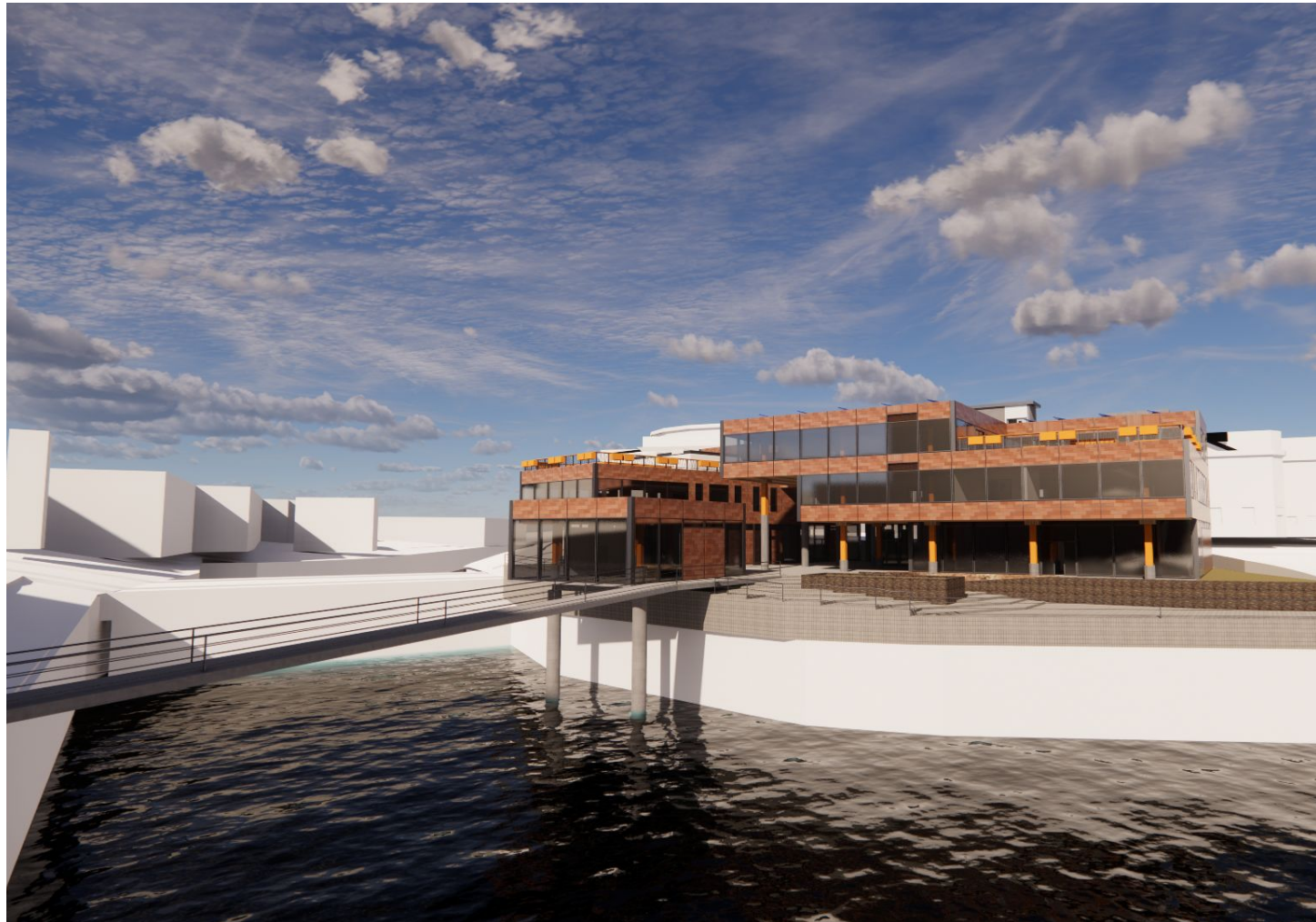

Lowell, MA: Maker-Space

The Divide

Studio 06, Summer 2022, *Project Portfolio* - Nathaniel Worthley, Team YM

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Renders by - Quang, N.

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Phase 1

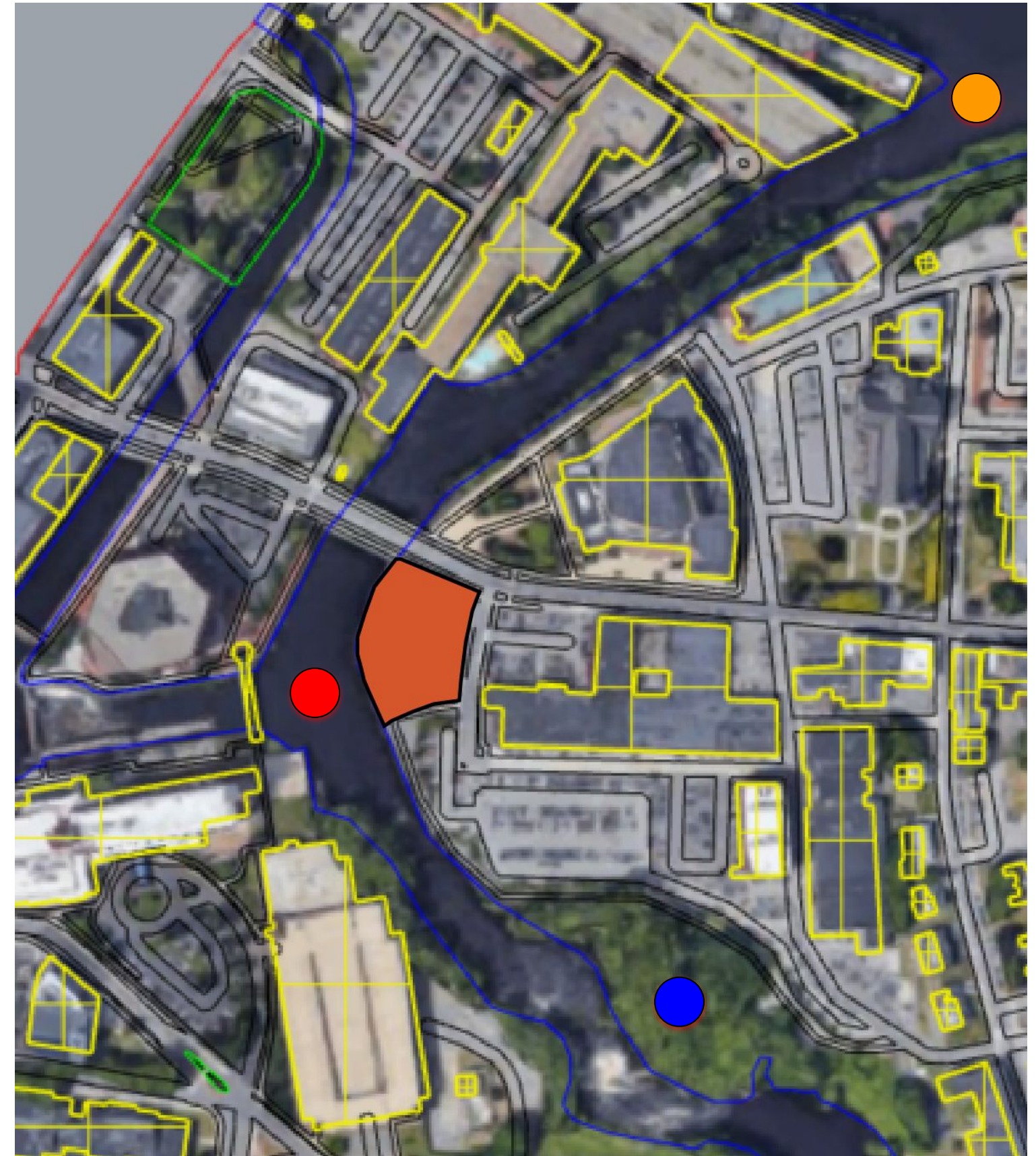
Site Context,
Documentation and
Analysis

The Site

Lowell, Ma located along the Merrimack river in North-Eastern Massachusetts was once a large Mill City. Many old Brick mills reside along the sides of the river and are being renovated into new spaces for different use.

Our Site is located at *1 E Merrimack St*, located along the Concord River which feeds directly into the **Merrimack**.

The now empty lot where our new building will reside is adjoined by two roads, southern access to the **Eastern Canal Park**, and the **Concord river** itself.



The Site Visit

While visiting the site a few things became very clear to us, and helped influence how we wanted to design our building.

1. Create a structure that can serve as a reason to want to cross the river and draw people in from the street.



2. Utilize the waterfront to our advantage.



The Site Visit

During the site visit it began to rain and pour and the lack of circulation between the two sides of the rivers became very clear.

3. Connect both sides of the river and create a safer more enjoyable option for pedestrians to cross from one side to the other. This will bring people directly into our Site.

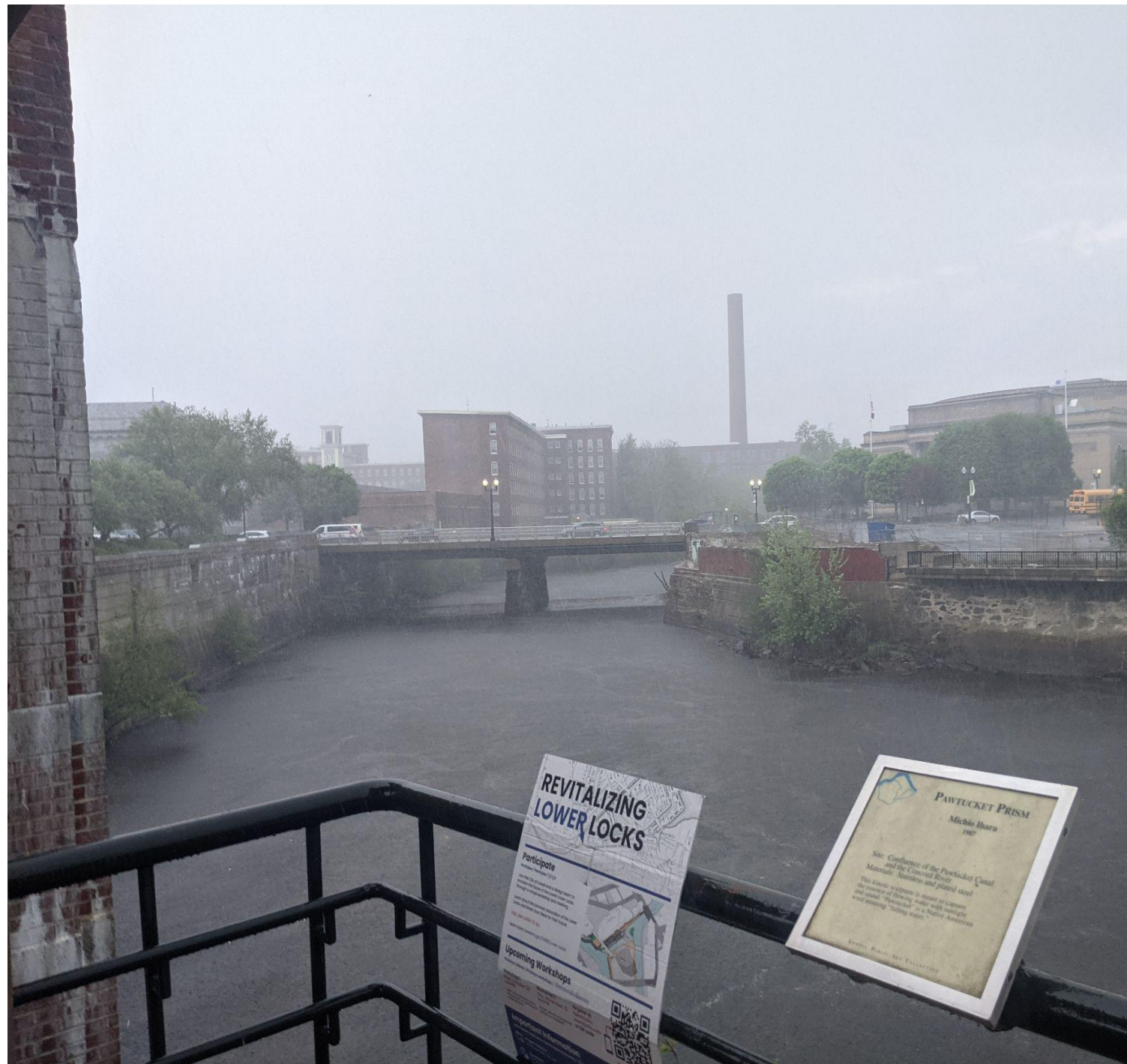


4. Level the site and make it safe, easy and inviting to move through.



Additional Photos

Rainstorm and Revitalizing the Lower Locks



Phase 2

Precedent Analysis
and Initial Concepts

Site Museum of Paracas Culture

Location: Paracas, Peru

Architects: Barclay & Crousse: BARCLAY & CROUSSE Architecture

Contractor : Consorcio Paracas

Area: 1170 m² (12593 ft²)

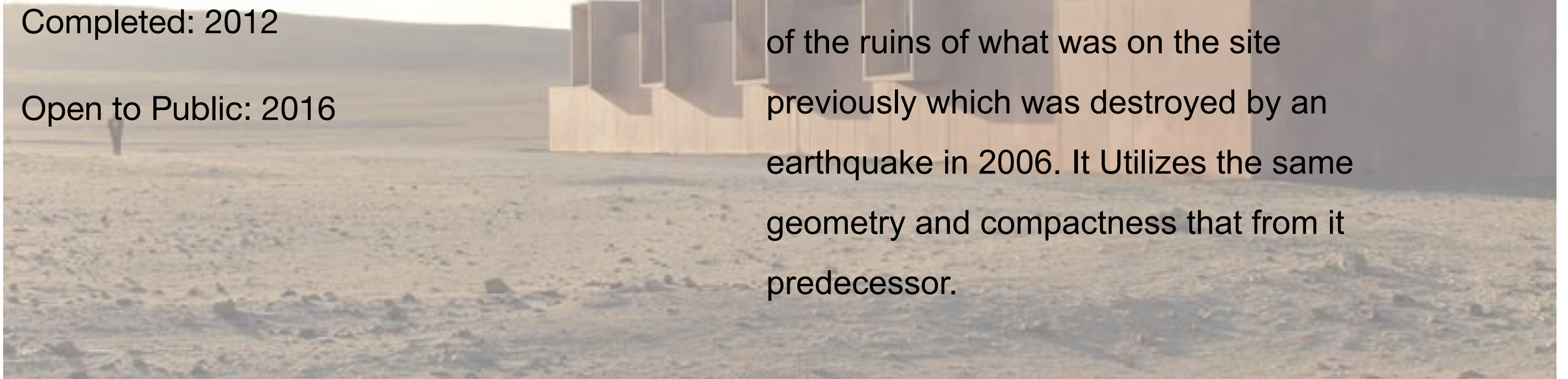
Completed: 2012

Open to Public: 2016

Situated in the Peruvian Coastal

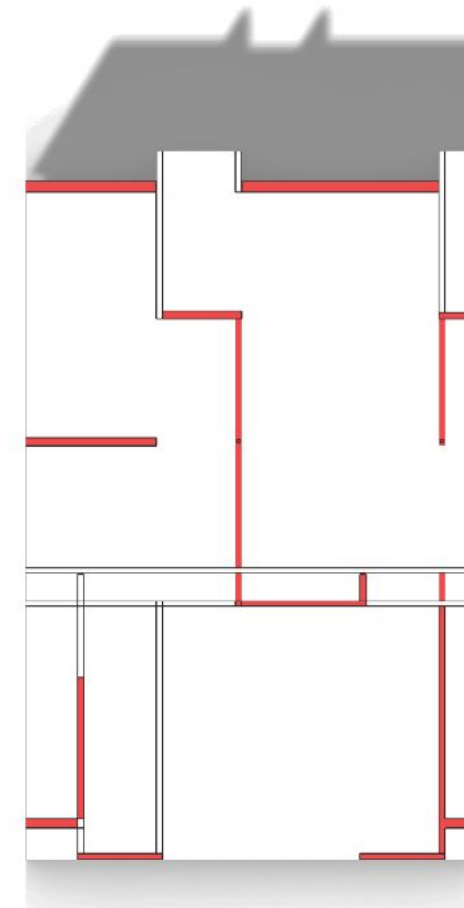
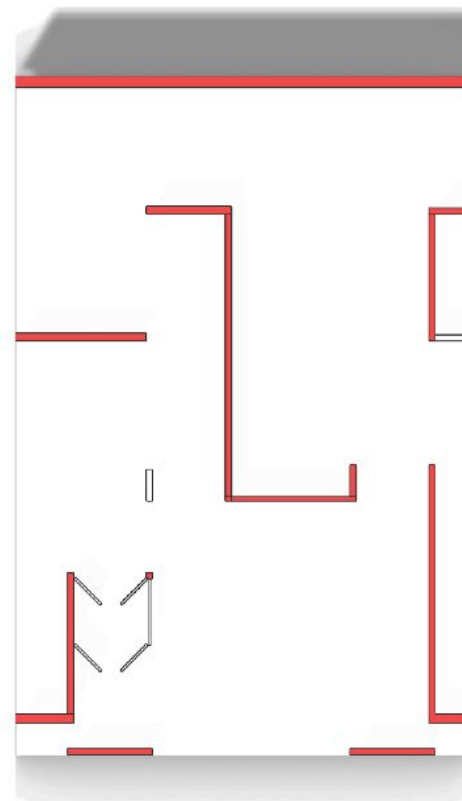
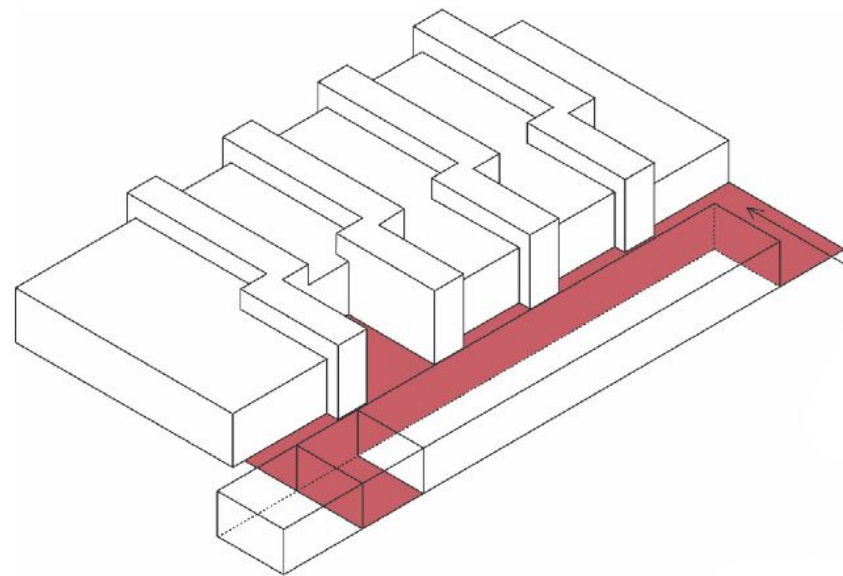
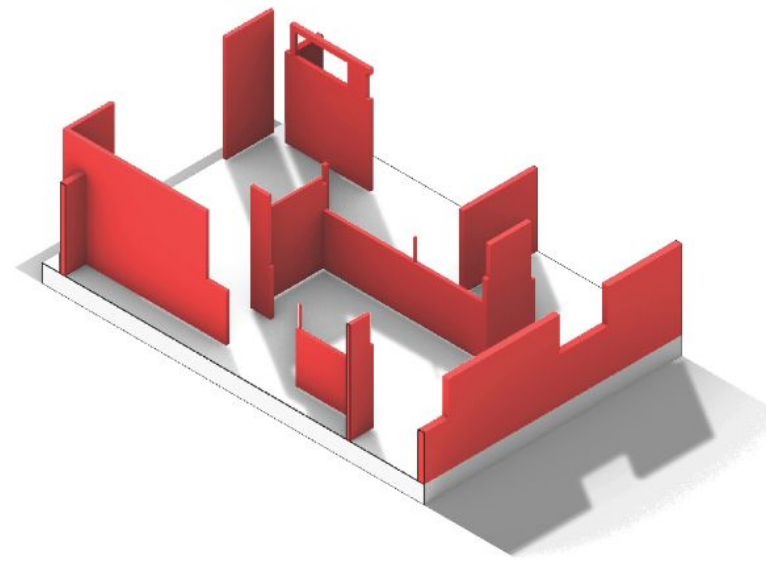
Desert the Paracas Museum is located in a biological and landscape reserve. Cradled in the landscape that is tremendously important to the Heritage of the area.

The project utilized the practicality of the ruins of what was on the site previously which was destroyed by an earthquake in 2006. It Utilizes the same geometry and compactness that from it predecessor.



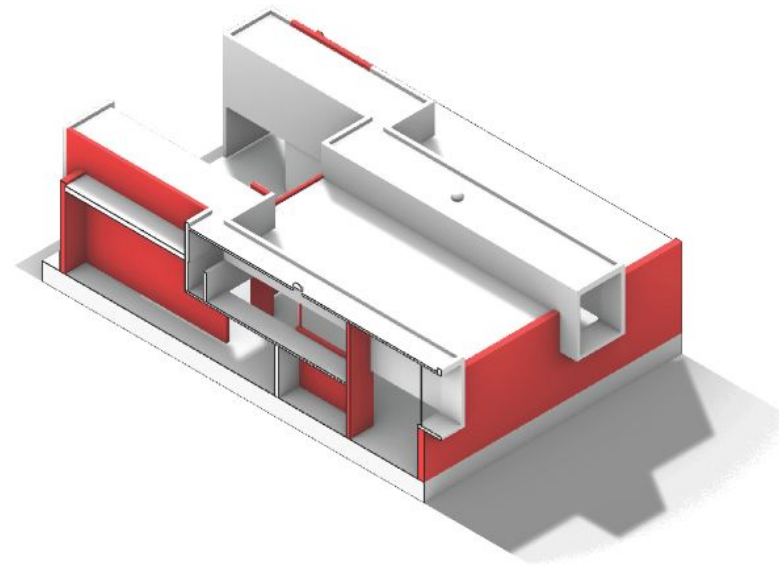
Precedent - Structure

Constructed entirely using salt-resistant reddish pozzolan cement. The exposed concrete and polished cement blend in with environment surrounding the museum. The colorization and choice of material along with the polished finish of the concrete material resembles the Pre - Columbian ceramics that are kept inside the museum. This creates a seamless connection between the environment, the building, and the art within.

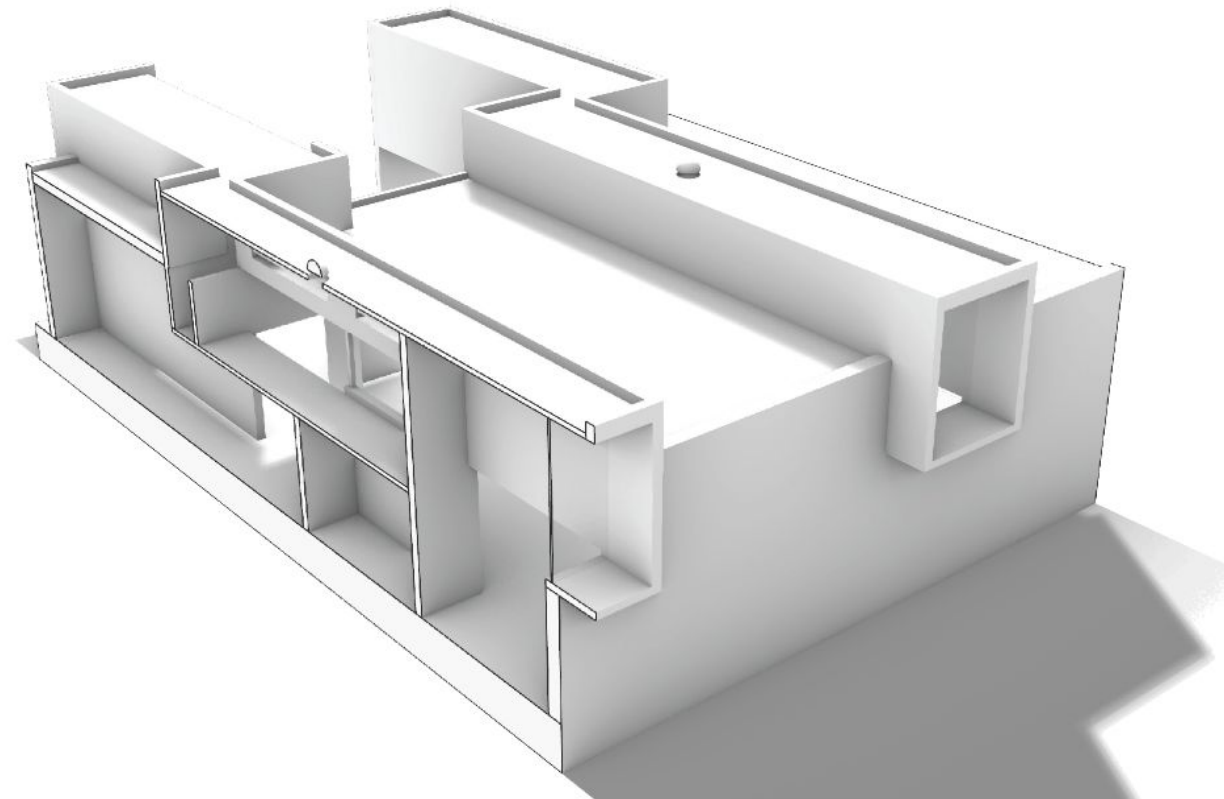


Precedent - Enclosure

The building as stated in the Structure section is constructed entirely from cement. The exterior is very smooth so little to no exterior is cladded or has any additional materials attached to it. The upper areas of the four sections do have fins attached for air flow and shades for allowing light to enter into the voids in the sectional area.

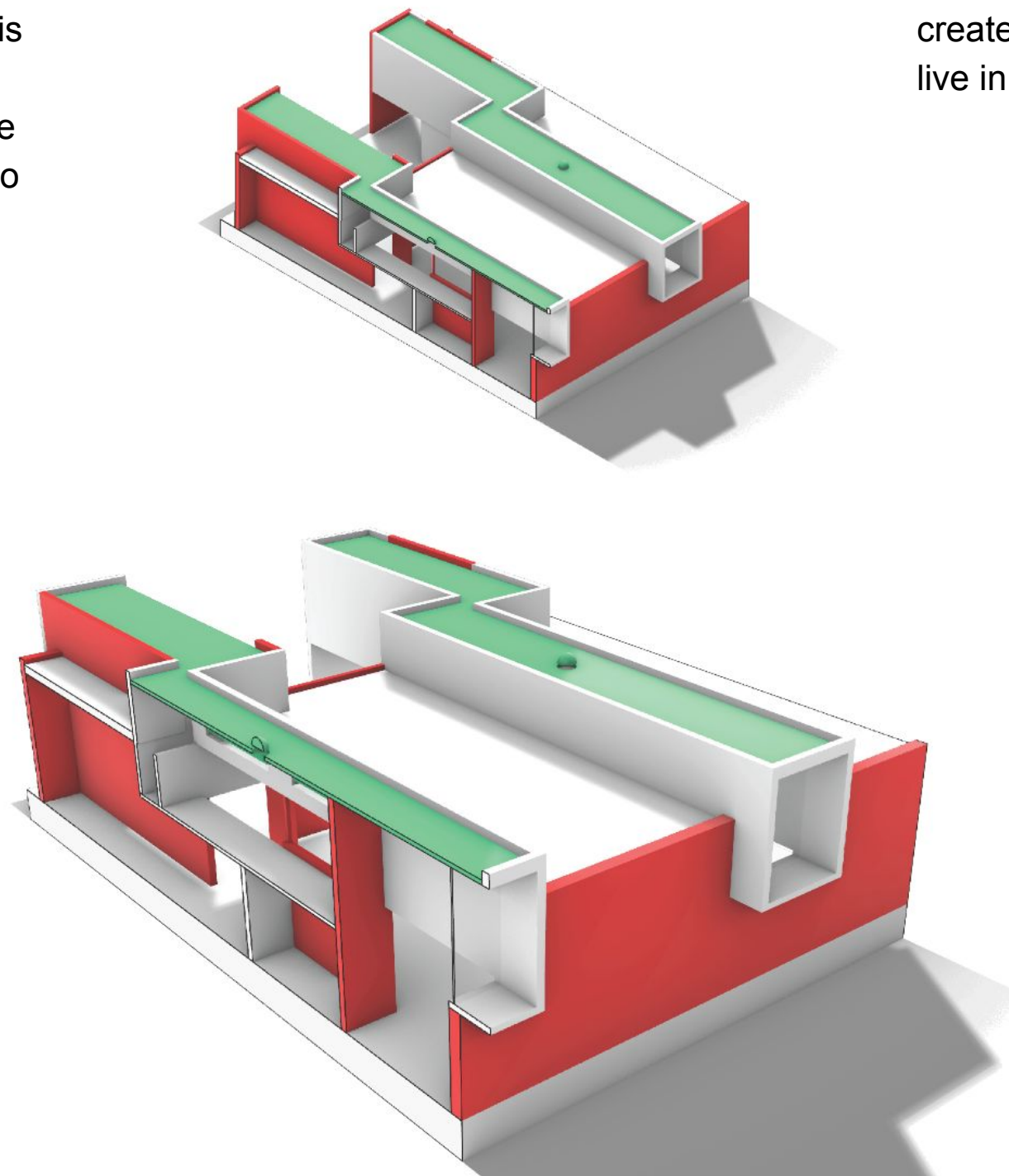
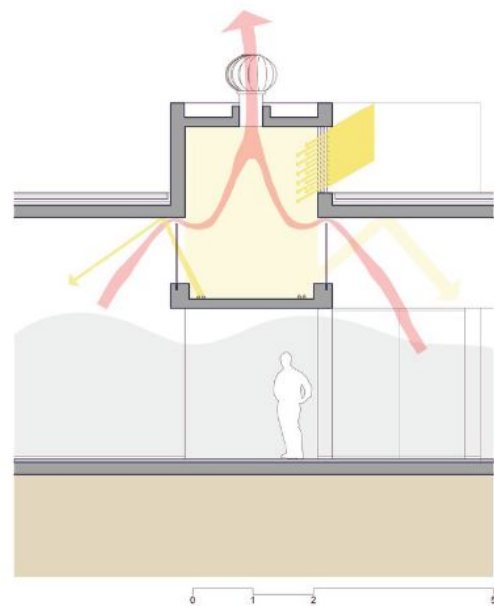


The concrete structure as well is laid out in such a way that the cement walls do create some enclosure areas that have glass installed to allow additional light to enter the building. The concrete walls extend beyond the windows to create shading and prevent most direct sunlight to enter the glass while still allowing the occupants to view the exterior landscape.



Precedent - Environmental Controls

The museum has four insert sections of the structure that provide a drop ceiling that creates a void section that is both to pull hot air from the inside of the structure up through the vents in the roof. This void is also used to take natural sunlight into the structure, it then bounces around inside the void and creates a hued light that emits into the structure.

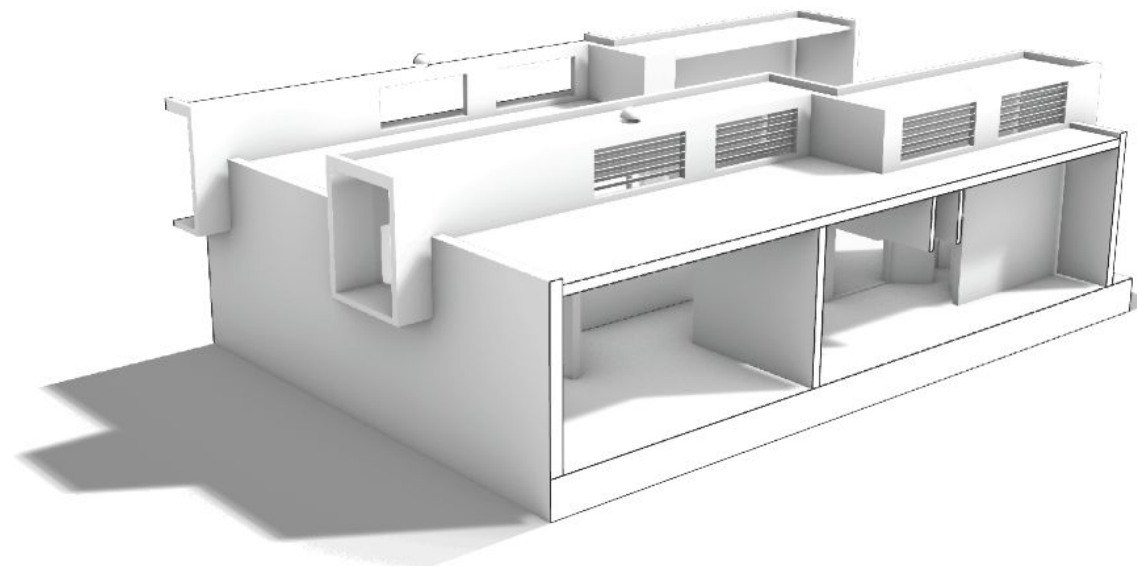
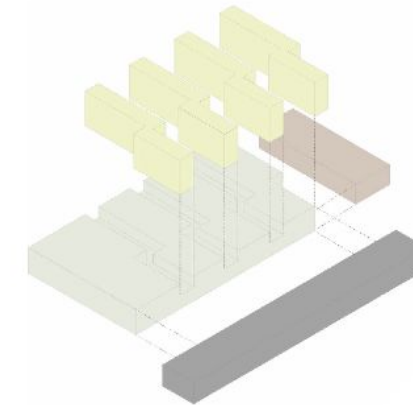
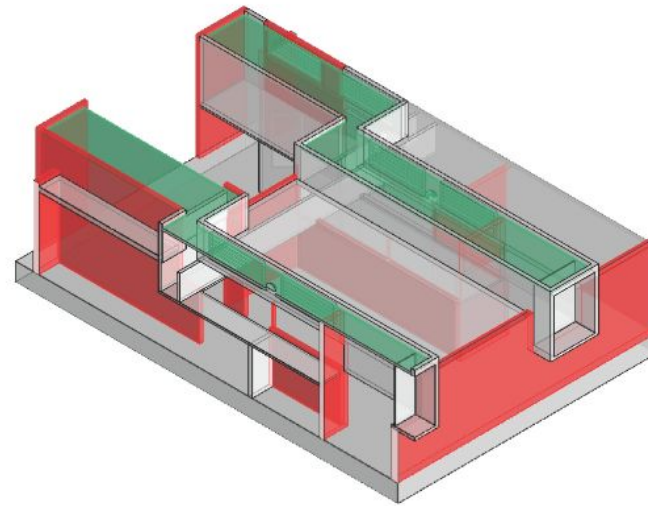


The access to the different spaces of the museum is done by this slice through the structure and creates an open space that frame portions of the landscape and helps create the necessary privacy and shelter to live in the vast desert.



Precedent - Composite Model

For our composite model we chose to recreate a section of the building that would best show its structure and its environmental controls. The enclosure for our precedent is very simple as the building is made of a single material. Focusing our model on how the structure is supported along with how the four different insert sections of the building allow for climate control was evident to us as the most important part of the building.



Phase 3

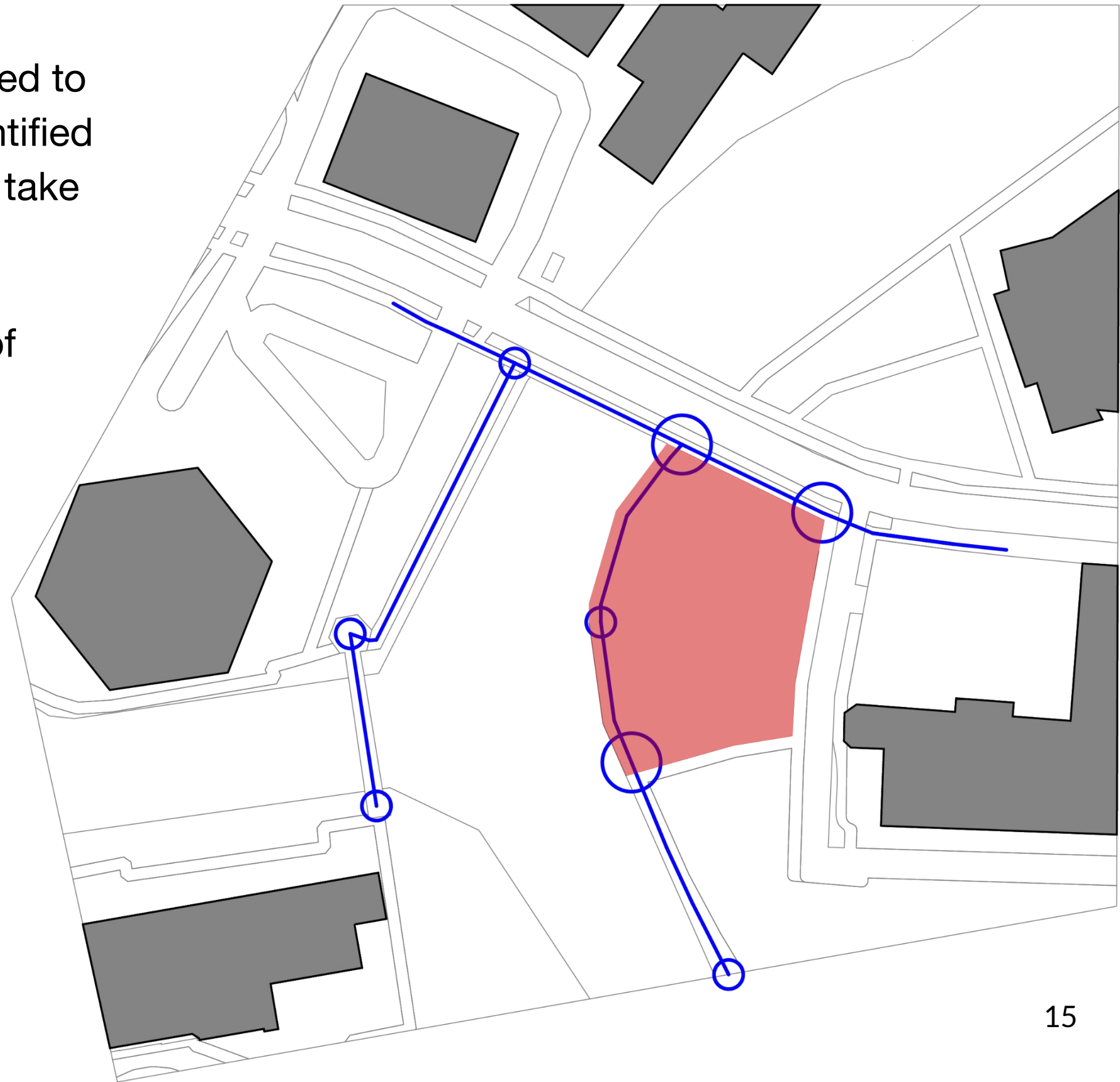
Prototype Design

Site Circulation

After Identifying the objectives we wanted to reach for the site with our Building, we identified the Points of Circulation that we wanted to take advantage of with our Design.

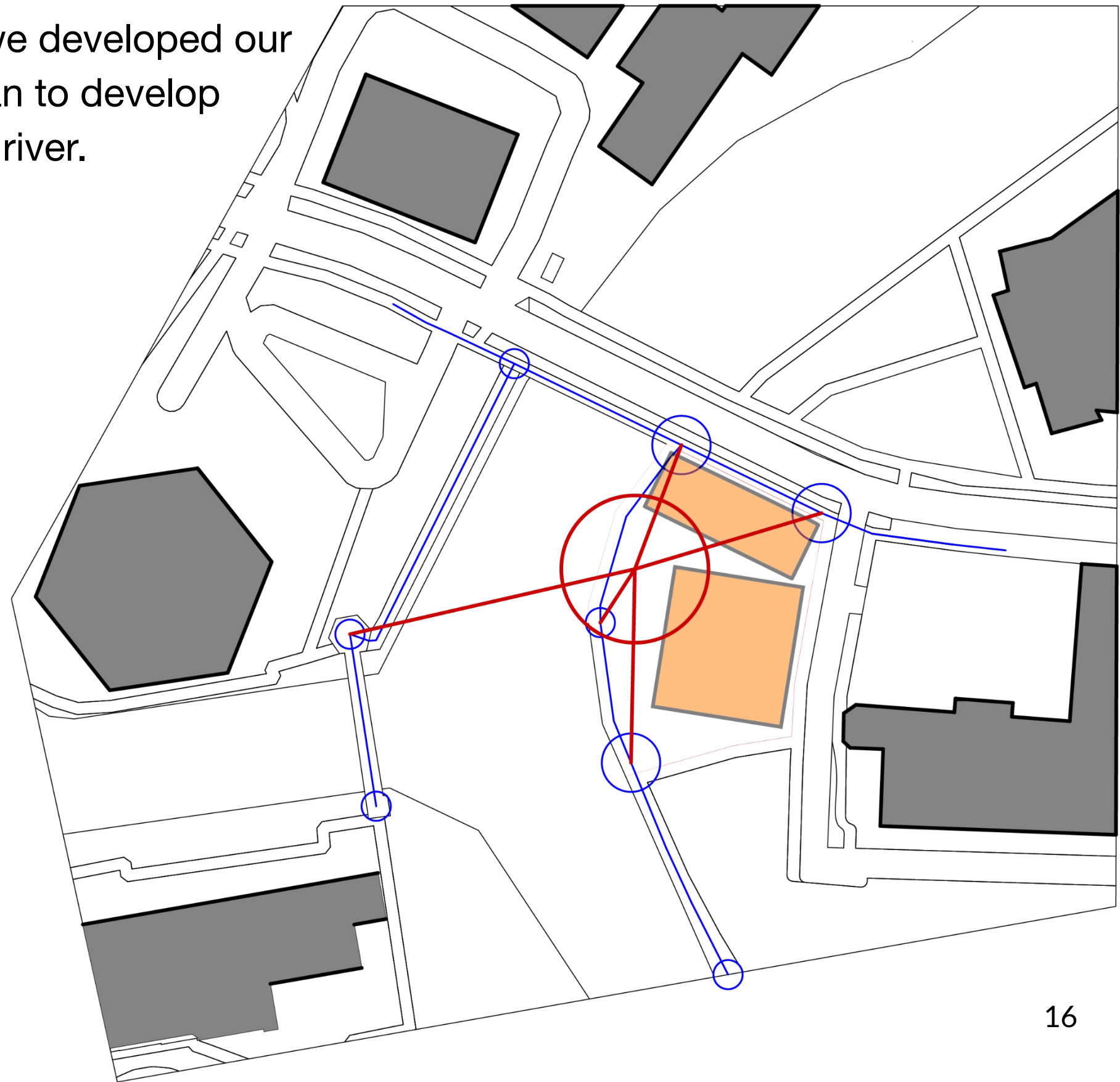
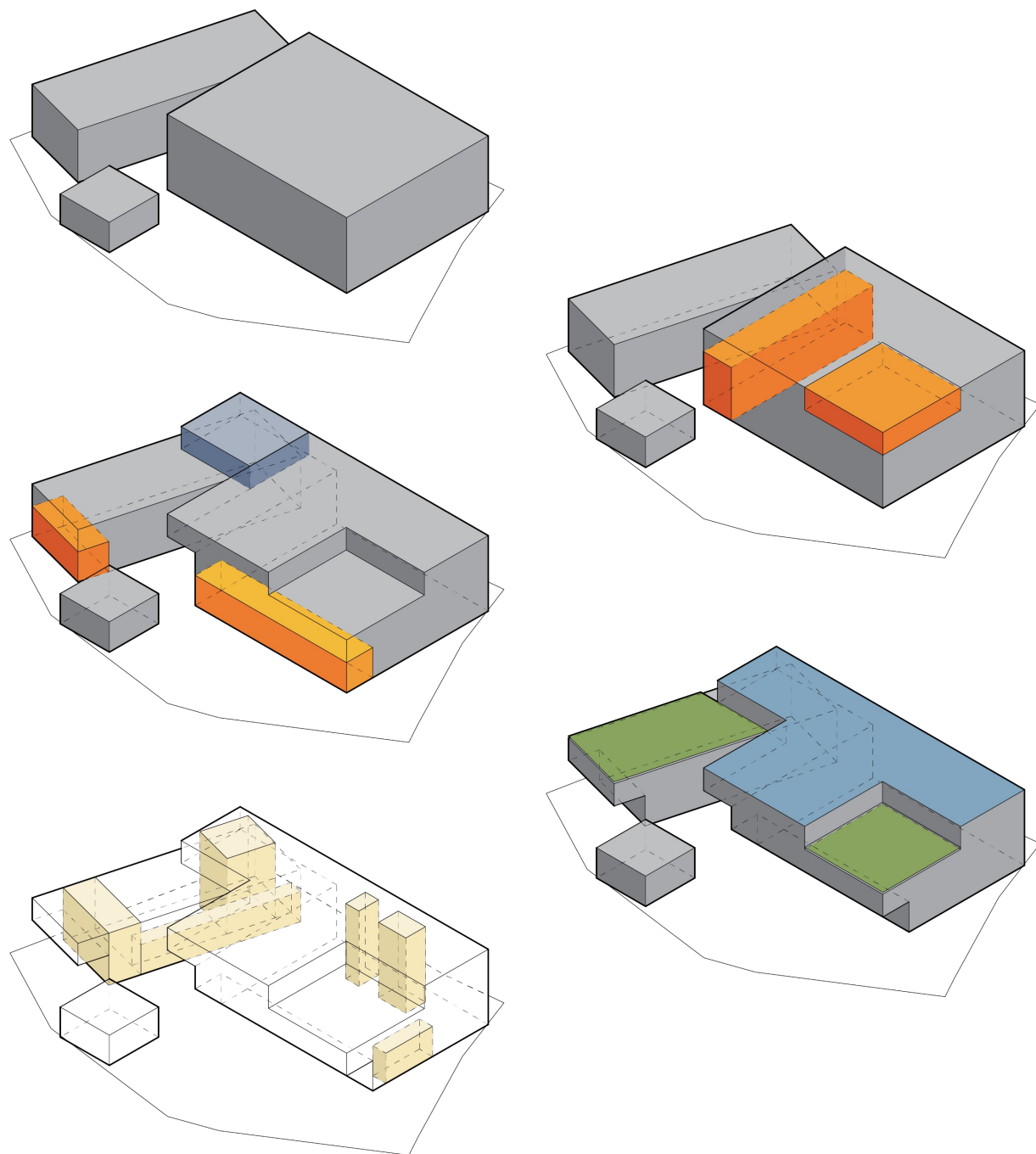
The three large Nodes are the corners of the site we want to have our building respond to.

The smaller nodes are the points where key decisions of travel seem to be happening.



Massing and Circulation

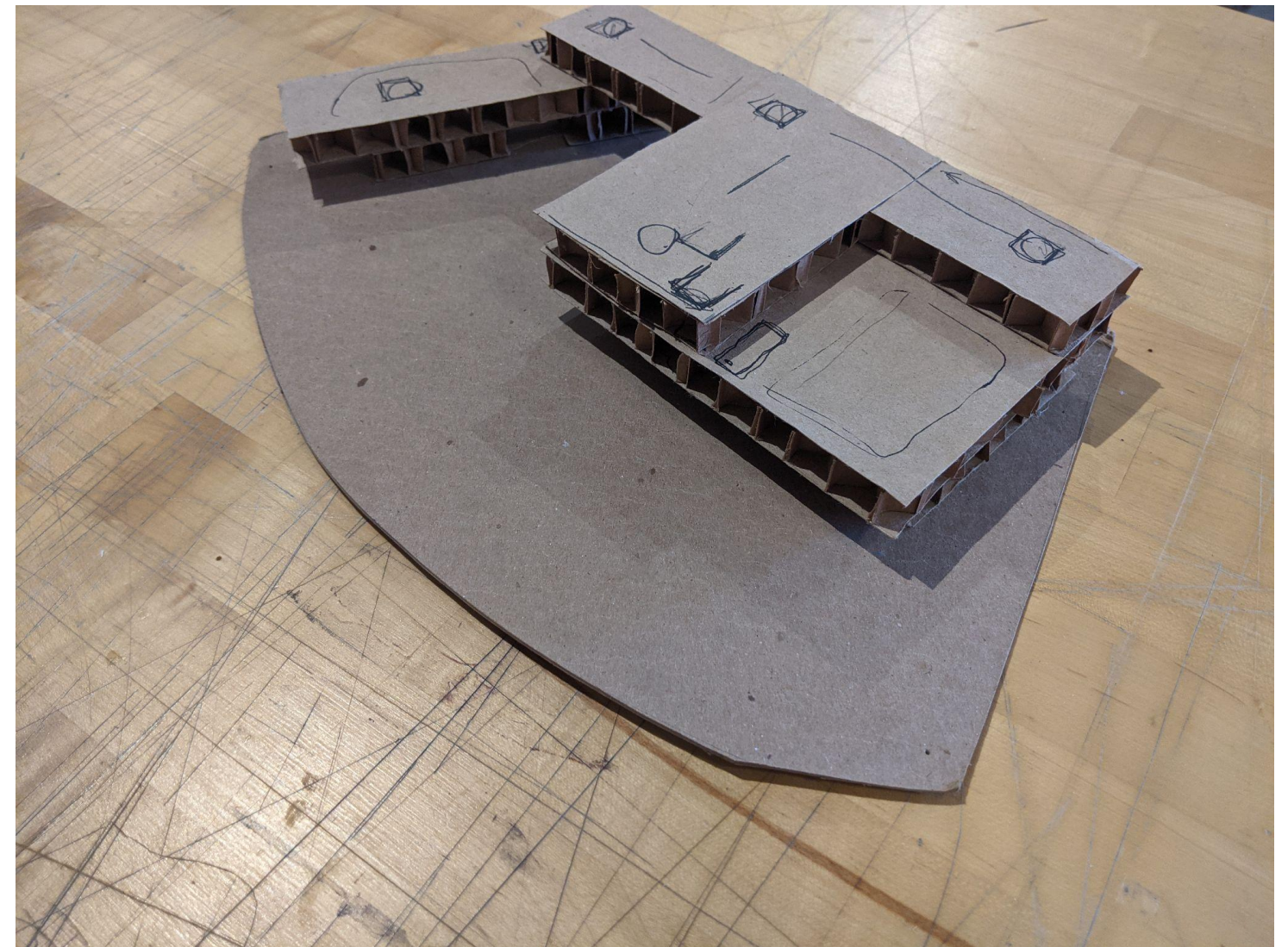
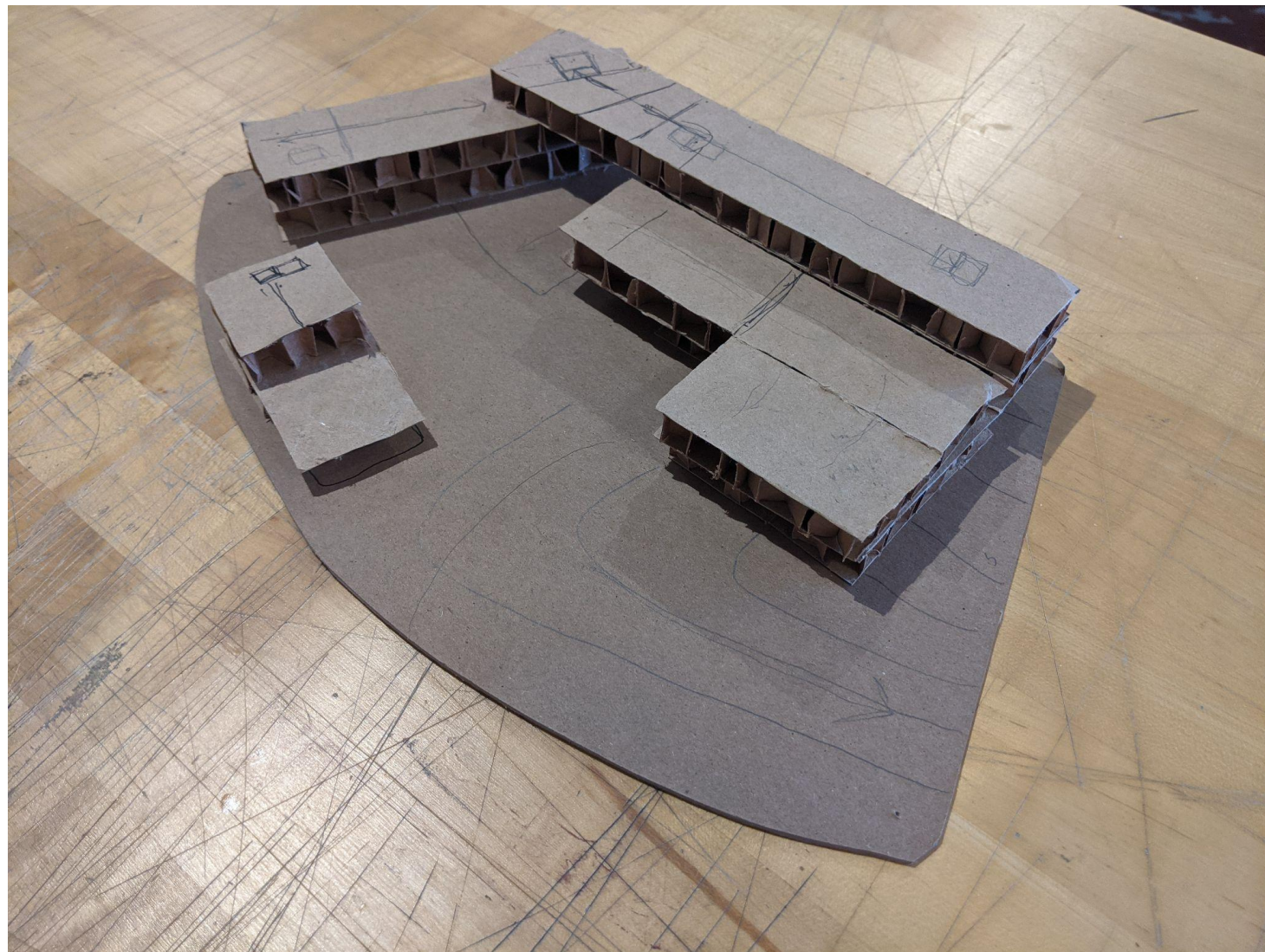
Once we identified the Nodes of circulation we developed our Massing to respond to the site. We also began to develop ideas as well for connecting both sides of the river.



Massing Models used to respond to desired site Circulation

Physical Concept Models

We began by using square blocks to develop a working massing for the site. We refined these into a working conceptual design.

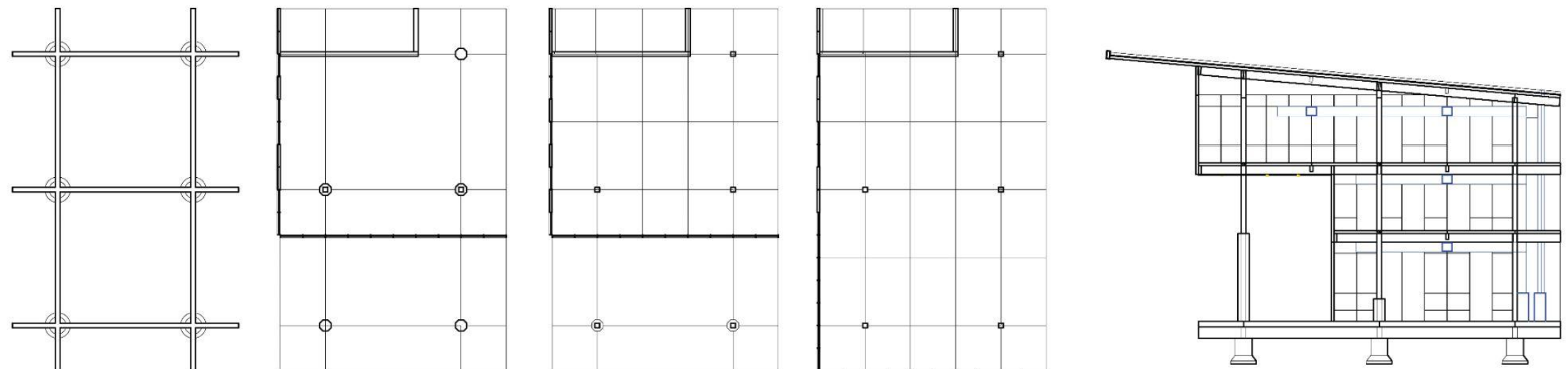
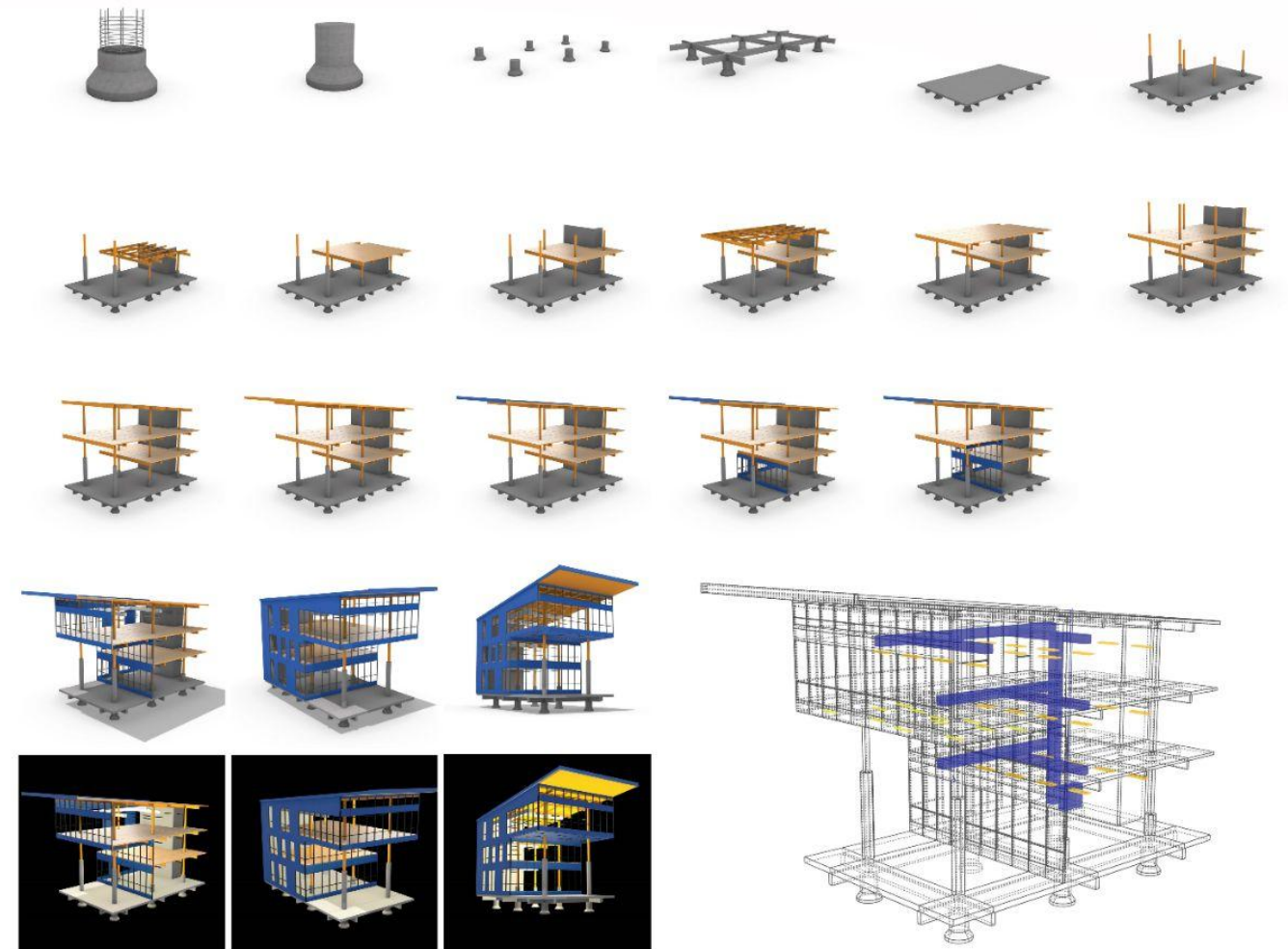
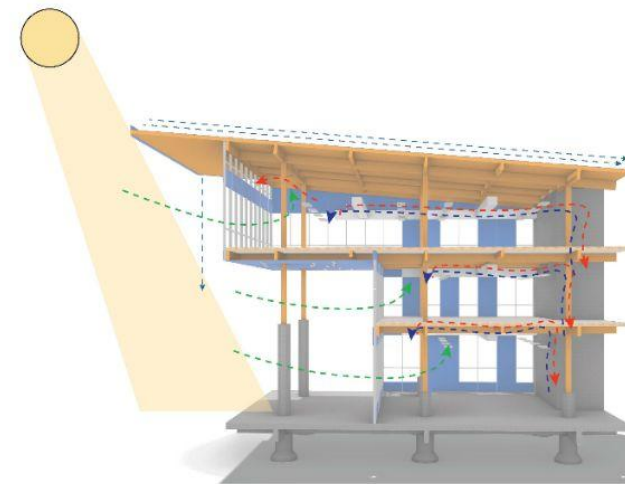


Original Concept Models developed by Team YM

Structure & Environment

The construction takes on a podium design. The Concrete base provides solid support while the Mass-timber structure above gives a lighter feel for the space. The columns are smoothly transitioned from round at the bottom to octagon on concrete to square on timber.

Both materials can have exposed finish. Shear-force is resisted using a rigid core which houses HVAC and Plumbing work for the entire Building. The envelope uses curtain walls to wrap around and protect the interior. More glass panes appear on the South elevation to capture most of the sunlight while less openings are shown on the West.



Initial Program Designs

The initial layout of the building was established after the Prototype design. The rough programming was created.



Phase 4

Prototype Design

Executive Summary

Summary

This building complex serves more than just as a makerspace. It aims to become a landmark and an important role in the revitalization of this area of Lowell.

Besides a number of essential-skill classes the complex has a wide outdoor area that opens toward the river as an appreciation of the historical rivers & canals. The building structural elements also pay homage to the industrial buildings that came before it.

This landscape also leads to the river walk and Eastern Canal Park, making the complex rather a social-physical connection. It connects people from the inside and a larger community from the outside. Creating a new physical pedestrian bridge allows our site and building to become a new area that can attract pedestrian and help to bridge the gap between the East and West sides of the Concord River.



Building Details

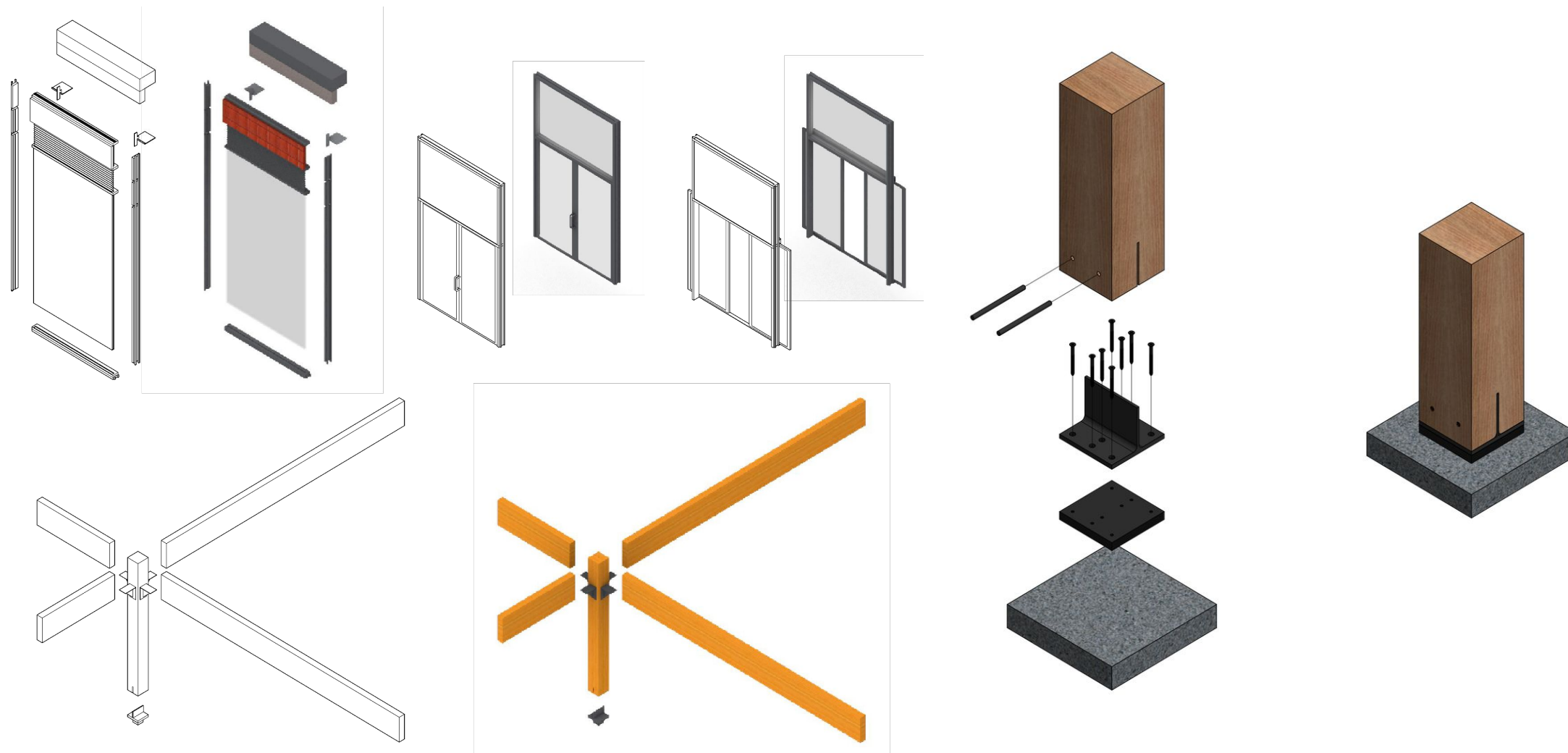
Codes and Specifications

1. Building Group: Section 304 - Business Group B. Occupancy, Group B - (Further Education and Lab Spaces)
2. Building Type: HT (Heavy Timber), S (Sprinkler)
 - i. Max Height = 85 feet.
 - ii. Max Stories = 6 stories
 - iii. Max Bldg. Area = 144,000 sq. feet.
3. As Built Building Dimensions
 - i. Actual Height = 52 feet.
 - ii. Total Stories = 3, (Plus Roof Access)
 - iii. Total Square Footage = 32,500 sq. feet.
 - iv. Total Outdoor Space = 23,300 sq. feet.
 - v. Total Site Sq. Footage = 28,000 sq. feet.



Structure

- Structure Type: Heavy Timber connected to Concrete Columns
- Hardware: Metal Brackets connecting Heavy Timbers to each other and the Concrete columns.
- Foundation: Caisson Foundation, Min 8 Feet Deep.
- Facade: 8 foot Modular Glass, and Terracotta Cladded Panels.



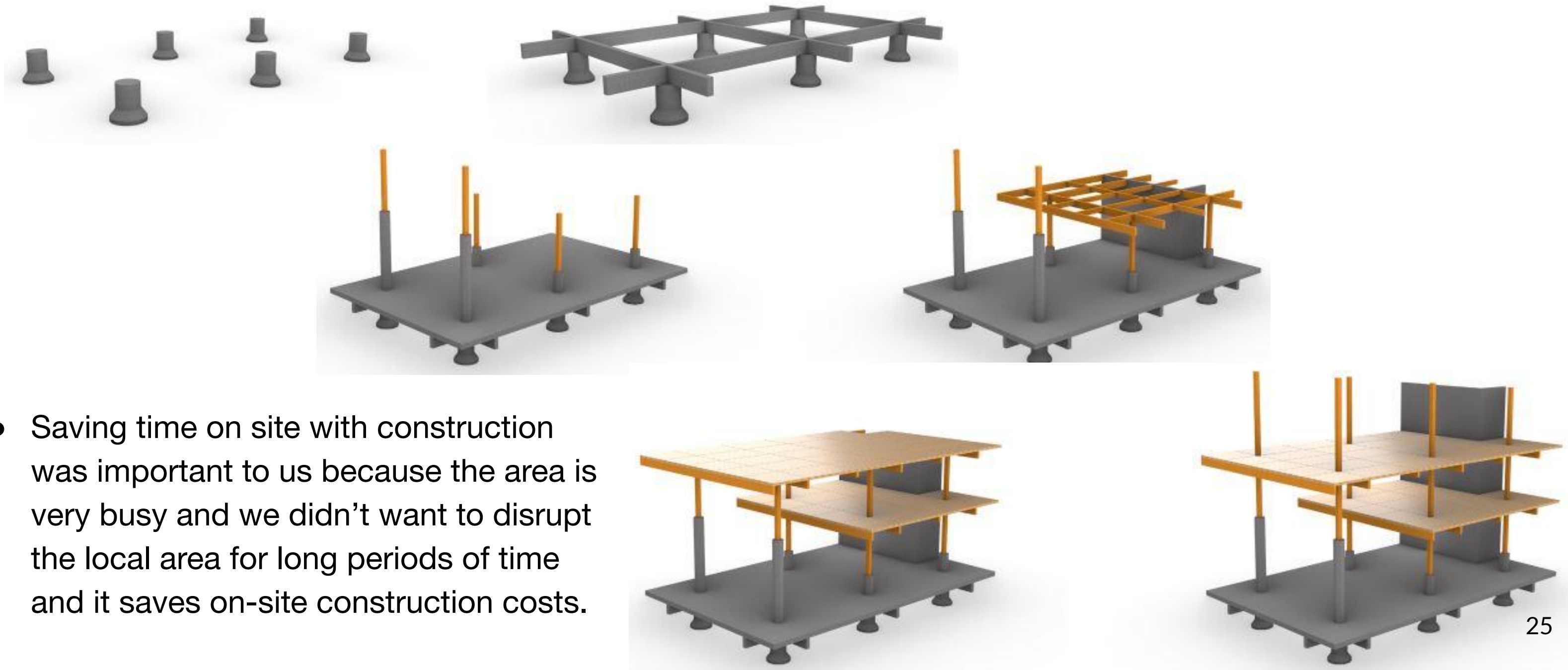
Structural Design

- For the building Envelope we utilized 8 foot Wide Panels to enclose the structure.
- The Heavy Timber Construction allows us to cantilever out 8 feet past our column so that we can use our envelope panels as our insulation and protection for the building. This allows us to keep the structural members and hardware exposed in the building. This is a deliberate choice.
- As mentioned previously in the intro the local area is full of Old Mill buildings that have been revitalized. As we were choosing design elements we took into account how our choices could pay homage in a way to the designs of the old industrial buildings of the city of Lowell.
- Using Heavy Timbers along with masonic elements and terracotta panels the idea was to create a modern building that responds to the older design elements used with early Mill Construction.



Structure - Building Block

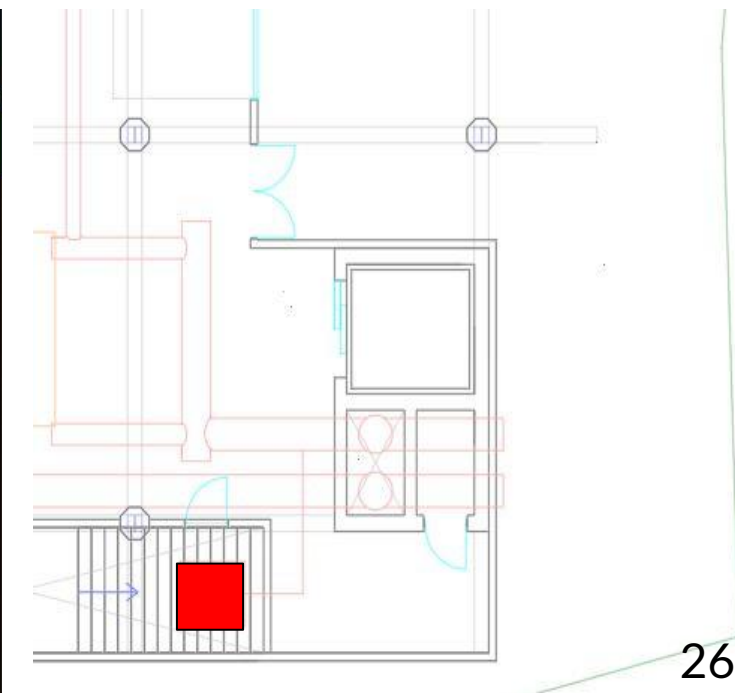
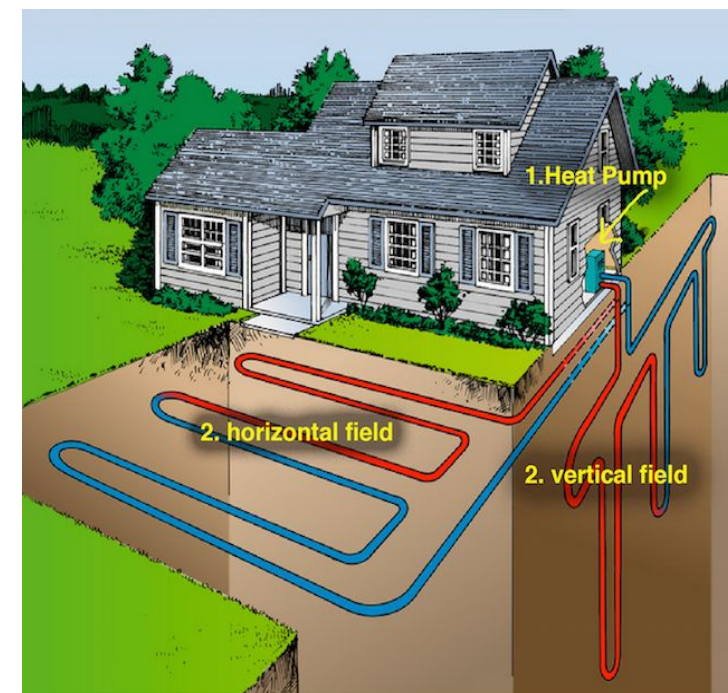
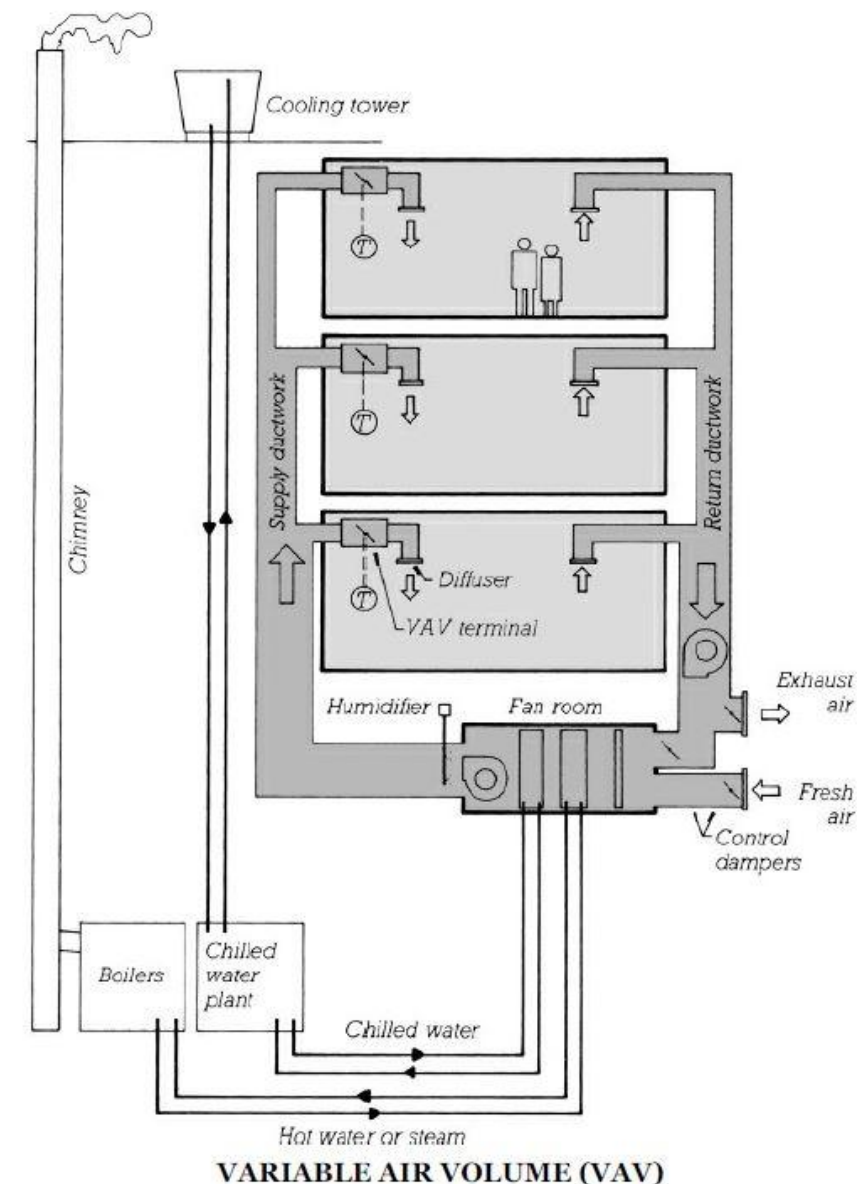
- We combined our different structural elements to create a 24' X 24' structural building block which we then used to design our project. This gives us a Modular type of construction where assembly of the building can happen fast with fabricated materials coming directly to the site, once the foundation is in place.



- Saving time on site with construction was important to us because the area is very busy and we didn't want to disrupt the local area for long periods of time and it saves on-site construction costs.

Mechanical Systems

- For the Mechanical HVAC system we decided to utilize a VAV (Variable Air Volume) system.
- The advantage: (Studio Companion) - *“This system offers a high degree of local temperature control at moderate cost. It is economical to operate and virtually self-balancing.”*
- The disadvantage: (Studio Companion) - *“VAV is limited in the range of heating or cooling demand that may be accommodated within a single system. When one area of a building needs heating while another needs cooling, a VAV system cannot serve both areas without help from a secondary system.”*
- To offset this disadvantage, and take advantage of the natural resources we decided to use a Geothermal ground system to help heat and cool our building throughout the year. We consulted with a mechanical specialist during one of our studio sessions and this was his main recommendation that we could utilize with our structure. He ran us through the concept of using the Concord River as a cooling source and the ground as a heating source. Running these lines back to a heating pump and tying that into our VAV system.



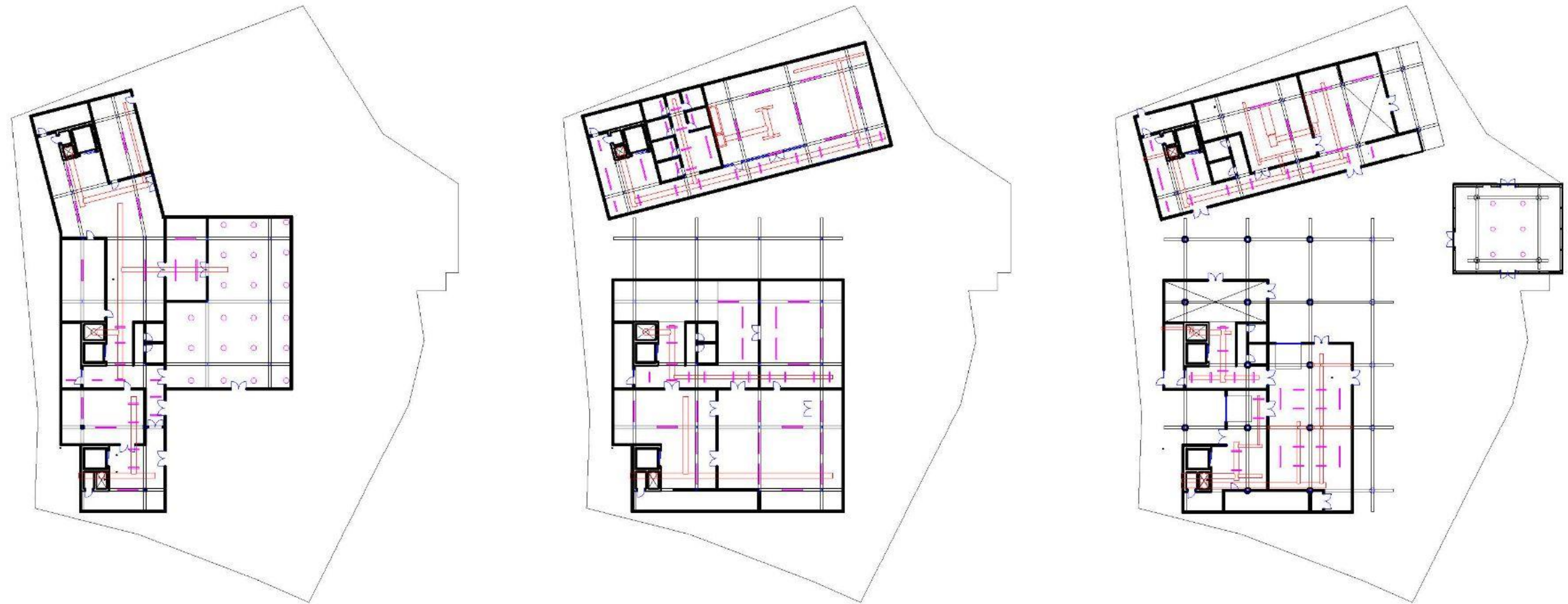
Systems Layout

- The mechanical HVAC System runs just below the structural beams that hold up the ceiling for each floor.
- Lighting for the building is achieved with both the large panel windows on all sides of the structure that let light in during the day and also utilizing both pendant strip light that can be hung directly from the beams or ceiling and provide ample light for the interior.
- We also are utilizing circular light pendants for specific areas of the building such as the greenhouse and Cafe.



Systems Layout - RCP

(Reflected Ceiling Plan)



- The reflected ceiling plan shows the locations for the proposed lighting and HVAC mechanical systems. The lighting system can be easily adjusted and moved if needed. The pendant lights allow for adjustments in the work spaces if lighting is required in a different spot or it becomes clear the exterior lighting is more than adequate in a particular spot.

Program Goals

1. The main objective of the program is to help learners become self-sufficient which for us has three levels of meaning.
 - a. Level 1. - They can begin to learn the essential skills to help provide and support themselves
 - b. Level 2. - They start to experiment and educate themselves so that they can teach others.
 - c. Level 3. - If they are ambitious and want to continue on, these classes and spaces can help them become self-reliant and even self-employed.
2. All the programs and provided classes allow students to utilize a facility and equipment they wouldn't generally have access to in a residential space.
3. Work spaces are all surrounded by glass so that to help inspire spectators but blinds can also be utilized to provide privacy and improve focus if needed. Different work and atrium spaces can be turned into showcase areas and gallery spaces when needed.



Program Details

Program Breakdown

- Building Circulation (Vertical and Horizontal) - 9,800 Sq. Feet.

02. Public Elevators

01. Service Elevator

02. Fully Enclosed three story stairs

02. Exposed two story stairs

- Restrooms, Showers, and Locker Rooms - 1,700 Sq. Feet.

09 Accessible Single Person Restrooms

05 Accessible Shower Stalls

Culinary education, Cafe and Production kitchens - 8,700 Sq. Feet.

Garden Prep. and Greenhouse - 3,100 Sq. Feet

Culinary Education - 1,800 Sq. Feet.

Cafe - 1,800 Sq. Feet.

Production Kitchen - 2000 Sq. Feet

Production, Industrial Shop, Wood Shop and Admin Space - 9,600 Sq. Feet.

Production, Computing, and CNC / Laser Lab - 3,400 Sq. Feet

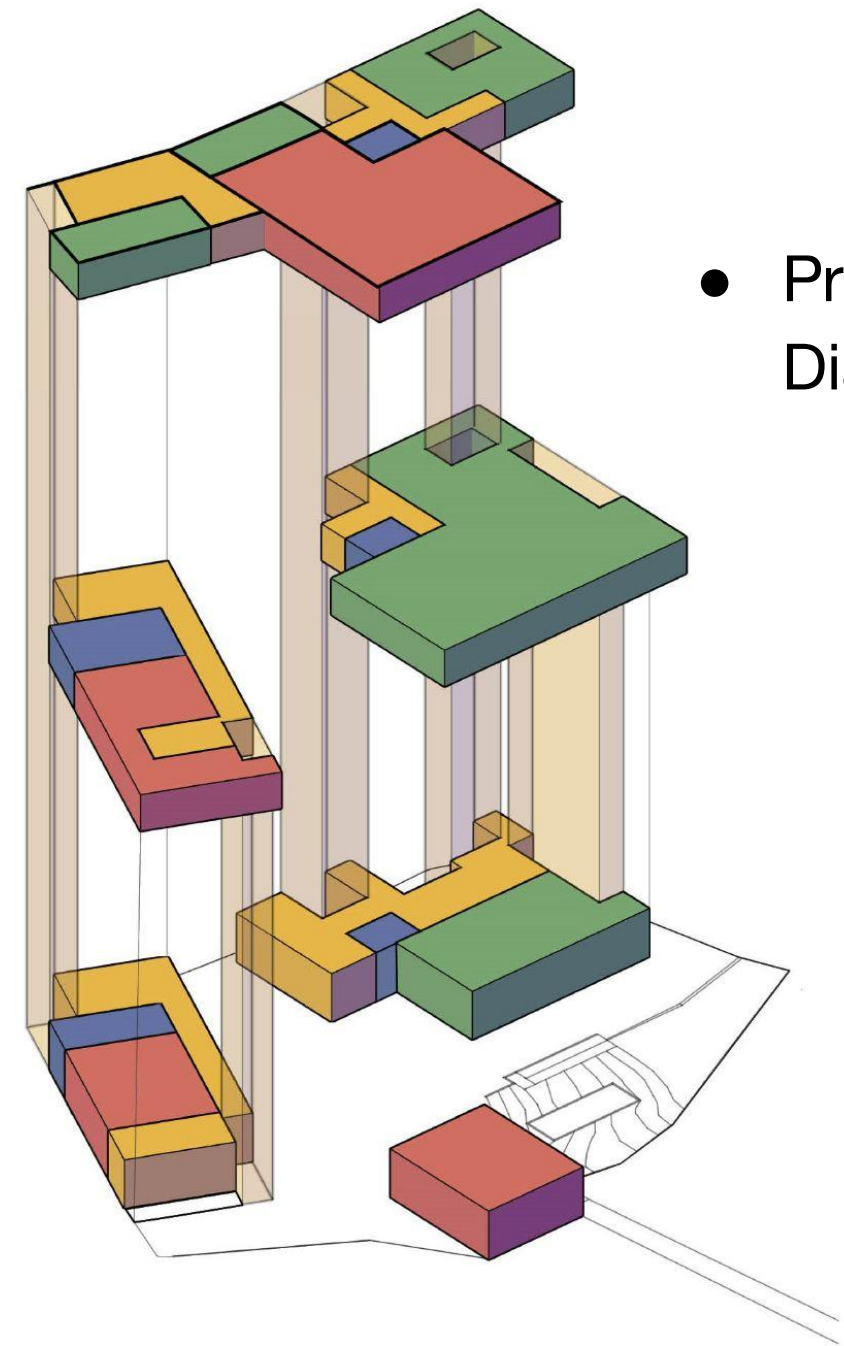
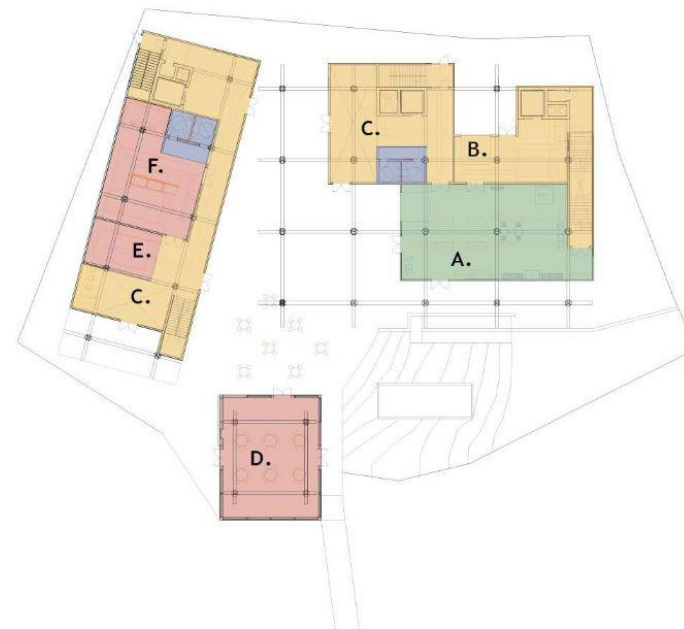
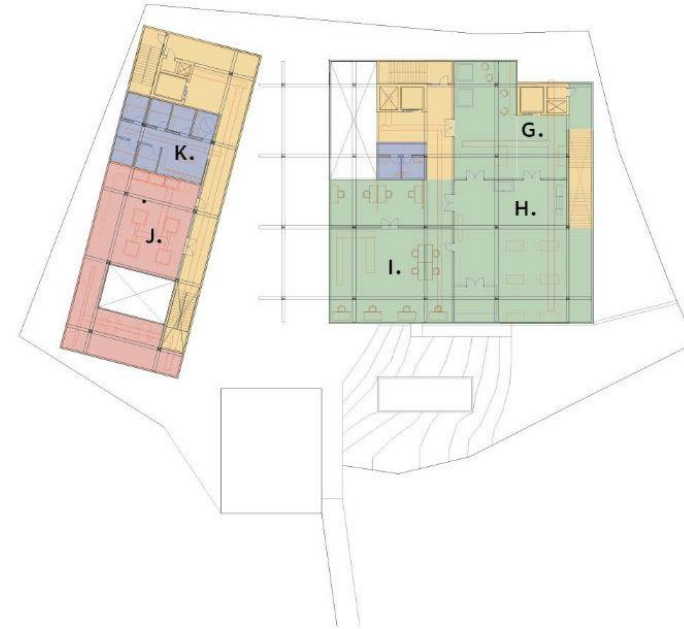
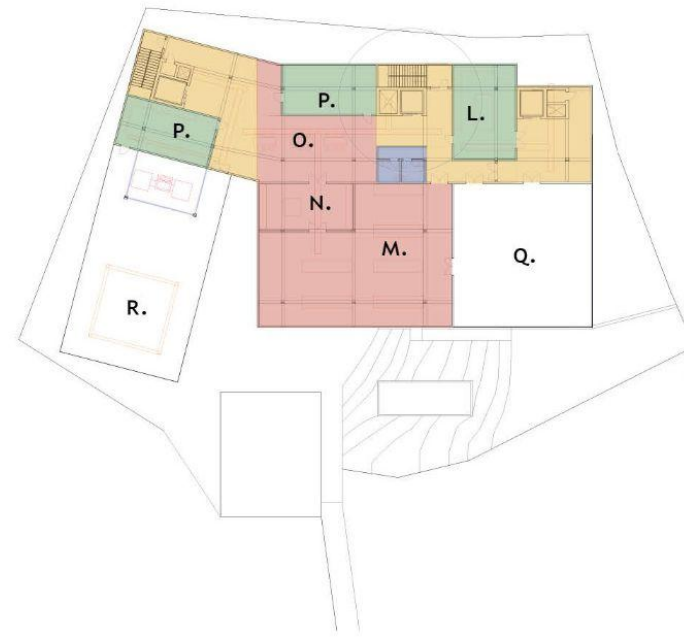
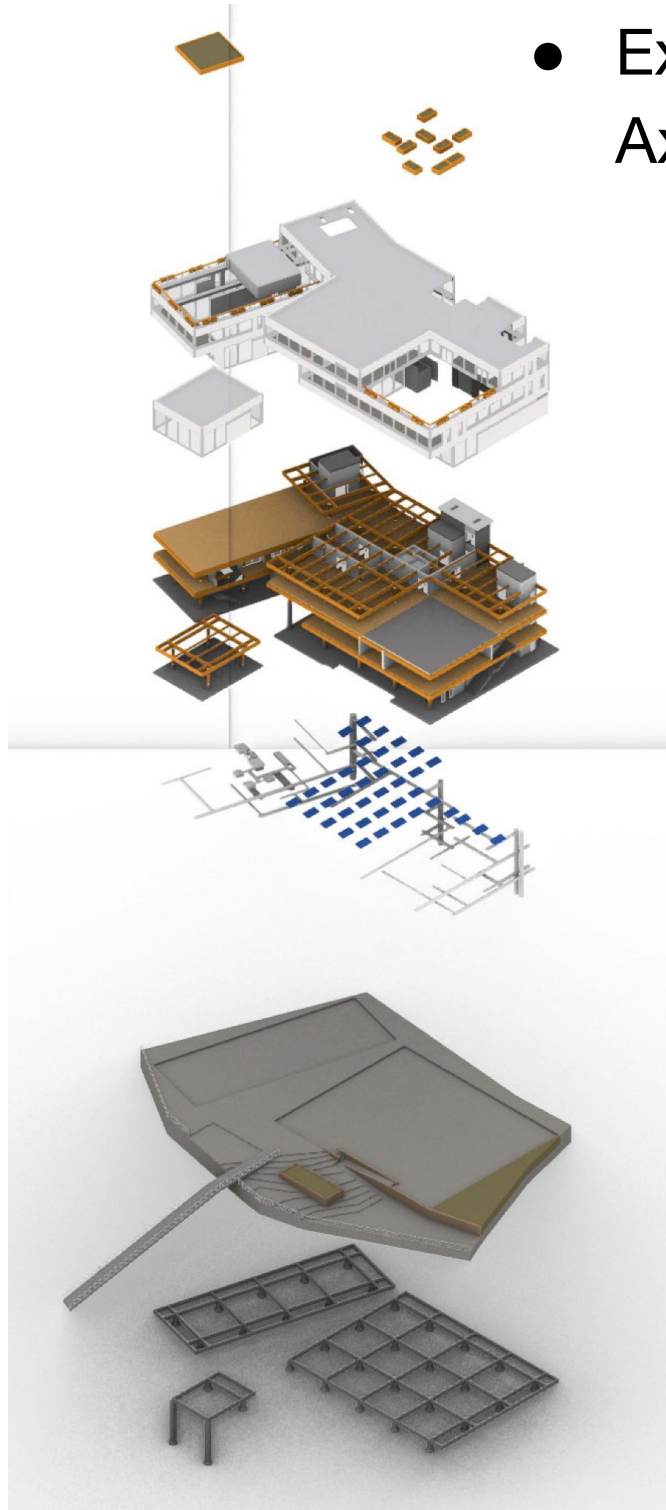
Industrial Shop - 2,400 Sq. Feet

Wood Shop - 2,600 Sq. Feet

Admin Space - 1,200 Sq. Feet

Breaking it Down

- Exploded Axon



- Program Diagrams



Program Labels

- First Floor

- A.- Wood Shop
- B.- Shipping and Receiving
- C.- Atrium
- D.- Cafe
- E.- Tasting Kitchen
- F.- Production Kitchen

- Second Floor

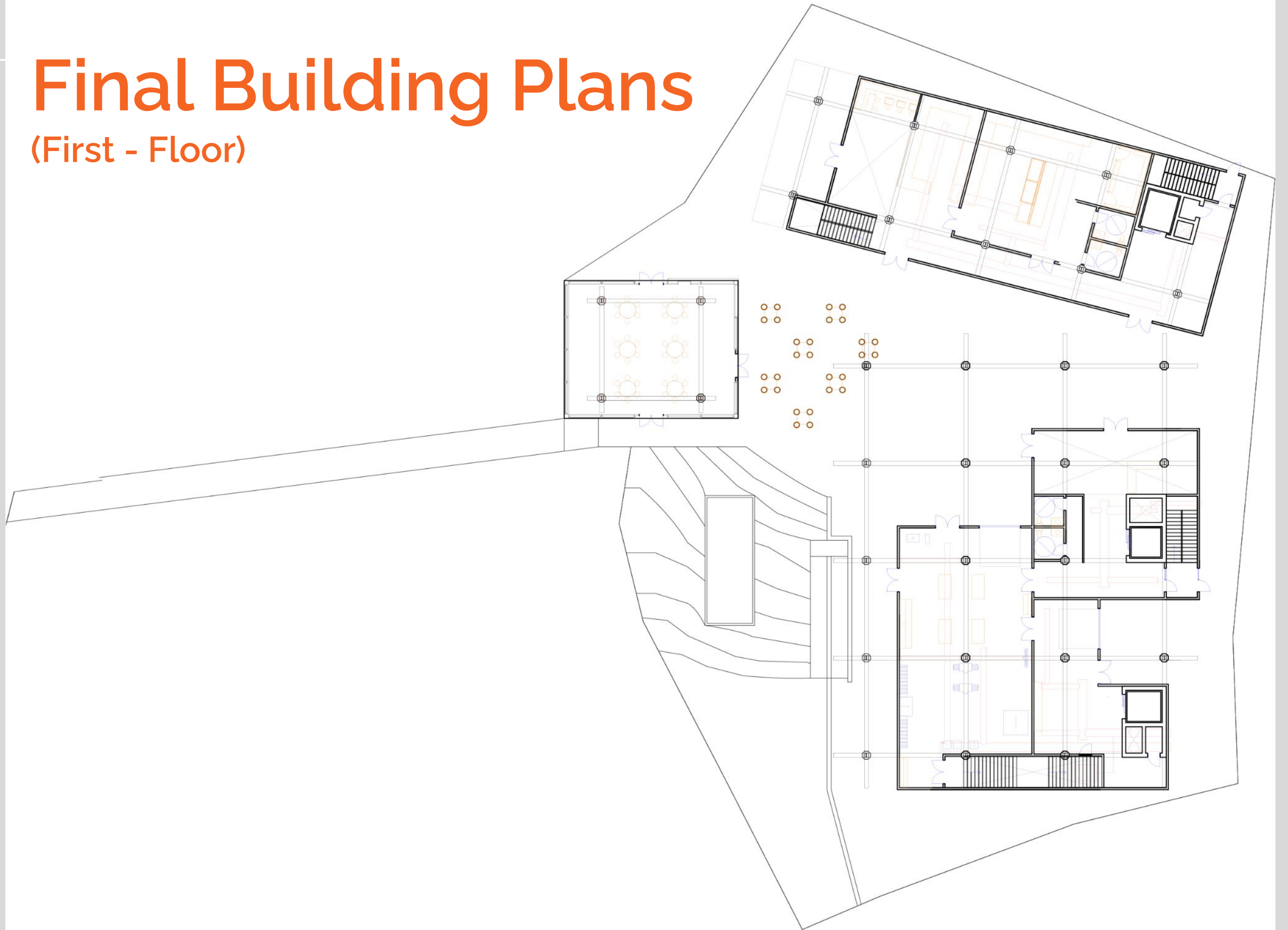
- G.- CNC / Laser Lab
- H.- Industrial Shop
- I.- Computing / 3D Print
- J.- Culinary Education
- K.- Locker Rooms

- Third Floor

- L.- Garden Prep. / Storage
- M.- Greenhouse
- N.- Greenhouse Storage
- O.- Public Eating Area
- P.- Admin.
- Q.- Outdoor Garden Space
- R.- Outdoor Green Space

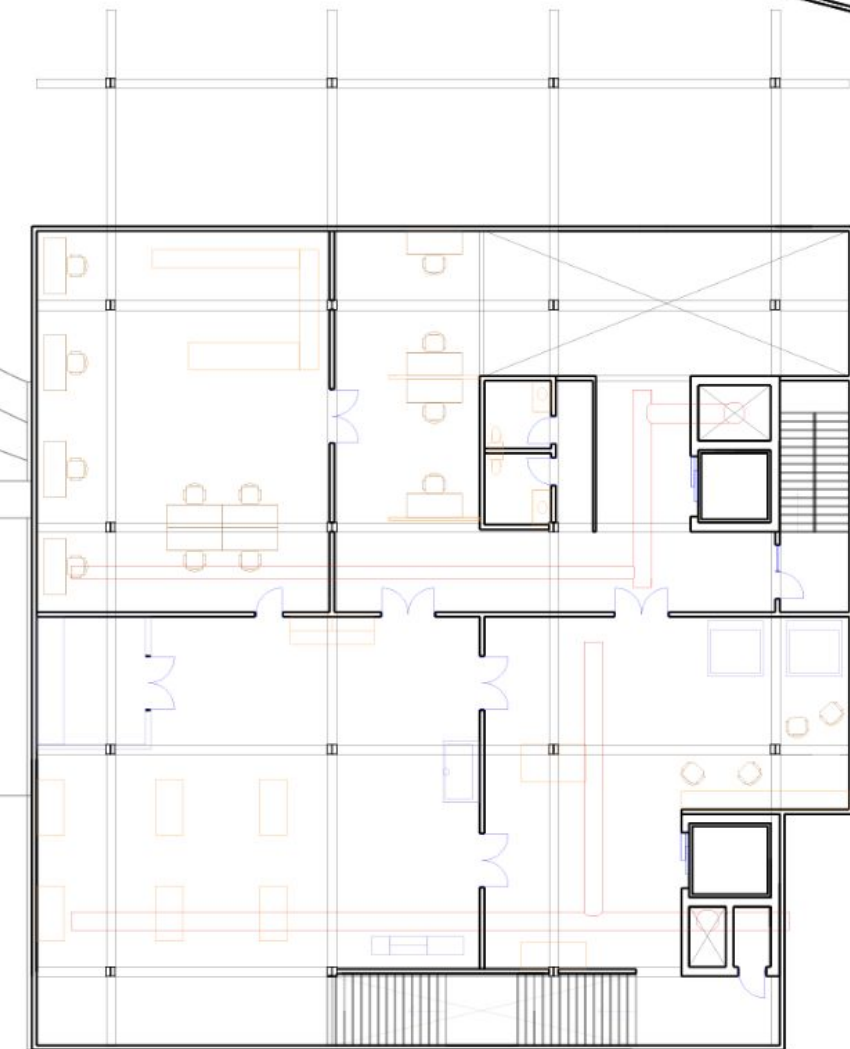
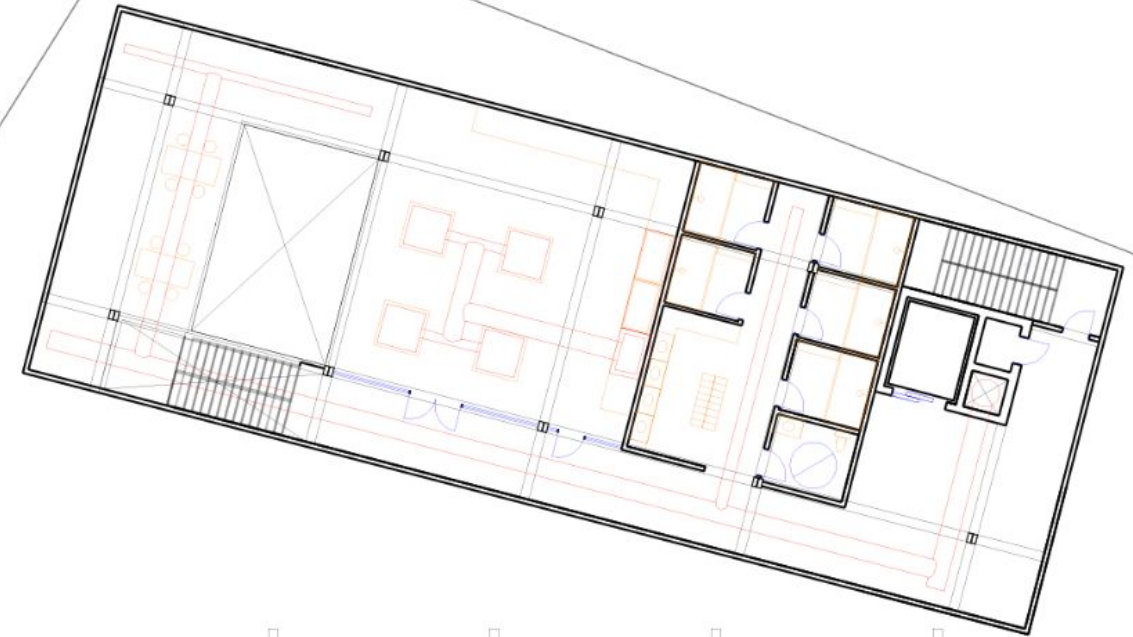
Final Building Plans

(First - Floor)



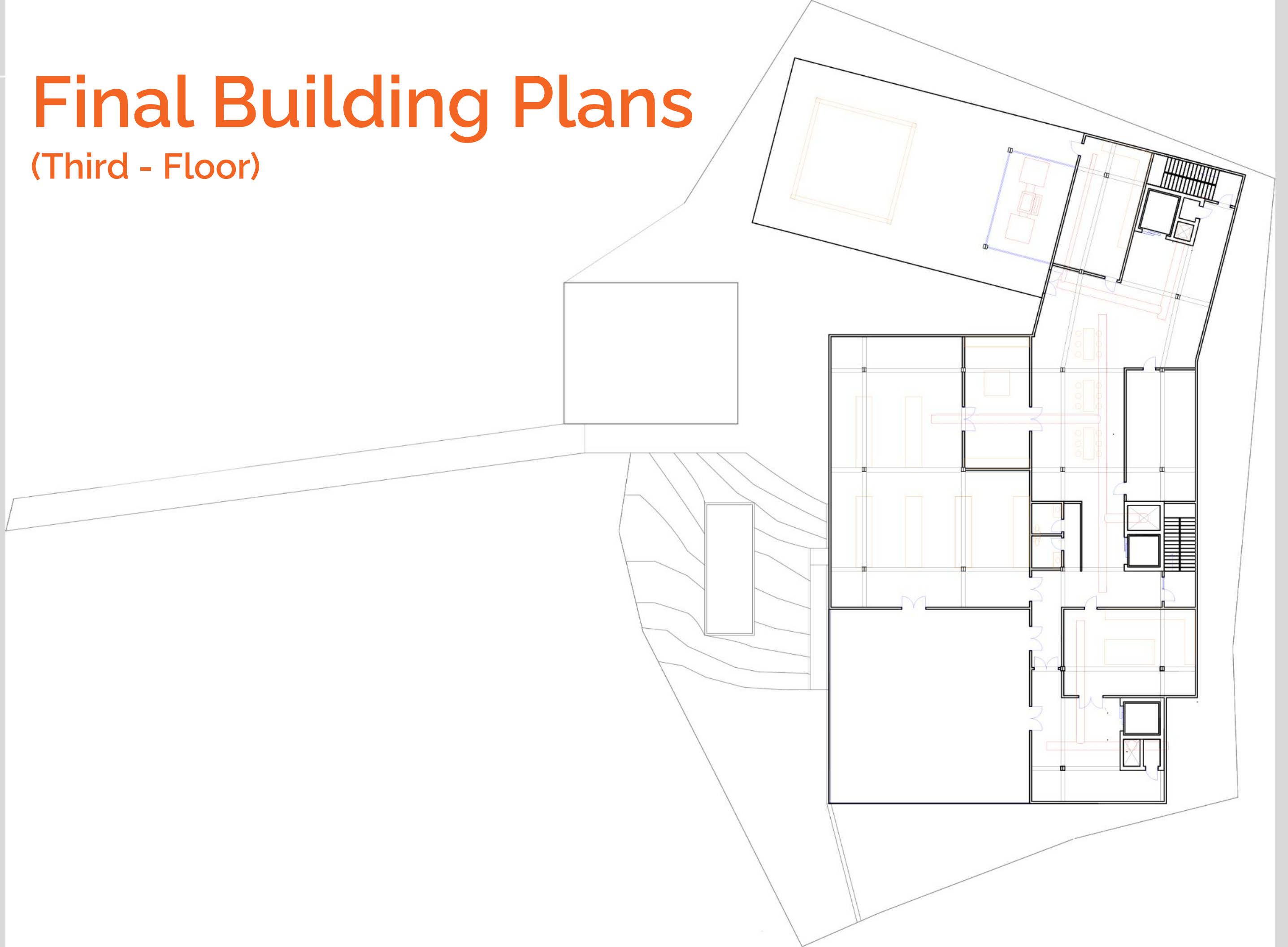
Final Building Plans

(Second - Floor)



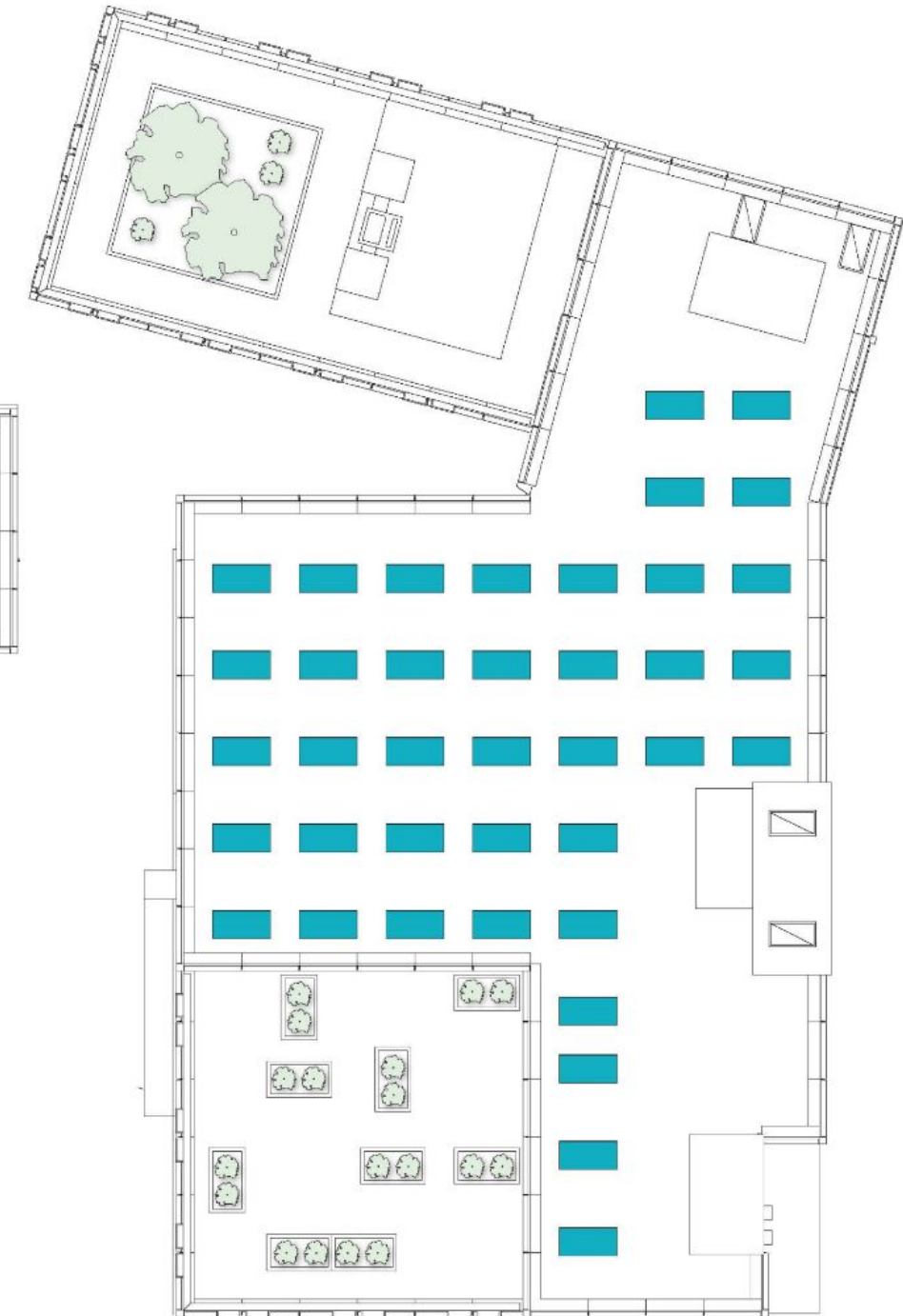
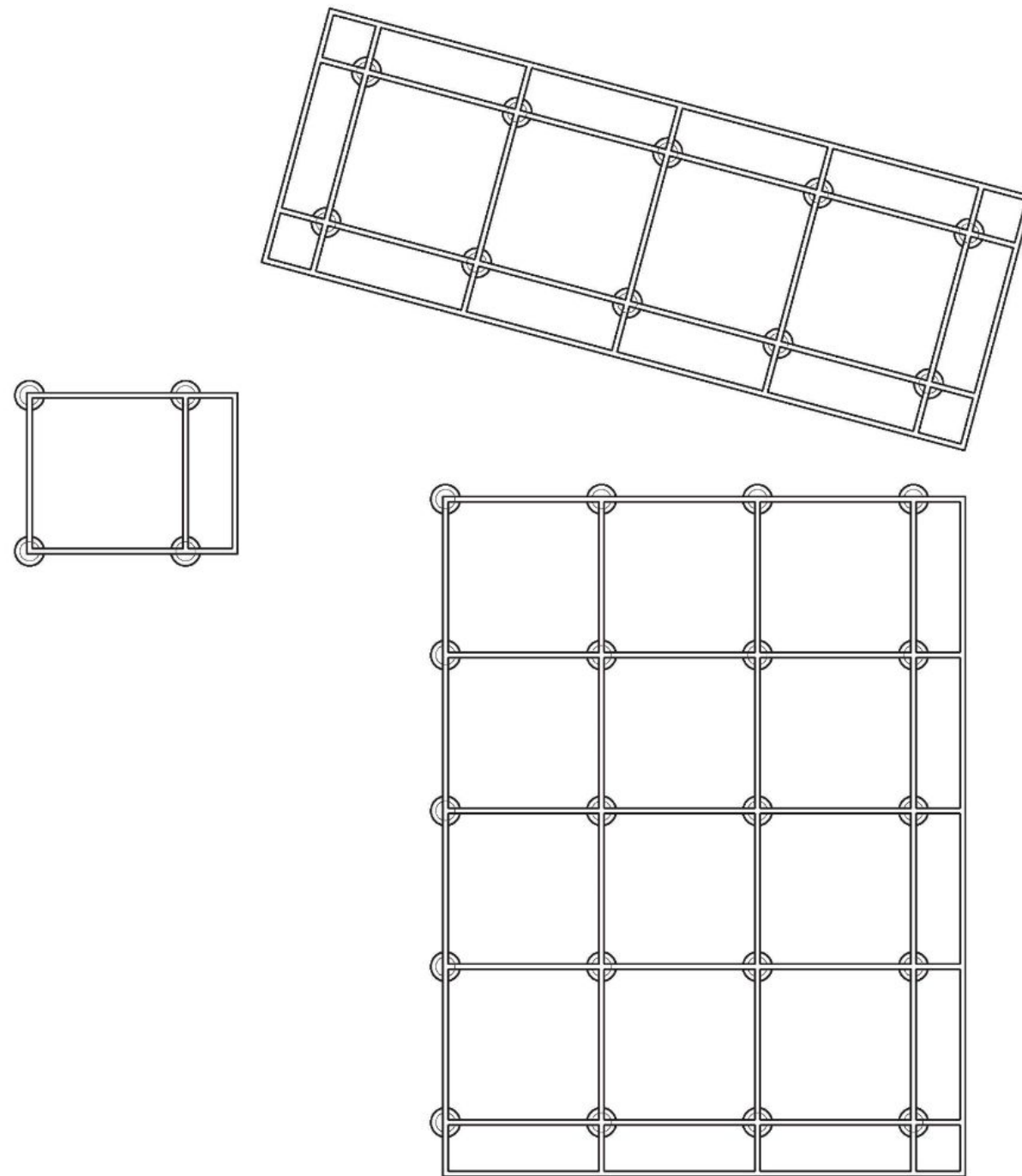
Final Building Plans

(Third - Floor)



Final Building Plans

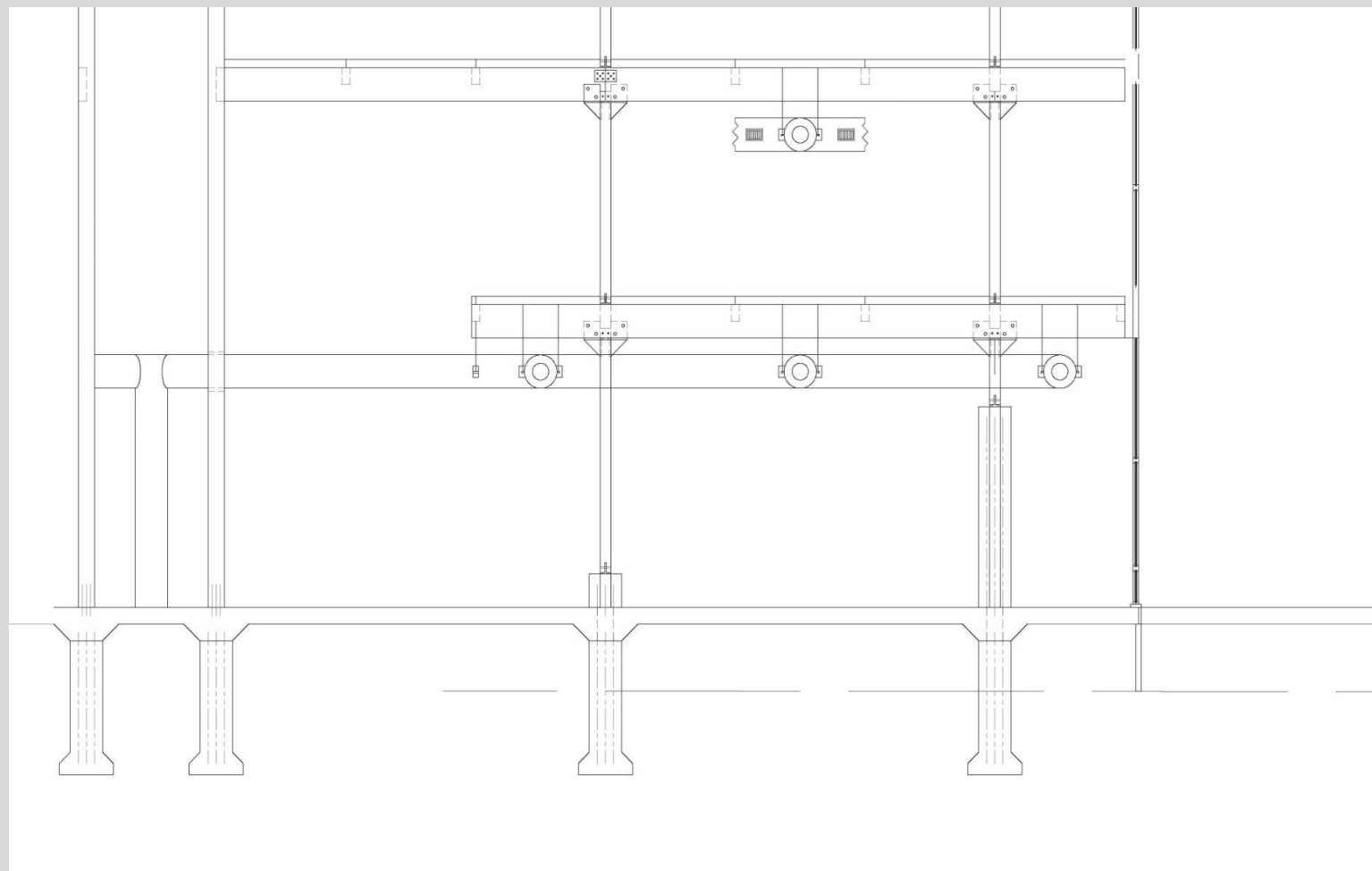
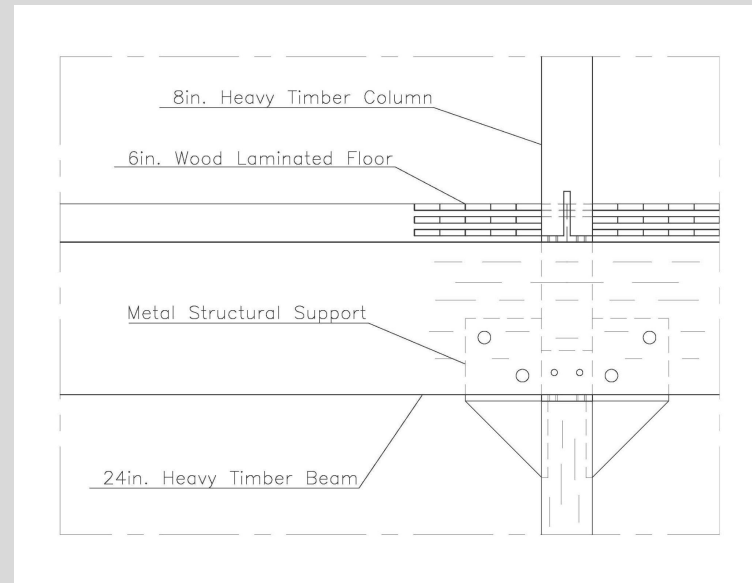
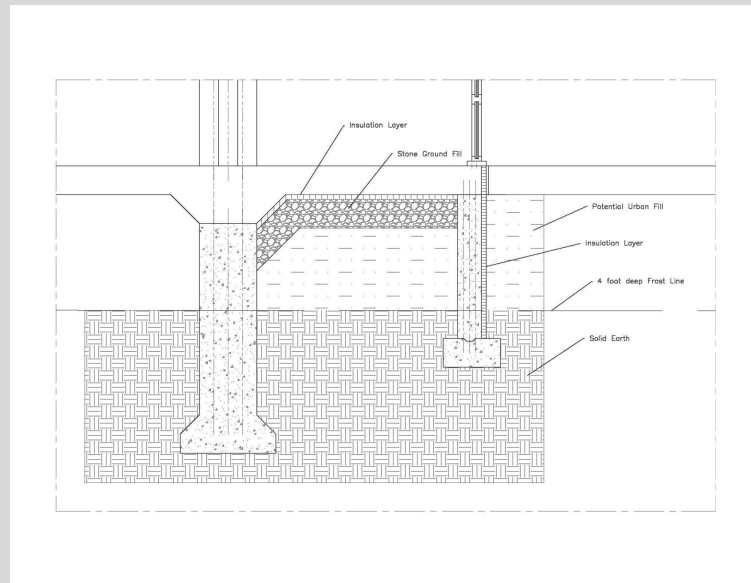
(Foundation and Roof)



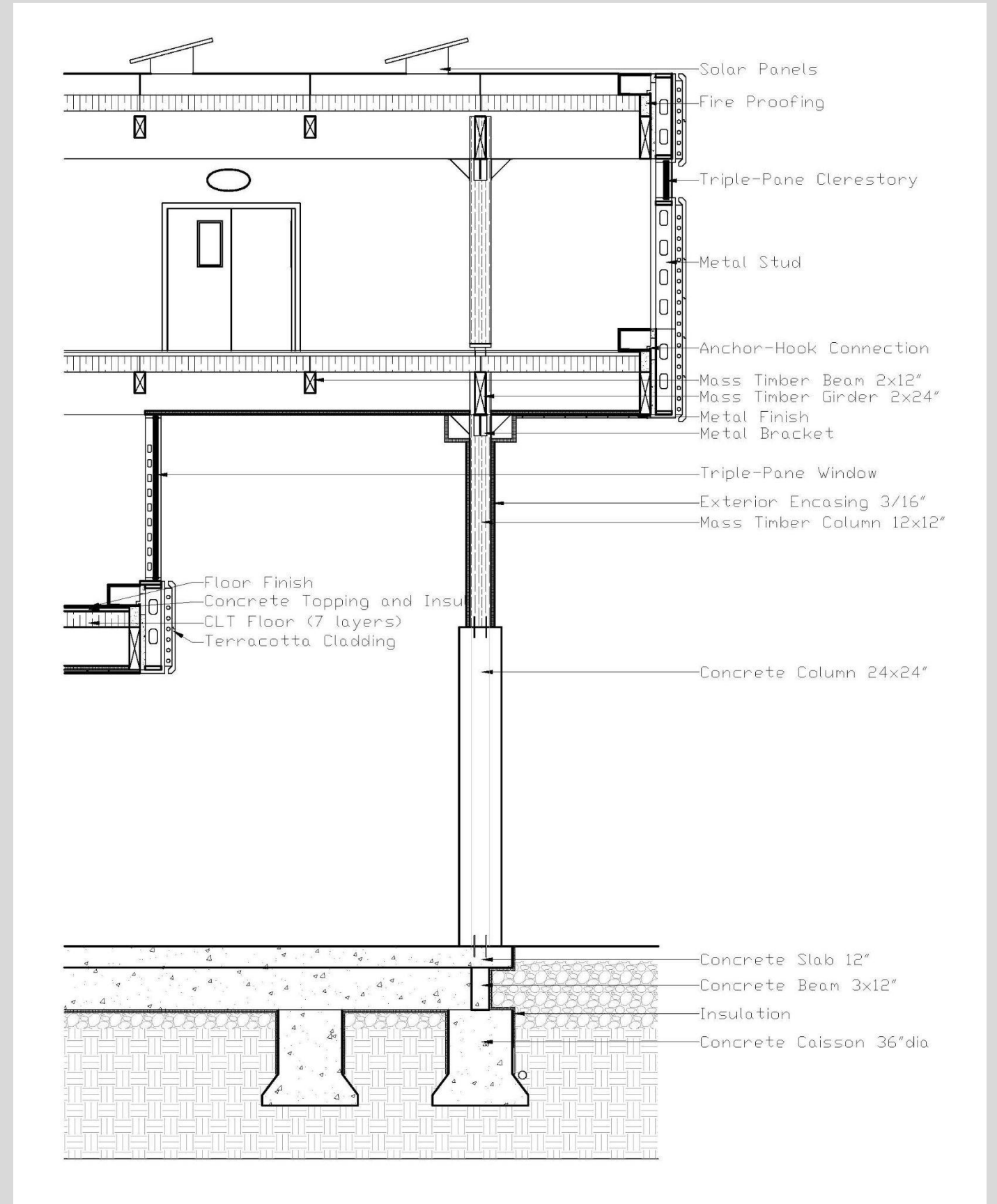
Foundation Plan 1/16"=1'-0"

Roof Plan 1/16"=1'-0"

Wall Sections



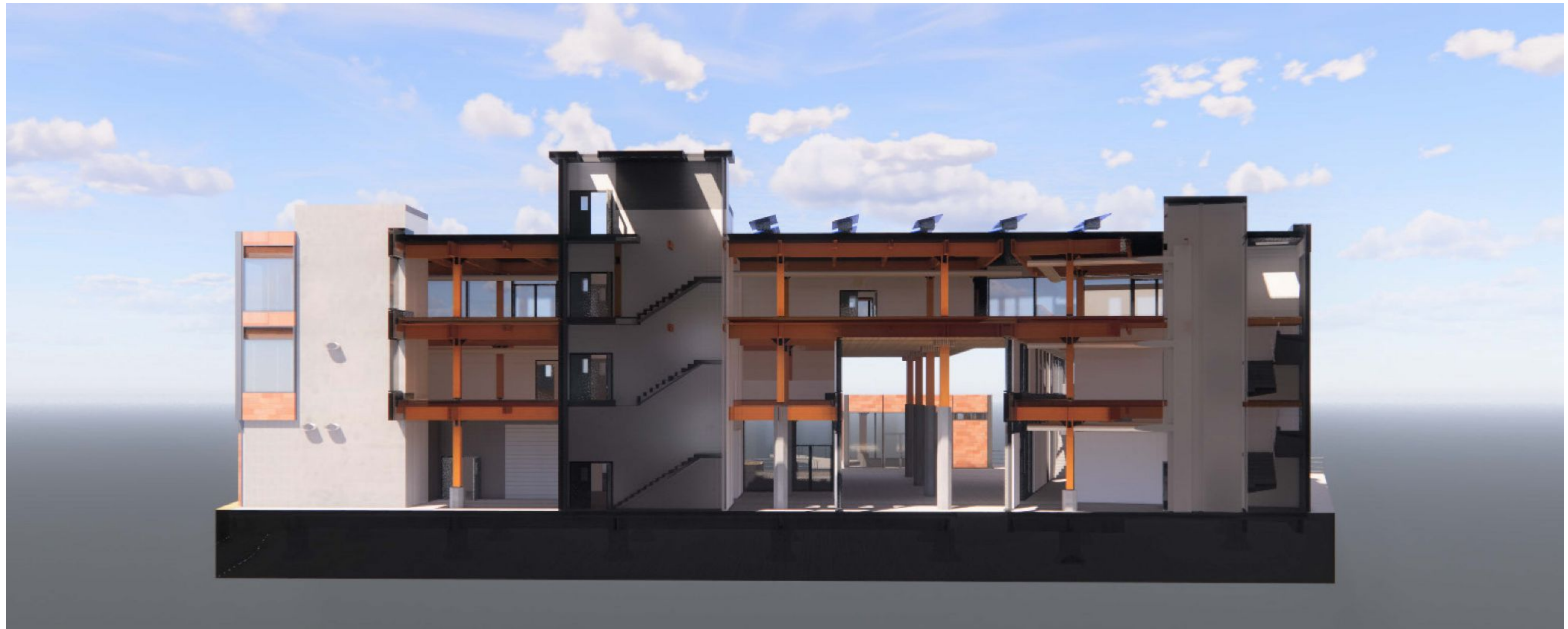
Prototype Wall Section Design



Final Wall Section Design

Section Drawing

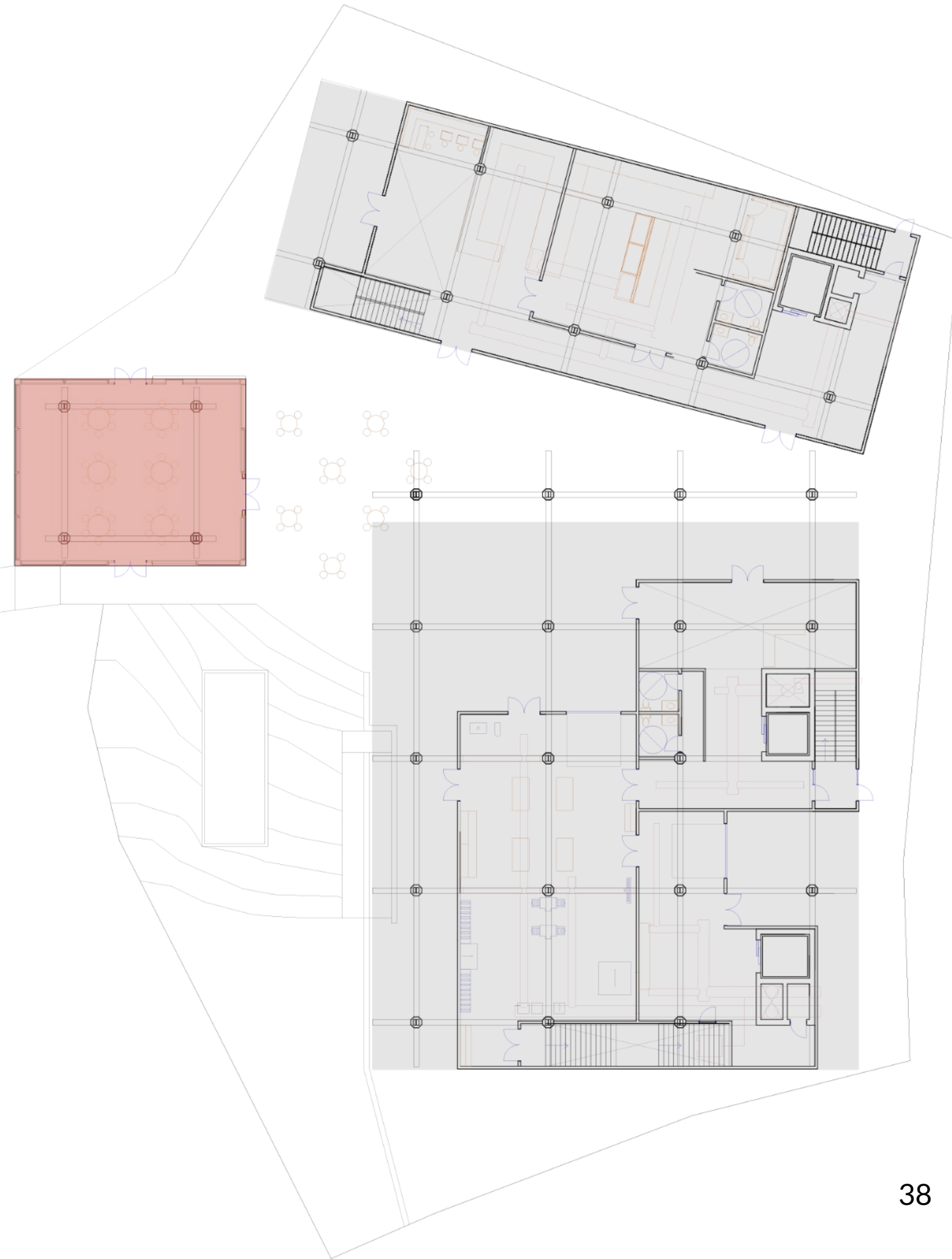
- You can see in this wall section the utilization of the cores of the building to act as both a fire safe stairway and also providing a large shaft area for HVAC and Mechanical Systems.



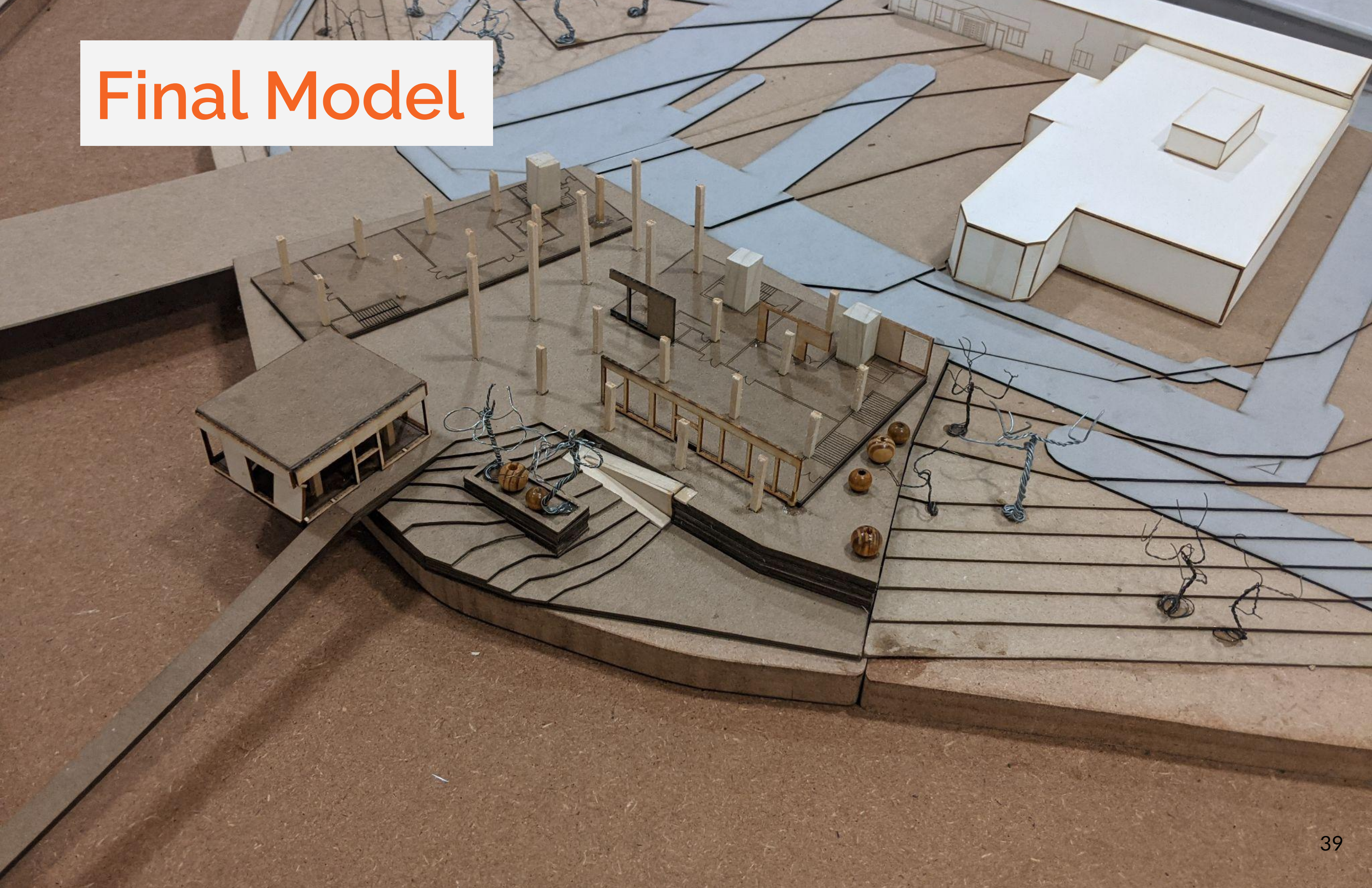
Design Summary

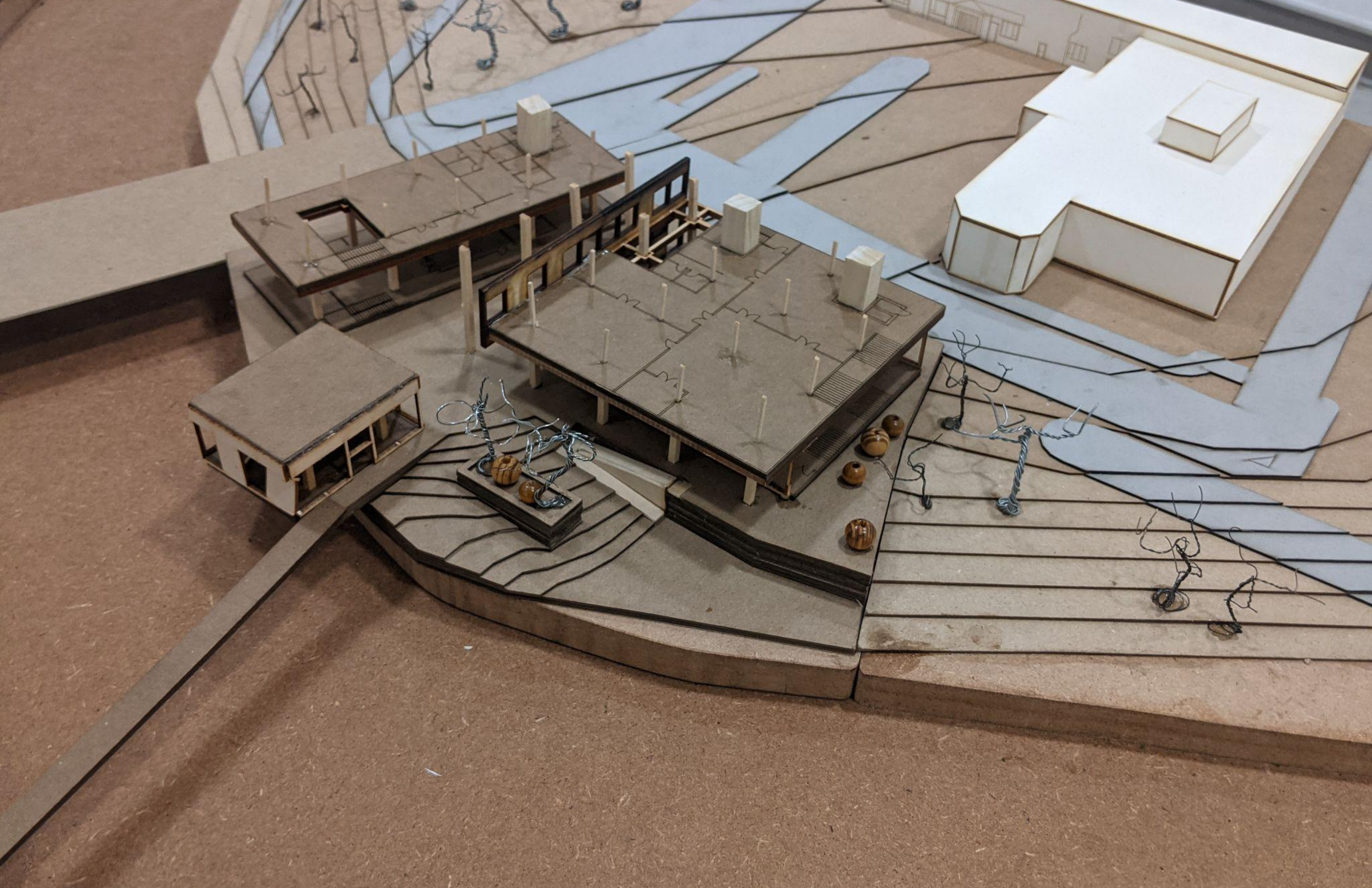
Inside, the complex comprises two large buildings connected by a large volume laying on top of them. The larger mass hosts the majority of the makerspaces while the smaller strip on the north along E Merrimack St hosts more supporting programs. Each building has a large roof garden in attempt to compensate for the land lost to building footprint. These gardens both preserve local plant species and provide products for cooking class.

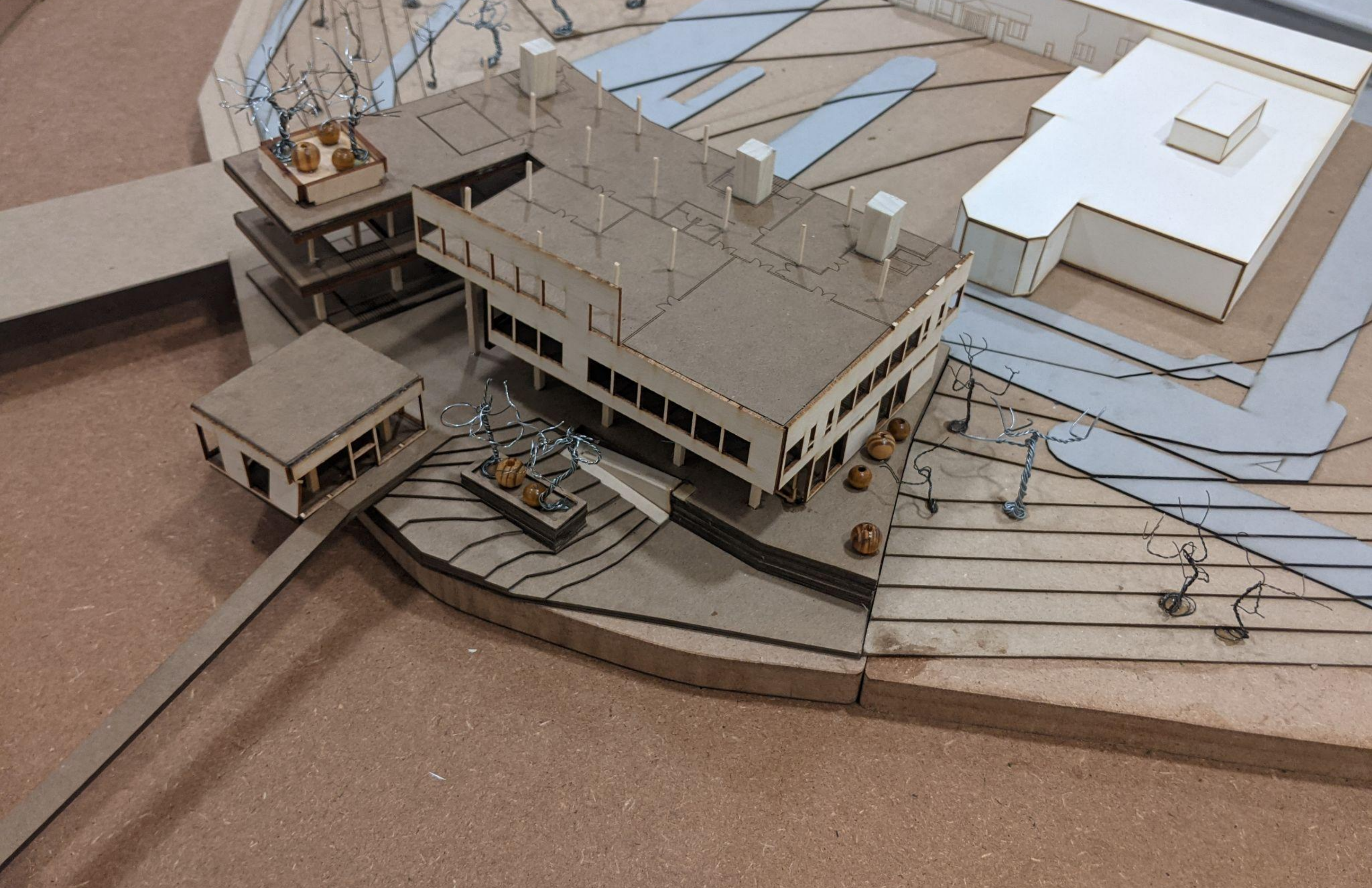
The Cafe, standing on its own, plays as a prototype or showcase of the whole construction. Standing alone also allows it to partially detach from the buildings and reach out to passers-by, hence creating more traffic to the site.



Final Model





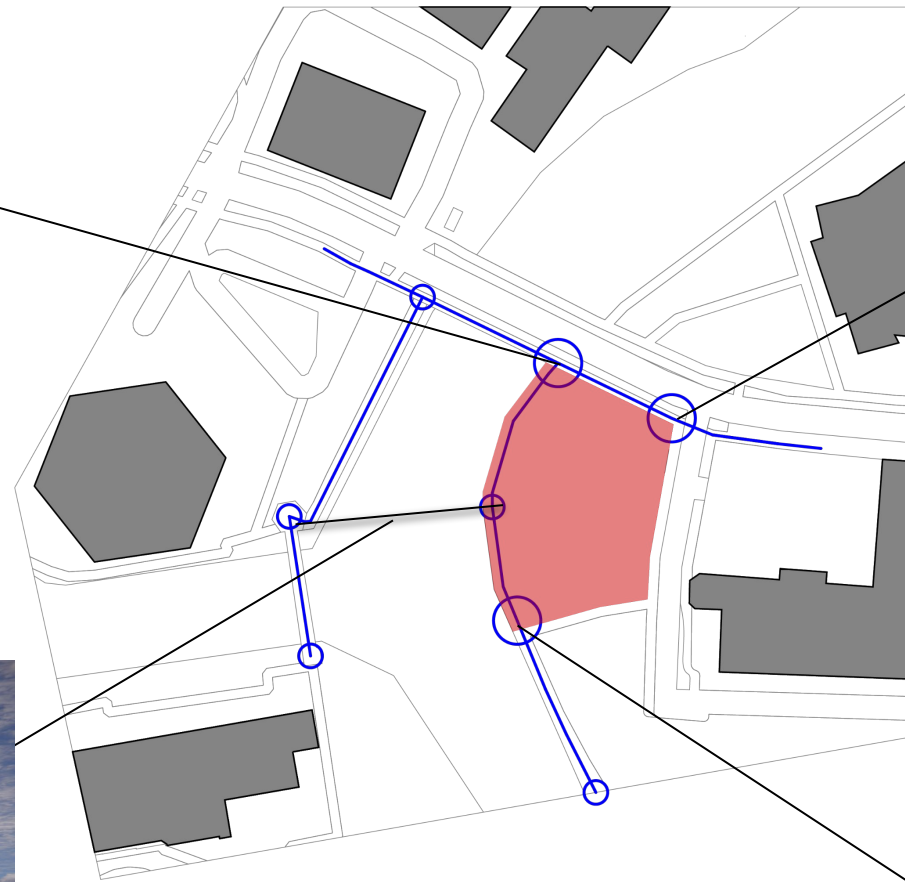




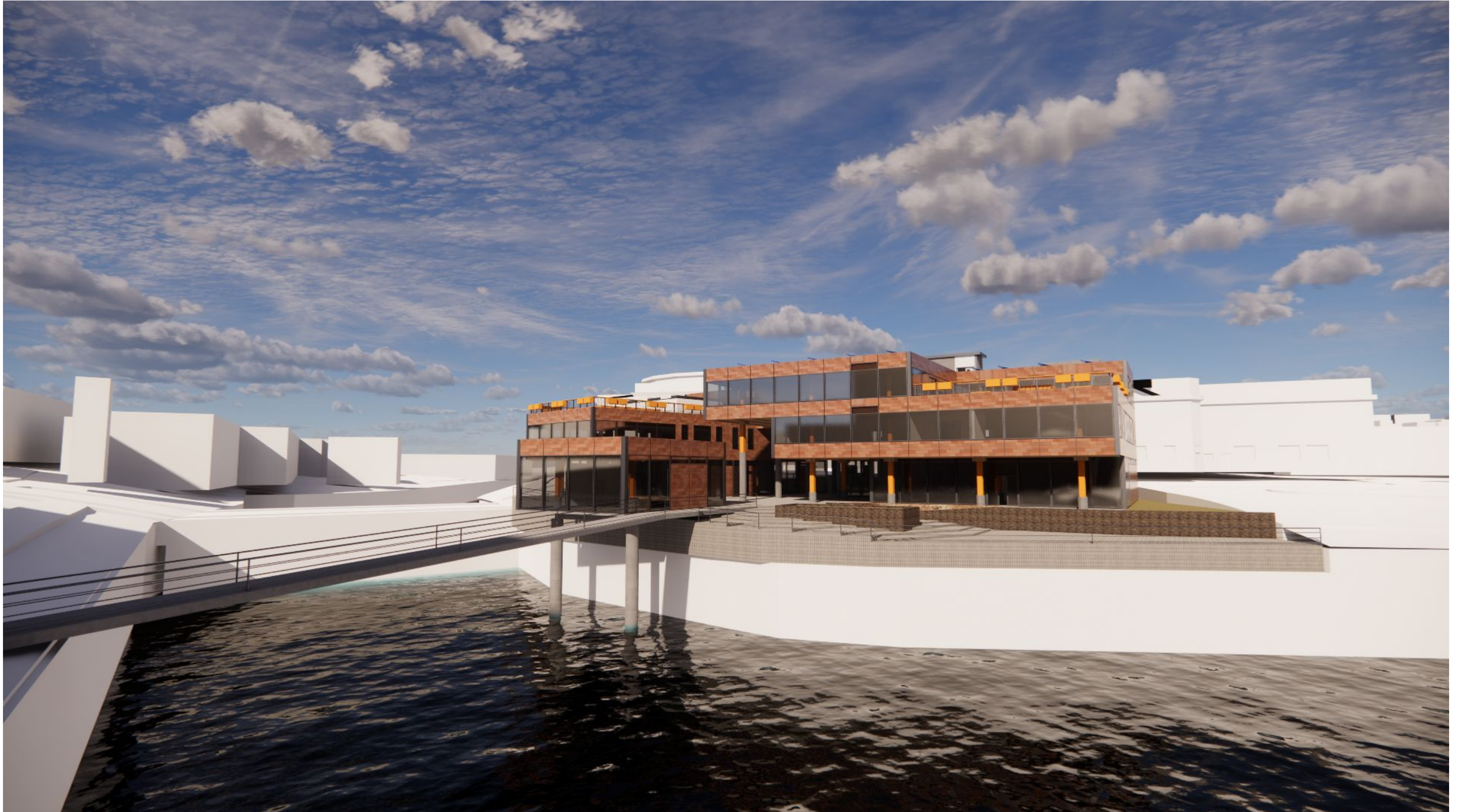
Birds Eye View



Responding Back to our Nodes



Utilizing the River



Thank You