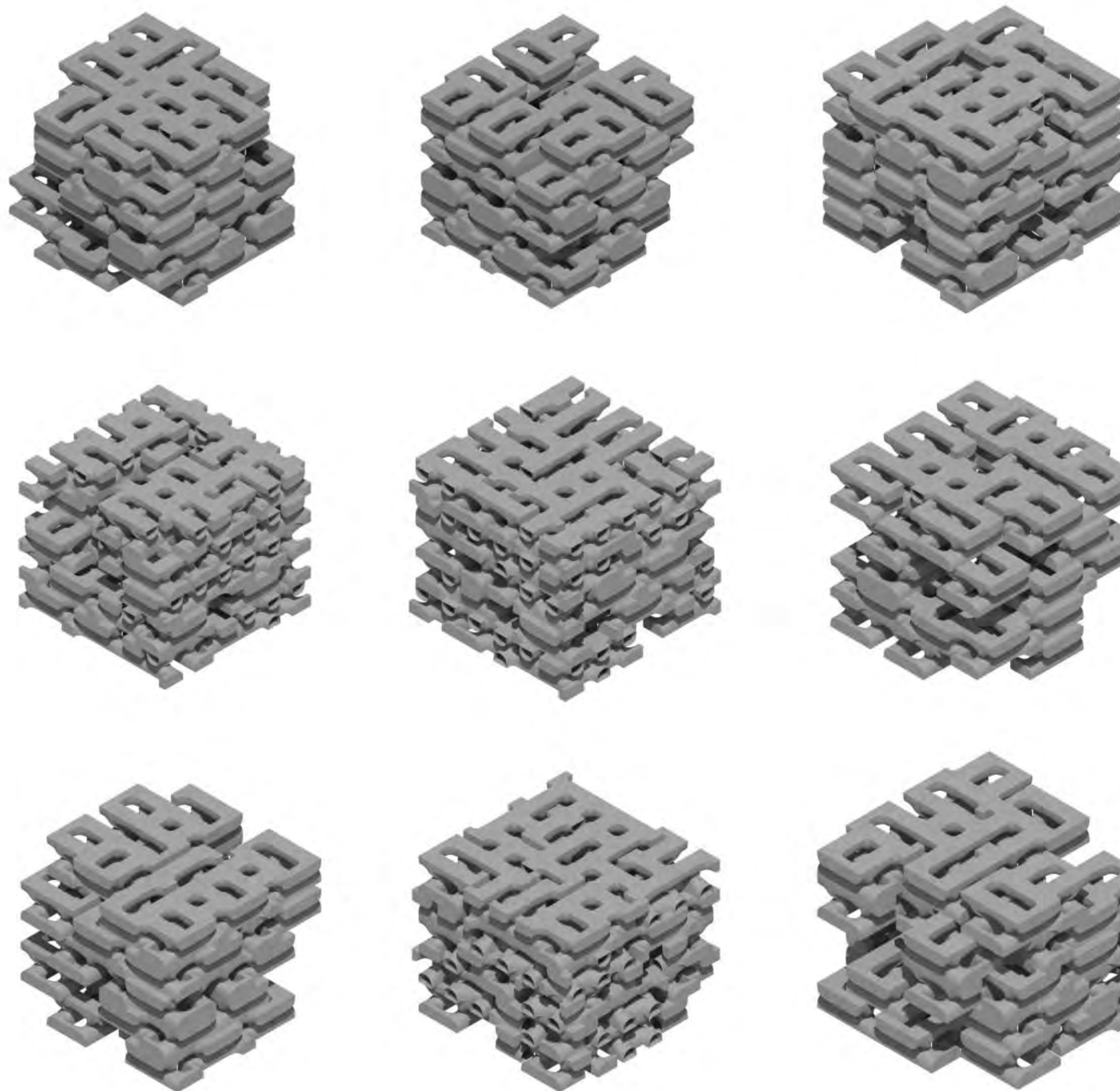
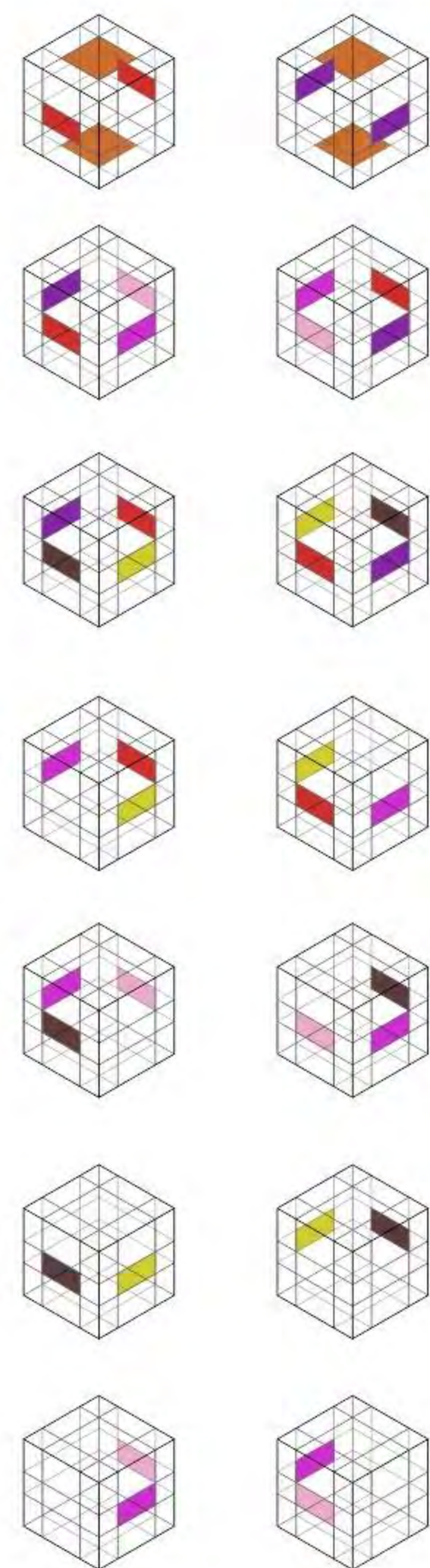
**Constrained Rules**

When the logic of the connected faces is constrained to the above situations, most of the 8\*8 box aggregation results are too regular and lack of changes in the elevation outcomes. Secondly, the edges of the 8\*8 box randomly scattered.



**All Rules and Geometric Results**

When more aggregation rules are set, the above problems can be solved. These feasible rules will be continued in the subsequent form design.



**TERRAIN FORM**

**Volume Range**

**Height Division**

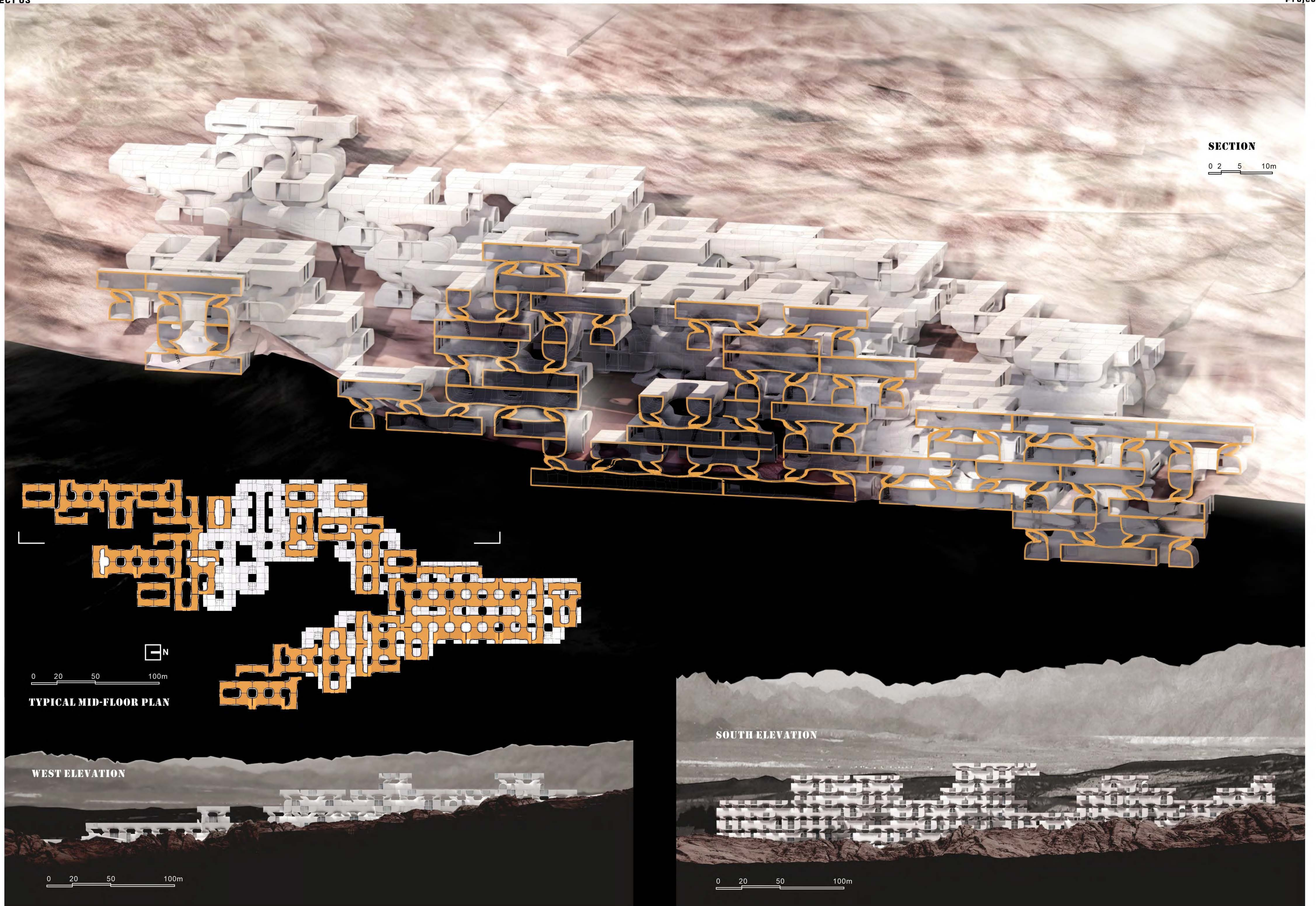
**ARCHITECTURAL FORM GENERATION**

**WFC Aggregation**

In order to avoid the impact of strong wind on the building surface, the architecture form on the ramp should not be too high. At the same time, it is more convenient to set simple vertical elevators in the building floor up to 5 floors. Therefore, the unit groups over 5 floors need to be removed.

**Final Form**

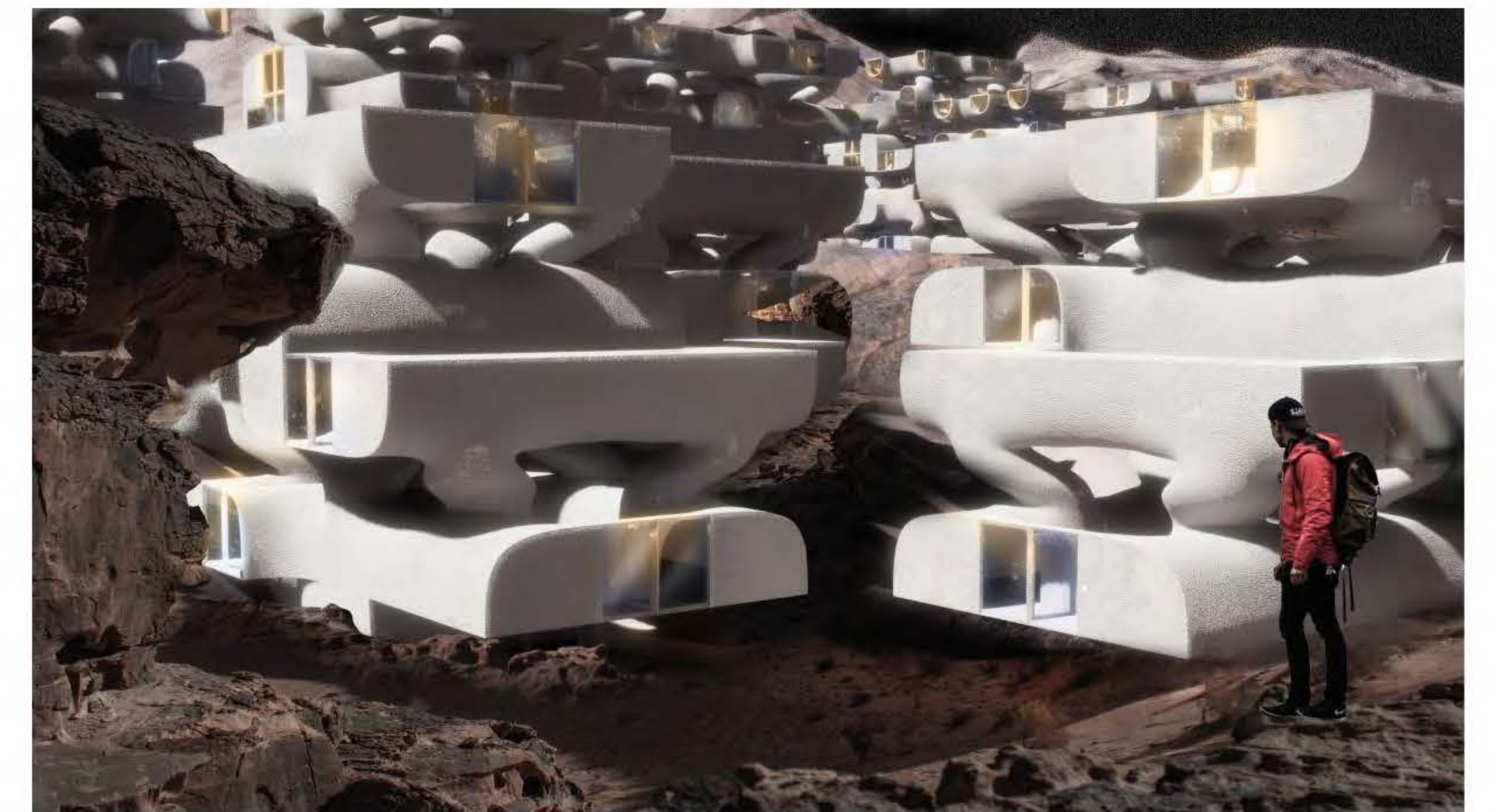
The final form of the hotel is flat, and the form changes accord with the canyon formed by wind-erosion.



AERIAL VIEW



HUMAN'S VIEW





Apartment Plan Sampling

15 Hudson Yards, #33J  
-\$2.99M (\$2593 per ft<sup>2</sup>)  
-1 bed, 1.5 baths  
-1155ft<sup>2</sup>



The Bryant, #25B  
-\$4.78M (\$2540 per ft<sup>2</sup>)  
-2 beds, 2.5 baths  
-1882 ft<sup>2</sup>



1 Central Park West, #47D  
-\$8.19M (\$3875 per ft<sup>2</sup>)  
-3 beds, 3.5 baths  
-2115 ft<sup>2</sup>



Typical Apartment Plan Types

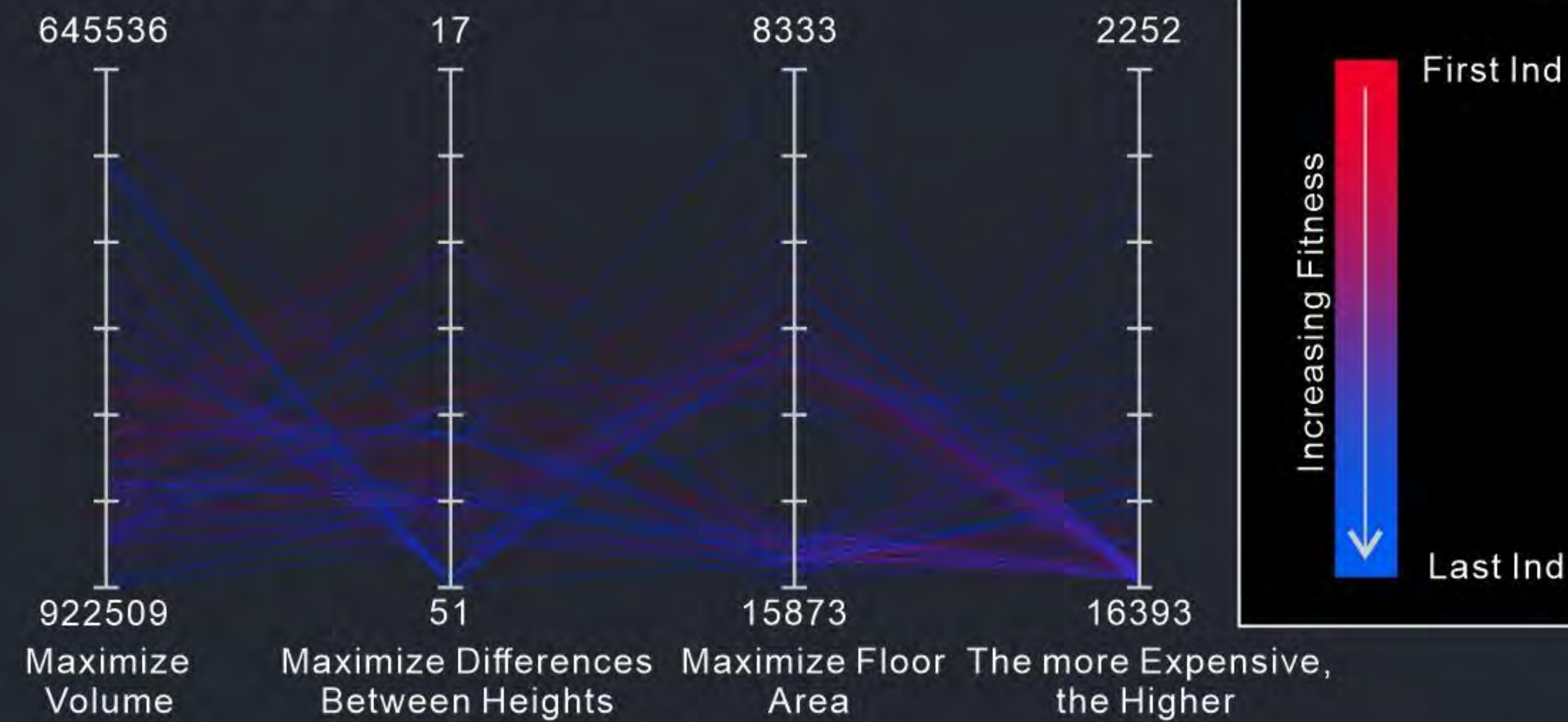
The apartment types in various areas of Manhattan are mainly divided into five types:  
1. Studio  
2. 1bed/1-1.5baths  
3. 2bed/2-2.5baths  
4. 3bed/3-3.5baths  
5. 4bed/4-4.5baths.

MULTI-OBJECTIVE GENETIC OPERATION

I extracted the outer contours of each typical apartment plan types and put it on the site for application. On the front site of Hudson Yard, a general high-rise outline of Podium-tower is designed first, and then small apartment blocks are parametrically generated from each flat type.

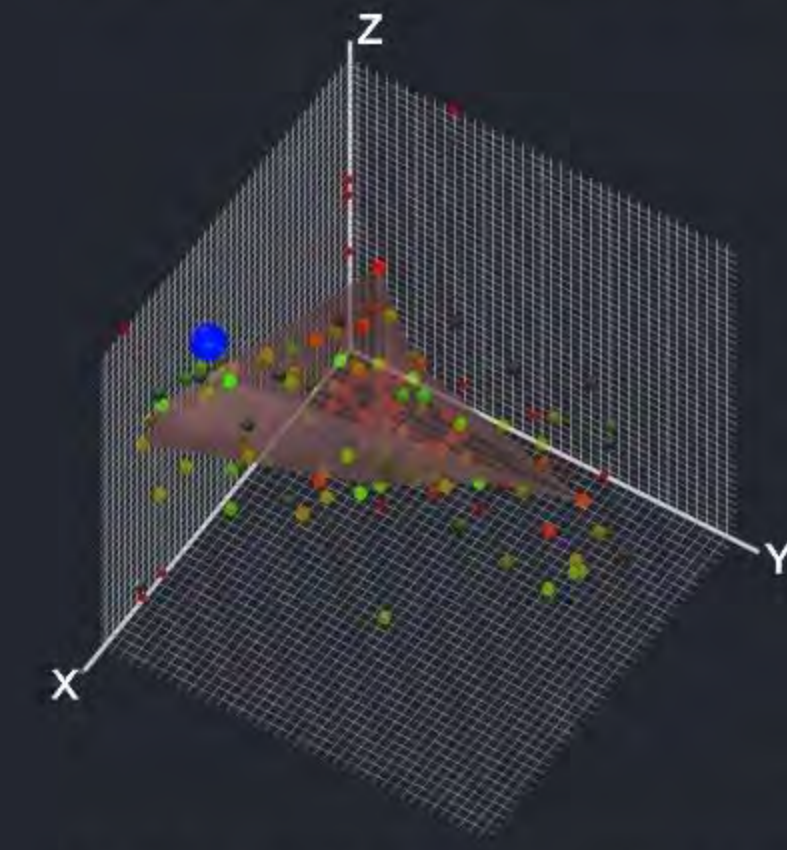
It is generated by parameterized stacking with WASP (in grasshopper) in the form of Podium-tower as the overall morphological constraint. Among them, the independent variables of parametric control are the scaling ratio of each plan and the change of the number of elevation floors. These independent variables are introduced into Wallacei X (in grasshopper) for multi-objective genetic optimization to control the posture generation of WASP in the previous step.

Parallel Coordinate Plot



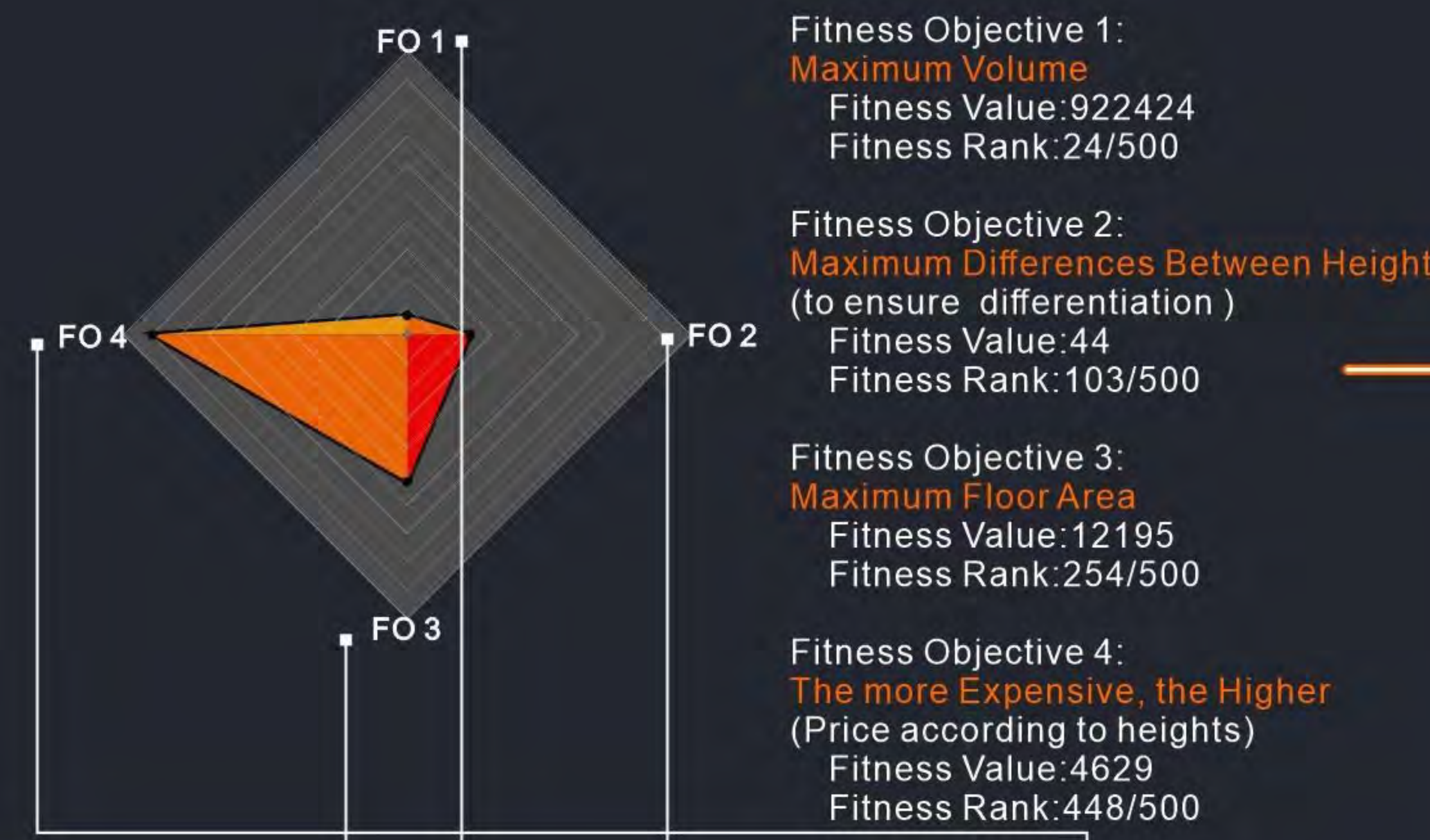
Objective Space

X - Axis  
Maximize Volume  
Y - Axis  
Maximize Differences Between Heights  
Z - Axis  
Maximize Floor Area  
Green (fittest) - Red (least fit)  
The more Expensive, the Higher



Each point represents an individual. The closer it is to the axis, the better the optimization effect on the optimization target represented by the axis. The red is the most unsuitable, the green is the most suitable. The red surface in the figure represents the surface formed by the connecting line of the last generation individual.

Rose Chart of Performance Assessment

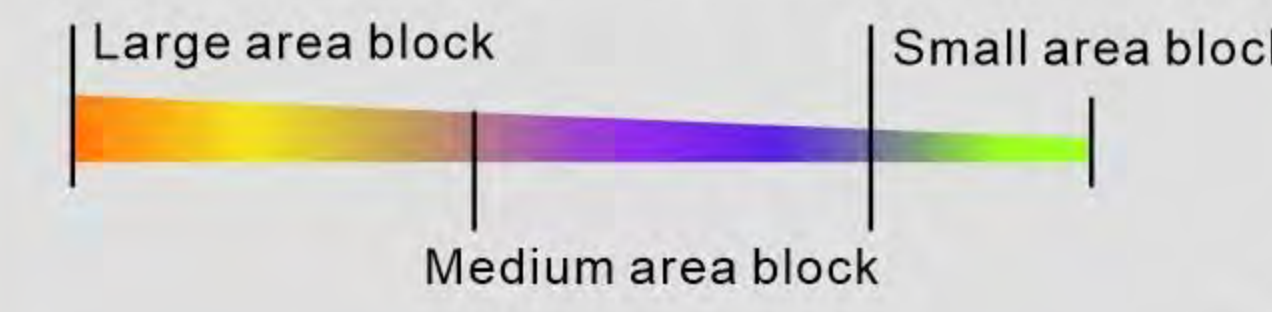


Standard Deviation Graph



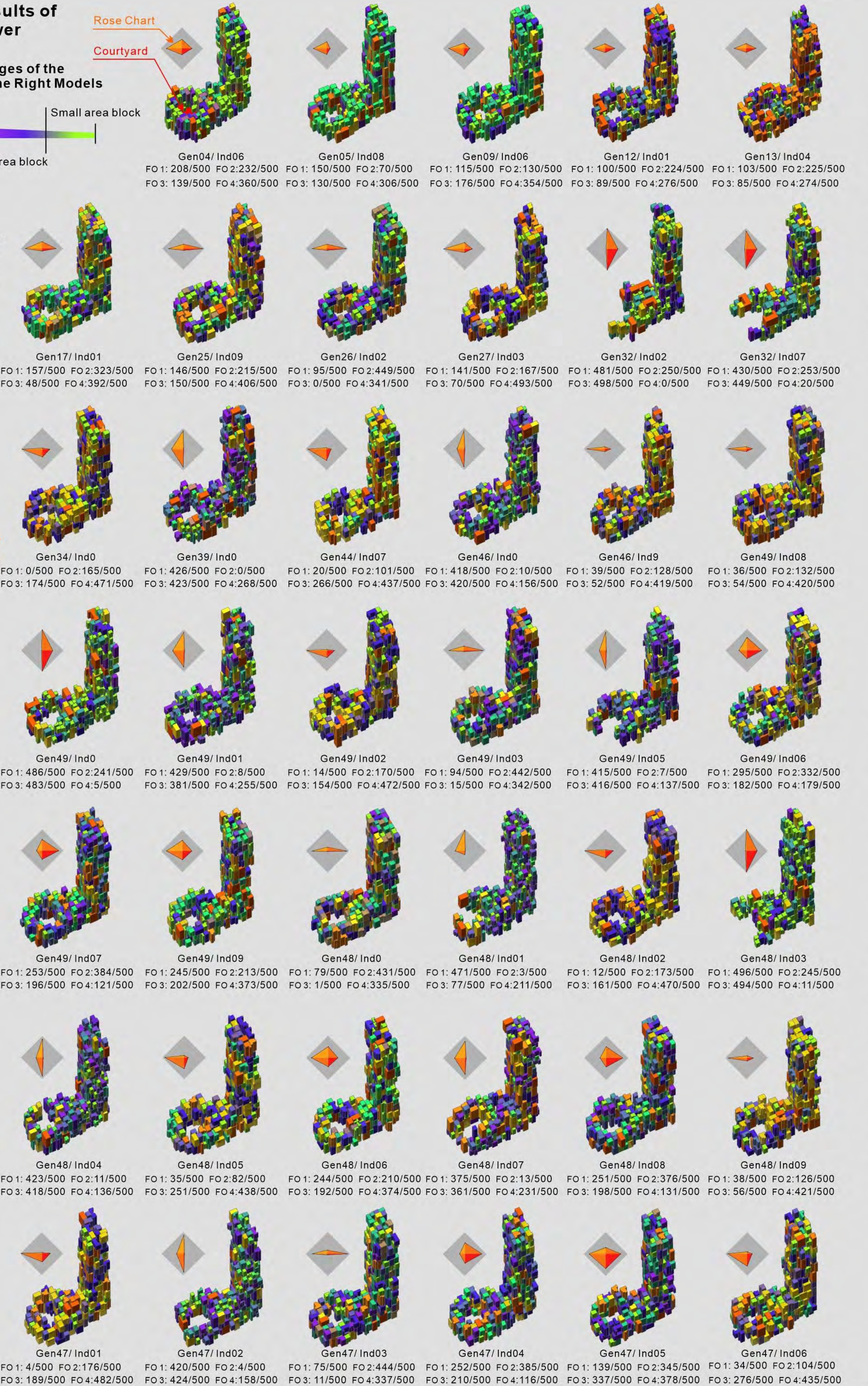
Generation Results of the Podium-tower

Area Gradient Changes of the Colored Blocks in the Right Models



Some typical examples extracted from 10 individuals in each generation from Generation 1 to 50 show the process of optimization.

According to the comprehensive optimization results of each objective in the rose chart of performance assessment, the corresponding podium-tower model is selected for the next process.



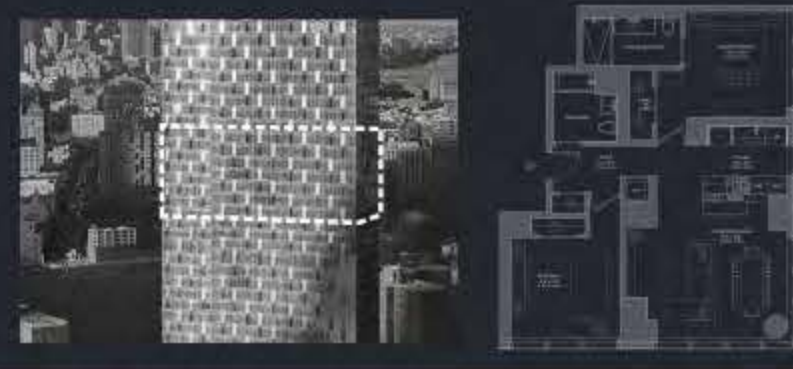
SPECIFIC EXAMPLE FOR A GRAPHIC MODEL

More Detailed Housing Unit

Small blocks are automatically generated in the small apartment building generated by the plans through Evomass in grasshopper. In these representational small houses, there is not only the direct superposition of the original plan, but also the automatic generation of representational buildings within the original block framework, including cantilevers, balconies, gardens, etc.

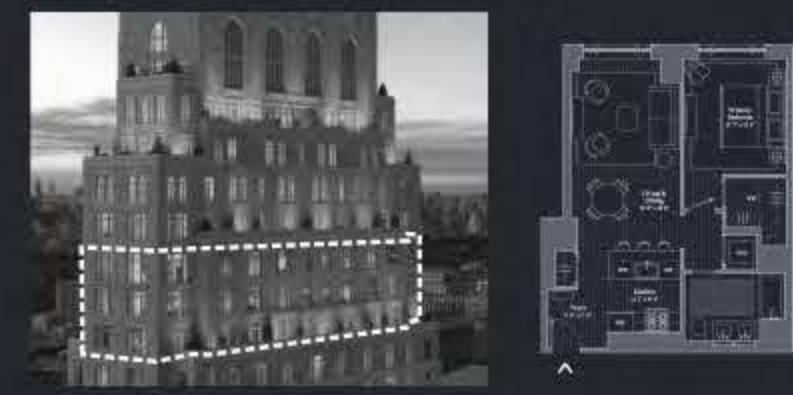
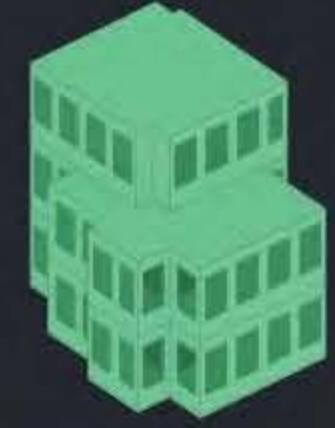
Evomass examples :

2 bedrooms, 2 bathrooms  
Square: 107.4 square meters  
Price: \$189.5 W



Benchmarking cases :

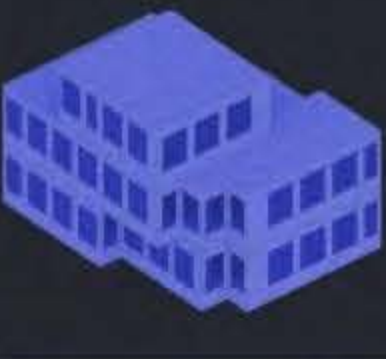
1 bedrooms, 1 bathrooms  
Square: 85.4 square meters  
Price: \$150 W  
Monthly taxes: 674\$



2 bedrooms, 2 bathrooms  
Square: 109 square meters  
Price: \$198.5 W  
Monthly taxes: 907\$



3 bedrooms, 3 bathrooms  
Square: 141.7 square meters  
Price: \$294.5 W  
Monthly taxes: 1312\$



1 bedrooms, 1 bathrooms  
Square: 67.2 square meters  
Price: \$123 W



3 bedrooms, 3 bathrooms  
Square: 138.1 square meters  
Price: \$354.7 W



1 bedrooms, 1 bathrooms  
Square: 88.3 square meters  
Price: \$155 W



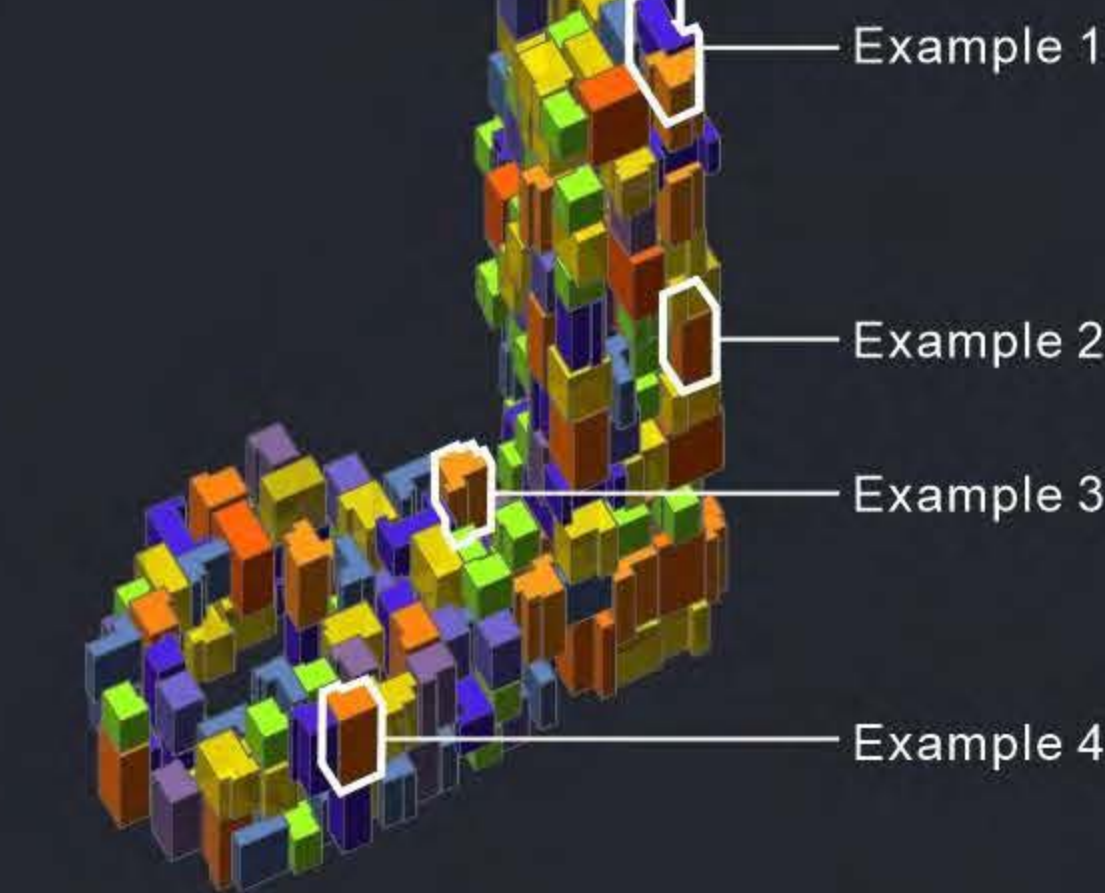
4 bedrooms, 4 bathrooms  
Exquisite Loft  
Square: 218.7 square meters  
Price: \$412 W



Wallacei X & Evomass Generated Example

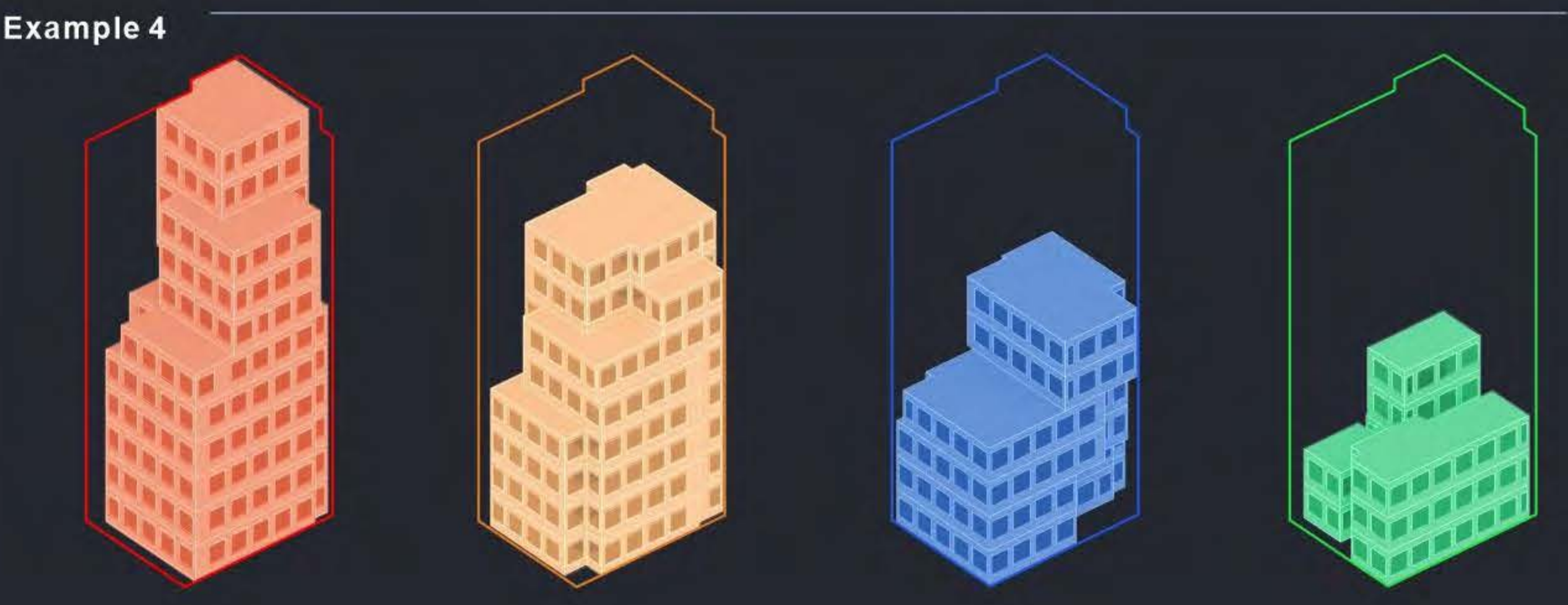
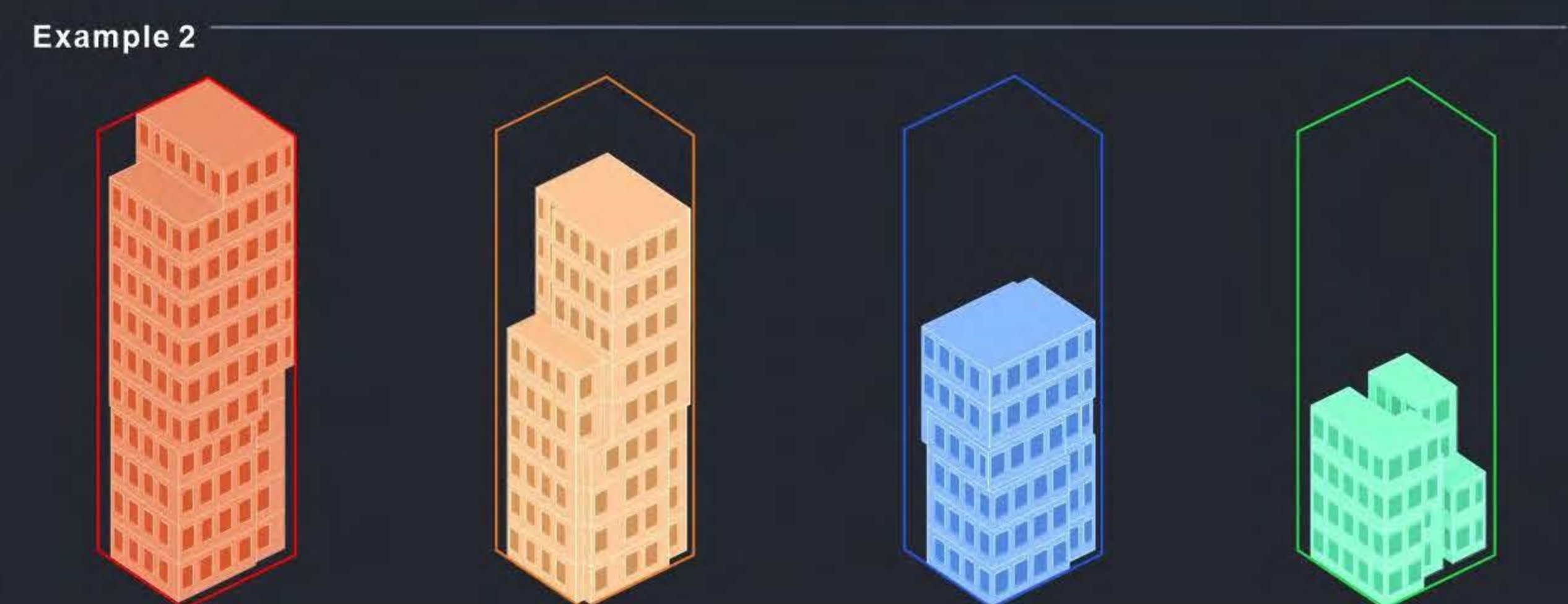
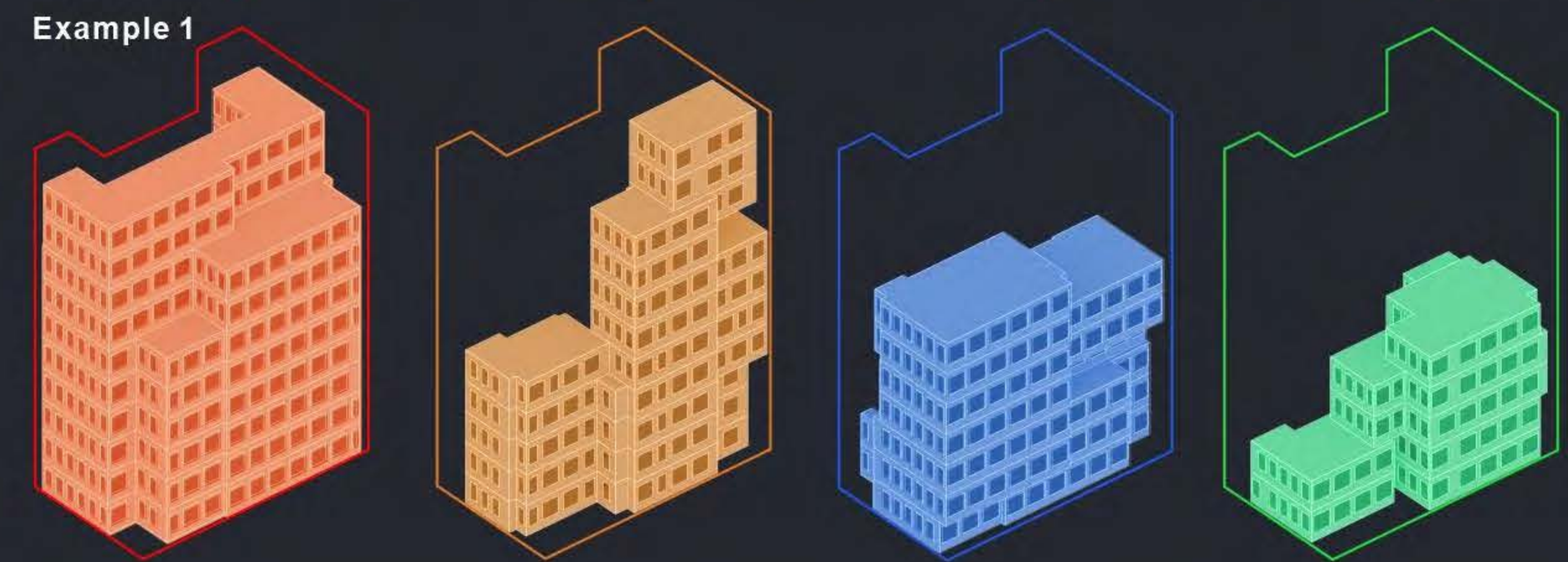


Gen46/ Ind9  
FO 1: 39/500  
FO 2: 128/500  
FO 3: 52/500  
FO 4: 419/500

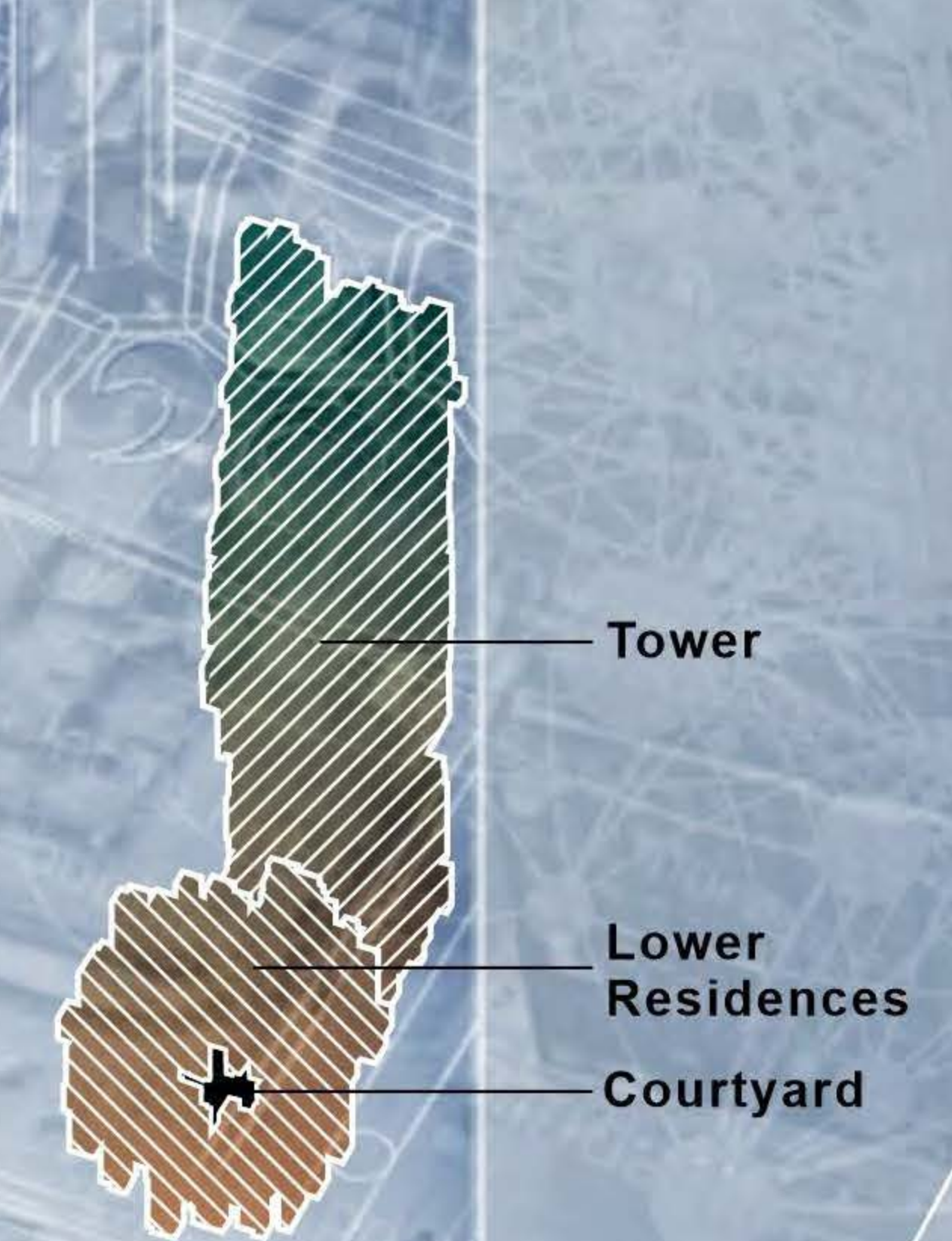


There are four plan types being selected from the plans generated in Wallacei X for specific analysis as examples :

The outer contour in each figure below represents the maximum elevation height that these blocks can be upgraded to (set as 11 floors). According to the change of economic indicators, the scale of its concrete buildings will also change, which is equivalent to turning the building scale into a stock. If the economic situation is good, and it is predicted that the building scale is large, namely the pictures are in red and orange in pictures (the stock is rising); The economic situation is poor. It is predicted that the construction scale is small, that is, the pictures are in blue and green (the stock falls).



Podium-tower Height Components



Graphic Architecture Asset Result



SITE MAP & TASK FLOW

VISUAL INTERFACE ILLUSTRATION

REAL ESTATE: FOLLOWING CREDIT PRODUCTS

NYDE(New York Digital Estate)

Buy	Sell
Upper East Side	3956.8
Upper West Side	11653.9
Midtown	1841.1
Downtown	24.68
Upper Manhattan	14410.0
Financial District	7385.8

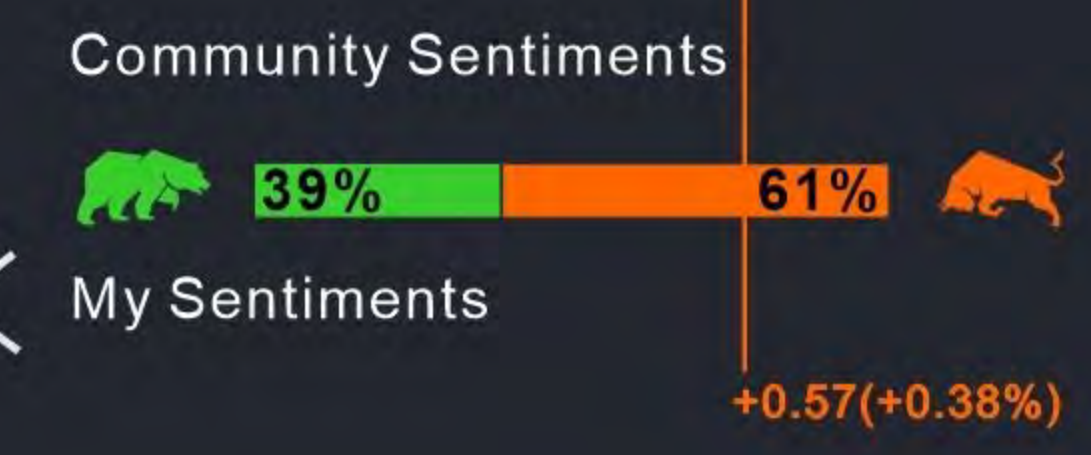


**Index Overview**

Upper East Side  
3956.8  
18/11 - Real Time, Currency in USD

**Index Components**

151.29  
+0.57(+0.38%)  
18/11 - Real Time, Currency in USD



**HouseTypes**

- Studio
- 1 Bedroom
- 2 Bedrooms
- 3 Bedrooms
- 4+ Bedrooms



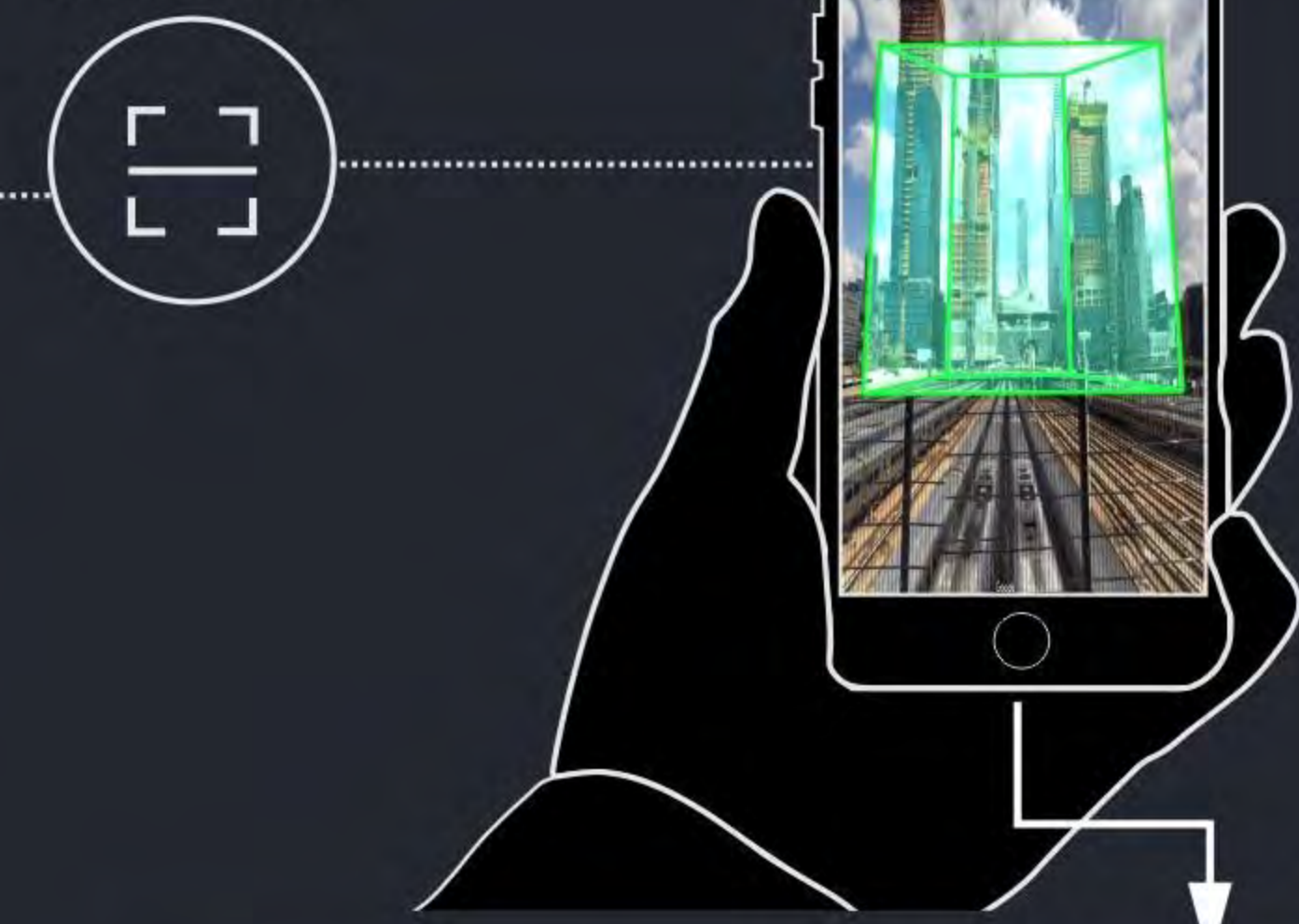
The overall rise and fall of the property on this date Modeled in Wallace X

If the price rises, the number of layers and area of the monomer will increase.

If the price decreases, the number of layers and area of the monomer will decrease.

**Home Page**

Scan the Site



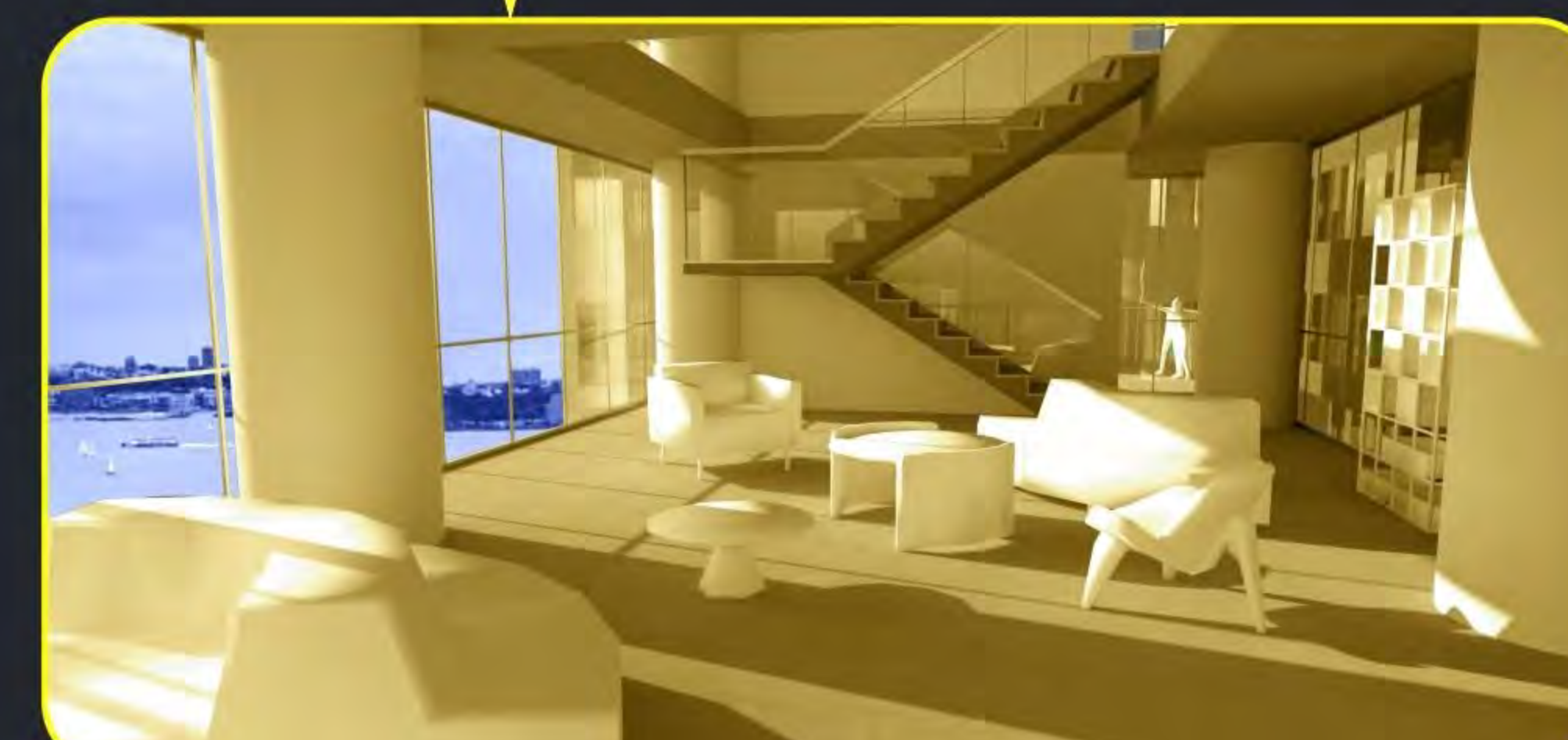
**Street Map**

Real-time Capital Visualization

**The Futures I bought already**

- Four-bedroom type modified on facade  
Trend: rise  
Advice: Valuation Peak can be sold
- Three-bedroom type modified on facade  
Trend: rebound  
Advice: wait for bigger bounce
- Two-bedroom type modified on facade  
Trend: recession  
Advice: sell, stop loss

**Interior Room**



**Trading Stage**

**Hudson Yards (Over Railway Parts)**  
Estimated Building date: 2024.04

- Total Apartments: 305
- Total Floors: 98
- Neighborhood: Midtown West Manhattan
- Avg. Price Right Now: \$2750/ft<sup>2</sup>

**Previous Situation(Prosperity)**

- Total Apartments: 385
- Total Floors: 108
- Avg. Price Right Now: \$3450/ft<sup>2</sup>

**Predictable future(Recession)**

- Total Apartments: 289
- Total Floors: 100
- Avg. Price Right Now: \$2410/ft<sup>2</sup>

**Future (Recession)**

- Total Apartments: 289
- Total Floors: 93
- Avg. Price Right Now: \$2250/ft<sup>2</sup>

Digital Estate Visualization System in Manhattan Demonstrating the Value Fluctuation from Coincident Economic Index

Digital Estate Visualization System in Manhattan Demonstrating the Value Fluctuation from Coincident Economic Index

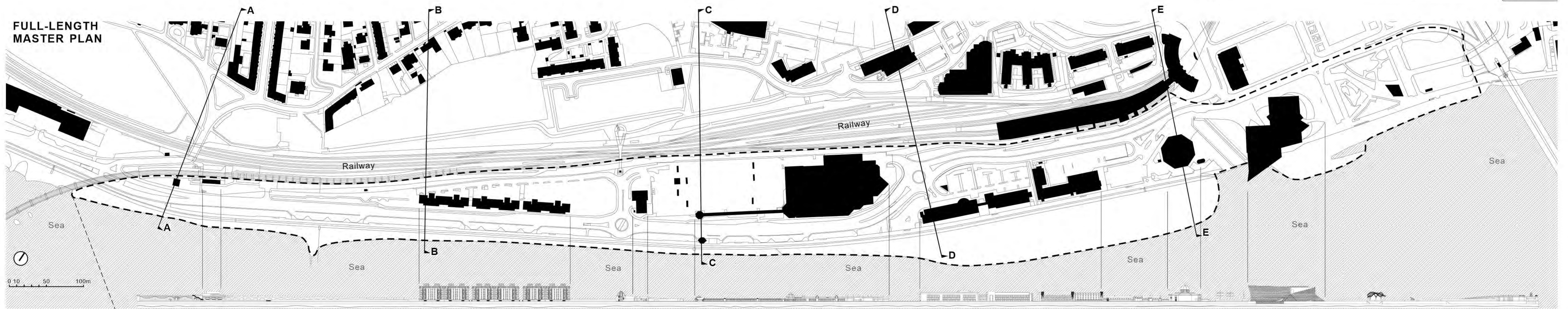
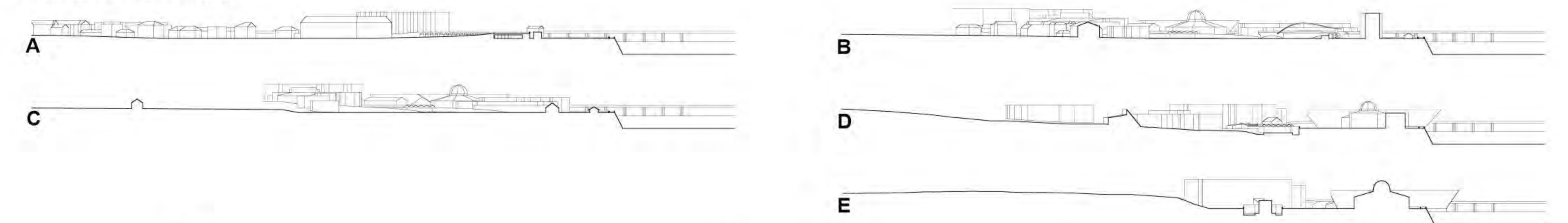
# 05 SELF-CONTAINED

## Newly-built Waterfront Residential Community Complex Design

Individual curriculum work

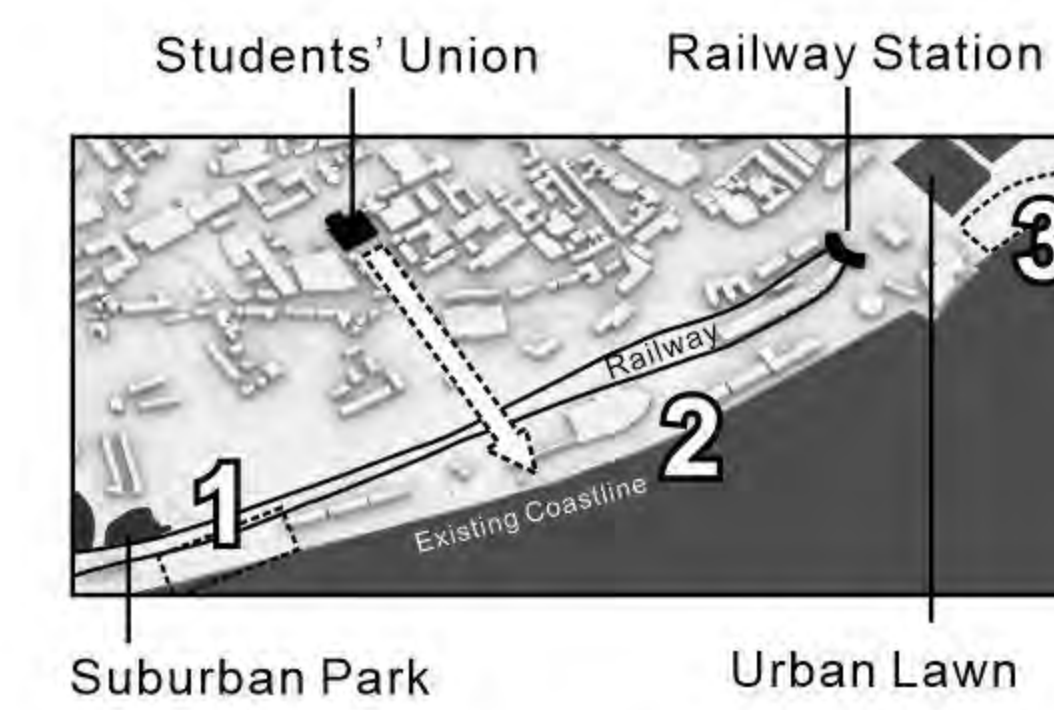
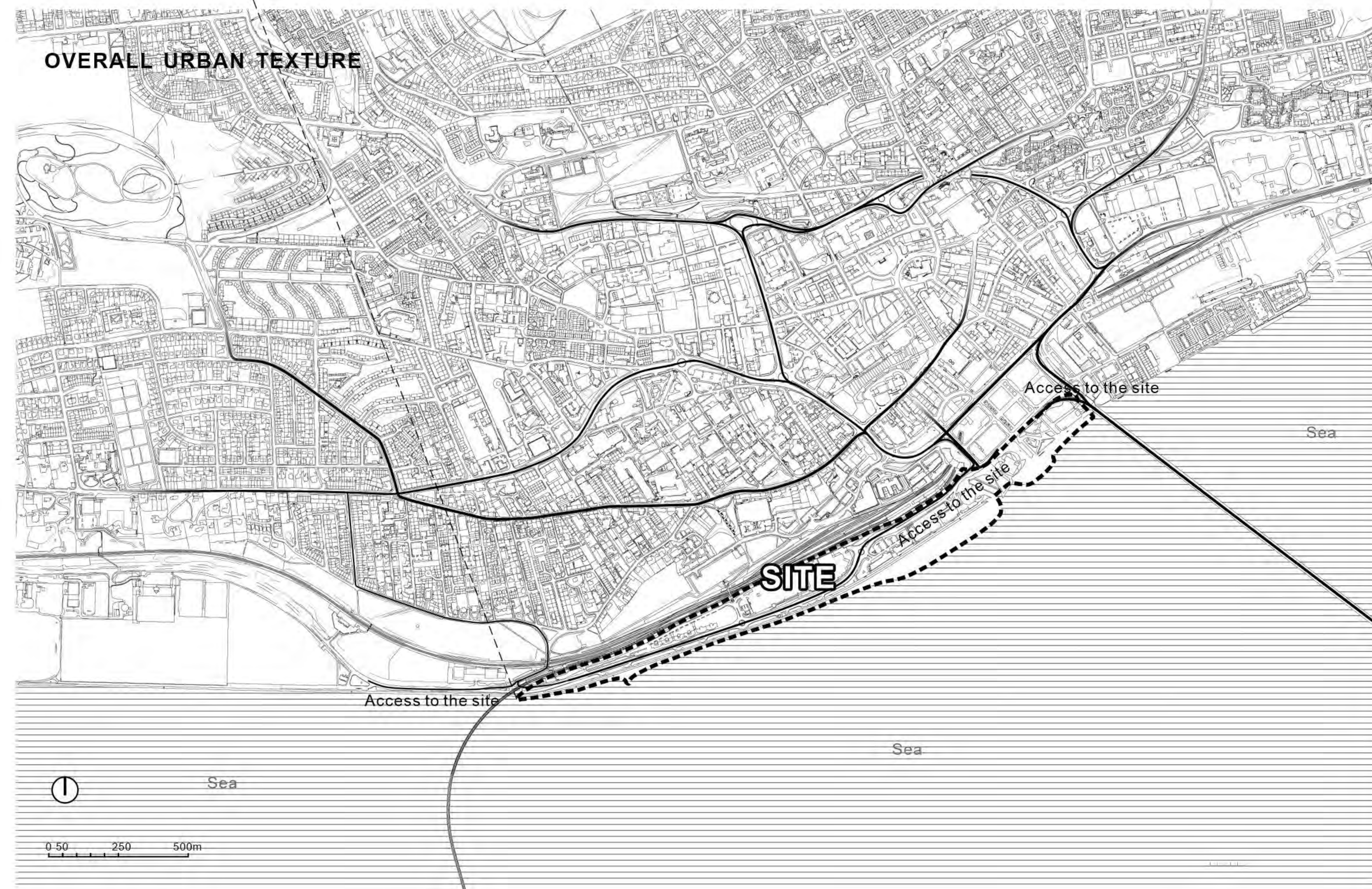
October-December 2022

### General Site Section



Dundee is divided by its own reinvention. Plaudits from international lifestyle magazines and travel journalists contrast with statistics of extremes of unemployment, poverty and drug addiction. The city's strategy for regeneration is likely to further polarise the social fabric of the city, with promotion of its first identity invariably involving the concealing, denial or cleansing of the second.

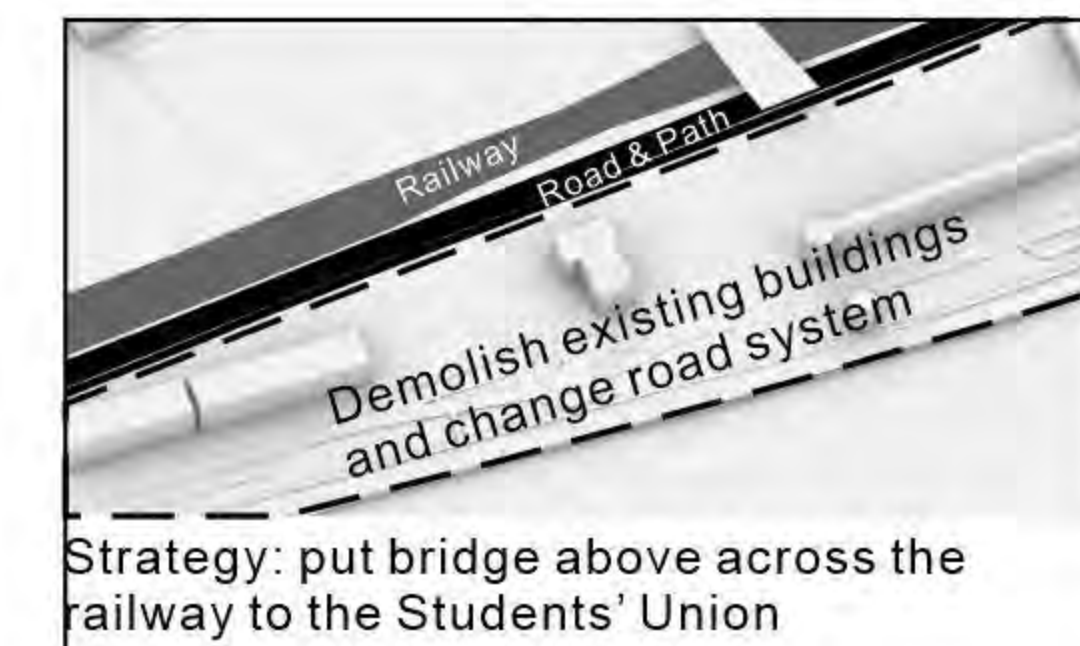
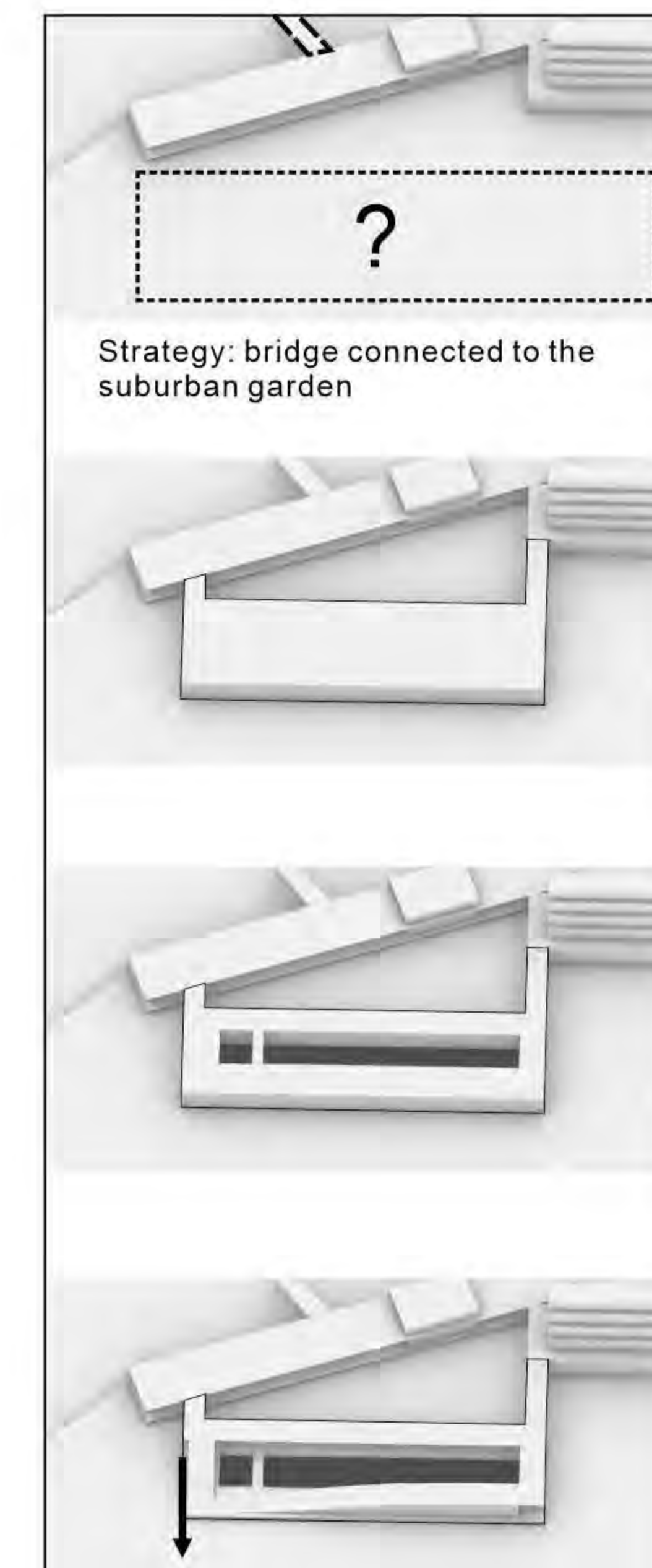
This project will not be complicit in this gentrification process. Instead, we will imagine a different agency for architecture, where we can conceive new socio-spatial formations under different economic imperatives. We will consider a new compact waterfront, compressing the components of the previous abandoned attempt at a 'social architecture' - housing, shopping, education, businesses, civic and cultural facilities - stretched along the artificial landscape of Dundee's waterfront in new formations of social-space, realised in new architectural form. A second attempt at the future.



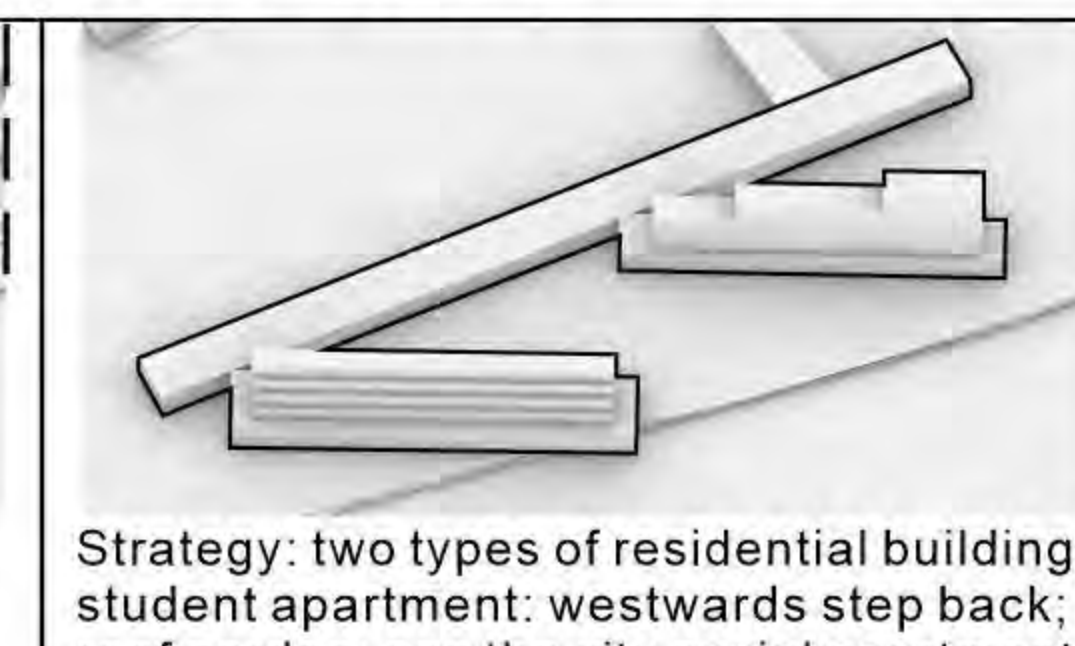
### 2 OVERALL URBAN TEXTURE

### 3 EASTERN EDGE

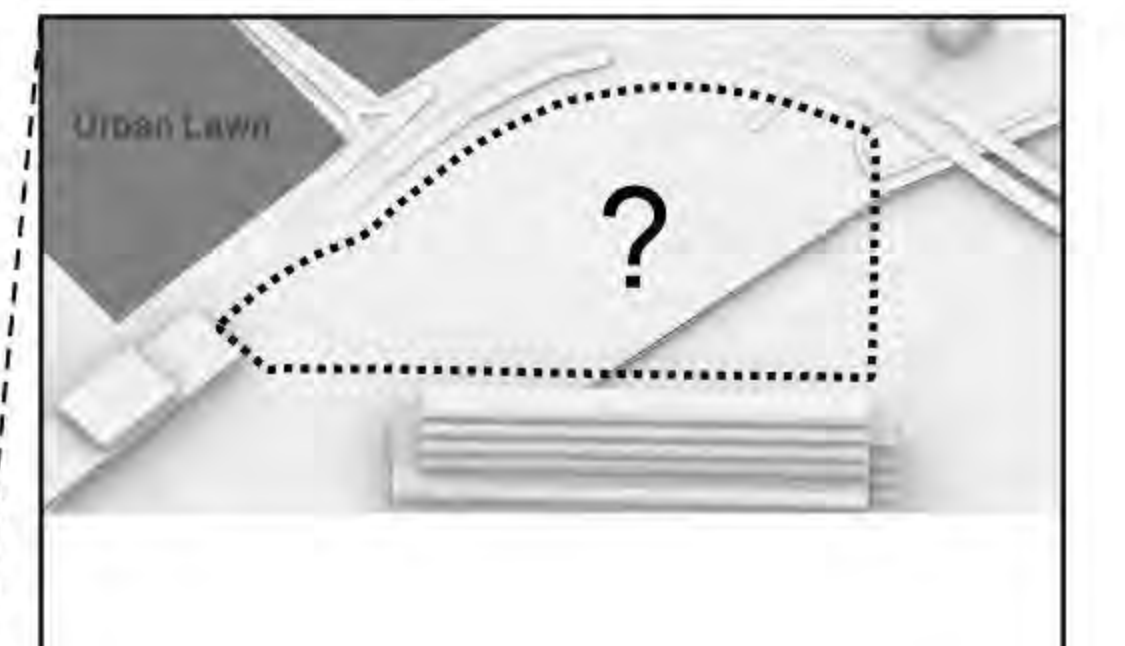
### 1 WESTERN EDGE



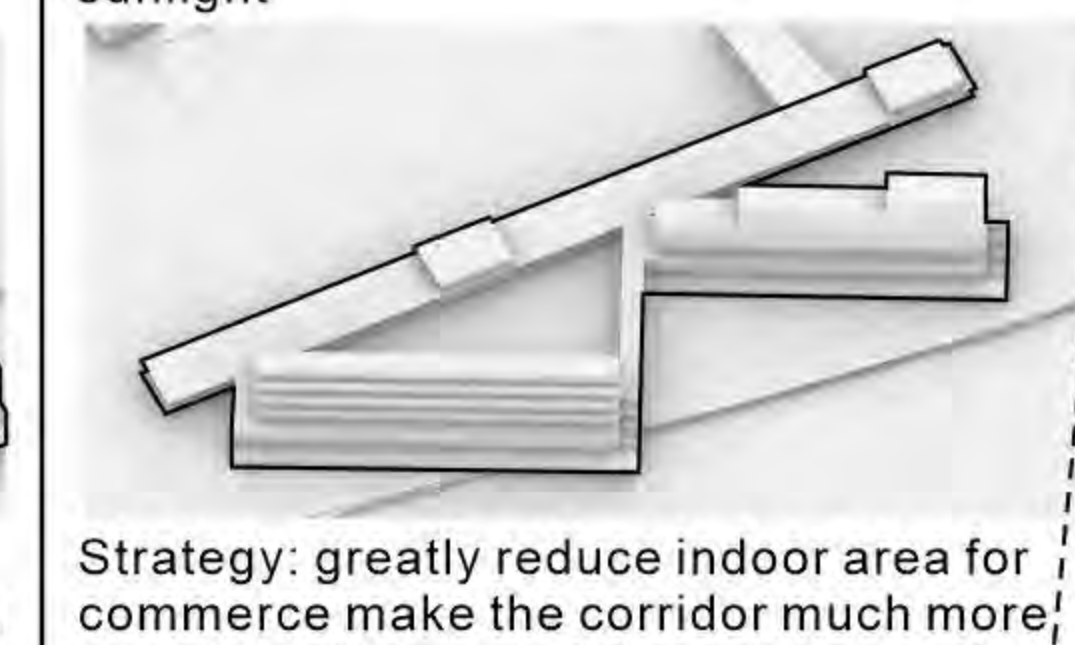
Strategy: put bridge above across the railway to the Students' Union



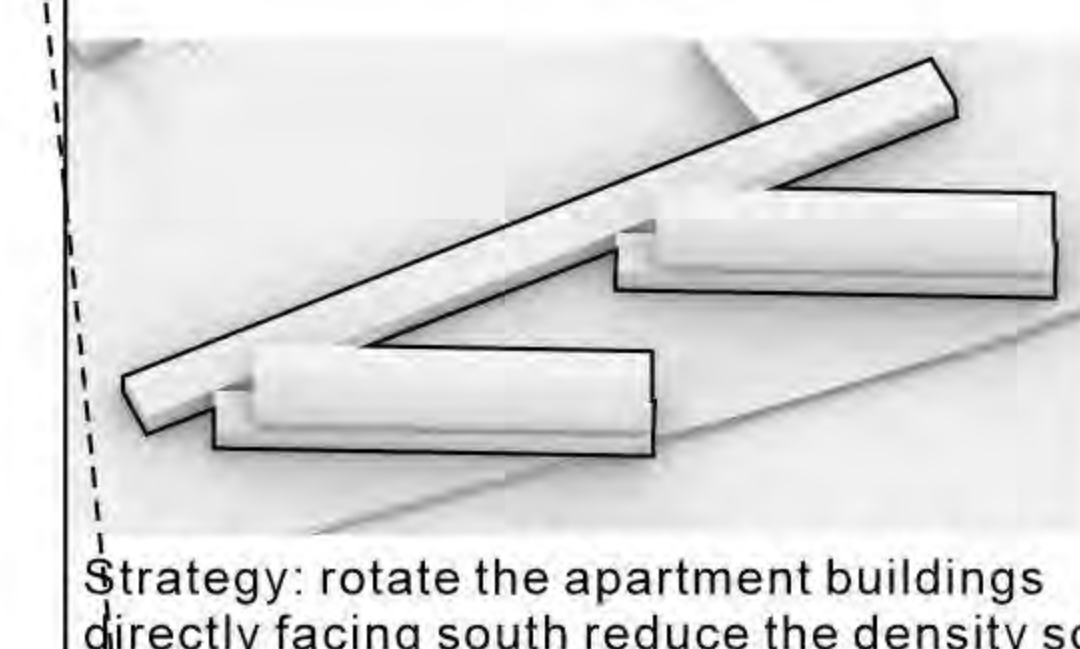
Strategy: two types of residential buildings student apartment: westwards step back; roof garden; see the city social apartment southwards step back; make use of sunlight



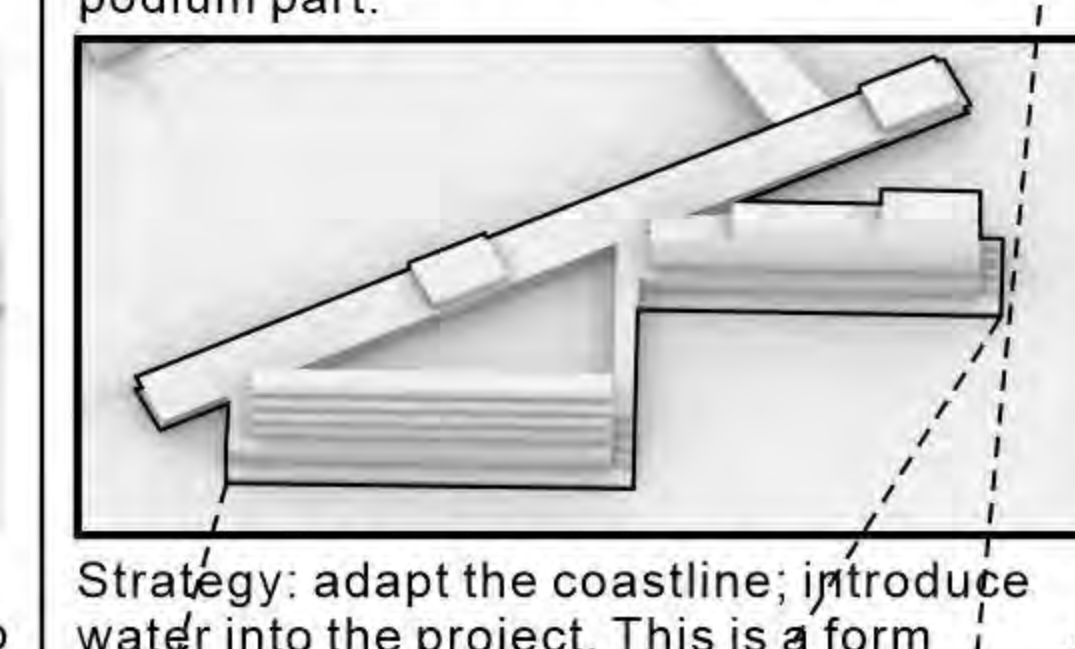
Strategy: commercial corridor and artificial ground facing the city; residential apartments facing the water



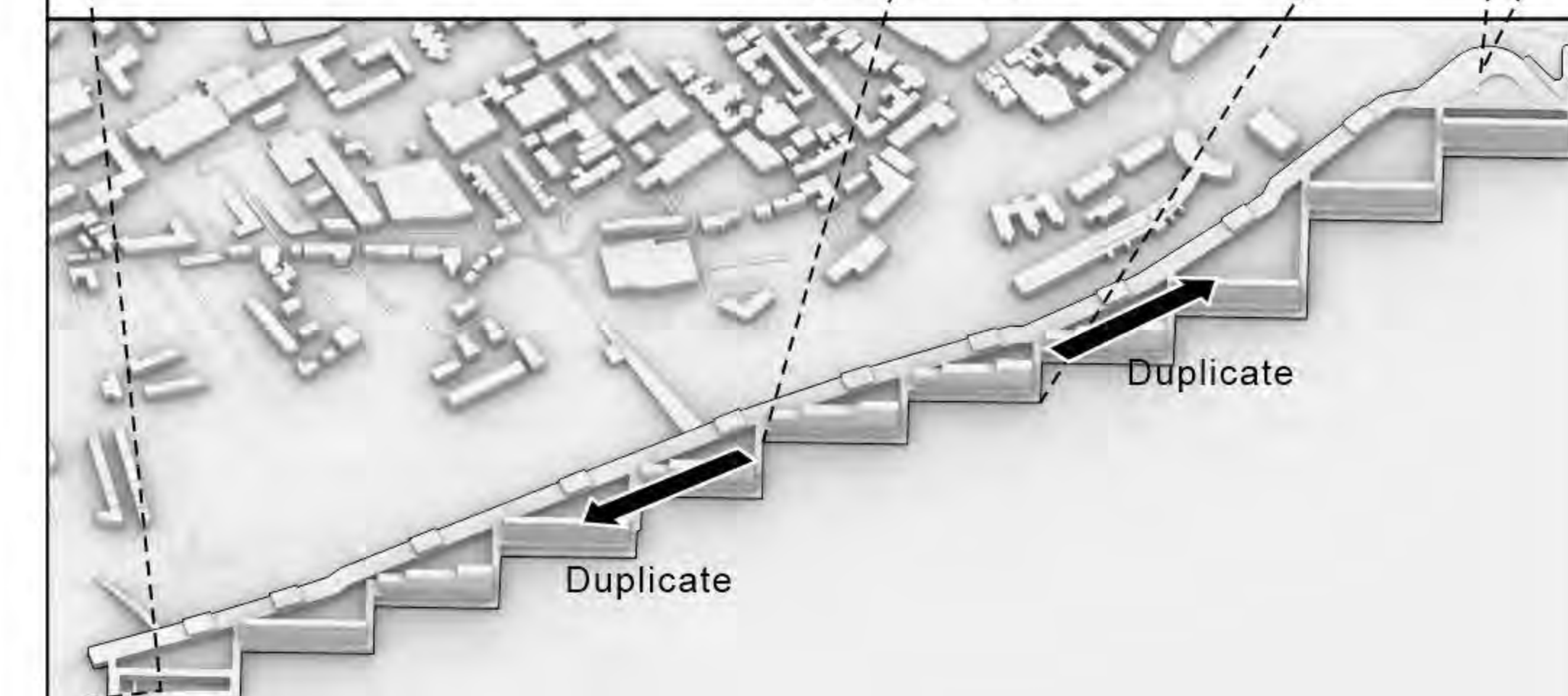
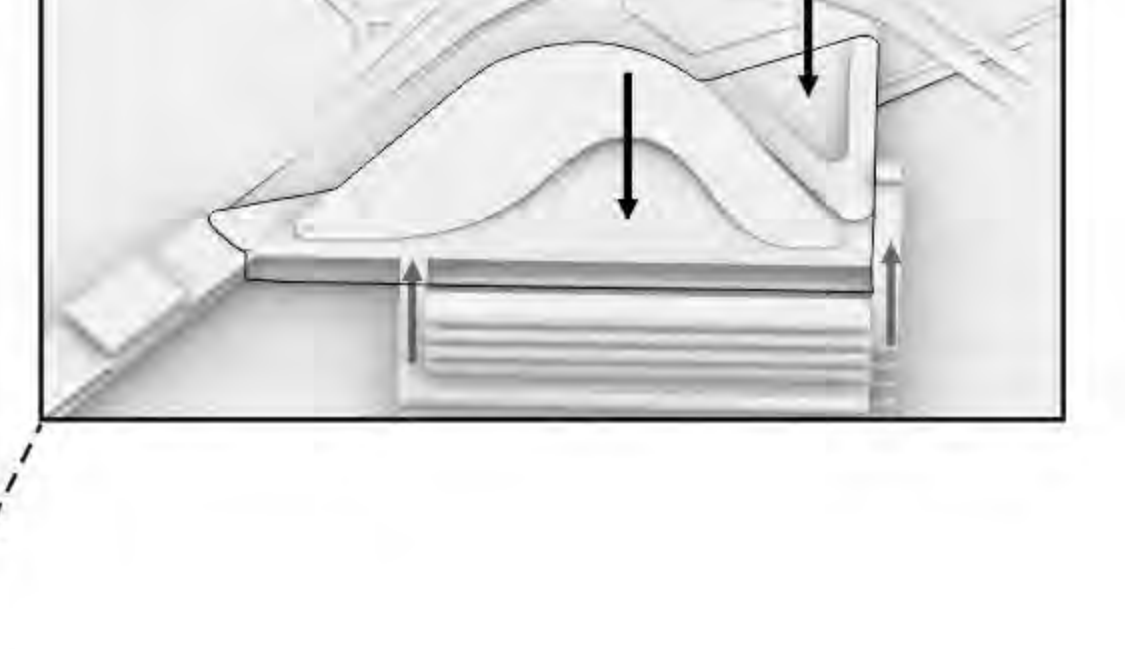
Strategy: greatly reduce indoor area for commerce make the corridor much more open to outdoor use bridge to connect each residential buildings above the podium part.

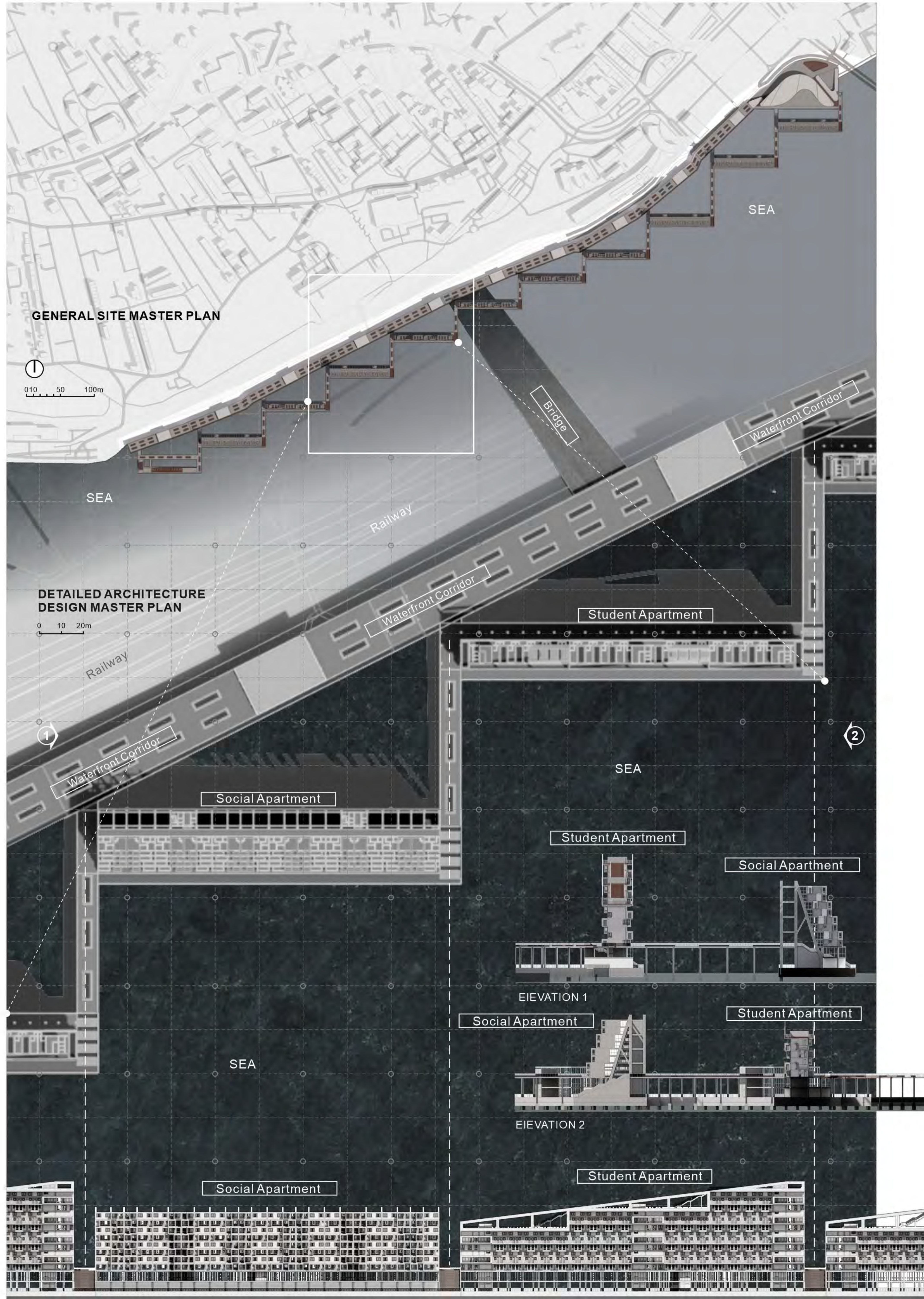


Strategy: rotate the apartment buildings directly facing south reduce the density so that every living units can see the water



Strategy: adapt the coastline; introduce water into the project. This is a form prototype which can be copied through the waterfront

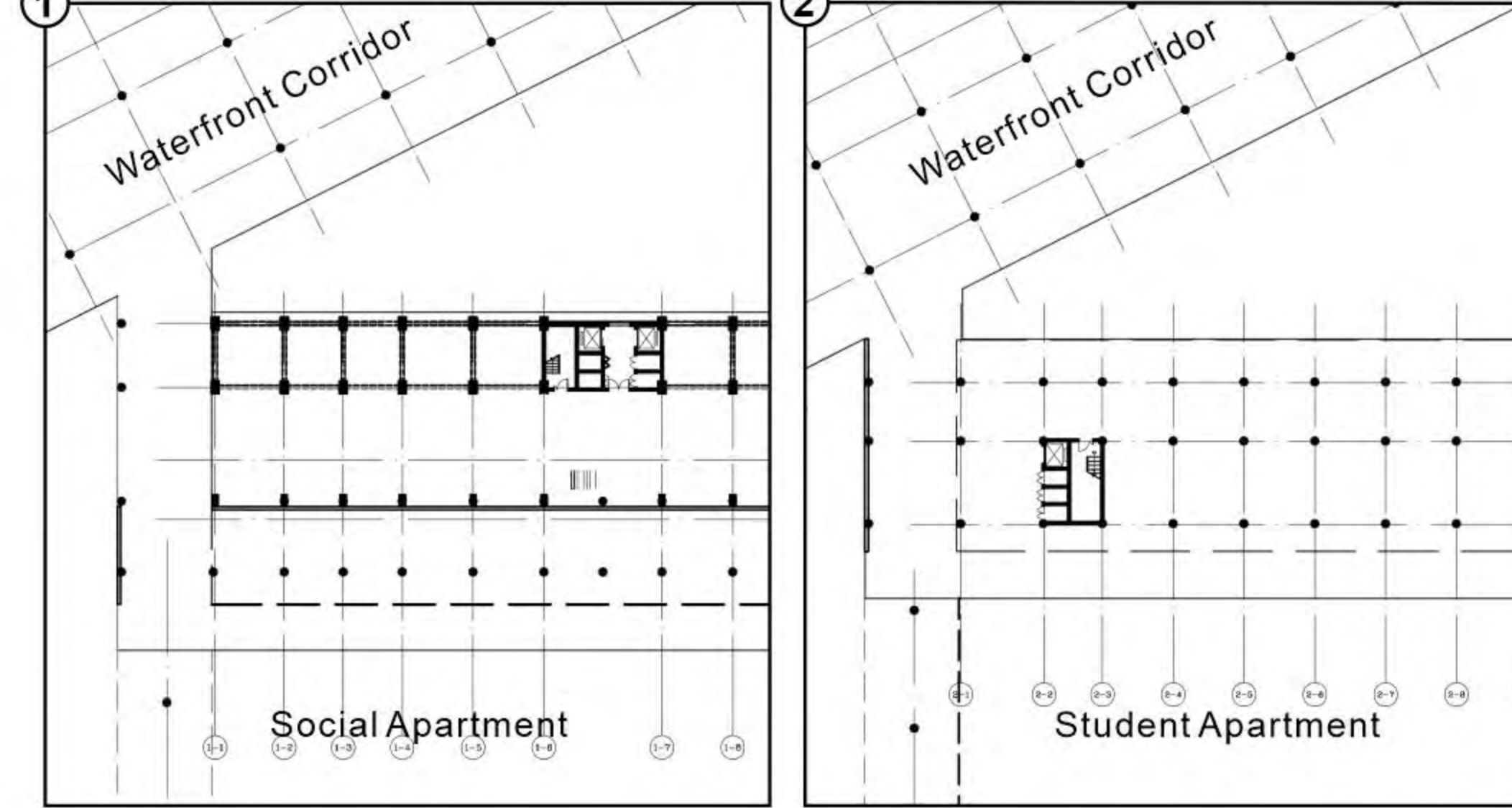




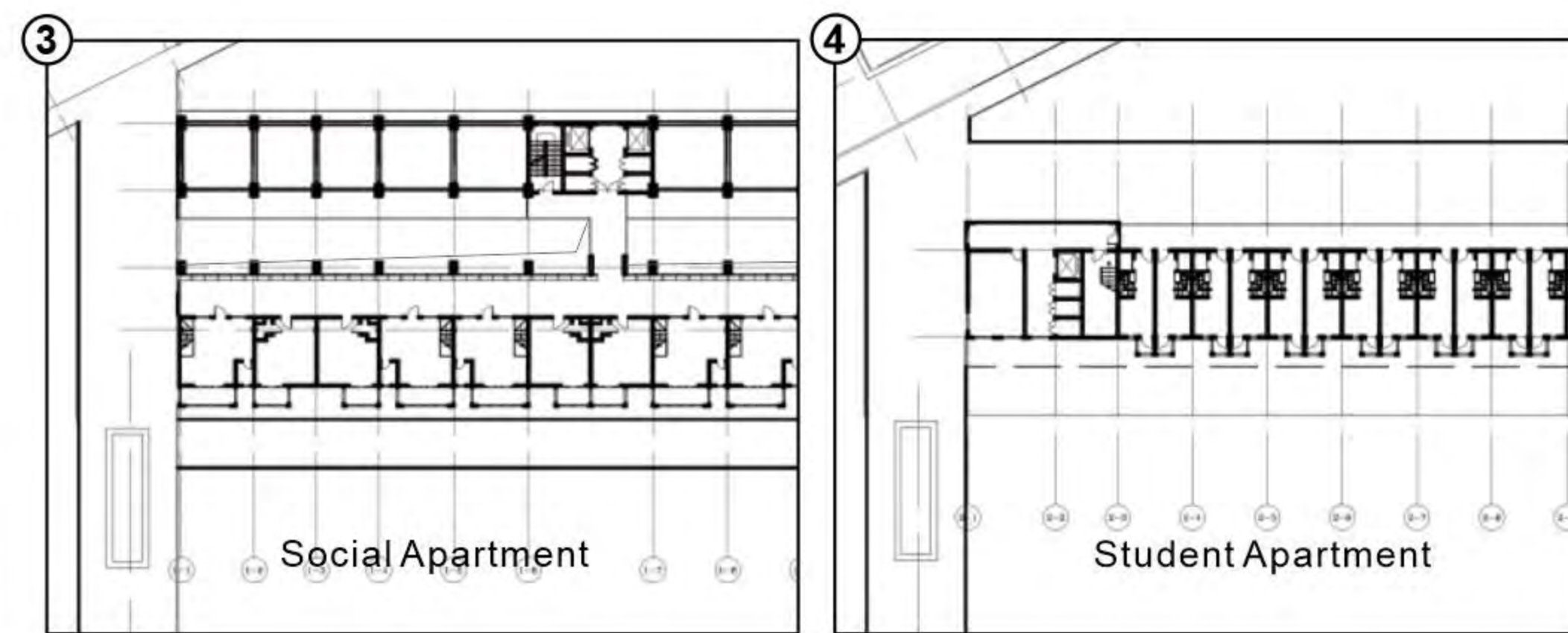
FLOOR PLAN

GF 0.000m  
Apartment GF: +1.400M  
Waterfront Corridor GF: +1.400M  
Water surface: -2.000m

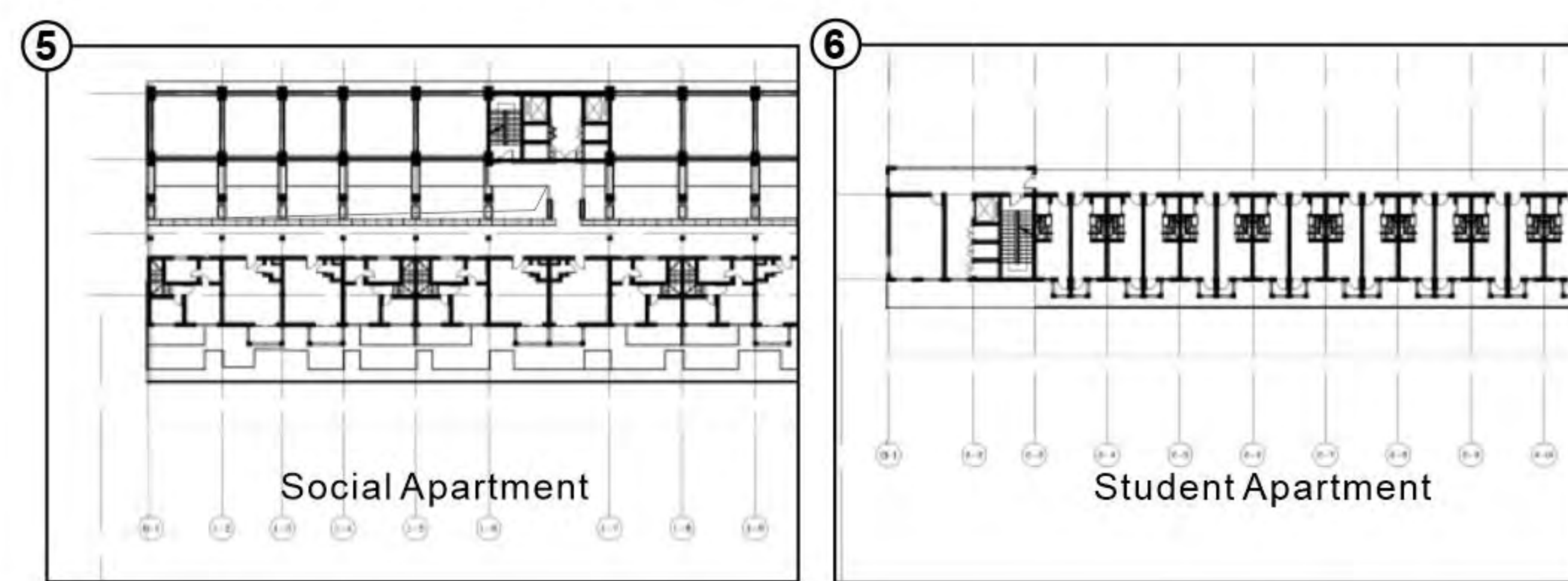
Detailed Floor Plan



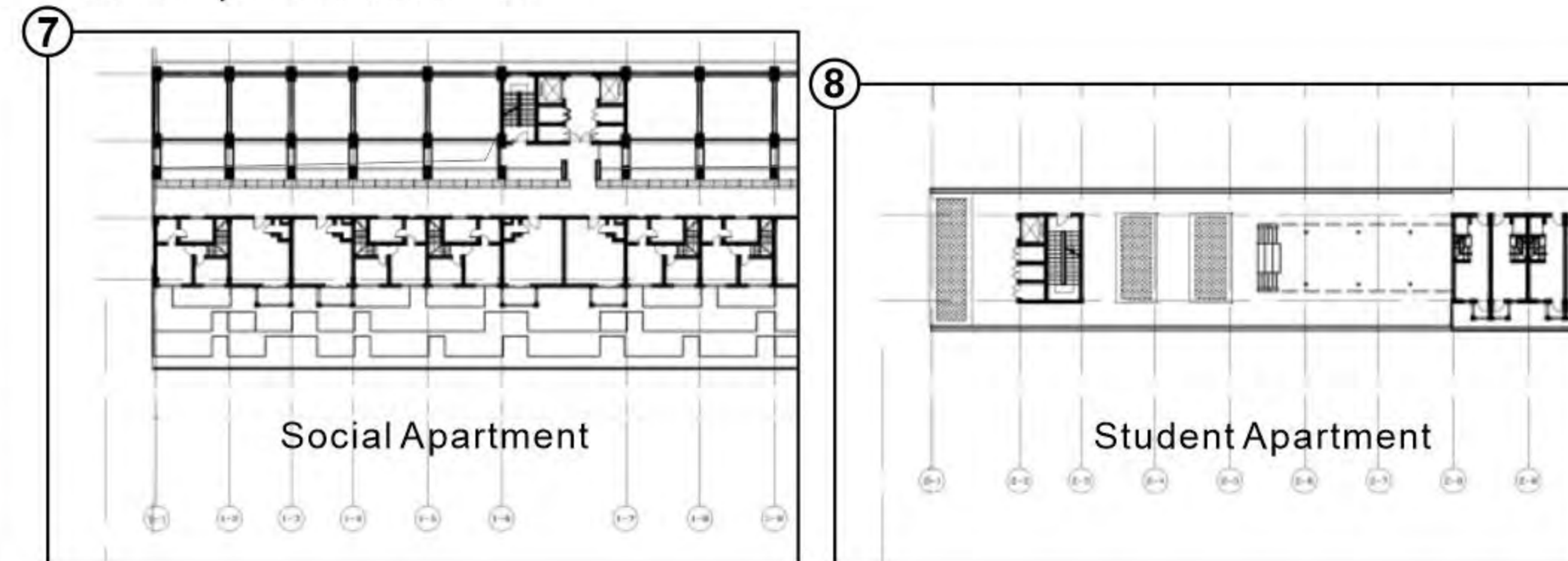
1F-2F: +9.400m(3.100m)  
Corridor rooftop: +8.000m



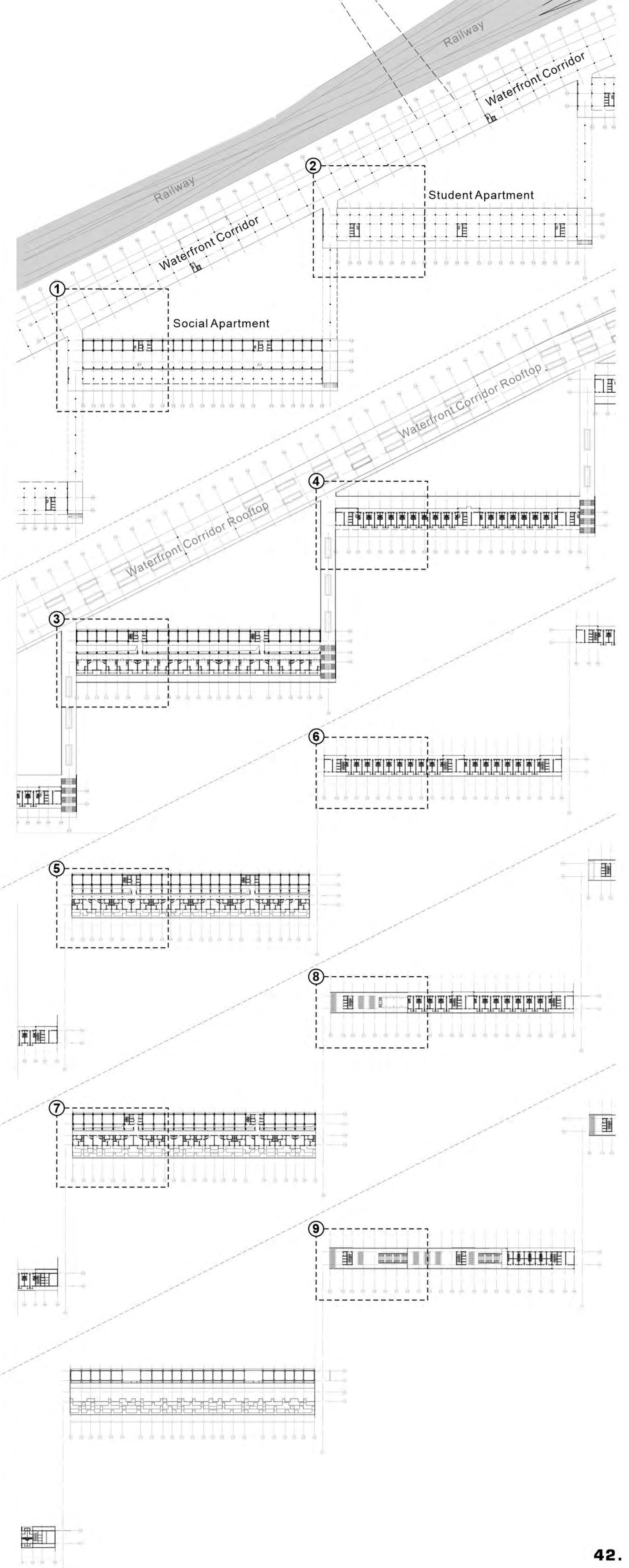
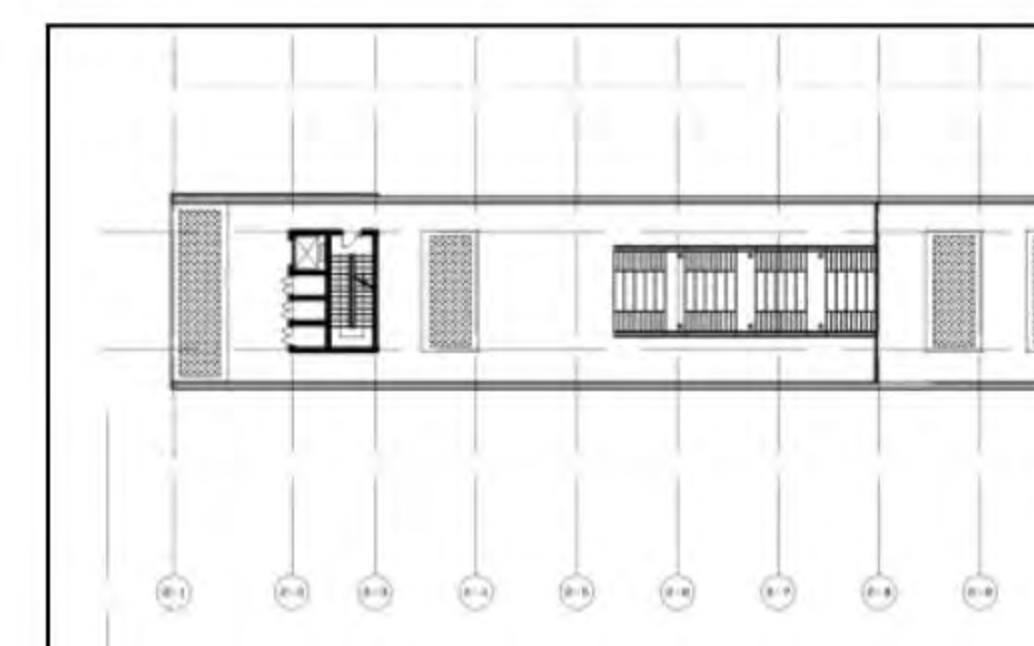
3F-5F: +17.000m(3.100m)



6F-8F: +25.000m(3.100m)  
Student Apartment: 6F-8F  
Social Apartment: 6F-7F



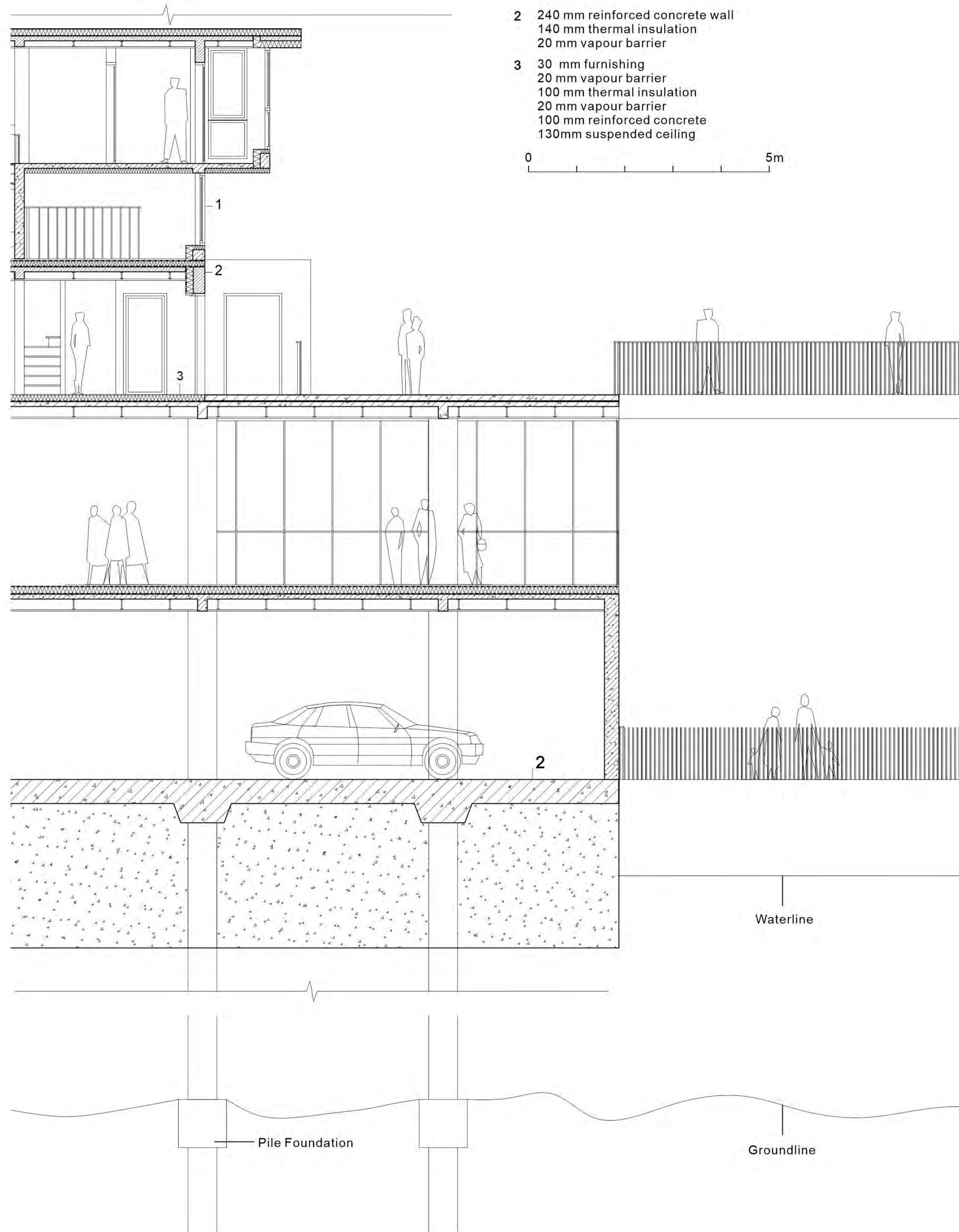
9F-12F: +34.600m(3.100m)  
Student Apartment: 9F-12F  
Social Apartment Rooftop



TYPICAL DETAIL SECTION OF WATERFRONT CORRIDOR

- 1 Double glazing EV window with sound insulation in the frame
- 2 240 mm reinforced concrete wall  
140 mm thermal insulation  
20 mm vapour barrier
- 3 30 mm furnishing  
20 mm vapour barrier  
100 mm thermal insulation  
20 mm vapour barrier  
100 mm reinforced concrete  
130mm suspended ceiling

0 5m

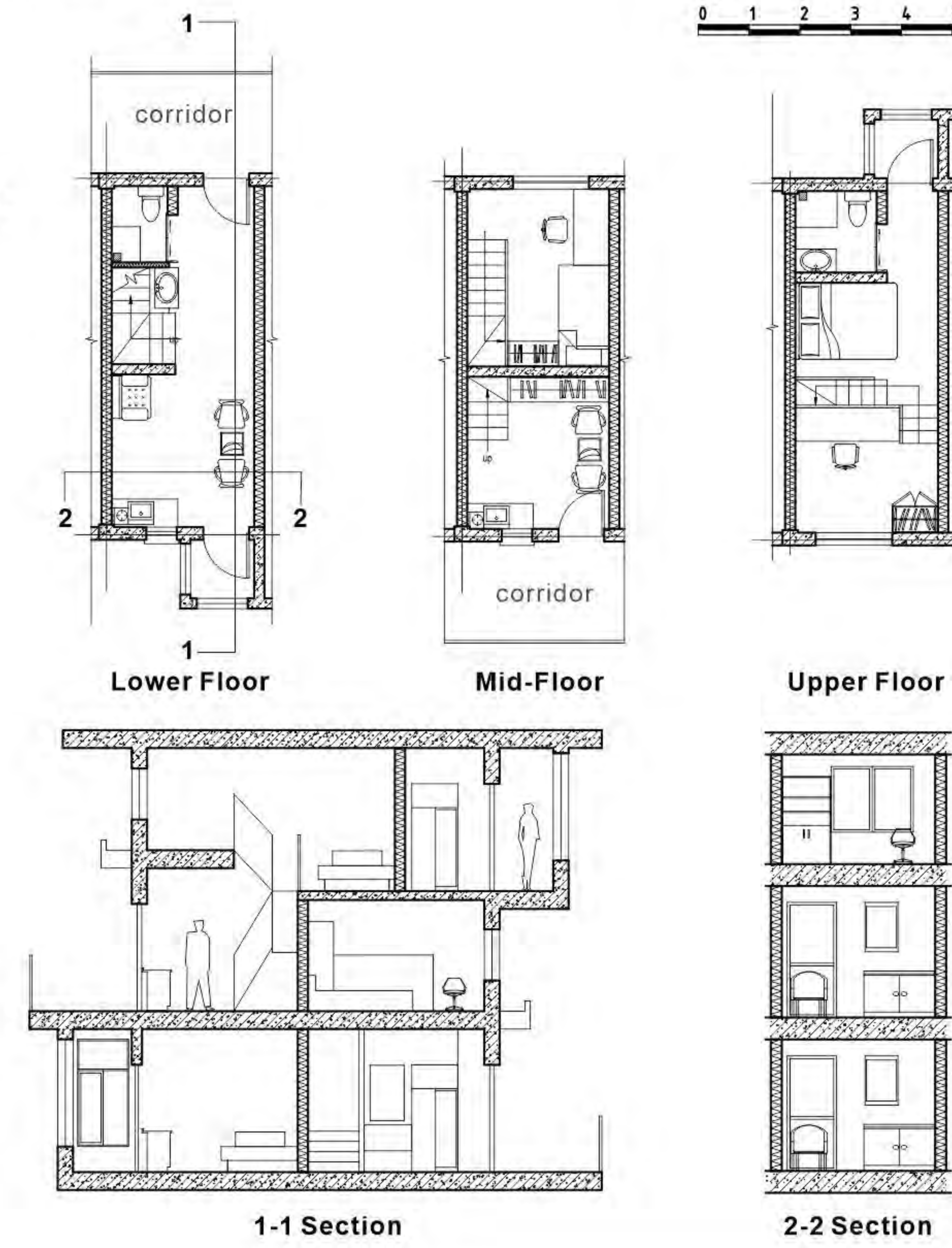


SELF-CONTAINED

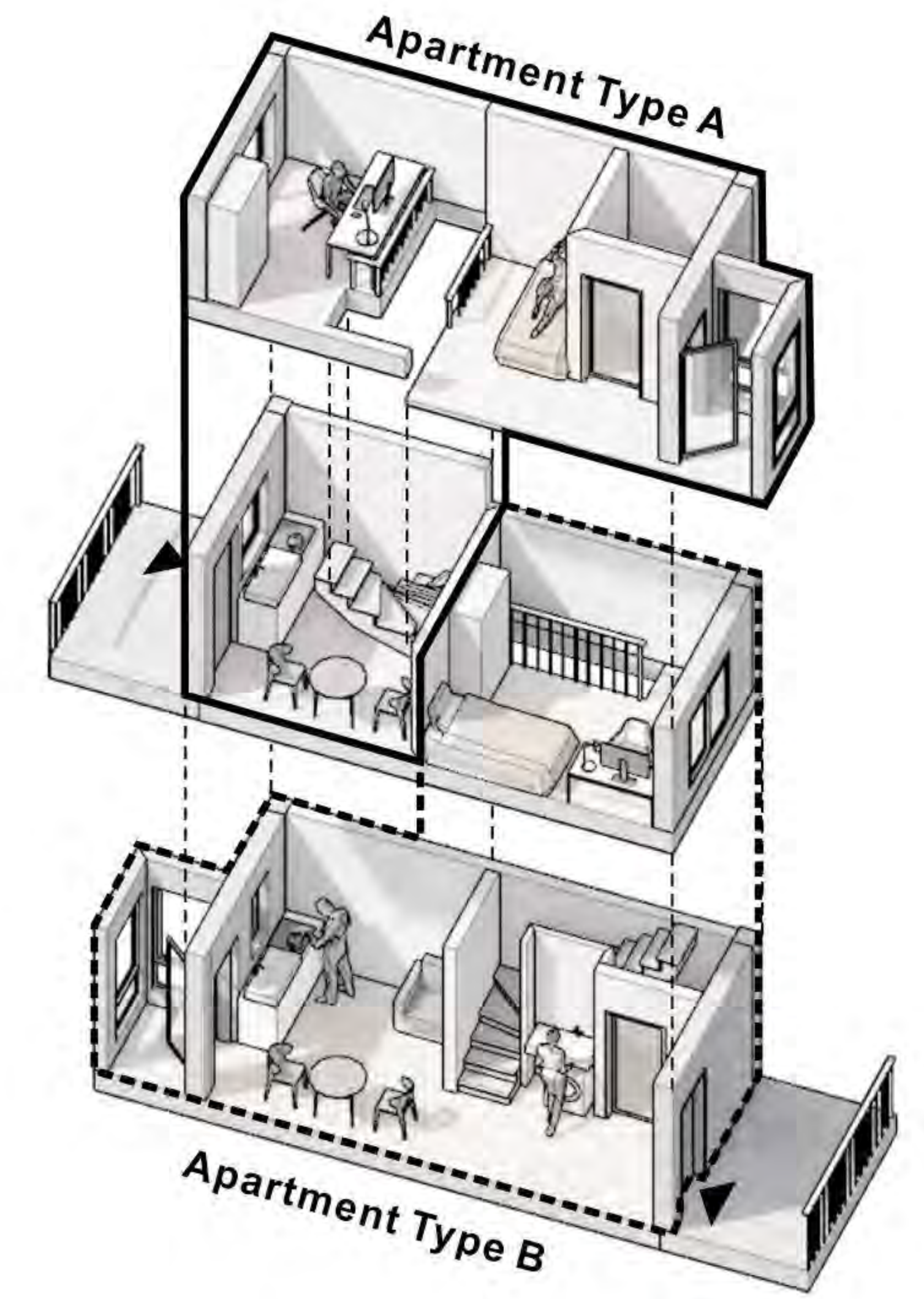
Newly-built Waterfront Residential Community Complex Design

APARTMENT TYPE

Three-storey Crossed Apartment



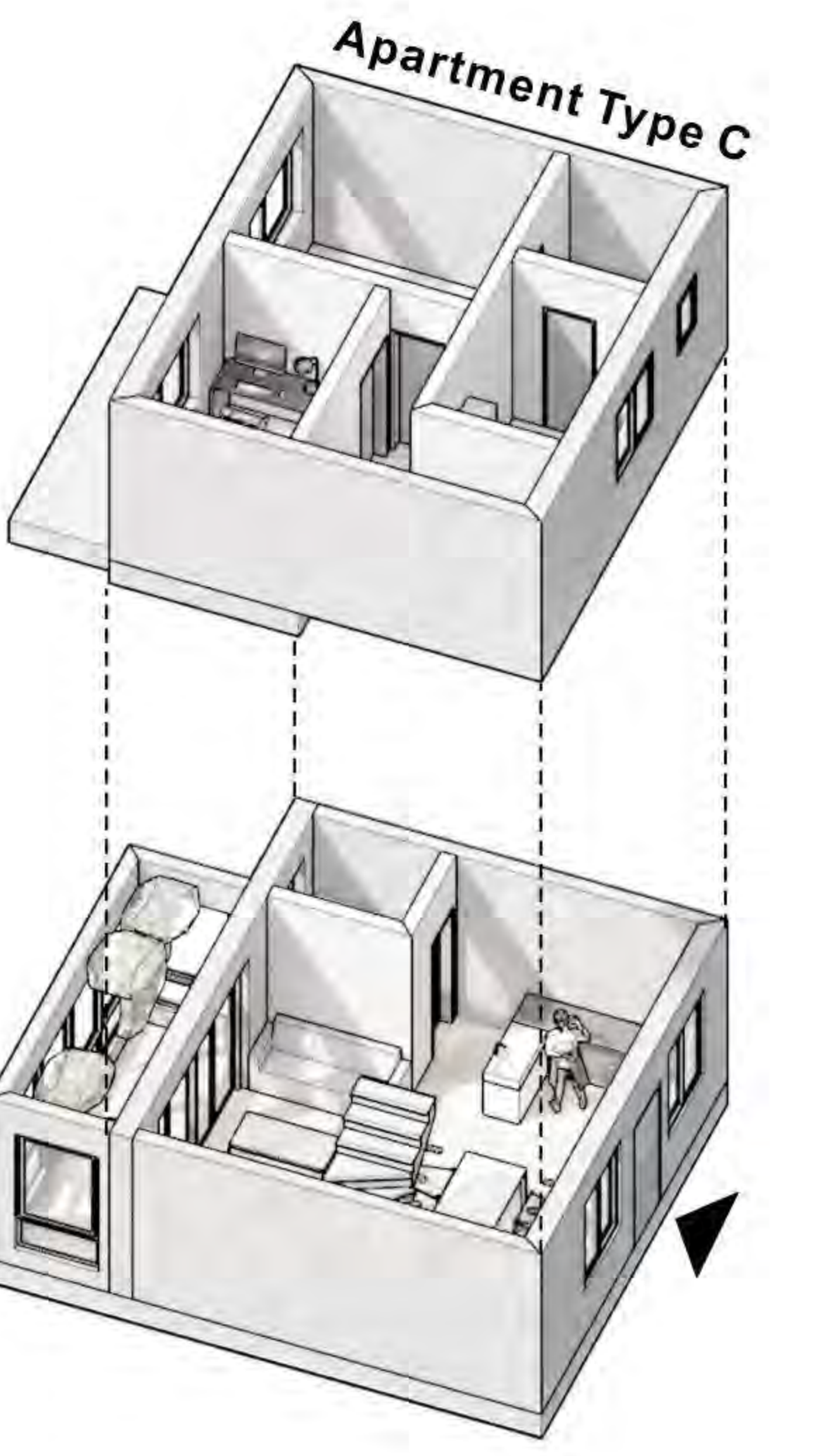
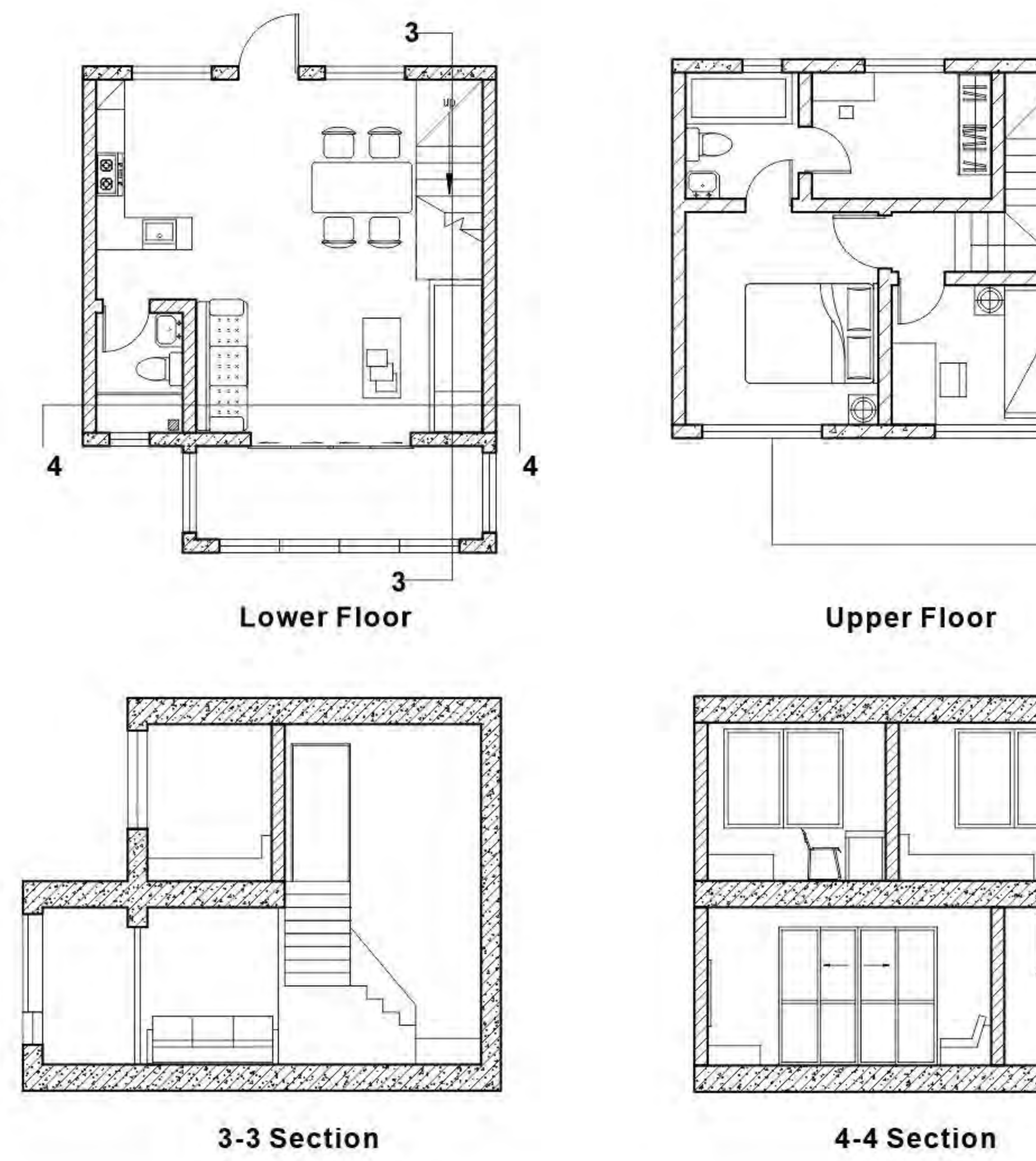
EXPLODED AXONOMETRIC VIEW OF APARTMENT TYPES



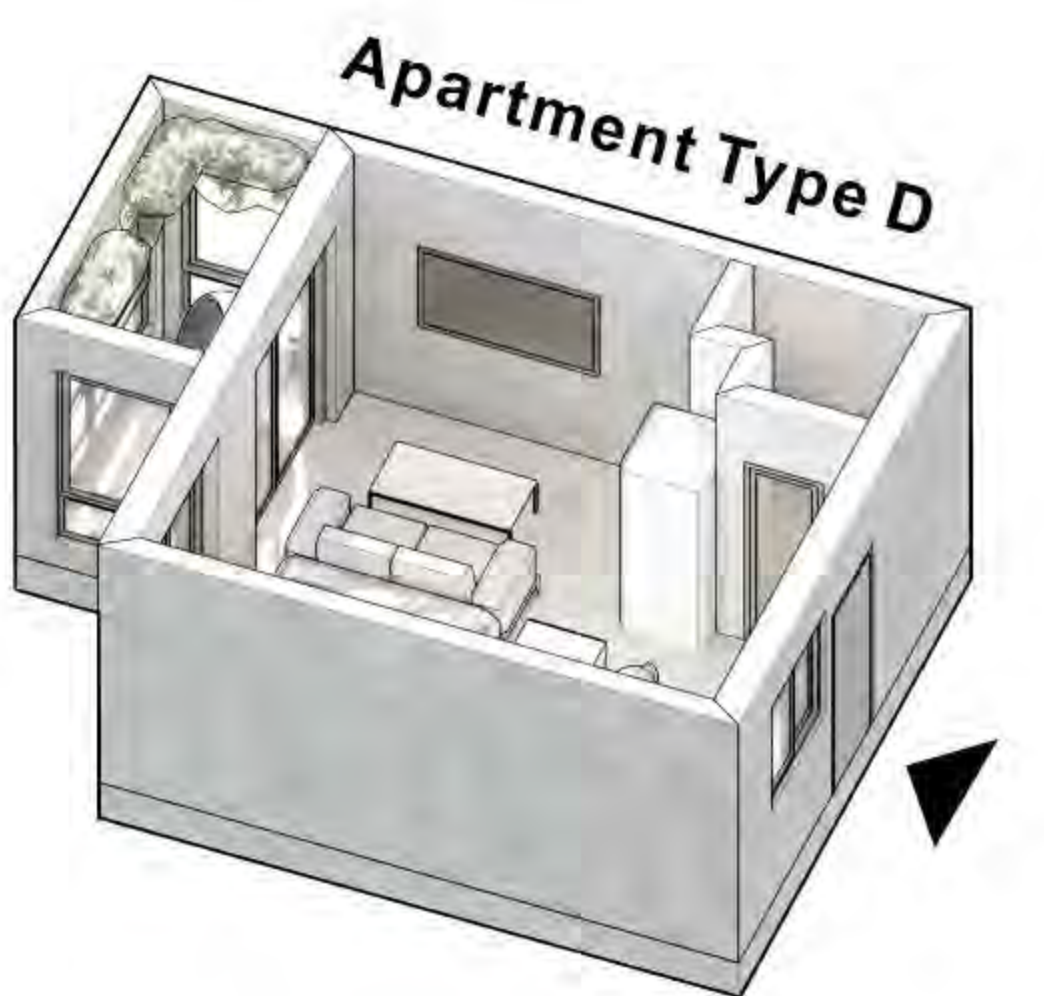
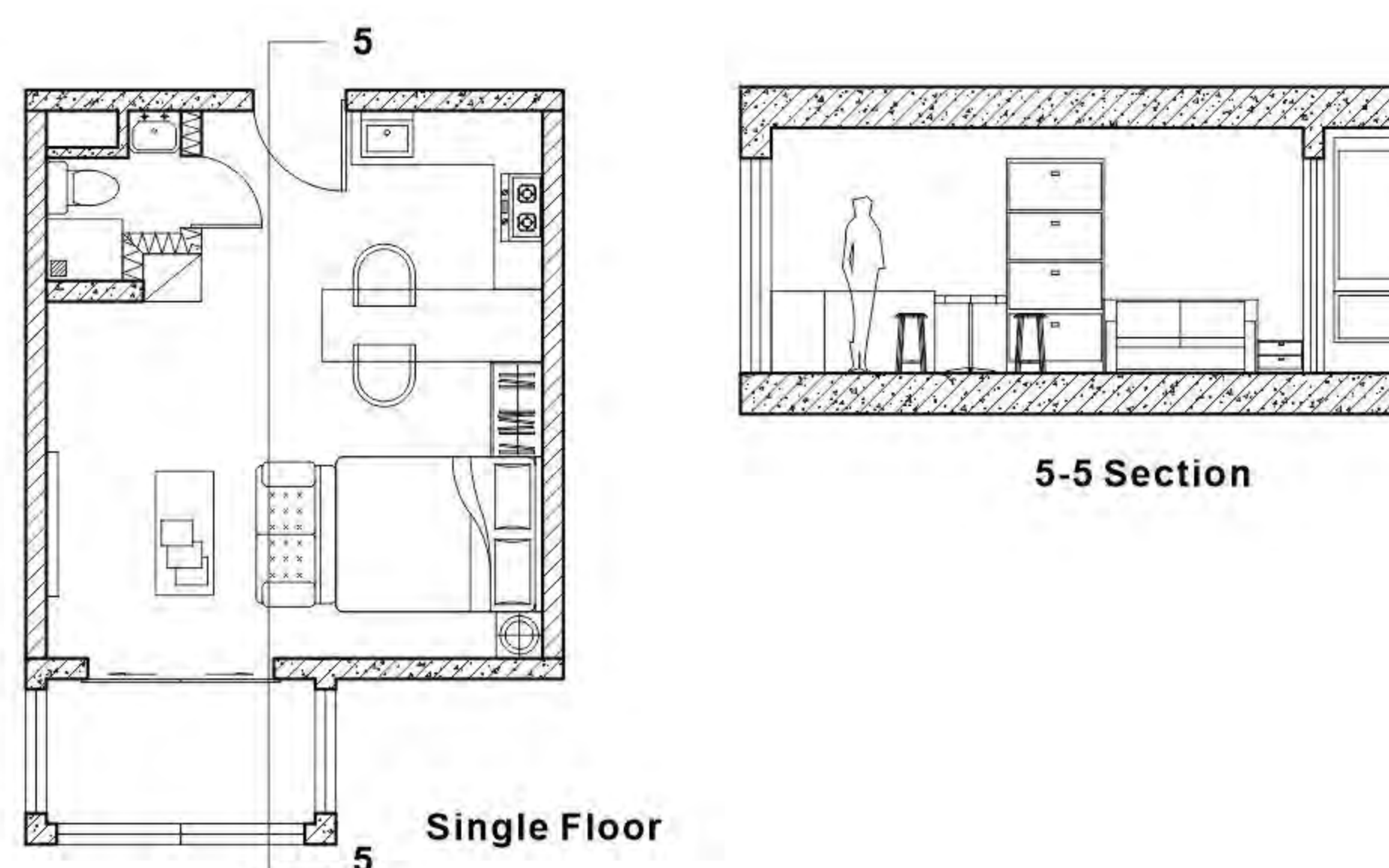
SELF-CONTAINED

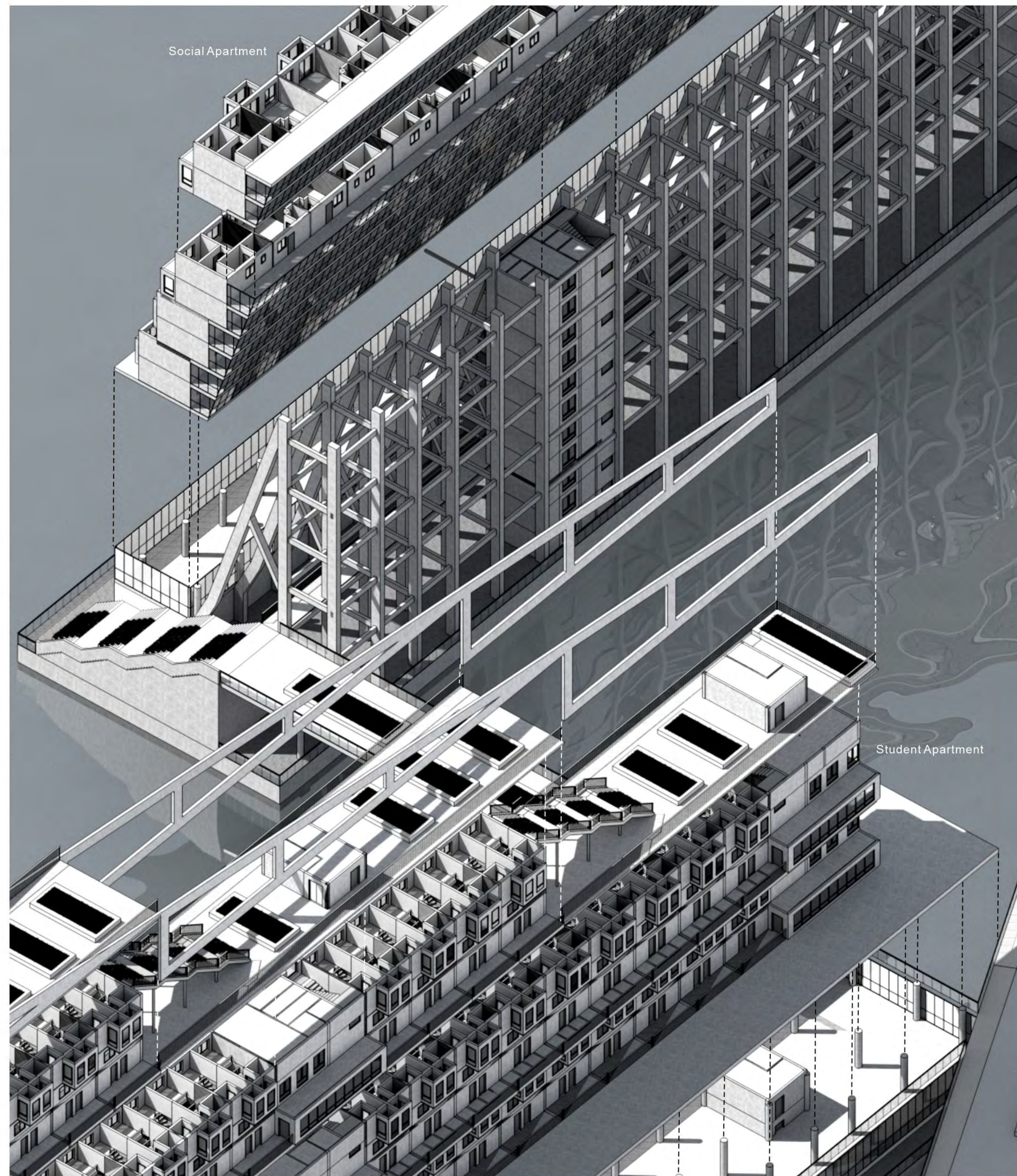
Newly-built Waterfront Residential Community Complex Design

Two-storey Loft Apartment



Single-storey En-suite





**EXPLODED MODEL**

The main task of this project is to utilise the waterfront between the rail and road bridges, and to create a self-contained community incorporating residential units, necessary amenities and associated infrastructure.

**VIEW FROM THE SEA**



**VIEW OF THE EASTERN ENTRANCE PLAZA**



GROUND MARKET

SELF-CONTAINED

Newly-built Waterfront Residential Community Complex Design



SELF-CONTAINED

Newly-built Waterfront Residential Community Complex Design

VIEW FROM THE WESTERN EDGY ENTRANCE PLAZA



VIEW OF WATERFRONT SCENERY



# 01 NYC TRANSPORTATION EQUITY

Individual academic work  
June-August 2023

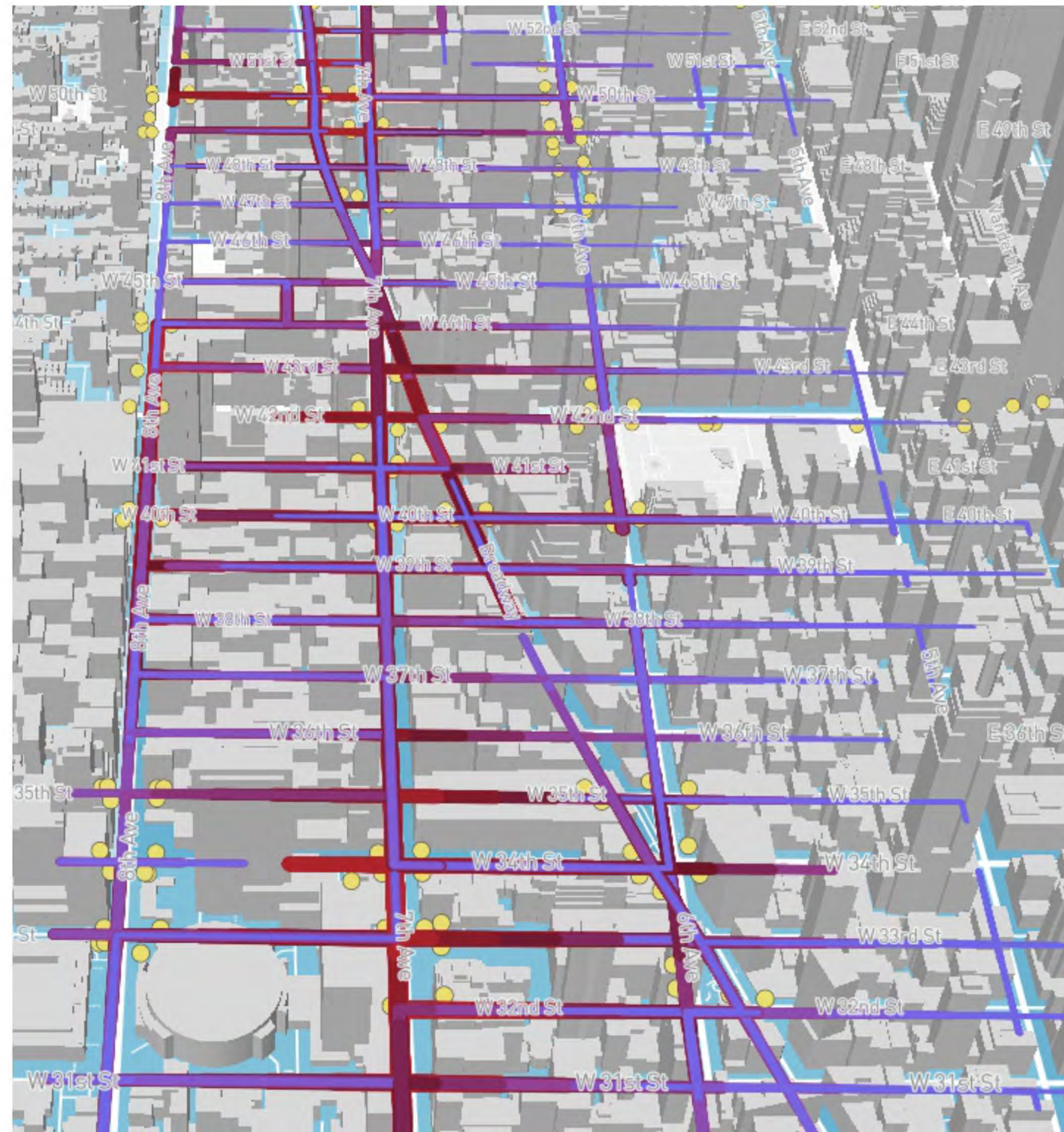
Urban Data Visualization and Analysis to Explore Equity of New York City Transportation

**BRIEF**

In selecting New York City public transportation system as the subject of investigation, this project was predominantly captivated by questions surrounding the equality of distribution within this intricate infrastructure. As an internationally renowned metropolis, public transit in New York City stands as an integral facet of daily life. Yet, ensuring equitable access to all its inhabitant within such a bustling system

presents an undeniably challenging endeavor.

To delve into the nuances of transit distribution and its ramifications on the city populace, this project employed both 2D and 3D data visualization techniques coupled with urban data analysis. The culmination of this research is manifested through Mapbox storytelling, aiming to present more vividly.



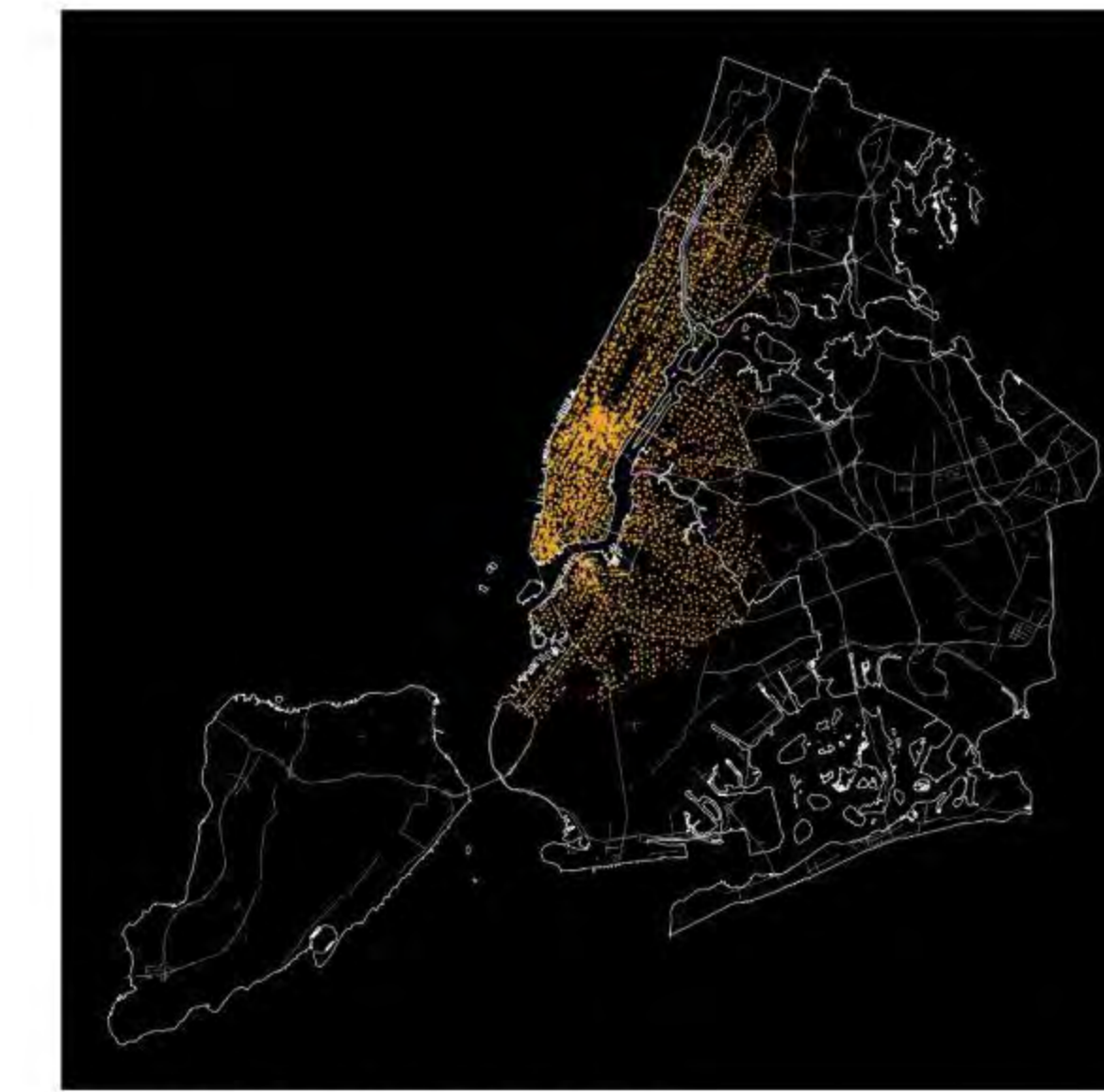
**Distribution of taxis/bikes 1**

Data credit: NYC Open Data, Census

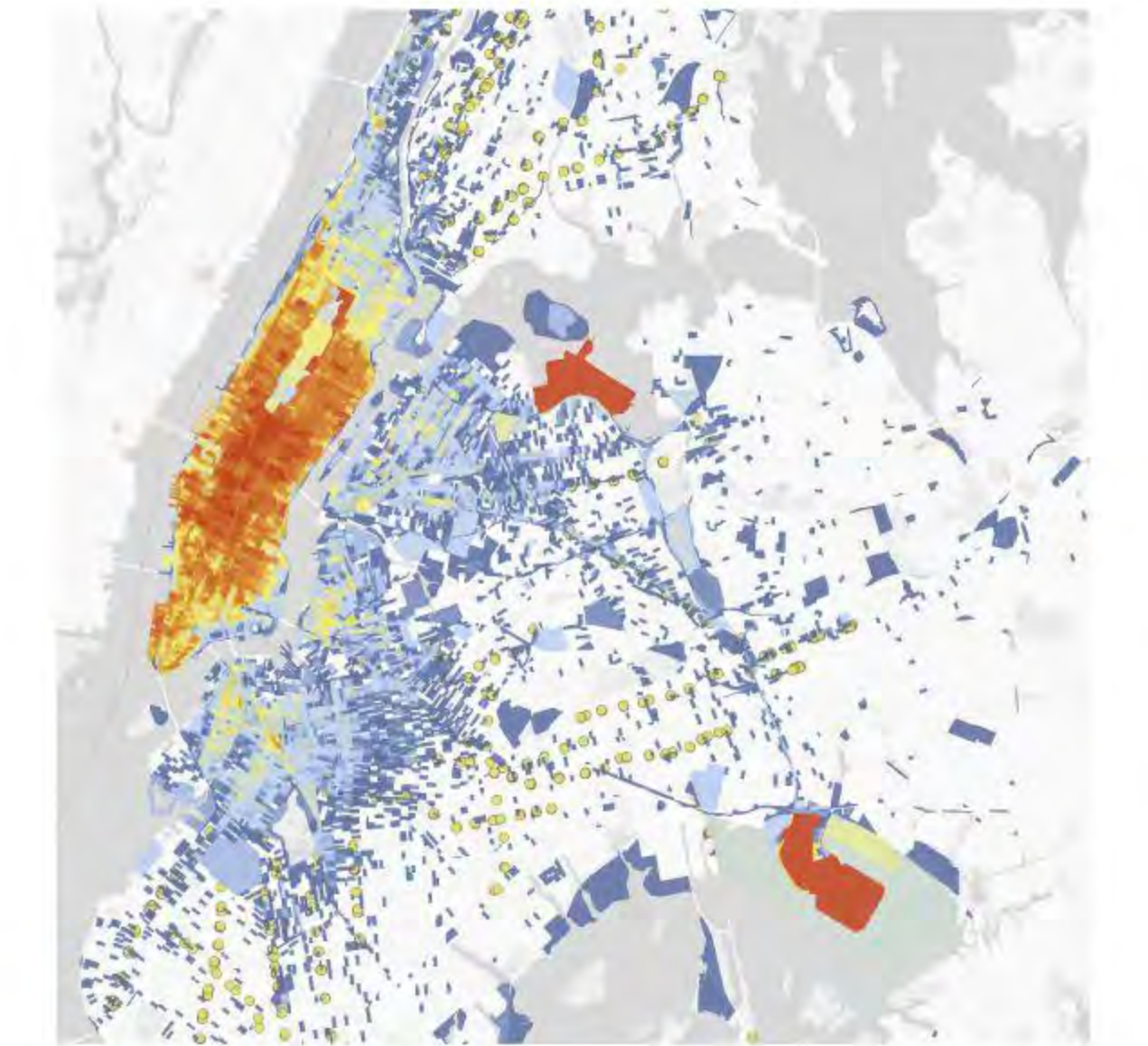
Firstly, I tried to understand NYC public transport through mapping of a broad scale. I started by applying mapping methods in python to see how different public transport options spread out across New York City. Specifically, I looked at where all the taxis went on February 1st, 2019. With this, I aimed to get a clear picture of taxis routes on that day. This visual approach helped me get a better sense of the city transport patterns and how transportation is distributed throughout different parts of the city.

Subsequently, I employed a similar method to analyze citibikes. In this visualization, I noticed evident gaps in the blocks covered by citibikes within a single day. This suggests that in certain areas, shared bicycles are not as prevalent, indicating potential disparities in access to this mode of transport.

In contrast to bicycles and taxis, subway entrances are fixed in location. Consequently, I adapted my visualization approach to analyze blocks proximate to subway entrances. I then compared the number of subway entrances contained within each block across different subway lines, providing insights into the distribution and accessibility of these transit points.



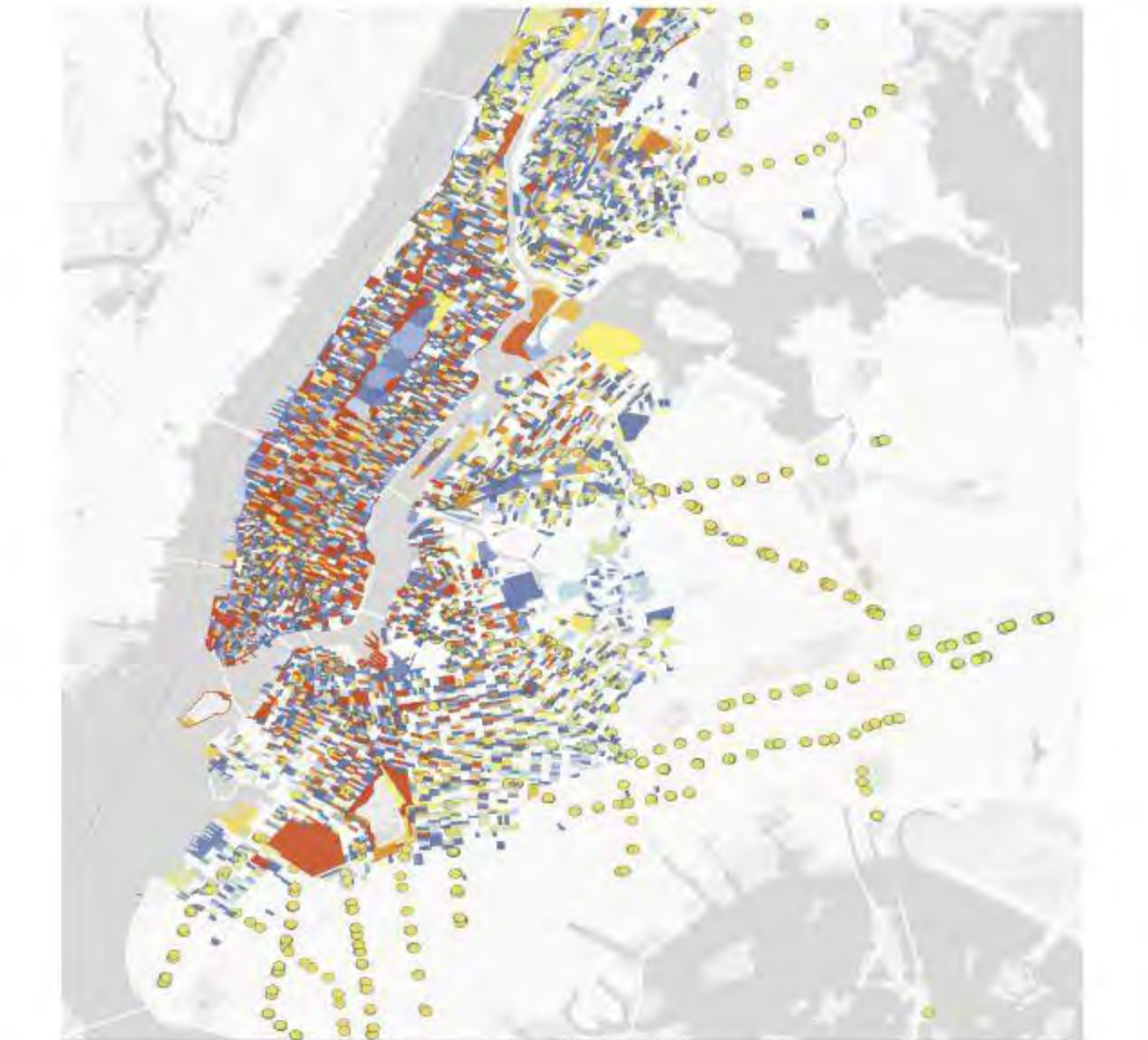
Taxi O-D points in NYC



Choropleth Mapping for taxis in NYC



Citibikes O-D points in NYC

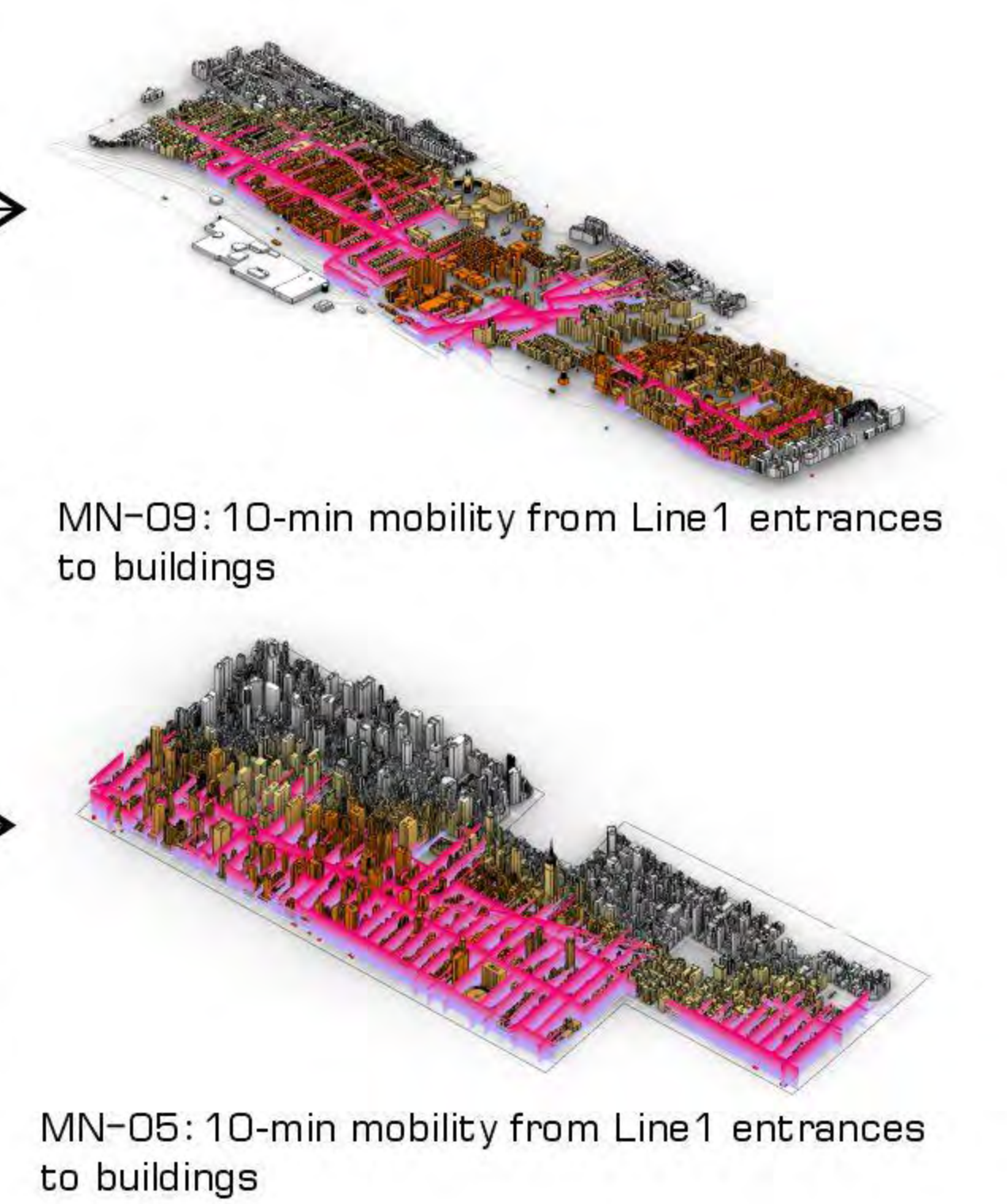
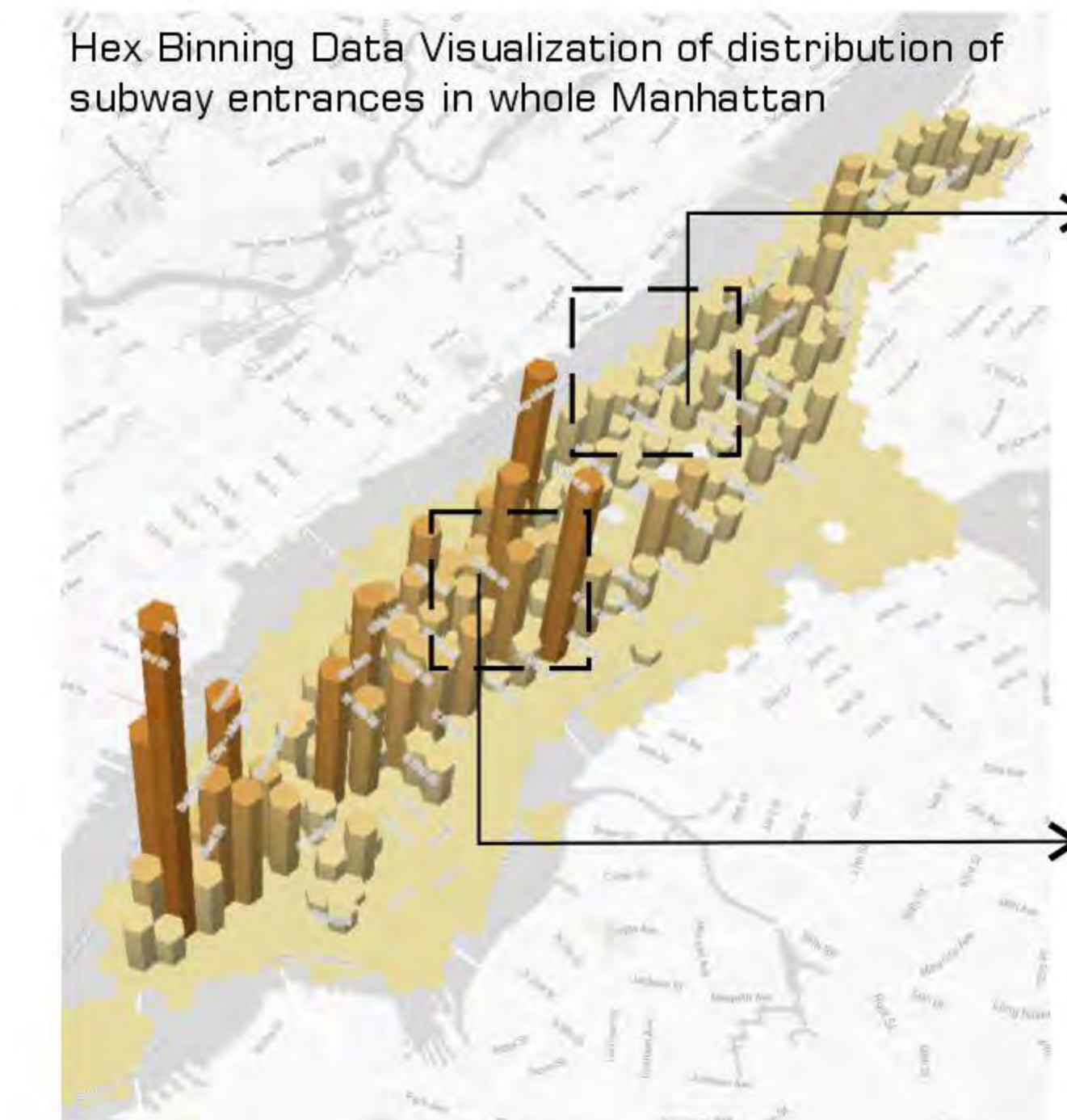


Choropleth Mapping for Citibikes in NYC

**Distribution of Subway Entrances Based on Two Distinctive Manhattan Districts 2**

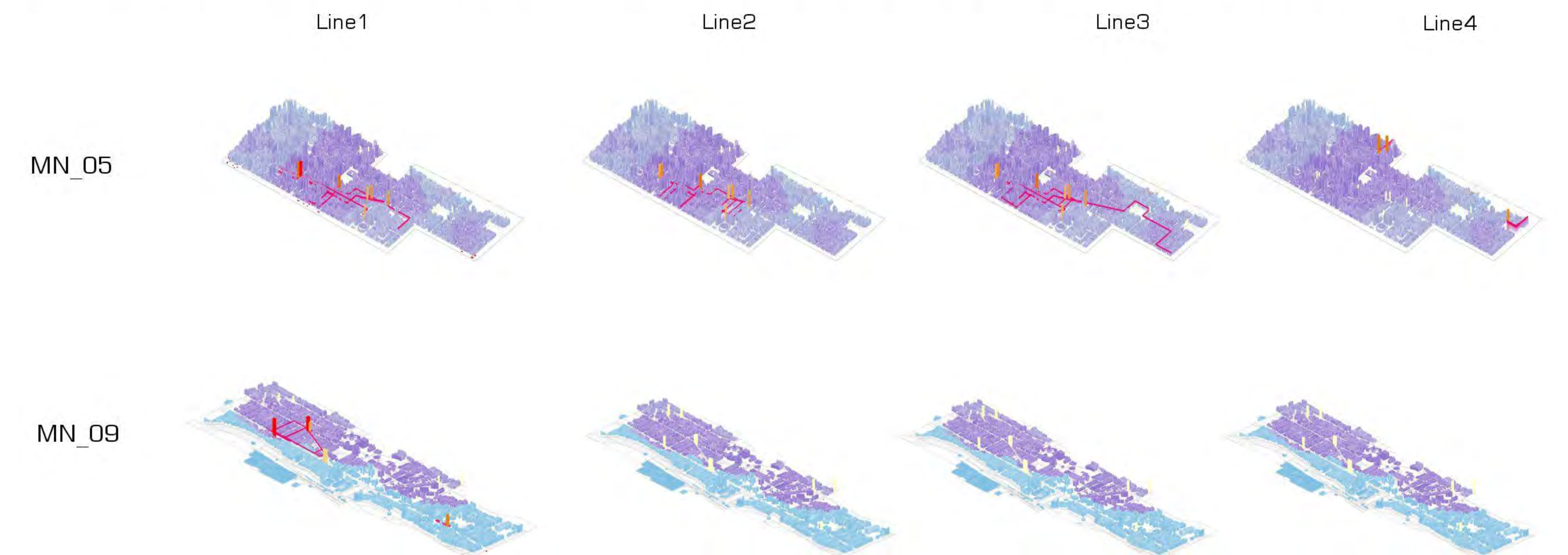
Data credit: NYC Planning

Hex Binning diagram is great for equal area analysis without the consideration of block shape or street patterns, which is fit for analyzing the distribution of subway entrances. From this broad scale of Manhattan, we can easily see that there is a distinct unequal distribution of subway entrances in Manhattan, especially varying from Uptown and Downtown. As a result, I chose two representative blocks for detailed analysis and comparison: MN-05 and MN-09.



**Plaza POI to Entrances of Different Subway Lines: Mobility Analysis; O-D Analysis 3**

We can see a distinct unequal distribution between O-D analysis(plaza to subway entrances) on each line for each block



# 02 CITY OBJECTIVE PERCEPTION

Individual academic work

## Data Visualization and Analysis of Street View Imagery in Relation to Income Equity in Manhattan

Sept. - December 2023

### BRIEF

The aim of this project is to explore relation between objective perception of Street View Image and Income Equity in Manhattan.

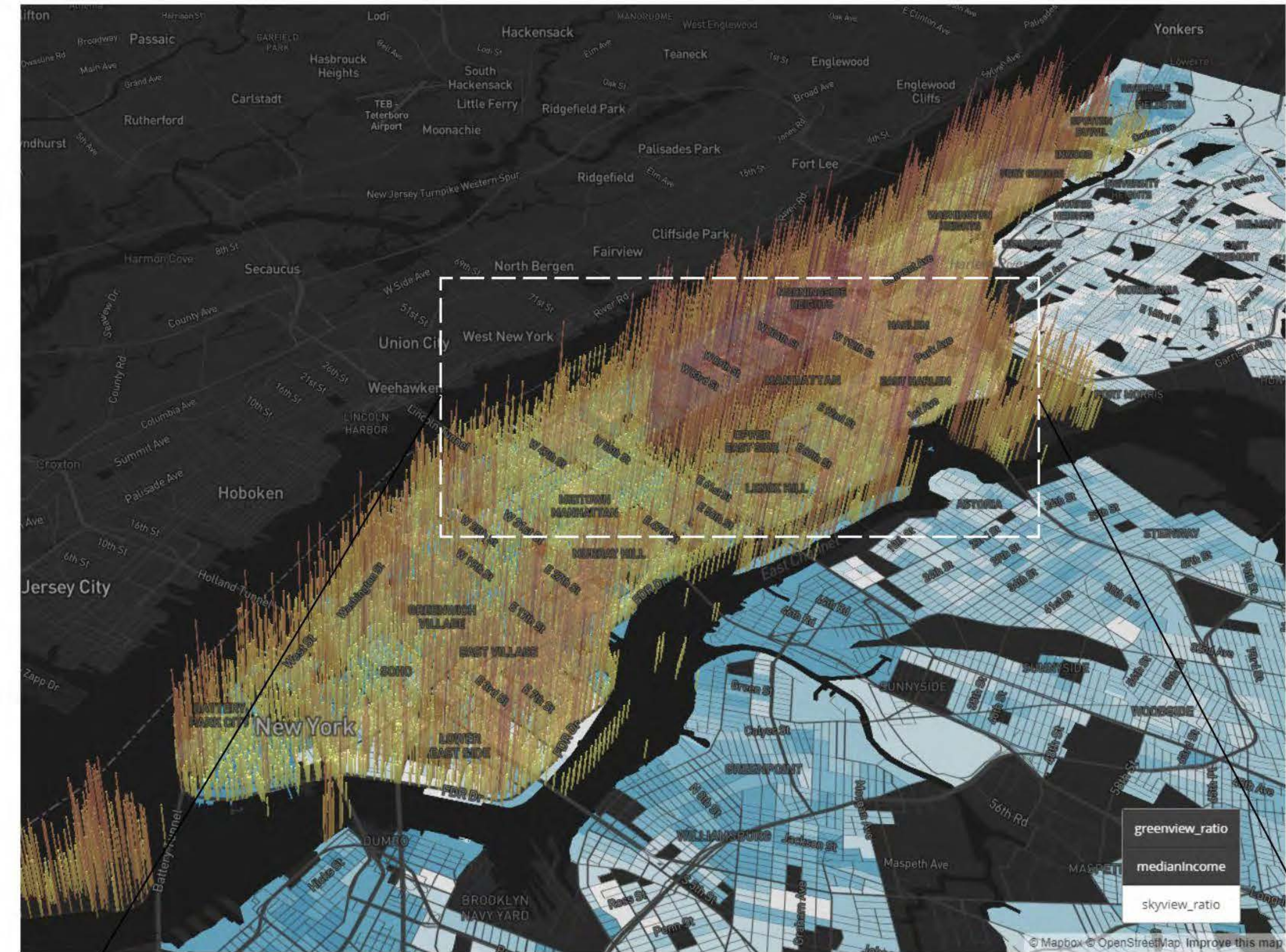
The first step of this project is to extract about 17,000 points along NYC street centerlines, and then to download these points' street view image(SVI) utilizing Google Static Street View API based on their location coordinates derived in QGIS.

The second step is to utilize advanced Computer Vision algorithm(PSPNet) to make semantic segmentation for each street view image. This algorithm aims to segment different categories in each image and give each category(tree, sky, car, building etc) a specific color.

The third step is to use python to calculate the final result of each category's ratio in each segmented image and join all those attributes to original street points with their longitude and latitude for further data visualization in Mapbox GL.

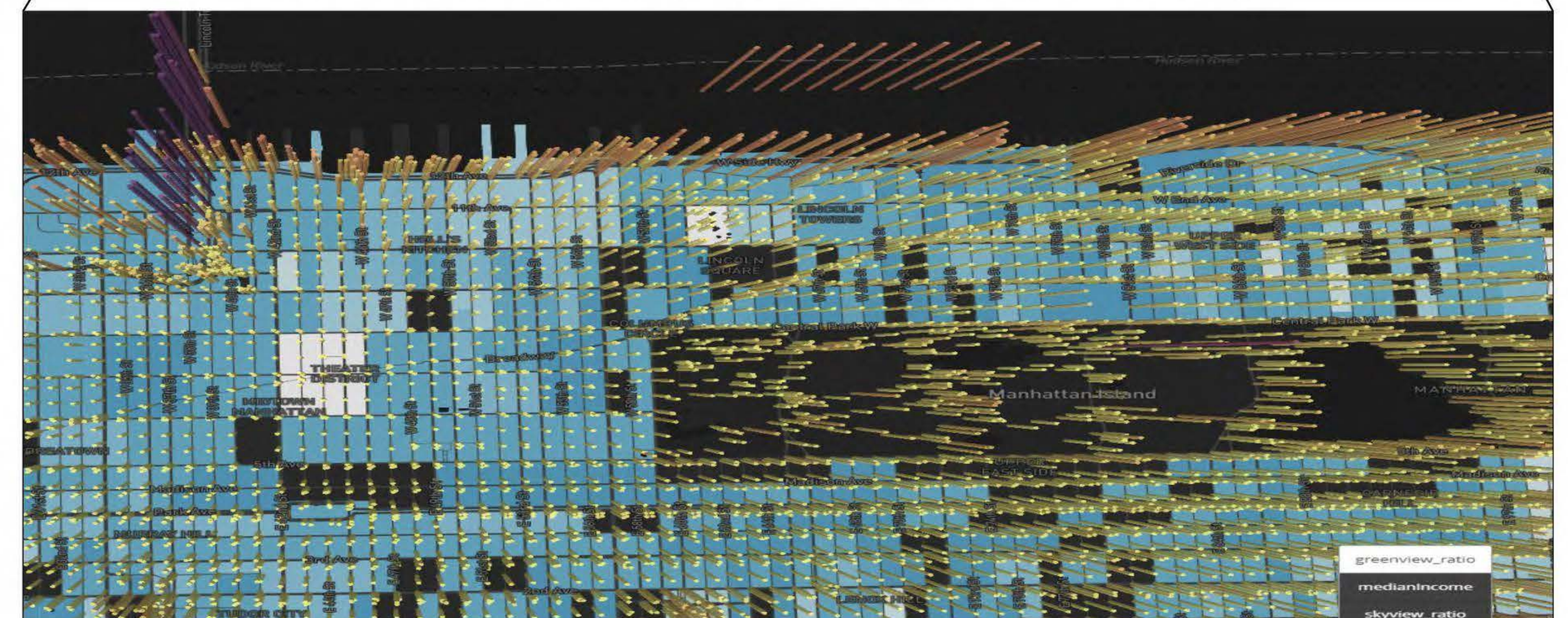


Data Vis of green-view ratio of each street view image underlying with income mapping



Legend ● → ● → ● Green View Ratio of SVI, 0 to 1 ● → ● → ● Sky View Ratio of SVI, 0 to 1

Data Vis of sky-view ratio of each street view image underlying with income mapping



Green-View Ratio Heatmap



After constructing the completed dataset, I imported the geojson file of 17,000 street points with attributes of each category's ratio from semantic segmentation into Mapbox GL to make data visualization. To be specific, I choose green-view ratio and sky-view ratio for visualization. I extruded each circle based on their attributes on these two ratios, and made color gradients for each extrusion.

Then I visualized NYC median house income per block and made blue-color gradient as a basemap to compare with street view image objective perception.

# AI in Design

## Parametric Design Toolkit + Stable Diffusion Rendering

Individual academic work

September-December 2023

### BRIEF

In this project, the integration of Stable Diffusion, a text-to-image algorithm, with parametric design in grasshopper, is explored. This project aims to enhance design efficiency and creativity by allowing architectural designers to produce dynamic design options and corresponding renderings through computational design in grasshopper and image generation with Stable Diffusion directly in Rhino. This approach, utilized at the concept design stage, melds AI's rapid image generation with the flexibility of parametric design, offering a novel workflow for designers.

### 1. Concept Development

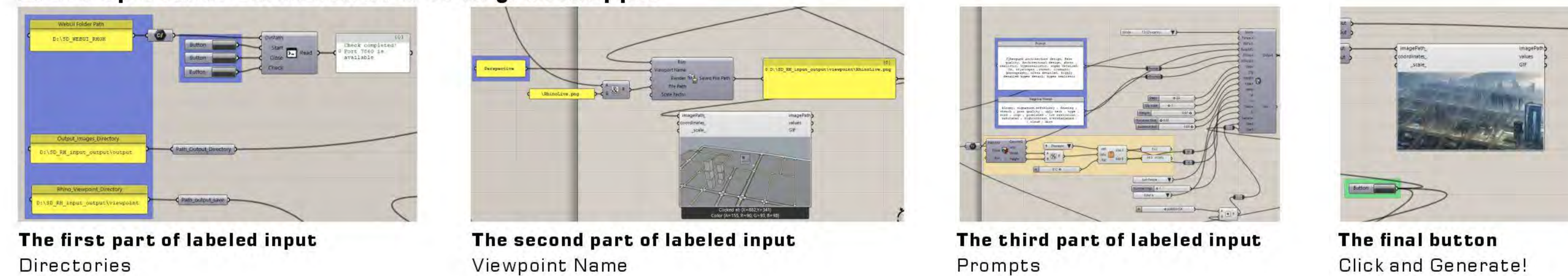
AI is currently the cutting edge technology while it integrates with architecture design in a quite slow speed. This is because the process of AI for design now is basically image-generated visual representation instead of genuinely understanding the design process.

Stable Diffusion(SD), which is a text-to-image algorithm, has become quite popular among designers. By adding positive and negative text prompts to the user interface, Stable Diffusion can generate realistic images quite fast and authentic, which will definitely inspire designers. Many architectural designers use it to generate great renderings for clients at the early stage of the project. However, it is too hard to generate accurate images of specific project's models if we only provide texts. We have to combine images of our models with text prompts on which we want AI to generate images based.

So here comes my question: what if I integrate Stable Diffusion algorithm with normal parametric design in architectural industry? By computational design in grasshopper, designers are able to generate dynamic design option, and then we can generate many corresponding renderings based on model option/ text prompts by Stable Diffusion. I believe this workflow could be radical and genuinely boosting designers efficiency and creativity.

This MVP(Minimal Viable Product) is designed for architectural designers, the market is for architectural firms. Users can use this MVP at the concept design(massing model) stage. The value proposition is combining AI(image generator) into the process of parametric design in grasshopper in architecture industry. The MVP consists of two parts. The first part is to set up Stable Diffusion webUI workflow into grasshopper. The second part is to make two parametric toolkits for auto facade/floor plan. In this way, designers can make interactivity between parametric model and renderings at the early stage of projects.

### 2. Set up Stable Diffusion WebUI in grasshopper

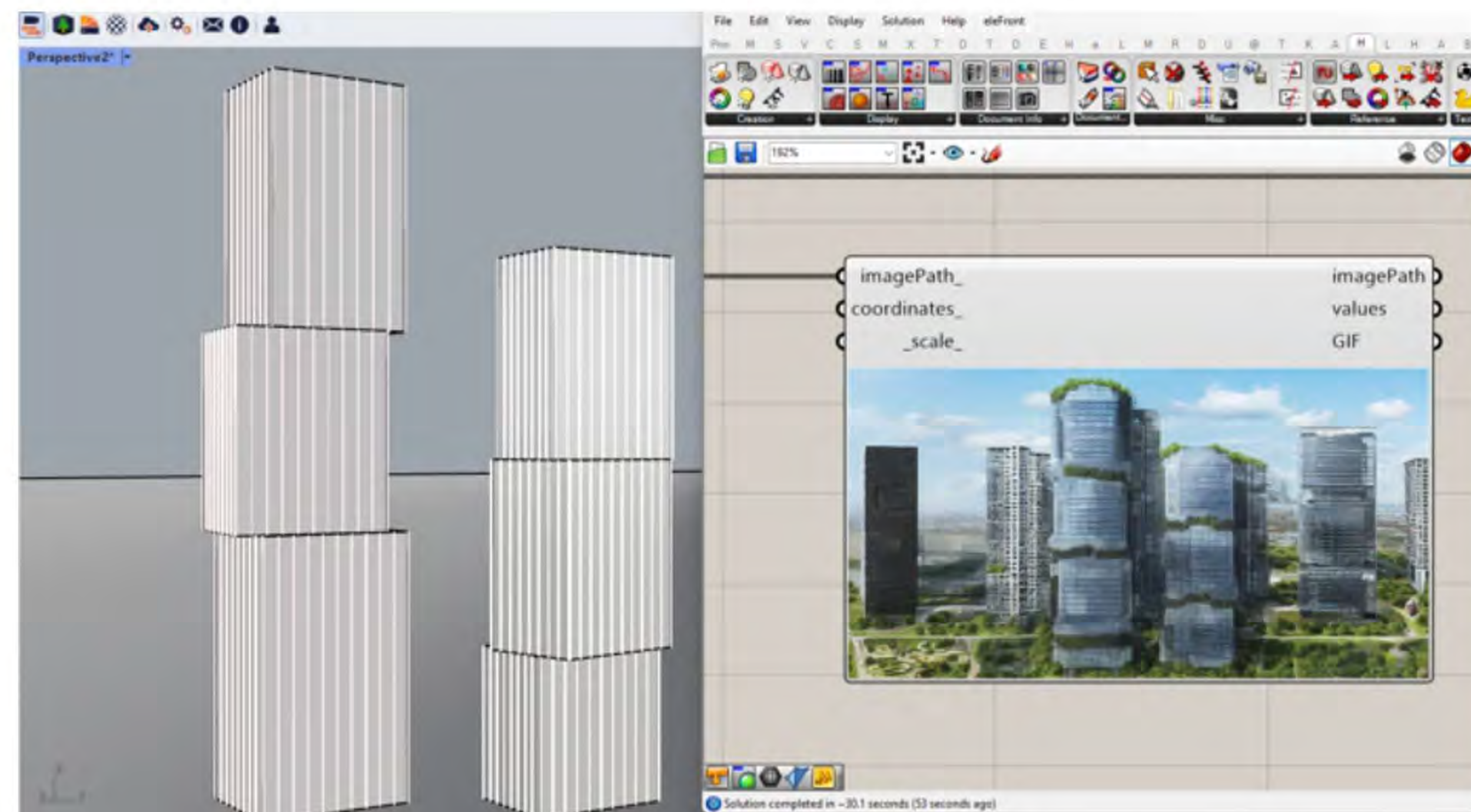


The first part of labeled input Directories

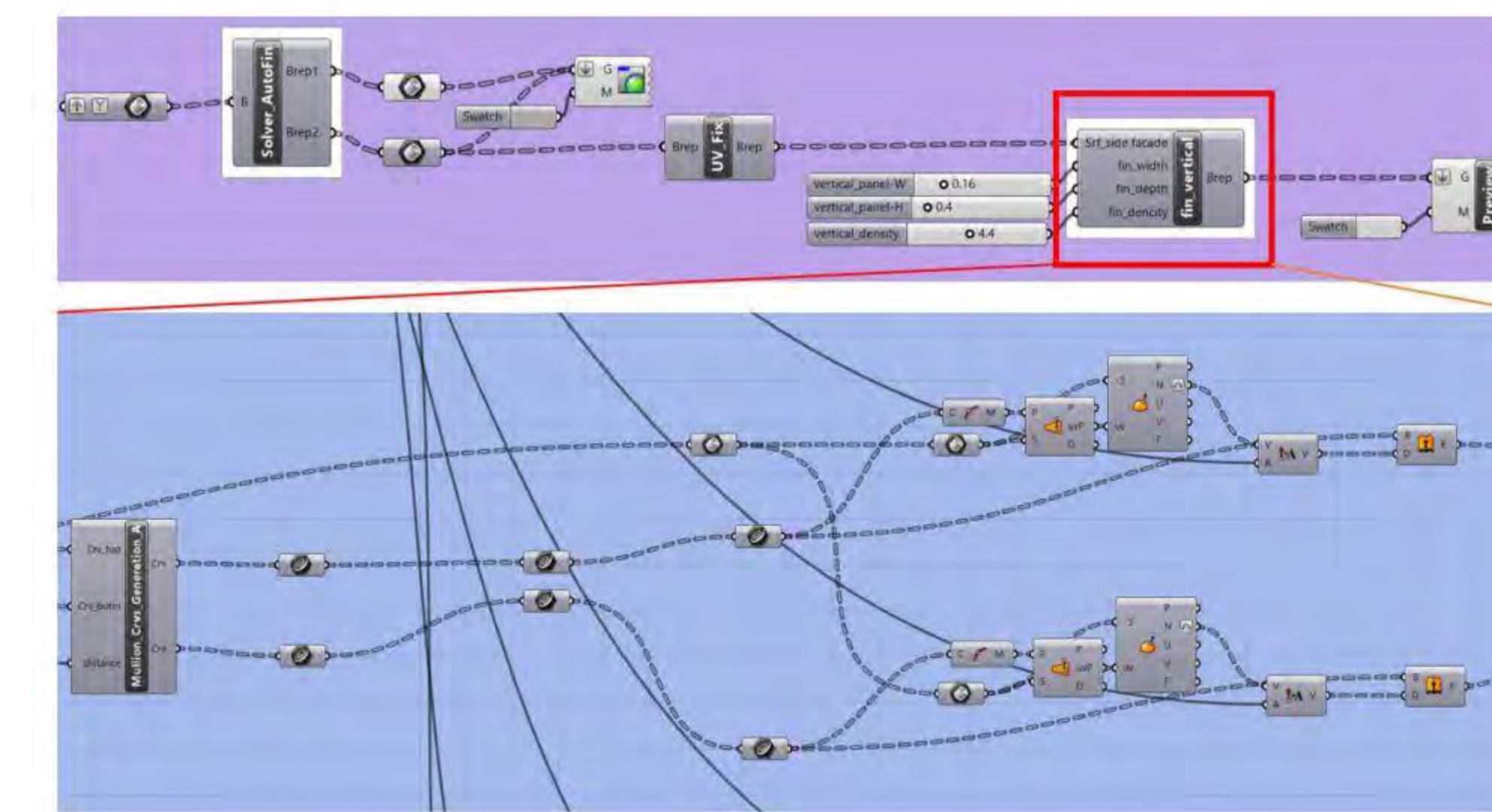
The second part of labeled input Viewpoint Name

The third part of labeled input Prompts

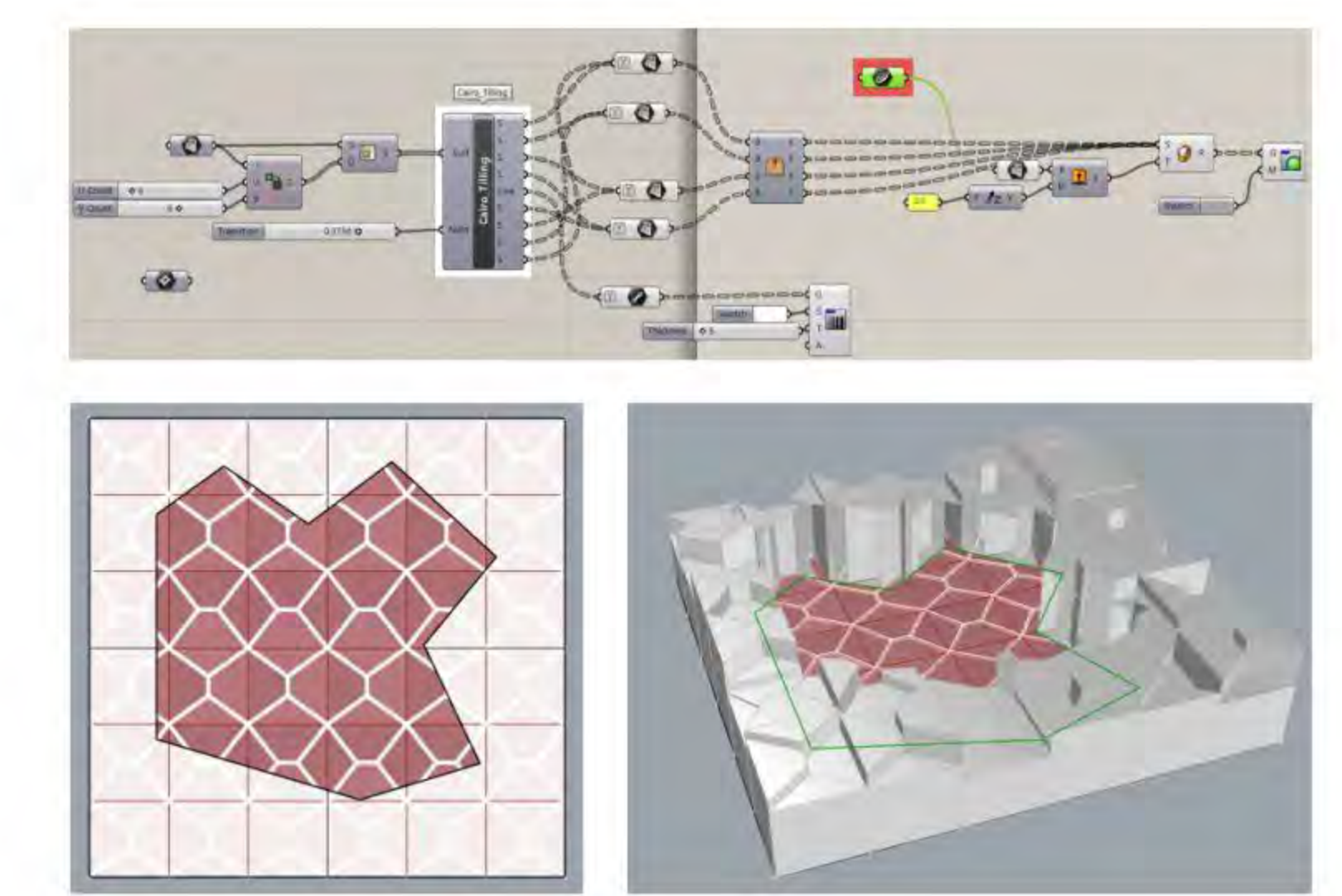
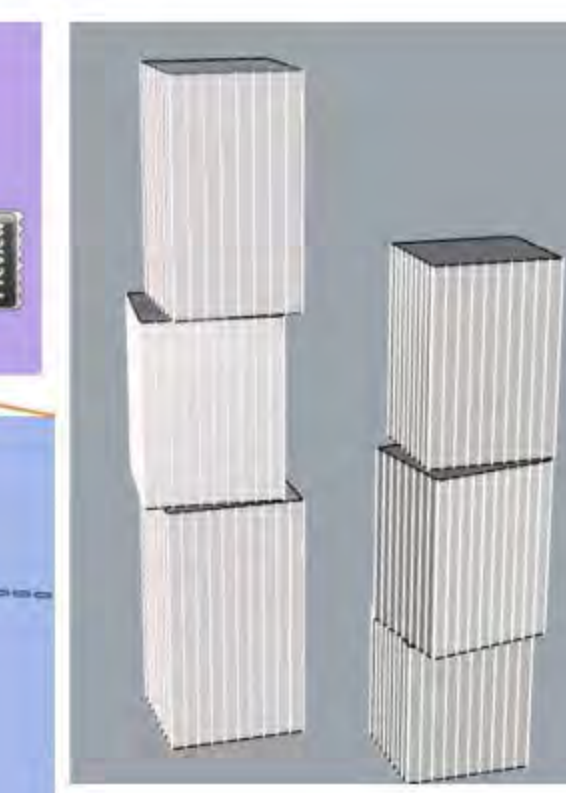
The final button Click and Generate!



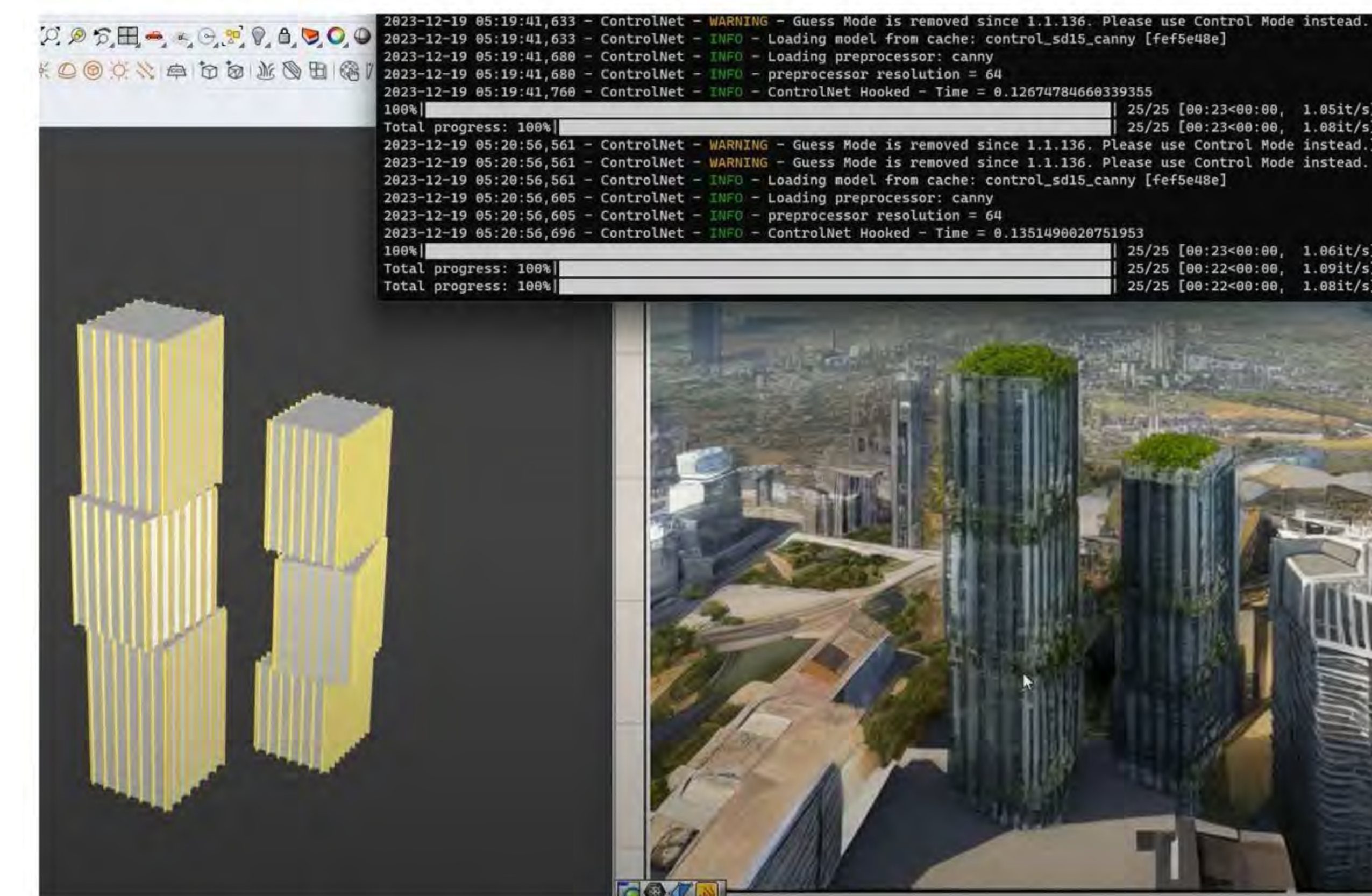
### 3. Set up Parametric Toolkit\_ Auto Facade/ Auto Plan



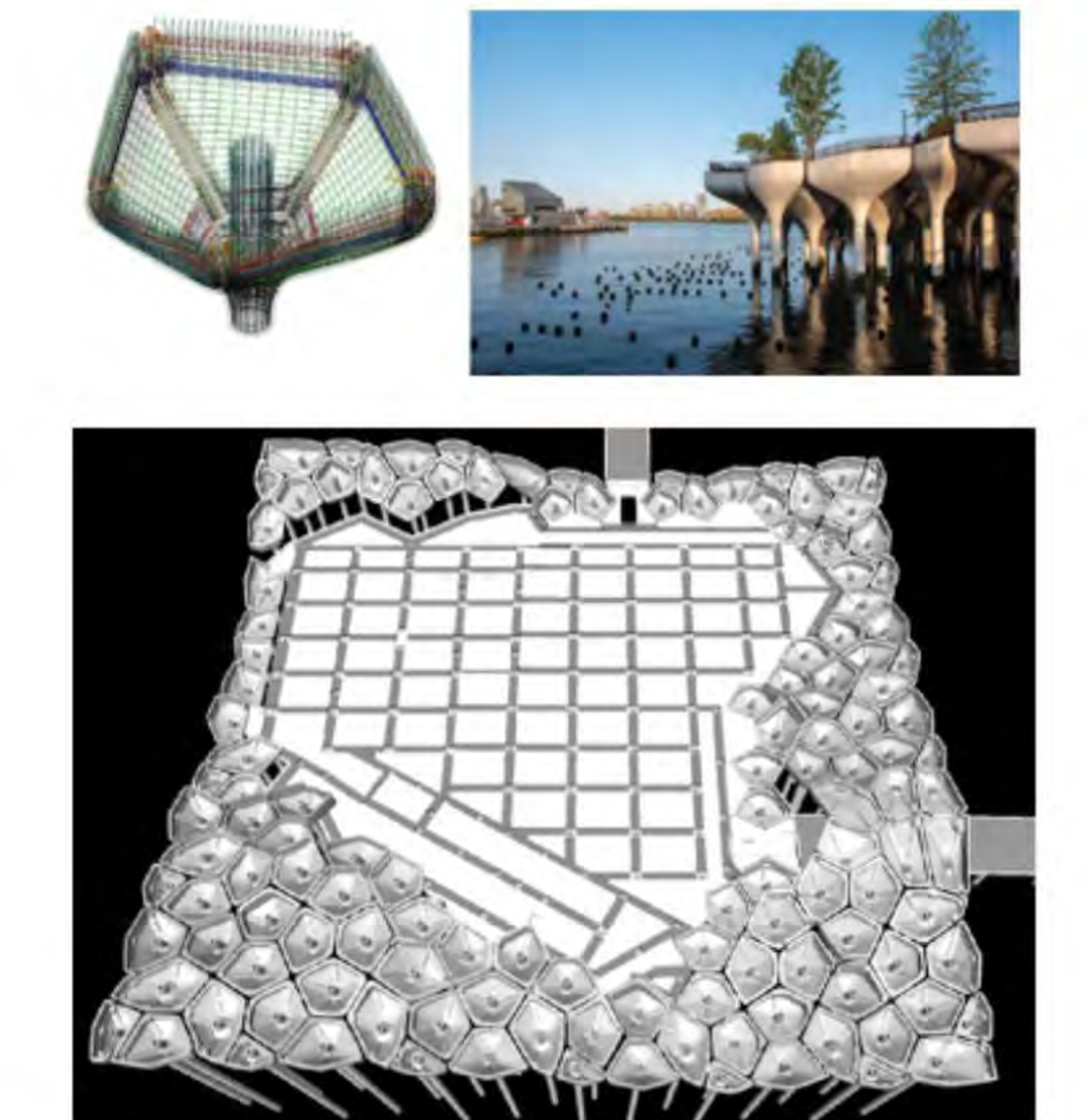
The Custom Tool of Auto Facade



The Custom Tool of Auto Plan

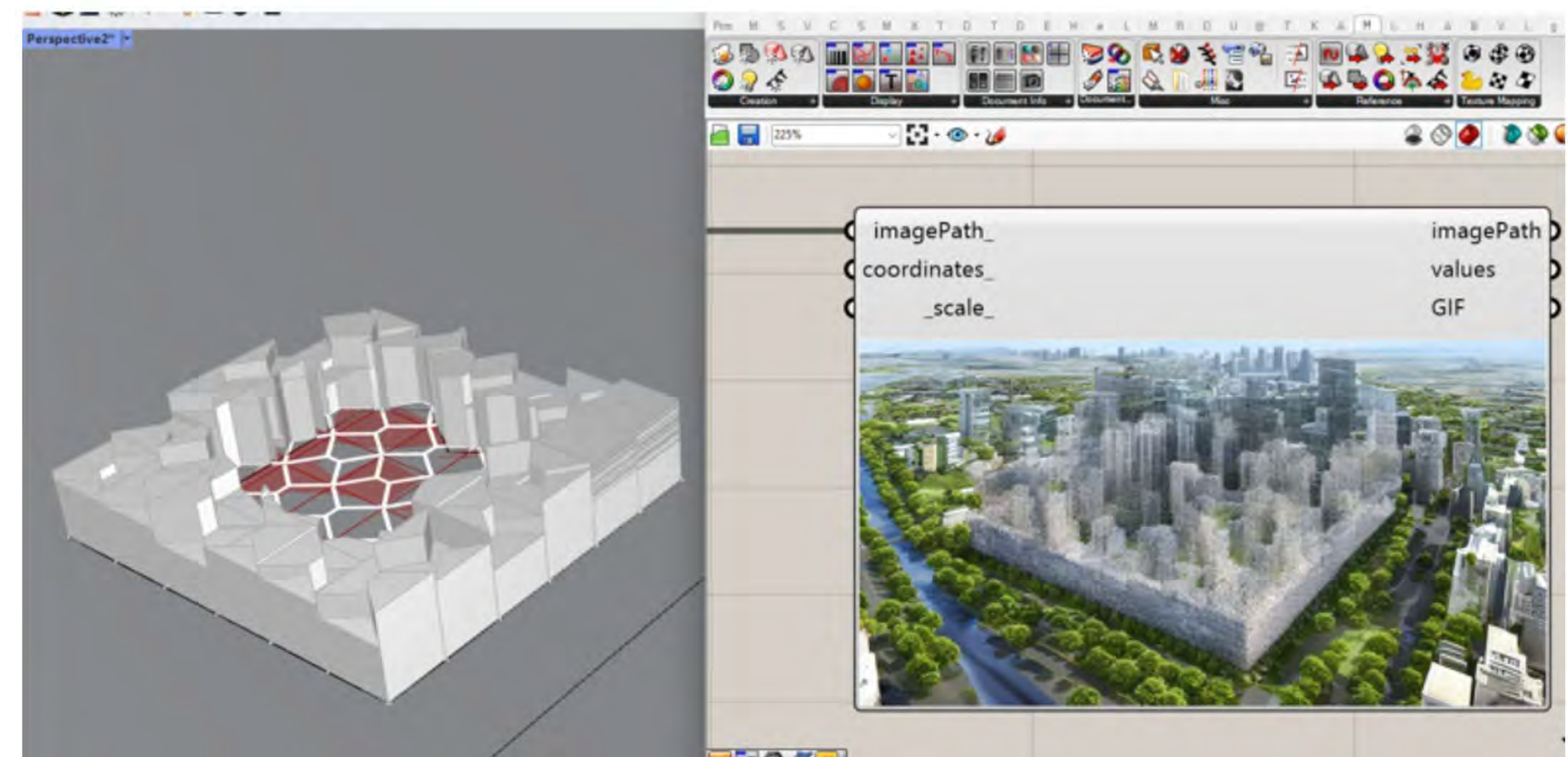


Responsive rendering generation between AI and Parametric Design



Example: Pier55 Island

I have also published an article on medium and a video, demonstrating how this MVP(Minimum Viable Product) works and the problem it solve. From the video and the article designers are able to imagine how this tool can inspire them and boost designers' efficiency and creativity.



# META TOOL

## Spatial Programming Language & Operating Manual about Managing Review Space in Avery Basement

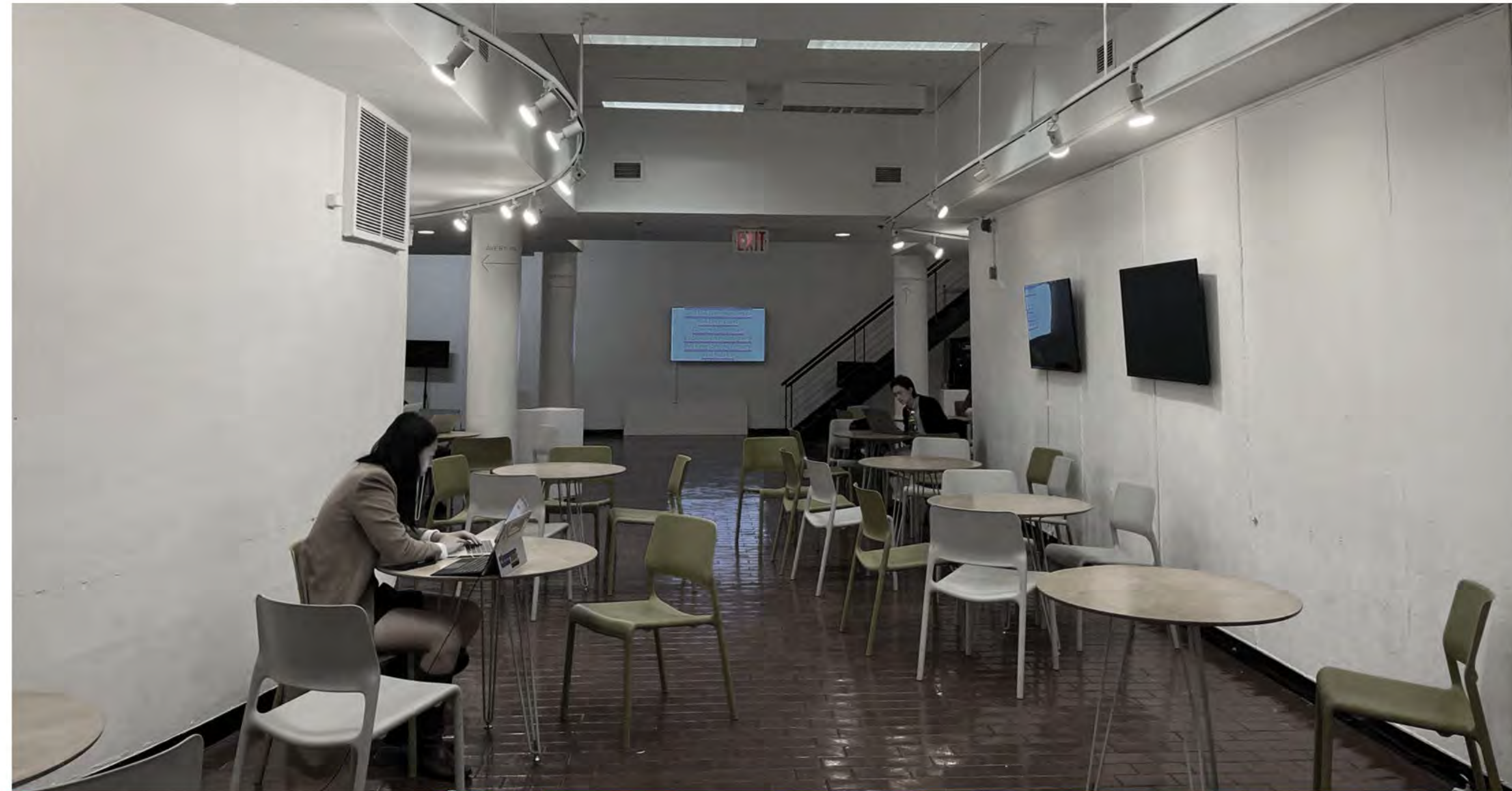
Individual academic work

September-December 2023

### BRIEF

This project provides a different perspective for review/exhibition space management in GSAPP's Avery Hall by developing a spatial programming language with Rhino/Grasshopper/Scout(a UI tool developed by KPF). By analyzing and optimizing studio review areas, my model adapts to varying academic needs, enhancing interaction and innovation.

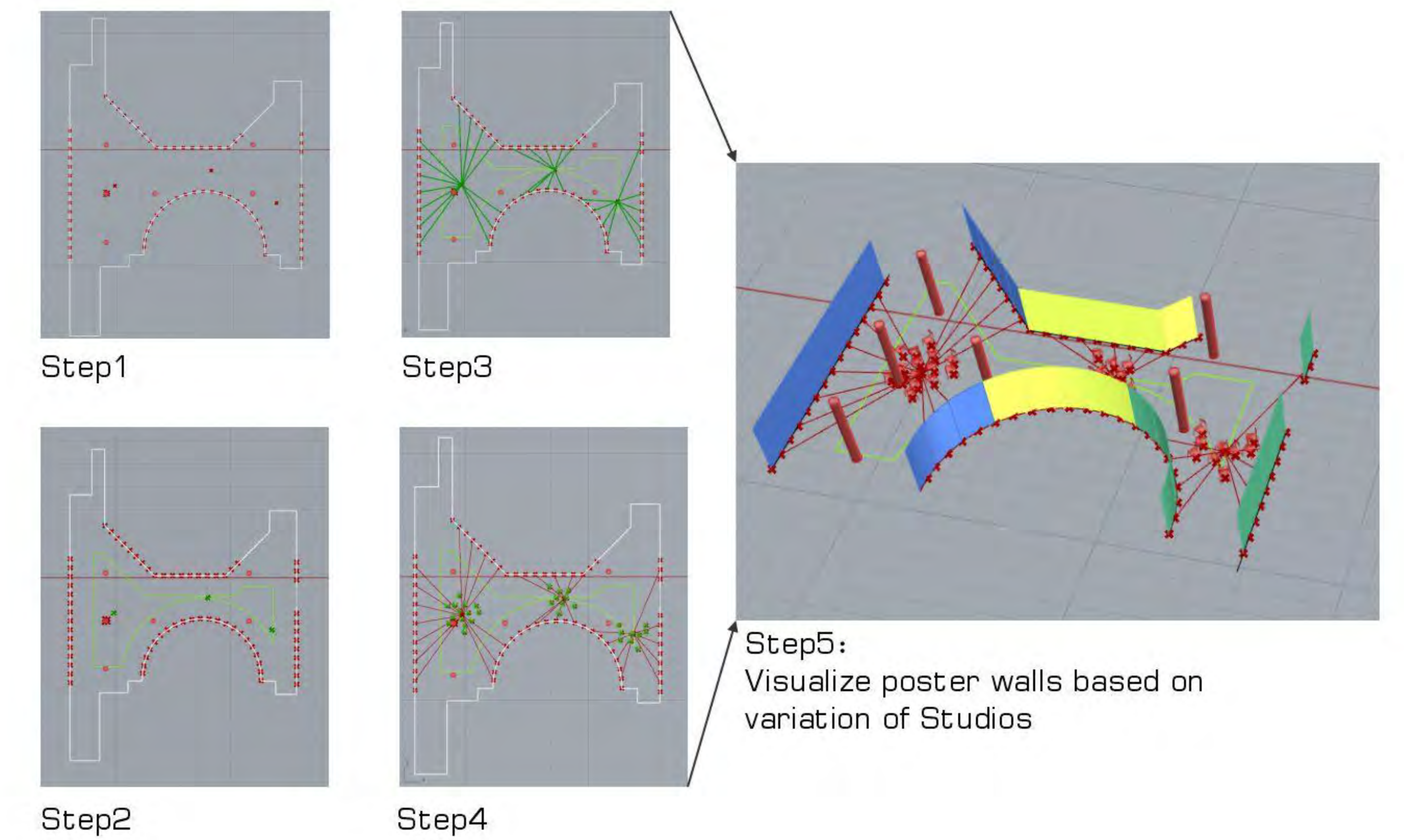
Utilizing Scout for data interoperability, I create an interactive platform, allowing users to explore and select the effective spatial configurations based on different metrics they want, showcasing a dynamic approach to architectural review space's spatial challenges.



### Methodologies

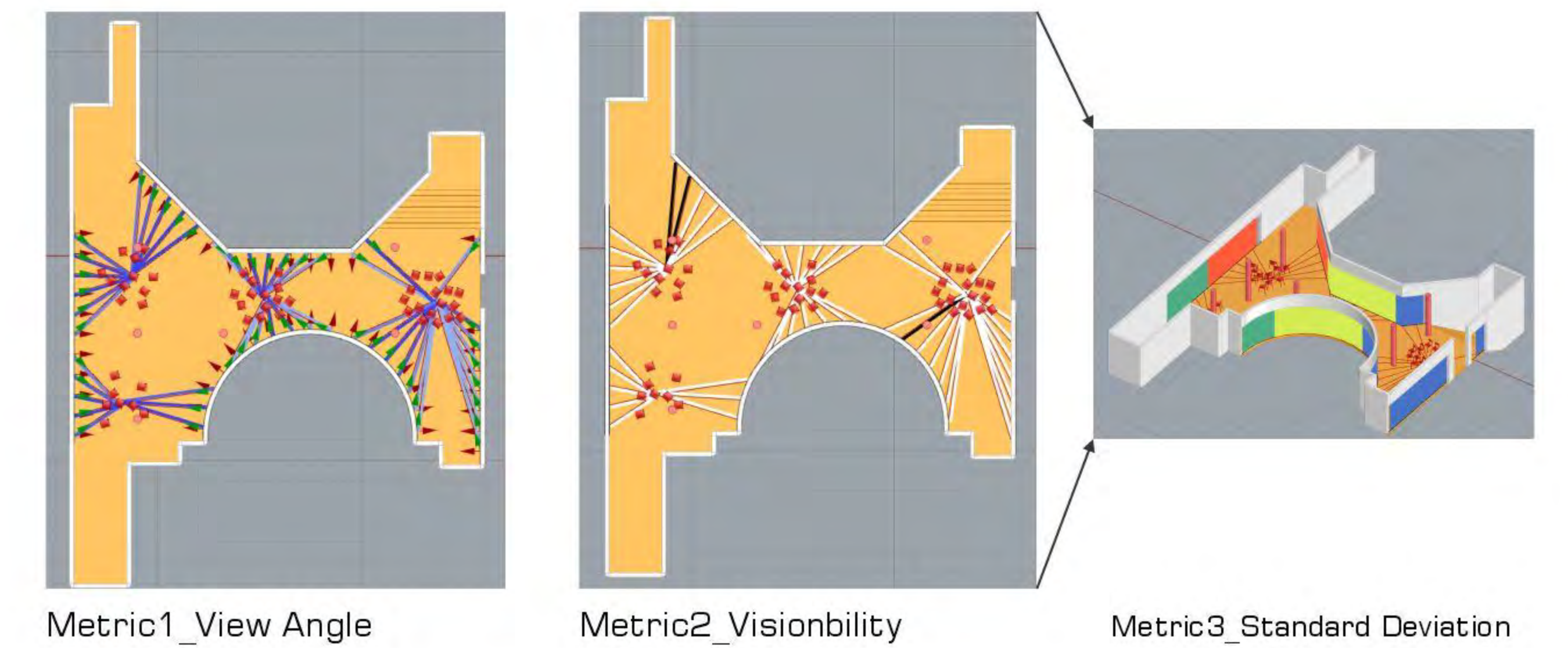
Based on the conceptual idea, I propose a four-step process:

1. Collect input information and calculate maximum wall space for each student;
2. Determine class boundary based on proximity to the walls.
3. Apply view angle, standard deviation and visibility(intersection with columns) as metrics to measure the performance for each design option.
4. Generate dynamic options and provide them to users based on different design space(parametric such as number of classes, student numbers in each class etc).



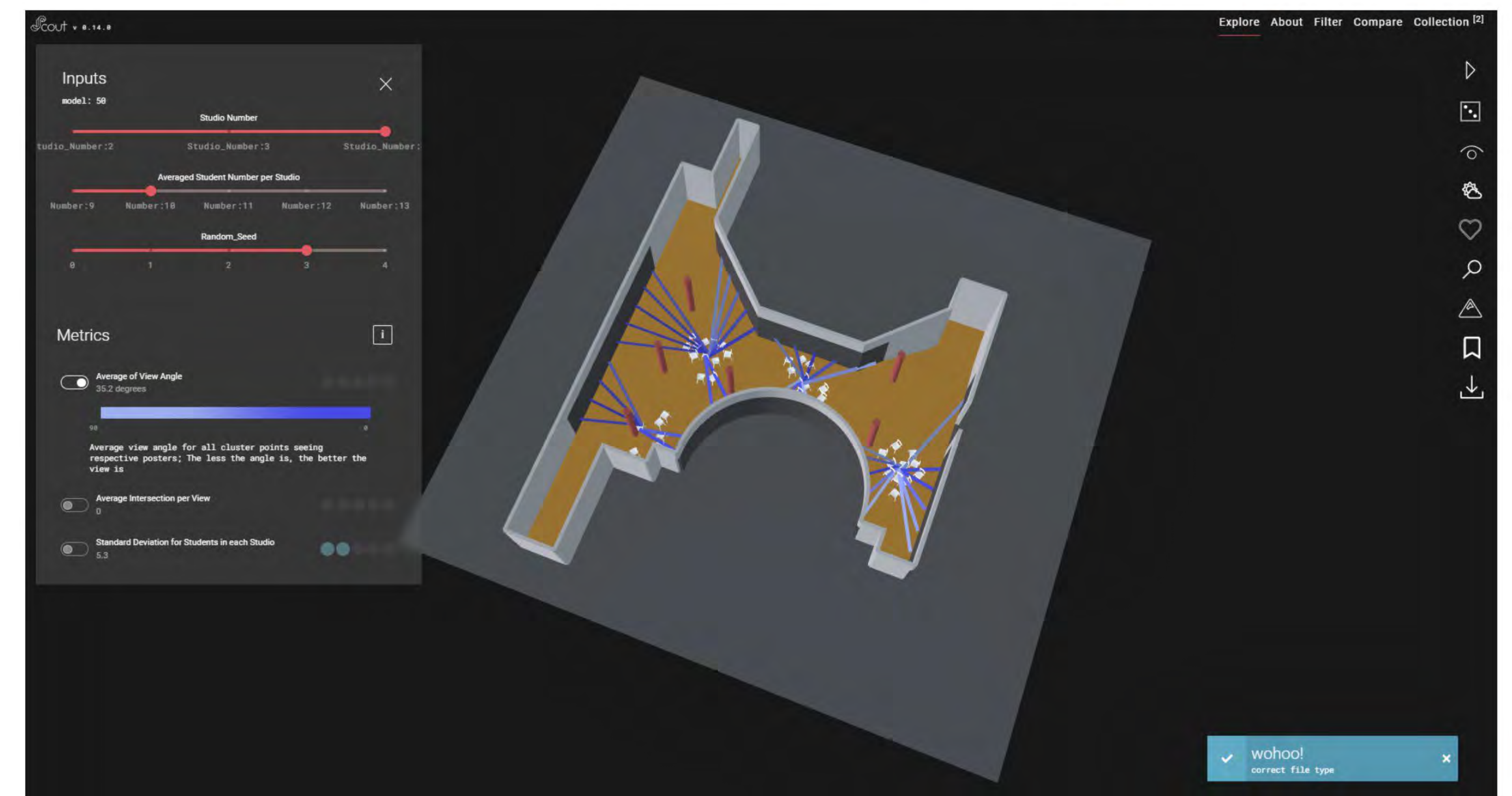
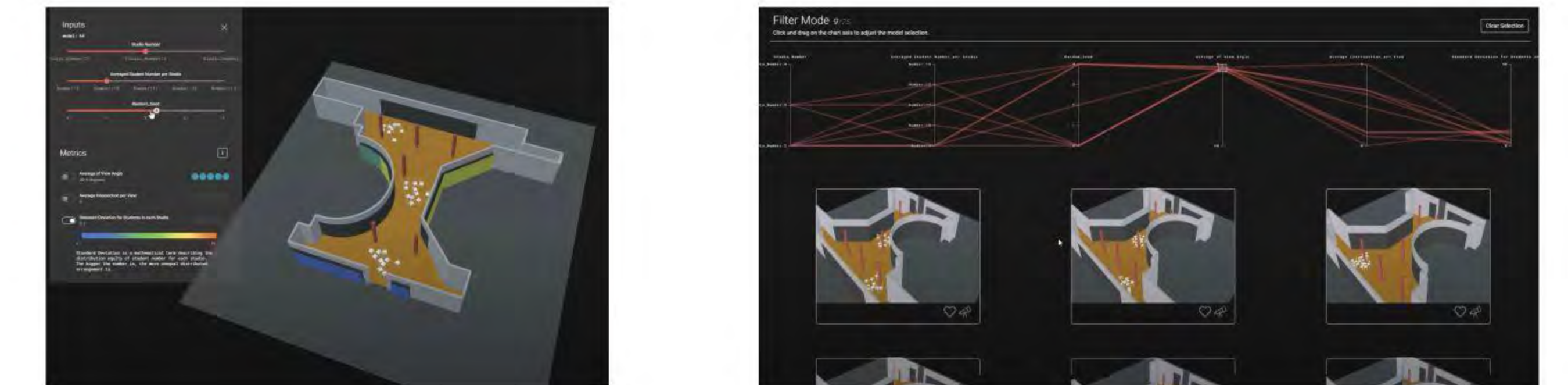
### Metrics Set up

1. Calculate the angle between the visual line and normal line as  $\alpha$ . A smaller value of  $\alpha$  indicates better visibility for the jury.
2. Calculate lines in a cluster intersect with columns, the average intersections are documented and counted. The smaller the number is, the better visibility the overall option has.
3. Calculate standard deviation of students in each studio to analyze distribution equality for each studio. The smaller the number is, the more averaged the distribution is.



### Data Interoperability

Transfer data into geojson format in grasshopper and upload settings, context, design space(csv) and models to kpf Scout.

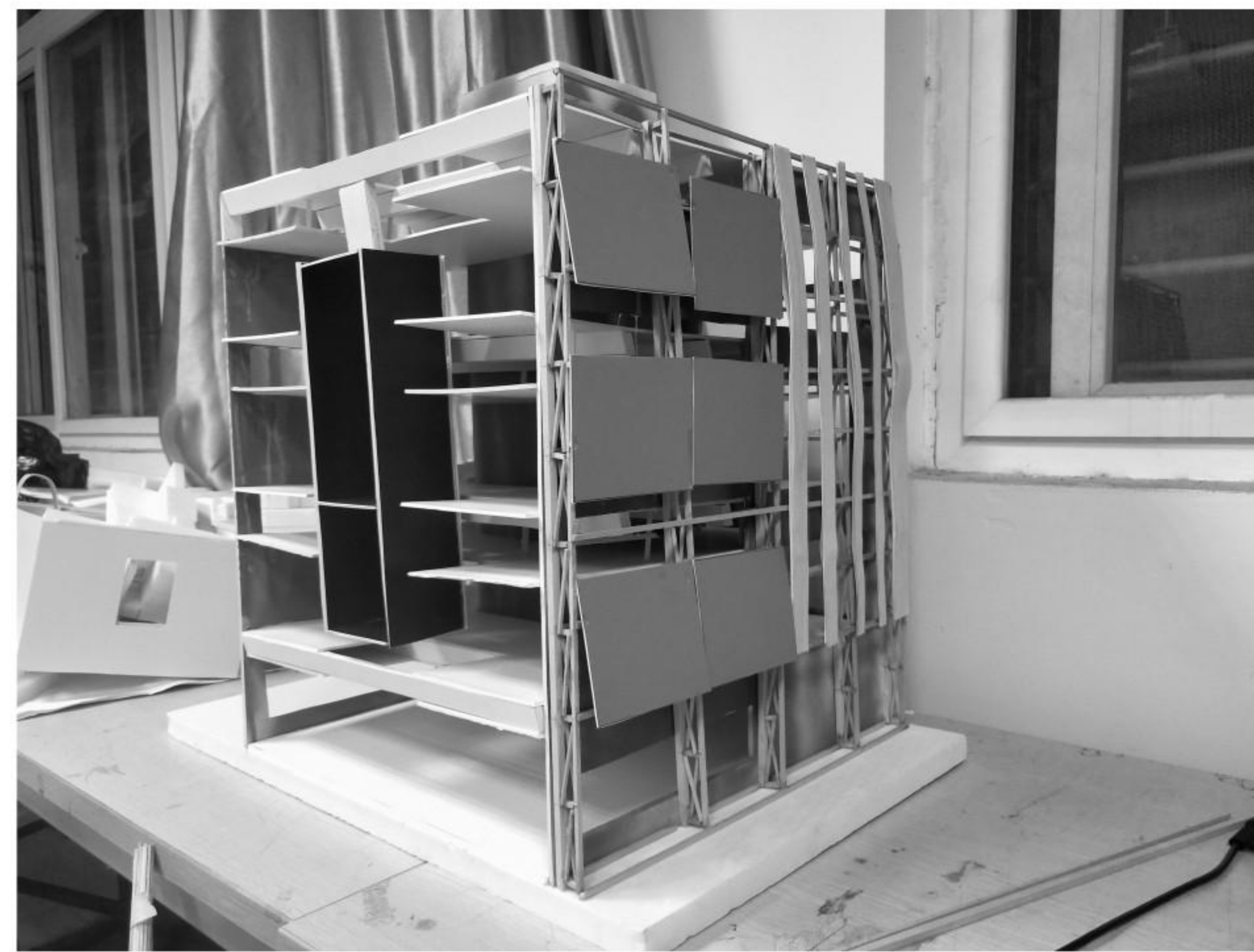
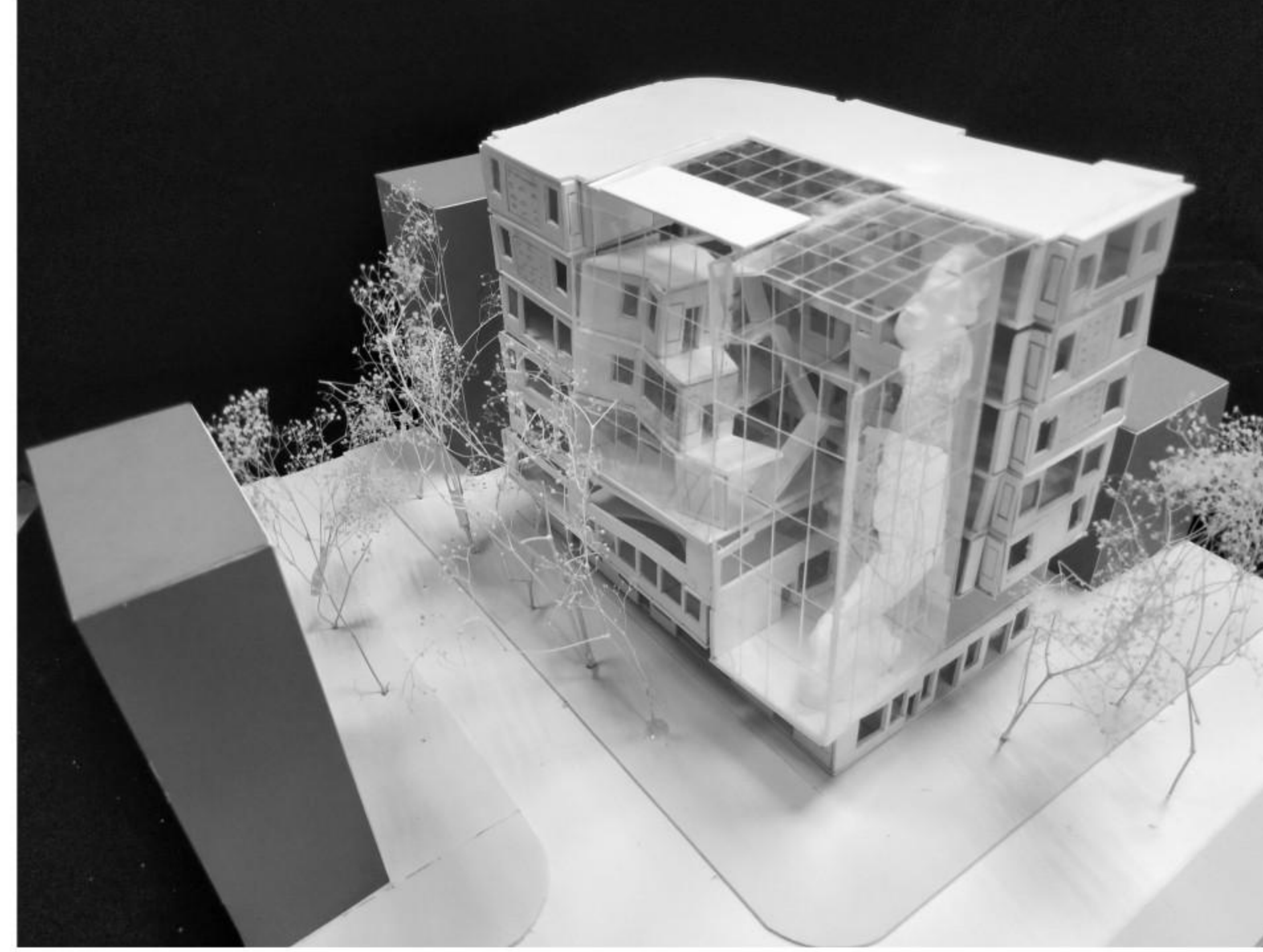


# OTHER WORK

## Physical Model

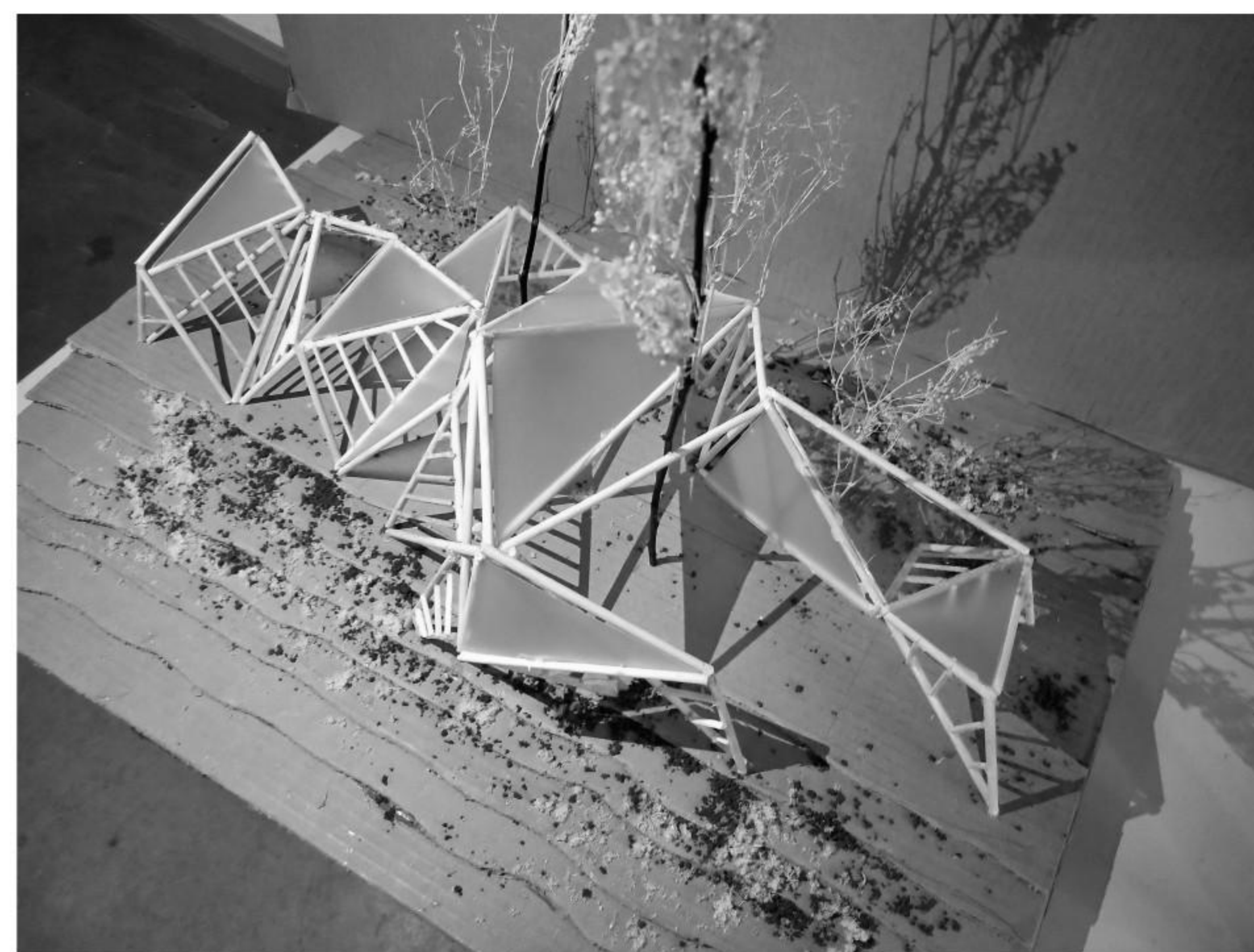
Apartment Building Design Assignment.

The first floor is for community service, and a rock climbing wall is set at the south corner for children around to play. Dormitory students can interact with residents in the step-back public space nearby over the second floor.



Exhibition Space in Museum Design Project  
Scale: 1:50

The model demonstrates the main structure, secondary structure, envelop, internal space, etc.



Landscape Corridor Design on Luojia Mountain, Wuhan University  
Scale: 1:20

This physical model (1:50) is made from 'as found' branded material.

It is used as a vehicle for exploring architectural ideas about facade - not as a display item for a finished article. The facade idea originated from very interesting fragments derived from urban textile of Wuhan.



## Architecture Sketch

Drew during my internship in Chengdu City, China in the year of 2021

