THE UNIVERSITY OF IOWA
IOWA INITIATIVE
FOR SUSTAINABLE COMMUNITIES

FINAL DELIVERABLE

Title	Camp Courageous- Cultural Education Center
Completed By	Austin Duffy, Nolan Osland, Grace Gudenkauf
Date Completed	December 2021
UI Department	Department of Civil & Environmental Engineering
Course Name	CEE:4850:0001 Project Design & Management
Instructor	Paul Hanley & Richard Fosse
Community Partners	Camp Courageous, Maquoketa River Watershed Management Authority, Iowa DNR

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Camp Courageous Cultural Education Center

Final Preliminary Design–December 10, 2021

Submitted By:

Austin Duffy, Nolan Osland, and Grace Gudenkauf

The University of Iowa, College of Engineering | Iowa City, Iowa 52240 | (319) 238-3856

Section I Executive Summary

Our team designed the proposed cultural education center for Camp Courageous in Monticello, Iowa. The design meets each of your envisioned uses for the center including:

- Four-season nature observation from within the building.
- A large, open space for engaging activities suitable for campers of all ages and members of the public.
- Space for educational displays of the native plant and animal species and audio/visual nature observation enhancement equipment.
- A storage room and restroom facilities.

The building and site plan meets all ADA design standards as well as integrating the seven Universal Design Principles into the final design. For the architectural design of the building, it is modern style that blends well with the natural environment and existing camp facilities. We emphasize an open concept with large windows spanning around the building. Our site location is situated in the northeast wooded area on the camp property, overlooking the valley leading to the Maquoketa River.

The design of the cultural education center was completed in the following phases:

- Data collection: Met with the client to determine the scope of the project and to gather design ideas. Then, collected spatial data of the site including elevation contours and soil types.
- Architectural design: Developed preliminary architectural designs utilizing AutoDesk Revit and Lumion and presented them to the client.
- Determined site location and building orientation.
- Structural analysis and design: An iterative process of sizing and spacing structural members to meet strength and safety requirements. AutoDesk Revit was utilized for the building modeling and FTool was employed for the structural analysis.
- Site Design: Line work, grading, utility, and earthwork design was completed using Civil 3D.
- Delivery of Design: A presentation to the client was delivered along with the plan sheets and the design report.

For the design of the project there were several alternatives to consider for the project location and architectural designs. Within the wooded area on the northeast side of the camp property there are two suitable locations for the building. The first is at the old outdoor church gathering space overlooking the valley and the second is located near the base of the valley overlooking a rock outcropping. We recommend the second site due to the opportunity to view various topographic features and it is a suitable area to cultivate animal wildlife viewing. For the structural framing of the center, we recommend the use of steel for longevity in the wooded location. The total cost of the building is estimated at $700,000 which includes material costs, general contractor's overhead and profit, contingencies, and administrative costs.

Section II Organization Qualifications and Experience

1. **Organization and Design Team Description**

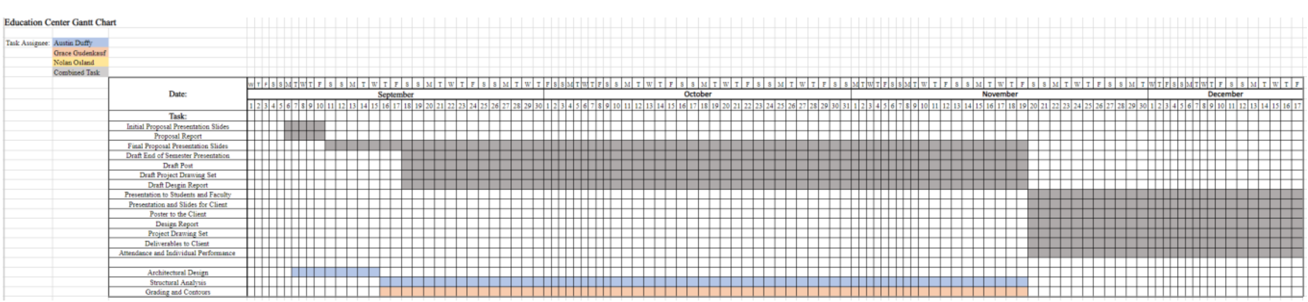
For our final semester at the University of Iowa, we designed the cultural education center at Camp Courageous in Monticello, IA. Our team, includes Austin Duffy as the project manager, Nolan Osland, and Grace Gudenkauf. Austin took the lead in architectural modeling as well as the structural modeling of the building. Nolan led the design work outside of the cultural education center which includes line work, grading, utilities, and earthwork. Grace led the structural design calculations for the building, foundation, and retaining wall.

Section III Proposed Services

1. Project Scope

For the cultural education center our goal was to provide a building to be used year-round that gives campers and the public the opportunity to interact with wildlife around the area. The building consists of a large open room for nature education and activities as well as wildlife exhibits. Additionally, there is a viewing room to provide an overlook of the forested area. To accomplish this, we began by collecting spatial data of the site including elevation contours, soil types, wetlands, river and stream channels, land use, and existing utilities using ESRI ArcMaps. After visiting the site location and determining the proposed building uses, several architectural design concept alternatives were developed using Revit and Lumion. Once an architectural design plan was determined, the structural framing plan was completed using AutoDesk Revit. When the building design was finished, a site design was completed in Civil 3D which includes plans for grading, landscaping, utility routing, and a sidewalk connection to the proposed trail. After the plans were finalized, a cost estimate for the design, materials, and construction was tabulated.

2. Work Plan



Above is the Gantt chart for the schedule of tasks for the project. See Appendix B for a larger version in landscape.

3. **Methods and Design Guides**

For the design of the cultural education center, we utilized the 2018 International Building Code, and 2010 ADA Standards for Accessible Design as well as the Universal Design Principles as our design standards. Additionally, the Universal Design Principles guided our architectural plans for the facility. To determine the applied and member loading for the structure, ASCE 7-10: Minimum Design Loads for Buildings and Other Structures was employed. To complete the structural analysis for the building, the Load and Resistance Factor (LRFD) method was used. The structural materials chosen for design were steel and concrete so the AISC Steel Construction Manual (15th Ed.) and ACI 319-19: Building Code Requirements for Structural Concrete were utilized.

For the design of the site surrounding the cultural education center, the 2021 Iowa Statewide Urban Design and Specifications (SUDAS) manual was used. The Iowa SUDAS manual includes design standards for sidewalks, utilities and erosion control.

Section IV Constraints, Challenges, and Impacts

1. **Constraints**

There were a variety of constraints that were present during the planning and construction of the cultural education center. The first constraint was the time limit for the design of the project. The design needed to be completed on December 8th, 2021, which gave our team approximately three months for the design process.

Another constraint was the cost of the project. Although there is not a set budget, the project needed to be cost-effective while meeting the client's goals for the design of the center and the site. The building material type, quantity, and technical difficulty of construction are just a few considerations that make a substantial impact on the cost of the overall project.

A third constraint is the location of the project within the property. Currently, the desired location for the center is an undeveloped timbered area with vast changes in elevations.

2. **Challenges**

One challenge for the design of this project was choosing a location for the building. The site for this project will be located within the forested area on the Camp Courageous property. This forested area has karst topography with varying elevations. Furthermore, this presented a challenge when meeting site grading requirements for ADA sidewalk standards and the client's desire to meet Universal Design principles.

During architectural planning the choice of building materials presented a challenge for the construction process. Certain materials will be difficult to transport to the site such as prefabricated trusses, pilings and concrete due to the size of vehicles required to deliver these materials. Additionally, the client preferred a modern style for the cultural education center, which caused difficulty in integrating the building into the natural environment.

Another challenge in the design process is the routing and design of utilities to the building. The distance from the existing tie-in points is relatively long which presented a high cost to extend utilities into a rural area with rough terrain. Additionally, the maintenance associated utilities presented a cost and goes against the client's desire for a low maintenance facility. The client also desired to remove as few trees as possible, therefore, the selected location needed to be without much required tree removal. Due to the site not being developed we chose underground electricity, as overhead electricity was not feasible.

A final challenge was to coordinate with other senior design project teams the location of our site in relation to their projects. The hiking trail design needed to align with the walkway towards the cultural education center and the water feature needed to be visible from the indoor viewing area.

3. **Societal Impact within the Community and/or State of Iowa**

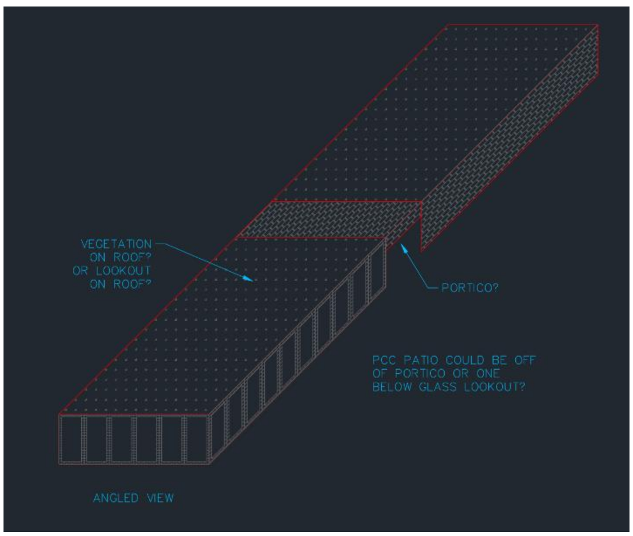
The cultural education center will create opportunities for campers as well as the public to experience and learn about the natural environment in Northeast Iowa. The proposed center will have educational displays and activities for campers and visitors to learn about the local ecosystem. Additionally, the center will have an indoor observation area for the viewing of the natural habitat. The center will help foster a greater appreciation for the natural environment and encourage environmental stewardship.

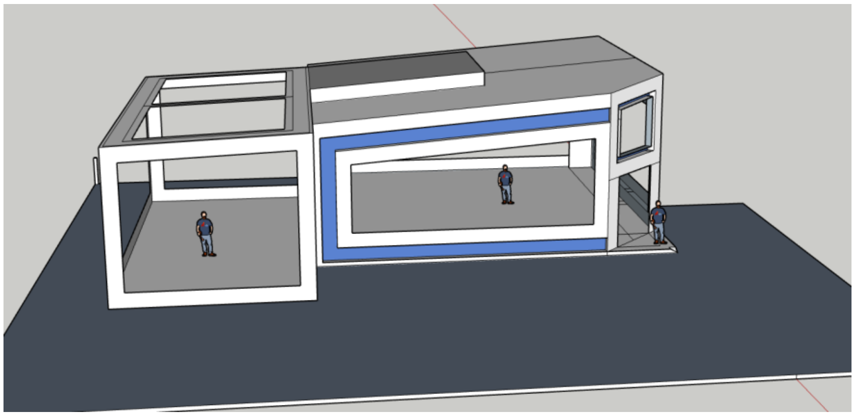
With this proposed camp amenity, there may also be an increase in campers attending Camp Courageous as well as members of the public who desire to utilize the facility and the connecting trail system. With a larger population of the public visiting the camp, there may be an increase in donations to support Camp Courageous and its operations.

Due to the construction of the center, the current habitat and subsurface conditions at the site will be altered. The alterations include the clearing of existing plant and animal species from the site and the grading and compaction of the existing soil. Additionally, after the construction of the center, there will be landscaping on the site to increase the aesthetic quality and draw wildlife to the viewing area.

Section V Alternative Solutions That Were Considered

Several alternative architectural designs were provided for the cultural education center. Each design provided a single-story open room plan, viewing area, and large windows spanning around the building to provide natural lighting and an overlook of the surrounding forested area. One of the proposed architectural styles considered was a modern design. This style was preferred due to the abundance of windows and use of multiple materials for the siding. A disadvantage to this style is the difficulty in having the building blend in with the natural environment and the existing camp buildings. Below are the initially proposed concepts for a modern design:

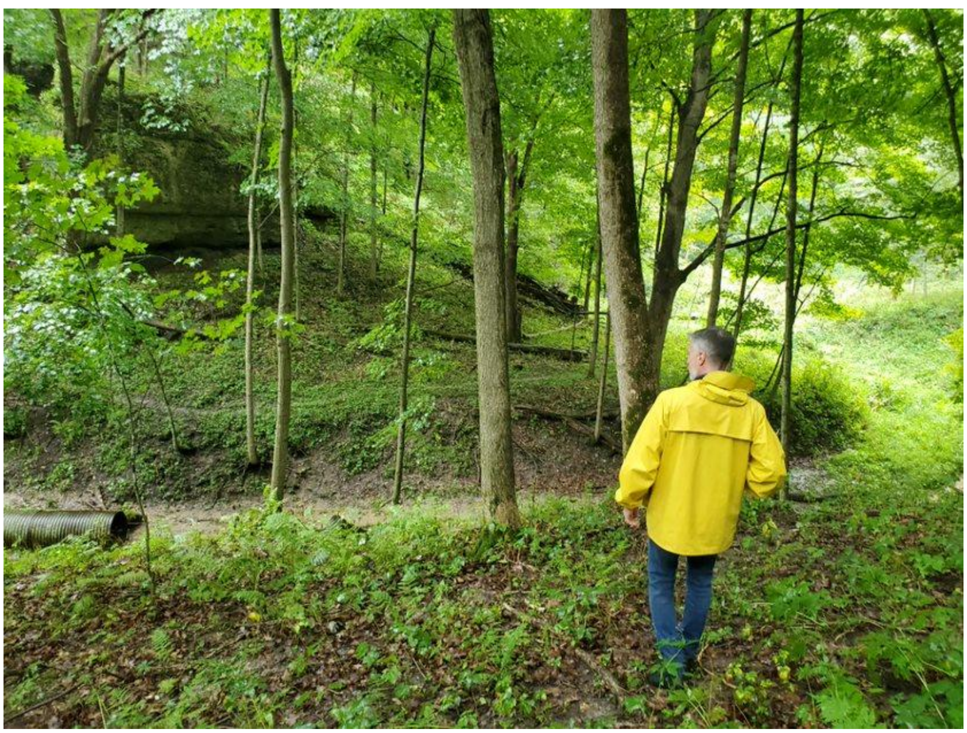




Another proposed design concept was the “Prairie style”, influenced by the architect Frank Lloyd Wright. One advantage of this design is its ability to blend in with the natural environment with the use of wood and limestone materials. One disadvantage is the lack of window space often found in this design style.

After the completion of our visit to Camp Courageous, there were two locations that were candidates for the site. The first is at the old outdoor church gathering space overlooking the valley. This location was ideal due to the high elevation for water drainage and ease of access for the proposed trail. A disadvantage is the need to clear a substantial number of trees to get a clear view of the valley. Below is a picture of the site:

The second option, which we chose as the site location, is located near the base of the valley overlooking a rock outcropping. We recommend this location due to the optimal viewing of diverse topography and the opportunity to cultivate a habitat for wildlife. Additionally, if water education projects were desired at the site location, near the valley would be the best location for water detention. Below is a photo of the proposed site:



Another consideration for the center is the choice of utilities provided. Utilities typically considered in the design of a structure include water, electric, sanitary, gas, telephone, and internet.

To adhere to the desire of the client for a maintenance-free center, we recommend providing electricity for lighting and the HVAC system.

Section VI Final Design Details

1. Load Calculations

For the design wind, snow, dead, and live load calculations for the building, the ASCE 7-16 design standard was employed. The total upper roof dead load was 49 psf and was chosen based on the upper roof superimposed dead loads from Table C3.1-1a which includes the metal roof, a waterproofing membrane, rigid insulation, plywood, a wood furring suspension system, and a mechanical and electrical allowance. The total roof live load was 20 psf and was chosen from Table 4.3-1. The sloped roof snow load was 20 psf and was determined using the procedure outlined in Chapter 7. The unbalanced roof snow load was a linear triangular distribution with a maximum of 34.5 psf in the snow drift roof area. The drift height was determined using Fig. 7.6-1 and the dimensions of the snow drift are defined based on Fig. 7.7-2. The wind load for the walls and roof were determined using the Directional Procedure in Chapter 27 for the main force resisting system. The maximum wall pressure was 11.5 psf and the maximum positive roof wind pressure was 0.375 psf. For the floor live load a value of 100 psf was chosen from Table 4.3-1 and the superimposed dead loads from Table C3.1-1a for the floor consisted of wood flooring and a subfloor which totaled 7 psf. These loads were factored using the load combinations for strength design, the Load and Resistance Factor Design method. The maximum load combinations to be used for the structural calculations were 49.1 psf for the roof and 168.4 psf for the floor. To check for serviceability, load combinations for short and long-term deflection were determined using the load combinations outlined in Appendix CC.

2. Structural Member Sizing

For the sizing of the metal roof deck, the Vulcraft Roof Deck Catalog was utilized based on the applied factored loads and the roof deck chosen for design was a 22 Gauge, 1.5B deck, grade 50 steel, 4' O.C. For the sizing of the roof and floor joists, the New Milennium Building Systems Joist Design Guide was used based on the applied factored loads, span length, and tributary area and the joist size used in design are 10K1, 4' O.C. The structural studs used are 600S162-68 6" stud, 2' O.C. and were sized using the ClarkDietrich Design Guide Catalog for the associated wind loading, wall height, and tributary area. For the design of the beams and columns, the AISC Steel Construction Manual was utilized. Each beam was modeled in FTool and the maximum bending moment and shear force were determined. Additionally, for the short and long-term deflection load combinations, the maximum deflection was determined. After choosing a preliminary member size, the plastic moment and nominal shear strength (AISC Eq. (F2-1)) were determined. These member specific values were compared to the applied loading by using the demand capacity ratio. For the serviceability checks, a deflection limit of L/240 was used for the main building and a stricter limit of L/480 for the viewing area due to the use of windows that extend up to the ceiling. The final beam size used for design is W12 x 26. For the sizing of the columns and the steel piers, the axial load was determined from the reaction forces from the beam FTool analysis as well as the beam self-weight for the given column tributary width. After a preliminary column size was chosen, the design strength was determined by finding the critical stress for the given slenderness parameter and gross cross-sectional area. The design strength was checked against the axial load by using the demand capacity ratio. The final column sizes for the main building were HSS 4x4x1/2. For the viewing area the columns are HSS 3x3x3/8 members, and for the steel piers, the members are HSS 6x6x5/8.

3. Foundation Design

For the design of the foundation, the soil data was determined based of the Iowa Web Soil Survey for our site location. Since the bedrock began at a depth of 14 to 18" below the ground level, the foundation was designed for bedrock, which is limestone in northeast Iowa. From Table 1806.2 from the IBC, the load-bearing values and coefficient of friction for sedimentary rock were determined. The bearing pressure for the square pier foundations and the continuous foundation around the building were determined using Vesic's method with the applied loads.

4. Retaining Wall Design

The cantilever retaining wall was designed based on ACI 318-02 using an Excel sheet that checks for overturning, soil bearing capacity, flexure capacity, and shear capacity. The retaining wall was designed for a surcharge load of 175 psf, which accounts for the pavement surcharge and vehicle access.

5. Site Design

The line work for the site was completed using a SU-23 Shuttle bus design vehicle. This vehicle will be used by the camp staff to transport the campers to and from the site. The 23 ft long design vehicle can get in and out of the site with a three-point turn. The site design also had to accommodate for a 30 ft firetruck to get in and out of the site. A SU-30 design vehicle was used to resemble the firetruck and this vehicle can turnaround by completing a five-point turn.

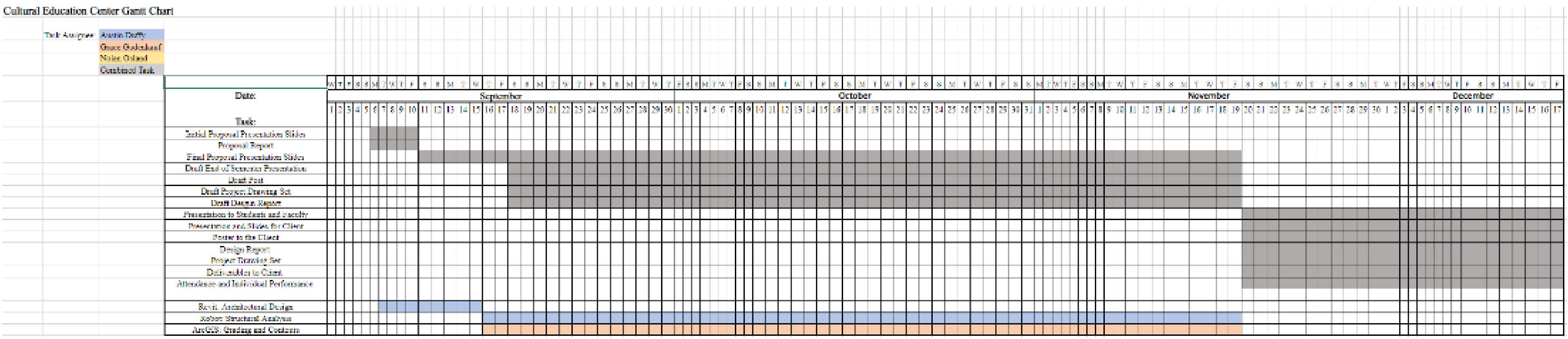
The site was graded using the criteria presented in chapter 8 of the SUDAS design manual, Appendix E. All slopes within the pavement are under 5% with a target of 1.5%. All the water that lands on the pavement will drain to the east. Additionally, everything drains away from the cultural education center. Adjacent to the pavement are a 1 ft and 2 ft soft 5% slope of grass until the retaining wall begins. This was designed to provide more safety for the campers. A cross section of this design is shown in Appendix D on the C-201 sheet.

The cultural education center also needed water and electric lines running to the building. The utilities run along the West side of the pavement with the electric and water at a 2ft and 4ft offset, respectively. The water line is designed by be 5’ under the FG elevations, while the electric line should be placed 3’ under the FG.

Section VII Engineer’s Cost Estimate

The cost estimate was divided into three major categories including structural materials, finishing materials, and site design costs. These costs consider general contractor’s overhead and profit, contingencies, and administrative costs. By utilizing the 2011 RSMeans Handbook and accounting for inflation, the total structural material cost was determined to be $214,000. The major structural material costs include $63,000 for the retaining wall and $44,000 for the metal stud framing. For the finishing materials, the total cost is $360,000. The main costs associated with these non-structural materials include $115,000 for the store front windows, $92,000 for the mullions, and $45,000 for the limestone veneer. Finally, the site design cost was estimated by employing the Iowa DOT awarded contract unit prices, 2019 RSMeans, and 2019 National Construction Estimator. The total site design cost was $120,000. The primary costs for the site design were $73,000 for earthwork, $38,000 for pavement, $7,000 for utilities, and $2,000 for erosion control. The overall total cost for the cultural education center is estimated at $700,000.

Appendix B -Gantt Chart



Cultural Education Center Gantt Chart

Task Assignee:	Austin Duffy
	Grace Gudenkauf
	Nolan Osland
	Combined Task

Date:
Task:
Initial Proposal Presentation Slides
Proposal Report
Final Proposal Presentation Slides
Draft End of Semester Presentation
Draft Post
Draft Project Drawing Set
Draft Desgin Report
Presentation to Students and Faculty
Presentation and Slides for Client
Poster to the Client
Design Report
Project Drawing Set
Deliverables to Client
Attendance and Individual Performance
Revit: Architectural Design
Robot: Structural Analysis
ArcGIS: Grading and Contours

Appendix C –Cost Estimates

Architectural Multi-Category Material Takeoff																
							2011									
							Material Cost					Total Cost				
Family and Type	**Material: Name**	**Material: Length (FT)**	**Material: Area (SF)**	**Material: Volume (CF)**	**Material: Unit weight**	**Count**	**Cost/LF**	**Cost/SF**	**Cost/CF**	**Cost/Count**	**Cost**	**Cost/LF**	**Cost/SF**	**Cost/CF**	**Cost/Count**	**Cost**
Compound Ceiling: 2' x 4' ACT System	Acoustic Ceiling Tile 24 x 48		339	17.65 CF	18.10 lb/ft^3	4		$ 0.37			$ 125.43		$ 1.49			$ 505.11
Basic Wall: Exterior - Limestone Insulated 2	Gypsum Wall Board		254	13.21 CF	68.67 lb/ft^3	4		$ 0.89			$ 226.06		$ 1.26			$ 320.04
Basic Wall: Exterior - Wood Finish Alt. 2	Gypsum Wall Board		1349	56.21 CF	68.67 lb/ft^3	5		$ 0.89			$ 1,200.61		$ 1.26			$ 1,699.74
Basic Wall: Interior - 5 1/2" Partition (1-hr)	Gypsum Wall Board		1808	94.19 CF	68.67 lb/ft^3	7		$ 0.89			$ 1,609.12		$ 1.26			$ 2,278.08
Basic Wall: Interior - 9" Partition	Gypsum Wall Board		360	18.75 CF	68.67 lb/ft^3	1		$ 0.89			$ 320.40		$ 1.26			$ 453.60
Basic Roof: Wood Rafter 8" - Tin - Insulated	Aluminum Sheet Panels		2426	50.55 CF		2		$ 1.14			$ 2,765.64		$ 2.52			$ 6,113.52
Basic Roof: Wood Rafter 8" - Tin - Insulated	Rigid Insulation		2426	50.55				$ 0.28			$ 679.28		$ 0.54			$ 1,310.04
Basic Wall: Exterior - Limestone Insulated 2	Limestone Veneer		507	406.99 CF		4		$ 48.00			$ 24,336.00		$ 52.59			$ 26,663.13
Basic Wall: Exterior - Limestone Insulated 2	Metal Furring		254	34.36 CF	490.06 lb/ft^3	4		$ 0.34			$ 86.36		$ 1.53			$ 388.62
Basic Roof: Wood Rafter 8" - Tin - Insulated	Plywood		2426	126.37 CF	34.46 lb/ft^3	2		$ 0.82			$ 1,989.32		$ 1.29			$ 3,129.54
Basic Wall: Exterior - Wood Finish Alt. 2	Plywood		1349	84.32 CF	34.46 lb/ft^3	5		$ 0.82			$ 1,106.18		$ 1.39			$ 1,875.11
Basic Wall: Exterior - Limestone Insulated 2	Rigid insulation		254	63.43 CF	3.12 lb/ft^3	4		$ 0.28			$ 71.12		$ 0.54			$ 137.16
Basic Wall: Exterior - Wood Finish Alt. 2	Vapor Retarder		1353	0.00 CF		5		$ 1.19			$ 1,610.07		$ 10.49			$ 14,192.97
Basic Wall: Exterior - Wood Finish Alt. 2	Fiber Cement Siding		1350	337.29 CF		5		$ 1.04			$ 1,404.00		$ 2.66			$ 3,591.00
Floor: Wood Joist 1.5" - Oak Wood Finish 2	Oak Flooring		1650	103.15 CF	42.01 lb/ft^3	2		$ 4.49			$ 7,408.50		$ 6.52			$ 10,758.00
Floor: Wood Joist 1.5" - Oak Wood Finish 2	Plywood		1650	103.15 CF	34.46 lb/ft^3	2		$ 0.82			$ 1,353.00		$ 1.29			$ 2,128.50
Door-Curtain-Wall-Double-Storefront: Door-Curtain-Wall-Double-Storefront						1				$ 1,200.00	$ 1,200.00				$ 1,257.50	$ 1,257.50
Door-Exterior-Double-Full Glass-Wood_Clad: 72" x 80"						1				$ 1,200.00	$ 1,200.00				$ 1,257.50	$ 1,257.50
Door-Interior-Single-2_Panel-Wood: 36" x 84"						2				$ 410.00	$ 820.00				$ 463.00	$ 926.00
Door-Interior-Single-Full Glass-Wood: 32" x 80"						2				$ 410.00	$ 820.00				$ 463.00	$ 926.00
Door-Double-Sliding: 68" x 80"						1				$ 885.00	$ 885.00				$ 1,057.00	$ 1,057.00
Rectangular Mullion: 2.5" x 5" rectangular	Aluminum		763	51.86 CF	169.18 lb/ft^3	91		$ 63.00			$ 48,069.00		$ 71.60			$ 54,630.80
Fascia: Fascia-Flat 1x12		271	543	15.89 CF		1		$ 5.95			$ 3,230.85		$ 8.80			$ 4,778.40
Gutter: Gutter - Bevel 5" x 5"		68.25	154 SF	0.81 CF		1	$ 2.58				$ 176.09	$ 6.02				$ 410.87
System Panel: Glazed	Glass		968			26		$ 62.00			$ 60,016.00		$ 70.05			$ 67,808.40
Toilet	Laminate					2				$ 520.00	$ 1,040.00				$ 556.50	$ 1,113.00
Sink Vanity-Square: 20" x 18"	Porcelain					2				$ 405.00	$ 810.00				$ 577.00	$ 1,154.00
2.5 Ton 16 Seer Air Conditioning System w/ Electric Heating						1				$ 3,150.00	$ 3,150.00				$ 3,312.00	$ 3,312.00
Water Heater						1				$ 935.00	$ 935.00				$ 1,350.00	$ 1,350.00
							Material Cost Total				**$ 168,643.03**	**Total Cost**				**$215,525.63**

Architectural Multi-Category Material Takeoff

			2021 Conversion													
			Material Cost					Total Cost					Total Project cost			
Family and Type	**Material: Name**	**Inflation**	**Cost/LF**	**Cost/SF**	**Cost/CF**	**Cost/Count**	**Cost**	**Cost/LF**	**Cost/SF**	**Cost/CF**	**Cost/Count**	**Cost**	**General Contractors Overhead and Profit (5%- 10%)**	**Contingency (5%- 10%)**	**Administrative Fees (3%- 5%)**	**Total Cost**
Compound Ceiling: 2' x 4' ACT System	Acoustic Ceiling Tile 24 x 48	33.3%		$ 0.49			$ 167.17		$ 1.99			$ 673.21	$ 67.32	$ 67.32	$ 33.66	$ 841.51
Basic Wall: Exterior - Limestone Insulated 2	Gypsum Wall Board	33.3%		$ 1.19			$ 301.29		$ 1.68			$ 426.55	$ 42.65	$ 42.65	$ 21.33	$ 533.19
Basic Wall: Exterior - Wood Finish Alt. 2	Gypsum Wall Board	33.3%		$ 1.19			$ 1,600.17		$ 1.68			$ 2,265.41	$ 226.54	$ 226.54	$ 113.27	$ 2,831.77
Basic Wall: Interior - 5 1/2" Partition (1-hr)	Gypsum Wall Board	33.3%		$ 1.19			$ 2,144.64		$ 1.68			$ 3,036.23	$ 303.62	$ 303.62	$ 151.81	$ 3,795.28
Basic Wall: Interior - 9" Partition	Gypsum Wall Board	33.3%		$ 1.19			$ 427.03		$ 1.68			$ 604.56	$ 60.46	$ 60.46	$ 30.23	$ 755.70
Basic Roof: Wood Rafter 8" - Tin - Insulated	Aluminum Sheet Panels	33.3%		$ 1.52			$ 3,686.04		$ 3.36			$ 8,148.10	$ 814.81	$ 814.81	$ 407.40	$ 10,185.12
Basic Roof: Wood Rafter 8" - Tin - Insulated	Rigid Insulation	33.3%		$ 0.37			$ 905.34		$ 0.72			$ 1,746.02	$ 174.60	$ 174.60	$ 87.30	$ 2,182.53
Basic Wall: Exterior - Limestone Insulated 2	Limestone Veneer	33.3%		$ 63.97			$ 32,435.02		$ 70.09			$ 35,536.62	$ 3,553.66	$ 3,553.66	$ 1,776.83	$ 44,420.77
Basic Wall: Exterior - Limestone Insulated 2	Metal Furring	33.3%		$ 0.45			$ 115.10		$ 2.04			$ 517.95	$ 51.80	$ 51.80	$ 25.90	$ 647.44
Basic Roof: Wood Rafter 8" - Tin - Insulated	Plywood	33.3%		$ 1.09			$ 2,651.37		$ 1.72			$ 4,171.05	$ 417.11	$ 417.11	$ 208.55	$ 5,213.81
Basic Wall: Exterior - Wood Finish Alt. 2	Plywood	33.3%		$ 1.09			$ 1,474.32		$ 1.85			$ 2,499.15	$ 249.91	$ 249.91	$ 124.96	$ 3,123.93
Basic Wall: Exterior - Limestone Insulated 2	Rigid insulation	33.3%		$ 0.37			$ 94.79		$ 0.72			$ 182.81	$ 18.28	$ 18.28	$ 9.14	$ 228.51
Basic Wall: Exterior - Wood Finish Alt. 2	Vapor Retarder	33.3%		$ 1.59			$ 2,145.90		$ 13.98			$ 18,916.39	$ 1,891.64	$ 1,891.64	$ 945.82	$ 23,645.49
Basic Wall: Exterior - Wood Finish Alt. 2	Fiber Cement Siding	33.3%		$ 1.39			$ 1,871.25		$ 3.55			$ 4,786.08	$ 478.61	$ 478.61	$ 239.30	$ 5,982.61
Floor: Wood Joist 1.5" - Oak Wood Finish 2	Oak Flooring	33.3%		$ 5.98			$ 9,874.05		$ 8.69			$ 14,338.26	$ 1,433.83	$ 1,433.83	$ 716.91	$ 17,922.83
Floor: Wood Joist 1.5" - Oak Wood Finish 2	Plywood	33.3%		$ 1.09			$ 1,803.28		$ 1.72			$ 2,836.86	$ 283.69	$ 283.69	$ 141.84	$ 3,546.08
Door-Curtain-Wall-Double-Storefront: Door-Curtain-Wall-Double-Storefront		33.3%				$ 1,599.36	$ 1,599.36				$ 1,676.00	$ 1,676.00	$ 167.60	$ 167.60	$ 83.80	$ 2,095.00
Door-Exterior-Double-Full Glass-Wood_Clad: 72" x 80"		33.3%				$ 1,599.36	$ 1,599.36				$ 1,676.00	$ 1,676.00	$ 167.60	$ 167.60	$ 83.80	$ 2,095.00
Door-Interior-Single-2_Panel-Wood: 36" x 84"		33.3%				$ 546.45	$ 1,092.90				$ 617.09	$ 1,234.17	$ 123.42	$ 123.42	$ 61.71	$ 1,542.72
Door-Interior-Single-Full Glass-Wood: 32" x 80"		33.3%				$ 546.45	$ 1,092.90				$ 617.09	$ 1,234.17	$ 123.42	$ 123.42	$ 61.71	$ 1,542.72
Door-Double-Sliding: 68" x 80"		33.3%				$ 1,179.53	$ 1,179.53				$ 1,408.77	$ 1,408.77	$ 140.88	$ 140.88	$ 70.44	$ 1,760.96
Rectangular Mullion: 2.5" x 5" rectangular	Aluminum	33.3%		$ 83.97			$ 64,066.36		$ 95.43			$ 72,811.93	$ 7,281.19	$ 7,281.19	$ 3,640.60	$ 91,014.91
Fascia: Fascia-Flat 1x12		33.3%		$ 7.93			$ 4,306.08		$ 11.73			$ 6,368.65	$ 636.87	$ 636.87	$ 318.43	$ 7,960.81
Gutter: Gutter - Bevel 5" x 5"		33.3%	$ 3.44				$ 234.69	$ 8.02				$ 547.60	$ 54.76	$ 54.76	$ 27.38	$ 684.50
System Panel: Glazed	Glass	33.3%		$ 82.63			$ 79,989.32		$ 93.36			$ 90,375.04	$ 9,037.50	$ 9,037.50	$ 4,518.75	$ 112,968.79
Toilet	Laminate	33.3%				$ 693.06	$ 1,386.11				$ 741.70	$ 1,483.41	$ 148.34	$ 148.34	$ 74.17	$ 1,854.26
Sink Vanity-Square: 20" x 18"	Porcelain	33.3%				$ 539.78	$ 1,079.57				$ 769.03	$ 1,538.05	$ 153.81	$ 153.81	$ 76.90	$ 1,922.56
2.5 Ton 16 Seer Air Conditioning System w/ Electric Heating		33.3%				$ 4,198.32	$ 4,198.32				$ 4,414.23	$ 4,414.23	$ 441.42	$ 441.42	$ 220.71	$ 5,517.79
Water Heater		33.3%				$ 1,246.17	$ 1,246.17				$ 1,799.28	$ 1,799.28	$ 179.93	$ 179.93	$ 89.96	$ 2,249.10
			Material Cost Total				**$224,767.42**	**Total Cost**				**$287,252.55**	**Total Project Cost**			**$ 359,065.69**

Material Takeoff RSMeans

										2011 Material Cost						2011 Total Cost					
Category	Family and Type	Material: Name		Material: Area SF	Material: Volume CF	Material: Unit weight	Length (ft)	Length (in)	Count	Cost/CY	Cost/SY	Cost/LF	Cost/Ton	Cost/Count	Cost	Cost/CY	Cost/SY	Cost/LF	Cost/Ton	Cost/Count	Cost
Walls	Basic Wall: Retaining - 12" Concrete	Concrete, Cast-in-Place gray		811	810.66	150.28 lb/ft^3			1						$ -						$ -
Floors	Floor: 5" Concrete	Concrete, Cast-in-Place gray		1799	749.64	150.28 lb/ft^3			1						$ -						$ -
Structural Foundations	Wall Foundation: Bearing Footing - 90" x 12"	Concrete, Cast-in-Place gray		1382	603	150.28 lb/ft^3			1	$ 136.00					$ 3,037.33	$ 243.43					$ 5,436.60
Walls	Basic Wall: Retaining - 12" Concrete	Concrete, Cast-in-Place gray		475	468.32	150.28 lb/ft^3			1						$ -						$ -
Structural Foundations	Wall Foundation: Bearing Footing - 90" x 12"	Concrete, Cast-in-Place gray		805	348.31	150.28 lb/ft^3			1	$ 136.00					$ 1,754.45	$ 243.43					$ 3,140.34
Floors	Floor: 5" Concrete	Concrete, Cast-in-Place gray		379	157.73	150.28 lb/ft^3			1						$ -						$ -
Walls	Basic Wall: Retaining - 12" Concrete	Concrete, Cast-in-Place gray		125	119.84	150.28 lb/ft^3			1						$ -						$ -
Floors	Floor: 5" Concrete	Concrete, Cast-in-Place gray		273	113.75	150.28 lb/ft^3			1						$ -						$ -
Walls	Basic Wall: Exterior - 8" Concrete	Concrete, Cast-in-Place gray		170	113.54	150.28 lb/ft^3			1	$ 136.00					$ 571.91	$ 243.43					$ 1,023.67
Walls	Basic Wall: Exterior - 8" Concrete	Concrete, Cast-in-Place gray		147	97.88	150.28 lb/ft^3			1	$ 136.00					$ 493.03	$ 243.43					$ 882.48
Structural Foundations	Wall Foundation: Bearing Footing - 36" x 12"	Concrete, Cast-in-Place gray		352	94.99	150.28 lb/ft^3			1	$ 136.00					$ 478.47	$ 243.43					$ 856.42
Structural Foundations	Wall Foundation: Bearing Footing - 90" x 12"	Concrete, Cast-in-Place gray		218	89.49	150.28 lb/ft^3			1	$ 136.00					$ 450.76	$ 243.43					$ 806.84
Structural Foundations	Wall Foundation: Bearing Footing - 36" x 12"	Concrete, Cast-in-Place gray		312	83.9	150.28 lb/ft^3			1	$ 136.00					$ 422.61	$ 243.43					$ 756.44
Walls	Basic Wall: Retaining - 12" Concrete	Concrete, Cast-in-Place gray		81	80.99	150.28 lb/ft^3			1	$ 136.00					$ 407.95	$ 1,296.54					$ 3,889.14
Walls	Basic Wall: Exterior - 8" Concrete	Concrete, Cast-in-Place gray		117	77.97	150.28 lb/ft^3			1	$ 136.00					$ 392.74	$ 243.43					$ 702.97
Structural Foundations	Wall Foundation: Bearing Footing - 36" x 12"	Concrete, Cast-in-Place gray		244	65.5	150.28 lb/ft^3			1	$ 136.00					$ 329.93	$ 243.43					$ 590.54
Structural Foundations	Wall Foundation: Bearing Footing - 90" x 12"	Concrete, Cast-in-Place gray		151	60.16	150.28 lb/ft^3			1	$ 136.00					$ 303.03	$ 243.43					$ 542.40
Floors	Floor: 5" Concrete	Concrete, Cast-in-Place gray		86	35.76	150.28 lb/ft^3			1	$ 136.00					$ 180.12						$ -
Walls	Basic Wall: Exterior - 8" Concrete	Concrete, Cast-in-Place gray		35	23.33	150.28 lb/ft^3			1						$ -	$ 243.43					$ 210.34
Structural Foundations	Wall Foundation: Bearing Footing - 36" x 12"	Concrete, Cast-in-Place gray		77	20	150.28 lb/ft^3			1	$ 136.00					$ 100.74	$ 243.43					$ 180.32
Structural Foundations	Wall Foundation: Bearing Footing - 36" x 12"	Concrete, Cast-in-Place gray		69	17.54	150.28 lb/ft^3			1	$ 136.00					$ 88.35	$ 243.43					$ 158.14
Walls	Basic Wall: Exterior - 8" Concrete	Concrete, Cast-in-Place gray		23	15.66	150.28 lb/ft^3			1	$ 136.00					$ 78.88	$ 243.43					$ 141.19
Structural Foundations	Wall Foundation: Bearing Footing - 36" x 12"	Concrete, Cast-in-Place gray		37	8	150.28 lb/ft^3			2	$ 136.00					$ 40.30	$ 243.43					$ 72.13
Walls	Basic Wall: Exterior - 8" Concrete	Concrete, Cast-in-Place gray		5	3.11	150.28 lb/ft^3			2	$ 136.00					$ 15.67	$ 243.43					$ 28.04
Roof	Floor: 1.5B-36, Grade 50, 1.5" Roof Metal Deck	Metal Deck		1332	166.55	490.06			1		$ 1.02				$ 1,358.64		$ 1.35				$ 1,798.20
Roof	Floor: 1.5B-36, Grade 50, 1.5" Roof Metal Deck	Metal Deck		452	56.46	490.06			1		$ 1.02				$ 461.04		$ 1.35				$ 610.20

Material Takeoff RSMeans

			2021 Conversion – Material Cost						2021 Conversion – Total Cost						Total Project cost			
Category	Family and Type	Inflation	Cost/CY	Cost/SY	Cost/LF	Cost/Ton	Cost/Count	Cost	Cost/CY	Cost/SY	Cost/LF	Cost/Ton	Cost/Count	Cost	General Contractors Overhead and Profit (5% - 10%)	Contingency (5% - 10%)	Administrative Fees (3% - 5%)	Total Cost
Walls	Basic Wall: Retaining - 12" Concrete		$ -					$ -	$ 1,296.54					$ 38,927.89	$ 3,892.79	$ 3,892.79	$ 1,946.39	$ 48,659.87
Floors	Floor: 5" Concrete		$ -					$ -		$ 58.61				$ 11,715.49	$ 1,171.55	$ 1,171.55	$ 585.77	$ 14,644.36
Structural Foundations	Wall Foundation: Bearing Footing - 90" x 12"	33.3%	$ 181.26					$ 4,048.16	$ 324.44					$ 7,245.90	$ 724.59	$ 724.59	$ 362.30	$ 9,057.38
Walls	Basic Wall: Retaining - 12" Concrete		$ -					$ -	$ 1,296.54					$ 22,488.73	$ 2,248.87	$ 2,248.87	$ 1,124.44	$ 28,110.91
Structural Foundations	Wall Foundation: Bearing Footing - 90" x 12"	33.3%	$ 181.26					$ 2,338.33	$ 324.44					$ 4,185.44	$ 418.54	$ 418.54	$ 209.27	$ 5,231.80
Floors	Floor: 5" Concrete		$ -					$ -		$ 58.61				$ 2,468.13	$ 246.81	$ 246.81	$ 123.41	$ 3,085.17
Walls	Basic Wall: Retaining - 12" Concrete		$ -					$ -	$ 1,296.54					$ 5,754.72	$ 575.47	$ 575.47	$ 287.74	$ 7,193.40
Floors	Floor: 5" Concrete		$ -					$ -		$ 58.61				$ 1,777.84	$ 177.78	$ 177.78	$ 88.89	$ 2,222.30
Walls	Basic Wall: Exterior - 8" Concrete	33.3%	$ 181.26					$ 762.24	$ 324.44					$ 1,364.35	$ 136.43	$ 136.43	$ 68.22	$ 1,705.43
Walls	Basic Wall: Exterior - 8" Concrete	33.3%	$ 181.26					$ 657.10	$ 324.44					$ 1,176.17	$ 117.62	$ 117.62	$ 58.81	$ 1,470.21
Structural Foundations	Wall Foundation: Bearing Footing - 36" x 12"	33.3%	$ 181.26					$ 637.70	$ 324.44					$ 1,141.44	$ 114.14	$ 114.14	$ 57.07	$ 1,426.80
Structural Foundations	Wall Foundation: Bearing Footing - 90" x 12"	33.3%	$ 181.26					$ 600.78	$ 324.44					$ 1,075.35	$ 107.53	$ 107.53	$ 53.77	$ 1,344.19
Structural Foundations	Wall Foundation: Bearing Footing - 36" x 12"	33.3%	$ 181.26					$ 563.25	$ 324.44					$ 1,008.18	$ 100.82	$ 100.82	$ 50.41	$ 1,260.22
Walls	Basic Wall: Retaining - 12" Concrete	33.3%	$ 181.26					$ 543.72	$ 1,728.03					$ 5,183.45	$ 518.34	$ 518.34	$ 259.17	$ 6,479.31
Walls	Basic Wall: Exterior - 8" Concrete	33.3%	$ 181.26					$ 523.44	$ 324.44					$ 936.92	$ 93.69	$ 93.69	$ 46.85	$ 1,171.15
Structural Foundations	Wall Foundation: Bearing Footing - 36" x 12"	33.3%	$ 181.26					$ 439.73	$ 324.44					$ 787.08	$ 78.71	$ 78.71	$ 39.35	$ 983.84
Structural Foundations	Wall Foundation: Bearing Footing - 90" x 12"	33.3%	$ 181.26					$ 403.88	$ 324.44					$ 722.91	$ 72.29	$ 72.29	$ 36.15	$ 903.64
Floors	Floor: 5" Concrete							$ 180.12		$ 58.61				$ 560.05	$ 56.01	$ 56.01	$ 28.00	$ 700.06
Walls	Basic Wall: Exterior - 8" Concrete	33.3%	$ -					$ -	$ 324.44					$ 280.34	$ 28.03	$ 28.03	$ 14.02	$ 350.43
Structural Foundations	Wall Foundation: Bearing Footing - 36" x 12"	33.3%	$ 181.26					$ 134.27	$ 324.44					$ 240.33	$ 24.03	$ 24.03	$ 12.02	$ 300.41
Structural Foundations	Wall Foundation: Bearing Footing - 36" x 12"	33.3%	$ 181.26					$ 117.75	$ 324.44					$ 210.77	$ 21.08	$ 21.08	$ 10.54	$ 263.46
Walls	Basic Wall: Exterior - 8" Concrete	33.3%	$ 181.26					$ 105.13	$ 324.44					$ 188.18	$ 18.82	$ 18.82	$ 9.41	$ 235.22
Structural Foundations	Wall Foundation: Bearing Footing - 36" x 12"	33.3%	$ 181.26					$ 53.71	$ 324.44					$ 96.13	$ 9.61	$ 9.61	$ 4.81	$ 120.16
Walls	Basic Wall: Exterior - 8" Concrete	33.3%	$ 181.26					$ 20.88	$ 324.44					$ 37.37	$ 3.74	$ 3.74	$ 1.87	$ 46.71
Roof	Floor: 1.5B-36, Grade 50, 1.5" Roof Metal Deck	33.3%		$ 1.36				$ 1,810.80		$ 1.80				$ 2,396.64	$ 239.66	$ 239.66	$ 119.83	$ 2,995.80
Roof	Floor: 1.5B-36, Grade 50, 1.5" Roof Metal Deck	33.3%		$ 1.36				$ 614.47		$ 1.80				$ 813.27	$ 81.33	$ 81.33	$ 40.66	$ 1,016.59
									$					**112,783.06**				**$ 140,978.82**

Material Takeoff RSMeans

Category	Family and Type	Material: Name		Material: Area SF	Material: Volume CF	Material: Unit weight	Length (ft)	Length (in)	Count	2011 Material Cost: Cost/CY	Cost/SY	Cost/LF	Cost/Ton	Cost/Count	Cost	2011 Total Cost: Cost/CY	Cost/SY	Cost/LF	Cost/Ton	Cost/Count	Cost
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	Steel ASTM A500, Grade B		1 SF	0.00 CF	490.00 lb/ft^3	0	9.875	1			$ 6.90			$ 5.68			$ 13.70			$ 11.27
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	Steel ASTM A500, Grade B		3 SF	0.01 CF	490.00 lb/ft^3	0	10.125	2			$ 6.90			$ 11.64			$ 13.70			$ 23.12
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	Steel ASTM A500, Grade B		3 SF	0.01 CF	490.00 lb/ft^3	0	10.25	2			$ 6.90			$ 11.79			$ 13.70			$ 23.40
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	Steel ASTM A500, Grade B		1 SF	0.00 CF	490.00 lb/ft^3	0	10.375	1			$ 6.90			$ 5.97			$ 13.70			$ 11.84
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	Steel ASTM A500, Grade B		19 SF	0.04 CF	490.00 lb/ft^3	0	10.5	13			$ 6.90			$ 78.49			$ 13.70			$ 155.84
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	Steel ASTM A500, Grade B		2 SF	0.00 CF	490.00 lb/ft^3	0	11	1			$ 6.90			$ 6.33			$ 13.70			$ 12.56
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	Steel ASTM A500, Grade B		2 SF	0.00 CF	490.00 lb/ft^3	0	11.125	1			$ 6.90			$ 6.40			$ 13.70			$ 12.70
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	Steel ASTM A500, Grade B		2 SF	0.00 CF	490.00 lb/ft^3	0	11.625	1			$ 6.90			$ 6.68			$ 13.70			$ 13.27
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	Steel ASTM A500, Grade B		137 SF	0.31 CF	490.00 lb/ft^3	3	6	23			$ 6.90			$ 555.45			$ 13.70			$ 1,102.85
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	Steel ASTM A500, Grade B		43 SF	0.10 CF	490.00 lb/ft^3	4	2.375	6			$ 6.90			$ 173.79			$ 13.70			$ 345.07
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	Steel ASTM A500, Grade B		8 SF	0.02 CF	490.00 lb/ft^3	4	11	1			$ 6.90			$ 33.93			$ 13.70			$ 67.36
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	Steel ASTM A500, Grade B		9 SF	0.02 CF	490.00 lb/ft^3	5	0.5	1			$ 6.90			$ 34.79			$ 13.70			$ 69.07
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	Steel ASTM A500, Grade B		9 SF	0.02 CF	490.00 lb/ft^3	5	2	1			$ 6.90			$ 35.65			$ 13.70			$ 70.78
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	Steel ASTM A500, Grade B		9 SF	0.02 CF	490.00 lb/ft^3	5	3.5	1			$ 6.90			$ 36.51			$ 13.70			$ 72.50
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	Steel ASTM A500, Grade B		9 SF	0.02 CF	490.00 lb/ft^3	5	5	1			$ 6.90			$ 37.38			$ 13.70			$ 74.21
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	Steel ASTM A500, Grade B		9 SF	0.02 CF	490.00 lb/ft^3	5	6.5	1			$ 6.90			$ 38.24			$ 13.70			$ 75.92
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	Steel ASTM A500, Grade B		13 SF	0.03 CF	490.00 lb/ft^3	7	9	1			$ 6.90			$ 53.48			$ 13.70			$ 106.18
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	Steel ASTM A500, Grade B		13 SF	0.03 CF	490.00 lb/ft^3	7	10.5	1			$ 6.90			$ 54.34			$ 13.70			$ 107.89
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	Steel ASTM A500, Grade B		14 SF	0.03 CF	490.00 lb/ft^3	8	0	1			$ 6.90			$ 55.20			$ 13.70			$ 109.60
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	Steel ASTM A500, Grade B		660 SF	1.50 CF	490.00 lb/ft^3	10	6	37			$ 8.05			$ 3,127.43			$ 14.85			$ 5,769.23
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	Steel ASTM A500, Grade B		206 SF	0.47 CF	490.00 lb/ft^3	11	0	11			$ 8.05			$ 974.05			$ 14.85			$ 1,796.85
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	Steel ASTM A500, Grade B		50 SF	0.11 CF	490.00 lb/ft^3	14	6.875	2			$ 13.50			$ 393.47			$ 23.80			$ 693.67
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	Steel ASTM A500, Grade B		250 SF	0.57 CF	490.00 lb/ft^3	14	8.375	10			$ 13.50			$ 1,984.22			$ 23.80			$ 3,498.10
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	Steel ASTM A500, Grade B		25 SF	0.06 CF	490.00 lb/ft^3	14	9.25	1			$ 13.50			$ 199.41			$ 23.80			$ 351.55
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	Steel ASTM A500, Grade B		25 SF	0.06 CF	490.00 lb/ft^3	14	9.625	1			$ 13.50			$ 199.83			$ 23.80			$ 352.29
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	Steel ASTM A500, Grade B		25 SF	0.06 CF	490.00 lb/ft^3	14	9.75	1			$ 13.50			$ 199.97			$ 23.80			$ 352.54
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	Steel ASTM A500, Grade B		51 SF	0.11 CF	490.00 lb/ft^3	14	10.75	2			$ 13.50			$ 402.19			$ 23.80			$ 709.04
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	Steel ASTM A500, Grade B		25 SF	0.06 CF	490.00 lb/ft^3	14	11.875	1			$ 13.50			$ 202.36			$ 23.80			$ 356.75
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	Steel ASTM A500, Grade B		26 SF	0.06 CF	490.00 lb/ft^3	15	0.125	1			$ 13.50			$ 202.64			$ 23.80			$ 357.25
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	Steel ASTM A500, Grade B		26 SF	0.06 CF	490.00 lb/ft^3	15	2.5	1			$ 13.50			$ 205.31			$ 23.80			$ 361.96
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	Steel ASTM A500, Grade B		26 SF	0.06 CF	490.00 lb/ft^3	15	3	1			$ 13.50			$ 205.88			$ 23.80			$ 362.95
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	Steel ASTM A500, Grade B		27 SF	0.06 CF	490.00 lb/ft^3	15	11.75	1			$ 13.50			$ 215.72			$ 23.80			$ 380.30
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	Steel ASTM A500, Grade B		27 SF	0.06 CF	490.00 lb/ft^3	16	2	1			$ 13.50			$ 218.25			$ 23.80			$ 384.77
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	Steel ASTM A500, Grade B		28 SF	0.06 CF	490.00 lb/ft^3	16	3.375	1			$ 13.50			$ 219.80			$ 23.80			$ 387.49
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	Steel ASTM A500, Grade B		28 SF	0.06 CF	490.00 lb/ft^3	16	4.25	1			$ 13.50			$ 220.78			$ 23.80			$ 389.23
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	Steel ASTM A500, Grade B		28 SF	0.06 CF	490.00 lb/ft^3	16	4.875	1			$ 13.50			$ 221.48			$ 23.80			$ 390.47
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	Steel ASTM A500, Grade B		28 SF	0.06 CF	490.00 lb/ft^3	16	5.875	1			$ 13.50			$ 222.61			$ 23.80			$ 392.45
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	Steel ASTM A500, Grade B		28 SF	0.06 CF	490.00 lb/ft^3	16	6.25	1			$ 13.50			$ 223.03			$ 23.80			$ 393.20
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	Steel ASTM A500, Grade B		28 SF	0.06 CF	490.00 lb/ft^3	16	7.5	1			$ 13.50			$ 224.44			$ 23.80			$ 395.68
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	Steel ASTM A500, Grade B		28 SF	0.06 CF	490.00 lb/ft^3	16	7.75	1			$ 13.50			$ 224.72			$ 23.80			$ 396.17
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	Steel ASTM A500, Grade B		28 SF	0.06 CF	490.00 lb/ft^3	16	9	1			$ 13.50			$ 226.13			$ 23.80			$ 398.65
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	Steel ASTM A500, Grade B		28 SF	0.06 CF	490.00 lb/ft^3	16	9.25	1			$ 13.50			$ 226.41			$ 23.80			$ 399.15
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	Steel ASTM A500, Grade B		29 SF	0.06 CF	490.00 lb/ft^3	16	10.5	1			$ 13.50			$ 227.81			$ 23.80			$ 401.63
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	Steel ASTM A500, Grade B		29 SF	0.07 CF	490.00 lb/ft^3	16	10.625	1			$ 13.50			$ 227.95			$ 23.80			$ 401.87
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	Steel ASTM A500, Grade B		29 SF	0.07 CF	490.00 lb/ft^3	17	0	1			$ 13.50			$ 229.50			$ 23.80			$ 404.60
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	Steel ASTM A500, Grade B		29 SF	0.07 CF	490.00 lb/ft^3	17	0.125	1			$ 13.50			$ 229.64			$ 23.80			$ 404.85
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	Steel ASTM A500, Grade B		58 SF	0.13 CF	490.00 lb/ft^3	17	1.5	2			$ 13.50			$ 462.38			$ 23.80			$ 815.15
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	Steel ASTM A500, Grade B		59 SF	0.13 CF	490.00 lb/ft^3	17	2.875	2			$ 13.50			$ 465.47			$ 23.80			$ 820.60
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	Steel ASTM A500, Grade B		89 SF	0.20 CF	490.00 lb/ft^3	17	4.5	3			$ 13.50			$ 703.69			$ 23.80			$ 1,240.58
			Total	**2329 SF**	**5.28 CF**				**151**						**$ 14,528.25**						**$ 26,224.43**
Structural Columns	HSS-Hollow Structural Section-Column: HSS3X3X3/8	Steel ASTM A500, Grade B		34 SF	0.5	490	10' - 6 3/4"		2				$ 6,500.00	$ 186.00	$ 372.00				$ 6,500.00	$ 259.50	$ 519.00
Structural Columns	HSS-Hollow Structural Section-Column: HSS3X3X3/8	Steel ASTM A500, Grade B		37 SF	0.53	490	11' - 3 3/4"		2				$ 6,500.00	$ 186.00	$ 372.00				$ 6,500.00	$ 259.50	$ 519.00
			Total	**71 SF**	**1.03 CF**				**4**						**$ 744.00**						**$ 1,038.00**
Structural Columns	HSS-Hollow Structural Section-Column: HSS4X4X1/4	Steel ASTM A500, Grade B		113 SF	1.1	490	15' - 8 1/8"		3				$ 6,500.00	$ 186.00	$ 558.00				$ 6,500.00	$ 259.50	$ 778.50
Structural Columns	HSS-Hollow Structural Section-Column: HSS4X4X1/4	Steel ASTM A500, Grade B		39 SF	0.38	490	16' - 0 7/8"		1				$ 6,500.00	$ 186.00	$ 186.00				$ 6,500.00	$ 259.50	$ 259.50
Structural Columns	HSS-Hollow Structural Section-Column: HSS4X4X1/4	Steel ASTM A500, Grade B		83 SF	0.8	490	17' - 1 3/8"		2				$ 6,500.00	$ 186.00	$ 372.00				$ 6,500.00	$ 259.50	$ 519.00
Structural Columns	HSS-Hollow Structural Section-Column: HSS4X4X1/4	Steel ASTM A500, Grade B		42 SF	0.41	490	17' - 6 7/8"		1				$ 6,500.00	$ 186.00	$ 186.00				$ 6,500.00	$ 259.50	$ 259.50
Structural Columns	HSS-Hollow Structural Section-Column: HSS4X4X1/4	Steel ASTM A500, Grade B		132 SF	1.28	490	18' - 2 1/2"		3				$ 6,500.00	$ 186.00	$ 558.00				$ 6,500.00	$ 259.50	$ 778.50
			Total	**409 SF**	**3.96 CF**				**10**						**$ 1,860.00**						**$ 2,595.00**
Structural Columns	HSS-Hollow Structural Section-Column: HSS6X6X5/8	Steel ASTM A500, Grade B		68 SF	1.64	490	10' - 1"		2				$ 6,500.00	$ 305.00	$ 610.00				$ 6,500.00	$ 384.00	$ 768.00
			Total	**68 SF**	**1.64 CF**	**490.00 lb/ft^3**			**2**						**$ 610.00**						**$ 768.00**
			Grand Total	**2877 SF**	**11.91 CF**				**167**						**$ 17,742.25**						**$ 30,625.43**

Material Takeoff RSMeans

			2021 Conversion															
			Material Cost						Total Cost						Total Project cost			
Category	Family and Type	Inflation	Cost/CY	Cost/SY	Cost/LF	Cost/Ton	Cost/Count	Cost	Cost/CY	Cost/SY	Cost/LF	Cost/Ton	Cost/Count	Cost	Overhead and Profit (5% - 10%)	Contingency (5% - 10%)	Administrative Fees (3% - 5%)	Total Cost
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	33.3%			$ 9.20			$ 7.57			$ 18.26			$ 15.03	$ 1.50	$ 1.50	$ 0.75	$ 18.78
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	33.3%			$ 9.20			$ 15.52			$ 18.26			$ 30.81	$ 3.08	$ 3.08	$ 1.54	$ 38.52
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	33.3%			$ 9.20			$ 15.71			$ 18.26			$ 31.19	$ 3.12	$ 3.12	$ 1.56	$ 38.99
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	33.3%			$ 9.20			$ 7.95			$ 18.26			$ 15.79	$ 1.58	$ 1.58	$ 0.79	$ 19.73
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	33.3%			$ 9.20			$ 104.61			$ 18.26			$ 207.70	$ 20.77	$ 20.77	$ 10.39	$ 259.63
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	33.3%			$ 9.20			$ 8.43			$ 18.26			$ 16.74	$ 1.67	$ 1.67	$ 0.84	$ 20.92
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	33.3%			$ 9.20			$ 8.53			$ 18.26			$ 16.93	$ 1.69	$ 1.69	$ 0.85	$ 21.16
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	33.3%			$ 9.20			$ 8.91			$ 18.26			$ 17.69	$ 1.77	$ 1.77	$ 0.88	$ 22.11
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	33.3%			$ 9.20			$ 740.30			$ 18.26			$ 1,469.88	$ 146.99	$ 146.99	$ 73.49	$ 1,837.35
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	33.3%			$ 9.20			$ 231.63			$ 18.26			$ 459.91	$ 45.99	$ 45.99	$ 23.00	$ 574.88
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	33.3%			$ 9.20			$ 45.22			$ 18.26			$ 89.78	$ 8.98	$ 8.98	$ 4.49	$ 112.22
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	33.3%			$ 9.20			$ 46.36			$ 18.26			$ 92.06	$ 9.21	$ 9.21	$ 4.60	$ 115.07
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	33.3%			$ 9.20			$ 47.51			$ 18.26			$ 94.34	$ 9.43	$ 9.43	$ 4.72	$ 117.93
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	33.3%			$ 9.20			$ 48.66			$ 18.26			$ 96.62	$ 9.66	$ 9.66	$ 4.83	$ 120.78
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	33.3%			$ 9.20			$ 49.81			$ 18.26			$ 98.90	$ 9.89	$ 9.89	$ 4.95	$ 123.63
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	33.3%			$ 9.20			$ 50.96			$ 18.26			$ 101.19	$ 10.12	$ 10.12	$ 5.06	$ 126.48
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	33.3%			$ 9.20			$ 71.27			$ 18.26			$ 141.51	$ 14.15	$ 14.15	$ 7.08	$ 176.89
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	33.3%			$ 9.20			$ 72.42			$ 18.26			$ 143.79	$ 14.38	$ 14.38	$ 7.19	$ 179.74
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	33.3%			$ 9.20			$ 73.57			$ 18.26			$ 146.07	$ 14.61	$ 14.61	$ 7.30	$ 182.59
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	33.3%			$ 10.73			$ 4,168.23			$ 19.79			$ 7,689.22	$ 768.92	$ 768.92	$ 384.46	$ 9,611.53
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	33.3%			$ 10.73			$ 1,298.21			$ 19.79			$ 2,394.84	$ 239.48	$ 239.48	$ 119.74	$ 2,993.55
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	33.3%			$ 17.99			$ 524.42			$ 31.72			$ 924.52	$ 92.45	$ 92.45	$ 46.23	$ 1,155.66
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	33.3%			$ 17.99			$ 2,644.57			$ 31.72			$ 4,662.27	$ 466.23	$ 466.23	$ 233.11	$ 5,827.84
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	33.3%			$ 17.99			$ 265.77			$ 31.72			$ 468.54	$ 46.85	$ 46.85	$ 23.43	$ 585.68
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	33.3%			$ 17.99			$ 266.33			$ 31.72			$ 469.53	$ 46.95	$ 46.95	$ 23.48	$ 586.91
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	33.3%			$ 17.99			$ 266.52			$ 31.72			$ 469.86	$ 46.99	$ 46.99	$ 23.49	$ 587.33
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	33.3%			$ 17.99			$ 536.04			$ 31.72			$ 945.01	$ 94.50	$ 94.50	$ 47.25	$ 1,181.26
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	33.3%			$ 17.99			$ 269.70			$ 31.72			$ 475.48	$ 47.55	$ 47.55	$ 23.77	$ 594.35
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	33.3%			$ 17.99			$ 270.08			$ 31.72			$ 476.14	$ 47.61	$ 47.61	$ 23.81	$ 595.18
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	33.3%			$ 17.99			$ 273.64			$ 31.72			$ 482.42	$ 48.24	$ 48.24	$ 24.12	$ 603.02
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	33.3%			$ 17.99			$ 274.39			$ 31.72			$ 483.74	$ 48.37	$ 48.37	$ 24.19	$ 604.67
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	33.3%			$ 17.99			$ 287.51			$ 31.72			$ 506.87	$ 50.69	$ 50.69	$ 25.34	$ 633.59
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	33.3%			$ 17.99			$ 290.88			$ 31.72			$ 512.82	$ 51.28	$ 51.28	$ 25.64	$ 641.02
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	33.3%			$ 17.99			$ 292.95			$ 31.72			$ 516.45	$ 51.65	$ 51.65	$ 25.82	$ 645.56
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	33.3%			$ 17.99			$ 294.26			$ 31.72			$ 518.76	$ 51.88	$ 51.88	$ 25.94	$ 648.46
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	33.3%			$ 17.99			$ 295.19			$ 31.72			$ 520.42	$ 52.04	$ 52.04	$ 26.02	$ 650.52
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	33.3%			$ 17.99			$ 296.69			$ 31.72			$ 523.06	$ 52.31	$ 52.31	$ 26.15	$ 653.83
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	33.3%			$ 17.99			$ 297.26			$ 31.72			$ 524.05	$ 52.41	$ 52.41	$ 26.20	$ 655.06
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	33.3%			$ 17.99			$ 299.13			$ 31.72			$ 527.36	$ 52.74	$ 52.74	$ 26.37	$ 659.19
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	33.3%			$ 17.99			$ 299.51			$ 31.72			$ 528.02	$ 52.80	$ 52.80	$ 26.40	$ 660.02
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	33.3%			$ 17.99			$ 301.38			$ 31.72			$ 531.32	$ 53.13	$ 53.13	$ 26.57	$ 664.15
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	33.3%			$ 17.99			$ 301.75			$ 31.72			$ 531.98	$ 53.20	$ 53.20	$ 26.60	$ 664.98
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	33.3%			$ 17.99			$ 303.63			$ 31.72			$ 535.29	$ 53.53	$ 53.53	$ 26.76	$ 669.11
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	33.3%			$ 17.99			$ 303.82			$ 31.72			$ 535.62	$ 53.56	$ 53.56	$ 26.78	$ 669.52
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	33.3%			$ 17.99			$ 305.88			$ 31.72			$ 539.25	$ 53.93	$ 53.93	$ 26.96	$ 674.06
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	33.3%			$ 17.99			$ 306.07			$ 31.72			$ 539.58	$ 53.96	$ 53.96	$ 26.98	$ 674.48
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	33.3%			$ 17.99			$ 616.25			$ 31.72			$ 1,086.43	$ 108.64	$ 108.64	$ 54.32	$ 1,358.04
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	33.3%			$ 17.99			$ 620.38			$ 31.72			$ 1,093.70	$ 109.37	$ 109.37	$ 54.69	$ 1,367.13
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	33.3%			$ 17.99			$ 937.87			$ 31.72			$ 1,653.44	$ 165.34	$ 165.34	$ 82.67	$ 2,066.80
								$ 19,363.25						**$ 34,951.92**				
Structural Columns	HSS-Hollow Structural Section-Column: HSS3X3X3/8	33.3%					$ 247.90	$ 495.80					$ 345.86	$ 691.72	$ 69.17	$ 69.17	$ 34.59	$ 864.65
Structural Columns	HSS-Hollow Structural Section-Column: HSS3X3X3/8	33.3%					$ 247.90	$ 495.80					$ 345.86	$ 691.72	$ 69.17	$ 69.17	$ 34.59	$ 864.65
								$ 991.60						**$ 1,383.45**				
Structural Columns	HSS-Hollow Structural Section-Column: HSS4X4X1/4	33.3%					$ 247.90	$ 743.70	$ -		$ -	$ 8,663.20	$ 345.86	$ 1,037.58	$ 103.76	$ 103.76	$ 51.88	$ 1,296.98
Structural Columns	HSS-Hollow Structural Section-Column: HSS4X4X1/4	33.3%					$ 247.90	$ 247.90	$ -		$ -	$ 8,663.20	$ 345.86	$ 345.86	$ 34.59	$ 34.59	$ 17.29	$ 432.33
Structural Columns	HSS-Hollow Structural Section-Column: HSS4X4X1/4	33.3%					$ 247.90	$ 495.80	$ -		$ -	$ 8,663.20	$ 345.86	$ 691.72	$ 69.17	$ 69.17	$ 34.59	$ 864.65
Structural Columns	HSS-Hollow Structural Section-Column: HSS4X4X1/4	33.3%					$ 247.90	$ 247.90	$ -		$ -	$ 8,663.20	$ 345.86	$ 345.86	$ 34.59	$ 34.59	$ 17.29	$ 432.33
Structural Columns	HSS-Hollow Structural Section-Column: HSS4X4X1/4	33.3%					$ 247.90	$ 743.70	$ -		$ -	$ 8,663.20	$ 345.86	$ 1,037.58	$ 103.76	$ 103.76	$ 51.88	$ 1,296.98
								$ 2,479.01						**$ 3,458.62**				
Structural Columns	HSS-Hollow Structural Section-Column: HSS6X6X5/8	33.3%					$ 406.50	$ 813.01	$ -		$ -	$ 8,663.20	$ 511.80	$ 1,023.59	$ 102.36	$ 102.36	$ 51.18	$ 1,279.49
								$ 813.01						**$ 1,023.59**				
								$ 23,646.87						**$ 40,817.57**				**$ 51,021.96**

Material Takeoff RSMeans

Category	Family and Type	Material: Name		Material: Area SF	Material: Volume CF	Material: Unit weight	Length (ft)	Length (in)	Count	2011 Material Cost: Cost/CY	Cost/SY	Cost/LF	Cost/Ton	Cost/Count	Cost	2011 Total Cost: Cost/CY	Cost/SY	Cost/LF	Cost/Ton	Cost/Count	Cost
Structural Framing	W Shapes: W12X26	Steel ASTM A992		24 SF	0.31 CF	490.00 lb/ft^3	6	4.5	1			$ 32.00		$ 451.38	$ 204.00			$ 36.85		$ 451.38	$ 234.92
Structural Framing	W Shapes: W12X26	Steel ASTM A992		40 SF	0.52 CF	490.00 lb/ft^3	10	3.125	1			$ 32.00		$ 584.05	$ 328.33			$ 36.85		$ 584.05	$ 378.10
Structural Framing	W Shapes: W12X26	Steel ASTM A992		140 SF	1.80 CF	490.00 lb/ft^3	17	6	2			$ 32.00		$ 1,093.00	$ 560.00			$ 36.85		$ 1,093.00	$ 1,289.75
Structural Framing	W Shapes: W12X26	Steel ASTM A992		146 SF	1.88 CF	490.00 lb/ft^3	18	0.875	2			$ 32.00		$ 1,093.00	$ 578.33			$ 36.85		$ 1,093.00	$ 1,331.97
Structural Framing	W Shapes: W12X26	Steel ASTM A992		187 SF	2.41 CF	490.00 lb/ft^3	23	2.125	2			$ 32.00		$ 1,093.00	$ 741.67			$ 36.85		$ 1,093.00	$ 1,708.15
Structural Framing	W Shapes: W12X26	Steel ASTM A992		97 SF	1.25 CF	490.00 lb/ft^3	24	0.5	1			$ 32.00		$ 1,093.00	$ 769.33			$ 36.85		$ 1,093.00	$ 885.94
Structural Framing	W Shapes: W12X26	Steel ASTM A992		303 SF	3.90 CF	490.00 lb/ft^3	25	0	3			$ 32.00		$ 1,053.00	$ 800.00			$ 36.85		$ 1,053.00	$ 2,763.75
Structural Framing	K-series Bar Joist-Angle Web 10K1				0.27	490	18	0.8125	7			$ 3.19	$ 6,000.00		$ 403.45			$ 7.91	$ 6,000.00		$ 1,000.41
Structural Framing	K-series Bar Joist-Angle Web 10K1				0.15	490	10	6.0625	7			$ 3.19	$ 6,500.00		$ 234.58			$ 7.91	$ 6,500.00		$ 581.67
Structural Framing	K-series Bar Joist-Angle Web 10K1				0.25	490	16	10.875	11			$ 3.19	$ 6,500.00		$ 593.24			$ 7.91	$ 6,500.00		$ 1,471.01
Structural Framing	K-series Bar Joist-Angle Web 10K1				0.23	490	15	10.125	11			$ 3.19	$ 6,500.00		$ 555.96			$ 7.91	$ 6,500.00		$ 1,378.56
			Total	**937 SF**	**12.07 CF**				**12**						**$ 5,768.90**						**$ 13,024.24**
			Grand Total	**1909 SF**	**14.93 CF**				**56**						**$ 5,768.90**						**$ 13,024.24**
										Material Cost					**$ 23,511.15**	**Total Cost**					**$ 43,649.66**

Material Takeoff RSMeans

Category	Family and Type	Material: Name	Inflation	2021 Conversion Material Cost: Cost/CY	Cost/SY	Cost/LF	Cost/Ton	Cost/Count	Cost	2021 Conversion Total Cost: Cost/CY	Cost/SY	Cost/LF	Cost/Ton	Cost/Count	Cost	Total Project cost: General Contractors Overhead and Profit (5% - 10%)	Contingency (5% - 10%)	Administrative Fees (3% - 5%)	Total Cost
Structural Framing	W Shapes: W12X26	Steel ASTM A992	33.8%			$ 42.82	$ -	$ 603.95	$ 272.95	$ -		$ 49.31	$ -	$ 603.95	$ 314.32	$ 31.43	$ 31.43	$ 15.72	$ 392.90
Structural Framing	W Shapes: W12X26	Steel ASTM A992	33.8%			$ 42.82	$ -	$ 781.46	$ 439.31	$ -		$ 49.31	$ -	$ 781.46	$ 505.89	$ 50.59	$ 50.59	$ 25.29	$ 632.37
Structural Framing	W Shapes: W12X26	Steel ASTM A992	33.8%			$ 42.82	$ -	$ 1,462.43	$ 749.28	$ -		$ 49.31	$ -	$ 1,462.43	$ 1,725.69	$ 172.57	$ 172.57	$ 86.28	$ 2,157.11
Structural Framing	W Shapes: W12X26	Steel ASTM A992	33.8%			$ 42.82	$ -	$ 1,462.43	$ 773.81	$ -		$ 49.31	$ -	$ 1,462.43	$ 1,782.18	$ 178.22	$ 178.22	$ 89.11	$ 2,227.73
Structural Framing	W Shapes: W12X26	Steel ASTM A992	33.8%			$ 42.82	$ -	$ 1,462.43	$ 992.35	$ -		$ 49.31	$ -	$ 1,462.43	$ 2,285.51	$ 228.55	$ 228.55	$ 114.28	$ 2,856.88
Structural Framing	W Shapes: W12X26	Steel ASTM A992	33.8%			$ 42.82	$ -	$ 1,462.43	$ 1,029.37	$ -		$ 49.31	$ -	$ 1,462.43	$ 1,185.38	$ 118.54	$ 118.54	$ 59.27	$ 1,481.73
Structural Framing	W Shapes: W12X26	Steel ASTM A992	33.8%			$ 42.82	$ -	$ 1,408.91	$ 1,070.40	$ -		$ 49.31	$ -	$ 1,408.91	$ 3,697.90	$ 369.79	$ 369.79	$ 184.89	$ 4,622.37
Structural Framing	K-series Bar Joist-Angle Web 10K1		33.8%			$ 4.27	$ 8,028.00	$ -	$ 539.82	$ -		$ 10.58	$ 8,028.00	$ -	$ 1,338.55	$ 133.85	$ 133.85	$ 66.93	$ 1,673.18
Structural Framing	K-series Bar Joist-Angle Web 10K1		33.8%			$ 4.27	$ 8,697.00	$ -	$ 313.87	$ -		$ 10.58	$ 8,697.00	$ -	$ 778.28	$ 77.83	$ 77.83	$ 38.91	$ 972.85
Structural Framing	K-series Bar Joist-Angle Web 10K1		33.8%			$ 4.27	$ 8,697.00	$ -	$ 793.76	$ -		$ 10.58	$ 8,697.00	$ -	$ 1,968.22	$ 196.82	$ 196.82	$ 98.41	$ 2,460.27
Structural Framing	K-series Bar Joist-Angle Web 10K1		33.8%			$ 4.27	$ 8,697.00	$ -	$ 743.87	$ -		$ 10.58	$ 8,697.00	$ -	$ 1,844.52	$ 184.45	$ 184.45	$ 92.23	$ 2,305.65
									$ 7,718.78						**$ 17,426.43**				$ 21,783.03
									$ 7,718.78						**$ 17,426.43**				
				Material Cost					**$ 31,365.66**	**Total Cost**					**$ 171,027.06**	**Total Project Cost**			**$ 213,783.82**

Material Takeoff - Iowa DOT awarded contract unit prices, 2019 RSMeans, and 2019 National Construction Estimator

				Material Cost				Total Cost				
Material	Material Length, LF	Material Area, SF	Material Volume, CY	$/LF	$/SF	$/CY	$/Each	$/LF	$/SF	$/CY	$/Each	Total per item
Earthwork												
Cut			425							34.3		14577.5
Fill			860							41.21		35440.6
Grading		5000									2021	2021
Clearning and Grubbing											5000	5000
Pavement												
5" PCC Pavement		3500			1.9				6.34			22190
Base Material		3500			1.56				1.56			5460
PCC Sidewalk		370							5.55			2053.5
Utilities												
6" Water Line	73			47.5				60.25				4398.25
Electric Line	75							13.31				998.25
Erosion Control												
Silt Fence	210							1.56				327.6
Erosion Control Blanket											500	500
												$ 93,000

Camp Couragous - Cultural Education Center Engineering Cost

UIS Engineering, Inc

Budget Summary

Task Description	Hours	Hourly Salary	Multiplier for Overhead and Profit	Total
Site Visits	25	30	3	$ 2,250
Proposal Report and Presentation	35	30	3	$ 3,150
Collecting existing data	20	30	3	$ 1,800
Development of articultural design	50	30	3	$ 4,500
Completing structural analysis	50	30	3	$ 4,500
Development of site design	50	30	3	$ 4,500
Preparation of Prelimiary Plan Sheets	50	30	3	$ 4,500
Preparation of Final Design Plan Sheets	50	30	3	$ 4,500
Design Presentation	35	30	3	$ 3,150
Design Report	50	30	3	$ 4,500
Presentation to client	8	30	3	$ 720
Total Billable Hours				423
Cost per hour				$ 90.0
Total Cost				$ 38,070

Cost Item	Cost
Site	$ 96,000
Material	$ 288,000
Structural	$ 171,200
	$ 560,000
Contengency	10%
Overhead and Profit	10%
Administrative Fees	5%
Total Project Cost	**$ 700,000**

Appendix D –Bibliography

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Appendix E –Structural Calculations

CEC Preliminary Load Calculations

Summary

$w_{roof} := 49.115\ psf$
$w_{greenRoof} := 82.715\ psf$
$w_{roofDriftArea} := 76.715\ psf$
$w_{floor} := 168.4\ psf$
$w_{wallWind} := 15.128\ psf$

Dead Loads:

Roof Framing SDL:
$w_{metalRoof} := 3\ psf$
$w_{waterproofingMem} := 0.7\ psf$
$w_{rigidInsulation} := 0.75\ psf$
$w_{OSB} := 3\ psf$
$w_{mep} := 4\ psf$
$w_{woodFurringSusSys} := 2.5\ psf$
$w_{extensiveGreenRoof} := 28\ psf$
$w_{roofSDL} := w_{metalRoof} + w_{waterproofingMem} + w_{rigidInsulation} + w_{OSB} + w_{mep} + w_{woodFurringSusSys} = 13.95\ psf$
$w_{roofSDLGreenRoof} := w_{roofSDL} + w_{extensiveGreenRoof} = 41.95\ psf$

Floor SDL:
$w_{woodFlooring} := 4\ psf$
$w_{subfloor} := 3\ psf$
$w_{floorSDL} := w_{woodFlooring} + w_{subfloor} = 7\ psf$

Live Loads:

$w_{LRoof} := 20\ psf$
$w_{LFloor} := 100\ psf$
$w_{LDeck} := 100\ psf$

Snow Loads:

(i) From Table 1.5-1 establish risk category for the structure.
Risk Category II

(ii) From Table 1.5-2 determine importance factor for snow loading, Is
$I_s := 1.00$

(iii) Determine ground snow load pg from maps in Figure 7.2-1 and Table 7.2-1, …, 7.2-8. Also Table C7.2-1 contains numerical values of pg (2% annual probability) for selected US cities.
$p_g := 25$

(iv) Use Section 26.7.2 and photographs in Figure C26.7-5 and 6 to establish surface roughness category for the site of the structure.

Surface Roughness B

(v) Use Table 7.3-1 to determine exposure factor Ce based on the surface roughness category and wind exposure.
$C_e := 1.0$ (partially exposed)

(vi) Use Table 7.3-2 to determine thermal factor Ct based on the thermal conditions of the structure.
$C_t := 1.0$

(vii) Determine uniform snow load for flat roofs. pf = 0.7 Ce Ct Is pg
$p_f := 0.7 \cdot C_e \cdot C_t \cdot I_s \cdot p_g = 17.5$

(viii) For roofs with slopes less than 15°, the uniformly distributed load on the roof is as follows.
ps = Max[pf , Is Min(pg, 20)]

(ix) For roofs with slopes greater than 15° the uniform snow load is determined on the horizontal projection of the roof surface as follows. ps = Cs pf
sloped roof (balanced) snow load, in lb⁄ft2

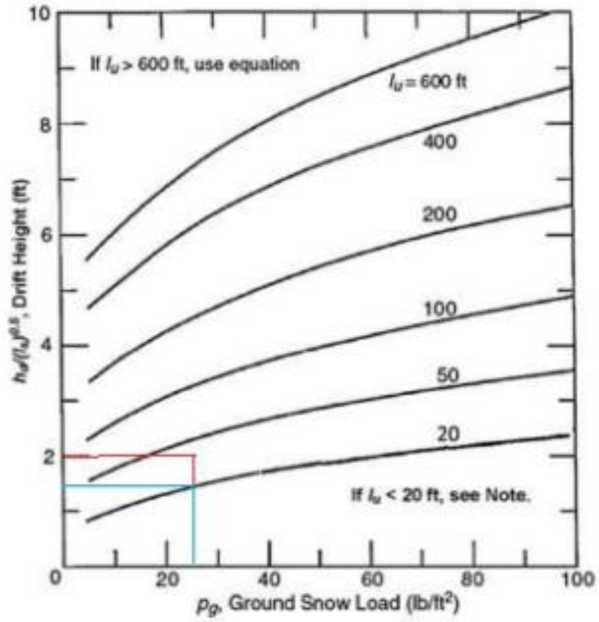
$pitch := \frac{1}{12}$ $slope := \operatorname{atan}(pitch) \cdot \frac{180}{\pi} = 4.764$

$C_s := 1$

Sloped roof (balanced) snow load (psf):
$p_s := \max(p_f, I_s \cdot min(p_g, 20)) = 20$

Unbalanced Snow Load:
16 ft width of unbalanced snow load onto lower roof
$\gamma := 0.13 \cdot p_g + 14 = 17.25$

$h_b := \frac{p_s}{\gamma} = 1.159$ $h_c := 10 + h_b = 11.159$ $\frac{h_c}{h_b} = 9.625$ > 0.2 drift load required



$$\frac{h_d}{\sqrt{I_s}} = \left(0.43\sqrt[3]{l_u}\,\sqrt[4]{p_g+10}\right) - 1.5$$

$l_{uLeeward} := 46.83$
$h_{dLeeward} := 2$
$p_{dLeeward} := h_{dLeeward} \cdot \gamma = 34.5$
$l_{uWindward} := 20.667$
$h_{dWindward} := \frac{3}{4} \cdot 1.5 = 1.125$
$h_d := \max\left(h_{dLeeward}, h_{dWindward}\right) = 2 \qquad w := \left(4 \cdot h_d\right)\, ft = 8\, ft$
$p_{dLeeward} := h_d \cdot \gamma = 34.5$

Summary of Snow Load:
$w_{snow} := 20\, psf$ (= p_s)
$b_{drift} := 18\, ft$
$\frac{\left(\frac{34.5 \cdot 8}{2}\right)}{8} = 17.25$ (convert triangular drift load to uniform)
$w_{snowDriftArea} := w_{snow} + \left(17.25\, psf\right) = 37.25\, psf$ for $w := 8\, ft$

Wind Loading:
(i) From Table 1.5-1 establish risk category for the structure.
Risk Category: II

(ii) From the wind hazard maps given in Section 26.5 determine wind speed V for the location of the structure.
$V := 106$ **mph**

(iii) Use Sections 26.7.2, 26.7.3, and photographs in Figure C26.7-5 and 6 to establish wind exposure category for the site of the structure.

Surface Roughness B: "Urban and suburban areas, **wooded areas**, or other terrain with numerous, closely spaced obstructions that have the size of single-family dwellings or larger."

Exposure B: "For buildings or other structures with a **mean roof height less than or equal to 30 ft** (9.1 m), Exposure B shall apply where the ground surface roughness, as **defined by Surface Roughness B**, prevails in the upwind direction for a distance greater than 1,500 ft (457 m)." -**See figure C26.7-1**

(iv) From Table 26.6-1 determine the wind directionality factor Kd.
$K_d := 0.85$

(v) From Figure 26.8-1 determine the topographic factor Kzt for the site of the structure.
$K_{zt} := 1.0$

(vi) From Table 26.9-1 determine the ground elevation factor Ke.
$z_g := 1200$
$K_e := e^{-0.0000362 \cdot z_g} = 0.957$

(vii) From the structure plan dimensions compute ratio L/B where B = dimension perpendicular to wind direction; L = dimension along the wind direction. Determine mean height of the roof h and compute ratio h/L.
$B_{EW} := 63.5$ (wind parallel to the E-W)
$L_{EW} := 45.75$
$B_{NS} := 45.75$ (wind parallel to the N-S)
$L_{NS} := 63.5$
B is always the face perpendicular to the wind loading.

(viii) From Table 26.10-1 determine the wind velocity pressure coefficients Kz for all height (z) values needed for the structure. Use linear interpolation to determine Kz coefficient for the mean height h of the roof. This value of the coefficient is called Kh.

$\alpha := 7.0$
$z_g := 1200$ (ft) (Table 26.11-1, Exposure B)
$z_{15} := 15$
$z_{roof} := 18.5$
$$z_h := \frac{z_{15} + z_{roof}}{2} = 16.75$$
For 15' < z < zg:
$$K_z := 2.01 \cdot \left(\frac{z_{15}}{z_g}\right)^{\frac{2}{\alpha}} = 0.575$$

For z < 15':
$$K_h := 2.01 \cdot \left(\frac{z_h}{z_g}\right)^{\frac{2}{\alpha}} = 0.593$$
(ix) Compute wind velocity pressure coefficient for each Kz value and for the coefficient Kh.
$q_z := 0.00256 \cdot K_z \cdot K_{zt} \cdot K_d \cdot K_e \cdot V^2 = 13.454$
$q_h := 0.00256 \cdot K_h \cdot K_{zt} \cdot K_d \cdot K_e \cdot V^2 = 13.885$

(x) Determine the wind gust factor G based on equations given in Section 26.11.
"The gust-effect factor for a **rigid building** or other structure is permitted to be taken as **0.85**."
$G := 0.85$

(xi) From Figure 26.13-1 determine the internal pressure coefficient GCpi for the structure.
$GC_{pi} := 0.18$ (+/-)

Wind Pressures for the Main Force Resisting System (Directional Procedure):

Wall pressure coefficients:
$\frac{L_{EW}}{B_{EW}} = 0.72 \quad \frac{L_{NS}}{B_{NS}} = 1.388$
$C_{pWindwardWall} := 0.8$
$C_{pLeewardWallEW} := -0.5$
$C_{pLeewardWallNS} := \frac{1.388-1}{2-1} \cdot (-0.3 - -0.5) + -0.5 = -0.422$
$C_{pSidewall} := -0.7$

Roof pressure coefficients:
h/L = $\frac{z_h}{L_{EW}} = 0.366$ h/L = $\frac{z_h}{L_{NS}} = 0.264$

$pitch := \frac{1}{12} \quad slope := \operatorname{atan}(pitch) \cdot \frac{180}{\pi} = 4.764$
$\theta_{roof} := 4.764$

Wind direction normal and parallel to ridge:
$\frac{z_h}{L_{EW}} = 0.366 \quad \frac{z_h}{L_{NS}} = 0.264$
h/L < 0.5 for E/W and N/S

sec 1: 0 to h/2: $C_{pRoofSec1\_1} := -0.9 \quad C_{pRoofSec1\_2} := -0.18$
sec 2: h/2 to h: $C_{pRoofSec2\_1} := -0.9 \quad C_{pRoofSec2\_2} := -0.18$
sec: 3: h to 2h: $C_{pRoofSec3\_1} := -0.5 \quad C_{pRoofSec3\_2} := -0.18$
sec 4: >2h: $C_{pRoofSec4\_1} := -0.3 \quad C_{pRoofSec4\_2} := -0.18$

Windward Wall Pressures:

$p_{windwardWallPos} := q_z \cdot G \cdot C_{pWindwardWall} - q_z \cdot (GC_{pi}) = 6.727$
$p_{windwardWallNeg} := q_z \cdot G \cdot C_{pWindwardWall} + q_z \cdot (GC_{pi}) = 11.571$

Leeward Wall Pressures:

E/W:
$p_{leewardWallEWPos} := q_h \cdot G \cdot C_{pLeewardWallEW} - q_h \cdot (GC_{pi}) = -8.401$
$p_{leewardWallEWNeg} := q_h \cdot G \cdot C_{pLeewardWallEW} + q_h \cdot (GC_{pi}) = -3.402$

N/S:
$p_{leewardWallNSPos} := q_h \cdot G \cdot C_{pLeewardWallNS} - q_h \cdot (GC_{pi}) = -7.485$
$p_{leewardWallNSNeg} := q_h \cdot G \cdot C_{pLeewardWallNS} + q_h \cdot (GC_{pi}) = -2.486$

Sidewall Pressures:

$p_{sidewallPos} := q_h \cdot G \cdot C_{pSidewall} - q_h \cdot (GC_{pi}) = -10.761$
$p_{sidewallNeg} := q_h \cdot G \cdot C_{pSidewall} + q_h \cdot (GC_{pi}) = -5.762$

Wind Roof Pressures (Normal and parallel to ridge):
sec 1: 0 to h/2:
sec 1_1:
$p_{roofSec1\_1Pos} := q_h \cdot G \cdot C_{pRoofSec1\_1} - q_h \cdot (GC_{pi}) = -13.122$
$p_{roofSec1\_1Neg} := q_h \cdot G \cdot C_{pRoofSec1\_1} + q_h \cdot (GC_{pi}) = -8.123$
sec 1_2:
$p_{roofSec1\_2Pos} := q_h \cdot G \cdot C_{pRoofSec1\_2} - q_h \cdot (GC_{pi}) = -4.624$
$p_{roofSec1\_2Neg} := q_h \cdot G \cdot C_{pRoofSec1\_2} + q_h \cdot (GC_{pi}) = 0.375$
sec 2: h/2 to h:
sec 2_1:
$p_{roofSec2\_1Pos} := q_h \cdot G \cdot C_{pRoofSec2\_1} - q_h \cdot (GC_{pi}) = -13.122$
$p_{roofSec2\_1Neg} := q_h \cdot G \cdot C_{pRoofSec2\_1} + q_h \cdot (GC_{pi}) = -8.123$
sec 2_2:
$p_{roofSec2\_2Pos} := q_h \cdot G \cdot C_{pRoofSec2\_2} - q_h \cdot (GC_{pi}) = -4.624$
$p_{roofSec2\_2Neg} := q_h \cdot G \cdot C_{pRoofSec2\_2} + q_h \cdot (GC_{pi}) = 0.375$
sec: 3: h to 2h:
sec 3_1:
$p_{roofSec3\_1Pos} := q_h \cdot G \cdot C_{pRoofSec3\_1} - q_h \cdot (GC_{pi}) = -8.401$
$p_{roofSec3\_1Neg} := q_h \cdot G \cdot C_{pRoofSec3\_1} + q_h \cdot (GC_{pi}) = -3.402$
sec 3_2:
$p_{roofSec3\_2Pos} := q_h \cdot G \cdot C_{pRoofSec3\_2} - q_h \cdot (GC_{pi}) = -4.624$
$p_{roofSec3\_2Neg} := q_h \cdot G \cdot C_{pRoofSec3\_2} + q_h \cdot (GC_{pi}) = 0.375$
sec 4: >2h:
sec 4_1:
$p_{roofSec4\_1Pos} := q_h \cdot G \cdot C_{pRoofSec4\_1} - q_h \cdot (GC_{pi}) = -6.04$
$p_{roofSec4\_1Neg} := q_h \cdot G \cdot C_{pRoofSec4\_1} + q_h \cdot (GC_{pi}) = -1.041$
sec 4_2:
$p_{roofSec4\_2Pos} := q_h \cdot G \cdot C_{pRoofSec4\_2} - q_h \cdot (GC_{pi}) = -4.624$
$p_{roofSec4\_2Neg} := q_h \cdot G \cdot C_{pRoofSec4\_2} + q_h \cdot (GC_{pi}) = 0.375$

Net Wind Pressures:

Wall E/W:
$p_{wallNetEWPos} := p_{windwardWallPos} - p_{leewardWallEWPos} = 15.128$
$p_{wallNetEWNeg} := p_{windwardWallNeg} - p_{leewardWallEWNeg} = 14.973$

Wall N/S:
$p_{wallNetNSPos} := p_{windwardWallPos} - p_{leewardWallNSPos} = 14.212$
$p_{wallNetNSNeg} := p_{windwardWallNeg} - p_{leewardWallNSNeg} = 14.057$

Sidewall:
$p_{sidewallPos} = -10.761$
$p_{sidewallNeg} = -5.762$

Roof (wind normal and parallel to ridge):
From 0 to h/2:
$p_{roofSec1\_1Pos} = -13.122$ $p_{roofSec1\_2Pos} = -4.624$
$p_{roofSec1\_1Neg} = -8.123$ $p_{roofSec1\_2Neg} = 0.375$

From h/2 to h:
$p_{roofSec2\_1Pos} = -13.122$ $p_{roofSec2\_2Pos} = -4.624$

$p_{roofSec2\_1Neg} = -8.123$ $\quad p_{roofSec2\_2Neg} = 0.375$

From h to 2h:

$p_{roofSec3\_1Pos} = -8.401$ $\quad p_{roofSec3\_2Pos} = -4.624$

$p_{roofSec3\_1Neg} = -3.402$ $\quad p_{roofSec3\_2Neg} = 0.375$

For >2h:

$p_{roofSec4\_1Pos} = -6.04$ $\quad p_{roofSec4\_2Pos} = -4.624$

$p_{roofSec4\_1Neg} = -1.041$ $\quad p_{roofSec4\_2Neg} = 0.375$

Maximum Net Wall Wind Pressure:

$w_{wallWind} := 15.128\ psf$

Maximum Positive Roof Wind Pressure:

$w_{roofWind} := 0.375\ psf$

Load Combinations:

Factored Roof Load:

$w_{roof2} := 1.2 \cdot w_{roofSDL} + 1.6 \cdot w_{LRoof} = 48.74\ psf$

$w_{roof3} := 1.2 \cdot w_{roofSDL} + 1.6 \cdot (w_{snow}) + 1.0 \cdot (w_{roofWind}) = 49.115\ psf$

$w_{roof4} := 1.2 \cdot w_{roofSDL} + 1.0 \cdot (w_{roofWind}) + 1.0 \cdot (w_{LRoof}) + 0.5 \cdot (w_{snow}) = 47.115\ psf$

$w_{roof} := \max(w_{roof2}, w_{roof3}, w_{roof4}) = 49.115\ psf$

Factored Roof Load with Green Roof:

$w_{roof2} := 1.2 \cdot w_{roofSDLGreenRoof} + 1.6 \cdot w_{LRoof} = 82.34\ psf$

$w_{roof3} := 1.2 \cdot w_{roofSDLGreenRoof} + 1.6 \cdot (w_{snow}) + 1.0 \cdot (w_{roofWind}) = 82.715\ psf$

$w_{roof4} := 1.2 \cdot w_{roofSDLGreenRoof} + 1.0 \cdot (w_{roofWind}) + 1.0 \cdot (w_{LRoof}) + 0.5 \cdot (w_{snow}) = 80.715\ psf$

$w_{greenRoof} := \max(w_{roof2}, w_{roof3}, w_{roof4}) = 82.715\ psf$

Factored Roof Load for Drift Area:

$w_{roof2} := 1.2 \cdot w_{roofSDL} + 1.6 \cdot w_{LRoof} = 48.74\ psf$

$w_{roof3} := 1.2 \cdot w_{roofSDL} + 1.6 \cdot (w_{snowDriftArea}) + 1.0 \cdot (w_{roofWind}) = 76.715\ psf$

$w_{roof4} := 1.2 \cdot w_{roofSDL} + 1.0 \cdot (w_{roofWind}) + 1.0 \cdot (w_{LRoof}) + 0.5 \cdot (w_{snowDriftArea}) = 55.74\ psf$

$w_{roofDriftArea} := \max(w_{roof2}, w_{roof3}, w_{roof4}) = 76.715\ psf$

Factored Floor Load:

$w_{floor} := 1.2 \cdot w_{floorSDL} + 1.6 \cdot w_{LFloor} = 168.4\ psf$

Deflection load combinations:

$w_{STDeflection} := w_{roofSDL} + w_{LRoof} = 33.95\ psf$

$w_{LTDeflection} := w_{roofSDL} + 0.5 \cdot w_{LRoof} = 23.95\ psf$

$w_{STDeflectionGR} := w_{roofSDLGreenRoof} + w_{LRoof} = 61.95\ psf$

$w_{LTDeflectionGR} := w_{roofSDLGreenRoof} + 0.5 \cdot w_{LRoof} = 51.95\ psf$

Summary (use for structural calculations):

$w_{roof} = 49.115\ psf$

$w_{greenRoof} = 82.715\ psf$

$w_{roofDriftArea} = 76.715\ psf$

$w_{floor} = 168.4\ psf$

$w_{wallWind} = 15.128\ psf$

Summary:
Roof Beam Size: W12x26
Main Building Columns: HSS 4x4x1/2
Viewing Area Columns: HSS 3x3x3/8
South Viewing Area Floor Beam Size: W12x26
Steel Pier Size: HSS 6x6x5/8

Factored Loading:

$w_{roof} := 49.115\ psf$ $\quad w_{floor} := 168.4\ psf$

$w_{roofdl} := 13.95\ psf$ $\quad w_{roofll} := 20\ psf$

$w_{roofSTDeflection} := w_{roofdl} + w_{roofll} = 33.95\ psf$

$w_{roofLTDeflection} := w_{roofdl} + 0.5 \cdot w_{roofll} = 23.95\ psf$

Column Lengths:

$L_1 := 17.7083\ ft$ $\quad L_2 := L_1$ $\quad L_3 := L_1$

$L_4 := 17.083\ ft$

$L_5 := 16.625\ ft$ $\quad L_6 := L_5$

$L_7 := 15.5\ ft$

$L_8 := 15.1667\ ft$ $\quad L_9 := L_8$ $\quad L_{10} := L_8$

$L_{11} := 9.25\ ft$ $\quad L_{12} := L_{11}$ $\quad L_{13} := L_{11}$ $\quad L_{14} := L_{11}$

Roof metal deck self-weight (22 gauge):

$w_{roofDeck} := 1.6\ psf$

Roof truss loading:

$L_{eastRoofTruss} := 16.906\ ft$ $\quad L_{westRoofTruss} := 15.8437\ ft$ $\quad L_{VARoofTruss} := 18.05\ ft$

$t_b := 4\ ft$ $\quad t_{bExt} := 2\ ft$

$w_{roofTruss} := \left(w_{roof} + w_{roofDeck}\right) \cdot t_b = 202.86\ plf$

$w_{extRoofTruss} := \left(w_{roof} + w_{roofDeck}\right) \cdot t_{bExt} = 101.43\ plf$

$$P_{eastTruss} := \frac{L_{eastRoofTruss} \cdot w_{roofTruss}}{2} = 1.715\ \textbf{kip}$$

$$P_{westTruss} := \frac{L_{westRoofTruss} \cdot w_{roofTruss}}{2} = 1.607\ \textbf{kip}$$

$$P_{VATruss} := \frac{L_{VARoofTruss} \cdot w_{roofTruss}}{2} = 1.831\ \textbf{kip}$$

$$P_{extEastTruss} := \frac{L_{eastRoofTruss} \cdot w_{extRoofTruss}}{2} = 0.857\ \textbf{kip}$$

$$P_{extWestTruss} := \frac{L_{westRoofTruss} \cdot w_{extRoofTruss}}{2} = 0.804\ \textbf{kip}$$

$$P_{extVATruss} := \frac{L_{VARoofTruss} \cdot w_{extRoofTruss}}{2} = 0.915\ \textbf{kip}$$

Serviceability loading for short-term and long-term deflection:

$$w_{roofTrussST} := \left(w_{roofSTDeflection} + w_{roofDeck}\right) \cdot t_b = 142.2\ \textbf{plf}$$

$$w_{extRoofTrussST} := \left(w_{roofSTDeflection} + w_{roofDeck}\right) \cdot t_{bExt} = 71.1\ \textbf{plf}$$

$$w_{roofTrussLT} := \left(w_{roofLTDeflection} + w_{roofDeck}\right) \cdot t_b = 102.2\ \textbf{plf}$$

$$w_{extRoofTrussLT} := \left(w_{roofLTDeflection} + w_{roofDeck}\right) \cdot t_{bExt} = 51.1\ \textbf{plf}$$

Short-Term Loading:

$$P_{eastTrussST} := \frac{L_{eastRoofTruss} \cdot w_{roofTrussST}}{2} = 1.202\ \textbf{kip}$$

$$P_{westTrussST} := \frac{L_{westRoofTruss} \cdot w_{roofTrussST}}{2} = 1.126\ \textbf{kip}$$

$$P_{VATrussST} := \frac{L_{VARoofTruss} \cdot w_{roofTrussST}}{2} = 1.283\ \textbf{kip}$$

$$P_{extEastTrussST} := \frac{L_{eastRoofTruss} \cdot w_{extRoofTrussST}}{2} = 0.601\ \textbf{kip}$$

$$P_{extWestTrussST} := \frac{L_{westRoofTruss} \cdot w_{extRoofTrussST}}{2} = 0.563\ \textbf{kip}$$

$$P_{extVATrussST} := \frac{L_{VARoofTruss} \cdot w_{extRoofTrussST}}{2} = 0.642\ \textbf{kip}$$

Long-Term Loading:

$$P_{eastTrussLT} := \frac{L_{eastRoofTruss} \cdot w_{roofTrussLT}}{2} = 0.864\ \textbf{kip}$$

$$P_{westTrussLT} := \frac{L_{westRoofTruss} \cdot w_{roofTrussLT}}{2} = 0.81\ \textbf{kip}$$

$$P_{VATrussLT} := \frac{L_{VARoofTruss} \cdot w_{roofTrussLT}}{2} = 0.922\ \textbf{kip}$$

$$P_{extEastTrussLT} := \frac{L_{eastRoofTruss} \cdot w_{extRoofTrussLT}}{2} = 0.432\ kip$$

$$P_{extWestTrussLT} := \frac{L_{westRoofTruss} \cdot w_{extRoofTrussLT}}{2} = 0.405\ kip$$

$$P_{extVATrussLT} := \frac{L_{VARoofTruss} \cdot w_{extRoofTrussLT}}{2} = 0.461\ kip$$

East Beam and Center Beam:

$M_{maxPos} := 18.4\ ft \cdot kip$ $\quad M_{maxNeg} := 23.2\ ft \cdot kip$ $\quad V_{max} := 5.5175\ kip$

$R_{1east} := 3.9645\ kip$ $\quad R_{2east} := 10.9850\ kip$ $\quad R_{3east} := 2.1995\ kip$

$\delta_{maxST} := 0.1732\ in$ $\quad \delta_{maxLT} := 0.1245\ in$

Bending moment check:

W12 x 26 $\quad Z_{x\_12x26} := 37.2\ in^3$ $\quad F_y := 50\ ksi$ $\quad \phi_b := 0.9$ $\quad \phi_v := 0.9$ $\quad E_s := 29000\ ksi$

$M_p := Z_{x\_12x26} \cdot F_y = 155\ ft \cdot kip$ $\quad \phi_b \cdot M_p = 139.5\ ft \cdot kip$ $\quad M_u := M_{maxNeg} = 23.2\ ft \cdot kip$

$$DCR_b := \frac{M_u}{\phi_b \cdot M_p} = 0.166$$

Check for shear:

$h := \left(10 + \left(\frac{1}{8}\right)\right)\ in = 10.125\ in$ $\quad t_w := 0.23\ in$ $\quad \frac{h}{t_w} = 44.022 \quad < \quad 2.45 \cdot \sqrt{\frac{E_s}{F_y}} = 59.004$

No web instability.

$A_w := h \cdot t_w = 2.329\ in^2$ $\quad V_u := V_{max} = 5.518\ kip$

$V_n := 0.6 \cdot F_y \cdot A_w = 69.863\ kip$ $\quad \phi_v \cdot V_n = 62.876\ kip$

$$DCR_v := \frac{V_u}{\phi_v \cdot V_n} = 0.088$$

Deflection check:

$$\delta_a := \frac{23.14 \cdot 12\ in}{240} = 1.157\ in$$

West Beam:

$M_{maxPos} := 12.3\ ft \cdot kip$ $\quad M_{maxNeg} := 17.2\ ft \cdot kip$ $\quad V_{max} := 4.8740\ kip$

$R_{1west} := 0.5185\ kip$ $\quad R_{2west} := 8.3734\ kip$ $\quad R_{3west} := 8.969\ kip$ $\quad R_{4west} := 1.5178\ kip$

$\delta_{maxST} := 0.115\ in$ $\quad \delta_{maxLT} := 0.08273\ in$

$M_u := M_{maxNeg} = 17.2\ ft \cdot kip$

$$DCR_b := \frac{M_u}{\phi_b \cdot M_p} = 0.123$$

Check for shear:

$V_u := V_{max} = 4.874\ kip$

$$DCR_v := \frac{V_u}{\phi_v \cdot V_n} = 0.078$$

Deflection check:

$$\delta_a := \frac{24 \cdot 12\ in}{240} = 1.2\ in$$

North Viewing Area Beam:

$M_{maxPos} := 12.4\ ft \cdot kip$ $M_{maxNeg} := 23.6\ ft \cdot kip$ $V_{max} := 5.7108\ kip$
$R_{1north} := 5.7108\ kip$ $R_{2north} := 5.2742\ kip$
$\delta_{maxST} := 0.09613\ in$ $\delta_{maxLT} := 0.06909\ in$

$$M_u := M_{maxNeg} = 23.6\ ft \cdot kip$$

$$DCR_b := \frac{M_u}{\phi_b \cdot M_p} = 0.169$$

Check for shear:

$$V_u := V_{max} = 5.711\ kip$$

$$DCR_v := \frac{V_u}{\phi_v \cdot V_n} = 0.091$$

Deflection check:

$$\delta_a := \frac{25 \cdot 12\ in}{480} = 0.625\ in$$

Column Sizing:
Main Building Columns:
Design for maximum loading: HSS 4x4x0.5

$L := L_6 = 16.625\ ft$ $P_u := R_{2east} = 10.985\ kip$
$\phi_c := 0.85$ $K := 0.8$ $r_x := 1.41\ in$ $A_g := 6.02\ in^2$ $L_{cx} := K \cdot L = 13.3\ ft$

$$F_{ex} := \frac{\pi^2 \cdot E_s}{\left(\frac{L_{cx}}{r_x}\right)^2} = \left(2.234 \cdot 10^4\right)\ psi \qquad F_e := F_{ex}$$

$$F_{cr} := \begin{cases} \left(0.658^{\left(\frac{F_y}{F_e}\right)}\right) \cdot F_y & \text{if } \frac{F_y}{F_e} \le 2.25 \\ 0.877 \cdot F_e & \text{else if } \frac{F_y}{F_e} > 2.25 \end{cases} = \left(1.959 \cdot 10^4\right)\ psi$$

$\phi_c P_n := 0.85 \cdot F_{cr} \cdot A_g = 100.262\ kip$ $\qquad P_u = 10.985\ kip$

$DCR_c := \dfrac{P_u}{\phi_c P_n} = 0.11$

Viewing Area Columns:

Design for maximum loading: HSS 3x3x3/8

$L := L_{11} = 9.25\ ft$ $\qquad P_u := R_{1north} = 5.711\ kip$

$\phi_c := 0.85$ $\qquad K := 0.65$ $\qquad r_x := 1.06\ in$ $\qquad A_g := 3.39\ in^2$ $\qquad L_{cx} := K \cdot L = 6.013\ ft$

$F_{ex} := \dfrac{\pi^2 \cdot E_s}{\left(\dfrac{L_{cx}}{r_x}\right)^2} = \left(6.178 \cdot 10^4\right)\ psi$ $\qquad F_e := F_{ex}$

$$F_{cr} := \begin{cases} \left(0.658^{\left(\frac{F_y}{F_e}\right)}\right) \cdot F_y & \text{if } \dfrac{F_y}{F_e} \le 2.25 \\ 0.877 \cdot F_e & \text{else if } \dfrac{F_y}{F_e} > 2.25 \end{cases} = \left(3.563 \cdot 10^4\right)\ psi$$

$\phi_c P_n := 0.85 \cdot F_{cr} \cdot A_g = 102.676\ kip$ $\qquad P_u = 5.711\ kip$

$DCR_c := \dfrac{P_u}{\phi_c P_n} = 0.056$

Viewing Area South Floor Beam Size:

$L_{VAFloorTruss} := 10.5\ ft$ $\qquad t_b := 4\ ft$ $\qquad t_{bExt} := 2\ ft$ $\qquad w_c := 150\ pcf$ $\qquad t_{slab} := 6\ in$

$w_{slab} := w_c \cdot t_{slab} = 75\ psf$

$w_{VAFloorTruss} := \left(w_{slab} + w_{floor}\right) \cdot t_b = 973.6\ plf$

$w_{VAFloorTrussExt} := \left(w_{slab} + w_{floor}\right) \cdot t_{bExt} = 486.8\ plf$

$w_{VAFloorTrussSelfWeight} := 4.6\ plf$

$$P_{VAFloorTruss} := \frac{L_{VAFloorTruss} \cdot \left(w_{VAFloorTruss} + w_{VAFloorTrussSelfWeight}\right)}{2} = 5.136\ kip$$

$$P_{VAFloorTrussExt} := \frac{L_{VAFloorTruss} \cdot \left(w_{VAFloorTrussExt} + w_{VAFloorTrussSelfWeight}\right)}{2} = 2.58\ kip$$

$M_{maxPos} := 34.9\ ft \cdot kip$ $\qquad M_{maxNeg} := 66.2\ ft \cdot kip$ $\qquad V_{max} := 16.032\ kip$

$R_{1south} := 16.032\ kip$ $\qquad R_{2south} := 14.807\ kip$

Bending Moment Check:

$M_u := M_{maxNeg} = 66.2\ ft \cdot kip$

$DCR_b := \dfrac{M_u}{\phi_b \cdot M_p} = 0.475$

Check for shear:

$V_u := V_{max} = 16.032\ kip$

$DCR_v := \dfrac{V_u}{\phi_v \cdot V_n} = 0.255$

Serviceability Check:

$w_{sdl} := 7\ psf$

$w_{floordl} := w_{sdl} + w_{slab} = 82\ psf$

$w_{floorll} := 100\ psf$

$w_{floorSTDeflection} := w_{floordl} + w_{floorll} = 182\ psf$

$w_{floorLTDeflection} := w_{floordl} + 0.5 \cdot w_{floorll} = 132\ psf$

$P_{STDeflection} := \dfrac{L_{VAFloorTruss} \cdot \left(w_{floorSTDeflection} \cdot t_b + w_{VAFloorTrussSelfWeight}\right)}{2} = 3.846\ kip$

$P_{STDeflectionExt} := \dfrac{L_{VAFloorTruss} \cdot \left(w_{floorSTDeflection} \cdot t_{bExt} + w_{VAFloorTrussSelfWeight}\right)}{2} = 1.935\ kip$

$P_{LTDeflection} := \dfrac{L_{VAFloorTruss} \cdot \left(w_{floorLTDeflection} \cdot t_b + w_{VAFloorTrussSelfWeight}\right)}{2} = 2.796\ kip$

$P_{LTDeflectionExt} := \dfrac{L_{VAFloorTruss} \cdot \left(w_{floorLTDeflection} \cdot t_{bExt} + w_{VAFloorTrussSelfWeight}\right)}{2} = 1.41\ kip$

$\delta_{maxST} := 0.2881\ in$ $\delta_{maxLT} := 0.2095\ in$

Deflection check:

$\delta_a := \dfrac{25 \cdot 12\ in}{480} = 0.625\ in$

Steel Pier Size:

HSS 6x6x5/8

$L_{pier} := 9.5\ ft$ $L_{southFloorBeam} := 25\ ft$ $L_{EWVABeam} := 18.052\ ft$

$w_{column13} := 12.17\ plf$ $w_{12x26} := 26\ plf$

$P_u := R_{1south} + R_{1north} + \left(L_{13} \cdot w_{column13}\right) + \left(w_{12x26} \cdot \dfrac{L_{southFloorBeam}}{2}\right) + \left(w_{12x26} \cdot \dfrac{L_{EWVABeam}}{2}\right) = 22.415\ kip$

$\phi_c := 0.85$ $K := 0.65$ $r_x := 2.17\ in$ $A_g := 11.7\ in^2$ $L_{cx} := K \cdot L = 6.013\ ft$

$F_{ex} := \dfrac{\pi^2 \cdot E_s}{\left(\dfrac{L_{cx}}{r_x}\right)^2} = \left(2.589 \cdot 10^5\right)\ psi$ $F_e := F_{ex}$

$$F_{cr} := \text{if } \frac{F_y}{F_e} \le 2.25 \quad = \left(4.612 \cdot 10^4\right) \, \textit{psi}$$

$$\left\| \left(0.658^{\left(\frac{F_y}{F_e}\right)}\right) \cdot F_y \right.$$

$$\text{else if } \frac{F_y}{F_e} > 2.25$$

$$\left\| 0.877 \cdot F_e \right.$$

$\phi_c P_n := 0.85 \cdot F_{cr} \cdot A_g = 458.639 \; \textit{kip}$ $\qquad P_u = 22.415 \; \textit{kip}$

$$DCR_c := \frac{P_u}{\phi_c P_n} = 0.049$$

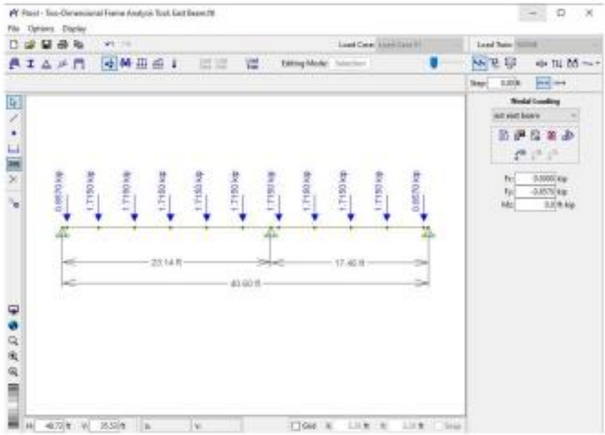
Foundation Design Loads:

$w_{HSS6x6} := 42.30 \; \textit{plf}$

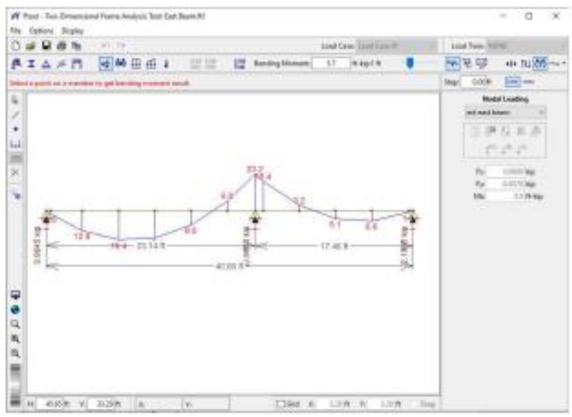
$P_{pierFoundation} := P_u + \left(w_{HSS6x6} \cdot L_{pier}\right) = 22.817 \; \textit{kip}$

East Beam and Center Beam:

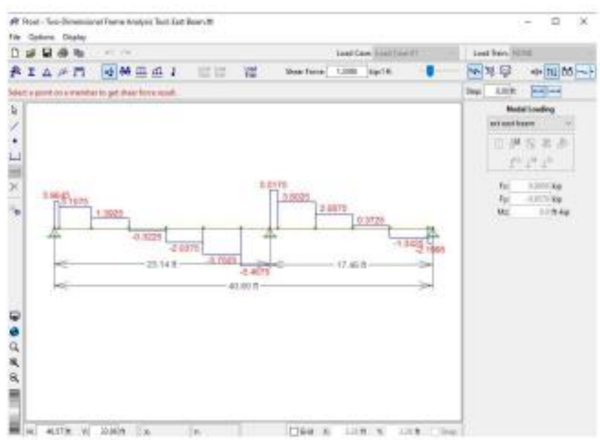
Loading:



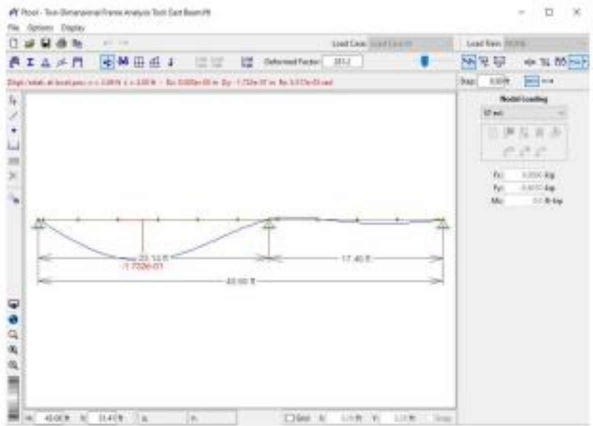
Bending Moment:



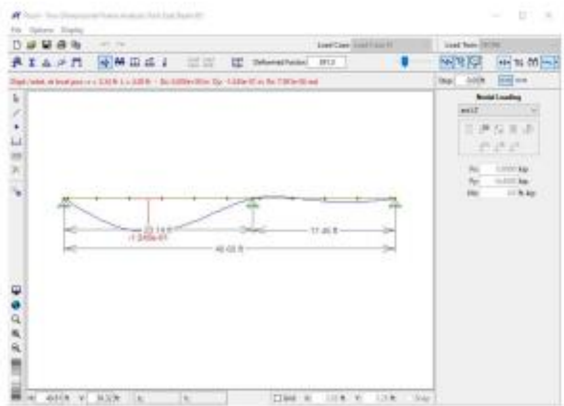
Shear:



Short-Term Deflection:

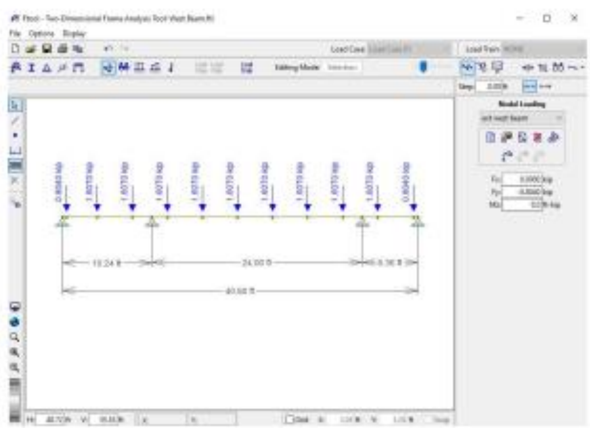


Long-Term Deflection:

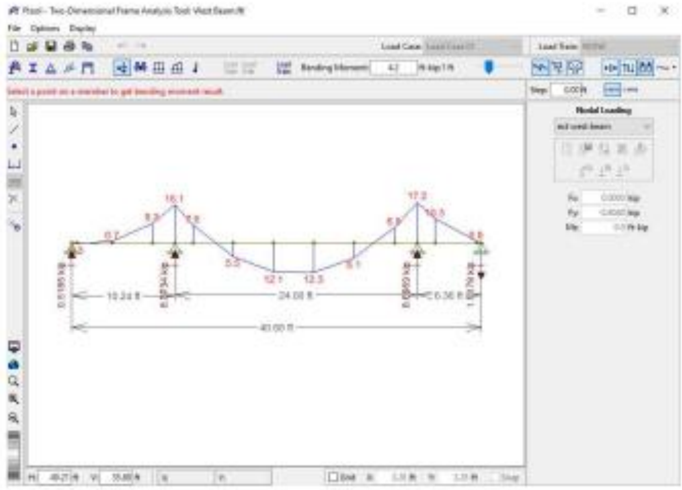


West Beam:

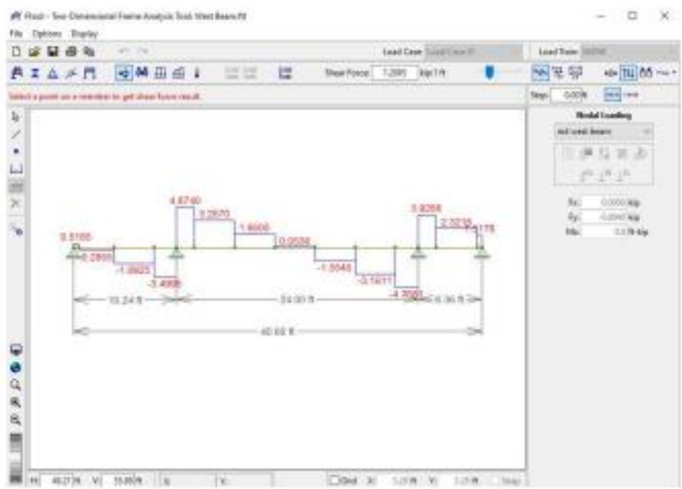
Loading:



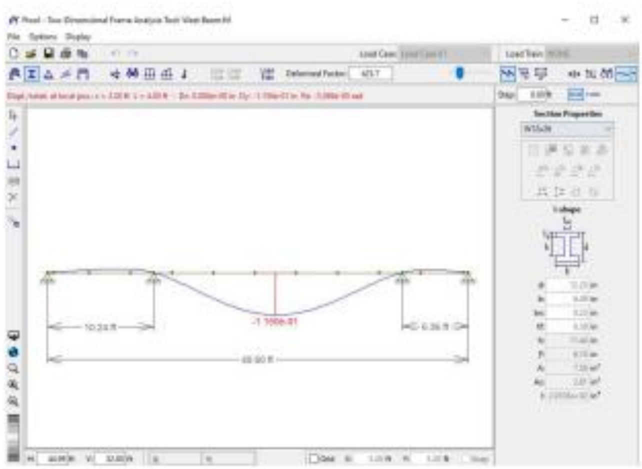
Bending moment:



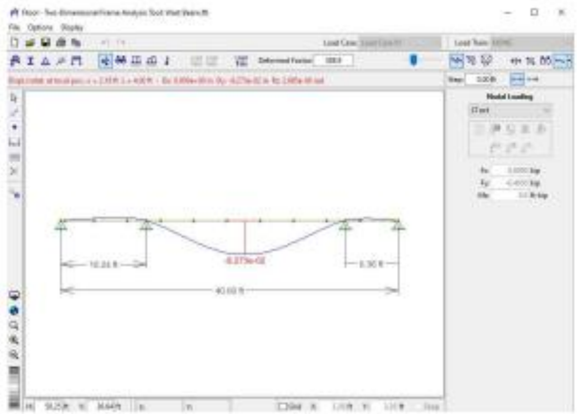
Shear:



Short-Term Deflection:

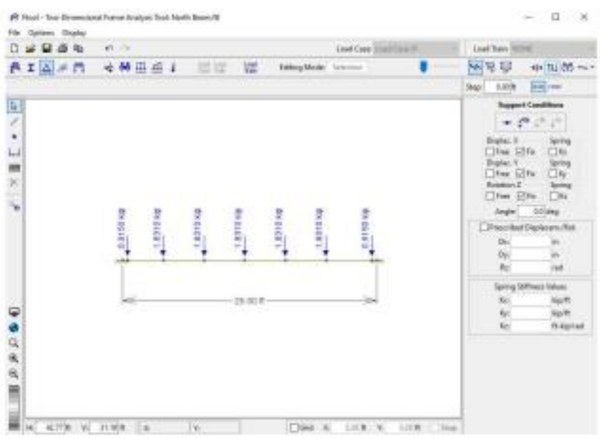


Long-Term Deflection:

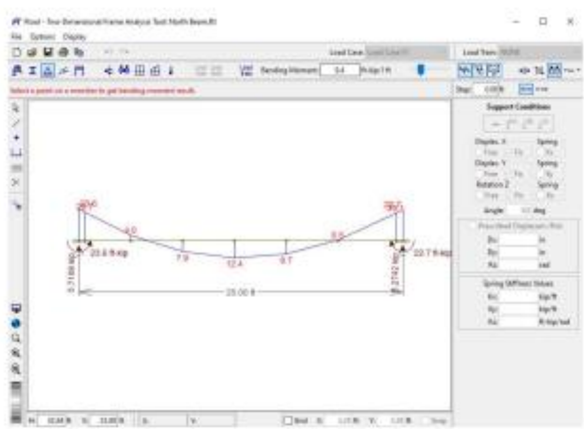


North and South Viewing Area Beams:

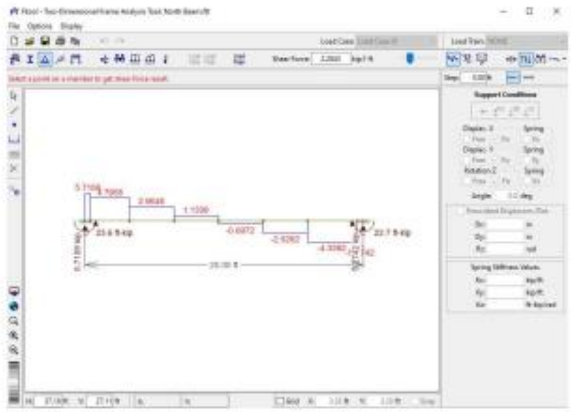
Loading:



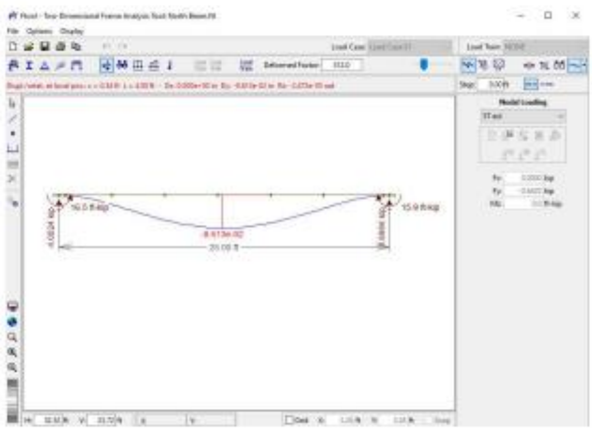
Bending Moment:



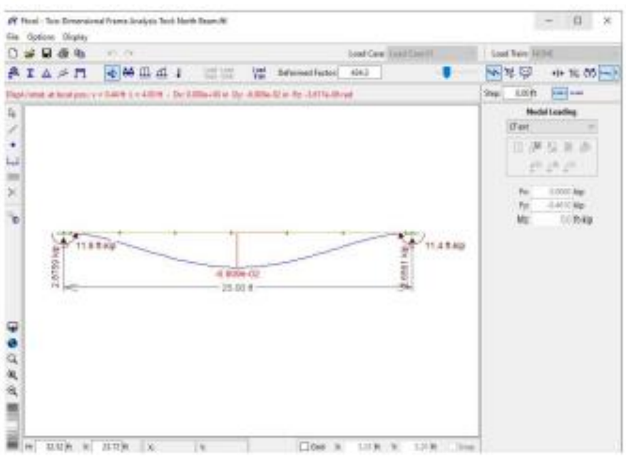
Shear:



Short-Term Deflection:

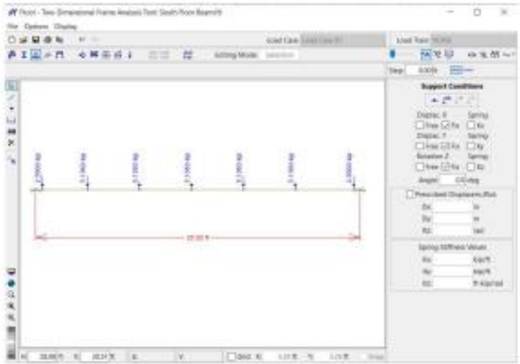


Long-Term Deflection:

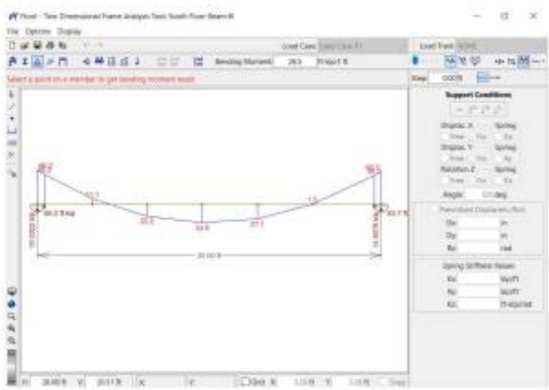


South Viewing Area Floor Beam:

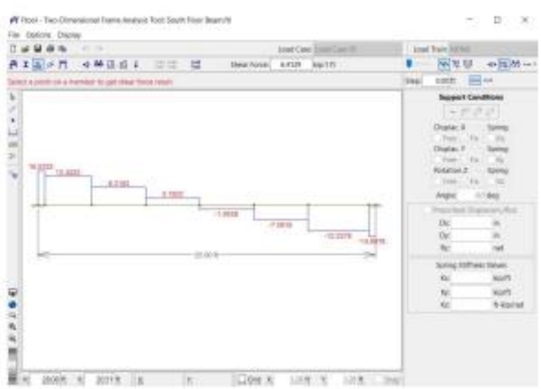
Loading:



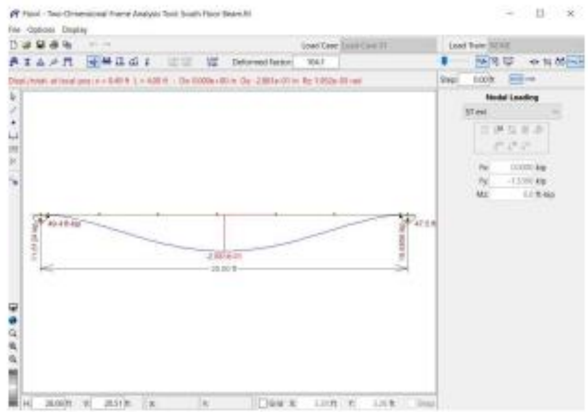
Bending Moment:



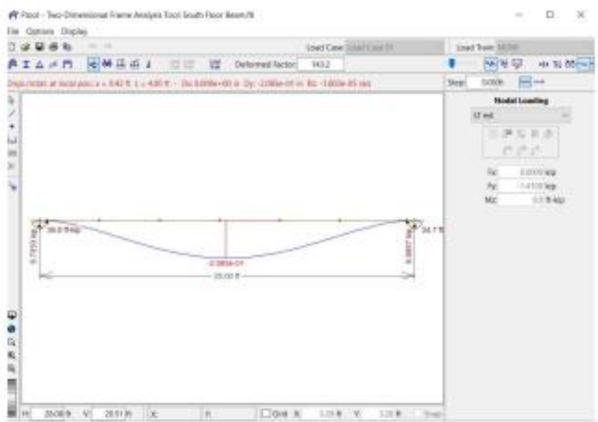
Shear:



Short-Term Deflection:



Long-Term Deflection:



CEC Foundation Design

Summary:

Pier Square Foundation: B = 3', t_f = 8", t_stem = 8", D_f = 3.5'
Continuous Foundation: B = 3', t_f = 8", t_stem = 8", D_f = 3.5'

Soil Data:

From Web Soil Survey:

Typical profile
H1 - 0 to 5 inches: loam
H2 - 5 to 8 inches: loam
H3 - 8 to 14 inches: silty clay loam
H4 - 14 to 18 inches: bedrock

Design for bedrock (Limestone)

IBC:

TABLE 1806.2 PRESUMPTIVE LOAD-BEARING VALUES

CLASS OF MATERIALS	VERTICAL FOUNDATION PRESSURE (psf)	LATERAL BEARING PRESSURE (psf/ft below natural grade)	LATERAL SLIDING RESISTANCE	
			Coefficient of friction[a]	Cohesion (psf)[b]
1. Crystalline bedrock	12,000	1,200	0.70	—
2. Sedimentary and foliated rock	4,000	400	0.35	—
3. Sandy gravel and gravel (GW and GP)	3,000	200	0.35	—
4. Sand, silty sand, clayey sand, silty gravel and clayey gravel (SW, SP, SM, SC, GM and GC)	2,000	150	0.25	—
5. Clay, sandy clay, silty clay, clayey silt, silt and sandy silt (CL, ML, MH and CH)	1,500	100	—	130

For SI: 1 pound per square foot = 0.0479 kPa, 1 pound per square foot per foot = 0.157 kPa/m.

a. Coefficient to be multiplied by the dead load.

b. Cohesion value to be multiplied by the contact area, as limited by Section 1806.3.2.

Bedrock data:

$q_a := 4000\ psf$ $\quad$ $q_a\_b := 4000\ plf$ $\quad$ $f := 0.35$

Backfill data:

$\gamma_{backfill} := 120\ pcf$

Pier Foundation Design:

$P_{pierFoundation} := 22.817\ kip$

Bearing Capacity:

Bearing pressure:

$B := 3\ ft$ $\quad$ $L := B$ $\quad$ $D_f := 3.5\ ft$ $\quad$ $t_f := 8\ in$ $\quad$ $w_c := 150\ pcf$ $\quad$ $u_D := 0\ psf$

$A := B \cdot L = 9\ ft^2$

$W_f := B \cdot L \cdot D_f \cdot w_c = 4.725\ kip$

$$q := \frac{P_{pierFoundation} + W_f}{A} - u_D = 3060.222\ psf \quad < \quad q_a = 4000\ psf$$

Continuous foundation footing:

$t_{stem} := 8\ in$ $\quad$ $L_{wallMax} := 17.7083\ ft$

$t_{slab} := 6\ in$ $\quad$ $b_{slabOnFooting} := \frac{t_{stem}}{2} = 4\ in$

$$w_{studWall} := \frac{2.36\ plf \cdot L_{wallMax}}{2\ ft} = 20.896\ plf$$

$$w_{insulation} := 2.25\ psf \cdot L_{wallMax} = 39.844\ plf$$

$$w_{plywood} := 1.2\ psf \cdot L_{wallMax} = 21.25\ plf$$

$$w_{siding} := 1.5\ psf \cdot L_{wallMax} = 26.562\ plf$$

$$w_{wall} := w_{studWall} + w_{insulation} + w_{plywood} + w_{siding} = 108.552\ plf$$

$$w_{slab} := w_c \cdot t_{slab} \cdot b_{slabOnFooting} = 25\ plf$$

$$P\_b := w_{slab} + w_{wall} = 133.552\ plf$$

$B := 3\ ft$ $\quad D_f := 3.5\ ft$ $\quad t_f := 8\ in$ $\quad w_c := 150\ pcf$ $\quad u := 0\ psf$

$$W_{f}\_b := B \cdot D_f \cdot w_c = \left(1.575 \cdot 10^3\right)\ plf$$

$$q := \frac{P\_b + W_{f}\_b}{B} - u = 569.517\ psf \qquad < \qquad q_a = 4000\ psf$$

Building surcharge on retaining wall:

$w_{floor} := 168.4\ psf$ $\qquad w_{slab} := t_{slab} \cdot w_c = 75\ psf$

$$q_s := w_{floor} + w_{slab} = 243.4\ psf$$

Retaining Wall Design

$w_c := 150\ pcf$ $t_{pavement} := 6\ in$ $H_w := 10\ ft$ $B := 0.75 \cdot H_w = 7.5\ ft$

$\gamma_{backfill} := 120\ pcf$ $\phi' := 30\ deg = 0.524$ $\beta := 0\ rad$ $\phi'_w := \left(\frac{2}{3}\right) \cdot \phi' = 0.349$

$F := 3$

$K_a := 0.2973$

$G_h := \gamma_{backfill} \cdot K_a \cdot \cos(\phi'_w) = 33.524\ pcf$

$$K_p := \left(\tan\left(\frac{\pi}{4} + \frac{\phi'}{2}\right)\right)^2 = 3$$

$$P_{p\_b} := \frac{\gamma_{backfill} \cdot H_w^{\ 2} \cdot K_p \cdot \cos(\beta)}{2} = \left(1.8 \cdot 10^4\right)\ plf$$

Excel Inputs:

$f_{c'} := 3000\ psi$ Type I concrete

$f_y := 60\ ksi$ Rebar yield stress

$P_a := G_h = 33.524\ pcf$

$P_p := P_{p\_b} = \left(1.8 \cdot 10^4\right)\ plf$

$w_s := 100\ psf + w_c \cdot t_{pavement} = 175\ psf$ (car parking, pavement surcharge)

$\mu_{backfill} := 0.3$ $\mu_{bedrock} := 0.35$

$Q_a := 4\ ksf$ (From IBC for limestone bedrock)

Footing Dimensions: using 'rule of thumb' from Coduto textbook

$$t_t := \frac{H_w}{10} = 12\ in$$

$$t_b := \frac{H_w}{10} = 12\ in$$

$L_T := 0.25 \cdot B = 1.875\ ft$

$L_H := B - L_T - t_t = 4.625\ ft$

$H_T := \frac{H_w}{2} = 5\ ft$ $H_B := \frac{H_w}{2} = 5\ ft$ $h_f := \frac{H_w}{10} = 12\ in$

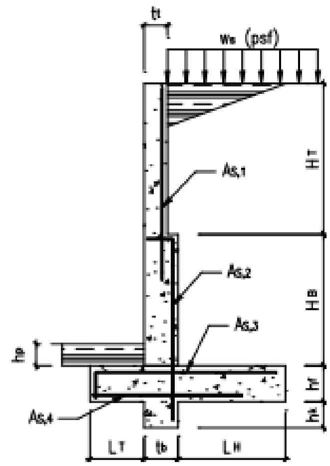
$h_k := 0\ in$ $h_p := 24\ in$

Daniel T. Li Engineering International	PROJECT :	Cultural Education Center	PAGE :	
	CLIENT :		DESIGN BY :	
	JOB NO. :	DATE : 11/8/2021	REVIEW BY :	

Retaining Wall Design Based on ACI 318-02

INPUT DATA & DESIGN SUMMARY

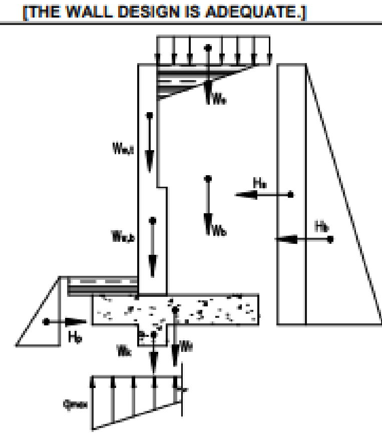
CONCRETE STRENGTH	f_c'	=	3	ksi			
REBAR YIELD STRESS	f_y	=	60	ksi			
LATER SOIL PRESSURE	P_a	=	33.524	pcf (equivalent fluid pressure)			
PASSIVE PRESSURE	P_p	=	18000	psf / ft			
SURCHARGE WEIGHT	w_s	=	411.8	psf			
FRICTION COEFFICIENT	μ	=	0.3				
ALLOW SOIL PRESSURE	Q_a	=	4	ksf			
THICKNESS OF TOP STEM	t_t	=	12	in			
THICKNESS OF KEY & STEM	t_b	=	12	in			
TOE WIDTH	L_T	=	1.875	ft			
HEEL WIDTH	L_H	=	4.625	ft			
HEIGHT OF TOP STEM	H_T	=	5	ft			
HEIGHT OF BOT. STEM	H_B	=	5	ft			
FOOTING THICKNESS	h_f	=	12	in			
KEY DEPTH	h_k	=	0	in			
SOIL OVER TOE	h_p	=	24	in			
TOP STEM REINF. ($A_{s,1}$)	1	#	6	@	16	in o.c., at middle	
BOT. STEM REINF. ($A_{s,2}$)	2	#	7	@	8	in o.c., at each face	
TOP REINF.OF FOOTING ($A_{s,3}$)		#	6	@	10	in	
BOT. REINF.OF FOOTING ($A_{s,4}$)		#	5	@	14	in	[THE WALL DESIGN IS ADEQUATE.]



ANALYSIS

SERVICE LOADS

$H_b = 0.5\ P_a\ (H_T + H_B + h_f)^2$	=	2.03	kips
$H_s = w_s\ P_a\ (H_T + H_B + h_f) / \gamma_b$	=	1.52	kips
$H_p = 0.5\ P_p\ (h_p + h_f + h_k)^2$	=	81.00	kips
$W_s = w_s\ (L_H + t_b - t_t)$	=	1.90	kips
$W_b = [H_T\ (L_H + t_b - t_t) + H_B\ L_H]\ \gamma_b$	=	4.63	kips
$W_f = h_f\ (L_H + t_b + L_T)\ \gamma_c$	=	1.13	kips
$W_k = h_k\ t_b\ \gamma_c$	=	0.00	kips
$W_{w,t} = t_t\ H_T\ \gamma_c$	=	0.75	kips
$W_{w,b} = t_b\ H_B\ \gamma_c$	=	0.75	kips



FACTORED LOADS

$\gamma H_b = 1.6\ H_b$	=	3.25	kips
$\gamma H_s = 1.6\ H_s$	=	2.43	kips
$\gamma W_s = 1.6\ W_s$	=	3.05	kips
$\gamma W_b = 1.2\ W_b$	=	5.55	kips
$\gamma W_f = 1.2\ W_f$	=	1.35	kips
$\gamma W_k = 1.2\ W_k$	=	0.00	kips
$\gamma W_{w,t} = 1.2\ W_{w,t}$	=	0.90	kips
$\gamma W_{w,b} = 1.2\ W_{w,b}$	=	0.90	kips

OVERTURNING MOMENT

	H	γH	y	H y	γH y
H_b	2.03	3.25	3.67	7.44	11.90
H_s	1.52	2.43	5.50	8.35	13.36
Σ	3.55	5.67		**15.79**	25.26

RESISTING MOMENT

	W	γW	x	W x	γW x
W_s	1.90	3.05	5.19	9.88	15.81
W_b	4.63	5.55	5.19	23.99	28.79
W_f	1.13	1.35	3.75	4.22	5.06
W_k	0.00	0.00	2.38	0.00	0.00
$W_{w,t}$	0.75	0.90	2.38	1.78	2.14
$W_{w,b}$	0.75	0.90	2.38	1.78	2.14
Σ	9.15	11.75		**41.65**	53.94

OVERTURNING FACTOR OF SAFETY

$$SF = \frac{\Sigma Wx}{\Sigma Hy} = 2.64 > 1.5$$

[Satisfactory]

CHECK SOIL BEARING CAPACITY (ACI 318-02 SEC.15.2.2)

$L = L_T + t_b + L_H$ = 7.50 ft

$e = \frac{L}{2} - \frac{\Sigma Wx - \Sigma Hy}{\Sigma W}$ = 0.92 ft

$$q_{MAX} = \begin{cases} \frac{\Sigma W\left(1+\frac{6e}{L}\right)}{BL}, & for \quad e \le \frac{L}{6} \\ \frac{\Sigma W}{3B(0.5L-e)}, & for \quad e > \frac{L}{6} \end{cases}$$

= 2.12 ksf < Q_a [Satisfactory]

CHECK FLEXURE CAPACITY, $A_{S,1}$ & $A_{S,2}$, FOR STEM (ACI 318-02 SEC.15.4.2, 10.2, 10.5.4, 7.12.2, 12.2, & 12.5)

		At top srem		At base of bottom stem	
$M_u = \gamma\left(\frac{P_a y^3}{6} + \frac{P_a y^2 w_s}{2\gamma_b}\right)$	=	3.88	ft-kips ,	19.98	ft-kips
$P_u = \gamma W_w$	=	0.90	kips ,	1.80	kips
$\phi M_n = \phi\left[A_s f_y\left(d - \frac{A_s f_y - P_u}{1.7 b f'_c}\right)\right]$	=	6.57	ft-kips ,	24.72	ft-kips
		>	M_u	>	M_u
			[Satisfactory]		[Satisfactory]
where d	=	6.00	in ,	8.70	in
b	=	12	in ,	12	in
ϕ	=	0.7	,	0.7	
A_s	=	0.33	in^2 ,	0.9	in^2
ρ	=	0.005		0.009	
$\rho_{MAX} = 0.75\left(\frac{0.85\beta_1 f'_c}{f_y}\frac{87}{87+f_y}\right)$	=	0.016		0.016	
		>	ρ	>	ρ
			[Satisfactory]		[Satisfactory]
$\rho_{MIN} = 0.0018\frac{t}{d}$	=	0.004		0.002	
		<	ρ	<	ρ
			[Satisfactory]		[Satisfactory]

CHECK SHEAR CAPACITY FOR STEM (ACI 318-02 SEC.15.5.2, 11.1.3.1, & 11.3)

		At top stem		At base of bottom stem	
$V = \gamma\left(\frac{P_a y^2}{2} + \frac{w_s P_a y}{\gamma_b}\right)$	=	1.77	kips ,	4.89	kips
$V_{allowable} = 2\phi b d\sqrt{f'_c}$	=	5.92	kips ,	8.58	kips
		>	V	>	V
			[Satisfactory]		[Satisfactory]

where ϕ = 0.75 (ACI 318-02, Section 9.3.2.3)

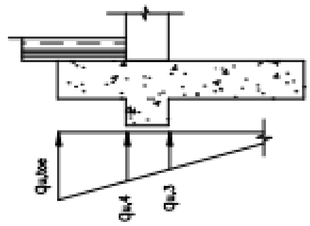
CHECK HEEL FLEXURE CAPACITY, $A_{S,3}$, FOR FOOTING (ACI 318-02 SEC.15.4.2, 10.2, 10.5.4, 7.12.2, 12.2, & 12.5)

$\rho_{MAX} = 0.75\left(\frac{0.85\beta_1 f'_c}{f_y}\frac{87}{87+f_y}\right)$ = 0.016

$\rho_{MIN} = \frac{0.0018}{2}\frac{h_f}{d}$ = 0.001

$$M_{u,3} = \begin{cases} \frac{L_H}{2}\left(\gamma w_s + \gamma w_b + \frac{L_H}{L}\gamma w_f\right) - \frac{\left(q_{u,3} + 2q_{u,heel}\right) b L_H^2}{6}, & for \quad e_u \le \frac{L}{6} \\ \frac{L_H}{2}\left(\gamma w_s + \gamma w_b + \frac{L_H}{L}\gamma w_f\right) - \frac{q_{u,3} b S^2}{6}, & for \quad e_u > \frac{L}{6} \end{cases}$$

= 18.59 ft-kips



$$\rho = \frac{0.85 f'_c \left(1 - \sqrt{1 - \frac{M_{u,3}}{0.383 b d^2 f'_c}}\right)}{f_y}$$ = 0.005

where	d	=	8.63 in	$q_{u,\,toe}$	=	1.60	ksf
	e_u	=	1.31 ft	$q_{u,\,heel}$	=	n/a	ksf
	S	=	4.45 ft	$q_{u,\,3}$	=	0.97	ksf

$(A_{s,\,3})_{required}$ = 0.51 in^2 / ft < $A_{s,\,3}$ **[Satisfactory]**

CHECK TOE FLEXURE CAPACITY, $A_{s,4}$, FOR FOOTING (ACI 318-02 SEC.15.4.2, 10.2, 10.5.4, 7.12.2, 12.2, & 12.5)

$$\rho_{MAX} = 0.75\left(\frac{0.85\beta_1 f'_c}{f_y}\frac{87}{87+f_y}\right)$$ = 0.016 $\rho_{MIN} = MIN\left(\frac{4}{3}\rho,\ \frac{0.0018}{2}\frac{h_f}{d}\right)$ = 0.001

$$M_{u,4} = \frac{\left(q_{u,4} + 2q_{u,toe}\right) b L_T^2}{6} - \frac{L_T^2}{2L}\gamma w_f$$ = 2.26 ft-kips

where	d	=	8.69 in
	$q_{u,\,4}$	=	1.19 ksf

$$\rho = \frac{0.85 f'_c \left(1 - \sqrt{1 - \frac{M_{u,4}}{0.383 b d^2 f'_c}}\right)}{f_y}$$ = 0.001

$(A_{s,\,4})_{required}$ = 0.08 in^2 / ft < $A_{s,\,4}$ **[Satisfactory]**

CHECK KEY CAPACITY FOR FOOTING

1.5 (H_b + H_s) = 5.32 kips < H_p + μ ΣW = 83.75 kips
[Satisfactory]

Technical References:

1. Alan Williams: "Structuiral Engineering Reference Manual", Professional Publications, Inc, 2001.
2. Alan Williams: "Structuiral Engineering License Review Problems and Solutions", Oxford University Press, 2003.

Appendix F – Civil Sheets

CULTURAL EDUCATION CENTER

MONTICELLO, IOWA

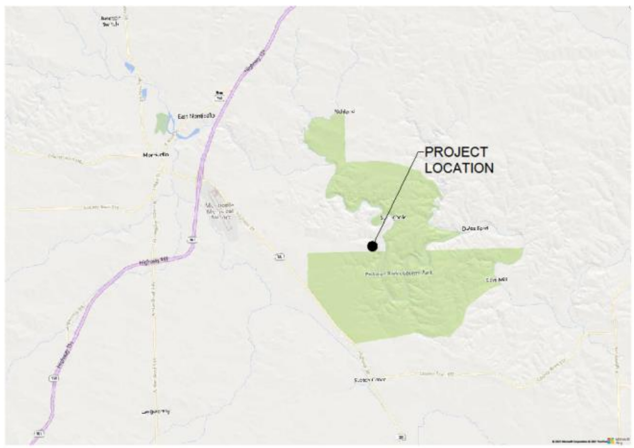
UTILITY NOTE

THE LOCATIONS OF THOSE BURIED AND ABOVE GROUND UTILITIES SHOWN ARE APPROXIMATE, ARE SHOWN FOR CONTRACTOR INFORMATIONAL USE ONLY, AND ARE NOT TO BE REFERENCED FOR CONSTRUCTION PURPOSES. THE IMPLIED PRESENCE OR ABSENCE OF UTILITIES IS NOT TO BE CONSTRUED BY THE OWNER, ENGINEER, CONTRACTOR, OR SUBCONTRACTORS TO BE AN ACCURATE AND COMPLETE REPRESENTATION OF UTILITIES THAT MAY OR MAY NOT EXIST ON THE CONSTRUCTION SITE. BURIED AND ABOVE GROUND UTILITY LOCATION, IDENTIFICATION, AND MARKING ARE THE SOLE RESPONSIBILITY OF THE CONTRACTOR. REROUTING, DISCONNECTION, PROTECTION, ETC. OF ANY UTILITY MUST BE COORDINATED BETWEEN THE CONTRACTOR, UTILITY COMPANY AND OWNER. SITE SAFETY, INCLUDING THE AVOIDANCE OF HAZARDS ASSOCIATED WITH BURIED AND ABOVEGROUND UTILITIES, REMAINS THE SOLE RESPONSIBILITY OF THE CONTRACTOR.

UTILITIES

811 Know what's below. Call before you dig.

IOWA ONE CALL 800/292-8989



VICINITY MAP
SCALE: 1" =5000'

MAP PROVIDED BY BING

Sheet List Table	
Sheet Number	Sheet Title
C-000	COVER
C-100	NOTES-DETAILS & LEGEND
C-200	SITE LAYOUT
C-201	OVERALL SITE WITH SECTION
C-300	GRADING PLAN
C-301	EROSION CONTROL PLAN
C-400	CIVIL DETAILS

DEVELOPER/OWNER
CAMP COURAGEOUS
12007 190TH ST.
MONTICELLO, IOWA 52310
CHARLIE BECKER - CEO
PH: 319-465-5916 (WORK)
PH: XXX-XXX-XXXX (CELL)

IOWA CIVIL & ENVIRONMENTAL ENGINEERING

GENERAL NOTES

1. ALL IMPROVEMENTS SHOWN ON THESE ENGINEERING PLANS SHALL COMPLY WITH THE ***CITY OF MONTICELLO*** DESIGN AND SPECIFICATIONS, LATEST EDITION, AND THE STANDARDS OF THE ***IOWA*** DEPARTMENT OF NATURAL RESOURCES, LATEST EDITION.
2. UNDERGROUND FACILITIES, STRUCTURES AND UTILITIES HAVE BEEN PLOTTED FROM AVAILABLE SURVEYS, RECORDS, AND FIELD INVESTIGATION. THEIR LOCATIONS MUST BE CONSIDERED APPROXIMATE ONLY. IT IS POSSIBLE THERE MAY BE OTHERS, THE EXISTENCE OF WHICH PRESENTLY NOT KNOWN OR SHOWN. IT IS THE CONTRACTOR'S RESPONSIBILITY TO DETERMINE THEIR EXISTENCE AND EXACT LOCATION AND TO AVOID DAMAGE THERETO.
3. ALL DEBRIS RESULTING FROM CONSTRUCTION OPERATIONS SHALL BE PROPERLY DISPOSED OF OFF-SITE UNLESS NOTED.
4. THE CONTRACTOR SHALL EXERCISE PROPER CAUTION TO PROTECT THE EXISTING IMPROVEMENTS. THE CONTRACTOR SHALL BE RESPONSIBLE FOR REPAIRING ANY DAMAGE.
5. PORTLAND CEMENT CONCRETE. CONCRETE SHALL HAVE THE FOLLOWING PROPERTIES. COMPRESSING STRENGTH SHALL BE 4000PSI IN 14 DAYS, AIR ENTRAINMENT SHALL BE BETWEEN 5 % AND 8% AND SLUMP SHALL BE 4 INCHES OR LESS ALL AS MEASURED BY THE APPROPRIATE ASTM METHODS. REINFORCING STEEL SHALL BE ASTM CERTIFIED 60KSI TENSILE STRENGTH. REINFORCING STEEL SHALL BE #4 SIZE UNLESS OTHERWISE SPECIFIED. HANDRAILS, BOLLARDS, AND OTHER APPURTENANCES SHALL BE INSTALLED PER PLAN AND MEET JURISDICTIONAL REQUIREMENTS.
6. CLEANUP AND FINAL INSPECTION. WORK BROKEN OR DAMAGED BY CONTRACTOR ACTIVITY SHALL BE REPAIRED OR REPLACED AT THE CONTRACTOR'S EXPENSE. ALL WASTE MATERIAL, CONCRETE WASHOUT, LANDSCAPE WASTE AND BUILDING MATERIAL SHALL BE REMOVED. SOIL SHALL BE REMOVED FROM PAVED AREAS AND THE PROJECT SHALL BE LEFT IN A CLEAN AND WORKMANLIKE MANNER.

GRADING NOTES

1. ALL EARTHWORK OPERATIONS SHALL BE IN ACCORDANCE WITH THE GEOTECHNICAL REPORT.
2. ALL ELEVATIONS SHOWN ARE TO FLOWLINE FINISHED GRADE OR TOP OF PAVEMENT UNLESS OTHERWISE STATED.
3. PROVIDE POSITIVE DRAINAGE AT ALL TIMES WITHIN THE CONSTRUCTION AREAS. DO NOT ALLOW WATER TO POND ON PROPERTY.
4. PRIOR TO PLACEMENT OF ANY FILL, THE STRIPPED SITE SHALL BE SCARIFIED TO A DEPTH OF 9 INCHES AND RE-COMPACTED TO 95% DENSITY. ANY UNSUITABLE SOILS FOUND AT THIS TIME SHALL BE DRIED AND RECOMPACTED OR REMOVED IF REQUIRED COMPACTION CANNOT BE OBTAINED. CUT AREAS SHALL ALSO BE SCARIFIED TO A DEPTH OF 9 INCHES AND RE-COMPACTED TO 95% DENSITY.
5. ALL FILL MATERIAL SHALL CONSIST OF APPROVED, SUITABLE SOILS PLACED IN LOOSE LIFTS OF 9 INCHES OR LESS AND COMPACTED TO AT LEAST 95% OF THE MATERIAL'S MAXIMUM STANDARD PROCTOR DRY DENSITY (ASTM D-698) IN ALL PAVEMENT, BUILDING ADDITION AND ATHLETIC FIELD AREAS. THE COMPACTION WILL BE FIELD TESTED BY A SOILS ENGINEERING CONSULTANT REPRESENTING THE OWNER.
6. PROJECT WILL BE COVERED BY A GENERAL PERMIT REGULATING RUNOFF FROM CONSTRUCTION SITES. IT IS THE CONTRACTOR'S RESPONSIBILITY TO PERFORM THE REQUIRED MONITORING, INSPECTION AND MAINTENANCE AS REQUIRED BY THE PERMIT.
7. ALL DISTURBED EMBANKMENTS GREATER THAN 3:1 SLOPES SHALL BE SEEDED ACCORDING TO A RECOMMENDED SEEDING MIX BY THE LANDSCAPER AND COVERED WITH EROSION CONTROL BLANKETS OR AS DIRECTED BY PLAN DOCUMENTS.
8. CONTRACTOR SHALL ADHERE TO THE ***CITY OF MONTICELLO*** EROSION AND SEDIMENT CONTROL REGULATIONS AND THE STATE OF ***IOWA*** CONSTRUCTION SITE EROSION CONTROL MANUAL.
9. ALL AREAS TO BE GREENSPACE AT PROJECT COMPLETION SHALL BE LEFT WITH 9 INCHES OF TOPSOIL WHEN MASS GRADING ACTIVITIES ARE COMPLETE.

EROSION CONTROL NOTES

1. EROSION CONTROL SHALL BE INSTALLED PRIOR TO ANY GRADING OPERATIONS WHERE POSSIBLE.
2. CONSTRUCTION ENTRANCE SHALL BE MAINTAINED TO PREVENT OFF-SITE TRACKING OF SEDIMENT ONTO PUBLIC ROADWAYS. ANY SEDIMENT DEPOSITED ON PUBLIC ROADS SHALL BE REMOVED BY SHOVELING OR STREET CLEANING BEFORE THE END OF EACH WORKING DAY.
3. SHOWN LOCATION OF SILTATION CONTROL IS APPROXIMATE. ACTUAL LOCATIONS TO BE DETERMINED IN THE FIELD AT THE TIME OF CONSTRUCTION.
4. WATER PUMPED DURING CONSTRUCTION OPERATIONS SHALL BE FILTERED.
5. ONCE CONSTRUCTION HAS BEEN COMPLETED, OR TEMPORARILY SUSPENDED FOR LONGER THAN 28 DAYS (SUCH AS WINTER SHUTDOWN), THE CONTRACTOR SHALL INITIATE SEEDING ON ALL AREAS DISTURBED IMMEDIATELY OF THE LAST DISTURBANCE. EROSION CONTROL DEVICES SHALL REMAIN IN PLACE AND BE MAINTAINED UNTIL THE CONTRACTOR ESTABLISHES A GOOD STAND OF GRASS OF UNIFORM COLOR AND DENSITY TO THE SATISFACTION OF THE ENGINEER.
6. CONTRACTOR SHALL ADHERE TO THE ***IOWA*** CONSTRUCTION SITE EROSION CONTROL MANUAL.
7. ALL EROSION CONTROL MEASURES MUST BE INSTALLED (WHERE POSSIBLE) PRIOR TO THE COMMENCEMENT OF ANY EARTH DISTURBING OPERATIONS. THE REMAINING EROSION CONTROL MEASURES SHALL BE INSTALLED AS SOON AS REASONABLY POSSIBLE AFTER GRADING OPERATIONS BEGIN. WHERE THE PRESENCE OF SILT FENCE WILL INTERFERE WITH ACTIVITIES, DIVERSION DITCHES AND SMALL TEMPORARY SEDIMENT TRAPS SHALL BE UTILIZED UNTIL SILT FENCE OR OTHER MEASURES MAY BE INSTALLED AND VEGETATION ESTABLISHED.
8. EROSION CONTROL MEASURES SHALL BE INSPECTED WEEKLY AND AFTER EACH PRECIPITATION EVENT AND REPLACED OR REPAIRED AS NECESSARY.
9. SILT FENCE AND SEDIMENT BASIN SHALL BE CLEANED OR REPLACED WHEN SILT BUILDS UP TO WITHIN ONE FOOT OF THE TOP OF THE SILT FENCE.
10. PROJECT WILL BE COVERED BY A GENERAL PERMIT REGULATING RUNOFF FROM CONSTRUCTION SITES. IT IS THE CONTRACTOR'S RESPONSIBILITY TO PERFORM THE REQUIRED MONITORING, INSPECTION AND MAINTENANCE AS REQUIRED BY THE PERMIT.
11. CONCRETE WASHOUT DEBRIS SHOULD BE HAULED OFF-SITE. WASHOUT SHOULD BE FILLED IN AND SEEDED.
12. ALL AREAS DISTURBED BEYOND LIMITS SHOWN SHOULD BE SEEDED WITH ADJACENT SEED MIXTURE OR IN-KIND.
13. THERE ARE NO EXPECTED DOWNSTREAM IMPACTS OTHER THAN THOSE ALLOWED PER ORDINANCE (2 YEAR, PRE-DEVELOPED RATE OF RELEASE)

UTILITY NOTES

1. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO PROTECT ALL EXISTING UTILITIES AND PAVED STREETS, INCLUDING ANY NOT SHOWN ON THESE DRAWINGS. THE CONTRACTOR SHALL VERIFY ALL EXISTING UTILITIES PRIOR TO CONSTRUCTION AND NOTIFY THE ENGINEER IF ANY CONFLICTS WITH THE DRAWINGS OCCUR. ANY DAMAGE TO EXISTING UTILITIES AND/OR PAVED STREETS CAUSED BY TRENCHING AND GRADING OPERATIONS SHALL BE REPAIRED AT THE CONTRACTOR'S EXPENSE. EXISTING UTILITY LOCATIONS SHOWN ON THE DRAWINGS ARE APPROXIMATE.
2. ALL EXISTING UNDERGROUND UTILITIES SHOWN WERE LOCATED PARTIALLY IN THE FIELD AND PARTIALLY FROM REVIEW OF EXISTING PUBLIC RECORDS. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO CONTACT EACH UTILITY COMPANY FOR THE FIELD LOCATION OF THEIR EXISTING LINES IN OR NEARBY THE CONSTRUCTION AREA PRIOR TO BEGINNING ANY CONSTRUCTION.
3. THE CONTRACTOR SHALL EXERCISE PROPER CAUTION TO PROTECT THE EXISTING IMPROVEMENTS. THE CONTRACTOR SHALL BE RESPONSIBLE FOR REPAIRING ANY DAMAGE.
4. THE LOCATIONS OF THOSE BURIED AND ABOVE GROUND UTILITIES SHOWN ARE APPROXIMATE, ARE SHOWN FOR CONTRACTOR INFORMATIONAL USE ONLY, AND ARE NOT TO BE REFERENCED FOR CONSTRUCTION PURPOSES. THE IMPLIED PRESENCE OR ABSENCE OF UTILITIES IS NOT TO BE CONSTRUED BY THE OWNER, ENGINEER, CONTRACTOR, OR SUBCONTRACTORS TO BE AN ACCURATE AND COMPLETE REPRESENTATION OF UTILITIES THAT MAY OR MAY NOT EXIST ON THE CONSTRUCTION SITE. BURIED AND ABOVE GROUND UTILITY LOCATION, IDENTIFICATION, AND MARKING ARE THE SOLE RESPONSIBILITY OF THE CONTRACTOR. REROUTING, DISCONNECTION, PROTECTION, ETC. OF ANY UTILITY MUST BE COORDINATED BETWEEN THE CONTRACTOR, UTILITY COMPANY AND OWNER. SITE SAFETY, INCLUDING THE AVOIDANCE OF HAZARDS ASSOCIATED WITH BURIED AND ABOVEGROUND UTILITIES, REMAINS THE SOLE RESPONSIBILITY OF THE CONTRACTOR.
5. WATER MAIN SHALL BE CONSTRUCTED IN ACCORDANCE WITH LOCAL WATER COMPANY STANDARD SPECIFICATIONS FOR WATER MAIN CONSTRUCTION.
6. ALL WATER MAIN SHALL HAVE A MINIMUM COVER OF 5 FEET.
7. MAINTAIN 18 INCHES VERTICAL SEPARATION (OUTER EDGE TO OUTER EDGE) BETWEEN WATER MAIN AND SEWER.
8. NITRILE GASKETS SHALL BE USED WHERE WATER MAIN CROSSES BELOW STORM SEWER.
9. UTILITY PIPING. ALL WORK SHALL BE PERFORMED IN CONFORMANCE WITH THE PIPE MANUFACTURER'S RECOMMENDATIONS FOR INSTALLATION METHODS INCLUDING BACKFILL MATERIAL AND MATERIAL DEPTHS. PIPE MATERIAL SHALL BE AS SPECIFIED ON THE PLANS. ALL MATERIAL SHALL MEET THE REQUIREMENTS OF THE LOCAL JURISDICTION FOR STRENGTH, MATERIAL TYPE AND CONFORMITY WITH THE EXISTING SYSTEM. SEWER LINES SHALL BE CONSTRUCTED STRAIGHT TO THE SPECIFIED LINE AND GRADES. MANHOLES, STORM INLETS, VALVE BOXES AND APPURTENANCES SHALL BE ADJUSTED TO GRADE OR PER PLAN PRIOR TO SEEDING/LANDSCAPING ACTIVITIES.

SITE CONTROL
SCALE: 1" = 200'

811
Know what's **below.**
Call before you dig.

LEGEND

PROPOSED | EXISTING

- STORM MANHOLE
- STORM INLET
- STORM INLET
- STORM DOUBLE INLET
- FLARED END SECTION
- DOWNSPOUT
- SANITARY MANHOLE
- SANITARY/STORM CLEANOUT
- UNKNOWN MANHOLE
- WATER VALVE
- HYDRANT
- WELL
- SPRINKLER BOX
- WATER METER
- WATER SERVICE
- POWER POLE
- POWER POLE W/ LIGHT
- POWER POLE W/ METER
- GUY WIRE
- GUY POLE
- ELECTRIC MANHOLE
- ELECTRIC PEDESTAL/TRANSFORMER
- ELECTRIC METER
- TELEPHONE POLE
- TELEPHONE MANHOLE
- TELEPHONE PEDESTAL
- UTILITY MANHOLE
- HANDHOLE
- GAS VALVE
- LIGHT POLE
- VAPOR LIGHT
- LIGHT JUNCTION BOX
- SIGN
- FLAGPOLE
- POST/BOLLARD
- CONIFER TREE
- DECIDUOUS TREE
- BUSH/SHRUB
- TREE STUMP
- CONTROL POINT
- BENCHMARK
- SOIL BORING HOLE
- R.O.W. MARKER, FOUND
- RAILROAD SPIKE, FOUND
- PIPE, FOUND
- CONCRETE MONUMENT, FOUND
- 100.00' MEASURED DIMENSION
- (100.00') RECORDED DIMENSION
- ×100.00 SPOT ELEVATION
- TC=100.00 / FL=100.00 GRADE LABEL
- 1.0% DRAINAGE SLOPE
- LINE CONTINUATION
- SURVEY BOUNDARY
- PROPERTY LINE
- CENTERLINE
- HISTORICAL LINE - AS NOTED
- EASEMENT LINE
- SECTION LINE
- R.O.W. LINE
- SETBACK LINE
- FORCE MAIN
- SANITARY SEWER
- STORM SEWER
- PIPE UNDERDRAIN
- W WATER LINE
- OE OVERHEAD ELECTRIC
- E UNDERGROUND ELECTRIC
- G GAS LINE
- T TELEPHONE LINE
- UT UTILITY LINE
- EDGE OF WATER LINE/DITCH FLOWLINE
- CHAIN LINK FENCE
- SILT FENCE
- 100 CONTOUR
- GUARD RAIL
- TREE LINE
- FLOOD PLAIN
- FLOODWAY
- CONSTRUCTION LIMITS

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EMAIL: civil-hawks@uiowa.edu
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DATE :	12/17/21
DRAWN BY:	NCO
REVISION:	

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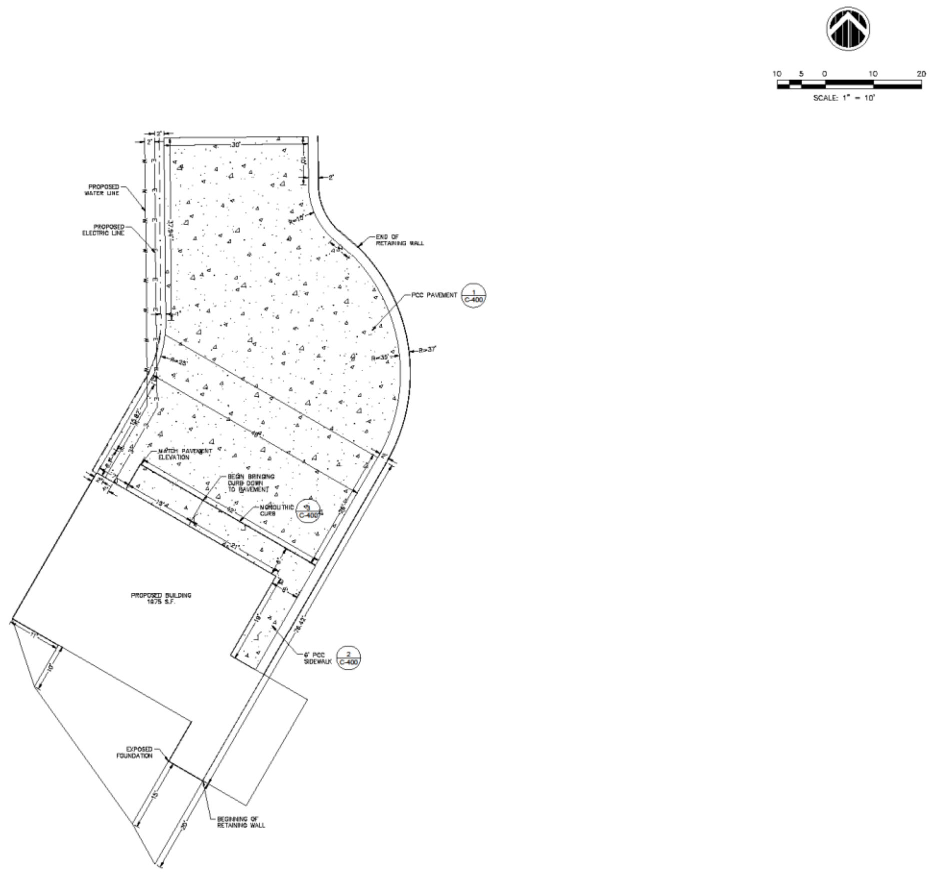
SHEET NAME
NOTES-DETAILS & LE
— LEGEND

SHEET NO.
C-100



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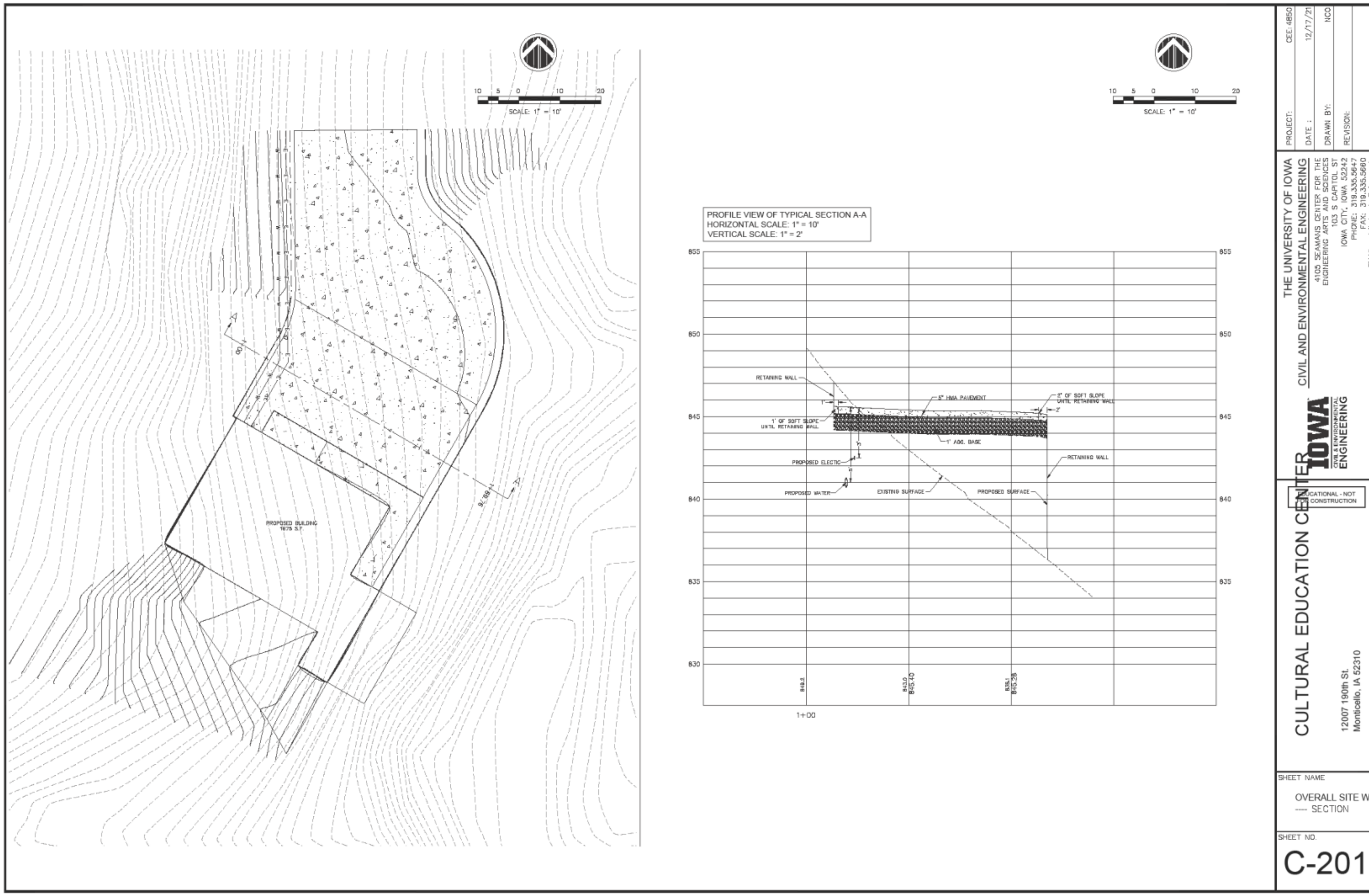
C-200


SCALE: 1" = 10'
PROFILE VIEW OF TYPICAL SECTION A-A
HORIZONTAL SCALE: 1" = 10'
VERTICAL SCALE: 1" = 2'
RETAINING WALL
1' OF SOFT SLOPE UNTIL RETAINING WALL
PROPOSED ELECTRIC
PROPOSED WATER
EXISTING SURFACE
PROPOSED SURFACE
1' AGG. BASE
PROPOSED BUILDING
1+00
855
850
845
840
835
830
845.40
845.28
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SHEET NAME
OVERALL SITE WITH S
---- SECTION
SHEET NO.
C-201


EXISTING SURFACE
PROPOSED SURFACE
SCALE: 1" = 10'
PROPOSED BUILDING
FFE = 845.00
EXISTING FOUNDATION
PROJECT: CEE:4850
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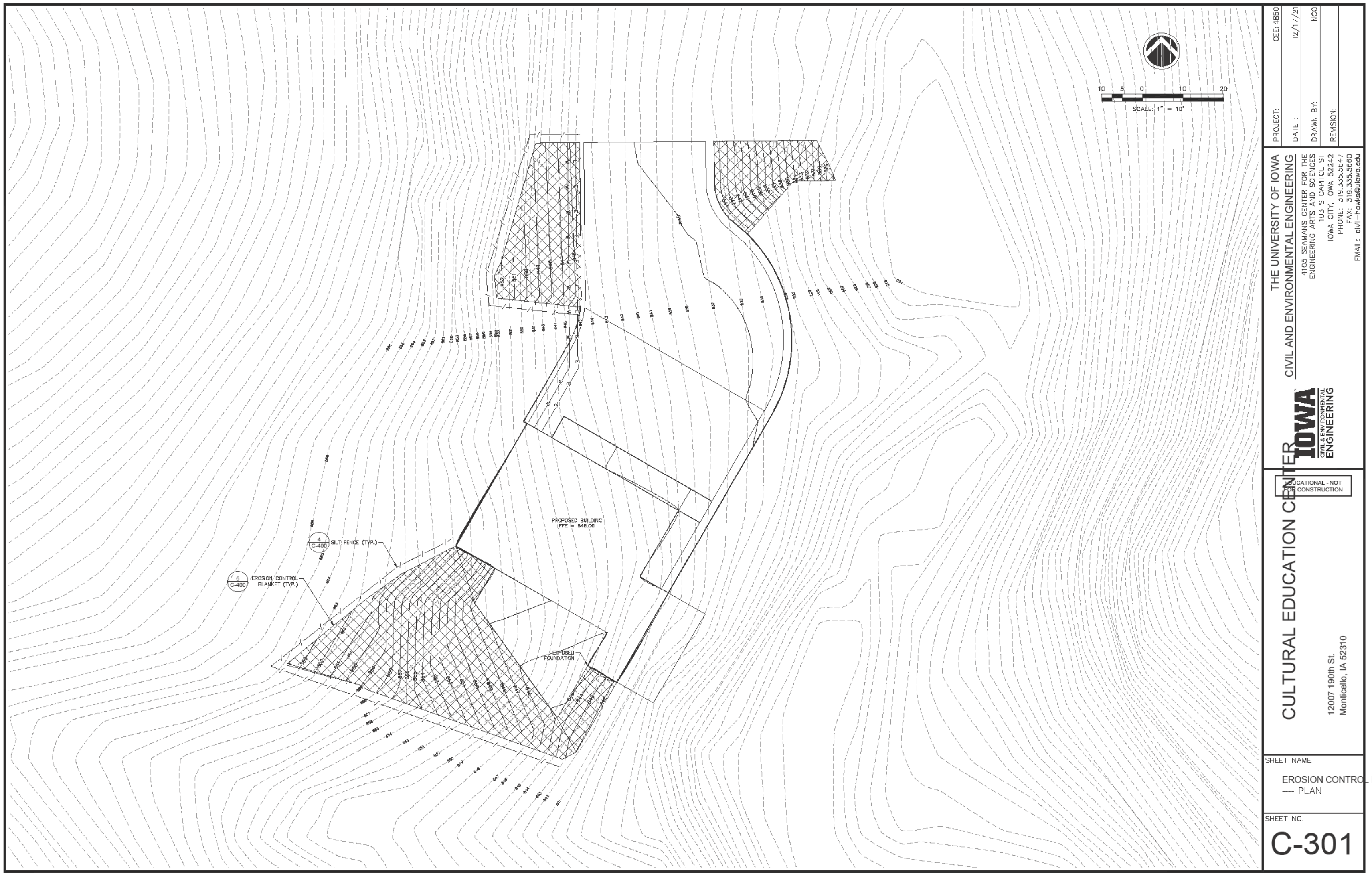
SHEET NAME
GRADING PLAN
SHEET NO.
C-300


SCALE: 1" = 10'
PROPOSED BUILDING
FFE = 848.00
SILT FENCE (TYP.)
EROSION CONTROL BLANKET (TYP.)
EXPOSED FOUNDATION
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DATE: 12/17/21
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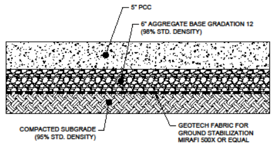
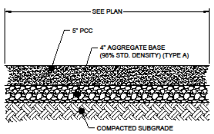
REVISION:
SHEET NAME
EROSION CONTROL PLAN
SHEET NO.
C-301



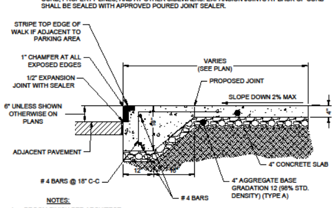
1 / C-400 **5" PCC PAVEMENT SECTION**
N.T.S.



2 / C-400 **PCC SIDEWALK DETAIL**
N.T.S.

NOTES:

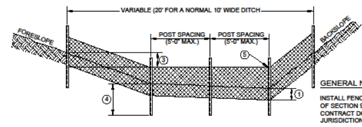
1. PROVIDE 3/8" WIDE x 1" DEEP TOOLED CONTRACTION JOINTS (TJ) AT 5' O.C. MAX.
2. TURN DOWN EDGE AT PAVEMENT AREA ONLY.
3. INSTALL 1/2" THICK EXPANSION JOINT AT 50' MAXIMUM SPACING AND AT DRIVEWAYS, BACK OF CURB, PROPERTY LINES, AND AT OTHER SIDEWALKS. EXPANSION JOINTS AT BACK OF CURB SHALL BE SEALED WITH APPROVED POURED JOINT SEALER.



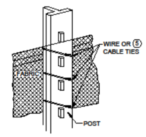
NOTES:

1. BROOM FINISH PER ARCHITECT.
2. TURN DOWN EDGE AT PAVEMENT AREA ONLY.
3. PROVIDE 3/8"WIDE BY 1" DEEP TOOLED CONTRACTION JOINTS @ 5' O.C. MAX.

3 / C-400 **MONOLITHIC PCC SIDEWALK**
N.T.S.



TYPICAL SILT FENCE DITCH CHECK



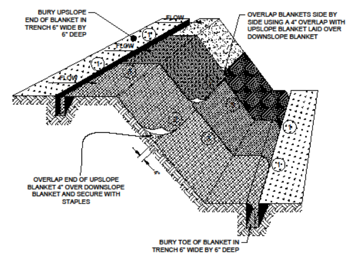
ATTACHMENT TO POST

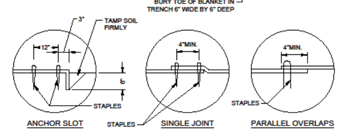
GENERAL NOTES:

INSTALL FENCE ACCORDING TO THE IA DOT REQUIREMENTS OF SECTION 9040, 3.07 AND AT LOCATIONS SHOWN IN THE CONTRACT DOCUMENTS OR AS DIRECTED BY THE JURISDICTIONAL ENGINEER

1. INSERT 12 INCH OF FABRIC A MINIMUM OF 6 INCH DEEP (FABRIC MAY BE FOLDED BELOW THE GROUND LINE)
2. COMPACT GROUND BY DRIVING ALONG EACH SIDE OF THE SILT FENCE AS REQUIRED TO SUFFICIENTLY SECURE THE FABRIC IN THE TRENCH TO PREVENT PULLOUT AND FLOW UNDER THE FENCE.
3. IN DITCHES, EXTEND SILT FENCE UP SIDE SLOPE SO THE BOTTOM ELEVATION AT THE END OF THE FENCE IS A MINIMUM OF 2 INCH HIGHER THAN THE TOP OF THE FENCE IN THE LOW POINT OF THE DITCH.
4. STEEL POSTS TO BE EMBEDDED 20 INCHES UNLESS OTHERWISE ALLOWED BY THE JURISDICTIONAL ENGINEER.
5. SECURE TOP OF ENGINEERING FABRIC TO STEEL POSTS USING WIRE OR PLASTIC TIES (50 LB. MIN.). SEE DETAILS OF "ATTACHMENT TO POSTS."

4 / C-400 **SILT FENCE DITCH CHECK**
N.T.S.





DETAIL 1 DETAIL 2 DETAIL 3

STAPLE DETAIL PUSH PIN DETAIL

NOTES:

1. STAPLES SHALL BE PLACED IN A DIAMOND PATTERN AT 2 PER S.Y. FOR STICHED BLANKETS. NON-STICHED SHALL USE 4 STAPLES PER S.Y. OF MATERIAL. THIS EQUATES TO 200 STAPLES WITH STICHED BLANKET AND 400 STAPLES WITH NON-STICHED BLANKET PER 100 S.Y. OF MATERIAL.
2. STAPLE OR PUSH PIN LENGTHS SHALL BE SELECTED BASED ON SOIL TYPE AND CONDITIONS (MINIMUM STAPLE LENGTH IS 6").
3. EROSION CONTROL MATERIAL SHALL BE PLACED IN CONTACT WITH THE SOIL OVER A PREPARED SEEDBED.
4. ALL ANCHOR SLOTS SHALL BE STAPLED AT APPROXIMATELY 12" INTERVALS.
5. DETAIL DERIVED FROM THE ILLINOIS URBAN MANUAL (STANDARD DWG NO. IUM-530).

5 / C-400 **EROSION CONTROL BLANKET**
N.T.S.

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C-400

Table 8B-1.03: Pavement Thickness for Light Loads
(Parking lots with 200 or less cars/day and/or 2 or less trucks/day or equivalent axle loads)

Subgrade CBR	Surface Material	On 12"of Prepared Subgrade		On 12" of Prepared Subgrade with 4" Granular Subbase	
		Minimum	*Desirable*	*Minimum*	*Desirable*
9	Rigid	5"	6"	4"	5"
	Flexible	5"	6"	4"	5"
6	Rigid	5"	6"	4"	5"
	Flexible	5"	6"	4"	5"
3	Rigid	5"	6"	4"	5"
	Flexible	6"	6"	5"	5"

E. Drainage

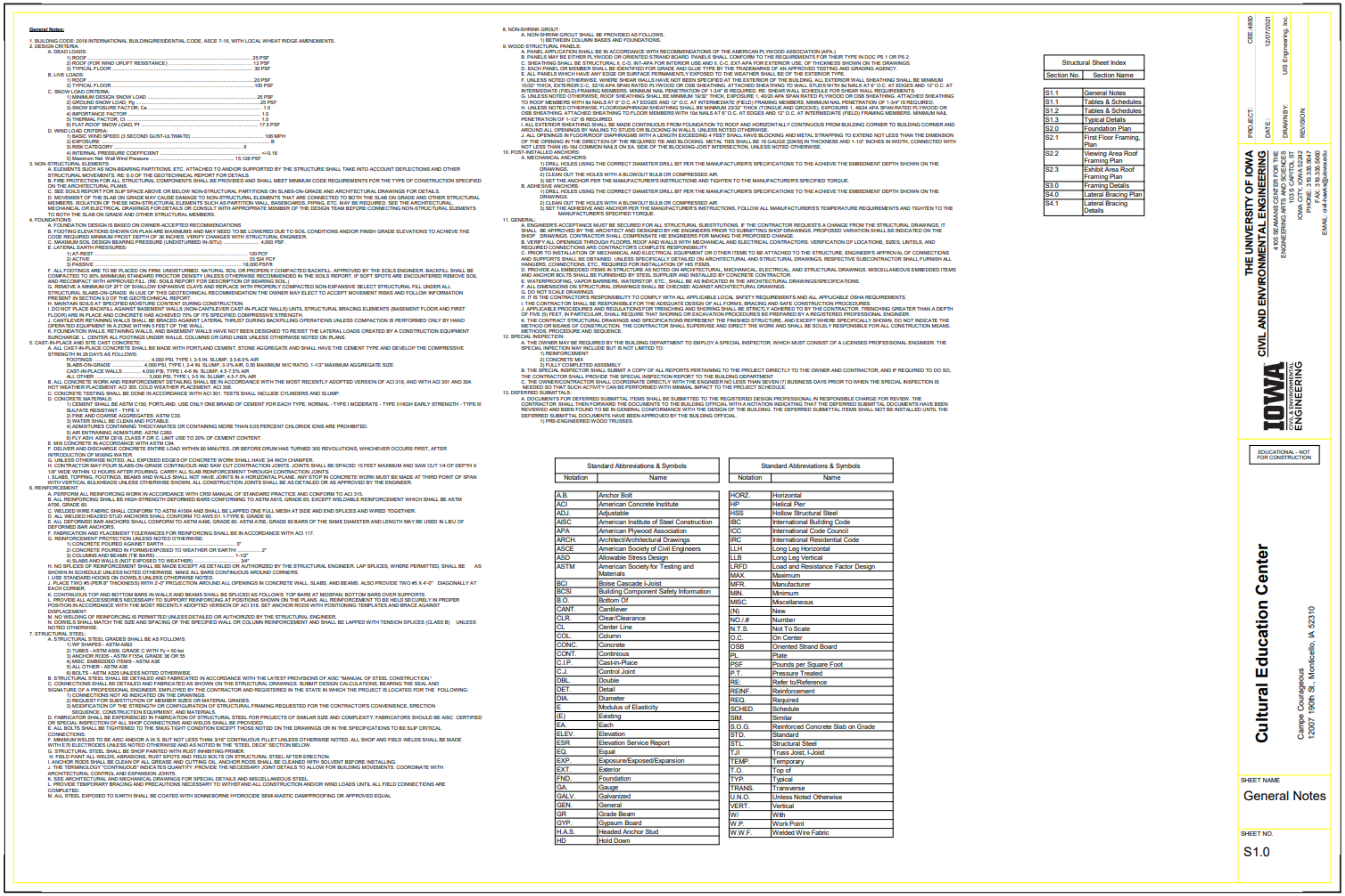
Internal parking lot drainage should be designed according to Chapter 2 - Stormwater.

Stormwater runoff from parking lots serving other than single and two family dwellings should not be discharged directly into the street; such runoff should be collected internally or discharged to an adjacent drainage way. After providing detention, when required, the collected stormwater may be discharged to the public storm sewer, ditch, or other conveyance. Stormwater runoff discharged to the street over the back of the curb or through a parking lot entrance, should be minimized. Check with the local jurisdiction for their stormwater requirements.

Where narrow (less than 10 feet wide) raised islands are provided, their presence should generally be disregarded when determining the runoff coefficient or curve number for the parking lot as they provide little benefit in reducing runoff. Wider islands, or islands that are depressed to collect stormwater runoff, are encouraged and may be taken into consideration when determining the runoff potential.

Pavement slopes of 1.5% should be provided to ensure proper drainage and eliminate standing water and icy conditions. Minimum pavement slopes of 0.6% may be used, however since the potential for flat areas is greater, additional measures to address drainage, such as slotted drains or pervious pavement, may be necessary. Slopes greater than 2% in areas between the parking lot destination and the accessible parking stalls should be avoided as they create a situation where constructing an accessible route is difficult. Slopes greater than 5% are discouraged.

Appendix H – Structural Sheets



Structural Sheet Index	
Section No.	Section Name
S1.1	General Notes
S1.1	Tables & Schedules
S1.2	Tables & Schedules
S1.3	Typical Details
S2.0	Foundation Plan
S2.1	First Floor Framing, Plan
S2.2	Viewing Area Roof Framing Plan
S2.3	Exhibit Area Roof Framing Plan
S3.0	Framing Details
S4.0	Lateral Bracing Plan
S4.1	Lateral Bracing Details

Standard Abbreviations & Symbols	
Notation	Name
A.B.	Anchor Bolt
ACI	American Concrete Institute
ADJ.	Adjustable
AISC	American Institute of Steel Construction
APA	American Plywood Association
ARCH.	Architect/Architectural Drawings
ASCE	American Society of Civil Engineers
ASD	Allowable Stress Design
ASTM	American Society for Testing and Materials
BCI	Boise Cascade I-Joist
BCSI	Building Component Safety Information
B.O.	Bottom Of
CANT.	Cantilever
CLR.	Clear/Clearance
CL	Center Line
COL.	Column
CONC.	Concrete
CONT.	Continious
C.I.P.	Cast-in-Place
C.J.	Control Joint
DBL.	Double
DET.	Detail
DIA.	Diameter
E	Modulus of Elasticity
(E)	Existing
EA.	Each
ELEV.	Elevation
ESR	Elevation Service Report
EQ.	Equal
EXP.	Exposure/Exposed/Expansion
EXT.	Exterior
FND.	Foundation
GA.	Gauge
GALV.	Galvanized
GEN.	General
GR	Grade Beam
GYP.	Gypsum Board
H.A.S.	Headed Anchor Stud
HD	Hold Down

Standard Abbreviations & Symbols	
Notation	Name
HORZ.	Horizontal
HP	Helical Pier
HSS	Hollow Structural Steel
IBC	International Building Code
ICC	International Code Council
IRC	International Residential Code
LLH	Long Leg Horizontal
LLB	Long Leg Vertical
LRFD	Load and Resistance Factor Design
MAX.	Maximum
MFR.	Manufacturer
MIN.	Minimum
MISC.	Miscellaneous
(N)	New
NO./#	Number
N.T.S.	Not To Scale
O.C.	On Center
OSB	Oriented Strand Board
PL.	Plate
PSF	Pounds per Square Foot
P.T.	Pressure Treated
RE:	Refer to/Reference
REINF.	Reinforcement
REQ.	Required
SCHED.	Schedule
SIM.	Similar
S.O.G.	Reinforced Concrete Slab on Grade
STD.	Standard
STL.	Structural Steel
TJI	Truss Joist, I-Joist
TEMP.	Temporary
T.O.	Top of
TYP.	Typical
TRANS.	Transverse
U.N.O.	Unless Noted Otherwise
VERT.	Vertical
W/	With
W.P.	Work Point
W.W.F.	Welded Wire Fabric

FASTENING SCHEDULE [1]

(IBC TABLE - 2304.10.1/IRC TABLE - R602.3(1))

DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER	SPACING AND LOCATION
ROOF [2]		
1. BLOCKING BETWEEN CEILING JOISTS, RAFTERS OR TRUSSES TO TOP PLATE OR OTHER FRAMING BELOW	3 - 8d COMMON (0.131" x 2-1/2"); OR 3 - 10d BOX (0.128" x 3"); OR 3 - (0.131" x 3") NAILS; OR 3 - (14 GA. x 3") STAPLES, 7/16" CROWN	EACH END, TOENAIL
BLOCKING BETWEEN RAFTERS OR TRUSS NOT AT THE WALL TOP PLATE, TO RAFTER OR TRUSS	2 - 8d COMMON (0.131" x 2-1/2") 2- (0.131" x 3") NAILS 2 - (14 GA. x 3") STAPLES	EACH END, TOENAIL
	2 - 16d COMMON (0.162" x 3-1/2") 3- (0.131" x 3") NAILS 3 - (14 GA. x 3") STAPLES	END NAIL
FLAT BLOCKING TO TRUSS AND WEB FILLER	16d COMMON (0.162" x 3-1/2") @ 6" O.C. (0.131" x 3") NAILS @ 6" O.C. (14 GA. x 3") STAPLES @ 6" O.C.	FACE NAIL
2. CEILING JOISTS TO TOP PLATE	3 - 8d COMMON (0.131" x 2-1/2"); OR 3 - 10d BOX(0.128" x 3"); OR 3 - (0.131" x 3") NAILS; OR 3 - (14 GA. x 3") STAPLES, 7/16" CROWN	EACH JOIST, TOENAIL
3. CEILING JOIST NOT ATTACHED TO PARALLEL RAFTER, LAPS OVER PARTITIONS (NO THRUST)	3 - 16d COMMON (0.162" x 3-1/2"); OR 4 - 10d BOX (0.128" x 3"); OR 4 - (0.131" x 3") NAILS; OR 4 - (14 GA. x 3") STAPLES, 7/16" CROWN	FACE NAIL
4. CEILING JOIST ATTACHED TO PARALLEL RAFTER (HEEL JOINT)	PER TABLE 2308.7.3.1 OR R802.5.2	FACE NAIL
5. COLLAR TIE TO RAFTER	3 - 10d COMMON (0.148" x 3"); OR 4 - 10d BOX (0.128" x 3"); OR 4 - (0.131" x 3") NAILS; OR 4 - (14 GA. x 3") STAPLES, 7/16" CROWN	FACE NAIL
6. RAFTER OR ROOF TRUSS TO TOP PLATE	3 - 10d COMMON (0.148" x 3"); OR 3 - 16d BOX(0.135" x 3-1/2"); OR 4 - 10d BOX (0.128" x 3"); OR 4 - (0.131" x 3") NAILS; OR 4 - (14 GA. x 3") STAPLES, 7/16" CROWN	TOENAIL
7. ROOF RAFTERS TO RIDGE VALLEY OR HIP RAFTERS; OR ROOF RAFTER TO 2-INCH RIDGE BEAM	2 - 16d COMMON (0.162" x 3-1/2"); OR 3 - 10d BOX (0.128" x 3"); OR 3 - (0.131" x 3") NAILS; OR 3 - (14 GA. x 3") STAPLES, 7/16" CROWN	END NAIL
	3 - 10d COMMON (0.148" x 3"); OR 4 - 16d BOX(0.135" x 3-1/2"); OR 4 - 10d BOX (0.128" x 3"); OR 4 - (0.131" x 3") NAILS; OR 4 - (14 GA. x 3") STAPLES, 7/16" CROWN	TOENAIL
WALL		
8. STUD TO STUD (NOT AT BRACED WALL PANELS)	16d COMMON (0.162" x 3-1/2")	24" O.C. FACE NAIL
	10d BOX (0.128" x 3"); OR (0.131" x 3") NAILS; OR 3 - (14 GA. x 3") STAPLES, 7/16" CROWN	16" O.C. FACE NAIL
9. STUD TO STUD AND ABUTTING STUDS AT INTERSECTING WALL CORNERS (AT BRACED WALL PANELS)	16d COMMON (0.162" x 3-1/2"); OR	16" O.C. FACE NAIL
	16d BOX (0.135" x 3-1/2"); OR	12" O.C. FACE NAIL
	(0.131" x 3") NAILS; OR 3 - (14 GA. x 3") STAPLES, 7/16" CROWN	12" O.C. FACE NAIL
10. BUILT-UP HEADER (2" TO 2" HEADER)	16d COMMON (0.162" x 3-1/2"); OR	16" O.C. EA. EDGE, FACE NAIL
	16d BOX (0.135" x 3-1/2"); OR	12" O.C. EA. EDGE, FACE NAIL
11. CONTINUOUS HEADER TO STUD	4 - 8d COMMON (0.131" x 2-1/2"); OR 4 - 10d BOX(0.128" x 3"); OR	TOENAIL
12. TOP PLATE TO TOP PLATE	16d COMMON (0.162" x 3-1/2"); OR	16" O.C. FACE NAIL
	10d BOX (0.128" x 3"); OR (0.131" x 3") NAILS; OR (14 GA. x 3") STAPLES, 7/16" CROWN	12" O.C. FACE NAIL
13. TOP PLATE TO TOP PLATE, AT END JOINTS	8 - 16d COMMON (0.162" x 3-1/2"); OR 12 - 10d BOX (0.128" x 3"); OR 12 - (0.131" x 3") NAILS; OR 12 - (14 GA. x 3") STAPLES, 7/16" CROWN	EA. SIDE OF END JOINT, FACE NAIL (MIN. 24" LAP SPLICE LENGTH EA. SIDE OF END JOINT
14. BOTTOM PLATE TO JOIST, RIM JOIST, BAND JOIST OR BLOCKING (NOT AT BRACED WALL PANELS)	16d COMMON (0.162" x 3-1/2"); OR	16" O.C. FACE NAIL
	16d BOX (0.135" x 3-1/2"); OR (0.131" x 3") NAILS; OR (14 GA. x 3") STAPLES, 7/16" CROWN	12" O.C. FACE NAIL
15. BOTTOM PLATE TO JOIST, RIM JOIST, BAND JOIST OR BLOCKING AT BRACED WALL PANELS	2 - 16d COMMON (0.162" x 3-1/2"); OR 3 - 16d BOX (0.135" x 3-1/2"); OR 4 - (0.131" x 3") NAILS; OR 4- (14 GA. x 3") STAPLES, 7/16" CROWN	16" O.C. FACE NAIL
16. STUD TO TOP OR BOTTOM PLATE	4 - 8d COMMON (0.131" x 2-1/2"); OR 4 - 10d BOX (0.128" x 3"); OR 4 - (0.131" x 3") NAILS; OR 4- (14 GA. x 3") STAPLES, 7/16" CROWN	TOENAIL
	2 - 16d COMMON (0.162" x 3-1/2"); OR 3 - 10d BOX (0.128" x 3"); OR 3 - (0.131" x 3") NAILS; OR 3- (14 GA. x 3") STAPLES, 7/16" CROWN	END NAIL
17. TOP PLATES, LAPS AT CORNERS AND INTERSECTIONS.	2 - 16d COMMON (0.162" x 3-1/2"); OR 3 - 10d BOX (0.128" x 3"); OR 3 - (0.131" x 3") NAILS; OR 3- (14 GA. x 3") STAPLES, 7/16" CROWN	FACE NAIL
18. 1" BRACE TO EA. STUD AND PLATE	2 - 8d COMMON (0.131" x 2-1/2"); OR 2 - 10d BOX (0.128" x 3"); OR 2 - (0.131" x 3") NAILS; OR 2- (14 GA. x 3") STAPLES, 7/16" CROWN	FACE NAIL
19. 1" x 6" SHEATHING TO EA. BEARING	2 - 8d COMMON (0.131" x 2-1/2"); OR 2 - 10d BOX (0.128" x 3")	FACE NAIL
20. 1" x 8" AND WIDER SHEATHING TO EA. BEARING	3 - 8d COMMON (0.131" x 2-1/2"); OR 3 - 10d BOX (0.128" x 3")	FACE NAIL
FLOOR [2]		
21. JOIST TO SILL, TOP PLATE, OR GIRDER	3 - 8d COMMON (0.131" x 2-1/2"); OR 3 - 10d BOX (0.128" x 3"); OR 3 - (0.131" x 3") NAILS; OR 3- (14 GA. x 3") STAPLES, 7/16" CROWN	TOENAIL
22. RIM JOIST, BAND JOIST, OR BLOCKING TO TOP PLATE, SILL OR OTHER FRAMING BELOW	8d COMMON (0.131" x 2-1/2"); OR 10d BOX (0.128" x 3"); OR (0.131" x 3") NAILS; OR (14 GA. x 3") STAPLES, 7/16" CROWN	6" O.C. TOENAIL
23. 1" x 6" SUBFLOOR OR LESS TO EA. JOIST	2 - 8d COMMON (0.131" x 2-1/2"); OR 2 - 10d BOX (0.128" x 3")	FACE NAIL
24. 2" SUBFLOOR TO JOIST OR GIRDER	2 - 16d COMMON (0.162" x 3-1/2"); OR	FACE NAIL
25. 2" PLANKS (PLANK & BEAM - FLOOR & ROOF)	2 - 16d COMMON (0.162" x 3-1/2"); OR	EACH BEARING, FACE NAIL
26. BUILT-UP GIRDERS AND BEAMS, 2" LUMBER PLIES/LAYERS	20d COMMON (0.192" x 4")	32" O.C., FACE NAIL AT TOP AND BOTTOM STAGGERED ON OPPOSITE SIDES
	10d BOX (0.128" x 3"); OR (0.131" x 3") NAILS; OR (14 GA. x 3") STAPLES, 7/16" CROWN	24" O.C., FACE NAIL AT TOP AND BOTTOM STAGGERED ON OPPOSITE SIDES
	AND: 2-20d COMMON (0.192" x 4"); OR 3-10d BOX (0.128" x 3"); OR 3-(0.131" x 3") NAILS; OR 3-(14 GA. x 3") STAPLES, 7/16" CROWN	ENDS AND AT EA. SPLICE, FACE NAIL
27. LEDGER STRIP SUPPORTING JOISTS OR RAFTERS	3 - 16d COMMON (0.162" x 3-1/2"); OR 4 - 10d BOX (0.128" x 3"); OR 4 - (0.131" x 3") NAILS; OR 4- (14 GA. x 3") STAPLES, 7/16" CROWN	EA. JOIST OR RAFTER, FACE NAIL
28. JOIST TO BAND JOIST OR RIM JOIST	3 - 16d COMMON (0.162" x 3-1/2"); OR 4 - 10d BOX (0.128" x 3"); OR 4 - (0.131" x 3") NAILS; OR 4- (14 GA. x 3") STAPLES, 7/16" CROWN	END NAIL
29. BRIDGING OR BLOCKING TO JOIST, RAFTER OR TRUSS	2 - 8d COMMON (0.131" x 2-1/2"); OR 2 - 10d BOX (0.128" x 3"); OR 2 - (0.131" x 3") NAILS; OR 2- (14 GA. x 3") STAPLES, 7/16" CROWN	EACH END, TOENAIL
WOOD STRUCTURAL PANELS (WSP), SUBFLOOR, ROOF & INTERIOR WALL SHEATHING TO FRAMING [3]		
30. 3/8" - 1/2"	8d COMMON OR DEFORMED (0.131"x2-1/2")	6" O.C. EDGE 12" O.C. FIELD
31. 19/32" - 3/4"	8d COMMON (0.131"x2-1/2")	6" O.C. EDGE 12" O.C. FIELD
PANEL SIDING TO FRAMING		
32. 1/2" OR LESS	6d CORROSION-RESISTANT SIDING (0.106"x1-7/8") NAILS; OR 6d CORROSION-RESISTANT CASING (0.099"x2") NAILS	6" O.C. EDGE 12" O.C. FIELD
33. 5/8"	8d CORROSION-RESISTANT SIDING (0.128"x2-3/8") NAILS; OR 8d CORROSION-RESISTANT CASING (0.113"x2-1/2") NAILS	6" O.C. EDGE 12" O.C. FIELD

NOTE:
1. USE THE ABOVE FASTENING SCHEDULE UNLESS NOTED OTHERWISE ON PLANS OR DETAILS.
2. STRUCTURAL COMPOSITE LUMBER (SCL) WHICH INCLUDES LAMINATED VENEER LUMBER (LVL), PARALLEL STRAND LUMBER (PSL) LAMINATED STRAND LUMBER (LSL) AND ORIENTED STRAND LUMBER (OSL), SHALL BE FASTENED PER MFR. REQUIREMENTS.
3. RE: DIAPHRAGM SCHEDULE FOR FLOOR AND ROOF SHEATHING FASTENING REQUIREMENTS.

REBAR SCHEDULE

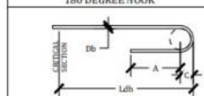
DEVELOPMENT LENGTHS - Ld

F'c = 3000 PSI					F'c = 4000 PSI				
BAR SIZE	STD. Ld		CLASS B		BAR SIZE	STD. Ld		CLASS B	
	TYP.	TOP	TYP.	TOP		TYP.	TOP	TYP.	TOP
#4	15"	19"	20"	25"	#4	13"	17"	17"	23"
#5	28"	36"	37"	47"	#5	24"	31"	32"	41"
#6	33"	43"	43"	56"	#6	29"	37"	38"	49"
#7	48"	63"	63"	82"	#7	42"	54"	55"	71"
#8	55"	72"	72"	94"	#8	48"	62"	63"	81"
#9	62"	81"	81"	106"	#9	54"	70"	71"	91"
#10	69"	90"	90"	117"	#10	60"	78"	78"	102"
#11	76"	98"	98"	128"	#11	66"	85"	86"	111"

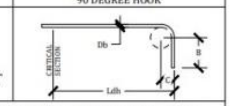
STANDARD HOOKS

F'c =3000 PSI					F'c =4000 PSI				
BAR SIZE	Ldh	HOOK DIMENSIONS			BAR SIZE	Ldh	HOOK DIMENSIONS		
		"A"	"B"	"C"			"A"	"B"	"C"
#4	6"	2-1/2"	6"	2"	#4	6"	2-1/2"	6"	2"
#5	10"	2-1/2"	7-1/2"	2-1/2"	#5	9"	2-1/2"	7-1/2"	2-1/2"
#6	12"	3"	9"	3"	#6	10"	3"	9"	3"
#7	14"	3-1/2"	10-1/2"	3-1/2"	#7	12"	3-1/2"	10-1/2"	3-1/2"
#8	16"	4"	12"	4"	#8	14"	4"	12"	4"
#9	18"	4-1/2"	13-1/2"	5-5/8"	#9	15"	4-1/2"	13-1/2"	5-5/8"
#10	20"	5"	15"	6-1/4"	#10	17"	5"	15"	6-1/4"
#11	22"	5-1/2"	16-1/2"	6-7/8"	#11	19"	5-1/2"	16-1/2"	6-7/8"

180 DEGREE HOOK



90 DEGREE HOOK



USE THE ABOVE TABLE UNLESS NOTED OTHERWISE ON PLANS OR DETAILS

PROJECT: CEE:4850
DATE: 12/07/2021
DRAWN BY: UIS Engineering, Inc.
REVISION:

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12007 190th St., Monticello, IA 52310

SHEET NAME
Tables & Schedules

SHEET NO.
S1.1

Material Takeoff

Category	Family and Type	Material: Name	Material: Area	Material: Volume	Material: Unit weight	Count
Floors	Floor: 5" Concrete	Concrete, Cast-in-Place gray	4320 SF	1799.92 CF	150.28 lb/ft^3	1
Walls	Basic Wall: Retaining - 12" Concrete	Concrete, Cast-in-Place gray	811 SF	810.66 CF	150.28 lb/ft^3	1
Floors	Floor: 5" Concrete	Concrete, Cast-in-Place gray	1799 SF	749.64 CF	150.28 lb/ft^3	1
Structural Foundations	Wall Foundation: Bearing Footing - 90" x 12"	Concrete, Cast-in-Place gray	1382 SF	603.00 CF	150.28 lb/ft^3	1
Walls	Basic Wall: Retaining - 12" Concrete	Concrete, Cast-in-Place gray	475 SF	468.32 CF	150.28 lb/ft^3	1
Structural Foundations	Wall Foundation: Bearing Footing - 90" x 12"	Concrete, Cast-in-Place gray	805 SF	348.31 CF	150.28 lb/ft^3	1
Floors	Floor: 5" Concrete	Concrete, Cast-in-Place gray	379 SF	157.73 CF	150.28 lb/ft^3	1
Walls	Basic Wall: Retaining - 12" Concrete	Concrete, Cast-in-Place gray	125 SF	119.84 CF	150.28 lb/ft^3	1
Floors	Floor: 5" Concrete	Concrete, Cast-in-Place gray	273 SF	113.75 CF	150.28 lb/ft^3	1
Walls	Basic Wall: Exterior - 8" Concrete	Concrete, Cast-in-Place gray	170 SF	113.54 CF	150.28 lb/ft^3	1
Walls	Basic Wall: Exterior - 8" Concrete	Concrete, Cast-in-Place gray	147 SF	97.88 CF	150.28 lb/ft^3	1
Structural Foundations	Wall Foundation: Bearing Footing - 36" x 12"	Concrete, Cast-in-Place gray	352 SF	94.99 CF	150.28 lb/ft^3	1
Structural Foundations	Wall Foundation: Bearing Footing - 90" x 12"	Concrete, Cast-in-Place gray	218 SF	89.49 CF	150.28 lb/ft^3	1
Structural Foundations	Wall Foundation: Bearing Footing - 36" x 12"	Concrete, Cast-in-Place gray	312 SF	83.90 CF	150.28 lb/ft^3	1
Walls	Basic Wall: Retaining - 12" Concrete	Concrete, Cast-in-Place gray	81 SF	80.99 CF	150.28 lb/ft^3	1
Walls	Basic Wall: Exterior - 8" Concrete	Concrete, Cast-in-Place gray	117 SF	77.97 CF	150.28 lb/ft^3	1
Structural Foundations	Wall Foundation: Bearing Footing - 36" x 12"	Concrete, Cast-in-Place gray	244 SF	65.50 CF	150.28 lb/ft^3	1
Structural Foundations	Wall Foundation: Bearing Footing - 90" x 12"	Concrete, Cast-in-Place gray	151 SF	60.16 CF	150.28 lb/ft^3	1
Floors	Floor: 5" Concrete	Concrete, Cast-in-Place gray	86 SF	35.76 CF	150.28 lb/ft^3	1
Walls	Basic Wall: Exterior - 8" Concrete	Concrete, Cast-in-Place gray	35 SF	23.33 CF	150.28 lb/ft^3	1
Structural Foundations	Wall Foundation: Bearing Footing - 36" x 12"	Concrete, Cast-in-Place gray	77 SF	20.00 CF	150.28 lb/ft^3	1
Structural Foundations	Wall Foundation: Bearing Footing - 36" x 12"	Concrete, Cast-in-Place gray	69 SF	17.54 CF	150.28 lb/ft^3	1
Walls	Basic Wall: Exterior - 8" Concrete	Concrete, Cast-in-Place gray	23 SF	15.66 CF	150.28 lb/ft^3	1
Structural Foundations	Wall Foundation: Bearing Footing - 36" x 12"	Concrete, Cast-in-Place gray	37 SF	8.00 CF	150.28 lb/ft^3	2
Walls	Basic Wall: Exterior - 8" Concrete	Concrete, Cast-in-Place gray	5 SF	3.11 CF	150.28 lb/ft^3	2
Concrete, Cast-in-Place gray			12492 SF	6058.99 CF		27
Structural Columns	HSS-Hollow Structural Section-Column: HSS6X6X5/8	Steel ASTM A500, Grade B, Rectangular and Square	68 SF	1.64 CF	490.00 lb/ft^3	2
Structural Columns	HSS-Hollow Structural Section-Column: HSS4X4X1/4	Steel ASTM A500, Grade B, Rectangular and Square	88 SF	0.85 CF	490.00 lb/ft^3	2
Structural Columns	HSS-Hollow Structural Section-Column: HSS4X4X1/4	Steel ASTM A500, Grade B, Rectangular and Square	44 SF	0.42 CF	490.00 lb/ft^3	1
Structural Columns	HSS-Hollow Structural Section-Column: HSS4X4X1/4	Steel ASTM A500, Grade B, Rectangular and Square	42 SF	0.41 CF	490.00 lb/ft^3	1
Structural Columns	HSS-Hollow Structural Section-Column: HSS4X4X1/4	Steel ASTM A500, Grade B, Rectangular and Square	83 SF	0.80 CF	490.00 lb/ft^3	2
Structural Columns	HSS-Hollow Structural Section-Column: HSS4X4X1/4	Steel ASTM A500, Grade B, Rectangular and Square	39 SF	0.38 CF	490.00 lb/ft^3	1
Structural Columns	HSS-Hollow Structural Section-Column: HSS4X4X1/4	Steel ASTM A500, Grade B, Rectangular and Square	76 SF	0.73 CF	490.00 lb/ft^3	2
Structural Columns	HSS-Hollow Structural Section-Column: HSS4X4X1/4	Steel ASTM A500, Grade B, Rectangular and Square	38 SF	0.36 CF	490.00 lb/ft^3	1

Material Takeoff

Category	Family and Type	Material: Name	Material: Area	Material: Volume	Material: Unit weight	Count
Structural Columns	HSS-Hollow Structural Section-Column: HSS3X3X3/8	Steel ASTM A500, Grade B, Rectangular and Square	37 SF	0.53 CF	490.00 lb/ft^3	2
Structural Columns	HSS-Hollow Structural Section-Column: HSS3X3X3/8	Steel ASTM A500, Grade B, Rectangular and Square	34 SF	0.50 CF	490.00 lb/ft^3	2
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	Steel ASTM A500, Grade B, Rectangular and Square	263 SF	0.78 CF	490.00 lb/ft^3	9
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	Steel ASTM A500, Grade B, Rectangular and Square	442 SF	1.30 CF	490.00 lb/ft^3	16
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	Steel ASTM A500, Grade B, Rectangular and Square	450 SF	1.33 CF	490.00 lb/ft^3	18
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	Steel ASTM A500, Grade B, Rectangular and Square	205 SF	0.61 CF	490.00 lb/ft^3	11
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	Steel ASTM A500, Grade B, Rectangular and Square	659 SF	1.94 CF	490.00 lb/ft^3	37
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	Steel ASTM A500, Grade B, Rectangular and Square	40 SF	0.12 CF	490.00 lb/ft^3	3
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	Steel ASTM A500, Grade B, Rectangular and Square	45 SF	0.13 CF	490.00 lb/ft^3	5
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	Steel ASTM A500, Grade B, Rectangular and Square	188 SF	0.55 CF	490.00 lb/ft^3	30
Structural Columns	ClarkDietrich-SFIA-S-Column: 600S162-68(50)	Steel ASTM A500, Grade B, Rectangular and Square	32 SF	0.09 CF	490.00 lb/ft^3	22
Steel ASTM A500, Grade B, Rectangular and Square			2873 SF	13.49 CF		167
Structural Framing	W Shapes: W12X26	Steel ASTM A992	203 SF	2.61 CF	490.00 lb/ft^3	2
Structural Framing	W Shapes: W12X26	Steel ASTM A992	100 SF	1.29 CF	490.00 lb/ft^3	1
Structural Framing	W Shapes: W12X26	Steel ASTM A992	97 SF	1.25 CF	490.00 lb/ft^3	1
Structural Framing	W Shapes: W12X26	Steel ASTM A992	187 SF	2.41 CF	490.00 lb/ft^3	2
Structural Framing	W Shapes: W12X26	Steel ASTM A992	146 SF	1.88 CF	490.00 lb/ft^3	2
Structural Framing	W Shapes: W12X26	Steel ASTM A992	140 SF	1.80 CF	490.00 lb/ft^3	2
Structural Framing	W Shapes: W12X26	Steel ASTM A992	40 SF	0.52 CF	490.00 lb/ft^3	1
Structural Framing	W Shapes: W12X26	Steel ASTM A992	24 SF	0.31 CF	490.00 lb/ft^3	1
Structural Framing	ClarkDietrich-SFIA-T-Horizontal: 600T125-68(50)	Steel ASTM A992	74 SF	0.22 CF	490.00 lb/ft^3	2
Structural Framing	ClarkDietrich-SFIA-T-Horizontal: 600T125-68(50)	Steel ASTM A992	133 SF	0.39 CF	490.00 lb/ft^3	4
Structural Framing	ClarkDietrich-SFIA-T-Horizontal: 600T125-68(50)	Steel ASTM A992	63 SF	0.19 CF	490.00 lb/ft^3	2
Structural Framing	ClarkDietrich-SFIA-T-Horizontal: 600T125-68(50)	Steel ASTM A992	283 SF	0.83 CF	490.00 lb/ft^3	12
Structural Framing	ClarkDietrich-SFIA-T-Horizontal: 600T125-68(50)	Steel ASTM A992	64 SF	0.19 CF	490.00 lb/ft^3	4
Structural Framing	ClarkDietrich-SFIA-T-Horizontal: 600T125-68(50)	Steel ASTM A992	41 SF	0.12 CF	490.00 lb/ft^3	3
Structural Framing	ClarkDietrich-SFIA-T-Horizontal: 600T125-68(50)	Steel ASTM A992	160 SF	0.47 CF	490.00 lb/ft^3	15
Structural Framing	ClarkDietrich-SFIA-T-Horizontal: 600T125-68(50)	Steel ASTM A992	13 SF	0.04 CF	490.00 lb/ft^3	2
Steel ASTM A992			1768 SF	14.51 CF		56

PROJECT: CEE 4850
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REVISION

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Cultural Education Center

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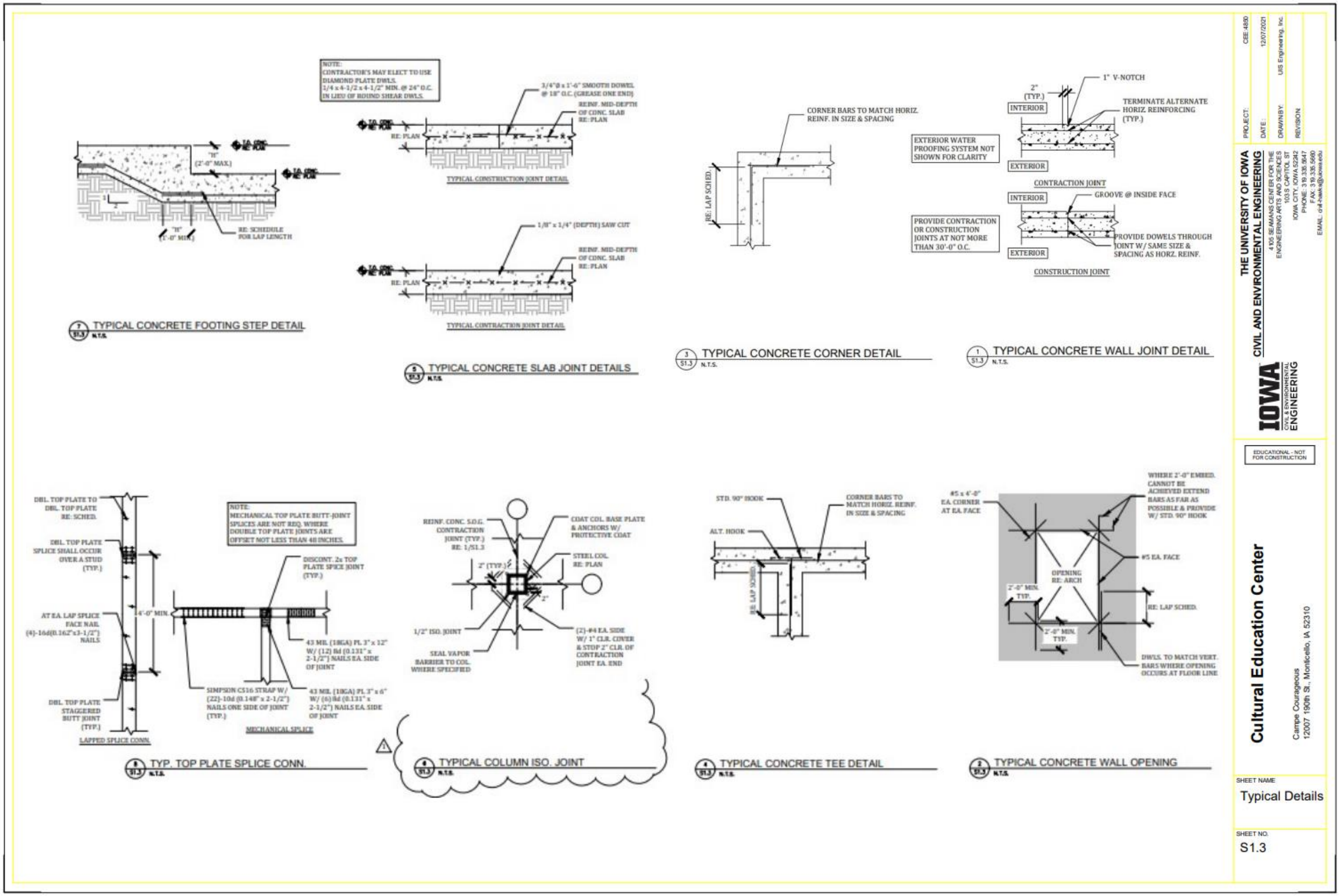
SHEET NAME
Tables & Schedules

SHEET NO.
S1.2


NOTE:
CONTRACTOR'S MAY ELECT TO USE DIAMOND PLATE DWLS.
1/4 x 4-1/2 x 4-1/2" MIN. @ 24" O.C. IN LIEU OF ROUND SHEAR DWLS.
"H" (2'-0" MAX.)
"H" (1'-0" MIN.)
RE: SCHEDULE FOR LAP LENGTH
TYPICAL CONCRETE FOOTING STEP DETAIL
N.T.S.
3/4"Ø x 1'-6" SMOOTH DOWEL @ 18" O.C. (GREASE ONE END)
REINF. MID-DEPTH OF CONC. SLAB RE: PLAN
RE: PLAN
TYPICAL CONSTRUCTION JOINT DETAIL
1/8" x 1/4" (DEPTH) SAW CUT
REINF. MID-DEPTH OF CONC. SLAB RE: PLAN
RE: PLAN
TYPICAL CONTRACTION JOINT DETAIL
TYPICAL CONCRETE SLAB JOINT DETAILS
N.T.S.
CORNER BARS TO MATCH HORIZ. REINF. IN SIZE & SPACING
RE: LAP SCHED.
TYPICAL CONCRETE CORNER DETAIL
S1.3 N.T.S.
1" V-NOTCH
2" (TYP.)
INTERIOR
TERMINATE ALTERNATE HORIZ. REINFORCING (TYP.)
EXTERIOR WATER PROOFING SYSTEM NOT SHOWN FOR CLARITY
EXTERIOR
CONTRACTION JOINT
INTERIOR
GROOVE @ INSIDE FACE
PROVIDE CONTRACTION OR CONSTRUCTION JOINTS AT NOT MORE THAN 30'-0" O.C.
PROVIDE DOWELS THROUGH JOINT W/ SAME SIZE & SPACING AS HORZ. REINF.
EXTERIOR
CONSTRUCTION JOINT
TYPICAL CONCRETE WALL JOINT DETAIL
S1.3 N.T.S.
DBL. TOP PLATE TO DBL. TOP PLATE RE: SCHED.
DBL. TOP PLATE SPLICE SHALL OCCUR OVER A STUD (TYP.)
AT EA. LAP SPLICE FACE NAIL (4)-16d(0.162"x3-1/2") NAILS
4'-0" MIN.
DBL. TOP PLATE STAGGERED BUTT JOINT (TYP.)
LAPPED SPLICE CONN.
NOTE:
MECHANICAL TOP PLATE BUTT-JOINT SPLICES ARE NOT REQ. WHERE DOUBLE TOP PLATE JOINTS ARE OFFSET NOT LESS THAN 48 INCHES.
DISCONT. 2x TOP PLATE SPICE JOINT (TYP.)
43 MIL (18GA) PL 3" x 12" W/ (12) 8d (0.131" x 2-1/2") NAILS EA. SIDE OF JOINT
SIMPSON CS16 STRAP W/ (22)-10d (0.148" x 2-1/2") NAILS ONE SIDE OF JOINT (TYP.)
43 MIL (18GA) PL 3" x 6" W/ (6) 8d (0.131" x 2-1/2") NAILS EA. SIDE OF JOINT
MECHANICAL SPLICE
TYP. TOP PLATE SPLICE CONN.
N.T.S.
REINF. CONC. S.O.G. CONTRACTION JOINT (TYP.) RE: 1/S1.3
COAT COL. BASE PLATE & ANCHORS W/ PROTECTIVE COAT
STEEL COL. RE: PLAN
2" (TYP.)
2"
1/2" ISO. JOINT
(2)-#4 EA. SIDE W/ 1" CLR. COVER & STOP 2" CLR. OF CONTRACTION JOINT EA. END
SEAL VAPOR BARRIER TO COL. WHERE SPECIFIED
TYPICAL COLUMN ISO. JOINT
N.T.S.
STD. 90° HOOK
CORNER BARS TO MATCH HORIZ. REINF. IN SIZE & SPACING
ALT. HOOK
RE: LAP SCHED.
TYPICAL CONCRETE TEE DETAIL
N.T.S.
#5 x 4'-0" EA. CORNER AT EA. FACE
WHERE 2'-0" EMBED. CANNOT BE ACHIEVED EXTEND BARS AS FAR AS POSSIBLE & PROVIDE W/ STD. 90° HOOK
#5 EA. FACE
OPENING RE: ARCH
2'-0" MIN. TYP.
RE: LAP SCHED.
2'-0" MIN. TYP.
DWLS. TO MATCH VERT. BARS WHERE OPENING OCCURS AT FLOOR LINE
TYPICAL CONCRETE WALL OPENING
N.T.S.
PROJECT: CEE:4850
DATE: 12/07/2021
DRAWN BY: UIS Engineering, Inc.
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SHEET NAME
Typical Details
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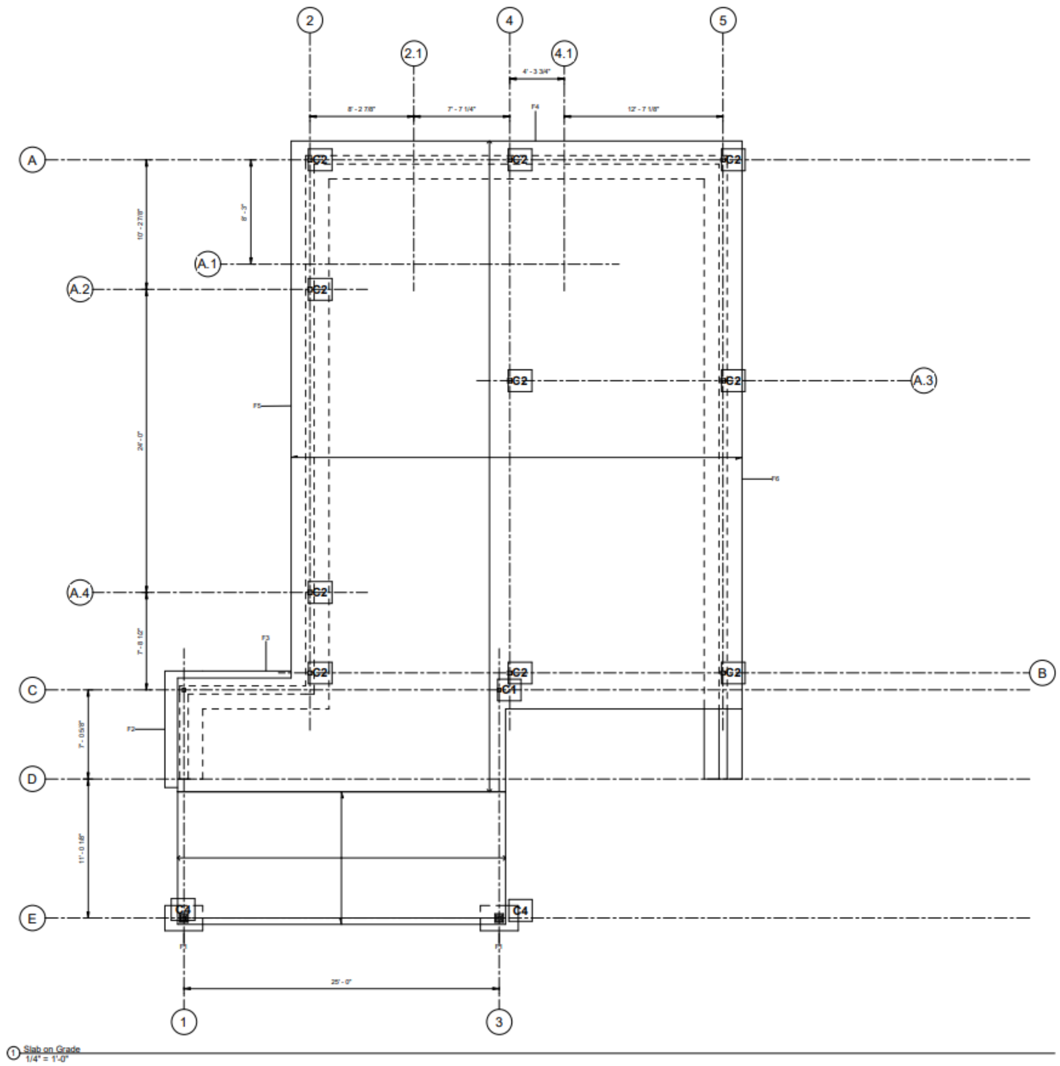

Wall Footing Schedule				
Mark	Width	Length	Volume	Type
F1	3' - 0"	2' - 0"	4.00 CF	Bearing Footing - 36" x 12"
F2	3' - 0"	8' - 0 5/8"	17.54 CF	Bearing Footing - 36" x 12"
F3	3' - 0"	11' - 4"	20.00 CF	Bearing Footing - 36" x 12"
F4	3' - 0"	34' - 9"	65.50 CF	Bearing Footing - 36" x 12"
F5	3' - 0"	43' - 3 3/8"	83.90 CF	Bearing Footing - 36" x 12"
F6	3' - 0"	50' - 0"	94.99 CF	Bearing Footing - 36" x 12"
F7	7' - 6"	8' - 0 5/8"	60.16 CF	Bearing Footing - 90" x 12"
F8	7' - 6"	11' - 11 1/4"	89.49 CF	Bearing Footing - 90" x 12"
F9	7' - 6"	46' - 5 5/8"	348.31 CF	Bearing Footing - 90" x 12"
F10	7' - 6"	80' - 5"	603.00 CF	Bearing Footing - 90" x 12"

Structural Column Schedule	
Mark	Type
C1	HSS3X3X3/8
C2	HSS4X4X1/4
C3	600S162-68(50)
C4	HSS6X6X5/8

Wall Foundation Schedule				
Mark	Type	Width	Length	Volume
W1	Exterior - 8" Concrete	0' - 8"	0' - 8"	1.56 CF
W2	Exterior - 8" Concrete	0' - 8"	7' - 6 5/8"	15.66 CF
W3	Exterior - 8" Concrete	0' - 8"	32' - 9"	77.97 CF
W4	Exterior - 8" Concrete	0' - 8"	49' - 6"	113.54 CF
W5	Exterior - 8" Concrete	0' - 8"	10' - 0"	23.33 CF
W6	Exterior - 8" Concrete	0' - 8"	41' - 11 3/8"	97.88 CF
W7	Retaining - 12" Concrete	1' - 0"	8' - 0 3/8"	80.99 CF
W8	Retaining - 12" Concrete	1' - 0"	11' - 11"	119.84 CF
W9	Retaining - 12" Concrete	1' - 0"	46' - 5 3/8"	468.32 CF
W10	Retaining - 12" Concrete	1' - 0"	80' - 4 3/4"	810.66 CF

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DATE: 12/07/2021
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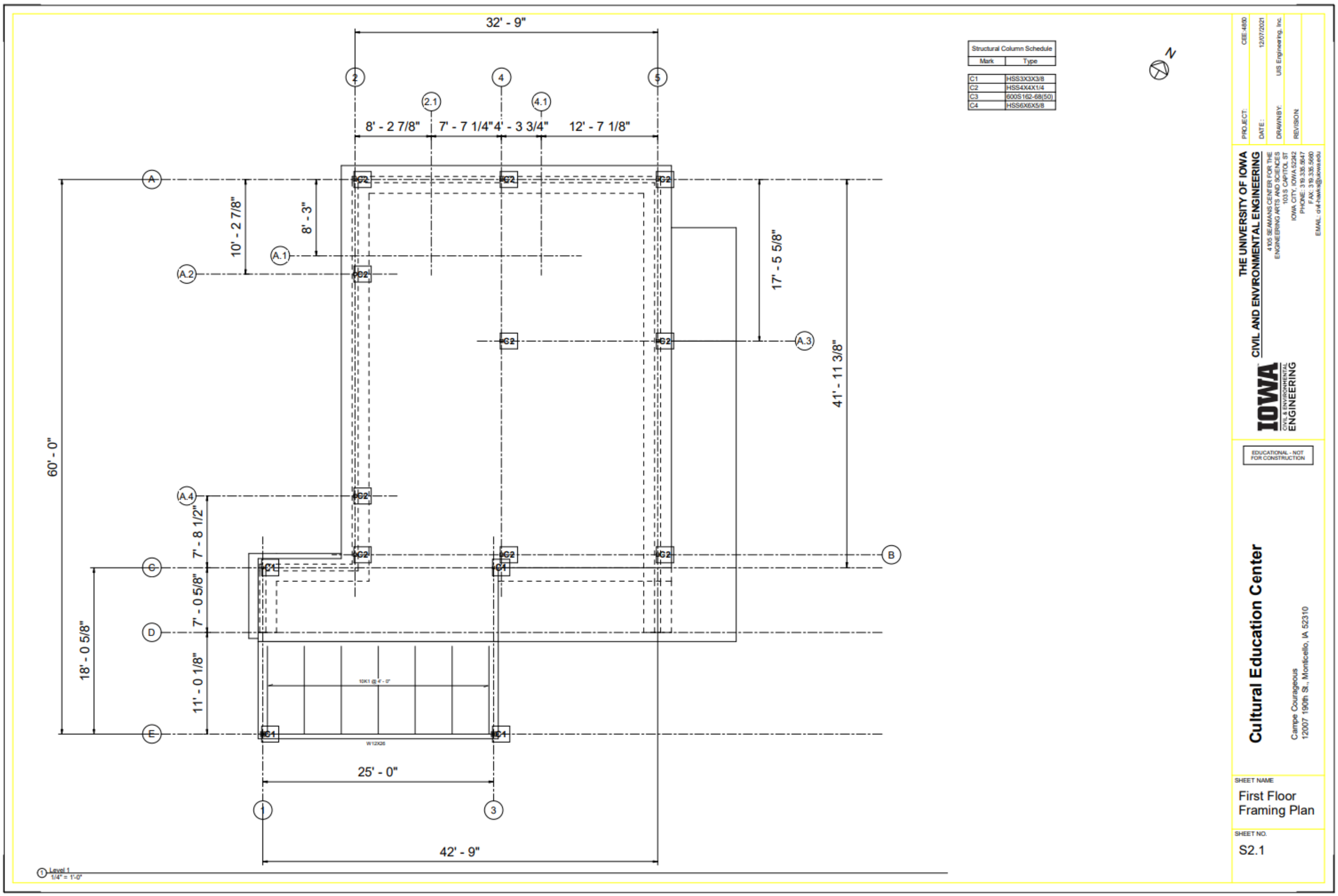
SHEET NAME
Foundation Plan

SHEET NO.
S2.0


32' - 9"
8' - 2 7/8"
7' - 7 1/4"
4' - 3 3/4"
12' - 7 1/8"
10' - 2 7/8"
8' - 3"
17' - 5 5/8"
41' - 11 3/8"
60' - 0"
7' - 8 1/2"
7' - 0 5/8"
11' - 0 1/8"
18' - 0 5/8"
25' - 0"
42' - 9"
Structural Column Schedule
Mark Type
C1 HSS3X3X3/8
C2 HSS4X4X1/4
C3 600S162-68(50)
C4 HSS6X6X5/8
N
PROJECT: CEE:4850
DATE: 12/07/2021
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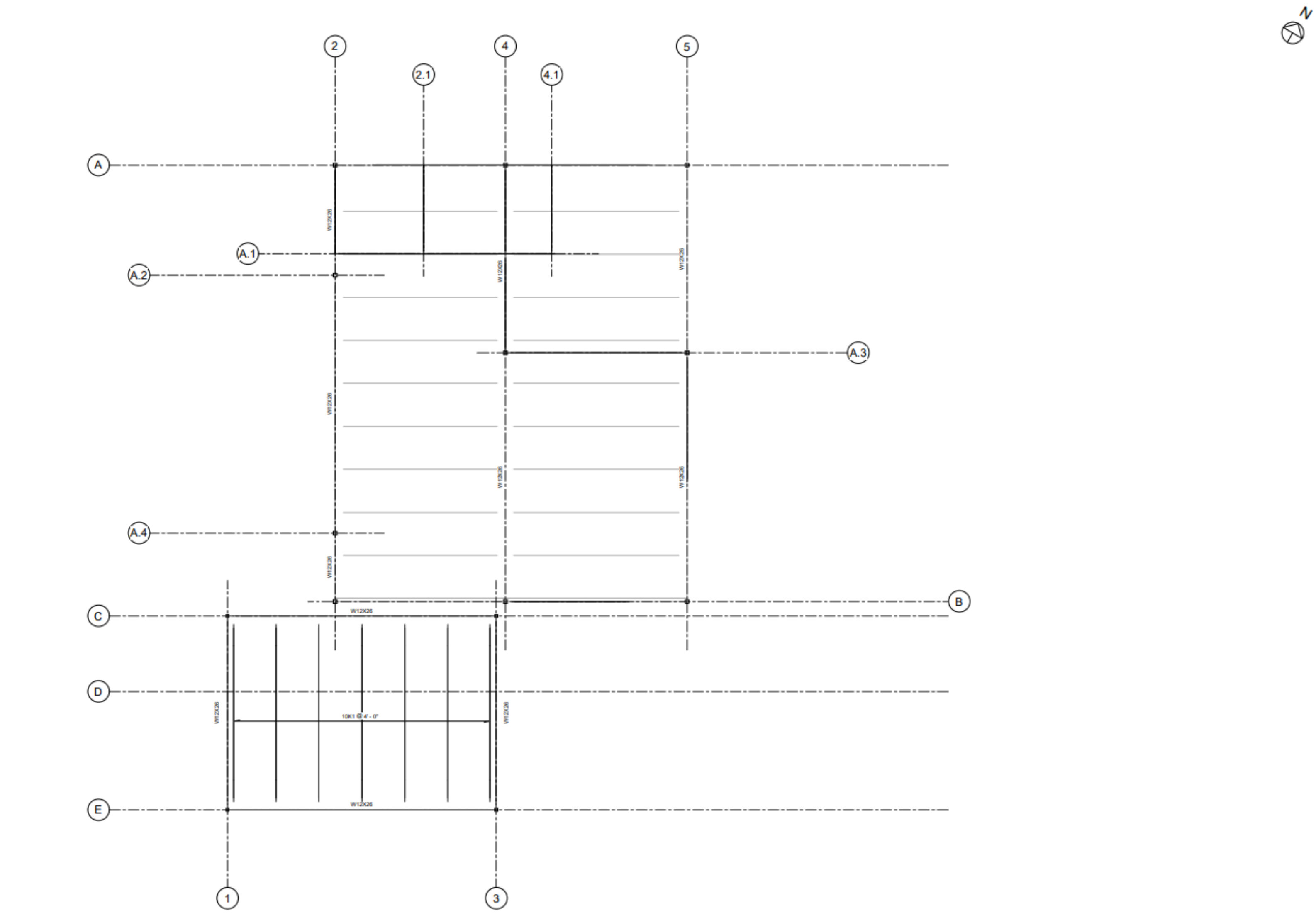
SHEET NAME
First Floor Framing Plan
SHEET NO.
S2.1
Level 1
1/4" = 1'-0"



1 Viewing Area Roof Bottom
1/4" = 1'-0"

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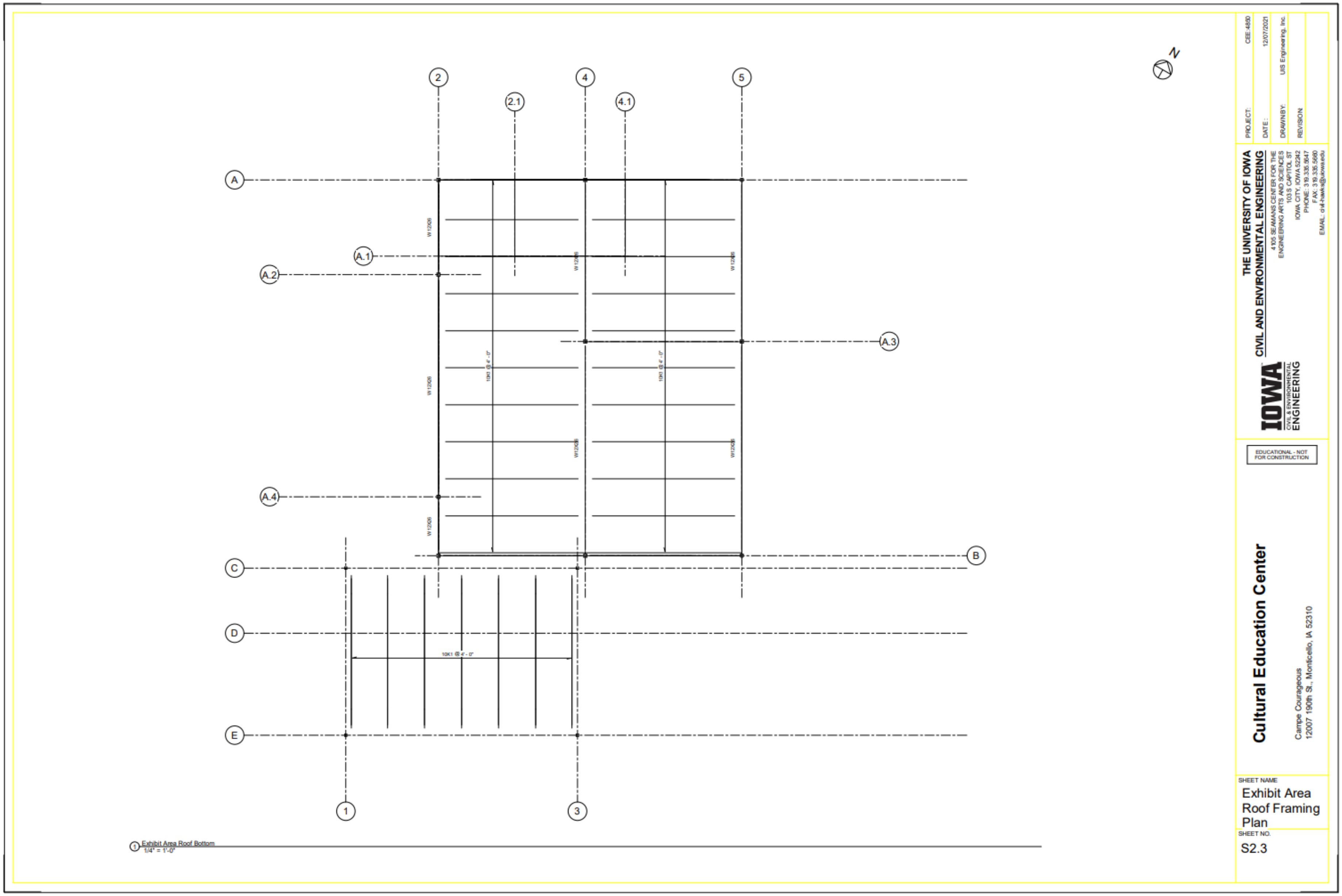
SHEET NAME
Viewing Area Roof Framing Plan

SHEET NO.
S2.2


N
2
4
5
2.1
4.1
A
A.1
A.2
A.3
A.4
B
C
D
E
1
3
10K1 @ 4' - 0"
Exhibit Area Roof Bottom
1/4" = 1'-0"
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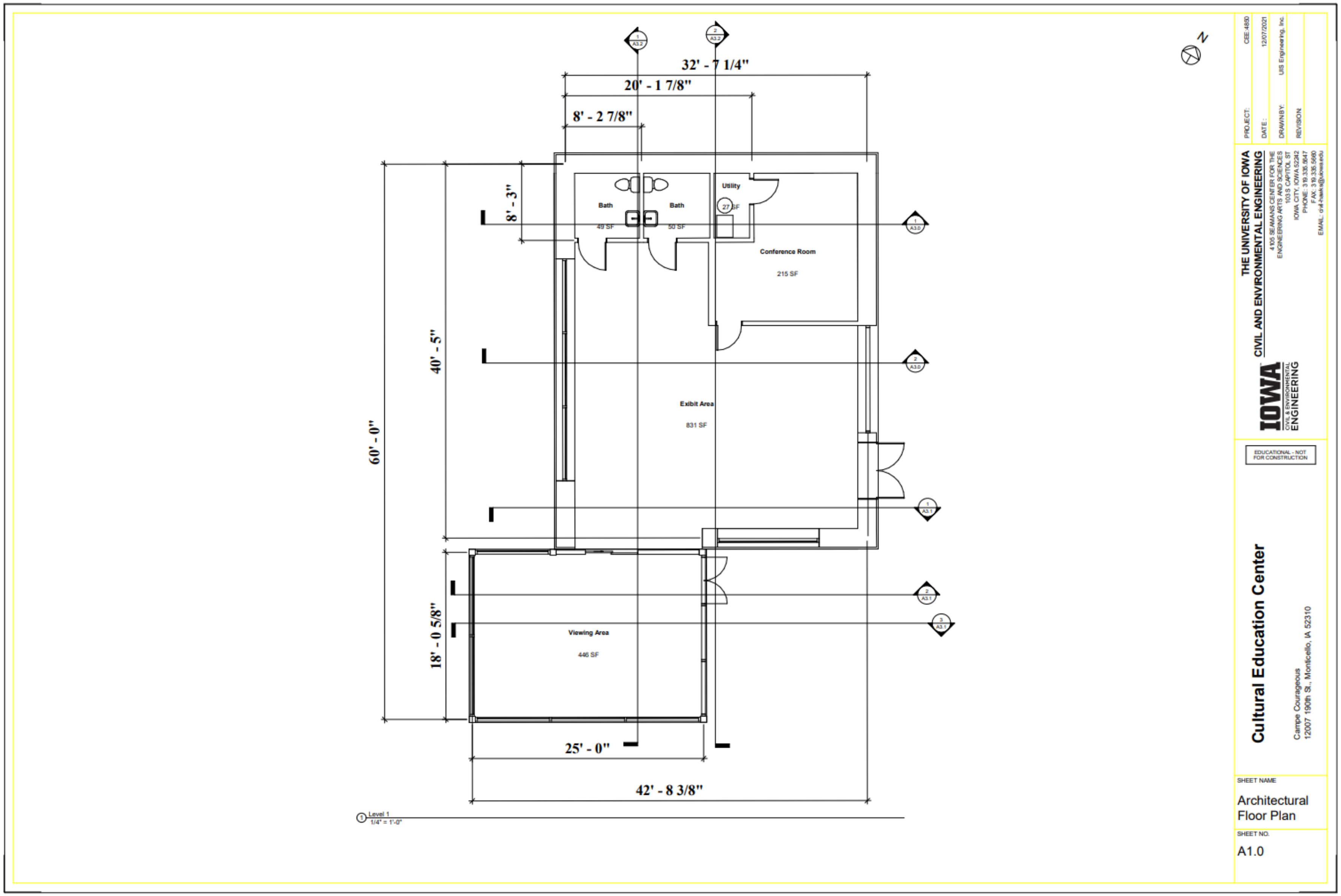
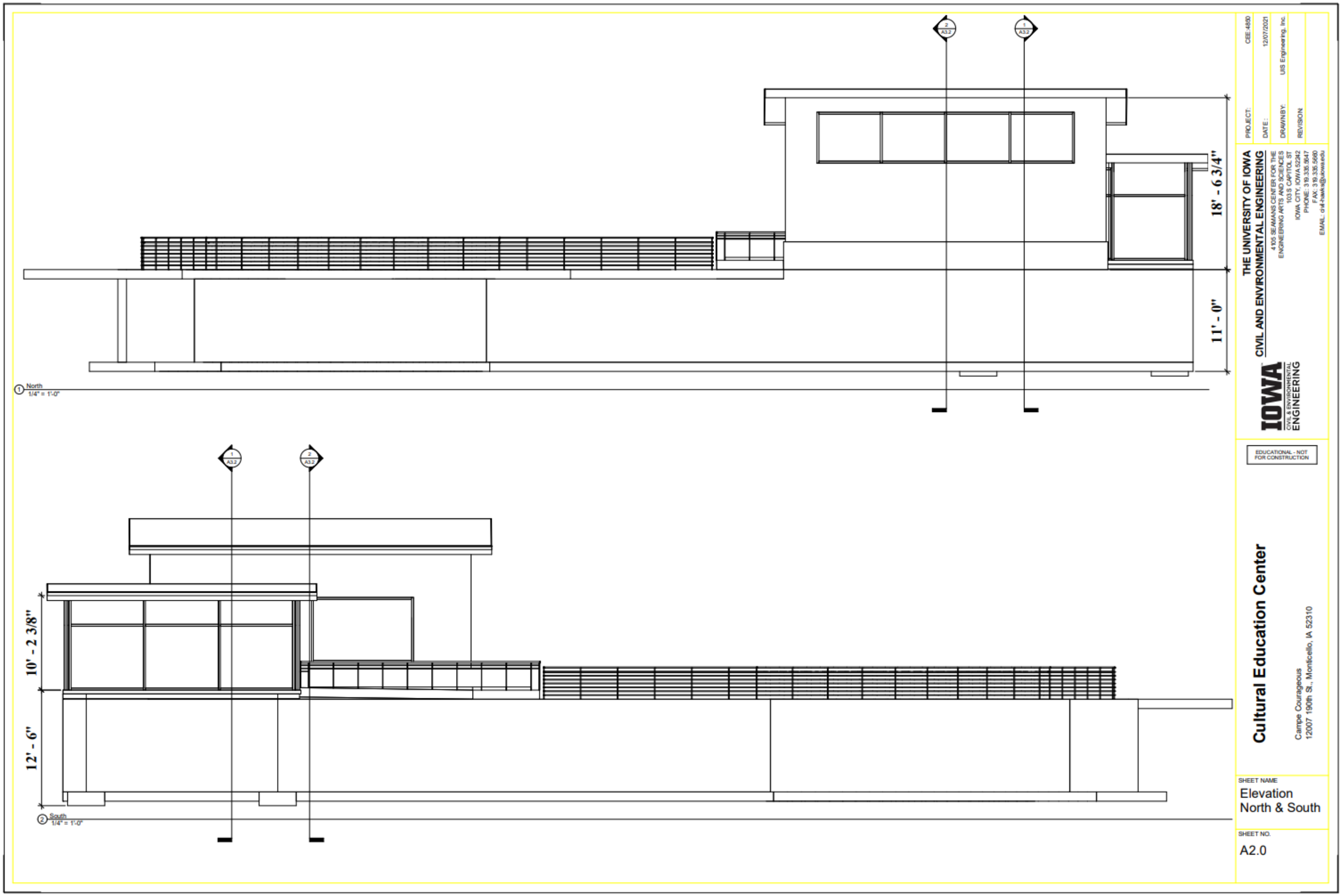
SHEET NAME
Exhibit Area Roof Framing Plan
SHEET NO.
S2.3

Appendix I –Architectural Sheets




18' - 6 3/4"
11' - 0"
North
1/4" = 1'-0"
10' - 2 3/8"
12' - 6"
South
1/4" = 1'-0"
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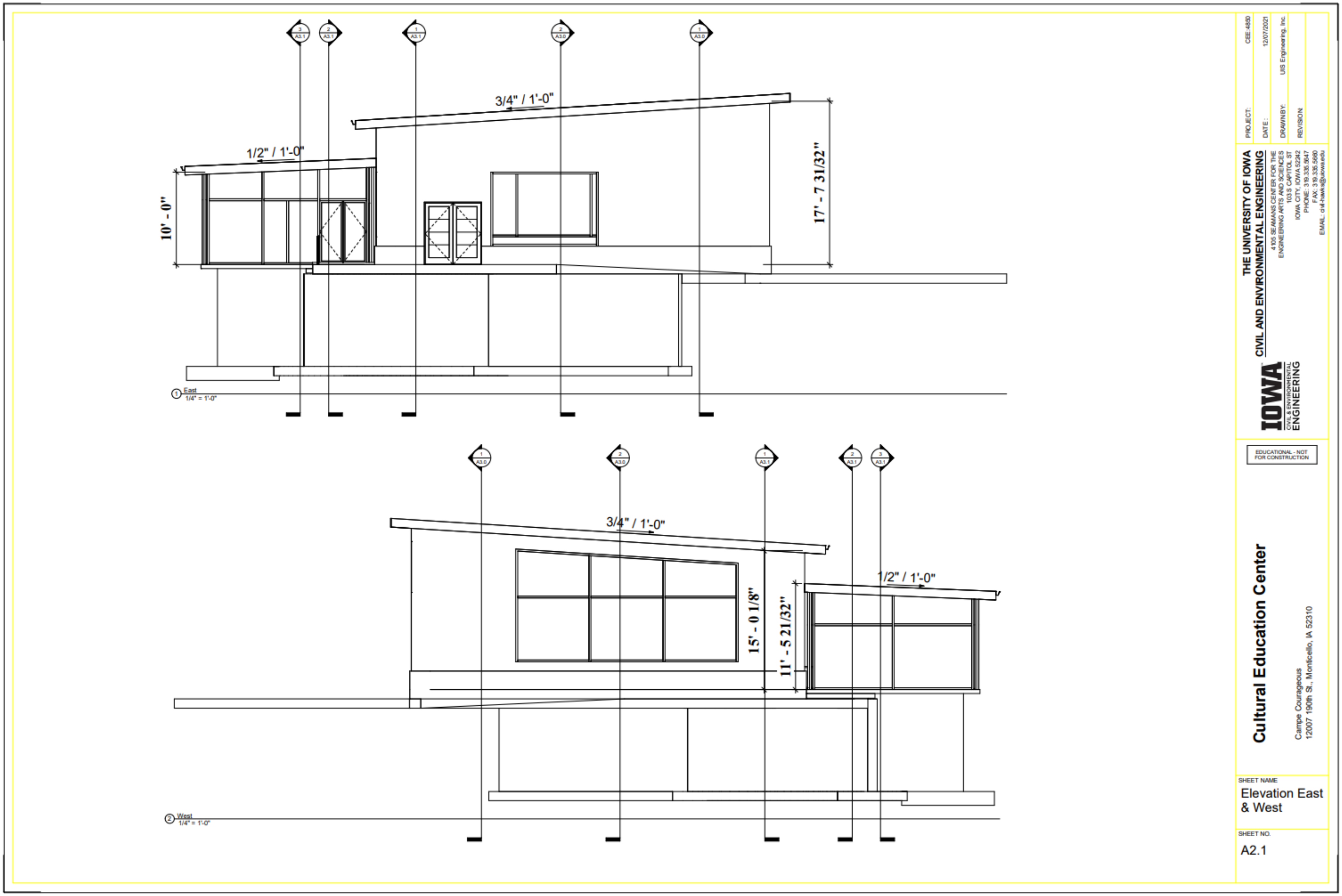
SHEET NAME
Elevation
North & South
SHEET NO.
A2.0


3/4" / 1'-0"
1/2" / 1'-0"
10' - 0"
17' - 7 31/32"
East
1/4" = 1'-0"
3/4" / 1'-0"
1/2" / 1'-0"
15' - 0 1/8"
11' - 5 21/32"
West
1/4" = 1'-0"
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DATE: 12/07/2021
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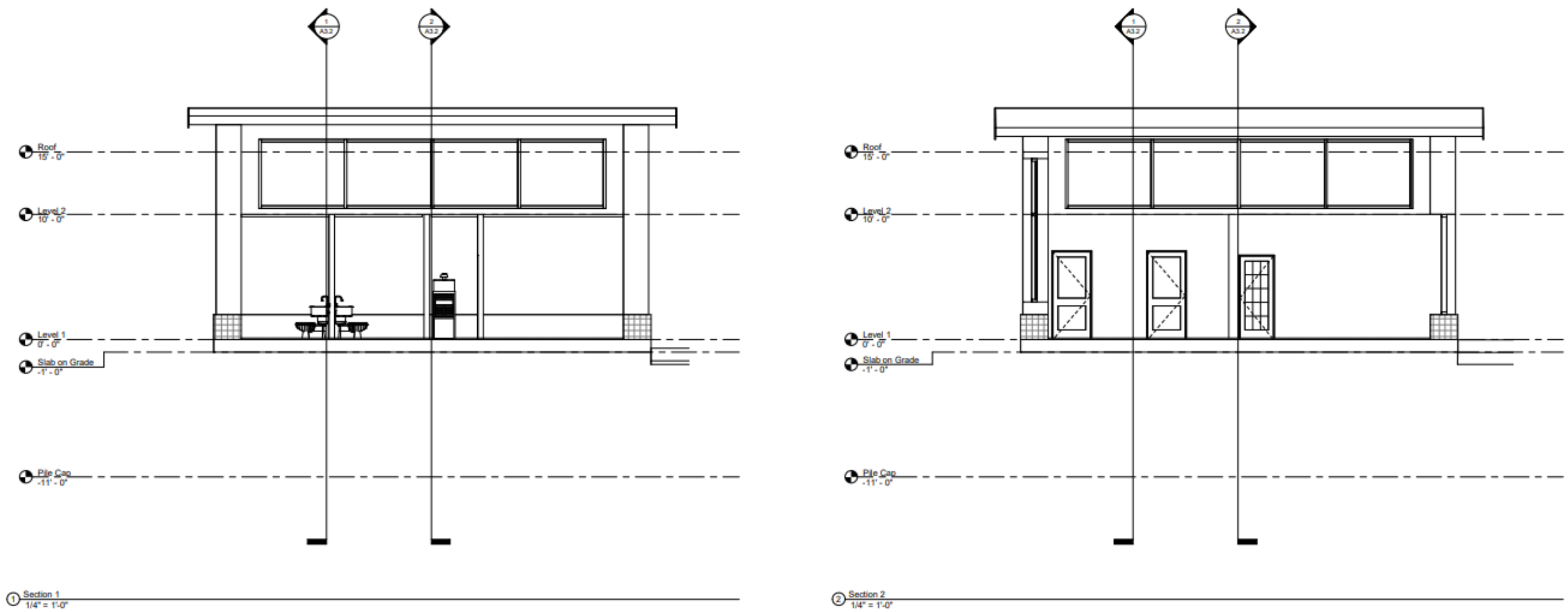
SHEET NAME
Elevation East & West
SHEET NO.
A2.1



PROJECT: CEE:4850
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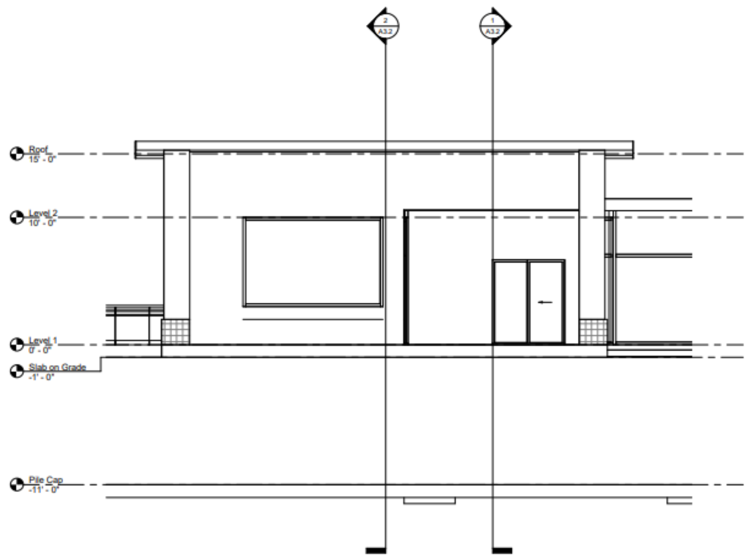
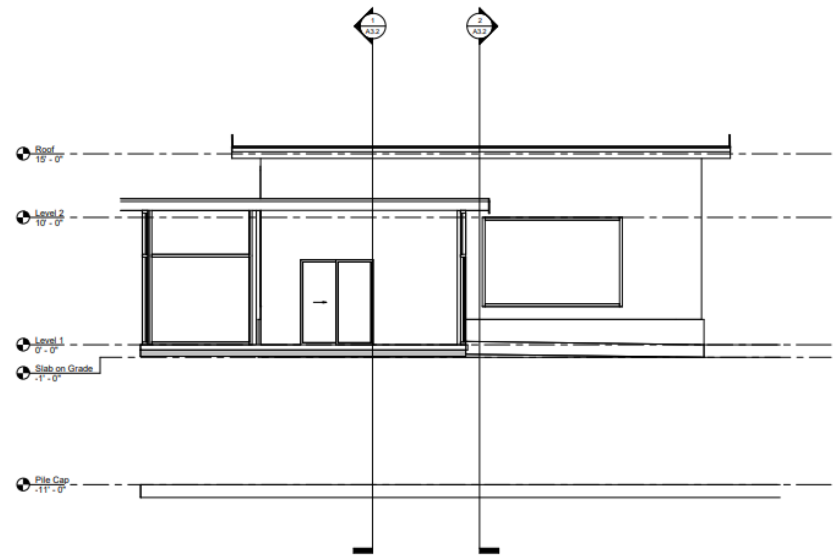
SHEET NAME
Wall Cross-Sections

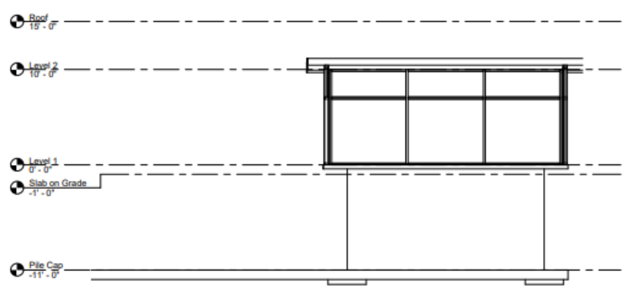
SHEET NO.
A3.0



1 Section 3
1/4" = 1'-0"



2 Section 4
1/4" = 1'-0"



3 Section 5
3/16" = 1'-0"

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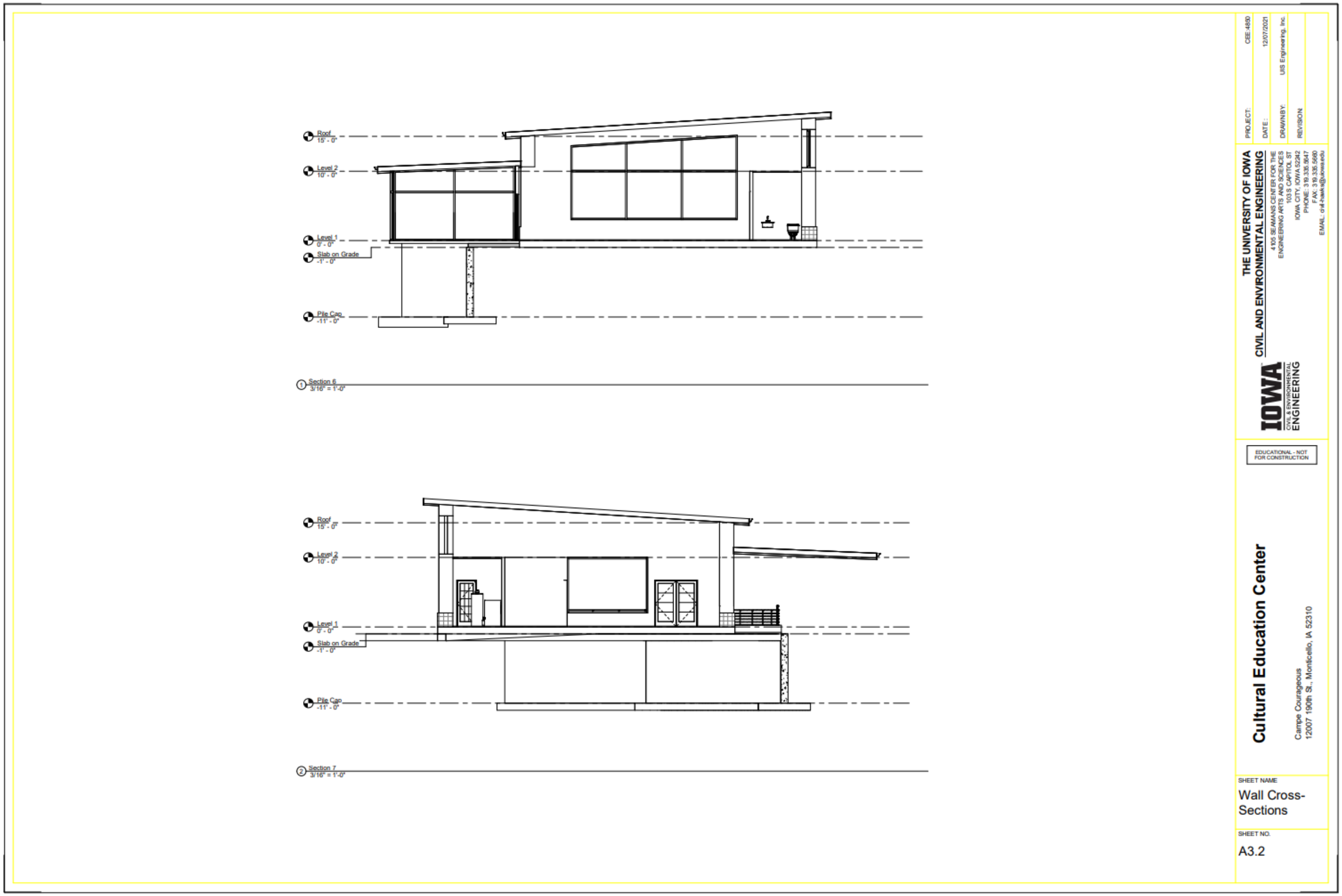
SHEET NAME
Wall Cross-Sections

SHEET NO.
A3.1


Roof
15' - 0"
Level 2
10' - 0"
Level 1
0' - 0"
Slab on Grade
-1' - 0"
Pile Cap
-11' - 0"
Section 6
3/16" = 1'-0"
Roof
15' - 0"
Level 2
10' - 0"
Level 1
0' - 0"
Slab on Grade
-1' - 0"
Pile Cap
-11' - 0"
Section 7
3/16" = 1'-0"
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Wall Cross-Sections
SHEET NO.
A3.2

Appendix J –Design Renderings and Models


LUMION
PRO STUDENT