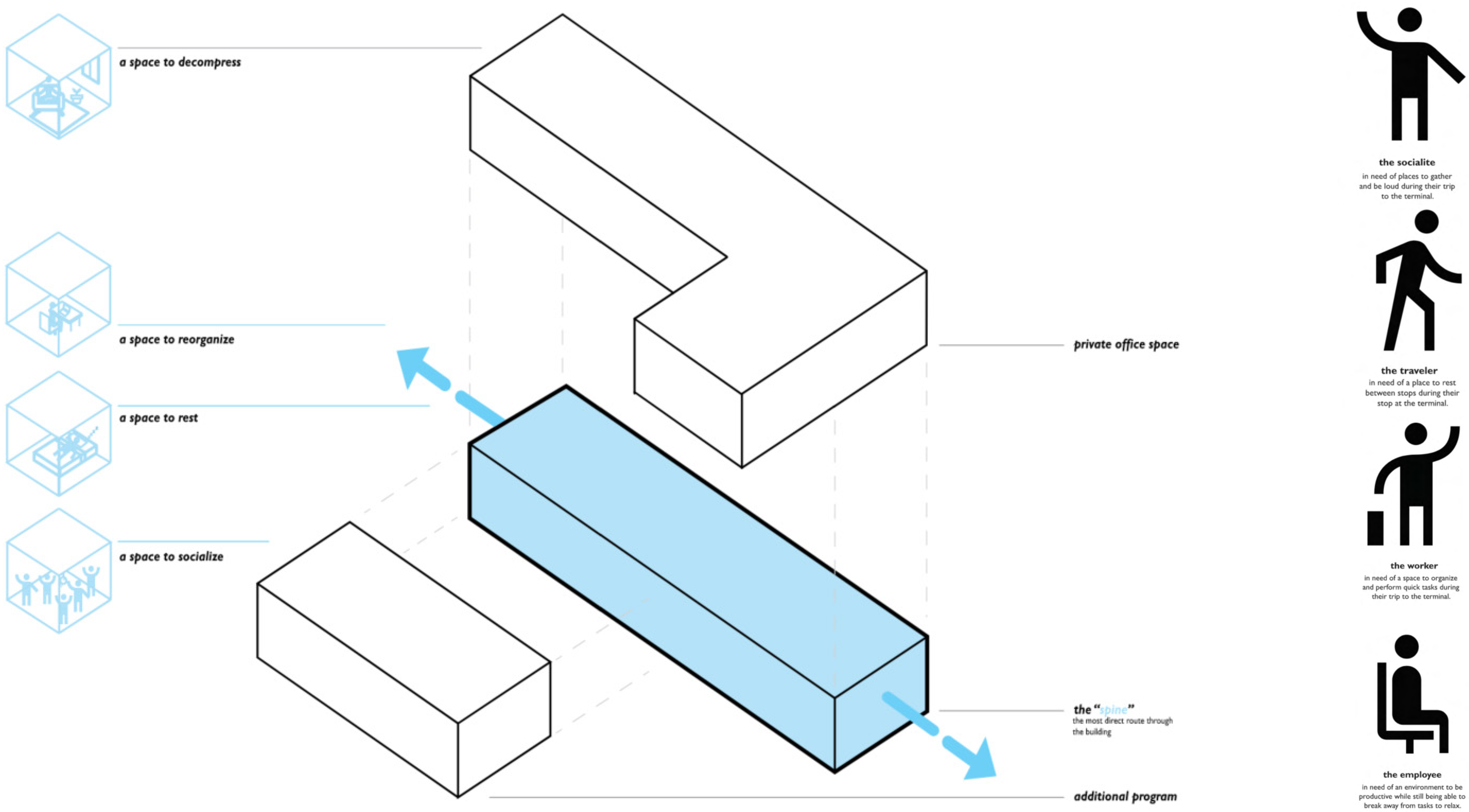
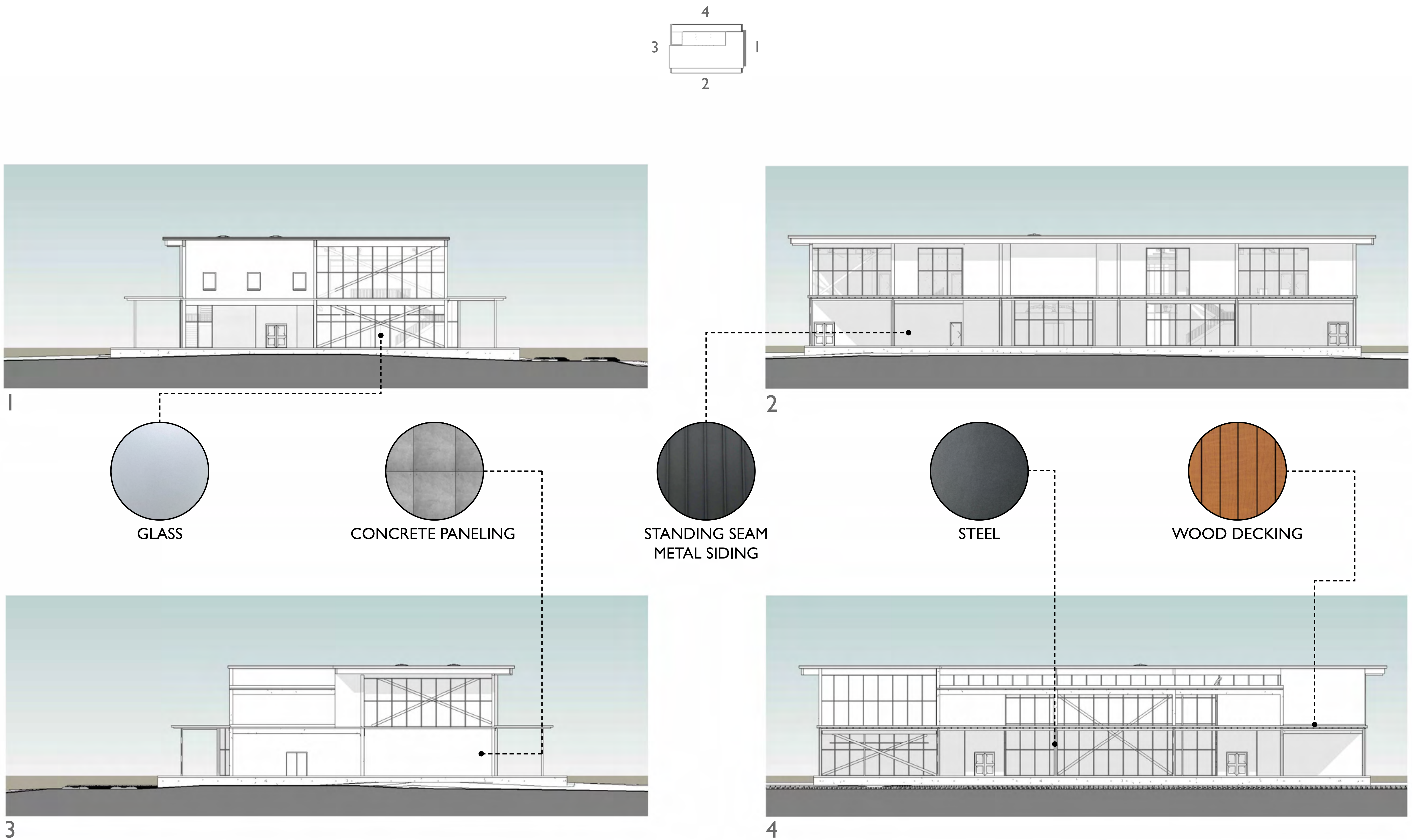
EDMOND MULTIMODAL TRANSIT HUB

HONORS THESIS
JILLIAN CORDRAY



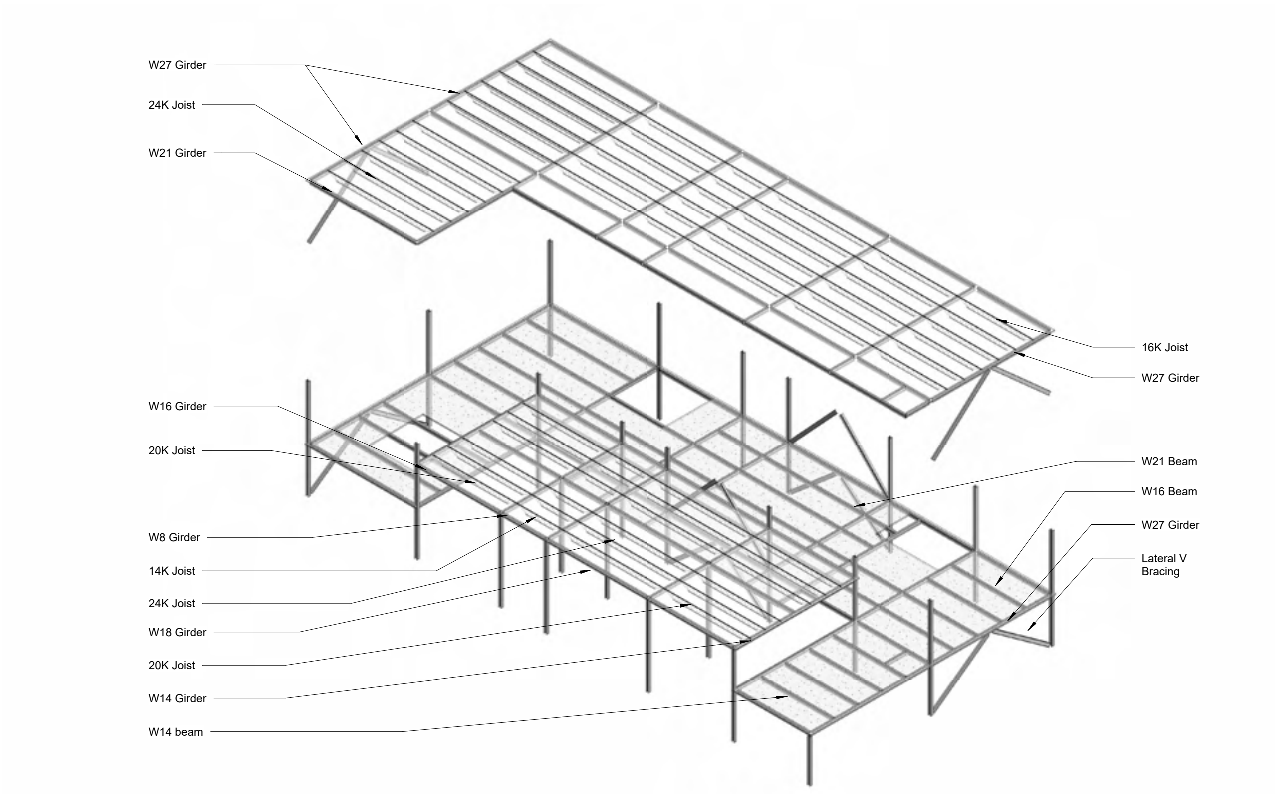
CONCEPT

The initial concept of the EMMTH started with the humans who would be using the building. The proposed program included spaces for shoppers, travelers, workers, and employees, all of whom needed quick access to their respective spaces. The building form took on a spinal structure, with one linear space in the middle that could ferry people to and from their destinations. The form remained a two story structure to better blend in with the surrounding environment of Downtown Edmond.



ELEVATIONS AND MATERIALS

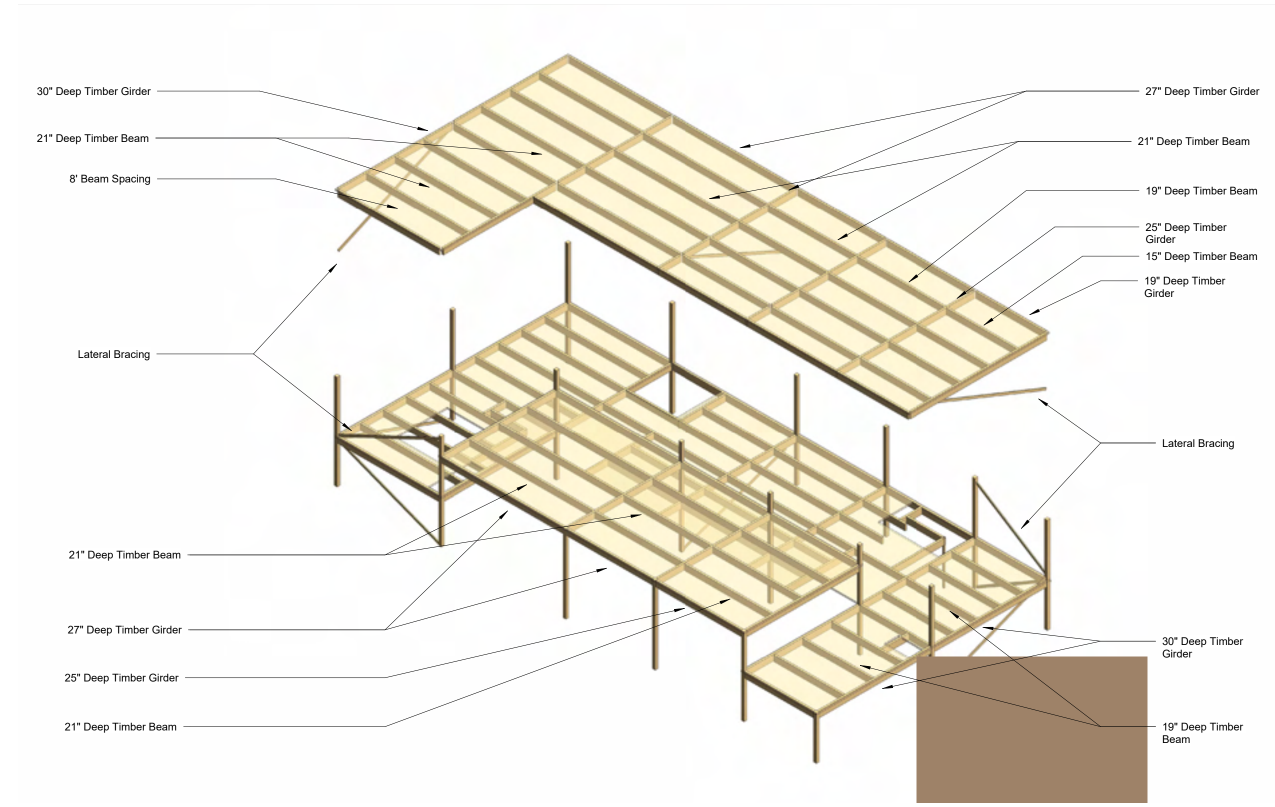
The concept of the project pushed the team to look at the vernacular architecture surrounding the site, which influenced the decision to use materials such as metal siding, wood, and concrete paneling. All of these materials were references to the surrounding area, where many buildings were made of sheet metal, wood, and concrete block.



STRUCTURAL SYSTEM 1: STEEL

The first option explored was a steel structural system. It is comprised of composite steel beams to support the first and second floor. The framing will be composed of w-shaped steel beams for both the columns and the floors with a span range between 20' – 40' to achieve maximum efficiency. The roof would be composed of steel joists. Columns are placed in the middle of the main lobby to maintain strength. The lateral force resisting system will be steel inverted V-braces and diagonal braces on different sides of the building where some will be visible.

PROS	CONS
- Long spans	- Good conductor of heat
- High strength and lightweight	- Subject to rust
- Durable	

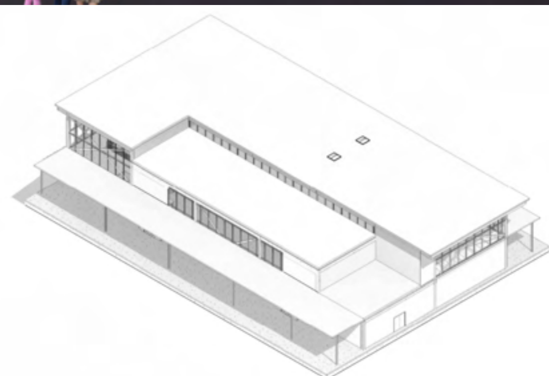


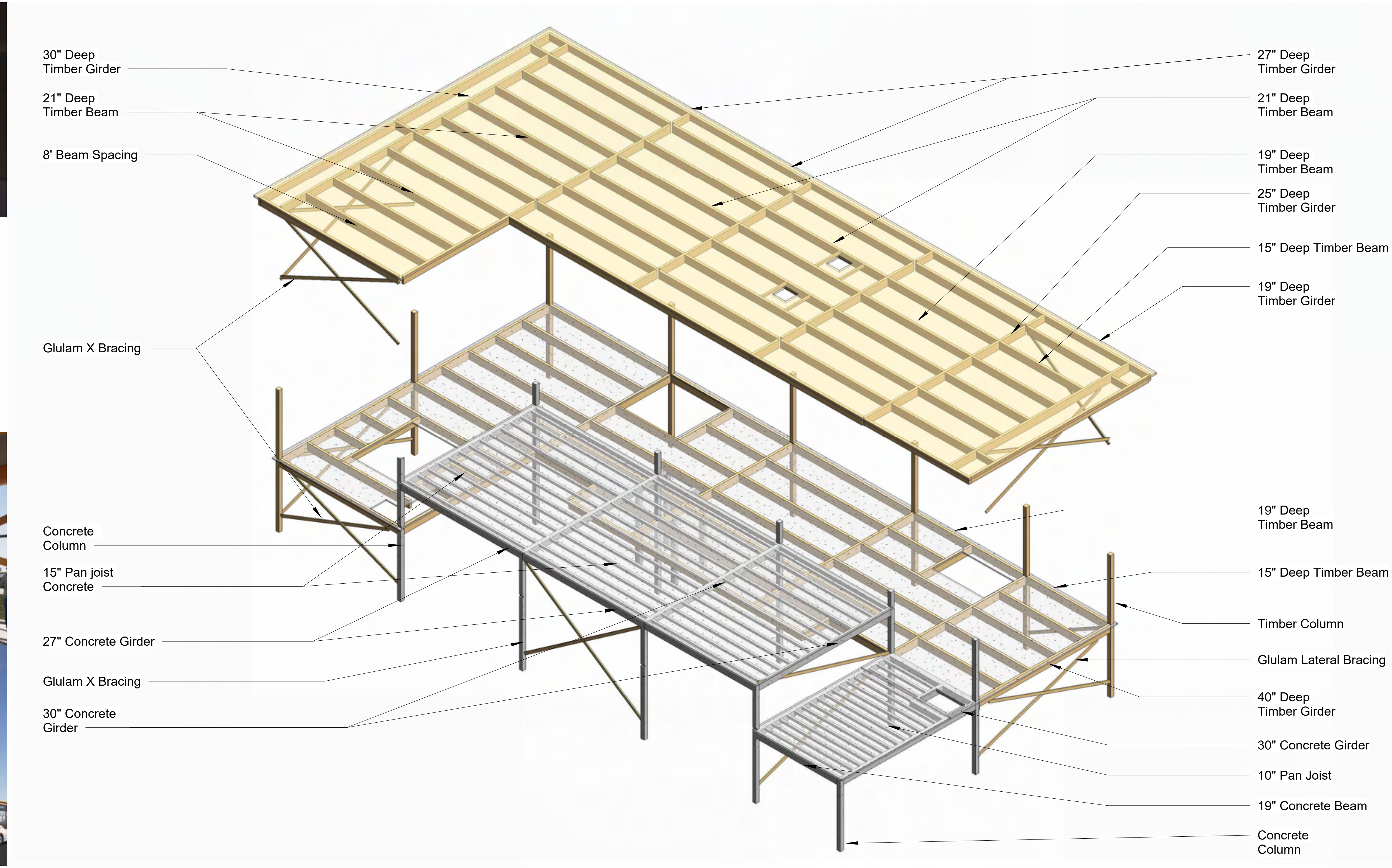
STRUCTURAL SYSTEM 2: HEAVY TIMBER

The second structural system considered was heavy timber. The system would be constructed with glue laminated timber beams and timber columns and the lateral forces would be taken by diagonal brace framed timber members located at the corners and in the center east side of the building.

PROS	CONS
- Lightweight	- Risk of fire and maintenance
- Faster construction	- Building code limitations
- Sustainable	- Additional members may be required

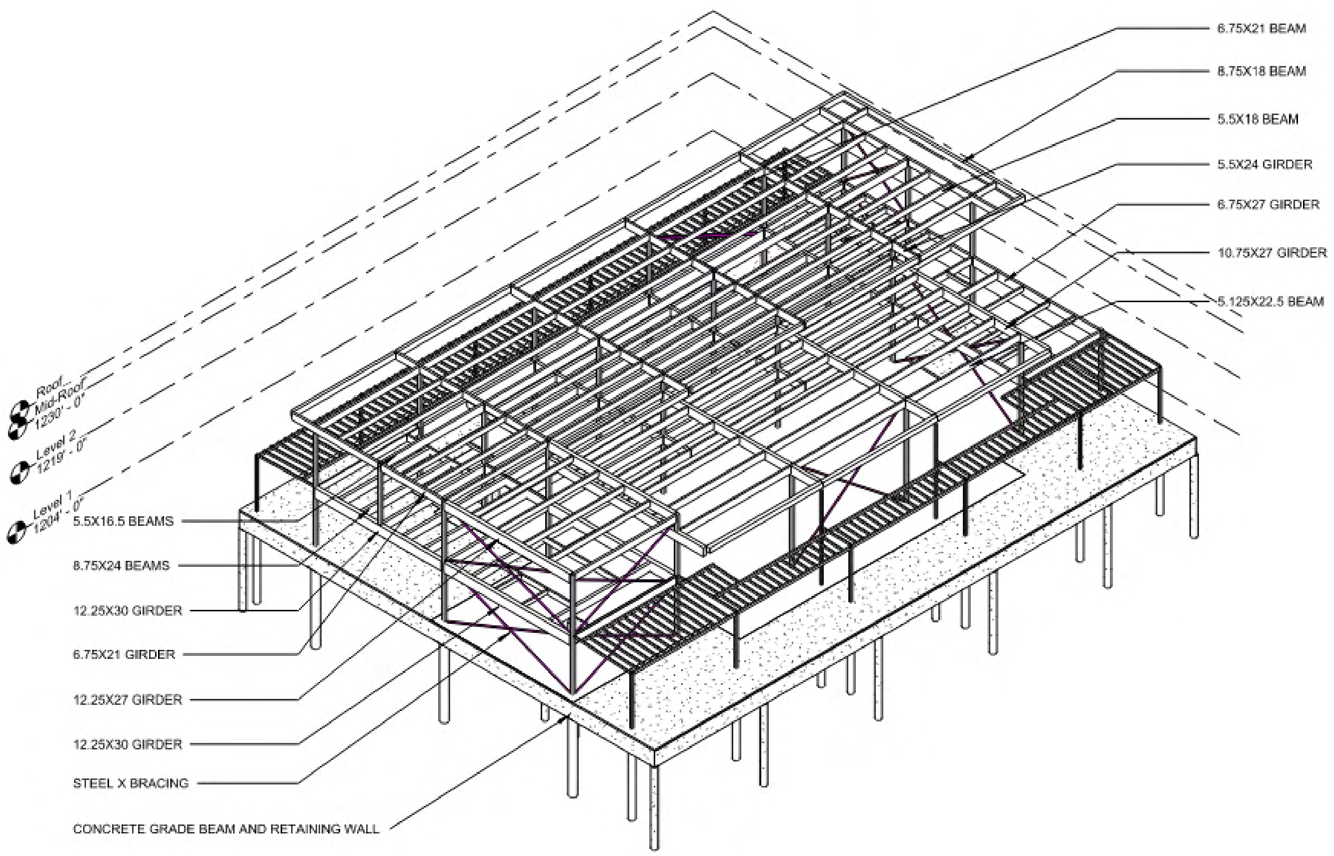
STRUCTURAL SYSTEM PROPOSALS

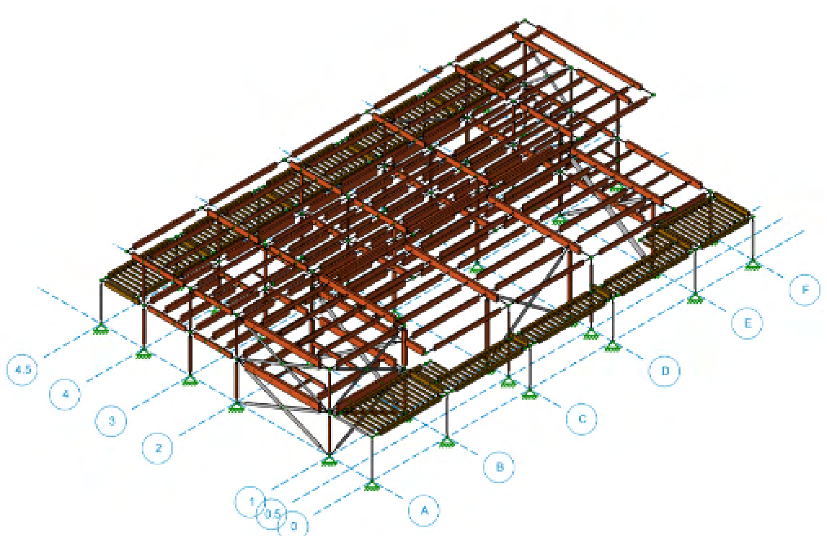


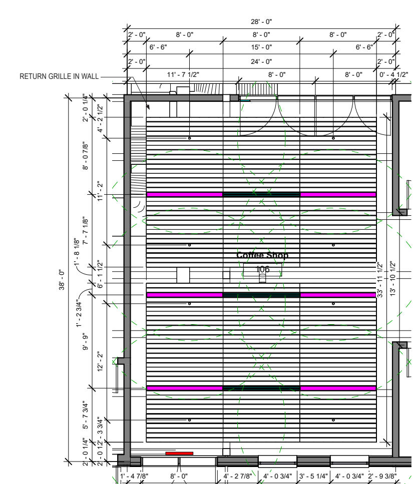


SD RECAP

The first iteration of design was an ambitious composite timber and concrete structure. The spinal lobby would be supported by a pan joist system, while the rest of the support spaces would be built with mass timbers and glue-laminate beams. This system would have provided good spanning from both materials, though girder depths could potentially conflict with the architecture. Additionally, the change in materiality would demarcate the hierarchical importance of the lobby space. However, this structure was abandoned due to its complexity in both loading and connection design. The other two structure types that were considered were a composite steel system and a mass timber system, both of which went on to be used by various members of the team during design development and construction documents.

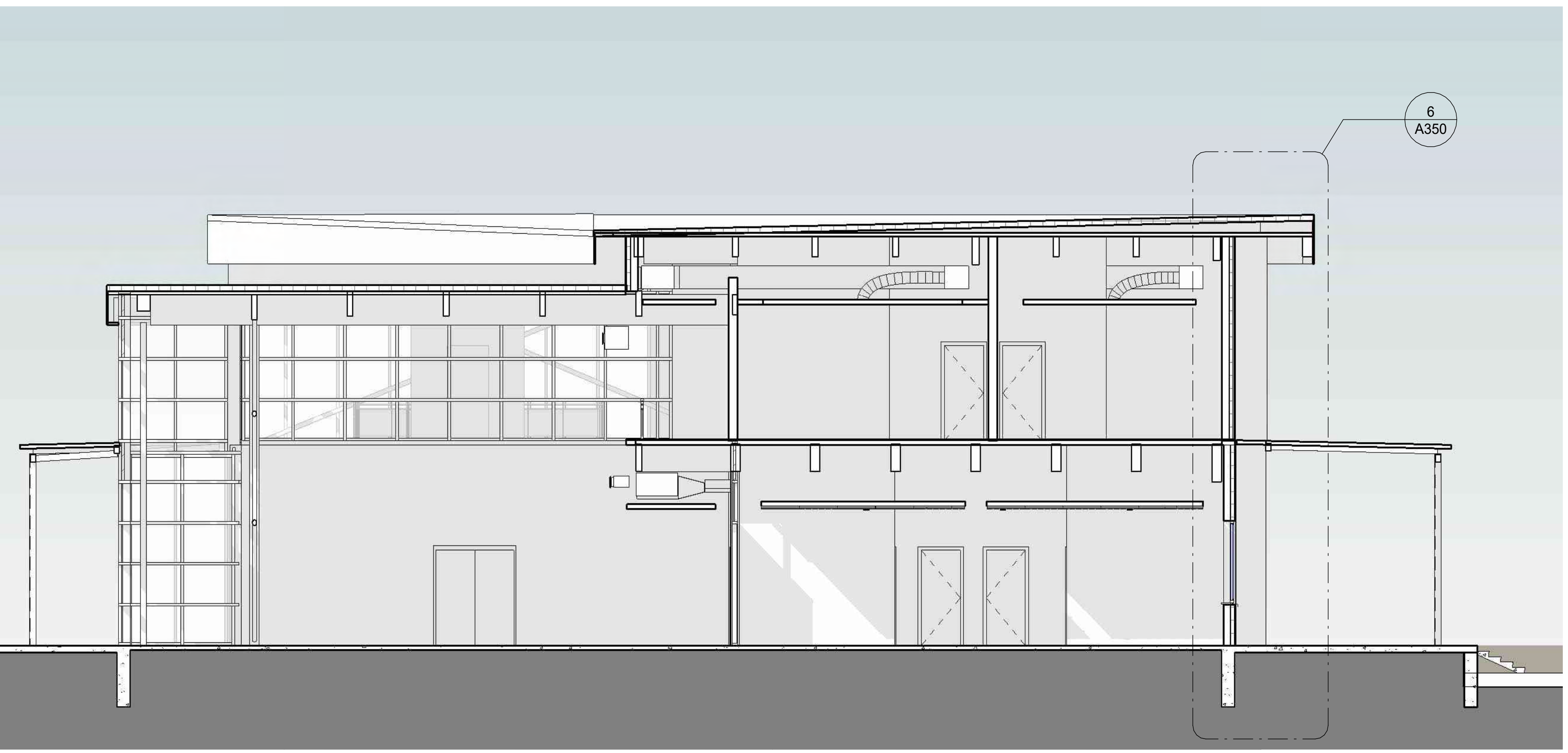


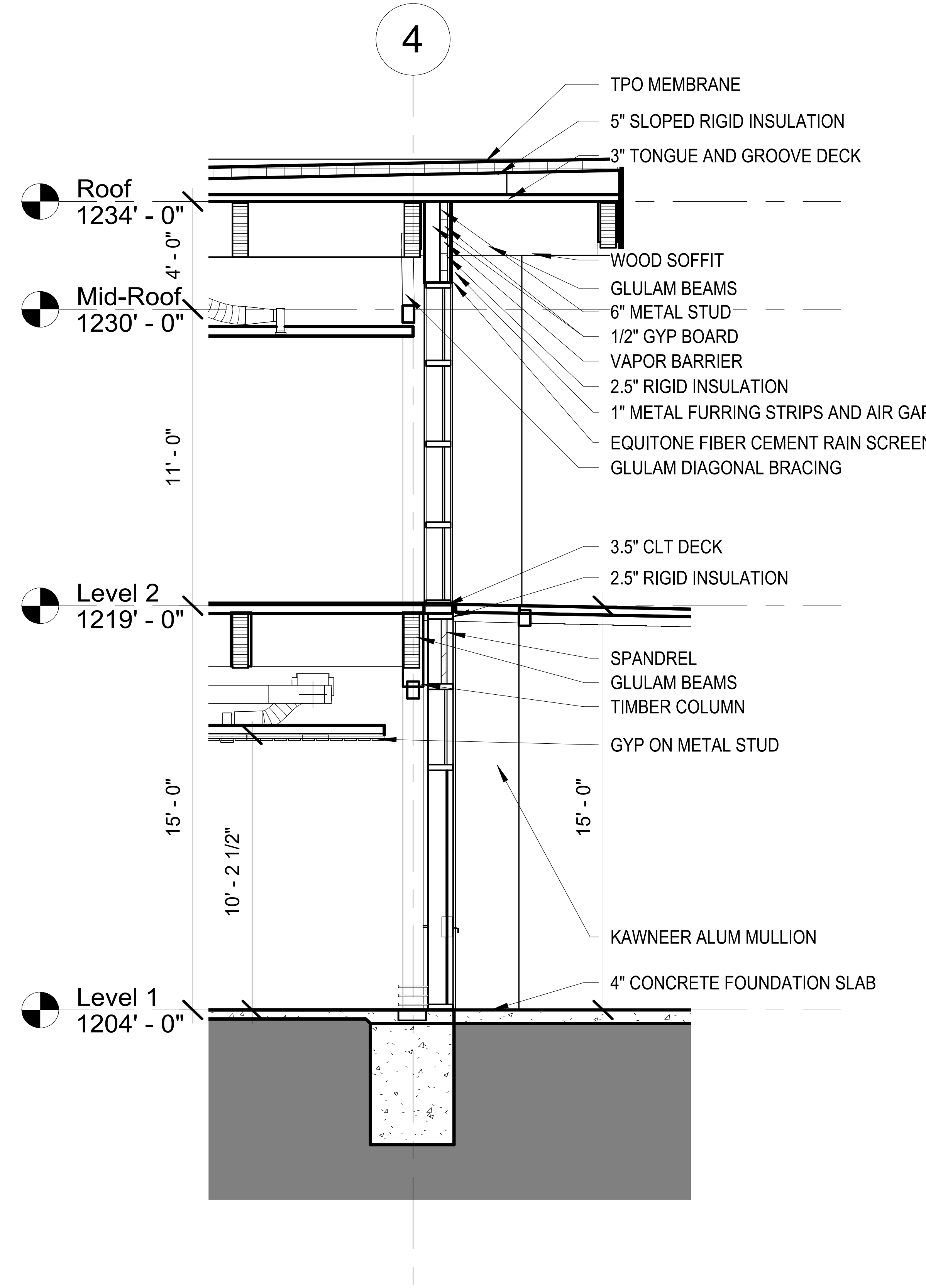




DD RECAP

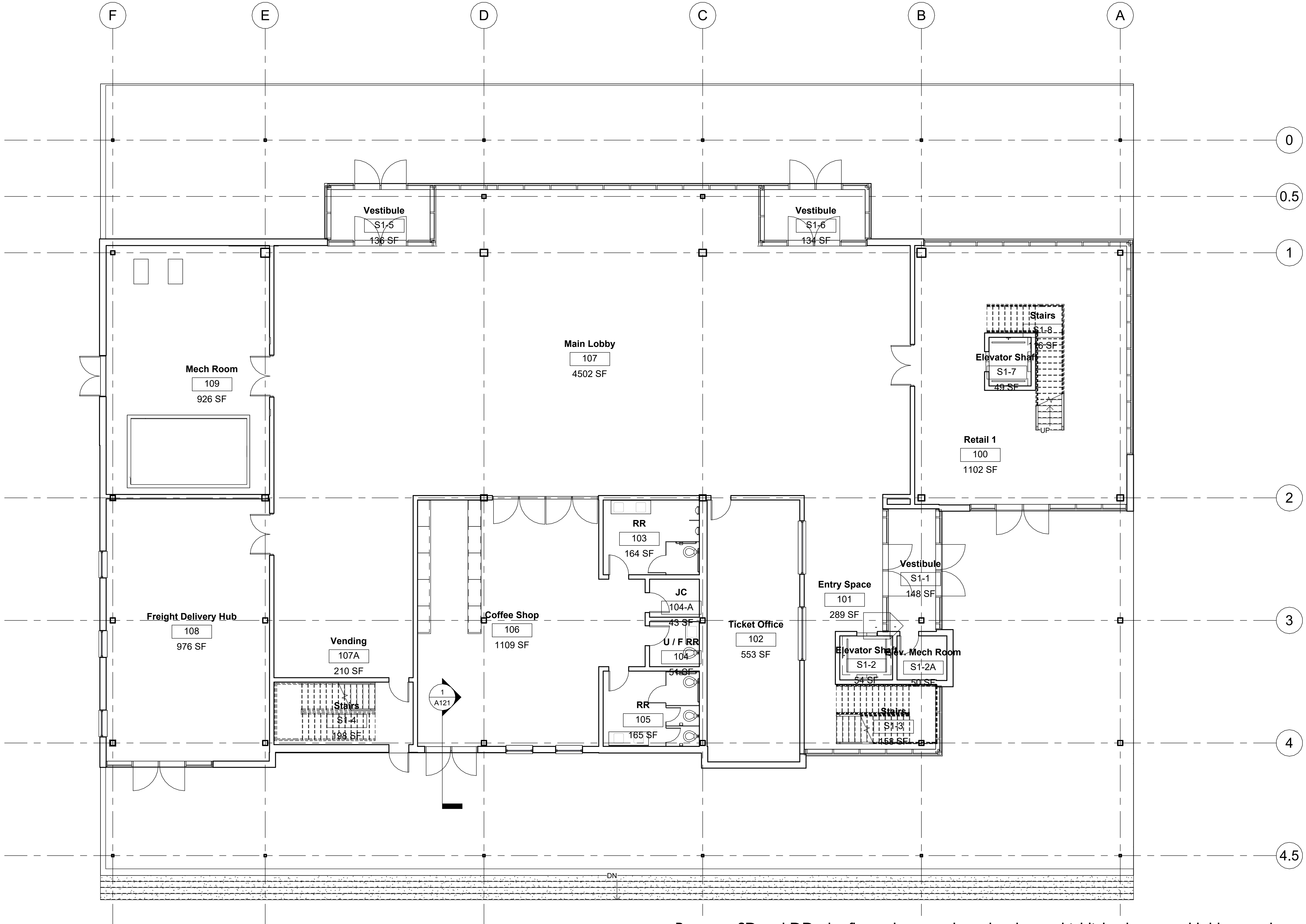
The Design Development phase ended up solidifying the final design as a fully Glulam structure. A RISA model for the building was created for analysis, and gravity members were sized. However, much of this phase was devoted to environmental design, such as HVAC and lighting, as well as modifying the original building design to be more streamlined. The coordination between all of these different disciplines was a difficult task, but in the end, it helped to make the product more coherent and realized. Factors such as ceiling heights and duct depths determined in this phase helped to guide the design parameters for the structure later on in the process.





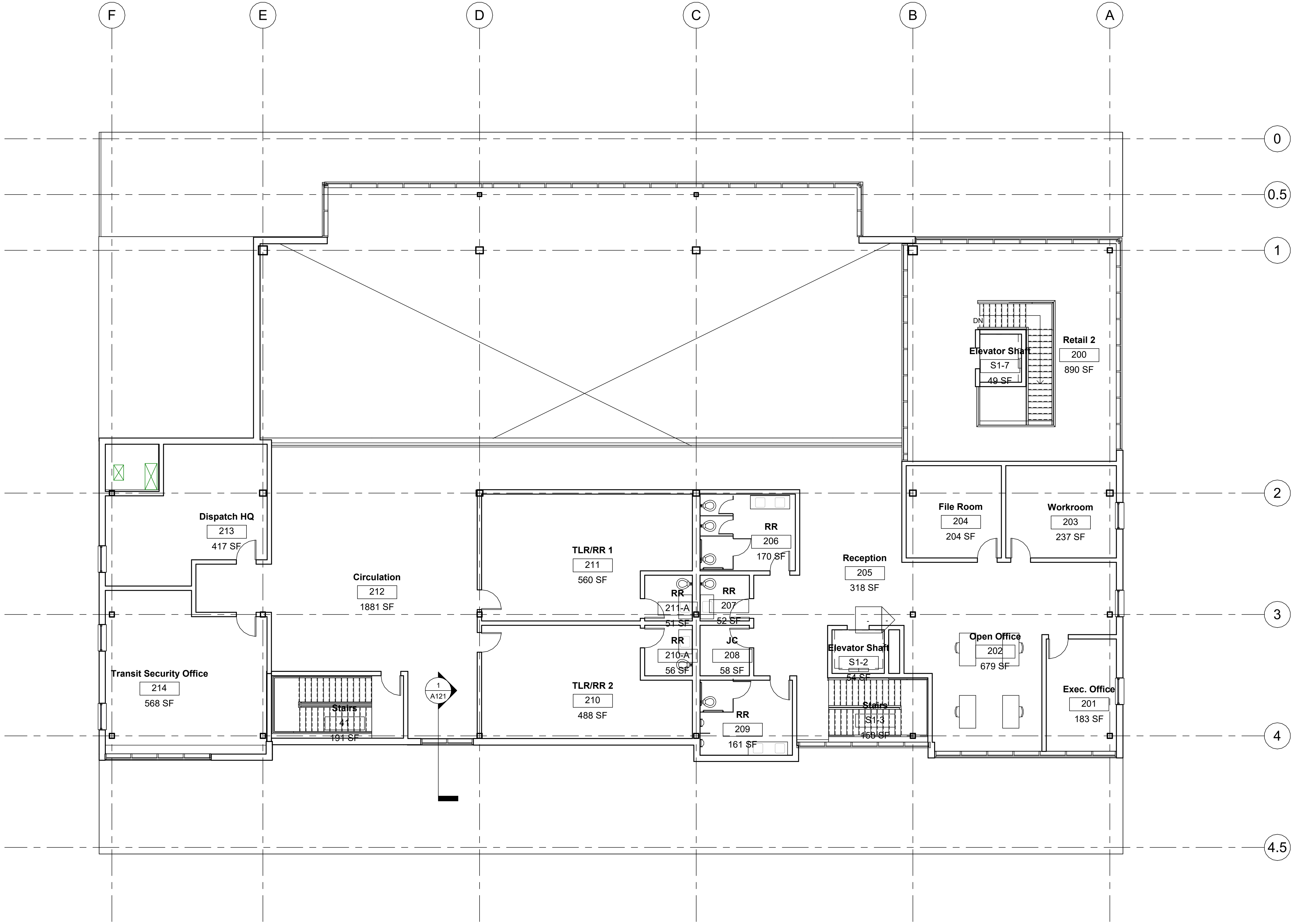
WALL SECTION

This following wall section was developed for the building considering structure, HVAC systems, environmental factors, and architectural vision. The focus space of the project, a coffee shop space, was heavily studied using both programs, such as EQuest and Revit, and a physical model. These analyses provided a clearer picture of the heating, cooling, and daylighting requirements in the space and how those requirements affected the wall section, such as glass type and insulation thickness.



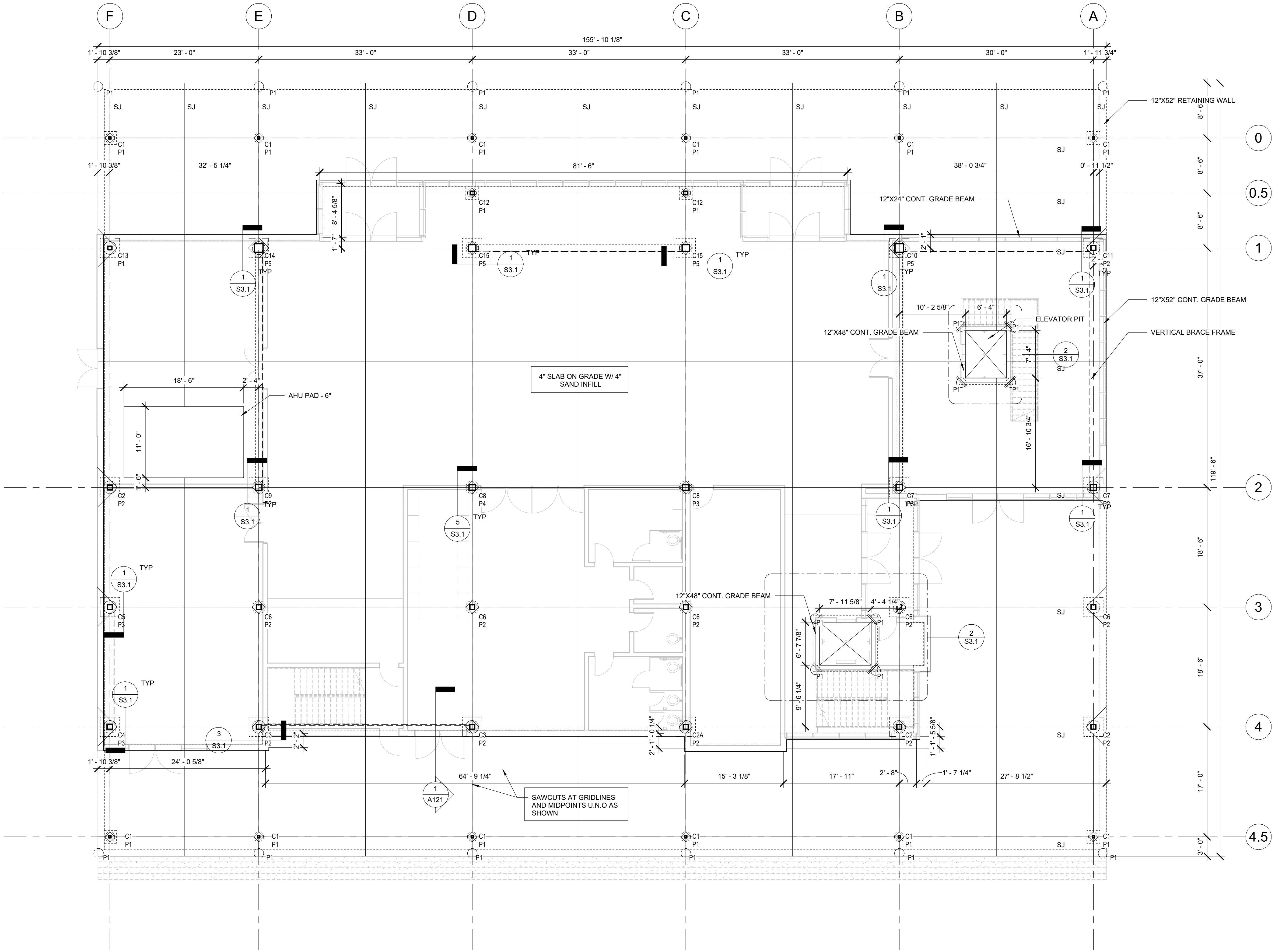
ARCHITECTURAL DRAWINGS FIRST FLOOR

Between SD and DD, the floor plan was altered to better highlight the central lobby area by slightly elongating the building. Additionally, the vestibules were better incorporated into the building form, the ticket office was moved to be near the main entrance, and the restrooms were turned away from the entry area. The entire building was also made more efficient in space, which led to energy savings.



ARCHITECTURAL DRAWINGS SECOND FLOOR

STRUCTURAL DRAWINGS



1 Level 1
1/8" = 1'-0"

FOUNDATION PLAN NOTES:

1. T.O.S. ELEVATION IS 100'-0"
2. TOP OF CONCRETE SLAB IS FINISH FLOOR UNLESS NOTED OTHERWISE
3. TYPICAL CONCRETE SLAB THICKNESS IS 4", REINFORCED WITH #4 @ 18" O.C.E.W
4. SHEET INDEX
   - S0.1 GENERAL NOTES
   - S3.1 FOUNDATION DETAILS
   - S4.1 PIER SCHEDULE
   - S4.1 COLUMN SCHEDULE

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FOUNDATION PLAN

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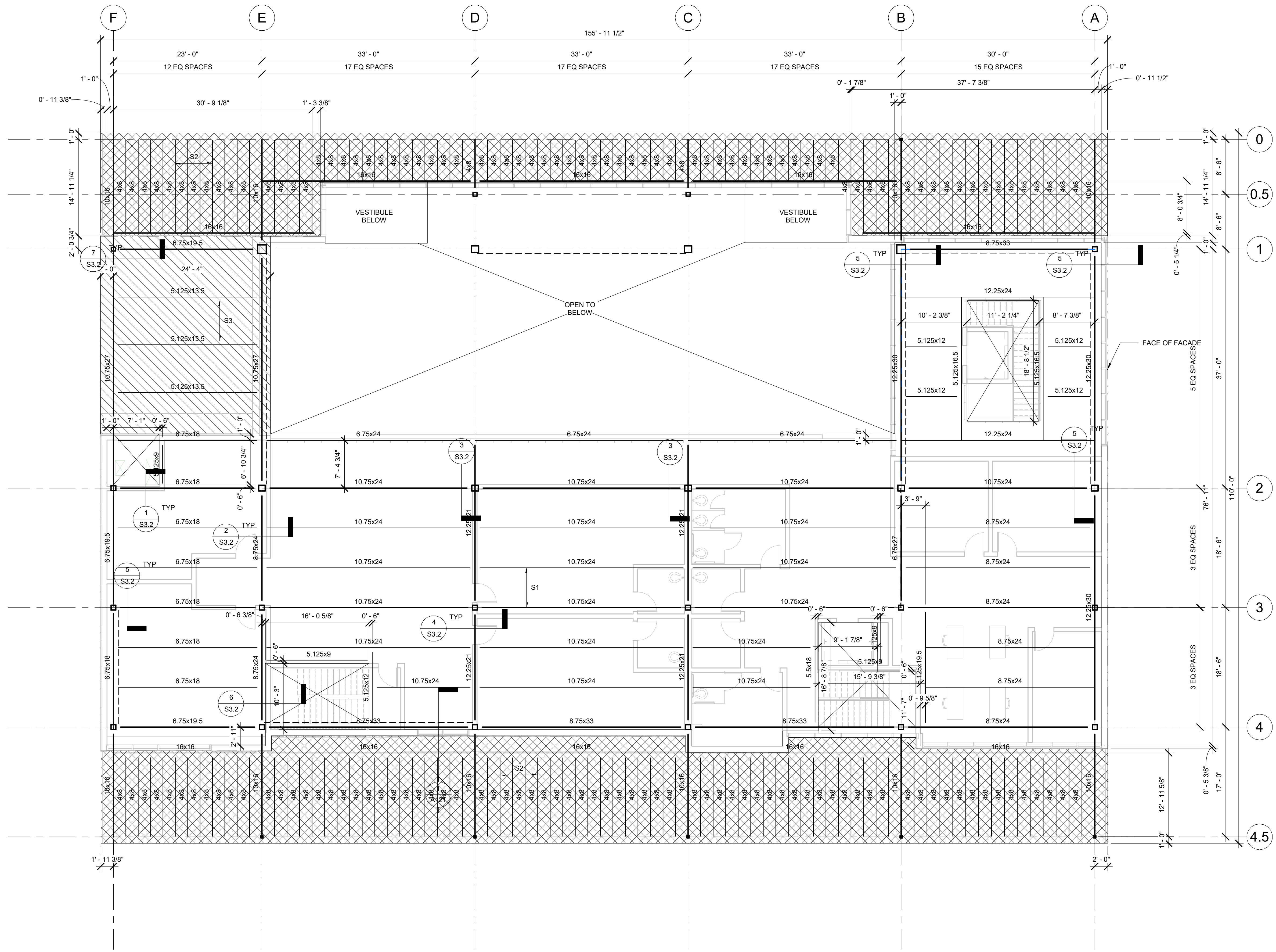
JC	Checked by

S1.1

As indicated

DECK LEGEND

- FLOOR DECK
- ROOF DECK
- AWNING DECK



1 Level 2
1/8" = 1'-0"

FLOOR PLAN NOTES:

1. FINISH FLOOR ELEVATION IS 115'-1 33/256"
2. TOP OF CLT DECK AT 115'-0"
3. DECK IS 87V (3.53") CLT DECK
4. TOP OF BEAMS AT 114'-8 1/2"
5. SHEET INDEX:
   - S0.1 GENERAL NOTES
   - S3.2 FLOOR DETAILS
   - S4.1 COLUMN SCHEDULE
   - S4.1 DECK SCHEDULE

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FLOOR 2 PLANS

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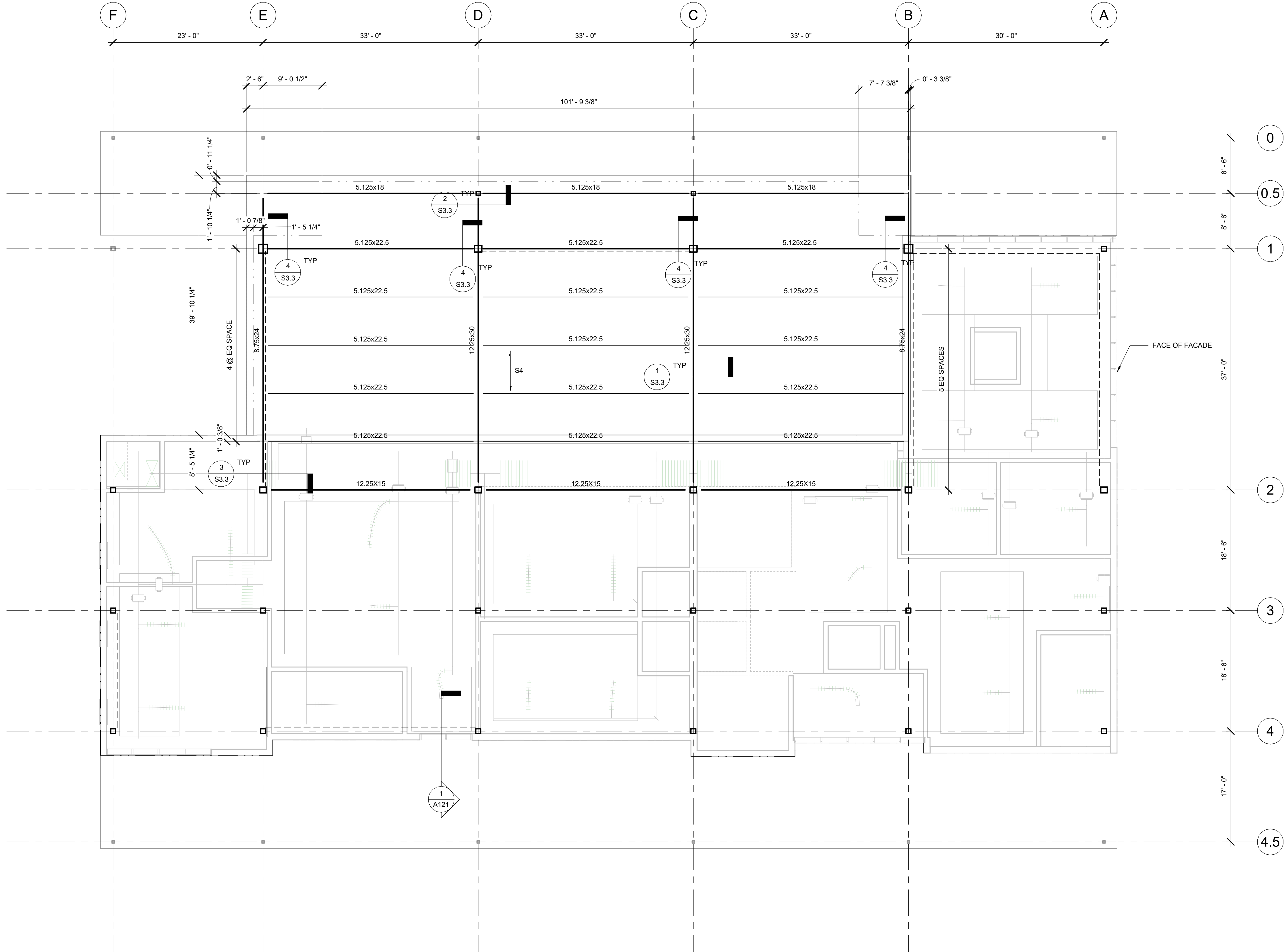

LOW ROOF PLAN NOTES:

1. DECK ELEVATION IS 126'-0"
2. TOP OF T&G DECK IS ALIGNED WITH LEVEL U.N.O
3. TOP OF BEAMS AT 123'-0 1/2"
4. DECK IS 3"X6" T&G DECK
5. SHEET INDEX:
   - S0.1 GENERAL NOTES
   - S3.3 ROOF DETAILS
   - S4.1 COLUMN SCHEDULE
   - S4.1 DECK SCHEDULE

1 Low Roof
1/8" = 1'-0"

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LOW ROOF PLAN

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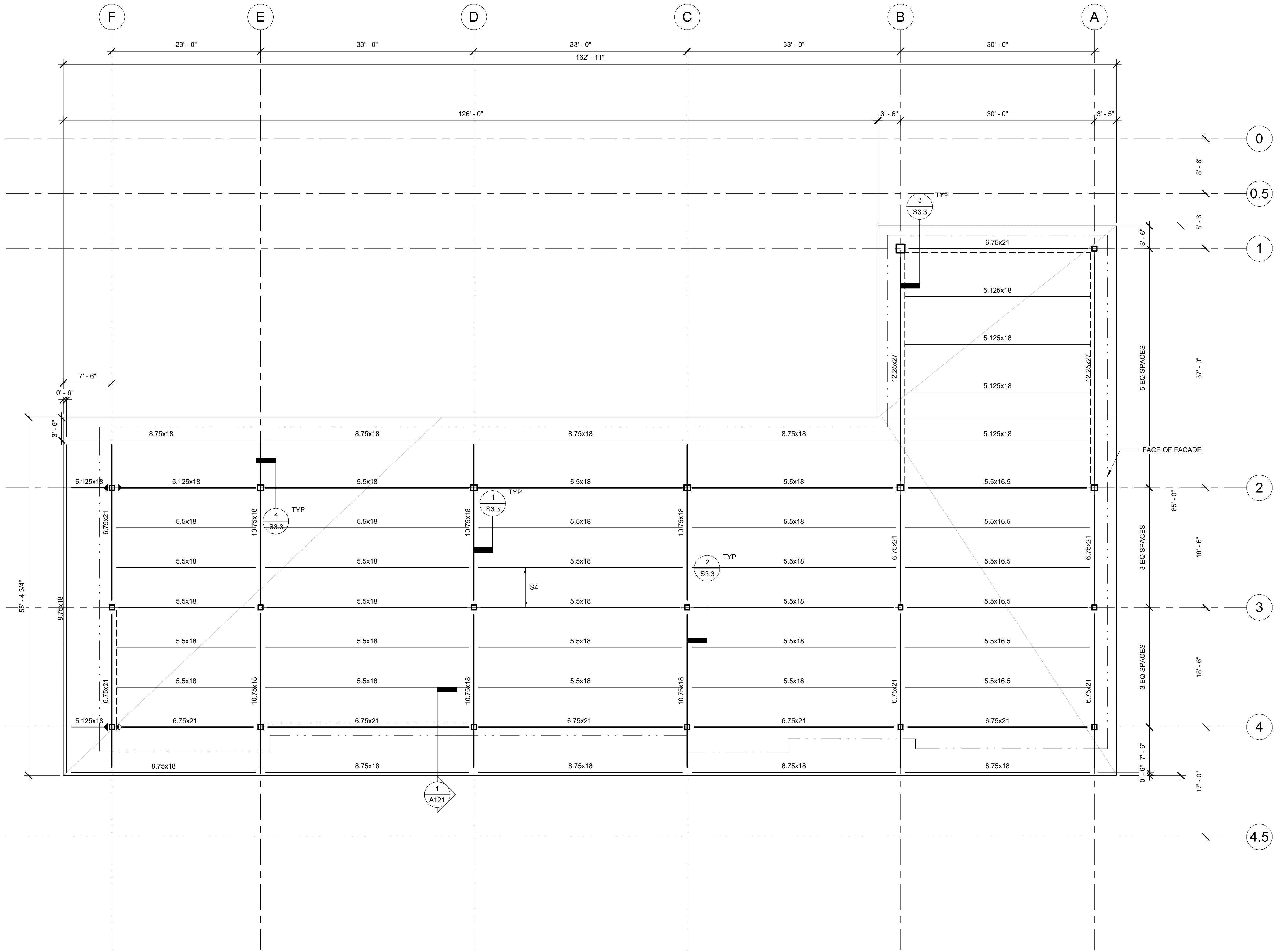

1 High Roof
1/8" = 1'-0"

HIGH ROOF PLAN NOTES:

1. DECK ELEVATION IS 130'-0"
2. TOP OF T&G DECK IS ALIGNED WITH LEVEL U.N.O
3. TOP OF BEAMS AT 127'-0 1/2"
4. DECK IS 3"X6" T&G DECK
5. SHEET INDEX:
   - S0.1 GENERAL NOTES
   - S3.3 ROOF DETAILS
   - S4.1 COLUMN SCHEDULE
   - S4.1 DECK SCHEDULE

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HIGH ROOF PLAN

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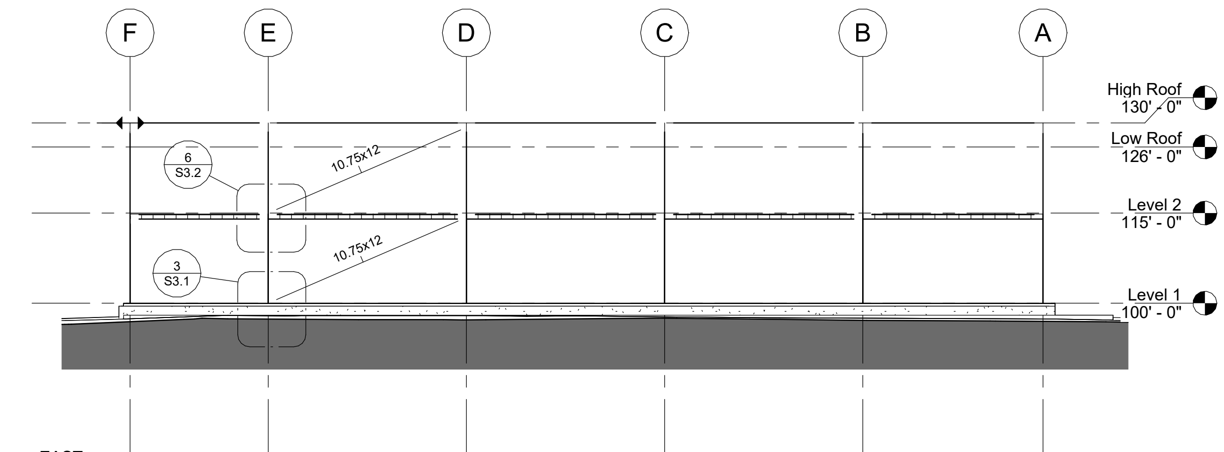
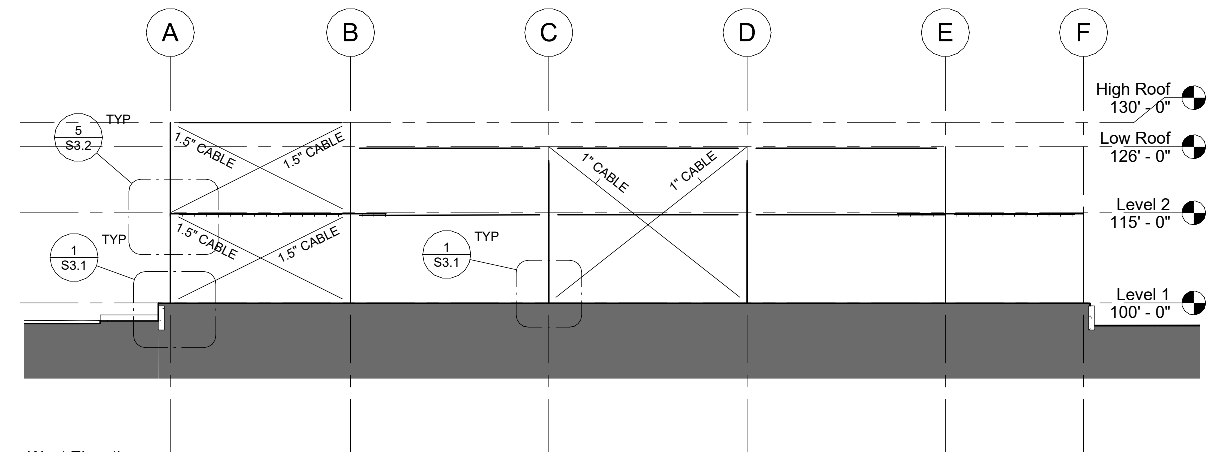
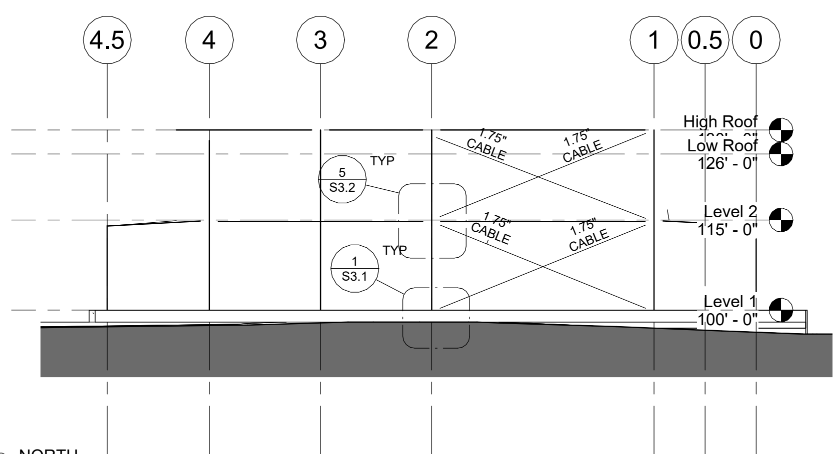


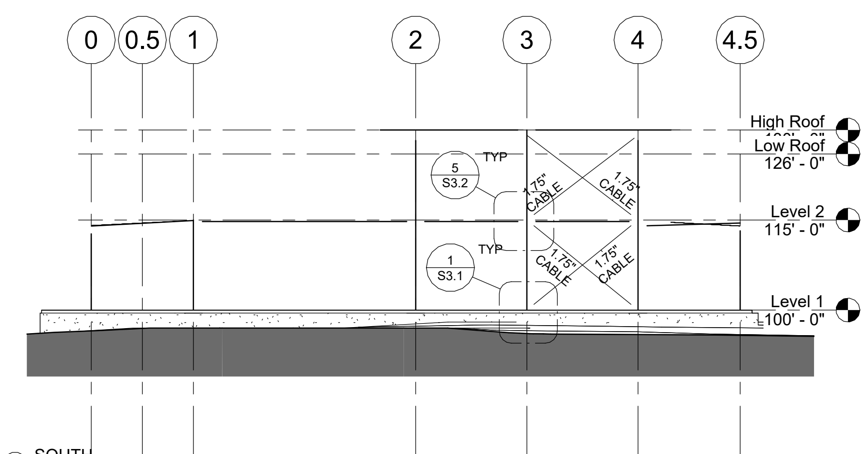
1 EAST
1/16" = 1'-0"



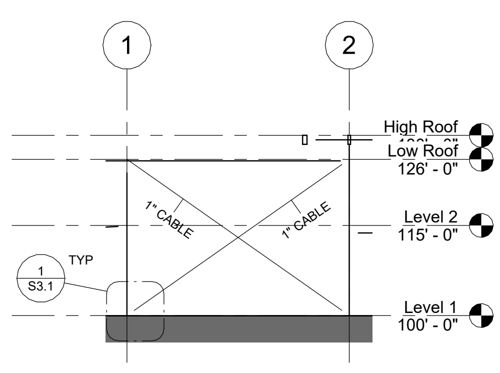
4 West Elevation
1/16" = 1'-0"



2 NORTH
1/16" = 1'-0"



3 SOUTH
1/16" = 1'-0"



5 GRIDS B & E
1/16" = 1'-0"

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BRACE FRAME ELEVATIONS

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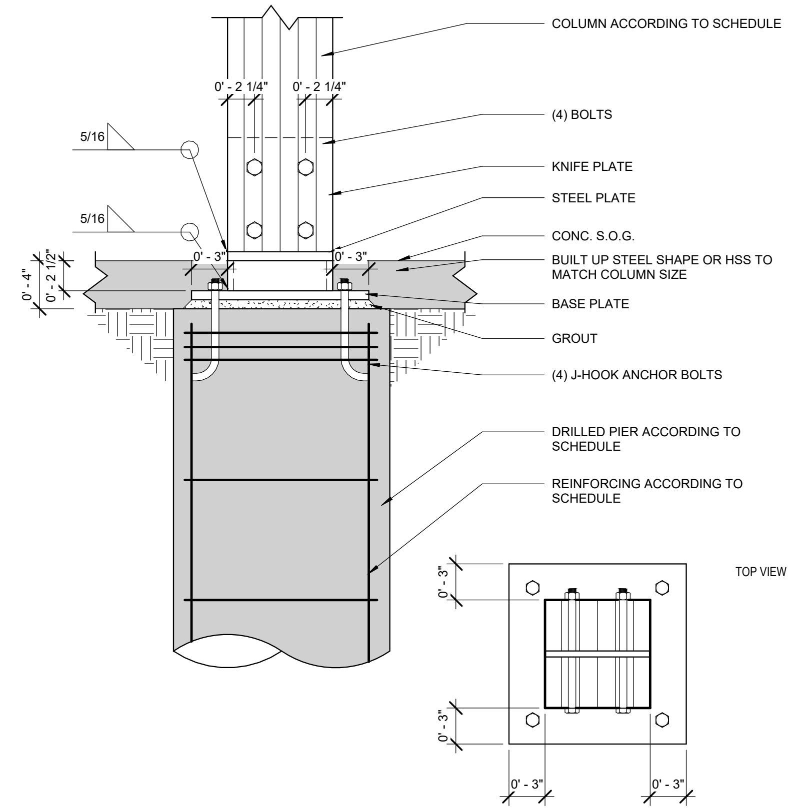
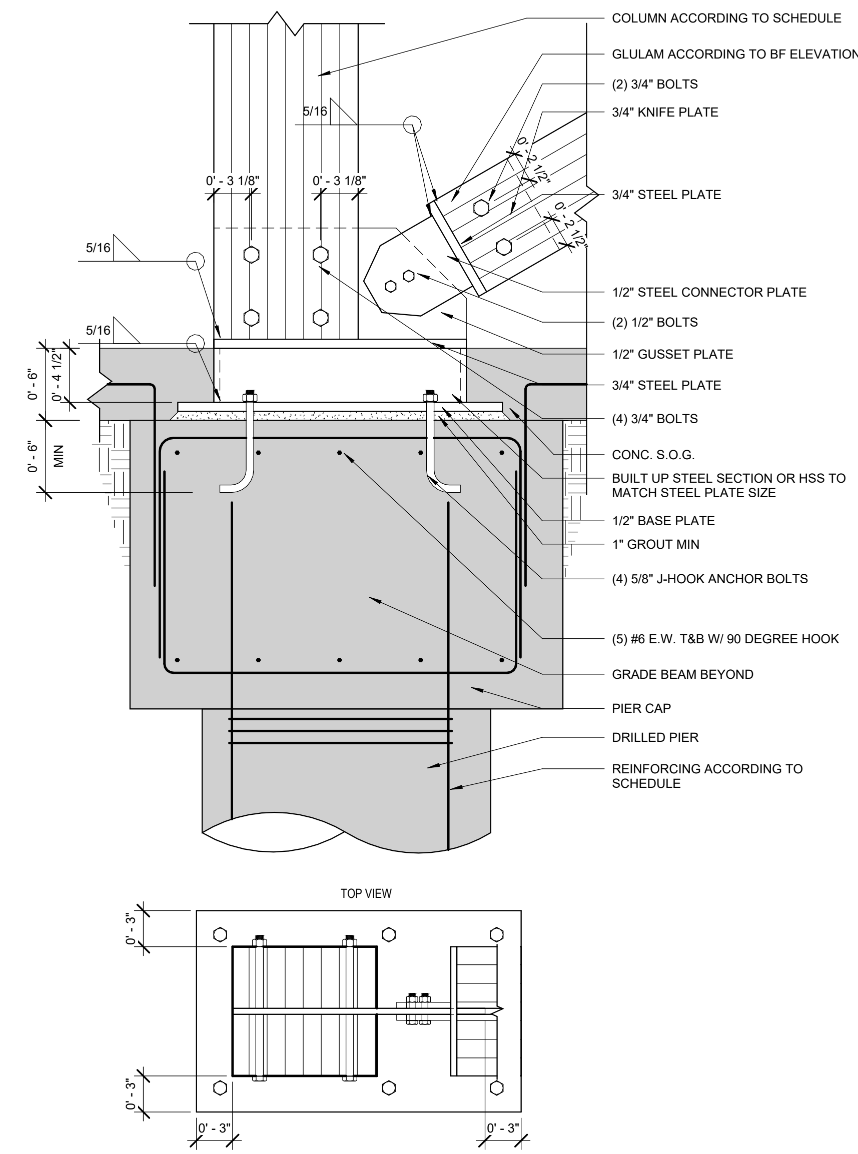
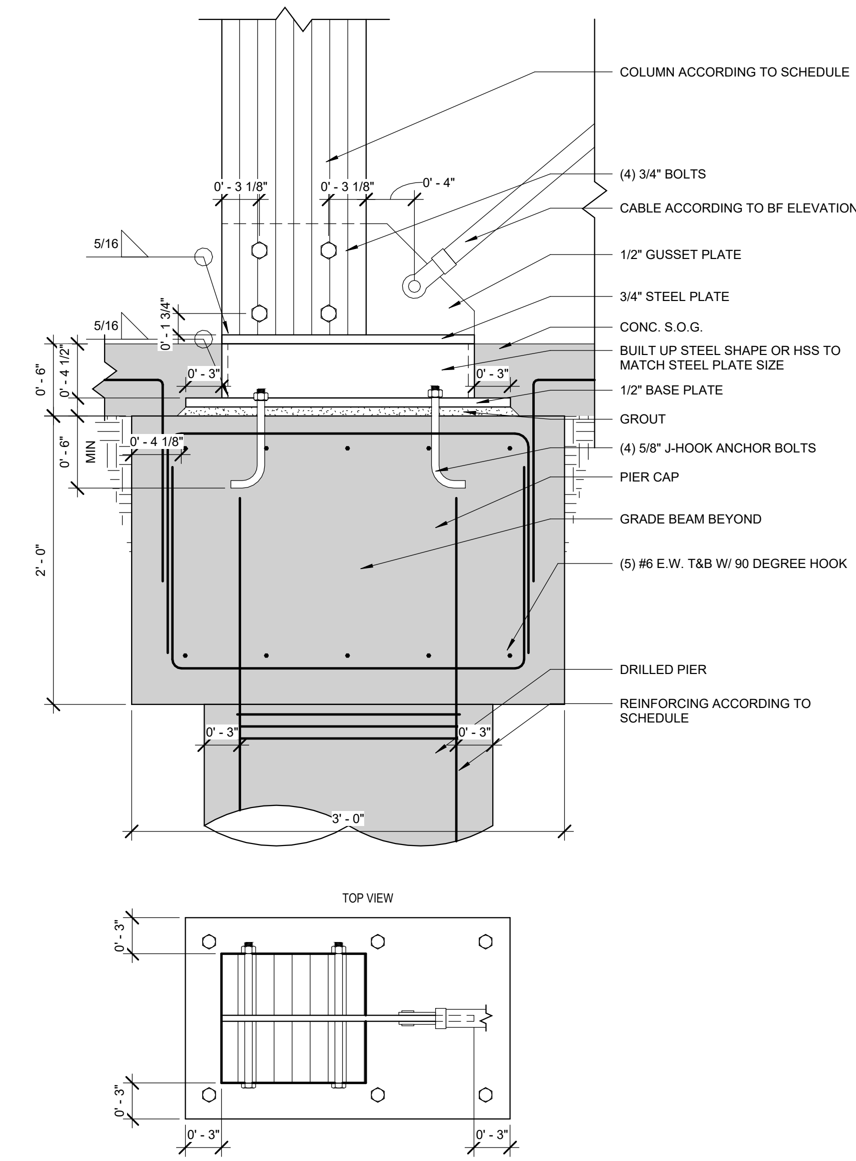
1/16" = 1'-0"



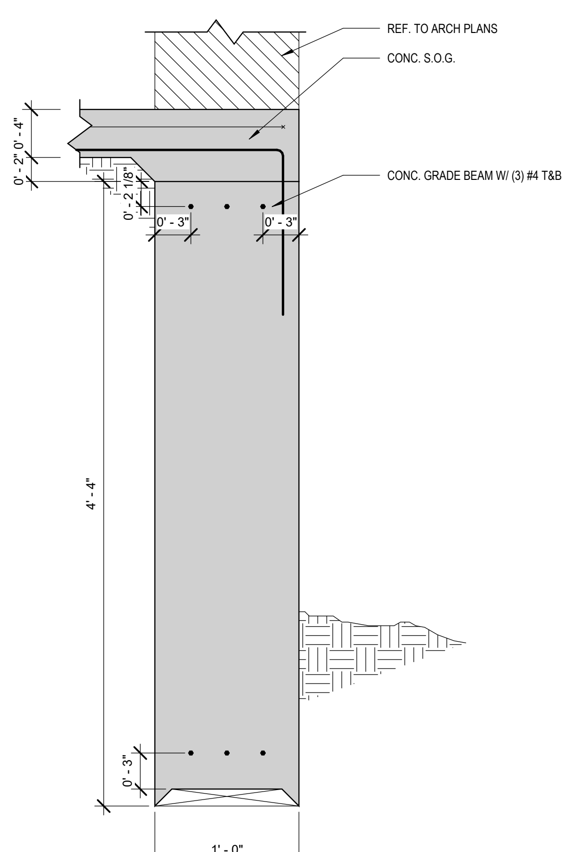
5 INTERIOR COLUMN BASE
1 1/2" = 1'-0"



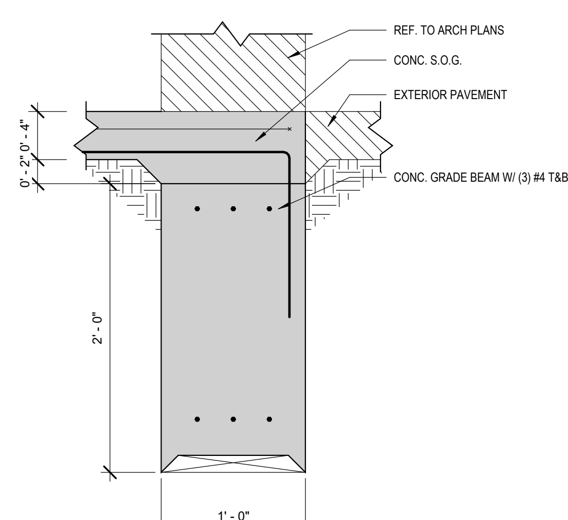
3 GLULAM BRACED FRAME BASE
1 1/2" = 1'-0"



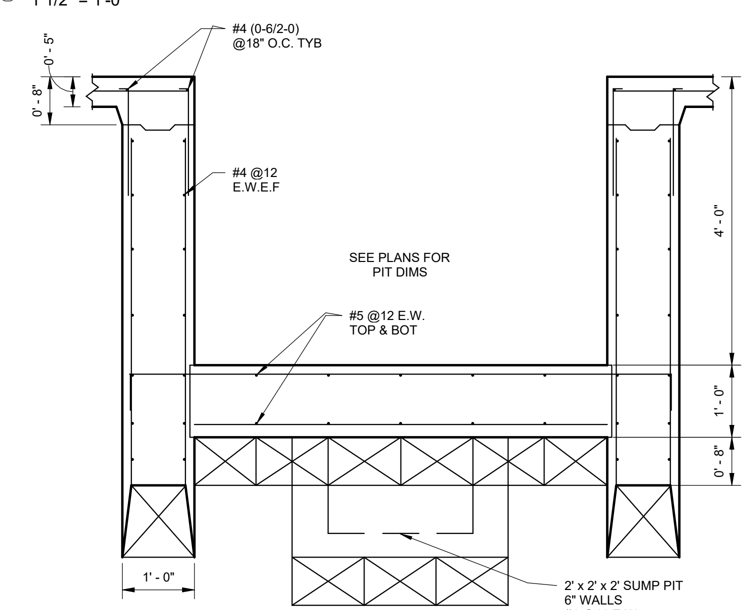
1 CABLE BRACED FRAME BASE
1 1/2" = 1'-0"



6 RETAINING BEAM
1 1/2" = 1'-0"



4 GRADE BEAM
1 1/2" = 1'-0"



2 ELEVATOR PIT
3/4" = 1'-0"

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FOUNDATION DETAILS

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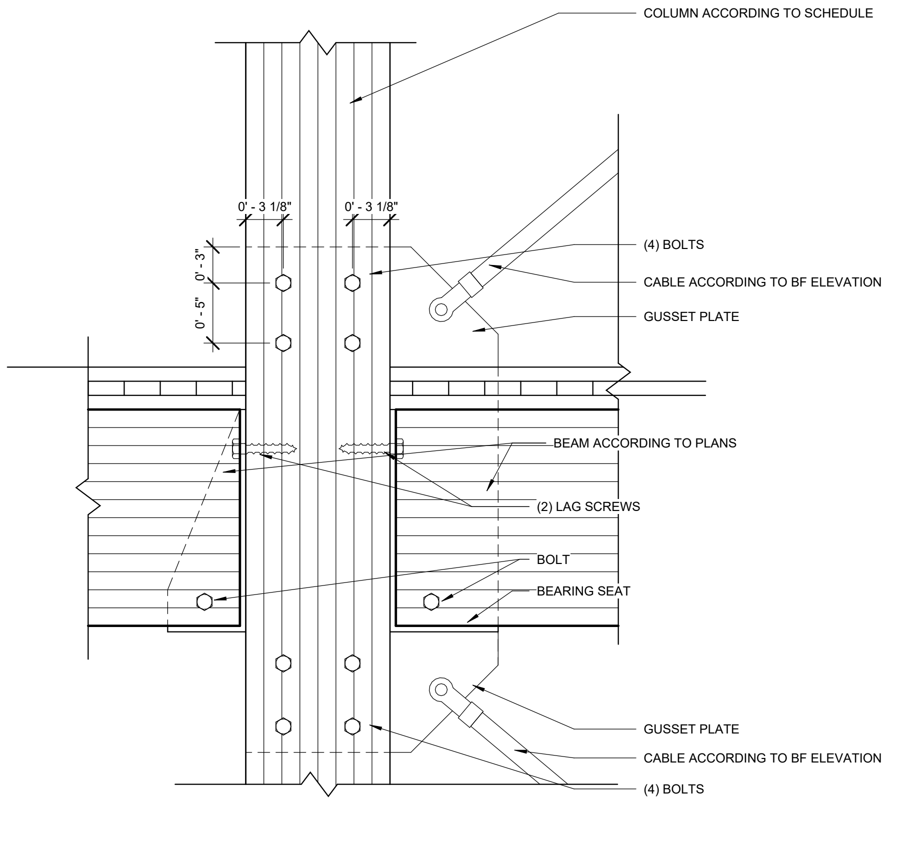
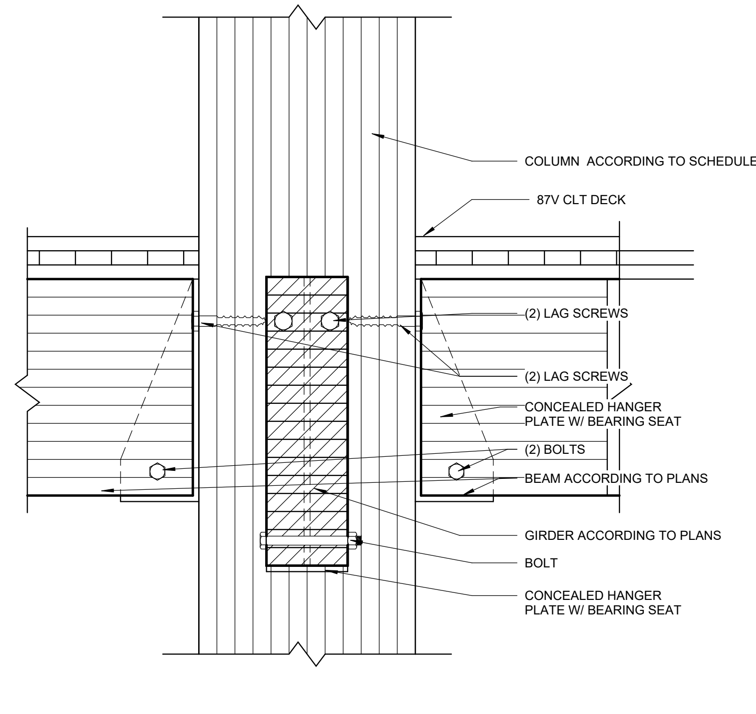
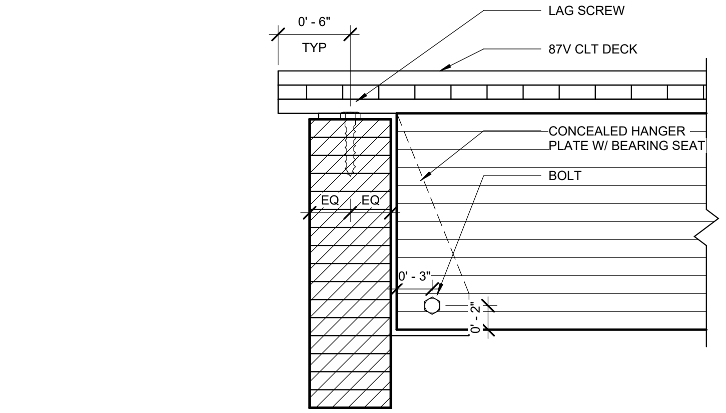


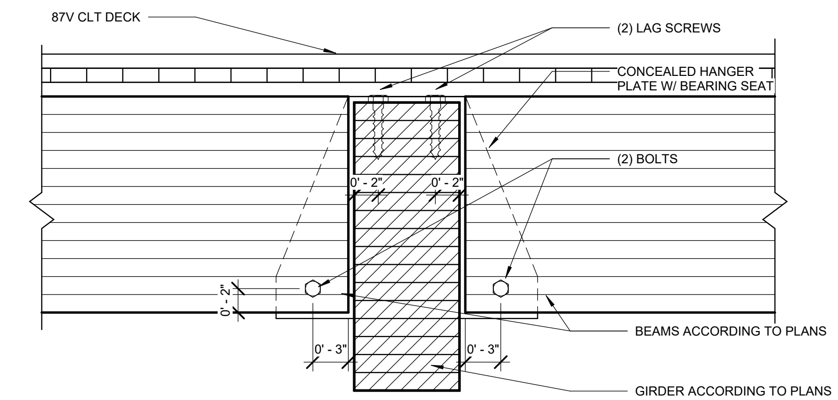
5 CABLE BRACED FRAME
1 1/2" = 1'-0"



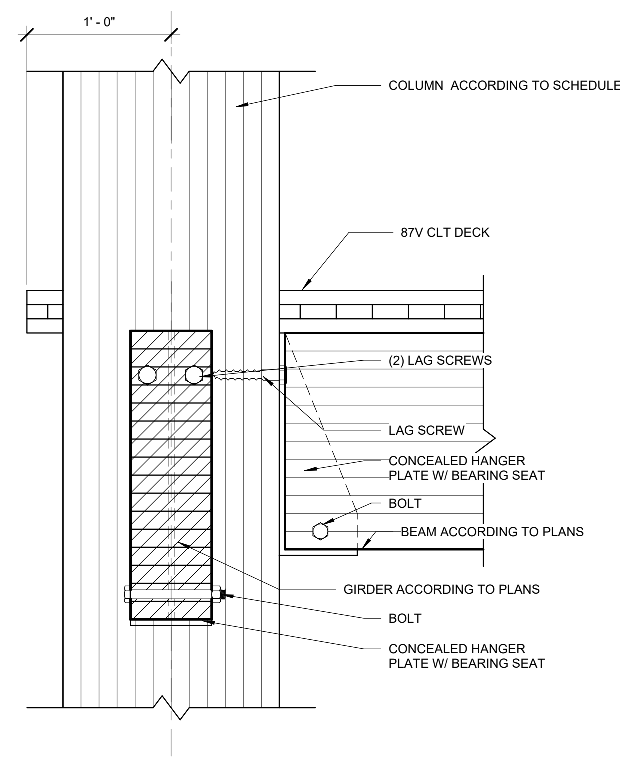
4 BEAM TO GIRDER TO COLUMN
1 1/2" = 1'-0"



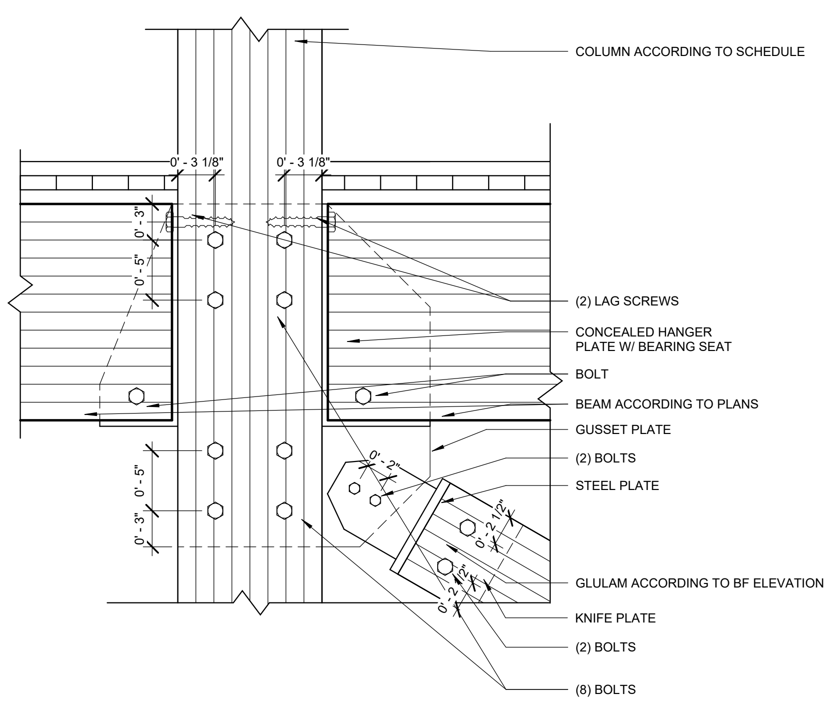
1 BEAM-TO-BEAM CONNECTION
1 1/2" = 1'-0"



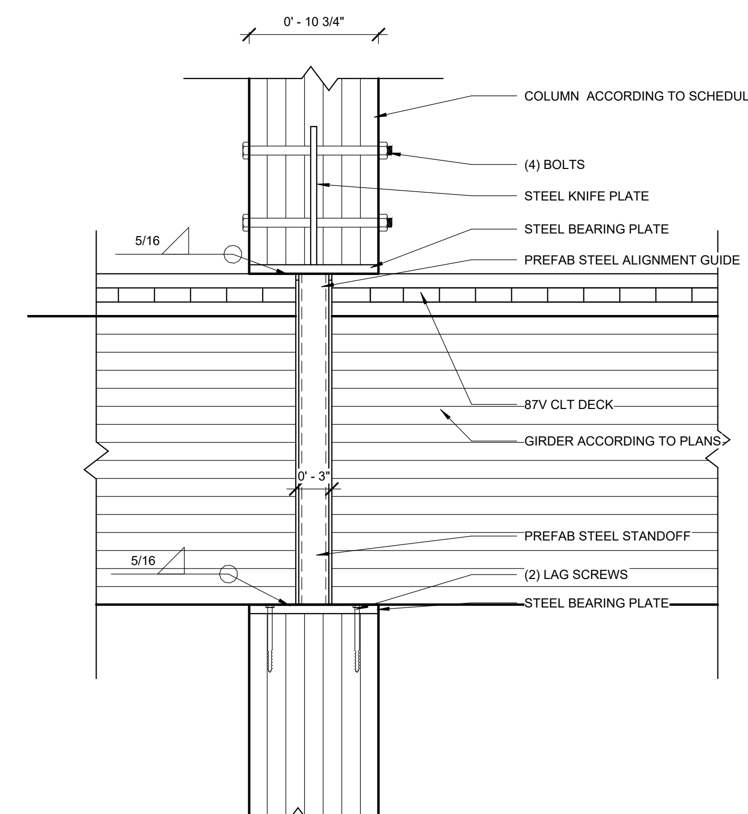
2 BEAM-TO-GIRDER CONNECTION
1 1/2" = 1'-0"



7 BEAM TO GIRDER TO COLUMN CORNER
1 1/2" = 1'-0"



6 GLULAM BRACED FRAME
1 1/2" = 1'-0"



3 CANTILEVER BEAM BEARING ON COLUMN
1 1/2" = 1'-0"

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FLOOR DETAILS

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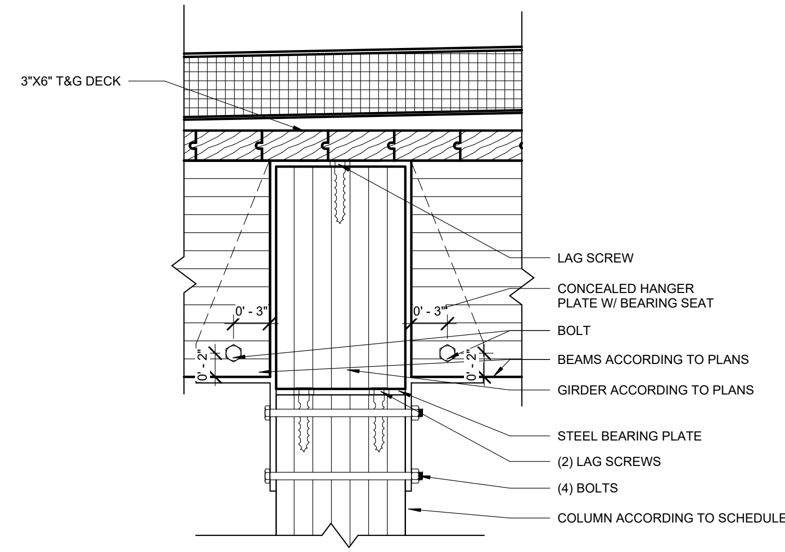
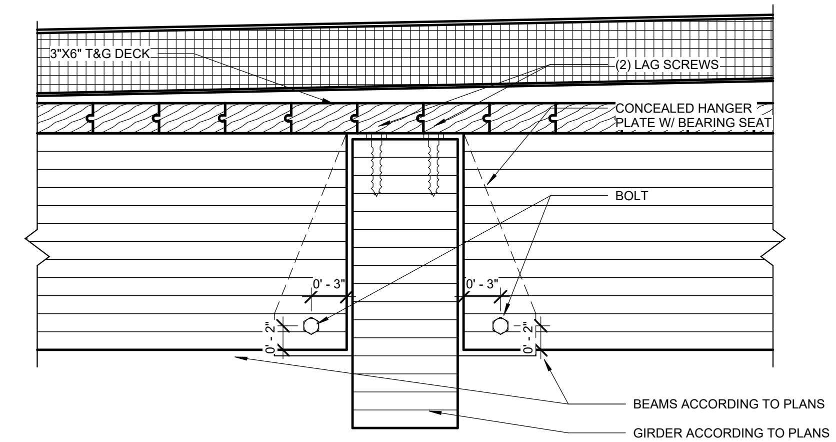
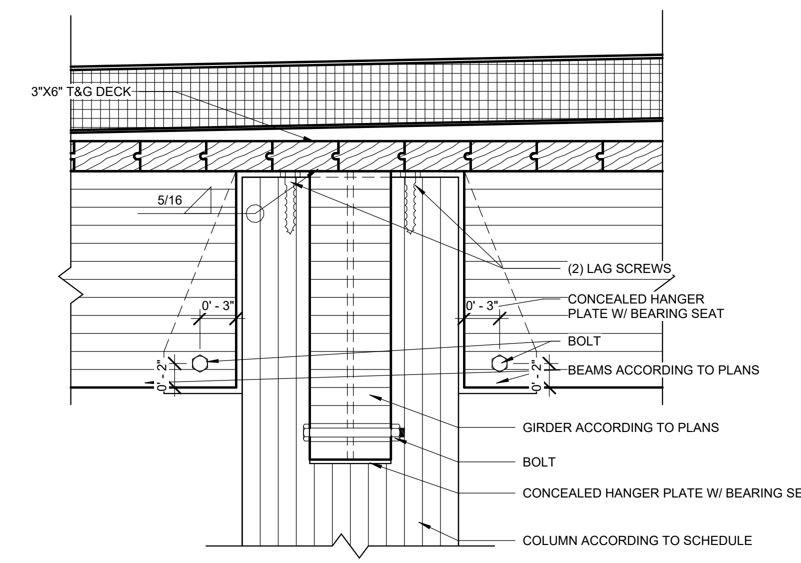
1 1/2" = 1'-0"



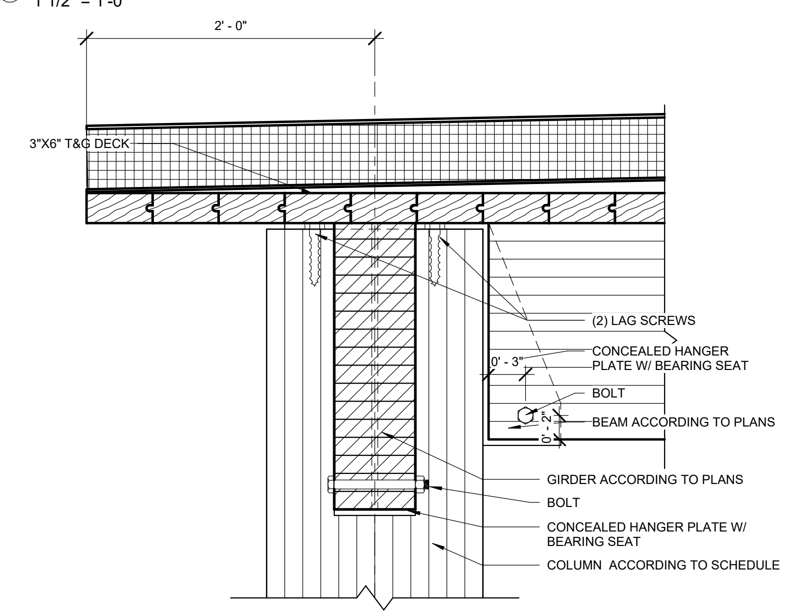
4 BEAM TO CANTILEVER GIRDER ROOF
1 1/2" = 1'-0"



1 BEAM-TO-GIRDER ROOF
1 1/2" = 1'-0"



2 BEAM TO GIRDER TO COLUMN ROOF
1 1/2" = 1'-0"



3 BEAM TO GIRDER TO COLUMN CORNER ROOF
1 1/2" = 1'-0"

Connection design was a major challenge in the Construction Documents phase. Though no calculations were run for these connections, there are not many standards for glulam connections, no are details widely available. Most of the connection details in this project had to be drafted from scratch and adapted to the unique conditions for the project. It was an exercise in structural knowledge as well as constructibility.

The foundation was fully designed, utilizing piers and grade beams to support the building. The analysis was performed by taking various load reactions from RISA for each column, then calculating individually the pier requirements for each column, taking into consideration the column size and load. After the analysis, all of the individual piers were generalized to five different types that would be used in the project. Finally, the grade beam was designed using a rectangular concrete beam design procedure, designed for the longest span and the highest facade load applicable.

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ROOF DETAILS

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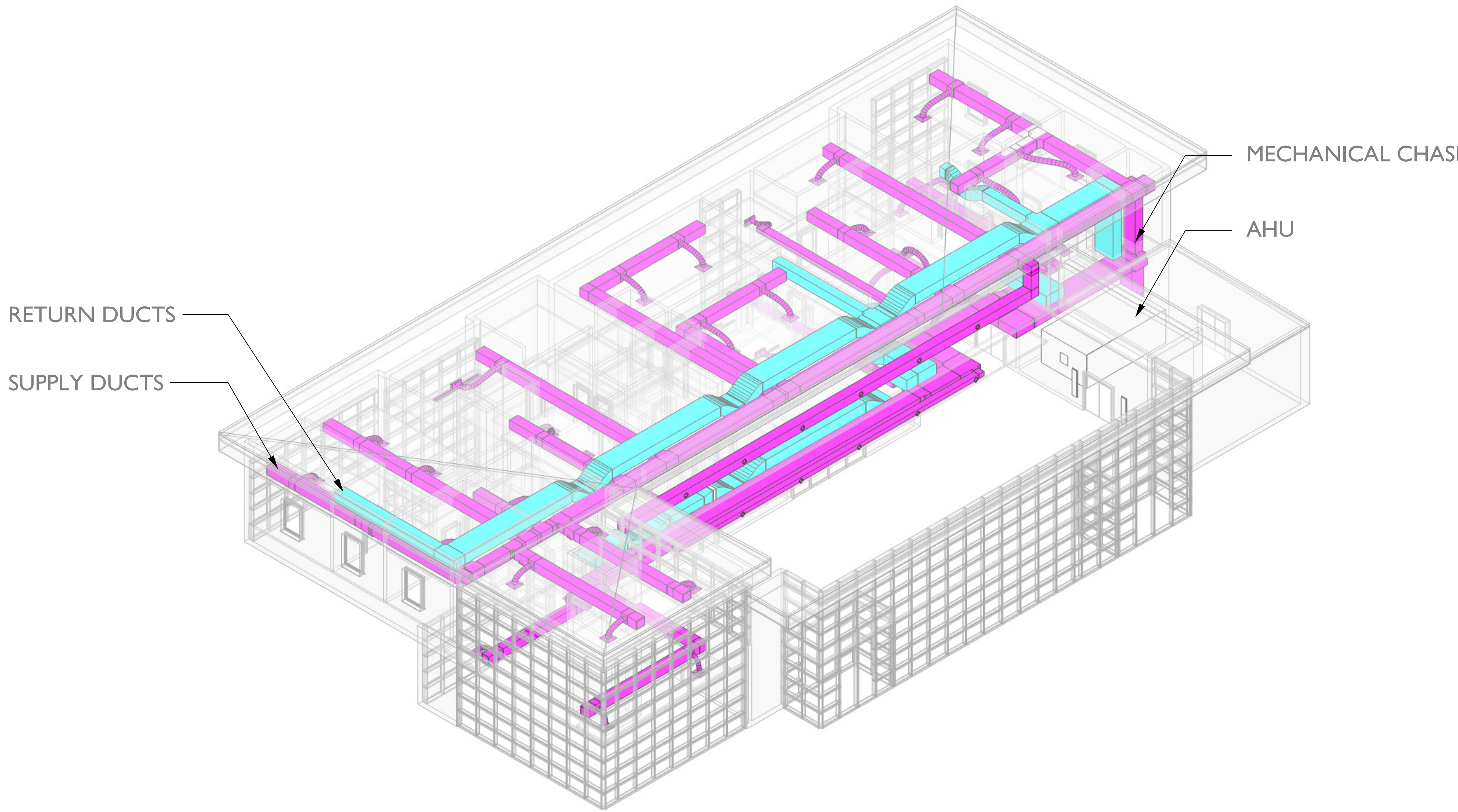
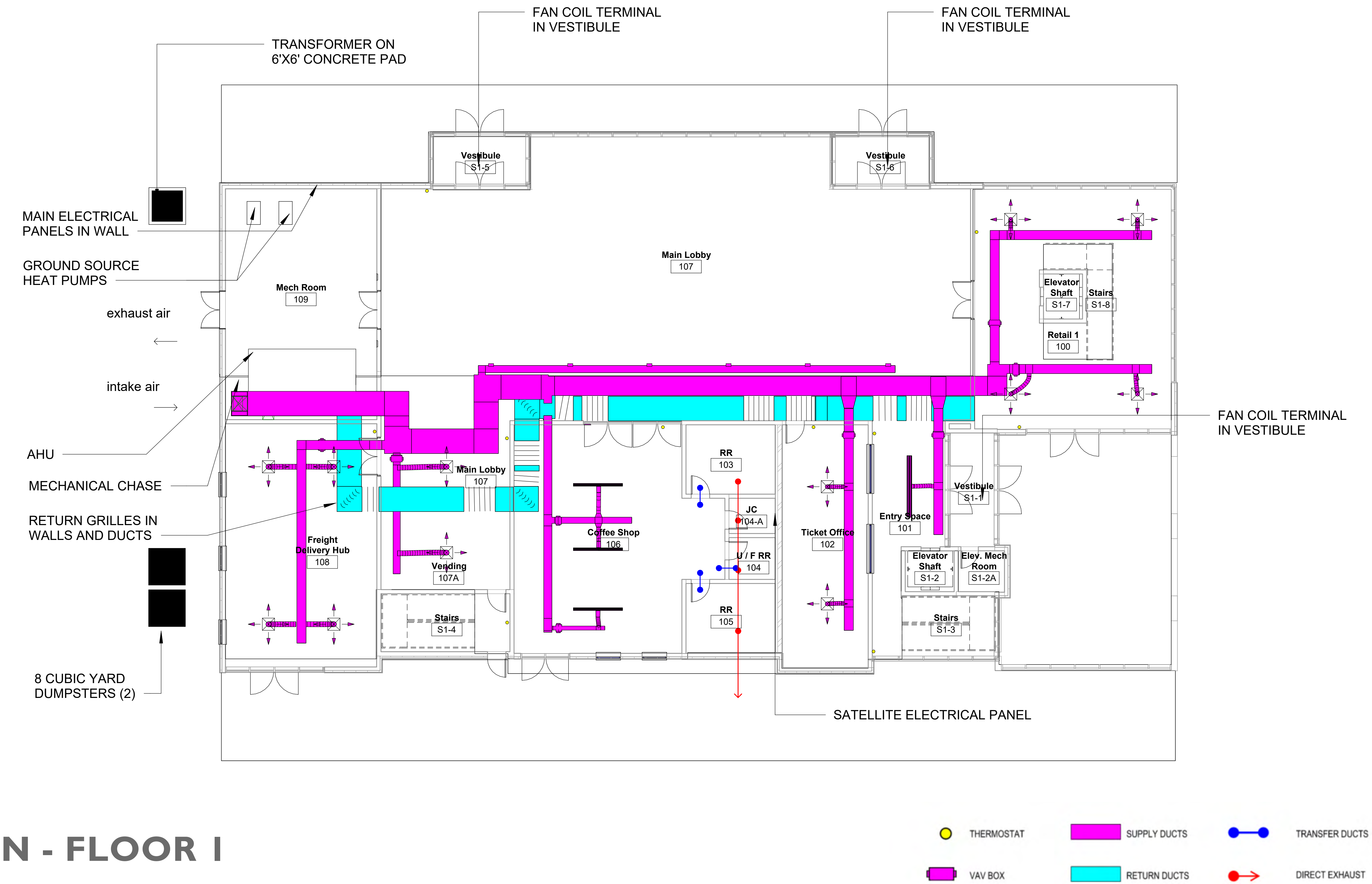
1 1/2" = 1'-0"

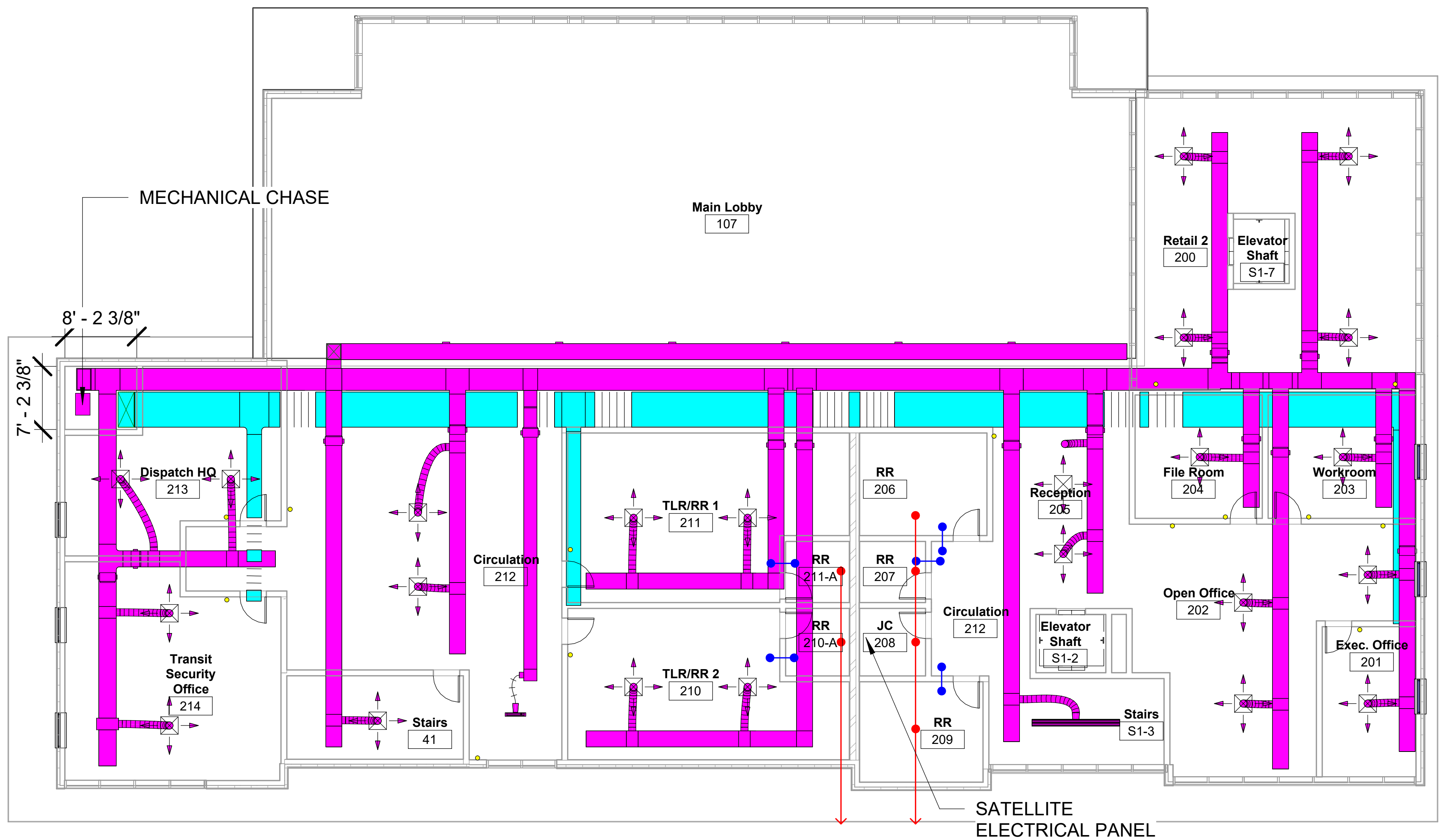


MEP SYSTEMS

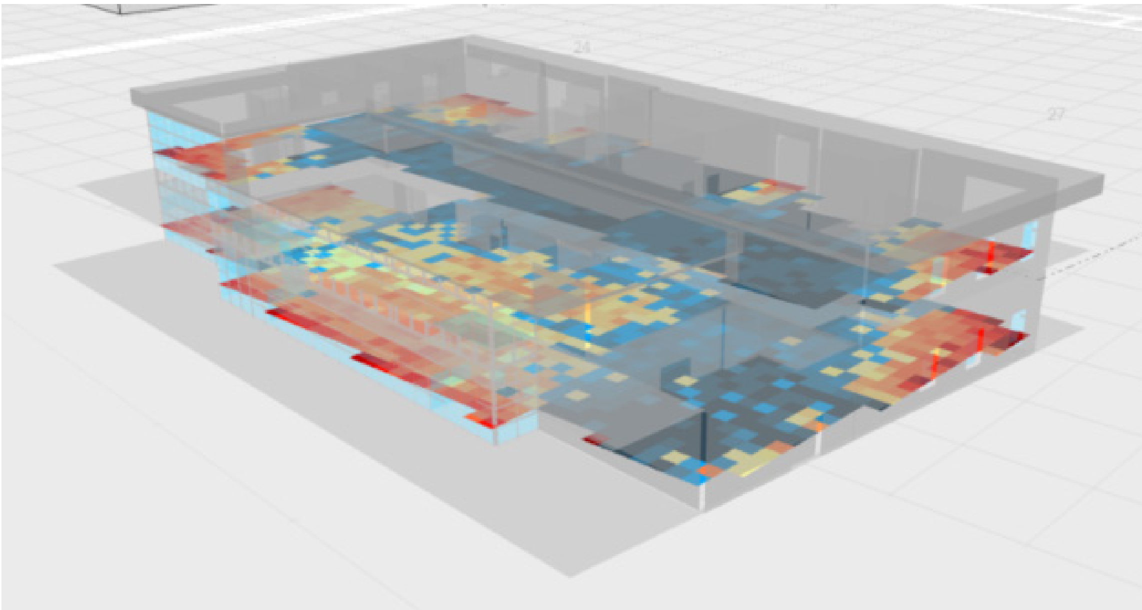
The HVAC system for the building was a challenge as the lack of a plenum space created the need for a large return duct that ran along the main corridor. As each return duct serviced an entire floor, they ended up being over three feet in diameter when modeled as round. To avoid the loss in ceiling height this would cause, the duct were changed to be rectangular, which gave more freedom to modify the dimensions of the ducts. However, more ceilings were added to the design to cope with the aesthetic change from round to rectangular ducts,

HVAC PLAN - FLOOR 1



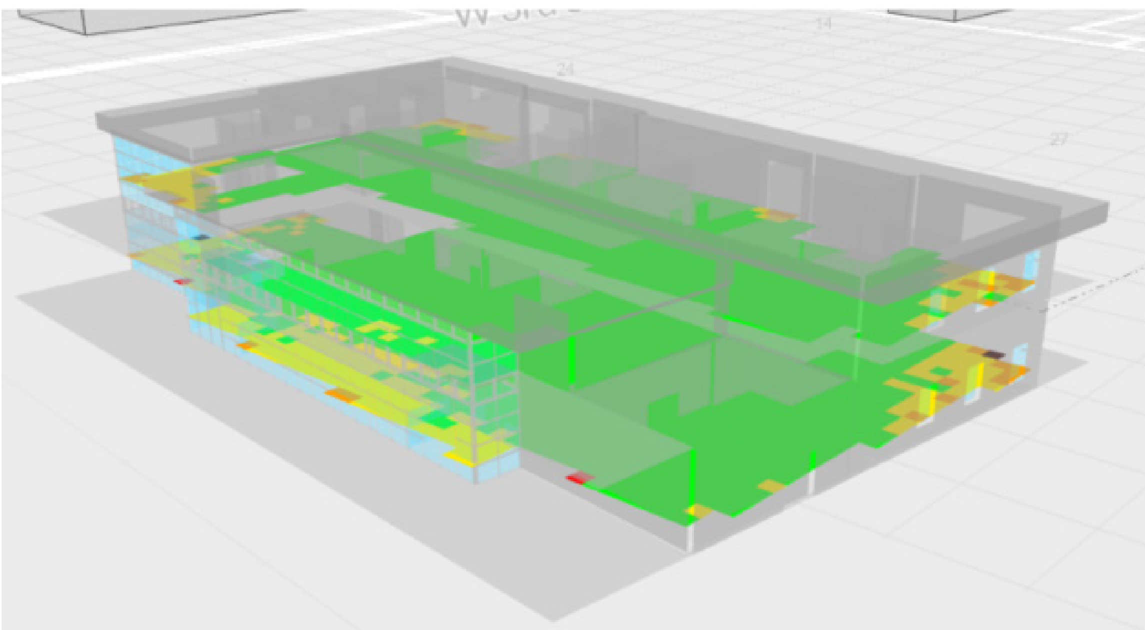


HVAC PLAN - FLOOR 2



DESIGN GLASS, VT = 0.52
SDA: 33%

30% GLASS, VT=.275
SDA: 15.5%

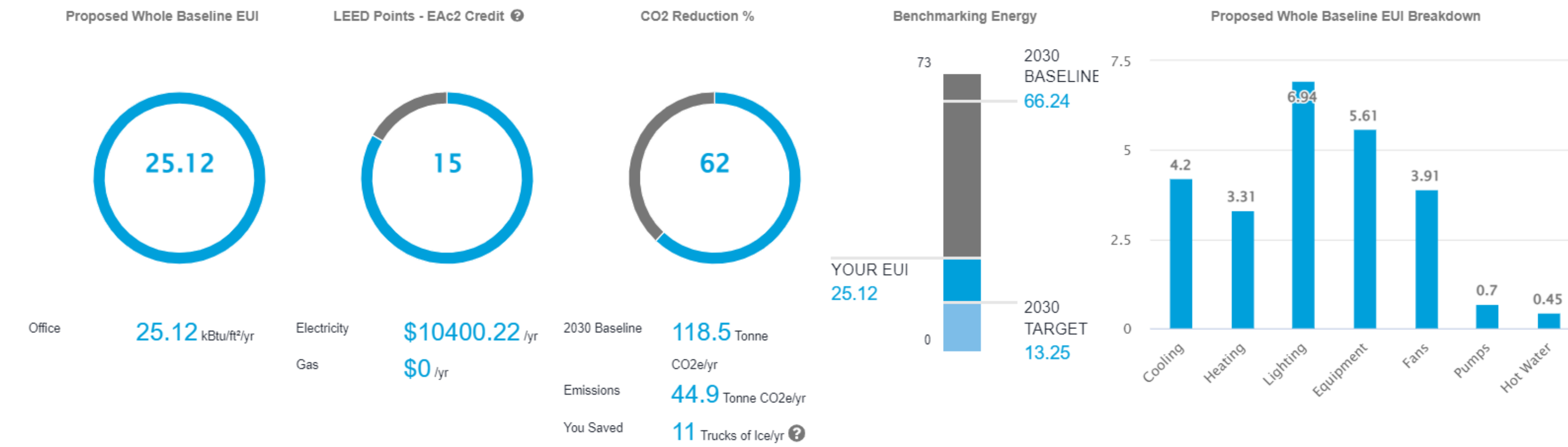


DESIGN GLASS, VT = 0.52
ASE: 17%

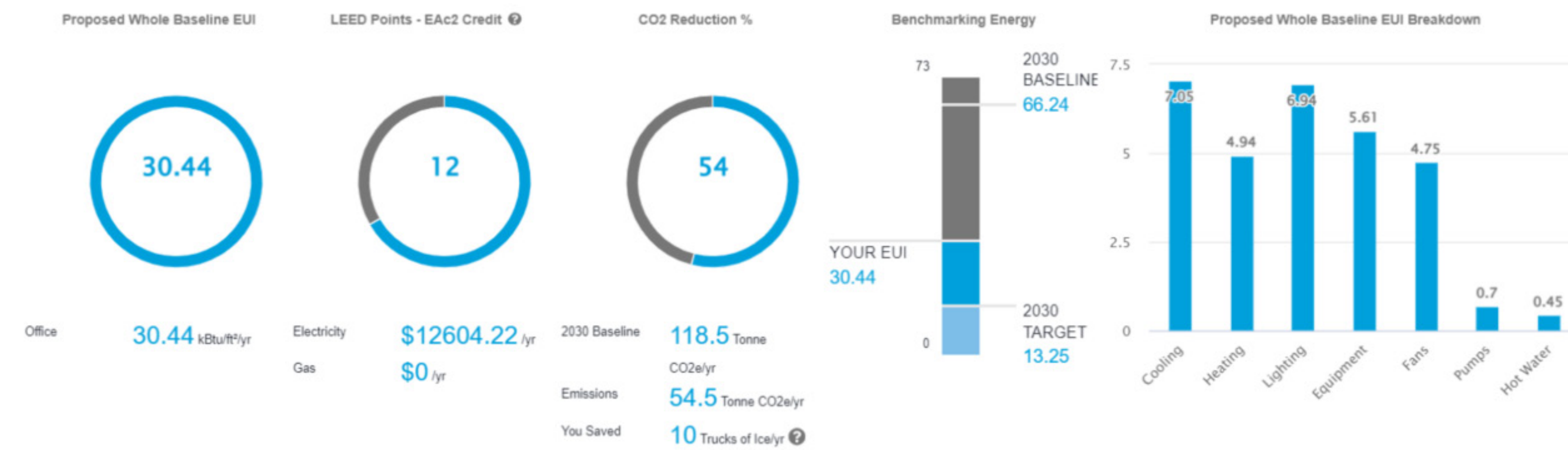
30% GLASS, VT=.275
SDA: 14.5%

Model C EUI: 25.12
Model A EDI: 32.80
% Savings: 23.4%

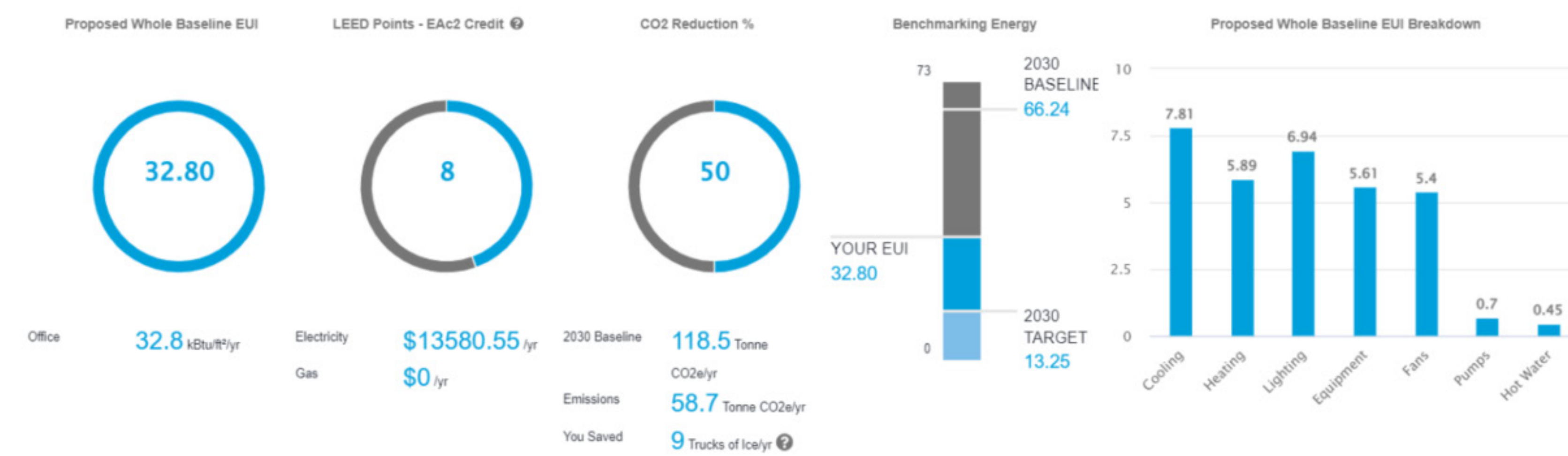
Model C: Improved Design GSHP System, Enthalpy Wheel



Model B: Initial Design 37.7% Glass Ratio, Improved Glass, Improved R-Values



Model A: Code Model



COVE TOOL COMPARISON