Rory

Fitzpatrick

Zero Energy Office

For my thesis project I designed a zero energy spec office building in downtown Jackson, MS. The site is located on W Amite St. and N Gallatin St. just west of the center of downtown. The area along N Gallatin St. is being redeveloped into a tech district for the City of Jackson.

This would be one of thirteen zero energy buildings in the southeast and the first in Mississippi. Zero energy buildings present a challenge to the southeastern United States due to the cooling and dehumidification needs of buildings in the summer.

In order to reduce heat gain for the building overhangs were implemented on the dominant southern facade. Operable triple glazed Low-E windows were specified to reduce heat gain and allow for natural ventilation on mild days.

660 Solar panels line the roof and overhangs to produce more electricity than the building is projected to use annually.

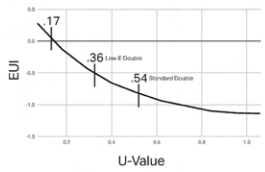
A ground source heat pump system is buried in the rear yard of the office. The ground loop supplies cooled water for three air handling units inside of the building. This provides cool air to the building in the most efficient way available.

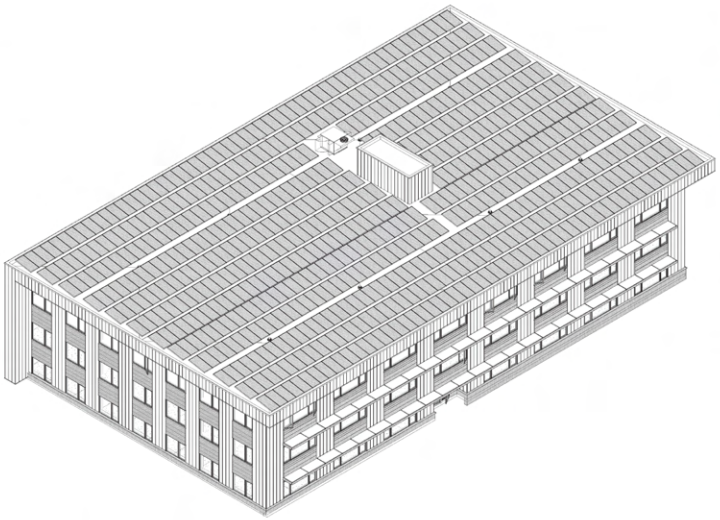
Glazing

Operablility

Eeast/West **37.5%**

North/South **44%**



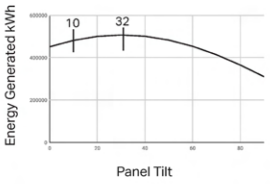


Solar Panels

516,581 kWh/yr

614 Panels on Roof

46 Panels on Overhangs



Average Office Site EUI

53 kBTU/Sq.Ft. /Yr

Source: EnergyStar Portfolio Manager

vs.

Baseline Site EUI

34 kBTU/Sq.Ft. /Yr

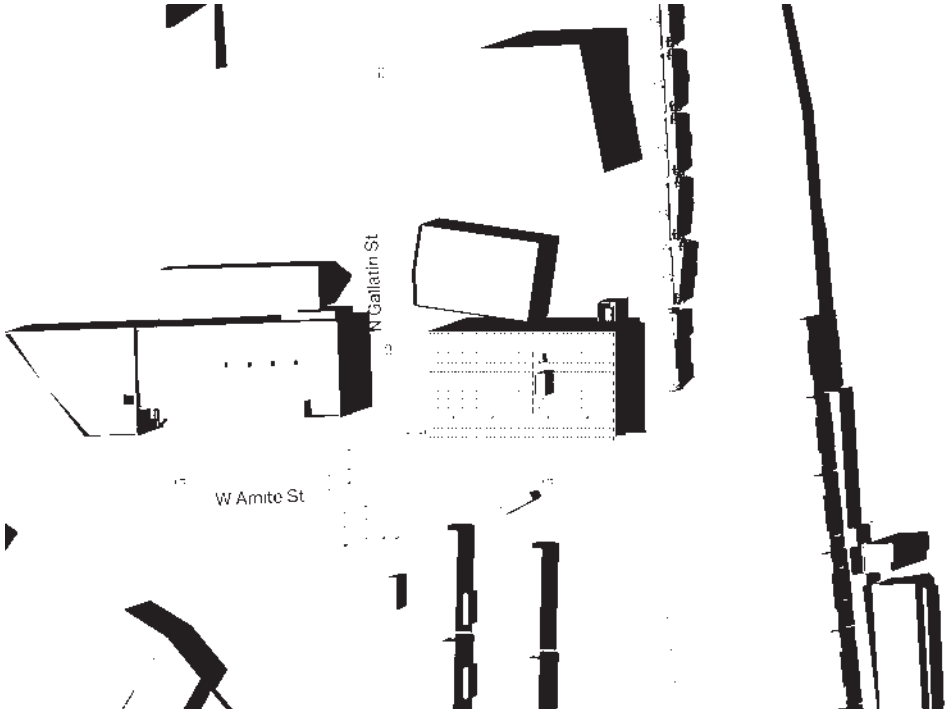
Total Energy Use 409,810 kWh/yr

Photovoltaic Offset

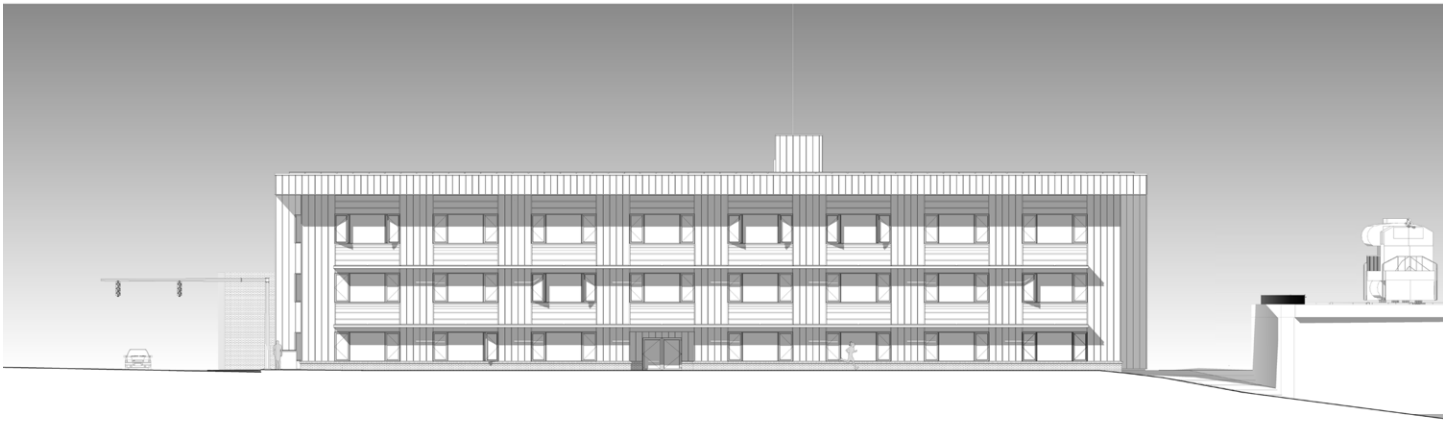
-3 kBTU/Sq.Ft. /Yr

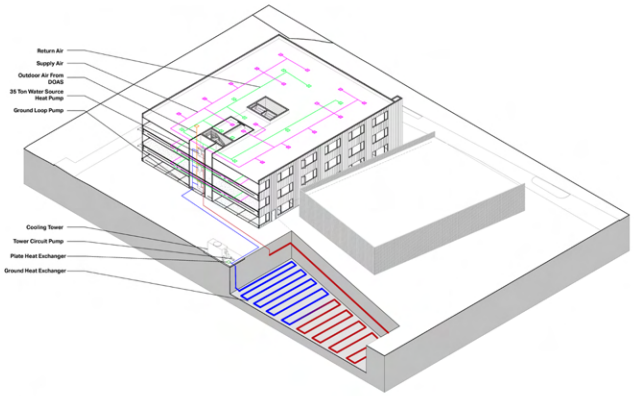
Natural Ventilation Offset

-8 kBTU/Sq.Ft. /Yr

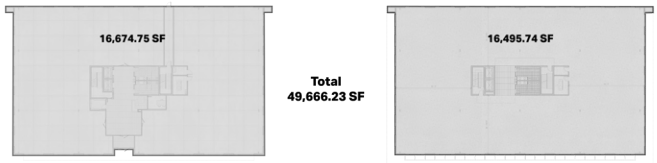


Top
Diagram showing energy use data
Bottom Left
Rendering looking west on Amite St
Bottom Right
Site Plan

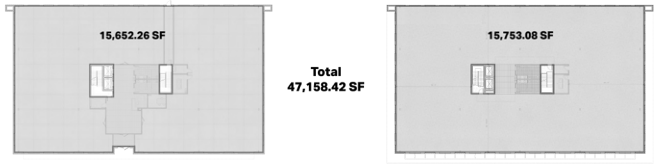




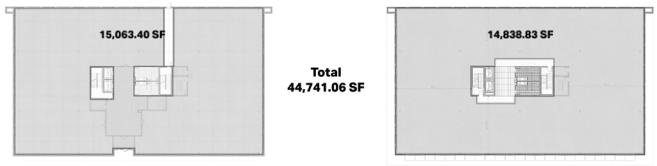
Gross Building Area



Rentable Area



Usable Area



Floor Rentable/Usable Ratio

First Floor: 1.04 **Total: 1.05** **Typical Floor: 1.06**

Program Break Down

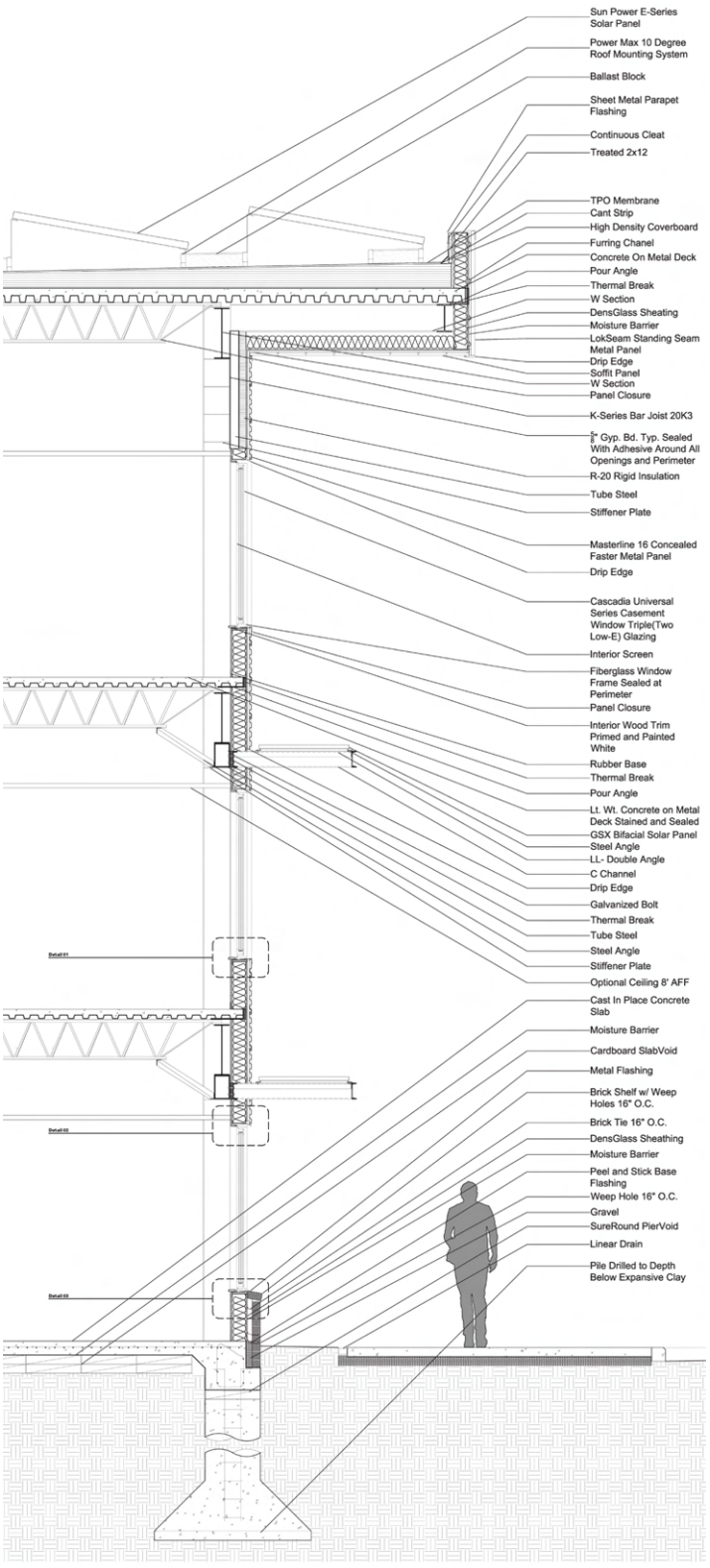
First Floor:

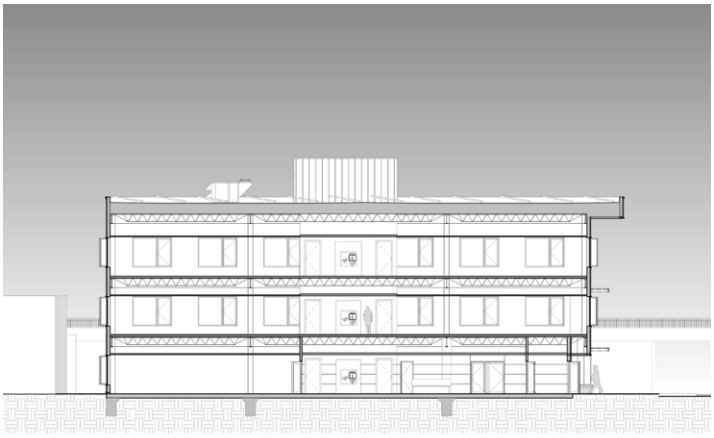
Vestibule	**112 SF**
Lobby	**897 SF**
Office	**110 SF**
Storage	**74 SF**
Men's Restroom	**144 SF**
Women's Restroom	**144 SF**
HVAC	**121 SF**
Janitor	**56 SF**
Shell Office	**13,422 SF**

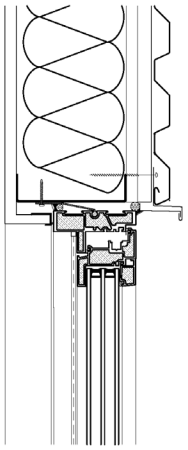
Typical Floor:

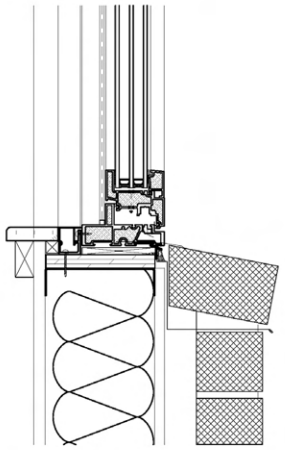
Lobby	**263 SF**
Men's Restroom	**144 SF**
Women's Restroom	**144 SF**
HVAC	**121 SF**
Server	**56 SF**
Shell Office	**14,773 SF**

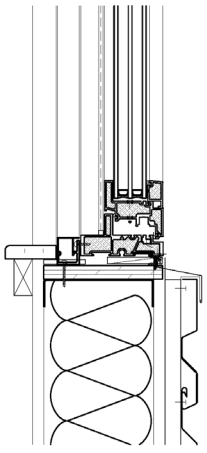
Top
South Elevation
Middle
West Elevation
Bottom Left
Mechanical Diagram
Bottom Right
Square footage calculations

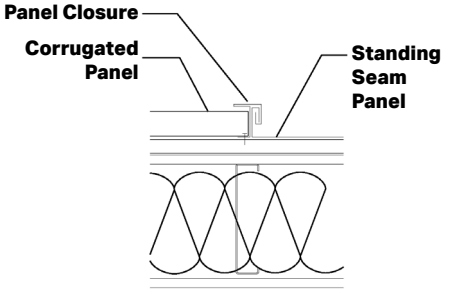






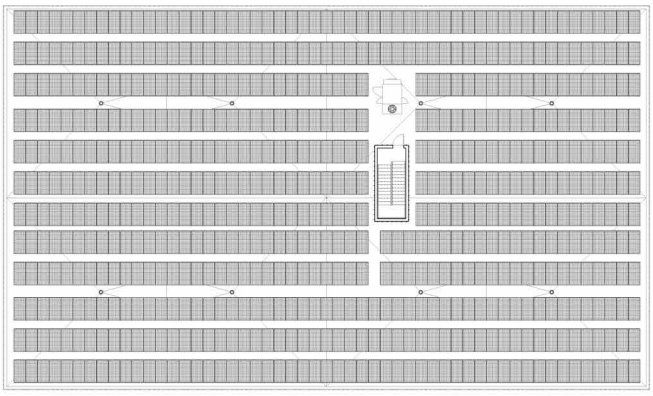




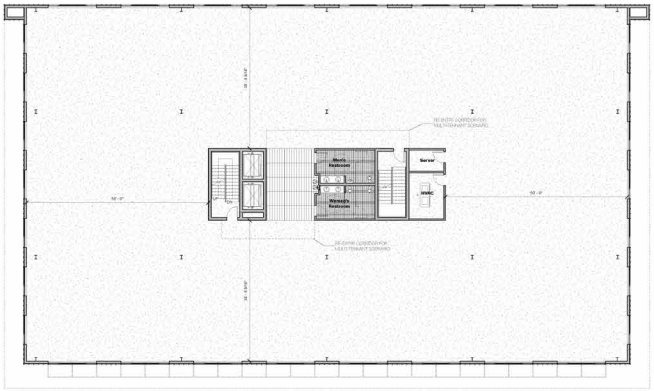


Left
Wall Section
Top Right
Building Section
Bottom Right
Enlarged Details

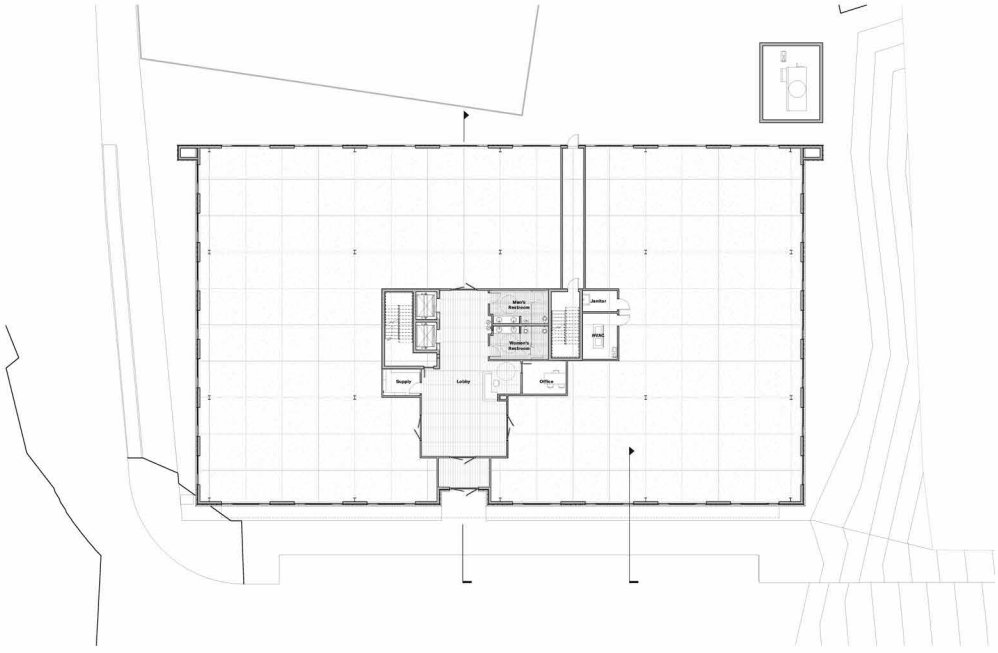
Roof Plan

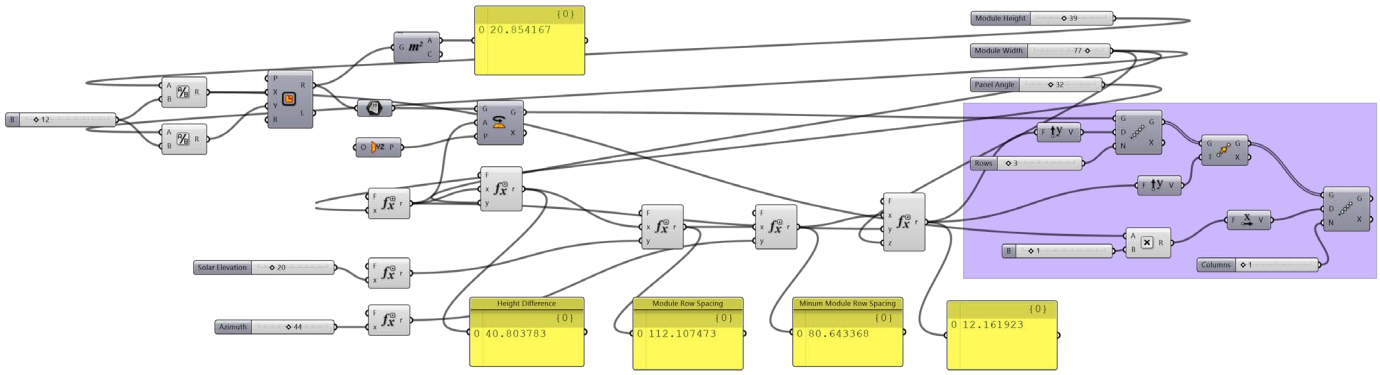


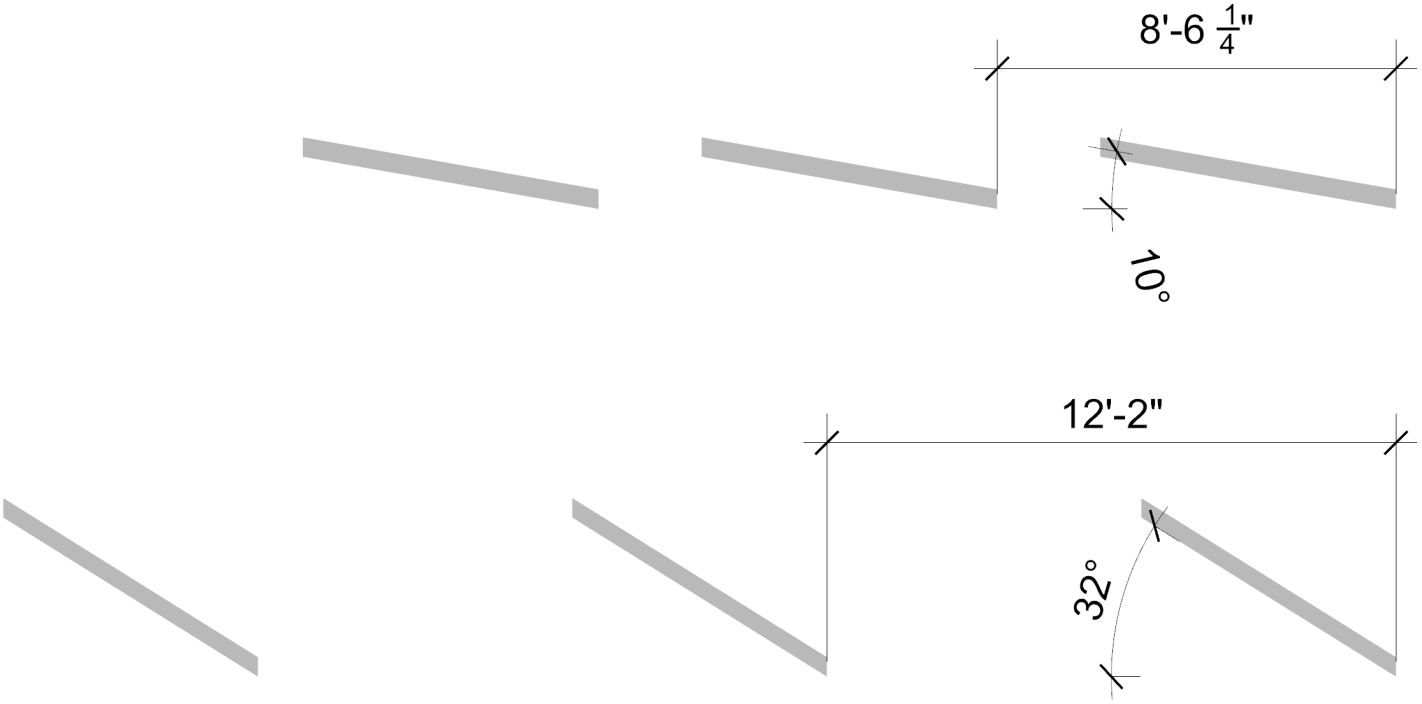
Typical Floor Plan



First Floor Plan

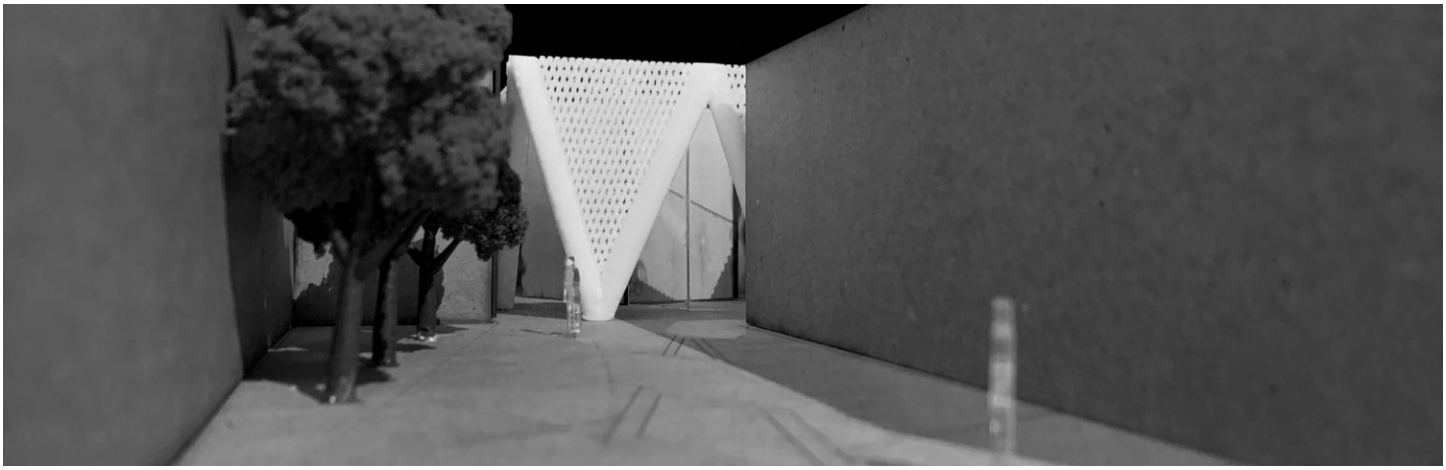






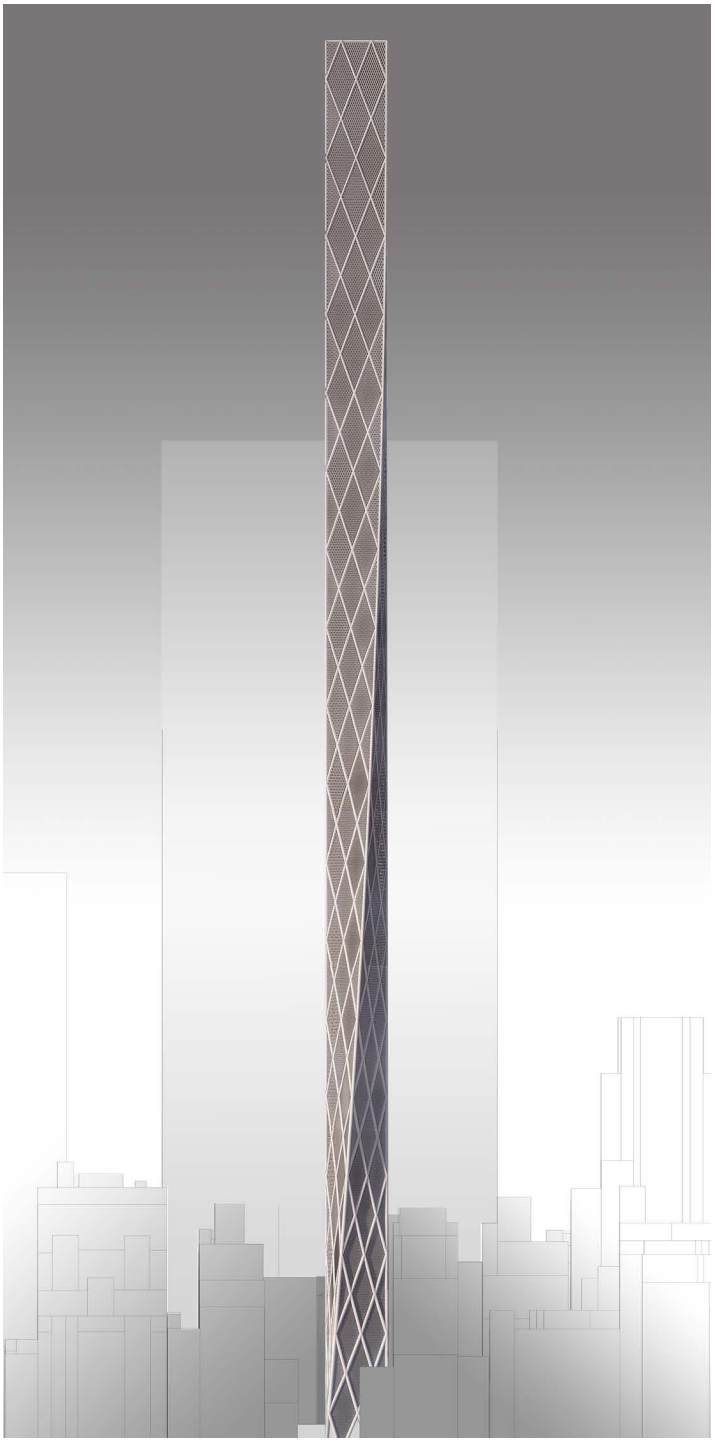
Above
A grasshopper script designed to determine the amount of space needed between rows of solar panels. If proper space is not allowed panels will cast shadows on each other reducing the amount of energy produced. 32 degrees is the optimal angle for Jackson, MS, the same as it's latitude, but a 10 degree angle allowed for more panels to be placed on the roof increasing overall energy production.

Manhattan Skyscraper

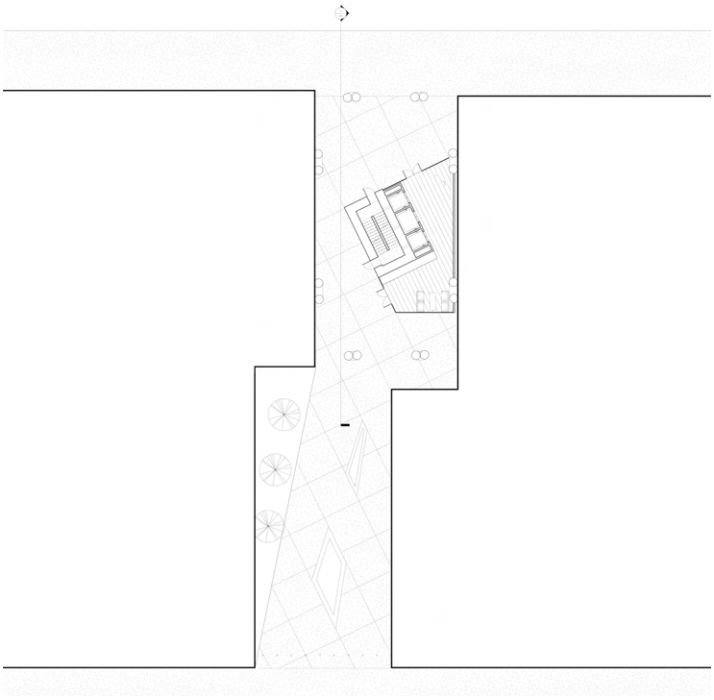


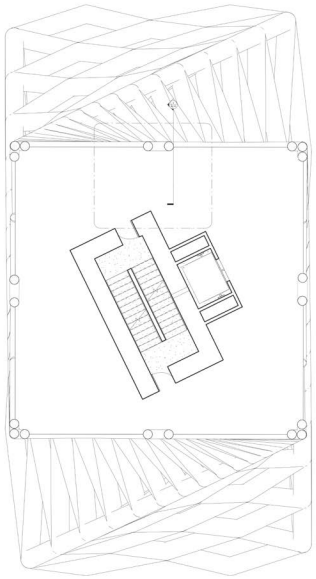
After a field trip to New York City, I was tasked with designing a skyscraper on Billionaires' Row in Midtown Manhattan.

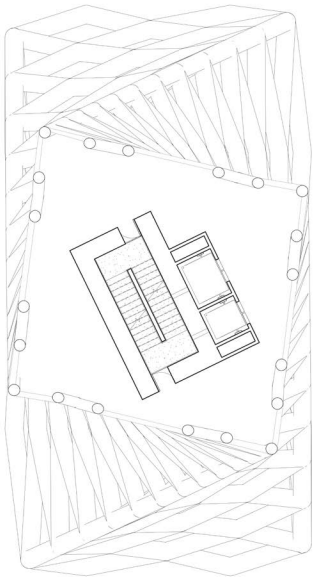
The main objective was to design a shell building that met local NYC zoning laws. I chose to make a residential tower that minimized floor area on lower floors and maximized floor area on the upper floors which had a view of Central Park to the north and lower Manhattan to the south. A mullion system was designed alongside to shade the southern facade and allow in more light on the northern facade. These objectives were accomplished through parametric modeling in grasshopper.

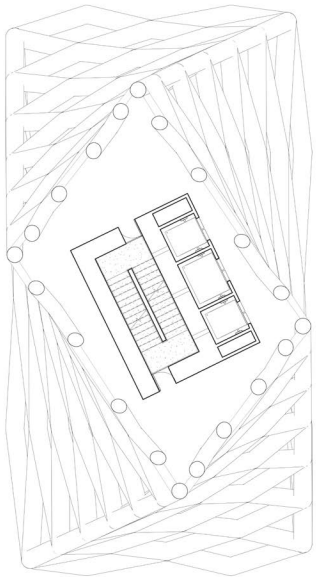


Left
South Elevation
Right
North Elevation

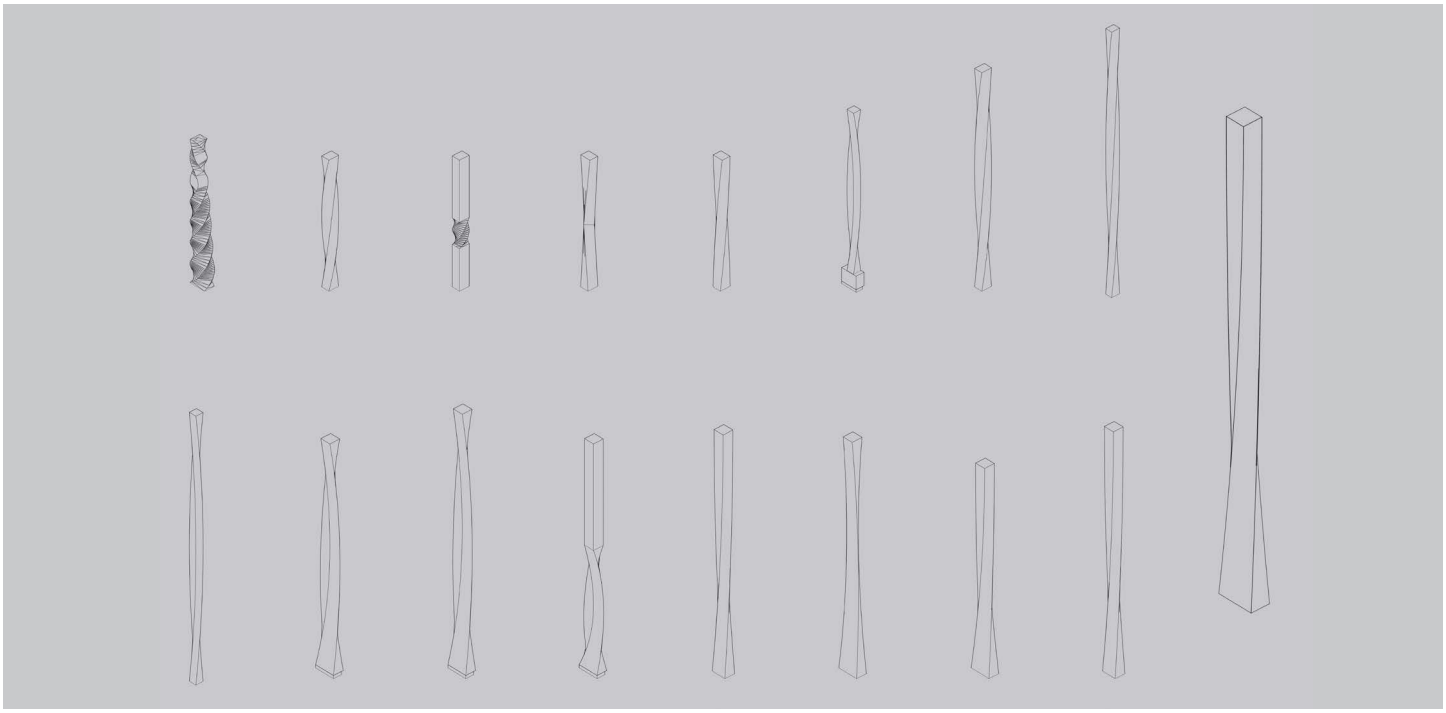


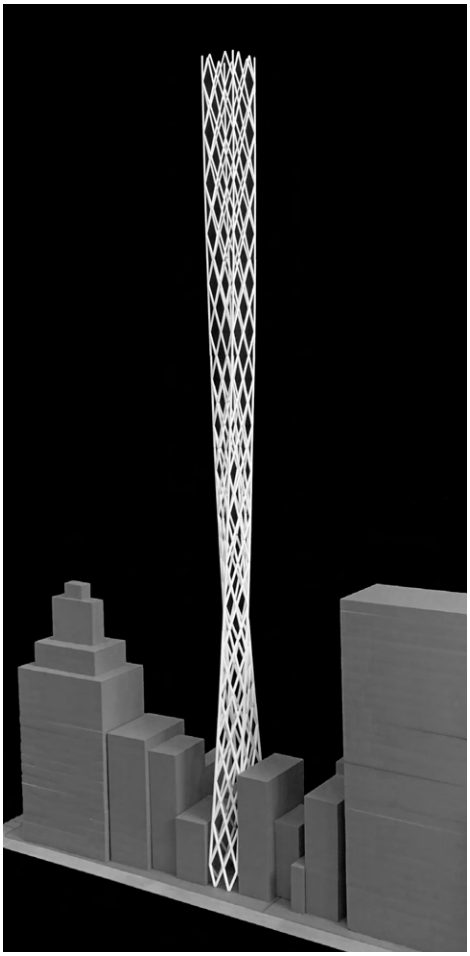


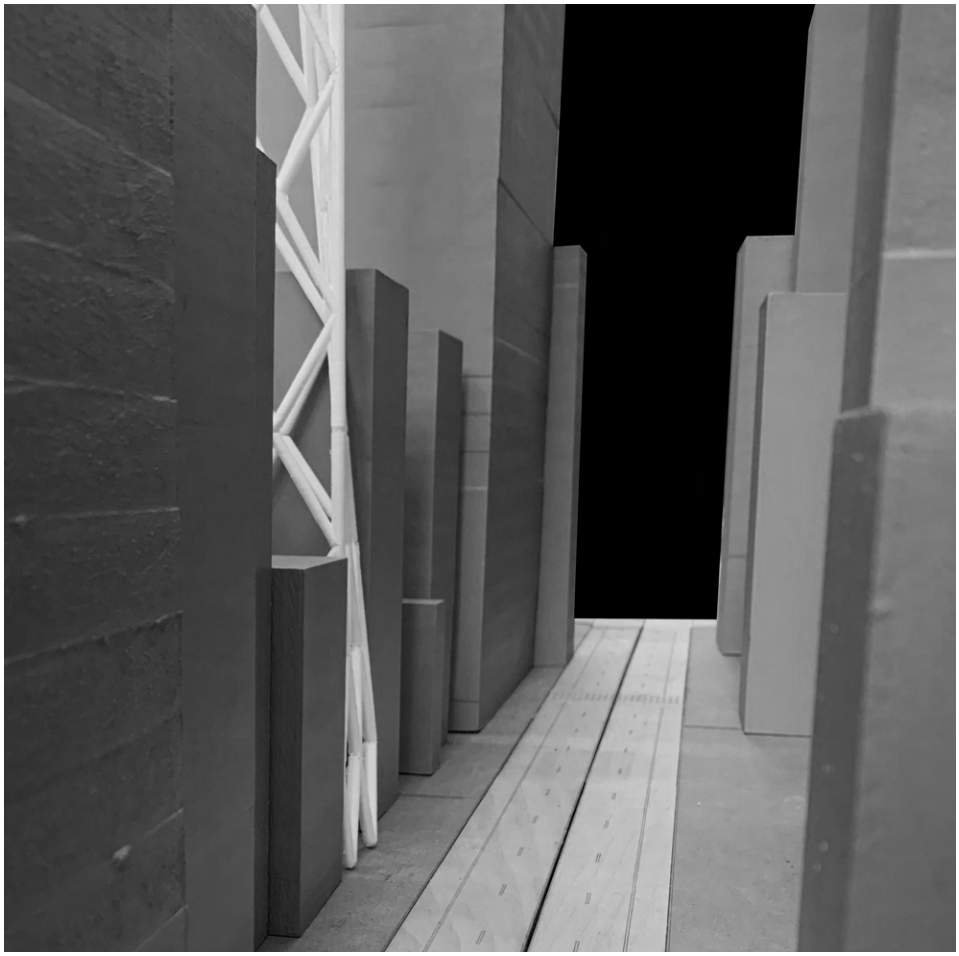




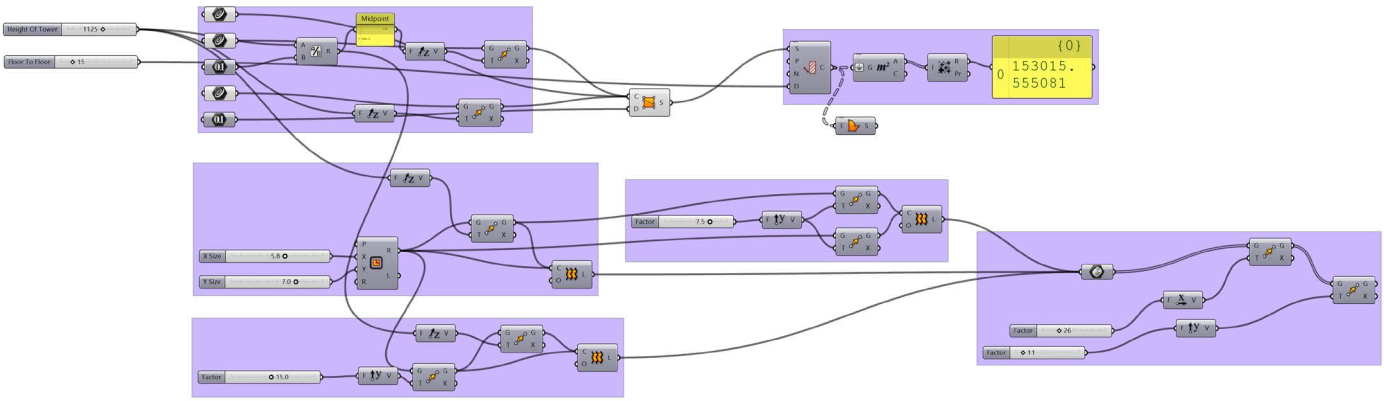
Top Left
Ground Floor Plan
Top Right
Largest Floor Plan
Bottom Left
Typical Floor Plan
Bottom Right
Smallest Floor Plan

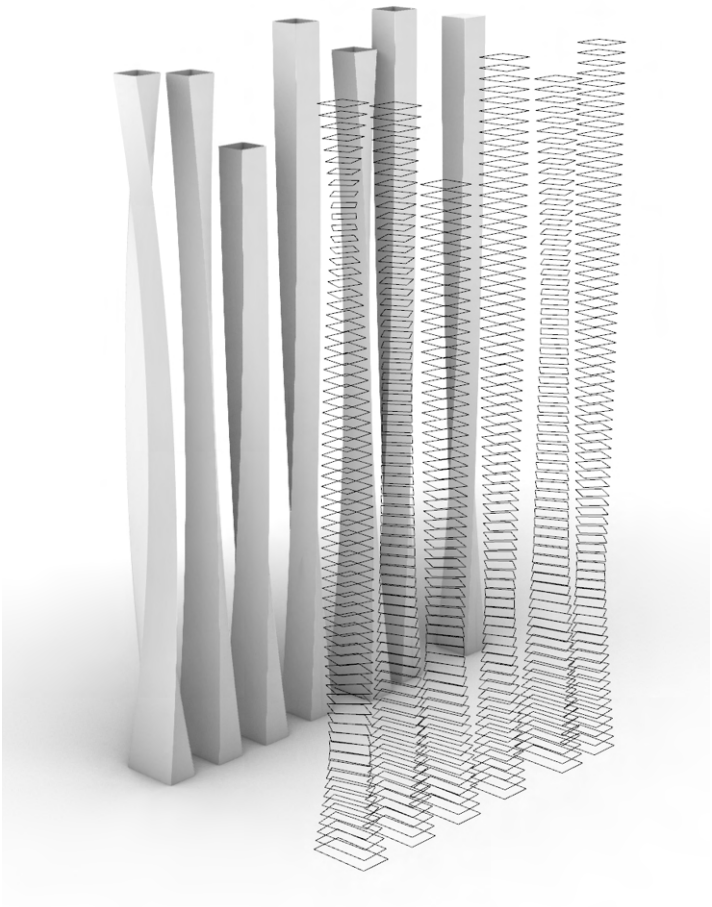






Top
Form Studies



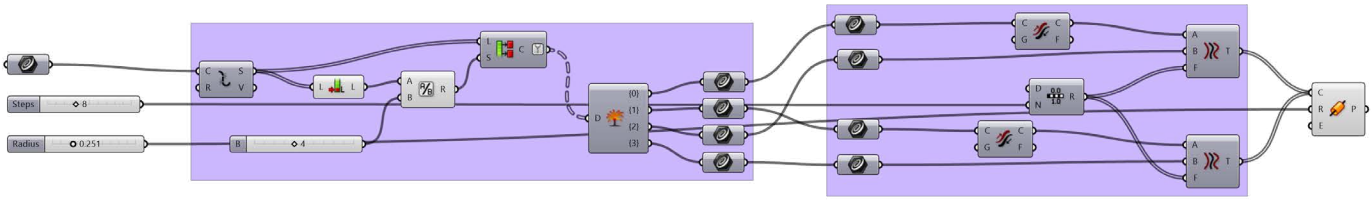


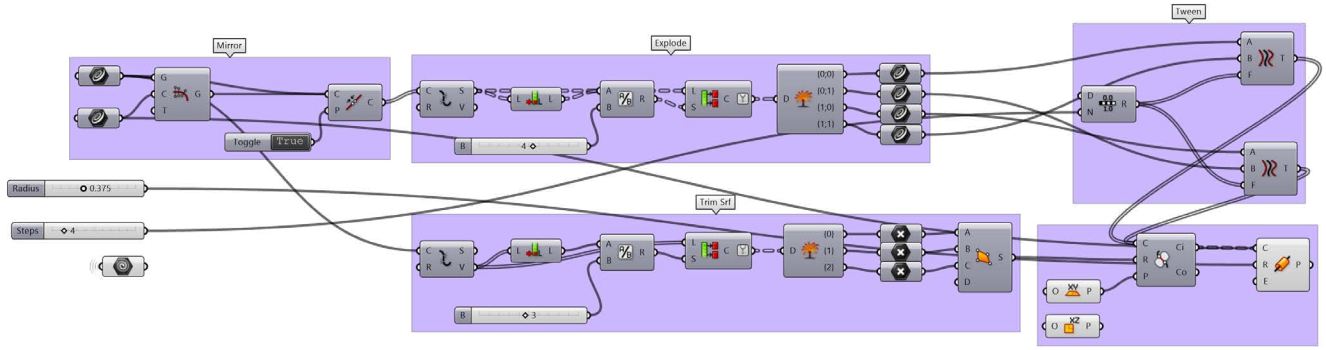
Left

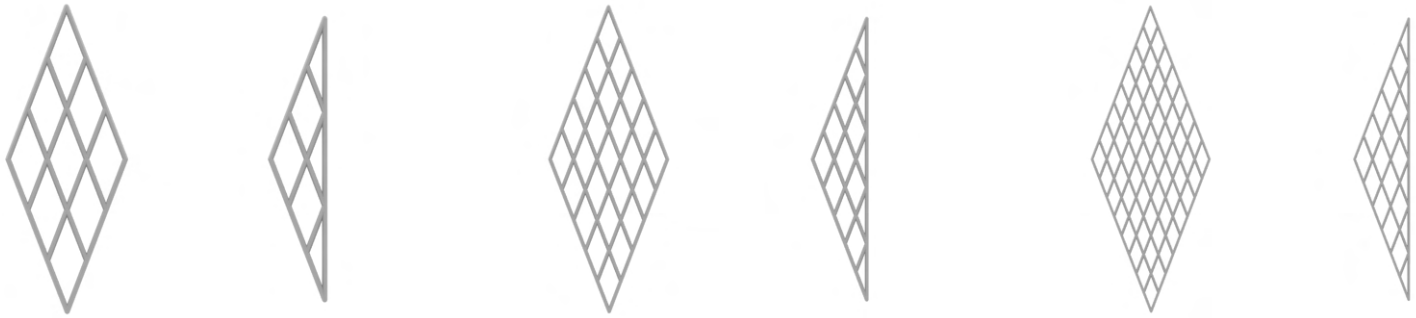
A grasshopper script was designed to help generate massing options. The script takes into account New York City zoning laws like setbacks, floor area ratio, and building square footage. The script works by lofting a set of rectangles to form a mass, then contouring the mass into floors at a set interval which are then used to calculate the masses gross square footage. Examples of forms generated using the script are shown beneath the script.

Right

After a form was decided each facade was subdivided into diamonds using Paneling Tools. Each diamond panel was assigned a value indicating the panel's orientation. If the panel faced more towards the north it would eventually have less mullions allowing more light in. If the panel faced south it would have more mullions allowing less light in. A script was then written that subdivided each panel with the desired amount of mullions. A second script was required to deal with the half diamond panels which exist on the corners of the structure.


Steps
8
Radius
0.251
4

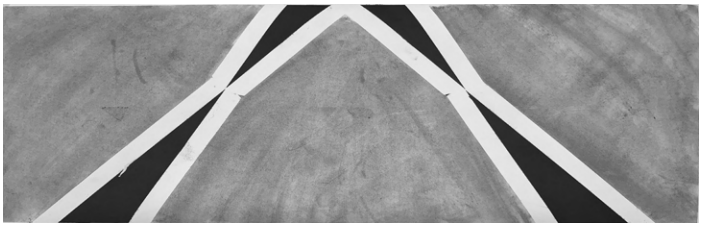

Mirror
Explode
Tween
Trim Srf
Toggle
True
Radius
0.375
Steps
4
4
3

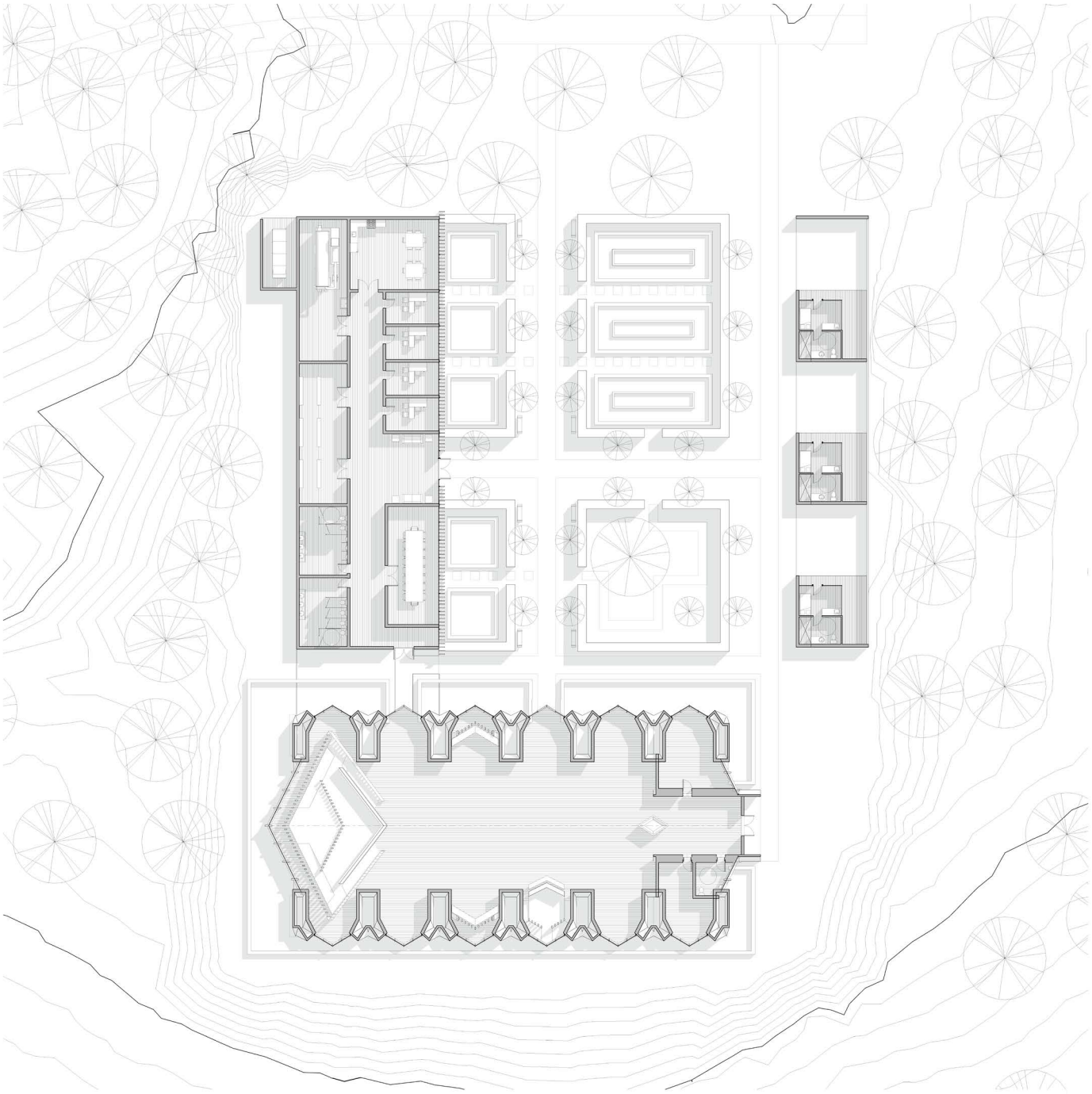


House of Worship

A mass timber worship hall designed for a future residential community in Hernando, MS.

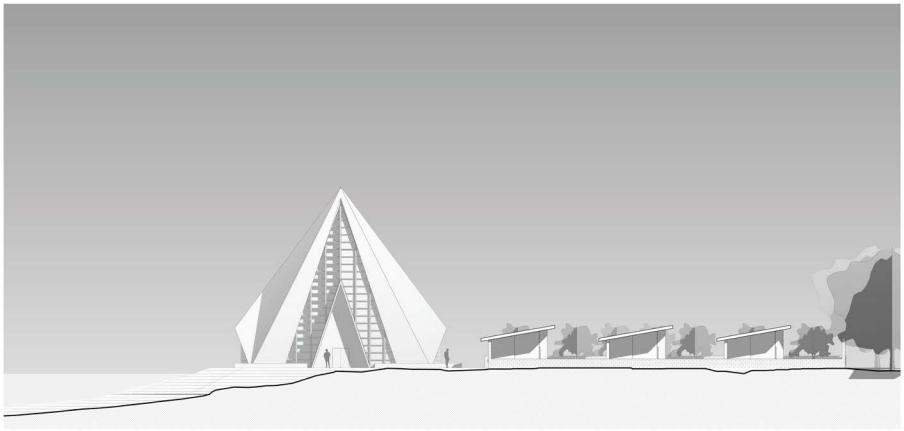
Three main structures are situated around a garden courtyard used for reflection and a community garden. The main worship hall is a double-shelled structure creating a monolithic form on the exterior and a series of side chapels on the interior. The worship hall is designed on two axes the main East/West starts in an entrance vestibule and terminates with the main altar, while the minor North/West axis starts in the garden and terminates at a smaller altar intended for blessing food grown in the community garden.



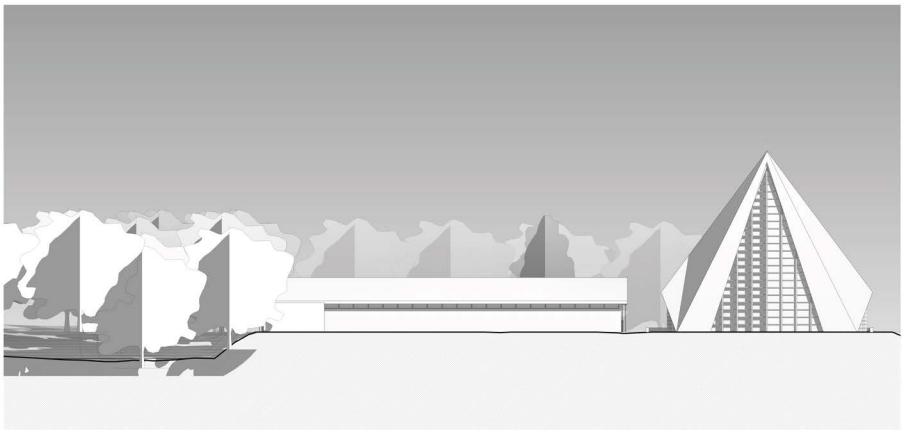


Top
Conceptual Charcoal Drawings
Above
Floor Plan

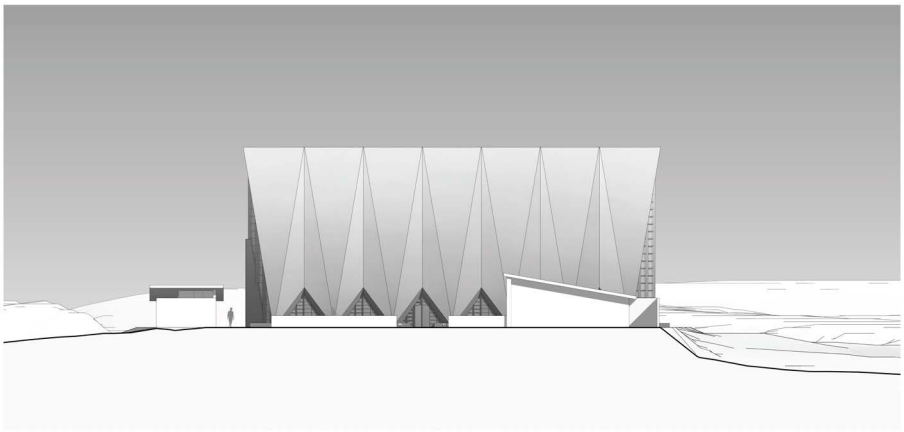
East Elevation



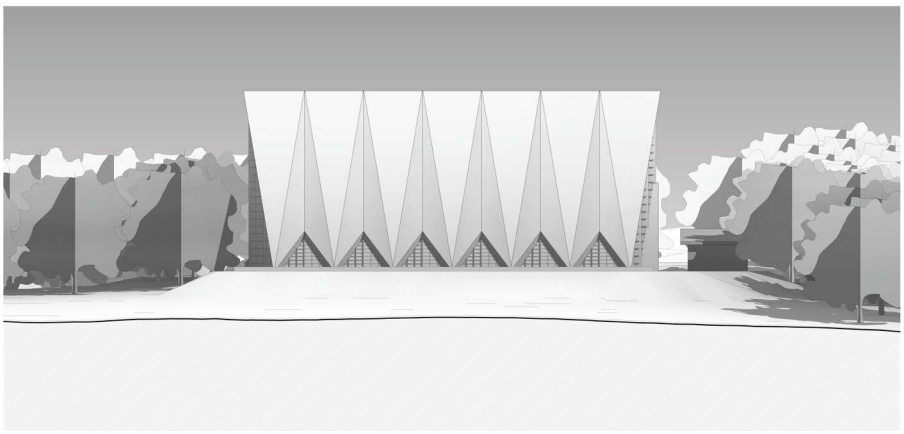
West Elevation

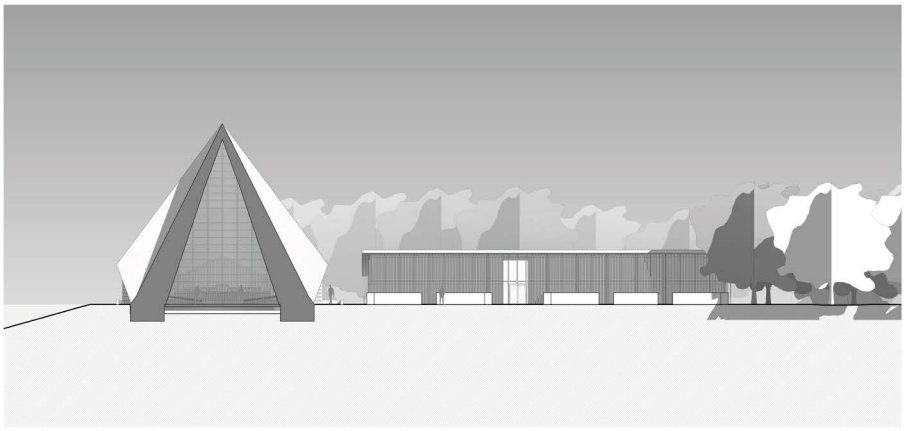


North Elevation

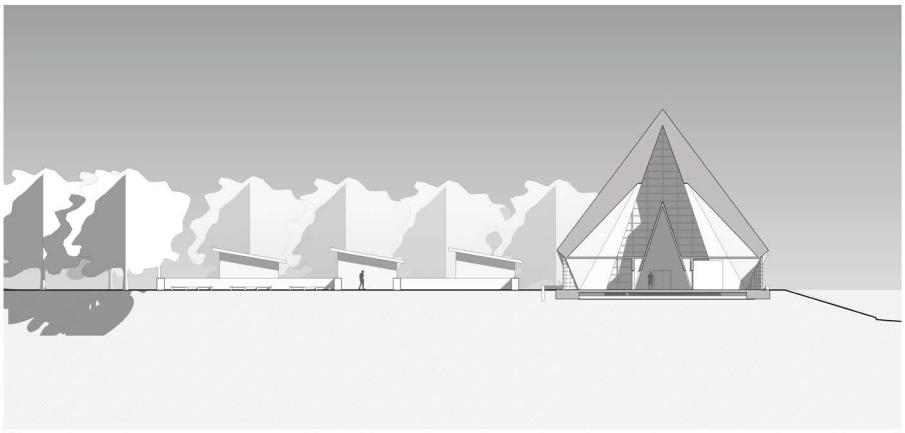


South Elevation





Section Through Nave

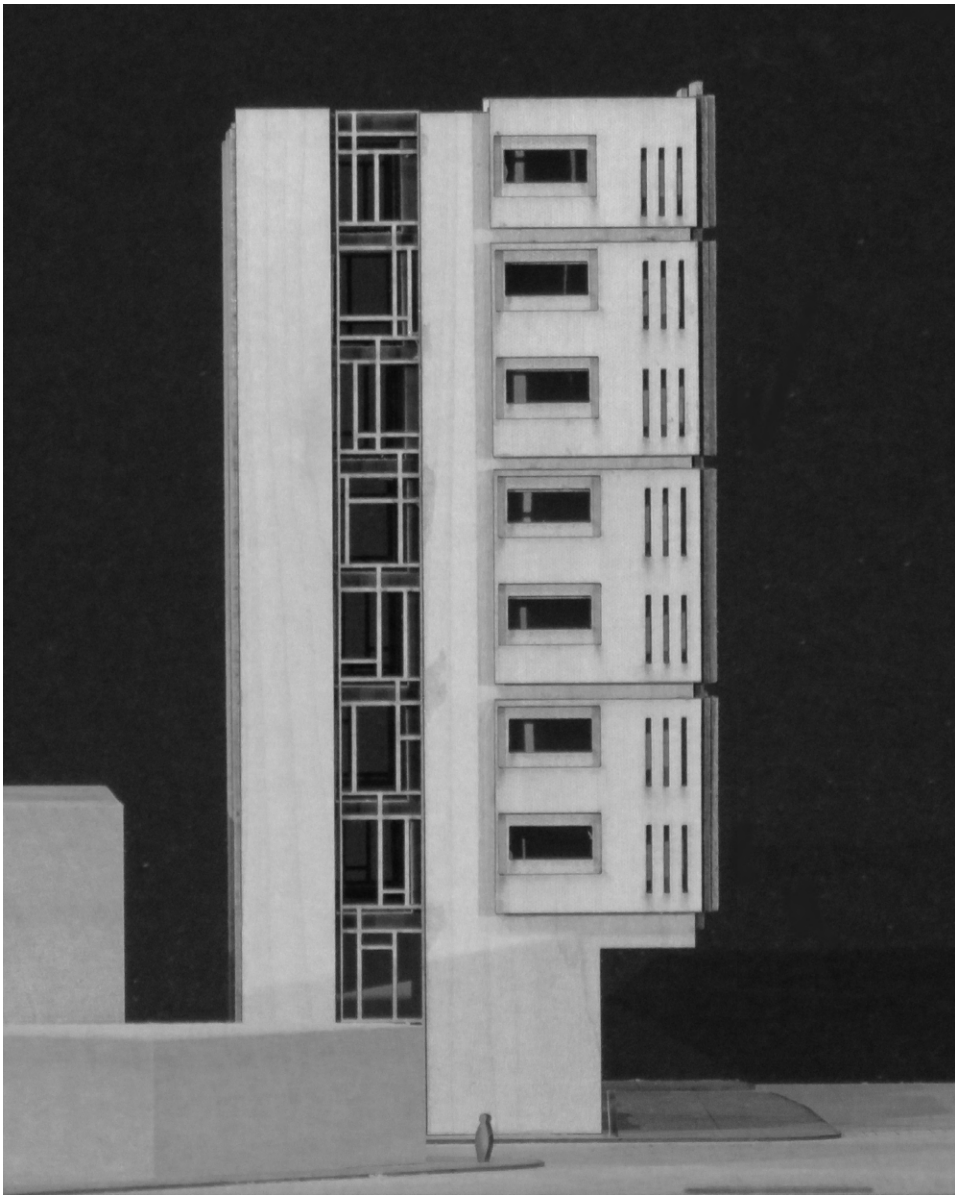


Section Through Side Chapel

Interior Rendering

Exterior Rendering

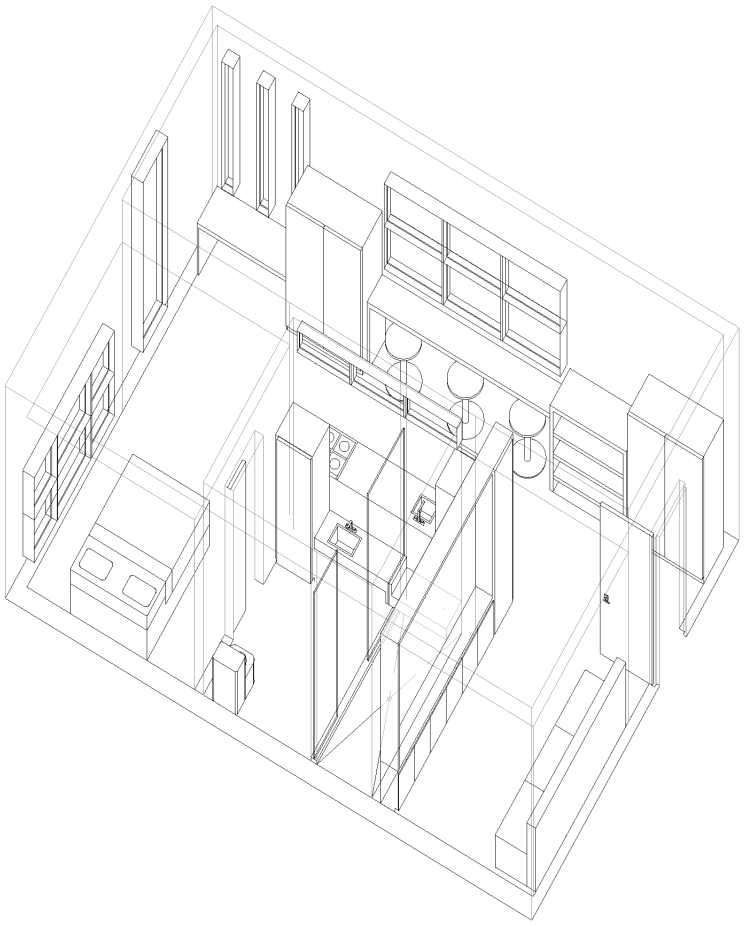
Chicago Apartments

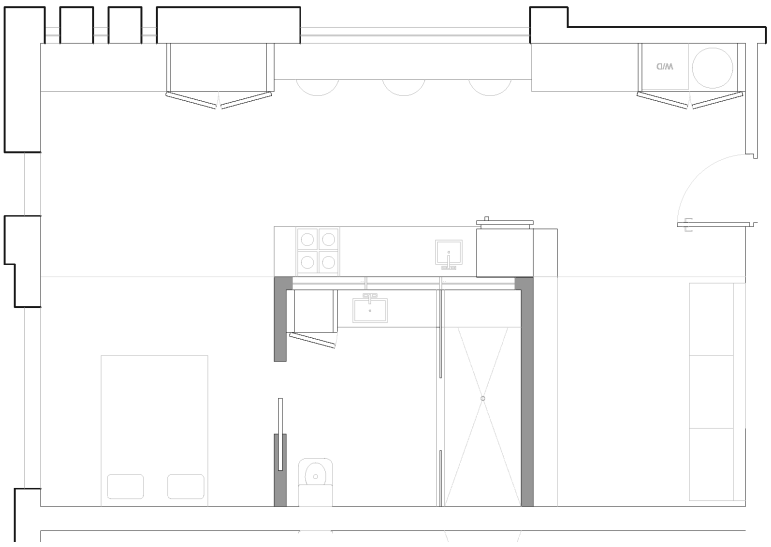


After a field trip to Chicago in my third year of school, I designed an apartment building for young professionals on the corner of Grand Ave. and Halstead St.

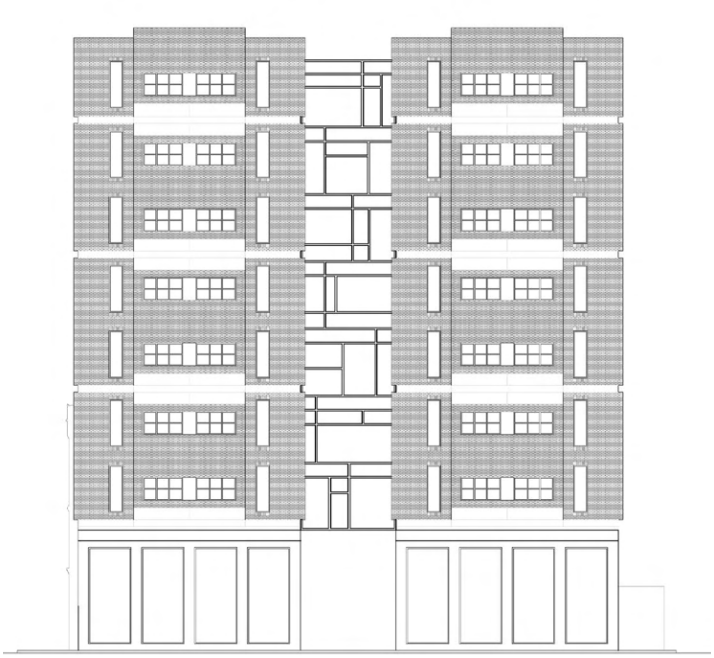
My focus during this semester was to design a roughly 500 sq. ft. unit which met ADA requirements and could be replicated to create a building which met egress requirements of the IBC.

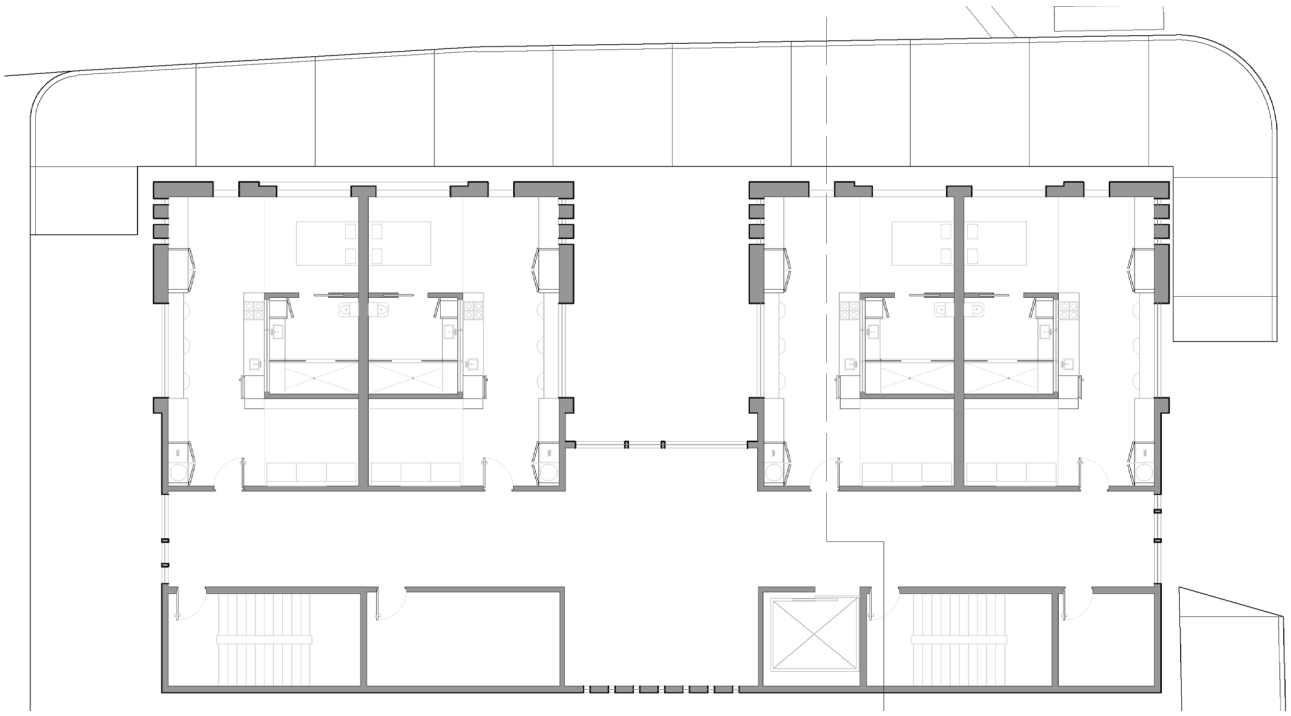
The unit was designed as a studio apartment that used a central bathroom core to separate the spaces within, similar to the Farnsworth house which I visited while on the field trip.



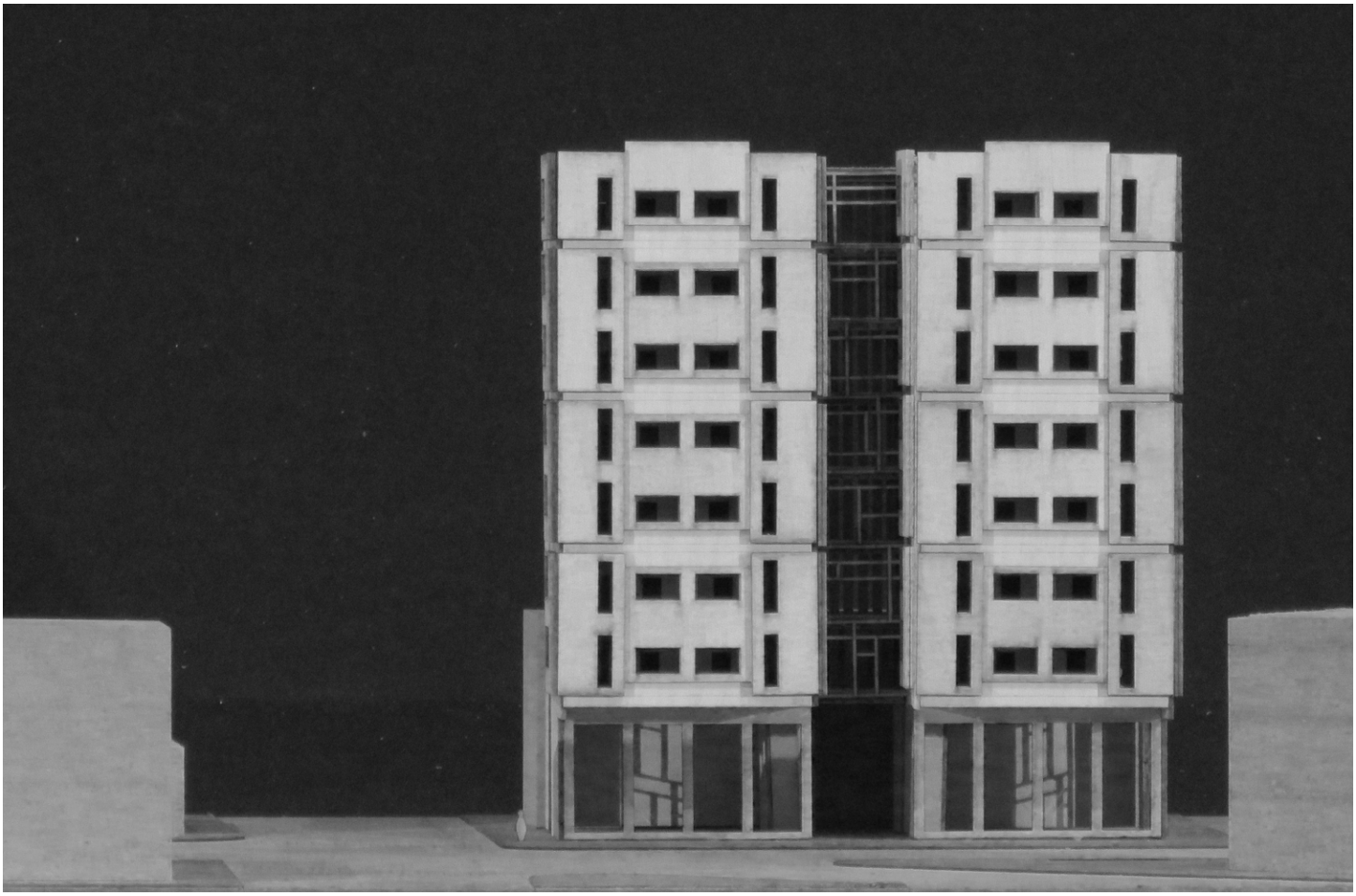


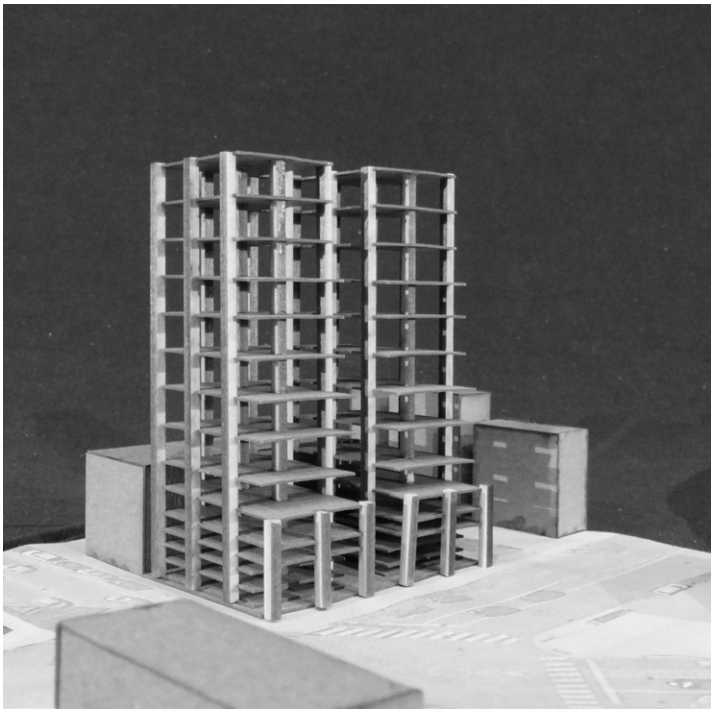
Top
Unit Plan Axonometric
Bottom
Unit Plan





Top Left
North Elevation
Top Right
East Elevation
Bottom
Typical Floor Plan





Bottom Right
Conceptual Model