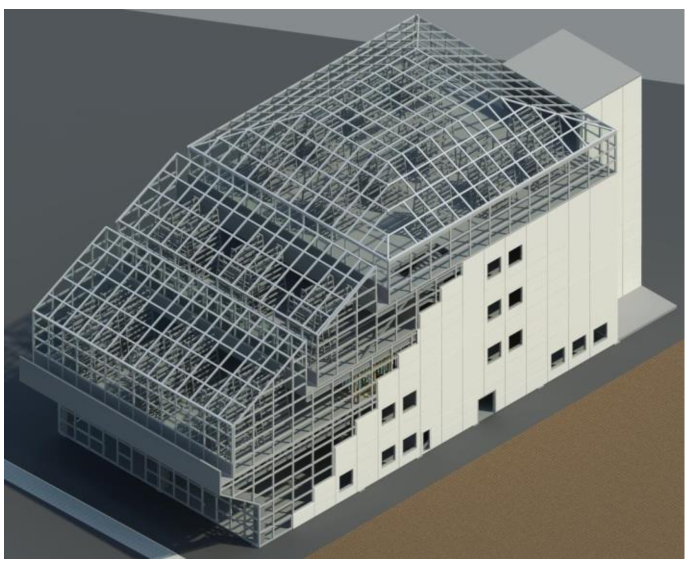
GROWING POWER VERTICAL FARM



IMPACT

Descriptive Narrative Section

AEI TEAM #8-2015
Building Systems Integration
Structural Systems

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Executive Summary

Urban population has grown in the past few decades and will increase considerably in the following ones. The concept of vertical farming has gained importance because approximately 800 million hectares of land were used for food production – approximating an area equivalent to Brazil – in 2004.[1] Vertical farming is the practice of cultivating food within a building or on vertically inclined structures for commercial purpose.[2]

"The decline in arable land, ongoing global climate change, water shortages and continued population growth could change our view of traditional farming from soil-based operations to highly efficient greenhouses or urban farms" – Allen Washatko, TKWA.[3]

Growing Power Inc. is a national nonprofit organization dedicated to the growing, processing, and marketing of healthy, high quality foods for communities across the country. The entity's main goal is "simply to grow foods, to grow minds, and to grow community"[4]. The organization has manifested their goal through the creation and operation of community food centers located in Wisconsin and Illinois. Currently, Growing Power Inc. is interested in creating a new building, an urban vertical farm, which will involve the community with their headquarters in Milwaukee. In the future, the organization hopes to expand this type of project to different locations such as Miami, FL.

Through this project, the team addressed the challenge of designing a building where Growing Power Inc. will be able to sustainably grow food. The urban farm spaces will combine theory and practice as a learning experience for the community, allowing Growing Power Inc. to inspire the community to build sustainable food systems that are equitable and ecologically sound. The class rooms will provide spaces where theory will be imparted. On the other hand, having a demonstrating kitchen, workshop, growing areas, and a market on site will exhibit the practical uses and methods of sustainable food production. Therefore, the team decided to be named *Impact* because of the effect the project will have on the community.

Impact is a multidisciplinary team composed of two Architectural Engineers, two Civil Engineers with structural design concentration, and one Civil Engineer with construction project management concentration. Each member contributed with their knowledge and different background skills to develop the design. To efficiently address the challenge presented by Growing Power Inc., *Impact* determined its project goals:

- To design a vertical farm building that meets the vision of Growing Power Inc.
- To develop innovative and original solutions that incorporate environmentally-friendly and efficient features into the design.
- To provide a cost efficient system that can be easily adapted to other locations in the United States.
- To present a solution that integrates all of the building's systems into a fully functional vertical farm and greenhouse space.
- To optimize all major high performance attributes of the building including energy conservation, safety, structural and material durability, accessibility, cost efficiency, growing productivity, sustainability, functionality, and operability.

Building Systems Integration Introduction

The focus of the 2015 AEI Pankow Student Design Competition is the development, integration, and construction of a first of its kind urban vertical farm located in Milwaukee, Wisconsin for Growing Power Inc. *Impact*'s building design strived to match the challenge set by the competition guidelines including the Growing Power's primary goal; to create a community center that grows and teaches the community of sustainable food systems.

Additionally, the design focuses on innovations within the different building systems and the overall integration of these systems to provide a high performance and sustainable building. The buildings components and systems have been designed to fulfill the following goals:

- Integration
- Energy Efficiency
- Cost Efficiency

Building Information Modelling (BIM).

Before the design process started, *Impact* decided to use a BIM approach as a resource for integrative collaboration between disciplines. As a multidisciplinary team, *Impact* considers that maintaining a good communication is vital throughout a project. Therefore, *Impact* used multiple tools to share information and the keep the group members constantly informed.

- University's server and Microsoft SharePoint to store and share large size files
- Google Drive to share and work on written documents
- Autodesk Revit to integrate the different models
- WhatsApp and University's email to maintain constant communication between team members.

To maintain successful communication and a collaborative design approach where all systems are integrated, *Impact* decided to hold different type of meetings. First, each discipline group met independently and constantly in an open studio space. Then, the whole team met twice a week in order to integrate the design work of all the disciplines. Additionally, *Impact* held weekly meetings with faculty advisors for general guidance and feedback

Software	S	A	M	L/E	PM
AGi32				x	
AutoCAD	x	x		x	
COMcheck			x		
MS Excel	x	x	x	x	x
MS Project					x
MS Word					x
MS PowerPoint		x	x		x
Revit Architecture		x	x	x	x
Revit Structure	x				
TEDDS	x				

Figure 1 Software Applications

Through the use of BIM and collaborative design techniques, *Impact* was able to take advantage of multiple software applications that permitted the integration of the building systems within the design. Figure 2 displays a list of the software applications used by the structural, architectural, mechanical, lighting/electrical, and project management disciplines.

Site Plan

The Growing Power Vertical Farm project will be built at 5500 West Silver Spring Drive. The project will encompass a five story building with a basement area consisting of approximately 50,000 total square feet. *Impact's* design for the vertical farm has a footprint with dimensions of approximately 70 feet by 150 feet. The site is in a suburban residential area; therefore, *Impact* created a site plan layout that will minimize the effects of the construction project on the surroundings. Safety, site accessibility, and security were the main principles that determined the allocation of spaces in the site plan layout. Figure 2 shows area subdivisions designated to specific purposes, allowing traffic accessibility without major interferences to construction activities. *Impact* also addressed security concerns by placing chain link fences around the perimeter of the property during the construction phase. The plan also separates the construction area from the existing buildings and adjacent dwelling. *Impact* decided to place 4 gates allowing regulated access to all areas in the property. Also, traffic was restricted to a one-way direction on the access road in order to facilitate large vehicle maneuvers and their loading/downloading processes.

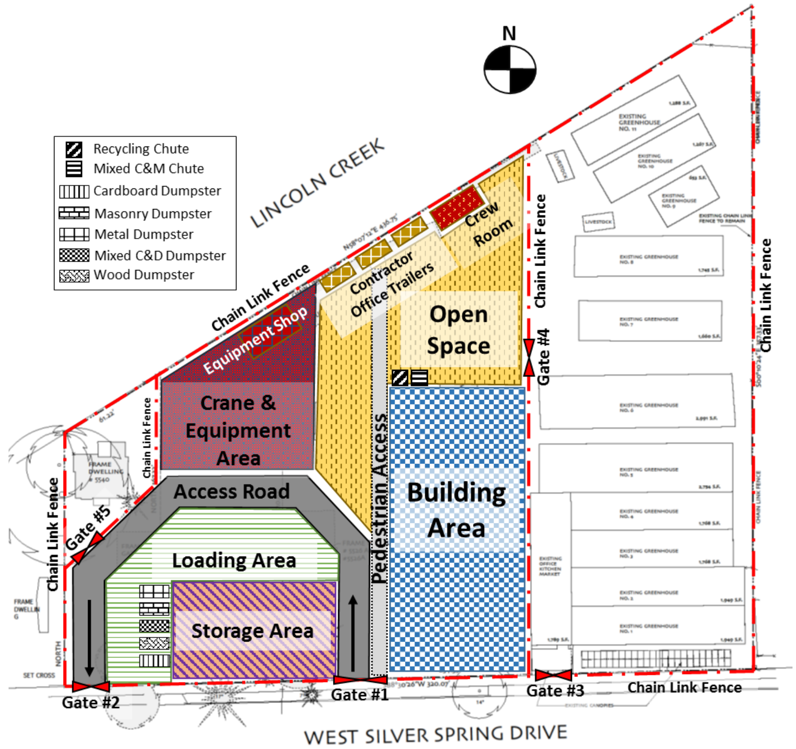


Figure 2 Site Plan Layout

Building Code

The applicable codes through the design of this building were the International Building Code® 2012 Edition[5] and the Milwaukee Commercial Building Code 2011 Edition[6]. Considering the distribution of spaces and that the greenhouse and processing facilities take up most of the square footage, the building fits most closely into the Low-Hazard Factory Industrial (F-2) use group under the International Building Code®.

Impact's design is a Type IIA building, composed by steel structure with fireproofing and covered by an automatic sprinkler system. Initially, Type IIB was taken into consideration, in an attempt to reduce the additional costs provided by fire protected structural members. However, due to its limitation of three stories in accordance to Chapter 5 - Table 503 of the International Building Code®, *Impact*'s design was constrained to the IIA construction type requirements.

On the other hand, the building height was restricted to avoid classification as a high-rise, which would incur in additional considerations and costs to its construction. These additional features would have included, a higher category seismic requirements in regards to lateral members and foundation, a full smoke control and fire alarm system, a standby power system for the fire detection devices and the elevator, and an impact resistant level 2 materials for enclosures of the exit stairways and elevator shaft, among others. Therefore, *Impact* decided to stay with the five-story, rather than the six-story building allowed by type IIA construction. A floor-to-floor height of 13 feet floor was determined by *Impact*, except for the basement whose freezer and coolers condensing units lead to a height of 15 feet.

Architectural Design

The vertical farm's architectural design gained inspiration from the Geisel Library of UC San Diego seen in Figure 3. Primary features borrowed from the library's design include the bent exterior columns and the ascending step back from floor to floor. The columns provide a unique building aesthetic, and the stepping back of the building's floors provides more floor area exposed to direct sunlight. The growing areas in particular take advantage of the direct sunlight with single slant roofs that face the south.

Figure 3 Geisel Library UC San Diego

Figure 5 Exterior Architectural Design

Impact's exterior architectural design is illustrated in Figure 4. It incorporates three Hollow Structural Section (HSS) steel columns that go along with the architectural and structural decision of using exposed columns throughout the building. These three columns are integrated to a truss joist system supporting the third floor area that is then connected to the steel framing and the composite slab that composes the building's structure. All of the building's interiors columns are characterized by a galvanized steel used to protect the member from the humidity and possible corrosion caused by the conditions in the growing areas.

Figure 4 Perforated Metal Encasement

One of the special features of the columns in the entry is its encasement. Even though the current model does not show the detail, the HSS column will be surrounded by a perforated custom made metal cover. In addition to its architectural appeal, this type of encasement will not interfere with the connection between the column and the truss. An example of this type of structure can be seen in Figure 5[7].

Architectural Spaces

One of the most important project requirements was to keep all interior spaces the same square footage or bigger than the original design. A vertical farm is a building type for which there are very few real world examples of floor plans. *Impact* relied heavily on the floor plans provided by AEI for inspiration. Fortunately, these original architectural floor plans were competent in their approach. *Impact* realized a common trend in the existing design of providing less and less public access in the building as it approached the top, as well as of placing complementary spaces adjacent to one another on the same floor. This method provides occupants with an easy to follow path from activity to activity, decreasing the chance of congestion and getting lost. Therefore, the distribution of spaces was kept very similar for these reasons. *Impact*'s major change on the distribution of spaces was to constrain the original four growing areas to the top three floors.

The uses on each floor are illustrated in Figure 6. The basement houses most of the building's storage space, which is ideally placed for easy transportation of goods back and forth from the market, shipping and processing area on the first floor. The first floor houses a 3647 ft^2 market at the building's main entrance and will incur the heaviest pedestrian traffic on a daily basis. Food processing and shipping areas are also located on the first floor creating an easy flow for the shipped products to go through processing to the market. The second floor contains the assembly area with an occupant load of approximately 600 people. The third floor contains learning spaces, three classrooms and a demo kitchen, with the primary feature being the movable partitions between all the classrooms, providing the flexibility to create one large room. The fourth floor serves as the business floor for the Growing Power offices, which includes general office space for seven cubicles, a staff lounge, a director's office, a meeting room and a central reception area. Finally the fifth floor is solely designated as a growing area.

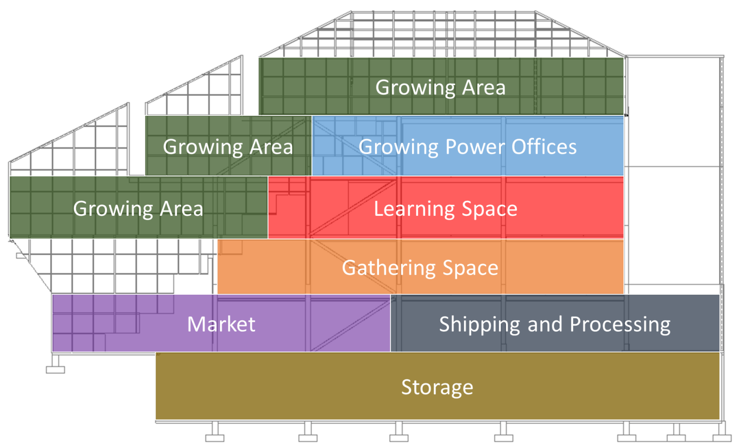


Figure 6 Floor use distribution

Feature Spaces

In addition to reevaluating all of the vertical farm floor layouts, *Impact* to further develop the design of three main spaces.

Atrium

The two-story atrium within the market is a by-product of the elimination of the second floor growing area. This atrium creates a dynamic and memorable entrance, drawing people into the building. The two story curtain walls that comprise the market walls allow sunlight to reach further into the building's interior decreasing the requirement of artificial light during the day. The market itself functions as the community hub and the most visited space within the building. The market exemplifies Growing Power's motto of providing the community with resources to grow high quality, and sustainable food. In addition to the market where the products grown on site are sold, *Impact's* design includes two aquaponic demonstration tanks in this space. The aquaponic demonstration tanks are purely an educational tool to show how fish and plants can be grown concurrently in a self-sufficient system. This feature will serve as an attraction for the community to learn about sustainable food production. The tanks are placed on the slab on grade, integrating the architectural feature with the structural design. In Figure 7, a render of the market is observed.

Figure 7 Market Render

Assembly Space

Figure 8 Assembly Space Render

On the second floor, *Impact* worked on the design of the assembly or gathering space. This space, dedicated to showcase presentations and big events for the community, had a capacity for 463 occupants in the original design. However, *Impact* realized that with an available space of 5,342 square feet, and based on the International Building Code 2012 Edition occupant load factor, this space had the potential to host 763 people. Consequently, the *Impact* increased the means of egress capacity of the floor by adding a third staircase. This addition will allow Growing Power to host bigger events for the community. The current design has a capacity of 600 people. A render view of the assembly space is shown in Figure 8. The details of this floor plan can be seen in page the Drawings section.

Growing Systems

Growing Power practices hydroponic and aquaponic methods, which allow the growing of crops and fish together in a re-circulating system. These cultivation practices use less water than traditional methods and provide the possibility of growing crops and fish at controlled indoor environments yearlong. *Impact* researched hydroponic & aquaponic systems used in multiple projects around the world to determine the specific type of systems suitable for this project.

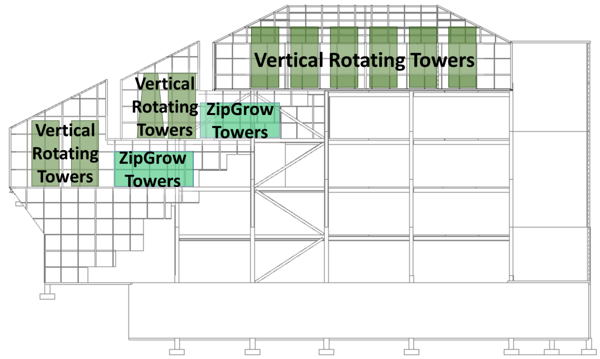


Figure 11 Growing Areas


Figure 10 A-Go-Gro System


Figure 9 ZipGrow System

Although the floor-to-floor height is 13 feet on the first four floors, the roof height extends to an average of 24 feet on the south side of the growing areas as well as on the fifth floor. As seen in Figure 9, these areas on the third and fourth floor have an increased vertical space for growing systems, which will provide more sunlight exposure to plants. For these increased height areas, *Impact* selected vertical rotating towers similar to the "A-Go-Gro" system used in vertical farms in Singapore[8] as seen in Figure 10[8]. The project's vertical rotating towers will incorporate features from three different growing systems to create an innovative solution that will produce an average of 12 plants per square foot of floor area. The vertical rotating towers will use less water than the regular "A-Go-Gro" system and will use a stone wool

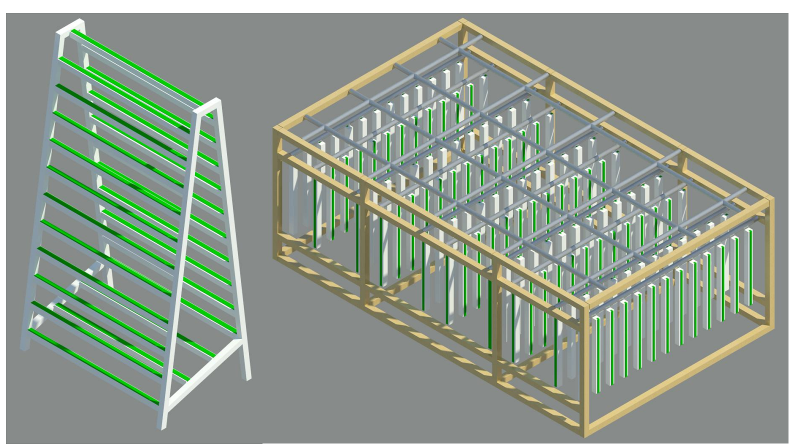


Figure 12 Growing Systems 3D Models

growing media instead of soil. A Revit model is illustrated in Figure 12.

The remaining area where the height is limited, 5 feet tall ZipGrow[6] towers will hang from a supporting wood and metal tube structure, illustrated in Figur11[9]. This system is composed of 4 inch square hollow towers that encase a growing matrix where plants are placed. This system set up works with dripping irrigation and will produce an average of 2.17 plants per square foot of area.

Impact designated the entire fifth floor growing area to be used with vertical rotating towers because of their higher capacity of plants per square foot. *Impact* created Revit models for these two systems, illustrated in Figure 12, to integrate them with the building model. Refer to the Drawings Section for further details.

Impact decided to use hydroponic systems in the vertical farm. The size of the water tanks for fish cultivation were considerably large for the food production desired. Therefore, the integration of aquaponic systems within the building was limited by the space available and the structural loads that they represented.

LED Lighting for Growing Areas

In addition to maximizing the sunlight through the towers and the exterior glazing system, *Impact*'s design uses an LED lighting system for the plants to increase the production of crops, especially during the winter season when the daylight hours are reduced. This system will be composed of a 105 W purple light LED fixture placed in between the crops, as can be seen in Figure 13[11]. In the case of the rotating towers, two lights will cover the 18 foot high structures and one light for the 5 foot ZipGrows towers.

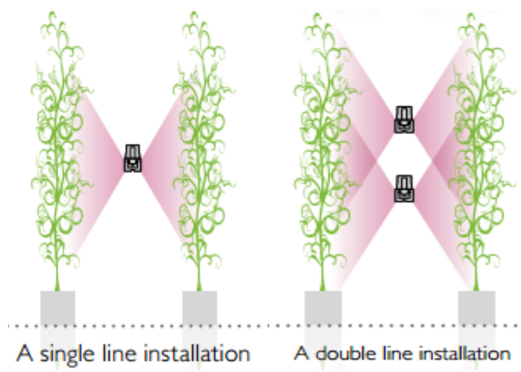


Figure 13 LED Lighting Fixtures

To minimize the energy consumption of the LED fixtures, the growing areas have lighting controlled by zones, as shown in the Drawings Section. Each type of fruit, vegetable or herb that can be grown in these spaces has different requirements for the amount of light and time exposed to it. Therefore, each zone is controlled by a daylighting sensor that will adjust to the lighting required by each type of crop. Then this will be controlled by the customer, who will have a panel to regulate the zones depending on the type of plant growing in it

Building Façade/ Envelope

The building façade and envelope is made of fully integrated, continuous insulation (CI) architectural precast panels. Complimentary to the continuous insulation, panels are fully integrated with space for LED lighting connections, and a built in secondary draining system that collects and drains incidental moisture. The panel's layers from the exterior include; 2 ½" of lightweight concrete with a reinforcing steel mesh. Following that there is a is 3" of NCFI spray foam insulation (R-6.8 per inch) that also works as the envelope's air and vapor barrier limiting mold and bacterial growth within the envelope while also providing and airtight seal. The final

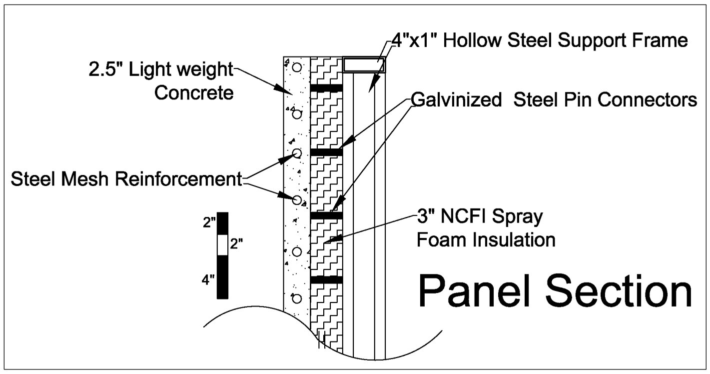


Figure 14 Panel Section

layer is comprised of a light gauge hollow steel support frame with galvanized steel pins to connect this frame to the reinforced concrete. A cross section of the panel can be seen in Figure 14.

These layers create an approximately 9" thick panel with a total R-Value of 20. This R-value is appropriate per the International Energy Conservation Code (IECC) Section C402 Building Envelope[11] requirements, for a building within the 6A climate zone Milwaukee is located in. The envelope is also satisfactory for a building envelope code compliance check.

The panels are delivered to the site with every component already in place including a thermally broken window installed. The only labor required during construction is the physical placement of the panels and the gypsum wallboard finish being applied to the panel's interior, saving construction time and cost. The panels will come in three distinct sizes, as shown in Figure 15.

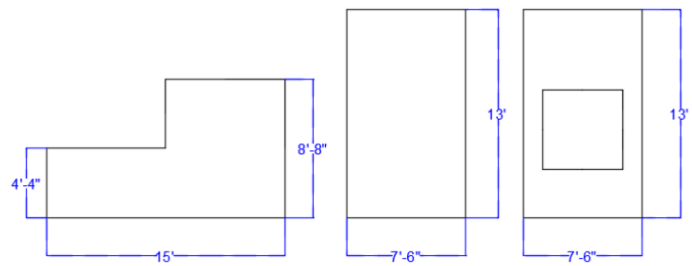


Figure 15 Panel Sizes

The use of fully integrated precast panels can be satisfactory for almost any climate zone thus vertical farms around the country can utilize a simple, modular design. A vertical farm located in Miami, Florida would use the same exact panel configuration, but with only two inches of the spray foam insulation to reach code compliance.

Glazing System

In addition to the exterior paneling system, glazing represented a major aspect of the building's façade design. All of the greenhouse space, composing a majority of the building's floor area, is covered by Cardinal Glass Industries LoE 272 and LoE 240 products, a double-pane low emissivity coating glass with argon filling shown in Figure 16[12].

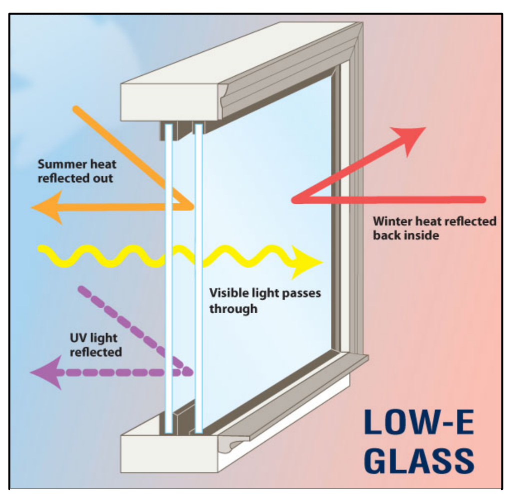


Figure 16 Cardinal Glass - LoE Glass

Low emissivity coating, also known as Low-E, has a very thin microscopically transparent layer of metallic particles that allow the glass to filter light wavelengths and heat. These particles the amount of ultraviolet and infrared light that passes through the glass without compromising the amount of visible light transmitted. Also, due to its low emissivity properties, the glass reflects the heat back. Therefore, during the winter when the interior heat of the space tries to escape to the colder outside, the heat is reflected back to the inside and the heat loss reduced. Meanwhile in the summer, it reflects the solar heat, helping to keep the interior cooler. Consequently, the U-value of this type of glass is lower in comparison to other existing, as it can be seen in Figure 17[12].

In the case of the Growing Power facility, the LoE 272 glazing implemented in the design has a U-value of 0.25 and a visible light transmittance of 70%. This visible light represents the range of spectrum waves, which is the source of light used by plants to carry their photosynthesis. Meanwhile, following the input provided by Solar Innovations[10], *Impact* decide to use a second type of Low-E glass, LoE 240, in the roof of the fifth floor greenhouse. This glazing has the same U-value of 0.25, but has a slight tint layer that provides a lower visible light transmittance in order to reduce glare in the space

Exterior Glass	Airspace	Inboard Glass	U-Value	Visible Light	Solar Heat Gain Coefficient
Clear (6mm)	Air (13mm)	Clear (6mm)	0.47	80%	0.72
LoE 272 (6mm)	Argon (13mm)	Clear (6mm)	0.25	70%	0.4
LoE 240 (6mm)	Argon (13mm)	Clear (6mm)	0.25	37%	0.24

Figure 17 Glass Specifications.

Mechanical System Selection

After reviewing several mechanical system options, *Impact* chose a water source heat pump (WSHP) heating and cooling system. A WSHP is a highly adaptable and energy efficient system. The system employs units of varying size, based on their tonnage, and distributed throughout the building, creating different zones connected through a water distribution loop. Spreadsheets illustrating the heating and cooling load calculations are located in the Supplementary Documents. Key plans showing the different zones identified with their cooling load and nominal size can be seen in the Supplementary Documents. The actual heat pump units vary in size from 0.5 tons to 10 tons. Water source heat pumps require minimum plenum space in comparison to other HVAC systems and were designed to easily fit within the minimum beam spacing present in the structural system. Furthermore the net weights of these units are easily supported by the building's steel structure.

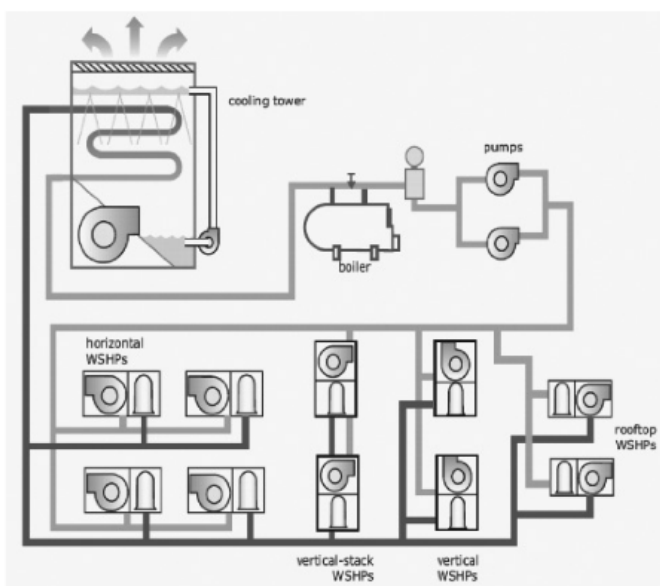


Figure 18 WSHP Layout[13]

The water distribution loop serving the heat pumps is connected to a boiler unit that adds heat to the system and a cooling tower that rejects heat from the system. These components allow different zones to be concurrently heating, cooling or completely shut off at any given time. The units that require heat will extract the heat from the distribution loop and the units that don't will reject heat back into the loop. In this way, the system is constantly recovering heat that is rejected and acts self-sufficiently, saving power. The best example of this self-sufficient process is when rejected waste heat from the heat pumps and the refrigeration system is redirected to the aquaponic demonstration tanks, other heat pumps, and the growing area heating systems. The system is controlled through thermostats placed in each individual zone.

Growing Area Mechanical System Selection

The growing areas only require heating, *Impact* decided to utilize a baseboard heating system around the perimeter of these areas. This baseboard counteracts the cold air downward flow near the exterior glass by creating a draft barrier that warms the air along the walls and the entire space as a whole. This heating method also balances the natural humidity in the growing area, keeping the relative humidity below 80% to prevent molding and rotting of the plants. The piping within the baseboard uses heated water directly from the same boiler used by the water source heat pumps.

Ventilation

The primary goals of any greenhouse ventilation system include:

- Minimizing interior drafts
- Providing accurate humidity control
- Preventing the over-heating of plants
- Sustaining optimum growing conditions

All of these goals can be met by implementing a forced air ventilation system for the growing areas. This system is automated, to mechanically exhaust hot air from the space when temperatures become too high. This creates a negative pressure within the space allowing colder outdoor air to naturally displace the air exhausted through the fans. The system will automatically shut off when a desired temperature level is achieved. Forced air ventilation was chosen over natural ventilation because there is greater control of the temperature and humidity within the space creating optimal growing conditions for plants.

Rain Harvesting System

To integrate the troughs used for the snow collection and supplement the demand for water irrigation, *Impact* incorporated a rain harvesting system into the design, which is shown in Figure 19. Depending on the season of the year, this system will harvest from 7,000 to 17,000 gallons of water per month, which will be used towards the irrigation of the growing areas. In Milwaukee, the warmest months, and consequently the months of highest water demand for irrigation, coincide with those of greatest rainfall, making the system very efficient for this location and diminishing the size of the

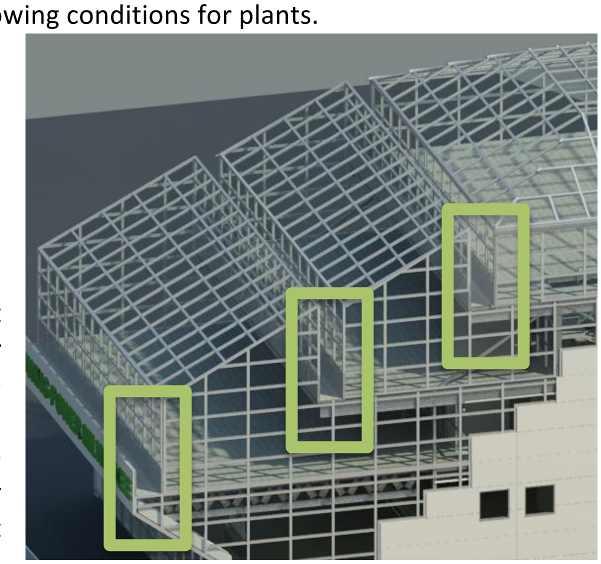


Figure 19 Rain and Snow Collection Troughs

required tank. This relation can be observed in Figure 20.

In addition to the trough design, the proposed system will have 4 inch wide gutters located at the perimeter of the fifth floor roof to maximize the collection of rain. This water will then be piped through 4 inch downspouts and stored in a 10,000 gallon underground tank. To avoid sediments in the system, a metal grate will serve as a first flush system. The first flush keeps large solid debris that accumulate on the roof from entering the system. Growing Power staff will be able to clean this tray through the access window that each greenhouse has. All of these details can be seen in the Drawings Section. In addition, to the first flush, the system will have a sediment filter, and an activated-carbon filter to remove any organic matter.

Water Consumption per Month per Season		
	Irrigation Water Demand	Average Gallons Collected per Month
Winter	2331	5690
Spring	12822	38093
Summer	23313	22062
Fall	12822	9320

Figure 20 Water Consumption

Electrical & Interior Lighting

Impact invested time to determine the total electric loads of the building and identify areas to work on and achieve the goal of energy efficiency. A summary of the calculations can be found in the Supporting Documents.

In addition to the purple LED lighting used in the greenhouses, the remainder of the building was illuminated with white lighting LED fixtures. By using LED fixtures through the building, *Impact* cut 45% of the energy consumption of lighting in comparison to the one required by 2013 ASHRAE Fundamentals[14].

Annual Lighting Design Comparison	
Total ASHRAE Handbook (kWh)	**59673**
Total *Impact* Design (kWh)	**26693**
Energy Saved (kWh)	**32981**
Cost Saved ($)	**4617**

Figure 21 Lighting Comparison

Regenerative Elevator

A regenerative elevator is another energy conscious feature of *Impact's* design. This type of elevator got its name from its regenerative technology. The elevator uses energy as it rises, but then releases the energy captured by the motor as it descends. This energy is reused by the elevator when it ascends. An additional advantage to its energy efficiency is that this type of elevator does not require an elevator machine room. This created an additional room that was later replaced with a recycling room, one of the requirements of the 2011 Edition of the Milwaukee Commercial Building Code[15]. Figure 22[14] illustrates the regenerative elevator system.

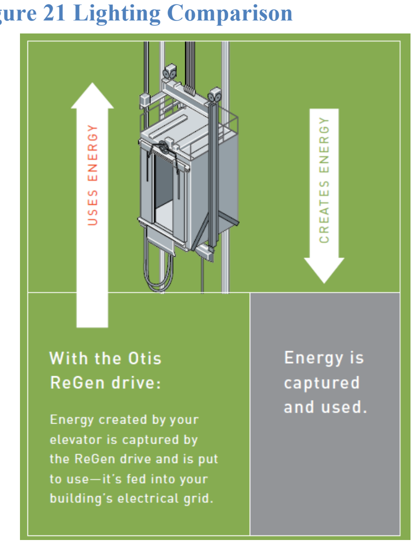


Figure 22 Regenerative Elevator System

Project Cost Estimate Summary

To ensure an advantageous life-cycle cost of the project, *Impact* explored different options of the building components that affected the initial cost but decrease the costs of operation. The LED lighting fixtures and the Mechanical System specified in the design are the major components that had an effect on the initial cost of the building. Ultimately their useful life duration and energy efficiency will decrease the maintenance and operation cost for the facility.

Impact's cost estimate at the design development level was calculated using RS Means 2014 values and broken into the 2012 CSI MasterFormat divisions in order to produce a Class-A, detailed and itemized estimate found in the Supporting Documents. The project cost estimate was then summarized into the UniFormat Categories to facilitate presentation and communication of the estimate detailed in the Supporting Documents. The total cost for the project located in Milwaukee is roughly $12.2 million, resulting in a cost of $245.4 per square foot of construction. *Impact* also analyzed the cost estimate of a future project to be built in Miami, FL, with a cost of $214.97 per square foot as noted in Figure 23. The lower cost for the project in Miami is primarily because Miami has a city cost index lower than the national average while Milwaukee's city cost index is higher.

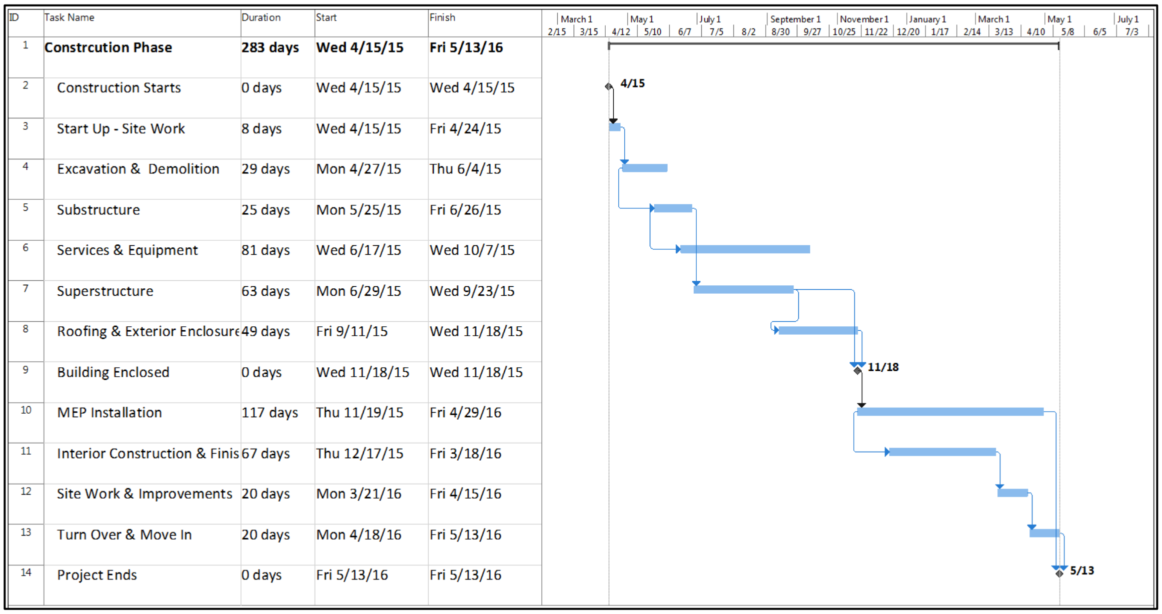
Project Cost Estimate			
Uniformat Category	**Total Cost**	**$ / S.F.**	**% of Cost**
A. Substructure	$ 1,212,160	$ 24.24	10%
B. Shell	$ 4,649,667	$ 92.99	39%
C. Interiors	$ 1,093,658	$ 21.87	9%
D. Services	$ 1,950,261	$ 39.01	17%
E. Equipment & Furnishings	$ 104,582	$ 2.09	1%
F. Special Construction & Demolition	$ 331,245	$ 6.62	3%
G. Building Sitework	$ 92,479	$ 1.85	1%
Y. Miscelaneous	$ 600,000	$ 12.00	5%
Z. General Conditions	$ 1,764,000	$ 35.28	15%
Project Total Cost Estimate	$ 11,798,052	$ 235.96	50,000 S.F.
Total Cost Estimate: Milwuakee, WI	**$ 12,269,974**	**$ 245.40**	
Total Cost Estimate: Miami, FL	**$ 10,748,498**	**$ 214.97**	

Figure 23 Project Cost Estimate Summary

The project's estimate included detailed cost for material, labor, equipment, and overhead and profit for all the construction work and building components contemplated within *Impact*'s design development documents. *Impact* based its cost estimate on R.S. Means 2014 values and rates. For the systems not included in *Impact*'s design, a square foot cost estimate was performed in order to complete the project's overall estimate as noted in the Supporting Documents.

Construction Schedule

The two biggest preconstruction services under construction management involve cost estimation and scheduling. For the Vertical Farm Project, *Impact* decided to start the construction schedule in April 2015 in order to have the building enclosed by the fall season and avoid any construction delays caused by snow. Construction must then be completed by May 2016, in approximately 13 months, as noted in Figure 22. A complete schedule, including the design and preconstruction phases, can be found in the Supplementary Documents.



ID	Task Name	Duration	Start	Finish
1	**Constrcution Phase**	**283 days**	**Wed 4/15/15**	**Fri 5/13/16**
2	Construction Starts	0 days	Wed 4/15/15	Wed 4/15/15
3	Start Up - Site Work	8 days	Wed 4/15/15	Fri 4/24/15
4	Excavation & Demolition	29 days	Mon 4/27/15	Thu 6/4/15
5	Substructure	25 days	Mon 5/25/15	Fri 6/26/15
6	Services & Equipment	81 days	Wed 6/17/15	Wed 10/7/15
7	Superstructure	63 days	Mon 6/29/15	Wed 9/23/15
8	Roofing & Exterior Enclosure	49 days	Fri 9/11/15	Wed 11/18/15
9	Building Enclosed	0 days	Wed 11/18/15	Wed 11/18/15
10	MEP Installation	117 days	Thu 11/19/15	Fri 4/29/16
11	Interior Construction & Finis	67 days	Thu 12/17/15	Fri 3/18/16
12	Site Work & Improvements	20 days	Mon 3/21/16	Fri 4/15/16
13	Turn Over & Move In	20 days	Mon 4/18/16	Fri 5/13/16
14	Project Ends	0 days	Fri 5/13/16	Fri 5/13/16

Figure 24 Construction Phase Schedule

Work	R.S. Means Crew	Additional Crews	Additional Labor Cost
Lighting	1 Electrician	4	$ 500,800.00
Painting	1 Painters	6	$ 133,150.61
Flooring	1 Tile Layers	5	$ 70,505.98
Finishes & Interior Construction	2 Carpenters	5	$ 217,062.99
Site Preparation	2 Common Building Laborers	2	$ 8,270.55
Glazing	2 Glaziers	9	$ 1,935,704.40
Compacting Backfill	B-10L	3	$ 20,117.58
Backfill	B-12E	7	$ 923,456.97
Concrete Placing	C-14E	1	$ 10,848.87
Tilling	D-7	2	$ 77,914.61
Exterior Panels Installation	J-1	1	$ 109,376.10

Figure 25 Additional Labor Cost Summary

Impact analyzed the float time available on each schedule activity in order to determine if any delays on the preceding activities will affect the overall project completion date. From this analysis, *Impact* recognized that there is not a considerable amount of float time on the early stages of the construction. *Impact* would suggest that the structural frames for the glazing walls and roof on the growing areas are built separately on ground level and then field welded together when erected. This will reduce the duration of the roofing work creating float time on preceding activities. Also, the construction management team will have to work with subcontractors to maintain the schedule and reach the building enclosure milestone before the winter months. A complete construction schedule can be found the Supplementary Documents. *Impact* also decided to take measures to reduce the duration of certain construction activities by increasing the number of crews working on those tasks. *Impact* decided to increase the number of crews instead of having

the original crews work overtime because overtime reduces the productivity rate. Reducing the amount of time needed to complete an activity resulted in an increase of the labor cost, which is reflected in Figure 25.

Virtual Construction Model

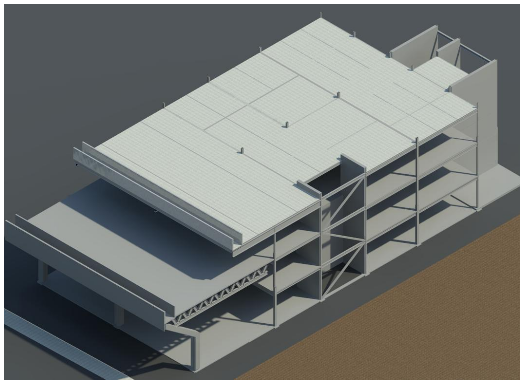


Figure 26 Virtual Construction Phase Render

Impact decided to create a virtual representation of the construction phase of the project using Autodesk Revit. This 3D model integrated structural, mechanical, and architectural features into the design. The creation of a virtual model provided a better understanding of the project to the different disciplines and enhanced the coordination of work on a collaborative file. *Impact* represented the construction phase of the building unit it reaches the enclosure milestone. Figure 26 illustrates the building construction up the fourth floor slab. A sequence of these phases can be found in page the Supplementary Documents.

Concluding Summary

In conclusion, *Impact*'s vertical farm design successfully reaches the initial project goals set by various means.

Integration was achieved by decreasing the basement area to create a slab on grade to easily support the aquaponic demonstration tanks. Precast panels used for the building envelope contain built in LED lighting connections. Water source heat pump units were designed to easily fit between the beam spacing and are also supported by the building's structural framing. A comprehensive BIM model was created and shared across disciplines on the project constantly communicating design changes.

Energy Efficiency was achieved by only having three thermally complex growing areas to heat and ventilate instead of four. Sensors that detect the amount of light required for specific crop types individually control LED lighting fixtures in the growing areas. The building's water source heat pump system is self-sufficient and supplies both heating and cooling to the different building zones. The building's regenerative elevator is also self-sufficient and doesn't require an elevator room.

Cost Efficiency was achieved through a well-planed site that minimizes congestion and construction activities interfering with one another, expediting the construction schedule. Vertical and rotating growing towers allow more plants to be grown in a smaller area increasing the yield of sellable product. Systems chosen for lighting and mechanical have low yearly operation and maintenance costs.

Safety concerns were addressed with a site plan layout that minimizes risks related to the construction activities that could affect the residential area in the surroundings. The second floor assembly space includes three separate means of egress to meet international building code requirements based on the space's square foot area.

Through the achievement of these goals *Impact*'s vertical farm design exemplifies the beliefs of Growing Power Inc. creating a high performance community center to teach and grow sustainable food systems.

Structural Systems Introduction

Impact emphasized the importance to mesh aesthetic and functional ideas with the physical layout of the structure. Beginning with design focuses, main features of the facility are laid out. A surface analysis of code followed by a couple sections explaining the design of important structural elements continue this section. Structural Notes are provided in the Supporting Documents.

Design Focuses

Highlighted below are main architectural features that were implemented using a variety of structural solutions. *Impact* highly valued integration in the multi-phased planning and design of the Growing Power Facility. Intentions were to not only have modern and innovative ideas and details but to provide innovative solutions to combine them with the physical structure. Below in Figure 27 are these primary features.

#	Architectural Features	Structural Solution	Notes
1	Open Market Atrium	Cantilevers	Eliminates several obstructive columns
		Open-Web Steel Truss Joists	Maximizes exterior light penetration, able to span 45', less steel per foot length, allows mechanical penetrations
2	Stair/Elevator Shaftway	Masonry Shear Wall Shafts	Also acts as a lateral force resistance system
3	Heavy Water Tank Loads on Level G	Reduced Basement Floor area	Slab on grade, saves time and money by reducing excavation volume
	Assembly Area	Mid Span Columns with Steel Framing	Steel is great for customizing areas and bays to maintain column alignment
4	Prominent Encased Columns	Moment Footings	HSS columns, encased with architectural material act as the south wall lateral force resisting system
5	Greenhouses	Stainless Steel HSS members structurally supporting Live and Dead Roof Loads while framing the glazing	Acting as mullions, the HSS members serve dual roles transfering loads to the main frame
		HSS Sill	Sill transfers column point loads which are not aligned with the super-structure columns into uniform loads
6	Rain Collection Troughs	Dual Level Column Bases	Frontward columns are supported by the primary use level of the greenhouse while opposite columns are integrated with the trough system
		Three Individual Greenhouse Systems	Discontinuous roof faces, segmenting potential load surfaces
7	Exterior Fascade Panels	Recognition of Surface Loading and Hanging Loads	Panels, Act as a continuous surface which transfers Wind Loads to their connection points to the project's frame
		Customization of Mullions to match panel dimensions	Maintaining structural requirements
8	Ceiling Height: 10', Level Height: 13'	Awareness when designing bays and framing schemes	Metal Decking spans and beam/girder layout

Figure 27 Architectural Features with Structural Solutions

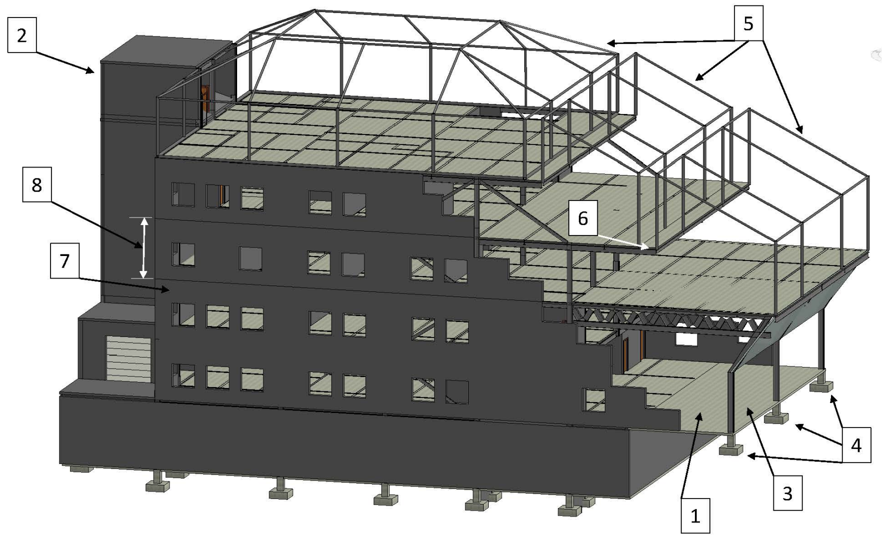


Figure 28 Architectural Features

Open Market Atrium

Open to the level above, the first floor market space was intended to welcome the visitor and provide significant daylight to visitors. The large opening and absence of a second floor meant that there would be a lack of interior columns in this space. Open web truss joists were chosen to span the large opening supporting the third floor. The ceiling of the atrium is exposed structural elements. The open web nature of the selected materials allow light and mechanical equipment to pass through as needed while weighing significantly less than a comparative wide flange girder; see Supporting Documents for specification. By utilizing the truss joists rather than wide flanges, *Impact* was able to decrease steel weight from 22,000 lbs to roughly 12,500 lbs to support this area. Often steel for a project is priced per weight and this reduction in weight proportionally equals project savings.

The overlapping floors located above the market space, but with the second floor below initially seemed proper for column placement for the top half of the structure. When analyzed, the load paths needed to vertically track to the foundation through the market area. As a solution, to reduce aforementioned columns, cantilever girders were designed for the overhanging growing areas. Using a software to aid in analysis, TEDDS was useful for cantilevers and a sample calculation is provided in the Supporting Documents. In addition to structural inconveniences, the avoided columns would have been obstructive to greenhouse layout. *Impact*'s growing systems are modular and their layout dispersed across the floor area. Excessive columns would have interfered with this plan.

Stair/ Elevator Shaft Ways

Side by side elevator and stair shafts stretching from the basement to top level in the northern portion of the facility breaks the steel framing grid. Initially a second staircase was placed along the eastward facing wall, designed for accordingly. After team review of International Building Code 2012, a second stairway stretching from the entry level to the second floor was added to satisfy egress requirements. The mirroring stairwells are built up with concrete masonry units (CMU) acting as core systems for each face.

For vibrations and/or lateral forces in the north and southward directions the lateral force resisting system (LFRS) is a combination of special steel truss moment frames and special reinforced masonry shear walls as named in Chapter 12 of ASCE 7-10. These tables can be found in the Supporting Documents. The north wall dual shafts were engineered for this resistance as well. Remaining was the south facing wall to ensure torqueing of the structure would not occur if solely the north face was held in place. The three large encased columns at the atrium space are integral to the structure and their strength is capable of counteracting potential lateral forces. Each column has a moment resisting isolated footing that has been designed to resist shear forces. Using the United States Geological Survey, ASCE 7-10 code was confirmed for design. This report can be found in the Supporting Documents. Seismic Base Shear was determined using the Seismic Weight of the building which was used in these footing and shear wall calculations. These three footings are the only foundations on a different level than the majority for the structure.

Aquaponic Demonstration Tanks

Part of the educational initiative this project has spawned is addressed by the public market space where interesting and attention grabbing systems are displayed. One of these systems is an aquaponic system which has two-172 gallon water tanks with a ZipGrow system. These high loads were challenging and being elevated was structurally inconvenient. It was *Impact*'s assessment of the advantages of a large basement versus the reduction of it with the aquaponic system bearing on grade. The conclusion was to reduce the basement footprint so that a separate slab on grade would support a section of market space where heavy loads are anticipated. An estimated 900 compacted-cubic yards of soil were saved from being excavated from this decision. Additionally, concrete for added length of foundation wall structure was avoided.

Assembly Area

Prior to the decision to use steel rather than reinforced concrete as the primary structural material, the areas were defined. The irregular layout lent itself to steel framing which can ideally customize spaces. The assembly area requires an open floor layout with few obstructive columns. Column placement was chosen at mid span of steel members spanning from East to West. Once bays were designed, *Impact* tried to replicate the same distances between beams so that maximum distance to be spanned would be regular. By regulating the span lengths, a uniform metal decking could be selected. By selecting one metal decking type for the project, construction errors are negated. One detail is required and continuity is emphasized. Decking type 2WH-36 Composite Deck made of 18 gauge steel with a normal weight concrete slab depth of 5.5 inches was selected. Its superimposed load capacity at the project's maximum open span exceeded projected loading scenarios and has a 1 hour fire rating. The specification can be found in the Supporting Documents

Encased Columns

The three prominent columns at the entrance to the Growing Power facility are encased in an architectural material. In addition to being encased, these columns are called to be galvanized. Galvanization is specified for all material which is exposed to the weather or high amounts of moisture as in the greenhouses. Another design alteration was a shift from wide flange members to hollow structural sections (HSS). Not only do HSS members weigh less per linear foot but they are visually more attractive. This is advantageous for *Impact*'s design as there was an intentional effort to have structural steel exposed.

Greenhouses and Rain Collection Troughs

Each of the three greenhouses were custom designed. Research of glazing material, live loads, and visual appearance were involved in this effort.

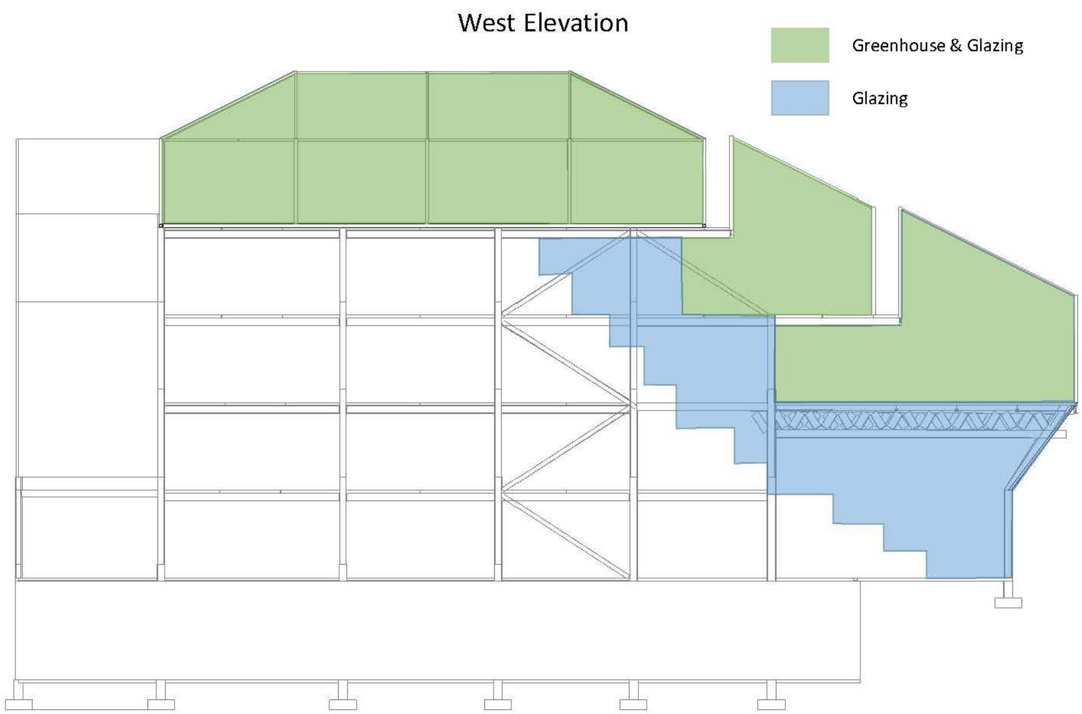


Figure 29 Greenhouse and Glazing Areas

Placement of growing area was the first decision that began structural planning. Once the growing areas were split to three greenhouse levels, the team approached the roofing design. The one slope roof system was chosen to maximize the potential of natural light penetration. Three roofs in a row unintentionally provided an incline for sliding snow that inevitably would accumulate on the roof tops. The roofs were split four feet horizontally in between the three areas as seen in Figure 29. The result of this were troughs in the empty spaces between the north and south-facing greenhouse walls. To utilize all resources as possible to continue the sustainable design, a collection system was implemented to collect any precipitation gathered by the roof area. There are three precipitation collection systems for the greenhouse roofs.

Greenhouse Glazing (All walls and roofs except roof on the 5th floor greenhouse)										
Unit Make Up			Physical Properties (Page 19)				Thermal Properties (U-Factor Argon – Page 8)		Light Properties	
Exterior Glass	Airspace	Inboard Glass	Total Thickness	Weight	Max Dimension	Max Area	Summer	Winter	Visible Light	UV Transmission
LoE 272 (6mm)	Argon (13mm)	Clear (6mm)	25mm (0.942 in)	6.5 lbs/ft^2	144 in	50 sq ft	0.22	0.25	70%	14%

5th Floor Greenhouse Roof Glazing										
Unit Make Up			Physical Properties (Page 19)				Thermal Properties (U-Factor Argon – Page 8)		Light Properties	
Exterior Glass	Airspace	Inboard Glass	Total Thickness	Weight	Max Dimension	Max Area	Summer	Winter	Visible Light	UV Transmission
LoE 240 (6mm)	Argon (13mm)	Clear (6mm)	25mm (0.942 in)	6.5 lbs/ft^2	144 in	50 sq ft	0.23	0.25	37%	13%

Figure 30 Glazing Properties

Specifications from Cardinal (selected glazing manufacturer) recommended a maximum glass pane of 50 ft^2 with a maximum dimension of 144 in. to resist fracture from wind loading. The design wind pressure is 35 psf, which can be compared to Figure 31 for adequate strength. Building on the integration of *Impact*'s design, the window panels were designed to similar dimensions as the exterior architectural paneling on the East and West faces of the building. HSS stainless steel members were chosen to both support the greenhouse as well as frame the glazing. The integration of this structurally supporting mullion system can be seen in Figure 32.

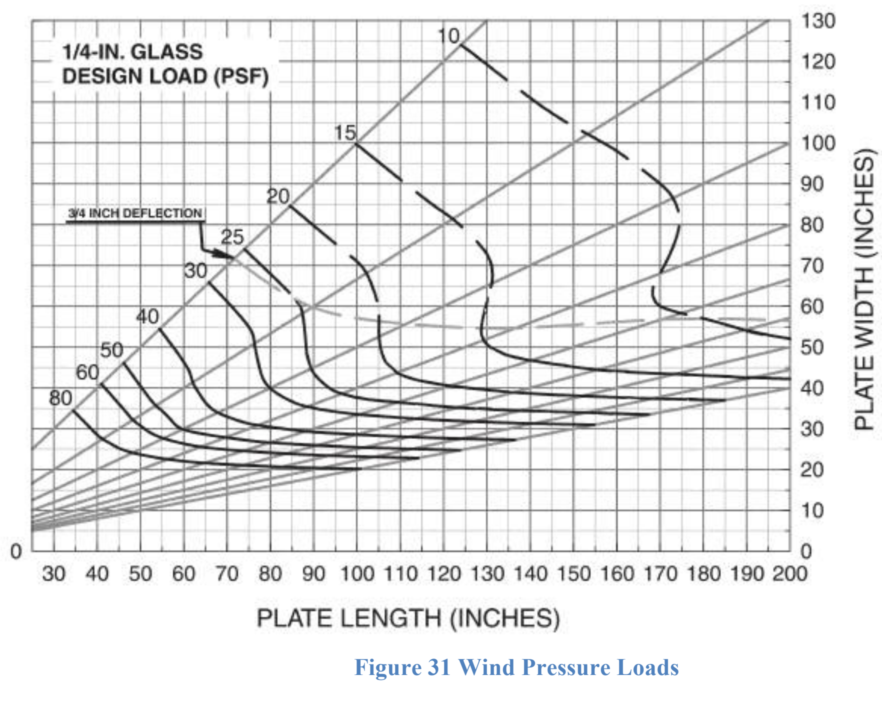


Figure 31 Wind Pressure Loads

Several greenhouse HSS columns line up with the super structure columns of the building in which direct axial load transfer occurs. In the spans where this does not happen, a horizontal transfer HSS member spans the length and converts point column loads from the greenhouse into a uniform load on the girders of the 4th steel level.

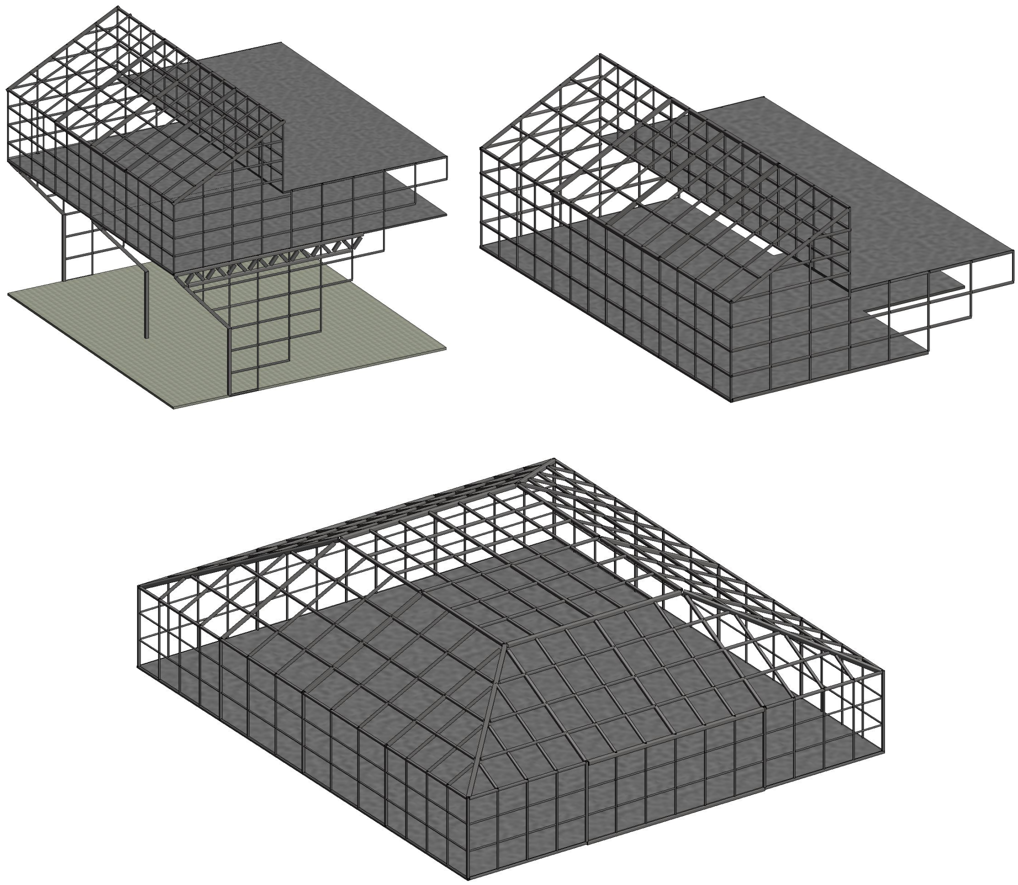


Figure 32 Lower, Middle, and Upper Greenhouse Framing (L-R, T-B)

Exterior Facade Panels

Façade panels receive wind load just as glazing does on the greenhouses. We recognized the wind pressure and the load distribution that the panels initiated. Each panel acts as a continuous surface which transfers wind loads to the associated steel framing member that it is connected to. Lateral loads from this transfer were minimal as well as the gravity load from panel weight. The connection sketches are included in the Drawings Section as SK-1 and SK-2. Noted in the greenhouse section, these panels were mimicked by the glazing panels to depict a visually uniform façade combination of transparency and solid panels.

Floor Heights

The designated floor heights from steel to steel was selected as 13 feet as ceilings would be a generous 10 feet above the top of finished slab. This provided the structural team with a restriction that all steel members must conform within this 3 foot section between metal decking of the above slab to the drop ceiling of the current level. Understanding that mechanical equipment and ducts need to run in this same gap area, *Impact* aimed to keep maximum member sizes 24 inches deep, leaving an independent level for all mechanical. Some members are larger such as W30x99 girders, which impede upon this gap. Clash detection and integration modeling allows for these instances where early design can run equipment in the unobstructed bays of beams.

Analysis of Codes

Wisconsin building code along with numerous other design aids were utilized during the analysis of this facility. Florida building code was also reviewed for an understanding of the similarities and differences to the International Building Code. When approaching a majority of structural design, ASCE 7-10 was adhered to. Key loads which were calculated or researched from historical models are listed in Figure 33.

1	DEAD LOADS		
	(A)	WEIGHT OF BUILDING COMPONENTS	AS REQUIRED
	(B)	ROOFING ALLOWANCE	60 PSF
	(C)	GREENHOUSE ROOF AREA - GLAZING & FRAMING	15 PSF
	(D)	GREENHOUSE AREAS	80 PSF
2	LIVE LOADS		
	(A)	OCCUPANCY CATEGORY	II
	(B)	INTERIOR UNLESS NOTED OTHERWISE	100 PSF
	(C)	LIGHT STORAGE	125 PSF
	(D)	LOADING DOCK	250 PSF
	(E)	MECHANICAL EQUIPMENT ROOM	150 PSF OR EQUIP WT
	(F)	CLASSROOMS	40 PSF
	(G)	OFFICES	50 PSF
	(H)	GREENHOUSE AREAS	80 PSF
3	SNOW LOADS		
	(A)	GROUND SNOW LOAD	30 PSF
	(B)	FLAT ROOF SNOW LOAD	20 PSF + DRIFT
	(C)	GREENHOUSE SLOPED ROOF SNOW LOAD	15 PSF + DRIFT
4	WIND LOADS		
	(A)	BASIC WIND SPEED	115 MPH (WI) & 180 MPH (FL)
	(B)	MAXIMUM WIND BASE SHEAR - EAST-WEST	35 KIPS
	(C)	MAXIMUM WIND BASE SHEAR - NORTH-SOUTH	25 KIPS
	(D)	MAIN WIND FORCE RESISTING SYSTEM - SHORT DIRECTION	SPECIAL REINFORCED MASONRY SHEAR WALL
	(E)	MAIN WIND FORCE RESISTING SYSTEM - LONG DIRECTION	STEEL SPECIAL TRUSS MOMENT FRAME
5	SEISMIC LOADS		
	(A)	BASIC LATERAL FORCE RESISTING SYSTEM - SHORT DIRECTION	SPECIAL REINFORCED MASONRY SHEAR WALL
	(B)	BASIC LATERAL FORCE RESISTING SYSTEM - LONG DIRECTION	STEEL SPECIAL TRUSS MOMENT FRAME
	(C)	ANALYSIS PROCEDURE	EQUIVALENT LATERAL FORCE
	(D)	BUILDING SEISMIC WEIGHT	2,200 KIPS
	(E)	BASE SHEAR DUE TO SEISMIC LOADS	60 KIPS

Figure 33 Area Loads

Not including the two small roofs in the rear of the building, the sloped glazed greenhouse roofs account for all roof surface area. Occupancy live loads weren't designed for because access to greenhouse roofing is restricted. Glazing panels were represented as dead loads, and snow loads were calculated. Rain will simply drain with the slope, allowing us to avoid ponding effects and similar situations that a flat roof has. The maintained temperature inside of the greenhouse provided a slippery slope for the roof, per code.

Snow Loads were essential to the Milwaukee location design. When navigating ASCE 7-10, the determination of ground snow loads, flat-roof, and sloped-roof systems was important. *Impact*'s design does not feature a "low-slope roof" because the monoslope is greater than 15-

degrees. The roof is a fully-exposed sloped roof which requires a roof slope factor, Cs. The Cs applicable to *Impact*'s design was 1.0, effectively leveling off the roof during analysis as expressed in Figure 34. In addition to the fully exposed nature which is an adjustment factor, the thermal factor is important for the majority of *Impact*'s roofing which is greenhouse glass. The greenhouse is "maintained at an internal temperature of 50 degrees-F or more which makes it a warm roof and a slippery surface". The definition of a slippery surface to ASCE is if there is "unobstructed and sufficient space available below the eaves to accept all the sliding snow". Our trough system is suitable for this.

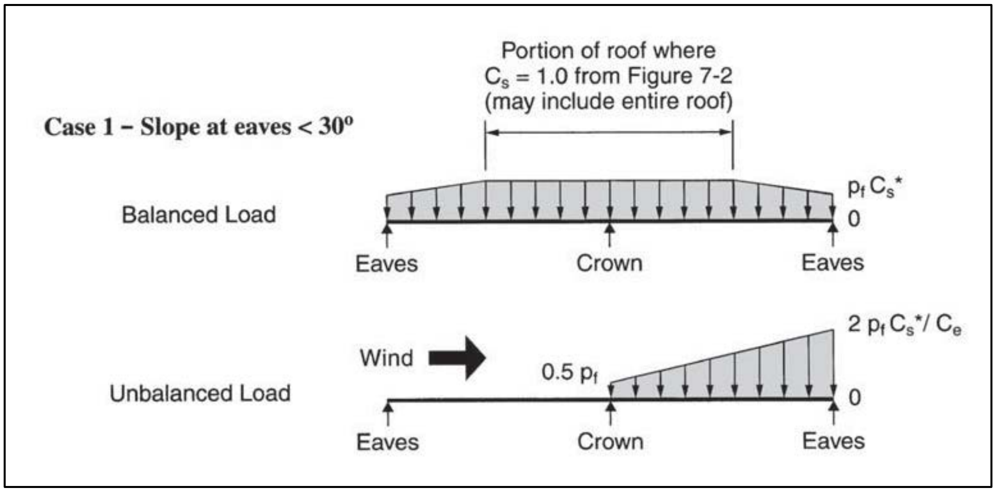


Figure 34 Slope Adjustment Factor

Despite the shallow slope not enabling the team to use a Cs reduction factor, it allows the design to be further investigated. The R-vale of our glass is less than 30 ft^2 hr F/Btu so when using Figure 35 the solid line is followed and crossed with the 26-degree slope angle. Drift was examined, but because of the geometry of *Impact's* roofing system, no addition build-up needed to be taken into account. Although slopes are separated, the horizontal distance requires attention towards superimposed snow which is analyzed not in combination with drift, unbalanced, partial, or rain-on-snow loads. Rain-on-snow criteria was inapplicable because Milwaukee's ground snow load is greater than 20 lb/ft^2. There is no ponding instability as well because the slope is sufficient.

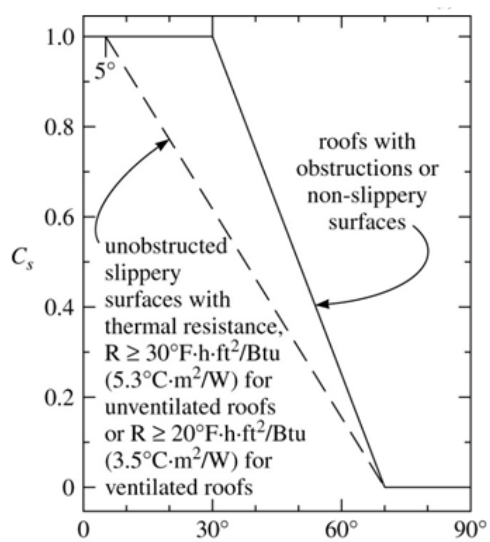


Figure 35 Slippery Surface Plot

Wind and Seismic loads were analyzed for their lateral effects. Chapters 12 and 19 of ASCE 7-10 were used for Seismic design. Chapter 26 used for wind pressure loading. Mentioned earlier in Features, dual systems were designed as our lateral force resisting systems. When gathering factors for load calculations, the specific systems were chosen from tables supplied in Supporting Documents. Seismic Base Shear was calculated and Seismic Weight summed.

Flood Loads do not apply to this building because it is not located in an area prone to flooding as defined on a flood hazard map.

Figures 37-41 graphically display dead and live occupancy loads used to calculate the steel framing system. Specified by the metal deck and concrete combined slab catalog located in the Supporting Documents, the dead load was rounded to 60 psf. The only different dead loads are for the roofs and subgrade ceilings. Level G has a subgrade roof that supports a layer of soil as well as a mechanical cooling tower (orange). The increased dead load is accounted for with a lower live load for maintenance as this is not a high traffic area. The blue area on this same plan is the loading dock which will experience high live loads from trucks, hence the 250 psf load situation. All greenhouse areas are coded in black and were designed with 80 psf live and dead load. The 80 psf live load was selected as these areas are largely growing units and paths are hallway-like. There is limited occupancy maximums for the greenhouse areas so this is sufficient. It was *Impact*'s decision to provide a surplus dead load to the composite slab weight to account for all growing equipment. Instead of calculating each point load for legs of growing towers, the distributed load was efficient. Punching shear of the concrete on metal deck was checked and approved. Classrooms, offices, and light storage received live loads as specified by Chapter 4 of ASCE 7-10.

Area Load Color Key

Figure 36 Area Load Color Key

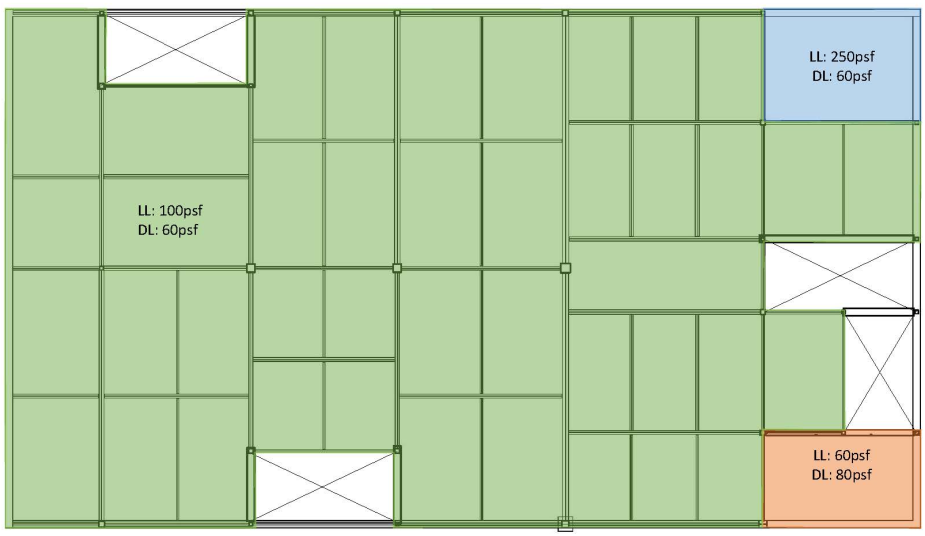


Figure 37 Level G Loads

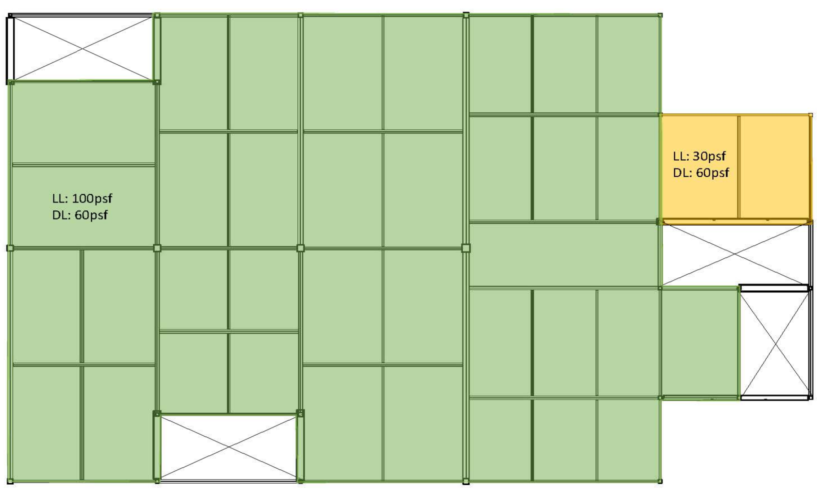


Figure 38 Level 1 Loads

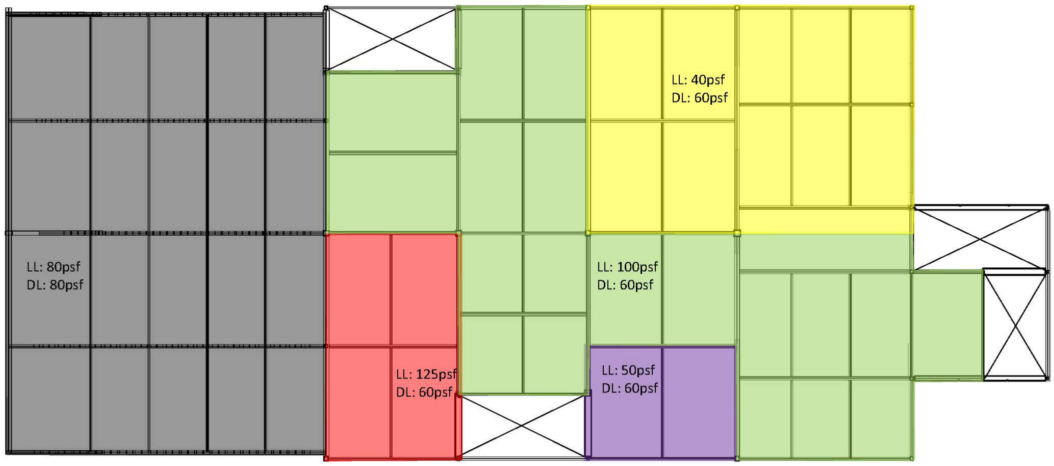


Figure 39 Level 2 Load

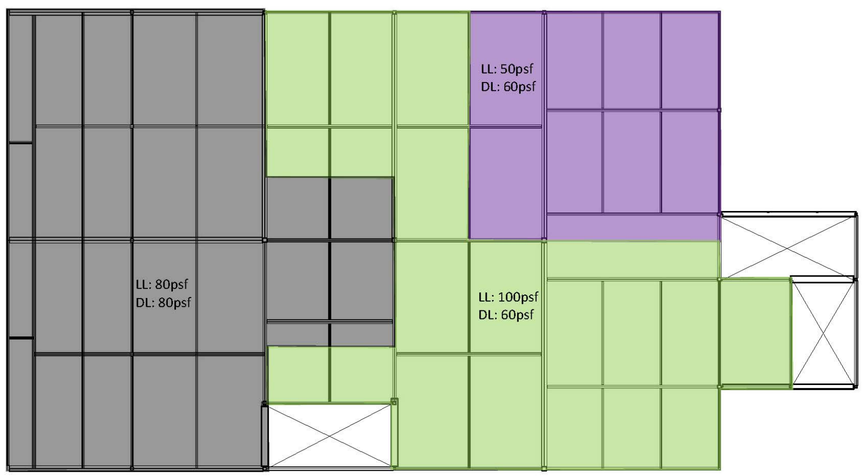


Figure 40 Level 3 Load

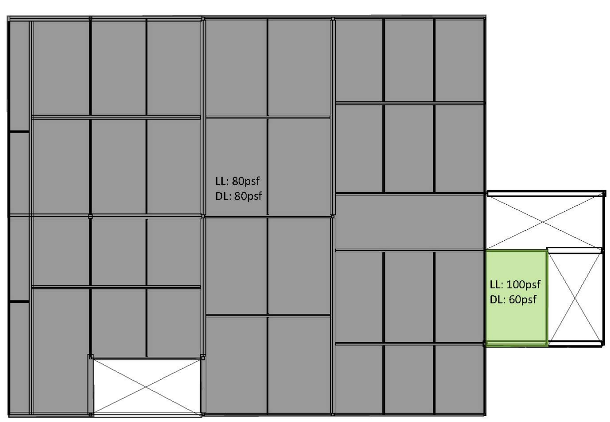


Figure 41 Level 4 Load

Steel Framing Design

To analyze gravity loads on horizontal members a spreadsheet was created to track each and every member (found in the Supporting Documents). Labels were given to members and their lengths and other situational properties were listed. Using area loads and tributary areas, uniform loads were calculated for framing which ran perpendicular to the metal decking as this is the primary support for it. Once the beams with uniform loads were calculated and their start and end shears found, girders with only point loads from shear connections or a combination of point and uniform loads were analyzed. When designing sections for the beams, total deflection was compared to the maximum allowable deflection and sections chosen based upon their factored moments. The sections with the most efficient use of material for their weight were selected using Table 3-2 of the AISC Steel Construction Manual, WF organized by Zx. Listed in the fore mentioned spreadsheet are start and end reactions for all members so that the steel fabricator will be able to engineer details for shear and moment connections where needed. Once the total loads from each floor were summed, the axial forces on each column were analyzed. The gradual buildup of load in some cases made it a viable option to taper the section of HSS columns down as elevation grew. A spreadsheet was used to organize which horizontal members connected to columns for each floor. This ensured an accurate calculation of the column load takedown. Seen in Figure 42, the column sizes vary.

Column Schedule

Levels — Roof (65'-0")

Levels																		
13'	4 (52'-0")		4x4x1/4	4x4x1/4	4x4x1/4	4x4x1/4	4x4x1/4				4x4x1/4							
13'	3 (39'-0")		4x4x1/4	4x4x1/4	4x4x1/4	4x4x1/4	4x4x1/4	4x4x1/4	4x4x1/4	4x4x1/4	4x4x1/4	4x4x1/4	4x4x1/4	6x6x3/16	6x6x3/8	6x6x3/8	6x6x3/16	6x6x3/16
13'	2 (26'-0")		4x4x1/4	4x4x1/4	4x4x1/4	4x4x1/4	4x4x1/4	4x4x1/4	6x6x3/16	6x6x3/16	6x6x3/16	6x6x3/16	4x4x1/4	6x6x3/8	9x9x3/8	8x8x5/16	6x6x3/8	8x8x5/16
13'	1 (13'-0")		4x4x1/4	4x4x1/4	4x4x1/4	4x4x1/4	4x4x1/4	6x6x3/16	6x6x3/16	6x6x3/16	6x6x3/8	6x6x3/8	6x6x3/16	8x8x5/16	12x12x3/8	8x8x3/8	8x8x5/16	9x9x3/8
13'	G (0'-0")	6x6x3/16	6x6x3/16	6x6x3/16	6x6x3/16	6x6x3/16	6x6x3/16	6x6x3/16	6x6x3/8	6x6x3/8	6x6x3/8	6x6x3/8	6x6x3/16	9x9x3/8	14x14x1/2	10x10x3/8	8x8x3/8	12x12x3/8
15'	Basement (-15'-0")					6x6x3/16	6x6x3/16		8x8x5/16	6x6x3/8	8x8x5/16	8x8x5/16			16x16x1/2			14x14x1/2
	Grid Lines	C-1	D-1	F-1	G-1	F-2	G-2	A-3	C-3	D-3	F-3	G-3	I-3	A-4	E-4	I-4	A-5	E-5
	Column Number	001	002	003	004	005	006	007	008	009	010	011	012	013	014	015	016	017
	Footing Type	A*	A*	D*	D*	D	D	A*	A	A	A	A	A*	B*	C	B*	B*	C
	Baseplate Type	A	A	A	A	A	A	A	B	A	B	B	A	B	F	C	B	E

Levels																		
13'	4 (52'-0")																	
13'	3 (39'-0")	6x6x3/16	4x4x1/4	6x6x3/8		8x8x5/16	4x4x1/4	6x6x3/8										
13'	2 (26'-0")	6x6x3/8	4x4x1/4	6x6x3/8		8x8x3/8	6x6x3/16	6x6x3/16	6x6x3/8			6x6x3/8	6x6x3/8	6x6x3/16	6x6x3/16			
13'	1 (13'-0")	6x6x3/8	4x4x1/4	8x8x5/16	6x6x3/16	10x10x3/8	6x6x3/8	6x6x3/16	6x6x3/8	6x6x3/8		8x8x3/8	6x6x3/8			8x8x5/16	8x8x5/16	8x8x5/16
13'	G (0'-0")	8x8x5/16	6x6x3/16	8x8x5/16	6x6x3/8	12x12x3/8	6x6x3/8	6x6x3/8	6x6x3/8	6x6x3/8		9x9x3/8				8x8x5/16	8x8x5/16	8x8x5/16
15'	Basement (-15'-0")	8x8x3/8			6x6x3/8	14x14x1/2	8x8x5/16			8x8x5/16	6x6x3/8							
	Grid Lines	H-5	I-5	A-6	B-6	E-6	H-6	I-6	A-7	B-7	E-7	I-7	E-7	C.1-7	F.3-7	A.1-9	E-9	H.1-9
	Column Number	018	019	020	021	022	023	024	025	026	027	028	029	030	031	032	033	034
	Footing Type	D	D*	D*	D	C	D	D*	D*	D	A	B*	/	/	/	/	C	C
	Baseplate Type	B	A	B	A	E	B	A	A	B	A	B	/	/	/	/	/	/

*=indicates part of foundation wall

Figure 42 Column Schedule

This Column Schedule lists numerical labels for columns as they were designed as well as grid references. Also noticeable at the bottom of this figure, footing types and baseplate types are specified by their correlating letter, explained in the Foundations Section.

Foundations

When approaching the challenge of foundations the first objective was determining whether a shallow or deep system should be used. The Geotechnical Report and Analysis was referenced in each decision relating to foundations. Important facts gathered from this report concerned allowable soil pressure, type of soil, water saturation levels, and recommendations from the geotechnical engineers.

Recommendations followed were that the slab on grade should be a separate system from the individual footings for the purposes of settlement and isolating load paths into the surrounding soil. The soil on site was determined to be mostly fill material in the upper strata followed by organic silty/sandy clay underlay. This soil will be referred to as the retained soil. A quantity of soil will need to be excavated to provide depth of at least 15 feet for the basement level of our building. An additional two feet was specified to be trenched for the foundations wall as well as each interior footing. The soil present on site was given a bearing pressure of 1500 psf by the geotechnical engineers. Engineered fill will be the cover material for the 2 additional excavated feet as well as bearing soil for the foundations. This engineered strata with a cast in place foundation wall can be seen in Figure 43. Take note that the foundation wall is reinforced and a typical detail is supplied in the Drawings portion of this document.

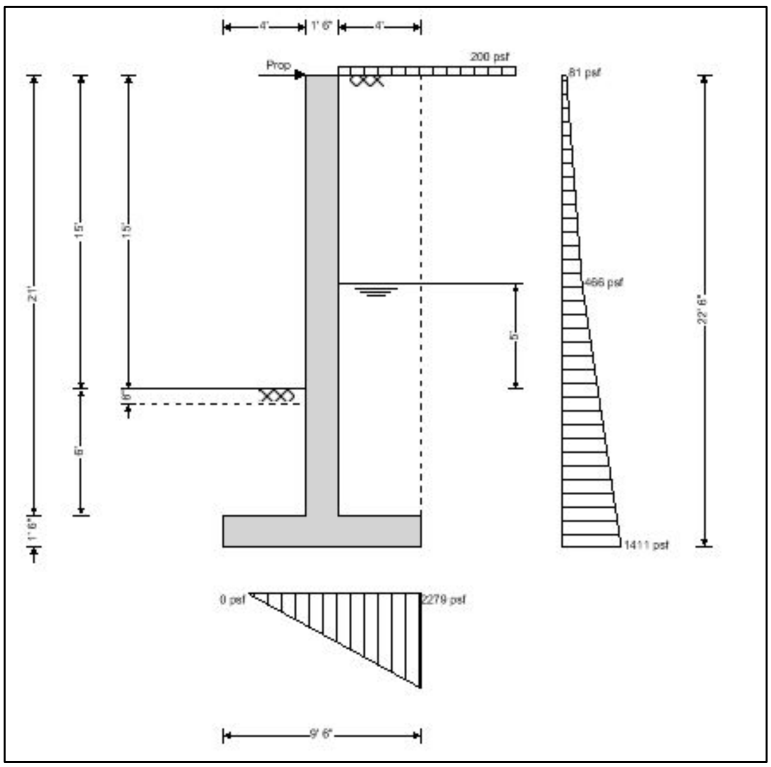


Figure 43 Typical Foundation Wall

Successfully transferring axial loads from the HSS columns to our reinforced concrete footings depends on proper baseplate design. The baseplates are welded to the base of columns which when placed are connected to the anchor bolts protruding from a leveling plate as seen in Figure 44. Baseplates were designed with TEDDS. Grout is then injected under the leveling plate to provide a continuous material for load transfer. The number of anchor bolts is determined by potential shear from lateral loads including seismic and wind loading. Details of a typical baseplate is shown in Figure 44

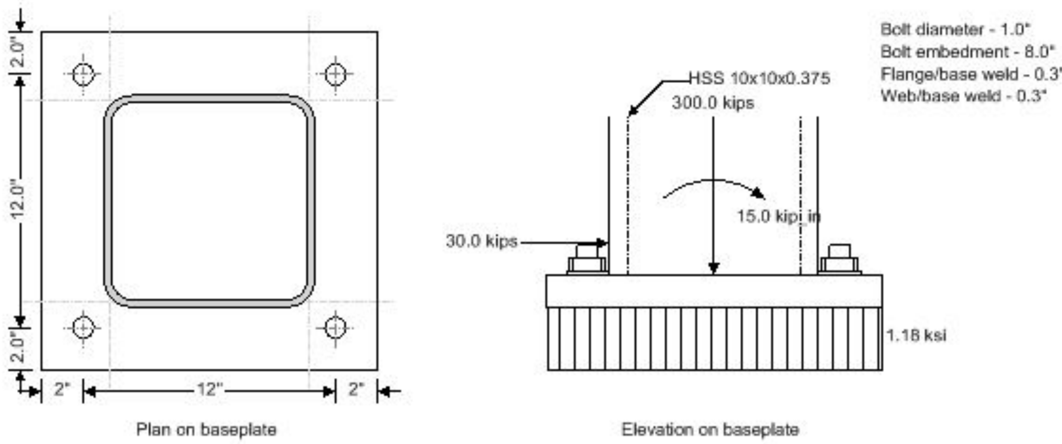


Figure 44 Typical Baseplate Detail

As for the footing itself, punching shear, beam bending, and one-way shear were analyzed. Reinforcement was placed based upon these factors and spaced at the discretion of the designer. Footings where overturning moments are applied were accounted for as well. Three types of footings were designed to better economize the formwork placement. Seen in Table 45 and Table 46 footings and baseplates are displayed. Each footing was assigned to a range of column loads. To maintain uniformity, baseplates were specified as well. For each section of HSS specified in the structural design, there is a corresponding baseplate.

Footing Log				
Footing Label	A	B	C	D
Type	Isolated	Isolated	Isolated	Strip
Dimensions	8' x 8' x 16"	10' x 10' x 16"	13.5' x 13.5' x 24"	CUSTOM
Load Range (k)	<200	200-400	>400	ALL
Reinforcing	#7 @ 10"	#7 @ 10"	#8 @ 10"	7 @ 10"
Top Elevation	-15'-6"	-15'-6"	-15'-6"	-15'-6"

*=indicates part of foundation wall

Figure 45 Footing Log

Baseplate Log							
Baseplate Label		A	B	C	D	E	F
HSS Section	b x h	6 x 6	8 x 8 & 9 x 9	10 x 10	12 x 12	14 x 14	16 x 16
Baseplate Dimensions	b x h	12" x 12"	15" x 15"	16" x 16"	19" x 19"	20" x 20"	23" x 23"
	t	1.5"	1.5"	1.5"	1.5"	1.5"	1.5"

Figure 46 Baseplate Log

Building Systems Integration & Structural Systems References

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GROWING POWER VERTICAL FARM

IMPACT

Supporting Documentation & Drawings Section

AEI TEAM #8-2015
Building Systems Integration
Structural Systems

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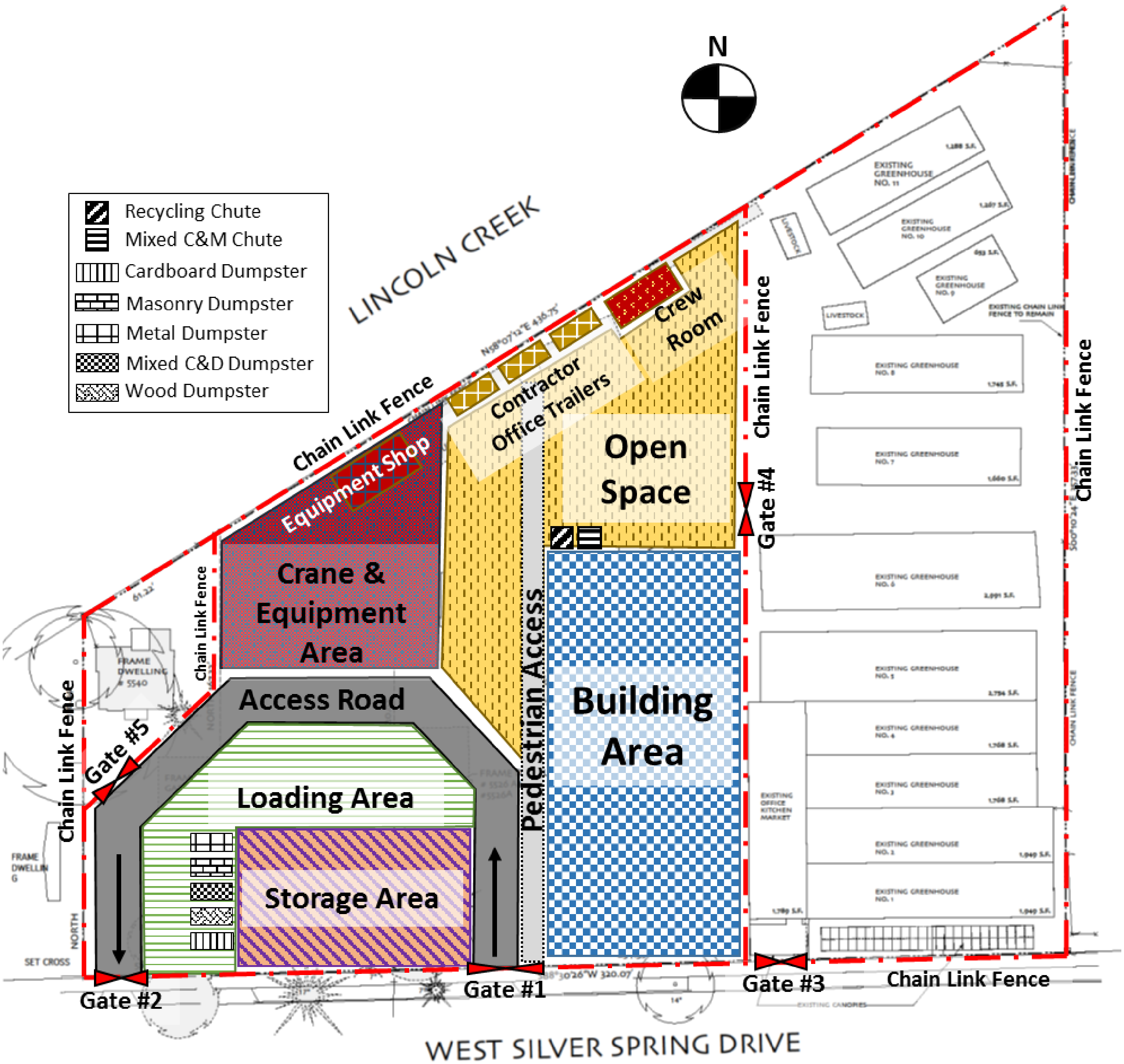
Building Systems Integration Supplementary Documents

Site Plan Layout



COMcheck Building Envelope Report

Generated by COM*check-Web* Software

Envelope Compliance Certificate

2012 IECC

Section 1: Project Information

Project Type: **New Construction**
Project Title : Urban Farm

Construction Site:	Owner/Agent:	Designer/Contractor:
5500 West Silver Spring Drive Milwaukee, Wisconsin 53202		

Additional Efficiency Package: **High efficiency HVAC. Systems that do not meet the performance requirement will be identified in the mechanical requirements checklist report.**

Section 2: General Information

Building Location (for weather data):	**Milwaukee, Wisconsin**
Climate Zone:	**6a**
Building Space Conditioning Type(s):	**Nonresidential**
Vertical Glazing / Wall Area Pct.:	**6%**

Activity Type(s)	Floor Area
Convention Center:Exhibit space	23892

Section 3: Envelope Assemblies

Envelope PASSES: Design 0.1% better than code.

Climate-Specific Requirements:

Component Name/Description	Gross Area or Perimeter	Cavity R-Value	Cont. R-Value	Proposed U-Factor	Budget U-Factor(a)
Ext. Wall: Other Exterior Wall, Heat capacity 0.0 (b)	11742	---	---	0.050	0.051
Window: Metal Frame, Thermal Break, Perf. Type: Other testing/cert. Product ID: panels, SHGC 0.45 (c)	1207	---	---	0.360	0.360
Door: Insulated Metal, Swinging	140	---	---	0.430	0.370
Floor: Unheated Slab-On-Grade, Horizontal without vertical 3 ft.	186	---	10.0	---	---
Basement: Solid Concrete, 10in. Thickness, Normal Density, Furring: Wood, Wall Ht 12.0, Depth B.G. 0.0	8750	0.0	10.0	0.080	0.108

(a) Budget U-factors are used for software baseline calculations ONLY, and are not code requirements.

(b) 'Other' components require supporting documentation for proposed U-factors.

(c) Fenestrations product performance must be certfied in accordance with NFRC and requires supporting documentation.

Section 4: Compliance Statement

Compliance Statement: The proposed envelope design represented in this document is consistent with the building plans, specifications and other calculations submitted with this permit application. The proposed envelope system has been designed to meet the 2012 IECC requirements in COM*check-Web* and to comply with the mandatory requirements in the Requirements Checklist.

Name - Title	Signature	Date

Project Title: Urban Farm
Data filename:

Report date: 02/09/15
Page 1 of 1

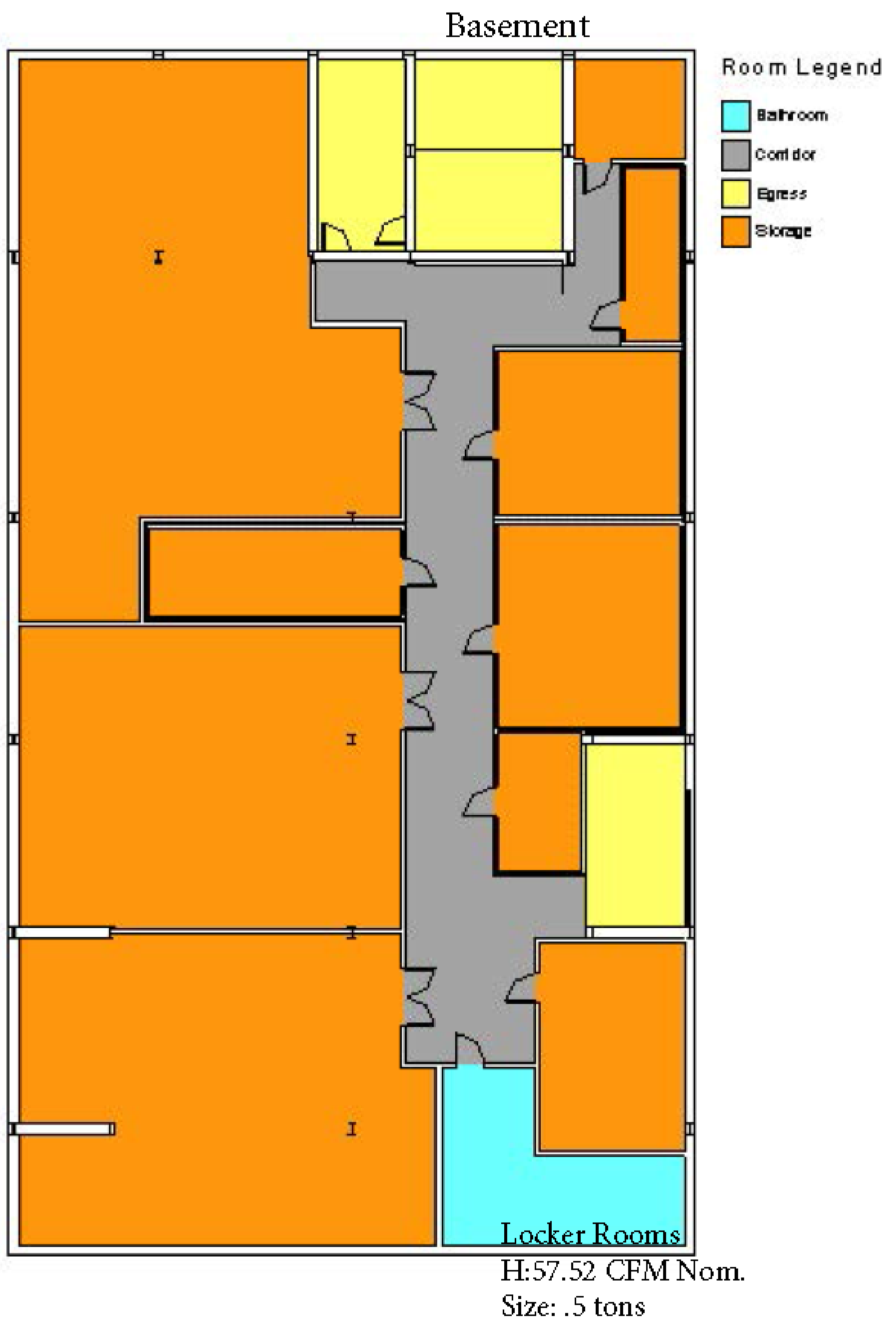
Heating Loads Calculation Spreadsheet

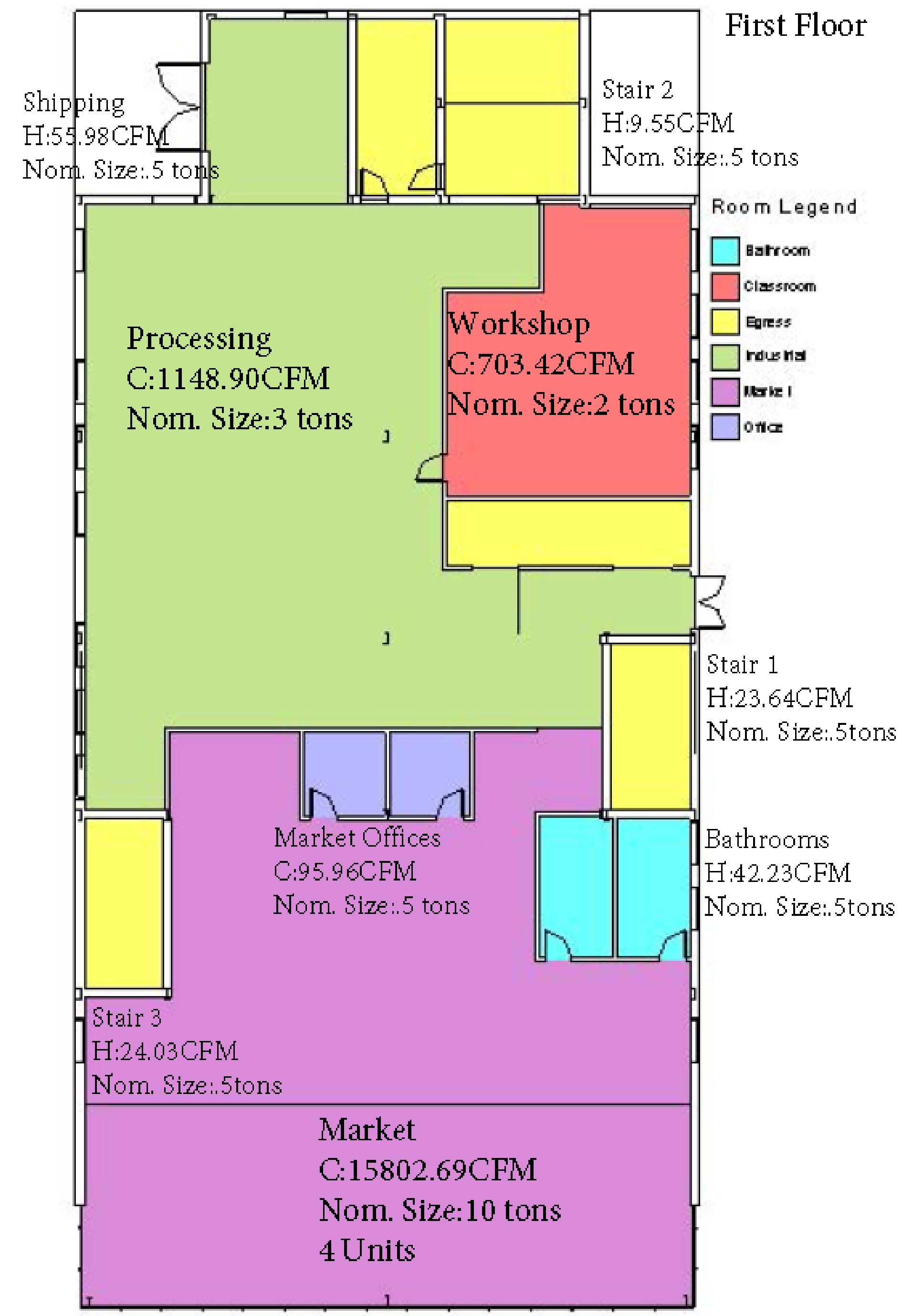
Heating			LOAD CALCULATION TEMPLATE																
			Summer	Winter															
		Outdoors	90.00	-7.0		Supply Air	120 F												
		Indoors	75.00	68.0															
		Daily Range	16.00																
																		Trane Heat Pumps	
	Wall	Gross	Glass	Net	Room	Room	Wall	Glass	Wall h	Glass h	Floor	Heating	Total	CFM		Tons		Nominal	Tons
Room	Lngth	Wall A	Area	Wall A	Area	Volume	U	U	BTUH	BTUH	BTUH	Load	BTUH					Size	
First Floor																			
Workshop N	12.5	162.5	0	162.5	810.1	10531.30	0.06	0.36	731.3	0		731.3		14.8		0.04			
Workshop E	34.3	445.3	100.00	345.3			0.06	0.36	1553.6	2700		4253.6	4984.9	85.9	100.70	0.21	0.25		
Women's Restroom	16.5	214.5	50.00	164.5	129.9	1689.22	0.06	0.36	740.3	1350		2090.3		42.2		0.11		0.006	0.5
Market S			2100.00	0.0	3647.2	94827.98	0.06	0.25	0.0	39375		39375.0		795.5		1.99			
Market E			832.48	0.0			0.06	0.25	0.0	15609		15609.0		315.3		0.79			
Market W			832.48	0.0			0.06	0.25	0.0	15609		15609.0		315.3		0.79			
Slab on Grade				0.0			0.06				7400.26	7400.3	77993.3	149.5	1575.62	0.37	3.94		
Processing N	14.3	185.3	25.00	160.3	3036.4	39473.72	0.06	0.36	721.1	675		1396.1		28.2		0.07			
Processing W	70.0	910.0	175.00	735.0			0.06	0.36	3307.5	4725		8032.5	9428.6	162.3	190.48	0.41	0.48		
Shipping N	16.8	217.8	25.00	192.8	330.8	4299.75	0.06	0.36	867.4	675		1542.4		31.2		0.08			
Shipping W	21.0	273.0	0.00	273.0			0.06	0.36	1228.5	0		1228.5		24.8	55.98	0.06	0.14		
Stairs 1	20.0	260.0	0.00	260.0	171.0	2223.00	0.06	0.36	1170.0	0		1170.0		23.6		0.06		0.006	0.5
Stairs 2	10.0	130.0	0.00	105.0	180.0	2340.00	0.06	0.36	472.5	0		472.5		9.5		0.02		0.006	0.5
Stair 3	20.3	264.3	0.00	264.3	173.0		0.06	0.36	1189.3	0		1189.3		24.0		0.06		0.006	0.5
Second Floor																			
Men's Restroom	3.5	45.5	0.00	45.5	191.4	2488.07	0.06	0.36	204.8	0		204.8		4.1		0.01			
Women's Restroom	9.0	117.0	0.00	117.0	216.6	2815.28	0.06	0.36	526.5	0		526.5		10.6		0.03			
Women's Restroom	27.0	351.0	0.00	351.0			0.06	0.36	1579.5	0		1579.5	2106.0	31.9	42.55	0.08	0.12	0.006	0.5
Breakout Space N	31.0	403.0	50.00	353.0	1374.6	17869.15	0.06	0.36	1588.5	1350		2938.5		59.4		0.15			
Breakout Space W	27.0	351.0	75.00	276.0			0.06	0.36	1242.0	2025		3267.0		66.0	125.36	0.17	0.31		
Gathering Area	84.0	1092.0	200.00	892.0	3967.5	51577.50	0.06	0.36	4014.0	5400		9414.0		190.2		0.48	0.48		
Third Floor																			
Class 1 N	31.0	403.0	50.00	353.0	591.8	7692.75	0.06	0.36	1588.5	1350		2938.5		59.4		0.15			
Class 1 W	18.5	240.5	25.00	215.5			0.06	0.36	969.8	675		1644.8	4583.3	33.2	92.59	0.08	0.23		
Class 2	19.0	247.0	50.00	197.0	600.0	7800.00	0.06	0.36	886.5	1350		2236.5		45.2		0.11	0.11		
Class 3	19.0	247.0	50.00	197.0	616.5	8014.50	0.06	0.36	886.5	1350		2236.5		45.2		0.11	0.11		
Demo Kitchen	28.0	364.0	32.50	331.5	991.9	12894.44	0.06	0.36	1491.8	878		2369.3		47.9		0.12	0.12		
Encubator Offices	23.5	305.5	50.00	255.5	485.8	6315.27	0.06	0.36	1149.8	1350		2499.8		50.5		0.13	0.13		
Women's Restroom	13.0	169.0	0.00	169.0	244.0	3172.00	0.06	0.36	760.5	0		760.5		15.4		0.04			
Women's Restroom	27.0	351.0	0.00	351.0			0.06	0.36	1579.5	0		1579.5	2340.0	31.9	47.27	0.08			
Men's Restroom	1.8	23.0	0.00	23.0	211.0	2743.00	0.06	0.36	103.5	0		103.5		2.1		0.01	0.12	0.006	0.5
Growing Area S		0.0	1120.00	0.0	3500.0		0.06	0.25		21000		21000.0		545.5		1.36			
Growing Area N		0.0	1109.00	0.0			0.06	0.25		20794		20793.8		540.1		1.35			
Growing Area E,W		0.0	2014.00	0.0			0.06	0.25		37763		37762.5		980.8		2.45			
Growing Area Roof		0.0	2030.00	0.0			0.06	0.25		38063		38062.5	117618.8	988.6	3055.03	2.47	7.64		
Fourth Floor																			
Copy	16.1	209.3	25.00	184.3	133.0	1729.00	0.06	0.36	829.4	675		1504.4		30.4		0.08	0.08		
Office Area N	14.4	187.5	25.00	162.5	880.9	11451.18	0.06	0.36	731.1	675		1406.1		28.4		0.07			
Office Area W	38.4	499.5	100.00	399.5			0.06	0.36	1797.6	2700		4497.6	5903.6	90.9	119.27	0.23	0.30		
Director's Office	12.7	164.7	0.00	164.7	394.4	5127.07	0.06	0.36	741.2	0		741.2		15.0		0.04	0.04		
Staff Area	26.6	345.6	75.00	270.6	334.0	4342.00	0.06	0.36	1217.7	2025		3242.7		65.5		0.16	0.16		
Meeting Room	19.6	254.5	25.00		444.4	5776.55	0.06	0.36	0.0	675		675.0		13.6		0.03	0.03		
Women's Restroom	9.5	123.5	0.00	123.5	140.0	1820.00	0.06	0.36	555.8	0		555.8		11.2		0.03			
Women's Restroom	16.8	218.8	0.00	218.8			0.06	0.36	984.6	0		984.6	1540.3	19.9		0.05			
Men's Restroom	3.0	39.0	0.00	39.0	136.0	1768.00	0.06	0.36	175.5	0		175.5		3.5	34.66	0.01	0.09	0.006	0.5
Growing Area S		0.0	1120.00	0.0	2950.4		0.06	0.25	0.0	21000		21000.0		545.5		1.36			
Growing Area N		0.0	927.50	0.0			0.06	0.25	0.0	17391		17390.6		451.7		1.13			
Growing Area E,W		0.0	1468.84	0.0			0.06	0.25	0.0	27541		27540.8		715.3		1.79			
Growing Area Roof		0.0	1610.00	0.0			0.06	0.25	0.0	30188		30187.5	96118.9	784.1	2496.59	1.96	6.24		
Fifth Floor																			
Growing Area S			910.00	0.0	5600.0		0.06	0.25		17063		17062.5		443.2		1.11			
Growing Area N			552.50	0.0			0.06	0.25		10359		10359.4		269.1		0.67			
Growing Area E,W			2080.00	0.0			0.06	0.25		39000		39000.0		1013.0		2.53			
Growing Area Roof			6138.14	0.0			0.06	0.25		115090		115090.1	181512.0	2989.4	4714.60	7.47	11.79		
Basement	0.0	0.0												0.0		0.00			
Locker Rooms	58.3	699.0	0.00	757.3	324.5		0.08		2847.3	0		2847.3		57.5		0.14		0.006	0.5
Totals												546278.3		13317.3		33.29			

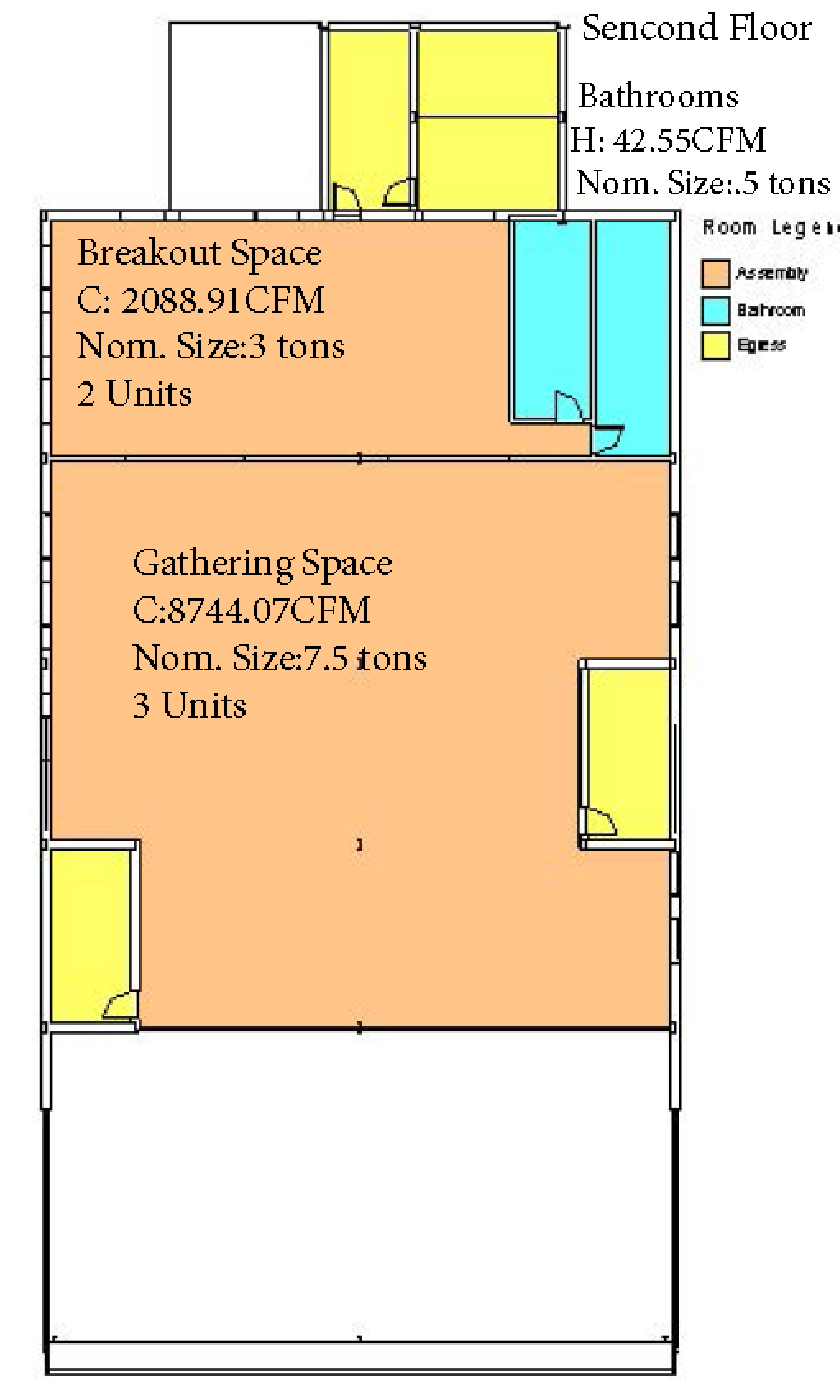
Heating Loads Calculation Spreadsheet

Cooling			LOAD CALCULATION TEMPLATE																								
			Summer	Winter		Supply Air	58 F																				
		Outdoors	90.0	-7.0																							
		Indoors	75.0	68.0																							
		Daily Range	16.0																								
																							Trane WSHP Unit Selection				
Room	Wall Lngth	Gross Wall A	Glass Area	Net Wall A	Ceiling Area	Room Area	Room Volume	Wall U	Glass U	Wall CLTD	Glass CLF	Glass c BTUH	Wall c BTUH	Expected occupancy	Occupancy BTUH	Lights BTUH	Appliances BTUH	Total Load	CFM	CFM Total	tons	tons total	Nominal Size	tons	# of units	Dimensions LxHtxW(Inches)	Net Weight lbs
First Floor																											
Workshop N	13.0	169.0	0.0	169.0		810.1	10531.3	0.06	0.36	8	0	0.0	81.1	8	2000	1134.1	221.8	3437.0	208.3		0.52						
Workshop E	34.0	442.0	100.0	342.0				0.06	0.36	18	78	7800.0	369.4					8169.4	495.1	703.4	1.24	1.76	0.024	2	1	46 x 18 x 23	269
Market S		0.0	2100.0	0.0		3647.2	94828.0	0.06	0.22	11	47	98700.0	0.0	100	25000	5835.6		129535.6	7850.6		19.63						
Market E		0.0	832.5	0.0				0.06	0.22	18	78	64933.4	0.0					64933.4	3935.4		9.84						
Market W		0.0	832.5	0.0				0.06	0.22	18	78	64933.4	0.0					64933.4	3935.4		9.84						
Ceiling		0.0	0.0		2485.0			0.06	0.36	9	0	0.0	1341.9					1341.9	81.3	15802.7	0.20	39.51	120	10	4		
Processing N	14.3	185.3	25.0	160.3		3036.4	39473.7	0.06	0.36	8	30	750.0	76.9	5	1250	2429.2		4506.1	273.1		0.68						
Processing W	70.5	916.5	175.0	741.5				0.06	0.36	18	78	13650.0	800.8		0			14450.8	875.8	1148.9	2.19	2.87	0.036	3	1	50 x 19 x 25	343
Market Office		0.0				87.9		1.53	0.36	9	0	0.0	0.0	1	250	87.9	453.8	791.7	48.0		0.12		0.006	0.5			
Market Office		0.0				87.9		1.53	0.36	9	0	0.0	0.0	1	250	87.9	453.8	791.7	48.0	96.0	0.12	0.24	0.006	0.5	1	40 x 15 x 20	165
Second Floor																											
Breakout Space N	31.0	403.0	50.0	353.0		1374.6	17869.2	0.06	0.36	8	30	1500.0	169.4	100	25000	1649.5		28318.9	1716.3		4.29						
Breakout Space W	27.0	351.0	75.0	276.0			0.0	0.06	0.36	18	78	5850.0	298.1					6148.1	372.6	2088.9	0.93	5.22	0.036	3	2	50 x 19 x 25	343
Gathering Area	84.0	1092.0	200.0	892.0		3967.5	51577.5	0.06	0.36	18	78	15600.0	963.4	490	122500	4761.0	221.8	144046.1	8730.1		21.83						
Ceiling		0.0	0.0		285.2			0.06	0.36	9	0	0.0	154.0					154.0	14.0	8744.1	0.03	21.86	0.09	7.5	3	40 x 15 x 20	165
Third Floor																											
Class 1 N	31.0	403.0	50.0	353.0		591.8	7692.8	0.06	0.36	8	30	1500.0	169.4	15	3750	710.1	221.8	6351.3	384.9		0.96						
Class 1 W	18.5	240.5	25.0	215.5				0.06	0.36	18	78	1950.0	232.7					2182.7	132.3	517.2	0.33	1.29	0.018	1.5	1	46 x 18 x 23	264
Class 2	19.0	247.0	50.0	197.0		600.0	7800.0	0.06	0.36	18	78	3900.0	212.8	15	3750	720.0	221.8	8804.5	533.6		1.33	1.33	0.018	1.5	1	46 x 18 x 23	264
Class 3	19.0	247.0	50.0	197.0		616.5	8014.5	0.06	0.36	18	78	3900.0	212.8	15	3750	739.8	221.8	8824.3	534.8		1.34						
Ceiling					52.5			0.06	0.36	9		0.0	28.4					28.4	1.7	536.5	0.00	1.34	0.018	1.5	1	46 x 18 x 23	264
Demo Kitchen W	28.0	364.0	32.5	331.5		984.0	12792.0	0.06	0.36	18	78	2535.0	358.0	15	3750	1377.6	9980.0	18000.6	1090.9		2.73						
Demo Kitchen S	35.0	455.0	0.0	455.0				0.35	0.36	9		0.0	1592.5					1592.5	144.8		0.36						
Ceiling					619.3			0.06	0.36	9		0.0	334.4					334.4	20.3	1256.0	0.05	3.14	0.042	3.5	1	58 x 21 x 33	431
Incubator Ofices	23.5	305.5	50.0	255.5		485.8	6315.3	0.06	0.36	18	78	3900.0	275.9	4	1000	485.8	443.6	6105.3	370.0		0.93	0.93	0.012	1	1		
Fourth Floor																											
Copy	16.1	209.3	25.0	184.3		133.0	1729.0	0.06	0.36	8	30	750.0	88.5	1	250	146.3	8000.0	9234.8	559.7		1.40						
Ceiling					133.0			0.06		9			71.8					71.8	4.4	564.0	0.01	1.41	0.018	1.5	1	46 x 18 x 23	264
Office Area N	14.4	187.5	25.0	162.5		880.9	11451.2	0.06	0.36	8	30	750.0	78.0	8	2000	968.9	4350.3	8147.2	493.8		1.23						
Office Area W	38.5	500.5	100.0	400.5				0.06	0.36	18	78	7800.0	432.5					8232.5	498.9		1.25						
Ceiling					880.9			0.06		9			475.7					475.7	28.8	1021.5	0.07	2.55	0.036	3	1	50 x 19 x 25	343
Director's Office W	12.7	164.7	25.0	139.7		394.4	5127.2	0.06	0.36	18	78	1950.0	150.9	2	500	394.4	221.8	3217.1	195.0		0.49						
Directors Office E	21.5	279.5	0.0	279.5				0.35	0.36	9		0.0	880.4					880.4	80.0		0.20						
Director's Office S	27.1	352.0	0.0	352.0				0.35	0.36	9	0	0.0	1232.1					1232.1	112.0		0.28						
Ceiling					394.4			0.06		9			213.0					213.0	12.9	399.9	0.03	1.00	0.018	1.5	1	46 x 18 x 23	264
Staff Area	26.6	345.6	75.0	270.6		334.5	4348.5	0.06	0.36	18	78	5850.0	292.2	4	1000	368.0	5000.0	12510.2	758.2		1.90						
Ceiling					334.5			0.06		9			180.6					180.6	10.9	769.1	0.03	1.92	0.024	2	1	46 x 18 x 23	269
Meeting Room W	19.6	254.5	25.0	229.5		444.4	5776.6	0.06	0.36	18	0	0.0	137.7	6	1500	444.4	221.8	2303.9	139.6		0.35						
Ceiling					444.4			0.06		9			239.9					239.9	14.5	154.2	0.04	0.39	0.006	0.5		40 x 15 x 20	165
Reception Area S	20.0	260.0	0.0	260.0		529.2	6880.1	0.35	0.36	9	0	0.0	819.0	3	750	582.2		2151.2	195.6		0.49						
Ceiling					529.2			0.06		9			285.8					285.8	17.3	212.9	0.04	0.53	0.01	1	1		
Basement																											
Locker Rooms	58.3	757.3	0.0	757.3		324.5		0.08																			
																	Totals	573158.5	34919.0		87.30				22		

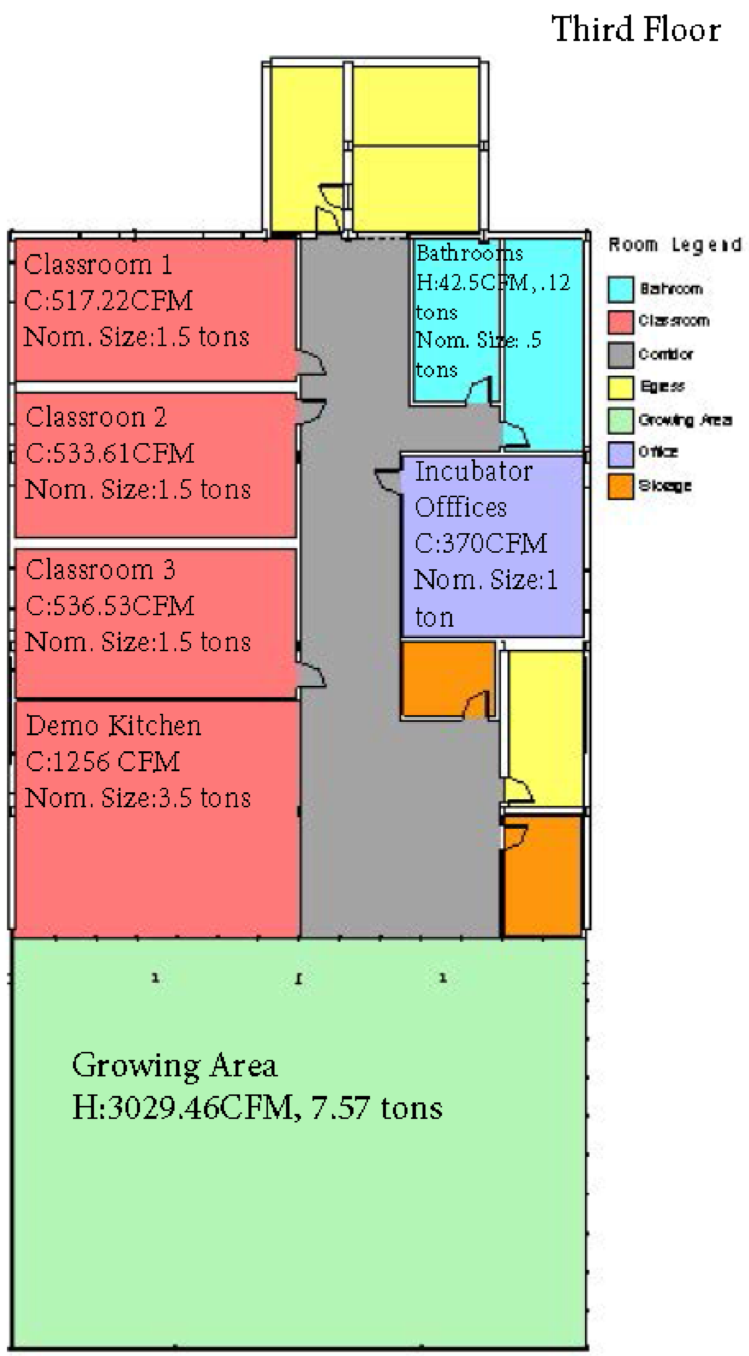
Mechanical Key Plan

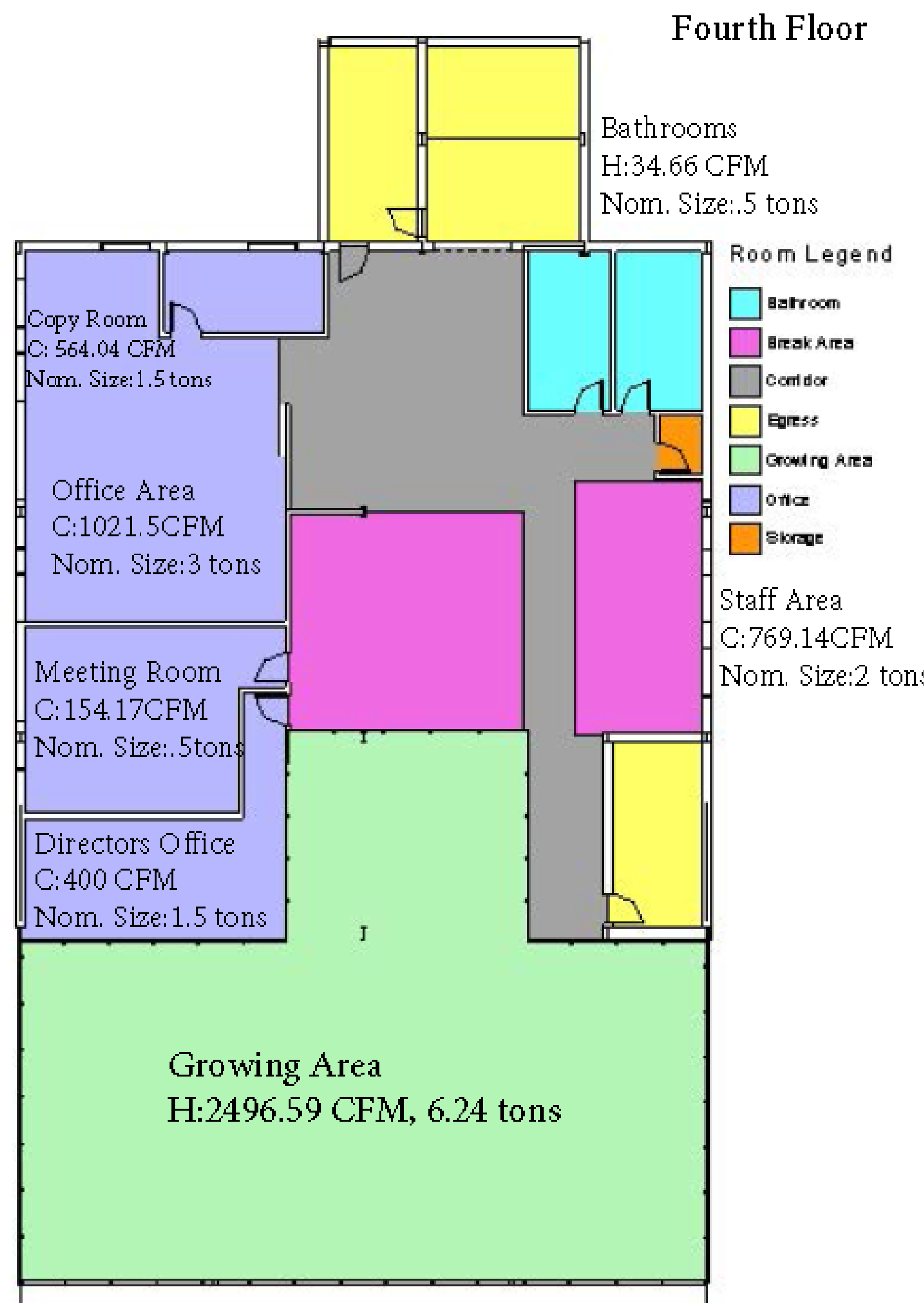


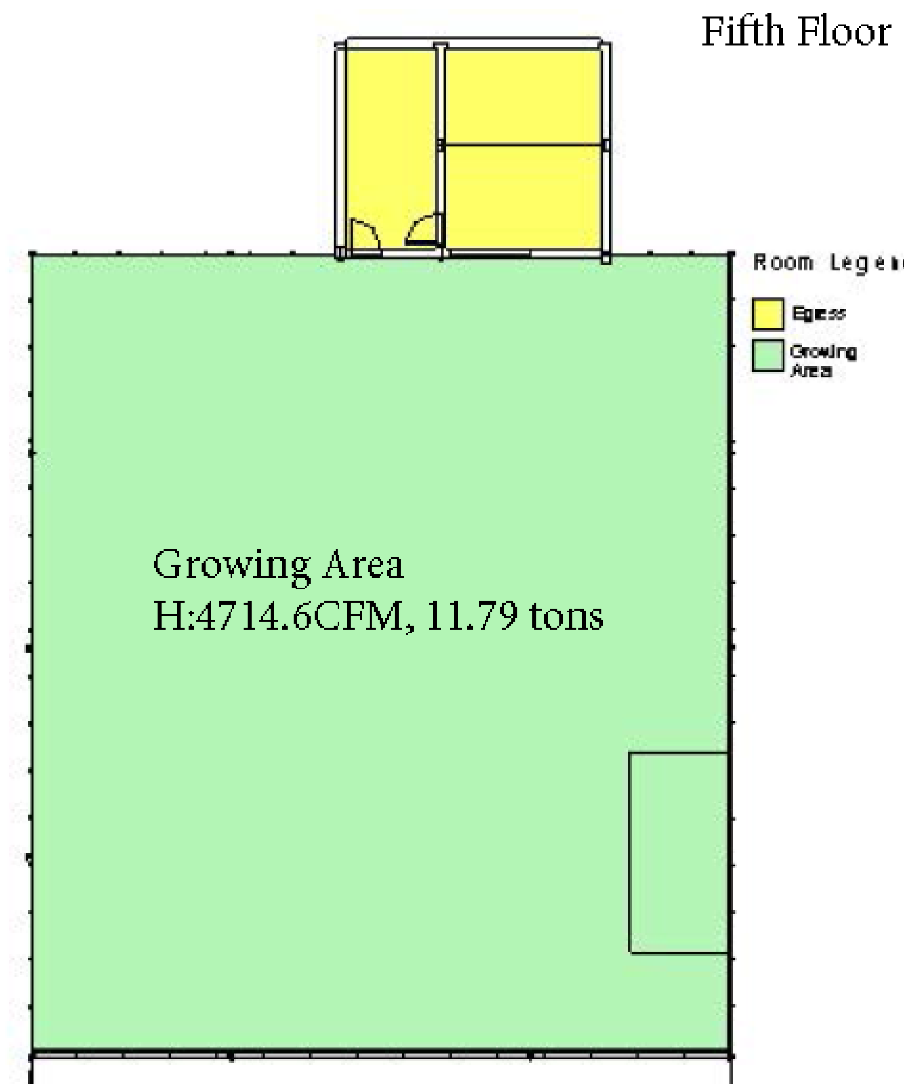




Mechanical Key Plan Cont.







Electric Loads Estimation – Calculation Spreadsheet

Electric Power Loads Estimation									
	Power Consumption (KW)	**Number of Units**	**Total Power Consumption (KW)**	**Average hourly usage (KWh)**	**Number of Hours**	**Total Daily Load (KWh)**	**Days of the Week Used**	**Annual Usage**	**Total Annual Load (KWh)**
Basement			**45.02**			**742.53**			**269794.83**
Cooler 1	4.09	1	4.087390029	4.08739	16	65.40	7	364	23804.96
Cooler 2	9.77	1	9.774486804	9.7744868	16	156.39	7	364	56926.61
Cooler 3	11.65	1	11.65366569	11.653666	16	186.46	7	364	67870.95
Cooler 4	4.64	1	4.636363636	4.6363636	16	74.18	7	364	27002.18
Freezer	11.20	1	11.20322581	11.203226	18	201.66	7	364	73403.54
Elevator	0.5	1	0.50	6	8	48.00	7	364	17472.00
Lighting	2.17	1	2.17	2.17		9.11			2367.92
Bathroom Small Power									
Hands Dryer	0.5	2	1	0.1666667	8	1.33	5	260	346.67
HVAC Heating									600.00
First Floor			**14.54**			**129.83**			**44931.91**
Lighting	4.54	1	4.54	4.42		31.20			8111.48
Work Shop Small Power									
Computer	0.097	1	0.097	0.097	10	0.97	4	208	201.76
Monitor	0.028	1	0.028	0.028	10	0.28	4	208	58.24
Rechargable Powe Tools	0.013	2	0.026	0.026	3	0.08	4	208	16.22
Electric Saw	1.2	2	2.4	1.2	4	4.80	4	208	998.40
Drill	0.72	1	0.72	0.36	4	1.44	4	208	299.52
Processing Small Power									
Rechargable Power Tools	0.013	2	0.026	0.026	3	0.08	5	260	20.28
Refrigeration Equipment									
Refrigerated Island	0.858	1	0.858	0.858	16	13.73	7	364	4996.99
Refrigeration	2.285	2	4.57	4.57	16	73.12	7	364	26615.68
Office Small Use									
Computer (2.3 GHz, 3GB RAM)	0.097	2	0.194	0.194	10	1.94	5	260	504.40
Monitor (480mm)	0.028	2	0.056	0.056	10	0.56	5	260	145.60
Multifunction Printer	0.03	1	0.03	0.03	10	0.30	5	260	78.00
Bathroom Small Power									
Hands Dryer	0.5	2	1	0.1666667	8	1.33	7	364	485.33
Other Small Power									0.00
HVAC Heating									2400.00
HVAC Cooling									11550.00
Second Floor			**5.29**			**26.22**			**10979.68**
Lighting	2.90	1	2.90	2.90		21.99			1855.26
Bathroom Small Power									
Hands Dryer	0.5	4	2	0.3333333	8	2.67	1.5	78	208.00
Other Small Power									
Proyector	0.354	1	0.354	0.354	4	1.42	1.5	78	110.45
Laptop (2.0 GHz, 2GB RAM, 430mm)	0.036	1	0.036	0.036	4	0.14	1.5	78	11.23
HVAC Heating									600.00
HVAC Cooling									10050.00
Third Floor			**85.16**			**514.20**			**136561.45**
Lighting	4.44	1	4.44	12.74		102.79			5509.68
Greenhouse Lighting	8.72	1	8.72			81.69	7	364	29735.16
Rotating Tower System	1	12	12	12	12	144.00	7	364	52416.00
Bathroom Small Power						0.00			
Hands Dryer	0.5	2	1	0.167	8	1.33	4	208	277.33
Classroom Small Power						0.00			
Proyector	0.354	3	1.062	1.062	4	4.25	4	208	883.58
Computer	0.097	3	0.291	0.291	4	1.16	4	208	242.11
Monitor	0.028	3	0.084	0.084	4	0.34	4	208	69.89
Kitchen Equipment/Small Power						0.00			
Stove (Induction Cooktop)	21.013	2	42.026	42.026	2	84.05	4	208	17482.82
Oven Convection Half-Size (Rated)	5.51	2	11.02	11.02	2	22.04	4	208	4584.32
Oven Convection Half-Size (Standby)	1.084	2	2.168	2.168	22	47.70	4	208	9920.77
Fridge						0.00			
Blenders	0.3	4	1.2	0.6	2	1.20	4	208	249.60
Lab Equipment/ Incubator						0.00			
Incubator	0.451	2	0.902	0.902	24	21.65	7	364	7879.87
Computer	0.097	2	0.194	0.194	8	1.55	5	260	403.52
Monitor	0.028	2	0.056	0.056	8	0.45	5	260	116.48
Small Power									
HVAC Heating									600.00
HVAC Cooling									11700.00
Fourth Floor			**30.77**			**388.44**			**121639.08**
Lighting	2.92	1	2.92	9		69.69			5855.77
Greenhouse Lighting	6.14	1	6.14			55.76	7	364	20294.82
Rotating Tower System	1	9	9	9	24	216.00	7	364	78624.00
Bathroom Small Power						0.00			
Hands Dryer	0.5	2	1	0.167	8	1.33	5	260	346.67
Office Small Power						0.00			
Computer	0.097	20	1.94	1.94	10	19.40	5	260	5044.00
Monitor	0.028	20	0.56	0.56	10	5.60	5	260	1456.00
Proyector	0.354	1	0.354	0.354	8	2.83	5	260	736.32
Copy/Print Equipment						0.00			
Printer	0.8	1	0.8	0.8	2	1.60	5	260	416.00
Staff Area Equipment/Small Power						0.00			
Coffe Brewing Urn (Rated)	3.81	1	3.81	0.635	5	3.18	5	260	825.50
Coffe Brewing Urn (Standby)	0.352	1	0.352	0.293	5	1.47	5	260	381.33
Microwave	3.194	1	3.194	1.597	2	3.19	5	260	830.44
Fridge			0			0.00	5	260	0.00
Water Cooler	0.7	1	0.7	0.7	12	8.40	5	260	2184.00
HVAC Heating									600.00
HVAC Cooling									9900.00
Fith Floor			**38.50**			**440.37**			**142026.25**
Lighting	1.84	1	1.84	12		58.41			2992.81
Greenhouse Lighting	9.66	1	9.66			57.96	7	364	21097.44
Rotating Tower System	1	27	27	27	12	324.00	7	364	117936.00
	Total (KWh)		**219**			**2242**			**725933**

Lighting Levels Estimation – Calculation Spreadsheet

Lighting Levels Estimation

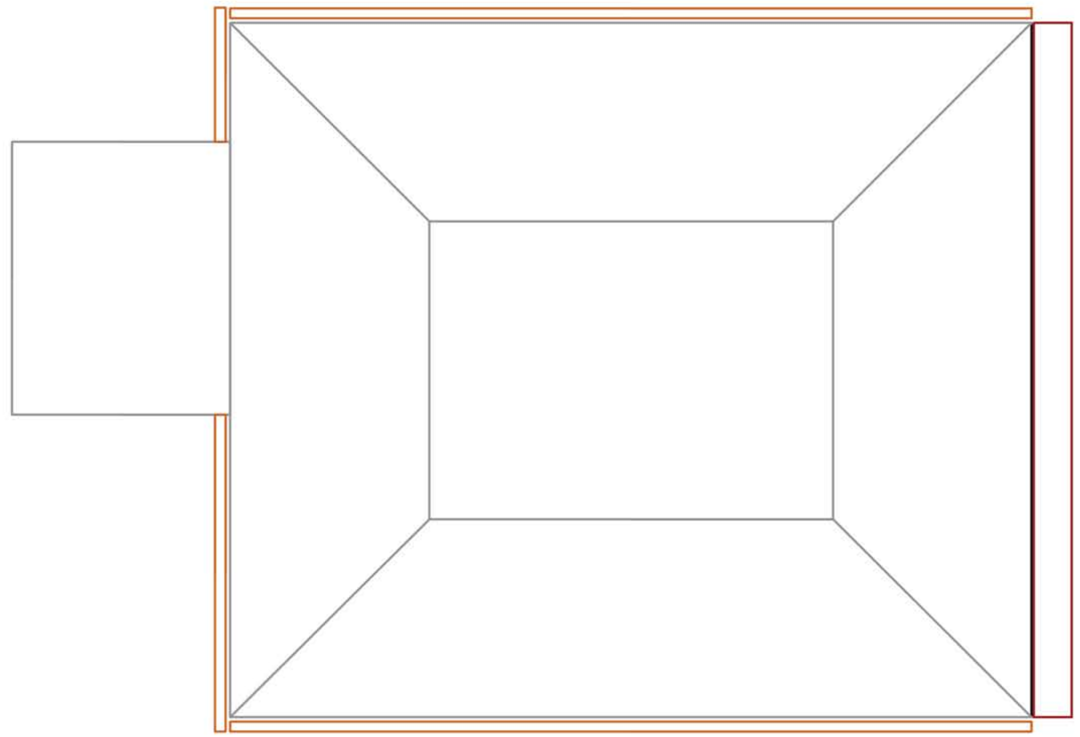
	Area	Lighting Power Densities (W/m^2)	Lighting Power Densities (W/ft^2)	Power Consumption (KW)	Average hourly usage(KWh)	Hours Used Daily	Total Daily Load (KWh)	Days of the Week Used	Annual Usage	Total Annual Load (KWh)
Basement				**5.06**			**21.09**			**5483.84**
Cooler 1	101.98	6.8	0.63	0.06	**0.06**	**3**	0.19	5	260	50.22
Cooler 2	321.58	6.8	0.63	0.20	**0.20**	**3**	0.61	5	260	158.37
Cooler 3	400.1	6.8	0.63	0.25	**0.25**	**3**	0.76	5	260	197.04
Cooler 4	124.14	6.8	0.63	0.08	**0.08**	**3**	0.24	5	260	61.14
Freezer	235.15	6.8	0.63	0.15	**0.15**	**3**	0.45	5	260	115.81
Storage I	1336.61	6.8	0.63	0.84	**0.84**	**4**	3.38	5	260	877.67
Storage II	1247.56	6.8	0.63	0.79	**0.79**	**4**	3.15	5	260	819.20
Storage III	1754.68	6.8	0.63	1.11	**1.11**	**4**	4.43	5	260	1152.19
Women's Locker Room	324.47	8.1	0.75	0.24	**0.24**	**3**	0.73	5	260	190.34
Men's Locker Room	325.23	8.1	0.75	0.24	**0.24**	**3**	0.73	5	260	190.79
Recycling Room	119.79	1.2	0.11	0.01	**0.01**	**1**	0.01	5	260	3.47
Elevator Lobby	164.93	6.88	0.64	0.11	**0.11**	**6**	0.63	5	260	164.36
Stairs I	180	7.4	0.69	0.12	**0.12**	**6**	0.74	5	260	192.94
Stairs II	191	7.4	0.69	0.13	**0.13**	**6**	0.79	5	260	204.73
Corridors	1075.03	7.1	0.66	0.71	**0.71**	**6**	4.25	5	260	1105.57
First Floor				**10.79**			**75.60**			**19656.57**
Market	3647.23	11.8	1.10	4.00	**4.00**	**8**	31.97	5	260	8311.76
Women's Bathroom	129.94	10.5	0.97	0.13	**0.13**	**4**	0.51	5	260	131.75
Men's Bathroom	135.65	10.5	0.97	0.13	**0.13**	**4**	0.53	5	260	137.54
Shipping & Receiving	330.75	13.9	1.29	0.43	**0.43**	**6**	2.56	5	260	665.92
Processing	3036.44	13.9	1.29	3.92	**3.92**	**8**	31.35	5	260	8151.30
Office I	87.88	8.1	0.75	0.07	**0.07**	**8**	0.53	5	260	137.47
Office II	87.08	8.1	0.75	0.07	**0.07**	**8**	0.52	5	260	136.22
Mud Room	211.1	7.1	0.66	0.14	**0.14**	**2**	0.28	5	260	72.37
Workshop	810.1	17.1	1.59	1.29	**1.29**	**2**	2.57	5	260	668.84
Elevator Lobby	164.93	6.88	0.64	0.11	**0.11**	**8**	0.84	5	260	219.15
Stair I	180	7.4	0.69	0.12	**0.12**	**8**	0.99	5	260	257.25
Stair II	191	7.4	0.69	0.13	**0.13**	**8**	1.05	5	260	272.97
Stair III	172.9	7.4	0.69	0.12	**0.12**	**6**	0.71	5	260	185.33
Corridors	225.13	7.1	0.66	0.15	**0.15**	**8**	1.19	5	260	308.70
Second Floor				**7.42**			**45.05**			**4015.15**
Gathering Space	3967.5	13.2	1.23	4.86	**4.86**	**6**	29.18	1.5	78	2275.73
Breakout Space	1374.55	13.2	1.23	1.68	**1.68**	**6**	10.11	1.5	78	788.43
Women's Bathroom	216.56	10.5	0.97	0.21	**0.21**	**6**	1.27	1.5	78	98.81
Men's Bathroom	191.39	10.5	0.97	0.19	**0.19**	**6**	1.12	1.5	78	87.33
Elevator Lobby	164.93	6.88	0.64	0.11	**0.11**	**6**	0.63	1.5	78	49.31
Stair I	180	7.4	0.69	0.12	**0.12**	**8**	0.99	5	260	257.25
Stair II	191	7.4	0.69	0.13	**0.13**	**8**	1.05	5	260	272.97
Stair III	172.9	7.4	0.69	0.12	**0.12**	**6**	0.71	5	260	185.33
Third Floor				**16.80**			**127.63**			**11725.64**
Classroom I	548.94	13.3	1.23	0.68	**0.68**	**4**	2.71	4	208	564.01
Classroom II	685	13.3	1.23	0.85	**0.85**	**4**	3.38	4	208	703.80
Classroom III	722.1	13.3	1.23	0.89	**0.89**	**4**	3.57	4	208	741.92
Kitchen	842.88	10.7	0.99	0.84	**0.84**	**2**	1.67	4	208	348.36
Growing Area Rotating Tower	[redacted]			5.04	**5.04**	**6**	30.24	7	364	
Growing Area Zip Grow				3.68	**3.68**	**14**	51.45	7	364	
Storage I	100.5	6.8	0.63	0.06	**0.06**	**1**	0.06	4	208	13.20
Storage II	140.54	6.8	0.63	0.09	**0.09**	**1**	0.09	4	208	18.46
University Incubator	485.79	13.8	1.28	0.62	**0.62**	**8**	4.98	7	364	1812.61
Women's Bathroom	244.09	10.5	0.97	0.24	**0.24**	**6**	1.43	4	208	296.99
Men's Bathroom	211.19	10.5	0.97	0.21	**0.21**	**6**	1.24	4	208	256.96
Elevator Lobby	164.93	6.88	0.64	0.11	**0.11**	**6**	0.63	5	260	164.36
Stairs I	180	7.4	0.69	0.12	**0.12**	**8**	0.99	5	260	257.25
Stairs II	191	7.4	0.69	0.13	**0.13**	**8**	1.05	5	260	272.97
Greenhouse	3500	7.1	0.66	2.31	**2.31**	**8**	18.46	5	260	4799.26
Corridors	1434.75	7.1	0.66	0.95	**0.95**	**6**	5.68	5	260	1475.51
Fourth Floor				**11.64**			**98.07**			**11000.69**
Copy Room	94.6	8.1	0.75	0.07	**0.07**	**2**	0.14	5	260	37.00
Office Area	886.18	8.1	0.75	0.67	**0.67**	**8**	5.33	5	260	1386.29
Meeting Room	444.35	13.2	1.23	0.54	**0.54**	**6**	3.27	5	260	849.59
Director Office	394.39	8.1	0.75	0.30	**0.30**	**8**	2.37	5	260	616.96
Growing Area Rotating Tower	[redacted]			3.78	**3.78**	**6**	22.68	7	364	
Growing Area Zip Grow				2.36	**2.36**	**14**	33.08	7	364	
Reception & Corridor	1561.95	7.1	0.66	1.03	**1.03**	**8**	8.24	5	260	2141.77
Staff Area	334.49	9.4	0.87	0.29	**0.29**	**8**	2.34	5	260	607.24
Storage	25.94	6.8	0.63	0.02	**0.02**	**1**	0.02	5	260	4.26
Women's Bathroom	140.9	10.5	0.97	0.14	**0.14**	**8**	1.10	5	260	285.72
Men's Bathroom	136.54	10.5	0.97	0.13	**0.13**	**8**	1.06	5	260	276.88
Elevator Lobby	164.93	6.88	0.64	0.11	**0.11**	**8**	0.84	5	260	219.15
Stairs I	180	7.4	0.69	0.12	**0.12**	**8**	0.99	5	260	257.25
Stairs II	191	7.4	0.69	0.13	**0.13**	**8**	1.05	5	260	272.97
Greenhouse	2950.38	7.1	0.66	1.95	**1.95**	**8**	15.56	5	260	4045.61
Fith Floor				**13.59**			**87.93**			**7791.59**
Stairs I	180	7.4	0.69	0.12	**0.12**	**4**	0.49	5	260	128.62
Stairs II	191	7.4	0.69	0.13	**0.13**	**4**	0.52	5	260	136.48
Elevator Lobby	164.93	6.88	0.64	0.11	**0.11**	**4**	0.42	5	260	109.57
Growing Area Rotating Tower	[redacted]			9.66	**9.66**	**6**	57.96	7	364	
Greenhouse	5409	7.1	0.66	3.57	**3.57**	**8**	28.53	5	260	7416.91
			Peak Consumption	**65.29**		**Maximum Daily Consumption**	**455.37**		**Total Annual Consumption**	**59673.47**

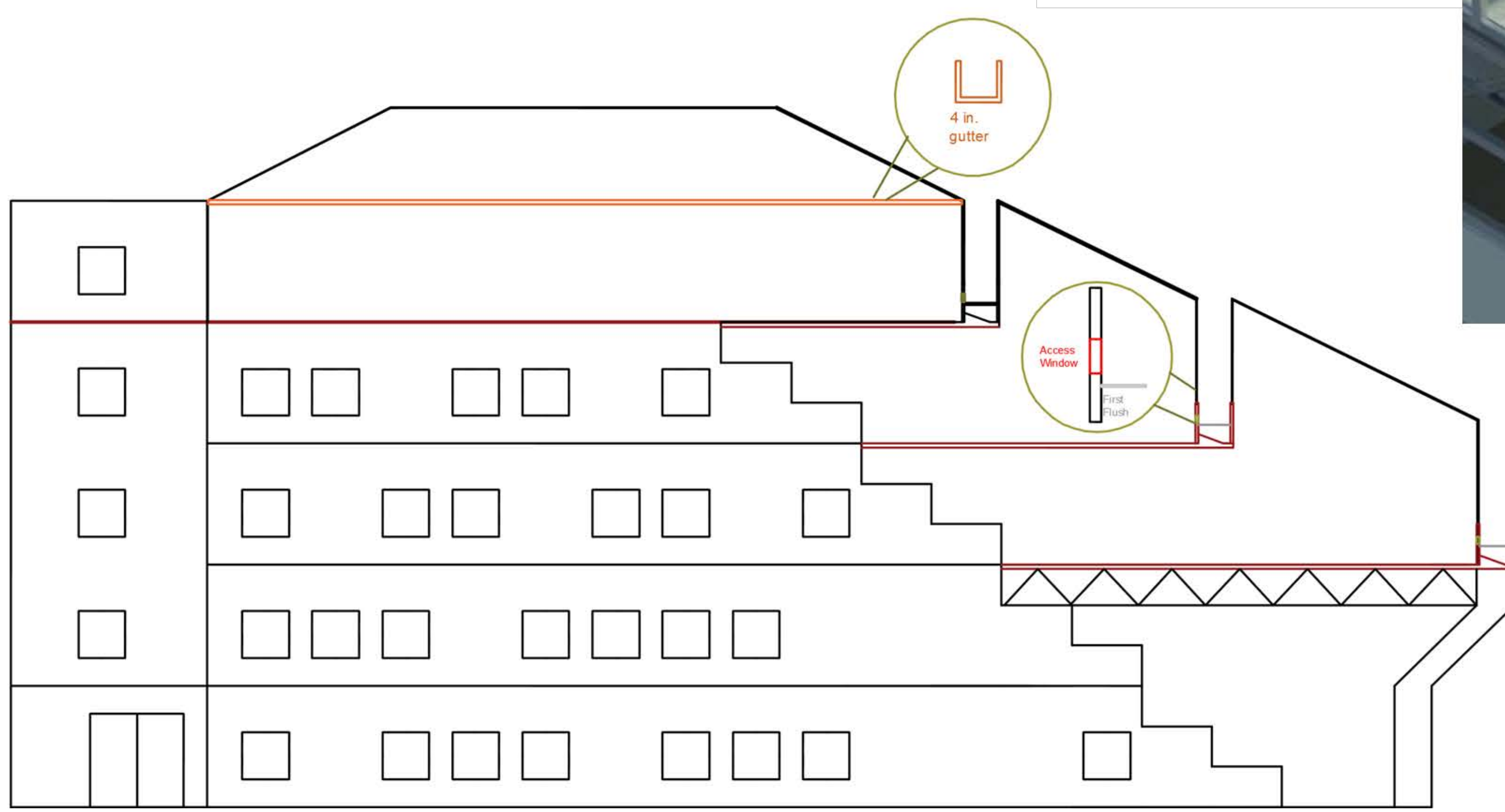
New Lighting Design – Calculation Spreadsheet

Lighting Levels Estimation

	Room Area	Lighting Level	Average Illuminance	# Fixtures	Fixture	Power Consumption per Fixture (W)	Room Power Consumption (W)	Lighting Density (W/ft^2)	Average hourly usage(KWh)	Hours Used per Day	Total Daily Load (KWh)	Days per Week Used	Annual Usage	Total Annual Load (KWh)
Basement				**79**			**2168**		**2.17**		**9.11**			**2367.92**
Cooler 1	101.98	**10**	**11.13**	**2**	**G**	**29**	**58**	**0.57**	0.06	**3**	0.17	5	260	45.24
Cooler 2	321.58	**10**	**13.3**	**4**	**G**	**29**	**116**	**0.36**	0.12	**3**	0.35	5	260	90.48
Cooler 3	400.1	**10**	**13.26**	**4**	**G**	**29**	**116**	**0.29**	0.12	**3**	0.35	5	260	90.48
Cooler 4	124.14	**10**	**11.38**	**2**	**G**	**29**	**58**	**0.47**	0.06	**3**	0.17	5	260	45.24
Freezer	235.15	**10**	**10.01**	**2**	**F**	**38**	**76**	**0.32**	0.08	**3**	0.23	5	260	59.28
Storage 1	1336.61	**10**	**11.97**	**9**	**G**	**29**	**261**	**0.20**	0.26	**4**	1.04	5	260	271.44
Storage 2	1247.56	**10**	**12.14**	**9**	**G**	**29**	**261**	**0.21**	0.26	**4**	1.04	5	260	271.44
Storage 3	1754.68	**10**	**12.18**	**13**	**G**	**29**	**377**	**0.21**	0.38	**4**	1.51	5	260	392.08
Women's	324.47	15	19.42	3	**G**	**29**	**108**	**0.33**	0.11	**3**	0.32	5	260	84.24
				3	H	7								
Men's	325.23	15	14.34	2	**G**	**29**	**72**	**0.22**	0.07	**3**	0.22	5	260	56.16
				2	H	7								
Recycling Room	119.79	10	11.33	2	**G**	29	**58**	**0.48**	0.06	**1**	0.06	5	260	15.08
Elevator Lobby	164.93	10	12.88	1	B	56.9	**56.9**	**0.34**	0.06	**6**	0.34	5	260	88.76
Stairs I	180	15	17.99	4	H	7	**28**	**0.16**	0.03	**6**	0.17	5	260	43.68
Stairs II	191	15	18.68	4	H	7	**28**	**0.15**	0.03	**6**	0.17	5	260	43.68
Corridors	1075.03	15	16.39	13	**F**	**38**	**494**	**0.46**	0.49	**6**	2.96	5	260	770.64
First Floor				**109**			**4536**		**4.42**		**31.20**			**8111.48**
Market	3647.23	30	30.98	18	A	74.4	**1900.2**	**0.52**	1.90	**8**	15.20	5	260	3952.42
				6	B	56.9								
				4	C	45.4								
				1	**F**	**38**								
Women's	129.94	15	24.55	2	**G**	**29**	**72**	**0.55**	0.07	**4**	0.29	5	260	74.88
				2	H	7								
Men's	135.65	15	25.22	2	**G**	**29**	**72**	**0.53**	0.07	**4**	0.29	5	260	74.88
				2	H	7								
Shipping & Receiving	330.75	15	17.45	4	**G**	**29**	**116**	**0.35**	0.12	**6**	0.70	5	260	180.96
Processing	3036.44	30	27.92	32	**F**	**38**	**1216**	**0.40**	1.22	**8**	9.73	5	260	2529.28
Office I	87.88	50	51.75	2	B	56.9	**113.8**	**1.29**	0.11	**8**	0.91	5	260	236.70
Office II	87.08	50	51.75	2	B	56.9	**113.8**	**1.31**	0.11	**8**	0.91	5	260	236.70
Mud Room	211.1	15	15.48	3	**F**	**38**	**114**	**0.54**	0.11	**2**	0.23	5	260	59.28
Workshop	810.1	50	44.25	13	C	45.4	**590.2**	**0.73**	0.59	**2**	1.18	5	260	306.90
Elevator Lobby	164.93	10	16.13	1	B	56.9	**56.9**	**0.34**	0.06	**8**	0.46	5	260	118.35
Stairs I	180	15	20.58	**4**	H	7	**28**	**0.16**	0.03	**8**	0.22	5	260	58.24
Stairs II	191	15	20.83	**4**	H	7	**28**	**0.15**	0.03	**8**	0.22	5	260	58.24
Stairs III	172.9	15	21.33	**4**	H	7	**28**	**0.16**	0.03	**6**	0.17	5	260	43.68
Corridors	225.13	15	18.6	**3**	**G**	**29**	**87**	**0.39**	0.09	**8**	0.70	5	260	180.96
Second Floor				**91**			**2896**		**3**		**21.99**			**1855.26**
Gathering Space	3967.5	30	32.26	48	**F**	**38**	**1824**	**0.46**	1.82	**8**	14.59	1.5	78	1138.18
Breakout Space	1374.55	30	29.7	19	**F**	**38**	**722**	**0.53**	0.72	**8**	5.78	1.5	78	450.53
Women's	216.56	15	24.9	3	**G**	**29**	**108**	**0.50**	0.11	**4**	0.43	1.5	78	33.70
				3	H	7								
Men's	191.39	15	22.59	3	**G**	**29**	**101**	**0.53**	0.10	**4**	0.40	1.5	78	31.51
				2	H	7								
Elevator Lobby	164.93	10	16.97	1	B	56.9	**56.9**	**0.34**	0.06	**6**	0.34	1.5	78	26.63
Stairs I	180	15	20.34	**4**	H	7	**28**	**0.16**	0.03	**8**	0.22	5	260	58.24
Stairs II	191	15	20.63	**4**	H	7	**28**	**0.15**	0.03	**8**	0.22	5	260	58.24
Stairs III	172.9	15	20.35	**4**	H	7	**28**	**0.16**	0.03	**8**	0.22	5	260	58.24
Third Floor				**118**			**4440**		**13**		**102.79**			**35244.84**
Classroom I	548.94	50	43.28	8	C	45.4	**363.2**	**0.66**	0.36	**4**	1.45	4	208	302.18
Classroom II	685	50	48.77	12	C	45.4	**544.8**	**0.80**	0.54	**4**	2.18	4	208	453.27
Classroom III	722.1	50	48.35	12	C	45.4	**544.8**	**0.75**	0.54	**4**	2.18	4	208	453.27
Kitchen	842.88	50	44.14	12	C	45.4	**544.8**	**0.65**	0.54	**2**	1.09	4	208	226.64
Growing Area Rotating Tower	[redacted]								5.04	**6**	30.24	7	364	11007.36
Growing Area Zip Grow									3.68	**14**	51.45	7	364	18727.80
Storage I	100.5	10	10.95	1	C	45.4	**45.4**	**0.45**	0.05	**1**	0.05	4	208	9.44
Storage II	140.54	10	10.95	1	C	45.4	**45.4**	**0.32**	0.05	**1**	0.05	4	208	9.44
University Incubator	485.79	50	45.62	14	**F**	**38**	**532**	**1.10**	0.53	**8**	4.26	7	364	1549.18
Women's	244.09	15	24.25	**3**	**G**	**29**	**108**	**0.44**	0.11	**6**	0.65	4	208	134.78
				3	H	7								
Men's	211.19	15	19.93	**2**	**G**	**29**	**72**	**0.34**	0.07	**6**	0.43	4	208	89.86
				2	H	7								
Elevator Lobby	164.93	10	14.92	1	B	56.9	**56.9**	**0.34**	0.06	**6**	0.34	5	260	88.76
Stairs I	180	15	21.09	**4**	H	7	**28**	**0.16**	0.03	**8**	0.22	5	260	58.24
Stairs II	191	15	20.89	**4**	H	7	**28**	**0.15**	0.03	**8**	0.22	5	260	58.24
Greenhouse	3500	15	14.7	14	D	48	**672**	**0.19**	0.67	**8**	5.38	5	260	1397.76
				10	E	42	**420**							
Corridors	1434.75	15	15.38	15	**G**	**29**	**435**	**0.30**	0.44	**6**	2.61	5	260	678.60
Fourth Floor				**78**			**2920**		**9**		**69.69**			**26150.59**
Copy Room	94.6	10	15.72	1	C	45.4	**45.4**	**0.48**	0.05	**2**	0.09	5	260	23.61
Office Area	886.18	50	46.99	10	B	56.9	**569**	**0.64**	0.57	**8**	4.55	5	260	1183.52
Meeting Room	444.35	30	31.45	4	C	45.4	**181.6**	**0.41**	0.18	**6**	1.09	5	260	283.30
Director Office	394.39	50	38.29	4	C	45.4	**188.6**	**0.48**	0.19	**8**	1.51	5	260	392.29
				1	H	7								
Growing Area Rotating Tower	[redacted]								3.78	**6**	22.68	7	364	8255.52
Growing Area Zip Grow									2.36	**14**	33.08	7	364	12039.30
Reception & Corridor	1561.95	15	16.86	12	**G**	**29**	**348**	**0.22**	0.35	**8**	2.78	5	260	723.84
Staff Area	334.49	**50**	**46.15**	**4**	B	56.9	**227.6**	**0.68**	0.23	**8**	1.82	5	260	473.41
Storage	25.94	10	10.5	1	**G**	**29**	**29**	**1.12**	0.03	**1**	0.03	5	260	7.54
Women's	140.9	15	26.7	2	**G**	**29**	**72**	**0.51**	0.07	**8**	0.58	5	260	149.76
				2	H	7								
Men's	136.54	15	31.17	2	**G**	**29**	**72**	**0.53**	0.07	**8**	0.58	5	260	149.76
				2	H	7								
Elevator Lobby	164.93	10	17.47	1	B	56.9	**56.9**	**0.34**	0.06	**8**	0.46	5	260	118.35
Stairs I	180	15	18.7	**4**	H	7	**28**	**0.16**	0.03	**8**	0.22	5	260	58.24
Stairs II	191	15	19.33	**4**	H	7	**28**	**0.15**	0.03	**8**	0.22	5	260	58.24
Greenhouse	2950.38	15	17.27	11	D	48	**1074**	**0.36**	1.07	**8**	8.59	5	260	2233.92
				13	E	42								
Fith Floor				**48**			**1841**		**12**		**58.41**			**24090.25**
Stairs I	180	15		**4**	H	7	**28**	**0.16**	0.03	**4**	0.11	5	260	29.12
Stairs II	191	15		**4**	H	7	**28**	**0.15**	0.03	**4**	0.11	5	260	29.12
Elevator Lobby	164.93	10		1	B	56.9	**56.9**	**0.34**	0.06	**4**	0.23	5	260	59.18
Growing Area Rotating Tower	[redacted]								9.66	**6**	57.96	7	364	21097.44
Greenhouse	5409	15		15	D	48	**1728**	**0.32**	1.73	**8**	13.82	4	208	2875.39
				24	E	42								
									Totals		293.19			97820.35

Rain & Snow Water Collection System Detail





Detailed Class-A Cost Estimate on CSI MasterFormat 2012 Divisions

Building Name: GROWING
Project Name: AEI STUDENT DESIGN COMPETITION
Building Square Footage: 50000
Date of Estimate: 2/5/2015

MASTERFORMAT ESTIMATE

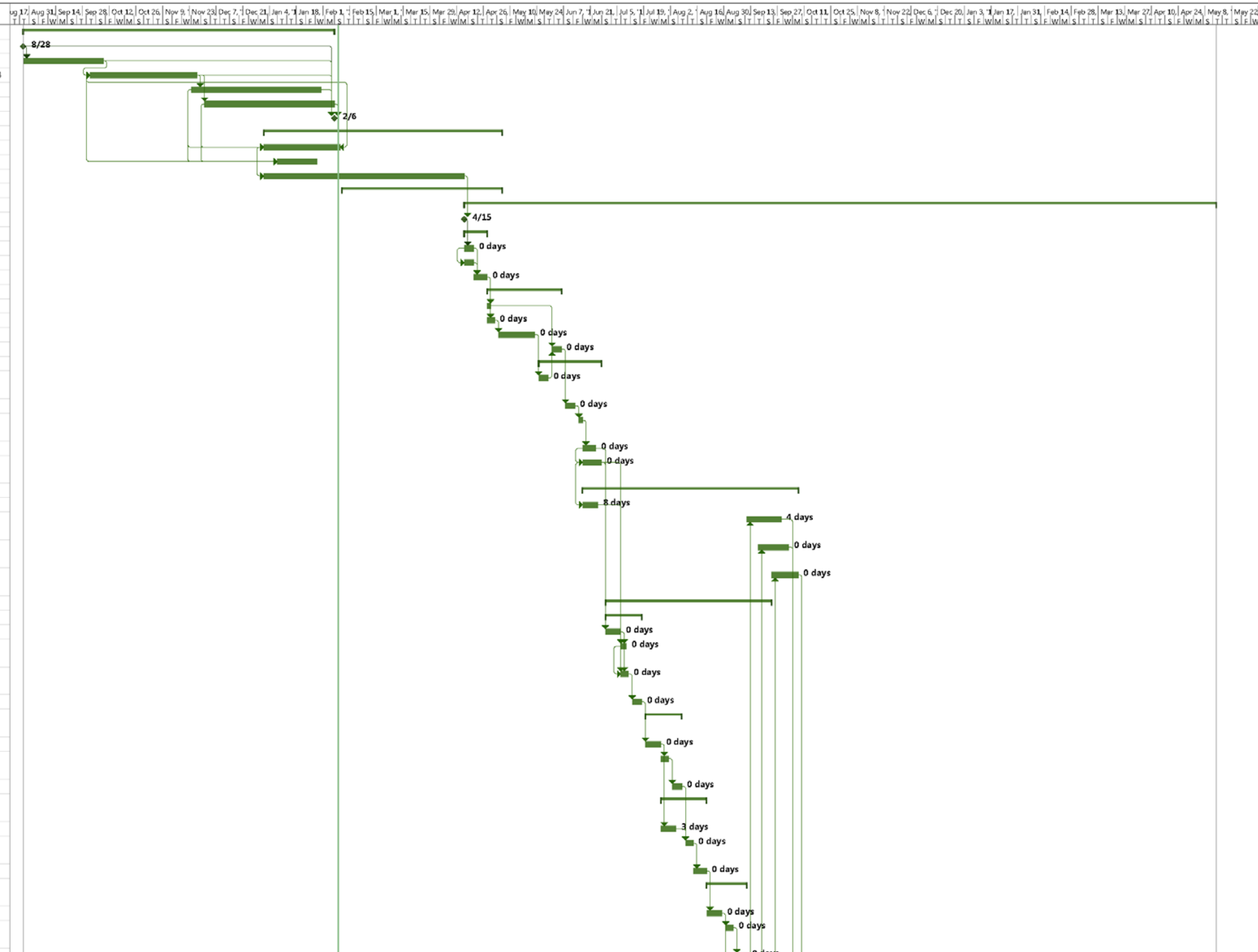
Division		Crew	Daily Output	Qnty. of Crews	Unit	Cost Inc O&P ($ per unit)	Quantity	Extra Labor Cost ($)	Total Cost
Division 1	**General Requirements**								
01 11 31.10 0010	Architectural Fees	-	-	-	Project	6.6%	12000000	$ -	792000
01 11 31.20 0110	Construction Management Fees to $10,000,000	-	-	-	Project	4.0%	12000000	$ -	480000
01 11 31.30 0200	Electrical Engineering Fees	-	-	-	Contract	4.8%	2000000	$ -	96000
01 11 31.30 1000	Mechanical (plumbing & HVAC) Fees	-	-	-	Contract	4.8%	2000000	$ -	96000
01 11 31.30 1300	Structural Engineering Fees	-	-	-	Project	2.5%	12000000	$ -	300000
01 21 16.50 0150	Contingencies, 5%	-	-	-	Project	5.0%	12000000	$ -	600000
01 56 26.50 0200	Temporary Fencing, chain link, 11 ga., 4' hight	2 Clab	400	3.00	L.F.	$ 5.50	2250	$ 8,270.55	$ 20,648.25
Division 2	**Existing Conditions**								
02 41 16.13 0100	Building Demolition, urban project, mixture of types.	B-8	20100	1.00	C.Y.	$ 0.50	2851.9	$ -	$ 1,425.93
02 41 16.13 1000	Building Demolition, urban project, single family house, wood 1600 S.F.	B-3	1	1.00	Ea.	$ 5,725.00	1.0	$ -	$ 5,725.00
Division 3	**Concrete**								
03 30 53.40 4700	Slab on grade (3500 psi), not including finish, 6" Thick	C-14-E	92	2.00	C.Y.	$ 186.00	161.4	$ 10,848.87	$ 40,875.54
03 30 53.40 4700	Slab on grade (3500 psi), not including finish, 6" Thick	C-14-E	92	1.00	C.Y.	$ 186.00	30.0	$ -	$ 5,582.41
03 30 53.40 6350	16' High	C-14-D	91	1.00	C.Y.	$ 320.00	231.1	$ -	$ 73,955.56
03 31 13.35 0150	Normal Weight Concrete, ready mix delivered, 3000 psi	-	-	1.00	C.Y.	$ 109.00	569.0	$ -	$ 62,025.40
03 31 13.70 1400	Concrete Placing, elevated slabs, less than 6" thick, pumped	C-20	140	1.00	C.Y.	$ 33.50	125.2	$ -	$ 4,194.56
03 31 13.70 1400	Concrete Placing, elevated slabs, less than 6" thick, pumped	C-20	140	1.00	C.Y.	$ 33.50	97.4	$ -	$ 3,262.45
03 31 13.70 1400	Concrete Placing, elevated slabs, less than 6" thick, pumped	C-20	140	1.00	C.Y.	$ 33.50	146.1	$ -	$ 4,893.95
03 31 13.70 1400	Concrete Placing, elevated slabs, less than 6" thick, pumped	C-20	140	1.00	C.Y.	$ 33.50	113.7	$ -	$ 3,808.29
03 31 13.70 1400	Concrete Placing, elevated slabs, less than 6" thick, pumped	C-20	140	1.00	C.Y.	$ 33.50	86.7	$ -	$ 2,903.59
03 31 13.70 2650	Concrete Placing, footings, spread, pumped	C-20	150	1.00	C.Y.	$ 31.00	230.3	$ -	$ 7,140.33
Division 4	**Masonry**								
04 22 10.24 0300	Concree Block, Exterior, C90, 2000 psi, Normal weight, 8" x 16" x 12" thick	D-9	250	1.00	S.F	$ 17.25	6876.9		$ 118,627.04
Division 5	**Metals**								
05 12 23.15 1000	Lightweight steel pipe members, 3-1/2" diameter	E-2	780	1.00	L.F.	$ 17.50	970.5	$ -	$ 16,983.75
05 12 23.77 0300	Stuctural Steel Projects, Office, steel bearing, 3 to 6 stories	E-5	10.3	1.00	Ton	$ 3,850.00	20.6	$ -	$ 79,117.50
05 12 23.77 0300	Stuctural Steel Projects, Office, steel bearing, 3 to 6 stories	E-5	10.3	1.00	Ton	$ 3,850.00	19.5	$ -	$ 75,190.50
05 12 23.77 0300	Stuctural Steel Projects, Office, steel bearing, 3 to 6 stories	E-5	10.3	1.00	Ton	$ 3,850.00	25.2	$ -	$ 96,908.35
05 12 23.77 0300	Stuctural Steel Projects, Office, steel bearing, 3 to 6 stories	E-5	10.3	1.00	Ton	$ 3,850.00	26.1	$ -	$ 100,523.50
05 12 23.77 0300	Stuctural Steel Projects, Office, steel bearing, 3 to 6 stories	E-5	10.3	1.00	Ton	$ 3,850.00	25.1	$ -	$ 96,481.00
05 12 23.77 3500	Stuctural Steel Projects,Welded construction, commercial buildings.,	E-9	8.3	1.00	Ton	$ 5,100.00	25.3	$ -	$ 129,093.93
05 12 23.77 3500	Stuctural Steel Projects,Welded construction, commercial buildings.,	E-9	8.3	1.00	Ton	$ 5,100.00	9.0	$ -	$ 45,798.00
05 12 23.77 3500	Stuctural Steel Projects,Welded construction, commercial buildings.,	E-9	8.3	1.00	Ton	$ 5,100.00	10.8	$ -	$ 55,131.00
05 12 23.77 3500	Stuctural Steel Projects,Welded construction, commercial buildings	E-9	8.3	1.00	Ton	$ 5,100.00	23.5	$ -	$ 119,832.56
05 21 13.50 3360	Steel Joist Framing, deep longspan joists, 37 lb./ft	E-7	220	1.00	L.F.	$ 43.50	90.0	$ -	$ 3,915.00
05 21 13.50 3120	Steel Joist Framing, deep longspan joists, 70 lb./ft	E-7	220	1.00	L.F.	$ 78.50	135.0	$ -	$ 10,597.50
05 31 33.50 6700	Steel Form Decking, 22 gauge, 2" deep uncoated	E-4	3600	1.00	S.F.	$ 3.60	8113.7	$ -	$ 29,209.21
05 31 33.50 6700	Steel Form Decking, 22 gauge, 2" deep uncoated	E-4	3600	1.00	S.F.	$ 3.60	6310.7	$ -	$ 22,718.41
05 31 33.50 6700	Steel Form Decking, 22 gauge, 2" deep uncoated	E-4	3600	1.00	S.F.	$ 3.60	9466.5	$ -	$ 34,079.40
05 31 33.50 6700	Steel Form Decking, 22 gauge, 2" deep uncoated	E-4	3600	1.00	S.F.	$ 3.60	7366.5	$ -	$ 26,519.40
05 31 33.50 6700	Steel Form Decking, 22 gauge, 2" deep uncoated	E-4	3600	1.00	S.F.	$ 3.60	5616.5	$ -	$ 20,219.40
05 51 16.50 0300	Metal Pan Stairs, cement fill metal pan, picket rail, 4' wide	E-4	30	1.00	Riser	$ 715.00	242.0	$ -	$ 173,030.00
05 51 16.50 1500	Metal Pan Stairs, Landing, steel pan , conventional	E-4	160	1.00	S.F.	$ 92.00	440.0	$ -	$ 40,480.00
Division 6	**Wood, Plastics, and Composites**								
06 11 10.14 0400	Columns and Fraiming, 4" x 4"	2 Carp.	0.52	1.00	M.B.F	$ 3,600.00	1.7	$ -	$ 6,264.00
Division 7	**Thermal & Moisture Protection**								
07 24 13.10 0105	Exterior Insulation and Finish Systems, field applied, 2" EPS insulation, with 1/2" cement board sheati	J-1	268	2.00	S.F	$ 12.75	2675.8	$ 25,654.85	$ 59,770.66
07 24 13.10 0105	Exterior Insulation and Finish Systems, field applied, 2" EPS insulation, with 1/2" cement board sheati	J-1	268	2.00	S.F	$ 12.75	2619.5	$ 25,115.44	$ 58,513.93
07 24 13.10 0105	Exterior Insulation and Finish Systems, field applied, 2" EPS insulation, with 1/2" cement board sheati	J-1	268	2.00	S.F	$ 12.75	2304.5	$ 22,095.15	$ 51,477.27
07 24 13.10 0105	Exterior Insulation and Finish Systems, field applied, 2" EPS insulation, with 1/2" cement board sheati	J-1	268	2.00	S.F	$ 12.75	1962.2	$ 18,813.78	$ 43,832.34
07 24 13.10 0105	Exterior Insulation and Finish Systems, field applied, 2" EPS insulation, with 1/2" cement board sheati	J-1	268	2.00	S.F	$ 12.75	1845.8	$ 17,696.89	$ 41,230.20
07 46 46.10 0070	Panel siding, 5/16" thick, smooth texture	2 Carp	750	1.00	S.F	$ 2.95	2675.8	$ -	$ 7,893.46
07 46 46.10 0070	Panel siding, 5/16" thick, smooth texture	2 Carp	750	1.00	S.F	$ 2.95	2619.5	$ -	$ 7,727.50
07 46 46.10 0070	Panel siding, 5/16" thick, smooth texture	2 Carp	750	1.00	S.F	$ 2.95	2304.5	$ -	$ 6,798.22
07 46 46.10 0070	Panel siding, 5/16" thick, smooth texture	2 Carp	750	1.00	S.F	$ 2.95	1962.2	$ -	$ 5,788.61
07 46 46.10 0070	Panel siding, 5/16" thick, smooth texture	2 Carp	750	1.00	S.F	$ 2.95	1845.8	$ -	$ 5,444.96
Division 8	**Openings**								
08 14 16.09 0210	Flush, interior 1-3/8", 7 ply, hollow core. Birch face, 3'-0" x 7'	2 Carp	16	1.00	Ea.	$ 191.00	40.0	$ -	$ 7,640.00
08 14 16.09 0210	Flush, interior 1-3/8", 7 ply, hollow core. Birch face, 3'-0" x 7'	2 Carp	16	1.00	Ea.	$ 191.00	6.0	$ -	$ 1,146.00
08 32 13.10 0450	Aluminum, 5/8" tempered insulated glass, 6' wide	2 Carp	4	1.00	Ea.	$ 1,275.00	3.0	$ -	$ 3,825.00
08 36 13.10 2650	Steel, 24 ga. Sectional, manual 10' x 10' high	2 Carp	1.8	1.00	Ea.	$ 1,825.00	1.0	$ -	$ 1,825.00
08 42 26.10 0100	Swingin Glass DoorsIncluding hardware, 1/2" thick, tempered, 6' x 7' opening	2 Glaz	1.4	1.00	Opng.	$ 5,500.00	1.0	$ -	$ 5,500.00
08 44 13.10 0200	Glazed Curtain Wall, aluminum stock, including glazing, maximum single glazed	H-1	160	1.00	S.F.	$ 209.00	267.9	$ -	$ 55,980.65
08 54 13.10 0280	Fiberglass single hung windows, 36" x 72"	2 Carp	16	1.00	Ea.	$ 585.00	49.0	$ -	$ 28,665.00
08 71 20.15 1000	Door hardware interior	-	-	1.00	Ea	$ 640.00	46.0	$ -	$ 29,440.00
08 81 30.10 0700	Instulating Glass, 1" thick dbl. glazed, 1/4" float, 1/4" tempered	2 Glaz	75	3.00	S.F.	$ 48.00	1225.0	$ 23,030.00	$ 81,830.00
08 81 30.10 0700	Instulating Glass, 1" thick dbl. glazed, 1/4" float, 1/4" tempered	2 Glaz	75	5.00	S.F.	$ 48.00	3557.2	$ 133,749.59	$ 304,493.75
08 81 30.10 0700	Instulating Glass, 1" thick dbl. glazed, 1/4" float, 1/4" tempered	2 Glaz	75	10.00	S.F.	$ 48.00	6220.5	$ 526,254.30	$ 824,838.30
08 81 30.10 0700	Instulating Glass, 1" thick dbl. glazed, 1/4" float, 1/4" tempered	2 Glaz	75	10.00	S.F.	$ 48.00	5126.3	$ 433,688.36	$ 679,752.68
08 81 30.10 0700	Instulating Glass, 1" thick dbl. glazed, 1/4" float, 1/4" tempered	2 Glaz	75	10.00	S.F.	$ 48.00	9680.6	$ 818,982.14	$ 1,283,652.86
Division 9	**Finishes**								
09 21 16.33 1200	1/2" interior, gypsum board, std, tape & finish 2 sides, metal studs 16" O.C., 3-5/8" wide, 6" wide	2 Carp	330	2.00	S.F.	$ 4.75	13759.0	$ 42,762.97	$ 108,118.22
09 30 13.10 3000	Ceramic tailing, floors, natural clay, random or uniform, thin set, color group 1	D-7	183	2.00	S.F.	$ 9.40	649.7	$ 3,148.38	$ 9,255.56
09 30 13.10 3000	Ceramic tailing, floors, natural clay, random or uniform, thin set, color group 1	D-7	183	3.00	S.F.	$ 9.40	265.6	$ 2,574.05	$ 5,070.59
09 30 13.10 3000	Ceramic tailing, floors, natural clay, random or uniform, thin set, color group 1	D-7	183	3.00	S.F.	$ 9.40	408.0	$ 3,953.77	$ 7,788.50
09 30 13.10 3000	Ceramic tailing, floors, natural clay, random or uniform, thin set, color group 1	D-7	183	3.00	S.F.	$ 9.40	455.3	$ 4,412.48	$ 8,692.12
09 30 13.10 3000	Ceramic tailing, floors, natural clay, random or uniform, thin set, color group 1	D-7	183	3.00	S.F.	$ 9.40	277.4	$ 2,688.89	$ 5,296.83
09 30 13.10 5810	Walls, interior, thin set, 8" x 8" tile	D-7	170	3.00	S.F.	$ 9.90	1547.5	$ 16,144.98	$ 31,465.23
09 30 13.10 5810	Walls, interior, thin set, 8" x 8" tile	D-7	170	3.00	S.F.	$ 9.90	880.0	$ 9,180.99	$ 17,892.99
09 30 13.10 5810	Walls, interior, thin set, 8" x 8" tile	D-7	170	3.00	S.F.	$ 9.90	1247.5	$ 13,015.09	$ 25,365.34
09 30 13.10 5810	Walls, interior, thin set, 8" x 8" tile	D-7	170	3.00	S.F.	$ 9.90	1255.0	$ 13,093.34	$ 25,517.84
09 30 13.10 5810	Walls, interior, thin set, 8" x 8" tile	D-7	170	3.00	S.F.	$ 9.90	930.0	$ 9,702.64	$ 18,909.64
09 51 23.30 1125	Mineral Fiber, on 15/16" T bar sup. 2' x 2' x 3/4" lay-in board	1 Carp	345	5.00	S.F.	$ 4.46	5290.0	$ 14,843.68	$ 38,436.99
09 51 23.30 1125	Mineral Fiber, on 15/16" T bar sup. 2' x 2' x 3/4" lay-in board	1 Carp	345	5.00	S.F.	$ 4.46	4671.2	$ 13,107.36	$ 33,940.87
09 51 23.30 1125	Mineral Fiber, on 15/16" T bar sup. 2' x 2' x 3/4" lay-in board	1 Carp	345	5.00	S.F.	$ 4.46	5753.1	$ 16,143.20	$ 41,802.02
09 51 23.30 1125	Mineral Fiber, on 15/16" T bar sup. 2' x 2' x 3/4" lay-in board	1 Carp	345	5.00	S.F.	$ 4.46	5610.9	$ 15,744.21	$ 40,768.87
09 51 23.30 1125	Mineral Fiber, on 15/16" T bar sup. 2' x 2' x 3/4" lay-in board	1 Carp	345	5.00	S.F.	$ 4.46	4185.5	$ 11,719.34	$ 30,386.58
09 51 23.30 1125	Mineral Fiber, on 15/16" T bar sup. 2' x 2' x 3/4" lay-in board	1 Carp	345	5.00	S.F.	$ 4.46	576.1	$ 1,612.94	$ 4,182.12
09 64 29.10 0020	Floor, Fir, vertical grain, 1" x 4", not incl. finish, C grade & better	1 Carp	255	4.00	S.F.	$ 5.25	1899.9	$ 8,207.48	$ 18,181.85
09 64 29.10 7500	Refinish wood floor, sand, 2 cts poly, wax	1 Carp	400	4.00	S.F.	$ 2.10	1899.9	$ 4,160.74	$ 8,150.49
09 65 16.10 8000	Vinyl, sheet goods, backed, 0,065 thick, minimum"	1 Tilf	250	6.00	S.F.	$ 6.50	3647.2	$ 24,436.44	$ 48,143.44
09 65 16.10 8000	Vinyl, sheet goods, backed, 0,065 thick, minimum"	1 Tilf	250	6.00	S.F.	$ 6.50	6876.1	$ 46,069.54	$ 90,763.86
09 91 23 40 0160	Concrete paint, latex , Roll, 1st coat	1 Pord	2600	2.00	S.F.	$ 0.40	19646.3	$ 2,357.55	$ 10,216.06
09 91 23.72 1670	Painting walls, complete, including surface prep, primer & 2 coats finish, on drywall or plaster, with rc	1 Pord	325	8.00	S.F.	$ 1.67	13759.0	$ 130,793.05	$ 153,770.58
Division 13	**Special Construction**								
13 21 26.50 6100	Cold Stroage Rooms, Prefab walk-in 8'-6" high, aluminum, incl. refrigeration, door & roomm, not incl. r	2 Carp	54.8	5.00	S.F. Flr.	$ 205.00	1182.9	$ 88,761.06	$ 331,245.31
Division 14	**Conveying Equipment**								
14 21 23.10 1700	Electric traction Passenger Elevator, base unit, 3500 lbs, 200 fpm, 5 stop, std, fin.	2 Elev	0.5	1.00	Ea.	$ 139,270.00	1.0	$ -	$ 139,270.00
Division 21	**Fire Suppression**								
21 13 13.50 3730	Wet-Pipe Sprinkler System, Sprinklers heads, standard spray, pendent or upright, brass	1 Spri	16	4.00	Ea.	$ 139,270.00	1.0	$ 41,250.00	$ 70,250.00
Division 22	**Plumbing**								
22 41 23.20 4000	Shower Stall, with drain only. Polypropylene w/ molded-stone floor, 30" x 30"	Q-1	2	1.00	Ea.	$ 1,325.00	2.0	$ -	$ 2,650.00
22 42 13.30 3140	Urinal wall hung, vitreous china, with hanger & sel-closing valve. Water saving 0.5 gpf	Q-1	3	1.00	Ea.	$ 1,050.00	4.0	$ -	$ 4,200.00
22 42 13.40 3360	Water closet, bowl only, with flush valve, seat, with floor outlet, 1.28 gpf	Q-1	5.8	1.00	Ea.	$ 860.00	12.0	$ -	$ 10,320.00
22 42 13.40 3362	Water closet bowl only, with flush valve, seat, with floor outlet, 1.28 gpf, ADA	Q-1	5.8	1.00	Ea.	$ 900.00	8.0	$ -	$ 7,200.00
22 42 16.40 7000	Lavatory fixture, sevice, all, P.E. on C.I. , roll rim, 22" x 18"	1 Plum	4	1.00	Ea.	$ 1,150.00	16.0	$ -	$ 18,400.00
22 42 39.10 2800	Faucets for lavatories, Self-closing, center set	1 Plum	10	1.00	Ea.	$ 240.00	16.0	$ -	$ 3,840.00
Division 23	**Heating, Ventilating, & Air Conditioning**								
23 52 13.10 2220	Electric Boiler, ASME, standard controls and trim, 296 KW, 1010 MBH	Q-19	0.55	1.00	Ea.	$ 21,200.00	1.0	$ -	$ 21,200.00
23 65 13.10 0150	Forced-draft Type Cooling Tower, Galvanized steel, induced draft, crossflow, vertical, belt drive, 100 tc	Q-6	100	1.00	TonAC	$ 244.00	88.0	$ -	$ 21,472.00
23 65 13.10 3500	Cooling tower, pumps and piping	Q-6	38	1.00	TonAC	$ 168.00	88.0	$ -	$ 14,784.00
23 81 46.10 2220	Water Source Heat Pumps, not incl. connecting tubing. Water source to air, single package. 5 ton cool	Q-5	0.9	3.00	Ea.	$ 4,750.00	22.0	$ 62,186.67	$ 166,686.67
Division 26	**Electrical**								
26 51 13.55 0160	Interior LED Fixtures, cylinder, 7.8 watts	1 Elec	8	5.00	Ea.	$ 565.00	80.0	$ 17,120.00	$ 62,320.00
26 51 13.55 1200	Interior LED Fixtures, troffers, volumetric recess mounted, 2' x 2'	1 Elec	5.7	5.00	Ea.	$ 720.00	236.0	$ 70,800.00	$ 240,720.00
26 51 13.55 2000	Strip, surface mounted, one light bar 4' long, 40 watt	1 Elec	8.5	5.00	Ea.	$ 865.00	72.0	$ 14,400.00	$ 76,680.00
26 51 13.55 2010	Strip, surface mounted, one light bar 4' long, 60 watt	1 Elec	8	5.00	Ea.	$ 900.00	30.0	$ 6,420.00	$ 33,420.00
26 51 13.55 2020	Strip, surface mounted, two light bar 4' long, 80 watt	1 Elec	7	5.00	Ea.	$ 1,175.00	18.0	$ 4,392.00	$ 25,542.00
26 51 13.55 3000	Linear, suspended mountedd, one light bar 4' long, 37 watt	1 Elec	6.7	5.00	Ea.	$ 460.00	87.0	$ 22,098.00	$ 62,118.00
26 51 13.55 6000	Greenhouse LED Lighting, 103 Watt	2 Elec	650	2.00	Ea.	1281	107.0	$ 14,017.00	$ 158,467.00
Division 31	**Earthwork**								
31 13 13.20 1750	Tree removal, 24" to 36" diameter, hardwood	B-10M	50	1.00	Ea.	$ 56.50	14.0	$ -	$ 791.00
31 23 16.16 6030	Machine excavation, for spread and mat footings, elevator pits, and small buildin foundations, commc	B-12-E	55	8.00	B.C.Y.	$ 28.50	4666.7	$ 923,456.97	$ 1,056,456.97
31 23 23.13 2300	Compactig backfill, 6" to 12" lifts, vibrating roller	B-10-L	700	3.00	E.C.Y.	$ 3.90	1805.6	$ 6,956.55	$ 13,998.21
31 23 23.14 2420	Backfill Structural, Dozer or F.E. loader, no compaction, 80 H.P., 300' haul, common earth	B-10-L	370	3.00	L.C.Y.	$ 3.64	1805.6	$ 13,161.04	$ 19,733.26
Division 32	**Interior Improvements**								
32 11 23.23 0303	Base course drainage layer, crushed 1-1/2" stone base, compacted to 8" deep	B-36-B	4500	1.00	S.Y.	$ 10.45	2222.2	$ -	$ 23,222.22
32 12 16.13 0200	Plant-mix Asphalt Paving, binder course, 4" thick	B-25	4140	1.00	S.Y.	$ 18.30	2222.2	$ -	$ 40,666.67
Miscelaneous									
50 17 00.61 3100	Total: Mechanical & Electrical, Interior space			1.00	S.F.	$ 23.00	36643	$ -	$ 341,989.00
50 17 00.69 3100	Total: Mechanical & Electrical, Greenhouse Space			1.00	S.F.	$ 57.50	12050	$ -	$ 468,732.33
Miscelaneous	Rotating Vertical Towers				Ea.	$ 1,250.00	21	$ -	$ 26,250.00
Miscelaneous	Rotating Vertical Towers				Ea.	$ 1,250.00	23	$ -	$ 28,750.00
Miscelaneous	ZipGrow Towers				Ea.	$ 57.00	462	$ -	$ 26,334.00

Complete Cost Estimate on UniFormat Categories.

	Building Name:	GROWING POWER - VERTICAL FARM				
	Project Name:	AEI STUDENT DESIGN COMPETITION 2015				
	Building Square Footage:	48693				
	Date of Estimate:	2/5/2015				
		UNIFORMAT ESTIMATE				
				TOTAL	COST /	% OF
	LEVEL 1 INFORMATION	LEVEL 2 INFORMATION	LEVEL 3 INFORMATION	COST	S. F.	TOTAL
A	SUBSTRUCTURE	A10 - FOUNDATIONS	A1010 - STANDARD FOUNDATIONS	$ 7,140.33		
		A20 - BASEMENT CONSTRUCTION	A1030 - SLAB ON GRADE	$ 40,875.54		
			A2010 - BASEMENT EXCAVATION	$ 1,090,188.44		
			A2020 - BASEMENT WALLS	$ 73,955.56		
			SUBTOTAL SUBSTRUCTURE	$ 1,212,159.87	24.89392462	10.27%
B	SHELL	B10 - SUPERSTRUCTURE	B1010 - FLOOR CONSTRUCTION	$ 811,243.77		
			B1020 - ROOF CONSTRUCTION	$ 220,761.56		
		B20 - EXTERIOR CLOSURE	B2010 - EXTERIOR WALLS	$ 2,224,099.84		
			B2020 - EXTERIOR WINDOWS & EXTERIOR DOORS	$ 117,820.00		
		B30 - ROOFING	B3010 - ROOF COVERING & OPENINGS	$ 1,275,741.95		
			SUBTOTAL SHELL	$ 4,649,667.12	95.48943622	39.41%
C	INTERIORS	C10 - INTERIOR CONSTRUCTION	C1010 - PARTITIONS	$ 164,098.87		
			C1020 - INTERIOR DOORS	$ 42,051.00		
			C1030 - FITTINGS / SPECIALTIES	$ -		
		C20 - STAIRCASES	C2010 - STAIR CONSTRUCTION	$ 213,510.00		
		C30 - INTERIOR FINISHES	C3010 - WALL FINISHES	$ 272,921.62		
			C3020 - FLOOR FINISHES	$ 211,559.29		
			C3030 - CEILING FINISHES	$ 189,517.47		
			SUBTOTAL INTERIORS	$ 1,093,658.25	22.46027656	9.27%
D	SERVICES	D10 - CONVEYING SYSTEMS	D1010 - ELEVATORS & LIFTS	$ 139,270.00		
		D20 - PLUMBING	D2010 - PLUMBING FIXTURES	$ 46,610.00		
		D30 - HVAC	D3020 - HEAT GENERATING SYSTEMS	$ 187,886.67		
			D3040 - HVAC DISTRIBUTION SYSTEMS	$ 504,988.33		
		D40 - FIRE PROTECTION	D4010 - FIRE PROTECTION SPRINKLER SYSTEM	$ 70,250.00		
		D50 - ELECTRICAL	D5010 - ELECTRICAL SERVICE & DISTRIBUTION	$ 341,989.00		
			D5020 - LIGHTING & BRANCH WIRING	$ 659,267.00		
			SUBTOTAL SERVICES	$ 1,950,261.00	40.05218409	16.53%
E	EQUIPMENT & FURNISHINGS	E10 - EQUIPMENT	E1090 - OTHER EQUIPMENT	$ 104,581.75		
			SUBTOTAL EQUIPMENT & FURNISHINGS	$ 104,581.75	2.147777915	0.89%
F	SPECIAL CONSTRUCTION & DEMOLITION	F10 - SPECIAL CONSTRUCTION	F1020 - INTEGRATED CONSTRUCTION	$ 331,245.31		
			SUBTOTAL SPECIAL CONST. & DEMO	$ 331,245.31	6.802729633	2.81%
G	BUILDING SITE WORK	G10 - SITE PREPARATION	G1010 - SITE CLEARING	$ 20,648.25		
			G1020 - SITE DEMOLITION & RELOCATIONS	$ 7,941.93		
		G20 - SITE IMPROVEMENTS	G2020 - PARKING LOTS	$ 63,888.89		
			SUBTOTAL BUILDING SITE WORK	$ 92,479.06	1.899227005	0.78%
			TOTAL PRELIMINARY BUDGET	$ 9,434,052.36	193.745556	79.96%
			DESIGN CONTINGENCY	$ 600,000.00		
			TOTAL ESTIMATED TRADE COSTS	$ 10,034,052.36		
			ARCHITECTURAL FEES	$ 792,000.00		
			CONSTRUCTION MANAGEMENT FEES	$ 480,000.00		
			ELECTRICAL ENGINEERING FEES	$ 96,000.00		
			MECHANICAL ENGINEERING FEES	$ 96,000.00		
			STRUCTURAL ENGINEERING FEES	$ 300,000.00		
			SUBTOTAL AE DESIGN COSTS	$ 1,764,000.00		
			PROJECT SUBTOTAL	$ 11,798,052.36		
			CM CONTINGENCY	$ -		
			SUBTOTAL CM FIXED LIMIT OF CONSTRUCTION	$ -		
			PROJECT SUBTOTAL	$ 11,798,052.36		
			ALLOWANCES	$ 500,000.00		
			SUBTOTAL ALLOWANCES	$ 500,000.00		
			PROJECT SUBTOTAL	$ 12,298,052.36		
Z	ALTERNATES		ALTERNATE #1: MILWAUKEE WI			
			MILWAUKEE, WI. LOCATION FACTOR	1.04		
			SUBTOTAL ALTERNATE #1	$ 12,789,974.45		
			MILWAUKEE PROJECT TOTAL	$ 12,789,974.45	$ 262.67	
			ALTERNATE #2: MIAMI, FL			
			MIAMI, FL. LOCATION FACTOR	0.876		
			SUBTOTAL ALTERNATE #2	$ 10,773,093.87	221.2452276	
			MIAMI PROJECT TOTAL	$ 10,773,093.87	$ 221.25	
			PROJECT TOTAL	$ 12,789,974.45	$ 262.67	100%

Complete Activities Schedule including Design, Preconstruction, and Construction Phases

ID	Task Name	Duration	Start	Finish
1	**Design Phase**	**117 days**	**Thu 8/28/14**	**Fri 2/6/15**
2	Project Start	0 days	Thu 8/28/14	Thu 8/28/14
3	Project Study	30 days	Thu 8/28/14	Wed 10/8/14
4	Architectural Design	40 days	Thu 10/2/14	Wed 11/26/14
5	Mechanical Design	50 days	Mon 11/24/14	Fri 1/30/15
6	Structural Engineer Design	50 days	Mon 12/1/14	Fri 2/6/15
7	Substancial Copletion	0 days	Fri 2/6/15	Fri 2/6/15
8	**Preconstruction Phase**	**89 days**	**Thu 1/1/15**	**Tue 5/5/15**
9	Estimate Complete	28 days	Thu 1/1/15	Mon 2/9/15
10	Scopes of Work Defined	15 days	Thu 1/8/15	Wed 1/28/15
11	Permits	75 days	Thu 1/1/15	Wed 4/15/15
12	**Delivery Times**	**60 days**	**Wed 2/11/15**	**Tue 5/5/15**
16	**Construction Phase**	**282 days**	**Wed 4/15/15**	**Fri 5/13/16**
17	Construction Starts	0 days	Wed 4/15/15	Wed 4/15/15
18	**Start Up - Site Work**	**8 days**	**Thu 4/16/15**	**Mon 4/27/15**
19	Fencing	3 days	Thu 4/16/15	Mon 4/20/15
20	Movilization	3 days	Thu 4/16/15	Mon 4/20/15
21	Site Work	5 days	Tue 4/21/15	Mon 4/27/15
22	**Excavation & Demolition**	**29 days**	**Tue 4/28/15**	**Fri 6/5/15**
23	Tree Removal	2 days	Tue 4/28/15	Wed 4/29/15
24	Demolition	4 days	Tue 4/28/15	Fri 5/1/15
25	Excavation	15 days	Mon 5/4/15	Fri 5/22/15
26	Backfill	5 days	Mon 6/1/15	Fri 6/5/15
27	**Substructure**	**25 days**	**Mon 5/25/15**	**Fri 6/26/15**
28	Foundations - Footings	5 days	Mon 5/25/15	Fri 5/29/15
29	Basement Slab	5 days	Mon 6/8/15	Fri 6/12/15
30	Steel Framing Basement	2 days	Mon 6/15/15	Tue 6/16/15
31	Foundation Walls	5 days	Wed 6/17/15	Tue 6/23/15
32	Basement Cooler Walls	8 days	Wed 6/17/15	Fri 6/26/15
33	**Services & Equipment**	**81 days**	**Wed 6/17/15**	**Wed 10/7/15**
34	Elevator Installation	6 days	Wed 6/17/15	Wed 6/24/15
35	Greenhouse Systems Installation (3rd floor)	12 days	Fri 9/11/15	Mon 9/28/15
36	Greenhouse Systems Installation (4th floor)	12 days	Thu 9/17/15	Fri 10/2/15
37	Greenhouse Systems Installation (5th floor)	10 days	Thu 9/24/15	Wed 10/7/15
38	**Superstructure**	**63 days**	**Mon 6/29/15**	**Wed 9/23/15**
39	**1st Floor Structure**	**15 days**	**Mon 6/29/15**	**Fri 7/17/15**
40	Framing 1st Floor	6 days	Mon 6/29/15	Mon 7/6/15
41	Slab on Grade F1st Floor	3 days	Tue 7/7/15	Thu 7/9/15
42	Metal Decking 1st floor	4 days	Tue 7/7/15	Fri 7/10/15
43	Slab 1st Floor	5 days	Mon 7/13/15	Fri 7/17/15
44	**2nd Floor Superstructure**	**15 days**	**Mon 7/20/15**	**Fri 8/7/15**
45	Framing 2nd Floor	6 days	Mon 7/20/15	Mon 7/27/15
46	Metal Decking 2nd Floor	4 days	Tue 7/28/15	Fri 7/31/15
47	Slab 2nd Floor	5 days	Mon 8/3/15	Fri 8/7/15
48	**3rd Floor Superstructure**	**18 days**	**Tue 7/28/15**	**Thu 8/20/15**
49	Framing 3rd Floor	6 days	Tue 7/28/15	Tue 8/4/15
50	Metal Decking 3rd floor	4 days	Mon 8/10/15	Thu 8/13/15
51	Slab 3rd Floor	5 days	Fri 8/14/15	Thu 8/20/15
52	**4th Floor Superstructure**	**15 days**	**Fri 8/21/15**	**Thu 9/10/15**
53	Framing 4th Floor	6 days	Fri 8/21/15	Fri 8/28/15
54	Metal decking 4th floor	4 days	Mon 8/31/15	Thu 9/3/15
55	Slab 4th floor	5 days	Fri 9/4/15	Thu 9/10/15



Project: MQP Schedule 01.28.20

Task, Split, Milestone, Summary, Project Summary, Inactive Task, Inactive Milestone, Inactive Summary, Manual Task, Duration-only, Manual Summary Rollup, Manual Summary, Start-only, Finish-only, External Tasks, External Milestone, Deadline, Progress, Manual Progress

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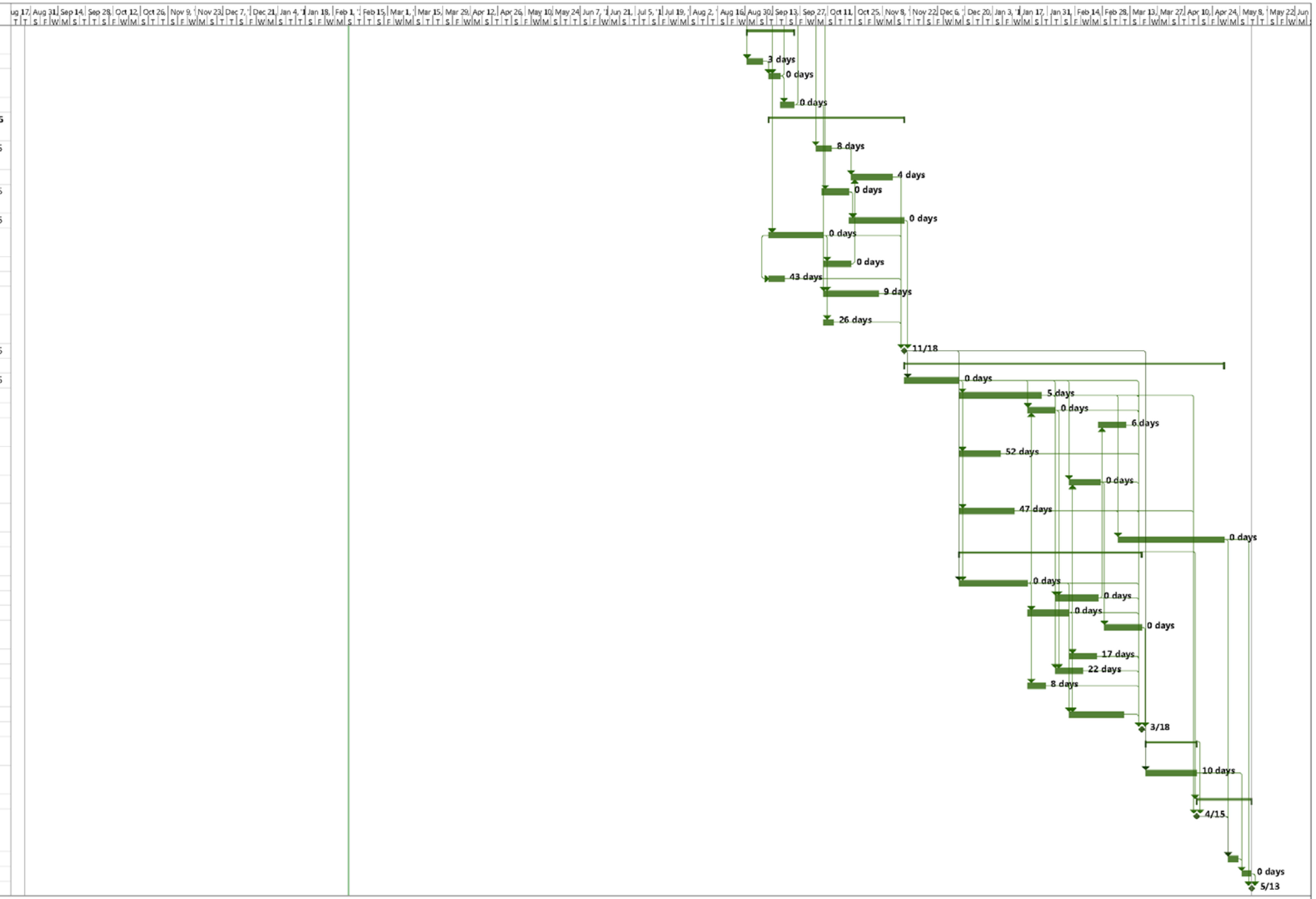
Complete Activities Schedule including Design, Preconstruction, and Construction Phases Cont.

ID	Task Mode	Task Name	Duration	Start	Finish
56		**5th Floor Superstructure**	**18 days**	**Mon 8/31/15**	**Wed 9/23/15**
57		Framing 5th Floor	6 days	Mon 8/31/15	Mon 9/7/15
58		Metal decking 5th Floor	4 days	Fri 9/11/15	Wed 9/16/15
59		Slab 5th Floor	5 days	Thu 9/17/15	Wed 9/23/15
60		**Roofing & Exterior Enclosure**	**49 days**	**Fri 9/11/15**	**Wed 11/18/15**
61		Roofing Structure 3rd & 4th Floor	6 days	Mon 10/5/15	Mon 10/12/15
62		Glazing 3rd & 4th Floor	15 days	Fri 10/23/15	Thu 11/12/15
63		Roofing Structure 5th Floor	10 days	Thu 10/8/15	Wed 10/21/15
64		Glazing 5th Floor	20 days	Thu 10/22/15	Wed 11/18/15
65		Panels Installation 1st & 2nd Floor	20 days	Fri 9/11/15	Thu 10/8/15
66		Glazing 1st & 2nd Floor	10 days	Fri 10/9/15	Thu 10/22/15
67		Windows Installation	6 days	Fri 9/11/15	Fri 9/18/15
68		Panels Installation 3rd & 4th Floor	20 days	Fri 10/9/15	Thu 11/5/15
69		Exterior Door Installation	3 days	Fri 10/9/15	Tue 10/13/15
70		Building Enclosed	0 days	Wed 11/18/15	Wed 11/18/15
71		**MEP Installation**	**117 days**	**Thu 11/19/15**	**Fri 4/29/16**
72		Duct & Pipe Work	20 days	Thu 11/19/15	Wed 12/16/15
73		HVAC Installation	30 days	Thu 12/17/15	Wed 1/27/16
74		Electric Installaions	10 days	Thu 1/21/16	Wed 2/3/16
75		Interior Lighting Installatin	10 days	Fri 2/26/16	Thu 3/10/16
76		Greenhouse Lighting Installation	15 days	Thu 12/17/15	Wed 1/6/16
77		Plumbing Fixtures Installation	12 days	Thu 2/11/16	Fri 2/26/16
78		Fire Protection Systems Installation	20 days	Thu 12/17/15	Wed 1/13/16
79		Commisioning	40 days	Mon 3/7/16	Fri 4/29/16
80		**Interior Construction & Finishes**	**67 days**	**Thu 12/17/15**	**Fri 3/18/16**
81		Interior Walls	25 days	Thu 12/17/15	Wed 1/20/16
82		Ceiling Installation	16 days	Thu 2/4/16	Thu 2/25/16
83		Flooring Installation	15 days	Thu 1/21/16	Wed 2/10/16
84		Toillet Wall ceramic tile installation	15 days	Mon 2/29/16	Fri 3/18/16
85		Floor Painting Finish	10 days	Thu 2/11/16	Wed 2/24/16
86		Interior Walls Paint	10 days	Thu 2/4/16	Wed 2/17/16
87		Interior Door Installation	7 days	Thu 1/21/16	Fri 1/29/16
88		Furniture	20 days	Thu 2/11/16	Wed 3/9/16
89		Interiors Complete	0 days	Fri 3/18/16	Fri 3/18/16
90		**Site Work & Improvements**	**20 days**	**Mon 3/21/16**	**Fri 4/15/16**
91		Loading and Parking area Paving	20 days	Mon 3/21/16	Fri 4/15/16
92		**Turn Over & Move In**	**20 days**	**Fri 4/15/16**	**Fri 5/13/16**
93		Construction Substancial Completion	0 days	Fri 4/15/16	Fri 4/15/16
94		Demovilization	5 days	Mon 5/2/16	Fri 5/6/16
95		Move In	5 days	Mon 5/9/16	Fri 5/13/16
96		Project Finish	0 days	Fri 5/13/16	Fri 5/13/16



Project: MQP Schedule 01.28.20

Task | Summary | Inactive Milestone | Duration-only | Start-only | External Milestone | Manual Progress
Split | Project Summary | Inactive Summary | Manual Summary Rollup | Finish-only | Deadline
Milestone | Inactive Task | Manual Task | Manual Summary | External Tasks | Progress

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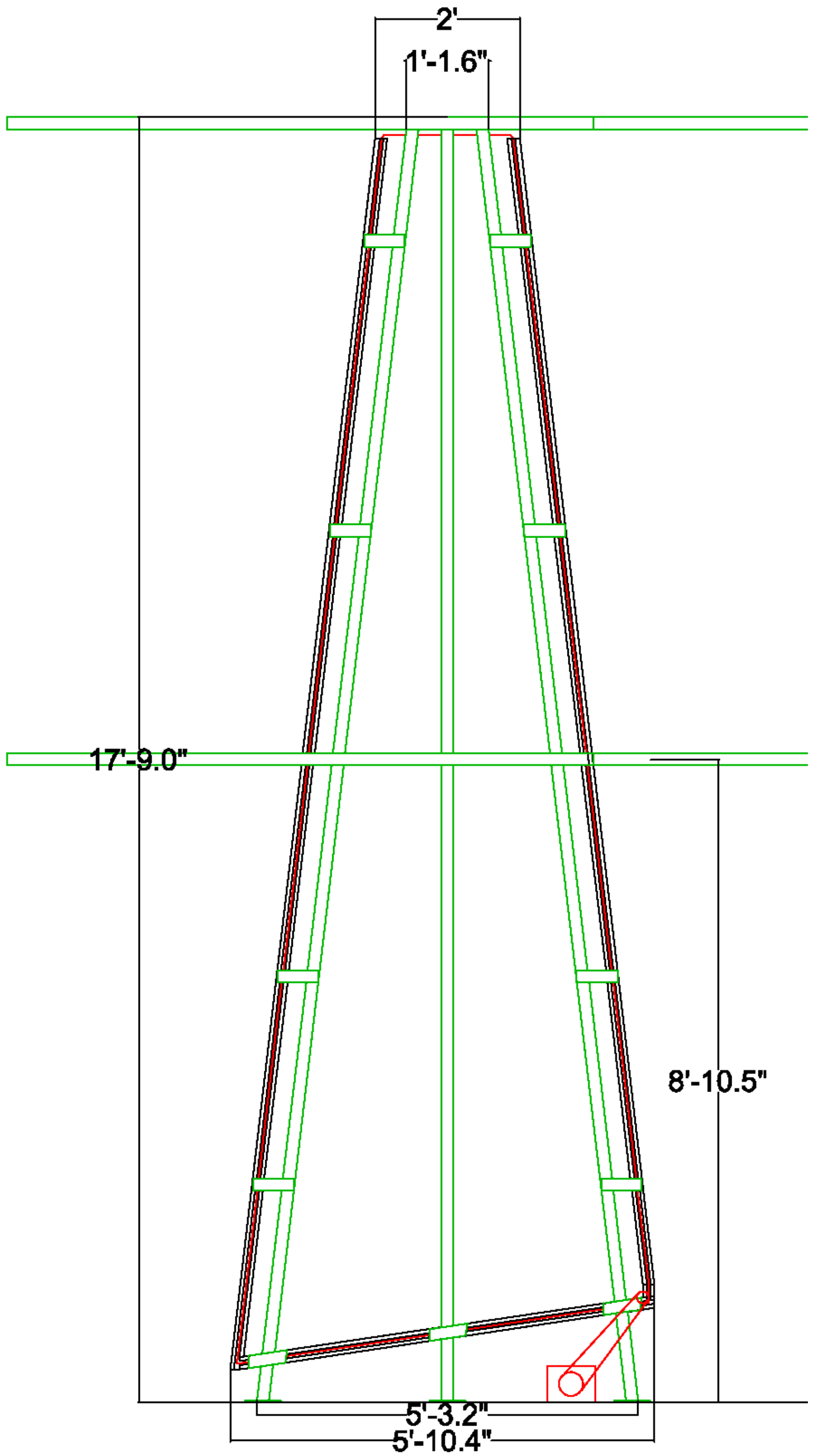
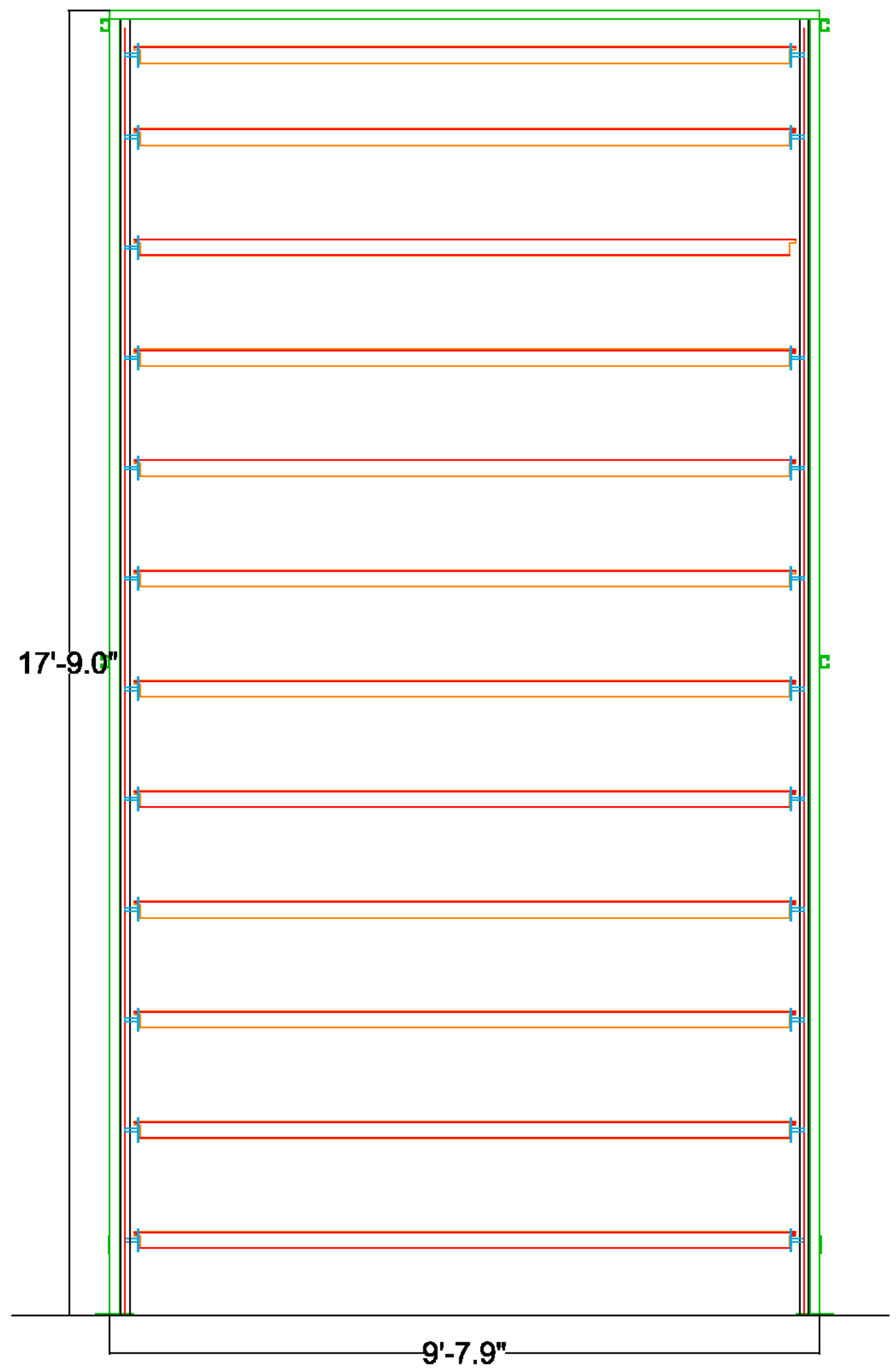
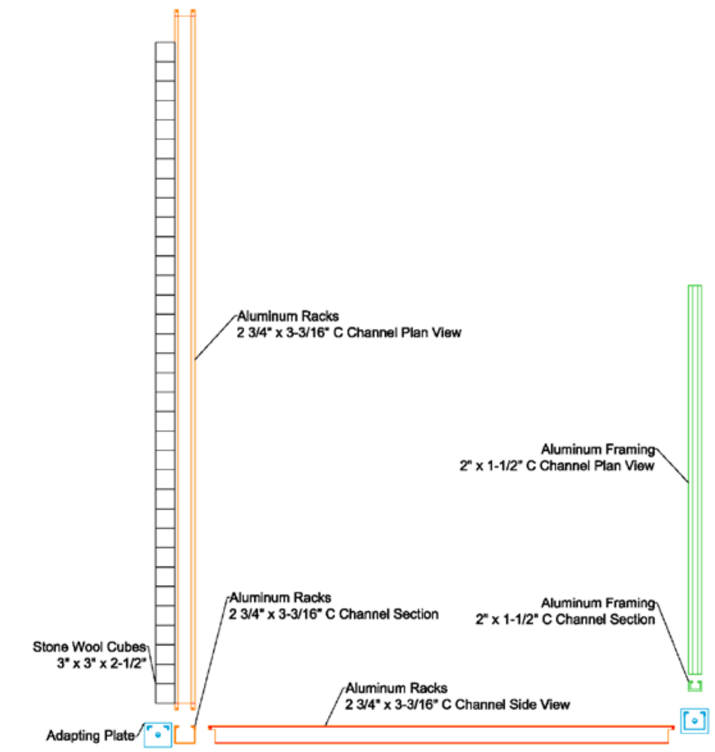
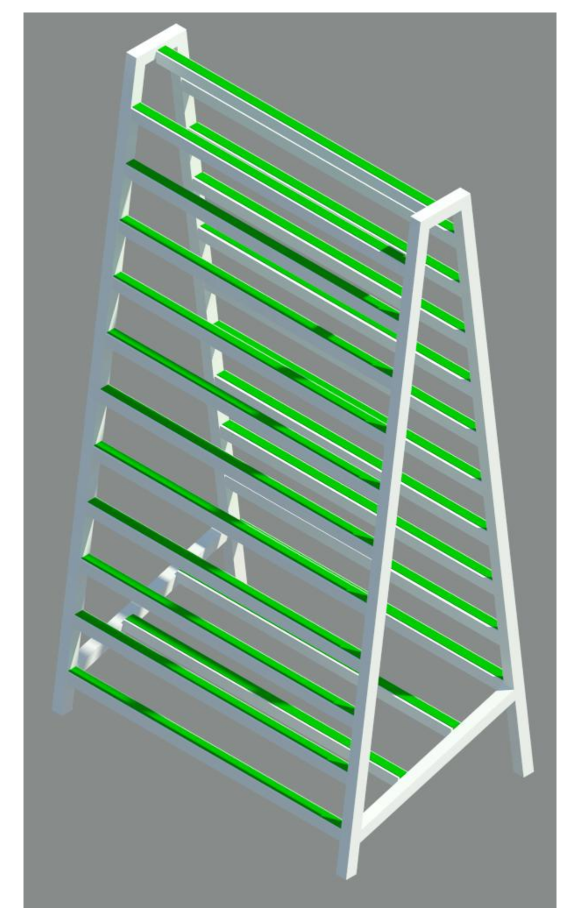
Vertical Rotating Towers Drawings and Details

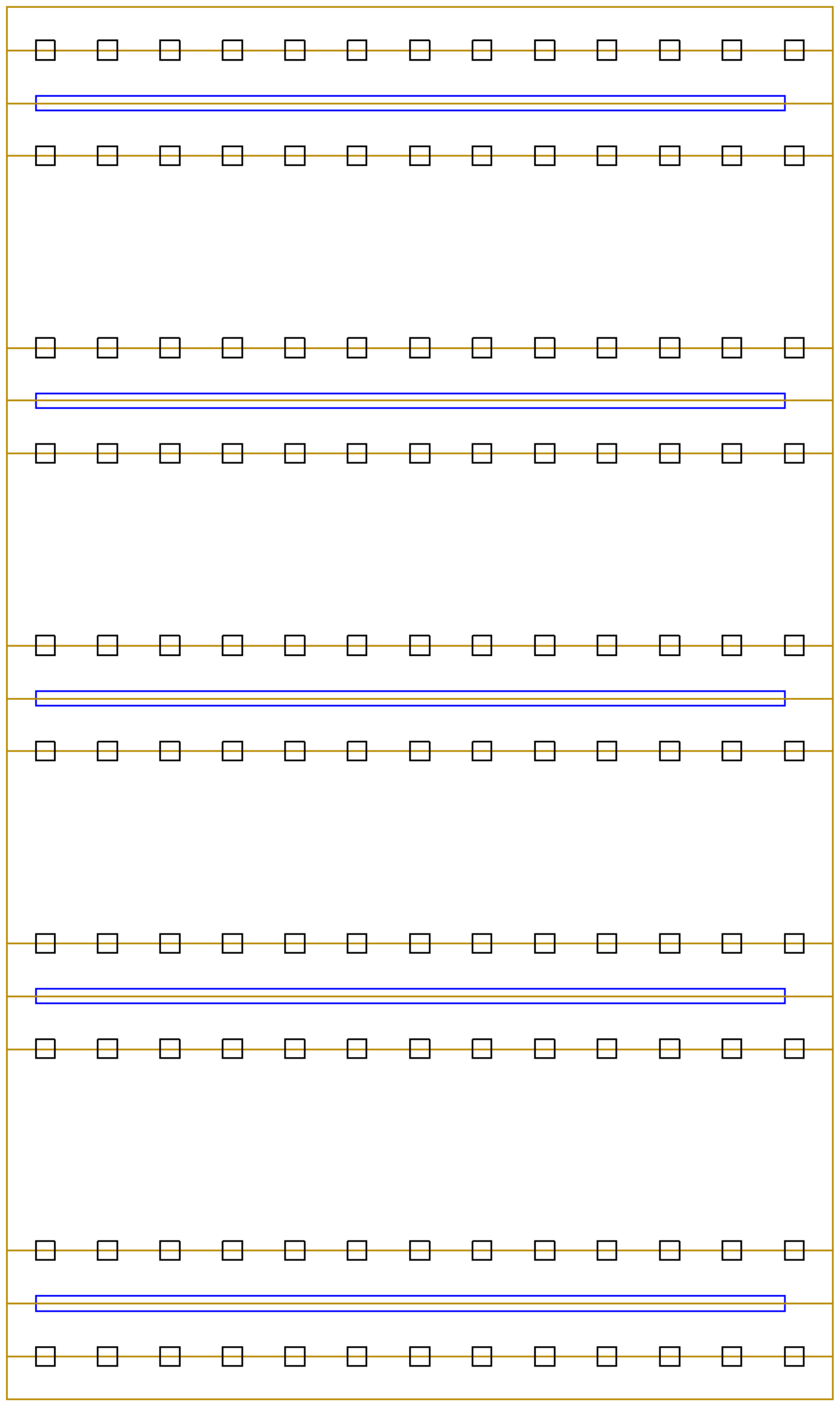


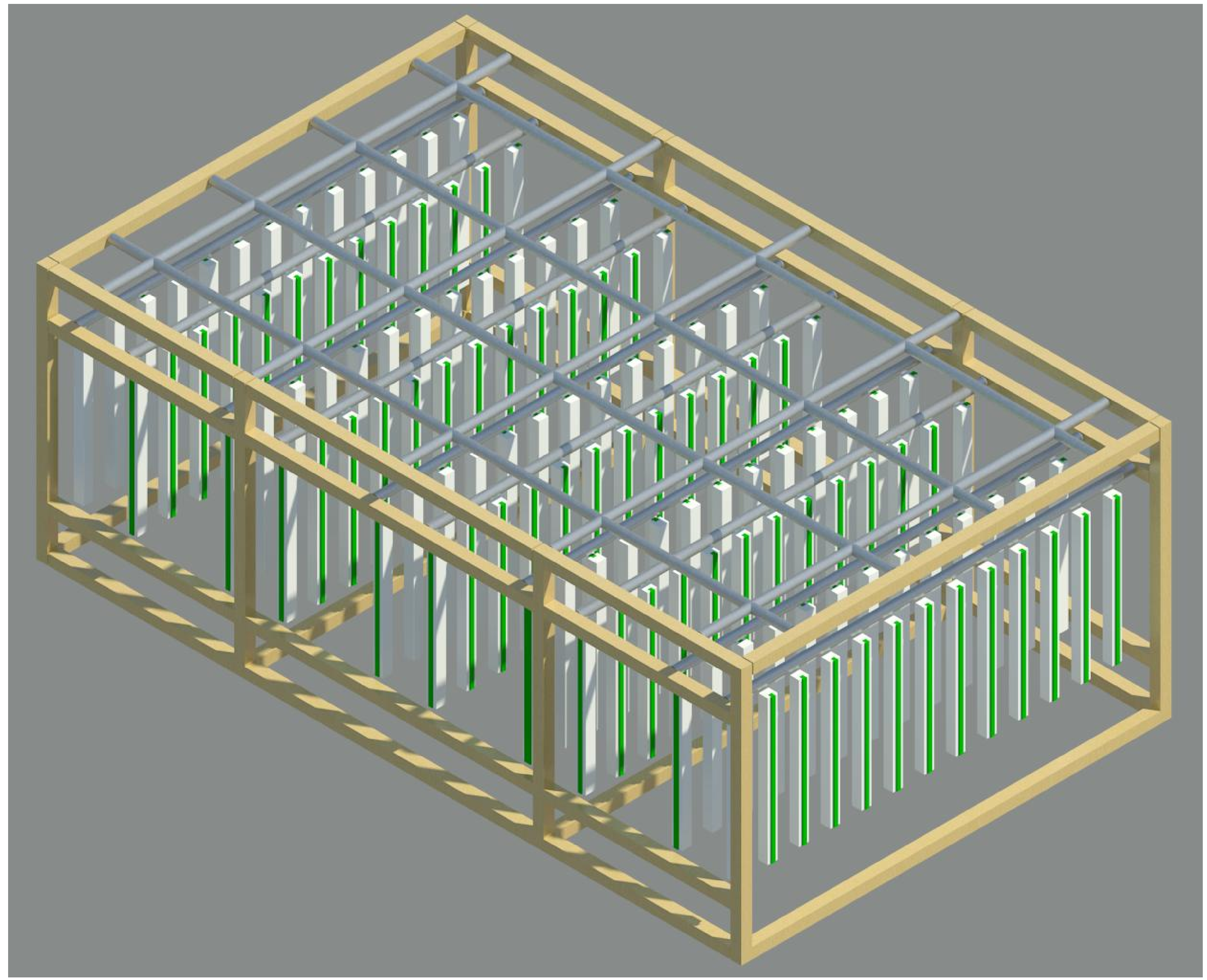




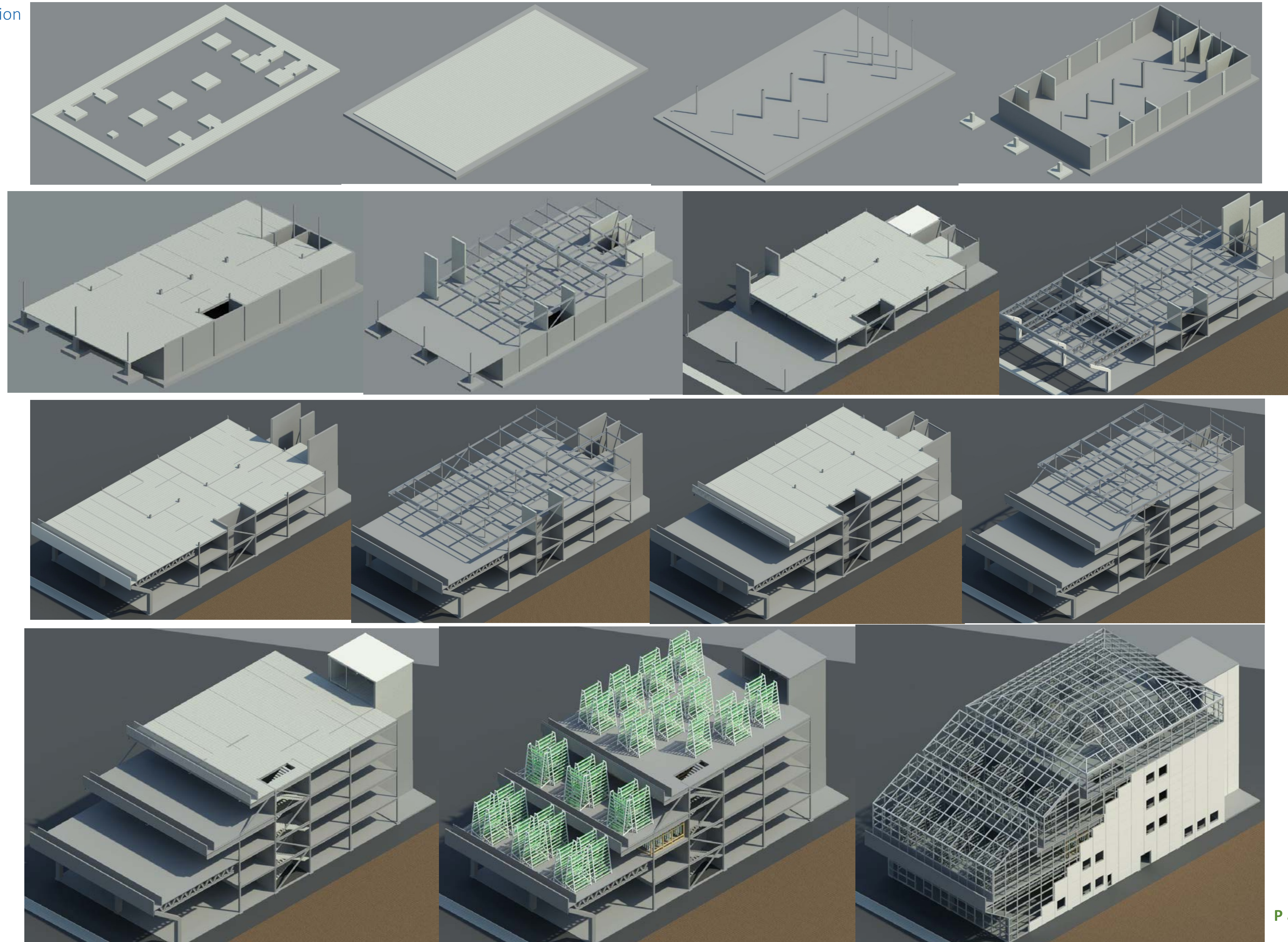


Typical ZipGrow Frame and Tower System





Revit Phasing Virtual Construction



Building Systems Integration Supplementary Drawings

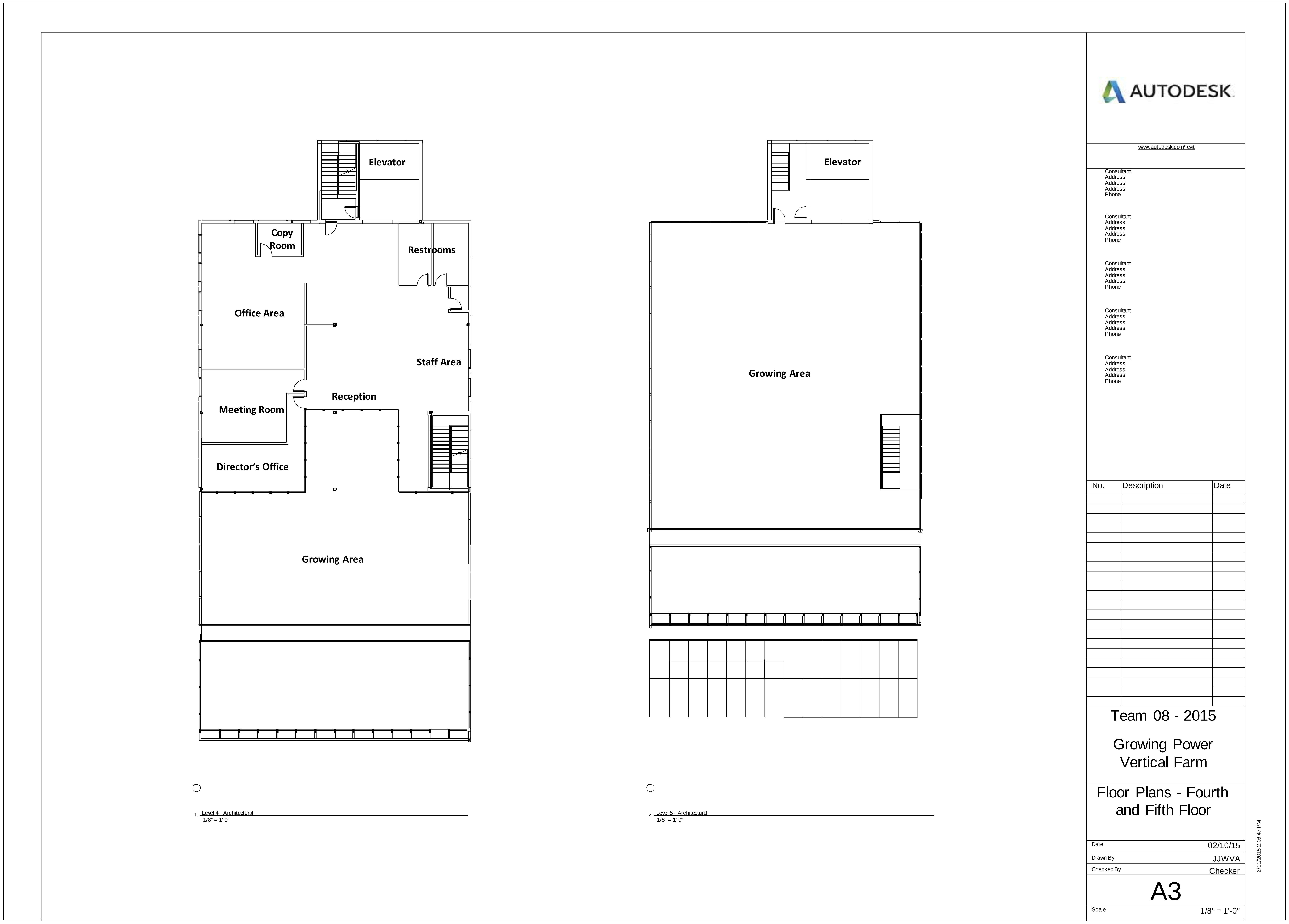
Greenhouse Lighting Control Zoning

THIRD FLOOR FOURTH FLOOR FIFTH FLOOR

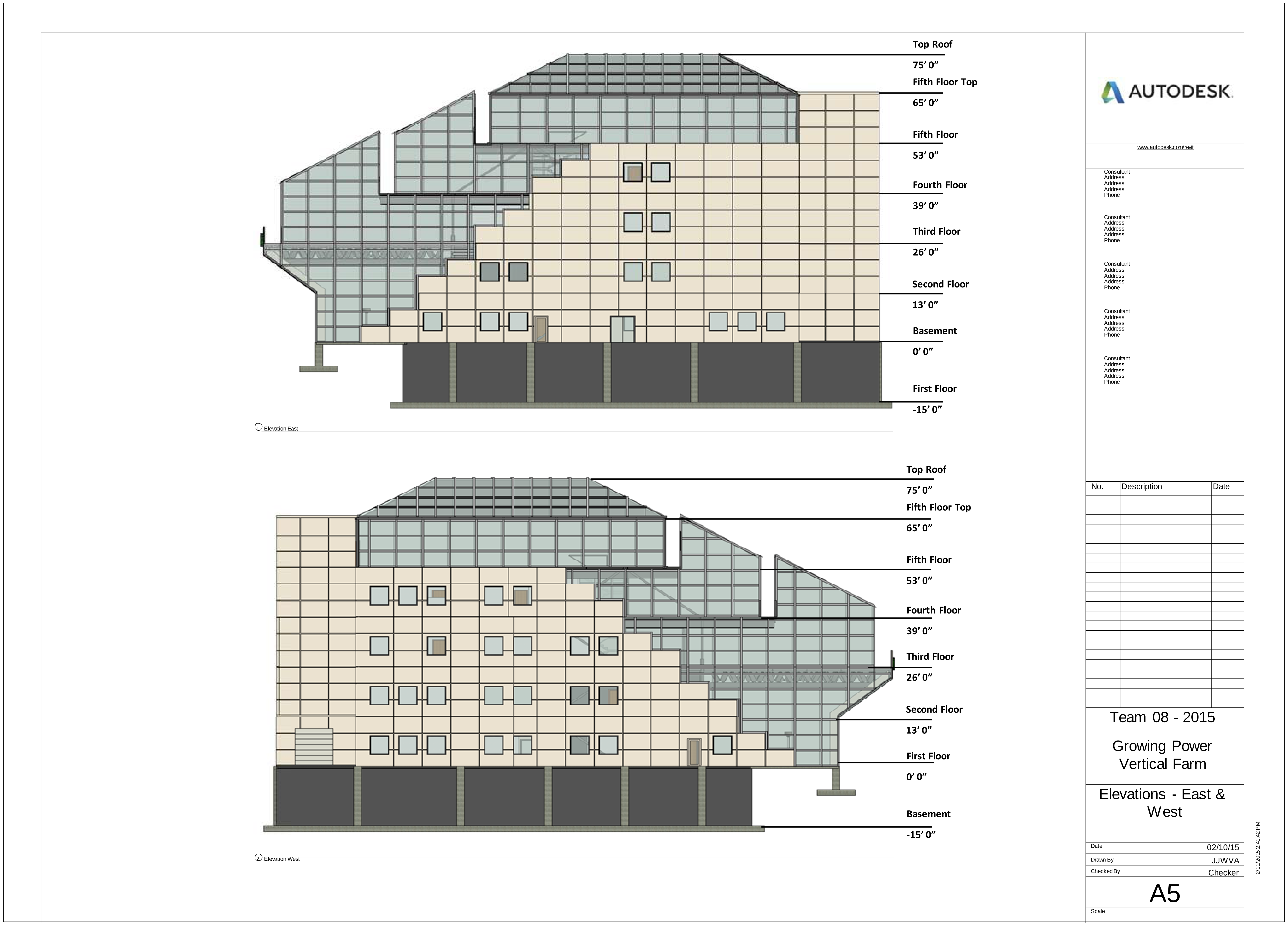
Basement & First Floor Architectural Floor Plans

Second Flor & Third Floor Architectural Floor Plans

Fourth Floor & Fifth Floor Architectural Floor Plans



East & West Elevations



North & South Elevations

Structural Supporting Documentation & Drawings Section

Notes

STRUCTURAL STEEL

1 STRUCTURAL STEEL SHALL BE NEW STEEL CONFORMING TO THE FOLLOWING:

(A)	UNLESS OTHERWISE NOTED	ASTM 992 OR A588 GRADE 50 (Fy=50 KSI)
(B)	ANGLES, CHANNELS, PLATES, BASE PLATES, AND BARS	ASTM A36 (Fy=36 KSI)
(C)	SQUARE AND RECTANGLE HOLLOW STRUCTURAL SECTIONS (HSS)	ASTM (A500, GRADE B (Fy=46 KSI)
(D)	ANCHOR RODS	ASTM F1554
(E)	HIGH STRENGTH BOLTS	ASTM A325

2 BOLTED CONNECTIONS SHALL BE AS FOLLOWS

(A) MINIMUM BOLT DIAMETER - 3/4"; TWO BOLTS MINIMUM

(B) STANDARD, OVERSIZED, OR HORIZONTAL SHORT-SLOTTED HOLES IN WEBS OF BEAMS

(C) SHEAR CONNECTIONS FOR MOMENT-CONNECTED MEMBERS - FRICTION TYPE HIGH STRENGTH BOLTS IN SINGLE SHEAR

(D) SHEAR CONNECTIONS FOR OTHER MEMBERS - SIMPLE SHEAR CONNECTIONS WITH EITHER FRICTION-TYPE HIGH STRENGTH BOLTS IN SINGLE SHEAR OR BEARING-TYPE HIGH STRENGTH BOLTS (THREADS INCLUDED IN SHEAR PLANE) IN SINGLE OR DOUBLE SHEAR

(E) SIMPLE SHEAR CONNECTIONS SHALL BE CAPABLE OF END ROTATION PER AISC REQUIREMENTS FOR "UNRESTRAINED MEMBERS"

3 BEAM AND GIRDER SHEAR CONNECTIONS TO COLUMNS SHALL CONSIST OF ONLY SIMPLE SHEAR CONNECTIONS CAPABLE OF END ROTATION PER AISC REQUIRMENTS. UNLESS NOTED OTHERWISE ON THE DRAWINGS, ANY CONNECTION TO COLUMNS THAT ARE NOT CAPABLE OF END ROTATION SHALL BE DESIGNED SO THAT NO MOMENT RESULTS ABOUT THE COLUMN CENTERLINE. ANY MOMENT DEVELOPED DUE TO ECCENTRICITY OF THE CENTER OF GRAVITY OF THE CONNECTION GROUP ABOUT THE COLUMN CENTERLINE SHALL BE RESOLVED BY THE INCLUSION OF SUPPLEMENTAL BOLTS OR WELDS

4 ANCHOR RODS, EMBED PLATES, LEVELING PLATES, OR BEARING PLATES SHALL BE LOCATED AND BUILT INTO CONNECTING WORK, PRESET BY TEMPLATES OR SIMILAR METHODS. PLATES SHALL BE SET IN FULL BEDS OF NON-SHRINK GROUT

5 ENDS OF COLUMNS AT SPLICES AND AT OTHER BEARING CONNECTIONS SHALL BE "FINISHED TO BEAR" TO COMPLETE TRUE BEARING

6 STRUCTURAL STEEL MEMBERS AND CONNECTIONS EXPOSED TO THE WEATHER SHALL BE GALVANIZED. REGIONS OF FIELD WELDS TO BE GALVANIZED SHALL BE TOUCHED UP WITH A ZINC RICH COATING AFTER COMPLETION AND INSPECTION OF THE WELD

7 CANTILEVERS SHALL BE TEMPORARILY SHORED UNTIL MOMENT CONNECTION IS INSTALLED TO FULL STRENGTH

STRUCTURAL DESIGN LOADS

1	DEAD LOADS		
	(A)	WEIGHT OF BUILDING COMPONENTS	AS REQUIRED
	(B)	ROOFING ALLOWANCE	60 PSF
	(C)	GREENHOUSE ROOF AREA - GLAZING & FRAMING	15 PSF
	(D)	GREENHOUSE AREAS	80 PSF
2	LIVE LOADS		
	(A)	OCCUPANCY CATEGORY	II
	(B)	INTERIOR UNLESS NOTED OTHERWISE	100 PSF
	(C)	LIGHT STORAGE	125 PSF
	(D)	LOADING DOCK	250 PSF
	(E)	MECHANICAL EQUIPMENT ROOM	150 PSF OR EQUIP WT
	(F)	CLASSROOMS	40 PSF
	(G)	OFFICES	50 PSF
	(H)	GREENHOUSE AREAS	80 PSF
3	SNOW LOADS		
	(A)	GROUND SNOW LOAD	30 PSF
	(B)	IMPORTANCE FACTOR (Is)	1.0
	(C)	EXPOSURE FACTOR (Ce)	0.9
	(D)	THERMAL FACTOR (Ct)	0.85
	(E)	FLAT ROOF SNOW LOAD	20 PSF + DRIFT
	(F)	GREENHOUSE SLOPED ROOF SNOW LOAD	15 PSF + DRIFT
4	WIND LOADS		
	(A)	BASIC WIND SPEED	115 MPH (WI) & 180 MPH (FL)
	(B)	IMPORTANCE FACTOR (Iw)	1.0
	(C)	EXPOSURE CATEGORY	C
	(D)	DIRECTIONALITY FACTOR (Kd)	0.85
	(E)	TOPOGRAPHIC FACTOR (Kzt)	1.0
	(F)	GUST FACTOR (G)	0.85
	(G)	EXTERNAL PRESSURE COEFFICIENT (Cp) (WINDWARD)	0.8
	(H)	EXTERNAL PRESSURE COEFFICIENT (Cp) (LEEWARD)	-0.5
	(I)	MAXIMUM WIND BASE SHEAR - EAST-WEST	35 KIPS
	(J)	MAXIMUM WIND BASE SHEAR - NORTH-SOUTH	25 KIPS
	(K)	MAIN WIND FORCE RESISTING SYSTEM - SHORT DIRECTION	SPECIAL REINFORCED MASONRY SHEAR WALL
	(L)	MAIN WIND FORCE RESISTING SYSTEM - LONG DIRECTION	STEEL SPECIAL TRUSS MOMENT FRAME
5	SEISMIC LOADS		
	(A)	Ss	0.087
	(B)	S1	0.046
	(C)	SITE CLASS - SITE SPECIFIC ANALYSIS	E
	(D)	Sds	0.144
	(E)	Sd1	0.108
	(F)	IMPORTANCE FACTOR (Ie)	1
	(G)	SEISMIC DESIGN CATEGORY	B
	(H)	BASIC LATERAL FORCE RESISTING SYSTEM - SHORT DIRECTION	SPECIAL REINFORCED MASONRY SHEAR WALL
	(I)	BASIC LATERAL FORCE RESISTING SYSTEM - LONG DIRECTION	STEEL SPECIAL TRUSS MOMENT FRAME
	(J)	RESPONSE MODIFICATION FACTOR	S= 5.5 L= 7.0
	(K)	OVERSTRENGTH FACTOR (Oo)	S= 2.5 L= 3.0
	(L)	DEFLECTION AMPLIFICATION FACTOR (Cd)	S= 4.0 L= 5.5
	(M)	ANALYSIS PROCEDURE	EQUIVALENT LATERAL FORCE
	(N)	BUILDING FUNDAMENTAL PERIOD (T)	0.5
	(O)	BUILDING SEISMIC WEIGHT	2,200 KIPS
	(P)	BASE SHEAR DUE TO SEISMIC LOADS	60 KIPS

USGS Seismic Report

USGS Design Maps Summary Report

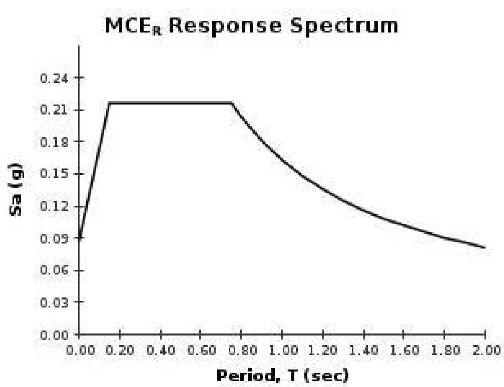
User–Specified Input

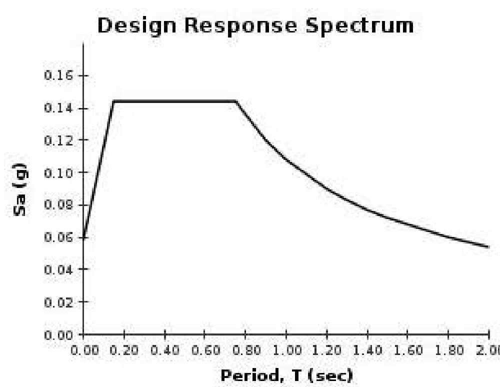
Building Code Reference Document	ASCE 7-10 Standard (which utilizes USGS hazard data available in 2008)
Site Coordinates	43.029°N, 87.913°W
Site Soil Classification	Site Class E – "Soft Clay Soil"
Risk Category	I/II/III

USGS–Provided Output

S_S =	0.087 g	S_{MS} =	0.216 g	S_{DS} =	0.144 g
S_1 =	0.046 g	S_{M1} =	0.163 g	S_{D1} =	0.108 g

For information on how the SS and S1 values above have been calculated from probabilistic (risk-targeted) and deterministic ground motions in the direction of maximum horizontal response, please return to the application and select the "2009 NEHRP" building code reference document.





For PGA_M, T_L, C_{RS}, and C_{R1} values, please view the detailed report.

Seismic Design Requirements 1/2

CHAPTER 12 SEISMIC DESIGN REQUIREMENTS FOR BUILDING STRUCTURES

Table 12.2-1 (*Continued*)

Seismic Force-Resisting System	ASCE 7 Section Where Detailing Requirements Are Specified	Response Modification Coefficient, R^a	Overstrength Factor, Ω_0^g	Deflection Amplification Factor, C_d^b	Structural System Limitations Including Structural Height, h_n (ft) Limits[c] — Seismic Design Category B	C	D^d	E^d	F^e
4. Special reinforced concrete shear walls[l,m]	14.2	6	2½	5	NL	NL	160	160	100
5. Ordinary reinforced concrete shear walls[l]	14.2	5	2½	4½	NL	NL	NP	NP	NP
6. Detailed plain concrete shear walls[l]	14.2 and 14.2.2.8	2	2½	2	NL	NP	NP	NP	NP
7. Ordinary plain concrete shear walls[l]	14.2	1½	2½	1½	NL	NP	NP	NP	NP
8. Intermediate precast shear walls[l]	14.2	5	2½	4½	NL	NL	40[k]	40[k]	40[k]
9. Ordinary precast shear walls[l]	14.2	4	2½	4	NL	NP	NP	NP	NP
10. Steel and concrete composite eccentrically braced frames	14.3	8	2 ½	4	NL	NL	160	160	100
11. Steel and concrete composite special concentrically braced frames	14.3	5	2	4½	NL	NL	160	160	100
12. Steel and concrete composite ordinary braced frames	14.3	3	2	3	NL	NL	NP	NP	NP
13. Steel and concrete composite plate shear walls	14.3	6½	2½	5½	NL	NL	160	160	100
14. Steel and concrete composite special shear walls	14.3	6	2½	5	NL	NL	160	160	100
15. Steel and concrete composite ordinary shear walls	14.3	5	2½	4½	NL	NL	NP	NP	NP
16. Special reinforced masonry shear walls	14.4	5½	2½	4	NL	NL	160	160	100
17. Intermediate reinforced masonry shear walls	14.4	4	2½	4	NL	NL	NP	NP	NP
18. Ordinary reinforced masonry shear walls	14.4	2	2½	2	NL	160	NP	NP	NP
19. Detailed plain masonry shear walls	14.4	2	2½	2	NL	NP	NP	NP	NP
20. Ordinary plain masonry shear walls	14.4	1½	2½	1¼	NL	NP	NP	NP	NP
21. Prestressed masonry shear walls	14.4	1½	2½	1¾	NL	NP	NP	NP	NP
22. Light-frame (wood) walls sheathed with wood structural panels rated for shear resistance	14.5	7	2½	4½	NL	NL	65	65	65
23. Light-frame (cold-formed steel) walls sheathed with wood structural panels rated for shear resistance or steel sheets	14.1	7	2½	4½	NL	NL	65	65	65
24. Light-frame walls with shear panels of all other materials	14.1and 14.5	2½	2½	2½	NL	NL	35	NP	NP
25. Steel buckling-restrained braced frames	14.1	8	2½	5	NL	NL	160	160	100
26. Steel special plate shear walls	14.1	7	2	6	NL	NL	160	160	100

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Seismic Design Requirements 2/2

MINIMUM DESIGN LOADS

Table 12.2-1 (*Continued*)

Seismic Force-Resisting System	ASCE 7 Section Where Detailing Requirements Are Specified	Response Modification Coefficient, R[a]	Overstrength Factor, Ω_0[g]	Deflection Amplification Factor, C_d[b]	Structural System Limitations Including Structural Height, h_n (ft) Limits[c] — Seismic Design Category B	C	D[d]	E[d]	F[e]
C. MOMENT-RESISTING FRAME SYSTEMS									
1. Steel special moment frames	14.1 and 12.2.5.5	8	3	5½	NL	NL	NL	NL	NL
2. Steel special truss moment frames	14.1	7	3	5½	NL	NL	160	100	NP
3. Steel intermediate moment frames	12.2.5.7 and 14.1	4½	3	4	NL	NL	35[h]	NP[h]	NP[h]
4. Steel ordinary moment frames	12.2.5.6 and 14.1	3½	3	3	NL	NL	NP[i]	NP[i]	NP[i]
5. Special reinforced concrete moment frames[n]	12.2.5.5 and 14.2	8	3	5½	NL	NL	NL	NL	NL
6. Intermediate reinforced concrete moment frames	14.2	5	3	4½	NL	NL	NP	NP	NP
7. Ordinary reinforced concrete moment frames	14.2	3	3	2½	NL	NP	NP	NP	NP
8. Steel and concrete composite special moment frames	12.2.5.5 and 14.3	8	3	5½	NL	NL	NL	NL	NL
9. Steel and concrete composite intermediate moment frames	14.3	5	3	4½	NL	NL	NP	NP	NP
10. Steel and concrete composite partially restrained moment frames	14.3	6	3	5½	160	160	100	NP	NP
11. Steel and concrete composite ordinary moment frames	14.3	3	3	2½	NL	NP	NP	NP	NP
12. Cold-formed steel—special bolted moment frame[p]	14.1	3½	3[o]	3½	35	35	35	35	35
D. DUAL SYSTEMS WITH SPECIAL MOMENT FRAMES CAPABLE OF RESISTING AT LEAST 25% OF PRESCRIBED SEISMIC FORCES	12.2.5.1								
1. Steel eccentrically braced frames	14.1	8	2½	4	NL	NL	NL	NL	NL
2. Steel special concentrically braced frames	14.1	7	2½	5½	NL	NL	NL	NL	NL
3. Special reinforced concrete shear walls[l]	14.2	7	2½	5½	NL	NL	NL	NL	NL
4. Ordinary reinforced concrete shear walls[l]	14.2	6	2½	5	NL	NL	NP	NP	NP
5. Steel and concrete composite eccentrically braced frames	14.3	8	2½	4	NL	NL	NL	NL	NL
6. Steel and concrete composite special concentrically braced frames	14.3	6	2½	5	NL	NL	NL	NL	NL

Continued

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Metal Deck Specification

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ASC STEEL DECK

2WH-36 Composite Deck 3.3

5 ½" Total Slab Depth

Normal Weight Concrete (145 pcf)

Concrete Volume 1.370yd³/100ft²

1 Hour Fire Rating

2W PANELS

GA	Vertical Load Span (in)	6'-0"	6'-6"	7'-0"	7'-6"	8'-0"	8'-6"	9'-0"	9'-6"	10'-0"	10'-6"	11'-0"	11'-6"	12'-0"	12'-6"	13'-0"
19	**ASD & LRFD - Superimposed Load, W (psf)**															
	ASD, W/Ω	913	772	660	569	495	434	382	339	301	269	242	218	196	178	161
	LRFD, ϕW	1461	1235	1055	911	792	694	611	542	482	431	387	348	314	284	257
	L/360	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	LRFD - Diaphragm Shear, ϕS_n (plf / ft) 36/4 Attachment Pattern															
	Arc Spot Weld 1/2" Effective Dia	4097	4065	4009	3959	3916	3878	3844	3836	3808	3782	3759	3738	3718	3717	3700
	PAF Base Steel ≥ .25"	3726	3723	3691	3663	3638	3616	3597	3602	3586	3570	3557	3544	3533	3539	3529
	PAF Base Steel ≥ 0.109"	3698	3698	3667	3641	3617	3597	3579	3585	3569	3555	3542	3530	3519	3526	3516
	#12 Screw Base Steel ≥ .034"	3677	3678	3649	3624	3602	3582	3565	3571	3556	3543	3530	3519	3508	3516	3506
	Concrete + Deck = 56.9 psf; I_{cr} = 69.8 in⁴/ft; M_{no}/Ω = 54.0 kip-in/ft; V_n/Ω = 4.57 kip/ft															
	$(I_{cr}+I_u)/2$ = 113.2 in⁴/ft; I_u = 156.6 in⁴/ft; ϕM_{no} = 82.6 kip-in/ft; ϕV_n = 6.86 kip/ft															
18	Vertical Load Span (in)	6'-0"	6'-6"	7'-0"	7'-6"	8'-0"	8'-6"	9'-0"	9'-6"	10'-0"	10'-6"	11'-0"	11'-6"	12'-0"	12'-6"	13'-0"
	ASD & LRFD - Superimposed Load, W (psf)															
	ASD, W/Ω	1004	849	726	627	546	479	423	375	334	299	269	242	219	198	180
	LRFD, ϕW	1607	1359	1162	1004	874	766	676	600	535	478	430	387	350	317	288
	L/360	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	LRFD - Diaphragm Shear, ϕS_n (plf / ft) 36/4 Attachment Pattern															
	Arc Spot Weld 1/2" Effective Dia	4202	4171	4106	4050	4001	3958	3919	3913	3880	3851	3824	3800	3778	3778	3758
	PAF Base Steel ≥ .25"	3782	3783	3746	3714	3686	3661	3639	3647	3628	3611	3595	3581	3568	3577	3565
	PAF Base Steel ≥ 0.109"	3752	3755	3720	3690	3663	3640	3619	3628	3610	3593	3578	3565	3552	3562	3550
	#12 Screw Base Steel ≥ .034"	3730	3735	3702	3672	3647	3624	3604	3614	3597	3581	3567	3553	3541	3552	3541
	Concrete + Deck = 57.2 psf; I_{cr} = 75.2 in⁴/ft; M_{no}/Ω = 59.1 kip-in/ft; V_n/Ω = 4.57 kip/ft															
	$(I_{cr}+I_u)/2$ = 117.2 in⁴/ft; I_u = 159.1 in⁴/ft; ϕM_{no} = 90.5 kip-in/ft; ϕV_n = 6.86 kip/ft															
16	Vertical Load Span (in)	6'-0"	6'-6"	7'-0"	7'-6"	8'-0"	8'-6"	9'-0"	9'-6"	10'-0"	10'-6"	11'-0"	11'-6"	12'-0"	12'-6"	13'-0"
	ASD & LRFD - Superimposed Load, W (psf)															
	ASD, W/Ω	1238	1049	898	777	678	595	526	468	418	375	338	306	277	252	230
	LRFD, ϕW	1982	1678	1437	1243	1084	953	842	749	669	600	541	489	443	403	367
	L/360	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	LRFD - Diaphragm Shear, ϕS_n (plf / ft) 36/4 Attachment Pattern															
	Arc Spot Weld 1/2" Effective Dia	4467	4438	4353	4280	4216	4159	4109	4108	4065	4026	3991	3959	3929	3936	3910
	PAF Base Steel ≥ .25"	3925	3937	3888	3846	3809	3776	3747	3765	3739	3716	3695	3676	3658	3675	3659
	PAF Base Steel ≥ 0.109"	3867	3884	3839	3800	3766	3736	3709	3729	3705	3683	3664	3646	3629	3648	3633
	#12 Screw Base Steel ≥ .034"	3866	3883	3838	3799	3765	3735	3708	3728	3704	3682	3663	3645	3629	3647	3632
	Concrete + Deck = 57.8 psf; I_{cr} = 88.5 in⁴/ft; M_{no}/Ω = 72.4 kip-in/ft; V_n/Ω = 4.57 kip/ft															
	$(I_{cr}+I_u)/2$ = 127.1 in⁴/ft; I_u = 165.7 in⁴/ft; ϕM_{no} = 110.7 kip-in/ft; ϕV_n = 6.86 kip/ft															

All Gages	LRFD - Diaphragm Shear, ϕS_n (plf / ft) for all vertical load spans, WWF Designation or Area of Steel per foot width				
3/4" Welded Shear Studs	6x6 W1.4xW1.4 A_s = 0.028 in²/ft	6x6 W2.9xW2.9 A_s = 0.058 in²/ft	6x6 W4.0xW4.0 A_s = 0.080 in²/ft	4x4 W4xW4 A_s = 0.120 in²/ft	4x4 W6xW6 A_s = 0.180 in²/ft
12 in o.c.	n/a	5890	6880	8680	11380
24 in o.c.	n/a	5890	6880	7750	7750
36 in o.c.	n/a	5170	5170	5170	5170

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Open Web Steel Truss Joist Specification

VULCRAFT

Design Guide Weight Table / Vulcraft Noncomposite Steel Joists, VLH-Series

Based on an Allowable Tensile Stress of 30,000 psi.

Joist Span (ft)	Joist Depth (in)	(plf)	Total Uniformly Distributed Joist Load in Pounds Per Linear Foot																						
			200	250	300	350	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1800	2000	2200	2400	2700	3000
44	22	Wtj	10	11	14	15	16	20	24	27	31	35	41	44	50	51	57	60	64	72	87	88	97	108	126
		W360	104	121	153	177	195	245	283	331	365	415	477	507	584	584	659	682	709	800	978	978	1037	1140	1339
	24	Wtj	8	10	11	13	15	18	22	25	29	33	37	41	44	48	51	54	57	68	72	87	88	97	118
		W360	114	134	157	193	212	262	309	361	411	460	522	576	613	657	707	750	797	913	972	1188	1188	1264	1501
	26	Wtj	8	9	11	12	14	17	21	24	26	30	34	37	41	44	48	51	54	60	68	73	88	90	103
		W360	123	147	180	201	228	287	350	405	450	507	570	620	685	730	782	842	892	987	1090	1161	1420	1420	1585
	28	Wtj	8	9	10	12	13	16	18	22	24	28	32	35	38	42	45	48	51	58	61	69	81	89	95
		W360	130	157	194	216	254	313	363	429	473	554	614	668	727	804	857	918	989	1115	1160	1283	1504	1673	1727
	30	Wtj	7	9	10	11	13	16	18	21	24	26	29	32	35	38	42	44	48	51	58	64	69	81	89
		W360	136	174	214	243	270	348	402	474	548	609	661	712	774	842	931	994	1065	1147	1295	1406	1492	1749	1947
	33	Wtj	7	9	10	11	12	15	17	20	22	25	27	30	32	35	38	42	42	49	55	61	61	73	83
		W360	166	201	240	268	316	387	457	532	606	669	744	809	871	948	1032	1142	1142	1306	1493	1655	1655	1955	2153
	36	Wtj	8	9	9	10	11	14	16	18	21	24	26	29	30	34	36	38	42	49	50	57	61	69	82
		W360	198	226	262	299	346	429	509	588	665	765	842	921	972	1091	1139	1183	1315	1572	1572	1797	1995	2215	2599
	40	Wtj	12	12	10	10	12	14	16	18	20	22	24	27	29	32	33	35	38	42	49	51	57	63	71
		W360	336	336	319	354	409	494	594	678	761	864	953	1049	1149	1259	1311	1361	1477	1642	1966	1966	2248	2498	2776
	44	Wtj	8	9	9	10	11	13	15	17	20	21	24	26	28	30	32	34	37	42	44	51	56	60	65
		W360	299	334	363	402	442	568	664	746	890	964	1105	1214	1317	1401	1453	1599	1723	1907	2006	2403	2538	2862	3058
46	24	Wtj	9	11	12	14	16	20	24	27	31	35	41	44	48	51	57	59	64	72	87	88	97	108	126
		W360	109	127	153	186	205	259	298	349	386	439	504	536	574	618	697	723	752	850	1039	1039	1105	1215	1428
	26	Wtj	9	10	11	13	15	18	22	25	29	33	37	41	44	48	51	54	57	68	72	87	88	98	117
		W360	118	138	162	200	219	271	320	374	426	477	542	599	638	684	736	780	830	953	1015	1242	1242	1323	1573
	28	Wtj	8	9	11	12	14	17	21	24	26	30	35	37	42	44	48	51	54	60	68	72	88	89	103
		W360	126	149	184	211	233	293	358	414	460	519	584	636	703	749	803	865	916	1014	1122	1195	1463	1463	1635
	30	Wtj	8	9	11	12	14	17	19	22	25	29	32	35	38	42	44	48	51	58	64	69	81	89	95
		W360	139	173	202	236	269	328	381	433	507	578	622	677	736	814	869	931	1003	1132	1229	1304	1530	1702	1758
	33	Wtj	8	9	10	12	13	16	18	21	24	27	30	32	35	38	42	45	48	54	59	61	69	82	89
		W360	147	185	227	266	303	371	429	506	585	651	708	761	829	902	998	1065	1142	1305	1389	1447	1604	1883	2096
	36	Wtj	8	9	10	11	13	15	17	20	22	24	27	30	33	36	38	42	43	49	56	61	62	74	83
		W360	176	217	262	281	331	417	478	558	636	703	781	850	915	996	1084	1201	1201	1375	1571	1744	1744	2063	2273
	40	Wtj	8	9	10	11	12	15	17	20	21	24	27	29	32	34	37	38	42	47	51	57	62	67	80
		W360	215	252	284	335	390	464	573	665	723	833	917	1004	1101	1146	1234	1291	1435	1600	1719	1965	2184	2311	2657
	44	Wtj	13	13	11	11	12	15	16	19	20	23	25	27	30	31	34	38	41	43	48	54	58	64	72
		W360	357	357	351	387	450	555	631	721	810	966	1016	1118	1225	1271	1398	1506	1668	1754	1955	2219	2403	2673	2974
48	24	Wtj	9	11	13	15	17	21	26	30	34	38	44	48	51	57	60	68	72	87	88	97	107	126	137
		W360	99	120	149	168	194	237	291	328	369	418	472	505	544	613	636	702	747	913	913	972	1068	1256	1340
	26	Wtj	9	11	12	15	16	21	24	27	31	35	41	44	48	51	57	60	64	72	87	88	97	108	127
		W360	113	132	159	193	214	269	311	364	403	458	527	561	601	647	730	759	790	892	1092	1092	1164	1279	1506
	28	Wtj	9	10	12	14	15	18	23	26	30	34	37	42	44	48	51	55	58	68	73	88	89	98	118
		W360	121	149	173	205	232	279	347	404	456	514	559	618	659	706	760	806	858	986	1050	1286	1286	1373	1633
	30	Wtj	8	10	11	13	15	17	22	24	27	32	35	37	42	44	48	51	55	60	69	81	88	93	103
		W360	127	157	187	214	260	298	381	421	468	547	595	647	716	764	819	882	935	1036	1147	1345	1497	1546	1676
	33	Wtj	8	9	11	12	14	16	19	22	26	29	32	35	38	42	45	48	51	55	61	69	81	89	94
		W360	140	176	217	243	275	351	409	466	572	622	670	729	793	878	937	1004	1082	1148	1273	1411	1655	1843	1906
	36	Wtj	8	9	10	11	14	16	19	21	24	27	30	33	36	38	42	45	48	55	60	61	70	83	90
		W360	160	194	239	266	319	391	452	534	618	687	747	805	876	953	1056	1128	1209	1382	1534	1534	1703	1998	2225
	40	Wtj	9	9	10	11	13	15	18	20	22	26	29	32	34	36	38	42	44	50	56	61	63	72	83
		W360	211	236	272	314	362	456	521	611	664	806	883	968	1008	1093	1135	1262	1319	1511	1728	1921	1921	2134	2506
	44	Wtj	12	13	10	11	13	15	17	19	22	25	28	29	30	34	37	40	42	48	50	57	60	68	81
		W360	314	333	309	358	417	511	613	684	775	893	983	1077	1117	1229	1325	1466	1542	1719	1848	2113	2200	2487	2864
	48	Wtj	9	10	10	12	13	15	17	20	21	23	26	29	31	32	36	39	40	44	49	56	59	64	71
		W360	274	306	356	394	438	568	664	758	853	928	1070	1178	1291	1339	1473	1588	1662	1850	2062	2342	2536	2825	2989
50	26	Wtj	9	11	13	15	17	21	26	30	34	38	44	48	50	57	59	68	71	87	87	97	107	126	136
		W360	103	126	155	175	195	249	306	344	388	439	496	531	572	646	671	741	789	965	965	1029	1131	1331	1420
	28	Wtj	9	11	12	15	16	21	24	27	32	36	41	44	48	51	57	60	64	72	87	88	97	108	126
		W360	116	143	164	199	220	278	322	376	417	475	546	582	624	672	758	788	822	929	1137	1137	1214	1335	1573
	30	Wtj	9	10	12	14	15	18	23	26	30	35	37	42	44	51	51	57	60	68	72	88	89	103	118
		W360	123	152	184	209	237	285	354	414	467	526	572	633	675	780	780	880	916	1014	1080	1323	1323	1482	1684
	33	Wtj	8	10	12	13	15	18	21	24	27	30	34	37	42	44	48	51	54	60	68	80	88	89	103
		W360	137	170	207	236	263	334	393	455	506	571	644	701	776	828	888	957	1015	1125	1247	1463	1629	1629	1829
	36	Wtj	8	9	11	12	14	17	20	22	26	29	32	35	38	42	45	48	52	56	61	69	128	89	93
		W360	154	186	229	257	291	372	434	494	572	660	711	774	843	933	997	1068	1152	1221	1356	1505	2743	1967	2036
	40	Wtj	10	10	11	12	14	16	19	21	24	27	29	32	36	38	42	43	49	56	57	62	71	84	91
		W360	217	217	252	303	350	430	498	587	648	757	781	856	966	1052	1116	1166	1336	1527	1527	1698	1887	2216	2468
	44	Wtj	8	10	10	12	14	16	18	20	24	26	29	31	34	37	40	42	45	51	58	59	63	71	84
		W360	213	263	292	338	409	491	560	630	751	825	952	988	1087	1171	1296	1363	1424	1633	1868	1945	2078	2312	2716
	48	Wtj	9	9	11	12	13	15	18	20	22	25	28	30	32	35	38	39	43	49	52	60	64	68	75
		W360	264	271	327	378	440	525	648	724	820	899	1041	1141	1183	1302	1404	1469	1635	1823	1960	2242	2442	2643	2781
Bridging Rows			3		2									1											

Joists whose weight is shown to the left of the heavy red line have 2 1/2 inch deep bearings.
Joists whose weight is shown between the heavy red and black lines have 5 inch deep bearings.
Joists whose weight is shown between the heavy black and blue lines have 7 1/2 inch deep bearings.
Joists whose weight is shown to the right of the heavy blue line have 10 inch deep bearinngs.

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Gravity Load Framing

GRAVITY LOAD FRAMING 1/5

HORIZONTAL

plant point loads
special condition
beam and plant point loads
beam point loads
don't fill

FLOOR	BEAM # (Floor-#)	Nominal LENGTH (ft)	TYPE (1,2, or 3)	area LL (psf)	area DL (psf)	Tributary Width (ft)	IFF 3, Dist. Load (lb/ft)	Dist total load (k)	Point load 1 (k)	Point load 2 (k)	Point Load 3 (k)	Total Load (k)
G-1	000-01	21.00	1	250	60	7.5	2325	48.83	13.200			62.025
	000-02	11.00	1					0.00				0.000
	000-03	11	1	60	80	6.5	910	10.01				10.010
	000-04	16.50	1	100	60	5.5	880	14.52				14.520
	000-05	15.00	1	100	60	4.5	720	10.80				10.800
	000-06	16.00	1	100	60	10.0	1600	25.60				25.600
	000-07	10.00	1									0.000
	000-08	16.50	1	100	60	10.0	1600	26.40				26.400
	000-09	12.50	1	100	60	4.5	720	9.00				9.000
	000-10	27.00	1						10.800	10.800		21.600
	000-11	27.00	2						22.320	22.320		44.640
	000-12	27.00	2	100	60	5.0	800	21.60	11.520	11.520		44.640
	000-13	27.00	2	100	60	5.0	800	21.60	11.880	11.880		45.360
	000-14	27.00	2						20.880	20.880		41.760
	000-15	27.00	1						9.000	9.000		18.000
	000-16	35.00	1	100	60	10.5	1680	58.80	22.320	22.320	16.100	119.540
	000-17	35.00	1	100	60	10.5	1680	58.80	22.680	20.880	16.100	118.460
	000-18	23.00	1						16.100			16.100
	000-19	23.00	2						16.100	16.100		32.200
	000-20	23.00	1						16.100	16.100		32.200
	000-21	23.00	2						16.100	16.100		32.200
	000-22	23.00	1						16.100			16.100
	000-23	35.00	1	100	60	11.0	1760	61.60	16.100	14.000		91.70
	000-24	25.00	1	100	60	11.0	1760	44.00	10.000	16.100		70.100
	000-25	20.00	1						14.000			14.000
	000-26	20.00	2						14.000	14.000		28.000
	000-27	20.00	1						14.000	10.000		24.000
	000-28	20.00	2						10.000	10.000		20.000
	000-29	20.00	1						10.000			10.000
	000-30	20.00	1									0.000
	000-31	25.00	1	100	60	5.0	800	20.00	14.000	20.417		54.417
	000-32	25.00	1	100	60	10.0	1600	40.00	10.000	15.400		65.400
	000-33	20.42	1									0.000
	000-34	20.42	1	100	60	6.5	1040	21.23				21.233
	000-35	20.42	2	100	60	12.5	2000	40.83				40.833
	000-36	20.42	1	100	60	6.5	1040	21.23	15.400			36.633
	000-37	20.42	2						15.400	15.400		30.800
	000-38	20.42	1						15.400			15.400
	000-39	25.00	1	100	60	6.5	1040	26.00	20.417	0.000		46.417
	000-40	35.00	1	100	60	12.0	1920	67.20	15.400	0.000		82.600
	000-41	12.67	1									0.000
	000-42	12.67	1									0.000
	000-43	12.67	1									0.000
	000-44	12.67	1									0.000
	000-45	12.67	1									0.000
	000-46	15.00	3	100	60	9.0	1440	21.60				21.600
	000-47	15.00	3	100	60	9.0	1440	21.60				21.600
	000-48	16.00	3	100	60	9.0	1440	23.04				23.040
	000-49	16.00	3	100	60	9.0	1440	23.04				23.040
	000-50	16.50	3	100	60	9.0	1440	23.76				23.760
	000-51	16.50	3	100	60	9.0	1440	23.76				23.760
	000-52	12.50	3	100	60	9.0	1440	18.00				18.000
	000-53	12.50	3	100	60	9.0	1440	18.00				18.000
	000-54	17.50	3	100	60	11.5	1840	32.20				32.200
	000-55	17.50	3	100	60	11.5	1840	32.20				32.200
	000-56	17.50	3	100	60	11.5	1840	32.20				32.200
	000-57	17.50	3	100	60	11.5	1840	32.20				32.200
	000-58	17.50	3	100	60	10.0	1600	28.00				28.000
	000-59	17.50	3	100	60	10.0	1600	28.00				28.000
	000-60	12.50	3	100	60	10.0	1600	20.00				20.000
	000-61	12.50	3	100	60	10.0	1600	20.00				20.000
	000-62	17.50	3	100	60	11.0	1760	30.80				30.800
	000-63	17.50	3	100	60	11.0	1760	30.80				30.800
	000-64	16.50	2	100	60	10.0	1600	26.40				26.400
		1253.83 ^TOTAL L (ft)										

Sum of Loads--> 1878.288

BEAM #	Current Conditions – Strength: Loaded Max M due to uniform (k-ft)	Strength: M due to point loads (k-ft)	Strength: TOTAL M (k-ft)	Stiffness: Deflection limit (l/360) (in)	Chosen – Section Properties: SIZE W Depth (in)	SIZE W (weight) (lb/ft)	M (k-ft)	E (psi)	Ix (in^4)	Deflection due to uniform (in)	Deflection due to point (in)	TOTAL DEFLECTION (in)	TOTAL WEIGHT (lb)	CONNECTIONS: SHEAR (Start) (k)	SHEAR (End) (k)	Total Connection Loads (k)	Difference (error) (k)
000-01	128.2	69.3	197.5	0.70	21	44	238	29,000,000	843	0.4162	0.1800	0.5962	924.00	31.000	31.000	62.000	0.025
000-02			0.0	0.37	12	16	50.1	29,000,000	103			0.0000	176.00	0.000	0.000	0.000	0.000
000-03	13.8		13.76375	0.3666667	12	16	50.1	29000000	103	0.1004		0.10035972	176	5.005	5.005	10.010	0.000
000-04	29.9		29.9	0.55	12	19	61.6	29,000,000	130	0.3893		0.3893	313.50	7.260	7.260	14.520	0.000
000-05	20.3		20.3	0.50	21	44	238	29000000	843	0.0335		0.0335	660.00	5.400	5.400	10.800	0.000
000-06	51.2		51.2	0.53	12	19	61.6	29,000,000	130	0.6258		0.6258	304.00	12.800	12.800	25.600	0.000
000-07			0.0	0.33	12	16	50.1	29,000,000	103			0.0000	160.00	0.000	0.000	0.000	0.000
000-08	54.5		54.5	0.55	12	19	61.6	29,000,000	130	0.7078		0.7078	313.50	13.200	13.200	26.400	0.000
000-09	14.1		14.1	0.42	12	16	50.1	29000000	103	0.1324		0.1324	200.00	4.500	4.500	9.000	0.000
000-10		97.2	97.2	0.90	14	26	100	29,000,000	245		1.8350	1.8350	702.00	10.800	10.800	21.600	0.000
000-11		200.88	200.88	0.90	21	44	238	29,000,000	843		1.1022	1.1022	1188.00	22.320	22.320	44.640	0.000
000-12	72.9	103.68	176.58	0.90	16	40	182	29,000,000	518	0.6368	0.9258	1.5626	1080.00	22.320	22.320	44.640	0.000
000-13	72.9	106.92	179.82	0.90	16	40	182	29,000,000	518	0.6368	0.9547	1.5915	1080.00	22.680	22.680	45.360	0.000
000-14		187.92	187.92	0.90	18	40	196	29,000,000	612		1.4203	1.4203	1080.00	20.880	20.880	41.760	0.000
000-15		81	81	0.90	14	22	82.8	29,000,000	199		1.8827	1.8827	594.00	9.000	9.000	18.000	0.000
000-16	257.3	352.855	610.1	1.17	30	99	778	29,000,000	3990	0.4902		0.4902	3465.00	53.355	67.385	120.740	-1.200
000-17	257.3	339.43	596.7	1.17	27	84	609	29,000,000	2850	0.6863		0.6863	2940.00	64.300	55.361	119.661	-1.201
000-18		96.6	96.6	0.77	14	26	100	29,000,000	245		0.9925	0.9925	598.00	8.050	8.050	16.100	0.000
000-19		193.2	193.2	0.77	18	40	196	29,000,000	612		0.7947	0.7947	920.00	16.100	16.100	32.200	0.000
000-20		193.2	193.2	0.77	18	40	196	29,000,000	612		0.7947	0.7947	920.00	16.100	16.100	32.200	0.000
000-21		193.2	193.2	0.77	18	40	196	29,000,000	612		0.7947	0.7947	920.00	16.100	16.100	32.200	0.000
000-22		96.6	96.6	0.77	14	26	100	29,000,000	245		0.9925	0.9925	598.00	8.050	8.050	16.100	0.000
000-23	269.5	263.375	532.9	1.17	24	84	559	29,000,000	2370	0.8646	0.3616	1.2262	2940.00	45.860	45.850	91.710	-0.010
000-24	137.5	122.875	260.4	0.83	21	50	274	29,000,000	984	0.5421		0.5421	1250.00	31.830	38.270	70.100	0.000
000-25		70	70.0	0.67	14	22	82.8	29,000,000	199		0.6987	0.6987	440.00	7.000	7.000	14.000	0.000
000-26		140	140.0	0.67	18	35	166	29,000,000	510		0.5452	0.5452	700.00	14.000	14.000	28.000	0.000
000-27		120	120.0	0.67	16	31	135	29,000,000	375		0.6356	0.6356	620.00	12.000	12.000	24.000	0.000
000-28		100	100.0	0.67	14	30	118	29,000,000	291		0.6825	0.6825	600.00	10.000	10.000	20.000	0.000
000-29		50	50.0	0.67	12	16	50.1	29,000,000	103		0.9642	0.9642	320.00	5.000	5.000	10.000	0.000
000-30			0.0	0.67	12	16	50.1	29,000,000	103			0.0000	320.00	0.000	0.000	0.000	0.000
000-31	62.5	180.125	242.6	0.83	21	50	274	29,000,000	984	0.2464		0.2464	1250.00	30.010	24.410	54.420	-0.003
000-32	125.0	120.25	245.3	0.83	21	50	274	29,000,000	984	0.4928		0.4928	1250.00	29.620	35.780	65.400	0.000
000-33			0.0	0.68	12	16	50.1	29,000,000	103			0.0000	326.67	0.000	0.000	0.000	0.000
000-34	54.2		54.2	0.68	12	19	61.6	29,000,000	130			0.0000	387.92	10.617	10.617	21.233	0.000
000-35	104.2		104.2	0.68	14	30	118	29,000,000	291	0.9265		0.9265	612.50	20.417	20.417	40.833	0.000
000-36	54.2	80.85	135.0	0.68	14	34	136	29,000,000	340	0.4124	0.4785	0.8909	694.17	18.320	18.320	36.640	-0.007
000-37		161.7	161.7	0.68	18	35	166	29,000,000	510		0.6380	0.6380	714.58	15.400	15.400	30.800	0.000
000-38		80.85	80.9	0.68	14	34	136	29,000,000	340		0.4785	0.4785	694.17	7.700	7.700	15.400	0.000
000-39	81.3	127.625	208.9	0.83	21	44	238	29,000,000	843	0.3739	0.4698	0.8437	1100.00	23.209	23.210	46.419	-0.002
000-40	294.0	134.75	428.8	1.17	21	55	314	29,000,000	1140	1.9609	0.7190	2.6799	1925.00	41.300	41.300	82.600	0.000
000-41			0.0	0.42	12	16	50.1	29,000,000	103			0.0000	202.67	0.000	0.000	0.000	0.000
000-42			0.0	0.42	12	16	50.1	29,000,000	103			0.0000	202.67	0.000	0.000	0.000	0.000
000-43			0.0	0.42	12	16	50.1	29,000,000	103			0.0000	202.67	0.000	0.000	0.000	0.000
000-44			0.0	0.42	12	16	50.1	29,000,000	103			0.0000	202.67	0.000	0.000	0.000	0.000
000-45			0.0	0.42	12	16	50.1	29,000,000	103			0.0000	202.67	0.000	0.000	0.000	0.000
000-46	40.5		40.5	0.50	14	22	82.8	29,000,000	199	0.2842		0.2842	330.00	10.800	10.800	21.600	0.000
000-47	40.5		40.5	0.50	14	22	82.8	29,000,000	199	0.2842		0.2842	330.00	10.800	10.800	21.600	0.000
000-48	46.1		46.1	0.53	12	26	92.8	29,000,000	204	0.3589		0.3589	416.00	11.520	11.520	23.040	0.000
000-49	46.1		46.1	0.53	12	26	92.8	29,000,000	204	0.3589		0.3589	416.00	11.520	11.520	23.040	0.000
000-50	49.0		49.0	0.55	14	26	100	29,000,000	245	0.3380		0.3380	429.00	11.880	11.880	23.760	0.000
000-51	49.0		49.0	0.55	14	26	100	29,000,000	245	0.3380		0.3380	429.00	11.880	11.880	23.760	0.000
000-52	28.1		28.1	0.42	12	19	61.6	29,000,000	130	0.2098		0.2098	237.50	9.000	9.000	18.000	0.000
000-53	28.1		28.1	0.42	12	19	61.6	29,000,000	130	0.2098		0.2098	237.50	9.000	9.000	18.000	0.000
000-54	70.4		70.4	0.58	12	22	73.1	29,000,000	156	0.8583		0.8583	385.00	16.100	16.100	32.200	0.000
000-55	70.4		70.4	0.58	12	22	73.1	29,000,000	156	0.8583		0.8583	385.00	16.100	16.100	32.200	0.000
000-56	70.4		70.4	0.58	12	22	73.1	29,000,000	156	0.8583		0.8583	385.00	16.100	16.100	32.200	0.000
000-57	70.4		70.4	0.58	12	22	73.1	29,000,000	156	0.8583		0.8583	385.00	16.100	16.100	32.200	0.000
000-58	61.3		61.3	0.58	10	22	64.9	29,000,000	118	0.9867		0.9867	385.00	14.000	14.000	28.000	0.000
000-59	61.3		61.3	0.58	10	22	64.9	29,000,000	118	0.9867		0.9867	385.00	14.000	14.000	28.000	0.000
000-60	31.3		31.3	0.42	12	16	50.1	29,000,000	103	0.2942		0.2942	200.00	10.000	10.000	20.000	0.000
000-61	31.3		31.3	0.42	12	16	50.1	29,000,000	103	0.2942		0.2942	200.00	10.000	10.000	20.000	0.000
000-62	67.4		67.4	0.58	12	22	73.1	29,000,000	156	0.8210		0.8210	385.00	15.400	15.400	30.800	0.000
000-63	67.4		67.4	0.58	12	22	73.1	29,000,000	156	0.8210		0.8210	385.00	15.400	15.400	30.800	0.000
000-64	54.5		54.5	0.55	12	19	61.6	29,000,000	130	0.7078		0.7078	313.50	13.200	13.200	26.400	0.000
													43088.83 ^TOTAL W(lb)	934.302	946.384		

Sum of Reactions--> 1880.686

Gravity Load Framing

GRAVITY LOAD FRAMING 2/5

FLOOR	BEAM #	Nominal LENGTH	TYPE	area LL	area DL	Tributary Width	IFF 3, Dist. Load	Dist total load	Point load 1	Point load 2	Point Load 3	Total Load	Loaded Max M due to uniform	M due to point loads	TOTAL M
	(Floor-#)	(ft)	(1,2, or 3)	(psf)	(psf)	(ft)	(lb/ft)	(k)	(k)	(k)	(k)	(k)	(k-ft)	(k-ft)	(k-ft)
1-1	001-01	21.00	1						7.425			7.425		38.98	39.0
	001-02	11.00	1									0.000			0.0
	001-03	11.00	1									0.000			0.0
	001-04	16.00	1	30	60	5.3	473	7.56				7.560	15.1		15.1
	001-05	10.00	1									0.000			0.0
	001-06	16.50	1									0.000			0.0
	001-07	16.50	1	100	60	5.5	880	14.52				14.520	29.9		29.9
	001-08	15.00	1	100	60	4.5	720	10.80				10.800	20.3		20.3
	001-09	16.00	1	100	60	9.5	1520	24.32				24.320	48.6		48.6
	001-10	10.00	1									0.000			0.0
	001-11	16.50	1	100	60	9.5	1520	25.08				25.080	51.7		51.7
	001-12	12.50	1	100	60	4.6	736	9.20				9.200	14.4		14.4
	001-13	27.00	1						10.800	10.800		21.600		97.2	97.2
	001-14	27.00	2						22.320	22.320		44.640		200.88	200.9
	001-15	27.00	2	100	60	5.0	800	21.60	11.520	11.520		44.640	72.9	103.68	176.6
	001-16	27.00	2	100	60	5.0	800	21.60	11.880	11.880		45.360	72.9	106.92	179.8
	001-17	27.00	2						20.880	20.880		41.760		187.92	187.9
	001-18	27.00	1						9.000	9.000		18.000		81	81.0
	001-19	35.00	1	100	60	10.5	1680	58.80	22.320	16.100	22.320	119.540	257.3	353.315	610.6
	001-20	35.00	1	100	60	10.5	1680	58.80	22.680	16.100	20.880	118.460	257.3	340.075	597.3
	001-21	23.00	1						16.100			16.100		92.575	92.6
	001-22	23.00	2						16.100	16.100		32.200		185.15	185.2
	001-23	23.00	1						16.100	16.100		32.200		92.575	92.6
	001-24	23.00	2						16.100	16.100		32.200		185.15	185.2
	001-25	23.00	1						16.100			16.100		92.58	92.6
	001-26	35.00	1	100	60	11.0	1760	61.60	16.100	14.000		91.700	269.5	263.375	532.9
	001-27	25.00	1	100	60	11.0	1760	44.00	10.000	16.100		70.100	137.5	122.875	260.4
	001-28	20.00	1						14.000			14.000		70	70.0
	001-29	20.00	2						14.000	14.000		28.000		140	140.0
	001-30	20.00	1						14.000	10.000		24.000		120	120.0
	001-31	20.00	2						10.000	10.000		20.000		100	100.0
	001-32	20.00	1						10.000			10.000		50	50.0
	001-33	20.00	1									0.000			0.0
	001-34	25.00	1	100	60	5.0	800	20.00	14.000	20.500		54.500	62.5	180.625	243.1
	001-35	25.00	1	100	60	10.0	1600	40.00	10.000	14.700		64.700	125.0	117.625	242.6
	001-36	20.42	1									0.000			0.0
	001-37	20.42	1	100	60	6.5	1040	21.23				21.233	54.2		54.2
	001-38	20.42	2	100	60	12.5	2000	40.83				40.833	104.2		104.2
	001-39	20.42	1	100	60	6.5	1040	21.23	14.700			35.933	54.2	75.34	129.5
	001-40	20.42	2						14.700	14.700		29.400		150.675	150.7
	001-41	20.42	1						14.700			14.700		75.34	75.3
	001-42	25.00	1						20.417			20.417		256.25	256.3
	001-43	35.00	1	100	60	6.5	1040	36.40	14.700			51.100	159.3	128.625	287.9
	001-44	16.50	2	30	60	10.0	900	14.85				14.850	30.6		30.6
	001-45	15.00	3	100	60	9.0	1440	21.60				21.600	40.5		40.5
	001-46	15.00	3	100	60	9.0	1440	21.60				21.600	40.5		40.5
	001-47	16.00	3	100	60	9.0	1440	23.04				23.040	46.1		46.1
	001-48	16.00	3	100	60	9.0	1440	23.04				23.040	46.1		46.1
	001-49	16.50	3	100	60	9.0	1440	23.76				23.760	49.0		49.0
	001-50	16.50	3	100	60	9.0	1440	23.76				23.760	49.0		49.0
	001-51	12.50	3	100	60	9.0	1440	18.00				18.000	28.1		28.1
	001-52	12.50	3	100	60	9.0	1440	18.00				18.000	28.1		28.1
	001-53	17.50	3	100	60	11.5	1840	32.20				32.200	70.4		70.4
	001-54	17.50	3	100	60	11.5	1840	32.20				32.200	70.4		70.4
	001-55	17.50	3	100	60	11.5	1840	32.20				32.200	70.4		70.4
	001-56	17.50	3	100	60	11.5	1840	32.20				32.200	70.4		70.4
	001-57	17.50	3	100	60	10.0	1600	28.00				28.000	61.3		61.3
	001-58	17.50	3	100	60	10.0	1600	28.00				28.000	61.3		61.3
	001-59	12.50	3	100	60	10.0	1600	20.00				20.000	31.3		31.3
	001-60	12.50	3	100	60	10.0	1600	20.00				20.000	31.3		31.3
	001-61	17.50	3	100	60	10.5	1680	29.40				29.400	64.3		64.3
	001-62	17.50	3	100	60	10.5	1680	29.40				29.400	64.3		64.3
		1233.00 ^TOTAL L (ft)													

BEAM #	Deflection limit (l/360)	SIZE W	SIZE W (weight)	M	E	Ix	Deflection due to uniform	Deflection due to point	TOTAL DEFLECTION	TOTAL WEIGHT	SHEAR (Start)	SHEAR (End)	Total Connection Loads	Difference (error)
(Floor-#)	(in)	Depth (in)	(lb/ft)	(k-ft)	(psi)	(in^4)	(in)	(in)	(in)	(lb)	(k)	(k)	(k)	(k)
001-01	0.70	12	16	50.1	29000000	103		1.6092	1.6092	336.00	3.713	3.713	7.425	0.000
001-02	0.37	12	16	50.1	29,000,000	103			0.0000	176.00	0.000	0.000	0.000	0.000
001-03	0.37	12	16	50.1	29,000,000	103			0.0000	176.00	0.000	0.000	0.000	0.000
001-04	0.53	12	16	50.1	29000000	103	0.2333		0.2333	256.00	3.780	3.780	7.560	0.000
001-05	0.33	12	16	50.1	29,000,000	103			0.0000	160.00	0.000	0.000	0.000	0.000
001-06	0.55	12	16	50.1	29,000,000	103			0.0000	264.00	0.000	0.000	0.000	0.000
001-07	0.55	12	16	50.1	29,000,000	103	0.4913		0.4913	264.00	7.260	7.260	14.520	0.000
001-08	0.50	12	16	50.1	29,000,000	103	0.2746		0.2746	240.00	5.400	5.400	10.800	0.000
001-09	0.53	12	16	50.1	29,000,000	103	0.7504		0.7504	256.00	12.160	12.160	24.320	0.000
001-10	0.33	12	16	50.1	29,000,000	103			0.0000	160.00	0.000	0.000	0.000	0.000
001-11	0.55	12	19	61.6	29,000,000	130	0.6724		0.6724	313.50	12.540	12.540	25.080	0.000
001-12	0.42	12	16	50.1	29,000,000	103	0.1354		0.1354	200.00	4.600	4.600	9.200	0.000
001-13	0.90	14	26	100	29,000,000	245		1.8350	1.8350	702.00	10.800	10.800	21.600	0.000
001-14	0.90	21	44	238	29,000,000	843		1.1022	1.1022	1188.00	22.320	22.320	44.640	0.000
001-15	0.90	18	40	196	29,000,000	612	0.5390	0.7836	1.3226	1080.00	22.320	22.320	44.640	0.000
001-16	0.90	18	40	196	29,000,000	612	0.5390	0.8081	1.3471	1080.00	22.680	22.680	45.360	0.000
001-17	0.90	18	40	196	29,000,000	612		1.4203	1.4203	1080.00	20.880	20.880	41.760	0.000
001-18	0.90	14	22	82.8	29,000,000	199		1.8827	1.8827	594.00	9.000	9.000	18.000	0.000
001-19	1.17	30	99	778	29,000,000	3990	0.4902		0.4902	3465.00	52.878	67.062	119.940	-0.400
001-20	1.17	30	99	778	29,000,000	3990	0.4902		0.4902	3465.00	63.970	54.895	118.865	-0.405
001-21	0.77	14	26	100	29,000,000	245		0.9925	0.9925	598.00	8.050	8.050	16.100	0.000
001-22	0.77	18	40	196	29,000,000	612		0.7947	0.7947	920.00	16.100	16.100	32.200	0.000
001-23	0.77	14	26	100	29,000,000	245		1.9851	1.9851	598.00	16.100	16.100	32.200	0.000
001-24	0.77	18	40	196	29,000,000	612		0.7947	0.7947	920.00	16.100	16.100	32.200	0.000
001-25	0.77	14	26	100	29,000,000	245		0.9925	0.9925	598.00	8.050	8.050	16.100	0.000
001-26	1.17	24	84	559	29,000,000	2370	0.8646	0.6760	1.5406	2940.00	45.850	45.850	91.700	0.000
001-27	0.83	21	50	274	29,000,000	984	0.5421		0.5421	1250.00	31.830	38.270	70.100	0.000
001-28	0.67	14	22	82.8	29,000,000	199		0.6987	0.6987	440.00	7.000	7.000	14.000	0.000
001-29	0.67	18	35	166	29,000,000	510		0.2726	0.2726	700.00	14.000	14.000	28.000	0.000
001-30	0.67	16	31	135	29,000,000	375		0.3708	0.3708	620.00	12.000	12.000	24.000	0.000
001-31	0.67	14	30	118	29,000,000	291		0.3413	0.3413	600.00	10.000	10.000	20.000	0.000
001-32	0.67	12	16	50.1	29,000,000	103		0.9642	0.9642	320.00	5.000	5.000	10.000	0.000
001-33	0.67	12	16	50.1	29,000,000	103			0.0000	320.00	0.000	0.000	0.000	0.000
001-34	0.83	21	50	274	29,000,000	984	0.2464		0.2464	1250.00	30.050	24.450	54.500	0.000
001-35	0.83	21	50	274	29,000,000	984	0.4928		0.4928	1250.00	29.410	35.290	64.700	0.000
001-36	0.68	12	16	50.1	29,000,000	103			0.0000	326.67	0.000	0.000	0.000	0.000
001-37	0.68	12	19	61.6	29,000,000	130	1.0785		1.0785	387.92	10.617	10.617	21.233	0.000
001-38	0.68	14	30	118	29,000,000	291	0.9265		0.9265	612.50	20.417	20.417	40.833	0.000
001-39	0.68	16	31	135	29,000,000	375	0.3739	0.4141	0.7880	632.92	17.970	17.970	35.940	-0.007
001-40	0.68	18	35	166	29,000,000	510		0.6090	0.6090	714.58	14.700	14.700	29.400	0.000
001-41	0.68	14	22	82.8	29,000,000	199		0.7804	0.7804	449.17	7.350	7.350	14.700	0.000
001-42	0.83	21	50	274	29,000,000	984		0.4025	0.4025	1250.00	10.250	10.250	20.500	-0.083
001-43	1.17	21	55	31	29,000,000	1140	1.0621	0.6863	1.7485	1925.00	25.350	25.350	50.700	0.400
001-44	0.55	12	16	50.1	29,000,000	103	0.5025		0.5025	264.00	7.425	7.425	14.850	0.000
001-45	0.50	12	16	50.1	29,000,000	103	0.5491		0.5491	240.00	10.800	10.800	21.600	0.000
001-46	0.50	12	16	50.1	29,000,000	103	0.5491		0.5491	240.00	10.800	10.800	21.600	0.000
001-47	0.53	12	16	50.1	29,000,000	103	0.7109		0.7109	256.00	11.520	11.520	23.040	0.000
001-48	0.53	12	16	50.1	29,000,000	103	0.7109		0.7109	256.00	11.520	11.520	23.040	0.000
001-49	0.55	12	16	50.1	29,000,000	103	0.8040		0.8040	264.00	11.880	11.880	23.760	0.000
001-50	0.55	12	16	50.1	29,000,000	103	0.8040		0.8040	264.00	11.880	11.880	23.760	0.000
001-51	0.42	12	16	50.1	29,000,000	103	0.2648		0.2648	200.00	9.000	9.000	18.000	0.000
001-52	0.42	12	16	50.1	29,000,000	103	0.2648		0.2648	200.00	9.000	9.000	18.000	0.000
001-53	0.58	12	22	73.1	29,000,000	156	0.8583		0.8583	385.00	16.100	16.100	32.200	0.000
001-54	0.58	12	22	73.1	29,000,000	156	0.8583		0.8583	385.00	16.100	16.100	32.200	0.000
001-55	0.58	12	22	73.1	29,000,000	156	0.8583		0.8583	385.00	16.100	16.100	32.200	0.000
001-56	0.58	12	22	73.1	29,000,000	156	0.8583		0.8583	385.00	16.100	16.100	32.200	0.000
001-57	0.58	12	19	61.6	29,000,000	130	0.8956		0.8956	332.50	14.000	14.000	28.000	0.000
001-58	0.58	12	19	61.6	29,000,000	130	0.8956		0.8956	332.50	14.000	14.000	28.000	0.000
001-59	0.42	12	16	50.1	29,000,000	103	0.2942		0.2942	200.00	10.000	10.000	20.000	0.000
001-60	0.42	12	16	50.1	29,000,000	103	0.2942		0.2942	200.00	10.000	10.000	20.000	0.000
001-61	0.58	10	22	64.9	29,000,000	118	1.0360		1.0360	385.00	14.700	14.700	29.400	0.000
001-62	0.58	10	22	64.9	29,000,000	118	1.0360		1.0360	385.00	14.700	14.700	29.400	0.000
										40637.25 ^TOTAL W(lb)				
											866.119	877.948		

Sum of Loads-> 1743.572

Sum of Reactions-> 1744.067

Gravity Load Framing

GRAVITY LOAD FRAMING 3/5

FLOOR (Floor-#)	BEAM #	Nominal LENGTH (ft)	TYPE (1,2, or 3)	area LL (psf)	area DL (psf)	Tributary Width (ft)	IFF 3, Dist. Load (lb/ft)	Dist total load (k)	Point load 1 (k)	Point load 2 (k)	Point Load 3 (k)	Total Load (k)	Loaded Max M due to uniform (k-ft)	M due to point loads (k-ft)	TOTAL M (k-ft)	Deflection limit (l/360) (in)	SIZE W Depth (in)	SIZE W (weight) (lb/ft)	M (k-ft)	E (psi)	Ix (in^4)	Deflection due to uniform (in)	Deflection due to point (in)	TOTAL DEFLECTION (in)	TOTAL WEIGHT (lb)	SHEAR (Start) (k)	SHEAR (End) (k)	Total Connection Loads (k)	Difference (error) (k)
2-1	002-01	11.00	1									0.000			0.0	0.37	12	16	50.1	29,000,000	103			0.0000	176.00	0.000	0.000	0.000	0.000
	002-02	11.00	1									0.000			0.0	0.37	12	16	50.1	29,000,000	103			0.0000	176.00	0.000	0.000	0.000	0.000
	002-03	10.00	1									0.000			0.0	0.33	12	16	50.1	29,000,000	103			0.0000	160.00	0.000	0.000	0.000	0.000
	002-04	16.50	1									0.000			0.0	0.55	12	16	50.1	29,000,000	103			0.0000	264.00	0.000	0.000	0.000	0.000
	002-05	16.50	1	100	60	5.5	880	14.52				14.520	29.9		29.9	0.55	12	16	50.1	29,000,000	103	0.4913		0.4913	264.00	7.260	7.260	14.520	0.000
	002-06	15.00	1	100	60	4.5	720	10.80				10.800	20.3		20.3	0.50	12	16	50.1	29,000,000	103	0.2746		0.2746	240.00	5.400	5.400	10.800	0.000
	002-07	16.00	1	100	60	4.5	720	11.52				11.520	23.0		23.0	0.53	12	16	50.1	29,000,000	103	0.3554		0.3554	256.00	5.760	5.760	11.520	0.000
	002-08	10.00	1									0.000			0.0	0.33	12	16	50.1	29,000,000	103			0.0000	160.00	0.000	0.000	0.000	0.000
	002-09	16.50	1	100	60	9.5	1520	25.08				25.080	51.7		51.7	0.55	10	19	53.9	29,000,000	96.3	0.9077		0.9077	313.50	12.540	12.540	25.080	0.000
	002-10	12.50	1	100	60	4.5	720	9.00				9.000	14.1		14.1	0.42	12	16	50.1	29,000,000	103	0.1324		0.1324	200.00	4.500	4.500	9.000	0.000
	002-11	27.00	1						6.750	6.750		13.500		60.75	60.8	0.90	12	19	61.6	29,000,000	130		2.1615	2.1615	513.00	6.750	6.750	13.500	0.000
	002-12	27.00	2						13.950	13.950		27.900		125.55	125.6	0.90	16	31	135	29,000,000	375		1.5486	1.5486	837.00	13.950	13.950	27.900	0.000
	002-13	27.00	2	100	60	5.0	800	21.60	7.200	7.200		36.000	72.9	64.8	137.7	0.90	18	35	166	29,000,000	510	0.6468	0.5877	1.2345	945.00	18.000	18.000	36.000	0.000
	002-14	27.00	2	100	60	5.0	800	21.60	11.880	11.880		45.360	72.9	106.92	179.8	0.90	16	40	182	29,000,000	518	0.6368	0.9547	1.5915	1080.00	22.680	22.680	45.360	0.000
	002-15	27.00	2						20.880	20.880		41.760		187.92	187.9	0.90	18	40	196	29,000,000	612		1.4203	1.4203	1080.00	20.880	20.880	41.760	0.000
	002-16	27.00	1						9.000	9.000		18.000		81	81.0	0.90	14	22	82.8	29,000,000	199		1.8827	1.8827	594.00	9.000	9.000	18.000	0.000
	002-17	35.00	1	40	60	10.5	1050	36.75	13.950	10.063	18.000	78.763	160.8	228.7275	389.5	1.17	21	68	399	29,000,000	1480	0.8260		0.8260	2380.00	33.563	45.450	79.013	-0.250
	002-18	35.00	1	65	60	10.5	1313	45.94	22.680	13.080	20.880	102.578	201.0	312.99	514.0	1.17	24	84	559	29,000,000	2370	0.6448		0.6448	2940.00	55.789	46.851	102.640	-0.063
	002-19	23.00	1						10.063			10.063		57.86	57.9	0.77	12	19	61.6	29,000,000	130		1.1691	1.1691	437.00	5.032	5.032	10.064	-0.002
	002-20	23.00	2						10.063	10.063		20.125		115.71875	115.7	0.77	14	30	118	29,000,000	291		1.0446	1.0446	690.00	10.063	10.063	20.126	-0.001
	002-21	23.00	1						10.063	16.100		26.163		150.437	150.4	0.77	18	35	166	29,000,000	510		0.7748	0.7748	805.00	13.080	13.080	26.160	0.003
	002-22	23.00	2						16.100	10.063		26.163		150.44	150.4	0.77	18	35	166	29,000,000	510		0.7748	0.7748	805.00	13.080	13.080	26.160	0.003
	002-23	23.00	1						10.063			10.063		57.86	57.9	0.77	12	19	61.6	29,000,000	130		1.1691	1.1691	437.00	5.032	5.032	10.064	-0.002
	002-24	35.00	1	65	60	11.0	1375	48.13	10.063	14.000		72.188	210.5	210.55125	421.1	1.17	24	68	442	29,000,000	1830	0.8748	0.6999	1.5747	2380.00	36.094	36.094	72.188	0.000
	002-25	25.00	1	65	60	11.0	1375	34.38	10.000	13.080		57.455	107.4	111.55	219.0	0.83	21	44	238	29,000,000	843	0.4943		0.4943	1100.00	25.924	31.156	57.080	0.375
	002-26	20.00	1						14.000			14.000		70	70.0	0.67	12	22	73.1	29,000,000	156		0.8912	0.8912	440.00	7.000	7.000	14.000	0.000
	002-27	20.00	2						14.000	14.000		28.000		140	140.0	0.67	18	35	166	29,000,000	510		0.5452	0.5452	700.00	14.000	14.000	28.000	0.000
	002-28	20.00	1						14.000	10.000		24.000		120	120.0	0.67	16	31	135	29,000,000	375		0.6356	0.6356	620.00	12.000	12.000	24.000	0.000
	002-29	20.00	2						10.000	10.000		20.000		100	100.0	0.67	14	30	118	29,000,000	291		0.6825	0.6825	600.00	10.000	10.000	20.000	0.000
	002-30	20.00	1						10.000			10.000		50	50.0	0.67	12	16	50.1	29,000,000	103		0.9642	0.9642	320.00	5.000	5.000	10.000	0.000
	002-31	20.00	1									0.000			0.0	0.67	12	16	50.1	29,000,000	103			0.0000	320.00	0.000	0.000	0.000	0.000
	002-32	25.00	1	100	60	5.0	800	20.00	14.000	20.420		54.420	62.5	181.63	244.1	0.83	21	50	274	29,000,000	984	0.2464		0.2464	1250.00	30.010	24.410	54.420	0.000
	002-33	25.00	1	100	60	10.0	1600	40.00	10.000	18.375		68.375	125.0	133.97	259.0	0.83	21	50	274	29,000,000	984	0.4928		0.4928	1250.00	30.513	37.863	68.375	0.000
	002-34	20.42	1	100	60	5.0	800	16.33				16.333	41.7		41.7	0.68	12	16	50.1	29,000,000	103	1.0471		1.0471	326.67	8.167	8.167	16.334	-0.001
	002-35	20.42	1	100	60	11.5	1840	37.57				37.567	95.9		95.9	0.68	14	26	100	29,000,000	245	1.0125		1.0125	530.83	18.780	18.780	37.560	0.007
	002-36	20.42	2	100	60	12.5	2000	40.83				40.833	104.2		104.2	0.68	14	30	118	29,000,000	291	0.9265		0.9265	612.50	20.420	20.420	40.840	-0.007
	002-37	20.42	1	100	60	6.5	1040	21.23	18.375			39.608	54.2	93.80	148.0	0.68	18	35	166	29,000,000	510	0.2749	0.3806	0.6555	714.58	19.804	19.804	39.608	0.000
	002-38	20.42	2						18.375	18.375		36.750		187.61	187.6	0.68	18	40	196	29,000,000	612		0.6944	0.6944	816.67	18.375	18.375	36.750	0.000
	002-39	20.42	1						18.375			18.375		93.80	93.8	0.68	14	26	100	29,000,000	245		0.7924	0.7924	530.83	9.188	9.188	18.375	0.000
	002-40	25.00	1	100	60	5.0	800	20.00	50.400	63.000	20.420	153.820	62.5	671.93	734.4	0.83	30	99	778	29,000,000	3990	0.0608		0.0608	2475.00	99.590	54.230	153.820	0.000
	002-41	35.00	1	100	60	10.5	1680	58.80	18.375	50.400	63.000	190.575	257.3	601.00	858.3	1.17	30	108	863	29,000,000	4470	0.4376	1.5690	2.0066	3780.00	95.288	95.288	190.575	0.000
	002-42	45.00	1	100	60	8.75	1400	63.00				63.000	354.4		354.375	1.5 JOIST		38						0.0000	1710	31.5	31.5	63.000	0.000
	002-43	45.00	1	100	60	17.50	2800	126.00				126.000	708.8		708.75	1.5 JOIST		69						0.0000	3105	63	63	126.000	0.000
	002-44	45.00	1	100	60	8.75	1400	63.00				63.000	354.4		354.375	1.5 JOIST		38		SEE JOIST SPEC				0.0000	1710	31.5	31.5	63.000	0.000
	002-45	45.00	2	100	60	17.5	2800	126.00				126.000	708.8		708.8	1.50	JOIST	69						0.0000	3105	63.000	63.000	126.000	0.000
	002-46	45.00	2	100	60	17.5	2800	126.00				126.000	708.8		708.8	1.50	JOIST	69						0.0000	3105	63.000	63.000	126.000	0.000
	002-47	35.00	1	100	60	4.0	1019.3	35.68	63.000			98.675	156.1	551.25	707.32878	1.1667	30	99	778	29000000	3990	0.2974	0.8404	1.13780893	3465	49.3375	49.3375	98.675	0.000
	002-48	35.00	1	100	60	4.0	1019.3	35.68	63.000			98.675	156.1	551.25	707.32878	1.1667	30	99	778	29000000	3990	0.2974	0.8404	1.13780893	3465	49.3375	49.3375	98.675	0.000
	002-49	15.00	3	40	60	9.0	900	13.50				13.500	25.3		25.3	0.50	12	16	50.1	29,000,000	103	0.3432		0.3432	240.00	6.750	6.750	13.500	0.000
	002-50	15.00	3	40	60	9.0	900	13.50				13.500	25.3		25.3	0.50	12	16	50.1	29,000,000	103	0.3432		0.3432	240.00	6.750	6.750	13.500	0.000
	002-51	16.00	3	40	60	9.0	900	14.40				14.400	28.8		28.8	0.53	12	16	50.1	29,000,000	103	0.4443		0.4443	256.00	7.200	7.200	14.400	0.000
	002-52	16.00	3	40	60	9.0	900	14.40				14.400	28.8		28.8	0.53	12	16	50.1	29,000,000	103	0.4443		0.4443	256.00	7.200	7.200	14.400	0.000
	002-53	16.50	3	100	60	9.0	1440	23.76				23.760	49.0		49.0	0.55	12	16	50.1	29,000,000	103	0.8040		0.8040	264.00	11.880	11.880	23.760	0.000
	002-54	16.50	3	100	60	9.0	1440	23.76				23.760	49.0		49.0	0.55	12	16	50.1	29,000,000	103	0.8040		0.8040	264.00	11.880	11.880	23.760	0.000
	002-55	12.50	3	100	60	9.0	1440	18.00				18.000	28.1		28.1	0.42	12	16	50.1	29,000,000	103	0.2648		0.2648	200.00	9.000	9.000	18.000	0.000
	002-56	12.50	3	100	60	9.0	1440	18.00				18.000	28.1		28.1	0.42	12	16	50.1	29,000,000	103	0.2648		0.2648	200.00	9.000	9.000	18.000	0.000
	002-57	17.50	3	40	60	11.5	1150	20.13				20.125	44.0		44.0	0.58	12	16	50.1	29,000,000	103	0.8125		0.8125	280.00	10.063	10.063	20.125	0.000
	002-58	17.50	3	40	60	11.5	1150	20.13				20.125	44.0		44.0	0.58	12	16	50.1	29,000,000	103	0.8125		0.8125	280.00	10.063	10.063	20.125	0.000
	002-59	17.50	3	100	60	11.5	1840	32.20				32.200	70.4		70.4	0.58	12	22	73.1	29,000,000	156	0.8583		0.8583	385.00	16.100	16.100	32.200	0.000
	002-60	17.50	3	40	60	11.5	1150	20.13				20.125	44.0		44.0	0.58	12	16	50.1	29,000,000	103	0.8125		0.8125	280.00	10.063	10.063	20.125	0.000
	002-61	17.50	3	100	60	10.0	1600	28.00				28.000	61.3		61.3	0.58	12	19	61.6	29,000,000	130	0.8956		0.8956	332.50	14.000	14.000	28.000	0.000
	002-62	17.50	3	100	60	10.0	1600	28.00				28.000	61.3		61.3	0.58	12	19	61.6	29,000,000	130	0.8956		0.8956	332.50	14.000	14.000	28.000	0.000
	002-63	12.50	3	100	60	10.0	1600	20.00				20.000	31.3		31.3	0.42	12	16	50.1	29,000,000	103	0.2942		0.2942	200.00	10.000	10.000	20.000	0.000
	002-64	12.50	3	100	60	10.0	1600	20.00				20.000	31.3		31.3	0.42	12	16	50.1	29,000,000	103	0.2942		0.2942	200.00	10.000	10.000	20.000	0.000
	002-65	17.50	3	140	60	10.5	2100	36.75				36.750	80.4		80.4	0.58	14	22	82.8	29,000,000	199	0.7679		0.7679	385.00	18.375	18.375	36.750	0.000
	002-66	17.50	3	140	60	10.5	2100	36.75				36.750	80.4		80.4	0.58	14	22	82.8	29,000,000	199	0.7679		0.7679	385.00	18.375	18.375	36.750	0.000
	002-67	16.50	3	100	60	9.0	1440	23.76				23.760	49.0		49.0	0.55	12	19	61.6	29,000,000	130	0.6370		0.6370	313.50	11.880	11.880	23.760	0.000
	002-68	16.50	3	100	60	9.0	1440	23.76				23.760	49.0		49.0	0.55	12	19	61.6	29,000,000	130	0.6370		0.6370	313.50	11.880	11.880	23.760	0.000
	002-69	16.50	3	100	60	9.0	1440	23.76				23.760	49.0		49.0	0.55	12	19	61.6	29,000,000	130	0.6370		0.6370	313.50	11.880	11.880	23.760	0.000
	002-70	16.50	3	100	60	9.0	1440	23.76				23.760	49.0		49.0	0.55	12	19	61.6	29,000,000	130	0.6370		0.6370	313.50	11.880	11.880	23.760	0.000
	002-71	17.50	3	100	60	9.0	1440	25.20				25.200	55.1		55.1	0.58	12	19	61.6	29,000,000	130	0.8060		0.8060	332.50	12.600	12.600	25.200	0.000
	002-72	17.50	3	100	60	9.0	1440	25.20				25.200	55.1		55.1	0.58	12	19	61.6	29,000,000	130	0.8060		0.8060	332.50	12.600	12.600	25.200	0.000
	002-73	17.50	3	100	60	9.0	1440	25.20				25.200	55.1		55.1	0.58	12	19	61.6	29,000,000	130	0.8060		0.8060	332.50	12.600	12.600	25.200	0.000
	002-74	17.50	3	100	60	9.0	1440	25.20				25.200	55.1		55.1	0.58	12	19	61.6	29,000,000	130	0.8060		0.8060	332.50	12.600	12.600	25.200	0.000
	002-75	17.50	3	100	60	9.0	1440	25.20				25.200	55.1		55.1	0.58	12	19	61.6	29,000,000	130	0.8060		0.8060	332.50	12.600	12.600	25.200	0.000
	002-76	17.50	3	100	60	9.0	1440	25.20				25.200	55.1		55.1	0.58	12	19	61.6	29,000,000	130	0.8060		0.8060	332.50	12.600	12.600	25.200	0.000
	002-77	17.50	3	100	60	9.0	1440	25.20				25.200	55.1		55.1	0.58	12	19	61.6	29,000,000	130	0.8060		0.8060	332.50	12.600	12.600	25.200	0.000
	002-78	17.50	3	100	60	9.0	1440	25.20				25.200	55.1		55.1	0.58	12	19	61.6	29,000,000	130	0.8060		0.8060	332.50	12.600	12.600	25.200	0.000
	002-79	16.50	3	100	60	9.0	1440	23.76				23.760	49.0		49.0	0.55	12	19	61.6	29,000,000	130	0.6370		0.6370	313.50	11.880	11.880	23.760	0.000
	002-80	16.50	3	100	60	9.0	1440	23.76				23.760	49.0		49.0	0.55	12	19	61.6	29,000,000	130	0.6370		0.6370	313.50	11.880	11.880	23.760	0.000
	002-81	16.50	3	100	60	9.0	1440	23.76				23.760	49.0		49.0	0.55	12	19	61.6	29,000,000	130	0.6370		0.6370	313.50	11.880	11.880	23.760	0.000
	002-82	16.50	3	100	60	9.0	1440	23.76				23.760	49.0		49.0	0.55	12	19	61.6	29,000,000	130	0.6370		0.6370	313.50	11.880	11.880	23.760	0.000
		1746.50 ^TOTAL L (ft)																							64332.58 ^TOTAL W (lb)				
																										1469.723	1434.294		
											Sum of Loads-->	2904.080													Sum of Reactions-->	2904.017			

Gravity Load Framing

GRAVITY LOAD FRAMING 4/5

FLOOR	BEAM #	Nominal LENGTH	TYPE	area LL	area DL	Tributary Width	IFF 3, Dist. Load	Dist total load	Point load 1	Point load 2	Point load 3	Total Load	Loaded Max M due to uniform	M due to point loads
	(Floor-#)	(ft)	(1,2, or 3)	(psf)	(psf)	(ft)	(lb/ft)	(k)	(k)	(k)	(k)	(k)	(k-ft)	(k-ft)
3-1	003-01	11.00	1									0.000		
	003-02	11.00	1									0.000		
	003-03	10.00	1									0.000		
	003-04	16.50	1									0.000		
	003-05	16.50	1	100	60	5.0	800	13.20				13.200	27.2	
	003-06	15.00	1	40	60	4.5	450	6.75				6.750	12.7	
	003-07	16.00	1	40	60	4.5	450	7.20				7.200	14.4	
	003-08	10.00	1									0.000		
	003-09	16.50	1	100	60	9.5	1520	25.08				25.080	51.7	
	003-10	12.50	1	100	60	4.5	720	9.00				9.000	14.1	
	003-11	27.00	1						6.750	6.750		13.500		60.75
	003-12	27.00	2						13.950	13.950		27.900		125.55
	003-13	27.00	2	100	60	5.0	800	21.60	7.200	7.200		36.000	72.9	64.8
	003-14	27.00	2	100	60	5.0	800	21.60	11.880	11.880		45.360	72.9	106.92
	003-15	27.00	2						20.880	20.880		41.760		187.92
	003-16	27.00	1						9.000	9.000		18.000		81
	003-17	35.00	1	40	60	10.5	1050	36.75	13.950	13.082	18.000	81.782	160.8	255.100
	003-18	35.00	1	100	60	10.5	1680	58.80	22.680	16.100	20.880	118.460	257.3	339.413
	003-19	23.00	1						10.063			10.063		57.86
	003-20	23.00	2						10.063	16.100		26.163		150.44
	003-21	23.00	1						16.100	16.100		32.200		185.15
	003-22	23.00	2						16.100	16.100		32.200		185.15
	003-23	23.00	1						16.100			16.100		92.575
	003-24	35.00	1	100	60	11.0	1760	61.60	14.000	13.082		88.682	269.5	236.9675
	003-25	25.00	1	100	60	11.0	1760	44.00	10.000	16.100		70.100	137.5	122.88
	003-26	20.00	1						14.000			14.000		70
	003-27	20.00	2						14.000	14.000		28.000		140
	003-28	20.00	1						14.000	10.000		24.000		120
	003-29	20.00	2						10.000	10.000		20.000		100
	003-30	20.00	1						10.000			10.000		50
	003-31	20.00	1									0.000		
	003-32	35.00	1	100	60	10.0	1600	56.00	14.000	12.600		82.600	245.0	232.75
	003-33	25.00	1	100	60	10.0	1600	40.00	10.000	12.600		62.600	125.0	109.75
	003-34	40.00	1		CANTILEVER							64.300		
	003-35	39.50	1						25.200	25.200	25.200	25.200		132.30
	003-36	40.00	1		CANTILEVER							91.800		
	003-37	39.50	1						25.200	25.200	25.200	25.200		132.30
	003-38	40.00	1		CANTILEVER							65.600		
	003-39	35.00					320.36	11.2126	12.600			23.813	49.1	110.25
	003-40	DOES NOT EXIST												
	003-41	35.00					320.36	11.2126	12.600			23.813	49.1	110.25
	003-42	15.00	3	40	60	9.0	900	13.50				13.500	25.3	
	003-43	15.00	3	40	60	9.0	900	13.50				13.500	25.3	
	003-44	16.00	3	40	60	9.0	900	14.40				14.400	28.8	
	003-45	16.00	3	40	60	9.0	900	14.40				14.400	28.8	
	003-46	16.50	3	100	60	9.0	1440	23.76				23.760	49.0	
	003-47	16.50	3	100	60	9.0	1440	23.76				23.760	49.0	
	003-48	12.50	3	100	60	9.0	1440	18.00				18.000	28.1	
	003-49	12.50	3	100	60	9.0	1440	18.00				18.000	28.1	
	003-50	17.50	3	40	60	11.5	1150	20.13				20.125	44.0	
	003-51	17.50	3	100	60	11.5	1840	32.20				32.200	70.4	
	003-52	17.50	3	100	60	11.5	1840	32.20				32.200	70.4	
	003-53	17.50	3	100	60	11.5	1840	32.20				32.200	70.4	
	003-54	17.50	3	100	60	10.0	1600	28.00				28.000	61.3	
	003-55	17.50	3	100	60	10.0	1600	28.00				28.000	61.3	
	003-56	12.50	3	100	60	10.0	1600	20.00				20.000	31.3	
	003-57	12.50	3	100	60	10.0	1600	20.00				20.000	31.3	
	003-58	17.50	3	100	60	9.0	1440	25.20				25.200	55.1	
	003-59	17.50	1	100	60	9.0	1440	25.20				25.200	55.1	
	003-60	17.50	3	100	60	9.0	1440	25.20				25.200	55.1	
	003-61	17.50	3	100	60	9.0	1440	25.20				25.200	55.1	
	003-62	17.50	1	100	60	9.0	1440	25.20				25.200	55.1	
	003-63	17.50	3	100	60	9.0	1440	25.20				25.200	55.1	
	003-64	17.50	3	100	60	9.0	1440	25.20				25.200	55.1	
	003-65	17.50	1	100	60	9.0	1440	25.20				25.200	55.1	
	003-66	17.50	3	100	60	9.0	1440	25.20				25.200	55.1	
	003-67	17.50	3	100	60	9.0	1440	25.20				25.200	55.1	
	003-68	17.50	1	100	60	9.0	1440	25.20				25.200	55.1	
	003-69	17.50	3	100	60	9.0	1440	25.20				25.200	55.1	
	003-70	DOES NOT EXIST												
	003-71	35.00					379.29	13.2752				13.275	58.1	
	003-72	35.00					379.29	13.2752				13.275	58.1	
	003-73	DOES NOT EXIST												
	003-74	4.50												
	003-75	4.50												
		1521.00												
		^TOTAL L (ft)												
											Sum of Loads-->	1961.419		

BEAM #	TOTAL M	Deflection limit (l/360)	SIZE W	SIZE W (weight)	M	E	Ix	Deflection due to uniform	Deflection due to point	TOTAL DEFLECTION	TOTAL WEIGHT	SHEAR (Start)	SHEAR (End)	Total Connection Loads	Difference (error)
	(k-ft)	(in)	Depth (in)	(lb/ft)	(k-ft)	(psi)	(in^4)	(in)	(in)	(in)	(lb)	(k)	(k)	(k)	(k)
003-01	0.0	0.37	12	16	50.1	29,000,000	103			0.0000	176.00	0.000	0.000	0.000	0.000
003-02	0.0	0.37	12	16	50.1	29,000,000	103			0.0000	176.00	0.000	0.000	0.000	0.000
003-03	0.0	0.33	12	16	50.1	29,000,000	103			0.0000	160.00	0.000	0.000	0.000	0.000
003-04	0.0	0.55	12	16	50.1	29,000,000	103			0.0000	264.00	0.000	0.000	0.000	0.000
003-05	27.2	0.55	12	16	50.1	29,000,000	103	0.4467		0.4467	264.00	6.600	6.600	13.200	0.000
003-06	12.7	0.50	12	16	50.1	29,000,000	103	0.1716		0.1716	240.00	3.375	3.375	6.750	0.000
003-07	14.4	0.53	12	16	50.1	29,000,000	103	0.2221		0.2221	256.00	3.600	3.600	7.200	0.000
003-08	0.0	0.33	12	16	50.1	29,000,000	103			0.0000	160.00	0.000	0.000	0.000	0.000
003-09	51.7	0.55	10	19	53.9	29,000,000	96.3	0.9077		0.9077	313.50	12.540	12.540	25.080	0.000
003-10	14.1	0.42	12	16	50.1	29,000,000	103	0.1324		0.1324	200.00	4.500	4.500	9.000	0.000
003-11	60.8	0.90	12	19	61.6	29,000,000	130		2.1615	2.1615	513.00	6.750	6.750	13.500	0.000
003-12	125.6	0.90	16	31	135	29,000,000	375		1.5486	1.5486	837.00	13.950	13.950	27.900	0.000
003-13	137.7	0.90	12	22	73.1	29,000,000	156	2.1145	1.9213	4.0358	594.00	18.000	18.000	36.000	0.000
003-14	179.8	0.90	14	30	118	29,000,000	291	1.1335	1.6995	2.8330	810.00	22.680	22.680	45.360	0.000
003-15	187.9	0.90	18	40	196	29,000,000	612		1.4203	1.4203	1080.00	20.880	20.880	41.760	0.000
003-16	81.0	0.90	14	22	82.8	29,000,000	199		1.8827	1.8827	594.00	9.000	9.000	18.000	0.000
003-17	415.9	1.17	24	68	442	29,000,000	1830	0.6680		0.6680	2380.00	34.945	46.837	81.782	-0.001
003-18	596.7	1.17	27	84	609	29,000,000	2850	0.6863		0.6863	2940.00	63.699	54.761	118.460	0.000
003-19	57.9	0.77	12	19	61.6	29,000,000	130		1.1691	1.1691	437.00	5.032	5.032	10.063	-0.001
003-20	150.4	0.77	18	35	166	29,000,000	510		0.7748	0.7748	805.00	13.082	13.082	26.163	0.000
003-21	185.2	0.77	18	40	196	29,000,000	612		0.7947	0.7947	920.00	16.100	16.100	32.200	0.000
003-22	185.2	0.77	18	40	196	29,000,000	612		0.7947	0.7947	920.00	16.100	16.100	32.200	0.000
003-23	92.6	0.77	14	26	100	29,000,000	245		0.9925	0.9925	598.00	8.050	8.050	16.100	0.000
003-24	506.5	1.17	24	84	559	29,000,000	2370	0.8646	0.6082	1.4728	2940.00	44.341	44.341	88.682	-0.001
003-25	260.4	0.83	21	50	274	29,000,000	984	0.5421		0.5421	1250.00	31.830	38.270	70.100	0.000
003-26	70.0	0.67	12	22	73.1	29,000,000	156		0.8912	0.8912	440.00	7.000	7.000	14.000	0.000
003-27	140.0	0.67	18	35	166	29,000,000	510		0.5452	0.5452	700.00	14.000	14.000	28.000	0.000
003-28	120.0	0.67	16	31	135	29,000,000	375		0.6356	0.6356	620.00	12.000	12.000	24.000	0.000
003-29	100.0	0.67	14	30	118	29,000,000	291		0.6825	0.6825	600.00	10.000	10.000	20.000	0.000
003-30	50.0	0.67	12	16	50.1	29,000,000	103		0.9642	0.9642	320.00	5.000	5.000	10.000	0.000
003-31	0.0	0.67	12	16	50.1	29,000,000	103			0.0000	320.00	0.000	0.000	0.000	0.000
003-32	477.8	1.17	24	76	499	29,000,000	2100	0.8871	0.6742	1.5612	2660.00	41.300	41.300	82.600	0.000
003-33	234.8	0.83	21	44	238	29,000,000	843	0.5752		0.5752	1100.00	28.780	33.820	62.600	0.000
003-34	650.9	1.33	30	99	778	29,000,000	3990				3960.00	88.400	-24.100	64.300	0.000
003-35	132.3	1.32	16	31	135	29000000	375		0.7187	0.7187	1224.50	12.600	12.600	25.200	0.000
003-36	816.4	1.33	30	108	863	29,000,000	4470				4320.00	118.300	-26.500	91.800	0.000
003-37	132.3	1.32	16	31	135	29000000	375		0.7187	0.7187	1224.50	12.600	12.600	25.200	0.000
003-38	652.7	1.33	30	99	778	29,000,000	3990				3960.00	88.700	-23.100	65.600	0.000
003-39	159.3	1.17	18	35	166	29,000,000	510	0.7313	0.2642	0.9956	1225.00	11.91	11.91	23.820	-0.007
003-40														0.000	0.000
003-41	159.3	1.17	18	35	166	29,000,000	510	0.7313	0.2642	0.9956	1225.00	11.91	11.91	23.820	-0.007
003-42	25.3	0.50	12	16	50.1	29,000,000	103	0.3432		0.3432	240.00	6.750	6.750	13.500	0.000
003-43	25.3	0.50	12	16	50.1	29,000,000	103	0.3432		0.3432	240.00	6.750	6.750	13.500	0.000
003-44	28.8	0.53	12	16	50.1	29,000,000	103	0.4443		0.4443	256.00	7.200	7.200	14.400	0.000
003-45	28.8	0.53	12	16	50.1	29,000,000	103	0.4443		0.4443	256.00	7.200	7.200	14.400	0.000
003-46	49.0	0.55	12	16	50.1	29,000,000	103	0.8040		0.8040	264.00	11.880	11.880	23.760	0.000
003-47	49.0	0.55	12	16	50.1	29,000,000	103	0.8040		0.8040	264.00	11.880	11.880	23.760	0.000
003-48	28.1	0.42	12	16	50.1	29,000,000	103	0.2648		0.2648	200.00	9.000	9.000	18.000	0.000
003-49	28.1	0.42	12	16	50.1	29,000,000	103	0.2648		0.2648	200.00	9.000	9.000	18.000	0.000
003-50	44.0	0.58	12	16	50.1	29,000,000	103	0.8125		0.8125	280.00	10.063	10.063	20.125	0.000
003-51	70.4	0.58	12	22	73.1	29,000,000	156	0.8583		0.8583	385.00	16.100	16.100	32.200	0.000
003-52	70.4	0.58	12	22	73.1	29,000,000	156	0.8583		0.8583	385.00	16.100	16.100	32.200	0.000
003-53	70.4	0.58	12	22	73.1	29,000,000	156	0.8583		0.8583	385.00	16.100	16.100	32.200	0.000
003-54	61.3	0.58	12	19	61.6	29,000,000	130	0.8956		0.8956	332.50	14.000	14.000	28.000	0.000
003-55	61.3	0.58	12	19	61.6	29,000,000	130	0.8956		0.8956	332.50	14.000	14.000	28.000	0.000
003-56	31.3	0.42	12	16	50.1	29,000,000	103	0.2942		0.2942	200.00	10.000	10.000	20.000	0.000
003-57	31.3	0.42	12	16	50.1	29,000,000	103	0.2942		0.2942	200.00	10.000	10.000	20.000	0.000
003-58	55.1	0.58	12	19	61.6	29,000,000	130	0.8060		0.8060	332.50	12.600	12.600	25.200	0.000
003-59	55.1	0.58	12	19	61.6	29,000,000	130	0.8060		0.8060	332.50	12.600	12.600	25.200	0.000
003-60	55.1	0.58	12	19	61.6	29,000,000	130	0.8060		0.8060	332.50	12.600	12.600	25.200	0.000
003-61	55.1	0.58	12	19	61.6	29,000,000	130	0.8060		0.8060	332.50	12.600	12.600	25.200	0.000
003-62	55.1	0.58	12	19	61.6	29,000,000	130	0.8060		0.8060	332.50	12.600	12.600	25.200	0.000
003-63	55.1	0.58	12	19	61.6	29,000,000	130	0.8060		0.8060	332.50	12.600	12.600	25.200	0.000
003-64	55.1	0.58	12	19	61.6	29,000,000	130	0.8060		0.8060	332.50	12.600	12.600	25.200	0.000
003-65	55.1	0.58	12	19	61.6	29,000,000	130	0.8060		0.8060	332.50	12.600	12.600	25.200	0.000
003-66	55.1	0.58	12	19	61.6	29,000,000	130	0.8060		0.8060	332.50	12.600	12.600	25.200	0.000
003-67	55.1	0.58	12	19	61.6	29,000,000	130	0.8060		0.8060	332.50	12.600	12.600	25.200	0.000
003-68	55.1	0.58	12	19	61.6	29,000,000	130	0.8060		0.8060	332.50	12.600	12.600	25.200	0.000
003-69	55.1	0.58	12	19	61.6	29,000,000	130	0.8060		0.8060	332.50	12.600	12.600	25.200	0.000
003-70														0.000	0.000
003-71	58.1	1.17	12	19	61.6	29,000,000	130	3.3969		3.3969	665.00	6.638	6.638	13.275	0.000
003-72	58.1	1.17	12	19	61.6	29,000,000	130	3.3969		3.3969	665.00	6.638	6.638	13.275	0.000
003-73														0.000	0.000
003-74		0.15	12	16	50.1	29,000,000	103				72.00	0.000	0.000	0.000	0.000
003-75		0.15	12	16	50.1	29,000,000	103				72.00	0.000	0.000	0.000	0.000
											53466.50				
											^TOTAL W(lb)				
												1158.051	803.385		
											Sum of Reactions-->	1961.435			

Gravity Load Framing

FLOOR	BEAM # (Floor-#)	Nominal LENGTH (ft)	TYPE (1,2, or 3)	area LL (psf)	area DL (psf)	Tributary Width (ft)	IFF 3, Dist. Load (lb/ft)	Dist total load (k)	Point load 1 (k)	Point load 2 (k)	Point Load 3 (k)	Total Load (k)	Loaded Max M due to uniform (k-ft)	M due to point loads (k-ft)	TOTAL M (k-ft)	Deflection limit (l/360) (in)	SIZE W Depth (in)	SIZE W (weight) (lb/ft)	M (k-ft)	E (psi)	Ix (in^4)	Deflection due to uniform (in)	Deflection due to point (in)	TOTAL DEFLECTION (in)	TOTAL WEIGHT (lb)	SHEAR (Start) (k)	SHEAR (End) (k)	Total Connection Loads (k)	Difference (error) (k)
4-1	004-01	11.00	1									0.000			0.0	0.37	12	16	50.1	29,000,000	103				176.00	0.000	0.000	0.000	0.000
	004-02	11.00	1									0.000			0.0	0.37	12	16	50.1	29,000,000	103				176.00	0.000	0.000	0.000	0.000
	004-03	10.00	1									0.000			0.0	0.33	12	16	50.1	29,000,000	103				160.00	0.000	0.000	0.000	0.000
	004-04	16.50	1									0.000			0.0	0.55	12	16	50.1	29,000,000	103				264.00	0.000	0.000	0.000	0.000
	004-05	16.50	1	100	60	5.0	800	13.20				13.200	27.2		27.2	0.55	12	16	50.1	29,000,000	103	0.4467		0.4467	264.00	6.600	6.600	13.200	0.000
	004-06	15.00	1	100	60	4.5	720	10.80				10.800	20.3		20.3	0.50	12	16	50.1	29,000,000	103	0.2746		0.2746	240.00	5.400	5.400	10.800	0.000
	004-07	16.00	1	100	60	4.5	720	11.52				11.520	23.0		23.0	0.53	12	16	50.1	29,000,000	103	0.3554		0.3554	256.00	5.760	5.760	11.520	0.000
	004-08	10.00	1									0.000			0.0	0.33	12	16	50.1	29,000,000	103			0.0000	160.00	0.000	0.000	0.000	0.000
	004-09	16.50	1	100	60	4.5	720	11.88				11.880	24.5		24.5	0.55	12	16	50.1	29,000,000	103	0.4020		0.4020	264.00	5.940	5.940	11.880	0.000
	004-10	12.50	1	100	60	4.5	720	9.00				9.000	14.1		14.1	0.42	12	16	50.1	29,000,000	103	0.1324		0.1324	200.00	4.500	4.500	9.000	0.000
	004-11	27	1	ROOF			456	12.312	10.800	10.800		33.912	41.6	97.2	138.753	0.9	18	35	166	29000000	510	0.36866698	0.88154288	1.250209862	945	16.960	16.960	33.920	-0.008
	004-12	27.00	2						22.320	22.320		44.640		200.88	200.9	0.90	21	44	238	29,000,000	843		1.10219003	1.1022	1188.00	22.320	22.320	44.640	0.000
	004-13	27.00	2	100	60	5.0	800	21.60	11.520	11.520		44.640	72.9	103.68	176.6	0.90	18	40	196	29,000,000	612	0.5390	0.78359367	1.3226	1080.00	22.320	22.320	44.640	0.000
	004-14	27.00	2	100	60	5.0	800	21.60	11.880	11.880		45.360	72.9	106.92	179.8	0.90	18	40	196	29,000,000	612	0.5390	0.80808097	1.3471	1080.00	22.680	22.680	45.360	0.000
	004-15	27.00	2						20.880	20.880		41.760		187.92	187.9	0.90	18	40	196	29,000,000	612		1.42026353	1.4203	1080.00	20.880	20.880	41.760	0.000
	004-16	27	1	ROOF			456	12.312	9.000	9.000		30.312	41.6	81	122.553	0.9	16	31	135	29000000	375	0.5013871	0.99908193	1.5005	837	15.156	15.156	30.312	0.000
	004-17	35	1	100	60	10.5	1680	58.80	22.320	16.100	22.320	119.540	257.3	352.9125	610.2	1.17	30	99	778	29000000	3990	0.49022232		0.4902	3465.00	52.755	66.785	119.540	0.000
	004-18	35	1	100	60	10.5	1680	58.80	22.680	16.100	20.880	118.460	257.3	339.4125	596.7	1.17	27	84	609	29000000	2850	0.68631125		0.6863	2940.00	63.699	54.761	118.460	0.000
	004-19	23	1	ROOF			1097	25.23	16.100			41.331	72.5	92.575	165.11413	0.7666667	18	35	166	29000000	510	0.4670166	0.47680819	0.9438	805	20.666	20.666	41.331	0.000
	004-20	23.00	2						16.100	16.100		32.200		185.15	185.2	0.77	18	40	196	29,000,000	612		0.79468032	0.7947	920.00	16.100	16.100	32.200	0.000
	004-21	23.00	1						16.100	16.100		32.200		185.15	185.2	0.77	18	40	196	29,000,000	612		0.79468032	0.7947	920.00	16.100	16.100	32.200	0.000
	004-22	23.00	2						16.100	16.100		32.200		185.15	185.2	0.77	18	40	196	29,000,000	612		0.79468032	0.7947	920.00	16.100	16.100	32.200	0.000
	004-23	23	1	ROOF			1097	25.23	16.100			41.331	72.5	92.575	165.075	0.7666667	18	35	166	29000000	510	0.4670166	0.47680819	0.9438	805	20.666	20.666	41.331	0.000
	004-24	35.00	1	100	60	11.0	1760	61.60	28.000	16.100		105.700	269.5	385.88	655.4	1.17	30	99	778	29000000	3990	0.51356624	0.58826679	1.1018	3465.00	52.850	52.850	105.700	0.000
	004-25	25.00	1	100	60	11.0	1760	44.00	20.000	16.100		80.100	137.5	185.38	322.9	0.83	30	108	863	29,000,000	4470	0.11933002		0.1193	2700.00	36.830	43.270	80.100	0.000
	004-26	34.5	1		CANTILEVER							89.800			645.8	1.15	30	99	778	29,000,000	3990				3415.50	106.500	-16.700	89.800	0.000
	004-27	30.5	1						28.000	28.000		56.000		294.00	294.0	1.02	21	55	314	29,000,000	1140		3.0090	3.0090	1677.50	28.000	28.000	56.000	0.000
	004-28	34.5	1		CANTILEVER							111.900			934.0	1.15	30	116	943	29,000,000	4930				4002.00	145.500	-33.600	111.900	0.000
	004-29	30.5	1						20.000	20.000		40.000		210	210.0	1.02	21	44	238	29,000,000	843		2.9066	2.9066	1342.00	20.000	20.000	40.000	0.000
	004-30	34.5	1		CANTILEVER							72.800			615.1	1.15	30	99	778	29,000,000	3990				3415.50	94.800	-22.000	72.800	0.000
	004-31	35	2	100	60	5.0	1400	49.00	28.000			77.000	214.375	245.00	459.375	1.1666667	24	76	499	29000000	2100	0.77618534		0.776185345	2660	38.500	38.500	77.000	0.000
	004-32	DOES NOT EXIST																										0.000	0.000
	004-33	35	2	100	60	5	1400	49.00	20.000			69.000	214.375	175.00	389.375	1.1666667	24	68	442	29000000	1830	0.89070449		0.890704494	2380	34.500	34.500	69.000	0.000
	004-34	DOES NOT EXIST																										0.000	0.000
	004-35	20.00	1						10.000			10.000		50	50.0	0.67	12	16	50.1	29000000	103		0.9642	0.964178105	320.00	5.000	5.000	10.000	0.000
	004-36	15.00	3	100	60	9.0	1440	21.60				21.600	40.5		40.5	0.50	12	16	50.1	29,000,000	103	0.5491		0.5491	240.00	10.800	10.800	21.600	0.000
	004-37	15.00	3	100	60	9.0	1440	21.60				21.600	40.5		40.5	0.50	12	16	50.1	29,000,000	103	0.5491		0.5491	240.00	10.800	10.800	21.600	0.000
	004-38	16.00	3	100	60	9.0	1440	23.04				23.040	46.1		46.1	0.53	12	16	50.1	29,000,000	103	0.7109		0.7109	256.00	11.520	11.520	23.040	0.000
	004-39	16.00	3	100	60	9.0	1440	23.04				23.040	46.1		46.1	0.53	12	16	50.1	29,000,000	103	0.7109		0.7109	256.00	11.520	11.520	23.040	0.000
	004-40	16.50	3	100	60	9.0	1440	23.76				23.760	49.0		49.0	0.55	12	16	50.1	29,000,000	103	0.8040		0.8040	264.00	11.880	11.880	23.760	0.000
	004-41	16.50	3	100	60	9.0	1440	23.76				23.760	49.0		49.0	0.55	12	16	50.1	29,000,000	103	0.8040		0.8040	264.00	11.880	11.880	23.760	0.000
	004-42	12.50	3	100	60	9.0	1440	18.00				18.000	28.1		28.1	0.42	12	16	50.1	29,000,000	103	0.2648		0.2648	200.00	9.000	9.000	18.000	0.000
	004-43	12.50	3	100	60	9.0	1440	18.00				18.000	28.1		28.1	0.42	12	16	50.1	29,000,000	103	0.2648		0.2648	200.00	9.000	9.000	18.000	0.000
	004-44	17.50	3	100	60	11.5	1840	32.20				32.200	70.4		70.4	0.58	12	22	73.1	29,000,000	156	0.8583		0.8583	385.00	16.100	16.100	32.200	0.000
	004-45	17.50	3	100	60	11.5	1840	32.20				32.200	70.4		70.4	0.58	12	22	73.1	29,000,000	156	0.8583		0.8583	385.00	16.100	16.100	32.200	0.000
	004-46	17.50	3	100	60	11.5	1840	32.20				32.200	70.4		70.4	0.58	12	22	73.1	29,000,000	156	0.8583		0.8583	385.00	16.100	16.100	32.200	0.000
	004-47	17.50	3	100	60	11.5	1840	32.20				32.200	70.4		70.4	0.58	12	22	73.1	29,000,000	156	0.8583		0.8583	385.00	16.100	16.100	32.200	0.000
	004-48	17.50	3	100	60	10.0	1600	28.00				28.000	61.3		61.3	0.58	12	19	61.6	29,000,000	130	0.8956		0.8956	332.50	14.000	14.000	28.000	0.000
	004-49	17.50	3	100	60	10.0	1600	28.00				28.000	61.3		61.3	0.58	12	19	61.6	29,000,000	130	0.8956		0.8956	332.50	14.000	14.000	28.000	0.000
	004-50	17.50	3	100	60	10.0	1600	28.00				28.000	61.3		61.3	0.58	12	19	61.6	29,000,000	130	0.8956		0.8956	332.50	14.000	14.000	28.000	0.000
	004-51	17.50	3	100	60	10.0	1600	28.00				28.000	61.3		61.3	0.58	12	19	61.6	29,000,000	130	0.8956		0.8956	332.50	14.000	14.000	28.000	0.000
	004-52	12.50	3	100	60	10.0	1600	20.00				20.000	31.3		31.3	0.42	12	16	50.1	29,000,000	103	0.2942		0.2942	200.00	10.000	10.000	20.000	0.000
	004-53	12.50	3	100	60	10.0	1600	20.00				20.000	31.3		31.3	0.42	12	16	50.1	29,000,000	103	0.2942		0.2942	200.00	10.000	10.000	20.000	0.000
	004-54	12.50	3	100	60	10.0	1600	20.00				20.000	31.3		31.3	0.42	12	16	50.1	29,000,000	103	0.2942		0.2942	200.00	10.000	10.000	20.000	0.000
	004-55	12.50	2	100	60	10.0	1600	20.00				20.000	31.3		31.3	0.42	12	16	50.1	29,000,000	103	0.2942		0.2942	200.00	10.000	10.000	20.000	0.000
	004-56	35.00					310	10.84				10.840	47.4		47.4	1.17	12	16	50.1	29,000,000	103	3.5007		3.5007	560.00	5.419	5.419	10.838	0.002
	004-57	35.00					310	10.85				10.850	47.5		47.5	1.17	12	16	50.1	29,000,000	103	3.5041		3.5041	560.00	5.419	5.419	10.838	0.012
	004-58	4.50														0.15	12	16	50.1	29,000,000	103				72.00	0.000	0.000	0.000	0.000
	004-59	4.50														0.15	12	16	50.1	29,000,000	103				72.00	0.000	0.000	0.000	0.000
		1185.50																							50112.50				
		^TOTAL L (ft)																							^TOTAL W(lb)				
											Sum of Loads-->	1941.876																	
																										1174.719	767.151		
																								Sum of Reactions-->	1941.869				

Column-Beam Connections

5th Floor	Beam	
Column	Start of	End of
002	004-03	
003	004-04	004-03
004		004-04
005	004-05	004-01
006		004-05 & 004-02
007	004-06	004-11
008	004-07	004-06 & 004-12
009	004-08	004-07 & 004-13
010	004-01 & 004-09	004-08 & 004-14
011	004-02 & 004-10	004-09 & 004-15
012		004-10 & 004-16
013	004-11 & 004-17	004-19
014	004-18	004-17 & 004-21
015	004-16	004-18 & 004-23
016	004-19 & 004-24	004-26
017	004-21 & 004-25	004-24 & 004-28
018		004-25 & 004-35
019	004-23	004-30
020	004-49 & 004-26*	004-26*
021		
022	004-53 & 004-28*	004-28*
023	004-35	004-55
024	004-30*	004-30*
025		
026		
027		
028		

4th Floor	Beam	
Column	Start of	End of
002	003-03	
003	003-04	003-03
004		003-04
005	003-05	003-01
006		003-02 & 003-05
007	003-06	003-11
008	003-07	003-06 & 003-12
009	003-08	003-07 & 003-13
010	003-01 & 003-09	003-08 & 003-14
011	003-02 & 003-10	003-09 & 003-15
012		003-10 & 003-16
013	003-11 & 003-17	003-19
014	003-18	003-17 & 003-21
015	003-16	003-18 & 003-23
016	003-19 & 003-24	003-26
017	003-21 & 003-25	003-24 & 003-28
018		003-25 & 003-30
019	003-23	003-31
020	003-26 & 003-32	003-34
021		
022	003-28 & 003-33	003-32 & 003-36
023	003-30	003-33
024	003-31	003-38
025	003-59 & 003-34*	003-34*
026		
027		
028	003-38*	003-68 & 003-38*

3rd Floor	Beam	
Column	Start of	End of
002	002-03	
003	002-04	002-03
004		002-04
005	002-05	002-01
006		002-02 & 002-05
007	002-06	002-11
008	002-07	002-06 & 002-12
009	002-08	002-07 & 002-13
010	002-01 & 002-09	002-08 & 002-14
011	002-02 & 002-10	002-09 & 002-15
012		002-10 & 002-16
013	002-11 & 002-17	002-19
014	002-18	002-17 & 002-21
015	002-16	002-18 & 002-23
016	002-19 & 002-24	002-26
017	002-21 & 002-25	002-24 & 002-28
018		002-25 & 002-30
019	002-23	002-31
020	002-26	002-34
021	002-32	002-35
022	002-28 & 002-33	002-32 & 002-37
023	002-30	002-33
024	002-31	002-39
025	002-34	002-42
026	002-35 & 002-40	
027	002-37 & 002-41	002-43
028	002-39	002-41 & 002-44

2nd Floor	Beam	
Column	Start of	End of
001	001-04	001-01
002	001-05	001-04
003	001-06	001-05
004		001-06
005	001-07	001-02
006		001-03 & 001-07
007	001-08	001-13
008	001-01 & 001-09	001-08 & 001-14
009	001-10	001-09 & 001-15
010	001-02 & 001-11	001-10 & 001-16
011	001-03 & 001-12	001-11 & 001-17
012		001-12 & 001-18
013	001-13 & 001-19	001-21
014	001-20	001-19 & 001-23
015	001-18	001-20 & 001-25
016	001-21 & 001-26	001-28
017	001-23 & 001-27	001-26 & 001-30
018		001-27 & 001-32
019	001-25	001-33
020	001-28	001-36
021	001-34	001-37
022	001-30 & 001-35	001-34 & 001-39
023	001-32	001-35
024	001-33	001-41
025	001-36	
026	001-37 & 001-42	
027	001-39 & 001-43	001-42
028	001-41	001-43

1st Floor	Beam	
Column	Start of	End of
001		000-01
002		
003		
004		
005	000-04	000-02
006		000-04 & 000-03
007	000-05	000-10
008	000-01 & 000-06	000-05 & 000-11
009	000-07	000-06 & 000-12
010	000-02 & 000-08	000-07 & 000-13
011	000-03 & 000-09	000-08 & 000-14
012		000-09 & 000-15
013	000-10 & 000-16	000-18
014	000-17	000-16 & 000-20
015	000-15	000-17 & 000-22
016	000-18 & 000-23	000-25
017	000-20 & 000-24	000-23 & 000-27
018		000-24 & 000-29
019	000-22	000-30
020	000-25	000-33
021	000-31	000-34
022	000-27 & 000-32	000-31 & 000-36
023	000-29	000-32
024	000-30	000-38
025	000-33	000-41
026	000-34 & 000-39	
027	000-36 & 000-40	000-39 & 000-43
028	000-38	000-40 & 000-45

Column Load Takedown 1/2

VERTICAL

from GH columns

from cantilevers

GRID LINES (NS-EW)	COLUMN #	BASE LEVEL (Floor #)	TOP LEVEL (Floor #)	Level 1 - Steel G Beam 1 (k)	Beam 2 (k)	Beam 3 (k)	Beam 4 (k)	AXIAL LOAD (k)	TOP DOWN LOAD (k)	Min REQ COLUMN	Level 2 - Steel 1 Beam 1 (k)	Beam 2 (k)	Beam 3 (k)	Beam 4 (k)	AXIAL LOAD (k)	TOP DOWN LOAD (k)	Min REQ COLUMN	Level 3 - Steel 2 Beam 1 (k)	Beam 2 (k)	Beam 3 (k)	Beam 4 (k)
13-11	001	FOUNDATION	1	31.00				31.00	38.49	6x6x3/16	3.78	3.71			7.49	7.49	6x6x3/16	x			
14-11	002	FOUNDATION	ROOF					0.00	3.78	6x6x3/16	0.00	3.78			3.78	3.78	6x6x3/16	0.00			
15-11	003	FOUNDATION	ROOF					0.00	0.00	6x6x3/16	0.00	0.00			0.00	0.00	6x6x3/16	0.00	0.00		
16-11	004	FOUNDATION	ROOF					0.00	0.00	6x6x3/16	0.00				0.00	0.00	6x6x3/16	0.00			
15-18	005	FOUNDATION	ROOF	7.26	0.00			7.26	34.98	6x6x3/16	7.26	0.00			7.26	27.72	6x6x3/16	7.26	0.00		
16-18	006	FOUNDATION	ROOF	7.26	0.80			8.06	35.78	6x6x3/16	0.00	7.26			7.26	27.72	6x6x3/16	0.00	7.26		
12-10	007	FOUNDATION	4	10.80	0.80			11.60	79.44	6x6x3/16	5.40	10.80			16.20	67.84	6x6x3/16	5.40	6.75		
13-10	008	FOUNDATION	4	0.80	31.00	12.80	22.32	66.92	190.03	8x8x5/16	3.71	12.16	5.40	22.32	43.59	123.11	6x6x3/8	5.76	5.40	13.95	
14-10	009	FOUNDATION	4	12.80	22.32	0.00		35.12	143.04	6x6x3/8	0.00	12.16	22.32		34.48	107.92	6x6x3/8	0.00	5.76	18.00	
15-10	010	FOUNDATION	ROOF	13.20	22.68	0.00	0.00	35.88	170.16	8x8x5/16	0.00	12.54	0.00	22.68	35.22	134.28	6x6x3/8	0.00	12.54	0.00	22.68
16-10	011	FOUNDATION	4	13.20	20.88	5.01	4.50	43.59	188.77	8x8x5/16	0.00	4.60	12.54	20.88	38.02	145.18	6x6x3/8	0.00	4.50	12.54	20.88
17-10	012	FOUNDATION	4	9.00	4.50			13.50	80.76	6x6x3/16	4.60	9.00			13.60	67.26	6x6x3/16	4.50	9.00		
12-24	013	FOUNDATION	4	10.80	8.05	53.36		72.21	326.39	10x10x3/8	10.80	52.88	8.05		71.73	254.18	9x9x3/8	6.75	33.56	5.03	
23-24	014	FOUNDATION	4	67.39	64.30	16.10		147.79	682.46	16x16x1/2	63.97	67.06	16.10		147.13	534.67	14x14x1/2	55.79	45.45	13.08	
17-24	015	FOUNDATION	4	55.36	9.00	8.05		72.41	367.63	12x12x3/8	9.00	54.90	8.05		71.95	295.22	10x10x3/8	9.00	46.85	5.03	
12-19	016	FOUNDATION	4	8.05	7.00	45.86		60.91	283.12	9x9x3/8	8.05	45.85	7.00		60.90	222.21	8x8x3/8	5.03	36.09	7.00	
23-19	017	FOUNDATION	4	45.85	16.10	31.83	12.00	105.78	475.11	14x14x1/2	16.10	31.83	45.85	12.00	105.78	369.33	12x12x3/8	13.08	25.92	36.09	12.00
21-19	018	FOUNDATION	4	38.27	5.00			43.27	214.24	8x8x3/8	38.27	5.00			43.27	170.97	8x8x5/16	31.16	5.00		
17-19	019	FOUNDATION	4	8.05	0.00			8.05	27.85	6x6x3/16	8.05	0.00			8.05	19.80	6x6x3/16	5.03	0.00		
12-20	020	FOUNDATION	4	7.00	0.00			7.00	173.87	8x8x5/16	7.00	0.00			7.00	166.87	8x8x5/16	7.00	8.17		
31-20	021	FOUNDATION	2	10.62	30.01			40.63	130.09	6x6x3/8	30.05	10.62			40.67	89.46	6x6x3/8	30.01	18.78		
23-20	022	FOUNDATION	4	24.41	12.00	29.62	18.32	84.35	479.99	14x14x1/2	12.00	29.41	24.45	17.97	83.83	395.64	12x12x3/8	12.00	30.51	24.41	19.80
21-20	023	FOUNDATION	4	35.78	5.00			40.78	177.75	8x8x5/16	5.00	35.29			40.29	136.97	6x6x3/8	5.00	37.86		
17-20	024	FOUNDATION	4	7.70	0.00			7.70	95.94	6x6x3/8	0.00	7.35			7.35	88.24	6x6x3/8	0.00	9.19		
12-22	025	FOUNDATION	3	0.00	0.00			0.00	140.67	6x6x3/8	0.00				0.00	140.67	6x6x3/8	31.50	8.17		
31-22	026	FOUNDATION	2	10.62	23.21			33.83	173.07	8x8x5/16	10.62	10.25			20.87	139.24	6x6x3/8	18.78	99.59		
23-22	027	FOUNDATION	G	23.21	18.32	41.30	0.00	82.83	82.83	6x6x3/8											
17-22	028	FOUNDATION	3	41.30	7.70	0.00		49.00	318.98	10x10x3/8	7.35	25.35			32.70	269.98	9x9x3/8	31.50	9.19	95.29	
23-22	029	1	3								-10.25	-17.97	-25.35		-53.57	322.25	10x10x3/8	63.00	54.23	95.29	19.80
36-22	030	2	3																		
39-22	031	2	3																		
32-34	032	G	2					0.00	87.59	6x6x3/8					0.00	87.59	6x6x3/8	31.50	49.34		6.75
23-34	033	G	2					0.00	161.68	8x8x5/16					0.00	161.68	8x8x5/16	63.00	49.34	49.34	
33-34	034	G	2					0.00	87.59	6x6x3/8					0.00	87.59	6x6x3/8	31.50	49.34		6.75
							LOAD FROM THIS LEVEL-->	1109.47						LOAD FROM THIS LEVEL-->	894.85						LOAD FROM THIS LEVEL-->

Column Load Takedown 2/2

AXIAL LOAD (k)	TOP DOWN LOAD (k)	Min REQ COLUMN	Level 4 - Steel 3 Beam 1 (k)	Beam 2 (k)	Beam 3 (k)	Beam 4 (k)	AXIAL LOAD (k)	TOP DOWN LOAD (k)	Min REQ COLUMN	Level 5 - Steel 4 Beam 1 (k)	Beam 2 (k)	Beam 3 (k)	Beam 4 (k)	AXIAL LOAD (k)	TOP DOWN LOAD (k)	Min REQ COLUMN	TOTAL AXIAL (k)
			x							x							38.493
0.00	0.00	4x4x1/4	0.000				0.000	0.000	4x4x1/4	0.000				0.000	0.000	4x4x1/4	3.780
0.00	0.00	4x4x1/4	0.000	0.000			0.000	0.000	4x4x1/4	0.000	0.0000			0.000	0.000	4x4x1/4	0.000
0.00	0.00	4x4x1/4	0.000				0.000	0.000	4x4x1/4	0.000				0.000	0.000	4x4x1/4	0.000
7.26	20.46	4x4x1/4	6.600	0.000			6.600	13.200	4x4x1/4	6.600	0.0000			6.600	6.600	4x4x1/4	34.980
7.26	20.46	4x4x1/4	0.000	6.600			6.600	13.200	4x4x1/4	6.600	0.0000			6.600	6.600	4x4x1/4	35.780
12.15	51.64	6x6x3/16	3.375	6.750			10.125	39.485	4x4x1/4	5.400	16.9600	7.000		29.360	29.360	4x4x1/4	79.435
25.11	79.52	6x6x3/16	3.600	3.375	13.950		20.925	54.405	6x6x3/16	5.760	22.3200	5.400		33.480	33.480	4x4x1/4	190.028
23.76	73.44	6x6x3/16	0.000	3.600	18.000		21.600	49.680	6x6x3/16	5.760	22.3200	0.000		28.080	28.080	4x4x1/4	143.040
35.22	99.06	6x6x3/8	0.000	12.540	0.000	22.680	35.220	63.840	6x6x3/16	5.940	22.6800	0.000	0.00	28.620	28.620	4x4x1/4	170.160
37.92	107.16	6x6x3/8	0.000	4.500	12.540	20.880	37.920	69.240	6x6x3/16	4.500	5.9400	20.880	0.00	31.320	31.320	4x4x1/4	188.765
13.50	53.66	6x6x3/16	4.500	9.000			13.500	40.156	4x4x1/4	4.500	15.1560	7.000		26.656	26.656	4x4x1/4	80.756
45.35	182.45	8x8x5/16	6.750	34.945	5.032		46.727	137.108	6x6x3/8	16.960	52.7550	20.666		90.381	90.381	6x6x3/16	326.391
114.32	387.54	12x12x3/8	63.699	46.837	16.100		126.636	273.220	9x9x3/8	63.699	66.7850	16.100		146.584	146.584	6x6x3/8	682.461
60.88	223.28	8x8x3/8	9.000	54.761	8.050		71.811	162.394	8x8x5/16	15.156	54.7610	20.666		90.583	90.583	6x6x3/8	367.632
48.13	161.31	8x8x5/16	5.032	44.341	7.000		56.373	113.189	6x6x3/8	20.666	52.8500	-16.700		56.816	56.816	6x6x3/16	283.125
87.10	263.55	9x9x3/8	16.100	31.830	44.341	12.000	104.271	176.451	8x8x5/16	16.100	36.8300	52.850	-33.6	72.180	72.180	6x6x3/16	475.109
36.16	127.70	6x6x3/8	38.270	5.000			43.270	91.540	6x6x3/8	43.270	5.0000			48.270	48.270	6x6x3/16	214.236
5.03	11.75	4x4x1/4	8.050	0.000			8.050	6.716	4x4x1/4	20.666	-22.0000			-1.335	-1.335	4x4x1/4	27.848
15.17	159.87	8x8x5/16	7.000	41.300	-24.100		24.200	144.700	6x6x3/8	14.000	106.5000			120.500	120.500	6x6x3/8	173.867
48.79	48.79	6x6x3/16	x							x							130.087
86.73	311.81	10x10x3/8	12.000	28.780	41.300	-26.500	55.580	225.080	8x8x3/8	14.000	145.5000	10.000		169.500	169.500	8x8x5/16	479.987
42.86	96.68	6x6x3/8	5.000	33.820			38.820	53.820	6x6x3/16	5.000	10.0000			15.000	15.000	4x4x1/4	177.753
9.19	80.89	6x6x3/16	0.000	-23.100			-23.100	71.700	6x6x3/16	94.800				94.800	94.800	6x6x3/8	95.938
39.67	140.67	6x6x3/8	12.600	88.400			101.000	101.000	6x6x3/8	x							140.667
118.37	118.37	6x6x3/8	x							x							173.067
			x							x							82.830
135.98	237.28	8x8x3/8	88.700	12.600			101.300	101.300	6x6x3/8	x							318.976
232.32	375.82	12x12x3/8	118.300	12.600	12.600		143.500	143.500	6x6x3/8								322.252
			50.400				50.400	50.400	6x6x3/16								50.400
			50.400				50.400	50.400	6x6x3/16								50.400
87.59	87.59	6x6x3/8															87.588
161.68	161.68	8x8x5/16															161.675
87.59	87.59	6x6x3/8															87.588

5115.189 <-- SUM OF AXIAL LOADS

1625.06

LOAD FROM THIS LEVEL--> 1151.728

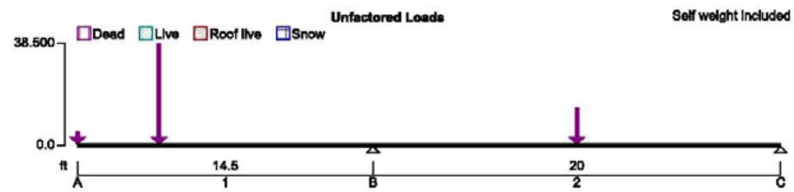
LOAD FROM THIS LEVEL--> 1093.99

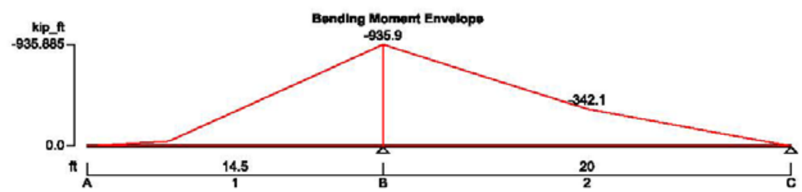
TEDDS Cantilever Analysis 1/4

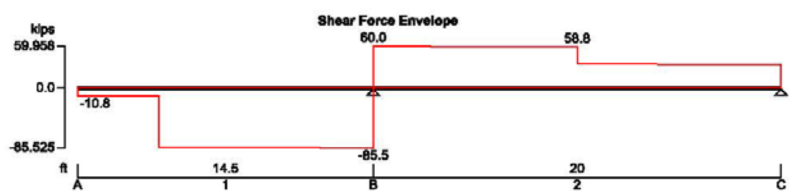
STEEL BEAM ANALYSIS & DESIGN (AISC360-10)

In accordance with AISC360 14th Edition published 2010 using the ASD method

Tedds calculation version 3.0.09







Support conditions

Support A	Vertically free
	Rotationally free
Support B	Vertically restrained
	Rotationally free
Support C	Vertically restrained
	Rotationally free

Applied loading

Beam loads	Dead point load 5.419 kips at 0.00 in
	Dead point load 5.419 kips at 0.00 in

TEDDS Cantilever Analysis 2/4

	Dead point load 38.5 kips at 48.00 in	
	Dead point load 34.5 kips at 48.00 in	
	Dead point load 14 kips at 294.00 in	
	Dead self weight of beam × 1	
	Dead point load 10 kips at 294.00 in	
Load combinations		
Load combination 1	Support A	Dead × 1.00
		Live × 1.00
		Roof live × 1.00
		Snow × 1.00
	Span 1	Dead × 1.00
		Live × 1.00
		Roof live × 1.00
		Snow × 1.00
	Support B	Dead × 1.00
		Live × 1.00
		Roof live × 1.00
		Snow × 1.00
	Span 2	Dead × 1.00
		Live × 1.00
		Roof live × 1.00
		Snow × 1.00
	Support C	Dead × 1.00
		Live × 1.00
		Roof live × 1.00
		Snow × 1.00
Analysis results		
Maximum moment;	M_{max} = **0** kips_ft;	M_{min} = **-935.9** kips_ft
Maximum moment span 1;	M_{s1_max} = **0** kips_ft;	M_{s1_min} = **-935.9** kips_ft
Maximum moment span 1 segment 1; kips_ft	$M_{s1\_seg1\_max}$ = **0** kips_ft;	$M_{s1\_seg1\_min}$ = **-40.1**
Maximum moment span 1 segment 2; kips_ft	$M_{s1\_seg2\_max}$ = **0** kips_ft;	$M_{s1\_seg2\_min}$ = **-318.9**
Maximum moment span 1 segment 3; kips_ft	$M_{s1\_seg3\_max}$ = **0** kips_ft;	$M_{s1\_seg3\_min}$ = **-626.6**
Maximum moment span 1 segment 4; kips_ft	$M_{s1\_seg4\_max}$ = **0** kips_ft;	$M_{s1\_seg4\_min}$ = **-935.9**
Maximum moment span 2;	M_{s2_max} = **0** kips_ft;	M_{s2_min} = **-935.9** kips_ft
Maximum shear;	V_{max} = **60** kips;	V_{min} = **-85.5** kips
Maximum shear span 1;	V_{s1_max} = **-10.8** kips;	V_{s1_min} = **-85.5** kips
Maximum shear span 1 segment 1;	$V_{s1\_seg1\_max}$ = **0** kips;	$V_{s1\_seg1\_min}$ = **-11.3** kips
Maximum shear span 1 segment 2;	$V_{s1\_seg2\_max}$ = **0** kips;	$V_{s1\_seg2\_min}$ = **-84.7** kips
Maximum shear span 1 segment 3;	$V_{s1\_seg3\_max}$ = **0** kips;	$V_{s1\_seg3\_min}$ = **-85.1** kips
Maximum shear span 1 segment 4;	$V_{s1\_seg4\_max}$ = **0** kips;	$V_{s1\_seg4\_min}$ = **-85.5** kips
Maximum shear span 2;	V_{s2_max} = **60** kips;	V_{s2_min} = **33.6** kips

TEDDS Cantilever Analysis 3/4

Deflection;	δ_{max} = **0** in;	δ_{min} = **0** in
Deflection span 1;	δ_{s1_max} = **0** in;	δ_{s1_min} = **0** in
Deflection span 2;	δ_{s2_max} = **0** in;	δ_{s2_min} = **0** in
Maximum reaction at support A;	R_{A_max} = **0** kips;	R_{A_min} = **0** kips
Maximum reaction at support B;	R_{B_max} = **145.5** kips;	R_{B_min} = **145.5** kips
Unfactored dead load reaction at support B;	R_{B_Dead} = **145.5** kips	
Maximum reaction at support C;	R_{C_max} = **-33.6** kips;	R_{C_min} = **-33.6** kips
Unfactored dead load reaction at support C;	R_{C_Dead} = **-33.6** kips	

Section details

Section type;	**W 30x116**
ASTM steel designation;	**A992**
Steel yield stress;	F_y = **50** ksi
Steel tensile stress;	F_u = **65** ksi
Modulus of elasticity;	E = **29000** ksi

Safety factors

Safety factor for tensile yielding;	Ω_{ty} = **1.67**
Safety factor for tensile rupture;	Ω_{tr} = **2.00**
Safety factor for compression;	Ω_c = **1.67**
Safety factor for flexure;	Ω_b = **1.67**
Safety factor for shear;	Ω_v = **1.50**

Lateral bracing

Span 1 has lateral bracing at supports plus quarter points
Span 2 has continuous lateral bracing
Cantilever tip is unbraced
Cantilever support is continuous with lateral and torsional restraint

Classification of sections for local buckling - Section B4.1

Classification of flanges in flexure - Table B4.1b (case 10)

Width to thickness ratio;	$b_f / (2 \times t_f)$ = **6.18**	
Limiting ratio for compact section;	$\lambda_{pff} = 0.38 \times \sqrt{[E / F_y]}$ = **9.15**	
Limiting ratio for non-compact section;	$\lambda_{rff} = 1.0 \times \sqrt{[E / F_y]}$ = **24.08**;	Compact

Classification of web in flexure - Table B4.1b (case 15)

Width to thickness ratio;	$(d - 2 \times k) / t_w$ = **47.79**	
Limiting ratio for compact section;	$\lambda_{pwf} = 3.76 \times \sqrt{[E / F_y]}$ = **90.55**	
Limiting ratio for non-compact section;	$\lambda_{rwf} = 5.70 \times \sqrt{[E / F_y]}$ = **137.27**;	Compact

Section is compact in flexure

Design of members for shear - Chapter G

Required shear strength;	$V_r = \max(\text{abs}(V_{max}), \text{abs}(V_{min}))$ = **85.525** kips
Web area;	$A_w = d \times t_w$ = **16.95** in^2
Web plate buckling coefficient;	k_v = **5**
Web shear coefficient - eq G2-2;	C_v = **1.000**
Nominal shear strength - eq G2-1;	$V_n = 0.6 \times F_y \times A_w \times C_v$ = **508.500** kips
Allowable shear strength;	$V_c = V_n / \Omega_v$ = **339.000** kips

PASS - Allowable shear strength exceeds required shear strength

TEDDS Cantilever Analysis 4/4

Design of members for flexure in the major axis at span 1 segment 4 - Chapter F

Required flexural strength; $M_r = \max(\text{abs}(M_{s1\_seg4\_max}), \text{abs}(M_{s1\_seg4\_min}))$ = **935.885** kips_ft

Yielding - Section F2.1

Nominal flexural strength for yielding - eq F2-1; $M_{nyld} = M_p = F_y \times Z_x$ = **1575** kips_ft

Lateral-torsional buckling - Section F2.2

Unbraced length; $L_b = L_{s1\_seg4}$ = **43.5** in

Limiting unbraced length for yielding - eq F2-5; $L_p = 1.76 \times r_y \times \sqrt{[E / F_y]}$ = **92.826** in

Distance between flange centroids; $h_o = d - t_f$ = **29.15** in

c = 1

$r_{ts} = \sqrt{[\sqrt{(I_y \times C_w)} / S_x]}$ = **2.697** in

Limiting unbraced length for inelastic LTB - eq F2-6

$L_r = 1.95 \times r_{ts} \times E / (0.7 \times F_y) \times \sqrt{[(J \times c / (S_x \times h_o)) + \sqrt{((J \times c / (S_x \times h_o))^2 + 6.76 \times (0.7 \times F_y / E)^2)}]}$ = **271.367** in

Nominal flexural strength; $M_n = M_{nyld}$ = **1575.000** kips_ft

Allowable flexural strength; $M_c = M_n / \Omega_b$ = **943.114** kips_ft

PASS - Allowable flexural strength exceeds required flexural strength

Design of members for vertical deflection

Consider deflection due to live loads

Limiting deflection; $\delta_{lim} = L_{s2} / 360$ = **0.667** in

Maximum deflection span 2; $\delta = \max(\text{abs}(\delta_{max}), \text{abs}(\delta_{min}))$ = **0** in

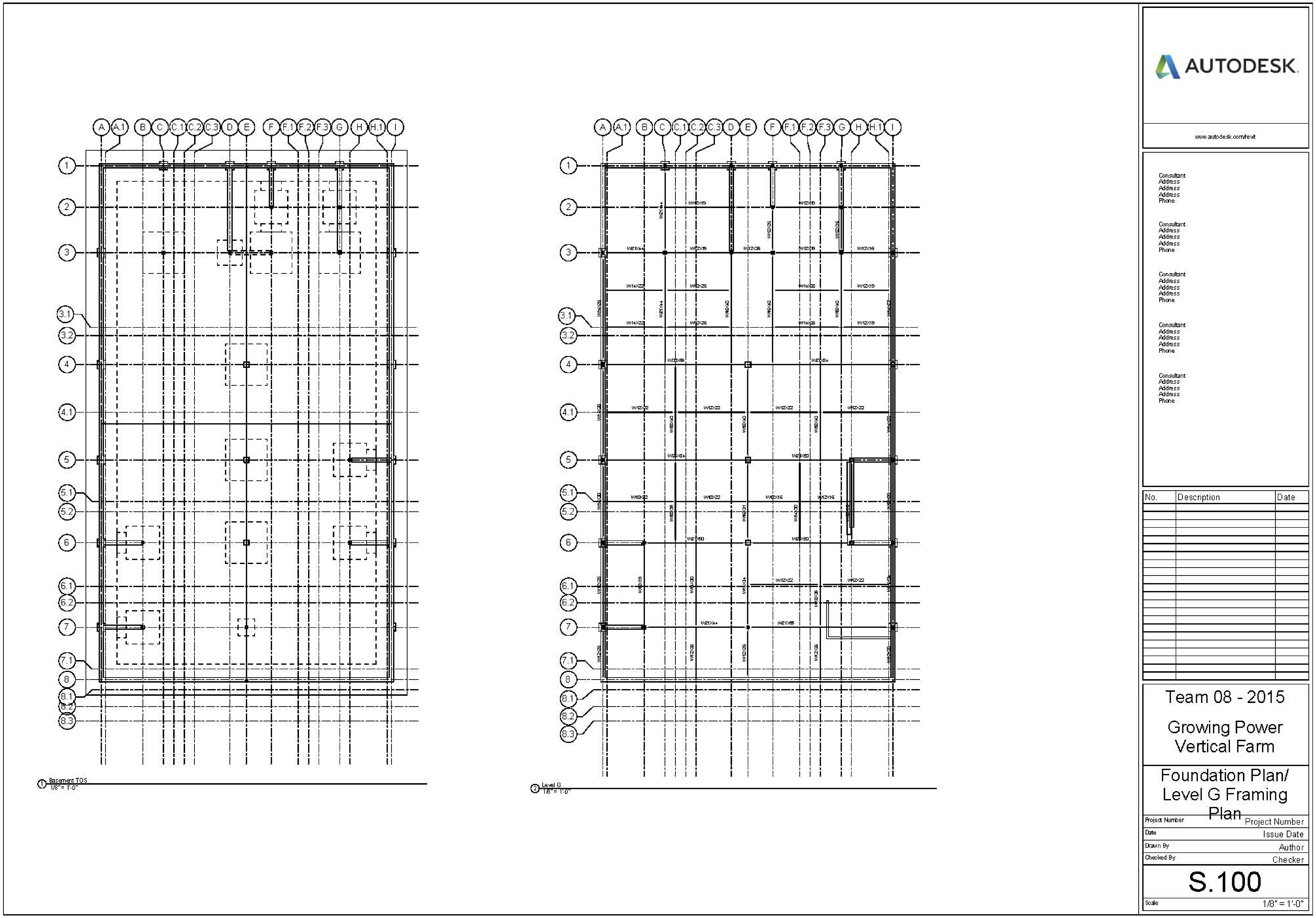
PASS - Maximum deflection does not exceed deflection limit

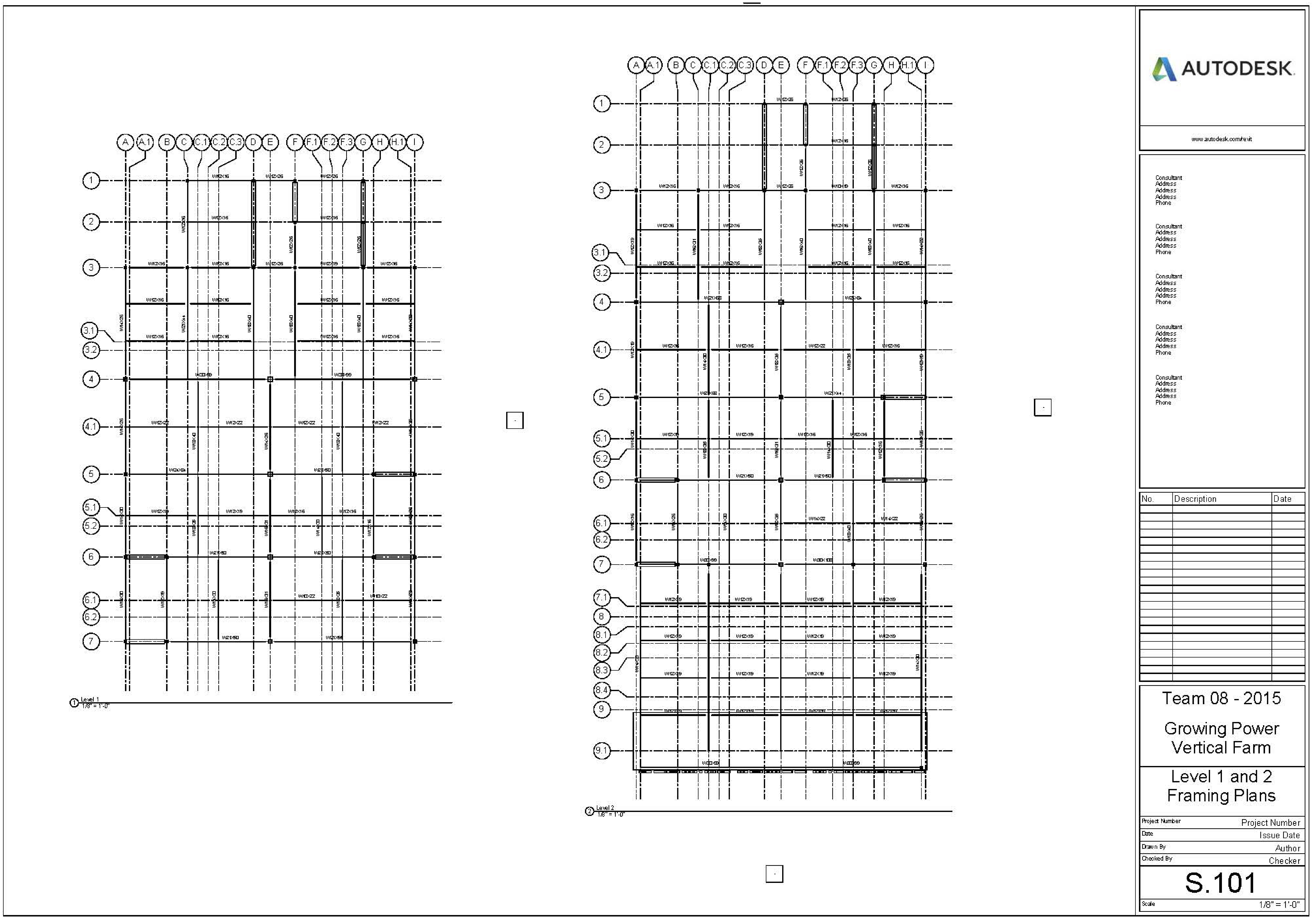
Greenhouse Framing Log

Greenhouse Framing

Member	Quantity	Level	IFF Column, Top Level	Length (ft)	trib ft	area load ksf	uniform load k/ft	load k	Total moment k-ft	Axial from above k	Total Axial force k	start shear	end shear	Size ZZxYYxWW	mom. Capacity k-ft	Weight (lb/ft)	Total Weight (lb)
Framing																	
	1	5 top		20.25	9.75	0.03	0.2925	5.923125	14.99291016					5.5x5.5x3/16	16.4	13.25	268.3125
	1	5 top		20.25	9.75	0.03	0.2925	5.923125	14.99291016					5.5x5.5x3/16	16.4	13.25	268.3125
	1	5 top		20.25	9.75	0.03	0.2925	5.923125	14.99291016					5.5x5.5x3/16	16.4	13.25	268.3125
	1	5 top		20.25	9.75	0.03	0.2925	5.923125	14.99291016					5.5x5.5x3/16	16.4	13.25	268.3125
	1	5 top		20.25	15	0.03	0.45	9.1125	23.06601563					5.5x5.5x5/16	25.9	21.21	429.5025
	1	5 top		20.25	15	0.03	0.45	9.1125	23.06601563					5.5x5.5x5/16	25.9	21.21	429.5025
	2	5 top		30	12.5	0.03	0.375	11.25	42.1875			5.625	5.625	7x7x3/8	50.7	32.58	1954.8
	1	5 top		30	20.25	0.03	0.6075	18.225	68.34375			9.1125	9.1125	7x7x5/8	75.9	50.81	1524.3
	8	5 top		15	6.75	0.03	0.2025	3.0375	5.6953125					4x4x3/16	8.42	9.42	1130.4
	24	5 top		6.75	5	0.03	0.15	1.0125	0.854296875					4x4x3/16	8.42	9.42	1526.04
	2	5 slope		30	12	0.03	0.36	10.8	40.5			5.4	5.4	7x7x3/8	50.7	32.58	1954.8
	8	5 slope		20	5	0.03	0.15	3	7.5					4x4x3/16	8.42	9.42	1507.2
	1	5 slope		22.36	12.5	0.03	0.375	8.385	23.436075			4.1925	4.1925	5.5x5.5x5/16	25.9	21.21	474.2556
	1	5 slope		22.36	15	0.03	0.45	10.062	28.12329					5.5x5.5x3/8	30	24.93	557.4348
	1	5 slope		22.36	12.5	0.03	0.375	8.385	23.436075			4.1925	4.1925	5.5x5.5x5/16	25.9	21.21	474.2556
	1	5 slope		22.36	15	0.03	0.45	10.062	28.12329			5.031	5.031	5.5x5.5x3/8	30	24.93	557.4348
	1	5 slope		22.36	20	0.03	0.6	13.416	37.49772			6.708	6.708	7x7x5/16	43.4	27.59	616.9124
	1	5 slope		22.36	15	0.03	0.45	10.062	28.12329			5.031	5.031	5.5x5.5x3/8	30	24.93	557.4348
	1	5 slope		22.36	12.5	0.03	0.375	8.385	23.436075			4.1925	4.1925	5.5x5.5x5/16	25.9	21.21	474.2556
	1	5 slope		22.36	15	0.03	0.45	10.062	28.12329					5.5x5.5x3/8	30	24.93	557.4348
	1	5 slope		22.36	12.5	0.03	0.375	8.385	23.436075			4.1925	4.1925	5.5x5.5x5/16	25.9	21.21	474.2556
	1	5 slope		22.36	15	0.03	0.45	10.062	28.12329			5.031	5.031	5.5x5.5x3/8	30	24.93	557.4348
	1	5 slope		22.36	20	0.03	0.6	13.416	37.49772			6.708	6.708	7x7x5/16	43.4	27.59	616.9124
	1	5 slope		22.36	15	0.03	0.45	10.062	28.12329			5.031	5.031	5.5x5.5x3/8	30	24.93	557.4348
	4	5 slope		31	10	0.03	0.3	9.3	36.0375					7x7x5/16	43.4	27.59	3421.16
	12	5 slope		15	5.5	0.03	0.165	2.475	4.640625					4x4x3/16	8.42	9.42	1695.6
	12	5 slope		20.25	5.5	0.03	0.165	3.34125	8.457539063					4x4x1/4	10.8	12.21	2967.03
	4	5 slope		20.25	5	0.03	0.15	3.0375	7.688671875					4x4x3/16	8.42	9.42	763.02
	112	5 slope		5.5	5	0.03	0.15	0.825	0.5671875					4x4x3/16	8.42	9.42	5802.72
	8	5 slope		16.5	5.5	0.03	0.165	2.7225	5.61515625					4x4x3/16	8.42	9.42	1243.44
	8	5 slope		11	5.5	0.03	0.165	1.815	2.495625					4x4x3/16	8.42	9.42	828.96
	8	5 slope		5.5	5	0.03	0.15	0.825	0.5671875					4x4x3/16	8.42	9.42	414.48
Framing																	
	4	5 wall		20.25	6.25	0.03	0.1875	3.796875	9.610839844					4x4x1/4	10.8	12.21	989.01
	8	5 wall		20	6.25	0.03	0.1875	3.75	9.375					4x4x1/4	10.8	12.21	1953.6
	2	5 wall		30	6.25	0.03	0.1875	5.625	21.09375					5.5x5.5x5/16	25.9	21.21	1272.6
	24	5 wall		6.75	4.1667	0.03	0.125001	0.84375675	0.711919750					2x2x3/16	2.21	4.32	699.84
	72	5 wall		5	4.1667	0.03	0.125001	0.625005	0.390628125					2x2x3/16	2.21	4.32	1555.2
	8	5 wall		12.5	6.75	0.03	0.2025	2.53125	0		2.53125			2.5x2.5x1/4	10	7.11	711
	34	5 wall		12.5	5	0.03	0.15	1.875	0		1.875			2.5x2.5x1/4	10	7.11	3021.75
Columns																	
001	1	5 wall		12.5	5	0.03	0.15	1.875	0	5.109	6.984			4x4x3/16	36	9.42	117.75
002	1	5 wall		12.5	5	0.03	0.15	1.875	0	19.1	20.975			4x4x3/16	36	9.42	117.75
003	1	5 wall		12.5	5	0.03	0.15	1.875	0	19.1	20.975			4x4x3/16	36	9.42	117.75
004	1	5 wall		12.5	5	0.03	0.15	1.875	0	5.109	6.984			4x4x3/16	36	9.42	117.75
005	1	5 wall		12.5	6	0.03	0.18	2.25	0	10.06	12.31			4x4x3/16	36	9.42	117.75
006	1	5 wall		12.5	6	0.03	0.18	2.25	0	10.06	12.31			4x4x3/16	36	9.42	117.75
007	1	5 wall		12.5	6.75	0.03	0.2025	2.53125	0	22.7	25.23125			4x4x3/16	36	9.42	117.75
008	1	5 wall		12.5	6.75	0.03	0.2025	2.53125	0	22.7	25.23125			4x4x3/16	36	9.42	117.75
009	1	5 wall		12.5	6	0.03	0.18	2.25	0	10.06	12.31			4x4x3/16	36	9.42	117.75
010	1	5 wall		12.5	6	0.03	0.18	2.25	0	10.06	12.31			4x4x3/16	36	9.42	117.75
011	1	5 wall		12.5	5	0.03	0.15	1.875	0	5.109	6.984			4x4x3/16	36	9.42	117.75
012	1	5 wall		12.5	5	0.03	0.15	1.875	0	19.1	20.975			4x4x3/16	36	9.42	117.75
013	1	5 wall		12.5	5	0.03	0.15	1.875	0	19.1	20.975			4x4x3/16	36	9.42	117.75
014	1	5 wall		12.5	5	0.03	0.15	1.875	0	5.109	6.984			4x4x3/16	36	9.42	117.75
								29.0625		102.476	211.5305						
Framing	4	4 slope		30	11.75	0.03	0.3525	7.05	17.625					5x5x5/16	21	19.08	1526.4
	2	4 slope		30	11.75	0.03	0.3525	10.575	39.65625					7x7x5/16	43.4	27.59	1655.4
	2	4 slope		23.5	10	0.03	0.3	7.05	20.709375			3.525	3.525	5.5x5.5x5/16	25.9	21.21	996.87
	2	4 slope		23.5	17.5	0.03	0.525	12.3375	36.24140625			8.8125	8.8125	7x7x5/16	43.4	27.59	1296.73
	1	4 slope		23.5	15	0.03	0.45	10.575	31.0640625			5.2875	5.2875	7x7x5/16	43.4	27.59	648.365
	6	4 slope		20	5.875	0.03	0.17625	3.525	8.8125					4x4x1/4	10.8	12.21	1465.2
	6	4 slope		15	5.875	0.03	0.17625	2.64375	4.95703125					4x4x3/16	8.42	9.42	847.8
	40	4 slope		5.875	5	0.03	0.15	0.88125	0.647167969					4x4x3/16	8.42	9.42	2213.7
	42	4 wall		5	4	0.03	0.12	0.6	0.375					4x4x3/16	8.42	9.42	1978.2
	42	4 wall		5	3.375	0.03	0.10125	0.50625	0.31640625					4x4x3/16	8.42	9.42	1978.2
	11	4 wall		16	5	0.03	0.15	2.4	0		2.4			2.5x2.5x1/4	10	7.11	1251.36
	11	4 wall		13.5	5	0.03	0.15	2.025	0		1.875			2.5x2.5x1/4	10	7.11	1055.835
Columns																	
001	1	4 wall		13.5	5	0.03	0.15	2.025	0	3.525	5.55			3x3x1/4	16	8.81	118.935
002	1	4 wall		13.5	5	0.03	0.15	2.025	0	8.8125	10.8375			3x3x1/4	16	8.81	118.935
003	1	4 wall		13.5	5	0.03	0.15	2.025	0	8.8125	10.8375			3x3x1/4	16	8.81	118.935
004	1	4 wall		13.5	5	0.03	0.15	2.025	0	3.525	5.55			3x3x1/4	16	8.81	118.935
005	1	4 wall		16	5	0.03	0.15	2.4	0	3.525	5.925			3x3x1/4	12.3	8.81	140.96
006	1	4 wall		16	5	0.03	0.15	2.4	0	8.8125	11.2125			3x3x1/4	12.3	8.81	140.96
007	1	4 wall		16	5	0.03	0.15	2.4	0	8.8125	11.2125			3x3x1/4	12.3	8.81	140.96
008	1	4 wall		16	5	0.03	0.15	2.4	0	3.525	5.925			3x3x1/4	12.3	8.81	140.96
											67.05						
										49.35							
Framing	4	3 slope		30	14.5	0.03	0.435	8.7	21.75					5.5x5.5x5/16	25.9	21.21	1696.8
	2	3 slope		30	14.5	0.03	0.435	13.05	48.9375					8x8x5/16	57.6	31.84	1910.4
	2	3 slope		29	10	0.03	0.3	8.7	31.5375			4.35	4.35	7x7x5/16	43.4	27.59	1600.22
	2	3 slope		29	17.5	0.03	0.525	15.225	55.190625			10.875	10.875	8x8x5/16	57.6	31.84	1846.72
	1	3 slope		29	15	0.03	0.45	13.05	47.30625			6.525	6.525	8x8x5/16	57.6	31.84	923.36
	8	3 slope		20	5.8	0.03	0.174	3.48	8.7					4x4x1/4	10.8	12.21	1953.6
	8	3 slope		15	5.8	0.03	0.174	2.61	4.89375					4x4x3/16	8.42	9.42	1130.4
	50	3 slope		5.8	5	0.03	0.15	0.87	0.63075					4x4x3/16	8.42	9.42	2731.8
	42	3 wall		5	4	0.03	0.12	0.6	0.375					4x4x3/16	8.42	9.42	1978.2
	42	3 wall		5	4	0.03	0.12	0.6	0.375					4x4x3/16	8.42	9.42	1978.2
	11	3 wall		16	5	0.03	0.15	2.4	0		2.4			2.5x2.5x1/4	10	7.11	1251.36
	11	3 wall		16	5	0.03	0.15	2.4	0		2.4			2.5x2.5x1/4	10	7.11	1251.36
Columns																	
001	1	3 wall		16	5	0.03	0.15	2.4	0	4.35	6.75			3x3x5/16	14	10.58	169.28
002	1	3 wall		16	5	0.03	0.15	2.4	0	10.875	13.275			3x3x5/16	14	10.58	169.28
003	1	3 wall		16	5	0.03	0.15	2.4	0	10.875	13.275			3x3x5/16	14	10.58	169.28
004	1	3 wall		16	5	0.03	0.15	2.4	0	4.35	6.75			3x3x5/16	14	10.58	169.28
005	1	3 wall		16	5	0.03	0.15	2.4	0	4.35	6.75			3x3x5/16	14	10.58	169.28
006	1	3 wall		16	5	0.03	0.15	2.4	0	10.875	13.275			3x3x5/16	14	10.58	169.28
007	1	3 wall		16	5	0.03	0.15	2.4	0	10.875	13.275			3x3x5/16	14	10.58	169.28
008	1	3 wall		16	5	0.03	0.15	2.4	0	4.35	6.75			3x3x5/16	14	10.58	169.28
											80.1						
										60.9							

Structural Drawings Section

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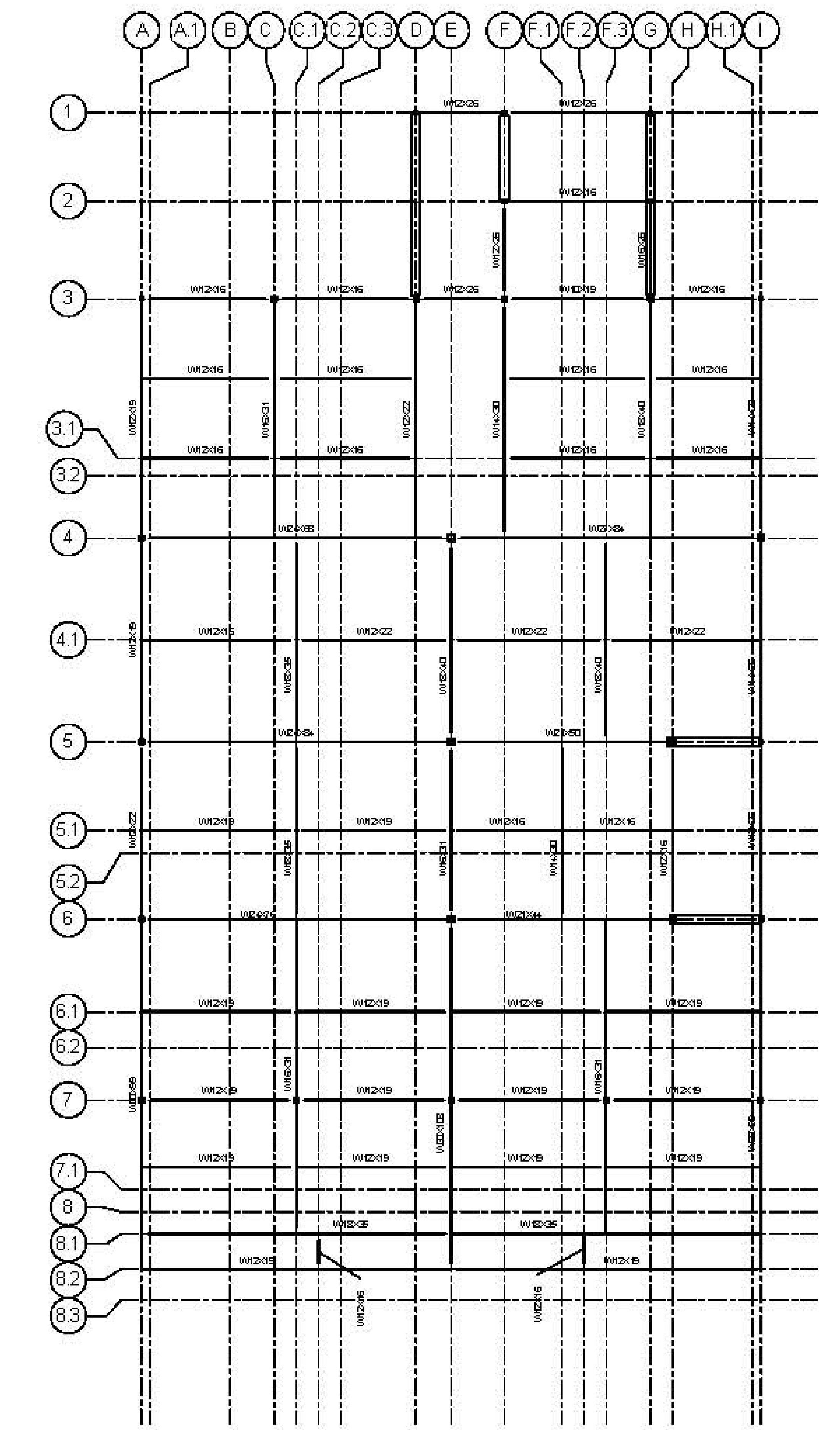
Growing Power Vertical Farm
Level 1 and 2 Framing Plans
Project Number
Project Number
Date
Issue Date
Drawn By
Author
Checked By
Checker
S.101
Scale
1/8" = 1'-0"
Level 1
1/8" = 1'-0"
Level 2
1/8" = 1'-0"



1 Level 3
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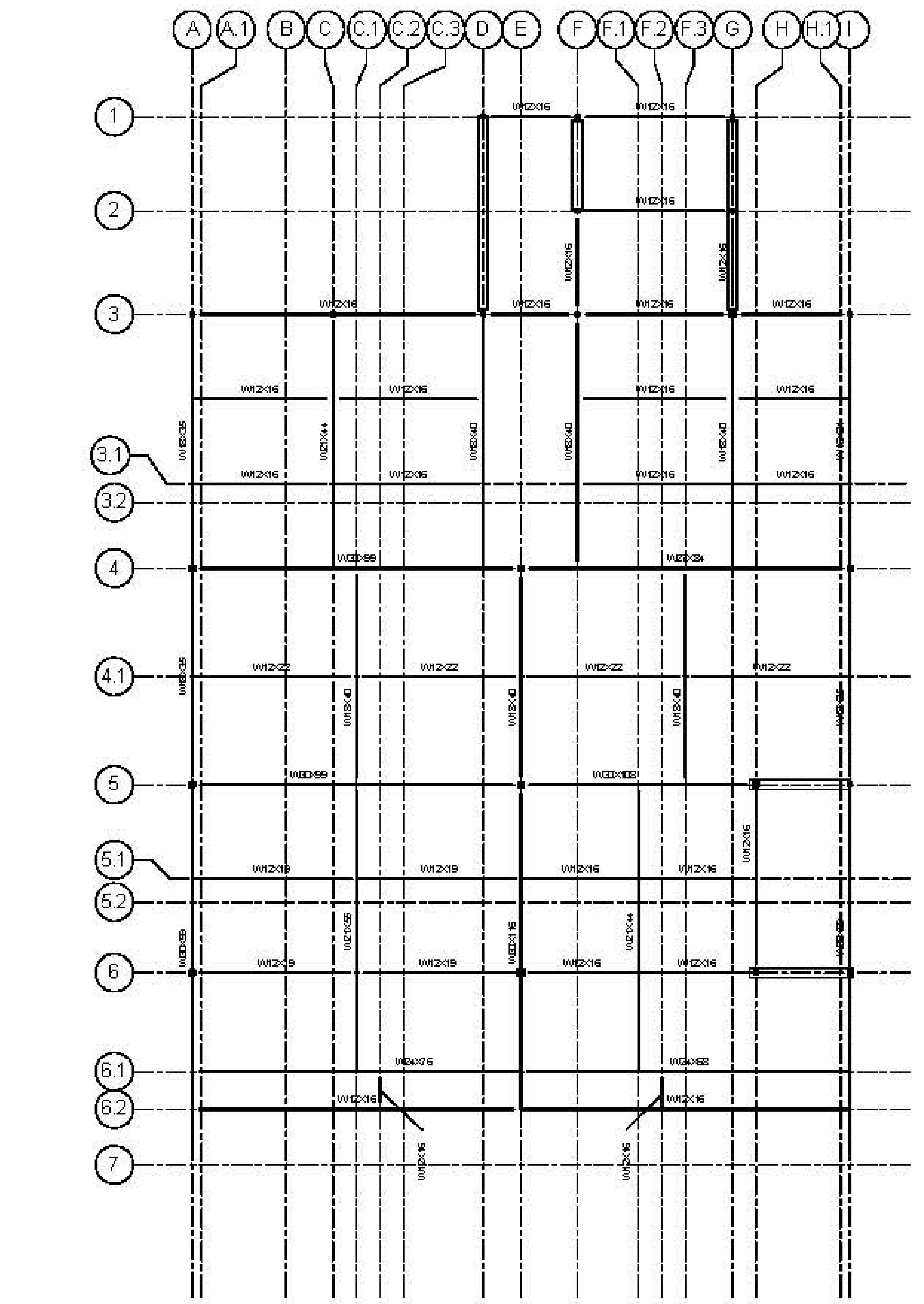

2 Level 4
1/8" = 1'-0"

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Growing Power Vertical Farm

Level 3 and 4 Framing Plans

Project Number	Project Number
Date	Issue Date
Drawn By	Author
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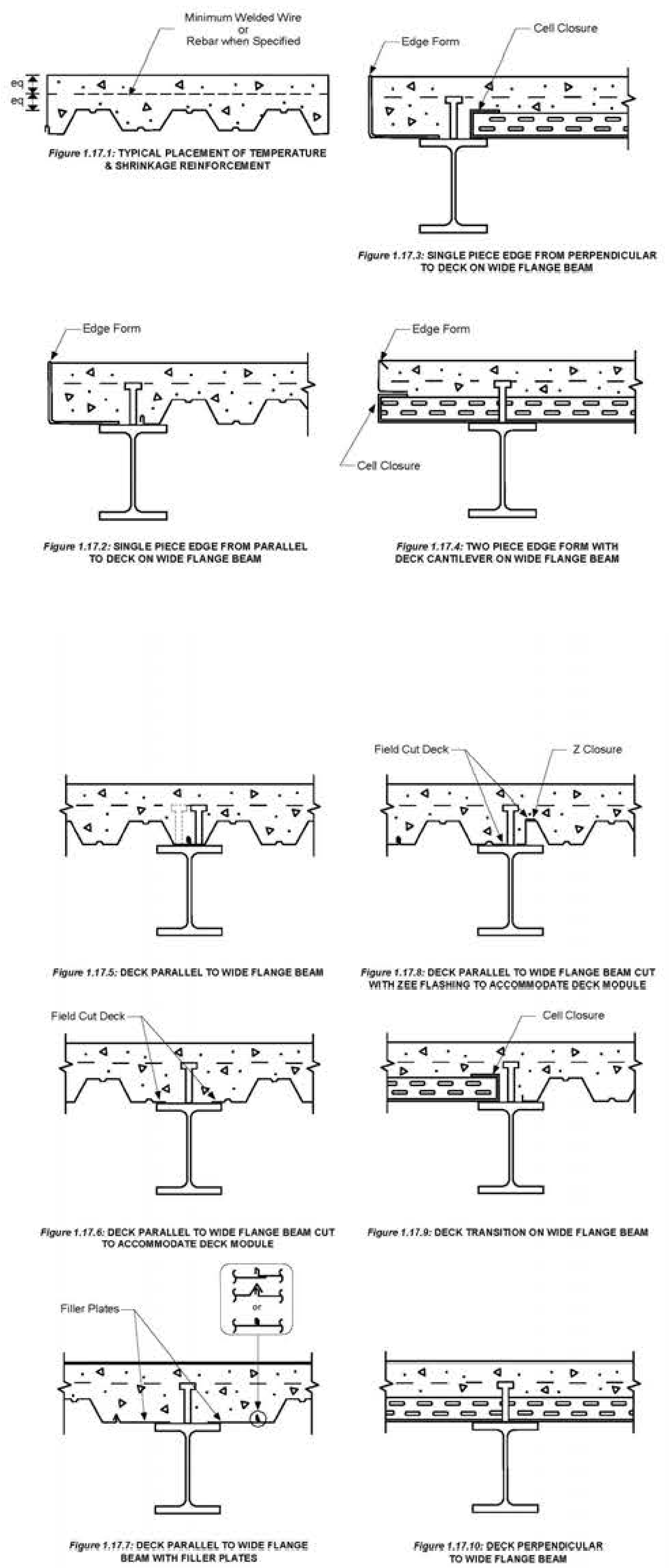
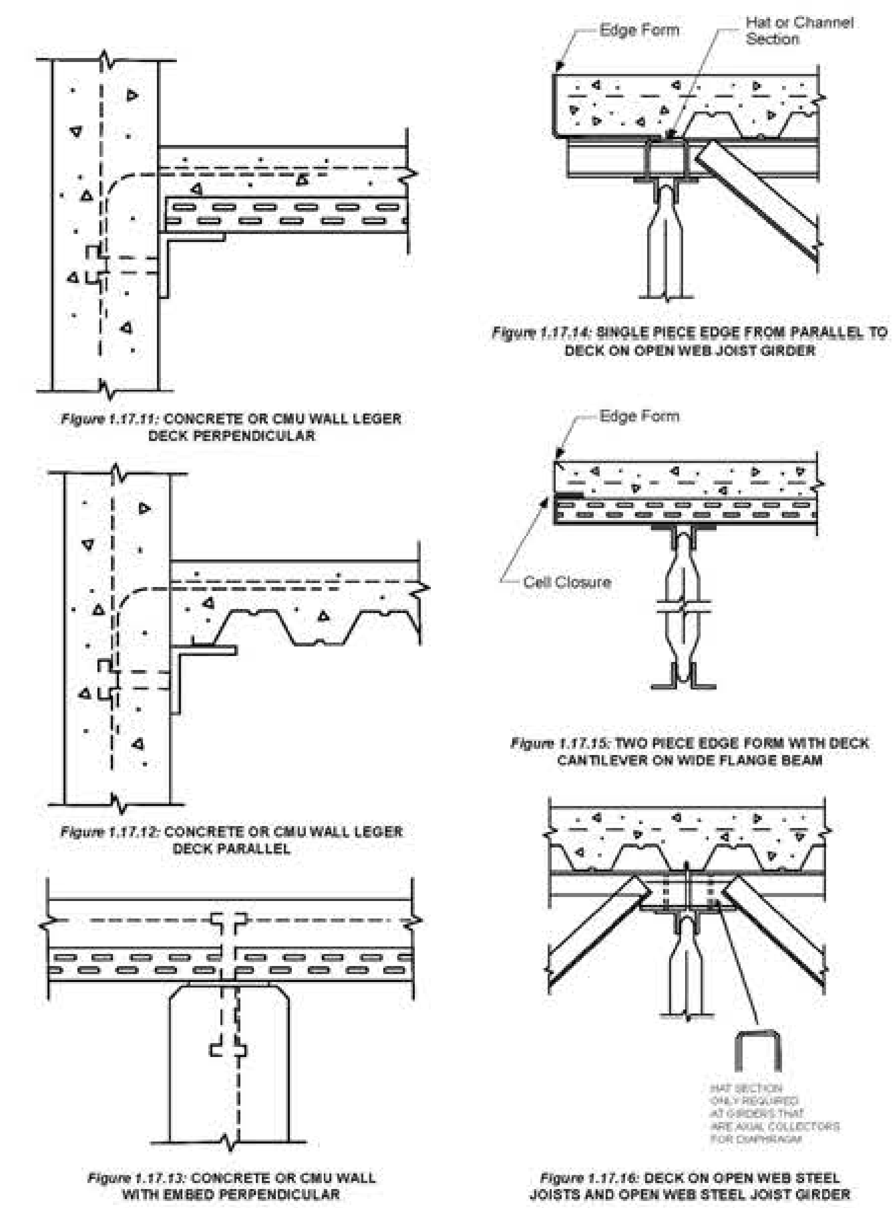
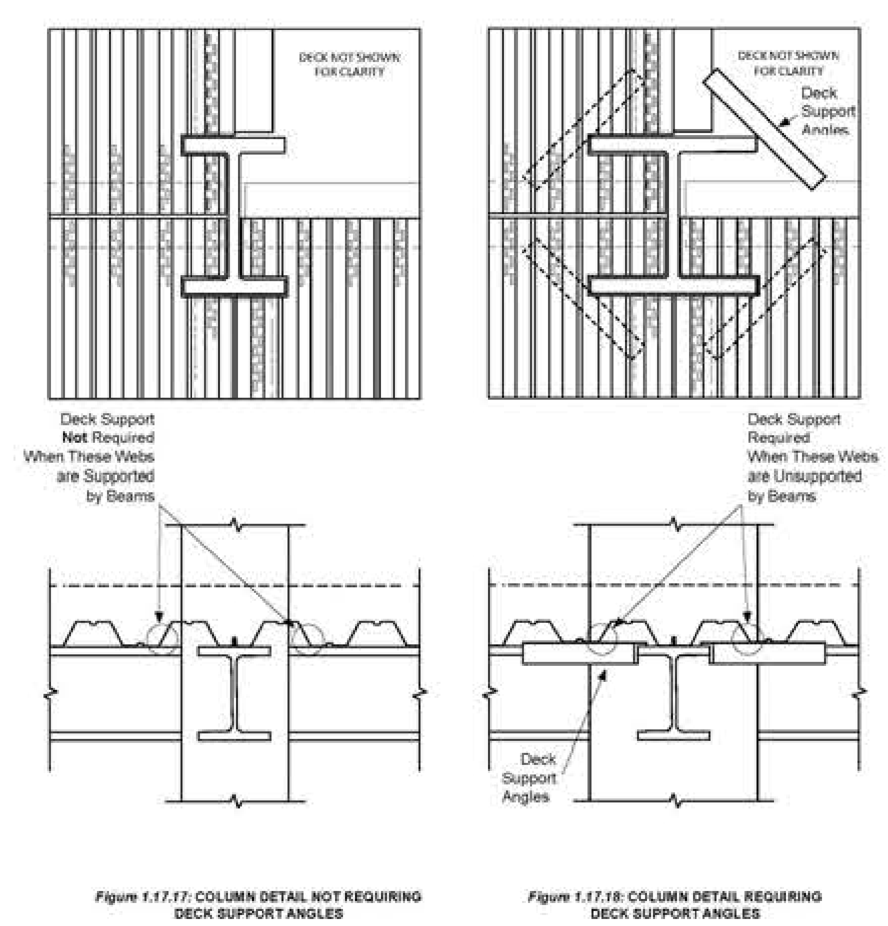
Scale 1/8" = 1'-0"





Column Flashings

Columns may require deck support angles depending on web support. Smaller columns often do not require deck support angles because there are no unsupported webs as shown in Figure 1.17.17. Large columns will create a condition in which one or more webs are unsupported, as shown in Figure 1.17.18. When the webs are unsupported, deck support angles are required to limit localized deflections during concrete placement. The Detail in Figure 1.17.18 is a common example of how deck may be supported when required. Using the thinnest support angles practical, when installed as shown, makes fitting and attaching the deck easier.



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Growing Power Vertical Farm

Metal Deck Details

Project Number	Project Number
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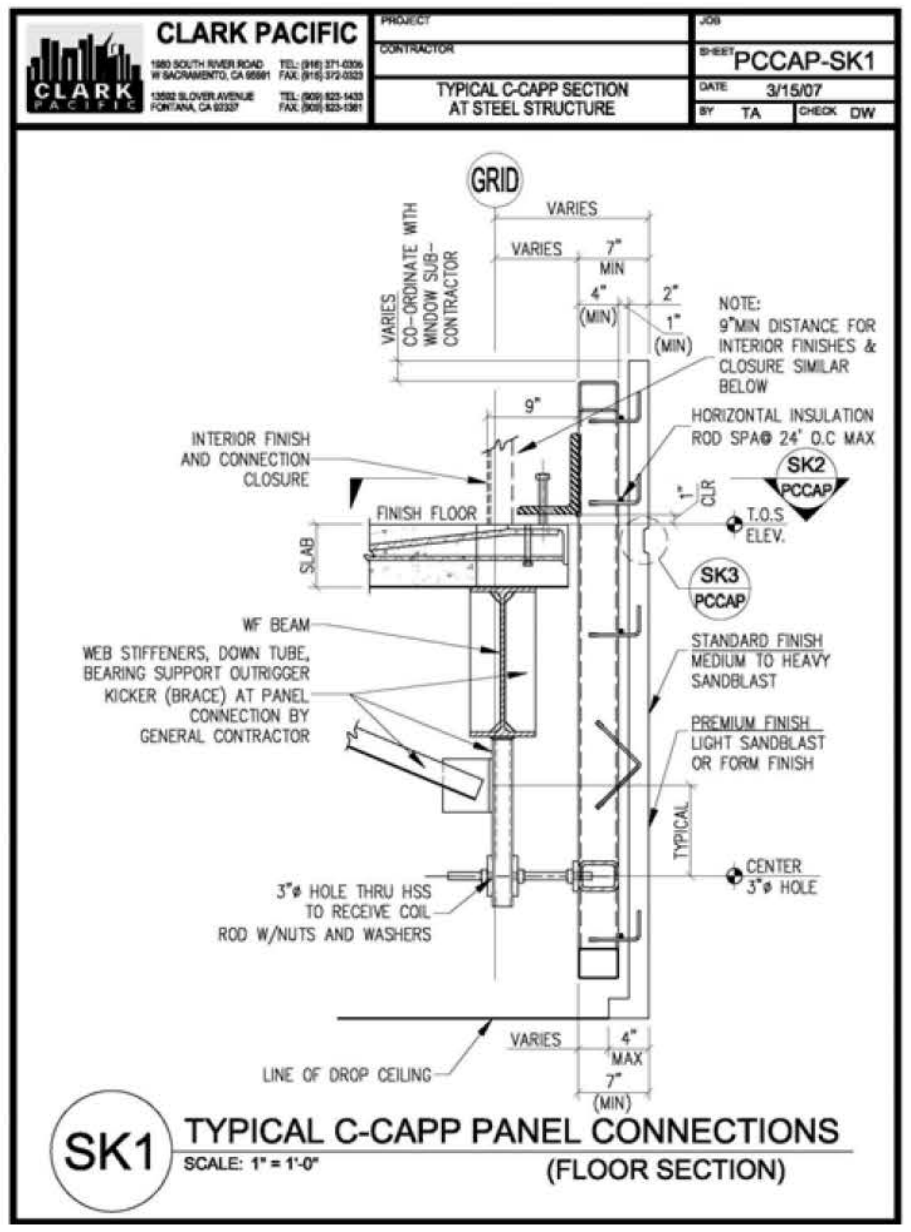
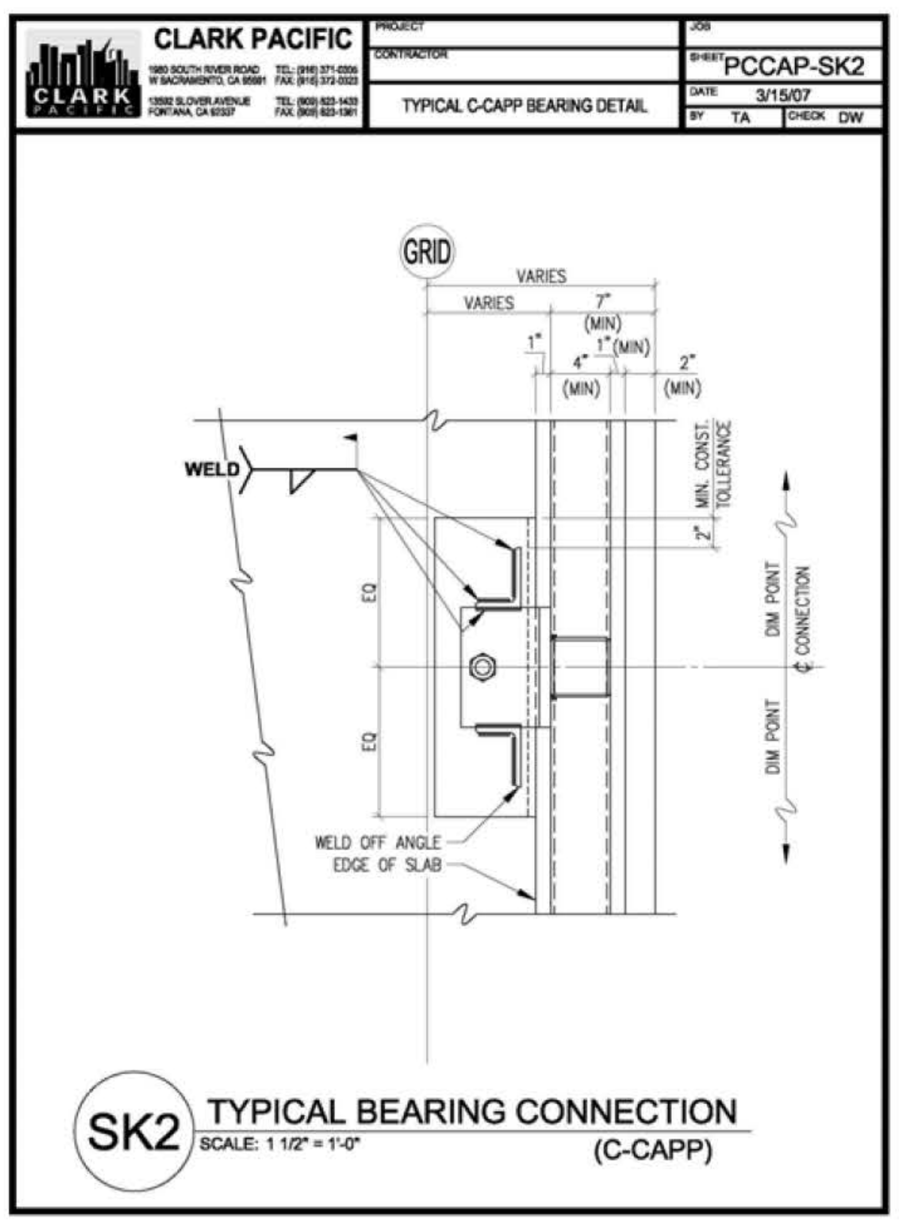
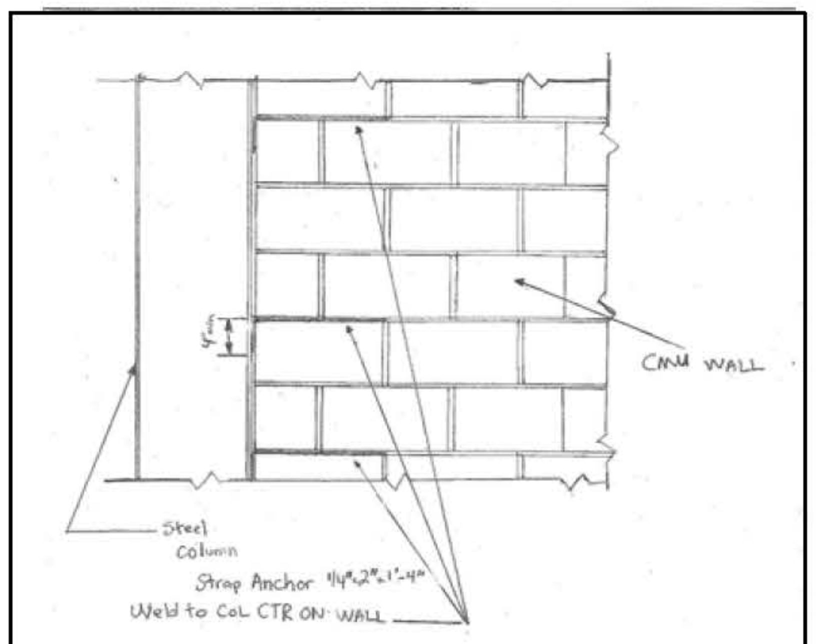
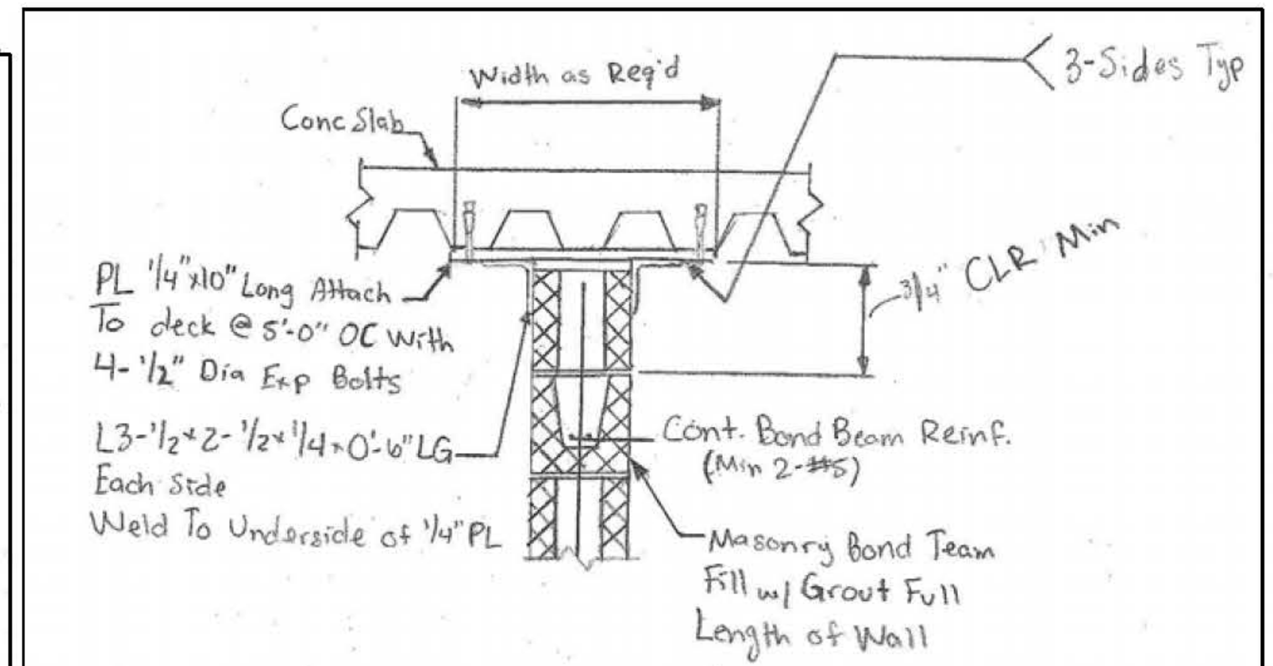


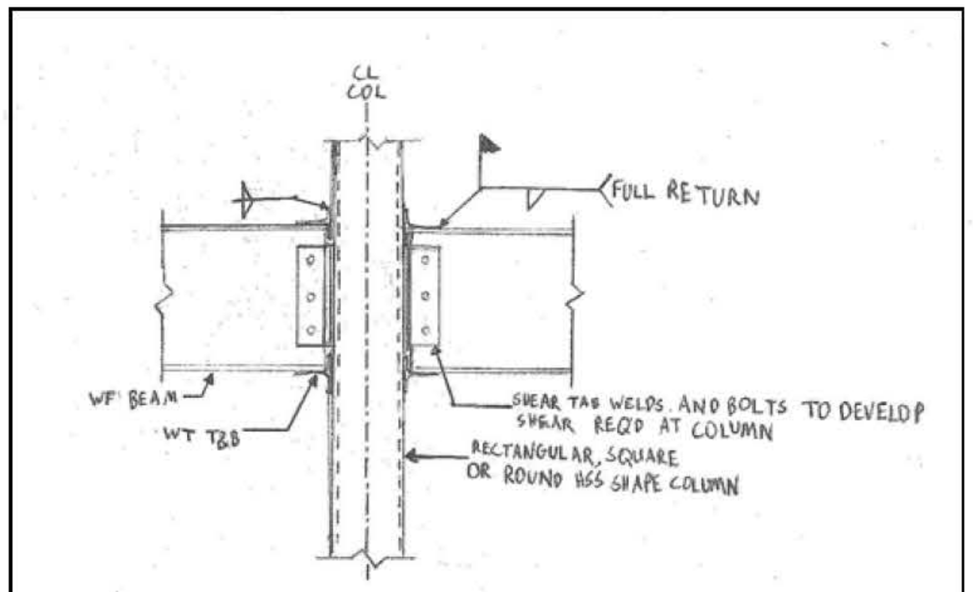




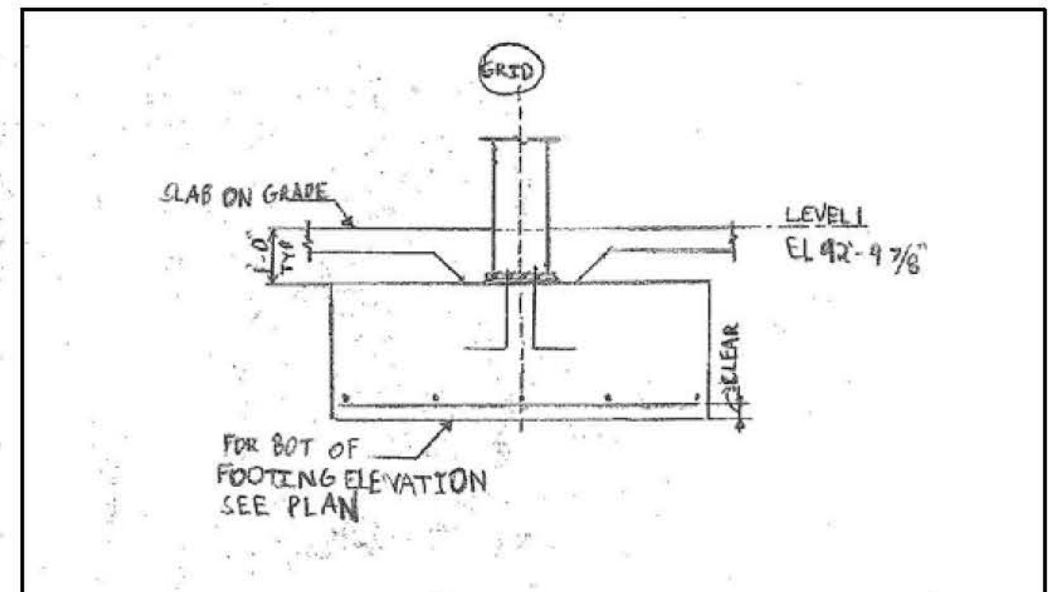
CONNECTION OF CMU TO STEEL COLUMNS



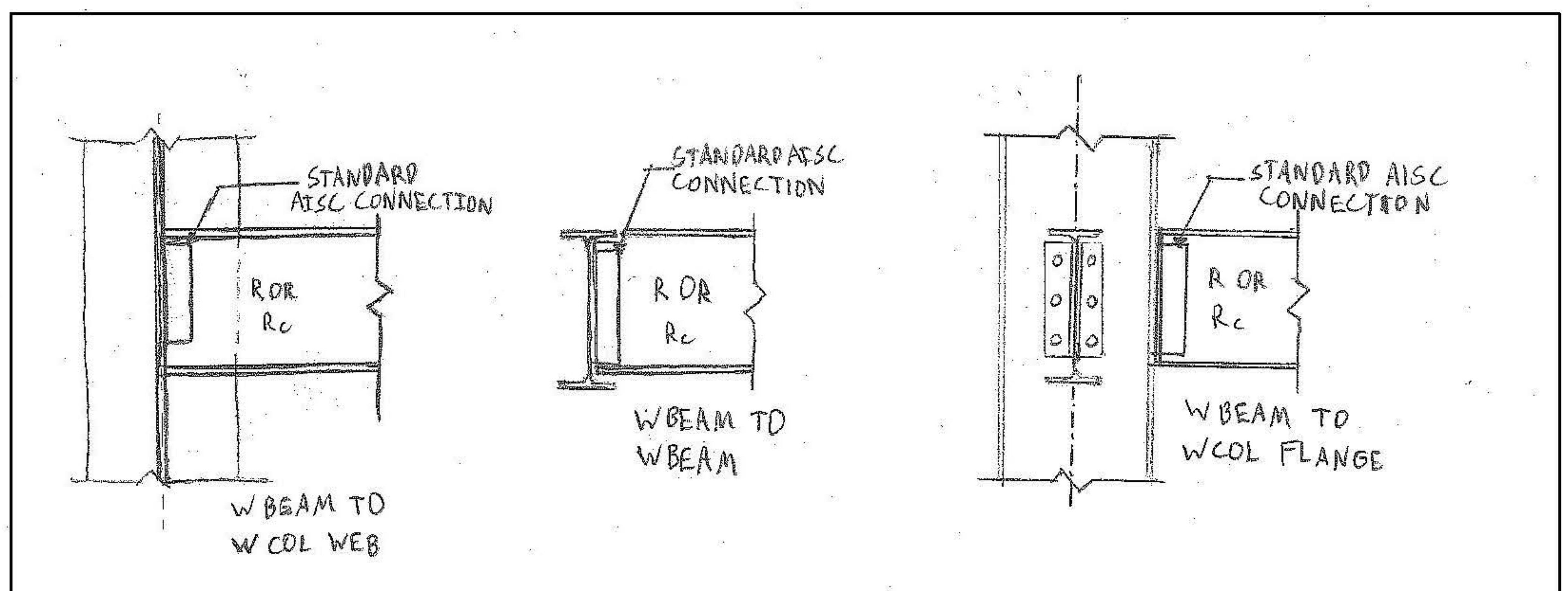
TOP OF CONCRETE MASONRY PARTITION AT COMPOSITE METAL DECK



W BEAM TO HSS COLUMN MOMENT



TYPICAL INTERIOR COLUMN FOOTING



TYPICAL BEAM CONNECTIONS

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Growing Power Vertical Farm

Typical Details

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Scale

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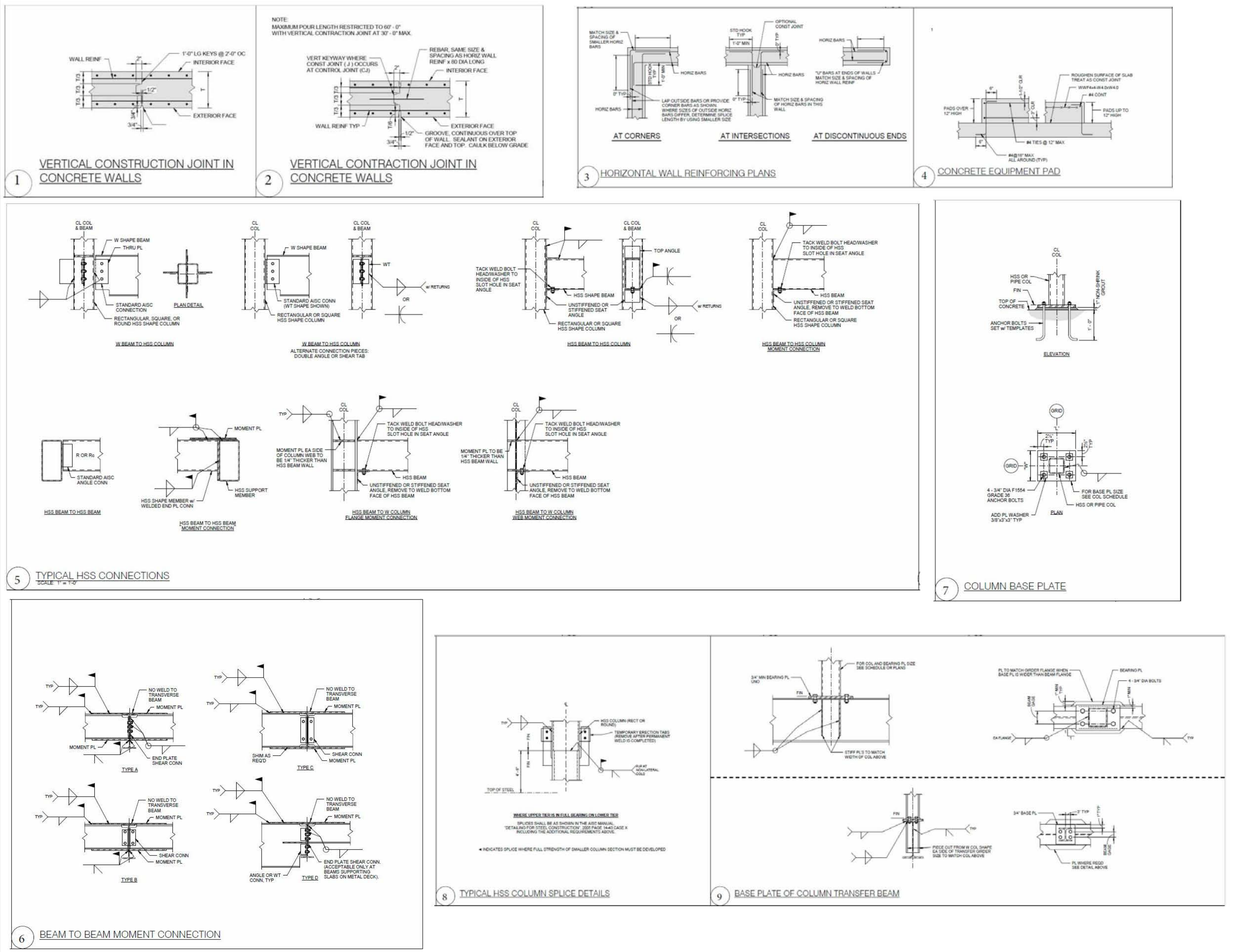

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No.	Description	Date

Team 08 - 2015

Growing Power Vertical Farm

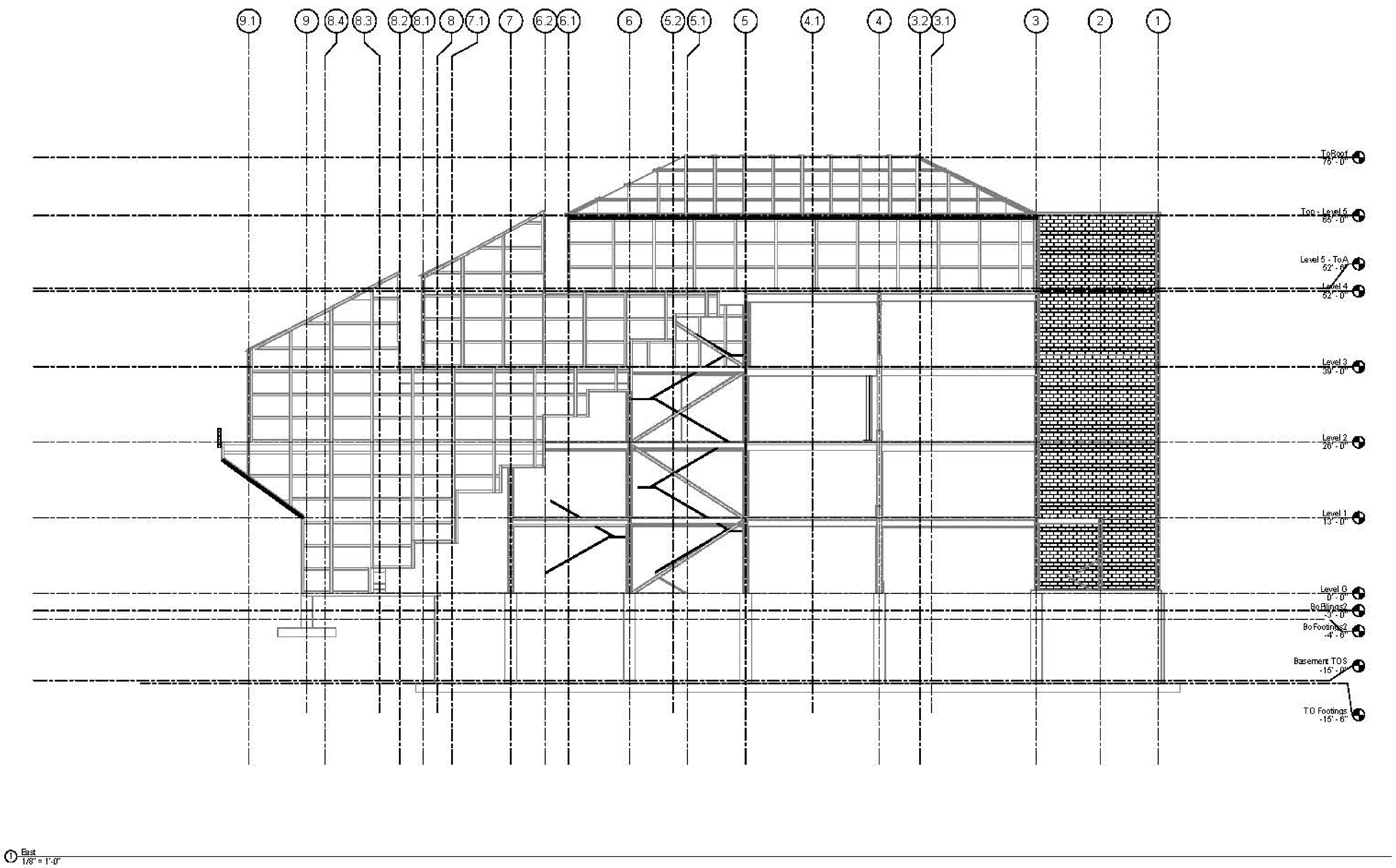
Typical Details

Project Number	Project Number
Date	Issue Date
Drawn By	Author
Checked By	Checker

S.202

Scale

2/12/2015 10:09:00 PM



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No.	Description	Date

Team 08 - 2015

Growing Power Vertical Farm

Elevation

Project Number	Project Number
Date	Issue Date
Drawn By	Author
Checked By	Checker

S.300

Scale 1/8" = 1'-0"

2/12/2015 10:09:11 PM