E N G A G E

Other Options Food Pantry • Midtown Community Center

ARCH 5226 – Comprehensive Studio – Architectural Engineering

Thesis Completed: May 10th, 2017

Submitted by: Eric Fleet

Course Abstract

I am designing a Food Pantry and Teen Community Center. The project design will be comprehensive, so I will be designing the overall building, mechanical systems, some technical details based on research and analysis, as well as an in-depth design and calculation of the structural system.

Personal Project Abstract

Historically, people with HIV/AIDS have felt disassociated with society, a stigma that is still very existent today. A strong interaction with the Oklahoma City community can provide this group of people with the acceptance and comfort that we all inherently desire. The opportunity to design a campus that integrates a food pantry with a community center provides a unique opportunity to chisel away at this stigma. Through creating architecturally separated, yet programmatically connected spaces, the building users experience a balance of both public and private spaces. Though the three primary users of this building are teens, staff, and the food pantry clients, it is the staff that ties the two polar building functions together and nurtures this overall connection to the community.

Engage is located on the corner of N. Robinson Avenue and N.W. 11th Street in Oklahoma City, a site with access to views toward the downtown and midtown areas. Users are invited inside through three main entrances, all located at strategic points across the site – one is more private and placed near the south bus stop for servicing primarily food pantry users, while the other two entrances pull people into the central lobby from the west and east sides of the site respectively. A central corridor accessed from the parking is utilized to help funnel staff and community center users into their respective spaces. The food pantry clients are symbolized through the use of precast concrete walls to express their resiliency and sense of reservation during this hard time. These clients have access to a more private set of spaces on the south side of the site, while the precast concrete walls continue throughout the building, interacting with spaces such as the teen lounge, the main lobby and the multipurpose classroom.

In contrast, teens will use the community center to the north, a more public and open set of spaces. This larger space is encapsulated by a planar wood façade with slots dispersed along its

surface for light access. The grand form serves to envelop the community center, engage the ground plane, and span across the building to interact with the food pantry and staff spaces. By moving up and interacting with the roof planes of both the gymnasium and the food pantry lobby, this large timber form begins to peel away pieces of the roof to reveal large skylights for allowing light penetration into the spaces below. Finally, by taking advantage of vertically aligned CMU walls, the loading and service spaces are clearly defined. As one moves around the building, these three contrasting materials begin to speak to one another and guide users throughout the building, highlighting the three primary users of the design.

The spaces may be separated by function, but various connections unify the building as a whole through the situation of the staff and the communication of differing materiality. The stigma against the HIV/AIDS community opposes what it means to even be a community. *Engage* promotes the entire community – all people – while still balancing the need for public and private spaces.

Pre-Design Phase

Project Research

Once the project parameters were introduced, I helped coordinate the entire comprehensive studio into a research endeavor to collect information on various aspects that would affect the overall design initiative. These areas of research were focused on the site given, the client's needs, the building codes of the area, the context of Oklahoma City, sustainability suggestions, effective loading scenarios, and the construction of a digital context model in Revit. After a week of intensive research collection and organization, a 175-page document was produced and dispersed amongst the class to help formulate some initial design proposals.

In addition to the strong focus on project research at the beginning of the semester, the class spent a day visiting the site in person, while also meeting our clients at Other Options Incorporated in Oklahoma City. This personal interaction helped to solidify the potential magnitude of our design on this facility that devotes everything to serving the community. As a requirement for the course, students were asked to volunteer one weekend at Other Options Inc. in order to experience the culture of the facility first hand. This experience also lent itself to allowing students to see any deficiencies in the current design so that solutions could begin to take shape early on in the design process.

Schematic Design Phase

Concept Search

The weeks following the pre-design phase were spent rigorously searching for an initial design concept that solved as many of the project challenges as possible. These concepts explored everything from site orientation and access of spaces, to massing and functionality of the loading dock. After several weeks of exploration and refinement, I honed in on a design concept that gave representation to the various user groups through the qualities of differing materials and how they can interact with one another. A general massing strategy was implemented that worked well programmatically with the spaces required and from there, the concept took over in making several important design decisions.

The initial schematic design process began with several inspiration pictures which led to a preliminary design concept. The idea of taking an important space and shifting it out of an overall, monolithic form provided a sense of hierarchy and intrigue. In addition, the use of contrasting materials around the façade allowed for flexibility in daylighting strategies while also creating an appealing exterior aesthetic.

Through the use of various conceptual communication methods such as sketching and Google Sketchup, the initial form of the design came into being. By altering the different mass configurations, scale was better understood and the relationships between masses was pinpointed. By looking into the programmatic relationships within each mass, the general plan was then able to function alongside the proposed 3D masses.

Once the main form was selected, ideas were explored that expressed the concept of community through exterior materiality. Finally, a scheme was chosen that symbolized the community center with a timber veneer, while the food pantry was represented by precast concrete walls.

SD HVAC

As the floor plans began to take shape, the location of the mechanical rooms and other service spaces had to be strategically placed in order to nurture a successful design. By placing the service core of the building in the southeast corner near the loading dock, these spaces were kept away from the main spaces of the building and remain hidden from view. An initial duct layout was proposed which followed the central circulation of the design to a tee. This decision allowed for an extremely efficient selection of mechanical ductwork that provided the required amount of conditioned air to the spaces with the least amount of ducting material possible.

Intake and exhaust air vents were placed a minimum of 8 feet apart to avoid cross-contamination of these separate air streams. Three air handling units were chosen to service the building. Two of these units operate on a variable-air-volume system (VAV) and service the occupied spaces on the first and second floors. The third air handling unit services the gymnasium alone and runs on a constant-air-volume system (CAV) due to the large volume and height of this space. In addition, VAV boxes were modeled to indicate when a space would have its own thermostat for controlling the specific environmental conditions of that space.

The heating and cooling system chosen for this design was accomplished through the use of ground source heat pumps located at the southeast corner of the building. Typically, these pumps cannot be placed underneath the building in case the need for servicing these wells arises. However, after researching the successful implementation of this sub-building installation method, I chose to pursue this approach in order to save space on the limited size of our given site.

SD Structure

The structure was explored during the schematic design phase from a very general perspective. Different systems were implemented and various advantages and disadvantages were studied. First, a timber system was studied to check feasibility. Though this system would result in a more efficient use of materials and an overall lighter structure, the member sizes would have to be larger to accommodate for the weakness of the material itself. Next, a concrete design was chosen, utilizing a one-way concrete slab. This approach provided minimal column footprints due to the strength of the material; however, the system would have resulted in fewer views out of the building, less daylight exposure, and a heavy roof load. Finally, a complete steel system was chosen for this design due to its strength, flexibility in design, and simplicity in installation. By using steel vertical braces, all lateral forces could be transferred into the foundation directly without the use of solid shear walls. A composite floor system was selected as well due to its strength and minimal thickness requirements.

Design Development Phase

Material Exploration

Before the design development phase, many of the major decisions that directed the form of the building had already been made. After the introduction to the design development phase, weeks were spent developing the interior experience of the design, as well as refining the interaction between both the interior and exterior materials. For my concept, the exterior materials represented the primary users of the building. However, during this phase, I integrated this concept throughout the spaces within, guiding the timber veneer drop-panels along a hallway while the precast concrete walls rose from the floor plane and began to enclose various volumes. In addition to expanding the use of the three main materials along the inner corridors, a stained concrete floor was utilized on the second floor to richen the community center areas and warm the gathering spaces. Also, acoustic drop panels were placed below the structure, the mechanical air ducts, and the fire protection system to provide noise control and scale to the community center.

Lighting design was also initiated during this phase. By utilizing the Lumen method, multiple lighting fixtures were researched and run through a trial and error process until one met the required lighting proficiencies. Once a fixture was selected after numerous calculations, the dimensions and spacing were included in a reflected ceiling plan to ensure complete coordination with the structural, fire protection, and HVAC systems for the building. To account for the effects of daylighting, a scale model was built and tested in our daylighting lab. Using eight sensors placed throughout the model, the typical light loads were recorded and analyzed. By checking for the predicted illuminance levels in the teen lounge during each of the four seasons, it was found that an internal shading device would be necessary during the summer months to help control the amount of daylight entering the space. Therefore, a mechanical roller blind system was placed in the detailed wall section and the interior rendering of the teen lounge.

DD HVAC

Before constructing an environmental performance model in the EnergyQuest program, the thermal resistance values had to be calculated for the roof, wall, and floor components. In addition, research was performed to find a glass type for the curtain wall that diffused the daylight sufficiently and provided thermal protection to the space within. Several values were recorded for the various thermal-resisting components such as the thermal conductance, thermal transmittance, glass shading coefficient, the solar heat gain coefficient, and the visible transmittance of the glass. By comparing my model with a 27% glass ratio to a baseline model with a 40% glass ratio, my design was found to be much more efficient and required a lower cooling load for the interior space. With these calculations, the main duct sizes were determined for each air handling unit, as well as the return duct sizes. Louver sizes were also found through calculations utilizing the air handling unit capacities and a 30% fresh air intake.

DD Structure

After proceeding through the schematic design phase of this project, my design was made possible by utilizing a structural steel framing system. With this material, overall depths of members were reduced when compared to the use of timber construction. In addition, visual connections between the interior space and the exterior environment were more readily available when compared to the use of concrete columns and slabs.

Upon reviewing the geotechnical report for our urban site in the heart of Oklahoma City, it was advised that a foundation system consisting of drilled piers and grade beams supporting a concrete slab for the ground floor would be the best option. This would result in the least amount of overall building movement when compared to slab-on-grade or subgrade wall systems. These drilled piers would also support a system of grade beams beneath the structure, which are located around the exterior walls of the building. They function by transferring gravity load directly from the columns above to the piers below.

Preliminarily, an 18-inch diameter pier would be drilled below all columns, with the exception of some localized areas across the site with an expected increase in gravity loading. Some instances of this occurring would be below the green roof since live and dead loads here will be higher when compared to other locations around the building. Piers located beneath the south side of the gymnasium, as well as in the middle of the Food Pantry space that extend upward to support the staff spaces on the second floor, should be sized near 24 inches or 30 inches in diameter to accommodate higher dead loads and large roof loads above the gymnasium.

The main horizontal structural system for this project is a composite deck system supported by steel post and beam construction. Steel columns and vertical bracing throughout the building support horizontal composite steel beams, whose purpose is to tie together the poured concrete slab, the corrugated steel decking, and the steel beams beneath. Before a three-inch concrete slab is poured, shear studs are attached to the deck/beam interface so that the concrete slab engages the structure itself. Vertical bracing (in the form of diagonal braces) is located primarily around the large gym space, as well as along the mechanical cores in the building and along the south side of the second floor staff spaces. These walls act as the main lateral force resisting elements for the design.

Sizing of the members throughout this design remains relatively consistent within each space. The gym is sheltered above by open-web joist girders, approximately six feet deep. These in turn support one-foot deep open-web roof joists, spaced at approximately five feet on center. Most columns were preliminarily designed to be wide flange members with a nominal depth of eight to ten inches. For the food pantry component of the program, open-web joist girders reaching a depth of three feet were used to support the green roof above. In addition, fourteen-inch deep steel roof beams comprise the exterior framing of the food pantry.

Design Documentation Phase

Construction Documents

As final documentation took place in the design process, numerous revisions were made to the structure to finalize the structural analysis model. In RISA, the structure was modeled and made stable after applying all the necessary seismic, wind, snow, and gravity loads to the building. Once the model ran successfully, various checks were performed to meet code and serviceability requirements such a lateral drift checks, member deflection checks, and interaction equation checks. Once the final member sizes were selected, the Revit model went through one final revision before construction documents were created.

For the documentation process, an index was formed that lists the typical drawings included if the project were being built by professional architects and engineers. I only developed a specific selection of these drawings for documentation as a structural engineering undergraduate. A detailed architectural plan was created, showing the various room numbers, associated door numbers, interior partition labels, and several interior elevation markers. From here, the foundation and framing plans came to life, providing layouts and details on brace locations, column and pier placements, edge of slab boundaries, slab elevations, and member sizes. Details for some of the specific structural connections were drawn throughout the building, showing different framing scenarios, the elevator pit detail, and the expansion joint detail. In order to quantify members and their sizes for the building, the final sheet on the construction drawings was devoted to schedules. Numerous calculations were performed here and the sizes of the main structural members were organized in tables such as the piers, grade beams, columns, beams, girders, slabs, and vertical braces.

Conclusion

Overall, the Architectural Engineering Comprehensive Design Studio course was a culmination of the last five years of my architecture and engineering education. Though the course curriculum is nearly identical for the architects and the engineers in this class, the engineers focused more on the structural components of their design rather than the architectural details. Since our major has a strict focus on structures, I personally feel like the course could be even more attuned to the structural engineering aspect of the profession than it currently is. The course places a heavy emphasis on the HVAC building system, but our degree does not have a focus in this area. If we had even just a couple more weeks to develop our individual structures and explore the RISA modeling software more in depth, the experience of completing this comprehensive design studio would be even more worthwhile. Nevertheless, the design experience that I have received through the School of Architecture at Oklahoma State University will be a valuable asset in my professional career in the years to come.

ENGAGE

MIDTOWN COMMUNITY CENTER & OTHER OPTIONS FOOD PANTRY

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THIS SEMESTER, THE ARCH 5226 COMPREHENSIVE ARCHITECTURAL ENGINEERING DESIGN STUDIO WAS TASKED WITH DESIGNING A FOOD PANTRY AND TEEN COMMUNITY CENTER LOCATED IN THE HEART OF DOWNTOWN OKLAHOMA CITY. OUR CLIENT, OTHER OPTIONS INC., PROVIDES BASIC FOOD ESSENTIALS TO HIV-POSITIVE MEMBERS OF THE METRO AREA. THIS GROUP OF PEOPLE CREATED A DESIGN CHALLENGE SINCE THE IDEA OF PRIVACY NEEDED STRONG CONSIDERATION. IN ADDITION, IT WAS REQUESTED THAT THE TEEN COMMUNITY CENTER BE A SAFE HAVEN FOR TEENS, BUT SPECIFICALLY FOR LGBT YOUTH. THIS MARGINALIZED GROUP OF YOUNG PEOPLE IS AT HIGH RISK FOR HOMELESSNESS. TOGETHER, THIS CAMPUS NEEDED TO TIE INTO THE URBAN COMMUNITY, AS WELL AS EXPRESS A BALANCE BETWEEN THE PUBLIC AND PRIVATE.

OTHER OPTIONS, INC.

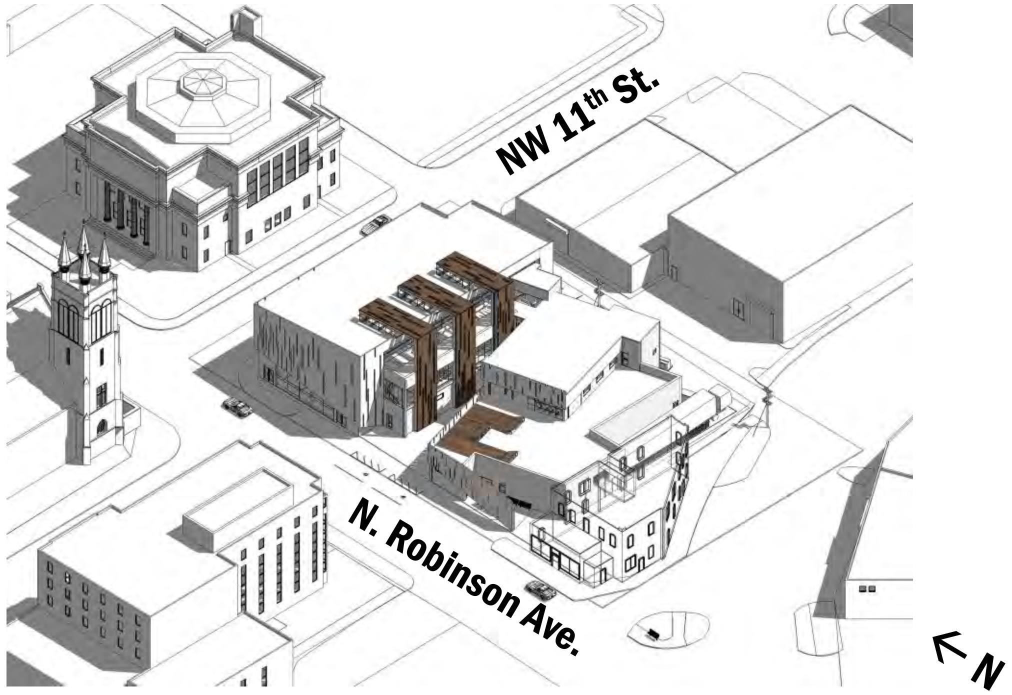
PROJECT STATEMENT / ABSTRACT:

HISTORICALLY, PEOPLE WITH HIV/AIDS HAVE FELT DISASSOCIATED WITH SOCIETY, A STIGMA THAT IS STILL VERY EXISTENT TODAY. A STRONG INTERACTION WITH THE OKLAHOMA CITY COMMUNITY CAN PROVIDE THIS GROUP OF PEOPLE WITH THE ACCEPTANCE AND COMFORT THAT WE ALL INHERENTLY DESIRE. THE OPPORTUNITY TO DESIGN A CAMPUS THAT INTEGRATES A FOOD PANTRY WITH A COMMUNITY CENTER PROVIDES A UNIQUE OPPORTUNITY TO CHISEL AWAY AT THIS STIGMA. THROUGH CREATING ARCHITECTURALLY SEPARATED, YET PROGRAMMATICALLY CONNECTED SPACES, THE BUILDING USERS EXPERIENCE A BALANCE OF BOTH PUBLIC AND PRIVATE SPACES. THOUGH THE THREE PRIMARY USERS OF THIS BUILDING ARE TEENS, STAFF, AND THE FOOD PANTRY CLIENTS, IT IS THE STAFF THAT TIES THE TWO POLAR BUILDING FUNCTIONS TOGETHER AND NURTURES THIS OVERALL CONNECTION TO THE COMMUNITY.

ENGAGE IS LOCATED ON THE CORNER OF N. ROBINSON AVENUE AND N.W. 11TH STREET IN OKLAHOMA CITY, A SITE WITH ACCESS TO VIEWS TOWARD THE DOWNTOWN AND MIDTOWN AREAS. USERS ARE INVITED INSIDE THROUGH THREE MAIN ENTRANCES, ALL LOCATED AT STRATEGIC POINTS ACROSS THE SITE – ONE IS MORE PRIVATE AND PLACED NEAR THE SOUTH BUS STOP FOR SERVICING PRIMARILY FOOD PANTRY USERS, WHILE THE OTHER TWO ENTRANCES PULL PEOPLE INTO THE CENTRAL LOBBY FROM THE WEST AND EAST SIDES OF THE SITE RESPECTIVELY. A CENTRAL CORRIDOR ACCESSED FROM THE PARKING IS UTILIZED TO HELP FUNNEL STAFF AND COMMUNITY CENTER USERS INTO THEIR RESPECTIVE SPACES. THE FOOD PANTRY CLIENTS ARE SYMBOLIZED THROUGH THE USE OF PRECAST CONCRETE WALLS TO EXPRESS THEIR RESILIENCY AND SENSE OF RESERVATION DURING THIS HARD TIME. THESE CLIENTS HAVE ACCESS TO A MORE PRIVATE SET OF SPACES ON THE SOUTH SIDE OF THE SITE, WHILE THE PRECAST CONCRETE WALLS CONTINUE THROUGHOUT THE BUILDING, INTERACTING WITH SPACES SUCH AS THE TEEN LOUNGE, THE MAIN LOBBY AND THE MULTIPURPOSE CLASSROOM.

IN CONTRAST, TEENS WILL USE THE COMMUNITY CENTER TO THE NORTH, A MORE PUBLIC AND OPEN SET OF SPACES. THIS LARGER SPACE IS ENCAPSULATED BY A PLANAR WOOD FAÇADE WITH SLOTS DISPERSED ALONG ITS LENGTH FOR LIGHT ACCESS. THE GRAND FORM SERVES TO ENVELOP THE COMMUNITY CENTER, ENGAGE THE GROUND PLANE, AND SPAN ACROSS THE BUILDING TO INTERACT WITH THE FOOD PANTRY AND STAFF SPACES. BY MOVING UP AND INTERACTING WITH THE ROOF PLANES OF BOTH THE GYMNASIUM AND THE FOOD PANTRY LOBBY, THIS LARGE TIMBER FORM BEGINS TO PEEL AWAY PIECES OF THE ROOF TO REVEAL LARGE SKYLIGHTS FOR ALLOWING LIGHT PENETRATION INTO THE SPACES BELOW. FINALLY, BY TAKING ADVANTAGE OF VERTICALLY ALIGNED CMU WALLS, THE LOADING AND SERVICE SPACES ARE CLEARLY DEFINED. AS ONE MOVES AROUND THE BUILDING, THESE THREE CONTRASTING MATERIALS BEGIN TO SPEAK TO ONE ANOTHER AND GUIDE USERS THROUGHOUT THE BUILDING, HIGHLIGHTING THE THREE PRIMARY USERS OF THE DESIGN.

THE SPACES MAY BE SEPARATED BY FUNCTION, BUT VARIOUS CONNECTIONS UNIFY THE BUILDING AS A WHOLE THROUGH THE SITUATION OF THE STAFF AND THE COMMUNICATION OF DIFFERING MATERIALITY. THE STIGMA AGAINST THE HIV/AIDS COMMUNITY OPPOSES WHAT IT MEANS TO EVEN BE A COMMUNITY. *ENGAGE* PROMOTES THE ENTIRE COMMUNITY – ALL PEOPLE – WHILE STILL BALANCING THE NEED FOR PUBLIC AND PRIVATE SPACES.



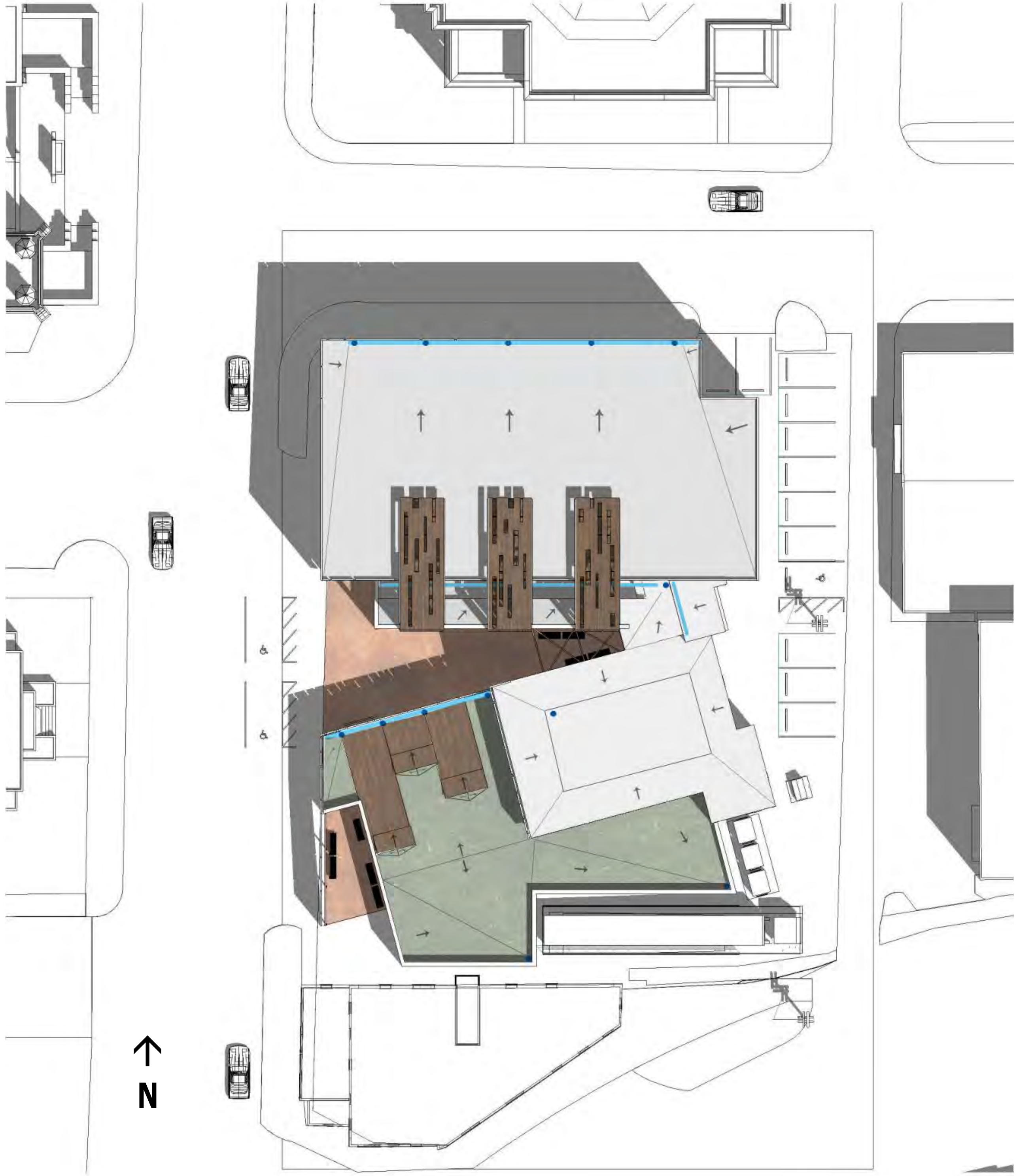
AERIAL PLAN SHOWING CONTEXT, SCALE, AND THE VERTICALITY OF THE TIMBER SKIN DESIGN

OVERALL CONTEXT AND SITE LOCATION. OKLAHOMA CITY, OKLAHOMA – MIDTOWN DISTRICT

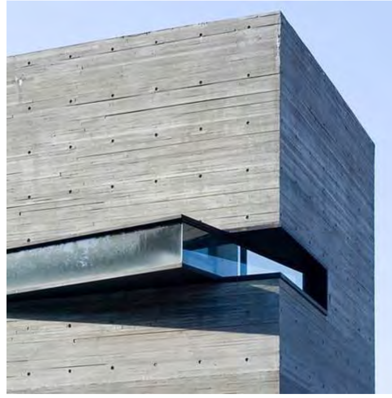
OUR SITE WAS LOCATED AT THE INTERSECTION OF NW 11TH STREET AND NORTH ROBINSON AVENUE. TO THE NORTH, AN ABANDONED CHURCH BUILDING OBSTRUCTED MOST VIEWS IN THAT DIRECTION. SIMILARLY, AN AUTOMOTIVE WORKSHOP RESTS TO THE EAST ACROSS FROM A UTILITY SERVICE ALLEY.

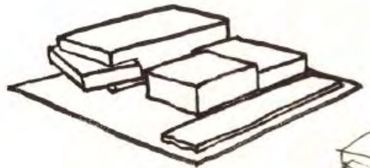
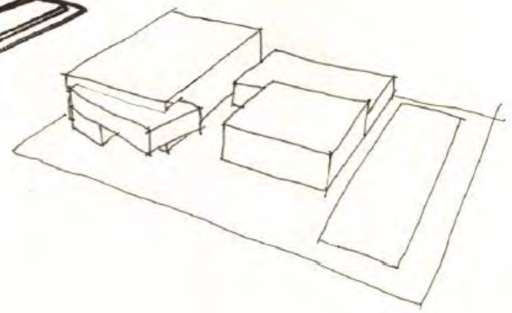
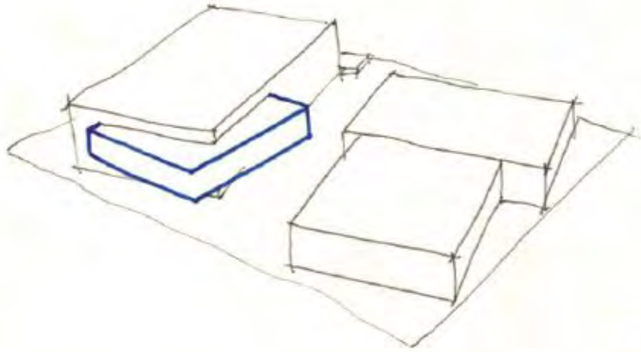
ALONG THE CURVED ROAD TO THE SOUTH LIE SEVERAL WAREHOUSES, USED PRIMARILY FOR FLOWER DISTRIBUTION. THIS STREET SEES A LARGE NUMBER OF SEMITRUCKS EVERY DAY, SO THE CONNECTION TO THE SERVICE ALLEY HERE IS VERY USEFUL FOR THIS DESIGN.

TOWARD THE WEST, THE STRYKER OFFICE BUILDING RISES SEVERAL STORIES, IMPEDING MOST VIEWS IN THAT DIRECTION. ADDITIONALLY, THE FIRST BAPTIST CHURCH ON THE NORTHWEST CORNER OF THE INTERSECTION IS AESTHETICALLY APPEALING, BUT RISES FAR ABOVE MOST OTHER BUILDINGS IN THE SURROUNDING AREA.

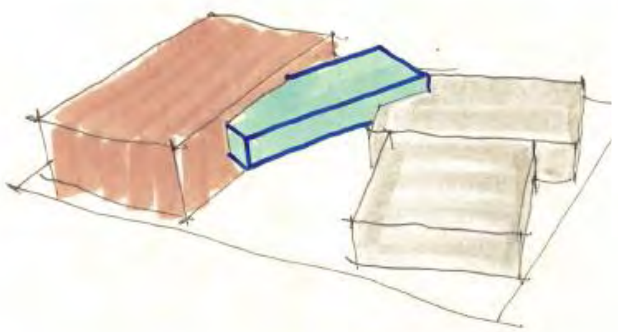
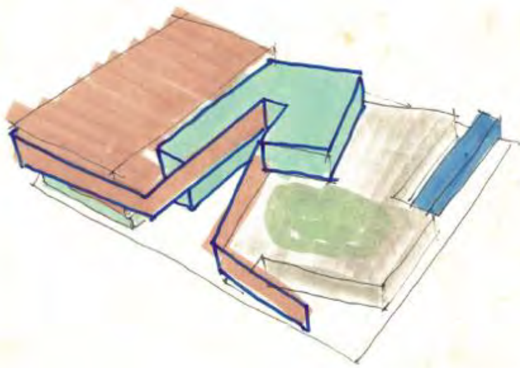
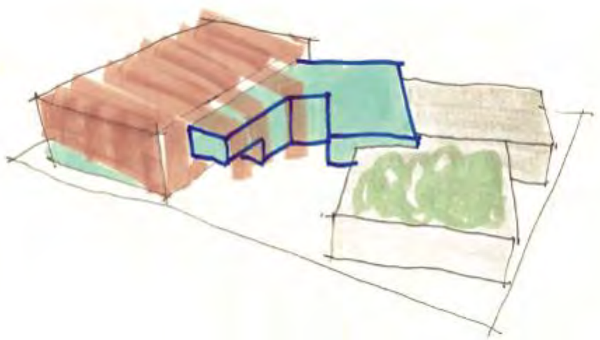
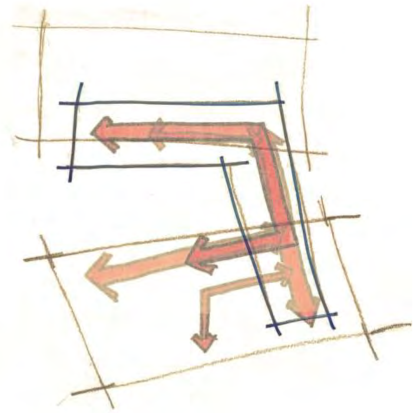


SITE PLAN, SHOWING DRAINAGE PLAN, CONTEXT, AND MATERIALITY

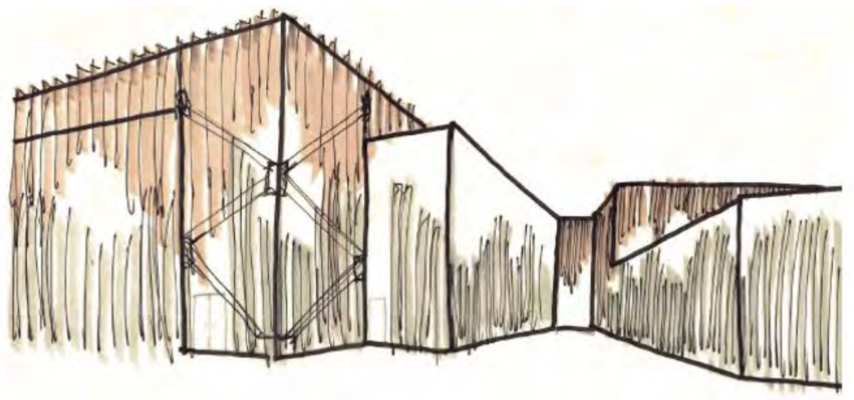


THE INITIAL SCHEMATIC DESIGN PROCESS BEGAN WITH SEVERAL INSPIRATION PICTURES WHICH LED TO A PRELIMINARY DESIGN CONCEPT. THE IDEA OF TAKING AN IMPORTANT SPACE AND SHIFTING IT OUT OF AN OVERALL, MONOLITHIC FORM PROVIDES A SENSE OF HIERARCHY AND INTRIGUE. IN ADDITION, THE USE OF CONTRASTING MATERIALS AROUND THE FAÇADE ALLOWS FOR FLEXIBILITY IN DAYLIGHTING STRATEGIES WHILE ALSO CREATING AN APPEALING EXTERIOR AESTHETIC.


THROUGH THE USE OF VARIOUS CONCEPTUAL COMMUNICATION METHODS SUCH AS SKETCHING AND GOOGLE SKETCHUP, THE INITIAL FORM OF THE DESIGN CAME INTO BEING. BY ALTERING THE DIFFERENT MASS CONFIGURATIONS, SCALE WAS BETTER UNDERSTOOD AND THE RELATIONSHIPS BETWEEN MASSES WAS PINPOINTED. BY LOOKING INTO THE PROGRAMMATIC RELATIONSHIPS WITHIN EACH MASS, THE GENERAL PLAN WAS THEN ABLE TO FUNCTION ALONGSIDE THE PROPOSED 3D MASSES.



ONCE THE MAIN FORM WAS SELECTED, IDEAS WERE EXPLORED THAT EXPRESSED THE CONCEPT OF COMMUNITY THROUGH EXTERIOR MATERIALITY. FINALLY, A SCHEME WAS CHOSEN THAT SYMBOLIZES THE COMMUNITY CENTER WITH A TIMBER VENEER, WHILE THE FOOD PANTRY IS REPRESENTED BY PRECAST CONCRETE. THESE RENDERINGS SHOW THE FINAL STAGES OF THE SCHEMATIC DESIGN PHASE.

FLOOR PLANS

1ST FLOOR PLAN

2ND FLOOR PLAN

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Occupant Loads - 1st Floor						Floor Total:	1041
Space	Area (sf)	Type	Load (sf/occ)	# of Occupants		Totals	# of Exits
Multipurpose Lobby	1040	Net	15	69.33	70	Pantry	2
Multipurpose Storage	233	Gross	300	0.78	1	111	1
Store	736	Gross	60	12.27	13		1
Fresh Distribution	213	Gross	300	0.71	1		1
Mens Restroom	333	Gross	100	3.33	4		1
Womens Restroom	235	Gross	100	2.35	3		1
Janitors Closet - Pantry	21	Gross	300	0.07	1		1
1 Staff Office	129	Gross	100	1.29	2		1
Volunteer Room	186	Gross	50	3.72	4		1
Mechanical - Fan room 1	521	Gross	300	1.74	2		1
GSHP Room	421	Gross	300	1.40	2		1
Receiving	200	Gross	300	0.67	1		1
Sorting	328	Gross	300	1.09	2		1
Dry Storage	357	Gross	300	1.19	2		1
Dry Food Storage	506	Gross	300	1.69	2		1
Cooler Storage	160	Gross	300	0.53	1		1
Teen Community Lobby	359	Net	15	23.93	24	Center	1
Community Center - M RR	260	Gross	100	2.60	3	930	1
Community Center - W RR	281	Gross	100	2.81	3		1
Family RR	96	Gross	100	0.96	1		1
Director's Office	149	Gross	100	1.49	2		1
Gym	6240	Net	7	891.43	892		3
Mailboxes	100	Gross	300	0.33	1		1
Janitor's Closet - Gym	16	Gross	300	0.05	1		1
Storage	83	Gross	300	0.28	1		1
Electrical Satellite Room	59	Gross	300	0.20	1		1
Electrical Satellite Room	14	Gross	300	0.05	1		1

Occupant Loads - 2nd Floor					Floor Total:	75
Space	Area (sf)	Type	Load (sf/occ)	# of Occupants		# of Exits
Teen Lounge	375	Net	15	25.00	25	1
Multipurpose Classroom	362	Net	20	18.10	19	1
Electrical Satellite Room	16	Gross	300	0.05	1	1
Computer Area	100	Gross	100	1.00	1	1
Staff office 1	188	Gross	100	1.88	2	1
Staff office 2	179	Gross	100	1.79	2	1
Laundry	215	Gross	50	4.30	5	1
Kitchenette/Break Room	221	Gross	200	1.11	2	1
Staff work area	299	Gross	100	2.99	3	1
Staff RR	103	Gross	100	1.03	2	1
Janitors Closet - Staff	39	Gross	300	0.13	1	1
Counselors Office 1	152	Gross	100	1.52	2	1
Counselors Office 2	162	Gross	100	1.62	2	1
Counselors Office 3	164	Gross	100	1.64	2	1
Conference Room	264	Gross	100	2.64	3	1
Mechanical - Fan room 2	279	Gross	300	0.93	1	1
Mechanical - Fan room 3	366	Gross	300	1.22	2	1

Occupancy	
Community Center	A-3
Gym	A-3
Teen Lounge	A-3
Exterior Space	A-3
Food Pantry - Clients	M
Food Pantry - BOH	S-2
Offices	B
Classroom	B
*Building is:	MIXED USE
Construction Type:	III

Widths of Egress Elements				
Element	Number of Occupants	Width (in)	USE: (in)	
Stairs	75	5	44	Table 1011.2
Corridors - 1st (Pantry)	111	16.65	44	
Corridors - 1st (Center)	38	5.7	44	*No gym included
Corridors - 2nd Floor	73	10.95	44	Table 1020.2
Doors - 1st	149	22.35	32	1010.1.1
Doors - 2nd	73	3.65	32	1010.1.1
Egress Doors - 2nd	73	3.65	32	1010.1.1
Doors - Gym (Main)	446	66.9	5.58	ft (1/2 Capacity)
Doors - Gym (other exits)	297.3333333	44.6	3.72	ft (1/3 capacity)

Number of Exits			
Floors	Occupant Load	# of Exits	*Table 1006.3.1
1st	1041	4	
2nd	75	2	

Dead End Corridors		
Remote Locations	Distance (ft)	<50 ft?
Fan Room 3	21	Yes

Remoteness of Exits			
Space	Max Diagonal / 3 (ft)	Distance (ft)	Meets 1007.1.1 Ex. 2
1st Floor	62	65	Yes
2nd Floor	37	42	Yes
Multipurpose Lobby	15	16	Yes
Gym	39	50	Yes

Common Path of Travel			
*Code requirements satisfied			
Exit Access Travel Distance			
Remote Locations	Distance (ft)	<250 ft?	*Table 1017.2
Middle of Gym	110	Yes	
Family RR	48	Yes	
Store	99	Yes	
Conference Room	60	Yes	

AS THE DESIGN PROGRESSED, BUILDING CODES HAD TO BE MAINTAINED. NUMEROUS CHECKS WERE PERFORMED ACCORDING TO THE INTERNATIONAL BUILDING CODE 2012 (IBC). OCCUPANCY LOADS WERE CALCULATED, WHICH ALLOWED FOR FURTHER CALCULATIONS TO DETERMINE THE WIDTH OF EGRESS ELEMENTS, THE NUMBER OF EXITS REQUIRED, AND ALL EXIT TRAVEL DISTANCES.

STRATIFIED TIMBER PANELING

PRECAST ARCHITECTURAL CONCRETE PANEL WALLS

CONCRETE MASONRY UNIT WALL SYSTEM

THE EXTERIOR EXPRESSION OF THE DESIGN DIRECTLY RELATES TO THE DESIGN CONCEPT OF OUR THREE PRIMARY SPACES AND USERS. CONCRETE MASONRY UNITS ENCASE THE SERVICE AND LOADING ZONES IN THE SOUTHEAST CORNER OF THE BUILDING NEAR THE LOADING DOCK. THE FOOD PANTRY IS REPRESENTED BY PRECAST CONCRETE WALLS AND SYMBOLIZES THE CLIENTS' RESILIENCE AND RESERVATION. AS THIS MATERIAL MOVES NORTH INTO THE COMMUNITY CENTER, THE TIMBER PANELING FACADE BEGINS TO EMBRACE AND ENGAGE THIS OPPOSING DURABLE MATERIAL. AS THE WOOD ENCOMPASSES PORTIONS OF THE BUILDING, IT EXPOSES NUMEROUS SKYLIGHTS ON THE ROOF PLANES, AS WELL AS ENFORCES THE CONCEPT OF ENCOURAGING A COMMUNITY THAT EMBRACES ALL.

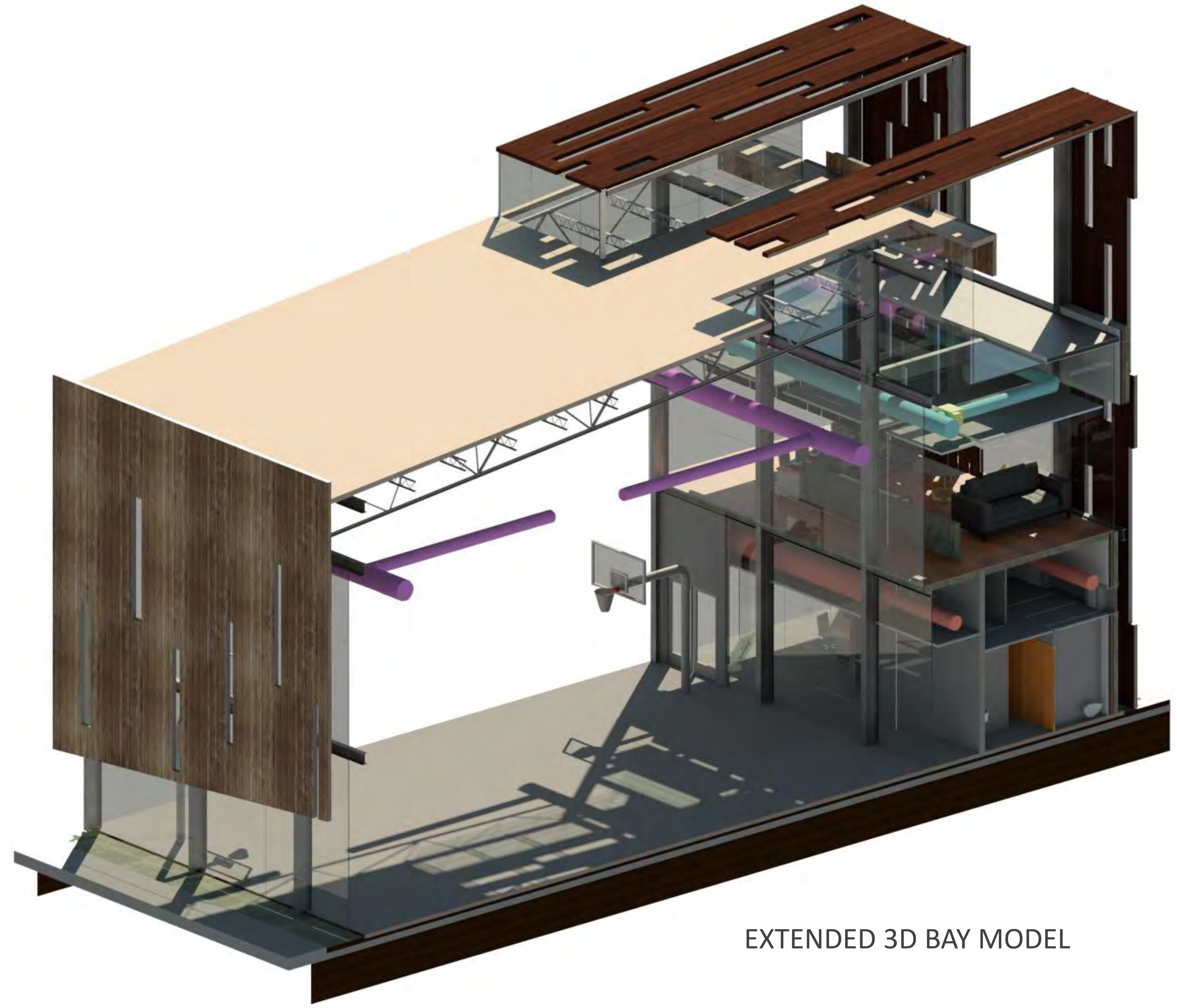
EXT. RENDERING

A FOCUS SPACE WAS SELECTED IN ORDER TO EXPLORE THE ROLE OF THE INTERIOR QUALITY OF THE SPACE. THE TEEN LOUNGE WAS CHOSEN DUE TO ITS STRATEGIC LOCATION FOR DAYLIGHTING, AND BECAUSE IT STRONGLY EXHIBITS HOW THE DIFFERENT MATERIALS INTERACT. AS SHOWN, THE PRE-CAST CONCRETE SEPARATES THE SPACE FROM THE COMPUTER LOUNGE, WHILE THE TIMBER DROP PANEL WALL TIES THE LOUNGE BACK INTO THE OVERALL FLOW OF TRAFFIC THROUGHOUT THE BUILDING. A STAINED CONCRETE FLOOR WAS CHOSEN TO AID THE WOOD IN WARMING THE INSIDE SPACE AND ACOUSTIC DROP CEILING PANELS SCALE THE LOUNGE DOWN WHILE HIDING THE FIRE PROTECTION AND HVAC SYSTEMS ABOVE.

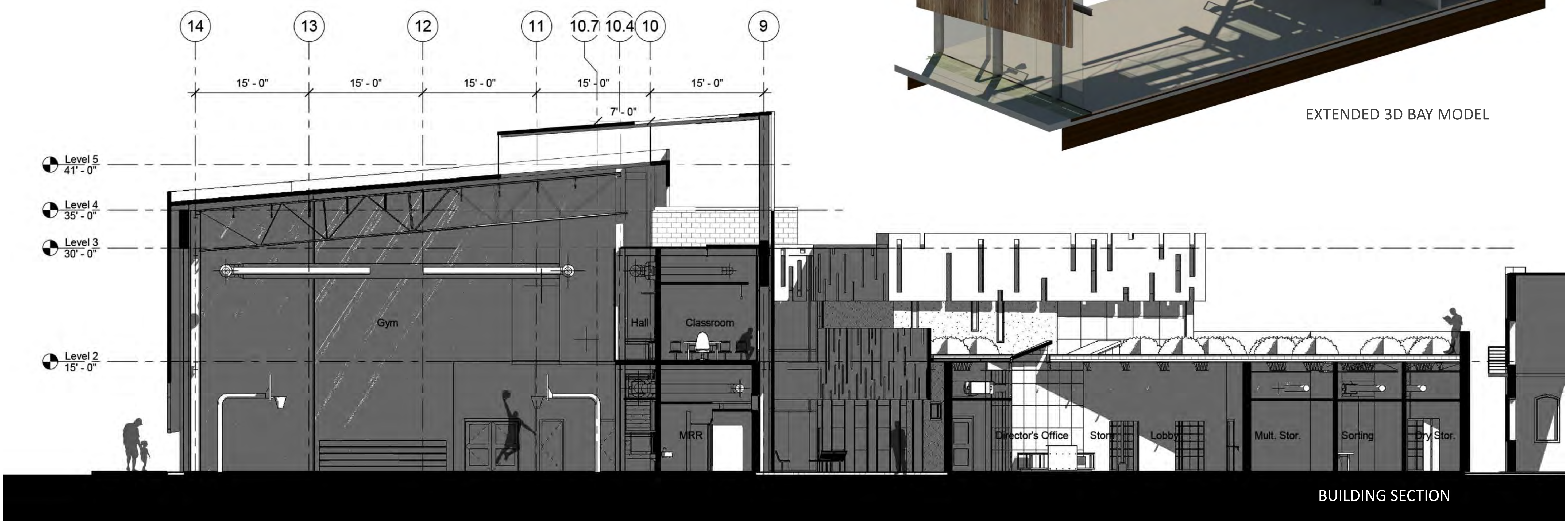
INTERIOR

IN SECTION, DAYLIGHTING AND SHADOWS ARE BETTER UNDERSTOOD. BY CUTTING THROUGH THE GYMNASIUM, EXTERIOR ENTRANCE SPACE, AND THE FOOD PANTRY LOBBY, BOTH SKYLIGHT SYSTEMS CAN BE STUDIED. SCALE FIGURES ARE INCLUDED TO GIVE A SENSE OF THE OVERALL SCALE OF THE INDIVIDUAL SPACE HEIGHTS. ELEVATIONS ARE LISTED TO GIVE AN INDICATION OF THE VARIOUS STORY HEIGHTS.

TO SEE HOW THE VARIOUS BUILDING SYSTEMS RELATE TO ONE ANOTHER, THE BAY MODEL 3D SECTION CUT TO THE RIGHT SHOWS THE HVAC, STRUCTURAL, ARCHITECTURAL, LIGHTING, AND FAÇADE SYSTEMS. CURTAIN WALLS ARE PLACED THROUGHOUT THE ENTIRE BUILDING TO MAXIMIZE LIGHT FLOW AND VIEWS ACROSS THE DESIGN.



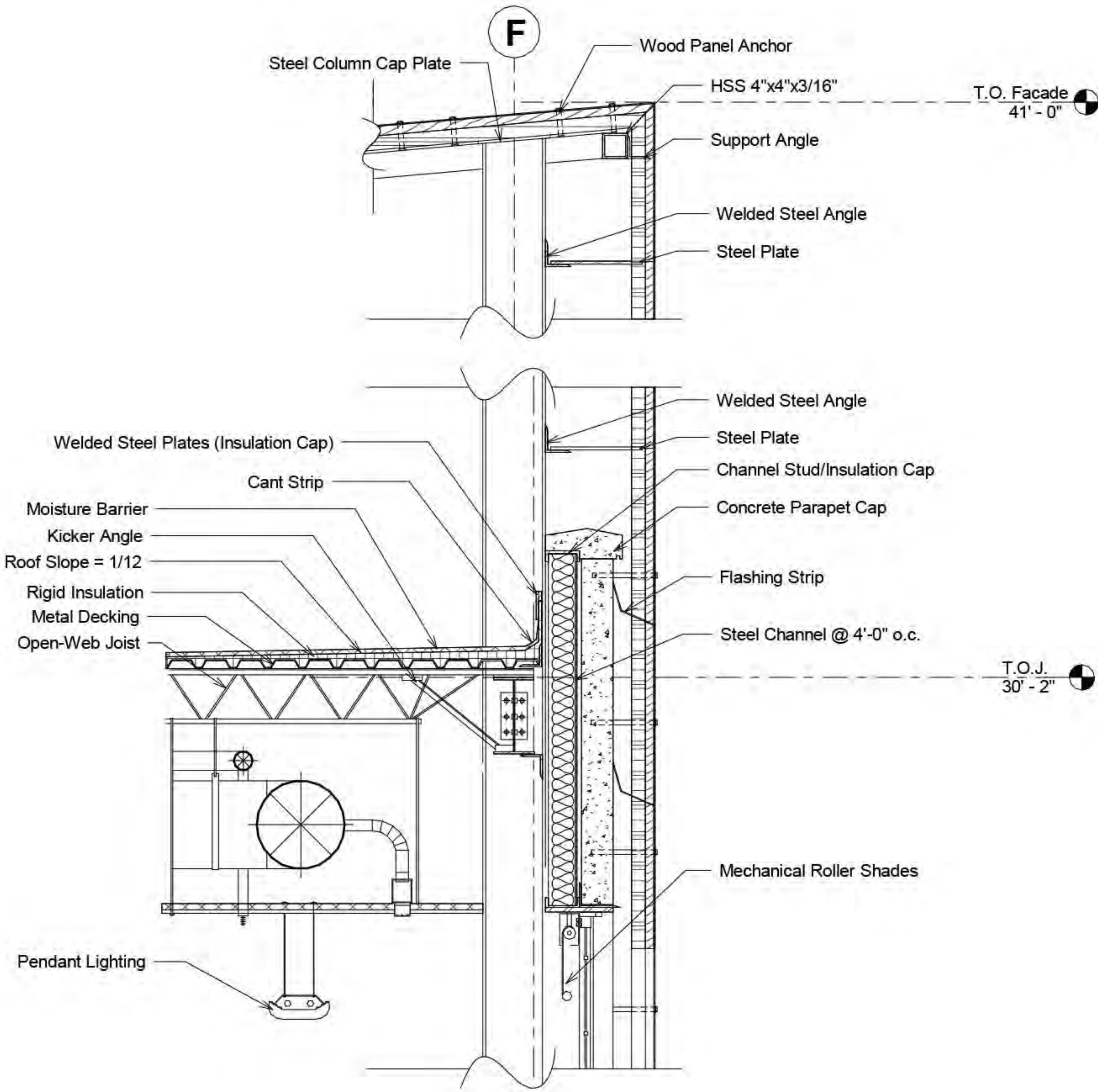
EXTENDED 3D BAY MODEL

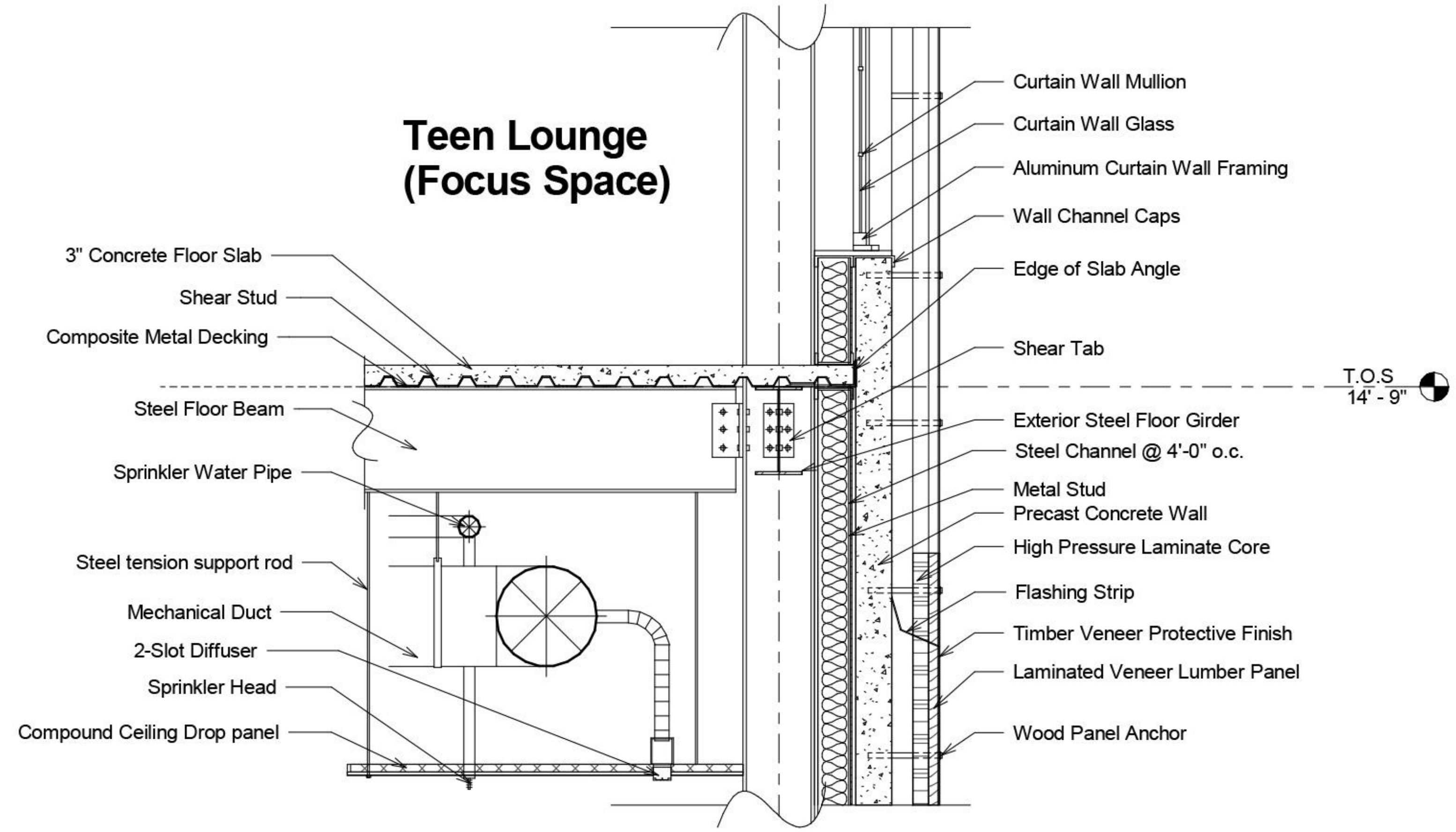


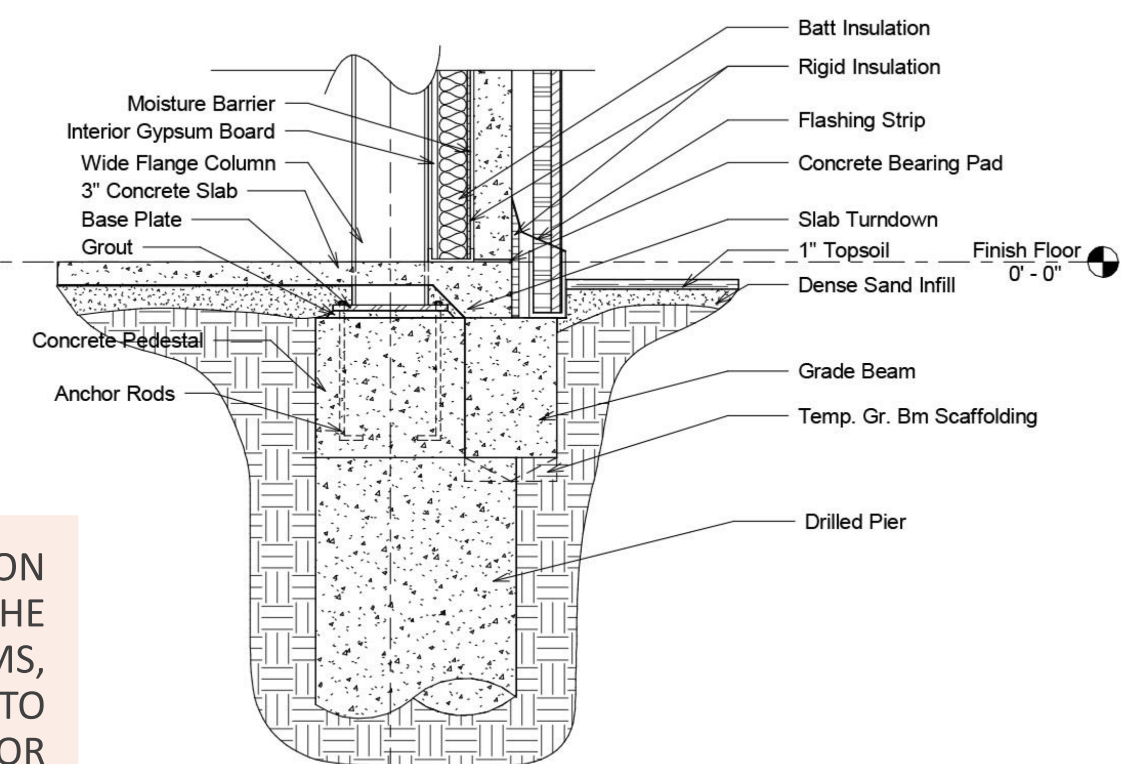
BUILDING SECTION

BUILDING SECTION

WALL SECTION







AFTER CRITIQUES WITH PROFESSIONAL ARCHITECTS AND ENGINEERS, A DEVELOPED WALL SECTION WAS DRAWN THROUGH THE TEEN LOUNGE SPACE TO SHOW THE DETAILED BREAKDOWN OF THE WALL COMPONENTS, SUCH AS SHADING DEVICES, THERMAL BREAKS, HVAC AND LIGHTING SYSTEMS, BUILDING STRUCTURE, AND FOUNDATION ELEMENTS. THIS DRAWING WAS LATER USED TO CALCULATE THE THERMAL RESISTANCE FOR THE INTERIOR SPACES WITHIN, AS WELL AS FOR CALCULATING THE STRUCTURAL DEAD LOAD FOR THE MAJORITY OF THE BUILDING.

BY CONSULTING REFERENCE DOCUMENTS FROM ASHRAE (AMERICAN SOCIETY OF HEATING, REFRIGERATING, AND AIR-CONDITIONING ENGINEERS) , THE THERMAL RESISTANCE VALUES WERE FOUND FOR EACH MATERIAL PRESENT ALONG THE PERIMETER OF THE TEEN LOUNGE SPACE, SUCH AS THE FLOOR, THE WALL, AND THE ROOF ABOVE. THE U-VALUE, OR THERMAL TRANSMITTANCE, CAN THEN BE DETERMINED BY DIVIDING 1 BY THE SUM OF THE RESISTANCE VALUES FOR THAT ELEMENT. THE TABLE TO THE RIGHT SHOWS THE VARIOUS COMPONENTS OF THESE THREE MAIN ELEMENTS, AS WELL AS THEIR DISTINCT R-VALUES FROM ASHRAE. IN ORDER TO DETERMINE THE THERMAL EFFICIENCY OF THE GLASS CHOSEN AND THE SYSTEMS UTILIZED, THESE VALUES WERE THEN PLUGGED INTO THE COMPUTER MODELING PROGRAM *EQUEST* AND AN ANALYSIS WAS PERFORMED.

Roof

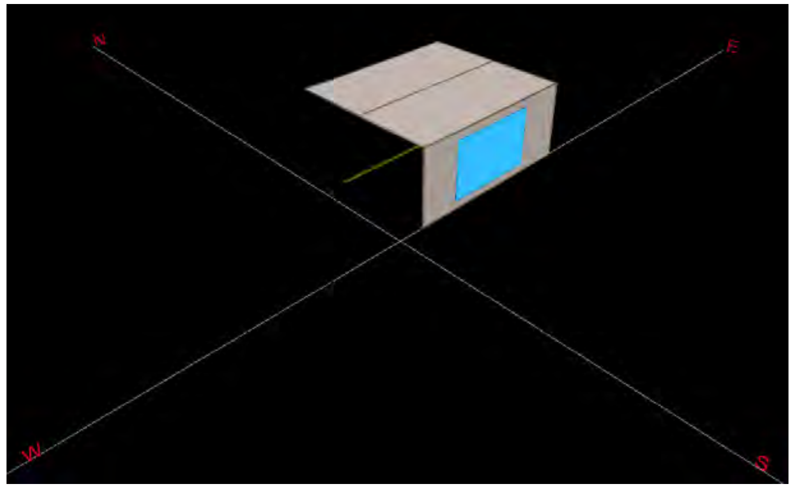
Materials	R-Value	U-Value	Reference
Outside Air Film	0.25		Pg. 22.1, Table 1, "Moving Air", 15 mph wind/winter
Moisture Membrane Barrier	0.12		Pg. 22.6, Building Membrane
Rigid Insulation, 4.5"	28.125		Pg. 22.7, Board and Slab Insulation, Cellular Polyurethane (6.25/in)
Metal Decking	0		*Negligible Thermal Resistance
Inside Air Film	0.92		Pg. 22.1, Table 1, "Still Air", Horizontal, Upward, Non-reflective
SUM:	**29.415**	**0.0340**	ft^2 x °F/ Btuh

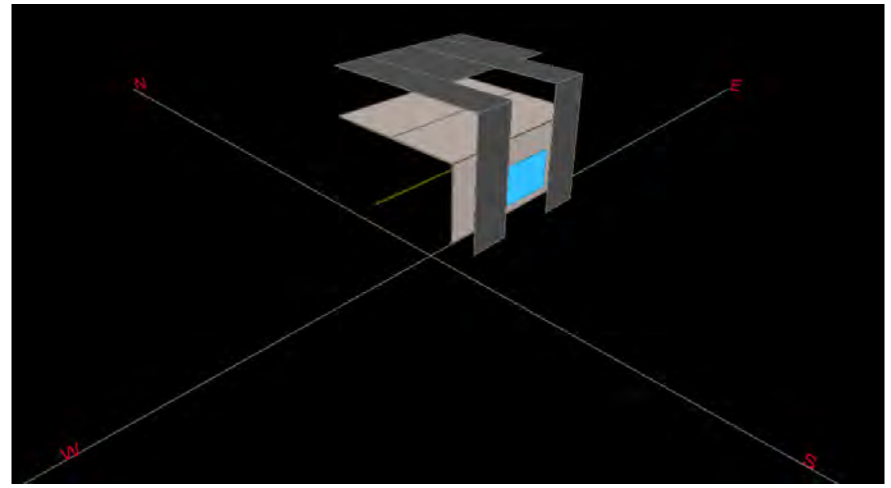
Wall

Materials	R-Value	U-Value	Reference
Outside Air Film	0.25		Pg. 22.1, Table 1, "Moving Air", 15 mph wind/winter
Wood Veneer Panels, 1"	1.48		Pg. 22.9, Woods, Softwoods, Cedars
Precast Concrete Wall, 4"	3.12		Pg. 22.8, Concretes, Lightweight Aggregate Concretes (0.78/in)
Vapor Barrier	0.12		Pg. 22.6, Building Membrane
Rigid Insulation, 2"	12.5		Pg. 22.7, Board and Slab Insulation, Cellular Polyurethane (6.25/in)
Loose Insulation, 4.5"	17.325		Pg. 22.7, Spray Applied Insulation, Glass Fiber (3.85/in)
*Account for Thermal Bridging	-7.20		IECC Table C402.1.4.1, lose 48% of resistance
Interior Gypsum Board	0.56		Pg. 22.6, 0.625" Gypsum Board
Inside Air Film	0.68		Pg. 22.1, Table 1, "Still Air", Vertical, Horizontal, Non-reflective
SUM:	**28.835**	**0.0347**	ft^2 x °F/ Btuh

Floor

Materials	R-Value	U-Value	Reference
Stained Concrete Finish	0.05		Pg. 22.6, Finish Flooring Materials
Concrete Slab, 3.5"	2.73		Pg. 22.8, Concretes, Lightweight Aggregate Concretes (0.78/in)
Inside Air Film	0.92		Pg. 22.1, Table 1, "Still Air", Horizontal, Downward, Non-reflective
SUM:	**3.7**	**0.2703**	ft^2 x °F/ Btuh





A BASELINE MODEL WAS MADE IN *EQUEST* WITH A 40% GLASS RATIO ON THE EXTERIOR WALL. THE ANALYSIS WAS RUN AND FOUND THE SPECIFIC COOLING LOADS REQUIRED TO KEEP THE INTERIOR AND EXTERIOR THERMAL ZONES AT A COMFORTABLE TEMPERATURE. TO COMPARE, MY DESIGN UTILIZED A SMALLER GLASS RATIO OF 27% WHILE ALSO EXHIBITING VERTICAL TIMBER SHADING DEVICES. THIS PROVED TO BE AN EFFICIENT THERMAL SYSTEM, REQUIRING LESS ENERGY TO PUMP COOL AIR INTO THE LOUNGE. FROM HERE, THE SIZE OF THE AIR HANDLING UNITS, SUPPLY AND RETURN DUCTS, AND FRESH AIR LOUVERS WAS DETERMINED BY USING A DUCTILATOR AND SIMPLE CALCULATIONS.

ARCH 4216/5226 & 4263

CHECK OF "ENVIRONMENTAL PERFORMANCE", DD. worksheet

(Focus Space)

BASELINE

PLEASE, *use this worksheet to document the environmental performance of your envelope design during the DD phase (First due for review on Tuesday March 21st, 2017, 1:30 p.m.)*

1. Description of the Envelope Design

- Wall type and materials (according to IECC code) .... Metal Framed
- Floor-to-floor height .... 15 Feet
- Glass Ratio (% of glass to overall area of wall) .... 40 %
- Thermal conductance (U-factor) of the opaque wall .... 0.064 BTU/(h-ft^2-F)
- Thermal conductance (U-factor) of roof .... 0.039 BTU/(h-ft^2-F)
- Thermal conductance (U-factor) of slab on grade .... 0.074 BTU/(h-ft^2-F)
- Glass type (model number and manufacturer) .... IECC 2015- CZ3 - SOUTH
- Glass thermal conductance (U-factor) .... 0.46 BTU/(h-ft^2-F)
- Glass Shading Coefficient (SC) .... 0.29 & SHGC = ... 0.25
- Glass Visible Transmittance (VT) .... 0.28 & UV Transmittance = ——
- External shading for glass (describe, if any) .... None in Baseline

[Note 1] Initial U-values in the computer model are the maximum allowed by IECC 2015. After your first run of energy simulation (baseline), you should create and use your selection of glass. Performance data of glass is typically provided by the glass manufacturer. [Note 2] SHGC = 0.87 x SC

2. Orientation

According to your selected focus space, this space is facing: (North), (East), $\boxed{\text{(South)}}$, (West)

3. Results of Energy Simulation

Perimeter Thermal Zone:

- Time of the maximum cooling load (day and hour) .... September 4th, 4:00 pm
- Maximum Cooling Load in the perimeter space (thermal zone) = (7.927) KBtuh
- Maximum Cooling load per Square Foot = (7.927)*1000 / 300 = ((26.423)) Btuh/sq.ft.
- Required air supply per square foot = ((26.423)) / 21.6ª = 1.223 CFM/sq.ft.
- Compare the cooling load (CFM/sq.ft) to your reference design (baseline) : N/A
- What is the energy saving (%), compared to baseline: N/A %

Interior Thermal Zone:

- Time of the maximum cooling load (day and hour) .... July 16th, 3:00 pm
- Maximum Cooling Load in the interior space (thermal zone) = (4.488) KBtuh
- Maximum Cooling load per Square Foot = (4.488)*1000 / 300 = ((11.22)) Btuh/sq.ft.
- Required air supply per square foot = ((11.22)) / 21.6ª = 0.519 CFM/sq.ft.

ª *Assuming Supply Air temperature equals 55°F to room temperature of 75°F*

*Remember, for complete documentation, you must attach a copy of your **envelope design** (wall section), peak cooling results from **eQuest** (two tables), and **glass performance data** to this form.*

ARCH 4216/5226 & 4263

CHECK OF "ENVIRONMENTAL PERFORMANCE", DD. worksheet

(Focus Space)

MY DESIGN

PLEASE, *use this worksheet to document the environmental performance of your envelope design during the DD phase (First due for review on Tuesday March 21st, 2017, 1:30 p.m.)*

1. Description of the Envelope Design

- Wall type and materials (according to IECC code) .... Metal Framed
- Floor-to-floor height .... 15 Feet
- Glass Ratio (% of glass to overall area of wall) .... 27.43 %
- Thermal conductance (U-factor) of the opaque wall .... 0.0347 BTU/(h-ft^2-F)
- Thermal conductance (U-factor) of roof .... 0.034 BTU/(h-ft^2-F)
- Thermal conductance (U-factor) of slab on grade .... 0.2703 BTU/(h-ft^2-F)
- Glass type (model number and manufacturer) .... SuperLite II-XL 120 Min. Glass, PPG
- Glass thermal conductance (U-factor) .... 0.41 BTU/(h-ft^2-F)
- Glass Shading Coefficient (SC) .... 0.31 & SHGC = ... 0.27
- Glass Visible Transmittance (VT) .... 0.297 & UV Transmittance = ——
- External shading for glass (describe, if any) .... Timber Veneer Shading Panels

[Note 1] Initial U-values in the computer model are the maximum allowed by IECC 2015. After your first run of energy simulation (baseline), you should create and use your selection of glass. Performance data of glass is typically provided by the glass manufacturer. [Note 2] SHGC = 0.87 x SC

2. Orientation

According to your selected focus space, this space is facing: (North), (East), $\boxed{\text{(South)}}$, (West)

3. Results of Energy Simulation

Perimeter Thermal Zone:

- Time of the maximum cooling load (day and hour) .... August 27th, 4:00 pm
- Maximum Cooling Load in the perimeter space (thermal zone) = (6.022) KBtuh
- Maximum Cooling load per Square Foot = (6.022)*1000 / 300 = ((20.073)) Btuh/sq.ft.
- Required air supply per square foot = ((20.073)) / 21.6ª = 0.929 CFM/sq.ft.
- Compare the cooling load (CFM/sq.ft) to your reference design (baseline) : 1.223
- What is the energy saving (%), compared to baseline: 24.03 %

Interior Thermal Zone:

- Time of the maximum cooling load (day and hour) .... July 16th, 3:00 pm
- Maximum Cooling Load in the interior space (thermal zone) = (4.488) KBtuh
- Maximum Cooling load per Square Foot = (4.488)*1000 / 300 = ((11.22)) Btuh/sq.ft.
- Required air supply per square foot = ((11.22)) / 21.6ª = 0.519 CFM/sq.ft.

ª *Assuming Supply Air temperature equals 55°F to room temperature of 75°F*

*Remember, for complete documentation, you must attach a copy of your **envelope design** (wall section), peak cooling results from **eQuest** (two tables), and **glass performance data** to this form.*

ARCH 4216/5226 & 4263

HVAC REVIEW CHECKLIST, DD.

BUILDING SYSTEMS COORDINATION *in* THE **DESIGN DEVELOPMENT** PHASE

Due Date: Friday, March 31st, 2017, 5:00 p.m. (for review only).

To help you being organized during the design development phase, and keep track of your project's **PROGRESS**, please fill in this worksheet. Refer to the list of required tasks, read it carefully, and feel free to ask questions. A mandatory final review of your building's energy efficiency, the coordination of building systems with architecture, and the ductwork layout will take place during the week of **March 20th**. Everyone is expected to be prepared for this mandatory review (sign up in the sign-up sheet).

1. Envelope Requirements for Energy Efficiency (Focus Space):

- IECC 2015: (Baseline design)

Tables: C402.1.3, C402.1.4, C402.4

Roofs:	Min. R =	R-25ci	Max. U =	U-0.039
Walls (above grade):	Min. R =	R-7.5+13ci	Max. U =	U-0.064
Walls (below grade):	Min. R =	——	Max. U =	——
Floors (above UC):	Min. R =	——	Max. U =	——
Floors (slab-on-grade):	Min. R =	NR		
Fenestration/windows:	Max.U =	0.46	Max. SHGC =	0.25
Fenestration/skylights:	Max.U =	——	Max. SHGC =	——

- Your values:

*Exterior shading devices have input transmittance values of 0.30

		Insulation ONLY / Total		
Roofs:	R =	28.13/29.03	U =	0.034
Walls (above grade):	R =	22.63/28.84	U =	0.035
Walls (below grade):	R =	——	U =	——
Floors (above UC):	R =	——	U =	——
Floors (slab-on-grade):	R =	3.7	U =	0.2703
Fenestration/windows:	U =	0.41	SHGC =	0.025
Fenestration/skylights:	U =	——	SHGC =	——

2. Environmental Performance – Cooling Load (Focus Space):

- Baseline:
  - Glass ratio .... 40.00 % .... %
  - Cooling load (interior zone) .... 0.519 .... CFM/SF
  - Cooling load (perimeter zone) .... 1.223 .... CFM/SF
- Your values:
  - Glass ratio .... 27.43 % .... %
  - Cooling load (interior zone) .... 0.519 .... CFM/SF
  - Cooling load (perimeter zone) .... 0.929 .... CFM/SF
- Light Load
  - Power allowance in IECC = ... 0.730 .... Watt/SF
  - Your calculated light load = ... 0.646 .... Watt/SF

3. Air Handling Units (Entire Building):

- Capacities (CFM):

AHU # **1**:	6,871.0	AHU # **5**:	——
AHU # **2**:	2,774.1	AHU # **6**:	——
AHU # **3**:	6,283.0	AHU # **7**:	——
AHU # **4**:	——	AHU # **8**:	——

4. Main Supply & Return Ducts (Entire Building):

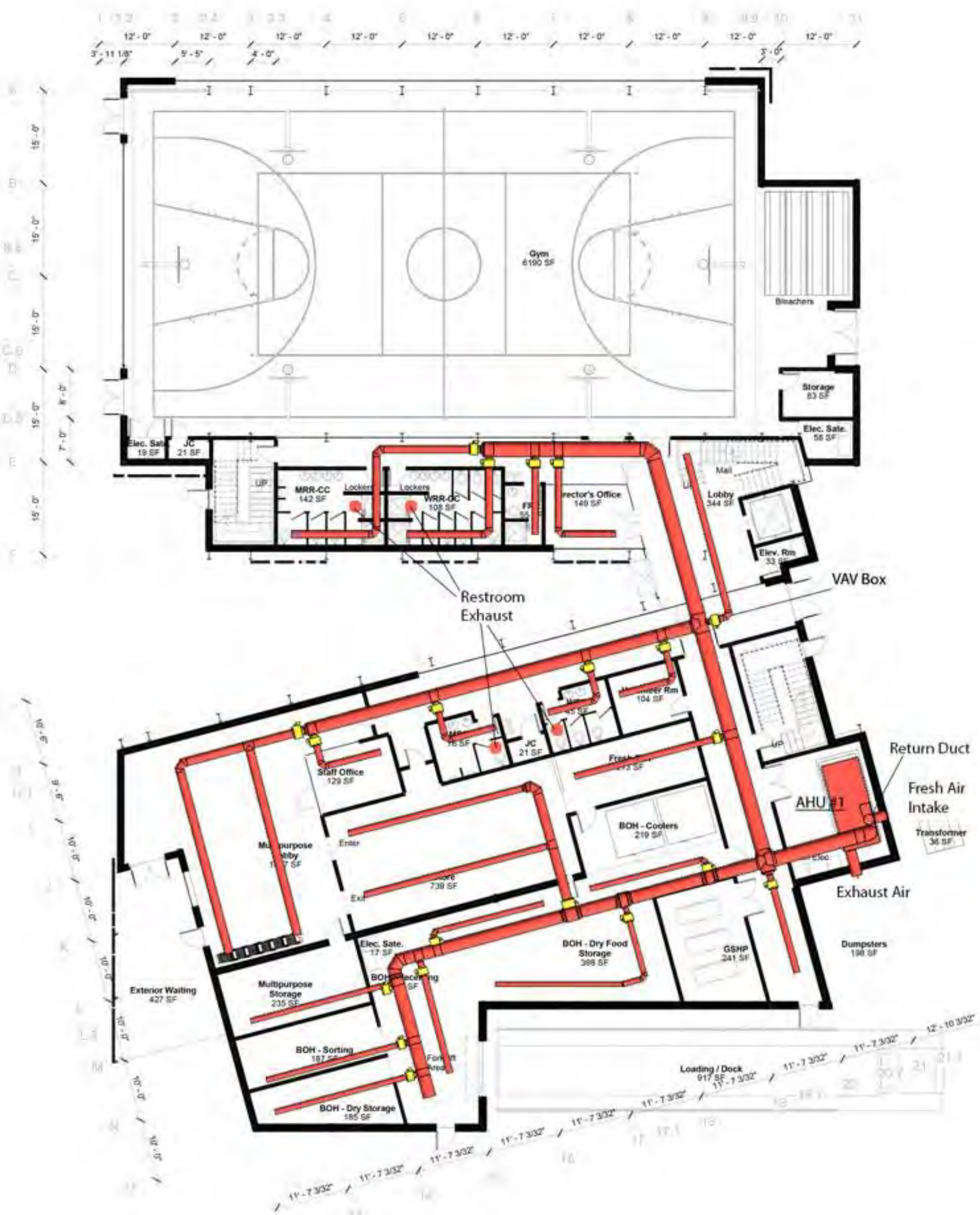
- Dimensions (ft):

	SA	RA		SA	RA
AHU # **1**	2'-6"	2'-9"	AHU # **5**	—	—
AHU # **2**	1'-9"	2'-0"	AHU # **6**	—	—
AHU # **3**	2'-4"	2'-8"	AHU # **7**	—	—
AHU # **4**	—	—	AHU # **8**	—	—

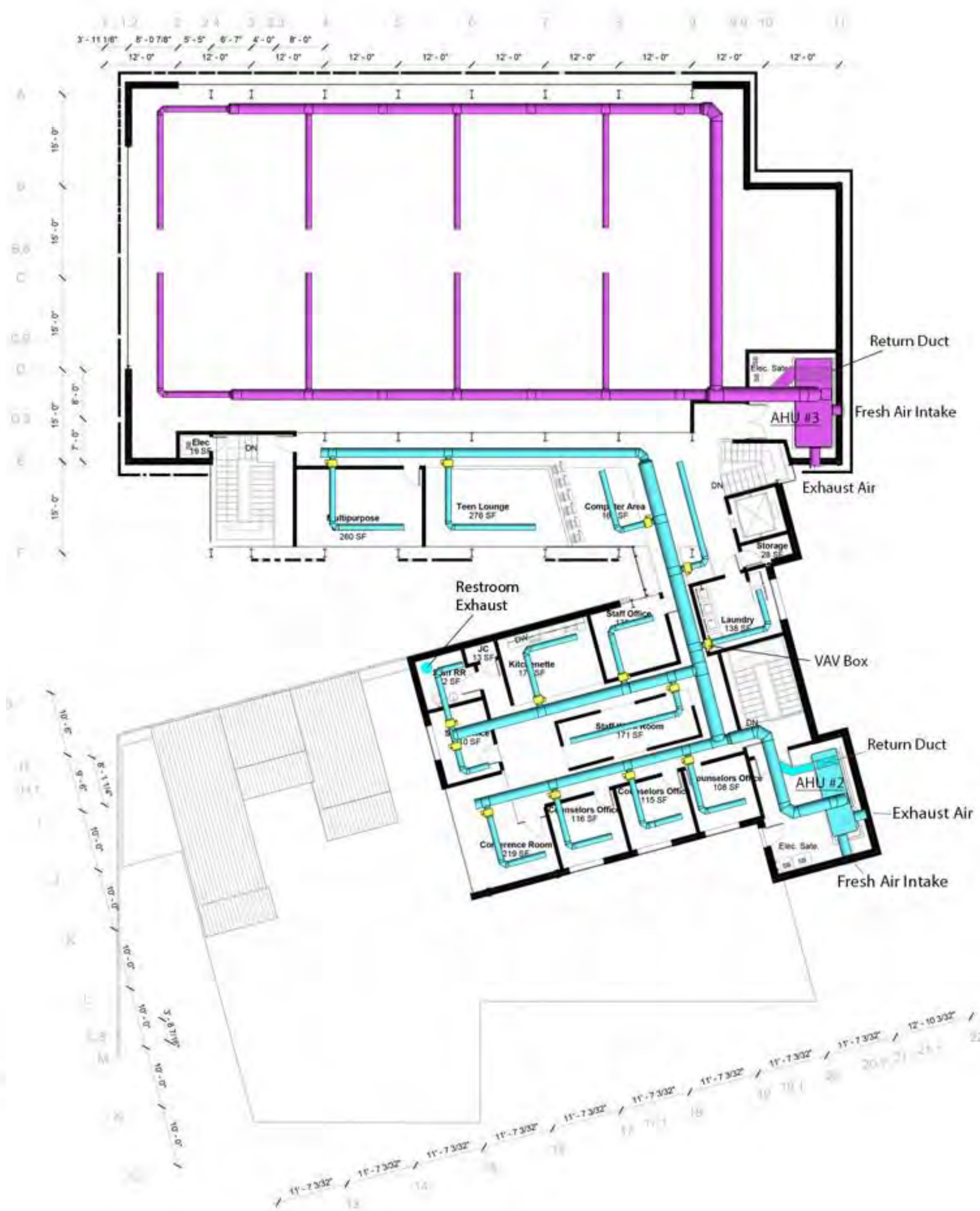
5. Louvers (Entire Building):

- % fresh air at AHU (for sizing louvers) .... 30% .... (typically not lower than 30%)
- Dimensions (ft):

	Intake	Exh		Intake	Exh
AHU # **1**	4'x3'	3'x3'	AHU # **5**	—	—
AHU # **2**	3'x2'	2'x2'	AHU # **6**	—	—
AHU # **3**	4'x3'	3'x3'	AHU # **7**	—	—
AHU # **4**	—	—	AHU # **8**	—	—



1ST FLOOR DUCT PLAN



2ND FLOOR DUCT PLAN

THE RED AND BLUE DUCT LAYOUT PLANS ARE VAV (VARIABLE AIR VOLUME) SYSTEMS, WHERE EACH ROOM HAS AT LEAST ONE THERMOSTAT TO CONTROL ITS SPECIFIC THERMAL ENVIRONMENT. THE VAV BOXES ARE SHOWN IN YELLOW FOR EACH SPACE. IN ADDITION, THE THREE FAN ROOMS IN THIS DESIGN HOLD THE BUILDING'S AIR HANDLING UNITS, AS WELL AS PROVIDE A SPACE FOR THE SUPPY AND RETURN DUCTS, FRESH AIR INTAKE, AND EXHAUST AIR.

THE GYMNASIUM IN PURPLE IS RUN ON A CAV (CONSTANT AIR VOLUME) SYSTEM. THIS STRATEGY WAS CHOSEN SINCE THE SPACE IS LARGE AND THE DUCT WORK MUST SERVICE SUCH A TALL ROOM. LUCKILY, THE SIZE OF DUCTS IN THIS ROOM WAS ABLE TO BE LOWERED SINCE THE AIR HANDLING UNIT ONLY SERVICES THIS ONE SPACE.

AHU #1 Capacity

		Rest of Floor	
Area		6871	
CFM/SF		1	*Assumed
Capacity		6871	
Total Capacity:	**6871**		

Louvers - AHU #1

Intake		Exhaust	
CFM	6871	CFM	6871
% Fresh	30%	% Fresh	30%
Air Flow	2061.3	Air Flow	2061.3
Face Vel.	400	Face Vel.	500
A(net)	5.15325	A(net)	4.1226
A(gross)	10.3065	A(gross)	8.2452
Dimensions	4	Dimensions	3
(ft)	3	(ft)	3

AHU #2 - Capacity, services focus space

	Interior	Perimeter	Rest of Floor	
Area	525	525	2332	
CFM/SF	0.282	0.56	1	*Assumed
Capacity	148.05	294	2332	
Total Capacity:		**2774.05**		

Louvers - AHU #2

Intake		Exhaust	
CFM	2774.05	CFM	2774.05
% Fresh	30%	% Fresh	30%
Air Flow	832.215	Air Flow	832.215
Face Vel.	400	Face Vel.	500
A(net)	2.0805375	A(net)	1.66443
A(gross)	4.161075	A(gross)	3.32886
Dimensions	3	Dimensions	2
(ft)	2	(ft)	2

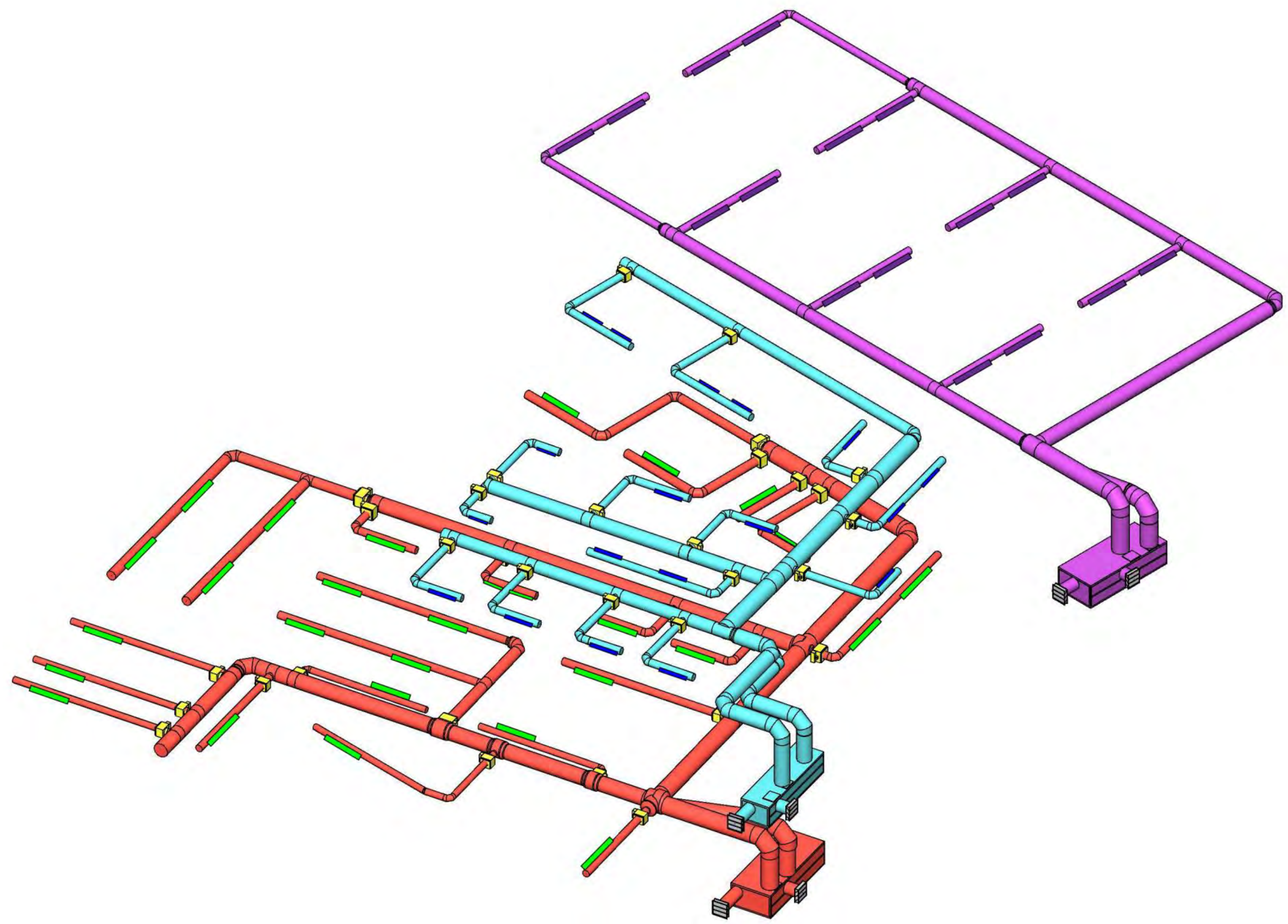
AHU #3 - Capacity

		Rest of Floor	
Area		6283	
CFM/SF		1	*Assumed
Capacity		6283	
Total Capacity:	**6283**		

Louvers - AHU #3

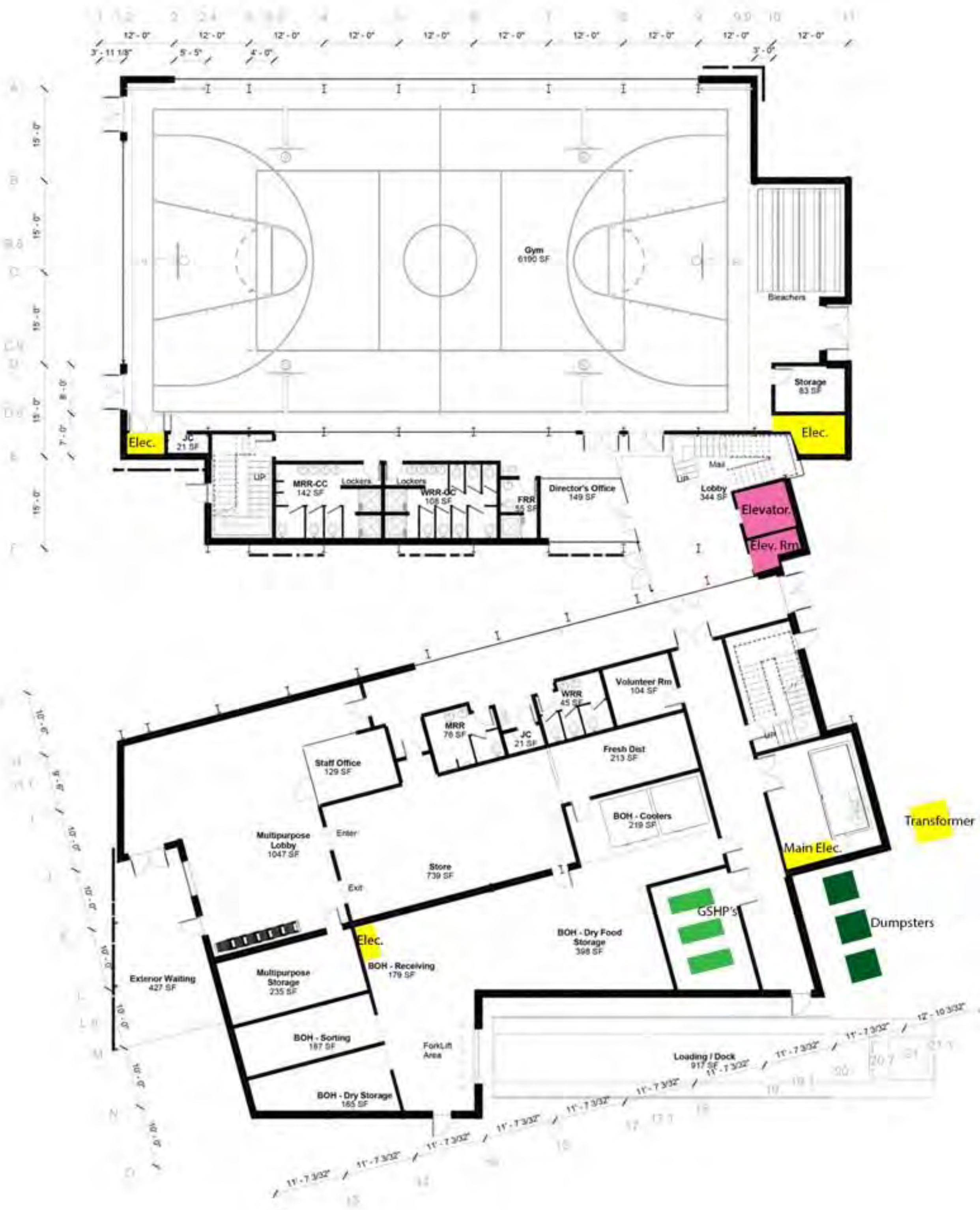
Intake		Exhaust	
CFM	6283	CFM	6283
% Fresh	30%	% Fresh	30%
Air Flow	1884.9	Air Flow	1884.9
Face Vel.	400	Face Vel.	500
A(net)	4.71225	A(net)	3.7698
A(gross)	9.4245	A(gross)	7.5396
Dimensions	3	Dimensions	3
(ft)	4	(ft)	3

CALCULATIONS FOR THE LOUVER SIZES WERE PERFORMED IN EXCEL AND WERE BASED ON THE CAPACITY REQUIRED OF THAT SPECIFIC AIR HANDLING UNIT. SINCE THESE LOUVERS MUST BE LOCATED A MINIMUM OF 8 FEET APART TO AVOID EXHAUST AND FRESH AIR CONTAMINATION, THE LOUVERS WERE PLACED AROUND A CORNER TO DECREASE THIS SPACING. THE 3D HVAC AXONOMETRIC HERE SHOWS THE TYPICAL LOCATION OF DIFFUSERS ALONG EACH DUCT SYSTEM. A 2 INCH, 2 SLOT DIFFUSER WAS SELECTED FOR MOST INTERIOR SPACES DUE TO ITS AESTHETIC APPEAL AND PERFORMANCE CRITERIA FROM *TITUS*.

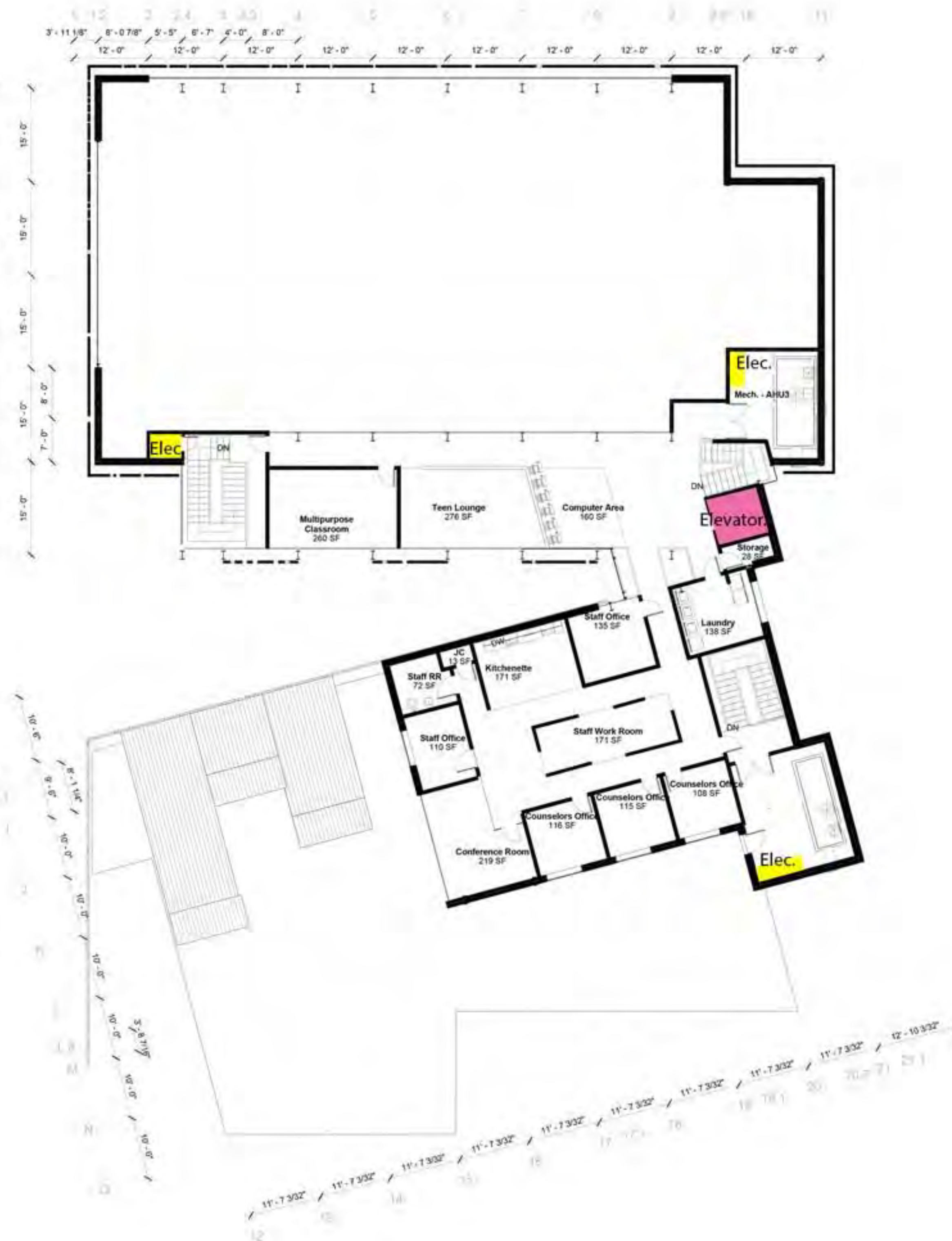


3D AXONOMETRIC DUCT/AHU LAYOUT

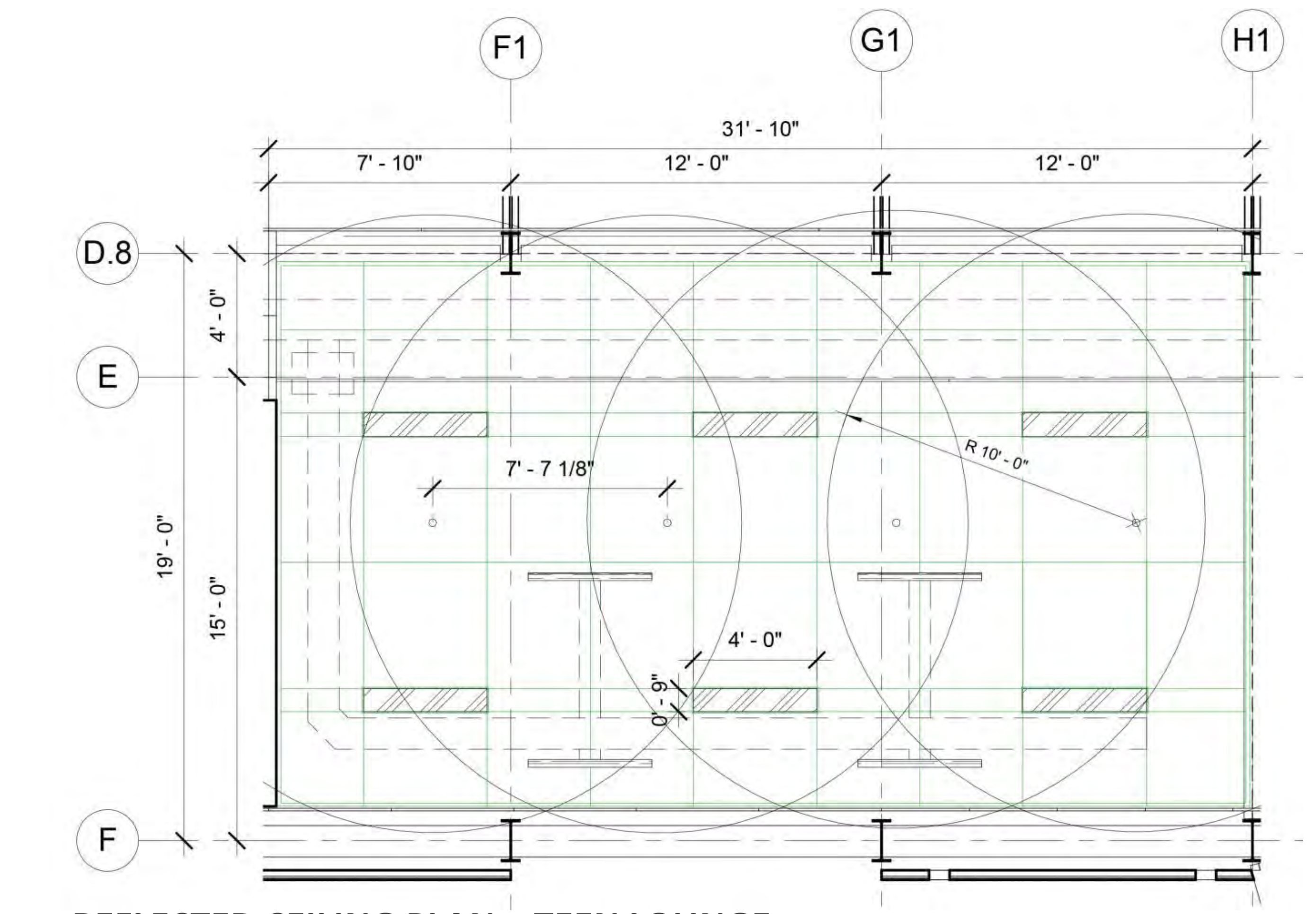
BUILDING CODE PUTS MANY RESTRICTIONS ON THE SERVICE SPACES OF A BUILDING, INCLUDING MECHANICAL ROOMS, ELECTRICAL CLOSETS, AND ELEVATOR ROOMS. THE ELECTRICAL CLOSETS MUST BE WITHIN 100 FEET OF EACHOTHER TO AVOID EXTENSIVE BRANCH CIRCUIT CABLE LENGTHS. GROUND SOURCE HEAT PUMPS PROVIDE THE BUILDING WITH HEATING AND COOLING, AND ARE LOCATED NEAR THE FIRST FLOOR MAIN MECHANICAL FAN ROOM. THE EXTERIOR TRANSFORMER IS ALSO LOCATED NEAR THE MAIN ELECTRICAL CLOSET ON THE FIRST FLOOR NEAR THE PARKING. FINALLY, DUMPSTERS WERE PLACED NEAR THE LOADING ZONE FOR AN EFFICIENT SERVICE TRUCK SYSTEM.



1ST FLOOR SERVICE PLAN



2ND FLOOR SERVICE PLAN



REFLECTED CEILING PLAN – TEEN LOUNGE

Alera Solaris Curved Lighting (4' x 9"), Uniform Distribution

Acoustic Ceiling Panel

1" Slot Diffuser, 2 slots (highthrow)

Return Grille

HVAC Layout (above ceiling)

Sprinkler head – 10ft Throw Distance

RCP LEGEND

IN ORDER TO MEET BUILDING CODE AND PROVIDE AN ADEQUATE AMOUNT OF ARTIFICIAL LIGHT IN THE TEEN LOUNGE, CALCULATIONS WERE PERFORMED TO TEST VARIOUS LIGHTING TYPES. AFTER MULTIPLE ATTEMPTS AT FINDING A DESIGN THAT WORKED, THE *ALERA SOLARIS* CURVED LIGHTING LUMINAIRE WAS CHOSEN DUE TO ITS SLEEK FORM AND STRONG LUMEN OUTPUT. THIS WAS INTEGRATED WITH THE HVAC, FIRE PROTECTION, STRUCTURAL, AND ACOUSTIC SYSTEMS IN THE TEEN LOUNGE TO PROVIDE LIGHT COVERAGE TO THE ENTIRE AREA OF THE SPACE. THIS SYSTEMS INTEGRATION CAN BE SEEN IN THE REFLECTED CEILING PLAN ABOVE.

Input values

Calculations

Photometric Data				
	Recommended illuminance		20	fc
	Lamp Type		F32-T8	
	Watts / Luminaire		62	
	Spacing Ratio (0 deg.)		1.2	
	Spacing Ratio (90 deg.)		1.31	
	Lamps / Luminaire		2	
	Fixture Efficiency		92.9	%
	Lumen output from one luminaire		5390	lm
Room Design				
	Length		32	ft
	Width		18	ft
	Height		15	ft
	CCR	*Ceiling Cavity Reflectance, RC	80	%
	RCR		50	%
	FCR		20	%
	hCC	*Ceiling to Fixtures	3.5	ft
	hRC	*Space in between	9	ft
	hFC	*ground to work plane	2.5	ft
Sizing of the System				
	Wsq		22.667	ft
A	RCR	*Wall Reflectance, RW	3.971	
	CU	*May have to interpolate	58.24%	
B	LLF	*Good=0.65, Avg.=0.55, Poor=0.45	0.65	
C	Useful lumens from one luminaire		2040.4384	lm
D	Total lumens needed		11,520	lm
	Number of luminaires (Round Up)		5.6458455	Luminaires
	Number of Fixtures to USE:		6	Luminaires
	Overall Efficiency		35.168224	%
E	Light Load		0.6458333	W/ft^2
	Code Maximum	*from IECC Table C405.4.2(2) -> Lounge, Otherwise	0.73	W/ft^2
	Area Covered per fixture		96	ft^2/fxtr

*DOES DESIGN WORK? YES

*See spacing on RCP

FEATURES

- Optional distribution covers allow the designer to maintain a single look throughout a facility while varying the light distribution
- Direct/Indirect distribution
- T8, T5, or T5HO lamps
- Heavy 20-gauge steel construction provides excellent housing rigidity
- Controls compatible
- Adjustable 48" (CM48) aircraft cable yoke hanger with vertical and horizontal balancing
- Patented die cast couplers and end caps ensure straight rows with no light leak
- Fixed louver stays in housing, even if fixture is struck or damaged
- Popular for educational and general office commercial facilities, also excellent for retail

SHAPE AND DIMENSIONS

2 ¾"

9½"

Interpolation Table	
RCR	CU
3	66.00%
3.971	58.24%
4	58.00%

LIGHTING DESIGN

PHOTOMETRIC DATA

LUMINAIRE DATA Test 12479

Luminaire	SLS-2T8-LD-EB8 Solaris Architectural Curve 9" x 48" 2 LAMP WITH 1 x 11 CELL SEMI-SPECULAR LOUVER
Ballast	RCN-2P32-SC
Ballast Factor	0.88
Lamp	F32T8
Lumens per Lamp	2900
Watts	62
Mounting	Pendant
Shielding Angle	0° = 21 90° = 24
Spacing Criterion	0° = 1.20 90° = 1.31
Luminous Opening in Feet	Length: 3.80 Width: 0.37 Height: 0.00

AVG. LUMINANCE (Candela/Sq. M.)

Angle	0.0	22.5	45.0	67.5	90.0
0	5711	5711	5711	5711	5711
30	5322	5852	5932	5994	5994
40	4907	5467	5706	5786	5876
45	4526	5078	5435	6085	6334
50	4026	4562	5300	6622	7718
55	3390	3884	5152	8209	9503
60	2480	2970	5374	7503	8590
65	1359	1884	4311	5127	5090
70	269	694	1947	1724	1500
75	177	296	503	769	828
80	132	220	353	485	573
85	176	176	264	439	439

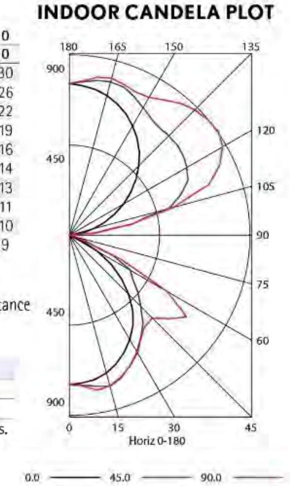
COEFFICIENTS OF UTILIZATION (%)

RC	80				70				50			0
RW	70	50	30	10	70	50	30	10	50	30	10	0
RCR 1	89	85	82	79	80	77	74	72	63	61	59	30
2	81	75	69	65	73	68	63	60	55	52	49	26
3	74	66	59	54	67	60	54	50	49	45	42	22
4	68	58	51	46	61	53	47	42	43	39	36	19
5	62	52	44	39	56	47	41	36	39	34	31	16
6	57	46	39	34	52	42	36	31	35	30	27	14
7	53	42	34	29	48	38	32	27	32	27	23	13
8	49	38	31	26	44	35	28	24	29	24	21	11
9	45	34	27	23	41	31	25	21	26	22	18	10
10	42	31	25	20	38	29	23	19	24	19	16	9

RCR = Room Cavity Ratio

RC = Effective Ceiling Cavity Reflectance RW = Wall Reflectance

INDOOR CANDELA PLOT



Test Date 4/4/2000

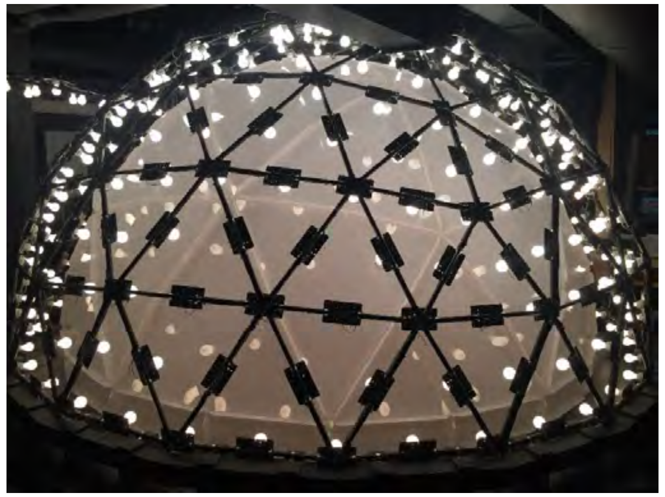
ZONAL LUMEN SUMMARY

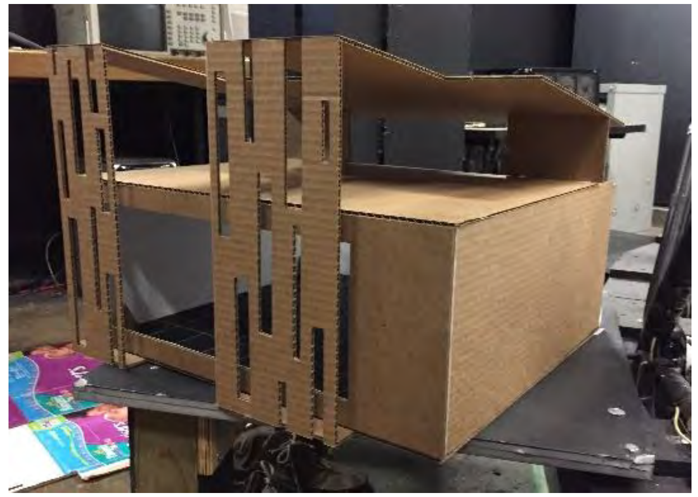
Zone	Lumens	% Lamp	% Fixt.
0-30	611	10.5	11.3
0-40	995	17.2	18.5
0-60	1774	30.6	32.9
0-90	2005	34.6	37.2
90-120	1161	20.0	21.5
90-130	1754	30.2	32.5
90-150	2745	47.3	50.9
90-180	3385	58.4	62.8
0-180	5390	92.9	100.0

ENERGY DATA

Total Luminaire Efficiency	92.9%
Luminaire Efficacy Rating (LER)	76
ANSI/IESNA RP-1-2004 Compliance	Yes-VDT Normal Use
Comparative Yearly Lighting Energy Cost per 1000 Lumens	$3.16 based on 3000 hrs. and $0.08 per KWH

LIGHTING





Eric Fleet
Teen Lounge
Side Light

Daylighting lab test results — Sky Condition: Standard CIE Overcast Sky

Light Sensor #	Multiplier	Meter's Reading	illumination level under artificial sky dome: lux	illumination level under artificial sky dome: fc	sensor's serial number
1	3.025	55.0	166 lux	72.1 fc	PH 8355
2	2.906	44.7	130 lux	72.1 fc	PH 8356
3	2.886	37.3	108 lux	10.0 fc	PH 8357
4	3.003	29.9	90 lux	8.3 fc	PH 8358
5	3.022	27.5	83 lux	7.7 fc	PH 8359
6	2.825	28.4	80 lux	7.5 fc	PH 8360
7	3.000	27.3	82 lux	7.6 fc	PH 8361
8	2.971	28.8	86 lux	8.0 fc	PH 8362
(single sensor) 9	2.840	248.5	706 lux	65.6 fc	PH 8363
Outside (under dome)	2.840	227.4	646 lux	60.0 fc	PH 8364

Measured outside illuminance = 60.0 fc

[NOTE]: This is the outside horizontal illuminance under the artificial sky dome in the lab, and not the standard illuminance at the location of your

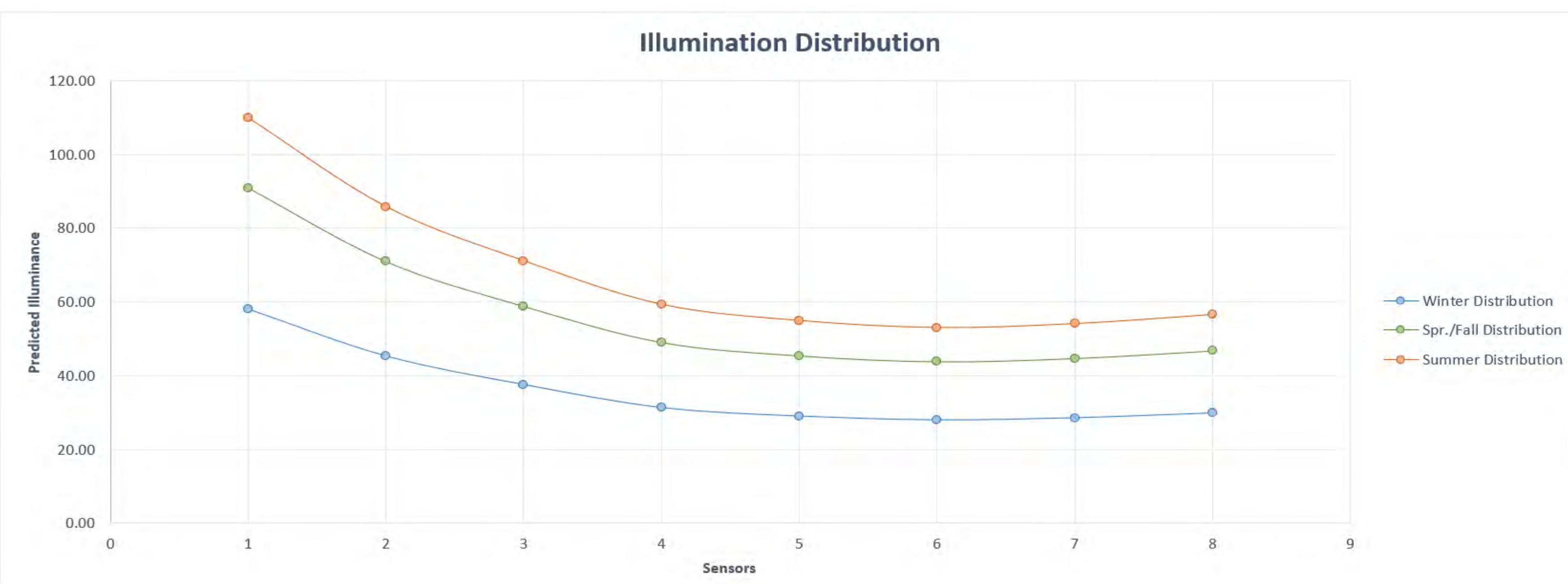
Daylighting Lab Test Results

Sensors	IL (Std, Winter)	Pred. IL [fc]	IL (Std, Spr./Fall)	Pred. IL [fc]	IL (Std, Summer)	Pred. IL [fc]	DF	VT (glass)	M (glass)
1	1019	58.01	1597	90.92	1931	109.93	25.76%	0.26	0.85
2		45.29		70.98		85.82	20.11%		
3		37.54		58.83		71.14	16.67%		
4		31.30		49.06		59.32	13.90%		
5		28.98		45.42		54.92	12.87%		
6		27.97		43.83		53.00	12.42%		
7		28.53		44.71		54.06	12.67%		
8		29.84		46.76		56.54	13.25%		
	DF Average, Winter:	35.94	DF Average, Spr./Fall:	56.33	DF Average, Summer:	68.11	DF Average	15.96%	
							Corrected DF Average	3.53%	

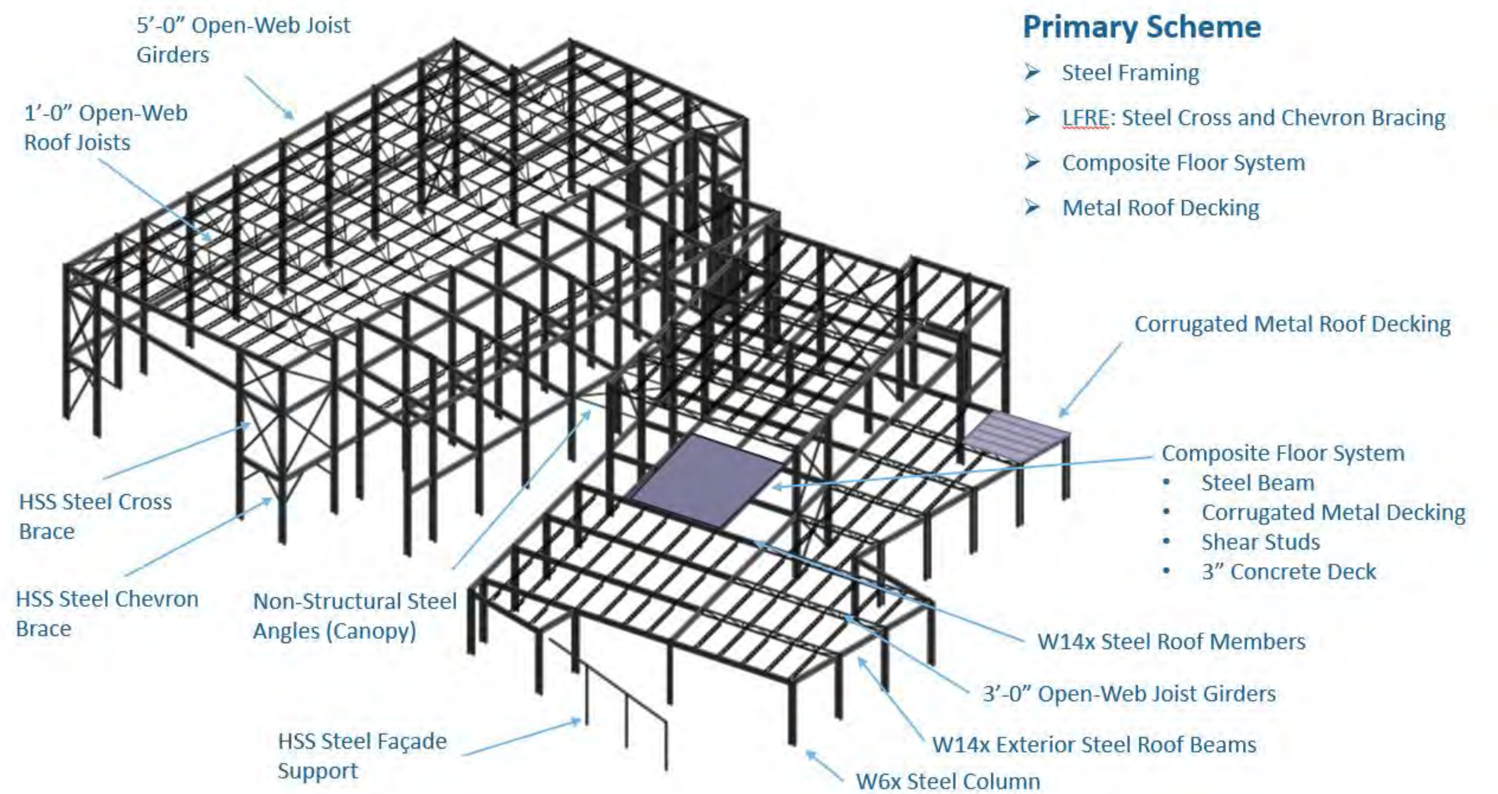
Daylight Factor for VT= 1.00 — For models tested with glass or trace paper | **Daylight Factor** — excluding effect of glass VT

	Daylight Factor for VT= 1.00	Daylight Factor excluding effect of glass VT
1	25.76%	25.76%
2	20.11%	20.11%
3	16.67%	16.67%
4	13.90%	13.90%
5	12.87%	12.87%
6	12.42%	12.42%
7	12.68%	12.68%
8	13.25%	13.25%
(single sensor) # 9		

OSU School of Architecture, Daylighting Laboratory 4/3/2



AN ANALYSIS WAS PERFORMED IN THE ARCHITECTURE DAYLIGHTING LAB IN ORDER TO DETERMINE THE DAYLIGHT QUALITIES OF A TEEN LOUNGE SCALE MODEL. FOR CERTAIN ILLUMINATION LEVELS THROUGHOUT THE YEAR (SUMMER, WINTER, AND SPRING/FALL), 3 ILLUMINANCE CURVES WERE GRAPHED AND COMPARED. WITH THIS DATA OBTAINED FROM THE 8 SENSORS USED, IT WAS DETERMINED THAT THE ILLUMINATION LEVEL IN THE TEEN LOUNGE DURING THE SUMMER MAY BE SLIGHTLY TOO HARSH, SO MECHANICAL ROLLER BLINDS WERE INSTALLED IN THE DESIGN TO RESOLVE THIS PROBLEM.



AFTER THE SCHEMATIC DESIGN PHASE, A STRUCTURAL STEEL FRAMING SYSTEM WAS CHOSEN FOR THE DESIGN. WITH THIS MATERIAL, OVERALL DEPTHS OF MEMBERS WOULD BE REDUCED. IN ADDITION, VISUAL CONNECTIONS BETWEEN THE INTERIOR AND THE EXTERIOR REMAIN UNIMPEDED.

UPON REVIEWING THE GEOTECHNICAL REPORT FOR THE OKLAHOMA CITY SITE, IT WAS ADVISED THAT A FOUNDATION SYSTEM CONSISTING OF DRILLED PIERS AND GRADE BEAMS SUPPORTING A CONCRETE SLAB FOR THE GROUND FLOOR WOULD BE THE BEST OPTION. THIS WOULD RESULT IN THE LEAST AMOUNT OF OVERALL BUILDING DRIFT. THESE DRILLED PIERS ALSO SUPPORT A SYSTEM OF GRADE BEAMS BENEATH THE STRUCTURE, WHICH ARE LOCATED AROUND THE EXTERIOR WALLS OF THE BUILDING.

PRELIMINARILY, AN 18 INCH DIAMETER PIER WOULD BE DRILLED BELOW ALL COLUMNS, WITH THE EXCEPTION OF SOME LOCALIZED AREAS WITH AN EXPECTED INCREASE IN GRAVITY LOADING, SUCH AS BELOW THE GREEN ROOF, BENEATH THE SOUTH SIDE OF THE GYMNASIUM, AND IN THE MIDDLE OF THE FOOD PANTRY SPACE THAT EXTENDS UPWARD TO SUPPORT THE STAFF SPACES ON THE SECOND FLOOR. THESE PIERS WERE EXPECTED TO BE SIZED NEAR 24 INCHES IN DIAMETER.

THE MAIN HORIZONTAL STRUCTURAL SYSTEM WAS A COMPOSITE DECK SYSTEM SUPPORTED BY STEEL POST AND BEAM CONSTRUCTION. STEEL COLUMNS AND VERTICAL BRACING THROUGHOUT THE BUILDING SUPPORT HORIZONTAL COMPOSITE STEEL BEAMS, WHOSE PURPOSE IS TO TIE TOGETHER THE POURED CONCRETE SLAB, THE CORRUGATED STEEL DECKING, AND THE STEEL BEAMS BENEATH. BEFORE A THREE INCH CONCRETE SLAB IS POURED, SHEAR STUDS ARE ATTACHED TO THE DECK/BEAM INTERFACE SO THAT THE CONCRETE SLAB ENGAGES THE STRUCTURE ITSELF. VERTICAL BRACING (IN THE FORM OF DIAGONAL BRACES) WAS LOCATED PRIMARILY AROUND THE LARGE GYM SPACE, AS WELL AS ALONG MECHANICAL CORES IN THE BUILDING AND ALONG THE SOUTH SIDE OF THE SECOND FLOOR STAFF SPACES. THESE WALLS ACT AS THE MAIN LATERAL FORCE RESISTING ELEMENTS FOR THE DESIGN.

SIZING OF MEMBERS THROUGHOUT THIS DESIGN REMAINS RELATIVELY CONSISTENT WITHIN EACH SPACE. THE GYM IS SHELTERED ABOVE BY OPEN-WEB JOIST GIRDERS, APPROXIMATELY SIX FEET DEEP. THESE IN TURN SUPPORT ONE-FOOT DEEP OPEN-WEB ROOF JOISTS, SPACED AT APPROXIMATELY FIVE FEET ON CENTER. MOST COLUMNS WERE PRELIMINARILY DESIGNED TO BE WIDE FLANGE MEMBERS WITH A NOMINAL DEPTH OF SIX INCHES, HOWEVER, THIS SIZING WAS EXPECTED TO INCREASE AS THE DESIGN DEVELOPED. FOR THE FOOD PANTRY COMPONENT OF THE PROGRAM, OPEN-WEB JOIST GIRDERS REACHING A DEPTH OF THREE FEET WERE USED TO SUPPORT THE GREEN ROOF ABOVE. IN ADDITION, FOURTEEN-INCH DEEP STEEL ROOF BEAMS COMPRISE THE EXTERIOR FRAMING OF THE FOOD PANTRY.

Roof Dead	
Components	**Load (psf)**
Structure	4.0
Galvanized Steel Decking (18 gage)	2.4
Rigid fiber glass insulation	4.5
Roofing System	6.0
Finish Ceiling - Acoustic Panels	3.0
Mech, Elec, Plumb	4.0
Sprinklers	3.0
Collateral	1.0
Total:	27.9

Roof Live	
Reference	**Load (psf)**
IBC 1607.1	20

Floor Dead	
Components	**Load (psf)**
Concrete Slab	50.0
Corrugated Metal Decking	2.4
Steel Structure	7.0
Stained Concrete Finish (1/2")	6.0
Finish Ceiling - Acoustic Panels	3.0
Mech, Elec, Plumb	4.0
Sprinklers	3.0
Collateral	3.0
Total:	78.4

Floor Live	
Reference	**Load (psf)**
IBC 1607.1 (Lobby, moveable seats)	100

Composite Design

Loading:			
wd	0.76	klf	= (Beam Spacing)*(Slab + Self Weight + Miscellaneous))/1000
wl	1	klf	= [(Beam Spacing)*(Live Non-Reducible Composite load)]/1000
Combinations:			
1.4*(Pd)	1.064	klf	
1.2*(Pd) + 1.6*(Pl)	2.512	klf	
Controlling Load (Pu)	**2.512**	klf	
P(Dead)	17.632	kips	= (0.5*(wd)*(L1))+(0.5*(wd)*(L2))
P(Live)	23.2	kips	= (0.5*(wl)*(L1))+(0.5*(wl)*(L2))
Pu	58.2784	kips	= (0.5*(wu)*(L1))+(0.5*(wu)*(L2))
Moment:			*Table 3-22a
Mu	1165.568	k-ft	= a*Pu*L; a = 0.5
Effective Flange Width:			
1.) (ft)	10	ft	= L/4
2.) (ft)	11.6	ft	= 1/2 dist. to adj. beam on each side
3.) (ft)	12.6	ft	= (1/2 dist. to adj. beam) + (dist. to edge of slab)
Controlling:	10	ft	*Min. of above 3 cases
Concrete Analysis:			
a(trial)	1.372549	in	= [0.5*(A)*(Fy)]/[0.85*(f'c)*(bef)*12]
Y2	5.3137255	in	= (Y1) - (a(trial)/2)
PNA to use	5		*5 = Conservative
*Take to Table 3-19			
For:	W24x76		
ϕMn	1180	k-ft	*Table 3-19
ΣQn	509	kips	*Table 3-19

Moment Check:			
Mu (k-ft)	1165.568		= a*Pu*L; a = 0.5
ϕMn (k-ft)	1180		*Table 3-19
Good?	YES		*Mu < ϕMp
Shear Check:			
Vu (kips)	37.7232		= c*P; c = 1.5
ϕVn (kip)	315		*Assumed greater than precomposite
Good?	YES		*Vu < ϕVn
"a" Check:			
a(check)	1.247549	GOOD	= (ΣQn)/[0.85*(f'c)*(bef)*12]
Deflection Check:			
*Table 3-20 for I(LB)	4110	in^4	*Table 3-20
Defl. (LL)	1.0763212	in	= (e*Pl*L^3)/(E*I); e = 0.05
Defl. (TL)	1.8943253	in	= (e*(Pd+Pl)*L^3)/(E*I); e = 0.05
Limit (LL)	1.3333333	in	= (L)*12/360
Limit (TL)	2.00	in	= (L)*12/240
Redesign for Live?	No		*Only if Defl. (LL) > Limit (LL)
Redesign for Total?	No		*Only if Defl. (TL) > Limit (TL)
DESIGN IS COMPLETE			
Ix (live)			*Take to 3-20 and 3-2, select new beam size
Ix (total)			*Take to 3-20 and 3-2, select new beam size
USE:	W24x76		

Gym Roof

Column Design

Dead Load (D)	27.9	psf	Trib. Length	28	ft
Live Load (L)	20	psf	Trib. Width	12	ft
			Trib. Area (At)	336	ft^2

Inputs

Dead Load (Pd)	9.3744	kips	= (At)*D/1000
Live Load (Pl)	6.72	kips	= (At)*L/1000

Combinations

1	13.12416	kips	= 1.4*(Pd)
2	22.00128	kips	= 1.2*(Pd) + 1.6*(Pl)
Controlling Load (Pu)	**22.00128**	kips	*Max. of combinations

Column Height	35	ft
Max Unbraced Length	35	ft

Top Support			Base Support		
Strong Axis	X	Pin	Strong Axis	X	Pin

Available Strength

Kx	1	*Table C-A-7.1	Ky	1	*Table C-A-7.1
Lx (Strong)	35	ft	Ly (Weak)	35	ft
			KL (ft)	35	= (Ky)*(Ly)

*Table 4.1 w/

KL= 35

ϕPn> 22.00128

Shape Options	lb/ft	ϕPn	
W8x			
W10x	49	112	Lightest Shape
W12x	53	116	

Check Weak Direction

rx/ry	1.71		*Table 4.1
KxLx/(rx/ry)	20.46783626	ft	
	21	ft	*Round up
ϕPn	294	kips	GOOD IN WEAK DIRECTION
**USE:	W10x49		

ASD

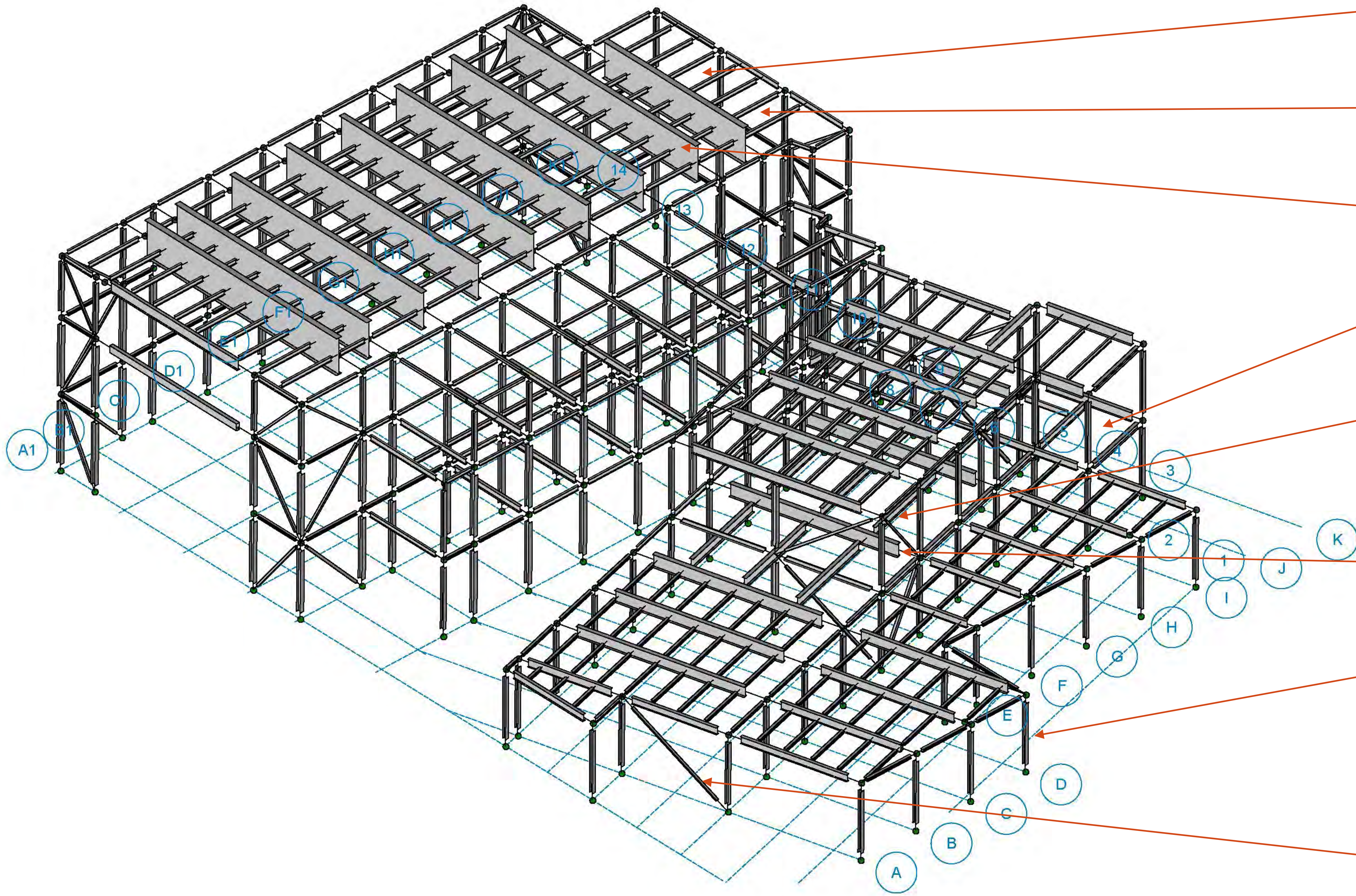
STANDARD LOAD TABLE FOR OPEN WEB STEEL JOISTS, K-SERIES
Based on a 50 ksi Maximum Yield Strength - Loads Shown In Pounds Per Linear Foot (plf)

Joist Designation	10K1	12K1	12K3	12K5	14K1	14K3	14K4	14K6	16K2	16K3	16K4	16K5	16K6	16K7	16K9
Depth (in.)	10	12	12	12	14	14	14	14	16	16	16	16	16	16	16
Approx. Wt (lbs./ft.)	5.0	5.0	5.7	7.1	5.2	6.0	6.7	7.7	5.5	6.3	7.0	7.5	8.1	8.6	10.0
Span (ft.)															
10	550 550														
11	550 542														
12	550 455	550 550	550 550	550 550											
13	479 363	550 510	550 510	550 510											

	5N@ 11.00	44	19	22	25	27	30	32	35	38	43	49	54	61	66	85	95	111	125	153	180	219	253	
		48	19	21	24	25	29	30	33	36	39	45	50	58	62	75	91	106	112	153	177	205	230	
		54	20	21	23	25	26	29	31	34	36	44	46	52	60	67	88	94	108	128	158	182	207	265
		60	20	22	22	24	27	27	31	32	34	39	45	47	53	64	77	90	97	116	137	162	185	237
		66	21	22	23	24	26	28	29	32	33	37	42	46	49	62	71	80	93	112	133	164	176	217
	6N@ 9.17	44	18	23	26	29	33	37	40	46	47	54	62	70	77	100	114	131	151	188	226	261		
		48	18	23	24	29	31	34	37	42	46	52	59	66	71	92	106	116	143	177	205	246	279	
		54	19	22	24	27	30	33	35	39	41	47	56	60	65	80	95	109	119	160	181	211	251	
		60	19	20	23	25	30	31	34	37	40	44	50	58	61	77	96	105	112	149	174	197	226	279
		66	20	20	23	26	29	32	32	35	37	41	49	52	59	72	84	99	110	130	156	187	205	269
	7N@ 7.86	44	22	25	28	33	36	41	46	51	54	62	71	78	91	105	131	153	176	216	263			
		48	21	24	28	31	34	39	45	46	52	59	68	77	79	106	117	143	158	205	237	291		
		54	19	24	26	29	32	36	39	43	48	57	64	69	78	95	109	129	148	182	213	259	301	
		60	20	23	25	29	31	34	37	41	43	50	59	67	70	84	406	113	138	166	199	235	277	
		66	20	23	25	29	32	33	37	38	43	50	54	60	68	82	100	114	124	157	194	219	261	317
55	9N@ 6.11	44	25	30	35	41	46	54	58	63	70	78	92	101	110	143	166	195	228	282				
		48	25	28	33	39	43	49	55	60	64	72	84	102	108	134	157	182	205	266				
		54	25	28	33	38	42	46	51	57	58	69	79	87	97	114	148	164	187	243	282			
		60	24	28	33	37	40	43	48	50	58	67	79	83	89	108	124	154	174	202	264	309		
		66	24	27	31	35	39	42	45	50	52	61	70	77	85	101	117	145	159	194	242	286	319	
	11N@ 5.00	44	31	37	46	52	58	66	70	78	91	101	107	131	142	179	205	253	297					
		48	29	34	41	47	55	63	67	72	79	93	106	116	113	158	195	231	269					
		54	28	33	39	46	49	57	62	69	73	81	96	109	116	150	181	199	241	302				
		60	26	32	37	41	48	51	59	64	68	80	84	98	112	140	166	189	214	269				
		66	27	31	36	39	46	50	55	62	65	74	84	100	102	124	147	170	194	261	293			
	14N@ 3.93	44	39	46	55	63	71	79	92	102	107	121	144	157	179	218	269							
		48	36	43	50	63	71	77	80	94	104	112	134	148	172	206	254	302						
		54	34	41	49	57	66	71	75	83	97	107	120	138	152	187	215	263	307					
		60	31	39	46	52	61	68	77	78	85	101	114	123	142	168	202	241	284					
		66	32	38	44	50	57	63	71	75	80	96	113	119	130	163	197	223	262	321				

AS THE DESIGN DEVELOPMENT PHASE PROGRESSED, PRELIMINARY MEMBER SIZES WERE CALCULATED BY HAND AND PLACED IN THE RISA STRUCTURAL ANALYSIS MODEL. THIS INCLUDED ALL DESIGN DEAD AND LIVE LOADS, ALL COMPOSITE STEEL BEAMS AND GIRDERS, FLOOR AND ROOF DECKING, AND ROOF JOIST SELECTION.

FINAL STRUCTURE



Roof Decking
- 1.5F22

Roof Joist
- 10K1, 12K1

Gym Joist Girder
- 66G11N14K

Floor Decking
- 3VLI22

Composite Beam
- W14x34
- W18x60

Composite Girder
- W30x124

Columns
- W8x31
- W10x12
- W10x45

Vertical Bracing
- HSS4x4x1/4
- HSS5x5x3/16

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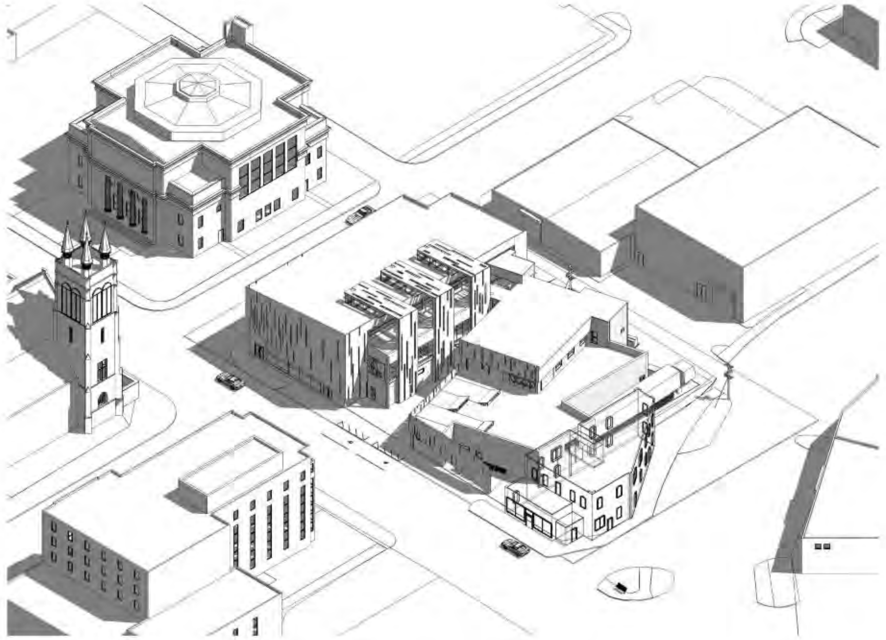

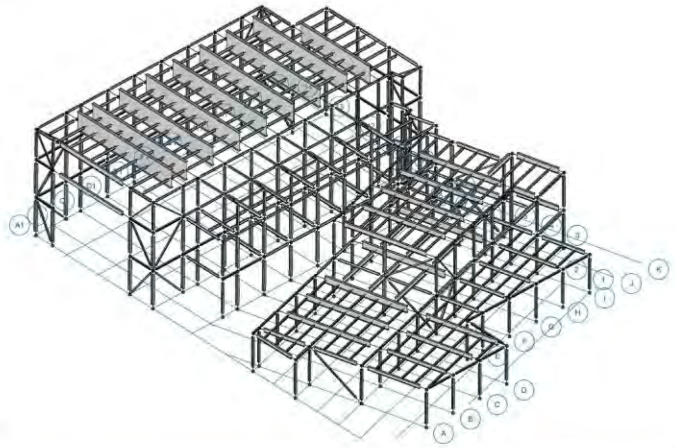

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ENGAGE

MIDTOWN COMMUNITY CENTER
OTHER OPTIONS FOOD PANTRY

181 NW 11th St.
Oklahoma City, OK 73103

Issue Date: 05/05/2017	Project Number: 0106792
Drawn By:	Eric Fleet
Checked By:	The Boilermakers
Approved By:	Bill Nye

Sheet Title:
Cover

Sheet Number:
G1.0

ABBREVIATIONS

@	AT
ϕ	DIAMETER
AB	ANCHOR BOLTS
ACI	AMERICAN CONCRETE INSTITUTE
AISC	AMERICAN INSTITUTE OF STEEL CONSTRUCTION
ANC	ANCHOR
ARCH	ARCHITECTURAL
ASTM	AMERICAN SOCIETY FOR TESTING AND MATERIALS
BM	BEAM
BOT	BOTTOM
BP	BASE PLATE
CG	CENTER OF GRAVITY
CJ	CONTROL OR CONSTRUCTION JOINT
CLR	CLEAR
CMU	CONCRETE MASONRY UNIT
COL	COLUMN
COMP	COMPRESSION
CONC	CONCRETE
CONN	CONNECTION
CONT	CONTINUOUS
DIM	DIMENSION
EJ	EXPANSION JOINT
ELECT	ELECTRICAL
ELEV	ELEVATOR
ENGR	ENGINEER
EXP	EXPANSION
FF	FINISHED FLOOR
FLR	FLOOR
FT	FEET
FTG	FOOTING
GA	GAUGE
GALV	GALVANIZED
GEN	GENERAL
GR	GRADE
IN	INCHES
INT	INTERIOR
JST	JOIST
MECH	MECHANICAL
MIN	MINIMUM
N	NORTH
NO	NUMBER
OC	ON CENTER
OPP	OPPOSITE
P/C	PRECAST CONCRETE
RAD	RADIUS
REF	REFERENCE
REINF	REINFORCED
REQD	REQUIRED
SECT	SECTION
SJ	STEEL JOIST
STD	STANDARD
STIFF	STIFFENER
STL	STEEL
STR	STRUCTURAL
SUP	SUPPORT
TEMP	TEMPERATURE
TOC	TOP OF CONCRETE
TOB	TOP OF BEAM
TOF	TOP OF FOOTING
TOJ	TOP OF JOIST
TOP	TOP OF PIER
TOS	TOP OF STEEL
TOW	TOP OF WALL
TYP	TYPICAL
UNO	UNLESS NOTED OTHERWISE
V	SHEAR
W/	WITH

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SECTION 1: GENERAL INFORMATION AND DESIGN CRITERIA

SECTION 1.1 - DOCUMENTS

1.1.1 Structural Construction Documents consist of Project Specifications and Structural Drawings. Structural drawings include General Notes and Typical details in addition to plans, sections and details.

1.1.2 General Notes and Typical Details describe general criteria that apply to all similar conditions throughout the project regardless of whether or not they are specifically referenced in the plans or details.

1.1.3 Do not scale plans, details and sections for quantity, length or fit of materials.

1.1.4 The structural documents are protected by U.S.A. Copyright Laws. They shall not be used for any purpose other than construction of the structure shown on the site indicated on the Architectural Drawings.

1.1.5 The design represented by these documents is valid only for the building site and the purposes shown on the Architectural Drawings.

1.1.6 The GEOTECHNICAL REPORT is a separate document (not part of contract documents) furnished by the project owner. The contractor is urged to obtain a copy of the report for reference as it describes sub-surface conditions that may be encountered during installation of foundations and contains other information pertinent to construction of the project.

1.1.7 The contractor must coordinate Structural Documents with other trades and disciplines including; architectural, mechanical, electrical, HVAC and fire protection. Every attempt is made to coordinate drawings prior to issue, however, some requirements are not known prior to issue, and change may occur during construction as layout and fabrication drawings are developed.

1.1.8 Promptly report deviations and interferences with structural components for resolution by the Engineer.

1.1.9 Verify dimensional location and depth of slab recesses and offsets with Architectural Drawings.

1.1.10 Verify weights, location and details of structurally supported mechanical equipment prior to construction of the supporting structure. Report deviations from assumed conditions to the Engineer prior to fabricating materials.

1.1.11 Verify the location, size and detail of roof openings and curbs for mechanical equipment prior to fabricating materials. Report deviations from assumed conditions to the Engineer before proceeding with work.

1.1.12 Verify location and size of floor and roof penetrations and sleeves for mechanical and electrical components. Openings in beams, girders, columns and slabs must be submitted for approval.

1.1.13 Heights of floor and roof decks and various framing components are given on the drawings relative to a reference elevation of 100'-0". This reference elevation is equivalent to a Mean Sea Level Elevation of 594.00.

SECTION 1.2 - CODES AND STANDARDS

1.2.1 Building Code of jurisdiction: 2015 International Building Code

1.2.2 Structural Concrete Code - American Concrete Institute (ACI) 318-08

1.2.3 Structural Steel Code - American Institute of Steel Construction 14th Edition

1.2.4 Structural Design Code – American Society of Civil Engineers (ASCE) 7-10

SECTION 1.3 - DESIGN LOADS

1.3.1 Live Loads:

Public Stairs	100 psf
Assembly, Lobbies	100 psf
Automobile Parking	50 psf
Corridors	100 psf
Kitchen	100 psf
Light Storage	125 psf
Mechanical Room	150 psf
Offices, Typical Floors	50 psf
Roof, All Slopes	20 psf
Terraces, Pedestrian	100 psf
Gymnasium	100 psf
Classrooms	40 psf

Notes:
(1) Plus partition loading (see Dead Loads)
(2) Minimum load, or weight of equipment (the heavier)

1.3.2 Dead Loads:

3 1/2" Composite Floor System	50 psf
Flooring	6 psf
Typical Ceilings	3 psf
Ceilings Below Roof Trusses	6 psf
Floor Collateral	8 psf
Floor Framing	7 psf
Floor Sprinklers	3 psf
Partition Loading	20 psf
Roof Collateral	5 psf
Roof Insulation	5 psf
Roof Sprinklers	3 psf
Roofing System	6 psf

Notes:
(1) Collateral loads include: lighting, ductwork, miscellaneous framing.
(2) Roofing system weight is the maximum unit weight of roofing materials and ballast (where applicable) for which the roof structure is designed.
(3) Sprinkler loadings are for distribution lines and heads, exclusive of mains, which are included Separately as concentrated dead loads.
(4) Applied where noted under "Live Loads".

1.3.3 Wind Loads:

Base Mean Wind Velocity	115 mph
Wind Exposure Classification	B
Wind Importance Factor	1.0

SECTION 2: FOUNDATIONS AND RELATED EARTHWORK

GEOTECHNICAL REPORT

2.1 Design of foundations and structural components in contact with soil is based on the recommendations given in the following:

Report by : TERRACON (Oklahoma City, OK)
Date of Report : May 29, 1998
Report Reference : 03985191

LAPPED SPLICE LENGTHS

3.2.7 Lap reinforcing 30 bar diameters at splices unless noted or detailed otherwise

CONCRETE COVER TO REINFORCING

3.2.8 Clearance from face of concrete to face of reinforcing:

Piers	3"
Formed Grade Beams	1-1/2" top, 2" sides, 3" bottom
Columns	1-1/2" interior, 2" exterior exposure
Walls	1" interior, 2" exterior exposure
Slabs	3/4"
Beams	1-1/2" interior, 2" exterior exposure
Basement Walls	1" inside face, 2" outside face

2.2 Refer to the geotechnical report for subsoil conditions that may be encountered in the installation of foundations, and other information relevant to foundations and site preparation.

2.3 Design of soil-supported building slabs is based on a range of soil movement of less than 1/2 inch, based on the recommendations of Geotechnical Report.

2.4 Refer to Specifications for soil stabilization under soil-supported building slabs.

EARTH RETENTION SYSTEMS

2.5 The design of earth retention systems is not included in Structural Documents. Refer to the Technical Specifications for requirements.

STRAIGHT SHAFT PIERS

2.6

Bearing Stratum:	Weathered Siltstone, 19 ft to 20 ft below grade
Top of Stratum Elevation: (For Bidding Purposes Only)	77 ft to 79 ft
Allowable End Bearing:	20,000 psf
Positive Side Friction:	2,000 psf
Upheaval Side Friction:	2,000 psf
Upheaval Design Depth:	3 ft into weathered siltstone
Negative Side Friction:	2,000 psf
Minimum Penetration of Strata:	3 ft

2.7 Pier depths indicated are for bidding purposes only. Actual pier depths may vary depending on depth to bearing stratum.

2.8 Steel dowels at tops of piers or footings shall extend 30 bar diameters above and below top of pier unless noted otherwise (noted as "LAP" on Typical Details).

2.9 Top of pier elevations given are relative to reference elevation 100'-0".

2.10 Over-pour at tops of piers ("mushrooms") shall be removed to the required pier diameter.

BELLED PIERS

2.6

Bearing Stratum:	Weathered Siltstone, 19 ft to 20 ft below grade
Top of Stratum Elevation: (For Bidding Purposes Only)	77 ft to 79 ft
Allowable End Bearing:	2,000 psf
Minimum Penetration of Strata:	3 ft

2.7 Pier depths indicated are for bidding purposes only. Actual pier depths may vary depending on depth to bearing stratum.

2.8 Steel dowels at tops of piers or footings shall extend 30 bar diameters above and below top of pier unless noted otherwise (noted as "LAP" on Typical Details).

2.9 Top of pier elevations given are relative to reference elevation 100'-0".

2.10 Over-pour at tops of piers ("mushrooms") shall be removed to the required pier diameter

SECTION 3: STRUCTURAL CONCRETE

3.0.4 Composite deck system shall be shored in accordance with manufacturer's requirements. Shoring is to remain in place until concrete has reached 75% of specified compressive strength. In addition, shoring is to remain in place until all levels have been placed and have reached 75% of specified compressive strength.

3.0.5 At support points and edge of deck locations, composite deck shall be attached to load bearing walls and structural steel support beams with Hilti Flex Screws, Type 12-14x7/8 HWH #3, at 12" o.c., UNO.

3.0.6 Deck shall span between supports. No midspan splicing of the deck is permitted. Provide # 10 tek screw side fasteners at 24" o.c.

SECTION 3.1 - CONCRETE FORMS

3.1.1 Formed Voids - Provide retained void spaces between bottom of structural members and sub grade as follows:

Grade Beams	6 inches
Structural Slabs	10 inches
Basement Walls	6 inches

3.1.2 Grade Beams - shall be formed both sides unless specifically shown or noted otherwise in the details.

SECTION 3.2 - STEEL REINFORCING

STEEL REINFORCING

3.2.1 All bars shall be deformed in accordance with ASTM A615. Reinforcing indicated to be welded shall conform to ASTM A796.

3.2.2 Strength of bars shall be as follows:

All Bars Grade 60

SPLICING OF REINFORCING BARS

3.2.3 Top bars in beams, slabs or joists shall be spliced at midspan between supports, unless noted otherwise.

3.2.4 Bottom bars in beams, slabs or joists shall be spliced at supports, unless noted otherwise.

3.2.5 Vertical bars in walls shall be spliced at top of concrete above floors, unless noted otherwise.

3.2.6 Column reinforcing shall be spliced at top of concrete above floors, unless noted otherwise.

PLACEMENT OF REINFORCING

3.2.9 Offsets in reinforcing bars shall be bent at a ratio of 1 (normal to bar axis) to 6 (parallel to bar axis).

3.2.10 Provide corner bars at intersections of beams and walls in accordance with Typical Details.

3.2.11 Provide dowels from grade beams or foundation equal in size and spacing to vertical bars in walls or pilasters and extend one splice length above and below joint line, unless noted otherwise.

3.2.12 Start stirrup spacing in beams 2 inches outside of face of supports.

3.2.13 Place first bar of slab reinforcing parallel to side 2 inches from a free edge or half of required bar spacing from face of edge beam.

3.2.14 Single layer reinforcing in walls shall be placed at center of walls unless noted otherwise.

3.2.15 Place welded wire reinforcing in slabs in toppings, or in slabs poured on metal deck at center of slab unless noted otherwise.

SECTION 3.3 - CONCRETE MIX DESIGNS

3.3.1 Concrete Mix Schedule:

a) "HRC" refers to hardrock concrete having air dry unit weight of approximately 145 PCF.
b) "LWC" refers to sand lightweight concrete having dry unit weight not to exceed 120 PCF.
c) Where w/c ratio is not indicated in the Concrete Mix Schedule, it shall be as necessary to meet strength requirements.
d) Where the w/c ratio is shown, it shall be adhered to regardless of strength requirements.
e) "Strength" is required compressive cylinder strength at an age of 28 days.

Conc. Class	Strength psi	Agg. Type	Agg. Size	Slump Inches	Max w/c	Notes
A	3000	HRC	1-1/2"	5-7	---	
B	3000	HRC	1"	3-5	---	
C	3500	HRC	1"	2-4	---	
D	4500	HRC	1"	3-5	---	
E	3000	HRC	3/4"	2-4	---	
F	4000	HRC	1"	3-5	---	

3.3.2 Mix Usage Schedule:

Description of Use	Concrete Class	Air Content
Drilled Piers	A	2.5-4%
Footings	A	5-6.5%
Grade Beams	B	4.5-6%
Interior Slab-on-Grade	C	4-5%
Basement Slab	D	3.5-5%
Basement Walls	D	2.5-4%
Retaining Walls	D	4.5-6%
Elevator Pit Walls	B	5-6.5%
Slab on Composite Metal Deck	E	3.5-5%
Structural Beams and Slab	D	5-6.5%
Structural Columns	D	2.5-4%
PCN Walls, Columns & Slabs	F	4.5-6%

SECTION 3.4 - CONCRETE SLABS

3.4.1 Slabs Placed on Grade

Location	Thickness	Reinforcing
All	5 inches	#3 @ 18 EW

a) Reinforcement shall be placed 2 inches from top of slab, unless detailed otherwise.
b) Provide construction joints in slabs where indicated on Plans. Allow minimum of 4 days interval between placing adjacent sections of slab.

SECTION 5: STRUCTURAL STEEL

SECTION 5.1 - STRUCTURAL FRAME

5.1.1 Structural Steel Properties:

High Strength Steel (Use High Strength Steel for W Shapes & Tees, uno)	ASTM A572 Grade 50
Angles, Channels, Plates, uno	ASTM A36
Pipe Columns	ASTM A53, Grade B
Tubular Columns	ASTM A500, Grade B
Erection Bolts	ASTM A307
High Strength Bolts	ASTM A325N
Anchor Bolts	ASTM A36 or A307
High Strength Anchor Bolts	ASTM A193 Grade B7

WELDING

5.1.2 Unless otherwise noted, angles, plates, rods, and miscellaneous framing shall be welded at contact joints and supports. Weld sizes shall conform to AWS D1.1 minimums, except where noted otherwise.

5.1.3 Where fillet weld sizes are not indicated on weld symbols, fillet size shall be 1/16th inch smaller than thickness of thinner of materials being joined.

5.1.4 Complete penetration welds are indicated by notation "CP" on weld symbols, partial penetration by "PP".

STRUCTURAL BOLTS

5.1.5 Bolts indicated on details shall be 3/4 inch diameter, unless noted otherwise.

5.1.6 Bolts shall be tightened by the AISC "Snug Tight" method unless noted otherwise.

5.1.7 Shelf angles supporting masonry shall have 1/4 inch wide expansion joints spaced not more than 40 feet apart.

5.1.8 Edge angles at perimeters of floors and roofs noted as "CHORD MEMBERS" or "CONTINUOUS" on details shall be butt welded at splices to develop full allowable tensile strength of member.

5.1.9 Edge angles supporting floor or roof deck shall be spliced only over supports.

SECTION 5.2 - METAL ROOF DECK

5.2.1 Metal Roof Decking:

5.2.2 Metal Roof deck at Gymnasium sloped roof shall be 1:12. Deck shall have G60 galvanized finish.

5.2.3 Metal roof deck at roof shall be 1 1/2", 22 gauge wide rib deck with the following minimum section properties:

I = 0.169 in4
Sp = 0.186 in3
Sn = 0.192 in3

SECTION 5.3 – LIGHT GAUGE COLD-ROLLED FRAMING

5.3.1 Lightgage Steel Properties:

Mbr	Material	Grade	Fy	Shop Coat
Studs	ASTM A446	C	40 ksi	Galvanize (G-60)
Joists	ASTM A446	C	40 ksi	Galvanize (G-60)
Track	ASTM A446	A	33 ksi	Galvanize (G-60)

5.3.2 Slide clip capacity and connection shall be adequate to safely brace metal wall studs against design lateral load of 700 pounds for each stud (allowable stress increase permitted by Building Code already taken into account).

5.3.3 Welding of light gage materials indicated on details shall be 1/8th inch fillet welds, unless noted otherwise. Use special welding equipment to prevent blow-out or burning through material.

5.3.4 Light gauge load bearing walls and roof trusses to be designed by a professional engineer registered in the state of Oklahoma. Design shall be based on vertical loads given in the contract documents, plus lateral loads as required by the governing building code.

5.3.5 Light gauge Framing Design Loads:

Design loadings for light gauge framing, and structural steel supporting framing are as follows:

FLAT ROOF: Dead Load = 22 psf + truss weight
Green Roof Dead Load = 100 psf + truss weight
Live Load = 20 psf (reducible)

SLOPED ROOF: Dead Load = 27 psf + truss weight
Live Load = 20 psf (reducible)

CORRIDORS, COMMONS AREA:
Dead Load = 75 psf
Live Load = 100 psf (reducible)

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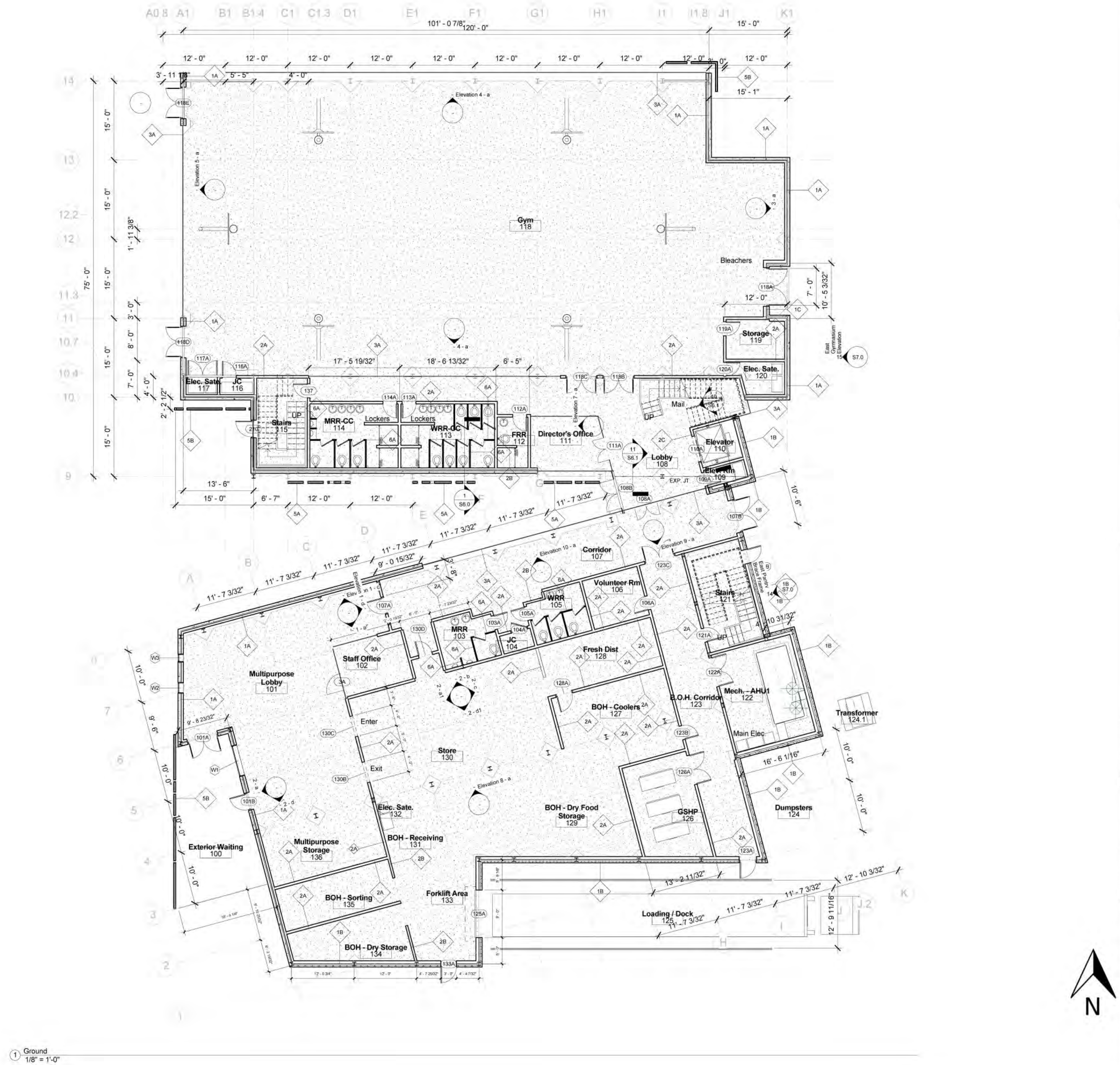
G E N E R A L N O T E S

GROUND FLOOR PLAN



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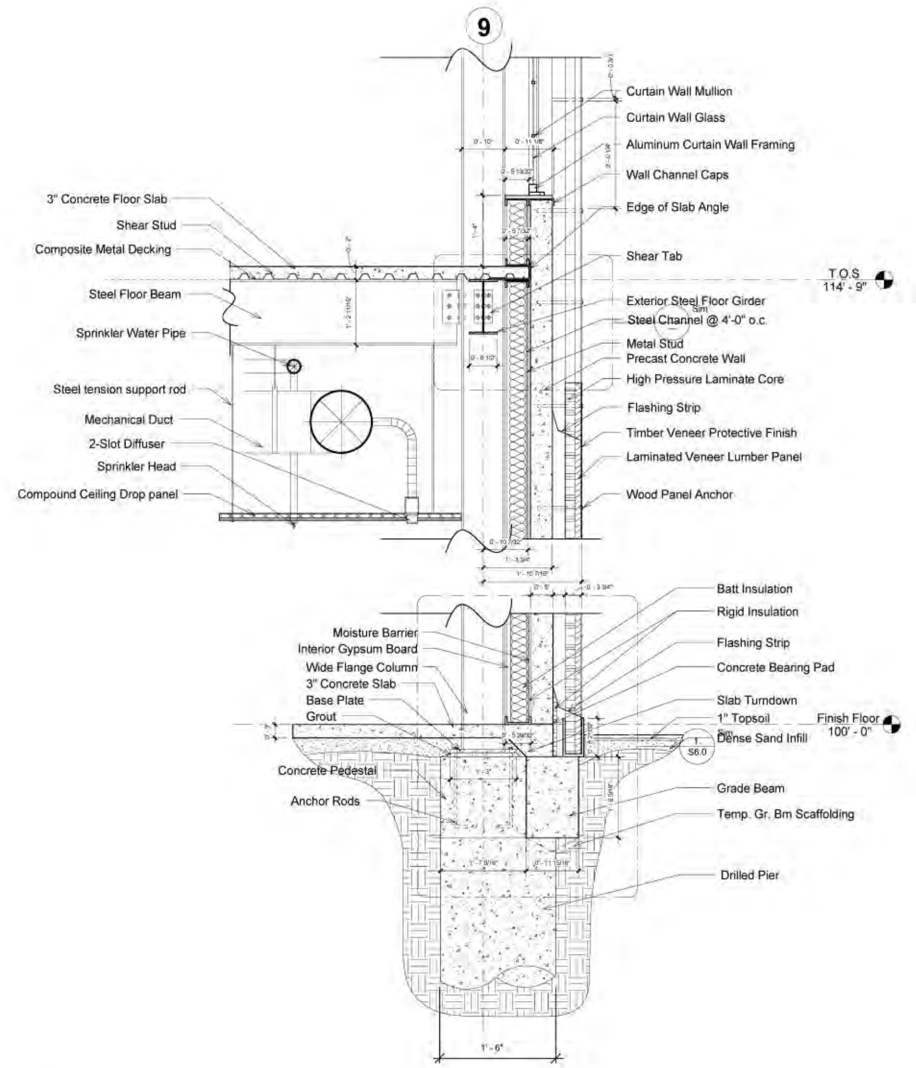
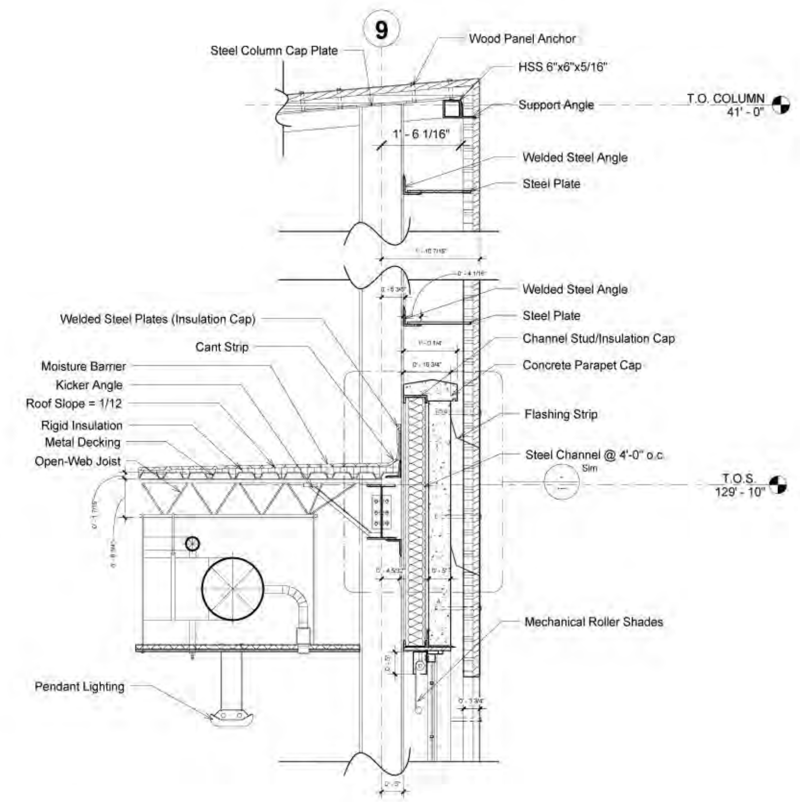
A2.0

W A L L S E C T I O N



1 Wall Section (a)
3/4" = 1'-0"



2 Wall Section (b)
3/4" = 1'-0"

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181 NW 11th St.
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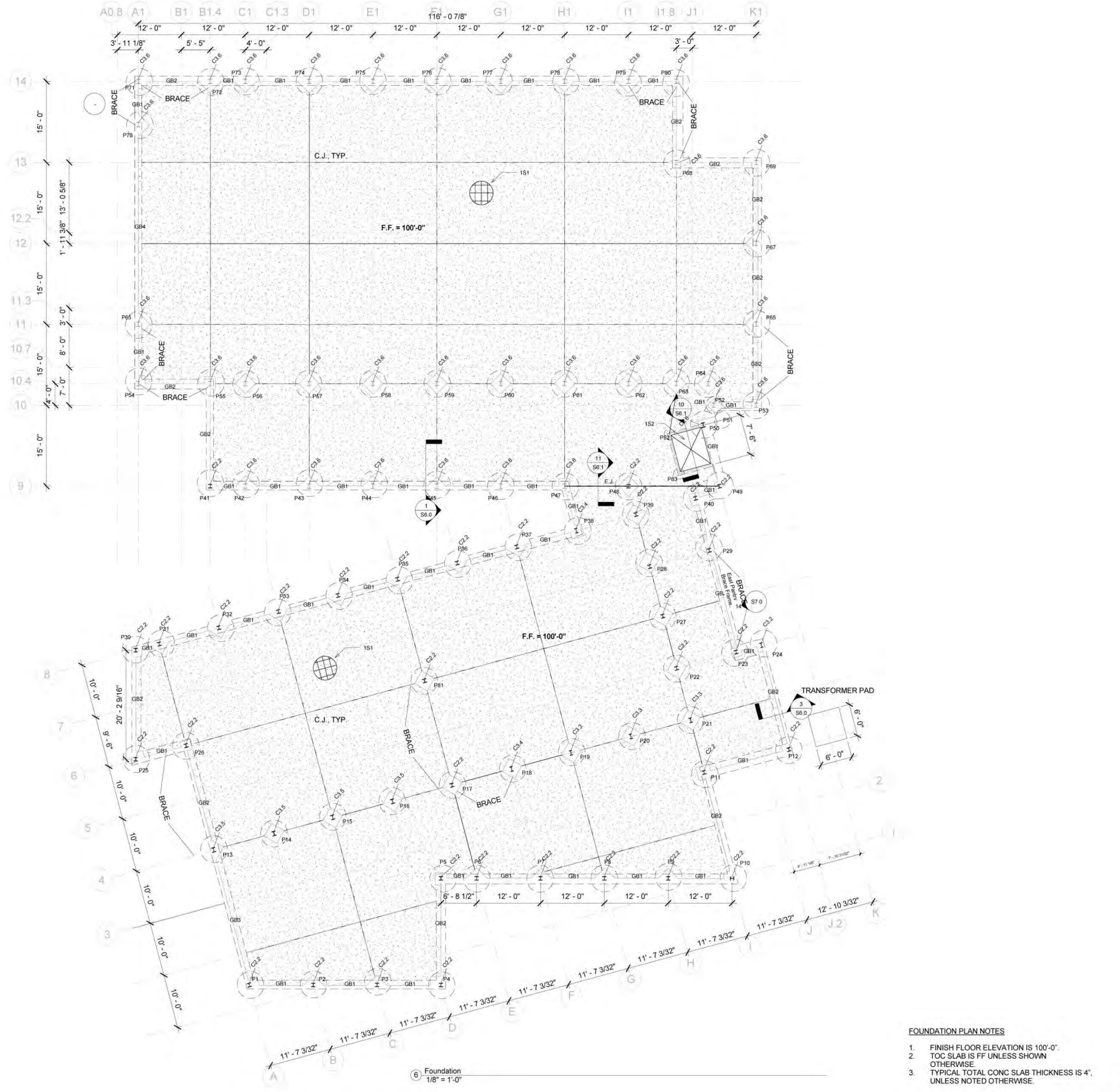
Issue Date: 05/05/2017	Project Number: 0106792
Drawn By:	Eric Fleet
Checked By:	The Boilermakers
Approved By:	Bill Nye

Sheet Title:
Wall Section

Sheet Number:
A7.3



FOUNDATION PLAN NOTES

1. FINISH FLOOR ELEVATION IS 100'-0".
2. TOC SLAB IS FF UNLESS SHOWN OTHERWISE.
3. TYPICAL TOTAL CONC SLAB THICKNESS IS 4", UNLESS NOTED OTHERWISE.

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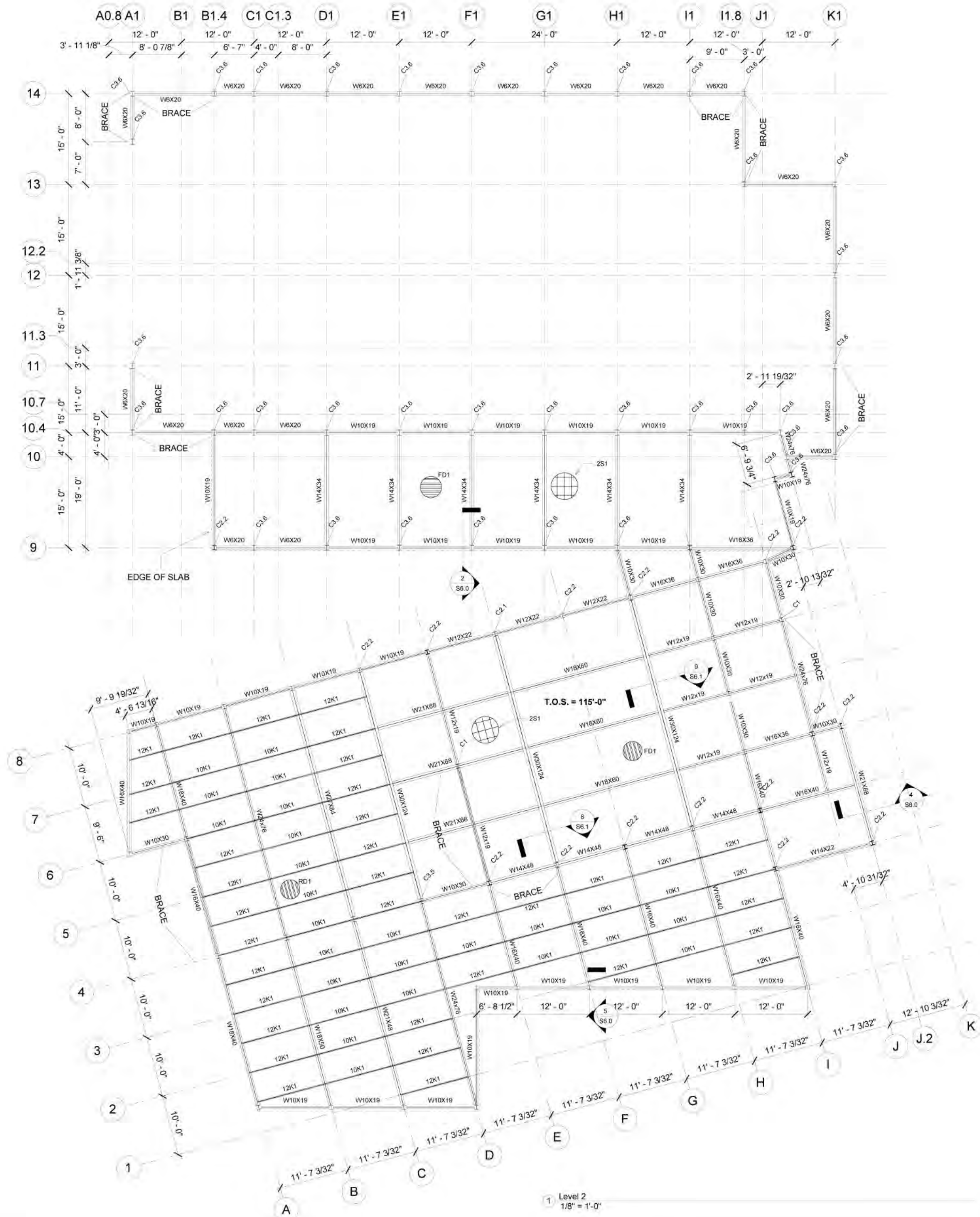
Sheet Title:
Foundation Plan

Sheet Number:
S2.0



2ND FLOOR FRAMING PLAN NOTES

1. FINISH FLOOR ELEVATION (RELATIVE TO DATUM 100-0) IS:
SECOND FLOOR 115'-0"
2. TOC SLAB IS FF UNLESS SHOWN OR NOTED OTHERWISE.
3. SLAB THICKNESS IS 3 1/2" NORMAL WEIGHT CONCRETE ON 3" COMPOSITE DECK (6 1/2" TOTAL THICKNESS)
4. RD1 = 1.5F22 ROOF DECKING
5. FD1 = 3VLI22 COMPOSITE FLOOR DECKING

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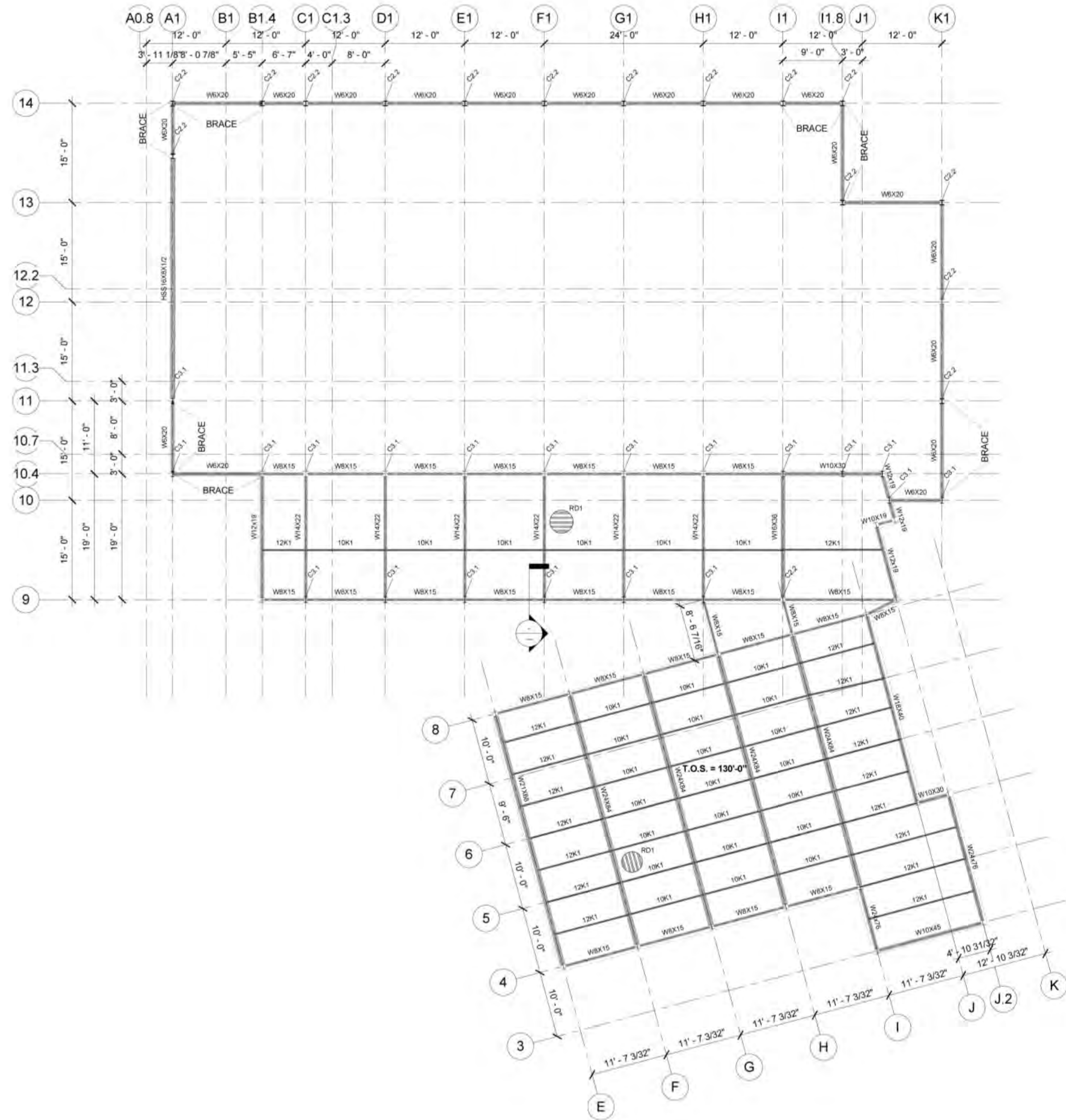
Sheet Title:
2nd Floor Framing Plan

Sheet Number:
S3.0

2ND FLOOR FRAMING



Level 3
1/8" = 1'-0"

3RD FLOOR FRAMING PLAN NOTES

1. FINISH FLOOR ELEVATION (RELATIVE TO DATUM 100-0) IS:
   THIRD FLOOR 130-0
2. TOC SLAB IS FF UNLESS SHOWN OR NOTED OTHERWISE.
3. SLAB THICKNESS IS 3 1/2" NORMAL WEIGHT CONCRETE ON 3" COMPOSITE DECK (6 1/2" TOTAL THICKNESS)
4. RD1 = 1.5F22 ROOF DECKING

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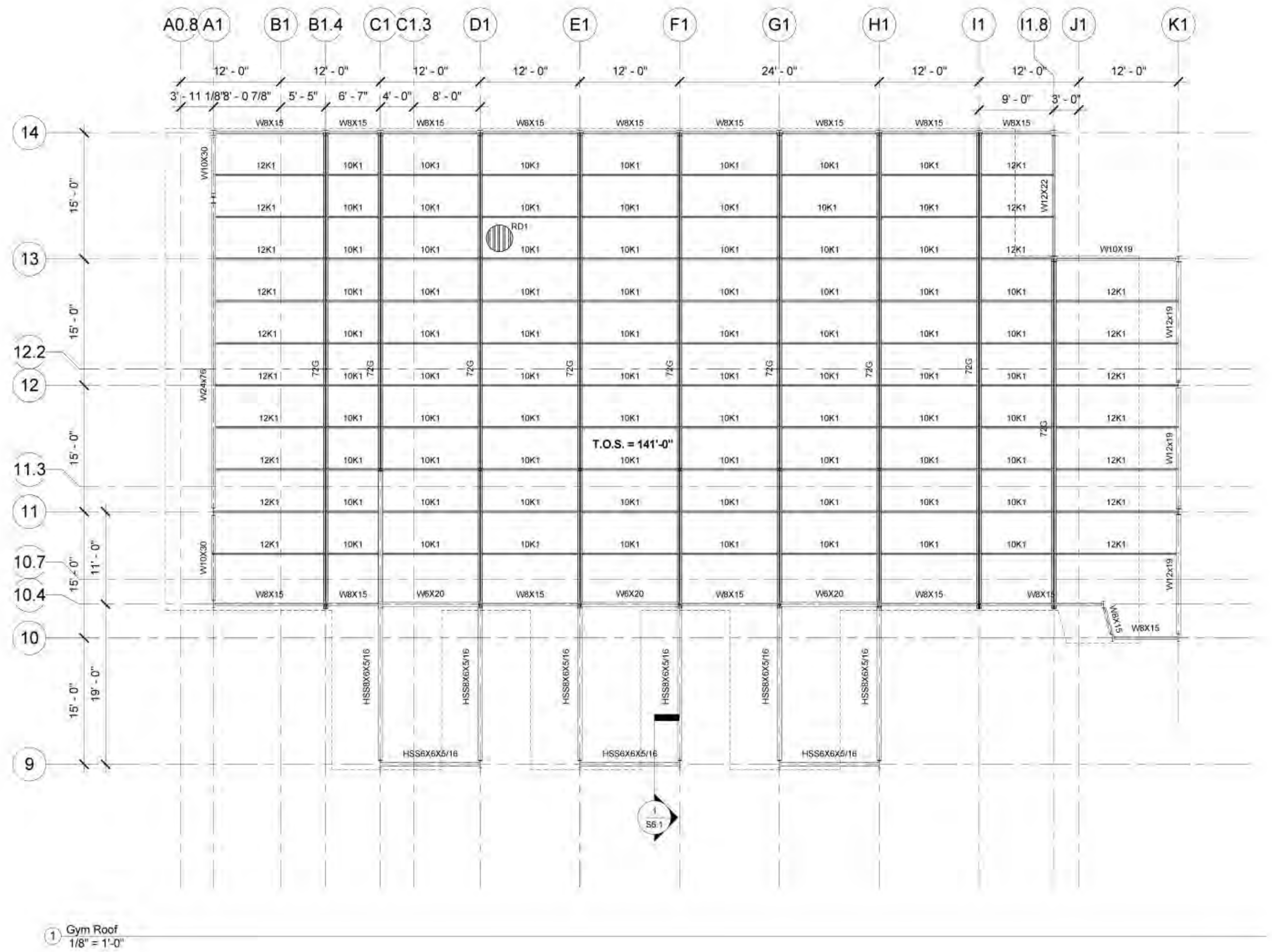
Sheet Title:
3rd Floor Framing Plan

Sheet Number:
S4.0

ROOF FRAMING



GYMNASIUM ROOF FRAMING PLAN NOTES

1. TOP OF ROOF STRUCTURE IS SLOPED FOR DRAINAGE. SEE ELEVATIONS NOTED ON PLAN.
2. UNLESS NOTED OTHERWISE, STEEL JOISTS SHALL BE CENTERED ON AND EQUALLY SPACE BETWEEN COLUMN CENTERLINES.
3. JOISTS SUPPORTING MECHANICAL EQUIPMENT SHALL BE DESIGNED FOR TYPICAL ROOF LOADINGS PLUS A CONCENTRATED LOAD OF 70% OF INDICATED EQUIPMENT WEIGHT PLACE AT ANY PANEL POINT.
4. DESIGN STEEL JOISTS FOR A NET UPLIFT OF <u>25</u> POUNDS PER SQUARE FOOT (PSF) FOR WIND LOADING.
5. RD1 = 1.5F22 ROOF DECKING
6. DECK BEARING = 2 1/2" TYP.

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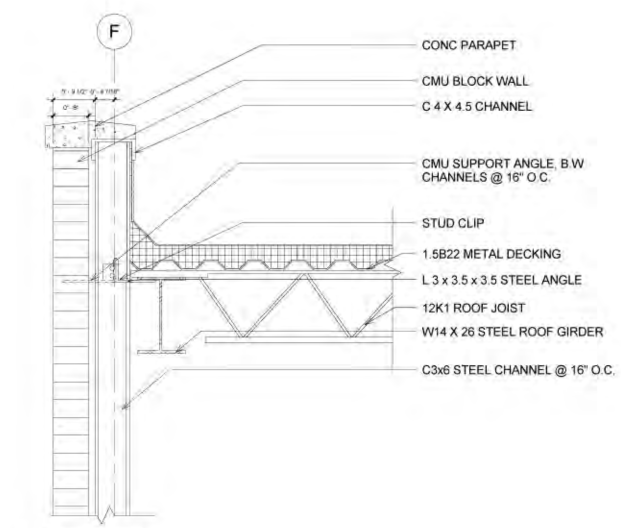
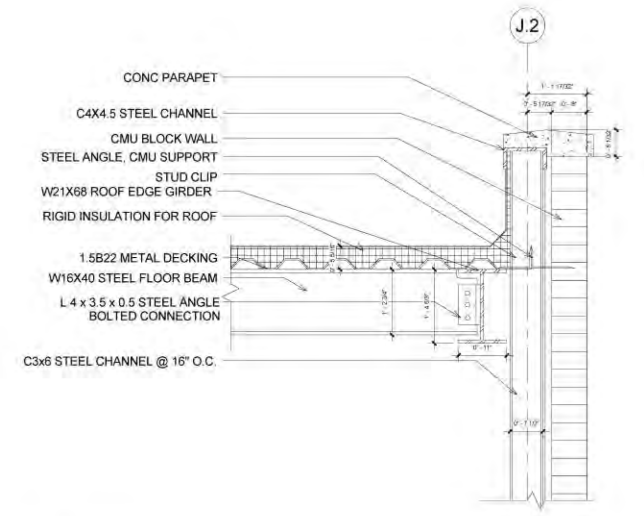
Sheet Title:
Roof Framing Plan

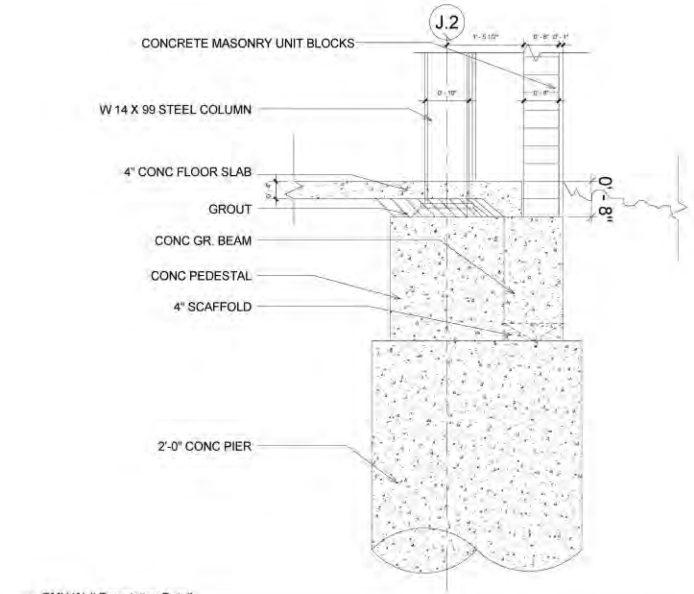
Sheet Number:
S5.0



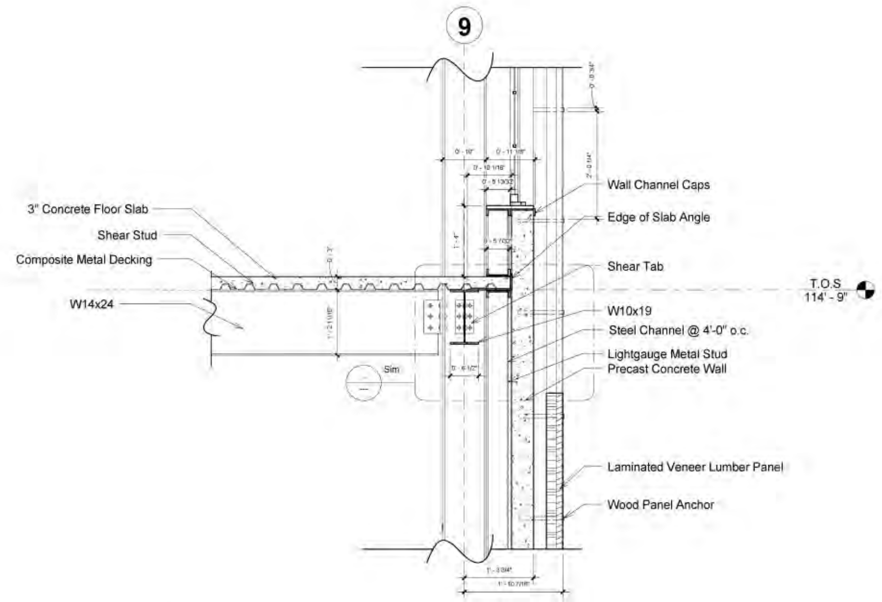
5 Roof Edge Framing
3/4" = 1'-0"



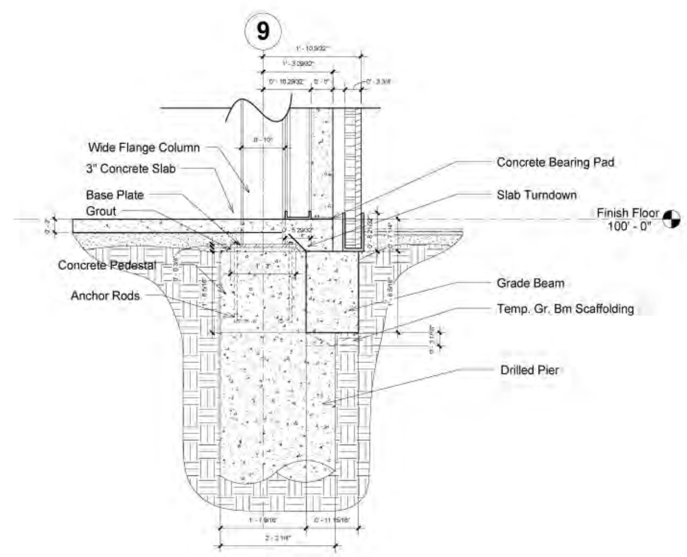
4 2nd Floor Framing
3/4" = 1'-0"



3 CMU Wall Foundation Detail
3/4" = 1'-0"



2 Wall Section - 2nd Floor Framing
3/4" = 1'-0"



1 Wall Section - Foundation Detail
3/4" = 1'-0"

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Issue Date: 05/05/2017	Project Number: 0106792
Drawn By:	Eric Fleet
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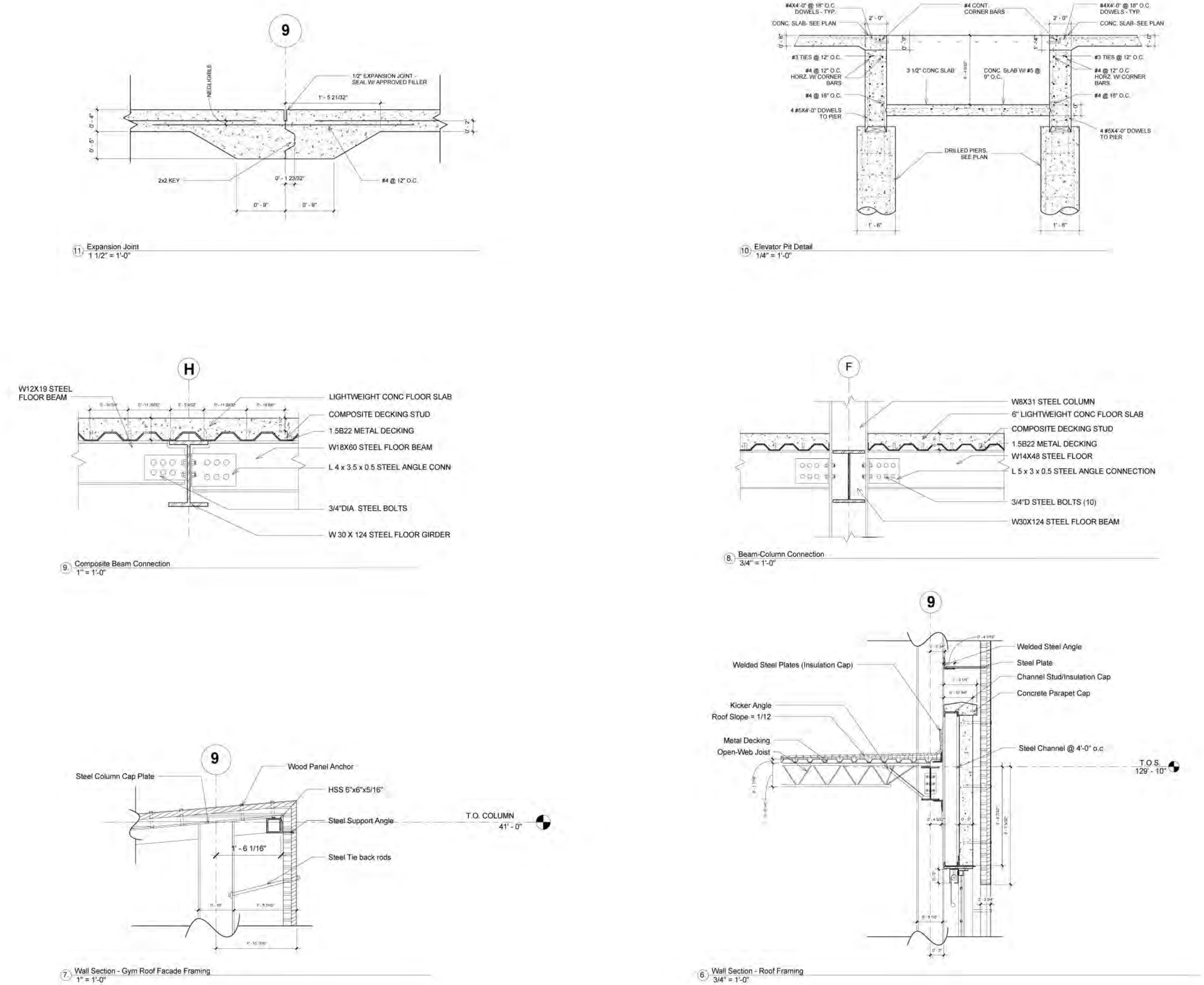
Approved By:	Bill Nye

Sheet Title: Details

Sheet Number: S6.0

D E T A I L S

DETAILS



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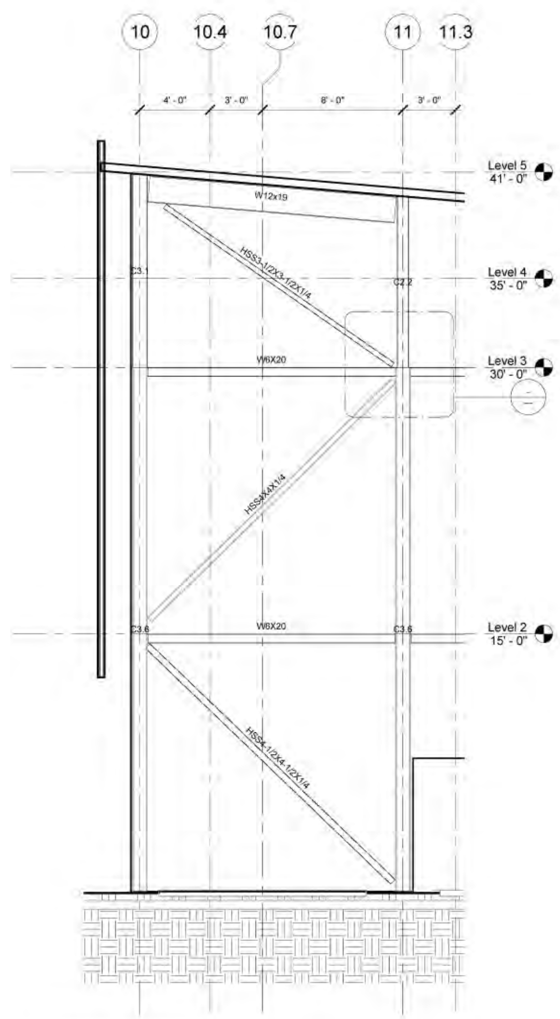
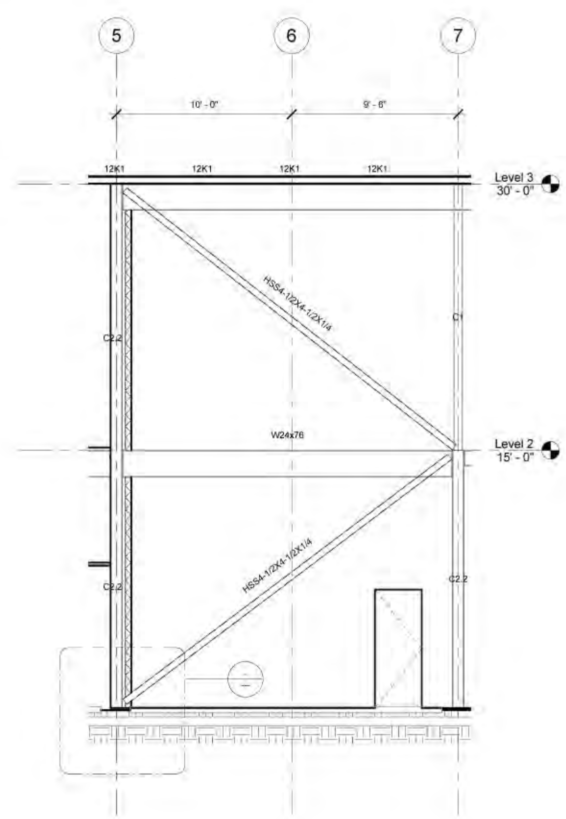
Sheet Title:
Details

Sheet Number:
S6.1

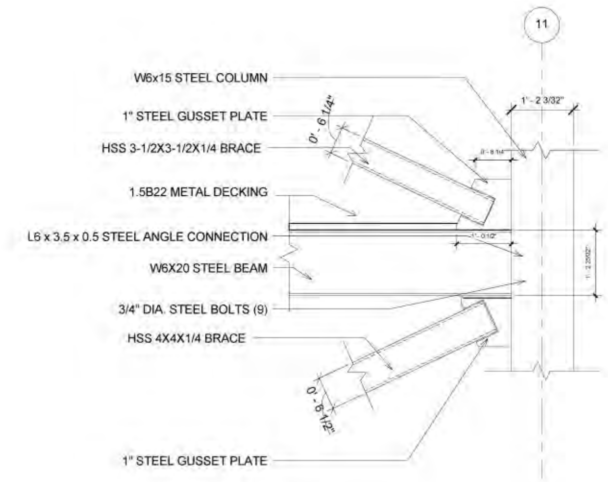
BRACE FRAMES



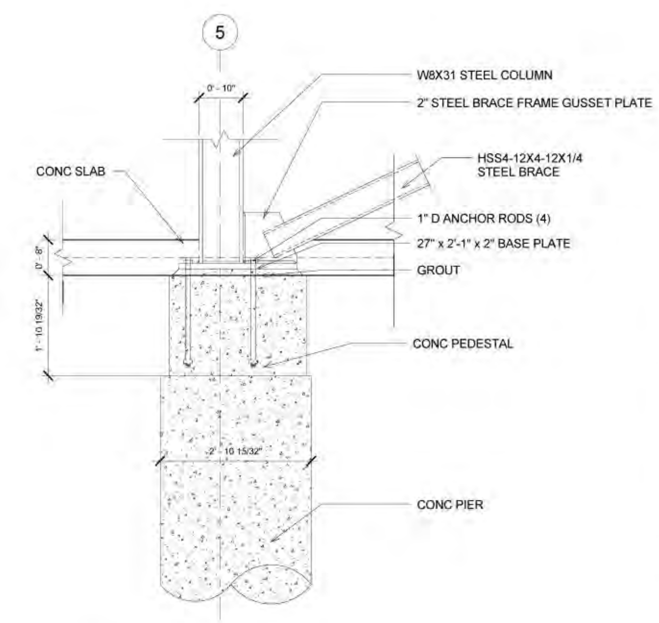
15 East Gymnasium Elevation
1/4" = 1'-0"



14 East Pantry Brace Frame
1/4" = 1'-0"



13 2nd Floor Brace Detail
3/4" = 1'-0"



12 Brace Detail at Foundation
3/4" = 1'-0"

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Drawn By:	Eric Fleet
Checked By:	The Boilermakers
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Sheet Title: Braced Frames

Sheet Number: S7.0

Pier Schedule

P	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	Total
12φ																																																																																			■	■	2
18φ	■	■	■	■	■	■	■	■	■	■	■		■	■	■	■						■		■	■	■	■	■		■	■	■	■	■	■		■			■	■	■	■	■	■	■			■	■	■	■											■	■			■		■				■											44
24φ												■							■		■								■										■								■	■					■			■	■	■	■	■	■	■									■			■	■	■	■	■	■	■				23
30φ																	■	■		■			■													■		■																■											■	■		■		■		■									■			13
36φ																																																							■																														1

From Geotechnical Report:

q (psf)	20000
Skin friction value (psf)	2000
Total depth of pier (ft)	22
Depth to Embedment (ft)	19
Height of friction interface (ft)	3
Weight of Concrete (pcf)	150

		*Bearing	*Friction (Uplift)	*Friction (Uplift)		Vertical Bars		Ties	
Designation	Pier Diameter (in)	qA (kips)	Friction Resistance (kips)	Weight of Pier (kips)	Uplift Resistance (kips)	Quantity	#	#	Spacing (in)
18φ	18	35.34	28.27	5.83	34.11	6	5	3	10
24φ	24	62.83	37.70	10.37	48.07	6	6	3	12
30φ	30	98.17	47.12	16.20	63.32	6	7	3	14
36φ	36	141.37	56.55	23.33	79.87	7	8	3	16
42φ	42	192.42	65.97	31.75	97.72	7	9	3	18
48φ	48	251.33	75.40	41.47	116.87	7	10	4	18
54φ	54	318.09	84.82	52.48	137.31	9	10	4	18
60φ	60	392.70	94.25	64.80	159.04	9	11	4	18

								Reinforcing Bars	
Designation	Span (ft)	Height of Wall (ft)	Facade Load (ksf)	Facade Load (klf)	Clear Cover (in)	h (in)	b (in)	Quantity	#
GB1	12	15	0.06	0.9	2.5	24	12	2	6
GB2	20	15	0.06	0.9	2.5	24	12	2	6
GB3	26	15	0.06	0.9	2.5	32	16	4	6
GB4	40	30	0.06	1.8	2.5	48	24	3	10

FROM RISA

Pier	Bearing Force	Uplift?	Pier Designation
1	4.865	0	18φ
2	8.831	0	18φ
3	9.267	0	18φ
4	6.644	0	18φ
5	1.085	0	18φ
6	5.802	0	18φ
7	6.685	0	18φ
8	7.211	0	18φ
9	7.882	0	18φ
10	2.816	0	18φ
11	25.36	0	18φ
12	35.11	0	24φ
13	10.184	2.879	18φ
14	18.869	0	18φ
15	19.565	0	18φ
16	30.819	0	18φ
17	71.687	31.643	30φ
18	92.503	24.166	30φ
19	38.506	0	24φ
20	85.03	0	30φ
21	41.501	0	24φ
22	20.413	0	18φ
23	63.522	6.923	30φ
24	12.544	0	18φ
25	1.677	0	18φ
26	9.96	3.188	18φ
27	20.678	0	18φ
28	20.157	0	18φ
29	52.345	14.1	24φ
30	1.211	0	18φ
31	3.925	0	18φ
32	10.988	0	18φ
33	10.988	0	18φ
34	22.164	0	18φ
35	17.382	0	18φ
36	73.613	0	30φ
37	31.237	0	18φ
38	89.178	0	30φ
39	37.544	0	24φ
40	18.497	0	18φ

FROM RISA

Pier	Bearing Force	Uplift?	Pier Designation
41	7.079	0	18φ
42	22.712	0	18φ
43	28.535	0	18φ
44	28.535	0	18φ
45	28.535	0	18φ
46	28.535	0	18φ
47	40.125	0	24φ
48	40.019	0	24φ
49	21.264	0	18φ
50	2.334	0	18φ
51	3.19	0	18φ
52	5.336	0	18φ
53	52.907	26.256	24φ
54	66.786	37.252	30φ
55	103.587	60.046	36φ
56	35.184	0	24φ
57	44.643	0	24φ
58	44.643	0	24φ
59	44.643	0	24φ
60	44.643	0	24φ
61	44.643	0	24φ
62	37.219	0	24φ
63	25.889	0	18φ
64	7.812	0	18φ
65	71.749	32.507	30φ
66	66.646	18.021	30φ
67	30.675	0	18φ
68	62.23	14.781	30φ
69	28.168	0	18φ
70	67.839	30.313	30φ
71	60.72	32.398	24φ
72	72.86	32.047	30φ
73	27.54	0	18φ
74	35.567	0	24φ
75	35.567	0	24φ
76	35.567	0	24φ
77	35.567	0	24φ
78	35.567	0	24φ
79	59.976	18.96	24φ
80	58.832	22.504	24φ
81	78.644	0	30φ

Grade Beam Schedule

Designation	Quantity
GB1	41
GB2	14
GB3	1
GB4	1

Column Schedule

Designation	Size	Quantity
C1	W6x15	2
C2.1	W8x24	1
C2.2	W8x31	65
C3.1	W10x12	20
C3.2	W10x22	2
C3.3	W10x26	3
C3.4	W10x30	3
C3.5	W10x33	5
C3.6	W10x45	74

Beam/Girder Schedule

Size	Quantity / Floor		
	2nd	3rd	Roof
W6x20	22	18	3
W8x15	0	27	16
W10x19	28	1	1
W10x30	11	2	2
W10x45	0	1	0
W12x19	7	4	3
W12x22	3	0	1
W14x22	1	6	0
W14x34	0	6	0
W14x48	4	0	0
W16x36	4	1	0
W16x40	8	0	0
W18x40	1	1	0
W18x50	1	0	0
W18x60	3	0	0
W21x48	1	0	0
W21x68	1	1	0
W24x76	6	2	1
W24x84	0	4	0
W27x84	1	0	0
W30x124	3	0	0
HSS16x8x1/2	0	1	0
HSS6x6x5/16	0	0	3
HSS8x6x5/16	0	0	6
72G J.G.	0	0	9
10K1	26	27	77
12K1	36	18	20

Slab Schedule

Designation	Thickness	Reinforcing		Notes
		Flexural Bars	Temp. Bars	
1S1	4.0"	#4 @ 12" o.c.	#4 @ 18" o.c.	*Slab on Grade
1S2	3.5"	#5 @ 9" o.c.	#4 @ 18" o.c.	*Elevator Pit Slab
2S1	6.5"	#4 @ 12" o.c.	#4 @ 18" o.c.	*2nd Floor Framing

Vertical Brace Schedule

Size	Quantity / Floor		
	1st	2nd	3rd
HSS5x5x3/16	6	7	0
HSS5x5x5/16	2	0	0
HSS6x6x5/16	3	0	0
HSS4x4x1/4	0	3	7

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Sheet Title: Schedules

Sheet Number: S8.0