Ridge Team

Winter Quarter Presentation

A

Sinan Mihelcic

E

Caroline Lewis
Justin Schwaiger
Annemarie Golz
(Apprentice)

MEP

Linette Bodilsen

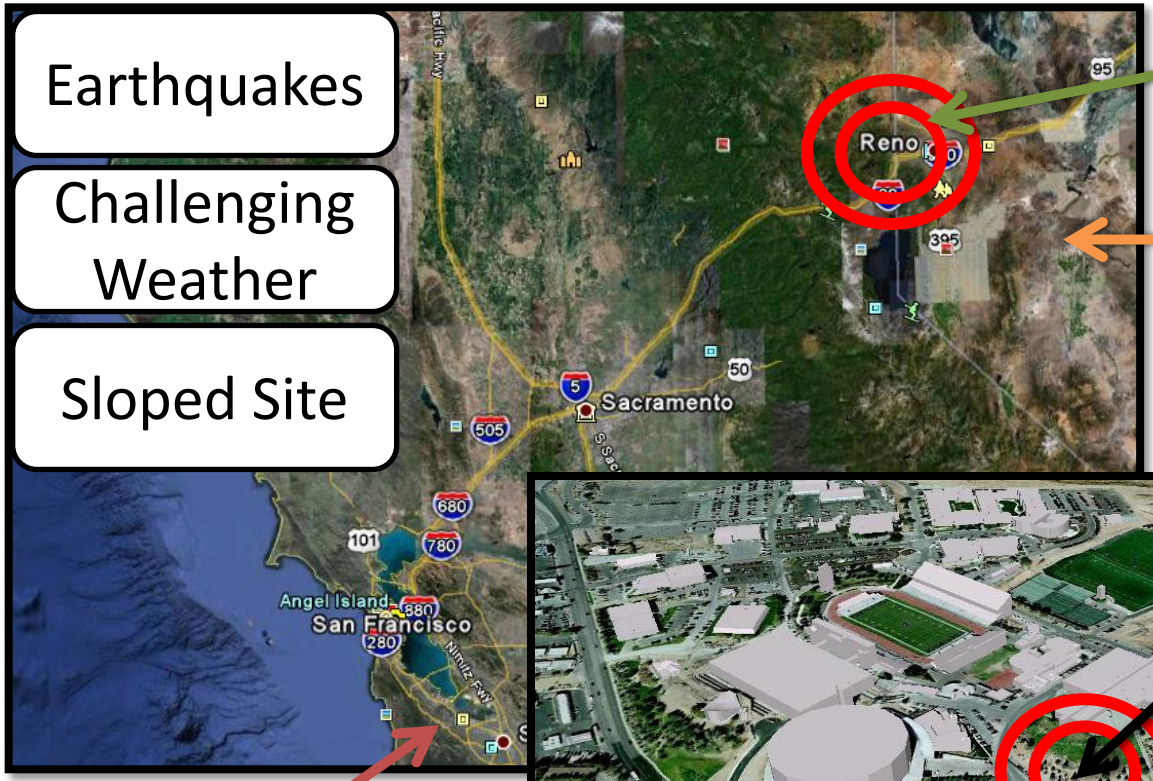
C

Maria Selk
Fernando Castillo

Owners: **Anja Jutraz and Josh Odelson**

University of Nevada, Reno

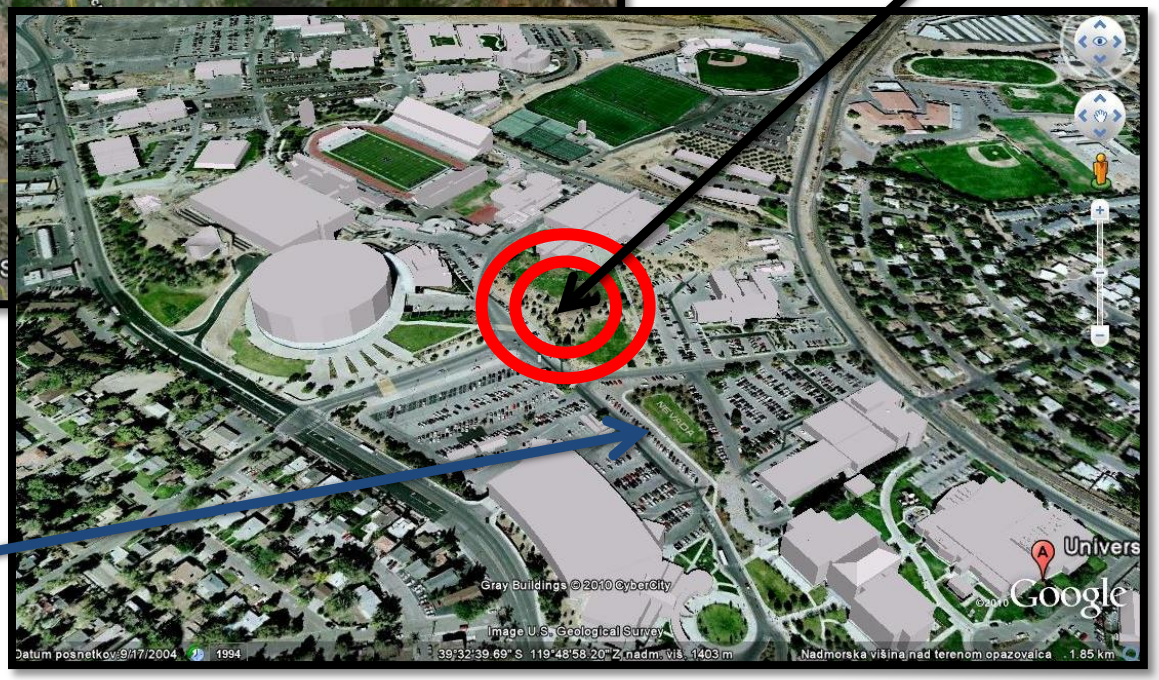
- Earthquakes
- Challenging Weather
- Sloped Site



Reno

Nevada

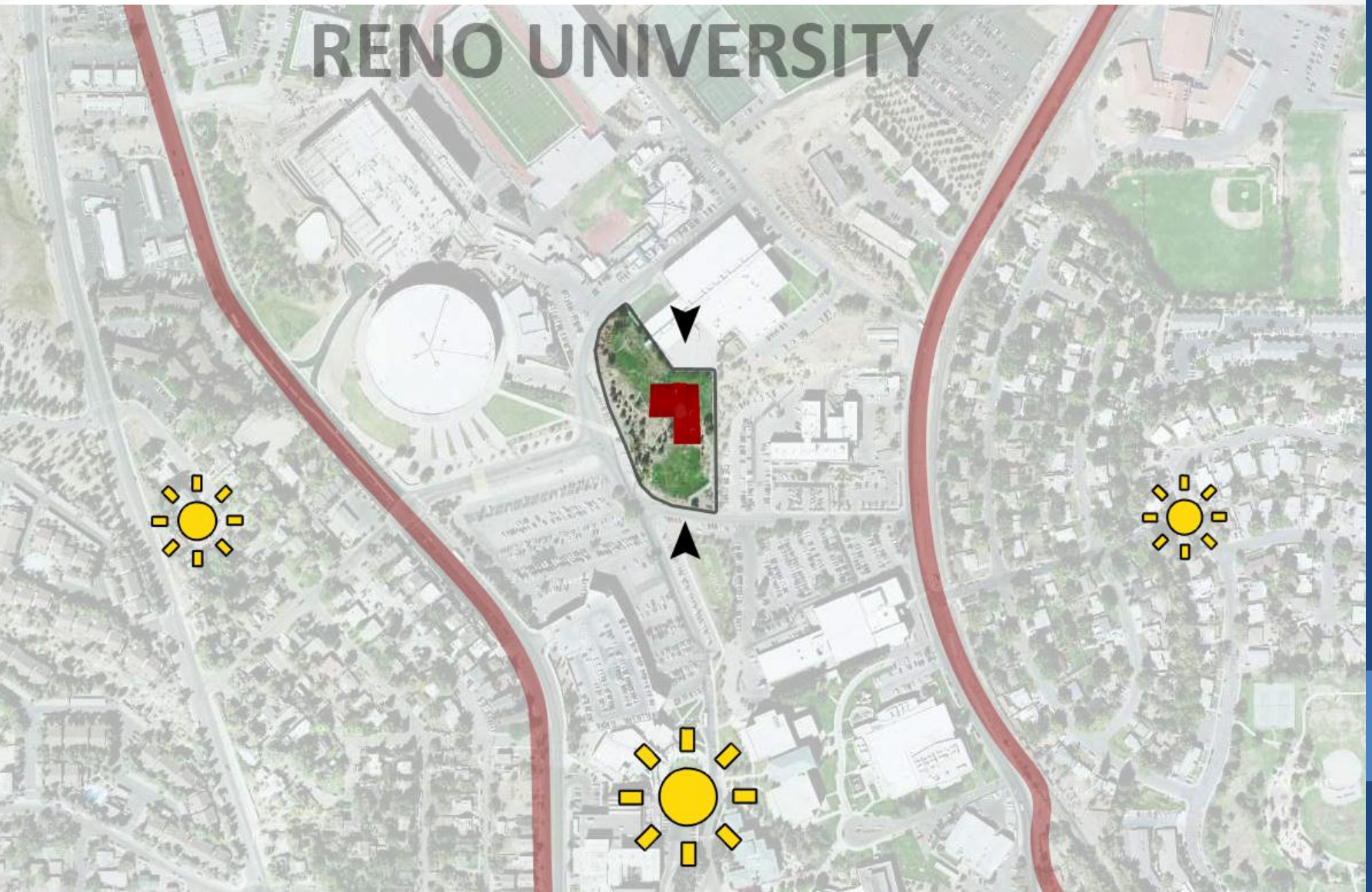
Construction Site



Stanford!

University of Nevada

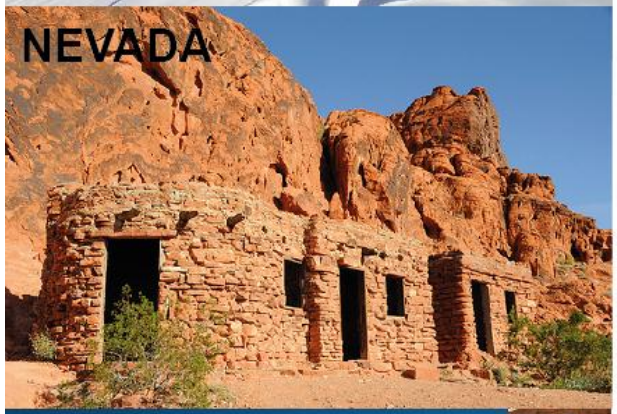
Location on the Site

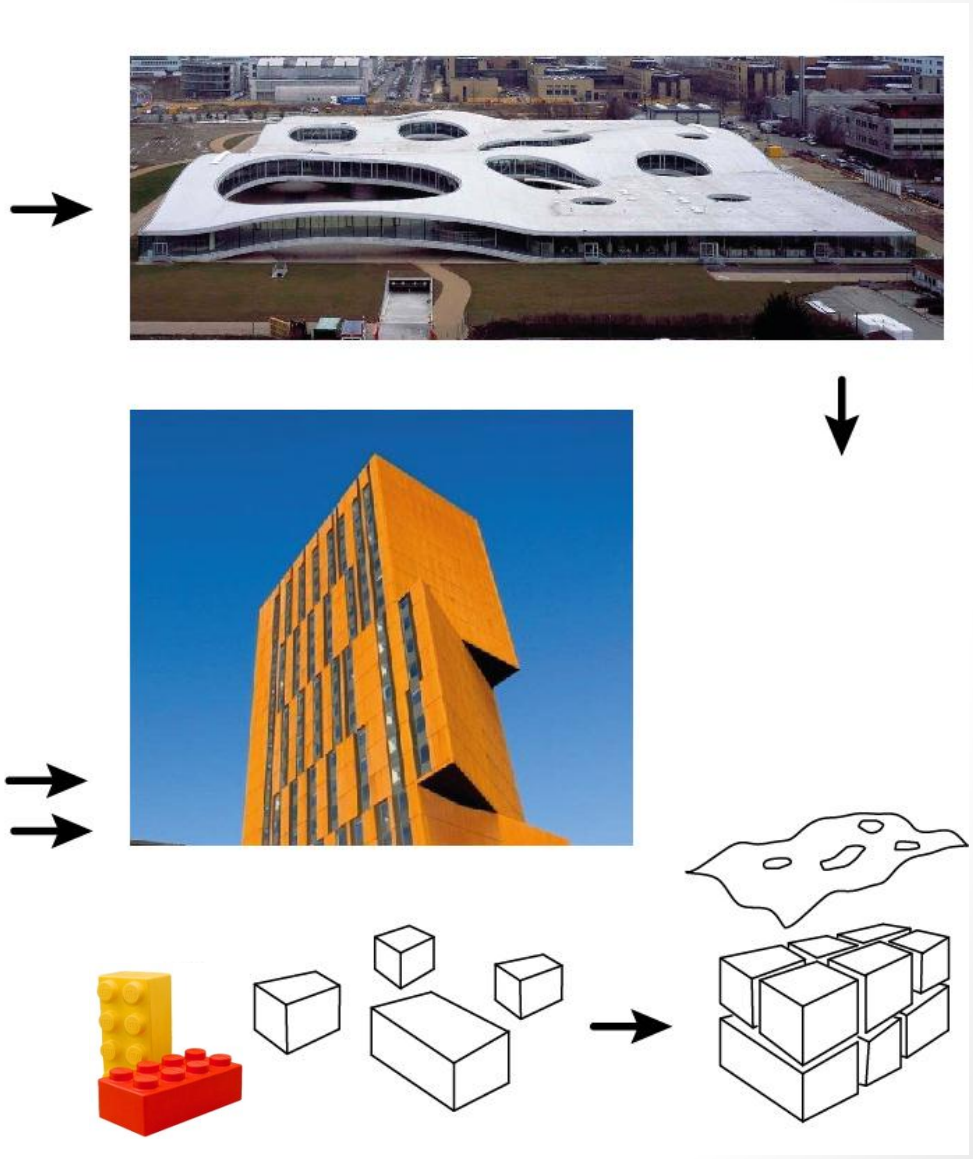


Education = Building

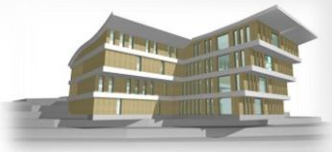
Design:
Lego Concept

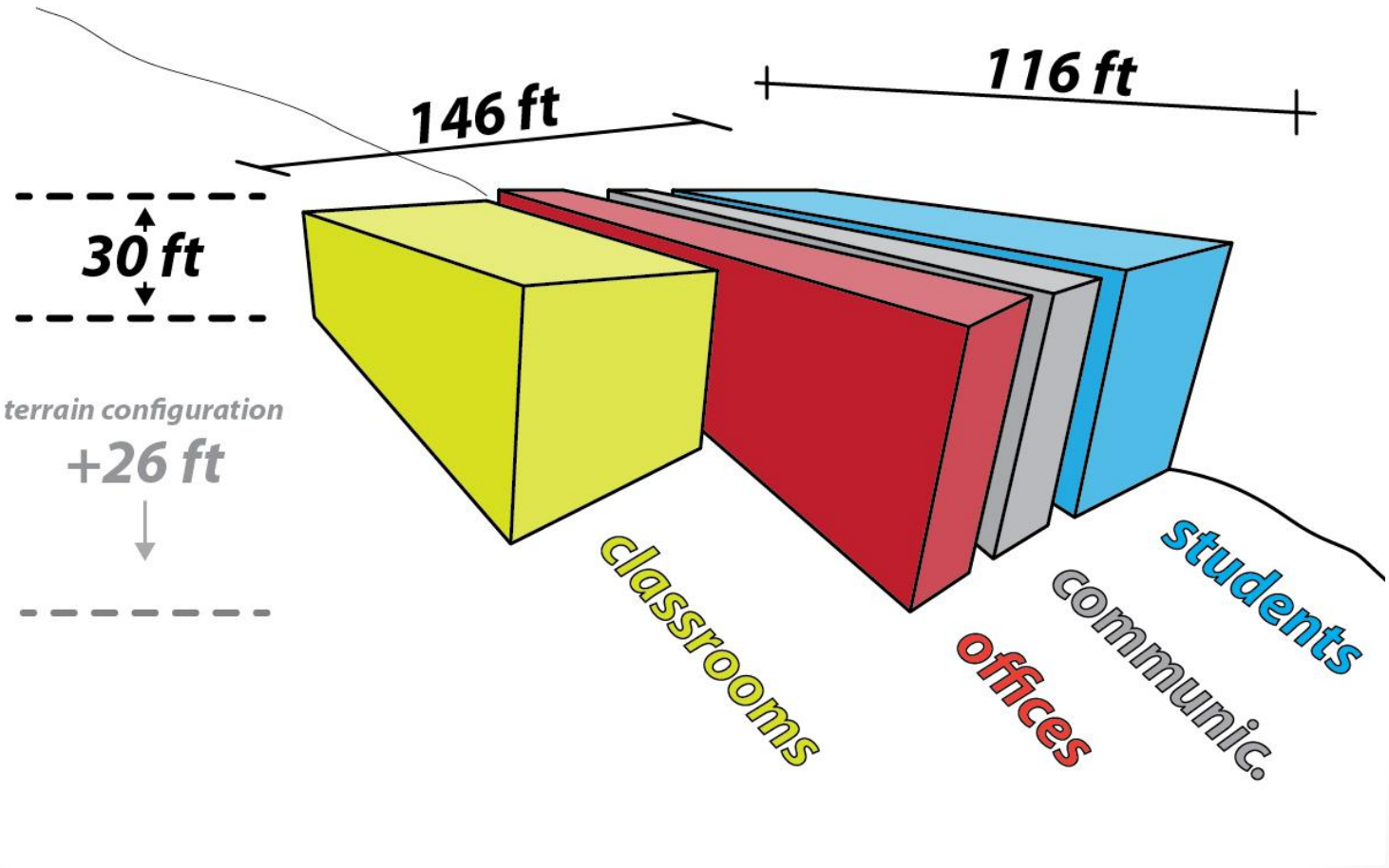
Big Ideas



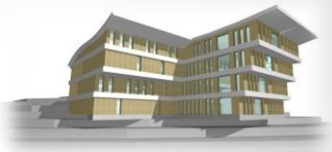


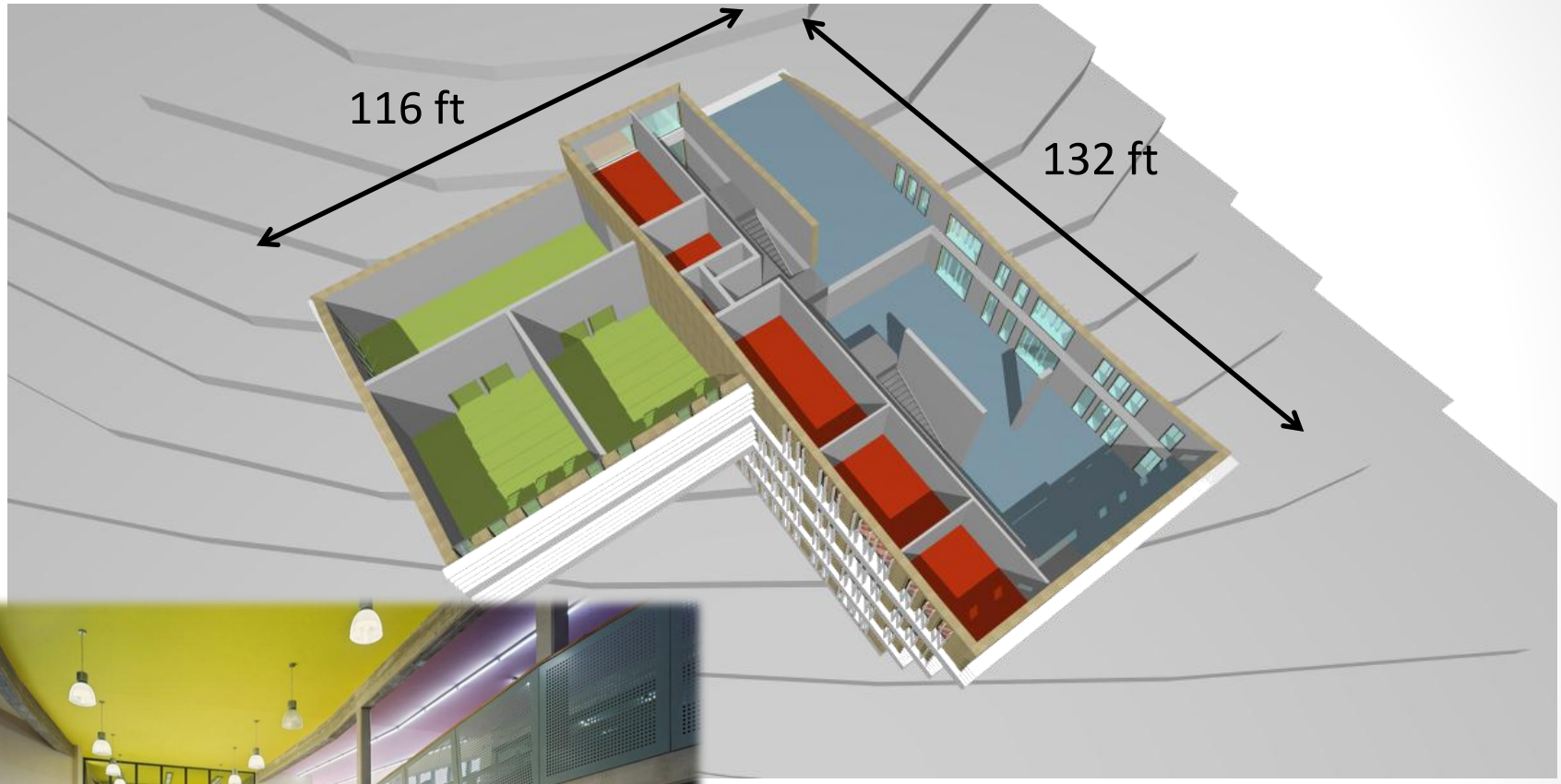
Program Scheme





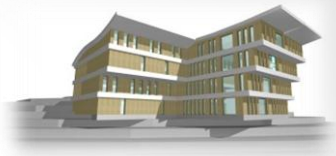
Logistics of the Building

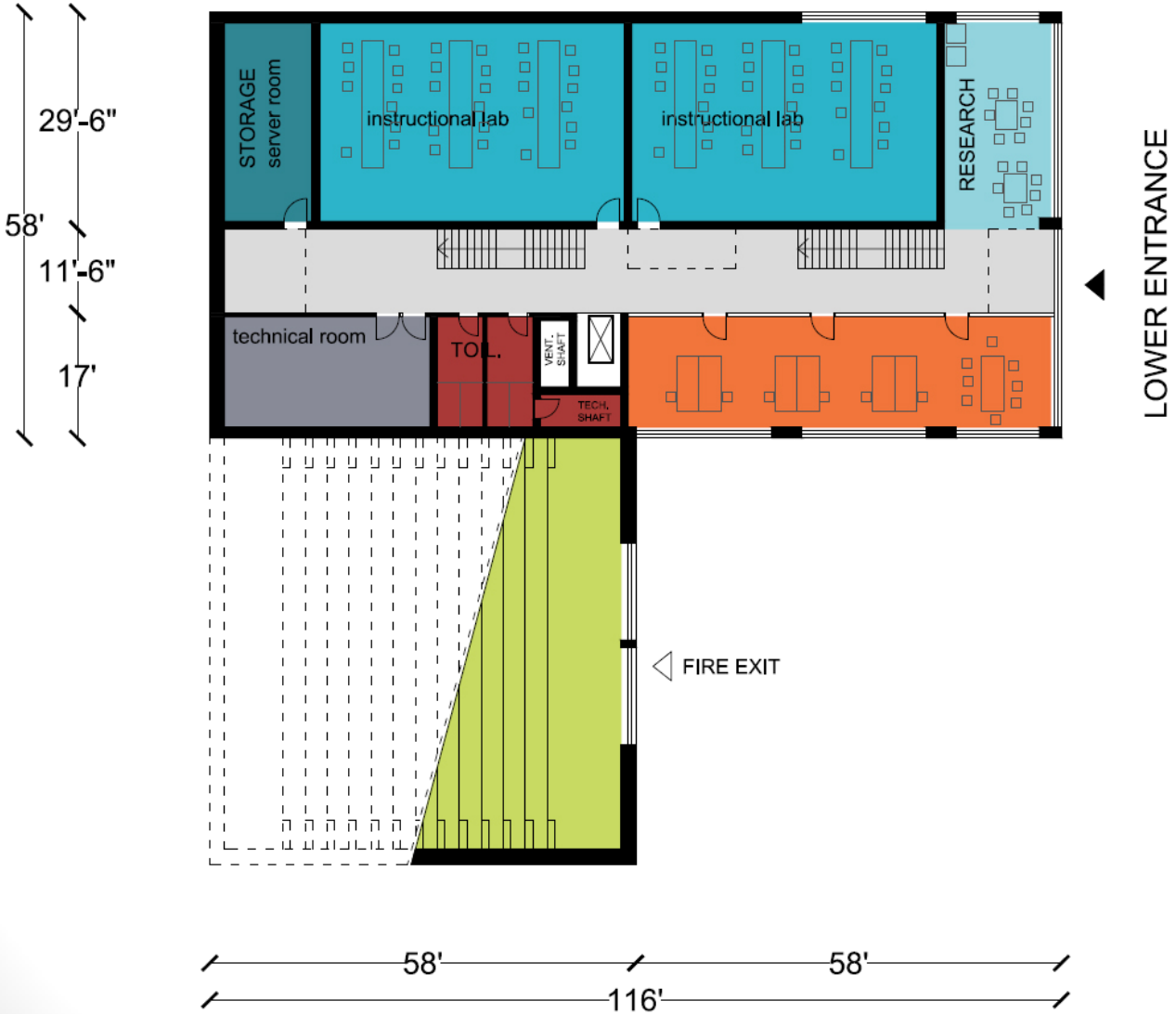




north

1st Floor



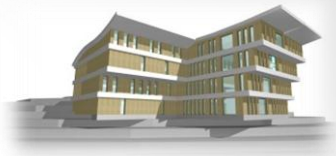


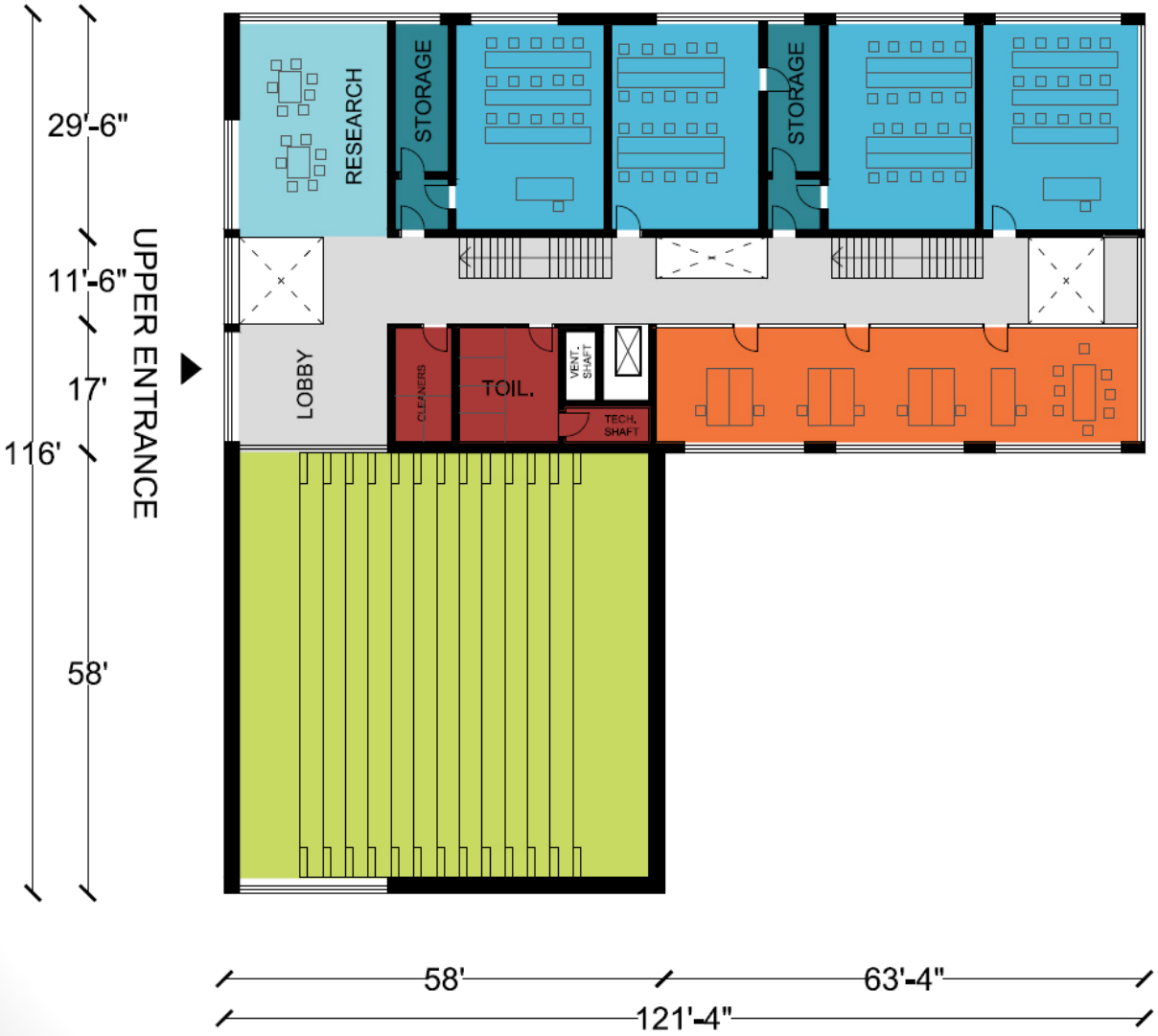
- instructional lab
- research
- storage
- auditorium
- faculty office
- toilets
- server room
- air space/shaft
- communications

N

1. floor

2nd Floor



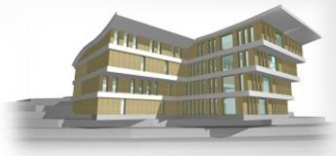


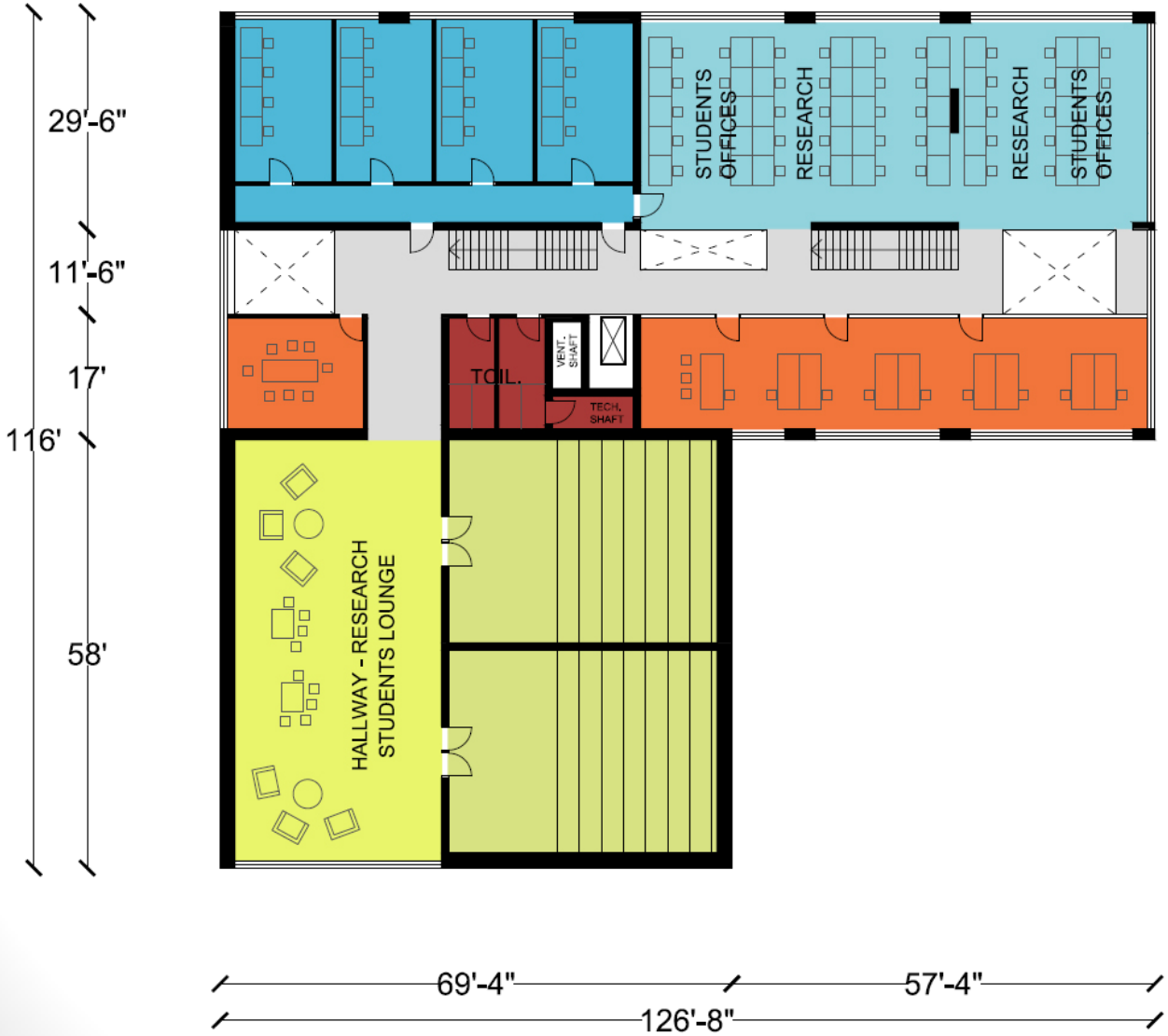
- small classrooms
- research
- storage
- auditorium
- faculty office
- toilets
- air space/shaft
- communications

N

2. floor

3rd Floor





seminar rooms

students offices

students lounge

large classrooms

faculty office

toilets

air space/shaft

communications

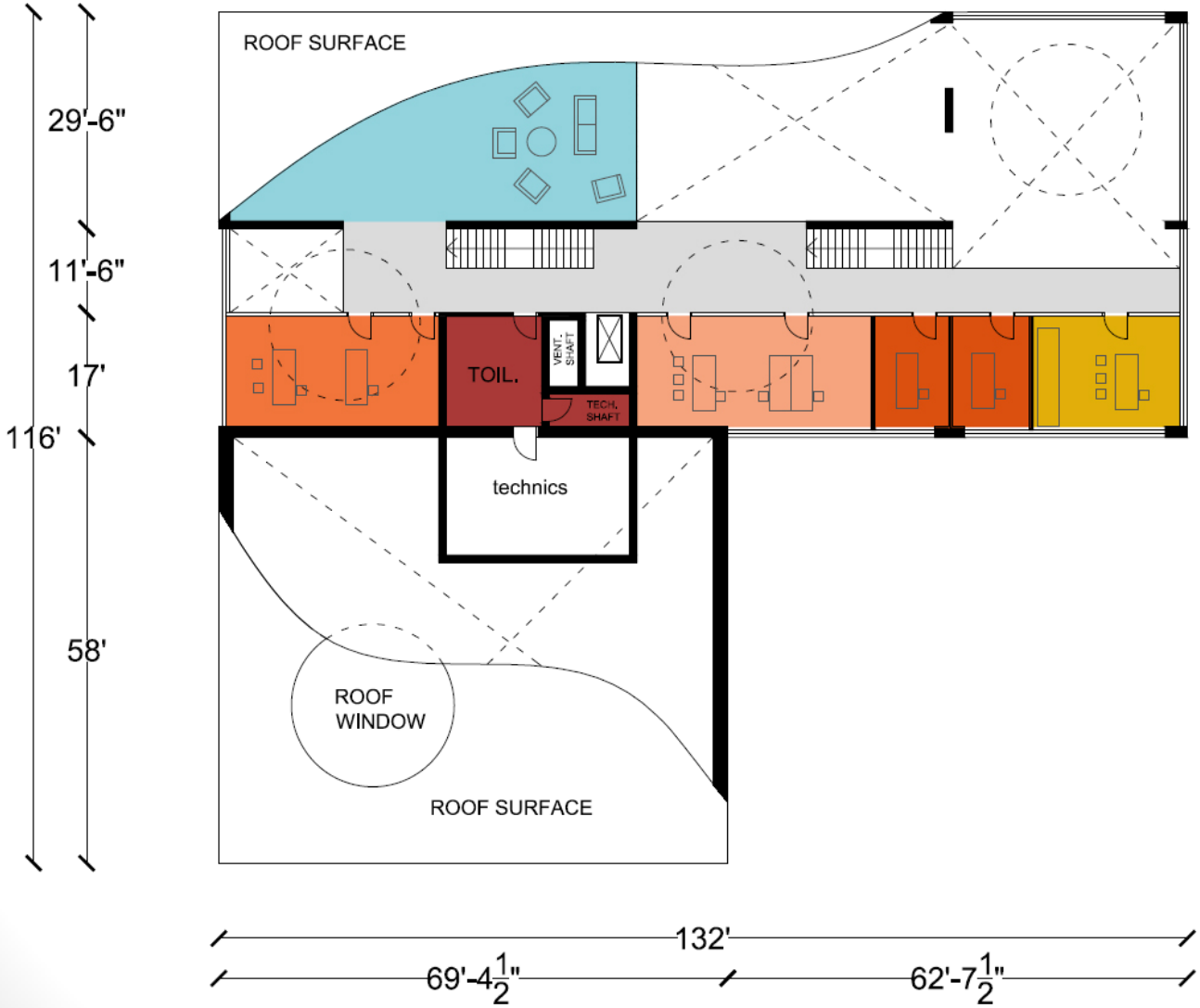
N

3. floor

AE MEP C

Ridge Team 2/18/2011

4th Floor

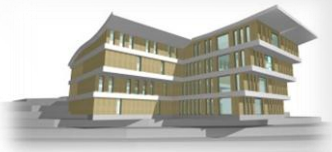


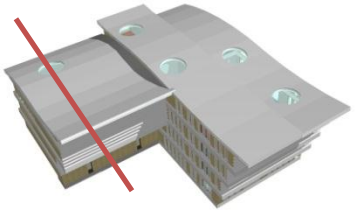
chairs office
senior assist.
administration
faculty office
toilets
air space
communications

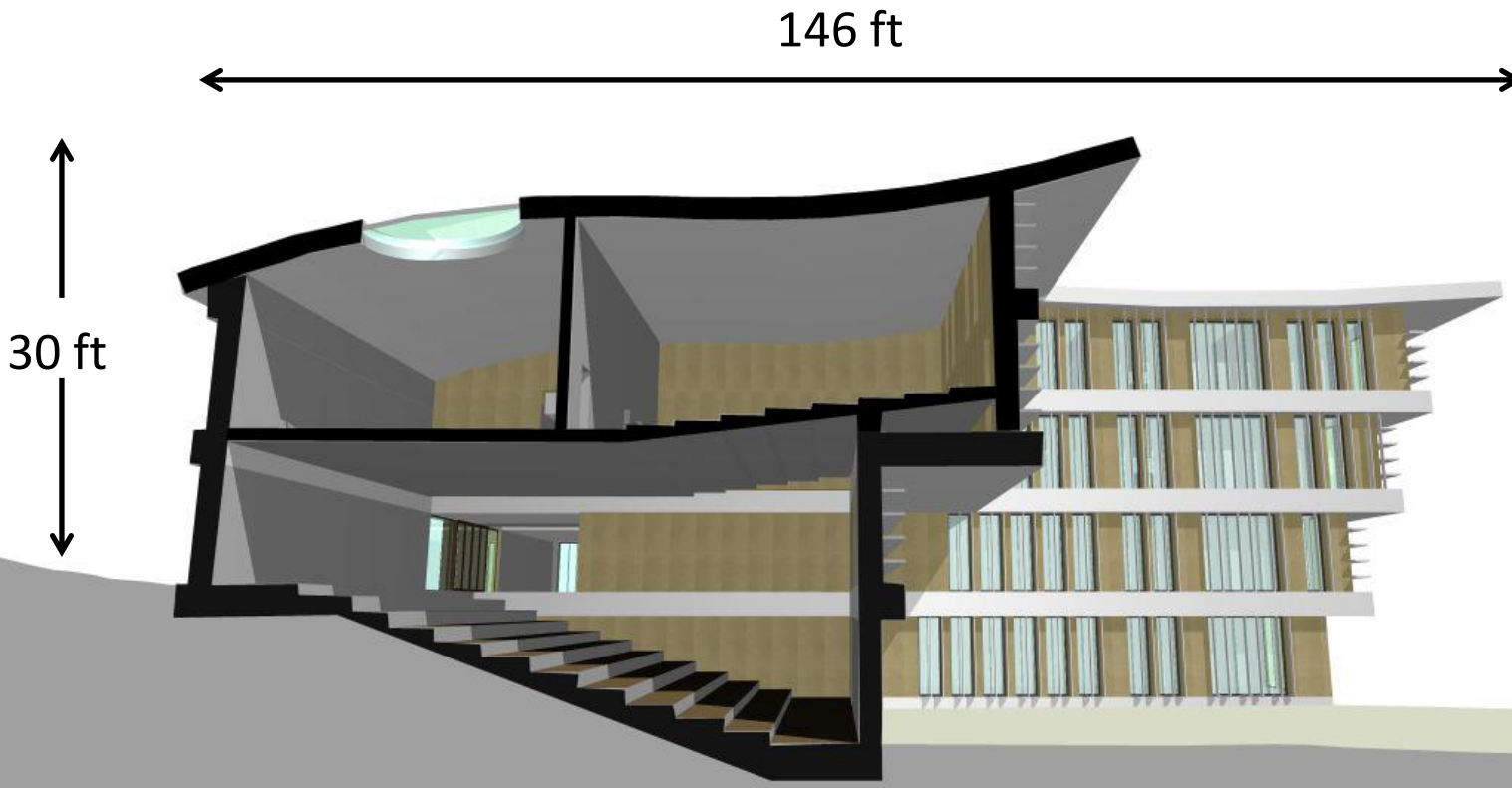
N

4. floor

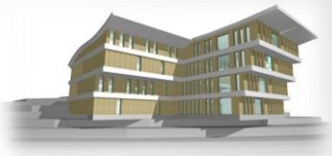
Section

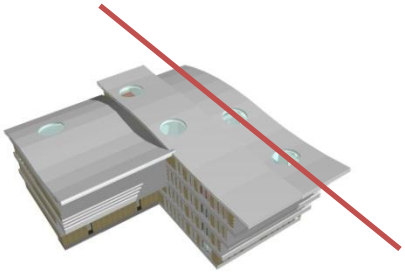


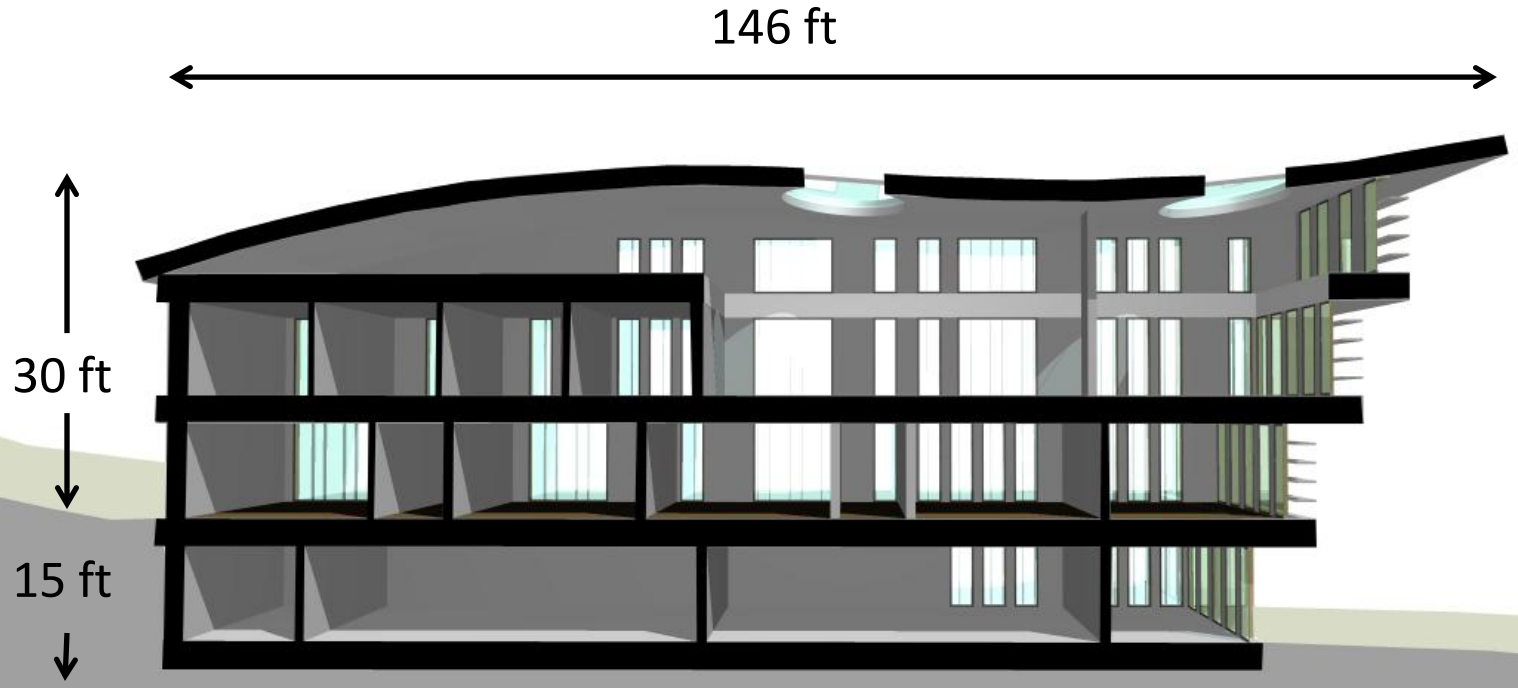




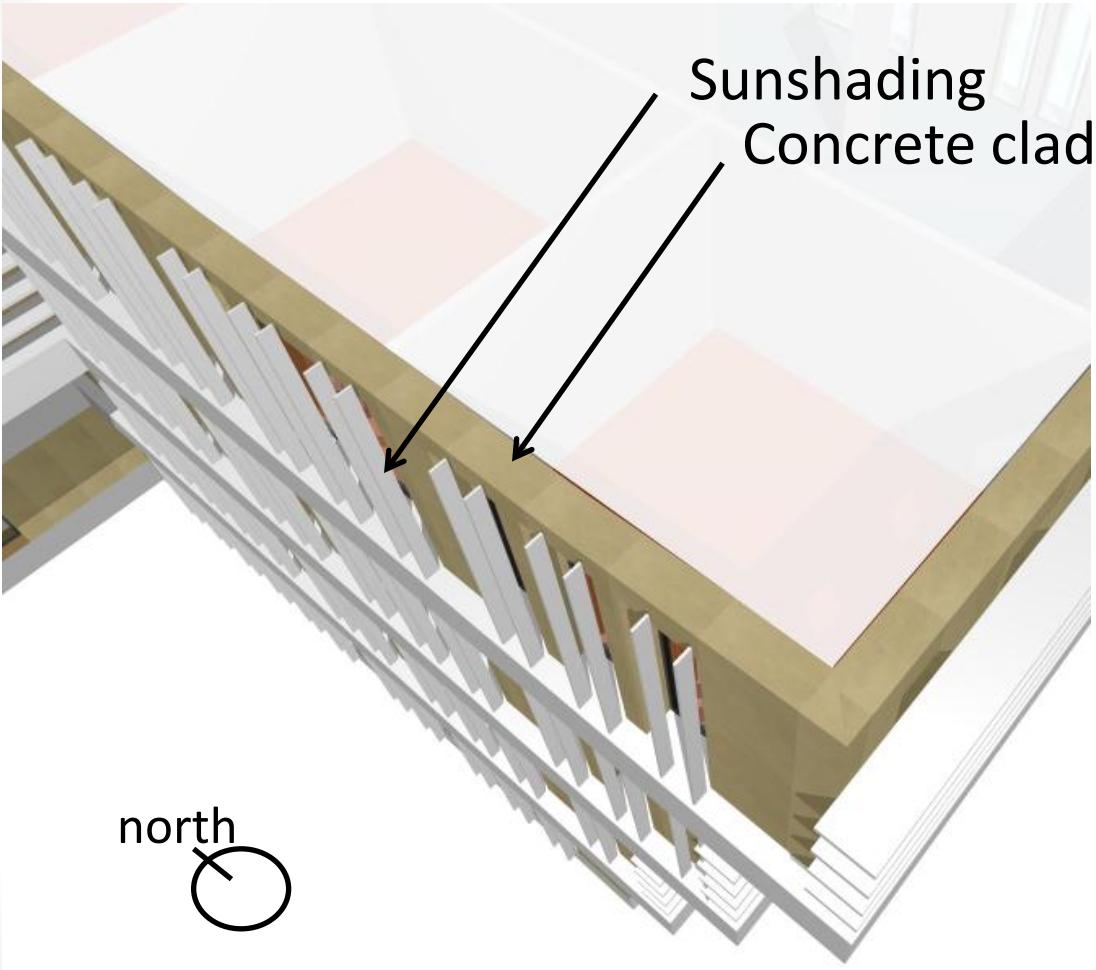
Section





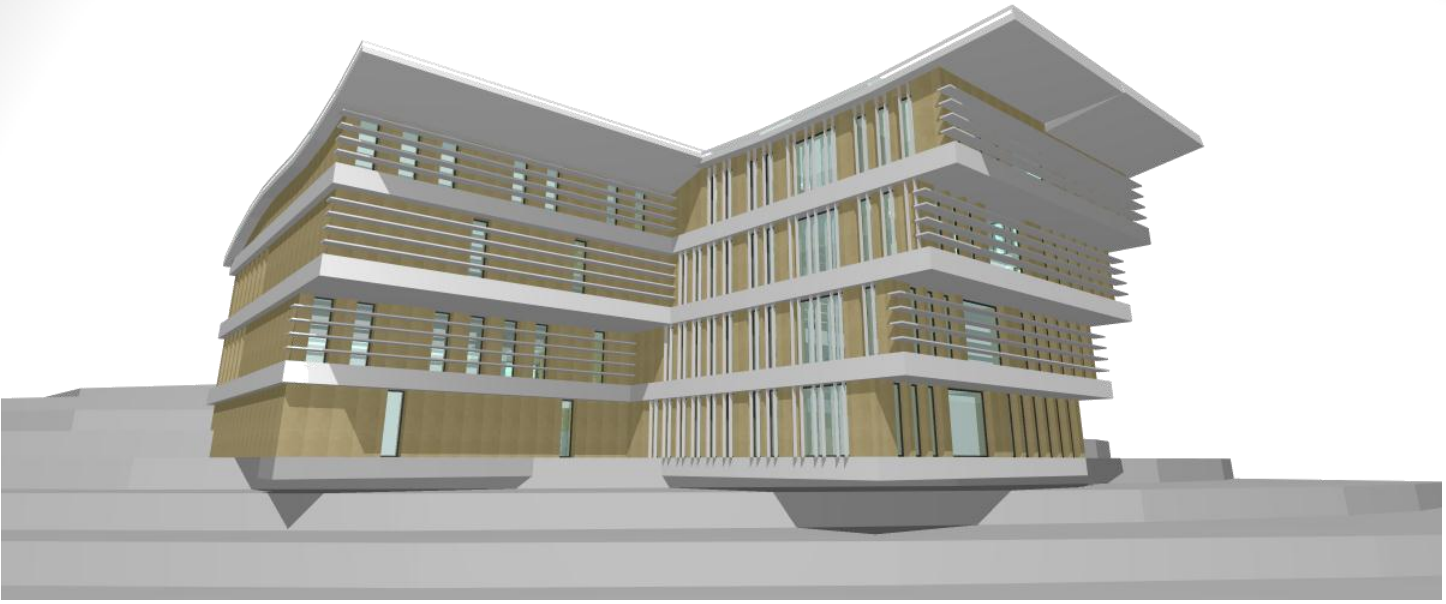


Façade

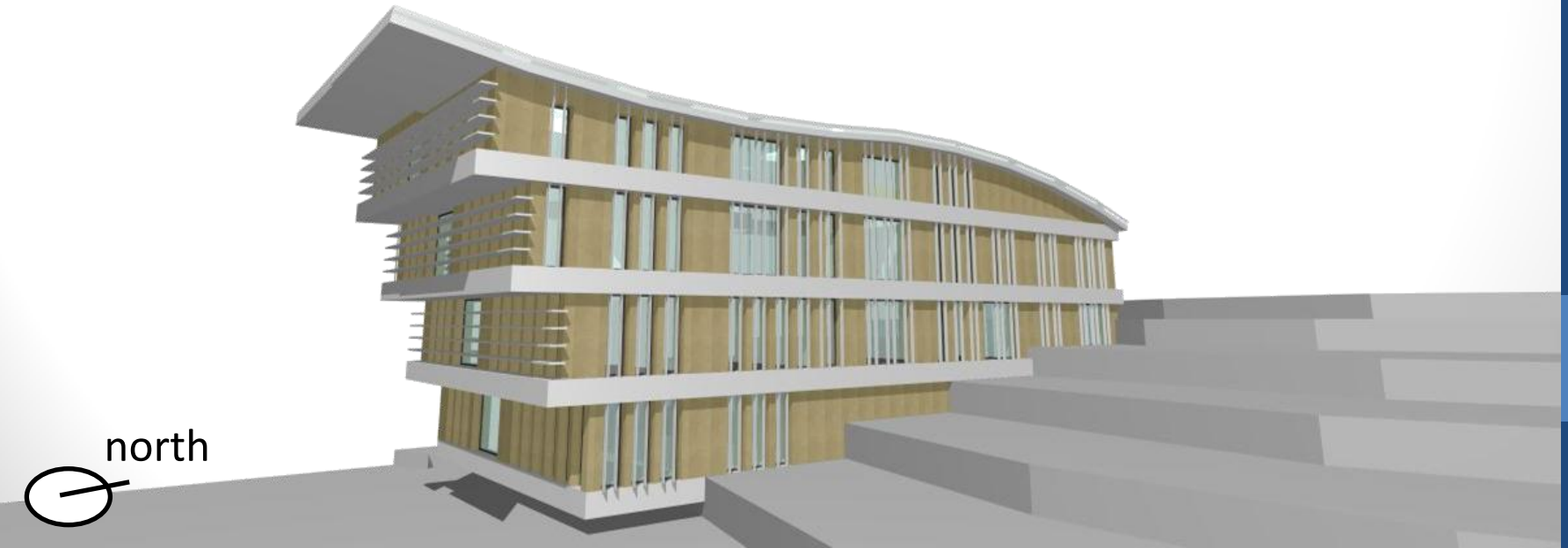


Local granulate

East & West View



north



north

Structural Loads

Dead Load: 100 psf

Live Load: 60 psf average

Snow Load: 10 psf

Concept 1

Earthquake base shear: 0.1337g = 535 kips

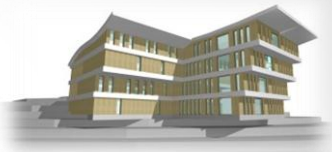
Wind shear: 87 kips

Concept 2:

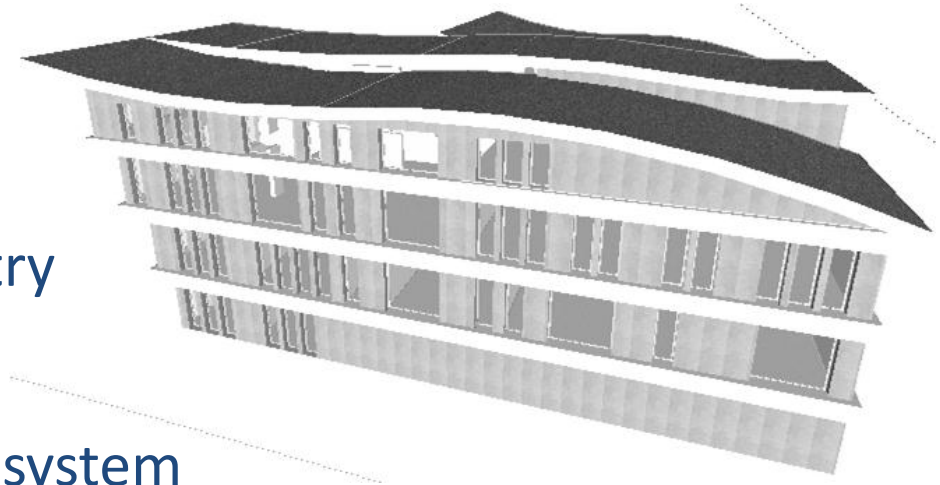
Earthquake base shear: 0.27g = 1100 kips

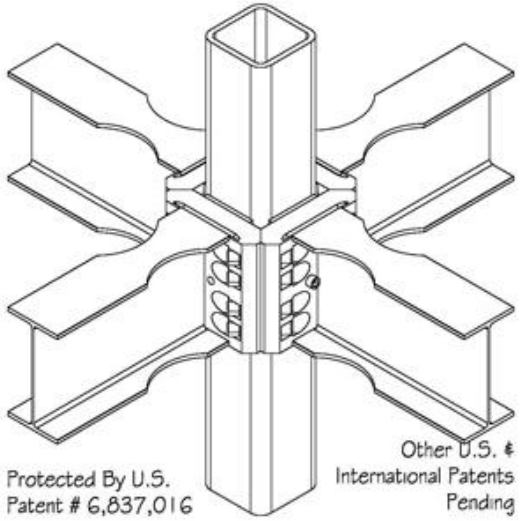
Wind shear: 87 kips

Structural Development

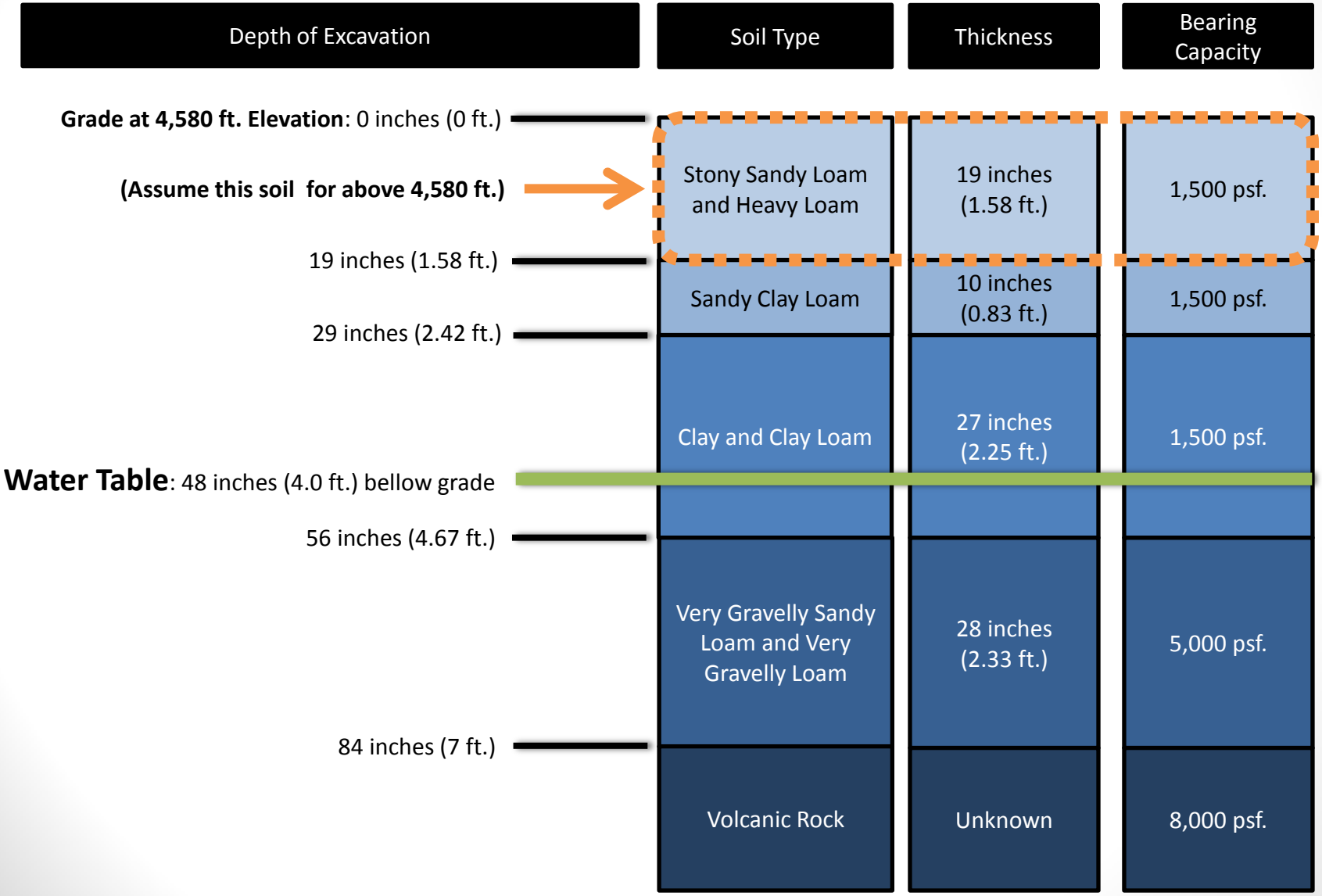


- Challenges:
  - Curved roof
  - Earthquake Country
- Solutions:
  - Curved roof truss system
  - Structural solution 1: Shear walls and viscous wall dampers
  - Structural solution 2: ConXtech

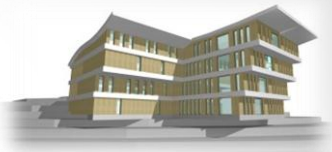


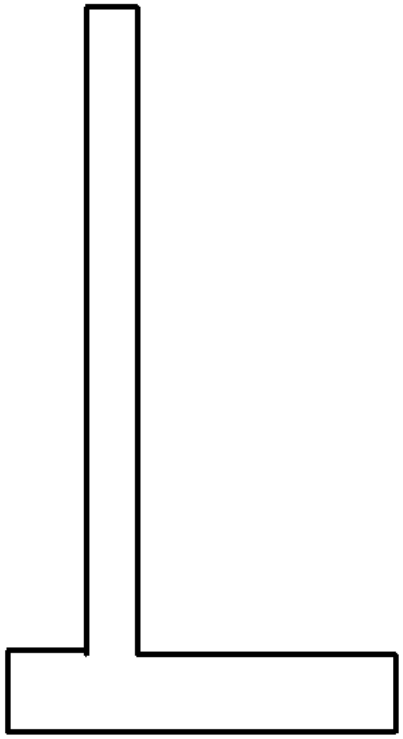


Soil Profile

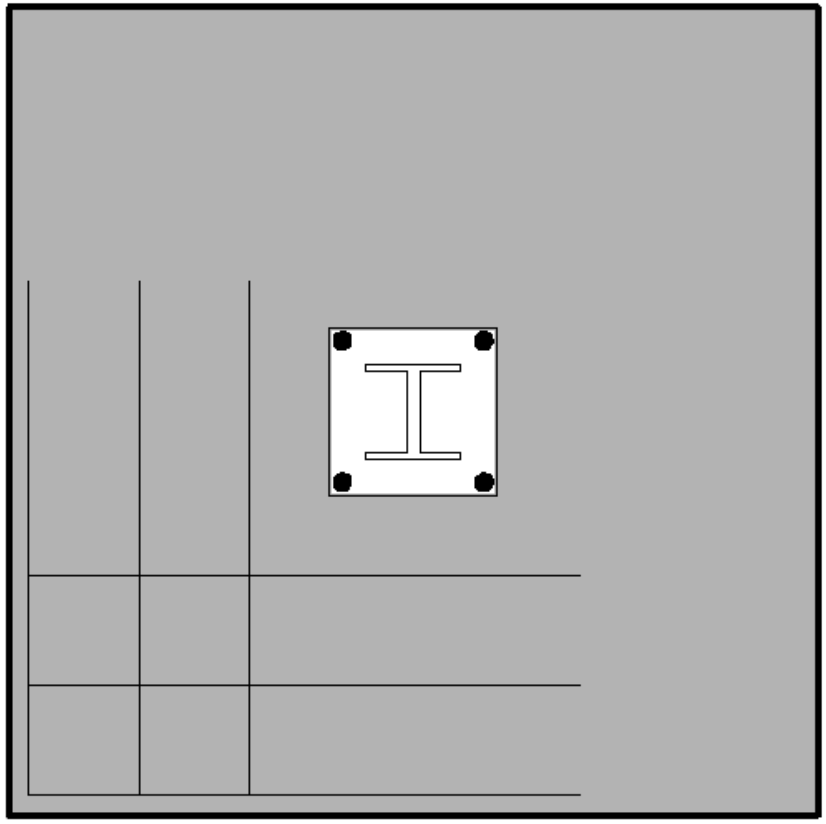


Foundations



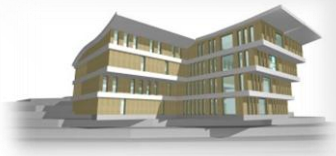


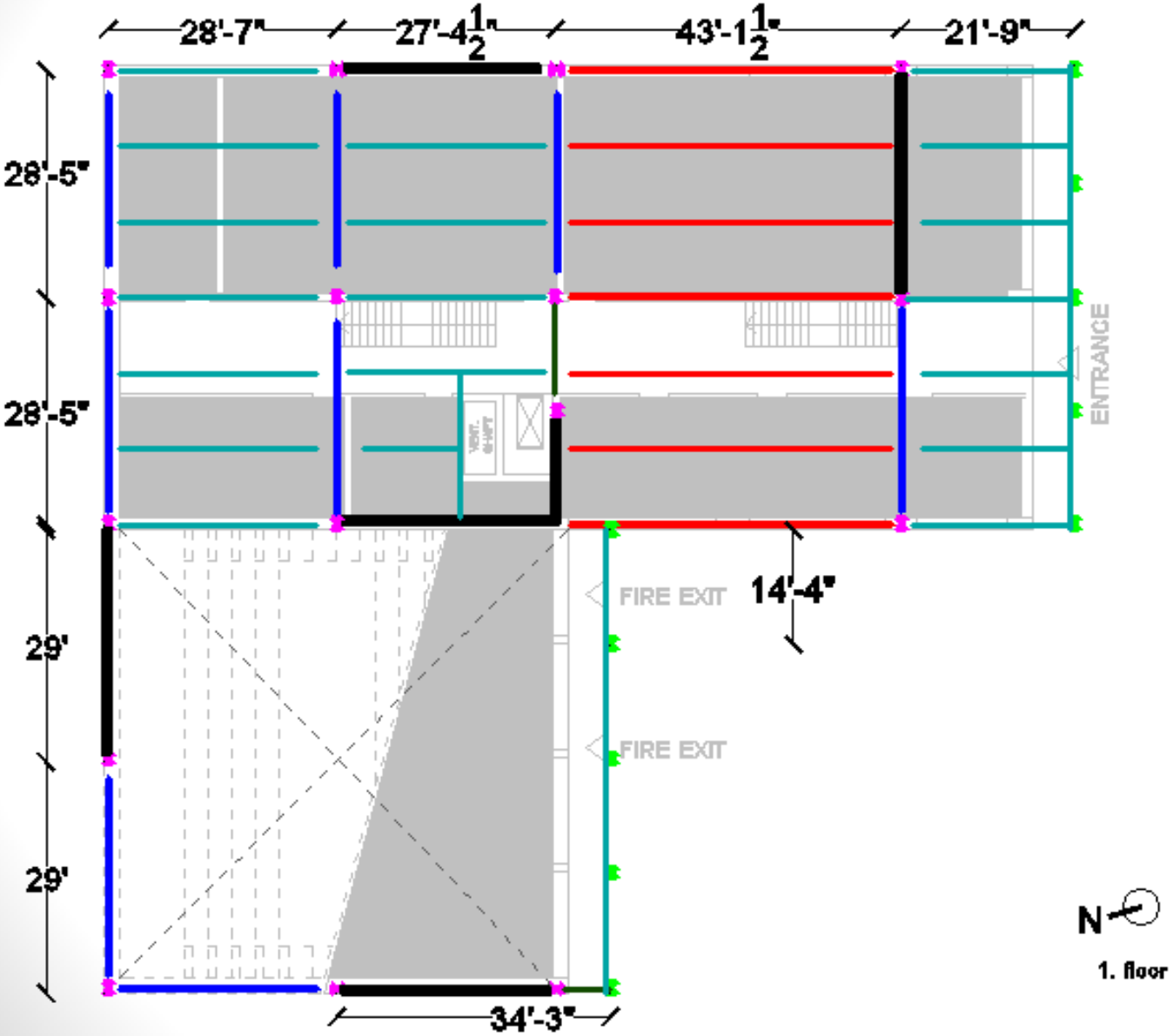
•15 ft tall retaining wall



•10x10 ft isolated spread footing
•25x25” base plate
•8#9 @16”
•3” Clear

Shear Wall: 2nd Floor Framing





Framing :

W18x50

W18x35

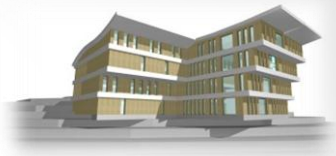
W16x36

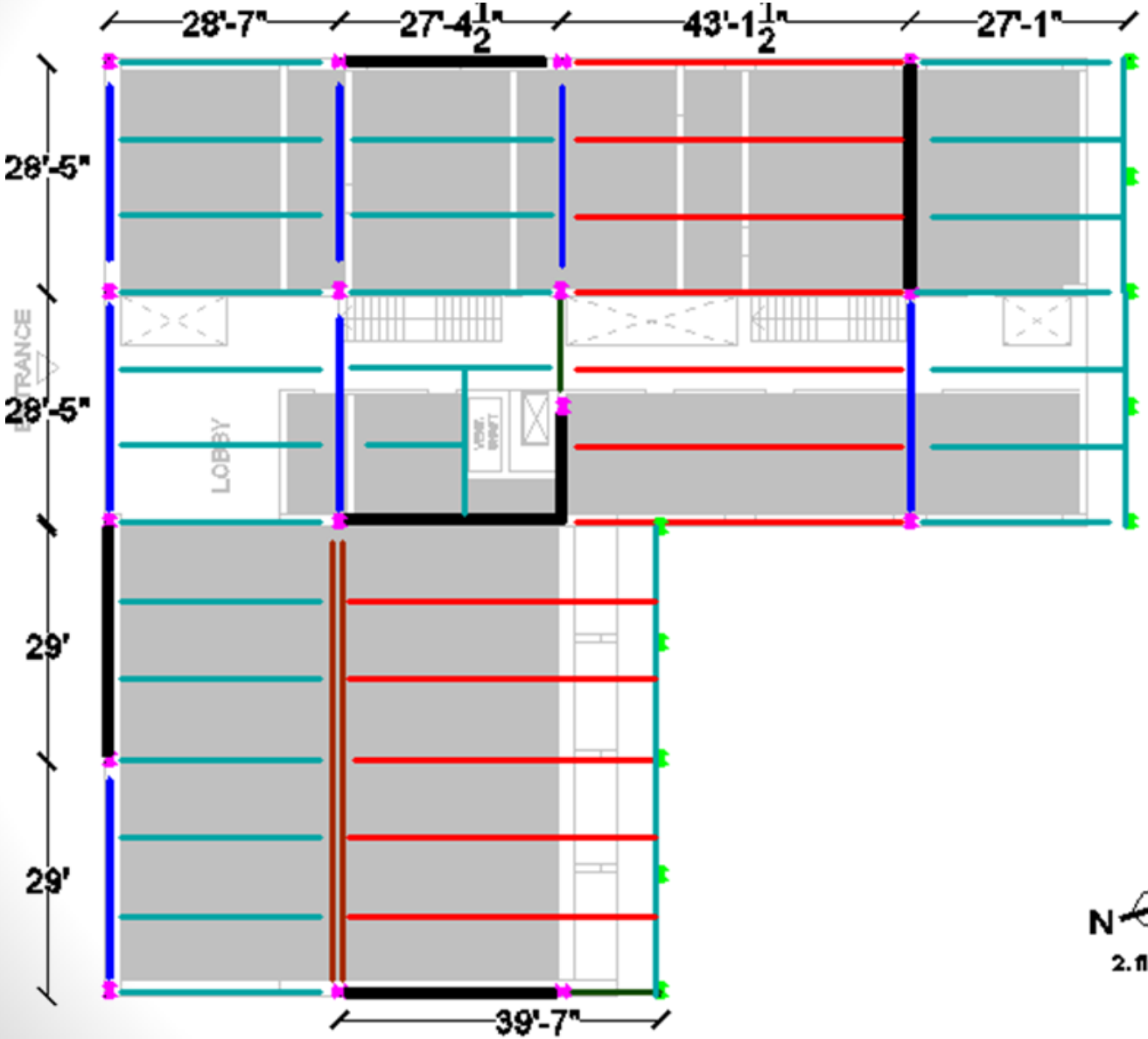
Column:

W14x90

W14x46

Shear Wall: 3rd Floor Framing





Framing :

W18x50

W18x35

W16x36

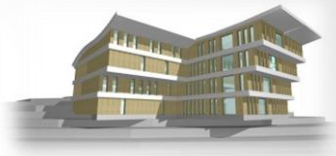
2 Story Truss

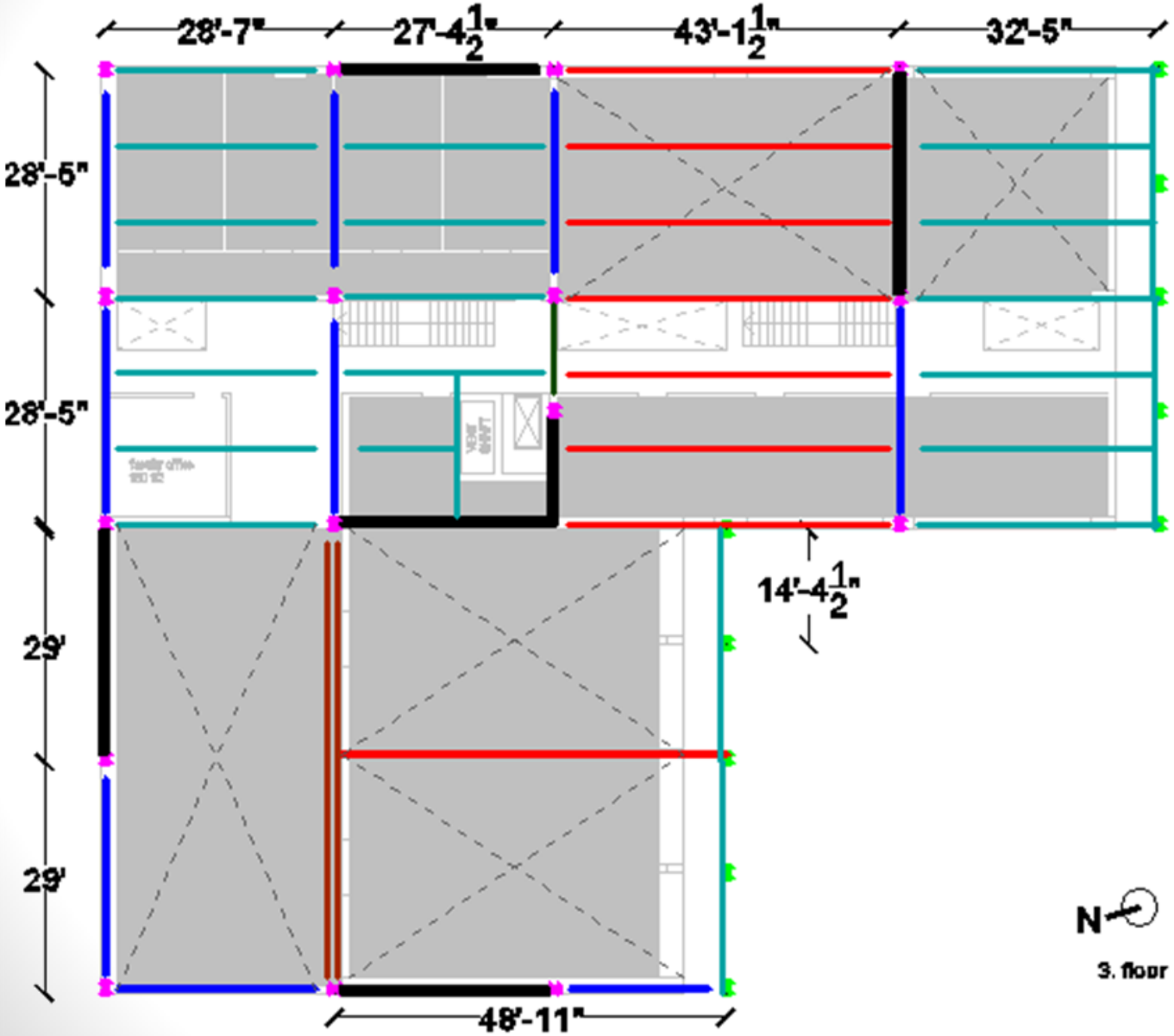
Column:

W14x90

W14x46

Shear Wall: 4th Floor Framing





Framing :

W18x50

W18x35

W16x36

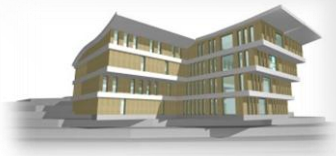
2 Story Truss

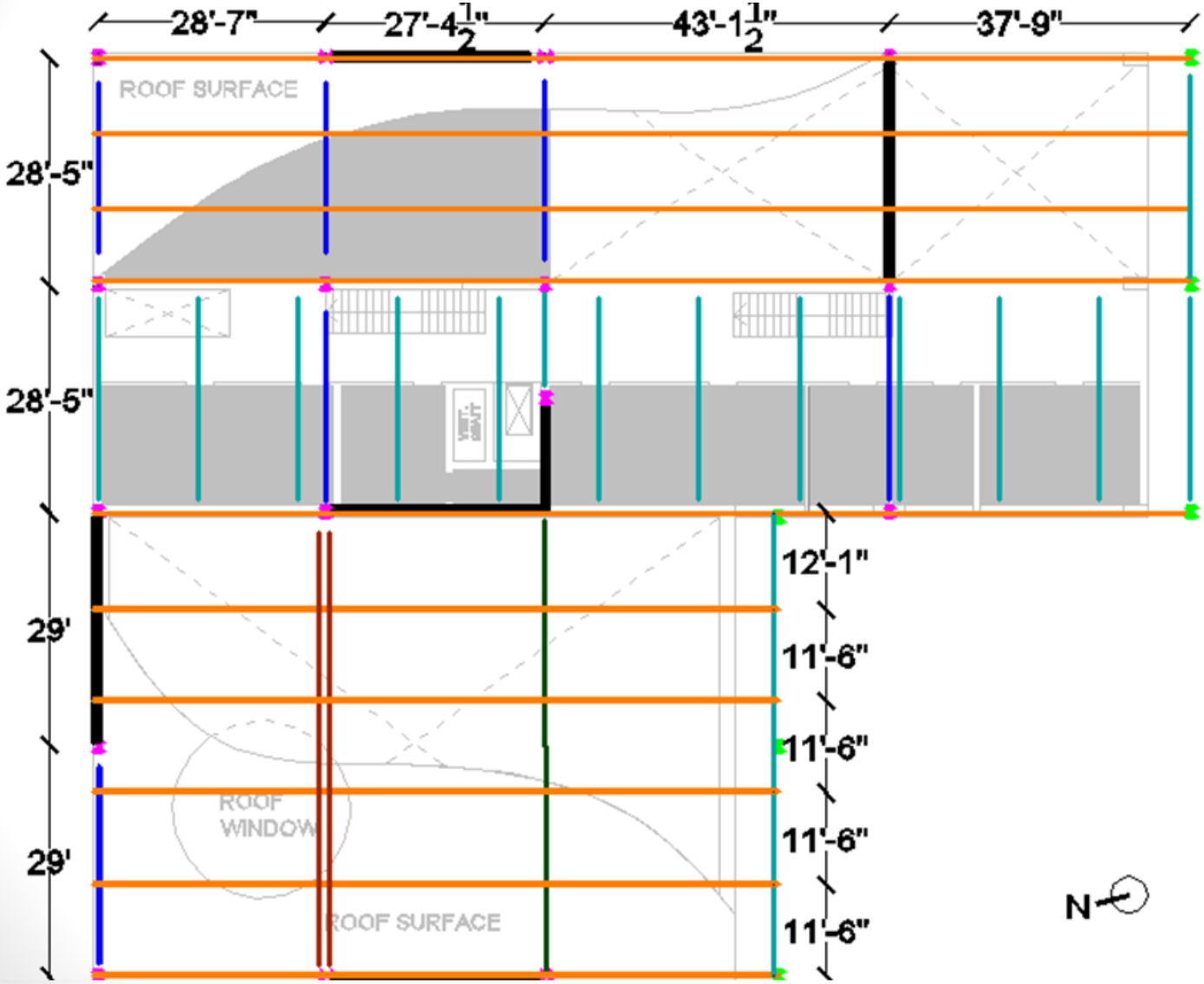
Column:

W14x68

W14x46

Shear Wall: Roof Framing





Framing :

W18x50

W18x35

W16x36

W24x55

2 Story Truss

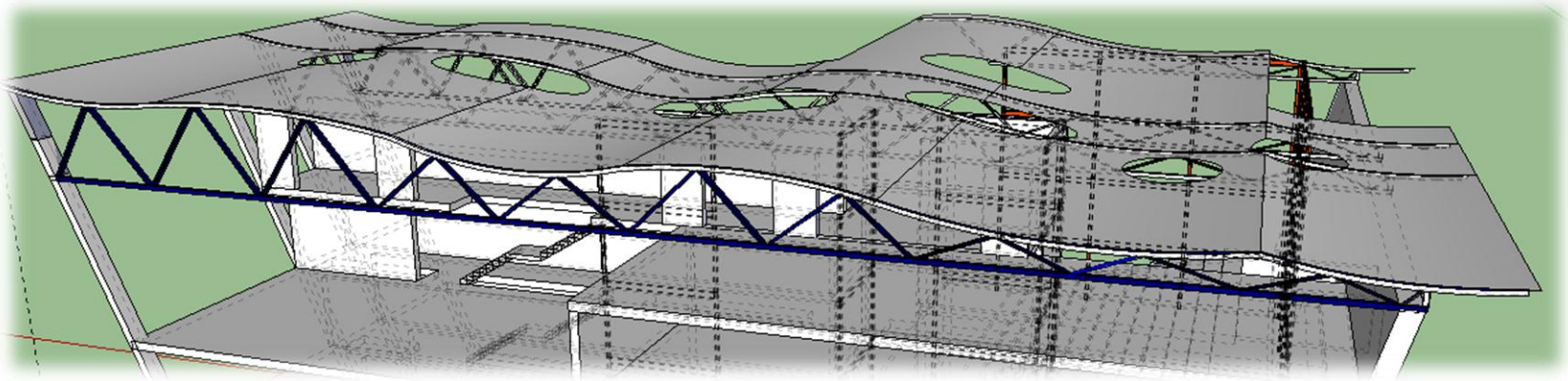
Roof Truss

Column:

W14x68

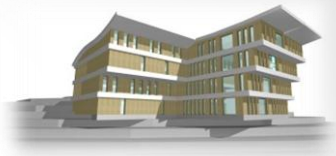
W14x46

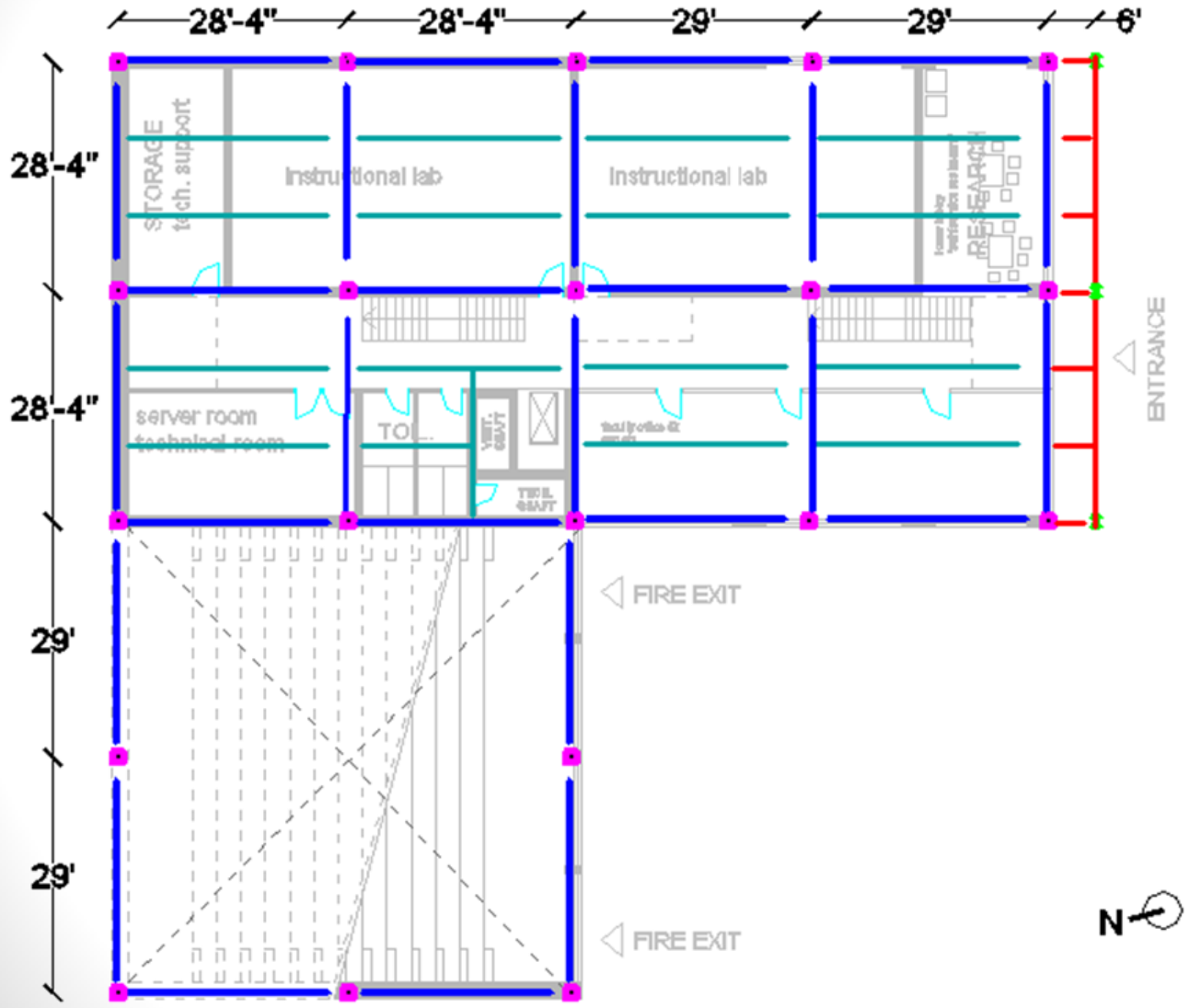
Curved Roof Truss



- Top members single curvature
- Separated by 10 ft.
- Steel decking formed over curved members
- Normal roofing procedure

ConXtech: 2nd Floor Framing





Framing :

W21x68

W16x36

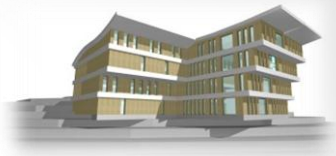
W12x30

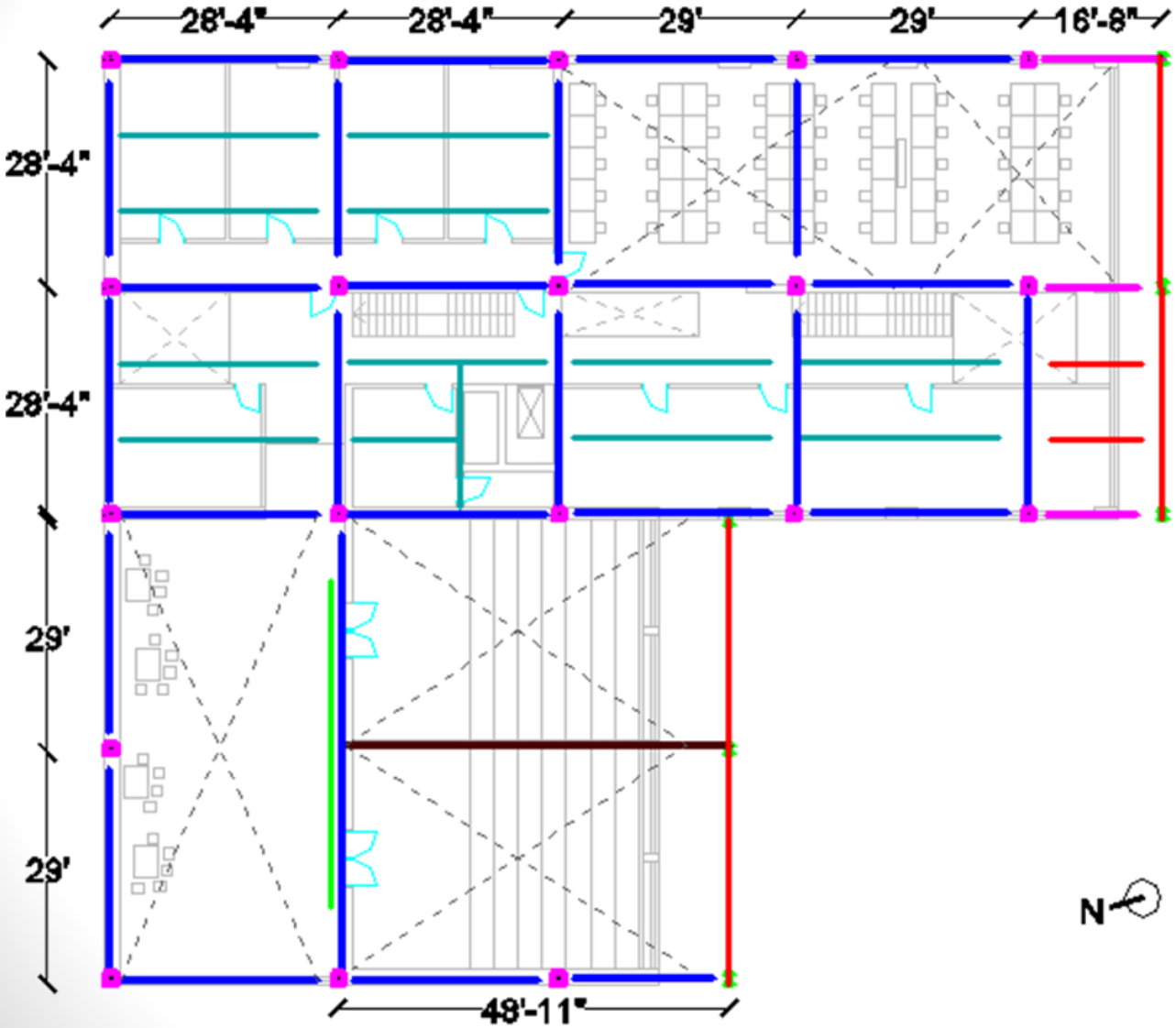
Column:

HSS 16x16x5/8

W14x46

ConXtech: 3rd Floor Framing





Framing :

W21x68

W16x36

W12x30

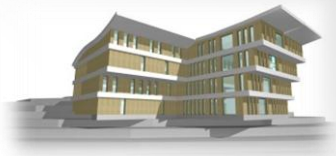
Queen Post Truss

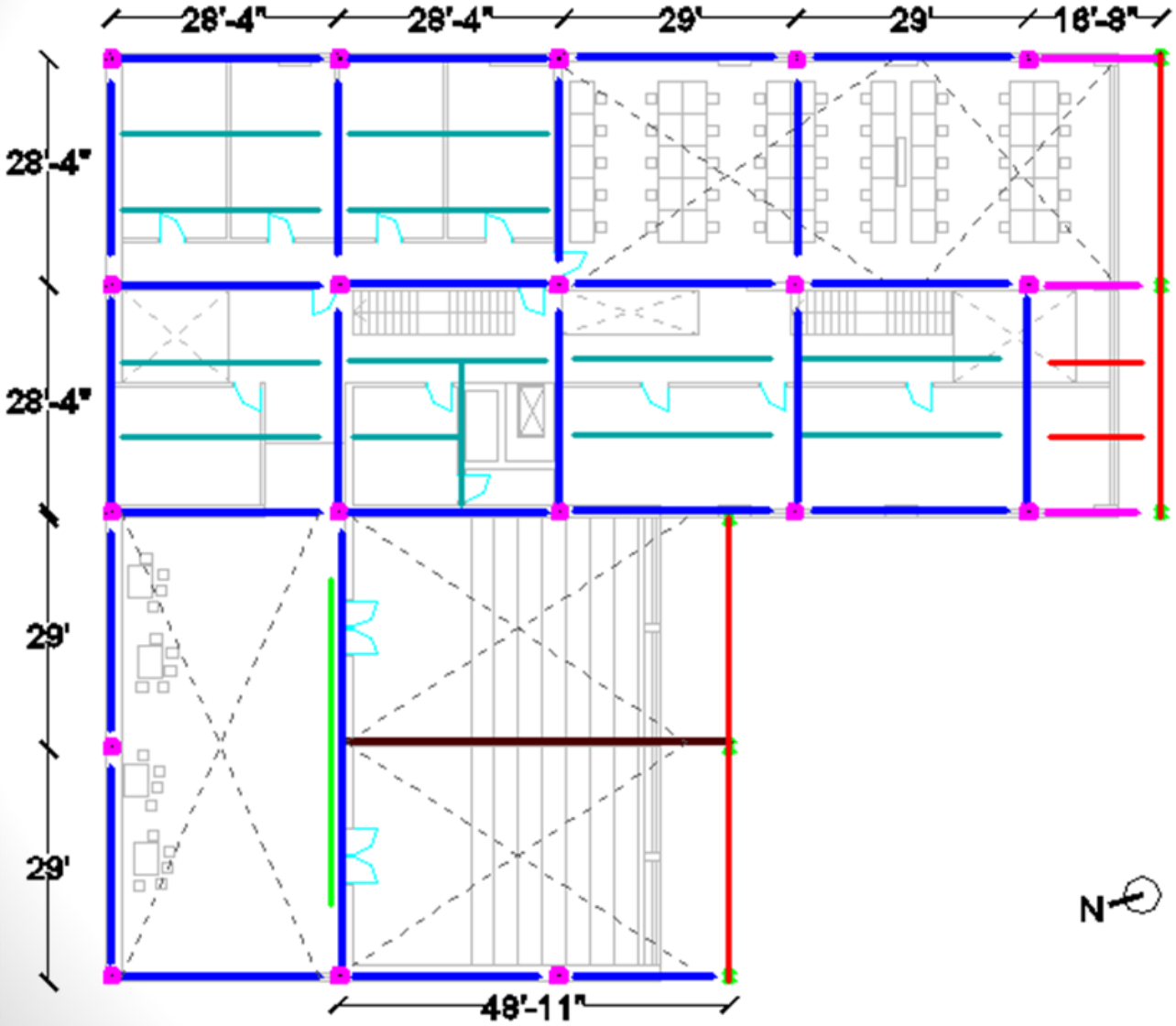
Column:

HSS 16x16x5/8

W14x46

ConXtech: 4th Floor Framing





Framing :

W21x68

W16x36

W12x30

W18x35

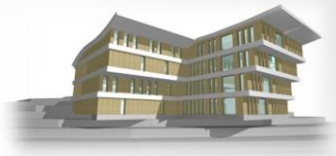
Queen Post Truss

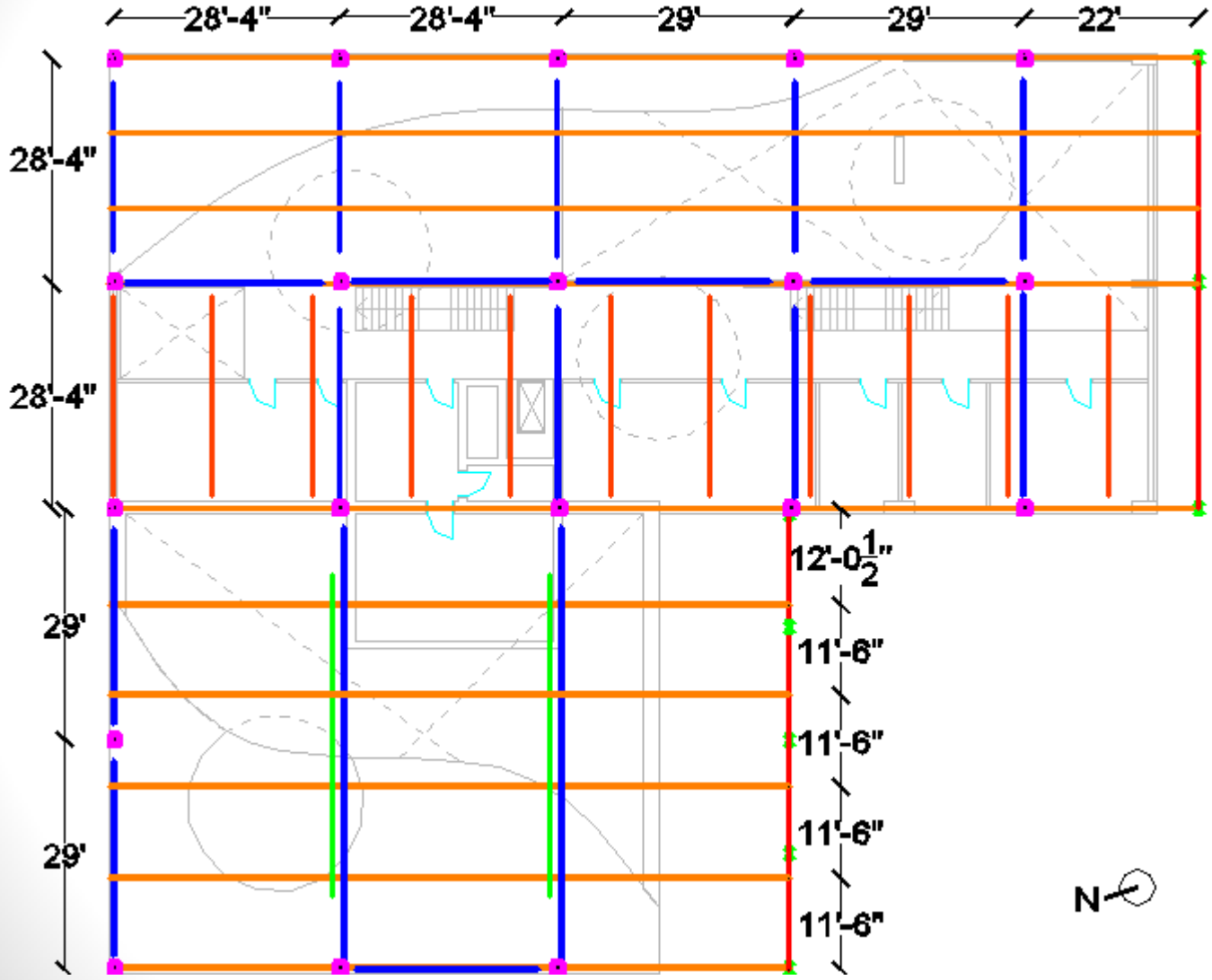
Column:

HSS 16x16x5/8

W14x46

ConXtech: Roof Framing





Framing :

W21x68

W16x36

W12x30

Roof Truss

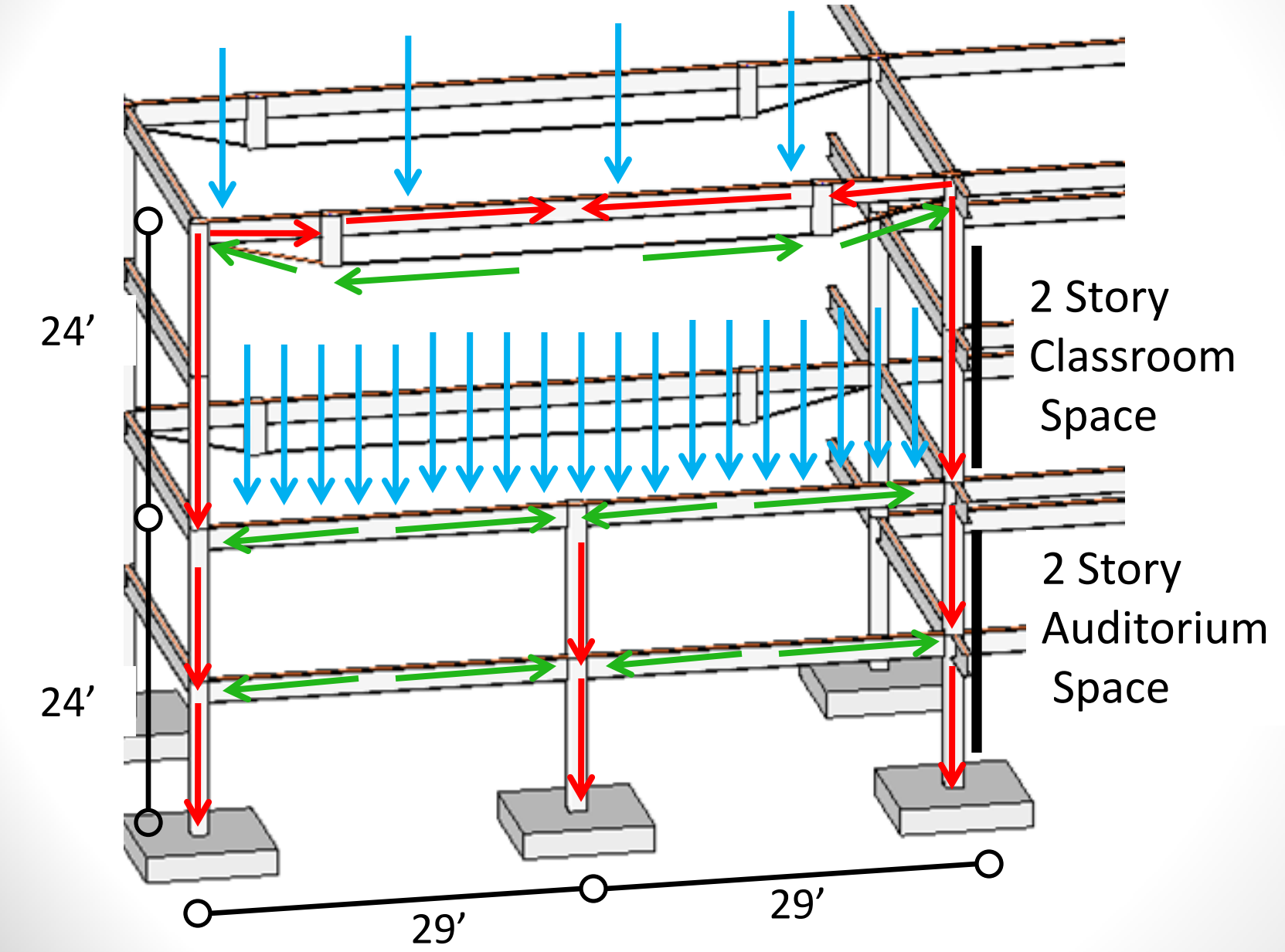
Queen Post Truss

Column:

HSS 16x16x5/8

W14x46

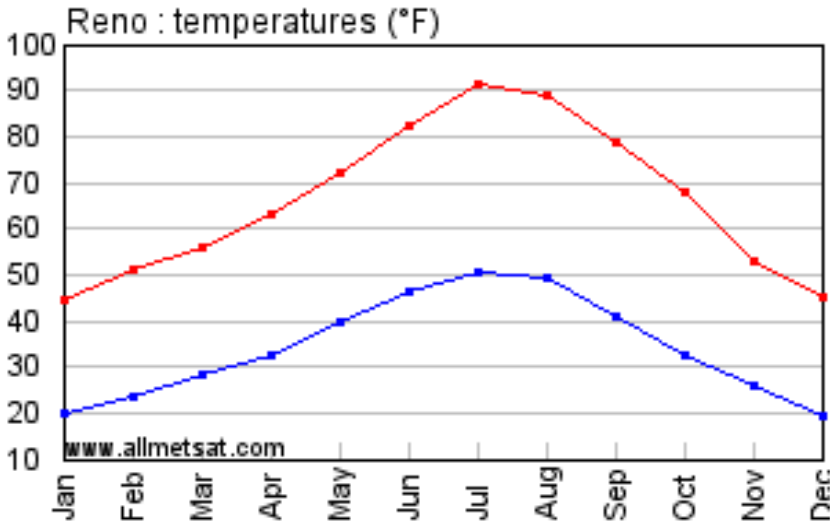
Load Path : Queen Post Truss

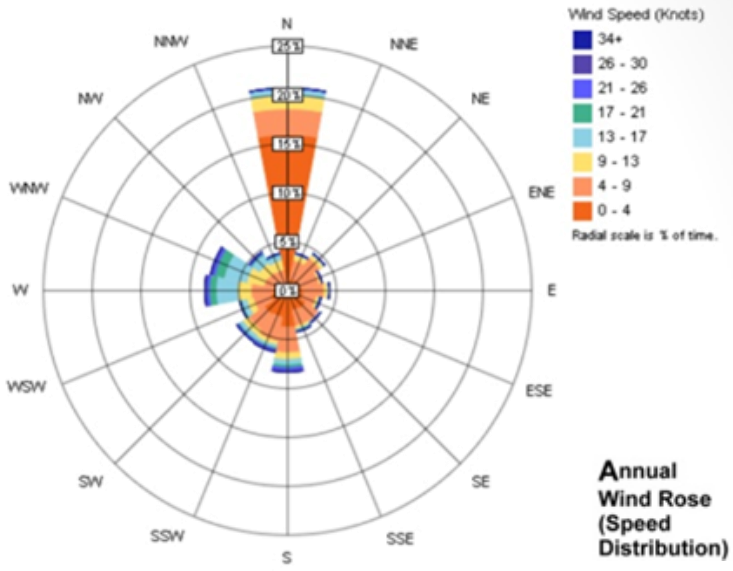


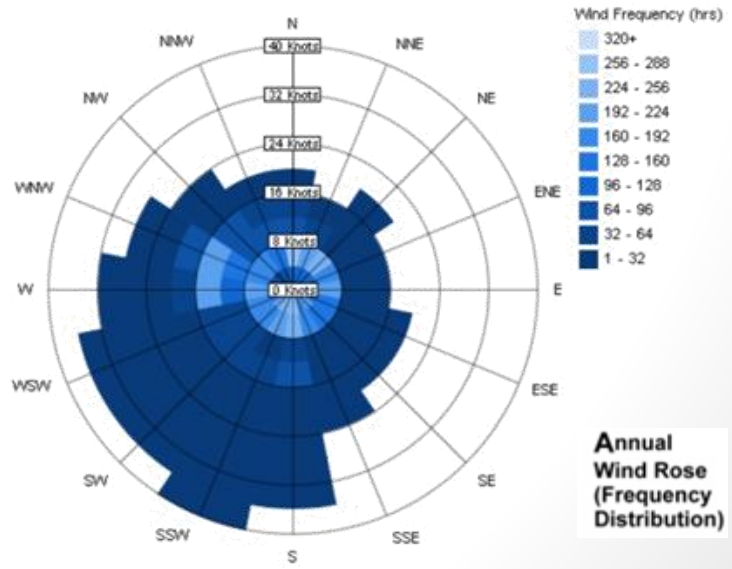
Climate Data

Annual relative air humidity [%]

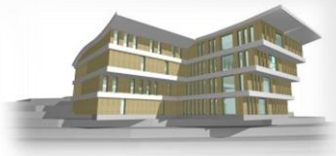
Morning	39	
Afternoon	39	
Highest	Morning	Afternoon
Jan	79	50
lowest	Morning	Afternoon
Sep	61	19



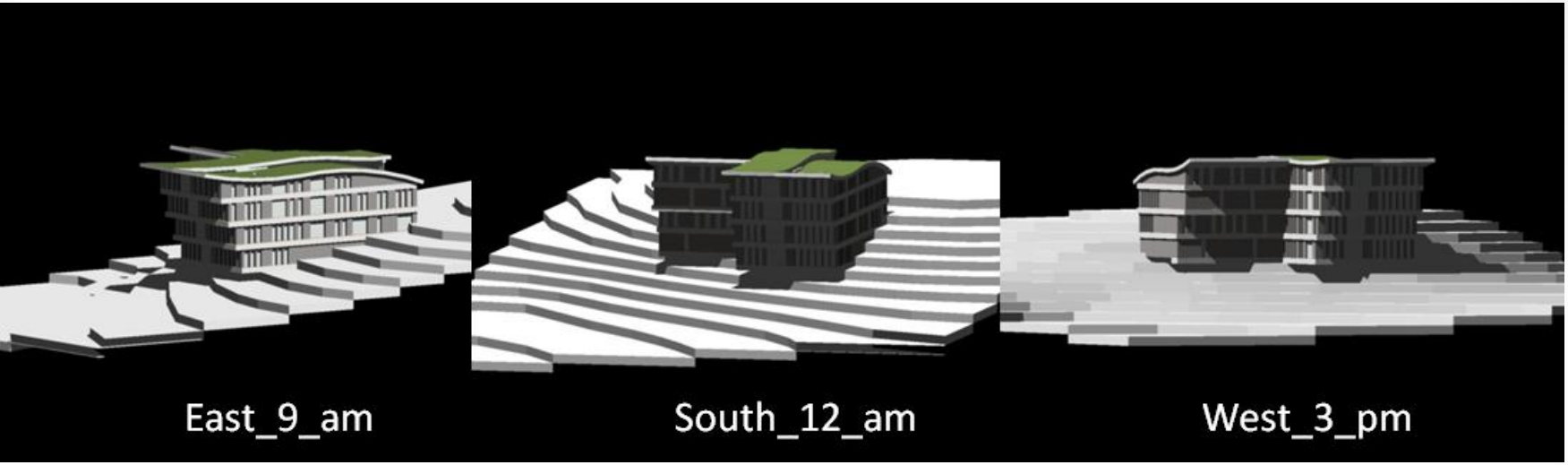




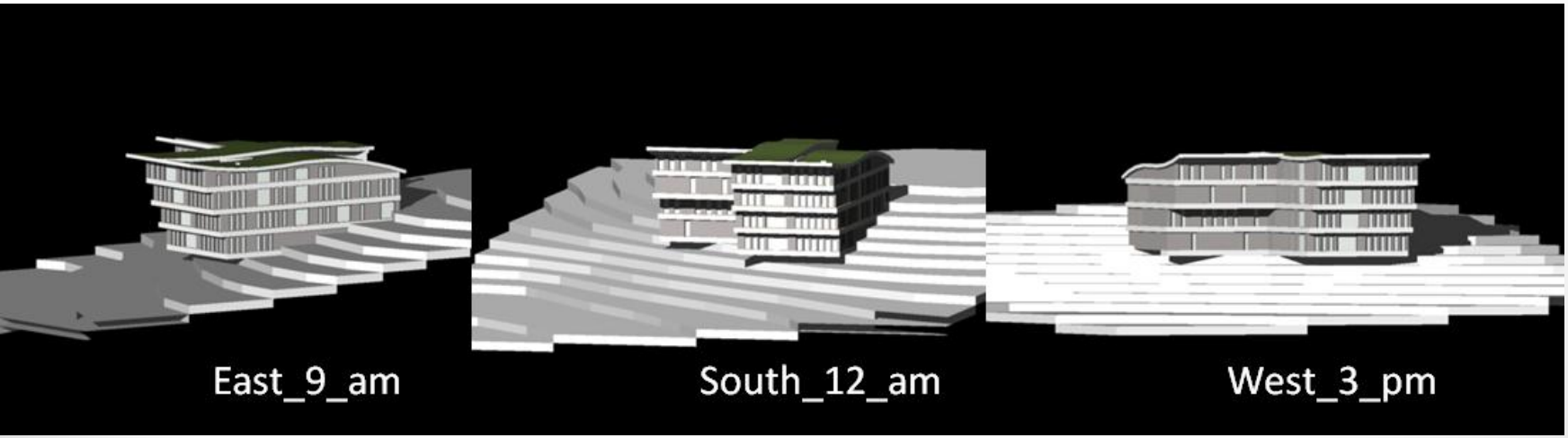
Solar Access Analysis



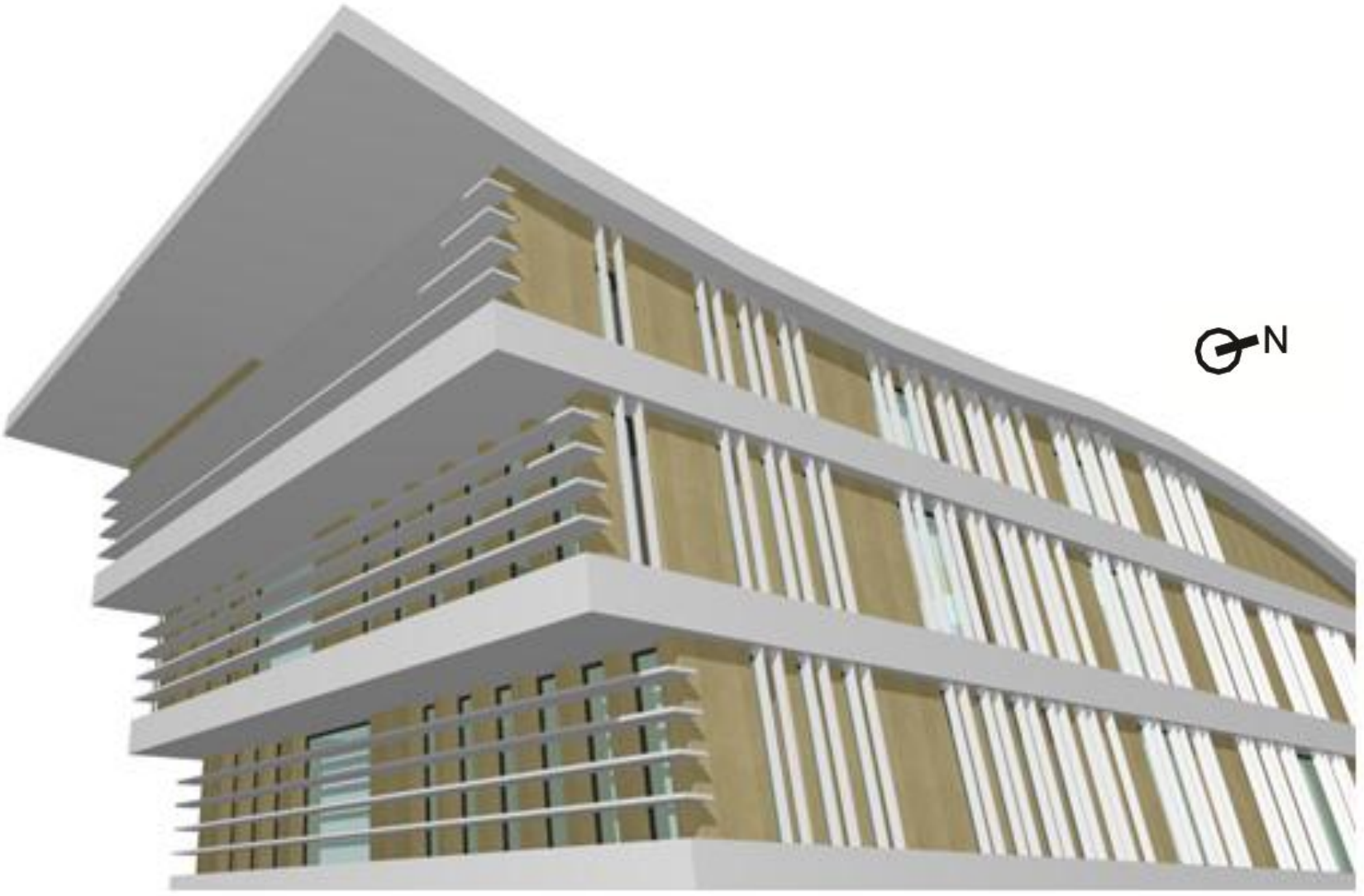
August



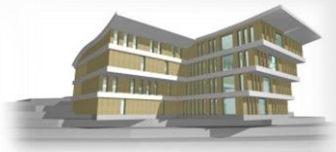
January



Façade Solution

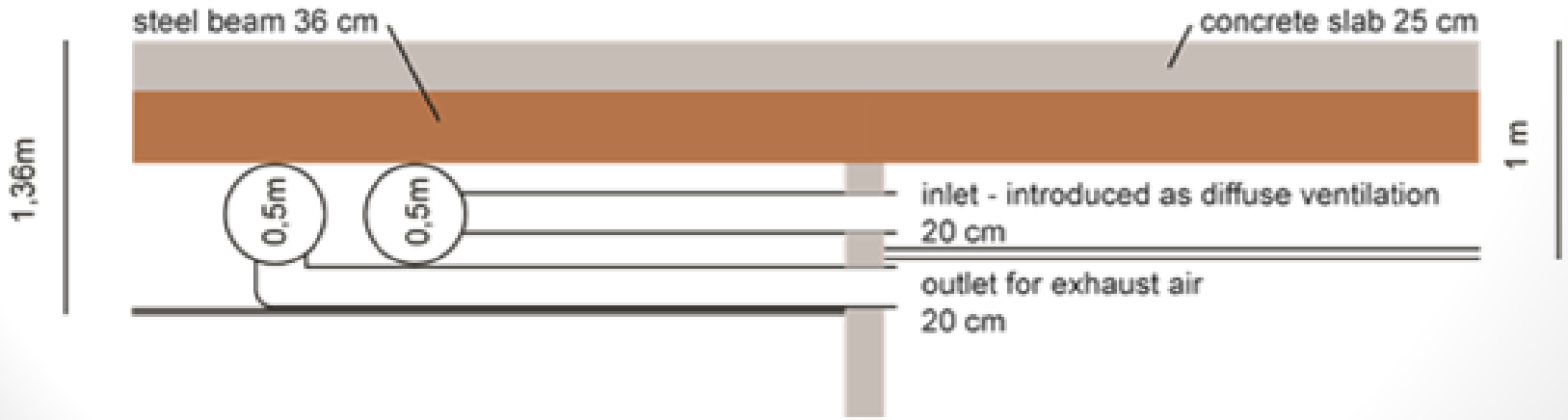


Capacity of the HVAC System

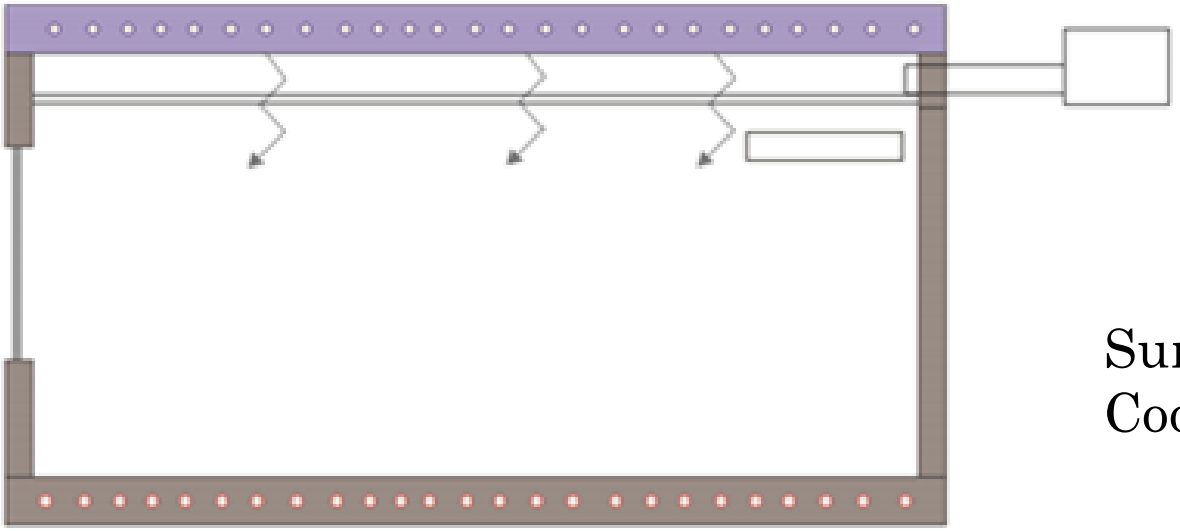


	area m2	qv m3/h	heating W	cooling W
concept 1	2856,304	14802,09	34965,44	-40620,3
concept 2	2829,641	15818,49	27799,15	-38491,7

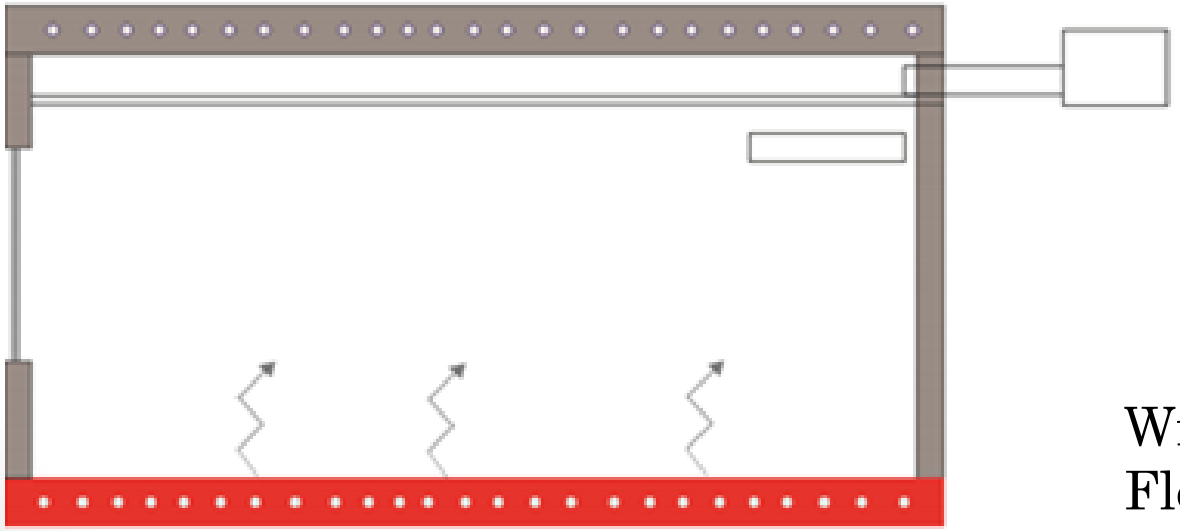
Ventilation based on ASHRAE 62.1



Geothermal Heating and Cooling

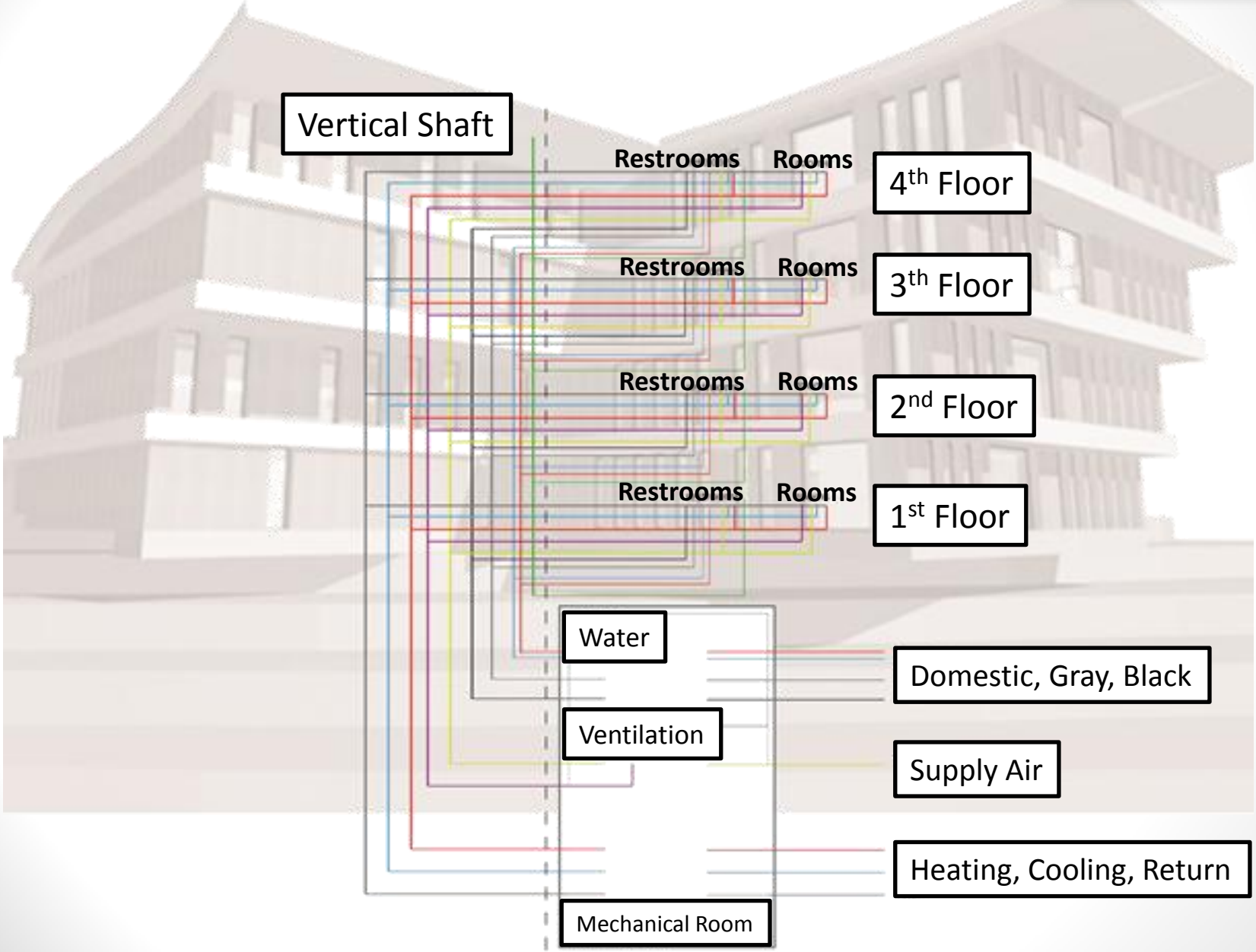


Summer:
Cooling in ceiling

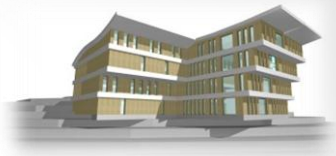


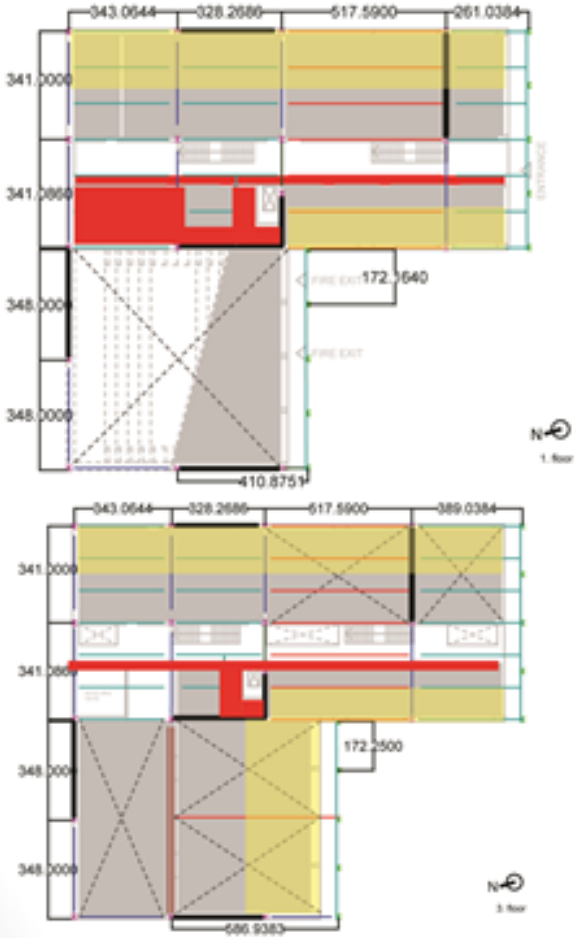
Winter:
Floor heating

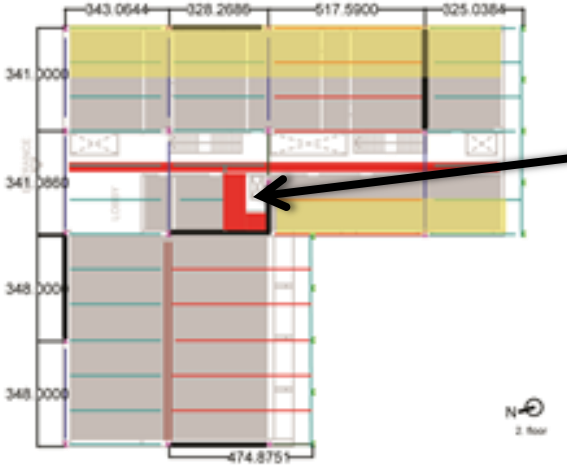
The Vertical Shaft

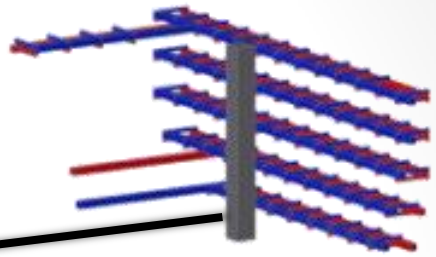


Duct System and Lighting Zones

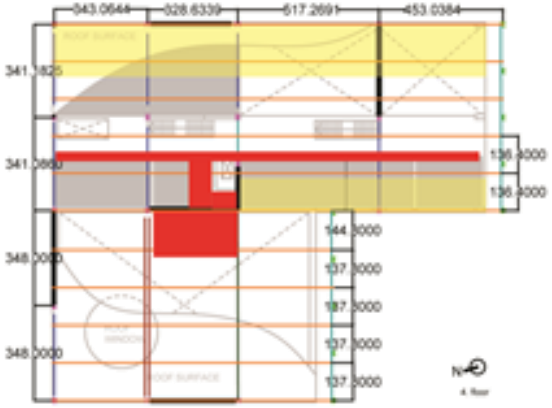








3D Model of Ducts



DF > 2%

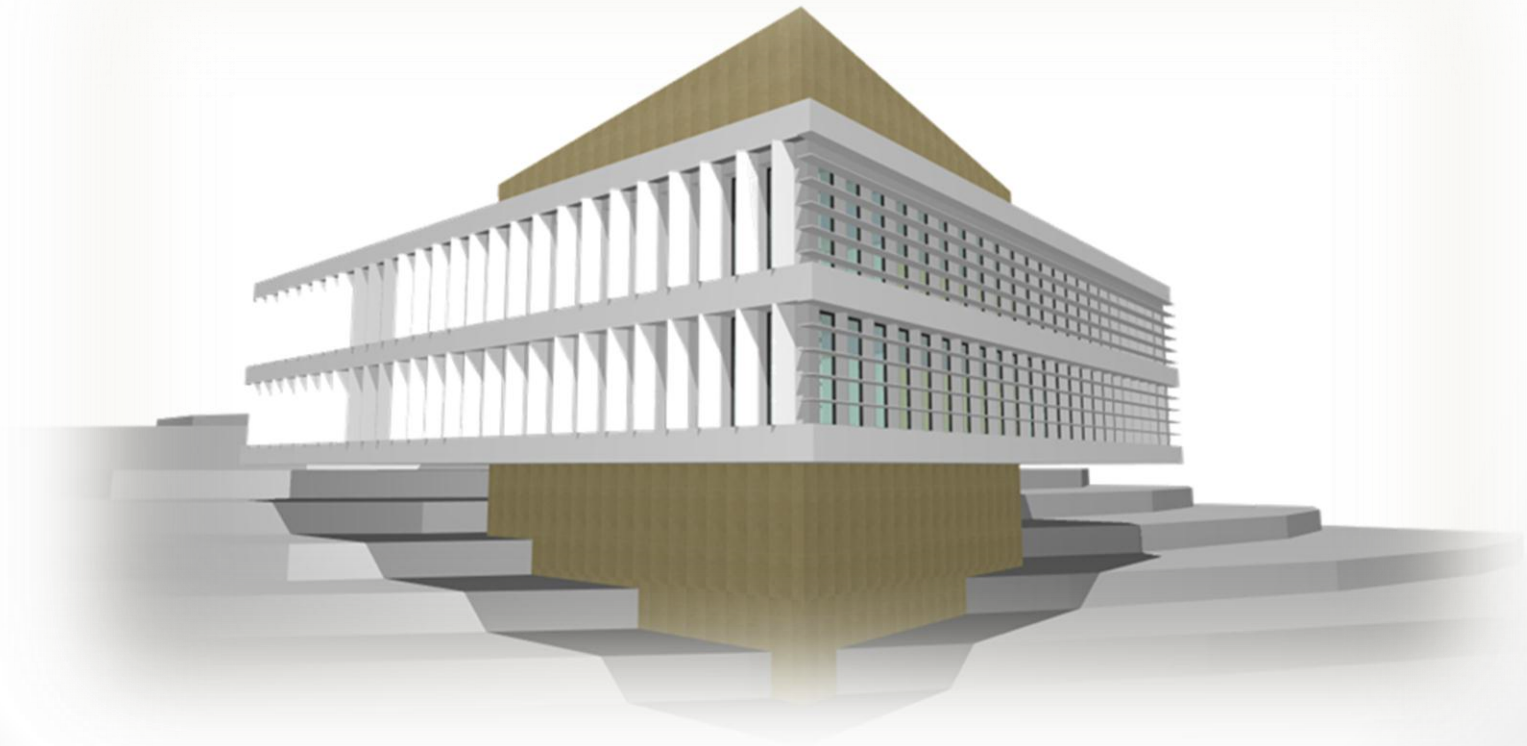
DF < 2%

Ducts and Mech Room

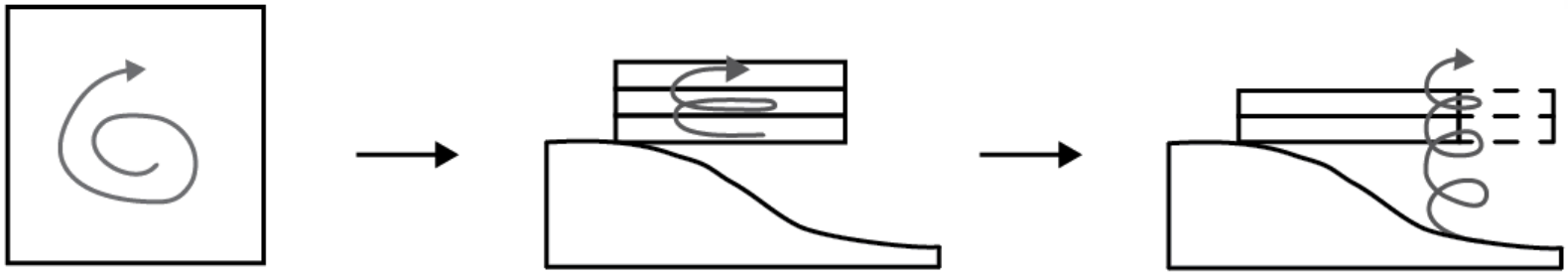
AEC MEP

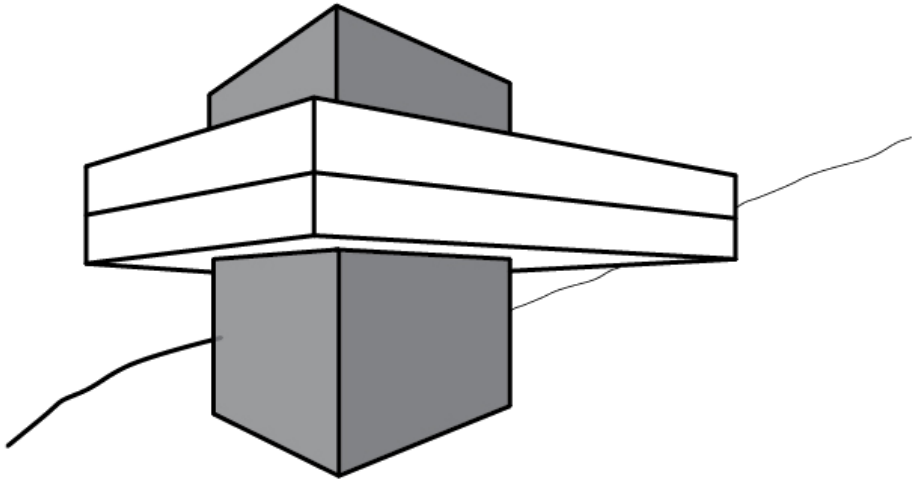
Ridge Team 2/18/2011

Design: Core Concept

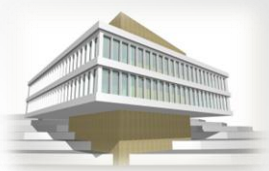


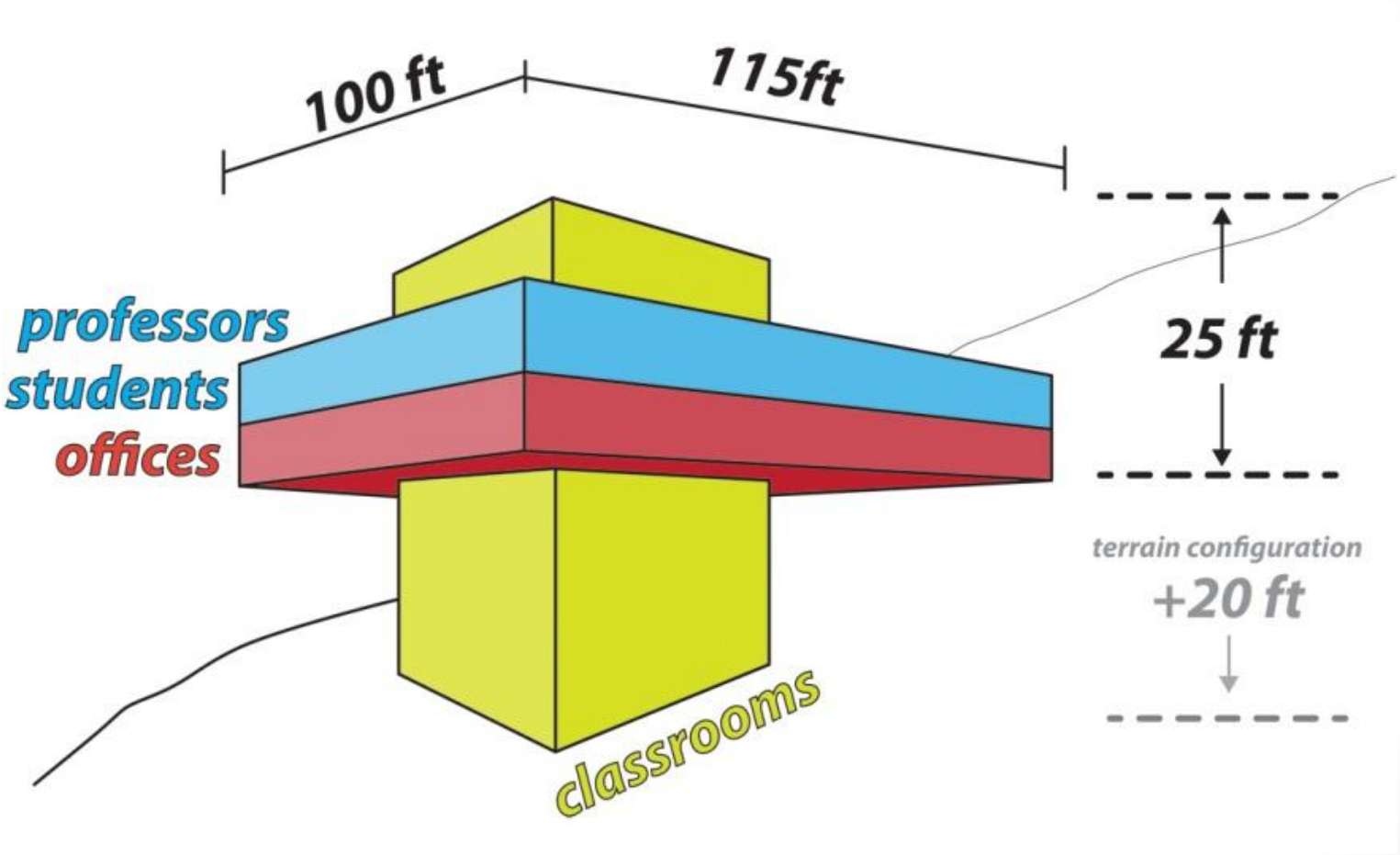
Big Idea



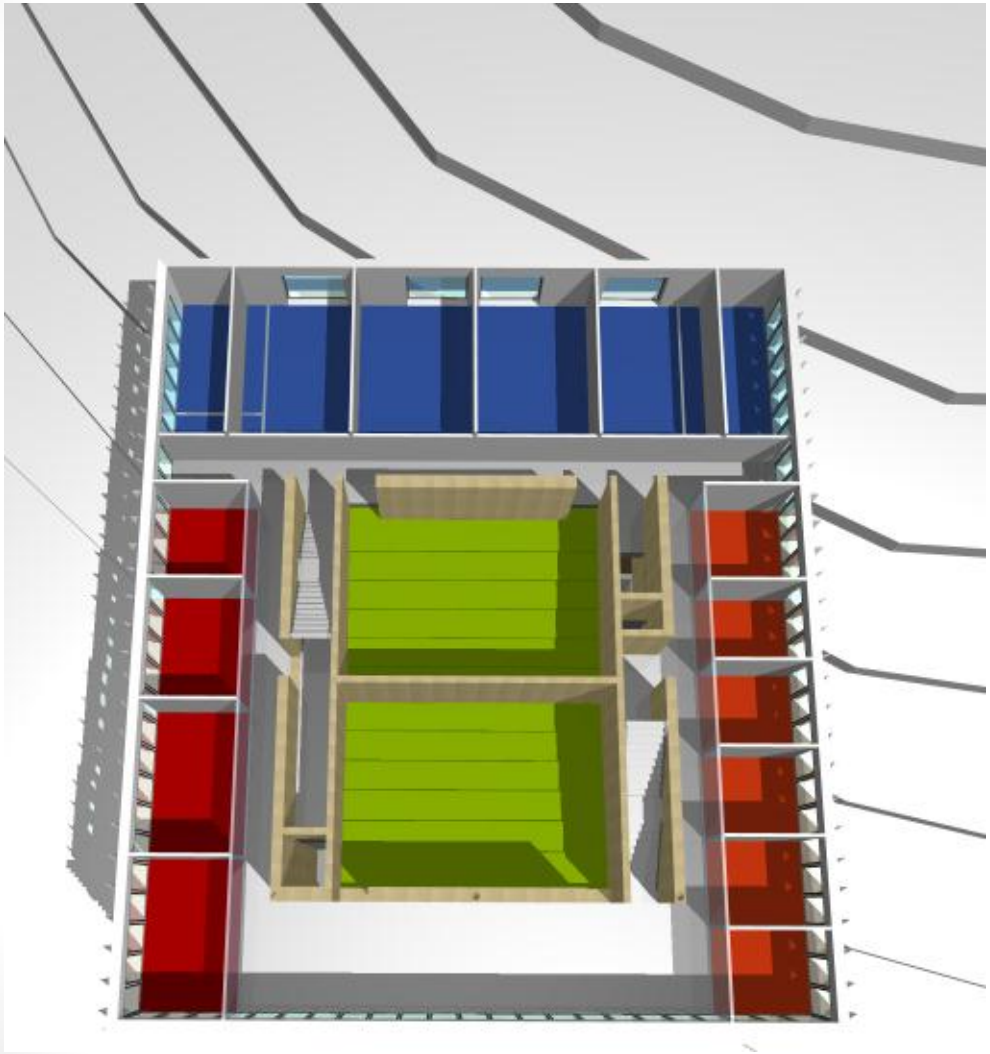


2nd Concept

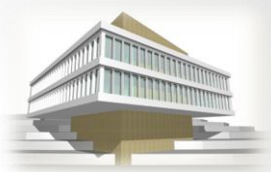


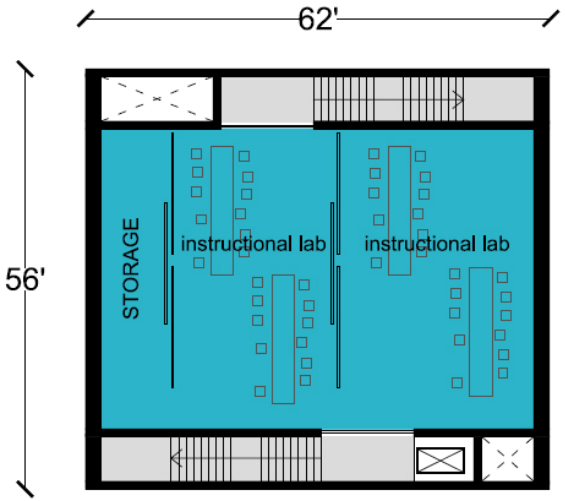

100 ft
115ft
professors
students
offices
25 ft
terrain configuration
+20 ft
classrooms

Logic of the Building

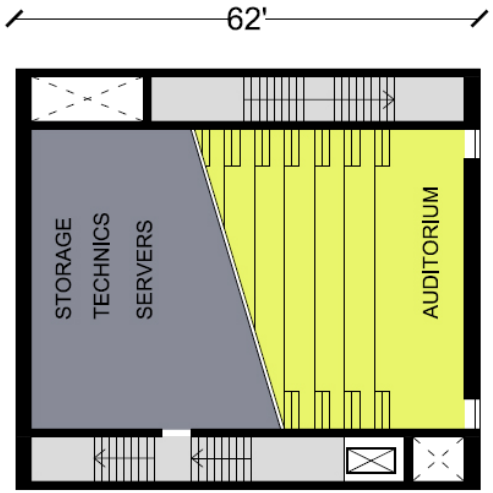


1st and 2nd Floors





1. floor



2. floor

instr. labs

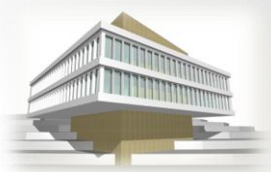
tech. servers, storage

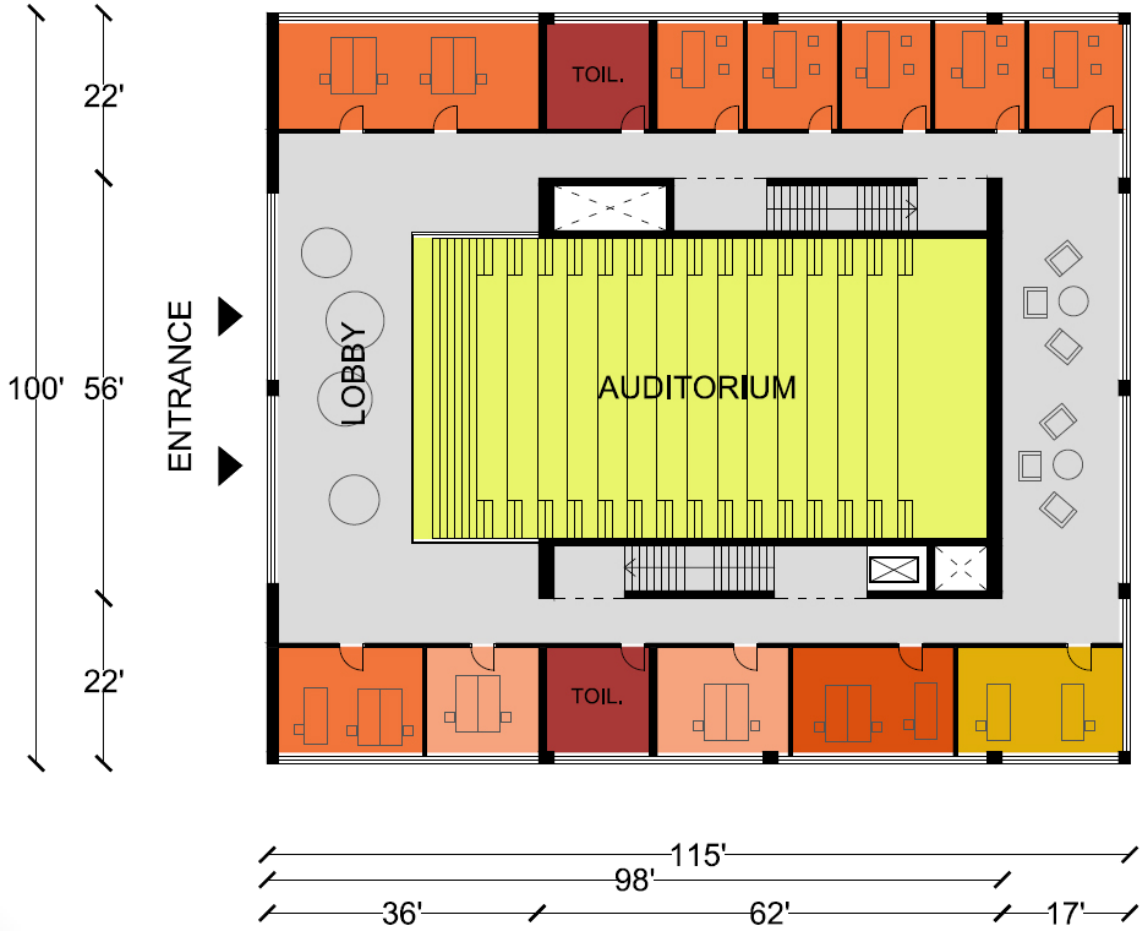
auditorium

air space/shaft

communications

3rd Floor



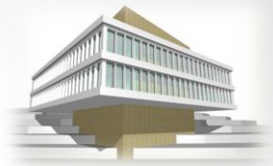


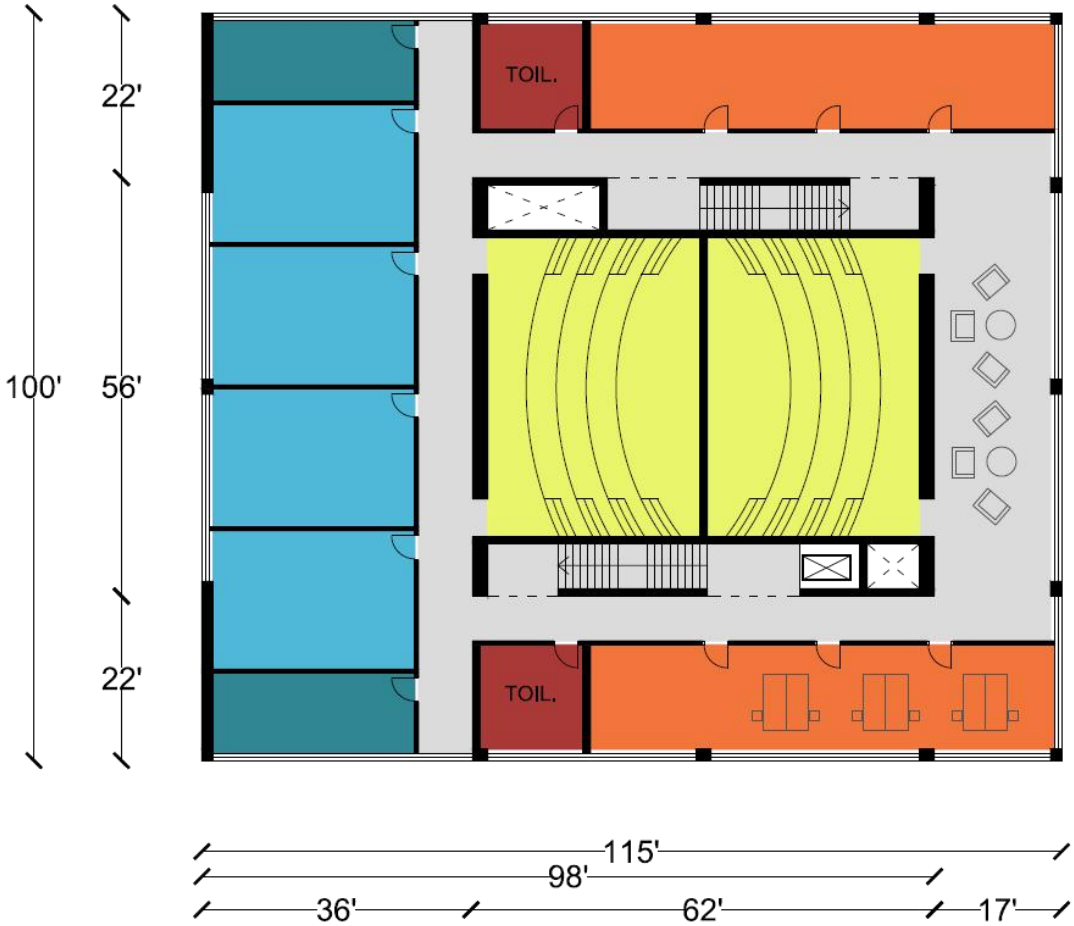
auditorium
chairs office
senior assist.
administration
faculty office
toilets
air space
communications

N

3. floor

4th Floor



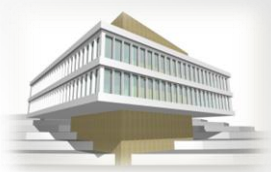


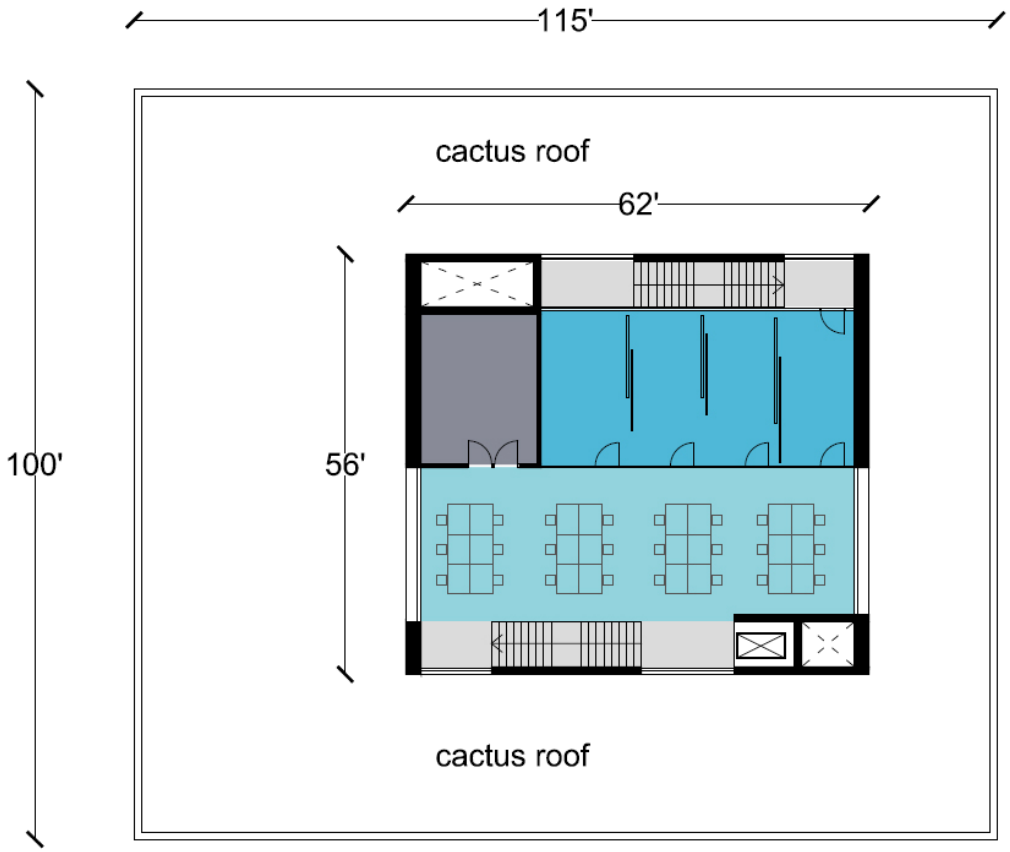
small classrooms
storage/seminar
large classrooms
faculty office
toilets
air space/shaft
communications

N

4. floor

5th Floor





seminar rooms

students offices

technics, storage

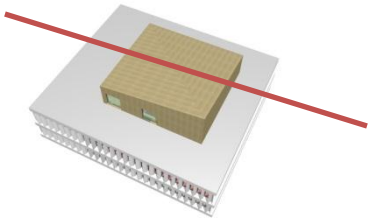
air space/shaft

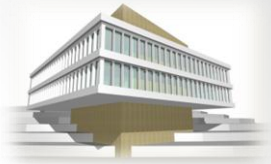
communications

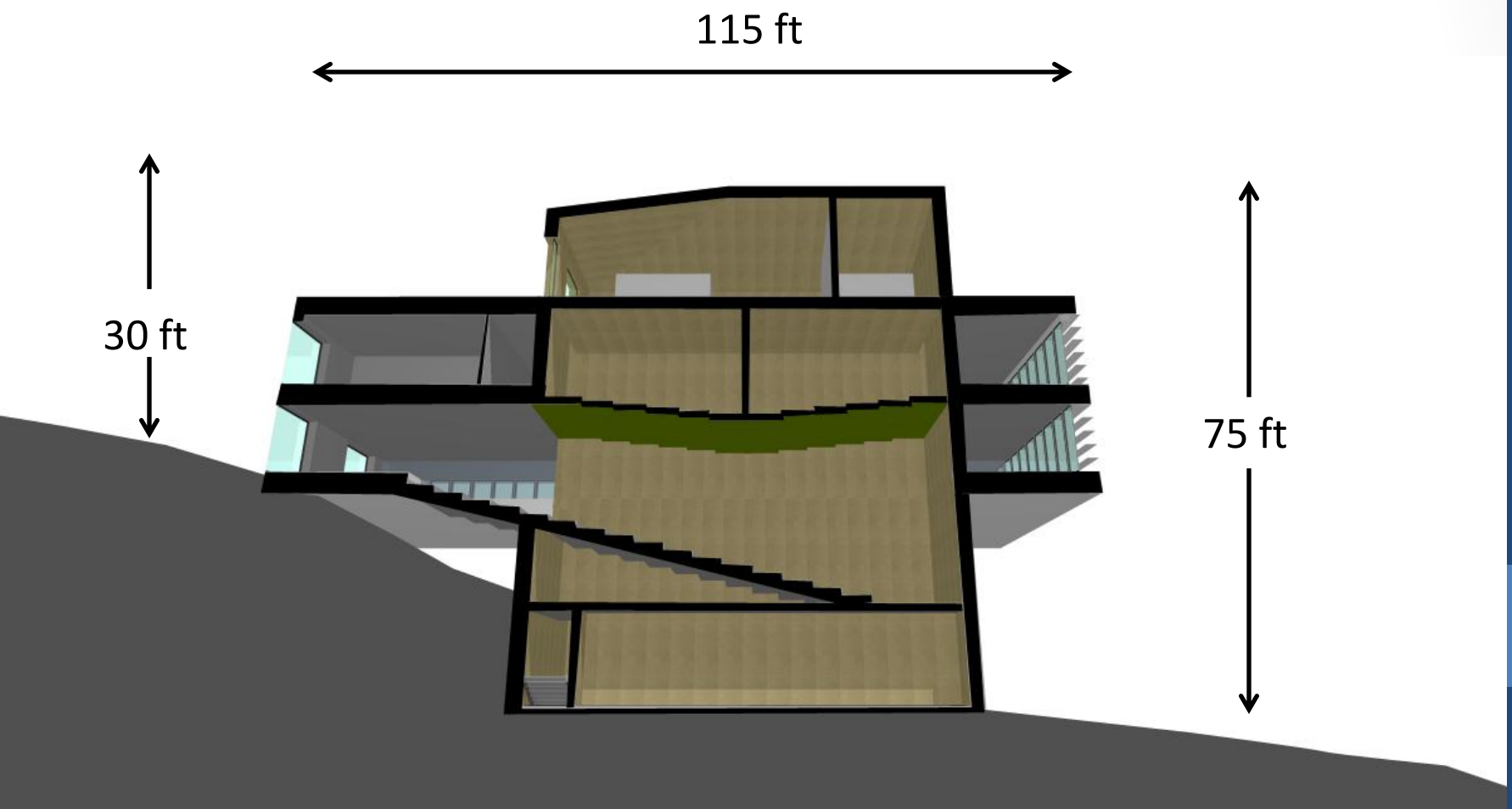
N

5. floor

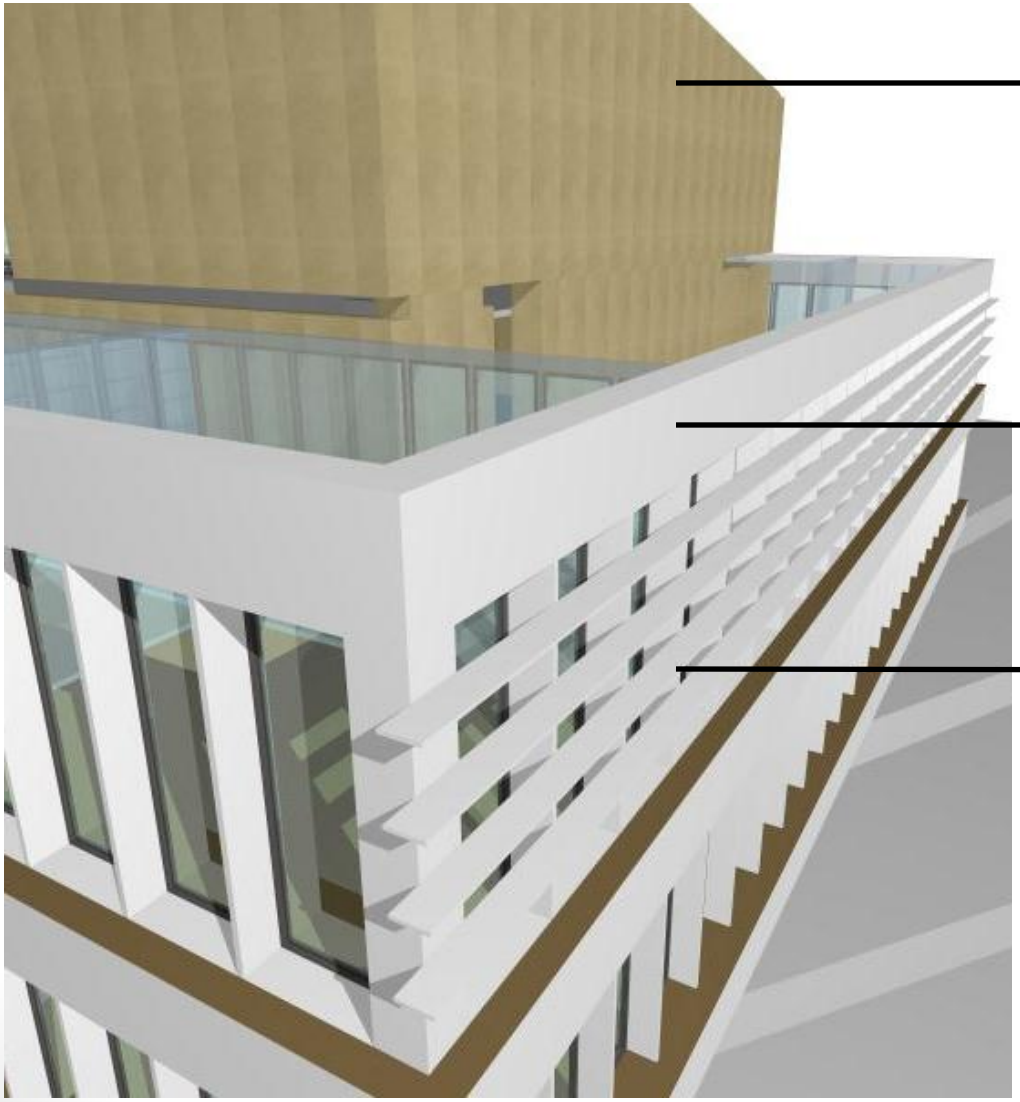
Section

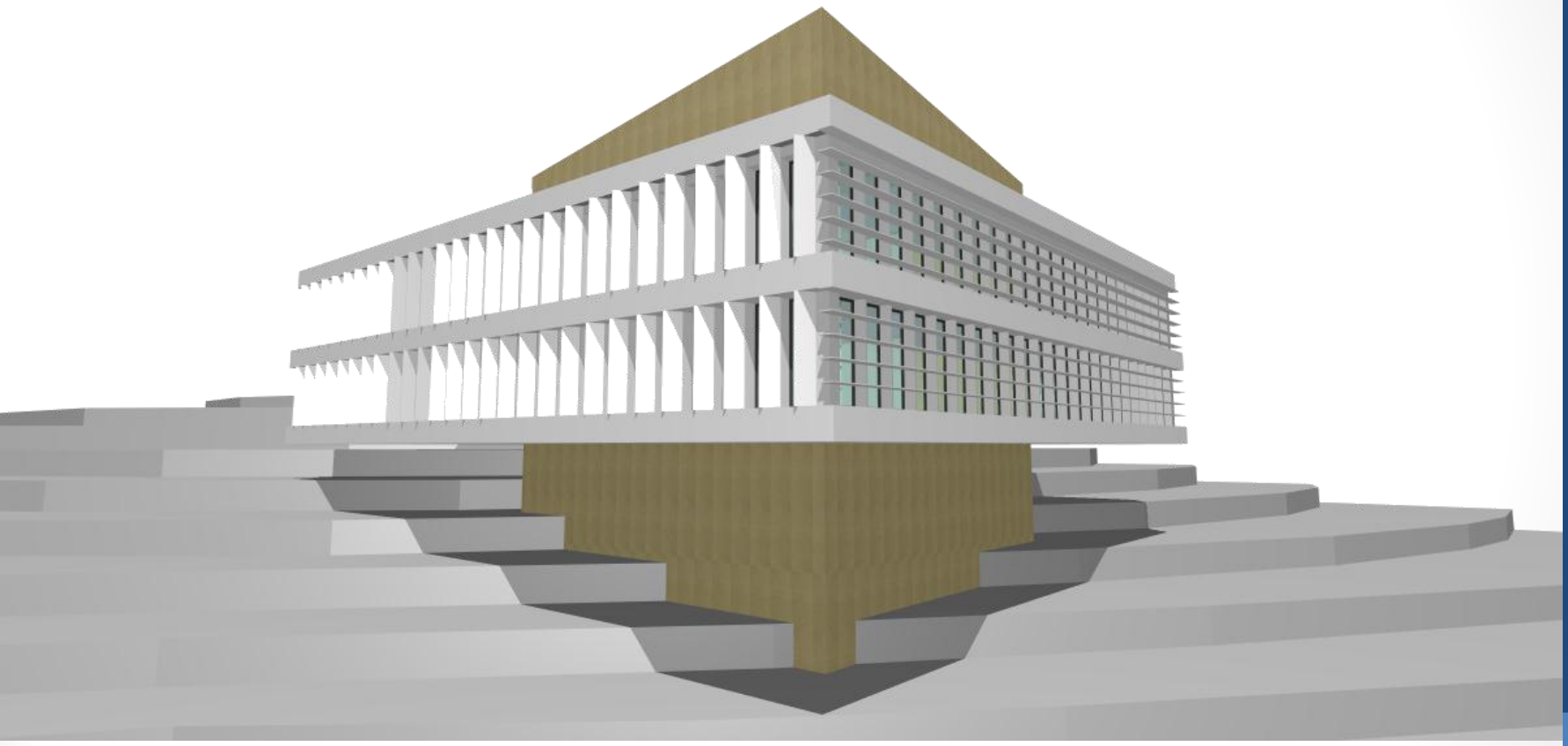






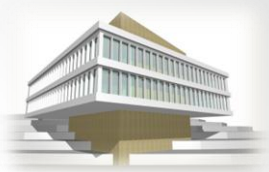
Façade



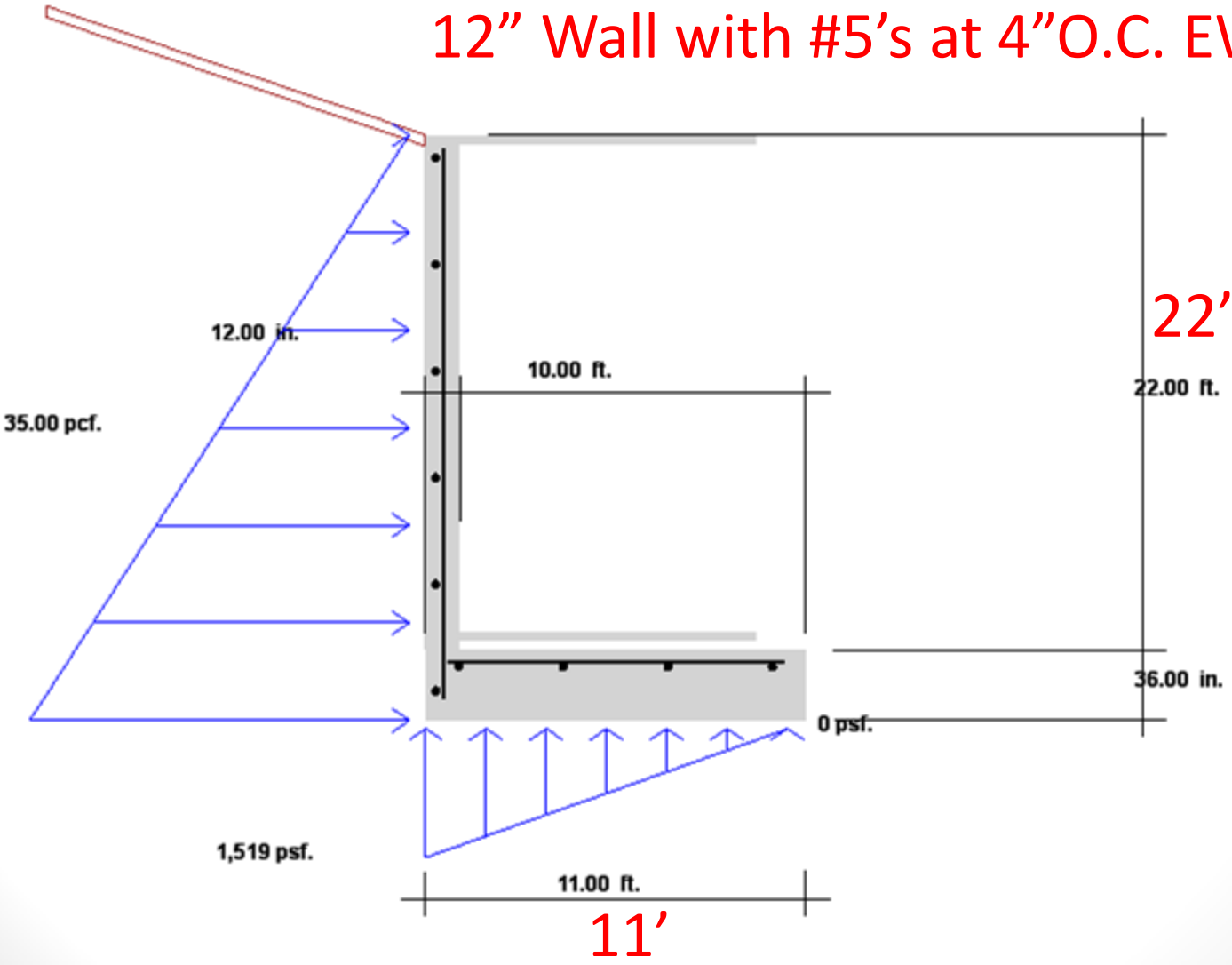


north

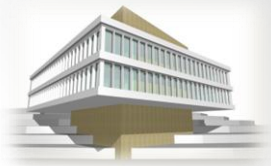
Core Concept– Retaining Wall

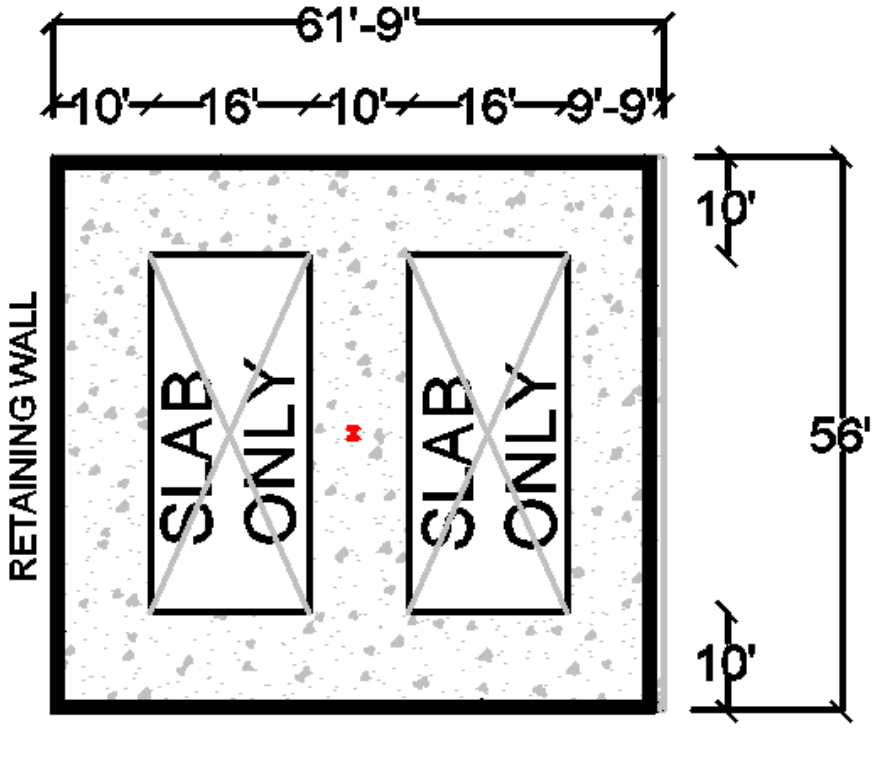


12” Wall with #5’s at 4”O.C. EW



Core Concept: Foundation Plan



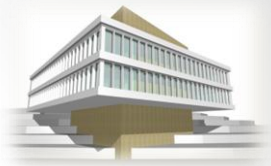


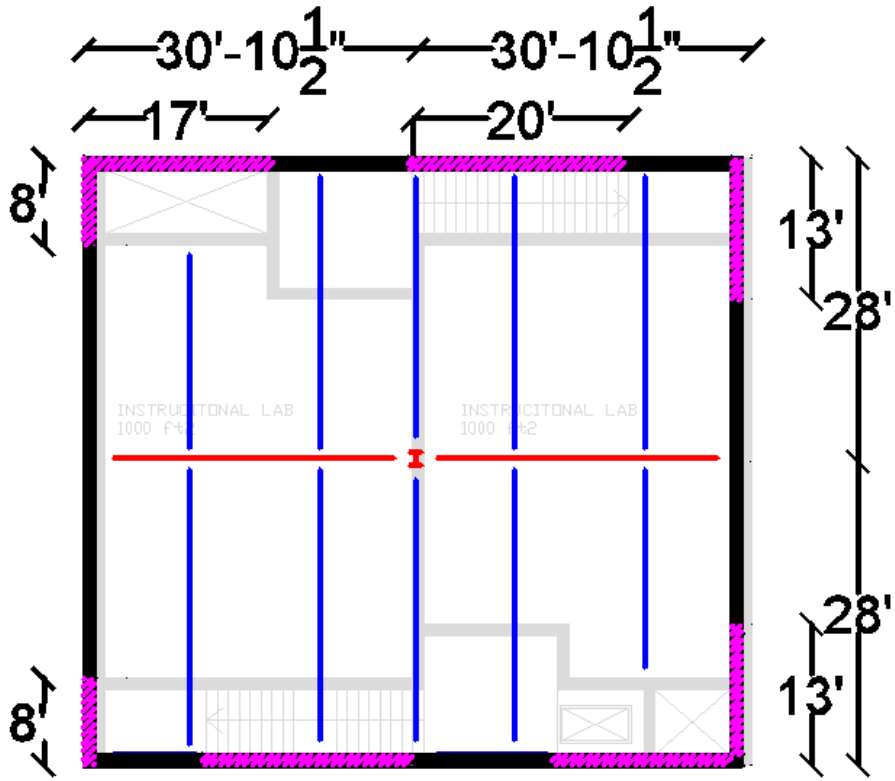
3' THICK MAT FOUNDATION.

Column Sizes:

W14x109

Core Concept: 1st Floor Framing





1. Framing Sizes:

   W18x35

   W21x57

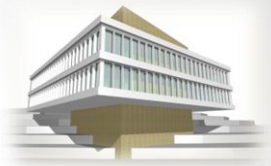
   Column Sizes:

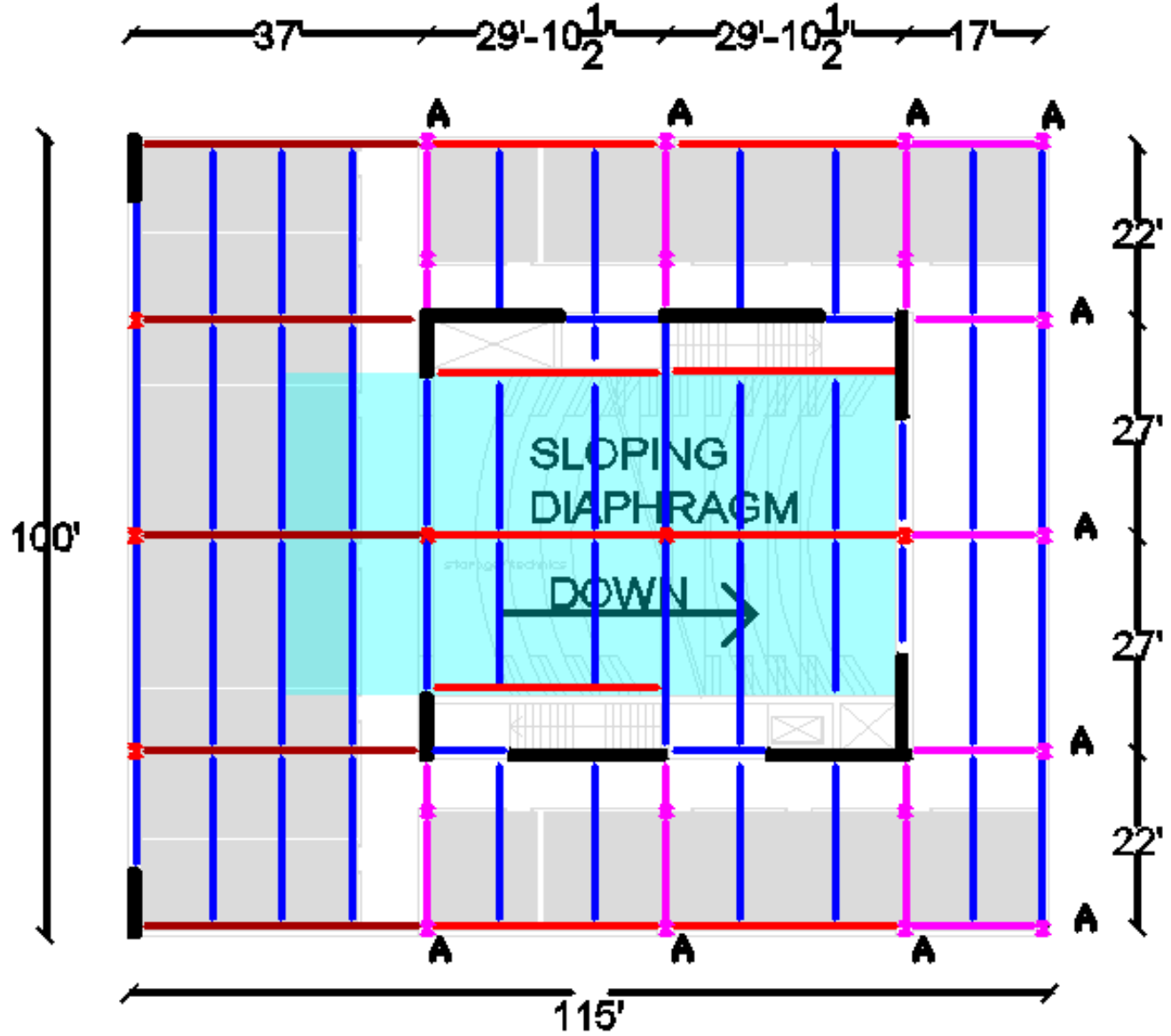
   W14x109

   Shear Wall Above

N

Core Concept: 2nd Floor Framing





Framing Sizes

W18x35

W21x57

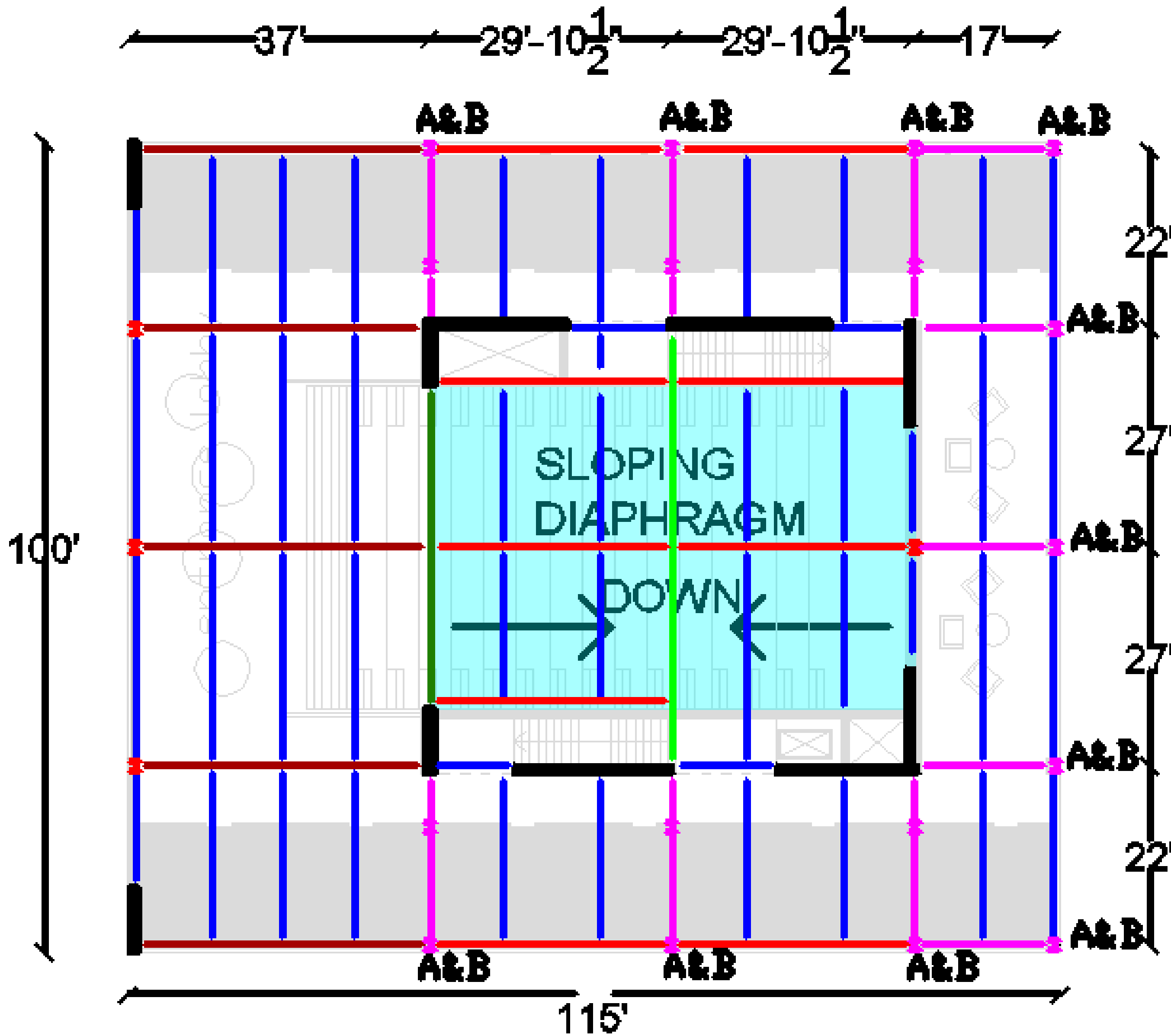
W24x76

W24x117

Column Sizes

W14x109

Core Concept: 3rd Floor Framing



Framing Sizes

W18x35

W21x57

W24x76

W40x249

W36x135

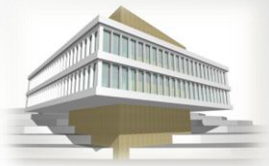
W24x117

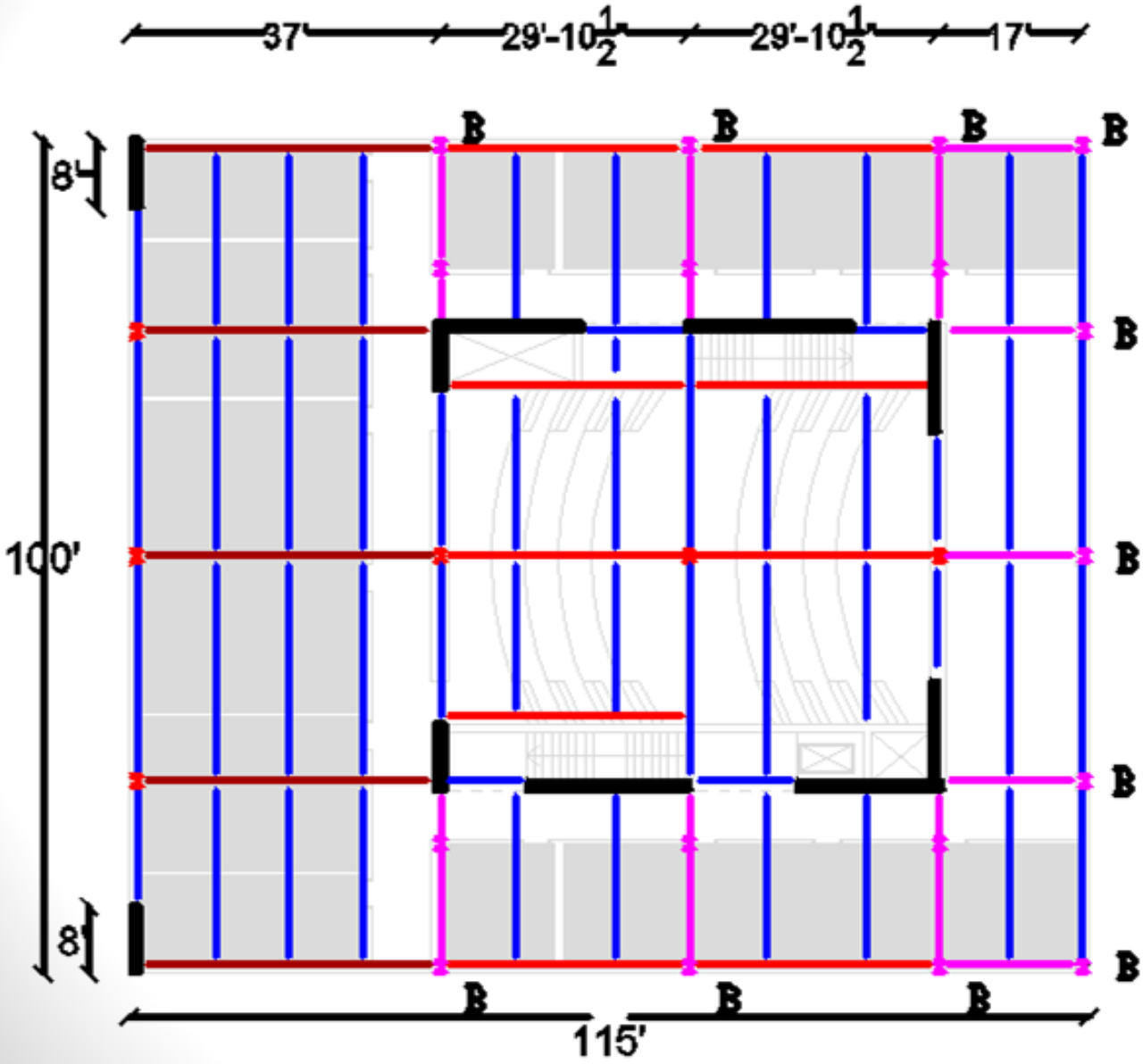
Column Sizes

W14x68

A E MEP C

Core Concept: 4th Floor Framing





4

Framing Sizes

W18x35

W21x57

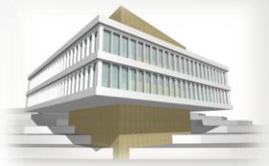
W24x76

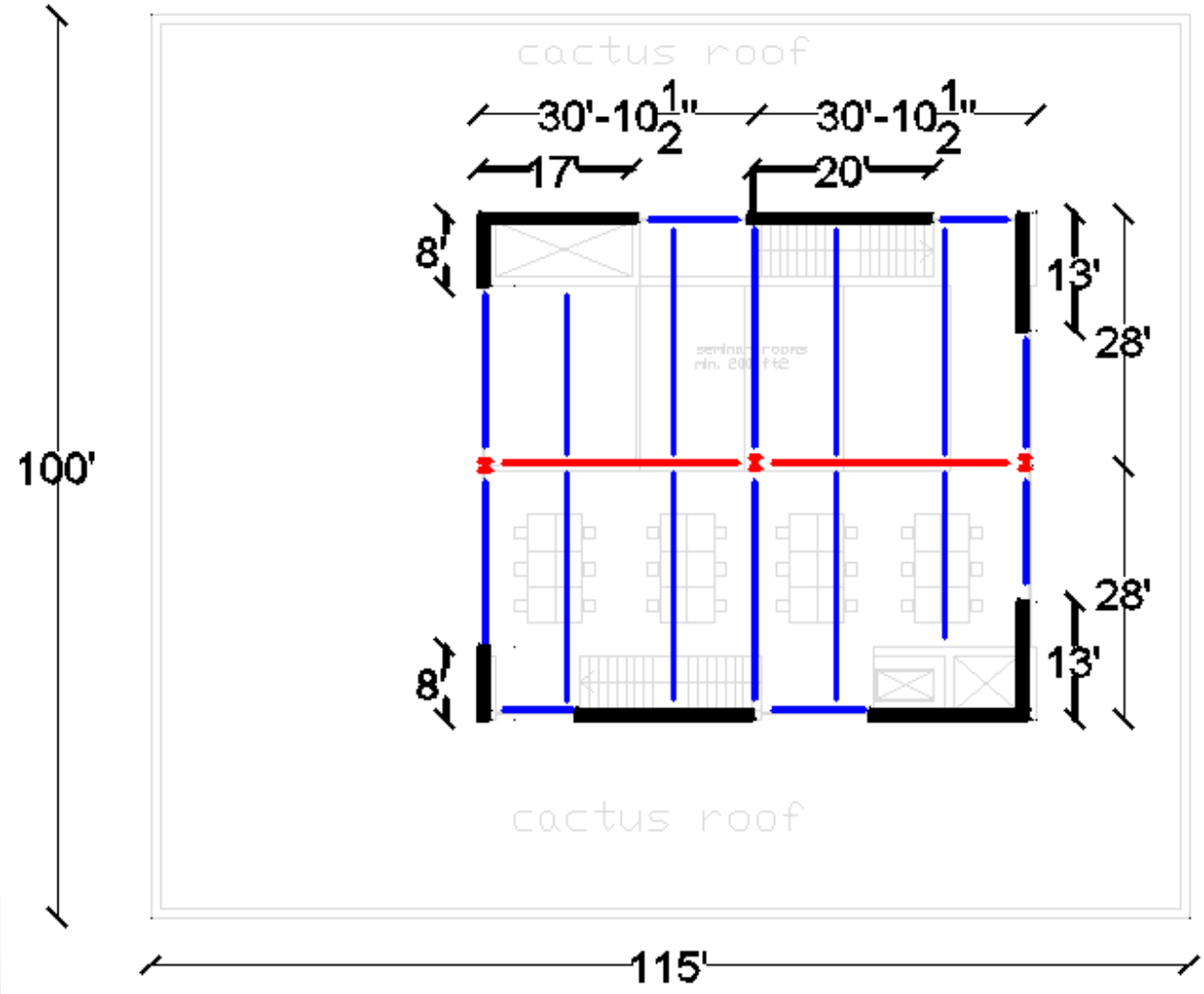
W24x117

Column Sizes

W14x68

Core Concept: Roof Framing Plan





5.

Framing Sizes

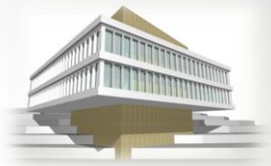
W18x35

W21x57

Column Sizes

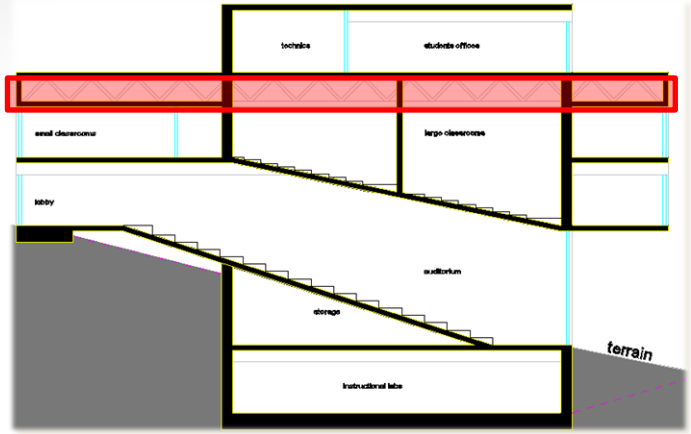
W14x68

Structural Development

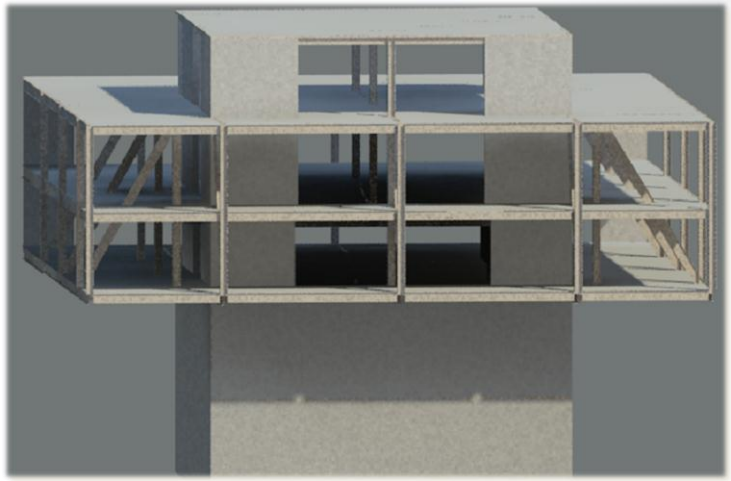


- Challenges:
  - Cantilevers (22’ and 17’)
  - Earthquake Country – Base Shear = .27% g
- Solutions:
  - Gravity Framing
    - Two story truss
    - Cable supported
  - Concrete shear walls
  - 3’ mat foundation

Structural Process

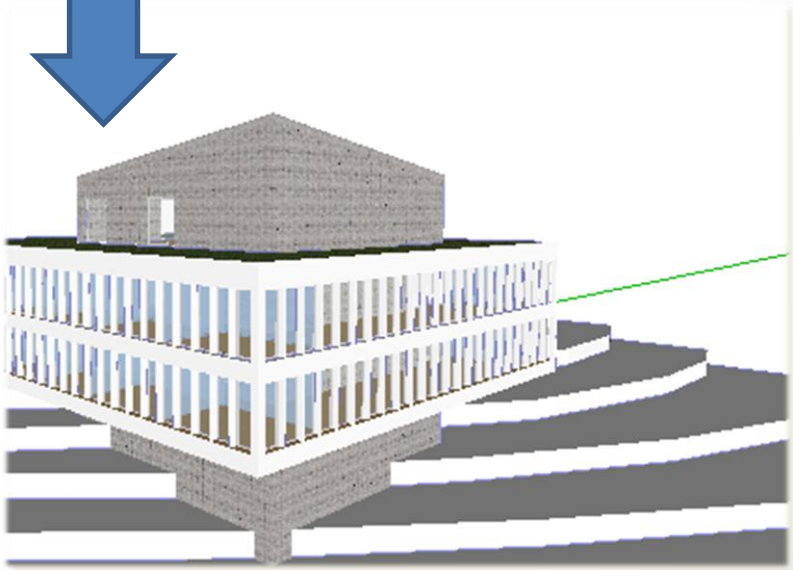


Truss Plenum



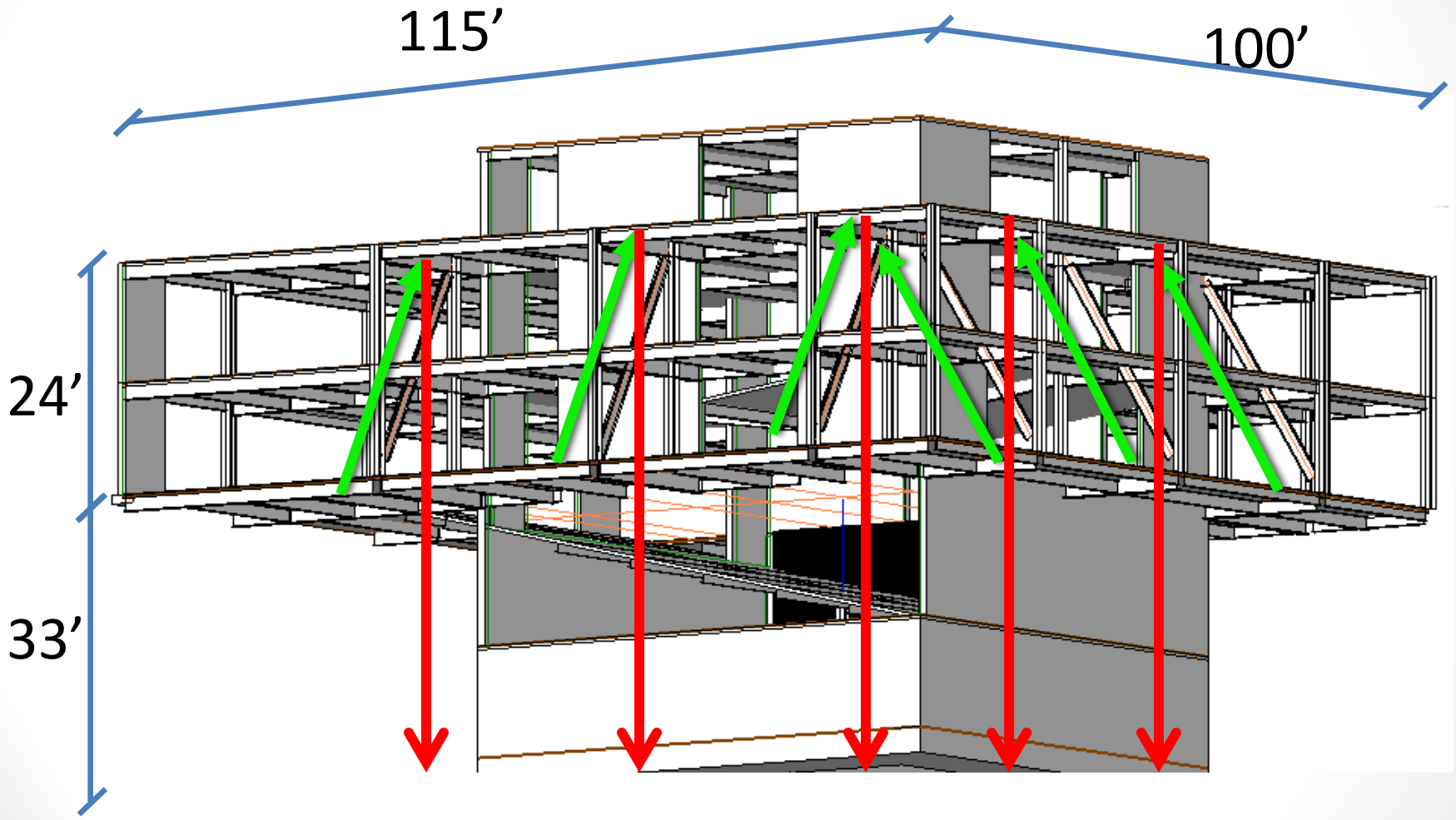
Two Story Truss

Cable Supported

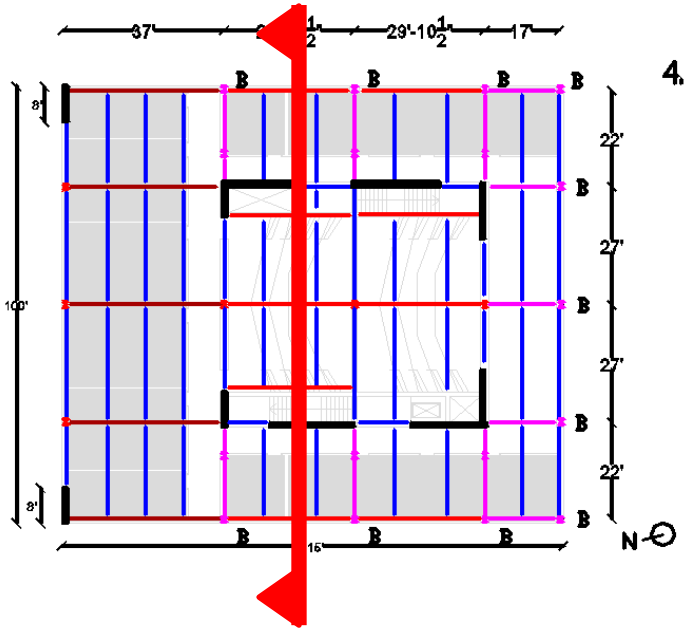


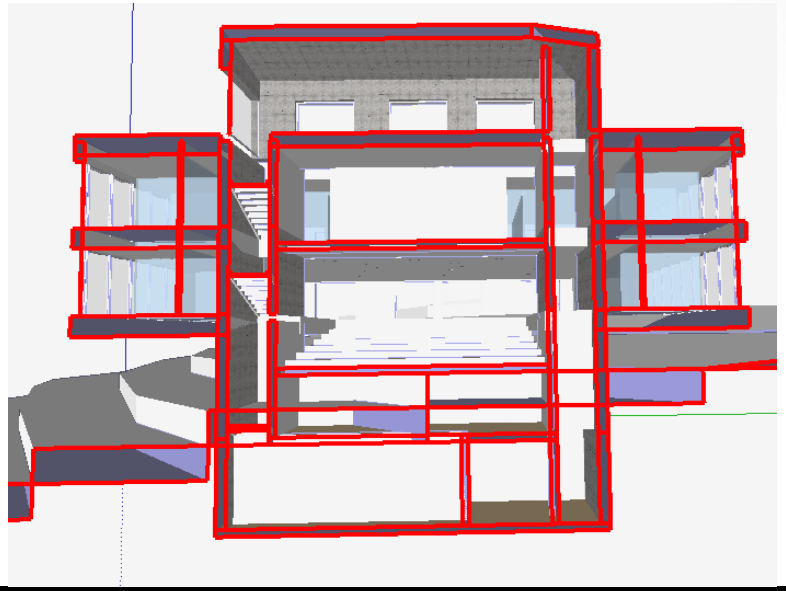
Architectural Model

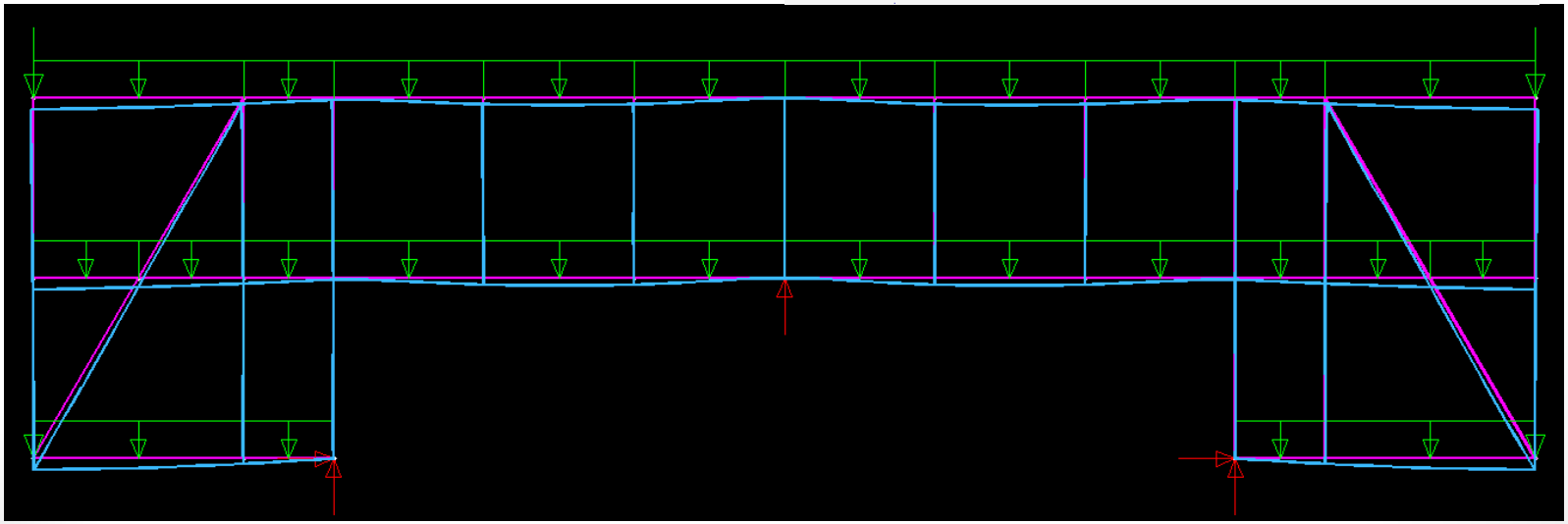
Two Story Truss Load Path



Two Story Truss



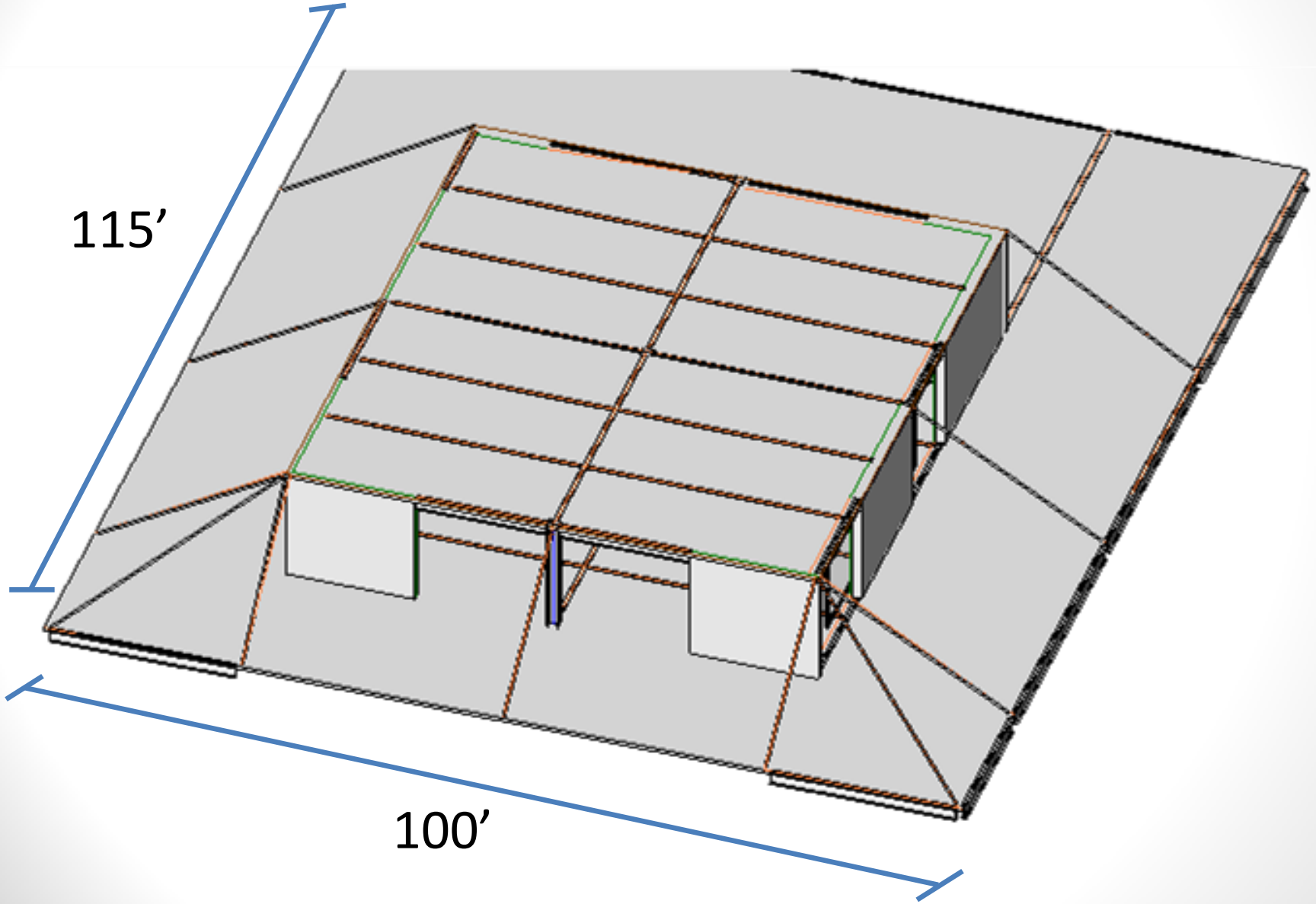




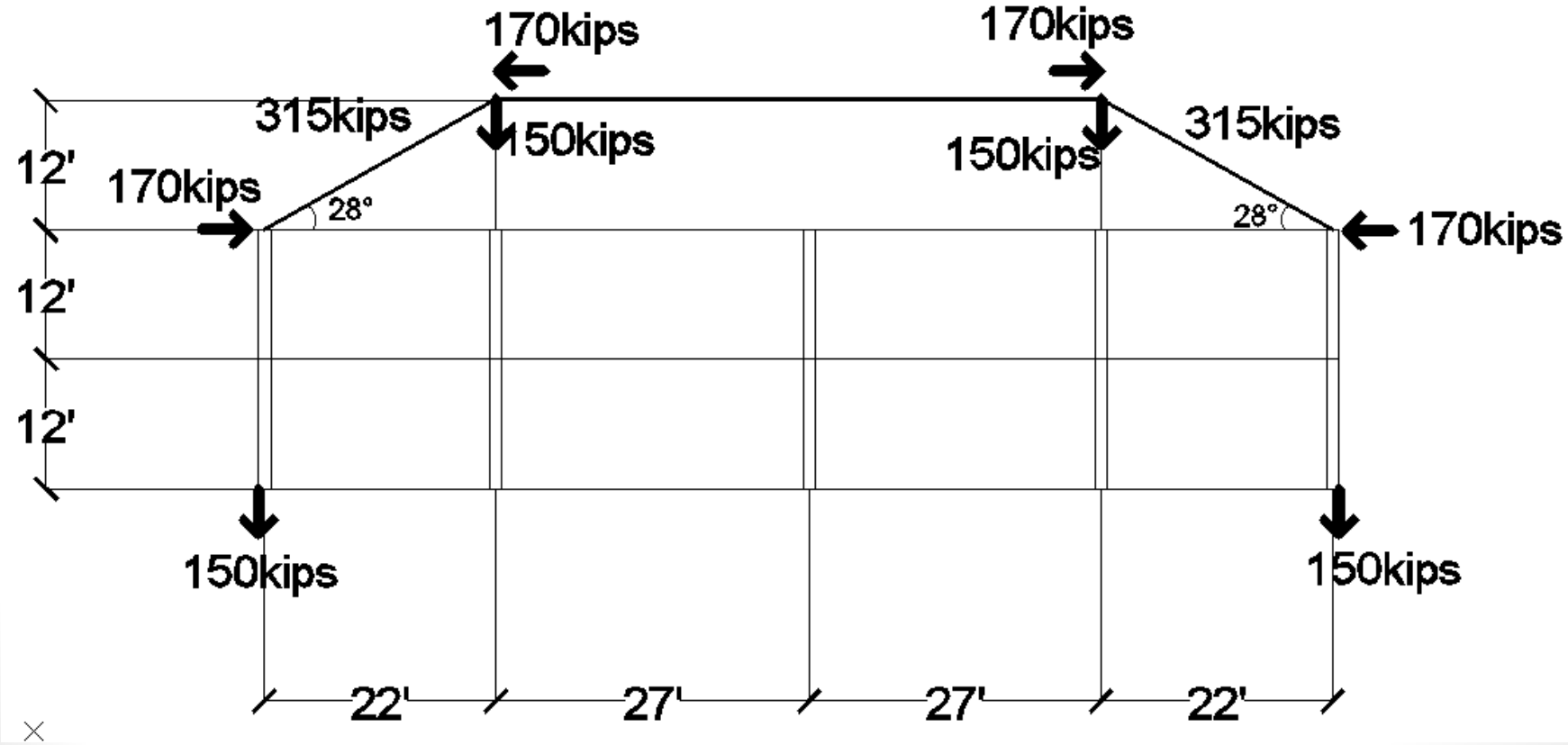
Δ = -0.75”

Δ = -0.75”

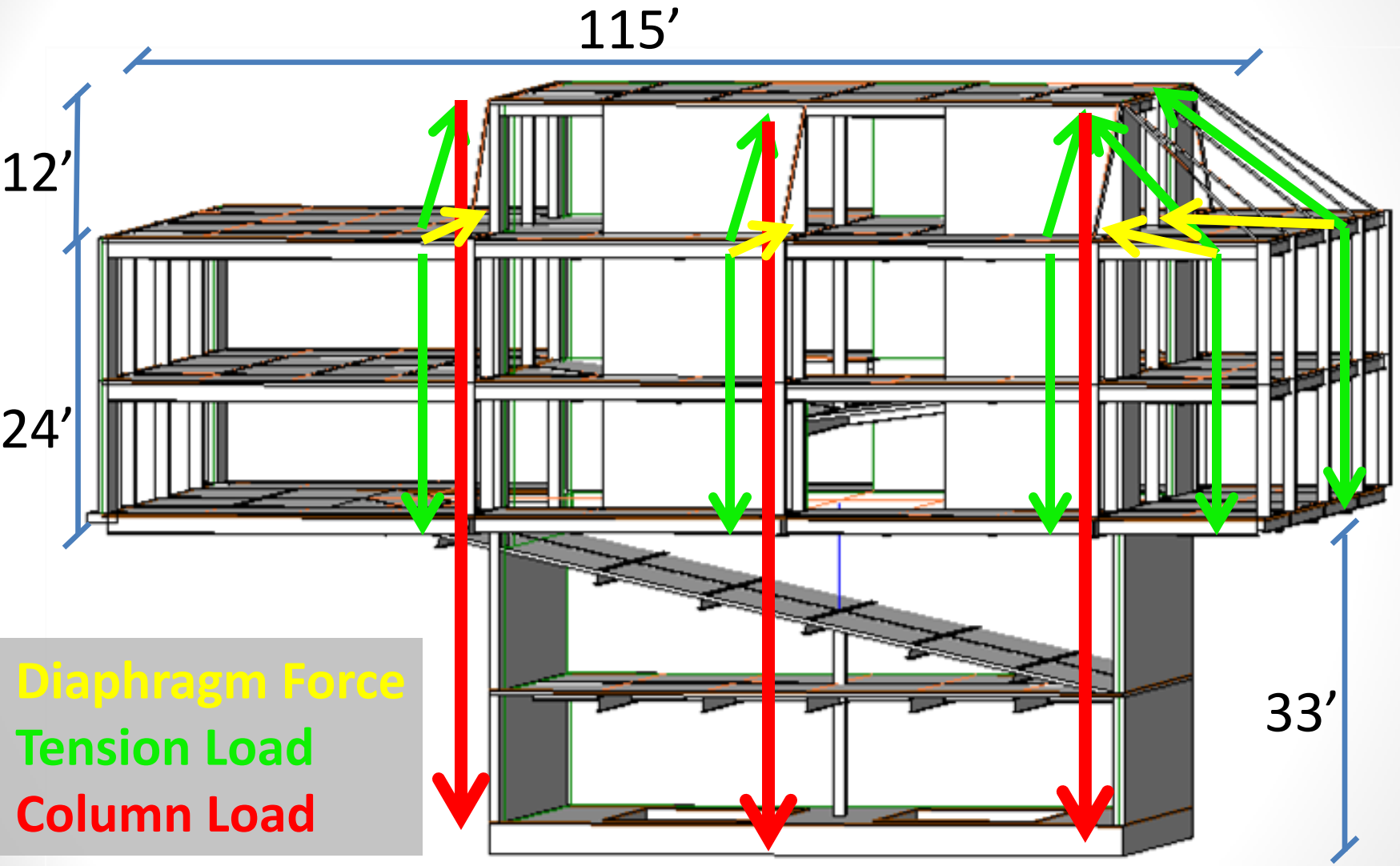
Cable Supports



Cable Supported

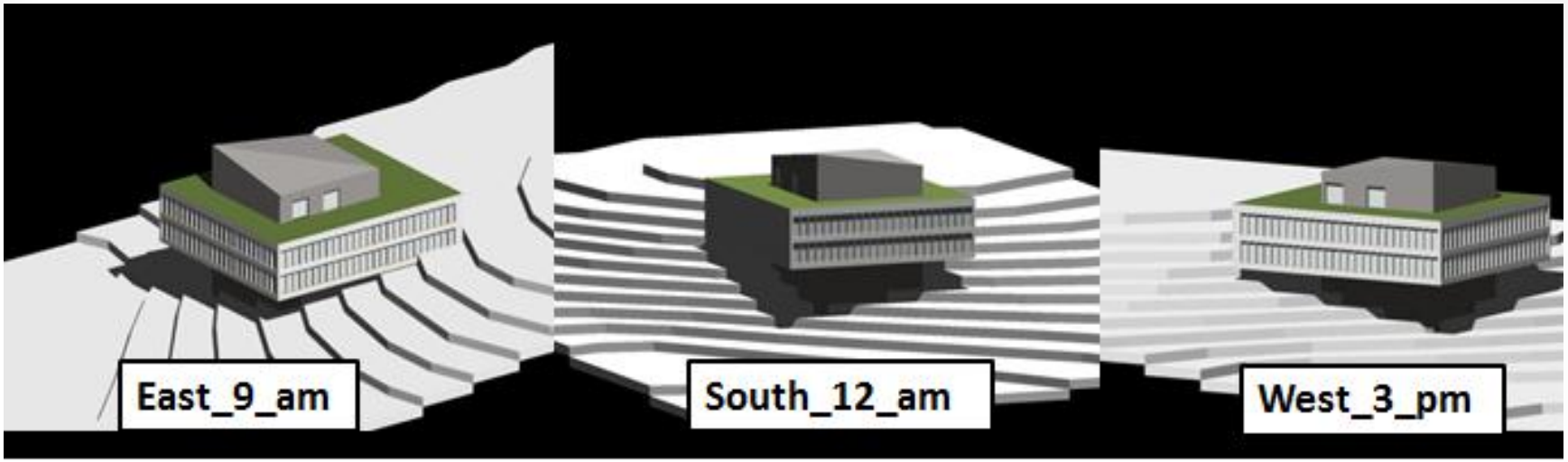


Cable Supported Load Path

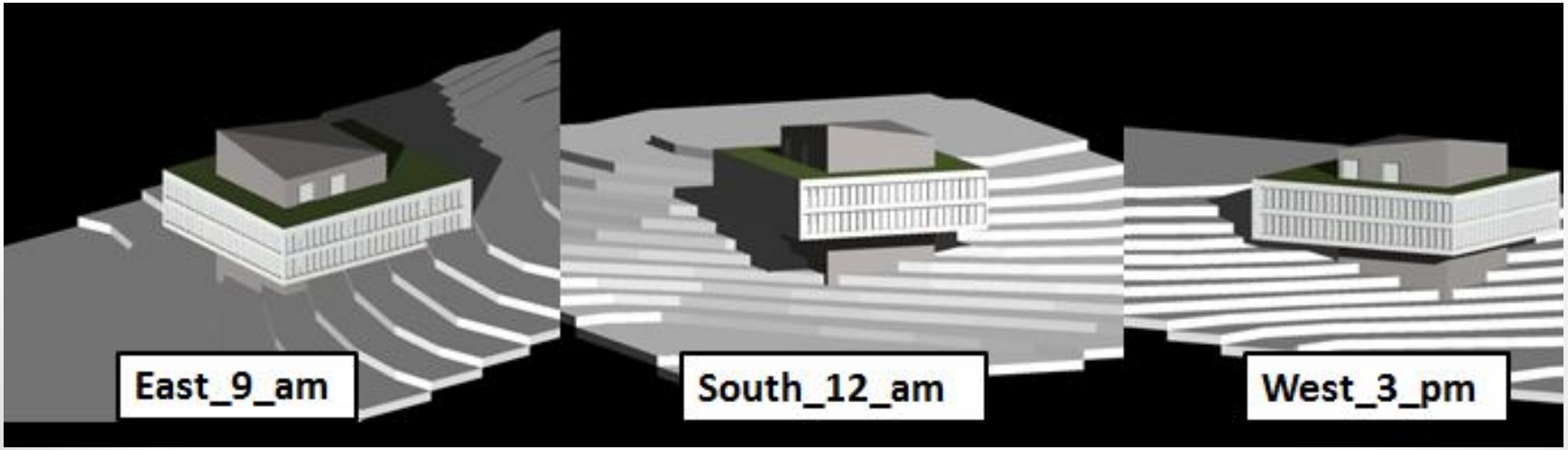


Solar Access Analysis

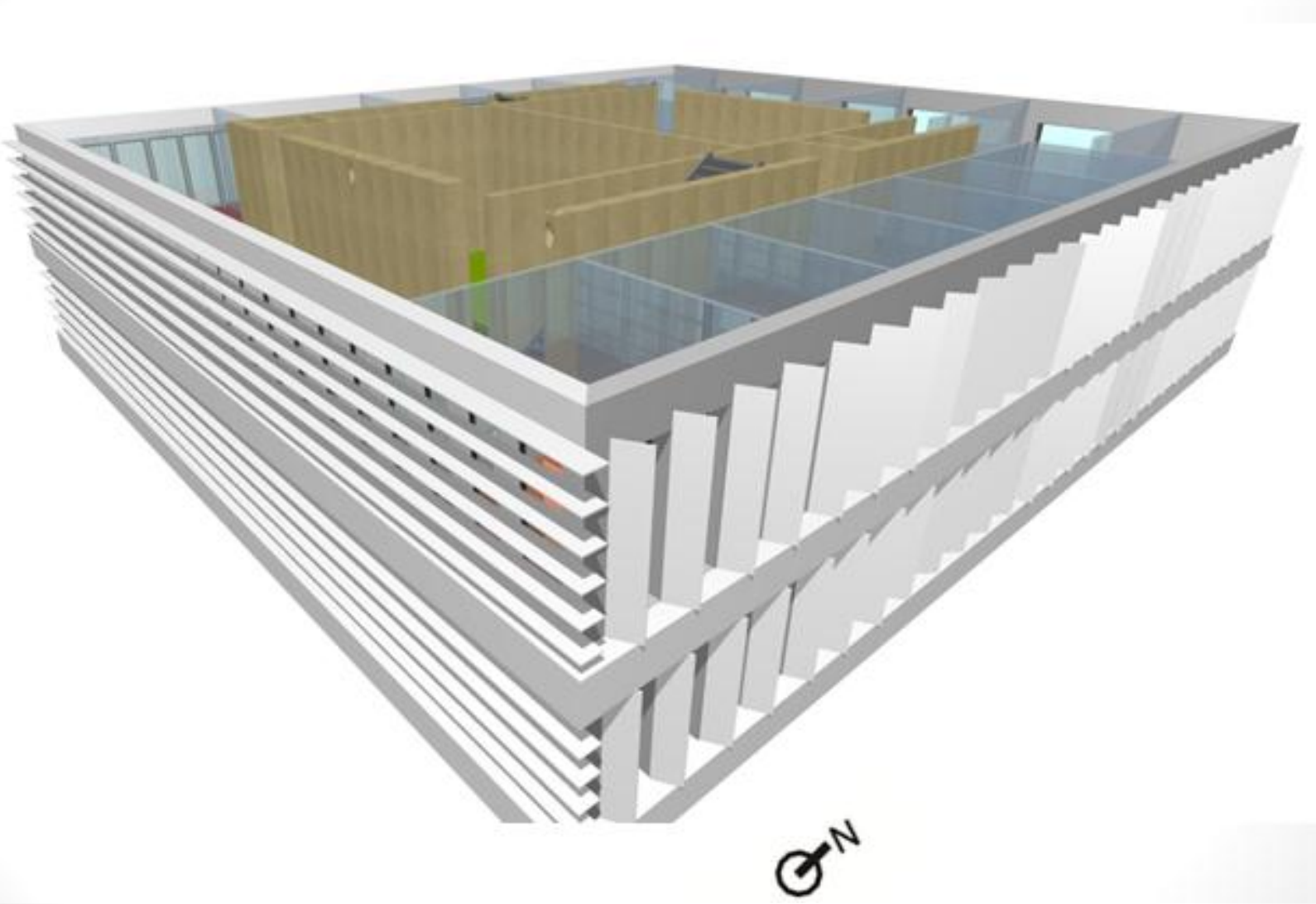
August



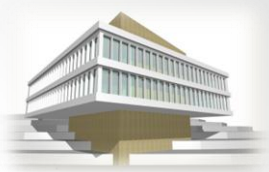
January

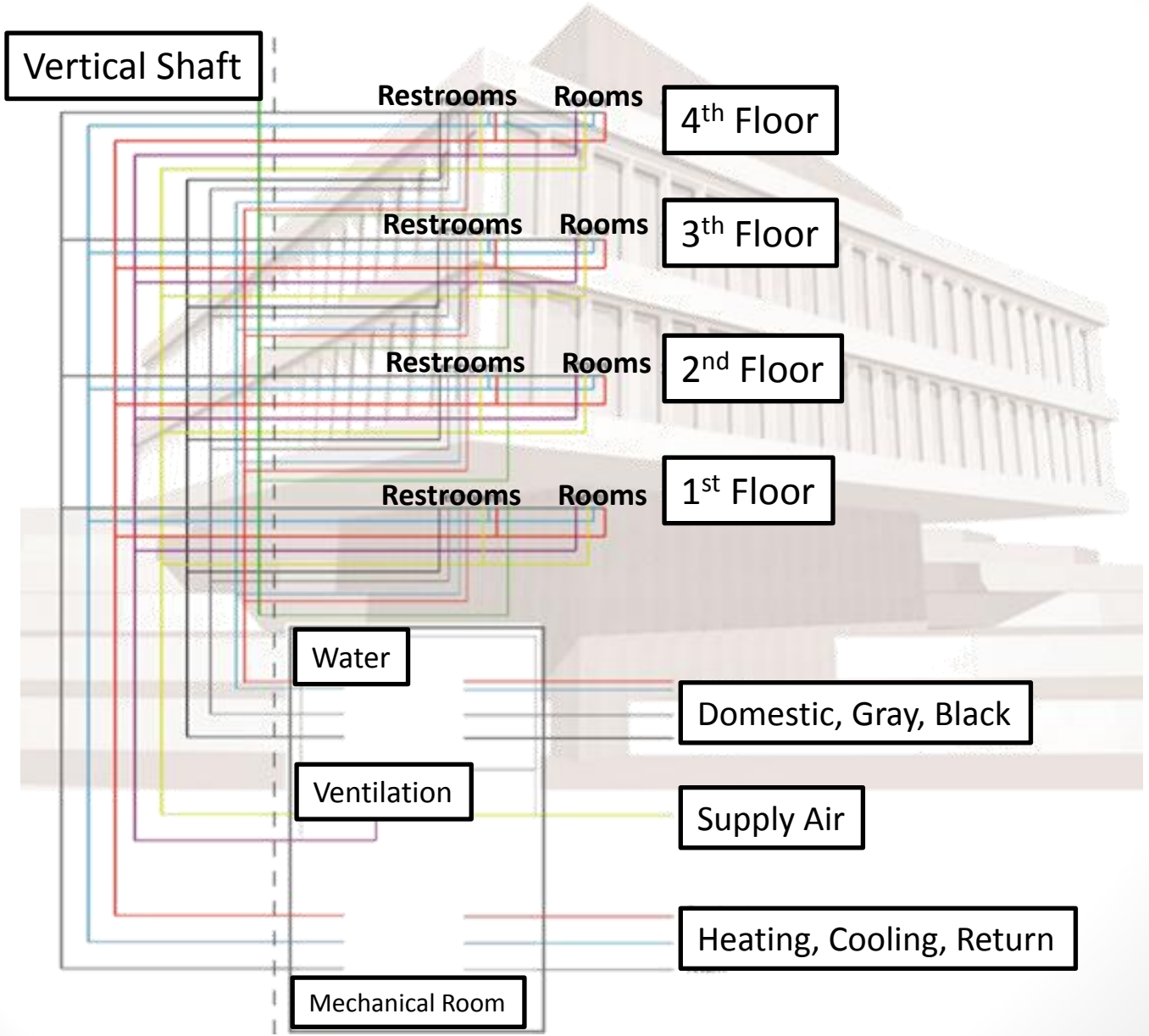


Façade Solution

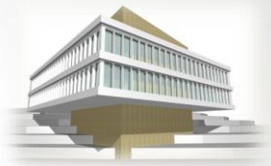


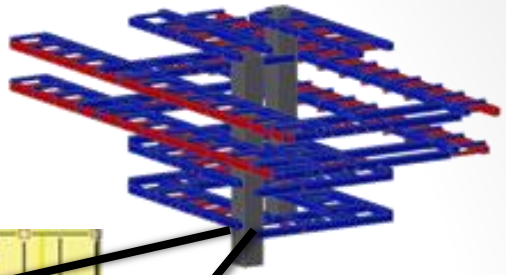
The Vertical Shaft

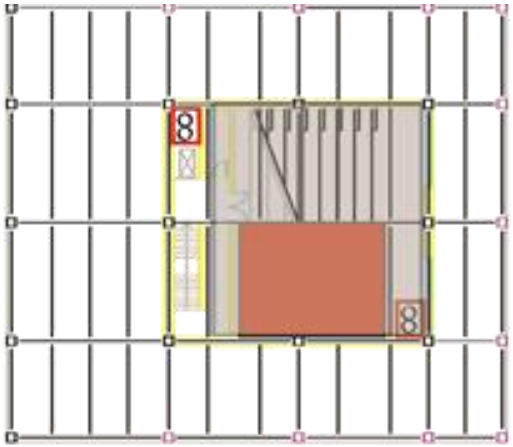




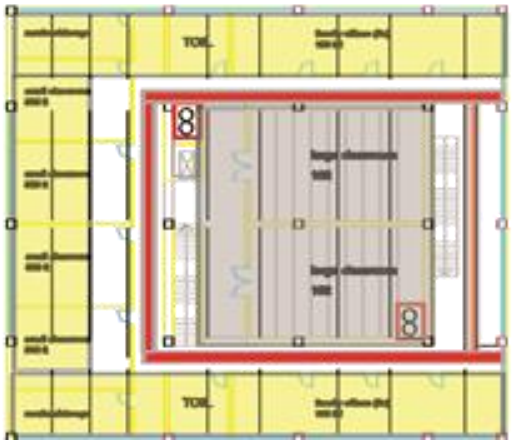
Duct System and Lighting Zones

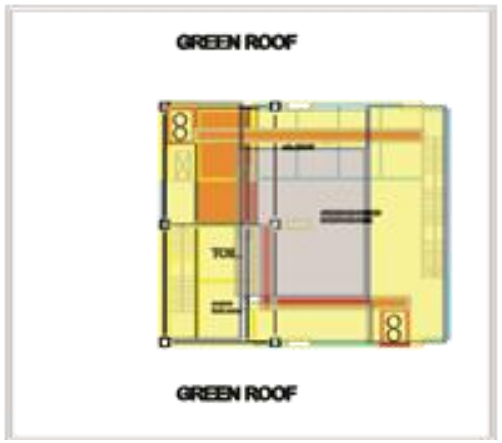






3D Model of Ducts





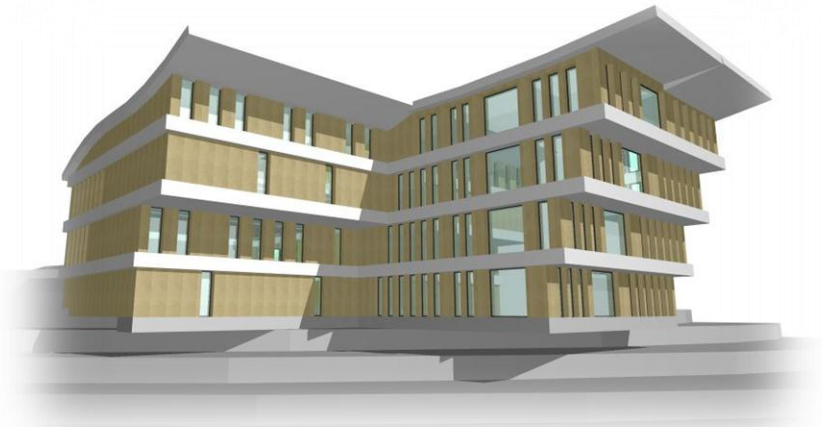
DF > 2%

DF < 2%

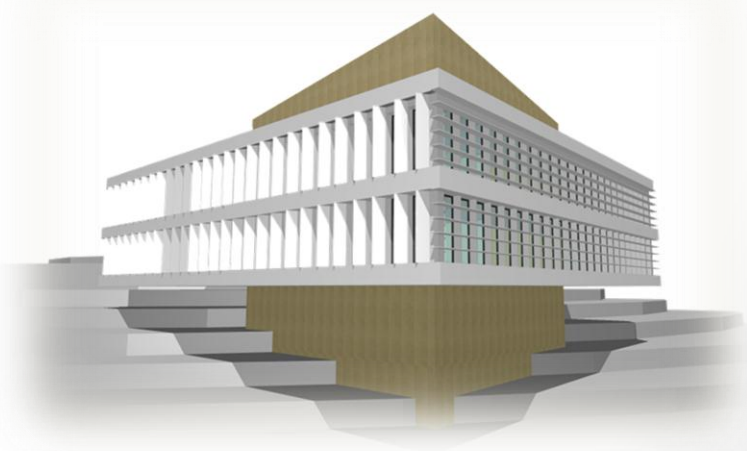
Ducts and mech room

Construction:

Lego Concept

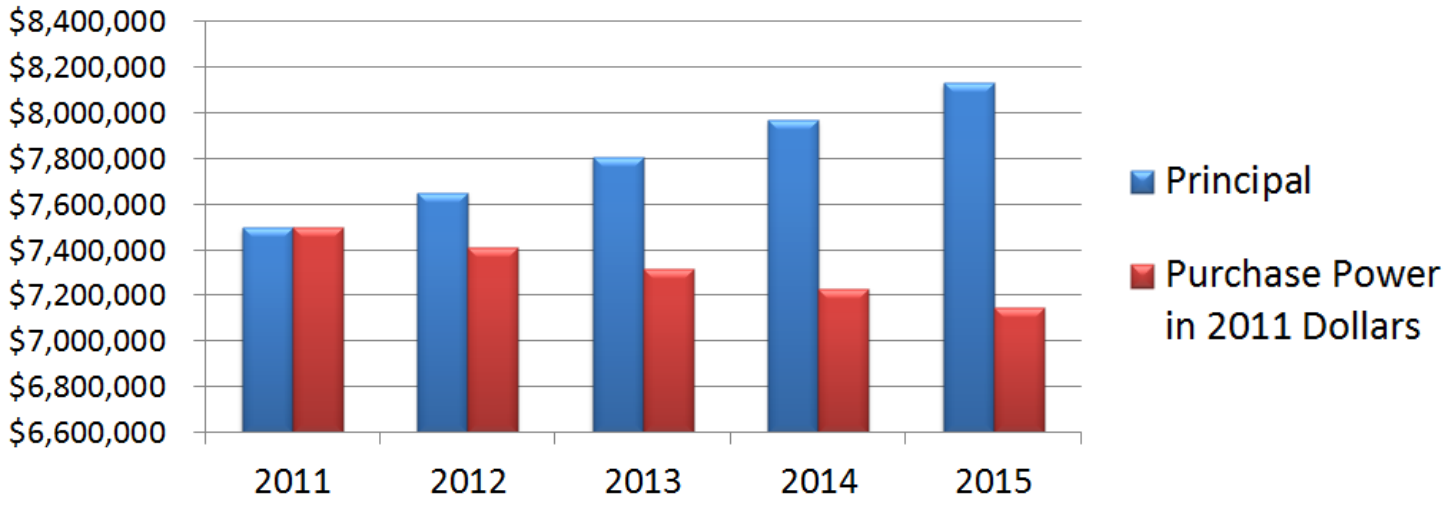


Core Concept



Finance: Budget

Budget in 2011 Dollars: $7,145,000



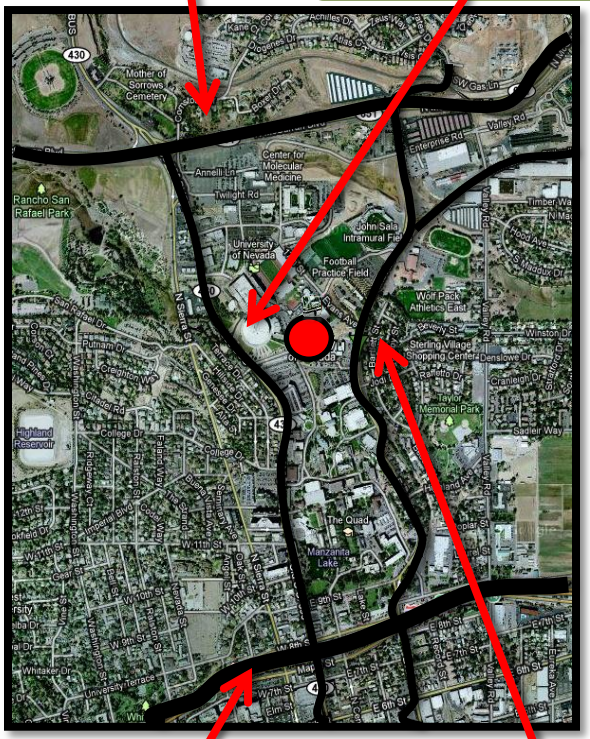
CD "Risk Free" Investment Return	**2.05%**
Expected Inflation	**3.25%**

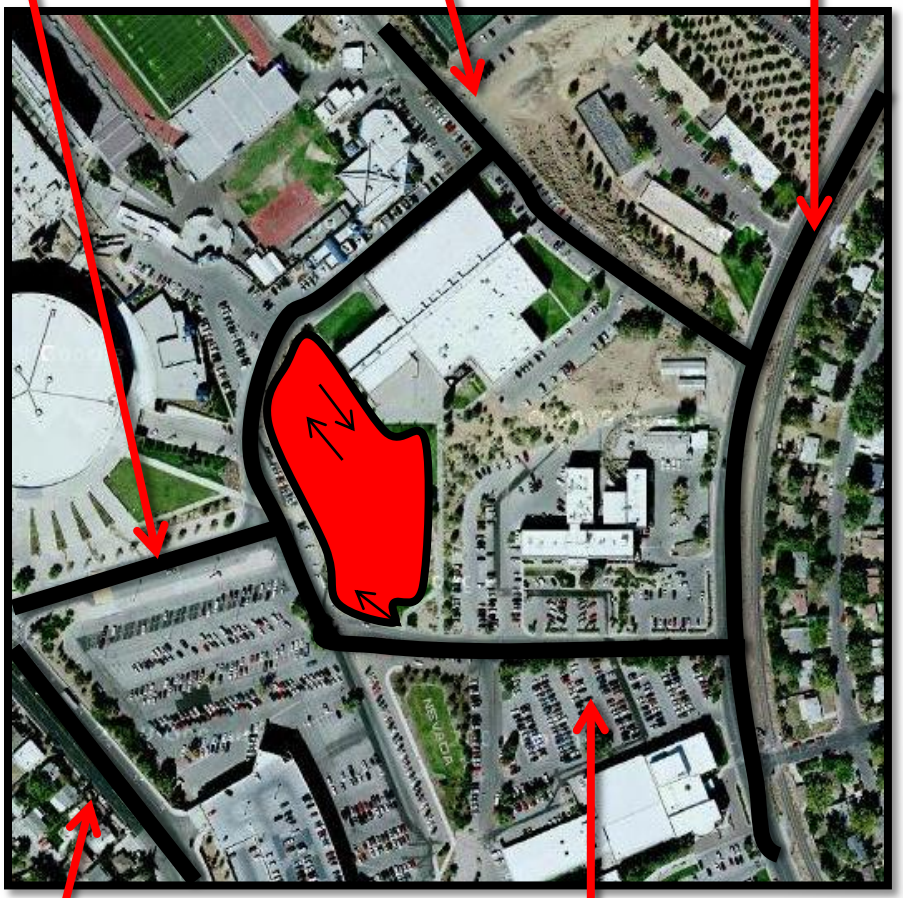
Logistics: The Job Site

Construction Site

Pedestrian Path

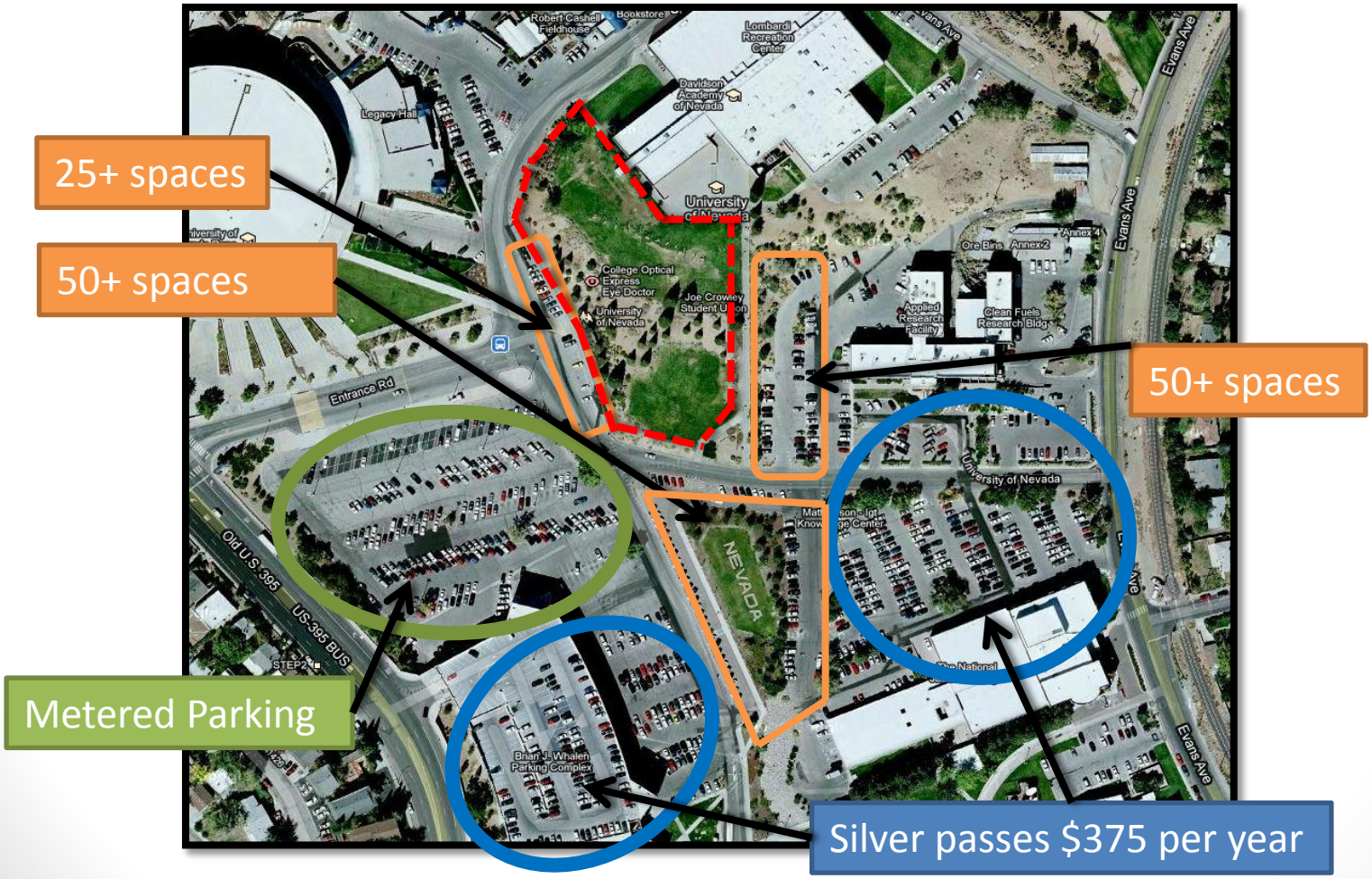
Logistics: Site Access



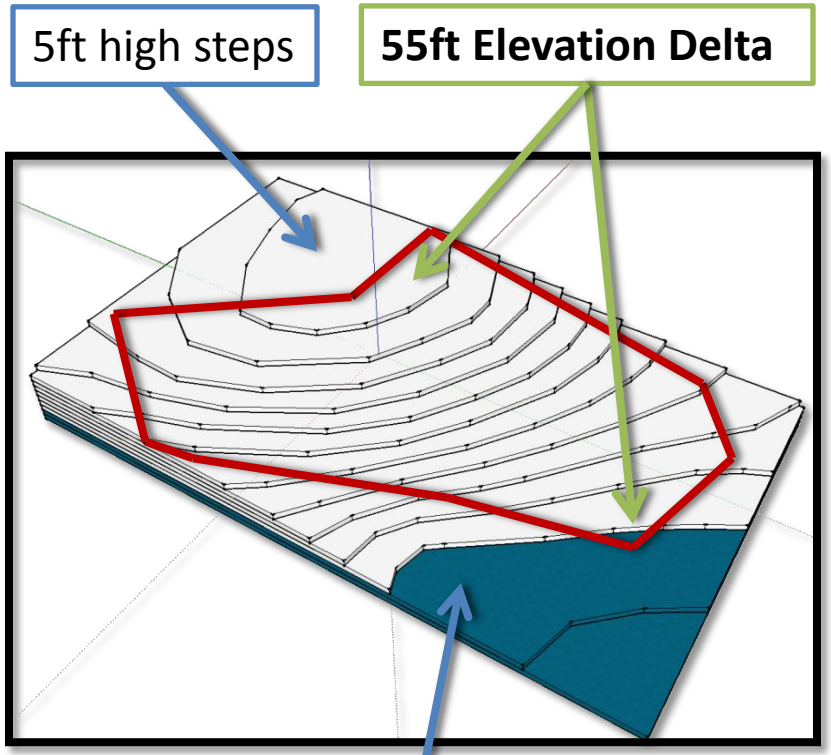


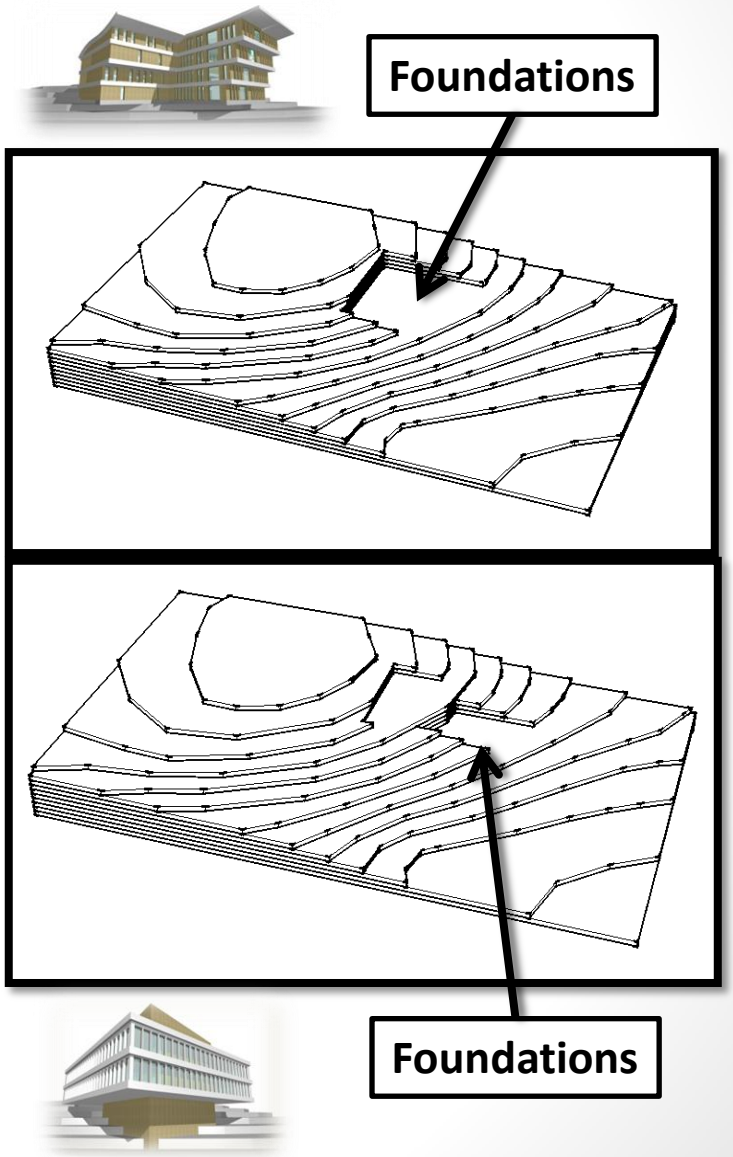
Logistics: Parking

- Owners reserved us 40 parking spots for ***free***!



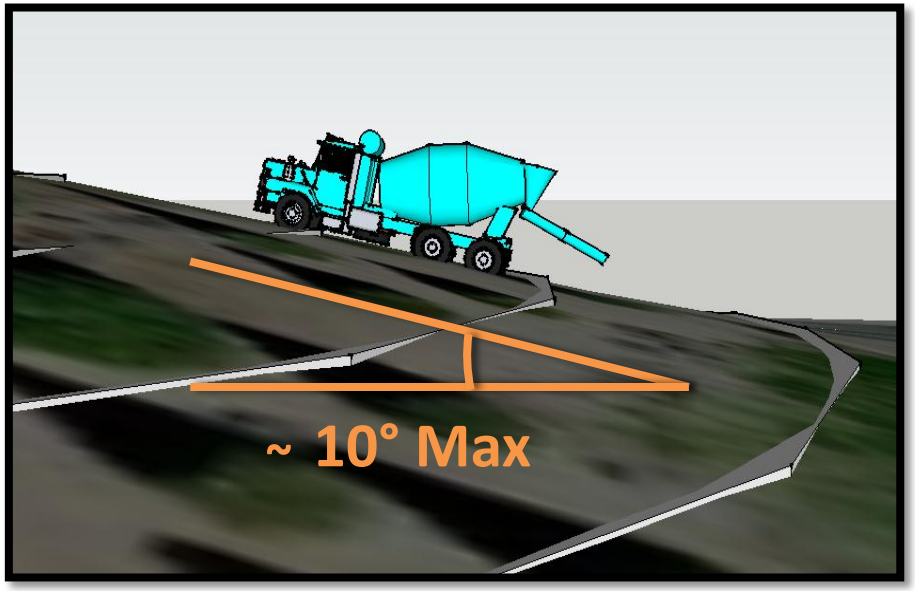
Constructability: Water Table





Constructability: Steep Slope

Steep slope divides construction site into a "top" and "bottom" section.



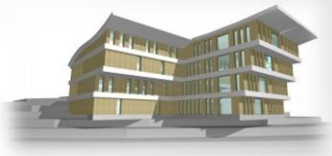
Slope is manageable but access by heavy equipment should be minimized.

Constructability: Soil Stability

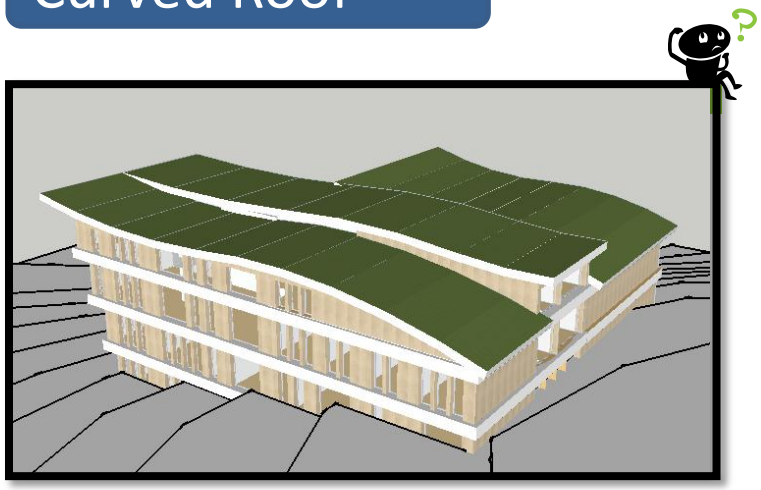
Very stable soil.
Approximately 50ft of soil without a retaining wall for construction.

Backfill

Constructability: Lego Concept

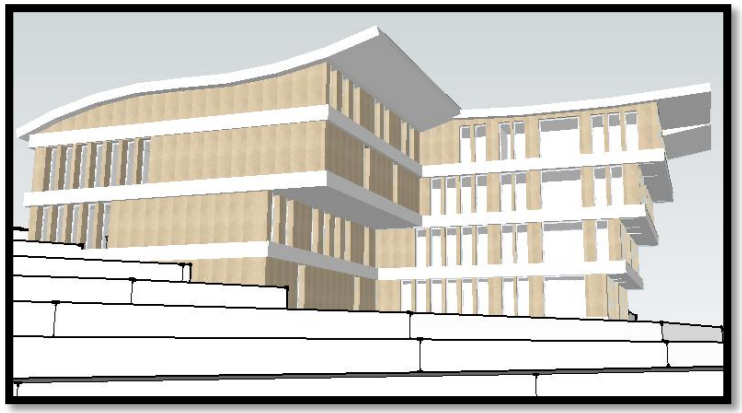


Curved Roof



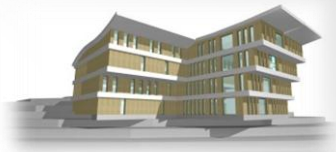
Curved steel roof structure.

Cantilevers

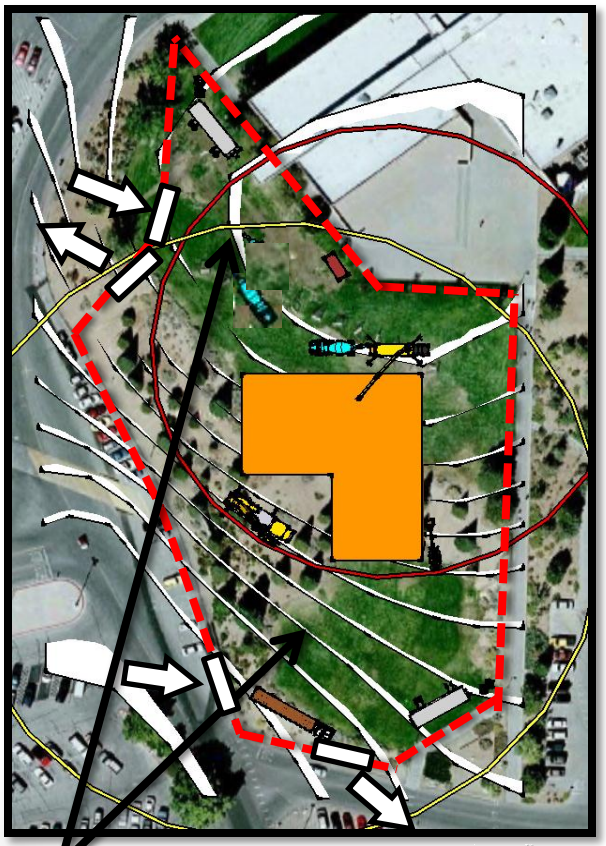


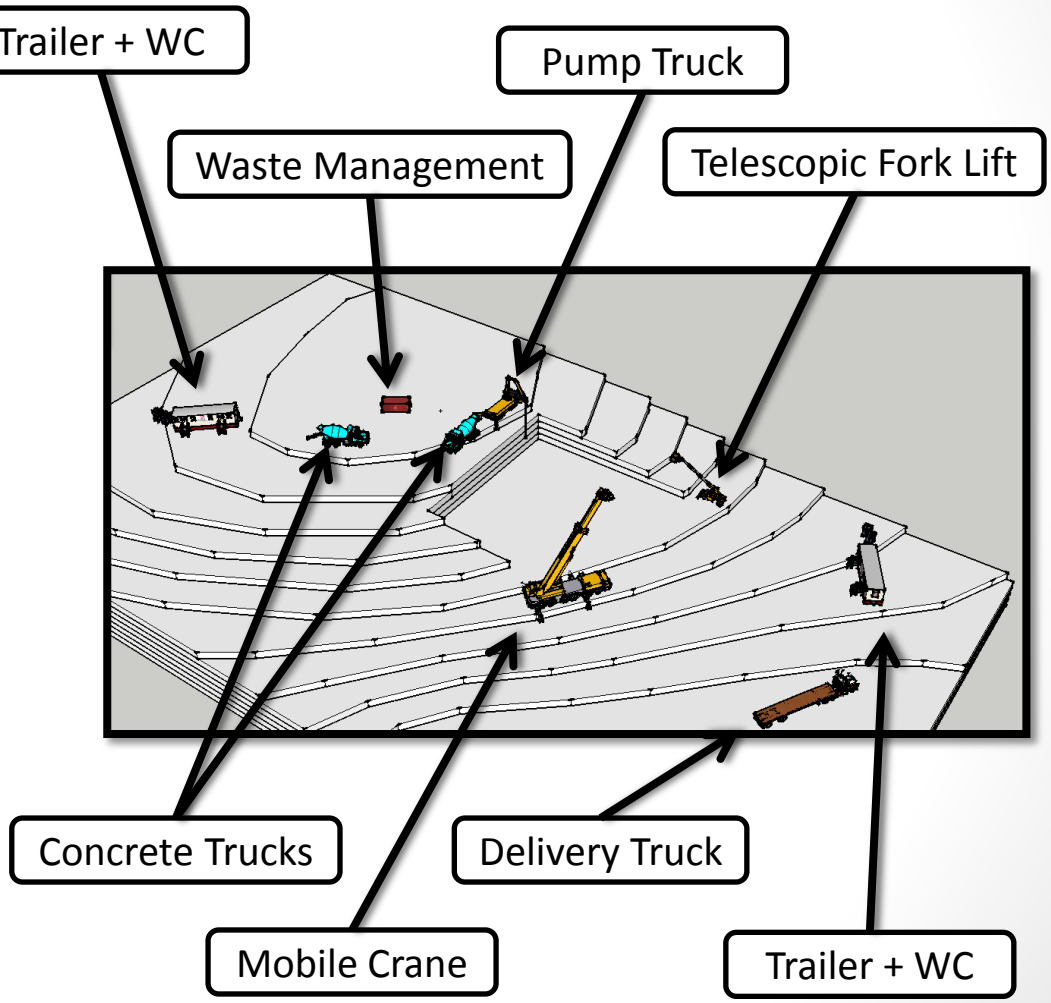
On site or prefab cantilevers.

Site Logistics: Lego Shear Walls

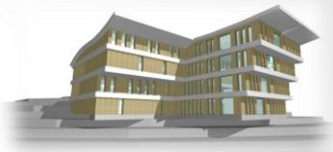


ShearWalls

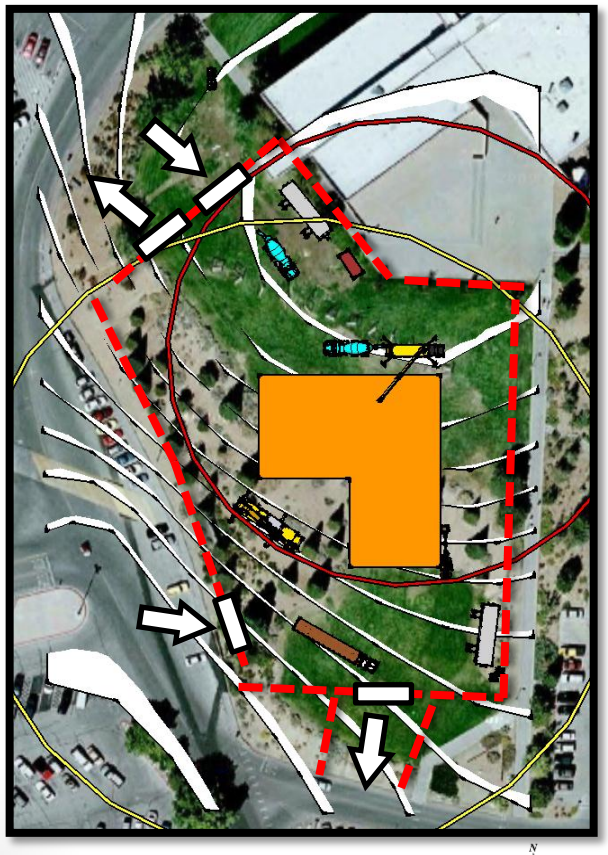


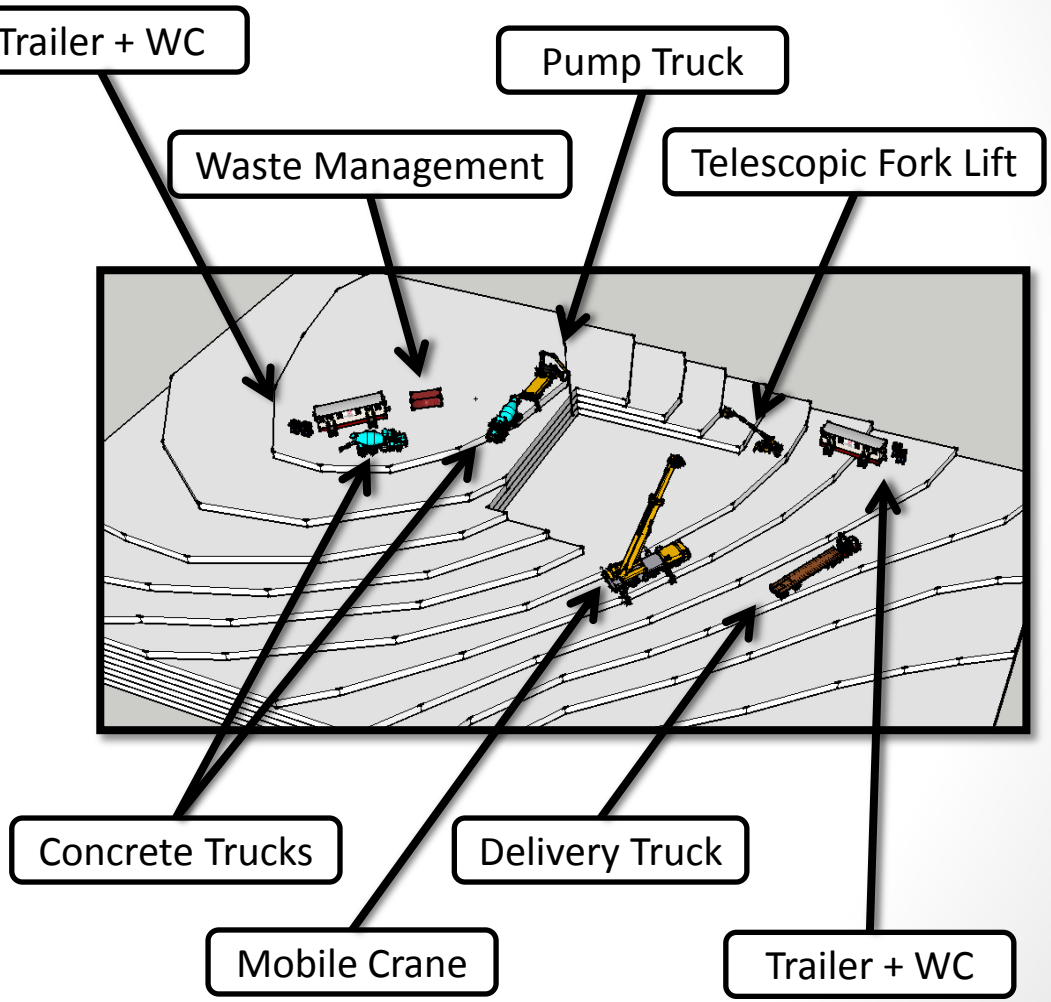


Site Logistics: Lego ConXtech



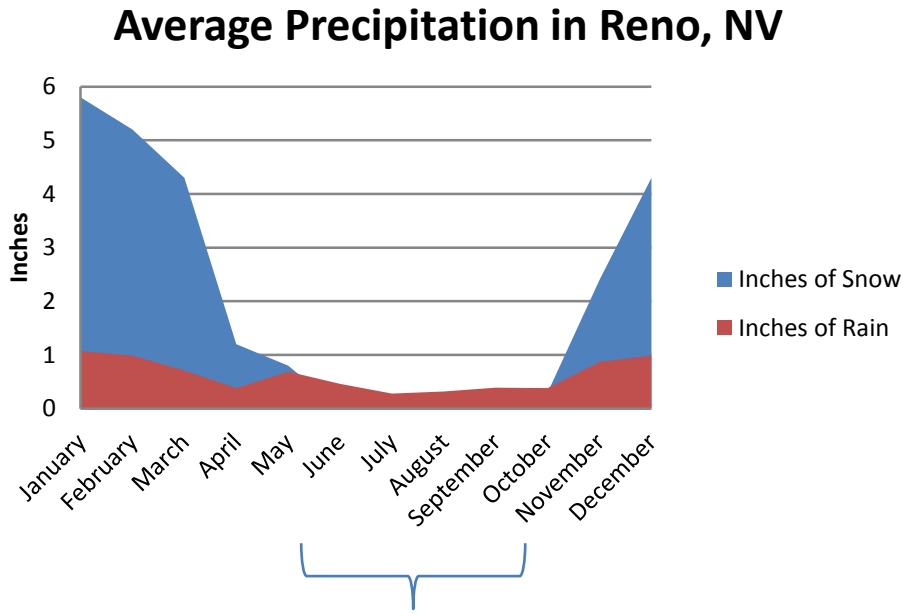
ConXtech





Site Logistics: Weather

Month	Inches of Snow	Inches of Rain
January	5.8	1.1
February	5.2	1.0
March	4.3	0.7
April	1.2	0.4
May	0.8	0.7
June	0	0.5
July	0	0.3
August	0	0.3
September	0	0.4
October	0.3	0.4
November	2.4	0.9
December	4.3	1.0



Need to enclose building during this time period.

This suggests a start of construction date of **June 1st 2015**

Schedule: Milestones

Start Construction: June 1, 2015 — Start

Milestone 1: Enclose building by Nov 1, 2015 — M1

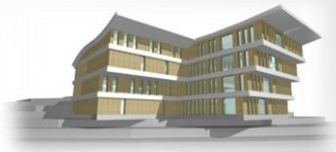
Milestone 2: Provide Lab Access by Jan 1, 2016 — M2

Milestone 3: Finish construction by May 31, 2016 — M3

	2015							2016					
Month	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	May.
Climate	No Snow, some rain.					Some snow, some rain.							**Dedicate Building on Jun 1st 2016**
Milestones	Earthwork, foundations, structure, enclosure, exterior systems.					Building interior systems, interior construction, interior finishes.							
								Faculty move in to install instructional labs and computer room.					

Start — M1 — M2 — M3

Schedule: Comparison

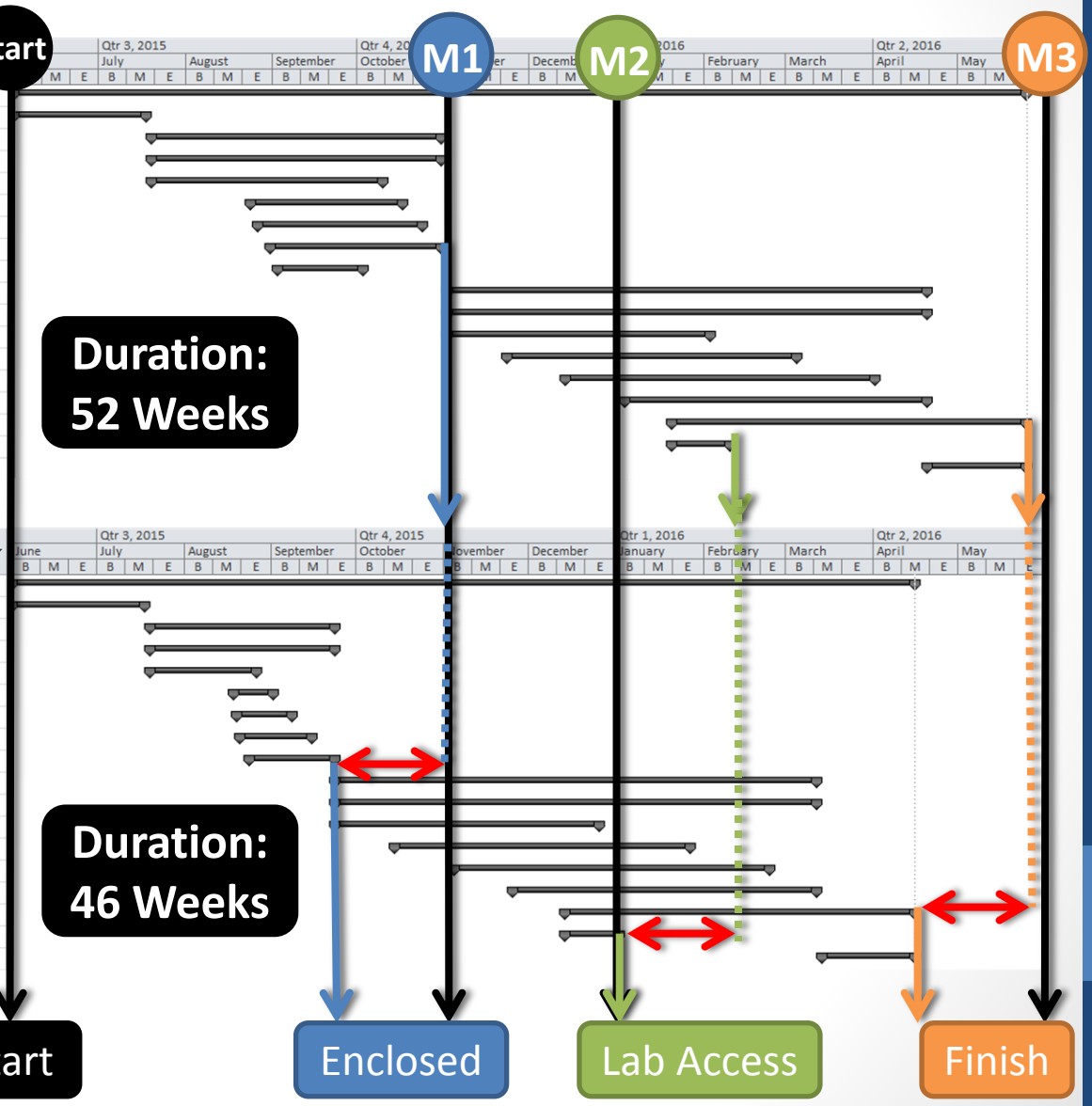


Shear Walls

		Duration
1	Ridge Building	51.5 wks
2	PHASE 1 - PRECONSTRUCTION	7 wks
13	PHASE 2 - SUBSTRUCTURE AND SHELL	15 wks
14	Area 1 (Building)	15 wks
15	Ground Level	12 wks
27	Level 2	8 wks
37	Level 3	8.5 wks
47	Level 4	9 wks
56	Roof Level	4.5 wks
62	PHASE 3 - SERVICES AND INTERIORS	24.5 wks
63	Area 2 (Building)	24.5 wks
64	Ground Level	13.5 wks
83	Level 2	15 wks
102	Level 3	16 wks
118	Level 4	15.5 wks
134	PHASE 4 - LANDSCAPING AND CONTINGENCY	18 wks
135	Area 0 (Bottom)	3 wks
139	Area 0 (Top)	5 wks

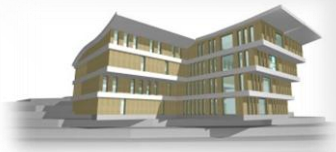
ConXtech

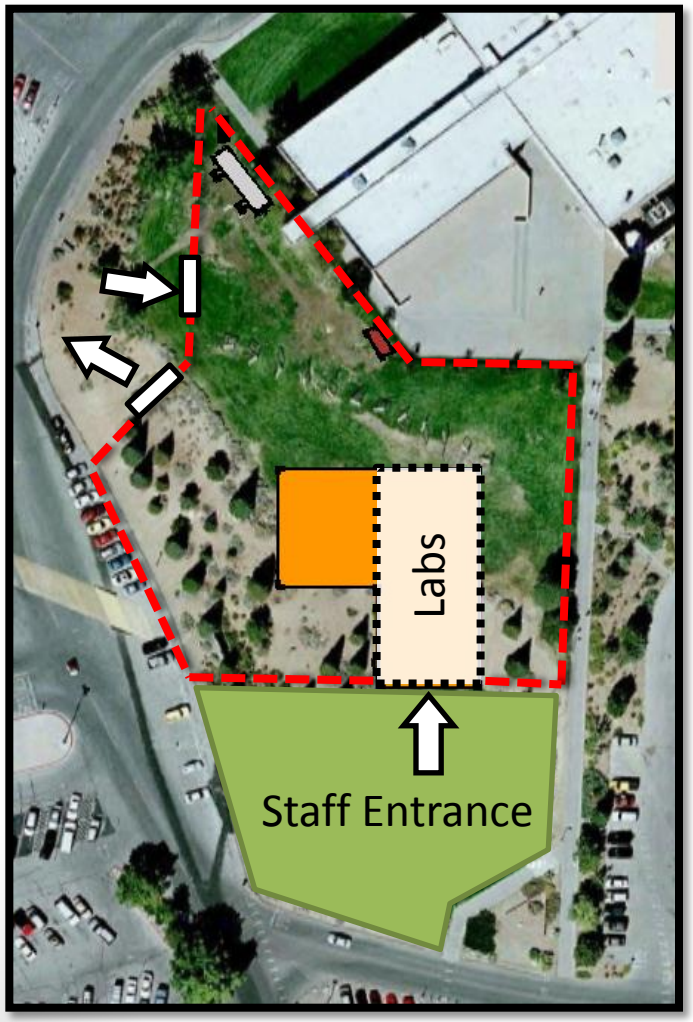
		Duration
1	Ridge Building	46 wks
2	PHASE 1 - PRECONSTRUCTION	7 wks
13	PHASE 2 - SUBSTRUCTURE AND SHELL	9.5 wks
14	Area 1 (Building)	9.5 wks
15	Ground Level	5.5 wks
26	Level 2	2 wks
35	Level 3	2.75 wks
44	Level 4	3.5 wks
52	Roof Level	4.5 wks
58	PHASE 3 - SERVICES AND INTERIORS	24.5 wks
59	Area 2 (Building)	24.5 wks
60	Ground Level	13.5 wks
79	Level 2	15 wks
98	Level 3	16 wks
114	Level 4	15.5 wks
130	PHASE 4 - LANDSCAPING AND CONTINGENCY	18 wks
131	Area 0 (Bottom)	3 wks
135	Area 0 (Top)	5 wks

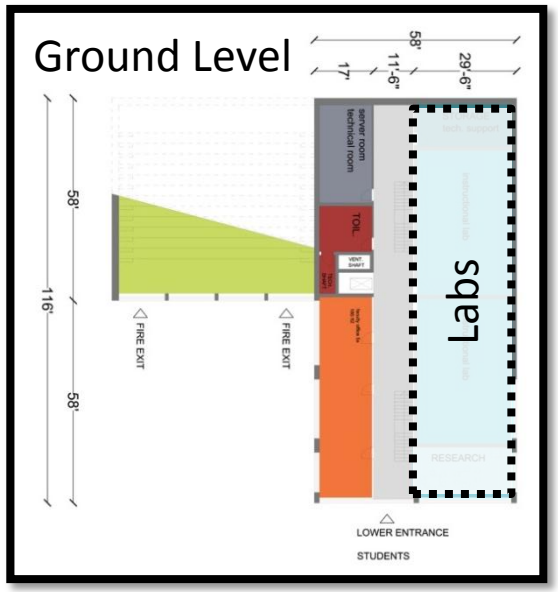


Milestones
Time Delta

Site Logistics: Early Lab Access







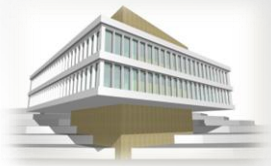
- Finish basement interior construction
- Adjust construction fence
- Secure all access from second floor to basement

Hard Hat Free Zone

Labs Zone

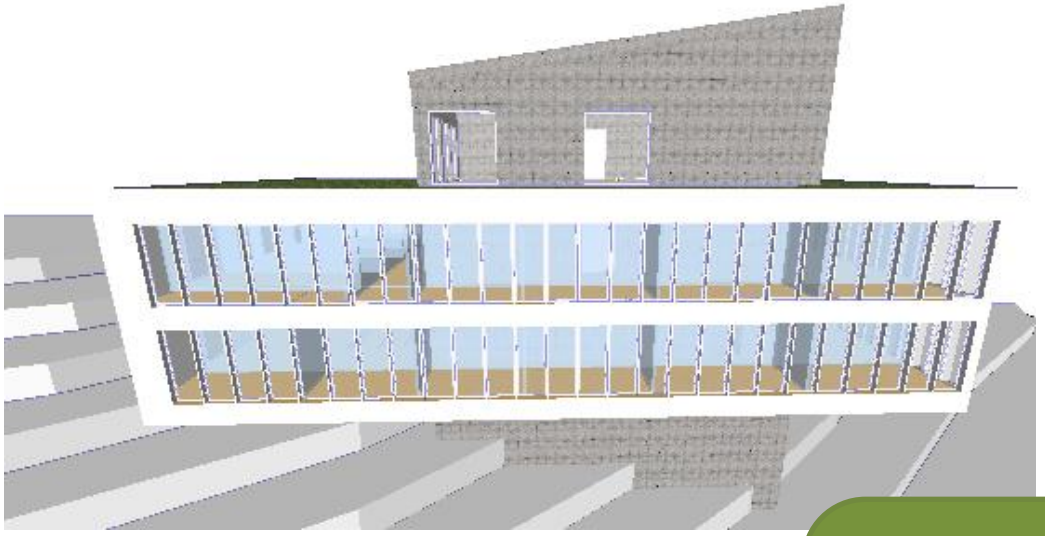
Construction Zone

Constructability: Core Concept



Cantilevers

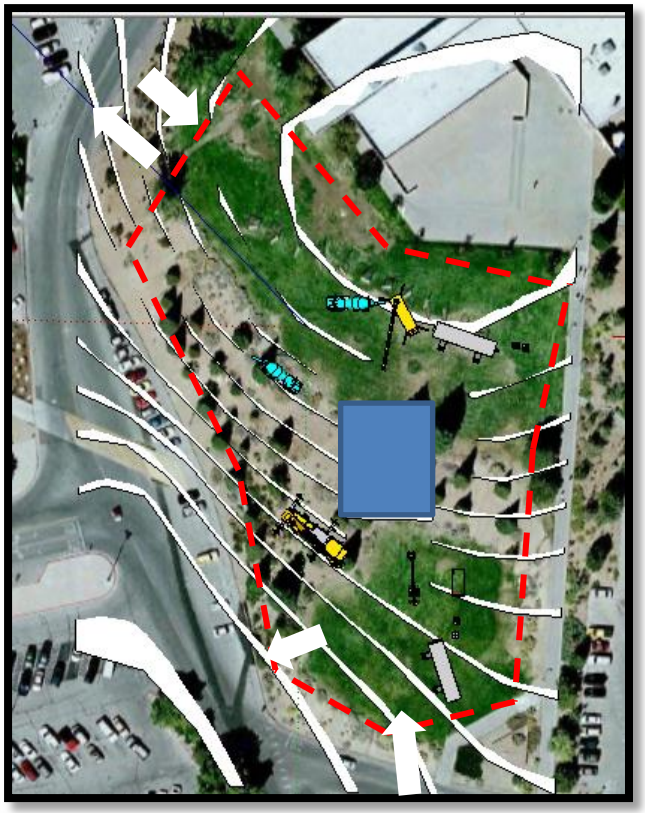
Structural Concepts

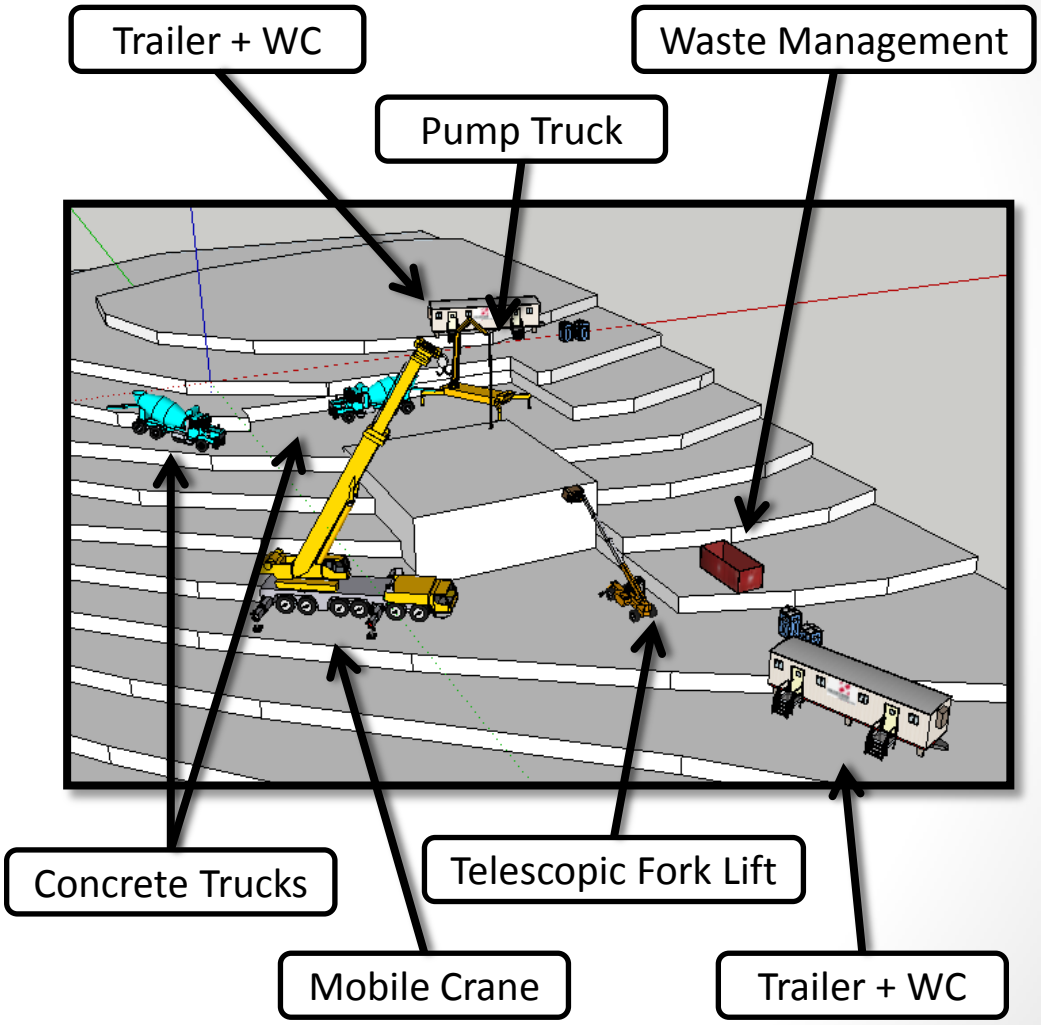


Need to carefully plan the scheduling for both designs in order to construct the building on time.

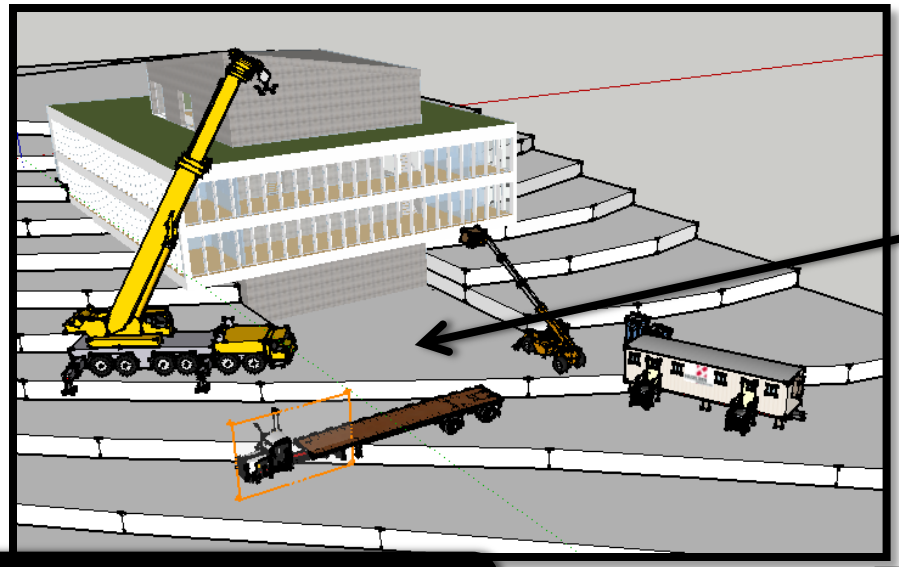
Trusses or Cables to support the cantilever? Trusses may not require the cantilevers to have temporary support, whereas a cable system will.

Site Logistics: Core Method





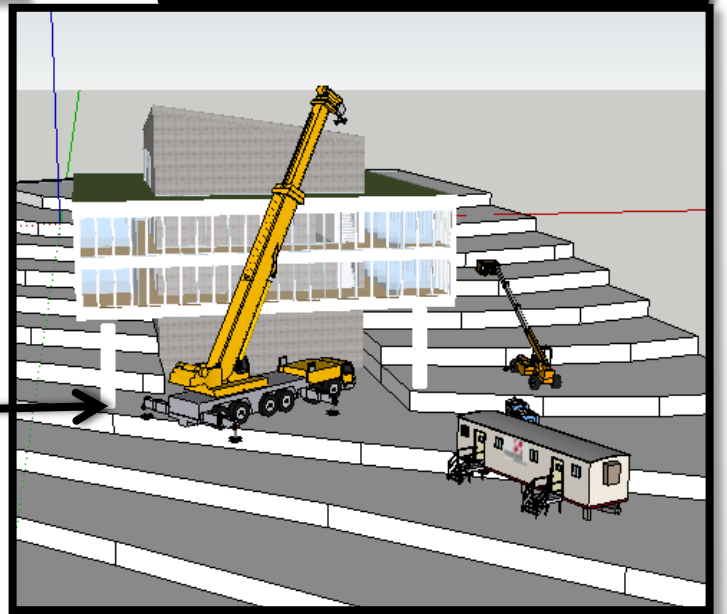
Site Logistics: Core Methods 1 & 2



Truss Assembly Area

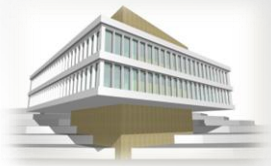
Truss System

Cable System



Temporary Supports

Schedule: Comparison

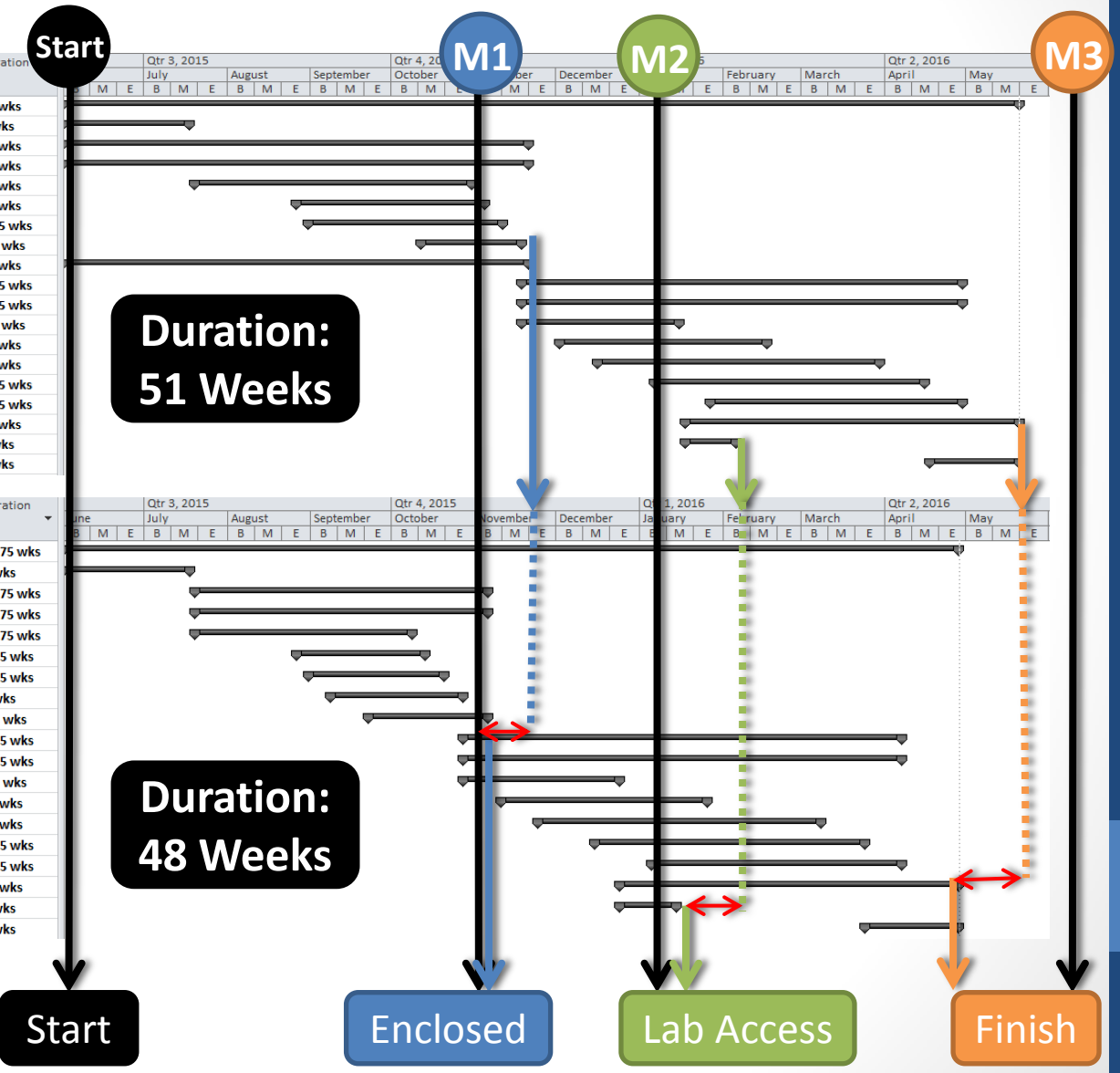


Truss System

	Task Name	Duration
1	Ridge Building	51 wks
2	PHASE 1 - PRECONSTRUCTION	7 wks
13	PHASE 2 - SUBSTRUCTURE AND SHELL	25 wks
14	Area 1 (Building)	25 wks
15	Ground Level	15 wks
26	Level 2	10 wks
36	Level 3 and 4	10.5 wks
45	Level 4	5.5 wks
52	Roof Level	25 wks
62	PHASE 3 - SERVICES AND INTERIORS	23.5 wks
63	Area 2 (Building)	23.5 wks
64	Ground Level	8.5 wks
80	Level 2	11 wks
99	Level 3	15 wks
118	Level 4	14.5 wks
134	Roof Level	13.5 wks
150	PHASE 4 - LANDSCAPING AND CONTINGENCY	18 wks
151	Area 0 (Bottom)	3 wks
155	Area 0 (Top)	5 wks

Cable System

	Task Name	Duration
1	Ridge Building	47.75 wks
2	PHASE 1 - PRECONSTRUCTION	7 wks
13	PHASE 2 - SUBSTRUCTURE AND SHELL	15.75 wks
14	Area 1 (Building)	15.75 wks
15	Ground Level	11.75 wks
26	Level 2	6.75 wks
36	Level 3	7.25 wks
46	Level 4	7 wks
55	Roof Level	6.5 wks
66	PHASE 3 - SERVICES AND INTERIORS	23.5 wks
67	Area 2 (Building)	23.5 wks
68	Ground Level	8.5 wks
84	Level 2	11 wks
103	Level 3	15 wks
122	Level 4	14.5 wks
138	Roof Level	13.5 wks
154	PHASE 4 - LANDSCAPING AND CONTINGENCY	18 wks
155	Area 0 (Bottom)	3 wks
159	Area 0 (Top)	5 wks



Milestones
Time Delta

AEMEP

Ridge Team 2/18/2011

Heavy Equipment Selection

Wacker Neuson
Small Turn Excavator
60032 • 80032

Excavator

Liebherr
LTM 1250-6.1

Mobile Crane
Max: 60m radius for 8.4 tons lift

Concrete Pump Truck
Max:42.6m radius

ZhengZhou
Boom Pump 50m

Light Equipment Selection

Fork Lift

Capacity: 9,000 lbs.

Max Height: 45 ft

Gradall
534D9-45

Wacker
RD 7H-ES

Excavation Roller

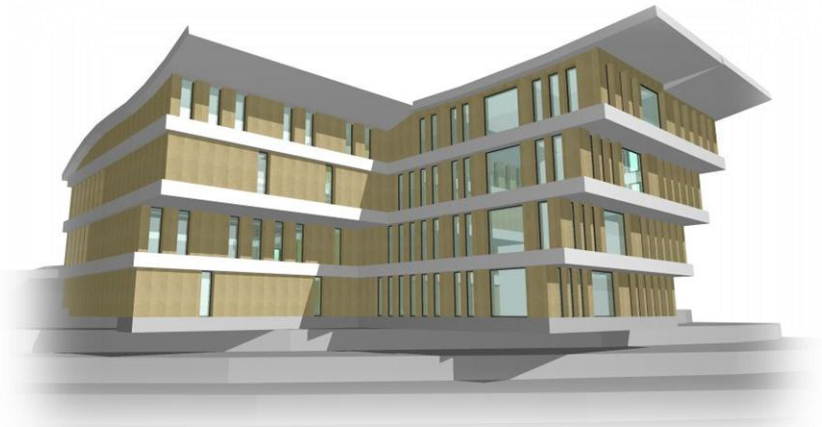
Volvo
MC60B

Skid Steer Loader

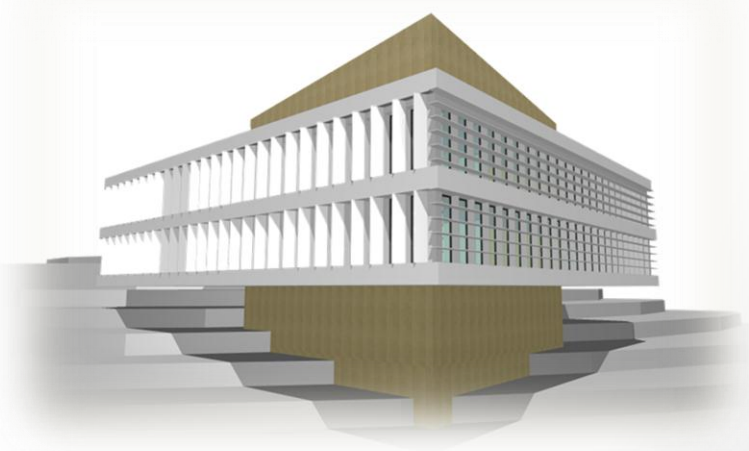
Capacity: 1400 lbs.

The Challenges:
Target Value Design

Lego Concept



Core Concept



TVD – Setting Targets

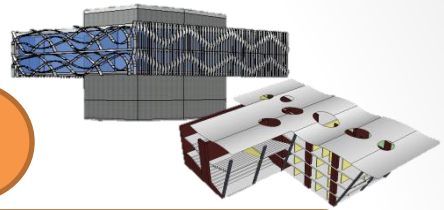
1

RSMeans S.F. Estimate

2 **$7,145,000**

Adjust RSMeans S.F. Estimate to our *Maximum Budget*

3



Consider 1 & 2 plus initial *design* concepts

1 2 3 ⇒ **Generate Initial Estimate and Targets**

4

Discuss ***options*** with *team* and design with a target!

5

Adjust based on feedback from *mentors* and *owners*.

6

(Next Step)

Discuss with owners, reset targets and commit to them!

4 5 6 ⇒ **Improve Estimate and Targets**

TVD – Estimate and Level of Detail

Line Items from Sub-Assembly TVD

Estimated Quantity

RS Means Unit Cost

Estimated Cost

Initial Source for Target Value

Team Chosen Target Value

	Assembly Number	Description	Quantity	Unit	Material O&P	Installation O&P	Total O&P	ESTIMATED VALUES % of Total	ESTIMATED VALUES OUR ESTIMATED VALUE	REFERENCE VALUES ESTIMATE VALUES % of Total	ESTIMATE VALUES RSMeans SQ.FT Estimate	MAX ADJUSTED VALUES % of Total	MAX ADJUSTED VALUES RSMeans Adjusted Value (MAX)	TARGET VALUE % of Total	TARGET VALUE TARGET VALUE	VALUE DELTA VALUE DELTA
B Shell TOTAL								25%	$ 1,821,662	25%	$ 1,762,000	31%	$ 2,208,682	30%	$ 2,125,000	$ 303,337.87
B1010 Floor Construction								15%	$ 1,062,737	11%	$ 803,500	14%	$ 1,007,194	14%	$ 1,000,000	$ (62,737)
	B10102086000	Steel column, W12, 400 KIPS, 16' unsupported height, 87 PLF	607.5	V.L.F.	$ 118.46	$ 7.89	$ 126.35	1%	$ 76,757.63							
	B10102088300	Steel column, W14, 800 KIPS, 16' unsupported height, 159 PLF	607.5	V.L.F.	$ 216.36	$ 7.89	$ 224.25	2%	$ 136,231.88							
	B10102525600	Floor, composite concrete slab on fireproofed W beam, 5" slab, 30'x30' bay, 34" total depth, 200 PSF superimposed load, 274 PSF total	25000	S.F.	$ 18.45	$ 14.33	$ 32.78	11%	$ 819,500.00							
	B10107203500	Fireproofing, gypsum board, fire rated, 1 layer, 1/2" thick, 10" steel column, 2 hour rating, 11 PLF	607.5	V.L.F.	$ 3.02	$ 21.59	$ 24.61	0%	$ 14,950.58							
	B10107203550	Fireproofing, gypsum board, fire rated, 1 layer, 1/2" thick, 14" steel column, 2 hour rating, 18 PLF	607.5	V.L.F.	$ 3.09	$ 22.09	$ 25.18	0%	$ 15,296.85							
B1020 Roof Construction								1%	$ 85,920	1%	$ 106,500	2%	$ 133,499	2%	$ 150,000	$ 64,080
	B10201125300	Floor, steel joists, beams, 1.5" 22 ga metal deck, on columns, 35'x35' bay, 28" deep, 20 PSF superimposed load, 42 PSF total load	12000	S.F.	$ 5.29	$ 1.87	$ 7.16	1%	$ 85,920.00							
B2010 Exterior Walls								2%	$ 143,730	6%	$ 440,500	8%	$ 552,171	4%	$ 300,000	$ 156,270
		GFRC Exterior Walls (60% wall, 40% window)	4791	S.F.	?	?	$ 30.00	2%	$ 143,730.00							
B2020 Exterior Windows								5%	$ 331,519	4%	$ 318,500	6%	$ 399,243	7%	$ 500,000	$ 168,481
	B20202102100	Aluminum flush tube frame, thermo-break frame, 2.25" x 4.5", 5'x6' opening, 2 intermediate horizontals	3712	S.F.	$ 29.94	$ 13.71	$ 43.65	2%	$ 162,028.80							
	B20202201700	Glazing panel, insulating, 1" thick units, 2 lites, light and heat reflective glass, tinted	3712	S.F.	$ 36.04	$ 9.62	$ 45.66	2%	$ 169,489.92							
B2030 Exterior Doors								0%	$ 33,907	0%	$ 23,000	0%	$ 28,831	0%	$ 25,000	$ (8,907)
	B20301106450	Door, aluminum & glass, without transom, wide stile, double door, hardware, 6'-0" x 7'-0" opening	6	Opng.	$ 4,075.58	$ 1,575.60	$ 5,651.18	0%	$ 33,907.08							
B3010 Roof Coverings								2%	$ 163,849	1%	$ 70,000	1%	$ 87,746	2%	$ 150,000	$ (13,849)
	B30101051600	Roofing, asphalt flood coat, gravel, base sheet, 4 plies 15# asphalt felt, mopped	12000	S.F.	$ 1.28	$ 1.63	$ 2.91	0%	$ 34,920.00							
	B30103201950	Insulation, rigid, roof deck, extruded polystyrene, 25 PSI compressive strength, 2" thick, R10	12000	S.F.	$ 1.29	$ 0.34	$ 1.63	0%	$ 19,560.00							
	B30101206500	Roofing, single ply membrane, reinforced, PVC, 60 mils, fully adhered, adhesive	12000	S.F.	$ 1.43	$ 0.82	$ 2.25	0%	$ 27,000.00							
	B30104201000	Roof edges, aluminum, mill finish, .050" thick, 4" face	474	L.F.	$ 13.66	$ 8.26	$ 21.92	0%	$ 10,390.08							
	B30104300040	Flashing, aluminum, no backing sides, .019"	12000	S.F.	$ 1.19	$ 2.95	$ 4.14	1%	$ 49,680.00							
	B30202100500	Roof hatch, with curb, 1" fiberglass insulation, 2'-6" x 4'-6", aluminum curb and cover, 150lbs	15	Opng.	$ 946.22	$ 204.81	$ 1,151.03	0%	$ 17,265.45							
	B30106305100	Gravel stop, aluminum, extruded, 4", mill finish, .050" thick	474	L.F.	$ 6.83	$ 3.79	$ 10.62	0%	$ 5,033.88							

TVD – Influencing Design

Options for Discussion

Floor

Quantity	Assembly Number	Description	Unit	Material O&P	Installation O&P	Total O&P
1	B10102082800	Steel column, W8, 100 KIPS, 10' unsupported height, 24 PLF	V.L.F.	$ 35.24	$ 10.49	$ 45.73
1	B10102083000	Steel column, W8, 100 KIPS, 16' unsupported height, 31 PLF	V.L.F.	$ 42.10	$ 7.89	$ 49.99
1	B10102083200	Steel column, W8, 100 KIPS, 20' unsupported height, 40 PLF	V.L.F.	$ 51.40	$ 7.89	$ 59.29
1	B10102084600	Steel column, W10, 200 KIPS, 10' unsupported height, 45 PLF	V.L.F.	$ 66.08	$ 10.49	$ 76.57
1	B10102084800	Steel column, W10, 200 KIPS, 16' unsupported height, 49 PLF	V.L.F.	$ 66.57	$ 7.89	$ 74.46
1	B10102085000	Steel column, W12, 200 KIPS, 20' unsupported height, 58 PLF	V.L.F.	$ 74.40	$ 7.89	$ 82.29
1	B10102085200	Steel column, W14, 300 KIPS, 10' unsupported height, 61 PLF	V.L.F.	$ 89.58	$ 10.49	$ 100.07
1	B10102085400	Steel column, W12, 300 KIPS, 16' unsupported height, 72 PLF	V.L.F.	$ 97.90	$ 7.89	$ 105.79
1	B10102085600	Steel column, W12, 300 KIPS, 20' unsupported height, 79 PLF	V.L.F.	$ 101.82	$ 7.89	$ 109.71

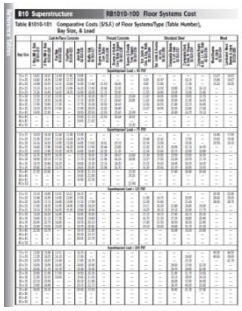
EXTERIOR WALLS

Quantity	Assembly Number	Description	Unit	Material O&P	Installation O&P	Total O&P
1	B20101012100	Concrete wall, reinforced, 8' high, 6" thick, plain finish, 3000 PSI	S.F.	$ 4.68	$ 12.20	$ 16.88
1	B20101014550	Concrete wall, reinforced, 8' high, 8" thick, aged wood liner, 3000 PSI	S.F.	$ 6.76	$ 14.19	$ 20.95
1	B20101015600	Concrete wall, reinforced, 8' high, 10" thick, plain finish, 3000 PSI	S.F.	$ 6.49	$ 12.86	$ 19.35
1	B20101091200	Concrete block (CMU) wall, regular weight, hollow, 4 x 8 x 16, 2000 PSI	S.F.	$ 2.00	$ 4.65	$ 6.65
1	B20101091450	Concrete block (CMU) wall, regular weight, hollow, 8 x 8 x 16, 4500 PSI, perlite core fill	S.F.	$ 4.31	$ 5.62	$ 9.93
1	B20101131360	Concrete block (CMU) wall, split rib, 16 ribs, regular weight, hollow, 6 x 8 x 16, perlite core fill	S.F.	$ 5.66	$ 6.42	$ 12.08
1	B20101251160	Brick wall, standard, solid, single wythe, 4" thick, common bond	S.F.	$ 7.49	$ 12.48	$ 19.97
1	B20101264150	Brick wall, standard, solid, double wythe, 8" thick, 1/2" thick collar joint	S.F.	$ 11.98	$ 18.22	$ 30.20
1	B20101321200	Brick wall, composite double wythe, standard face/CMU back-up, 8" thick, perlite core fill	S.F.	$ 10.42	$ 17.01	$ 27.43
1	B20101282350	Stone wall, ashlar veneer, 4" thick, 8' high, 8" CMU back-up, low priced stone	S.F.	$ 16.36	$ 20.20	$ 36.56
1	B20101355180	Brick wall, core, standard face, 6" lightweight CMU back-up, 10" thick, perlite core fill	S.F.	$ 9.81	$ 16.00	$ 25.81

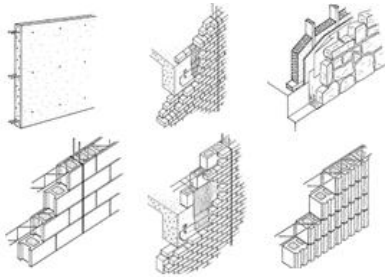
EXTERIOR WINDOWS

Quantity	Assembly Number	Description	Unit	Material O&P	Installation O&P	Total O&P
Frame						
1	B20202102000	Aluminum flush tube frame, thermo-break frame, 2.25" x 4.5", 5'x6' opening, no intermediate horizontals	S.F.	$ 17.97	$ 9.38	$ 27.35
1	B20202102050	Aluminum flush tube frame, thermo-break frame, 2.25" x 4.5", 5'x6' opening, 1intermediate horizontal	S.F.	$ 23.84	$ 11.57	$ 35.41
1	B20202102100	Aluminum flush tube frame, thermo-break frame, 2.25" x 4.5", 5'x6' opening, 2 intermediate horizontals	S.F.	$ 29.94	$ 13.71	$ 43.65
Glazing Panels						
1	B20202201000	Glazing panel, insulating, 1/2" thick, 2 lites 1/8" float glass, clear	S.F.	$ 11.48	$ 8.61	$ 20.09
1	B20202201400	Glazing panel, insulating, 1" thick units, 2 lites, 1/4" float glass, clear	S.F.	$ 19.07	$ 10.87	$ 29.94
1	B20202201700	Glazing panel, insulating, 1" thick units, 2 lites, light and heat reflective glass, tinted	S.F.	$ 36.04	$ 9.62	$ 45.66

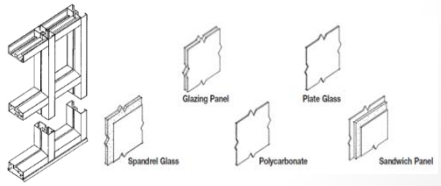
Floor Systems



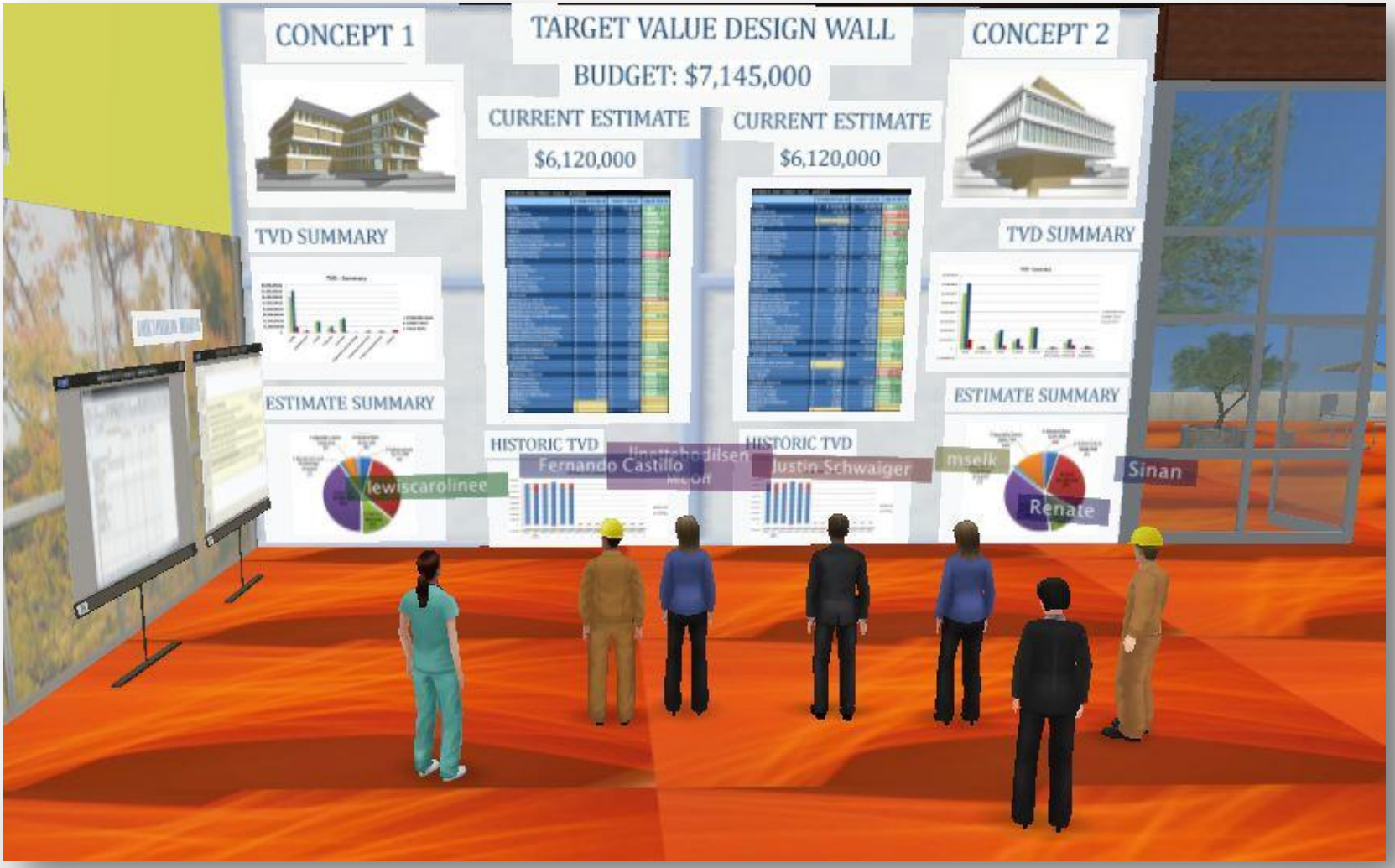
Exterior Walls



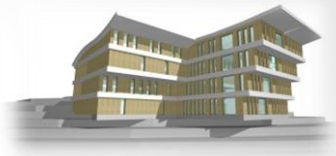
Exterior Windows

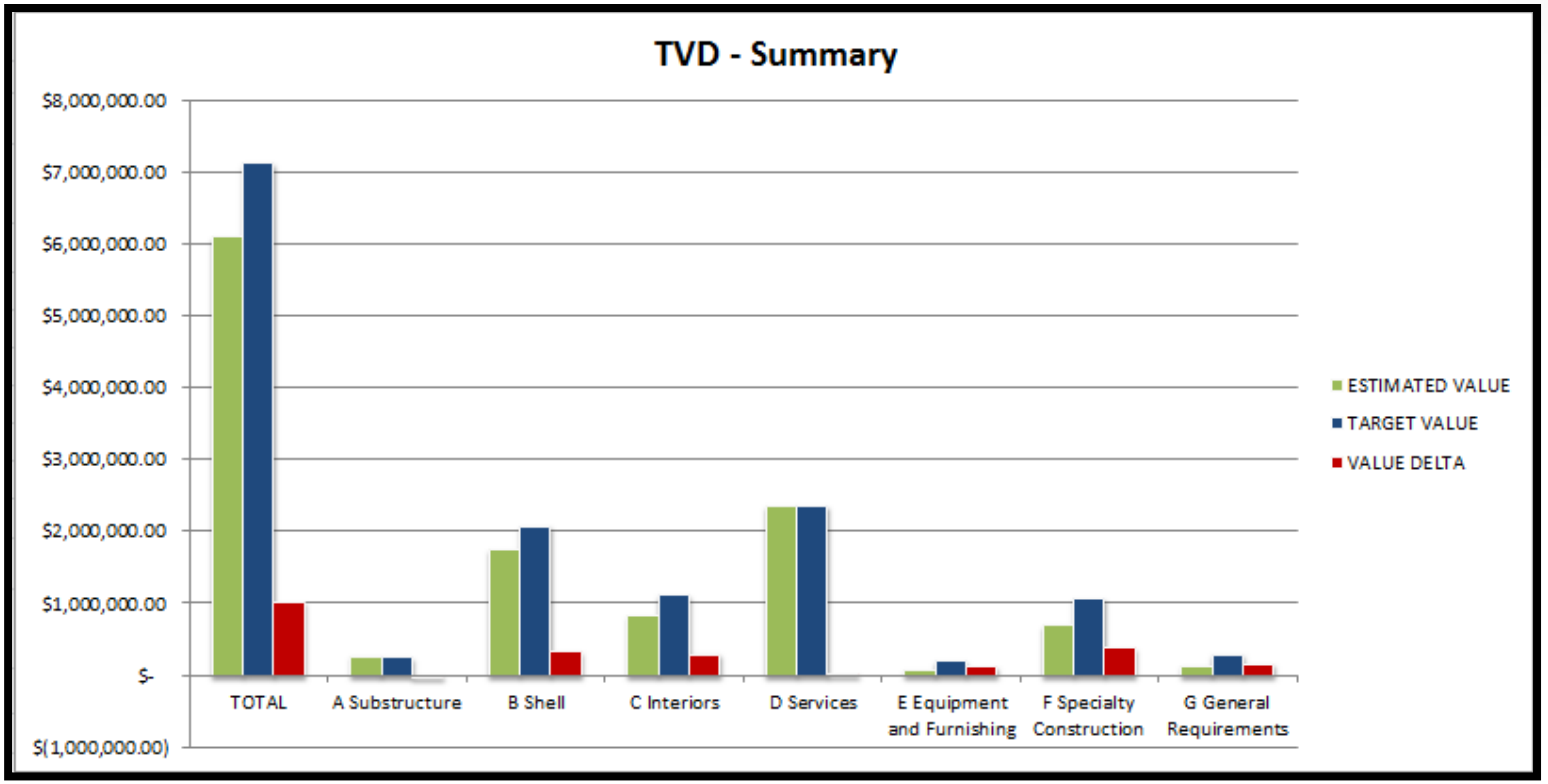


TVD – The Target Value Design Wall



TVD Results: Lego Concept

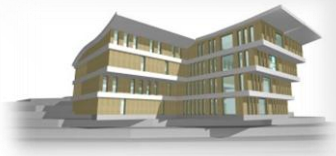




ESTIMATE AND TARGET VALUE - SUMMARY			
	ESTIMATED VALUE	TARGET VALUE	VALUE DELTA
TOTAL	$ 6,119,648.87	$7,145,000.00	$ 1,025,351
A Substructure	$ 277,246.20	$ 385,000.00	$ 107,754
B Shell	$ 1,850,189.24	$ 1,925,000.00	$ 74,811
C Interiors	$ 827,618.20	$ 1,100,000.00	$ 272,382
D Services	$ 2,362,154.22	$ 2,514,000.00	$ 151,846
E Equipment and Furnishing	$ 74,633.13	$ 100,000.00	$ 25,367
F Specialty Construction	$ 295,412.50	$ 350,000.00	$ 54,588
G General Requirements	$ 155,149.18	$ 300,000.00	$ 144,851
H Others	$ -	$ 471,000.00	$ 471,000

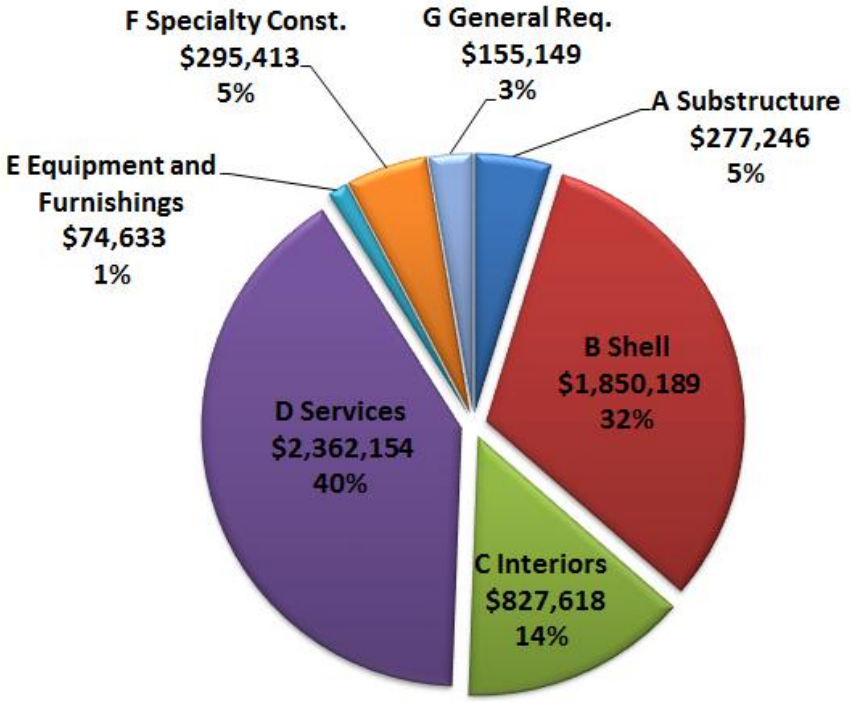
ESTIMATE AND TARGET VALUE - SUMMARY			
	ESTIMATED VALUE	TARGET VALUE	VALUE DELTA
TOTAL	$ 6,118,906.67	$ 7,145,000.00	$ 1,026,093
A Substructure	$ 268,100.30	$ 250,000.00	$ (18,100)
B Shell	$ 1,756,677.62	$ 2,085,000.00	$ 328,322
C Interiors	$ 827,618.20	$ 1,125,000.00	$ 297,382
D Services	$ 2,362,154.22	$ 2,364,000.00	$ 1,846
E Equipment and Furnishing	$ 74,633.13	$ 200,000.00	$ 125,367
F Specialty Construction	$ 693,764.02	$ 1,075,000.00	$ 381,236
G General Requirements	$ 135,959.18	$ 296,000.00	$ 160,041

Cost Estimate: Lego Concept



ESTIMATE AND TARGET VALUE - DETAILED			
	ESTIMATED VALUE	TARGET VALUE	VALUE DELTA
TOTAL	$ 6,119,649	$ 7,145,000	$ 1,025,351
A Substructure	$ 277,246	$ 385,000	$ 107,754
A1010 Standard Foundations	$ 62,539	$ 110,000	$ 47,461
A1030 Slab on Grade	$ 74,300	$ 75,000	$ 700
A2020 Basement Walls	$ 140,407	$ 200,000	$ 59,593
B Shell	$ 1,850,189	$ 1,925,000	$ 74,811
B1010 Floor Construction	$ 736,651	$ 750,000	$ 13,349
B1020 Roof Construction	$ 85,920	$ 150,000	$ 64,080
B2010 Exterior Walls (excludes slanted)	$ 270,000	$ 300,000	$ 30,000
B2020 Exterior Windows	$ 464,412	$ 500,000	$ 35,588
B2030 Exterior Doors	$ 33,907	$ 25,000	$ (8,907)
B3010 Roof Coverings	$ 259,299	$ 200,000	$ (59,299)
C Interiors	$ 827,618	$ 1,100,000	$ 272,382
C1010 Partitions	$ 161,600	$ 175,000	$ 13,400
C1020 Interior Doors	$ 42,374	$ 175,000	$ 132,626
C1030 Fittings	$ 13,885	$ 25,000	$ 11,115
C2010 Stair Construction	$ 116,609	$ 125,000	$ 8,391
C3010 Wall Finishes	$ 106,800	$ 175,000	$ 68,200
C3020 Floor Finishes	$ 174,250	$ 200,000	$ 25,750
C3030 Ceiling Finishes	$ 212,100	$ 225,000	$ 12,900
D Services	$ 2,362,154	$ 2,514,000	$ 151,846
D1010 Elevators and Lifts	$ 156,118	$ 150,000	$ (6,118)
D2010 Plumbing Fixtures	$ 503,500	$ 503,500	$ -
D2020 Domestic Water Distribution	$ 76,000	$ 76,000	$ -
D2040 Rain Water Drainage	$ 19,000	$ 19,000	$ -
D3050 Heating, Cooling, and Distribution	$ 592,037	$ 750,000	$ 157,963
D4010 Sprinklers	$ 92,000	$ 92,000	$ -
D4020 Standpipes	$ 9,000	$ 9,000	$ -
D5010 Electrical Service/Distribution	$ 221,000	$ 221,000	$ -
D5020 Lighting and Branch Wiring	$ 437,000	$ 437,000	$ -
D5030 Communications and Security	$ 233,500	$ 233,500	$ -
D5090 Other Electrical Systems	$ 23,000	$ 23,000	$ -
E Equipment and Furnishings	$ 74,633	$ 100,000	$ 25,367
E Auditorium Equipment	$ 33,533	$ 50,000	$ 16,467
E Auditorium Furnishing	$ 41,100	$ 50,000	$ 8,900
F Specialty Construction	$ 295,413	$ 350,000	$ 54,588
Curvy Roof Extras	$ 100,000	$ 100,000	$ -
Sheer Walls	$ 95,413	$ 150,000	$ 54,588
Façade Elements	$ 100,000	$ 100,000	$ -
G Building Sitework	$ 155,149	$ 300,000	$ 144,851
G1030 Excavation	$ 25,920	$ 50,000	$ 24,080
G2050 Landscaping	$ 25,000	$ 50,000	$ 25,000
G3010 Water Supply	$ 22,660	$ 50,000	$ 27,340
G3020 Sanitary Sewer	$ 10,915	$ 50,000	$ 39,085
G4010 Electrical Distribution	$ 20,654	$ 50,000	$ 29,346
Mobilization	$ 50,000	$ 50,000	$ -
Rent Penalties	$ -	$ -	$ -
Parking	$ -	$ -	$ -
H Others	$ -	$ 471,000	$ -

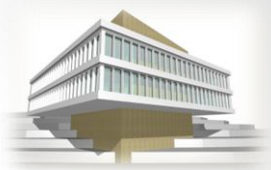
VALUE DELTA: $1,000,000



Structure M1 (Standard): $736,000

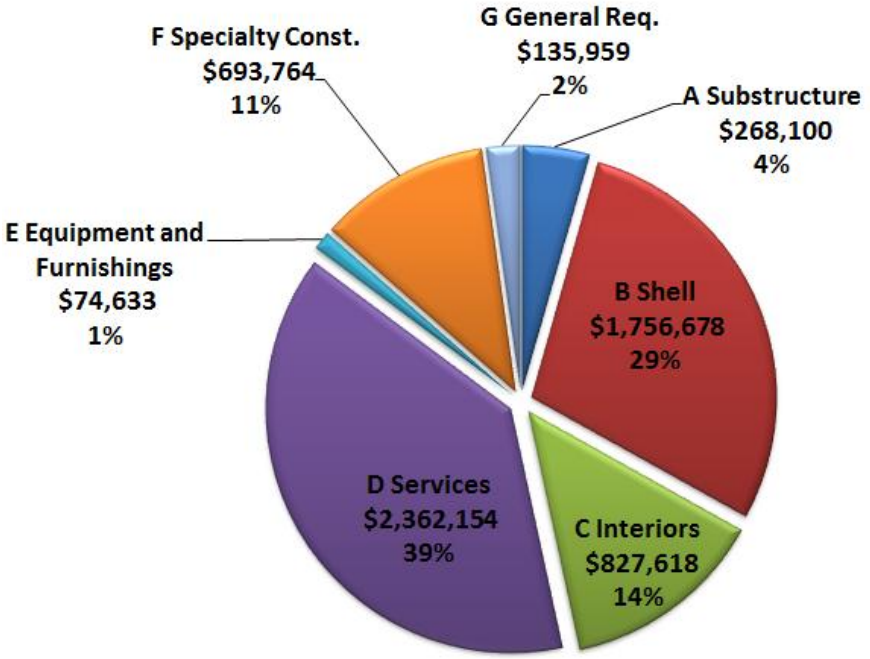
Structure M2 (ConXtech): $750,000

Cost Estimate Core Concept

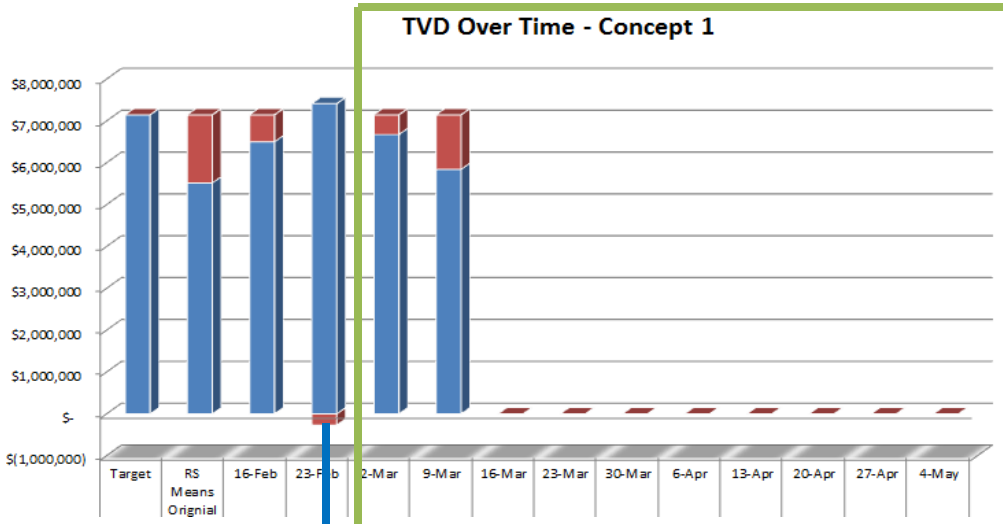


ESTIMATE AND TARGET VALUE - DETAILED			
	ESTIMATED VALUE	TARGET VALUE	VALUE DELTA
TOTAL	$ 6,118,906.67	$ 7,145,000.00	$ 1,026,093
A Substructure	$ 268,100.30	$ 250,000.00	$ (18,100)
A1010 Standard Foundations	$ 132,525	$ 70,000	$ (62,525)
A1030 Slab on Grade	$ -	$ 80,000	$ -
A2020 Basement Walls	$ 135,575	$ 100,000	$ (35,575)
B Shell	$ 1,756,677.62	$ 2,085,000.00	$ 328,322
B1010 Floor Construction	$ 1,062,737	$ 800,000	$ (262,737)
B1020 Roof Construction	$ 85,920	$ 150,000	$ 64,080
B2010 Exterior Walls	$ 167,685	$ 500,000	$ 332,315
B2020 Exterior Windows	$ 242,579	$ 400,000	$ 157,421
B2030 Exterior Doors	$ 33,907	$ 35,000	$ 1,093
B3010 Roof Coverings	$ 163,849	$ 200,000	$ 36,151
C Interiors	$ 827,618.20	$ 1,125,000.00	$ 297,382
C1010 Partitions	$ 161,600	$ 200,000	$ 38,400
C1020 Interior Doors	$ 42,374	$ 200,000	$ 157,626
C1030 Fittings	$ 13,885	$ 50,000	$ 36,115
C2010 Stair Construction	$ 116,609	$ 120,000	$ 3,391
C3010 Wall Finishes	$ 106,800	$ 150,000	$ 43,200
C3020 Floor Finishes	$ 174,250	$ 180,000	$ 5,750
C3030 Ceiling Finishes	$ 212,100	$ 225,000	$ 12,900
D Services	$ 2,362,154.22	$ 2,364,000.00	$ 1,846
D1010 Elevators and Lifts	$ 156,118	$ 150,000	$ (6,118)
D2010 Plumbing Fixtures	$ 503,500	$ 503,500	$ -
D2020 Domestic Water Distribution	$ 76,000	$ 76,000	$ -
D2040 Rain Water Drainage	$ 19,000	$ 19,000	$ -
D3040 Distribution Systems	$ 141,018		
D3050 Terminal and Package Units	$ 451,019	$ 600,000	$ 148,981
D4010 Sprinklers	$ 92,000	$ 92,000	$ -
D4020 Standpipes	$ 9,000	$ 9,000	$ -
D5010 Electrical Service/Distribution	$ 221,000	$ 221,000	$ -
D5020 Lighting and Branch Wiring	$ 437,000	$ 437,000	$ -
D5030 Communications and Security	$ 233,500	$ 233,500	$ -
D5090 Other Electrical Systems	$ 23,000	$ 23,000	$ -
E Equipment and Furnishings	$ 74,633.13	$ 200,000.00	$ 125,367
E Auditorium Equipment	$ 33,533	$ 150,000	$ 116,467
E Auditorium Furnishing	$ 41,100	$ 50,000	$ 8,900
F Specialty Construction	$ 693,764.02	$ 1,075,000.00	$ 381,236
Roof Extras	$ 160,500	$ 250,000	$ 89,500
Base Isolation (0 if brace frame)	$ -	$ -	$ -
Lateral Brace Framing (0 if base isolation)	$ -	$ -	$ -
Retaining Walls	$ 37,852	$ -	$ (37,852)
Truss System	$ 400,000	$ -	$ (400,000)
Sheer Walls	$ 95,413	$ 750,000	$ 654,588
G Building Sitework	$ 135,959.18	$ 296,000.00	$ 160,041
G1030 Excavation	$ 20,160	$ 50,000	$ 29,840
G2050 Landscaping	$ 25,000	$ 50,000	$ 25,000
G3010 Water Supply	$ 13,596	$ 50,000	$ 36,404
G3020 Sanitary Sewer	$ 6,549	$ 46,000	$ 39,451
G4010 Electrical Distribution	$ 20,654	$ 50,000	$ 29,346
Mobilization	$ 50,000	$ 50,000	$ -
Parking	$ -	$ -	$ -

VALUE DELTA: $1,000,000

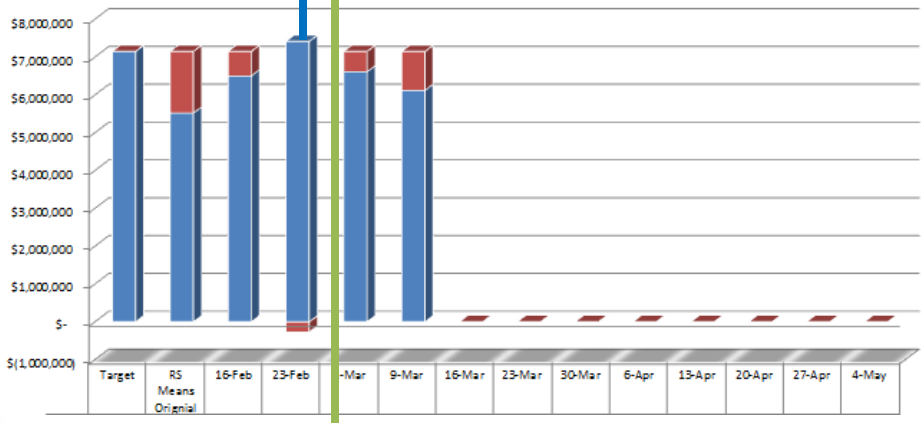


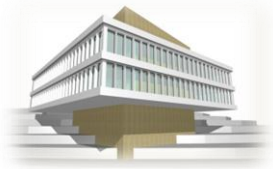
Historic TVD: Lego and Core



Concepts Diverge

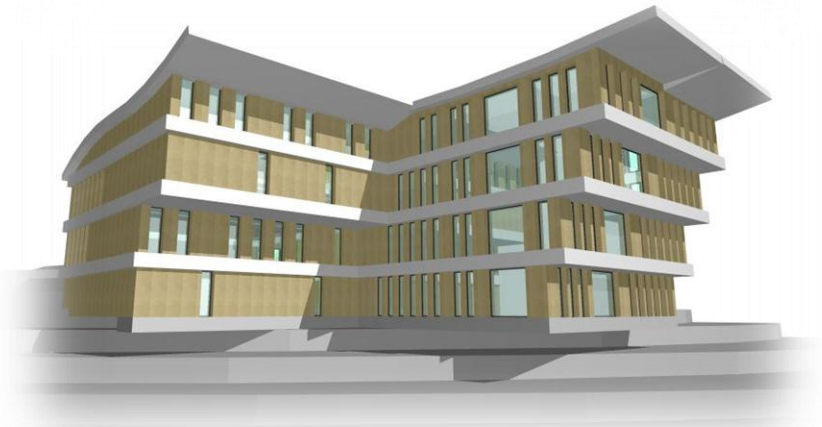
Estimate exceeded the target value



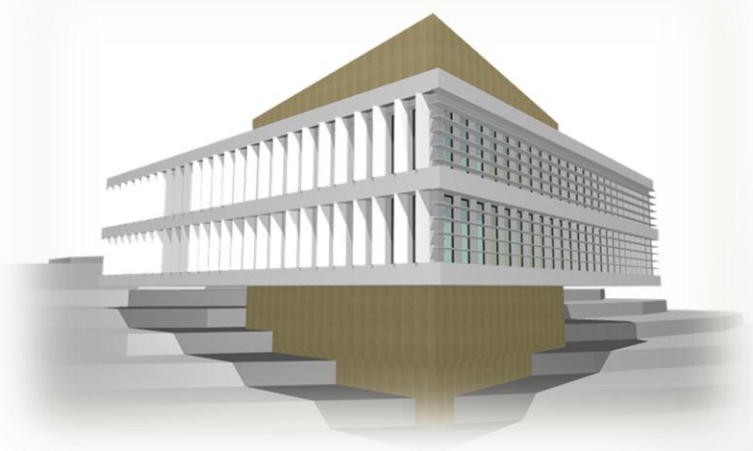


The Challenges:
Being Native

Lego Concept



Core Concept



Being Native

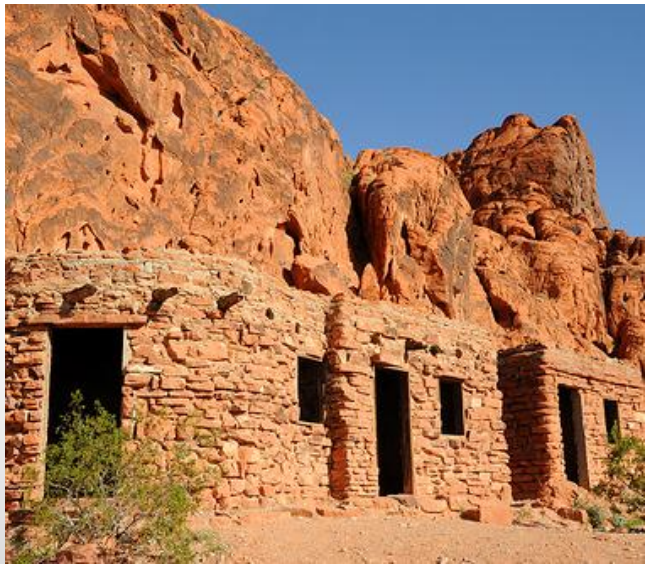
SOCIAL INTEGRATION

LOCAL STUDENTS

RECYCLE (PARTICIPATE)

REUSE

PHYSICAL INTEGRATION



LOCAL MATERIAL

Local Providers

University of Nevada, Reno

10 Miles 20 Miles 30 Miles

Steel Fabrication and Erection

MARTIN IRON WORKS, INC.

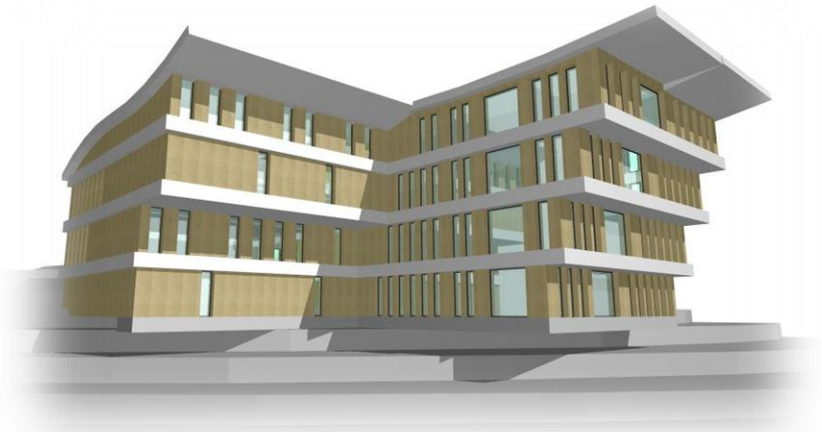
Concrete

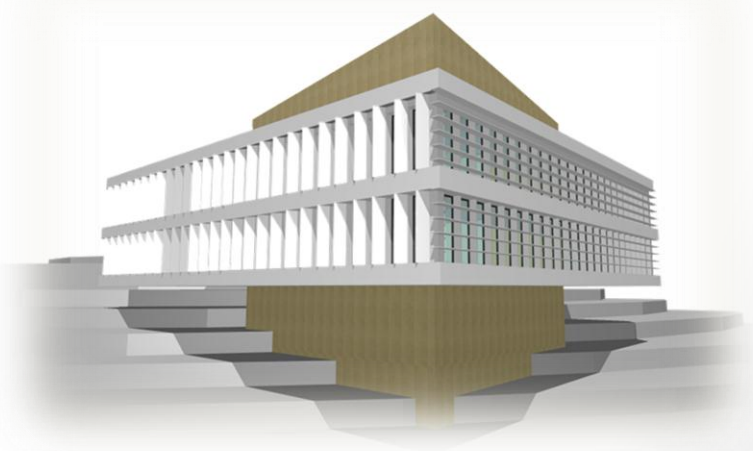
Quality Concrete Construction, LLC

Cement

NEVADA CEMENT COMPANY

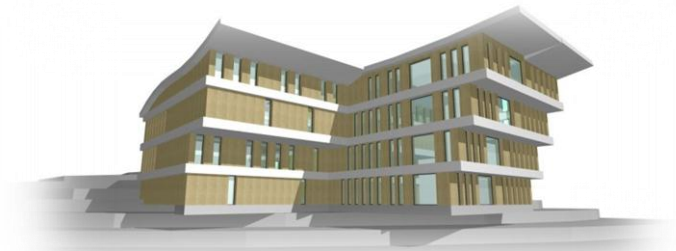
Decision Matrix
and
Team Process





Decision Matrix

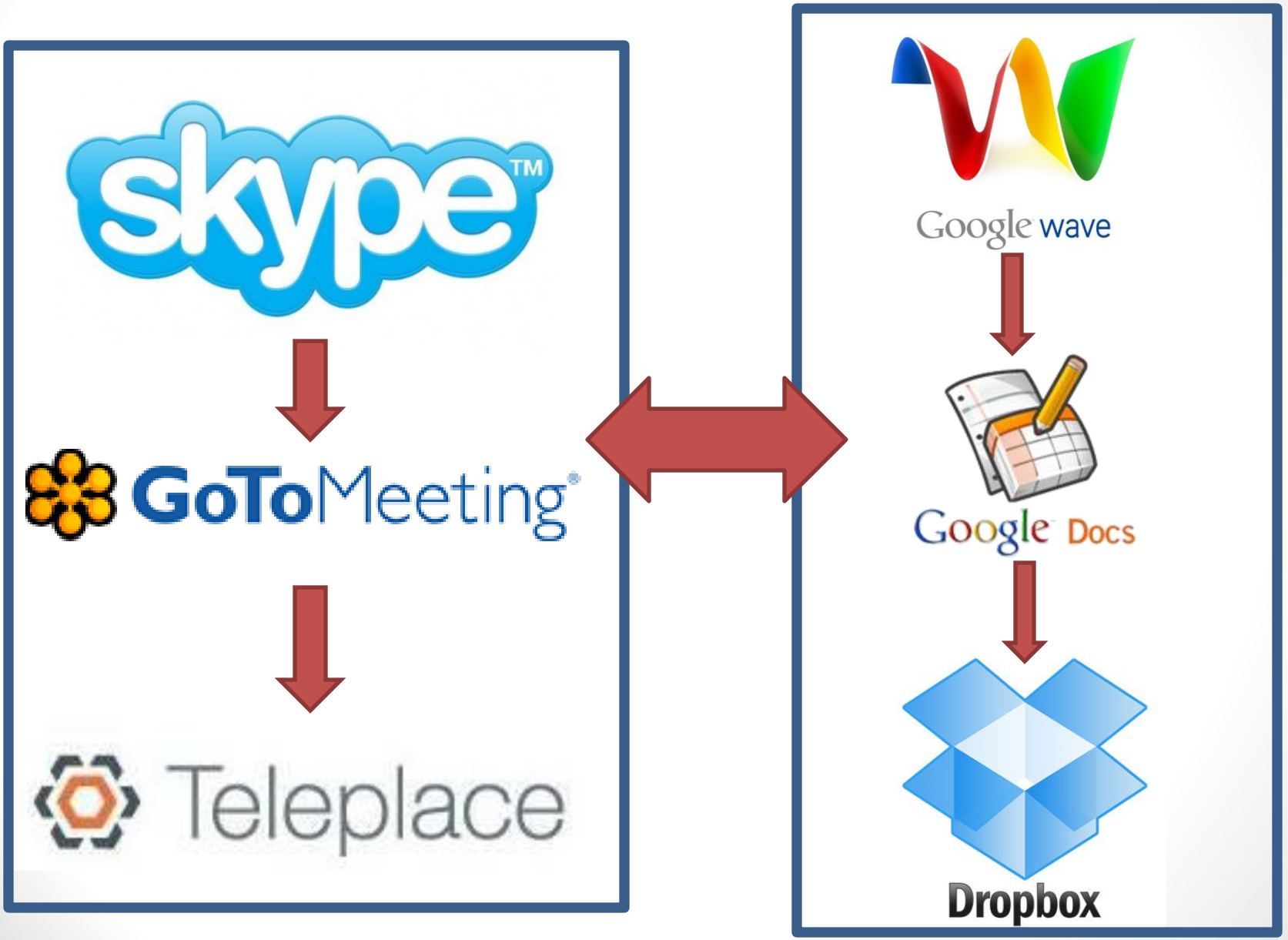
Lego Concept



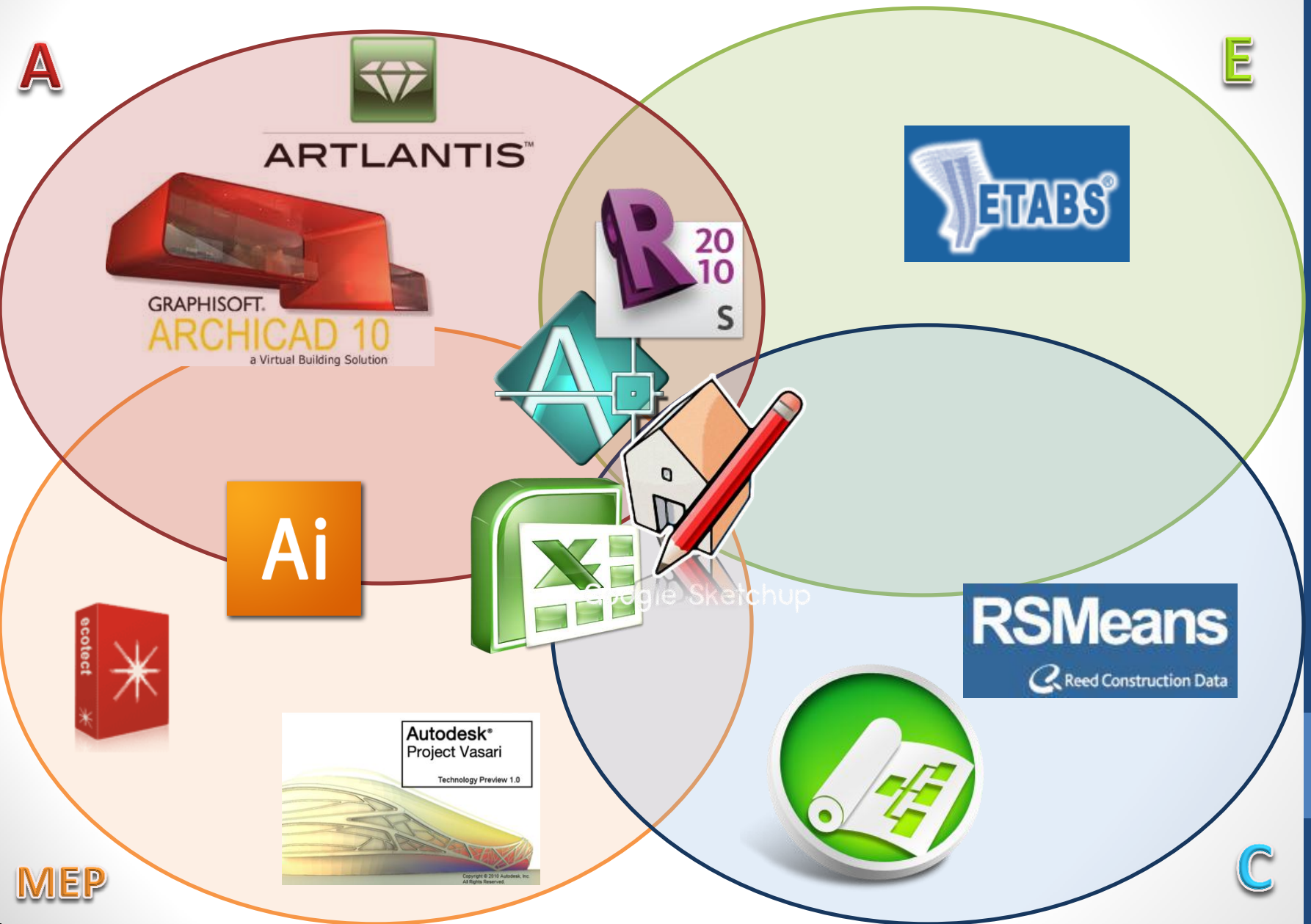
Core Concept

	Shear Walls	ConXtech	Truss Systems	Cable System
Sustainability				
Being Native	30	30	20	20
Building Envelope in terms of Energy Consumption	30	30	30	20
MEP systems's energy consumption	24	24	24	16
optimizing active systems	12	12	12	6
Economy				
Estimate's compliance to target	20	20	20	20
Structural cost	15	15	5	10
Achievement of milestones	18	27	18	18
Discipline Based				
Complexity Level	12	18	18	12
Clarity of Concept/Idea	20	20	30	10
Clarity of Program Organization	15	15	10	10
Additional Int&ext Social Space	15	15	5	5
Constructability	20	30	20	10
TOTAL	**231**	**256**	**212**	**157**

Communications



Use of Software



LEED

- MATERIALS
  - Recycled
  - Local
- ENERGY USAGE
  - Geothermal
  - Sun Shades
  - Natural lighting
  - Natural ventilation during night time
- Bicycle racks

Lessons Learned

This is a Learning Experience!

Team collaboration makes everything easier

Constantly seek mentors advice in advance

Fulfilling commitment to self manage the task list is difficult

Thanks To:

Erik Kneer
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Greg Luth

Josh Odelson
Anja Jutraz

Questions?

Renate
Mentors
Classmates

Alex Ershov
Adhamina Rodrigez
Daniel Gonzales
Henning Roedel