1 **KIT**
Kibera Slum Renovation Project | Nairobi, Kenya

2 **FRAME**
Adaptive Reuse Hotel Project in Euljiro | Seoul, Korea

3 **Archive of Everyday**
Hanok Adaptive Reuse Archive Project | Seoul, Korea

4 **Prism of the city**
City Library Project | Gwangju, Korea

5 **ANT**
Logistics Modular Mobility Design Project

6 **Flexity**
Computation Schemetic Design Tool Develope

7 **Yongsan Riverway**
Waterfront Urban Design Project | Seoul, Korea

8 **Urban Floor**
Multi-Layered City Design Project | Seoul, Korea

9 **Network Campus City**
Campus City Design Project | Mongolia

10 **Opacity 50**
Garden of Knowledge Competition | Pavia, Italy

11 **Build Back Better**
Logistics-Based Future City | Ukraine

12 **Food Detector**
Restaurant Hygiene Score Service | Seoul, Korea

13 **Buildable Envelope Automation**
LLM-Based Design Automation Thesis | Seoul, Korea

14 **PLE Index**
Parcel Layout Efficiency Research | Seoul, Korea

15 **Density and Closure**
Business Closure Research | Seoul, Korea

16 **UTCI Workflow**
Sidewalk Design Workflow Research

KIT

Slum renovation with housing kit factory and bridge

Location : Kenya, Kibera
Year : 2021
Type : Factory / Module
Size : 20,000m2 ~

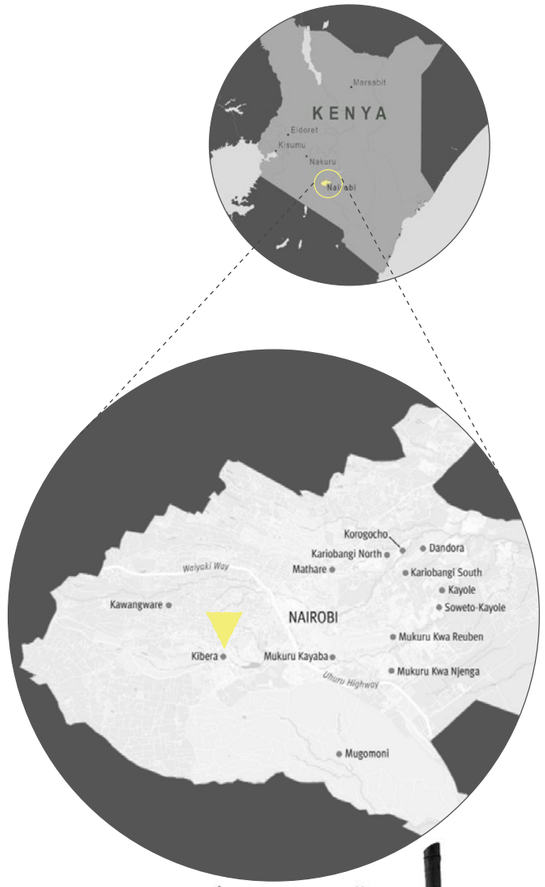
As a perspective of a architect, I focus on housing problem first. pool residential environment effect on people's mind and it causes many social issues. In other words, if the housing problem is solved, many problem like crime is also can be solved not only housing and sanitary issue.
So I decide to design factory that makes hosuing kit for slum, and this factory hire people from slum to solve job issues and give hope to people in slum. Then this Factory has to be more then just facotry. This project has to focus on bridging the gap between city and slum.

Kibera Slum

The largest urban slum in Africa

Area : 2.38 km2
Population : 250,000 ++
Desnsity : 2000 residents per hectare

Kibera needs ***land/tenancy rights, housing, water, electricity, health clinics, education, employment, security*** plus much more. All these issues are being addressed to a lesser or greater extent by many organizations including the Churches, UN-Habitat, MSF and AMREF etc. Money is finding its way through from many international organizations including Gates Foundation, Bill Clinton Foundation, all the well known charities and of course the churches both in Africa and internationally. However, money cannot help without people to direct it – all the organizations require assistance. They all need intelligent, keen, willing, and compassionate people to help.





Kibera slum in Nairobi

Kibera is the largest slum in Nairobi, and the largest urban slum in Africa. The 2009 Kenya Population and Housing Census reports Kibera's population as 170,070, contrary to previous estimates of one or two million people. The most unusual thing is that it exists in the middle of the city. Like there is a border between slum and the other part of city



slum *city*

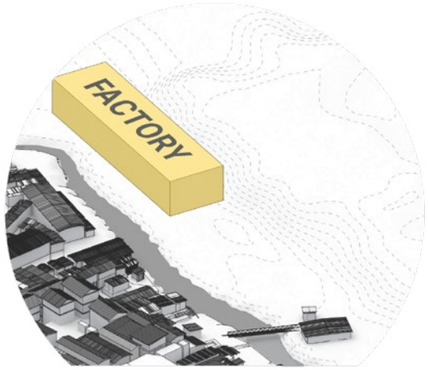




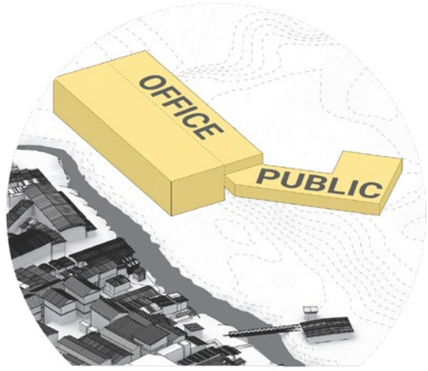


Site Between City and Slum

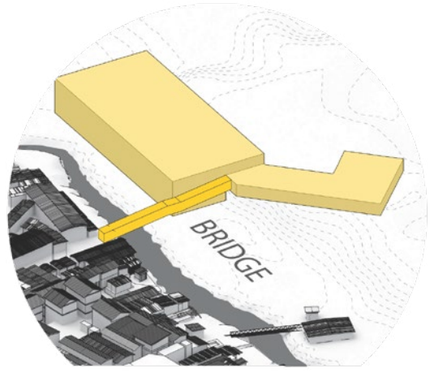
This project must be the bridge between city and slum. And this is the reason why this project must place at boreder of the slum. And the site required more then 20,000m2 of area, and easy to access from both side.



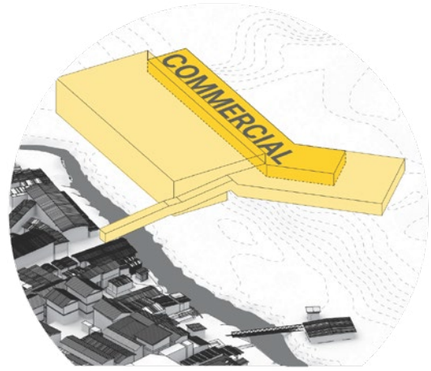
Step 1 Factory Area



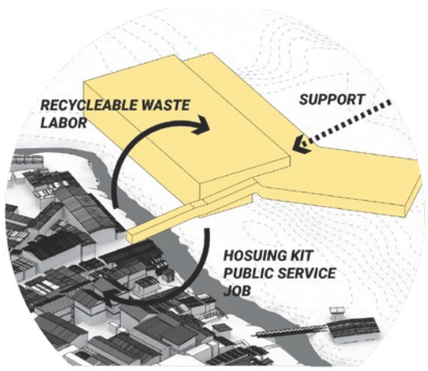
Step 2 Office and Public Area



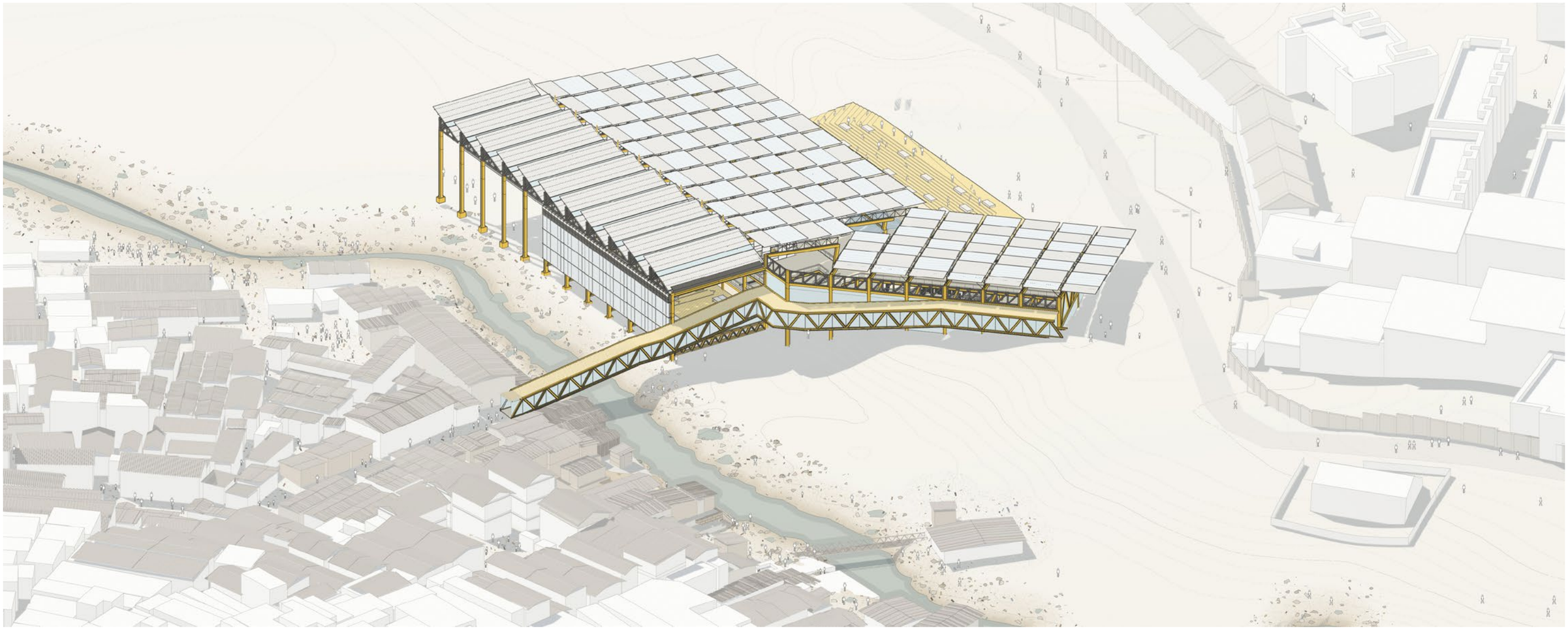
Step 3 Bridge Through Public Area



Step 4 Commercial Area Next to Public Area

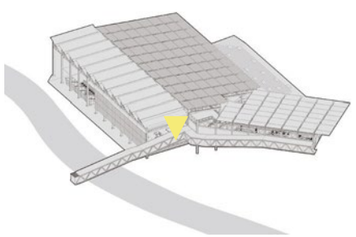


Step 5 Connect City and Slum



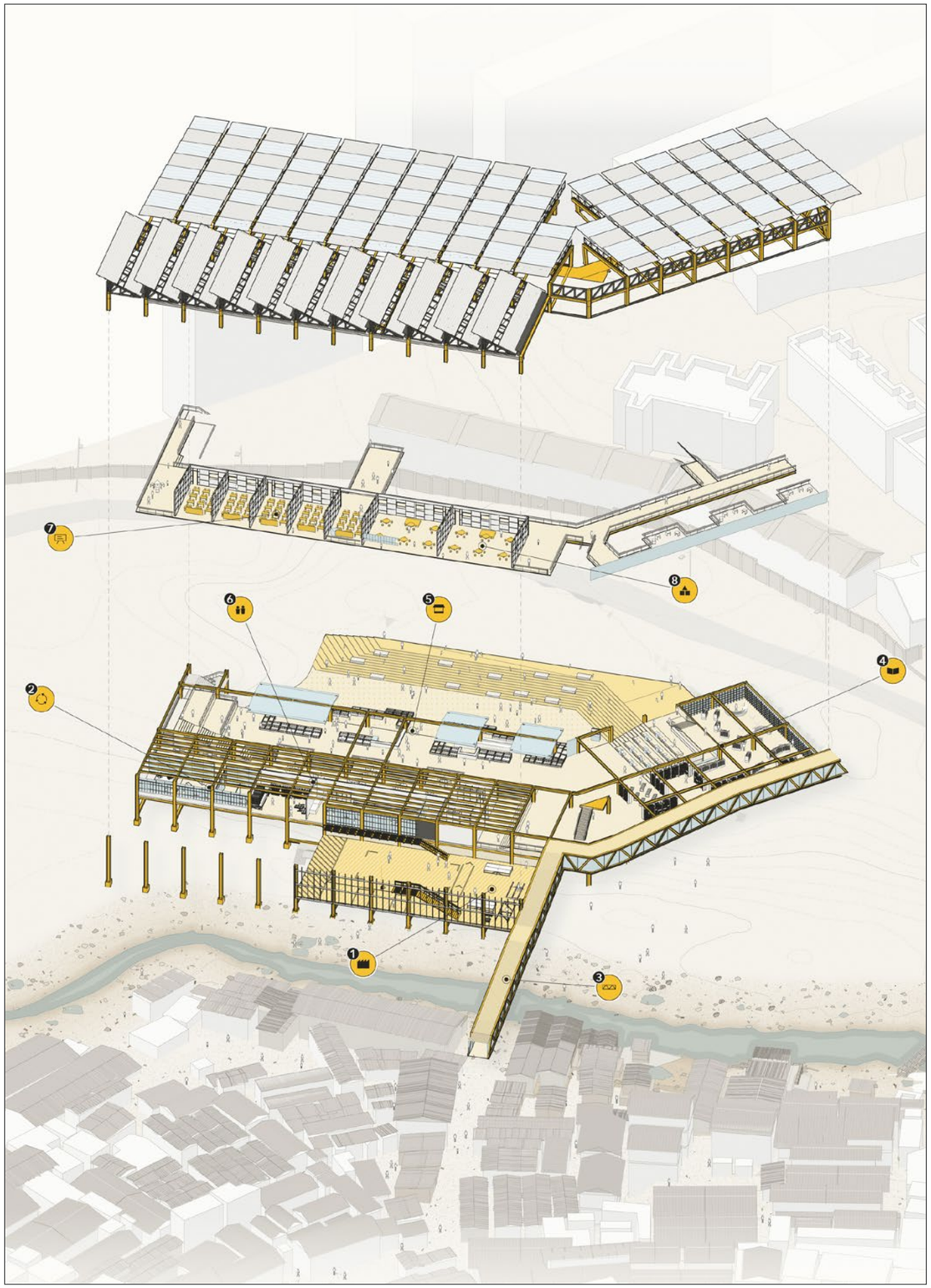
Bridge Between Slum and Others

Bridging the gap between slum and city. Literally, the bridge connects the slum with the city. And also the the kit from this factory and many other public program will connect two different society. People from city and people from slum will meet at border of the slum and finally the border will slowly fade away

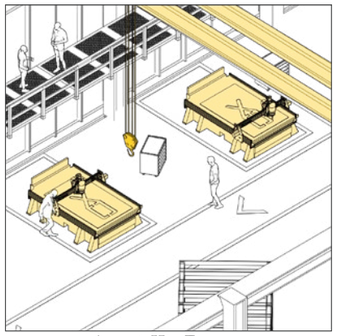


Bridge and Factory

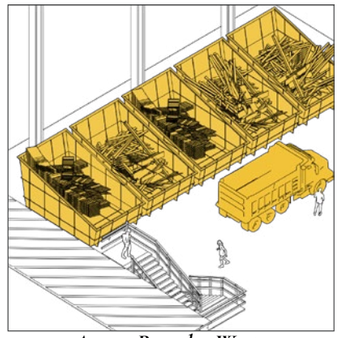
People from slum can see how the KIT factory manufacture housing kit and how this kit change the slum. And also many people from slum without a job can work here. Then eventuallyW, they change the slum wih their own hands.



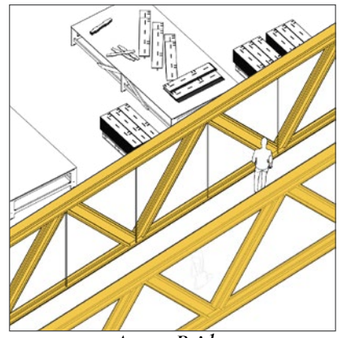
Exploded Axono with Detail View



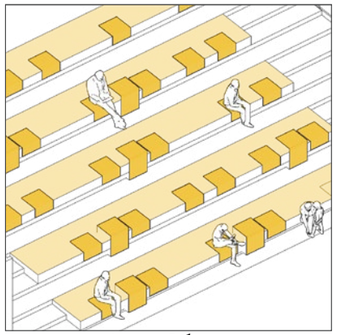
Area 1 Kit Factory



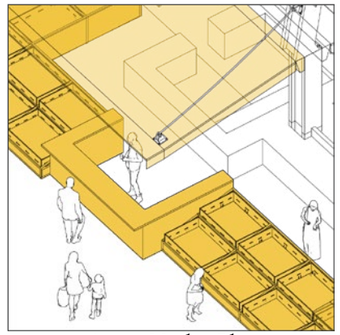
Area 2 Recyclee Waste



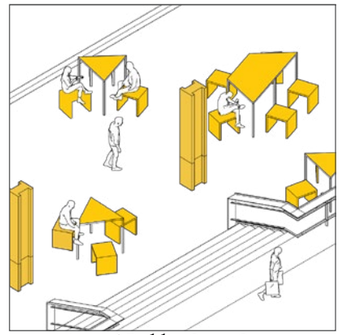
Area 3 Bridge



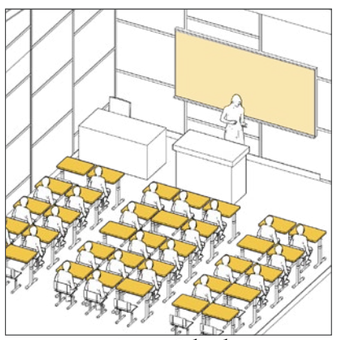
Area 4 Library



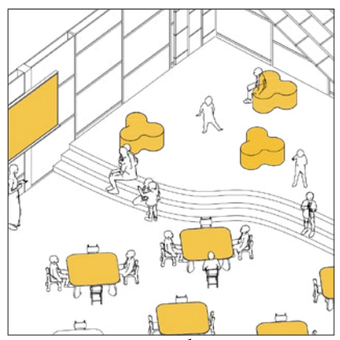
Area 5 Market Place



Area 6 Public Open Space



Area 7 School

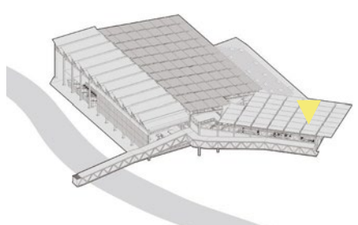


Area 8 Kindergarten

8 Main Area

Every Place in KIT is for people of slum,. Main sector of this project is Factory Area Everything happen from this housing kit factory.
Kit from this factory will provide better residential Environment, and Educational sector will provide kid a safe place to spend time and give them a chance to study as much as kid at Non-slum area.
e



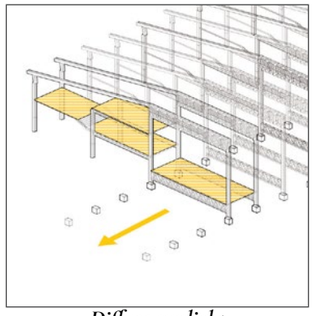


Library

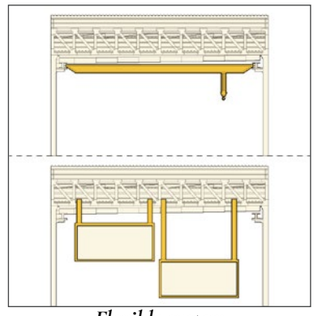
Balance between factory area and public space is a imprtant key of this project. That's why this project has many public programs. Library is one of a many public space in KIT project.

Module System

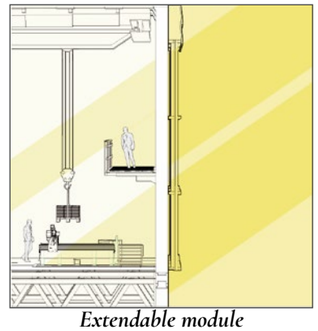
KIT project is not just a factory. forr the slum renovation, it is also design to provide many things to kibera , after the slum renovation. it will chagne to park along the river.
Therefore, it must be designed universally to adpative after slum.



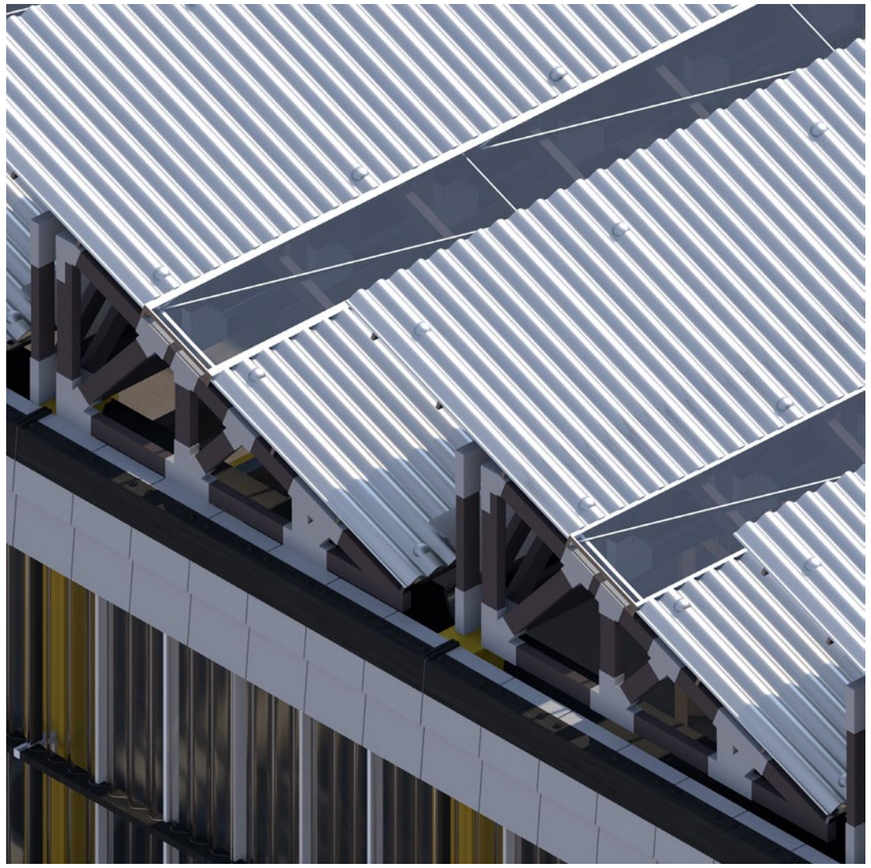
Diffuse sunlight

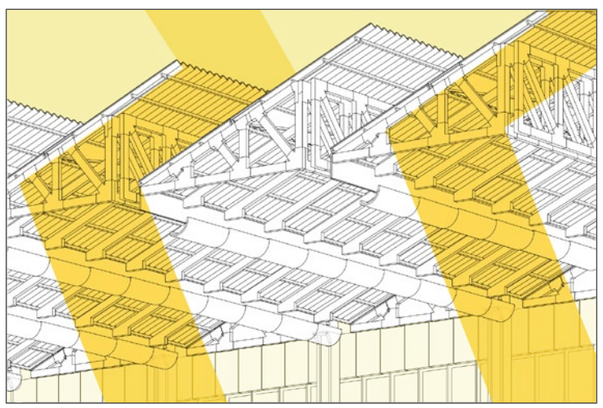


Flexible system



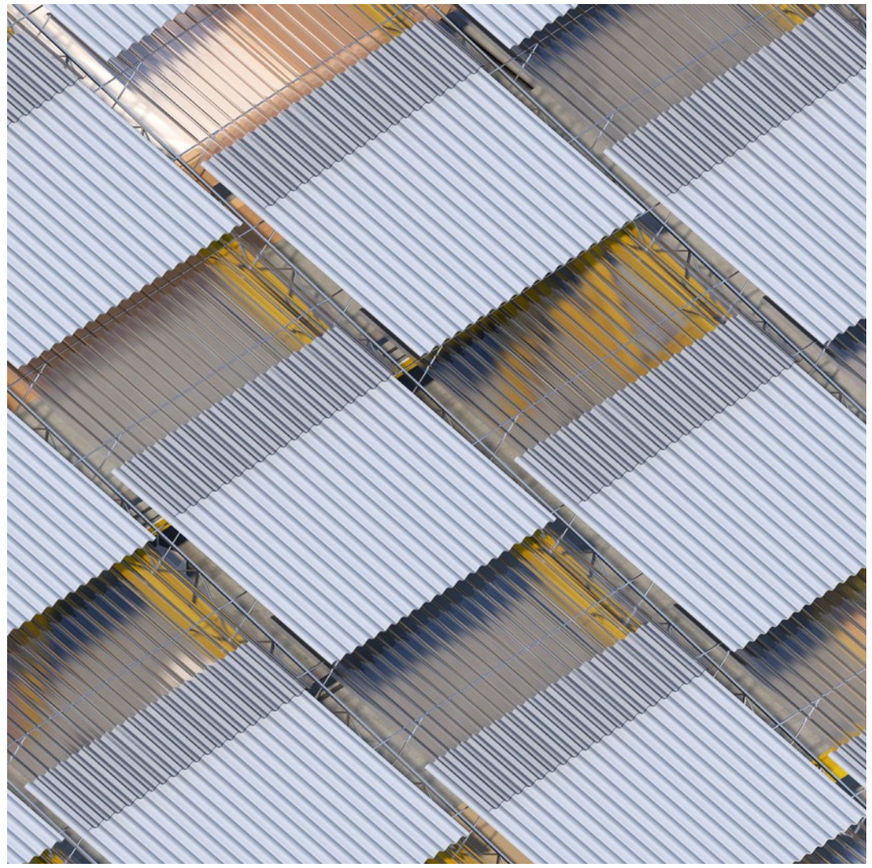
Extendable module

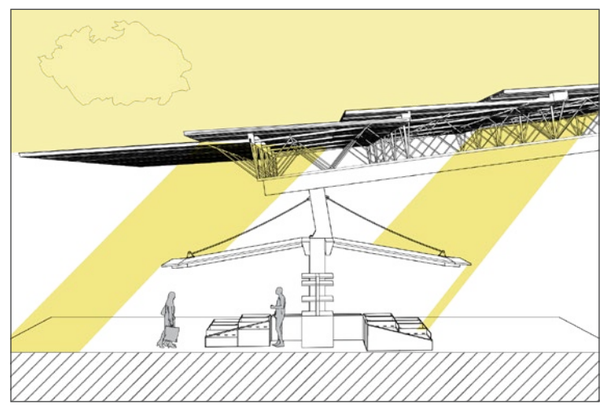




Reflect Sunlight

This roof is at a place where workers work, the roof was designed to provide a pleasant environment. It's for the adequate sunlight and ventilation

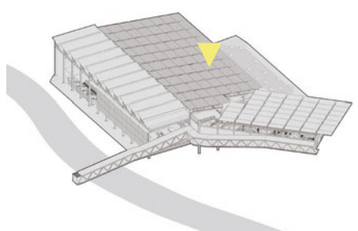




Block Direct Sunlight

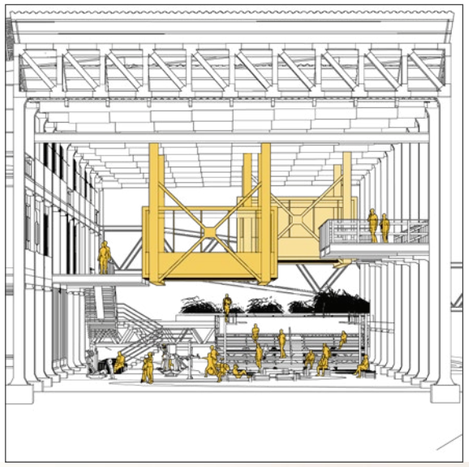
This roof is at a place where many people stay at a daytime, like library and market place. So the roof was designed to provide pleasant environment by blocking direct sunlight, but not to dark.

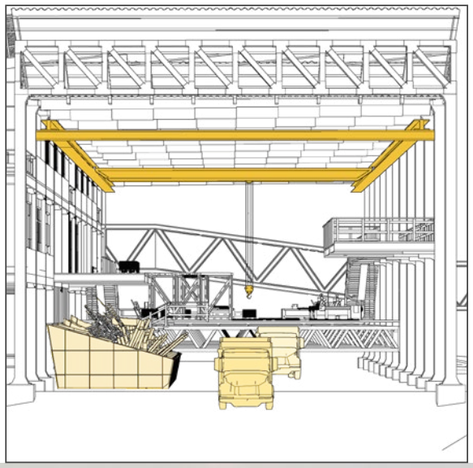




Market Place

The main program of KIT project is factory, but that dosen't mean the worker is main target of this project. Eventually, the project will serve as a bridge between the city and the slum. So it has to serve many public programs for those people, and therefore this market place is one of those public program.





After Slum

Over time, when the slum redevelopment project is successfully carried out and no longer has to rely on kit-based buildings, "KIT" finally meets a next phase.
Thanks to its modular design, which is easy to expand and change, the production area along the river is replaced by a park and transformed into the space needed for the changed kibera.



FRAME

Adaptive Reuse Hotel Proejct in Euljiro

Location : Seoul, Korea
Year : 2020
Type : Hotel
Size : 600m2

Euljiro, which has undergone dynamic changes throughout the years, is an area where the past and present coexist. This unique environment and the recent retro craze have brought Euljiro back into the spotlight as 'Hip-jiro'.

Through dynamic changes and growth, Euljiro has become full of skyscrapers. However, in this modern atmosphere, traces of its long history are hidden here and there.

This project is adaptive reuse hotel project. It's targeting both domestic and foreign tourists. Site of this project is old plaza named Asea, and it has great location for tourist to enjoy local atmosphere of euljiro.

The hotel was designed with a concept that considered the atmosphere and appearance around Euljiro, like old craft shop and 'Hip-jiro' street's

Asea Plaza *Project Site*

Asea Plaza is an old Ramen Structure building and its has five floors. It was built more than 60 years ago. Currently, access to the upper-class theater is restricted for safety reasons.

A *Lighting Shop Street*

It is one of the several industrial craft streets in Euljiro, and it is a street filled with stores that mainly sell lighting-related goods.

B *Metal Craft Shop*

There are many hardware stores in the center of Euljiro Industrial Street and many places that process iron. In the past, it was such a great place that it was possible to make tanks here.

C *Printing Shop Street*

It is a place that not only makes simple books, but also handles all the printing materials necessary for the industry as a whole, such as banners, business cards, pamphlets, etc.

Sewoon Plaza

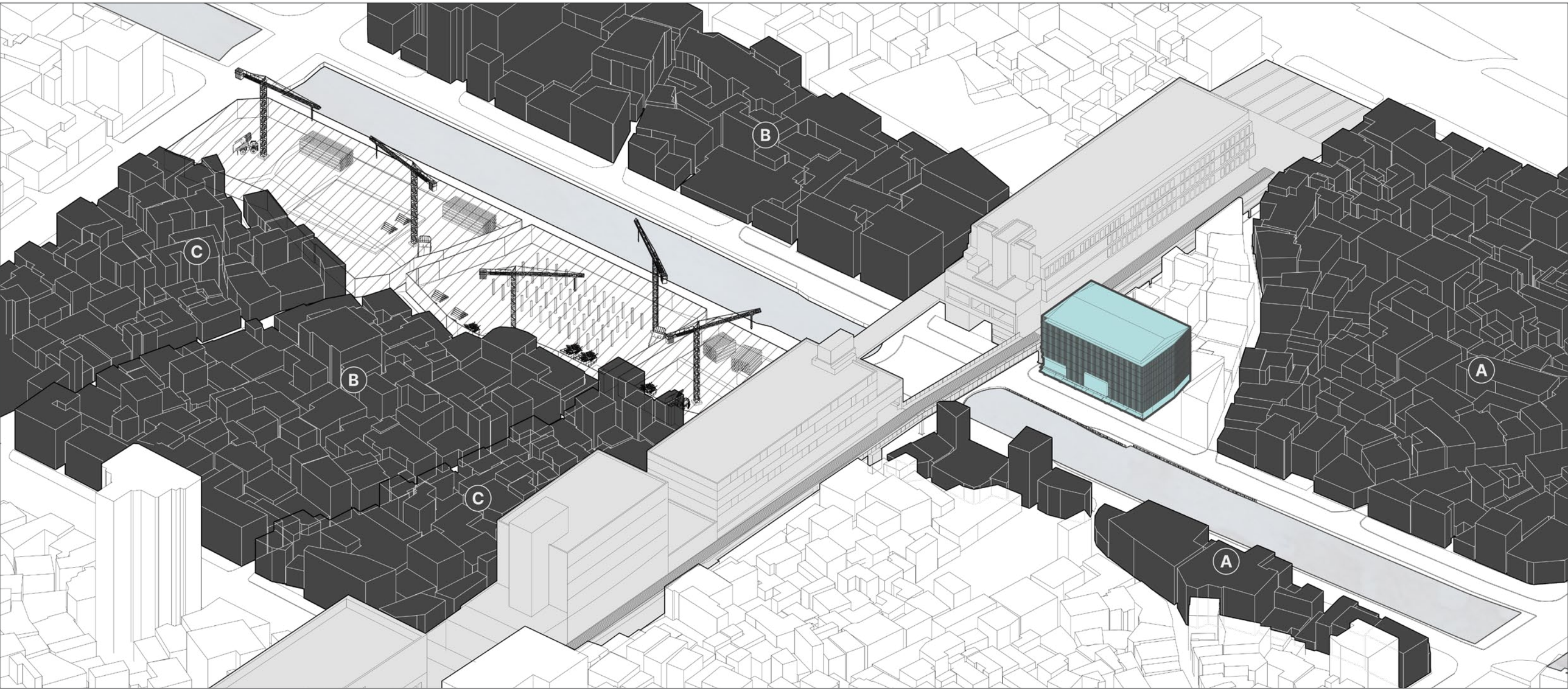
Sewoon Shopping Center is one of the elements that penetrates Euljiro along with Cheonggyecheon Stream and has more than just a building.
In the past, it was the center of Euljiro Industrial, but now it is the center of commerce as a 'Hip-Hiro'.

Construction Site

It shows Euljiro, which is changing, and several redevelopment works are underway in Euljiro.

Cheonggyecheon

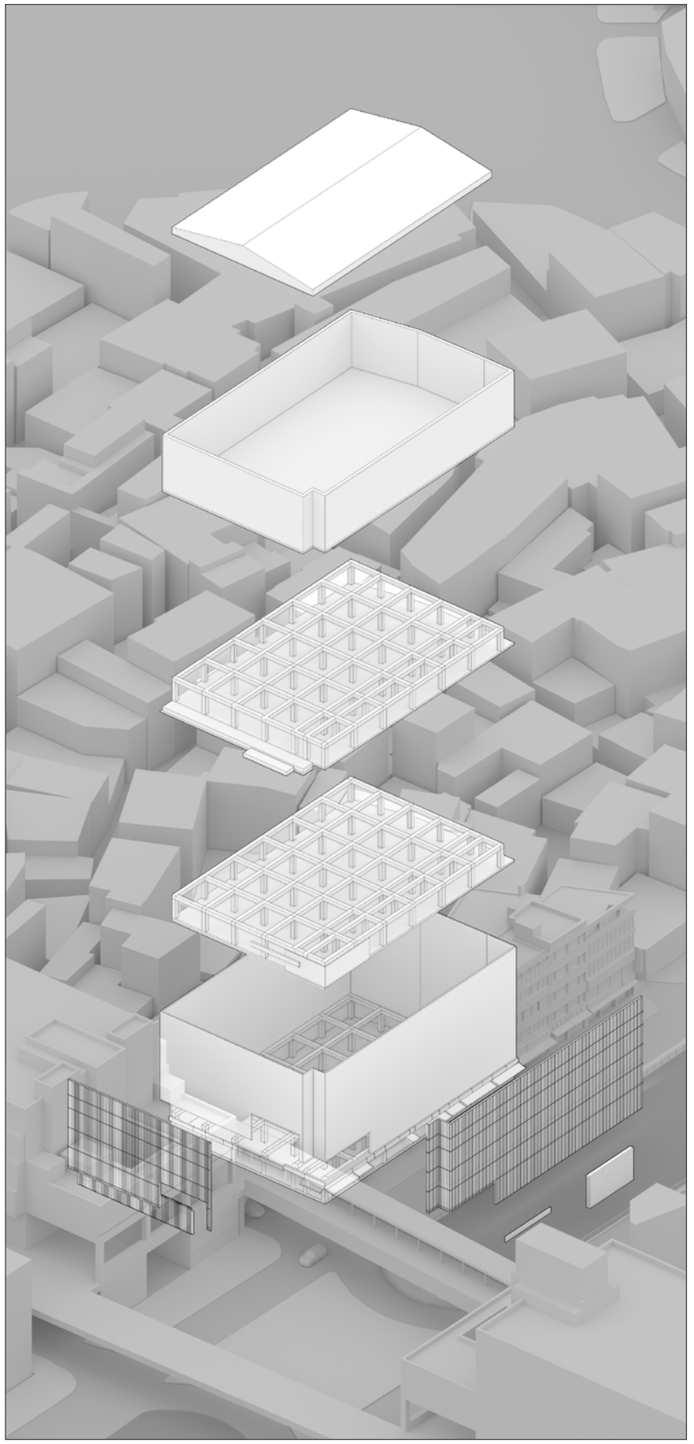
After redevelopment, it not only became a landmark of Euljiro, but also one of the landmarks of Seoul.



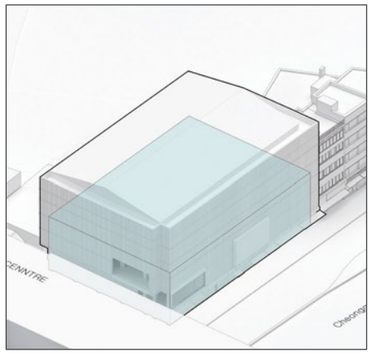
Euljiro Site

The area of Euljiro is full of history and trendy locations right in the heart of Seoul. The area is centered around Sewoon Plaza, a large commercial building built in the 1970s. As unique and trendy shops began opening alongside the old printing factory, lighting, and tool stores, this hot place received the name "hipjiro," a combination of the words hip and Euljiro.

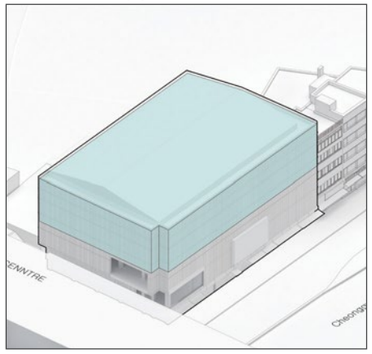
Exploded Axono



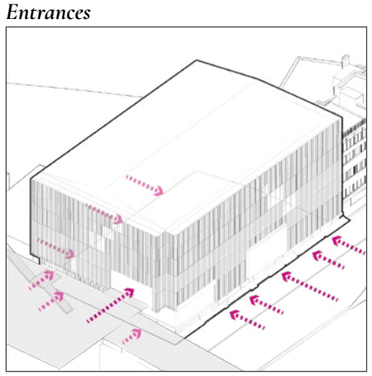
Commercial Area



Cinema Area (empty)

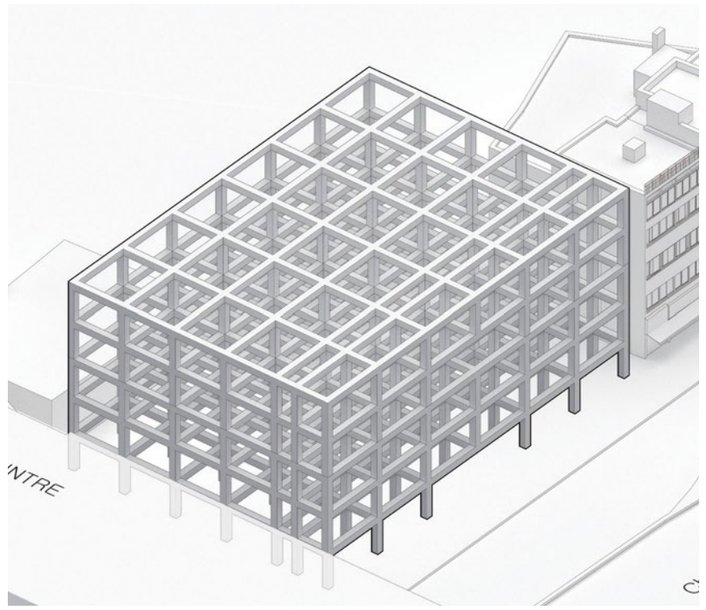


Entrances

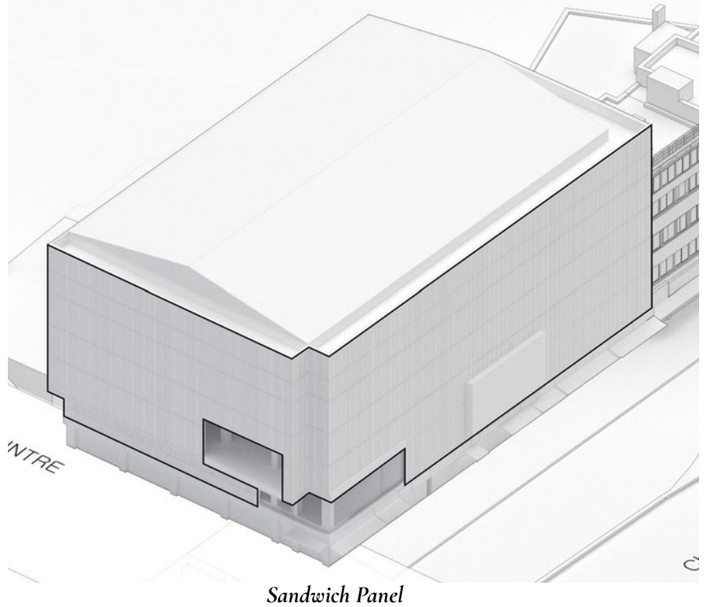


Existing Building Analysis

Asea plaza is a old building built with a ramen structure. It is now used as an electronic shopping mall, and the other part of the building was once a cinema, but now it is close due to safety problem. And it has many entrance include entrance to the sewoon plaza.



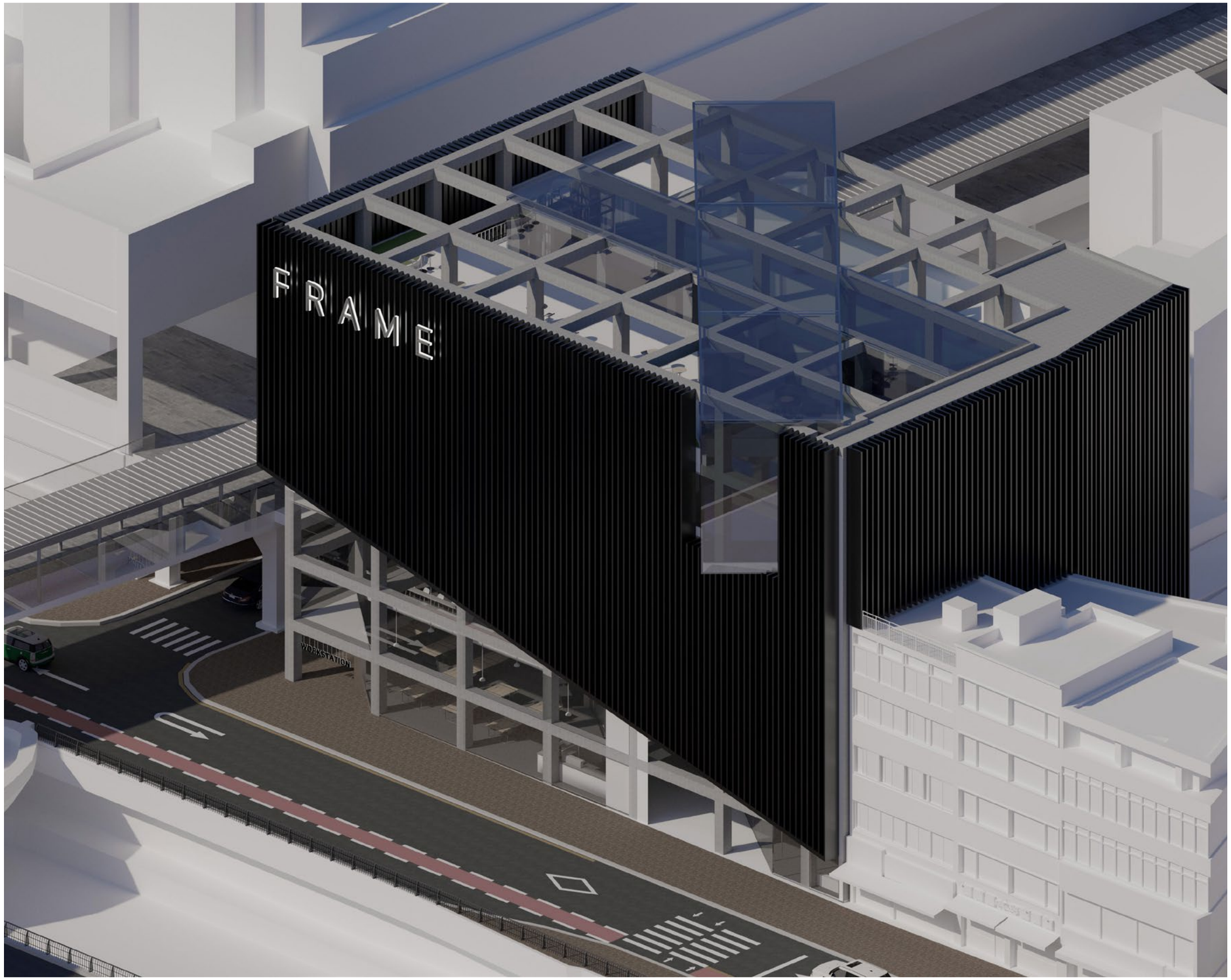
Ramen Structure

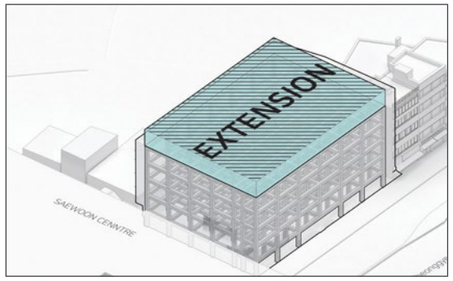


Sandwich Panel

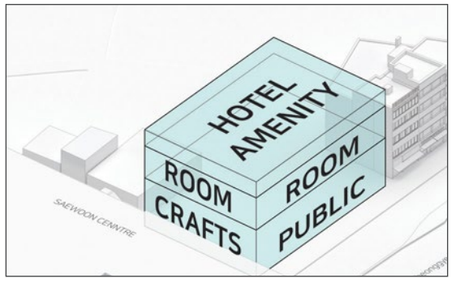
Design Element

Ramen structure and Sandwich panel, this two things are the most significant element of this building. From the beginning, I felt that these two elements would be the core design concept. The ramen structure maintains its original state. And for the facade, get a idea from the form of sandwich panel and re design it

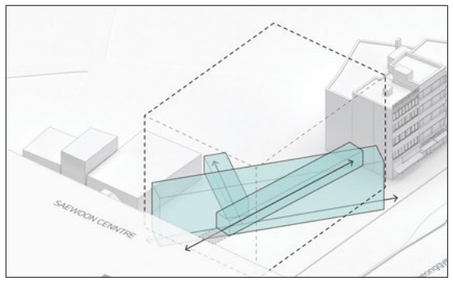




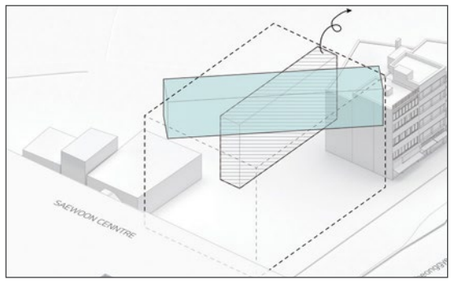
Rahmen Structure



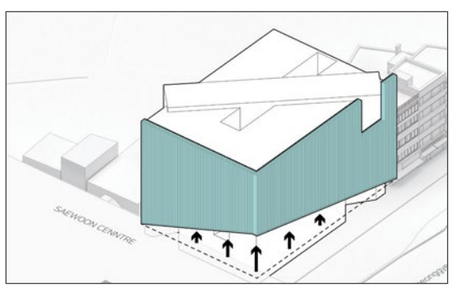
Programs



Connet to Urban Tissue



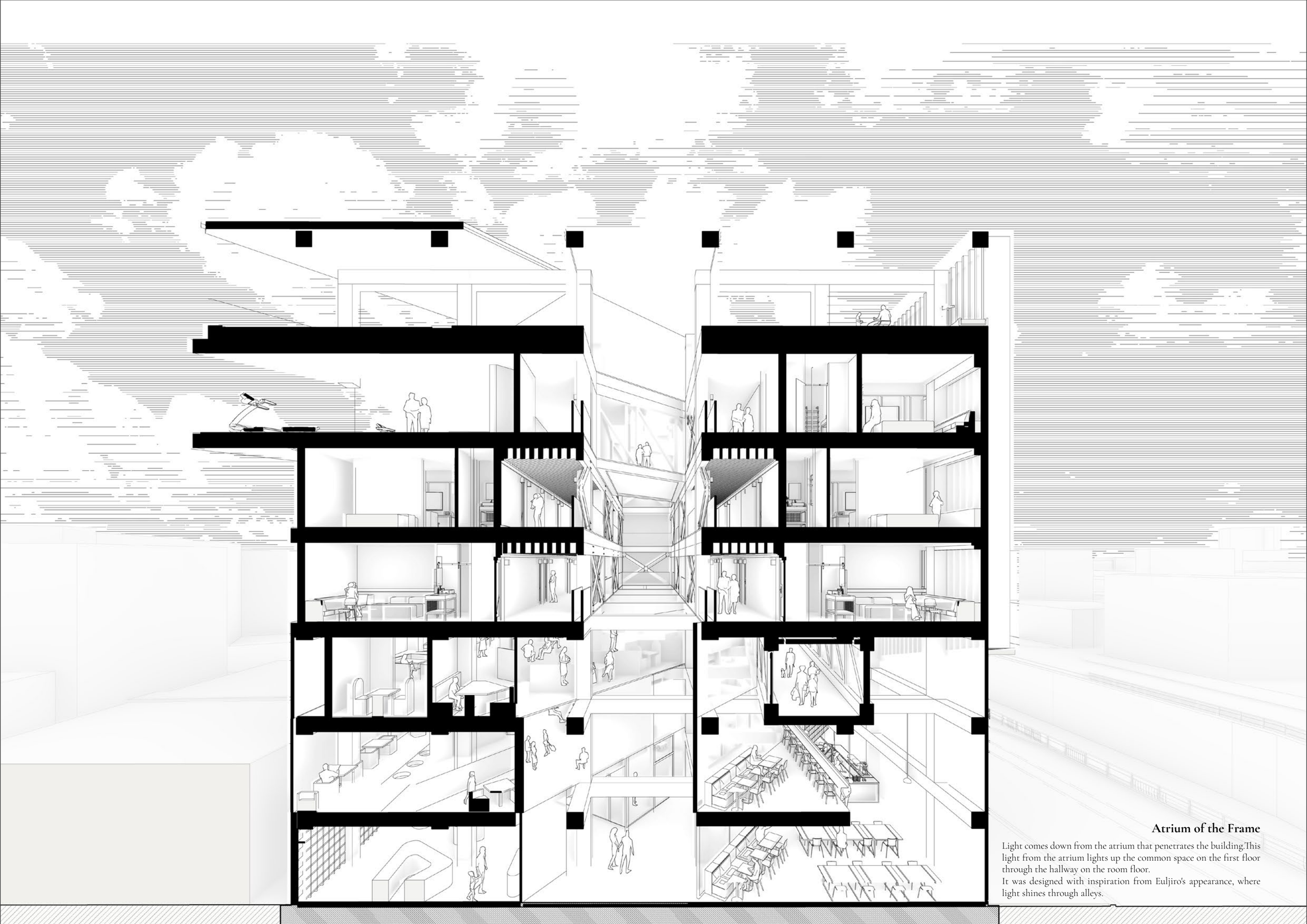
Void and Mass



Facade and Glance

Redesign Asea Plaza

The key of the redesign is to interpret the Euljiro's urban context and bring it into the Hotel. In this process, it is important to keep the connection with the surrounding cities that the existing buildings had.



Atrium of the Frame

Light comes down from the atrium that penetrates the building.This light from the atrium lights up the common space on the first floor through the hallway on the room floor.
It was designed with inspiration from Euljiro's appearance, where light shines through alleys.

ROOF

BAR

POOL

6F

GUESTROOM

BAR

GYM

5F

GUESTROOM

4F

GUESTROOM

3F

RESTRAUNT

2F

WORKSTATION

SE:CLOUD

LOUNGE

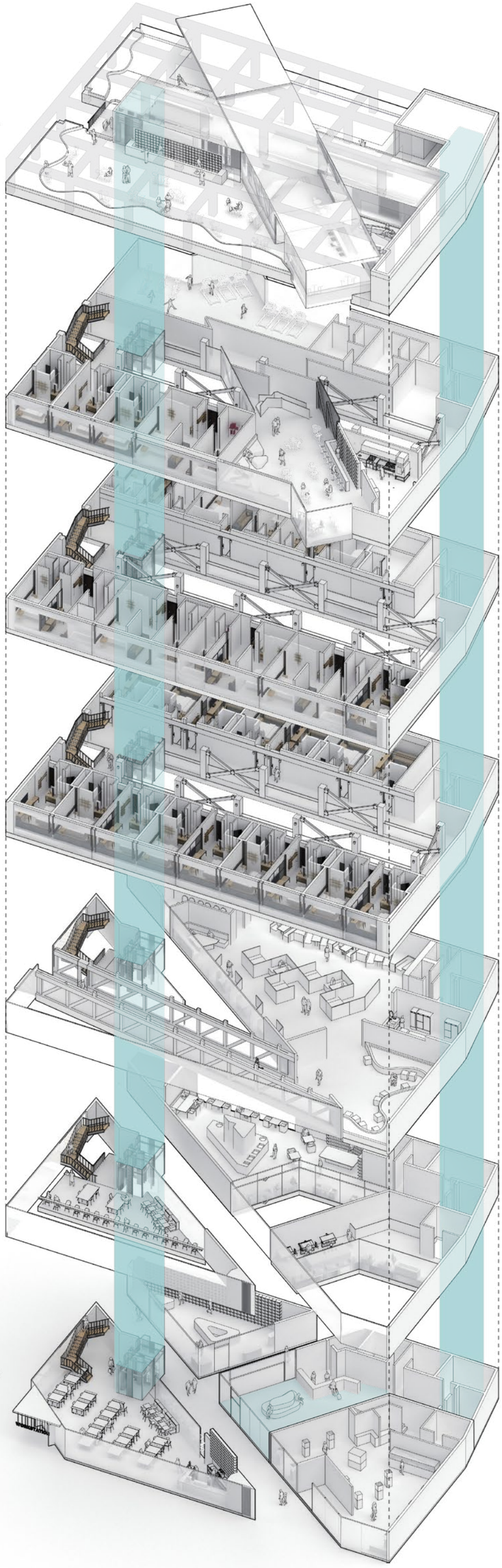
1F

WORKSTATION

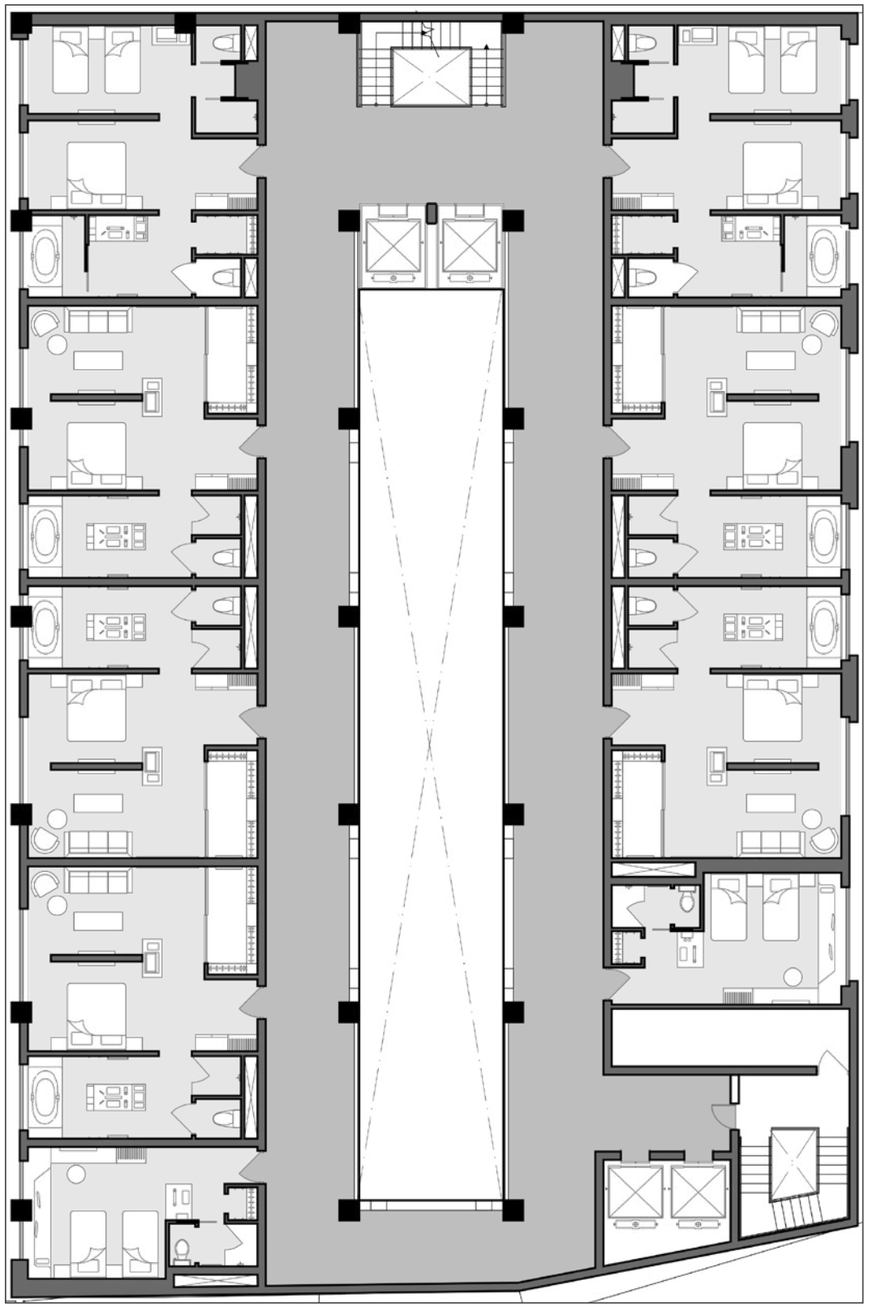
SE:CLOUD

COMMERCIAL

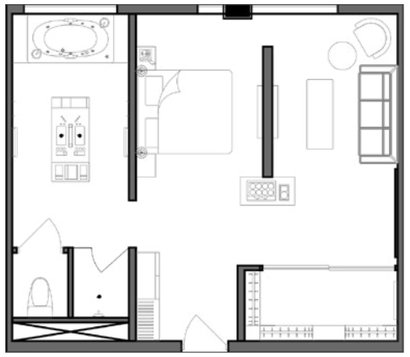
LOBBY



Hotel Programs





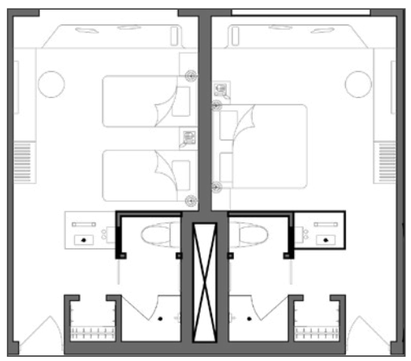


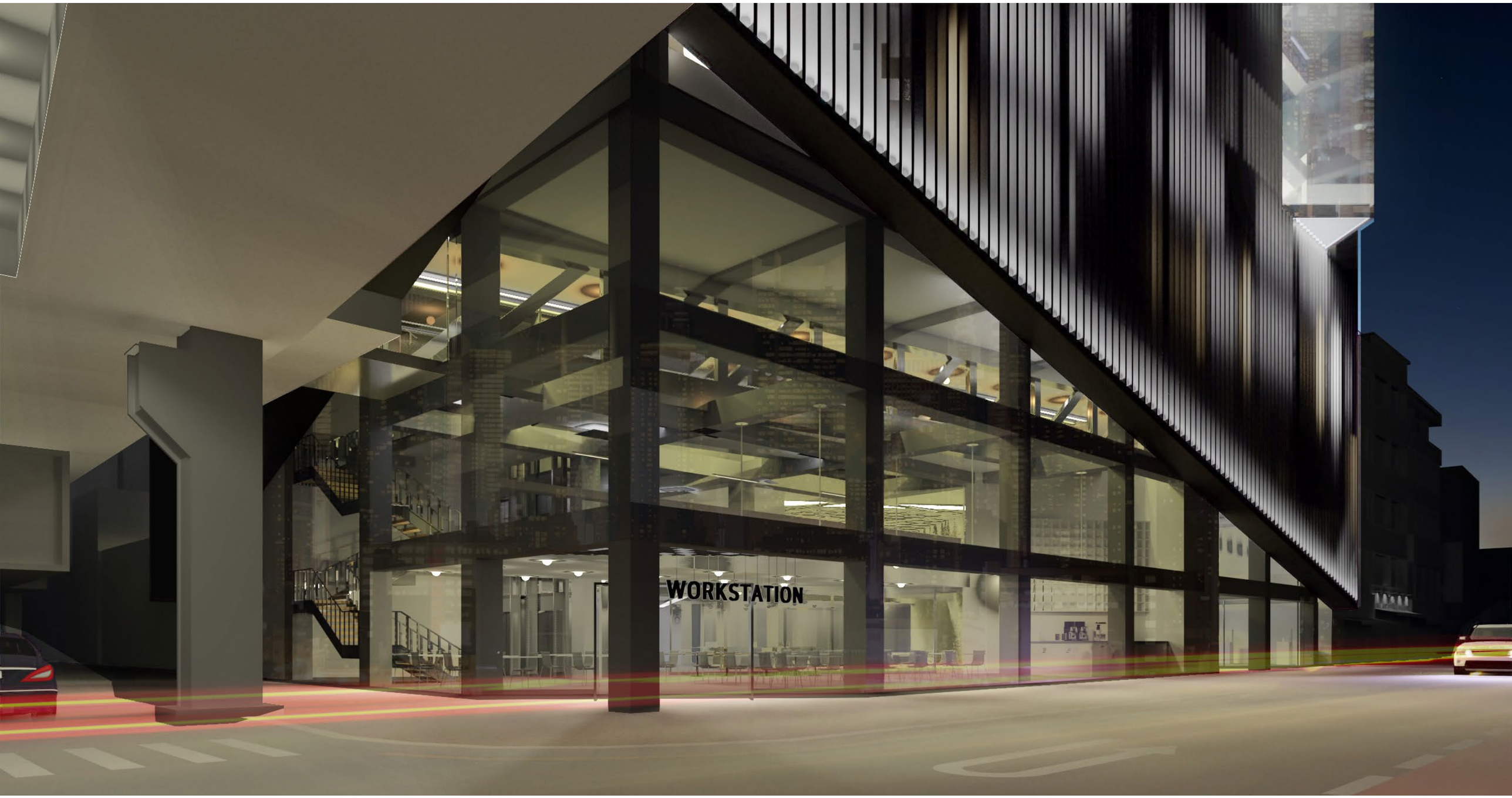
Stay Relax

Stay Relax is a room type for the people who want to staty more comfortable. There is a large bathroom with a sofa, a large luggage compartment, and a bathtub. It is a top-notch room prepared for guests who have had a hard day due to travel or business trips, and is twice the size of ordinary rooms.

Stay Close

Staty close is a room type for a people who want to stay close each otther. There are two types of rooms, a double bad type and a king bad type. It is a room with a wonderful advantage of seeing the mountain from the sofa in the direction of the window.





Night View of Frame

In the FRAME Hotel, there are two different images of day and night, just like Euljiro, where the past and present coexist.
The night and illuminated hotel will be a catalyst for accelerating the change to Euljiro, which is being renewed around Sewoon Shopping Center. Especially, the appearance of the glass gourd that stands out from afar is very impressive.



Night View of Frame

ARCHIVE OF EVERYDAY

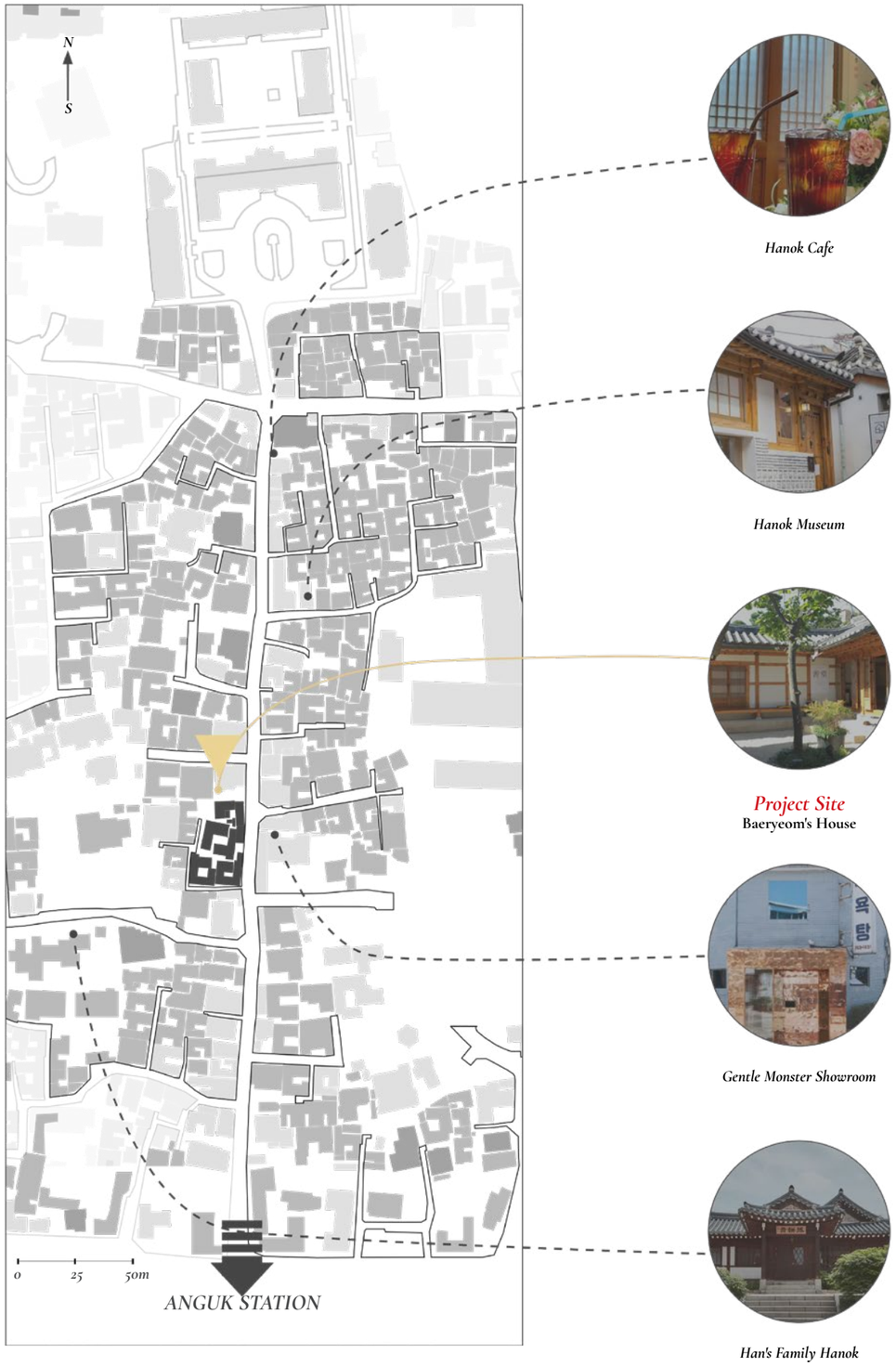
Korean Traditional Architecture /

Adaptive Reuse Archive

Location : Seoul, Korea
Year : 2020
Type : Archive
Size : 600m2

"What is tradition?", The design began with this question.
The design site where the existing building called Baeryeom House was located has a long tradition.
In this situation, it is the purpose of this client and the core of the design that requires a design that respects tradition.
Then the question comes back to square one, "What is tradition?"
I was able to find the answer to the question in record and communication, and I concluded that those who read the record should find what tradition is.

Archive of Everyday is an archive that records the ordinary days of those who lived in the past and today. Although it is similar to the existing archives in that it accumulates a vast amount of data, it is an archive that has the characteristic that many people should be able to access and view easily.
While satisfying these characteristics, the existing house of mind respected the context and attempted bold adaptive reuse.



Hanok Cafe

Hanok Museum

Project Site
Baeryeom's House

Gentle Monster Showroom

Han's Family Hanok

Neaby Traditional Hanok Architecture

Gyedong-gil, Jongno-gu, where Baeryeom House is located, is a street filled with old hanoks. In addition, along with hanoks, stylish design buildings that are in the spotlight by young people are hidden in every corner.



Baeryeom <1911-1968>

Baeryeom

In 1939, he left Cheongjeon Hwasuk to explore the Geumgangsan Mountain area, and the following year, he held his first solo exhibition at Hwashin Gallery in Seoul, and from then on, he began to show his own and unique style of painting. From 1941 to 1943, he participated in the Cheongjeon Hwasuk Exhibition.



Baeryeom's drawing of Seorak mt in 1965.

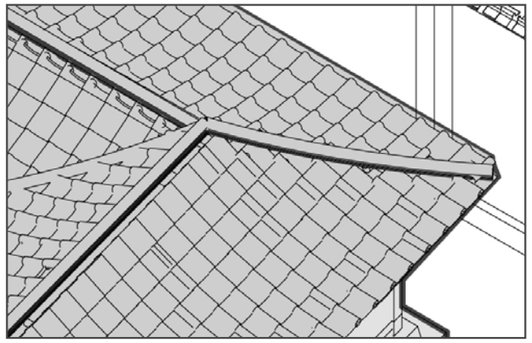


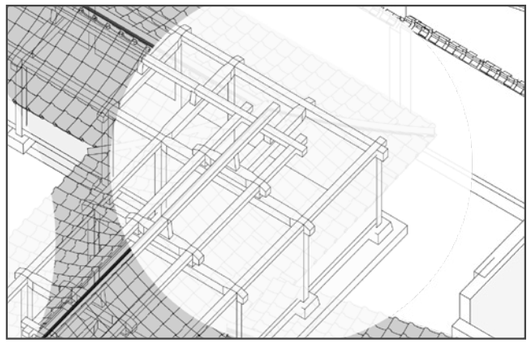
Baeryeom's House

Design Keywords

Giwa Tile Roof

The repeated curved pattern of tiles is one of the characteristics of hanok. These features are used as elements to design the functional roof of the upcoming archive.
Even if the material and the overall shape change, it was designed to preserve the repetitive and curved shape of the existing pattern.



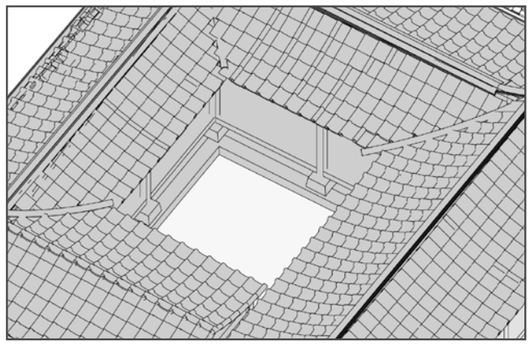


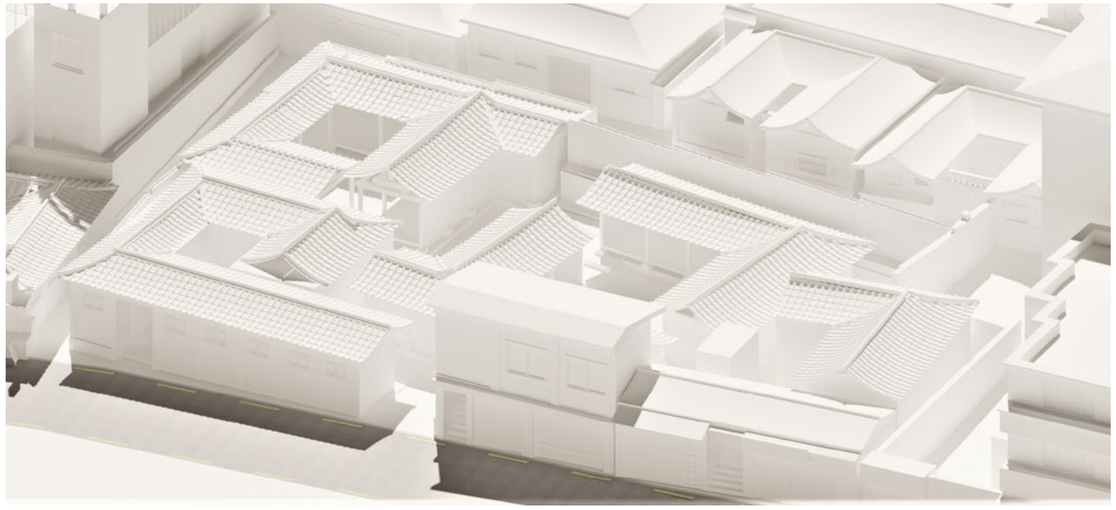
Wooden Frame

The wooden structure of the hanok is a systematic and computational method. It feels like we're looking at a modular architecture today.
By borrowing the combined method of this wooden structure and the repeated grid form, it not only played the structural role of the actual building, but also used it as a design element by exposing it.

Atrium

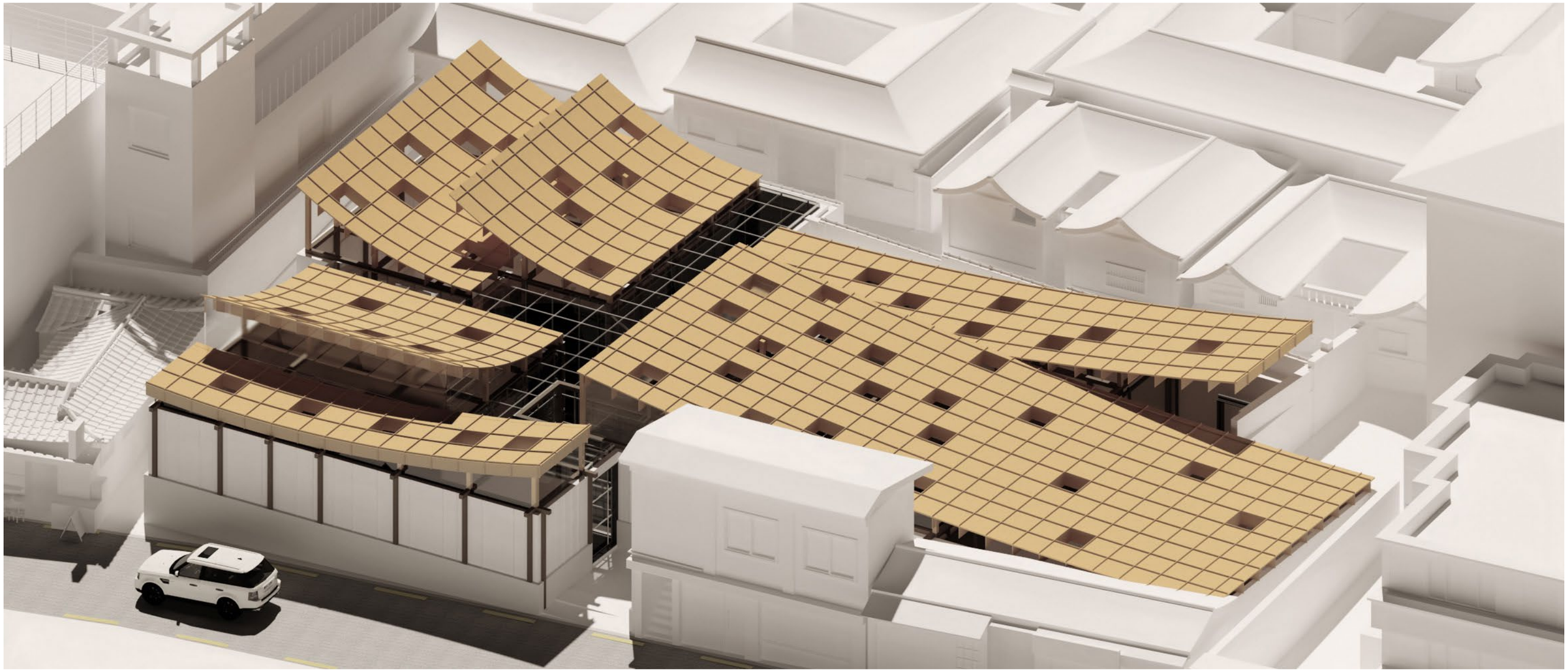
The newly built archive required more area than the existing building, and for this purpose, the underground space had to be actively used. In this situation, the movement and space to go down to the basement were planned by inheriting the location of the atrium of the existing buildings, and the inflow of natural light was actively utilized.

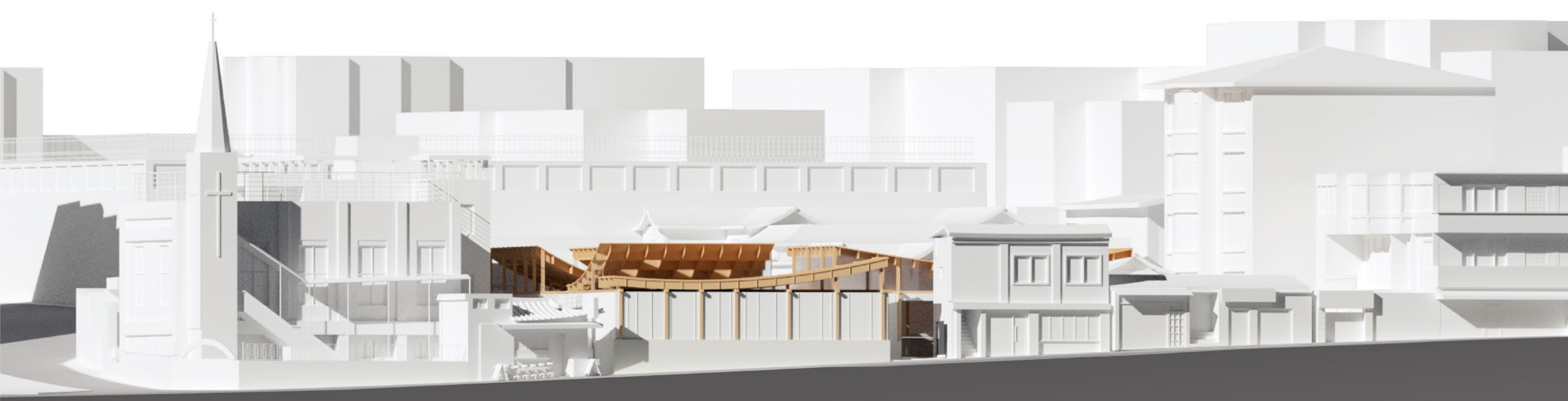




Archive of Every day

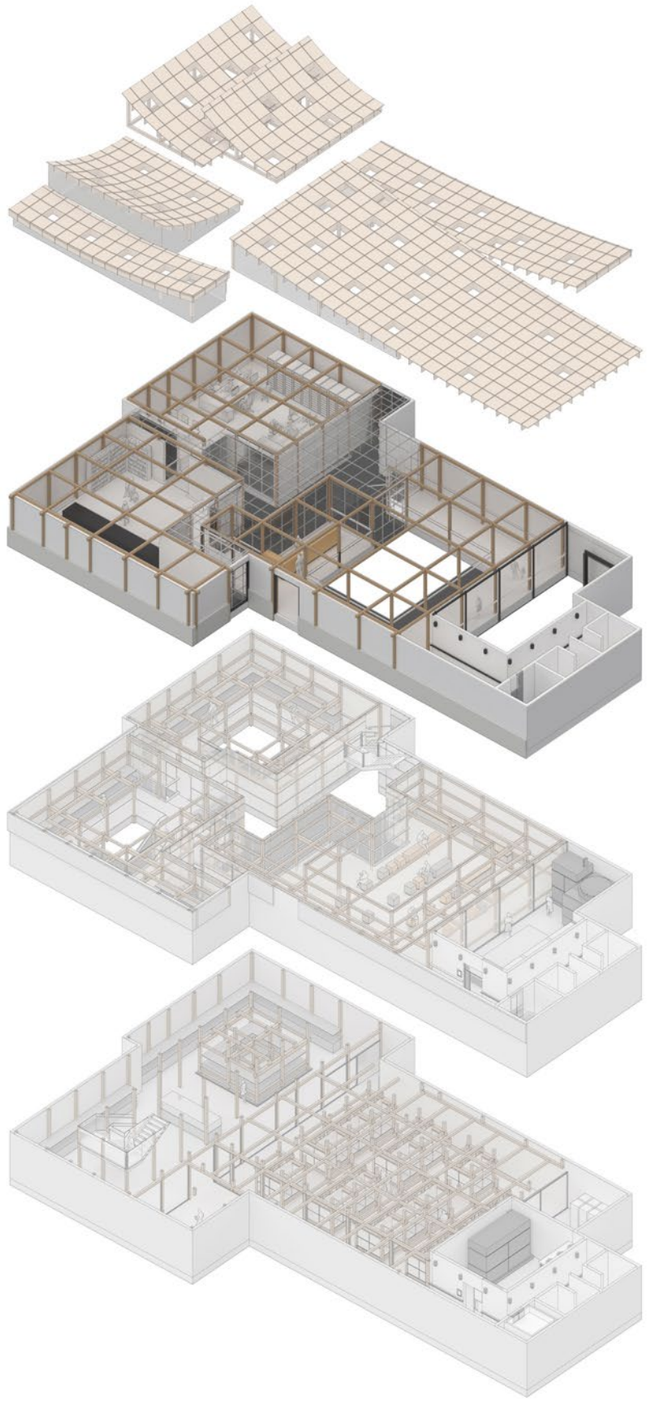
The context of the existing building was respected through the design of the material properties, patterns, and spatial composition. The above three elements naturally established themselves as the core design elements of the new building so that you can feel the old emotions in the new space.





Urban Context

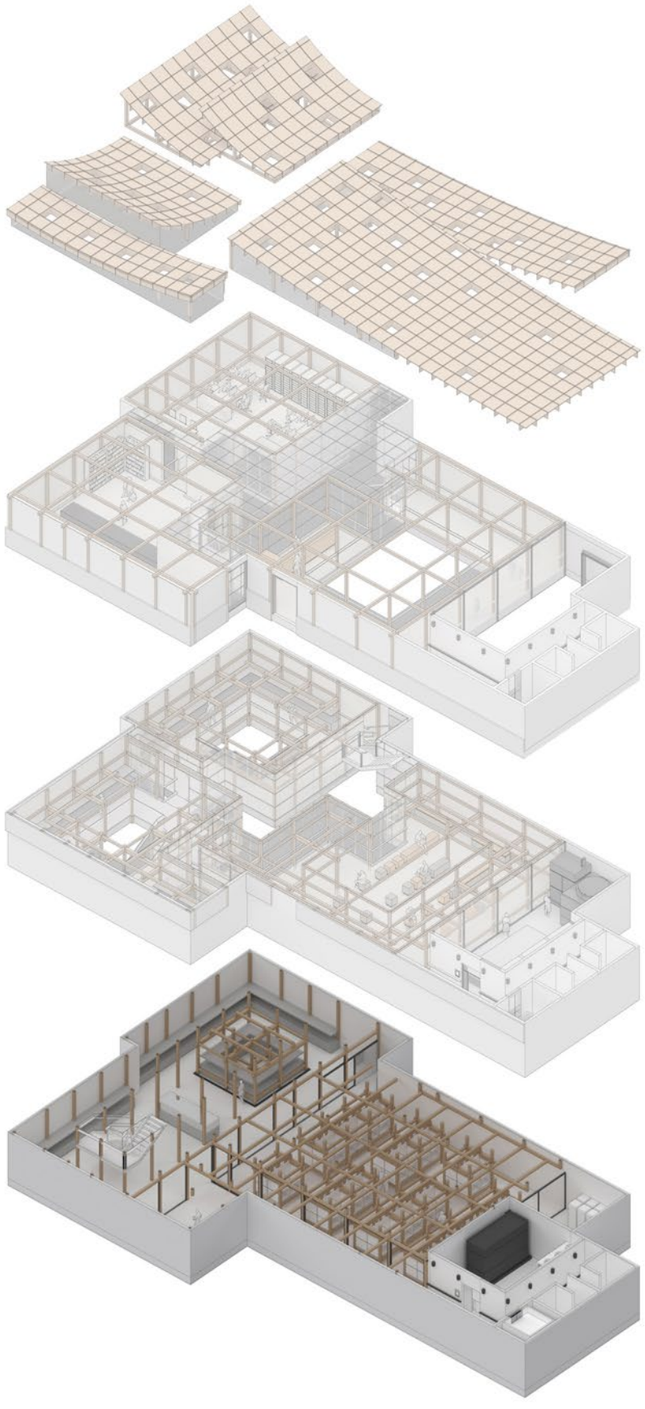
If you reach the front of the archive through the alley, you can see the entrance through the building. It can be entered through a small entrance in contrast to a large underground space.





Atrium and Entrance Sequence

If you enter the archive through the entrance, the larger atrium will greet users where the existing atrium was. Light shines from the ceiling to the basement through the atrium.



Main Storage of Archive

All records are moved to the third basement floor and stored digitally. Physical records that cannot be dataized are also kept in the same place, and anyone can browse them if they want.





Archive of Everyday

The further down, the records of people living in the past and present are piled up. The purpose of the "Archive of Everyday" design is to help people judge for themselves what is tradition in the future through these records.

Prism of the city

Gwangju Library Competition

Internship / Competition

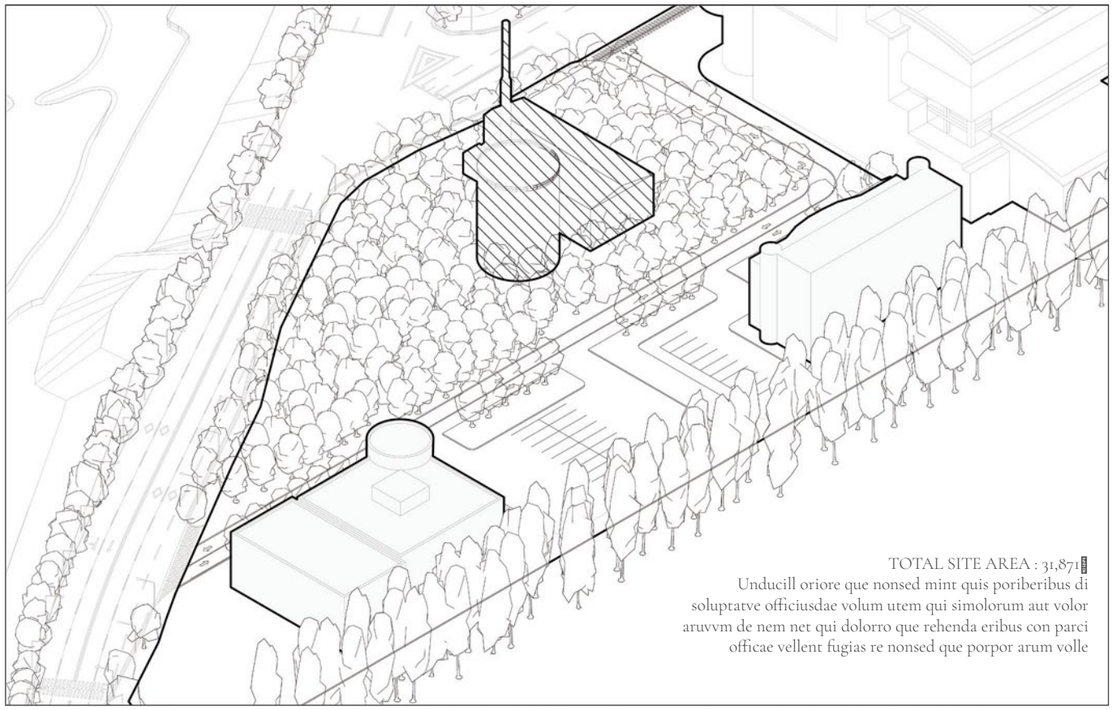
Location : Gwangju, Korea
Year : 2019
Type : Library
Size : 11,000m2

The site for the City Main library Gwangju is located at the city's green park next to residential area and directly adjacent to
Gwangju streams hence has great opportunity to create spectacle views along the river and park. Along with Incinerator factory
regeneration project and performing art center project planned at neighbor site, City Main library Gwangju has great potential to
grow as new cultural center of the city.
Proposal envisions to provide library and the gathering place for the community at the same time. Project accommodates programs for the community members to utilize and occupy on daily base, library function is naturally separated in different floors.

Cafeteria is allocated in transitional zone and works as connector to bridge programs and promotes social interactions within.
Proposed massing combined with materiality physically express the importance of this cultural center and reveal its iconic identity, PRISM OF THE CITY. Massing was optimized to naturally receive the pedestrian access with the consideration of the upcoming future developments. Podium definition allows programmatic flexibility at ground level and enhance its prismatic presence.
Serrated exterior enclosure with dual materiality forms PRISM OF THE CITY with ever changing appearance under constantly
changing daylight condition.

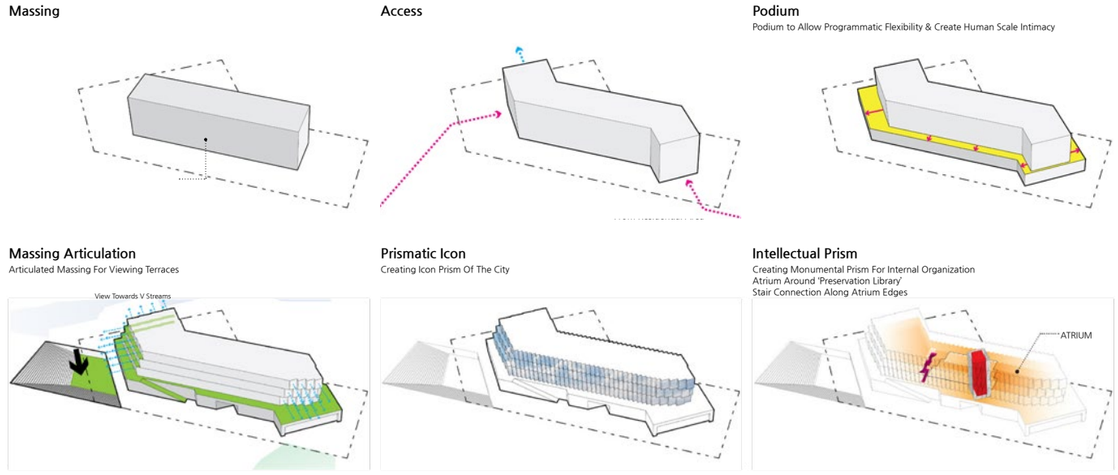


Sangmo Garbage Incinerator



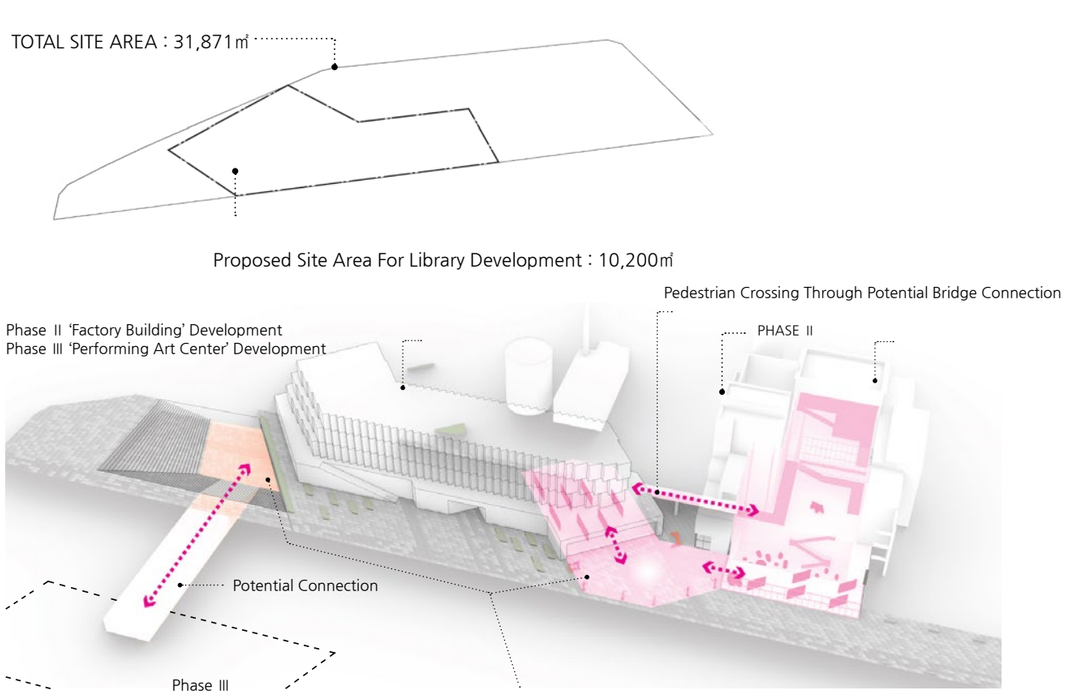
Project Site

A library representing Gwangju will be built by utilizing part of the recycling plant in the old Sangmu district. The library is designed by freely utilizing the remaining areas except for some buildings in the factory.
Ruptaqu amendus sedi aceptaque mos vendem. Et lam aut eictur?



Desing Process

hrough the six-step process, the form is designed in consideration of the entrance route from rivers, parks, and apartment complexes, and the central prism is installed.



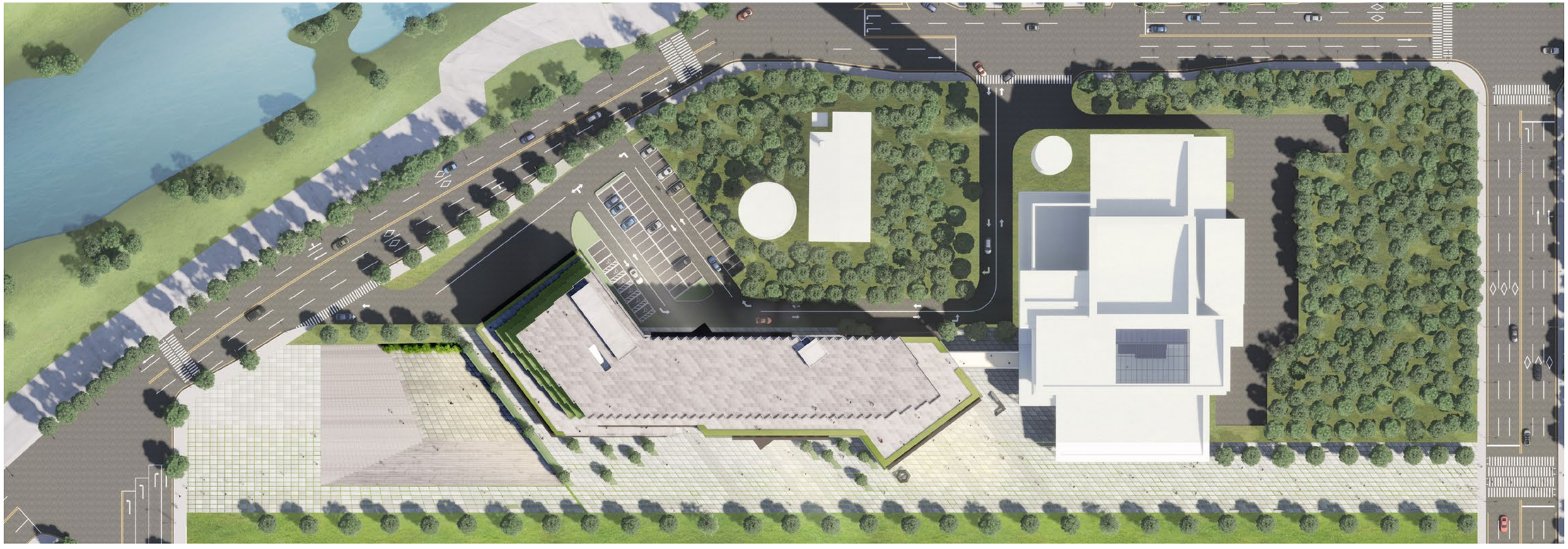
Development Phase

After the completion of the project, Gwangju library, the construction of the art center using the remaining site of the recycling plant will begin.



Gwangju Library

Gwangju Library is a library surrounded by Gwangju Stream and green areas in the park. It will be a place where Gwangju citizens can not only read books, acquire knowledge, and exchange, but also enjoy nature.





Prism of the City

The pillars consisting of books located in the center of the building are the prism of knowledge that will illuminate Gwangju. The prismatic pillar located in Jungjeong is located in a location visible from anywhere inside the library and is positioned as a central element of the building.

ANT

Next Generation of Logistics

Software / Hardware

Year : 2021
Type : Mobility

"ANT" is a transportation unit that can achieve next-generation logistics innovation. Units consisting of smaller units are suitable for responding to the increasingly personalized demand of transport logistics. In addition, modular-designed units can be combined as needed to respond to larger logistics needs.

The use of this device as a simple means of transportation is not the end. You can visit the right place in the city that changes over time and become a pop-up store or a commodity locker to fulfill your purpose as a real estate asset, not just a means of transportation.
Software assistance to assist in these organic activities is also essential, and these software acts as the brain to enable "ANT" to achieve maximum efficiency.

TOYOTA LOGISTIC COMPETITION

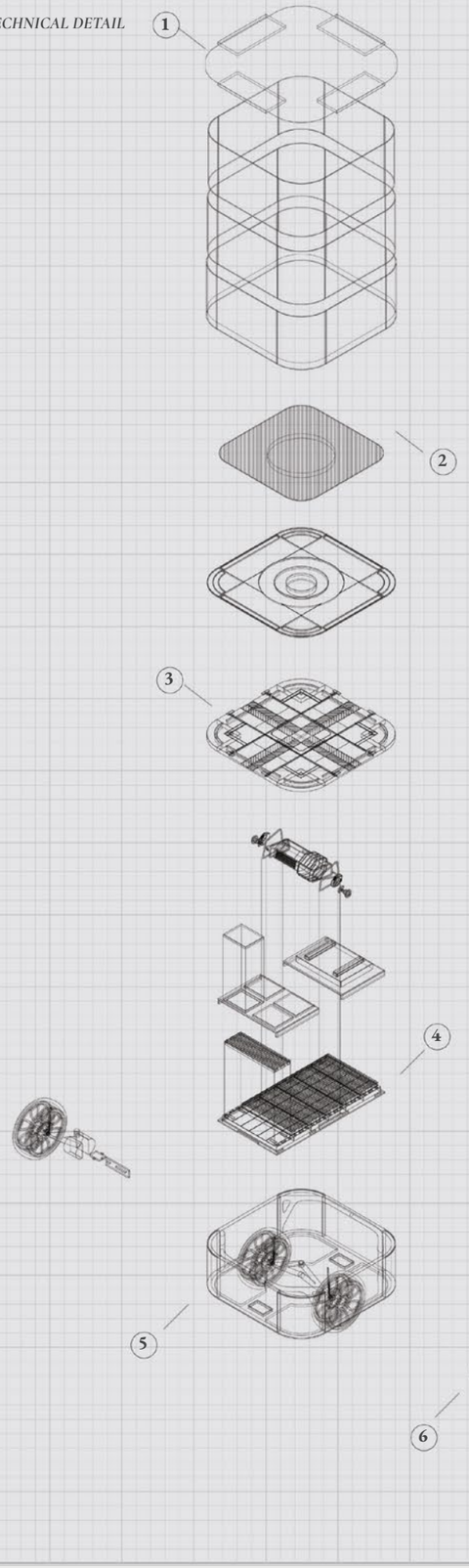
TOYOTA ANT

TECHNICAL DETAIL

NO . 20220123

PROJECT . ANT

TEAM KISUJO



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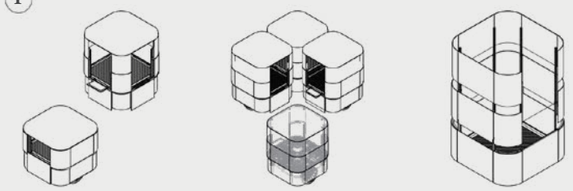

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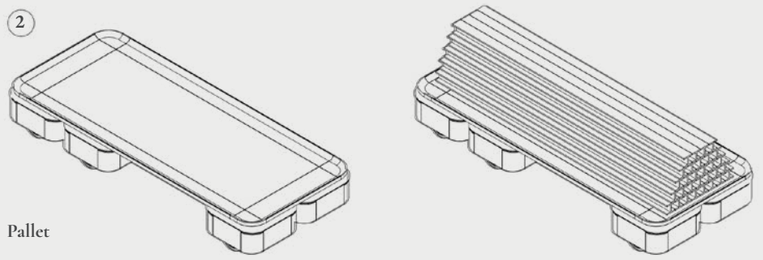
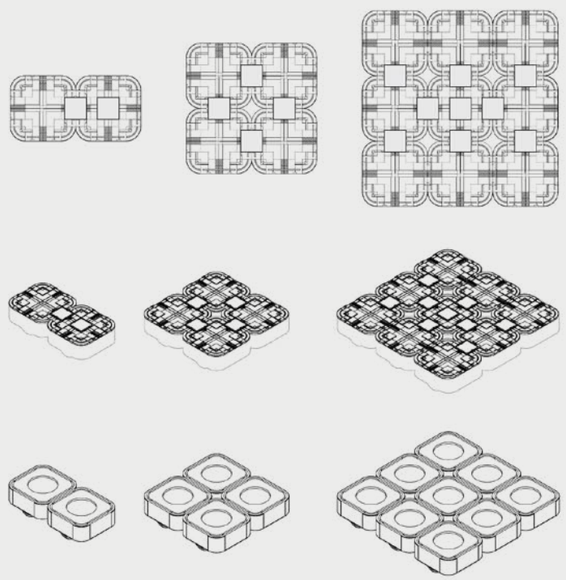


Pallet

Strength of using adaptive unit

It's one of many usage of Ant unit, That show this unit can handle not only lastmile or personal logistic needs but also can handle large size of logistic

3

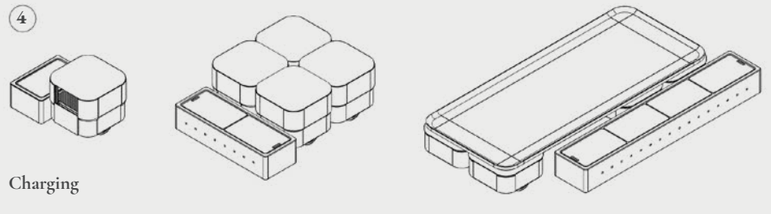


Connection

Connect and share via slider

Connect each unit by slider inside the center of the unit.
It helps the transmitting power and control of the combined units.

4



Charging

Adapte to anywhere

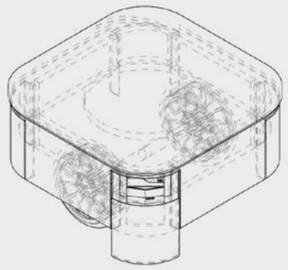
Easy to move, Easy to install, Can adapte to anywhere , any circumstance.
Slighley lower height of charging unit and wireless charging pad make it possible to park and charge without plug in something

5

Sensor

Feeler of the Ant

Sensor and control panel are built inside the curved wall.
It can be opened only for maintenance.



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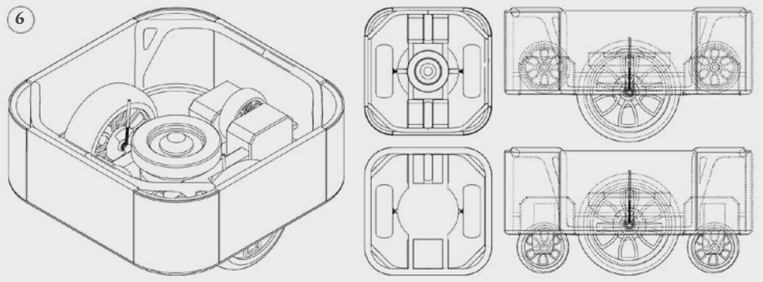
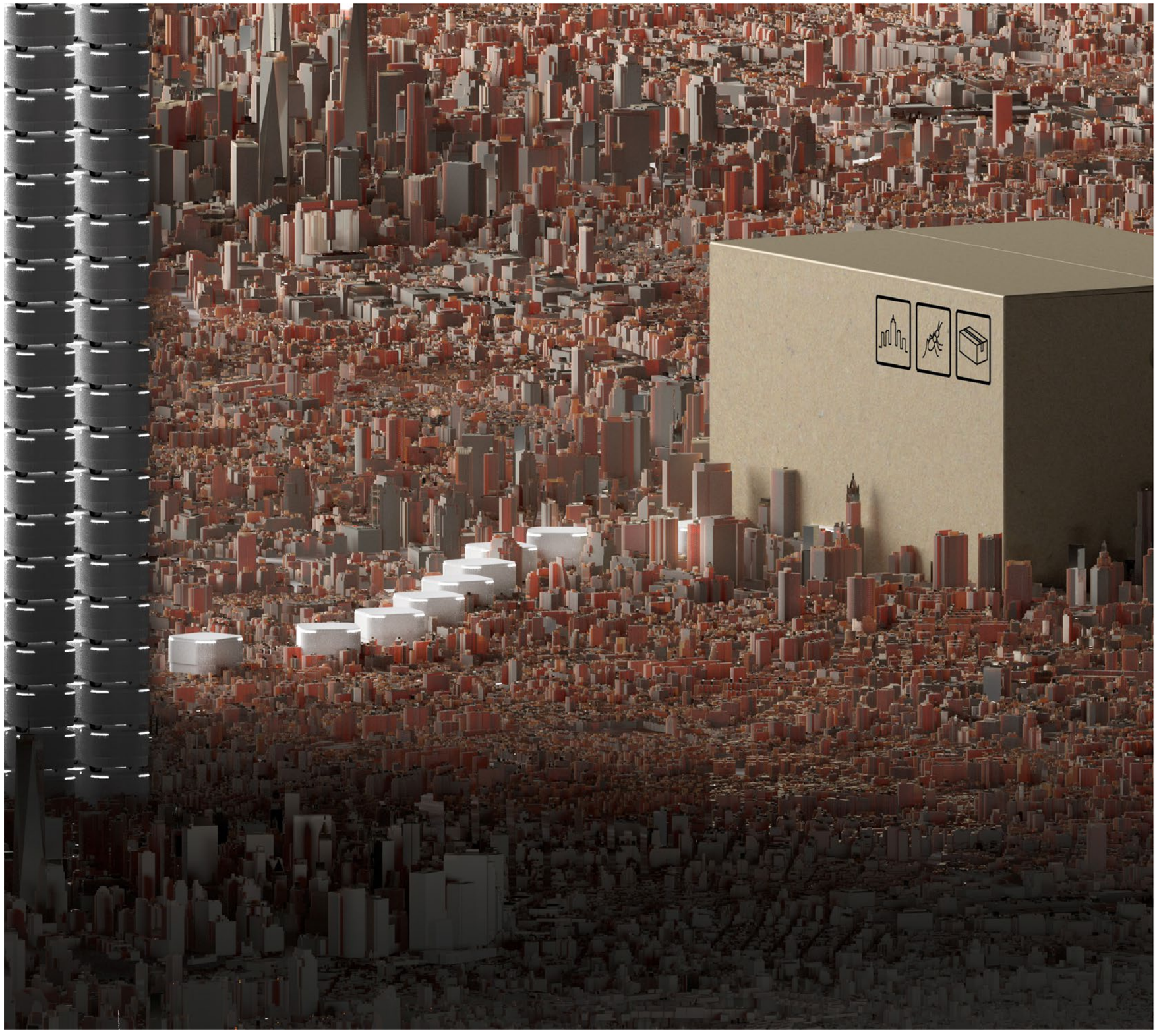


Wheel

Sub wheels, main wheels

In case of driving single unit, a pair of sub wheels steer the unit and a pair of main wheels are for main engine power.
In case of driving multiple unit, a pair of sub wheels hide inside and a pair of main wheels at front unit steers the units group.



ANT

Is an autonomous, adaptive logistic module that provides transportaion services to meet the customers'
personalized logistical needs



ANT's Software

You can modules as many as you need from single module to cluster of multiple objects with just tap on your phone.

Can be used anywhere, from mart to houses to deliver groceries and to construction sites to deliver construction materials.

Responds delicately to extremly diverrsified types of urban logistics and places on demand.

ANT's Hardware

Can transport from Small to large logitics and covers a function as an installation when needed. Modular Unit of 900mm * 900mm, and can be expanded to varius sizes thrugh combination of modules.

Outer shell of each object can be extended vertically, providing height as a space such as pop-up store and covenience store depending on the situation.

Supports extra pallet mouning. enables effcient and stable strasportation of large logistics such as furniture and building materials.



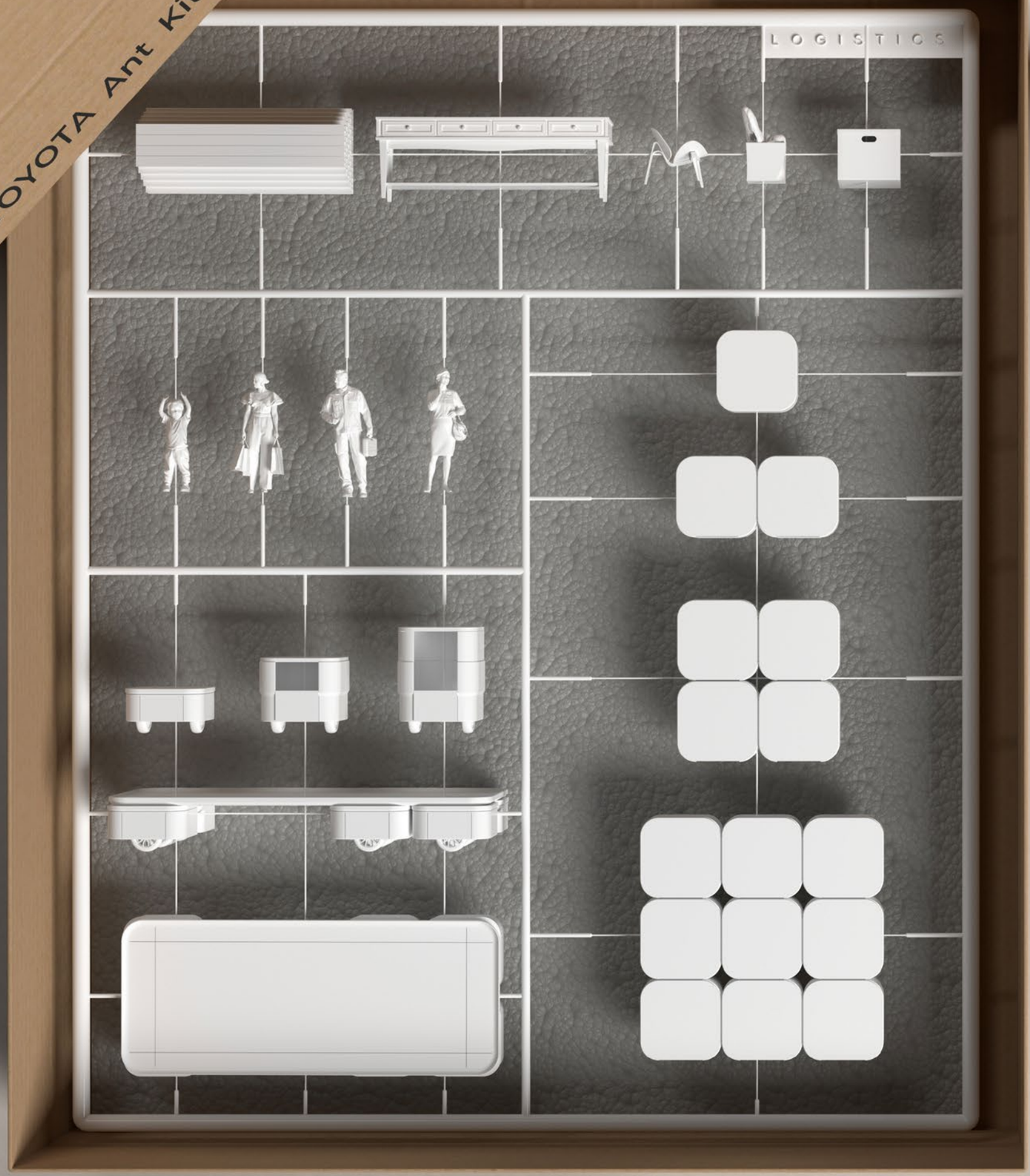


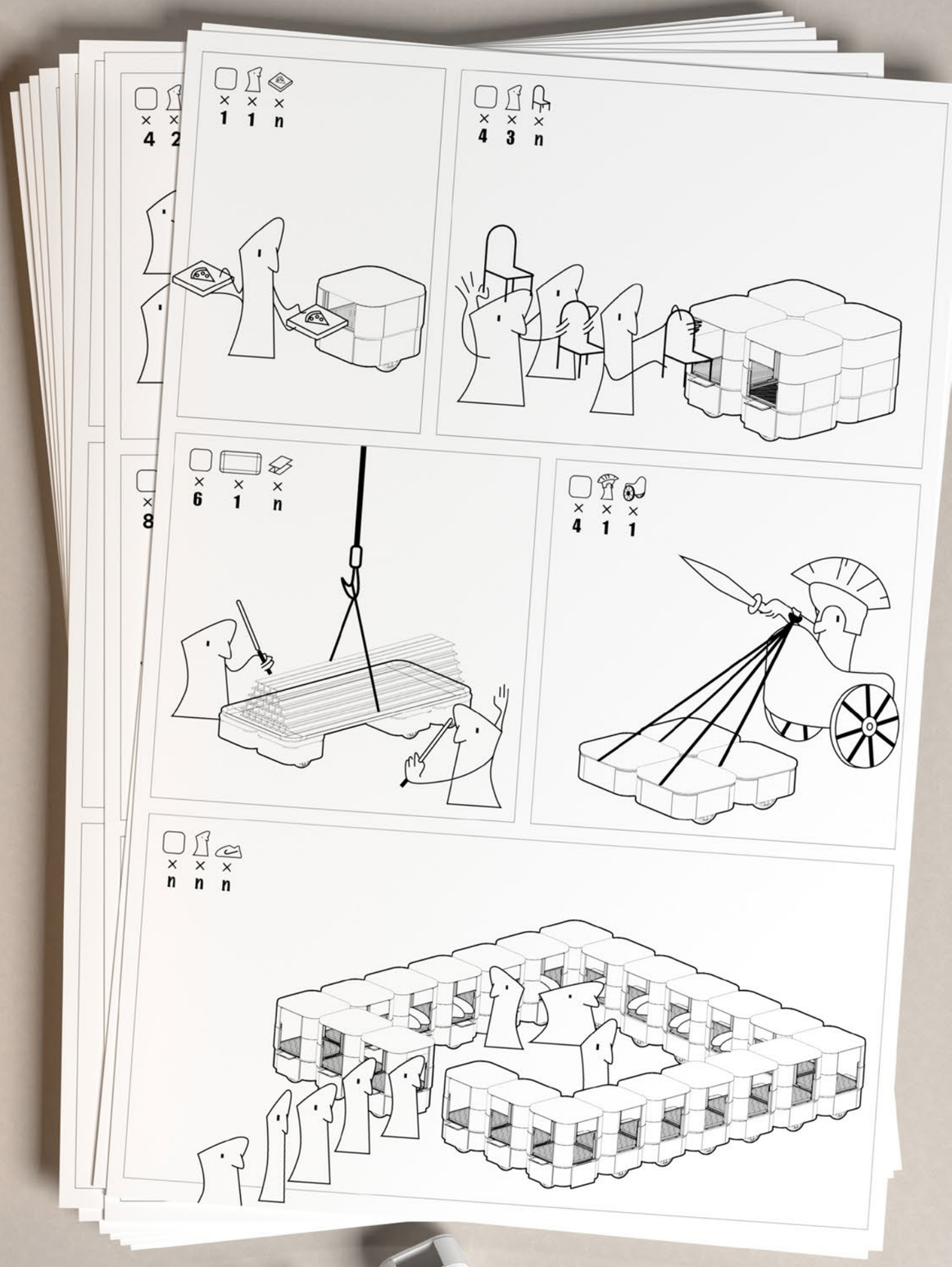
ANT In the CIty

Ant mobilizes based on real-time networks and handles instant and dispersed supply of urban logistics one-on-one.
Ant collects thre entrie distribution process in micro-data units.
Ant can unloaded thre burden of logistics hubs thrrough 24-hour transportation.

TOYOTA Ant Kit

LOGISTICS





Flexity

Computation Schemetic Design Tool

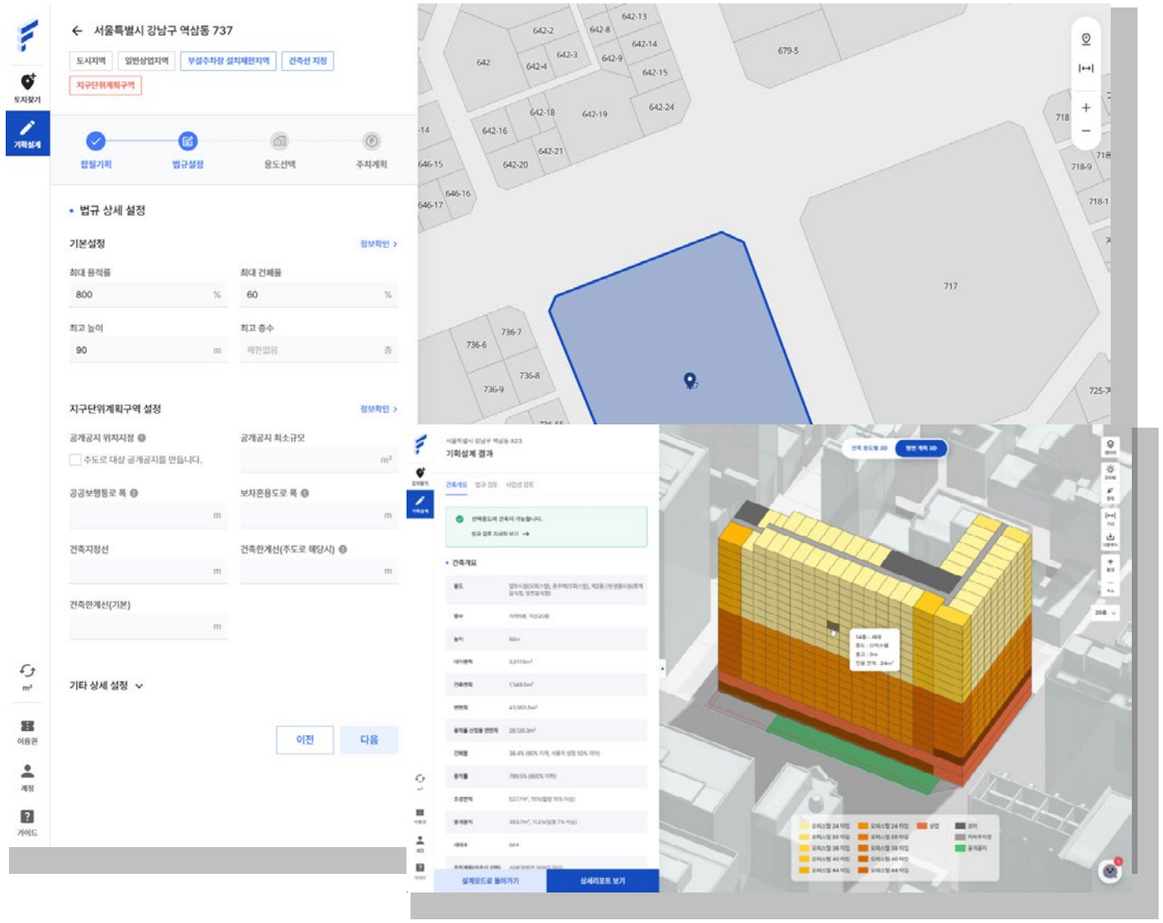
Software Development

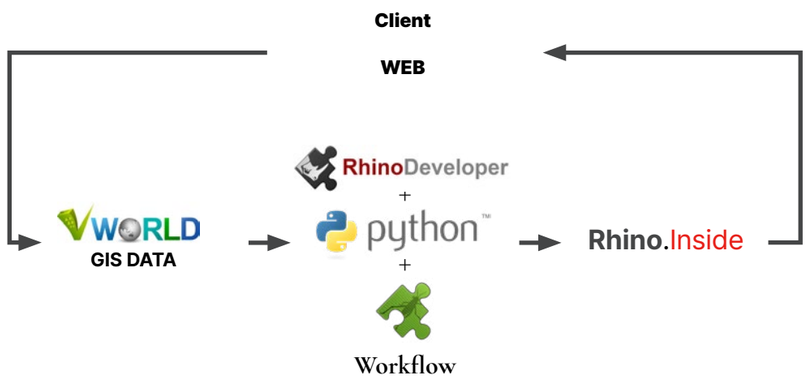
Location : Seoul, Korea
Year : 2020~2022
Type : Architecture Sass Product

Flexity

Architecture + IT Software

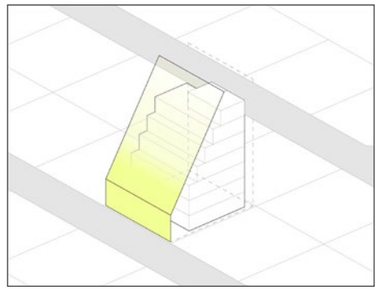
Saas Product that automatically designs appropriate schemetic design for each site by interpreting building regulations.
Among the tens of thousands of cases, we designed an algorithm that derived the most optimized design and developed it.





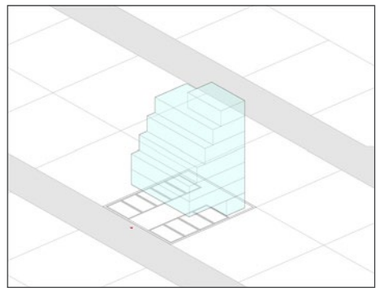
It receives GIS information from "V-world" and organizes data before proceeding with automated design, and then performs 2D and 3D operations according to the user's purpose. The tool used at this time used Python-based Rhino API.

Things I done



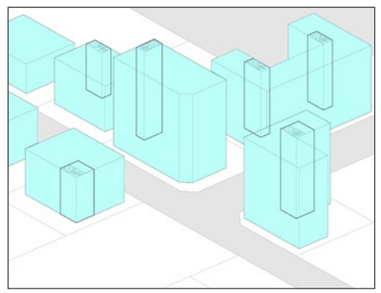
Architectural Slant Line for the Daylight Calculation

By interpreting the architecture law data of the area where the design is in progress, the optimized form is calculated to guarantee the right to sunlight on the surrounding land.



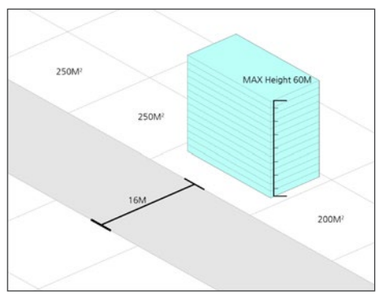
Automatic Parking Lot Design Algorithm

Various considerations, such as the shape of the land, the entrance, and the use core, are calculated to derive an optimized parking plan, not just the maximum number of parking lots.



Automatic Core Design

As the beginning of the design to derive the optimized plane of the reference layer, the size and location of the optimized core are calculated according to its purpose and shape.



Heigth Calculation Based on Law

Through the interpretation of building laws, the laws applied to the selected lands as special areas are interpreted and the maximum height of buildings that can be built is calculated by considering the surrounding environment.

Yongsan Riverway

Waterfront Urban Design
New Face of Han-River

Location : Yongsan, Seoul, Korea
Year : 2024
Type : Urban Design Studio (Team)
Site : 1,276,252 m2

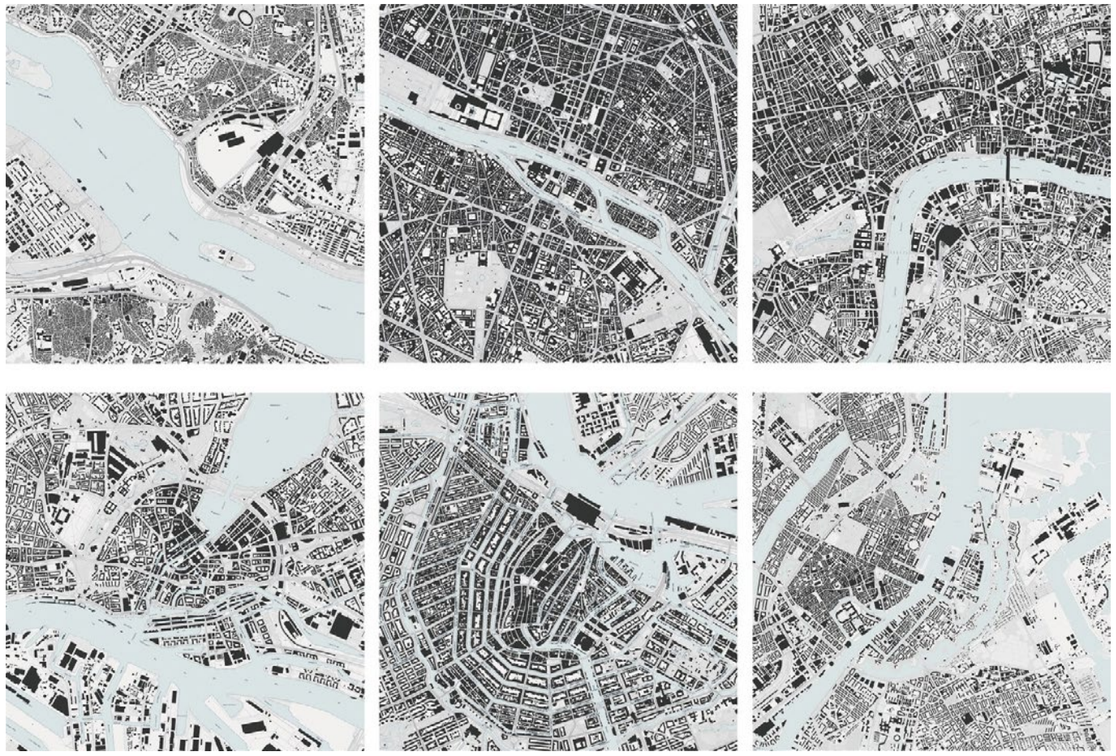
River Way is an urban design for the Yongsan waterfront, a 1.28 km2 site between Yongsan Station and the Han River. Its backbone is Mancho Stream, revitalized as a water corridor that runs from the Yongsan International Business District to the river and gives each of three zones its own public space.
A KT data center next to the site gives off about 3.6 TJ of heat a day, the heating energy of 33,000 households. The design carries this heat through the district in pipes for heating and cooling water instead of letting it go to waste.

Bridging masses over the Gangbyeon Expressway link the city centre to the waterfront and hold public programs, which turns the site into a tourism hub.
Studio project of the Graduate School of Environmental Studies, Seoul National University (IPUD), Team 1, with Hyeonguk Jeon. The work received the Excellence Award at the 2nd Urban Design Exhibition of the Urban Design Institute of Korea in November 2025.



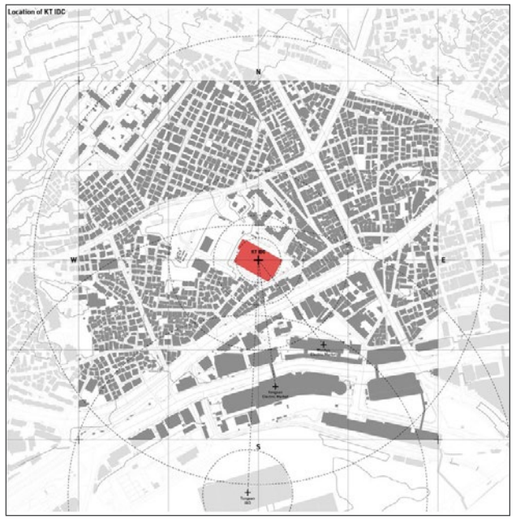
Yongsan Riverway at Night

Aerial view from the Han River. The ring-shaped river bus station sits in the foreground, the Yongsan IBD behind it and Nodeul Island at the right.



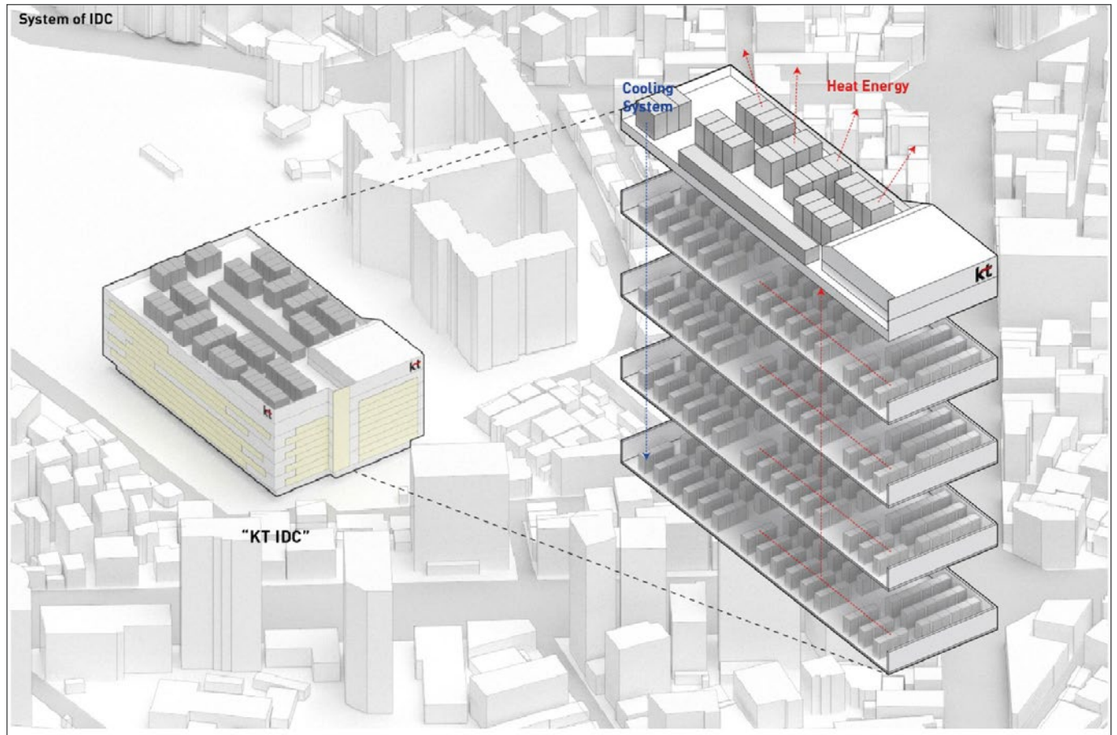
Urban Form

Seoul's waterfront has not been developed as densely as those of Paris, London, Hamburg, Amsterdam and Copenhagen.



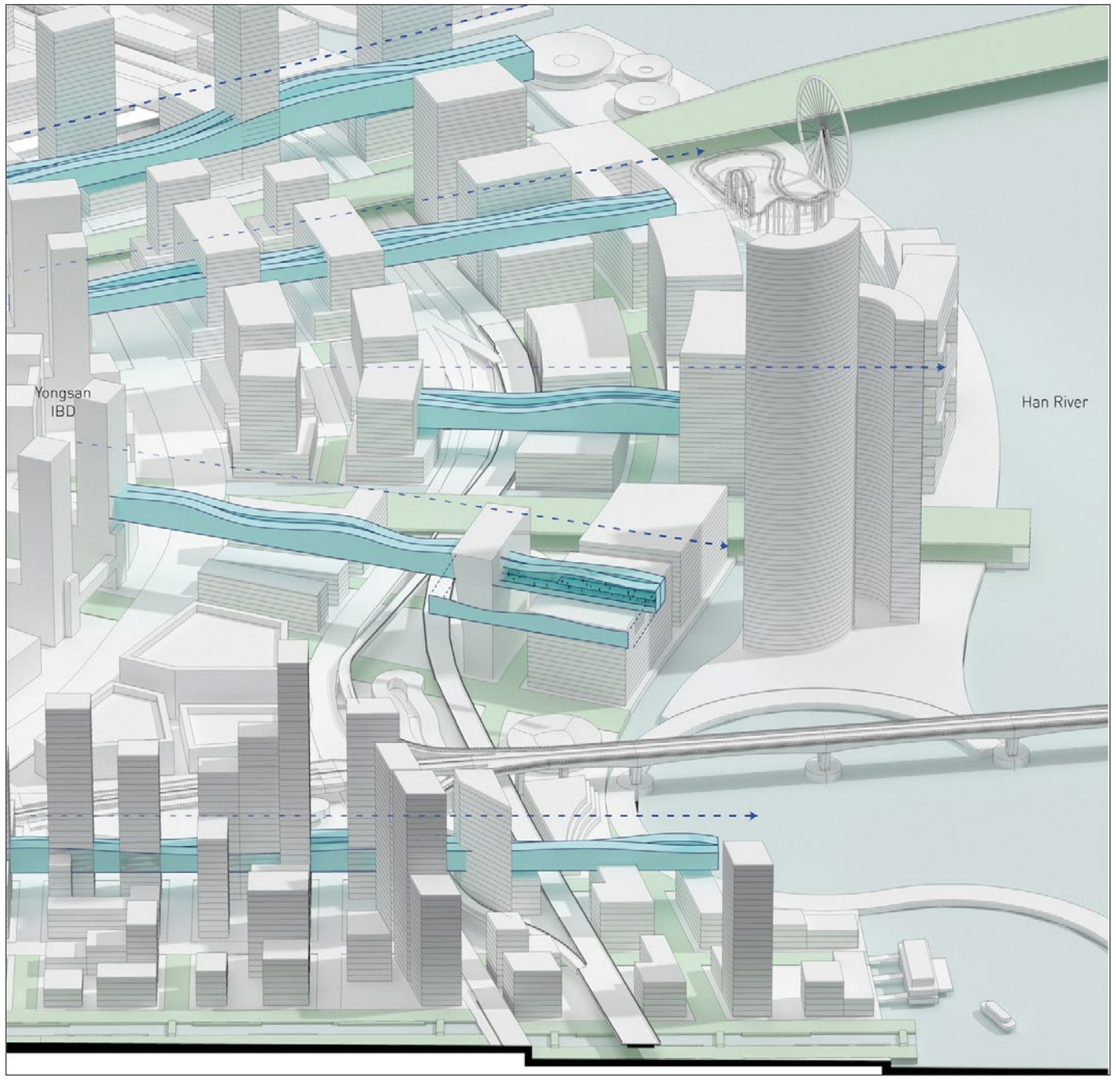
Location of the Data Center

The KT data center stands in the dense blocks north of the Yongsan electronics markets and the IBD site.



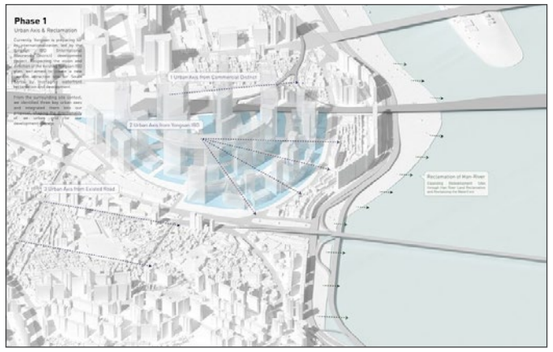
Energy of the Data Center

The data center uses 1,200 MWh a day, which is 0.9% of Seoul's electricity and the use of 100,000 households. It also gives off 3.6 TJ of heat a day, the heating energy of 33,000 households.



Concept

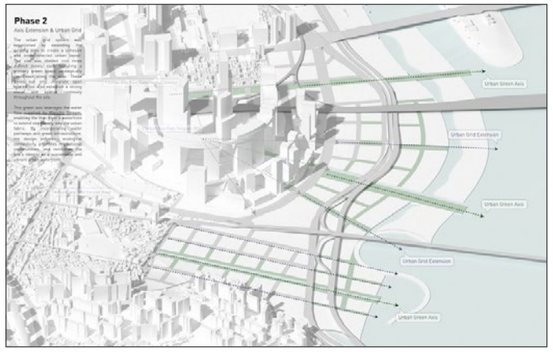
Water from Mancho Stream is carried from the Yongsan IBD to the Han River along several routes. These routes become the backbone of the public spaces.



Phase 1

Urban Axis & Reclamation

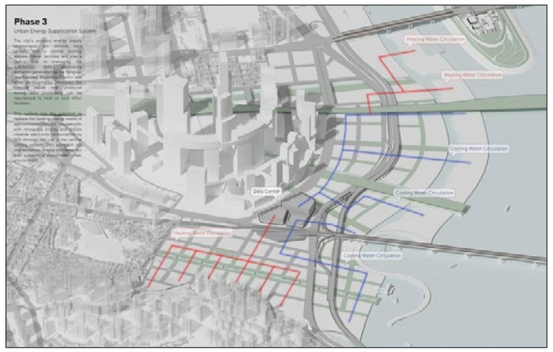
Three urban axes are read from the commercial district, the Yongsan IBD and the existing road. The riverfront is widened by land reclamation.



Phase 2

Axis Extension & Urban Grid

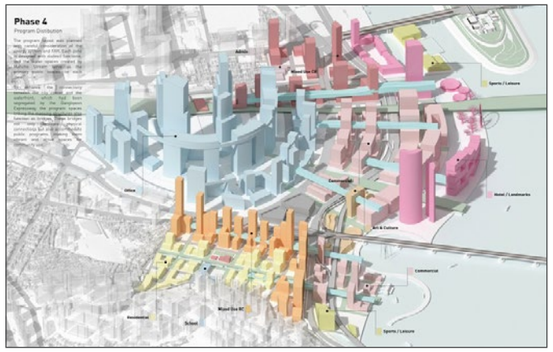
The axes extend into an urban grid and the site splits into three zones. A green axis fed by Mancho Stream runs through each zone.



Phase 3

Urban Energy Supply System

The data center and a central cooling system supply the district. Loops of heating water and cooling water run along the grid.



Phase 4

Program Distribution

Programs are placed by FAR and by the energy system. Bridging masses over the Gangbyeon Expressway link the city centre and the waterfront and hold public programs.

Area Table (m2)	
Site Area	1,276,252
Residential	169,411
Commercial	1,822,500
Mixed Use RC	543,034
Mixed Use CR	446,830
Sports	114,858
Admin	9,550
School	19,983
Tourism	565,248
Coulture	34,262
Bridging Mass	190,252
Utility	34,491
Total	3,781,007

① Zone 1
② Zone 2
③ Zone 3
④ Data Center
⑤ Ring & River Bus Station
⑥ Yongsan IBD
⑦ Yongsan Station
⑧ Gyeongbu train line
⑨ Nodeul Island

N

0 50 100 200 500(m)

Master Plan

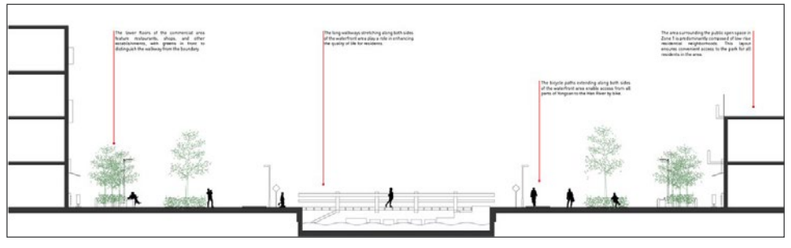
Three zones are laid out along Mancho Stream between the Yongsan IBD and the Han River. The area table lists residential, commercial, mixed-use, tourism, cultural and public uses on a site of 1,276,252 m2.

Urban Skyline





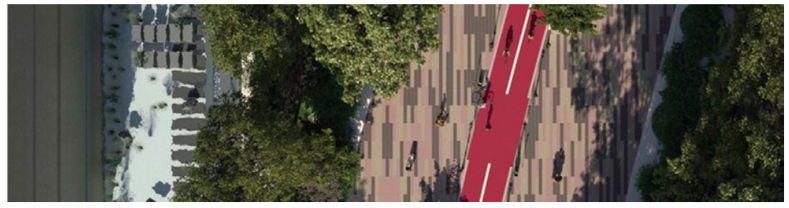


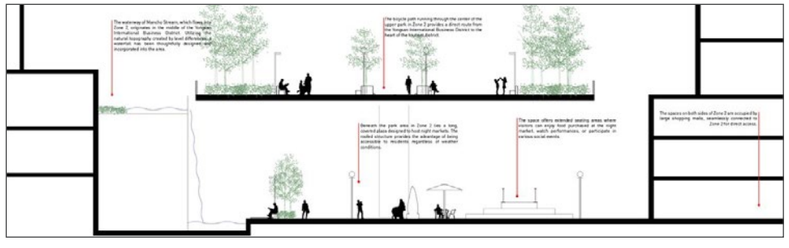


Zone 1

Low-rise housing and a commercial street face the stream. Walkways and bicycle paths run along both sides of the water.





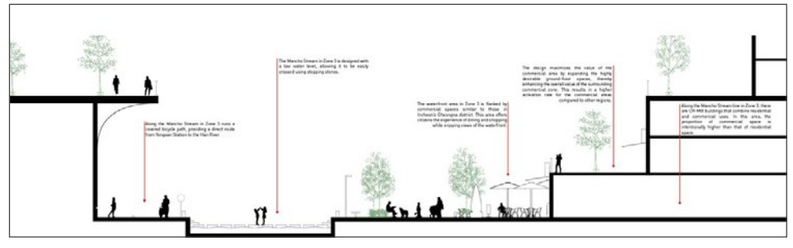


Zone 2

The stream starts in the middle of the Yongsan IBD and drops over a waterfall. A covered plaza for night markets lies beneath the upper park.







Zone 3

A shallow stream crossed by stepping stones runs beside a covered bicycle path from Yongsan Station to the Han River.

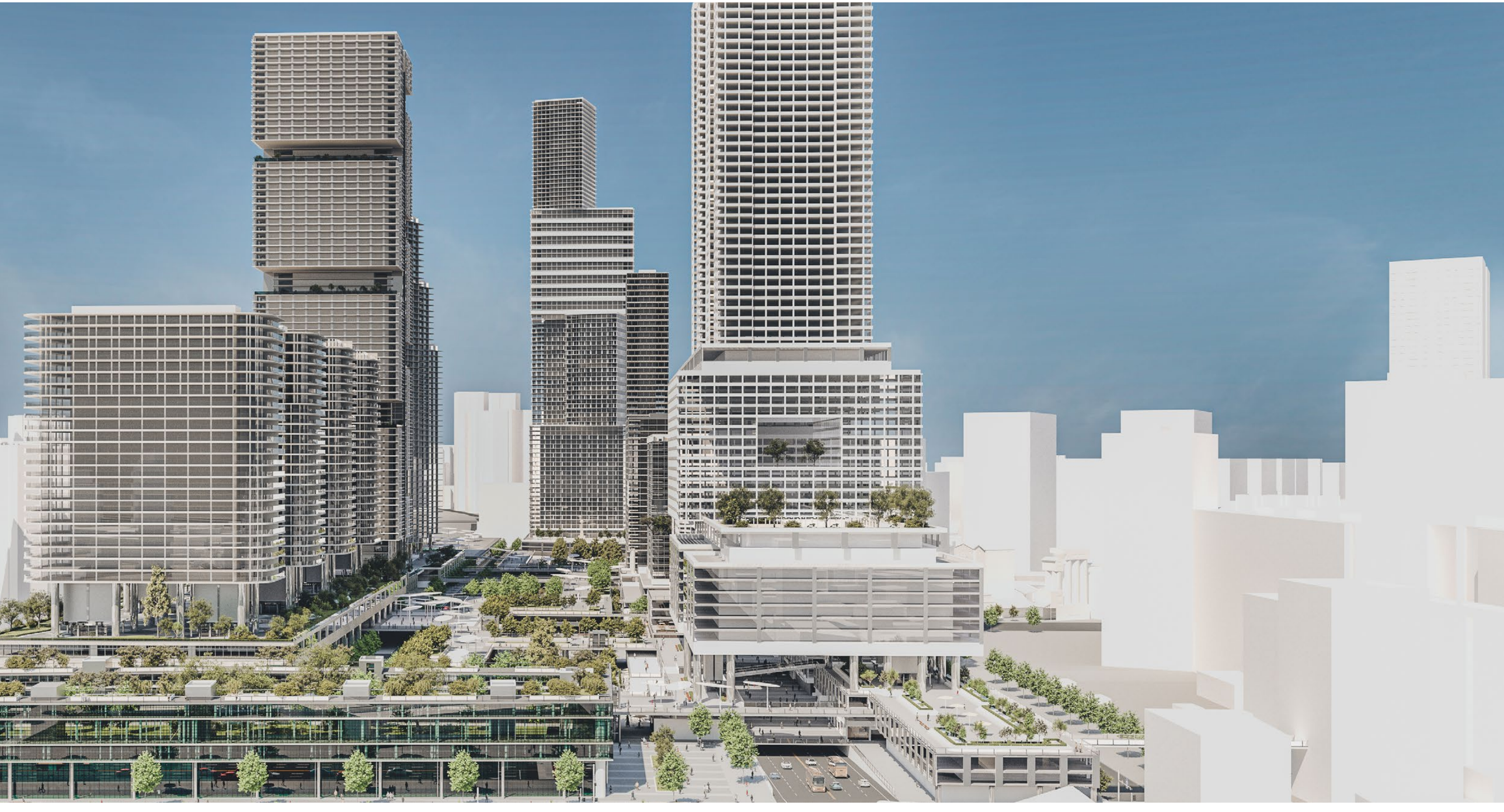
Urban Floor

Multi-Layered City
Yeongdeungpo, Seoul

Location : Yeongdeungpo, Seoul, Korea
Year : 2025
Type : Urban Design Studio (Team)
Team : with Woojin Cho
Role : planning, site analysis, ground-level and underground public space, platform landscape, diagrams, perspectives

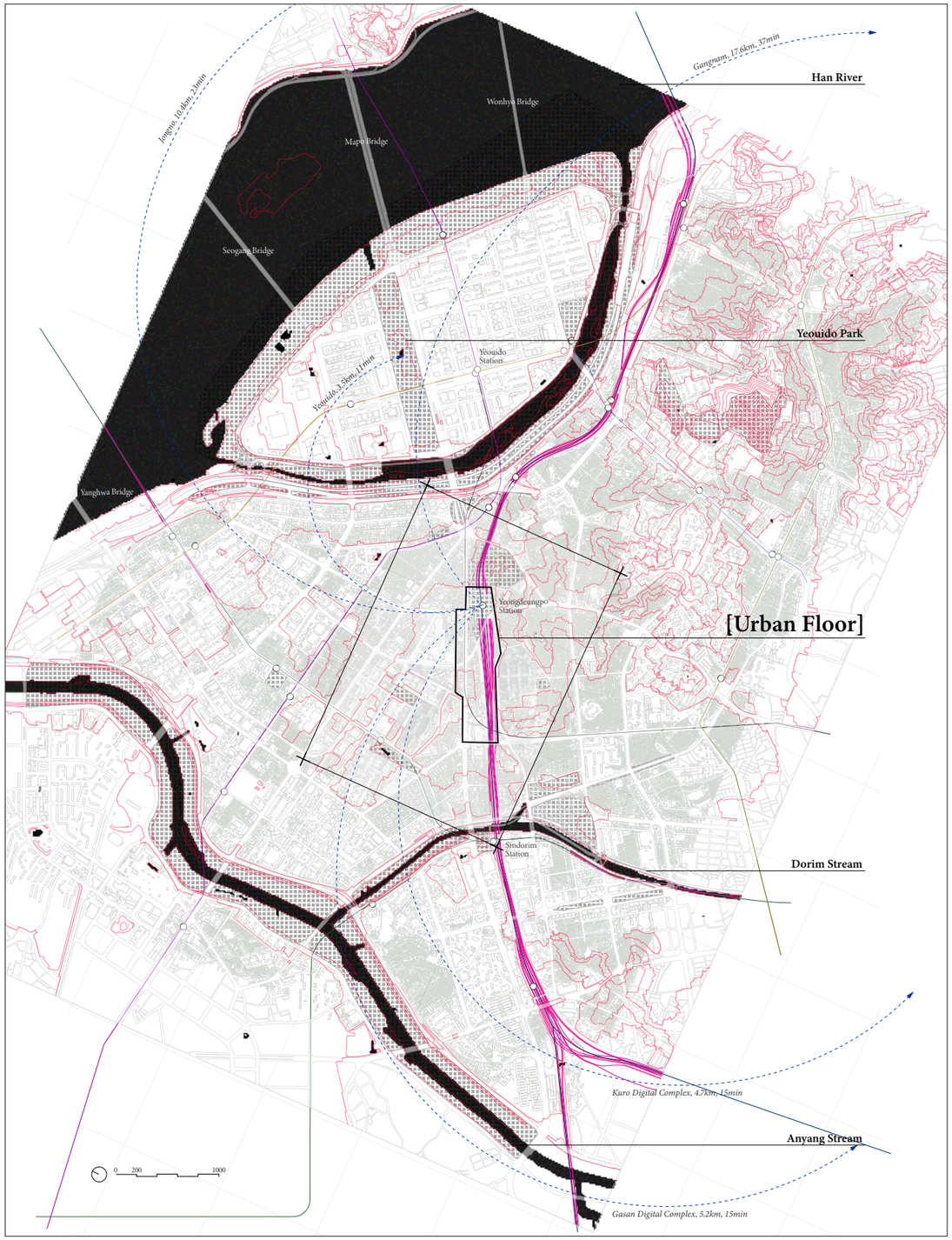
Cities are layered and keep changing. Yeongdeungpo, once a leading commercial centre of Seoul, was a composite city where layers of space and daily life built up over a long time. Large shopping malls and online shopping have since led to the decline of its traditional markets and small shopping streets, and the productive functions it once held remain as voids in the urban fabric.
Gyeongin-ro and the railway split the district north from south, and a sharp gap separates the dense mixed-use centre from the ageing housing and shops around it. The site faces deep inequality in quality of life and an uneven share of development gains.

In response, the project proposes Urban Floor for Yeongdeungpo: beyond physical reconstruction, a three-dimensional city where community and commerce, housing and culture, movement and staying cross and coexist. The arterial road and the railway go underground, and the basements of the office buildings are joined and filled with public programs such as cultural facilities and parking, so that profitability and public contribution are met together.
Studio project of the Graduate School of Environmental Studies, Seoul National University (IPUD), Urban Design Studio 3, with Woojin Cho.



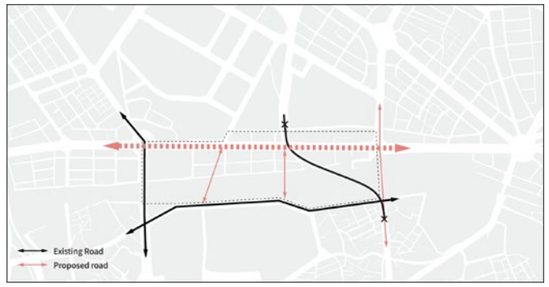
Urban Floor, Yeongdeungpo

Towers rise from a continuous green floor that lies above the undergrounded railway and Gyeongin-ro.

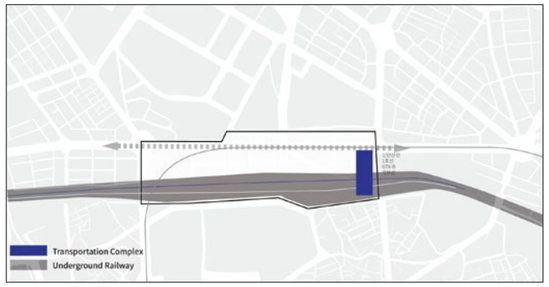


Site Context

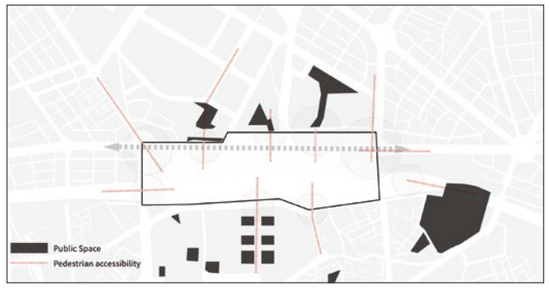
Yeongdeungpo is a strategic midpoint between the business districts of polycentric Seoul and has the potential to become a more residential place: an urban intermediary space.



Undergrounding Gyeongin-ro and removing the overpass



Linking the public transport network

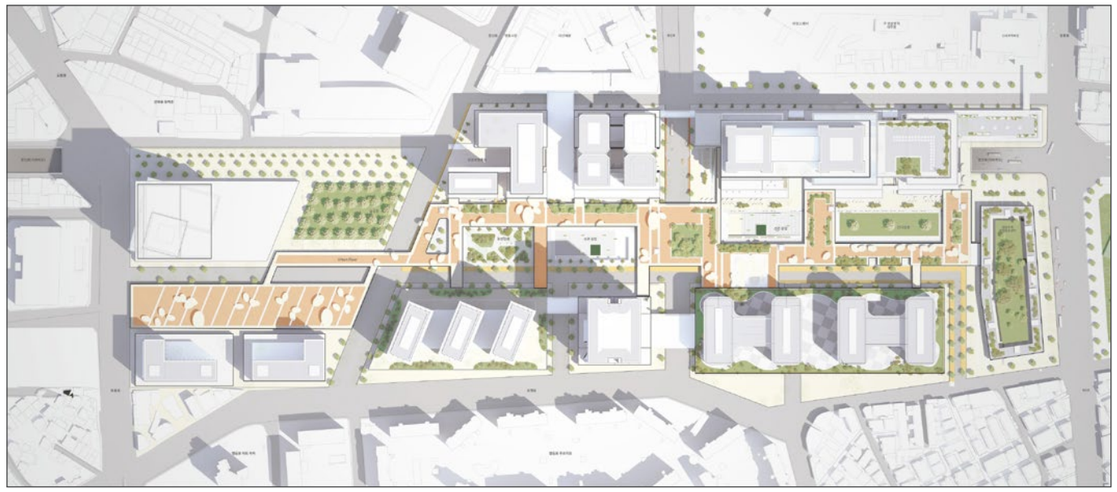


Better pedestrian access to public space



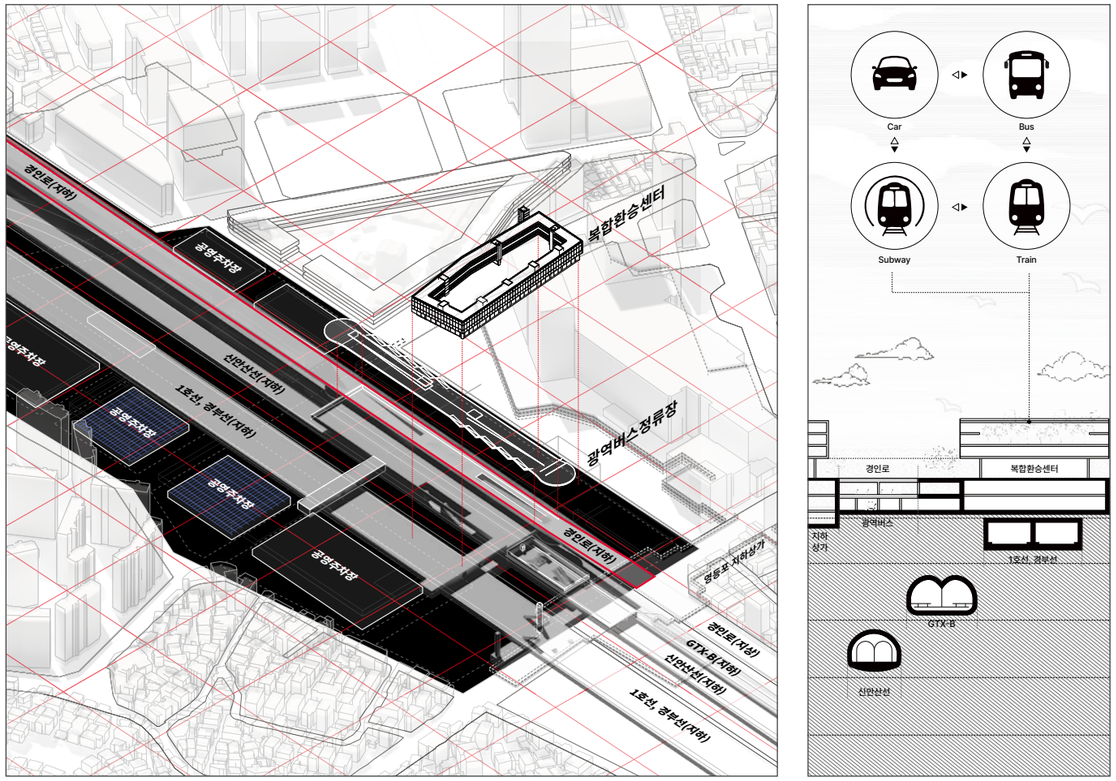
Multi-layered mixed-use program

Design Process



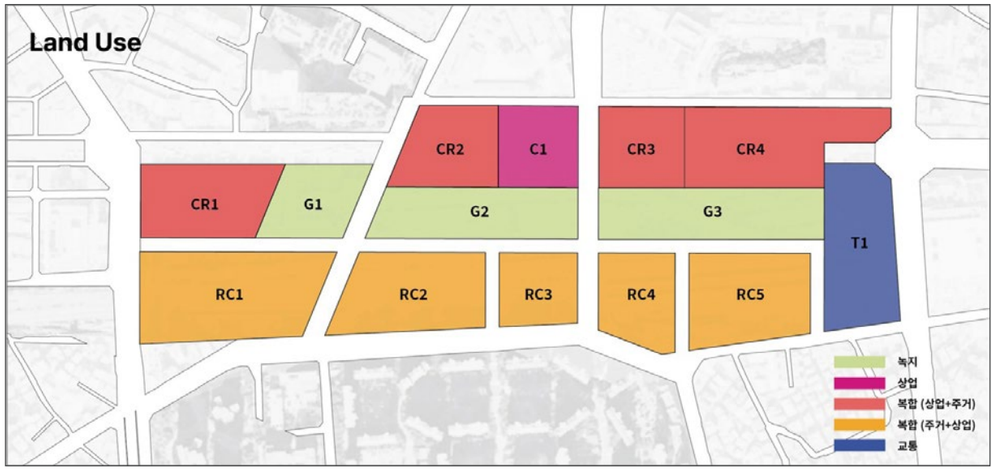
Master Plan

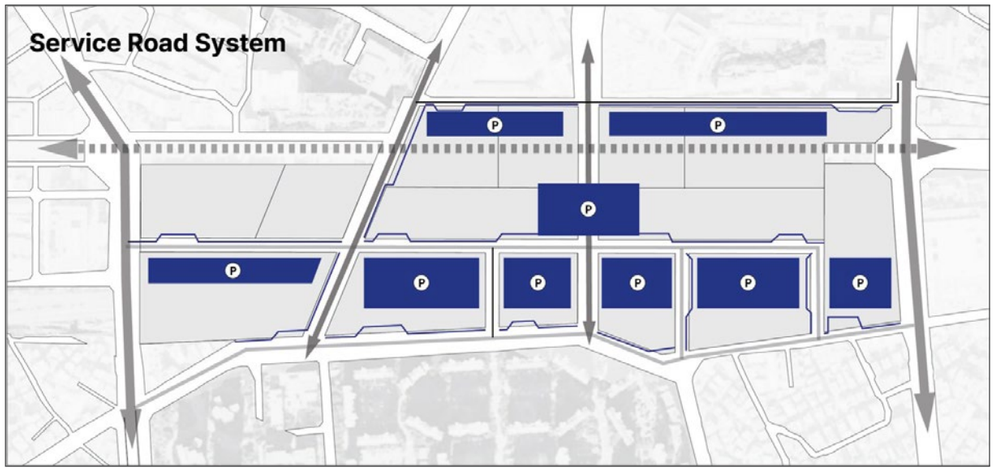
Mixed-use blocks stand along the new pedestrian floor.

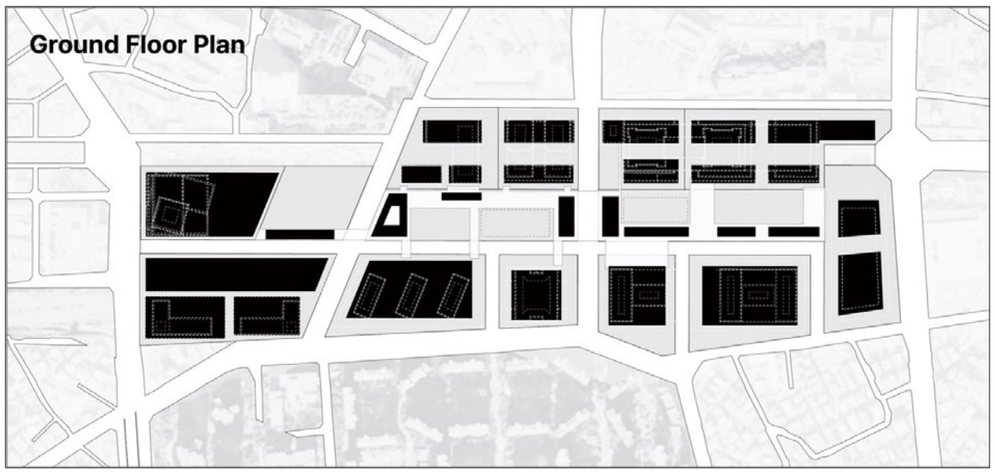


Underground Transportation System

The Line 1 railway and Gyeongin-ro, the main cause of the split, go underground, and the ground above becomes a green, pedestrian public realm. The space below is an infrastructure layer for transport and support functions that brings together a transfer centre, public parking, cultural facilities and spaces for logistics and operation.

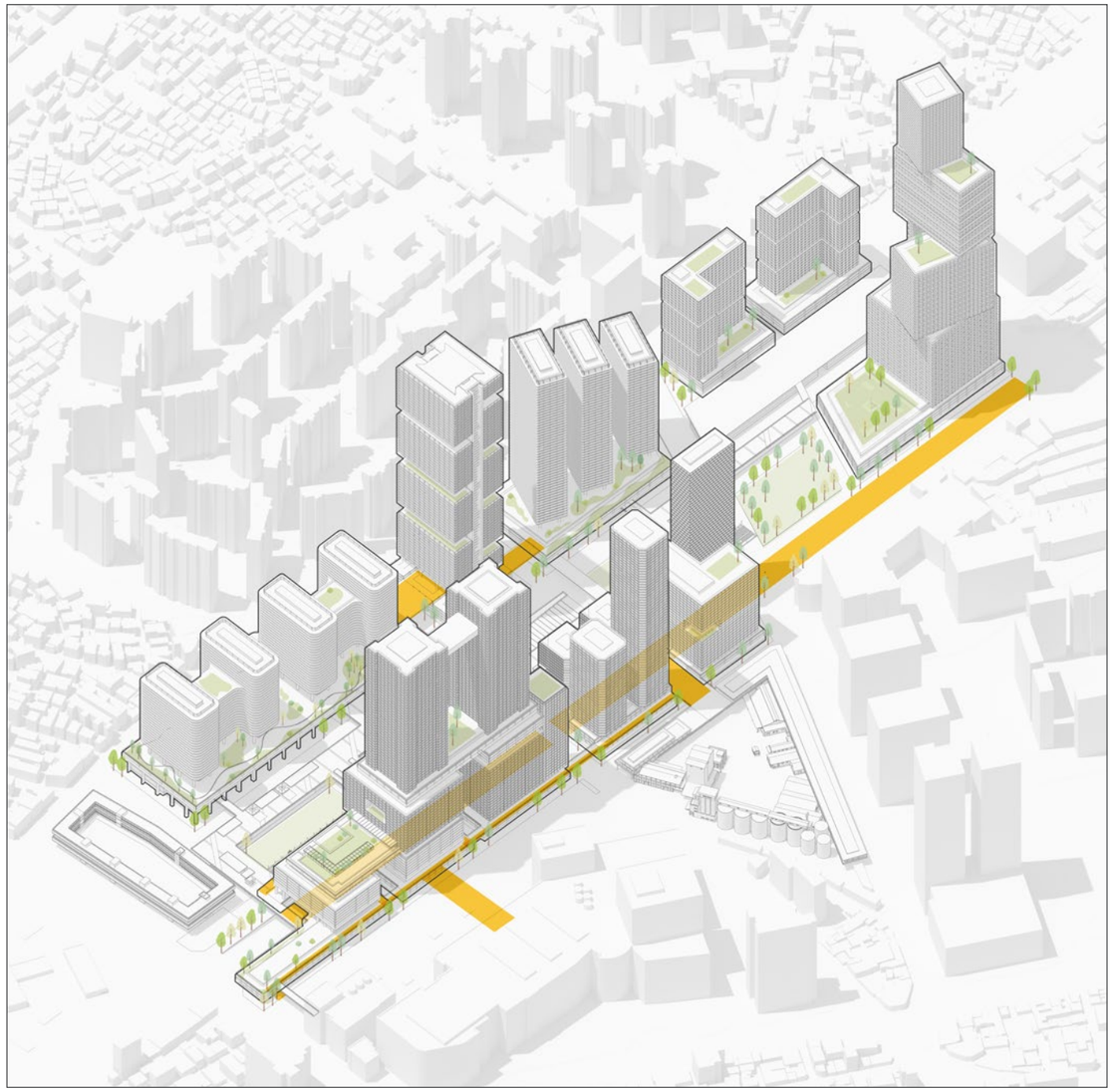






Land Use, Service Roads and Ground Floor

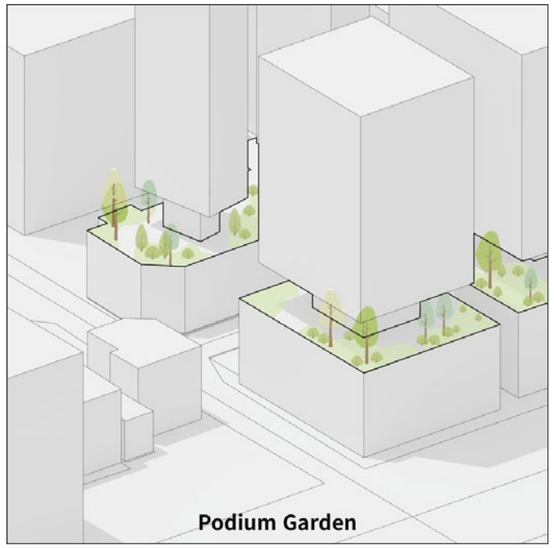
Commercial-residential, commercial and green blocks sit on a grid of service roads, and the ground floor plan shows the footprints of the new blocks.



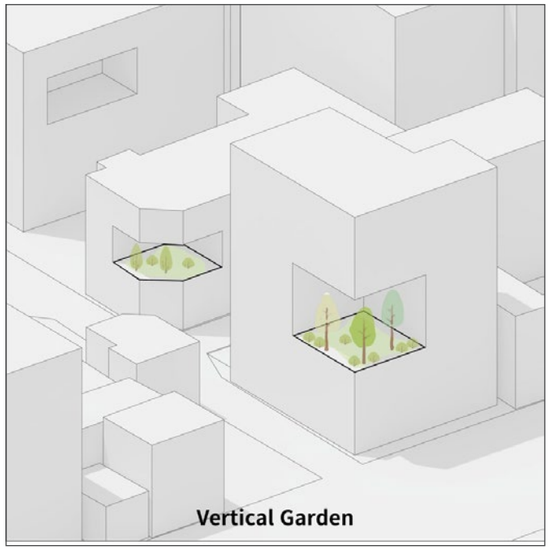
Urban Floor joining the divided Gyeongin-ro



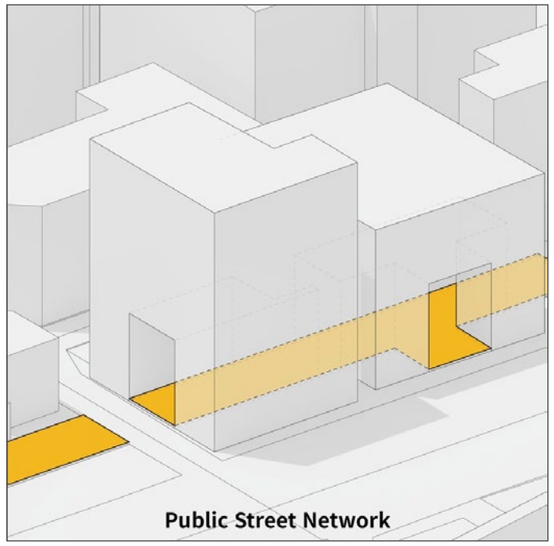
Urban Floor with the ground-level public walkways highlighted



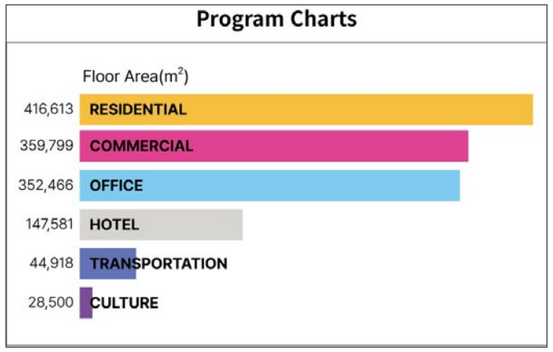
A garden on top of the podium gives residents a green space and a meeting place that is out of sight from the street.



Gardens built between the floors add the green area the district lacks and help with fine dust, heat and views.



A public walkway runs through the podium of the shops. It leads pedestrians through naturally and brings more visitors to the shops.



Floor area by program in m2: residential 416,613, commercial 359,799, office 352,466, hotel 147,581, transportation 44,918, culture 28,500.

Urban Floor

A new ground level over the railway infrastructure restores the broken flow of the city and takes in the everyday density of people. This Urban Floor works as an active platform where different urban events happen by time of day and by user group.



Urban Floor linking Sindorim and Yeongdeungpo



A green park in the city centre, returned as a public contribution space



The Daesun Flour Mill cultural space seen from an office



Multi-level public open space

Public Spaces

Each open space, linked to the programs and walking routes around it, supports everyday activities such as exhibitions, markets, outdoor talks and community meetings. It works as a spatial device that prompts activity and brings people together.

Network Campus City

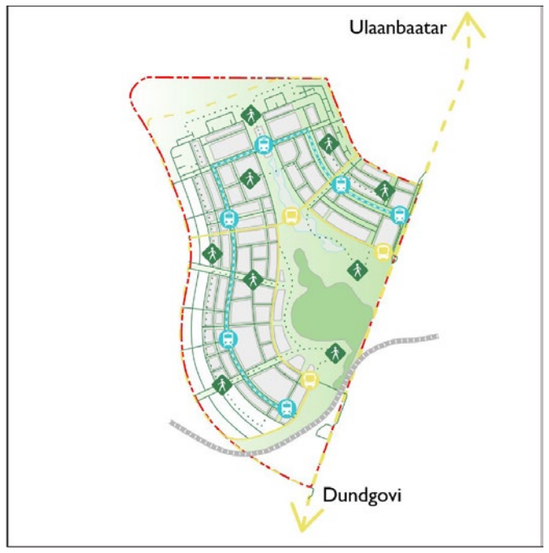
Campus City Design Project
A New Growth Engine for Mongolia

Location : Hunnu City, Mongolia
Year : 2025
Type : Urban Design Studio (Team Leader)
Team : with Youngjun Lee and Jungwon Lee

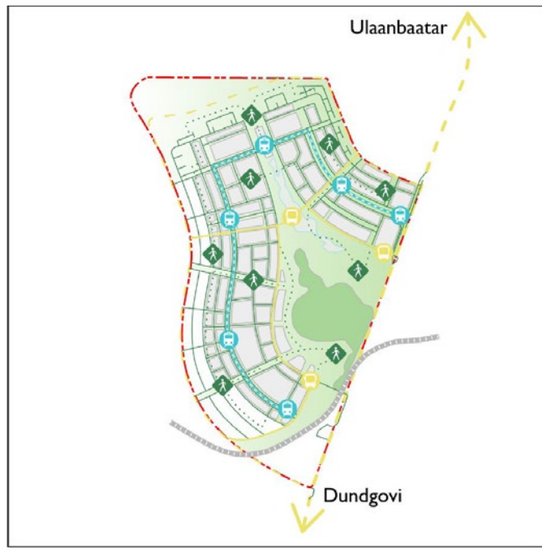
Network City is an urban model that joins a city and its campuses into one continuous structure. Centred on an LRT station, research, education, housing and everyday life meet within a five-minute walking radius and form what the project calls a campus-oriented urban ecosystem.
The plan follows the flow of the LRT corridor. Three networks, drawn from an analysis of the site's topography and existing urban fabric, frame the mobility, the movement through the campus and the exchange of knowledge, so that urban growth and campus operation support each other.

The site is in Hunnu City, Kushug Valley, Mongolia, and the campus city is spread over the whole city as a network. About 8.9 km2 is divided into four campus clusters, a green network and a reserve that is built out last, in three phases up to 2050.
Studio project of the Graduate School of Environmental Studies, Seoul National University (IPUD), Urban Design Studio 4, September to December 2025, as a KOICA-SNU-MUST cooperation project, with the final review on 16 December. I led the team of Sanghoon Byun, Youngjun Lee and Jungwon Lee (Korea) with B. Aminaa, E. Dashnyam and A. Sochigerel (Mongolia). All work and presentations were in English. The project was presented at the 2nd Korea-Mongolia UrbanForum, where a local mayor rated it an excellent project.

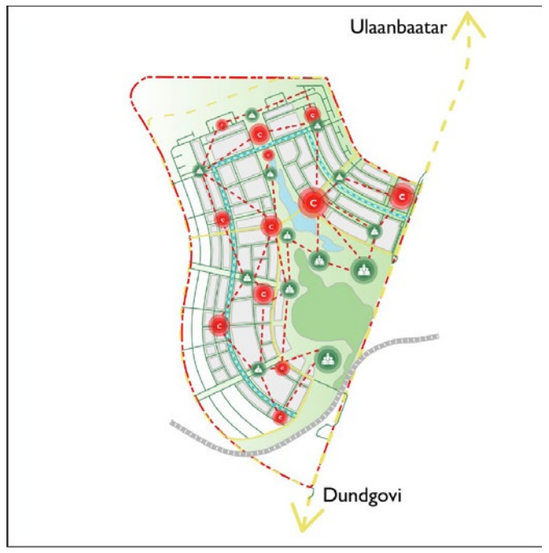




1. Spatial Network



2. Academic Network



3. Social Network

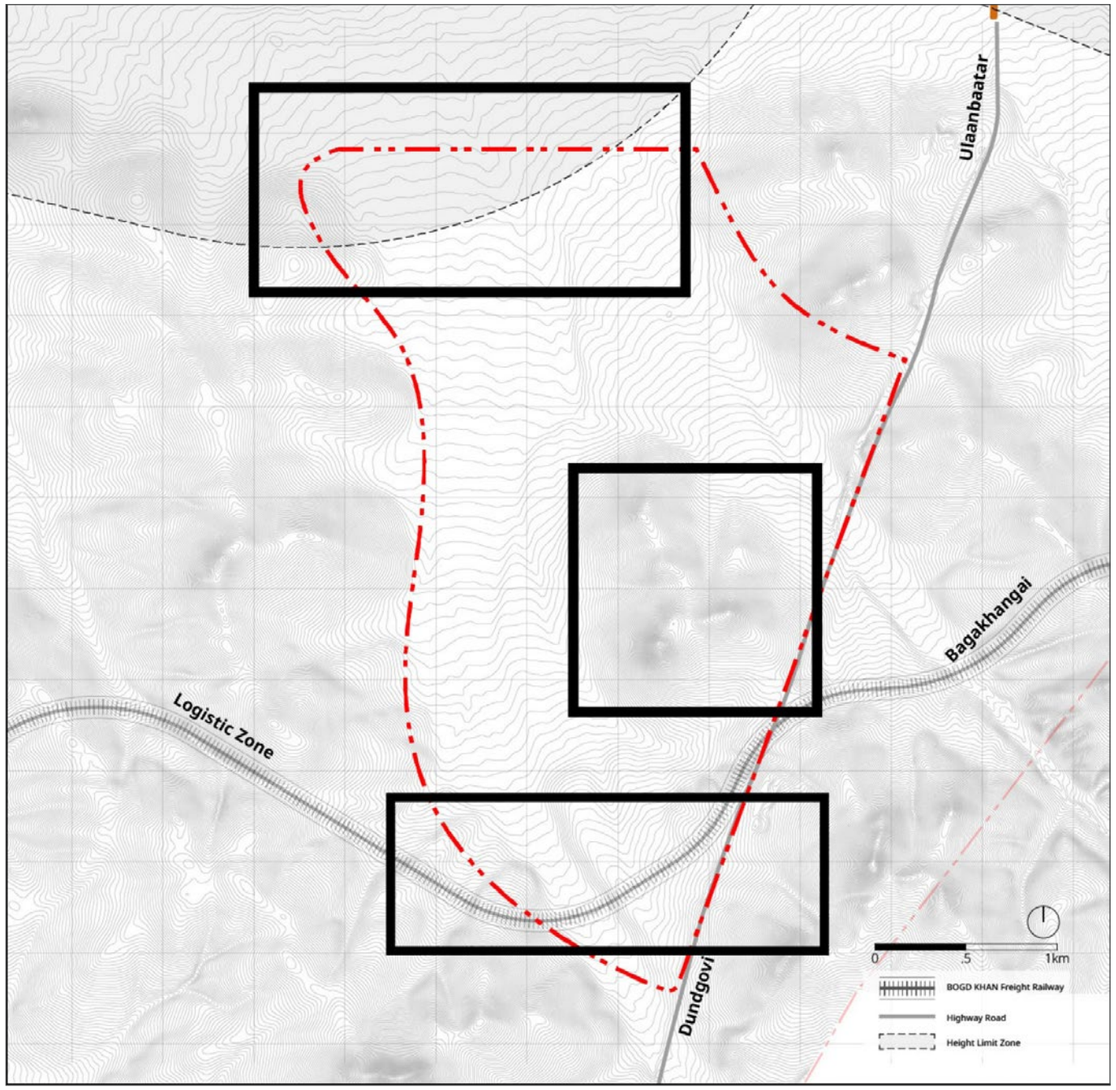
Network City, Hunnu

A new growth engine for Mongolia. The campuses are spread over the whole city and tied together along the LRT corridor.

Spatial Network. Connects the major programs along the LRT corridor and improves accessibility and movement.

Academic Network. Links the campuses through walkable and programmatic connections that support collaboration and the exchange of knowledge.

Social Network. Centres on the green axis, encourages everyday interaction among different users and creates a shared community space.



Site Analysis

Flight height limits, steep terrain and the logistics railway set the limits of development and give the site its green structure.

1. Height Limit Zone
The northern area lies inside the flight height restriction zone and holds protected plant habitats. It stays a green corridor and forms the upper green belt.

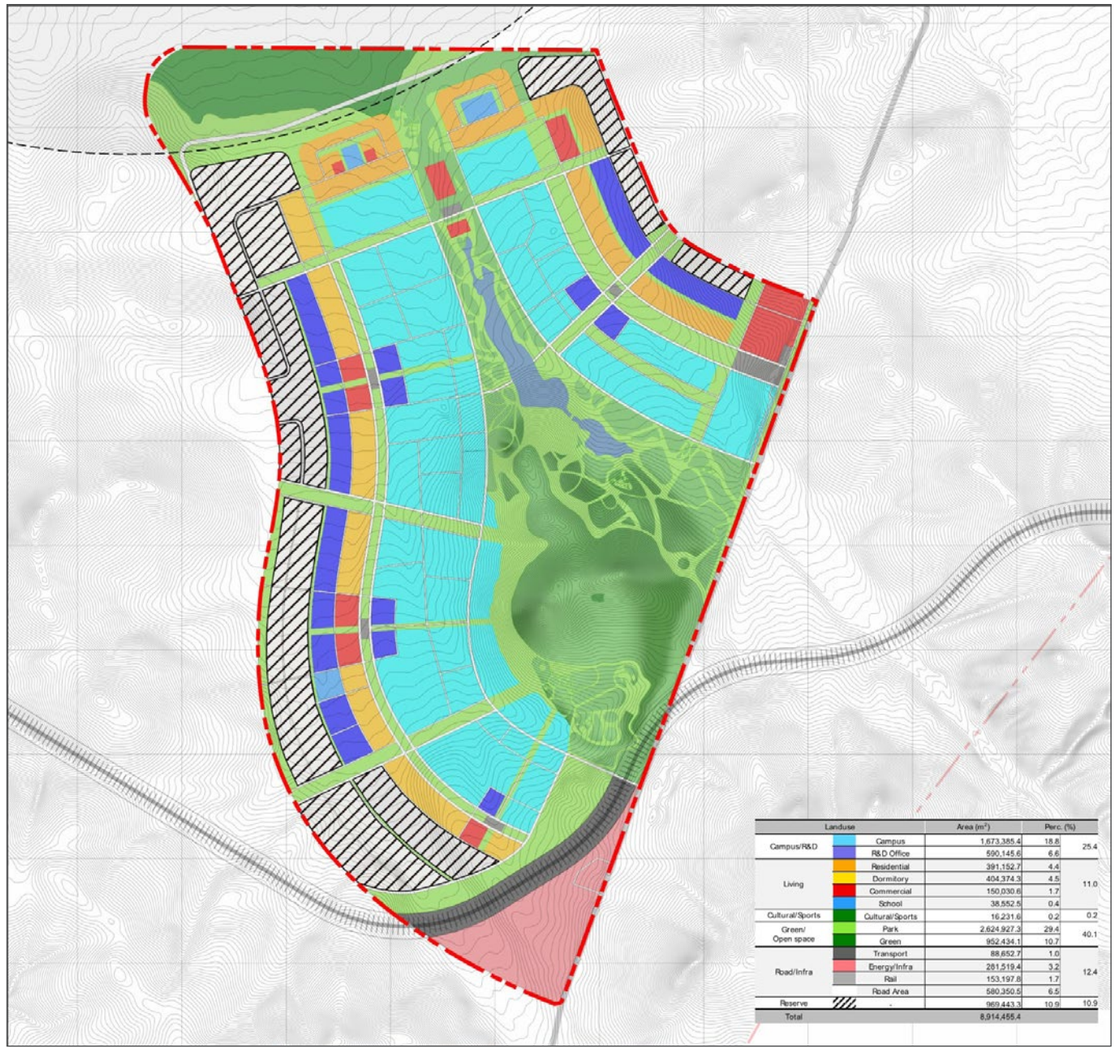
2. Steep Slope Zone
The central zone has steep terrain and development-restricted areas. It is kept as a natural open-space belt that organises the green structure of the campus.

3. Logistic Rail Zone
The southern edge borders the logistics railway, where noise and vibration are a problem. A broad green buffer protects the site and forms a transition to the campus districts.



Master Plan

The four campus clusters, the green network and the reserve are laid out along the LRT line that crosses the site.



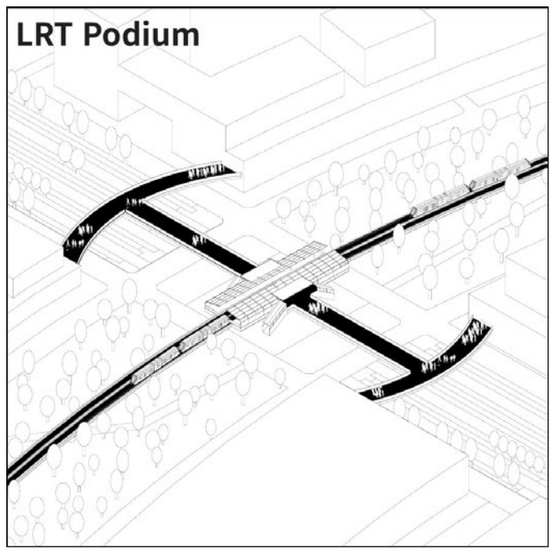
Land Use Plan

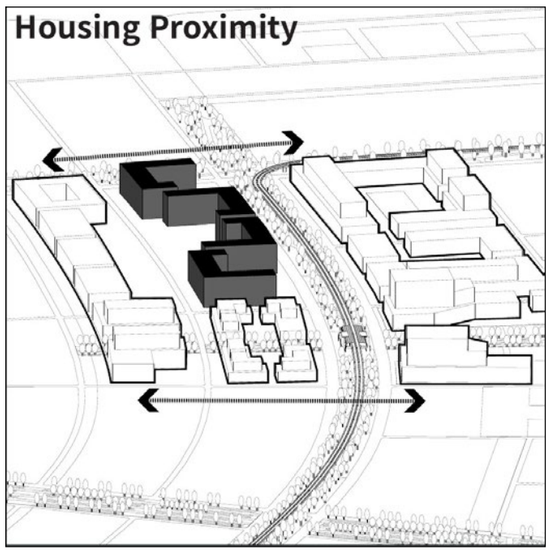
Campus and R&D uses take 25.4% of the site of about 8.9 km2, living areas 11.0%, green and open space 40.1% and roads and infrastructure 12.4%. The remaining 10.9% is a reserve that is built out in the last phase.

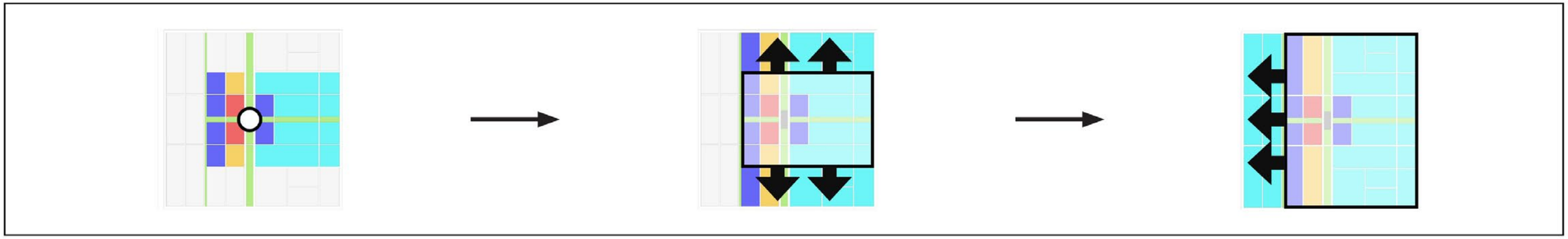


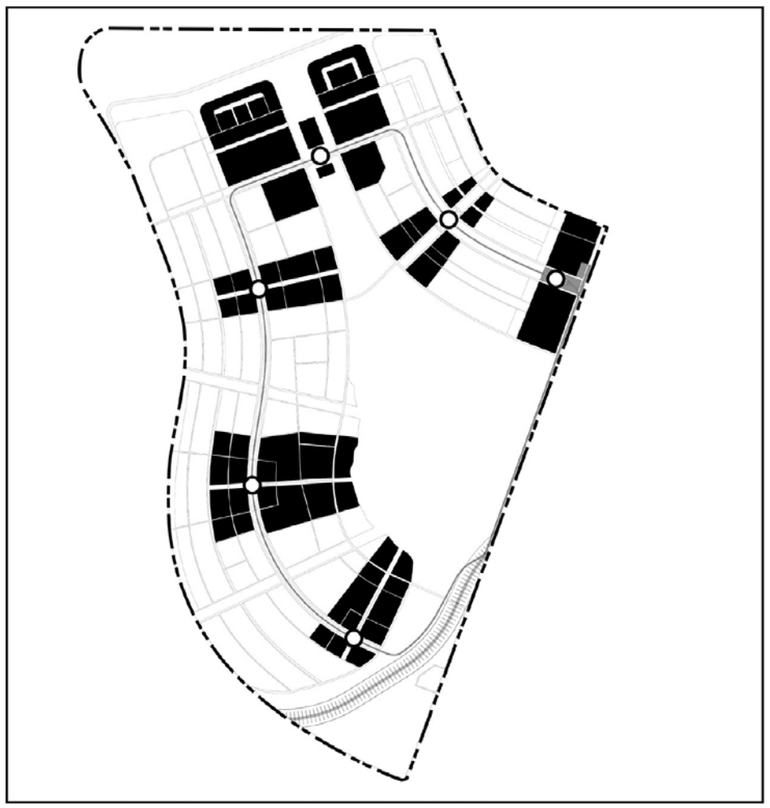
Campus Cluster and Detail Network

Four clusters share the campus area at 14.1%, 31.2%, 18.1% and 36.6%. Cluster 2 holds the Center Campus, the core hub for connectivity and shared academic resources. Two details show the network along the LRT line, the LRT Podium at the station and Housing Proximity next to the line.

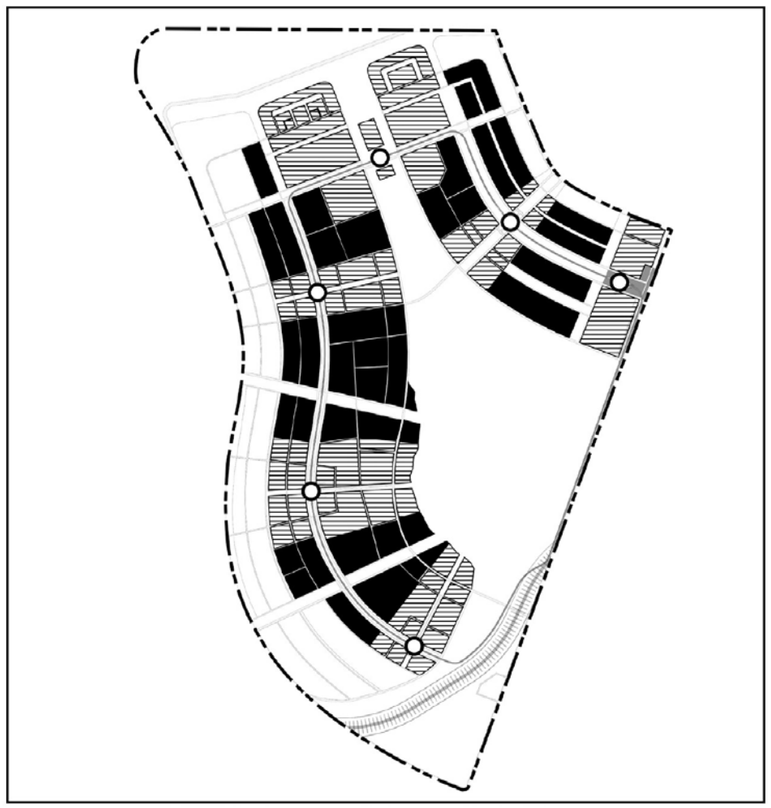




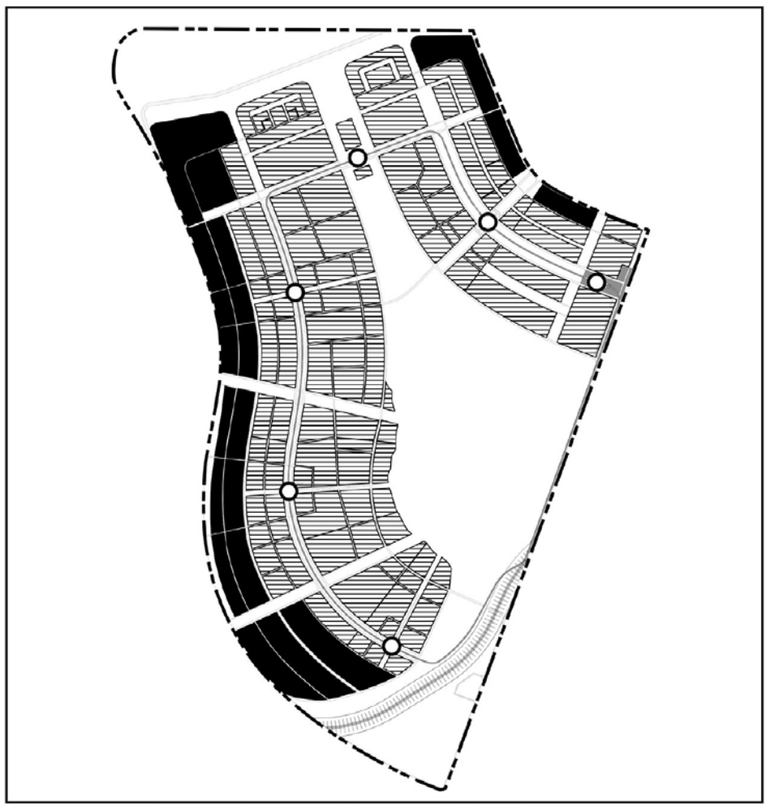




Phase 1 (2021-2030)
Station-centred core development begins a walkable mixed-use academic hub.



Phase 2 (2031-2040)
East-west expansion strengthens the campus clusters and the shared infrastructure.



Phase 3 (2041-2050)
The northern reserve area is activated to complete the 2050 campus vision.

Phase Plan

The campus grows outward from the station in three decades, from the station-centred core to the full campus of 2050.



1. HUREE + CHN University
A creative gateway for IT and software that blends academic, commercial and start-up ecosystems.



2. MNU + Center Campus
The Center Campus is the core hub for connectivity and shared academic resources.



3. UFE + NAOG
A specialised hub for policy and finance with a convention center for global events.



4. MUST + UTIS
The largest cluster, joining science and technology universities with R&D for strong synergy.



Center Green
A large waterfront park at the heart of the city. It is an open recreation space and a landmark where nature and community meet.



Linear Green
A major green axis along the LRT line. It works as an eco-friendly transit corridor that links the key urban nodes and the waterfront.



Axis Green
Long linear green corridors between the building blocks. They create wind paths through the city and a pleasant street for pedestrians.

Four Clusters and the Green Network

Each cluster has its own role in the network, and three kinds of green space connect them to the station and the waterfront.

Opacity 50

Garden of Knowledge Competition
Almo Collegio Borromeo, Pavia

Location : Pavia, Italy
Year : 2025
Type : Design Competition (YAC)

The Almo Collegio Borromeo in Pavia, founded in 1561, has a large green area that was once used for vegetable gardens and orchards, the Horti. The Garden of Knowledge competition, organised by YAC (Young Architects Competitions) with the college, asked for a public space that joins contemporary architecture with the history of the place.
Opacity 50 takes its cue from the arches of the existing buildings in the Horti. A modular, perforated vault lets the exhibition spaces open to both the historic buildings and the garden, so that the new structure continues the park instead of dividing it.

The vault is a kit of columns and roofs that can be put up and taken down with ease. Bolts hold the pillars and the roof together and joints carry the load between them, which keeps the intervention reversible and leaves the historic fabric almost untouched, as the brief asked.
The perforated roof plays with light and shadow through the day, and the exhibition spaces can host varied activities and events.
Team entry to the competition, deadline 15 January 2025, awarded an Honorable Mention in February 2025.



Exhibition Vault in the Horti

The perforated vault runs along the garden and meets the existing building. Its arches follow those of the old buildings around it.

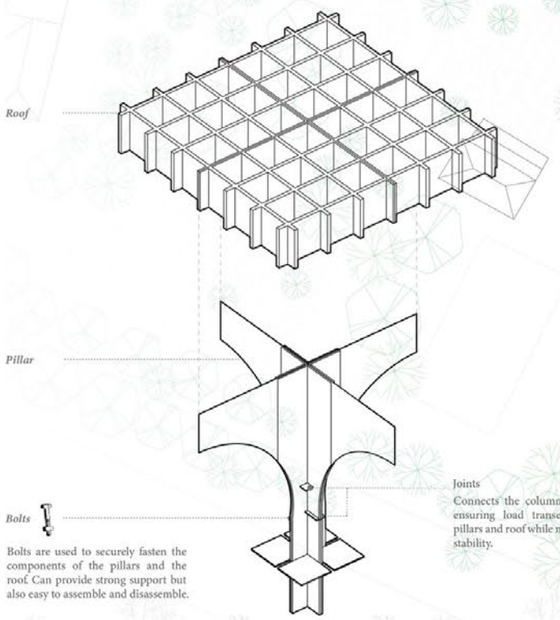
Opacity 50

Our design draws inspiration from the elegant arch structures of the existing buildings within the Horti area, aiming to create a seamless dialogue between the historic architecture and the surrounding park. The proposed intervention introduces a modular, perforated vault system designed to enhance visual openness while maintaining structural integrity. This transparency allows the exhibition spaces to interact with both the built environment and the natural landscape, encouraging a sense of continuity rather than division.

The modular vault system, consisting of easily assembled and disassembled columns and roofs, is engineered for maximum adaptability. This approach not only respects the principles of sustainability and reversibility outlined in the competition brief but also ensures minimal disruption to the historic fabric of the site. The perforated design introduces light and shadow play, fostering dynamic and engaging spaces that evolve throughout the day.

By integrating this modern intervention, the exhibition spaces are reimagined as inviting, flexible areas capable of hosting diverse activities and events. Our goal is to activate the Horti as a transparent and inclusive platform that celebrates art, nature, and cultural exchange. Through careful blending of the historic, the natural, and the contemporary, our design aspires to embody the spirit of the Horti and redefine its role within the city of Pavia.

Vault Structure Module



Vault Module, Site Plan and Section

The vault module with its pillar, bolts and joints, and the site plan of the Horti with the section along Via Galileo Vercesi.



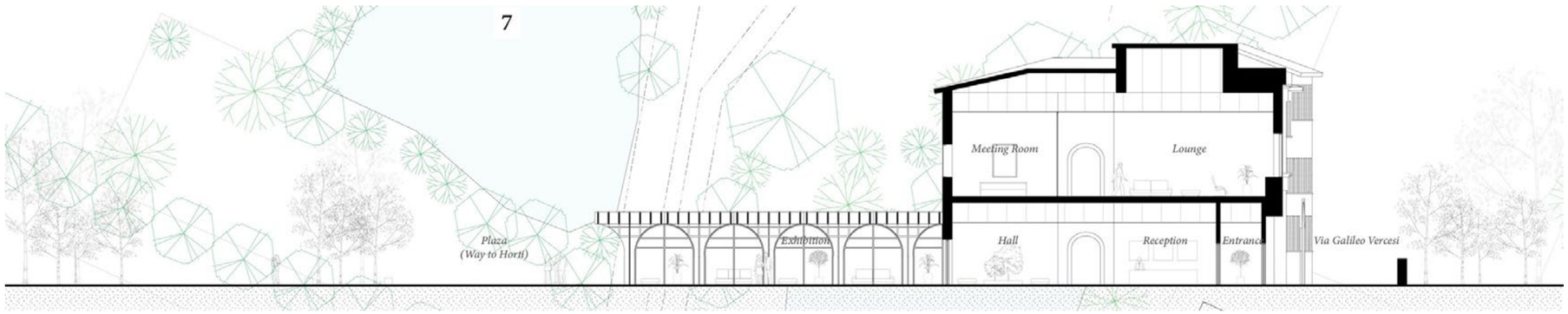
Glazed bay
A glazed bay under the vault, with a hedge and an orange tree in front of it.



Gallery
The exhibition gallery under the perforated vault, with the garden seen through the arch.



Hall
A double-height interior with a mezzanine and a stair under the vault structure.



Section
Through the vault and the building beside it on Via Galileo Vercesi. The vault holds the exhibition space next to the plaza that leads to the Horti. The building has a hall, a reception and an entrance on the ground floor, with a lounge and a meeting room above.

Three Views and the Section

The glazed bay, the gallery and the hall, seen from inside the vault, and a section through the vault and the building next to it.

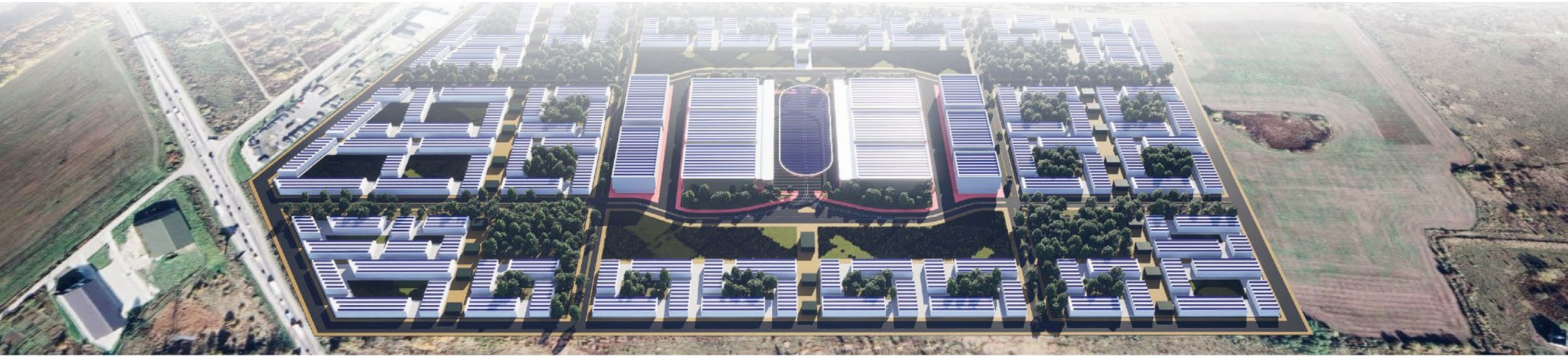
Build Back Better

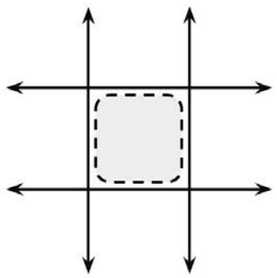
Logistics-Based Future City
A New Model for Ukraine's Reconstruction

Location : Lviv, Odessa and Vinnytsia, Ukraine
Year : 2025
Type : Urban Design Proposal (Internship)
Office : Grundot

The reconstruction of Ukraine needs three things at once: space for housing, offices, hospitals, clinics and schools, energy to run those spaces and the food supply chain, and a logistics framework that moves raw materials, finished goods and food. Logistics-Based Future City answers them with one new type of city, a city of renewable energy and smart farms that is centred on a logistics center.
Seven principles shape it: a logistics center at the heart of the city, renewable energy, smart farms, modular housing that goes up fast, education and job training, neighbourhood amenities and inviting shared spaces.

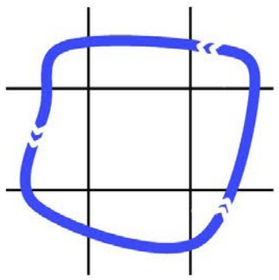
The concept is applied to three sites with a high influx of displaced persons and established logistics networks: Lviv on the western edge of the country close to Poland, Vinnytsia slightly west of the centre and Odessa on the southern coast of the Black Sea. Each site covers from about 365,000 to about 430,000 m2.
Proposal for Ukraine's reconstruction by Grundot, February 2025, made during my internship there. I worked on the Lviv and Odessa sites, wrote the business plan and built the program that automated the city-scale review and the modelling in Grasshopper.





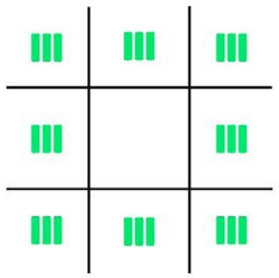
Logistics Anchor

A logistics center at the heart of the city manages the storage, processing and distribution of goods.



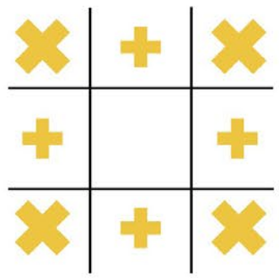
Renewable Energy

Solar panels over active farmland generate energy and protect the crops in severe weather, which localises energy production.



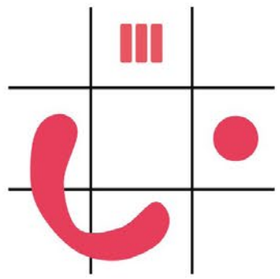
Smart Farms

Container smart farms grow food all year round with little water and energy.



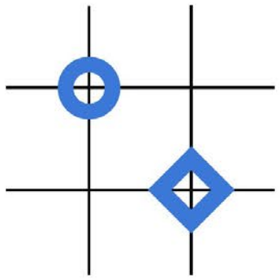
Modular Housing

Modular units made off site put housing up fast and let it change as the number of residents changes.



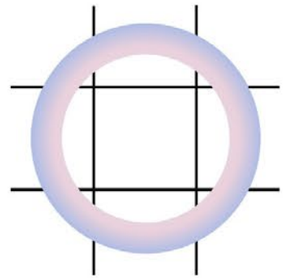
Education & Training

Job-training facilities prepare residents for work in smart farm management and logistics.



Empowering Amenities

Childcare, coworking spaces and cafes support a self-sustaining local economy.



Inviting Spaces

Welcoming shared spaces encourage interaction and support the wellbeing of all residents.

Project Vision

A new city of renewable energy and smart farms, centred around logistics. The seven principles run from the logistics center at its heart to the shared spaces between the buildings.



Logistics center
Trucks arrive at the logistics center that anchors the city, with solar panels in front of it.



Smart farm
A container smart farm at the edge of the fields.



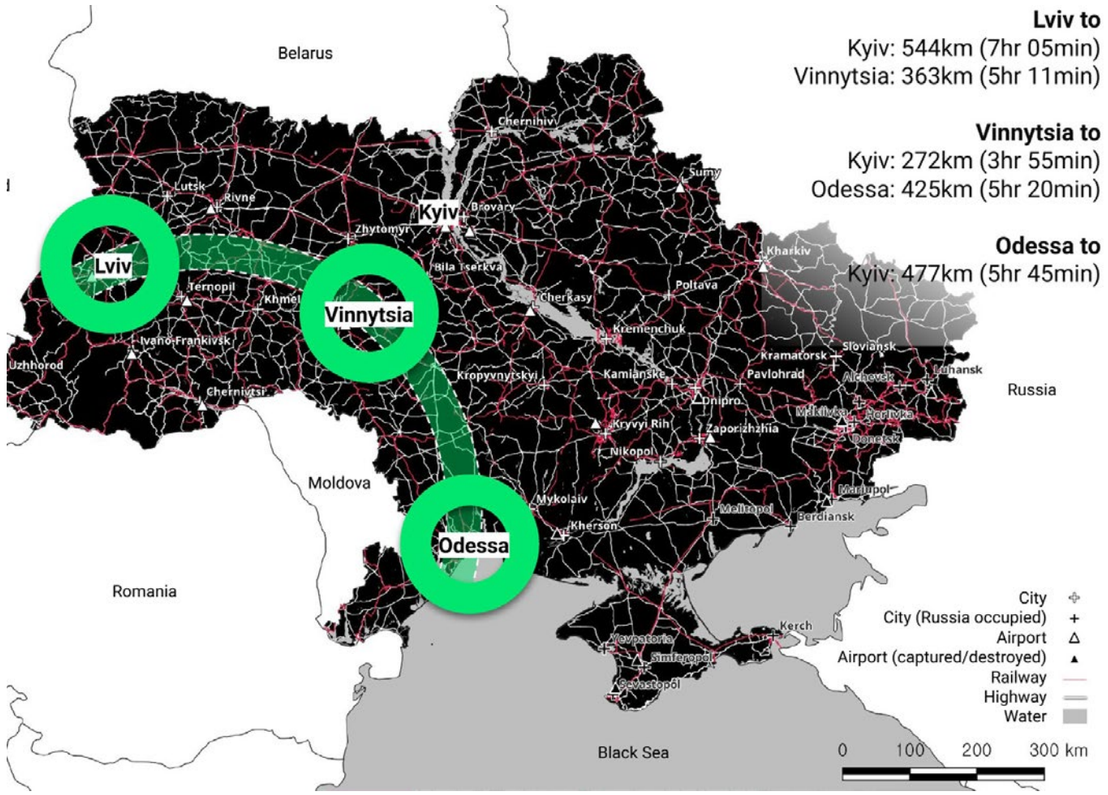
Modular housing
Modular housing around a shared courtyard.



Solar roofs and shared space
Solar roofs over the modular buildings and a plaza for the community.

Views of the Future City

Street-level views show where the principles meet on the ground: the logistics center, a smart farm, modular housing and a community plaza.



Infrastructure

Ukraine lies at the crossroads of the EU, Russia, the Black Sea and the Caspian region. Its key trade routes are maritime trade from Odessa, the Danube, road and rail to the EU and the Trans-Caspian route. Seven airports were captured or destroyed and the rest are temporarily closed, with Lviv set to reopen at the end of January 2025. The three target sites lie on one corridor from the EU border to the Black Sea.



Lviv
Western edge, close to Poland. Pre-war population 717,273. Internally displaced persons present: 146,000.

Vinnytsia
Slightly west of the centre. Pre-war population 369,739. Internally displaced persons present: 106,000.

Odessa
Southern coast on the Black Sea. Pre-war population 1,010,537. Internally displaced persons present: 224,000.

Target Sites

Cities with a high influx of displaced persons and established logistics networks. Displacement figures: IOM UN Migration, Ukraine Internal Displacement Report, October 2024.

'Build Back Better': the Three Needs of Rebuilding

Spatial demands
Housing, offices, hospitals, clinics and schools are urgently needed. The team offers design, construction management and project management to create modular spaces for them.

Energy demands
Running the spaces and supporting the food supply chain takes a lot of energy. Solar farming systems over farmland, agrivoltaics, integrate with existing and future agricultural infrastructure.

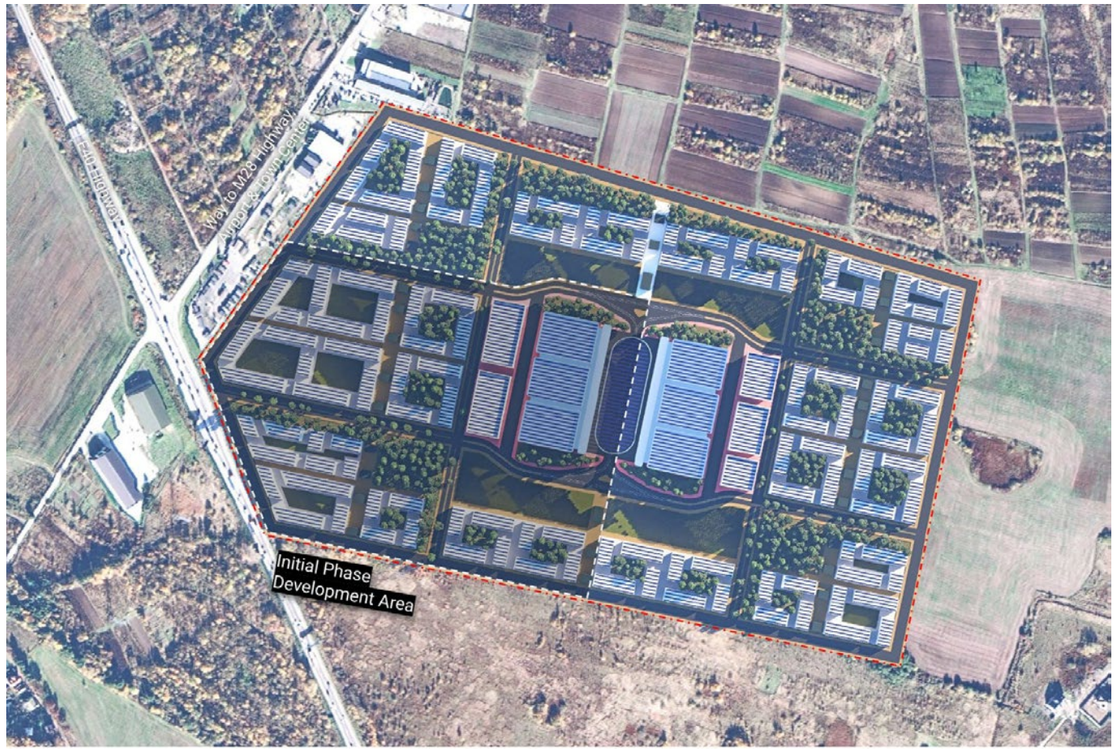
Logistics demands
Raw materials, finished products and food have to move efficiently. The success of the reconstruction relies on an optimized logistics framework that uses resources, time and budget well.





Lviv Site

Lviv is a gateway to the European Union, close to the Polish border. The site is 14 minutes from the airport, 22 minutes from Lviv Station and 30 minutes from the Old Town, and the 2025 Lviv master plan zones it as grazing meadow. It covers 406,405 m2.





Site plan



Road network



Green network

Lviv Master Plan

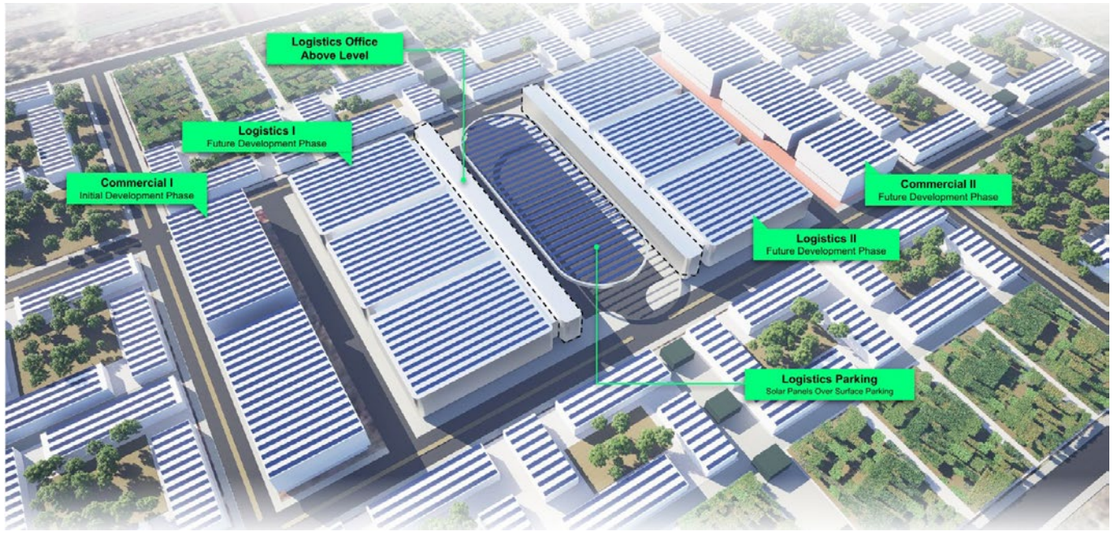
Six uses are laid out around a central logistics center: commercial, residential, logistics, agriculture and parking, smart farm, and community and vocational space. An initial phase is built first and the rest follows in later phases.

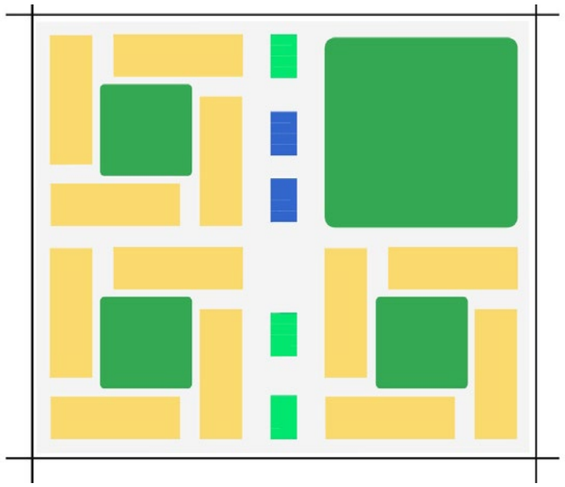




Lviv, Full Build-Out

The full build-out around the logistics center, with solar panels on the roofs and over the surface parking. The labels in the lower view mark the initial and the future development phases.







Logistics Center and Typical Block

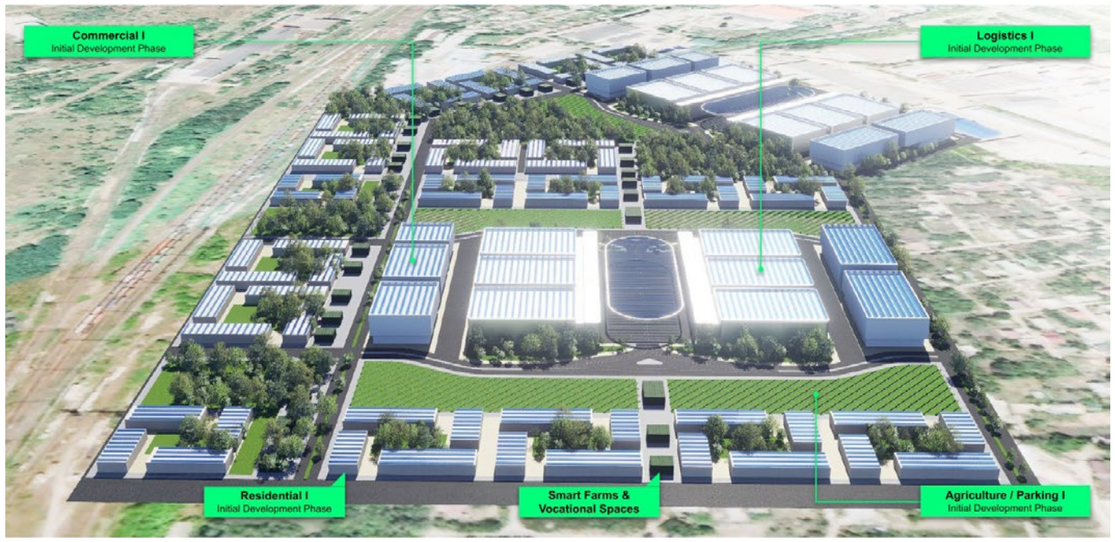
The logistics center has an office level above, and its surface parking lies under solar panels. In a typical residential block the smart farm, the shared green space and the community and job-training space lie between the housing rows.





Odessa Site and Master Plan

The Odessa site is about 15 minutes from Odessa International Airport and from Zastava-1 Station, with the E95 highway two minutes away, and suits a logistics hub for ocean freight. The master plan shows the initial development area and the full build-out.





Odessa, Full Build-Out

The labels mark the initial and the future development phases of logistics, commercial, residential, agriculture and parking, and shared green space. The close-up shows logistics buildings with solar roofs next to the housing blocks.

Food Detector

Restaurant Hygiene Score Service
Cheese Grades from Public Data

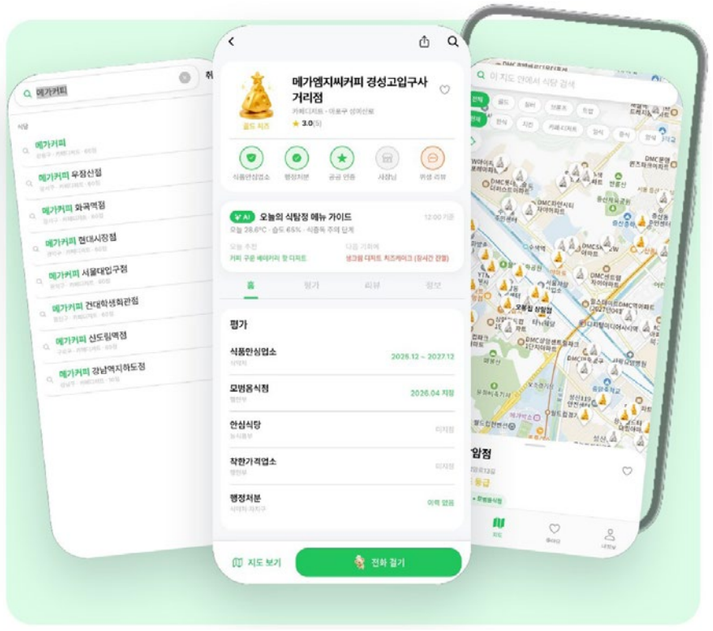
Location : Seoul, Korea
Year : 2026
Type : Web App and Data Pipeline (Team)
Team : Woojin Cho

Food Detector is a hygiene check for the moment after a restaurant has been picked in a delivery or map app. It does not search or order. It answers the last question, can this place be trusted, by scoring each restaurant out of 100 and showing the result as a cheese grade: Gold, Silver, Bronze, or Trap for a restaurant with an administrative penalty for a hygiene violation.

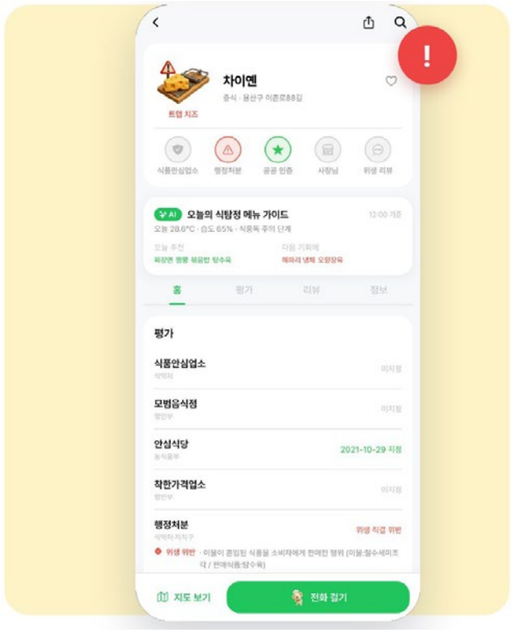
The score has three parts, public data (70 points), cleaning records posted by verified owners (15) and hygiene ratings from users (15). The first design weighted them 50, 25 and 25, and it changed on 10 May when four external certifications were added.

AI reads the original text of each administrative penalty and labels the type of violation, so that a restaurant with a hygiene violation cannot reach a high grade. The home screen shows a five-step food-poisoning risk for each district, built from the weather, the air quality and the forecast of the Ministry of Food and Drug Safety.

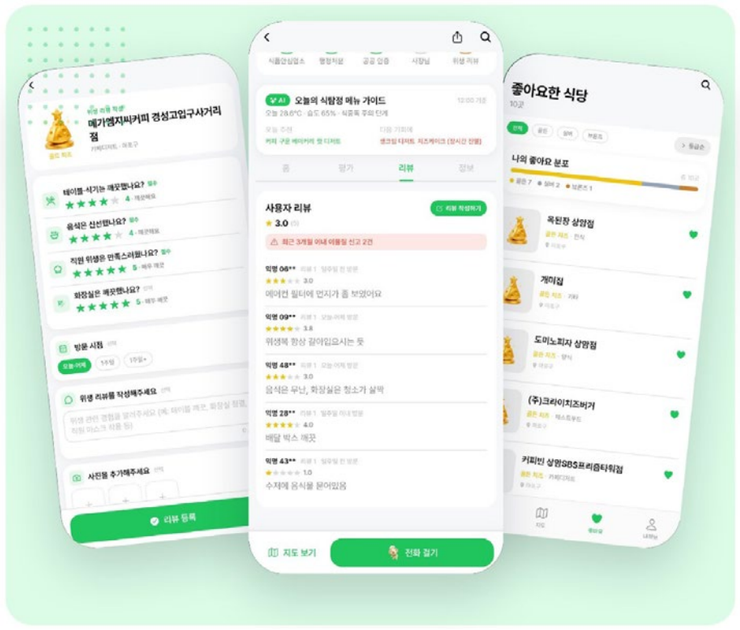
Entry to the 2026 Seoul Big Data Utilization Contest, start-up category, deadline 13 May 2026. The repository sits on the account of teammate Woojin Cho.



Cheese Grade
Public data, owner verification and user reviews are combined into a four-step cheese grade. It can be read within a second in the search results, on the map and in the restaurant report.



Trap Cheese
A restaurant that has an administrative penalty for a hygiene violation, such as foreign matter, bacteria or expired goods, is marked as a trap cheese automatically, and the original reason is shown.



User Reviews and Likes
Hygiene ratings on four axes (table, food, staff and restroom), a one-line comment and photos. Liked restaurants are shown by grade.

App Screens

Five screens of the app, from the cheese grade at the centre to the real-time alert for the district.

Why It Is Needed

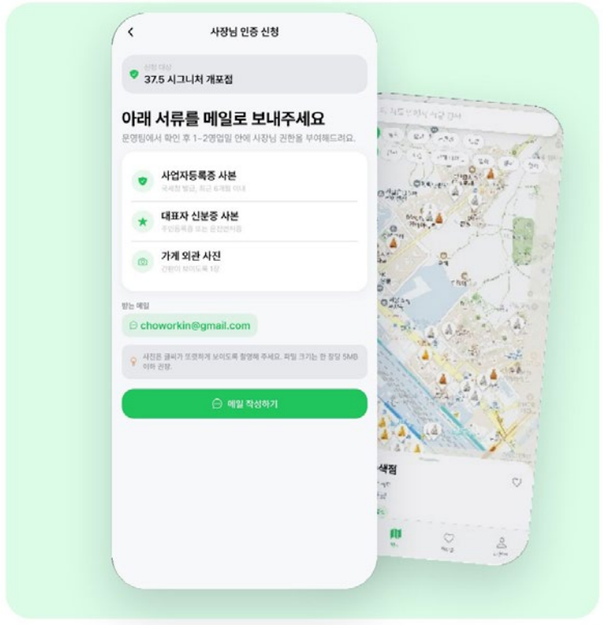
9,046
complaints about delivered food reached the government in three years, from February 2022 to January 2026.

12%
of the restaurants in Korea hold the official hygiene grade of the Ministry of Food and Drug Safety. The other 88% have no official hygiene indicator.

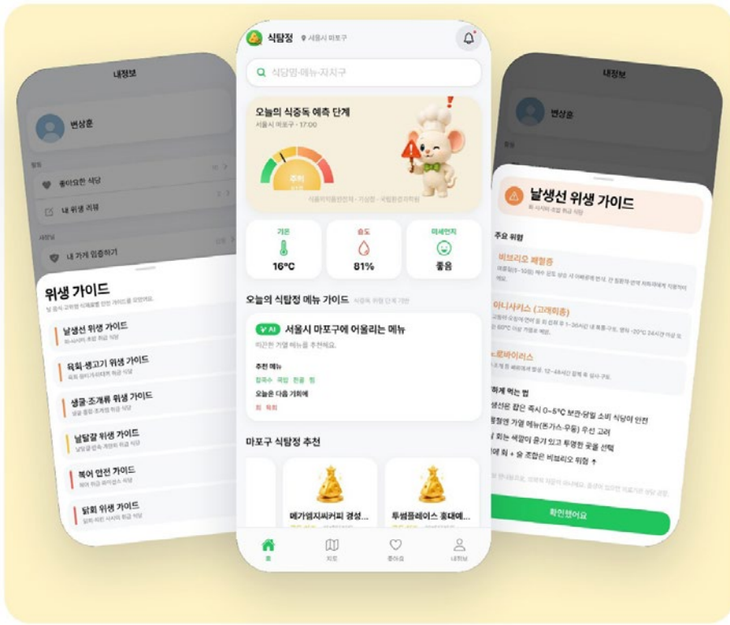
3 years
A hygiene grade stays valid for three years after it is awarded.

For Diners
Young adults, parents and seniors check a restaurant by its score and use the menu guide in daily life.

For Owners
Small and medium restaurant owners raise their score by verification, and a Gold restaurant can use its grade for marketing.



Owner Verification
An owner who has passed the business verification posts cleaning and hygiene activities and earns extra hygiene points. The restaurant is then shown with a higher grade on the map and in the search results.



Real-Time Food Poisoning Alert
Temperature, humidity, air quality and the food-poisoning forecast give each district a risk level in five steps, and hygiene guides for high-risk ingredients come with it.

Development Process

Six stages in about four weeks, with the frontend and the backend work overlapping.

Research 3 days	Survey of data sources, design of the score model and a design system.
Pipeline 5 days	Public data collected, converted to coordinates, classified by AI and split by district.
Frontend 10 days	Expo PWA with 19 screens, Kakao map, search and the cheese grade interface.
Backend 4 days	Supabase Postgres and Storage for multi-user reviews, likes and owner verification.
Polish 5 days	Redesign of the restaurant report, a policy for data sources and hygiene guides.
Deploy 3 days	Automatic deployment on Vercel, a rehearsal and the submission.

Timeline



The bars follow the order of the stages above. The frontend and the backend overlap from the end of week 2 into week 3.

Tools

The app is written in TypeScript with React Native and Expo and is published as a PWA on Vercel, which avoids the app store review. Supabase (Postgres, Storage and row-level security, six tables) holds the reviews, the likes and the owner verifications, and the map is the Kakao Maps SDK. The data pipeline runs as Node.js scripts, and the AI classification goes through the Claude API. Claude Code was used with parallel worktrees and review by pull request.

Information Architecture

Four tabs and five stack screens, arranged along a four-step user journey. Browsing is public, and sign-in is asked only for writing a review, liking a restaurant and the owner mode, a policy the deck calls a soft wall.

01 Discover Neighbourhoods and restaurants

Home Tab, public
A hero with the risk level of the district, an environment card with air, temperature and food poisoning, menu guide suggestions and the search entry.

Map Tab, public
Cheese grade markers, filters for grade and category, and a bottom sheet with the restaurant card.

02 Verify Hygiene reliability

Search results Public
Autocomplete, category chips and a list with a preview of each grade.

Restaurant report Public
The cheese grade hero (70 + 15 + 15), a five-axis radar chart, hygiene reviews with replies, a menu guide and links to the delivery apps.

03 Engage Reviews and likes

Hygiene review Sign-in
A rating on four axes (table, food, staff, restroom), the time of the visit, a one-line comment and a photo.

Favourites Tab, sign-in
Liked restaurants by grade and the list of saved restaurants.

04 Manage Profile and owners

Profile Tab, sign-in
My reviews and likes, a library of hygiene guides and the entry to the owner mode.

Owner verification Owner
Verification of the business number, posts of cleaning records and replies to reviews.

AI in the Product

Penalty Text
The reason text of each administrative penalty is read for its meaning and labelled as hygiene-related or not, with a severity. The label sets off the trap cheese and gives a penalty of 10 to 50 points.

Review Topics
Reviews collected through the Google Places API are sorted into hygiene, cleanliness, service and taste, and the frequency of negative hygiene keywords weights the user score.

Menu Guide
The weather of the day and the food-poisoning index decide which dishes of a restaurant are safe today and which to avoid.

User Flow

Home and Map lead to the Restaurant Report, then to the review and the likes, and then to the Profile and the owner mode.

Public Data

Five institutions, 37 datasets and one SDK were joined into a master list of the restaurants in Seoul.

151,592
operating restaurants in Seoul, 120,762 general and 30,830 rest restaurants

99.8%
of the restaurants have coordinates

86-90%
of the certification records match the master list, counted conservatively

Seoul Open Data Plaza	3 datasets: general and rest restaurants, and the resident population.
Public Data Portal	4 datasets: model restaurants, hygiene grade, Ansim restaurants and good-price shops.
Food Safety Korea	2 datasets of the Ministry of Food and Drug Safety: administrative penalties (I2630) and the hygiene grade list.
Saeol e-Civil Complaint Window	Administrative penalties of the 25 districts, 3,734 raw records.
Kakao Developers	Three Local API datasets for coordinates and new restaurants, and the Maps SDK for the map.

Certifications in the Score

Four certifications add points and the administrative penalties take points off.

Certification	*Restaurants*	*Points*
Hygiene grade	5,931	+35
Model restaurant	10,499	+25
Ansim restaurant	2,191	+15
Good-price shop	1,251	+15
Administrative penalty	979	-10 to -50

Score and Grade

Each restaurant gets up to 100 points. Public data is the largest part, and owners and users add 15 points each.



Data 70 *Owner 15* *User 15*

Data	Starts at 25 points and adds the points of the certifications and the penalties. Without a hygiene grade, the model, Ansim and good-price marks together count for at most 35.
Owner	The smaller of 1.5 points per cleaning verification in the last 30 days and 15 points.
User	3 points per star of the average rating.

Grades

The share of the 151,592 restaurants in each grade.

Gold	65 points or more	2.6%
Silver	40 to 64 points	24.1%
Bronze	below 40 points	73.3%
Trap	a hygiene violation	23 restaurants

Matching

The four certifications are matched by the normalised business name and the prefix of the road-name address. The penalties are matched by the business name and the district, and a penalty is skipped when several restaurants match. Five scripts attach eight signals, called flags, to each restaurant, and one function derives the grade from the score, the flags and the statistics.

Buildable Envelope Automation

LLM-Based Design Automation
Simulating Daylight Setback Regulation Changes

Location : Seoul, Korea
Year : 2025-2026
Type : Master's Thesis and Journal Paper
Advisor : Bumjoon Kang

Building regulations are written in natural language, and every time a number in them changes the rules have to be read, coded and checked again. This thesis gives a large language model (LLM) one narrow job, extracting the logic of a regulation, and keeps it away from the design itself. The LLM never draws a buildable envelope. It turns the legal text into a specification that a designer can read and correct, and a deterministic geometry script computes the result from that specification.

The pipeline has three stages. Retrieval-augmented generation (RAG) collects the articles of the Building Act Enforcement Decree and the Seoul ordinance. The LLM structures them as RASE JSON (Requirement, Applicability, Selection, Exception), which the designer verifies. A script in Rhino then cuts the 3D buildable envelope of every parcel, floor by floor.

The case is the amendment of the daylight setback rule in Article 86 of the Enforcement Decree, which raises the base height from 10 m to 17 m. It was run on 21,280 parcels of the general residential zones of Gangnam-gu, Seoul. On the fourth and fifth floors the buildable area grows by up to 7.81% depending on the zone. Four invented rule changes then run through the same code by replacing numbers in the JSON.

Master of Engineering thesis, Interdisciplinary Program in Urban Design, Seoul National University, August 2026. A paper on the work, with Jungseuk Oh and Bumjoon Kang, appeared in the Journal of the Urban Design Institute of Korea (vol. 27, no. 3, June 2026). I wrote the thesis and am the first author of the paper. The code is public at github.com/snu-laus/TranslateZoning2BuildableVolume.

Three-Stage Pipeline

The LLM only extracts logic. Each stage ends in a product that the designer can read and correct before the next stage starts.

1 ***Collect with RAG***
A TF-IDF search over 711 chunks of the Enforcement Decree and the Seoul Building Ordinance. Gemini writes the queries and picks the articles.
Output: article texts with their sources

Designer
Checks that no key article is missing.

2 ***Structure as RASE JSON***
The LLM splits each article into Requirement, Applicability, Selection and Exception. The numbers sit apart, in one parameters field.
Output: a RASE JSON specification

Designer
Reads the JSON against the original article and corrects it.

3 ***Compute the Geometry***
A RhinoCommon script runs on the verified JSON. It finds the north boundary, sets the setback of each floor and cuts the parcel.
Output: an envelope for each parcel and a table of areas

Designer
Checks the code, the geometry and the exceptions.

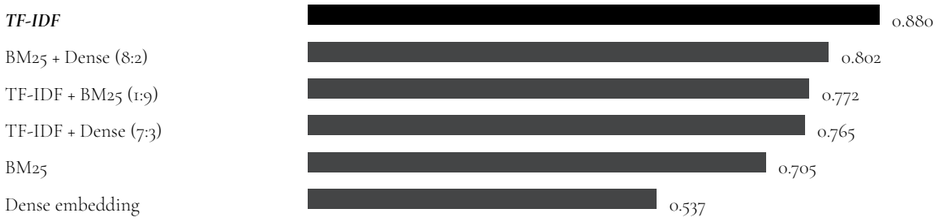
RASE JSON of Article 86

Stage 2 output for the current rule, shortened. The numbers are kept in the parameters field: low_threshold 10, low_setback 1.5, mid_threshold and mid_setback empty, slope_ratio 0.5.

R Requirement	In exclusive and general residential zones, a building keeps a set distance from the adjacent site boundary to the north, to secure sunlight.
A Applicability	Exclusive and general residential zones. All buildings, and apartment housing except dormitories.
S Selection	Up to 10 m in height, at least 1.5 m from the boundary. Above 10 m, at least half the height. Apartment housing and the distance between buildings follow their own rules.
E Exception	Not applied next to a road 20 m wide or more, or when the lot to the north is not residential. Across a park, road or river the line starts at the far boundary, and for apartment housing at the centre line.

Choosing the Retriever

Six configurations on 50 test queries about the sunlight, height-limit and setback articles, scored by Recall@5, the share of the required articles found among the first five results.



Search that matches words wins in legal text. Embeddings blur the article numbers and figures that carry the meaning, and mixing them in did not help.

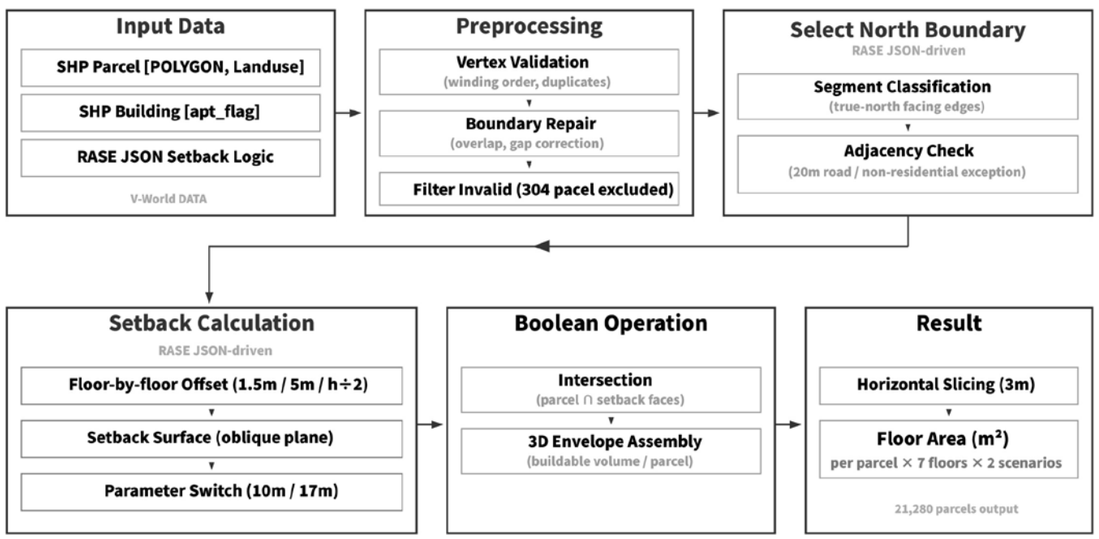
Where the Designer Stepped In

Stage 1 Retrieval query split
One query for every regulation that affects the buildable envelope failed. It returned only incidental articles such as the definition of a site. Split into three queries on sunlight, setbacks and height limits, it collected all eight key articles.

Stage 2 Structuring missing article
The LLM extracted Article 86 correctly but missed Article 30 of the Seoul ordinance (open space within the site), to which the Decree delegates. The designer found it and added it to the JSON.

Stage 3 Geometry code and data
The first code from the LLM had API errors and mixed coordinate systems, and it took rounds of error feedback to run. The parcel data needed repair too. The 304 parcels (1.4%) that still failed were left out.

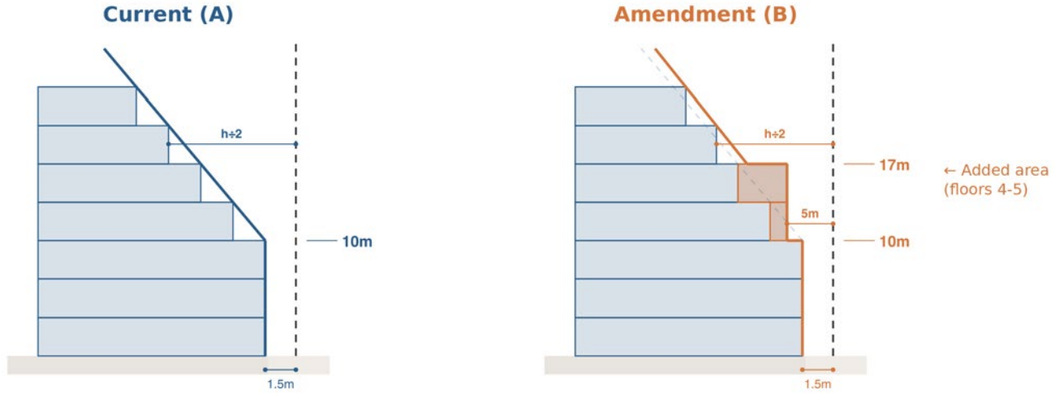
Geometry Stage



The envelope of a floor is the parcel minus the cutters from its north boundary, intersected with the 1 m inner offset. Setback 1.5 m, 5 m or h/2 is chosen by the height of the floor.

The Setback Rule

A building on a residential lot steps back from the boundary to the north. Up to 10 m the distance is fixed at 1.5 m, and above it the distance is half the height. The amendment stretches the fixed zone: from 10 m up to 17 m the distance stays at 5.0 m, and only above 17 m does it follow h/2. The fourth and fifth floors (12 m and 15 m) gain room, as their distance falls from 6.0 m and 7.5 m to 5.0 m.



Section on the north boundary of a seven-storey building with a floor height of 3 m. The shaded part is the added area.

Six Scenarios, One Script

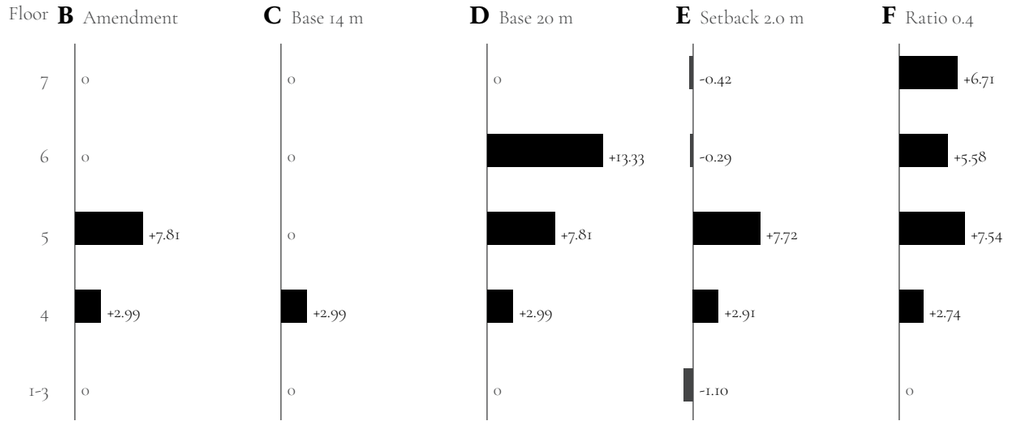
A is the current rule and B the amendment. C to F are invented changes of three kinds of parameter, made to test whether the pipeline copes with each by replacing numbers in the JSON.

Scenario	*Rule*	*Field changed in the JSON*
A Current baseline	Up to 10 m: 1.5 m. Above: h x 0.5	none, this is the base
B Amendment base height 17 m	10 to 17 m: 5.0 m. Above 17 m: h x 0.5	mid_threshold: empty to 17
C Base height 14 m stepwise relaxation	10 to 14 m: 5.0 m. Above 14 m: h x 0.5	mid_threshold: empty to 14
D Base height 20 m upper limit	10 to 20 m: 5.0 m. Above 20 m: h x 0.5	mid_threshold: empty to 20
E Fixed setback 2.0 m opposite direction	Up to 10 m: 2.0 m. Otherwise as B	low_setback: 1.5 to 2.0
F Slope ratio 0.4 ratio change	Above 17 m: h x 0.4. Otherwise as B	slope_ratio: 0.5 to 0.4

The floor height of 3 m (floors 1 to 7), the 1 m inner offset and the exception for roads of 20 m or more are the same in all six. No line of code was edited for any of them.

Area Change by Floor

Change of the buildable area against scenario A in the Type 2 general residential zone, the largest with 11,420 parcels. Each scenario reads as a tower of floors, with the seventh floor at the top. Figures are in per cent.



Black bars add buildable area and grey bars take it away. The small drops on floors 6 and 7 in E are at the level of numerical precision.

The Same Bands in Every Zone

Scenarios E and F in the three general residential zones, in per cent. The bands are the same in all of them and only the size of the change differs. The gains are largest in the Type 2 zone.

	E Setback 2.0 m			**F** Ratio 0.4		
Floor	*Type 1*	*Type 2*	*Type 3*	*Type 1*	*Type 2*	*Type 3*
7	-0.47	-0.42	-0.18	+4.39	+6.71	+3.77
6	-0.40	-0.29	-0.14	+3.56	+5.58	+3.21
5	+4.97	+7.72	+4.50	+4.96	+7.54	+4.44
4	+1.81	+2.91	+1.74	+1.79	+2.74	+1.67
1–3	-0.80	-1.10	-0.70	0	0	0

What the Numbers Show

Base height B, C, D
A higher base height widens the band of the fixed 5.0 m setback. The gain reaches floor 4 in C, floors 4 and 5 in B and floors 4 to 6 in D, and never touches floors 1 to 3. Below 15 m a partial relaxation to 14 m brings nothing to floor 5.

Fixed setback E
A fixed setback of 2.0 m takes 0.7 to 1.1% from floors 1 to 3 and still adds to floors 4 and 5, because the base height in E stays at 17 m.

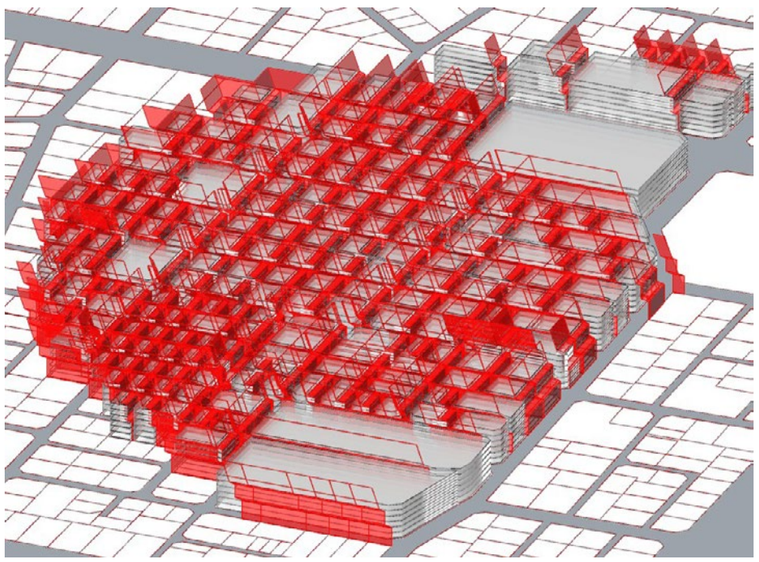
Slope ratio F
A ratio of 0.4 adds area on every floor from the fourth up, and the gain grows with the height, from 2.74% on floor 4 to 6.71% on floor 7.

The three parameters work in separate height bands. The base height changes the middle floors, the fixed setback the lower floors and the ratio the upper floors, so a policy maker can treat them as independent levers. Scenarios D and F reach almost the same total buildable volume by different routes, one in the middle floors and one in the upper floors.



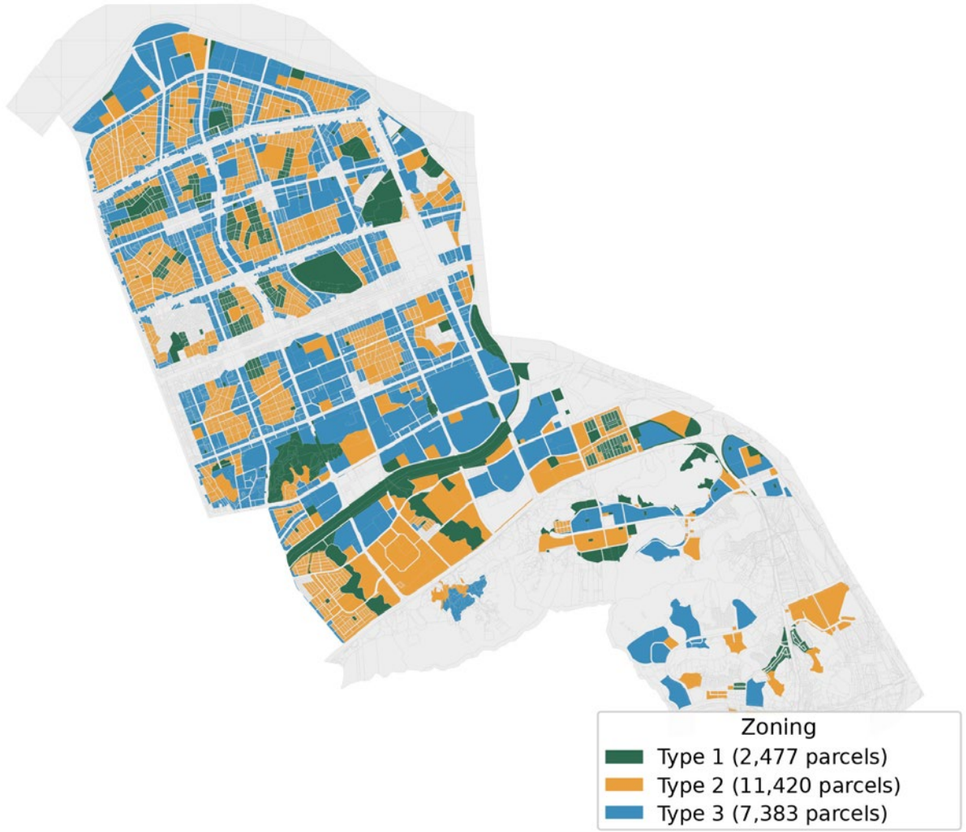
Heat Map of the Area Increase

Every one of the 21,280 parcels is coloured by the growth of its buildable area on floors 4 and 5 under the amendment, from 0 to 30%. High values gather on small parcels and on parcels with a long north boundary.



Same Logic, Every Parcel

The cut envelopes of part of the district with the amendment applied, floor by floor. Roads, parcel widths and the zone of the lot to the north differ from parcel to parcel, and the same JSON still gives a consistent pattern of cutters.



Parcels by Zone

The 21,280 parcels of the three general residential zones. The Type 2 and Type 3 zones hold 88% of them.

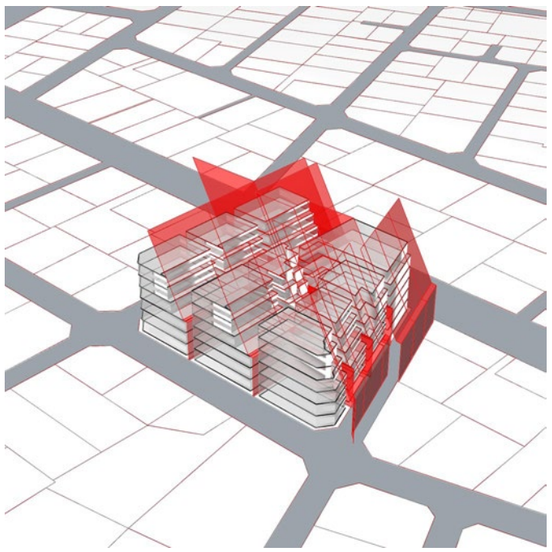
Zone	*Parcels*	*Floor 4*	*Floor 5*
Type 1 general residential	2,477	+1.96% (+20.1 m2)	+5.13% (+50.8 m2)
Type 2 general residential	11,420	+2.99% (+13.0 m2)	+7.81% (+32.5 m2)
Type 3 general residential	7,383	+1.78% (+16.0 m2)	+4.54% (+39.8 m2)

Rise of the buildable area under the amendment against the current rule. The gap between the two rules sits on floors 4 and 5 only.

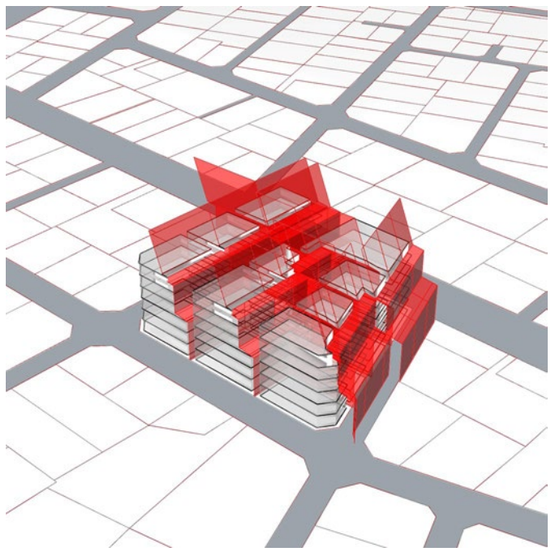
21,280
parcels analysed out of the 21,584 extracted. 304 (1.4%) failed the geometry repair and were left out.

+7.81%
on floor 5 of the Type 2 zone, the largest rise, with +32.5 m2.

4 - 5
floors where the two rules differ. Floors 1 to 3, 6 and 7 do not change.



A Current rule
Buildable envelope of the nine-parcel block in Sinsa-dong, with the setback cutters in red.



B Amendment
The same block with the base height at 17 m. The cutters give way on floors 4 and 5.



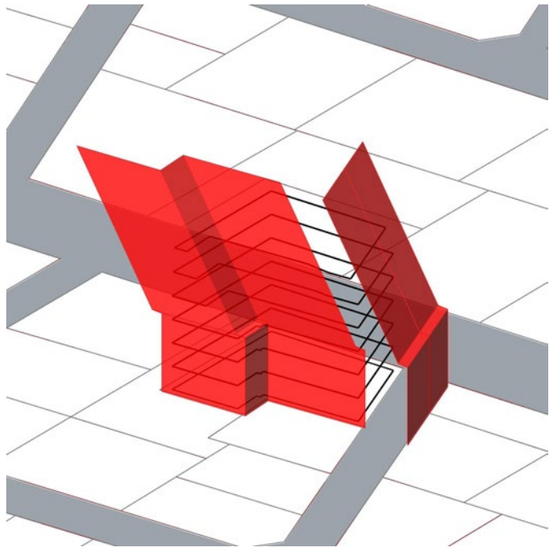
Against the Real Fabric

The photo shows the same block from the same angle. Not every parcel is built to the limit. The building in the middle of the photo, cut along the north setback, shows room for extra area on floors 4 and 5 under the amendment. The average rise in the city-scale figures shows up in this block as the change in the mass of one building.

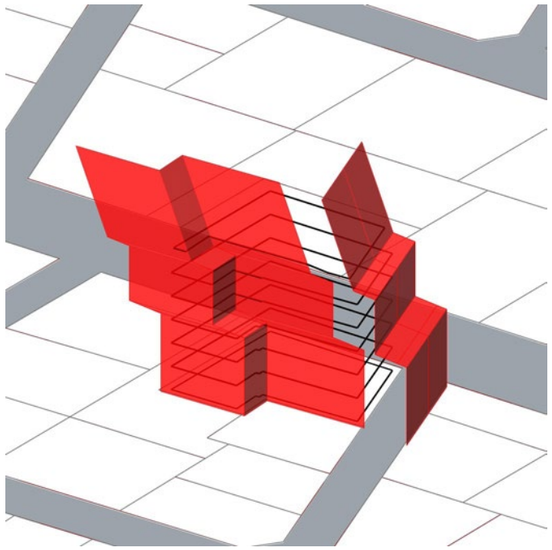
Single Parcels and the Exception

Where an apartment complex lies to the north across the road, Article 86 moves the start of the setback to the centre line of the road. Two parcels of the block check that the pipeline takes this branch. In both cases the result before and after the amendment is stable, and the exception for the neighbouring lot is reflected.

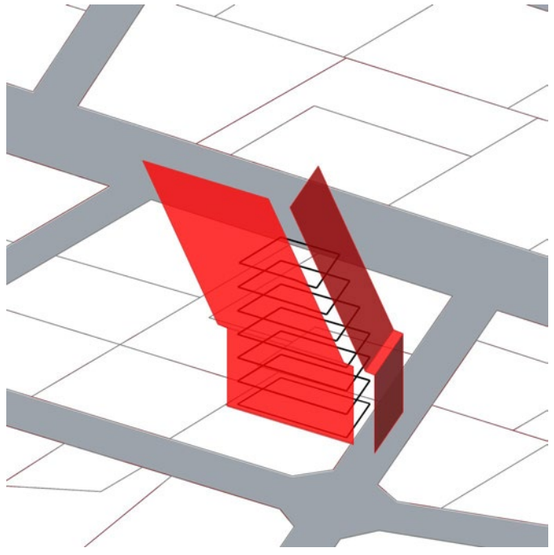
A Current rule

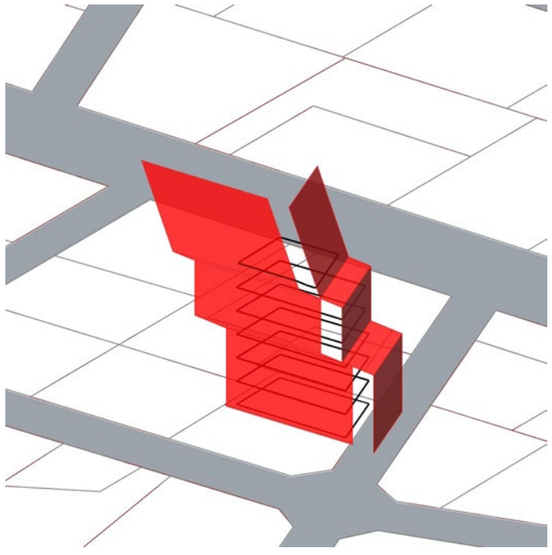


B Amendment



Ordinary lot to the north
The setback line starts at the boundary of the lot across the road.





Apartment complex to the north
The exception applies and the line starts at the centre line of the road.

PLE Index

Parcel Layout Efficiency
Redevelopment Feasibility of Parcels in Seoul

Location : Seoul, Korea
Year : 2025-2026
Type : Research Paper (CAADRIA 2026)
Team : with Dongjun Park and Bumjoon Kang

Seoul's old neighbourhoods are divided into small, irregular and sometimes landlocked parcels, and the city's small residential redevelopment models (SRRMs) mostly work by merging them. Existing indices judge one parcel against an ideal shape. They leave out the building code and the road frontage, and they cannot score a group of parcels or a block. The PLE (Parcel Layout Efficiency) index starts from another question: how much of a block's own potential does the present division of it keep?

Four indices describe a block: Shape, Topography, Buildable Area and Road Access. Each compares the parcels as they are with the same block as if it were one lot, and a weighted sum of the four gives the score. The rules come from the Building Act and from the official land price appraisal standard. A score near 1 means that the division loses little.

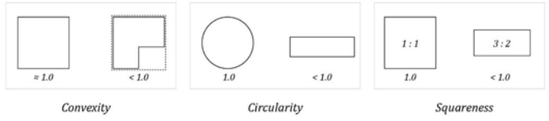
The code runs in Rhino Python with GeoPandas and PyShp and is open source at github.com/969flash/parcel_layout_evaluation_analysis.

I ran it on the 902,001 parcels of Seoul, which form about 42,000 blocks. After single-parcel blocks and large apartment complexes were removed, 27,491 blocks were scored with equal weights, and the scores ran from 0.052 to 0.917. High scores gather in planned districts such as Gangnam-gu and Seocho-gu, and low scores in historic cores and hillside areas such as Jongno-gu and Gwanak-gu.

Full paper and oral presentation at CAADRIA 2026 in Hsinchu, Taiwan, in April 2026, written with Dongjun Park and Bumjoon Kang. I am the first author.

Four Indices

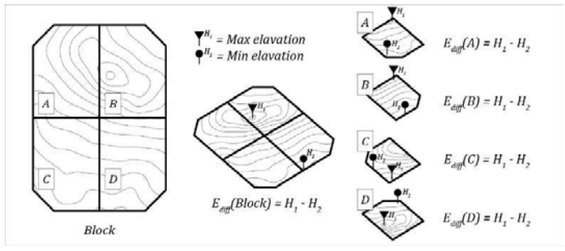
Each index compares the parcels as they are divided today with the same block as if it were still one lot. All four are scaled from 0 to 1, and a low value marks a block that loses much of its potential through the way it was divided.



Shape

Each parcel is scored on convexity, circularity and squareness. Flag-shaped and L-shaped lots lose convexity, long thin lots lose circularity, and a form near a square with four corners scores best. The mean score of the parcels is divided by the score of the whole block.

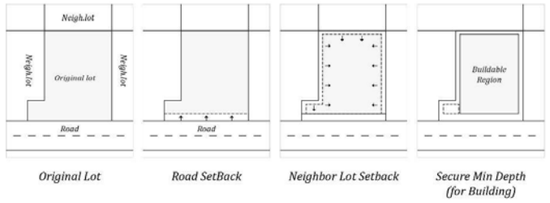
Basis: the shape rule of the land price appraisal standard and the parcel shape index of Demetriou et al. (2013).



Topography

The height difference inside each parcel is compared with the height difference of the whole block. The score is high when the division leaves parcels that are much flatter than the block, and a parcel average under 0.5 m counts as flat.

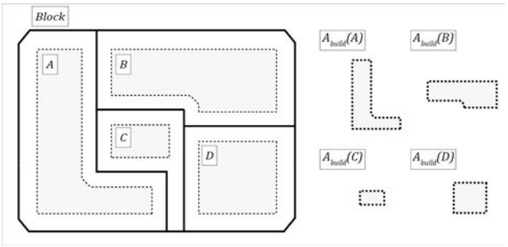
Basis: the terrain classes of the appraisal standard, flat, gentle slope and steep slope.

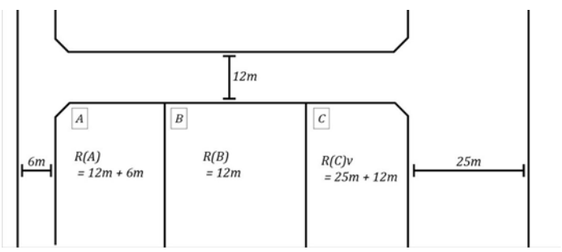


Buildable Area

The net area of each parcel is found after the setback from the building line, the setback from the neighbouring lot and a minimum building width that removes thin strips. The sum over the parcels is divided by the buildable area of the undivided block.

Basis: Articles 46 and 58 of the Building Act.





Road Access

Each parcel takes the land price multiplier of its road frontage, one of 12 types from wide road down to blind land with no road, and the legal minimum of 2 m of contact with a road is built in. The mean over the parcels is divided by the best score the block could reach.

Basis: the road frontage rule of the appraisal standard and Article 44 of the Building Act.

What Was Missing

Content
Earlier indices score the two-dimensional shape of a parcel and leave out the building code and the road. A parcel can be geometrically efficient and still unbuildable.

Scale
They work on single parcels or on whole blocks, and not on the groups of parcels that a small redevelopment project forms.

Method
They measure the distance from an ideal shape, and not how a division compares with the potential of its own block.

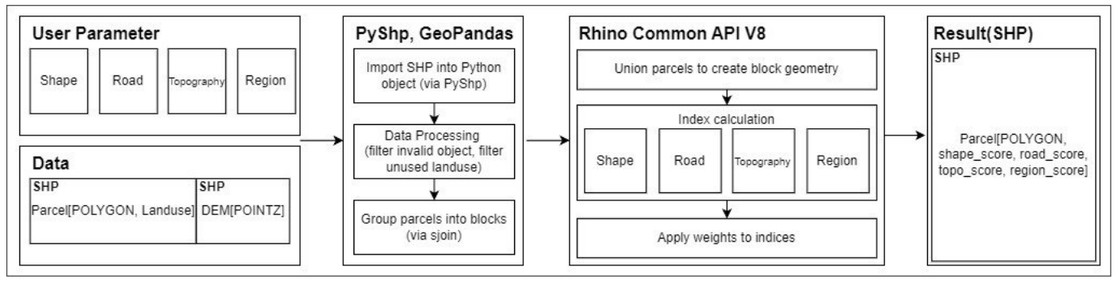
Relative Efficiency

The PLE score is the weighted sum of the four indices. It does not value the divided parcels in absolute terms. It measures how well the present division uses the potential that the block had before it was divided, so blocks of different size and character sit on one scale. A score near 0 marks a block with a strong need for merging and re-dividing the parcels.

Shape + Topography + Buildable Area + Road Access = PLE

The weights are set by the user and add up to 1. The run on Seoul used equal weights of 0.25.

The Pipeline in Rhino



Parcel and elevation shapefiles go in. PyShp and GeoPandas clean the data and group the parcels into blocks. Rhino builds the geometry of each block, computes the four indices and applies the weights, and a shapefile with the scores comes out. The code is public at github.com/969flash/parcel_layout_evaluation_analysis.

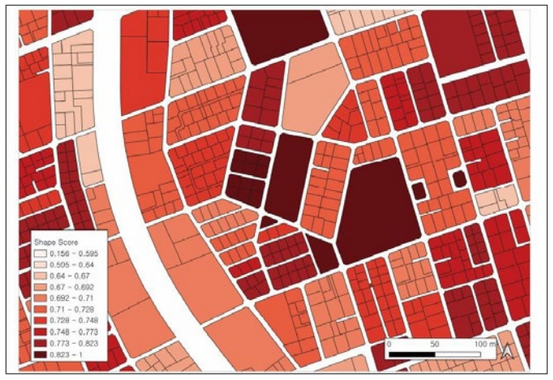
What the User Sets

Besides the four weights, eight parameters adapt the index to a land use and a place. The run on Seoul used the settings for residential use.

Shape	Weights of convexity, circularity and squareness
Topography	Height difference below which a parcel counts as flat
Buildable Area	Setback from the building line, setback from the neighbouring lot and minimum building width
Road Access	Land price multiplier of each of the 12 road frontage types

Planned and Unplanned Seoul

The study took the two most common residential zones, Type 1 and Type 2 general residential. Of the roughly 42,000 blocks of Seoul, single-parcel blocks, whose score is always 1, and large apartment complexes were removed, which left 27,491 blocks. Eight planned and eight unplanned residential areas were then compared.



A Planned area, Gangnam-gu
High shape scores, in dark red, where parcels are regular and rectangular.



B Unplanned area, Jongno-gu
Very low shape scores, in pale tones, where parcels are irregular and fragmented.

27,491
blocks scored out of about 42,000 in Seoul, after single-parcel blocks and apartment complexes were removed.

0.052 - 0.917
the range of the PLE score with equal weights, from the least to the most efficient division.

What the Scores Say

Planned districts
Blocks with a high PLE gather in planned development districts such as Gangnam-gu and Seocho-gu.

Historic cores and hillsides
Blocks with a low PLE sit in old city centres and hillside residential areas such as Jongno-gu and Gwanak-gu.

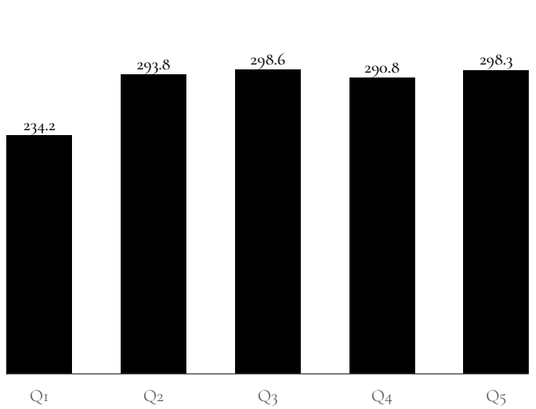
One weak index
Many low blocks fail on one or two indices only. The sub-indices therefore point to a remedy for each block, road access in the historic cores and terrain on the slopes.

Does the Score Follow Built Scale?

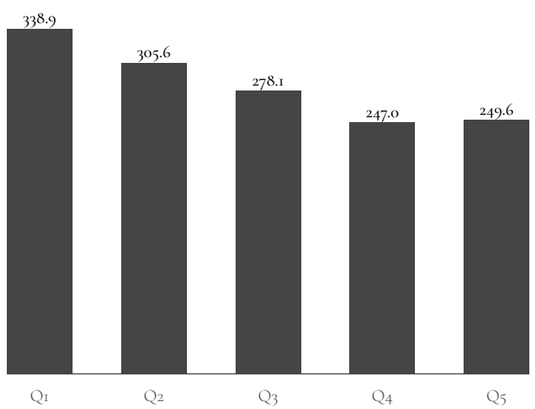
The 9,669 blocks of the Type 2 general residential zone were sorted into fifths by each index score, Q1 the lowest and Q5 the highest. For each index and each outcome, the table gives the change of the mean from Q1 to Q5. The groups were compared with the Mann-Whitney U test and a Holm correction.

	Building coverage	*Gross floor area*	*Floor area ratio*	*Land price*
Shape	+8.9% ***	+17.1% ***	+22.5% ***	+11.5% ***
Topography	+0.6% **	-26.4% ***	-17.1% ***	-4.3% **
Buildable Area	+6.1% ***	+22.4% ***	+14.9% ***	+0.1% ns
Road Access	+6.7% ***	+27.4% ***	+22.2% ***	-2.6% *

Black bars mark a rise from Q1 to Q5 and grey bars a fall. Stars show the significance after the Holm correction, and ns means not significant.



A Road Access and gross floor area
The top fifth by road score has a mean gross floor area 27.4% above the bottom fifth. Most of the rise comes between Q1 and Q2, and the other fifths stay close to it.



B Topography and gross floor area
The top fifth by topography score has a mean gross floor area 26.4% below the bottom fifth. The fall runs to Q4 and the last two fifths are level.

Built scale
Shape, Buildable Area and Road Access all go with a larger built scale. The largest rises from Q1 to Q5 are +27.4% in gross floor area for Road Access and +22.5% in floor area ratio for Shape. The topography score goes the other way, and the talk puts this down to saturation on flat blocks and the development pressure that remains on slopes.

Land price
Land price follows the scores only weakly, with changes from -4.3% to +11.5% and rank-biserial effect sizes of 0.15 or less, against up to 0.32 for the built-scale outcomes. The talk reads the index as a strong predictor of construction scale and a weak predictor of land price, which is governed by the building stock and the location.

Limits and next steps
The test is cross-sectional and correlational, so it shows an association and not a cause. The next steps are a time series before and after redevelopment and a generative re-parceling simulation built on the index.

Density and Closure

Industry-Specific Spatial Density and Business Closure
A Spatio-Temporal Analysis of Gangnam-gu, Seoul

Location : Gangnam-gu, Seoul, Korea
Year : 2025
Type : Conference Paper (Spring 2025)
Team : with Woojin Cho

Shops of the same industry compete for customers, and how closely they stand together is often read as the strength of that competition. Earlier studies of why small businesses close mostly look at a few industries such as restaurants or treat all industries as one group, and they take the distance to competitors at a single date. A shop, however, lives through a changing neighbourhood in which competitors open and close around it.

This study asks how the density of an industry around a business affects whether the business survives its first three years, and whether the answer is the same for every industry.

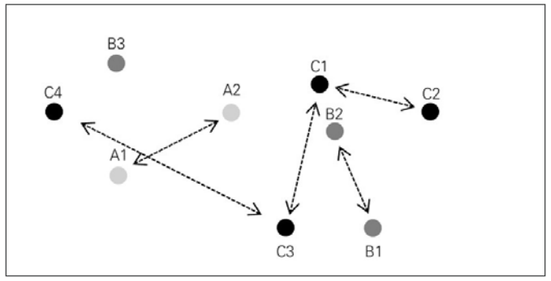
The study follows the 7,647 businesses that opened in Gangnam-gu in 2016, in 22 industries, using the permit records of the national LOCALDATA system. For each business, two measures describe the competition it met on the days it was open: the mean distance to the nearest business of the same industry, and the number of same-industry businesses within that industry's own mean distance. Each industry was then tested separately with a t-test and a logistic regression.

Closure within three years ranged from 3.4% for publishers to 88.8% for on-the-spot sales and processing shops, and density mattered in some industries and not in others.

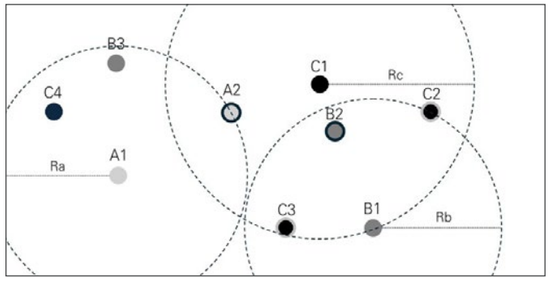
Paper presented at the Spring Conference 2025 of the Urban Design Institute of Korea on 19 April 2025, written with Woojin Cho. I am the second author.

Competition, Day by Day

Earlier studies took the distance to competitors at one date. Here the competition is measured on every day a business was open, and only the businesses of the same industry that were open on that day count. The history of one business becomes a series of daily values, and two numbers summarise it.



A Nearest neighbour distance
Letters give the industry and numbers the business. Each business is joined to the nearest business of its own industry that is open on the same day, and the distances of all the days it was open are averaged.



B Adjacent businesses
A business counts as adjacent to the businesses of its own industry that lie within a radius R, the mean of that industry's nearest neighbour distances. Each industry has its own radius. In the example A1 and B1 have one adjacent business each and C1 has two.

$$\overline{NND}_i = \frac{1}{T_i} \sum_{t=s_i}^{e_i} d_{i,t}$$

NND mean daily nearest neighbour distance of the business.

d distance on day t from the business to the nearest business of its own industry that is open that day.

s, e first and last day of measurement, the opening date and the closing date or the reference date of 31 December 2019.

T number of days measured, e − s + 1.

Tool Python and the KDTree of SciPy, on the EPSG:5174 coordinates of the permit data.

Data and Definition

Gangnam-gu holds 104,299 businesses, 8.8% of the 1,177,287 in Seoul (2023 business census), in many industries and at high density. The permit records give the opening date, the closing date and the coordinates of each business. Businesses that stopped for administrative reasons were left out, and 31 December 2019 was set as the reference date to keep the COVID-19 pandemic out of the data.

7,647
businesses that opened in Gangnam-gu in 2016, in the 22 industries with at least 50 openings.

Survival period

More than 3 years	3 years or less
surviving = 1	**closed = 0**

Counted from the date on which each business reported its opening.

Share of start-ups still open



Small and Medium Business Administration, 2013

Closure Differs by Industry

Share of the businesses opened in 2016 that closed within three years, with the mean nearest neighbour distance and the mean number of adjacent businesses of each industry.

Industry	*Businesses*	*Closed within three years*	*Mean nearest distance (m)*	*Adjacent businesses*
On-the-spot sales and processing	535	88.8%	72.7	**39.5**
Cafes and snack shops	902	57.0%	71.5	**40.1**
Bakeries	122	54.9%	288.1	4.2
Door-to-door sales	56	53.6%	471.9	4.8
Pharmacies	58	48.3%	436.4	2.1
Livestock product sales	74	46.0%	360.3	2.4
General travel agencies	56	42.9%	410.9	1.7
Tobacco retail	197	41.1%	238.2	1.9
Beauty services	494	39.3%	116.5	2.8
Convenience-store medicines	128	37.5%	301.4	2.5
General restaurants	1,164	34.8%	66.1	2.4
Distribution specialty sales	117	34.2%	270.4	2.0
Health food retail	403	30.8%	127.8	2.2
Medical device sales and rental	337	30.3%	136.2	2.0
Health food distribution	77	29.9%	272.1	2.4
Clinics	192	24.5%	145.7	3.9
Online and mail-order sales	2,176	18.5%	44.6	2.7
Game production	57	15.8%	357.4	2.7
Arts and culture planning	147	12.2%	169.0	1.7
Film production	76	7.9%	292.4	2.9
Video production	98	5.1%	260.0	2.0
Publishers	178	3.4%	190.6	1.8

Names are translated from the categories of the permit data. Black bars mark the 10 industries in which at least one of the two measures significantly changes the chance of survival in the logistic regression ($p < 0.05$).

Wide spread
Closure within three years runs from 3.4% for publishers to 88.8% for on-the-spot sales and processing, a gap of 26 times.

Two crowded industries
Cafes and snack shops and on-the-spot sales and processing have about 40 adjacent businesses on average, against 4.8 or fewer in every other industry. They also have the second-highest and the highest closure rate.

No simple order
The mean distance alone does not rank the industries. Online and mail-order sales have the shortest mean distance, 44.6 m, and a closure rate of 18.5%, lower than that of 16 of the 22 industries.

What the Tests Found

Each industry was tested on its own. A t-test compared the closed and the surviving businesses, and a logistic regression related survival to the two density measures.

13 of 22
industries in which the nearest neighbour distance differs between closed and surviving businesses (t-test, $p < 0.1$).

8 of 22
industries in which the number of adjacent businesses differs between the two groups (t-test, $p < 0.1$).

10 of 22
industries in which at least one of the two measures is significant in the regression ($p < 0.05$).

Industry	*Distance coefficient*	*Adjacent coefficient*	*McFadden R-squared*
Door-to-door sales	+0.0009	**-0.3540**	0.297
On-the-spot sales and processing	**+0.0042**	**-0.0178**	0.221
Cafes and snack shops	**+0.0041**	**-0.0217**	0.201
Publishers	+0.0012	**-0.6820**	0.185
Livestock product sales	+0.0013	**-0.2902**	0.135
General travel agencies	**+0.0030**	+0.3465	0.094
Distribution specialty sales	+0.0017	**+0.3208**	0.038
Beauty services	**+0.0028**	+0.0178	0.015
General restaurants	**+0.0031**	+0.0136	0.007
Online and mail-order sales	0.0000	**-0.0452**	0.005

Only the 10 industries with a significant result are listed, in order of fit. The coefficients are for survival. A positive distance coefficient means that survival was more likely farther from the nearest competitor, and a negative coefficient on adjacent businesses that survival was less likely with more neighbours of the same industry. Bold figures are significant at $p < 0.05$.

Crowded industries
On-the-spot sales and processing and cafes and snack shops lose on both measures. Survival is more likely farther from competitors and less likely with more neighbours. Door-to-door sales, publishers, livestock product sales and online and mail-order sales lose on the number of neighbours.

Competition can help
Distribution specialty sales are the exception, with a better chance of survival when more businesses of the industry stand nearby. The talk reads this as a cluster effect.

Fit of the models
McFadden R-squared is highest for door-to-door sales, on-the-spot sales and processing, and cafes and snack shops, at 0.297, 0.221 and 0.201. It is below 0.05 in four of the ten industries.

Industries Respond Differently

The paper reads the results as a case against one management rule for every industry. Density helps or hurts depending on the industry, and a distance judged against the average of the industry describes the competition more closely than an absolute distance.

How survival responds to the two measures (logistic regression, $p < 0.05$)

	More neighbours, less survival	*Neighbours without effect*	*More neighbours, more survival*
Survival more likely farther from competitors	On-the-spot sales and processing Cafes and snack shops	Beauty services General restaurants General travel agencies	None
Distance without clear effect	Door-to-door sales Publishers Livestock product sales Online and mail-order sales	The other 12 industries	Distribution specialty sales

The shaded cell holds the industries in which both measures weigh on survival. Classes follow the significance of each coefficient in the regression.

Policy options named in the paper

Limit new entry
Regulate the entry of new businesses into crowded industries.

Keep a distance
Encourage a minimum separation between businesses of the same industry.

Mix industries
Plan a mix of industries along a street instead of a run of one.

Limits

Scope
Only Gangnam-gu and the businesses opened in 2016 are covered, which limits how far the results can be generalised.

Competition may be underestimated
Businesses that opened before 2016 and were still operating are left out of the distance calculation, so the real competition may be larger than measured.

Industry codes
The categories of the permit data can differ from the way a shop actually operates, which limits the design of the variables.

Next Steps

Other places
Compare districts of different types and cities of different sizes.

Existing businesses
Count all operating businesses in the distance, not only those opened in the study year.

Finer industry classes
Reclassify the industries with the business name or the text of the business type, and add survival analysis.

Non-spatial factors
Add rent, brand type and shop size to the analysis.

UTCI Workflow

A Practical Approach to Urban Design
A UTCI-Based Workflow and Framework with Ladybug

Year : 2025
Type : Conference Paper (Autumn 2025)
Tools : Rhino, Python, Ladybug
Team : with Benjamin Erazo and Justin Heejoon Lim

Sidewalks still fail the people who walk on them, although guidelines and regulations exist. A designer has to consult the regulations and guidelines of specific sources, and the results of simulation-based design are complex and hard to use. This study builds a workflow for the detailed design of sidewalks and pedestrian spaces, in which a designer changes the design, reviews the result at once and corrects it again.
The workflow runs in Rhino with Python and Ladybug. It measures and visualises the Universal Thermal Climate Index (UTCI) on pedestrian paths and turns the design elements into one score.

A ten-point index describes a sidewalk by ten elements that can be turned into numbers in the model, from width, seating, lighting and shade to bike lanes, crosswalks and pavement temperature. Each element scores 0, 0.5 or 1. The index draws on two design guides, the AASHTO guide for pedestrian facilities (2021) and the NACTO Urban Street Design Guide (2013), and on levels of service for transport.
The tool serves phase 5 of the six phases of urban design in the model of Southworth and Ben-Joseph, streetscape and edge detail. More parameters, weights and a pedestrian network are planned as next steps.
Conference paper of the Autumn Conference 2025 of the Urban Design Institute of Korea, written with Benjamin Erazo and Justin Heejoon Lim. I am the second author.

A Ten-Point Sidewalk Index

Each of ten parameters scores 0, 0.5 or 1, so a sidewalk segment can reach 10 points. Only elements that a designer can turn into a number in the model were kept, and the thresholds follow the design guides that the study reviewed. An element that is absent scores 0.

Group	*Parameter*	*Score 0*	*Score 0.5*	*Score 1*
Curbs	Sidewalk width	None	1.5 - 2.4 m	2.41 - 3 m
Urban furniture	Public seating	None	Spacing of 150 m or more	Spacing of 100 - 150 m
	Street lighting	None	Spacing of 15 - 30 m	Spacing of 12 - 15 m
	Street vending spaces	None	-	Provided
Buffer areas	Roadside planting or garden width	None	0.6 - 1.5 m	1.5 - 2.5 m or more
	Bike lane width	None	1.5 - 2.1 m	3 - 4 m
	Separation of pedestrians from motor vehicles	None	-	Provided
Connectivity	Crosswalks	None	Spacing of 200 - 300 m	Spacing of 80 - 120 m
Shading	Natural shading or shading devices	None	Spacing of 9 - 12 m	Spacing of 6 - 9 m
	Pavement temperature	Measured in degrees Celsius by use of UTCI values.		

Table 1 of the paper. The two binary parameters have no middle score. The ten maximum scores add up to the 10 points of the index.

Design guides
The AASHTO Guide for the Planning, Design, and Operations of Pedestrian Facilities (2021) and the NACTO Urban Street Design Guide (2013) were the two main guides studied.

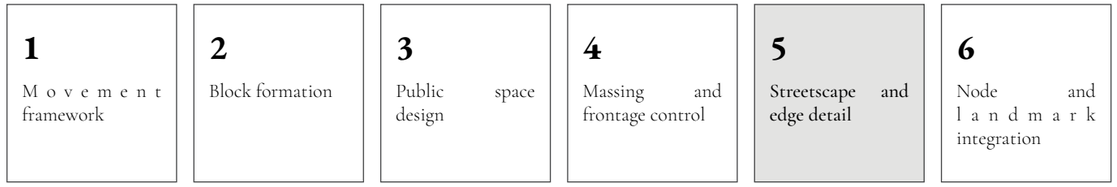
Levels of service and indices
The guidelines for levels of service in transport and the Pedestrian Environmental Quality Index were taken into account as well.

Concepts of walkability
Walk Score, the five parameters of well-being in public space by Mehta and the view of Gehl on safety, comfort and human scale were reviewed. They describe the urban space as a whole, and the index looks at the design of the sidewalk itself.

From Index to Workflow

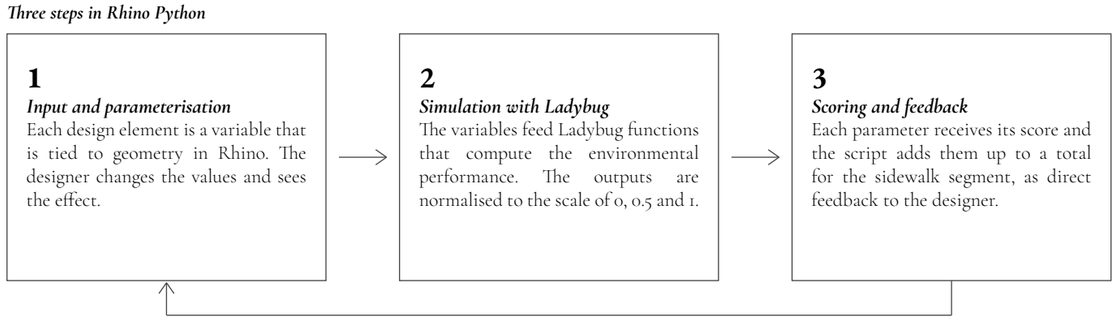
Simulation results are hard for a designer to read. The workflow turns a sidewalk design into a score in a loop of trial, review and correction, and it sits in the detailed design of public space.

Where the tool sits: six phases of urban design



The phases of Southworth and Ben-Joseph (2003). The tool serves phase 5, the pedestrian comfort and sidewalk design of the final stage.

Three steps in Rhino Python



Trial, review and correction: the designer revises the design and runs the workflow again.

Next Steps

More parameters and finer scores
Add more variants of the parameters and raise the accuracy of the scoring.

Weights
Develop a weighting system that gives a more precise scale of the importance of each element.

Pedestrian network
Develop an algorithm that generates hierarchies in pedestrian spaces and builds a pedestrian network under the same parameterised standard.