STEAM ENGINE BUILDING

CONCEPT FROM TEAM SD

BROOKE WENTZ
SCHEMATIC DESIGN
ARCH 5226
HONORS THESIS

TABLE OF CONTENTS

SCHEMATIC DESIGN

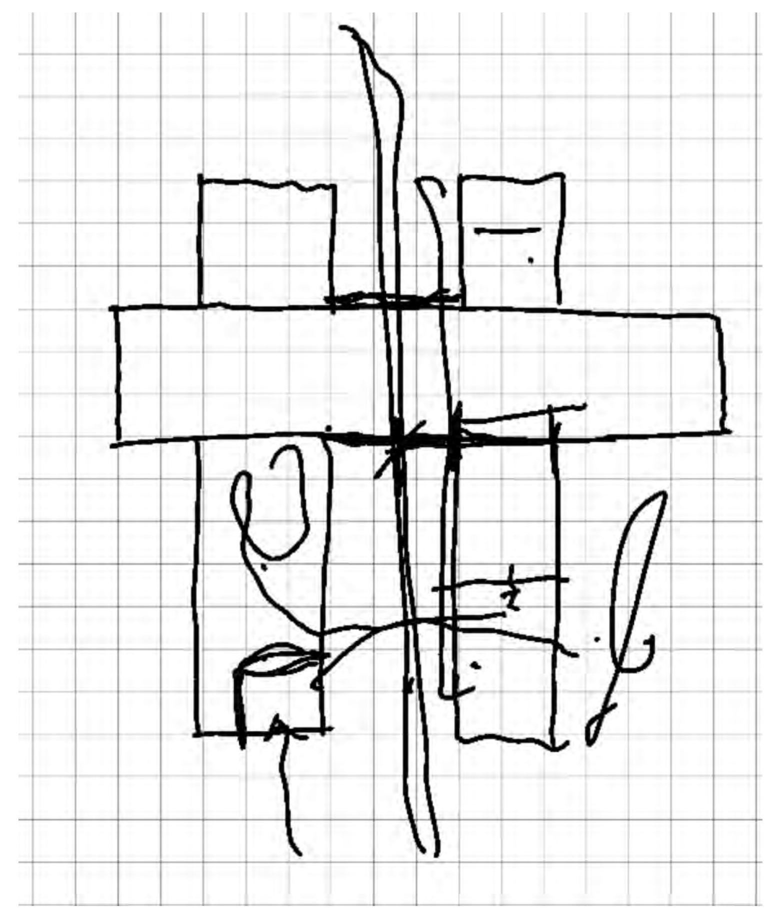
DESIGN DEVELOPMENT

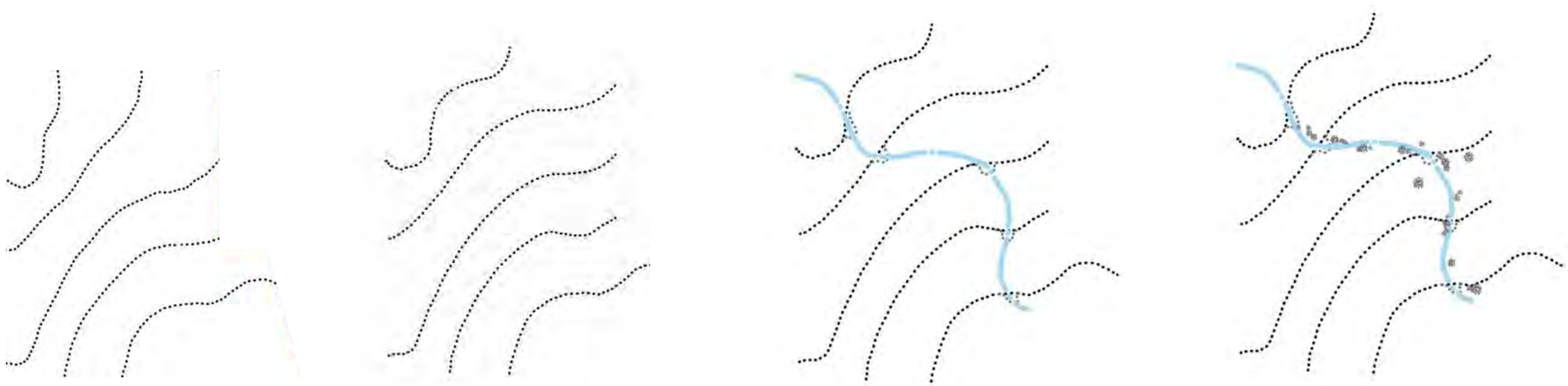
CONSTRUCTION DOCUMENTS

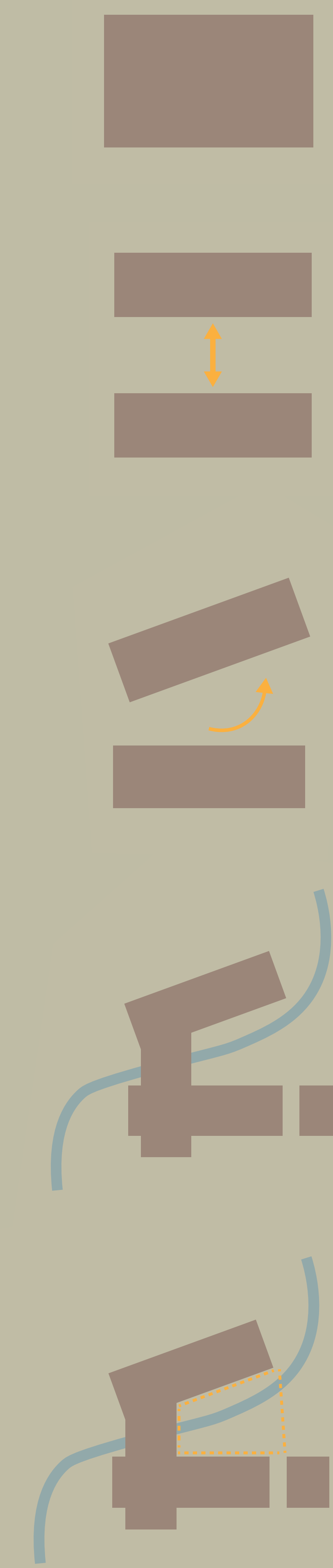
CONCEPT FROM SCHEMATIC DESIGN

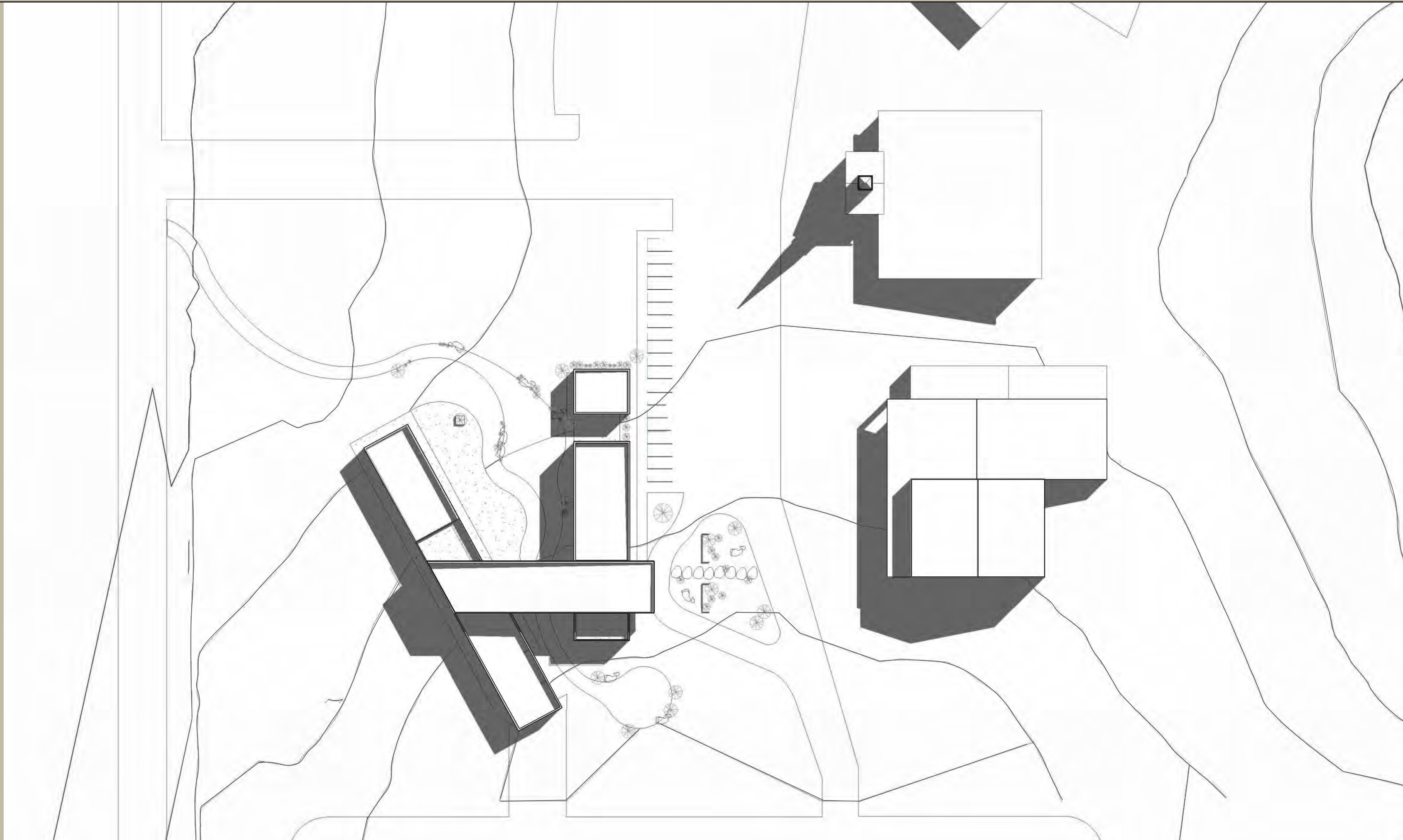
LOW IMPACT DEVELOPMENT

Traditional Oklahoma schools generally rest on flat sites with minimal landscaping due to the focus of an indoor learning environment. Flat sites and indoor learning conditions prevent children from connecting to the outside world because they are solely taught inside while not exploring their outward surroundings. Therefore, the action of “deinstitutionalizing” the traditional school site with Low Impact Development (LID) techniques is the driving force in the design of the STEAM building. The site contours of the STEAM building manipulate the earth, creating a "retention river" that runs between two ground level buildings. A "retention river" helps remove the unappealing detention pond located on the northern end of the site by redirecting water drainage. Vegetated buffers rest on either side of the riverbanks to manage runoff while also adding natural landscaping to the site. The centralized courtyard, next to the "retention river", is the ultimate path of circulation where children are constantly submerged in nature. Pervious concrete is the chosen exterior ground material because it mitigates water drainage and improves the site. Large curtain wall systems and glass folding doors are used to connect the interior classrooms to the exterior environment. The second-floor office space connects to the outdoors through curtain wall systems and outdoor terraces. By providing a non-traditional STEAM facility site, the natural world is brought to the common classroom through LID methods while also encouraging students to learn through outdoor experiences.





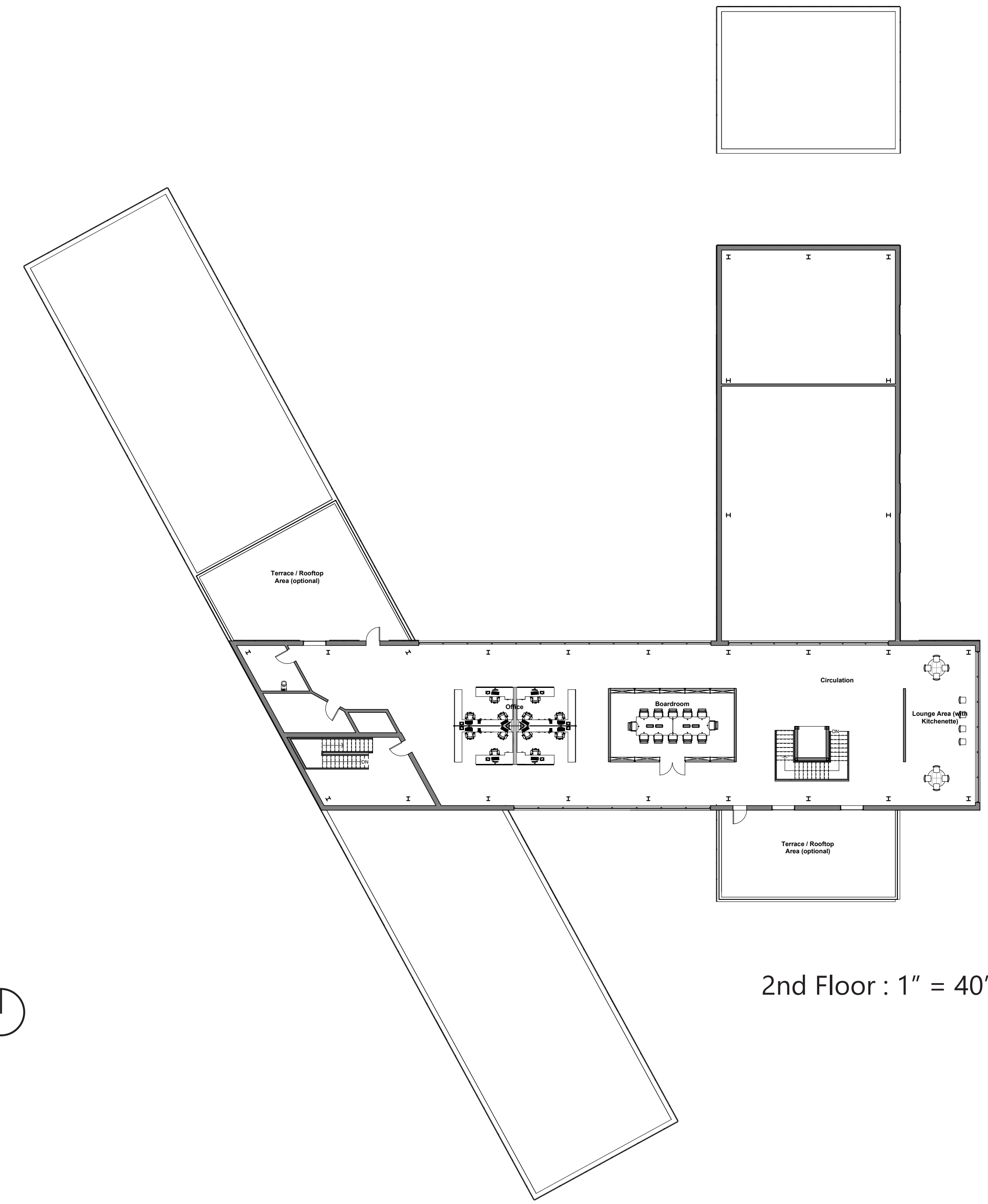




Site Plan : 1″= 60′

Aerial Site Plan

Ground Floor : 1” = 40’

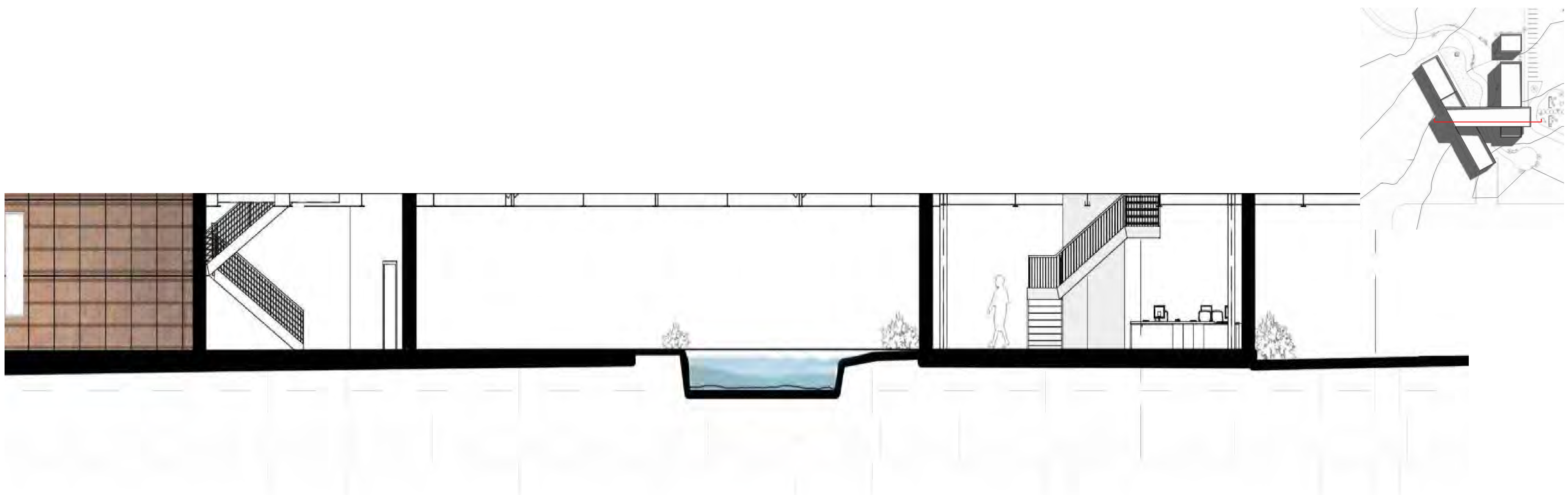


2nd Floor : 1” = 40’

Gross Area : 26,219 SQFT
Net Area : 20,173 SQFT

Floor Plans : 1” = 40’

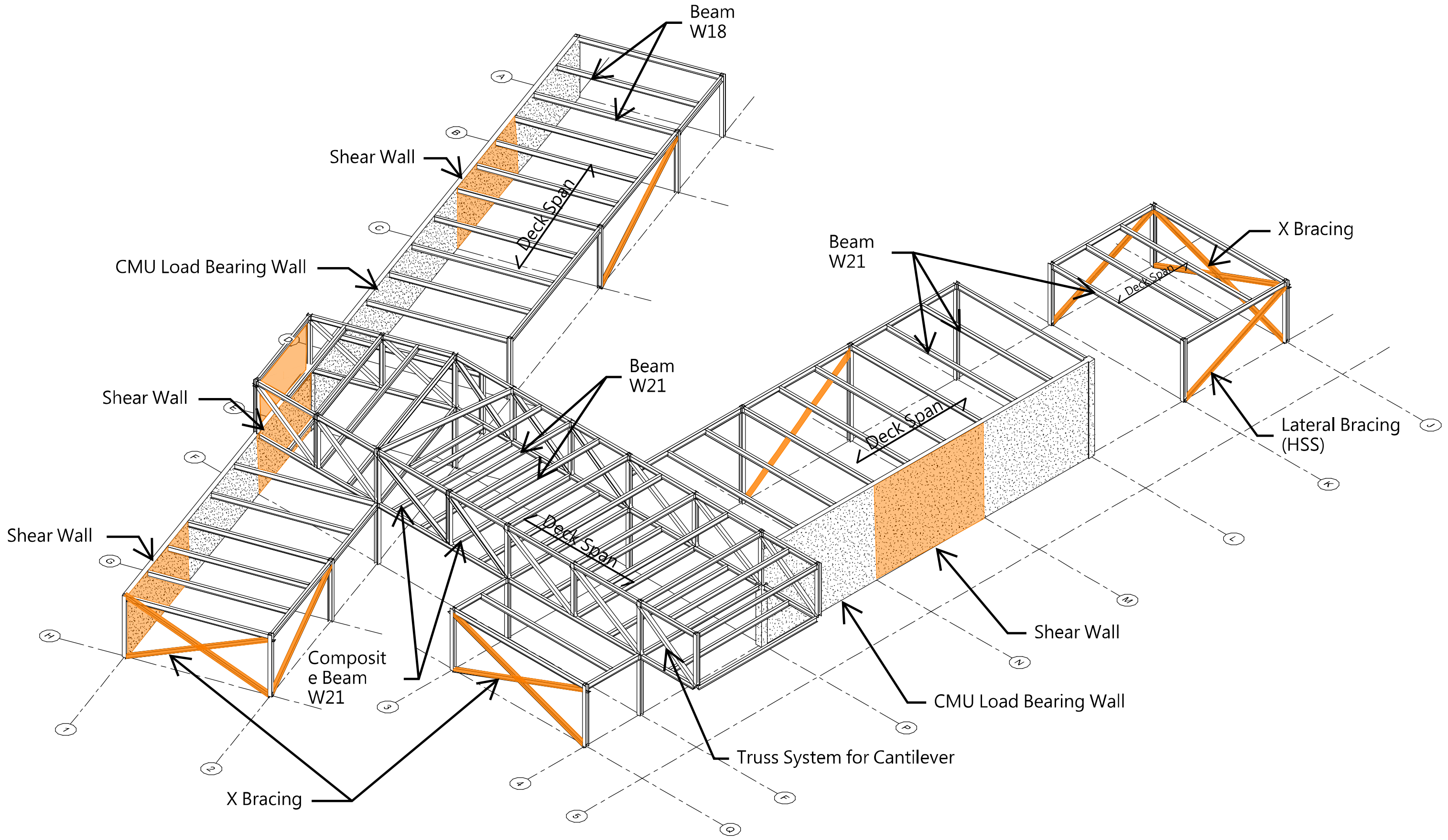
North Elevation : 1/16” = 1-0’



Section : 1/16” = 1-0’

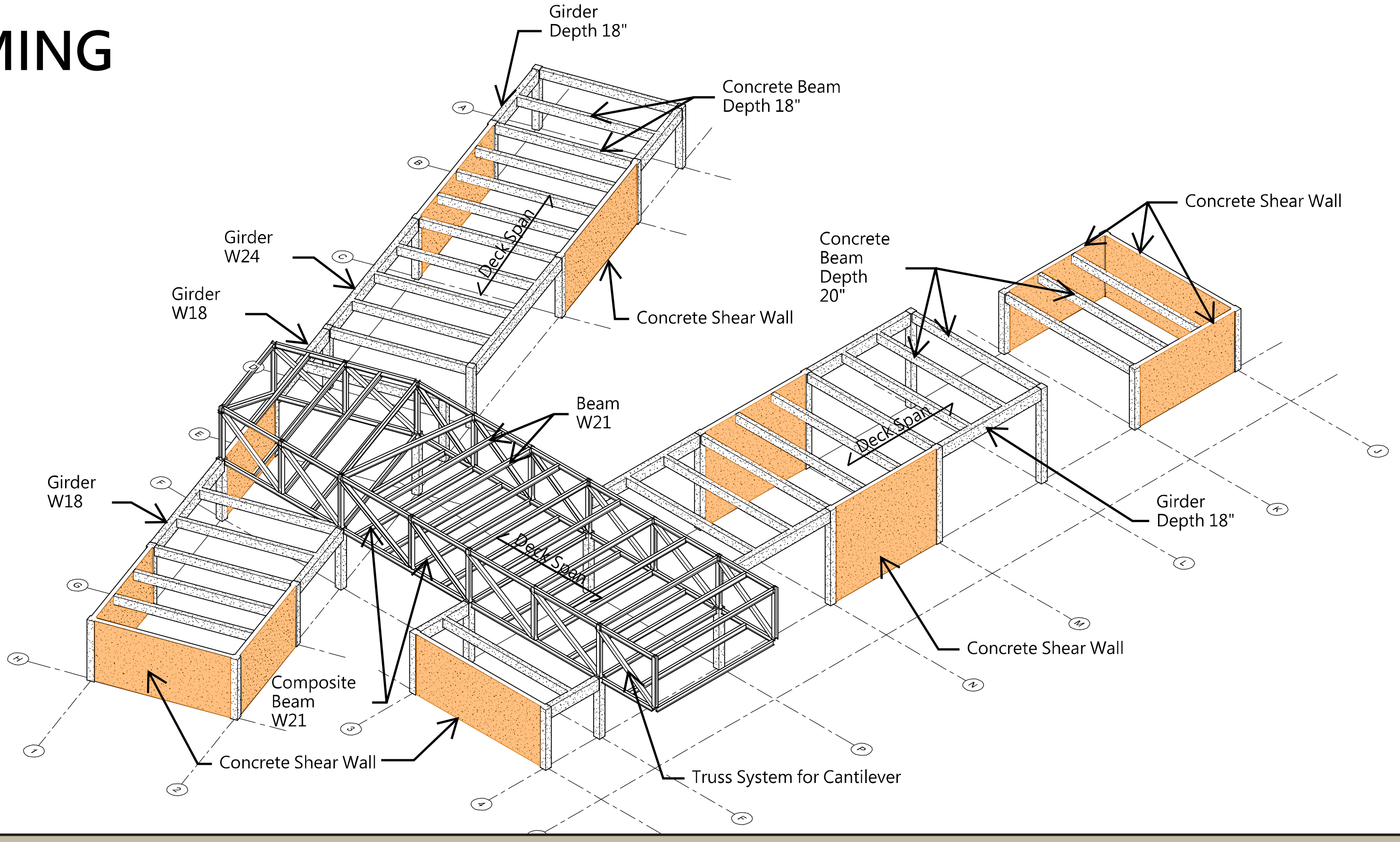
STRUCTURAL SYSTEM 1: **LOAD BEARING MASONRY AND STEEL FRAMING**

The first structural system exploration is load bearing CMU with steel framing. Composite steel beams support the second floor. Steel beams were chosen for the roof framing over steel joists to better support rooftop terraces and green roofs. Diagonal bracing, X bracing, and shear walls will serve as the lateral force resisting system for both portions of the building. These will occur where there are not garage doors into the studio spaces. The spans for the steel beams and girders range from 20'-0" to 38'-0". The studio spaces will remain column free since those spaces span 30'-0" and 35'-0". The exterior walls of each portion of the buildings have load bearing CMU which serve as a visual barrier. This will draw attention to the central courtyard, a main design aesthetic, between the two building portions.



STRUCTURAL SYSTEM 2: **CONCRETE AND STEEL FRAMING**

The second structural system exploration is concrete framing with composite steel beams supporting the second floor. Concrete beams were chosen for the roof framing to support rooftop terraces and green roofs. Shear walls will serve as the lateral force resisting system for both portions of the building. These will occur where there are not garage doors into the studio spaces. The spans for the concrete beams and girders range from 20'-0" to 38'-0". The studio spaces will remain column free since those spaces span 30'-0" and 35'-0".



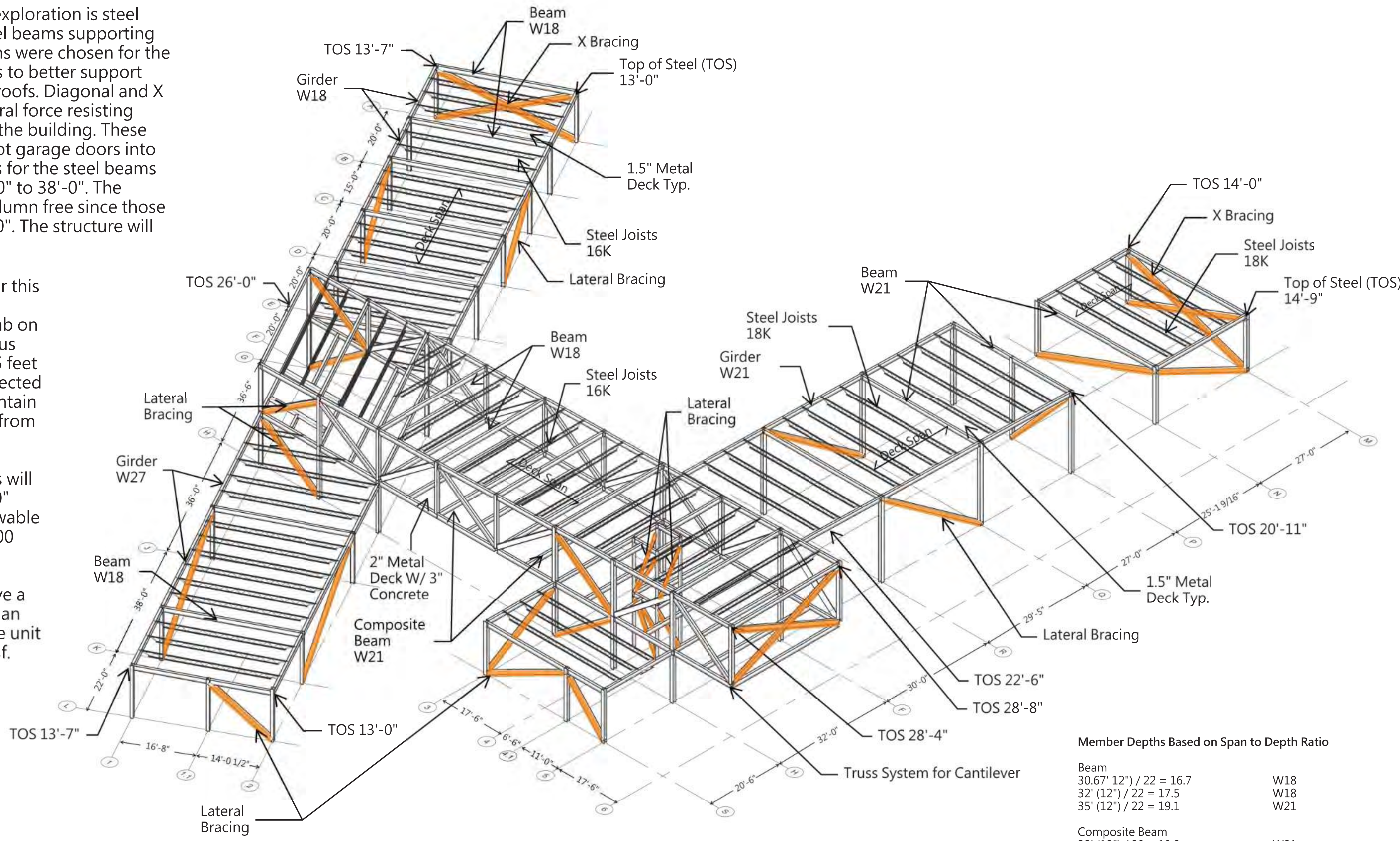
STRUCTURAL SYSTEM #3: **STEEL FRAMING**

The third structural system exploration is steel framing with composite steel beams supporting the second floor. Steel beams were chosen for the roof framing over steel joists to better support rooftop terraces and green roofs. Diagonal and X bracing will serve as the lateral force resisting system for both portions of the building. These will occur where there are not garage doors into the studio spaces. The spans for the steel beams and girders range from 20'-0" to 38'-0". The studio spaces will remain column free since those spaces span 30'-0" and 35'-0". The structure will be as exposed as possible.

The proposed foundation for this building is a shallow footing foundation system with a slab on grade. Spread and continuous footings will bear at least 2.5 feet below final grade to be protected from frost heave and to maintain constant moisture pressure from soils.

Spread footings for columns will have a minimum width of 30" and be designed for an allowable unit bearing pressure of 2,000 psf.

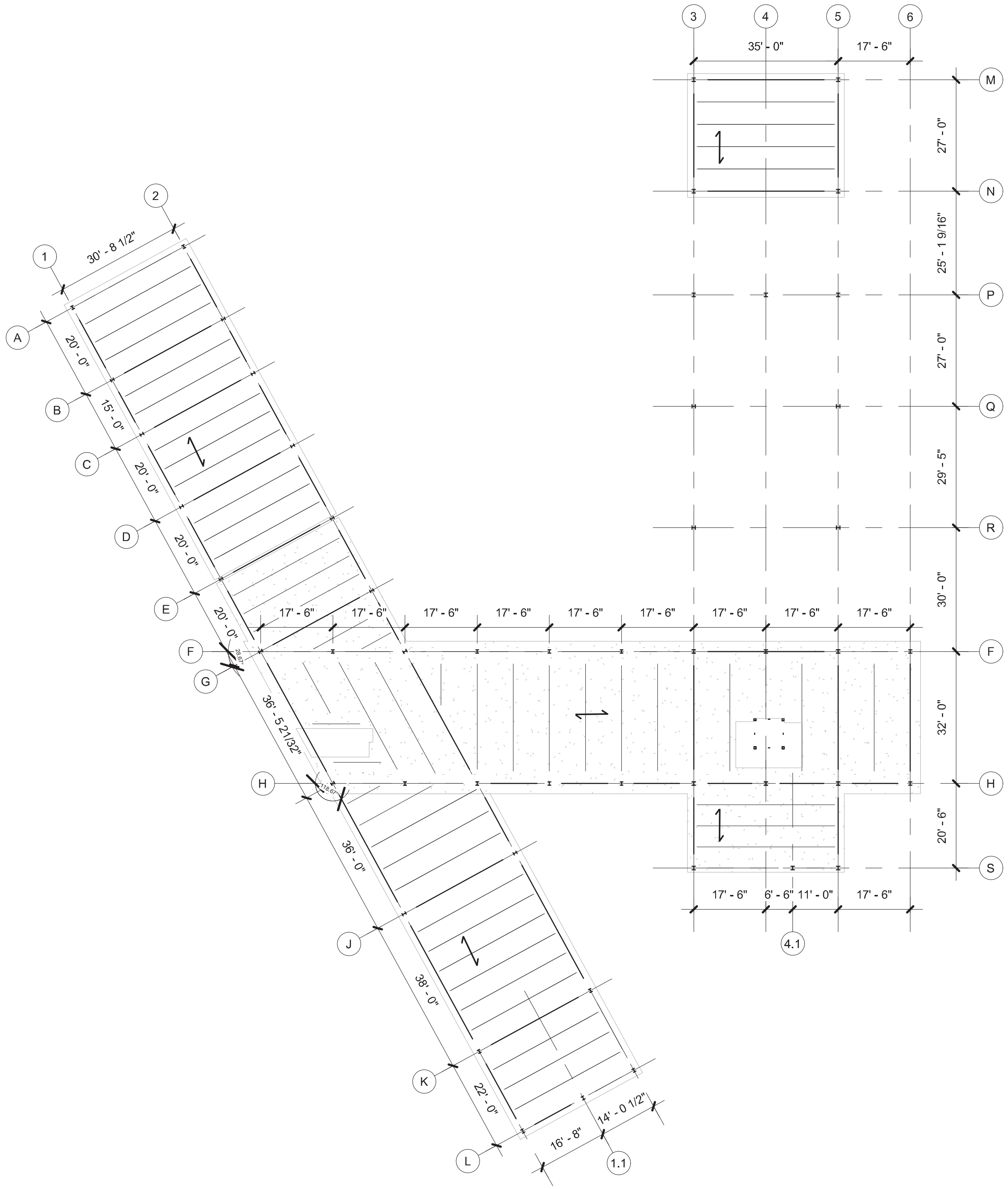
Continuous footings will have a minimum width of 16" and can be designed for an allowable unit bearing pressure of 1,600 psf.



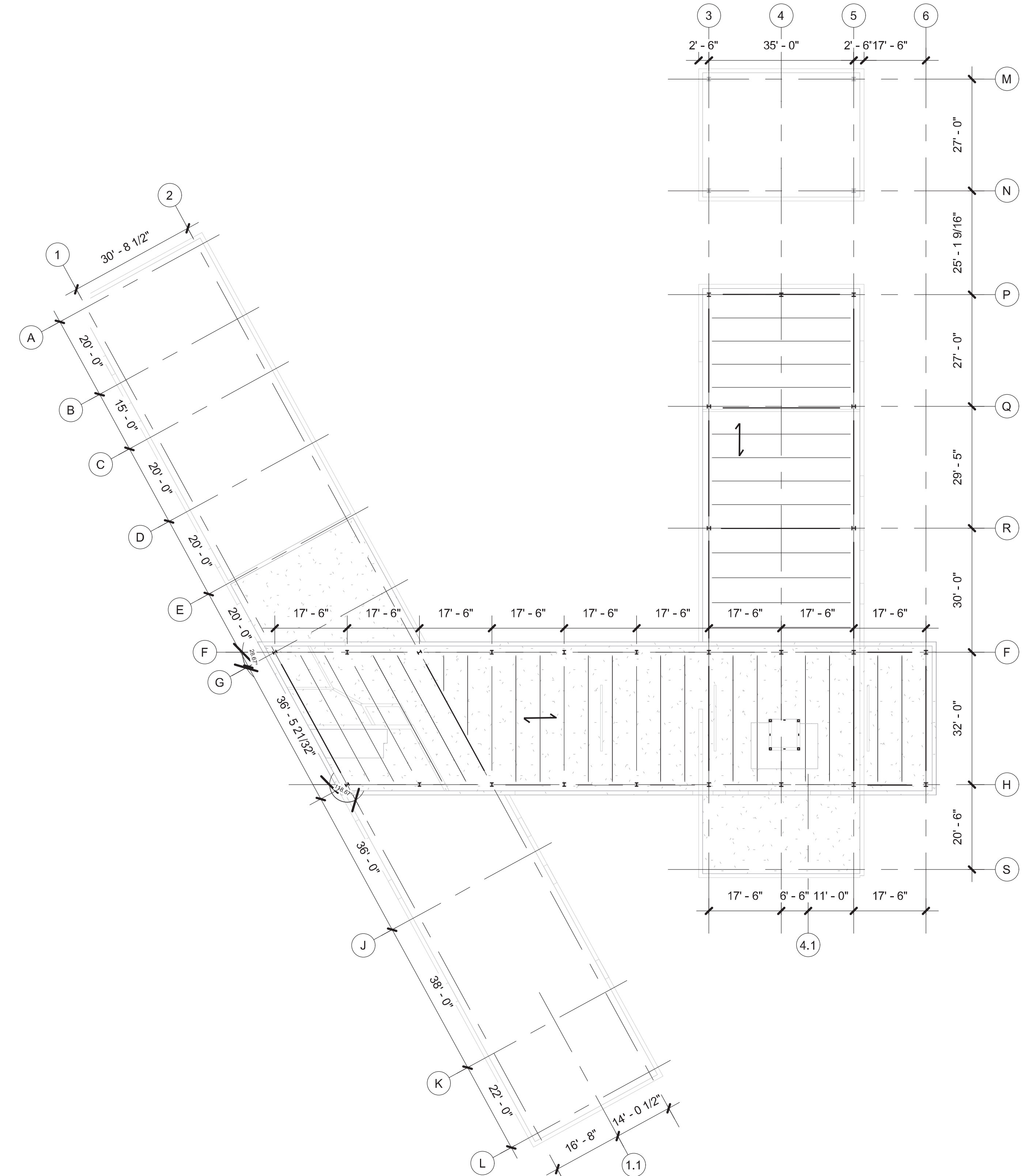
Member Depths Based on Span to Depth Ratio

Beam	
30.67' 12") / 22 = 16.7	W18
32' (12") / 22 = 17.5	W18
35' (12") / 22 = 19.1	W21
Composite Beam	
32' (12") / 20 = 19.2	W21
Girder	
20' (12") / 18 = 13.3	W14 (W18 for Beam)
30' (12") / 18 = 20	W21
38' (12") / 18 = 25.3	W27
Joist	
30.67' (12") / 24 = 15.3	16K
32' (12") / 24 = 16	16K
35' (12") / 24 = 17.5	18K

FRAMING PLANS

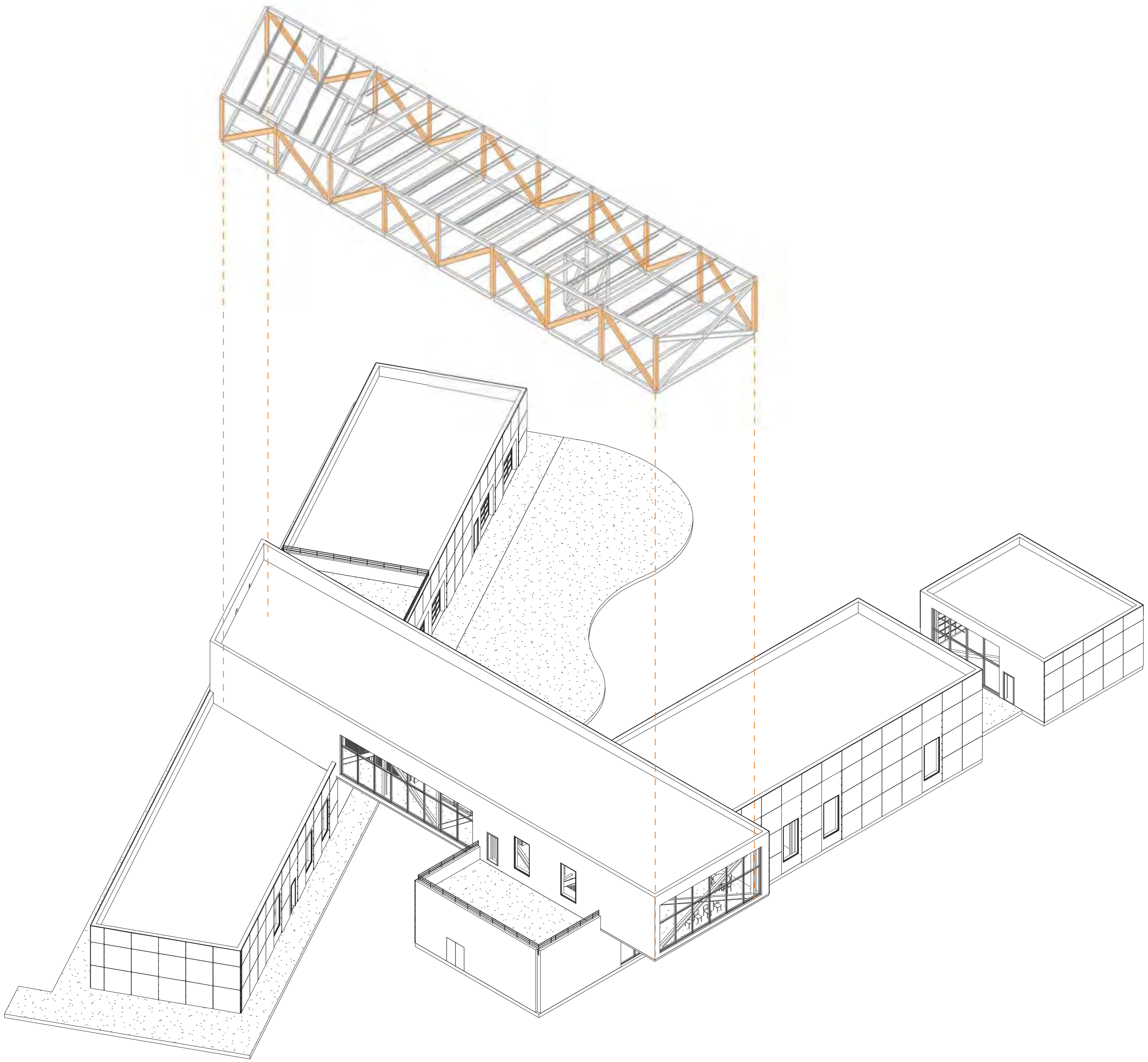


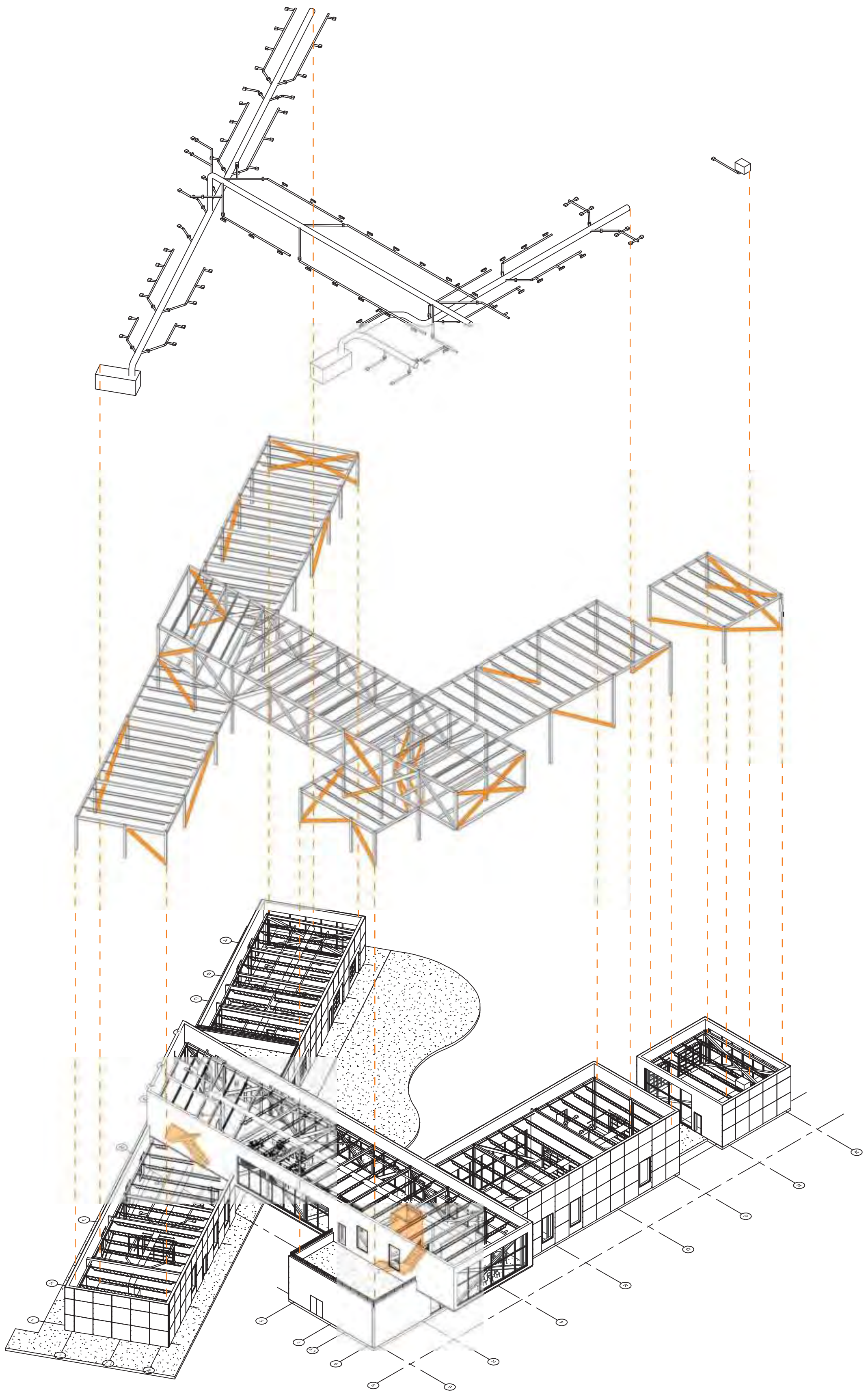
Elevated Floor/Low Roof Plan



High Roof Plan

SYSTEMS AXONOMETRIC





WATER CONSERVATION & HYDROLOGY

Curve Number (CN) is an empirical parameter used in hydrology for predicting direct water runoff or infiltration from rainfall excess. This provides an idea of how well the water will be absorbing into the soil and if it will create runoff on the site. The curve number method was developed by the USDA Natural Resources Conservation Service. The curve number was developed from an empirical analysis of runoff from small catchments and hill slope plots monitored by the USDA. It is widely used and an efficient method for determining the approximate amount of direct runoff from a rainfall event in a particular area. CN has a range from 30 to 100. Lower numbers indicate low runoff potential and good absorption into the soil while large numbers indicate a greater runoff potential.

The curve number is related to soil type, soil infiltration capability, land use, and the depth of the seasonal high water table. The NRCS has divided soils into four hydrologic soil groups (HSGs). Our site falls into HSG Group D with high runoff potential and very slow infiltration rates. This group is mainly clay soils with a high swelling potential and slow rate of water transmission.

Design for water

Good design conserves and improves the quality of water as a precious resource.

Design for ecosystems

Good design mutually benefits human and nonhuman inhabitants.

Curve Number without LID Methods

Input	
Output	

Total Area = 255,000.0 sq ft

Predevelopment

Grass		
CN =	80	(Soil Group D)
Area =	255,000.0	sq ft
CN_c =	80	

Postdevelopment

Impervious		
CN =	98	(Soil Group D)
Area =	33,200	sq ft

Grass		
CN =	80	(Soil Group D)
Area =	221,800.0	sq ft
CN_c =	82.34	

Difference in CN between Pre and Postdevelopment

2.34

Curve Number with LID Methods

Input	
Output	

Total Area = 255,000.0 sq ft

Predevelopment

Grass		
CN =	80	(Soil Group D)
Area =	255,000.0	sq ft
CN_c =	80	

Postdevelopment

Impervious - Building Footprint		
CN =	98	(Soil Group D)
Area =	18,200	sq ft

Pervious Concrete		
CN =	60	(Based on research)
Area =	15,000	sq ft

LID Vegetation Buffer - Brush-Weed-Grass Mixture		
CN =	73	(Soil Group D)
Area =	7,500	sq ft

Bioretention		
CN =	77	(Soil Group D)
Area =	20,000	sq ft

Grass		
CN =	80	(Soil Group D)
Area =	194,300.0	sq ft
CN_c =	79.7	

Difference in CN between Pre and Postdevelopment

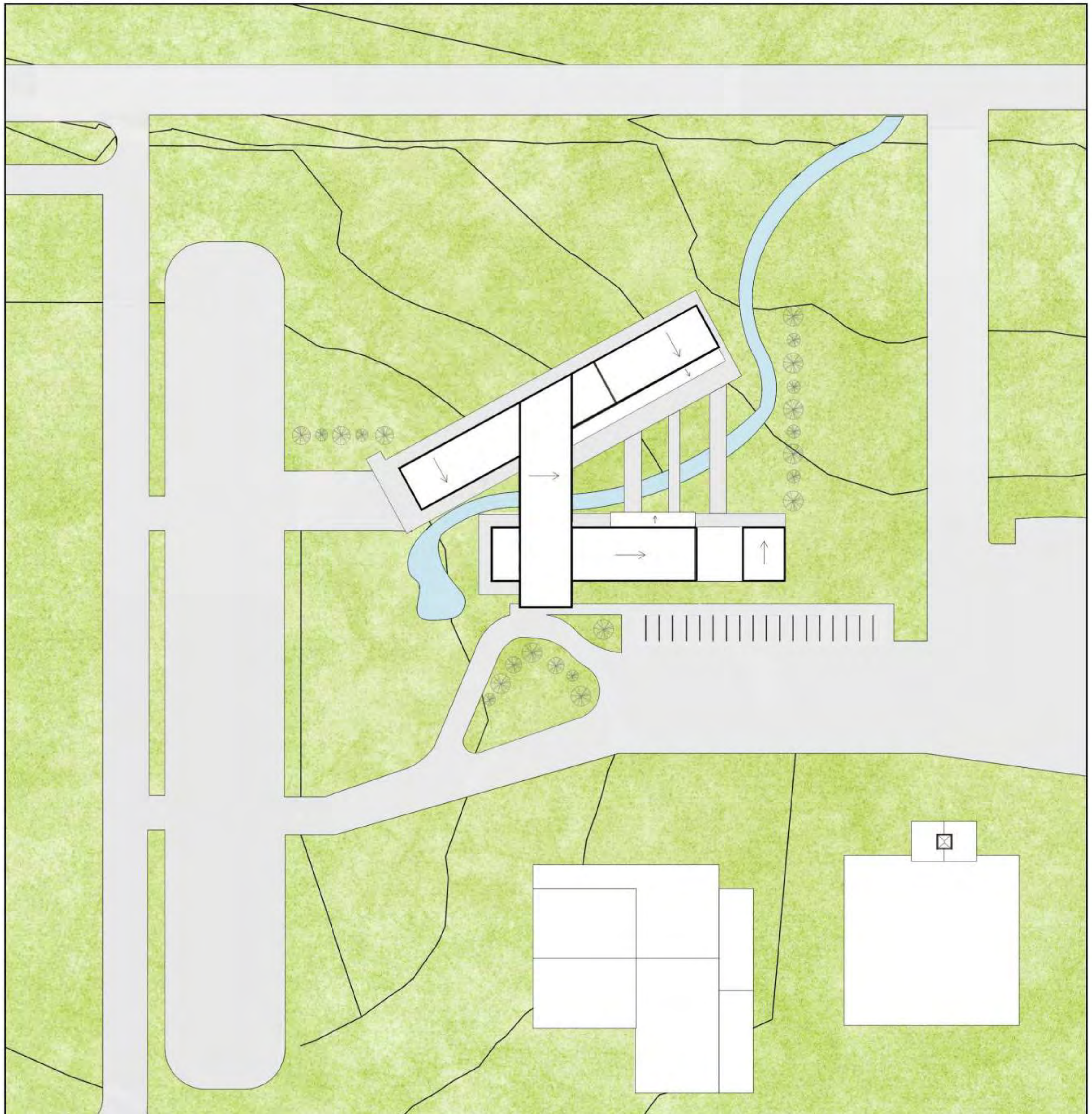
-0.33

STEAM ENGINE BUILDING

BROOKE WENTZ
DESIGN DEVELOPMENT
ARCH 5226
HONORS THESIS

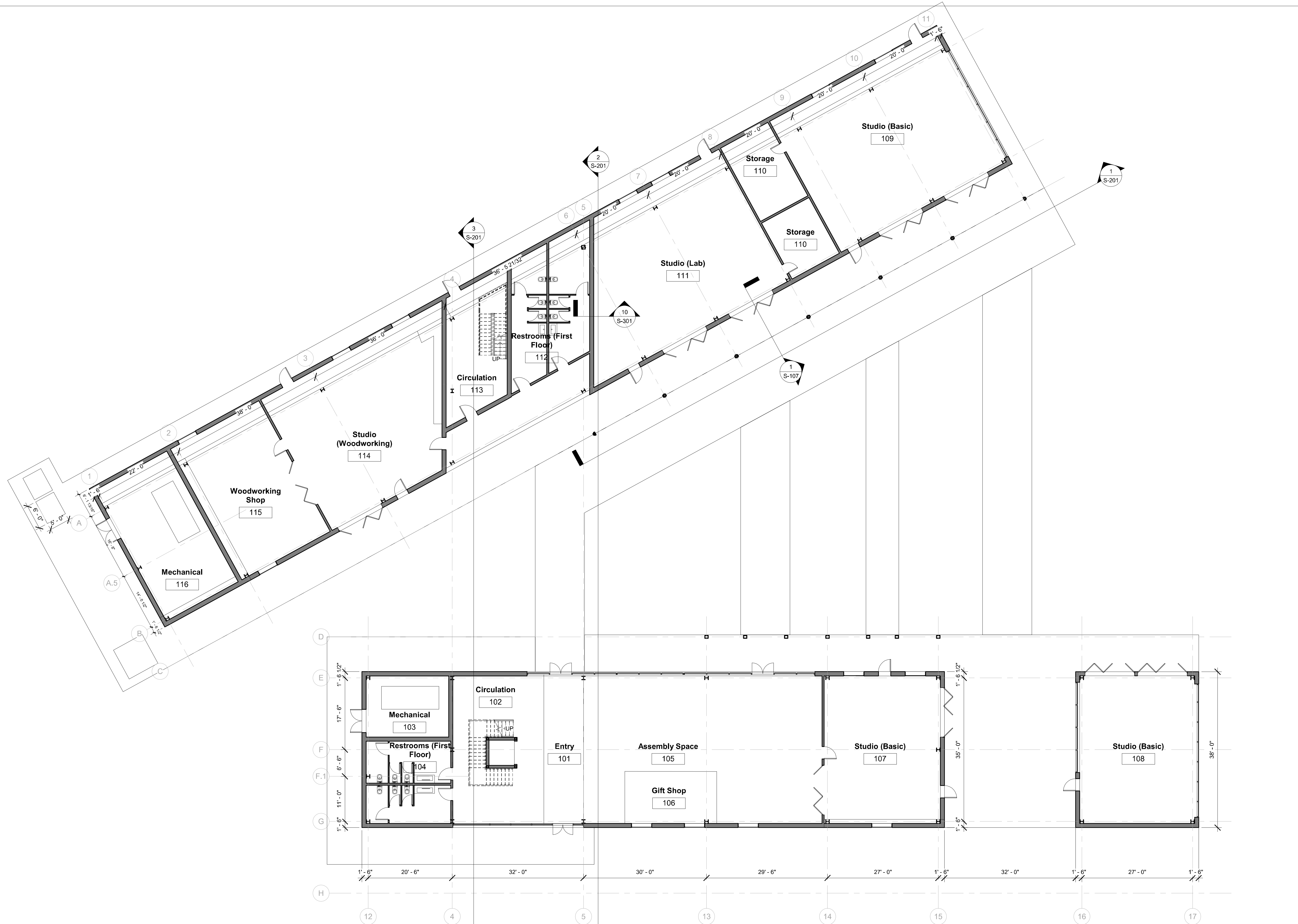
AERIAL

SITE PLAN



1 SITE PLAN
1" = 80'-0"

N



1 GROUND FLOOR PLAN
3/32" = 1'-0"

STEAM ENGINE BUILDING

PROJECT NAME: STEAM ENGINE BUILDING

STUDENT NAME: BROOKE WENTZ

COURSE: COMPREHENSIVE (ARCH 5226)

SEMESTER: SPRING 2022

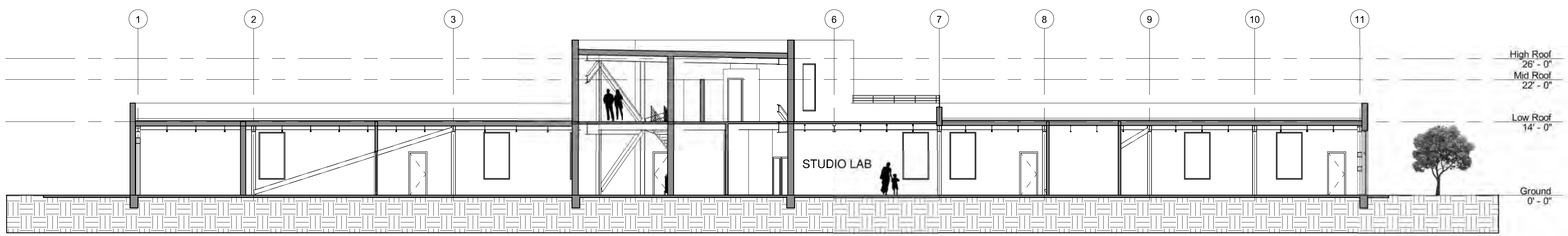
DRAWN BY: BW

SCALE: AS INDICATED

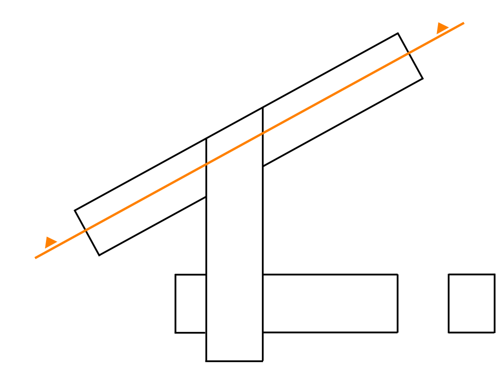
SHEET TITLE: GROUND FLOOR PLAN

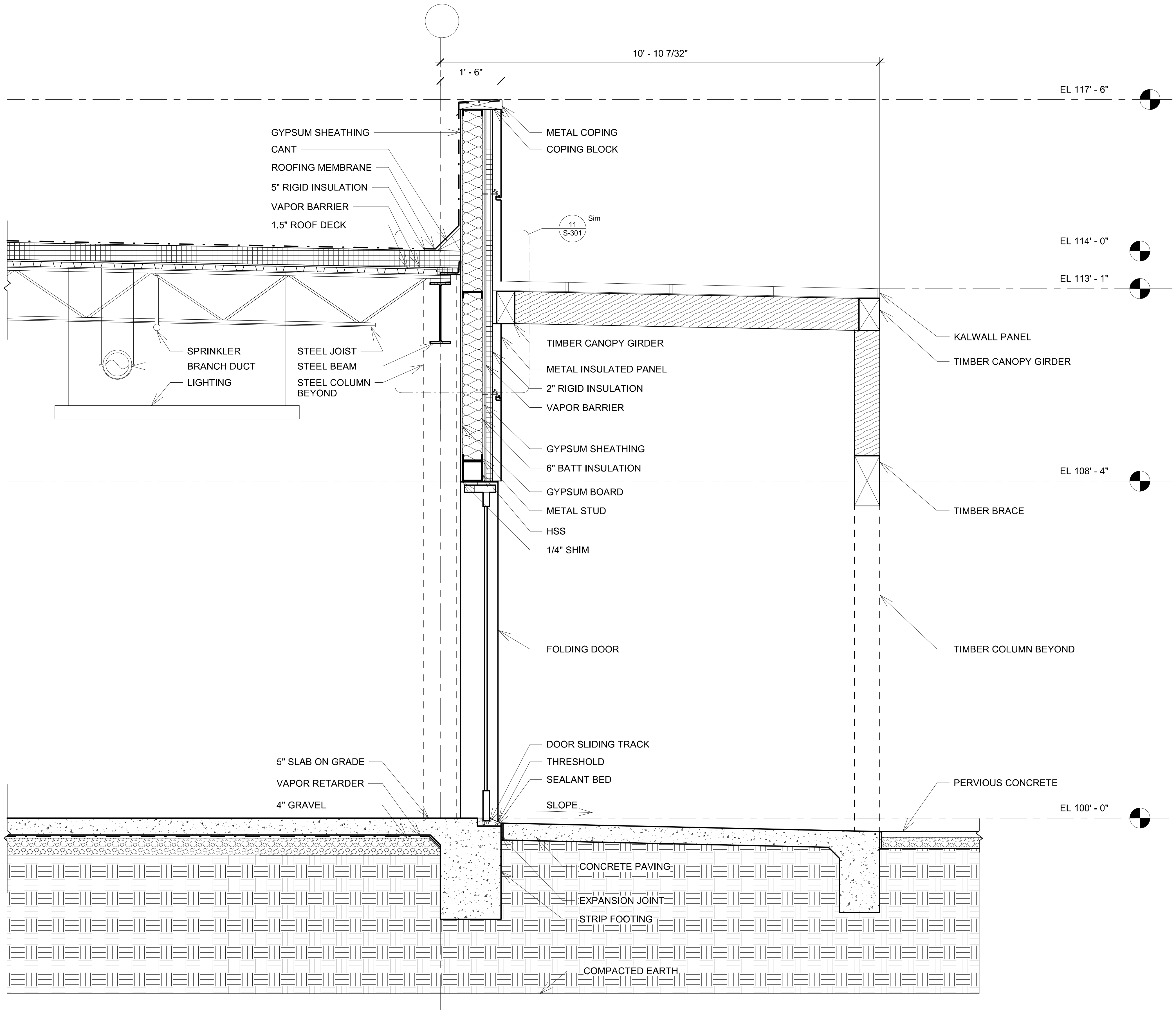
SHEET NUMBER: S-100

BUILDING SECTION



1 BUILDING SECTION
1" = 20'-0"





1 WALL SECTION
3/4" = 1'-0"

STEAM ENGINE BUILDING

PROJECT NAME: STEAM ENGINE BUILDING

STUDENT NAME: BROOKE WENTZ

COURSE: COMPREHENSIVE (ARCH 5226)

SEMESTER: SPRING 2022

DRAWN BY: BW

SCALE: AS INDICATED

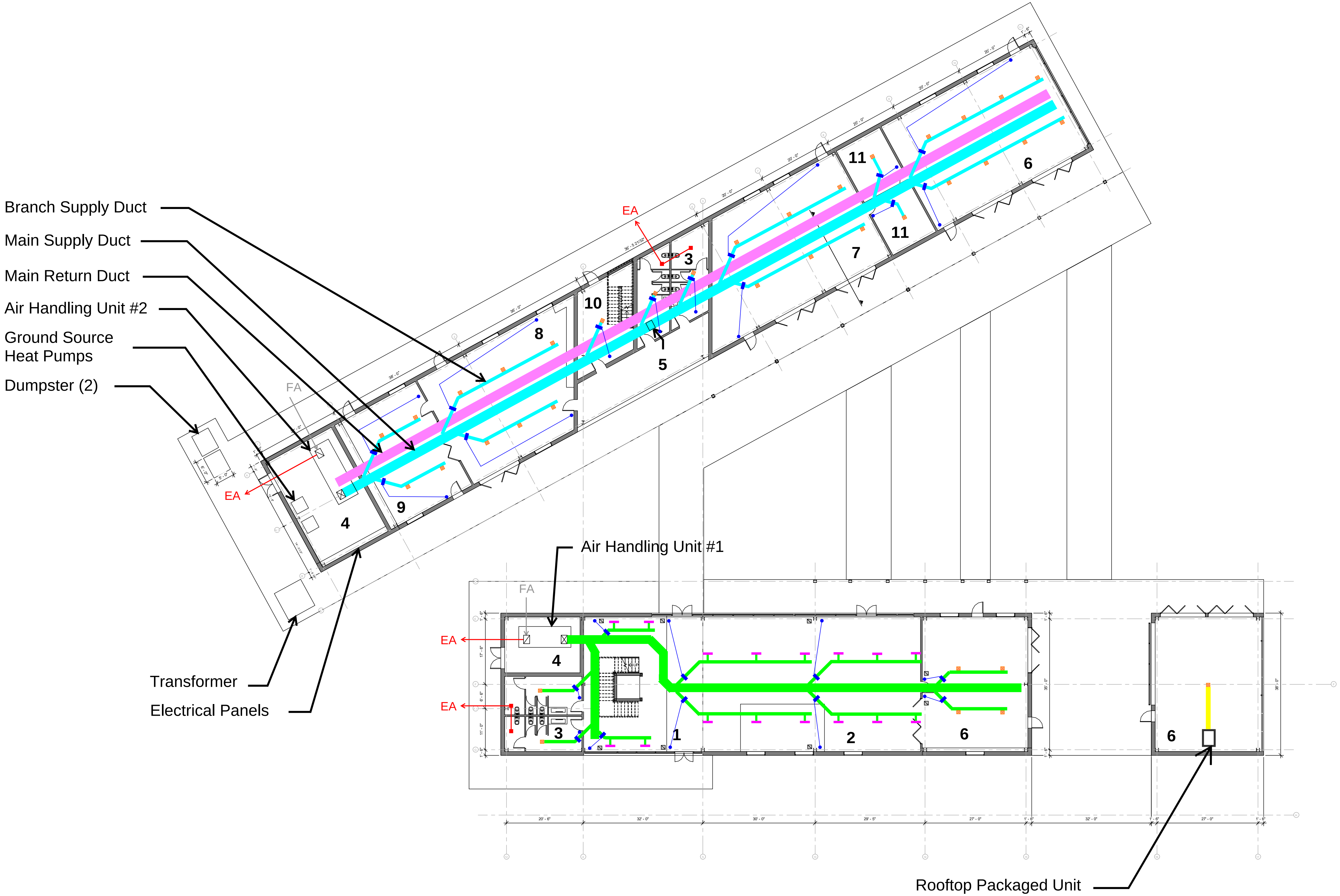
SHEET TITLE: WALL SECTION

SHEET NUMBER: S-107

EXTERIOR PERSPECTIVE

INTERIOR PERSPECTIVE

MECHANICAL PLAN



Key

1. Lobby
2. Gathering Space
3. Restrooms
4. Mechanical Room
5. Mechanical Chase
6. Studio (Basic)
7. Studio (Lab)
8. Studio (Woodworking)
9. Woodworking Studio
10. Egress Stairs
11. Storage
12. Board Room
13. Lounge
14. Open Office Space

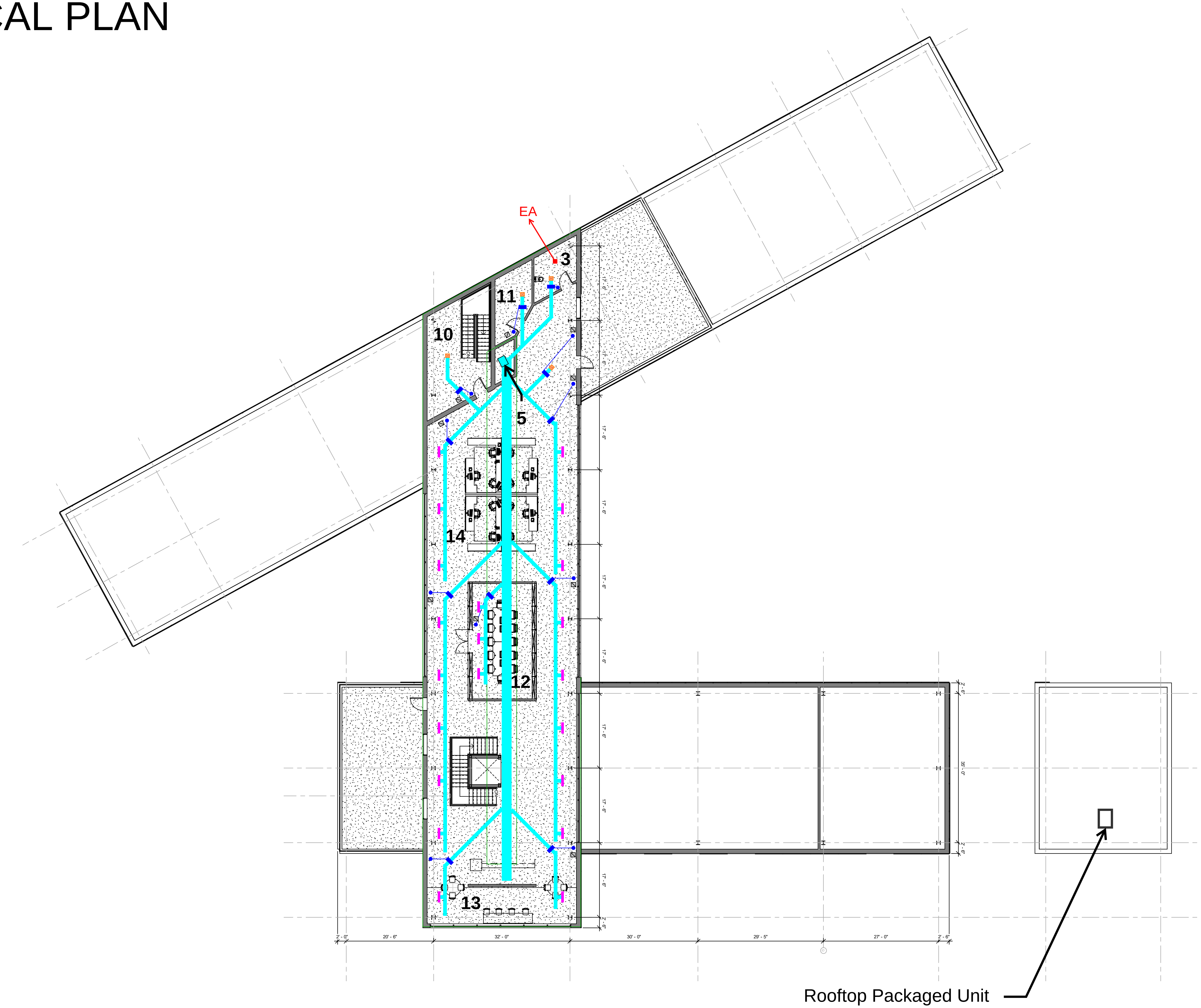
- Ceiling Diffuser
- VAV Box
- Thermostat
- Slot Diffuser
- Return Grill
- FA Fresh Air
- EA Exhaust Air

First Floor Plan

System selected: Ground source heat pumps. VAV central air with air handling units.

N

MECHANICAL PLAN



Second Floor Plan

Air delivery: VAV central air with chase from air handling unit. Rooftop packaged unit for separate studio.

N

Key

1. Lobby
2. Gathering Space
3. Restrooms
4. Mechanical Room
5. Mechanical Chase
6. Studio (Basic)
7. Studio (Lab)
8. Studio (Woodworking)
9. Woodworking Studio
10. Egress Stairs
11. Storage
12. Board Room
13. Lounge
14. Open Office Space

- Ceiling Diffuser
- VAV Box
- Thermostat
- Slot Diffuser
- Return Grill
- FA Fresh Air
- EA Exhaust Air

MECHANICAL CALCULATIONS

DIFFUSER CALCULATIONS:

Floor Area = 1460 ft^2
Air Flow Rate = 0.987 CFM/ft^2
Total Flow = 1460(0.987) = 1441.02 CFM
Supply Duct ⟶ 8" Round Duct
Airflow Per Diffuser = 279 CFM
Number of Diffusers = 1441.02 CFM / 279 CFM/Diffuser
= 5.17 Diffusers ⟶ 6 Diffusers

Total Airflow Provided = 6(279) = 1674 CFM
Throw = 18 ft
NC = 21 < 25

MAIN SUPPLY DUCT

Online Ductulator

Duct type: Metal (●) Ductboard ( ) Flex ( )
Size by: Friction rate ( ) Velocity (●)
Velocity: 6500 fpm
Duct TEL : 100 ft. * include fittings in the Duct TEL
Enter either: CFM: (●) or Duct Size: ( )
CFM: 11633
Calculate

Diameter = 18.1" Friction Rate = 2.813

Total Diameter with Insulation = 18.1" + 2" = **20.1"**

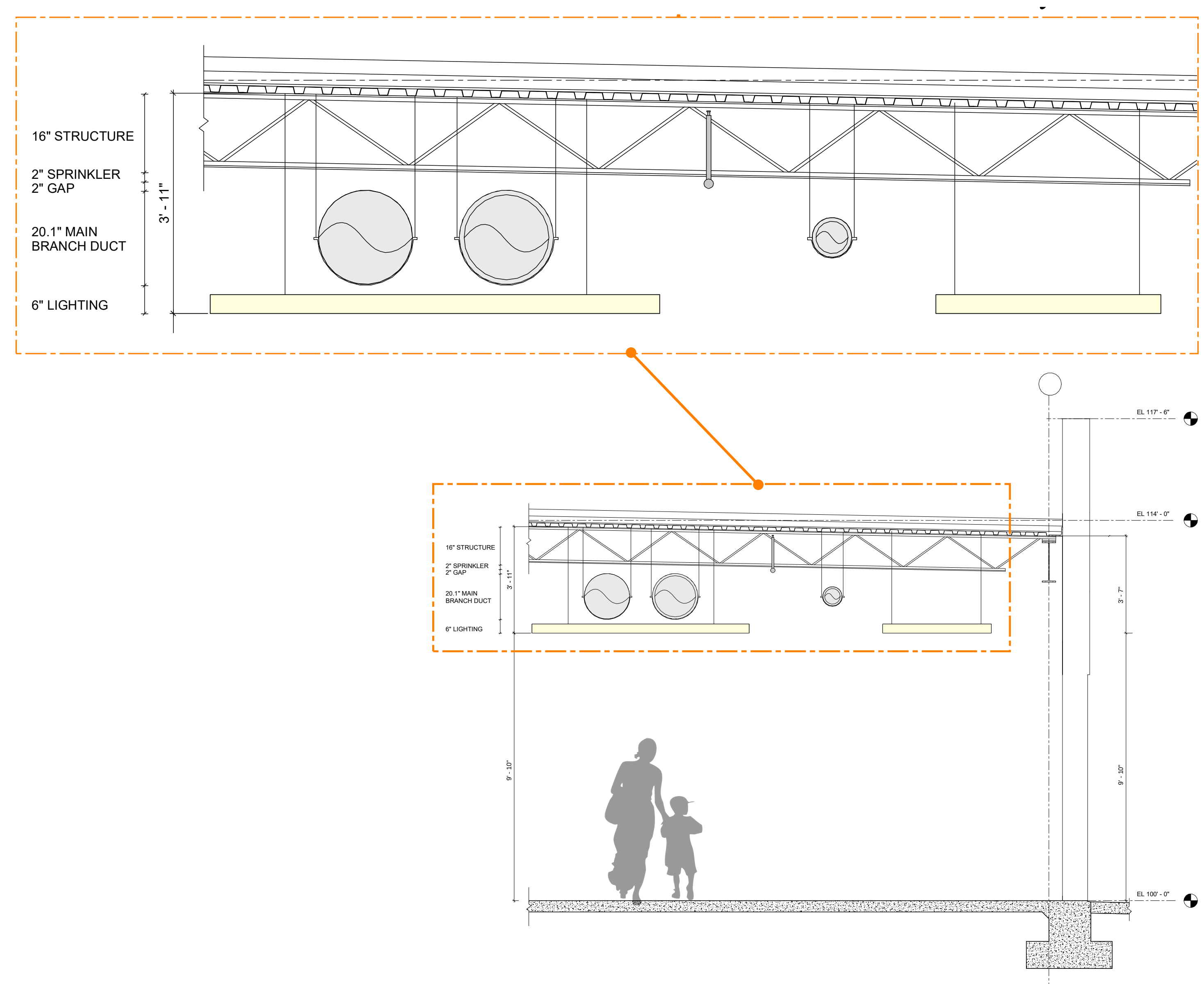
MAIN BRANCH DUCT

Online Ductulator

Duct type: Metal (●) Ductboard ( ) Flex ( )
Size by: Friction rate ( ) Velocity (●)
Velocity: 3000 fpm
Duct TEL : 100 ft. * include fittings in the Duct TEL
Enter either: CFM: (●) or Duct Size: ( )
CFM: 775
Calculate

Diameter = 6.9" Friction Rate = 2.073

Total Diameter with Insulation = 6.9" + 2" = **8.9"**



Titus
Redefine your comfort zone.™

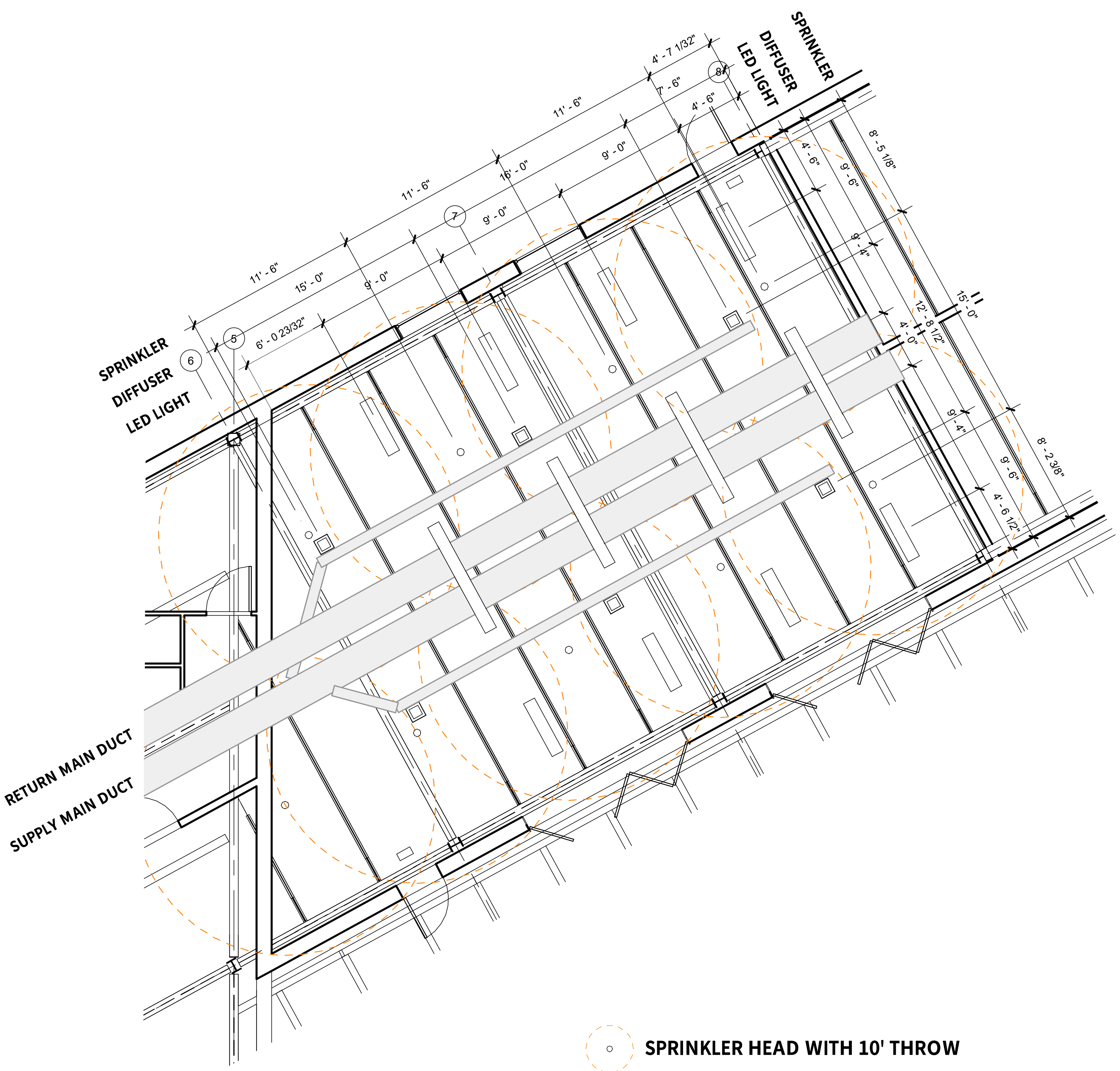
PERFORMANCE DATA

diffusers

OMNI / OMNI-AA - ARCHITECTURAL CEILING / SQUARE PLAQUE

Module Size	Neck										
		Neck Velocity	400	500	600	700	800	900	1000	1200	1400
		Velocity Pressure	0.010	0.016	0.022	0.031	0.040	0.051	0.062	0.090	0.122
12"x12" Module Size	4" Round Neck	Airflow, cfm	35	44	52	61	70	79	87	105	122
		Total Pressure, Inches WG	0.034	0.053	0.076	0.103	0.134	0.170	0.210	0.303	0.412
		Throw Feet	1-2-3	1-2-4	2-2-5	2-3-6	2-3-6	2-4-7	3-4-8	3-5-10	4-6-11
		NC (Noise Criteria)	-	-	12	17	21	24	27	33	38
	5" Round Neck	Airflow, cfm	55	68	82	95	109	123	136	164	191
		Total Pressure, Inches WG	0.040	0.063	0.091	0.124	0.161	0.204	0.252	0.363	0.494
		Throw Feet	2-2-5	2-3-6	2-3-7	3-4-8	3-5-9	3-5-10	4-6-12	5-7-14	5-8-15
		NC (Noise Criteria)	-	-	12	17	21	24	28	33	38
	6" Round Neck	Airflow, cfm	78	98	118	137	157	176	196	235	274
		Total Pressure, Inches WG	0.049	0.076	0.109	0.149	0.194	0.246	0.303	0.437	0.594
		Throw Feet	2-3-6	3-4-8	3-5-9	4-5-11	4-6-12	5-7-14	5-8-15	6-9-17	7-11-18
		NC (Noise Criteria)	-	-	12	17	21	24	28	33	38
	7" Round Neck	Airflow, cfm	107	134	160	187	214	240	267	320	374
		Total Pressure, Inches WG	0.058	0.091	0.131	0.178	0.233	0.295	0.364	0.524	0.714
		Throw Feet	3-4-8	3-5-9	4-6-11	4-7-13	5-8-15	6-9-17	6-9-18	8-11-20	9-13-21
		NC (Noise Criteria)	-	-	12	17	21	24	28	33	38
	8" Round Neck	Airflow, cfm	140	175	209	244	279	314	349	419	489
		Total Pressure, Inches WG	0.070	0.109	0.156	0.213	0.278	0.352	0.434	0.626	0.852
		Throw Feet	3-5-9	4-6-11	5-7-14	5-8-16	6-9-18	7-10-19	8-11-20	9-14-22	11-16-24
		NC (Noise Criteria)	-	-	12	17	21	24	28	33	38
20" x 20" Module Size	6" Dia.	Airflow, cfm	78	98	118	137	157	173	196	235	274
		Total Pressure	0.016	0.025	0.036	0.049	0.063	.080	0.100	0.142	0.193
		NC (Noise Criteria)	-	-	-	16	20	24	28	34	39
		Throw feet	1-1-3	1-1-4	1-2-4	1-3-5	1-3-6	2-3-6	2-4-7	3-5-8	3-5-8
	8" Dia.	Airflow, cfm	140	175	209	244	279	314	349	419	489
		Total Pressure	0.019	0.030	0.043	0.058	0.075	.096	0.118	0.169	0.229
		NC (Noise Criteria)	-	-	-	18	22	26	30	36	41
		Throw feet	1-2-4	2-3-6	2-4-6	3-4-7	3-5-7	3-5-8	4-6-8	5-6-9	5-7-10
	10" Dia.	Airflow, cfm	218	273	327	382	436	491	545	654	763
		Total Pressure	0.024	0.038	0.055	0.074	0.096	.123	0.151	0.215	0.292
		NC (Noise Criteria)	-	-	-	18	23	27	31	37	42
		Throw feet	3-4-6	3-4-7	4-5-8	4-6-8	5-6-9	5-7-9	6-7-10	6-8-11	7-9-12

REFLECTED CEILING PLAN AND LIGHTING CALCULATIONS



SPRINKLER HEAD WITH 10' THROW

DIRECT/INDIRECT PENDANT LED LIGHT

12" x 12" DIFFUSER

EXIT SIGN

AVERAGE ILLUMINANCE WORKSHEET-ELECTRIC LIGHTING
[LUMEN METHOD-SIMPLIFIED]

Designer: Brooke Wentz Space type: Studio (Lab)

PHOTOMETRIC DATA

IESNA Illuminance category: Q

IESNA Recommended illuminance (average): 20 (fc)

[Refer to IESNA tables]

Lamp type: LED PLLR10ID 4FT 80CRI 30K

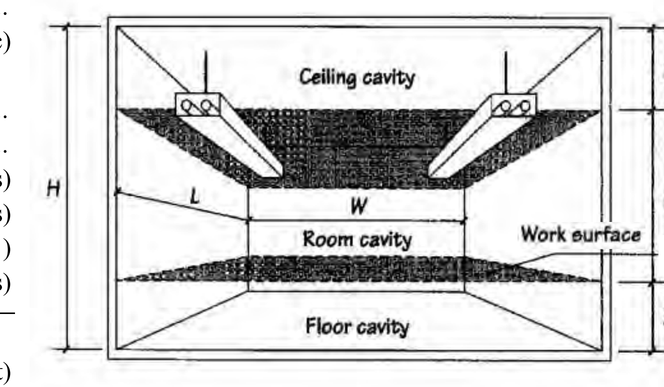
Recommended spacing ratio 1.2 // 1.21 ⊥

Lumen output from one lamp (initial): 4958.2 (lumens)

Number of lamps per luminaire: 1 (lamps)

Fixture efficiency: 100 (%)

Lumen output from one luminaire: 4958.2 (lumens)



ROOM DESIGN

L = 46.17 (ft)

W = 31.67 (ft)

H = 14 (ft)

Ceiling cavity reflectance = CCR = 80 (%)

Room cavity reflectance (walls) = RCR = 50 (%)

Assumed floor cavity reflectance = FCR = 20 (%)

h_{CC} = 4 (ft)

h_{RC} = 7.5 (ft)

h_{FC} = 2.5 (ft)

SIZING OF THE SYSTEM

a. Effect of room geometry: Determine equivalent-square room length (W_{sq}), and the Room Cavity Ratio (RCR).

W_{sq} = W + [(L-W) / 3] = 31.67 + [(46.17 - 31.67) / 3] = 36.5 ft

RCR = (10 x h_{RC}) / W_{sq} = (10 x 7.5) / 36.5 = 2.055

From manufacturer's data, obtain the Coefficient of Utilization (CU) of this luminaire in this space.

CU = 0.785 = 78.5%

b. Effect of maintenance conditions of the space and the system (includes ballast factor): Estimate LLF.

Light Loss Factor = **LLF** = Good conditions = 0.65 (Circle one)
Average conditions = 0.55
Poor conditions = 0.45

c. Calculate useful lumens from one luminaire (on the workplane):

Useful lumens from one luminaire = Lumen output from one luminaire x CU x LLF
= 4958.2 x 0.785 x 0.65 = 2529.92 Lumens

d. Determine total lumens needed on the workplane:

Total lumens needed on the workplane = Recommended illuminance x area
= 20 x 46.17 x 31.67 = 29,244.08 Lumens

e. Determine needed number of luminaires:

Number of luminaires = Total lumens needed on the workplane/useful lumens from one luminaire

Number of luminaires = 29,244.08 / 2529.92 = 11.6 Luminaires ⟶ 12 Luminaires

Actual illumination level provided = 20(12/11.6) = 20.69 fc

Light load = 12(43.4W) / (46.17)(31.67) = 0.356 W/SF < 1.11 W/SF So complies with code

Light load index = 0.356 W/SF / 20.69 fc = 0.0172 W/SFfc

Covered area per luminaire = 46.17(31.67) / 12 = 121.85 ft^2 / Luminaire

System's overall efficiency = 1(0.785)(0.65) = 0.510 = 51.0%

DAYLIGHTING

ARCH 4263 / 5262
Space Use: Studio Lab - close to doors between
Student Names: Brooke Wentz

Daylighting lab test results

Sky Condition: Standard CIE Overcast Sky

Light Sensor #	Multiplier	Meter's Reading	illumination level under artificial sky dome: lux	illumination level under artificial sky dome: fc	sensor's serial number
1	2.9210	24.7	72 lux	6.7 fc	PH 8355
2	2.8313	22.5	64 lux	5.9 fc	PH 8356
3	2.8248	19.2	54 lux	5.0 fc	PH 8357
4	2.9378	15.9	47 lux	4.3 fc	PH 8358
5	2.9792	14.4	43 lux	4.0 fc	PH 8359
6	2.7992	15.1	42 lux	3.9 fc	PH 8360
7	2.9673	15.4	46 lux	4.2 fc	PH 8361
8	2.9431	17.7	52 lux	4.8 fc	PH 8362
(single sensor) 9	2.7651	267.3	739 lux	68.7 fc	PH 8363
Outside (under dome)	2.7390	269.8	739 lux	68.7 fc	PH 8364

Measured outside illuminance = 68.7 fc

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

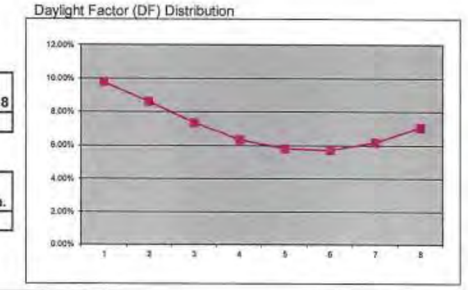
Space Use: Studio Lab - close to doors between
Student Names: Brooke Wentz

Daylight Factor
excluding effect of glass VT

DF
9.76%
8.62%
7.34%
6.32%
5.81%
5.72%
6.18%
7.05%

Average sens # 1 to 8: 7.10%
Ratio of Max. to Min.: 1.71

Daylight Factor (DF) Distribution



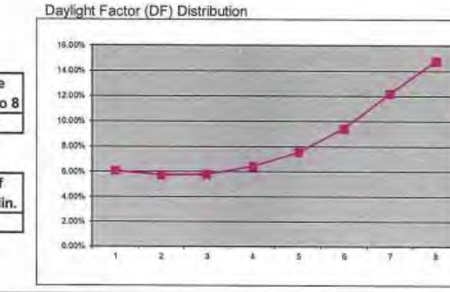
Space Use: Studio Lab - close to windows between
Student Names: Brooke Wentz

Daylight Factor
excluding effect of glass VT

DF
6.09%
5.75%
5.81%
6.44%
7.54%
9.39%
12.17%
14.78%

Average sens # 1 to 8: 8.49%
Ratio of Max. to Min.: 2.57

Daylight Factor (DF) Distribution



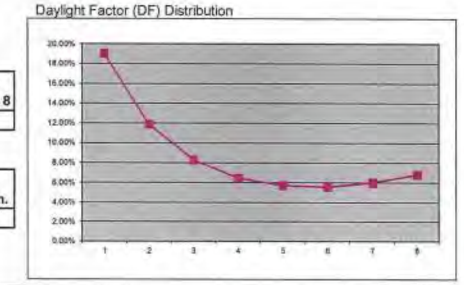
Space Use: Studio Lab - close to doors
Student Names: Brooke Wentz

Daylight Factor
excluding effect of glass VT

DF
19.01%
11.88%
8.26%
6.44%
5.72%
5.57%
5.98%
6.81%

Average sens # 1 to 8: 8.71%
Ratio of Max. to Min.: 3.41

Daylight Factor (DF) Distribution



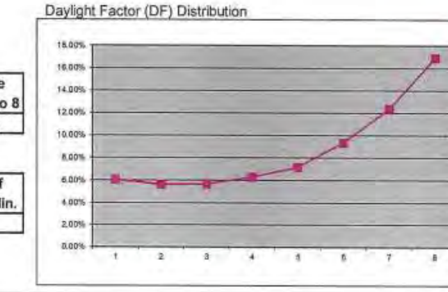
Space Use: Studio Lab - close to windows
Student Names: Brooke Wentz

Daylight Factor
excluding effect of glass VT

DF
6.09%
5.67%
5.70%
6.32%
7.18%
9.32%
12.37%
16.93%

Average sens # 1 to 8: 8.70%
Ratio of Max. to Min.: 2.99

Daylight Factor (DF) Distribution



Predicted Illumination Level (Illuminance)

$IL_{provided} = IL_{standard} \times DF \times VT_{glass} \times M_{glass}$

$IL_{standard}$ = 1386 fc (Latitude 36) (2:00pm March & Sept 21)

M_{glass} = 0.85

Light Sensor	1	2	3	4	5	6	7	8	9	10
$IL_{standard}$ (fc)	1386	1386	1386	1386	1386	1386	1386	1386	1386	1386
DF	0.14385	0.1025	0.06945	0.06045	0.0576	0.060125	0.0672	0.081425	0.1227	0.15855
VT_{glass}	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18
M_{glass}	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Total (fc)	**30.505**	**21.736**	**14.727**	**12.819**	**12.215**	**12.750**	**14.250**	**17.267**	**26.020**	**33.622**
Target	**20**	**20**	**20**	**20**	**20**	**20**	**20**	**20**	**20**	**20**

Sliding Doors - Openings

	1	2	3	4	5	6	7	8
DF	0.1901	0.1188	0.0826	0.0644	0.0572	0.0557	0.0598	0.0681

Windows- Openings

			1	2	3	4	5	6	7	8
DF			0.0609	0.0567	0.057	0.0632	0.0718	0.0932	0.1237	0.1693

Average	1	2	3	4	5	6	7	8	9	10
	0.1901	**0.1188**	**0.07175**	**0.06055**	**0.0571**	**0.05945**	**0.0658**	**0.08065**	**0.1237**	**0.1693**

Sliding Doors - Between Openings

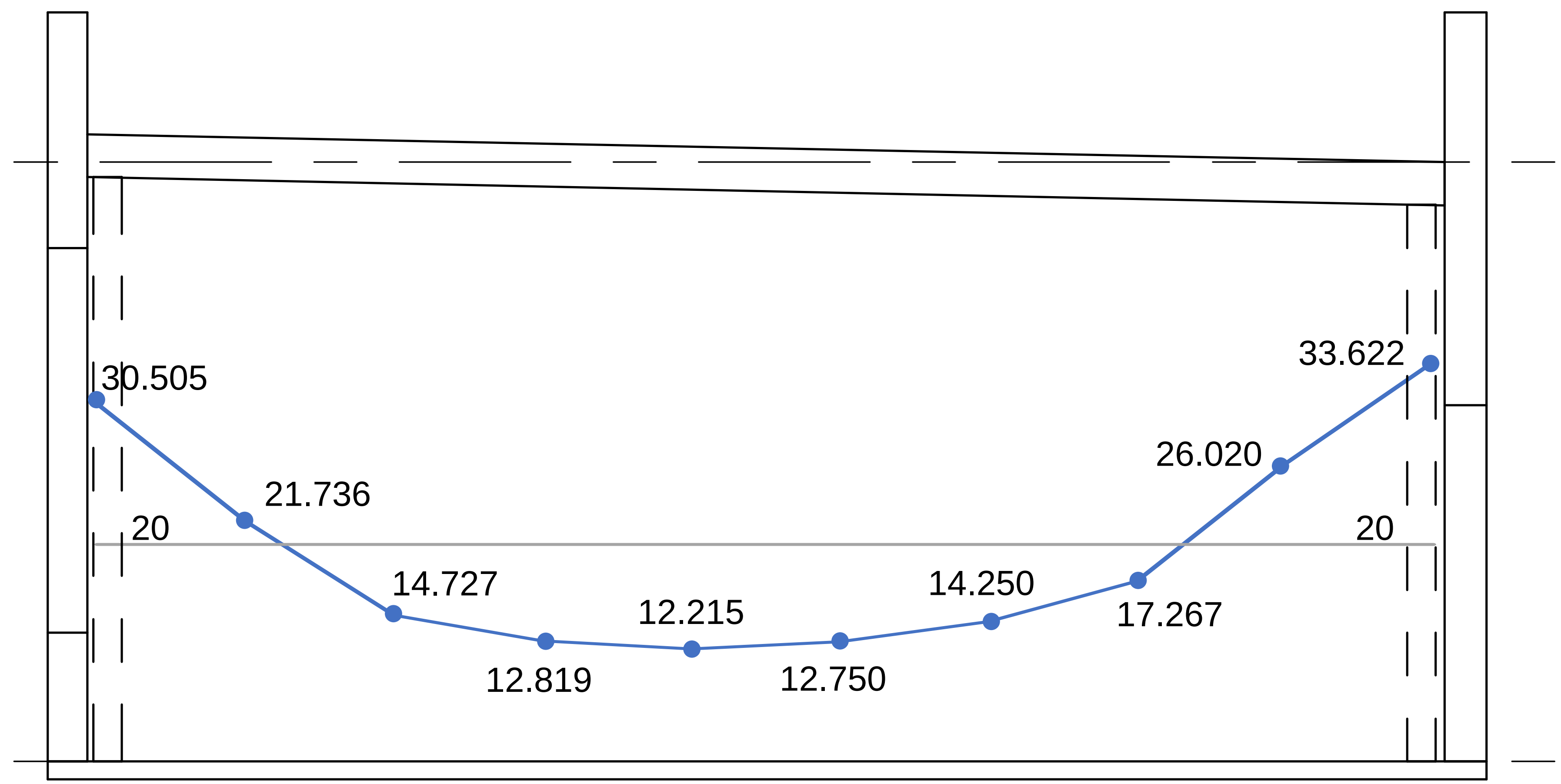
	1	2	3	4	5	6	7	8
DF	0.0976	0.0862	0.0734	0.0632	0.0581	0.0572	0.0618	0.0705

Windows - Between Openings

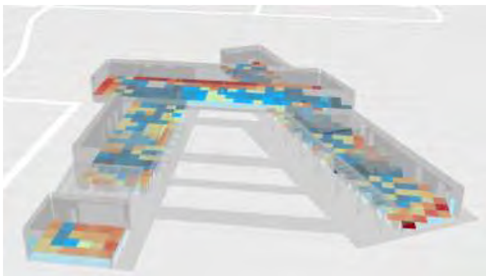
			1	2	3	4	5	6	7	8
DF			0.0609	0.0575	0.0581	0.0644	0.0754	0.0939	0.1217	0.1478

Average	1	2	3	4	5	6	7	8	9	10
	0.0976	**0.0862**	**0.06715**	**0.06035**	**0.0581**	**0.0608**	**0.0686**	**0.0822**	**0.1217**	**0.1478**

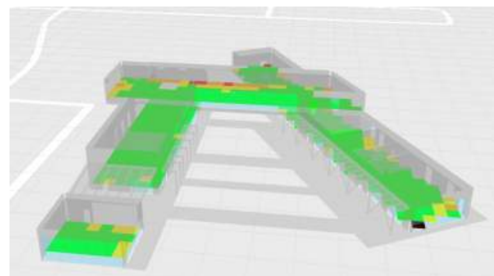
Total Average	1	2	3	4	5	6	7	8	9	10
	0.14385	**0.1025**	**0.06945**	**0.06045**	**0.0576**	**0.060125**	**0.0672**	**0.081425**	**0.1227**	**0.15855**



ENERGY PERFORMANCE
COVETOOL AND EQUEST

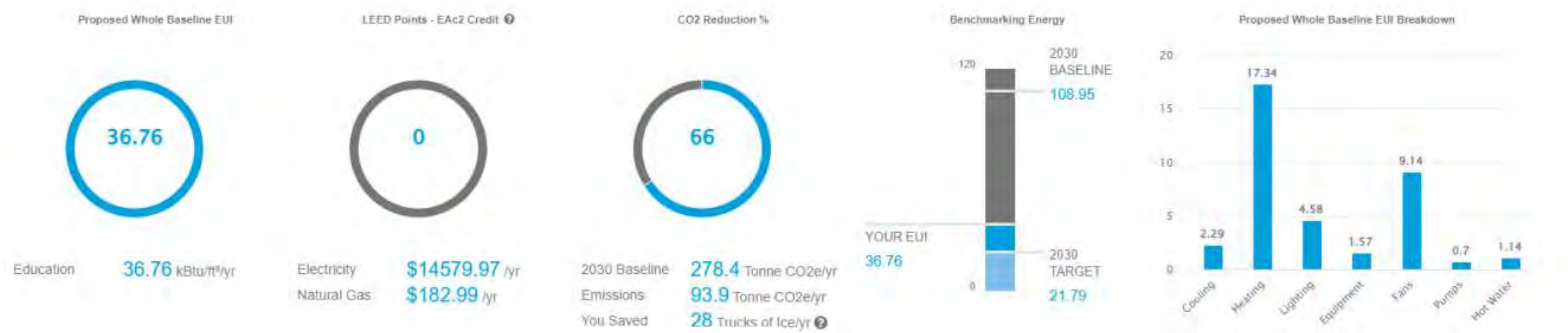


sDA = 35%



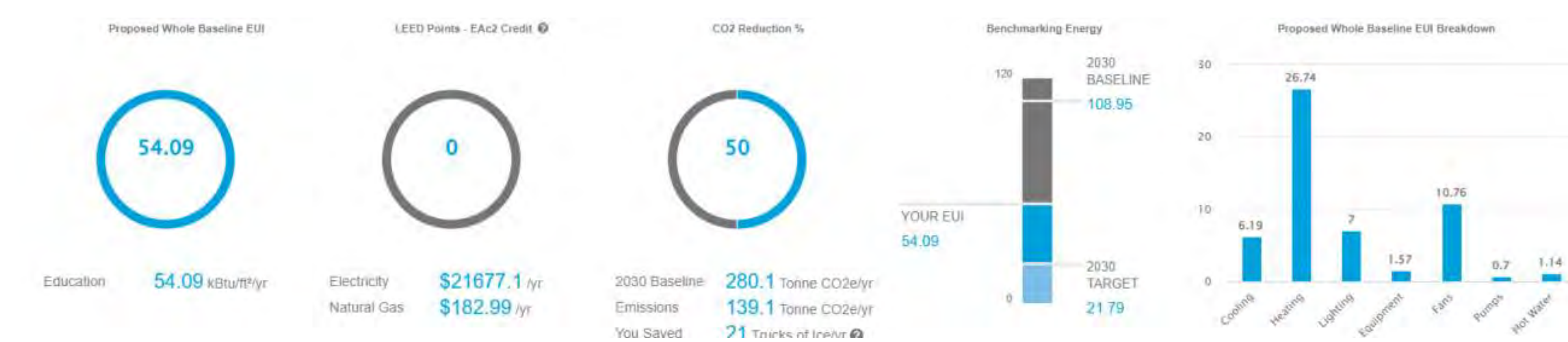
sDA = 15%

MODEL C - Current Improved Design and Equipment

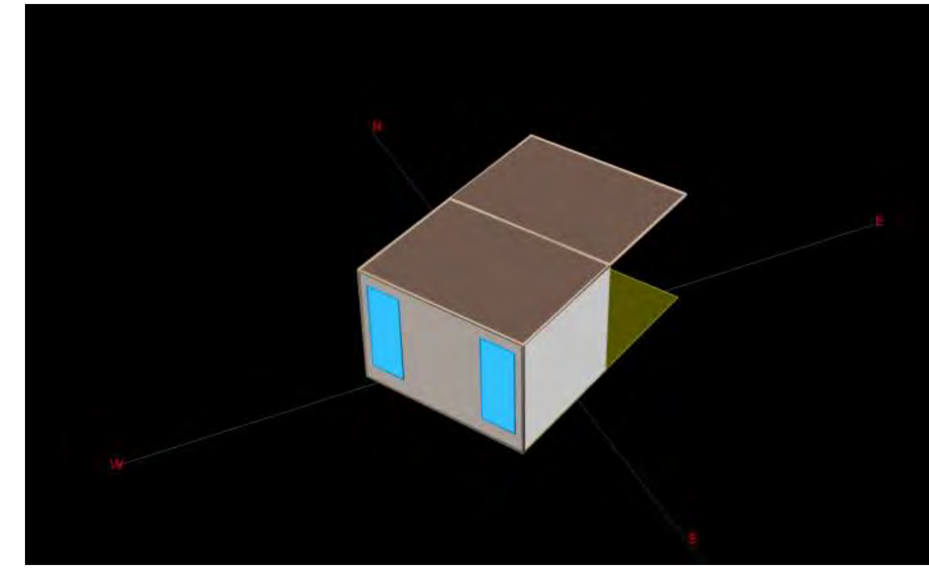


MODEL B - Improved Glass Design and 100% Code Compliant Equipment

MODEL A - 30% Glass and 100% Code Compliant Equipment

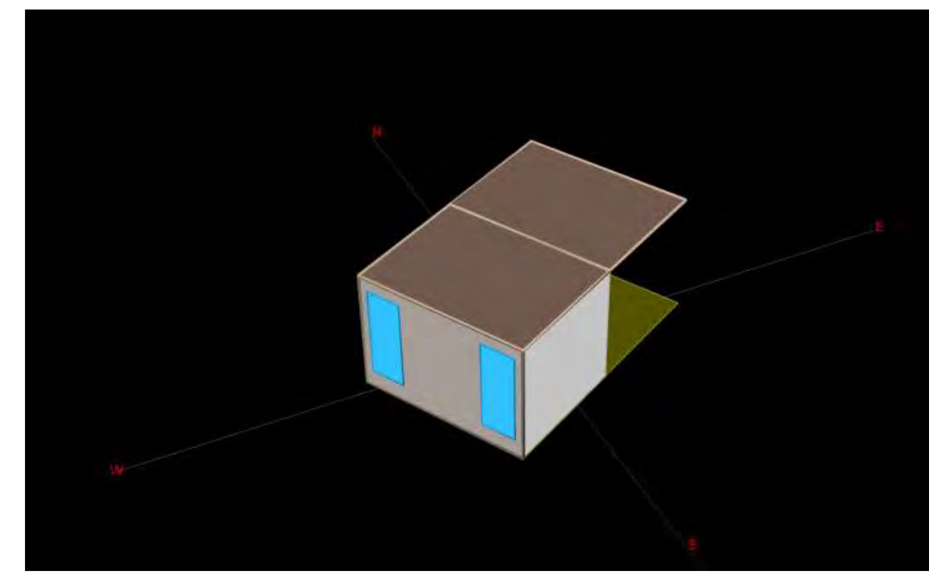


CURRENT DESIGN



28.57% Glass

BASELINE

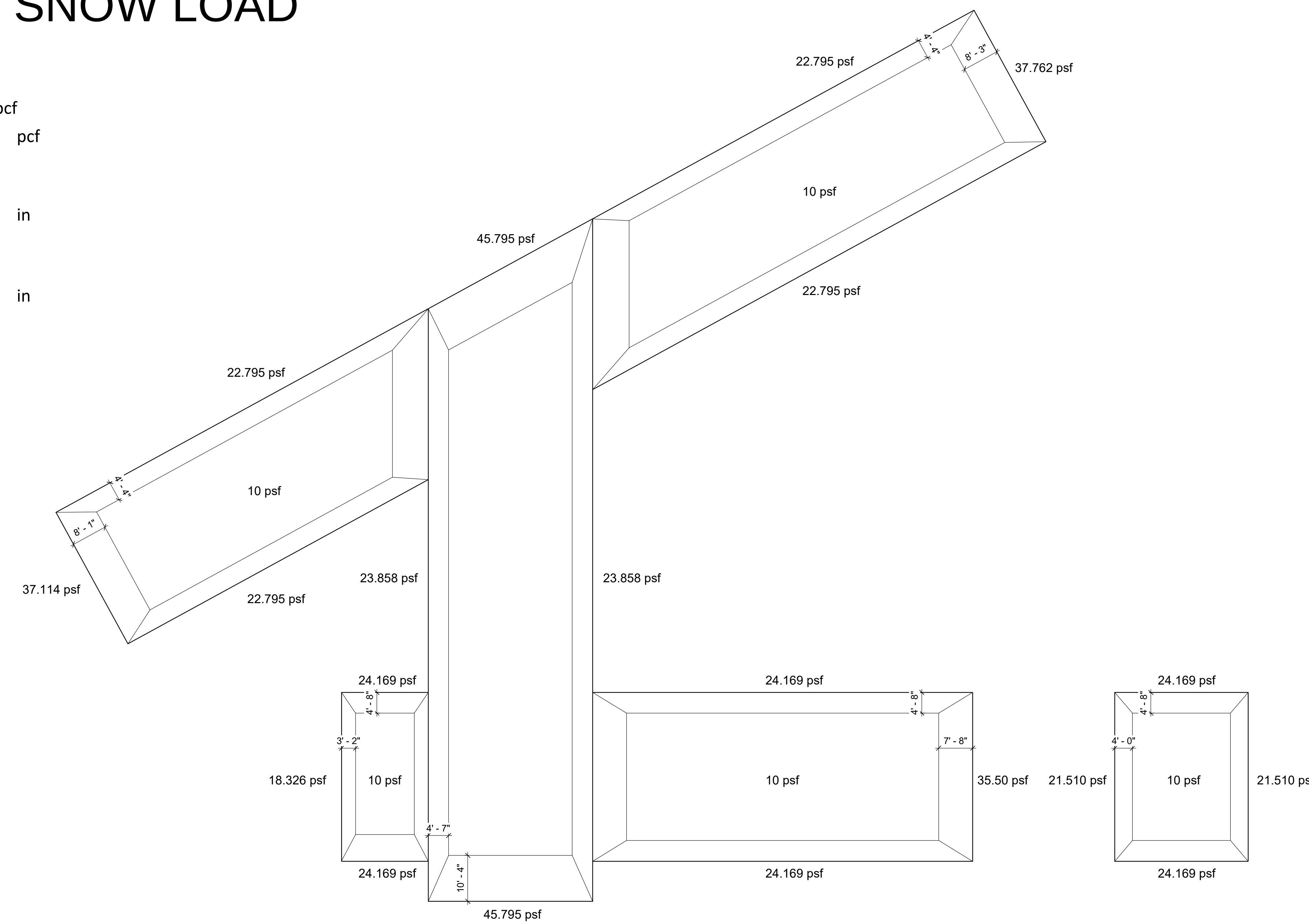


30% Glass

EQUEST RESULTS:
19.63% energy savings for perimeter zone cooling loads for current design from the baseline.

COVETOOL RESULTS:
32.04% energy savings for Model C compared to Model A and 19.32% energy savings for Model B.

STRUCTURAL CALCULATIONS - SNOW LOAD



Flat Roof Snow Load

$p_f = 0.7C_eC_tI_sp_g$

C_e =	0.9	Exposure Factor (T.7.3-1)
C_t=	1	Thermal Factor (T.7.3-2)
I_s =	1	Importance Factor (T.1.5-2)
p_g =	10	Ground Snow Load (Fig 7.2-1)

p_f = 6.3 psf

Minimum Snow Load for Flat Roof:

$p_m = I_sp_g$ (When p_g <= 20psf)

$p_m = 20(I_s)$ (When p_g >20psf)

p_m = 10 psf

p_m = 10 psf

Density:

$\gamma = 0.13p_g + 14 <= 30$ pcf

γ = 15.3 pcf

Snow thickness for p_m

$(p_m / \gamma)*12$ = 7.843 in

Snow thickness for p_f

$(p_f / \gamma)*12$ = 4.941 in

Snow Drift - 2

l_{u1} = 33.667 ft

l_{u2} = 88 ft

h_{d1} = $[(0.43*(l_{u1})^{1/3}*(p_g + 10)^{1/4}) - 1.5]*(I_s)^{1/2}$ = 1.436 ft

h_{d2} = $[(0.43*(l_{u2})^{1/3}*(p_g + 10)^{1/4}) - 1.5]*(I_s)^{1/2}$ = 2.545 ft

h_b = p_f / γ = 0.412 ft

h = 3 ft (Height of Parapet)

h_c = $h - h_b$ = 2.588 ft

h_c / h_b = 6.286 Snow drift occurs

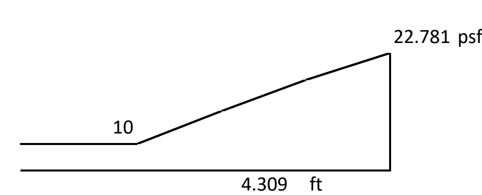
$w_1 = 4\ h_{d1}$ If $h_d<h_c(h_b)$, $w = 4h_d$ and drift ht. = h_d

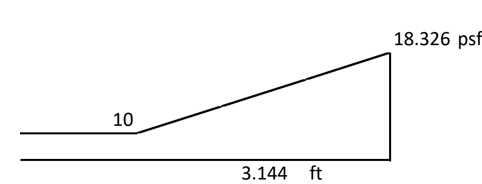
$w_2 = 4\ h_{d2}^2 / h_c$ If $h_d > h_c$, use $w= (4h_d^2)/h_c$ and drift ht. = h_c

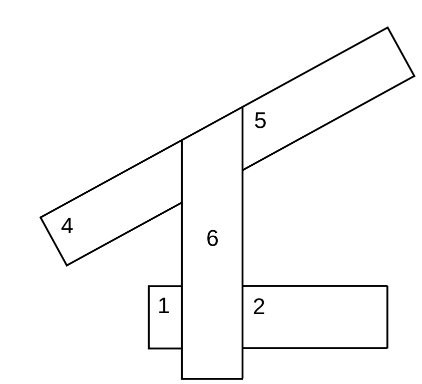
l_u (ft)	h_d (ft)	WW $0.75h_d$ (ft)	w (ft)	Drift Height (ft)	$8h_c$ (ft)
33.667	1.436	1.077	4.309	1.077	20.706
88	2.545	1.909	7.634	1.909	20.706

Load:

=	1.077	*	15.3	+	6.3	=	22.781 psf
=	1.909	*	15.3	+	6.3	=	35.500 psf







STRUCTURAL CALCULATIONS - WIND LOAD

Wind - A

	B		L
Building Dimensions:	33.667	by	199.5

$p = qGC_p - q_i(GC_{pi})$ $q_i = q_h$ for roof

$q_i(GC_{pi}) = 0$ for WW & LL forces

B = 33.667

L = 199.5

$q = 0.00256K_zK_{zt}K_dK_eV^2$

V =	109	mph
K_{zt} =	1	
K_d =	0.85	
K_e =	1	

$q = 25.853\ K_z$

G = 0.85 (26.11.4)

C_p =	0.8	WW			
	-0.2	LW	for L/B =	5.926	Longitudinal Direction
	-0.5	LW	for B/L =	0.169	Transverse Direction

C_p for LW

L/B	C_p	
0-1	-0.5	USE
2	-0.3	
>=4	-0.2	

GCpi = 0.18 -0.18

p = 25.853 Kz * 0.85 * C_p - q_h * 0.18

At roofs only (uplift)

	Height	Kz	P (WW)	P (LW - Long)	P (LW - Trans)
Roof Ht.	0-15	0.57	10.02	-6.26	-6.26
Parapet	17	0.59			

Parapet:

$p_p = q_pGCpn$

q_p = 25.853 * 0.59 = 15.253

GC_{pn} = 1.5 WW

-1.0 LW

p_p =	15.253	*	1.5	=	22.88	psf	WW
	15.253	*	-1.0	=	-15.25	psf	LW

Roof Uplift:

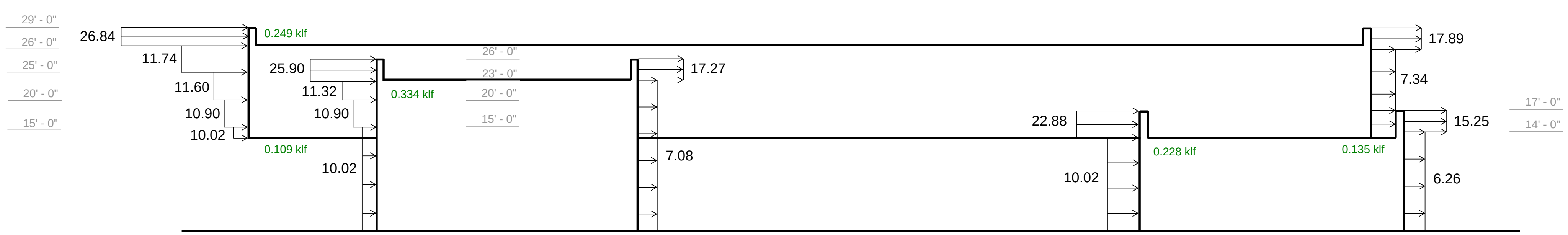
h = 14 ft

p_{up} = 25.853 * 0.57 * 0.85 * C_p - 25.853 * 0.57 * 0.18

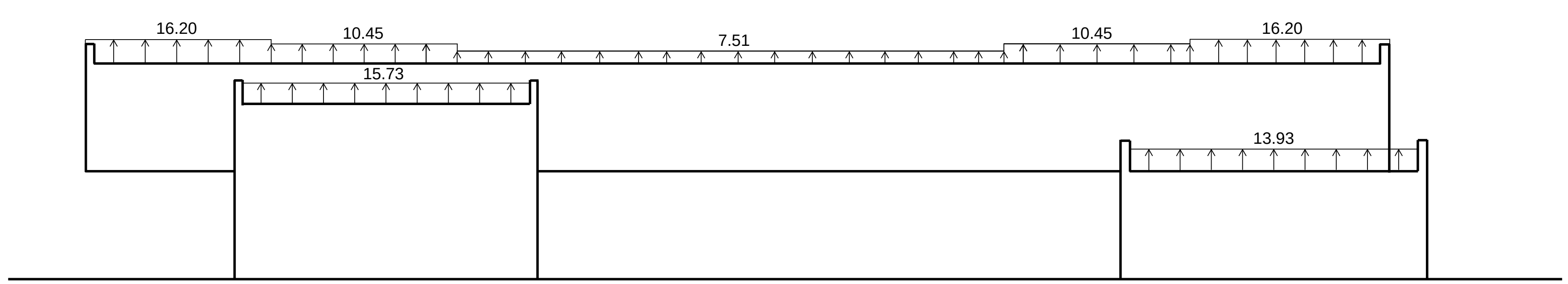
C_p =	-0.9	0 to h	for h/B =	0.416	Transverse Direction
	-0.5	h to 2h	for h/L =	0.070	Longitudinal Direction
	-0.3	> 2h			

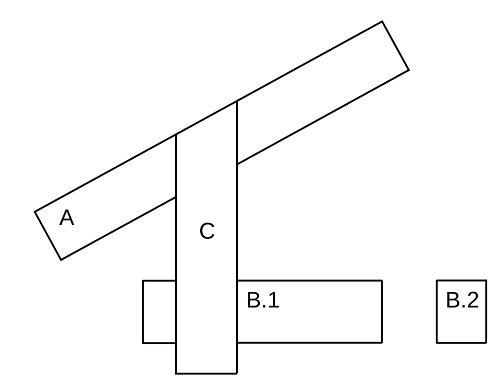
p_{up} =	-13.93	psf	0' - 14'
	-8.92	psf	14' - 28'
	-6.41	psf	> 28'

WIND LOAD DIAGRAM (psf)



ROOF UPLIFT DIAGRAM (psf)





STRUCTURAL CALCULATIONS - SEISMIC LOAD

Seismic
(From seismicmaps.org)

S_S =	0.279	
S_1 =	0.078	
S_{MS} =	0.363	
S_{M1} =	0.116	
S_{DS} =	0.242	
S_{D1} =	0.078	
T_L =	12	
I_e =	1	(T. 1.5-2)

Seismic Design Category: B

ASCE T 12.2-1
Use Steel Ordinary Concentrically Braced Frames
R = 3.25

Use Equivalent Lateral Force Analysis Method
$V = C_s * W$

Fundamental Building Period, T
$T_a = C_t h_n^x$

C_t =	0.03	(T. 12.8-2)
h_n =	26	(Building Height)
x =	0.75	(T. 12.8-2)

T_a = 0.3454
$T = C_u T_a$

C_u = 1.7 (T. 12.8-1)

T = 0.5872

$C_s = S_{DS} / (R/I_e)$
C_s = 0.0745

Maximum C_s
For T <= T_L — For T > T_L
$C_s = S_{D1} / T(R/I_e)$ — $C_s = (S_{D1}T_L) / T^2(R/I_e)$
C_s = 0.0409

Minimum C_s
$C_s = 0.044 S_{DS} I_e$
C_s = 0.0106

C_s = 0.0409 Controls

Dead Load: 14' Roof (B.2)
Superimposed

Superimposed = 1140 ft² * 0.028 ksf = **31.92 k**

Facade

Metal Panel System=	30	ft	*	7	ft	*	0.017	ksf	=	3.570	k
	5	ft	*	7	ft	*	0.017	ksf	=	0.595	k
	30	ft	*	7	ft	*	0.017	ksf	=	3.570	k
	16	ft	*	7	ft	*	0.017	ksf	=	1.904	k
Curtainwall =	32.5	ft	*	7	ft	*	0.015	ksf	=	3.413	k

Facade Roof = 13.052 k
Facade Ground = 13.052 k

Total Roof DL = 44.972 k

Building Weight, W

Level	Framing	Facade	Total (k)
Roof, 14'	31.920	13.052	44.972
Ground	0	13.052	13.052
		∑	58.023

$V = C_s * W$ = 0.0409 * 58.023 = 2.371 k

Vertical Distribution:
$F_x = C_{vx} * V$ (EQN 12.8-11)
$C_{vx} = w_x h_x^k / (\sum w_i h_i^k)$ (EQN 12.8-12) k = 1.174 for T = 0.587

Level	w_x (kips)	h_x (ft)	$w_x h_x^k$	C_{vx}	$F_x = C_{vx}*V$
Roof, 14'	44.972	14	996.533	1.00	2.371
Ground	13.052	0	0	0	0
		∑	996.533	∑	2.371 k = V ok

Load Effects Combination:
$E = E_h + E_v$ (EQN 12.4-1)
$E = E_h - E_v$ (EQN 12.4-2)
$E_h = \rho Q_E = 1.0 F_x$ (EQN 12.4-3)
p = 1.0 (For Seismic Design Category B)
Q_E = F_x
E_h = 1.0 F_x
$E_v = 0.2 S_{DS} D = 0.2 S_{DS} w_x$ (EQN 12.4-4a)
E_v = 0.0484 w_x

Final Seismic Loads:

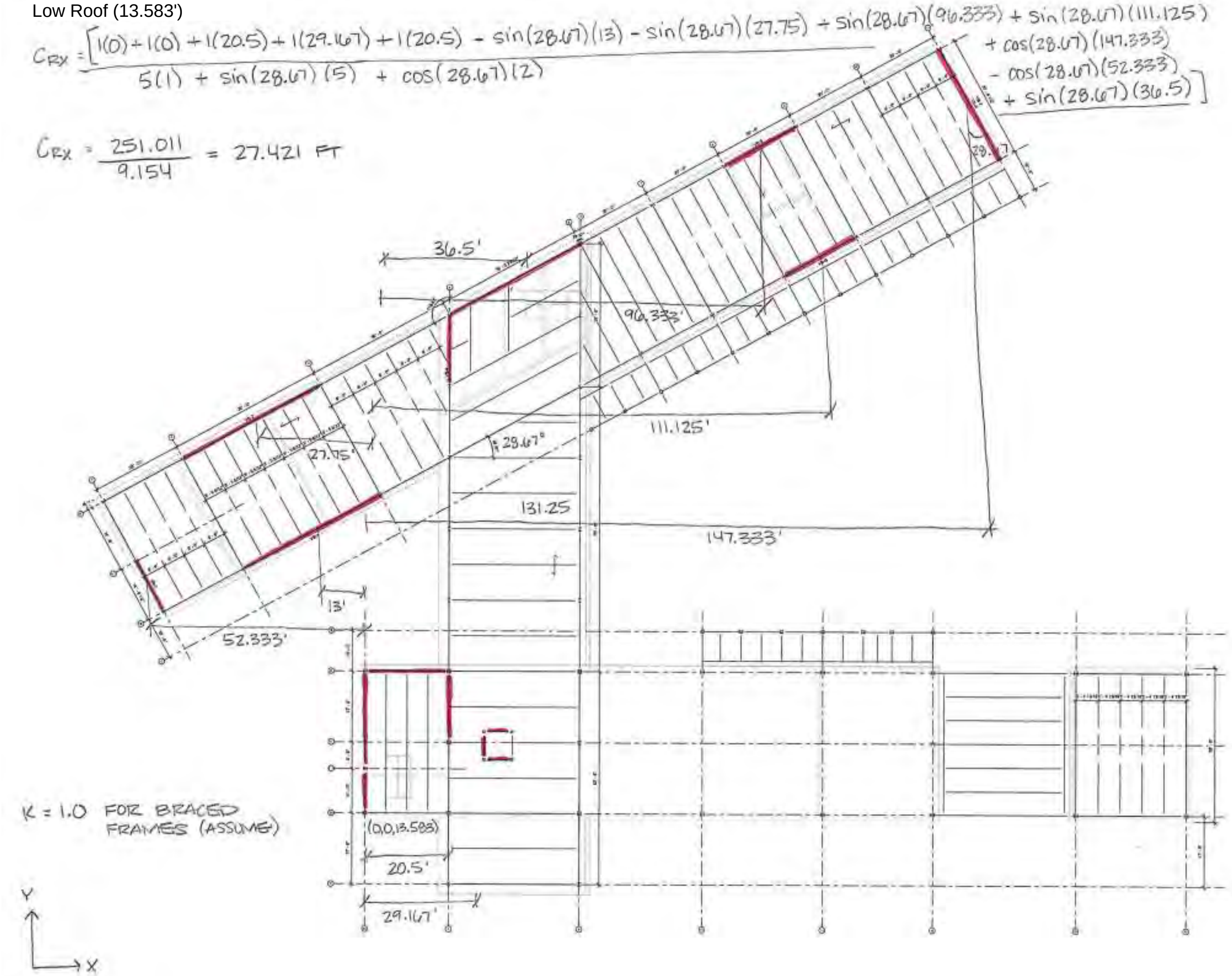
Level	$E_h = 1.0F_x$	w_x	$E_v = 0.0484w_x$
Roof, 14'	2.371	44.972	2.177
Ground	0	13.052	0.632

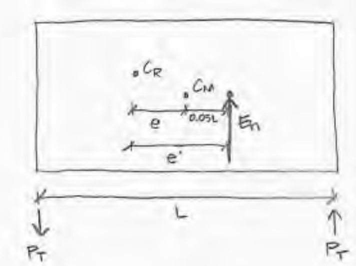
CENTER OF RIGIDITY

Low Roof (13.583')

$C_{RX} = \frac{[1(0)+1(0)+1(20.5)+1(29.167)+1(20.5) - \sin(28.67)(13) - \sin(28.67)(27.75) + \sin(28.67)(96.333) + \sin(28.67)(111.125) + \cos(28.67)(147.333) - \cos(28.67)(52.333) + \sin(28.67)(36.5)]}{5(1) + \sin(28.67)(5) + \cos(28.67)(2)}$

$C_{RX} = \frac{251.011}{9.154} = 27.421$ FT



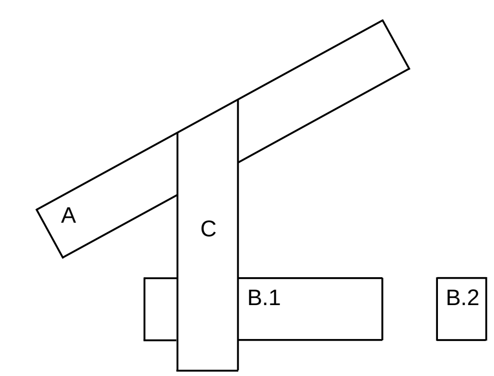


$e' = e + 0.05L$

$P_T = \frac{E_h(e + 0.05L)}{L}$

13.583'
X DIR.
e = 39.628 − 27.421 = 12.207'
L = 203.964'
e' = 12.207 + 0.05(203.964) = 22.405'
E_h = 32.067
$P_T = \frac{32.067(22.405)}{203.964} = 3.522$ K

Y DIR
e = 84.257 − 75.288 = 8.969'
L = 205.481'
e' = 8.969 + 0.05(205.481) = 19.243'
$P_T = \frac{32.067(19.243)}{205.481} = 3.00$ K



STEAM ENGINE BUILDING

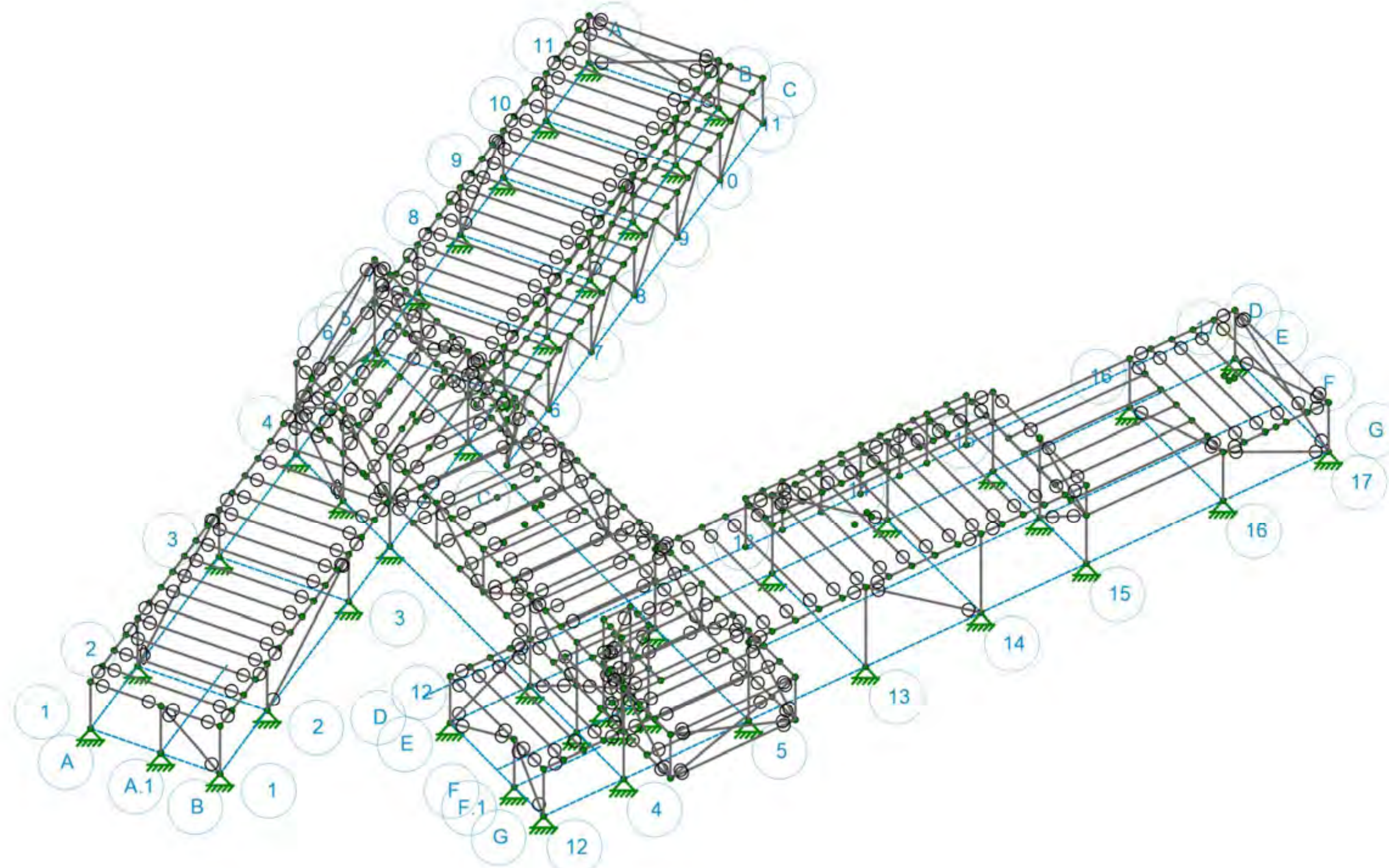

CONCEPT FROM TEAM SD

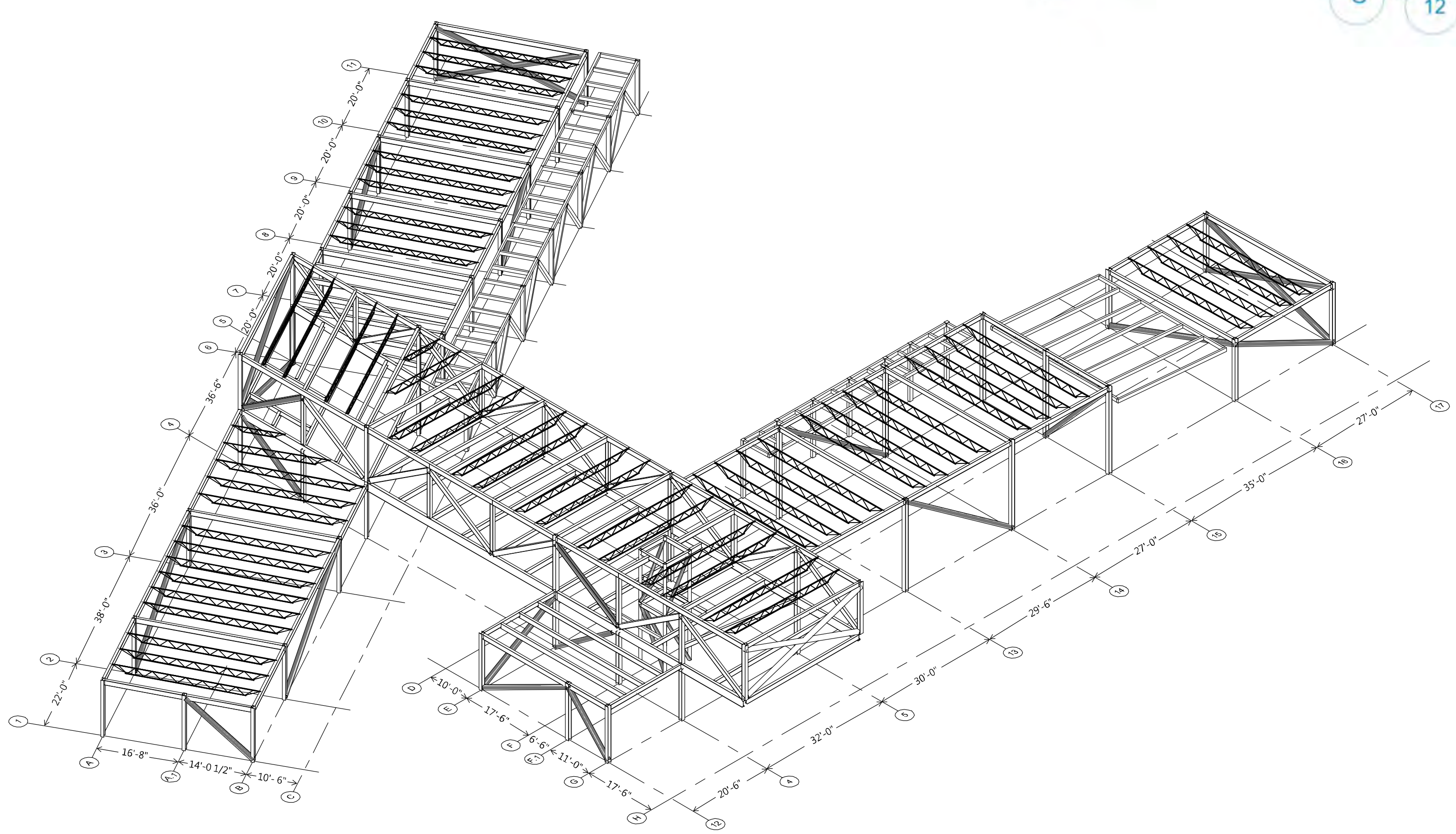
BROOKE WENTZ
CONSTRUCTION DOCUMENTS
ARCH 5226
HONORS THESIS

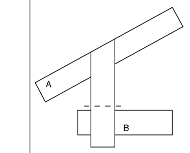
STEAM ENGINE BUILDING

ARCH 5226
BROOKE WENTZ

SHEET INDEX
S-000 TITLE SHEET
S-001 GENERAL NOTES
S-002 SCHEDULES
S-100 GROUND FLOOR PLAN
S-101 FOUNDATION PLAN A
S-102 FOUNDATION PLAN B
S-103 ELEVATED FLOOR/LOW ROOF PLAN A
S-104 ELEVATED FLOOR/LOW ROOF PLAN B
S-105 HIGH ROOF PLAN A
S-106 HIGH ROOF PLAN B
S-107 WALL SECTION
S-200 VERTICAL BRACE ELEVATIONS
S-201 TRUSS AND CANOPY ELEVATIONS
S-300 TYPICAL DETAILS
S-301 TYPICAL DETAILS







STEAM ENGINE BUILDING

PROJECT NAME:
STEAM ENGINE BUILDING

STUDENT NAME:
BROOKE WENTZ

COURSE:
COMPREHENSIVE (ARCH 5226)

SEMESTER: SPRING 2022

DRAWN BY: BW

SCALE: AS INDICATED

SHEET TITLE:
TITLE SHEET

SHEET NUMBER:
S-000

GENERAL NOTES

SECTION 1: GENERAL INFORMATION AND DESIGN CRITERIA

SECTION 1.1 - DOCUMENTS

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

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

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

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

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

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

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

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

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

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

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

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

1.1.13 Verify dimensions, details, plumbness and squareness of existing structures meeting or tieing into new construction.

1.1.14 Heights of floor and roof decks and various framing components are given on the drawings relative to a reference elevation of 100'-0". This reference elevation is equivalent to a Mean Sea Level Elevation of approximately 1204 ft.

SECTION 1.2 - CODES AND STANDARDS

1.2.1 Building Code: 2015 International Building Code (IBC)

1.2.2 Concrete Code: American Concrete Institute ACI 318-14

1.2.3 Steel Code: AISC Steel Construction Manual, 15th edition

1.2.4 Wood Code: National Design Specification (NDS), 2018

1.2.5 ASCE/SEI 7-16: Minimum Design Loads for Buildings and Other Structures

SECTION 1.3 - DESIGN LOADS

1.3.1 Live Loads:

Public Stairs	100	psf
Assembly, Lobbies	100	psf
Outdoor Terraces	100	psf
Corridors Above First Floor	80	psf
Light Storage	125	psf
Restrooms	60	psf
Offices, Typical Floors	50	psf (1)
Roof, Slope Less than 4:12	20	psf

Notes:
(1) Plus partition loading (see Dead Loads)

1.3.2 Dead Loads:

6 1/2" Non-Composite Floor System	62.5	psf
Finish Flooring - Epoxy	1	psf
Floor Collateral	3	psf (1)
Floor Sprinklers	3	psf (3)
Floor MEP	4	psf
Floor Structure Weight	6.5	psf
Partition Loading	15	psf (4)
Roof Collateral	3	psf (1)
Roof Insulation	7.5	psf
Roof MEP	4	psf
Roof Deck, 1.5"	2.5	psf
Roof Joist and Steel Structure Weight	6	psf
Roof Non-Composite Slab	62.5	psf
Roof Terrace Paving	2.5	psf
Roof Sprinklers	3	psf (3)
Roofing System	2	psf (2)
Canopy Structure Weight	5	psf
Canopy Kalwall Panel	3	psf
Facade:		
Glass Curtainwall	15	psf
Metal Panel System	17	psf

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

1.3.3 Wind Loads: MWFRS

Base Mean Wind Velocity	109 mph
Wind Exposure Classification	C
Risk Category	II
Wind Importance Factor	1.0
Analysis Procedure -	Directional Procedure

1.3.4 Seismic Loads:

Mapped Spectral Response Acceleration, S_s	0.279
Mapped Spectral Response Acceleration, S_1	0.078
Spectral Response Coefficient, S_{DS}	0.242
Spectral Response Coefficient, S_{D1}	0.078
Site Class	C
Seismic Importance Factor, I_e	1.0
Seismic Use Group	II
Seismic Design Category, SDC	B
Seismic Response Coefficient, C_s	0.0409
Basic Seismic Force Resisting System	IMRF
Response Modification Factor, R	3.25
Design Base Shear	60.497 K and 2.371 K

Analysis Procedure - Equivalent Lateral Force Procedure

1.3.5 Snow Loads:

Risk Category	II
Importance Factor, I_w	1.0
Surface Roughness	B
Exposure	Fully Exposed
Ground Snow Load	10 psf
p_{min}	10 psf
p_f	6.3 psf

SECTION 2: FOUNDATIONS AND RELATED EARTHWORK

GEOTECHNICAL REPORT

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

Report by : Red Rock Consulting, LLC
Date of Report : September 23, 2019
Report Reference : 19051

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

2.3 Design of soil-supported building slabs is based on a range of soil movement of 0 to 1 inch(es), based on the recommendations of Geotechnical Report.

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

CONCRETE FOOTINGS

2.5 Design Criteria:
Bearing Material: Fat Clay
Bearing Elevation: 100'-0"
(For Bidding Purposes Only)
Spread Footing Bearing Capacity: 2000 psf
Continuous Footing Bearing Capacity: 1600 psf

2.6 Required footing thickness is minimum and shall be adjusted as necessary to achieve required bearing conditions.

2.7 Steel dowels at tops of footings shall extend 30 bar diameters above and shall be hooked 3" above bottom of footing unless noted otherwise.

2.8 Top of footing elevations given are relative to reference elevation 100'-0".

SECTION 3: STRUCTURAL CONCRETE

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

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

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

SECTION 3.1 - CONCRETE FORMS

3.1.1 Formed Voids - Provide retained void spaces between bottom of structural members and sub grade as follows:
Structural Slabs 10 inches

SECTION 3.2 - STEEL REINFORCING

STEEL REINFORCING

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

3.2.2 Strength of bars shall be as follows:

All Bars Grade 60

SPLICING OF REINFORCING BARS

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

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

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

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

LAPPED SPLICE LENGTHS

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

CONCRETE COVER TO REINFORCING

3.2.8 Clearance from face of concrete to face of reinforcing:
Footings 3"
Slabs 3/4"

PLACEMENT OF REINFORCING

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

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

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

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

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

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

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

SECTION 3.3 - CONCRETE MIX DESIGNS

3.3.1 Concrete Mix Schedule:

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

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

3.3.2 Mix Usage Schedule:

Description of Use	Concrete Class	Air Content
Footings	A	------
Interior Slab-on-Grade	C	------
Elevator Pit Walls	B	------
Slab on Non-Composite Metal Deck	E	------

SECTION 3.4 - CONCRETE SLABS

3.4.1 Slabs Placed on Grade

Location	Thickness	Reinforcing
All	5 inches	#3 @ 18 EW

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

SECTION 5: STRUCTURAL STEEL

SECTION 5.1 - STRUCTURAL FRAME

5.1.1 Structural Steel Properties:

W-shapes and Tees	ASTM A992
Angles, Channels, Plates, uno	ASTM A36
HSS Rectangular	ASTM A500, Grade B
HSS Round	ASTM A500, Grade B
Erection Bolts	ASTM A307
High Strength Bolts	ASTM A325N
Anchor Bolts	ASTM A36 or A307
High Strength Anchor Bolts	ASTM A193 Grade B7

WELDING

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

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

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

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

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

STRUCTURAL BOLTS

5.1.7 Bolts indicated on details shall be ¾" diameter, unless noted otherwise.

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

5.1.9 Shelf angles supporting masonry shall have ¼" wide expansion joints spaced not more than 40 feet apart.

SECTION 5.2 - METAL ROOF DECK

5.2.1 Metal Deck Schedule:

Deck Gauge	SDI Deck Type	Deck Depth (In.)	Sheet Width (In.)	Min. Ix (In.4)	Min. Sx(top) (In.3)	Min. Sx(bot) (In.3)
22	WR	1.5	36	0.169	0.192	0.186

5.2.2 Metal Deck Connection Schedule:

Mark	Conn. @ Supports (W/N)	Conn. @ Parallel Edges (In.)	Sidelap Conn. (#/span)	Req'd Shear Capacity (lb/ft)
I	36/4	12	1	310

5.2.3 Support and parallel edge connections shall be 5/8-inch diameter puddle welds. Sidelap connections shall be #10 hex screws. W/N = sheet width / # connections each sheet.

5.2.4 Roof deck shall be connected as indicated for Mark I unless noted otherwise.

SECTION 5.3 – LIGHT GAUGE METAL FRAMING

5.3.1 Metal stud sizes, spacing, gages, details and connections are minimum requirements based on member section properties of Dietrich Industries. Contractor shall provide complete engineered light gage framing system for exterior and interior metal stud framing.

5.3.2 Lightgage Steel Properties:

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

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

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

5.3.5 Do not weld 20 gage or lighter metal framing unless called for on plans or details.

SECTION 6: STRUCTURAL TIMBER

WOOD TIMBER

6.1.1 Framing shall be Douglas Fir, with grades as follows:

Canopy Columns, Beams, and Girders - Stud grade and No. 1/No. 2

6.1.2 Nailing of wood framing shall be in accordance with "Fastening Schedule" Table in the 2015 International Building Code.

6.1.3 Metal connectors referenced on details are "Strong Tie" connectors manufactured by Simpson Co.

STEAM ENGINE BUILDING

PROJECT NAME: STEAM ENGINE BUILDING

STUDENT NAME: BROOKE WENTZ

COURSE: COMPREHENSIVE (ARCH 5226)

SEMESTER: SPRING 2022

DRAWN BY: BW

SCALE: AS INDICATED

SHEET TITLE: GENERAL NOTES

SHEET NUMBER: S-001

STEEL COLUMN SCHEDULE

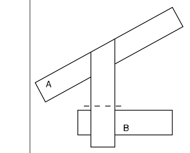
HIGH ROOF														
126'-0" MID ROOF														
123'-0" LOW ROOF													W10X15	W12X14
114'-0" GROUND	W8X18	W8X21	W8X18	W10X26	W8X18	W10X22	W10X33	W10X39	W12X26	W21X48	W14X48	HSS5X5X3/16		
100'-0"														
COLUMN MARK	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14
COLUMN LOCATIONS	A-1, A1.1, A-2, A-3, A-7, A-8, A-9, A-10, A-11, B-1, B-2, B-3, B-7, B-8, B-9, B-10, B-11, E-12, E-16, E-17, F-12.1, G-12, G-16, G-17	B-6	E-15, F-15, G-15	E-13, E-14, G-13, G-14	A-4	A-4.1	E-4, F-4, G-4, G-5	E-5	A-5	B-5	B-4	AROUND ELEVATOR	ALONG GRID 4 AND GRID 5	ALONG GRID 5 BETWEEN GRID A AND B

TIMBER COLUMN SCHEDULE

TOP OF TIMBER 113'-0"		TOP OF TIMBER 114'-0"	
GROUND 100'-0"	4X10	GROUND 100'-0"	4X10
COLUMN MARK	C15		C16

FOOTING SCHEDULE

FOOTING	DIMENSIONS	REINFORCEMENT
F1	2'-6"X2'-6"X1'-0"	3#5 E.W.
F2	3'-6"X3'-6"x1'-0"	3#5 E.W.
F3	4'-0"X4'-0"x1'-0"	4#5 E.W.
F4	4'-6"X4'-6"x1'-0"	4#5 E.W.
F5	5'-6"X5'-6"x1'-0"	5#5 E.W.
F6	6'-0"X6'-0"x1'-0"	6#5 E.W.
F7	7'-6"X7'-6"x1'-2"	6#6 E.W.
F8	8'-6"X8'-6"x1'-4"	8#6 E.W.
F9	10'-0"X10'-0"x1'-6"	8#7 E.W.



STEAM ENGINE BUILDING

PROJECT NAME: STEAM ENGINE BUILDING

STUDENT NAME: BROOKE WENTZ

COURSE: COMPREHENSIVE (ARCH 5226)

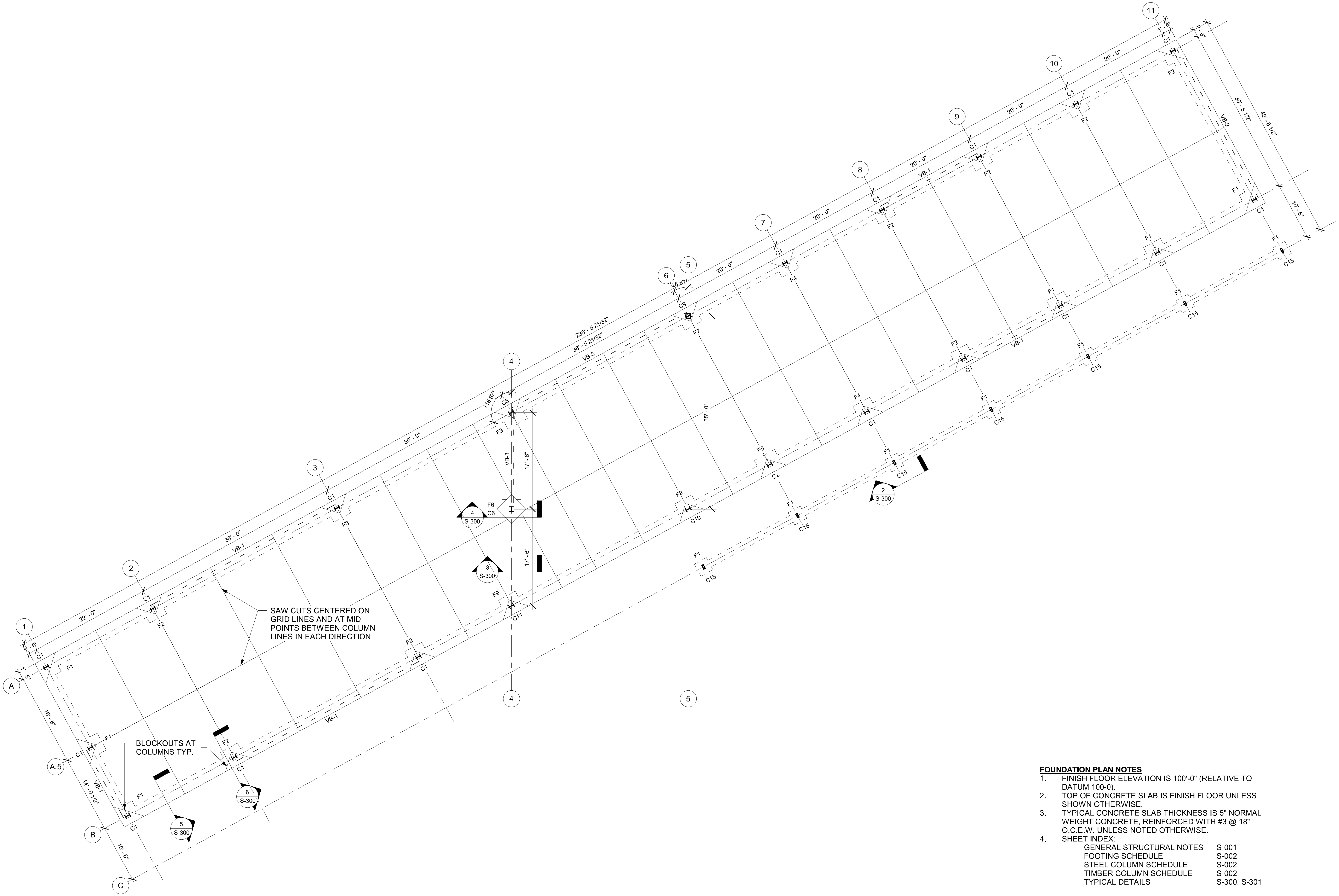
SEMESTER: SPRING 2022

DRAWN BY: BW

SCALE: AS INDICATED

SHEET TITLE: SCHEDULES

SHEET NUMBER: S-002



1 FOUNDATION PLAN A
1/8" = 1'-0"

N

FOUNDATION PLAN NOTES

1. FINISH FLOOR ELEVATION IS 100'-0" (RELATIVE TO DATUM 100-0).
2. TOP OF CONCRETE SLAB IS FINISH FLOOR UNLESS SHOWN OTHERWISE.
3. TYPICAL CONCRETE SLAB THICKNESS IS 5" NORMAL WEIGHT CONCRETE, REINFORCED WITH #3 @ 18" O.C.E.W. UNLESS NOTED OTHERWISE.
4. SHEET INDEX:

GENERAL STRUCTURAL NOTES	S-001
FOOTING SCHEDULE	S-002
STEEL COLUMN SCHEDULE	S-002
TIMBER COLUMN SCHEDULE	S-002
TYPICAL DETAILS	S-300, S-301

STEAM ENGINE BUILDING

PROJECT NAME: STEAM ENGINE BUILDING

STUDENT NAME: BROOKE WENTZ

COURSE: COMPREHENSIVE (ARCH 5226)

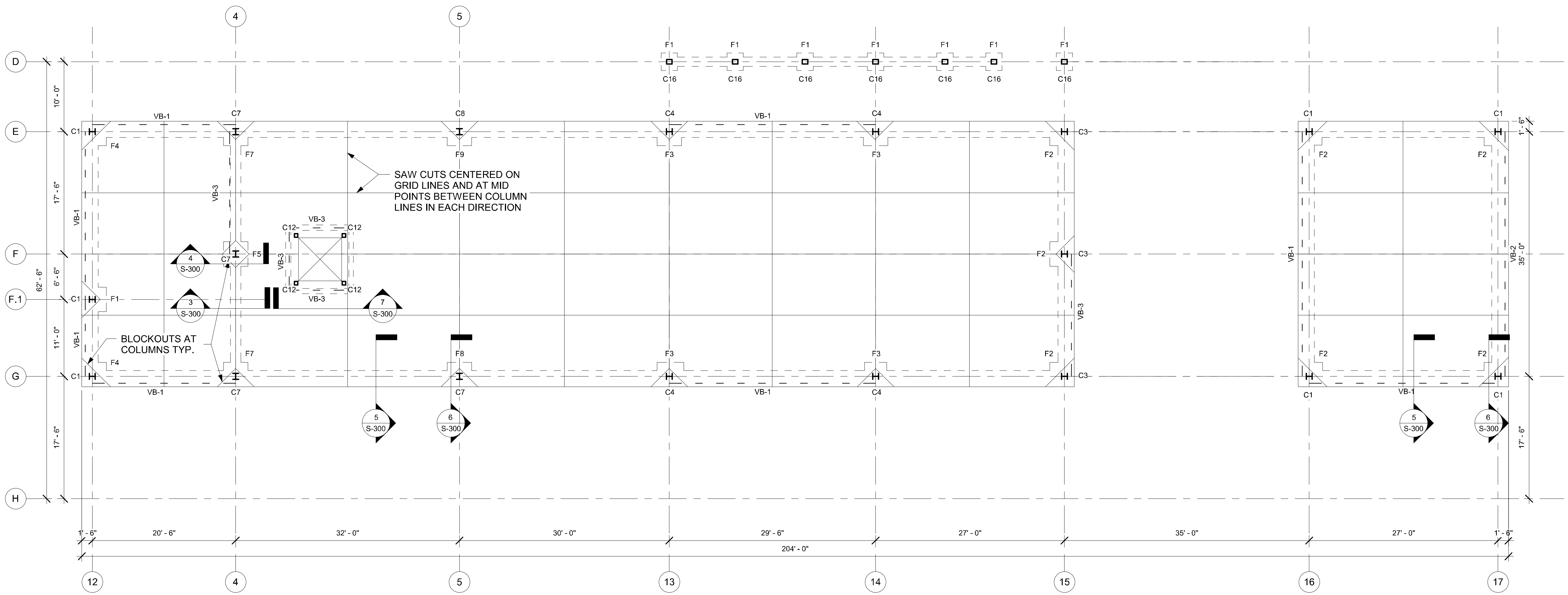
SEMESTER: SPRING 2022

DRAWN BY: BW

SCALE: AS INDICATED

SHEET TITLE: FOUNDATION PLAN A

SHEET NUMBER: S-101



1 FOUNDATION PLAN B
1/8" = 1'-0"

FOUNDATION PLAN NOTES

1. FINISH FLOOR ELEVATION IS 100'-0" (RELATIVE TO DATUM 100-0).
2. TOP OF CONCRETE SLAB IS FINISH FLOOR UNLESS SHOWN OTHERWISE.
3. TYPICAL CONCRETE SLAB THICKNESS IS 5" NORMAL WEIGHT CONCRETE, REINFORCED WITH #3 @ 18" O.C.E.W. UNLESS NOTED OTHERWISE.
4. SHEET INDEX:

GENERAL STRUCTURAL NOTES	S-001
FOOTING SCHEDULE	S-002
STEEL COLUMN SCHEDULE	S-002
TIMBER COLUMN SCHEDULE	S-002
TYPICAL DETAILS	S-300, S-301

STEAM ENGINE BUILDING

PROJECT NAME: STEAM ENGINE BUILDING

STUDENT NAME: BROOKE WENTZ

COURSE: COMPREHENSIVE (ARCH 5226)

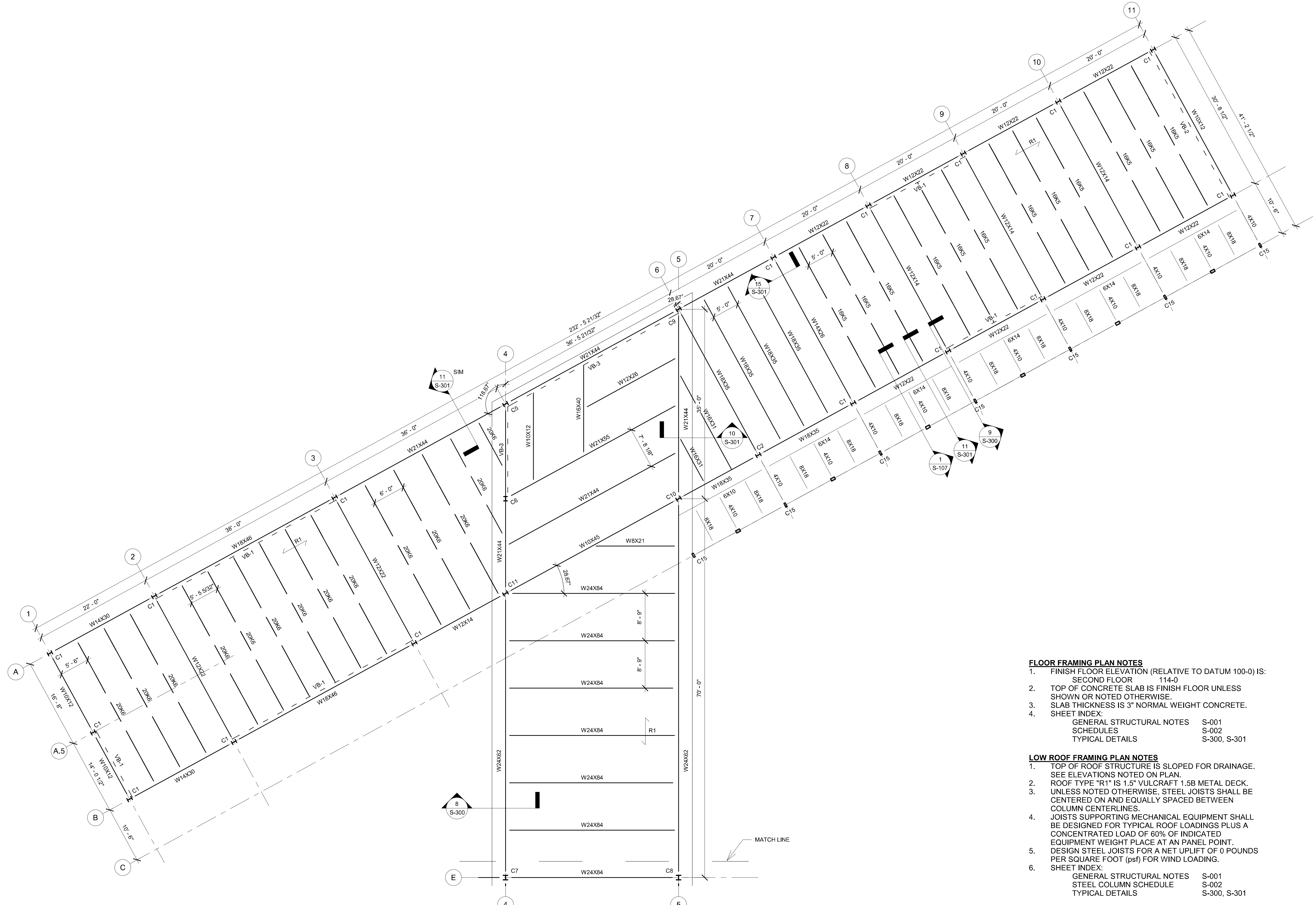
SEMESTER: SPRING 2022

DRAWN BY: BW

SCALE: AS INDICATED

SHEET TITLE: FOUNDATION PLAN B

SHEET NUMBER: S-102



1 ELEVATED FLOOR/LOW ROOF PLAN A
1/8" = 1'-0"

FLOOR FRAMING PLAN NOTES

1. FINISH FLOOR ELEVATION (RELATIVE TO DATUM 100-0) IS:
   SECOND FLOOR 114-0
2. TOP OF CONCRETE SLAB IS FINISH FLOOR UNLESS SHOWN OR NOTED OTHERWISE.
3. SLAB THICKNESS IS 3" NORMAL WEIGHT CONCRETE.
4. SHEET INDEX:
   GENERAL STRUCTURAL NOTES S-001
   SCHEDULES S-002
   TYPICAL DETAILS S-300, S-301

LOW ROOF FRAMING PLAN NOTES

1. TOP OF ROOF STRUCTURE IS SLOPED FOR DRAINAGE. SEE ELEVATIONS NOTED ON PLAN.
2. ROOF TYPE "R1" IS 1.5" VULCRAFT 1.5B METAL DECK.
3. UNLESS NOTED OTHERWISE, STEEL JOISTS SHALL BE CENTERED ON AND EQUALLY SPACED BETWEEN COLUMN CENTERLINES.
4. JOISTS SUPPORTING MECHANICAL EQUIPMENT SHALL BE DESIGNED FOR TYPICAL ROOF LOADINGS PLUS A CONCENTRATED LOAD OF 60% OF INDICATED EQUIPMENT WEIGHT PLACE AT AN PANEL POINT.
5. DESIGN STEEL JOISTS FOR A NET UPLIFT OF 0 POUNDS PER SQUARE FOOT (psf) FOR WIND LOADING.
6. SHEET INDEX:
   GENERAL STRUCTURAL NOTES S-001
   STEEL COLUMN SCHEDULE S-002
   TYPICAL DETAILS S-300, S-301

STEAM ENGINE BUILDING

PROJECT NAME: STEAM ENGINE BUILDING

STUDENT NAME: BROOKE WENTZ

COURSE: COMPREHENSIVE (ARCH 5226)

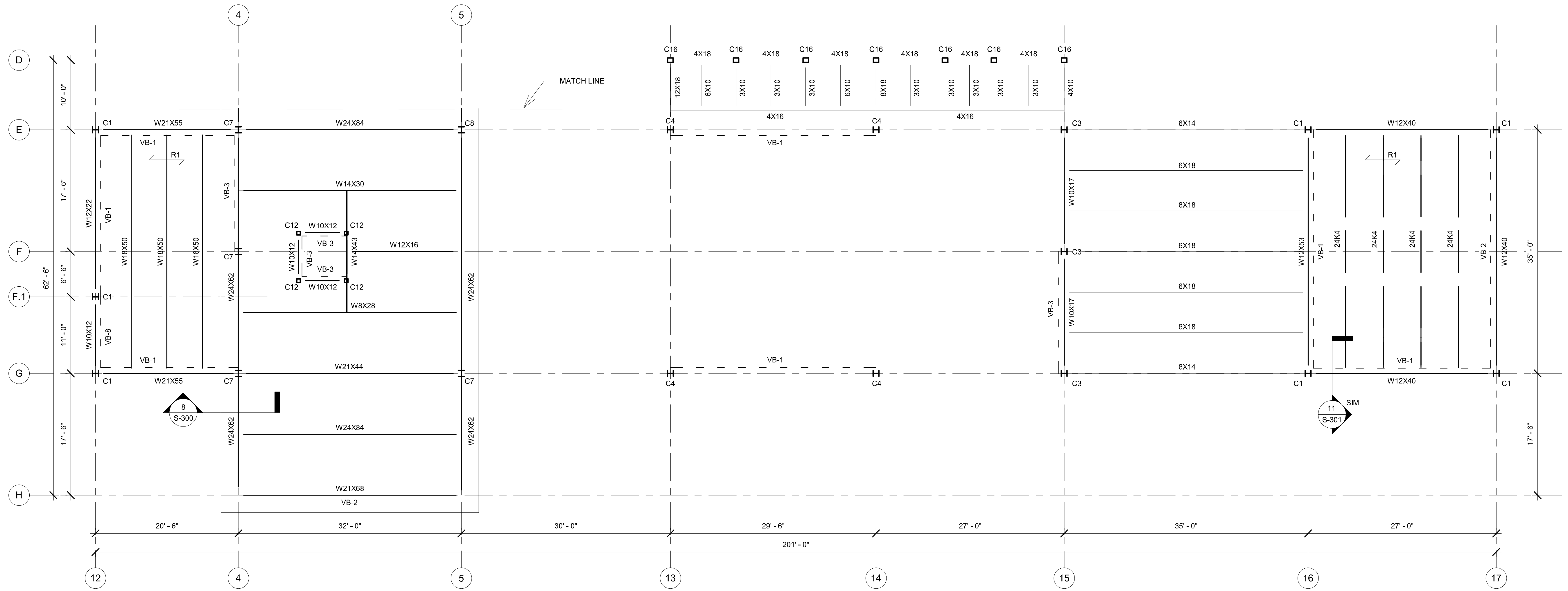
SEMESTER: SPRING 2022

DRAWN BY: BW

SCALE: AS INDICATED

SHEET TITLE: ELEVATED FLOOR/LOW ROOF PLAN A

SHEET NUMBER: S-103



FLOOR FRAMING PLAN NOTES

1. FINISH FLOOR ELEVATION (RELATIVE TO DATUM 100-0) IS:
   SECOND FLOOR 114-0
2. TOP OF CONCRETE SLAB IS FINISH FLOOR UNLESS SHOWN OR NOTED OTHERWISE.
3. SLAB THICKNESS IS 3" NORMAL WEIGHT CONCRETE.
4. SHEET INDEX:

GENERAL STRUCTURAL NOTES	S-001
SCHEDULES	S-002
TYPICAL DETAILS	S-300, S-301

LOW ROOF FRAMING PLAN NOTES

1. TOP OF ROOF STRUCTURE IS SLOPED FOR DRAINAGE. SEE ELEVATIONS NOTED ON PLAN.
2. ROOF TYPE "R1" IS 1.5" VULCRAFT 1.5B METAL DECK.
3. UNLESS NOTED OTHERWISE, STEEL JOISTS SHALL BE CENTERED ON AND EQUALLY SPACED BETWEEN COLUMN CENTERLINES.
4. JOISTS SUPPORTING MECHANICAL EQUIPMENT SHALL BE DESIGNED FOR TYPICAL ROOF LOADINGS PLUS A CONCENTRATED LOAD OF 60% OF INDICATED EQUIPMENT WEIGHT PLACE AT AN PANEL POINT.
5. DESIGN STEEL JOISTS FOR A NET UPLIFT OF 0 POUNDS PER SQUARE FOOT (psf) FOR WIND LOADING.
6. SHEET INDEX:

GENERAL STRUCTURAL NOTES	S-001
STEEL COLUMN SCHEDULE	S-002
TYPICAL DETAILS	S-300, S-301

1 ELEVATED FLOOR/LOW ROOF PLAN B
1/8" = 1'-0"

N

STEAM ENGINE BUILDING

PROJECT NAME: STEAM ENGINE BUILDING

STUDENT NAME: BROOKE WENTZ

COURSE: COMPREHENSIVE (ARCH 5226)

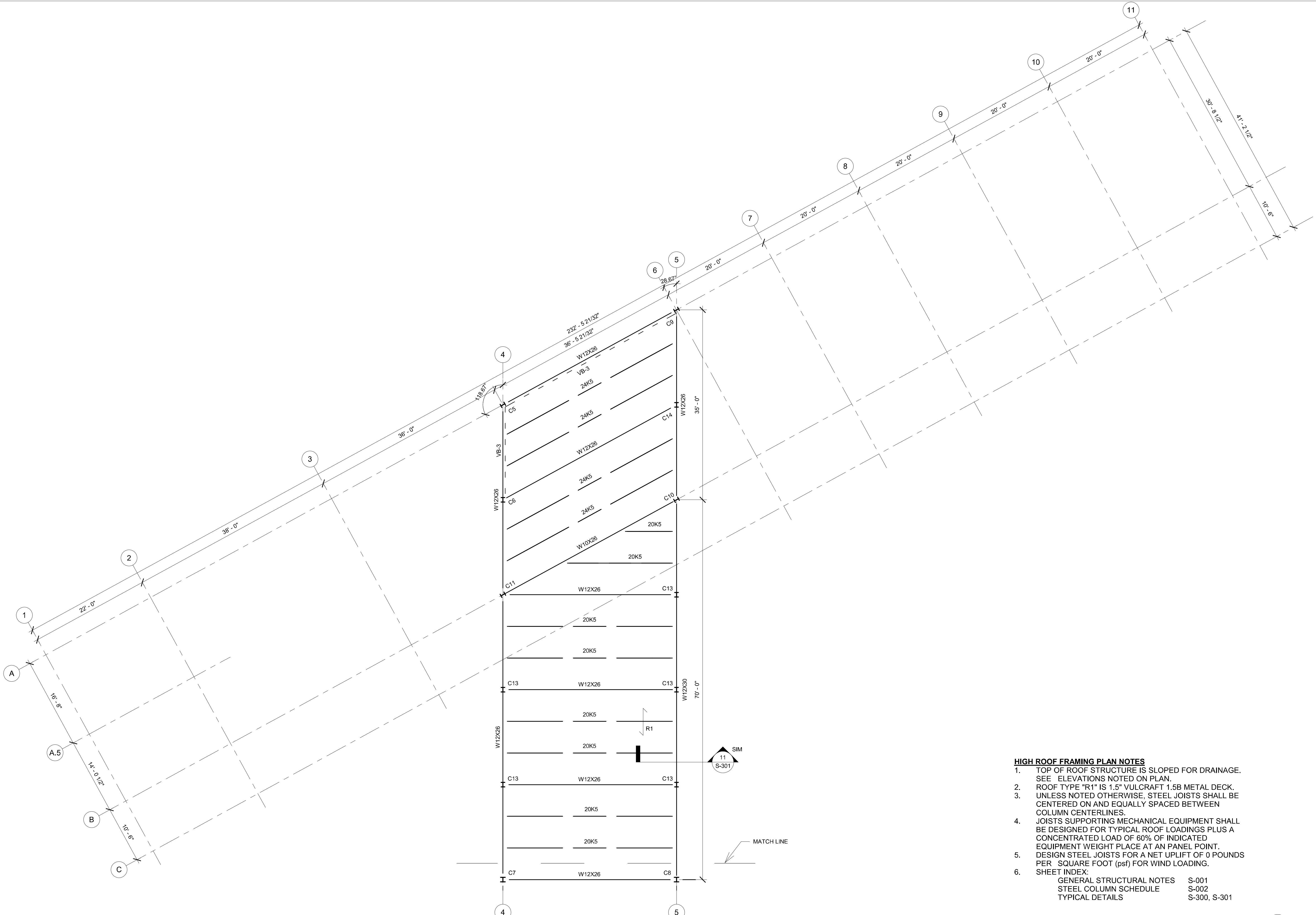
SEMESTER: SPRING 2022

DRAWN BY: BW

SCALE: AS INDICATED

SHEET TITLE: ELEVATED FLOOR/LOW ROOF PLAN B

SHEET NUMBER: S-104



1 HIGH ROOF PLAN A
1/8" = 1'-0"

HIGH ROOF FRAMING PLAN NOTES

1. TOP OF ROOF STRUCTURE IS SLOPED FOR DRAINAGE. SEE ELEVATIONS NOTED ON PLAN.
2. ROOF TYPE "R1" IS 1.5" VULCRAFT 1.5B METAL DECK.
3. UNLESS NOTED OTHERWISE, STEEL JOISTS SHALL BE CENTERED ON AND EQUALLY SPACED BETWEEN COLUMN CENTERLINES.
4. JOISTS SUPPORTING MECHANICAL EQUIPMENT SHALL BE DESIGNED FOR TYPICAL ROOF LOADINGS PLUS A CONCENTRATED LOAD OF 60% OF INDICATED EQUIPMENT WEIGHT PLACE AT AN PANEL POINT.
5. DESIGN STEEL JOISTS FOR A NET UPLIFT OF 0 POUNDS PER SQUARE FOOT (psf) FOR WIND LOADING.
6. SHEET INDEX:

GENERAL STRUCTURAL NOTES	S-001
STEEL COLUMN SCHEDULE	S-002
TYPICAL DETAILS	S-300, S-301

STEAM ENGINE BUILDING

PROJECT NAME: STEAM ENGINE BUILDING

STUDENT NAME: BROOKE WENTZ

COURSE: COMPREHENSIVE (ARCH 5226)

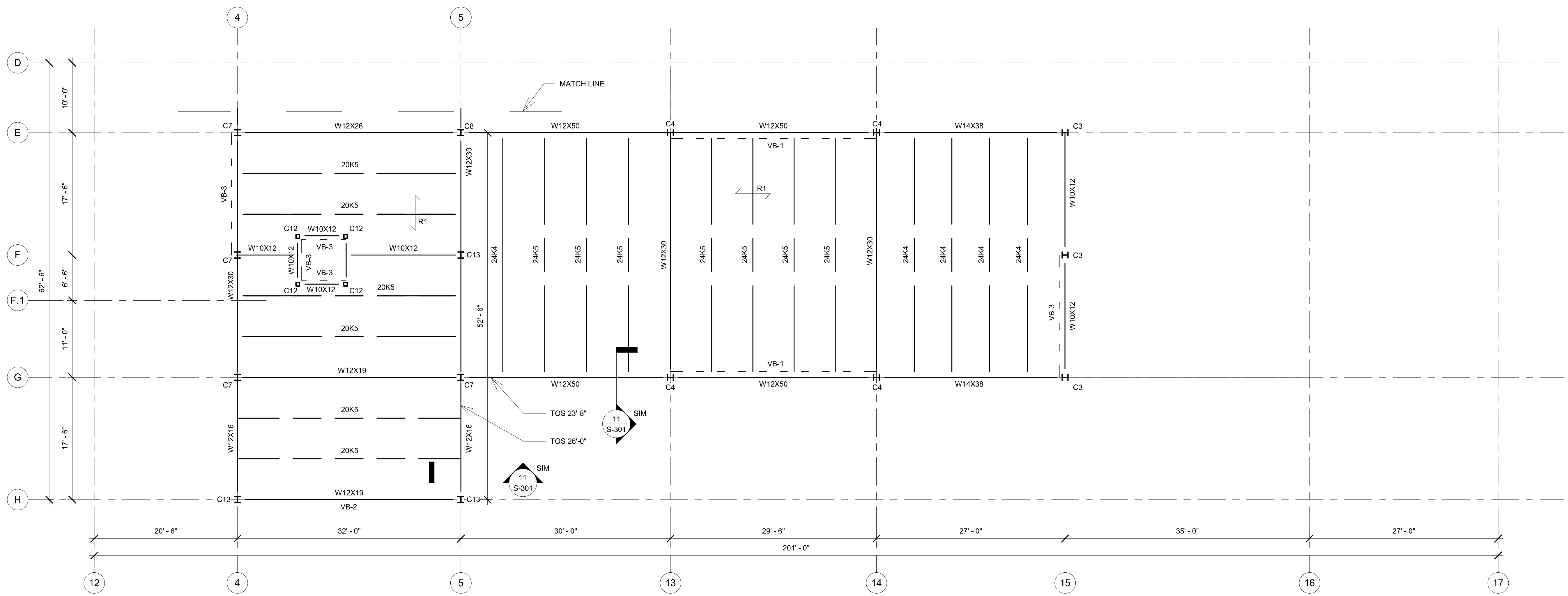
SEMESTER: SPRING 2022

DRAWN BY: BW

SCALE: AS INDICATED

SHEET TITLE: HIGH ROOF PLAN A

SHEET NUMBER: S-105



1 HIGH ROOF PLAN B
1/8" = 1'-0"

HIGH ROOF FRAMING PLAN NOTES

1. TOP OF ROOF STRUCTURE IS SLOPED FOR DRAINAGE. SEE ELEVATIONS NOTED ON PLAN.
2. ROOF TYPE "R1" IS 1.5" VULCRAFT 1.5B METAL DECK.
3. UNLESS NOTED OTHERWISE, STEEL JOISTS SHALL BE CENTERED ON AND EQUALLY SPACED BETWEEN COLUMN CENTERLINES.
4. JOISTS SUPPORTING MECHANICAL EQUIPMENT SHALL BE DESIGNED FOR TYPICAL ROOF LOADINGS PLUS A CONCENTRATED LOAD OF 60% OF INDICATED EQUIPMENT WEIGHT PLACE AT AN PANEL POINT.
5. DESIGN STEEL JOISTS FOR A NET UPLIFT OF 0 POUNDS PER SQUARE FOOT (psf) FOR WIND LOADING.
6. SHEET INDEX:

GENERAL STRUCTURAL NOTES	S-001
STEEL COLUMN SCHEDULE	S-002
TYPICAL DETAILS	S-300, S-301

STEAM ENGINE BUILDING

PROJECT NAME: STEAM ENGINE BUILDING

STUDENT NAME: BROOKE WENTZ

COURSE: COMPREHENSIVE (ARCH 5226)

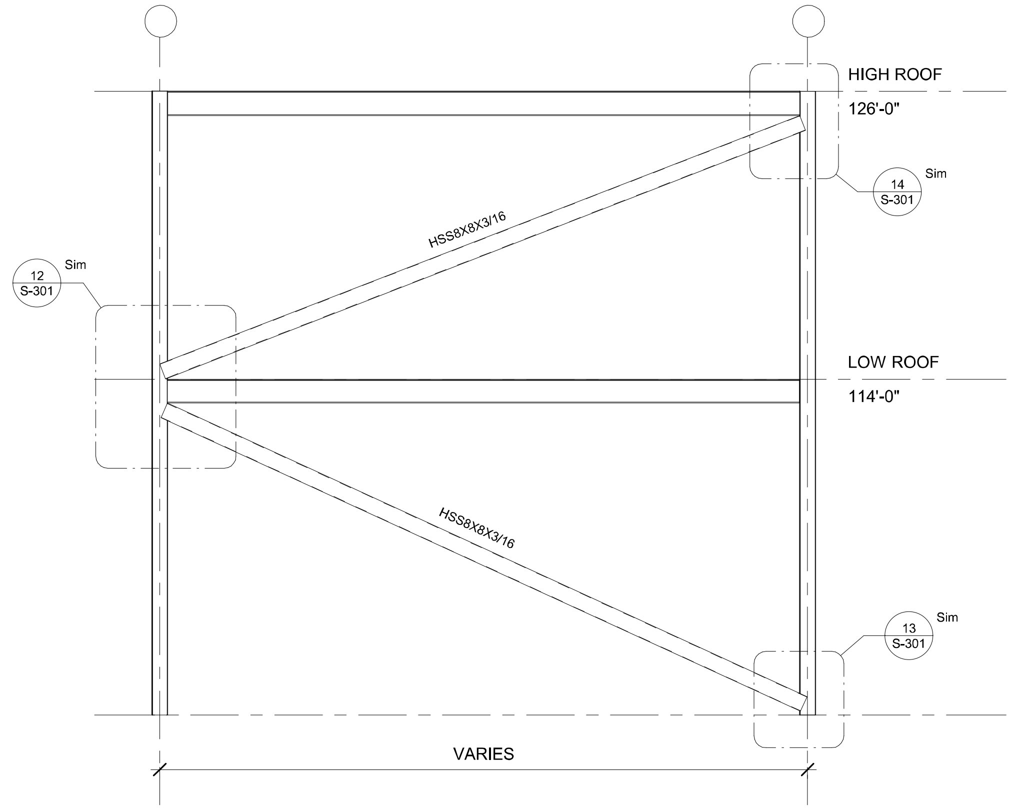
SEMESTER: SPRING 2022

DRAWN BY: BW

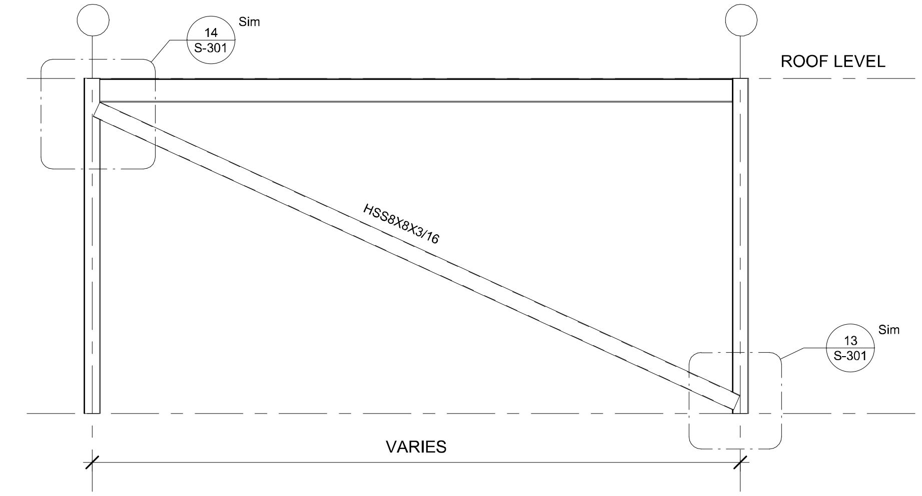
SCALE: AS INDICATED

SHEET TITLE: HIGH ROOF PLAN B

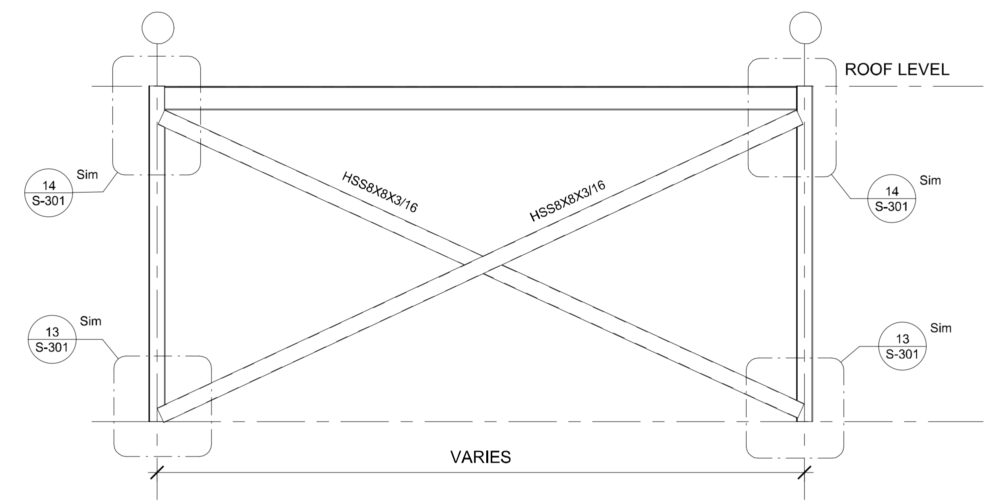
SHEET NUMBER: S-106



3 VERTICAL BRACE ELEVATION 3
1/4" = 1'-0"



1 VERTICAL BRACE ELEVATION 1
1/4" = 1'-0"



2 VERTICAL BRACE ELEVATION 2
1/4" = 1'-0"

STEAM ENGINE BUILDING

PROJECT NAME: STEAM ENGINE BUILDING

STUDENT NAME: BROOKE WENTZ

COURSE: COMPREHENSIVE (ARCH 5226)

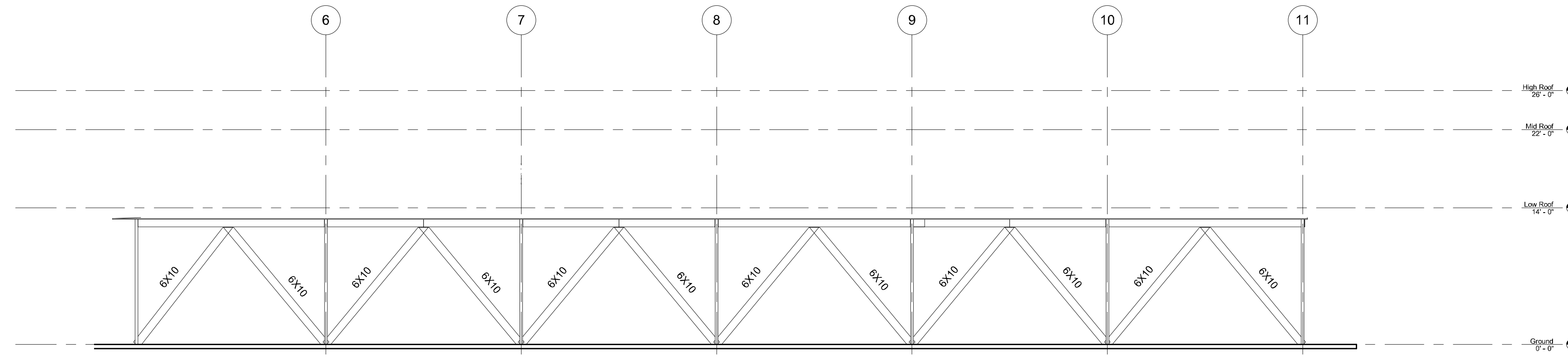
SEMESTER: SPRING 2022

DRAWN BY: BW

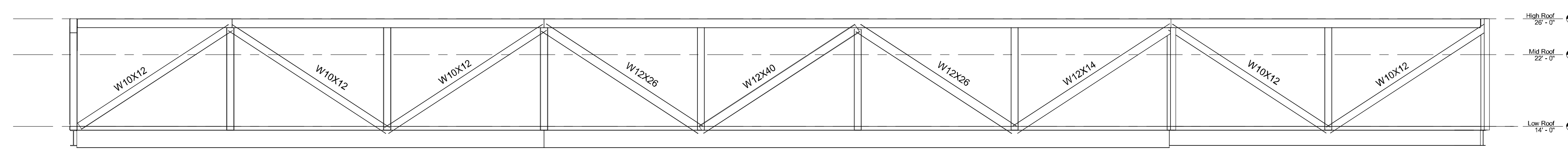
SCALE: AS INDICATED

SHEET TITLE: VERTICAL BRACE ELEVATIONS

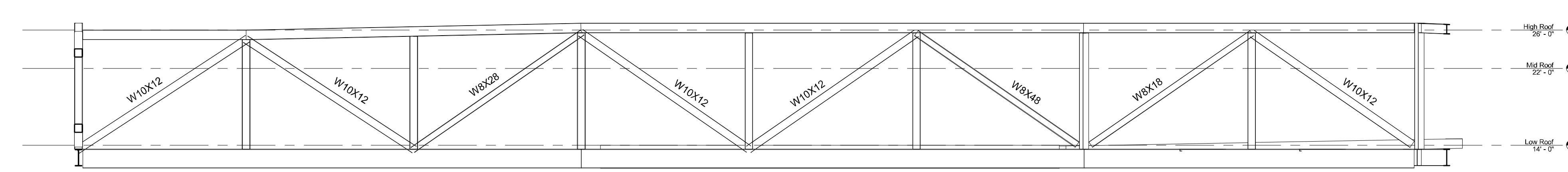
SHEET NUMBER: S-200



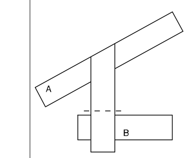
1 TIMBER CANOPY ELEVATION 1
1/8" = 1'-0"



2 TRUSS ELEVATION 1
1/8" = 1'-0"



3 TRUSS ELEVATION 2
1/8" = 1'-0"



STEAM ENGINE BUILDING

PROJECT NAME: STEAM ENGINE BUILDING

STUDENT NAME: BROOKE WENTZ

COURSE: COMPREHENSIVE (ARCH 5226)

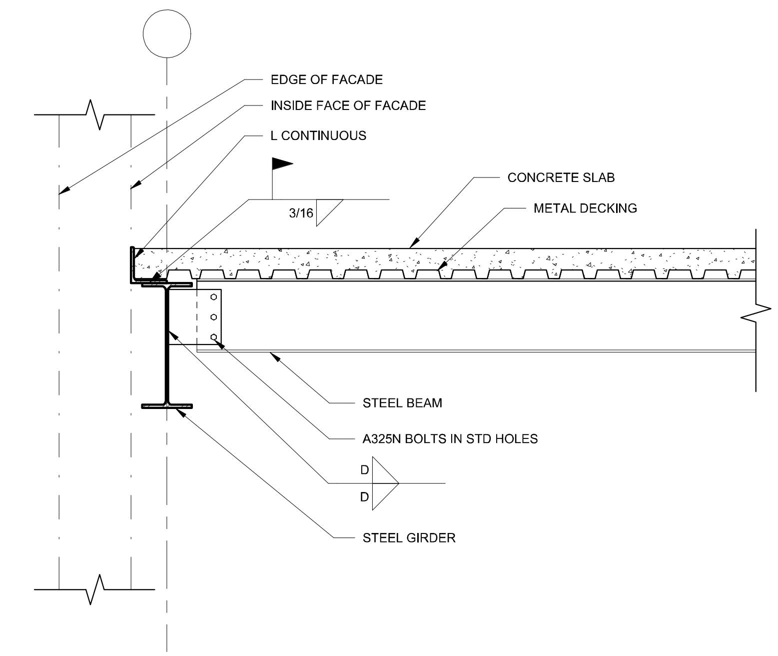
SEMESTER: SPRING 2022

DRAWN BY: BW

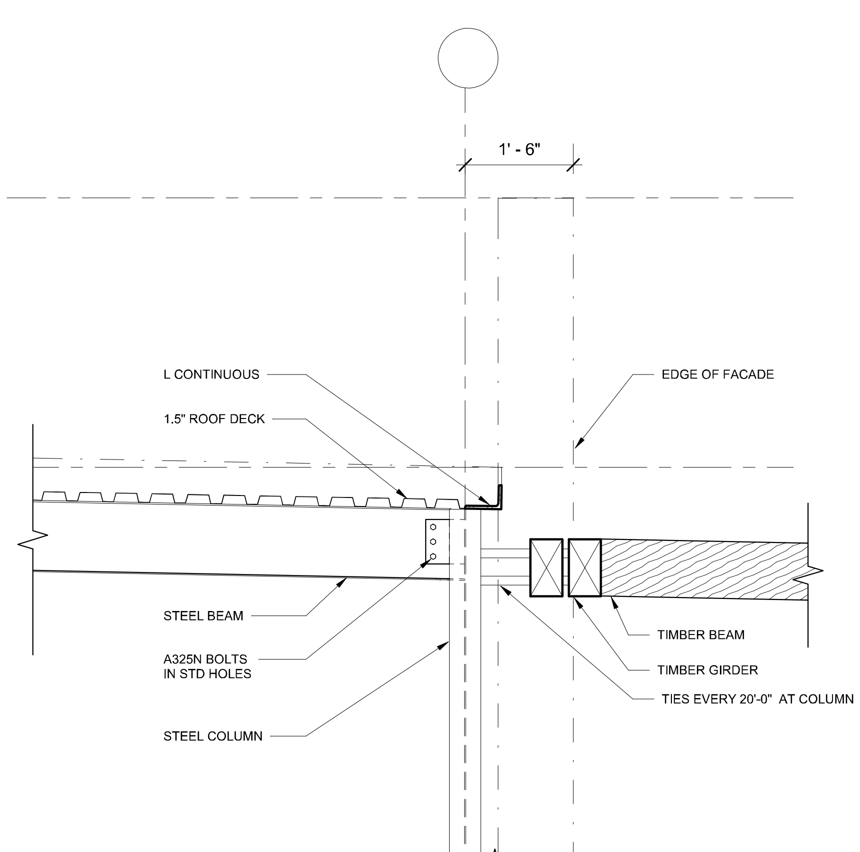
SCALE: AS INDICATED

SHEET TITLE:
TRUSS AND CANOPY ELEVATIONS

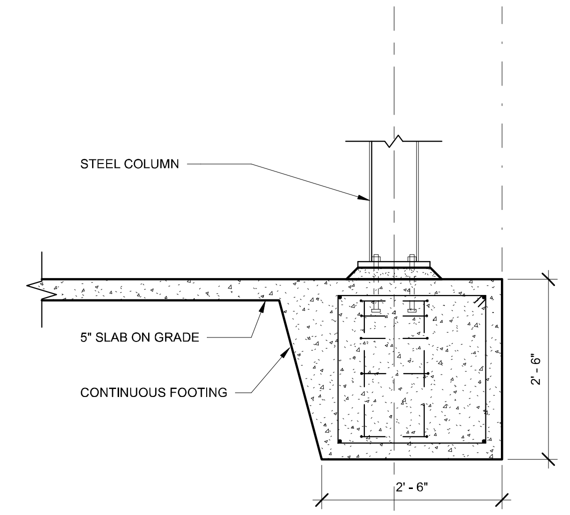
SHEET NUMBER:
S-201



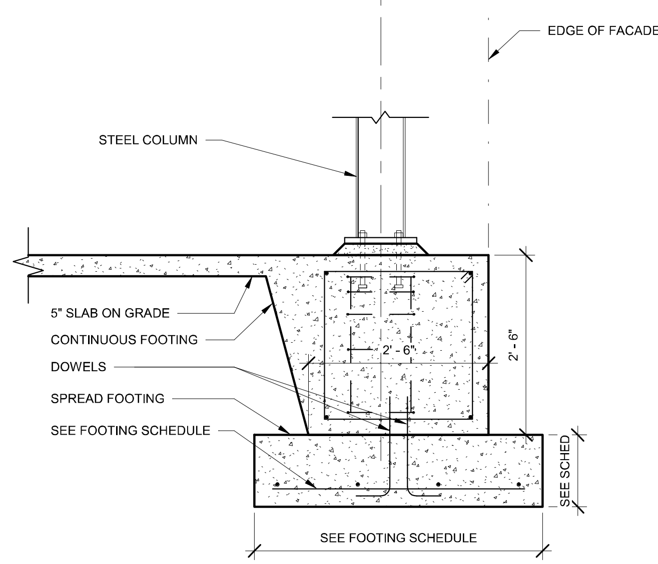
8 FLOOR BEAM TO GIRDER
3/4" = 1'-0"



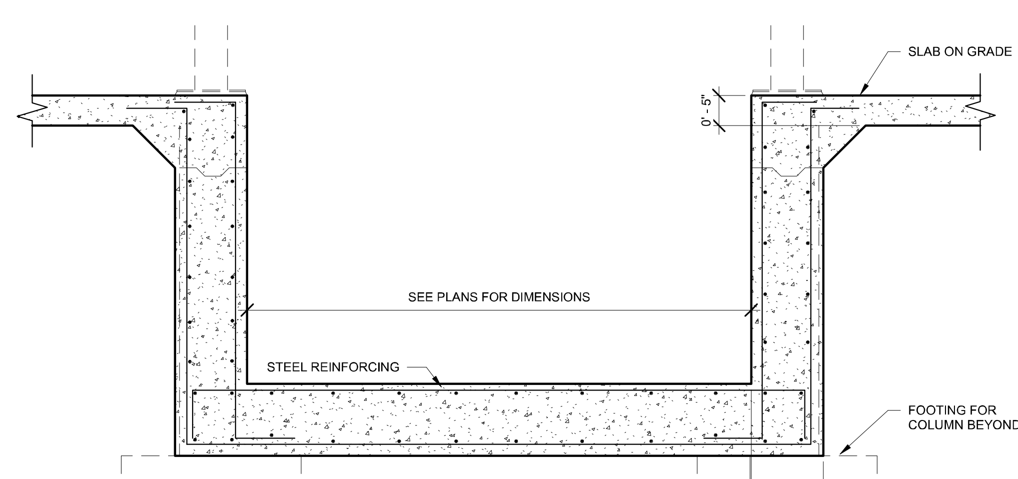
9 TIMBER CANOPY TO STEEL COLUMN
3/4" = 1'-0"



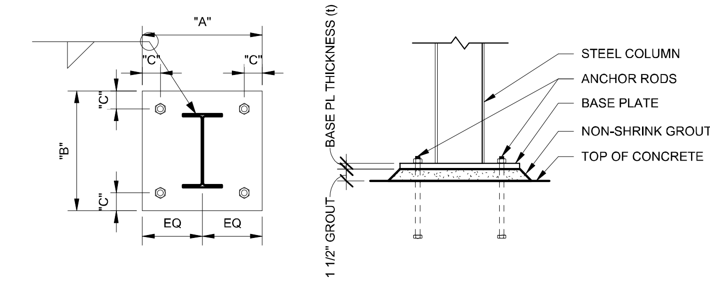
5 EXTERIOR CONTINUOUS FOOTING
3/4" = 1'-0"



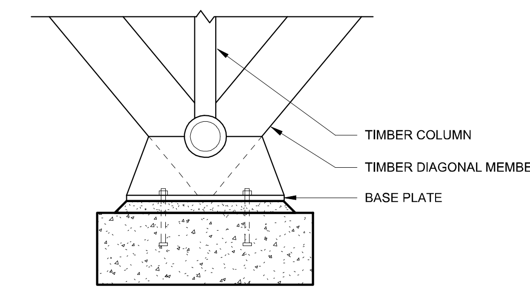
6 EXTERIOR SPREAD FOOTING
3/4" = 1'-0"



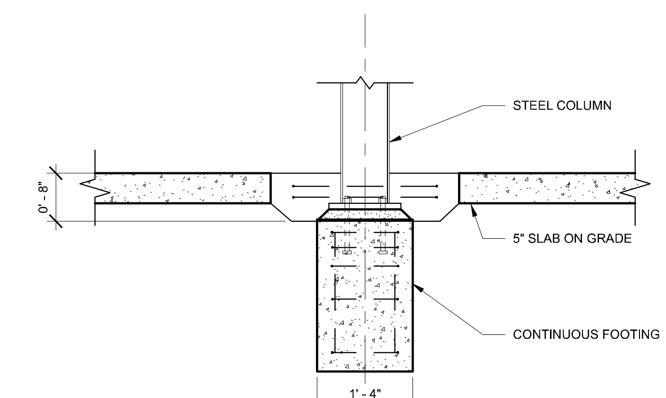
7 ELEVATOR PIT
3/4" = 1'-0"



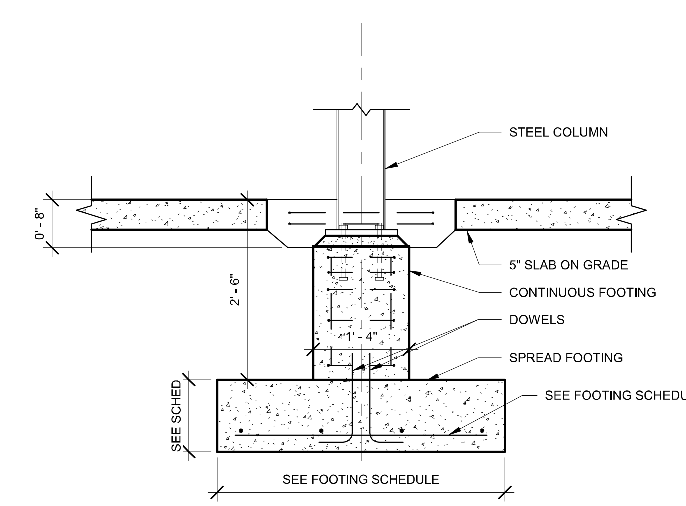
1 BASE PLATE
3/4" = 1'-0"



2 TIMBER CANOPY AT BOTTOM
3/4" = 1'-0"



3 INTERIOR CONTINUOUS FOOTING
3/4" = 1'-0"



4 INTERIOR SPREAD FOOTING
3/4" = 1'-0"

STEAM ENGINE BUILDING

PROJECT NAME:
STEAM ENGINE BUILDING

STUDENT NAME:
BROOKE WENTZ

COURSE:
COMPREHENSIVE (ARCH 5226)

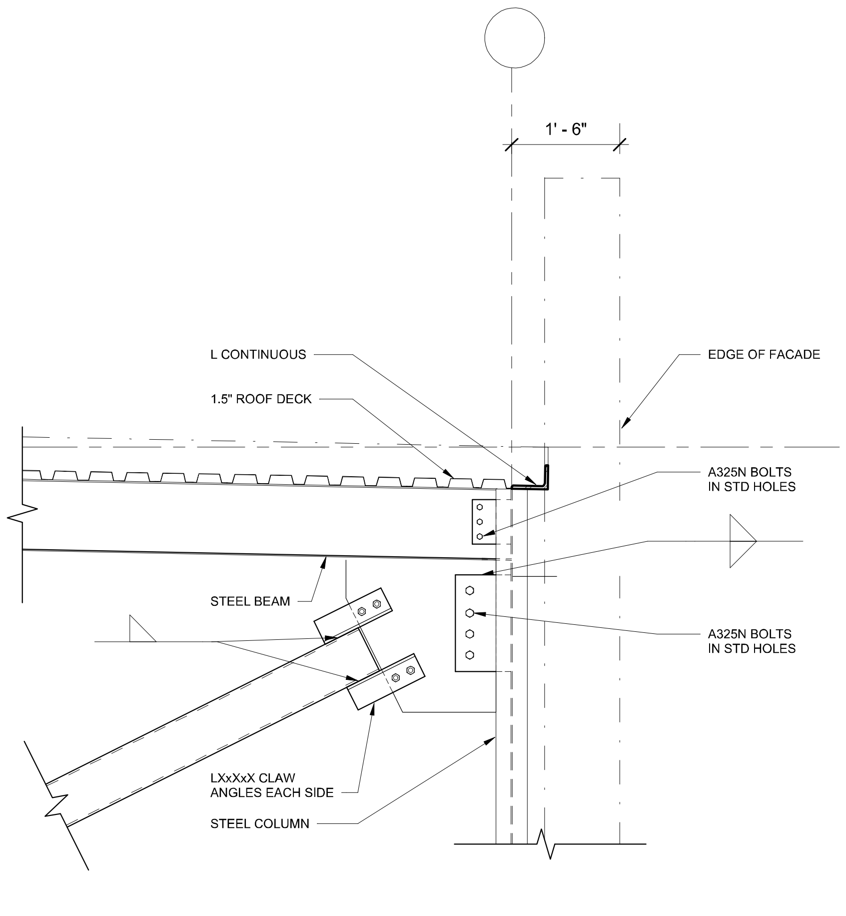
SEMESTER: SPRING 2022

DRAWN BY: BW

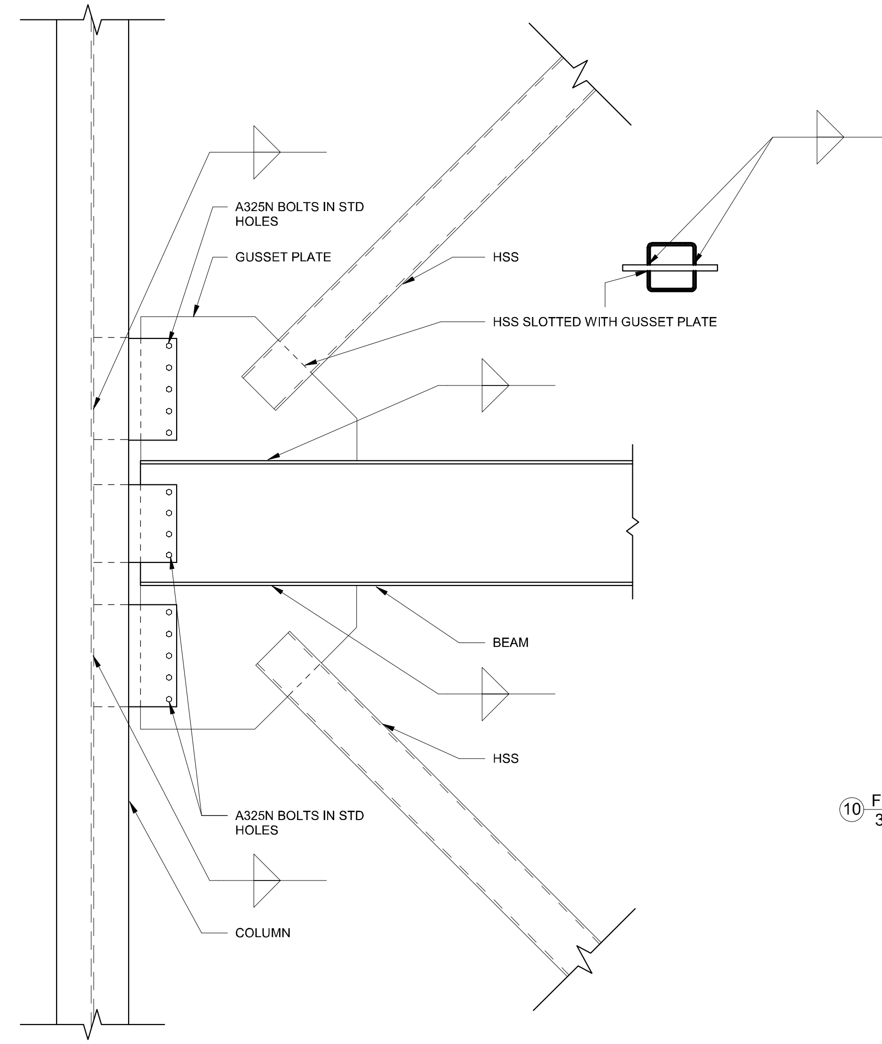
SCALE: AS INDICATED

SHEET TITLE:
TYPICAL DETAILS

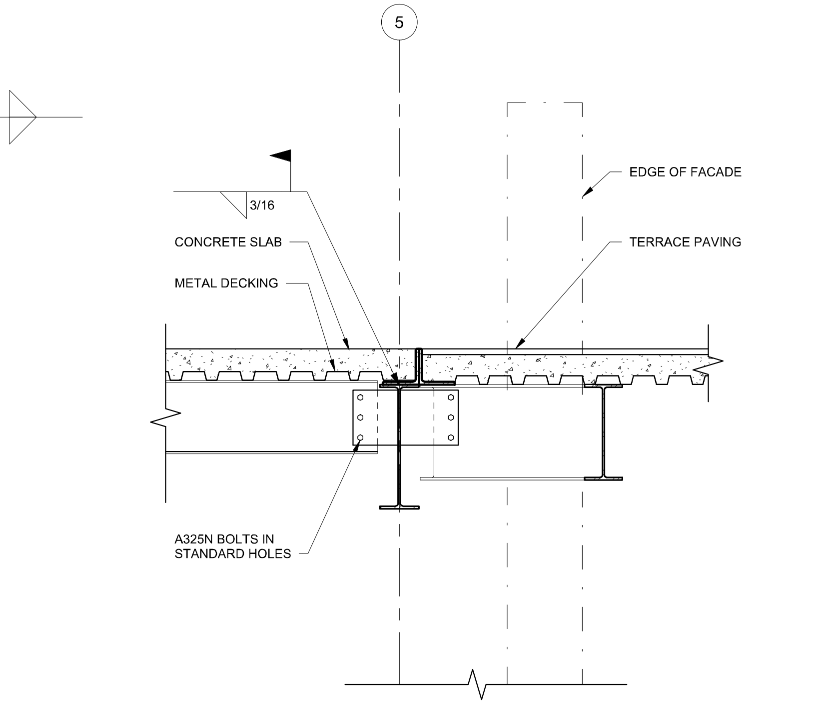
SHEET NUMBER:
S-300



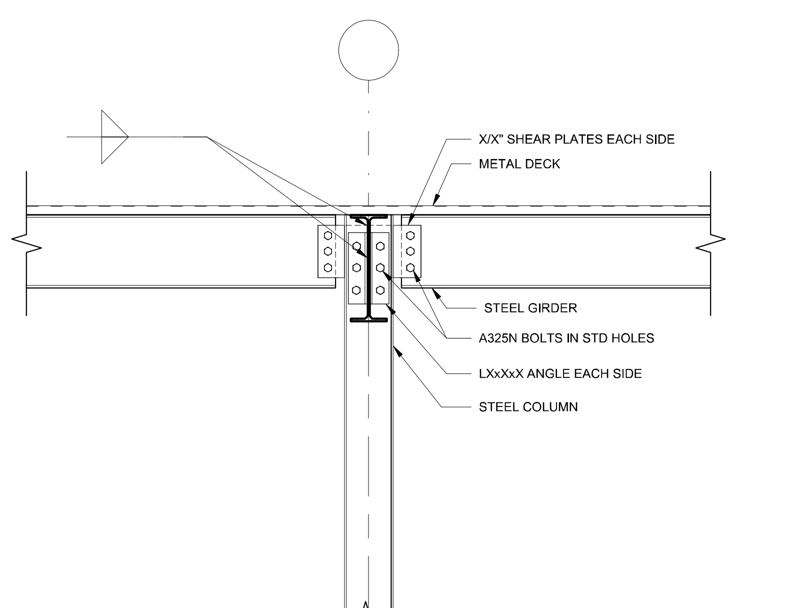
14 BRACE FRAME AT ROOF
3/4" = 1'-0"



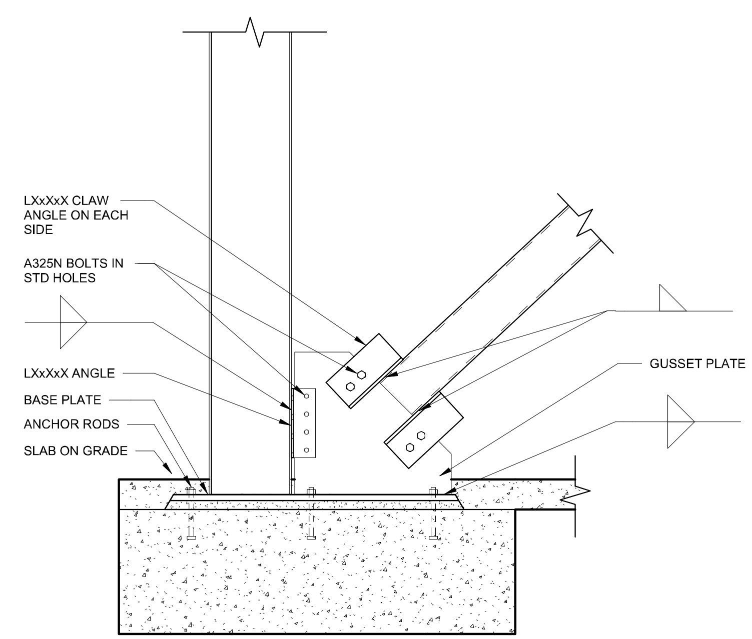
12 BRACE FRAME AT FLOOR
3/4" = 1'-0"



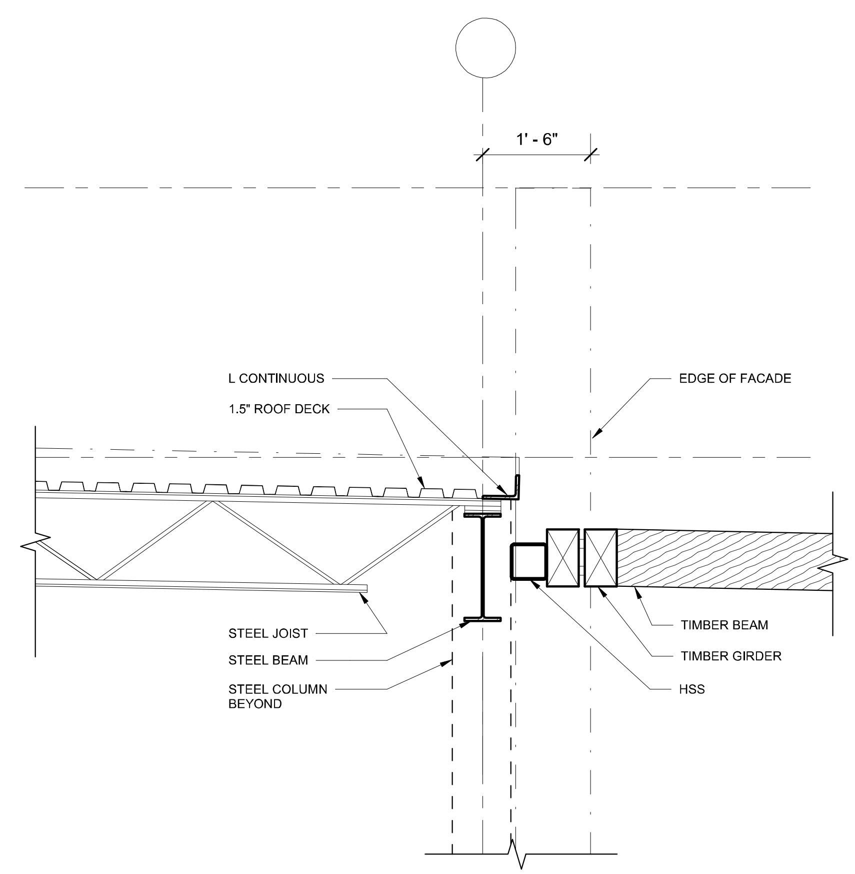
10 FLOOR TO TERRACE
3/4" = 1'-0"



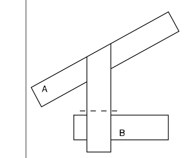
15 GIRDER TO COLUMN
3/4" = 1'-0"



13 BRACE FRAME AT BASE
3/4" = 1'-0"



11 ROOF JOIST TO GIRDER
3/4" = 1'-0"



STEAM ENGINE BUILDING

PROJECT NAME: STEAM ENGINE BUILDING

STUDENT NAME: BROOKE WENTZ

COURSE: COMPREHENSIVE (ARCH 5226)

SEMESTER: SPRING 2022

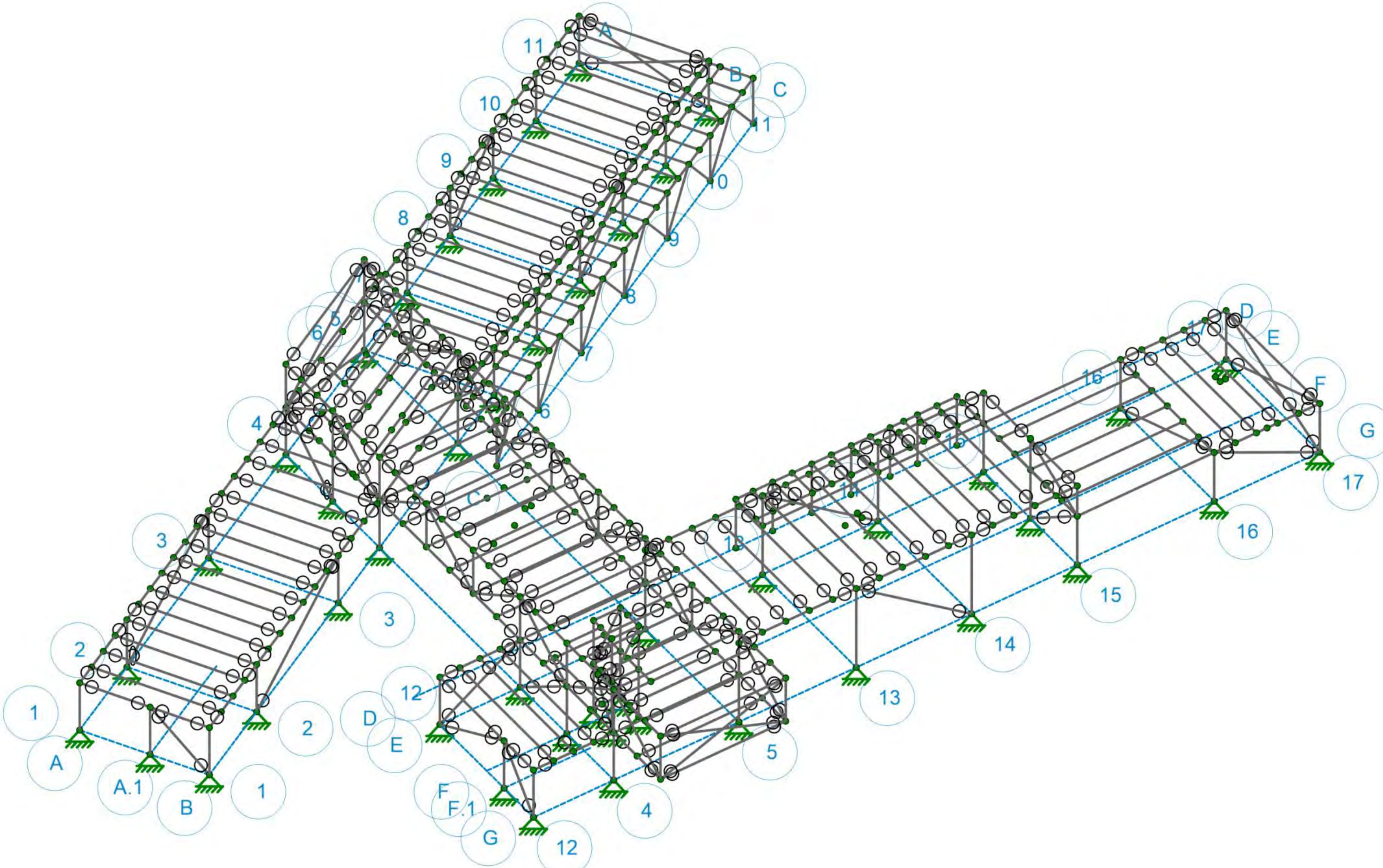
DRAWN BY: BW

SCALE: AS INDICATED

SHEET TITLE: TYPICAL DETAILS

SHEET NUMBER: S-301

STRUCTURAL AXONOMETRIC - RISA MODEL



STRUCTURAL AXONOMETRIC