XINNING HUA

GSAPP MSAAD
2019–2020

STUDIO WORK

+

BUILDING SCIENCE & TECHNOLOGY

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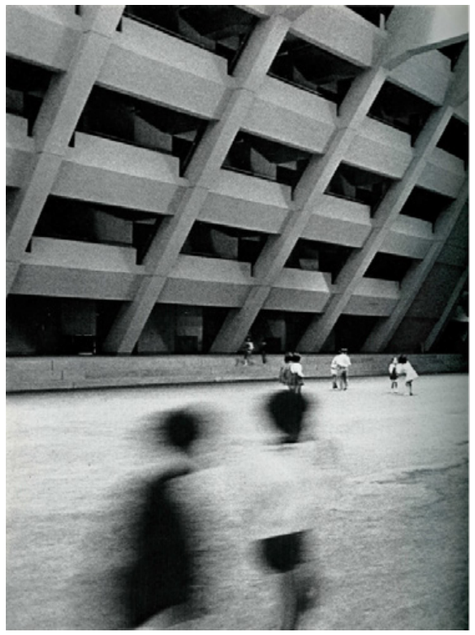
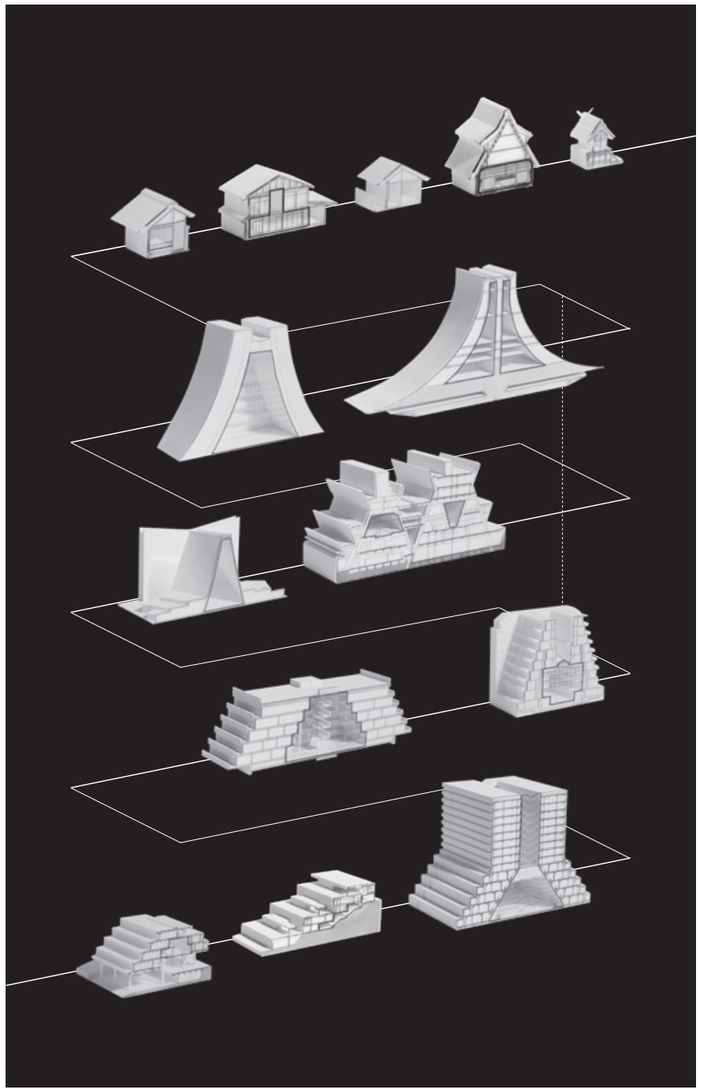
STUDIO WORK

川崎市河原町
高層住宅団地



Kenchizu Bunka_1972_DEC_Kawaramachi High Rise Apartment Houses in Kawasaki City_314-103



01

Double the Surface

A–Framed Structure and Urban Publicity in Japan

2020 GSAPP Spring Studio
Critic: Enrique Walker
Partners: Qifeng Gao, Yechi Zhang, Haitong Chen
Individual Contribution: Conceptual and Overall Schemetic Design, Site/Housing/Library Modeling and Drawings

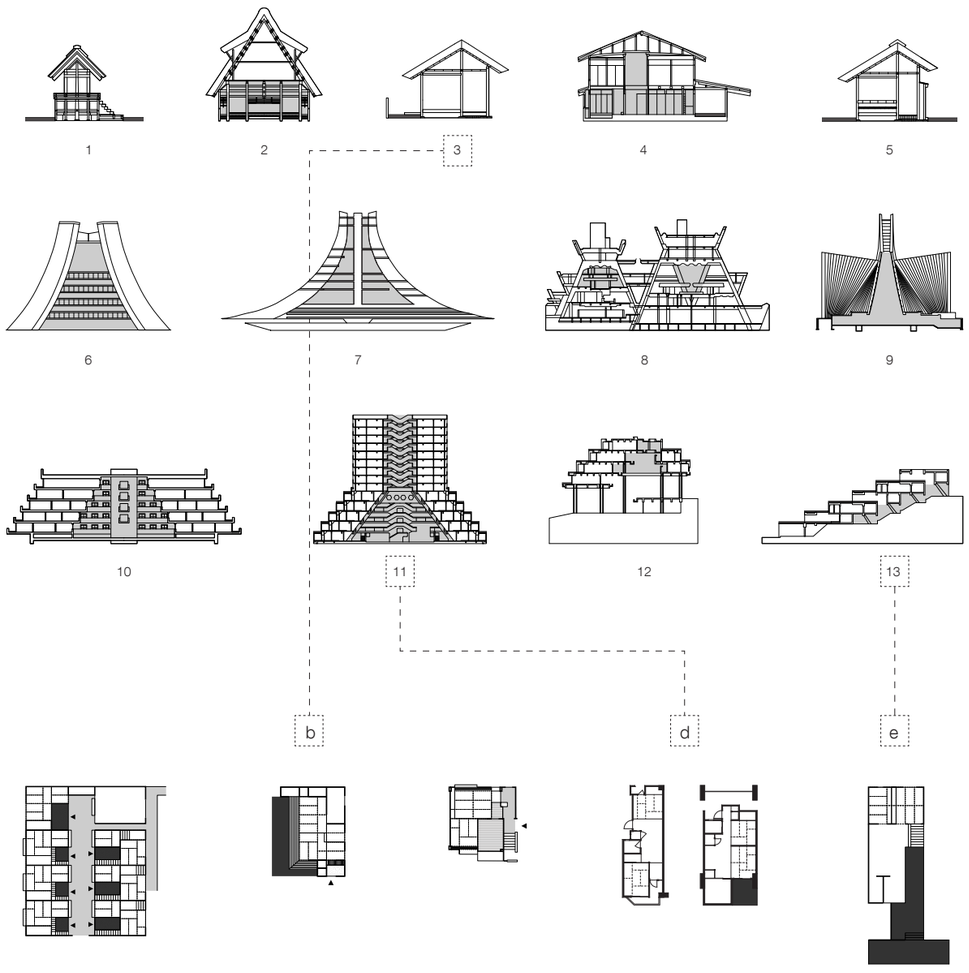
Kawaramachi Housing Project is an A-framed megastructure housing complex designed by Japanese architect Sachio Otani located in Kanagawa, Japan. Over the time with the fall of Danchi, a cluster of apartment buildings, it is fading away nowadays because of cramped living space and the aging envelope.

By transforming housing types, the old A-framed atrium will be extended to an even larger A-framed campus in the middle. Public space here will be doubled, followed with a clash of a new college program to the existing residencial complex. Individual housing units are also doubled, to trace back to the life in Nagaya with new tiered housing structure.

In this way, A Frame here is no longer an island swimming in the sea of nothingness, but an urban approach that bring publicity to the city.

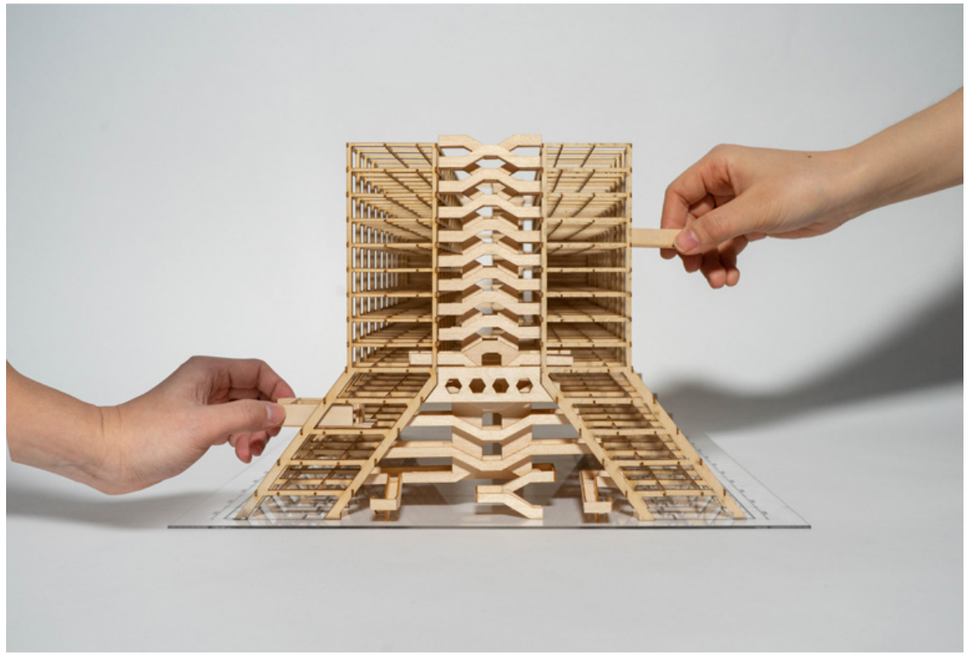
Kawaramachi Housing Project in Japanese Architecture Genealogy

The A-framed structure makes this Danchi project an extraordinary one. As the result of this special form, this building was embeded with three important features: A-framed shape as the Japanese symbol, semi-open atrium as interior public space, and tiered units as new Japanese housing typology.



1. Ise Shrine, 500. 2. Gashho House, 1200. 3. Nagaya, 1500. 4. Machiya, 1600. 5. Katsura Villa, 1750. 6. Boston Bay, Kenzo Tange, 1959. 7. Tokyo Bay, Kenzo Tange, 1960. 8. Kyoto International Conference Center, Sachio Otani, 1963. 9. St. Mary's Cathedral, Kenzo Tange, 1964. 10. Tree Shaped Community, Kionori Kikutake, 1968. 11. Kawaramachi Housing Project, Sachio Otani, 1970. 12. Pasadena Height, Kionori Kikutake, 1972. 13. Hirato Resort Hotel, Kuni Ken, 1977.

a. Nagaya Small Units Collection, 1500. b. Nagaya Big Unit, 1500. c. First 2DK Unit, JHK Danchi, 1951. d. Kawaramachi Housing Project Housing Units, Sachio Otani, 1970. e. Pasadena Height Unit, Kionori Kikutake, 1972

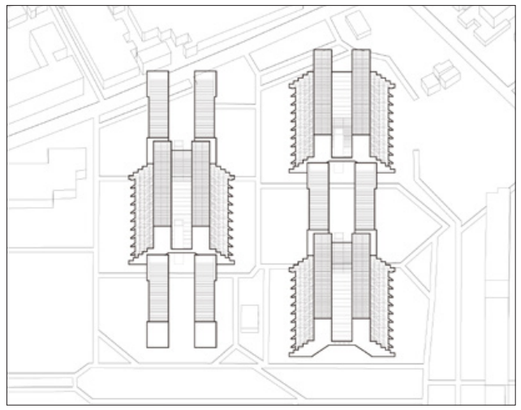


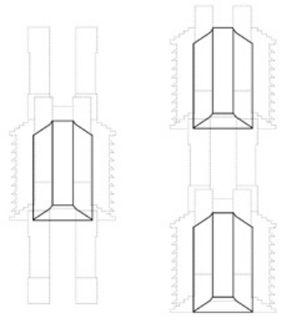
▲ A-Framed Housing Structure Model

▼ Kawaramach Housing Porject Aerial View

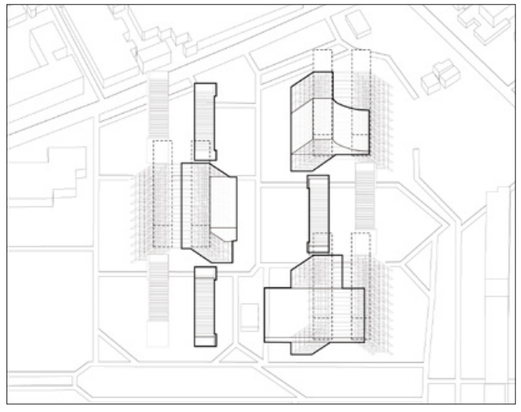
Transform Isolated A–Frame to an Urban Approach

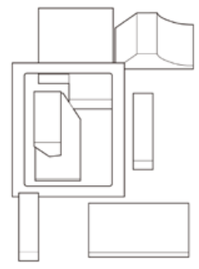
In original scheme, the A-framed atriums are far from lively. Not only because they are isolated from the urban context, but also lacking of programs. By transforming the housing structure above, we can integrate these semi-public space to a mega urban structure.



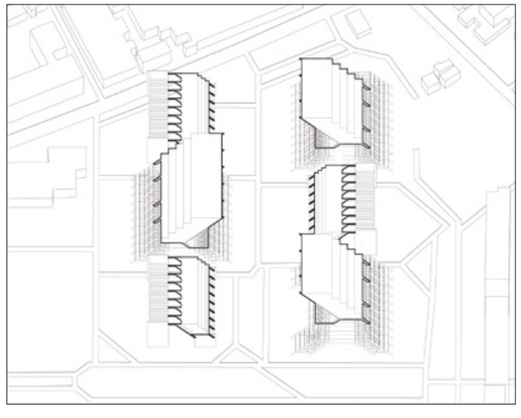


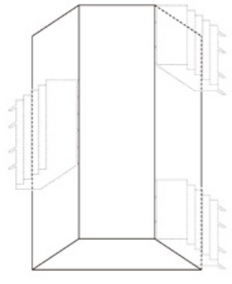
1. Original Isolated A-Framed Atriums



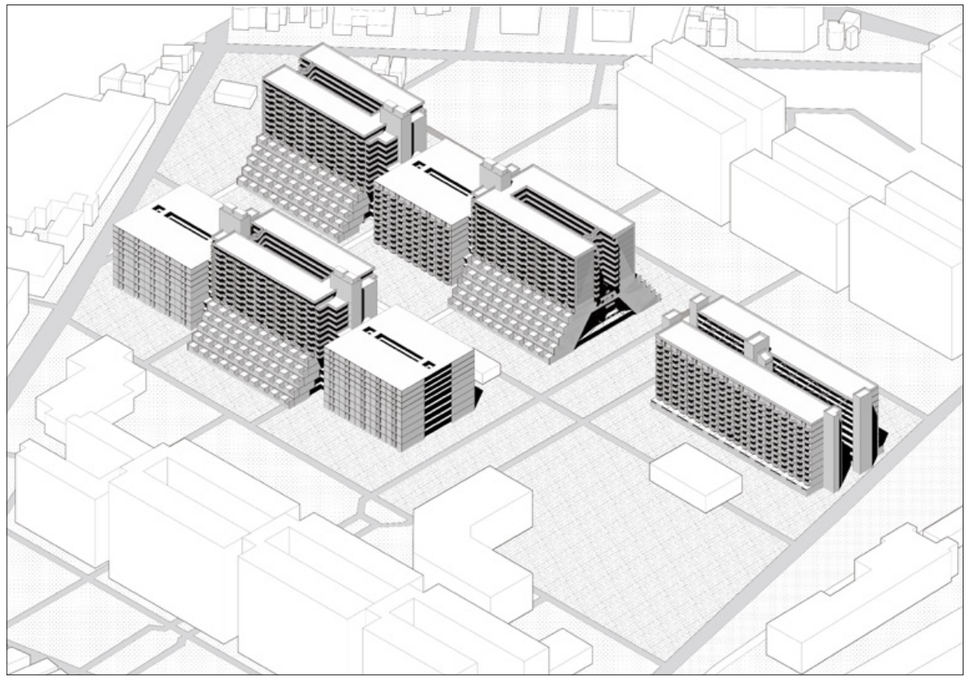


2. Integrated Public Programs



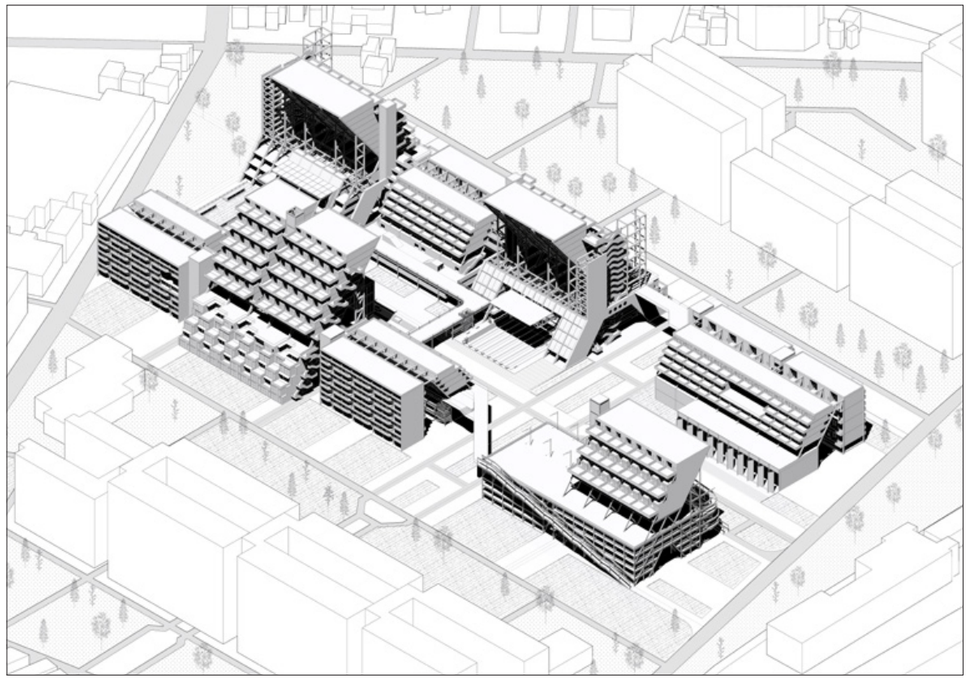


3. A-Framed Mega Urban Structure



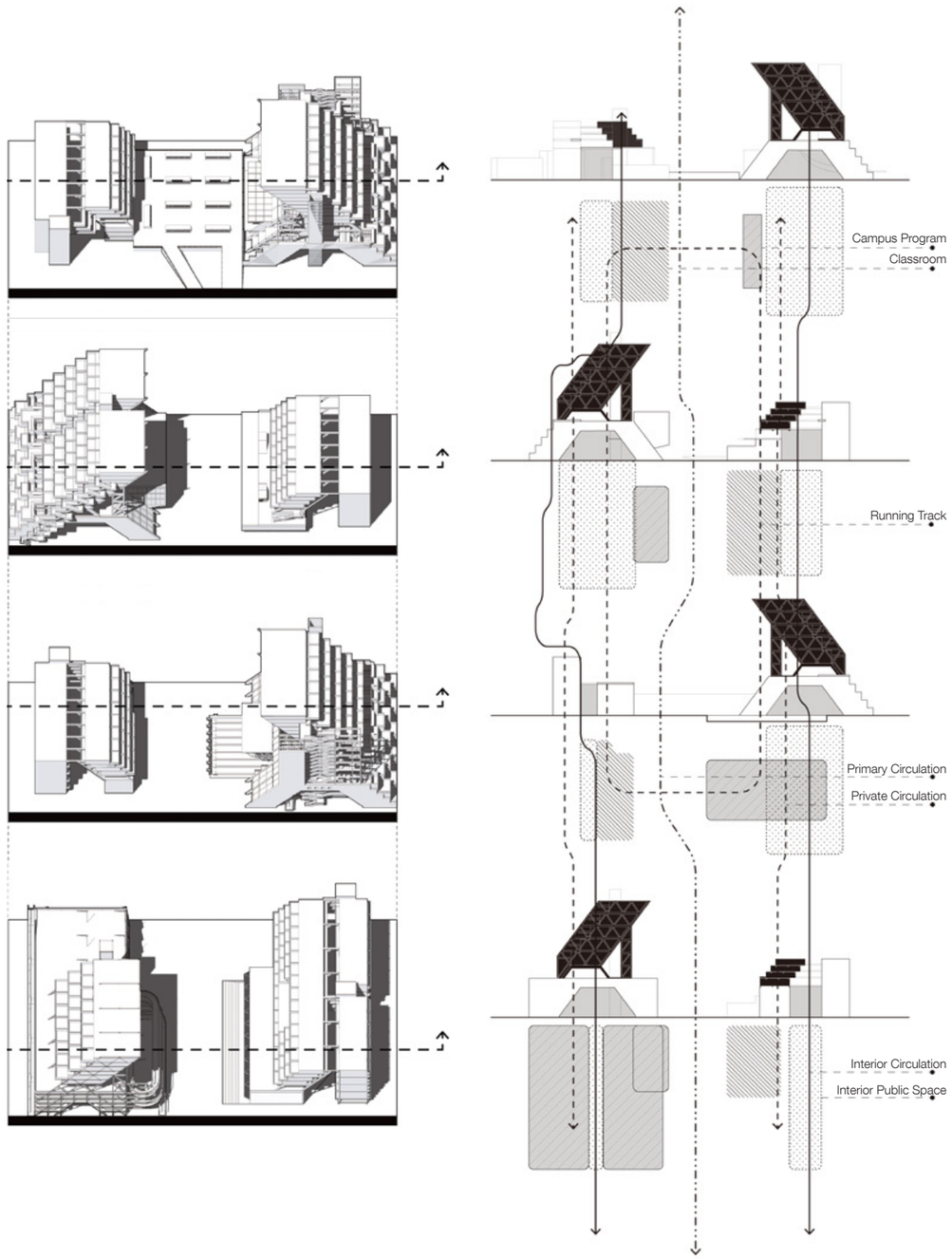
▲ Original Project Designed by Sachio Otani

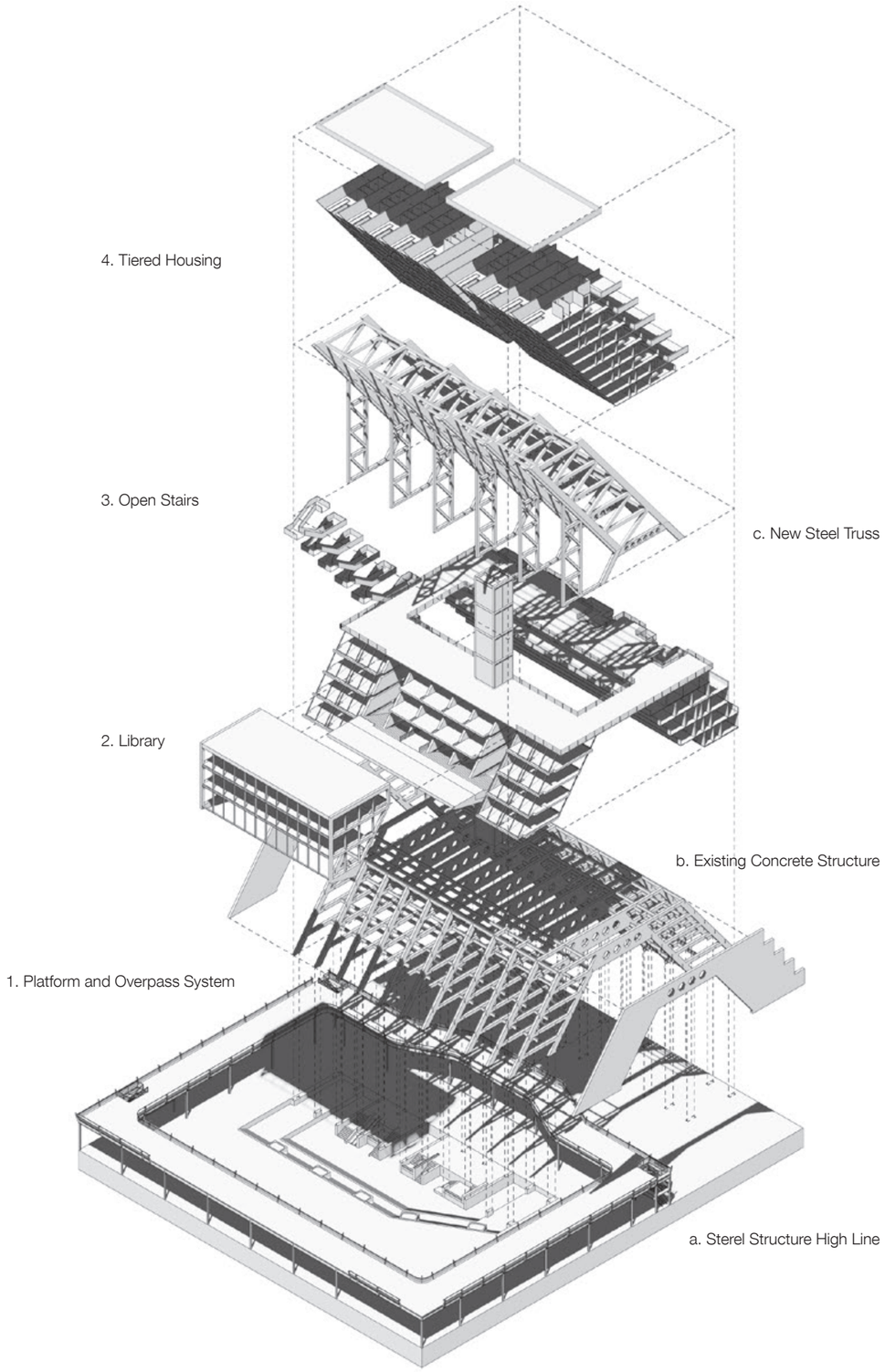
▼ After Doubling the Public Surface



Overlapping Campus and Housing

The new gallery space is now a linkage that ties the campus to the community.The new internal atrium space is now occupied with different programs such as auditorium and leisure area for students. The central framed space is now open to the public and reactivated by the neighbors.



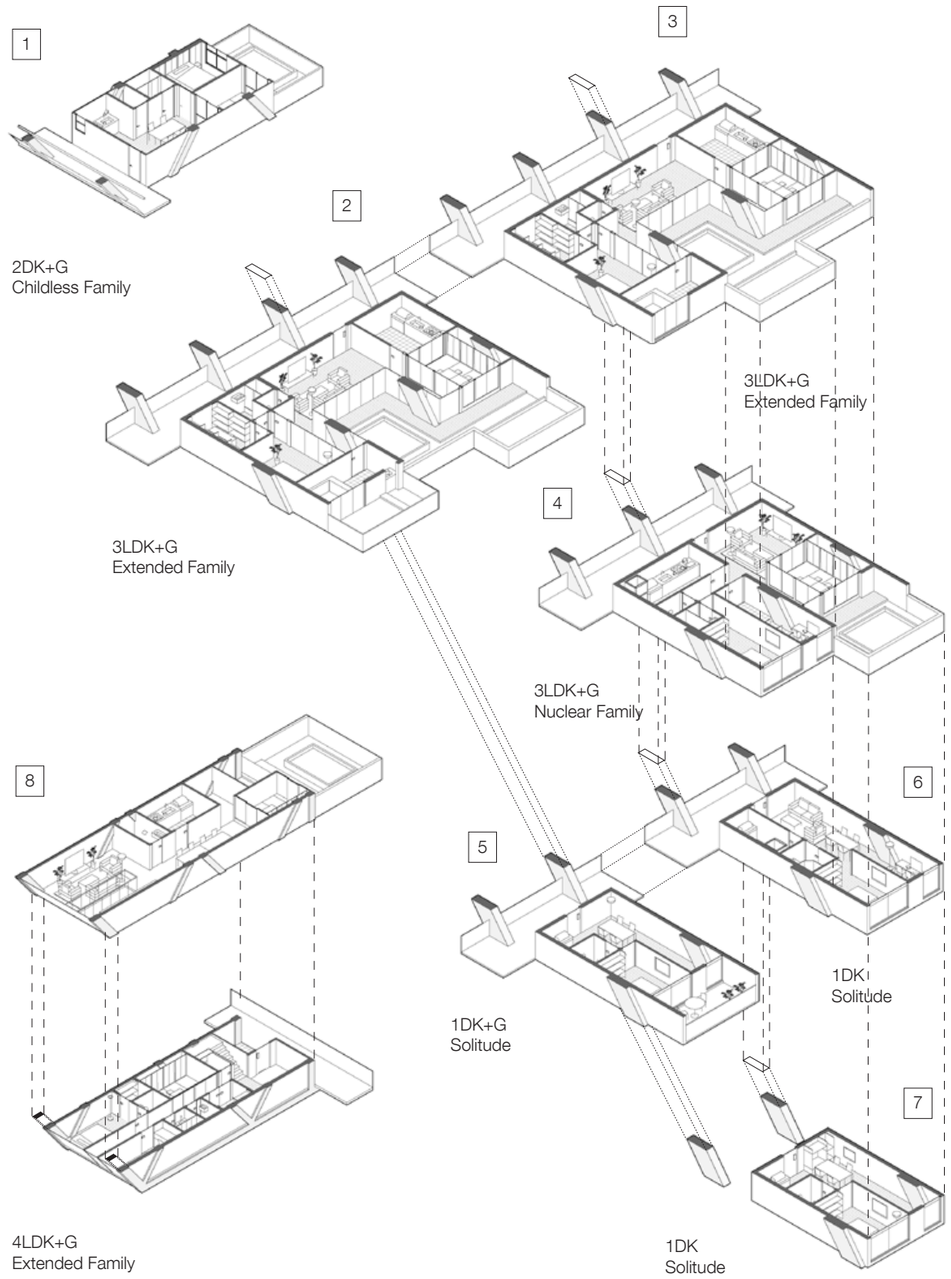


Lower Level Renovation on Existing Concrete Structure

Based on the existing structure grids, we reorganized the ground level programs to revitalize this site. New Interior basketball court, swimming pool and auditorium will serve both campus students and residents above.

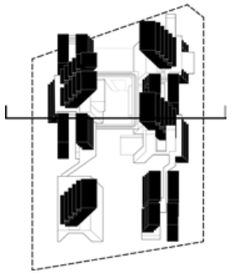
New Housing Units in Tiered Structure

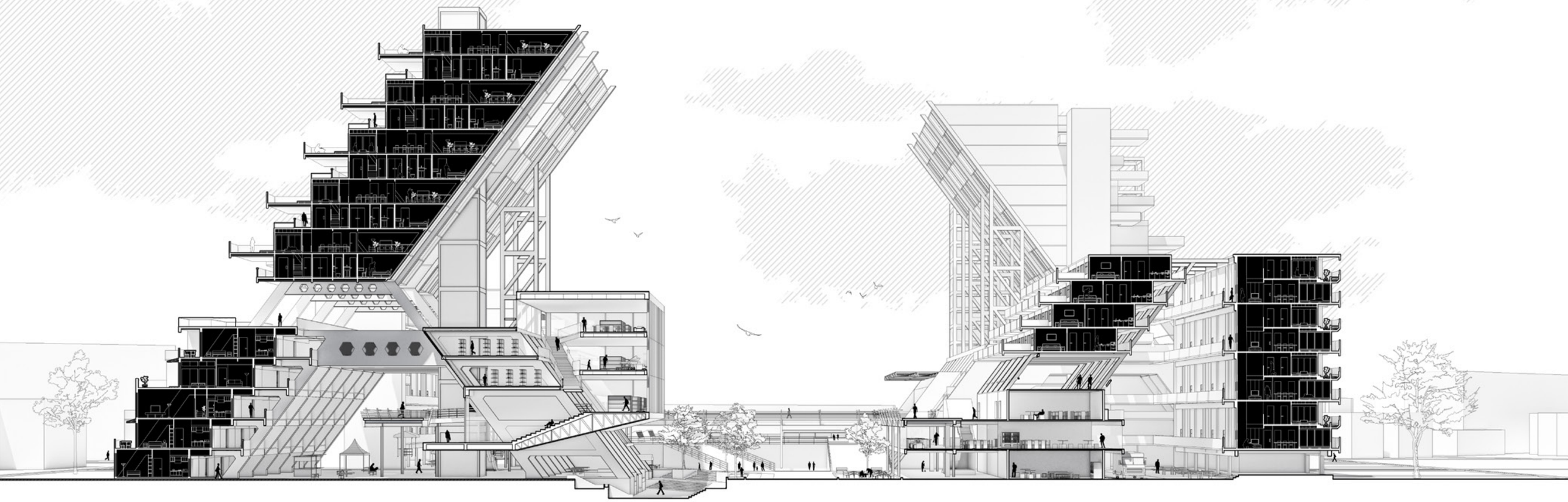
Japanese cherish the tie between family members.Compared with apartments like Danchi, they prefer to live in there own house with family. Before the 2nd World War, there is no housings more than 3 floors. All housings are 2-storie buildings with yard, orgin from Nagaya during Edo period.



Swimming Pool

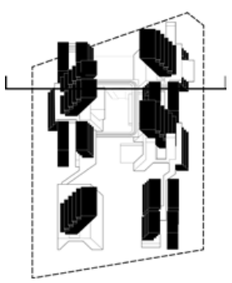
This is a connection from the old interior, a frame space to the even larger A framed campus, where the school activities become a tie between two different identities.

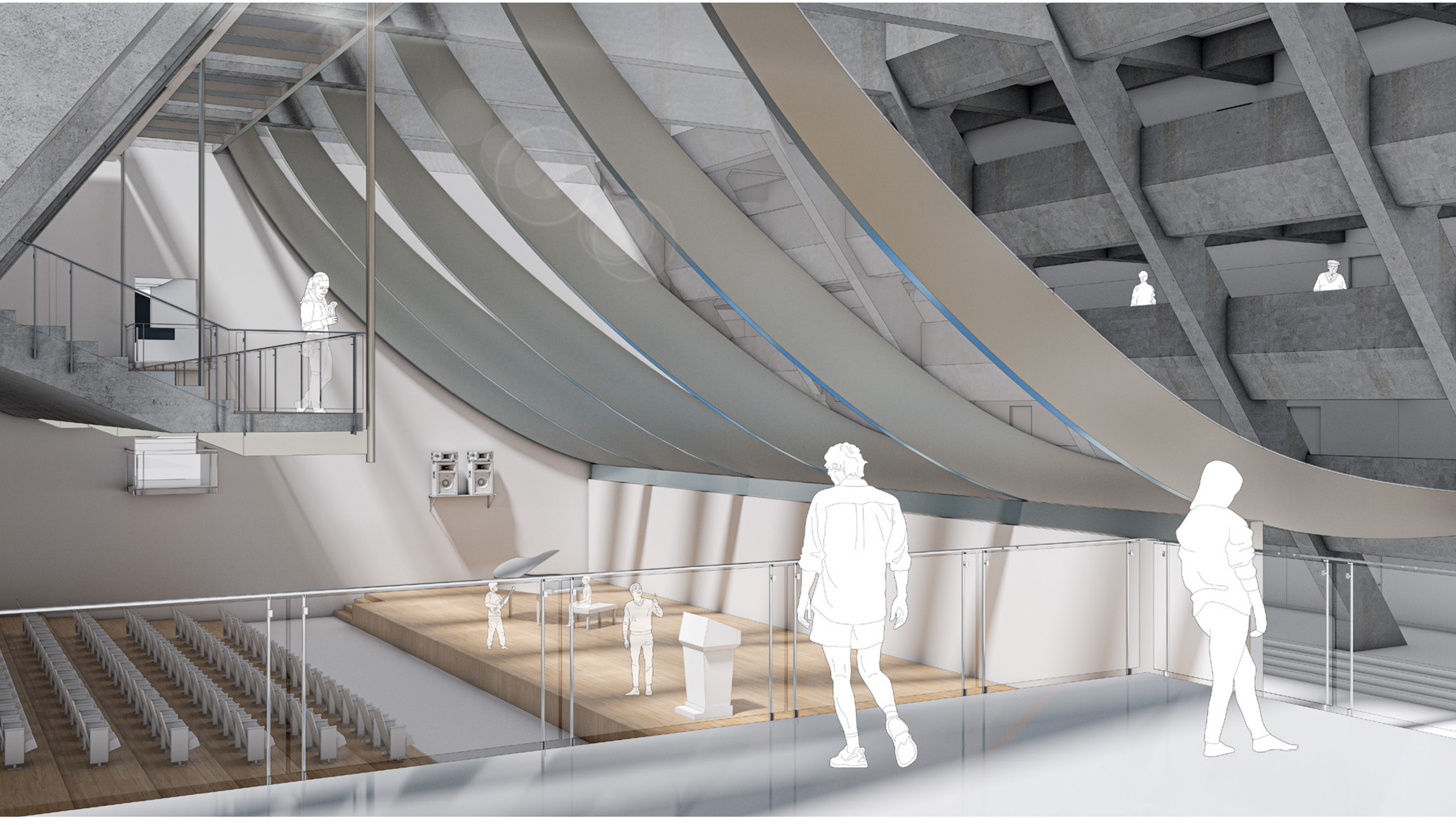


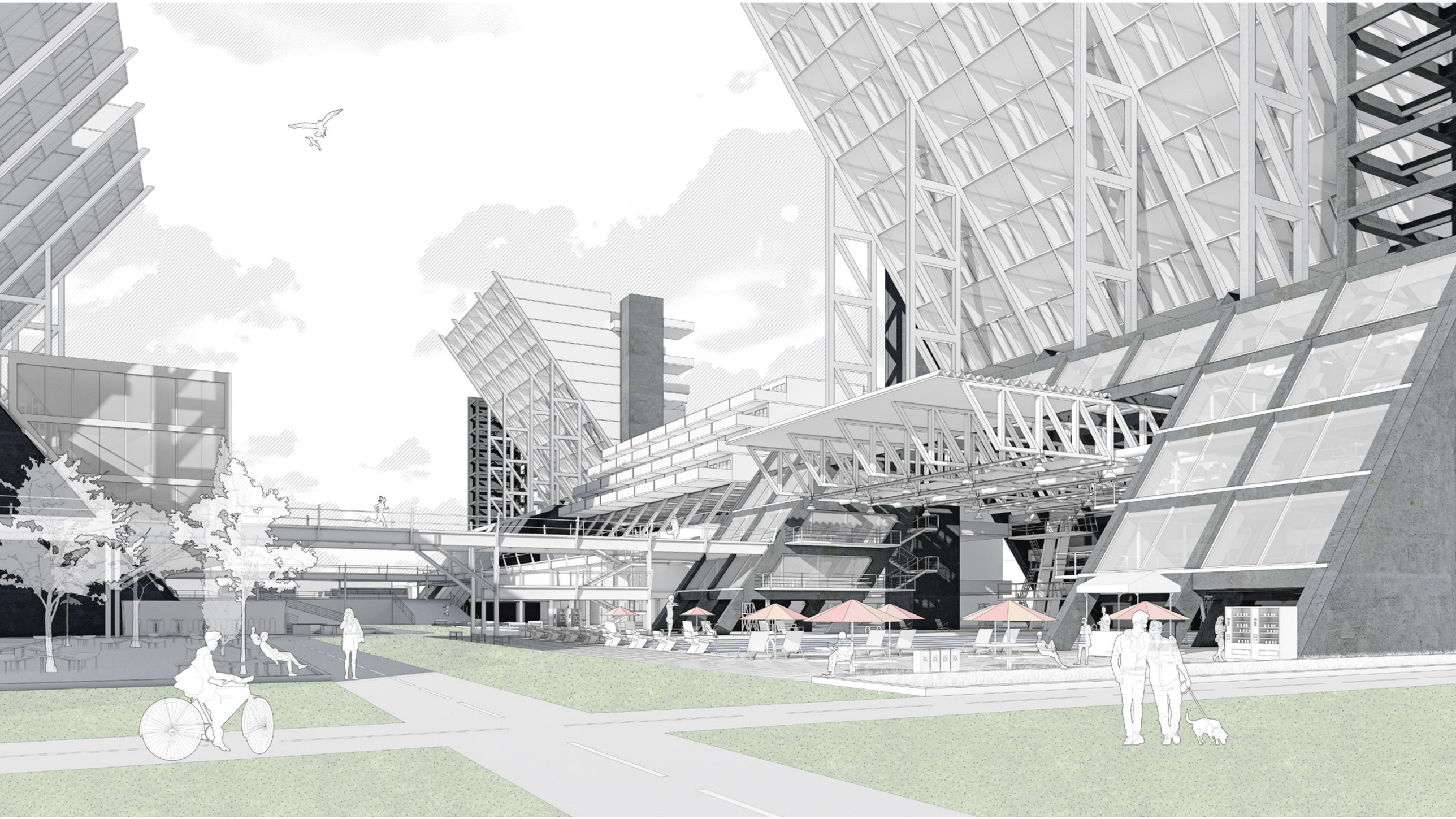


Library & Dining Hall

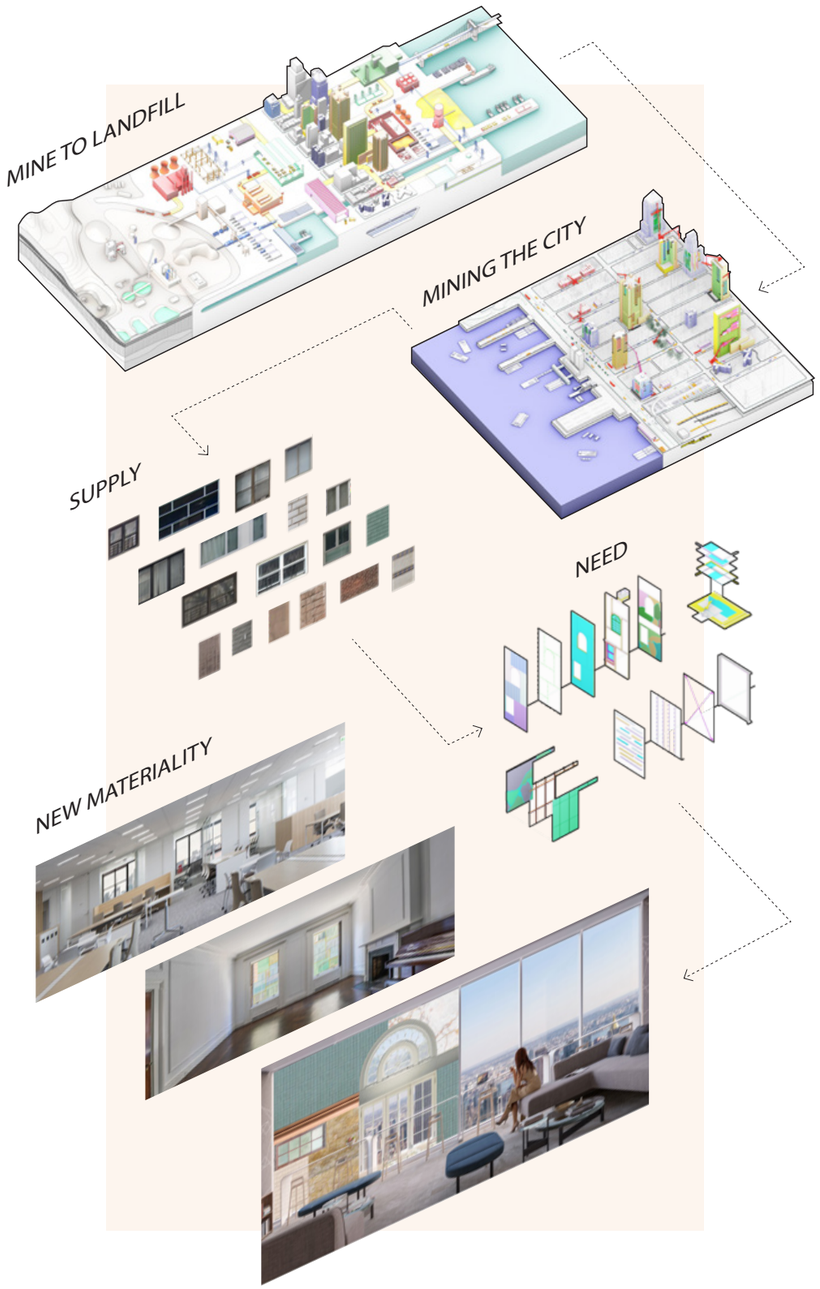
This is a connection from metabolism to contemporary architecture, where the doubled surface redefined the old megastructure and revitalized urbanism.







DeCarbonized Design_www.decarbonizedesign.com



02

Mining the City

A Just–In–Time System of NYC Building Upgrade

2019 GSAPP Fall Studio
Critic: Andres Jaque
Partner: Yining He
Individual Contribution: Co-led Conception of Design, Technical Study of Material, Modeling and Drawings, Mock-Up Making

We human have come to the point that saving our living environment is in an emergency. Dec. 2015, Paris Agreement sets out an ambition to limit climate change and temperature rise to well below 2°C, with efforts to limit this to 1.5°C.

According to Green New Deal, 2°C means all existing buildings in the United States should be upgraded to achieve maximum performance. However, upgrading with traditional construction contains massive embodied energy, which would rise from 32% to 67% if we upgrade our building in conventional mine-to-landfill mode.

So instead of mining nature, what if the materials we need are already in our city? To treat our city as a production system, different building types provide different materials supply, and at the same time require materials to retrofit. Therefore, a Just-in-Time system of material exchange is a must to deal with climate change as an emergency.

Material Footorint of Mine–to–Landfill

Embodied energy is all of the energy required to extract, transport, manufacture and assemble material into buildings, which would increase dramatically if upgrading buildings in a conventional way.

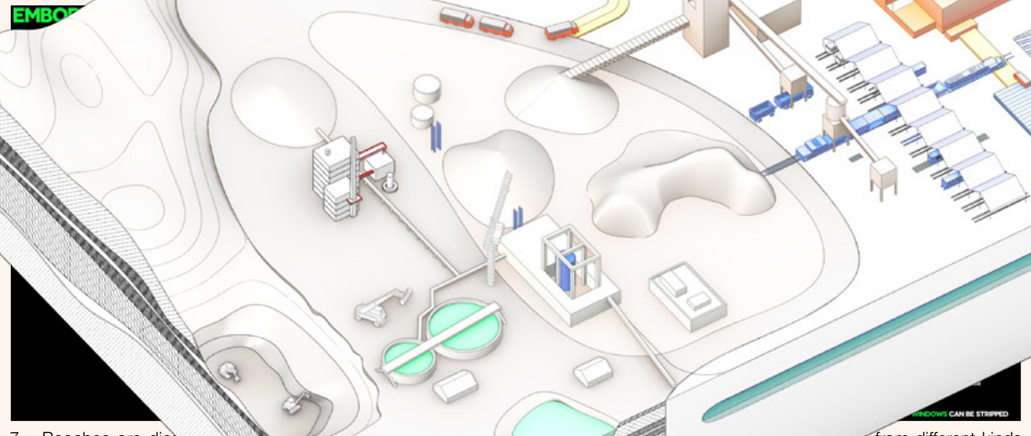
1. How to achieve building upgrade in real time.

2. Conversations between buildings that need to be upgraded.

3. C

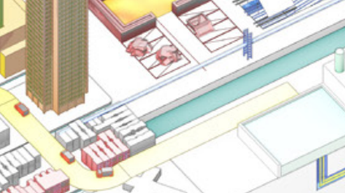
4. To achieve the goal, all
NYC need to be up

7. Beaches are disa
sand mining for cons



is from different kinds
in NYC.

16. The first life and second life of materials.



17. Interview record from law school professor.

18. Let's swap material to achieve builidng upgrade.

15. Different strategies of performance improvement for different buildings.

14. Huge cranes moving materials from one buildings to another.

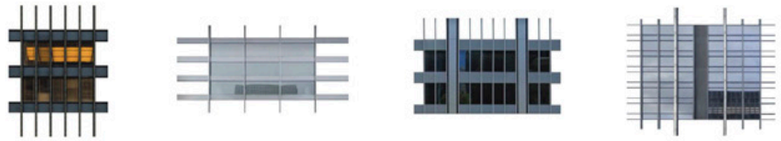
for the view after
xchange.

https://vimeo.com/379396731
Why We Need A Real-Time Material Exchange System

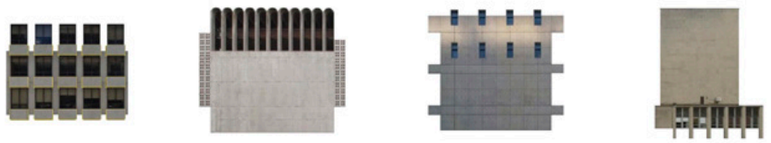
From Mining Nature to Mining the City

An abundance of materials on existing buildings could be available to be exchanged and mobilized to fullfill performance improvement.

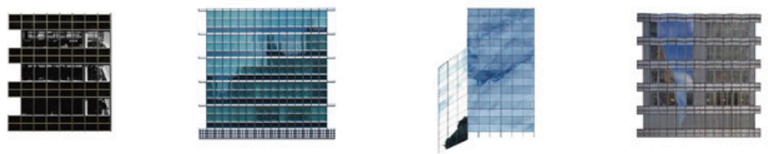
Available Decorative Steel



Excessive Stone



Excessive Curtain Wall Glass



Available Office Partition Wall

Low Performance Window Glass

01_ Townhouse
Supply: windows
Need: glass, windows, windows

02_ Post-War Tower
Supply: stone, bricks, windows
Need: glass, windows, windows

03_ Glass Towers
Supply: glass
Need: solid panels, windows

Materials are Exchanged to Fullfill Performance Improvement for All

Insulation Improvement
1. with used insulation frame&foam

Brise Soleil Assembly
2. with decorative tiles
3. with curtain wall steel frame

Window Update
4. with curtain wall steel frame
5. with asbestos for glass
6. with townhouse windows

Window-to-Wall Ratio Improvement
7. with curtain wall glass
8. with solid panels collections

surface protection
scaffold

Glass Replace
Fabricated IGU Window

1-4 FAMILY HOME;
MULTY FAMILY PRE-WAR
BUILDING AREA
41.5%
GHG EMISSION
30%
TARGET FULFILLMENT
6.08 - 9.12%

Glass Replace
IGU Window

security curtain
cable for mateiral
extension ladder

Glass Replace
Double Layer

metal joint
existing window
overlap window

Sunlight Motion in Different Season

COMMERCIAL VERY
LARGE
BUILDING PERCENTAGE
5.9%
GHG EMISSION
11.7%
TARGET FULFILLMENT
4.86 - 5.27%

fabricated panel
bracket system

Reduce Radiation
Add Brise Soleil

scaffold

Vertical Shading

Wall Insulation Diagram

COMMERCIAL
PRE-WAR
BUILDING PERCENTAGE
6.1%
GHG EMISSION
12.2%
TARGET FULFILLMENT
2.17 - 2.78%

Façade Extension
Shading Units

replacing wall unit
insulation unit

dry wall cart
buck hoist
construction barrier

Seagram Facade Detail

Mies I-Beam

Improve Window-to-Wall Ratio
Remove Decorative Steel

Glass Replace
IGU Window

sliding rail
curtain wall window
drywall cart
scaffolding

Aerial View

Single Pane Window

scaffold

1-4 FAMILY HOME;
MULTY FAMILY PRE-WAR
BUILDING AREA
41.5%
GHG EMISSION
30%
TARGET FULFILLMENT
6.08 - 9.12%

metal joint
mobile frame
frame rail

HOK Precast Building System

Reduce Radiation
& Improve Ventilation

COMMERCIAL VERY
LARGE
BUILDING PERCENTAGE
5.9%
GHG EMISSION
11.7%
TARGET FULFILLMENT
4.86 - 5.27%

Brise Soleil

COMMERCIAL
PRE-WAR
BUILDING PERCENTAGE
6.1%
GHG EMISSION
12.2%
TARGET FULFILLMENT
2.17 - 2.78%

brise soleil panels
flexible frame system

Reduce Radiation
Add Brise Soleil

fabricated IGU
double window

robot arms
assemble surface
cherry picker

south facade shade
west facade shade

Façade Recalding
Improve Insulation

Wall Insulation

safety fence
scaffold platform

Townhouse Reclad

Window AC

Fabricated Double Pane Window

MULTI-FAMILY HOME;
MULTY FAMILY PRE-WAR
BUILDING AREA
41.5%
GHG EMISSION
30%
TARGET FULFILLMENT
6.08 - 9.12%

Glass Replace
Double Layer

window improve
wall recladding
wall insulation

cherry picker
forklift

On-Site Fabrication
IGU Window

Glass Replace
Fabricated IGU Window

New Aesthetics of New Materialality

Materials would be dismantled, transported, fabricated and remounted as a common scene in our future city. A new aesthetic is introduced to our city with existing building languages.

Facts

Commercial Post–War Buildings

Building Area

2.1%

GHG Emission

12.2%

Target Fullfillment

2.17% – 2.78%

Commercial Very Large Glass Towers

Building Area

5.9%

GHG Emission

11.7%

Target Fullfillment

4.86% – 5.27%

Multi–Family Home Townhouse

Building Area

41.5%

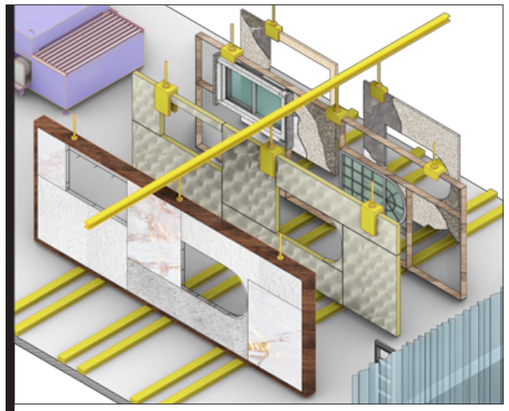
GHG Emission

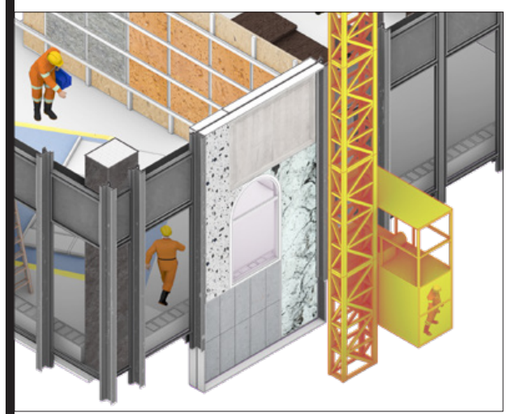
30%

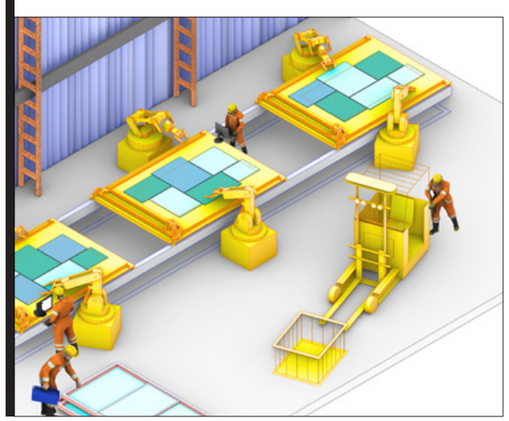
Target Fullfillment

6.08% – 9.12%

Machinary







Working Site

High Performance Building Element Mock–Ups Making

01_ Used Glass

Clear Ribbed Glass Luxfer Tile, 4 in. square x 0.125 in. D, used for window glass.

02_Used Glass

60 in. H x 30 in. W x 1 in. D, with stained patterns, used for window glass.

03_Used Window

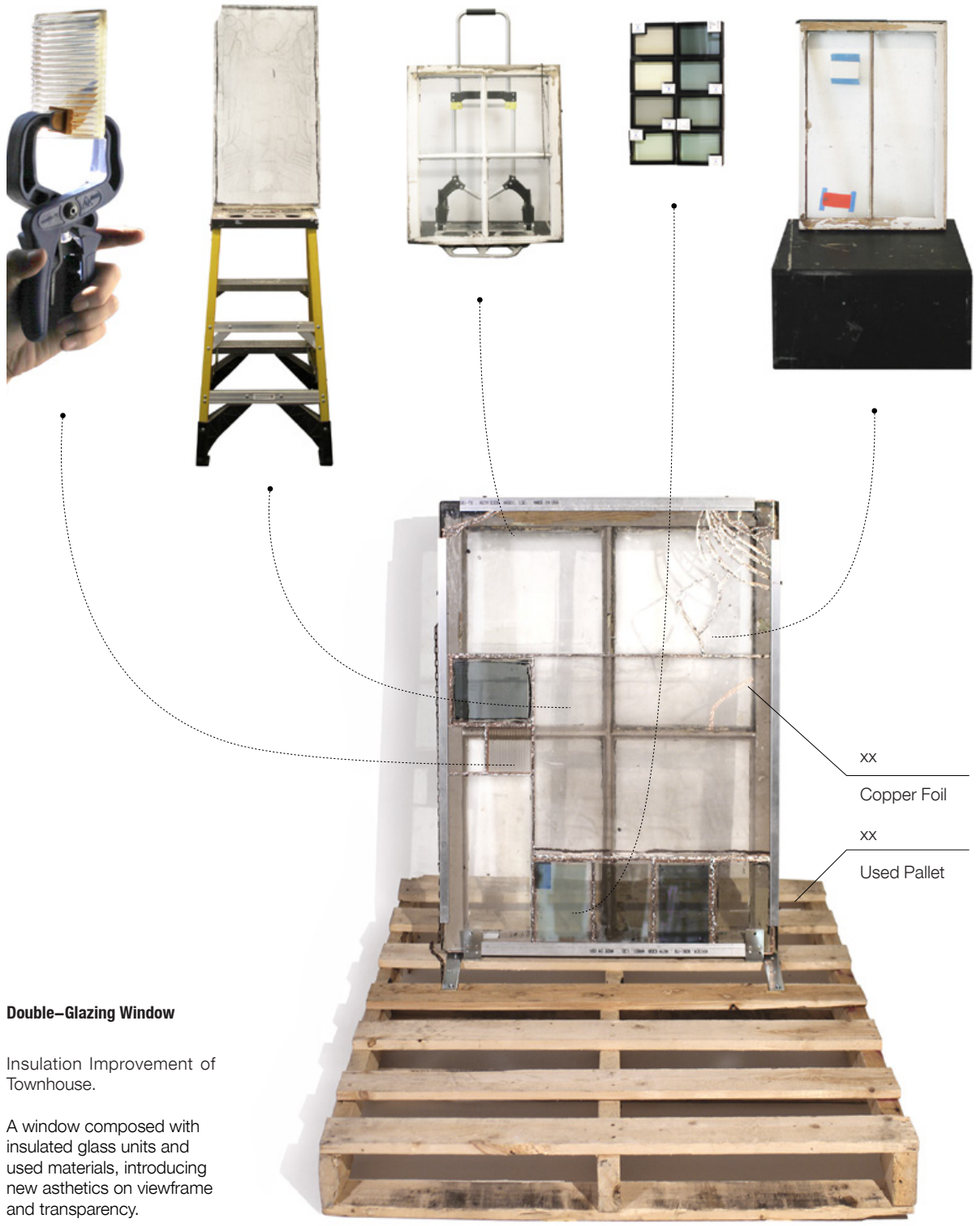
53.25 in. H x 35 in. W x 1.375 in. D, four panel wood window, used for window frame and glass.

04_IGU

1” (5” x 7”) Insulating units with black spacers and black silicone, used for window glass.

05_Used Window

55 in. H x 30 in. W x 1 in. D, two panel wood window, used for window frame and glass.



Double–Glazing Window

Insulation Improvement of Townhouse.

A window composed with insulated glass units and used materials, introducing new asthetics on viewframe and transparency.

https://ny.curbed.com/2018/12/26/18156397/nycha-receivership-federal-takeover

03

Sealing the Gap

NYCHA Public Housing Regeneration Plug–Ins

2019 GSAPP Summer Studio
Critics: Nahyun Hwang, David Eugin Moon
Partner: Rui Wang
Individual Contribution: Conception of Design, Schemetic Design, Modeling and Drawings

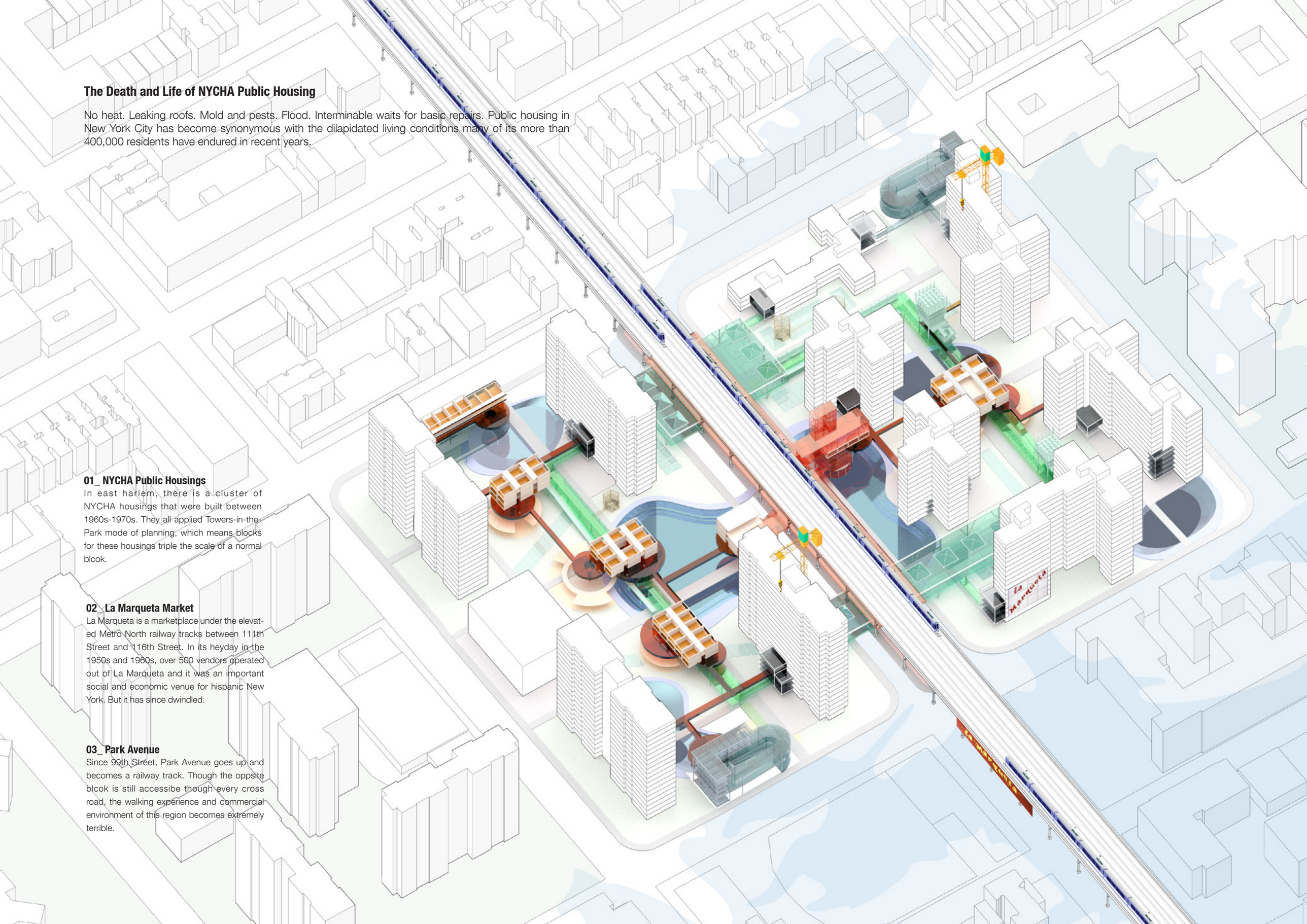
From 96th Street to 117th Street Park Avenue, NYCHA public housing, also known as Tower in the Park, is facing serious maintenance issues caused by aging and flood.

To activate the aging machine and reconnect the neighborhood isolated by super block and train track, we propose a plug in system with multi-layered programs that connect each tower on both sides of park avenue. As an infrastructure targeting at multiple issues, we highlight the flexibility of function as well as construction to deal with emerging challenges like increasing resilience towards flooding, generating revenue for maintainence through urban farming, supporting the market under bridge and anything unknown in the future.

We believe that in this way, the aging machine would come back into life with renewed vigor and generate a self-sustained system in the ever-changing world.

The Death and Life of NYCHA Public Housing

No heat. Leaking roofs. Mold and pests. Flood. Interminable waits for basic repairs. Public housing in New York City has become synonymous with the dilapidated living conditions many of its more than 400,000 residents have endured in recent years.



01_ NYCHA Public Housings

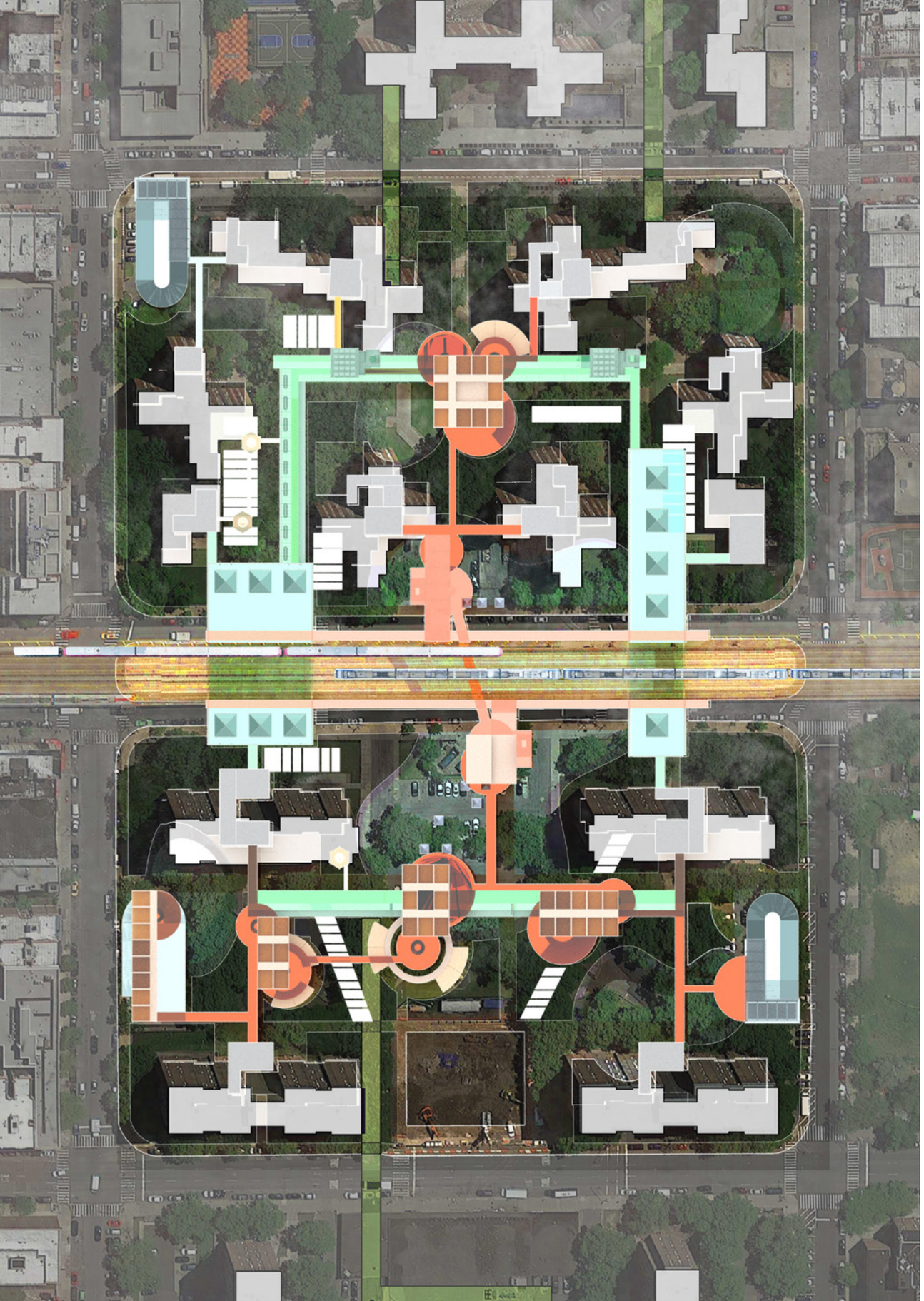
In east harlem, there is a cluster of NYCHA housings that were built between 1960s-1970s. They all applied Towers-in-the-Park mode of planning, which means blocks for these housings triple the scale of a normal blcok.

02_ La Marqueta Market

La Marqueta is a marketplace under the elevated Metro North railway tracks between 111th Street and 116th Street. In its heyday in the 1950s and 1960s, over 500 vendors operated out of La Marqueta and it was an important social and economic venue for hispanic New York. But it has since dwindled.

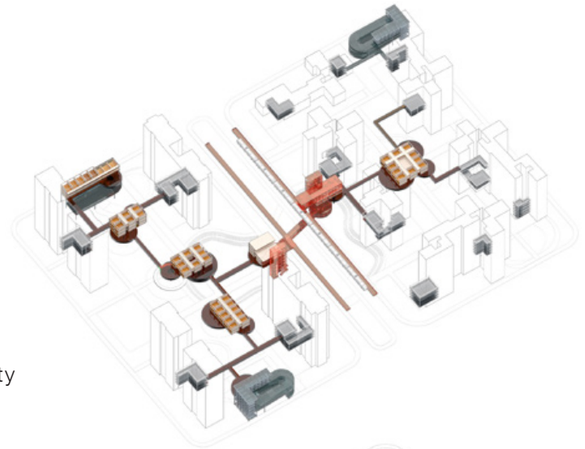
03_ Park Avenue

Since 99th Street, Park Avenue goes up and becomes a railway track. Though the oppsite blcok is still accessibe though every cross road, the walking experience and commercial environment of this region becomes extremely terrible.



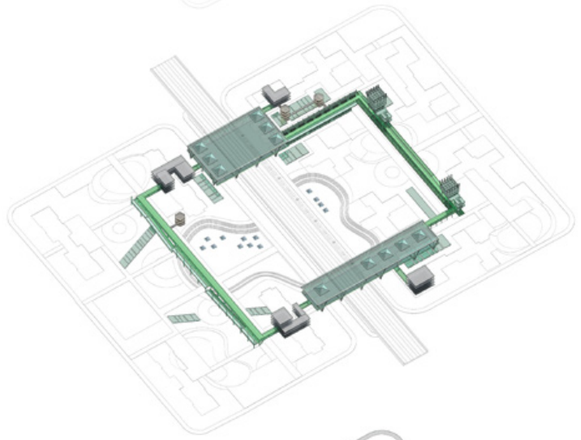
A Self–Sustained Plug–In System

Permenant structure, long lasting mechanical system, easy to change space plan and everchanging activities.



Housing Maintainence System

1. train station 2. parking garage
3. new housing units 4. community center



Organic Farming Market

1. venders 2. bee house
3. organic market 4. verticle farming

Flood Resiliance System

1. sunken plaza 2. swimming pool
3. children playground

1:100 Partial Model

Different kinds of pop-up space for different seasons and differen climate conditions.

01_Modular Housing
shelter tenants when NYCHA working on existing housings maintanence

02_Verticle Farming
here tenants could grow their own vegetations and provide food for sale

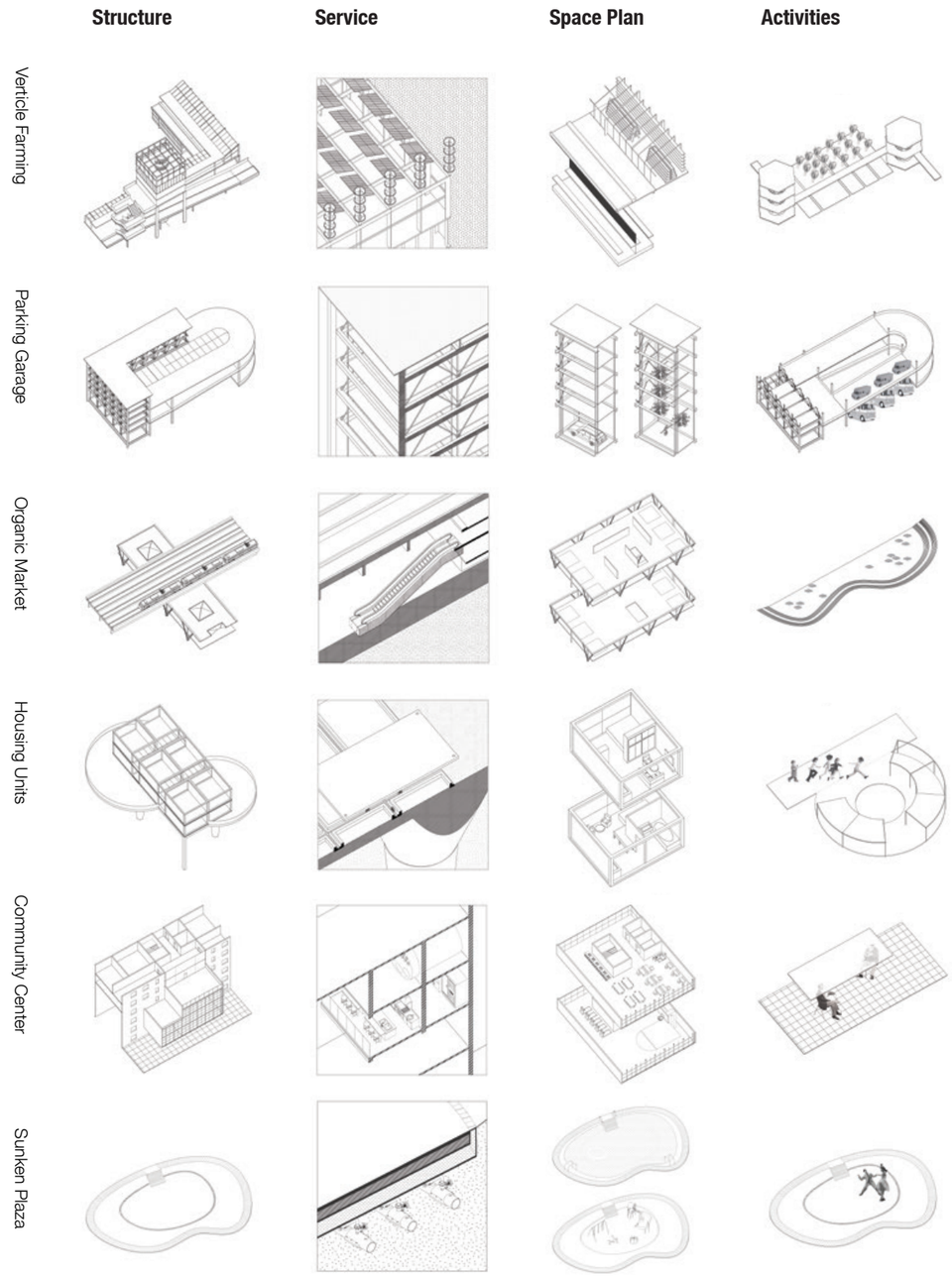
03_Community Lounge
a pop-up lounge with communal refrigerators, warming and cooling facilities

04_Train Station
collect people from surrounding neighborhoods and revitalize the nearby market

05_Organic Market
create revenue for NYCHA which could be used for aging housing maintanence

Plug–in Elements for NYCHA Housing Regeneration

Permenant structure, long lasting mechanical system, easy to change space plan and everchanging activities.



Vertical Farms

With new energy system and low-tech grean house, vertical farms could provide food for the community and merchandise for the market in differnet seasons.

Super Dormitory Lobby_view from Campus Core

Organic Market

Market could attract people from the neibourhood and help the existing under bridge market to survive and prosper.

Under Bridge Market of Local Organic Food

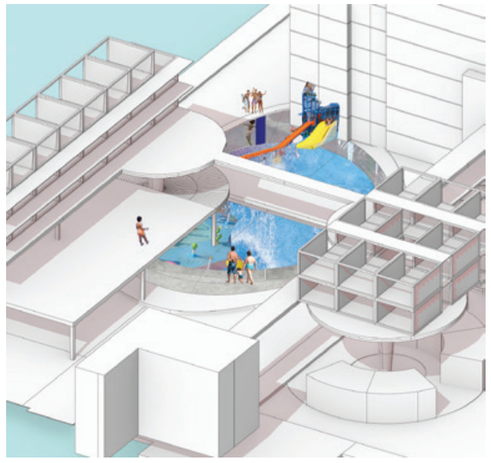
An Everchanging Infrastructure

New View of Community from Old Units

Market and gardens could be part of the daily scenarios that delight the life of residents here, which also help make the revenue to maintain the old aging housing.

Pre–Farbricated Housing Units

Easy to assemble and demolish, the number of this kind of housing units could be adjust by the actual demond. For example, while most old units are being maintained, residents there could move here.



BUILDING SCIENCE & TECHNOLOGY

04

Resorts in the Mountain

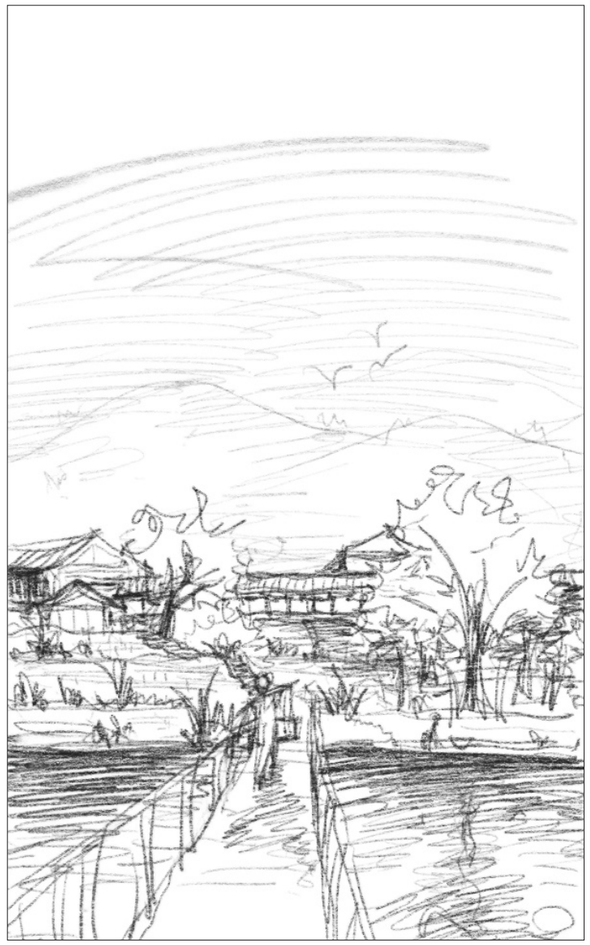
Techniques of UltraReal

2019 GSAPP Fall Tech Course
Critic: Phillip Crupi, Joseph Brennan
Partners: Mengzhe Zhang, Lu Xu, Yining He
Individual Contribution: Schemetic Design, Modeling in Rhino, Bridge Rendering in 3Ds Max

The use of perspective and rendering is often an afterthought. With the abundance of 3D modeling software and the ability to see every angle of a project instantaneously, renderings are often thought of as a last minute tool for representation.

This class challenges the participants to not only think of rendering as a method of presentation, but also a tool for design. We encourage the use of perspective and rendering early and often in the design process. In addition to learning techniques for creating ultrarealistic images, we will teach a workflow that encourages early exploration.

We will focus on color, light, material, context, reflection, and opacity throughout the course of the entire design project. Will will look for inspiration in many places, including art, photography and cinematography.



05

Embodied Energy Visualization

Footprint: Carbon & Design

2019 GSAPP Fall Tech Course
Critic: David Benjamin
Individual Work: Concept Diagram, Project Technical Sheets, MOMA Exhibition Interior Rendering

The Embodied Energy Project aims to uncover key questions, issues, and opportunities for architectural design in the context of embodied energy.

In conjunction with the exhibition Energy, The Museum of Modern Art commissioned The Embodied Energy Pilot Project at Columbia University's Graduate School of Architecture, Planning and Preservation to create a series of visualizations about embodied energy—what it is and how it relates to the Museum's new building.

Energy, organized by Paola Antonelli and Anna Burckhardt, opened at the Museum of Modern Art in October 2019. Research and visualizations were realized by GSAPP students in the Fall 2019 seminar "Footprint: Carbon and Design" led by David Benjamin, and by The Living.

Embodied Energy of All Building Materials in NYC

Embodied energy is all of the energy required to extract, transport, manufacture and assemble material into buildings, which would increase dramatically if upgrading buildings in a conventional way.

HOW MANY BUILDING MATERIALS ARE AVAILABLE IN NYC?

BLDG TYPE	 1-4 family home	 commercial pre-war <7	 commercial pre-war >7	 commercial post-war >7	 commercial very large	 multi-family pre war <7	 multi-family post war >7	 multi-family post 1980 >7
CITYWIDE BLDG AREA	25.7%	2.7%	2.7%	0.7%	5.9%	15.8%	5.9%	3.3%
AVAILABEL MATERIAL	single pane window				curtain wall	single pane window		
		marble, granite, partition wall			steel frame	drywall, bricks, brownstone, wood frame		
AVAILABLE FACADE AREA	5%	10%	13%	13%	40%	13%	15%	13%

*RESOURCE: ONE CITYBUILT TO LAST_TECHNICAL WORKING GROUP REPORT_TRANSFORMING NEW YORK CITY BUILDINGS_FOR A LOW-CARBON FUTURE
HTTPS://WWW1.NYC.GOV/ASSETS/SUSTAINABILITY/DOWNLOADS/PDF/PUBLICATIONS/TWGREPORT_04212016.PDF

MATERIAL TYPE	single strength glass	cladding glass	steel	mable/granite	bricks	gympsum	wood	brownstone
QUANTITY(t)	4250	3550	2600	93	350	46	720	210

*RESOURCE: DENSITY OF COMMON MATERIALS
HTTPS://WWW.ENGINEERINGTOOLBOX.COM/DENSITY-MATERIALS-D_1652.HTML

HOW TO CALCULATE THE EMBODIED ENERGY OF MATERIAL'S 2nd LIFE?

1ST LIFE	A1: RAW MATERIAL SUPPLY	A2: PRODUCTION	A3: CONSTRUCTION	A4: USE	A5: END OF LIFE
	76% of overall	12% of overall	8% of overall	3% of overall	1% of overall
2ND LIFE	DISMANTLE =20%A1	FARBRICATE =60%A2	ASSEMBLE =110%A3	USE	AFTER LIFE=0
	Demolition Work Dismentle Processing Material Transfer	Transportation Refurbishment Prefarbrication Digital Management	Transportation Construction Work Tenants Settlement	Use in Building Maintenance Repair Repalcement	Included in 3rd life of material, which could be eliminated here

*RESOURCE: DECORBONIZED DESIGN_HTTPS://WWW.DECARBONIZEDESIGN.COM/
HULYA KOLOZALI / PROCEDIA ENVIRONMENTAL SCIENCE 34 (2016) 212-221_ HTTPS://DRIVE.GOOGLE.COM/DRIVE/FOLDERS/1EHPLQOPITIHGTSF835YK85NJKR1403_T

HOW MUCH ENERGY CAN WE SAVE IF WE UPGRADE BUILDINGS WITH EXCHANGED MATERIAL?

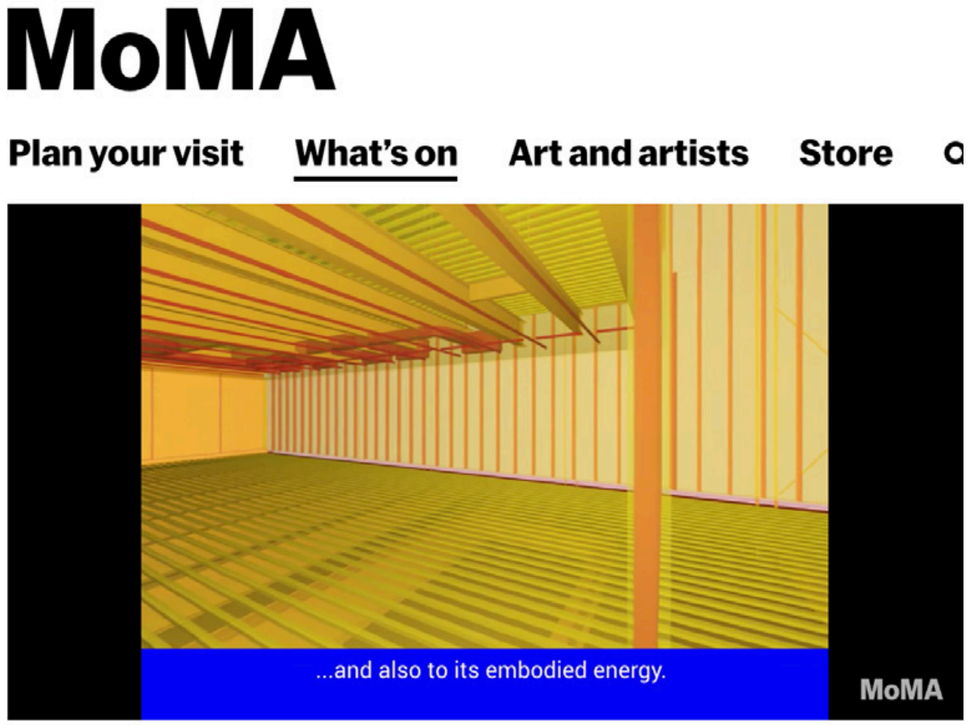
units: MJ/kg

MATERIAL TYPE	single strength glass	cladding glass	steel	mable/granite	bricks	gympsum	wood	brownstone
EMBODIED ENERGY (1ST life)	12.7	25.3	38.0	13.9	1.5	2.9	10.4	11.5
EMBODIED ENERGY (2ST life)	3.81	8.43	11.4	4.63	0.51	0.87	3.12	3.83
ENERGY SAVED	8.9	16.87	26.6	9.27	0.99	2.03	7.28	7.67

*RESOURCE: LAWSON 1996 / CSIRO
HTTPS://WWW.YOURHOME.GOV.AU/MATERIALS/EMBODIED-ENERGY

units: MJ

ENERGY SAVED	37,825,000	59,889,000	69,160,000	862,110	346,000	93,080	5,241,600	1,610,700
Total	**170,310,490**							



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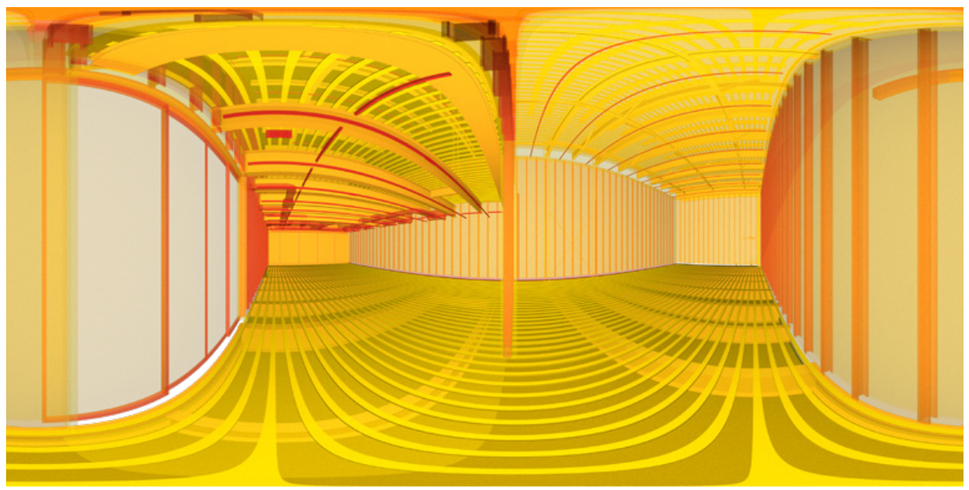


06

The New Lever House

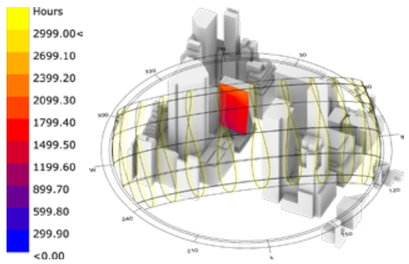
Re–Thinking BIM

2020 GSAPP Spring Tech Course
Critic: Jared B. Friedman
Partner: Shuchang Zhou
Individual Contribution: Schemetic Design, Grasshopper Script Design, Technical Drawings

Lever House was designed by Gordon Bunshaft and Natalie de Blois of Skidmore, Owings and Merrill and was constructed from 1950 to 1952. Located at 390 Park Avenue in New York, New York, the building was the second curtain wall skyscraper in the city and has influenced the architecture of New York ever since. Lever Brothers, a British company, commissioned the design as a headquarter in America.

Although Lever House has been an example to many other architects in designing the new office building typology, it has a negative reputation from an environmental point of view. The minimalistic aesthetics caused various problems for the human comfort and sustainability of the building. With this project, I would like to propose a way in which Lever House can be environmentally aware and create a new image for the company.

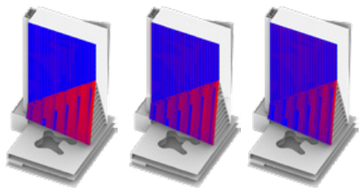
Existing Facade
Sunlight Hours Analysis



Due to the existing glass facade with minimalistic aesthtics brings direct sunlight to the interior, Lever House has problems of human comfort and sustainability of the building.This project proposes a new facade to bring comfort and interior shading to the occupants. Also, it provides a brand new view to the city.
The fins on the proposing facade with appropiate depth brings more interior shading. Responding to the urban context and lifted envelope, the fins twist in calculated angle to provide a balance between interior shading and sunlight.

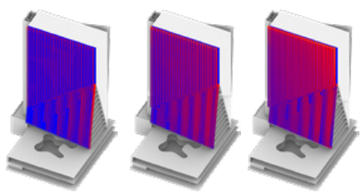
Proposing Facade
Sunlight Hours Analysis

Fins Depth Study



1 Foot 2 Feet 3 Feet

Fins Angle Study

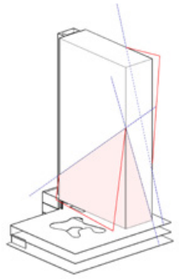


Vertical 15 Degree 30 Degree

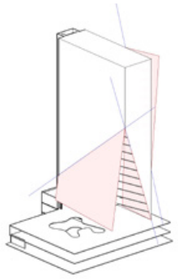
Interior Shading Study

13:00 pm Interior Shading Study (Existing Exterior Facade)

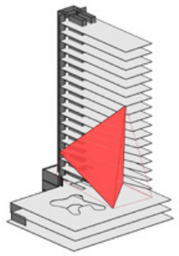
Folding System Generation



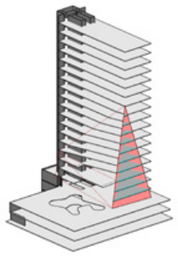
1. folding line and existing facade to get rid of



2. lifted facade and new envelope

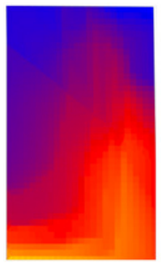


3. new atrium shaped by the new facade

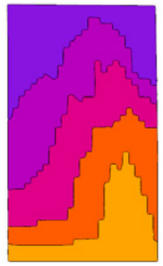


4. exterior terrace and vertical garden

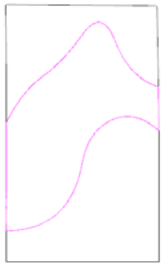
Shading Fins Generation



1. analysis result



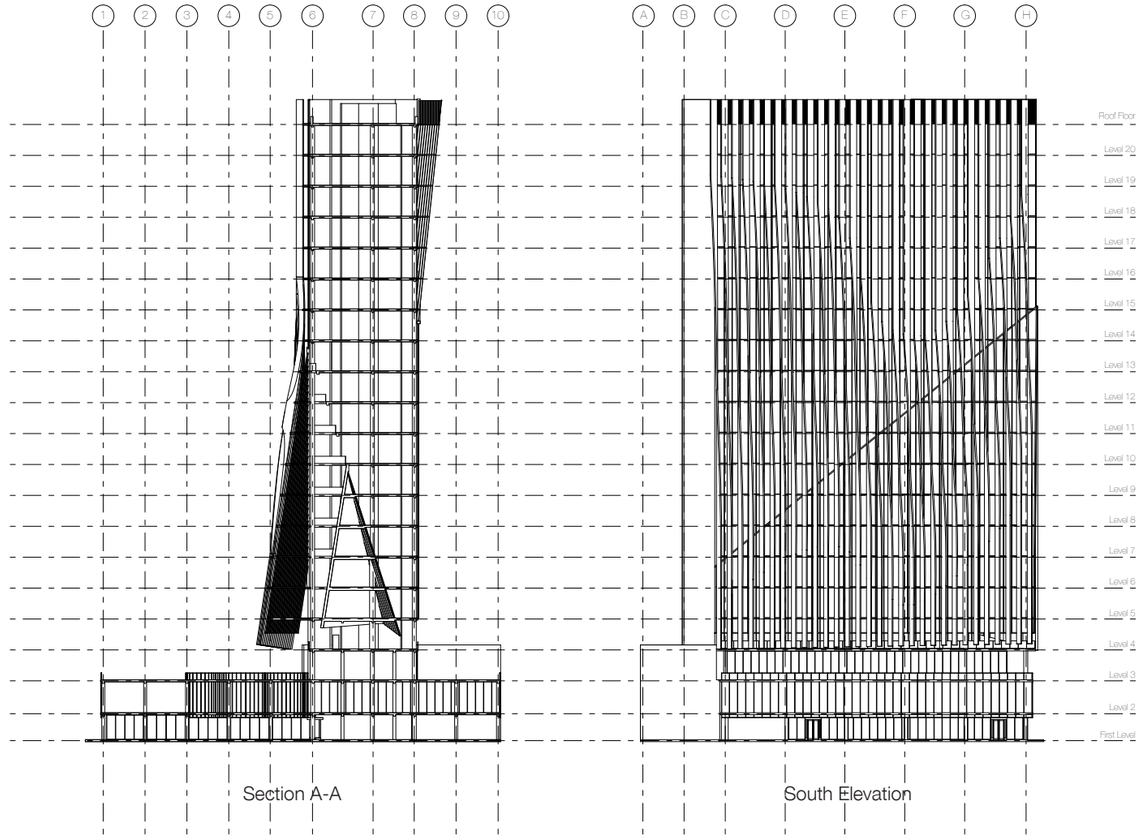
2. pattern trace



3. pattern simplify

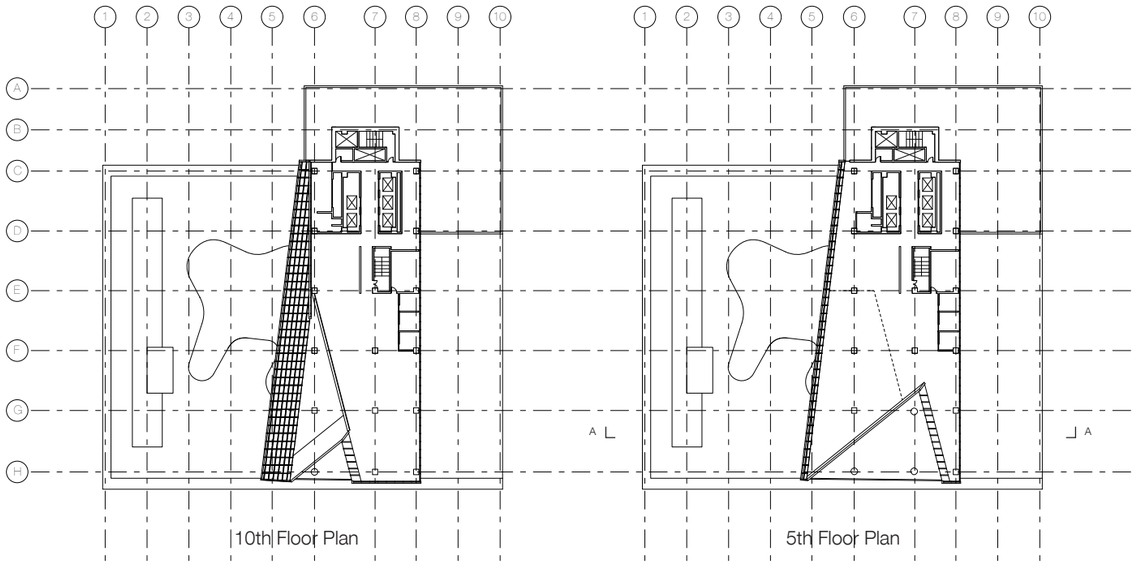
4. final option

13:00 pm Interior Shading Study (Proposing Exterior Shading Facade)



Section A-A

South Elevation



10th Floor Plan

5th Floor Plan

Envelope

Part of the existing envelope is replaced by a new piece that is folded upward around the axis of the folding line. In this move, the new envelope shapes an open atrium for the office, which could also be a ventilation shaft.

Ventilation

The exhaust port on top and bottom of the new envelope could make a stack effect in the building, to enhance natural ventilation. There are two lifted pieces of facade here, with two wind wells that cover all the floors.

Shading

A shading system with striped brise soleil is attached to the envelope on the southern facade. According to the annual sunlight test, we apply different width and twisted angles to each stripe to make a reasonable and artistic shape.

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