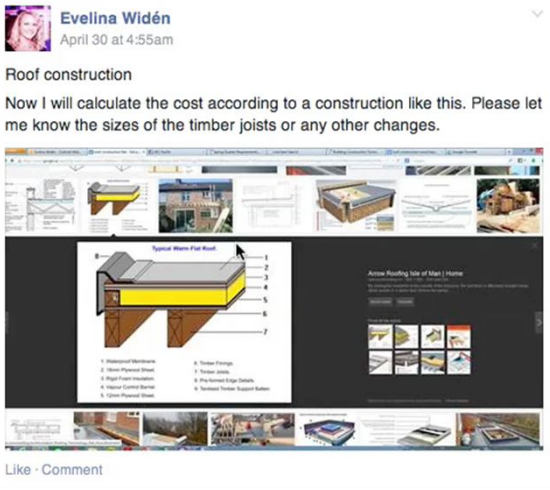

Evelina
CM
Jackie
Engineer
Flavia
MEP
Kyunki
CM
Alicja
Architect
Claire
Apprentice
Ben
Engineer
PACIFIC 2014
Vladstudio

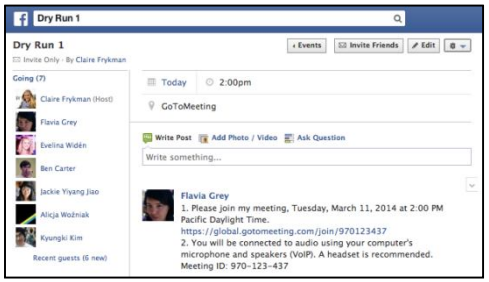
Communication and Interaction

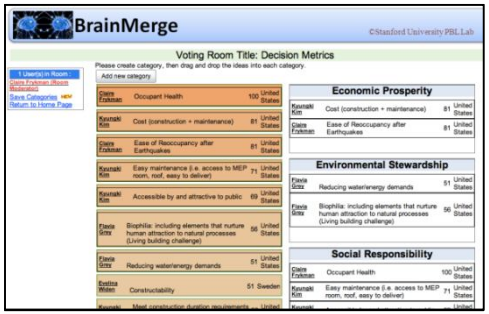
- box -- Permanent files
  - E_CF_Presentation_MAY6_v4.ppt
- Google docs -- Co-editing
- facebook -- Inspire, broadcast + forward

Inspire, Broadcast + Forward

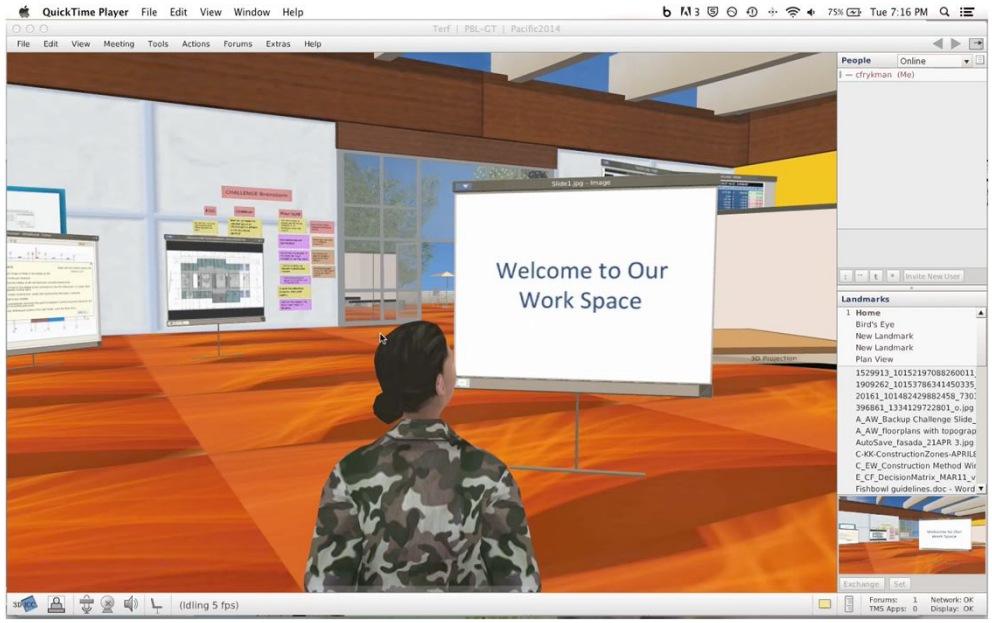


Meeting Protocol

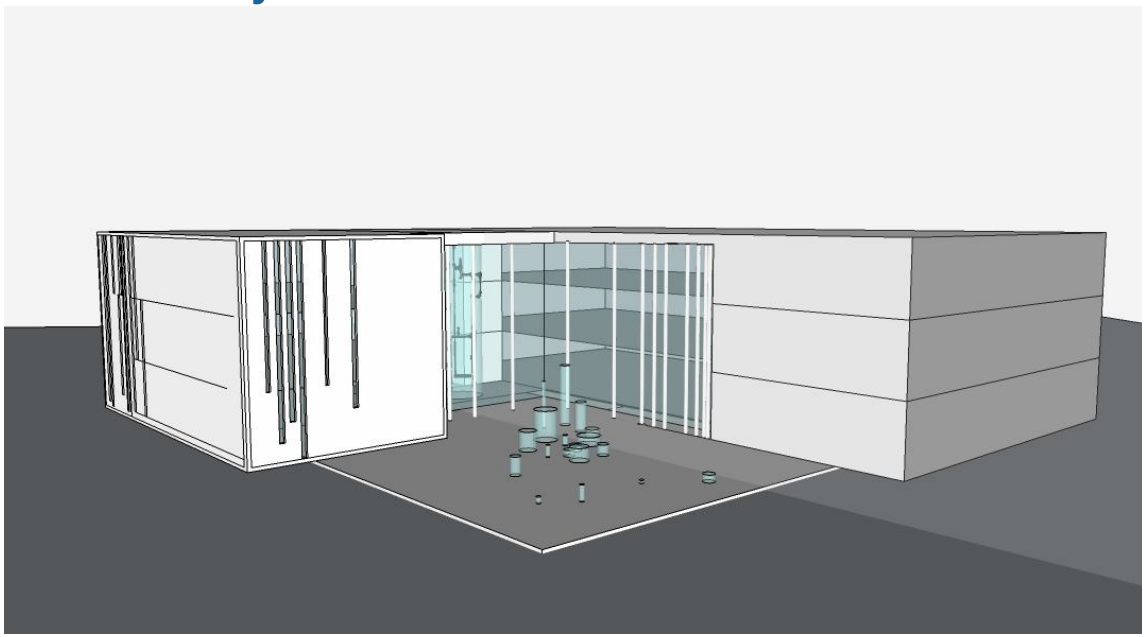




TERF – Online Collaboration

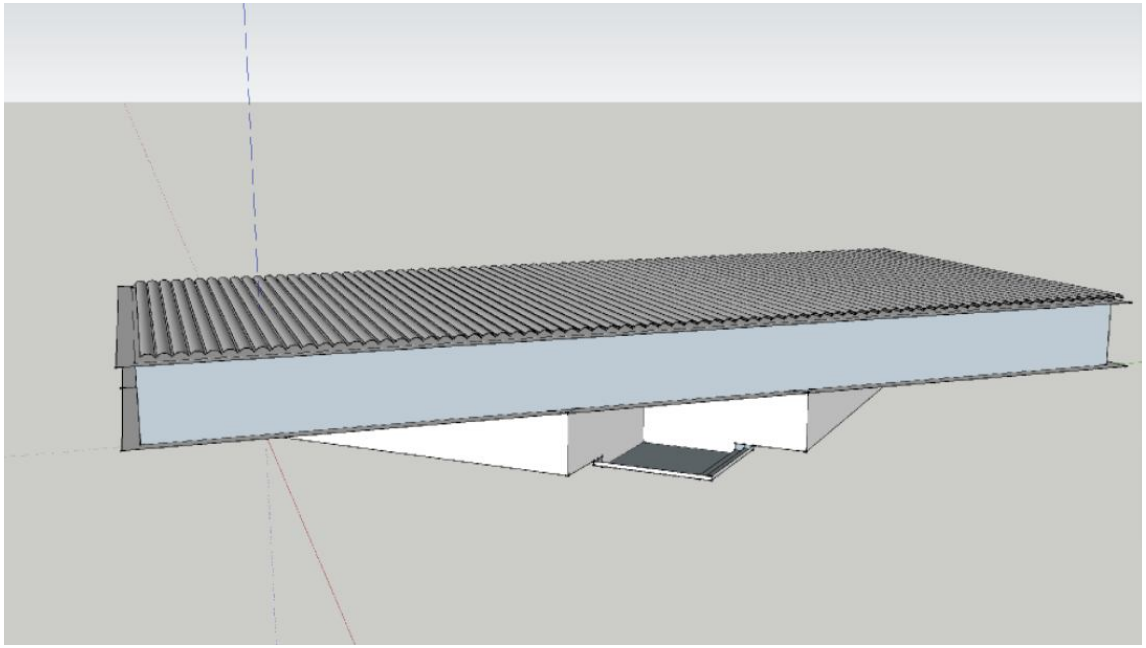


January - Kickoff

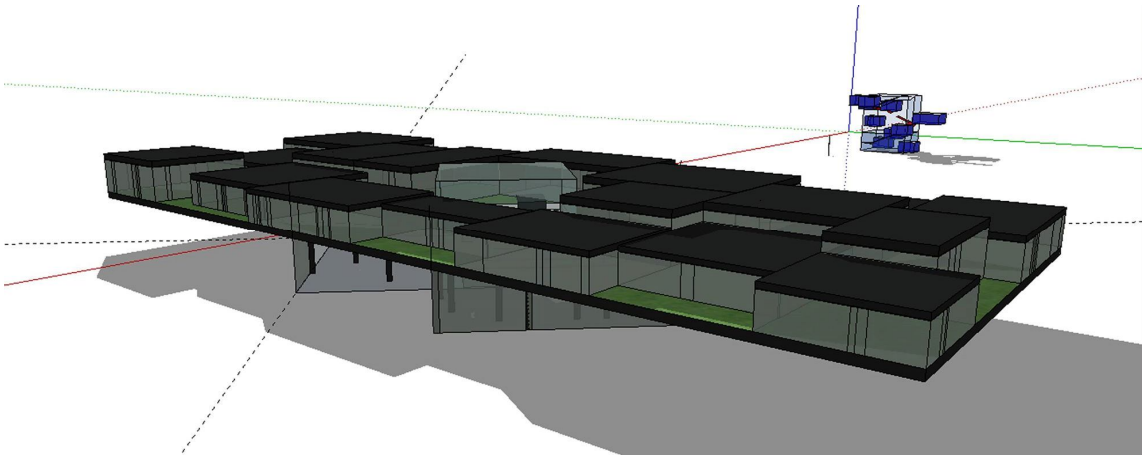


March – Winter Presentation

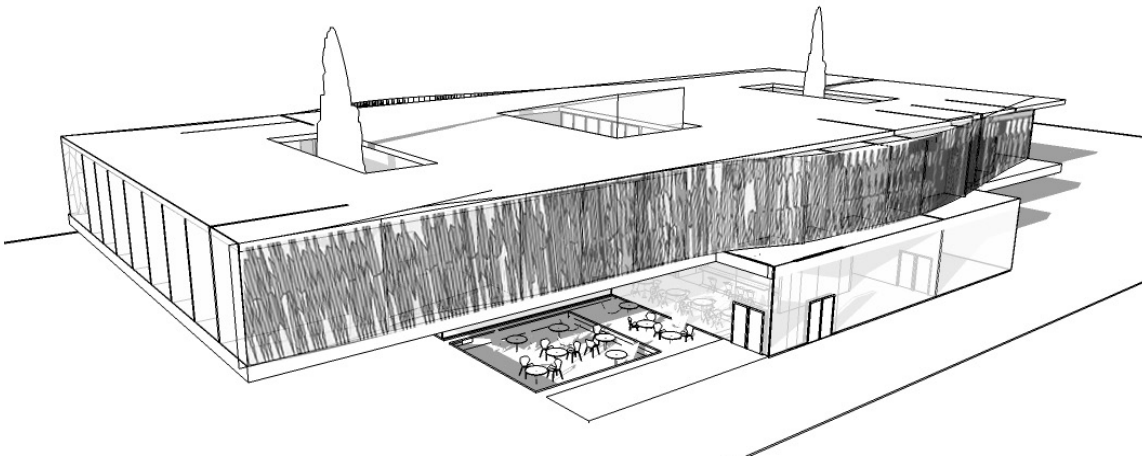
February



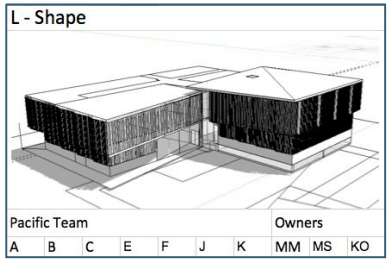
Late February

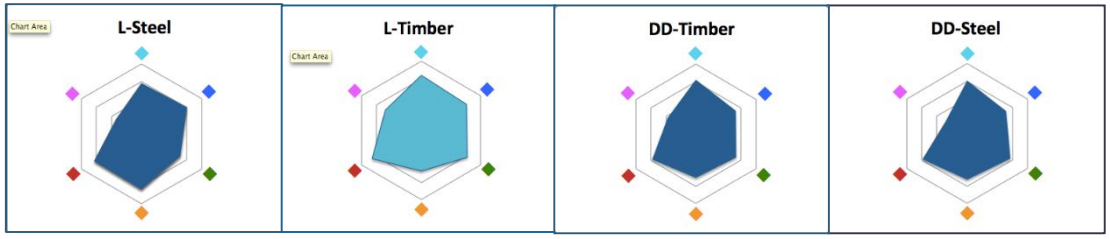


March - Fishbowl



Decision Matrix





◆ Personal Preference ◆ Architecture

◆ Social Responsibility ◆ Economic Prosperity ◆ Environmental Stewardship

Fullfill client goals = Project Success

Karolina

“Innovative, efficient, flexible and sustainable. “

“Make nature penetrate the building, make building “floating”"

Michael

“Value on performance after seismic event.”

“Emphasize the concept of nature.”

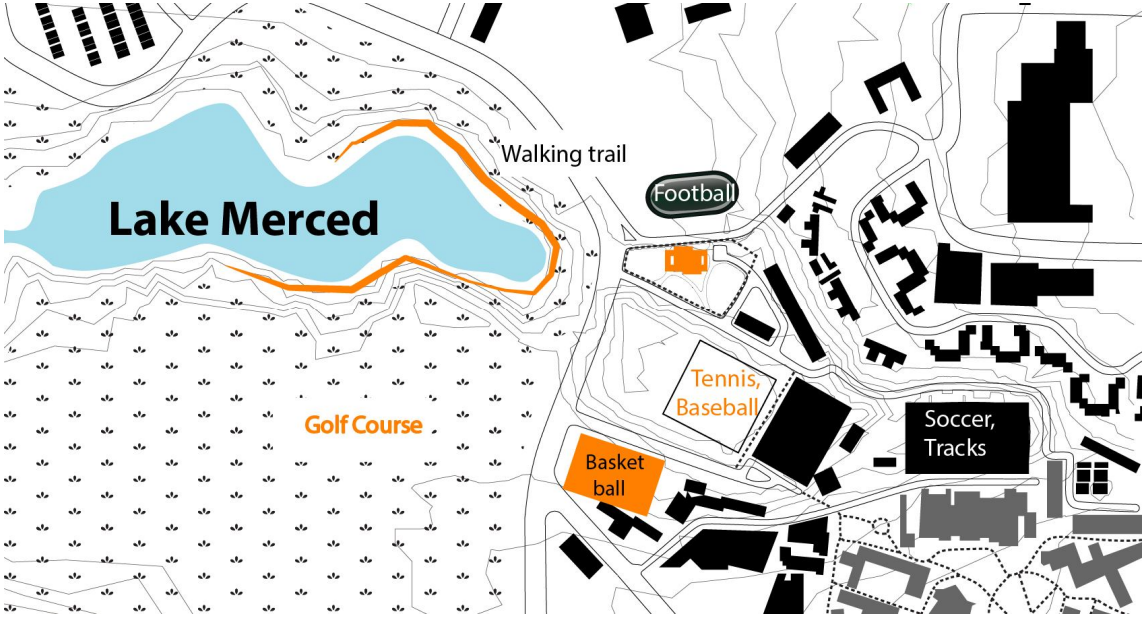
Mike

“Statement building”

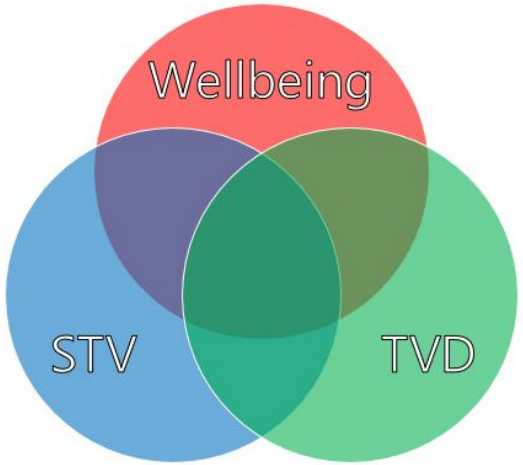
“Access - a lot of people will need to enter and exit the building.”

Total Value Framework

Healthy Building

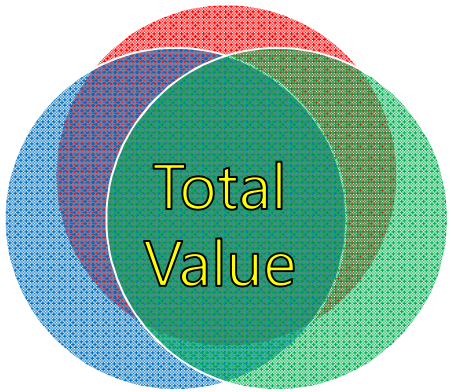


Total Value Framework



Wellbeing
Target Value Design (TVD)
Sustainable Target Value (STV)

Total Value Framework



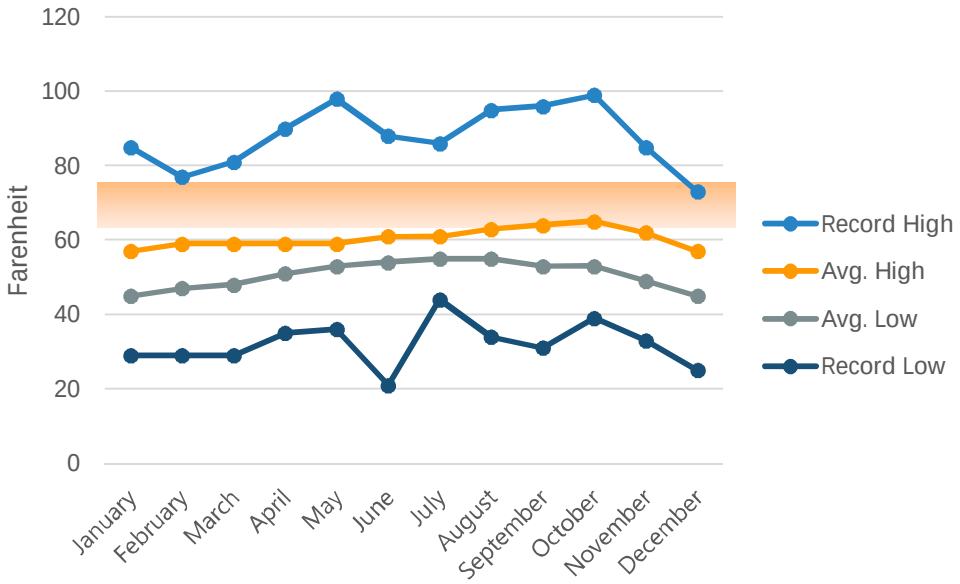
Total Value Framework

Wellbeing

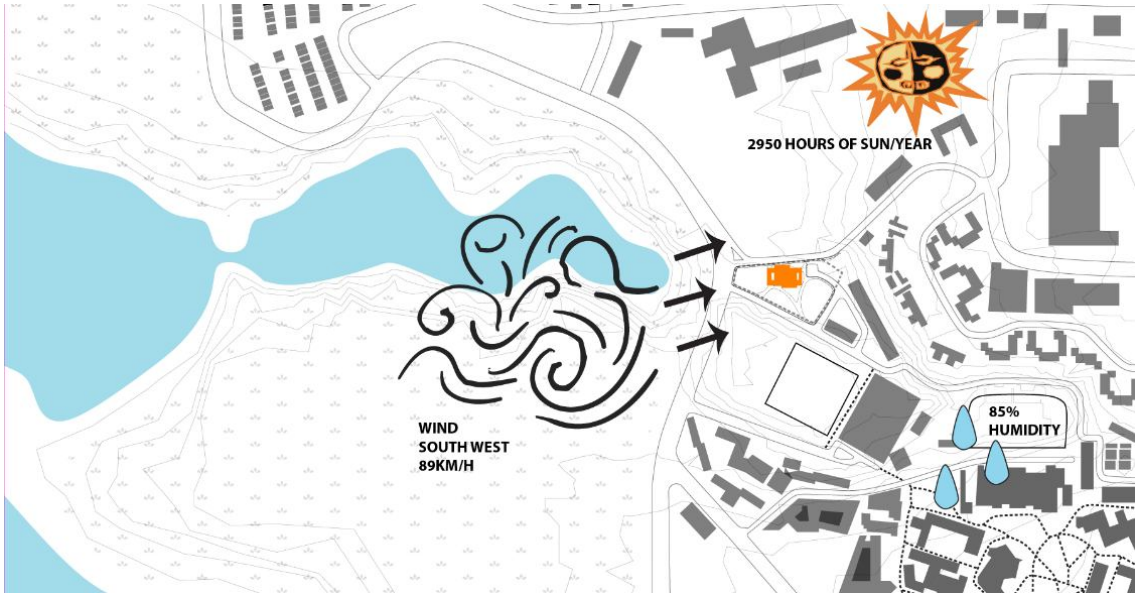
≠

Wellness

Lake Merced Weather



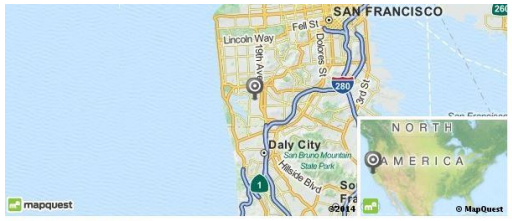
Lake Merced Weather



Earthquake Information

S_S = 2.177 g

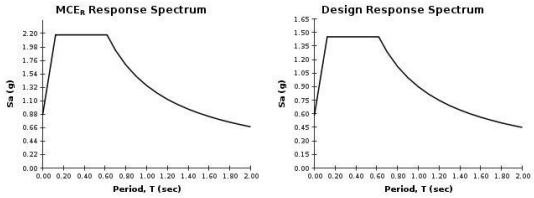
S_{DS} = 1.451 g



USGS-Provided Output

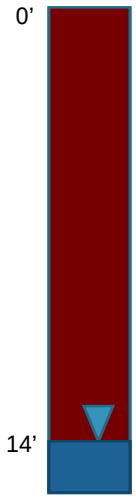
S_S =	2.177 g	S_{MS} =	2.177 g	S_{DS} =	1.451 g
S_1 =	1.037 g	S_{M1} =	1.348 g	S_{D1} =	0.899 g

For information on how the SS and S1 values above have been calculated from probabilistic (risk-targeted) and deterministic ground motions in the direction of maximum horizontal response, please return to the application and select the "2009 NEHRP" building code reference document.

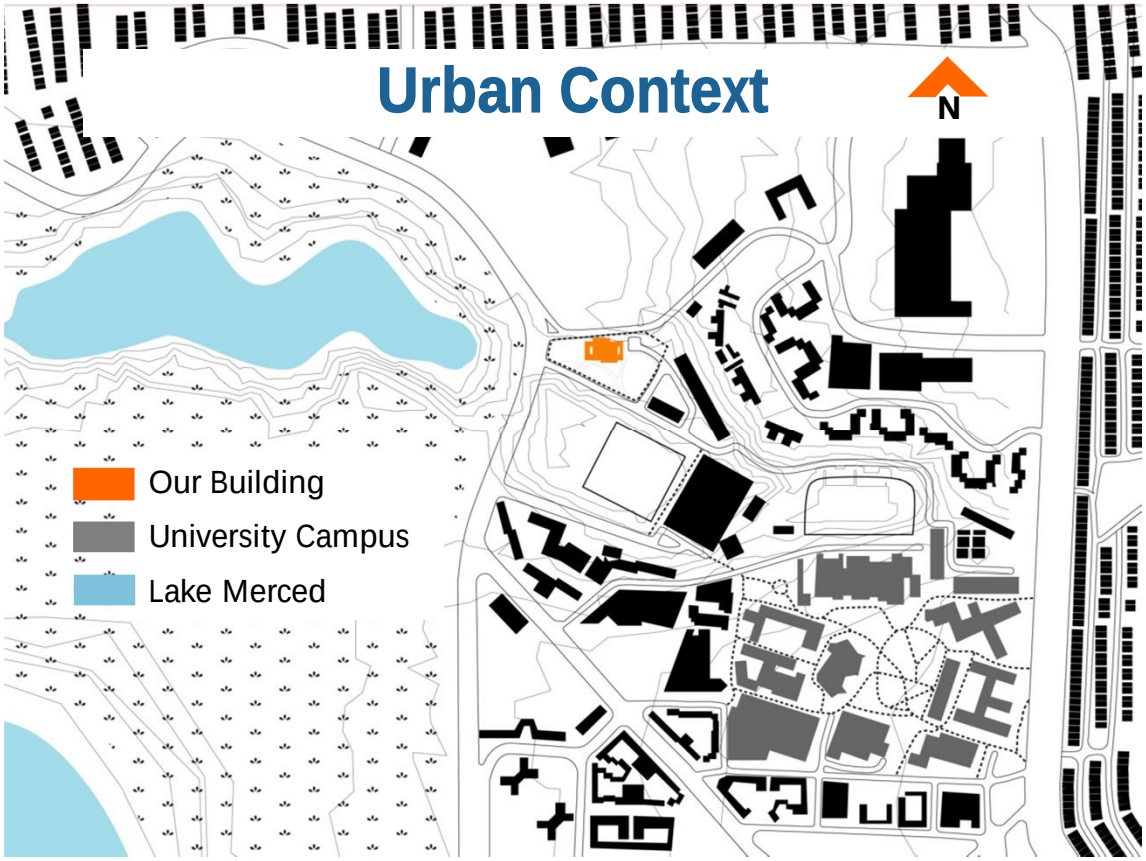


http://geology.com/articles/images/san-andreas-fault-map.jpg

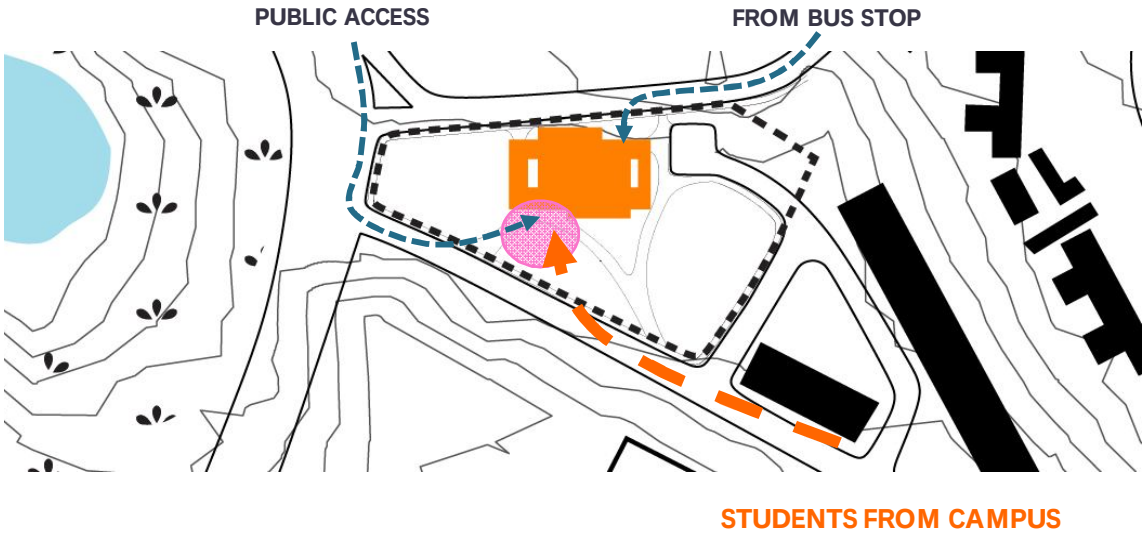
Soil Profile



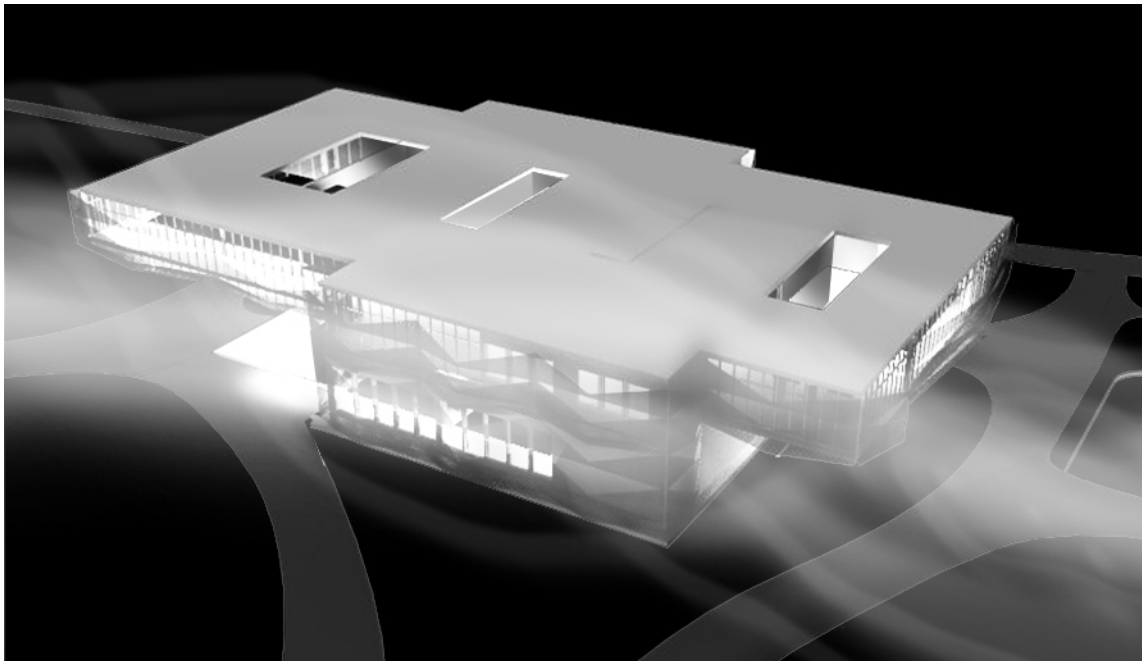
- USGS Soil Type C
- Well sorted fine to medium sand
- Water table: 14ft below grade
- Friction angle = 40 degrees
- Ka = 0.217, Ko = 0.357, Kp = 4.599
- Unit weight = 116 pcf, saturated = 135 pcf
  (from Lindeburg, *Civil Engineering Reference Manual for the PE Exam, 8th ed.*)


Urban Context
N
Our Building
University Campus
Lake Merced

Building Access

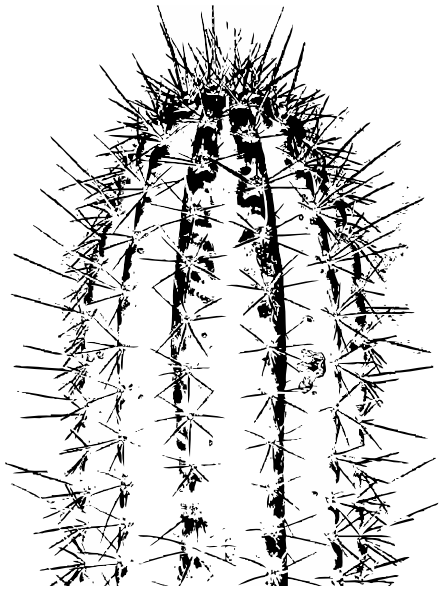


The Fog Catcher



Fog Harvesting Methods

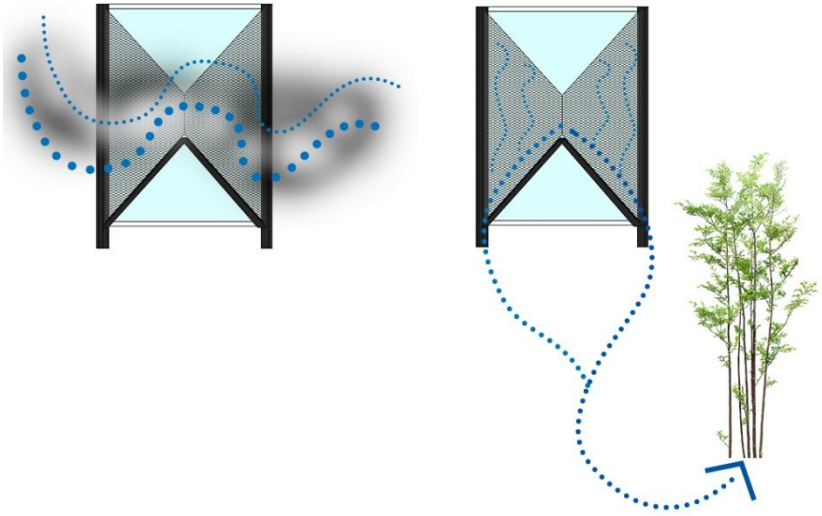
Biomimicry – The Cactus



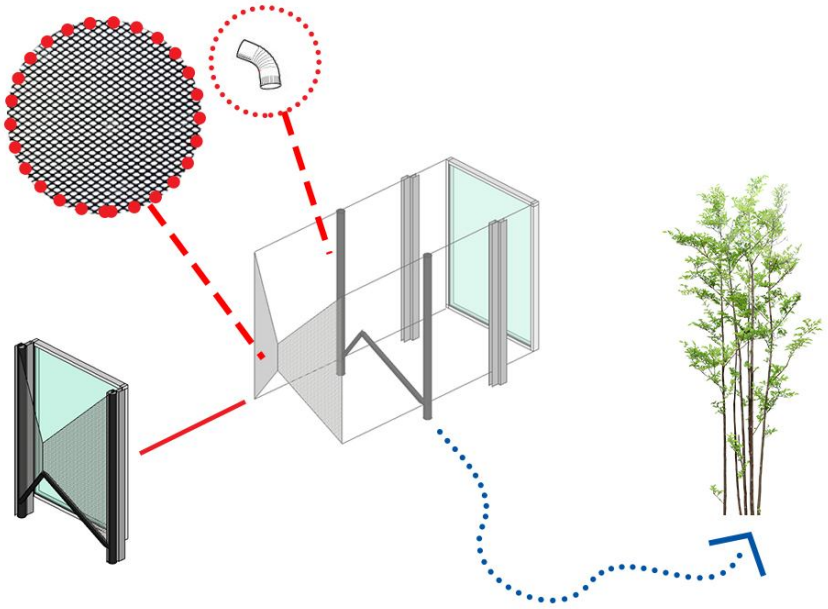
Water Conservation

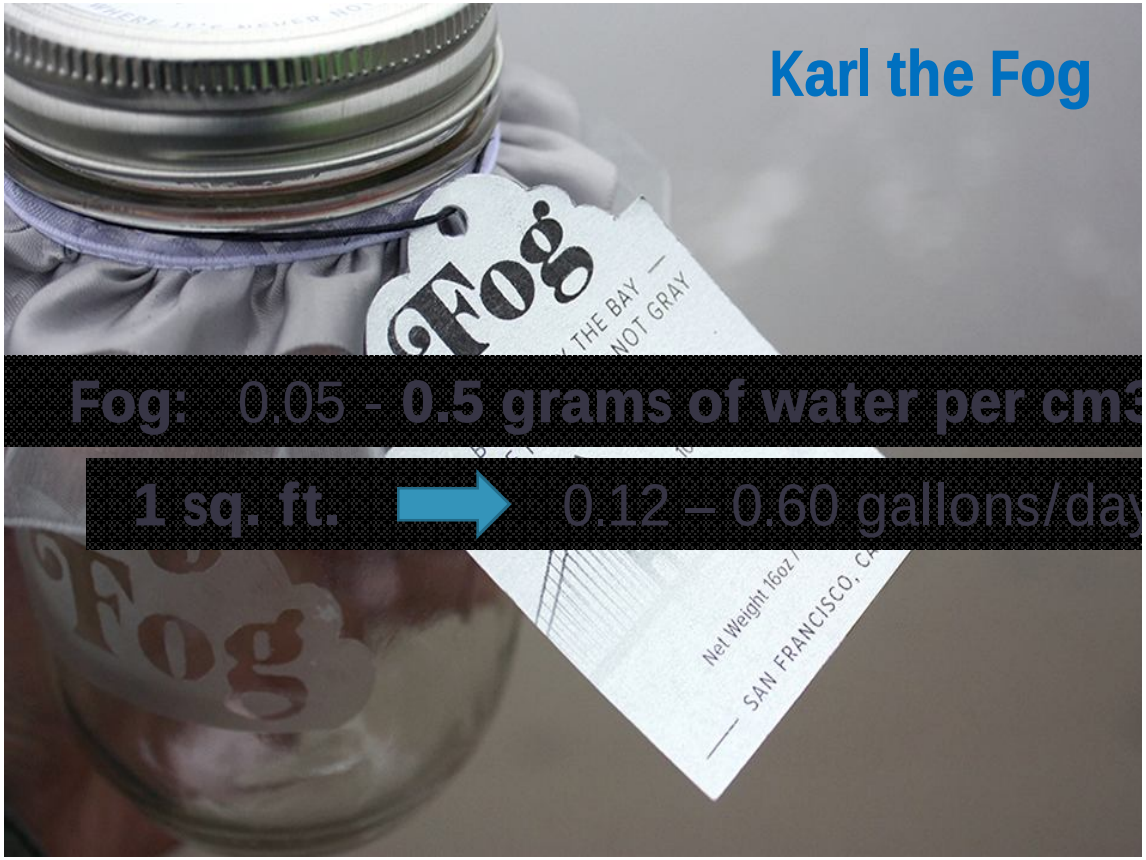
- Reduce evaporation
- Provide shade
- Condense moisture for roots

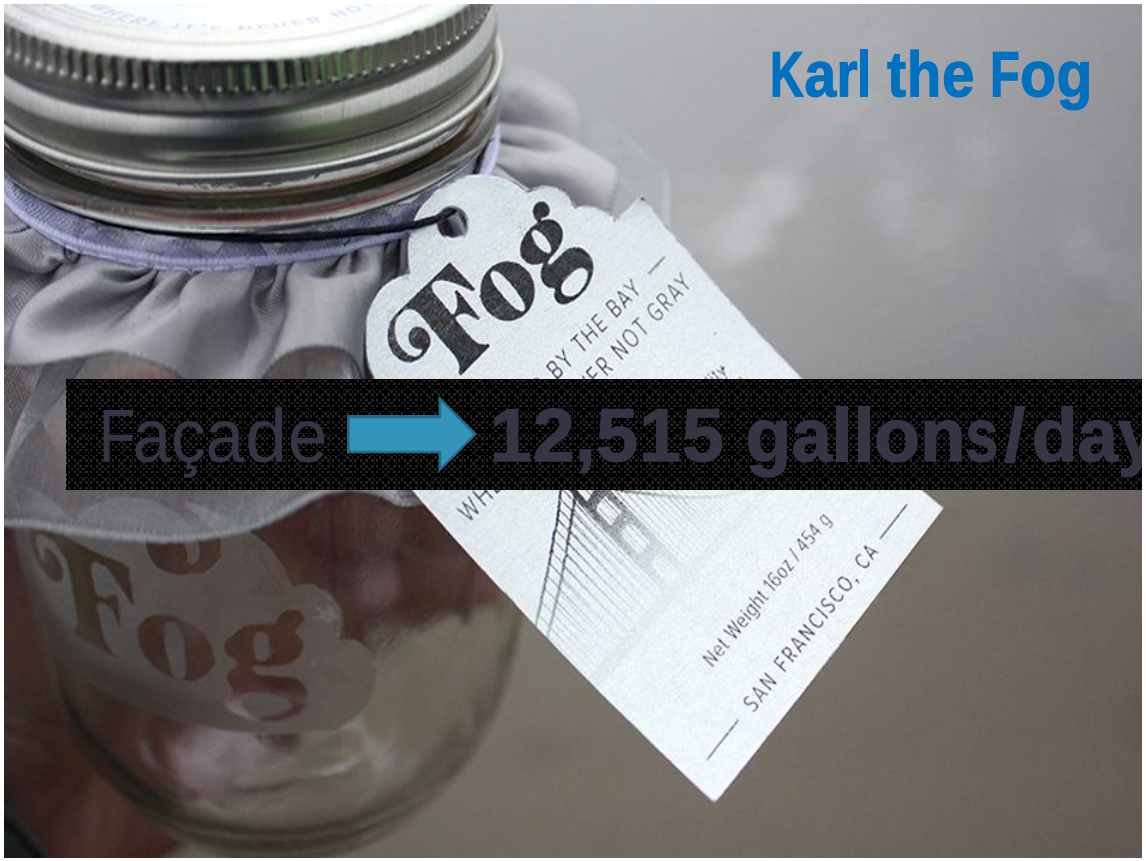
How it Works



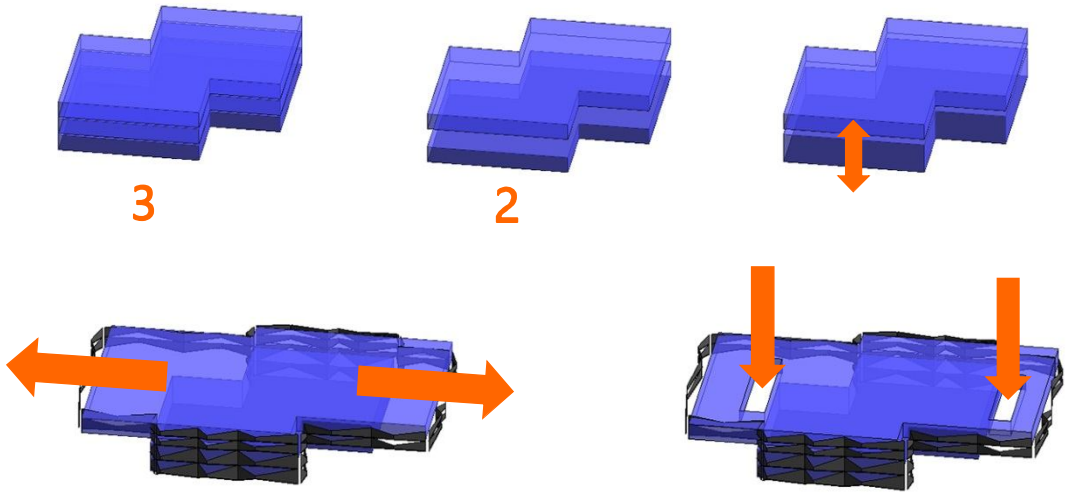
How it Works



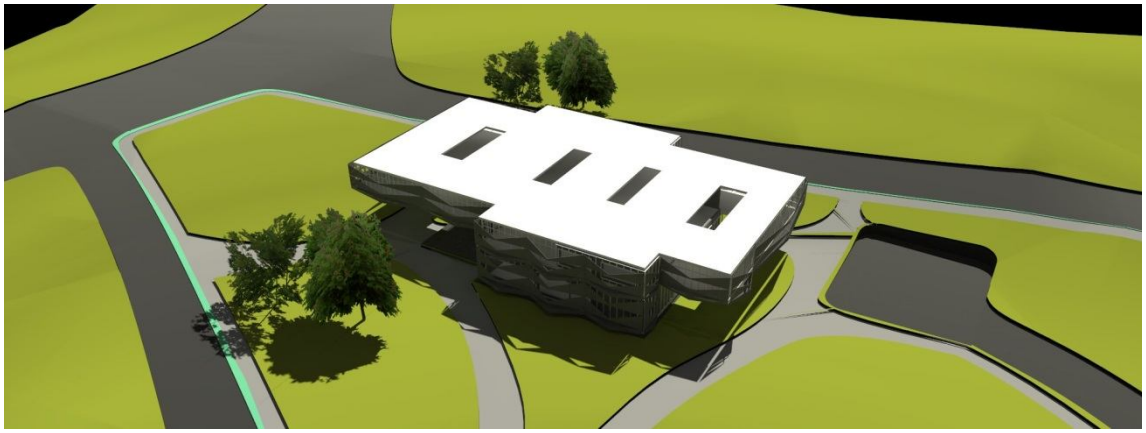

Karl the Fog
Fog
Fog: 0.05 - 0.5 grams of water per cm3
1 sq. ft.
0.12 – 0.60 gallons/day


Karl the Fog
Fog
BY THE BAY
Net Weight 16oz / 454 g
SAN FRANCISCO, CA
Façade
12,515 gallons/day

Shape Evolution

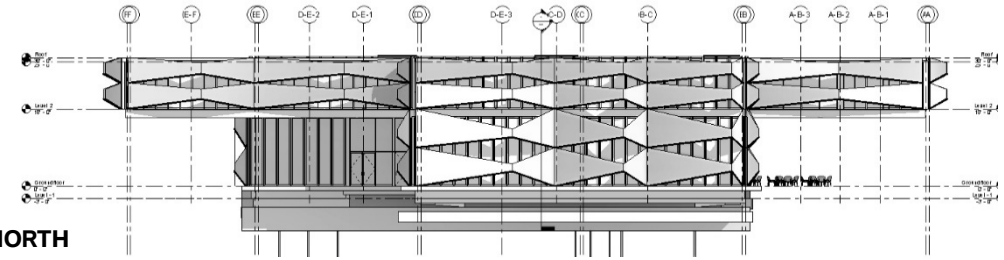


Site Placement

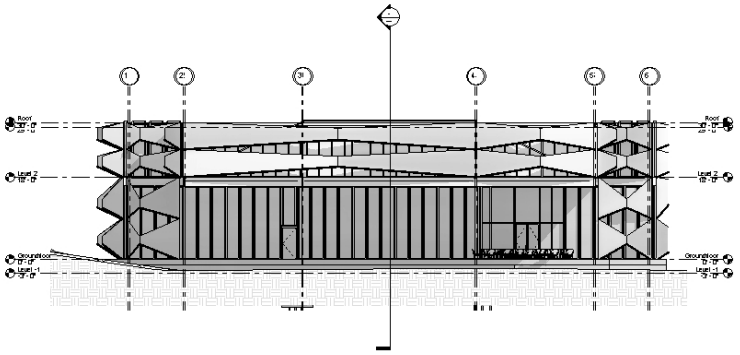


Site Placement

Elevations

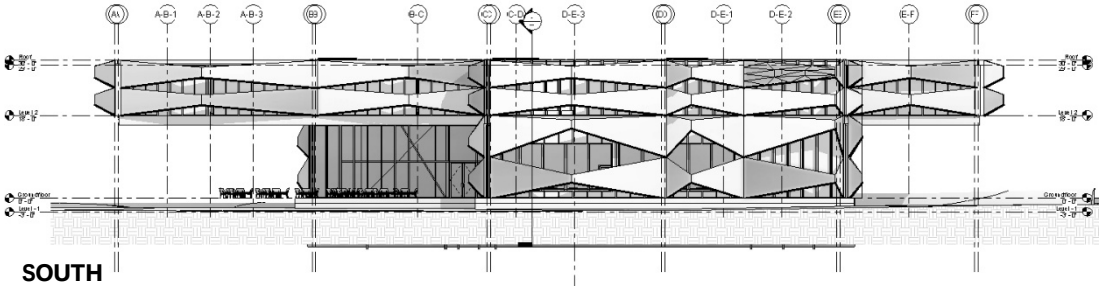


NORTH

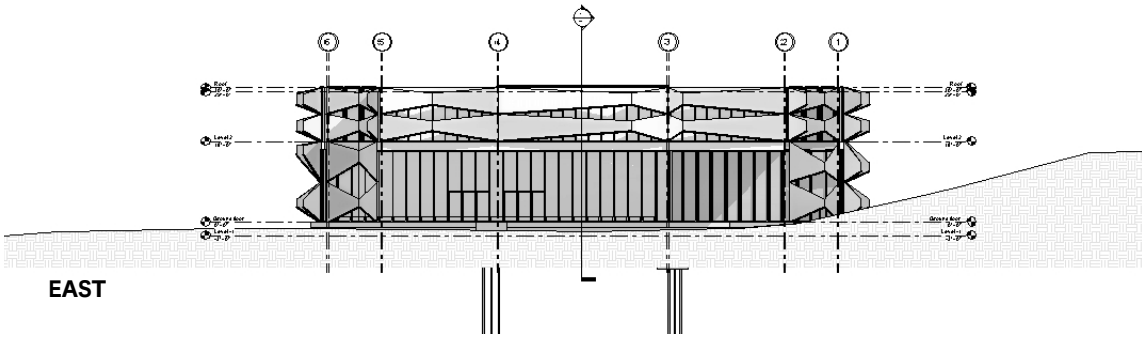


WEST

Elevations

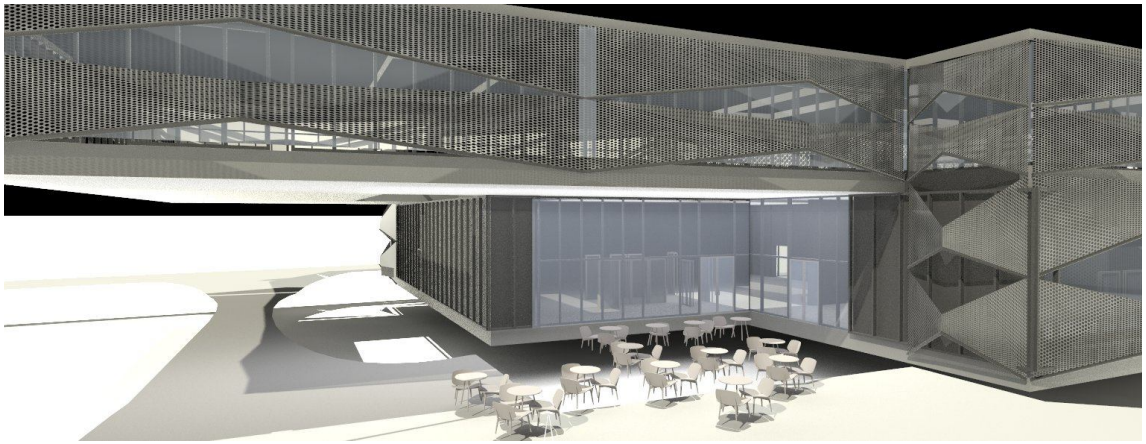


SOUTH



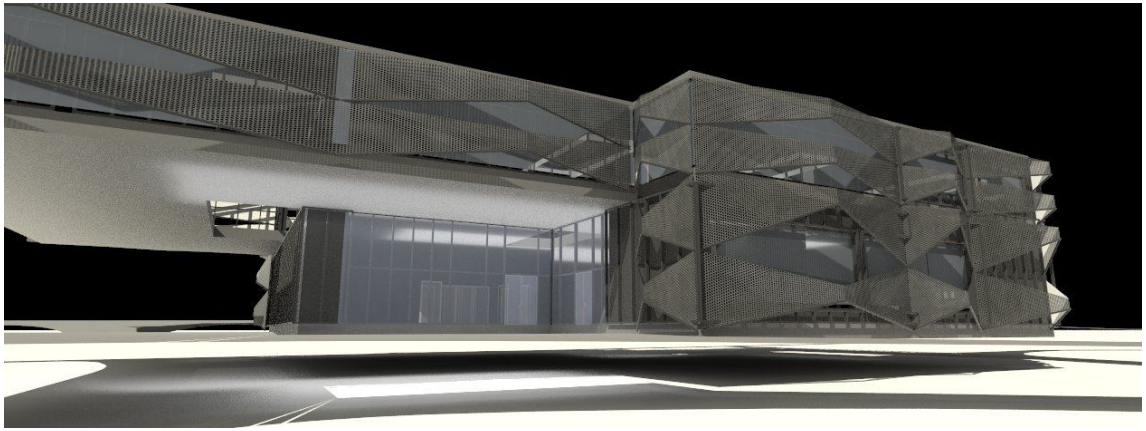
EAST

Under the Cantilever

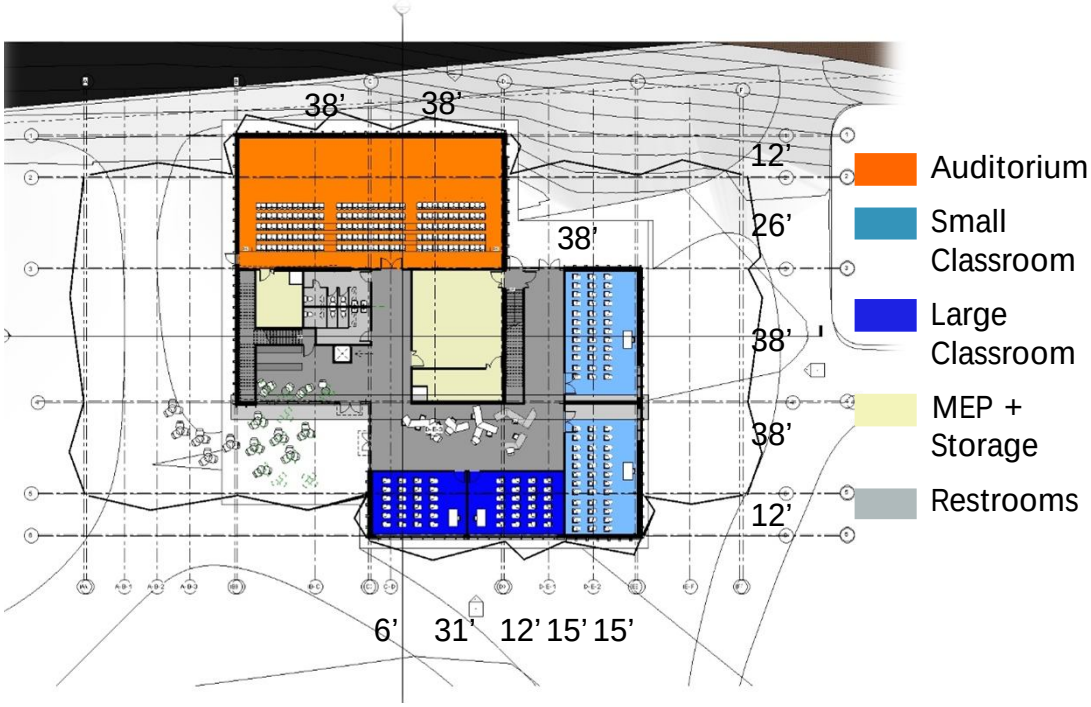


Under the Cantilever

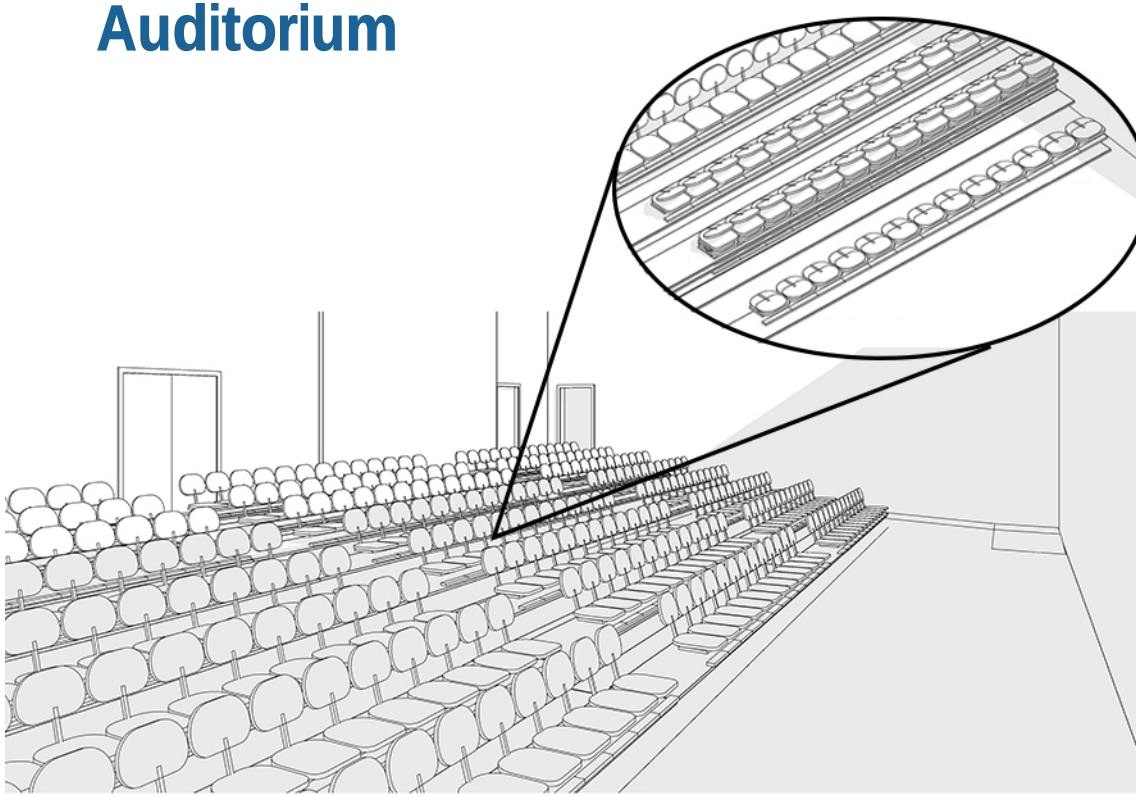
Under the Cantilever

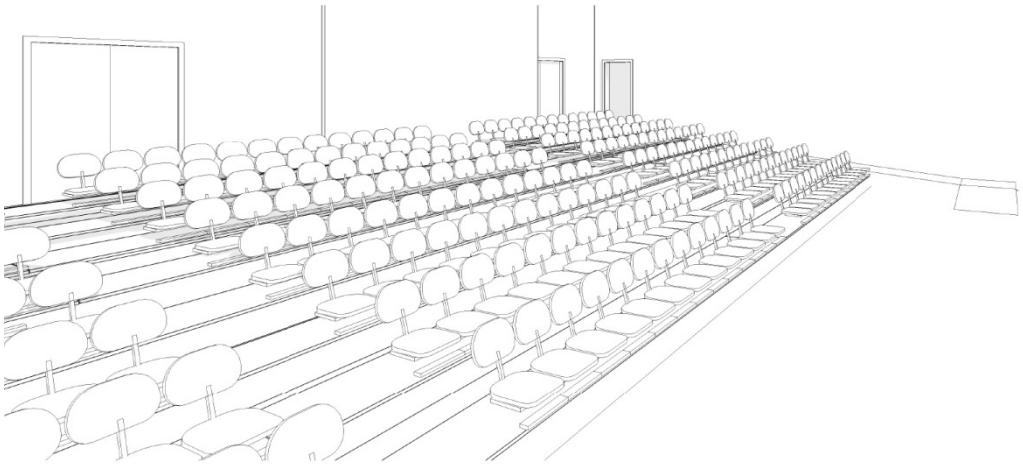


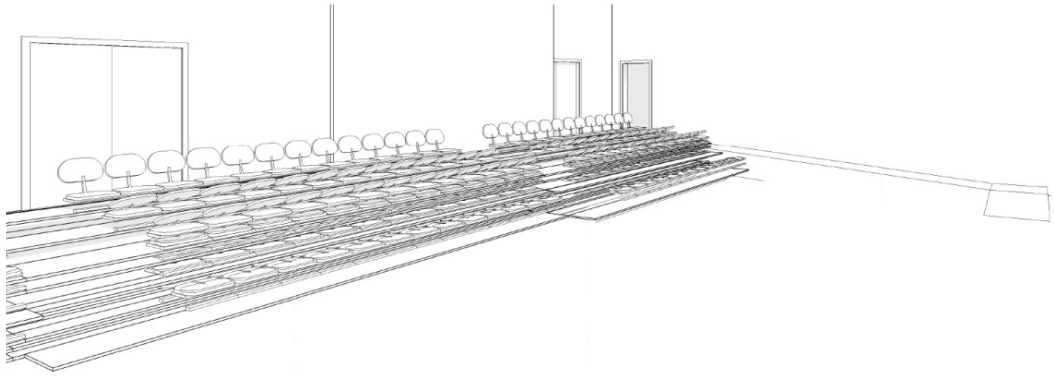
Floor Plan - Ground

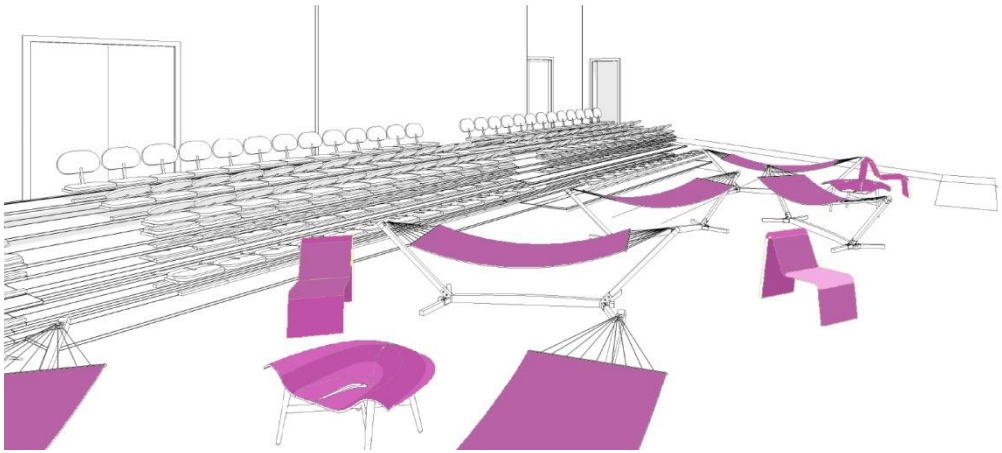


Auditorium









Floor Plan - 2

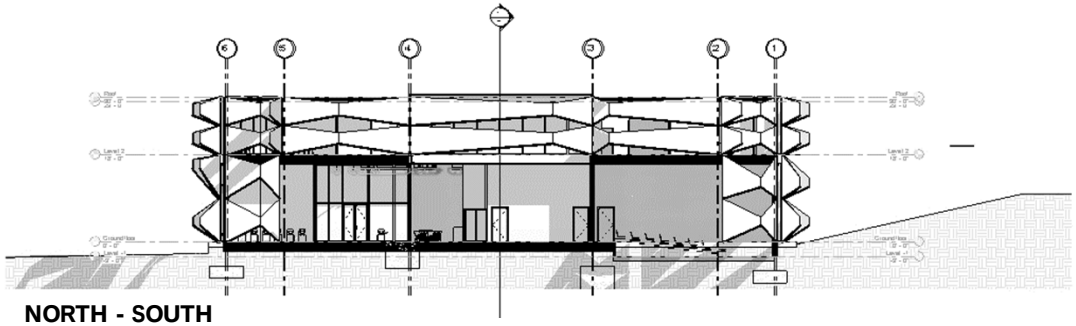

Department Chair's Office
Faculty Office
Faculty Lounge
Seminar Room
Student Office
Small Classroom
Restrooms
Administrative Office

Faculty Lounge

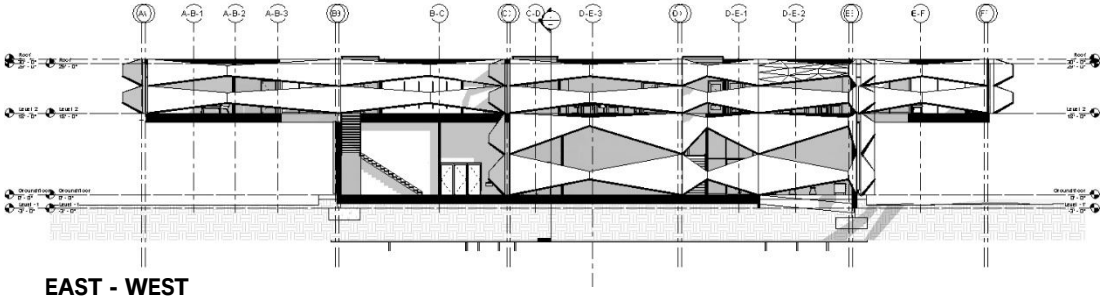
Student Collaboration Space

Student Collaboration Space

Sections



NORTH - SOUTH



EAST - WEST

Structural Floorplan – 2nd Floor

Glulam Columns 8“x8”

Steel Column W14x257

L-shape Beams 8”x 6”

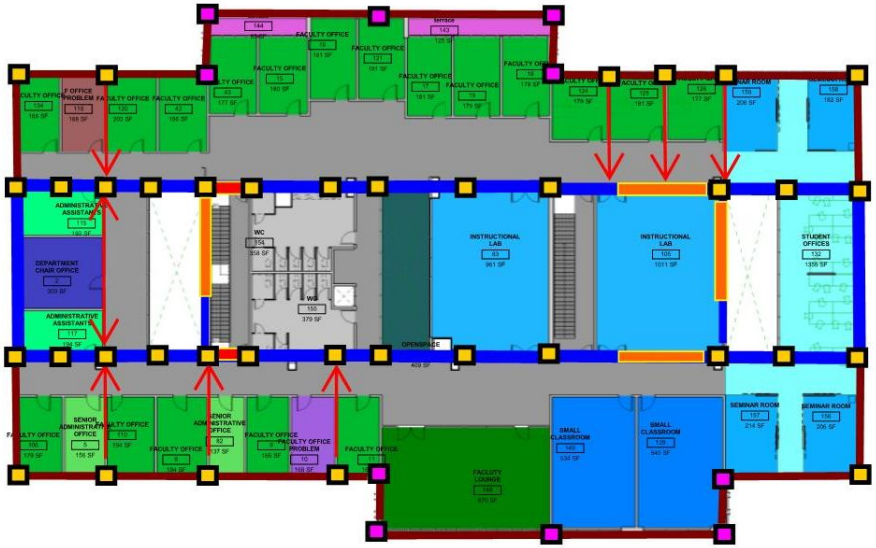
Prestressing Cables 2 in^2

Timber Shear Walls 12”

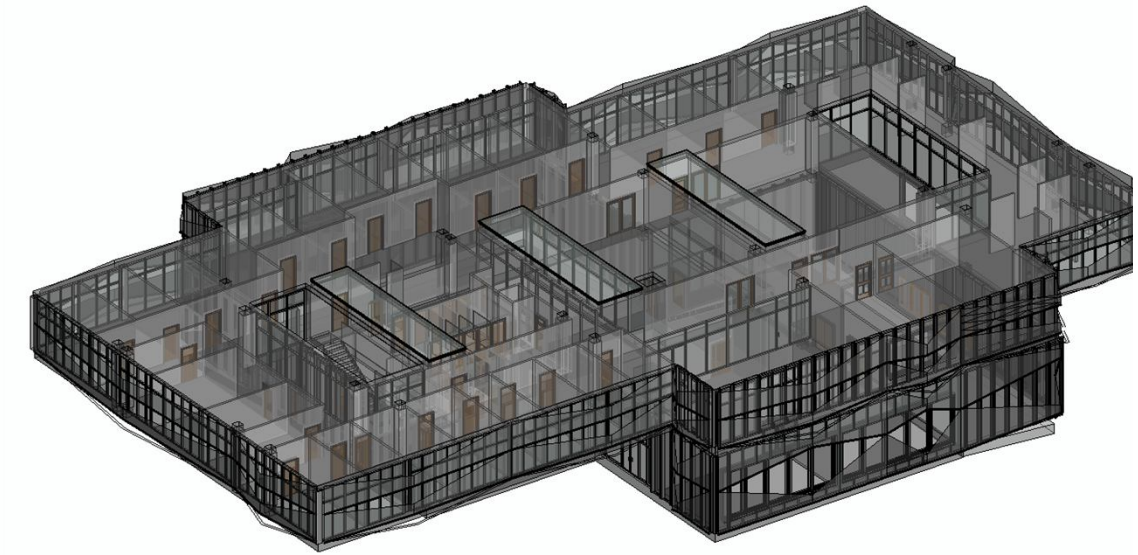
Steel Shear Walls 12“

Truss System (W18x106 for cantilever, W18x86 for interior beams)

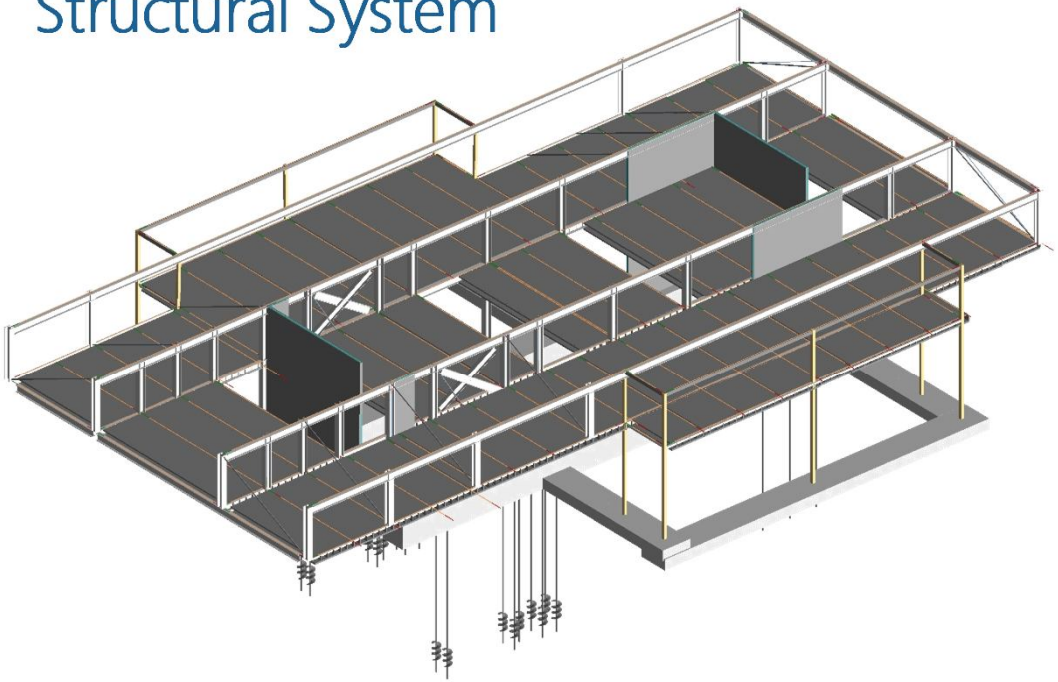
Structural Floorplan – 2nd Floor



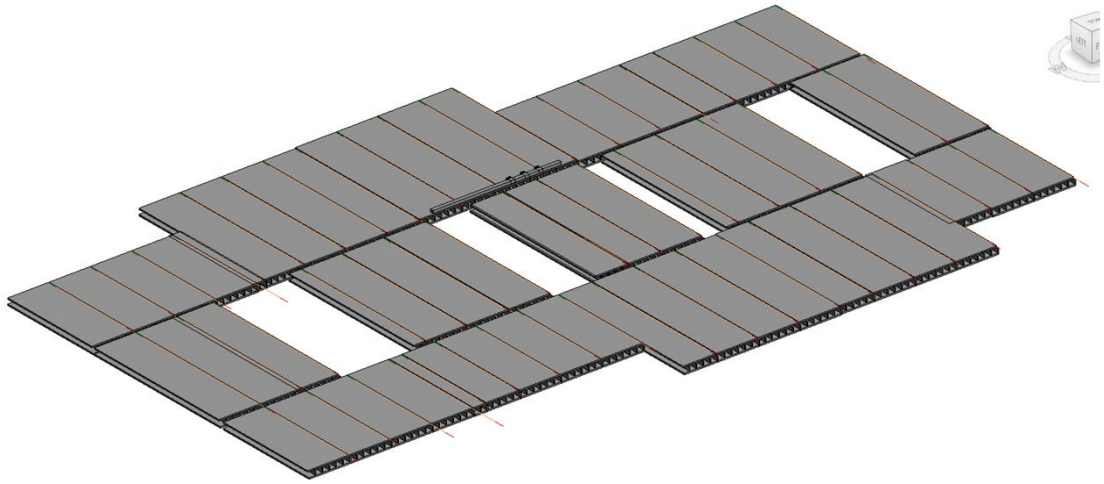
Architecture



Structural System



Timber Floors System



Decision Matrix - Cantilever

		SE	MEP (STV)	ARCH	CM
Steel		+	-	+	+
CLT Wall		-	+	+	-
Hybrid		+	+/-	-	+/-

Live Load Requirements

Room Function Type	Total Area (Sq-Ft)	Minimum Live Load (psf)
Faculty Offices	3600	50
Faculty Lounge	1000	100
Student Offices	1200	50
Auditorium	3000	100
Classroom	3600	40
Storage Rooms	1000	150

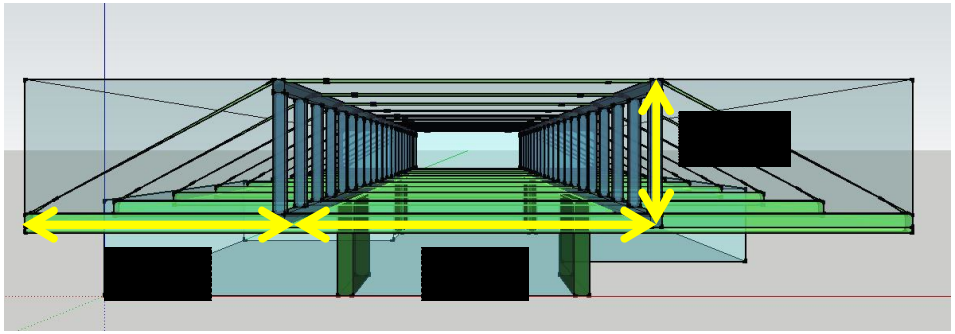
Based on California Building Code:
http://www.ecodes.biz/ecodes_support/free_resources/2013California/13Building/PDFs/Chapter%2016%20-%20Structural%20Design.pdf

Lateral Loads

	Base shear (kips)	Overturning Moment (kip-ft)
Pure shear wall system	7100	135300
Pure BRBF system	2200	42300

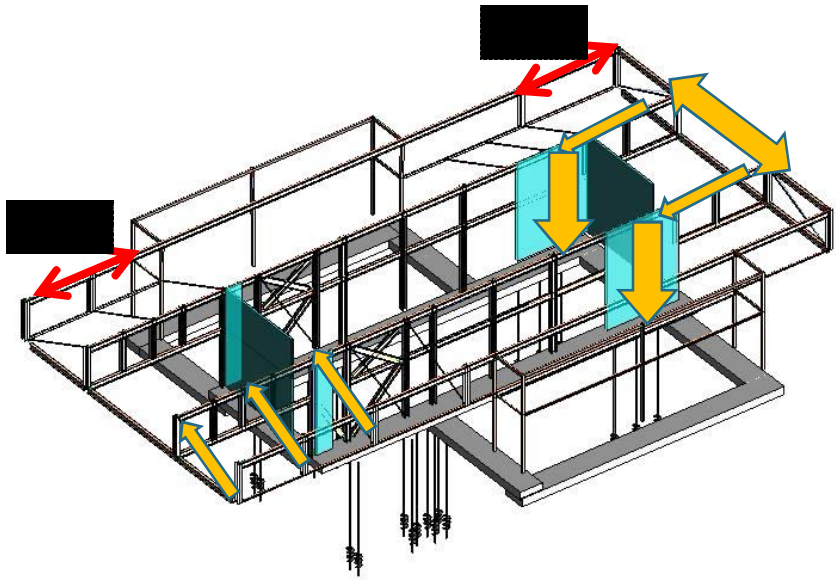
From ASCE 7-10

Truss System Detail

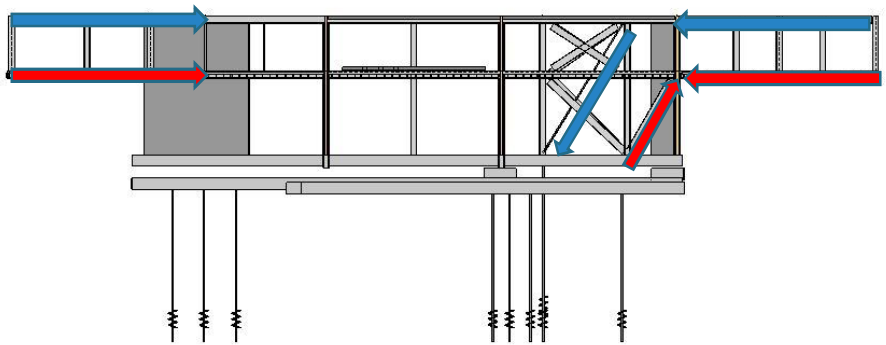


- Vierendeel Truss
  - Beam W18x106
  - Column W14x257

Load Path

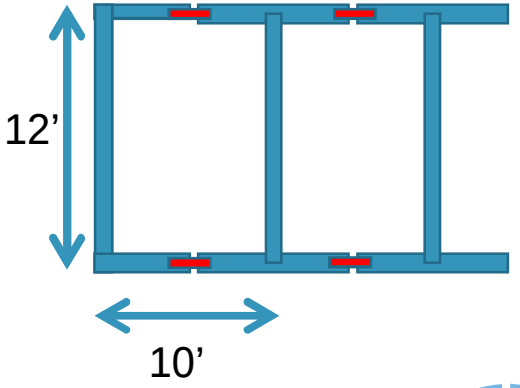


Load Path



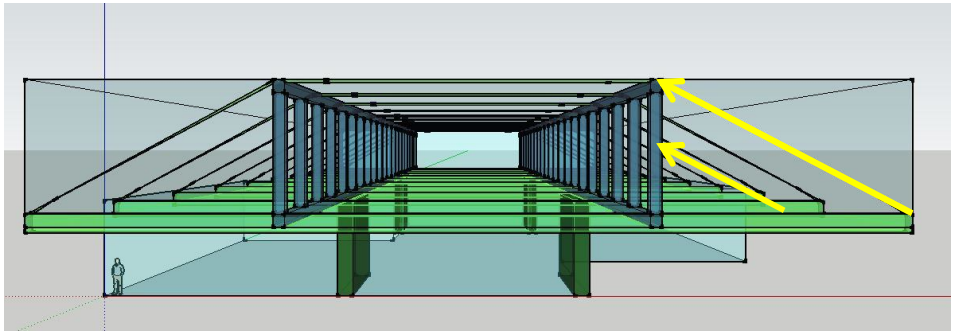
- Gravity Systems
- Lateral Systems

Truss Detail



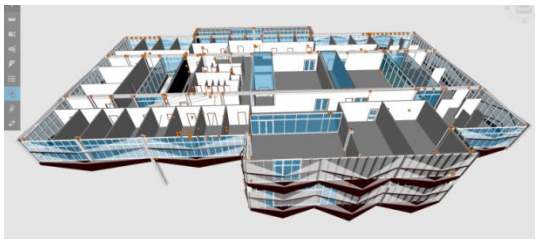
- Regular prefabricated modules
- Assembled on site with bolts
- Pre-cambered

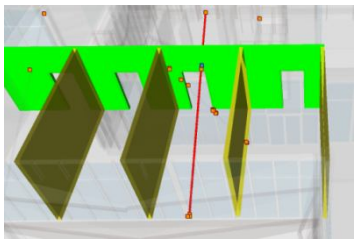
Cable System

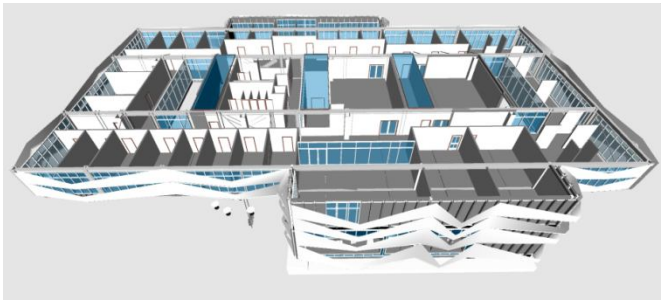


- Cable Systems
  - 7-wire strand pre-stressing wires
  - Cross section area = 2 in^2

Coordination between SE ad Arch

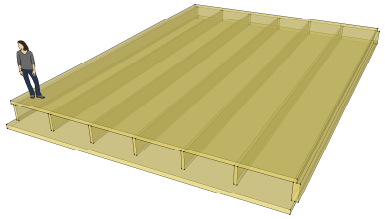






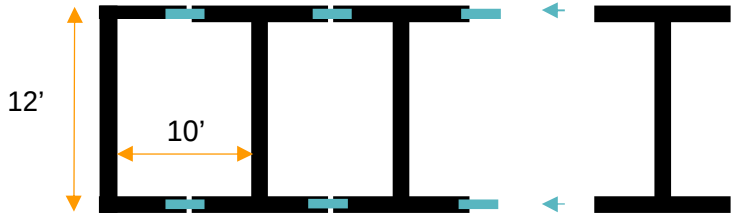
Roof Solutions

- Traditional roof solution



Steel Truss

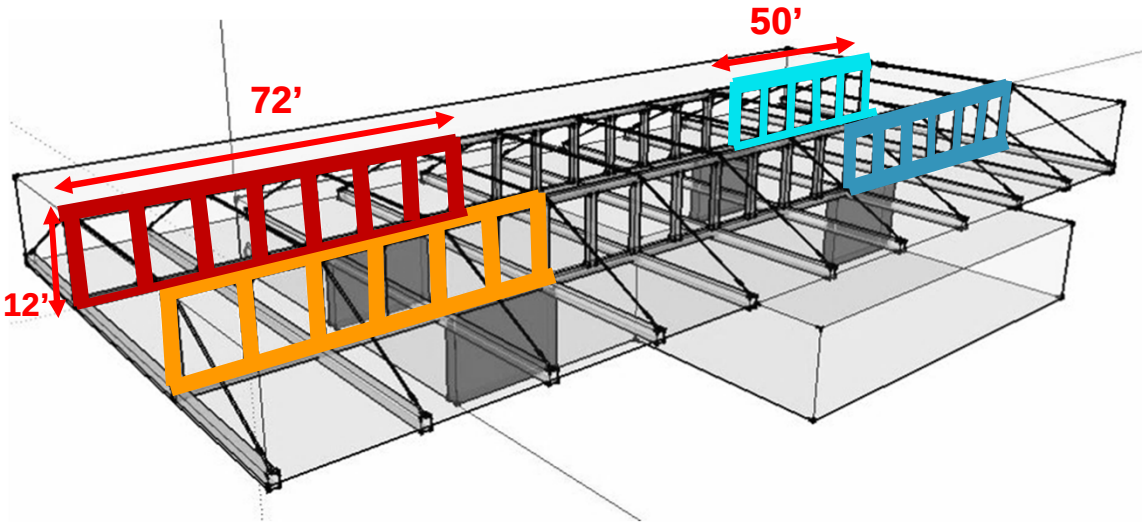
- Assembled while the concrete slab in foundation hardens
- Assembled into 4 pieces, each 40 000 lbs ~ 20 short ton



Mobile Crane 40 ton = $212hr

1 RED = Assembled on ground
2 ORANGE = Assembled on ground
3 BLUE=Assembled on ground
4 TURQUOISE=Assembled on ground

1,2,3,4 are lifted in place and connected

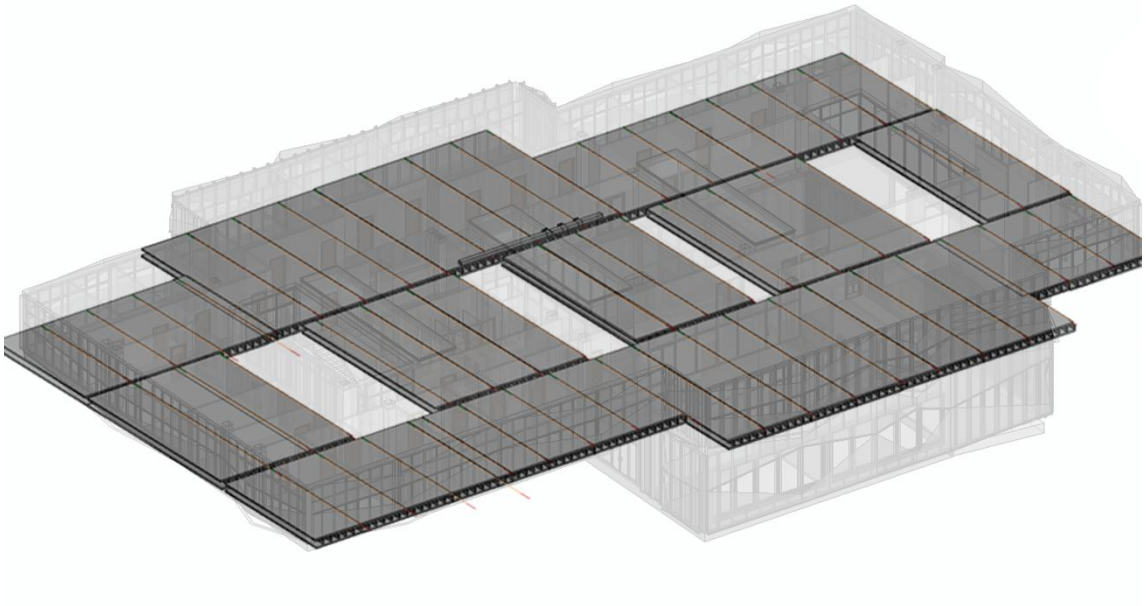


Truss System Value

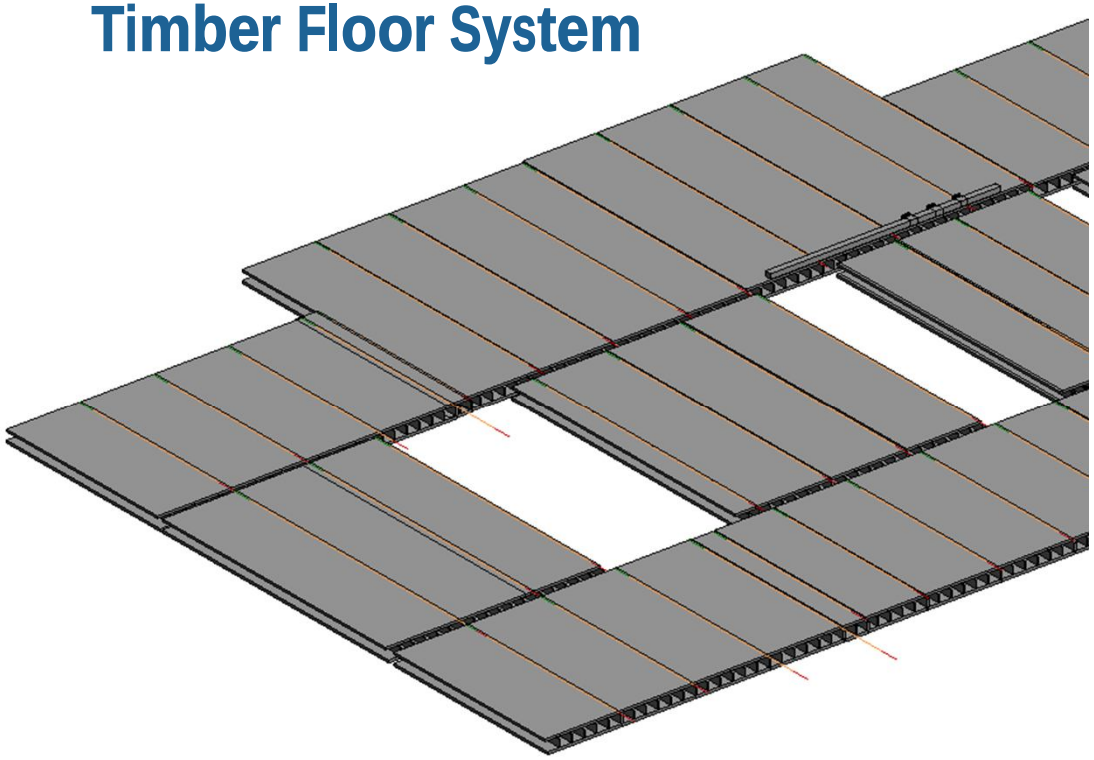
Value
Easy to transport
Easy to connect
Reduce stress on the truss
Safer
Less expensive
Architectural freedom

How?
No site welding
Assembly method – fewer lifts
No proprietary connections
Customized design
Increased open space

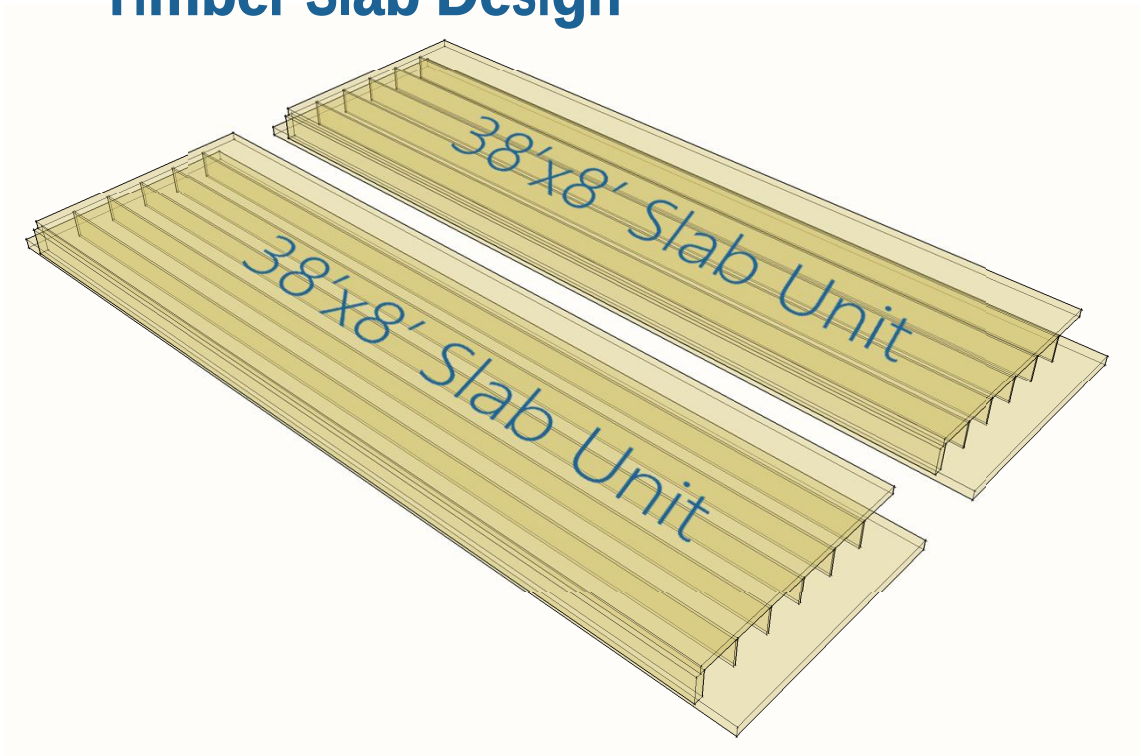
Timber Floor System



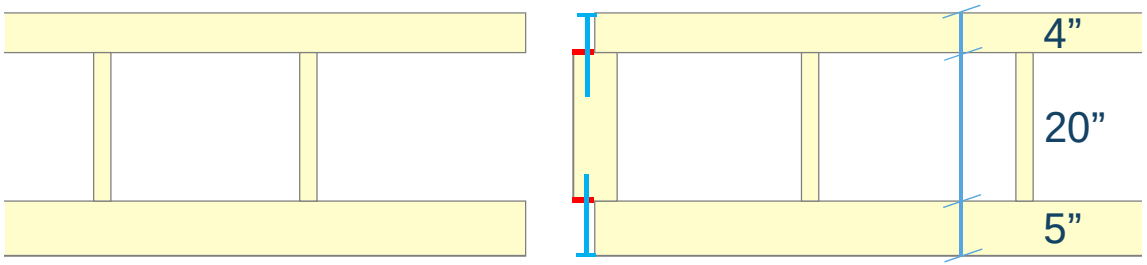
Timber Floor System



Timber Slab Design

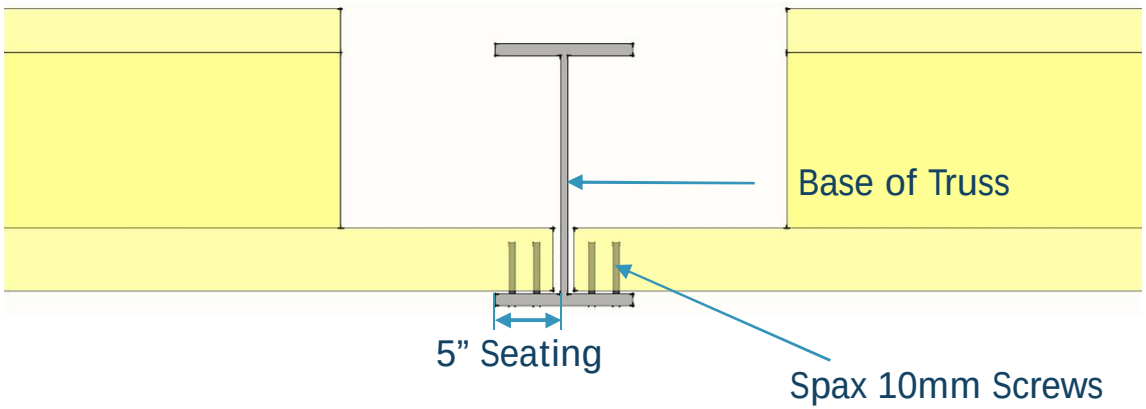


Slab to Slab Connection



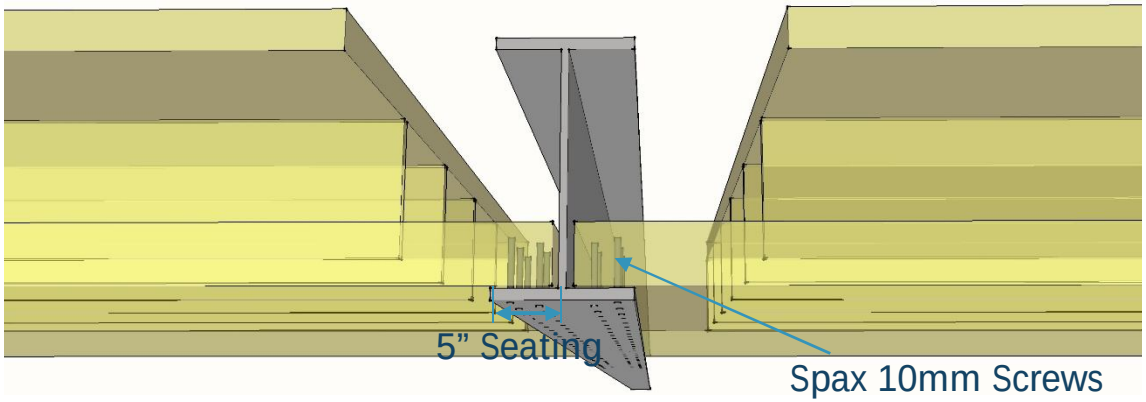
- Timber slabs “key” together
- Epoxy + Screws for site connections

Slab to Truss Connection



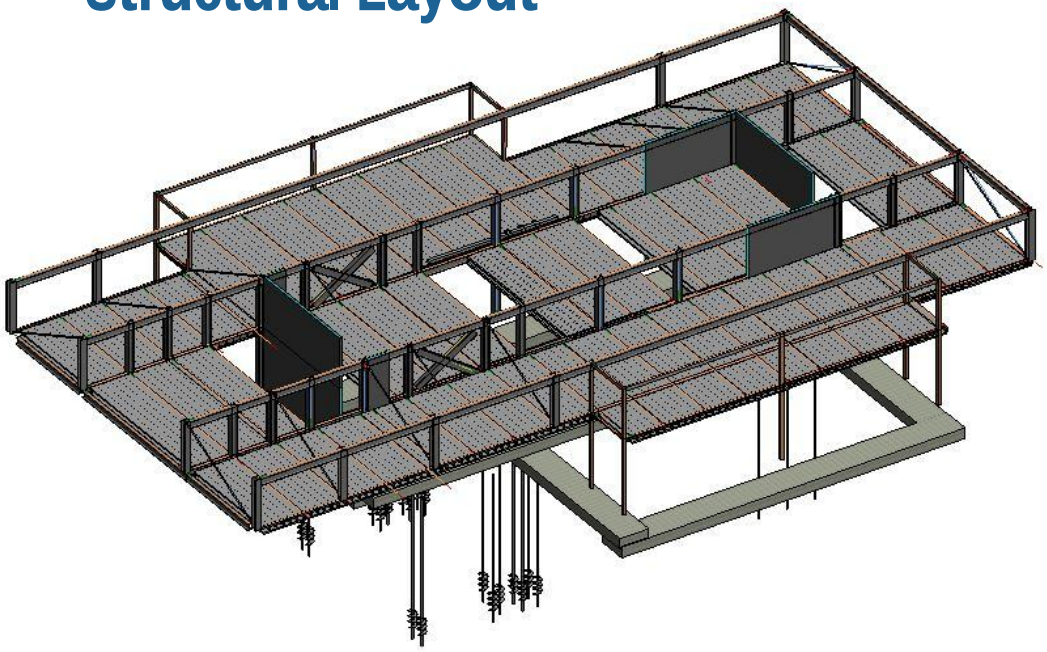
- Structural Screws in Staggered Pattern

Slab to Truss Connection

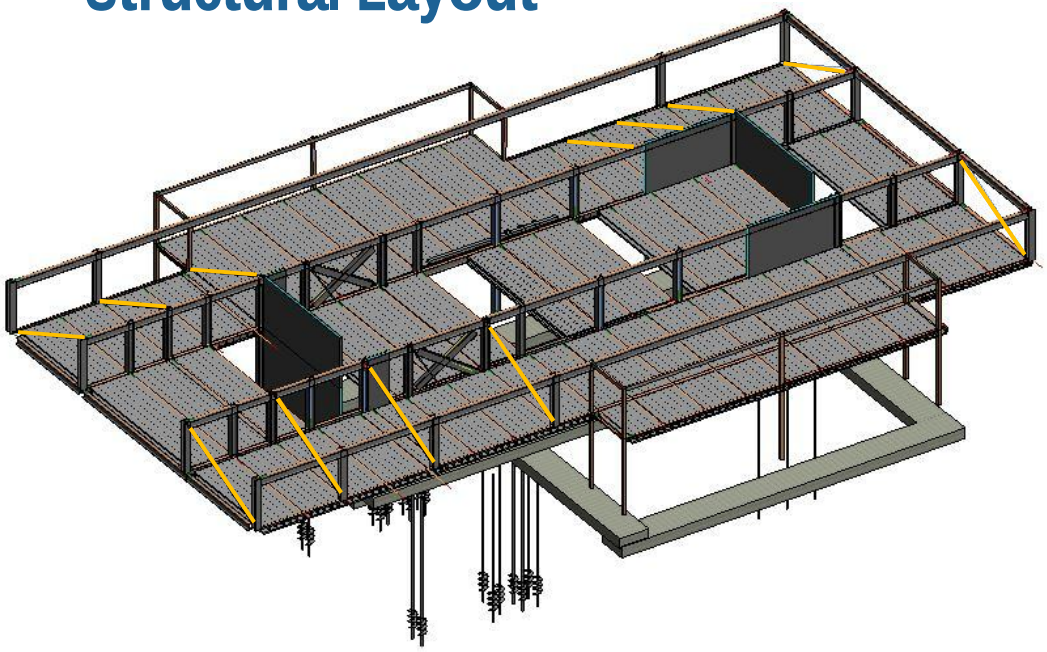


- Structural Screws in Staggered Pattern

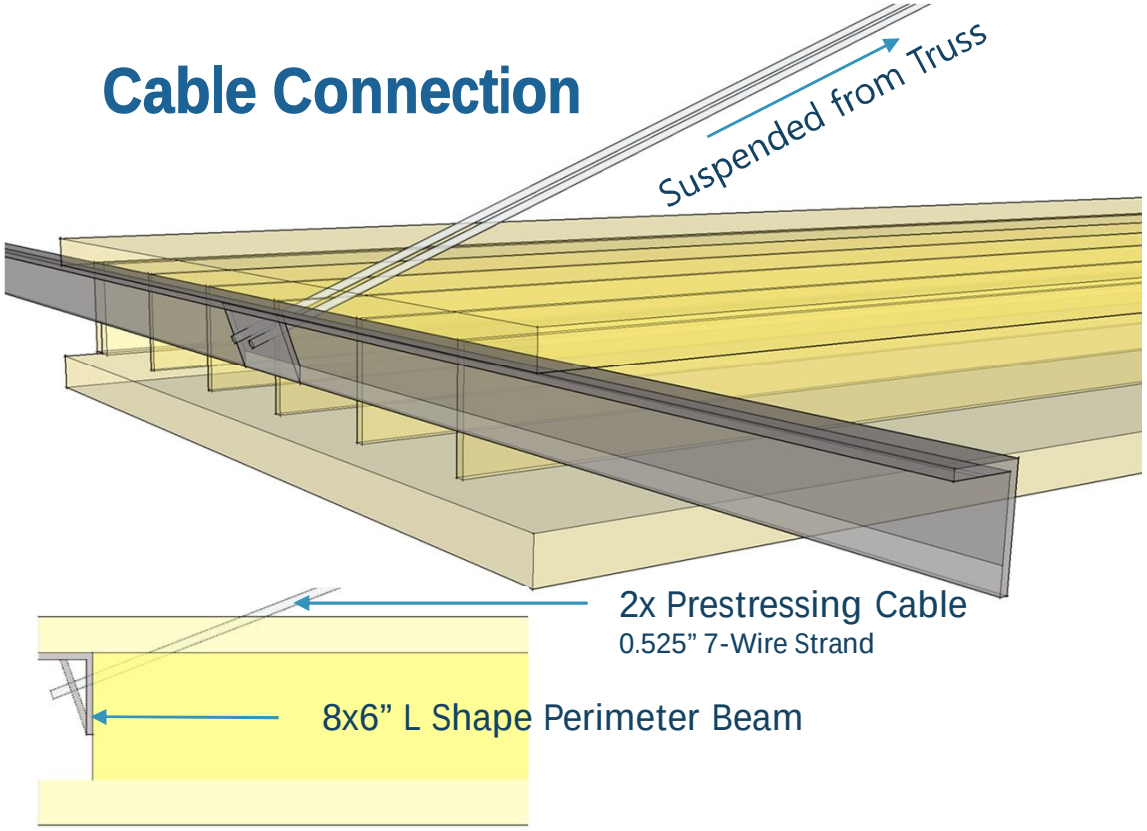
Structural Layout



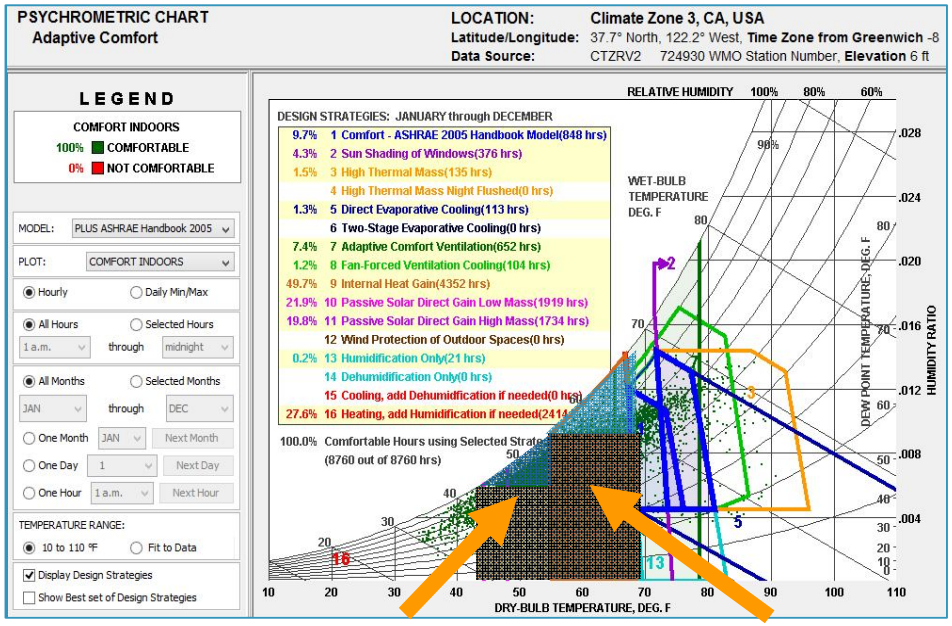
Structural Layout



Cable Connection



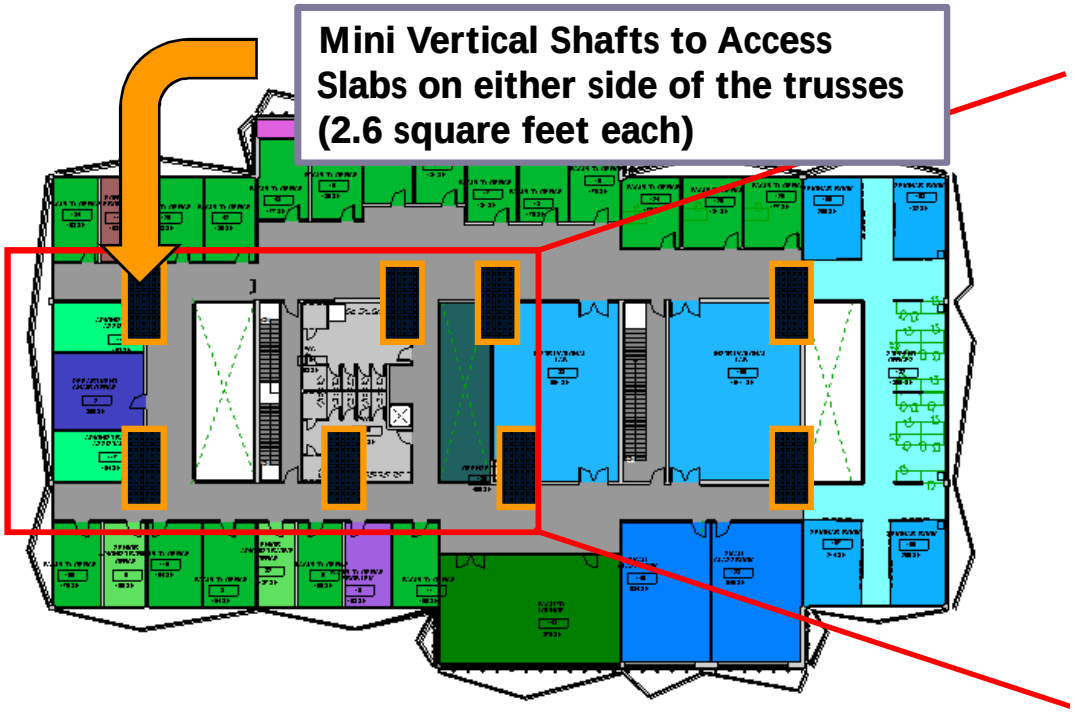
HVAC Design Strategies



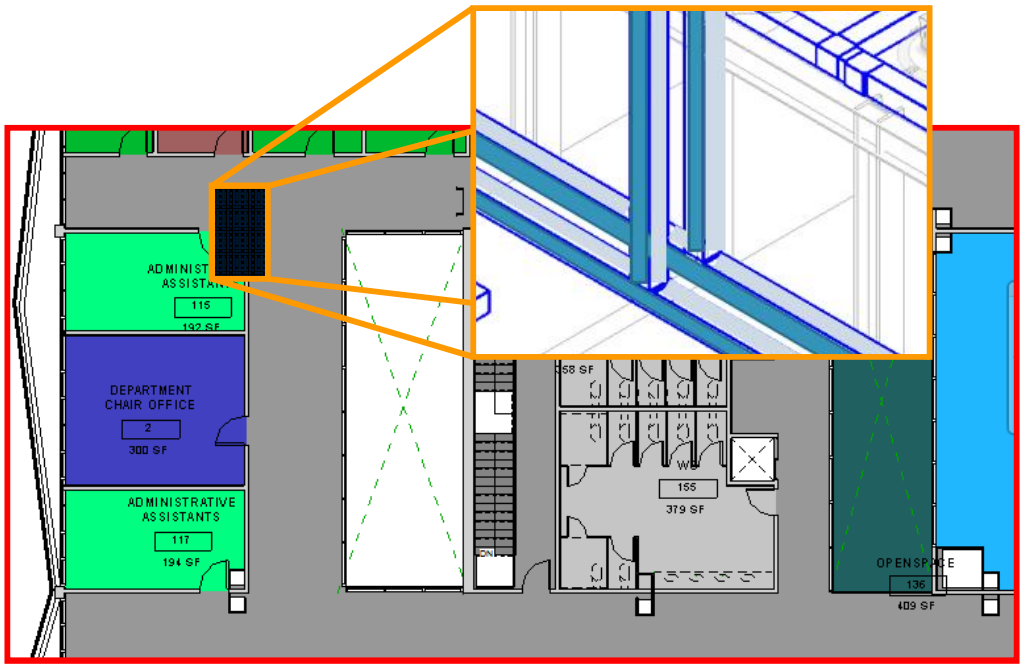
40%: Solar gains

50%: Internal gains

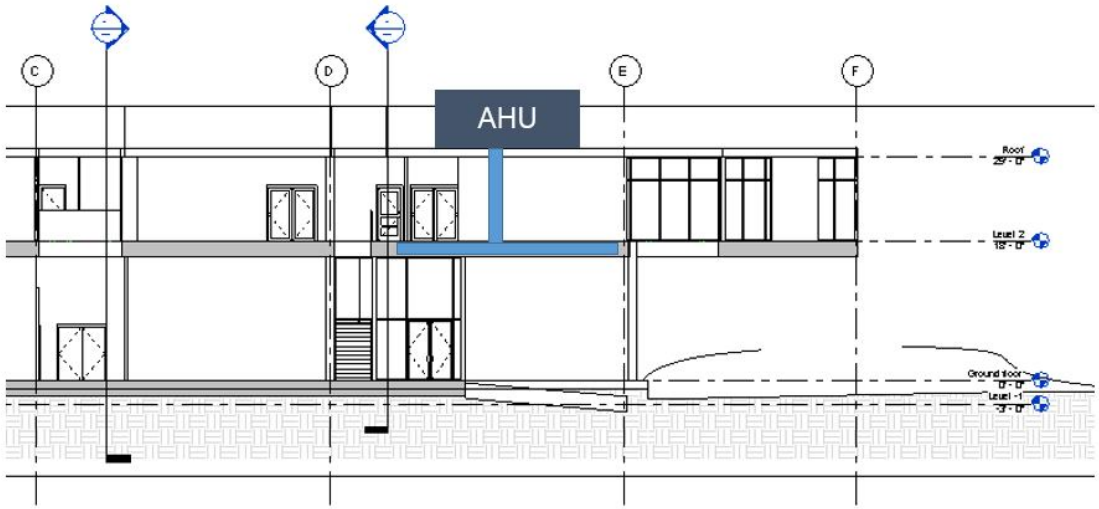
Mini Shafts


Mini Vertical Shafts to Access Slabs on either side of the trusses (2.6 square feet each)

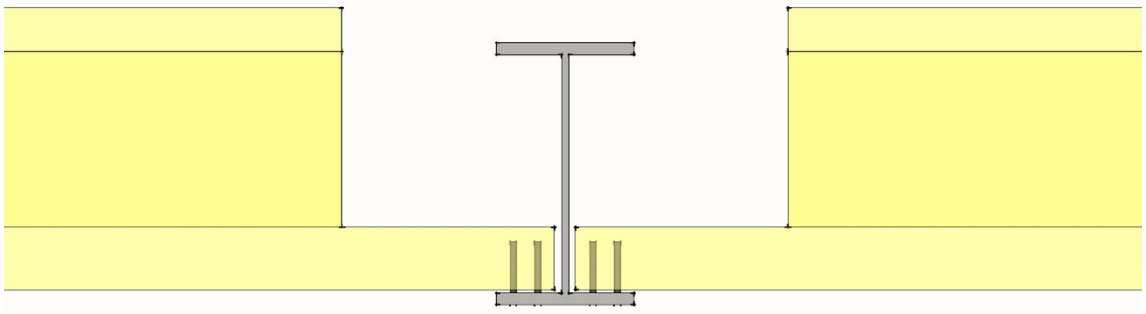
MEP Mini Shafts



Section View of Mini Shafts

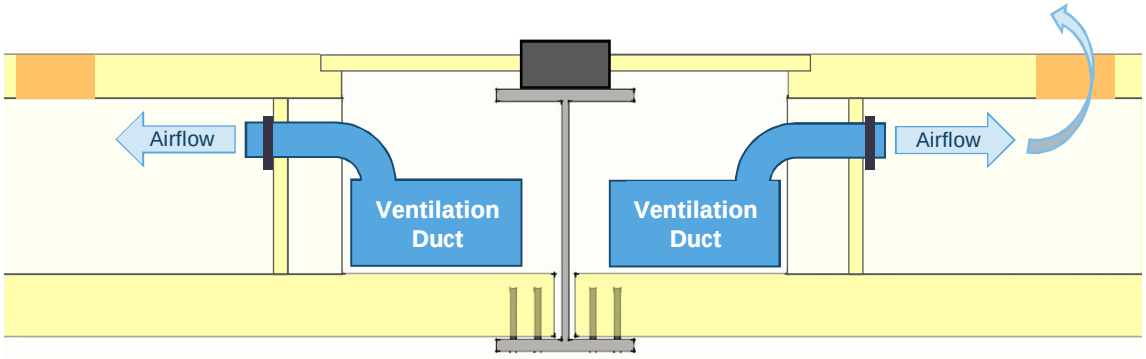


MEP Integration



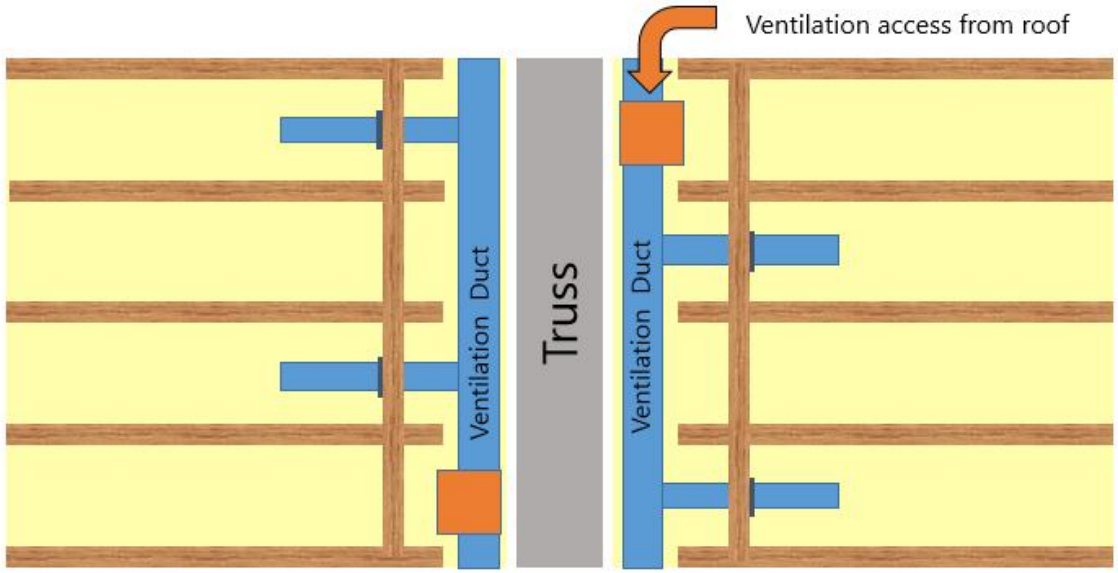
Hollow Slabs → Underfloor air distribution plenum

MEP Integration



Hollow Slabs → Underfloor air distribution plenum

Under Floor Air Distribution using Timber Slab



Prefabrication of floor system

- On-site prefabrication
  - Size of site = 130 000 SF
- 56 slabs
  - Two main versions

Manufacturing plant

Already existing tents on site

Time comparison

Steel concrete composite floor

- 35-40 days

Timber slab

- 110 days to manufacture
- 17 days to lift and install

Time saving ~18-23 days

Cost comparison

Steel concrete composite floor

- ~$245 000

Prefabricated timber slab incl. Underfloor Air Distribution ductwork

- ~$290 000

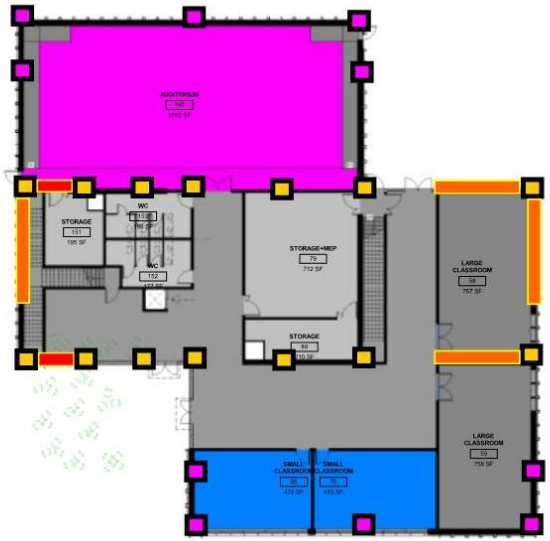
Labour	Material
Carpenter Crew $63 0000	LVL $65 000
Finishes $33 000	CLT $60 000
HVAC crew $48 000	Ducts $12 000

Timber Slab

Added Value
Faster schedule
Increased quality
Environmentally advantagous
Good seismic preformance

How?
Prefabricated units
Integrated MEP and bearing structure
Timber solution
Lightweight

Structural Floorplan - Groundfloor



Structural Floorplan – Groundfloor

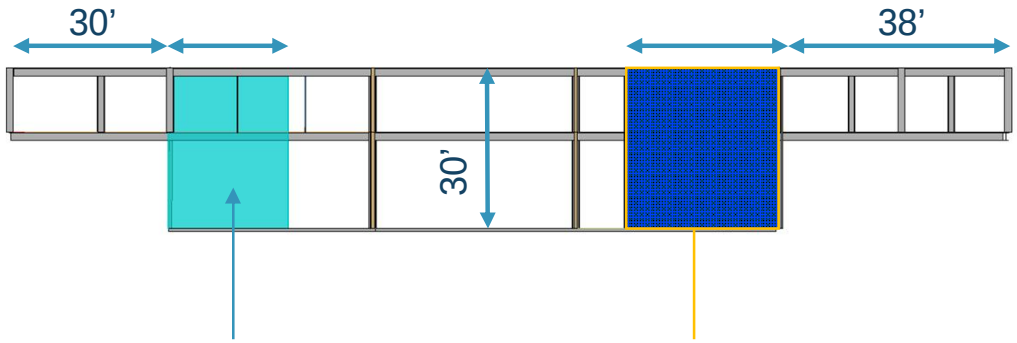
Glulam Columns 8”x8”

Steel Column W14x257

Timber Shear Walls 12”

Steel Shear Walls 12”

Lateral Load Systems



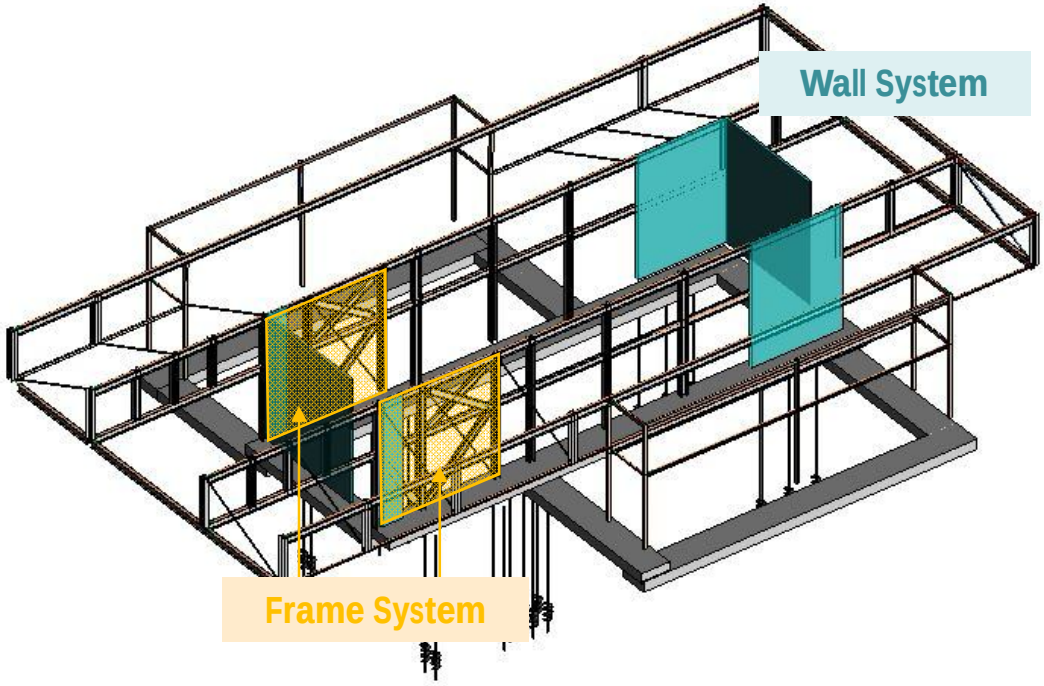
Wall System

- CLT Mass Timber wall

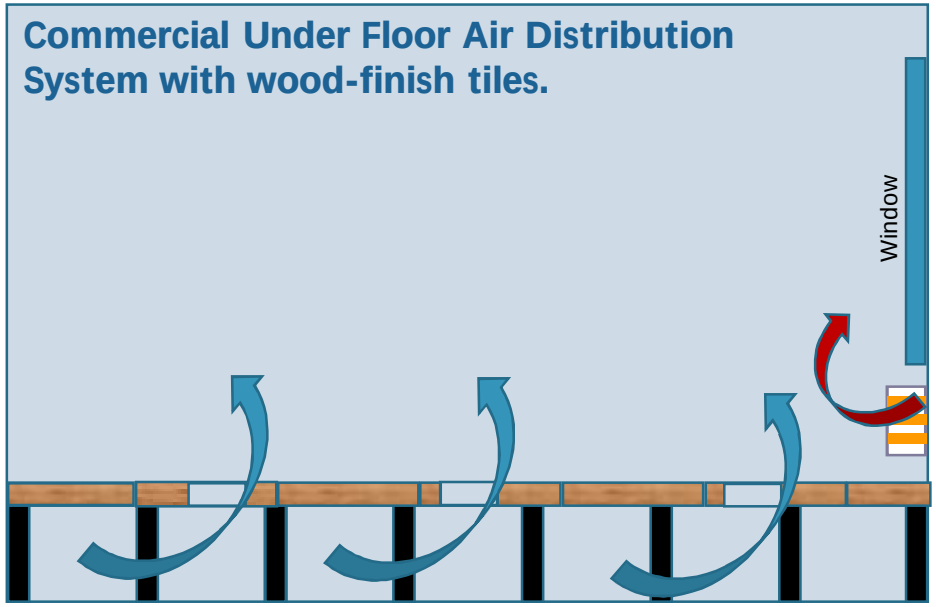
Frame System

- High Stiffness Wall Equivalent
- Post-tensioning system
- 8.0 sq.in BRB Element

3D View of Lateral Systems



Ground Floor HVAC Solution

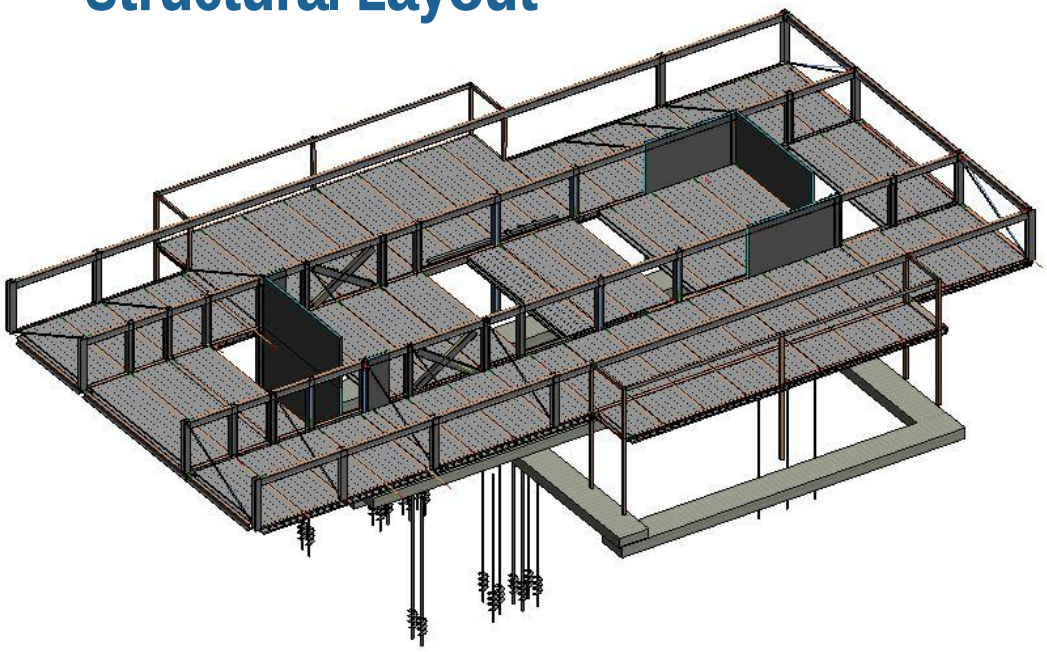


Auditorium

- Heating and cooling
- Versatile connections

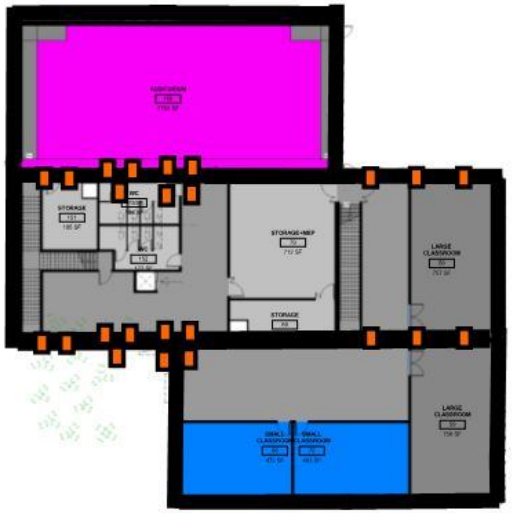
Ground Floor HVAC Solution

Structural Layout



Foundations

- Strip Footings

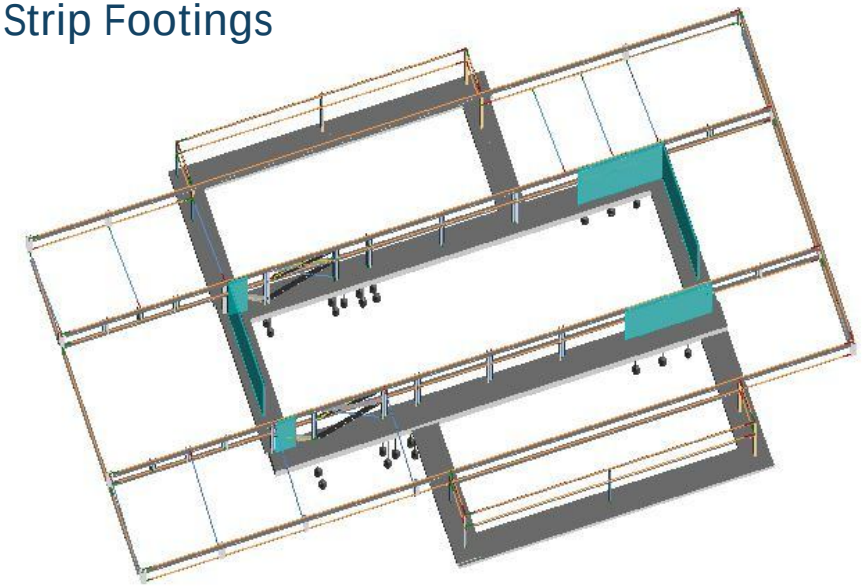


Depth = 2.16 ft

Width = 7.5 ft

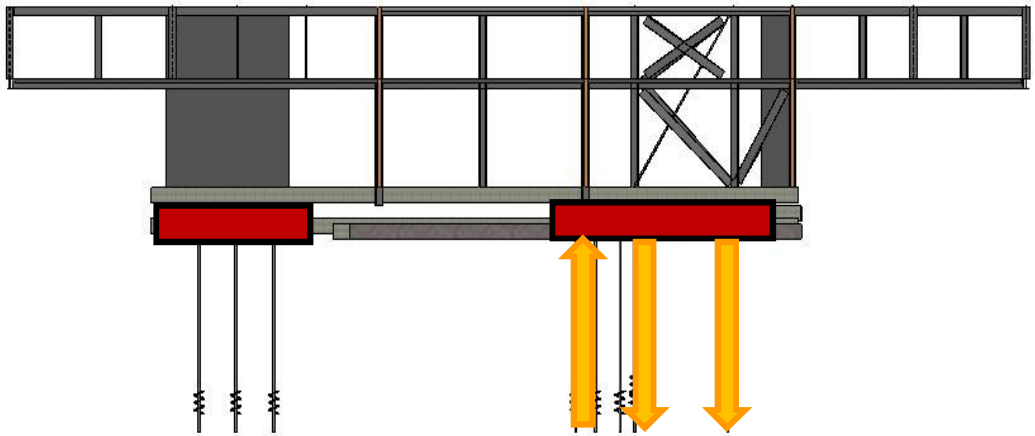
Foundations

- Strip Footings



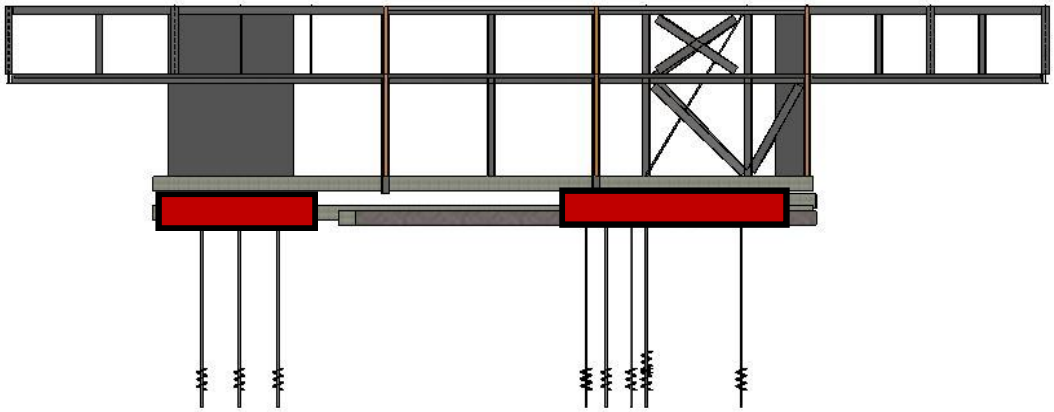
Foundations

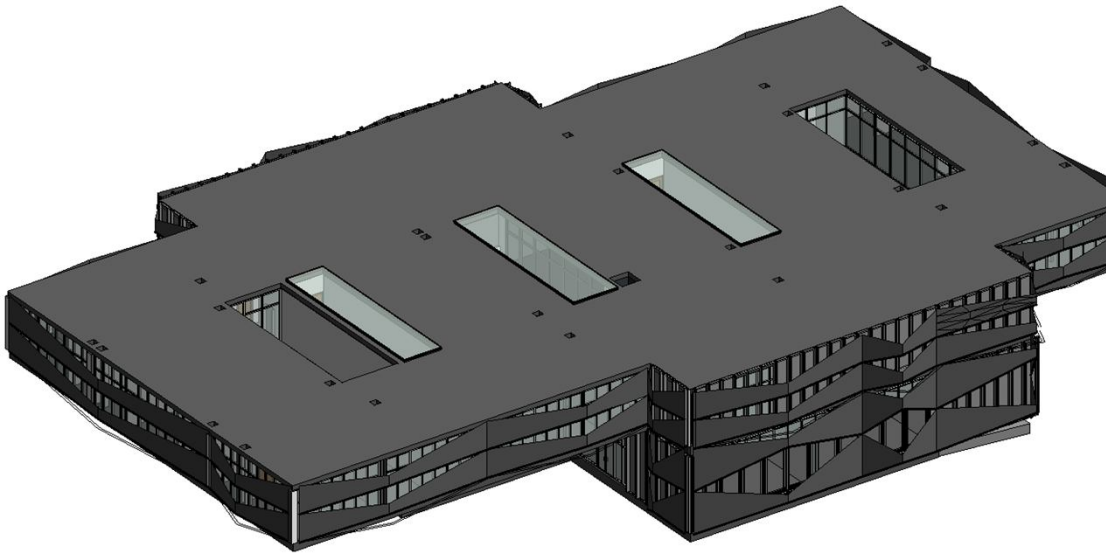
- Use Strip Footings as Pile Caps



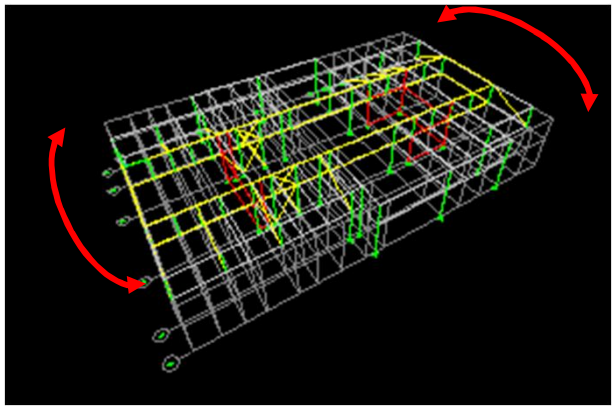
Foundations

- Helical Screw Piles
  - No dewatering needed
  - 14” dia. 3-1/2” turbular



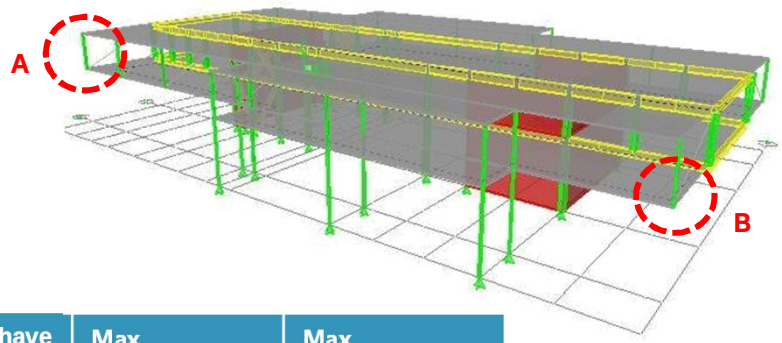


Structural Analysis



Primary Mode	Largest Period
Torsion	0.20 s

Structural Analysis - Deflections



Points that have largest deflections	Max Deflections (Gravity) - in	Max Deflections (Lateral) -in
A	3.87	1.16
B	1.80	0.96

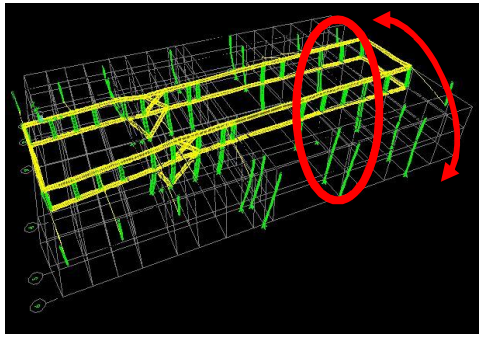
Structural Analysis

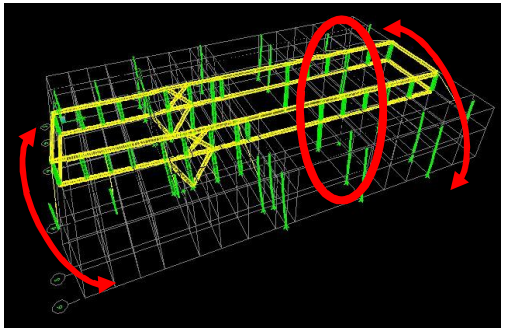
	Base shear (kips)	Overturning Moment (kip-ft)
Pure shear wall system	7100	135300
Pure BRBF system	2200	42300
ETABS Analysis Results	2800	67000

- Hybrid System

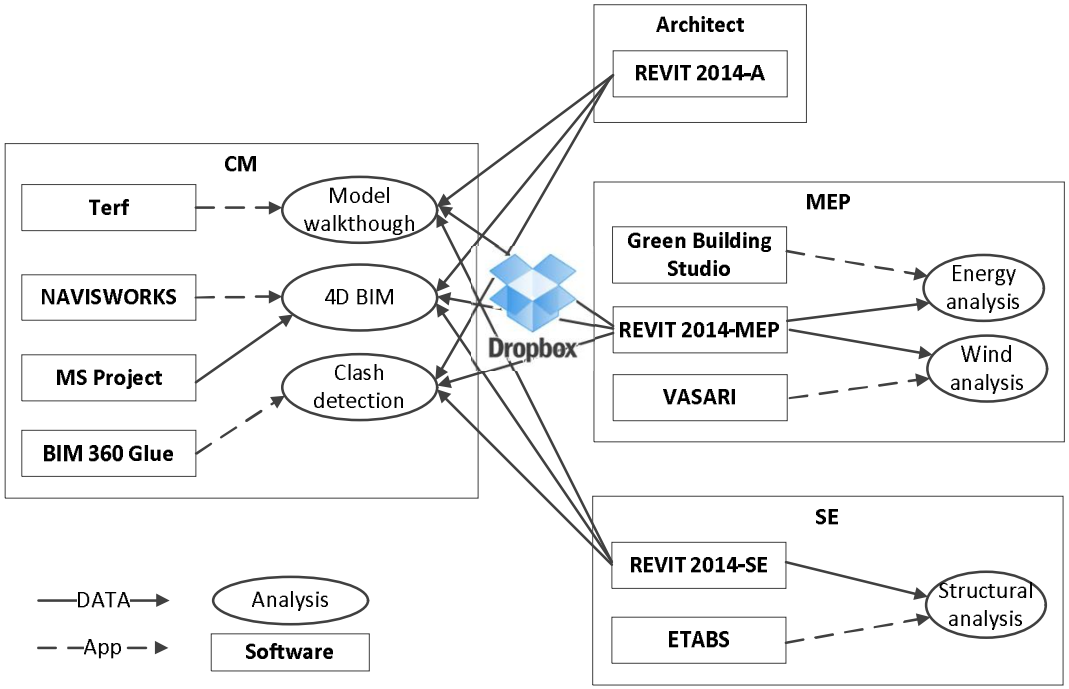
Balance Stiffness

- Stiffen the shear walls on one side of the building





BIM Coordination Plan-software

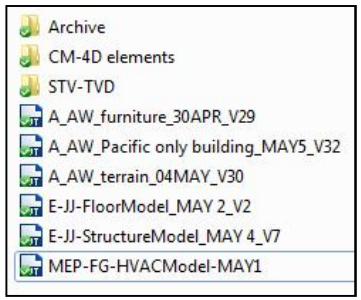


BIM Coordination Plan-team

- **Early coordination (1-2 weeks)**

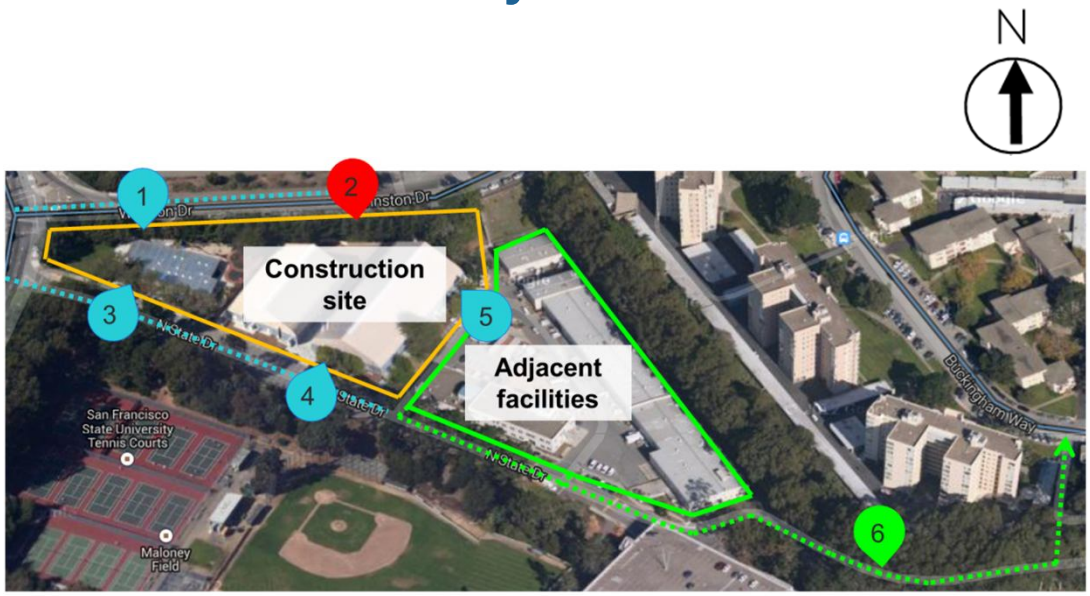
- First Architectural REVIT model > REVIT SE > REVIT MEP
- Interdisciplinary discussions for decision making

- **Coordination using shared models**

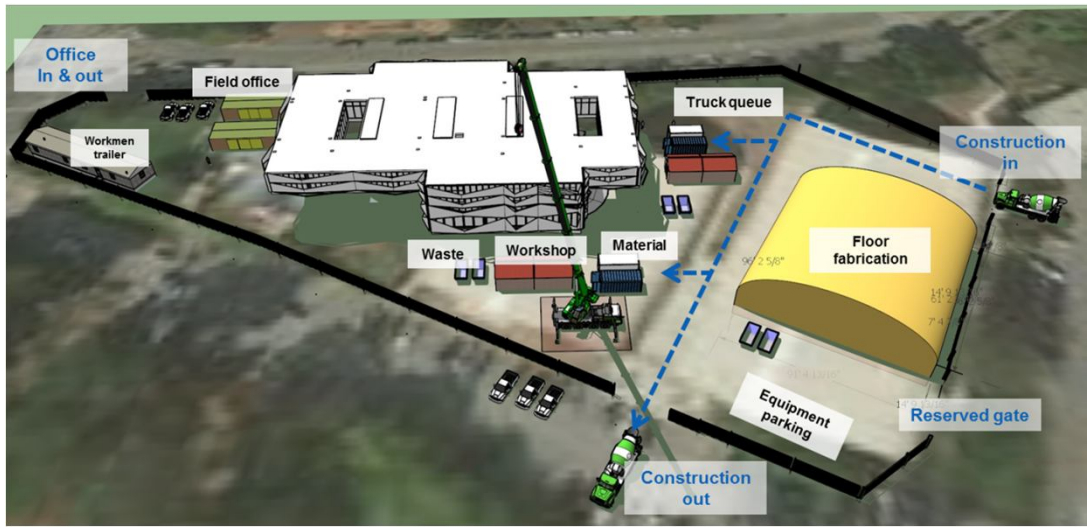


- Layers
- Dropbox: model sharing
- NAVISWORKS: 4D simulation
- Terf: model walkthrough
- BIM 360 Glue: model integration, clash detection

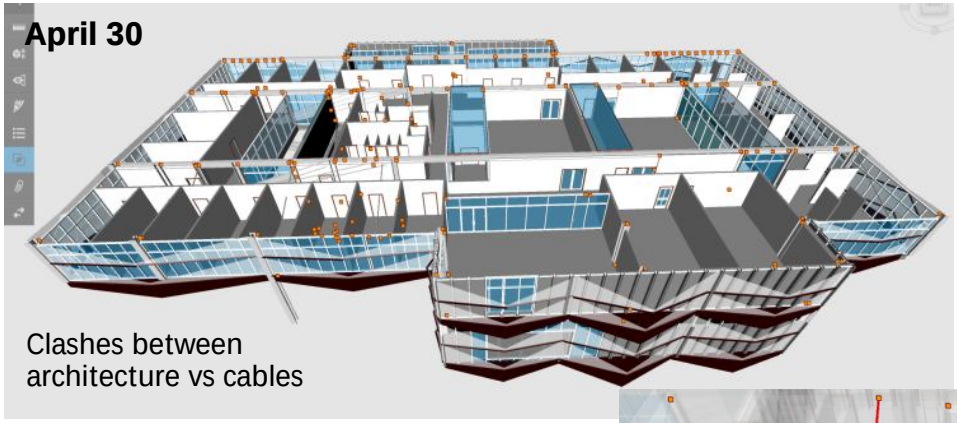
Site Access Analysis



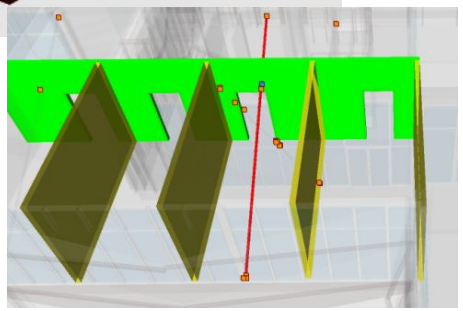
Site Layout Plan



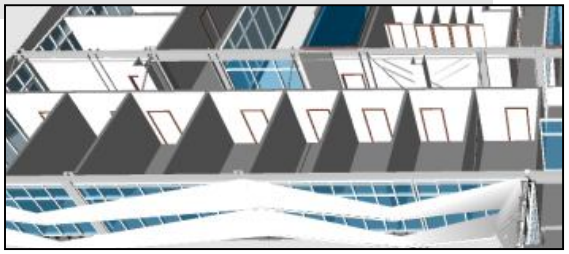
Clash Detection-before



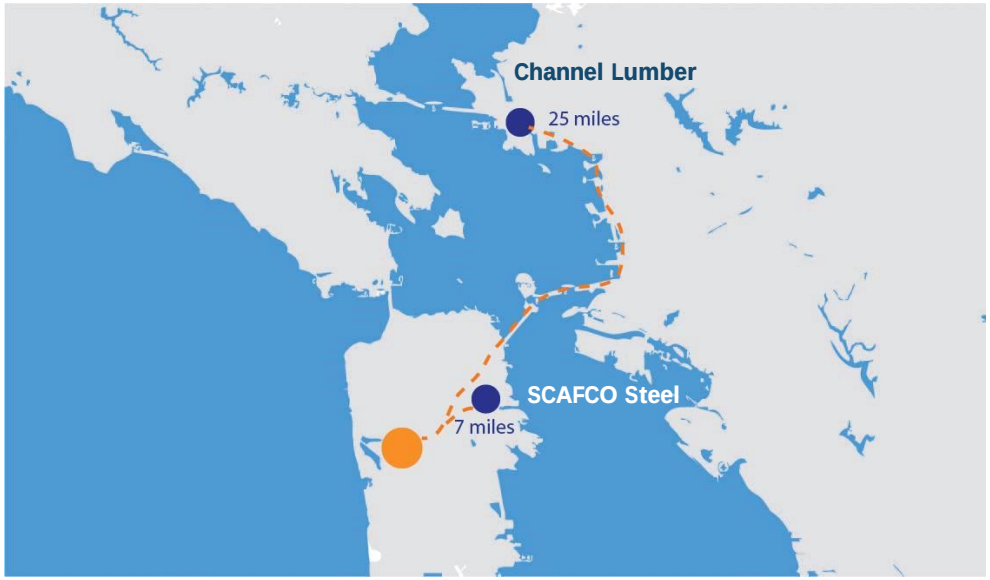
Clashes between
architecture vs cables



Clash Detection-after

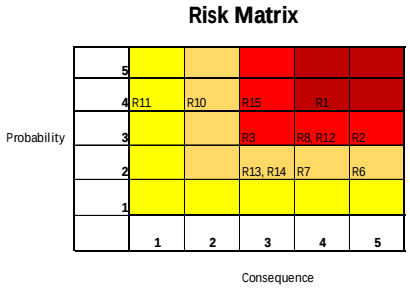


Material Access



Health and safety approach

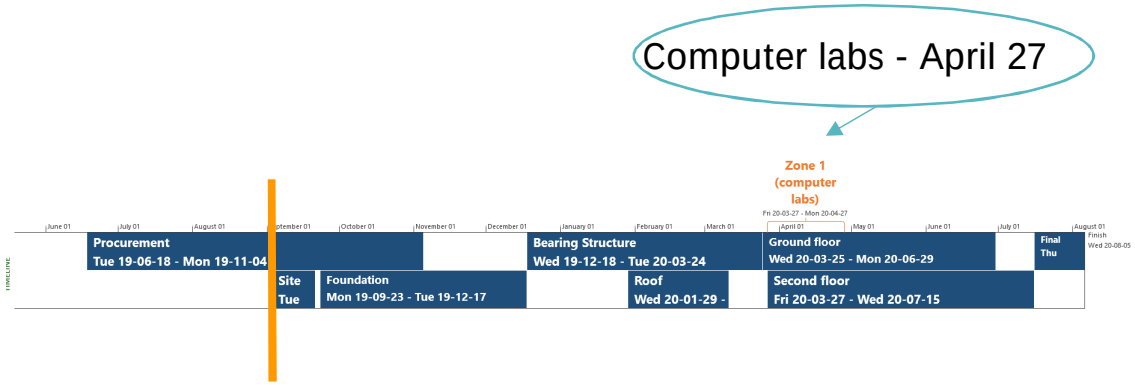
- Adress all risks
  - RED; E.g. falling, squeezing and run-over
  - YELLOW; E.g. dust, noise and chemicals.
- YELLOW most dangerous in long run
- Design for safety
- Fire and safety rounds



- Education;
  - Hand tools, work in elevation, welding, heavy lifting

”Achieve a healthy building through a healthy approach during both the design AND the construction”

Computer lab schedule

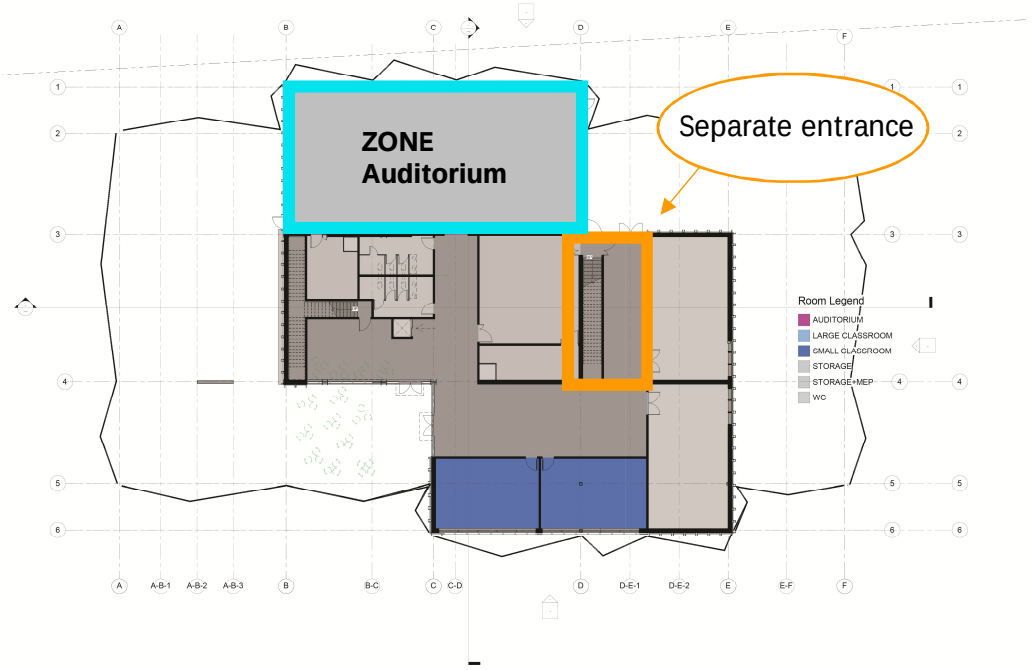


Construction Start
September 2019

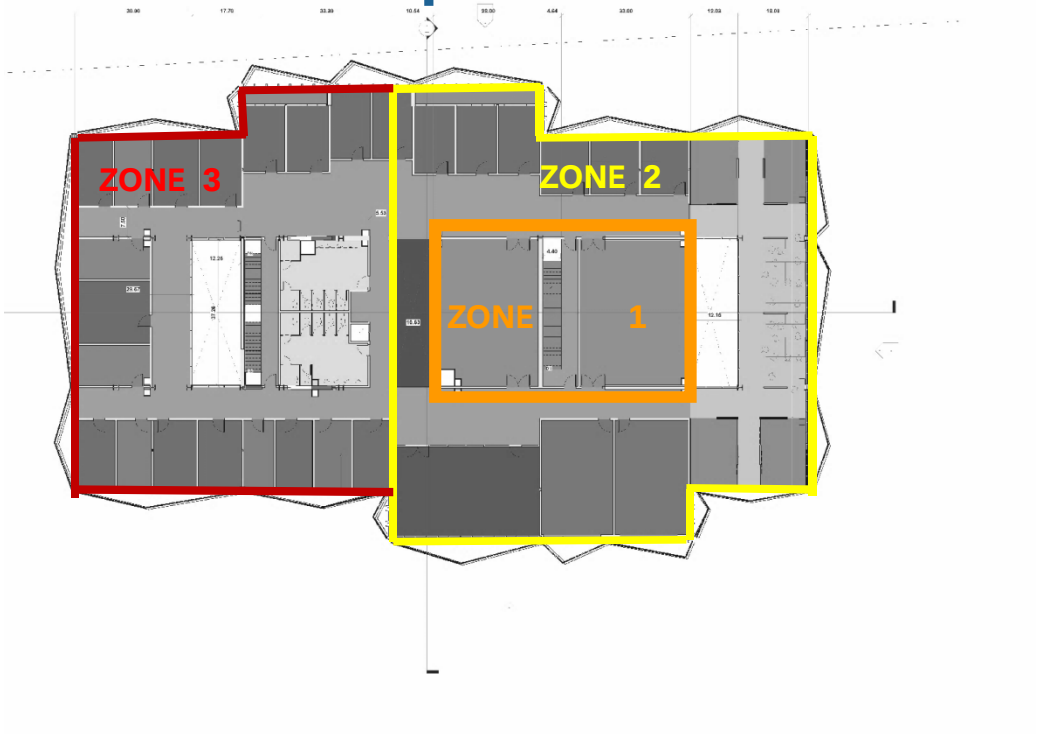
Computer Managers Access

Access from N. State Drive
for Computer Manager

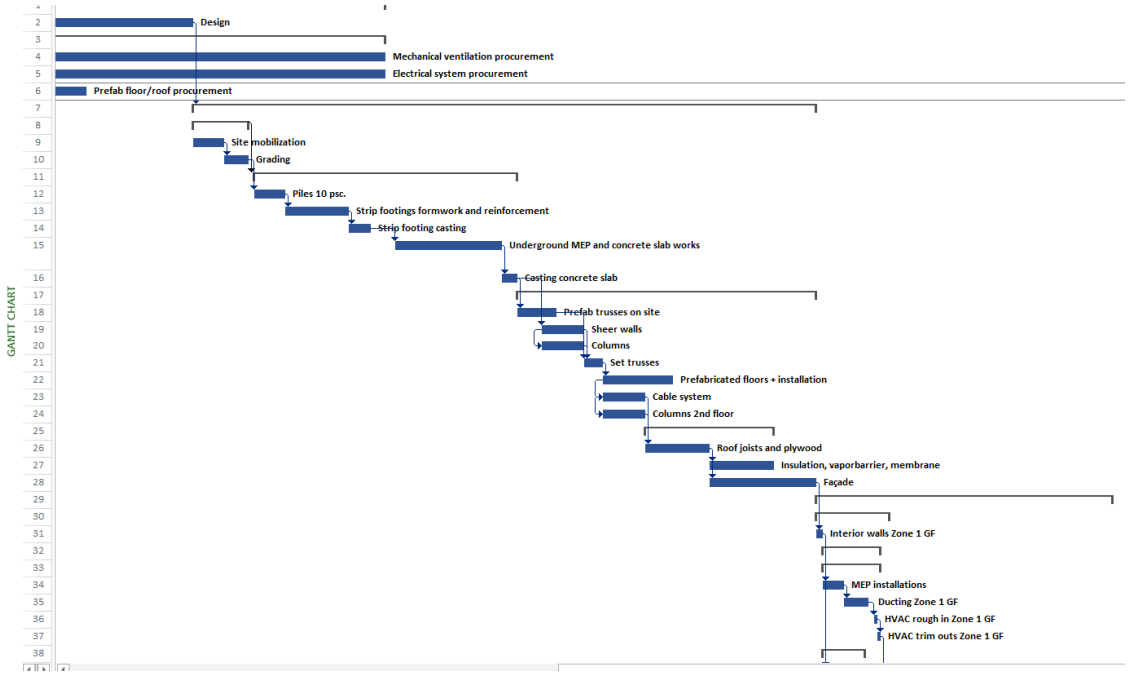
Computer Managers Entrance



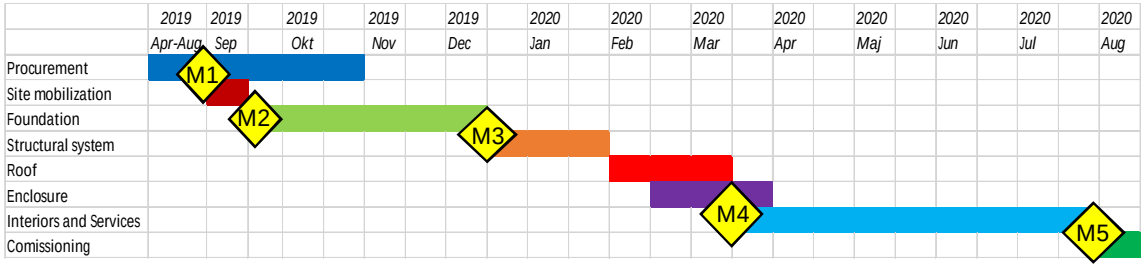
Zone 1 - Computer labs



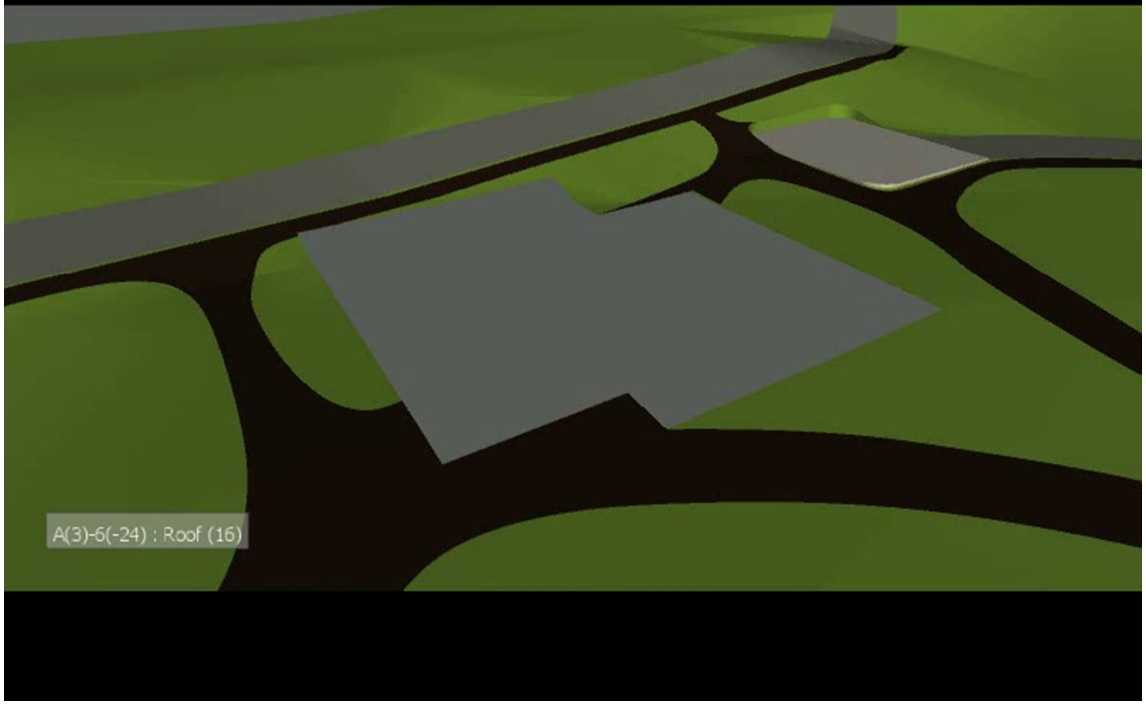
Gantt Schedule



Milestones


2019 Apr-Aug
2019 Sep
2019 Okt
2019 Nov
2019 Dec
2020 Jan
2020 Feb
2020 Mar
2020 Apr
2020 Maj
2020 Jun
2020 Jul
2020 Aug
Procurement
Site mobilization
Foundation
Structural system
Roof
Enclosure
Interiors and Services
Comissioning
M1
M2
M3
M4
M5

4D Construction



Critical Activities

GANTT CHART

	Task Mode	Task Name	Duration	Start	Finish	Predecessors	Resource Names
1		**Pre-construction**	**220 days**	**Tue 19-01-01**	**Mon 19-11-04**		
2		Design	175 days	Tue 19-01-01	Mon 19-09-02		
3		**Procurement**	**140 days**	**Tue 19-04-23**	**Mon 19-11-04**		
4		Mechanical ventilation procurement	90 days	Tue 19-07-02	Mon 19-11-04	2SS+130 days	
5		Electrical system procurement	80 days	Tue 19-07-16	Mon 19-11-04	2SS+140 days	
6		Prefab floor procurement	70 days	Tue 19-04-23	Mon 19-07-29	2SS+80 days	
7		**Construction bearing structure**	**146 days**	Tue 19-09-03	**Tue 20-03-24**	**2**	
8		**Site work**	**14 days**	**Tue 19-09-03**	**Fri 19-09-20**		
9		Site mobilization	8 days	**Tue 19-09-03**	Thu 19-09-12		Excavation crew B 30
10		Grading	6 days	**Fri 19-09-13**	Fri 19-09-20	9	Excavation crew B 30
11		**Foundation**	**62 days**	**Mon 19-09-23**	**Tue 19-12-17**	**8**	
12		Piles 10 psc.	8 days	Mon 19-09-23	Wed 19-10-02	10	Bearing structure crew piles
13		Strip footings formwork and reinforcement	15 days	Thu 19-10-03	Wed 19-10-23	12	Bearing concrete crew;Water and S
14		Strip footing casting	5 days	Thu 19-10-24	Wed 19-10-30	13	Casting crew
15		Underground MEP and concrete slab works	25 days	Fri 19-11-08	Thu 19-12-12	14FS+6 days	Water and Sewage crew; Bearing concrete crew
16		Casting concrete slab	3 days	Fri 19-12-13	Tue 19-12-17	15	Casting crew
17		**Bearing Structure**	**70 days**	**Wed 19-12-18**	**Tue 20-03-24**		
18		Prefab trusses on site	9 days	Wed 19-12-18	Mon 19-12-30	16	Casting crew
19		Sheer walls	10 days	Thu 19-12-26	Wed 20-01-08	16FS+6 days	Bearing steel structure
20		Columns	10 days	Thu 19-12-26	Wed 20-01-08	19SS	Bearing steel structure 2
21		Set trusses	4 days	Thu 20-01-09	Tue 20-01-14	19;20;18	Bearing steel structure
22		Prefabricated floors + installation	17 days	Wed 20-01-15	Thu 20-02-06	21	HVAC crew
23		Cable system	10 days	Wed 20-01-15	Tue 20-01-28	22SS	Bearing structure crew
24		Columns 2nd floor	10 days	Wed 20-01-15	Tue 20-01-28	23SS	Bearing steel structure 2
25		**Roof**	**30 days**	**Wed 20-01-29**	**Tue 20-03-10**		
26		Roof joists and plywood	15 days	Wed 20-01-29	Tue 20-02-18	23;24	Bearing steel structure 2
27		Insulation, vaporbarrier, membrane	15 days	Wed 20-02-19	Tue 20-03-10	26	Bearing structure crew
28		Façade	25 days	Wed 20-02-19	Tue 20-03-24	26	Bearing steel structure 2
29		**Ground floor**	**69 days?**	**Wed 20-03-25**	**Mon 20-06-29**		
30		**Zone 1 GF (MEP + storage)**	**18 days?**	**Wed 20-03-25**	**Fri 20-04-17**		
31		Interior walls Zone 1 GF	2 days	Wed 20-03-25	Thu 20-03-26	28	Interior crew
32		**Services**	**13 days?**	**Fri 20-03-27**	**Tue 20-04-14**		
33		**HVAC**	**13 days?**	**Fri 20-03-27**	**Tue 20-04-14**		
34		MEP installations	5 days	Fri 20-03-27	Thu 20-04-02	31	HVAC crew
35		Ducting Zone 1 GF	6 days	Fri 20-04-03	Fri 20-04-10	34	HVAC crew
36		HVAC rough in Zone 1 GF	1 day?	Mon 20-04-13	Mon 20-04-13	35	HVAC crew
37		HVAC trim outs Zone 1 GF	1 day?	Tue 20-04-14	Tue 20-04-14	36	HVAC crew
38		**Electricity**	**10 days**	**Fri 20-03-27**	**Thu 20-04-09**		

TVD Winter Quarter

ESTIMATE AND TARGET VALUE WINTER	ESTIMATED VALUE	TARGET VALUE	VALUE DELTA
TOTAL	**9 260 000**	**9 800 000**	**540 000**
A Substructure	86 000	710 000	624 000
B Shell	3 400 000	3 330 000	-70 000
C Interiors	1 240 000	1 000 000	-240 000
D Services	3 600 000	3 500 000	-100 000
E Equipment and Furnishing	140 000	160 000	20 000
F Specialty Construction	200 000	330 000	130 000
G Building Sitework	240 000	270 000	30 000
H General Conditions	350 000	470 000	120 000

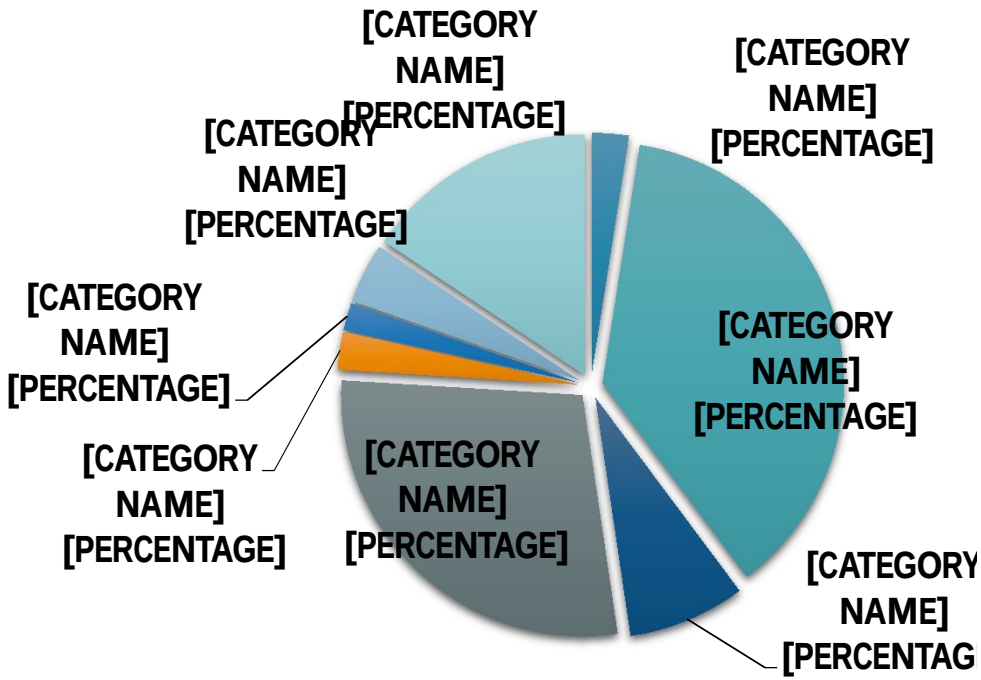
WINTER ESTIMATE: $9 260 000

TVD Spring Quarter

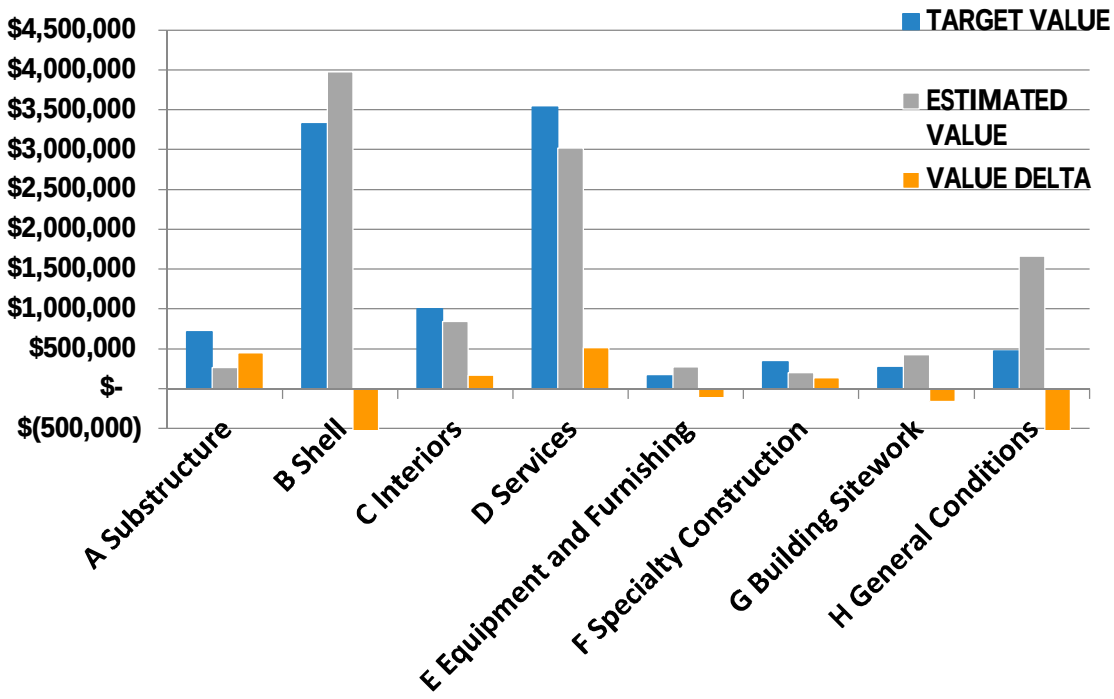
ESTIMATE AND TARGET VALUE			
SPRING	ESTIMATED VALUE	TARGET VALUE	VALUE DELTA
TOTAL	**10 650 000**	**9 800 000**	**-850 000**
A Substructure	260 000	710 000	450 000
B Shell	3 980 000	3 330 000	-650 000
C Interiors	840 000	1 000 000	160 000
D Services	3 020 000	3 530 000	510 000
E Equipment and Furnishing	270 000	160 000	-110 000
F Specialty Construction	200 000	330 000	130 000
G Building Sitework	430 000	270 000	-160 000
H General Conditions	1 660 000	470 000	-1 190 000

SPRING ESTIMATE: $10 650 000

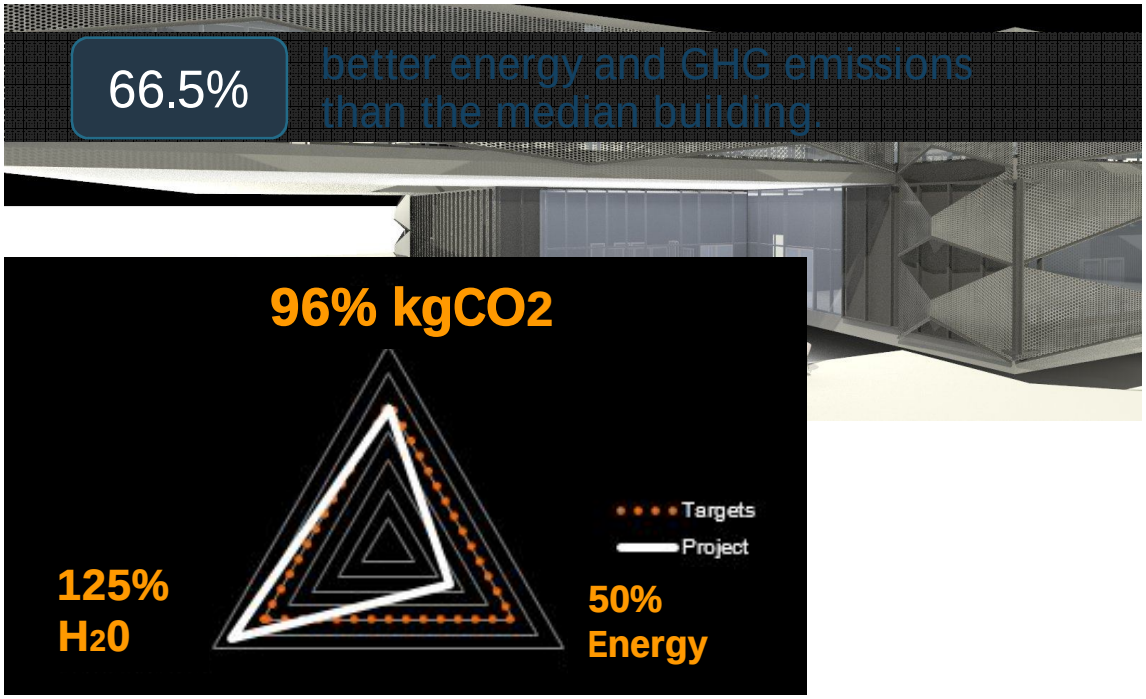
COST ESTIMATE



Targets by Cluster



Building Performance - STV



LEED

Previous Swinerton Challenges

- Leapfrog Sustainability
- Biomimicry
- Native
- Sustainable Performance
- Sustainable Design and Construction

Wellbeing – Active Design

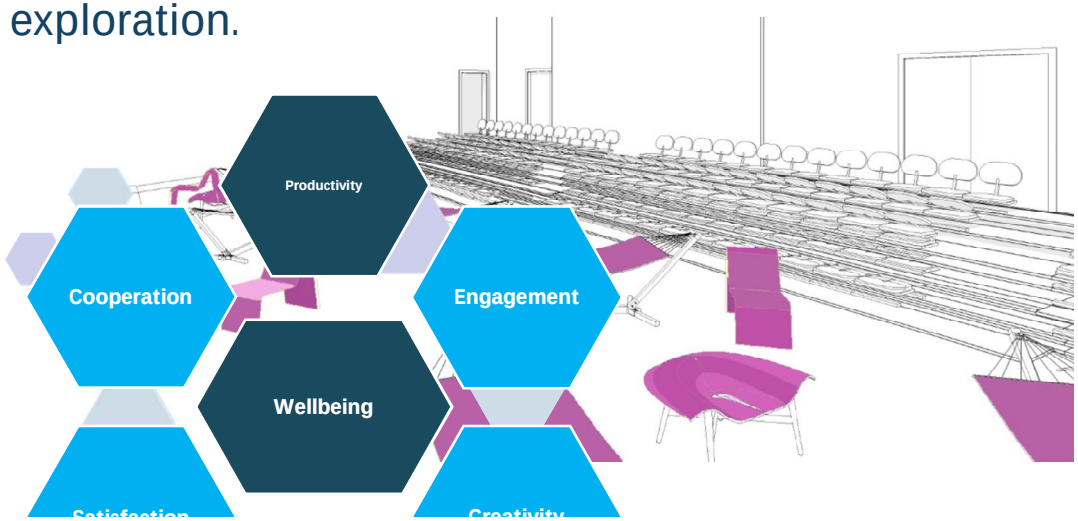
- Smoke-free building.
- Stairs, elevators and bathrooms encourage movement.
- Access to take a break or be active.

Wellbeing - Biophilia

- Reduced stress through views of natural landscapes.
- Increased social interactions and sense of community.
- 10 to 25% better mental function and memory.

Wellbeing - Auditorium

- Area for relaxation, quiet, socializing, fitness.
- Quiet room with soft music for times of stress.
- Creativity, self-expression, cooperation, exploration.

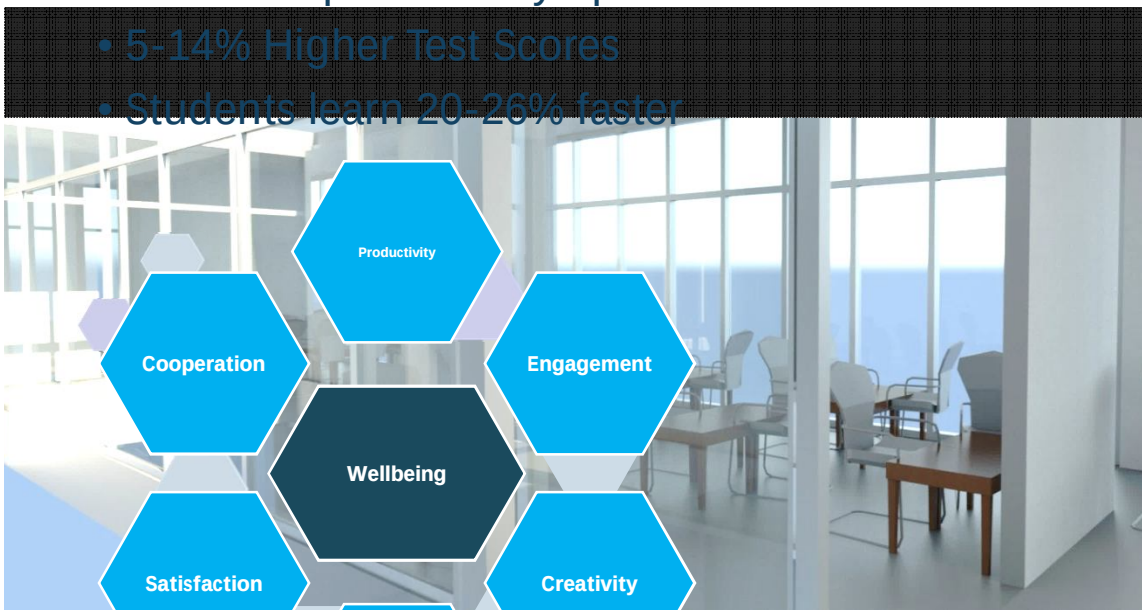


Wellbeing - Workspaces

- Opportunity to engage in spontaneous social encounters
- Freedom to move from one social phase to another
- Better ventilation improves productivity by 11%
- Individual temperature control by 3%

Wellbeing - Daylight

- Increased productivity up to 18%.
- 5-14% Higher Test Scores
- Students learn 20-26% faster



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All mentors that supported and inspired our work

Team Pacific

Learning experiences

“Even if you say green and I say green, I´m thinking blue and you´re thinking orange.”

“Remember to mute your mic/Unmute your mic.”

“What drives project success is a strong interest in everyone's ideas that arise during the project.”

”Maybe I want to be an architect?” // Structural Engineer

”The social interaction is the best – I love you guys.”

”Embrace your differences and take advantage of them”