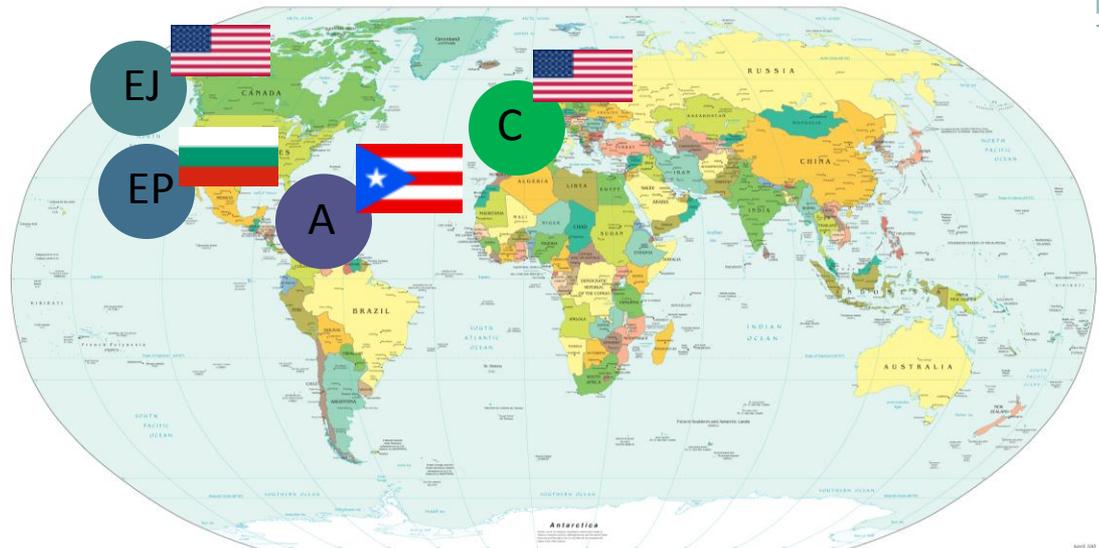


# Ridge 2010

## Winter Presentation

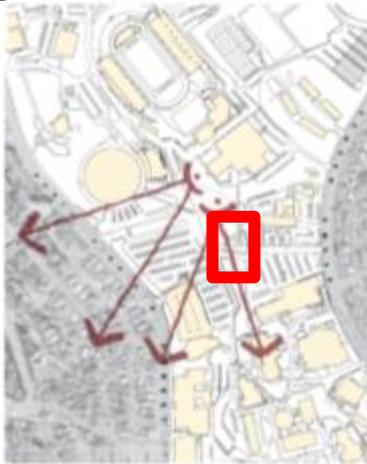




# Site - University of Nevada, Reno

## Challenges

- Earthquakes
- Gusts from the Sierra Nevada
- Large Diurnal Temperature Variation
- Cactus Collection
- Slope



## Advantages

- Mid-Campus Location
- Views to South Campus
- Abundant sun



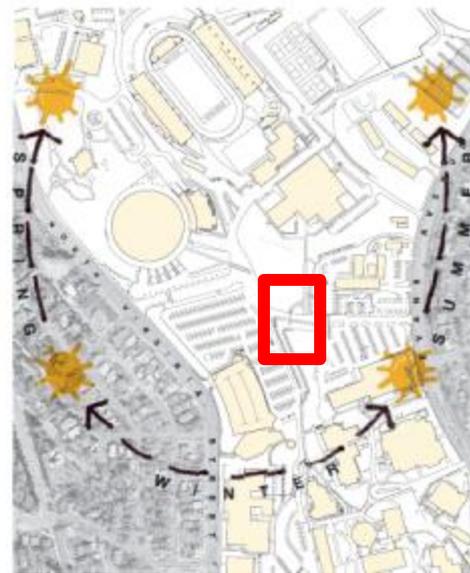
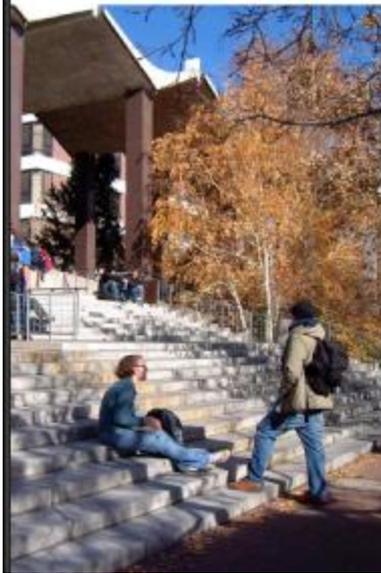


# Site - University of Nevada, Reno

## 2-9 Solar Orientation

*Public building entrances will need to maximize their orientation to the south and southwest to facilitate year-round use.*

*The existing library steps serve as a prime example of orienting and designing access to serve as informal seating, thus encouraging campus community interaction*



## 2-8 Informal Seating

*Accessways, stairs, and other site features can provide informal seating areas and places of interaction.*



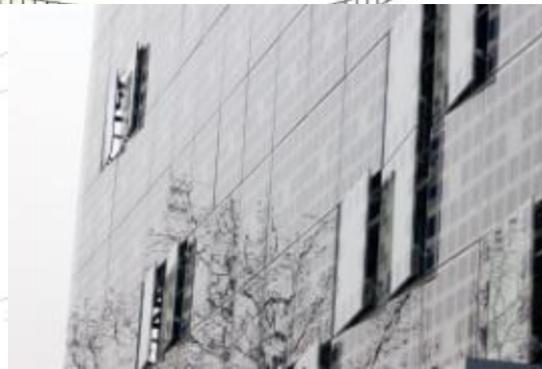
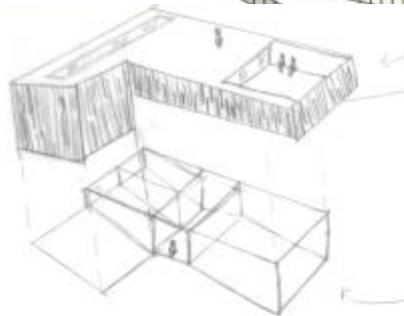
# Big Idea

Emphasizes on how technology and nature intertwine for fostering sustainability and the interaction it aids to provide

## Goals:

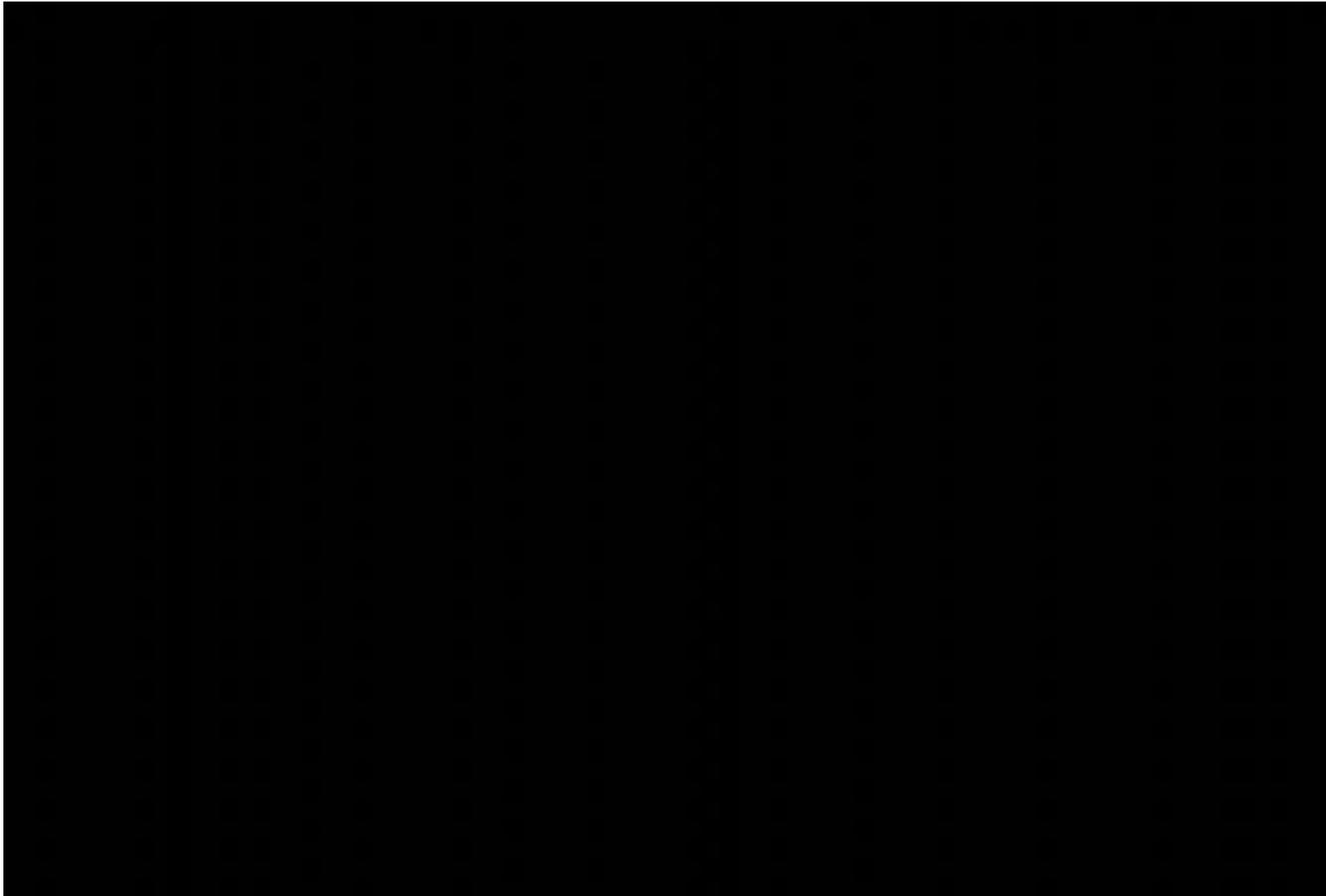
- Sustainability Tech Integration

## PIXEL

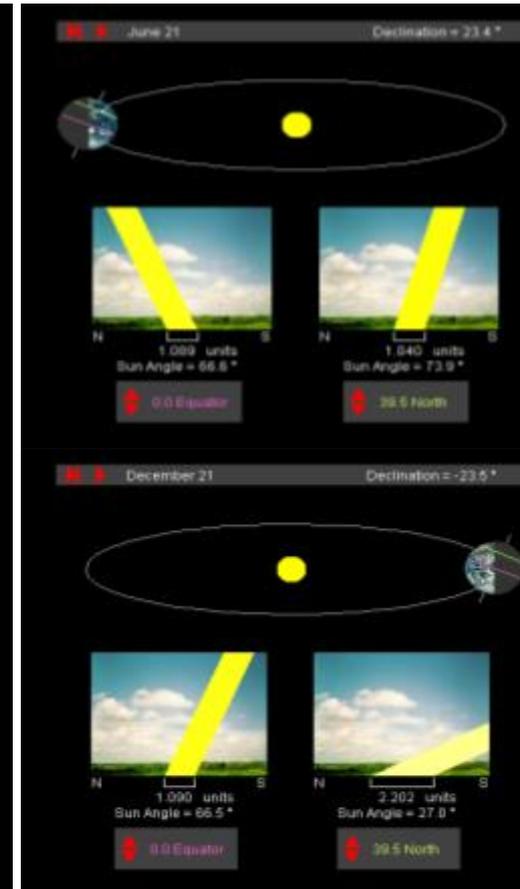


# Sun Study

FROM BUILDING'S SOUTHWEST FAÇADE:  
JANUARY 21-DECEMBER 21 AT 1PM

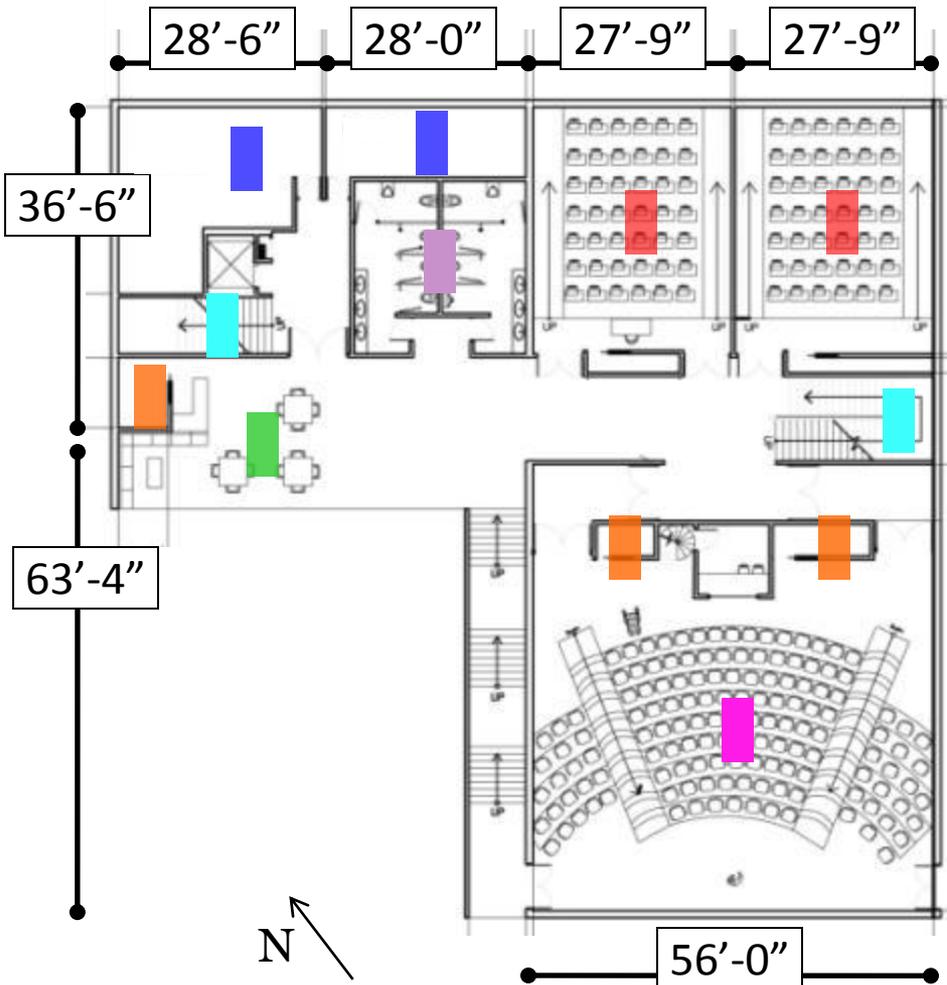


Summer Solstice  
Sun Angle= 73.9°



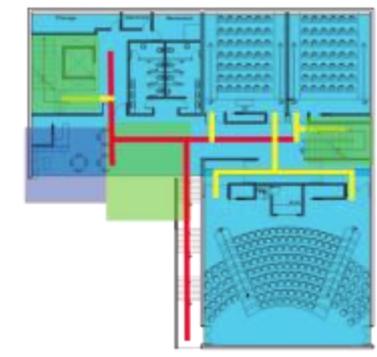
Winter Solstice  
Sun Angle= 27°

# Floor 1



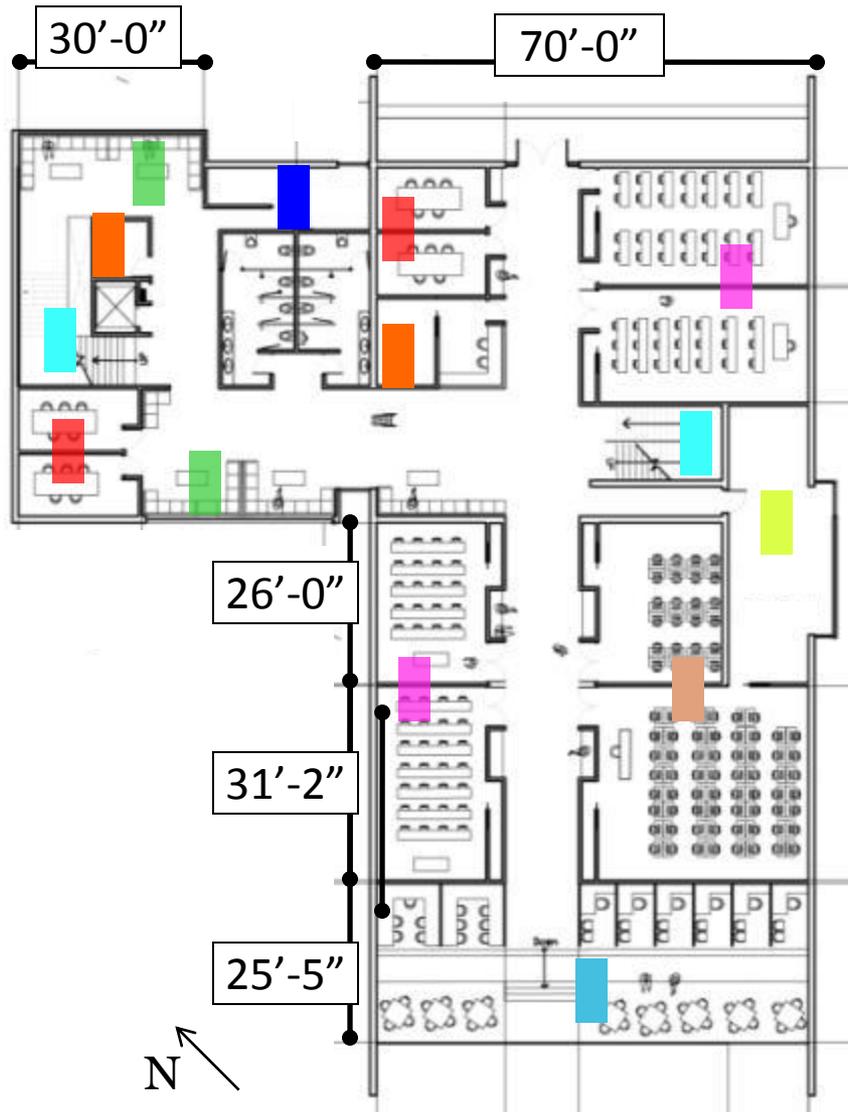
Level: -16'-0"  
 Height: 16'-0" - 26'-0"

-  Bathrooms
-  MEP
-  Storage
-  Café
-  Large Classrooms
-  Auditorium
-  Vertical Cores



# Floor 2

Level: 0'-0"  
Height: 10'-0"



- MEP
- Storage
- Interaction Areas
- Seminar Rooms
- Small Classrooms
- Vertical Cores
- Instructional Labs
- Server Room
- Student Office Area



# Floor 3

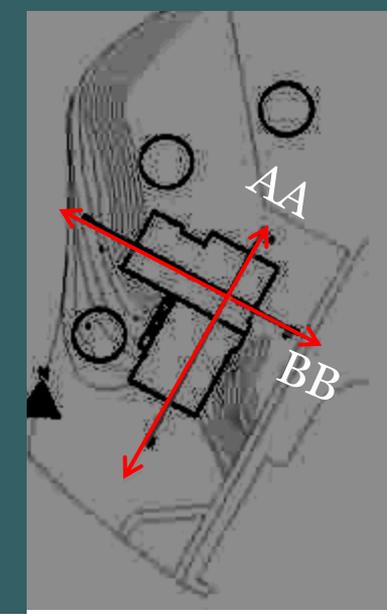
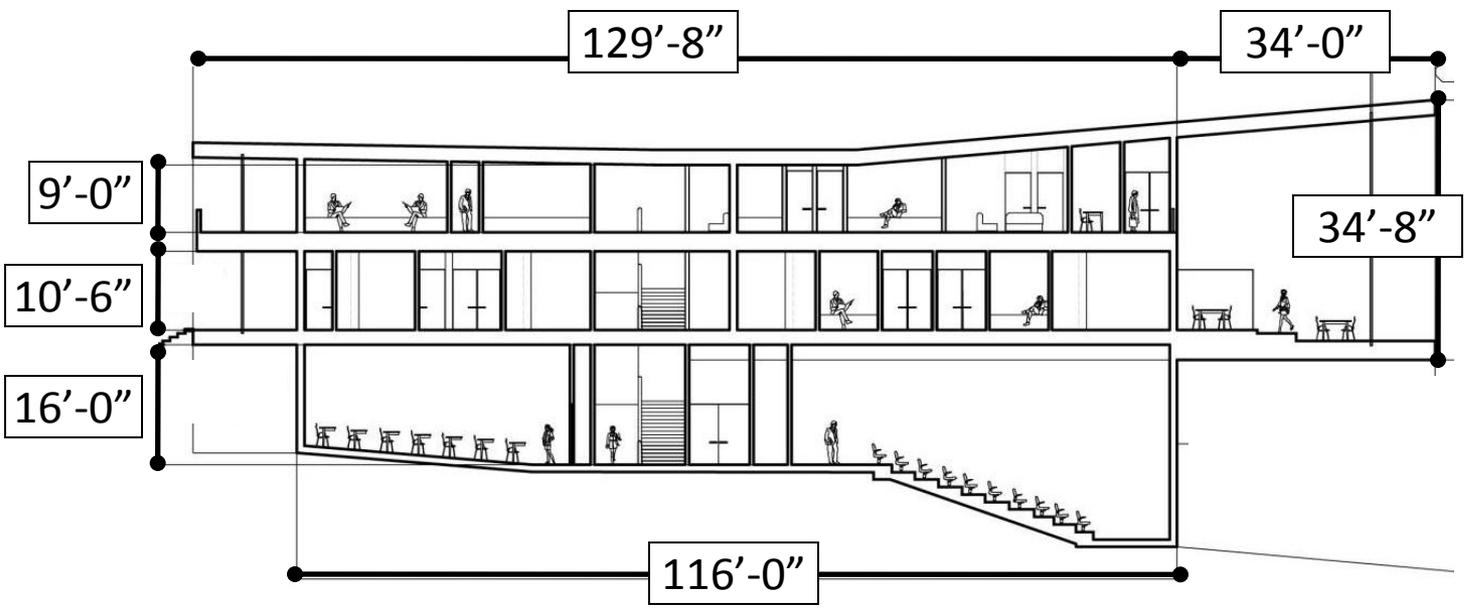


Level: +13'-0"  
 Height: 9'-0"-11'-0"

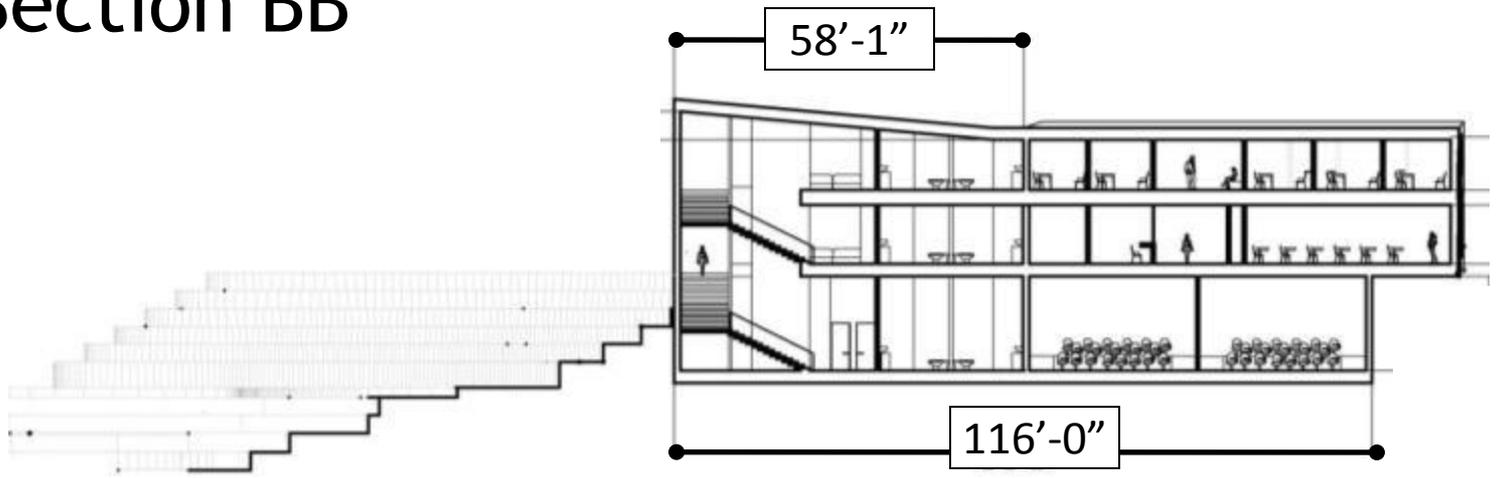
- Bathroom
- MEP
- Storage
- Faculty Offices
- Interaction/Lounge Areas
- Vertical Cores



# Section AA



# Section BB



# North Façade



# South Façade



# East Façade

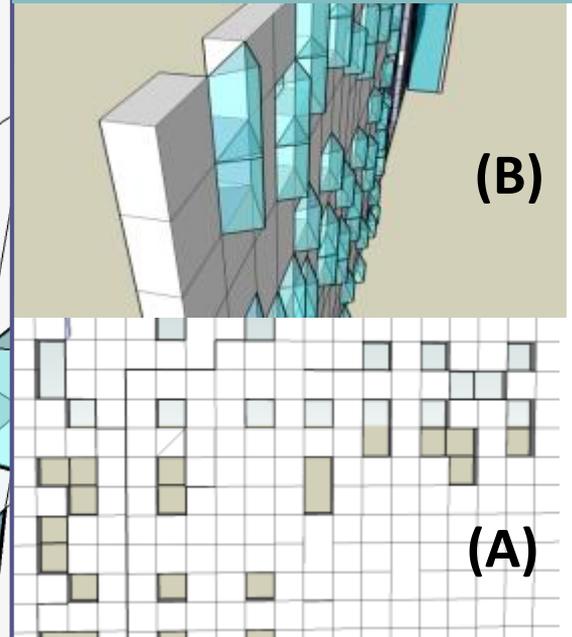
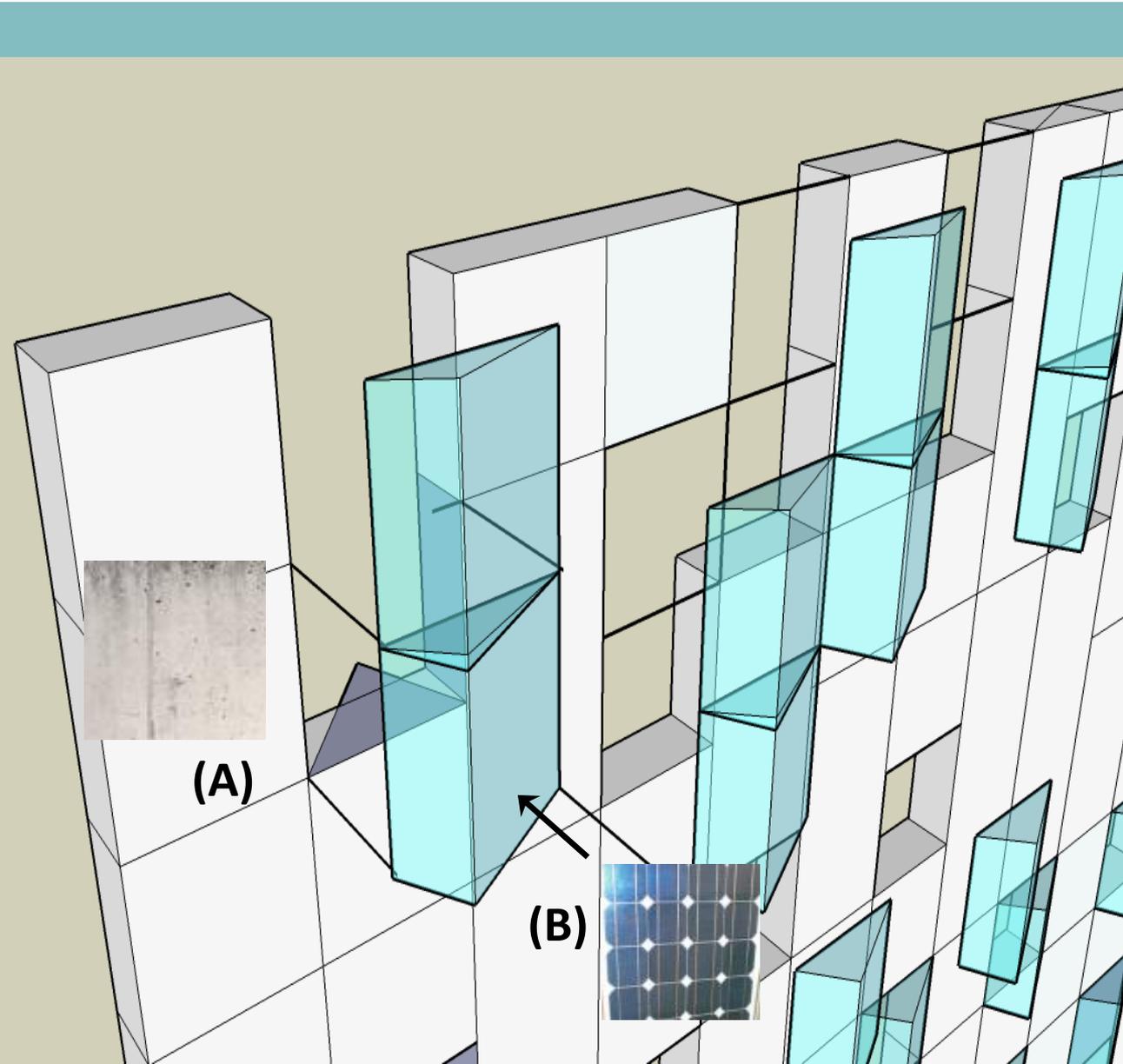


# West Façade

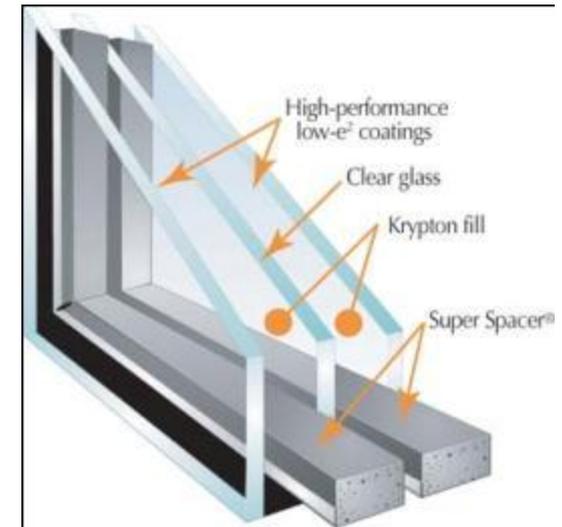
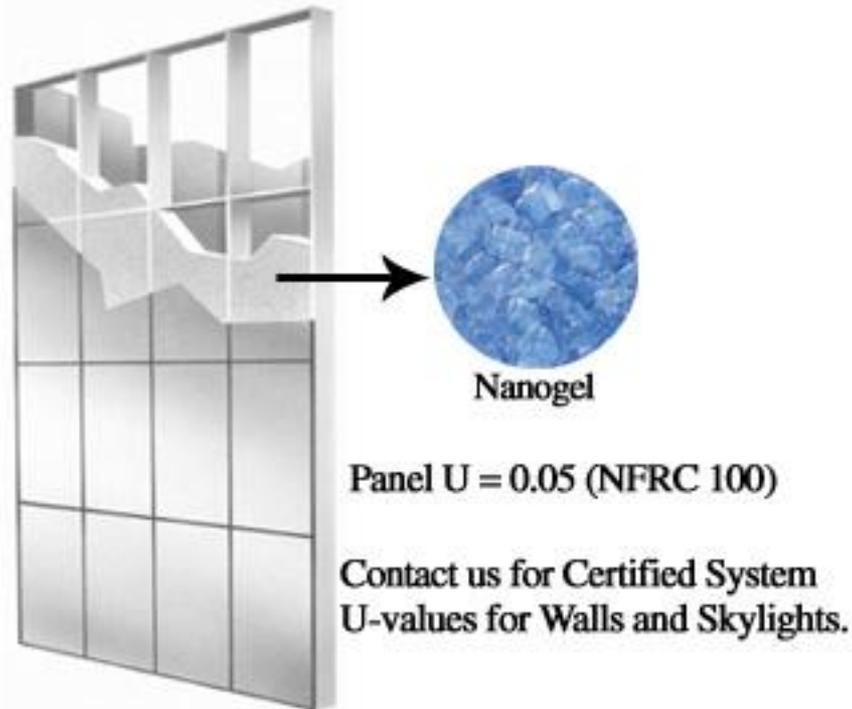


# Façade

- A. Concrete wall that works in openings according to structural capacity
- B. Pre-fabricated module photovoltaic, glass panels which would capture solar energy



# Possible Glass Materials

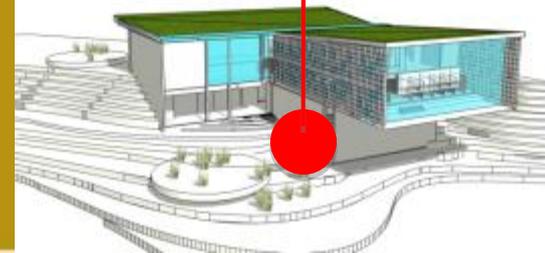


Nano-Gel Windows

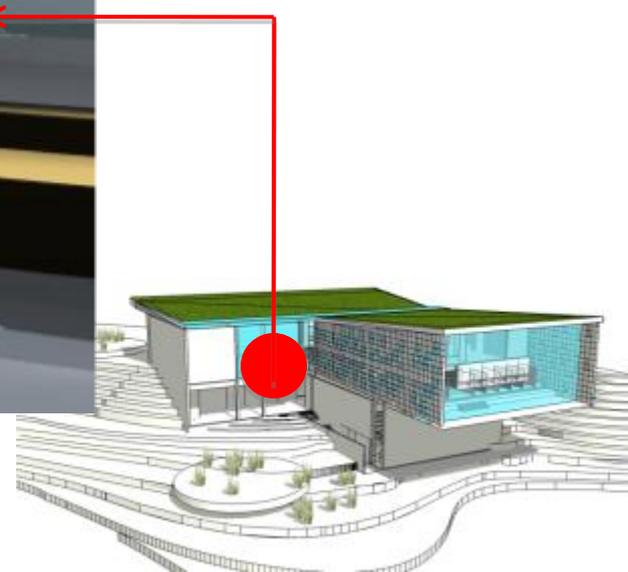
Eco Insulating Glass

Triple Glazed Window

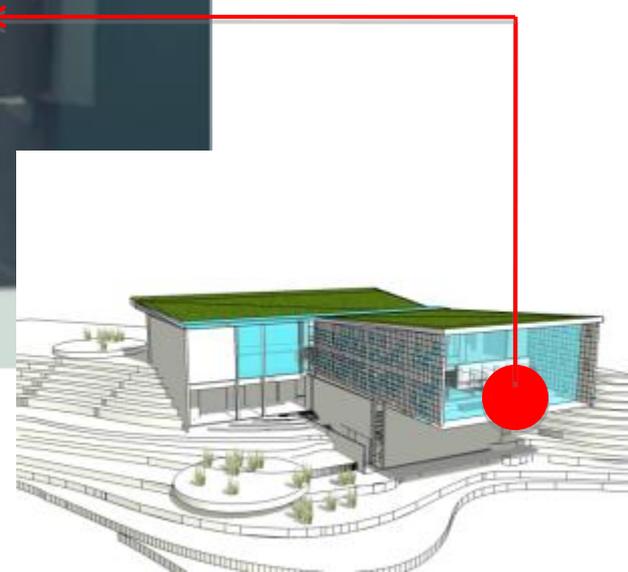
# First Floor Entrance



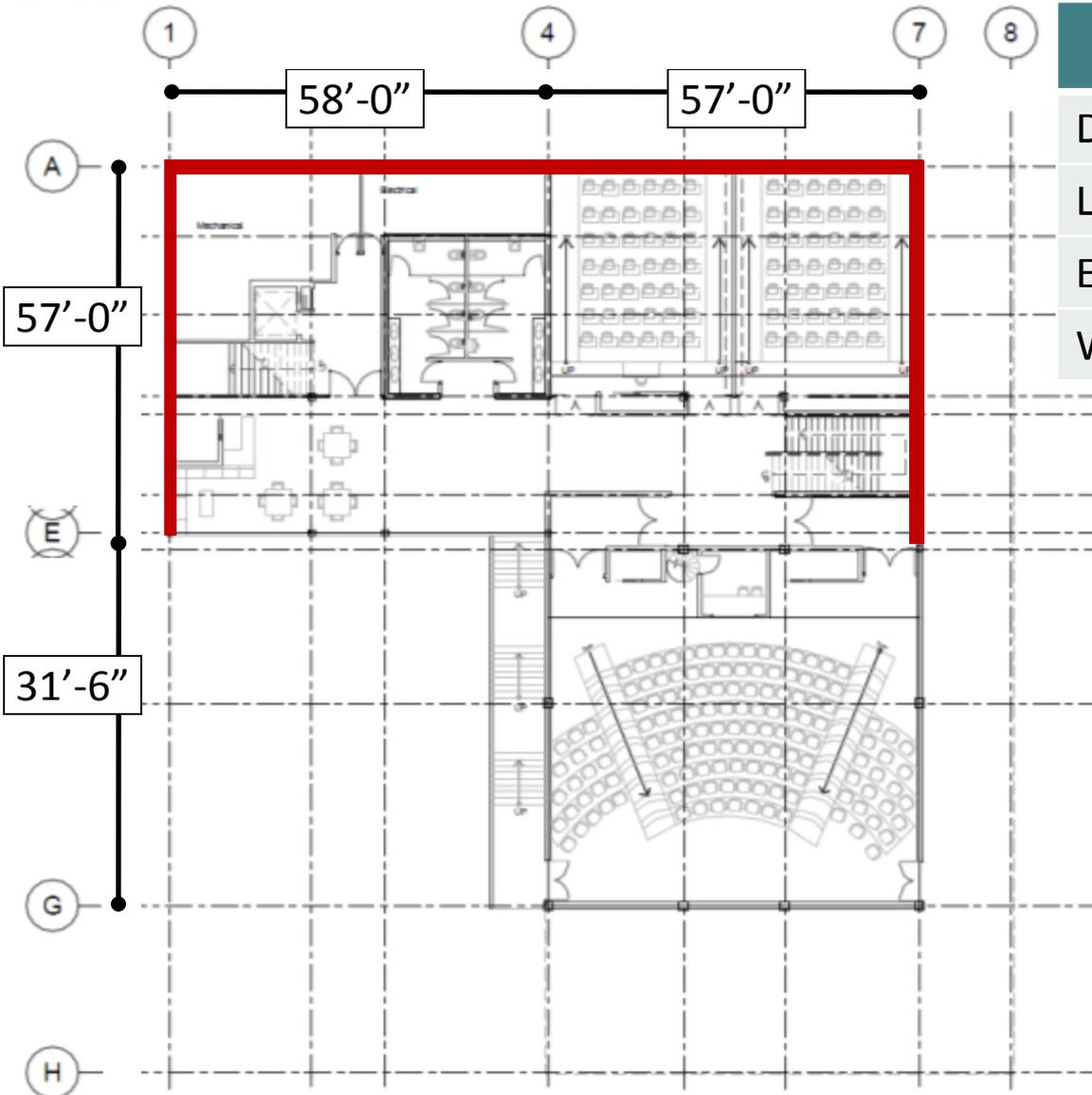
# Second Floor Interaction Area



# Second Floor Student Area



# Steel



## Loads

Dead: self weight+ MEP	85 psf
Live: corridors	100 psf
EQ: base shear	538 kips
Wind: basic wind speed	100 mph

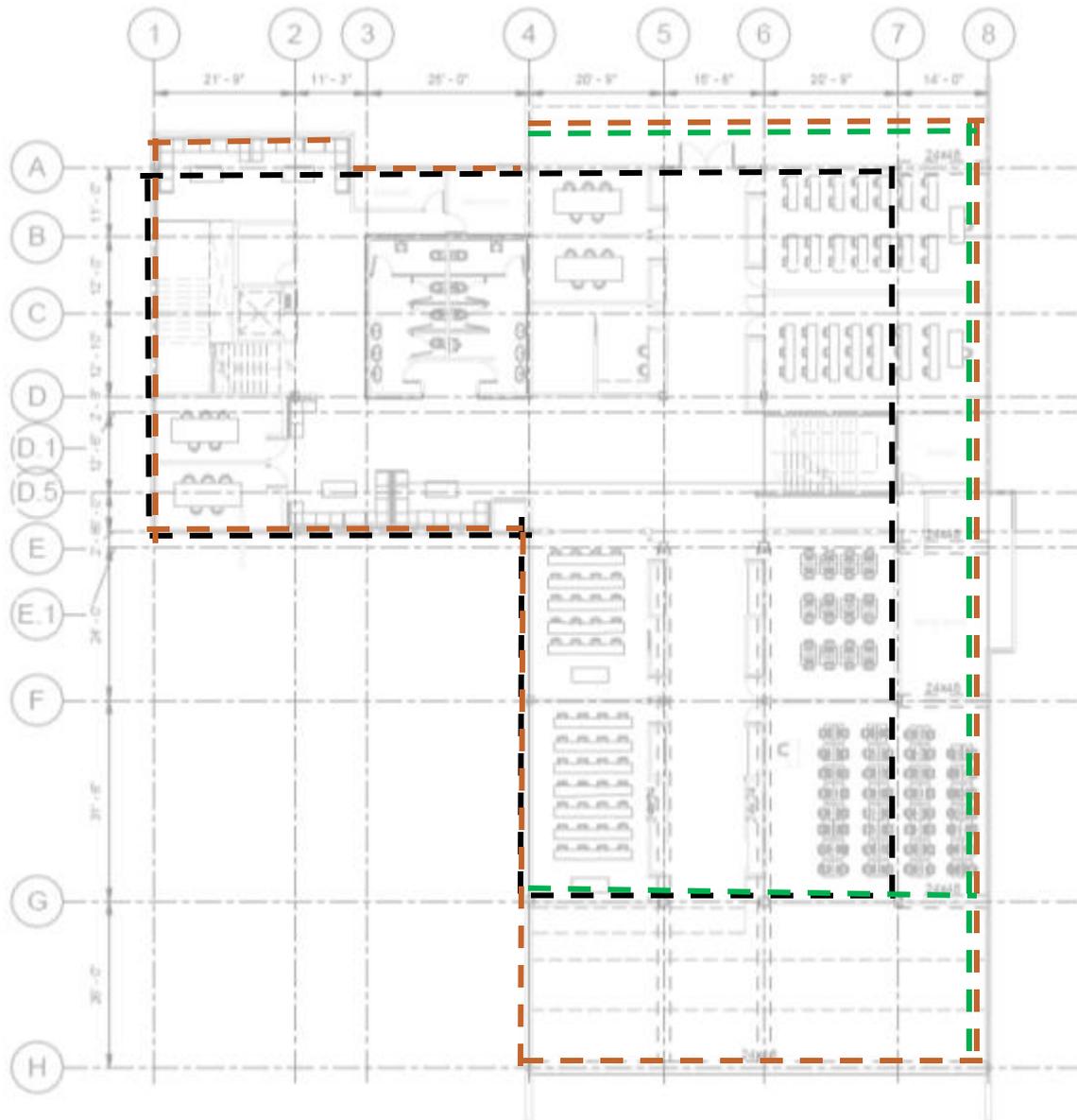
### Floor 1

- Retaining Wall
- 16" Spread footing
- 8" Slab on grade

### Floor 2 & 3

- 4 ½" NW 2VLI16 metal deck

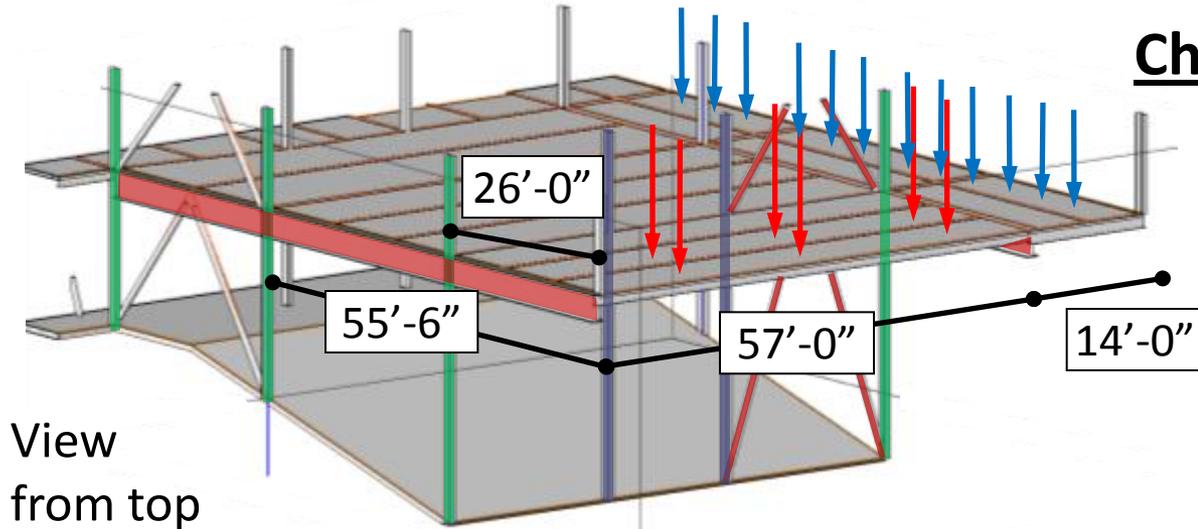
# Steel



## Cantilevers

- Floor 1 footprint
- - - Floor 2
- - - Floor 3

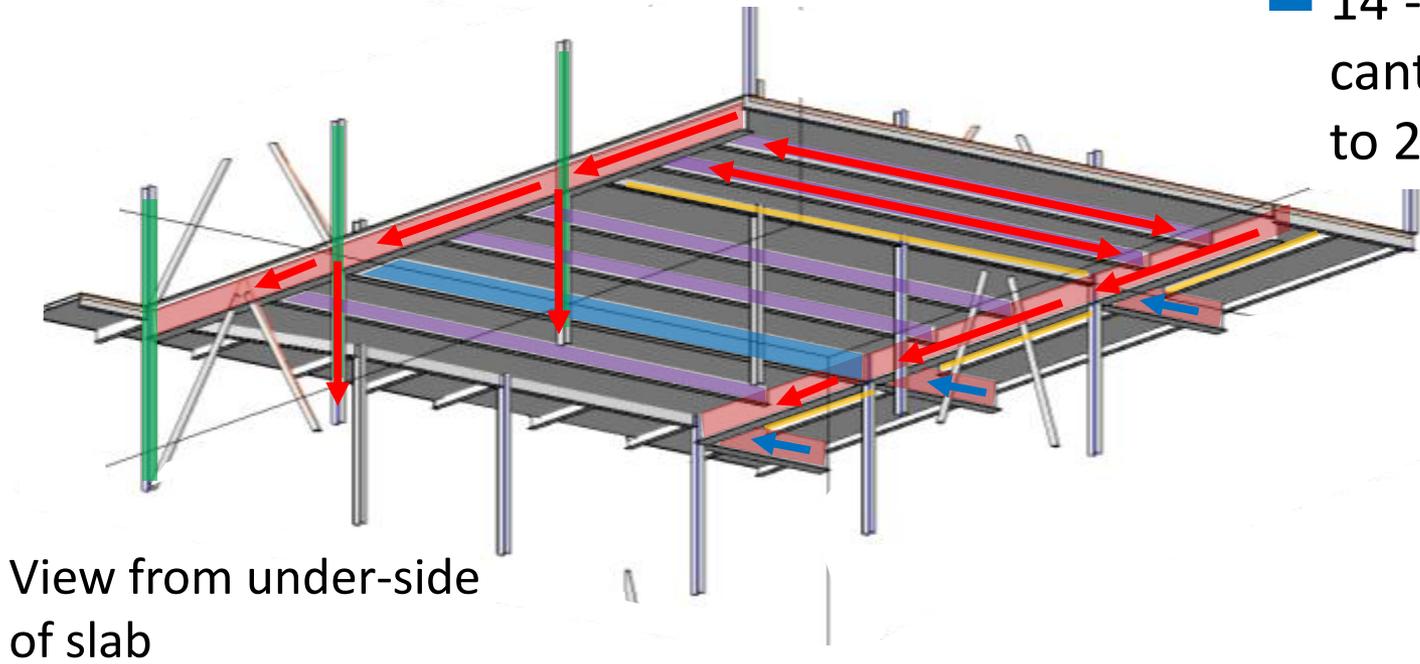
# Steel - Load Path



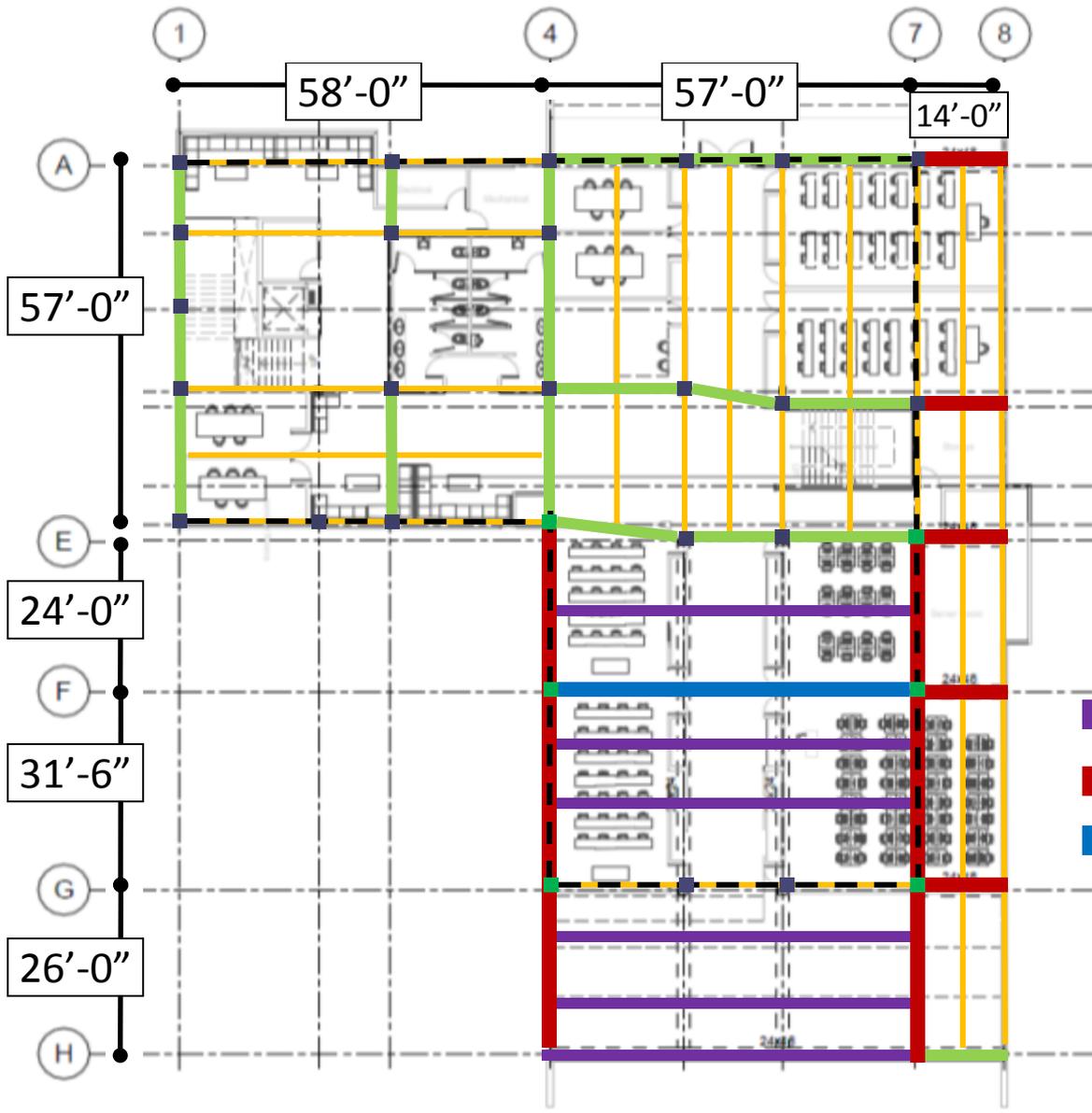
## Challenge Areas

### Floor 2

- 26'-0" cantilever supported by 55'-6" auditorium span
- 14'-0" side cantilever attached to 26'-0" cantilever



# Steel



## Floor 2

### Columns

- W12x 65
- W14x 170

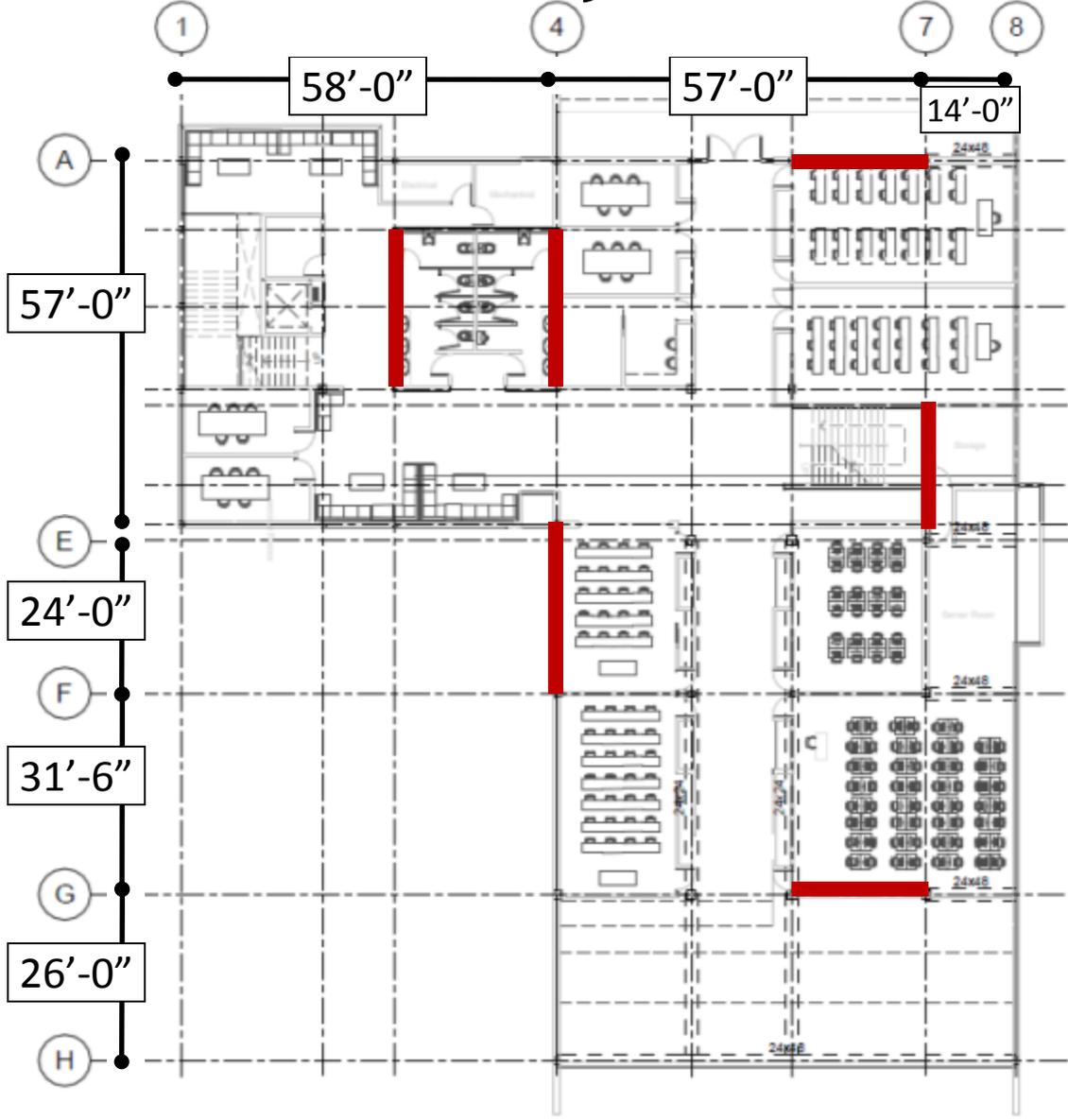
### Beams

- W14x 38
- W18x 50

### Challenges

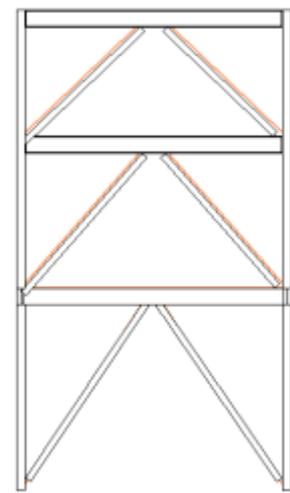
- W24x 84 Auditorium-span
- W36x 182 Cantilever beams
- W36x 247 Transfer girder

# Steel - Lateral System



## Typical

- Concentrically Braced Frames - HSS 6x6x1/2



# Steel - Lateral System

## Auditorium & Cantilever Solution



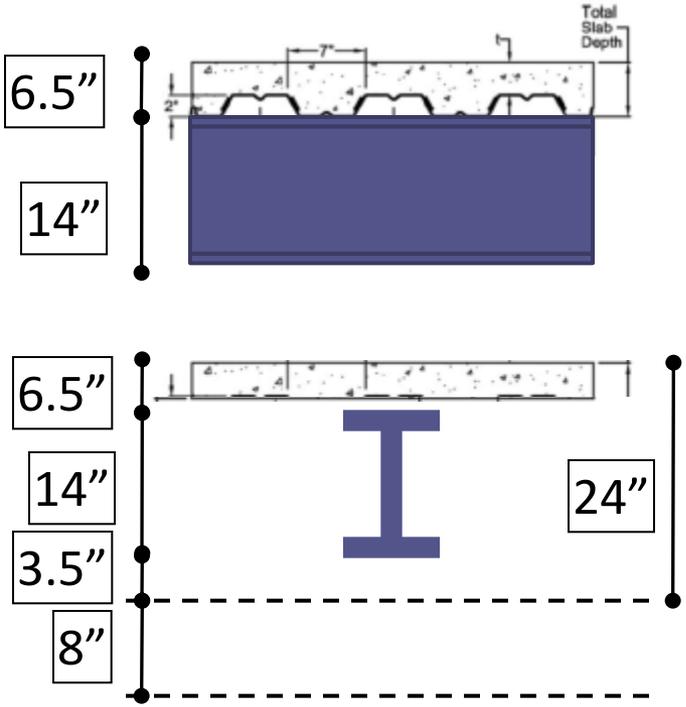
Fully restrained moment connections

No roof live load

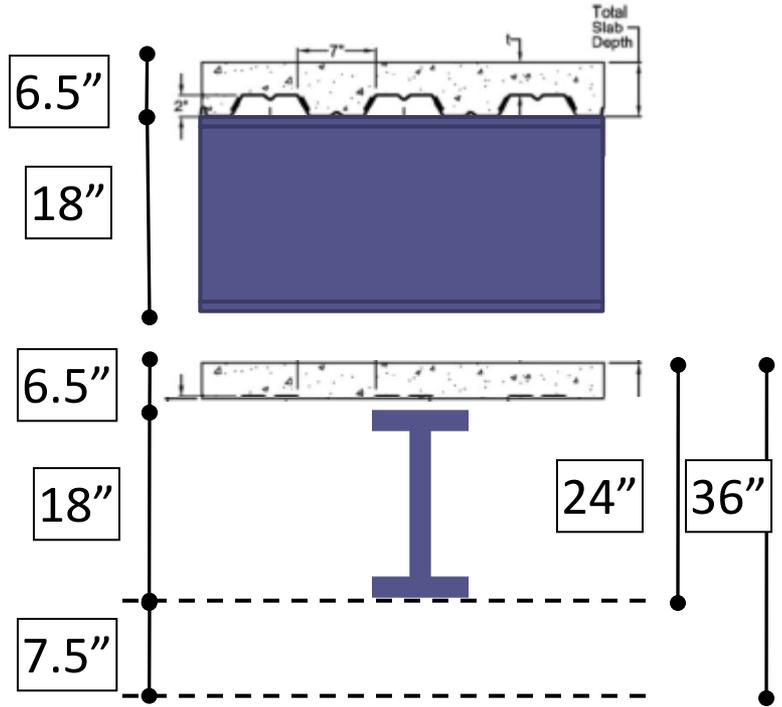
$\Delta_{LL}$  of cantilever tip  $\sim 0.76$  in

- W14x 170 columns
- W36x 182 cantilever beams
- Floor 2 to roof column

# Steel



Beams

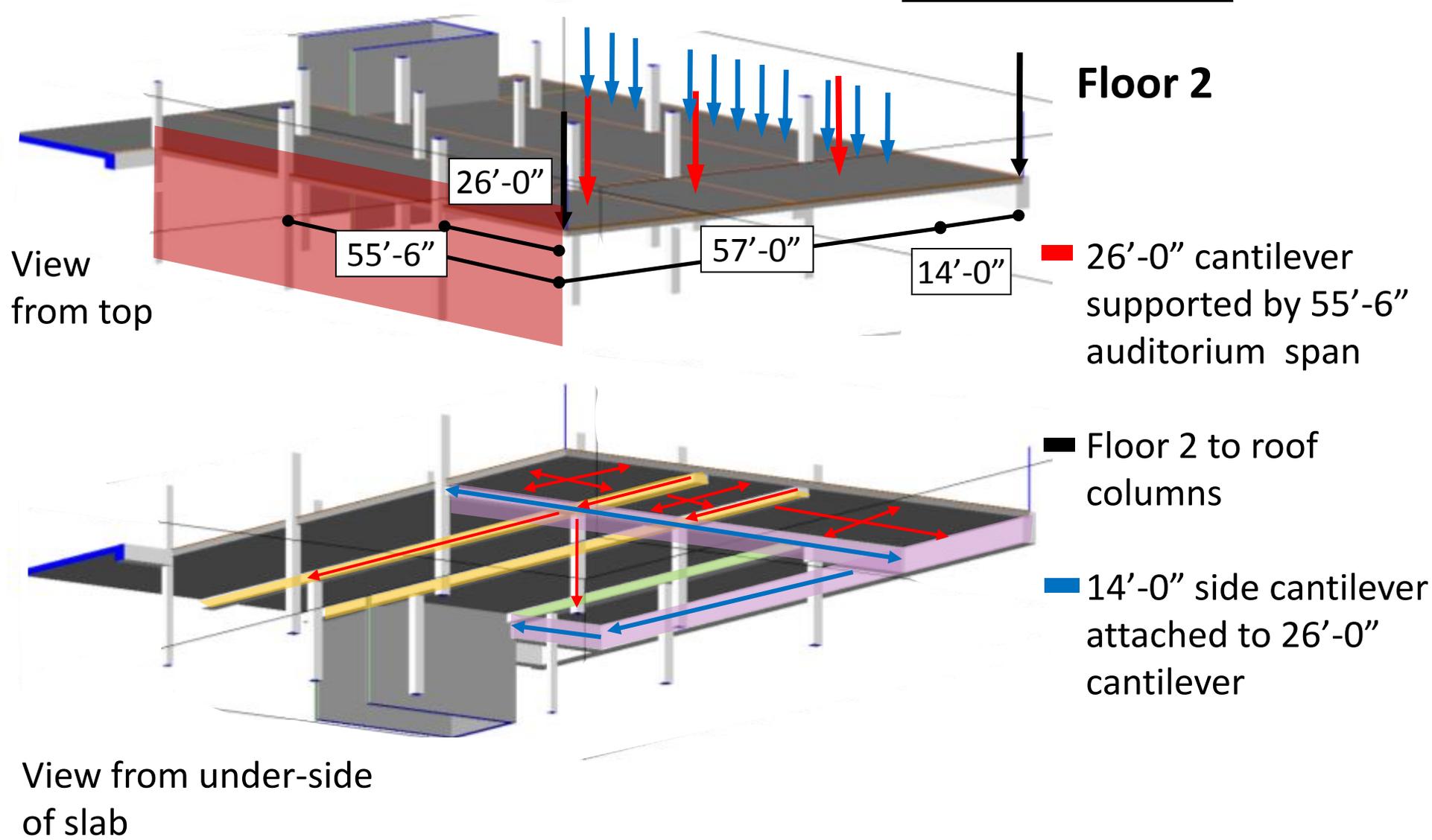


Girders

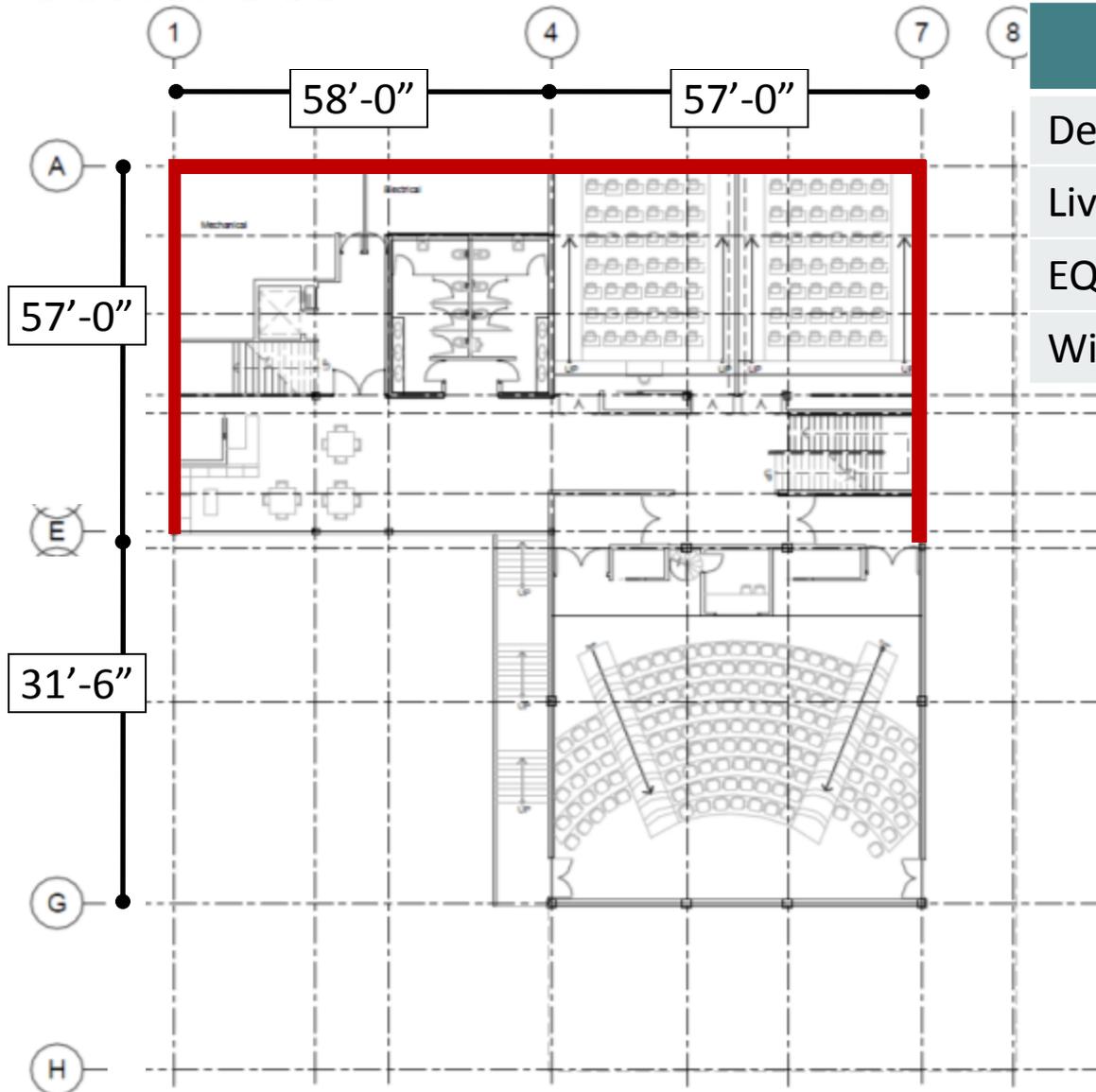
# Concrete - Load Path

## Challenge Areas

### Floor 2



# Concrete



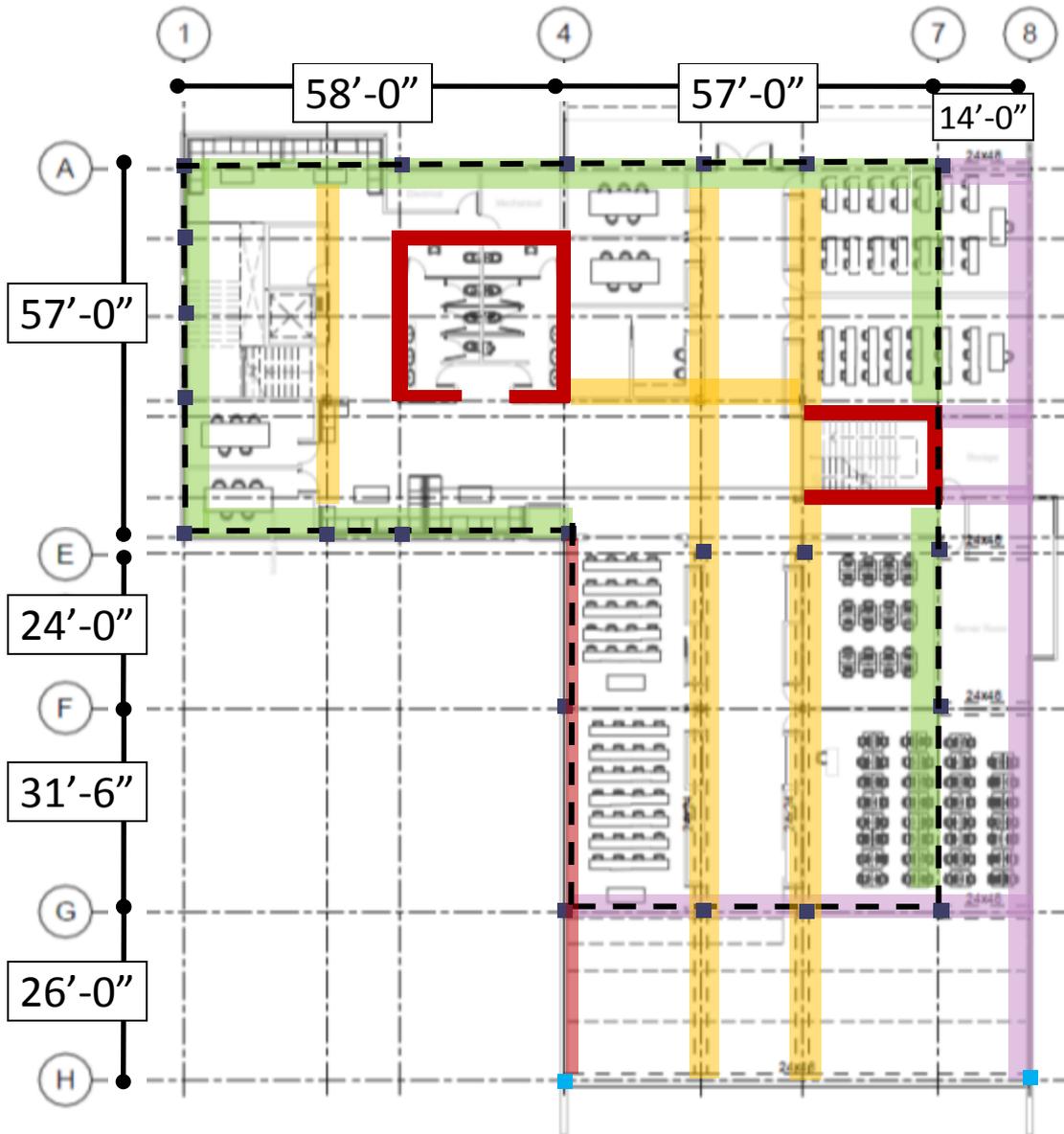
## Loads

Dead: 14" slab NWC + MEP	170 psf
Live: corridors, reduced	82 psf
EQ: base shear	1048 kips
Wind: basic wind speed	100 mph

### Floor 1

- Retaining Wall
- 16" Spread footing
- 8" Slab on grade

# Concrete



## Floor 2

### Gravity

10" Pre-Stressed Flat Slab

■ 12"x12" Perimeter columns

■ 14"x14" Interior columns

■ 24"x48" Spandrel beams

### Lateral

■ 10" Shear Wall

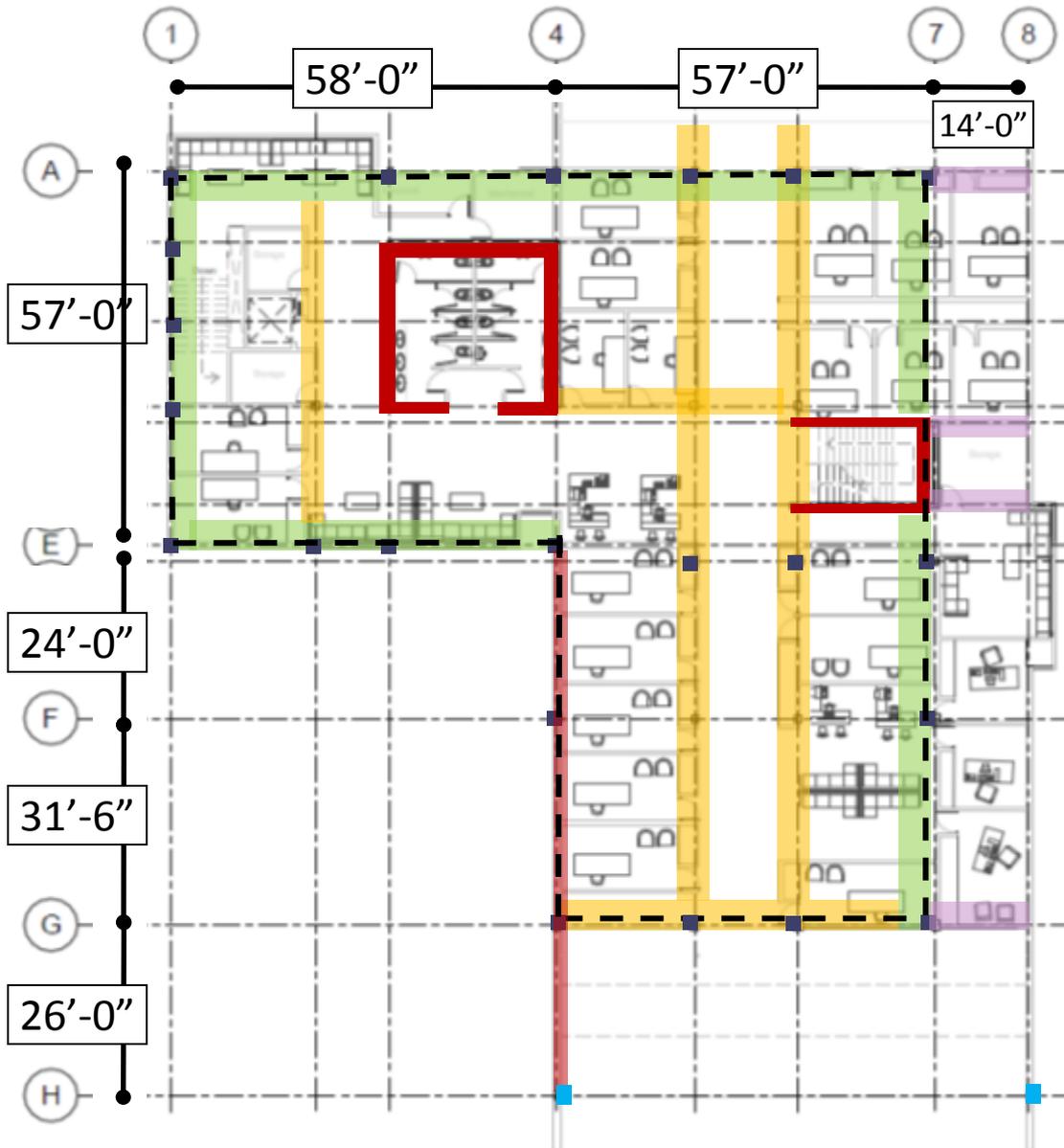
### Challenges

■ 24"x48" Cantilevered beams

■ 24"x24" Auditorium &  
Cantilevered beams

■ Perforated Shear Wall

# Concrete



## Floor 3

### Gravity

10" Pre-Stressed Flat Slab

■ 12"x12" Perimeter columns

■ 14"x14" Interior columns

■ 24"x48" Spandrel beams

### Lateral

■ 10" Shear Wall

### Challenges

■ 24"x48" Cantilevered beams

■ 24"x24" Beams

■ Floor 2 to Roof columns

# Concrete



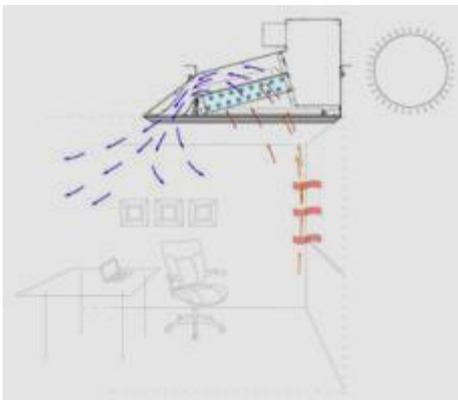
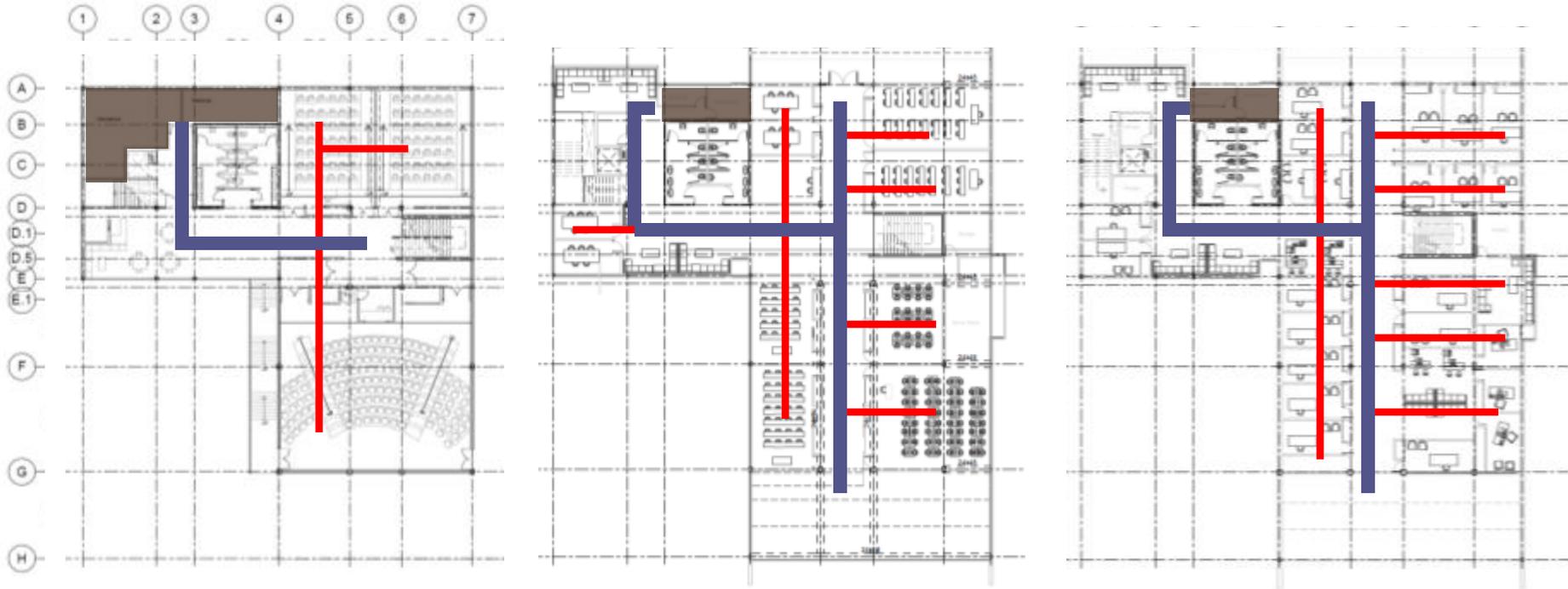
Section AA



Section BB

- 48" deep beams 
- 24" deep beams 
- 10" thick shear wall 
- MEP primary ducts 

# MEP Distribution



**Chilled Beam System** coupled with Geo-Thermal Central Plant

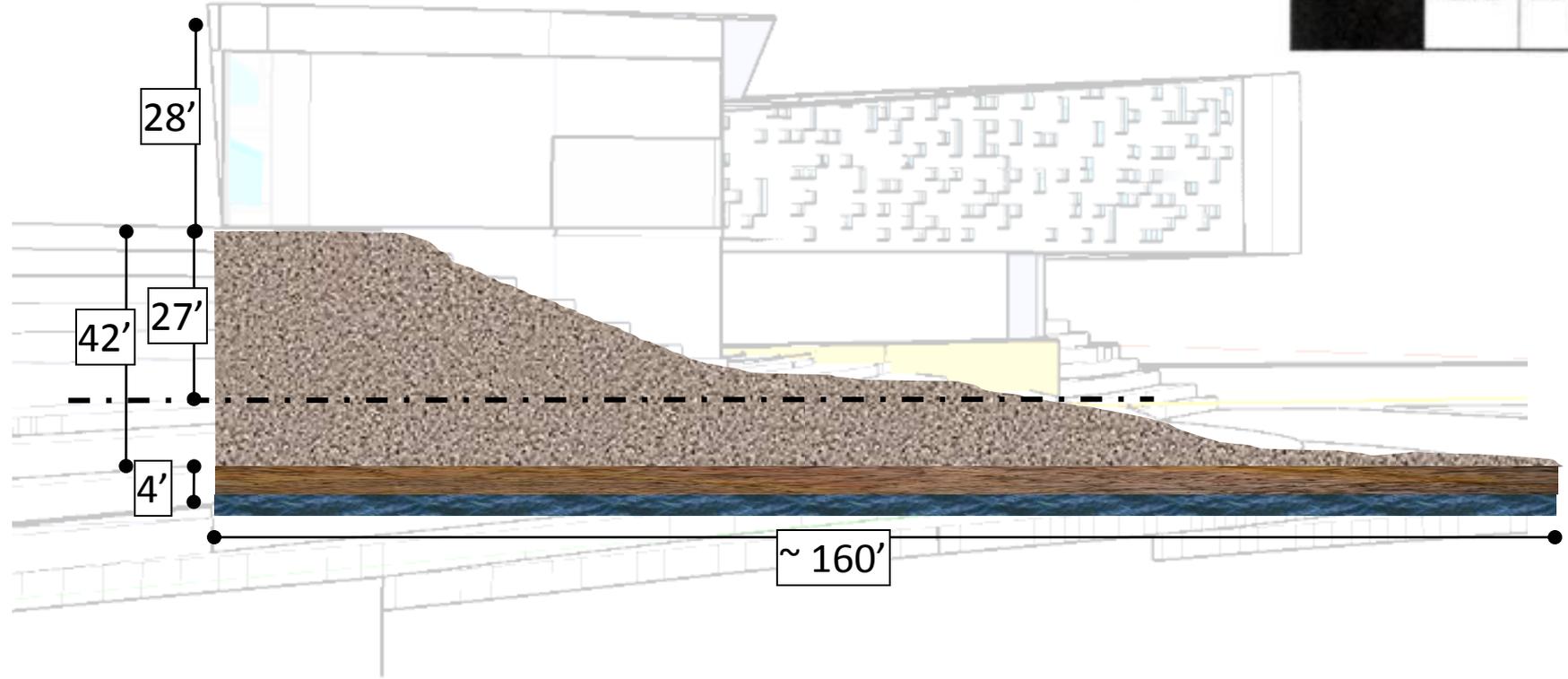
-  MEP rooms
-  Primary Ducts
-  Secondary Ducts

# Soil Profile

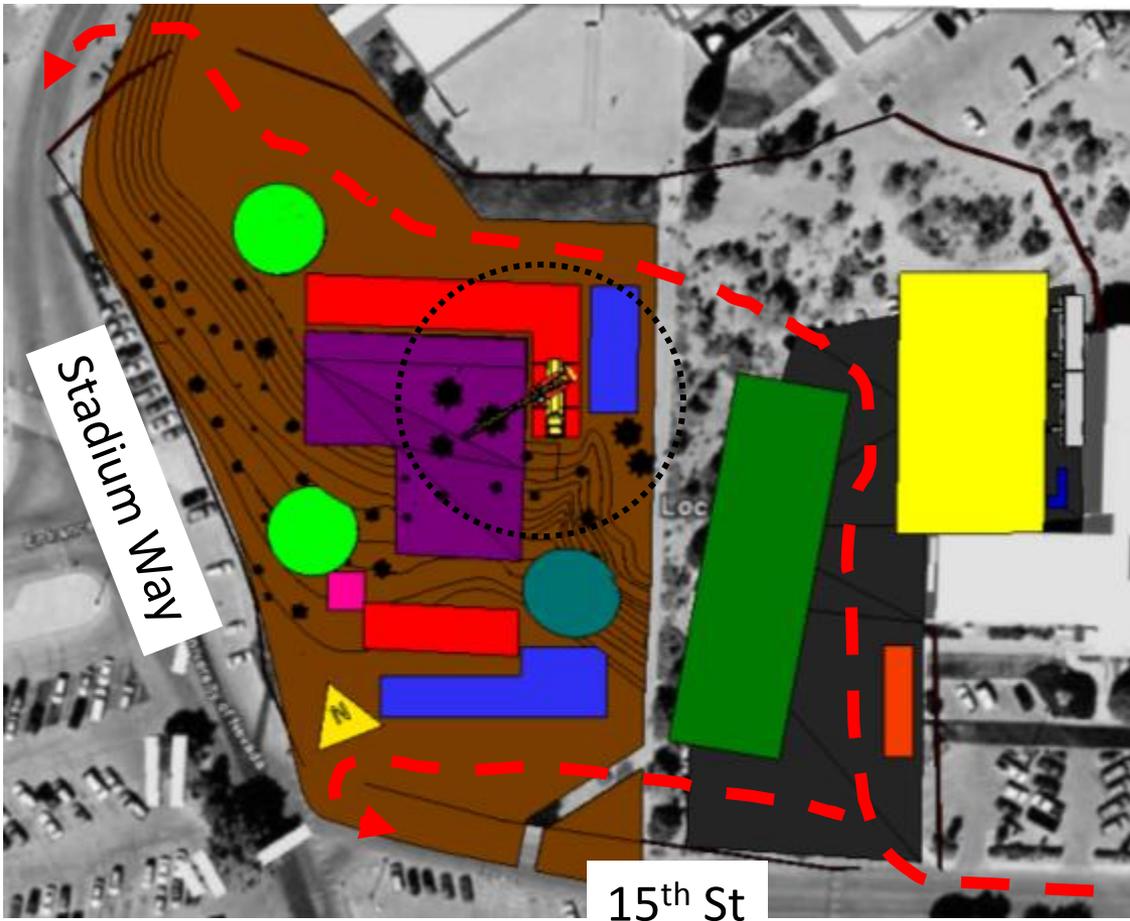
## Soil Profile applies to the low of the slope

- Frost line at 4' below grade (1500 psf Bearing)
- Bearing Capacity of 5000 psf at 5' below grade and 8000 psf at 7' below grade

Depth of Excavation (Inches)	Soil Type	Thickness
0	Silty Sandy Loam and Heavy Loam	12"
24	Sandy Clay Loam	12"
48	Clay and Clay Loam	24"
72	Water Table at 6' Below Grade	24"
96	Very Silty Sandy Loam and Very Silty Loam	24"
120	Unknown	Unknown



# Site Plan



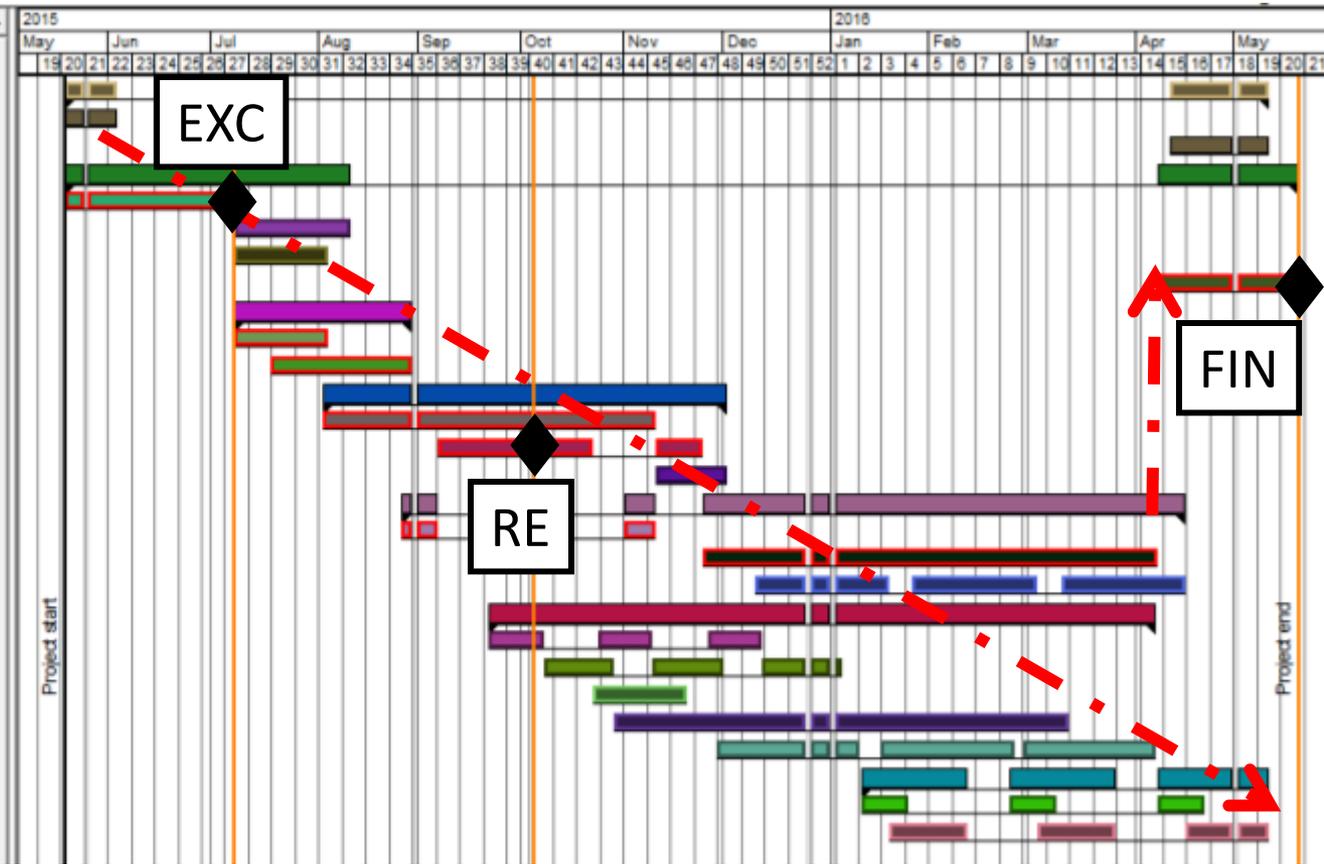
Cactus Gardens

Building Footprint

Site Area	3.6 acres
Crane Space	2 locations
JIT delivery sites	5150 SF
Excavation Storage	700 CY
Assembly Fabrication	12000 SF
Recycling & Waste Control	6x20 CY bins
Parking	50-55 spots
Site Trailers	1000 SF
Restrooms	4 Units
Heat Relief Area	400 SF

# Schedule Budget

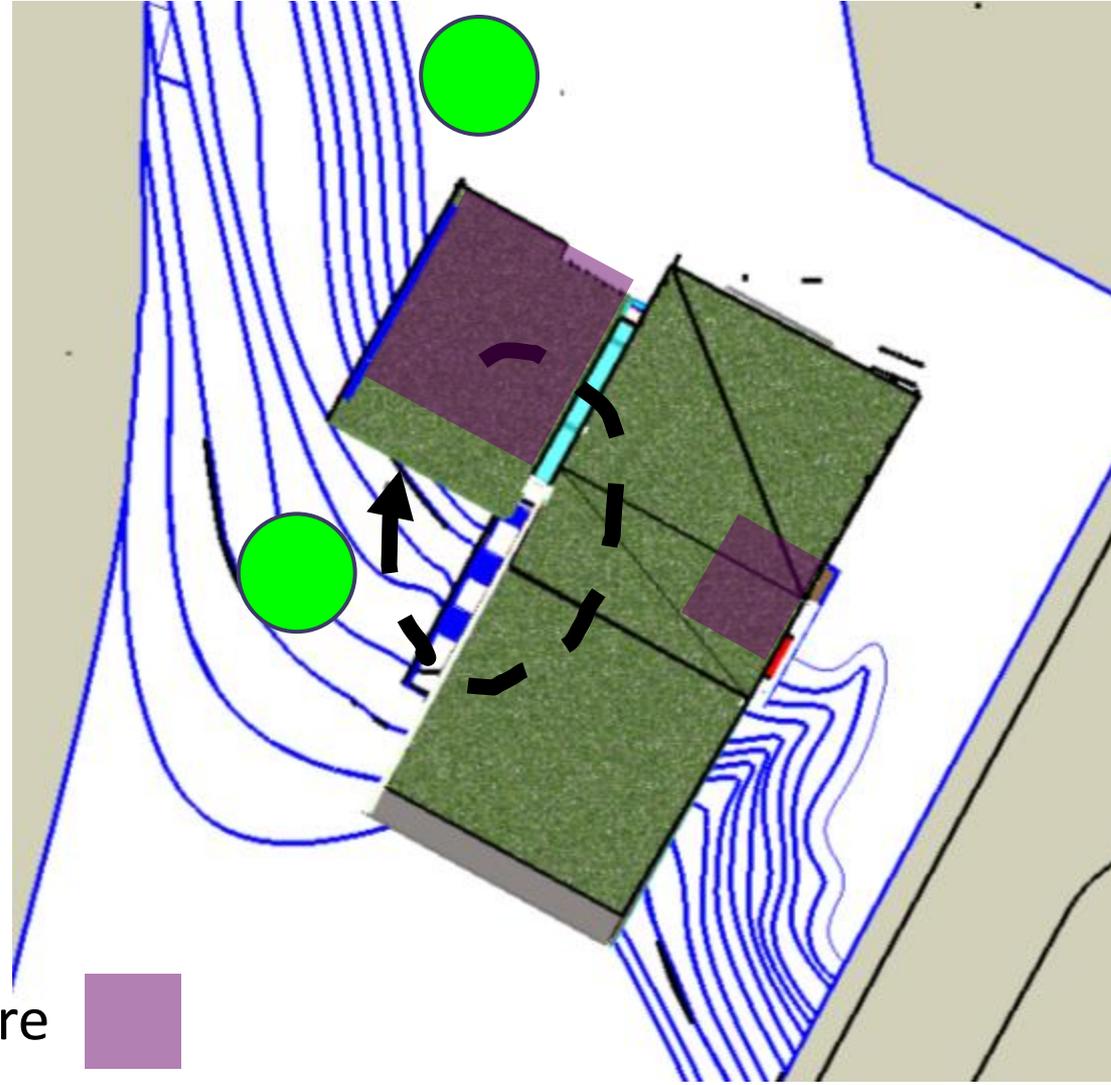
Code	Name	Duration	Start	End
Z10	*GENERAL REQUIREME	(30)	5/19/2015	5/11/2016
Z10	General Requirements	10	5/19/2015	6/2/2015
Z10	General Requirements	20	4/12/2016	5/11/2016
G	SITWORK	109	5/19/2015	5/19/2016
G10	*SITE PREPARATION	(35)	5/19/2015	7/7/2015
G30	*CIVIL AND MECHANICA	(25)	7/8/2015	8/11/2015
G40	*SITE ELECTRICAL	(20)	7/8/2015	8/4/2015
G20	*SITE IMPROVEMENTS	(29)	4/8/2016	5/19/2016
A	SUB-STRUCTURE	50	7/8/2015	8/28/2015
A10	*FOUNDATIONS	(20)	7/8/2015	8/4/2015
A20	*BASEMENTS	(30)	7/20/2015	8/28/2015
B	SHELL	125	8/4/2015	12/1/2015
B10	*SUPERSTRUCTURE	(70)	8/4/2015	11/10/2015
B20	*EXTERIOR ENCLOSURE	(40)	9/7/2015	11/24/2015
B30	*ROOF	(15)	11/11/2015	12/1/2015
C	INTERIORS	195	8/26/2015	4/15/2016
C20	*STAIRS	(20)	8/26/2015	11/10/2015
C10	*INTERIOR CONSTRUCT	(95)	11/25/2015	4/7/2016
C30	*INTERIOR FINISHES	(80)	12/10/2015	4/15/2016
D	SERVICES	280	9/22/2015	4/7/2016
D40	*FIRE PROTECTION	(35)	9/22/2015	12/11/2015
D20	*PLUMBING	(45)	10/8/2015	1/5/2016
D10	*CONVEYING SYSTEM	(20)	10/22/2015	11/19/2015
D30	*HVAC	(95)	10/29/2015	3/11/2016
D50	*ELECTRICAL	(85)	11/30/2015	4/7/2016
E	EQUIP. & FURNISHINGS	80	1/11/2016	5/11/2016
E10	*EQUIPMENT	(30)	1/11/2016	4/21/2016
E20	*FURNISHINGS	(50)	1/19/2016	5/11/2016



**Duration: 365 days**

Critical Path   
 Milestone 

# Erection Sequence



Vertical Core 

# Milestones



Milestone 1:  
Excavation  
Complete  
Jun 7, 2015

Milestone 2:  
Rammed Earth  
Finished  
Oct 5, 2015

Milestone 3:  
Building  
Complete  
May 19, 2016



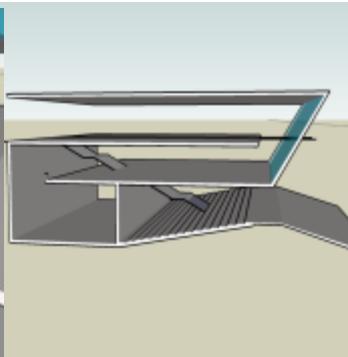
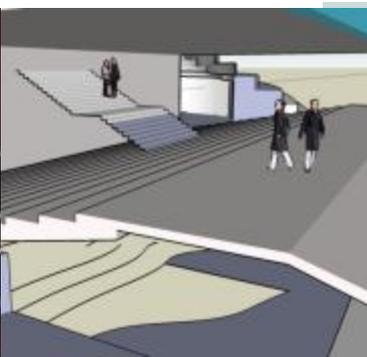
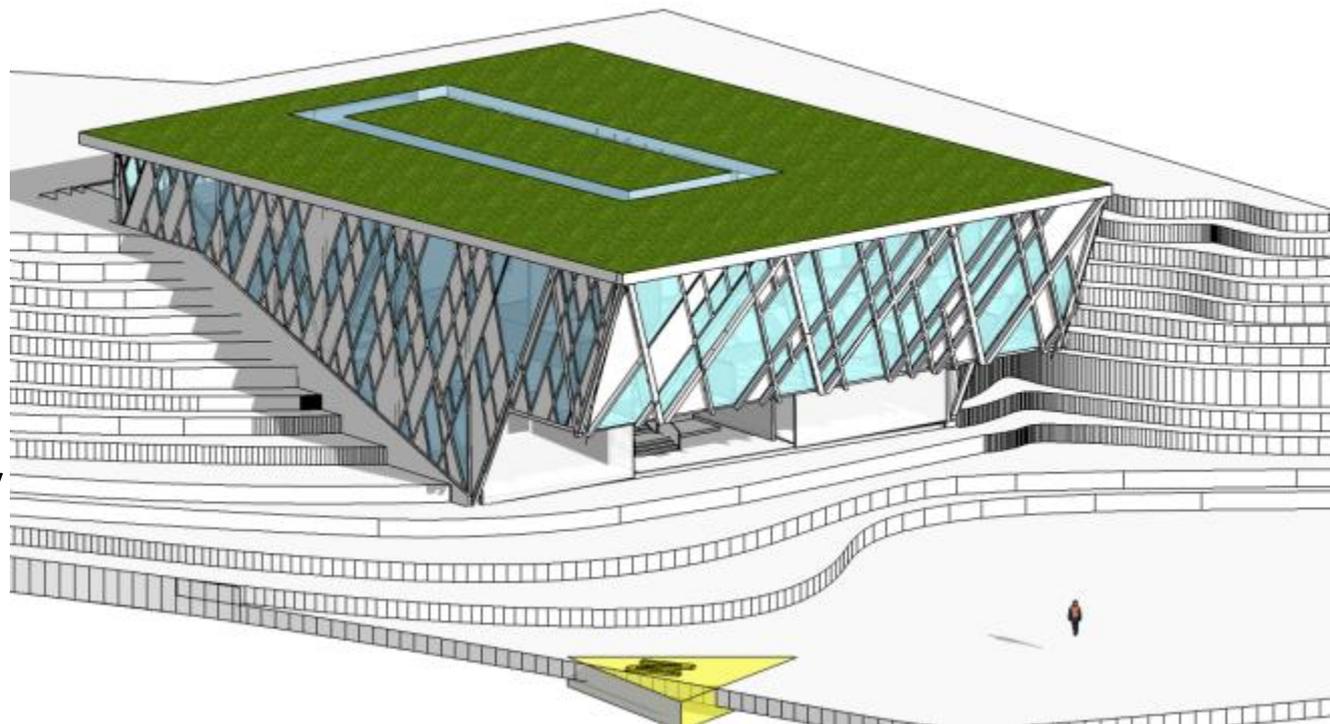
# Big Idea

## “Ridge” to Bridge

Emphasizes on the feeling of inhabiting the areas in between

### Goals:

- Circulation
- Campus Connectivity
- Daylight Interaction
- Encourage Pedestrian Use

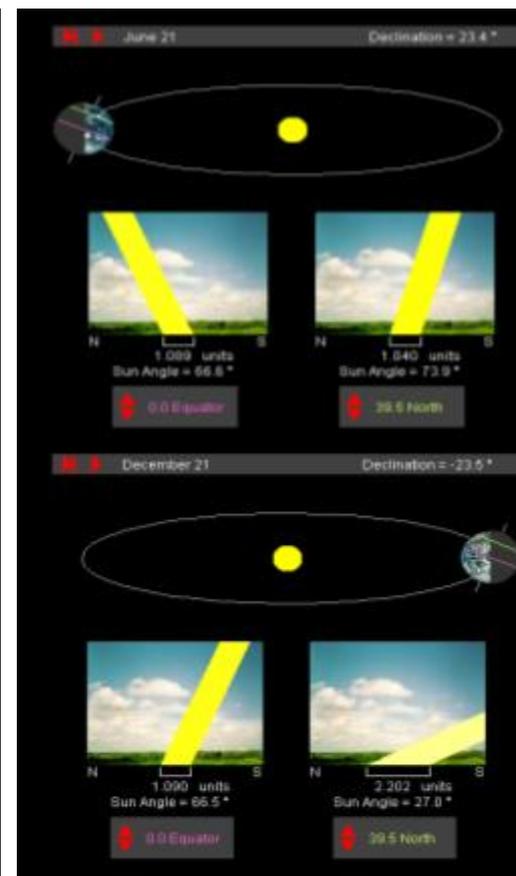




# Sun Study

FROM BUILDING'S SOUTHWEST FAÇADE:  
JANUARY 21-DECEMBER 21 AT 1PM

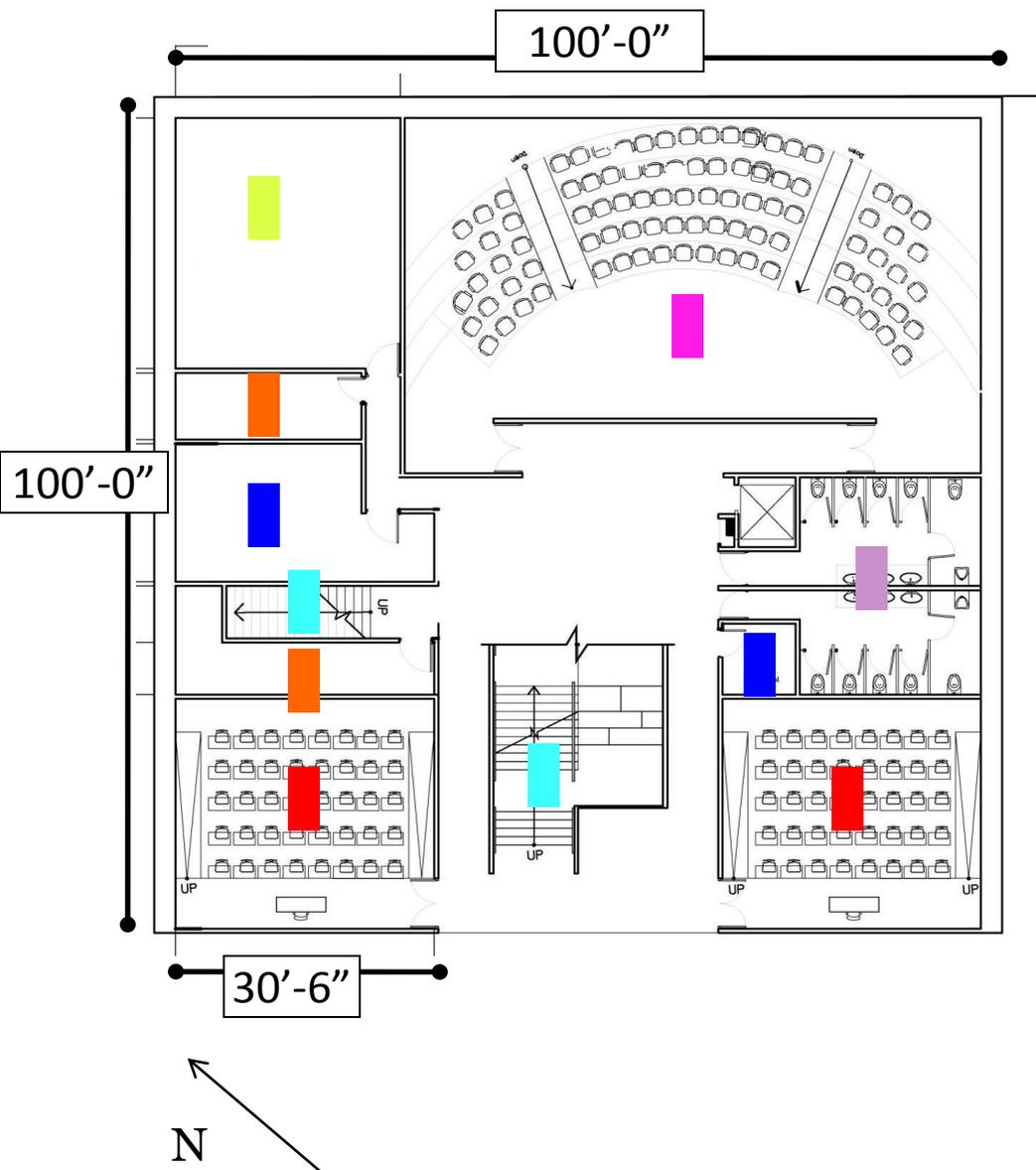
Summer Solstice  
Sun Angle =  $73.9^\circ$



Winter Solstice  
Sun Angle =  $27^\circ$

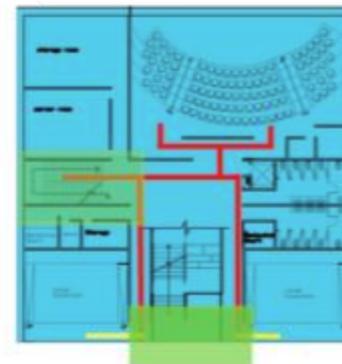


# Floor 1



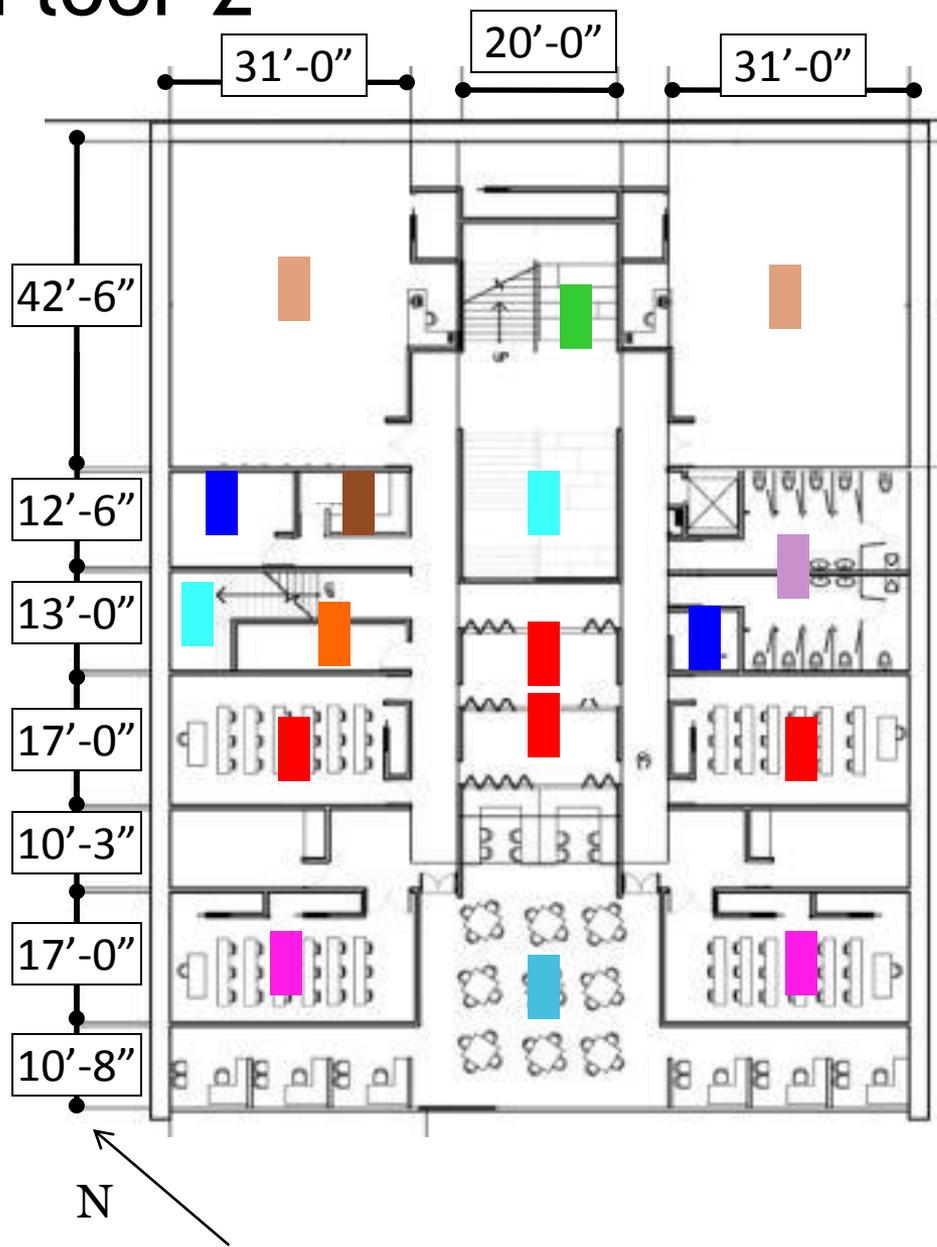
Level: -30'-0"  
Height: 16'-0"

- Bathrooms
- MEP
- Storage
- Large Classrooms
- Auditorium
- Vertical Cores
- Server Room





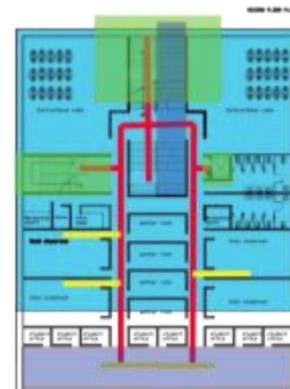
# Floor 2



Level: -10'-0"

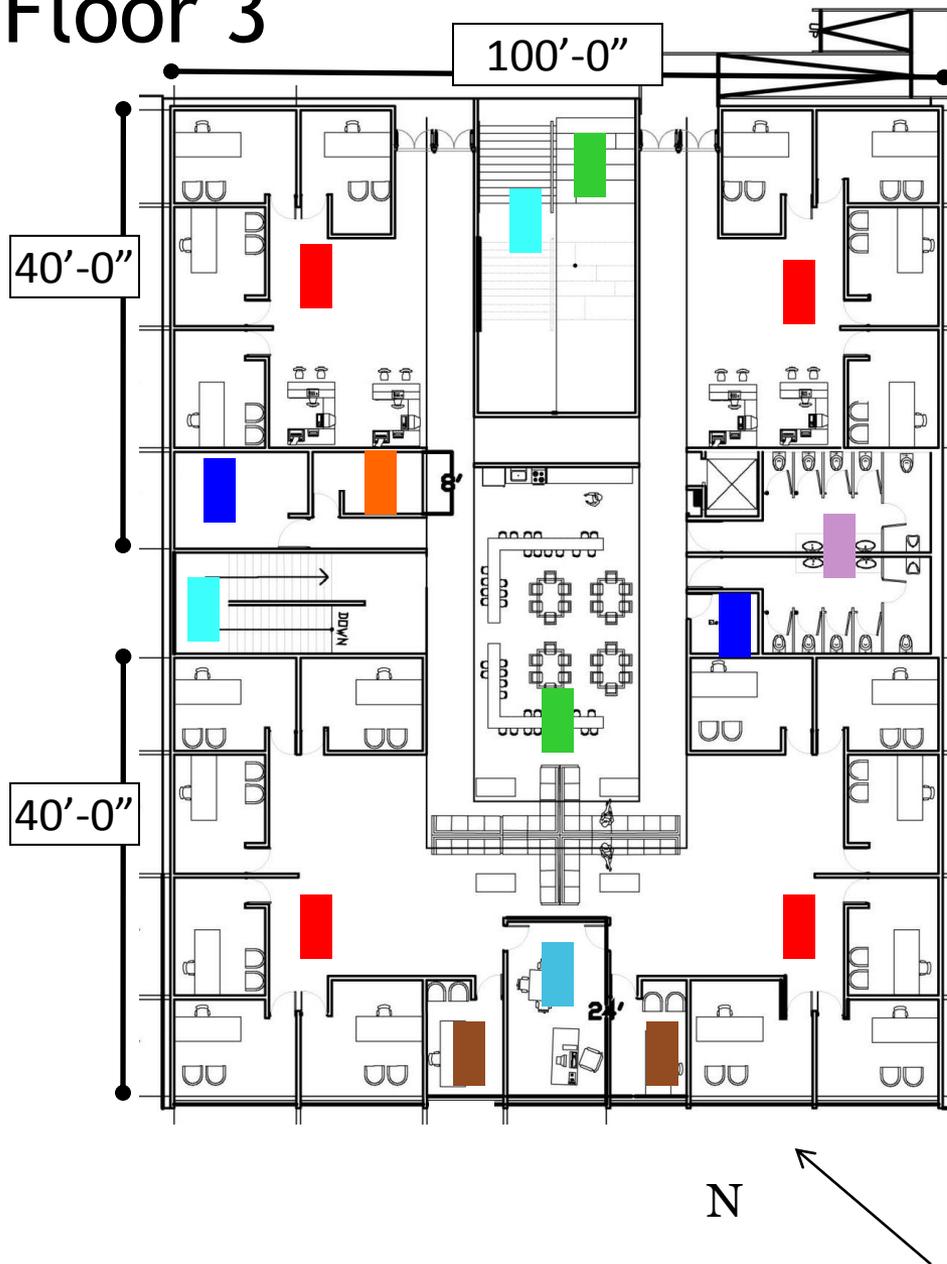
Height: 12'-0"

- Bathroom
- MEP
- Storage
- Interaction Areas
- Seminar Rooms
- Small Classrooms
- Vertical Cores
- Instructional Labs
- Student Office Area
- Tech Support





# Floor 3



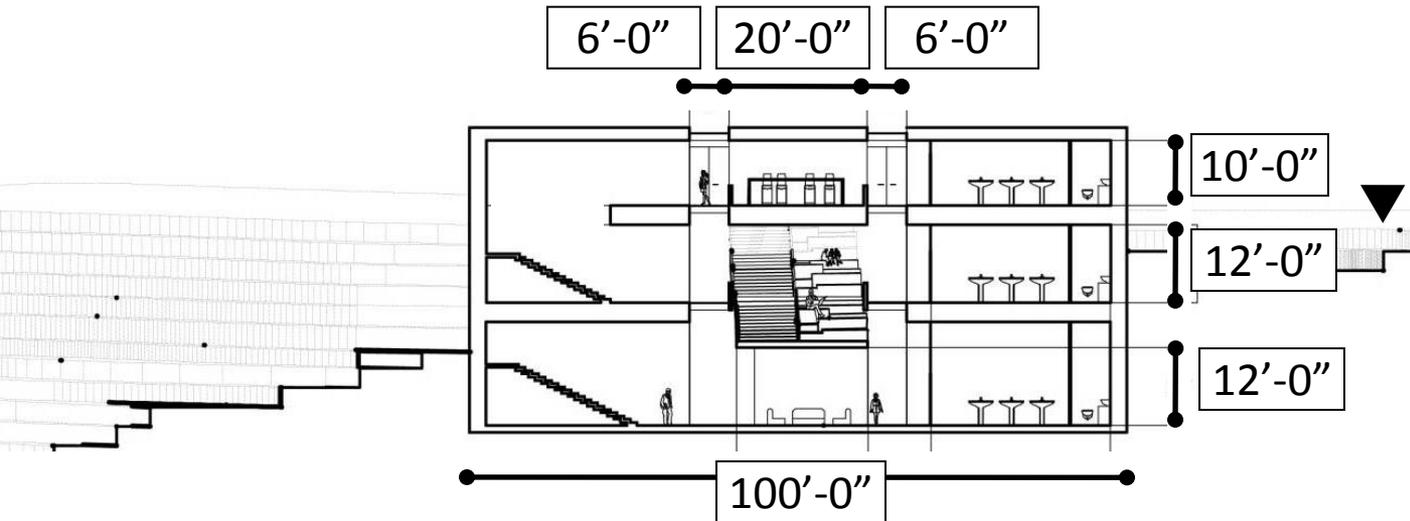
Level: 0'-0"  
Height: 10'-0"

- Bathroom
- MEP
- Storage
- Faculty Offices
- Interaction/Lounge Areas
- Vertical Cores
- Department Chair Office
- Senior Administrative Assistants

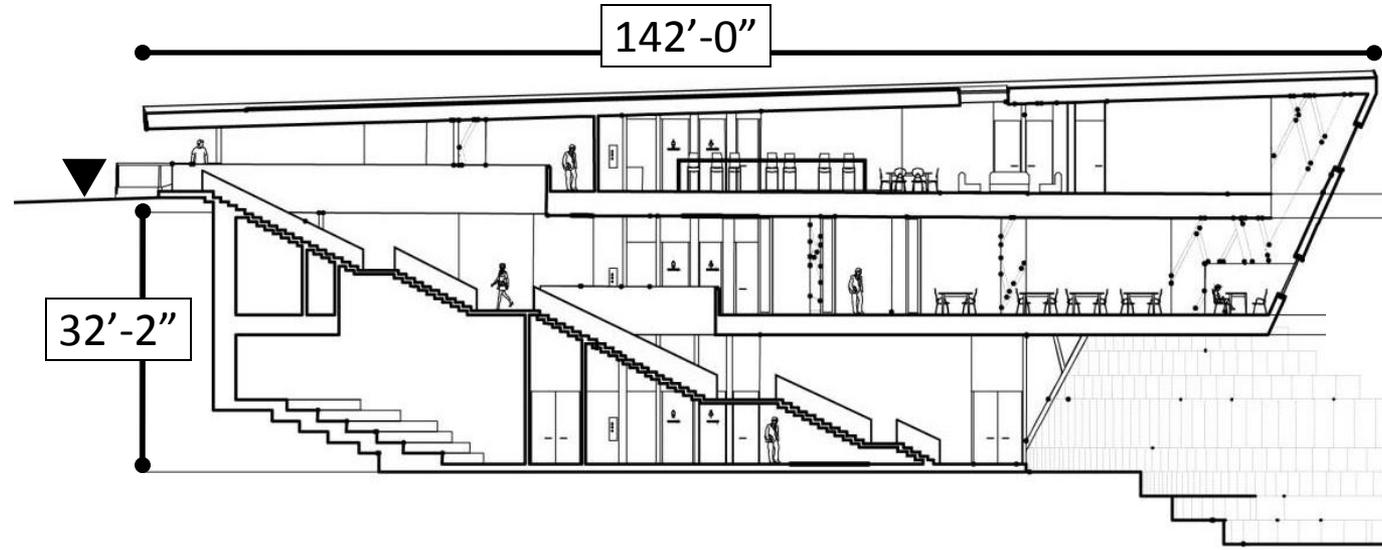




# Section AA

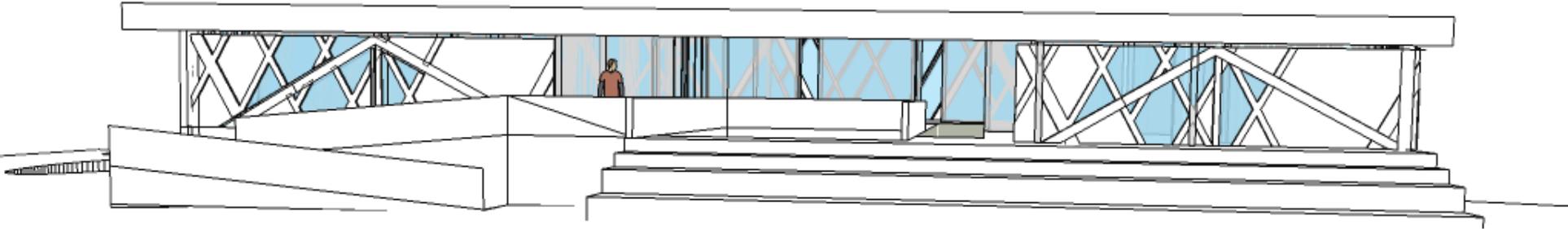


# Section BB

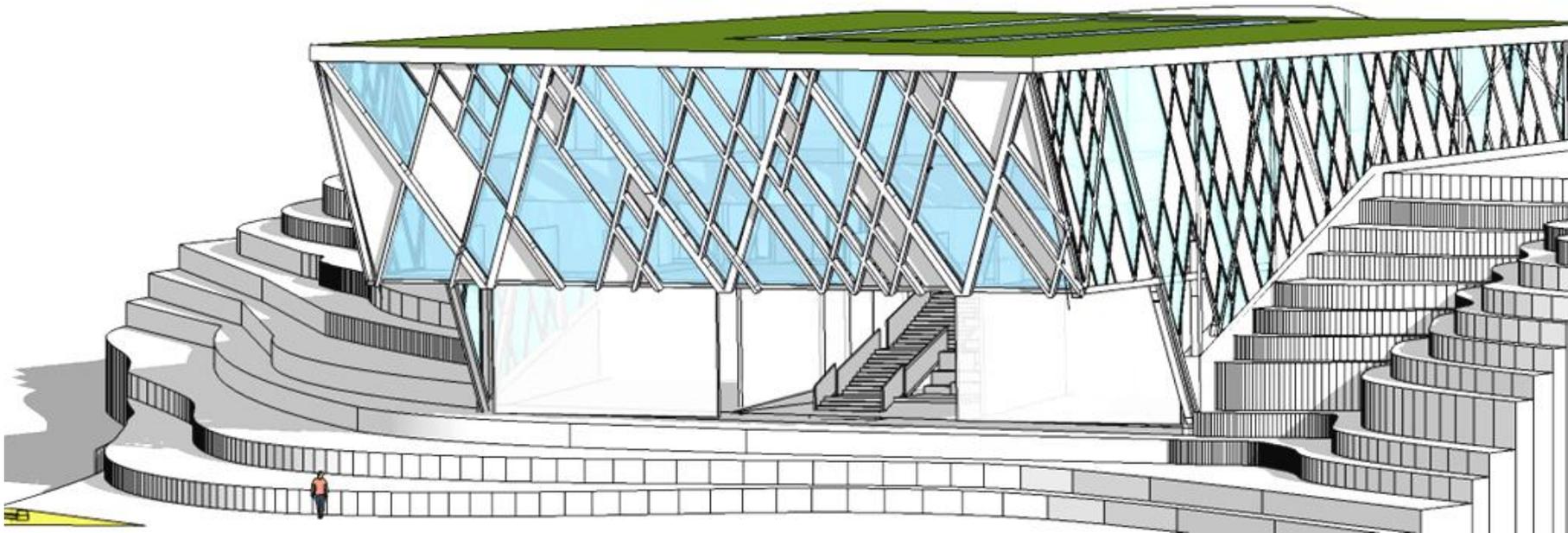




# North Façade

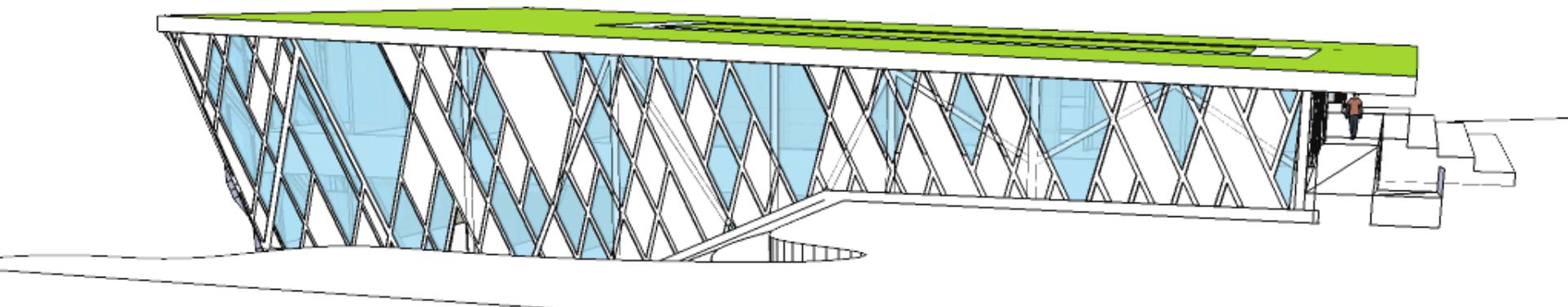


# South Façade

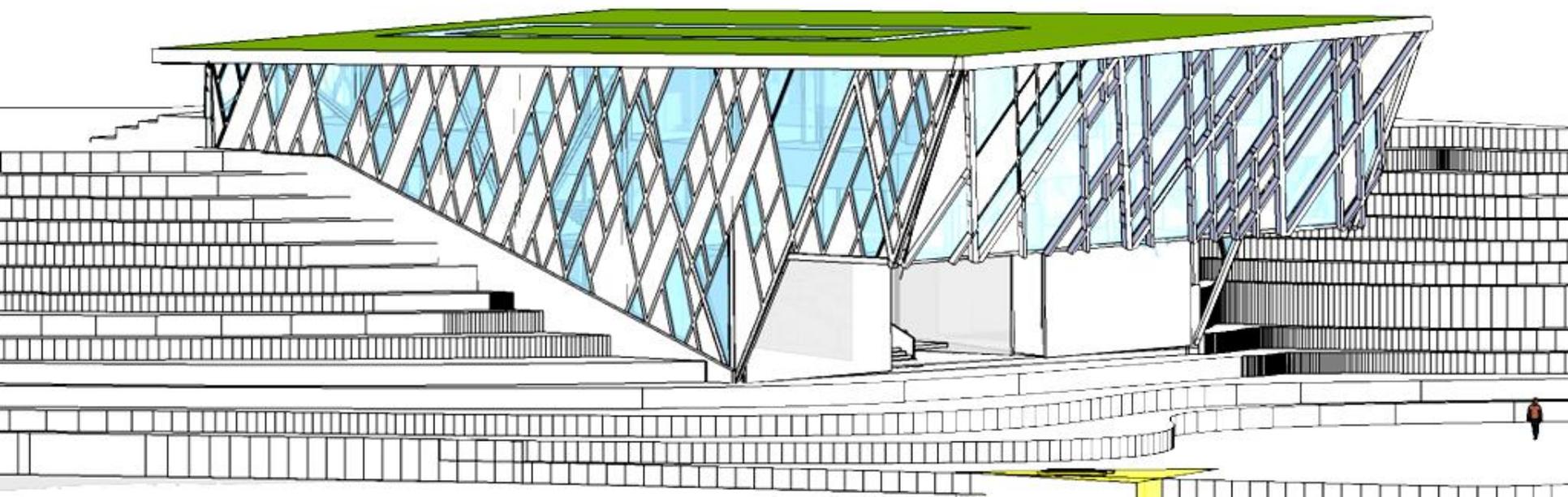




# East Façade



# West Façade





88'-0"

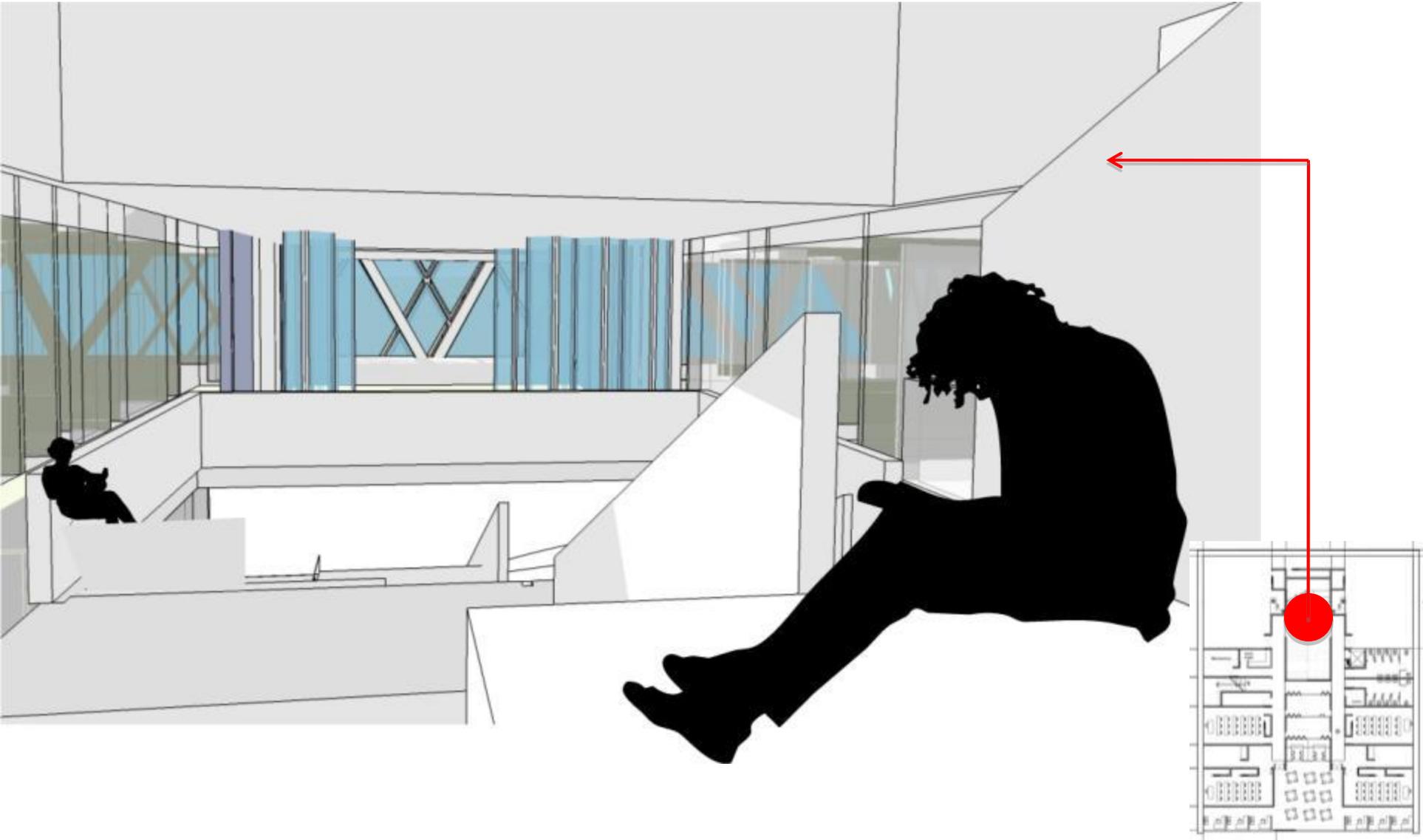
20'-0"

# Main Stairway/Interaction Area



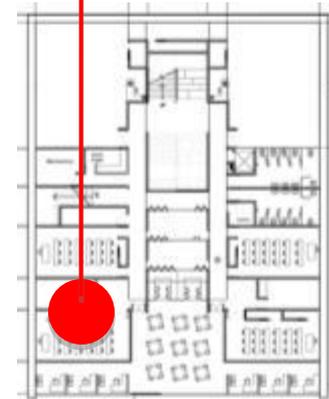
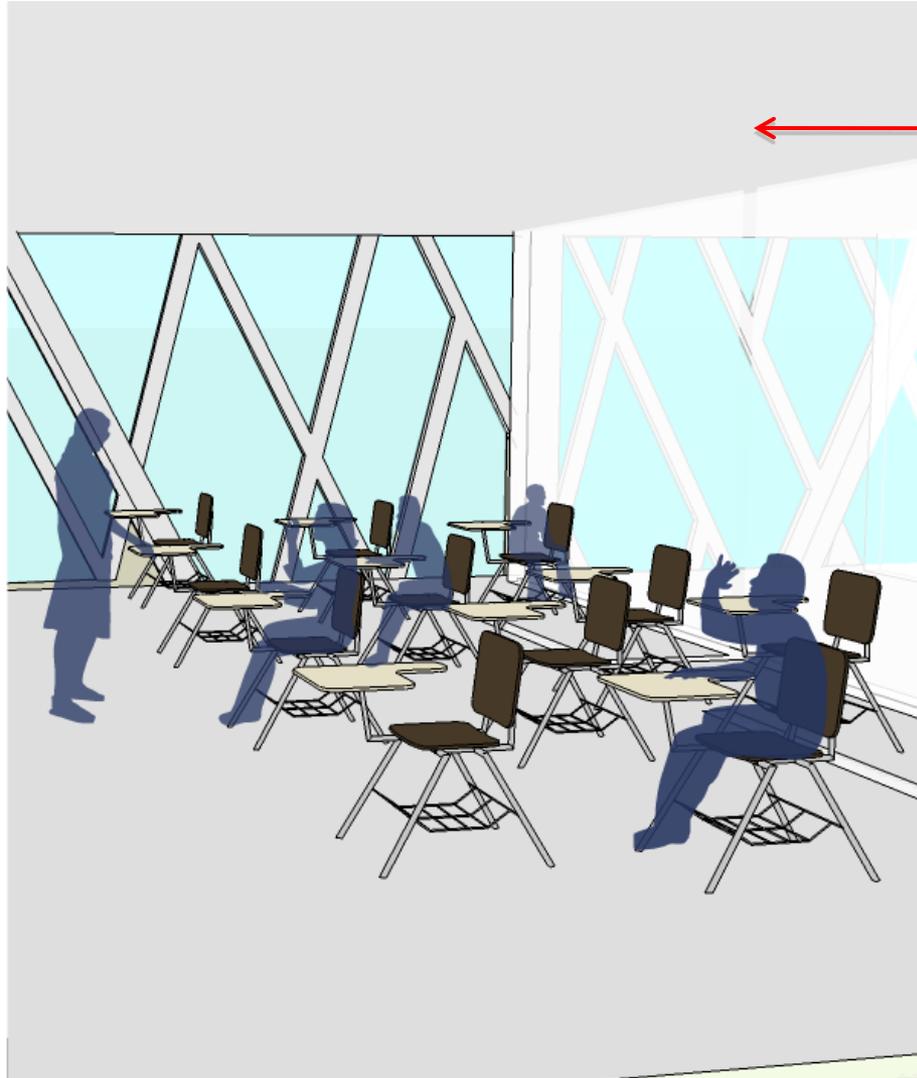


# Second Floor Interaction Area





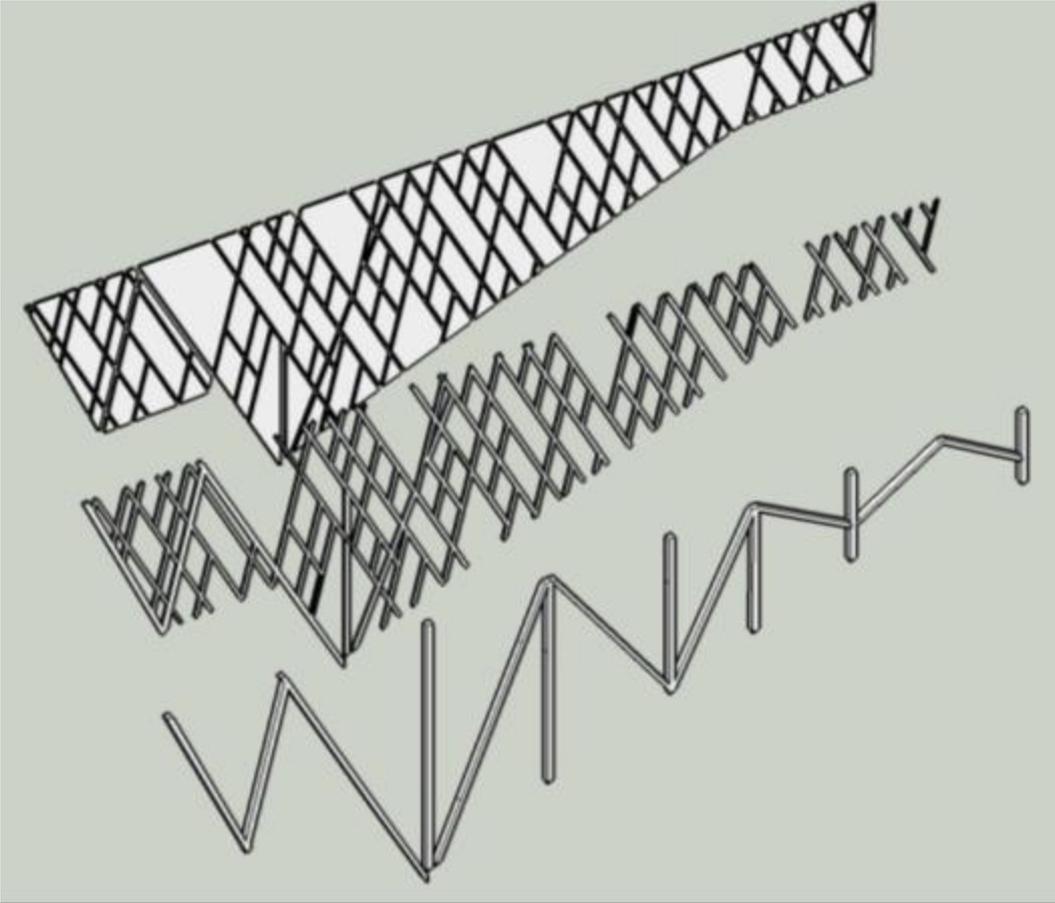
# Second Floor Classroom



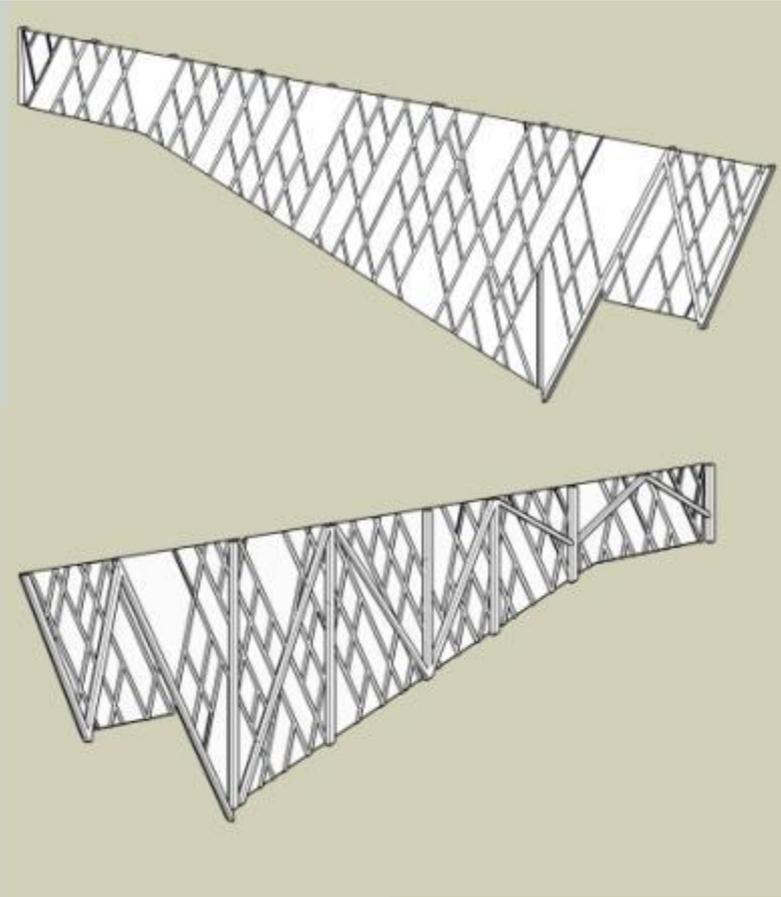


# Façade Development

Façade arrangement



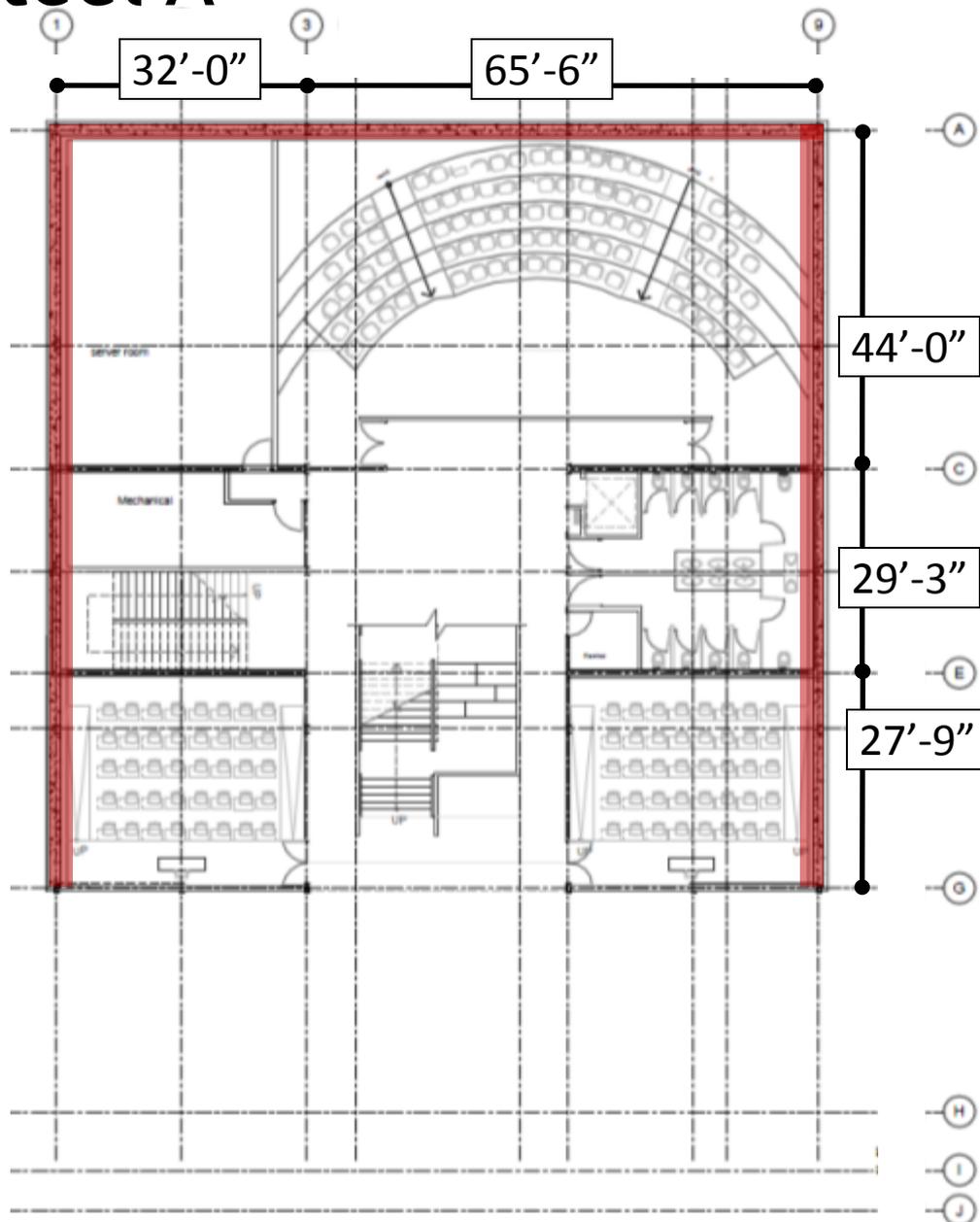
Façade without exposed structure



Façade with exposed structure



# Steel A



## Loads

Dead: self weight+ MEP	95 psf
Live: corridors	100 psf
EQ + soil: base shear	4000 kips
Wind: basic wind speed	100 mph

### Floor 1

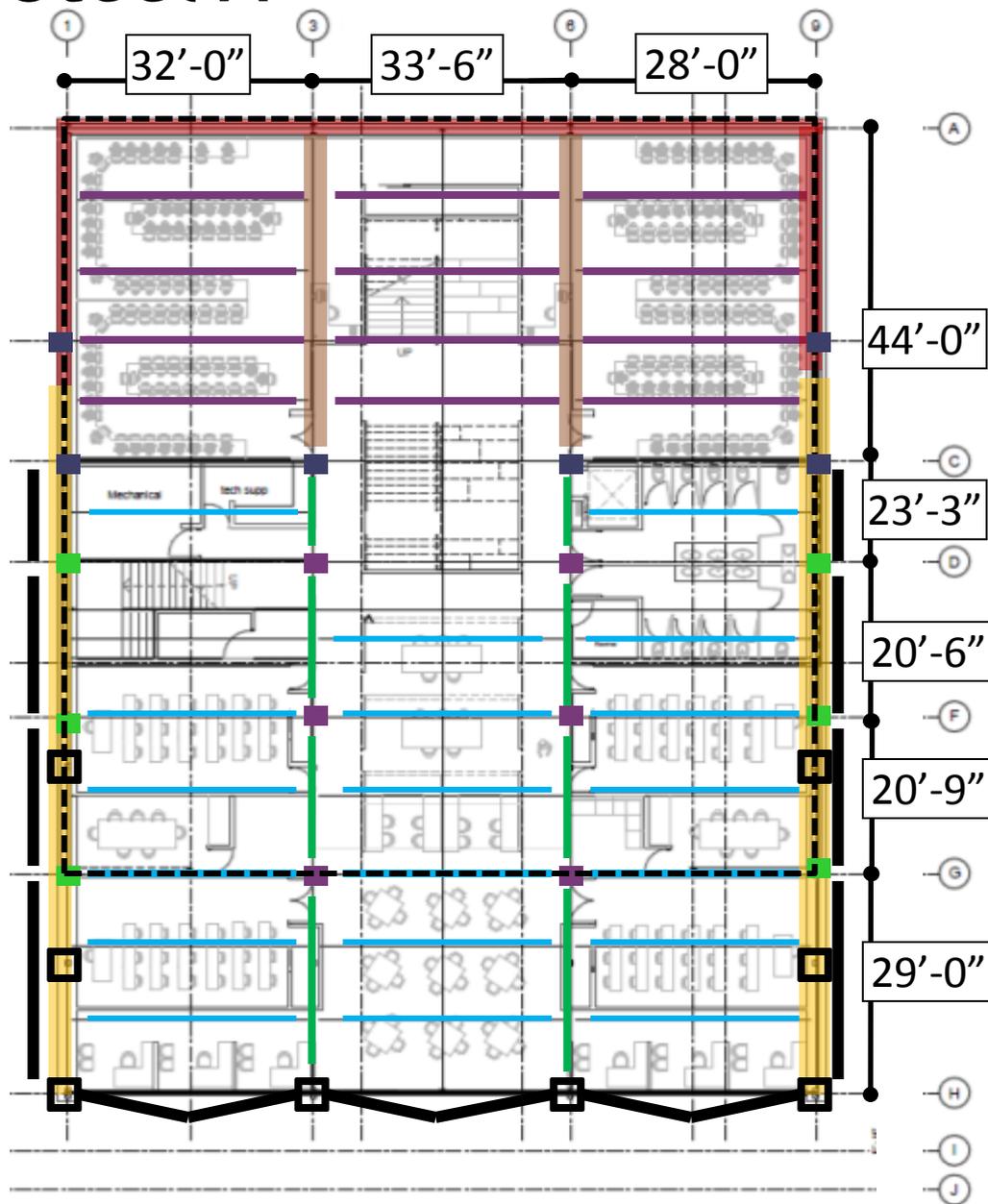
- Retaining Wall
- 30" Spread footing
- 8" Slab on grade

### Floor 2 & 3

- 4 ½" NW 3VLI19 metal deck



# Steel A



## Floor 2

### Columns

- W12x 45
- W14x 233
- W14x 159

### Beams

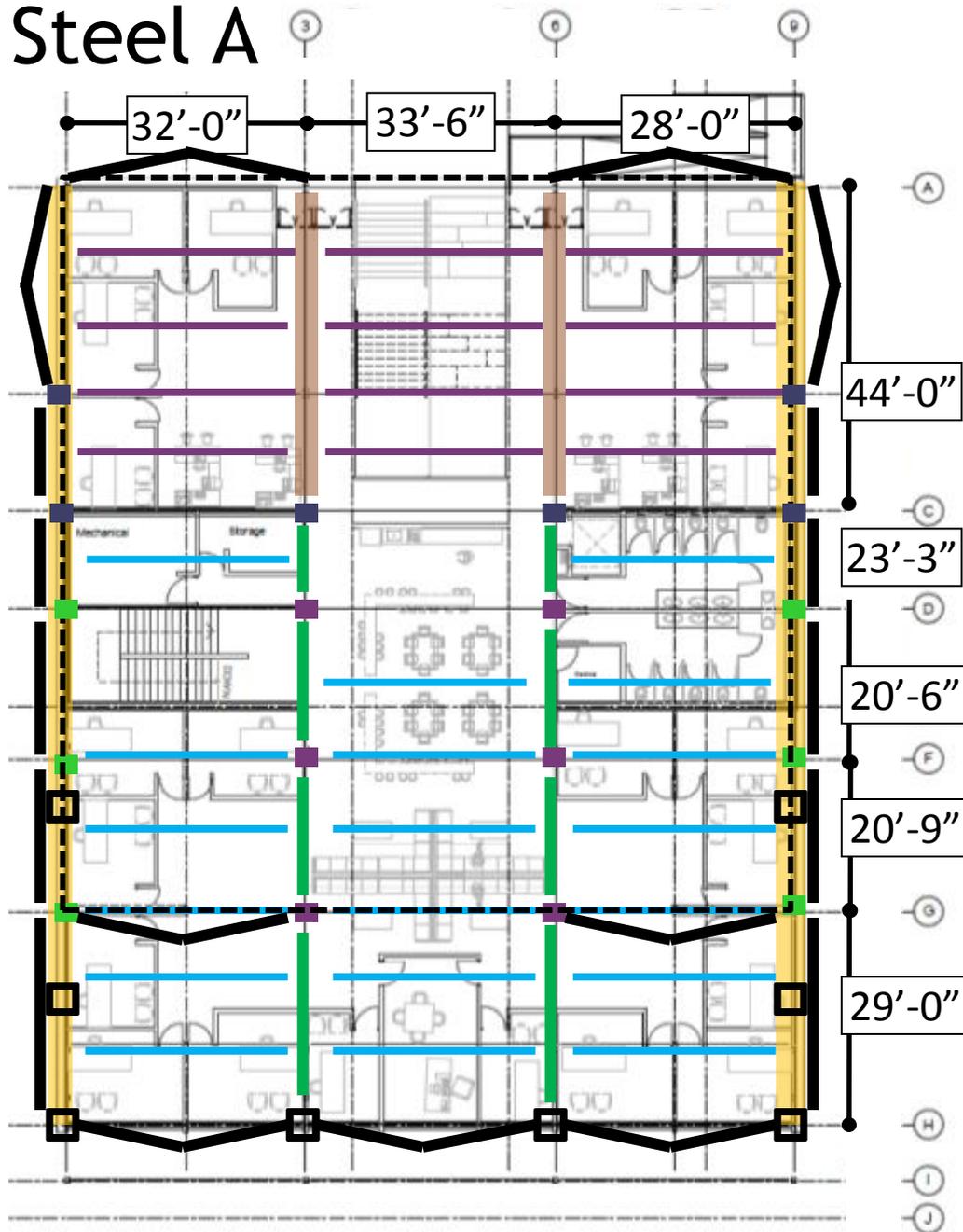
- W12x 26
- W12x 30
- W18x 40

### Challenges

- W24x 250 Auditorium-Span bms
- W27x 122 Perimeter Brace bms
- HSS 10x 10x 5/8 Slanted elements



# Steel A



## Floor 3

### Columns

- W12x 45
- W14x 233
- W14x 159

### Beams

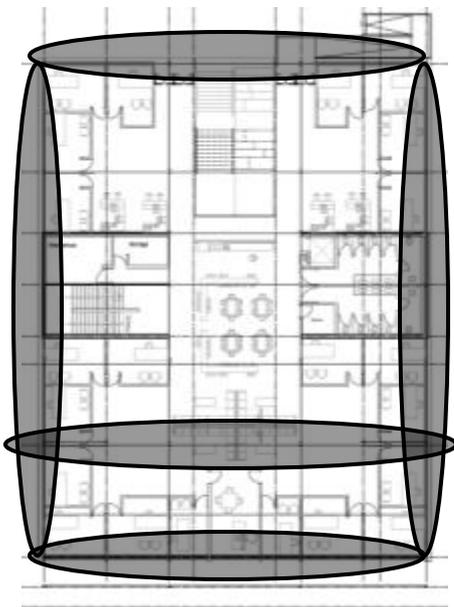
- W12x 26
- W12x 30
- W18x 40

### Challenges

- W24x 250 Auditorium-Span bms
- W27x 122 Perimeter Brace bms
- HSS 10x 10x 5/8 Slanted columns
- ┆ HSS 10x 10x 5/8 Perimeter braces

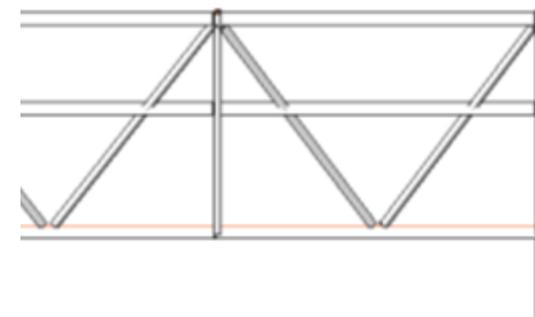
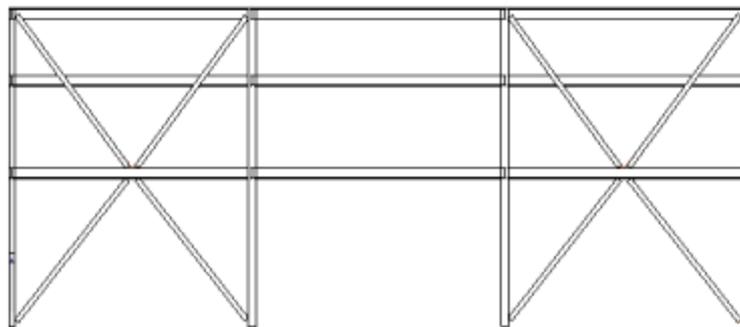
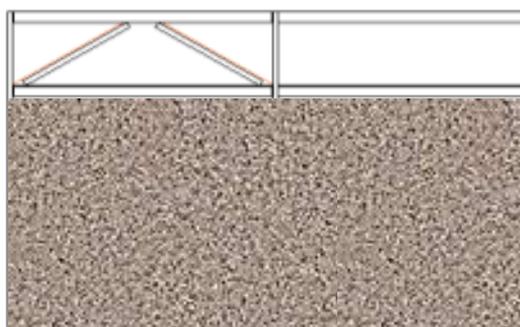
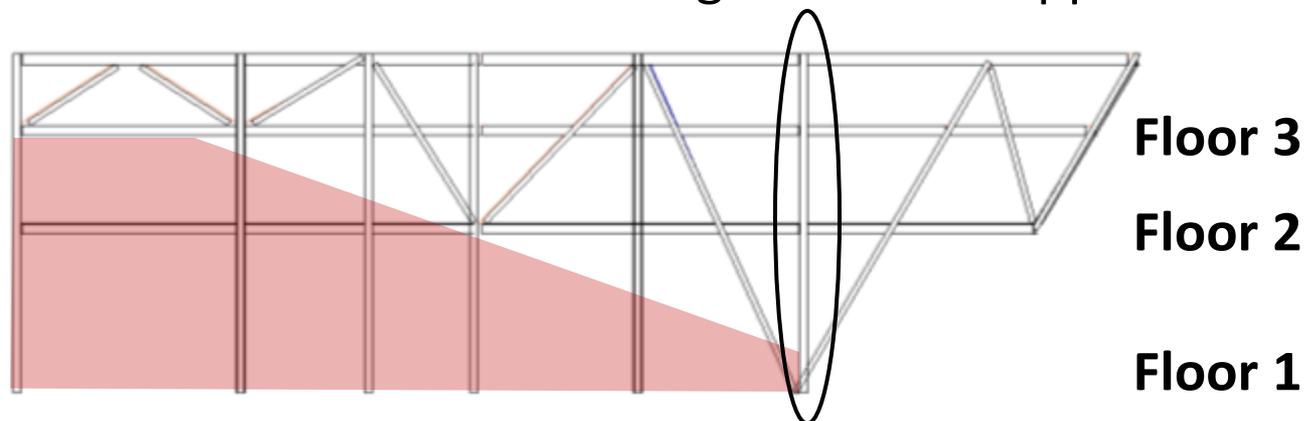


# Steel A



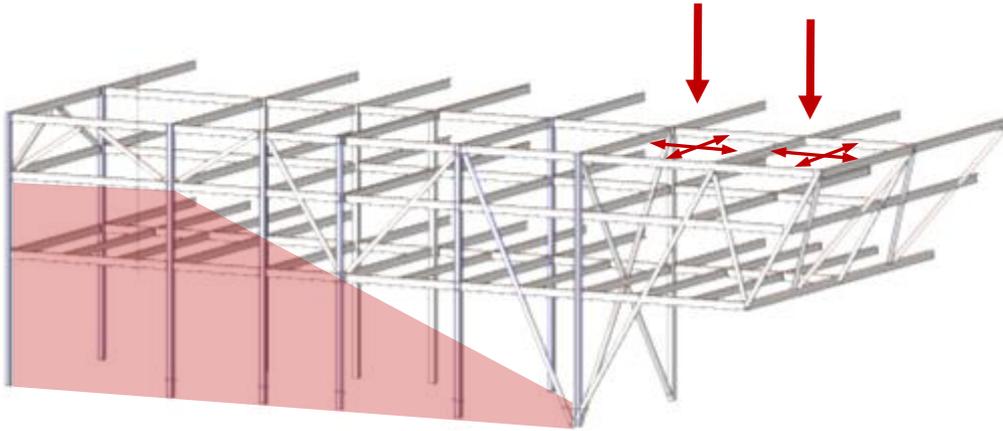
## Cantilever Solution

- Perimeter Trusses integrated into the façade
- HSS 10x 10x x  $\frac{5}{8}$  diagonals
- Interior cross bracing for lateral support

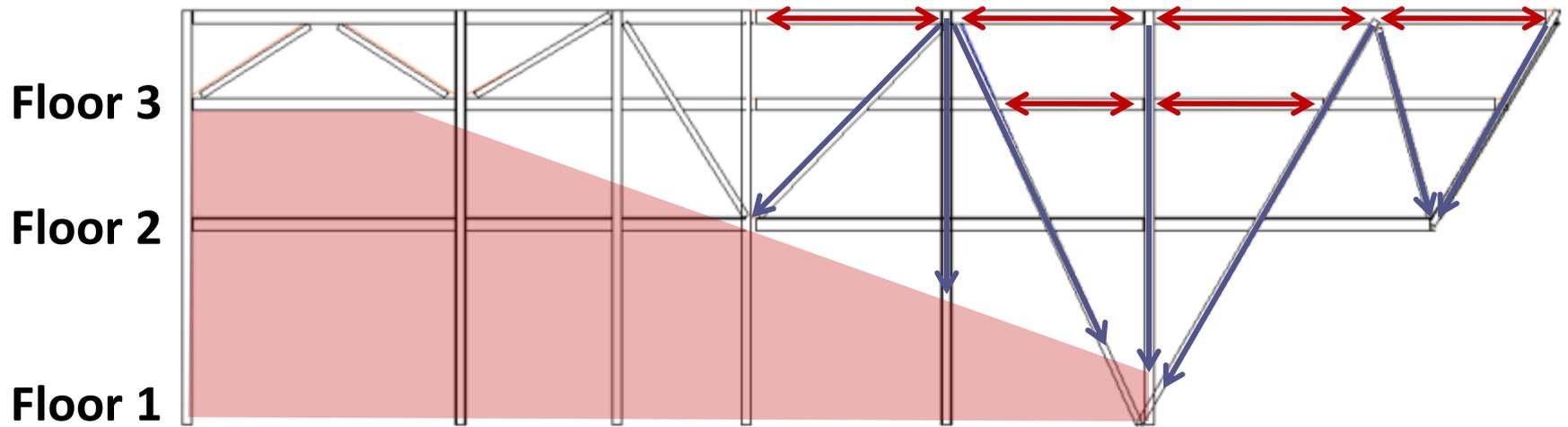
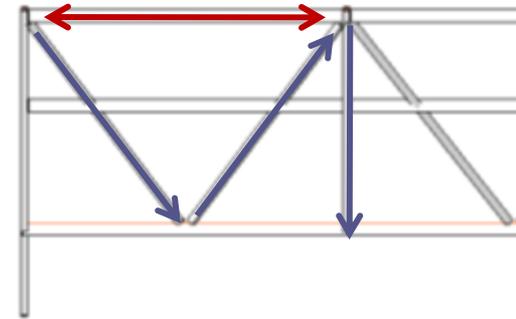




# Steel A

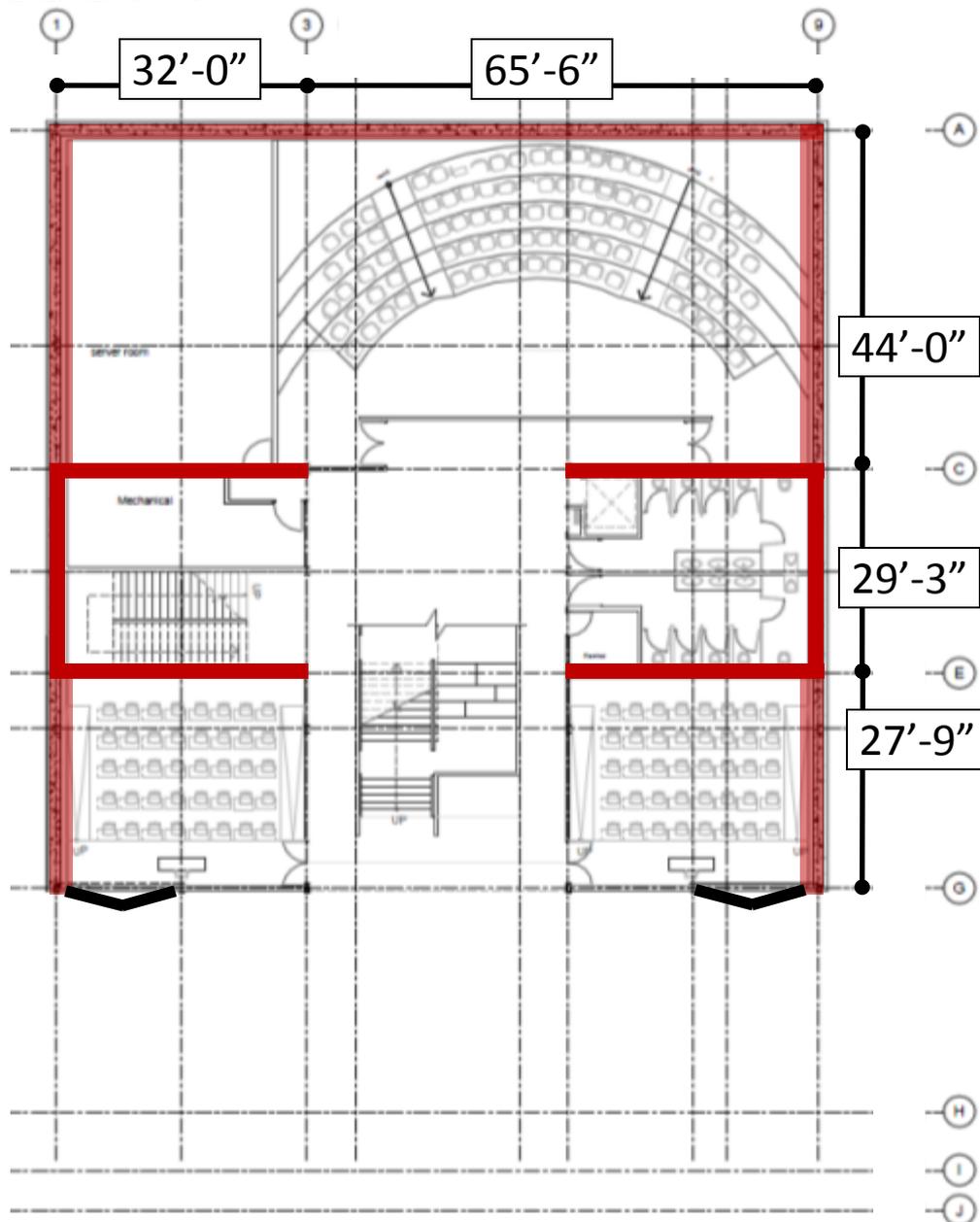


## Cantilever Load path





# Steel B



## Loads

Dead: self weight+ MEP	95 psf
Live: corridors	100 psf
EQ + soil: base shear	4000 kips
Wind: basic wind speed	100 mph

### Floor 1

- Retaining Wall
- 30" Spread footing
- 8" Slab on grade

### Floor 2 & 3

- 4 ½" NW 3VLI19 metal deck

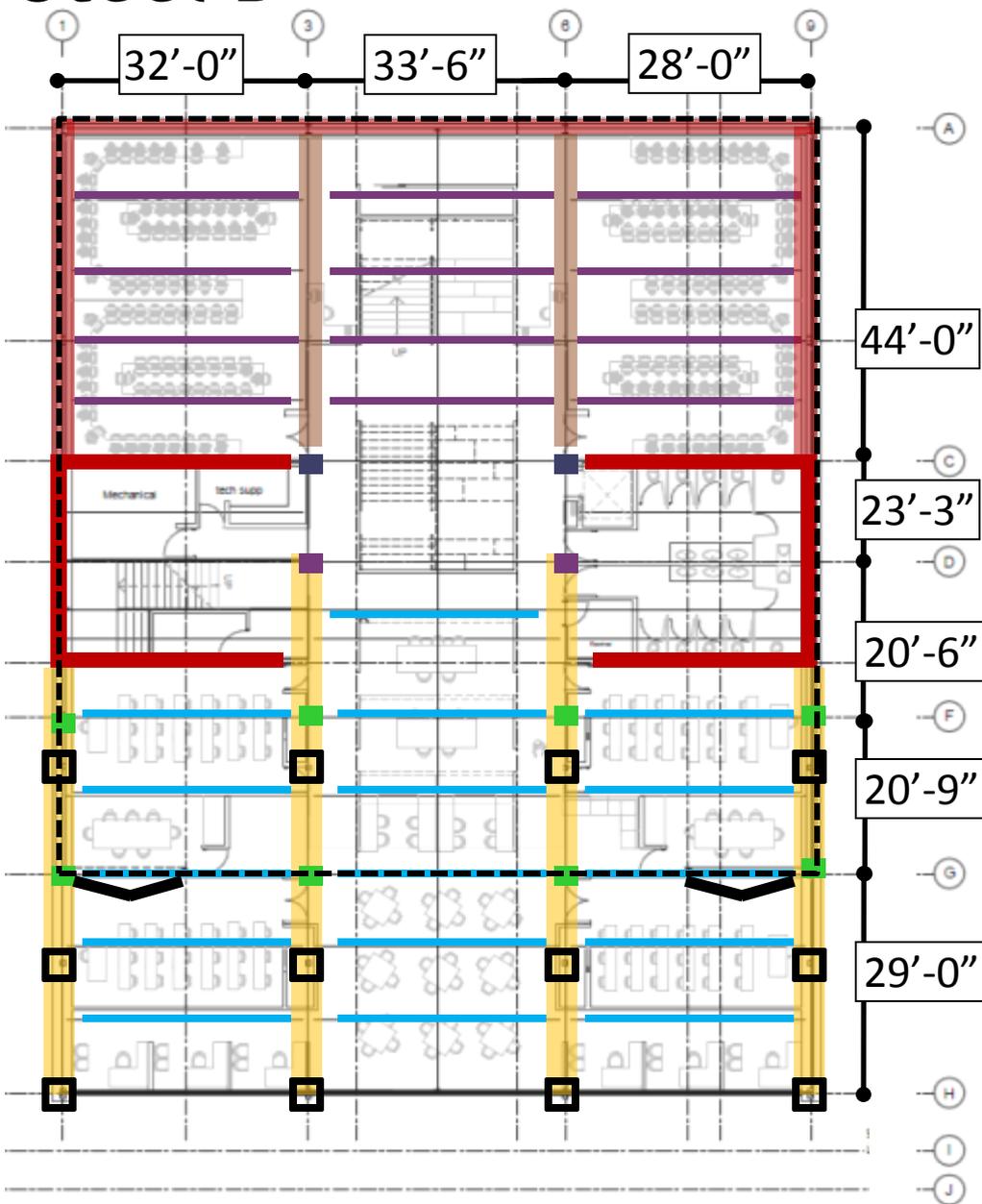
### Lateral

- 10" Shear Wall
- HSS cross braces



# Steel B

## Floor 2



### Columns

- 12x 45
- 14x 120
- 14x 159

### Beams

- 12x 26
- 12x 30

### Challenges

- 24x 250 Auditorium-Span beam
- 21x 122 Cantilever tie-back beams
- HSS 4- ½ x 4 ½ x ¼ Slanted Columns

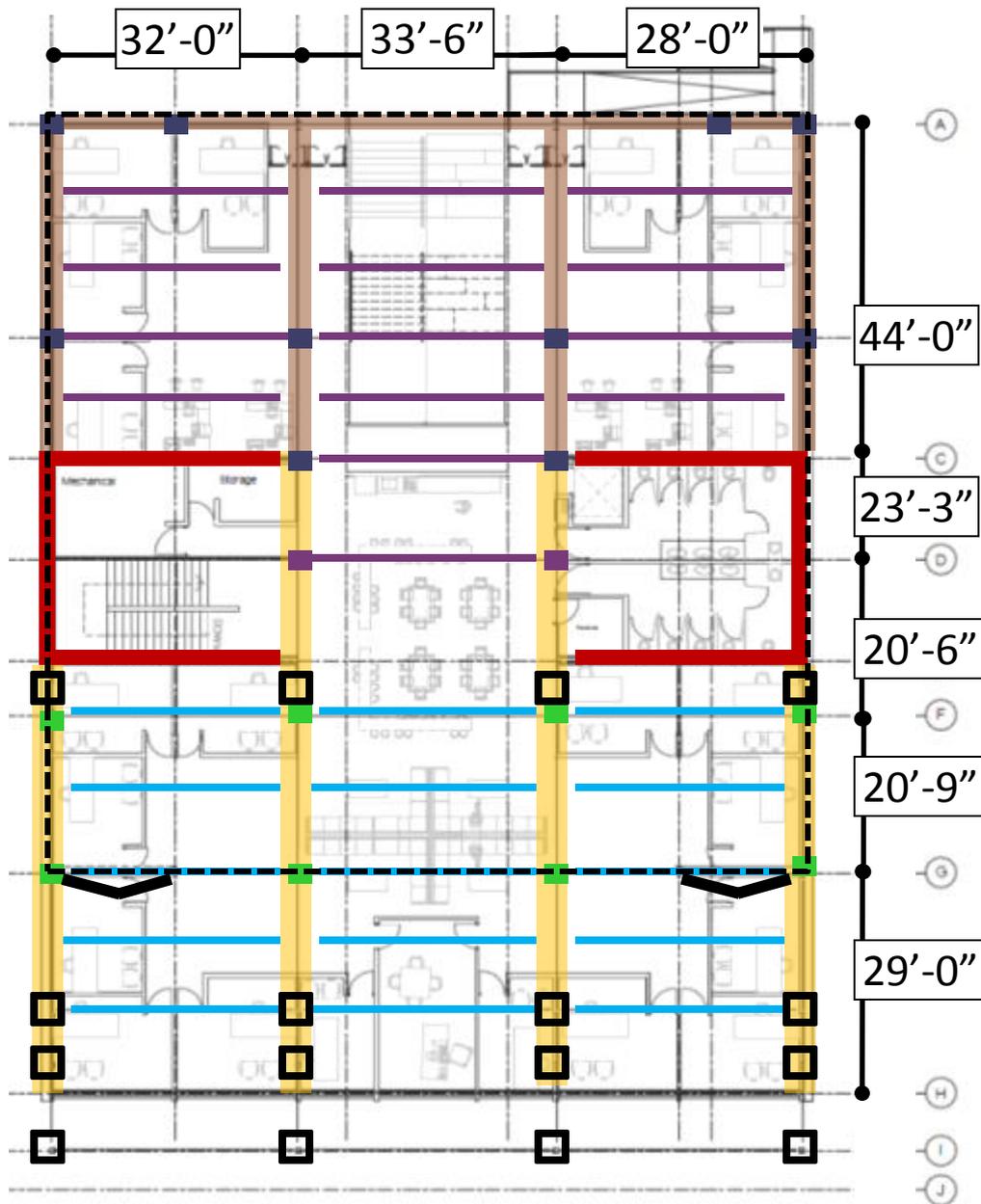
### Lateral

- 10" Shear Wall
- HSS cross braces



# Steel B

## Floor 3



### Columns

- W12x 45
- W14x 120
- W14x 159

### Beams

- W12x 26
- W12x 30

### Challenges

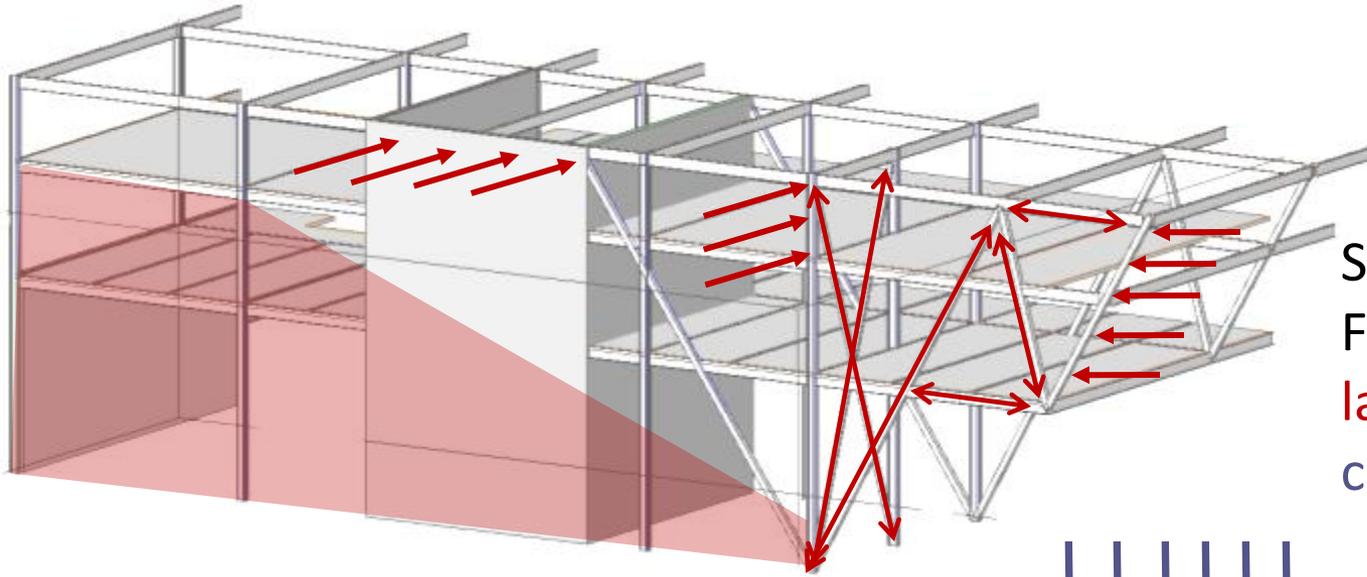
- W24x 250 Auditorium-Span beam
- W21x 122 Cantilever tie-back bms
- HSS 4- ½ x 4 ½ x ¼ Slanted columns

### Lateral

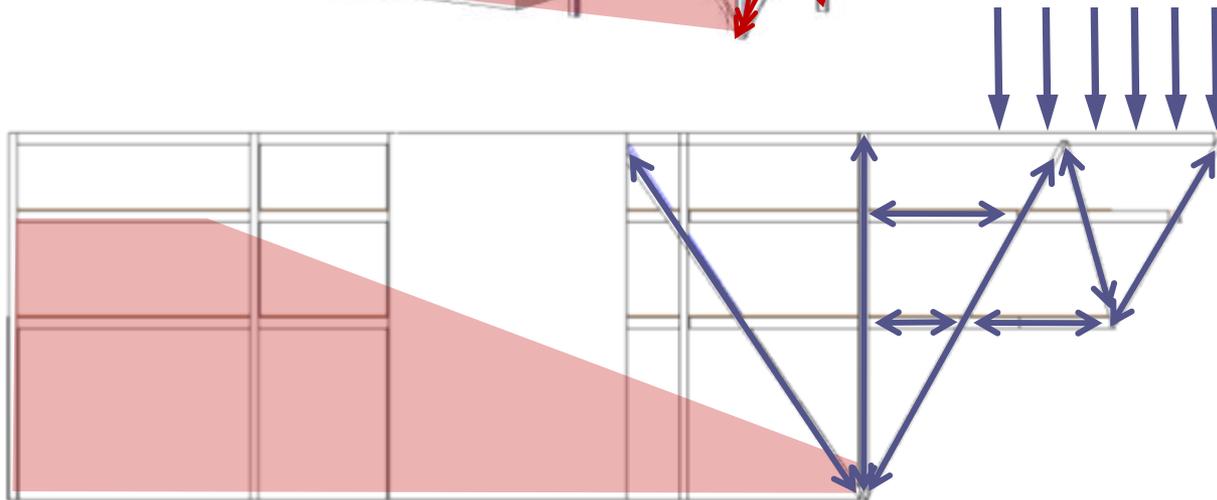
- 10" Shear Wall
- HSS cross braces



# Steel B - Load Path



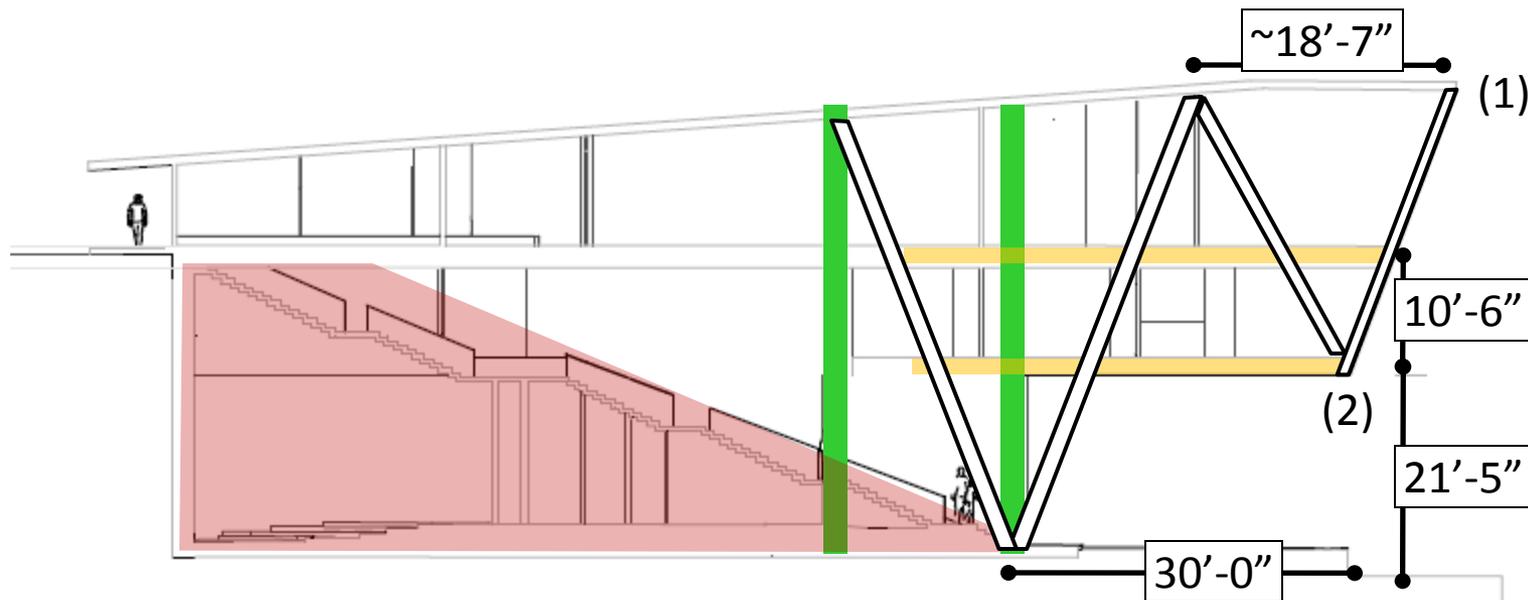
Slanted Column  
Frames resist both  
**lateral loads** and  
cantilever loads





# Steel B - Load Path

## Cantilever Solution



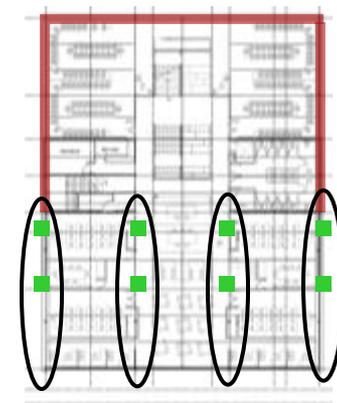
4 slanted-column frames

No roof live load

$\Delta_{LL}$  of cantilever tip: (1) 1.12" ( $<L/360 = 1.42"$ )

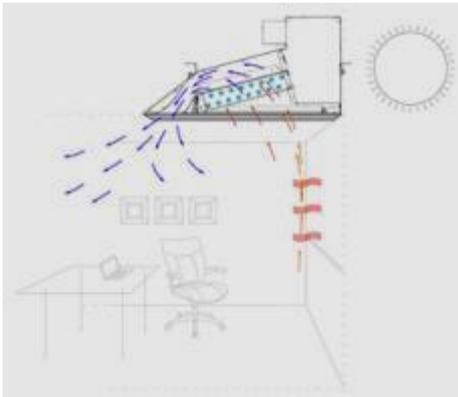
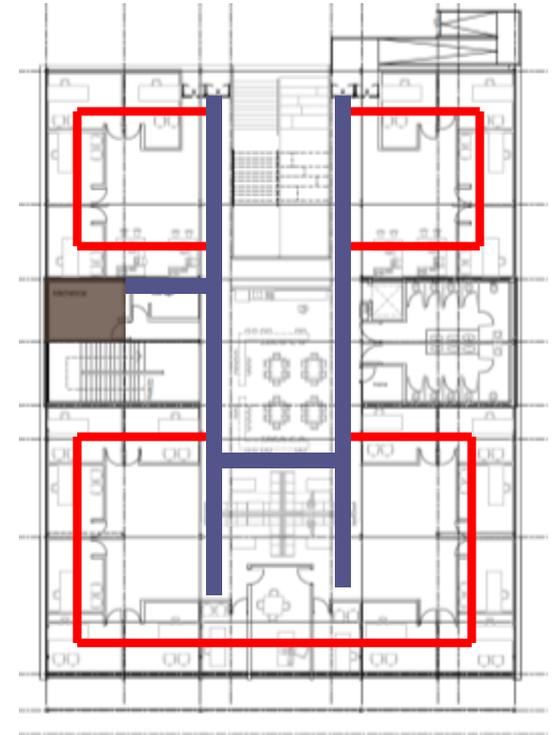
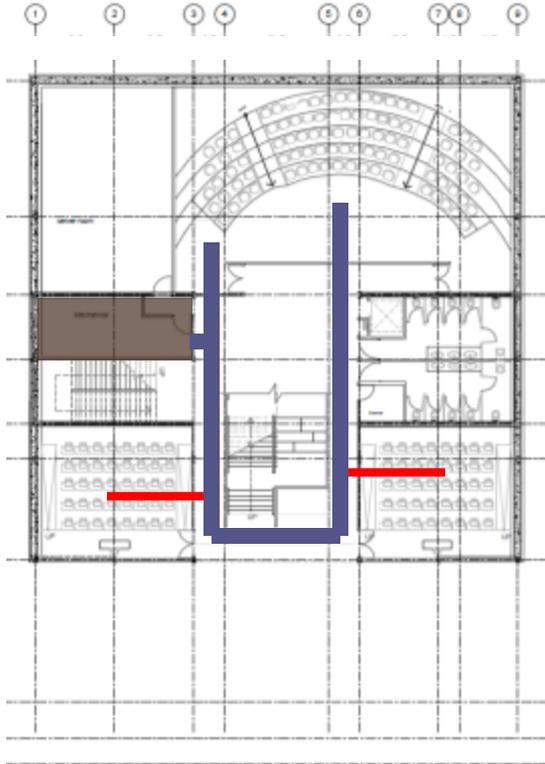
(2) 0.75" ( $<L/360 = 0.97"$ )

- W14x 120 columns
- W21x 122 Cantilever beams
- HSS 4- ½x 4-½x ¼ Slanted columns





# MEP Distribution



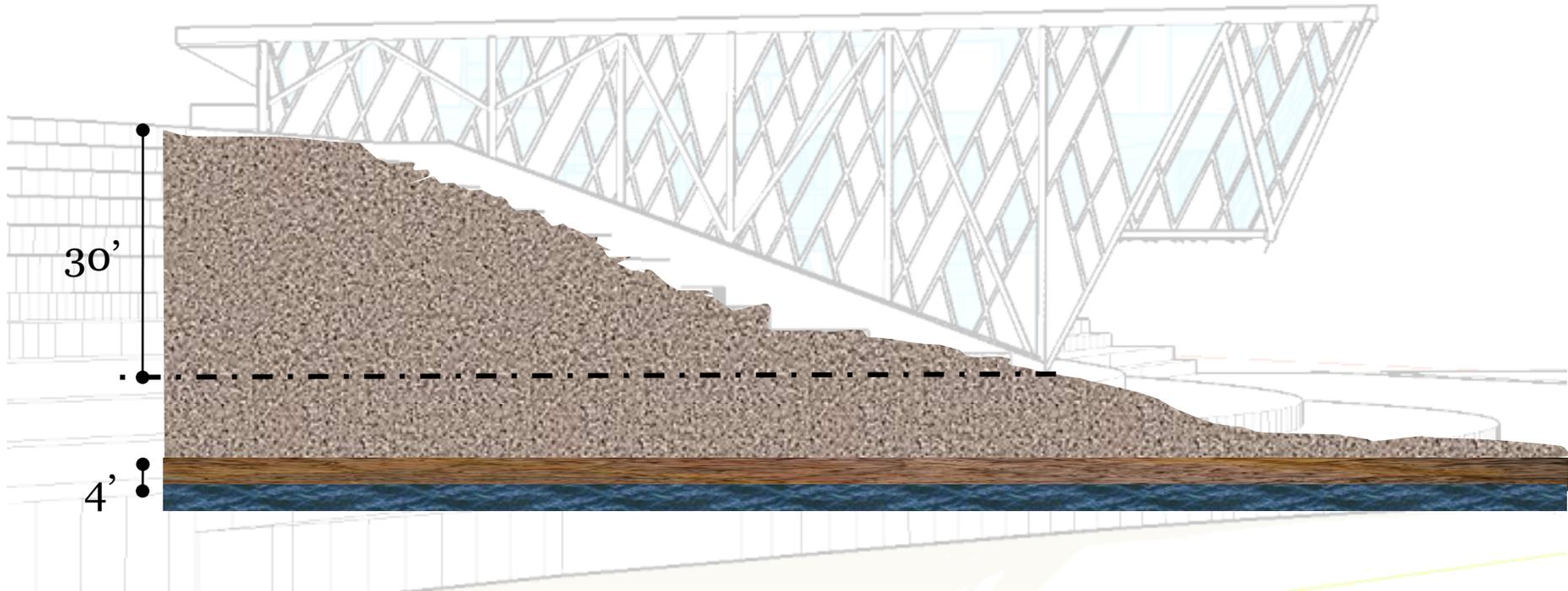
**Chilled Beam System** coupled with Geo-Thermal Central Plant

- MEP rooms
- Primary Ducts
- Secondary Ducts



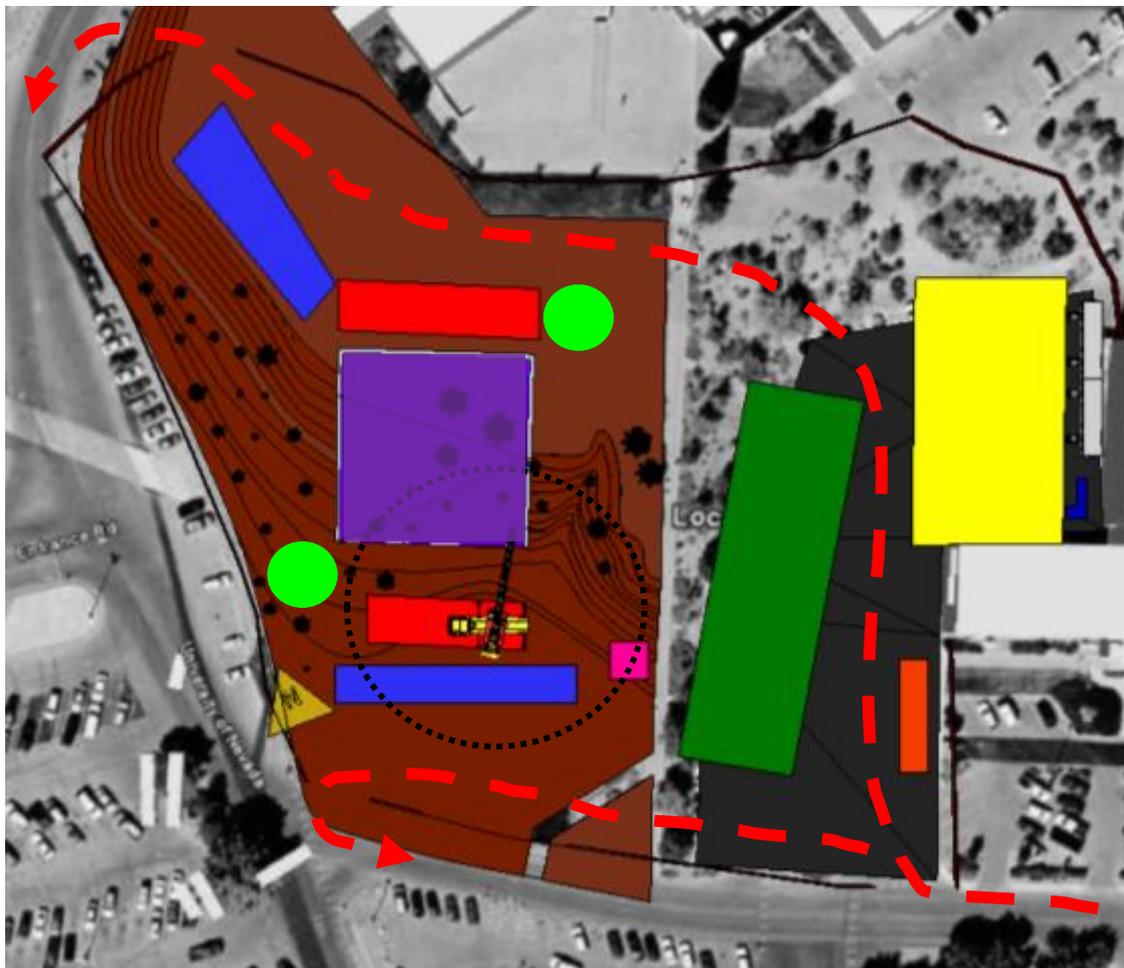
# Soil Profile

**Soil Profile applies to the low of the slope**





# Site Plan



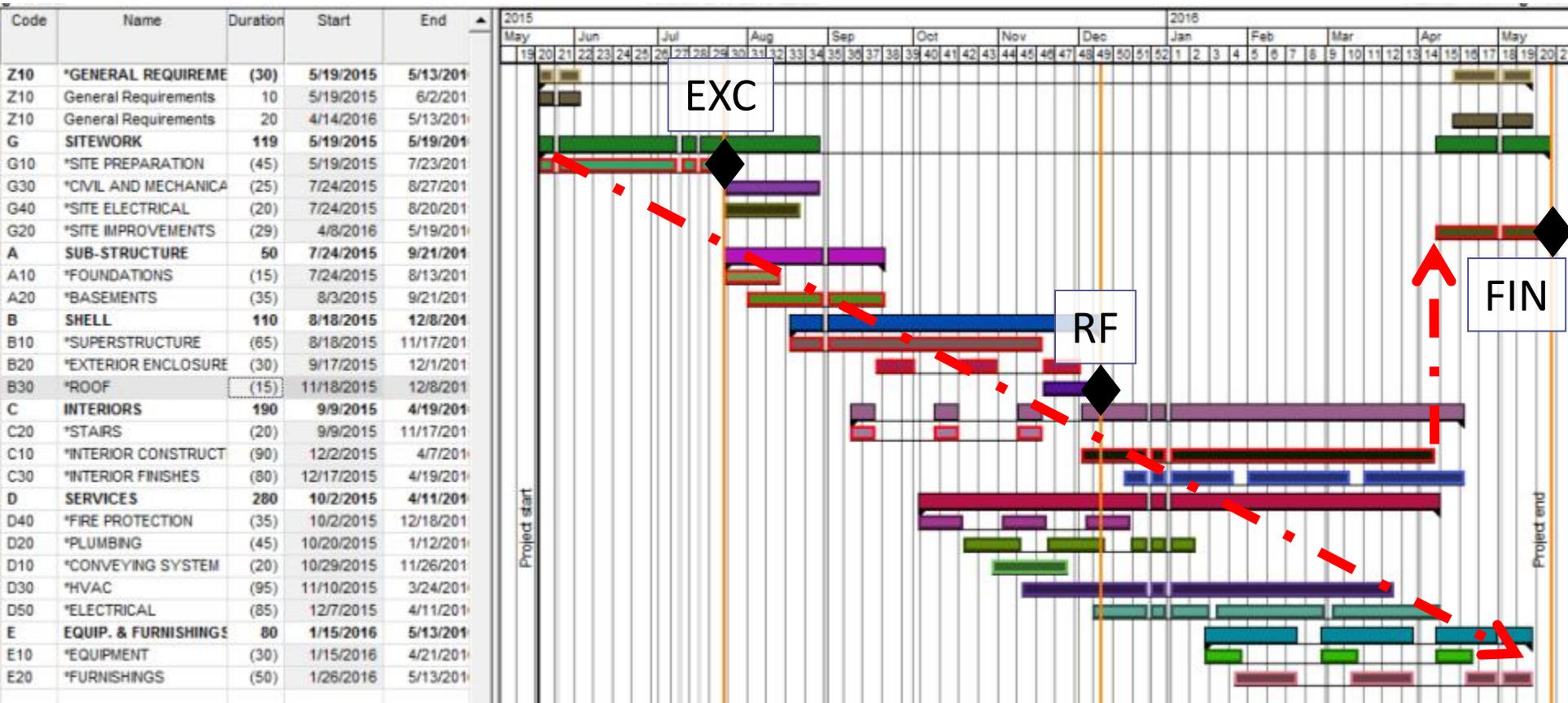
Cactus Gardens

Building Footprint

Site Area	3.6 acres
JIT delivery sites	5150 SF
Heat Relief Area	400 SF
Parking	50-55 spots
Assembly Fabrication	12000 SF
Site Trailers	1000 SF
Restrooms	4 Units
Recycling & Waste Control	6x20 CY bins
Crane Space	2 locations



# Schedule Budget



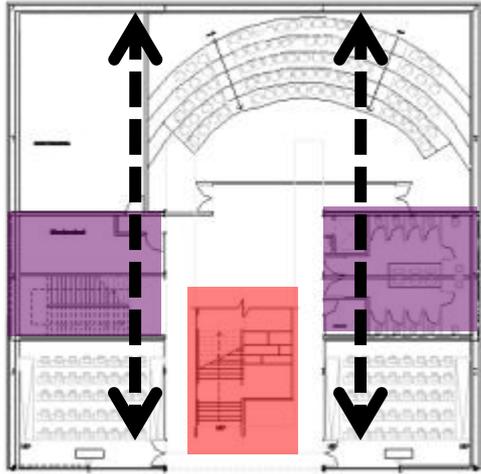
**Duration: 365 days**

Critical Path

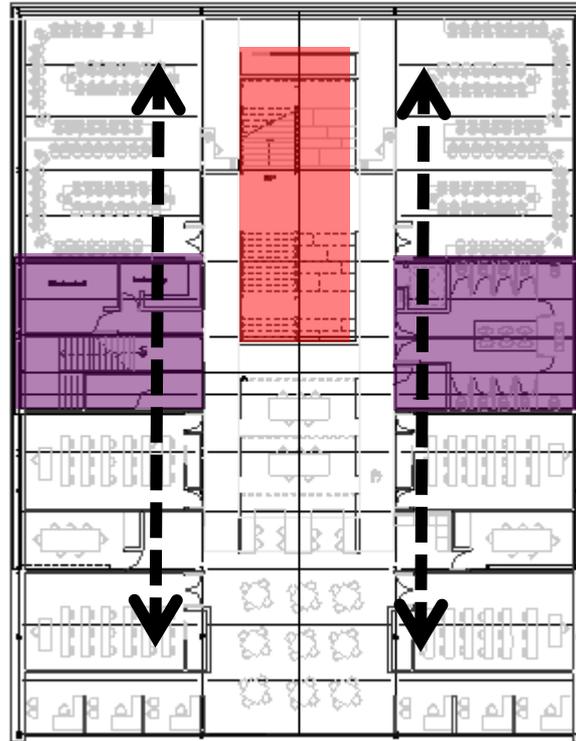
Milestone



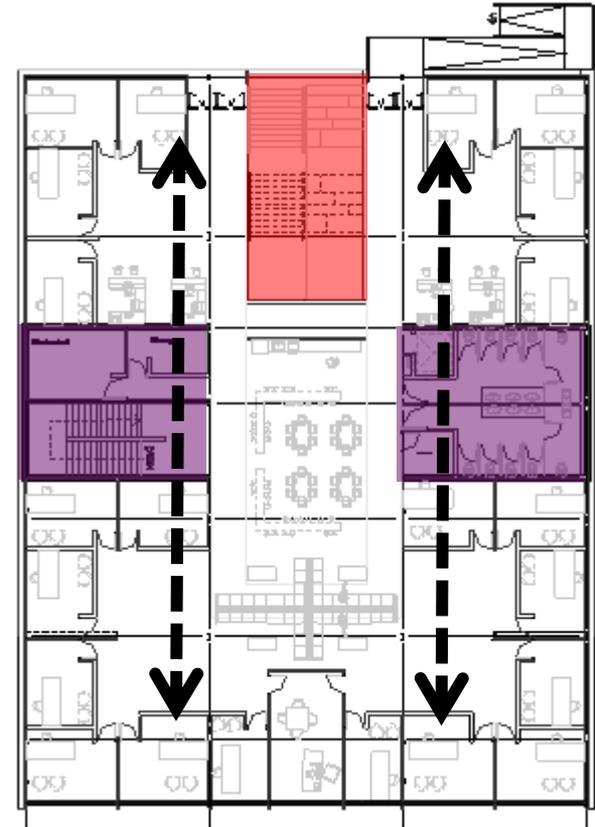
# Erection Sequence



Floor 1



Floor 2



Floor 3

Vertical Core

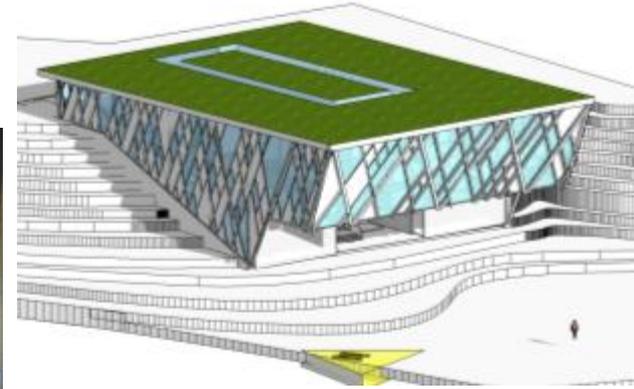


Main Staircase





# Milestones



Milestone 1:  
Excavation  
Complete  
Jul 23, 2015

Milestone 2:  
Water tight  
Dec 8, 2015

Milestone 3:  
Building  
Complete  
May 19, 2016

# Construction Method Comparison

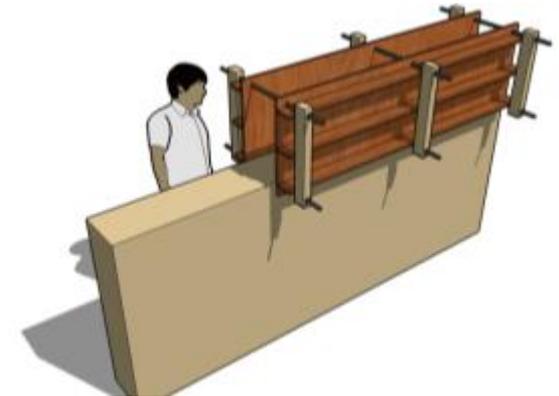
## In-situ Concrete



## Steel



## Rammed Earth





# Project Equipment - General

## Heavy material handling



Volvo L220F Hybrid

## Concrete pump



SANY 5253THB

## Excavation



Kamatsu PC200-8 Hybrid



JLG 723A

## Material and Personnel Handler

## Geothermal Drill-rig



Techno Drill 410



# Project Equipment - Crane

## Concept 2B



Grove TM500E-2  
45ton Truck Mounted-  
Hydraulic Crane

## All Other Concepts



Link Belt HTC8675T  
75ton Truck Mounted-  
Hydraulic Crane



# Target Value Comparison

## PIXEL

### Pixel Steel Targets



## R2B

### R2B Steel Targets



### Pixel Concrete Targets



### R2B Dual Targets



**Budgeted Cost: \$7.5 Million**



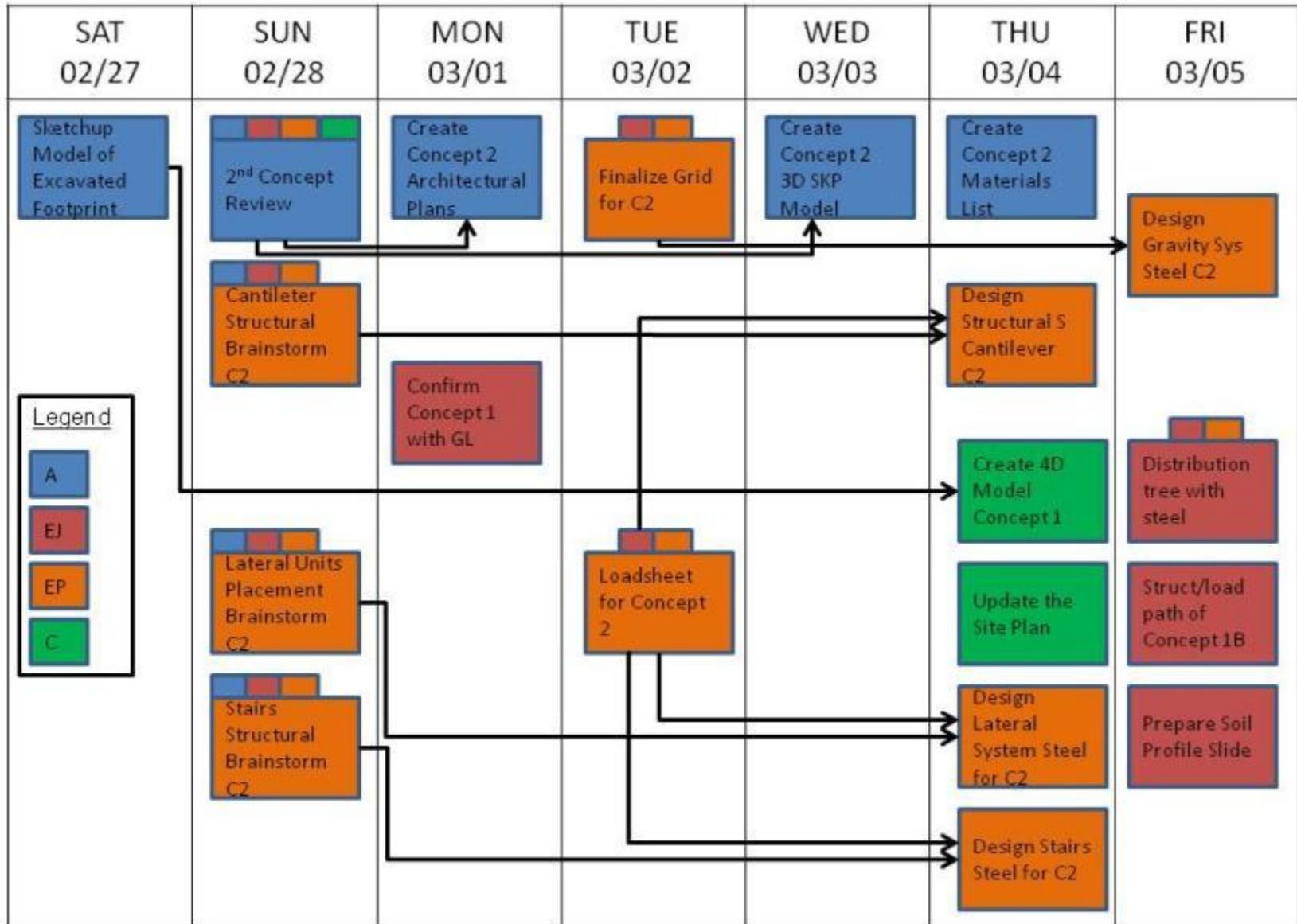
# LEED Certification

LEED Rating Categories	Yes	No	Maybe	Possible Points
Sustainable Site	18	5	3	26
Water Efficiency	0	1	6	10
Energy and Atmosphere	11	0	2	35
Materials and Resources	4	3	0	14
Indoor Environmental Quality	14	1	0	15
Innovation and Design Process	0	0	0	4 (bonus)
Regional Priority Credits	4	0	0	4 (bonus)
<b>Silver Accredited</b>	<b>51</b>	<b>10</b>	<b>11</b>	<b>50-59</b>



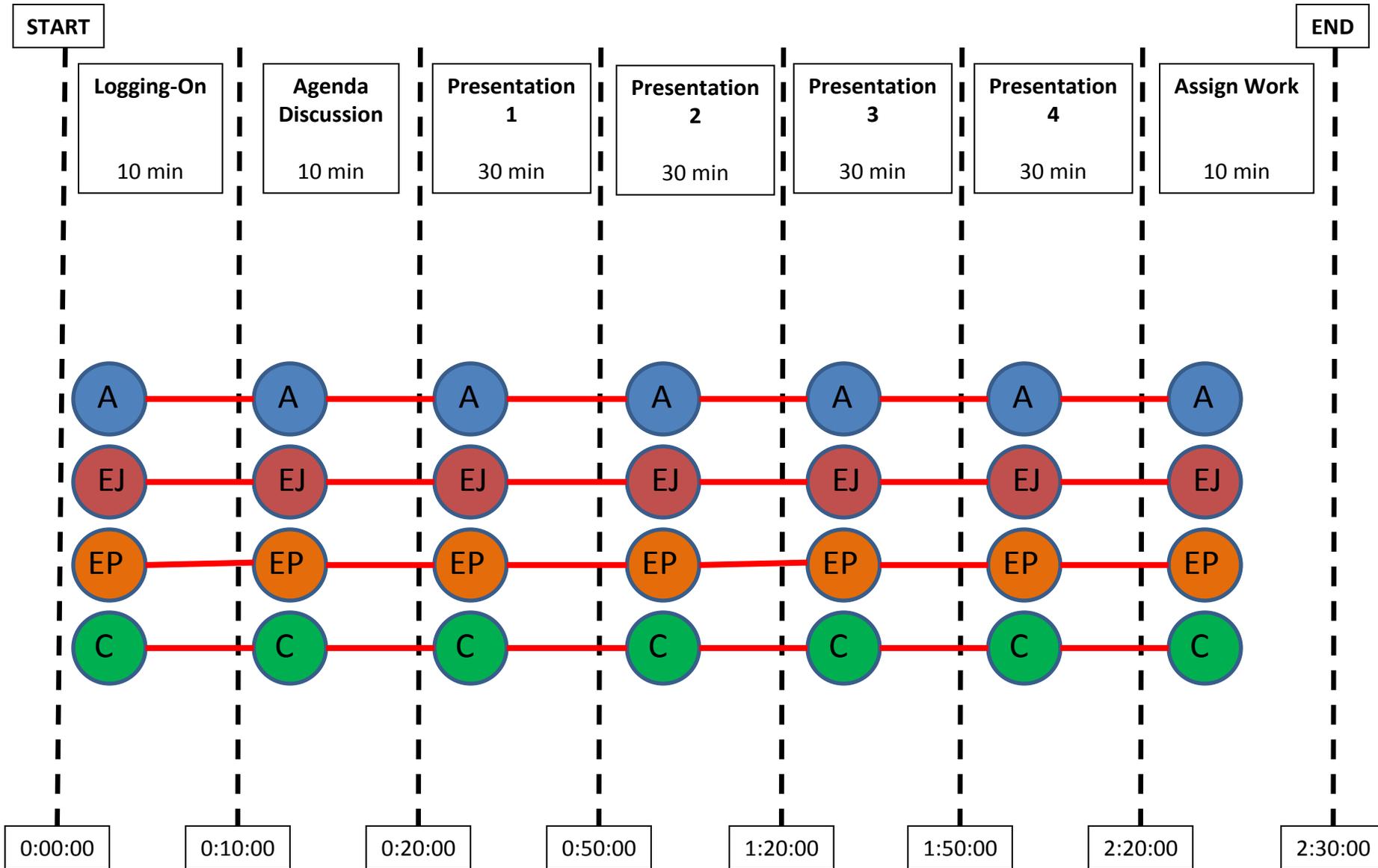


# Task List to Weekly Production Plan



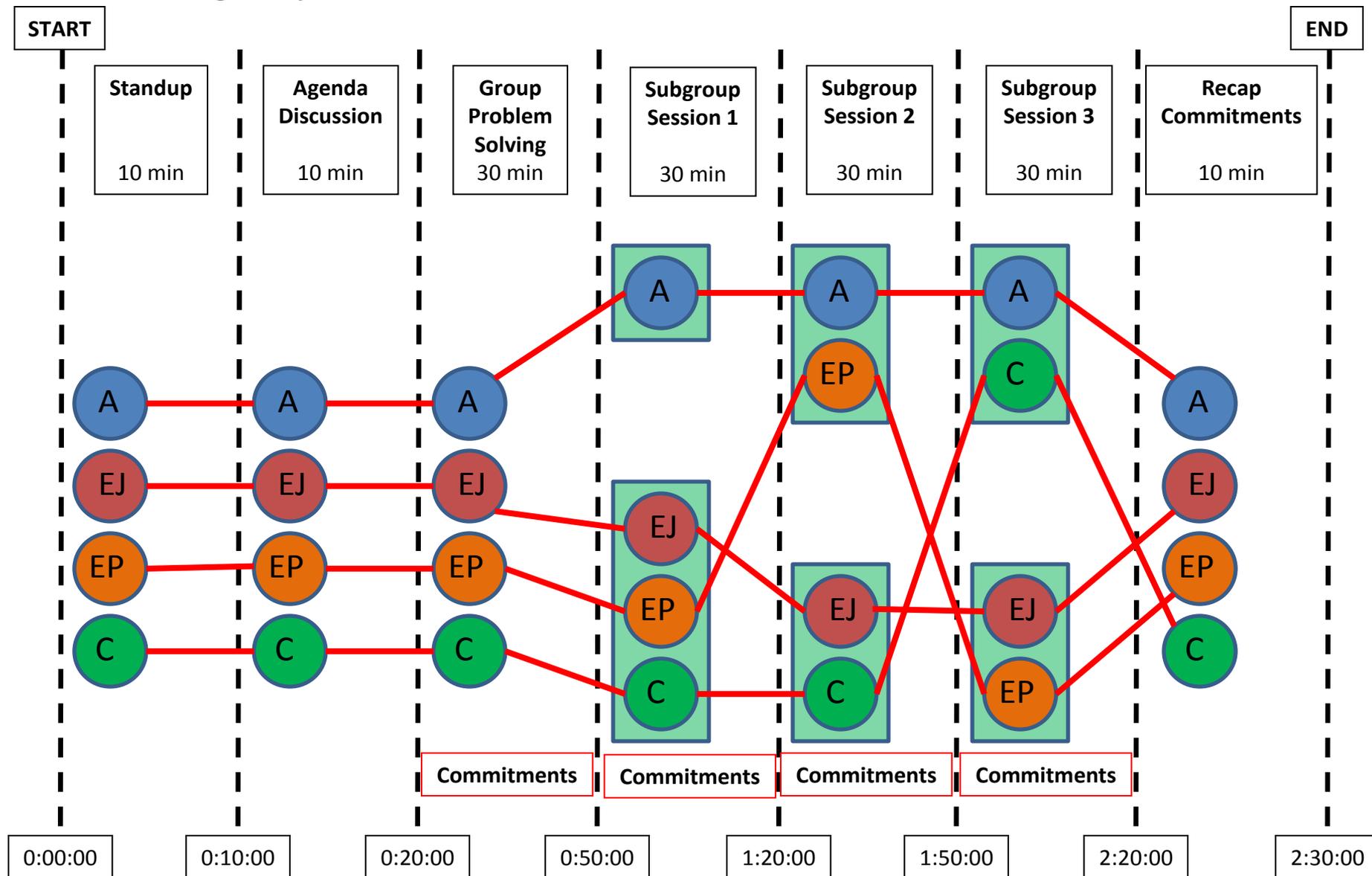


# Meeting Dynamics - Beginning of Quarter



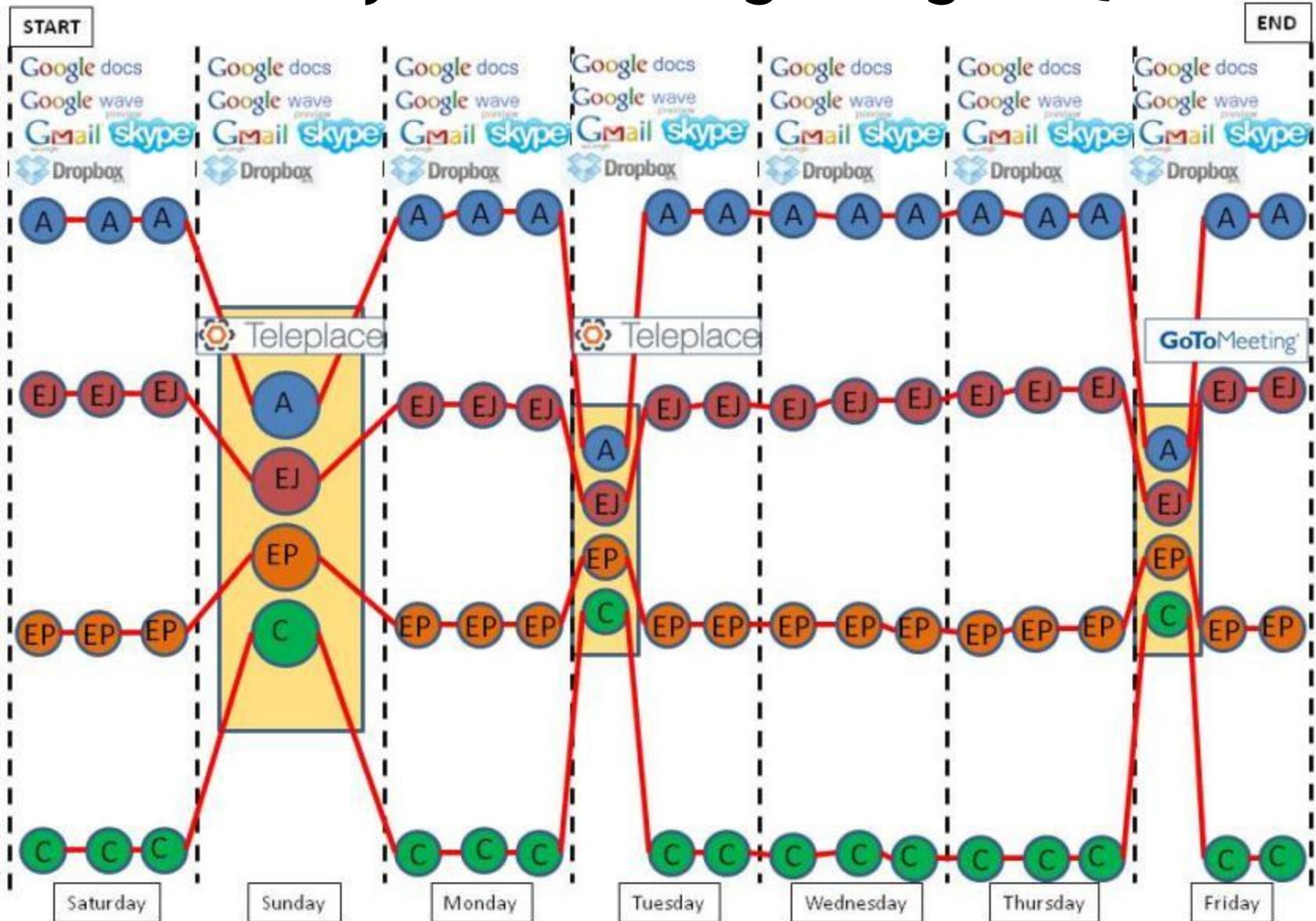


# Meeting Dynamics - End of Quarter



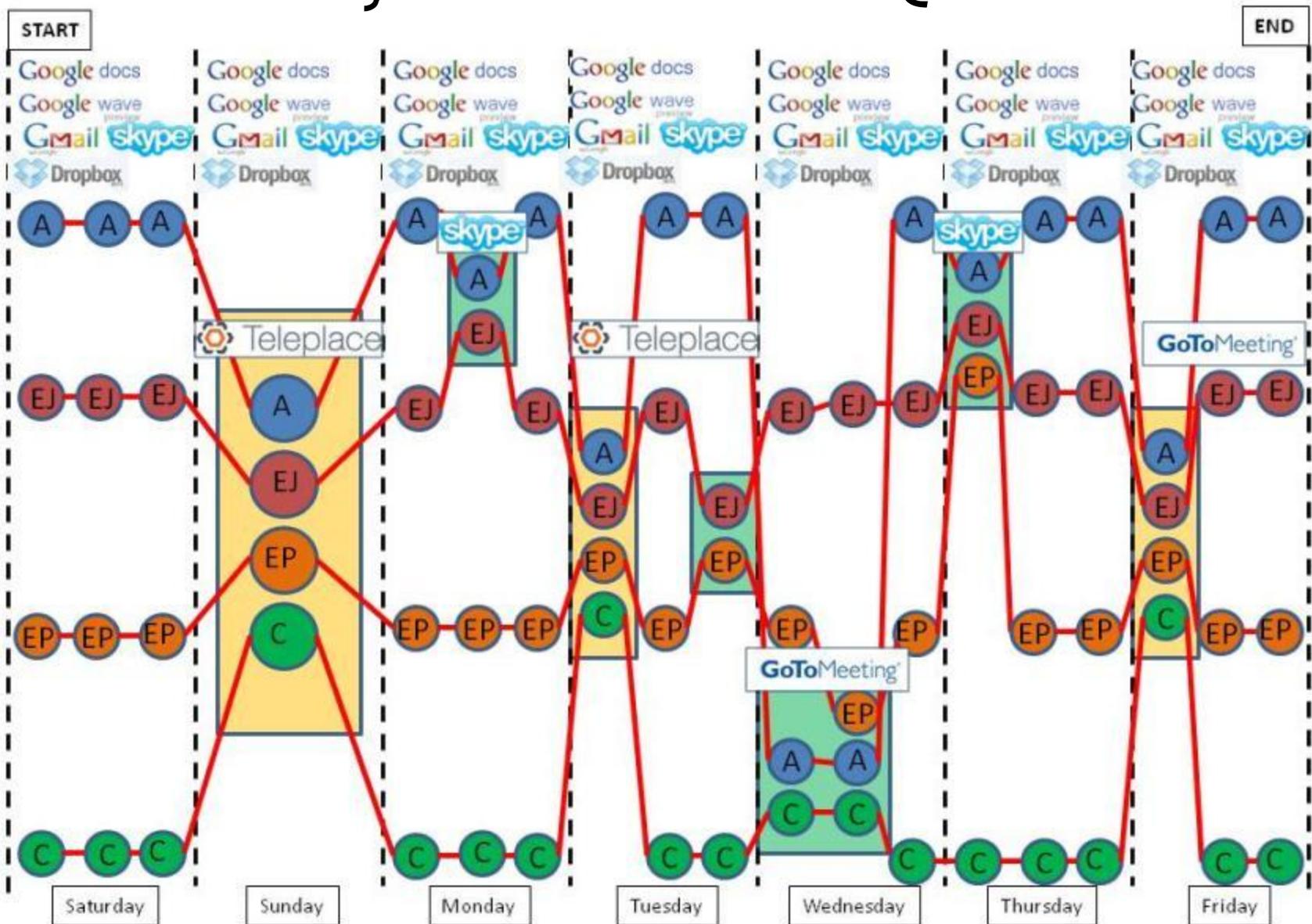


# Work Week Dynamics - Beginning of Quarter



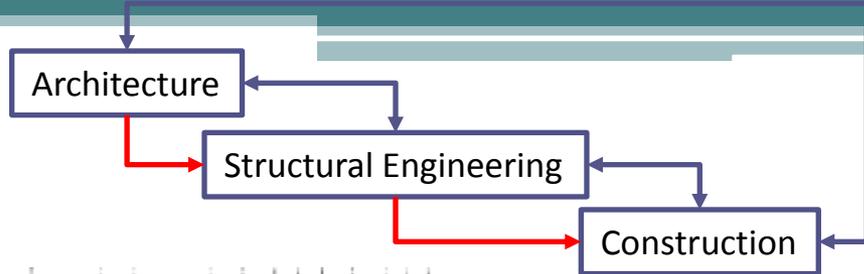


# Work Week Dynamics - End of Quarter

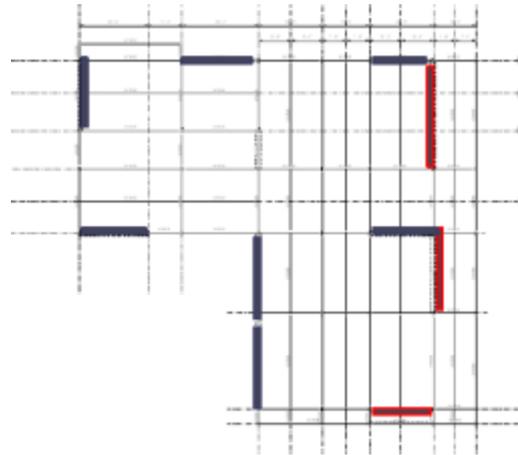




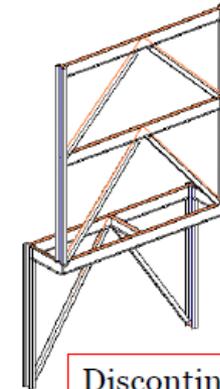
# Compromises



Architectural Vision

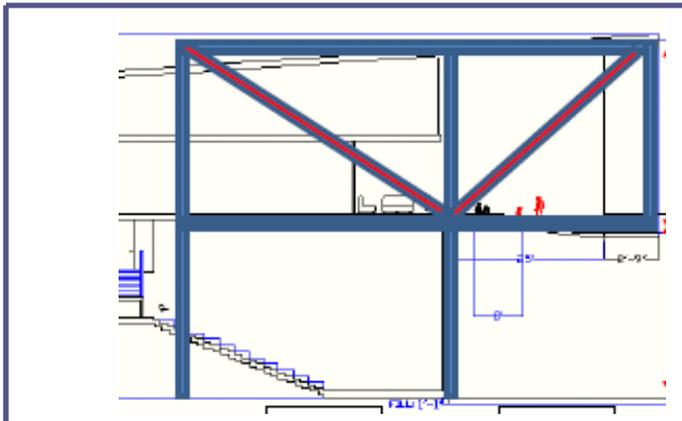


Structural Solution

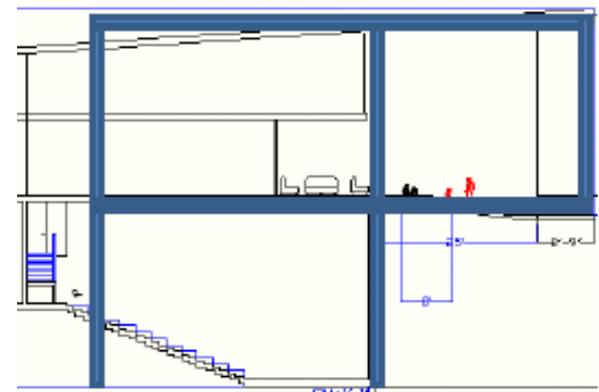


Discontinuous brace at cantilevers

Structural Problems

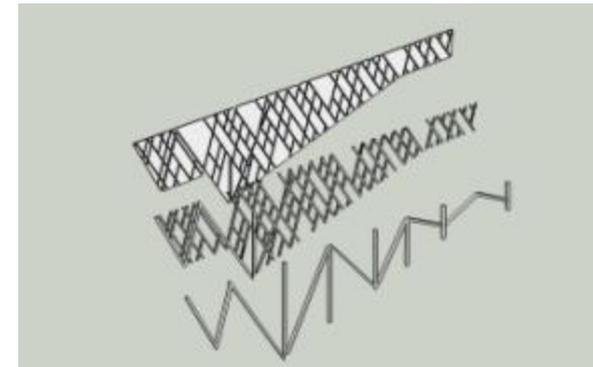
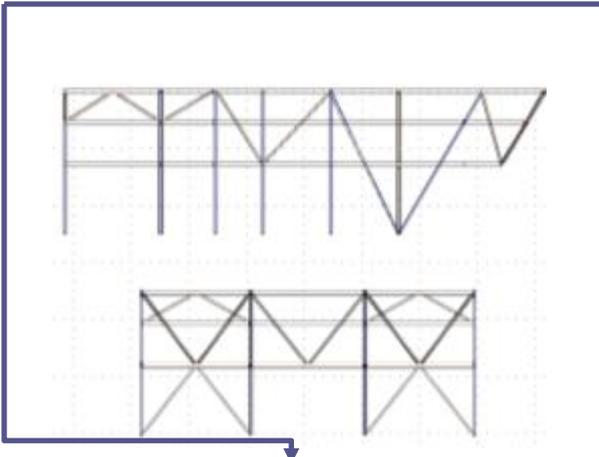
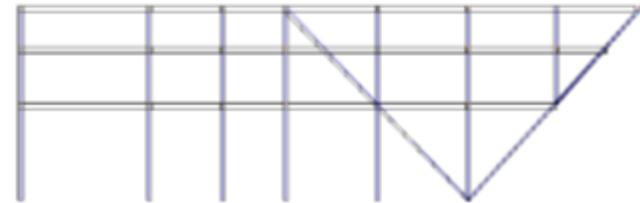
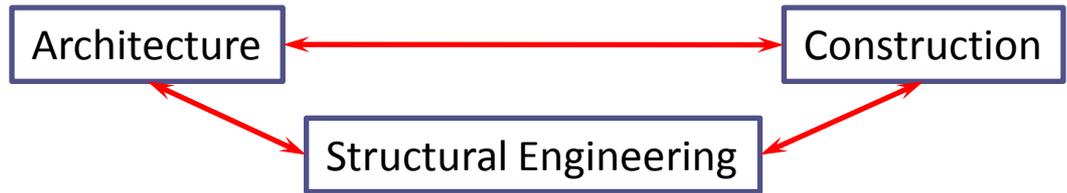
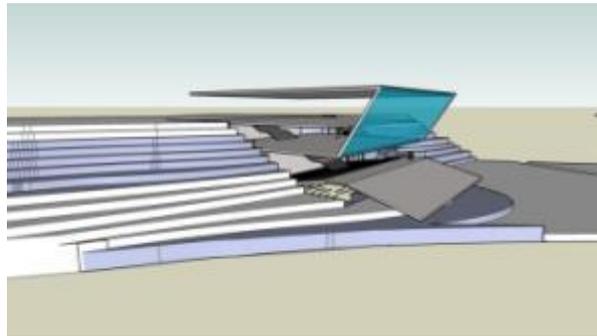


Structural Compromises



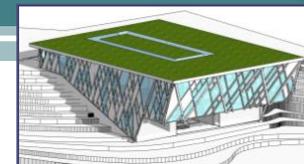
Constructability Compromises

# Opportunities





# Team Ridge Decision Matrix

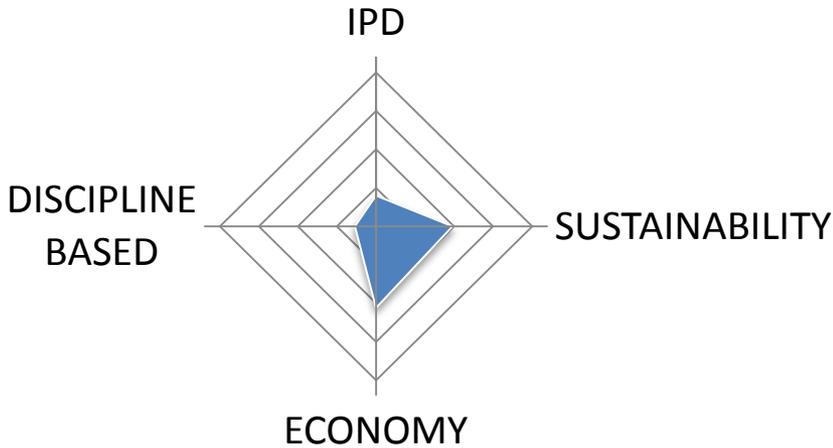


	Steel	Concrete	Steel	Dual
<b>IPD</b>	1	1	3	2
<b>SUSTAINABILITY</b>				
Solar Production	2	2	1	1
Natural Lighting	2	2	1	1
Campus Connectivity	0	0	3	3
Quality of Indoor Space	1	1	2	2
Fostering Innovative Educational Practices	0	0	2	2
Creating Sustainability Awareness	1	1	2	2
Building Flexibility	1	2	3	-1
<b>ECONOMY</b>				
Budget Risk (by Building System)	1	1	-1	0
Opportunity for Prefabrication	2	-1	2	1
Efficiency of Structural System	1	0	2	3
Schedule Risk (by System Duration)	1	2	1	0
<b>DISCIPLINE BASED</b>				
Functional Space Affinities	-1	-1	0	0
Innovativeness of Structural Solution	0	0	3	1
Just-in-Time Construction Approach	1	0	2	2
Building Response to Earthquake Events	-1	-1	1	1

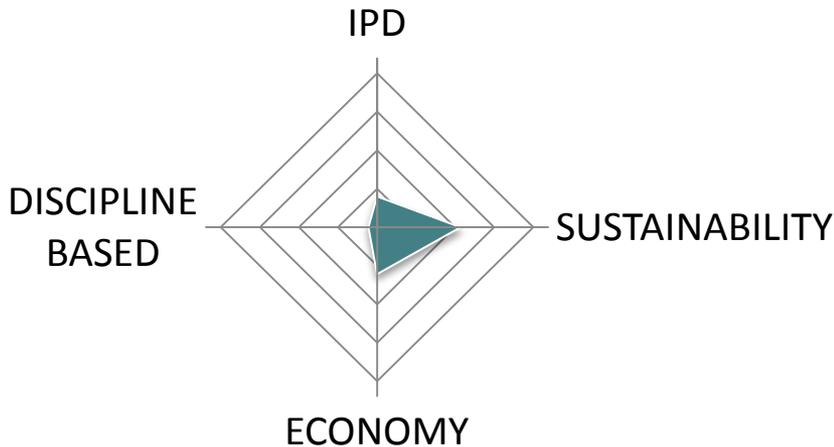


# Team Ridge Decision Matrix

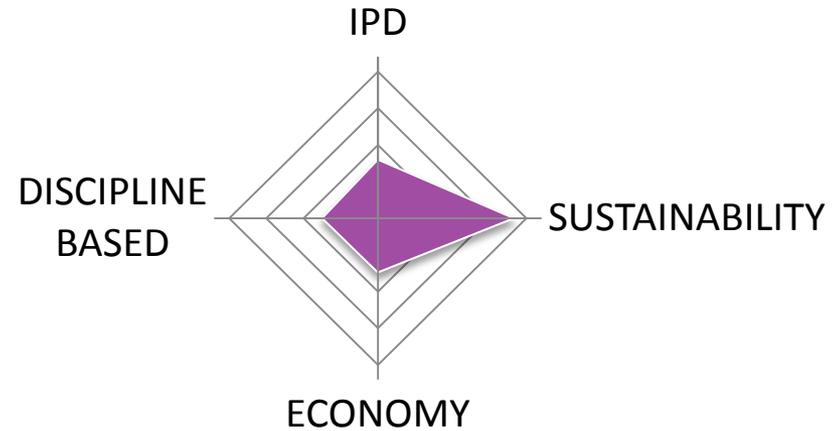
**Pixel A**



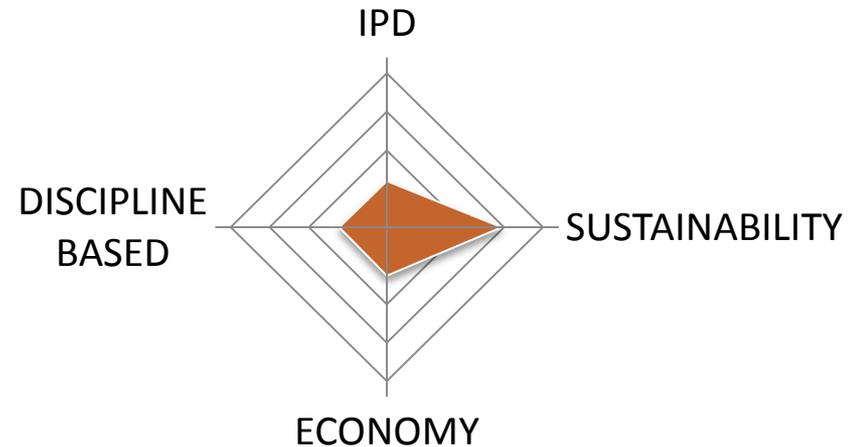
**Pixel B**



**R2B A**



**R2B B**





# THANK YOU

