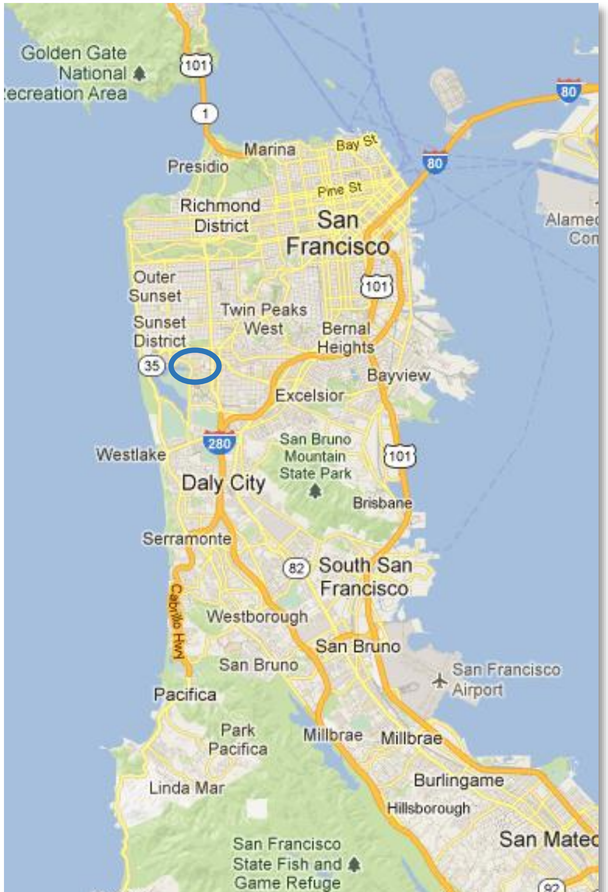
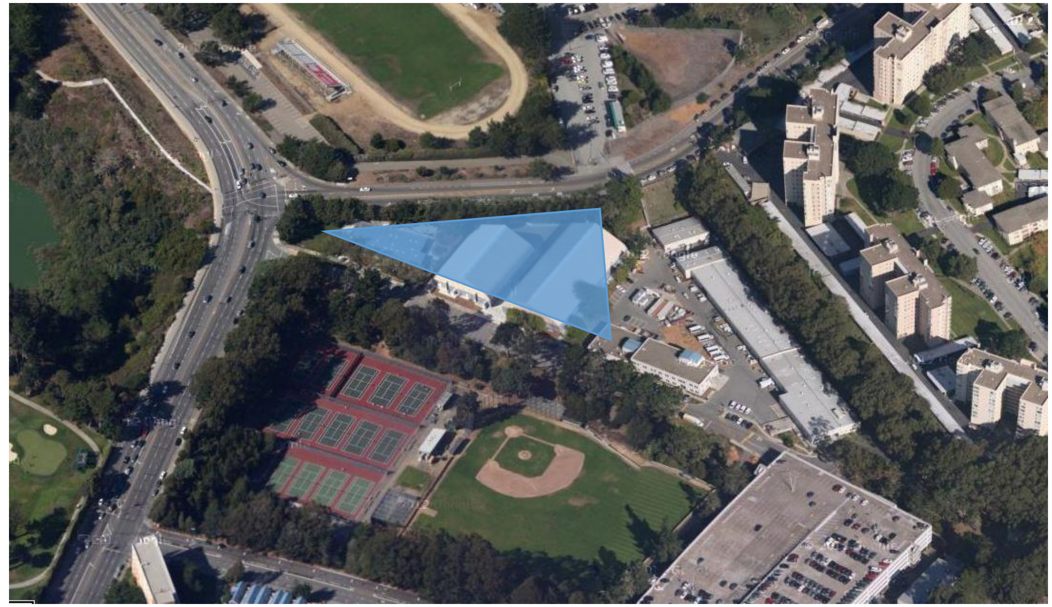
Pacific Team

Ethan Landy	**Sijia Tao**	**Mike Muller**	**Nolan Milord**	**Enrique Hernandez**	**Donata Trost**	**Bjarke Apollo-Andreasen**
MEP	Appr.	SE	CM	CM	SE	Arch

SITE OVERVIEW



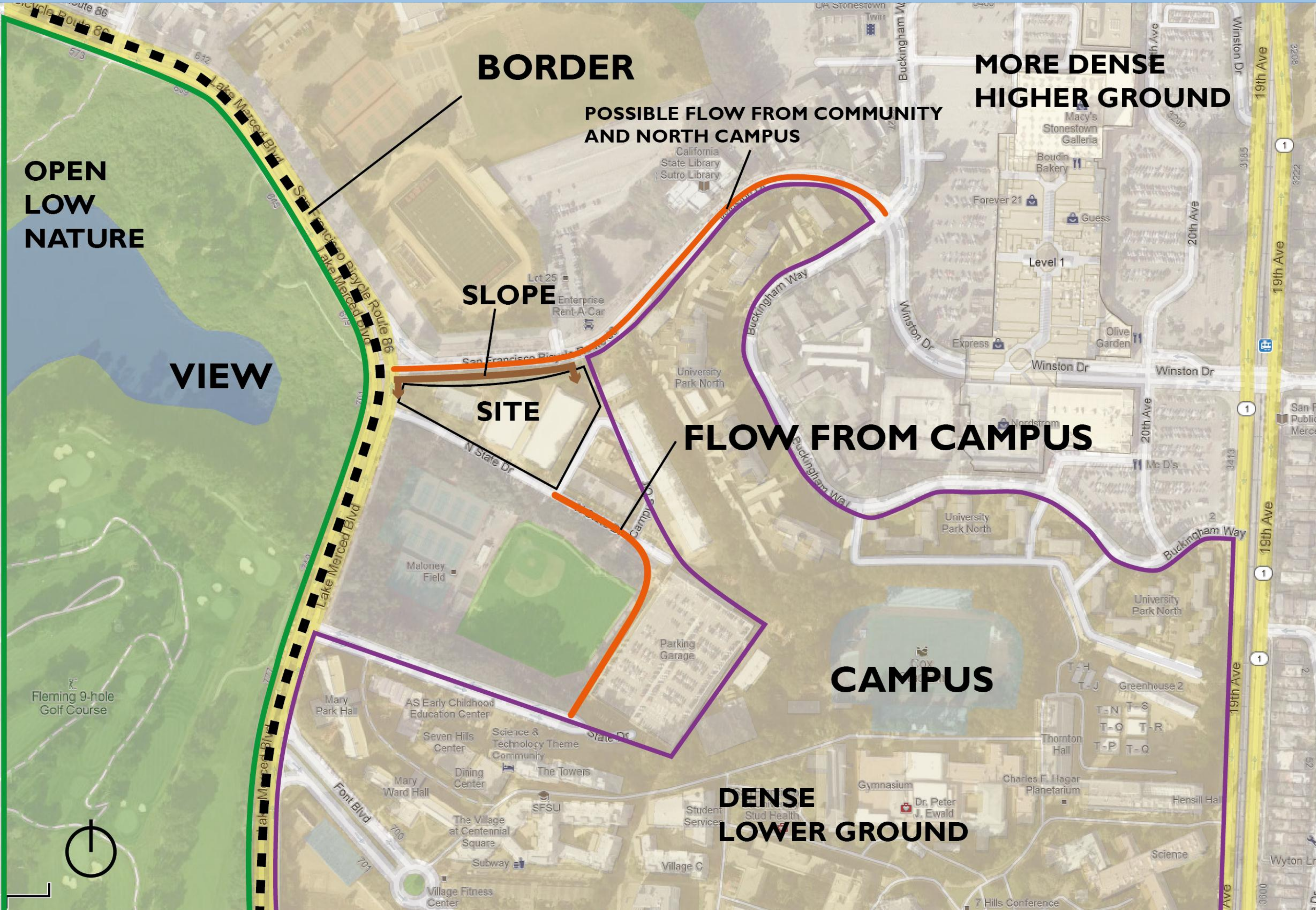


San Francisco
State University

San Francisco, CA

A MEP SE CM

SITE & ACCESS


BORDER
POSSIBLE FLOW FROM COMMUNITY AND NORTH CAMPUS
MORE DENSE HIGHER GROUND
OPEN LOW NATURE
SLOPE
VIEW
SITE
FLOW FROM CAMPUS
CAMPUS
DENSE LOWER GROUND

SITE CONDITIONS

Seismic

- S_s= 2.190 g
- S_1= 1.044 g

Soil

- NEHRP Site Class C
- Lateral Soil Pressure: 35 psf/ft
- Bearing Capacity: 3,500 psf
- Water table: 14' below grade
- Well-sorted fine-medium sand

Temperature

Summer Design Temperature:

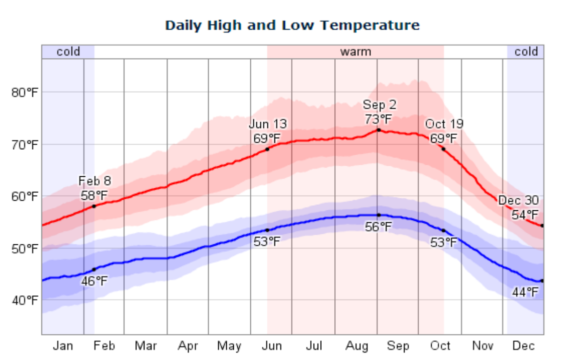
- 79˚F Dry Bulb
- 63˚F WB

Winter Design Temperature:

- 41˚F Dry Bulb

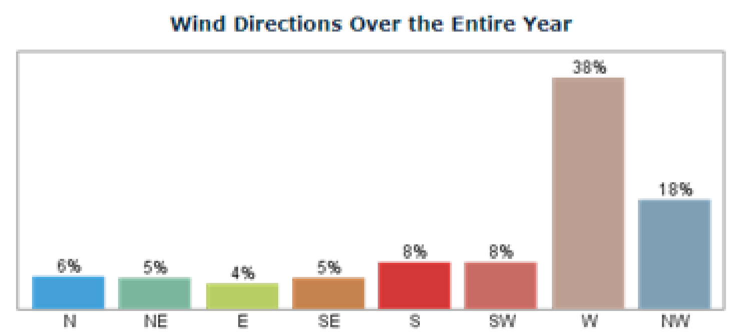
Relative Humidity

- 74% (Average)



Wind

- Average of 10-15 mph from the west



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EMBRACE

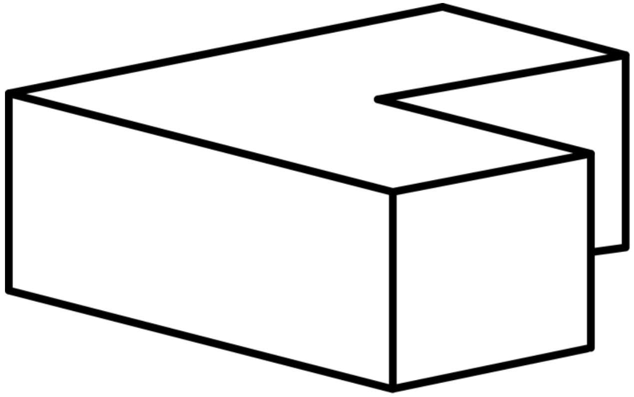
Embrace flow

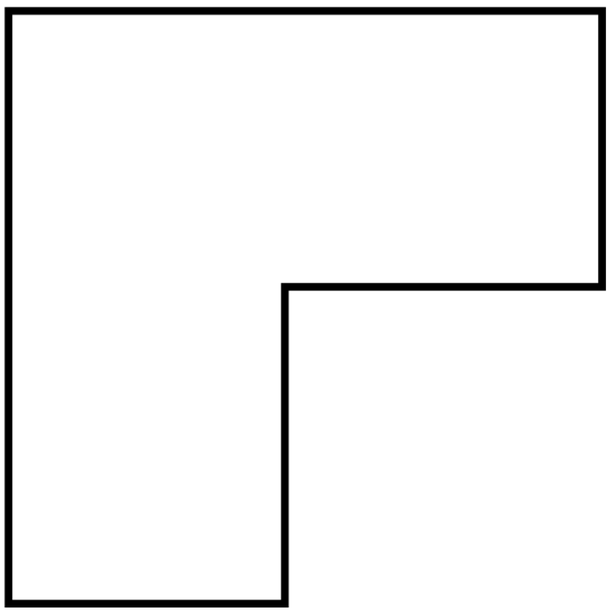
Embrace wind

Be a landmark

A MEP SE CM

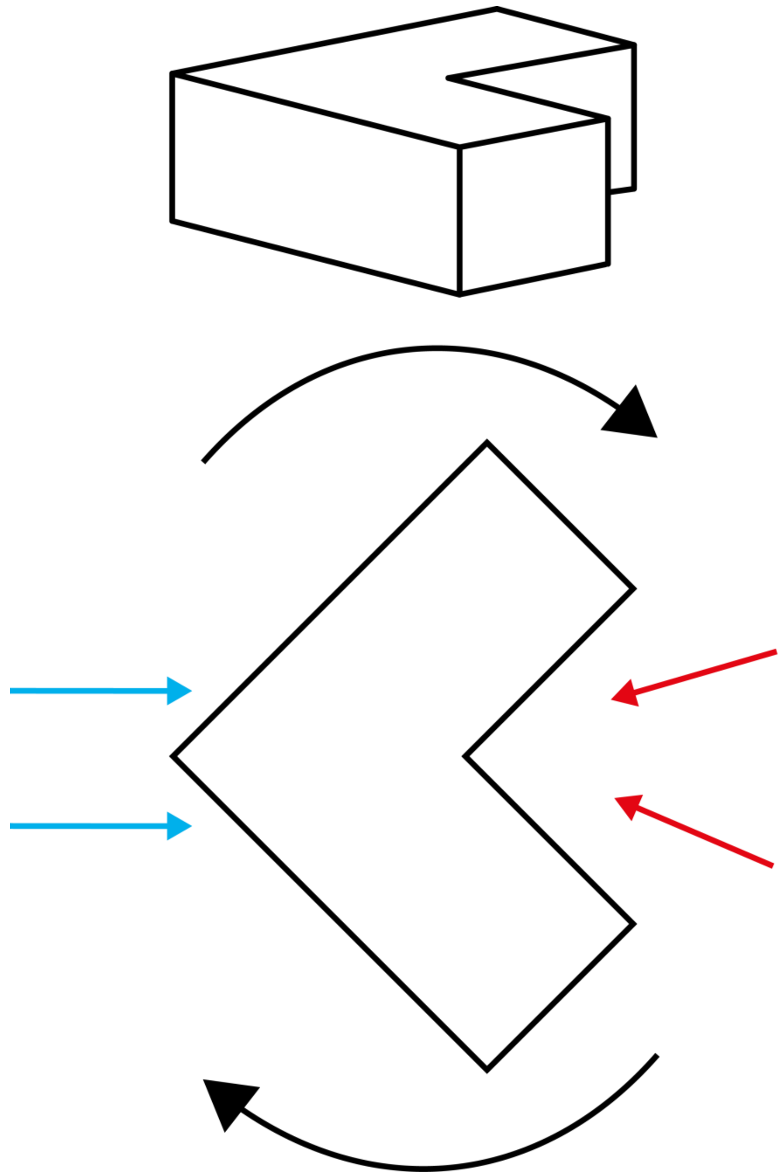
ITERATIONS





WIND & CAMPUS FLOW

A + MEP



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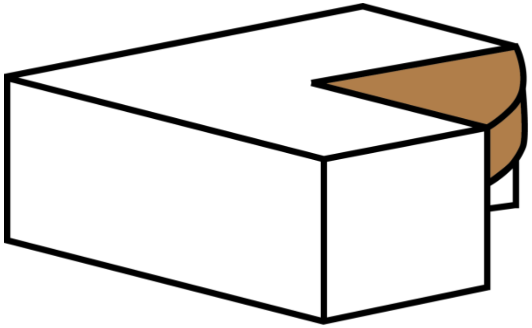
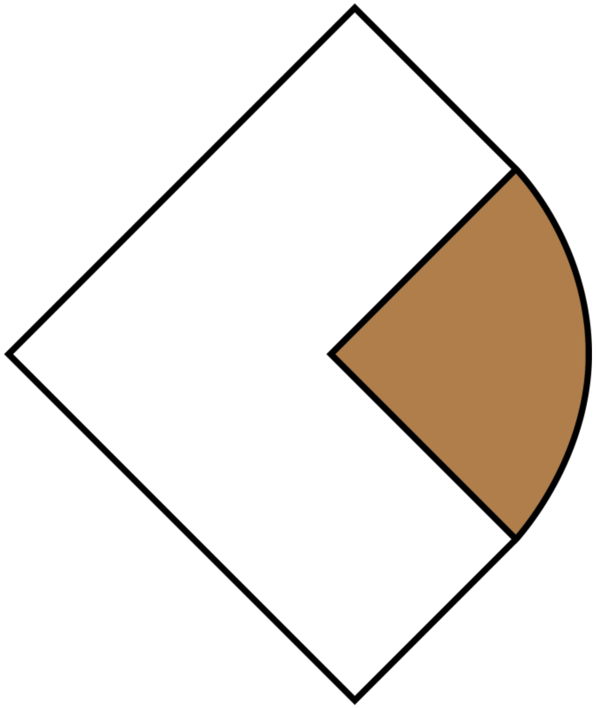
TIMBER AUDITORIUM

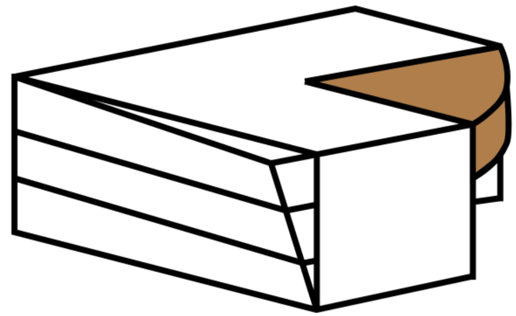
A + SE

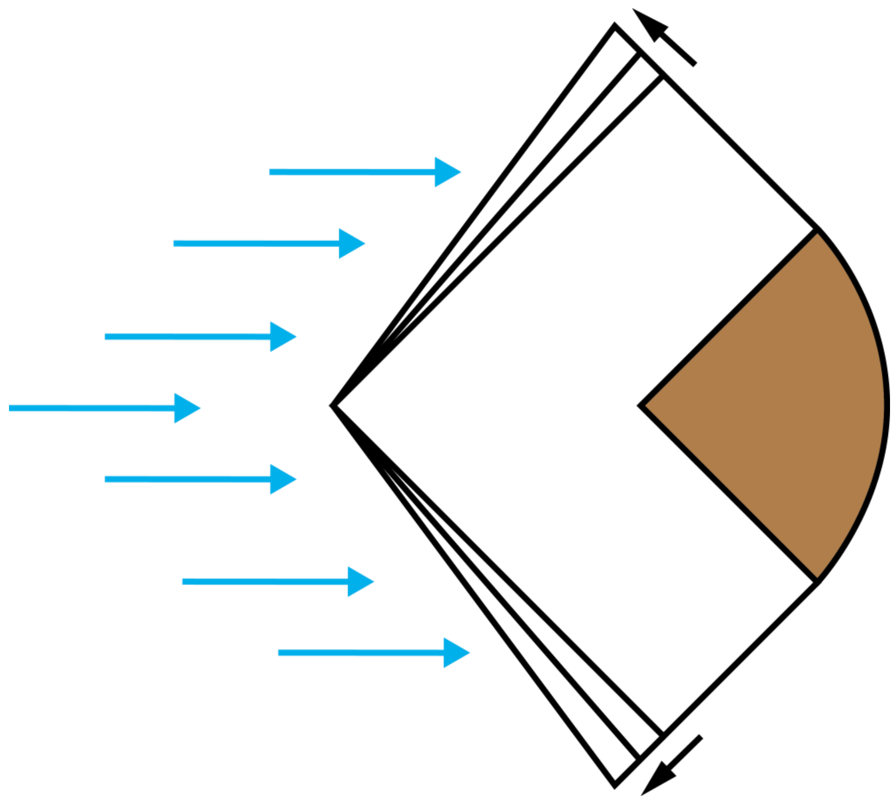




EXTRUSION OF FACADE

A + MEP + SE





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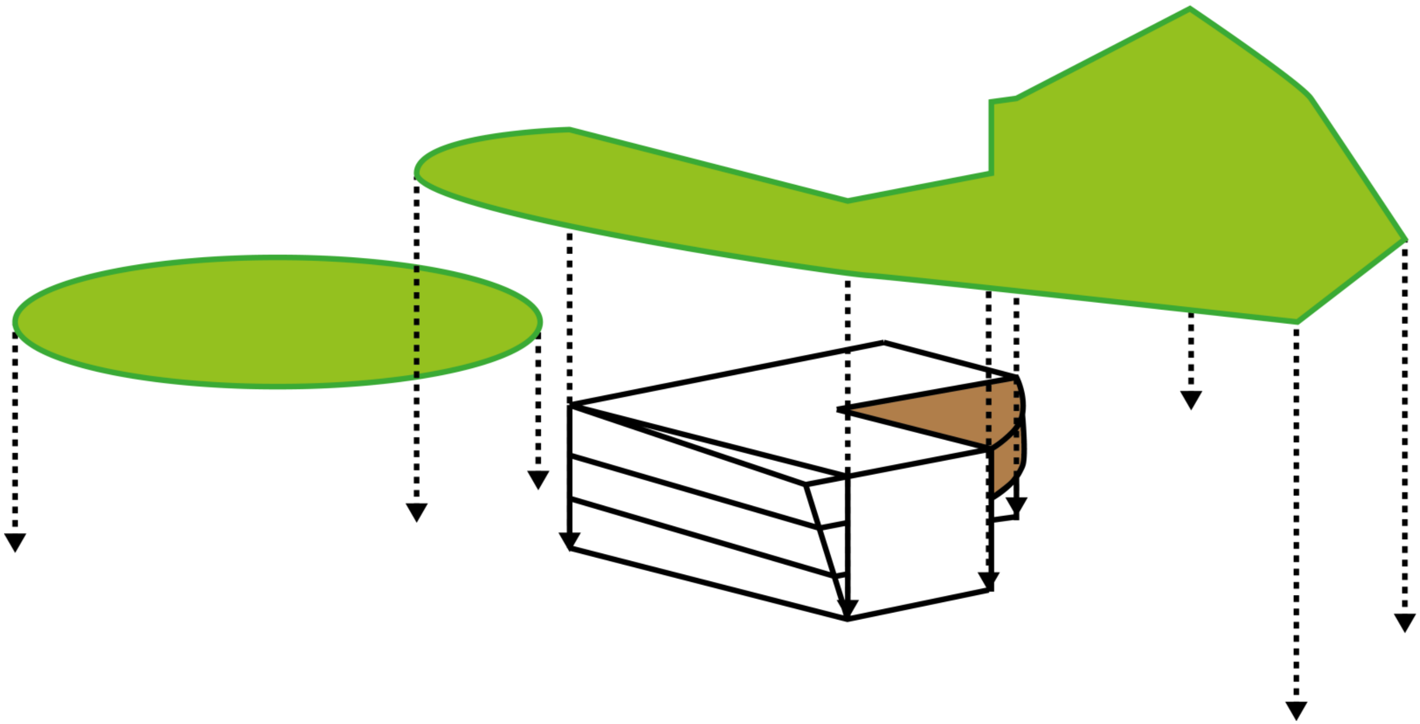
THE SURROUNDING AREA



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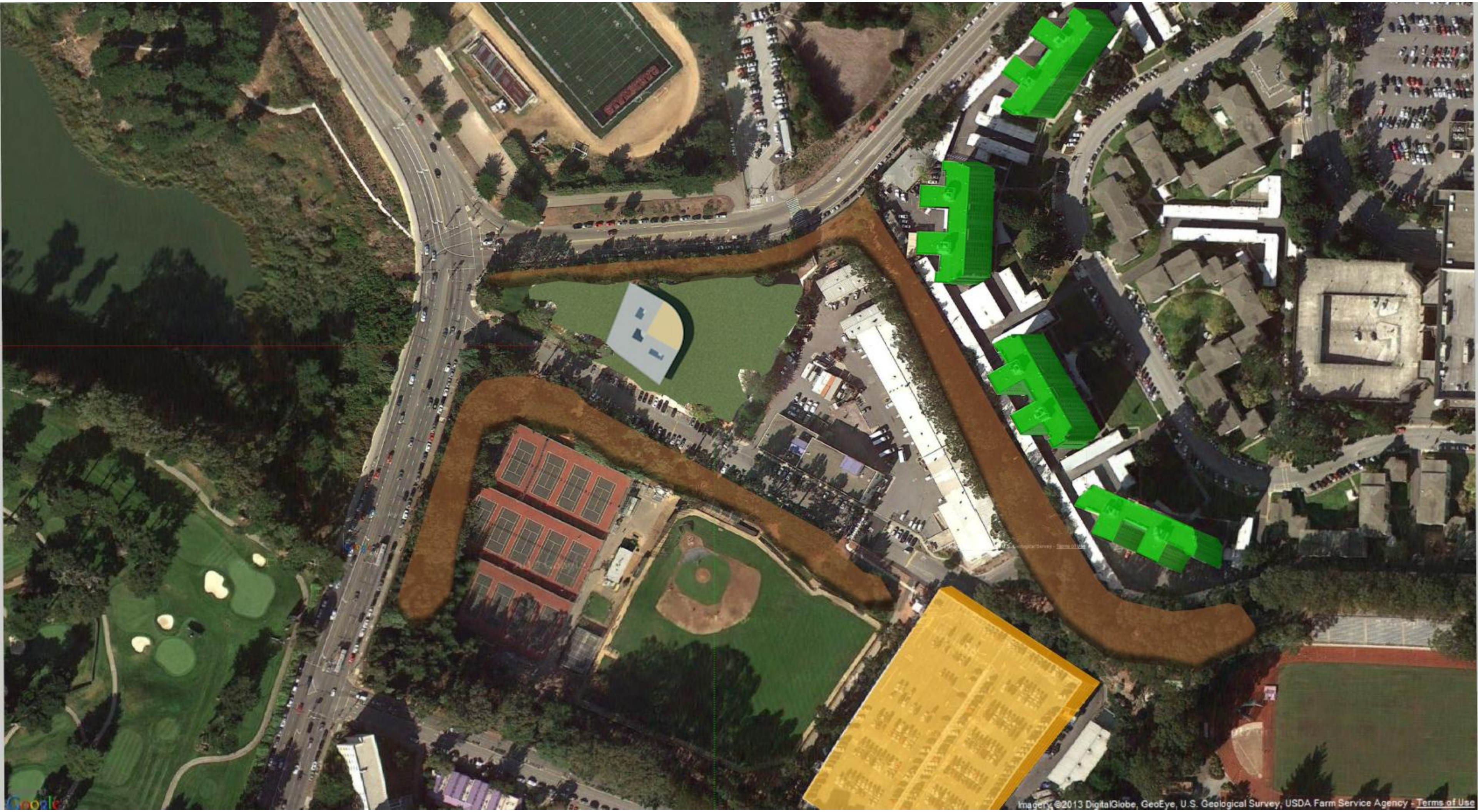
SITE PLAN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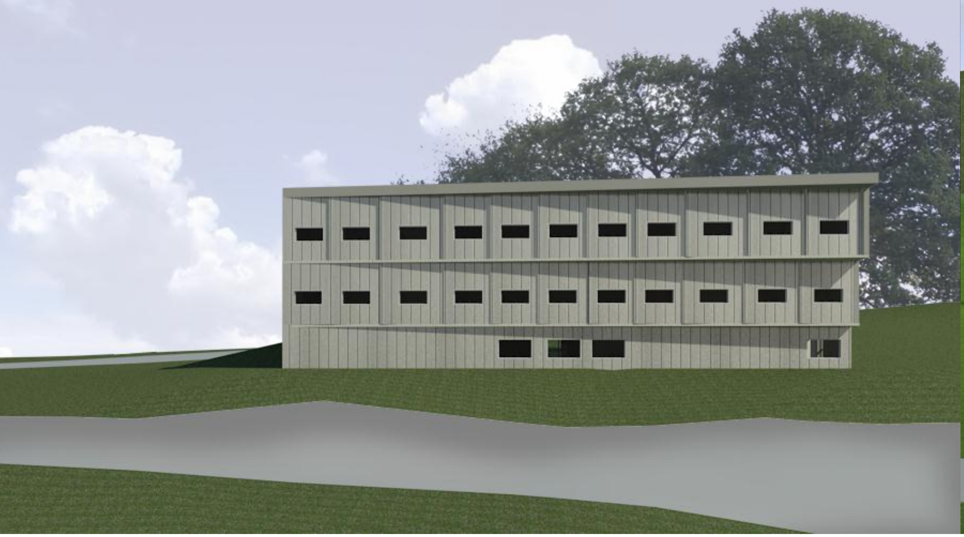
RENDERS



South

West

East

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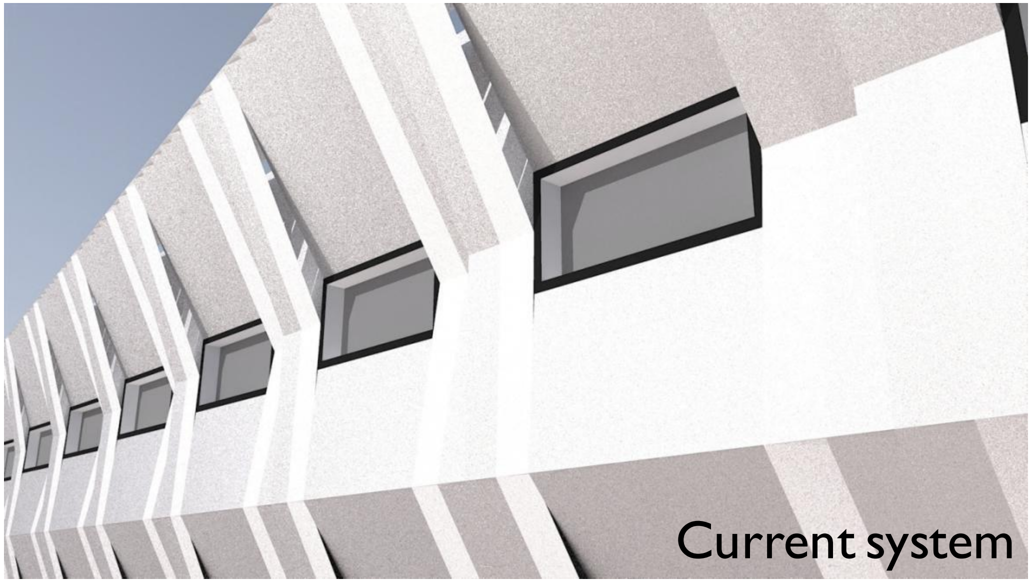
FACADE SYSTEM



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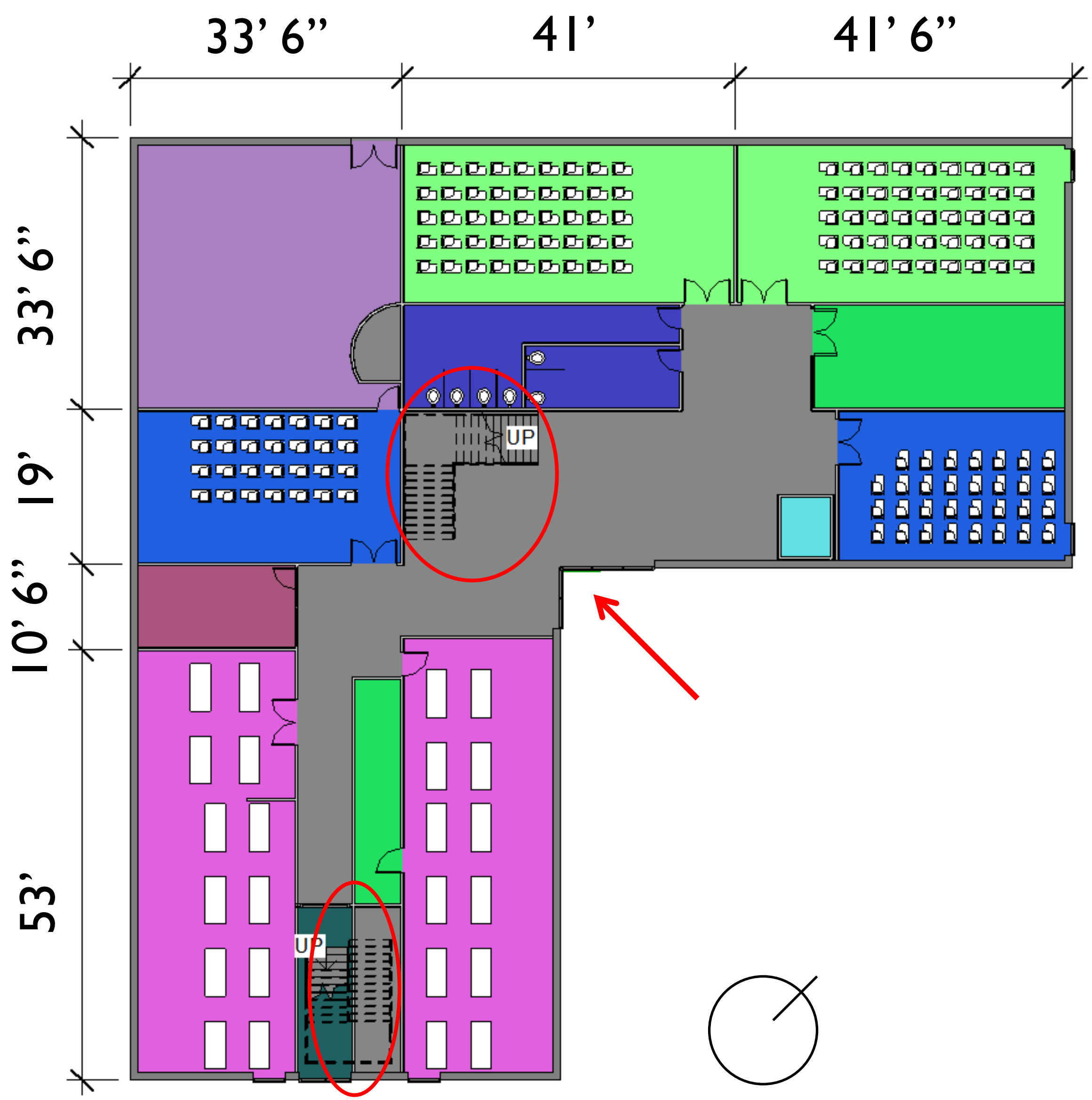
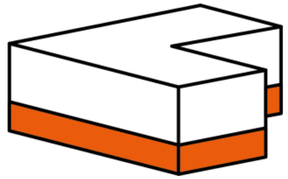
GROUND FLOOR





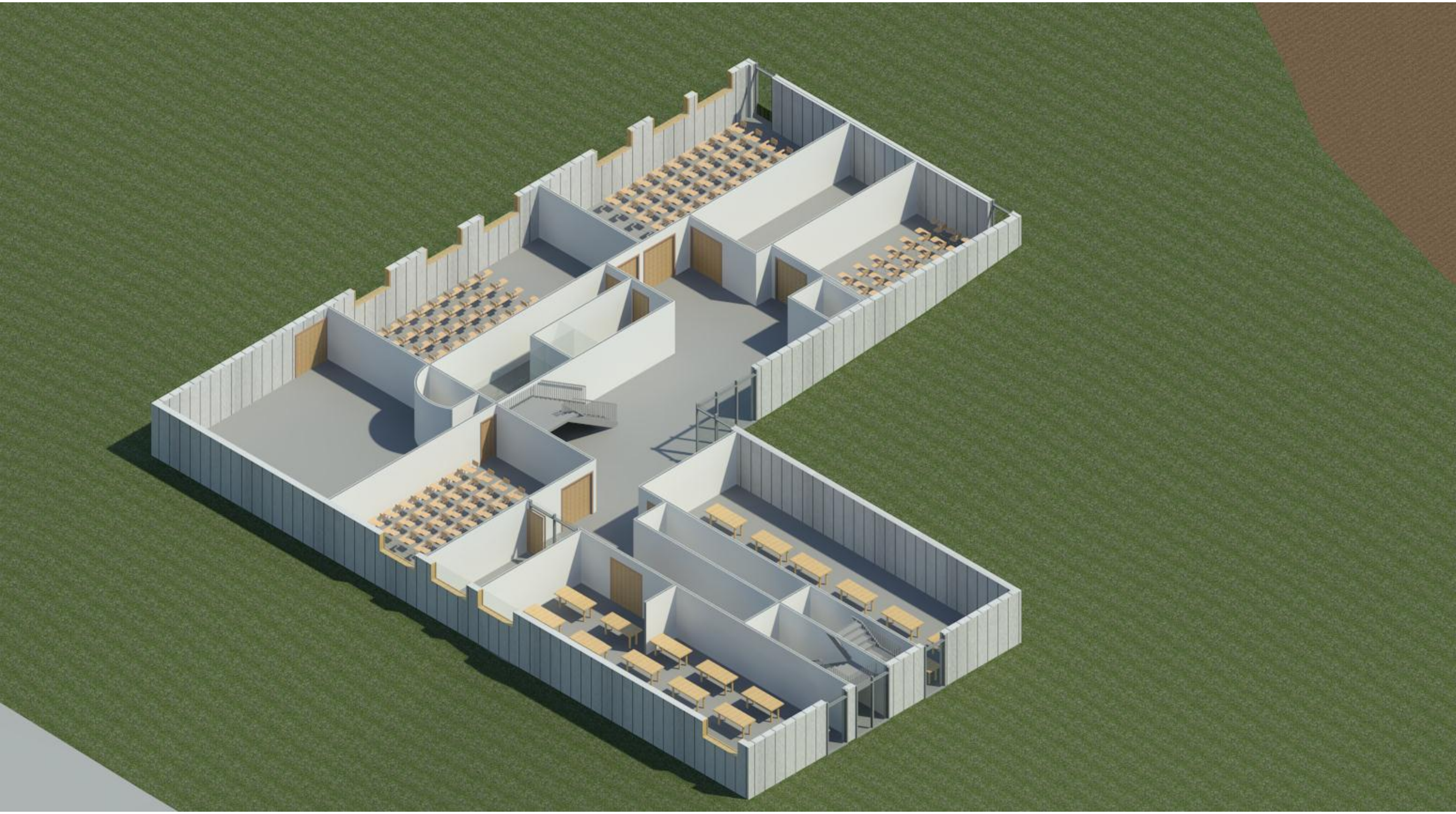
Department Legend

- Computer labs
- Elevator
- Large Classroom
- Mechanical room
- Restroom
- Small Classroom
- Staircase
- Storage
- Technical Support

A MEP SE CM

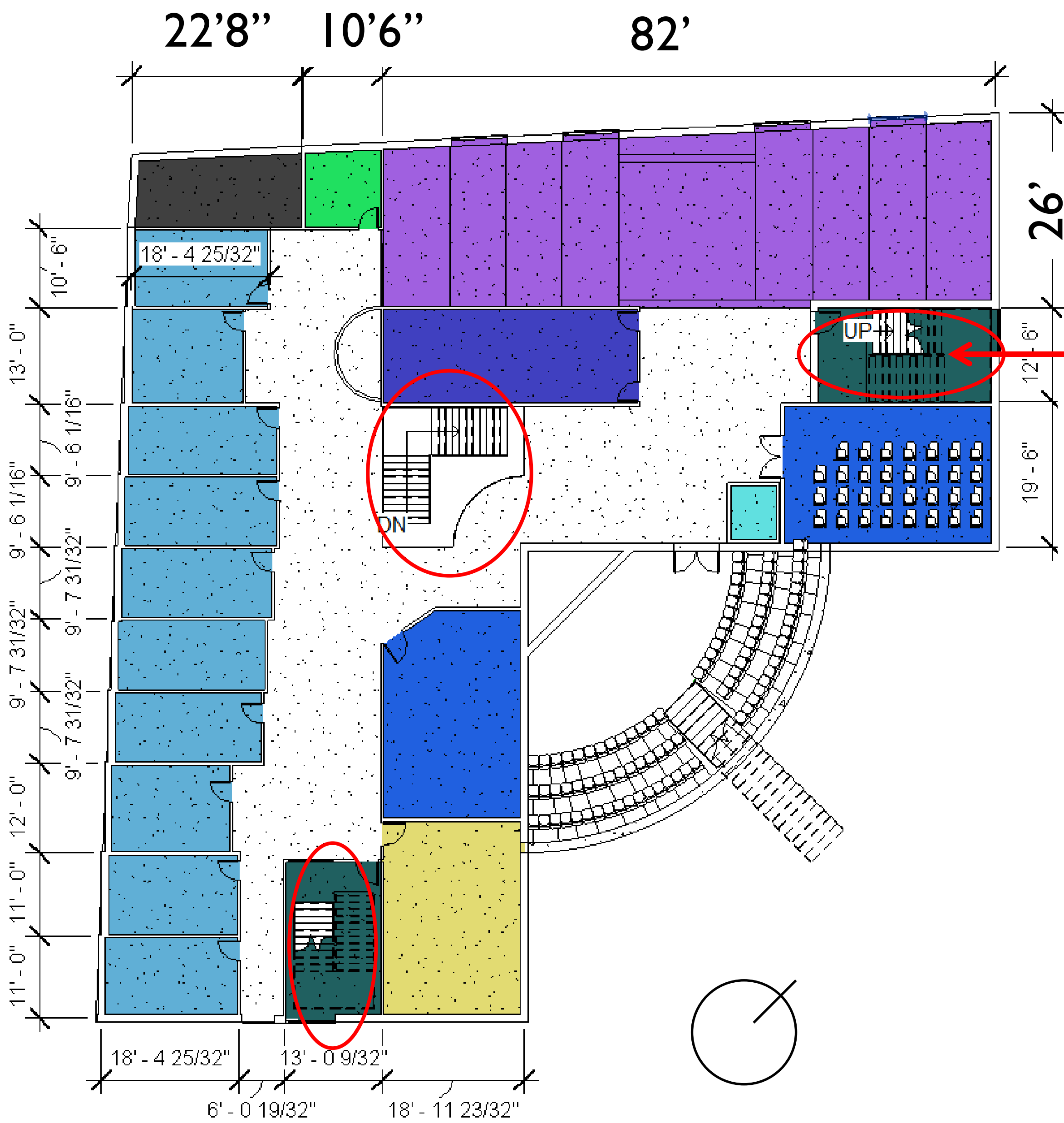
GROUND FLOOR

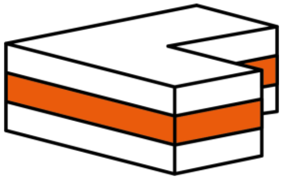
View From South



A MEP SE CM

FIRST FLOOR





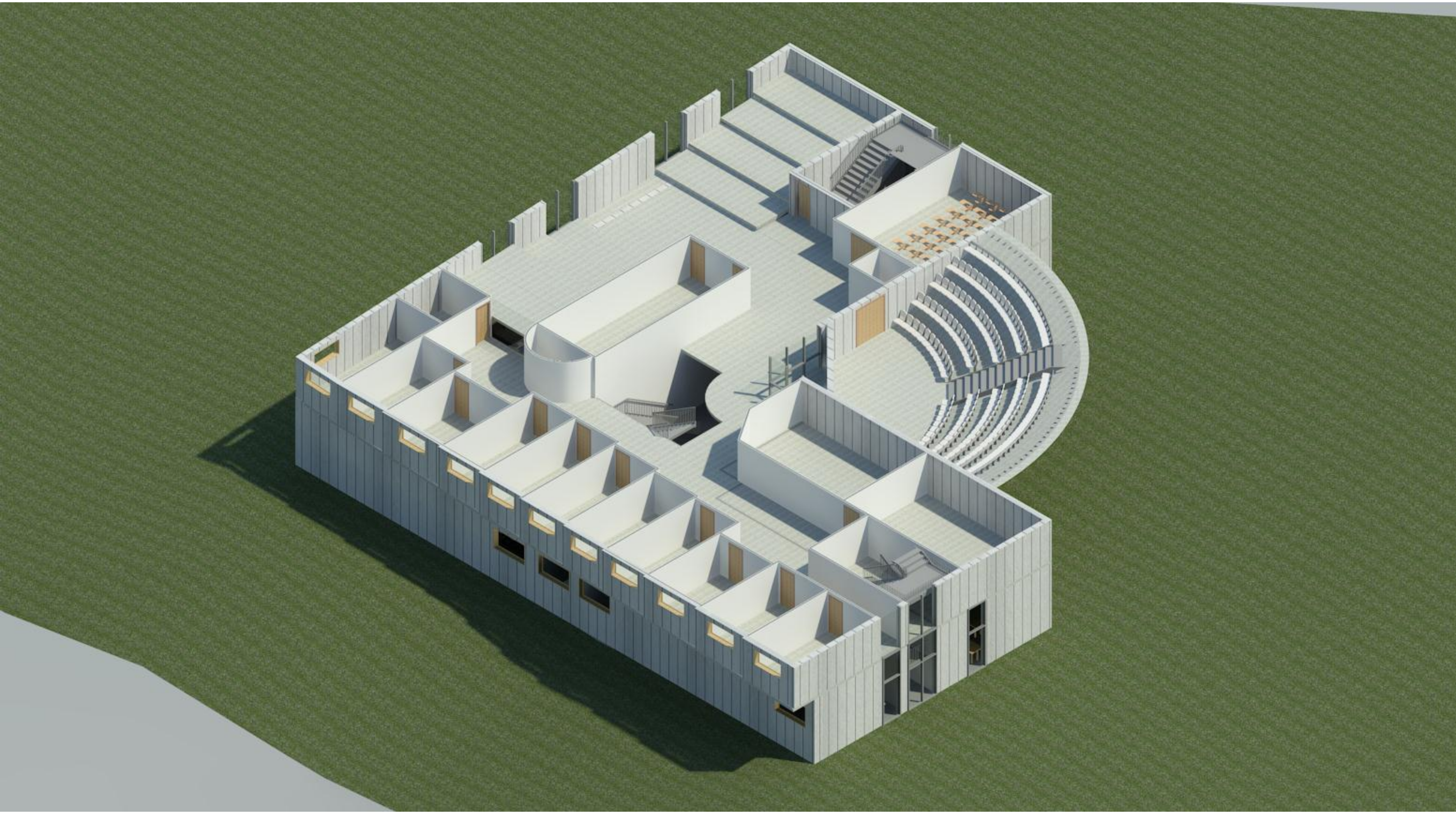
Department Legend

- Auditorium
- Elevator
- Faculty Lounge
- Faculty
- Restroom
- Seminar
- Seminar and student - flexible
- Small Classroom
- Staircase
- Storage

A MEP SE CM

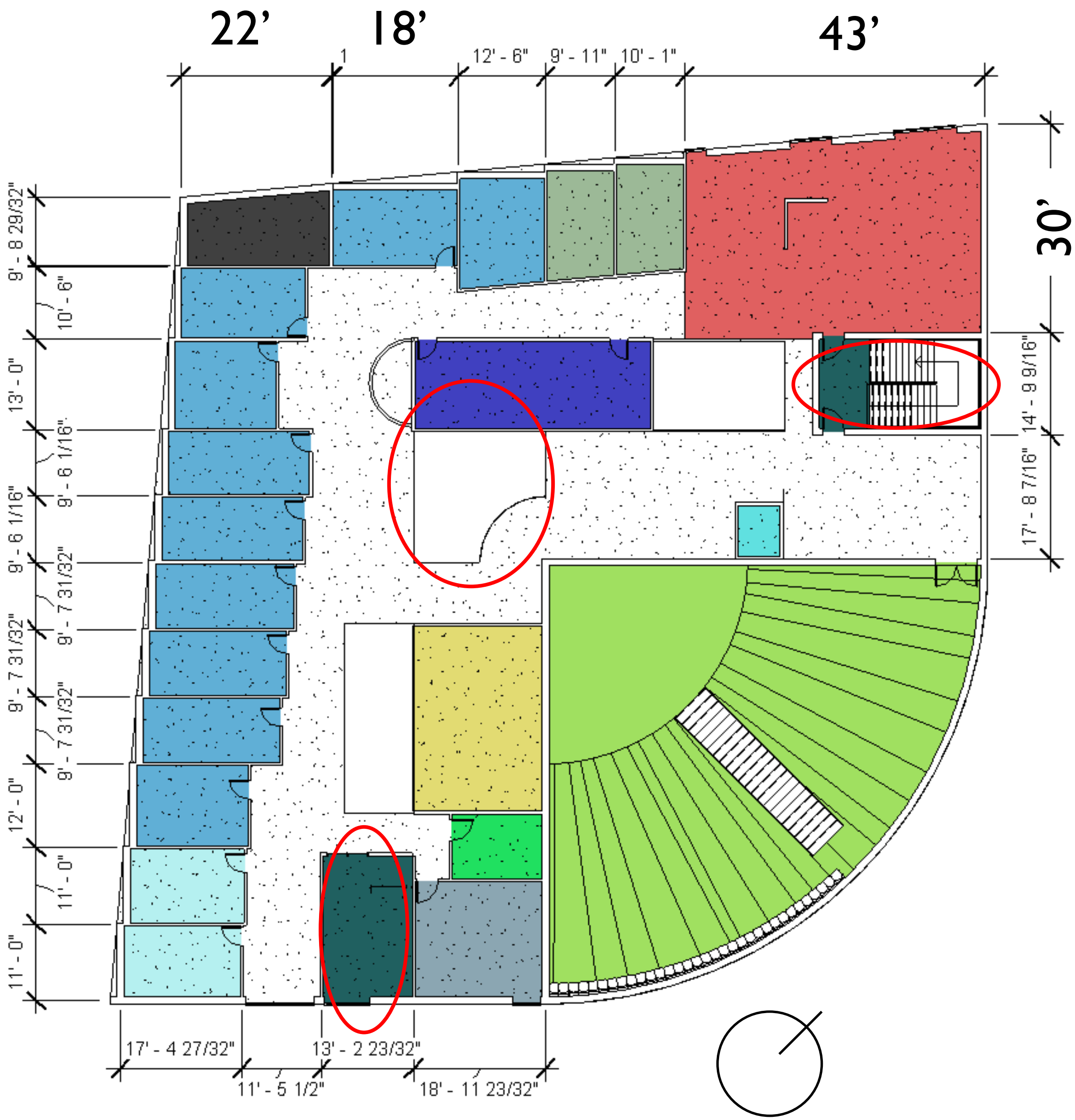
FIRST FLOOR

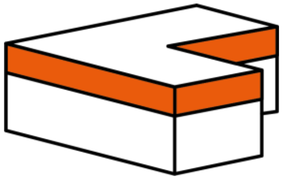
View From South



A MEP SE CM

SECOND FLOOR





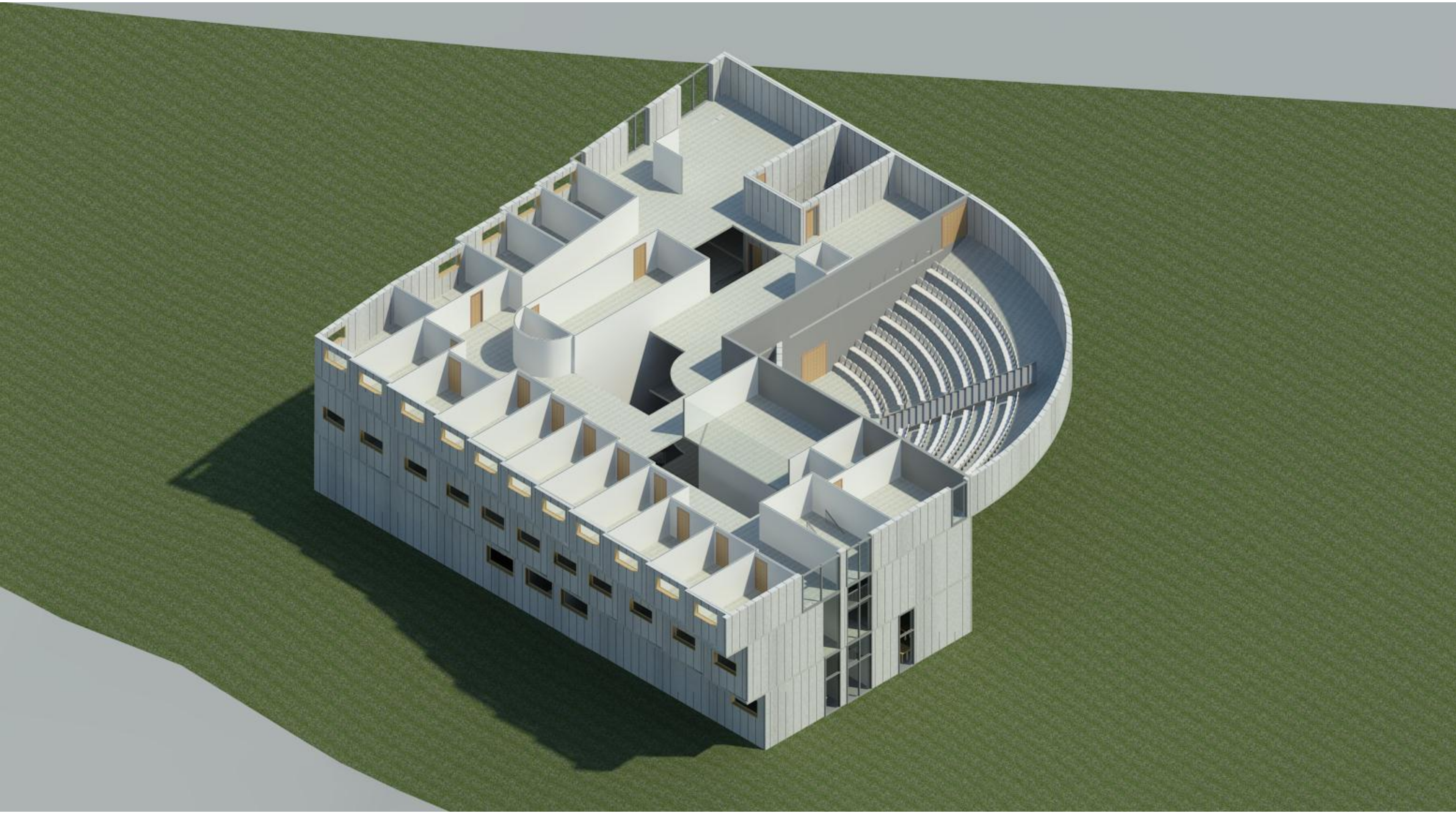
Department Legend

- Adm Assistant
- Auditorium
- Chairman
- Elevator
- Faculty Lounge
- Faculty
- Restroom
- Seminar
- Senior
- Staircase
- Storage
- Student

A MEP SE CM

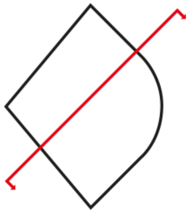
SECOND FLOOR

View From South



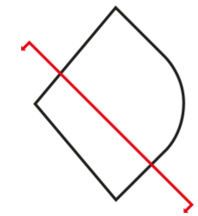
A MEP SE CM

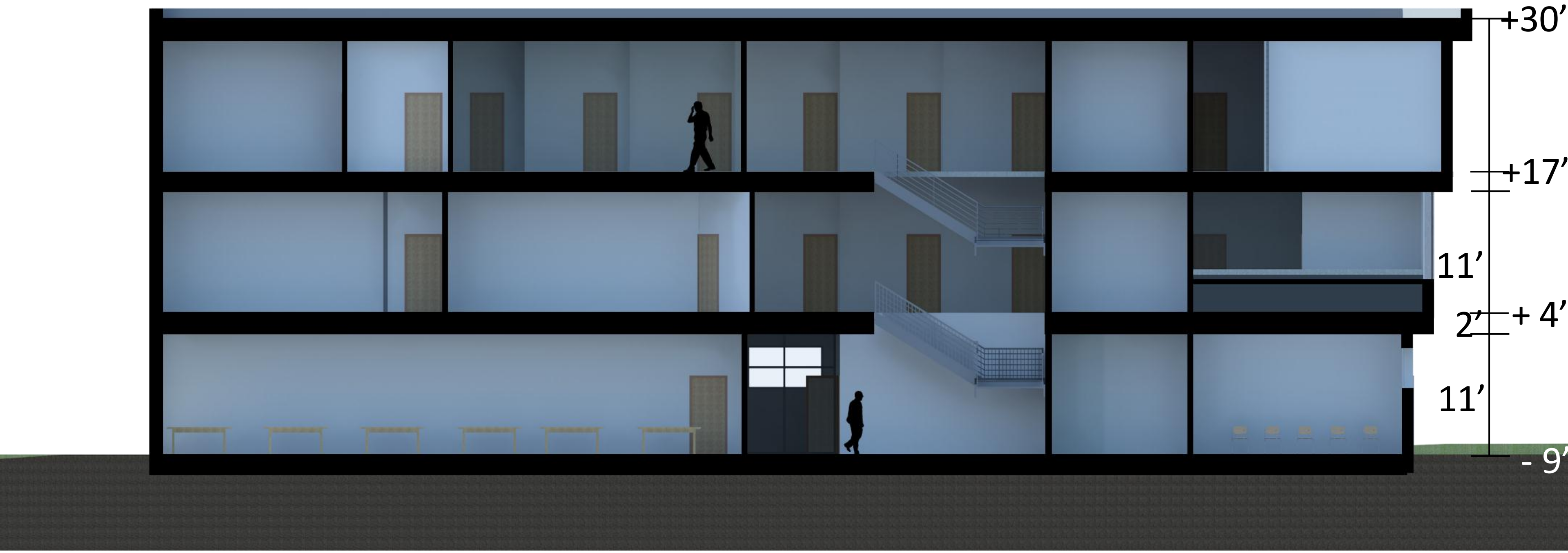
SECTION THROUGH AUDITORIUM



A MEP SE CM

SECTION THROUGH MAIN STAIRCASE





A MEP SE CM

COMFORT & DESIGN TARGETS

Summer Design Conditions (0.5%)

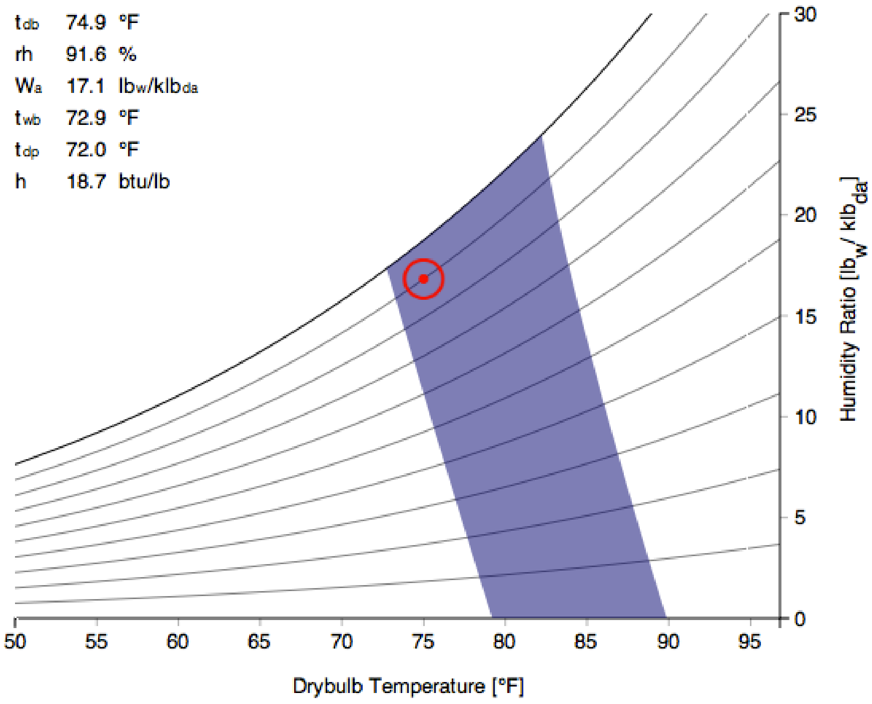
- 79˚F Dry Bulb
- 63˚F WB

Winter Design Conditions (0.2%)

- 41˚F Dry Bulb

Relative Humidity

- 74% (Average)



Indoor Design Targets
(+/- 0.5 PMV, ASHRAE 55-2010)

- **Summer:**
  - 74˚F Dry Bulb
  - 52 fpm (max)
  - Clo = 0.5
- **Winter:**
  - 68˚F Dry Bulb
  - 76 fpm (max)
  - Clo = 1.1
- Max Relative Humidity: 90%
- Met = 1.2

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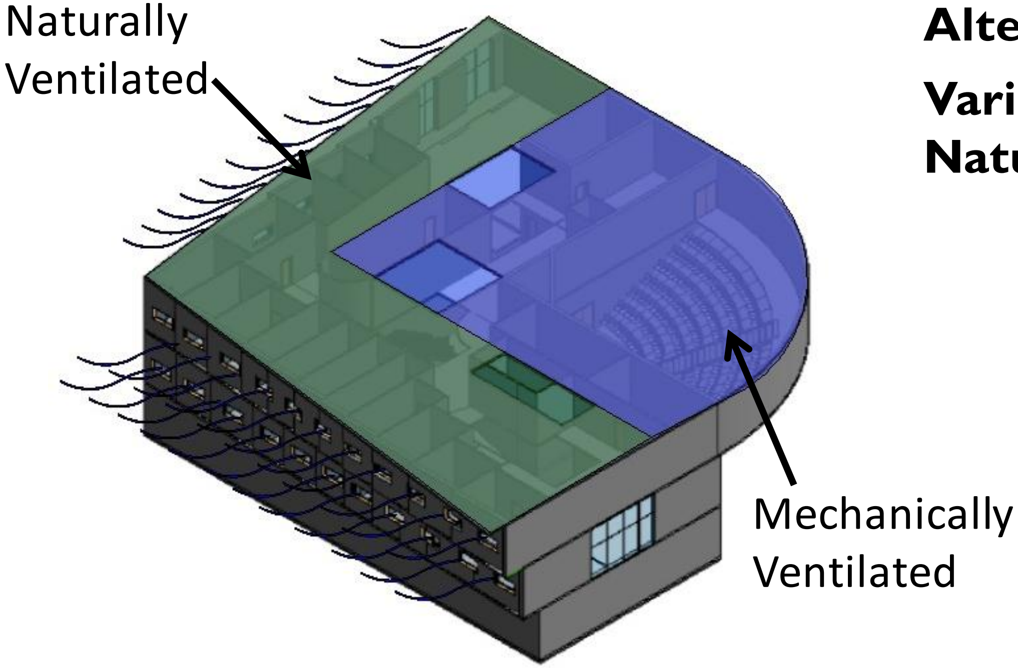
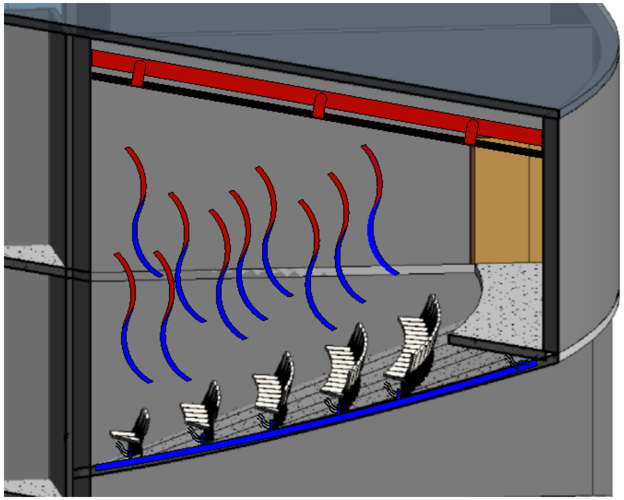
VAV & NATURAL VENTILATION



Alternative 1:

Variable Air Volume (VAV) – Natural Ventilation Hybrid System

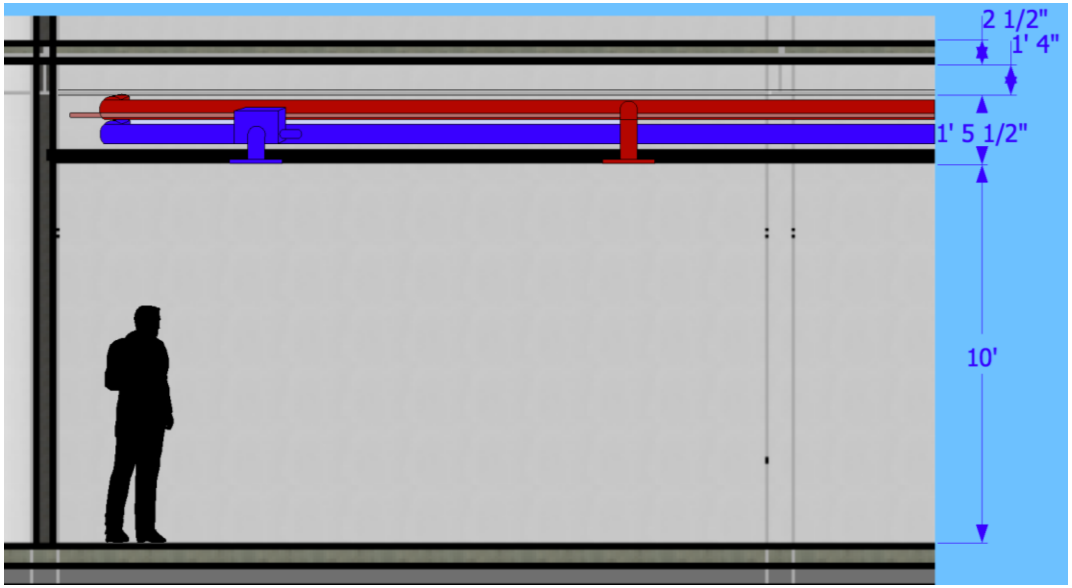


MEP SE CM

VAV / HYBRID - SECTION

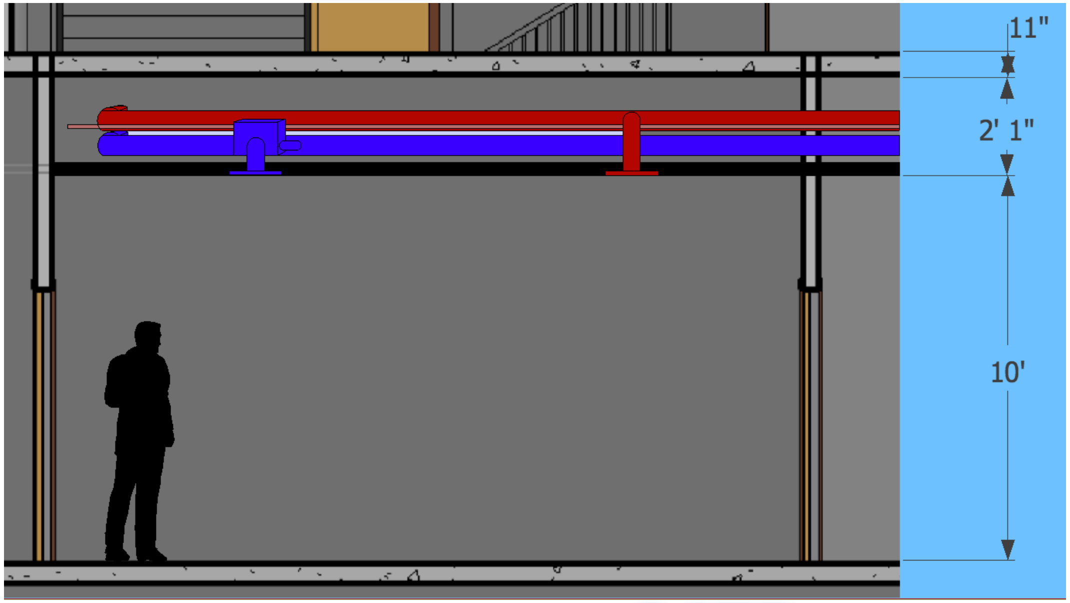
A MEP SE CM

VAV/HYBRID – FLOOR SANDWICHES



Steel Structural System

Concrete Structural System



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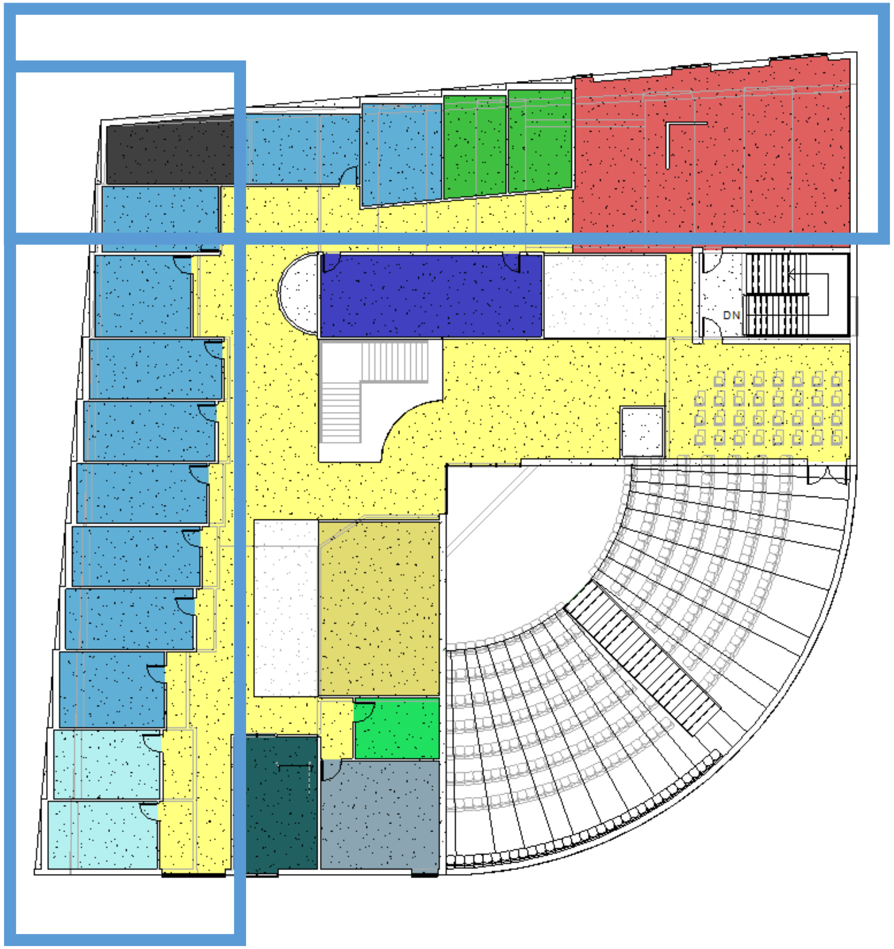
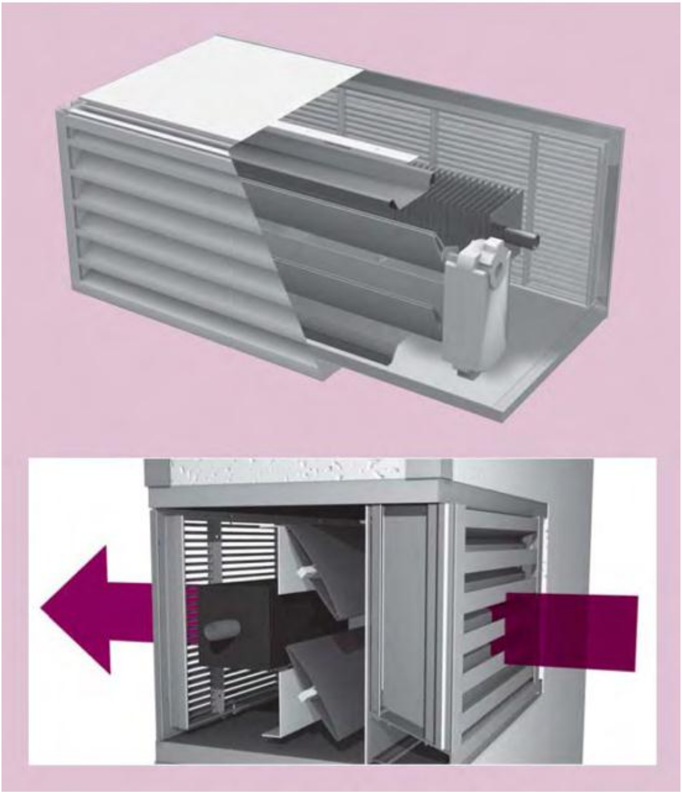
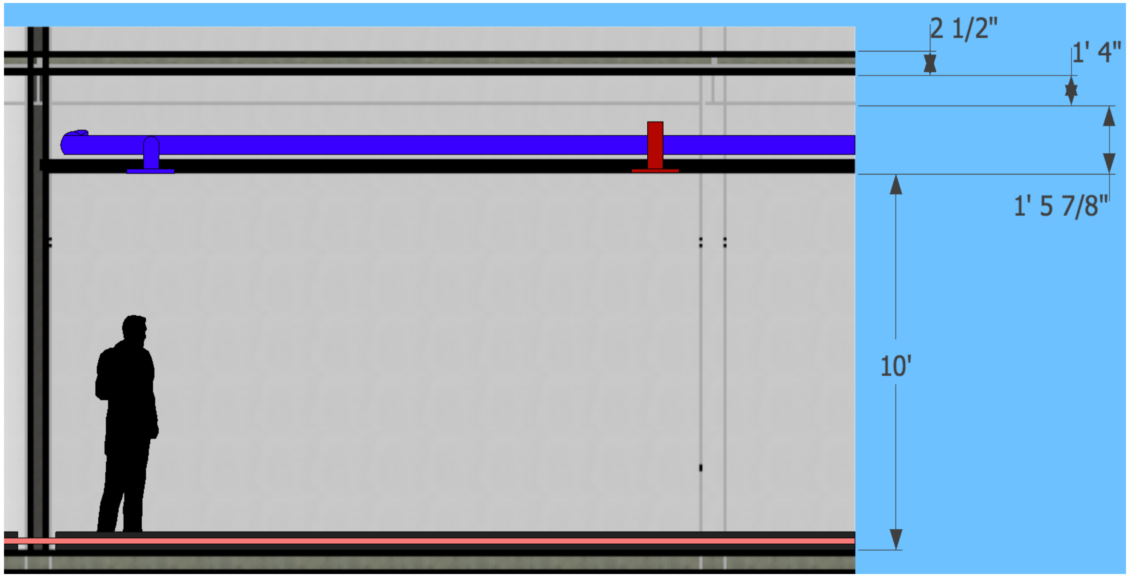
HYDRONIC SYSTEM

Alternative 2: Hydronic Heating with DOAS / Trickle Ventilation



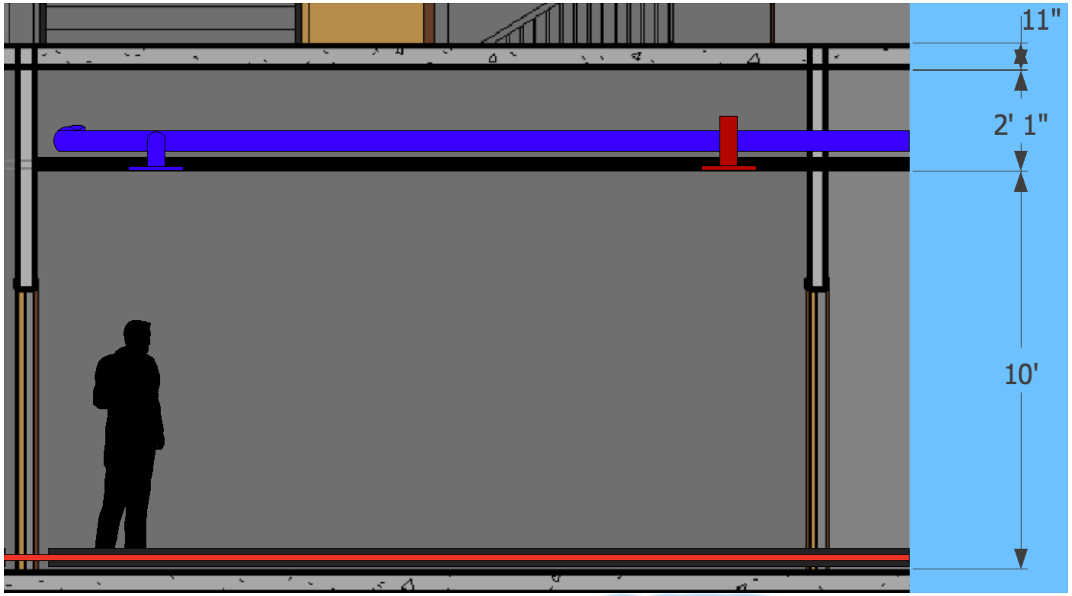


HYDRONIC – FLOOR SANDWICHES



Steel Structural System

Concrete Structural System

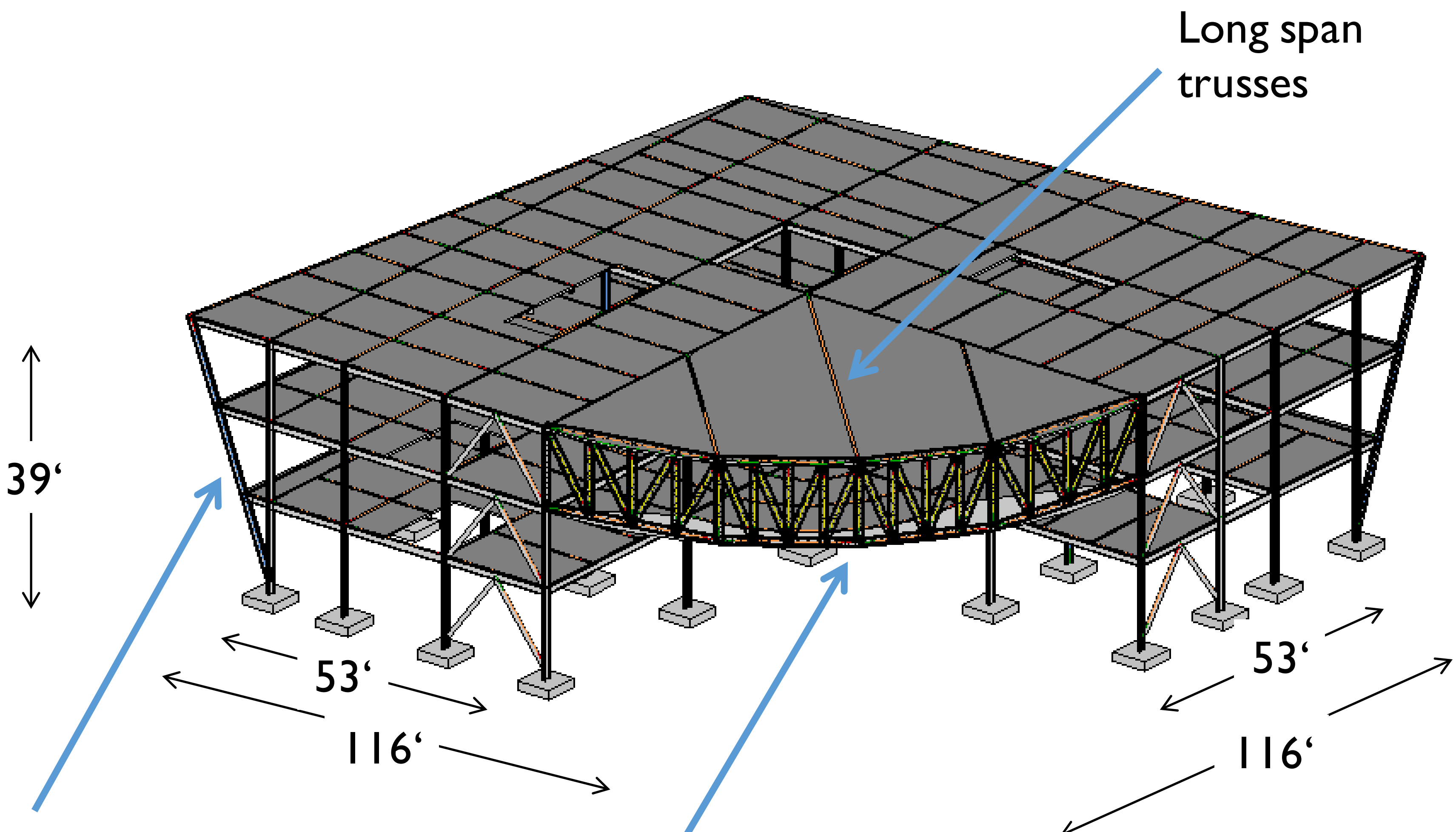


A MEP SE CM

GRAVITY LOADS

Occupancy/ Use	Uniform psf
office	50
classroom	40
large classroom	60
assembly area (fixed seats)	60
assembly areas (movable seats)	100
computer lab	100
lobby/access floor systems	100
corridors (1st floor)	100
corridors above	80
storage (light)	125
storage (heavy)	250
roof (garden)	100
roof (assembly)	60
roof (ordinary)	20
restrooms	50
construction	20

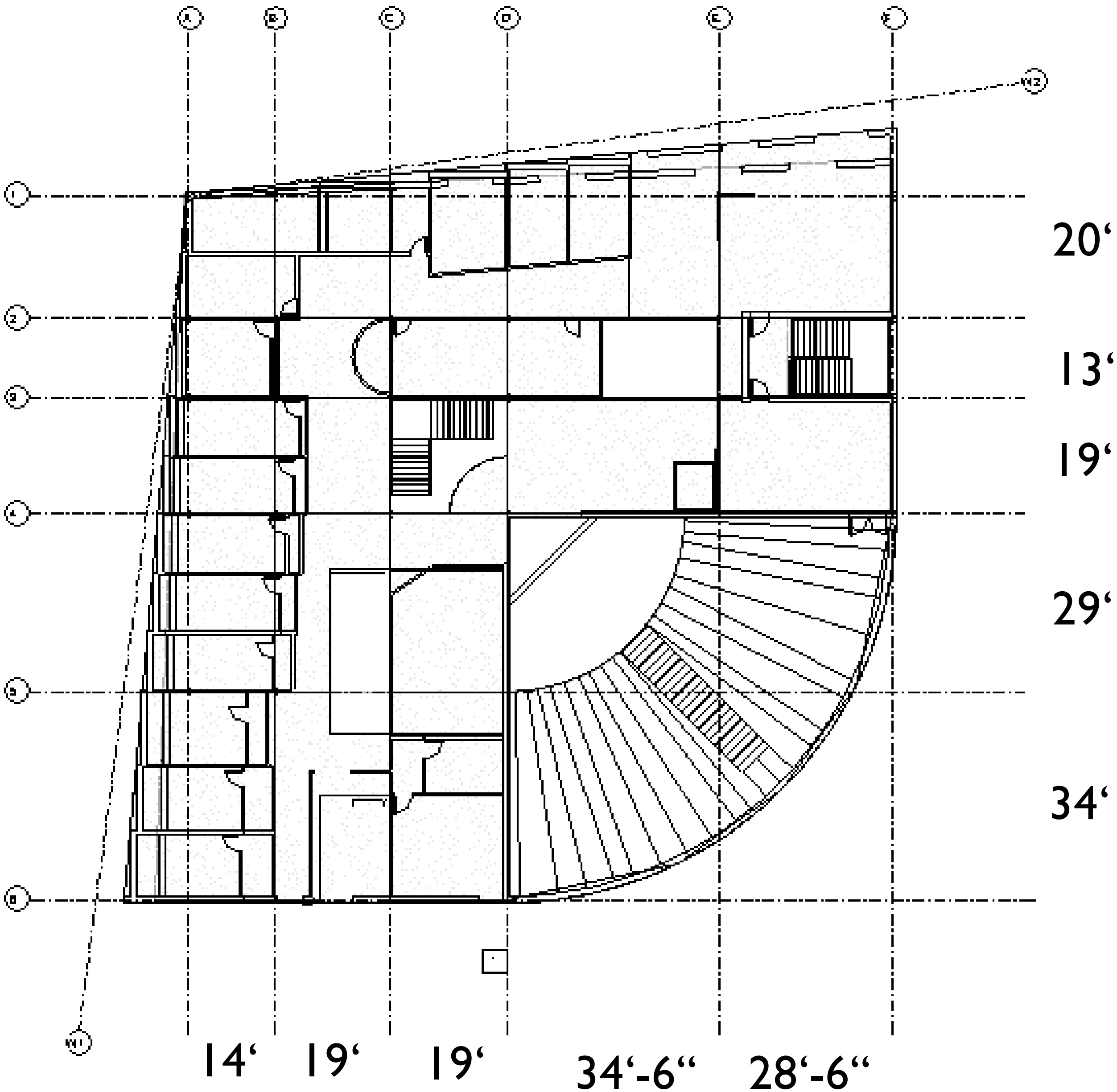
COMPOSITE STEEL DECK SYSTEM



Slanted W shape columns on north/ west facades

Auditorium supported by sloped floor and curved Pratt truss (floor to ceiling)

TYPICAL GRID & OVERLAY



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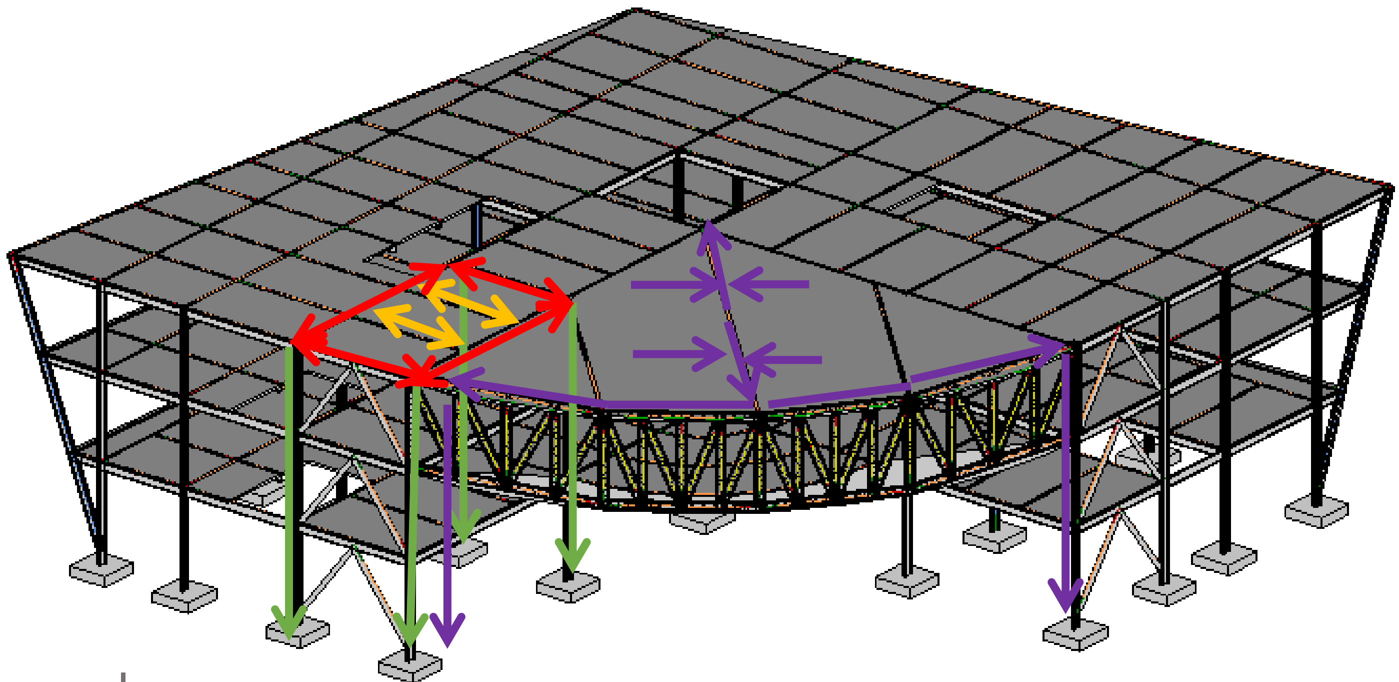
GRAVITY SYSTEM



Composite metal deck panels

- 2VLI20 Vulcraft deck with 2.5" LW concrete overlay, fire protected gypsum board

Filler beams

- W14x48 typ.
- Longest span 20'

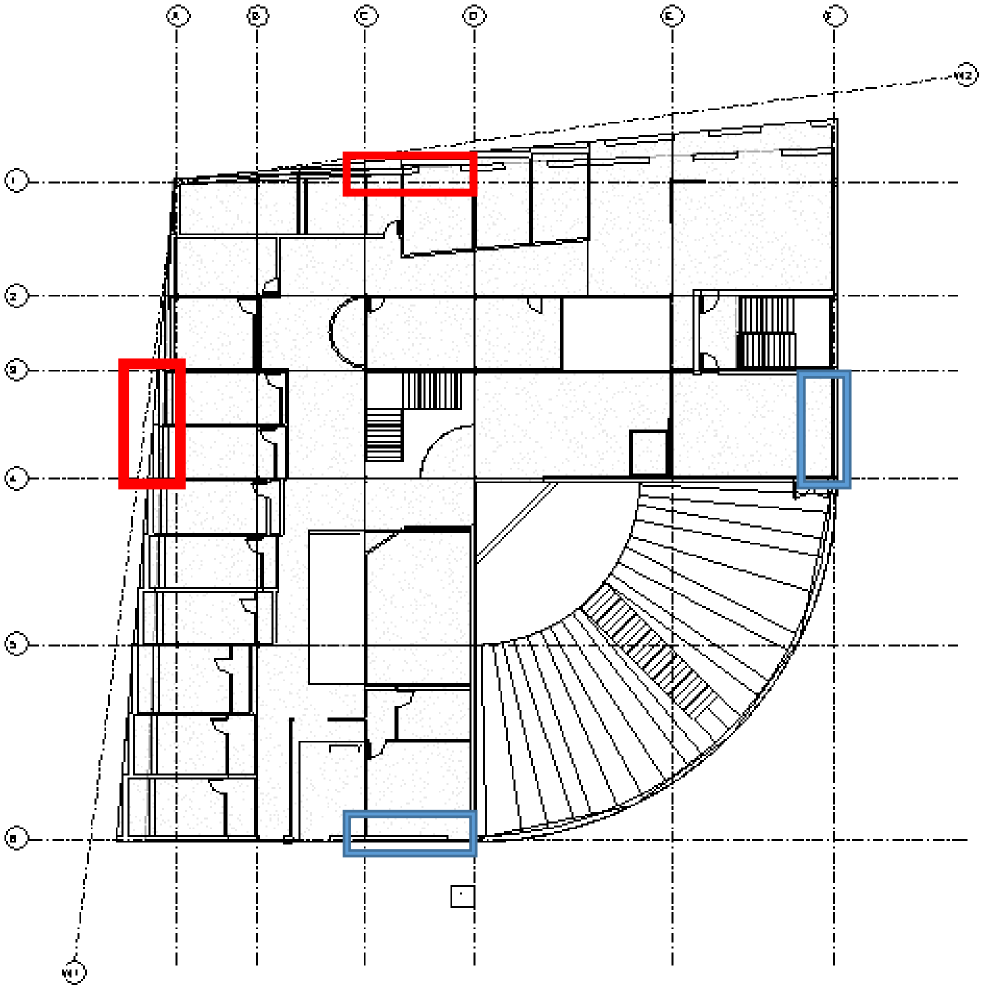
Girders

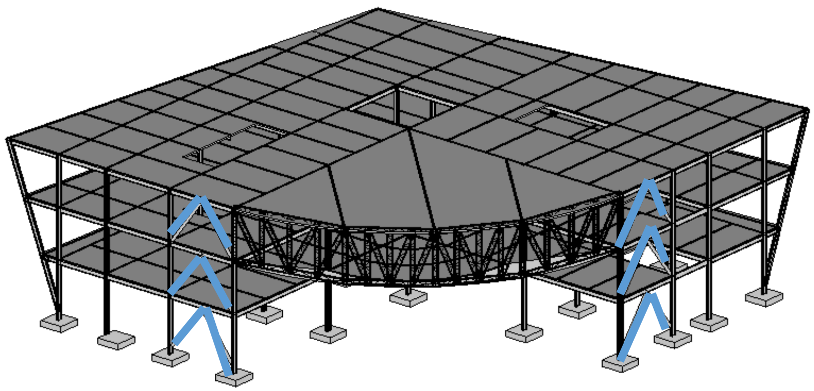
- W21x62 typ.
- Longest span 34'

Columns

- W14x48 typ.
- Three 13' floors, 41' total (one column)

LATERAL SYSTEM





BRBF

- 3 in^2 steel core
- A36 steel

SMRF

- W30x116 largest beam
- W18x130 largest column
- RBS employed

- Dual system is both stiff and ductile
- Torsion controlled
- SMRF because slanted columns

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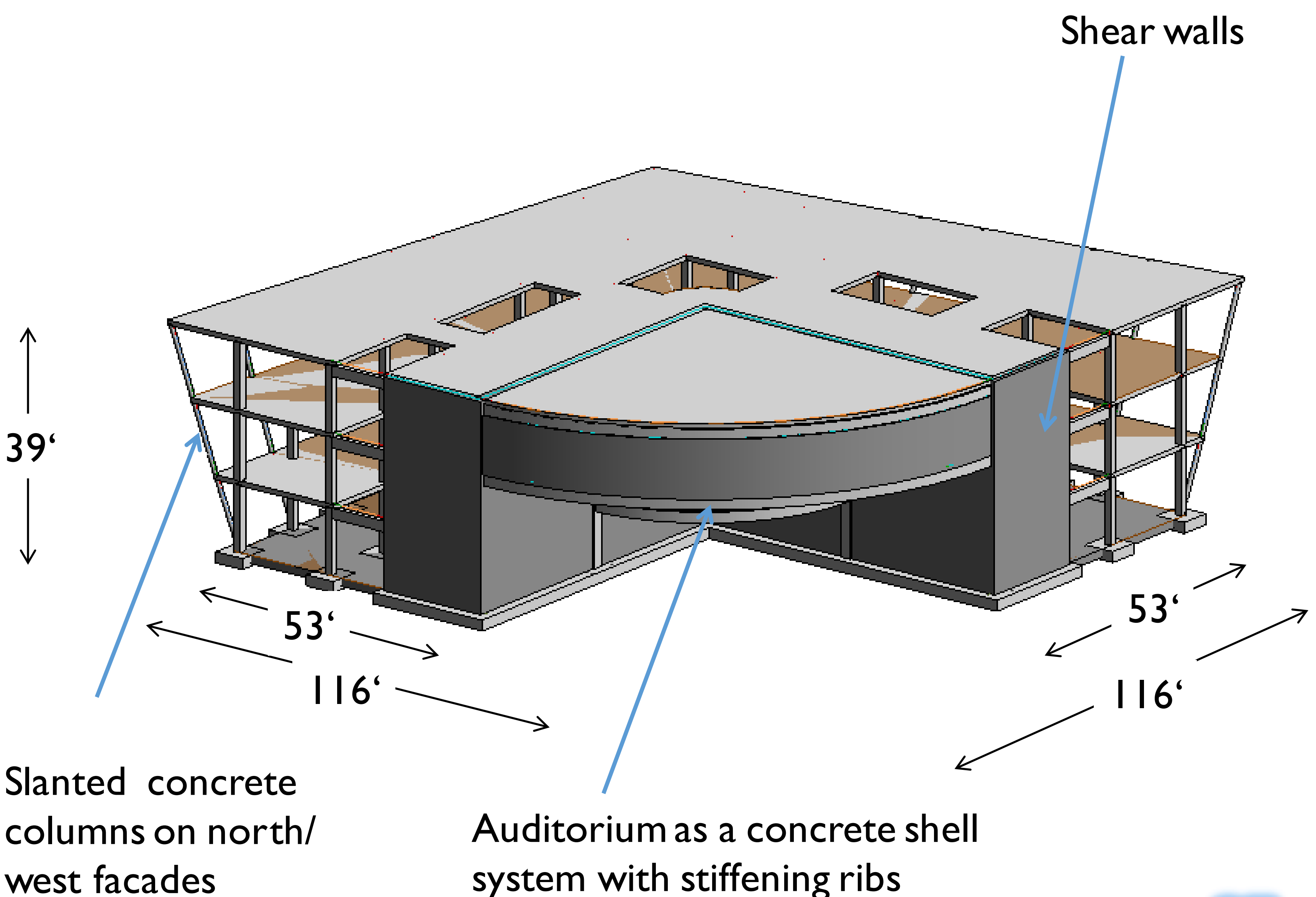
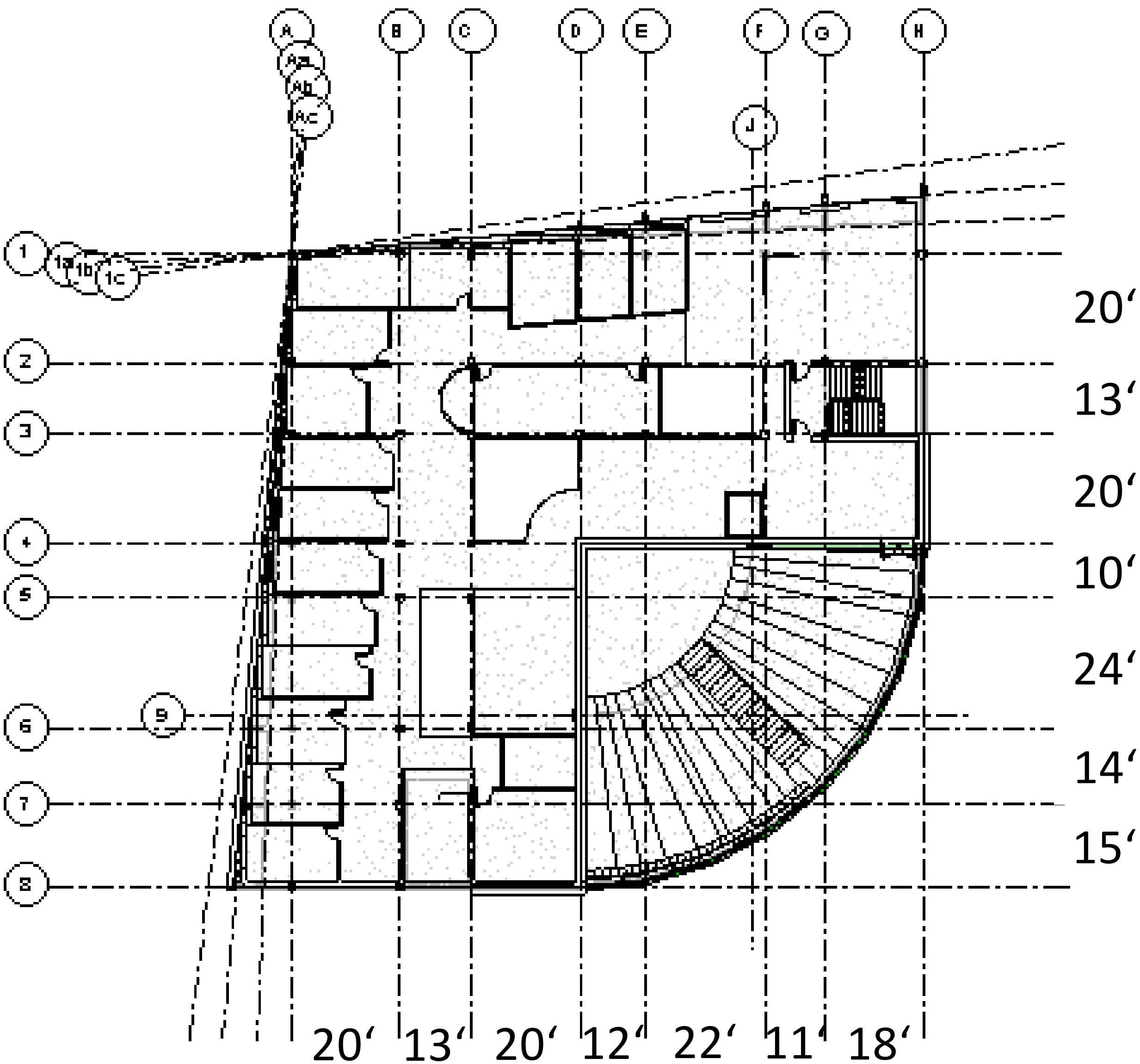
POST-TENSIONED CONCRETE SYSTEM



TYPICAL GRID & OVERLAY



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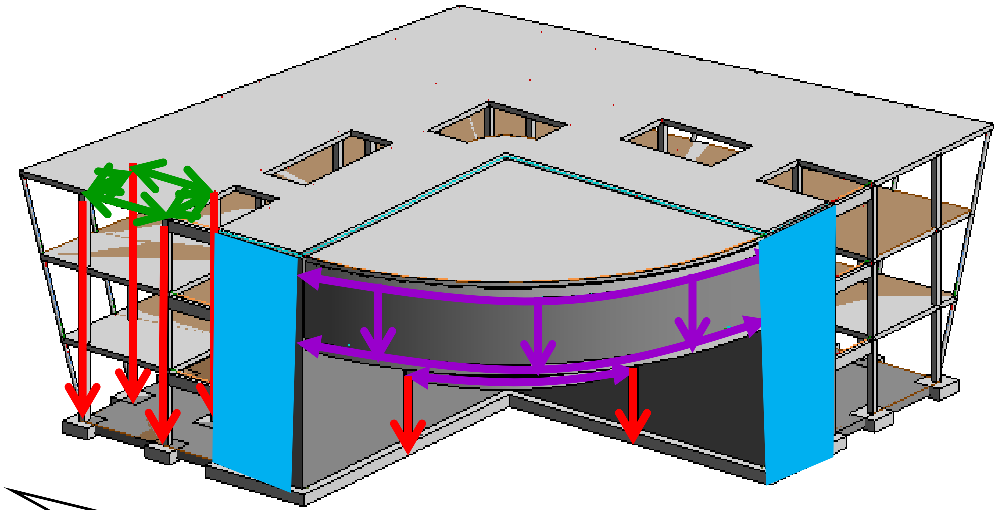
GRAVITY SYSTEM

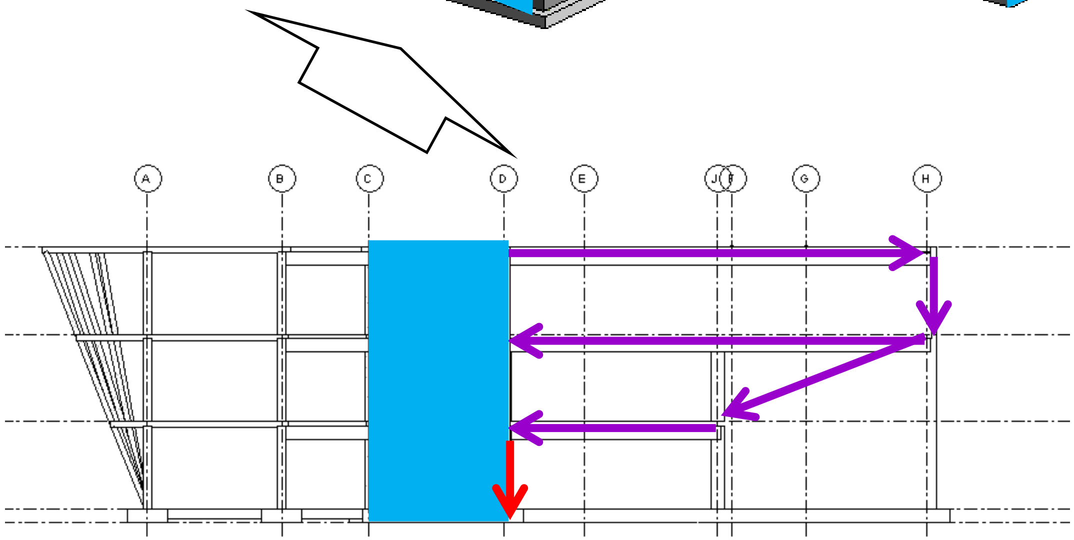
Post tensioning Concrete slab

- 11" solid slab
- Longest span 33'

Columns

- 16" x 16" section
- 13' height over one floor

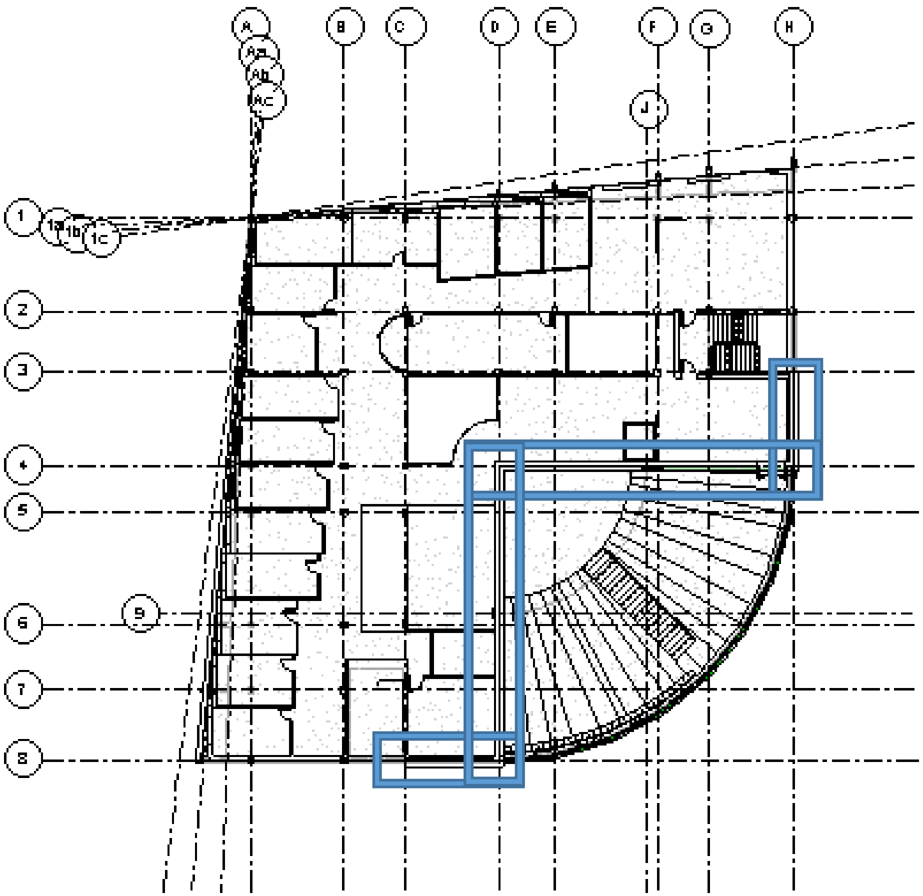


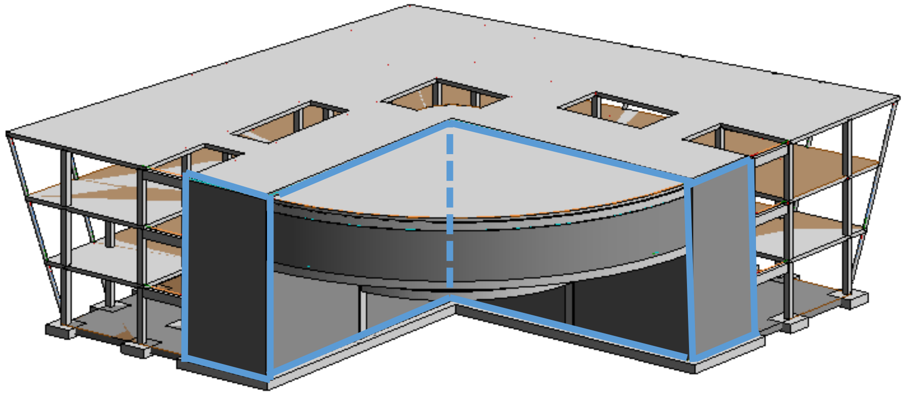


Concrete shell

Shear walls

LATERAL SYSTEM



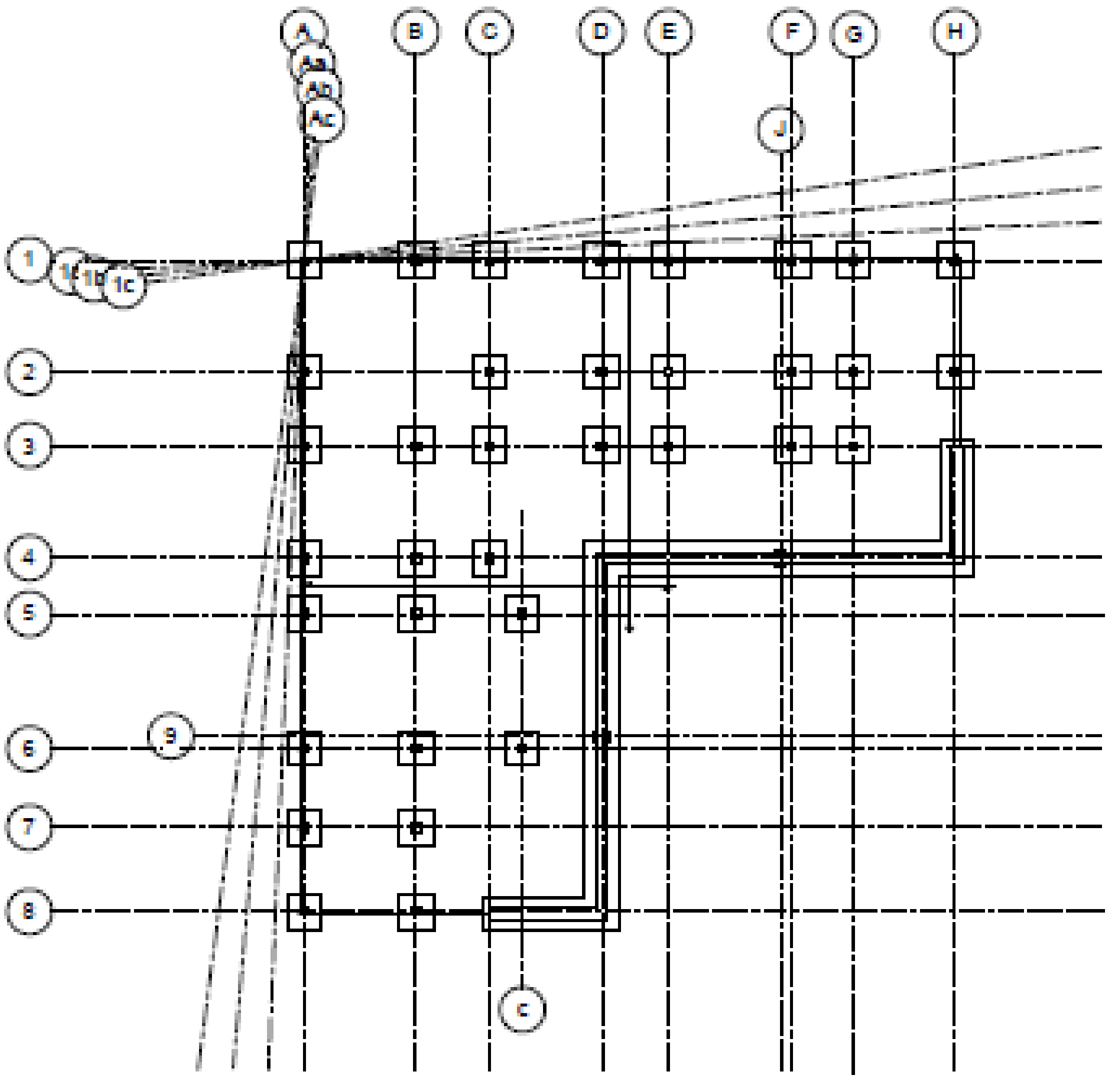


Shear walls

- 20" concrete shear walls

- Responding to horizontal loads from auditorium
- Transferring tensile loads from slabs due to slanted columns

FOUNDATIONS – CONCRETE SYSTEM



Isolated Concrete Foundations

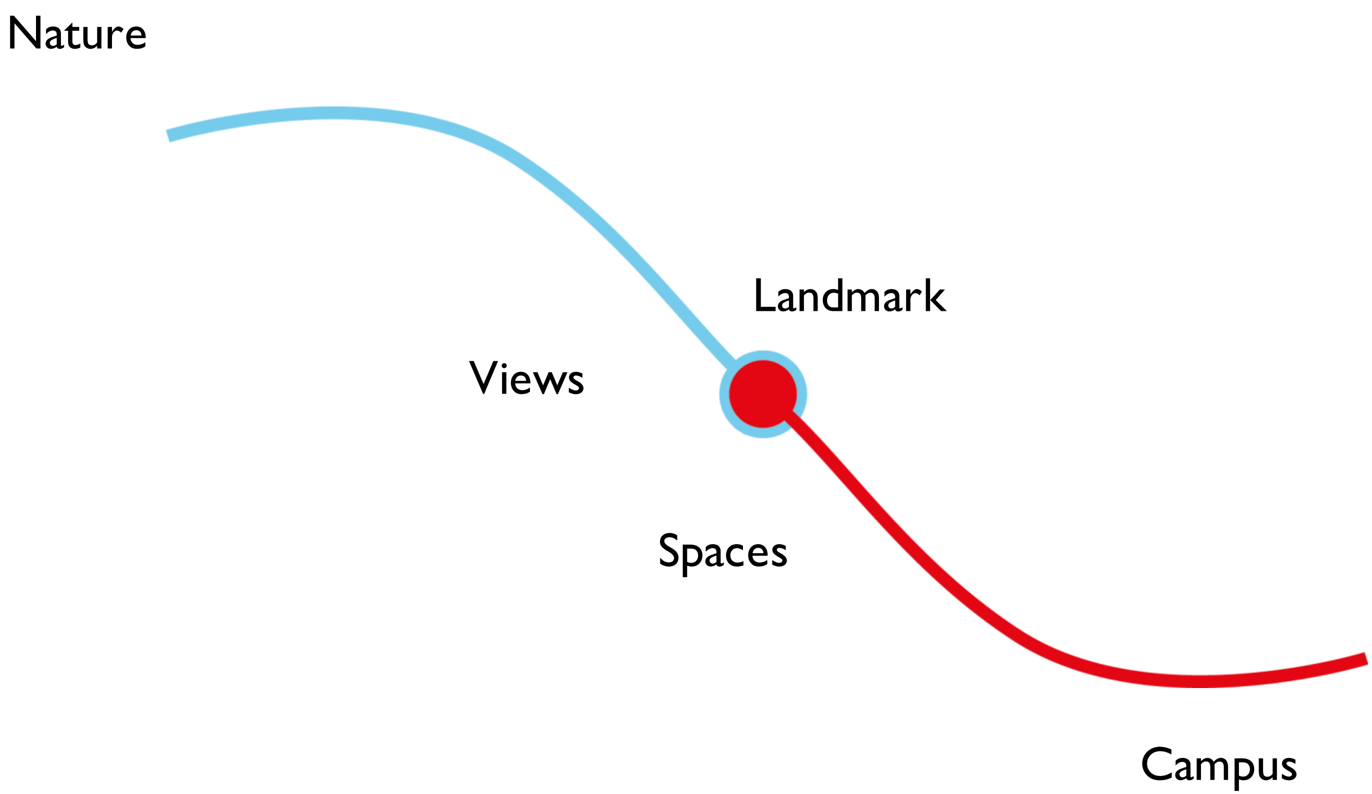
- 6' x 6' x 18"

Strip Concrete Foundations Walls and MRF

- 6' x 18"

A MEP SE CM

FLOWS



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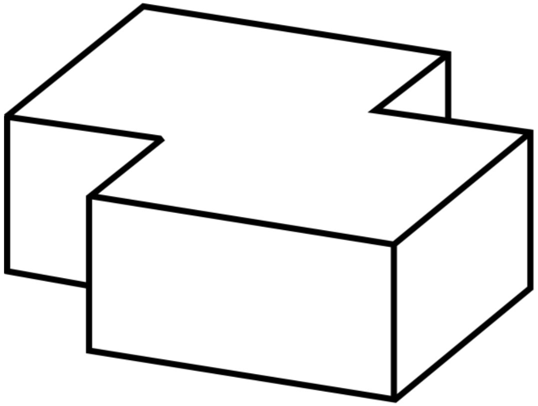
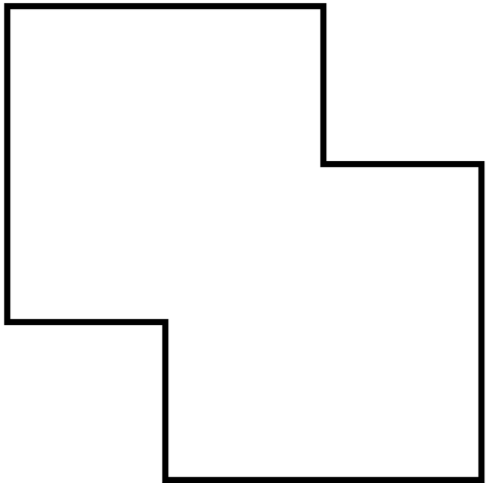
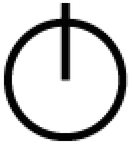
ITERATIONS



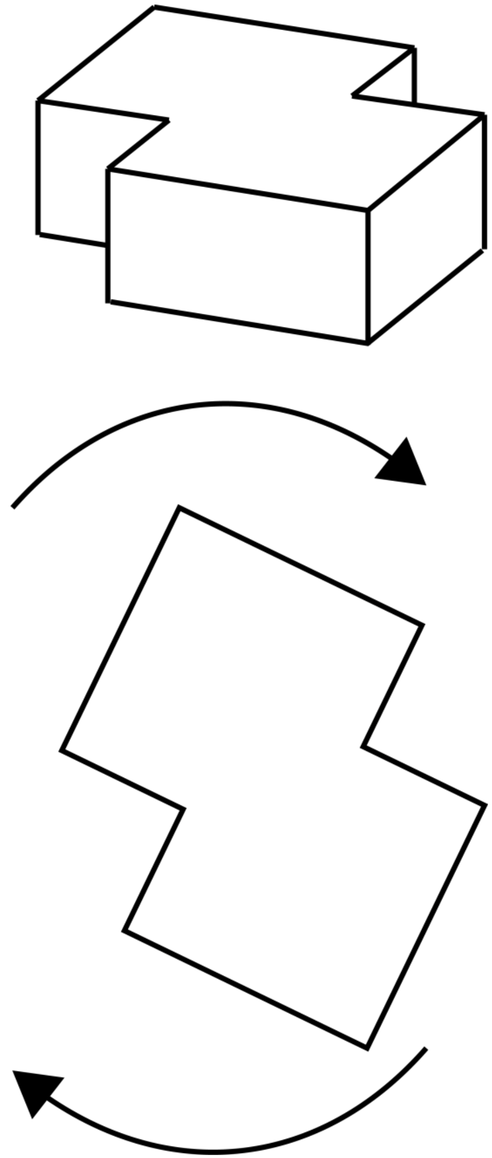




A MEP SE CM

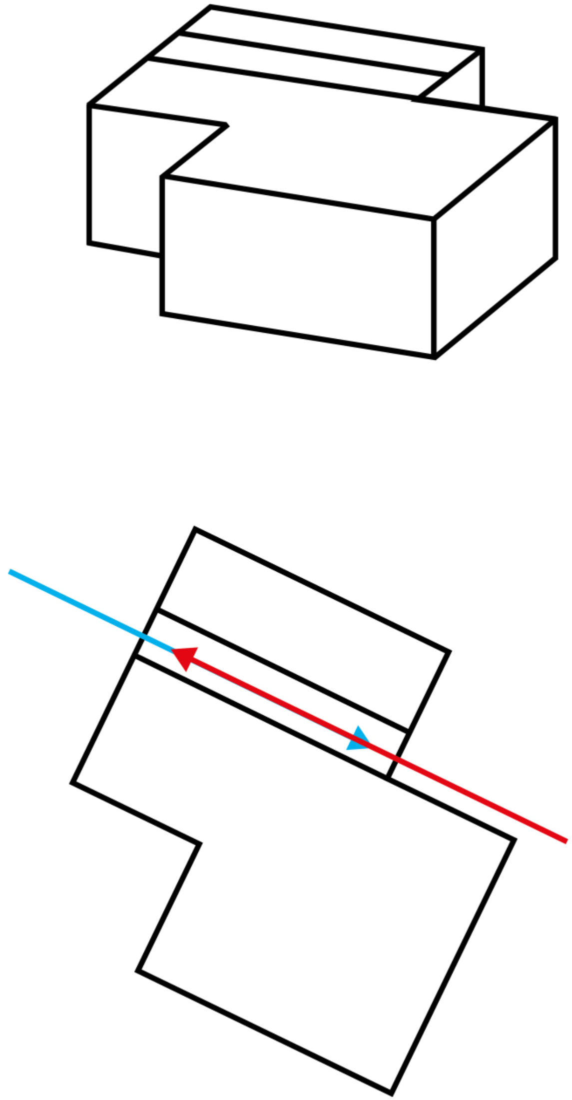
FLOWS AND VIEWS

A



ATRIUM CANYON

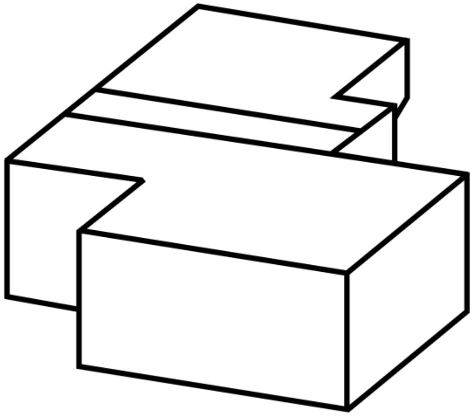
A + MEP

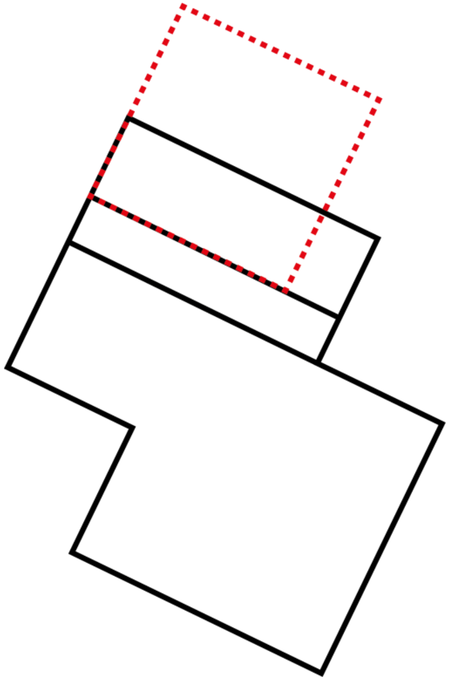


A MEP SE CM

AUDITORIUM

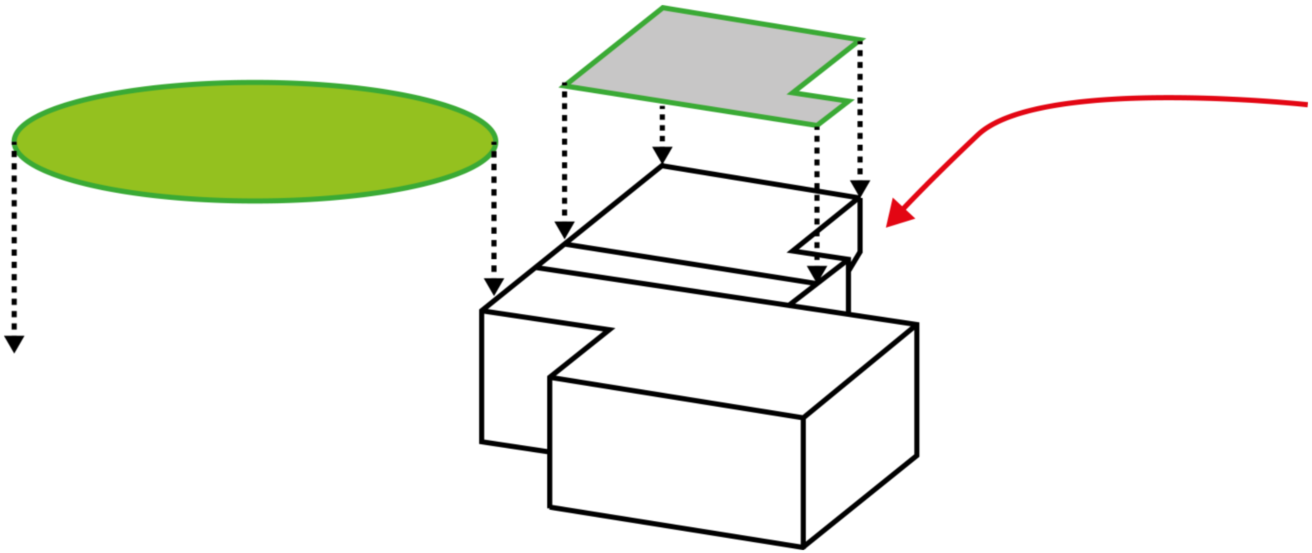
A + SE





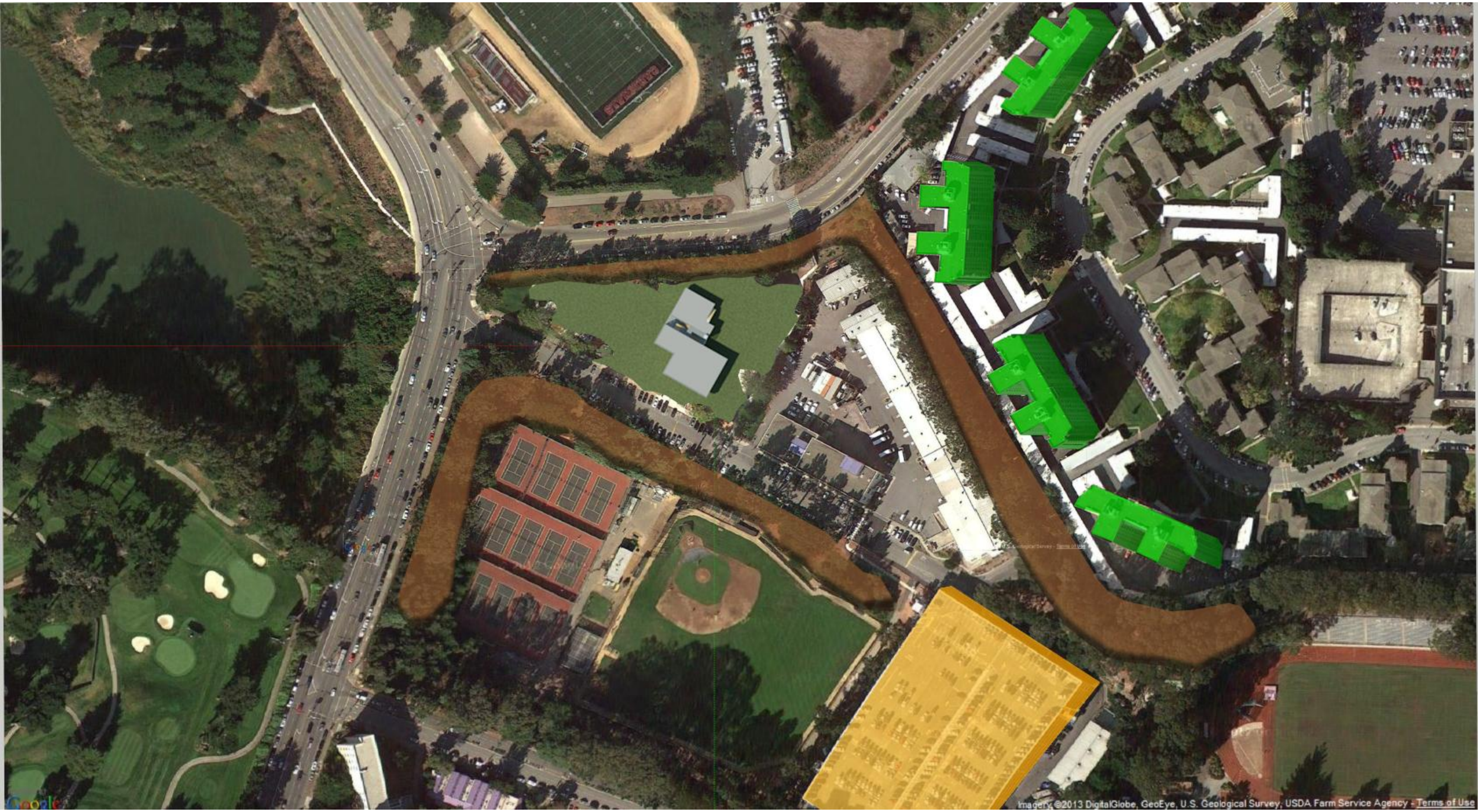
A MEP SE CM

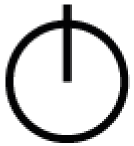
INTEGRATING THE FLOWS



A MEP SE CM

SITE PLAN



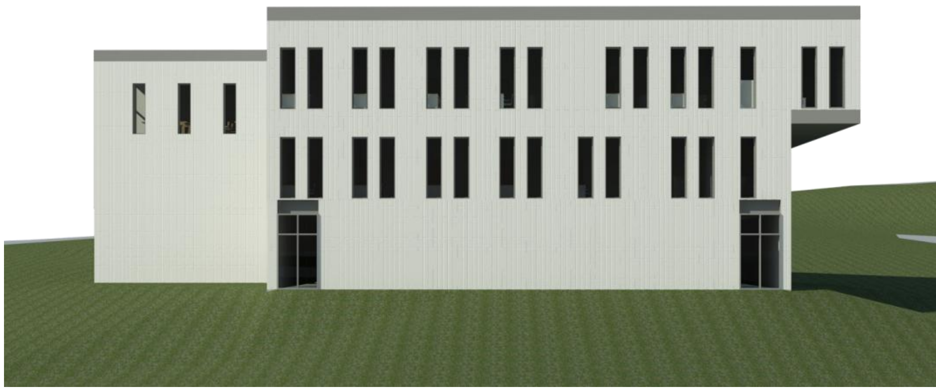


A MEP SE CM

OVERVIEW

THE BUILDING

NORTH



SOUTH

EAST

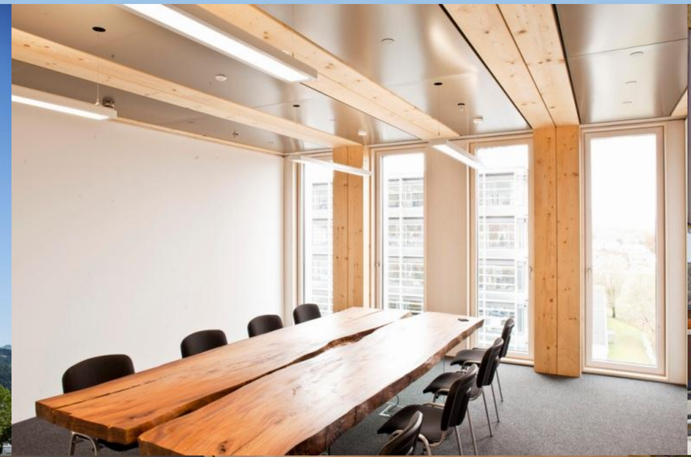
WEST

A MEP SE CM

ATRIUM

A MEP SE CM

FACADES AND CONSTRUCTION



CREE modular constructional system – **CREATIVE RESOURCE & ENERGY EFFICIENCY**

- Tall windows
- Shows construction in facade
- Integrates construction in the indoor aesthetics

ATRIUM FACADE

Metal siding

Plate material – Both reflective and non-reflective

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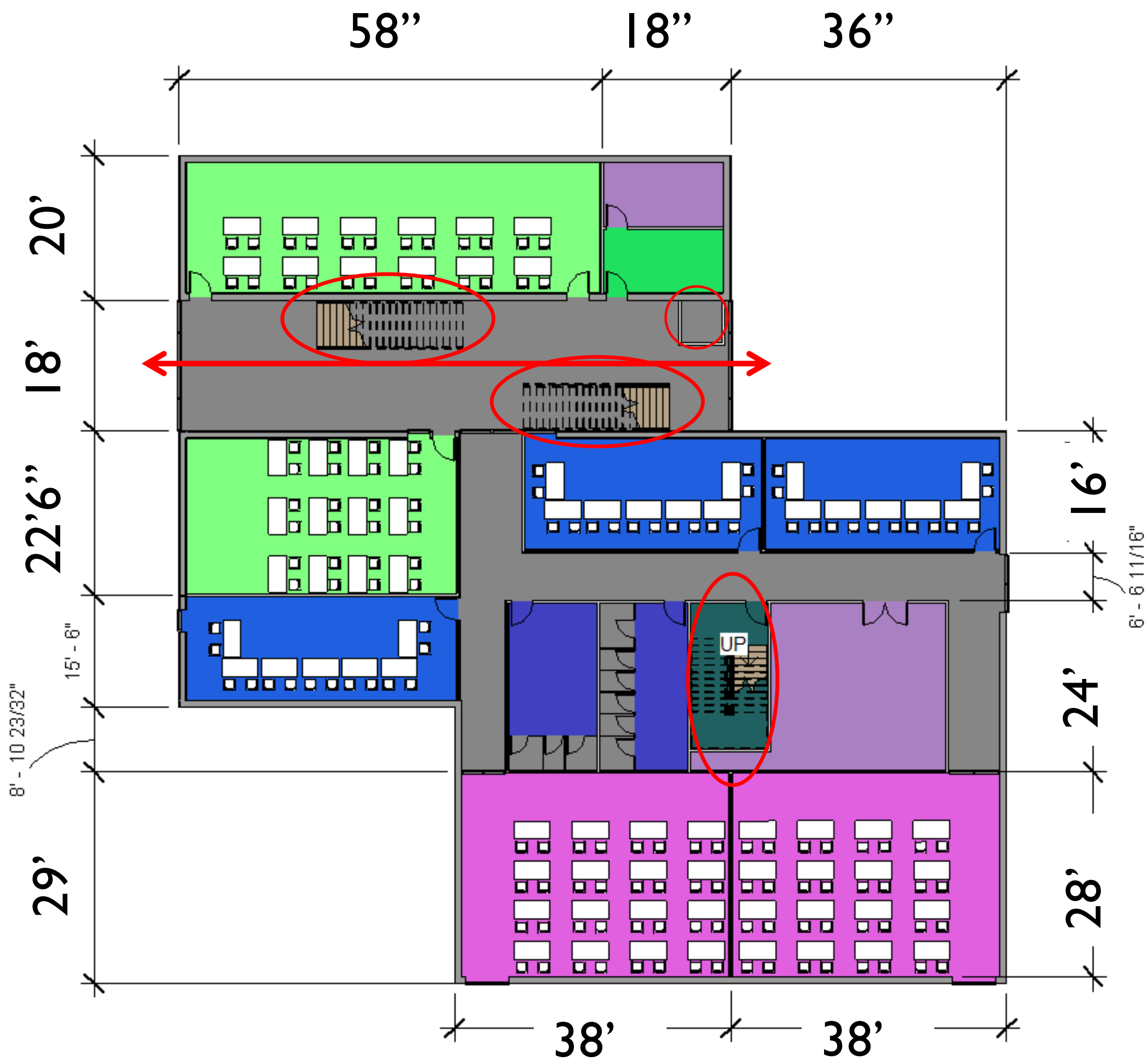
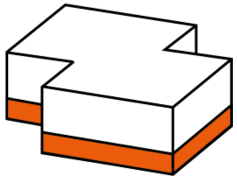
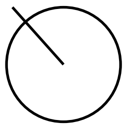
GROUND FLOOR





Department Legend

- Computer labs
- Large Classroom
- Mechanical room
- Restroom
- Small Classroom
- Staircase
- Storage



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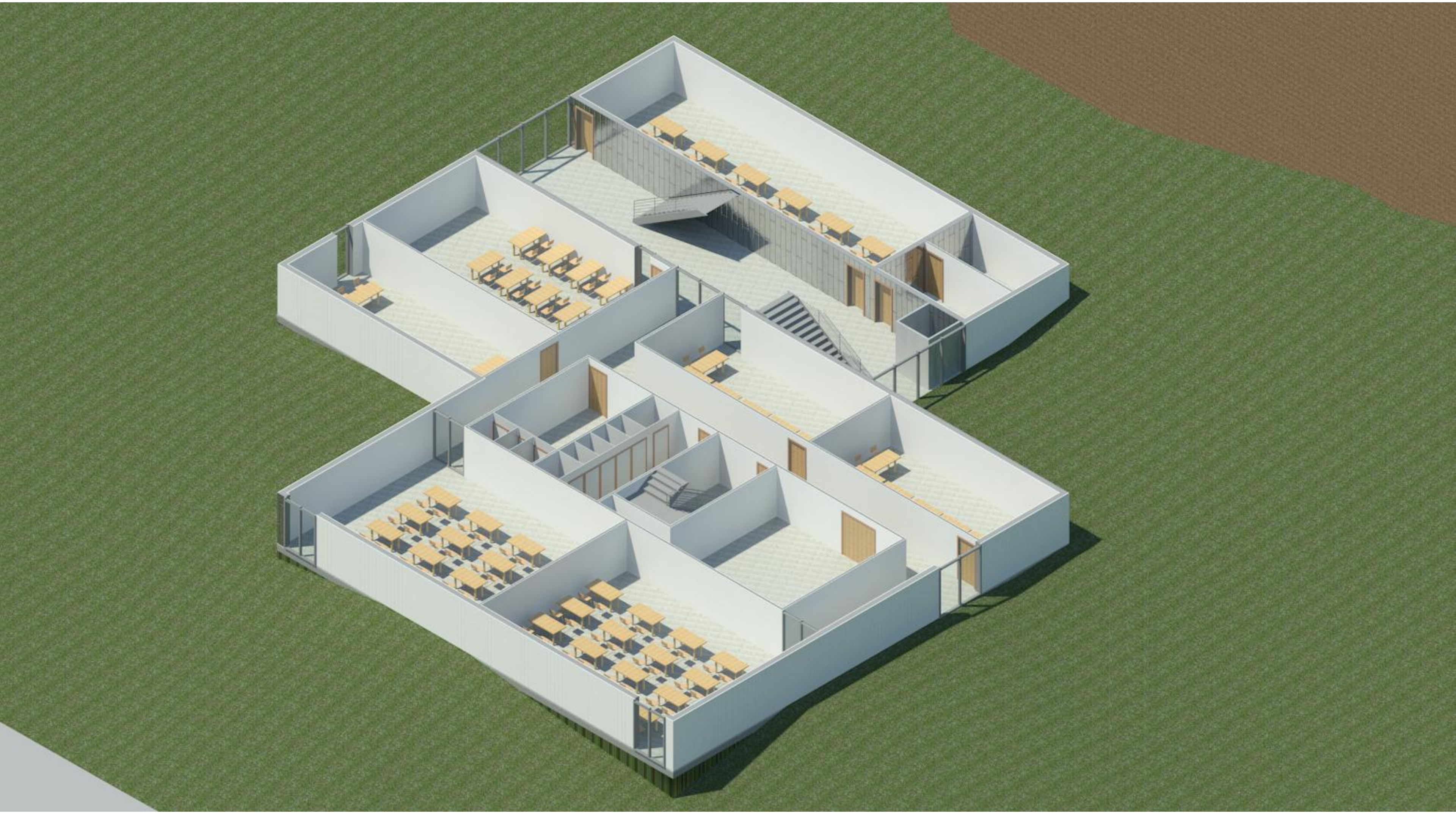
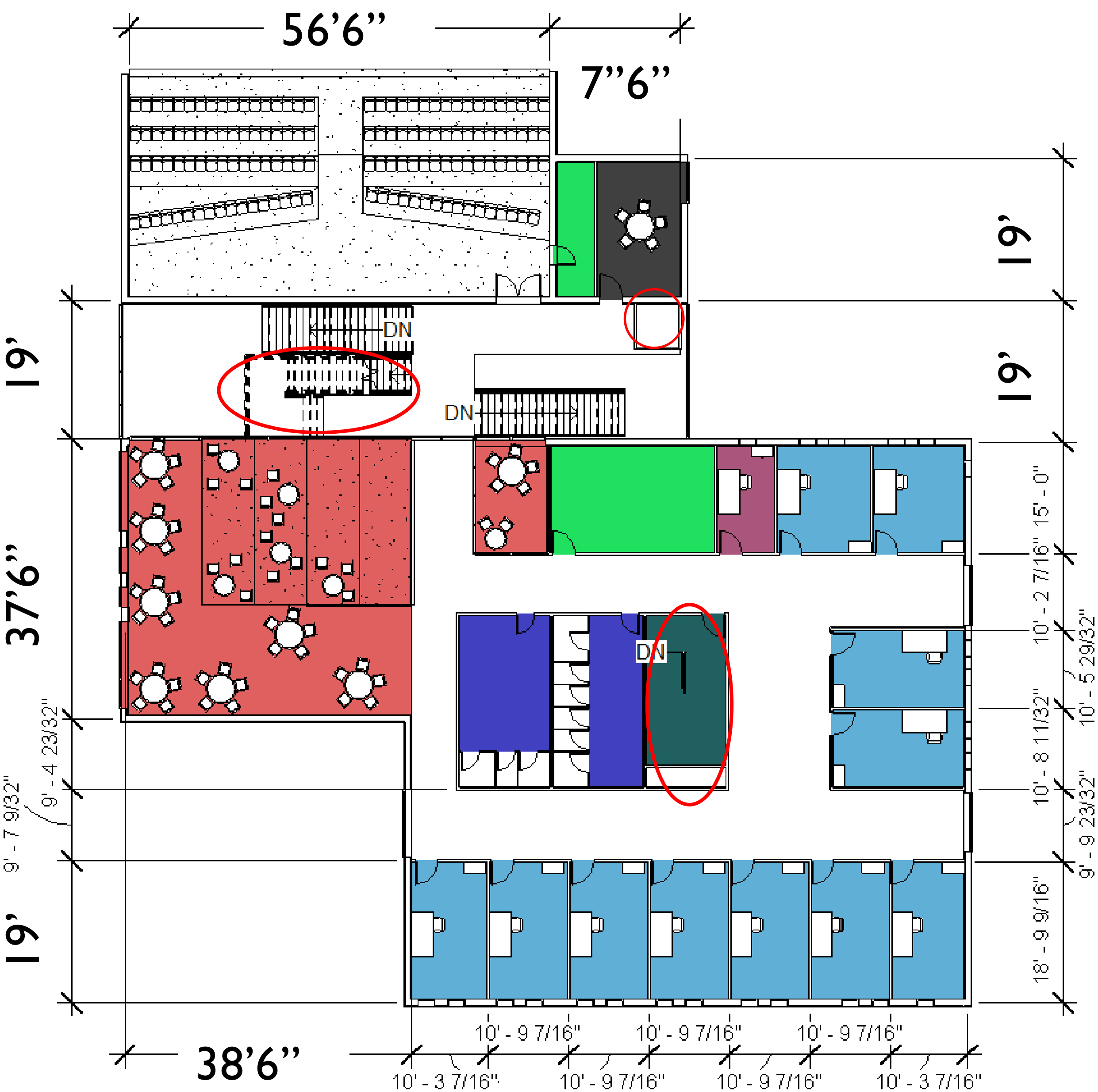
GROUND FLOOR

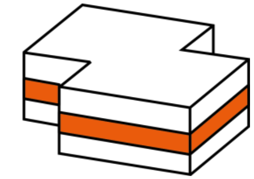
View From South



A MEP SE CM

FIRST FLOOR





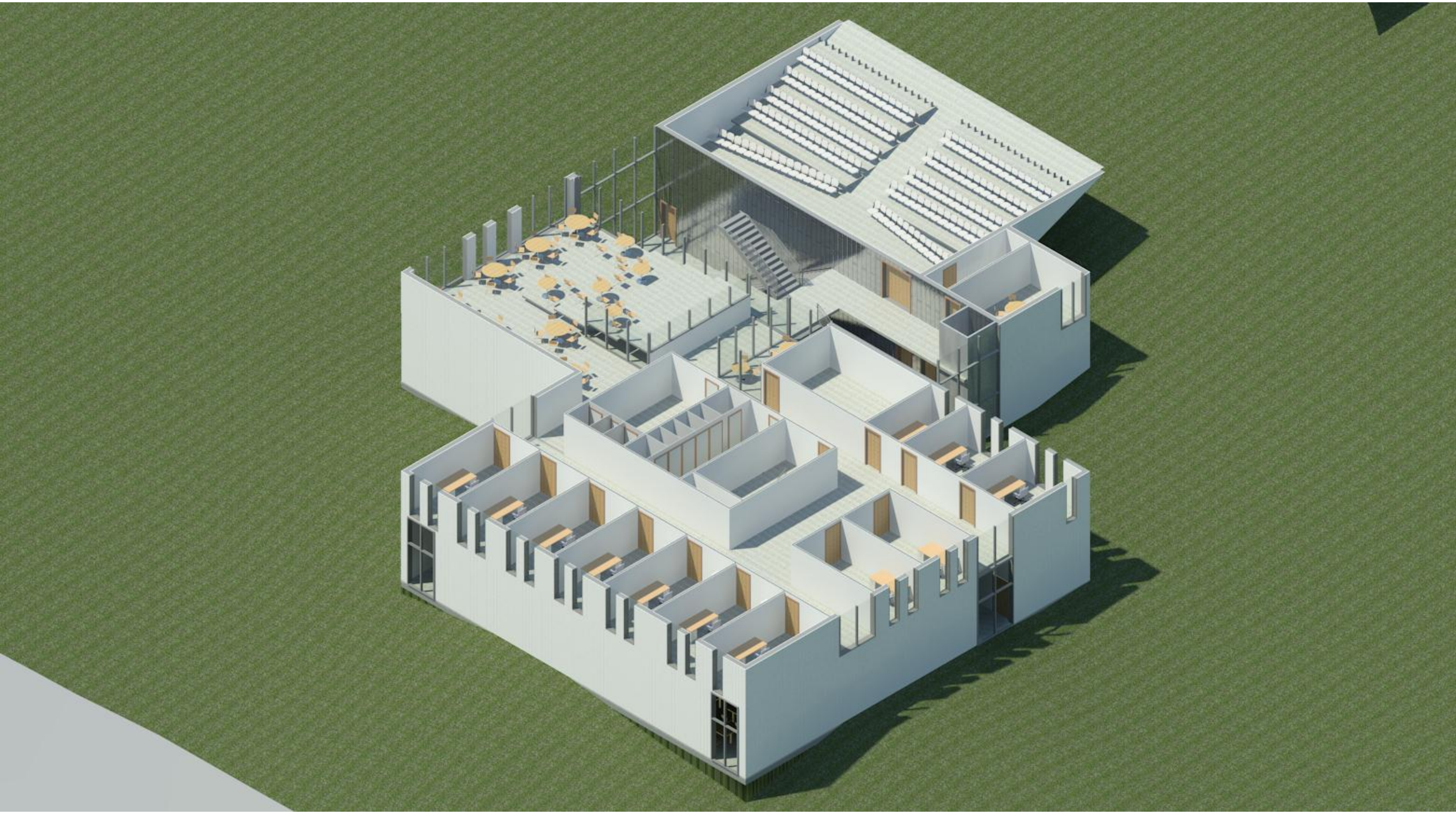
Department Legend

- Auditorium
- Faculty
- Restroom
- Seminar
- Staircase
- Storage
- Student
- Technical Support

A MEP SE CM

FIRST FLOOR

View From South



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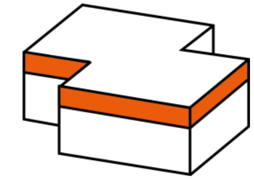
SECOND FLOOR



Department Legend

- Adm Assistant
- Auditorium
- Chairman
- Faculty Lounge
- Faculty
- Restroom
- Seminar
- Senior
- Small Classroom
- Staircase
- Storage

SECOND FLOOR

View From South

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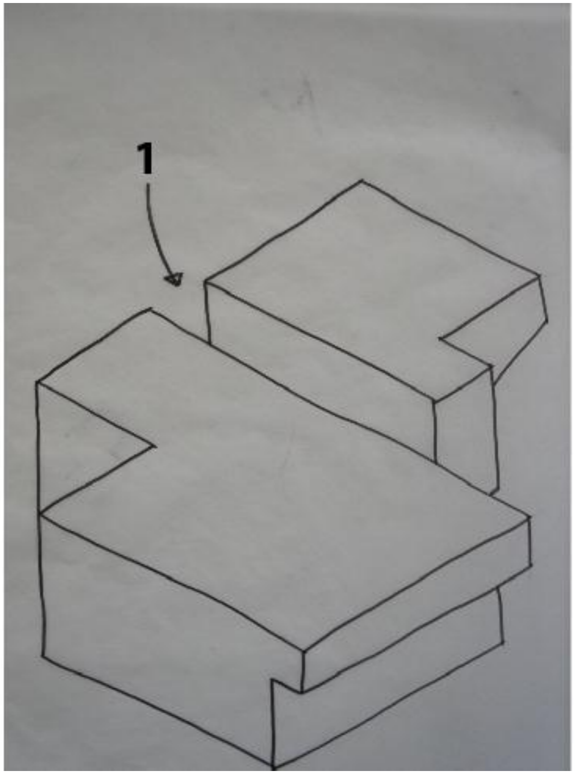
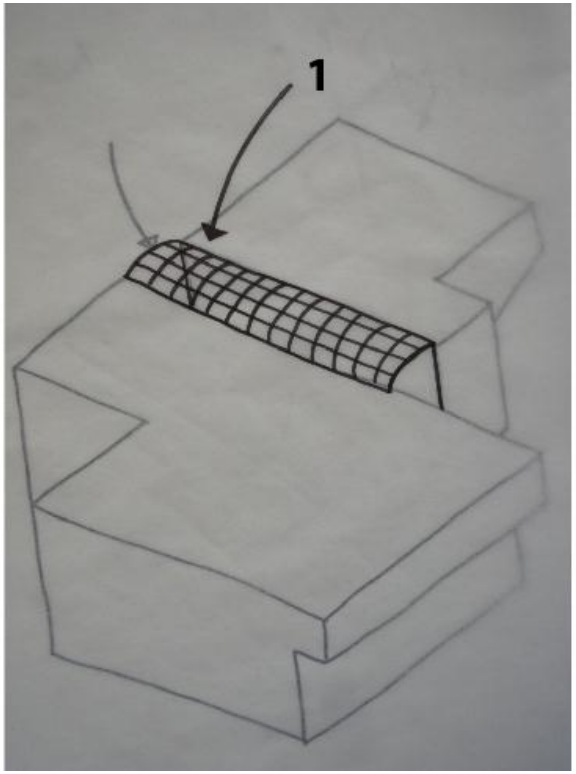
ROOF EVOLUTION

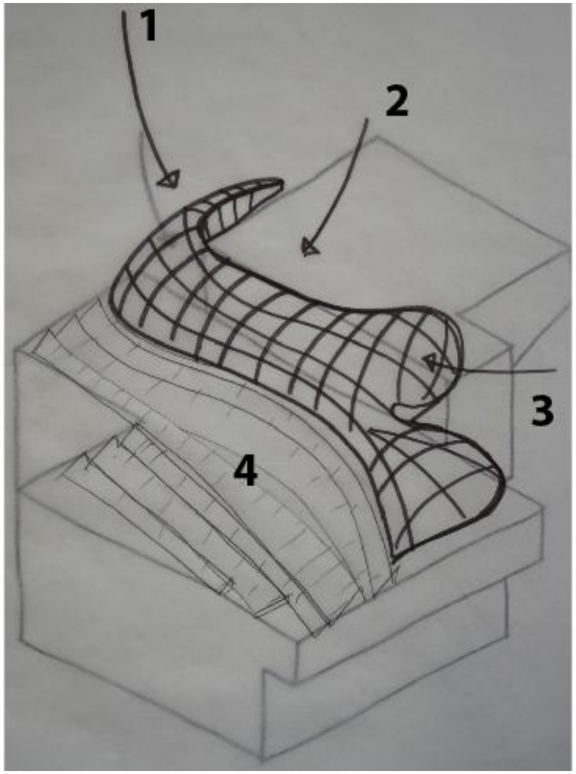
1: Slice through building

1: Glazed roof allowing for light to enter the area below, while covering from rain

Potential:
1: Relation to wind and water
2: Cover for roof terrace
3: Integrate elevator
4: Integrate PV's and/or turbines







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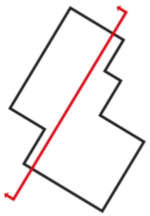
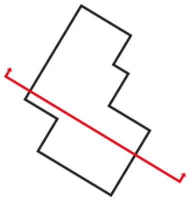
SECTION THROUGH AUDITORIUM



SECTION ALONG ATRIUM



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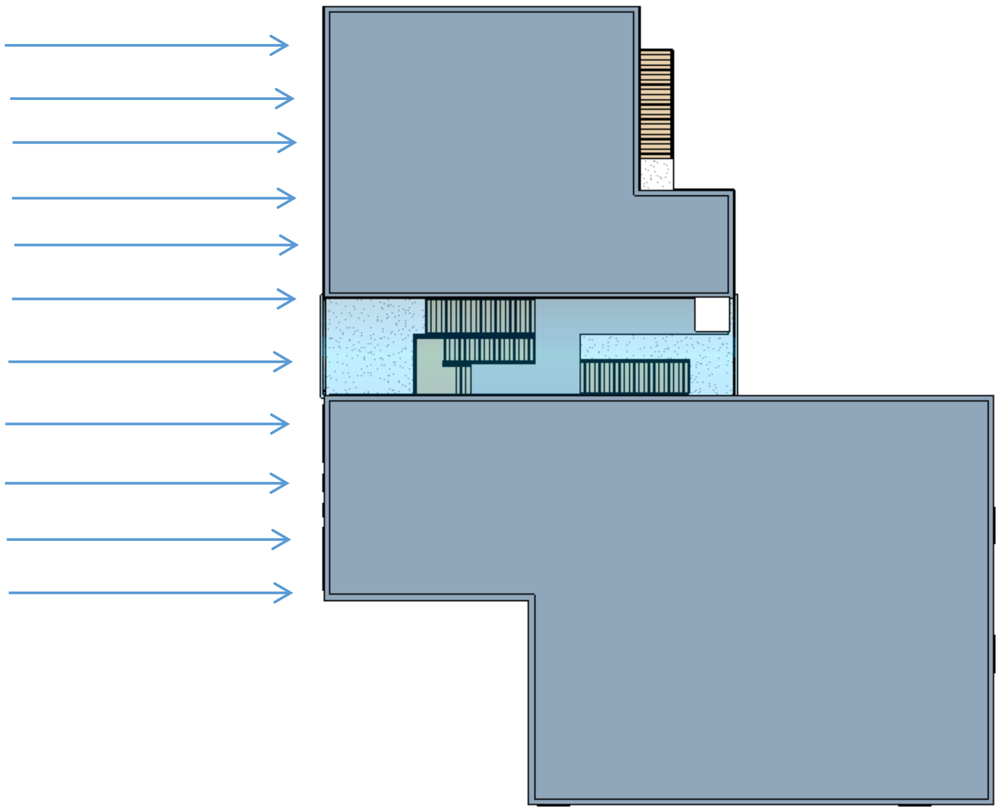
BUILDING FORM



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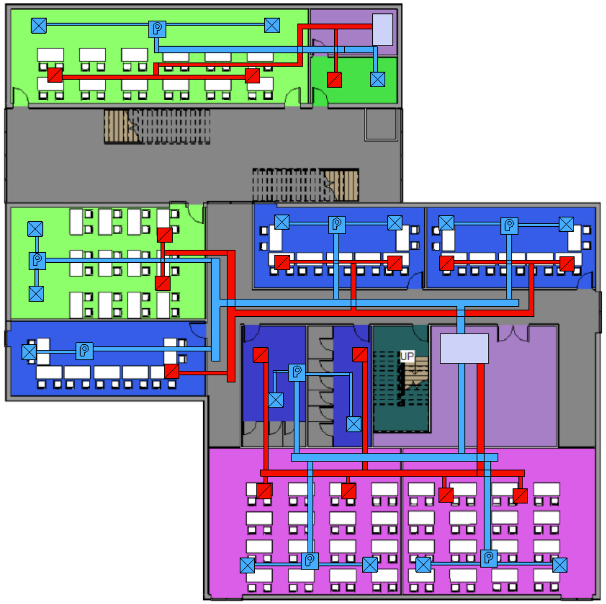
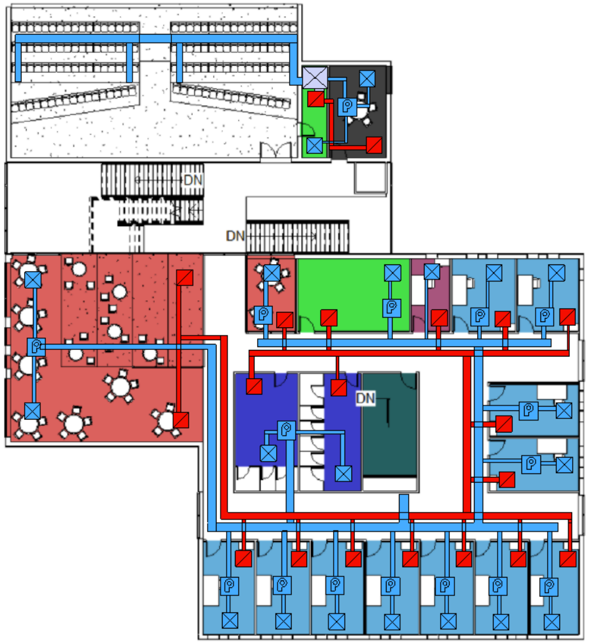
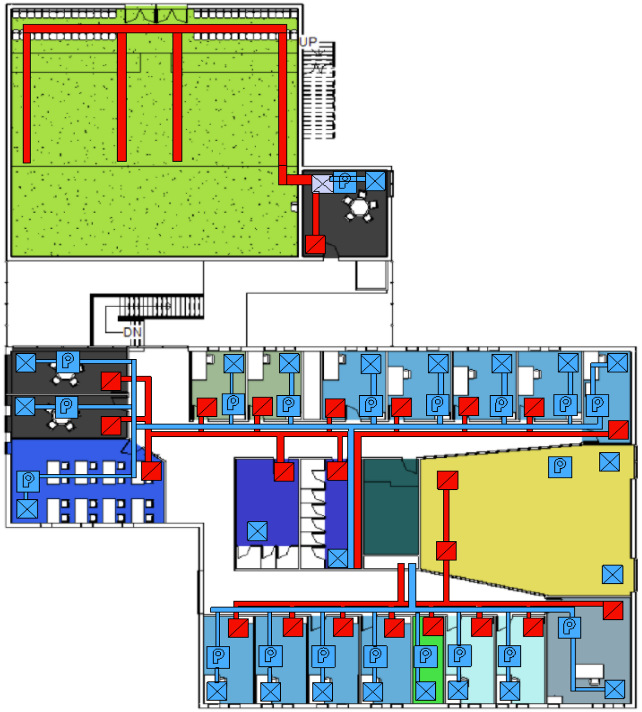
VAV – FLOOR PLANS



Ground Floor



First Floor

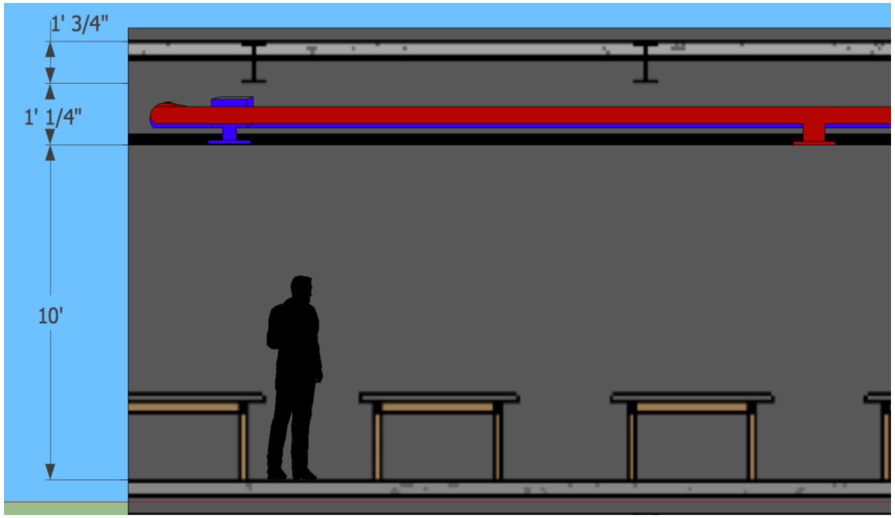


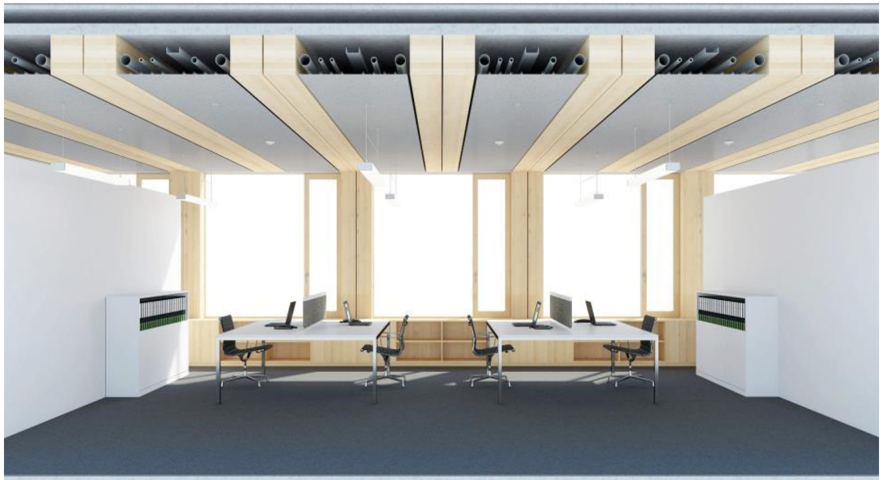
Second Floor

A MEP SE CM

VAV – FLOOR SANDWICHES

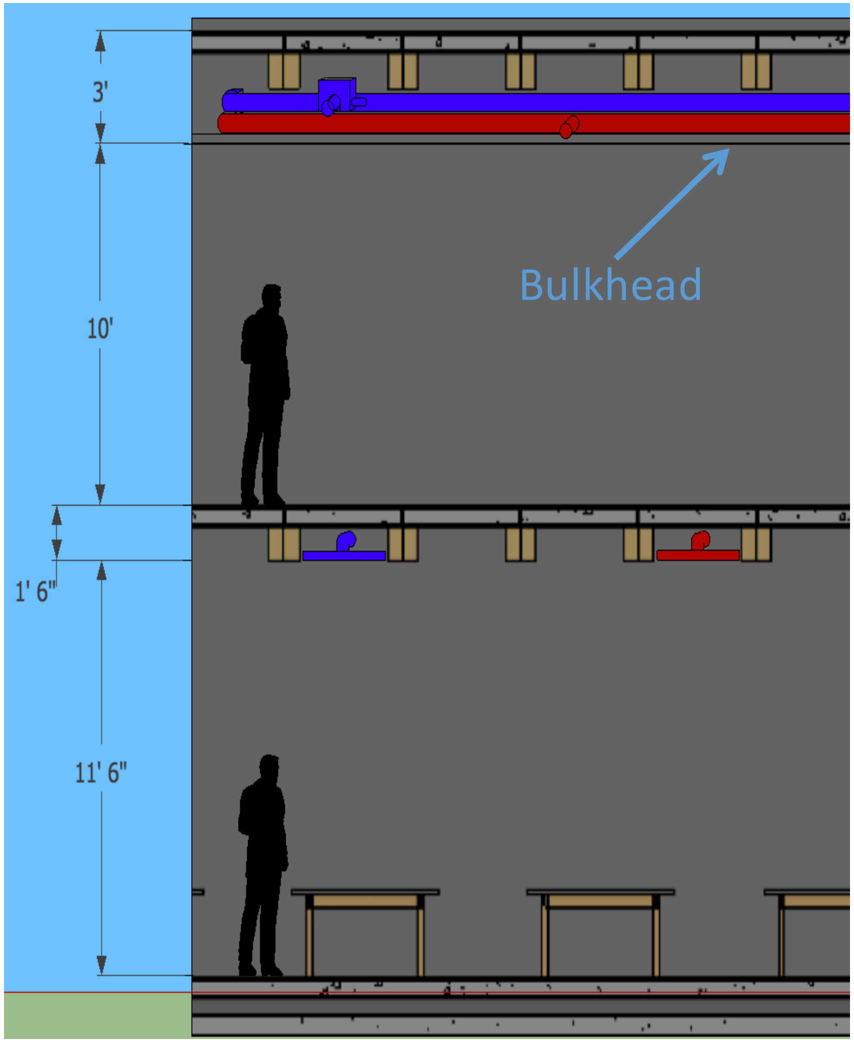
Steel Structural System





CREE Structural System – Ducts and Conduits

CREE Structural System



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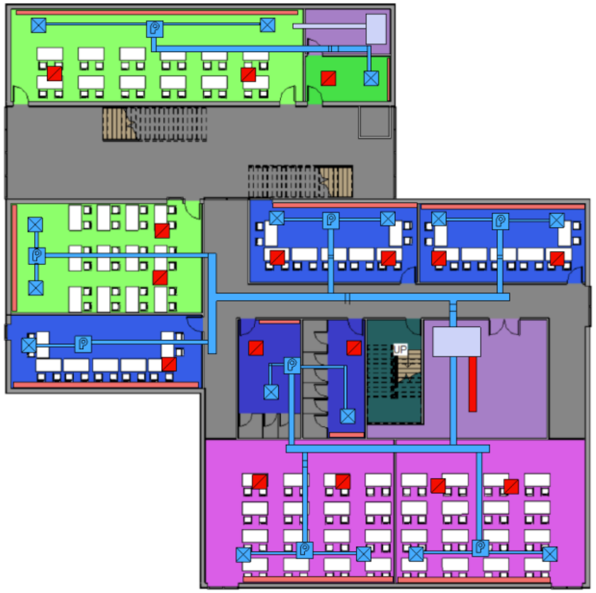
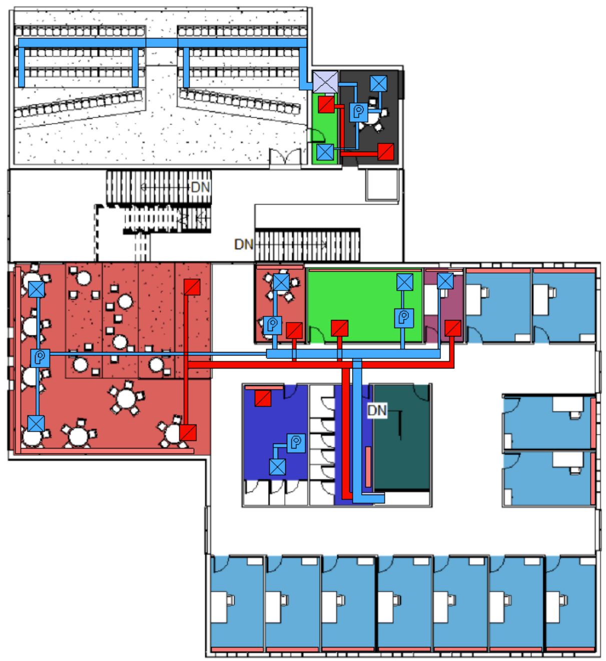
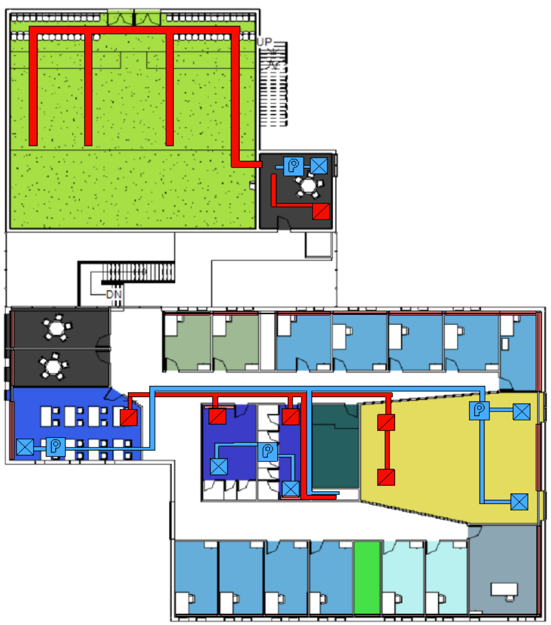
HYDRONIC – FLOOR PLANS



Ground Floor



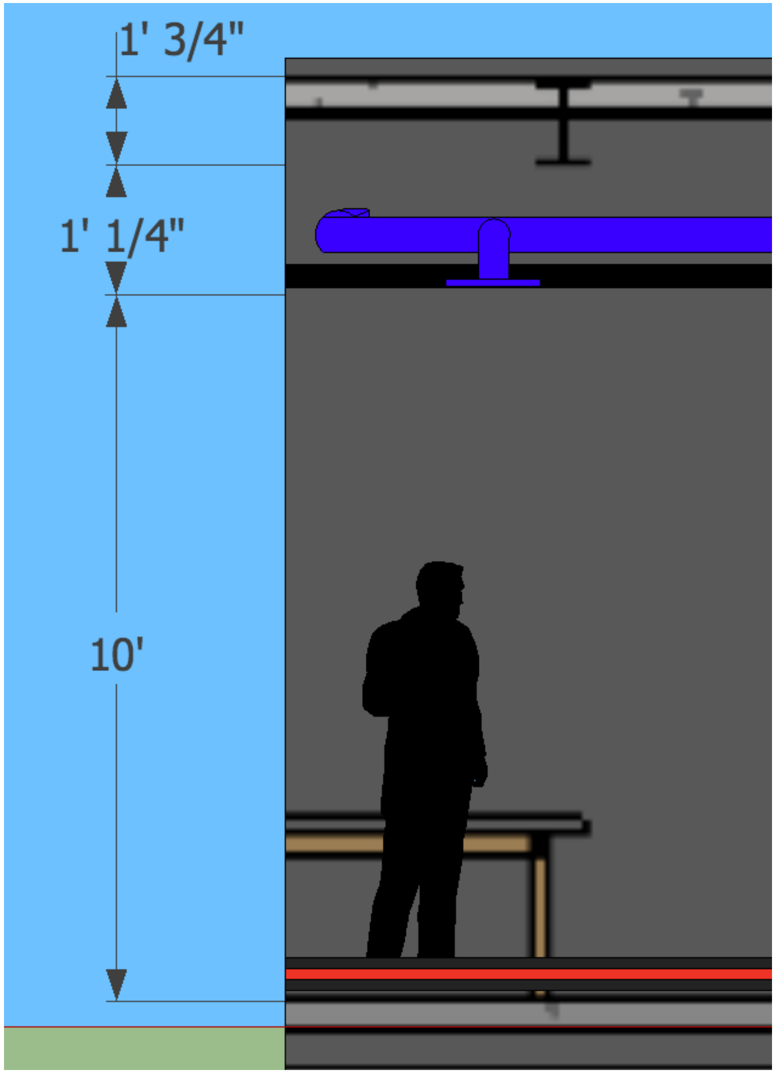
First Floor



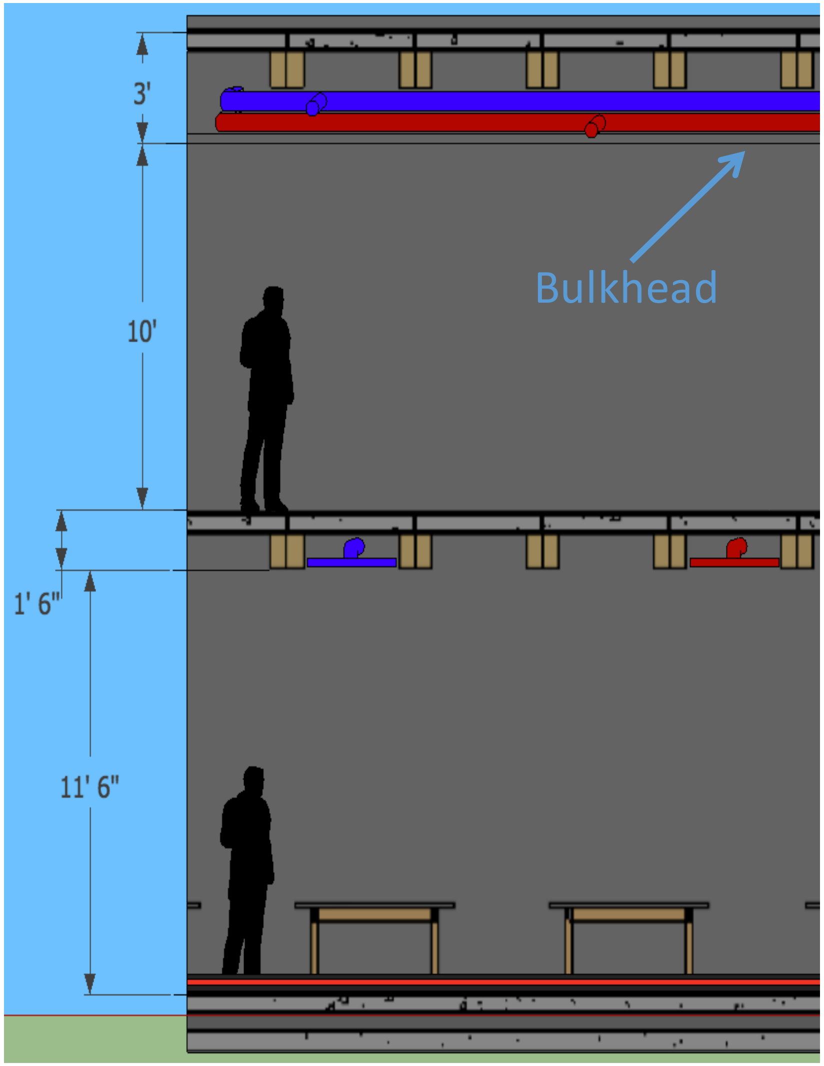
Second Floor

HYDRONIC – FLOOR SANDWICHES

Steel Structural System



CREE Structural System



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MEP SYSTEM COMPARISON

Criteria	Weight	VAV	NV + VAV (Interlock)	Hydronic + Trickle & DOAS
HVAC System First Costs	**20**	10	9	8
Architectural Impacts/Central Space Impacts	**10**	8	10	9
Ceiling Space Requirements /Floor-to-Floor Impacts	**5**	8	9	10
Energy Efficiency/Utility Costs	**20**	8	9	10
Acoustical Impact	**5**	8	9	10
Indoor Air Quality	**10**	8	10	9
Comfort/Individual Control/IEQ	**20**	8	9	10
Maintenance Costs & Reliability	**10**	10	8	9
Total Score	**100**	**68**	**73**	**75**

SUSTAINABILITY MEASURES

Daylighting

CREE System

Rainwater Harvesting & Site Water Usage

U.S. GREEN BUILDING COUNCIL
LEED SILVER
USGBC™

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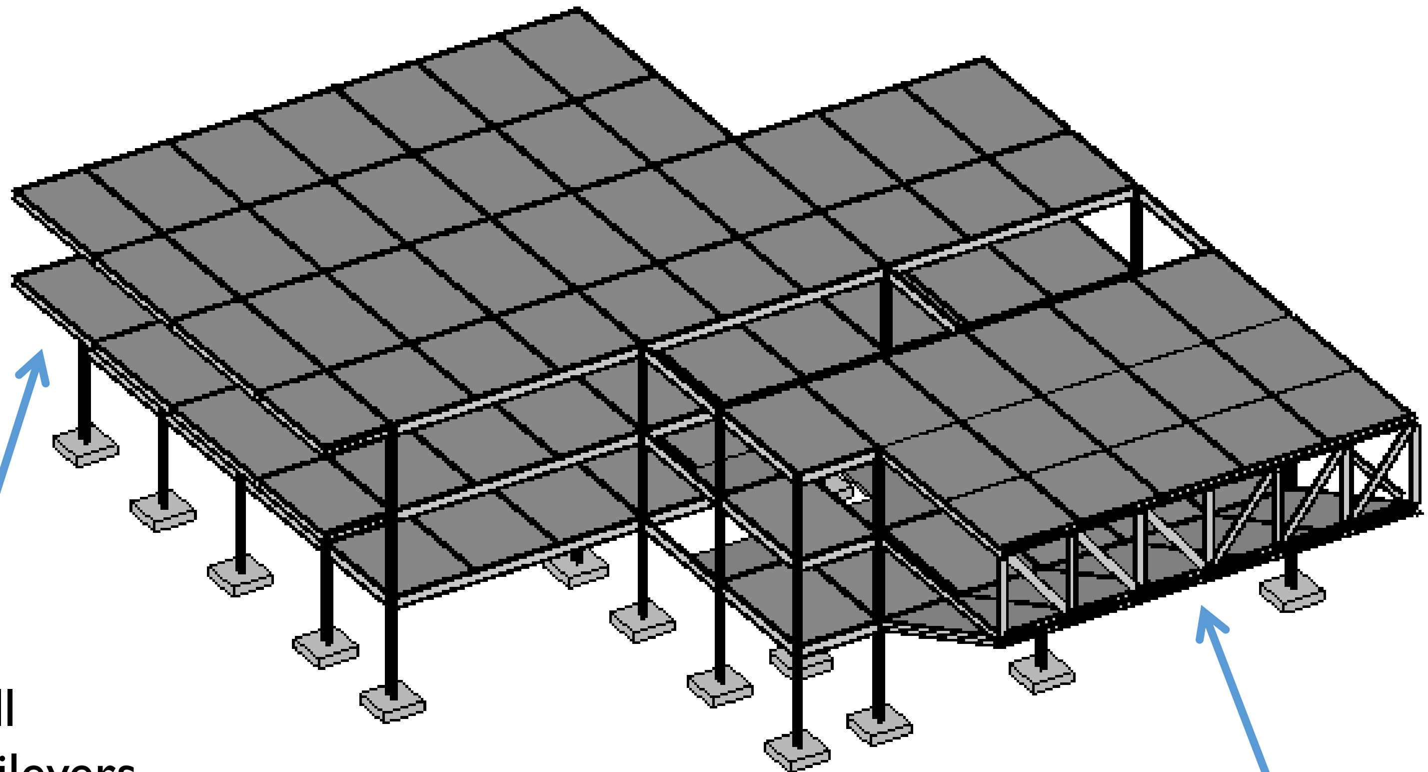
COMPOSITE DECK SYSTEM

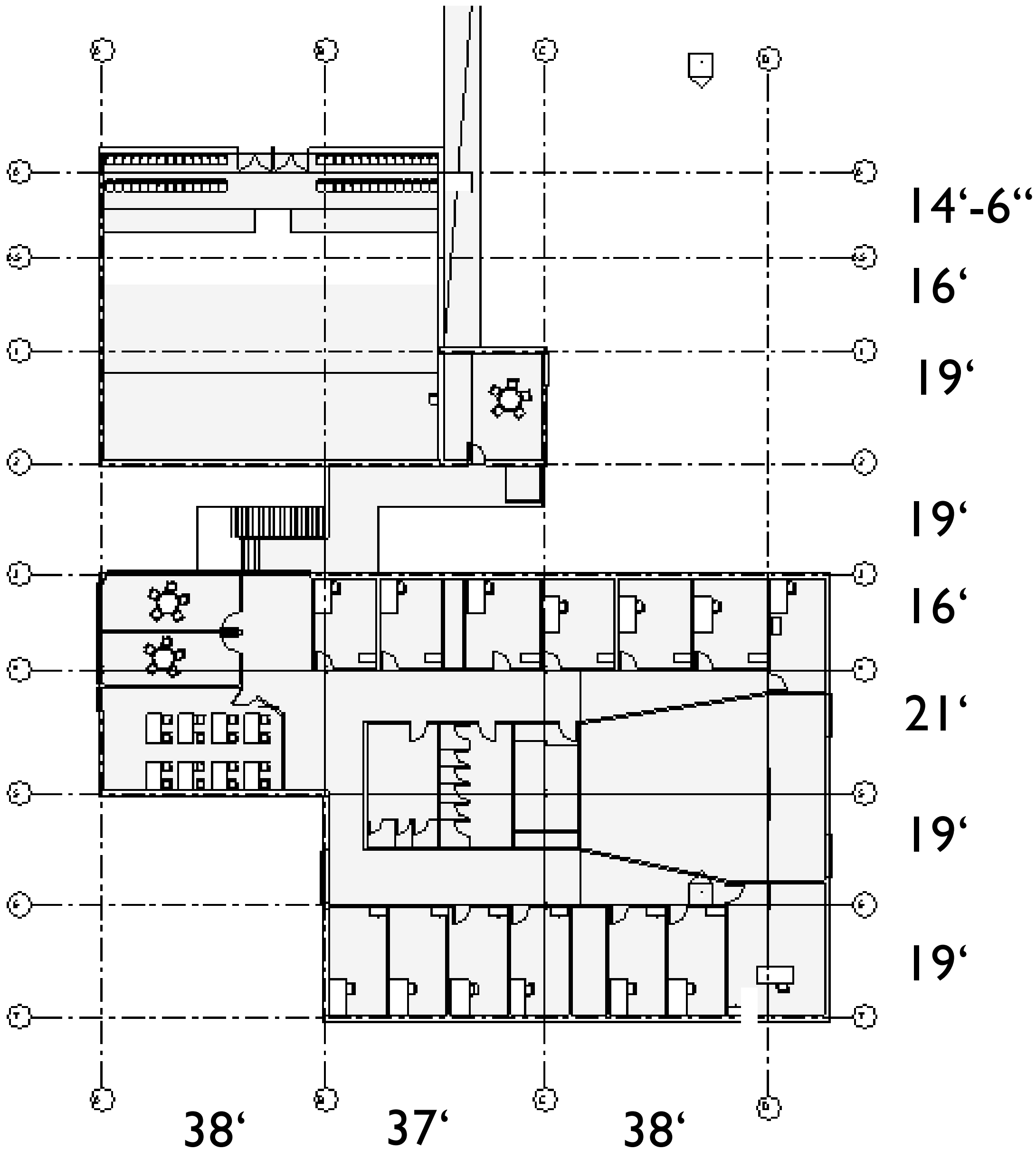


39'

Small cantilevers

Pratt truss to support cantilevered auditorium

TYPICAL GRID & OVERLAY



- Very modular grid
- Perfect rectangular steel deck system layout

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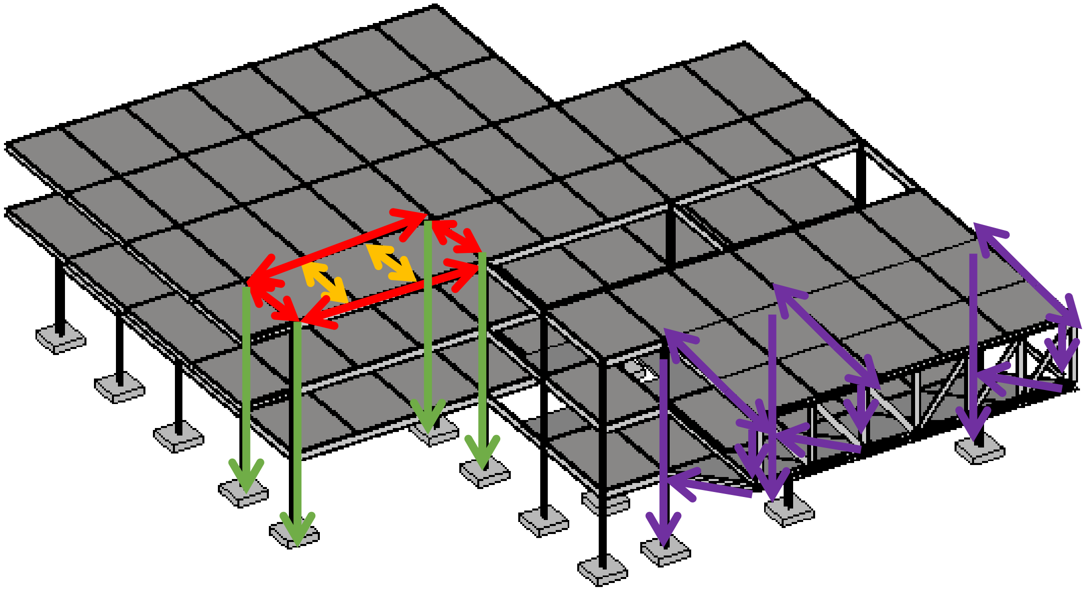
GRAVITY SYSTEM



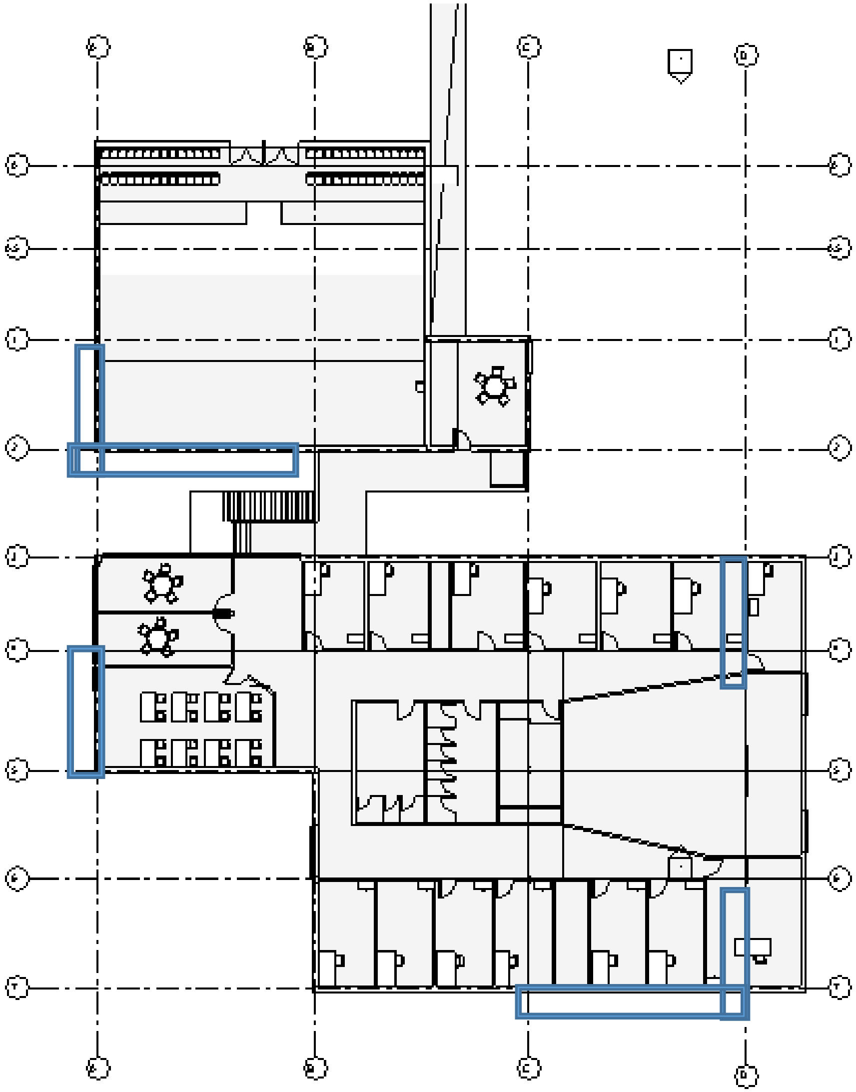
Composite metal deck panels
- 2VLI20 Vulcraft deck with 2.5” LW concrete overlay, fire protected gypsum board

Filler beams
- W14x48 typ.
- Longest span 21’

Girders
- W21x62 typ.
- Longest span 38’

Columns
- W14x48 typ.
- Three 13’ floors, 41’ total (one column)

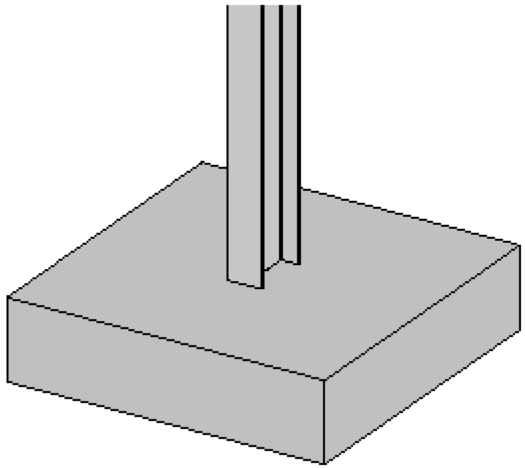
LATERAL SYSTEM



BRBF

- 3 in^2 steel core
- A36 steel

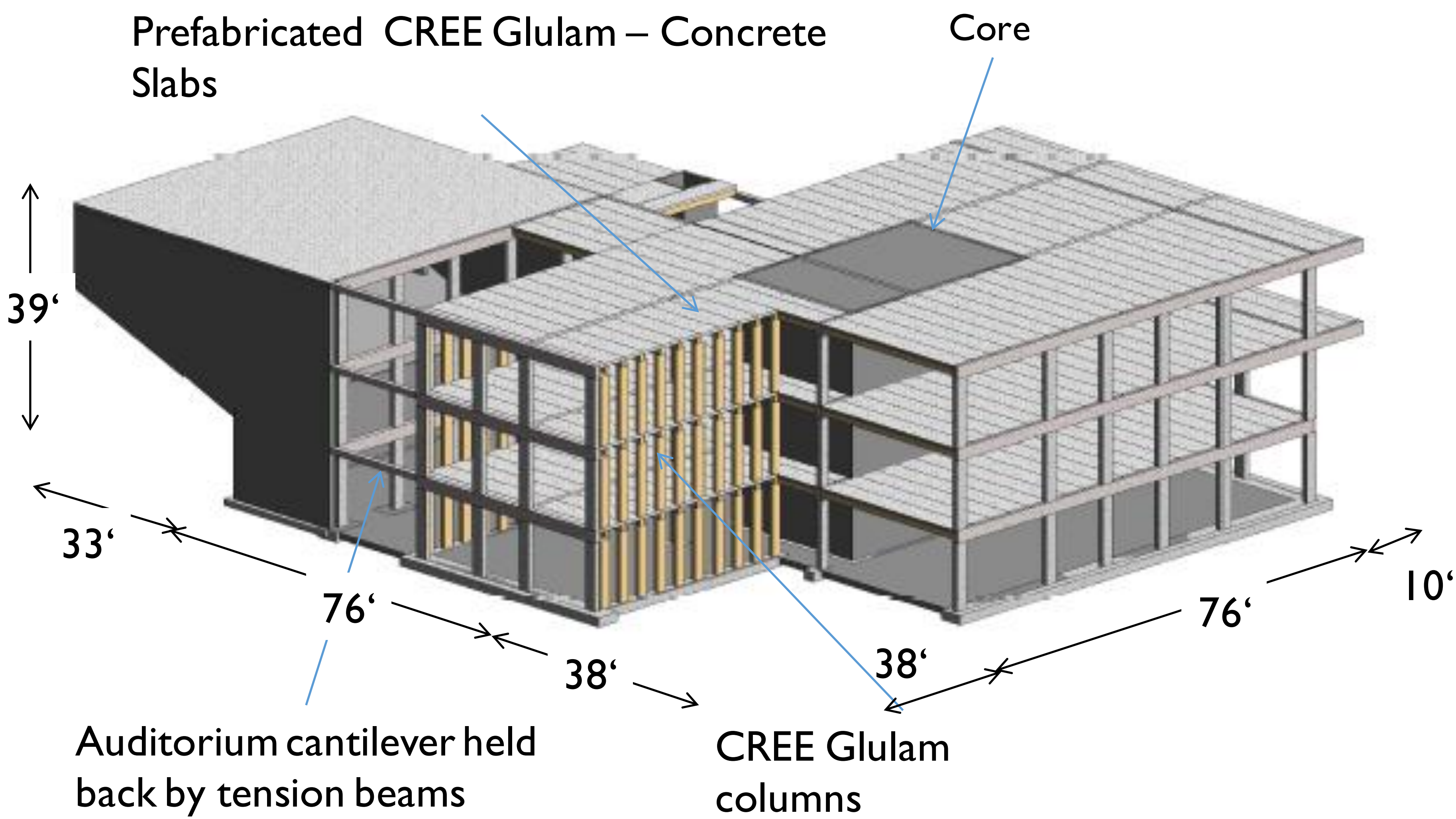
FOUNDATIONS FOR STEEL SYSTEMS



Isolated Concrete Foundations

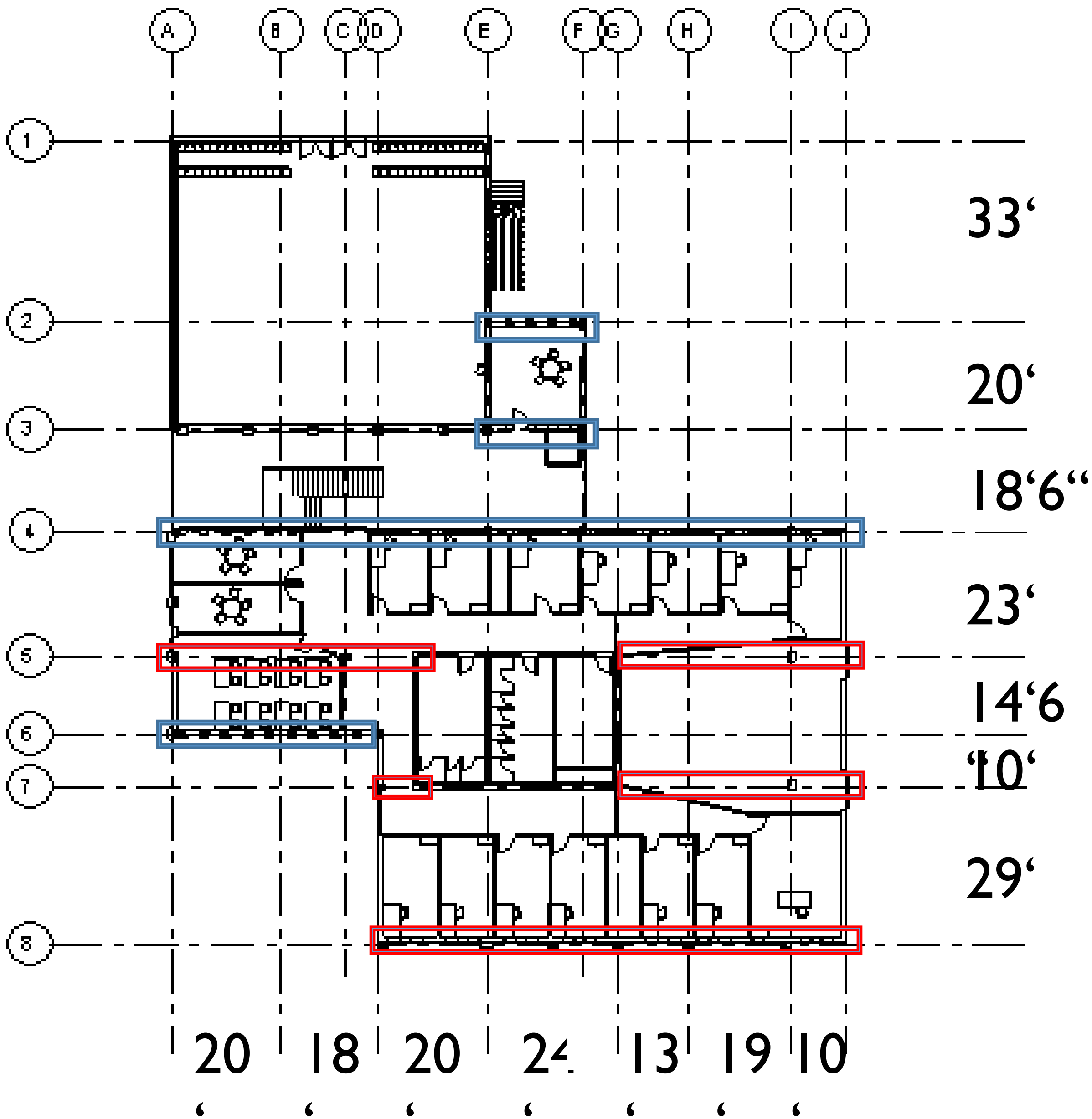
- 6' x 6' x 18"
- #8 @ 6" o.c.

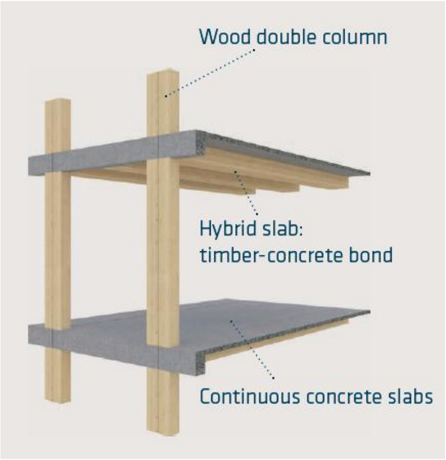
CREE GLULAM CONCRETE SYSTEM



A MEP SE CM

TYPICAL GRID & OVERLAY





CREE Hybrid slabs span between Glulam columns

or prestressed concrete beams

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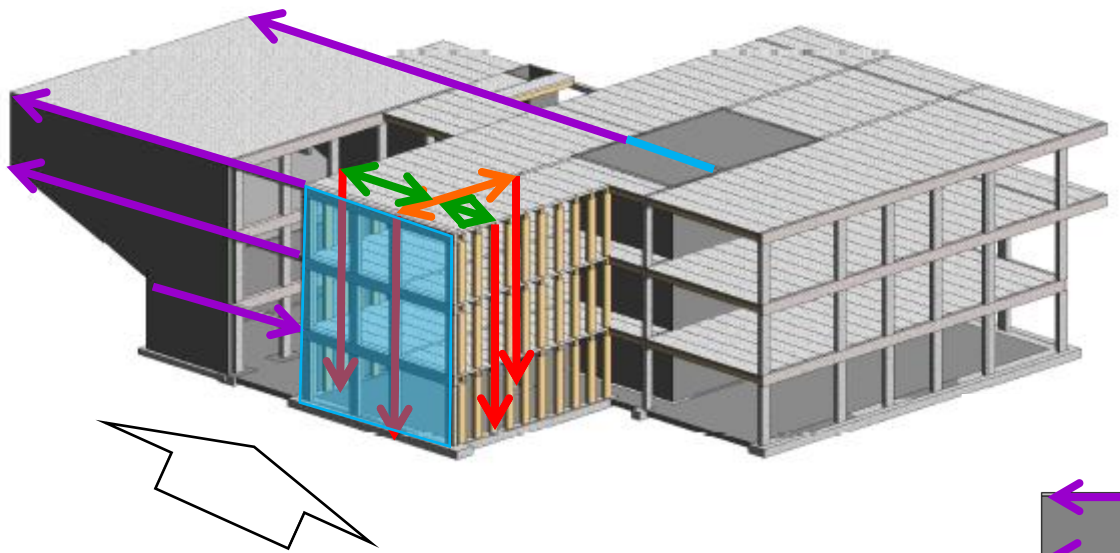
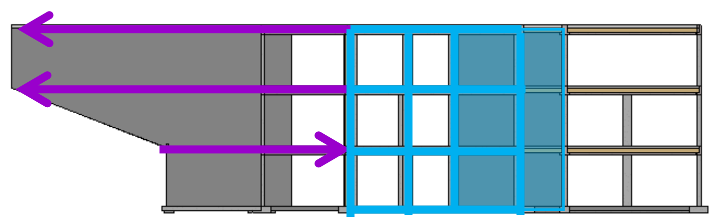
GRAVITY SYSTEM





Hybrid Glulam – Concrete slabs
- Total depth 18”
- Max span 29’

Prestressed Concrete beams
- 12”x24”
- Longest span 32’

Columns
- Glulam columns 10“x 20“ (11’ 6”)
- Concrete columns 12”x18” (11’)

Beams for tension/ compression

Shear wall and moment resisting frame with same stiffness

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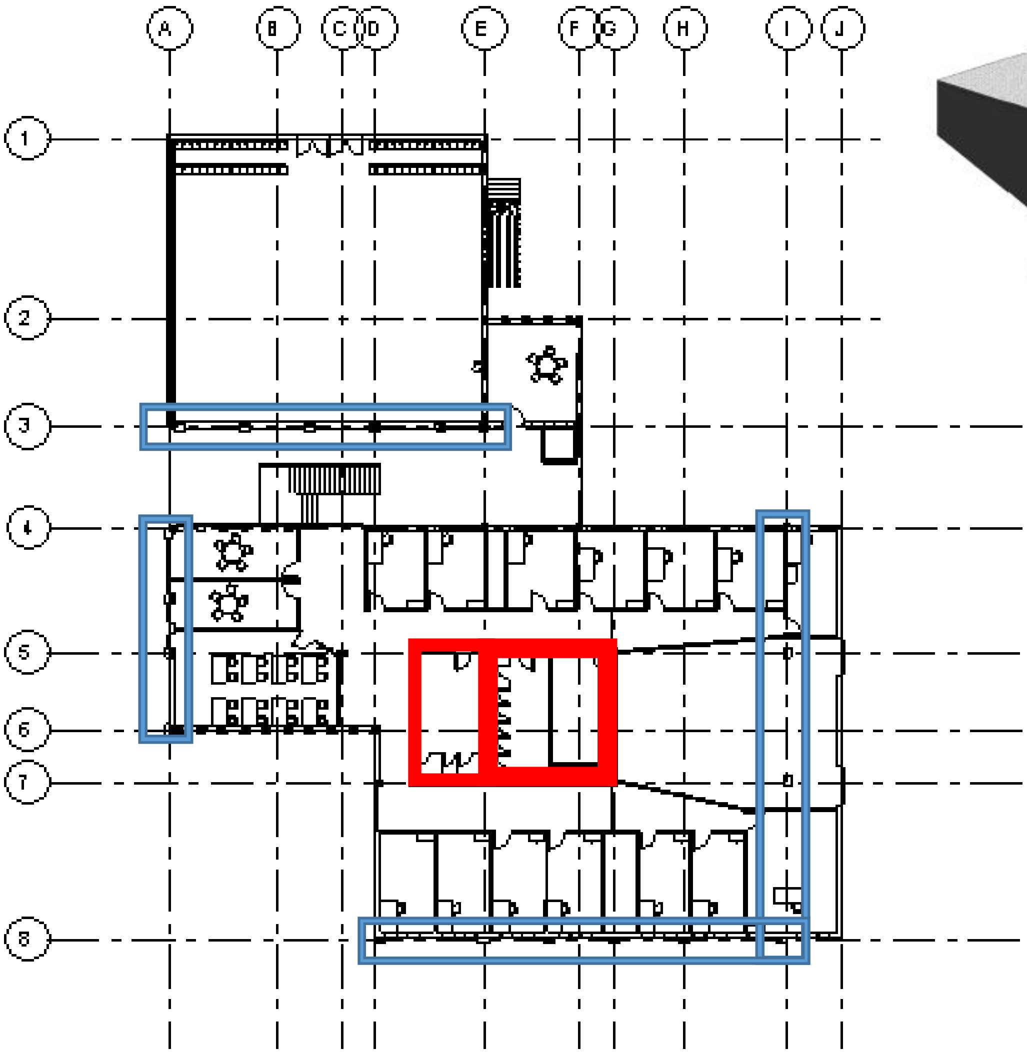
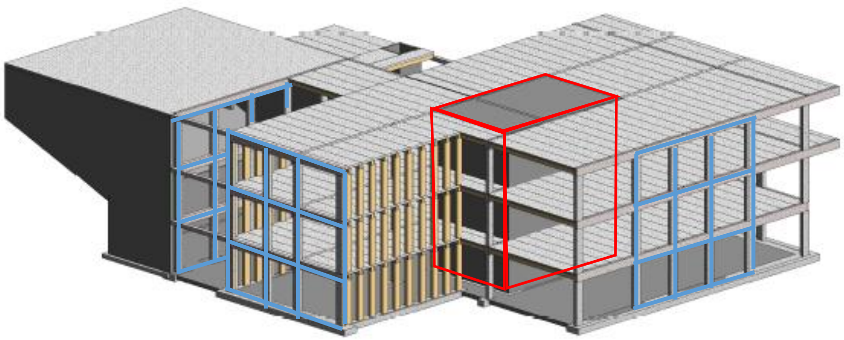
LATERAL SYSTEM





Moment resisting frames

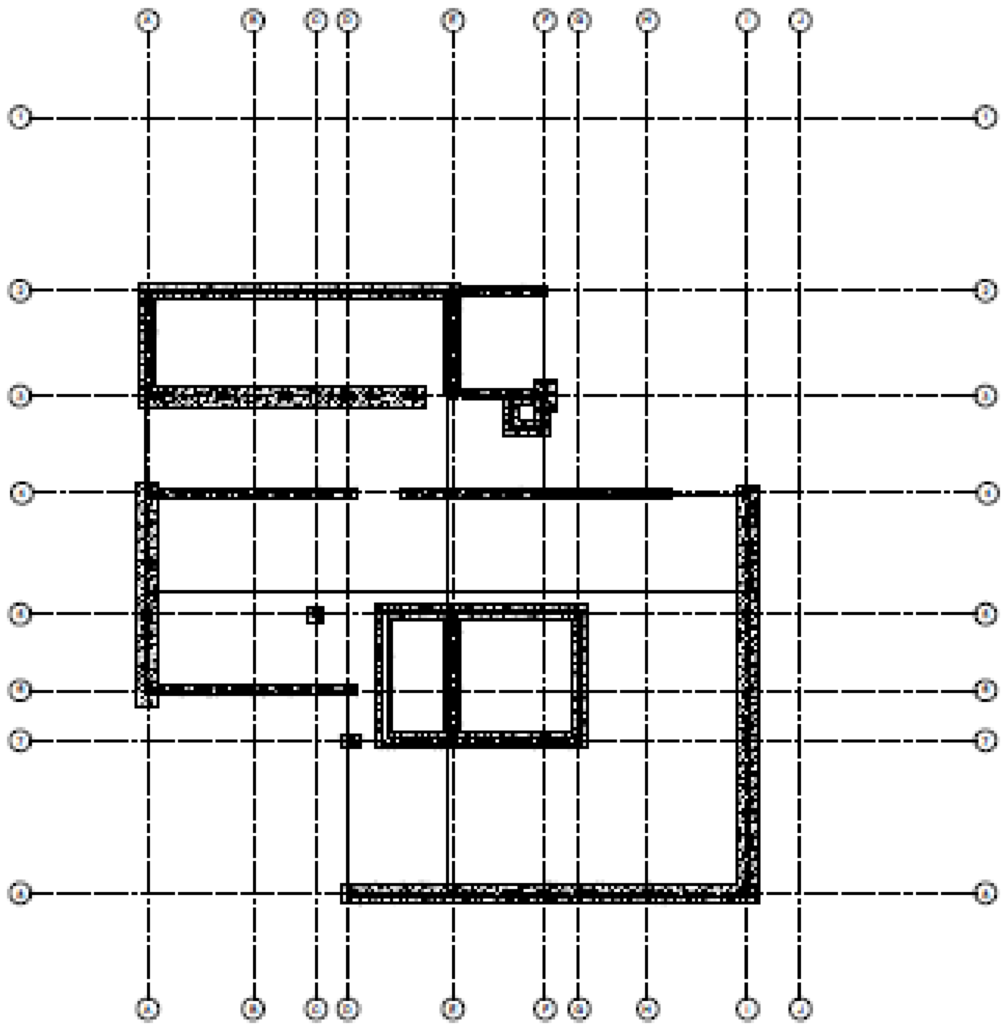
- Reinforced concrete
- Prefabricated post tensioning connections

Concrete core

- Reinforced concrete shear walls 12"

- Auditorium is held back by MRF and core (same stiffness required)
- Torsion controlled

FOUNDATIONS FOR CREE SYSTEM



Isolated Concrete Foundations

- 6' x 4' x 18"

Strip Concrete Foundations

Walls and MRF

- 6' x 18"

Glulam columns

- 4' x 18"

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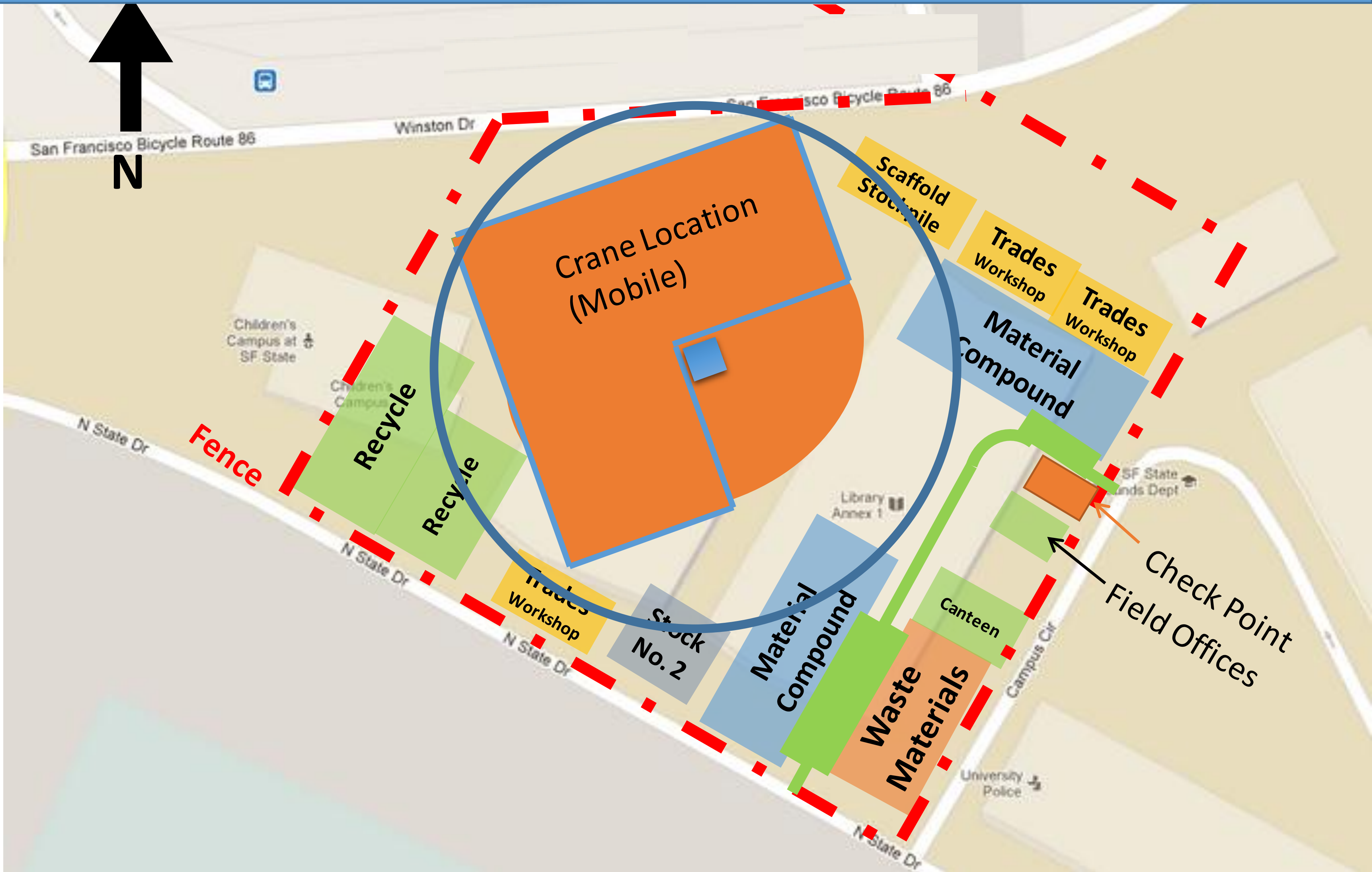
SITE LAYOUT



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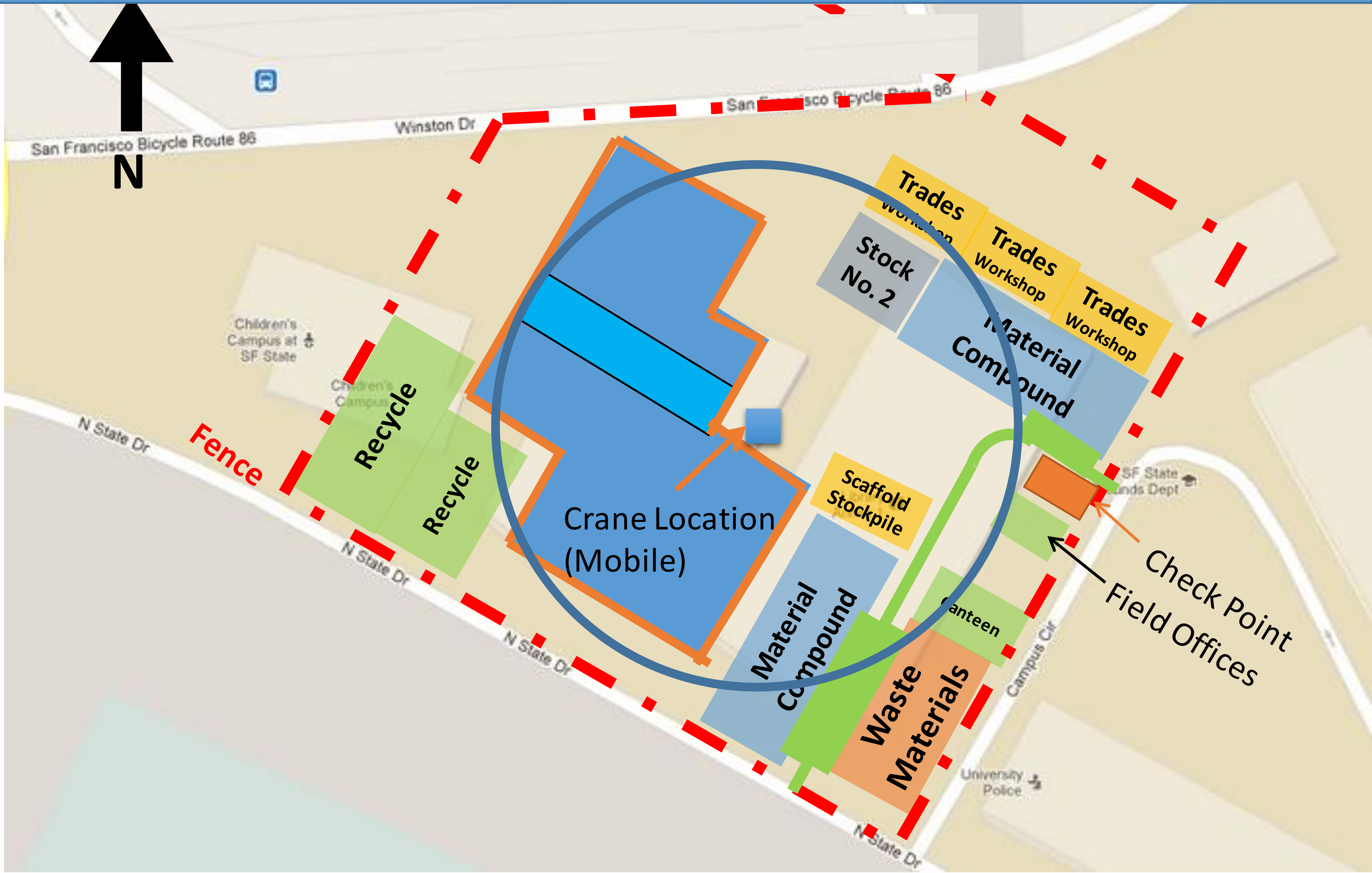
SITE LAYOUT



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CONSTRUCTION RISK MAPPING

1-. Identify Hazards

- Electrical
- Excavation and Trenching
- Falls
- Stairway Ladder
- Scaffolding
- Heavy Construction Equipment

Stanford Accident Cost Accounting System (Severity)

2-. Risk Matrix

Risk Identity & Cause					
Risk ID	Category	Location	Risk Description	Cause	Effect
Current Assesment					
Probability of Occurrence (P)	Impact (Cost & Time)	Risk Score			
Mitigation					
Strategy	Risk Plan	Action Owner			

3-. Risk Map

Likelihood of Occurance		Hazard Severity: Negligible 1	Slight 2	Moderate 3	High 4	Very High 5
	Very Unlikely 1	1	2	3	4	5
	Unlikely 2	2	4	6	8	10
	Possible 3	3	6	9	12	15
	Likely 4	4	8	12	16	20
	Very Likely 5	5	10	15	20	25

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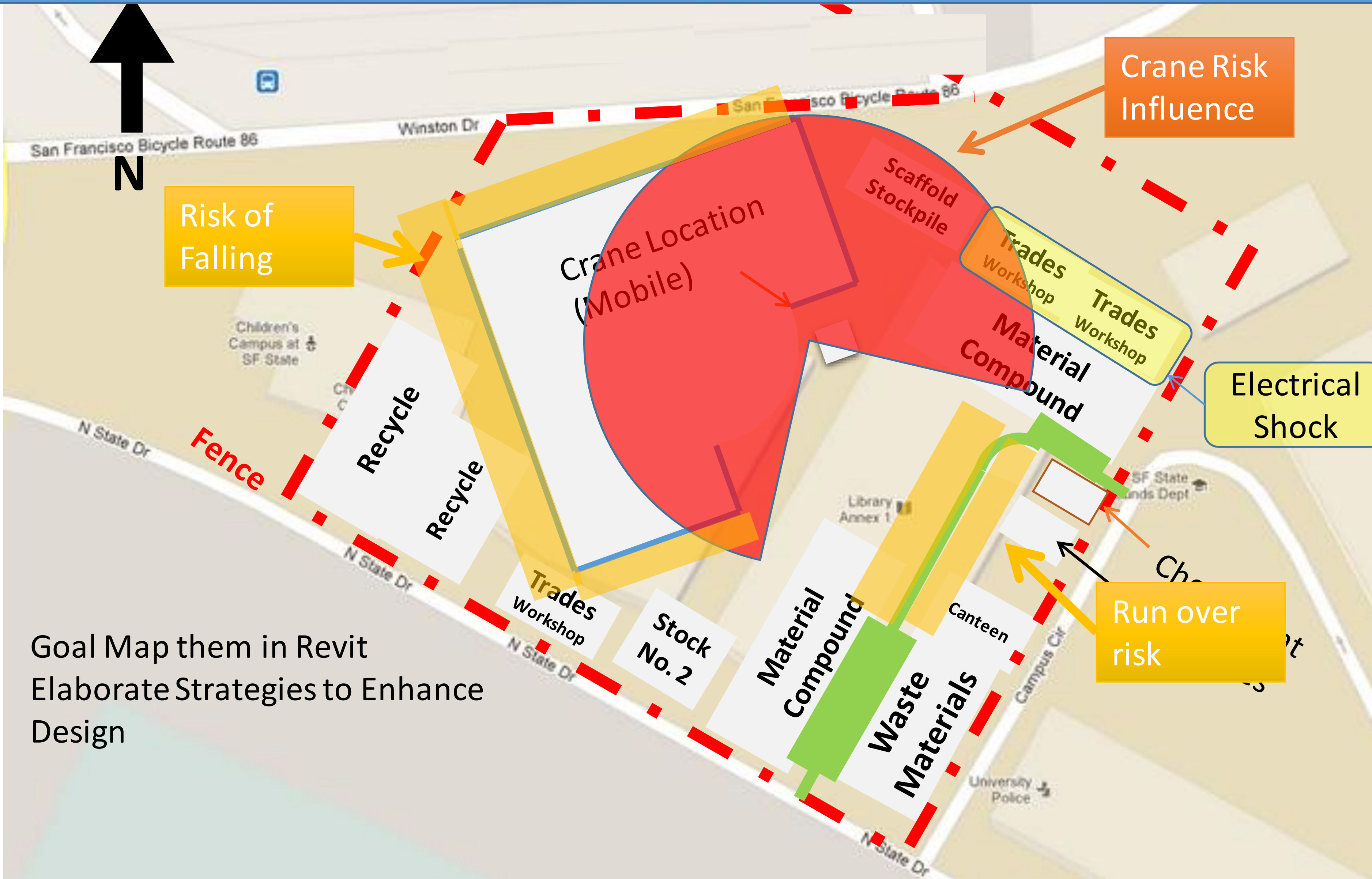
RISK MAPPING PROTOTYPE



Goal Map them in Revit
Elaborate Strategies to Enhance Design

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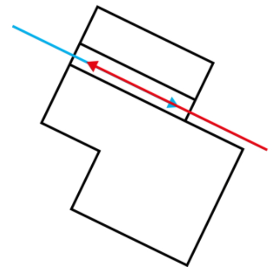
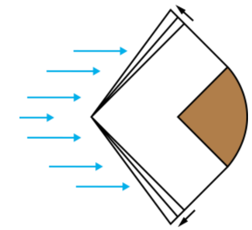
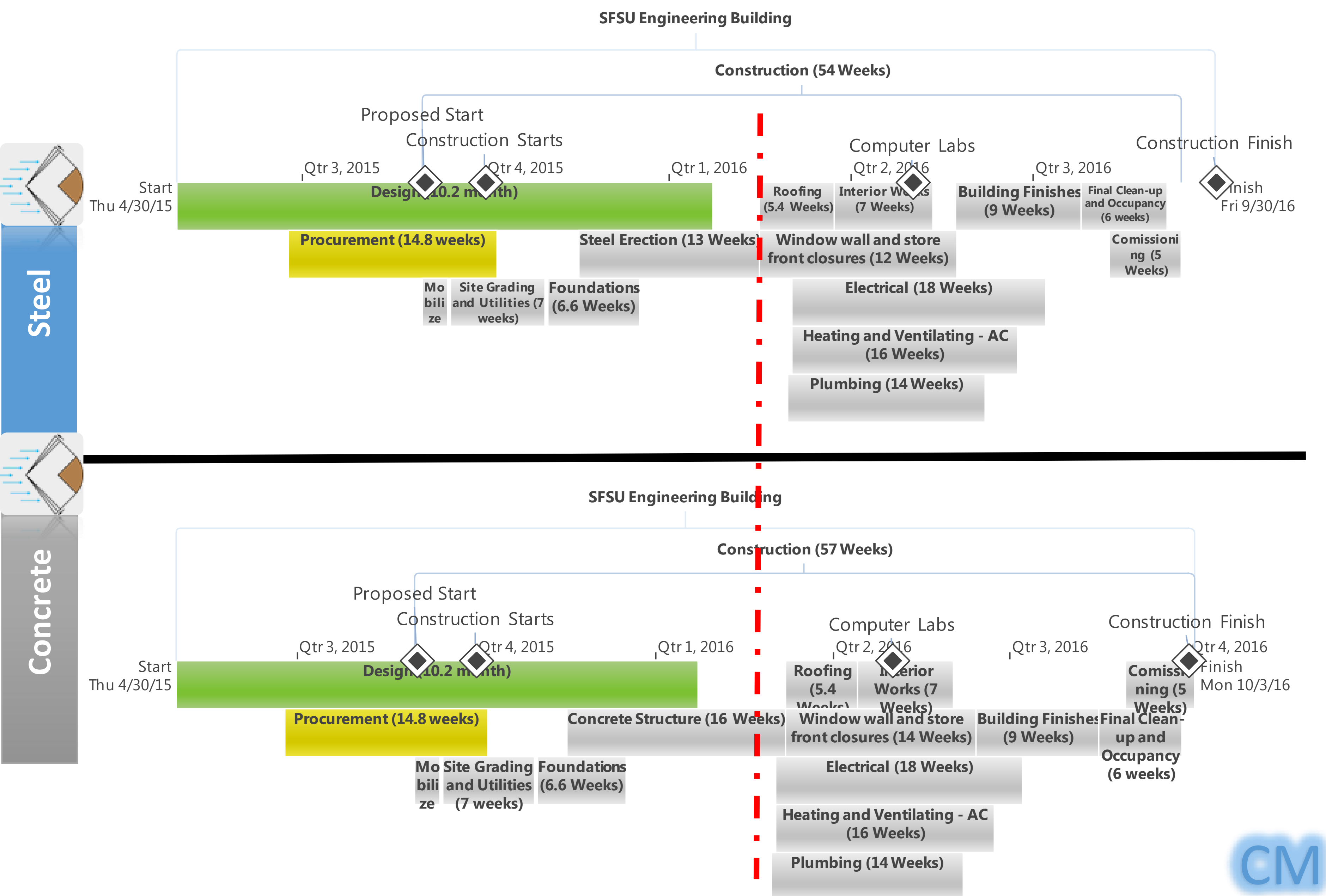
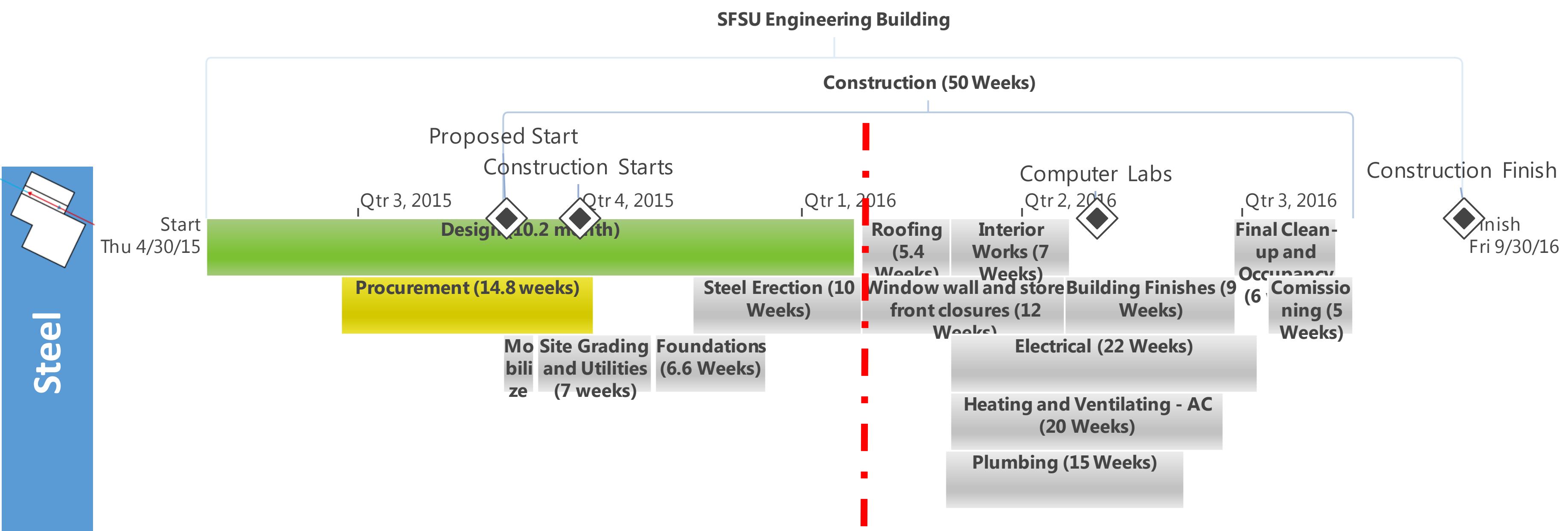
SCHEDULING

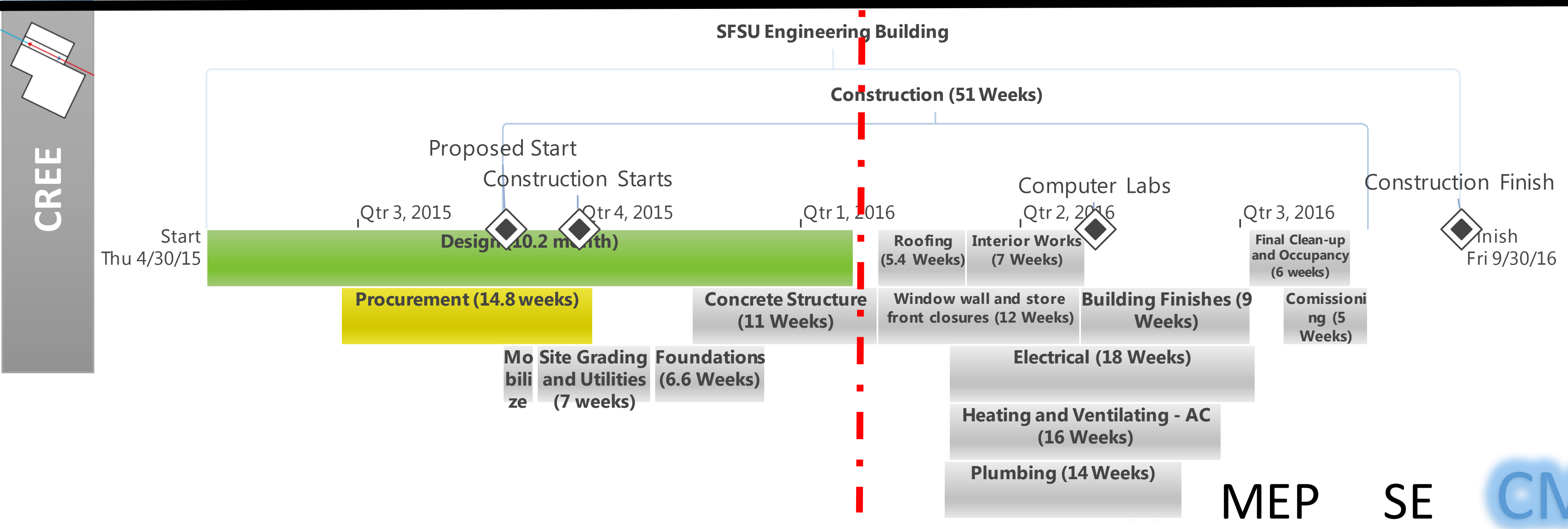
				
Foot Print	Flow - DD		Embrace-LS	
Structure Type	Steel (50 wk)	CREE (51 wk)	Steel (53 wk)	Concrete (57 wk)
Steel Erection/ Concrete Pouring	10 Wk	11 Wk	13 Wk	16 Wk
Façade	12 Wk	12 Wk	14 Wk	14 Wk

SCHEDULING CONSIDERATIONS



SCHEDULING CONSIDERATIONS





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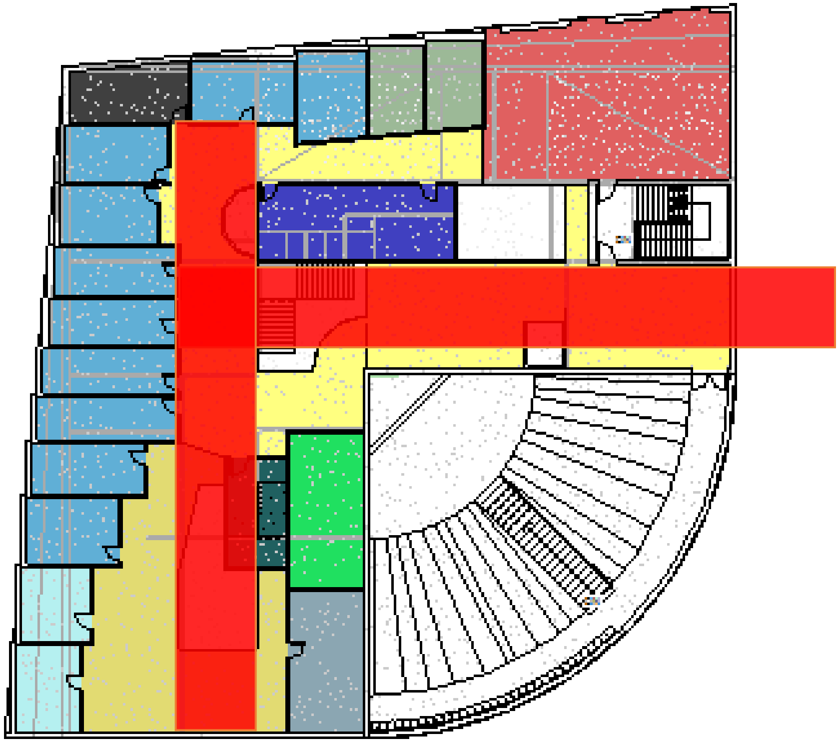
MEP PREFABRICATION OPPORTUNITIES

Dimension Restriction

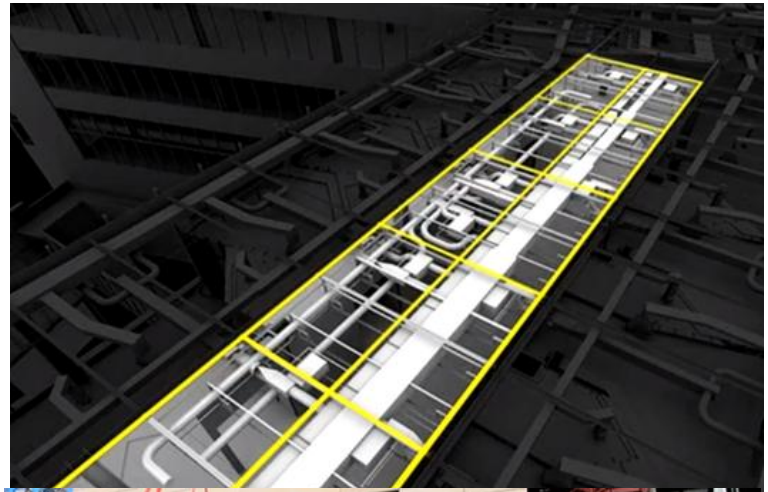
Flatbed truck

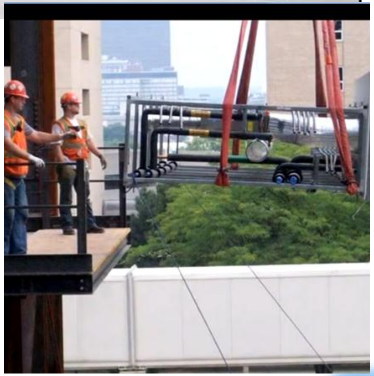
102” Wide

48’ Long



•Corridors Utility Racks





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CREE SYSTEM IMPACT

- Located in San Francisco
- Highly modular
- Efficiency
- Construction period cut by half
- Materials installed hold their value from a deconstruction standpoint

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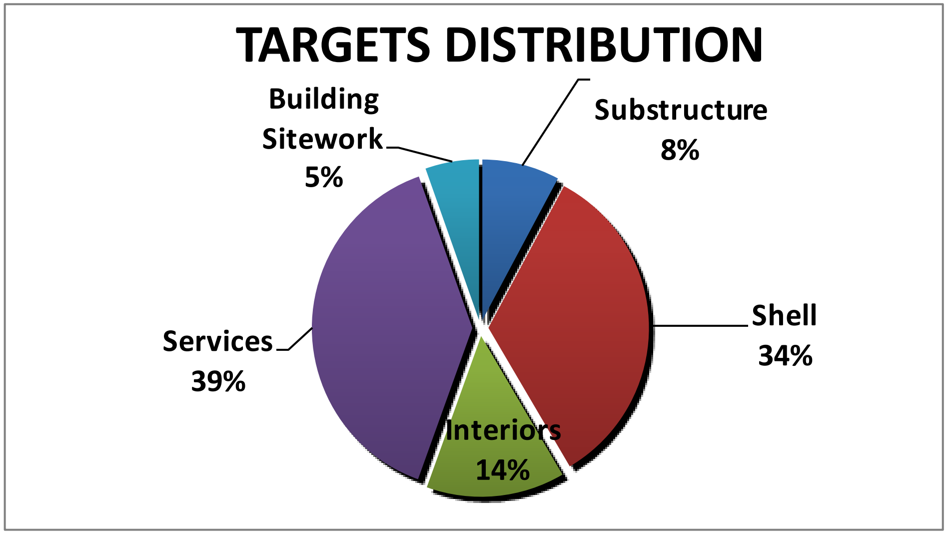
TARGET VALUE DESIGN

Overall Budget and Target	
Construction Grant from Donor	$8,500,000
Grant Year	2013
Construction Year	2015
Expected Inflation	2.00%
BUDGET	$8,200,000
TARGET	$7,250,000

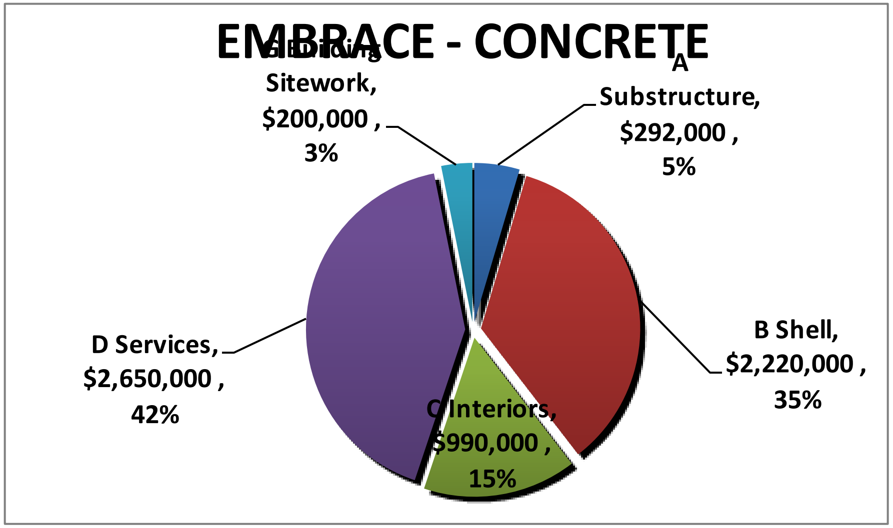
	Cluster Targets (%)	Based on RS Means SF Estimate (College: Classrooms & Administration)	Based on RS Means SF Estimate (College: Science, Engineering, Laboratory)	Based on Previous Project	Average of Previous 3	Based on Owner's Input	Additional % Based on Team's Input	TARGETS
A	Substructure	10%	10%	9%	9.7%	2.0%	6%	8%
B	Shell	33%	31%	32%	32.0%	7.6%	33%	34%
C	Interiors	15%	13%	14%	14.0%	2.9%	14%	14%
D	Services	36%	41%	40%	39.0%	7.3%	41%	39%
G	Building Sitework	6%	5%	5%	5.3%	0.9%	6%	5%
	SUM	100%	100%	100%	100%	21%	100%	100%



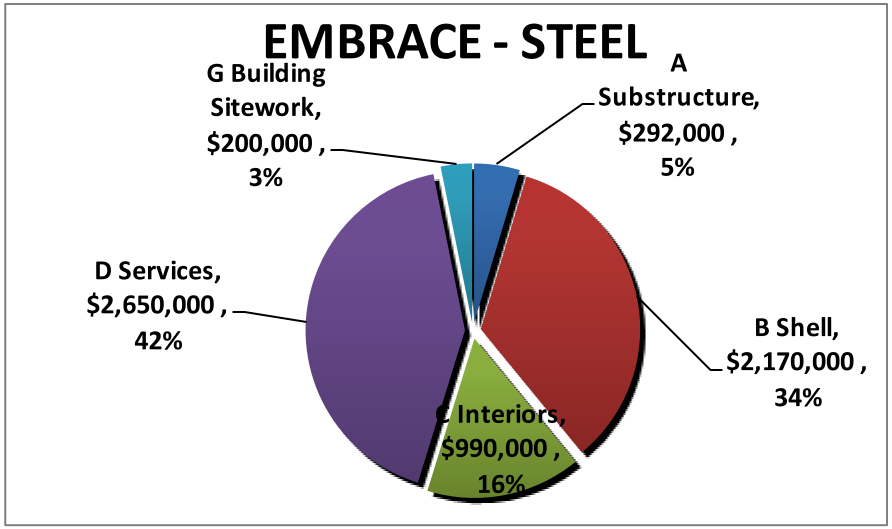
- $8,200,000 accounts for purchase power in 2015
- $7,250,000 target lower than budget to allow for contingency
- Targets based off of owner input, previous projects, RS means, and team input

ESTIMATE – PIE CHARTS

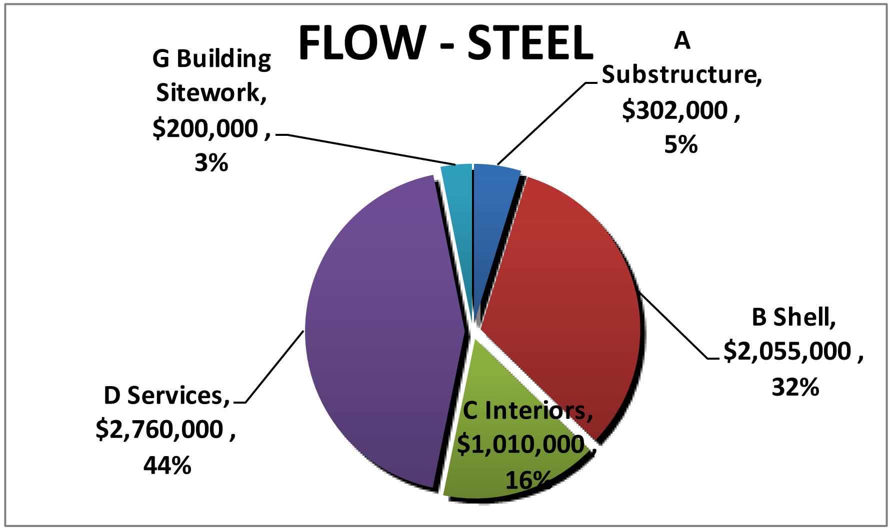
$6,352,000



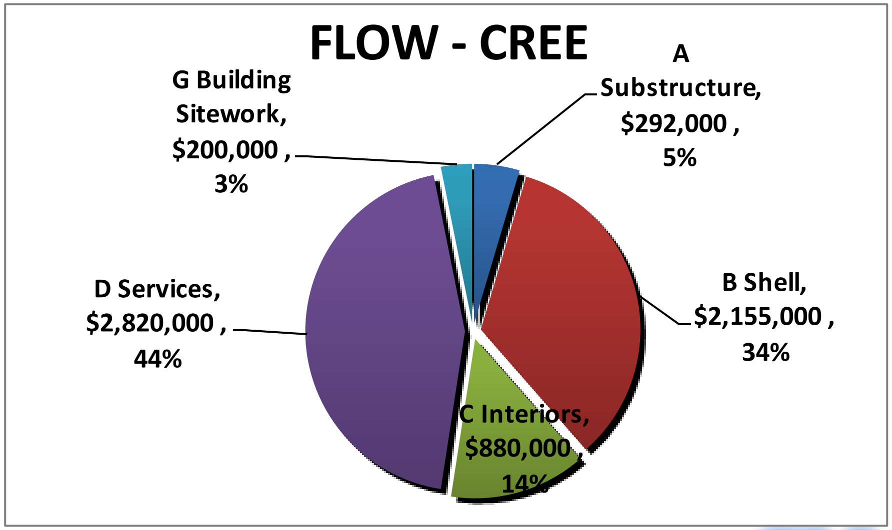
$6,302,000



$6,327,000



$6,347,000



A MEP SE CM

MAIN COST CONSIDERATIONS

- Auditorium
  - Embrace > Flow
    - Irregular conical shape of Embrace
- Services
  - Flow > Embrace
    - Separation by atrium requires two major service zones
- Steel vs. Concrete vs. Cree (Glulam)
  - Steel is cheapest initial cost
    - Not including fire proofing
  - Concrete cost could be offset by amount of fireproofing necessary
  - Cree is high material cost, but low labor, so less risk
    - Glulam can serve as exterior and interior finish

DECISION MATRIX

Criteria	Subcriteria	Description
		Points available
Economical		
	Construction Costs	Calculation of the construction costs by RSMeans.
	Operation & Maintenance Costs	Includes expenses for cleaning, energy and administration as well as those for maintenance and replacements.
	Space efficiency	The ratio of net external area to gross external area to determine the space efficiency.
	Construction Time	Required construction time according to the work schedules of the different alternatives.
	Income	Additional income
	Constructability	How to building will be built and what techniques will be used (complexity associated with the production of the property).
Environmental		
	CO2-Emission	CO2-Emission in tons per year.
	Renewable Energy	Usage of renewable energy (e.g. PV, wind turbine, earth heat).
	Life Cycle of Material	Life span of used materials.
	Recycled Material	Usage of recycled materials.
	Structural Performance	Performance of the building in seismic activity.
	Ventilation	The possibility to integrate a natural ventilation system in a building.
Social		
	Comfort	Comfort of the users and employees (mostly depending on the lighting conditions and the indoor climate).
	Flexibility	Flexibility describes how spaces can be customized to different requirements.
	Student/Faculty Collaboration	Interaction and collaboration between students and faculty members to enable a fruitful work environment.
	Design/Iconicity	Attractiveness and iconicity of the design/building.
	Innovation	In which extend innovations are included in the construction project.

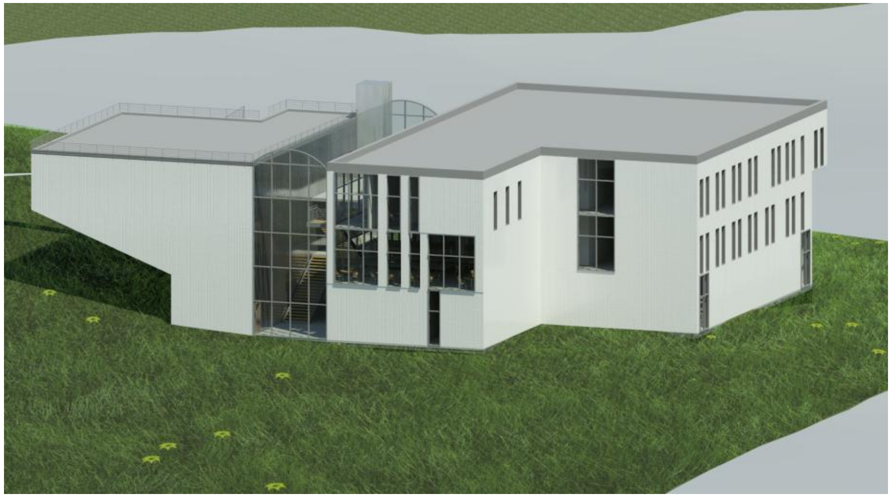
- Weighted based on team and owner input
- Alternatives multiplied by respective subcriteria factor
- Final results based on 50% team input and 50% owner input

DECISION – FLOW CREE

		Embrace Steel	Embrace Concrete	Flow Steel	Flow CREE
Team	**50%**	388	330	422	425
Karolina		386	325	410	411
Michael	**50%**	386	327	409	412
Lauren		397	337	418	422
Total Score		**778**	**660**	**834**	**840**

Final Decision Making Process:

- Flow Steel vs. Flow CREE
- CREE system offers:
  - Unique challenges
  - High sustainability, modularity, and iconicity
- Steel system offers:
  - Simplicity
  - Lower cost
- New challenges = New opportunities

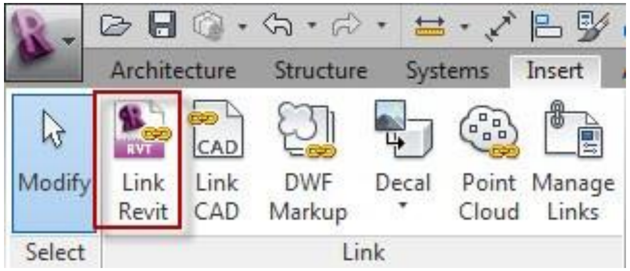


TEAM PROCESS AND DYNAMIC

- Continue weekly meetings in 3D ICC
- Further develop Agile IPD format and protocol for effective asynchronous collaboration over break
- Revit linking has and will continue to facilitate accurate coordination of discipline designs
- Facebook and Skype for relaxed communication

3D I.C.C.
IMMERSIVE COLLABORATION CONSULTING

Activity	Deliverable	By Whom	For Whom	INITIAL Estimated Finish Date	INITIAL Estimated Work Hours
Find Real Topography	Digital Topography	MM	BA	2/5/2013	
Review TVD	Range of materials needed for pricing	SE	NM	2/5/2013	0.5
CM/Architect meeting	A: Some materials that need pricing CM: Input for constructability issues	EH/NM	BA	2/5/2013	
CM/ Structural	Meeting	EH/NM	MM/DT	2/5/2013	0.5
MEP/Arch Meeting Determine orientation of corridors and rooms to maximize natural ventilation + technology	Optimized orientation of corridors and rooms to improve natural ventilation	EL/BA	All	2/6/2013	0.5
Research leapfrog solutions	bring a technology with an implementation plan	ALL	ALL	2/5/2013	2
SE/A Meeting 11am PST	Grids to help architectural plans	MM/DT	BA	2/4/2013	0.5
SE/MEP Meeting 11am PST	Running stuff aslong beams where-more coordination	MM/DT	EL	2/6/2013	0.5
Pre-lim plans for solving labs and other stuff (restrooms, mep etc)	Plans (revit or sketchup)	BA	MEP/SE/(CM)	2/5/2013	lots



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