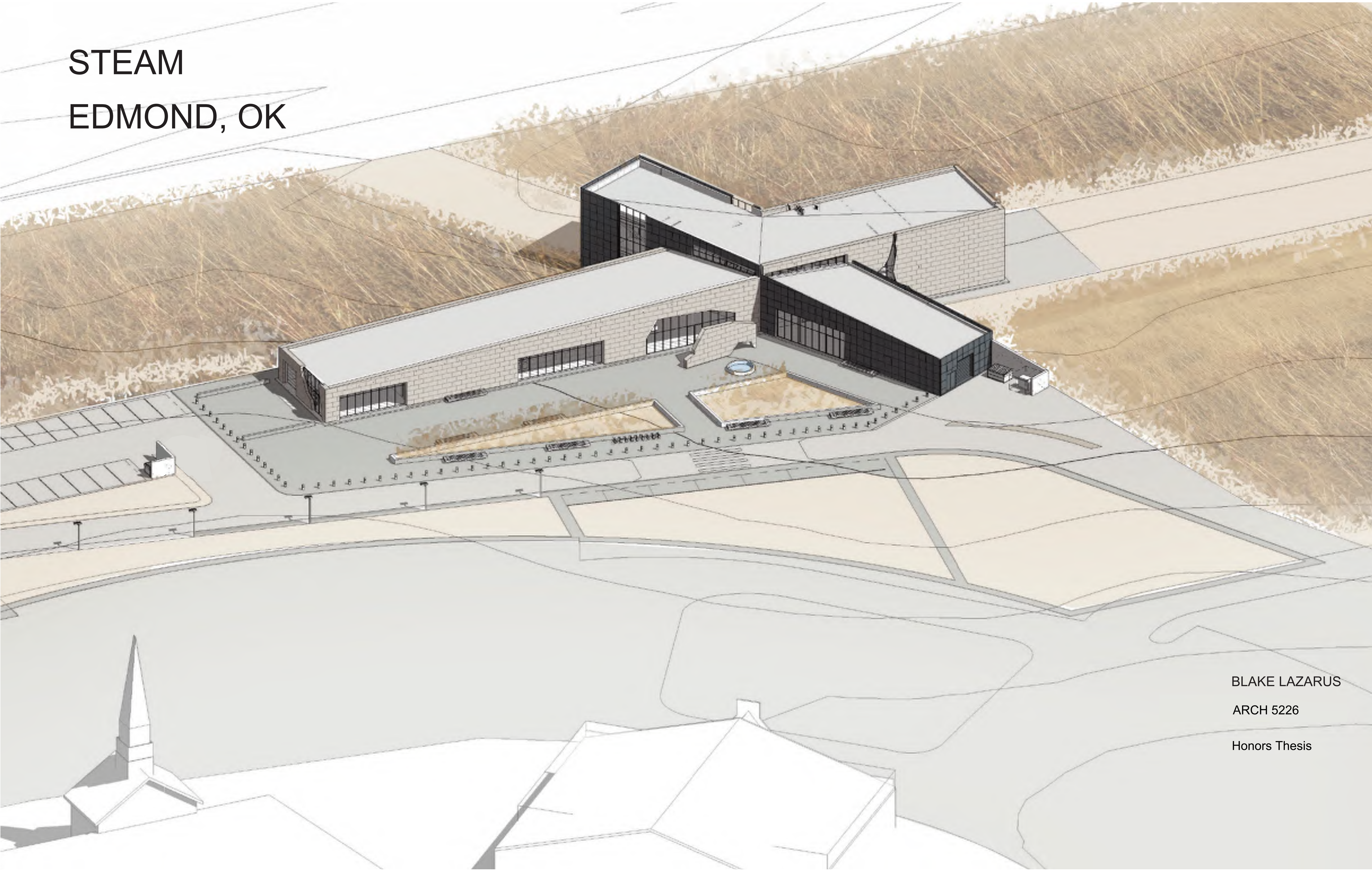
STEAM

EDMOND, OK



BLAKE LAZARUS

ARCH 5226

Honors Thesis

TABLE OF CONTENTS

Schematic Design Presentation 03

Title Page 04
Premise 05
Educational Displays 06
Site Context 10
SD Site Plan 12
Sun and Shadow Diagrams 13
Programming 14
SD Sections 15
SD Interior Perspective 16
SD Aerial View 17
SD Elevation 18
SD Exterior Perspective 19
SD Materiality 20
Structural System Options 21
Selected Structural System 22
Systems Coodination 23

Design Development Presentation 24

Title Page 25
Structural Concept 26
Site Plan 27
Building Sections 28
Exterior Aerial View 29
Exterior Perspective 30
Interior Perspective 31
Mechanical Plans 32
Mechanical Design and Code Compliance 33
Lighting Design and Reflected Ceiling Plan 34
Daylighting Design 35
Energy Efficiency 36
Structural Hand Calculations 37
Axonometrics 39

Construction Documents 41

Title Page 42
Architectural Floor Plan 43
Architectural Wall Section 44
Foundation Plan 45
Elevated Floor/Low Roof Framing Plan 46
High Roof Framing Plan 47
Foundation Details 48
Floor Details 49
Roof Details 50
Lateral Force Resisting System Details and Vertical Brace Elevations 51
Structural Schedules 52

SCHEMATIC DESIGN PRESENTATION (TEAM 6B)

IMMERSIVE.DISCOVERY

education through observation of the world around us

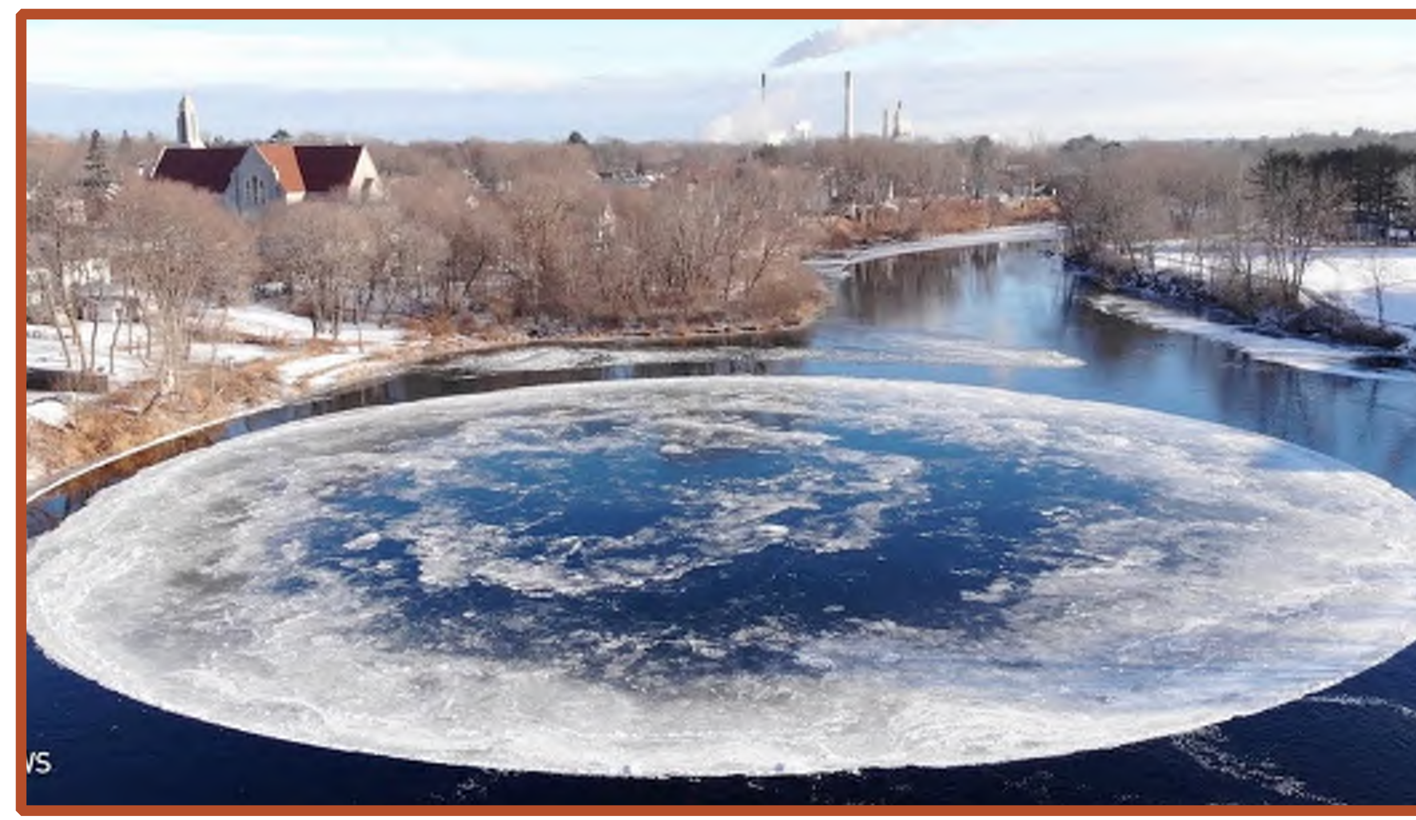
6B • Erlinger • Lazarus • Trower

P R E M I S E

The STEAM Engine of Oklahoma City has the ambition of cultivating the next generation of creators, innovators, and critical thinkers. The proposed design's goal for The STEAM Engine facility focuses on creating a flexible learning environment that immerses the students into an atmosphere of discovery. Architectural applications of varying **academic principles such as; light refraction, thermodynamics, robotics, etc.** present the students something to discover and inquire about, further inspiring critical thinking and **active** participation in learning.The first interaction with the building occurs upon approach, visitors are greeted by two sloping forms crossing one another, rising from an ocean of prairie grass. As they progress to the entrance, the **collision** of these two forms becomes more apparent through the use of facsimile fractures in the facade of both structures. The lobby/gathering place is created by the purported destruction of the two buildings, which subsequently showcases the interaction of various building and structural systems. The central hub provides **diverse learning** spaces to be used for varying education techniques. With the future of education requiring adaptability, a major facet of the design was to **define the spaces while allowing their use to remain abstract.** Adjacent to the entrance, three studio classrooms enclose a collaborative learning center used for presentations and communication workshops, while the furthest end of the facility accommodates two maker spaces, a woodshop, and an assembly lab. The woodshop is acoustically separated from the rest of the building but connected through shared storage with the assembly lab. Throughout all these spaces, the students experience both large-scale and minute **applications of science, technology, engineering, art, and mathematics.**

R O B O T I C S

F L U I D . D Y A N A M I C S



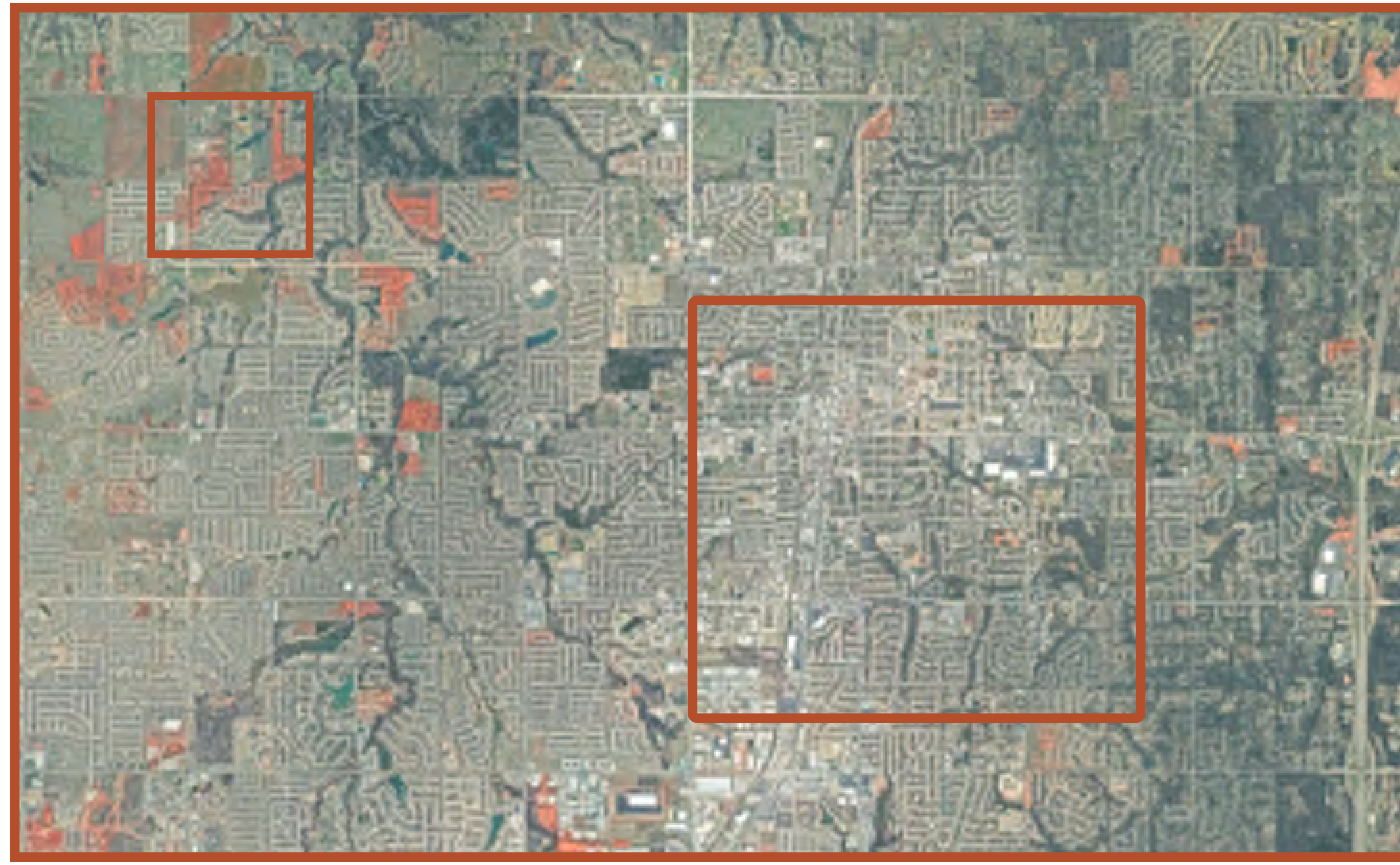
THERMO.DYANMICS

PARTICLE.PHYSICS

A S T R O N O M Y A R C H I T E C T U R E

Using both large-scale and small applications of these principles to generate an environment that pulls students' focus into observing and discovering the world around them.

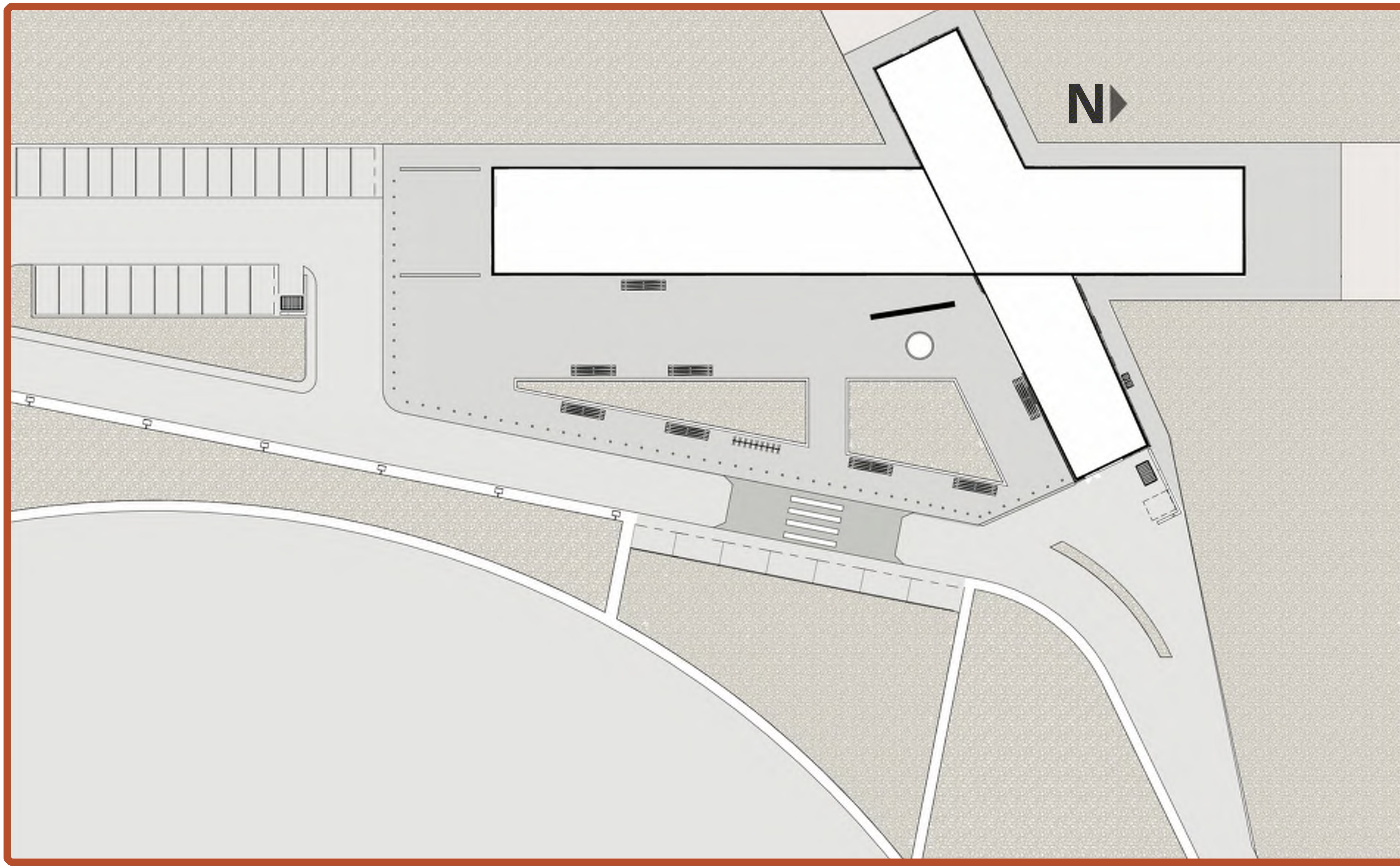
This immerses the students and rewards active learning with the ability to see topics of STEAM integrated with their everyday life.



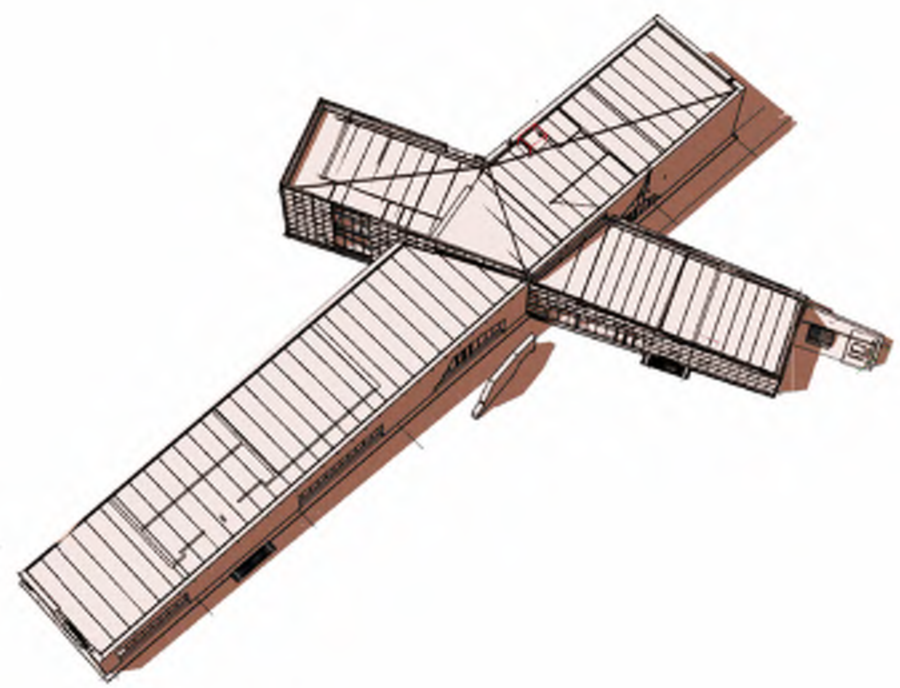
Located at 4848 W. Covell Rd, the proposed site lies to the north-west of the greater Edmond area. Edmond in recent years has begun more substantial development along it's northern edge, master-planning shopping centers, theaters, and schools. The STEAM Engine site's southern neighbour is Frontier Elementary & recently constructed Heartland Middle School. While the eastern side of the site is shared with Acts 2 United Methodist Church. The remaining context mostly consists of residential and light commercial further east. Overall the site is very bike friendly and with some special attention paid to site shows potential to be highly walkable.

Special focus was put into the pedestrian connection to the church to the east and schools to the south. The main axis of the facility runs north/south to emphasize the physical link with Frontier Elementary, while the transverse arm angles to frame views into the buidling plaza from Acts 2 Methodist Church.

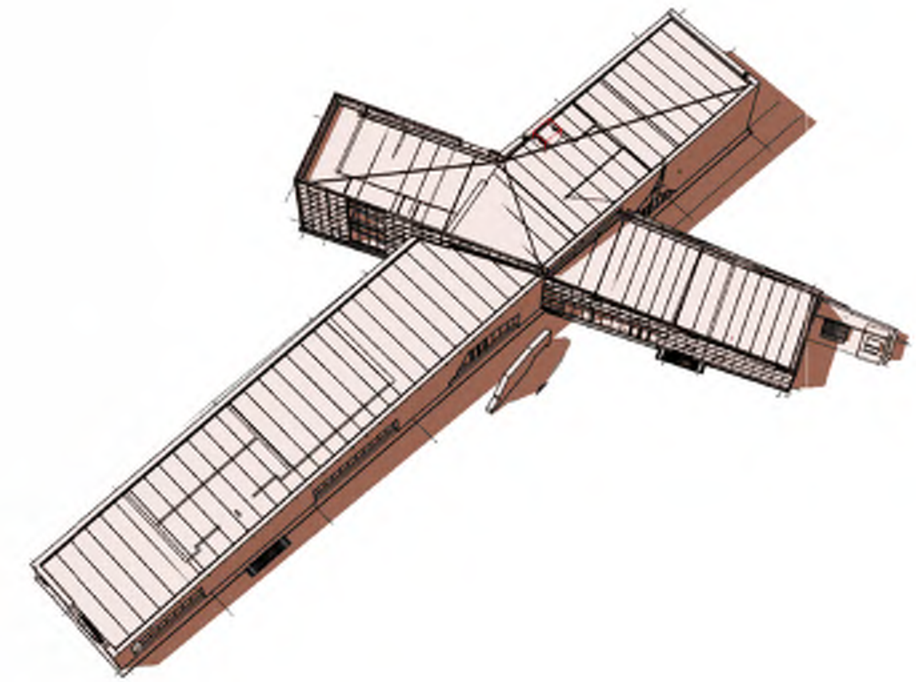
Both of these axis continue through the landscape up to the roads' edge through well kempt clearings. This will contrast with the rest of the site being filled with native Oklahoma flora, such as bluestem, switchgrass, red cedar, etc. These plants not only create a mysticism of the building from outside the site, but play a large part towards water conservation.



***Building was rotated 90 degrees on the site during DD to maximize southern exposure and minimize east/west exposure.

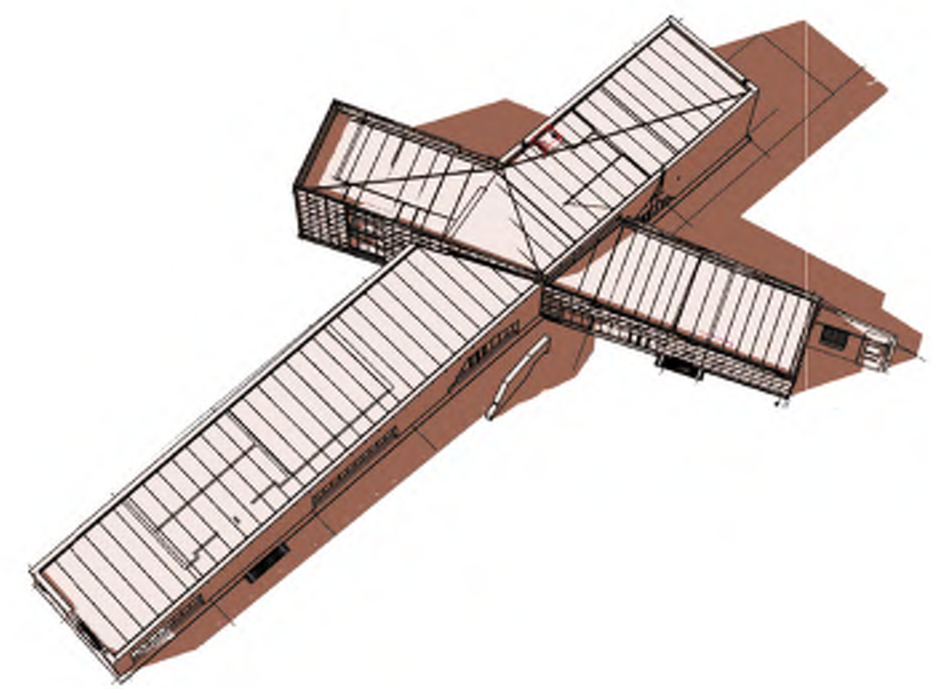


SPRING EQUINOX

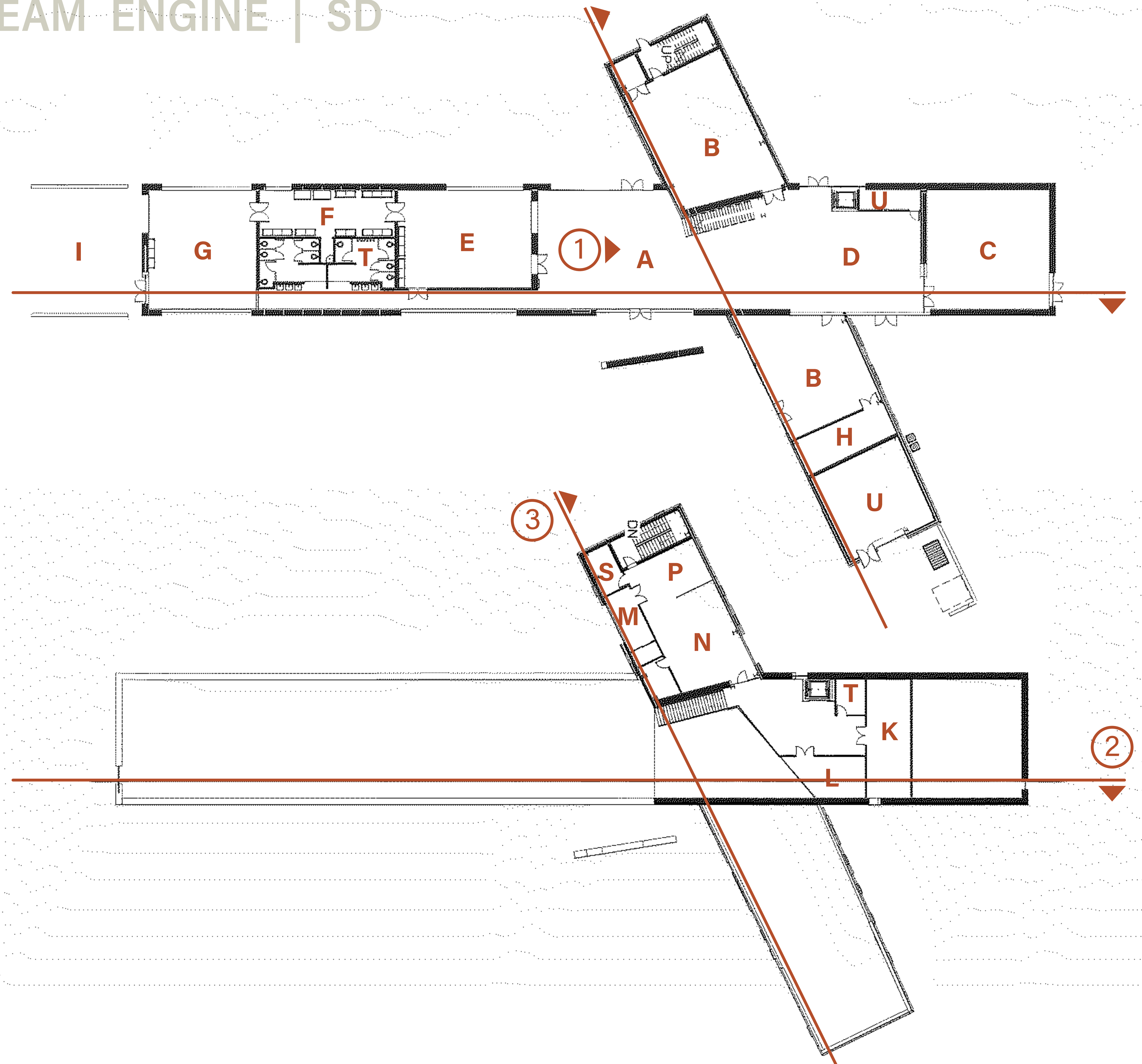


FALL EQUINOX

SUMMER SOLSTICE

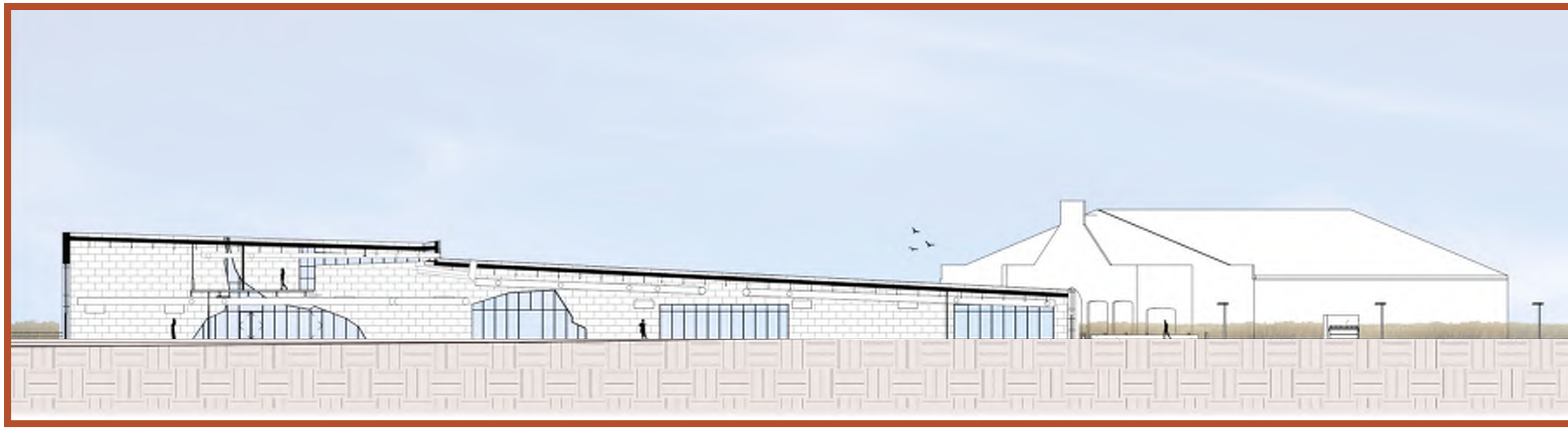


WINTER SOLSTICE

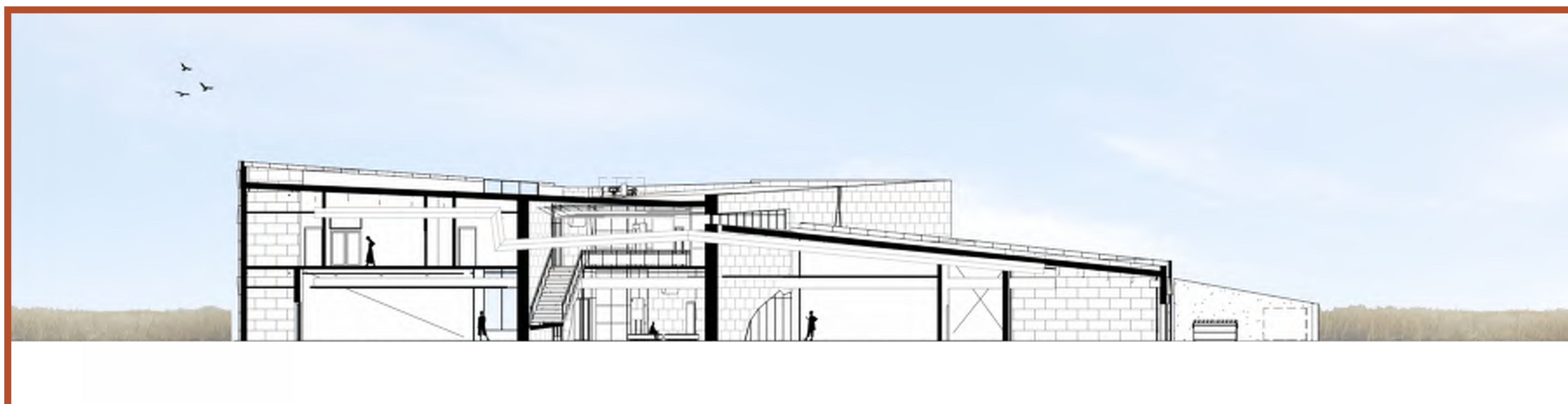


A Entry Lobby / Gathering Place
B Studio Classrooms (2)
C Teaching Kitchen
D Collaborative Learning Center
E Assembly Lab
F Shared Storage
G Wood Shop
H Classroom Storage
I Outdoor Workspace
K Boardroom
L Directors Office
M General Office
N Open Offices
P Lounge / Kitchenette
S Staff Restrooms
T Public Restrooms
U Mechanical

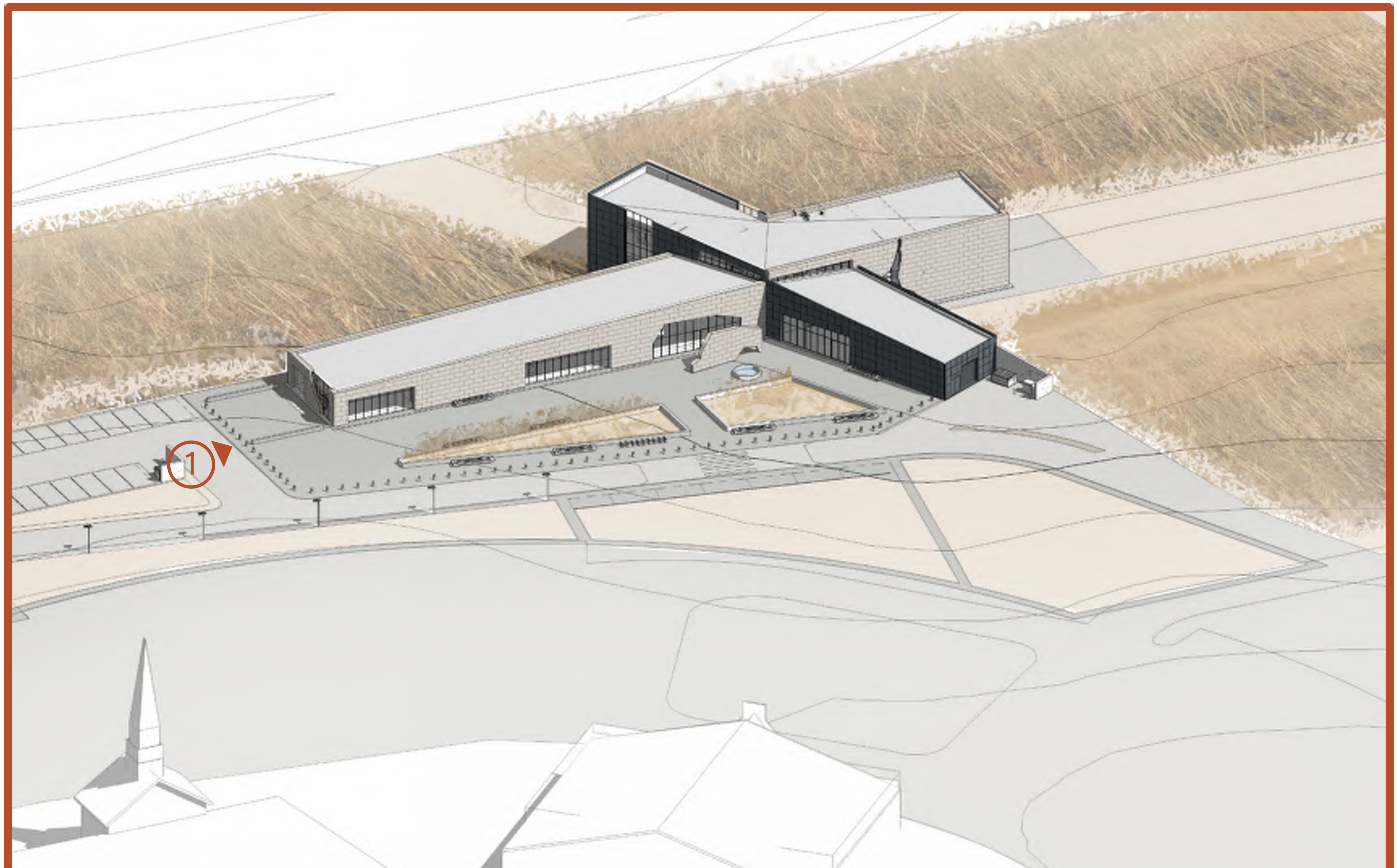
② Longitudinal Section



③ Transverse Section



1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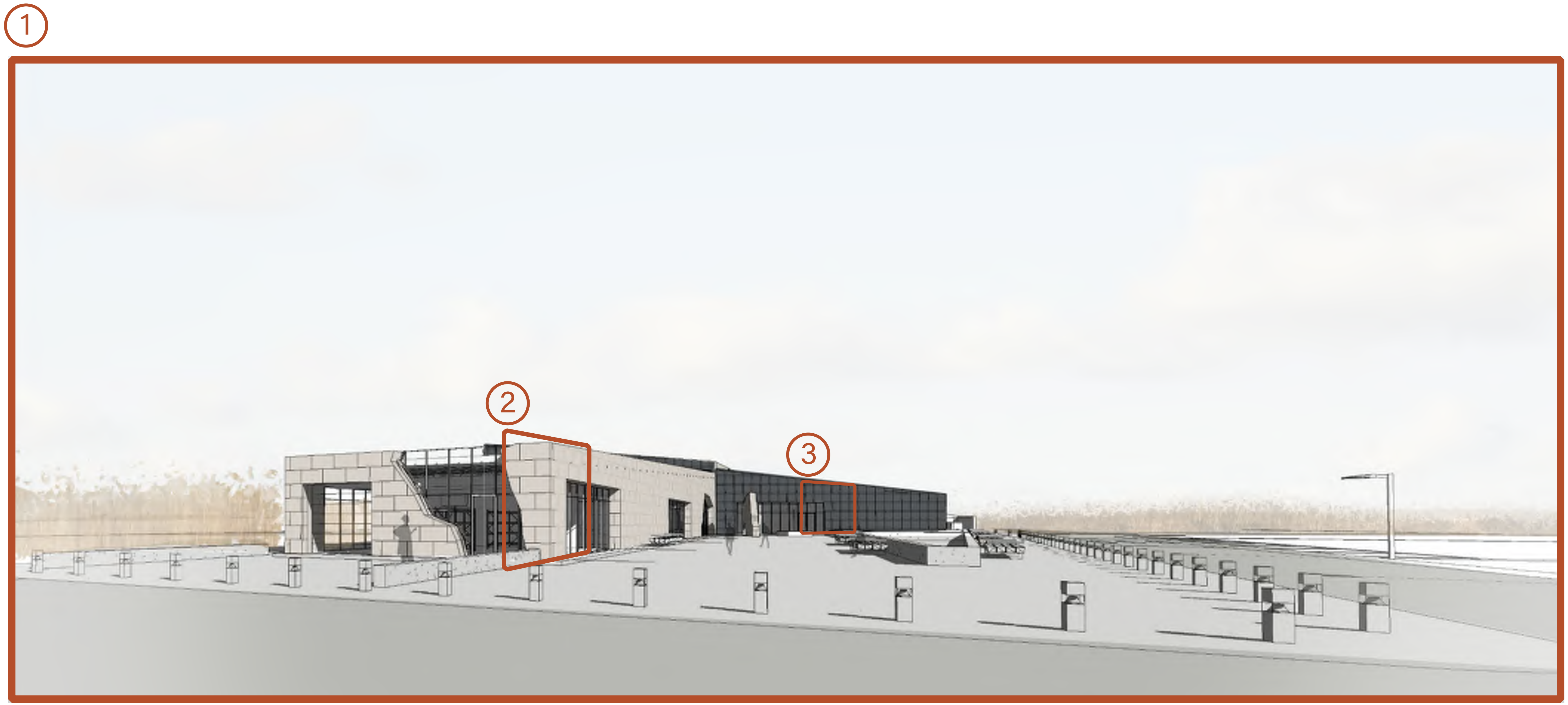

1
2
3

② Texas Limestone

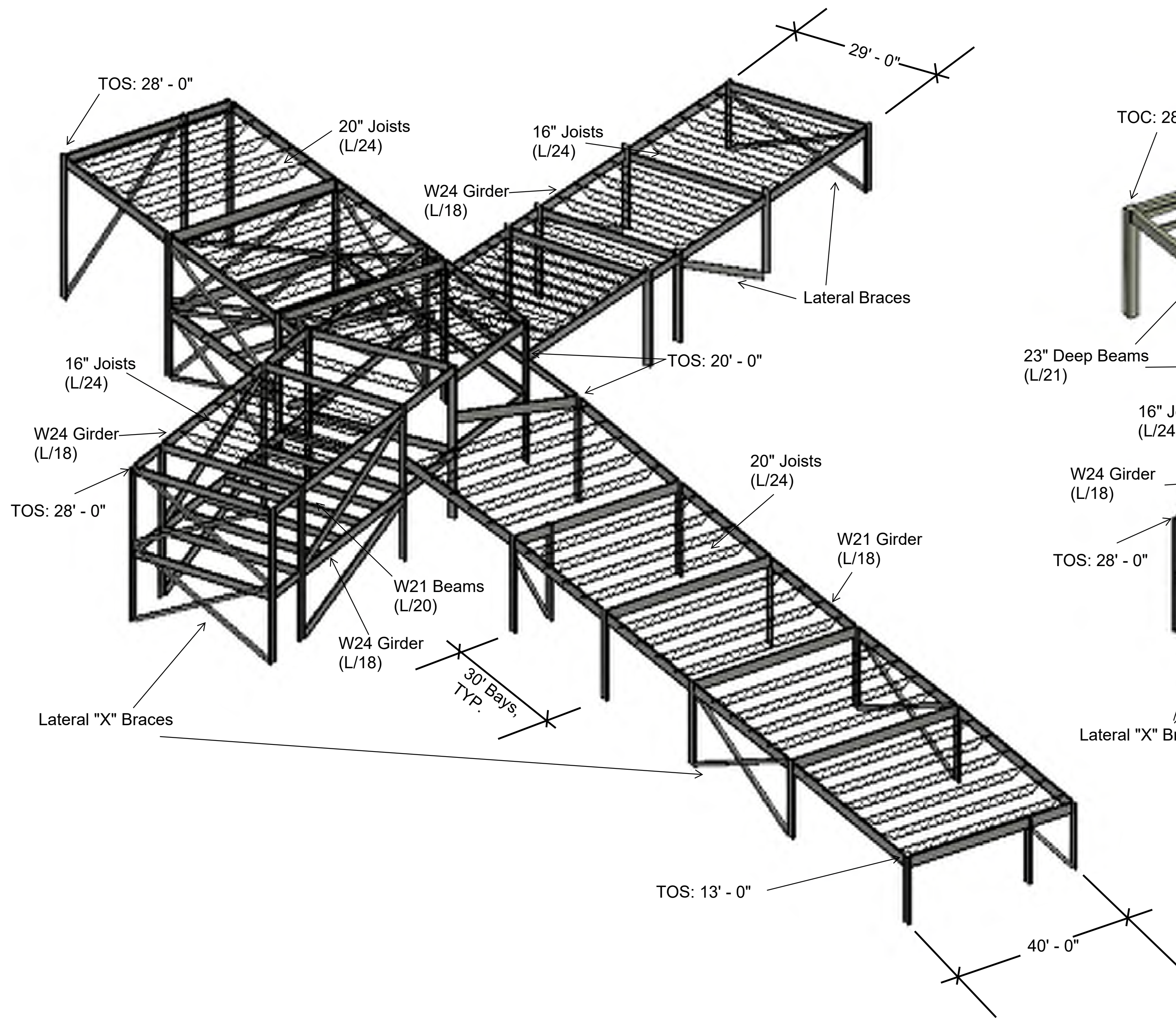
③ Dri-Design VM Zinc Panels

Structural System 1: Steel

The steel framing would be composed of W-Shapes for the columns and floor framing, and steel joists for the roof framing. This would be the case for all wings of the building. The masonry blocks would be cladding and would not carry any loads. Since the entire structure is steel framing, the lateral forces on the building would be handled by braced frames between selected steel columns.

Pros:
- Long spans achieved
- Material coordination and connection is easier than with load bearing masonry or concrete
- Cost of reinforcing within the masonry veneer is less than with load bearing masonry

Cons:
- Design concept not achieved as well
- Higher cost for steel members
- Need specific placement for lateral system

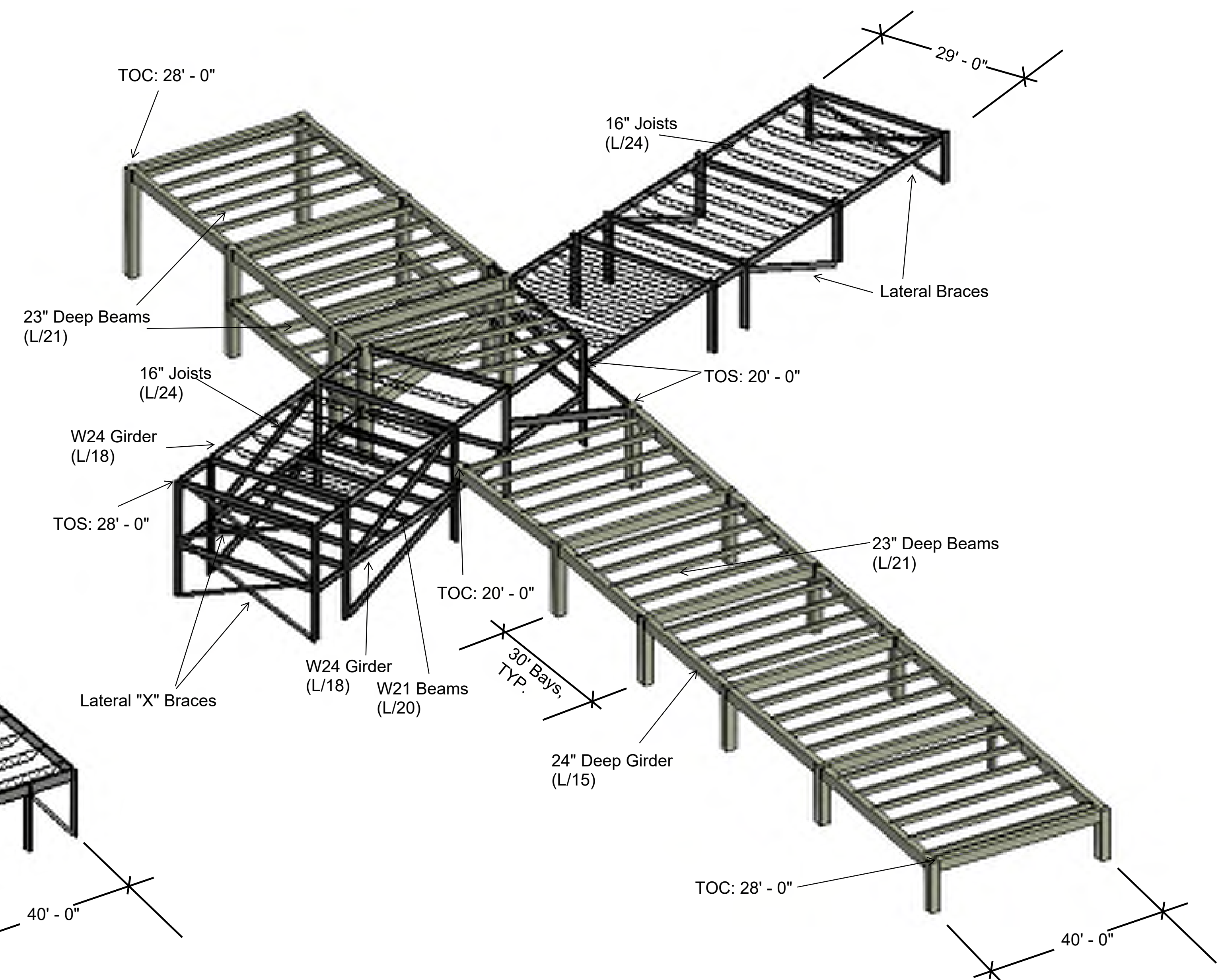


Structural System 2: Steel + Concrete

Each wing would have its own framing system and its own lateral systems. The steel framed wings would utilize braced frames for lateral support, and the concrete framed wings would have concrete shear walls or rigid frames providing the lateral resistance. Using this system, the design concept of one building axis being a light framed, long span structure, and the other axis being a heavy/bulky structure is still achieved well due to the deep concrete members.

Pros:
- Very durable
- Sound proofing
- Can get more flexible forms than with modular CMU

Cons:
- Formwork required
- Less eco-friendly
- Could require larger members, leading to higher floor-to-floor heights
- Skilled labor required for concrete



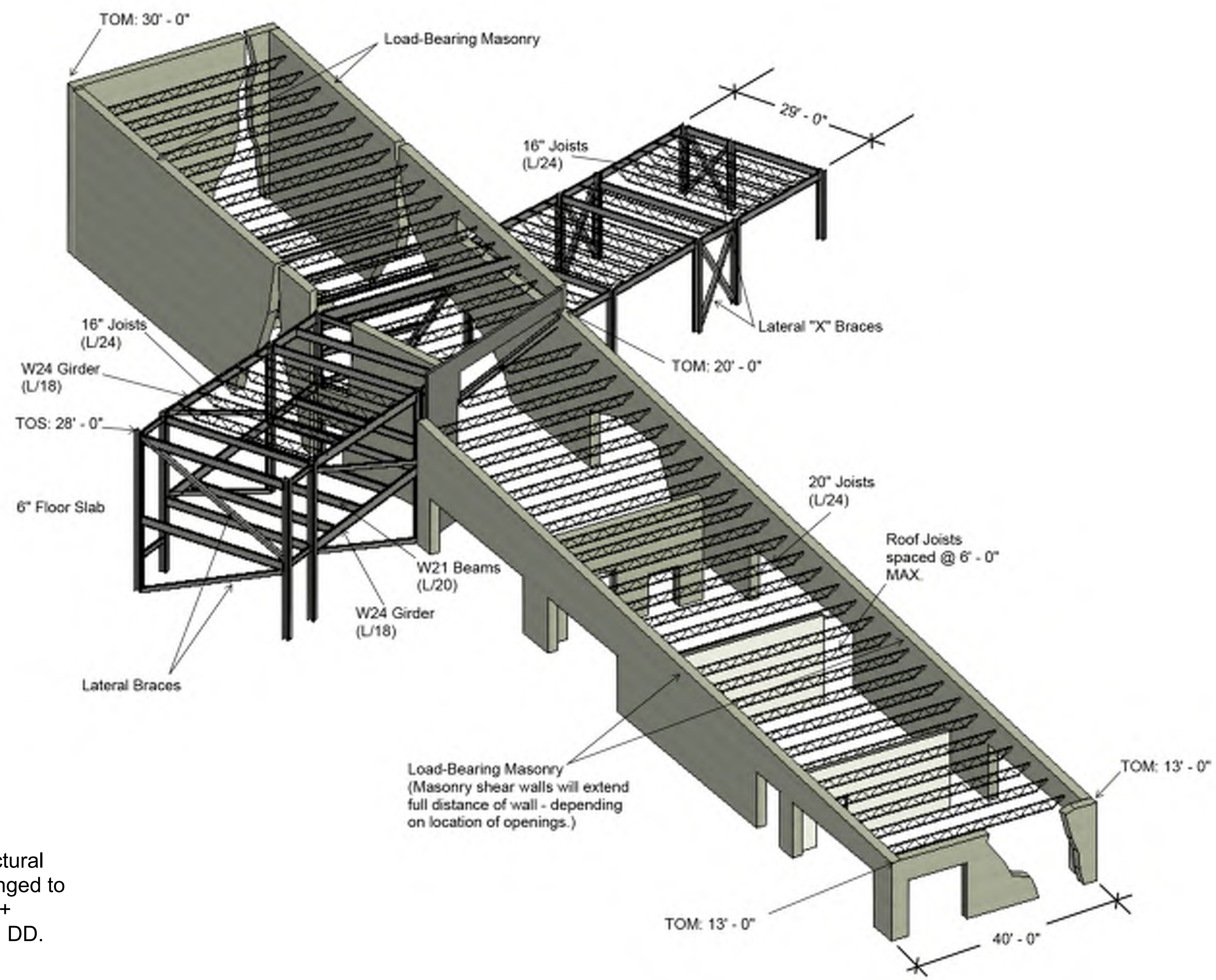
Structural System 3 (Selected): Steel + Masonry

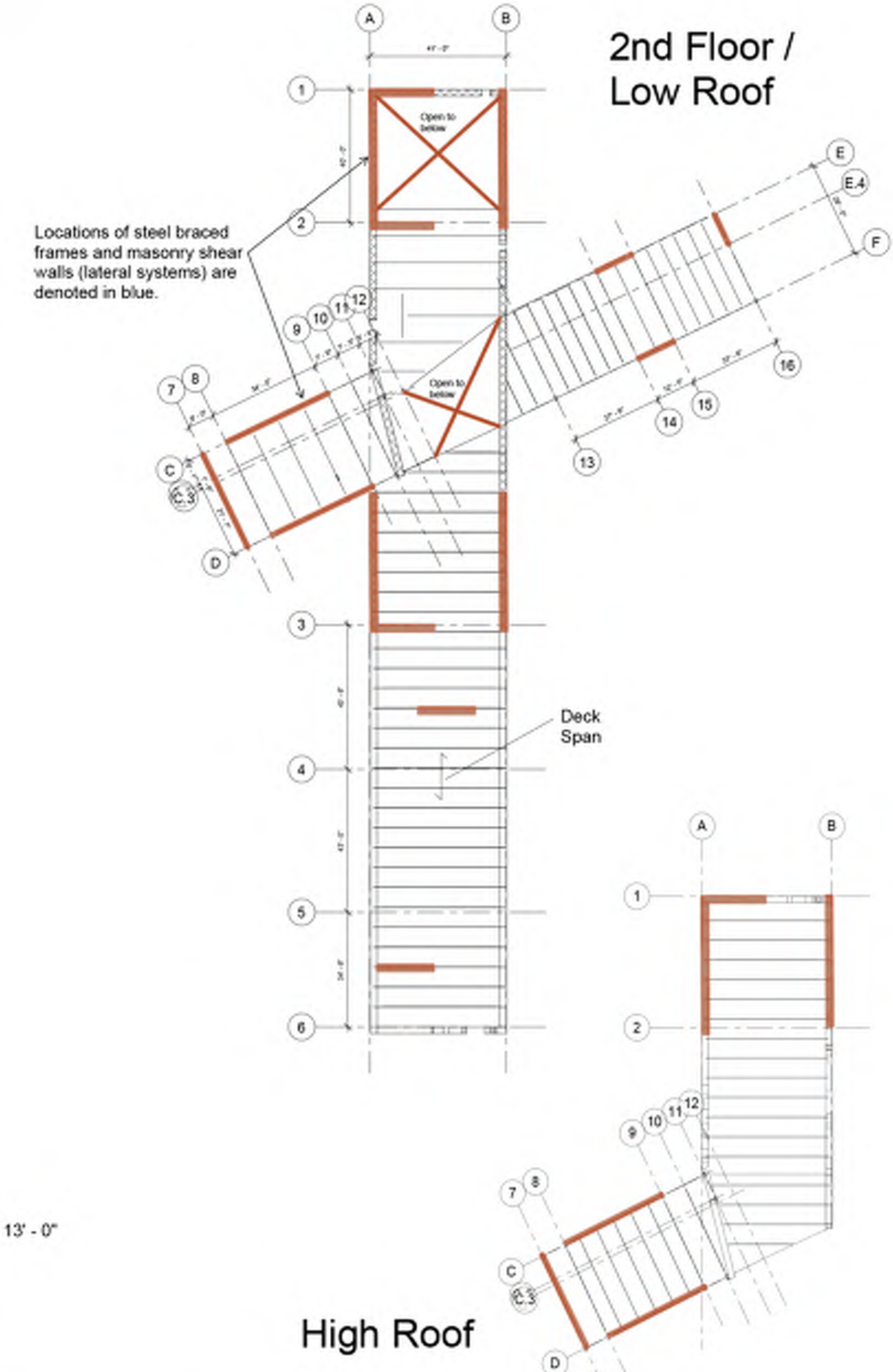
The steel framing would be composed of @-Shapes for the columns and floor framing, and steel joists for the roof framing. Where floor-to-floor heights is not an issue, deeper sections and therefore longer spans can be achieved for wider openings.

The load-bearing masonry will be reinforced for the appropriate building loads. The steel members frame into the masonry, and steel joists will span across the walls to support the roof system. Masonry shear walls will achieve later resistance in these wings of the building.

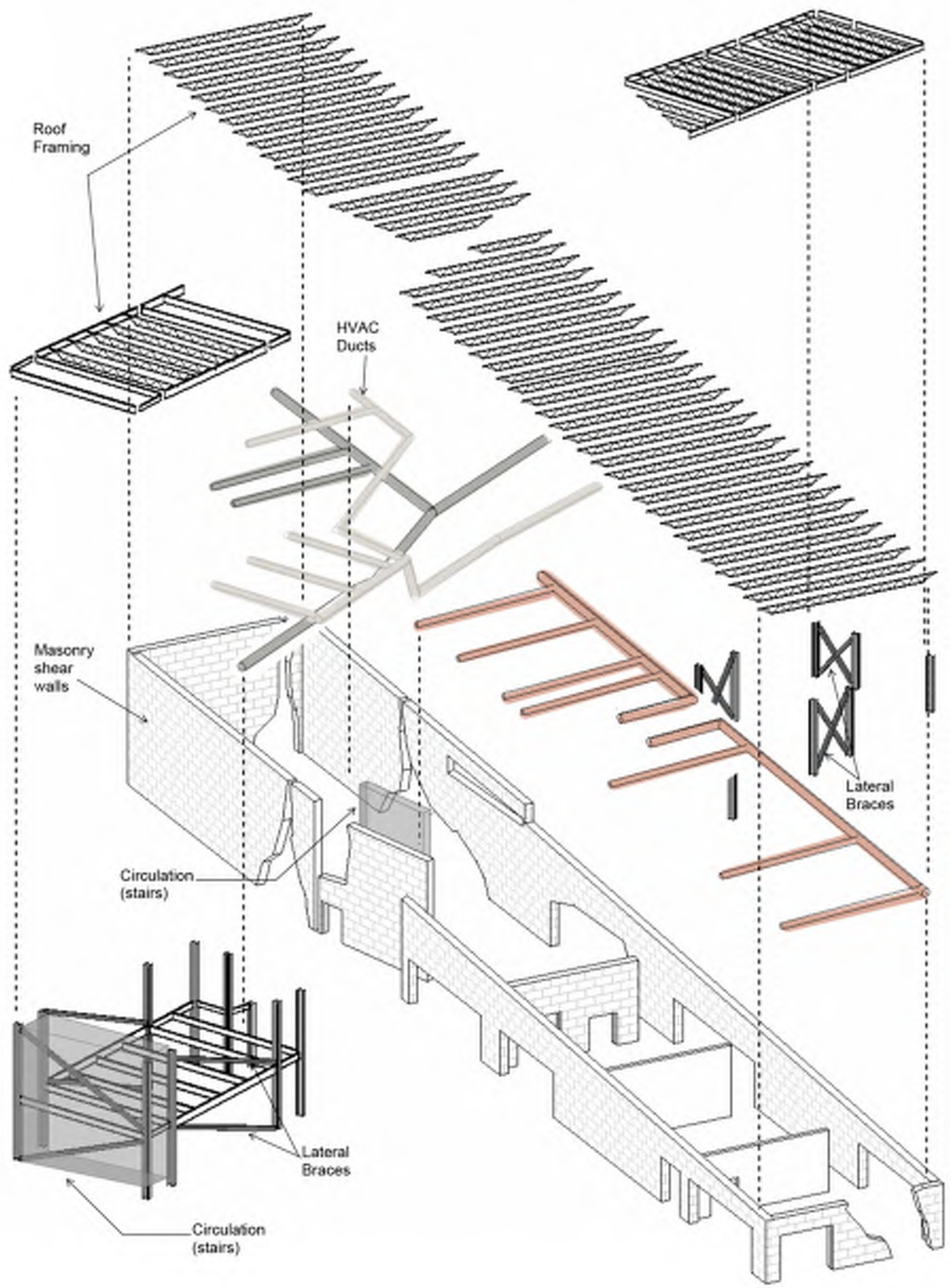
Pros:
- Long spans achieved with steel frame
- Flexibility within spaces
- Materials are recyclable/reusable
- Expressive envelope can be achieved (fits concept)

Cons:
- High cost for material and labor (masonry)
- Construction can be difficult
- The two materials have drastically different fire ratings





***Selected structural system was changed to System 2 (Steel + Concrete) during DD.



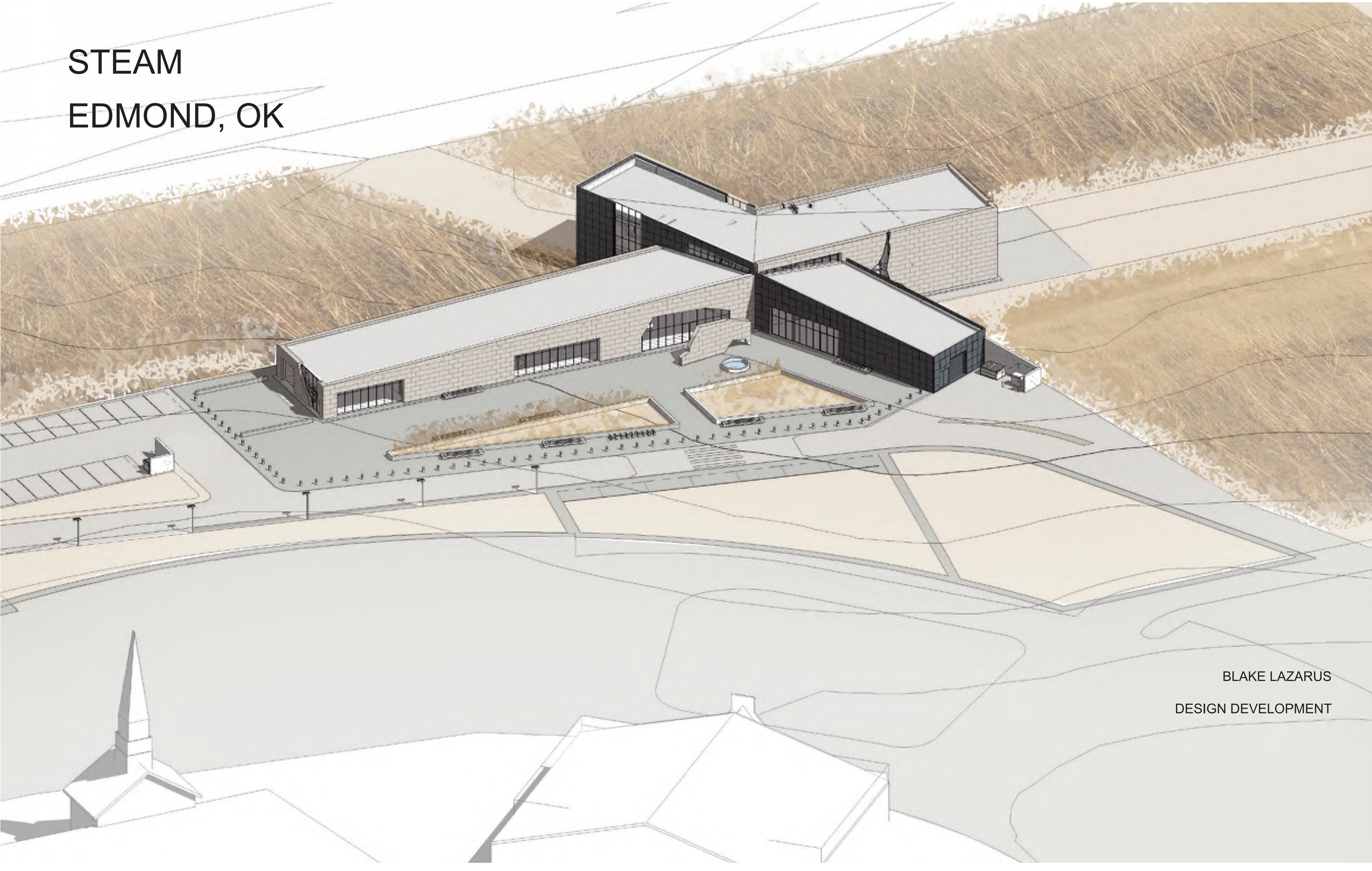
Roof Framing
HVAC Ducts
Masonry shear walls
Circulation (stairs)
Lateral Braces
Lateral Braces
Circulation (stairs)

C
A
B
Slot Diffuser
Spot Diffuser
Wall Mount VRF
Ceiling Mount VRF
A VRF Heat Pumps
B Dumpster
C Facility Transformer

DESIGN DEVELOPMENT PRESENTATION

STEAM

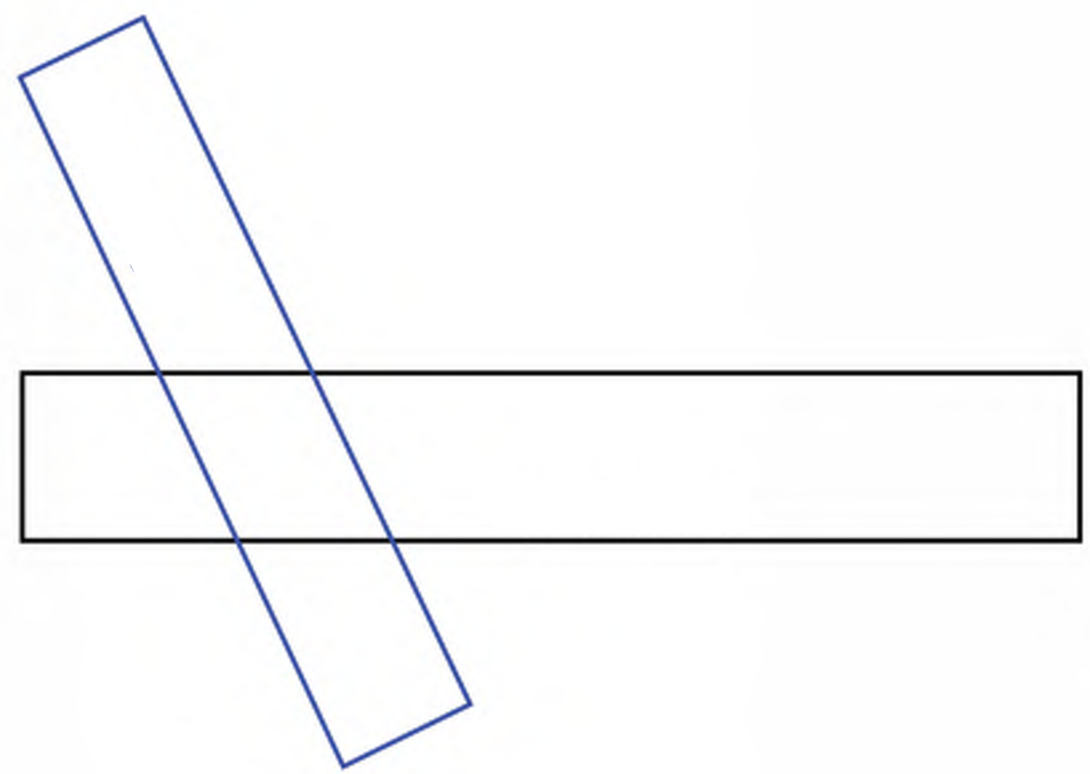
EDMOND, OK

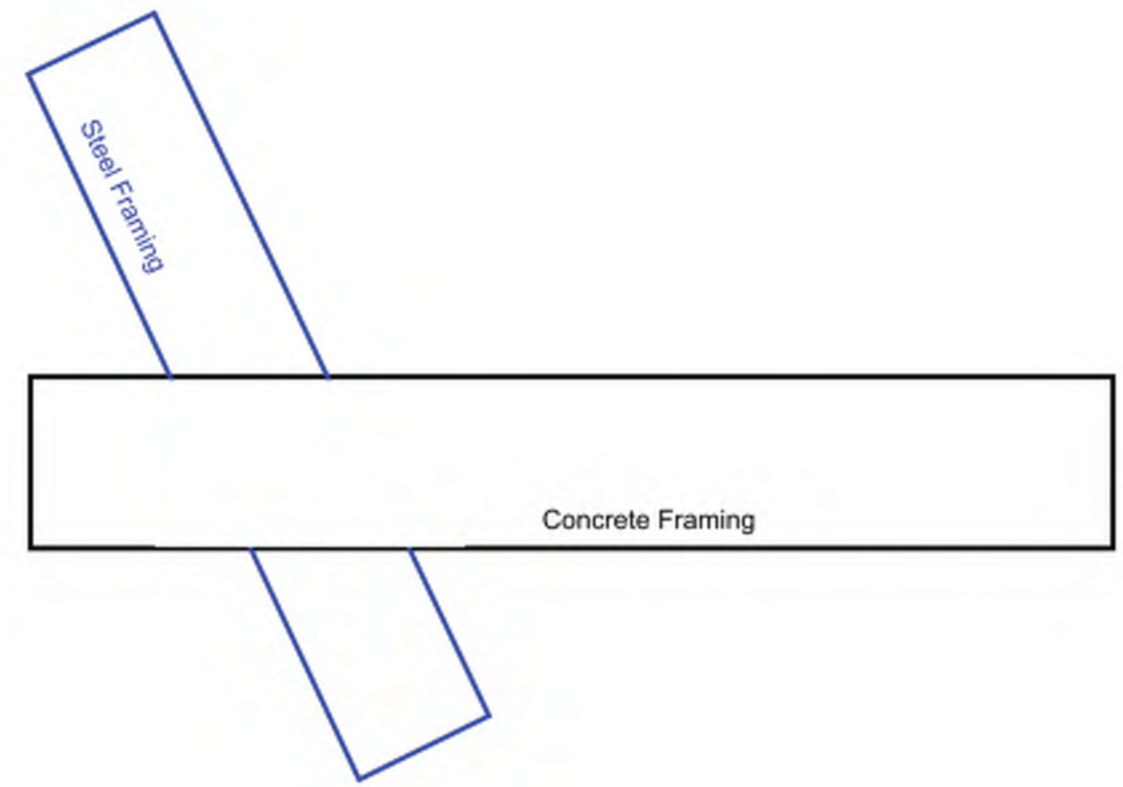


BLAKE LAZARUS

DESIGN DEVELOPMENT

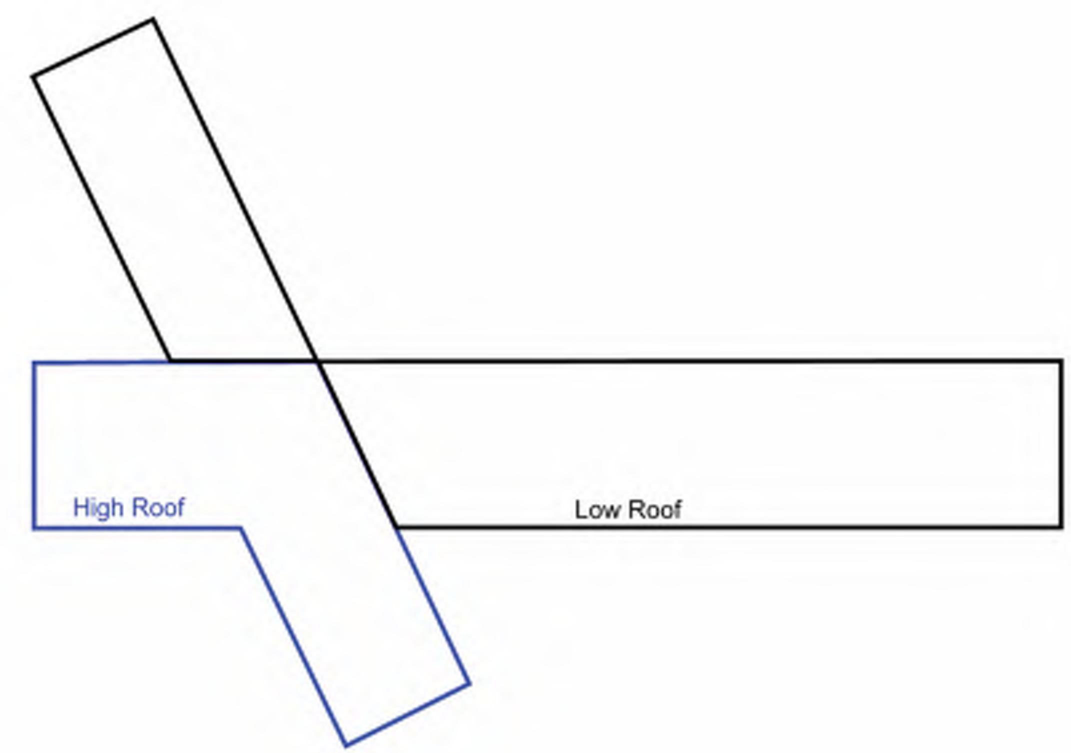
STRUCTURAL CONCEPT - COLLISION OF STRUCTURES



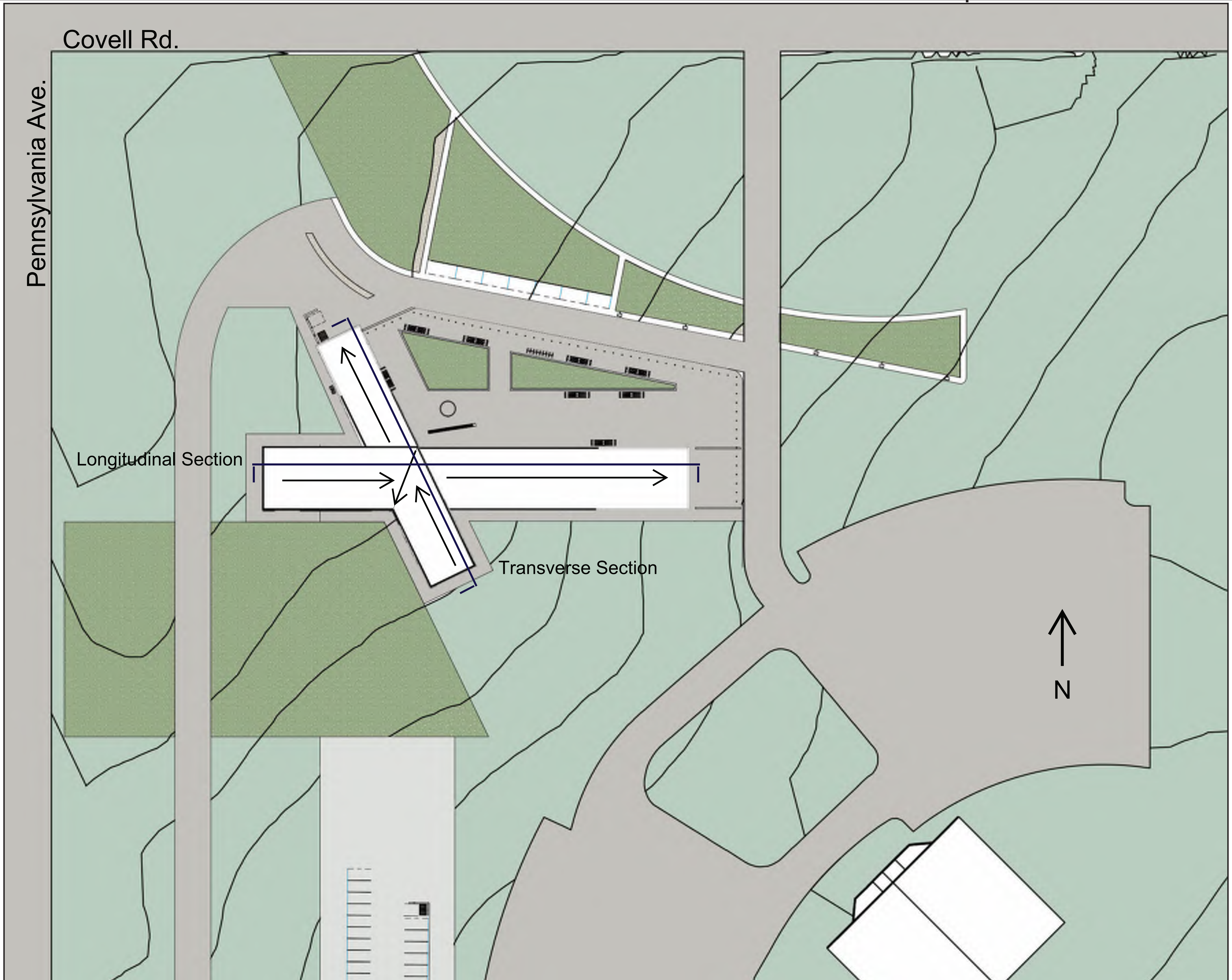


PREMISE FROM SD

The STEAM Engine of Oklahoma City has the ambition of cultivating the next generation of creators, innovators, and critical thinkers. The proposed design's goal for The STEAM Engine facility focuses on creating a flexible learning environment that immerses the students into an atmosphere of discovery. Architectural applications of varying academic principles such as; light refraction, thermodynamics, robotics, etc. present the students something to discover and inquire about, further inspiring critical thinking and active participation in learning.The first interaction with the building occurs upon approach, visitors are greeted by two sloping forms crossing one another, rising from an ocean of prairie grass. As they progress to the entrance, the collision of these two forms becomes more apparent through the use of facsimile fractures in the facade of both structures. The lobby/gathering place is created by the purported destruction of the two buildings, which subsequently showcases the interaction of various building and structural systems. The central hub provides diverse learning spaces to be used for varying education techniques. With the future of education requiring adaptability, a major facet of the design was to define the spaces while allowing their use to remain abstract. Adjacent to the entrance, three studio classrooms enclose a collaborative learning center used for presentations and communication workshops, while the furthest end of the facility accommodates two maker spaces, a woodshop, and an assembly lab. The woodshop is acoustically separated from the rest of the building but connected through shared storage with the assembly lab. Throughout all these spaces, the students experience both large-scale and minute applications of science, technology, engineering, art, and mathematics.

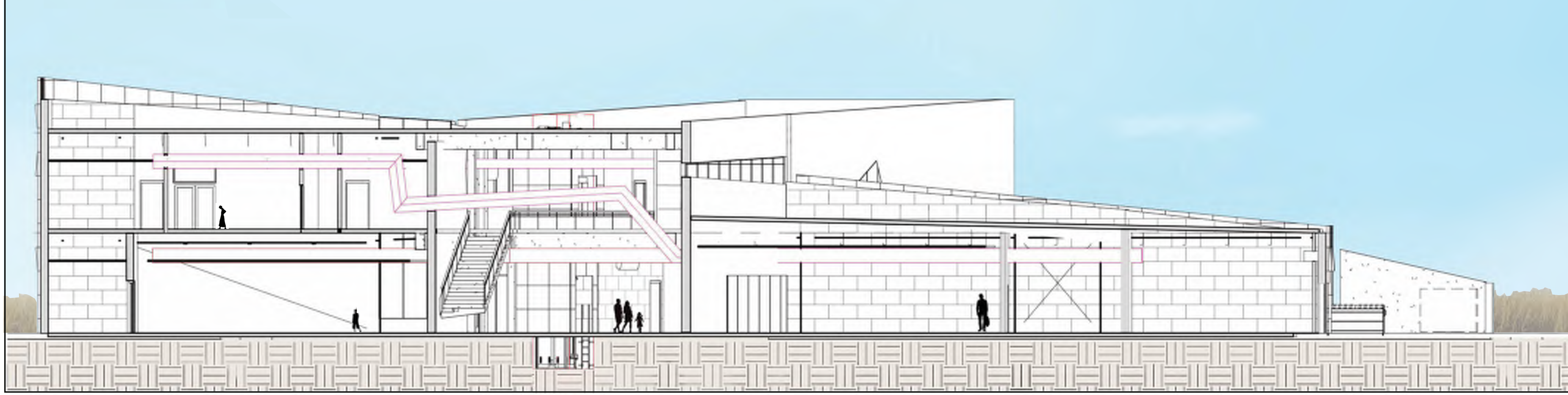


SITE PLAN

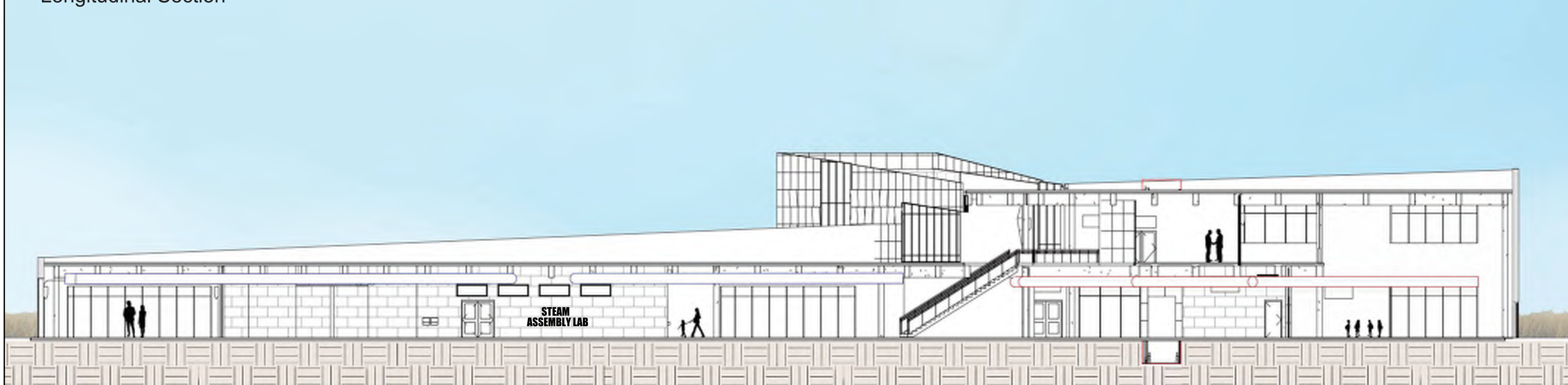

Covell Rd.
Pennsylvania Ave.
Longitudinal Section
Transverse Section
N

BUILDING SECTIONS

Transverse Section



Longitudinal Section



EXTERIOR AERIAL VIEW

EXTERIOR PERSPECTIVE

INTERIOR PERSPECTIVE

MECHANICAL PLANS

1/40" = 1'-0" SCALE

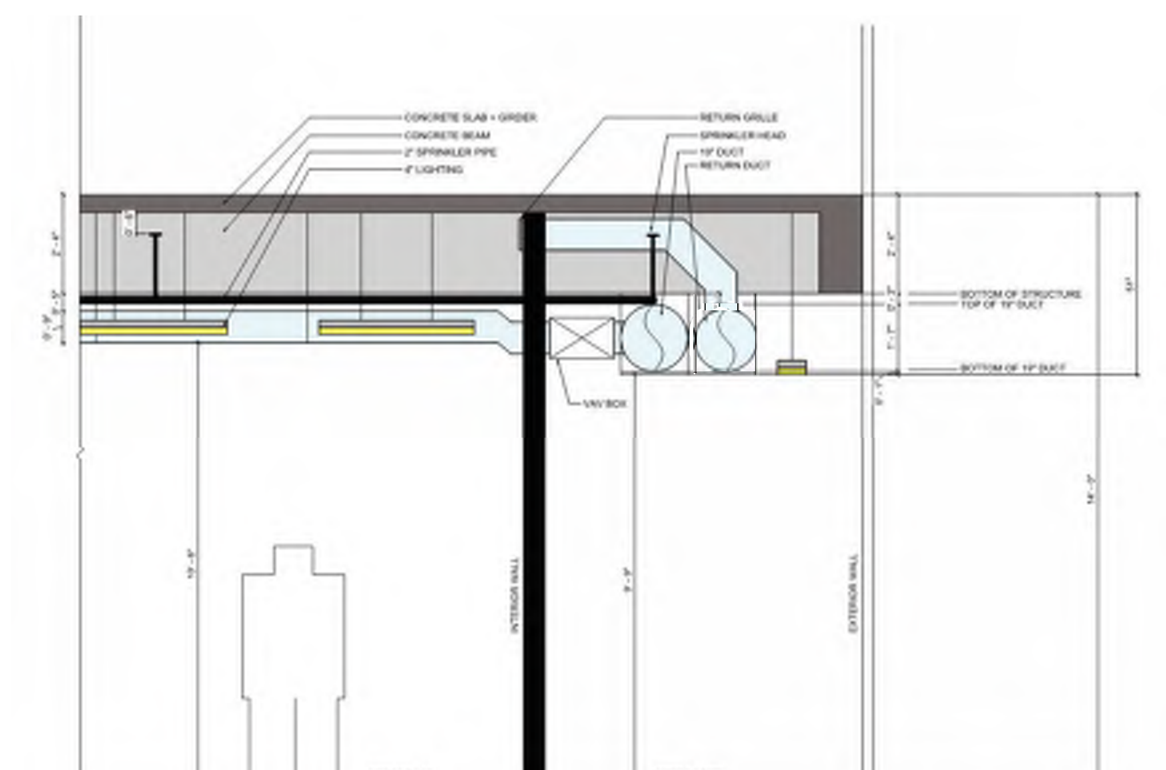
MECHANICAL DESIGN AND CODE COMPLIANCE

HVAC Main Ducts - Zone 1		
Area 1	6271.5	SF
Peak Load	1.09	CFM/SF
CFM =	6835.935	
Supply	19"	Diameter
Return	18"	Diameter

HVAC Main Ducts - Zone 2		
Area 2	10654.5	SF
Peak Load	1.09	CFM/SF
CFM =	11613.41	
Supply	24"	Diameter

HVAC Main Ducts - Zone 3		
Area 3	3538	SF
Peak Load	1.09	CFM/SF
CFM =	3856.42	
Supply	15"	Diameter

HVAC Branch Ducts - Focus Space		
Area	6271.5	SF
Peak Load	1.09	CFM/SF
CFM =	6835.935	
Supply	21"	Diameter



Critical Section

Envelope Code Requirements, IECC 2021
Climate Zone 3
Construction Type: Metal Frame

Roof:

Outside Air for Summer.. 0.25
EPDM Roof Membrane.. 0.24
5" Extruded Polystrene Rigid Insulation................ 25.0
5" Concrete Slab.. 0.35
Inside Air.. 0.92

R-value	**26.76**
U-value	**0.0374**

Exterior Wall:

Outside Air for Summer.. 0.25
4" Brick Veneer - Hollow Clay................................ 1.11
1" Air Space (Conservatively us 0.75").................... 2.32
Vapor-Seal, 2 Layers of mopped 15-LB Felt............ 0.12
1.5" Extruded Polystrene Rigid Insulation.............. 7.50
Batt Insulation, 8".. 22.00

Thermal Bridging -> 22.00 x 0.38 = 8.36

5/8" Gypsum Board.. 0.56
Inside Air.. 0.68

R-value	**20.90**
U-value	**0.0478**

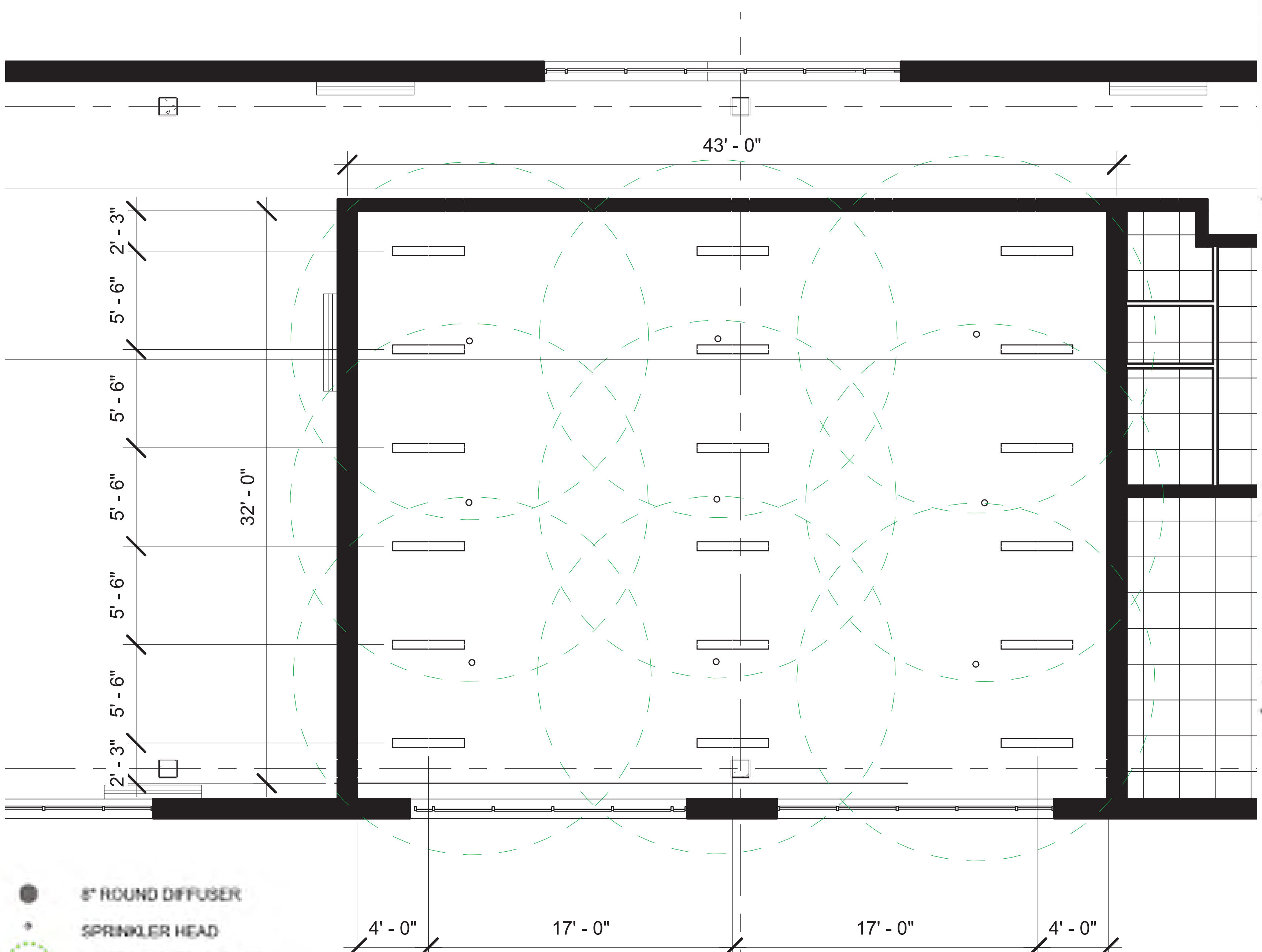
Slab-on-Grade:

Inside Air.. 0.92
Epoxy Floor Finish.. 0
5" Concrete Slab on Grade.................................... 1.22
Vapor Barrier.. 0.06

R-value	**2.20**
U-value	**0.4545**

	Min. R	R (ci)	R	Pass	Fail	Max. U	U	Pass	Fail
Roof	25	25	26.76	Pass		0.039	0.0374	Pass	
Above Grade Wall	13 + 7.5ci	7.5	20.90	Pass		0.064	0.0478	Pass	
Slab-on-Grade	-	0	2.20			0.73	0.4545	Pass	

LIGHTING DESIGN AND REFLECTED CEILING PLAN



8" ROUND DIFFUSER
SPRINKLER HEAD
10' SPRINKLER THROW
PENDANT LIGHT
RETURN GRILLE
INTERIOR THERMAL ZONE
EXTERIOR THERMAL ZONE

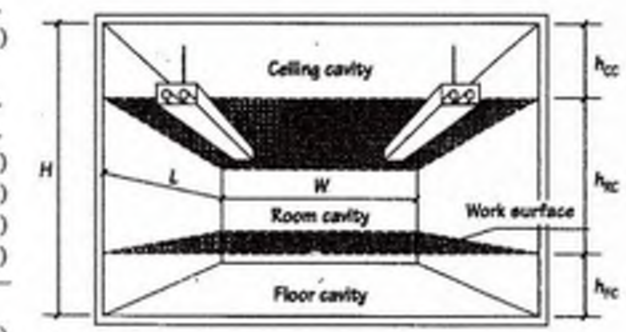
RCP 1/8" = 1'-0"

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

Designer: Blake Lazarus Space type: Science Lab / Classroom

PHOTOMETRIC DATA

IESNA Illuminance category: ....
IESNA Recommended illuminance (average): 20 (fc)
[Refer to IESNA tables]
Lamp type: LED
Recommended spacing ratio 1.23 || and 1.21 ⊥
Lumen output from one lamp (initial): 3393 (lumens)
Number of lamps per luminaire: 1 (lamps)
Fixture efficiency: 100 (%)
Lumen output from one luminaire: 3393 (lumens)



ROOM DESIGN

L = 43 (ft)
W = 32 (ft)
H = 14 (ft)
Ceiling cavity reflectance = CCR = 80 (%)
Room cavity reflectance (walls) = RCR = 50 (%)
Assumed floor cavity reflectance = FCR = 20 (%)

h_{CC} = 0 (ft)
h_{RC} = 11.5 (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] = 32 + (1/3)(43-32) = 35.667 ft.
RCR = (10 x h_{RC}) / W_{sq} = 10 x 11.5 / 35.667 = 3.2243

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

CU = 79 + [(3.2243-3)/(4-3)](70-79) = 76.9813 % = 0.769813

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
= 3393 x 0.769813 x 0.65 = 1697.8 Lumens per luminaire

d. Determine total lumens needed on the workplane:
Total lumens needed on the workplane = Recommended illuminance x area
= 20 x (43 x 32) = 27,520 Lumens

e. Determine needed number of luminaires:
Number of luminaires = Total lumens needed on the workplane/useful lumens from one luminaire

Number of luminaires = 27,520 / 1697.8 = 16.21 Luminaires ∴ Use 18

Actual illumination level provided = 20(18/16.21) = 22.21 FC
Light load = 18 luminaires x 40.9 Watts per luminaire / (43' x 32') = 0.535 W/SF < 1.11
Light load index = 0.535 / 22.21 = 0.0240900 W/(SF-FC)
Area covered per luminaire = (43'x32')/18 luminaires = 76.44 SF / Luminaire
System's overall efficiency = 1.0 x 0.769813 x 0.65 = 0.50 = 50%

DAYLIGHTING DESIGN

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	55.1	161 lux	15.0 fc	PH 8355
2	2.8313	39.0	110 lux	10.3 fc	PH 8356
3	2.8248	27.3	77 lux	7.2 fc	PH 8357
4	2.9378	18.9	56 lux	5.2 fc	PH 8358
5	2.9792	14.5	43 lux	4.0 fc	PH 8359
6	2.7992	12.2	34 lux	3.2 fc	PH 8360
7	2.9673	9.8	29 lux	2.7 fc	PH 8361
8	2.9431	9.2	27 lux	2.5 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

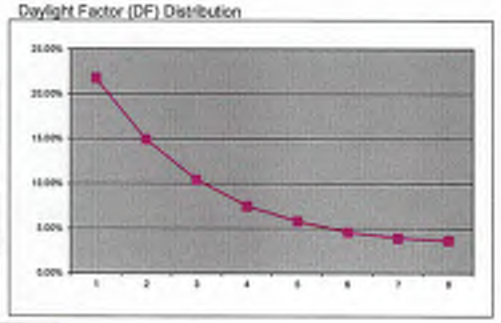
[NOTE]: This is the outside horizontal illuminance under the artificial sky dome in the lab, and not the standard illuminance at the location of your building.

Daylight Factor for VT= 1.00 (For models tested with glass or trace paper)		Daylight Factor (excluding effect of glass VT)
1	21.78%	21.78%
2	14.94%	14.94%
3	10.44%	10.44%
4	7.51%	7.51%
5	5.85%	5.85%
6	4.62%	4.62%
7	3.94%	3.94%
8	3.66%	3.66%
(single sensor) # 9		

Average sens # 1 to 8: 9.09%

Ratio of Max. to Min.: 5.94

Daylight Factor (DF) Distribution



Lab Tests - Trial 1

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	16.1	47 lux	4.4 fc	PH 8355
2	2.8313	20.4	58 lux	5.4 fc	PH 8356
3	2.8248	19.5	55 lux	5.1 fc	PH 8357
4	2.9378	16.0	47 lux	4.4 fc	PH 8358
5	2.9792	13.5	40 lux	3.7 fc	PH 8359
6	2.7992	12.1	34 lux	3.1 fc	PH 8360
7	2.9673	9.8	29 lux	2.7 fc	PH 8361
8	2.9431	9.2	27 lux	2.5 fc	PH 8362
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Measured outside illuminance = 68.7 fc

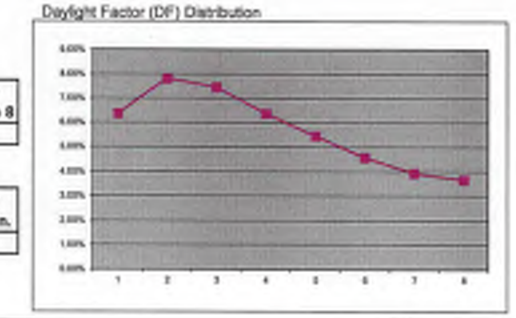
[NOTE]: This is the outside horizontal illuminance under the artificial sky dome in the lab, and not the standard illuminance at the location of your building.

Daylight Factor for VT= 1.00 (For models tested with glass or trace paper)		Daylight Factor (excluding effect of glass VT)
1	6.36%	6.36%
2	7.82%	7.82%
3	7.45%	7.45%
4	6.36%	6.36%
5	5.44%	5.44%
6	4.58%	4.58%
7	3.94%	3.94%
8	3.66%	3.66%
(single sensor) # 9		

Average sens # 1 to 8: 5.70%

Ratio of Max. to Min.: 2.13

Daylight Factor (DF) Distribution

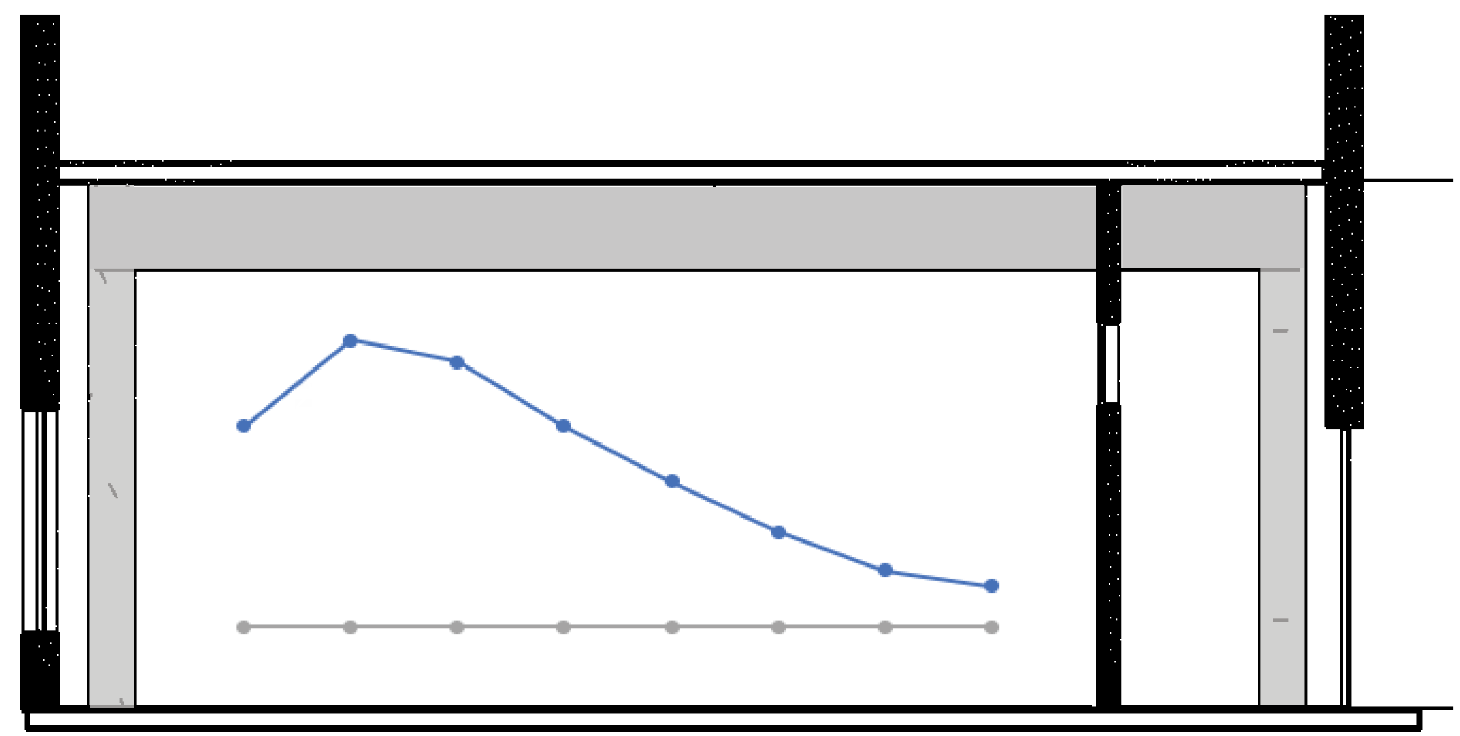


Lab Tests - Trial 2

$$IL_{PREDICTED} = IL \times DF \times VT \times M$$

Standard Illumination Level = 1386 FC
Daylight Factor (final) = 3.66%
Visible Transmittance of Glass = 57%
Transmittance Depreciation = 85%

$IL_{PREDICTED}$ = 24.58 FC



ENERGY EFFICIENCY - COVE.TOOL & eQUEST

% Energy Savings in Design Development

33.65%

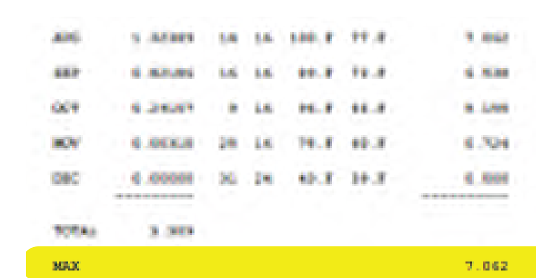
% Reduction (avg.) in Peak Cooling Load

11.55%

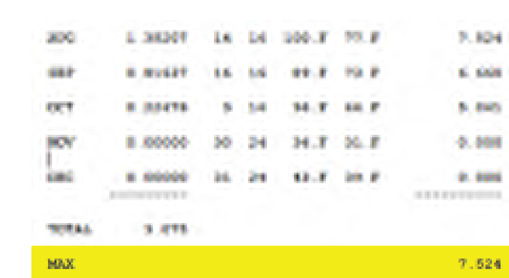
Model A - Baseline

Model B - Improved Building

Perimeter Project

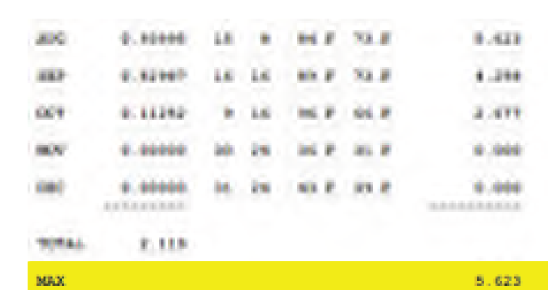


Perimeter Baseline

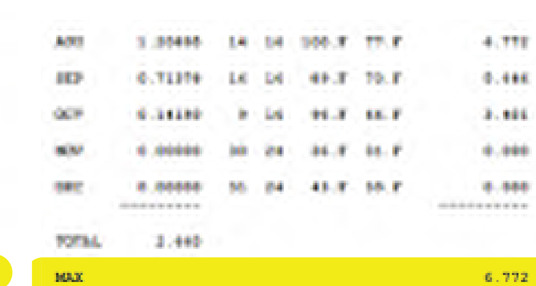


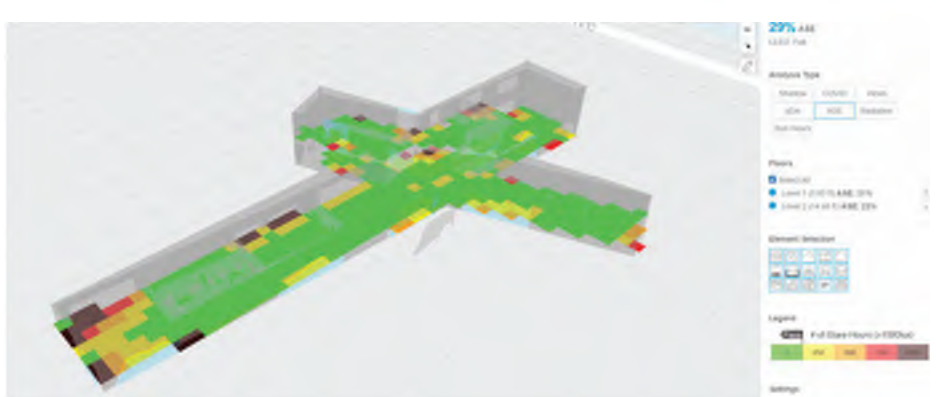
Model C - Improved Building and Systems

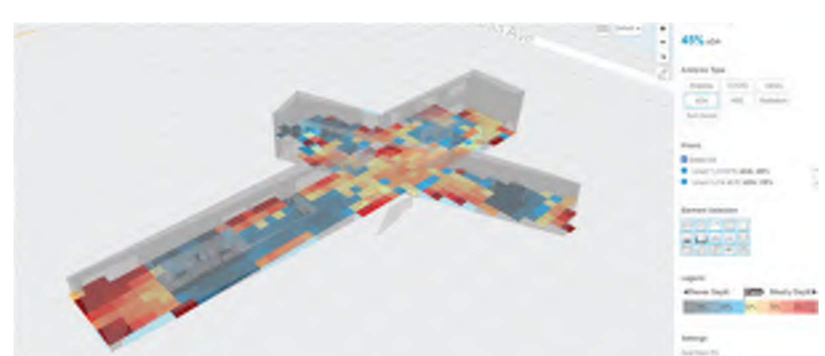
Interior Project

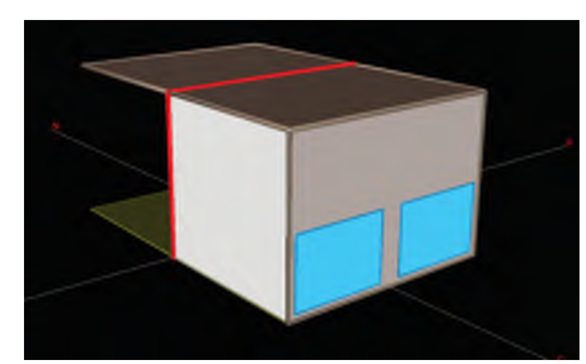


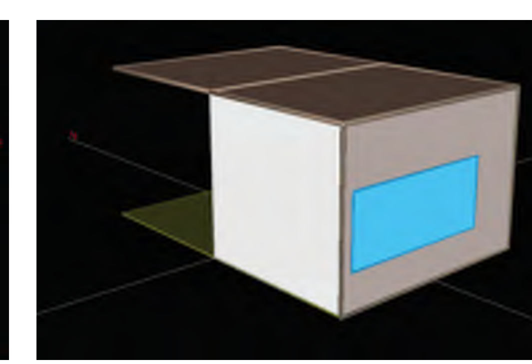
Interior Baseline







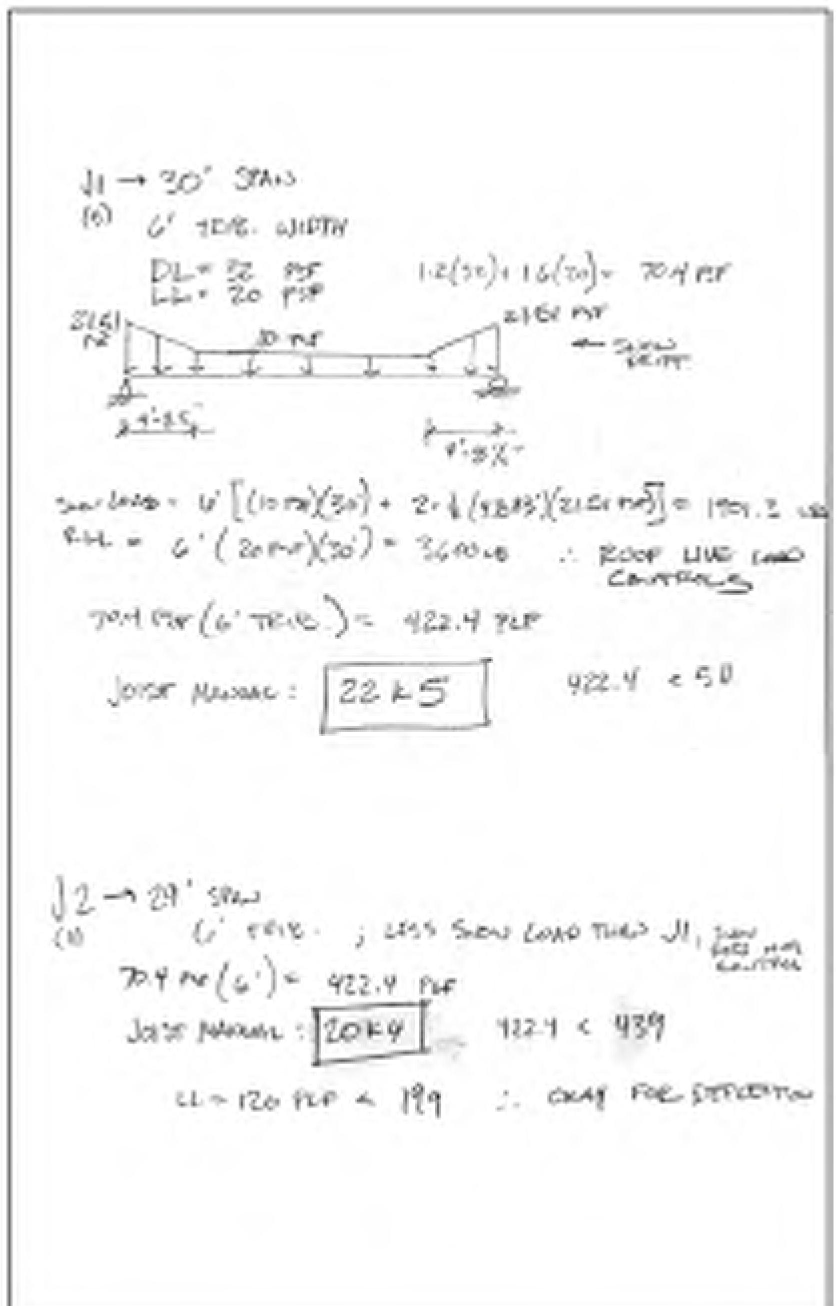




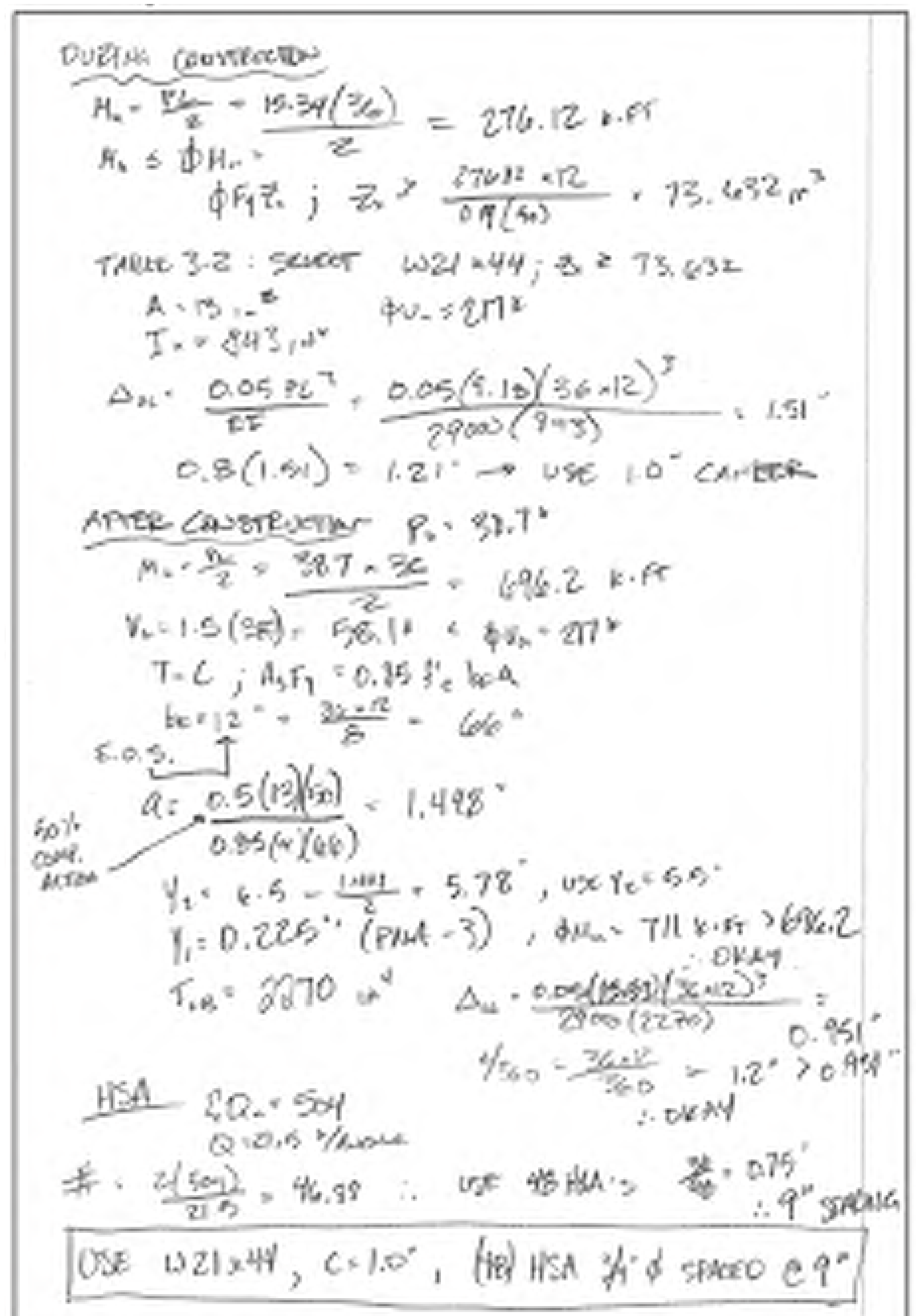
STRUCTURAL HAND CALCULATIONS

There are some elements that are not designed by RISA, such as:

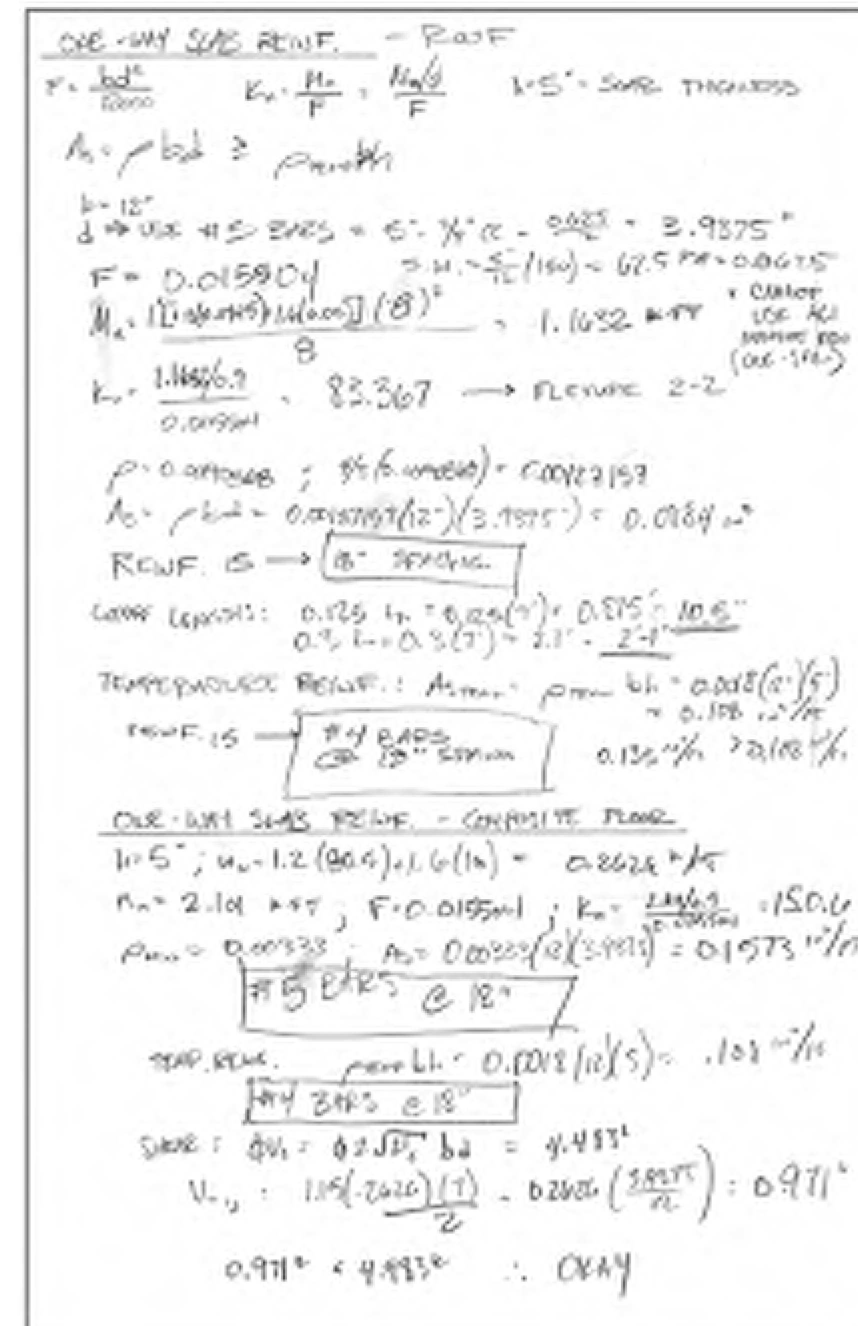
Joists



Composite Steel



Slab Reinforcing



STRUCTURAL HAND CALCULATIONS

Some load calculations done by hand:

Wind

MWFRS

RISK CATEGORY II

V_{ult} = 109 MPH (ATC HAZARDS)
K_d = 0.85 (T. 26.6-1)
EXPOSURE : B (SECTION 26.7)
K_{zt} = 1.0 (NO ABRUPT CHANGES IN TOPOGRAPHY)
K_e = 1.0 (T. 26.9-1)
G = 0.85 (26.11)
ENCLOSED, GC_{pi} = ±0.18

EQN. 26.10-1 : $q_z = 0.00256 K_z K_{zt} K_d K_e V^2$
$= 0.00256 K_z (1)(0.85)(1)(109)^2$ = 25.853 K_z

HEIGHT	K_z	q_z	Cp (WW)	Cp (LW)	P (WW)	P (LW)
0-15	0.57	14.74	0.8	-0.5	10.02 PSF	-7.54
20	0.62	16.03	0.8	-0.5	10.90 PSF	-7.514
25	0.66	17.06	0.8	-0.5	11.60 PSF	-7.514
28	0.684	17.68	0.8	-0.5	12.02 PSF	-7.514

← CONSERVATIVE

$P = qGC_p - q_i(GC_{pi})$
USE $q = q_h$ FOR ALL LW

GC_{pi} CAN BE NEGLECTED FOR WW & LW (DOF FOR URUFY)

PARAPETS: $P_p = q_p (GC_{pn})$

GC_{pn} = +1.5 (WW)
-1.0 (LW)

PARAPET HEIGHTS: 15', 22', 27', 33.5', 56'
DUE TO SLOPING PARAPETS, TAKE HIGHEST PARAPET HEIGHT AT EACH CONDITION.

P_{15} = 25.853(0.57)(1.5) = 22.1 PSF (WW)
= 25.853(0.57)(-1.0) = -14.74 PSF (LW)
P_{22} = 25.853(0.658)(1.5) = 25.52 PSF (WW)
= 25.853(0.658)(-1.0) = -17.01 PSF (LW)
P_{27} = 25.853(0.694)(1.5) = 26.91 PSF (WW)
= 25.853(0.694)(-1.0) = -17.94 PSF (LW)
$P_{33.5}$ = 25.853(0.721)(1.5) = 27.96 PSF (WW)
= 25.853(0.721)(-1.0) = -18.64 PSF (LW)

P_{56} = 25.853(0.736)(1.5)
= 28.54 PSF (WW)
= 25.853(0.736)(-1.0)
= 19.03 PSF (LW)

Snow

Factors and Loads		Value	ASCE
Exposure Factor	C_e	0.9	Table 7.3-1
Thermal Factor	C_t	1	Table 7.3-2
Risk Category	I_S	1	Table 1.5-2
Ground Snow Load	p_g	10	Figure 7.2-1

p_f = 6.3 psf

p_m = 10 psf

p_f = 10 psf

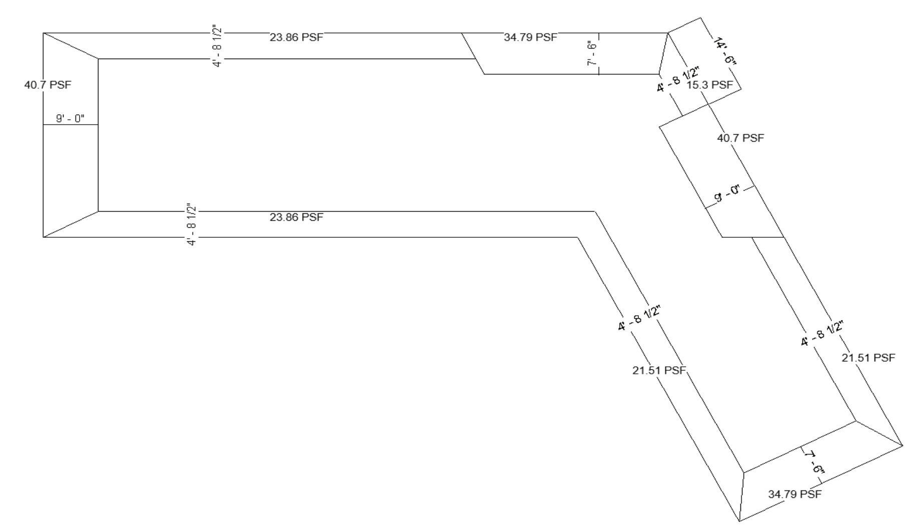
Use 6.3 psf at drift

Lu (ft.)	WW or LW	hd (ft.)	hc	0.75hd	hd > hc?	w (EQN.)	h_{drift}	8hc	w	Load = 6.3 psf + (hdrift * 15.3 pcf)			
121	WW	2.998	0.588	2.248	yes	4hd2/hc	0.588	4.71	4.71	15.30	psf		
121	WW	2.998	4.088	2.248	no	4hd	2.248	32.71	8.99	40.70	psf		
84	WW	2.482	7.338	1.862	no	4hd	1.862	58.71	7.45	34.79	psf		
37	WW	1.530	0.588	1.148	yes	4hd2/hc	0.588	4.71	4.71	15.30	psf	***	not used
37	WW	1.530	4.088	1.148	no	4hd	1.148	32.71	4.59	23.86	psf		
30	WW	1.326	0.588	0.994	yes	4hd2/hc	0.588	4.71	4.71	15.30	psf	***	not used
30	WW	1.326	7.338	0.994	no	4hd	0.994	58.71	3.98	21.51	psf		

For Lu = 121' and WW:
Since the parapet slopes, the load will change along the roof, where hd = hc. This occurs when the parapet is about 2' - 7 1/2", which falls at the point load on the concrete edge girder.

For Lu = 37' and WW:
Since the parapet slopes, the load will change along the roof, where hd = hc. This occurs when the parapet is about 1' - 6 1/2", which does not occur for this condition.

For Lu = 30' and WW:
Since the parapet slopes, the load will change along the roof, where hd = hc. This occurs when the parapet is about 1' - 4 3/4", therefore, conservatively use the worse condition, since this occurs so close to the smallest parapet height.



Seismic

VERTICAL DISTRIBUTION OF BASE SHEAR:

$F_x = C_{vx} V$ $\qquad C_{vx} = \frac{w_x h_x^k}{\sum w_i h_i^k}$

T < 0.5
∴ k = 1
FOR BOTH

LEVEL	w	h	$w_i h_i^{1.0}$
3	820 KIPS	28'	22,960
2	2462	14'	34,468
			Σ = 57,428

LEVEL	C_{vx}	$F_x = C_{vx}$ (264.76)
3	22,960 / 57,428 = 0.4	106 KIPS
2	34,468 / 57,428 = 0.6	159 KIPS

← USE EVERYWHERE (CONSERVATIVE)

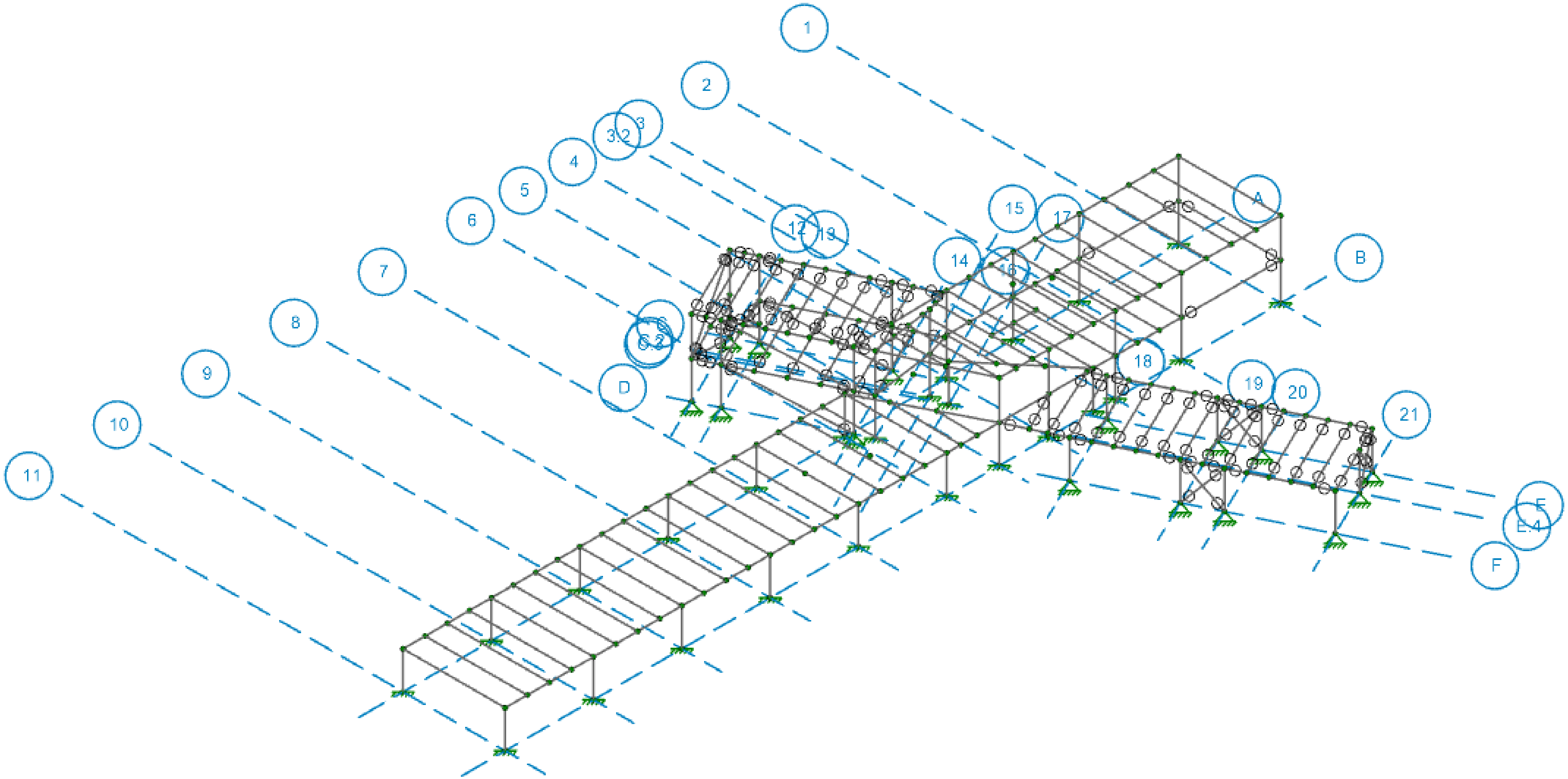
12.4 SEISMIC LOAD EFFECTS AND COMBINATIONS

$E = E_h + E_v$; $E = E_h - E_v$
$E_h = \rho Q = \rho F_x$ AND $\rho = 1.0$ FOR SDC B
$E_v = 0.2 S_{DS} D = 0.2(0.242) D = 0.0484 W_x$

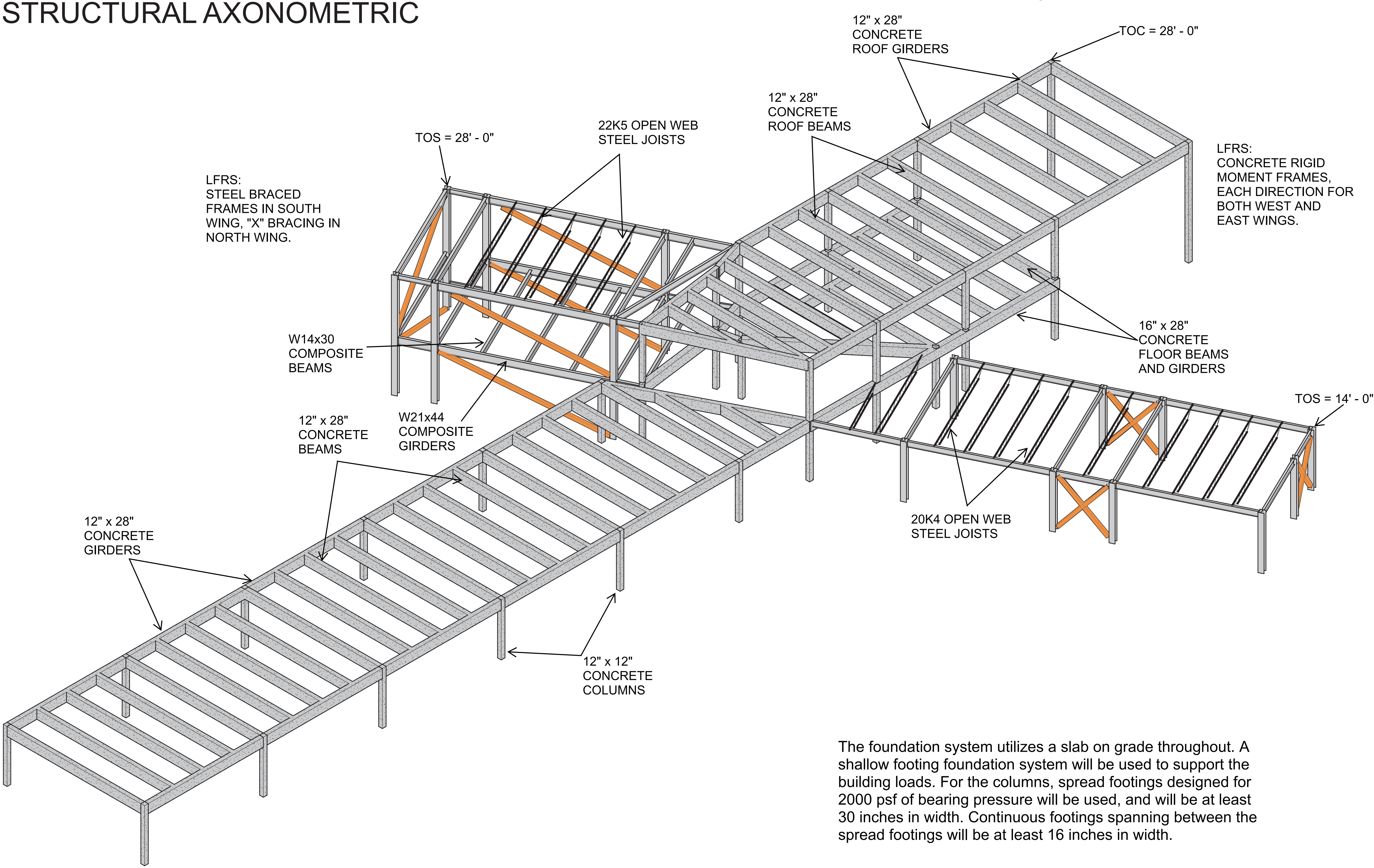
FINAL SEISMIC LOADS PER LEVEL

LEVEL	$E_h = 1.0 F_x$	W_x	$E_v = 0.0484 W_x$
3	106 k	820 k	39.7 k
2	159 k	2462 k	119.2 k

RISA AXONOMETRIC

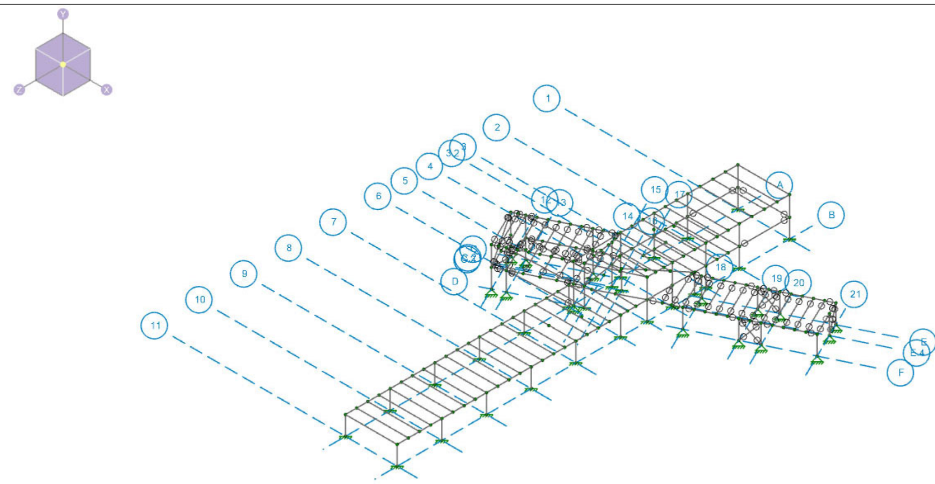


STRUCTURAL AXONOMETRIC



The foundation system utilizes a slab on grade throughout. A shallow footing foundation system will be used to support the building loads. For the columns, spread footings designed for 2000 psf of bearing pressure will be used, and will be at least 30 inches in width. Continuous footings spanning between the spread footings will be at least 16 inches in width.

CONSTRUCTION DOCUMENTS



Blake Lazarus
ARCH 5226
SP22

SHEET INDEX

GENERAL NOTES	000
FLOOR PLAN	A101
WALL SECTION	A102
FOUNDATION PLAN	S101
ELEVATED FLOOR AND ROOF FRAMING PLAN	S102
HIGH ROOF FRAMING PLAN	S103
FOUNDATION DETAILS	S201
FLOOR DETAILS	S202
ROOF DETAILS	S203
LFRS DETAILS AND VB ELEVATIONS	S204
STRUCTURAL SCHEDULES	S301

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 1099 feet.

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), 2015

SECTION 1.3 - DESIGN LOADS

1.3.1 Live Loads:

Public Stairs	100	psf
Assembly, Lobbies	100	psf
Corridors	100	psf
Kitchen	100	psf
Light Storage	125	psf
Mechanical Room	150	psf (2)
Offices, Typical Floors	50	psf (1)
Residential Floors	40	psf (1)

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

1.3.2 Dead Loads:

3 1/2" Composite Floor System	63	psf
Flooring	1	psf
Typical Ceilings	4	psf
Floor Collateral	3	psf (1)
Floor Sprinklers	3	psf (3)
MEP	4	psf
Lighting	2.5	psf
Partition Loading	15	psf (4)
Roof Collateral	3	psf (1)
Roof Insulation	7.5	psf
Roof Sprinklers	3	psf (3)
Roofing System	16	psf (2)

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
Wind Importance Factor	1.0
Analysis Procedure -	Directional Procedure

1.3.4 Seismic Loads:

Mapped Spectral Response Acceleration, Ss	0.279
Mapped Spectral Response Acceleration, S1	0.078
Spectral Response Coefficient, Sds	0.242
Spectral Response Coefficient, Sd1	0.078
Site Class	C
Seismic Importance Factor, Ie	1.0
Seismic Use Group	II
Seismic Design Category, SDC	B
Seismic Response Coefficient, Cs	0.08067
Basic Seismic Force Resisting System	OMRF
Seismic Response Coefficient, Cs	0.07446
Basic Seismic Force Resisting System	OCBF
Response Modification Factor, R	3 and 3.25
Design Base Shear	264.76 K
Analysis Procedure - Equivalent Lateral Force Procedure	

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	: Project No. 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, 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: Low volume change fill material
Bearing Elevation:
(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.

2.9 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:

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

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	---	
D	4500	HRC	1"	3-5	---	
E	3000	HRC	3/4"	2-4	---	
F	4000	HRC	1"	3-5	---	

3.3.2 Mix Usage Schedule:

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

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
Pipe Columns	ASTM A53, Grade B
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
Headed Stud Anchors	ASTM A108

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	0.732	0.387	0.410

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	36/5	12	4	265

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.

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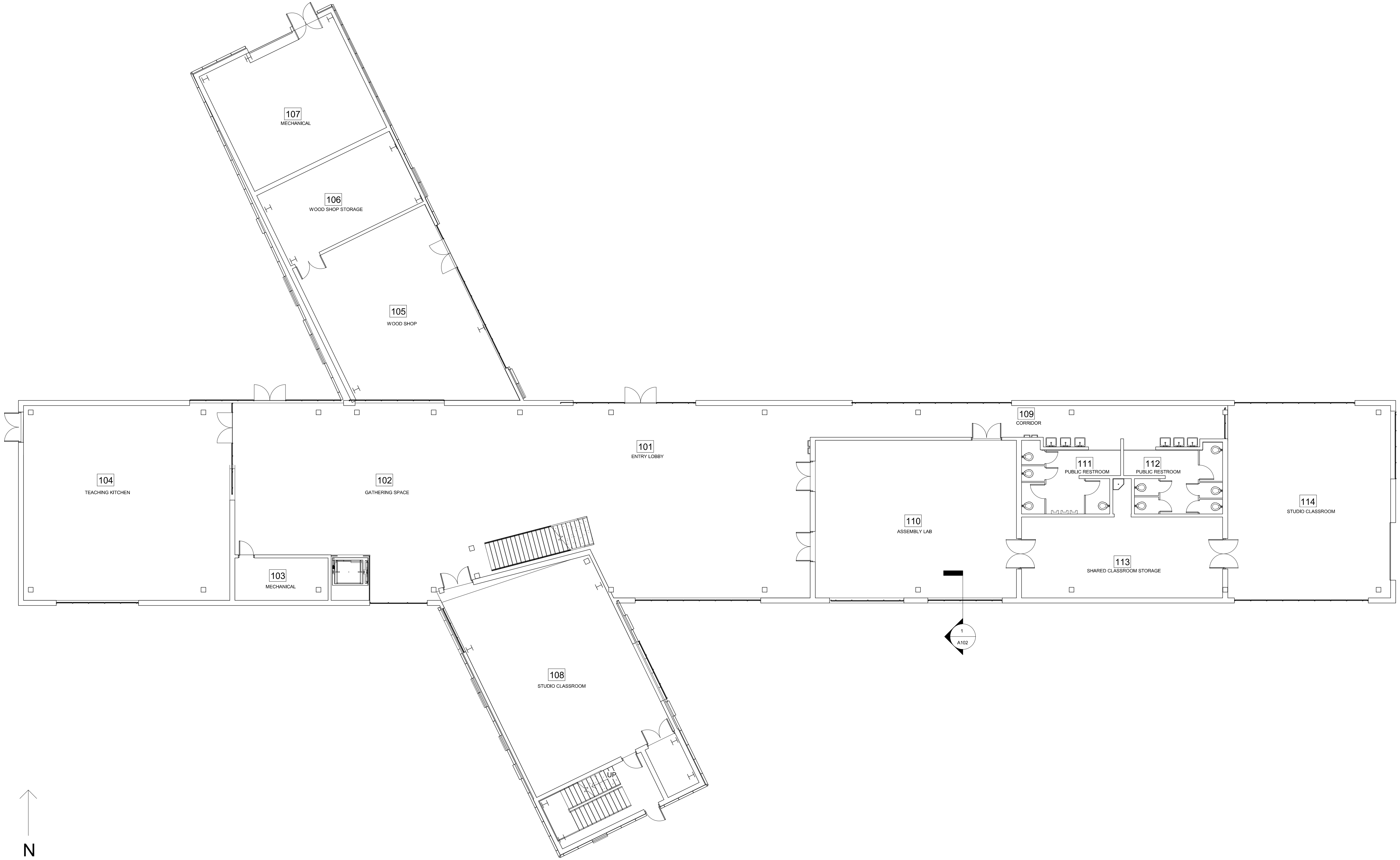
GENERAL NOTES

Project number	Project Number
Date	Issue Date
Drawn by	Author

000

Scale



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

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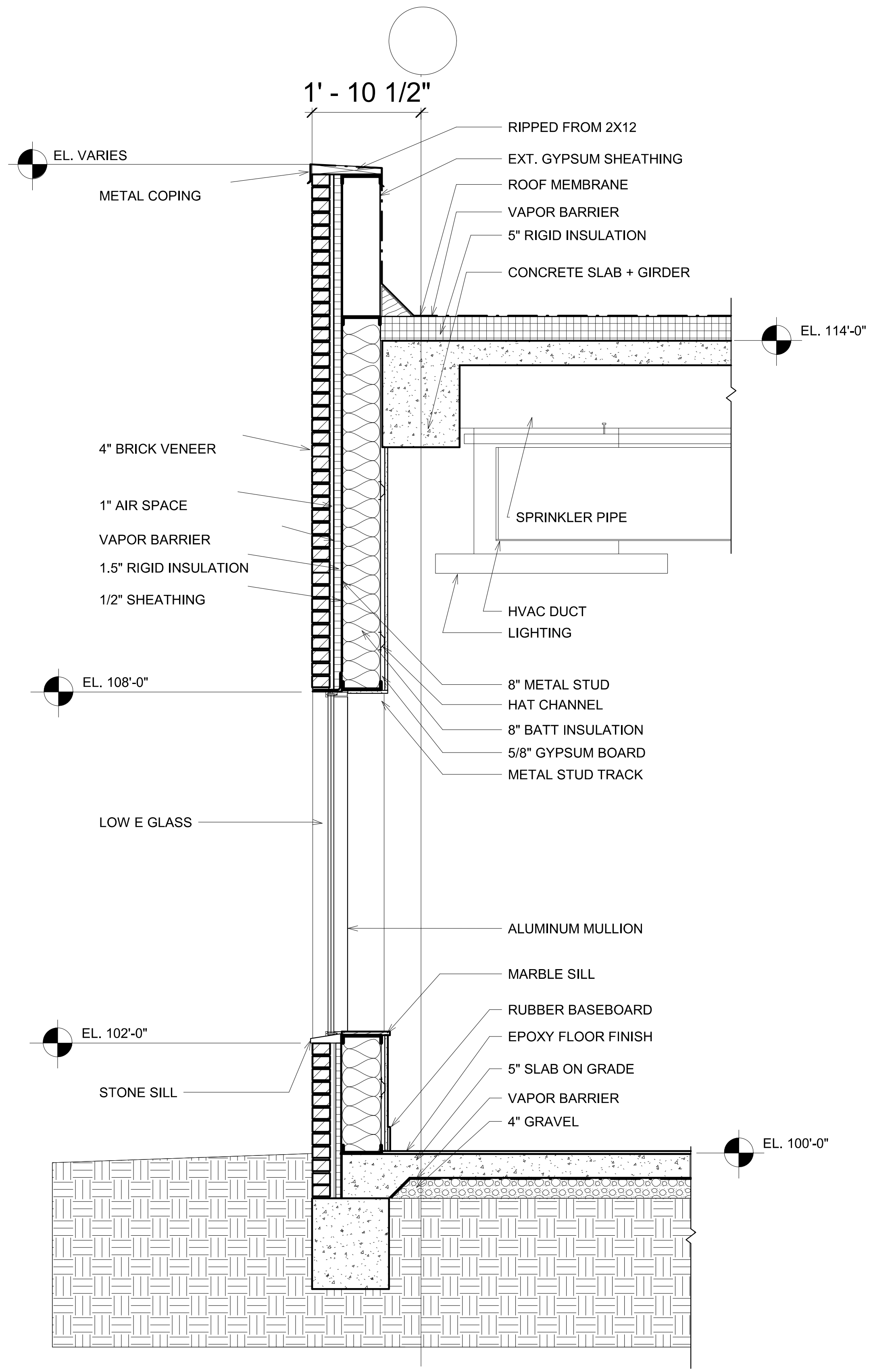
EDUCATION

FLOOR
PLAN

Project number	Project Number
Date	Issue Date
Drawn by	Author
A101	
Scale	3/32" = 1'-0"



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

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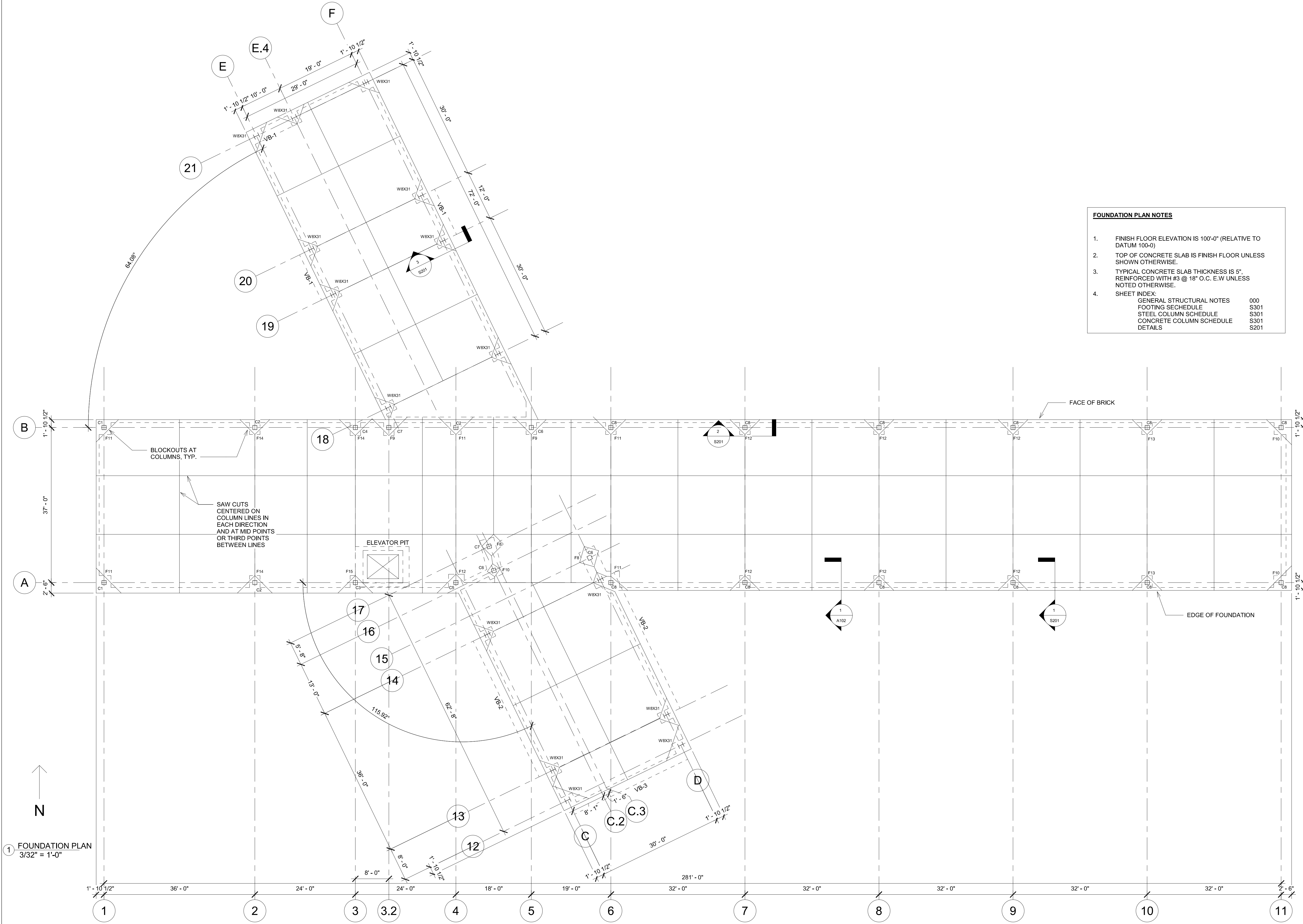
STEAM EDUCATION

WALL SECTION

Project number	Project Number
Date	Issue Date
Drawn by	Author
	A102
Scale	3/4" = 1'-0"



1 FOUNDATION PLAN
3/32" = 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", REINFORCED WITH #3 @ 18" O.C. E.W UNLESS NOTED OTHERWISE.
4. SHEET INDEX:

GENERAL STRUCTURAL NOTES	000
FOOTING SECHEDULE	S301
STEEL COLUMN SCHEDULE	S301
CONCRETE COLUMN SCHEDULE	S301
DETAILS	S201

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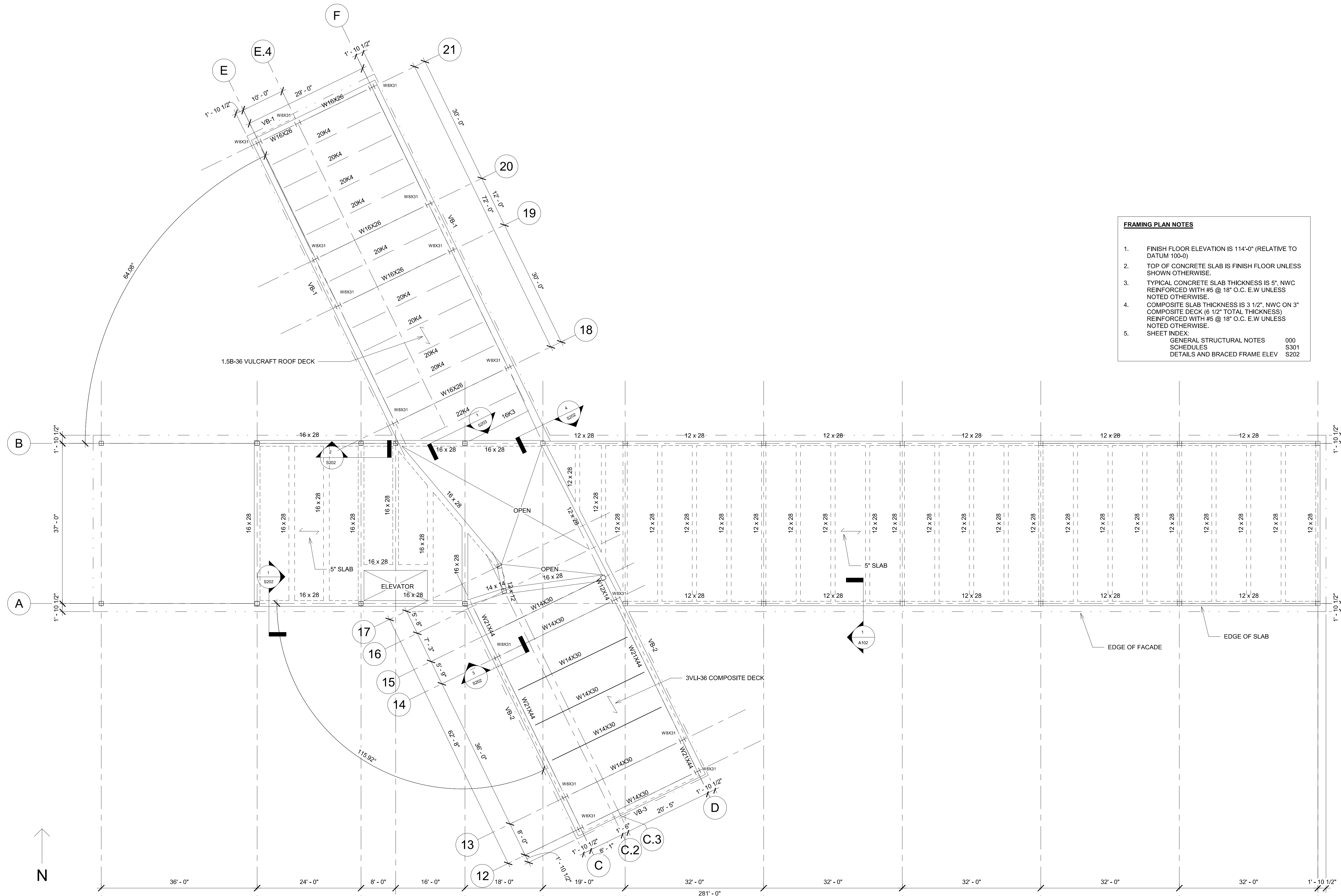
STEAM EDUCATION

FOUNDATION PLAN

Project number	Project Number
Date	Issue Date
Drawn by	Author
S101	
Scale	3/32" = 1'-0"



1 ELEVATED FLOOR AND LOW ROOF FRAMING PLAN
3/32" = 1'-0"

FRAMING PLAN NOTES

1. FINISH FLOOR ELEVATION IS 114'-0" (RELATIVE TO DATUM 100-0)
2. TOP OF CONCRETE SLAB IS FINISH FLOOR UNLESS SHOWN OTHERWISE.
3. TYPICAL CONCRETE SLAB THICKNESS IS 5", NWC REINFORCED WITH #5 @ 18" O.C. E.W UNLESS NOTED OTHERWISE.
4. COMPOSITE SLAB THICKNESS IS 3 1/2", NWC ON 3" COMPOSITE DECK (6 1/2" TOTAL THICKNESS) REINFORCED WITH #5 @ 18" O.C. E.W UNLESS NOTED OTHERWISE.
5. SHEET INDEX:

GENERAL STRUCTURAL NOTES	000
SCHEDULES	S301
DETAILS AND BRACED FRAME ELEV	S202

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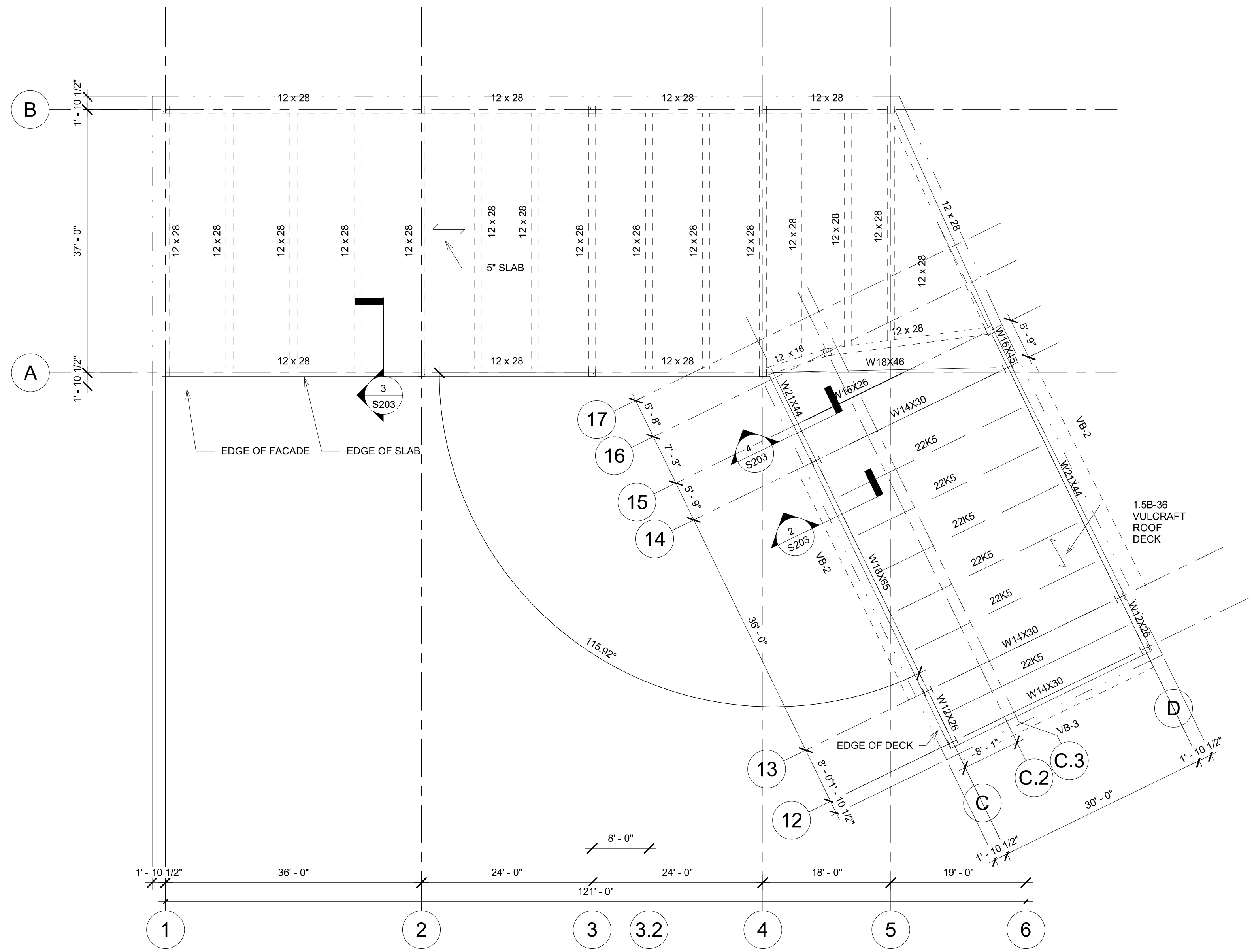
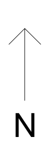
STEAM EDUCATION

ELEVATED FLOOR AND LOW ROOF FRAMING PLAN

Project number	Project Number
Date	Issue Date
Drawn by	Author
	S102
Scale	3/32" = 1'-0"





1 HIGH ROOF FRAMING PLAN
3/32" = 1'-0"

FRAMING PLAN NOTES

1. TOP OF ROOF STRUCTURE IS SLOPED FOR DRAINAGE.
2. UNLESS NOTED OTHERWISE, STEEL JOISTS SHALL BE CENTERED ON AND EQUALLY SPACED BETWEEN COLUMN CENTERLINES.
3. TOP OF CONCRETE SLAB IS FINISH FLOOR UNLESS SHOWN OTHERWISE.
4. TYPICAL CONCRETE SLAB THICKNESS IS 5", REINFORCED WITH #4 @ 18" O.C. E.W UNLESS NOTED OTHERWISE.
5. SHEET INDEX:

GENERAL STRUCTURAL NOTES	000
STEEL COLUMN SCHEDULE	S301
CONCRETE COLUMN SCHEDULE	S301
DETAILS AND VB ELEV	S204

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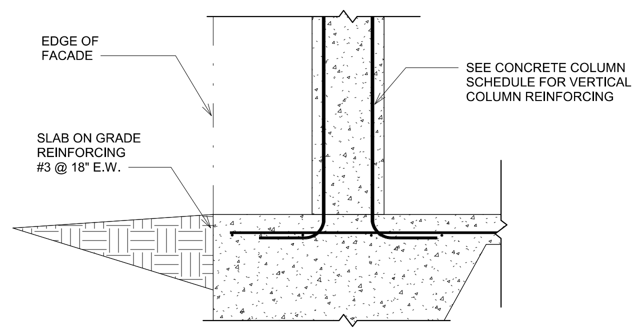
HIGH ROOF FRAMING PLAN

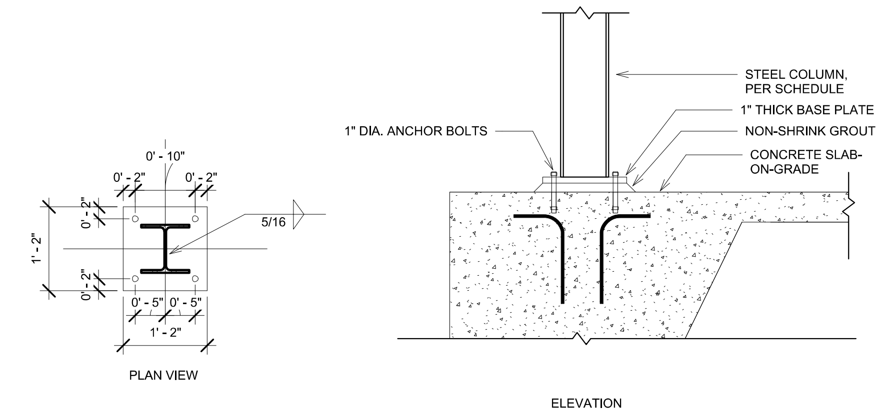
Project number	Project Number
Date	Issue Date
Drawn by	Author

S103

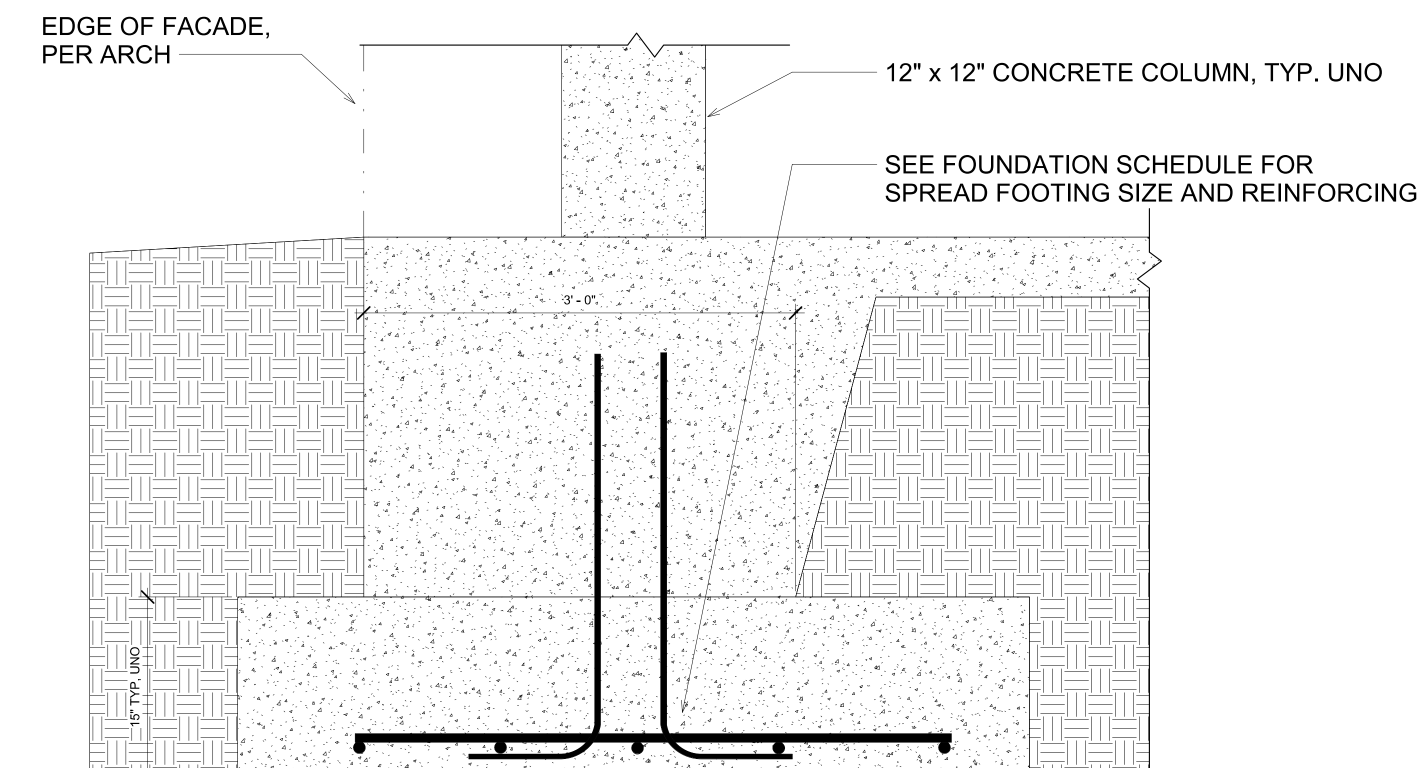
Scale 3/32" = 1'-0"



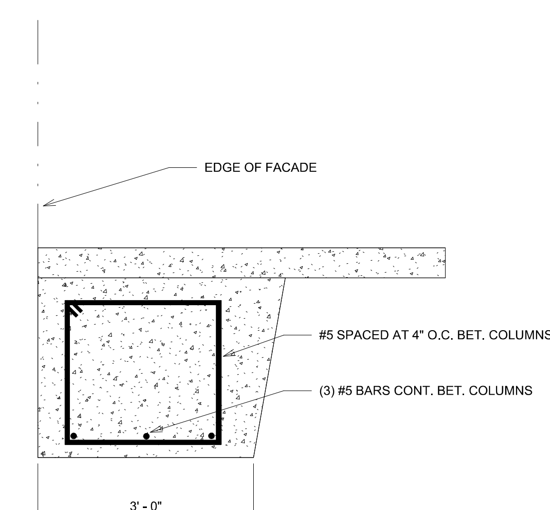
4 SLAB ON GRADE REINFORCING
3/4" = 1'-0"



3 STEEL COLUMN TO BASE PLATE
3/4" = 1'-0"



2 SPREAD FOOTING REINF. AT
CONCRETE COLUMN
1 1/2" = 1'-0"



1 CONTINUOUS FOOTING REINFORCING
BETWEEN COLUMNS
3/4" = 1'-0"

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STEAM

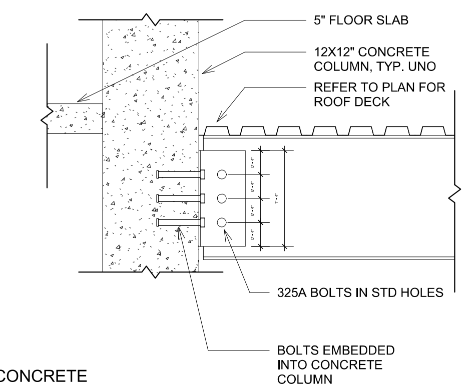
EDUCATION

FOUNDATION
DETAILS

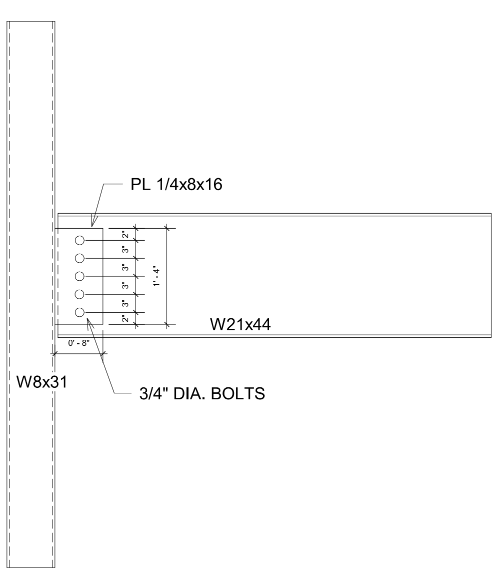
Project number	Project Number
Date	Issue Date
Drawn by	Author

S201

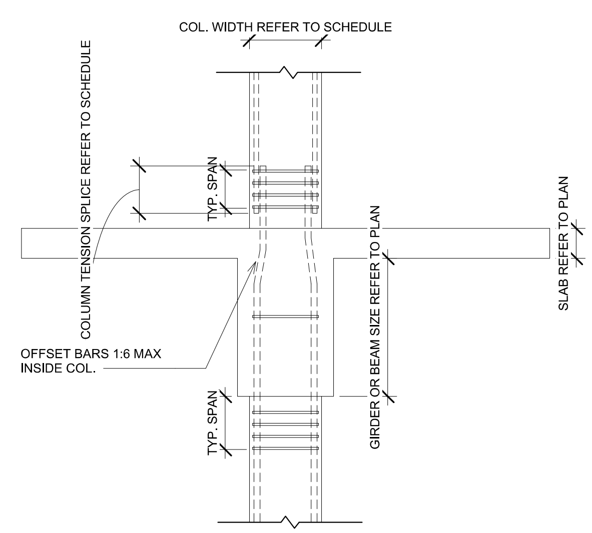
Scale	As indicated



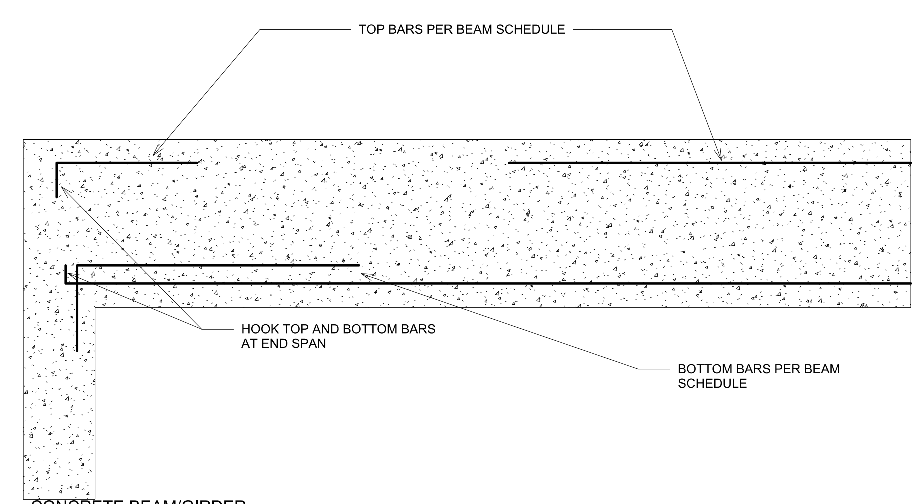
4 STEEL BEAM TO CONCRETE COLUMN/GIRDER CONNECTION
3/4" = 1'-0"



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



2 CONCRETE COLUMN SPLICE
3/4" = 1'-0"



1 CONCRETE BEAM/GIRDER REINFORCING END SPAN
3/4" = 1'-0"

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STEAM EDUCATION

FLOOR DETAILS

Project number	Project Number
Date	Issue Date
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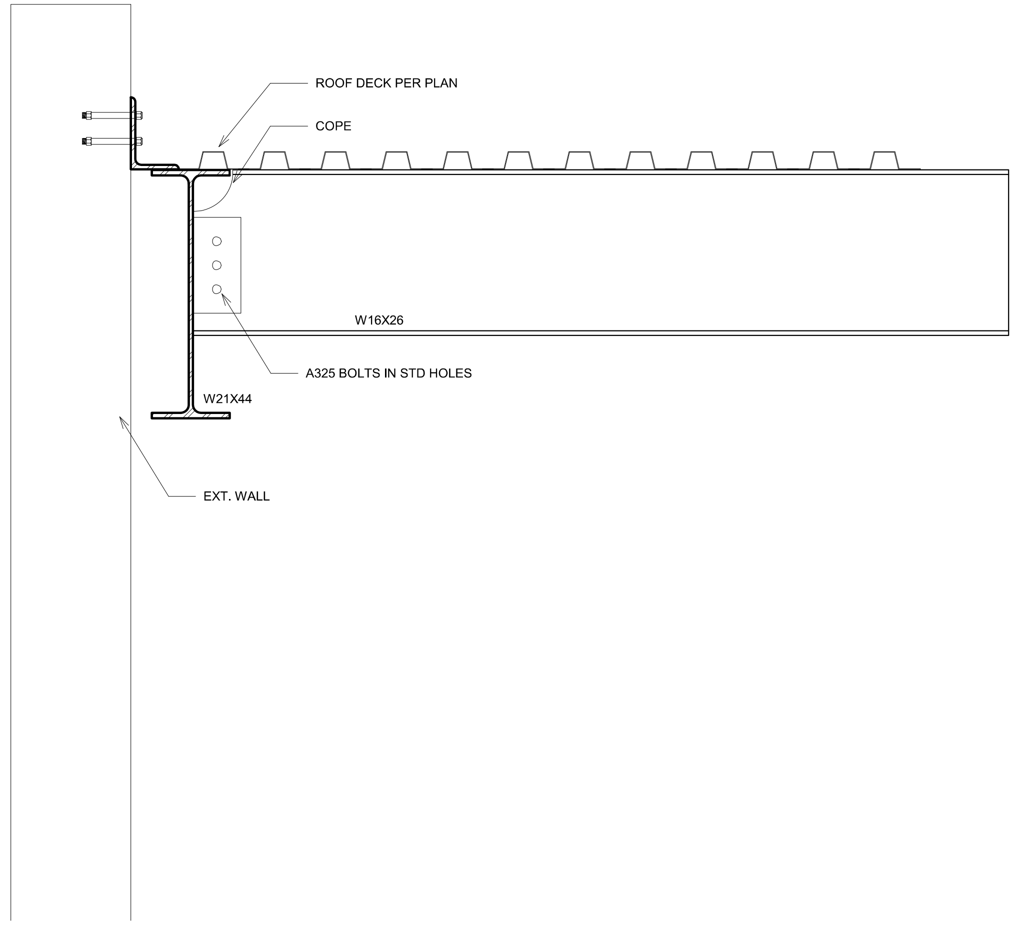
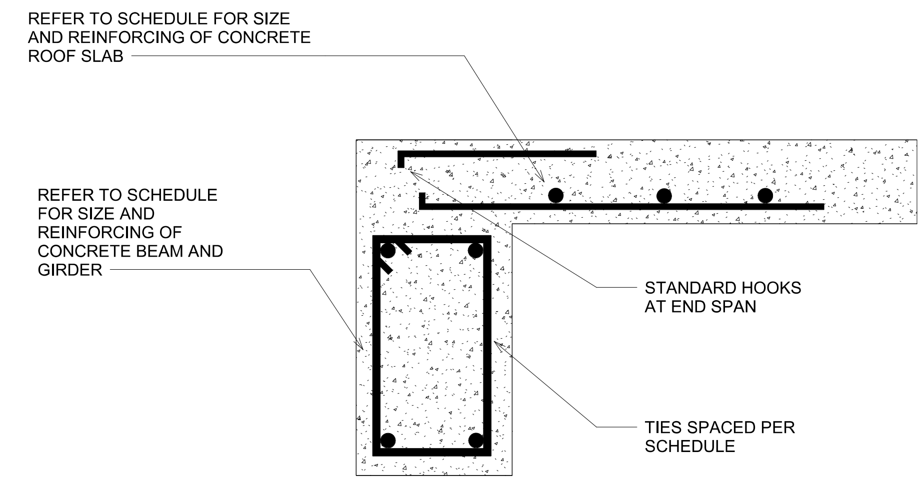
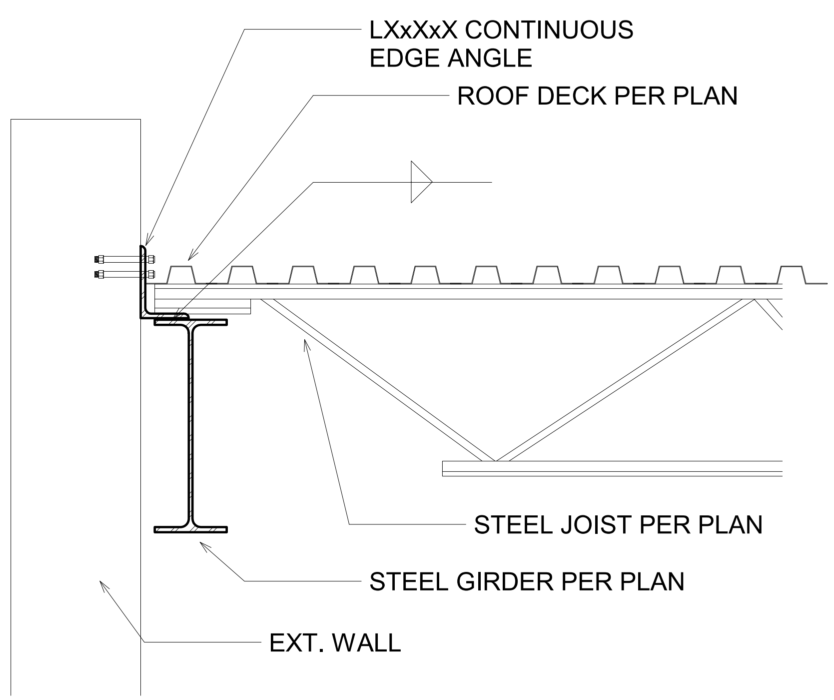
	S202
Scale	3/4" = 1'-0"



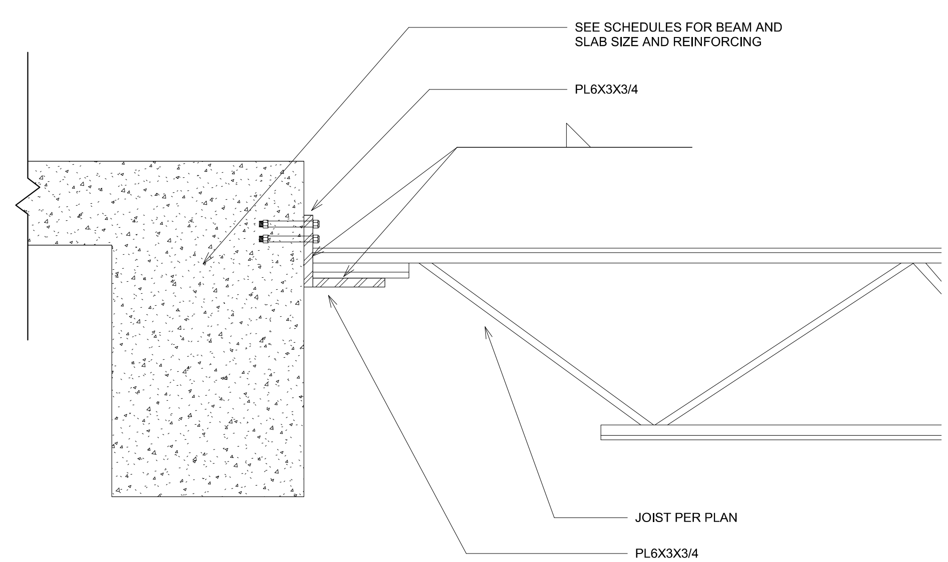
4 ROOF STEEL BEAM TO GIRDER
1 1/2" = 1'-0"



3 ROOF SLAB + BEAM/GIRDER
REINFORCING PLACEMENT
1 1/2" = 1'-0"



2 JOIST TO STEEL BEAM
1 1/2" = 1'-0"



1 JOIST TO CONCRETE BEAM
1 1/2" = 1'-0"

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STEAM

EDUCATION

ROOF
DETAILS

Project number	Project Number
Date	Issue Date
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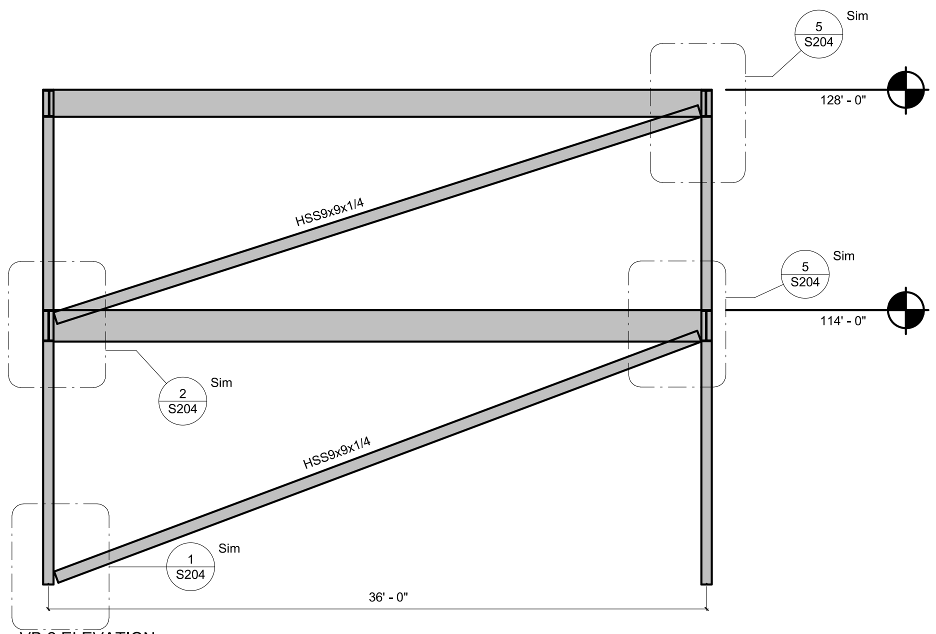
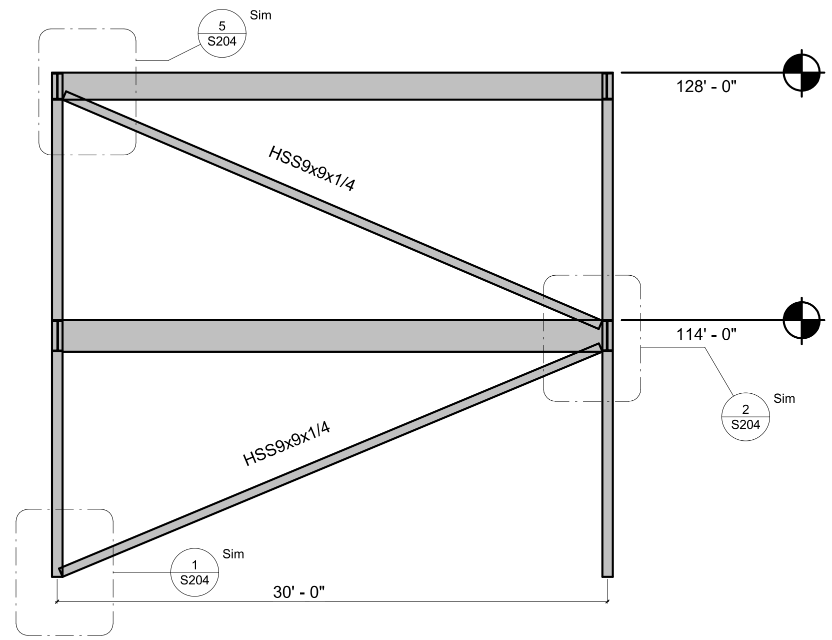
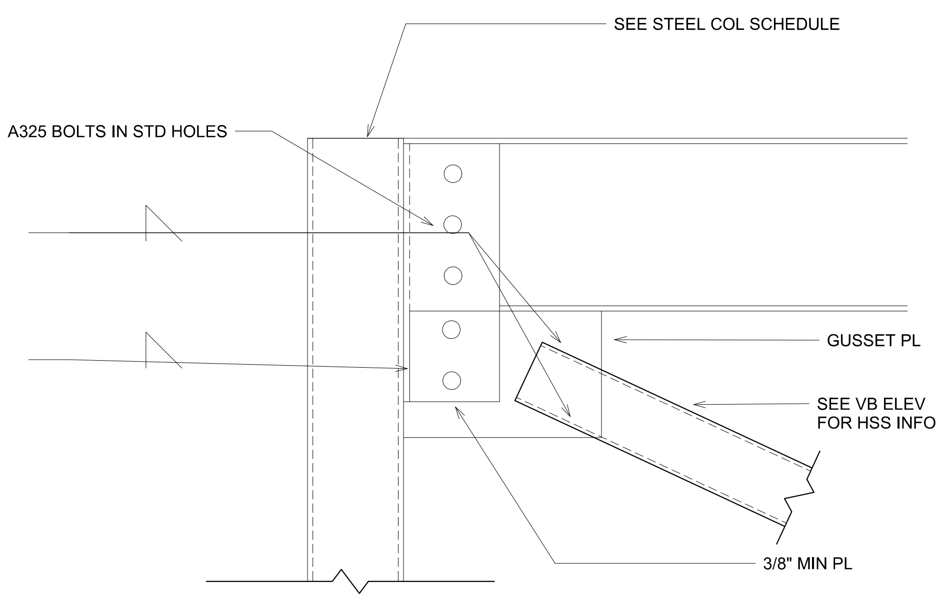
	S203
Scale	1 1/2" = 1'-0"



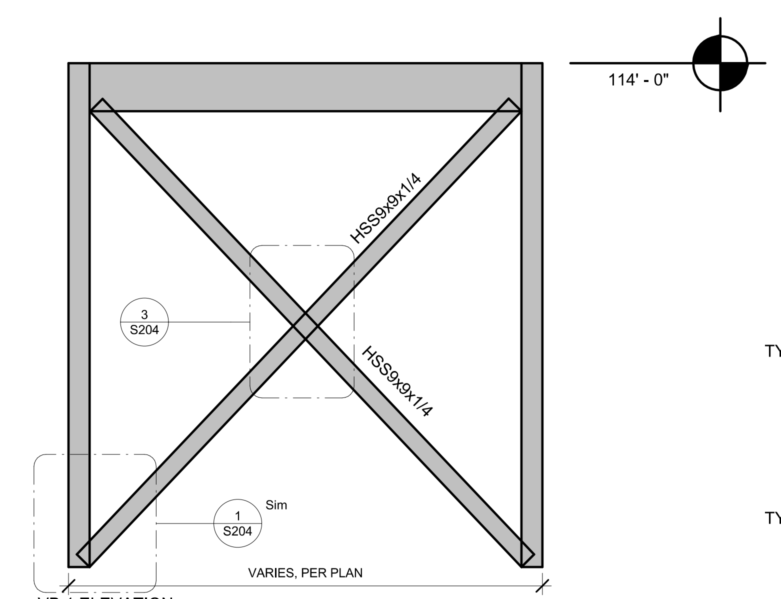
7 VB 2 ELEVATION
3/16" = 1'-0"



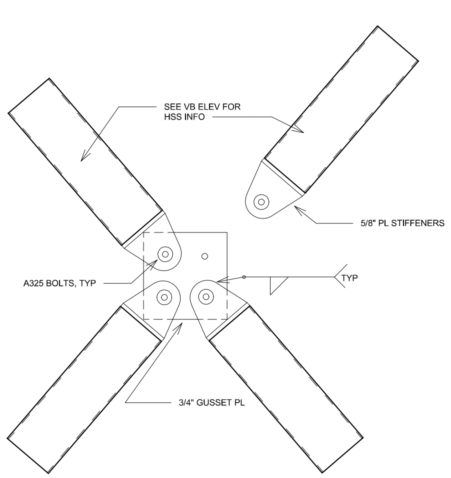
6 VB 3 ELEVATION
3/16" = 1'-0"



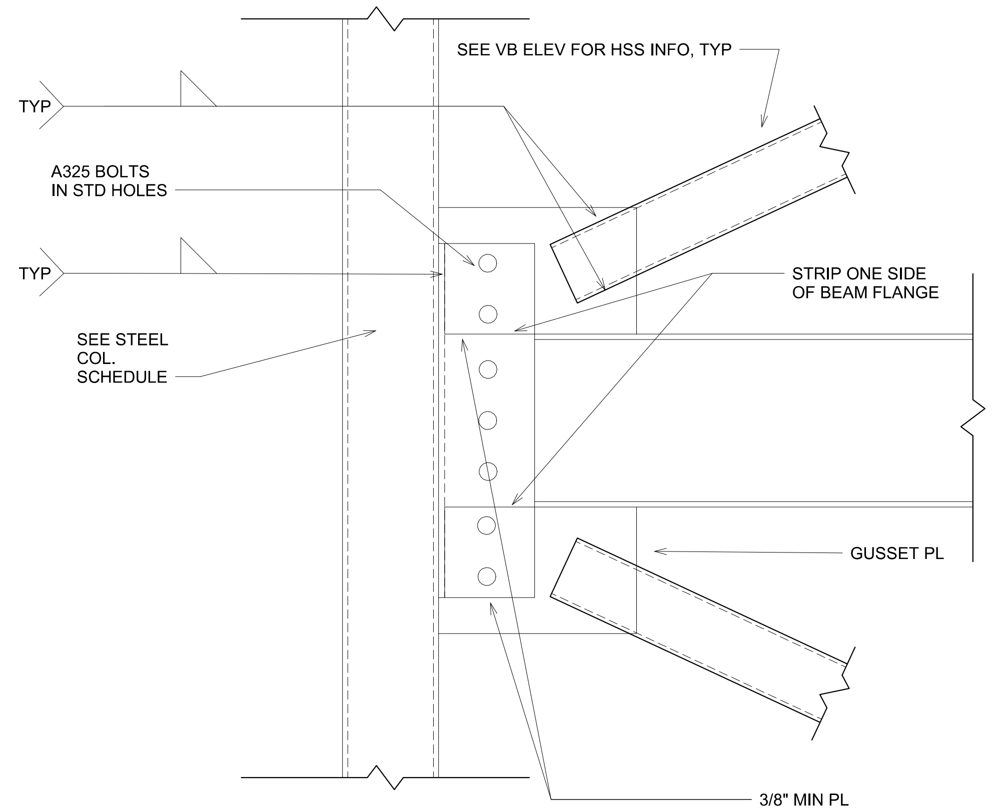
5 VB DETAIL AT ROOF
1 1/2" = 1'-0"



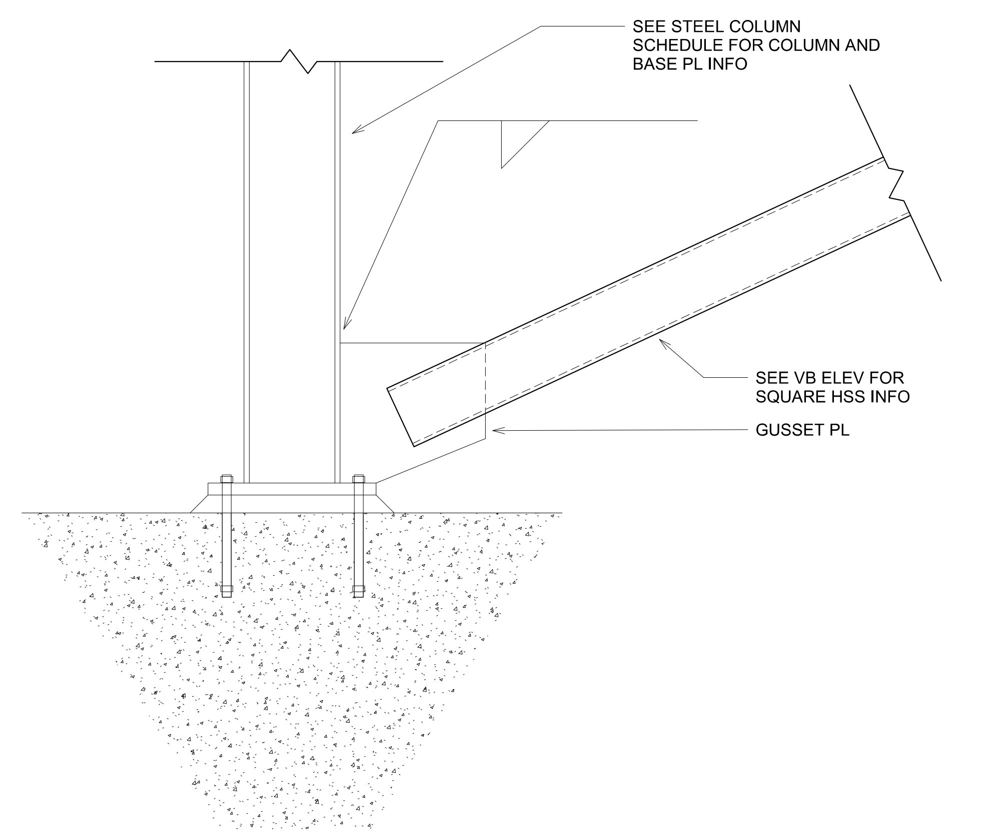
4 VB 1 ELEVATION
3/8" = 1'-0"



3 X-BRACING DETAIL
3/4" = 1'-0"



2 VB DETAIL AT FLOOR 2
1 1/2" = 1'-0"



1 VB DETAIL AT FLOOR 1
1 1/2" = 1'-0"

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STEAM

EDUCATION

LFRS
DETAILS
AND VB
ELEV

Project number	Project Number
Date	Issue Date
Drawn by	Author

S204

Scale	As indicated

BEAM / GIRDER SCHEDULE

MARK	SIZE	BAR TYPE (Support – Support)	STIRRUPS TYPE and SIZE	STIRRUPS SPACING	NOTES
B1	14" X 14"	2 #6 / 2 #6 / 2 #6	#3	NO STIRRUPS REQUIRED	
B2	12" X 12"	3 #7 / 3 #7 / 2 #6	#3	1 @ 2", 8 @ 4" Left end, 1 @ 2", 8 @ 4" right end	
B3	16" X 16"	3 #6 / 3 #6 / 2 #6	#3	NO STIRRUPS REQUIRED	
B4	12" X 16"	3 #7 / 3 #6 / 3 #6	#3	1 @ 2", 3 @ 6" Left end, 1 @ 2", 3 @ 6" right end	
B5	12" X 28"	5 #8 / 5 #6 / 3 #9	#3	1 @ 2", 9 @ 8" Left end, 9 @12" Left Second region 1 @ 2", 6 @ 12" right end	
B6	12" X 28"	10 #6 / 10 #6 / 2 #10	#3	1 @ 2", 7 @ 12" Left end, 1 @ 2", 7 @ 12" right end	
B7	12" X 28"	5 #6 / 5 #6 / 2 #8	#3	1 @ 2", 2 @ 12" Left end, 1 @ 2", 2 @ 12" right end	
B8	12" X 28"	5 #8 / 5 #8 / 2 #9	#3	1 @ 2", 27 @ 12" Left end, 1 @ 2", 15 @ 11" right end	
B9	12" X 28"	5 #6 / 5 #8 / 2 #10	#3	1 @ 2", 6 @ 9" Left end, 1 @ 2", 18 @ 9" right end	
B10	12" X 28"	2 #10 / 2 #10 / 2 #7	#3	1 @ 2", 10 @ 11" Left end, 1 @ 2", 15 @ 11" right end	
B11	12" X 28"	5 #7 / 10 #6 / 2 #10	#3	1 @ 2", 9 @ 12" Left end, 1 @ 2", 7 @ 12" right end	
B12	12" X 28"	6 #6 / 5 #8 / 3 #10	#3	1 @ 2", 15 @ 12" Left end, 1 @ 2", 6 @ 12" right end	
B13	12" X 28"	5 #7 / 5 #6 / 2 #9	#3	1 @ 2", 9 @ 9" right end 1 @ 2", 9 @ 9" left end	
B14	16" X 28"	10 #6 / 10 #6 / 3 #8	#3	1 @ 2", 9 @ 12" right end 1 @ 2", 9 @ 12" left end	
B15	16" X 28"	10 #6 / 10 #6 / 3 #10	#3	1 @ 2", 4 @ 3" right end 1 @ 3", left end	
B16	16" X 28"	6 #6 / 6 #6 / 3 #9	#3	1 @ 2", 9 @ 12" right end 1 @ 2", 9 @ 12" left end	

CONCRETE COLUMN SCHEDULE

Column Location	A1, B1	A2, B2, B4	A3	B3	A4	B5, C.2-16, D15	B3.2, C.3-17	A6, A7, A8, A9, A10, A11, B6, B7, B8, B9, B10, B11
SECOND FLOOR	18" X 18" (20)-#6 VERTICAL (22) #3 TIES @ 7"	18" X 12" (8)-#9 VERTICAL (21) #3 TIES @ 7"	18" X 12" (4)-#10 VERTICAL (21) #3 TIES @ 7"	18" X 12" (8)-#8 VERTICAL (36) #3 TIES @ 4"	12" X 12" (4)-#9 VERTICAL (36) #3 TIES @ 4"	12" X 12" (4)-#7 VERTICAL (13) #3 TIES @ 4"		
GROUND FLOOR	18" X 18" (8)-#6 VERTICAL (14) #3 TIES @ 12"	18" X 12" (4)-#9 VERTICAL (22) #3 TIES @ 7"	18" X 12" (4)-#7 VERTICAL (37) #3 TIES @ 7"	18" X 12" 4-#9 VERTICAL (22) #3 TIES @ 7"	12" X 12" (4)-#6 VERTICAL (13) #3 TIES @ 12"	12" X 12" (4)-#6 VERTICAL (13) #3 TIES @ 12"	12" X 12" (4)-#6 VERTICAL (37) #3 TIES @ 4"	12" X 12" (4)-#10 VERTICAL (37) #3 TIES @ 4"
MARK	C1	C2	C3	C4	C5	C6	C7	C8

Notes:
1) Provide standard hook for vertical reinforcing at top of columns at roof.

FOOTING SCHEDULE

MARK	FOOTING SIZE	FLEXURAL REINFORCING
F1	2.5' X 2.5'	(2) #6 E.W.
F2	3' X 3'	(5) #4 E.W.
F3	3.5' X 3.5'	(2) #7 E.W.
F4	5.5' X 5.5'	(4) #6 E.W.
F5	6' X 6'	(2) #9 E.W.
F6	6.5' X 6.5'	(3) #8 E.W.
F7	7' X 7'	(4) #8 E.W.
F8	7' X 7'	(2) #9 + (1) #5 E.W.
F9	7.5' X 7.5'	(2) #10 E.W.
F10	8' X 8'	(6) #7 E.W.
F11	8.5' X 8.5'	(3) #10 E.W.
F12	9' X 9'	(2) #10 + (3) #7 E.W.
F13	9.5' X 9.5'	(3) #11 E.W.
F14	11' X 11'	(5) #10 E.W.
F15	11.5' X 11.5'	(5) #11 E.W.

SLAB SCHEDULE

MARK	DEPTH	FLEXURAL REINFORCING TOP LEFT BARS	TOP RIGHT BARS	BOTTOM BARS	TEMPERATURE REINFORCING	NOTES
S1	5"	#3 @ 15"	#3 @ 15"	#3 @ 15"	#3 @ 12"	
S2**	5"	#3 @ 15"	#3 @ 15"	#3 @ 15"	#3 @ 12"	
S3	5"	#4 @ 15"	#4 @ 15"	#4 @ 15"	#3 @ 12"	
S4**	5"	#4 @ 15"	#4 @ 15"	#4 @ 15"	#3 @ 12"	
S5	5"	#3 @ 18"	#3 @ 18"	#3 @ 18"	#3 @ 12"	SOG

Notes:
1) If no top bars shown, reinforcing will be in one layer.
2) ** indicates a standard hook required at the edge of slab

Column Splice Schedule

Bar Size	Comp. Splic	Tension Splice 4000 psi	5000 psi	6000 psi	7000 psi
#7	27"	54"	49"	45"	41"
#8	30"	62"	56"	51"	47"
#9	34"	70"	63"	57"	53"
#10	39"	79"	71"	64"	60"
#11	43"	87"	78"	71"	66"

Concrete Column Tie Schedule

Bar Size / Col. Size	#6	#7	#8	#9	#10	#11	#14
12"	#3 @ 12	#3 @ 12	#3 @ 12	#3 @ 12	#3 @ 12	#4 @ 12	#4 @ 12
16"	#3 @ 12	#3 @ 14	#3 @ 16	#3 @ 16	#3 @ 16	#4 @ 16	#4 @ 16
18"	#3 @ 12	#3 @ 14	#3 @ 16	#3 @ 18	#3 @ 18	#4 @ 18	#4 @ 18

STEEL COLUMN SCHEDULE

Column Location	C12, C13, C14, D12, D13, D14	E18, E19, E20, E21, E.4-21, F18, F19, F20, F21
SECOND FLOOR	W8X31	
GROUND FLOOR	W8X31	W8X31
BASE PLATE	1'-2"X14"X1" (N) - X" DIA. ANCHOR BOLTS	1'-2"X14"X1" (N) - X" DIA. ANCHOR BOLTS

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STEAM EDUCATION

STRUCTURAL SCHEDULES

Project number	Project Number
Date	Issue Date
Drawn by	Author

S301

Scale