

HAN KUO PORTFOLIO

**2021-2022**

M S ADVANCED ARCHITECTURAL DESIGN

Bernard Tschumi

Michael Bell

Laura González Fierro

COLUMBIA  
**GSAPP**

 COLUMBIA UNIVERSITY  
IN THE CITY OF NEW YORK

**REMOVAL OF MOTION**

**ISLAND**

**RE-THINKING BIM**

**ACCESSIBILITY**

**ADVANCED CURTAIN WALL**

**Michael Bell  
New Prototype of  
Working Space  
Spring**

**REMOVAL  
OF MOTION**

**2022**

# “Everything All on Track” - a prototype of modular house

2022 Spring - Michael Bell - Removal of Motion

As modern society develops rapidly, we have lived in a constantly changing world that architecture is expected to catch up by evolving into more flexible and adaptive utility than ever. Unlike majority of houses with static setting and unchanging characteristics, the proposed built space is designed to be multi-purpose, internally movable and changeable over time to meet occupant's shifting needs, whether social or environmental reasons.

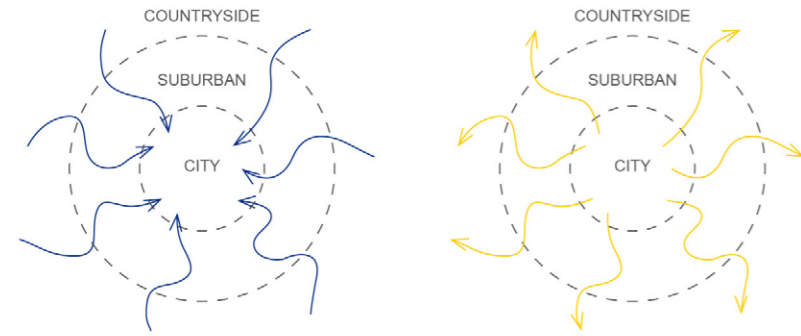


Due to constant urbanization, in 2007, for the first time, there are more people living in urban than in rural regions globally.

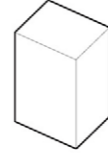
However, In the wake of pandemic, more and more people are forced to work remotely. According to some surveys, 35% of American workers were at home in the early days of the pandemic. Many of these people aren't thrilled about the idea of going back to a physical office. Gallup survey found that 30% of office workers never want to return. Another 60% want to stay on a hybrid model, only going to the office a few days a week.

With the standardized components, this structural module is limited within a 2.5m x 2.5m square that can be expanded to diverse range of scale through repetition of the module in order to accommodate either individual, a couple or a bigger family. This assembly process is well simplified and standardized. Therefore, the modular house can effortlessly be deployed in any field, no matter urban, suburban or rural setting, with minimum manpowers and equipment.

## A migration of counter-urbanization emerges that people escape from cities and work remotely

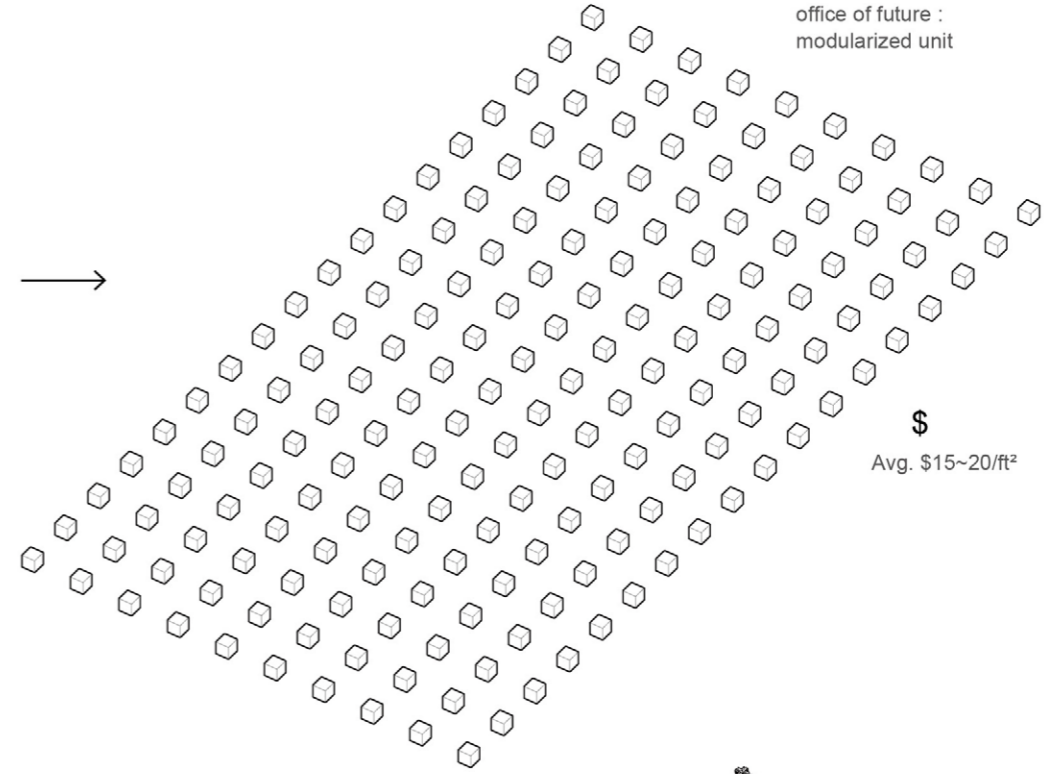
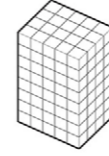


conventional office building

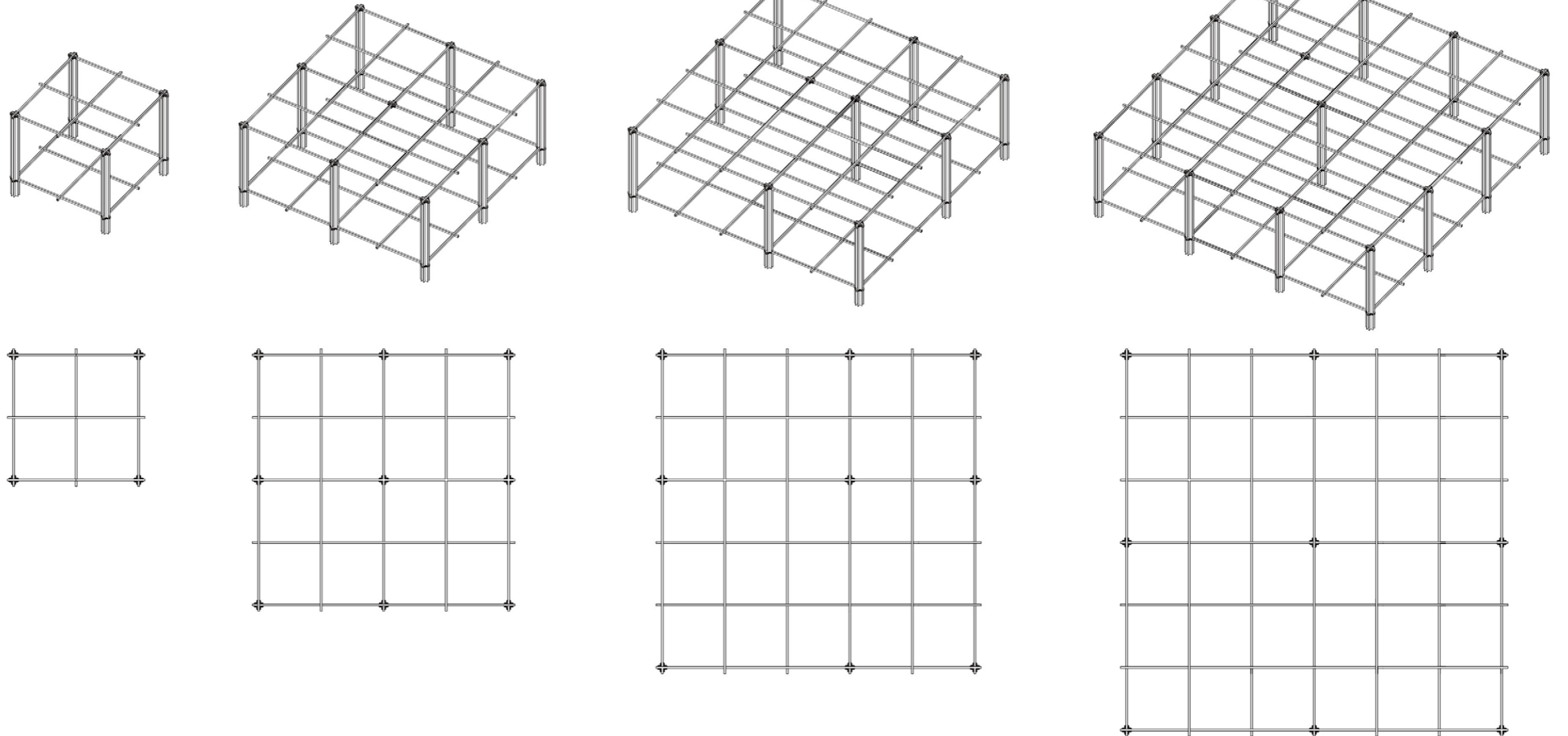
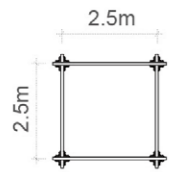
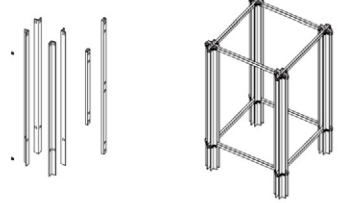


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Avg. \$660/ft<sup>2</sup>



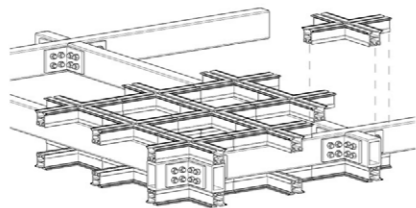
module scale variation



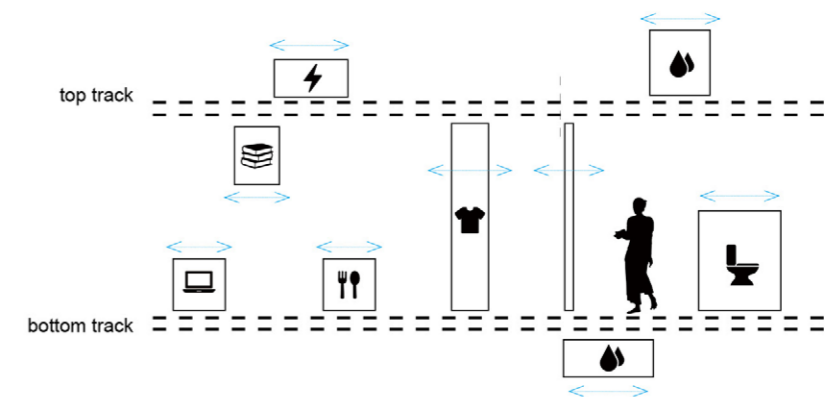


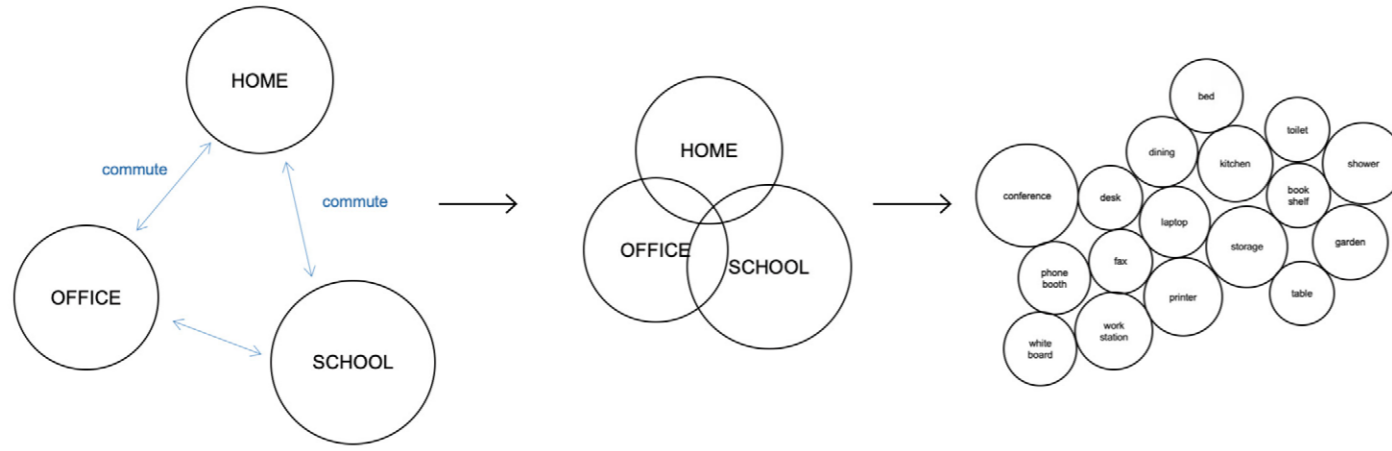
In order to keep the dynamics of space in the modular house, track system is introduced. The track and carrier provides ease of systematic operation and directional flexibility. All furniture for living is fixed with operable wheels. The cross-shaped junction gives occupants freedom to effectively relocate every household furniture and operable partitions via 2 perpendicular axes, enhancing the versatility of interior space.

Tracks are not only function as internal infrastructure inside the house, but also on the roof and under the floor for those supportive units including rainwater collector, photovoltaic panels, water supply and septic tank, etc.



expandable and replaceable track system



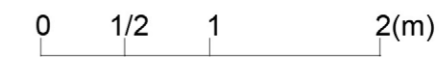
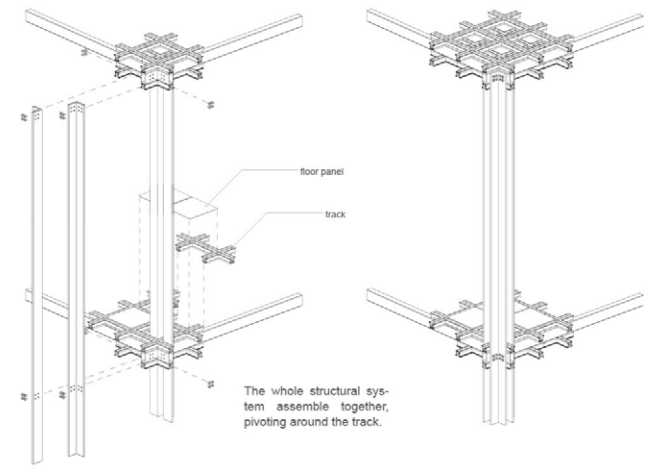
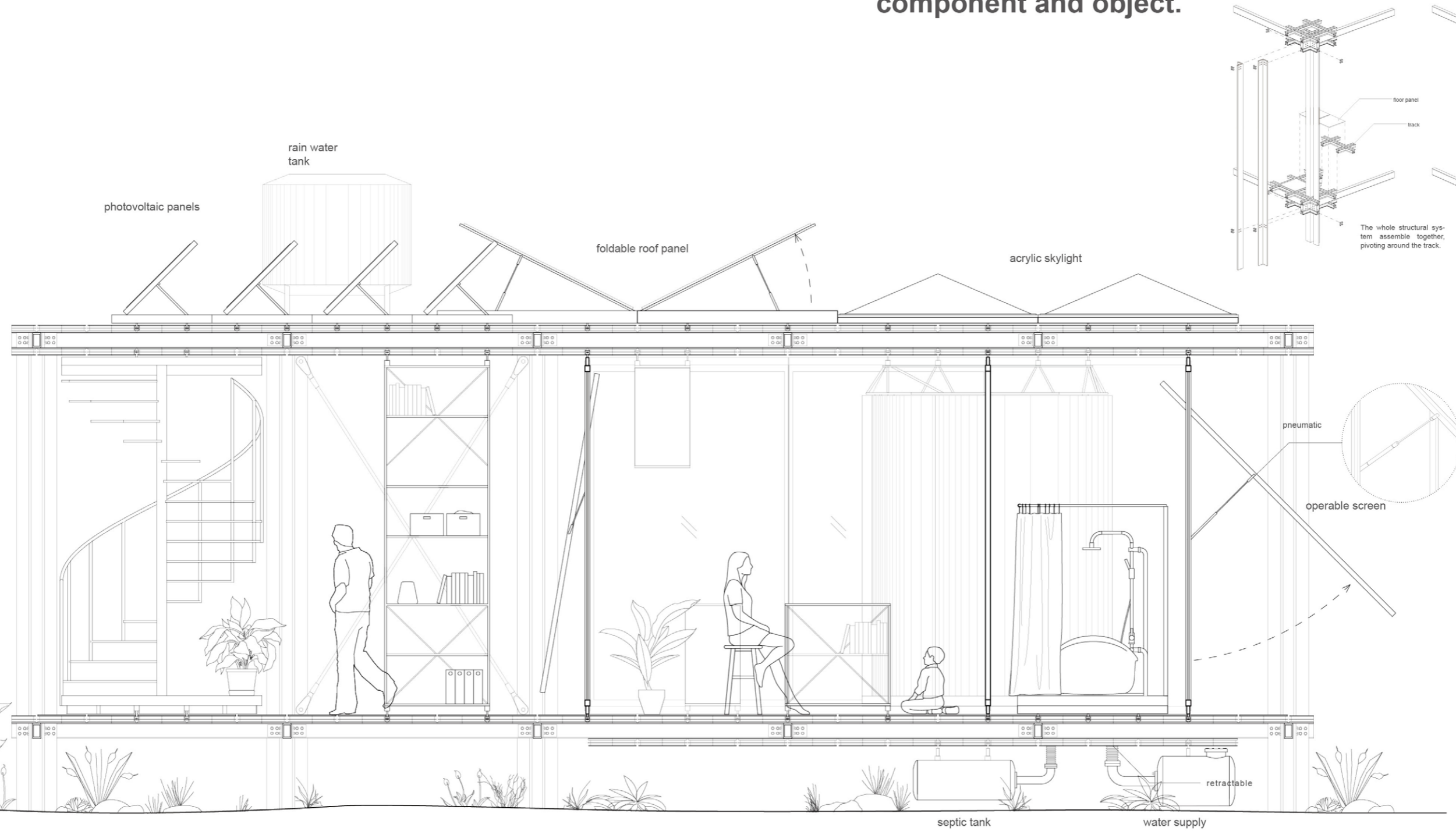


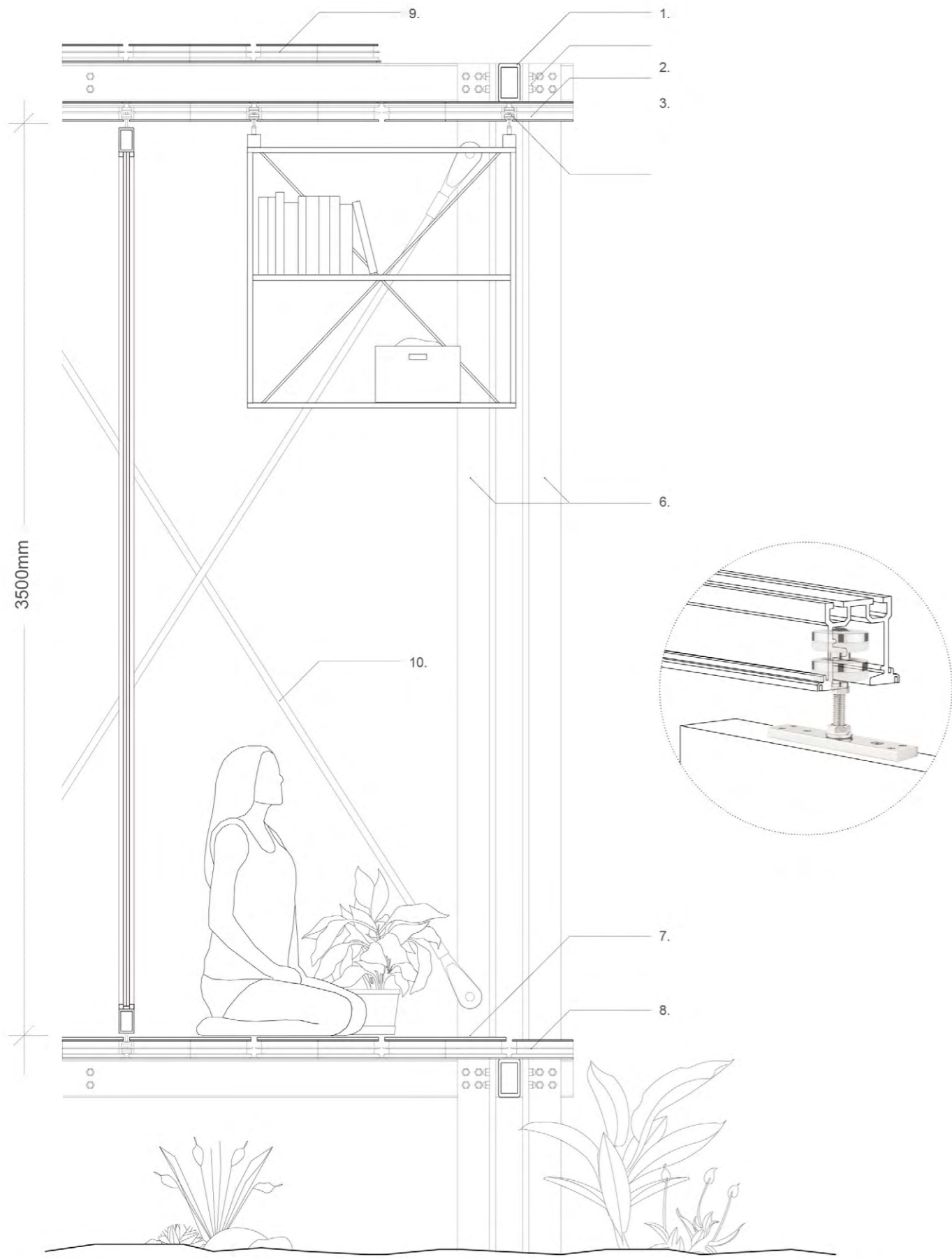
Due to end of commute, boundary between office, home and even school become blur and merge together.

This house is intentionally designed to be "roomless." Inside there is no static accumulation of rooms, but merely a dynamic and changeable open zone full of "domestic units and events."

No bedroom except beds, no dining room except dining, no bathroom except bath, no living room except all the elements that build up the feeling of living. It's a big open space awaiting occupants to define its characteristic and functions.

**In a "roomless" house, definition of space is dissolved and re-merged into modularized furniture component and object.**

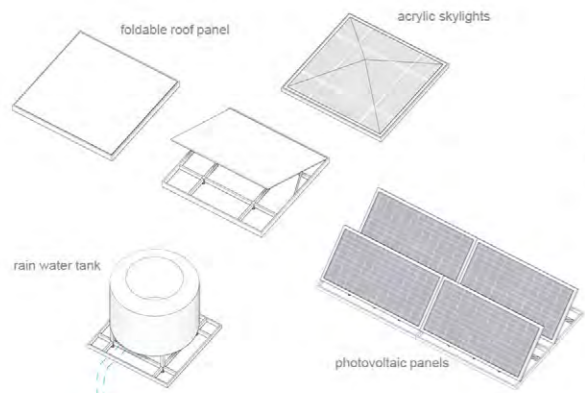




- section 1:25
- 1. steel beam
  - 2. L-shaped fastener
  - 3. head track (alum. extrusion)
  - 4. running carriers
  - 5. threaded rod
  - 6. steel column assembly
  - 7. floor panel (removable)
  - 8. floor track
  - 9. roof track
  - 10. steel tension bar

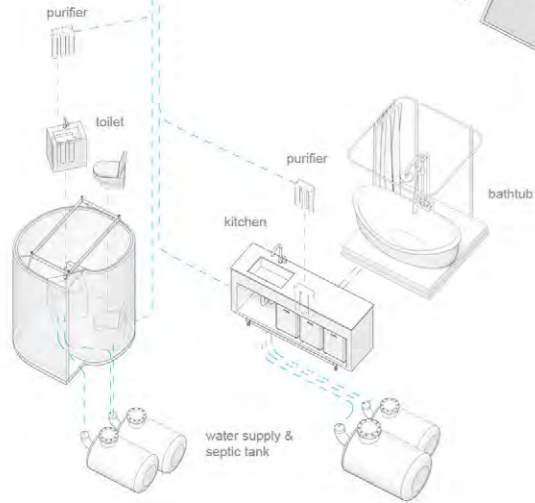
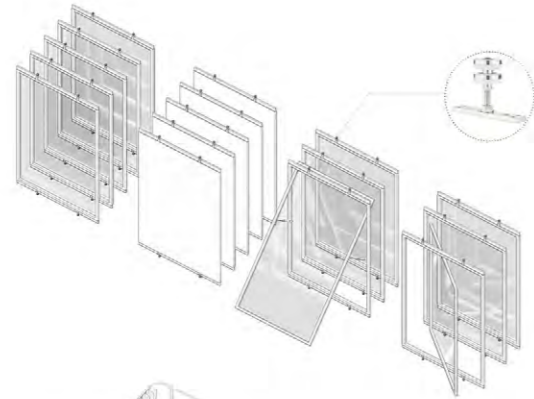




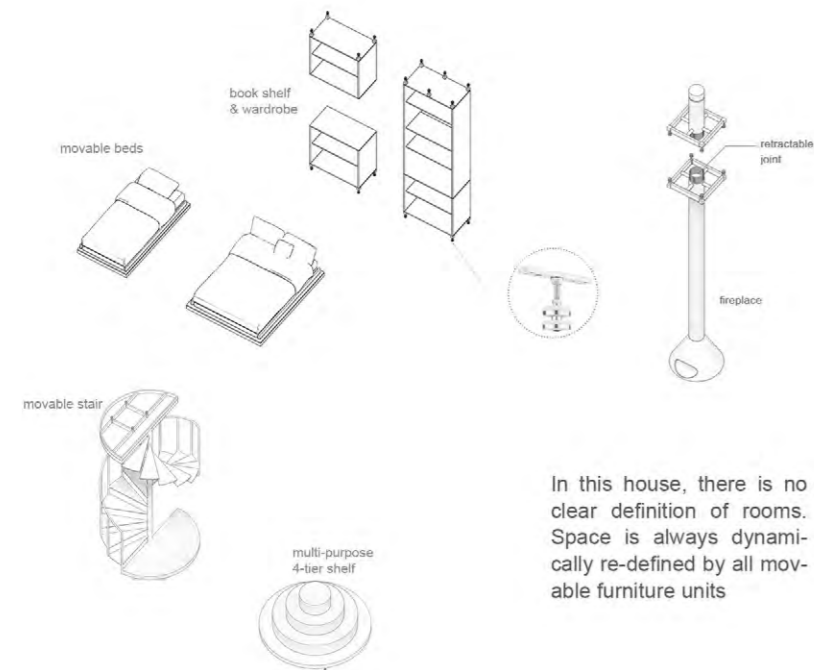


photovoltaic panels on roof generate electricity for residents. Rain water tank recycles and filters rain for water supply.

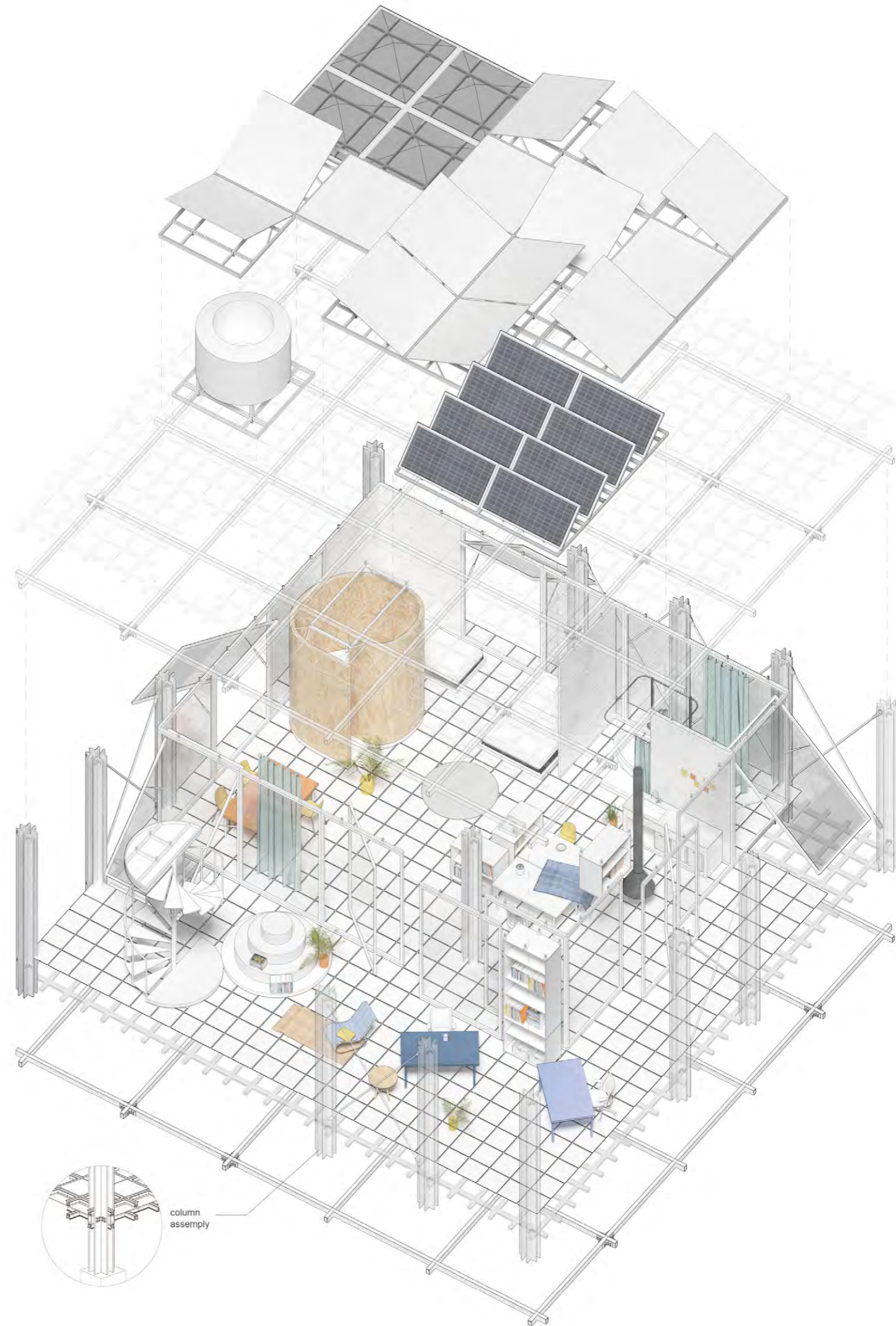
various types of partitions that can slide to define the boundary between space or interior and exterior



water supply and septic tanks under the house are able to follow toilet, kitchen and bathtub by relocation



In this house, there is no clear definition of rooms. Space is always dynamically re-defined by all movable furniture units



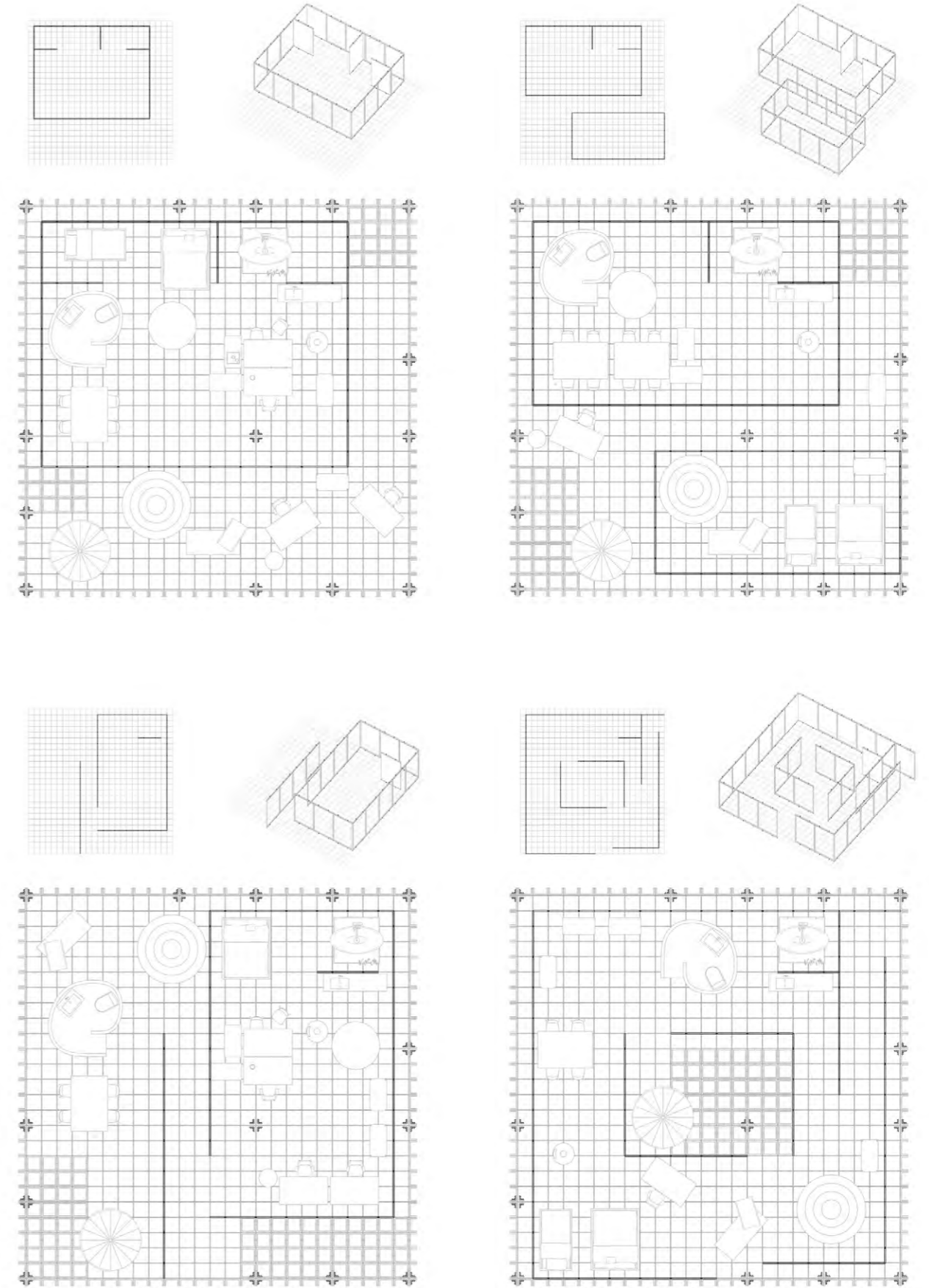
column assembly



0 1/2 1 2(m)

floor plan (1:45)

Based on user's preference, the overall interior configuration can be personalized. A wide variety of possible permutations of furniture, objects and partitions moving along the track system provide various spatial experience and living quality.



**Bernard Tschumi**  
**ISLAND Studio**  
**Fall**

team of air  
Han Kuo  
Ece Cetin  
Zhanhao Fan

**ISLAND**

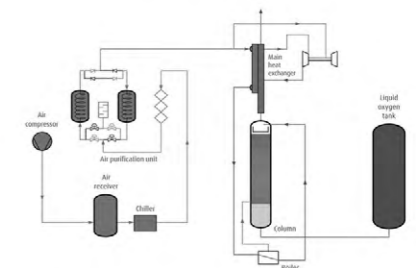
**2021**



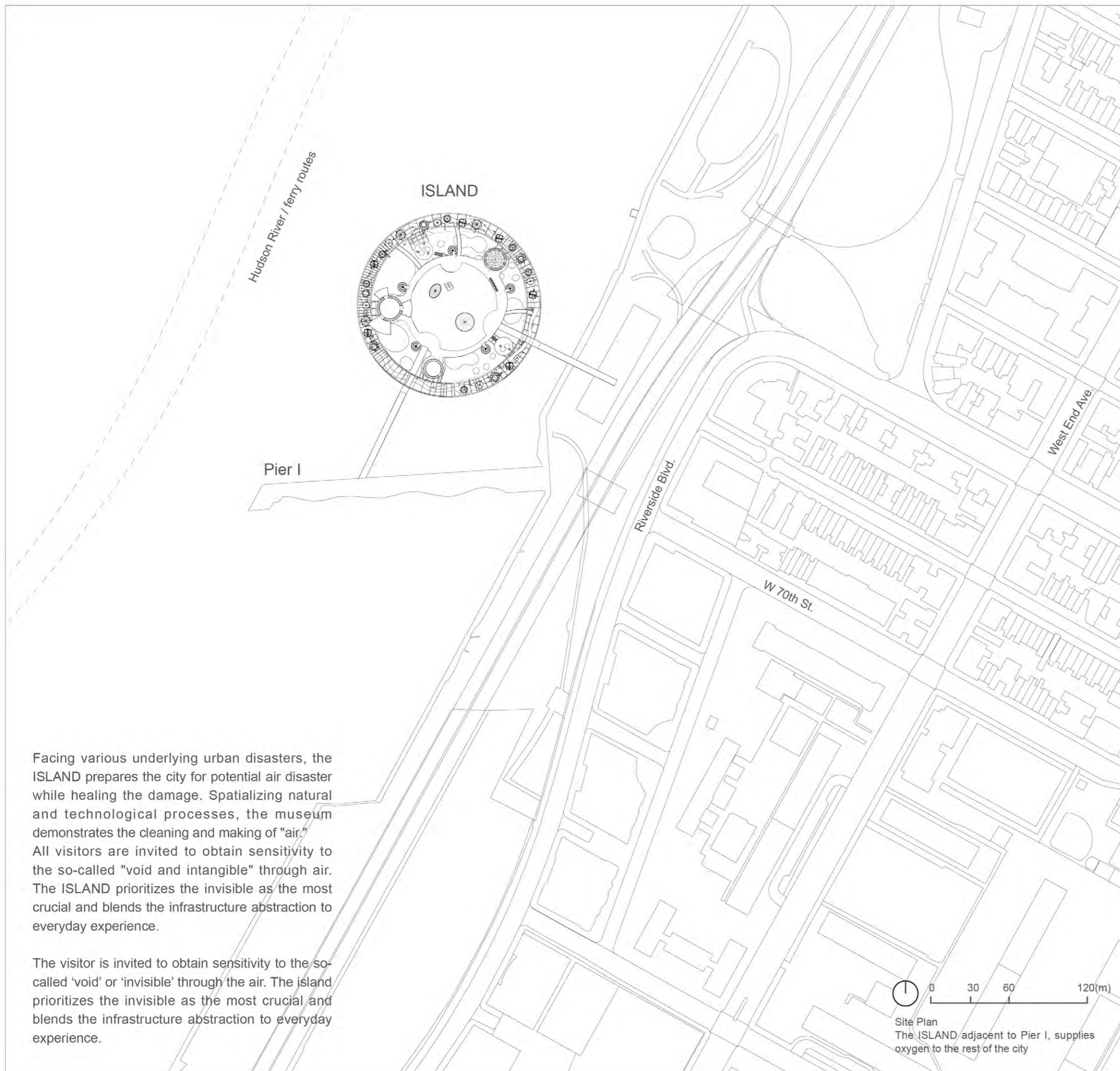
team of air : Han Kuo / Ece Cetin / Zhanhao Fan

## The floating Island on Hudson River is not merely a factory, but also the museum and air-purifier of New York city.

The ISLAND studio aims to explore the potential of city infrastructure in response to airborne catastrophe, such as Covid-19 pandemic, seeking the character of architecture in the post-pandemic era. As a result, the island becomes a factory, museum, and purifier of air.

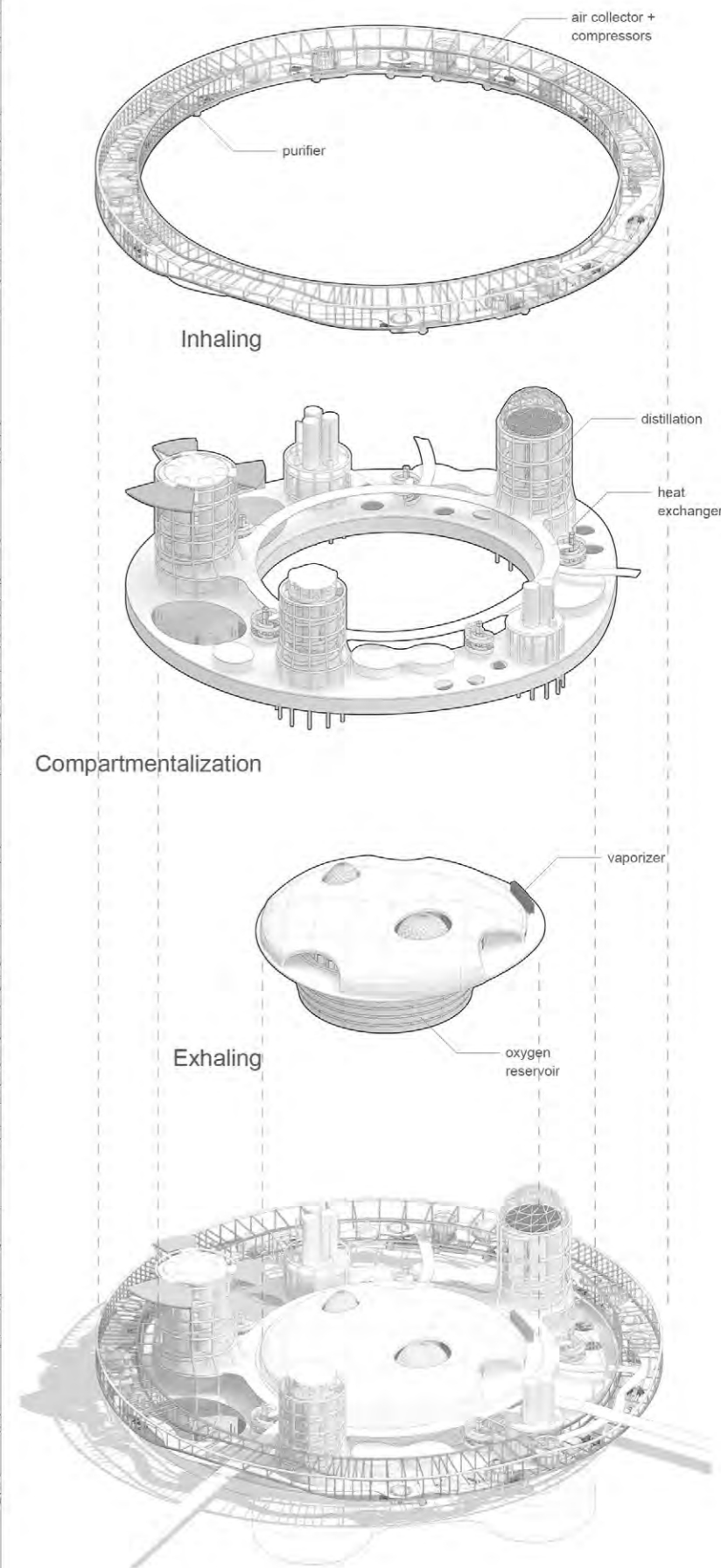


air purification diagram

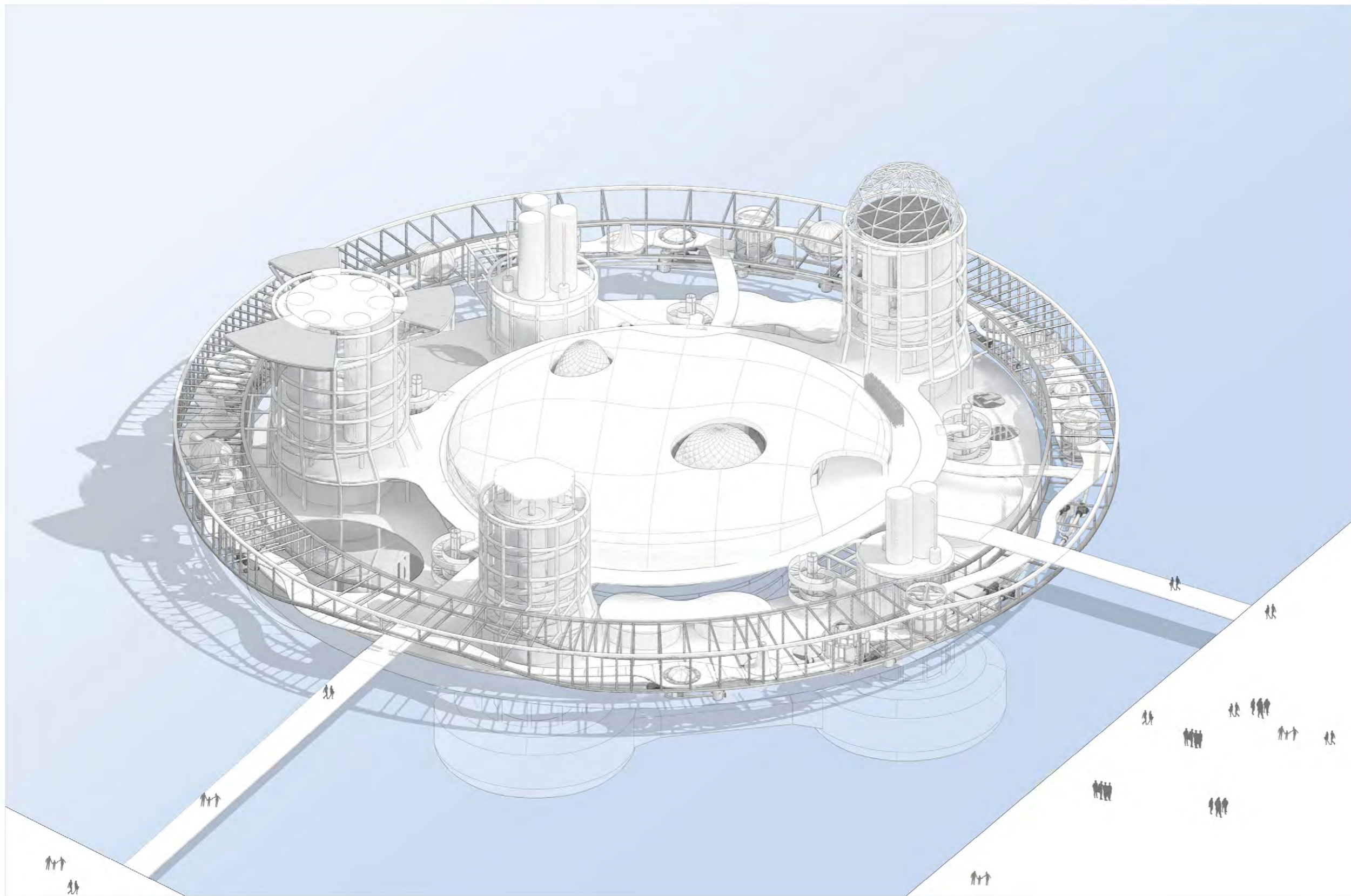


Facing various underlying urban disasters, the ISLAND prepares the city for potential air disaster while healing the damage. Spatializing natural and technological processes, the museum demonstrates the cleaning and making of "air." All visitors are invited to obtain sensitivity to the so-called "void and intangible" through air. The ISLAND prioritizes the invisible as the most crucial and blends the infrastructure abstraction to everyday experience.

The visitor is invited to obtain sensitivity to the so-called 'void' or 'invisible' through the air. The island prioritizes the invisible as the most crucial and blends the infrastructure abstraction to everyday experience.



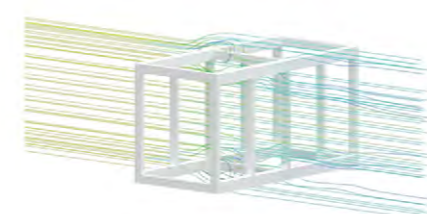
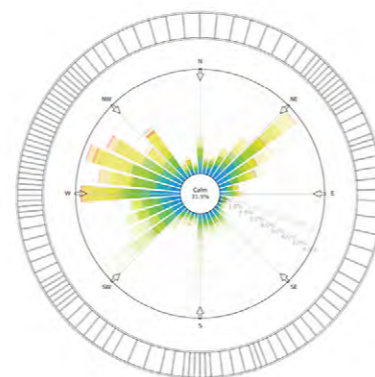
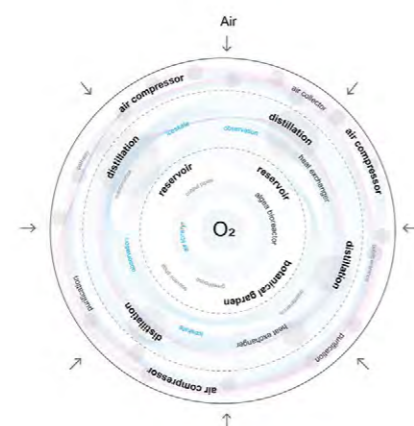
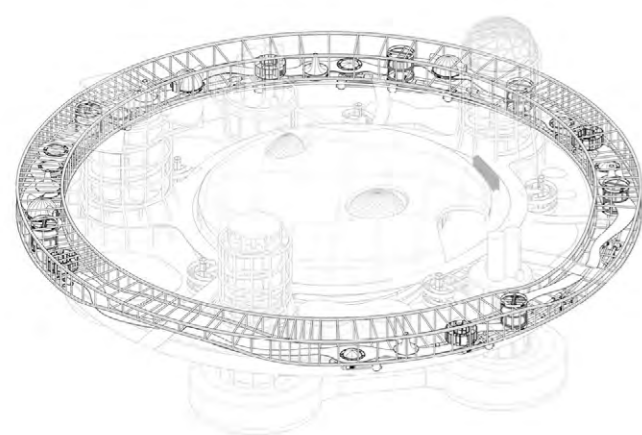
The whole mechanism of producing oxygen is simply conceptualized in three major parts on the island : inhaling, compartmentalizing, and exhaling.



The ISLAND is a factory, museum, and purifier of air. Facing various underlying urban disasters, The Lung prepares the city for potential air catastrophes while healing the damage. Spatializing natural and technological processes, the museum demonstrates the cleaning and making of 'air.'

It consists of three major parts, from outermost to innermost, including Inhaling, Compartmentalization and Exhaling respectively. Each part functions as different process for purification of polluted air of New York.

## The island seeks a way to give form to the formless air.



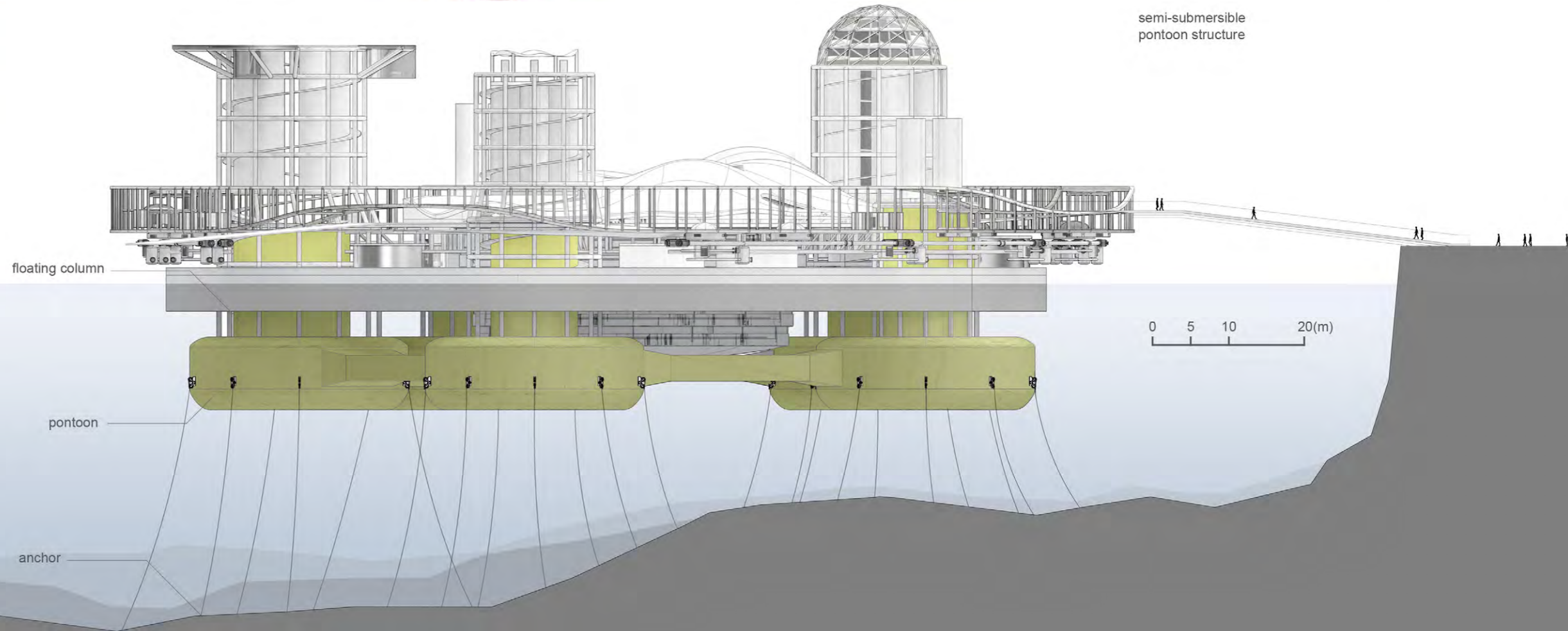
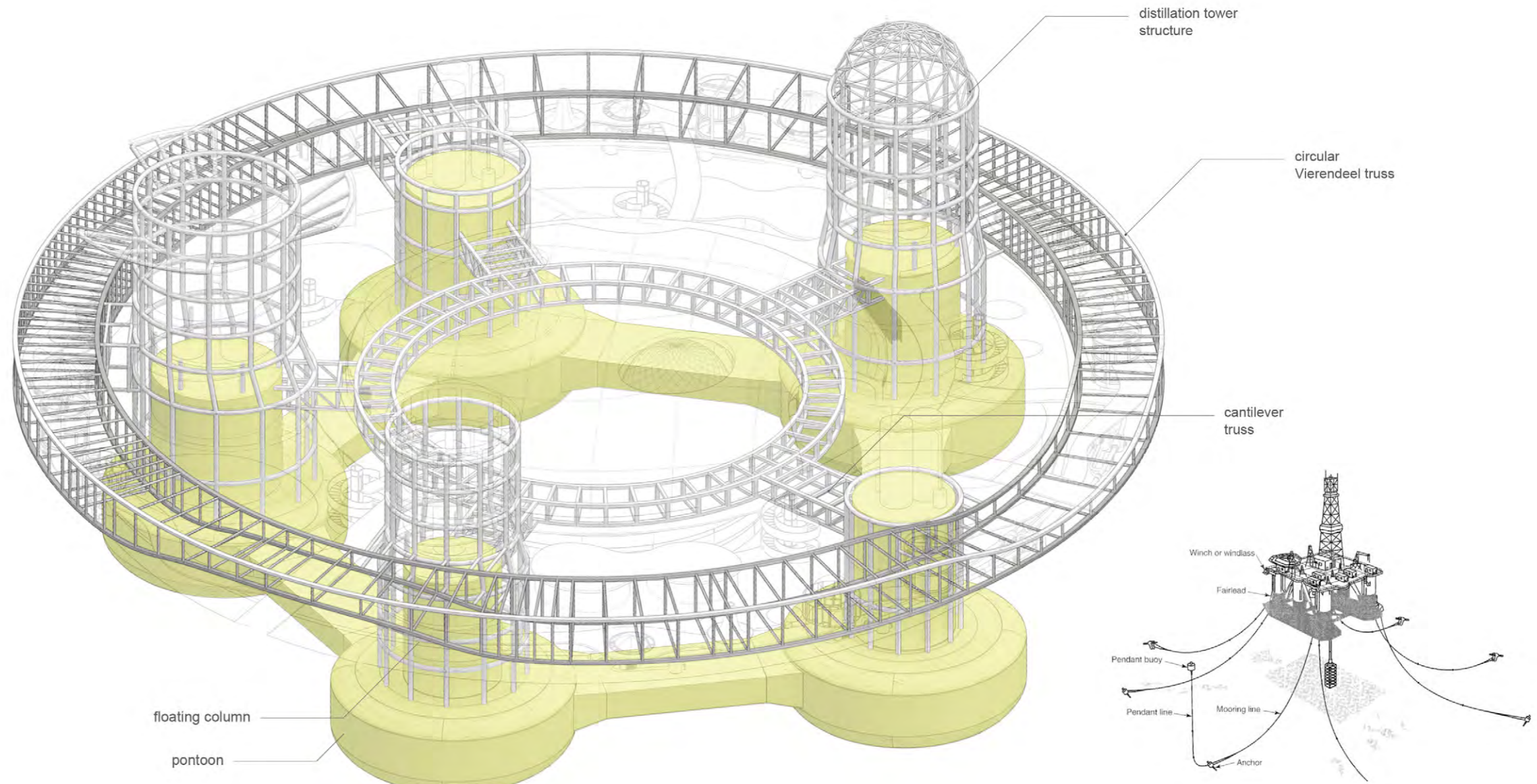
vierendeel truss

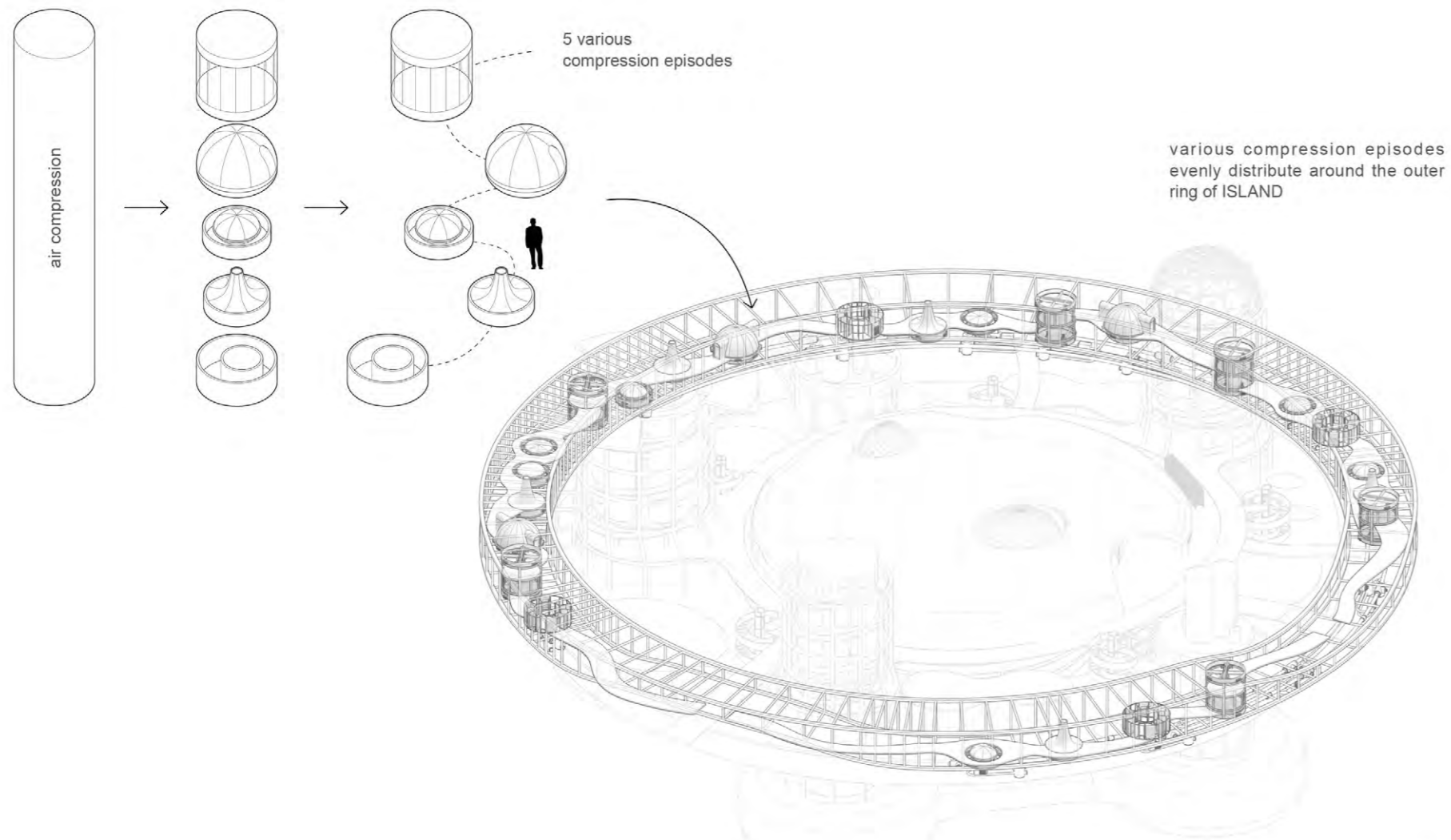
The structural truss density at the outer ring is organized according to the annual windrose diagram of New York City. By manipulating the density of truss, the structure can interact with the invisible context of air.

The mechanisms of oxygen production are demonstrated across scales through spatial experiences at the ISLAND, as the visitors participate and encounter the process of making breathable air. Instead of using typical compression machinery, we try to visualize the behavior of air compression by introducing 5 various compression episodes. And distribute them around the outer ring, connected by a public pathway. When people walk around it, they experience and interact with each unique compression episode.



The structure consists of semi-submersible pontoons, which are commonly used in the offshore oil industry, enhancing the impression and relation between intangible air and the solid structure. The truss density at the outer ring is organized in response to the annual windrose diagram of New York City. The mechanisms of oxygen production are demonstrated across scales through spatial experiences at The ISLAND, as the visitors participate and encounter the process of making breathable air.

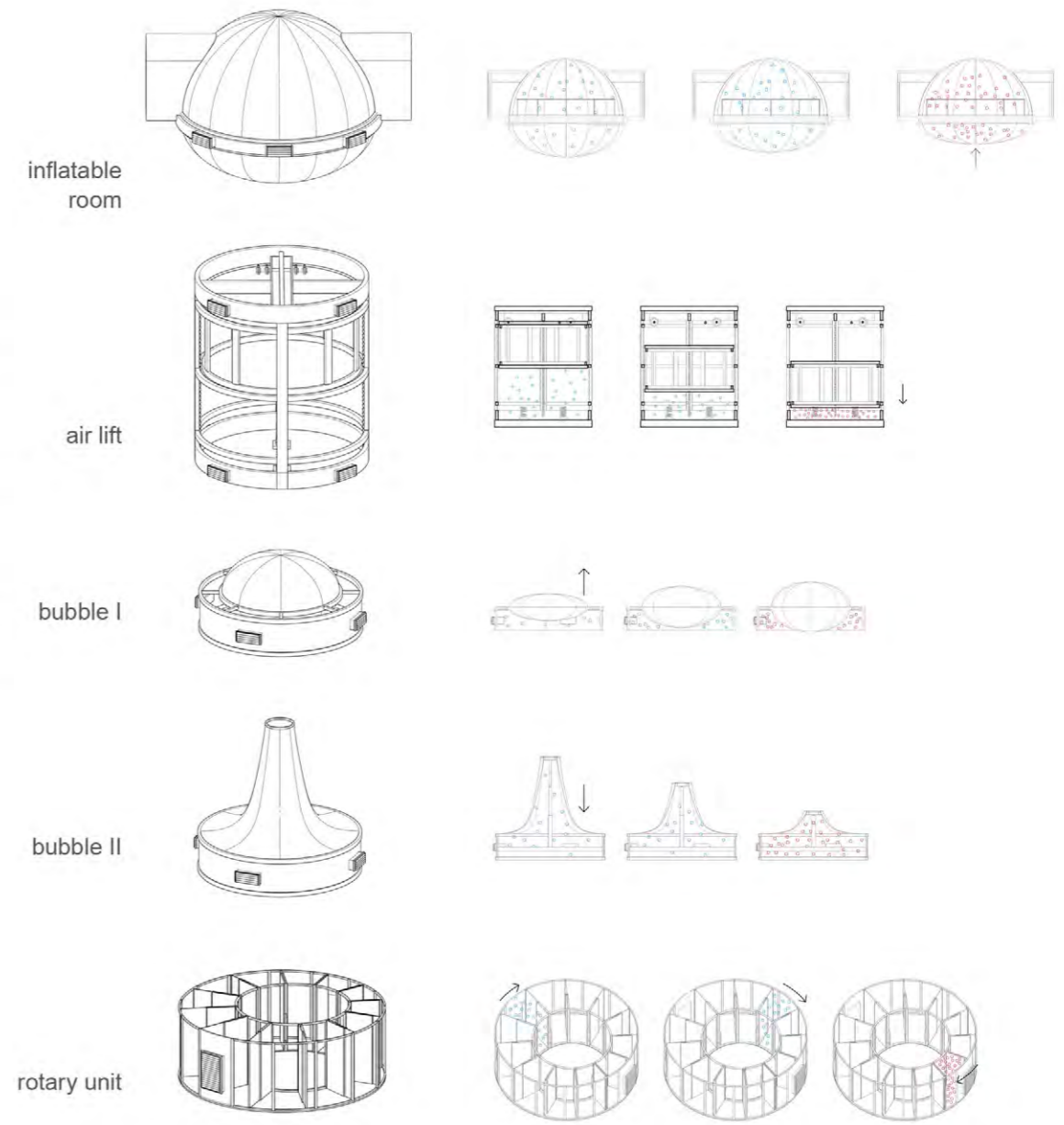
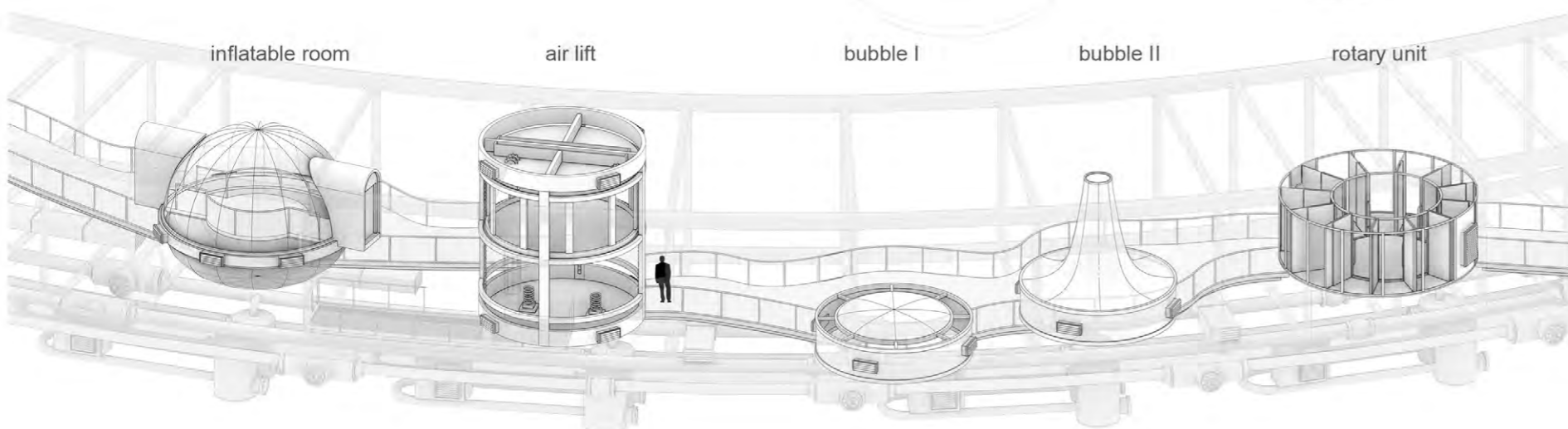




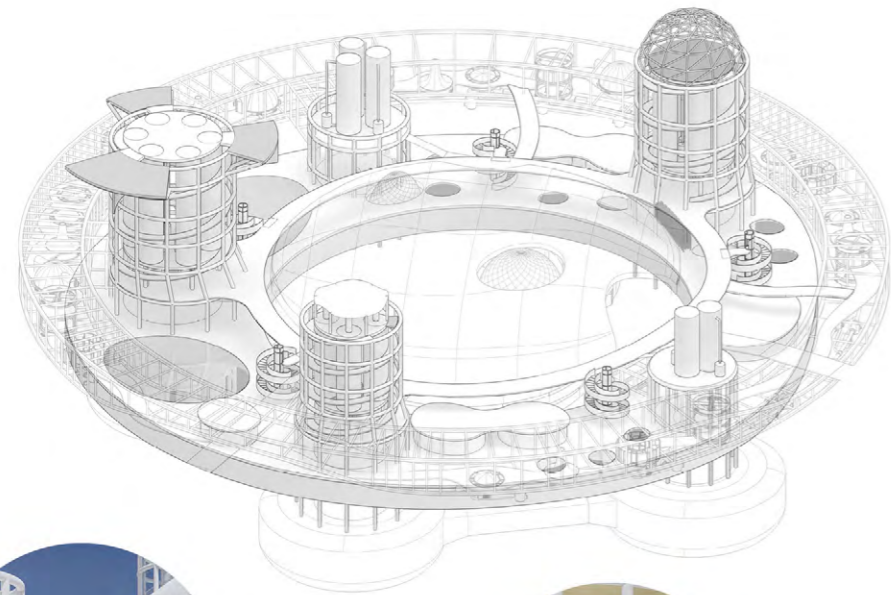
The air is first compressed and purified during inhaling; liquefied to distill oxygen out during absorption. Lastly, the liquid oxygen goes into the reservoir to be vaporized for later use during exhaling. Instead of installing conventional machinery, we try to visualize the process of air compression by introducing 5 various compression episodes. And distribute them around the outer ring, connected by the public pathway. When people walk around it, they experience and interact with the unique compression mechanism of each episode.

For the inflatable rooms, visitors are invited to walk in to feel the process of compression; For the air lift, this unit isn't only designed to compress air, but also helps to carry people to different levels; For the bubbles, 2 types of units compress the air outside or inside of them. They could be used as furniture, offering a chance for people to sit. In the end, visitor can immerse themselves in the rotary chamber before their next destination.

**air compression is "volume change of space"**







Frigid Garden



Observation Windows



Ice skating

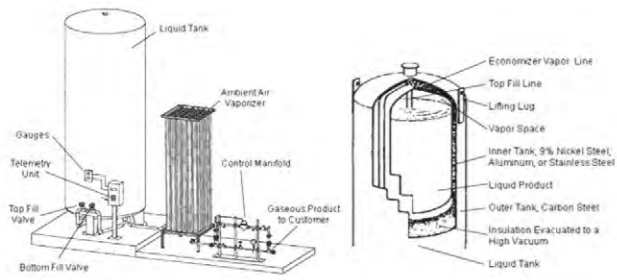


Ice Cream Cafe

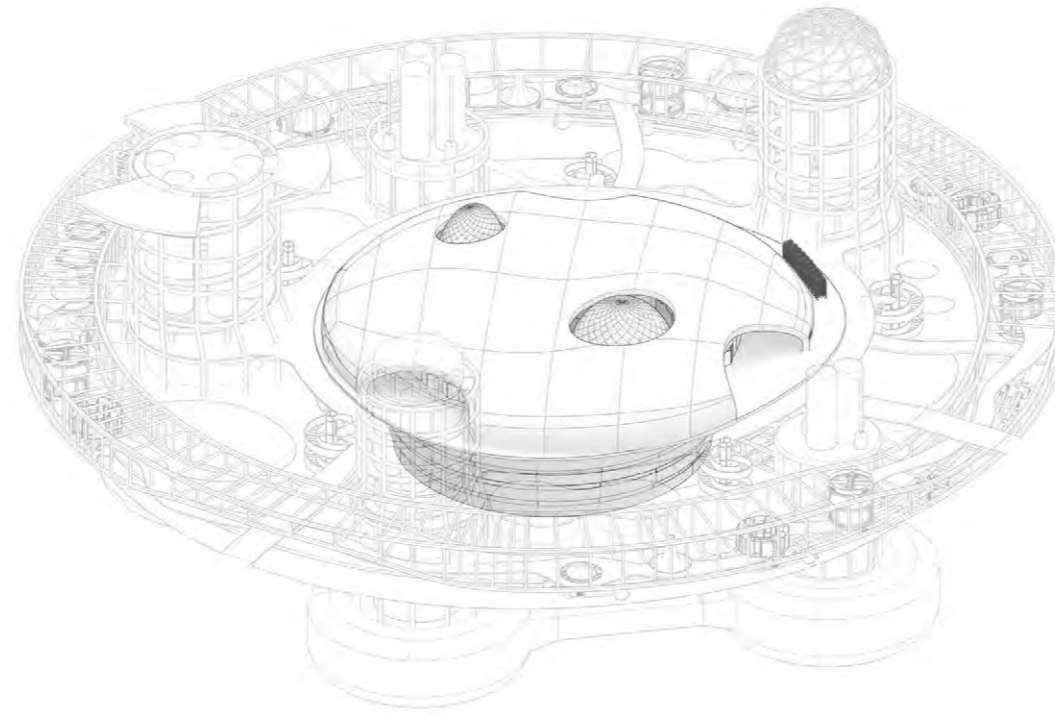
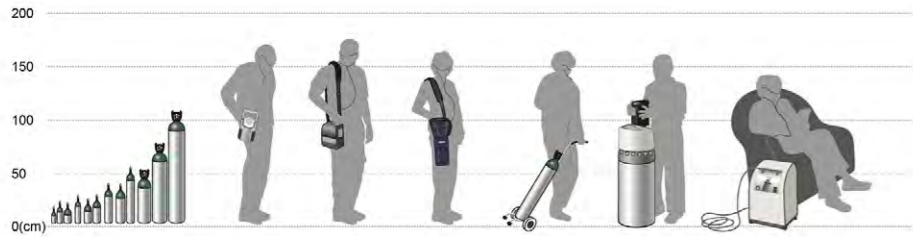
The compartmentalization process includes the distillation towers and the heat exchanger. We took inspiration from the distillation process and the side effects of congesting ice outside the heat exchanger due to low temperature, and try to invent new architectural experiences with them. We designed the distillation towers to museums featuring different attributes of air, and the "Ice Ring" featuring various experiences with the coldness around heat exchanger. The layout of the Towers and the Ice Ring also respond to the amount of air collected in each direction around the year.

Zooming in to the towers, the first tower is about the Flow of Air. We placed rotary observation decks powered by wind like a horizontal windmill in the direction where the wind is the strongest ; The second tower is about the temperature change of Air. Based on the mechanism of air circulation, we designed a snow room at the bottom of the tower. The third tower is about the forms of air. We opened transparent seams on the distillation tower for visitors to observe the air being distilled. And on top of the tower, a changing canopy blown by the clean waste air out of the chimneys further visualizes the form of the invisible air.





Typical Liquid oxygen storage system and cross section of storage tank

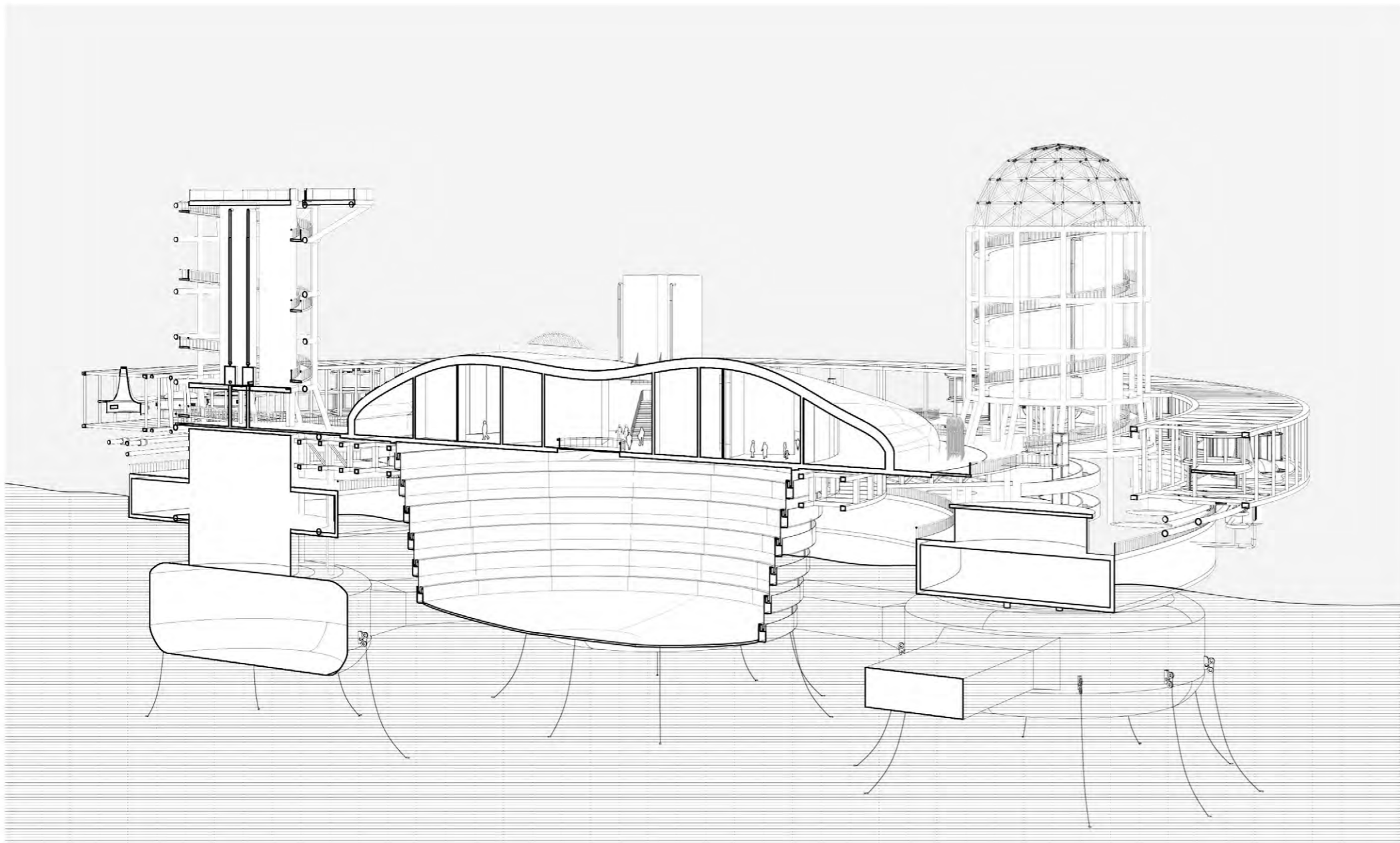


We are interested in the various forms oxygen takes from air particles in a room taken for granted, to a scale of a carryable tank with a strap, to a static large infrastructure. The need for breathable air radically transforms the conception and the container of it.

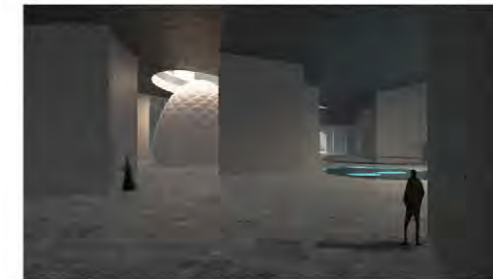
The exhaling part is constituted of the semi-immersed liquid oxygen tank, gallery spaces and the oxygen tank pool on the cantilever structure, pneumatic spaces and concrete landscape shell. Reaching to the central reservoir the visitor sees the expandable semi-immersed liquid oxygen tank. Above the floor inflatable pneumatic gallery rooms react to the production of gas oxygen, using it as a material for its form.

The visitor is able to experience sounds and volumetric differences associated with the change in form from liquid to gas. The expandable reservoir structure is inspired by the precedents of gas holders from 1950s. But it expands downwards instead of upwards in order to hold liquid oxygen.

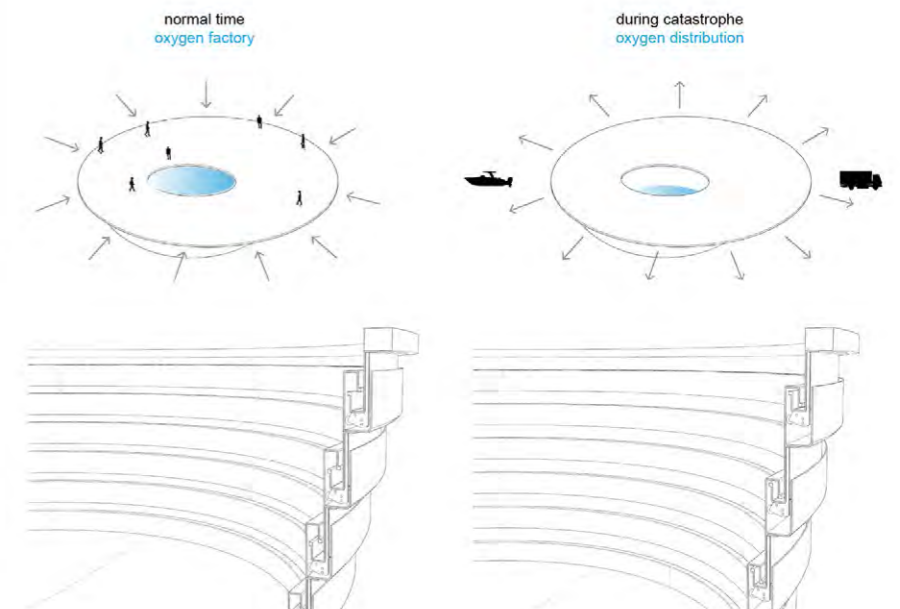
Inside, the atmosphere gallery rooms demonstrate the history of air on earth through various simulations. The oxygen pool dynamically responds to the production flows at the island which visitor is able to peek through. The ISLAND breathes and reacts in response while demonstrating the process of air production.



visitor gallery

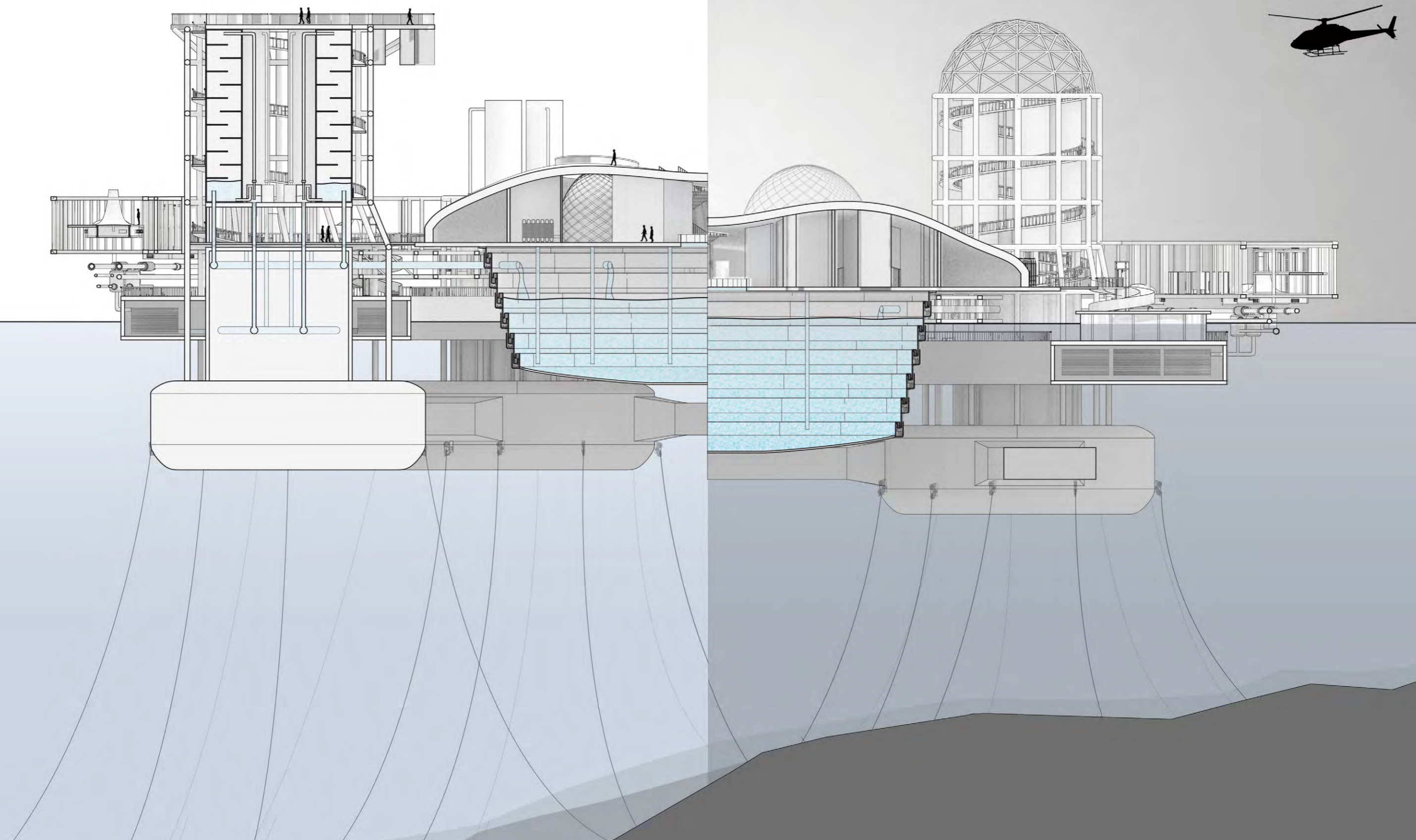


reservoir hall





During normal time, the lung provides visitors with various experiences while producing oxygen.  
During catastrophe, the island reacts to increased breathable air demands, expanding its oxygen capacity.



**Laura González Fierro  
Entangled Studio  
New Ground Floor  
Summer**

**ACCESS  
SIBILITY**

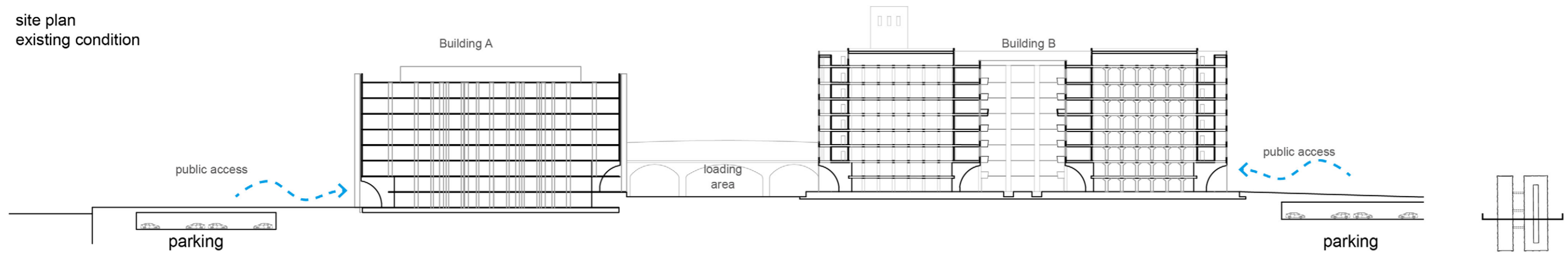
**2021**



Brooklyn Army Terminal, New York

The whole project is trying to create the feeling of accessibility by visualizing it. Undoubtedly, the ground floor of every building is the most publicly accessible. However, the whole complex of Brooklyn Army Terminal is mostly occupied by automobile pathway and parking, and two monstrous buildings act like two gigantic walls dividing the neighborhood and waterfront. The strategy is to simply open the ground floor in order to not only re-build the linkage between local community and waterfront, but also offer new space for public programs.

N  
site plan  
existing condition



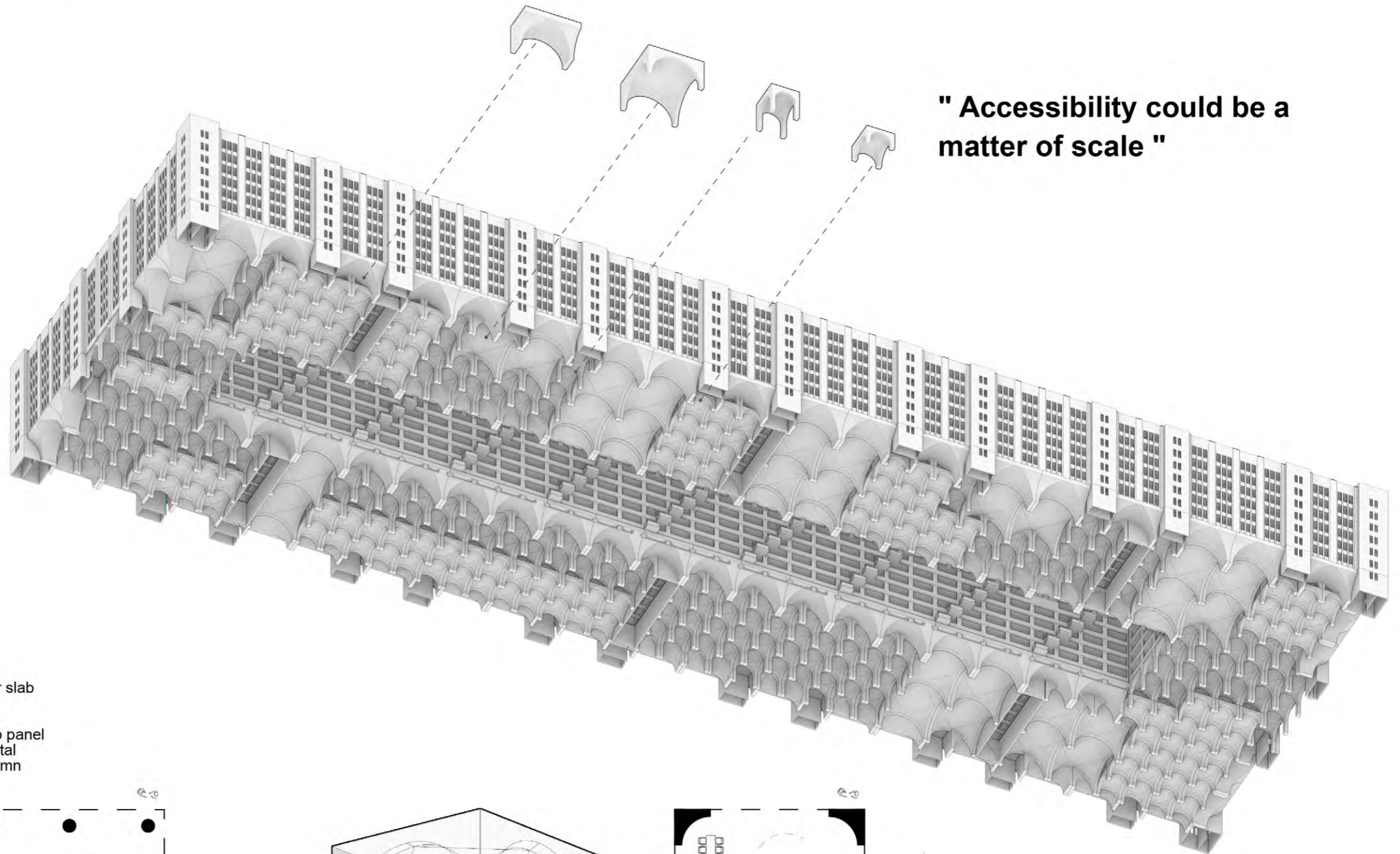


Brooklyn Army Terminal construction photo, New York, 1918

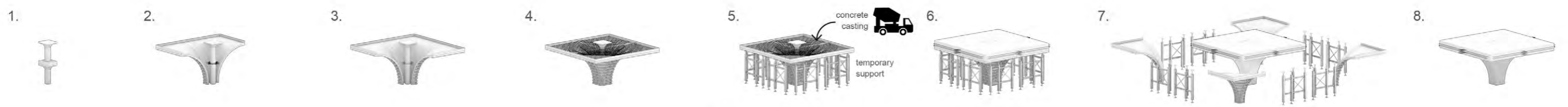
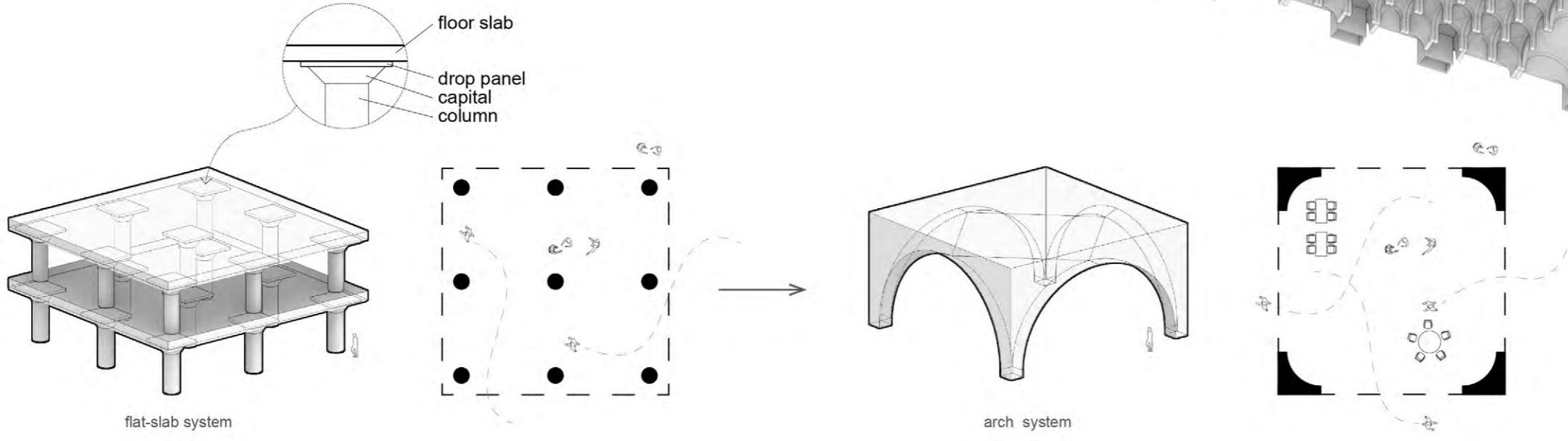


Based on the variety of programs, there are 4 different scales of arches replacing existing column in attempt to make ground floor more public and open.

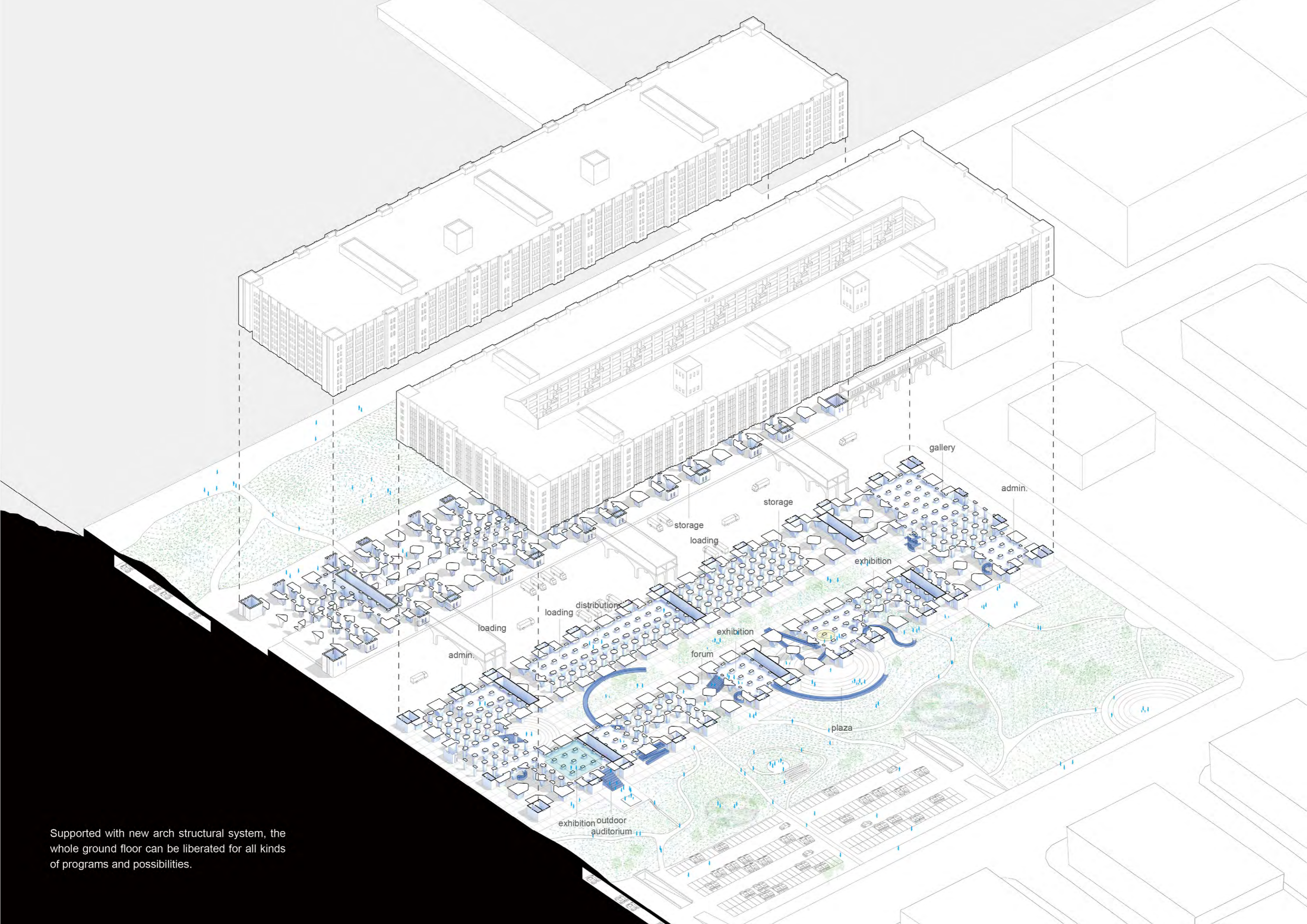
**" Visualize Accessibility "**



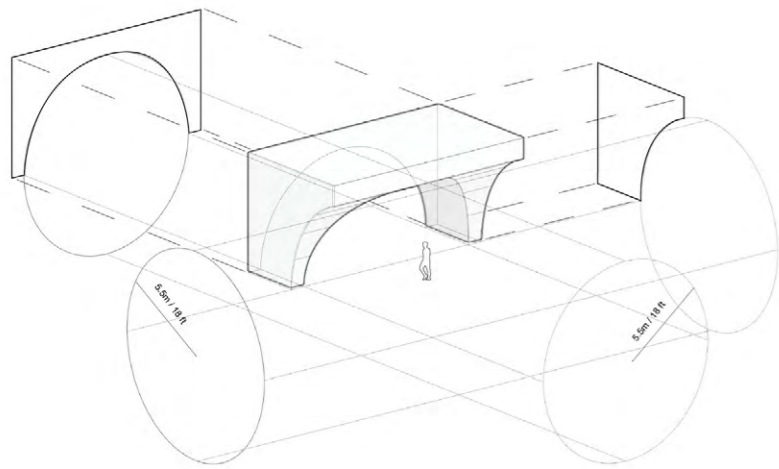
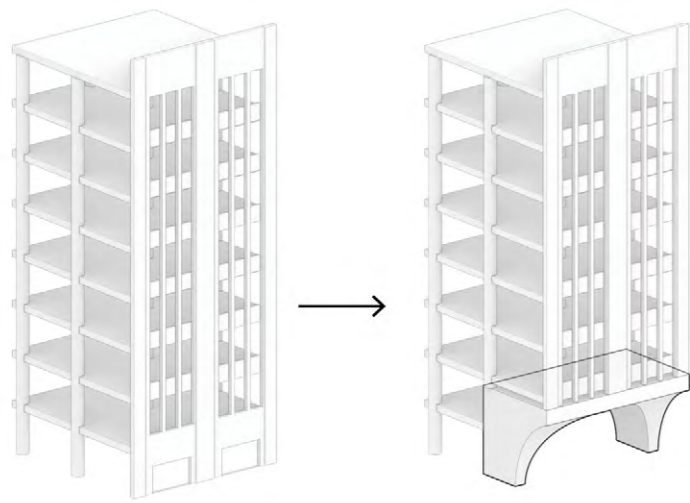
**" Accessibility could be a matter of scale "**



construction sequence of concrete arch



Supported with new arch structural system, the whole ground floor can be liberated for all kinds of programs and possibilities.



view between outdoor and semi-indoor space

By introducing new arch structure, the boundary between indoor and outdoor gradually evaporates. Natural landscape or artificial pavement easily cross through the disappearing periphery of this historical building. This upgrade of building open itself, welcoming all visitors and tourists to access.





Original ground floor  
vs  
New ground floor

All different scales of arches with wider spans or higher ceiling drastically improve the experience of space and “transparency” of the two buildings. Ground floor can completely open to the general public. Visitors are able to see what’s happening under the monolithic historical infrastructure, which also naturally generate a more welcoming gesture.

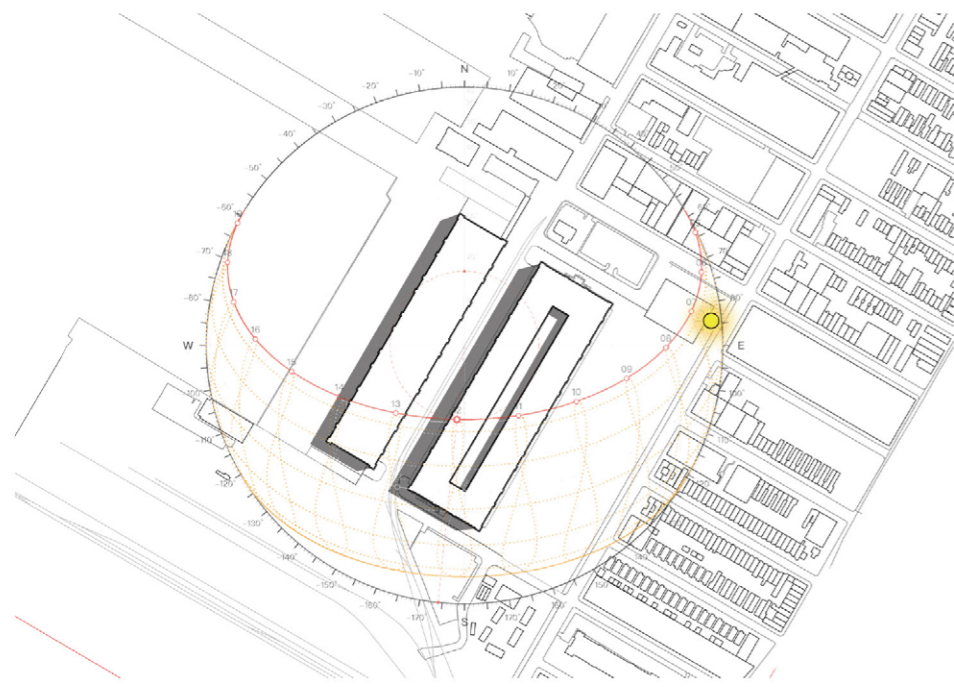


- top double-high exhibition hall & 2F balcony
- left open space for local market
- below open space for temporary performing space

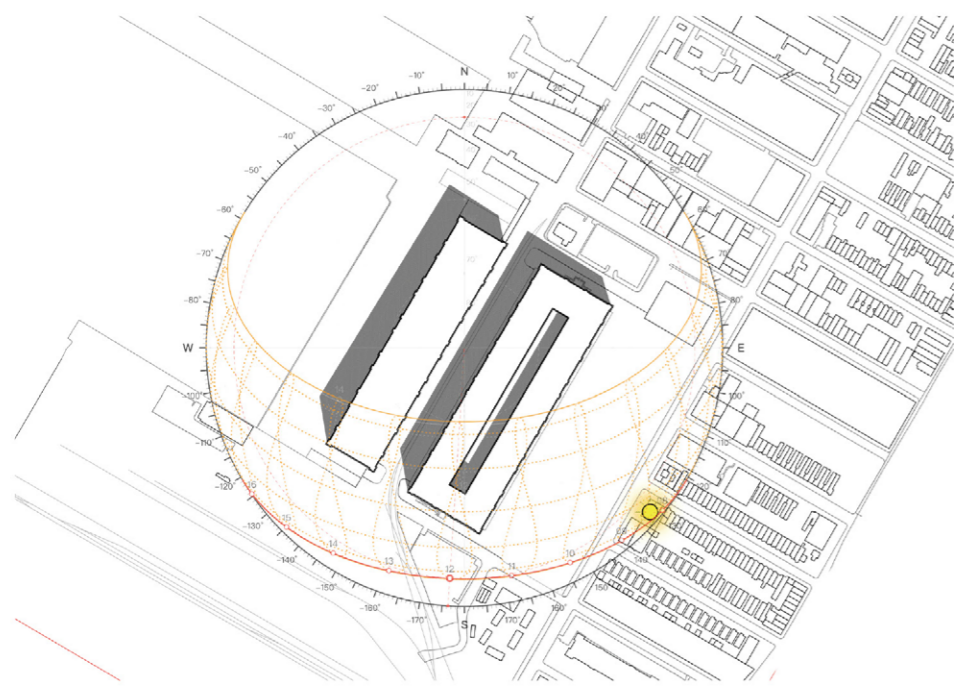
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sun path in summer

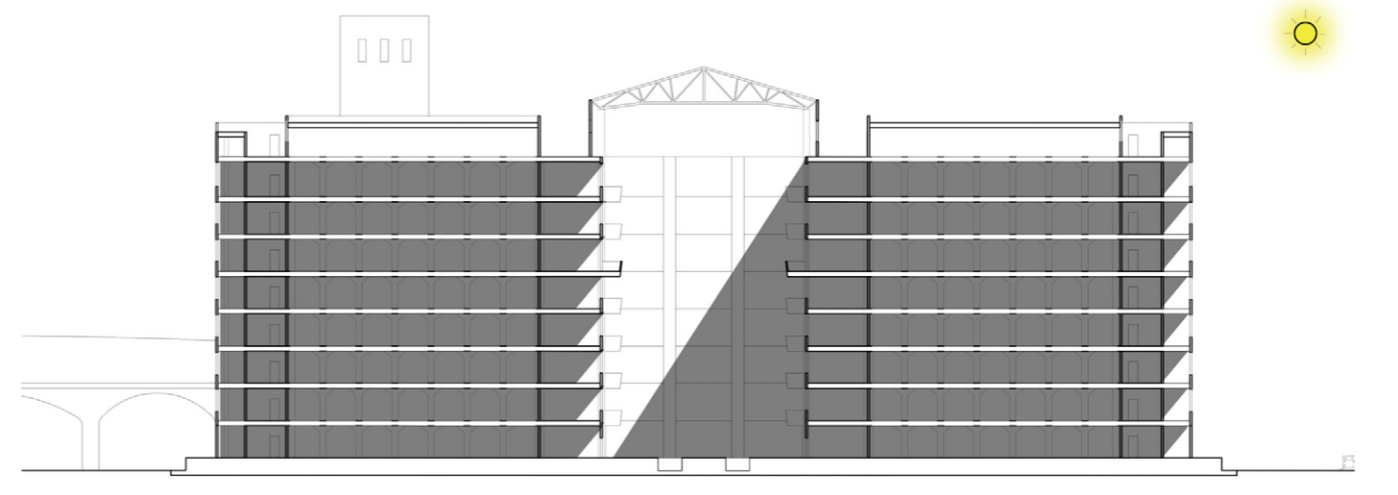
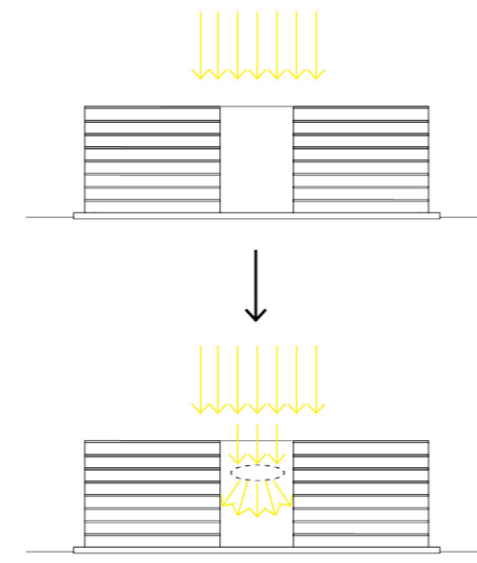
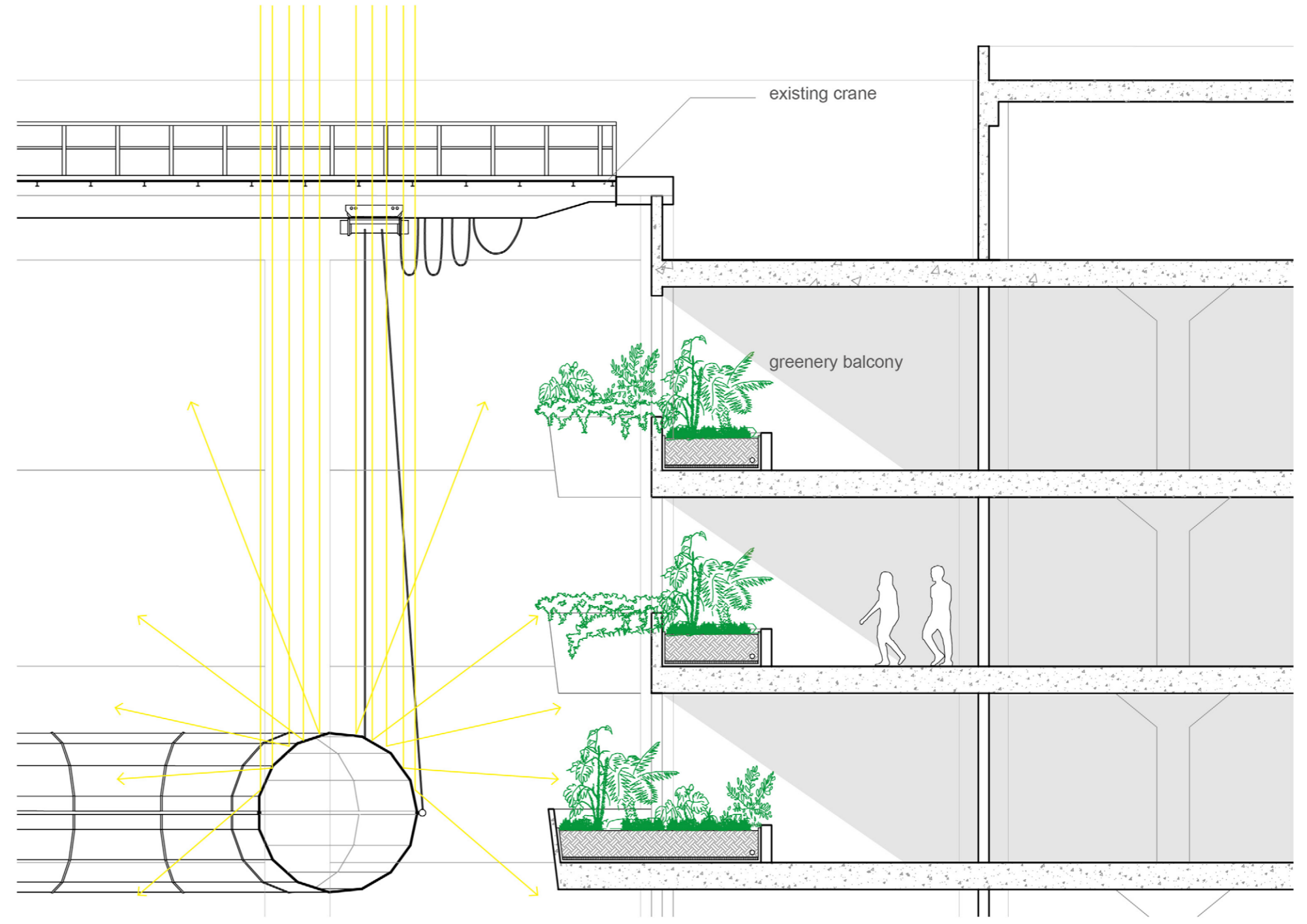


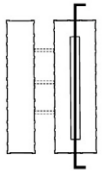
sun path in winter

New York  
 Latitude :40° 43' 50.1960" N  
 Longitude : 73° 56' 6.8712" W

New York city situates at the middle latitude of northern hemisphere, which means it's difficult for sun light to reach the bottom of atrium in building B. The atrium is always in shadow without sufficient coverage of sunlight.

By reusing the existing crane, reflectors with particular geometric shape are able to effectively re-distribute the sun light to not only various levels but also bottom of building B.

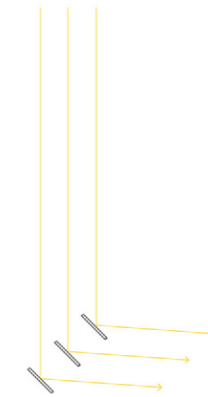
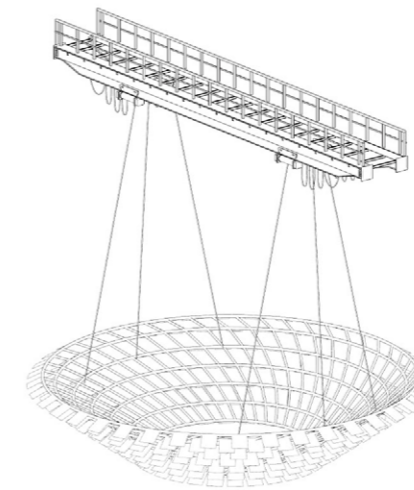
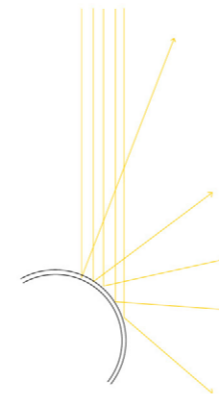
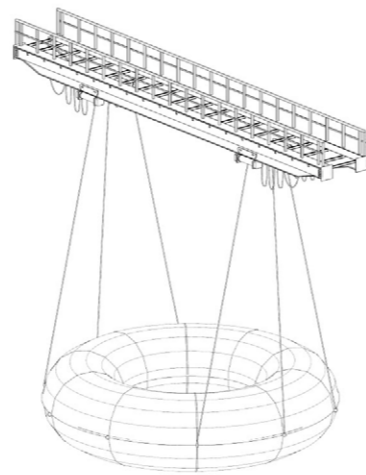
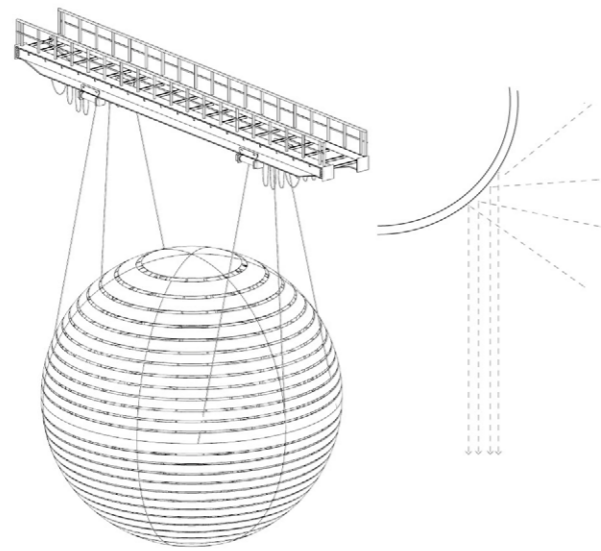
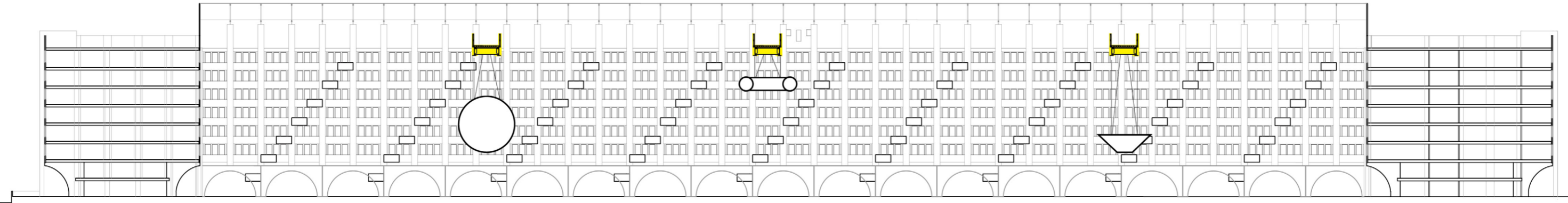




reflector 1

reflector 2

reflector 3



These 3 reflectors have their own characteristics and reflection design, hanged by the cranes which can move horizontally and vertically. With the help of reflectors, light condition of atrium can be greatly improved. The atrium can be brighter and full of greenery, welcoming all the public visitors.

Building B atrium - existing condition



Building B atrium - new ground floor + reflectors

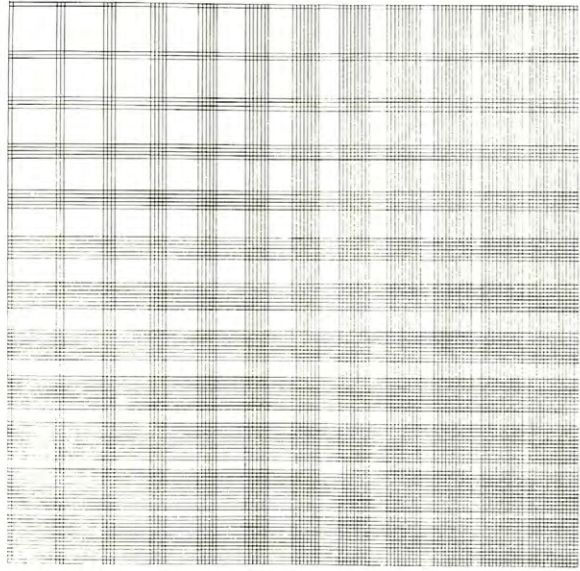


**Daniel A. Vos**  
**Fall**

**ADVANCED**  
**CURTAIN**  
**WALL**

**2021**

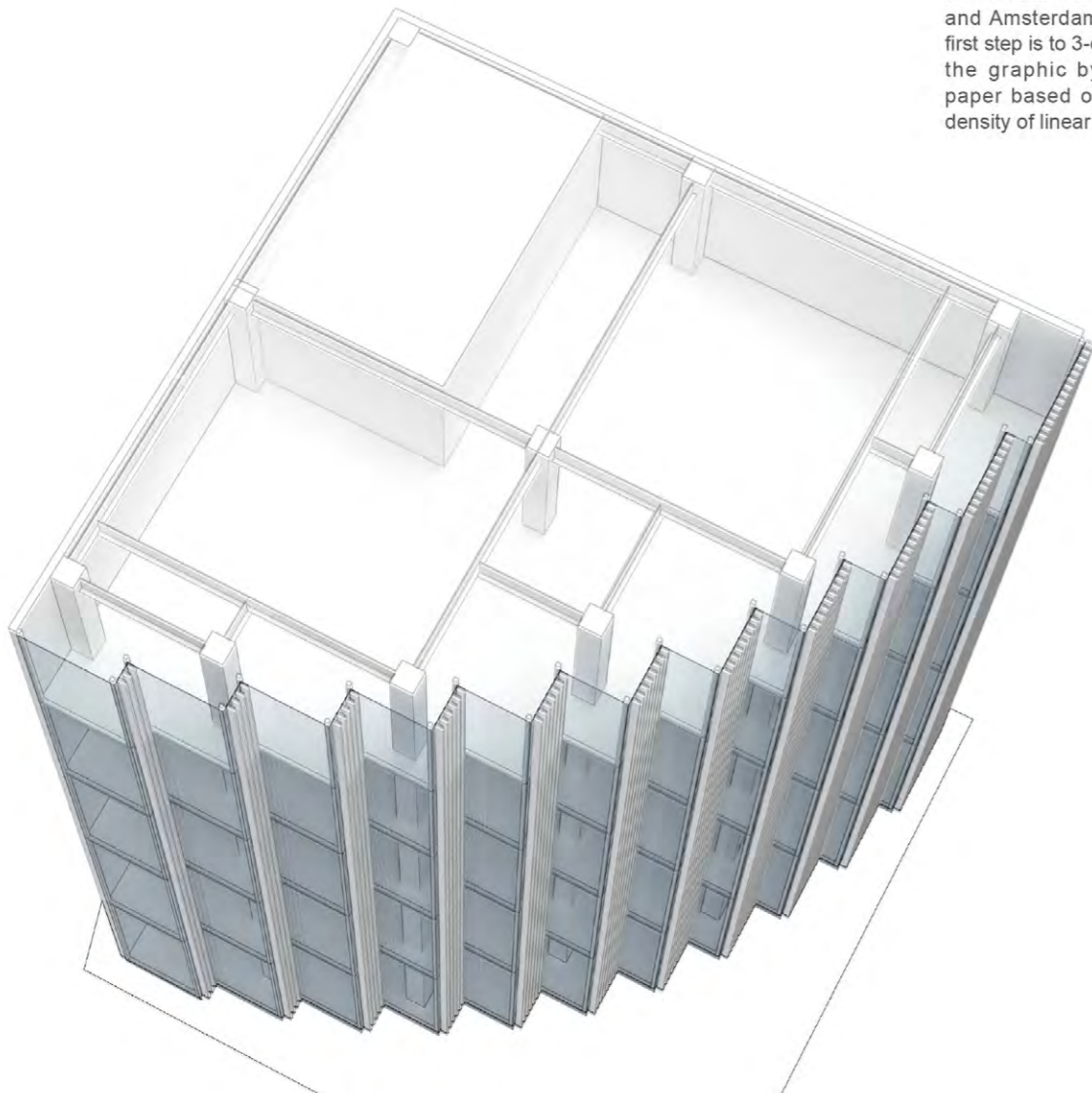
Inspired by Sol LeWitt's artwork, a progressive overlapping of lines, this graphic is 3-dimensionalized by folding the paper based on the various density of lines - horizontal line represent the decreasing height of each floor ; on the other hand, the vertical line refer to a different openness of facade, creating two unique faces of building.

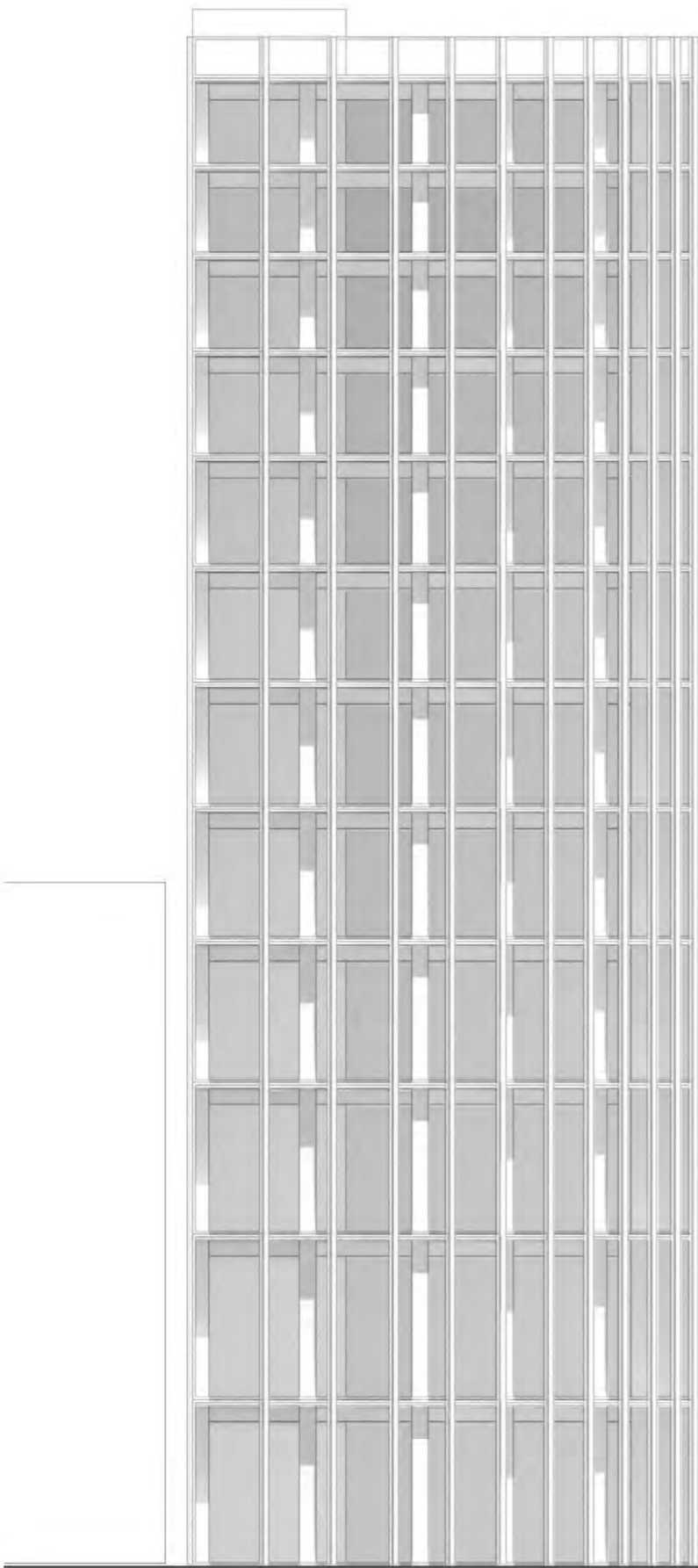


Sol LeWitt | August 10, 1972

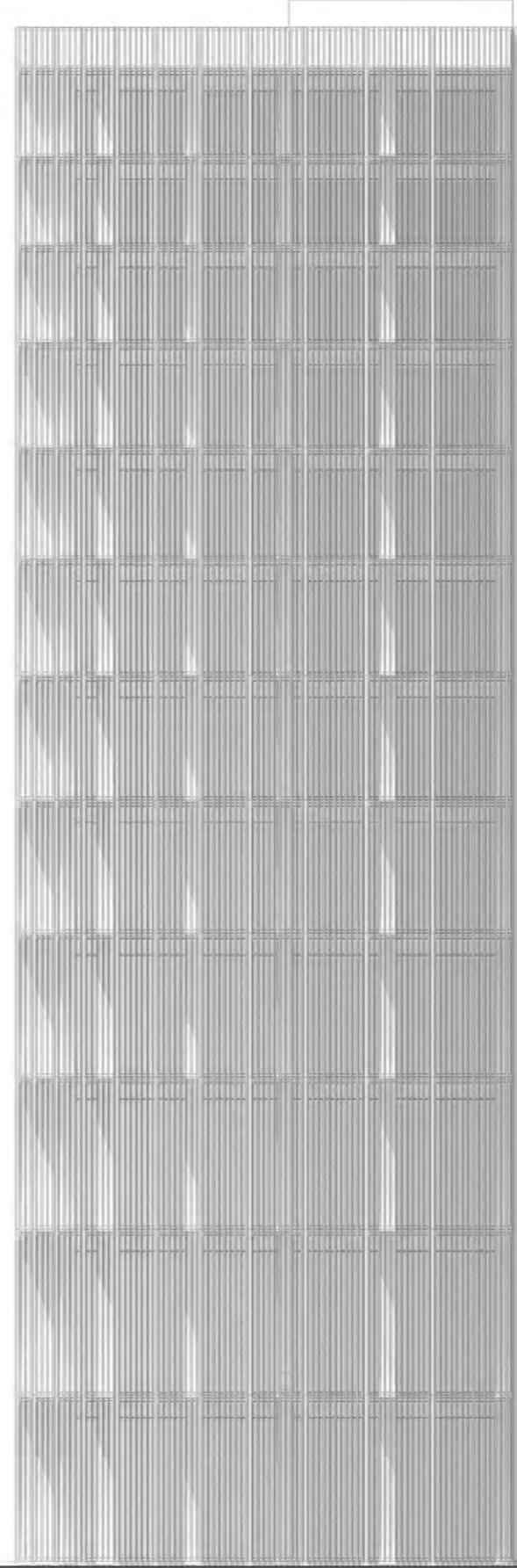


Due to the site toward street and Amsterdam avenue, the first step is to 3-dimensionalize the graphic by folding the paper based on the various density of linear lines.

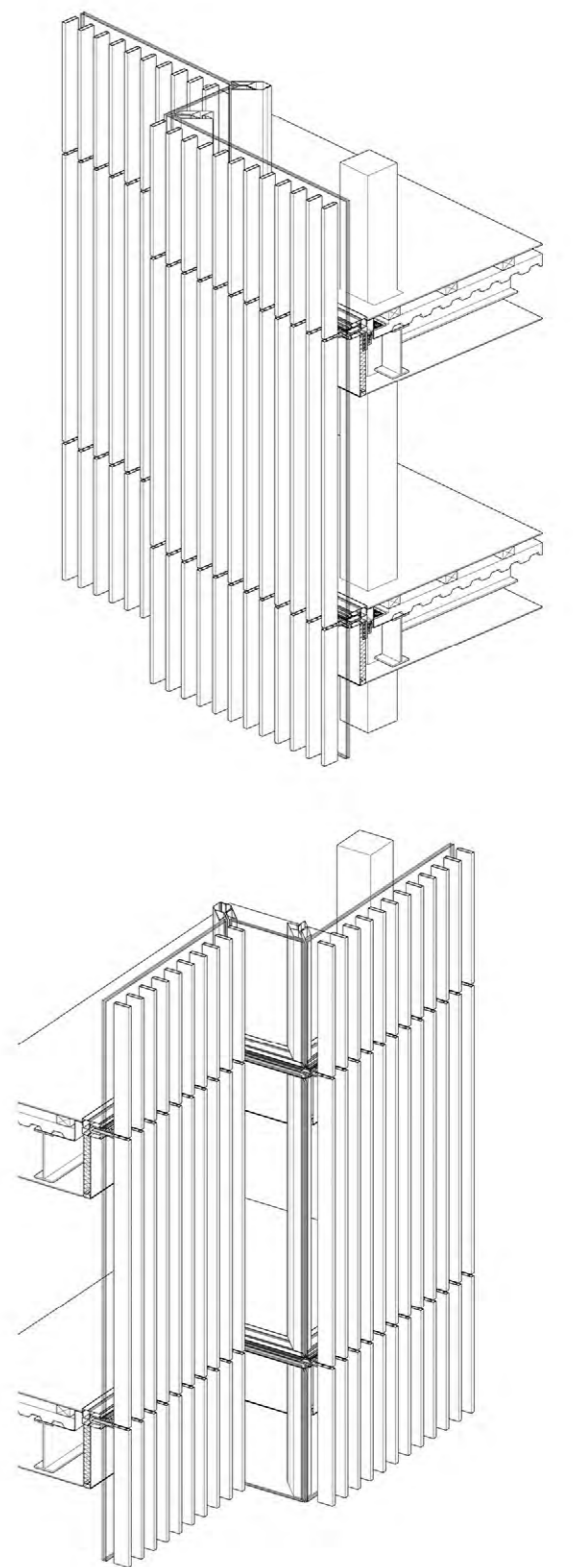
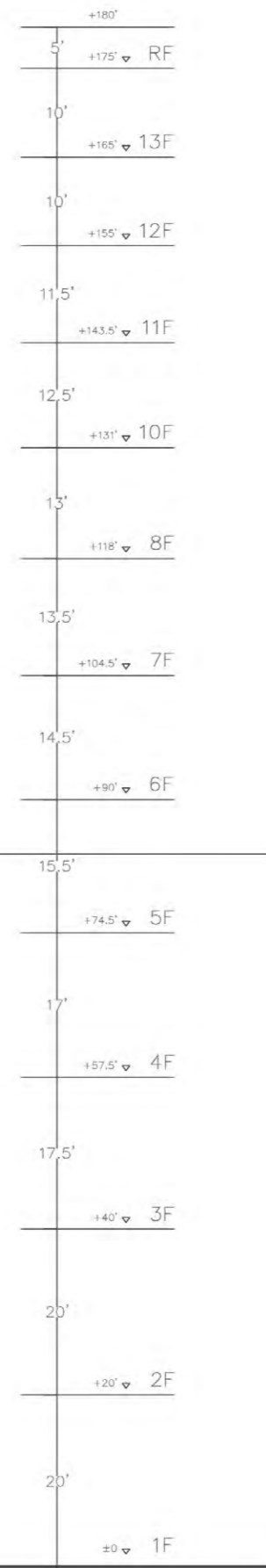




south elevation

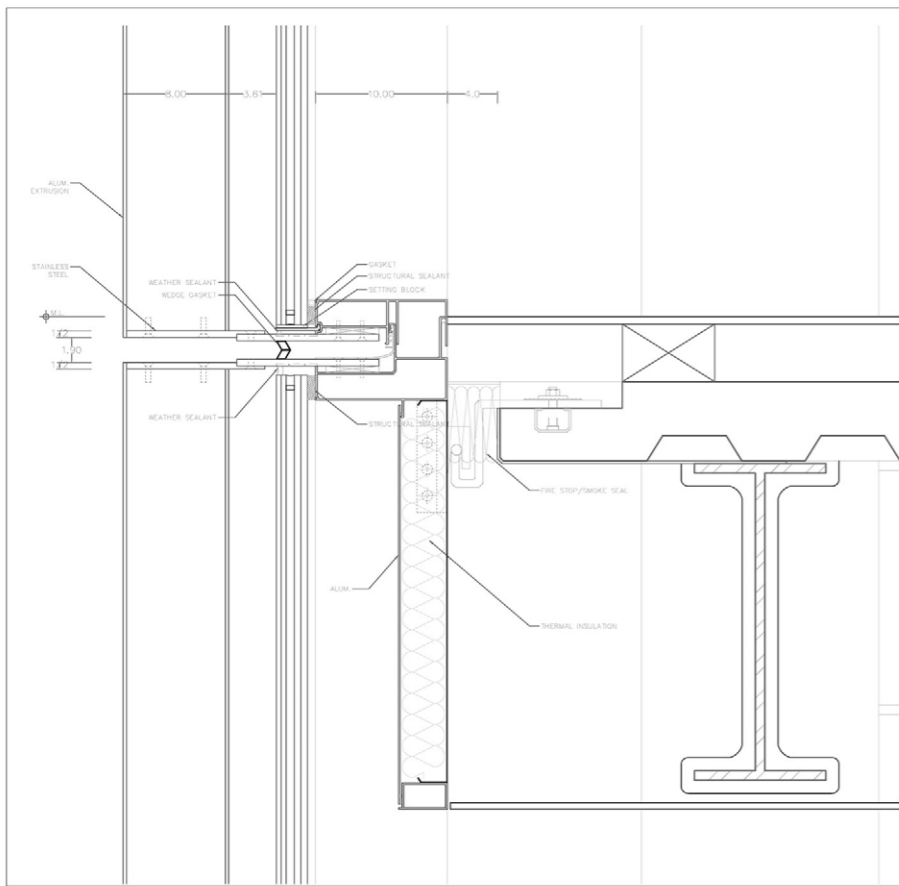


east elevation

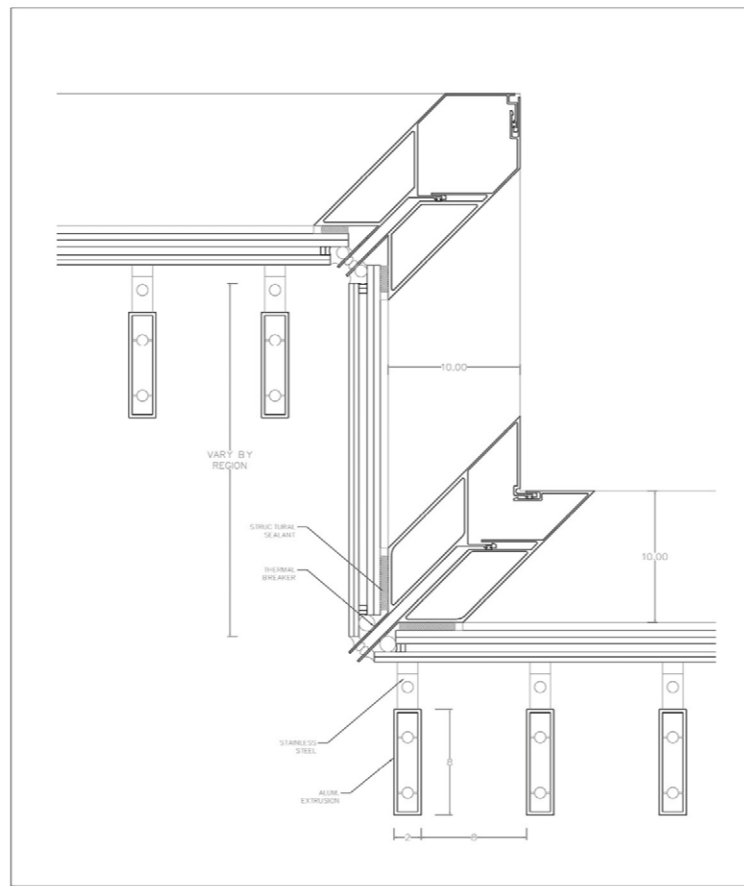


The horizontal line represent the decreasing height of each floor ; on the other hand, the vertical line refer to a different openness of facade.

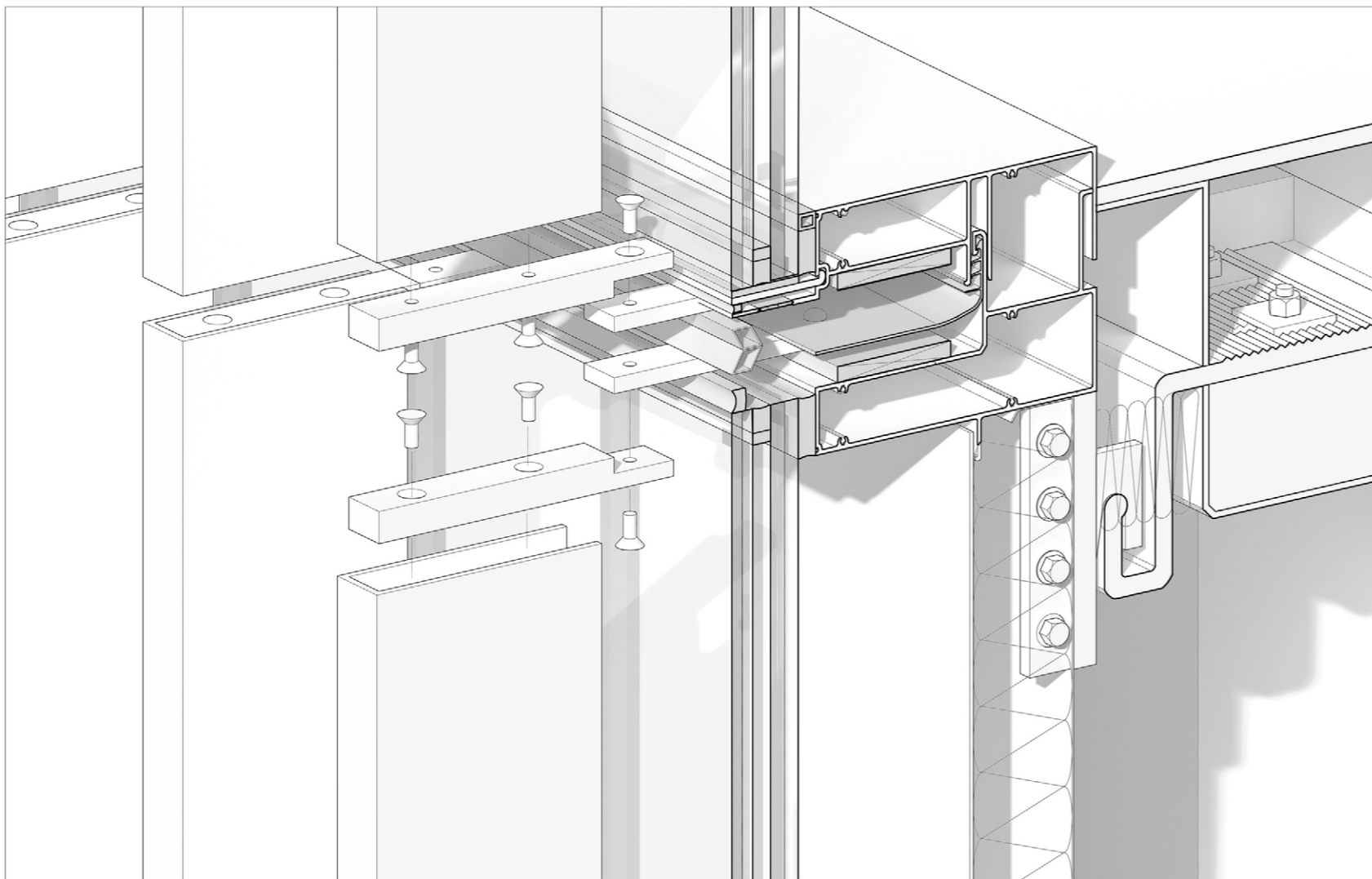
In this way, two faces of the building show totally different characteristics. Viewing from the south side, It will be completely transparent. but from the east side, it's another story that aluminum grating creates an intriguing shadow on the facade.



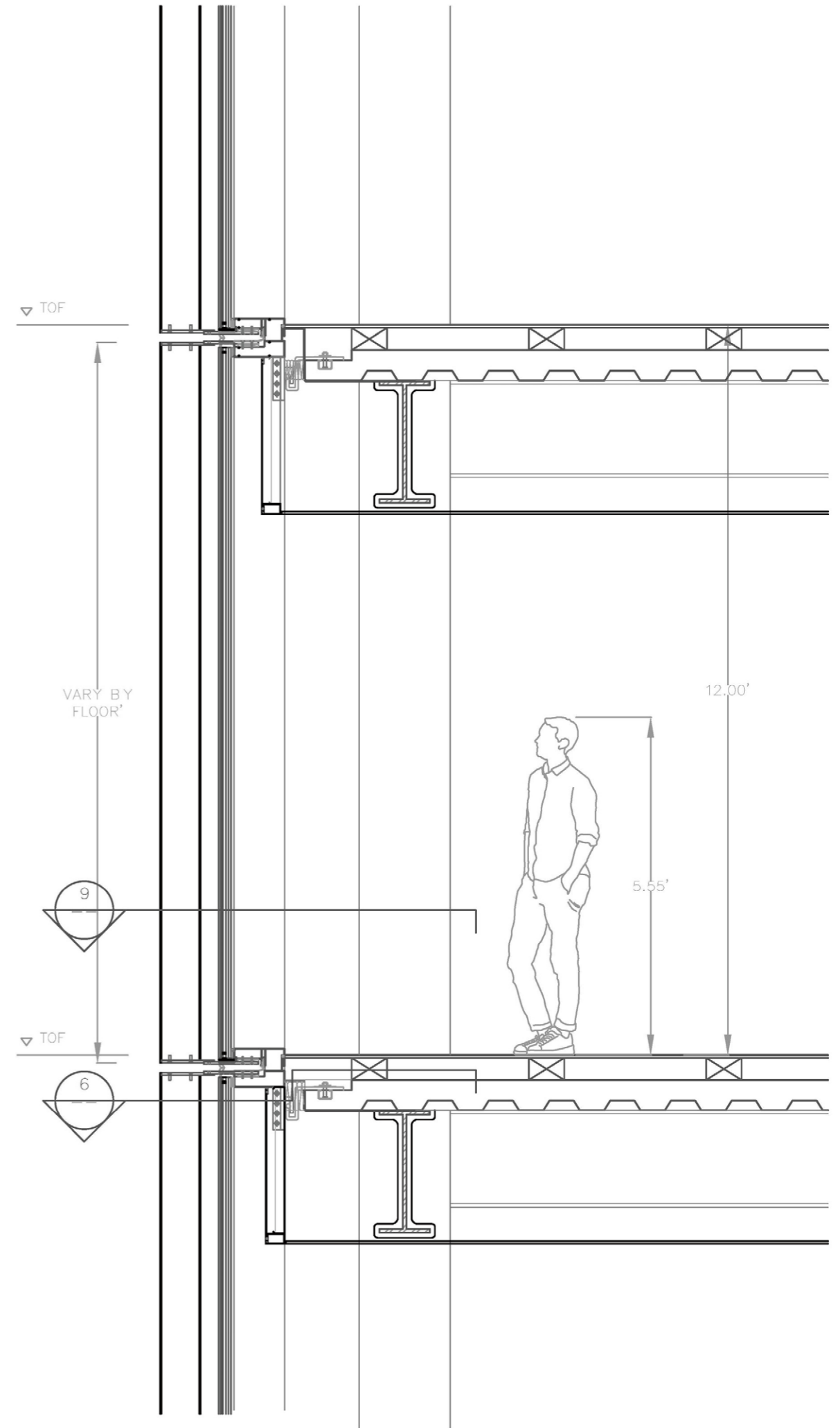
detail section



detail plan



curtain wall detail



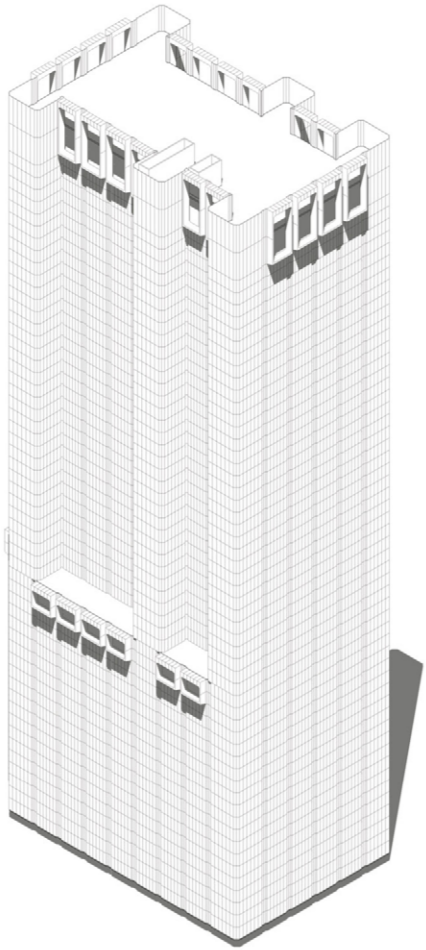


**Mark Green**  
**Fall**

Ata Gun Aksu  
Richard Sa  
Han Kuo

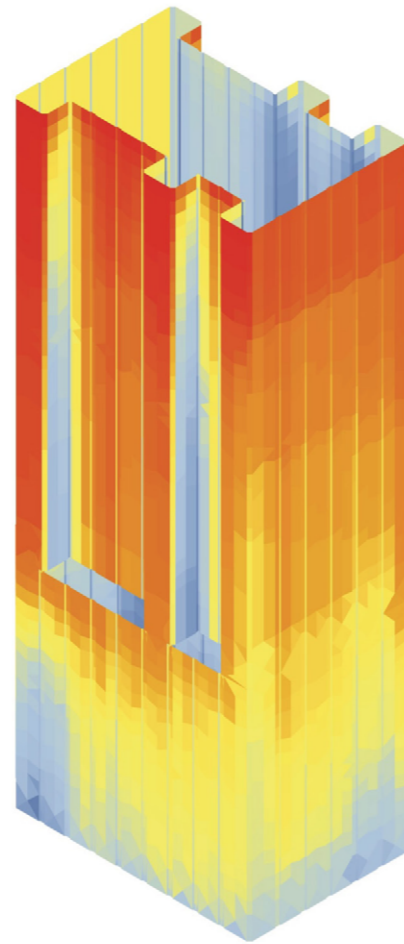
**RE-THINKING**  
**BIM** **2021**

## EXISTING



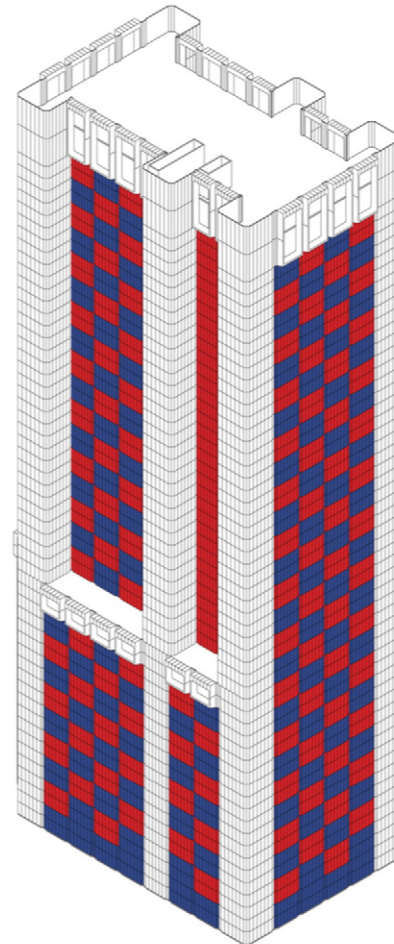
The façade at 33 Thomas Street, formerly known as the AT&T Long Lines Building, reflects the original use of the building. The windowless skyscraper was used for telephone exchange. The façade is made of precast concrete panels clad with granite.

## SOLAR ANALYSIS



The upper floors of the facade capture most of the sunlight. In this diagram, red represents the most time exposed to the sun. While blue represents the least amount of time exposed to sun.

## PATTERN



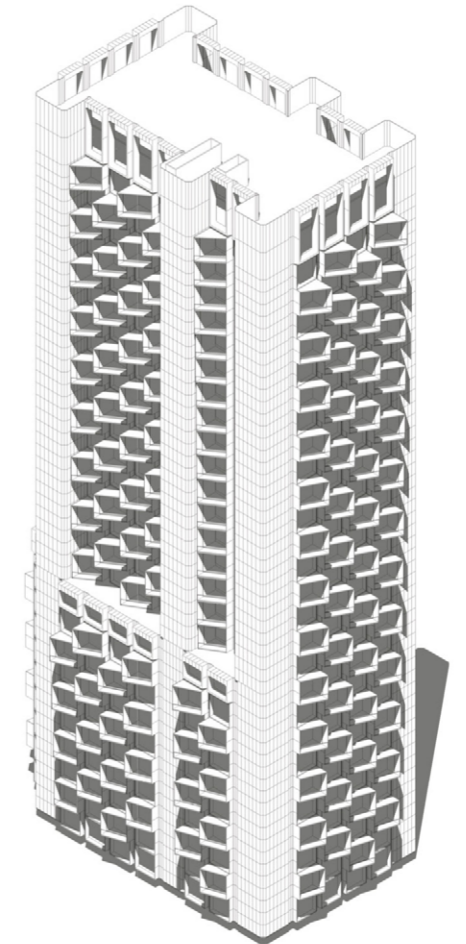
Our proposal is to convert 33 Thomas Street into a residential tower. The facade is divided into an alternating pattern to allow for flexibility in design for residential units. This alternating pattern always allows for a living room and bedroom to be next to one another.

## SOLAR ANALYSIS GRID



By extracting the living room modules we are able to see how much sunlight each living room captures during the day.

## RESIDENTIAL UNITS



The living rooms of each unit would include a balcony. This balcony is the changing parameter within our design process. The protrusion of the balcony is adjusted according to how much sunlight each space captures.

