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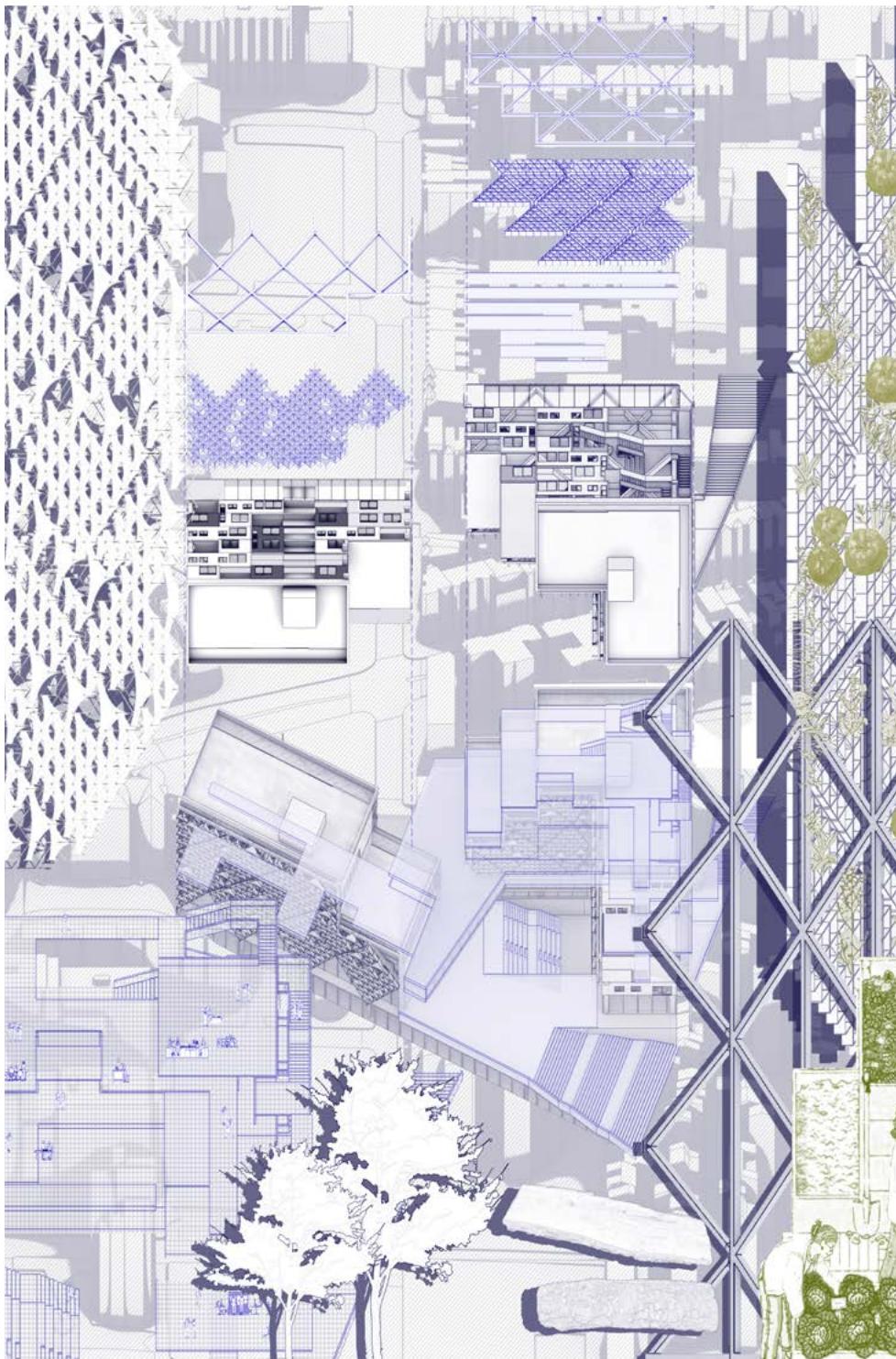
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01

URBAN LIVING AFFORDABLE HOUSING DESIGN IN WASHINGTON DC

*Academic Work
Praxis II at Carnegie Mellon University
Spring 2023*

The project aims to create a collective housing with five different scaled unit types. The positioning of the site in the central Washington area became the catalyst of this design, which one which renounces the traditional isolated housing, and instead actively engages with city life and foster social interaction between people with different background in a variety of scale.

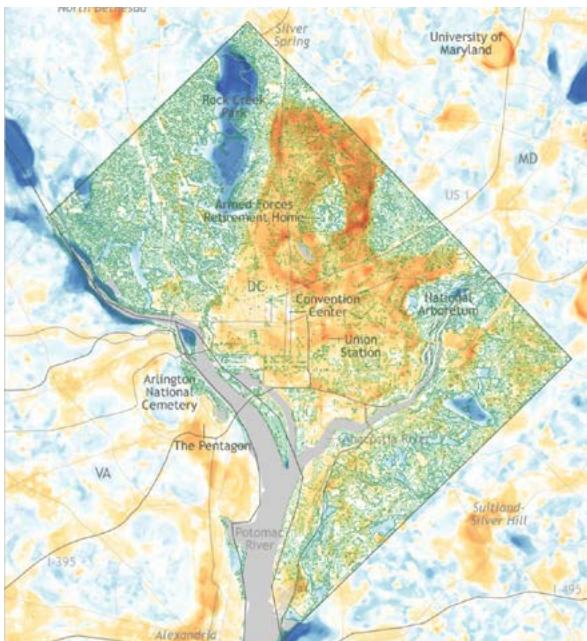
Two towers form a path that connects the streets on the north and south sides of the site and a central plaza that invites citizens to circulate up. Various public programs that are missing from the surroundings are embedded into the project to active city life, such as vertical garden, cooking education, grocery store, etc.

As for the building space arrangement, public spaces are integrated into each floor and connected vertically on the northeast corner of the building. Void spaces are reserved to provide further development possibilities of residents.



Infrastructure Analysis

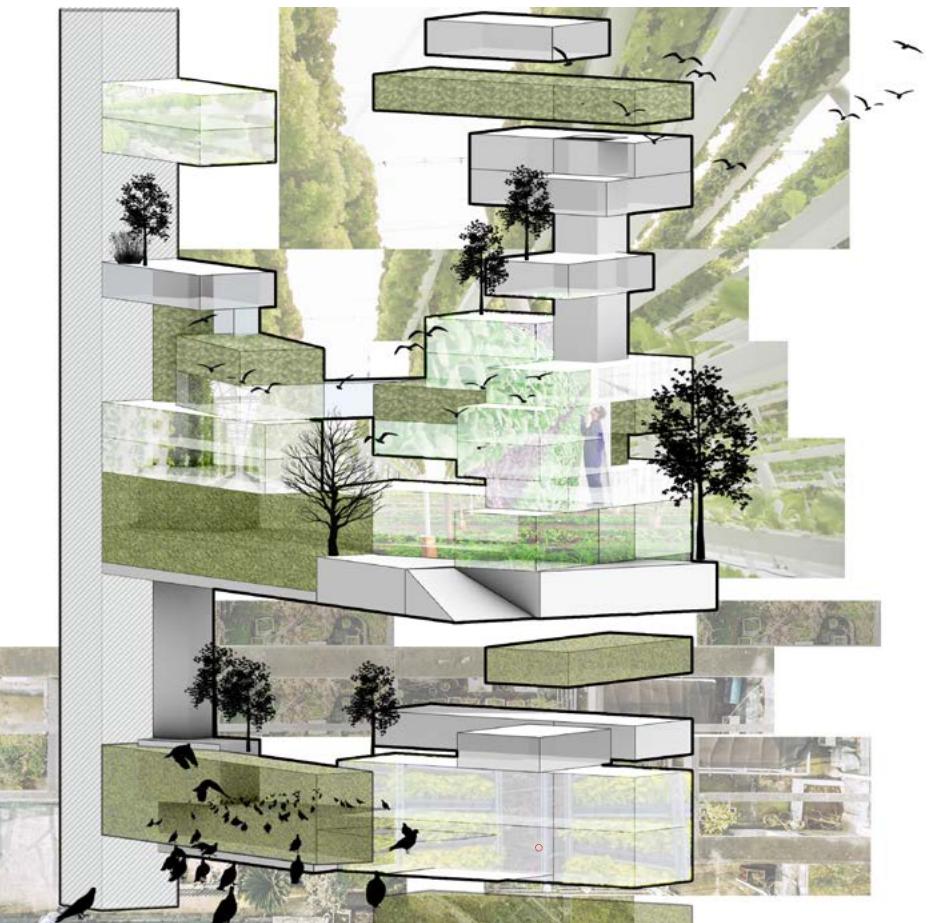
The surrounding buildings are monofunctional and the service infrastructures and public spaces are far beyond the walking distance.



Data Source: Climate.gov, Open Data DC

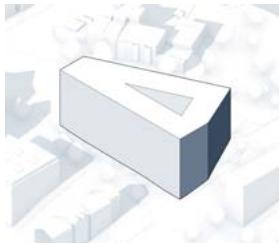
UHI & GI Map

The Heat Island effect of the central D.C. area is relatively serious due to the large area of concrete surface and the lack of tree canopy and other green infrastructures.



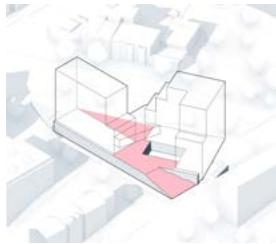
Urban Farming

To create a self-supporting community and encourage a collective lifestyle, the building is conceived as an urban farming system. The roof terrace and courtyard provide enough space for farm land, which not only satisfy the needs of residents' daily life but also increase green space and therefore reduce the heat island effect in Washington D.C.



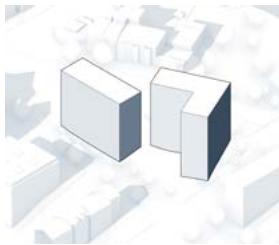
Occupy the Site

Single volume is used to occupy the whole site, a central courtyard is preserved to ensure the enough daylight.



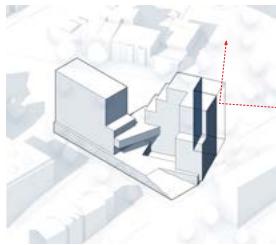
Passageway

Triangular squares and a passageway are formed by the two towers to provide a public city space.



Opening

Open the building by dividing it into two towers and promote social engagement.



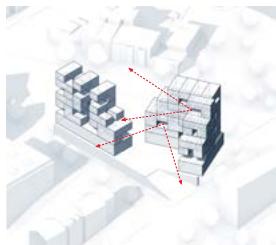
Vertical Public Space

Public spaces are located on the corner in response to the crossroad.



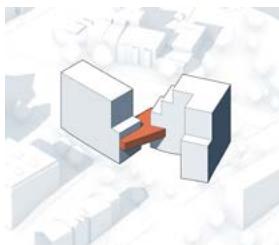
Setback

To reduce the pressure on the streets, the massing setbacks while creating more roof terraces that could be used for roof gardening.



Units Aggregation

Different unit types aggregated together while keeping some blank spaces to adapt to family development in the future.



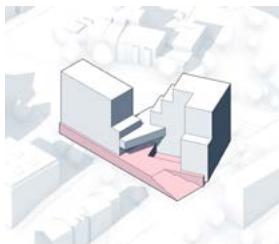
Connection

A bridge on the second floor connects the two towers while shape the passageway spatially.



Shading

Horizontal shading panels overhang above the window to reduce solar heat gain in the summer while ensure adequate winter illumination.



Topography

Shape the topography and create a private courtyard for the residents.



Green Space

Roof terraces and the north facade are designed as green surfaces to promote a sustainable lifestyle.

Strategy and Massing

Each unit has public space on the first floor, bedrooms and bathroom on the second. Terrace is provided to promote interaction between units.



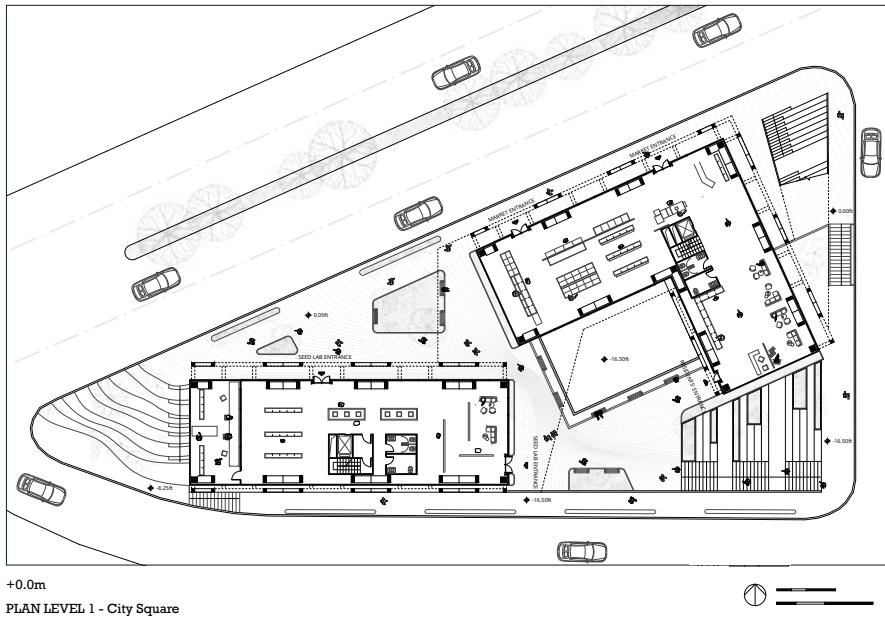
Through-passage Way

The two tower are connected on the second floor with an iconic orange bridge to maintain consistency and permeability of sights and circulation.



Public Corner

The spaces on the corner of the building are connected in a vertical direction and open to the public. A public circulation traverses the building volume.



+0.0m - Ground Floor Plan

The towers, on north and south sides of the site, enclose a plaza formed by two triangles connected at the center of the site which serves as the living room of the city. In addition to the public programs on the ground floor, the plaza invites the public to pass through and participate in the public activities held there.



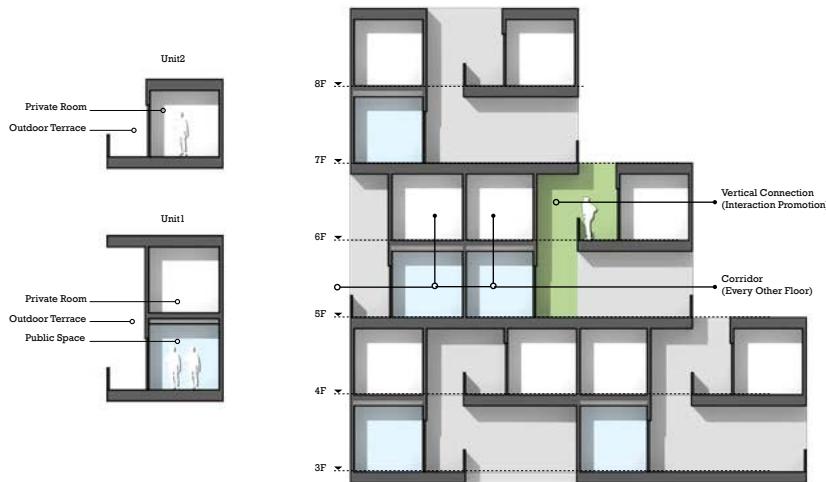
Longitudinal Section

The vertically penetrating public spaces are located in the most open corners with great views of the city.



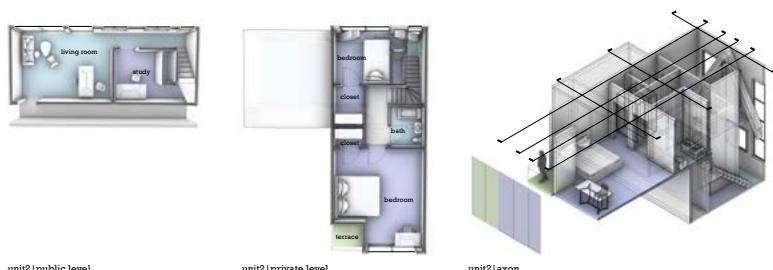
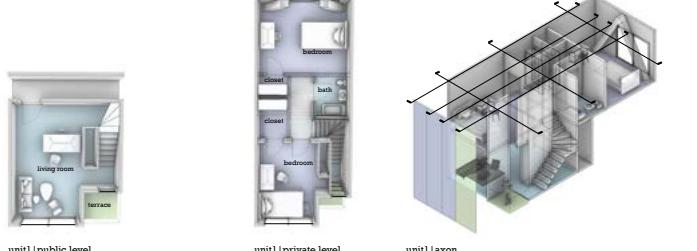
Transverse Section

The different levels of courtyards form a transition from public streets to fully private gardens.



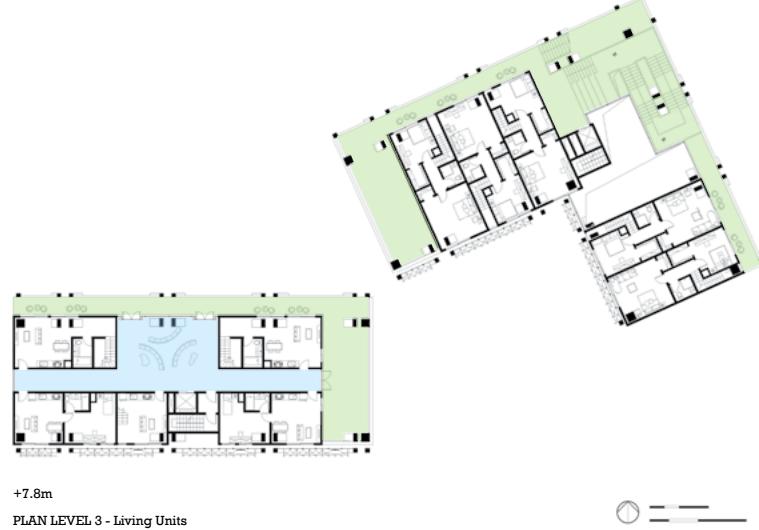
Units Aggregation

Two representative living unit types facing north in the north tower are connected vertically by terrace space.



The Double-floor Units

Each unit has public space on the first floor, bedrooms and bathroom on the second. Terrace is provided to promote interaction between units.



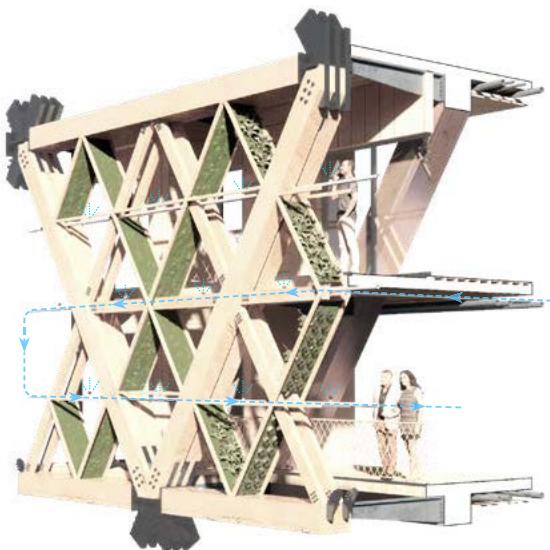
+0.0m - Typical Floor Plan

The public-semi-public-private spatial hierarchy exists on each level. Due to site constraints, walkways are only present on even-numbered floors to ensure sufficient depth of space.



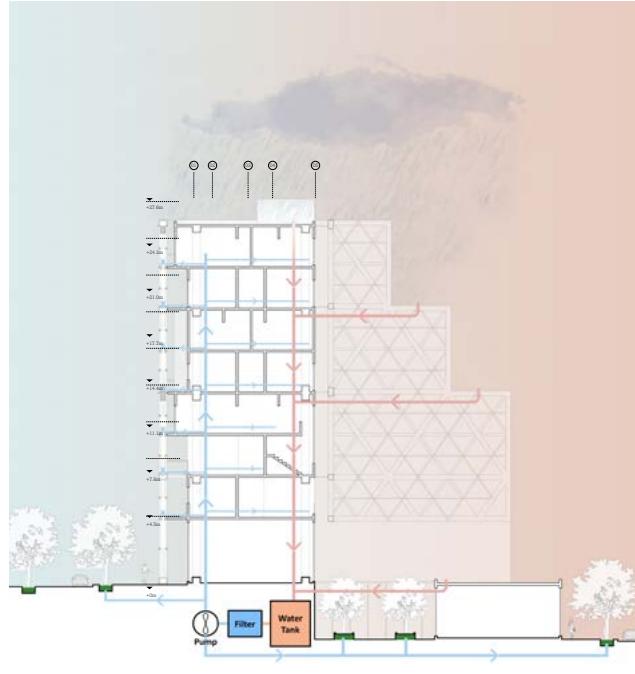
Aeroponic System & Sustainable Living

Aeroponic gardening are applied on the north facade to create a green elevation and purifying the outdoor air polluted by vehicle. When all the triangular cells are filled by plants, the facade could also serves as a noise barrier.



Aeroponic Facade System

Clean water with nutritions are pumped from the ground and distributed to each floor for daily water use and aeroponic cells. The water flows in the pipe is spreaded to irrigate all the plants and vegies planted by residents.



Rainwater Harvesting Diagram

The rainwater collected from the rooftop are used for irrigation of the aeroponic system, flushing and gardening after filtered on site.



Precipitation & Amount of Water Collected

Considering about the rooftop collection efficiency, the total amount of the rainwater collection from rainwater harvesting is calculated according to the precipitation of rainwater in Washington DC, which is 80,004 per year.

Two months of storage: 3,840 gal = 513.37 cubic feet
 Sizing round cistern: $3.14 \times \text{radius of cistern squared} \times \text{max height of stored}$
 $r = 4.8', d = 10'$



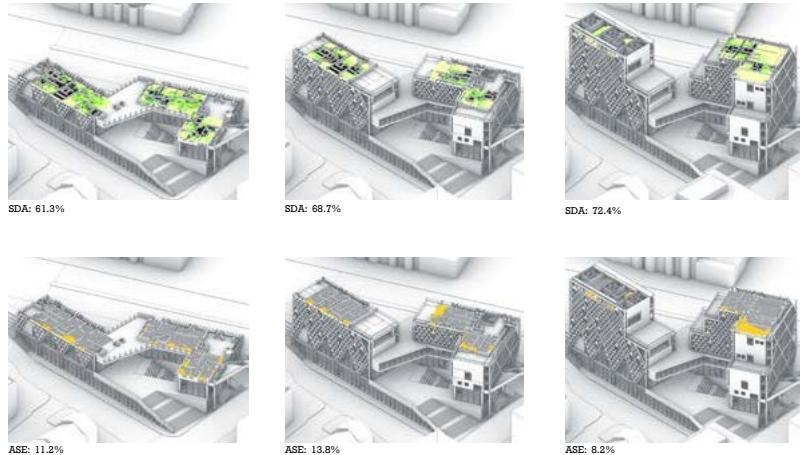
Roof Terrace and Shading System

The stepped roof shapes the urban image and reduces the mutual obstruction of views between the two towers. The application of shading system on the south side block the excessive sunlight and therefore improve the building's energy performance.



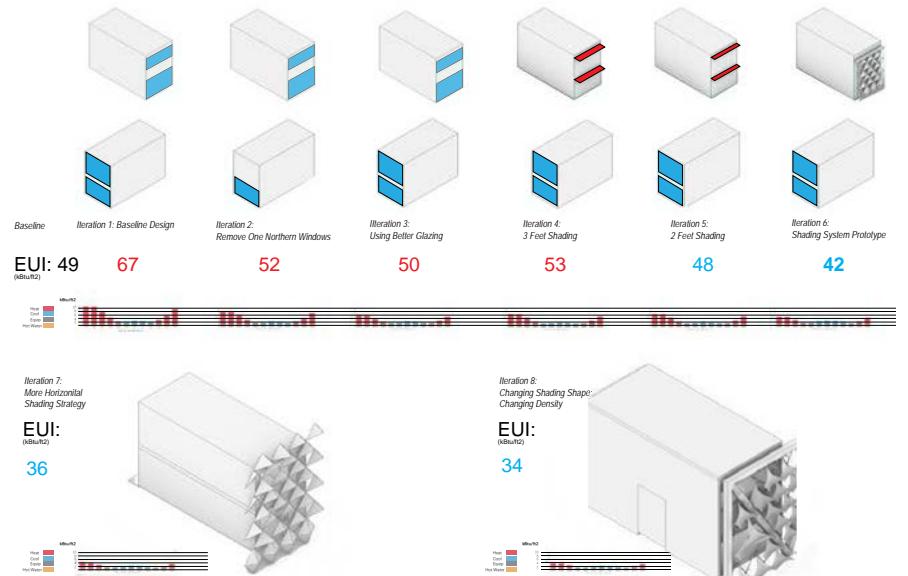
Verticle Public Space

The verticle public space is designed on the northeast corner of the site where has a great city view. The vibrant orange color not only energizes the cityscape, but also demonstrates an inviting attitude towards the public.



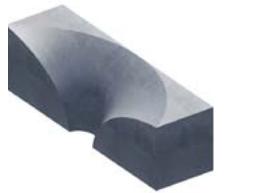
Daylight Analysis

Three representative floors are selected to do the spatial daylight analysis and annual sun exposure analysis. The depth of each floor are controled to guarantee the central area could have enough daylight while the sun exposure of the peripheral area is kept at a lower value.



Energy Simulation

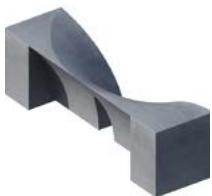
By reducing galzing area, optimizing building envelope and adding proper shadings, the total site EUI is decreased from 67 to 34.



02

POCHE DILEMMA

A 3D POCHE COMPREHENSION WITH PERCEPTION



Academic Work

Group Work

Summer 2019

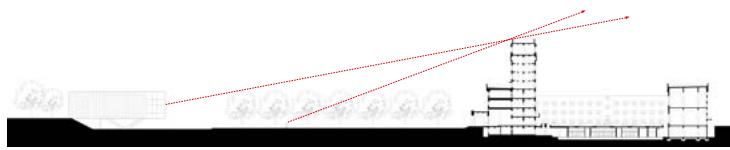
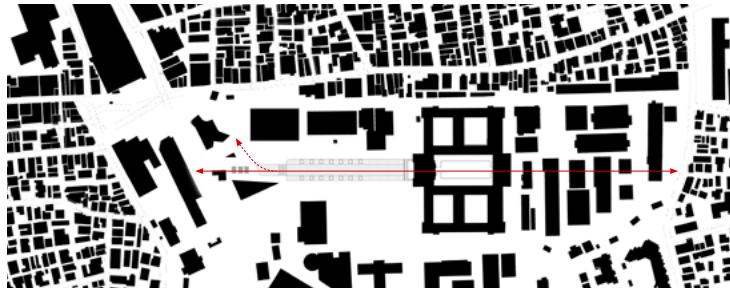
My Work: Concept proposal and all drawings in this portfolio



This project attempts to explore a new strategy of poche, transforming a negative space into a positive space through the replacement of black and white. At the same time, it combines the perception and experience of the participants in the space to create a poche circulation, thus breaking the barriers between two pairs of contradictions: material and void, internal and external, and giving poche a new interpretation.

The enclosed and heavy wall perfectly isolates the internal space from the external environment. As the only place where you can feel the sun, air and water, the atrium is abandoned due to space constraints. *The thick wall evokes our thinking about poche. How to use poche to activate the external space while considering about the site conditions, realize the connection between the inside and the outside, and solve the contradiction in the site is the main topic of this project.*





Spacial Sequence & Axis

The main building is located at the end of the campus axis which is emphasised by a wooden plank road and tall trees on both sides of the road. The Triangular shaped library at the start of the axis points towards the main building, furthere reinforcing the status of the building.

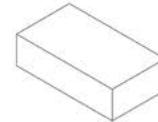


Elevation Illustrated

The bell tower is the symbol of the Tokyo Institute of technology and outlines the skyline. This expressive facade should not be veiled by the new canopy added in the courtyard. The continuous arcade is another culture symbol of the university.



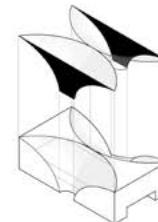
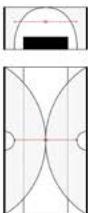
3D



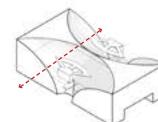
1. Site
The site is bounded by four walls to form a rectangular volume.



2. Classroom
Cut out a rectangular functional space from the site.



3. Mirrored mass
The organic volume of the two mirror images is subtracted from the main body.



4. Transparency
The transparency of glass makes it possible for the line of sight to participate in poche perception.

5. Continuity
The addition of the platform provides the possibility for the body to cross the poche.

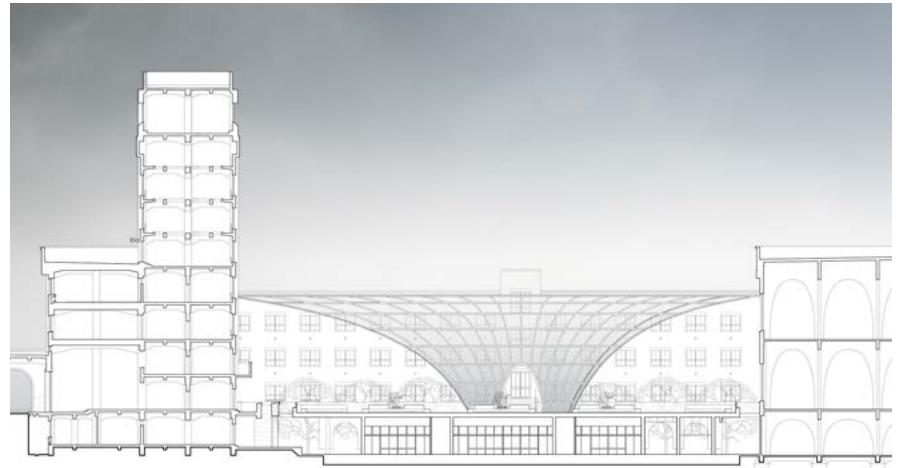
3D Poche Interpretation

To understand poche in the way of digging out of the entity, to observe poche from a 3D space, and to perceive poche through the participation of the body.



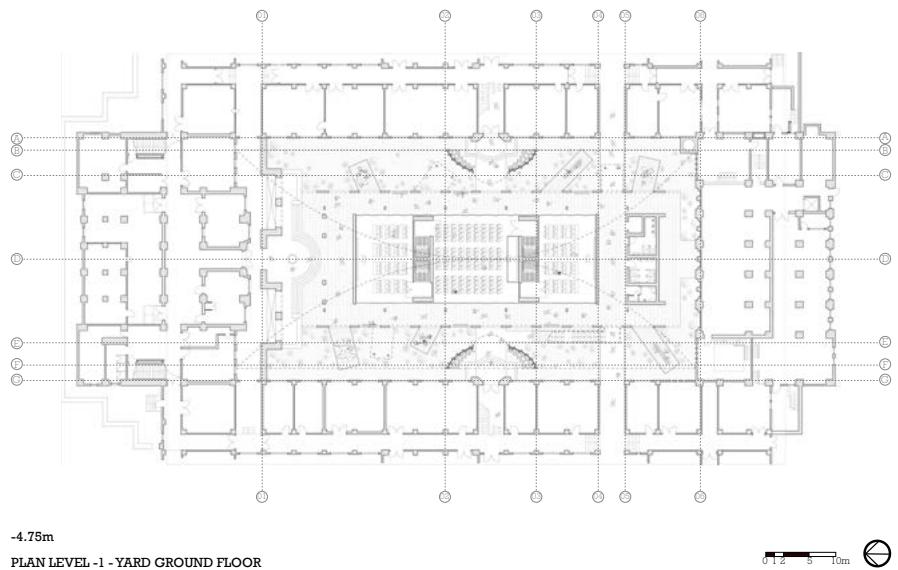
Poche Opened to the Sky

The poche, which opens to the sky, squeezes the central square space defined by it inward.



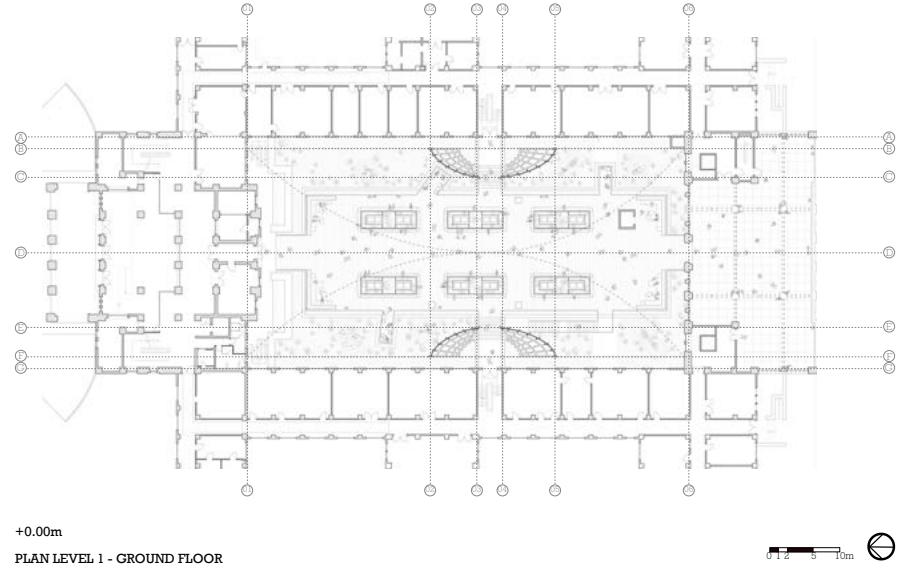
Longitudinal Section

The space flow out of the poche, Integrate internal and externa



-4.75m - Yard Ground Floor Plan

Central yard with an additional building in the middle



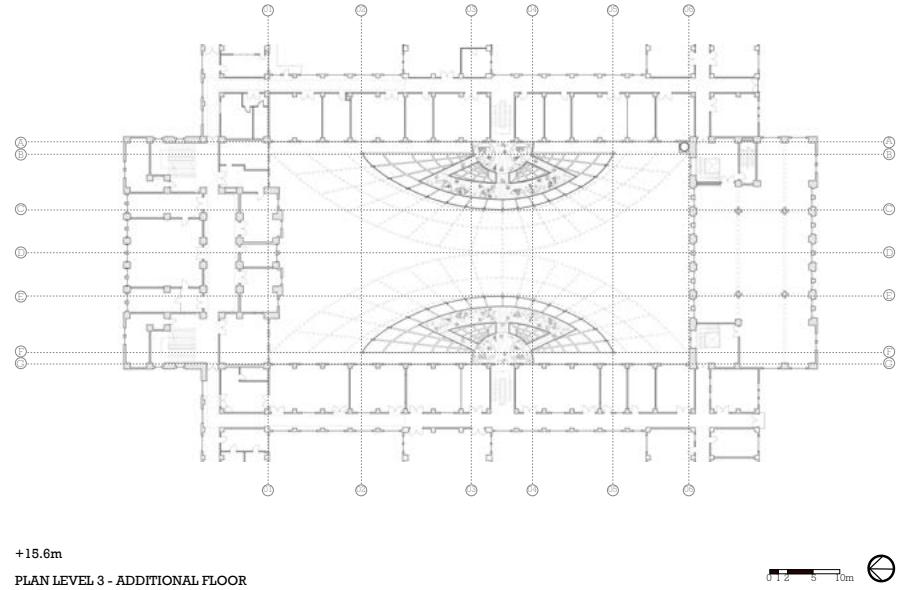
+0.00m - Ground Floor Plan

A central station connecting the both wings of the old building



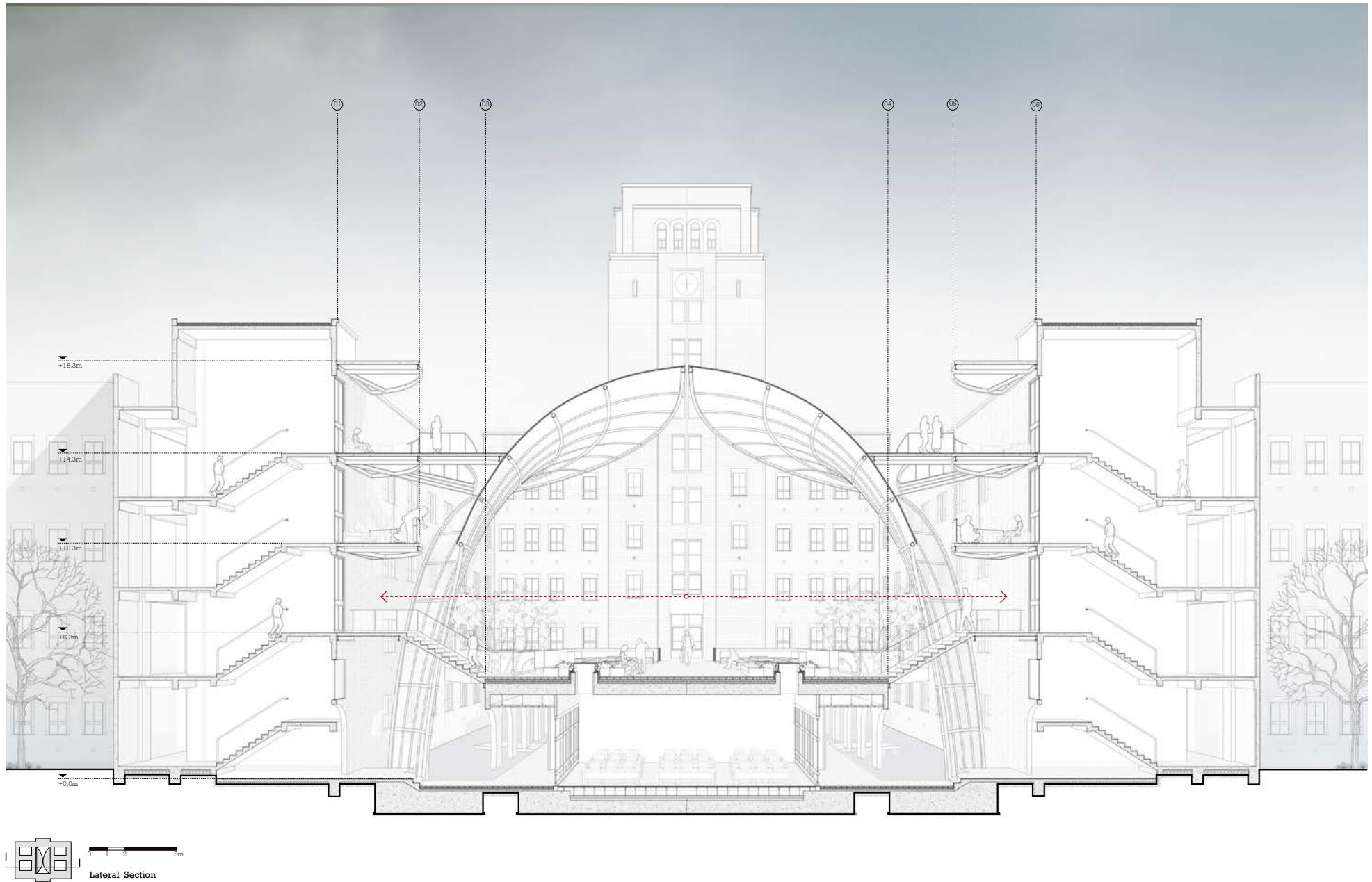
Transparent Poche Dilemma

The gaps, connected platforms, and glass provide the possibility for the body and sight to pass through the Poche. The mirrored space is another way to interpret the poche.



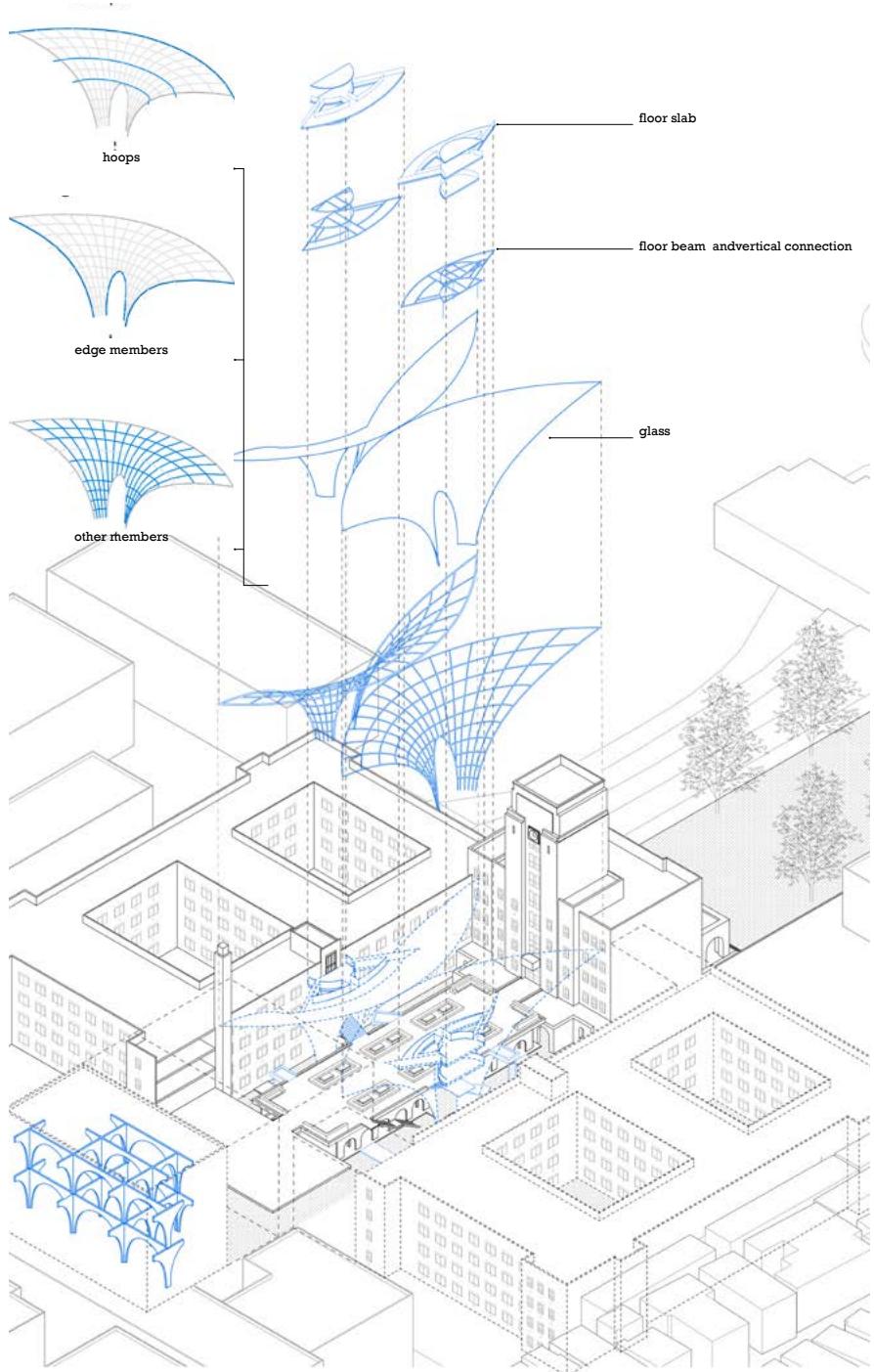
+15.6m - Additional Floor Plan

Additional plan between the old facade and the new

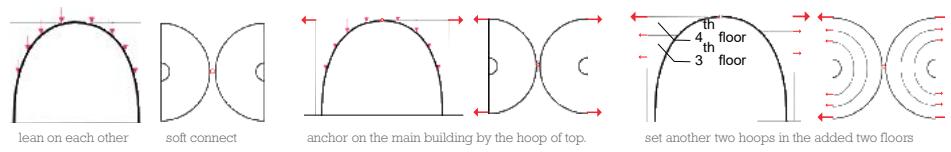


Multilayered Poche Perception with Body

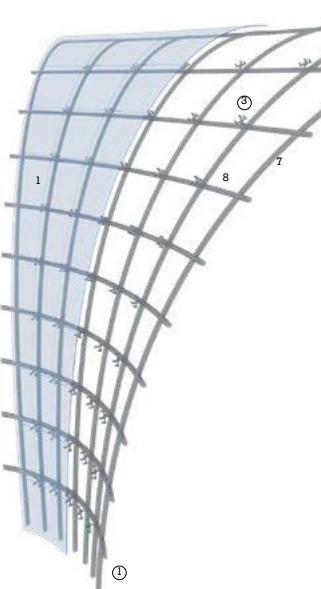
The detached double skins create a layer of cavity, the penetration of the body breaks the barrier of the solid wall, the addition of the platform realizes the continuity of the inner and outer spaces, and the transparency of the glass provides the possibility of sight penetration. When the individual passes through the first wall, it seems to have reached the outdoors, and the mirrored poche on the opposite side gives us a sense of being still in the poche. After crossing the second transparent barrier, when the individual stands in the center of the courtyard, he can observe the multi-layered space of the poche from the outside.



Multilayered Poche Space



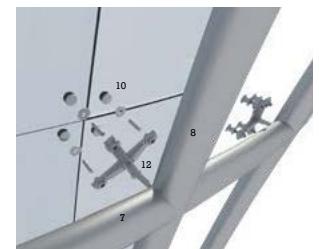
Structure Analysis



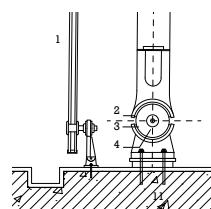
Sketch Map of Structure

3D view showing clamped glazing system with steel structural support system.

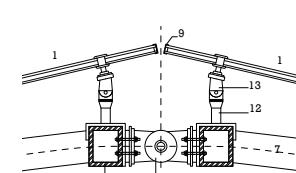
1 glass
2 cast steel hing joint
3 stainless steel cover plate
4 stainless steel pivot pin
5 rectangular steel tube
6 steel connector
7 steel tube
8 steel tube section
9 aluminium glazing section
10 stainless steel bolt fixing
11 concrete foundation
12 steel arm for support
13 stainless steel connector



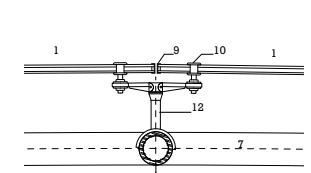
3D view of supporting steel framework structure for bolt fixed glazing and exploded 4-point glass connection fixing details



Joint①
connection at ground level with steelwork fixed to the ground.



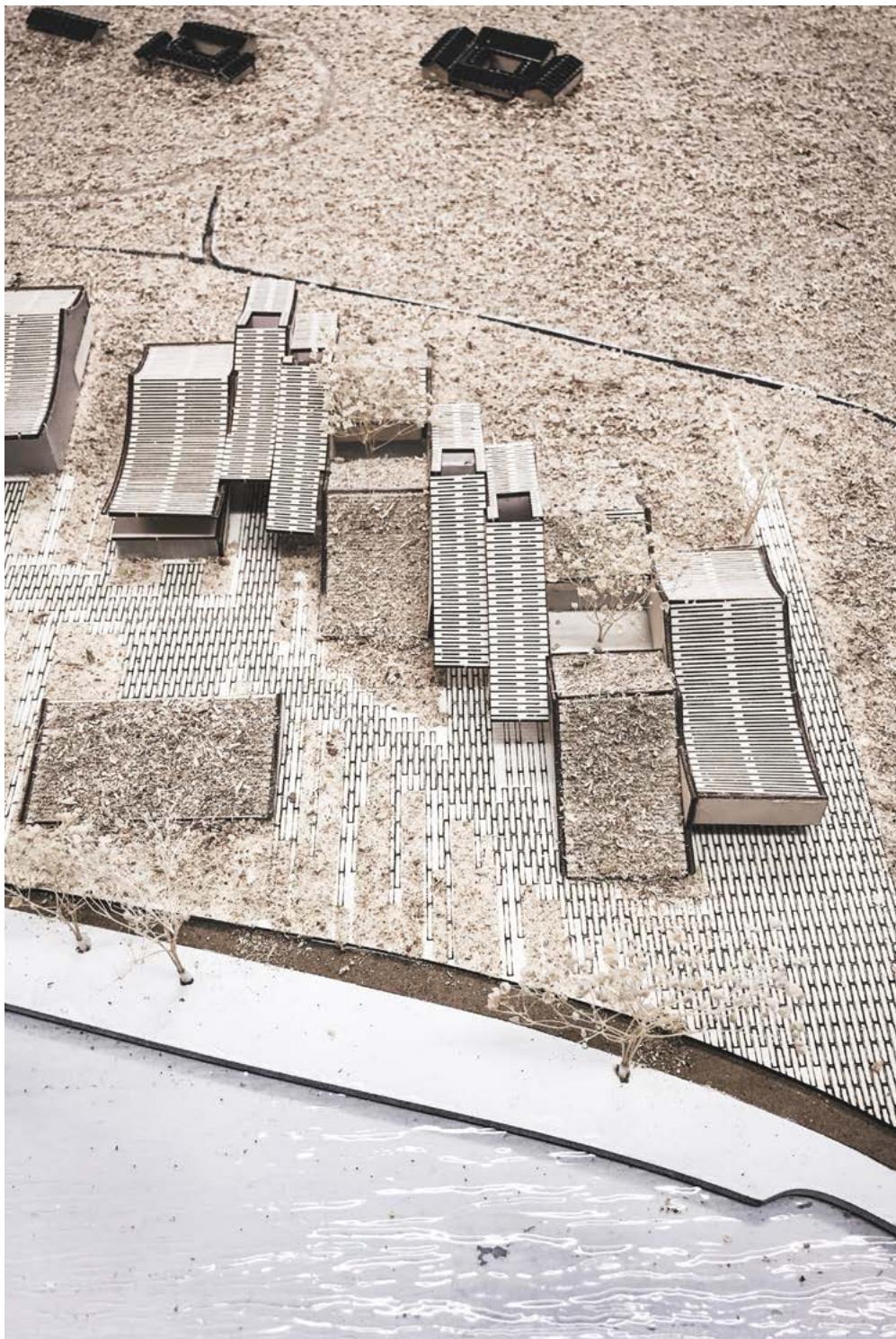
Joint②
soft connection between rectangular steelworks at the top of the half grid structure.



Joint③
bolt fixed glazing connection fixed to steel framework.

Detail Drawing of Joint Structure





03

TRANSCENDENT NATURE AN ARTIFICIAL REPRESENTATION OF NATURE

*Academic Work
Individual Work
Spring 2016*

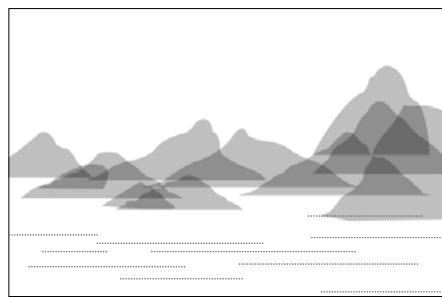
When it comes to the relationship between man and nature, the East and the West have completely different ideas. Western civilization originated from hunting, and it tends to conquer nature. The rational way of Westerners thinking pattern requires them to show nature objectively. Eastern civilization originated from collection. ***People seek to return to the natural state of life, emphasizing the perception of nature with the soul.*** Therefore, the traditional Chinese view of nature requires ***architecture to be open to nature.***

If architecture is to be integrated into nature, the first thing that needs to be explored is how to represent nature in architecture. ***Painting is an art form that best expresses the traditional concepts of Chinese literati,*** and it is also a way of artificially representing nature. While architecture is a man-made object, it is also an art. Therefore, ***this project starts with traditional Chinese painting, and through exploring its expression techniques, the painting inspires architecture to represent nature and express people's understanding of universe.***

The Method of Chinese Painting



Qianli Jiangshan Map, Ximeng Wang, Song Dynasty



Multilayer and Parallel Perspective of Chinese Painting

Painting is one of the ways for humans to praise nature. Its **expression method and painting techniques** reflect **people's attitude towards** nature and the way the viewer connects with the universe.

Since the 13th century, people's consciousness has been awakened, and artists have begun to develop the vanishing points in the fixed perspective to reproduce the real space. Chinese painters have always maintained a **high-angle parallel perspective** painting method. Expressing the spiritual understanding of nature in a transcendent way expresses the concept of the unity of nature and man in Chinese culture.

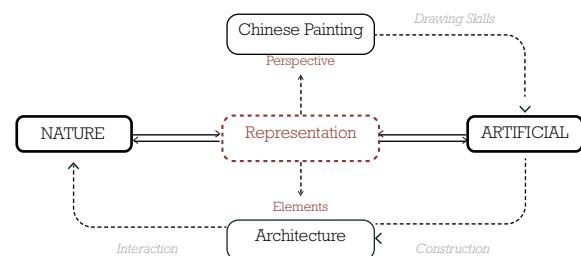
Xi Guo, a painter in Song dynasty, proposed the "three distances" painting composition method. **There is no change in the proportion and perspective in the picture, expressing a dynamic space that integrates time and space.** In the parallel perspective of traditional Chinese painting, people walk through the picture from the perspective of God, and **the lines in the picture are parallel to each other and have no vanishing points.** There are **discontinuities** in the paintings of different levels of landscapes in the distance: far, middle and near. In other words, **different levels of landscape are superimposed together in a way similar to "transparency".**

This project attempts to learn from the expression methods of ancient Chinese paintings, starting from the traditional Chinese view of nature, and **exploring the way architecture intervenes in nature through the arrangement of various architectural elements.** I call it "transcendental nature".

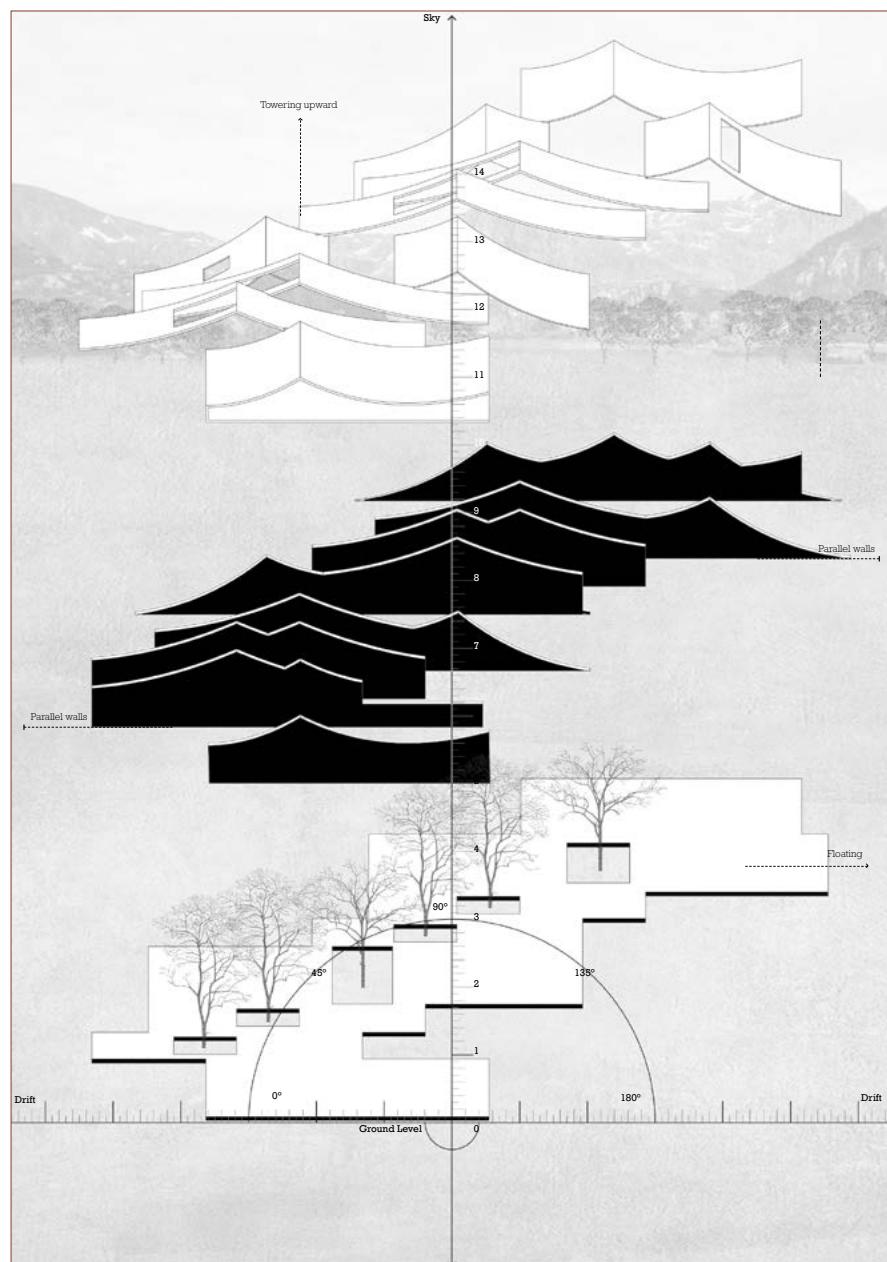
Reference:

Visual analysis of Chinese and Western painting methods in space, Zhongfeng Ye
God and Human Eyes—Comparison of Viewing Ways of Chinese and Western Paintings, Yueying Deng

Artificial Method of Nature Representation



The Presentation of Duality



Arrangement of Elements

The walls are arranged in parallel and staggered back and forth. In parallel perspective, there is no change in proportion and perspective between the front and the back. They are superimposed on each other, which is a kind of display of traditional Chinese painting.



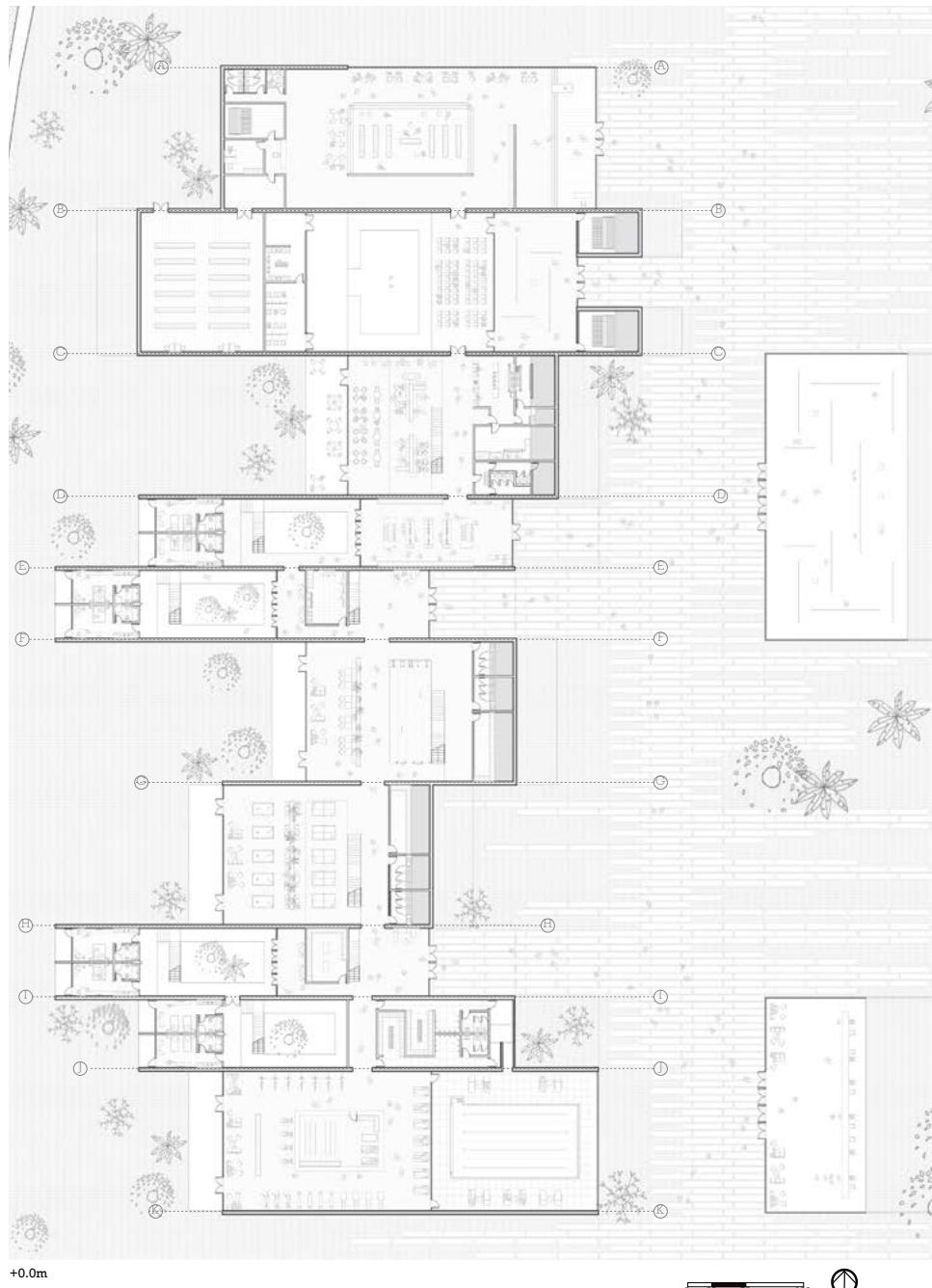
The Horizontal Layer

On the master plan, it can be clearly read that the building volume is staggered and overlapped in the horizontal direction, and continues in the longitudinal direction to form a whole.



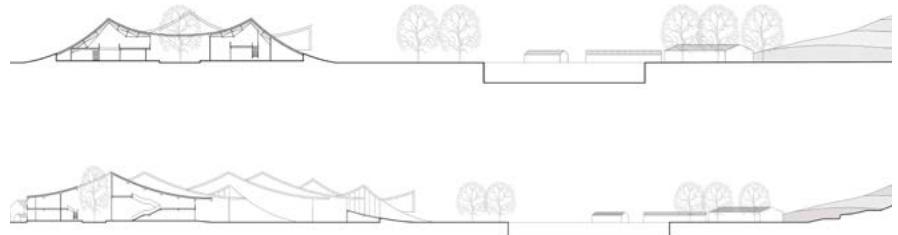
Undulating and Parallel Volumes

The different types of volumes that are parallel to each other fluctuate in height, which is the continuation of the distant mountains.



+0.0m - Ground Floor Plan

Organization of different functional units



The Overlapping of Parallel Layers



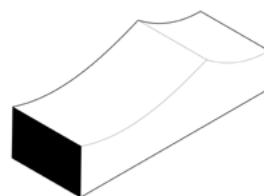
Type A
Area: 480m²
Function: Entertainment



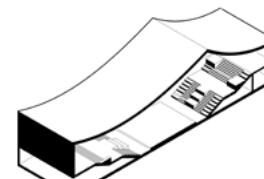
Floor: 2
Function: Restaurant



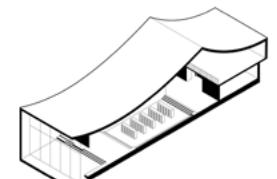
Floor: 2
Function: Exhibition



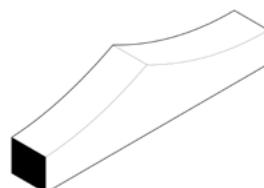
Type B
Area: 720m²
Function: Gathering Activities



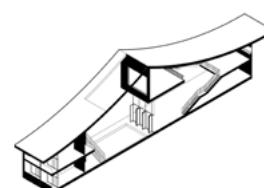
Floor: 1
Function: Lecture



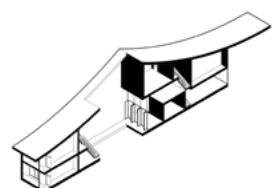
Floor: 2
Function: Library



Type C
Area: 360m²
Function: Private Space



Floor: 3
Function: Hotel



Floor: 3
Function: Office and Service

Different Function Organ

Different unit types have different functions. They are like organs, arranged in an orderly manner, forming an organic whole together.



Yard
Bluring boundary



04

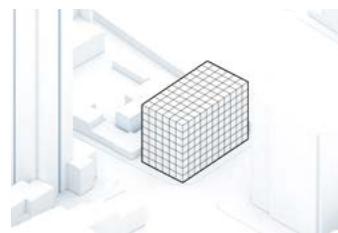
NONSTANDARDIZED LIFE A RECONSTRUCTION OF "JUNK SPACE"

*Academic Work
Individual Work
Fall 2019*

The development of science and technology has brought about a rapid increase in the number of buildings. However, **mass production leads to the continuity of consumerist buildings**, the similar architectural features and the expressionless people. To some extent, the consumerist space that Koolhaas criticized is **the result of a downward shift in design power, where architecture caters to people's needs rather than the prerogative of architects.**

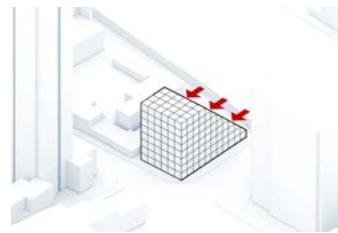
This project aims to explore the emotion hidden behind the indifferent technology by emotionalize the machine. Through the use of materials with different characteristics, while achieving rapid production, it pays attention to the personal emotions and feelings of the occupants, and integrates the isolated emotions of modern people with the environment. *And in an attempt to revise the modernism*

Most modern people resort their emotions to social platforms on the Internet because of the great privacy of public networks. That doesn't mean that people do not need the public social space in reality, but lack the space to move between the public and private extremes. Therefore, **how to ensure that residents have an independent and private space while allowing them to show themselves to the public to a certain extent** has become another research topic of this project.



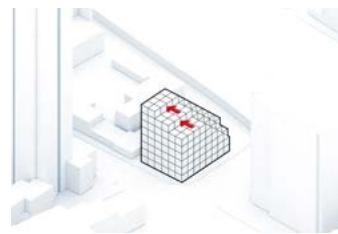
1. Massing

Occupying the site with the single volume that consists of multiple basic cubic units.



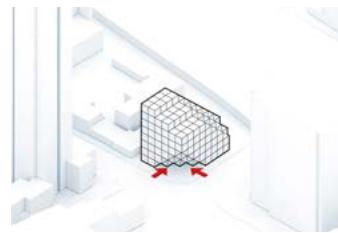
2. Offsets

The east side gives way to a three-tiered rooftop terrace in response to the beautiful views of the Pearl River.



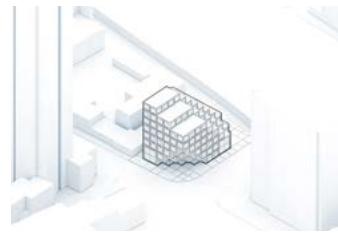
3. Offsets

The tops of the buildings on the south side are set back floor by floor to reduce the pressure on the street.



4. Plaza

The corner portion of the street is set back from the plaza in a diagonal direction to alleviate pedestrian congestion.

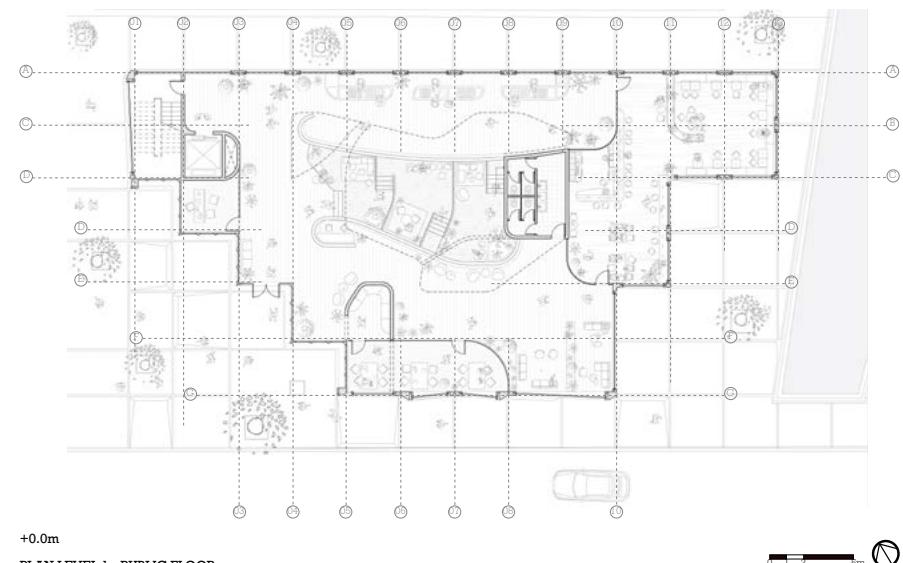


5. Adjustment

Partial resizing of the modules and continuation of the grid pattern of the facade in the landscape shaping.

Massing Strategy

The basic cubic units are first stacked to form the entire building volume, and then the final volume is formed by subtracting the local modules. The roof terrace and entrance plaza respond well to the surrounding elements of the site.

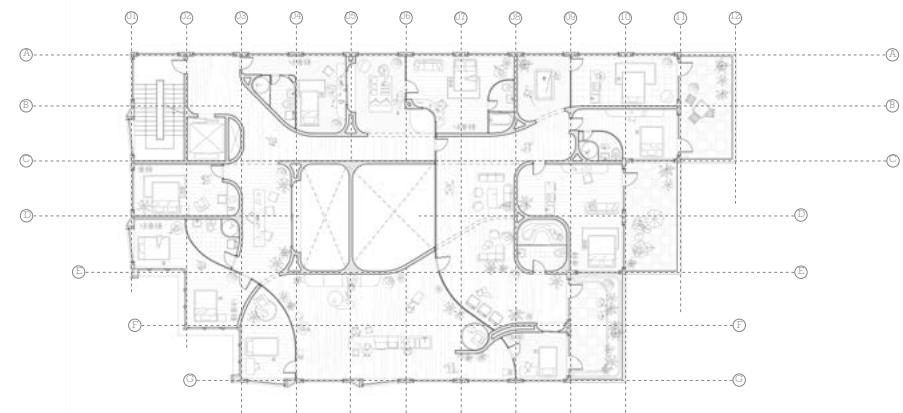


+0.0m

PLAN LEVEL 1 - PUBLIC FLOOR

+0.0m - Ground Floor Plan

Public gathering space with a stage and a restaurant



+7.0m

PLAN LEVEL 3 - TYPICAL FLOOR

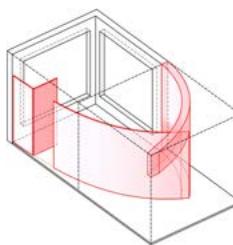
+7.0m - Upper Floor Plan

Private living space with a sharing dining hall and entertainment area

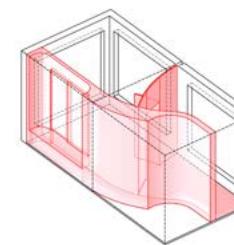


Dynamic Public Space

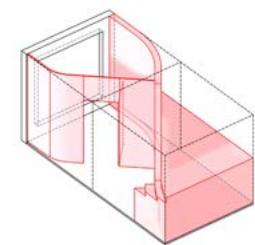
The design of the interior space uses a chamfered curve to connect the front and back, up and down spaces together to form a dynamic visual effect.



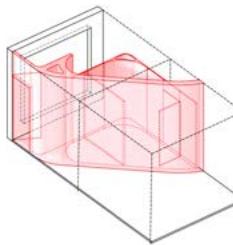
Floor: +7.0m
Area: 14.4m²
Function: Bedroom
Feature: Glass boundary



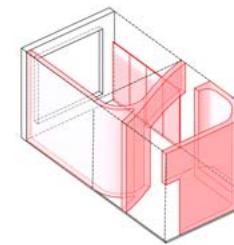
Floor: +7.0m
Area: 15.6m²
Function: Bedroom
Feature: niche on the wall



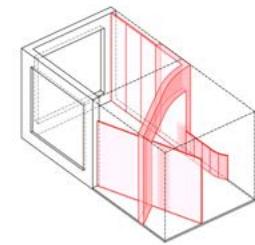
Floor: +10.5m
Area: 14.1m²
Function: Bedroom
Feature: Different height



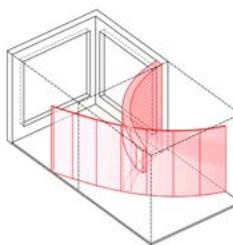
Floor: +7.0m
Area: 9.7m²
Function: Bathroom



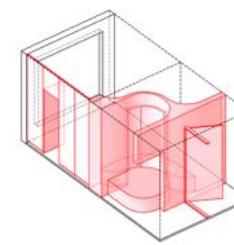
Floor: +7.0m
Area: 14.7m²
Function: Entertainment



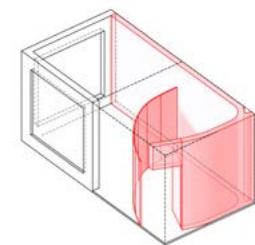
Floor: +10.5m
Area: 14.1m²
Function: Meeting



Floor: +7.0m
Area: 11.7m²
Function: Bedroom



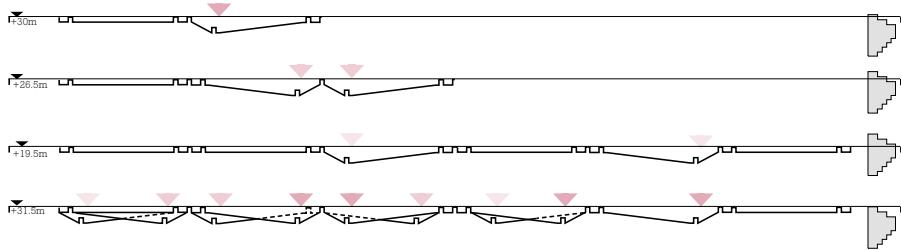
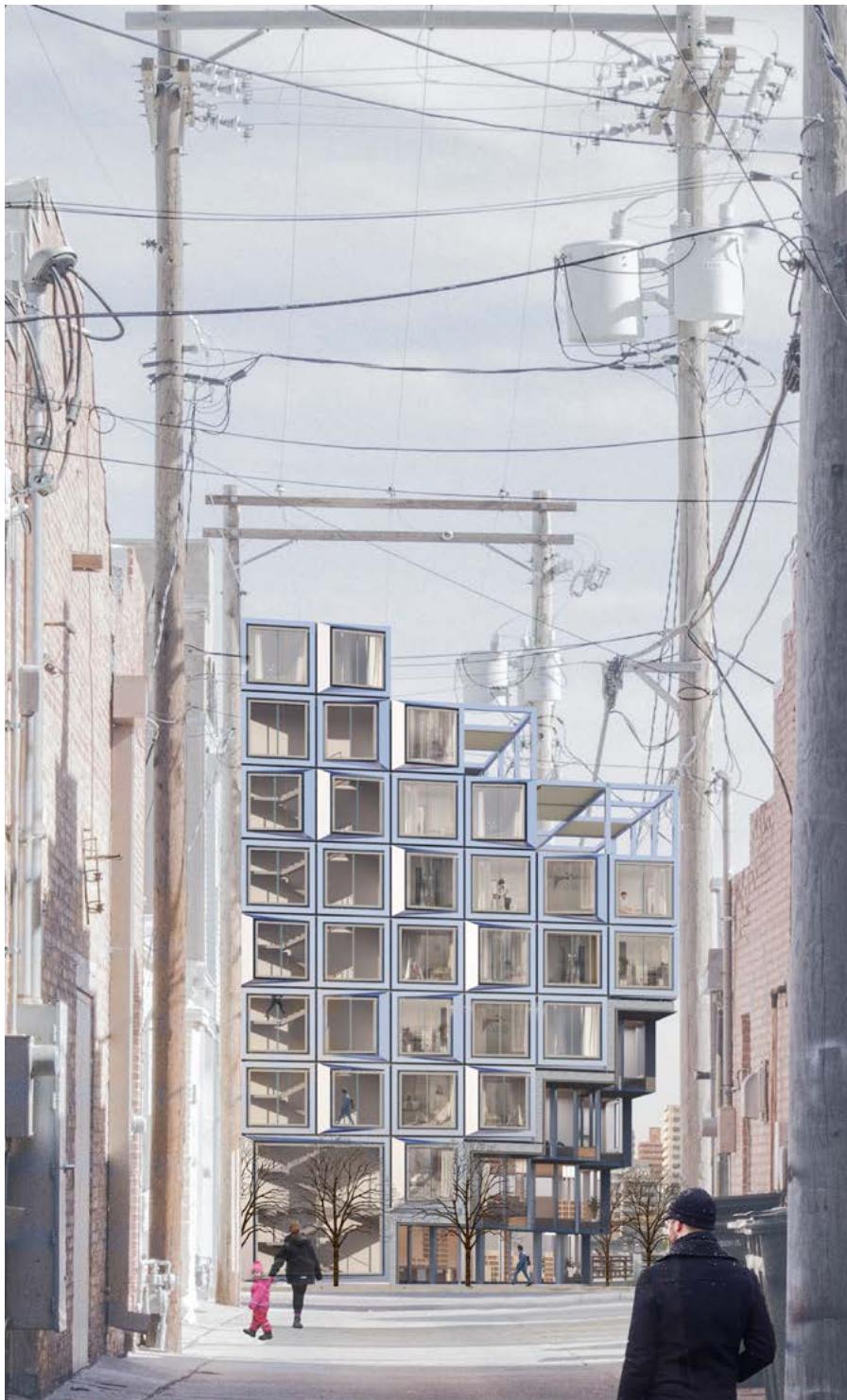
Floor: +7.0m
Area: 18.6m²
Function: Bedroom
Feature: niche on the wall



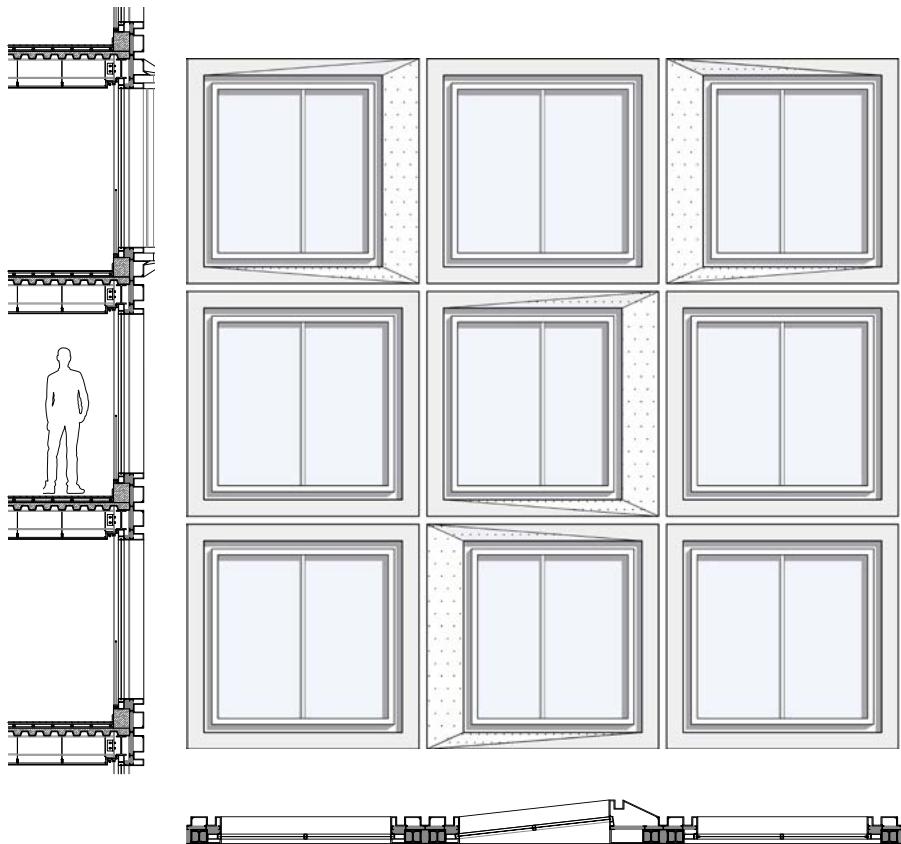
Floor: +7.0m
Area: 23.5m²
Function: Bedroom
Feature: A shared bathroom

Space in Grid Catering for Dwellers

To some extent, Consumerist architecture represents a downward shift in design dominance. Standardized grids are wrapped with non-standard living spaces, those spaces of different shapes and sizes are suitable for residents with different personalities and needs.



Random Rhythm of Facade



Construction Drawing of Facade

The industrialized production methods brought about by the Industrial Revolution and the use of steel and glass materials have made assembly-type production possible. Convenient and efficient mass production has given modernism a mechanical and indifferent color.



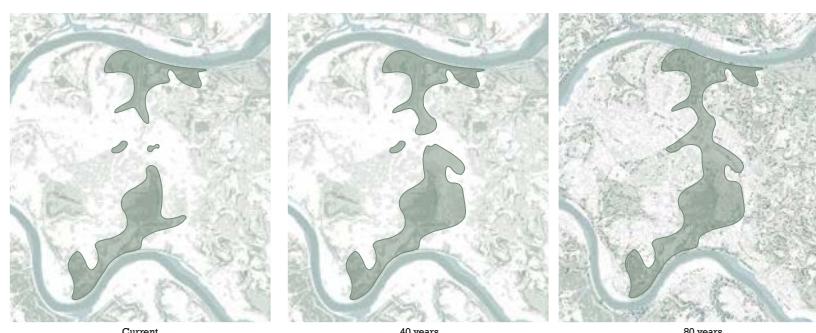
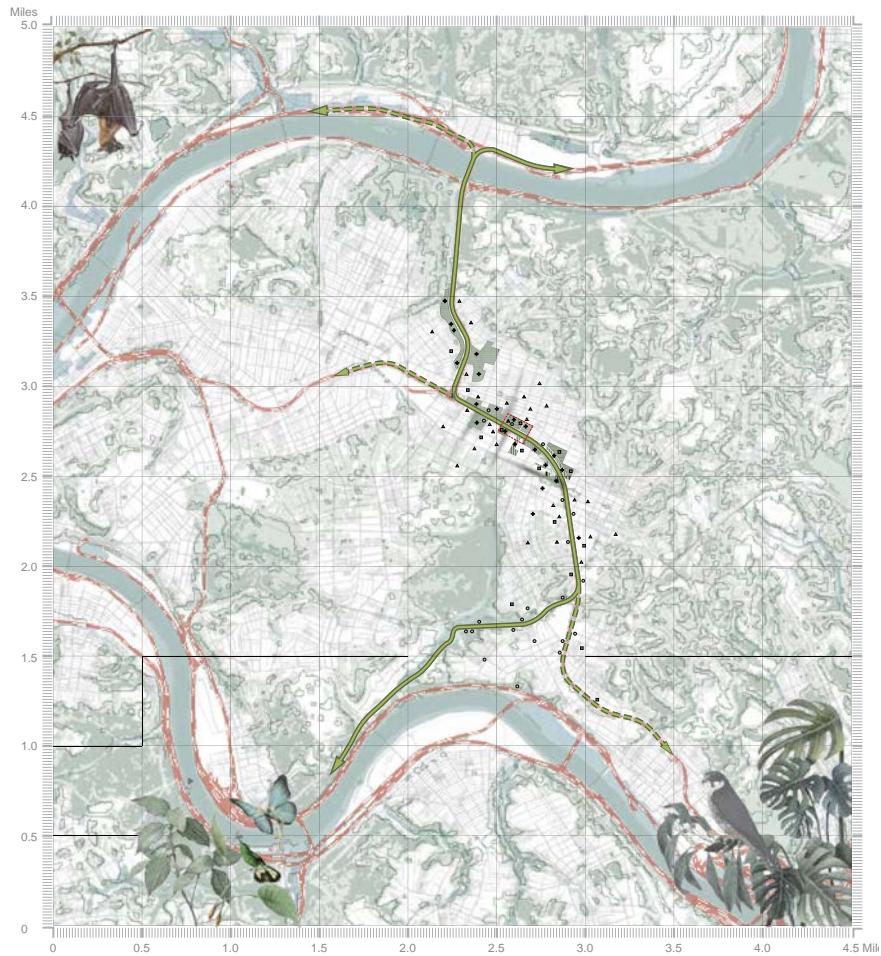
05

BIO-CORRIDOR A DESIGN FOR TRANSITIONS

Academic Work
Praxis I at Carnegie Mellon University
Fall 2022

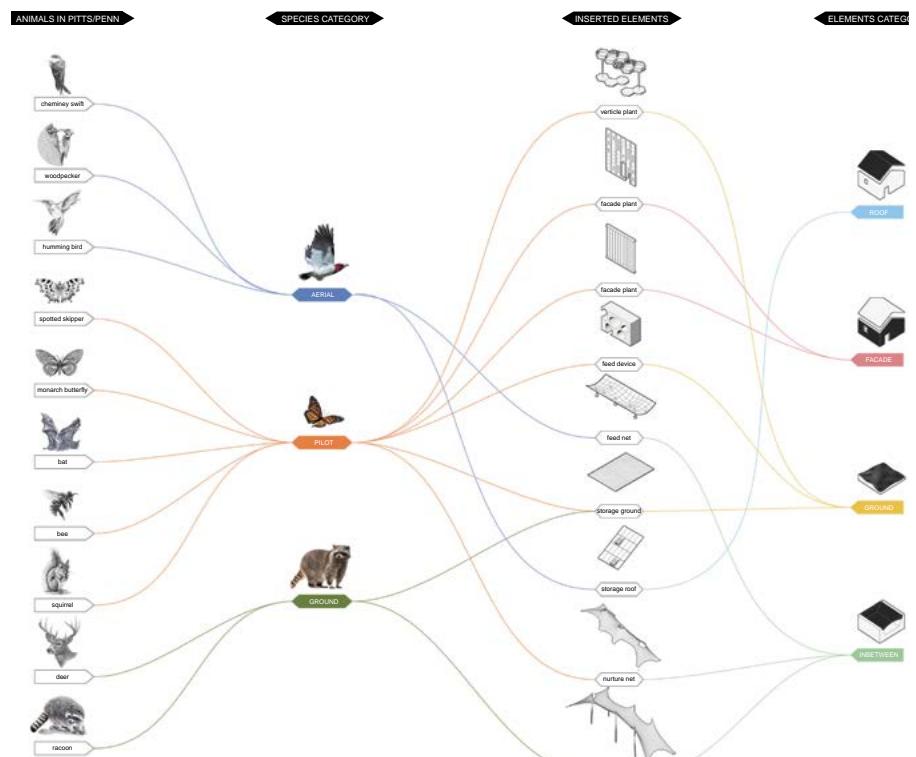
Our project focuses on and uses biodiversity methods to reshape the urban ecological environment and propose anew way of life between people and nature. We want to be able to reconstitute an ecological corridor in Pittsburgh over time through the implantation of various ecological devices. We study the relationship between people and animals in the Pittsburgh city through urban environmental analysis. We found ecologically valuable green habitats in Pittsburgh and studied the relationship between these green spaces and the urban environment. Further, based on urban research, we found sites that could become new stable habitats.

We selected six site situations with different characteristics throughout the ecological corridor: residential areas, industrial areas, parks, public open spaces, and transportation hubs. By analyzing the characteristics of different sites, we propose a flexible combination of ecological plug-ins. These plug-ins study to meet the needs of different animal habitats and human activities, with the aim of promoting the interaction between humans and different organisms. We hope that through this method, we can adapt to the needs of different urban environments and people with different living habits.



Pittsburgh Green Development Mapping

By using the railroad as a green corridor to promote the growth of patches, the city's green resources can be connected as a whole over a longer period of time.



Species and Plug-in System

Endangered animals in Pennsylvania are classified into three categories and four different kinds of intervention devices are designed to restore animal habitat.

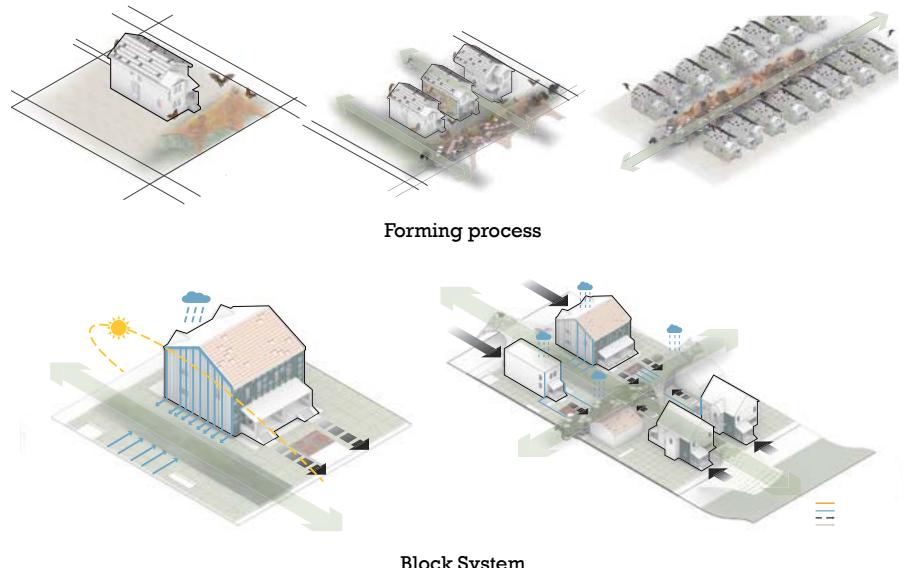


Animal Behavior Analysis

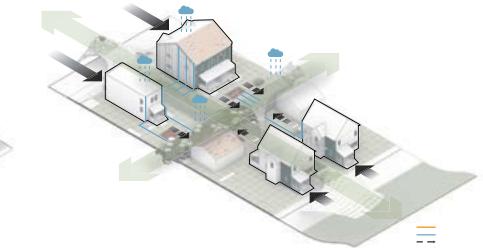
Woodpeckers have a habit of hiding their food in cracks, such as the gaps between roof shingles.



Site Concept Model



Forming process



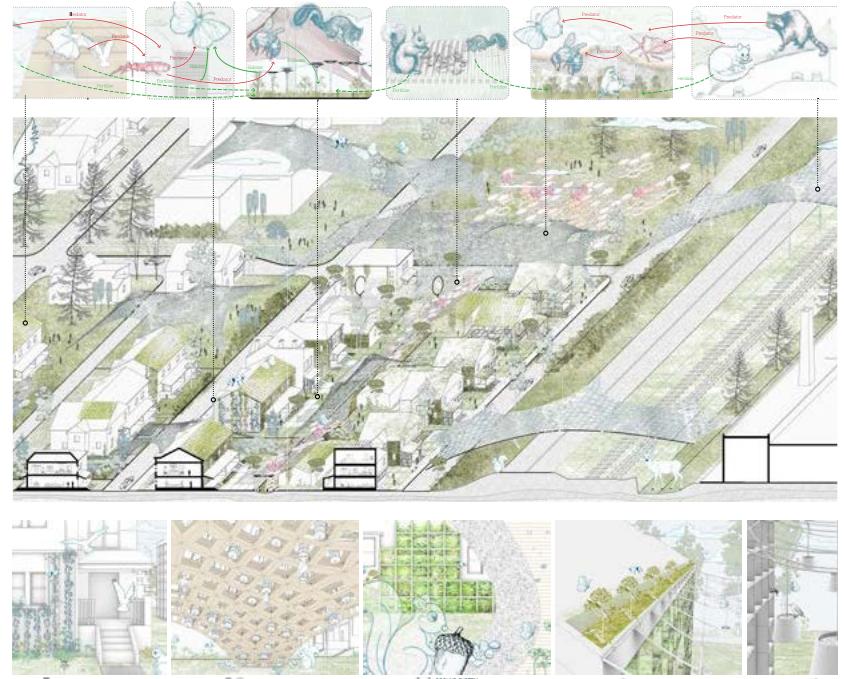
Block System

The whole system changes the way of life in the neighborhood, the way of transportation in a variety of ways. Changes in the entire area originate from a single family, and then slowly expand to the entire neighborhood. The family contributes the front yard space and gradually forms a bioswale.



Neighborhood Renovation

Shutting down the one-way streets between blocks and converting them into bioswales while creating spaces for public activities. The central bioswale extends on both sides to the front and back yards of each house. In this way, the design hopes to promote the development of the community as a whole, rather than the development of individual families.



Neighborhood Ecological Scenario



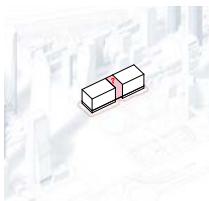
06

SHKP FUS MIXED-USE DEVELOPMENT COMBINED WITH TOD

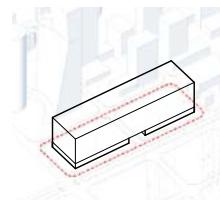
*Professional Work
Intern Project in Pelli Clarke & Partners
Spring 2022*

SHKP FUS is a mixed-use development combined with TOD in the Shenzhen City. The site is located in the Shenzhen Bay Super Headquarters Base. The potential of convenient transportation and unique landscape views provided the project a great chance.

The project integrates three major functions: office, culture, and commerce. The key to the design is to continue the urban ecology and create a green cross. It also links the surrounding buildings and integrates the development with multi-functional functions such as urban rail transportation. In addition, the 'infinite' form is used in the architectural shape to create a future image and emphasize the character of the city.



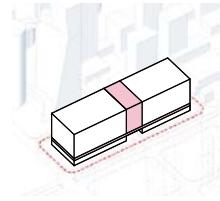
1. Integrated Plots
Occupying two rectangular bases but part of the area is located above the municipal road.



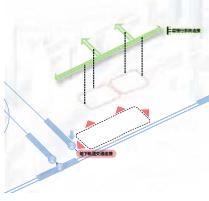
1. Massing
The horizontal volume spans over the road and occupies two parcels of land.



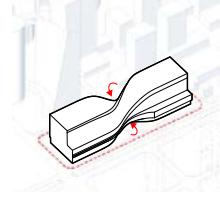
2. Ecological continuity
Excellent view on the central park side, but the problem of how to effectively respond to the park.



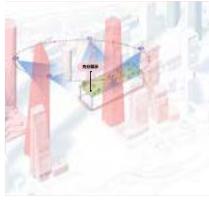
2. Culture introduce
The middle part introduces cultural functions to enliven the city atmosphere.



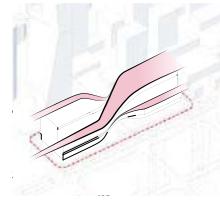
3. TOD complex development
A transportation hub with high pedestrian flow while the problem is how to interconnect with the surrounding parcels.



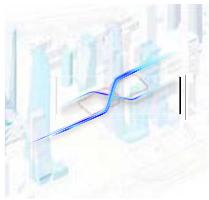
3. Twist
The southern part of the volume is inward by a certain distance, and the two wings are twisted to form an x-form.



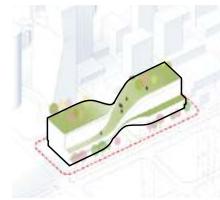
4. 'Ultra-low' height
Surrounded by high-rise buildings means a great potential for a fifth façade design, but the question is how to stand out?



4. X path
The roofs on both sides continue to form an x-shaped road.



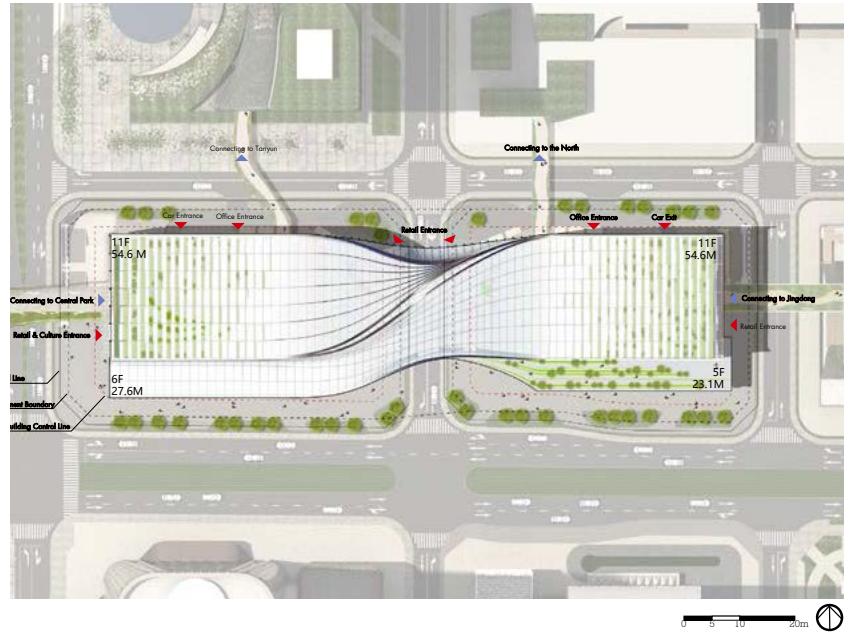
5. Futuristic shaping
Surrounded by outstanding architectural works, the key point is how to respond to the city's aspirations for future development.



5. Roof green
Rooftop greening to continue the ecology and dialogue with the central green axis.

Design Challenges and Strategies

The site's excellent location and natural resources present both significant opportunities and challenges for the project. The x form continues the city's main development lineage, it is futuristic while vitalizing the urban interface, and connects to the central park green axis, foreshadowing a sustainable future.



Site plan

The fifth elevation clearly shows the x-shaped volume of the building. A terrace is left on the south side to provide an urban viewing platform, while the remaining three sides are connected to the surrounding buildings.



Futuristic Ridge of the City

The permeable curved shape reinforces the futuristic concept and continues the urban vein.



Central Atrium

The atrium space continues the design concept, forming a cultural flow line that circles upwards, connecting the external city road with the living room.



City's Living Room

The atrium with a high ceiling combined with a twisted glass enclosure creates a display space that combines technology and culture.



Integrated Development

The building integrates urban transit development with a central park, commercial offices, and cultural arts.

ATCHAIN | IN