

# TEAM CENTRAL - UCLA

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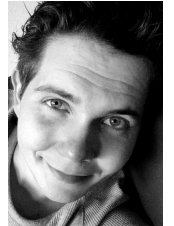
**CM**  
RYAN  
USA



**LCFM**  
NORAYR  
GERMANY



**SE**  
MANDY  
GERMANY



**A**  
JAKOB  
DENMARK

EVA  
GERMANY

HAN  
CHINA

MELISSA  
USA

ALEŠ  
SLOVENIA

TAWA  
USA

NICOLAJ  
DENMARK

BIRTHE  
DENMARK

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LCFM

CM

SE

SE

CM

A

MEP

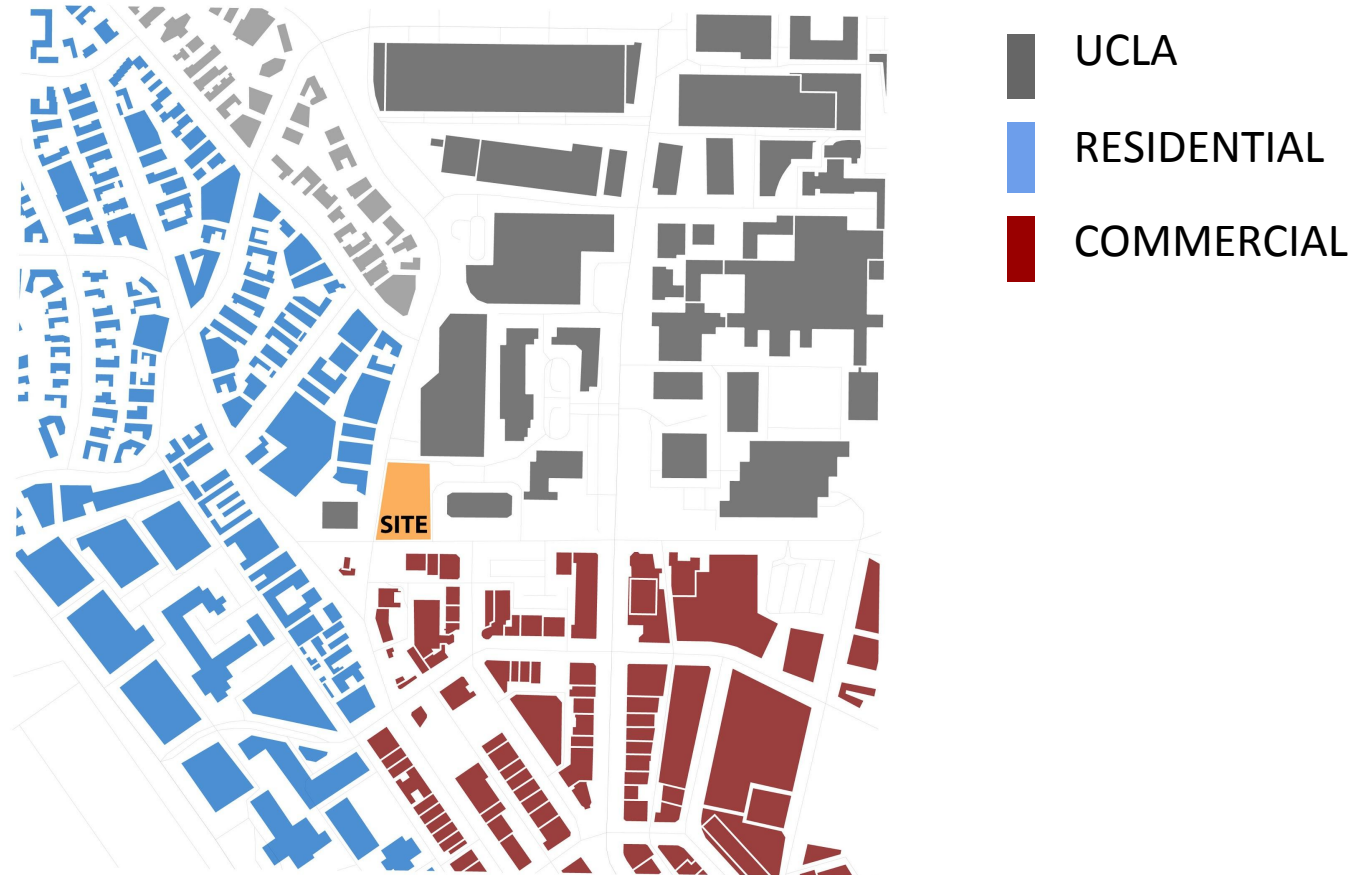
# SITE LOCATION

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# INTERSECTION OF COMMUNITIES

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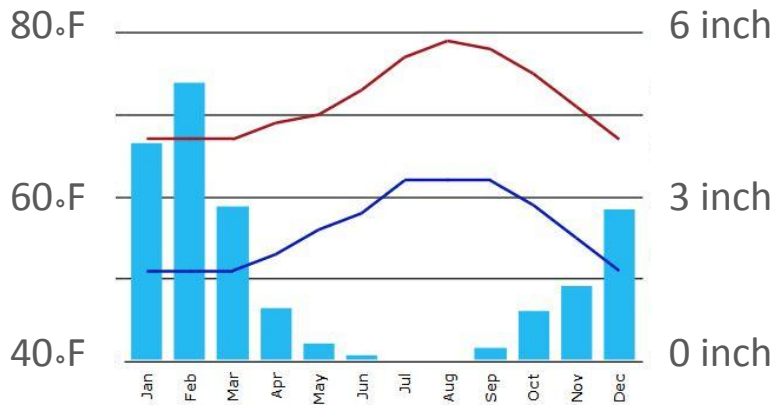
# CONDITION ON SITE

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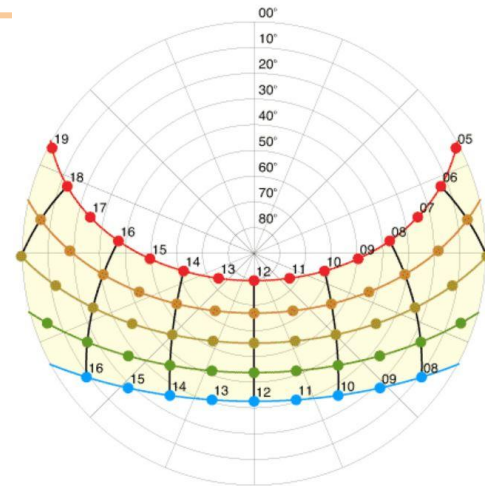
# CLIMATE CONDITIONS

## Temperature and precipitation

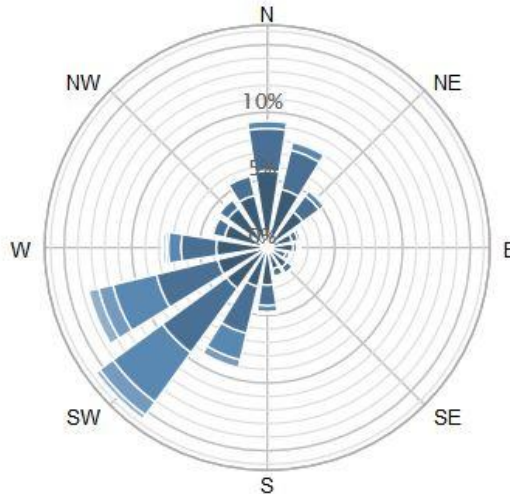
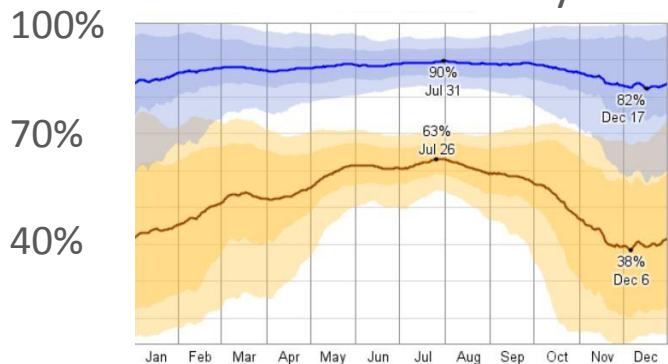


## Sun position

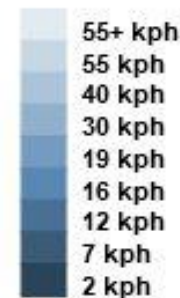
- Solstice ●—●
- Equinox ●—●
- Solstice ●—●
- Solstice ●—●

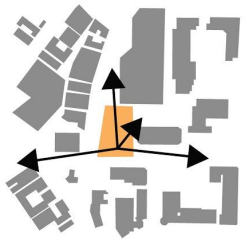


## Relative humidity

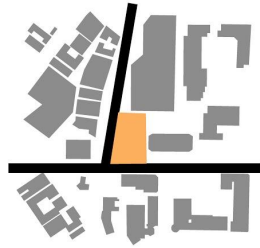


## Wind speeds





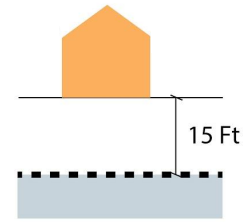
CONNECTION



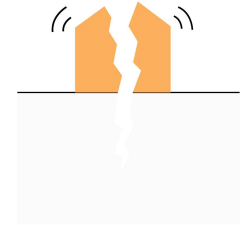
LA TRAFFIC



ABUNDANCE OF  
SUNLIGHT



DEEP WATER  
TABLE



EARTHQUAKE

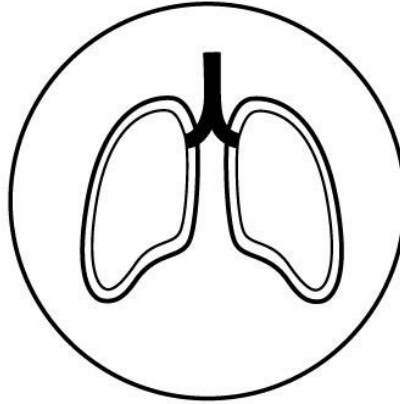


## THE LUNGS

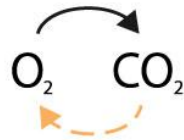
EVA // HAN // MELISSA // ALĚŠ // TAWA // NICOLAJ // BIRTHE

# 1st BIG IDEA - THE LUNG

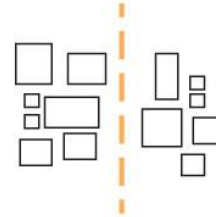
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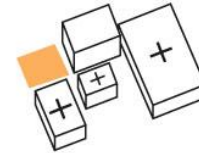
LA: THE MOST POLLUTED CITY IN USA



OXYGEN TO CO<sup>2</sup> REVERSE?



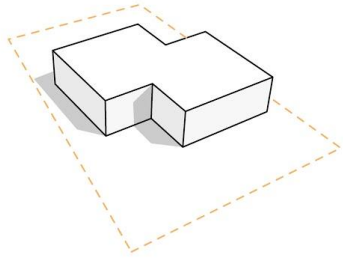
ADMINISTRATION VS. EDUCATIONAL



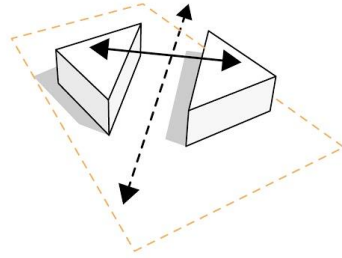
MEDICAL CENTRE NEARBY



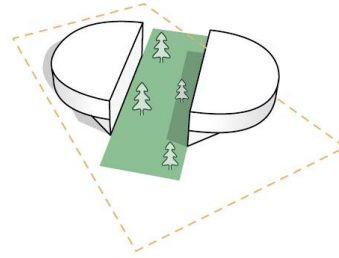




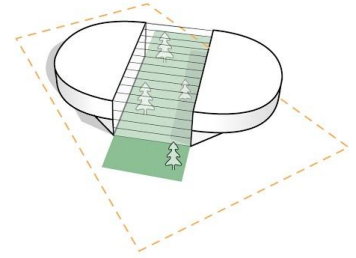
DOUBLE DIAMOND  
ON SITE



SPLITTING BUILDING  
OPENING TOWARDS COMMUNITY



INTRUDING GREEN ELEMENTS  
SHADING, FLOW AND VIEWS



ENCLOSING GARDEN

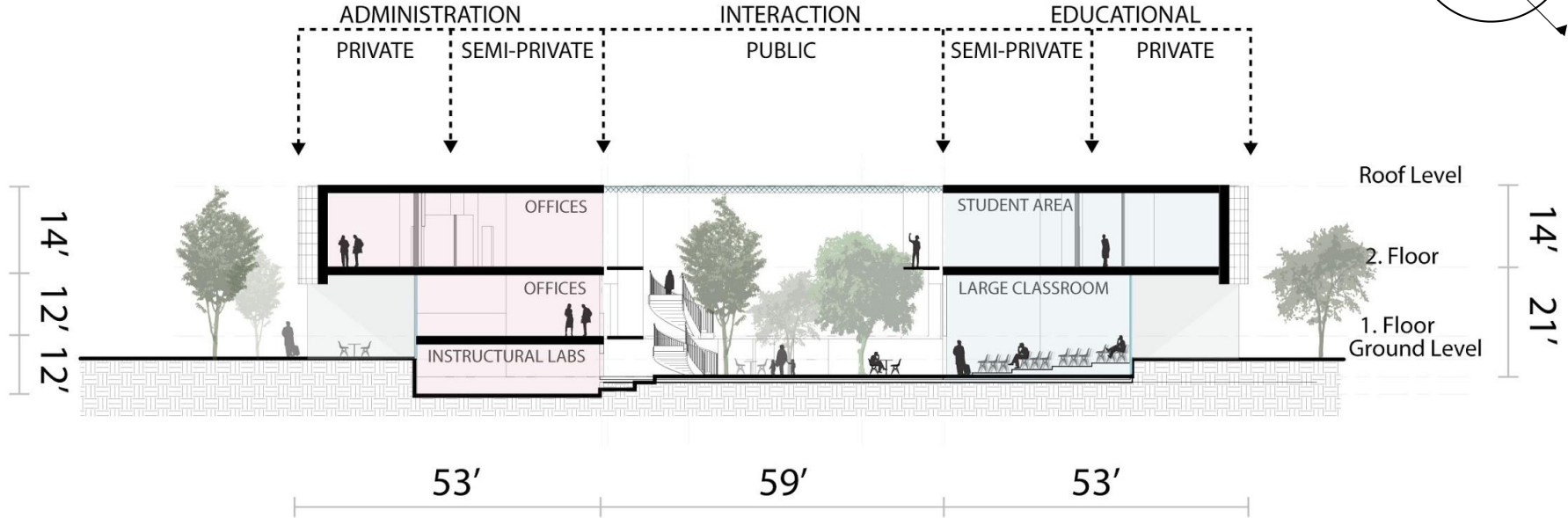
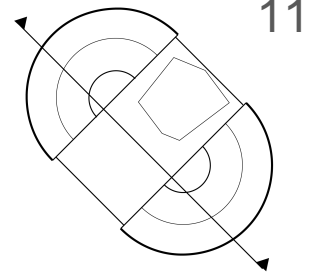


# THE BUILDING TO LUNG FOR!

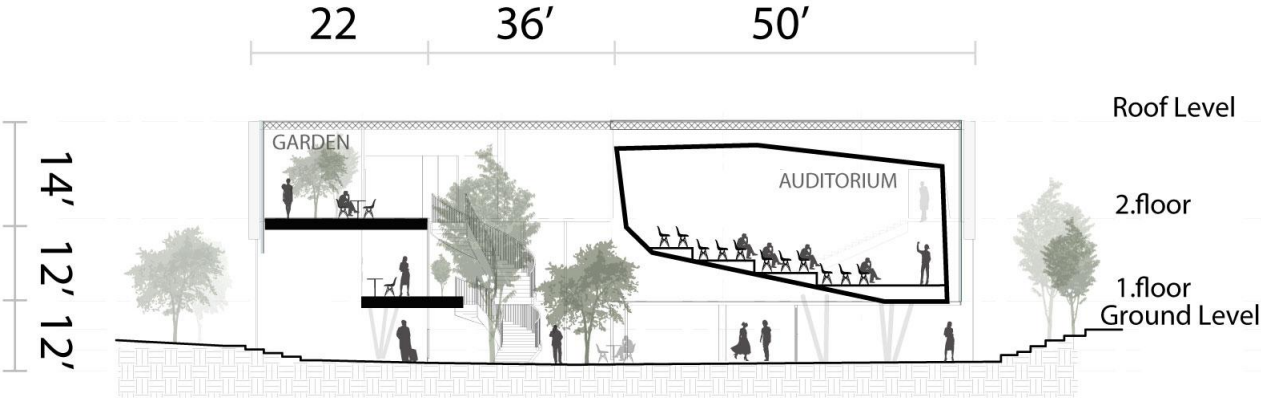
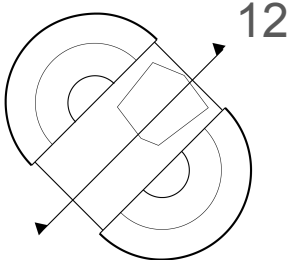
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# SECTION THROUGH WINGS



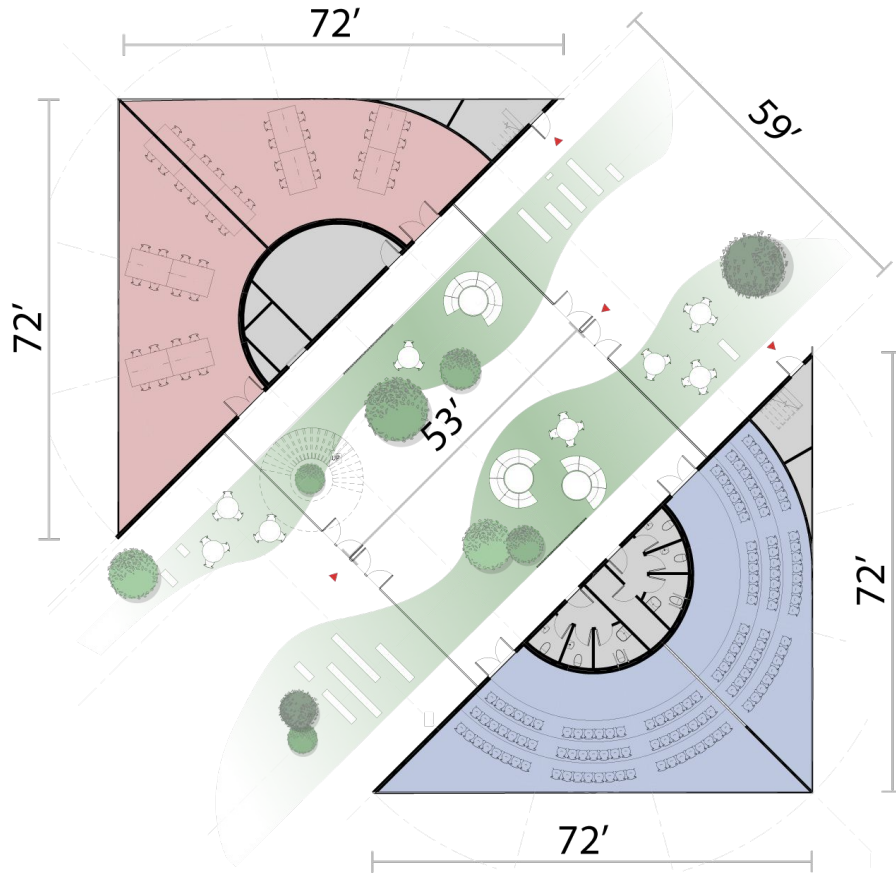
# SECTION THROUGH GARDEN



# ROOF PLAN



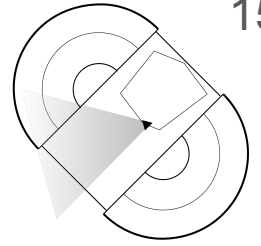
# GROUND FLOOR



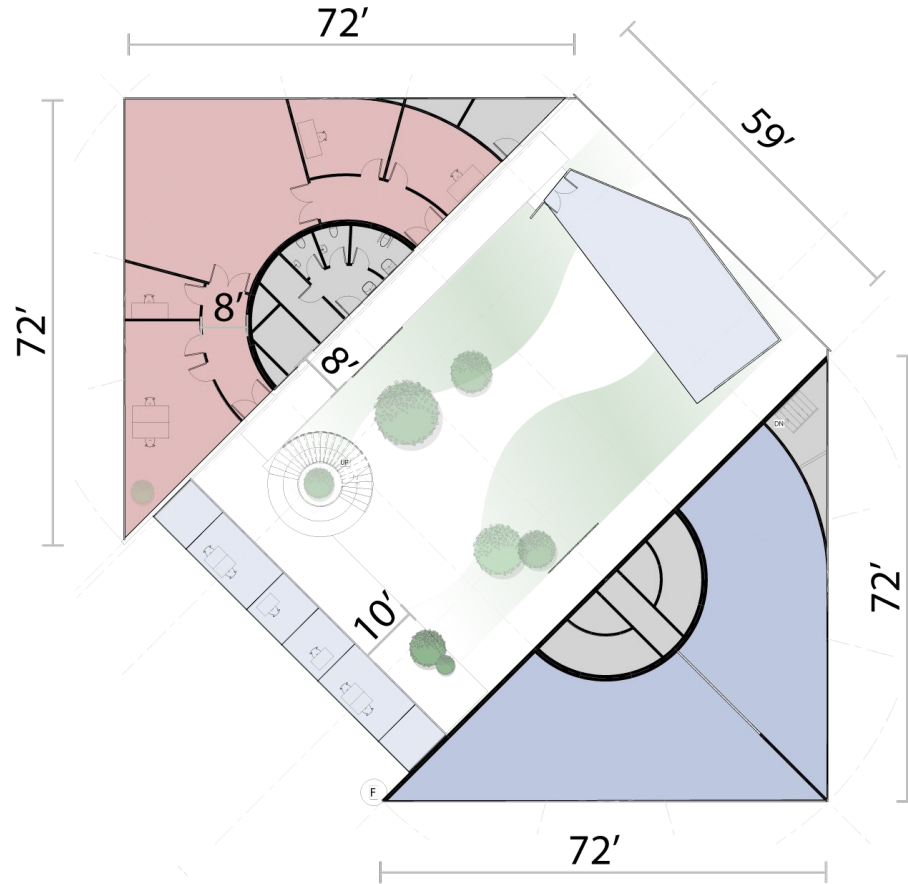
- 2 x Large Classroom
- 4 x Restroom
- 2 x Handi. Restroom
- 2 x Emergency exit
- Technical Room
- 2 x Instructional Lab



# VIEW IN THE GARDEN



# FLOOR 1

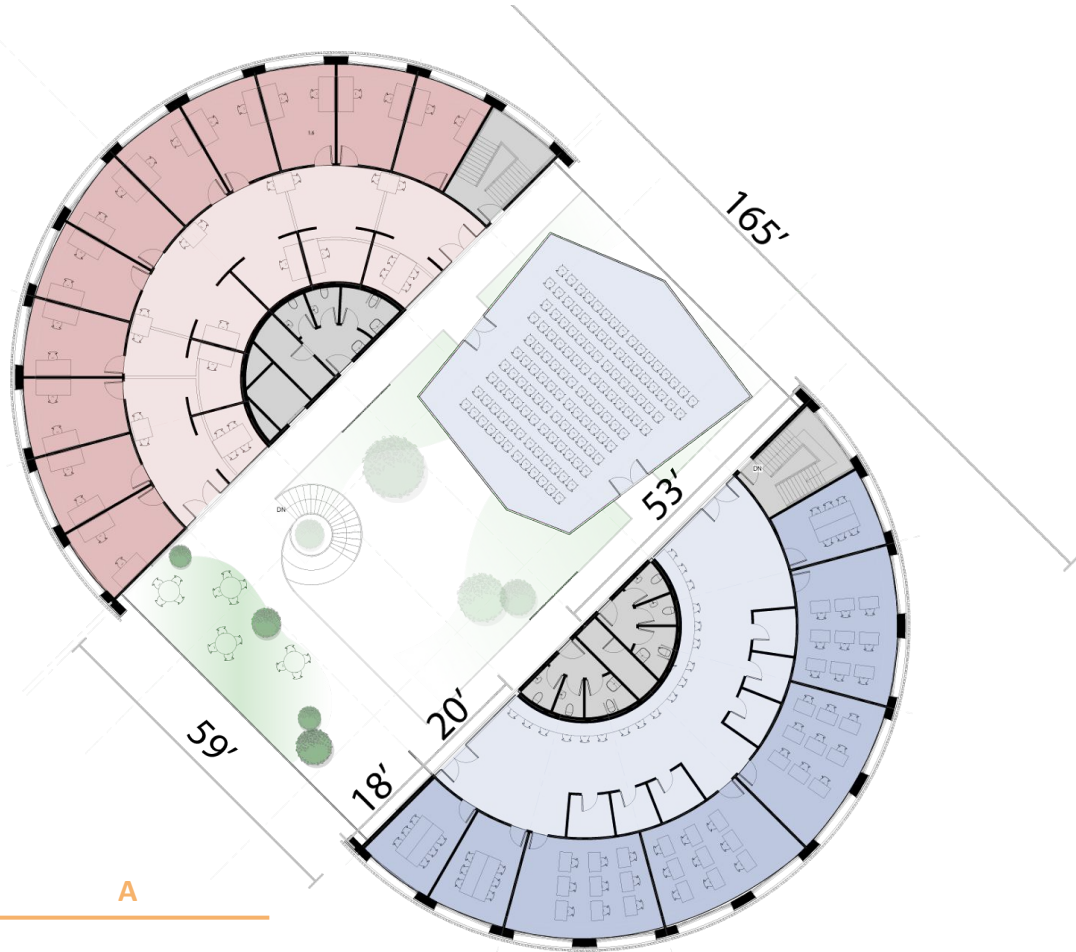


- Auditorium
- 6 x Study Room
- 2 x Restroom
- Handi. Restroom
- 2 x Emergency exit
- 6 x Faculty Office
- 2 x Senior Office
- Admin. Assist.
- Chair's Office
- Storage





# FLOOR 2

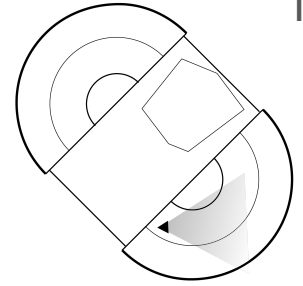


- 4 x Small Classroom
- 6 x Student Office
- 3 x Seminar Room
- Collaborative Space
- Auditorium
- 6 x Restroom
- 3 x Handicap. Restroom
- Emergency Exit
- 10 x Faculty Office
- Admin. Assist.
- 6 x Open Office

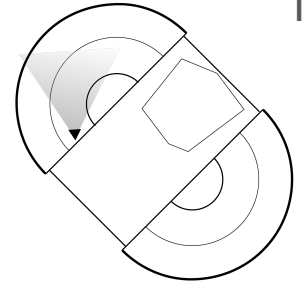


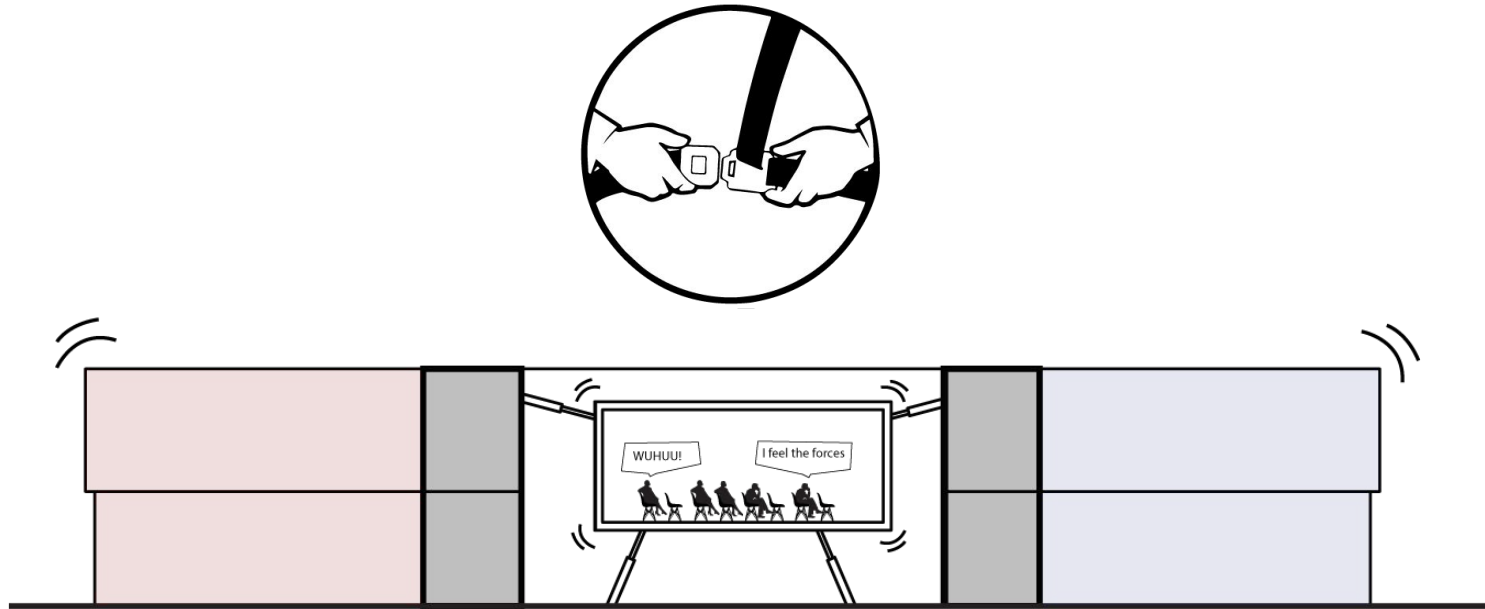
A

# VIEW OF EDUCATIONAL WING



# VIEW OF ADMINISTRATION WING





EARTHQUAKE!! .....Fasten your seatbelts.



## Soil conditions

Bearing Capacity 5000 psf

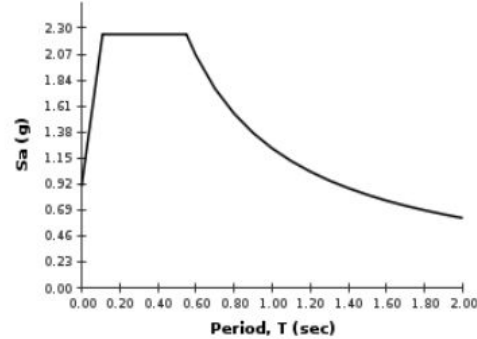


## Seismic loads

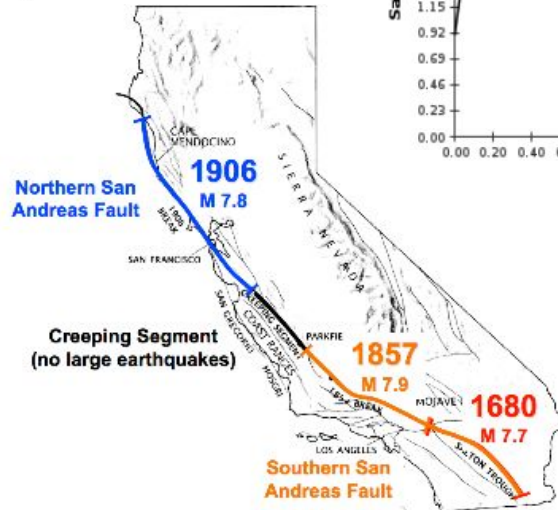
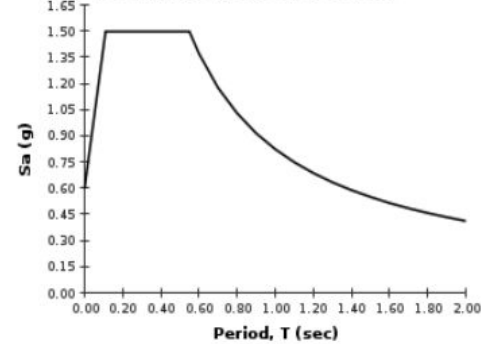
USGS-Provided Output

$S_s = 2.245 \text{ g}$	$S_{M5} = 2.245 \text{ g}$	$S_{D5} = 1.497 \text{ g}$
$S_1 = 0.823 \text{ g}$	$S_{M1} = 1.234 \text{ g}$	$S_{D1} = 0.823 \text{ g}$

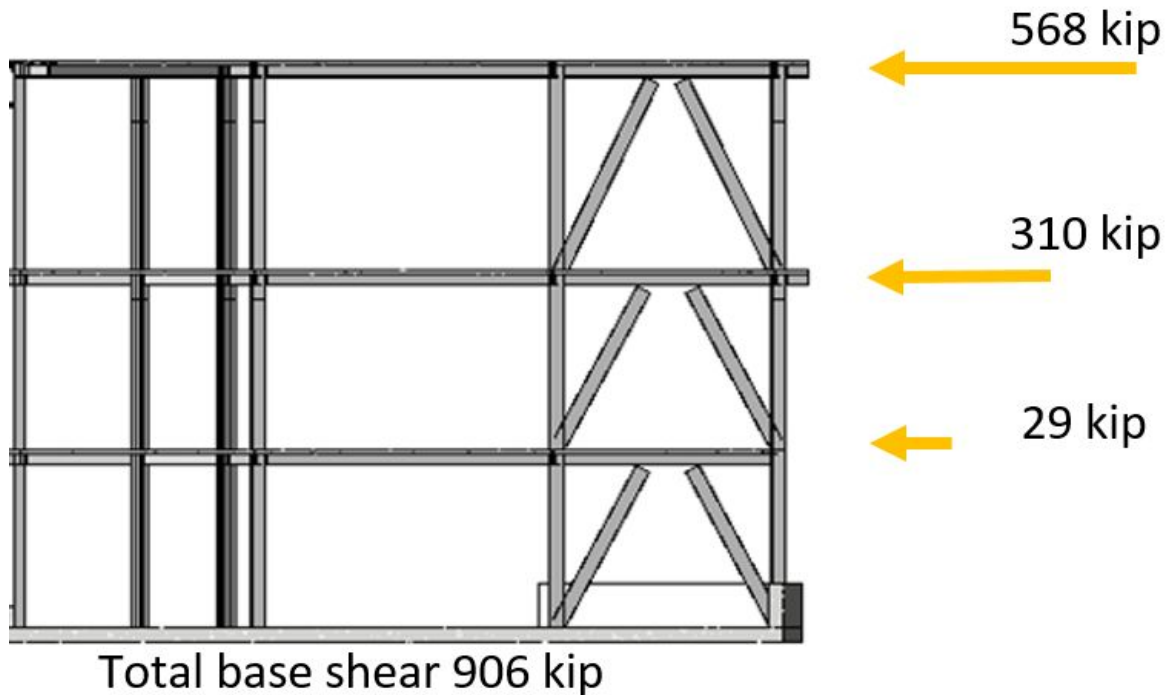
MCE<sub>R</sub> Response Spectrum



Design Response Spectrum

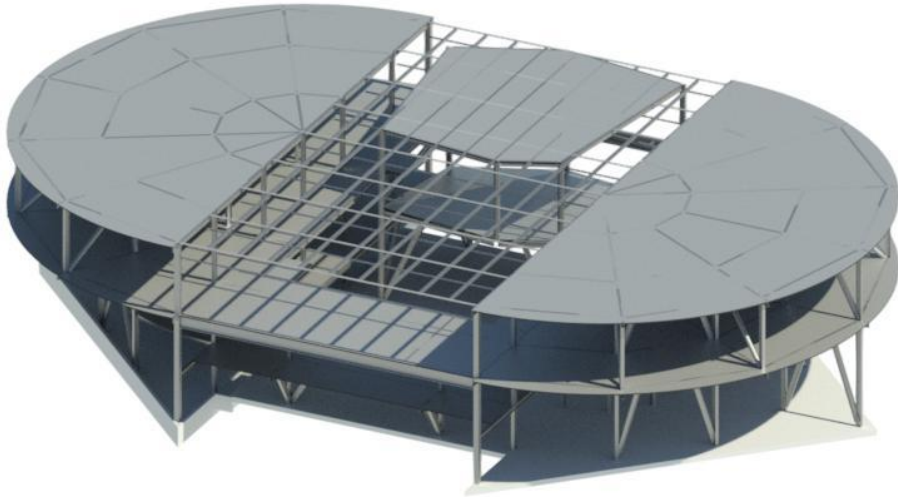


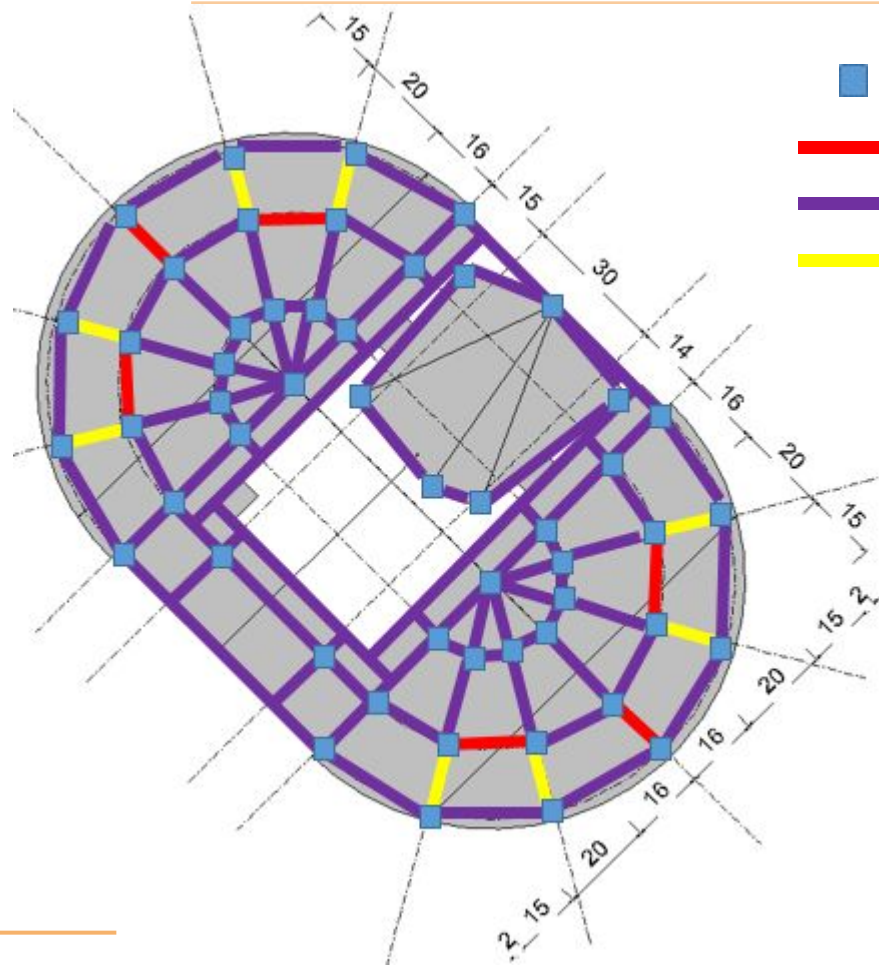
Use	Uniform (psf)
Office	50
Classroom	40
Auditorium	100
Roof	40
Stairs	100
Corridors	100



Steel Design

Concrete and Steel Design

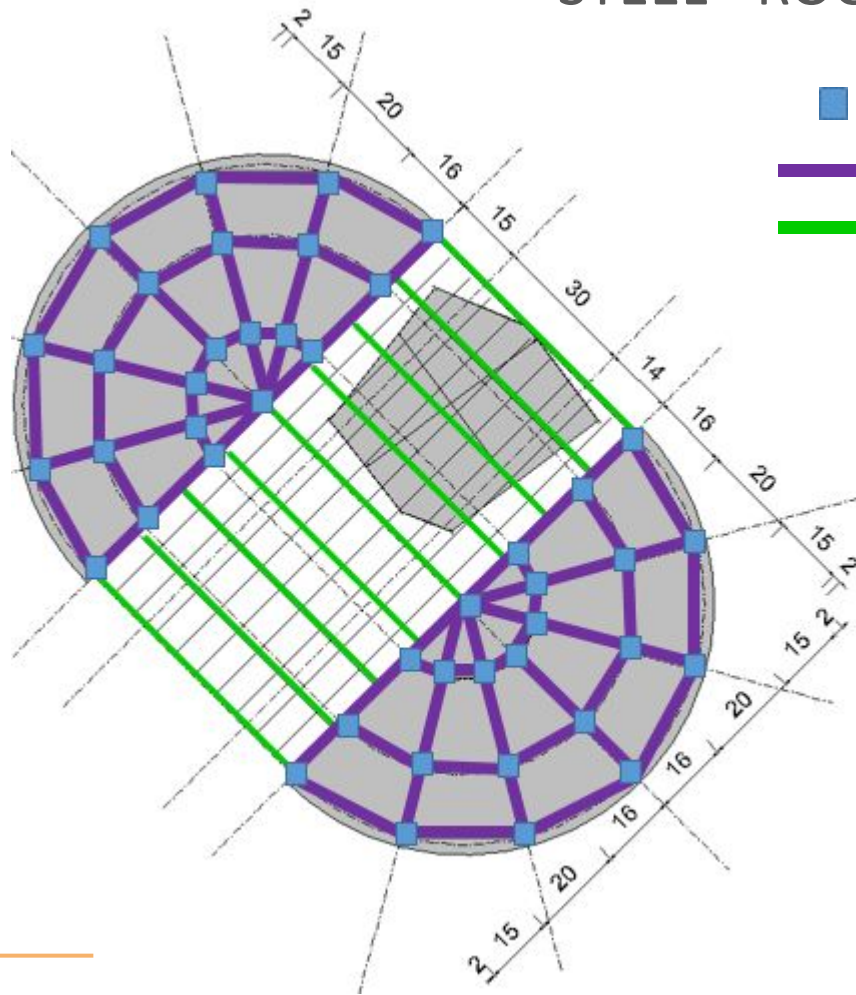





- Columns W12  $\text{I}$
- BRBF A\_core = 5 in<sup>2</sup>
- Beams W12 typical  $\text{I}$
- Diagonal HSS  $\square$
- Slabs 3" concrete over 2" metal deck

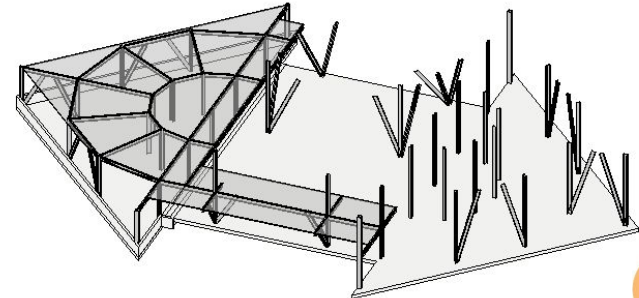
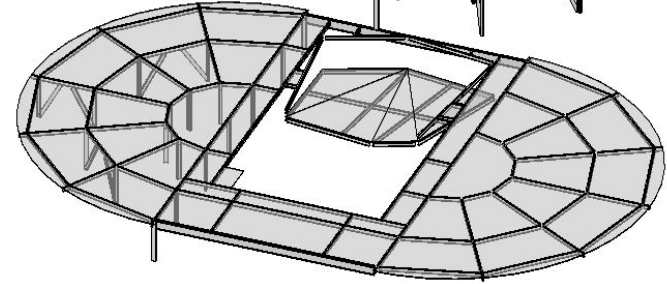
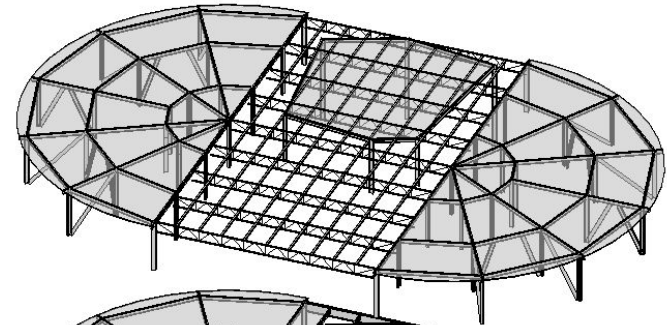
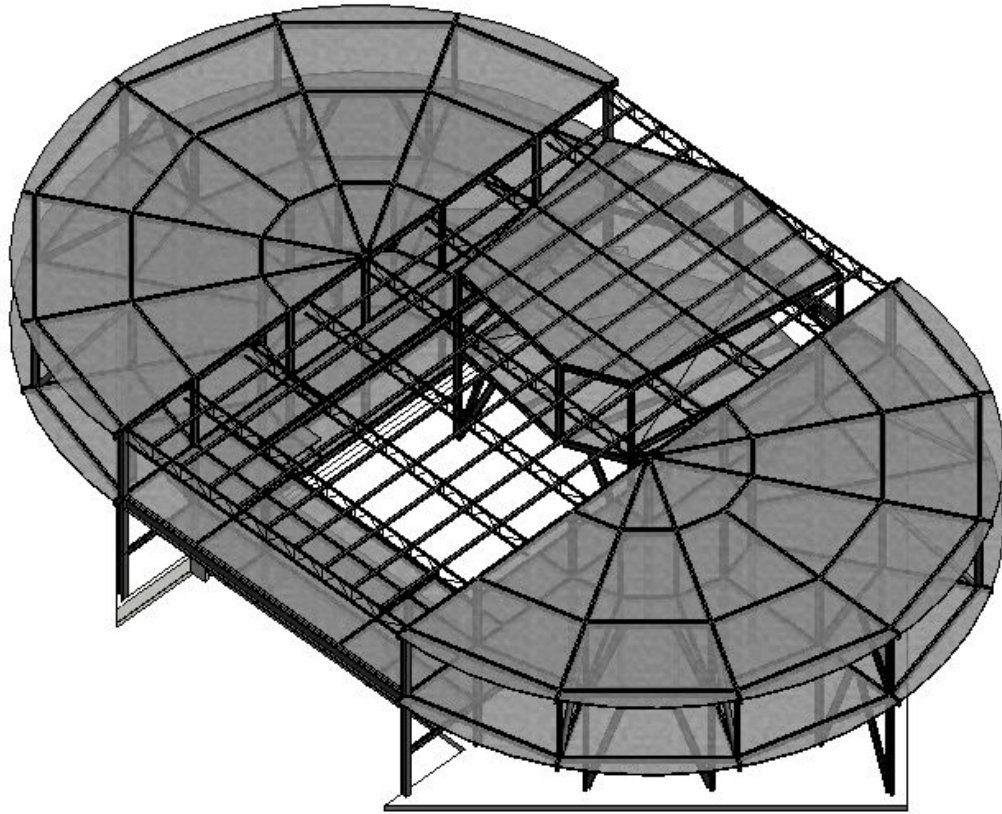






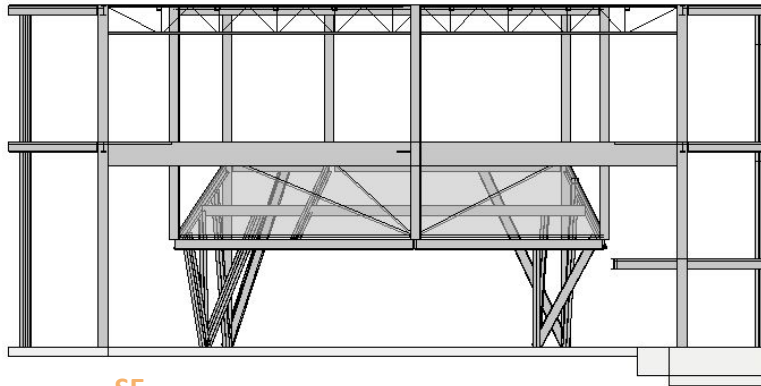
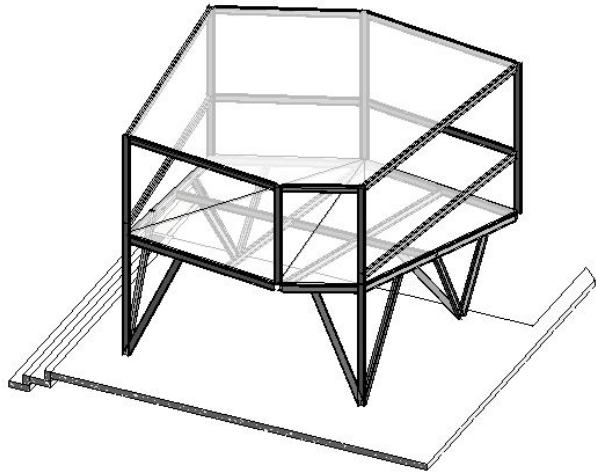
- Columns W12 I
- Beams W12 typical I
- Steel truss 3' 
- Slabs 3" concrete over 2" metal deck





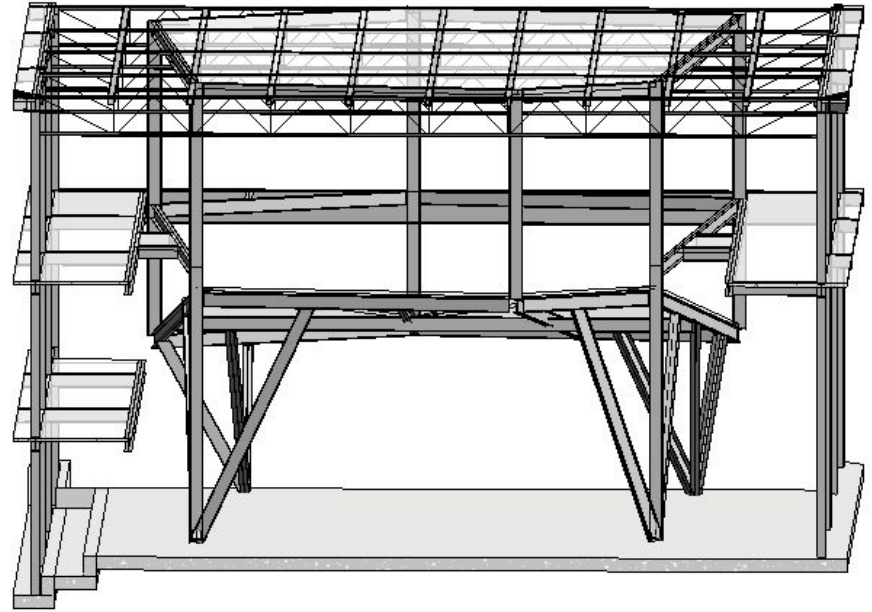
SE



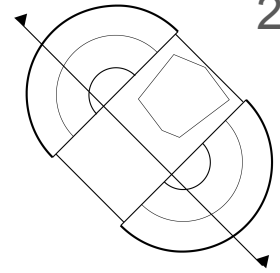


SE

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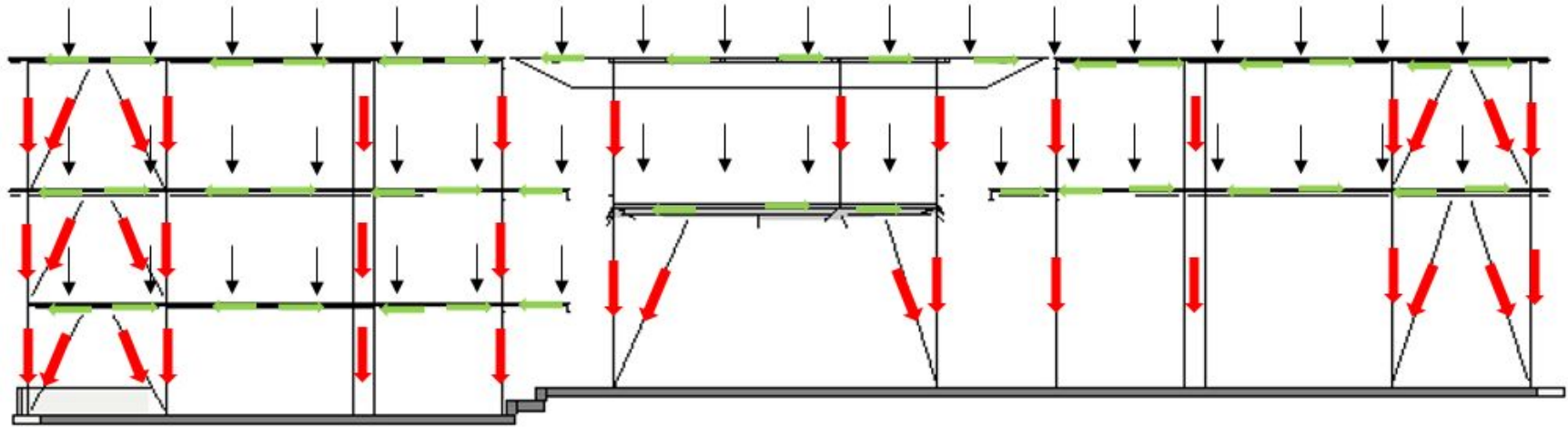


# VERTICAL LOAD PATH

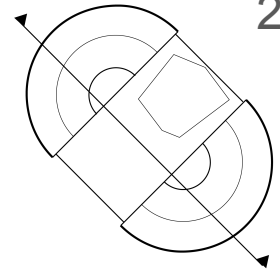


← tension

← compression

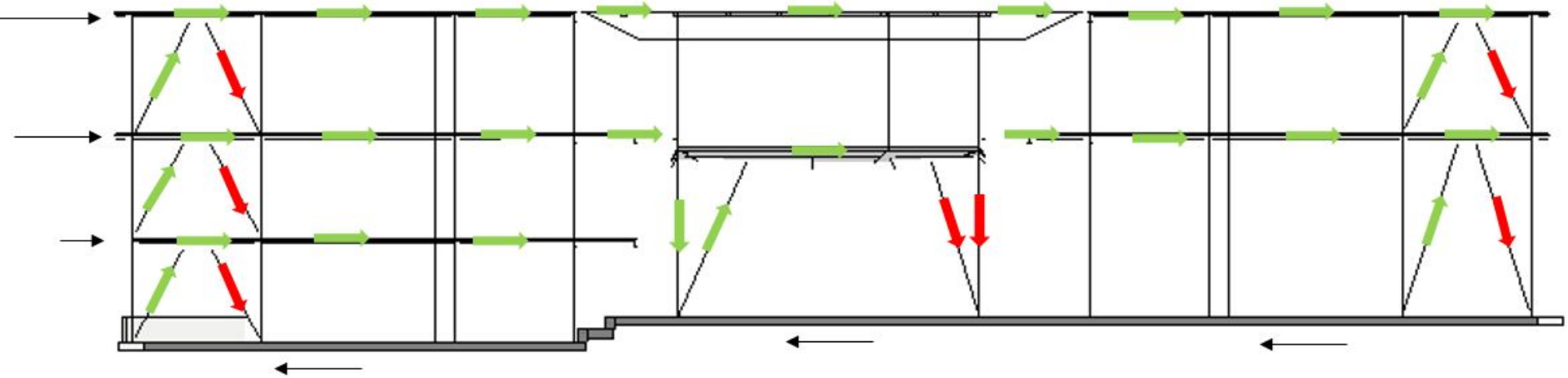


# HORIZONTAL LOAD PATH

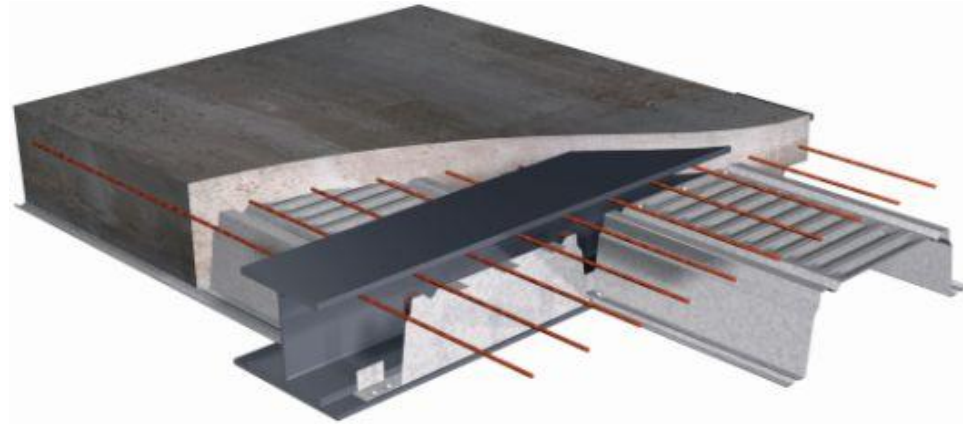


← tension

← compression

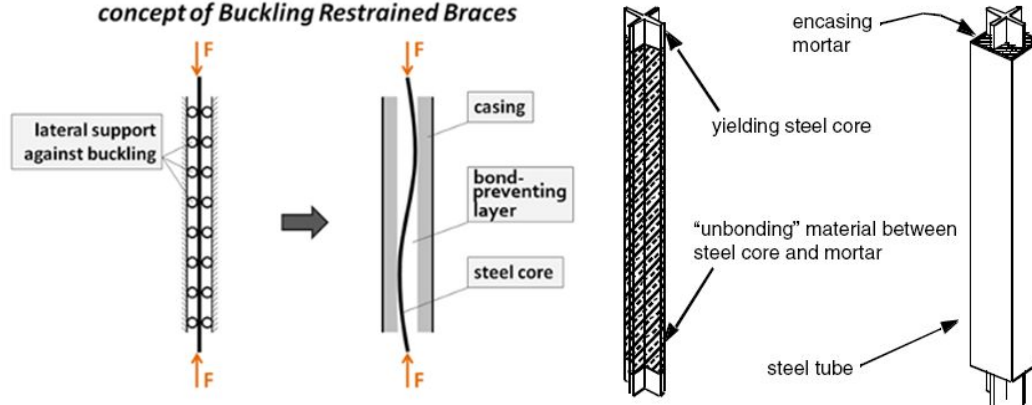


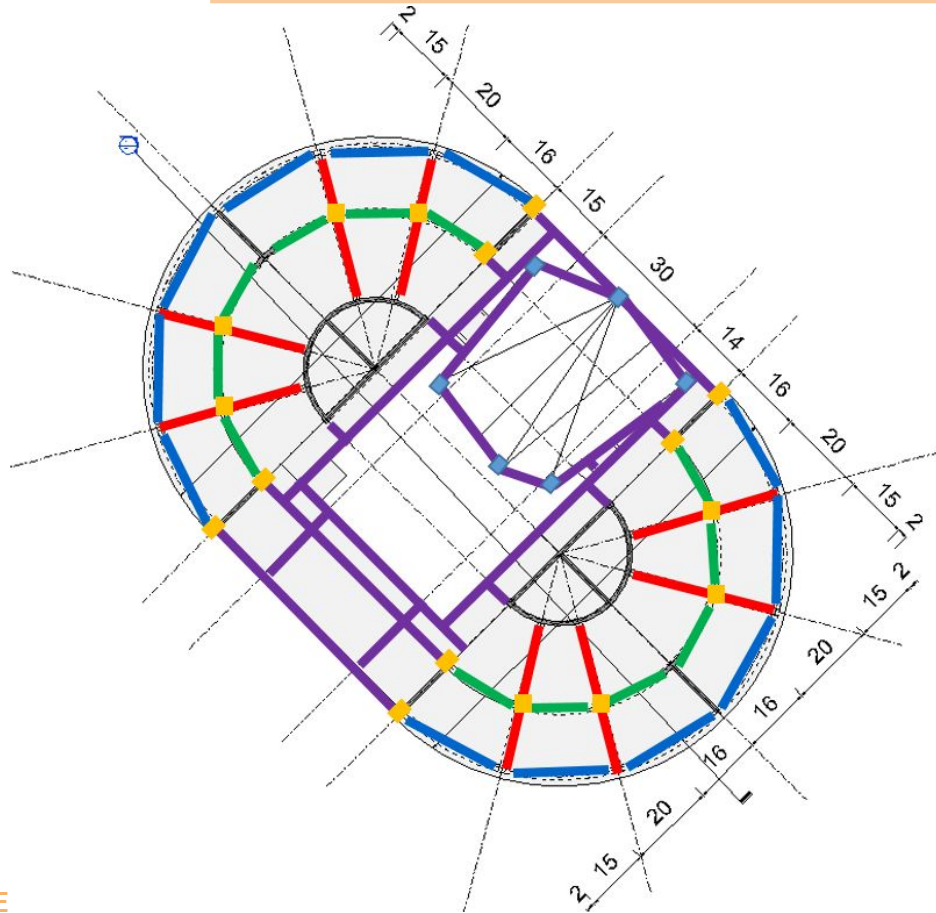
Integrated beam



Bracing - BRBF

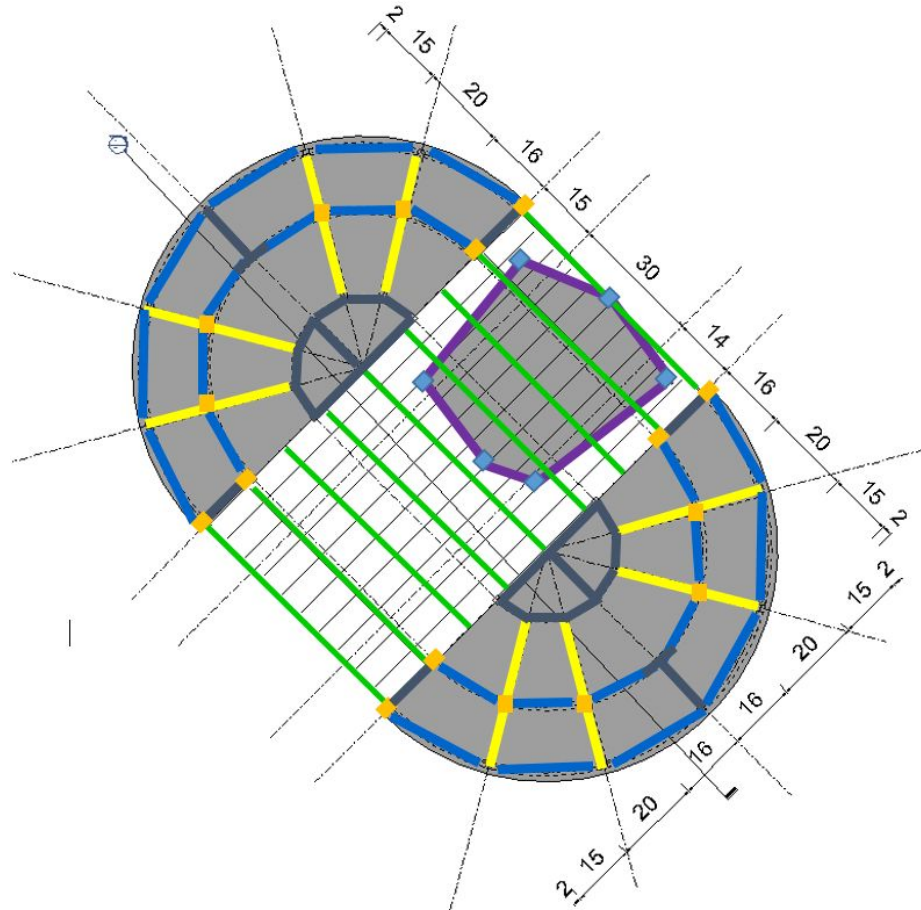
concept of Buckling Restrained Braces






- Shear walls 12"
- RC columns 18" x 18"
- Steel columns W12  $\perp$
- Steel beams W12  $\perp$
- RC beams 18" x 14"
- RC beams 18" x 12"
- RC beams 18" x 18"



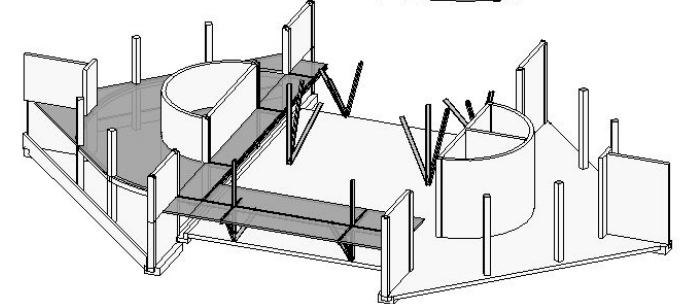
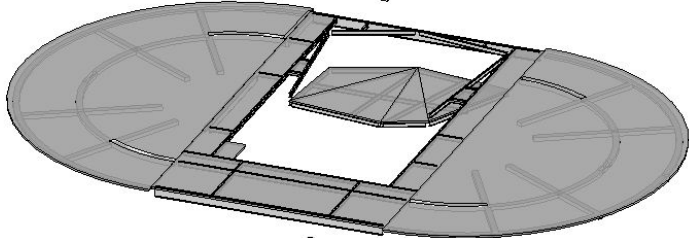
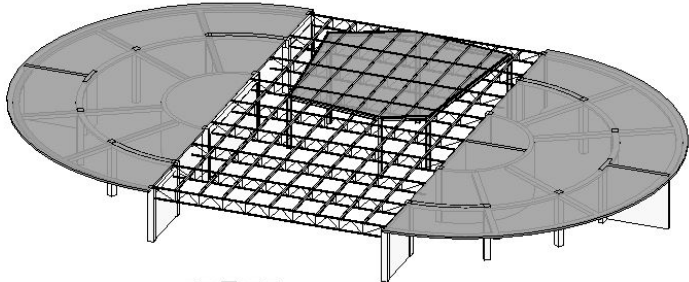
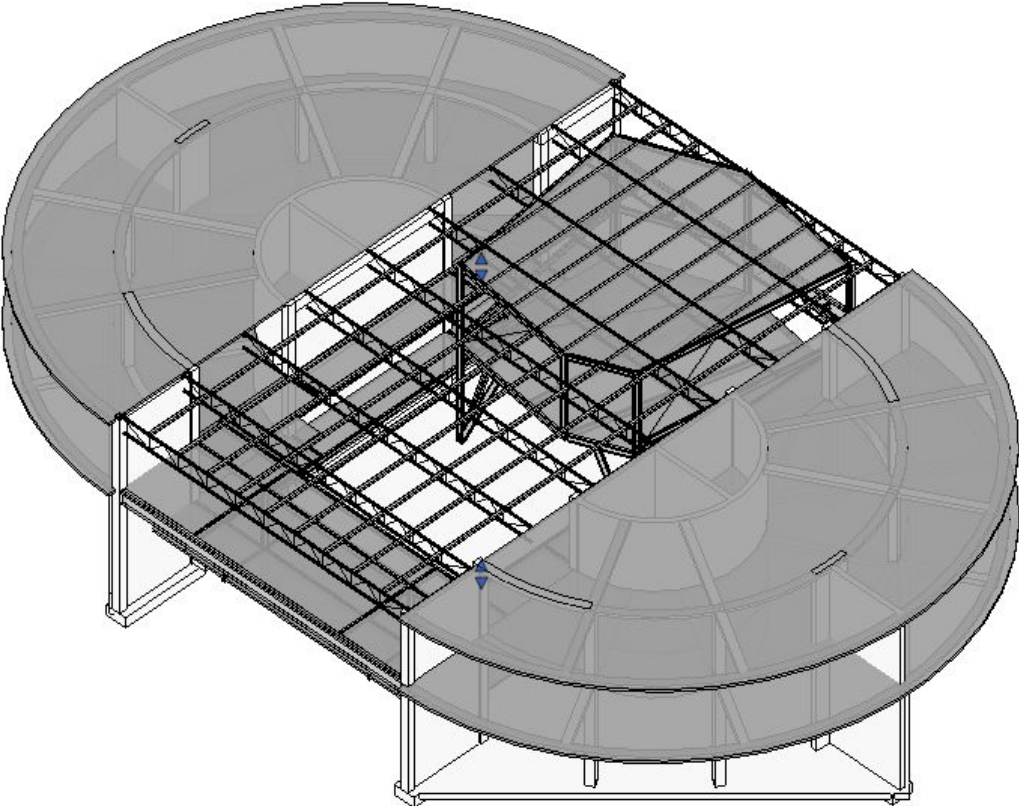


- Shear walls 12"
- RC columns 18" x 18"
- Steel columns W12 I
- Steel beams W12 I
- RC beams 18" x 16"
- RC beams 18" x 12"
- Steel Truss 3' 





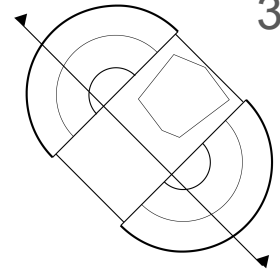
# CONCRETE - 3D SECTION CUTS



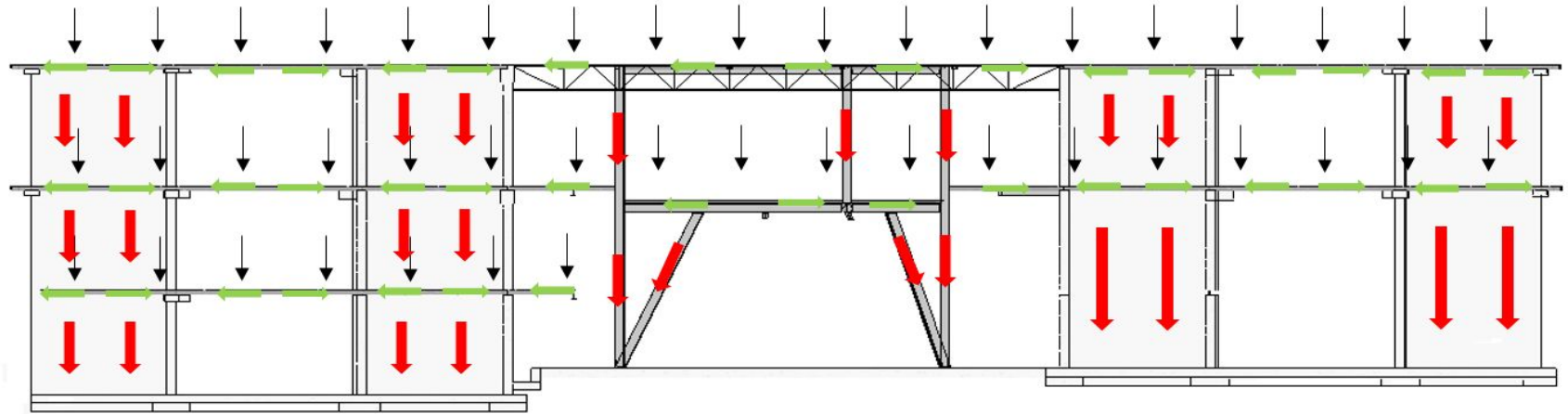
SE



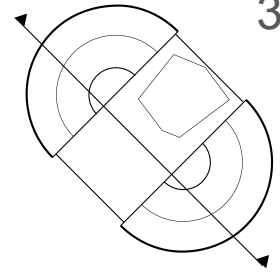
# VERTICAL LOAD PATH



← tension      ← compression

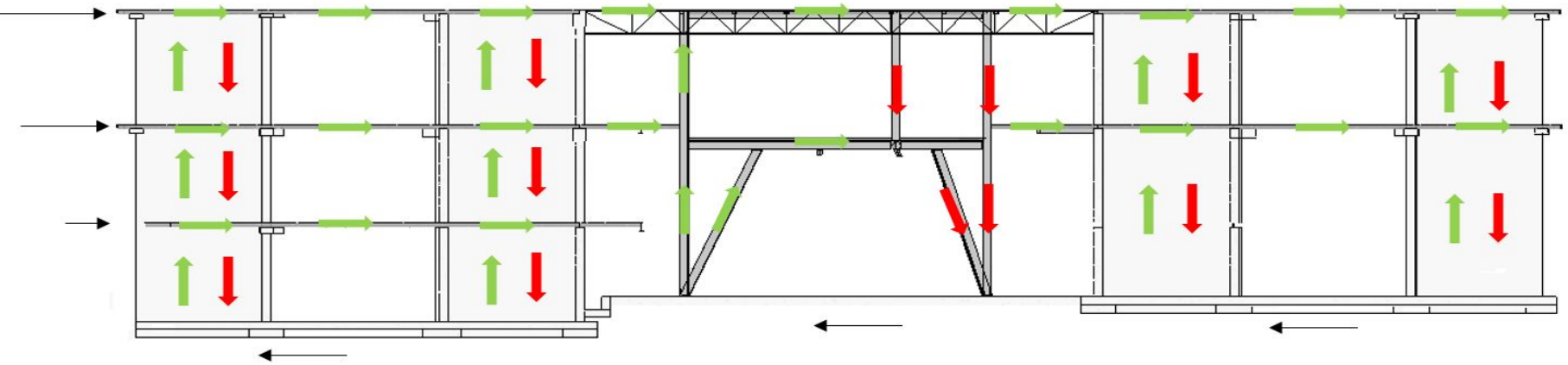


# HORIZONTAL LOAD PATHS

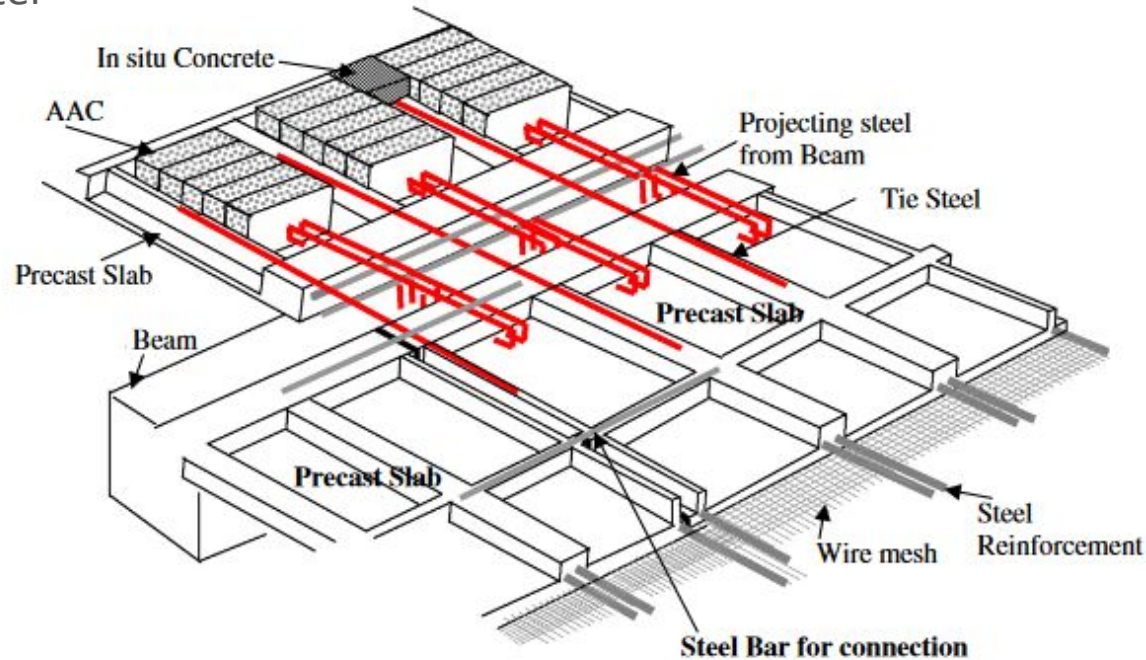


← tension

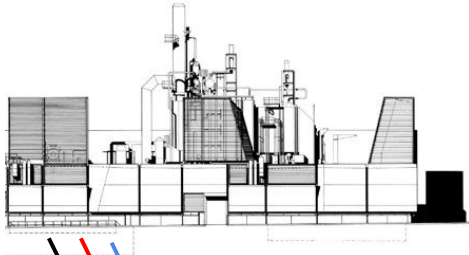
← compression



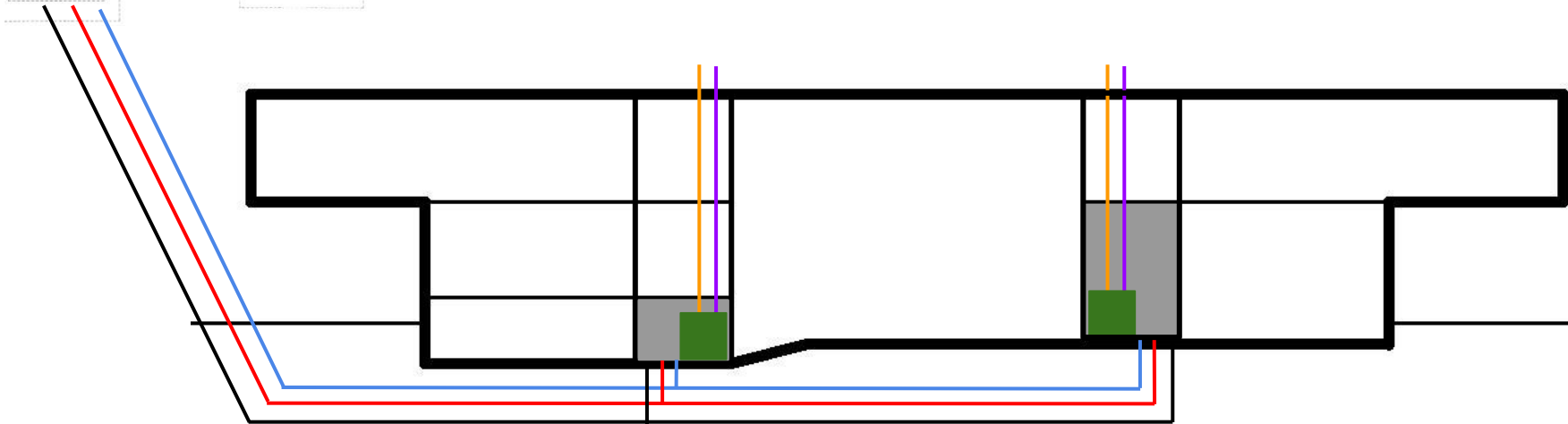
- AAC (Autoclaved Aerated Concrete) light weight precast composite floor slab
- 30 % lighter



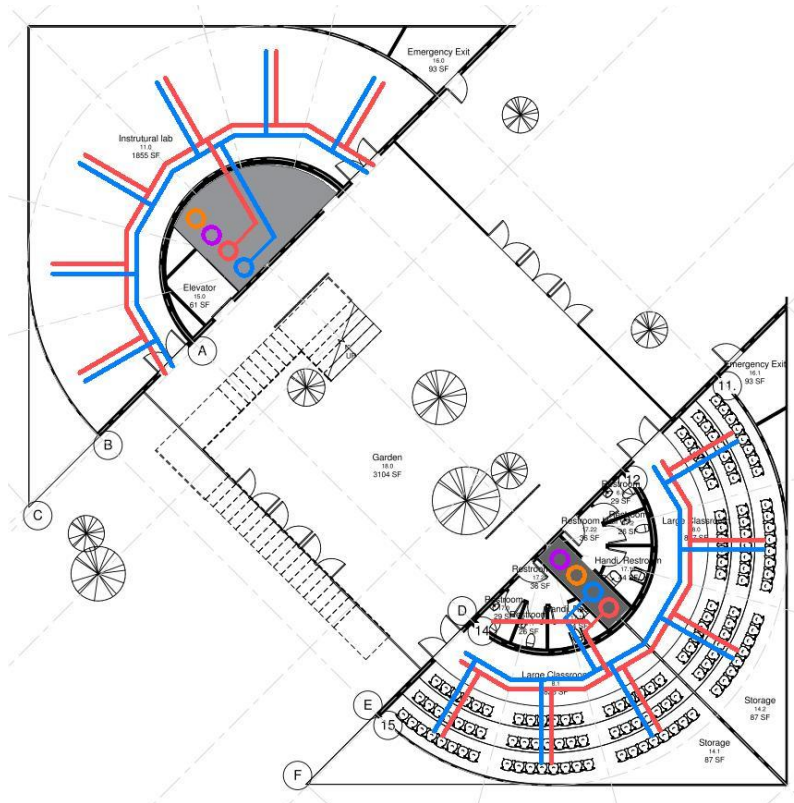
## UCLA cogeneration plant



- Heating
- Cooling
- Electricity
- Inlet
- Exhaust
- AHU
- MEP room



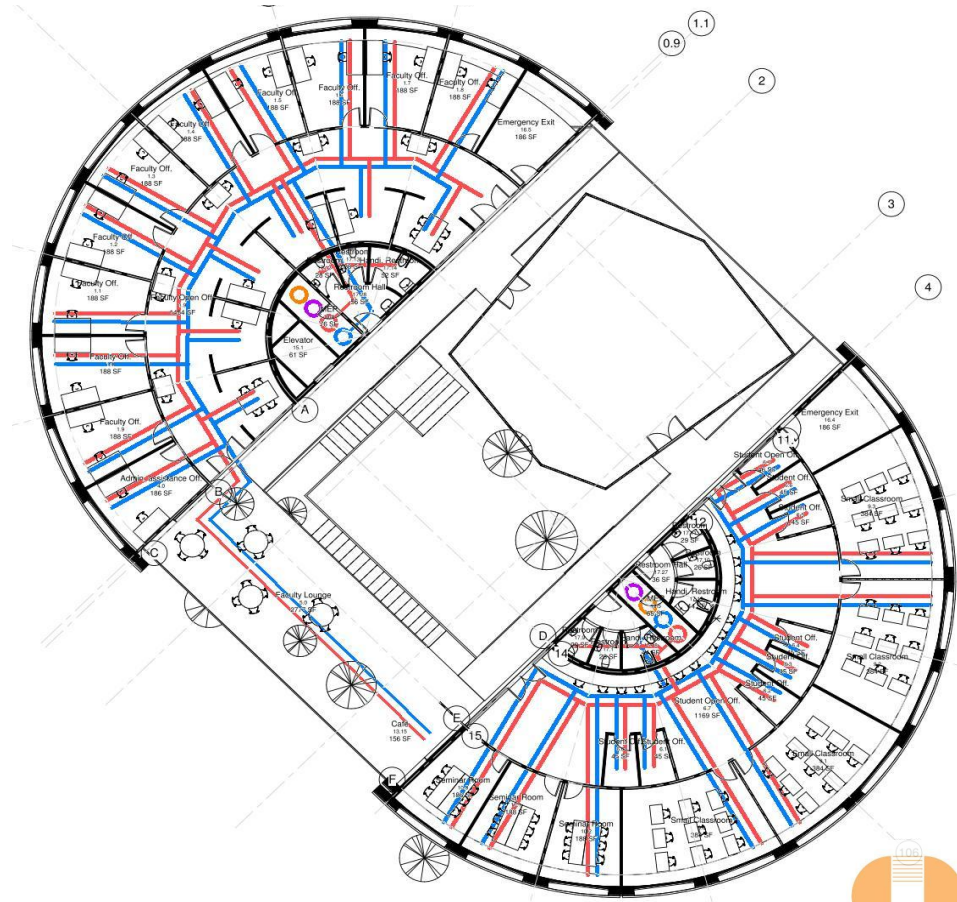
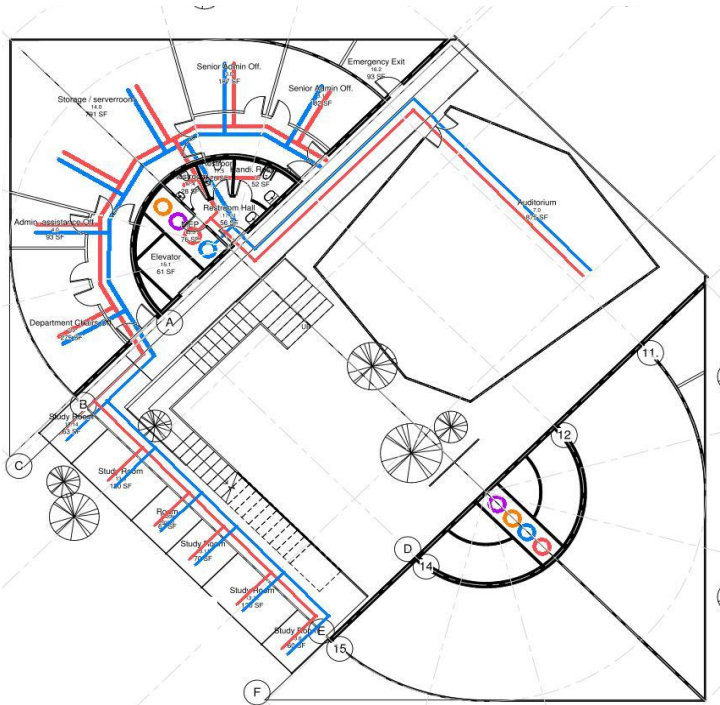
# OVERHEAD MIXING - GROUND FLOOR

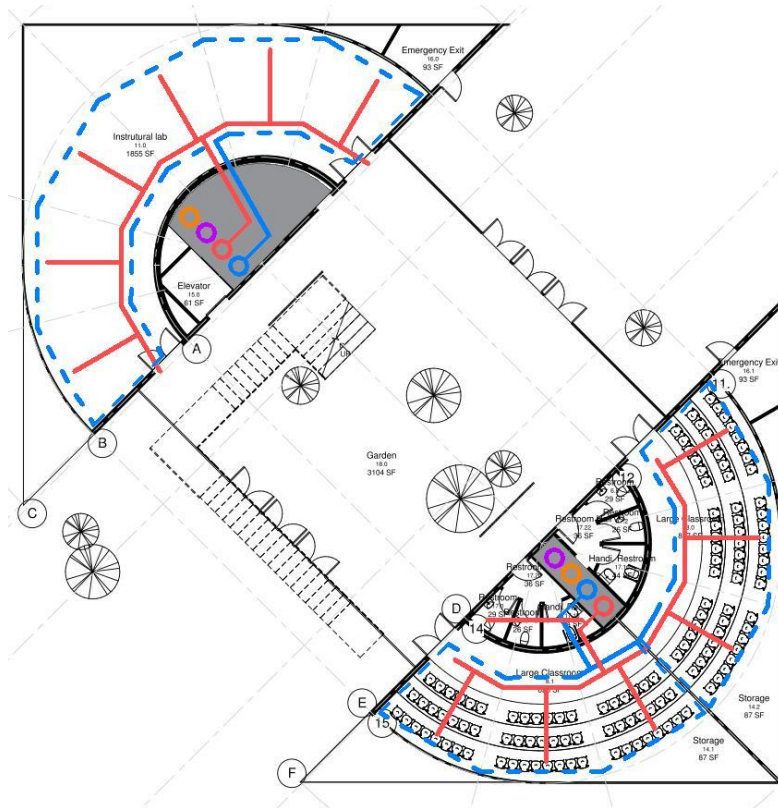


- Supply duct
- Return duct
- Vertical supply duct
- Vertical return duct
- Vertical inlet
- Vertical exhaust
- MEP room



# OVERHEAD MIXING - FLOORS 1 & 2



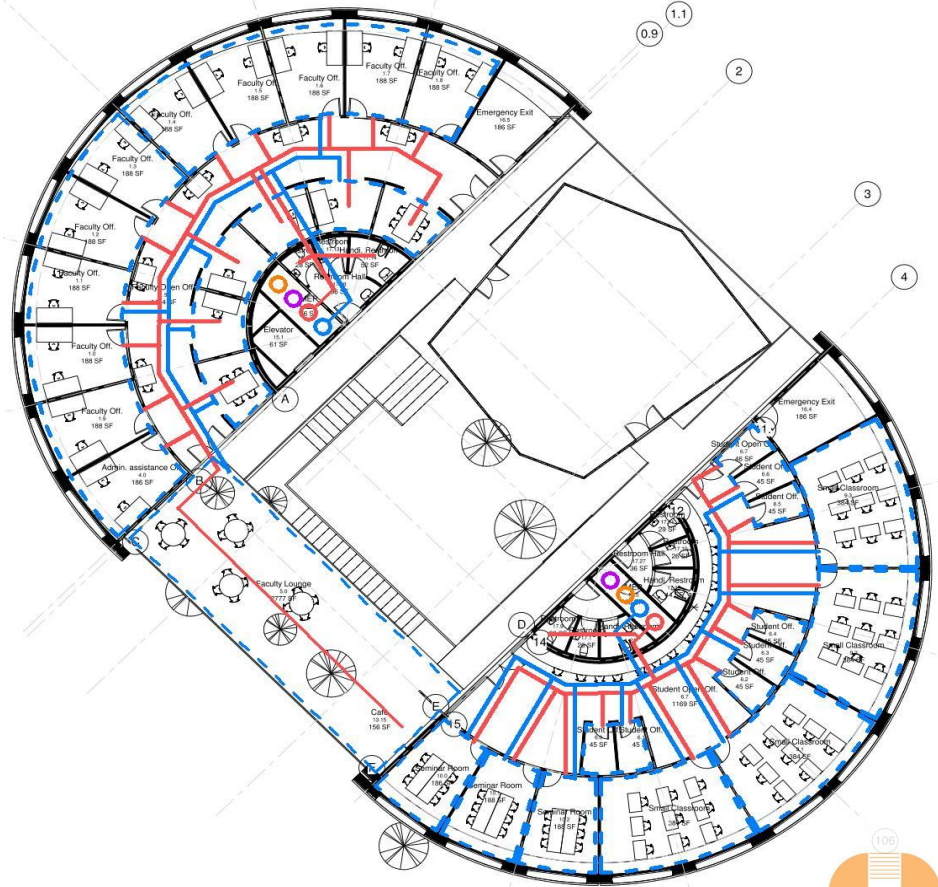
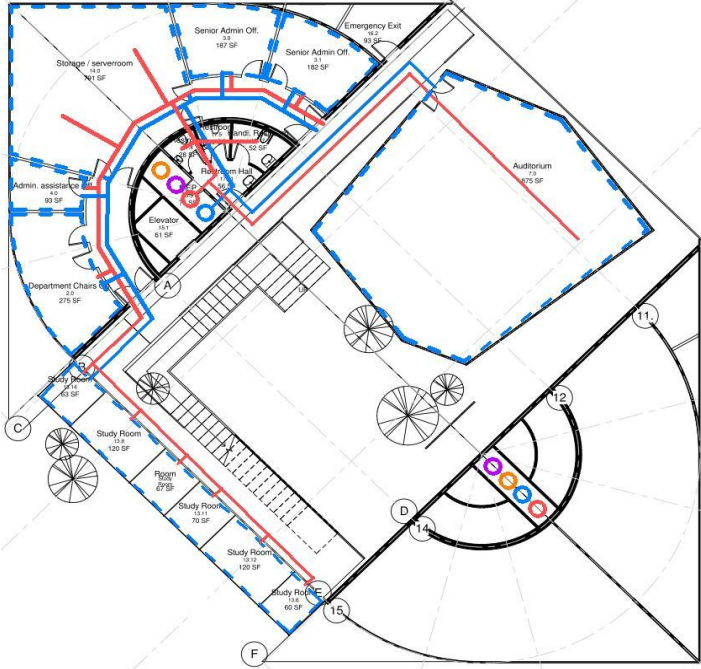


- Supply duct
- - - Outline of plenum
- Return duct
- Vertical supply duct
- Vertical return duct
- Vertical inlet
- Vertical exhaust
- MEP room

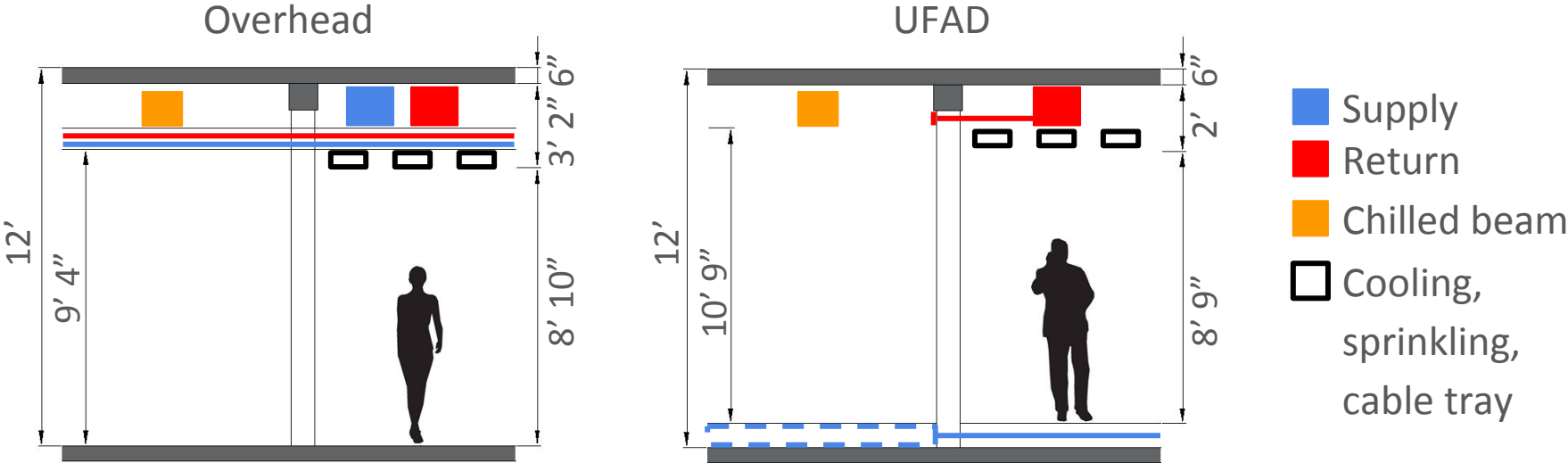




# UFAD - FLOORS 1 & 2



# FLOOR SANDWICH



	Overhead	UFAD
<b>Cost</b>	\$14.05/SF	\$14.51/SF
<b>GWP embodied</b>	1.4%	1.3%

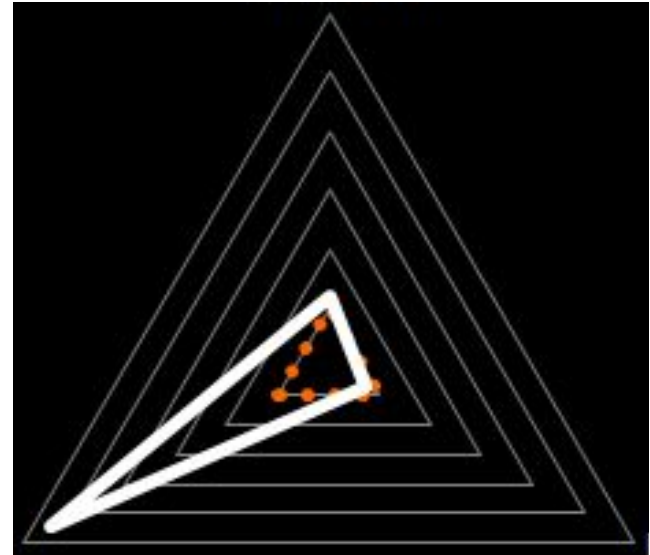
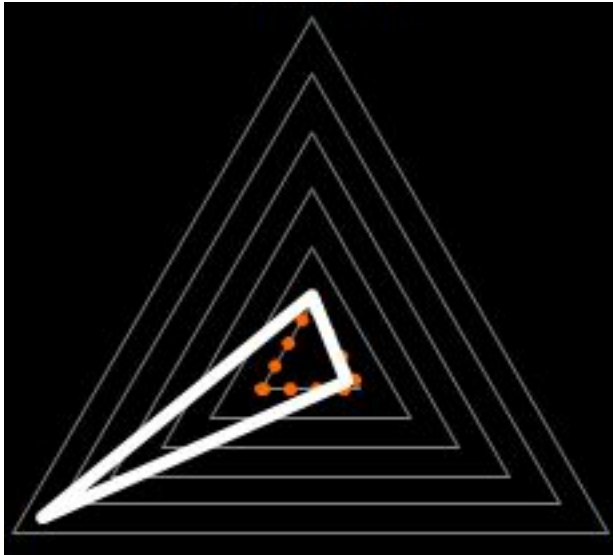


Steel

Concrete

Carbon (kg CO<sub>2</sub>-eq)

Carbon (kg CO<sub>2</sub>-eq)



Water (kg H<sub>2</sub>O-eq)

Energy (MJ)

Water (kg H<sub>2</sub>O-eq)

Energy (MJ)



# SITE ACCESS





## Concrete Pump

Unit

Technical Parameters

BPL2525-5KVM39X

1

- Boom Length : 39m
- Max Concrete Output : 210 cubic yards / hour



## Excavator

Unit

Technical Parameters

John Deere G250LC

1

- Max Digging Depth : 25ft.
- Arm Digging Force : 25,224–25,628 lb.



## Mobile Crane

Unit

Technical Parameters

Grove TMC540

1

- Max Lift Capacity : 40 ton
- Boom Length : 31m (+7.9~13.7m extension)



## Forklift

Unit

Technical Parameters

Caterpillar P6000-LE

1

- Max Lift Capacity : 6000 lb.
- Maximum Lift Height : 15.5 ft.



## Scissor Lift

Unit

Technical Parameters

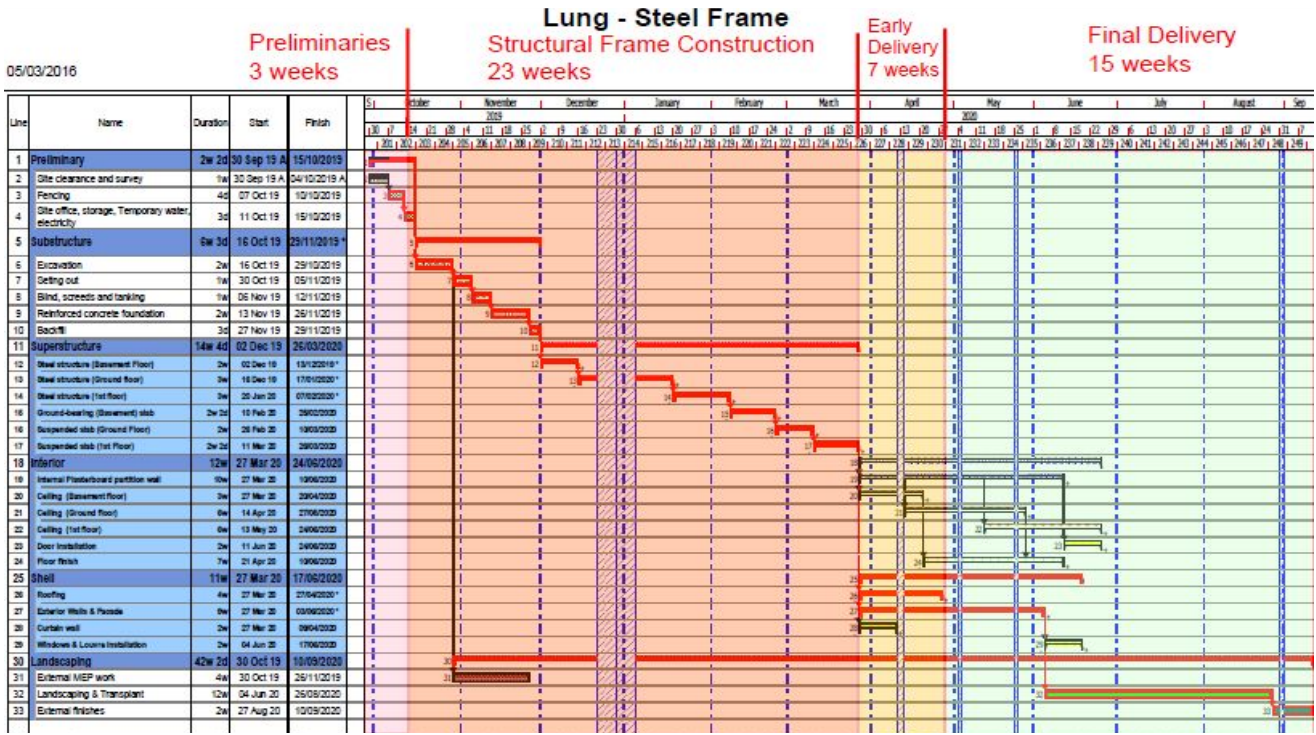
GS 3390RT

1

- Max Lift Capacity : 2500 lb.
- Maximum Working Height : 39ft.



# SCHEDULE - LUNG STEEL



Start	09/30/2019
Preliminaries completion	10/15/2019
Structural frame completion	03/26/2020
Instrumental lab delivery	04/28/2020
Whole building completion	06/17/2020
Landscaping completion	09/10/2020



# SCHEDULE- LUNG CONCRETE



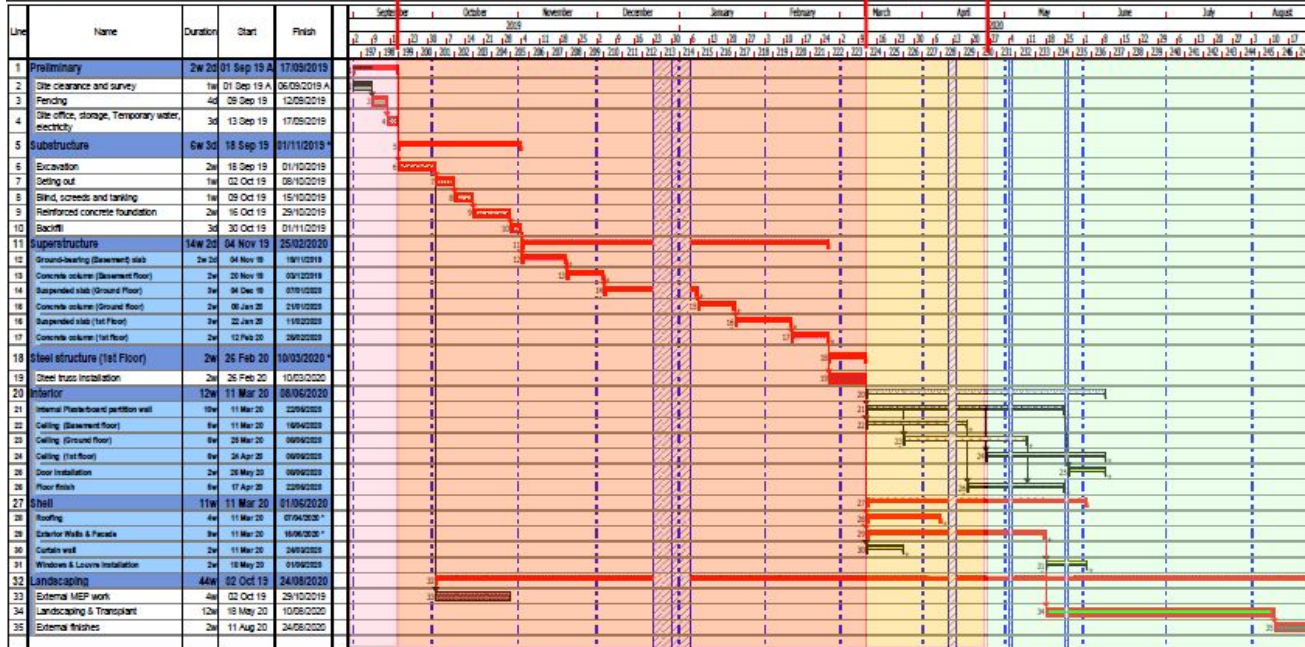
Preliminaries  
3 weeks

Lung - Concrete Frame  
Structural Frame Construction  
23 weeks

Early  
Delivery  
7 weeks

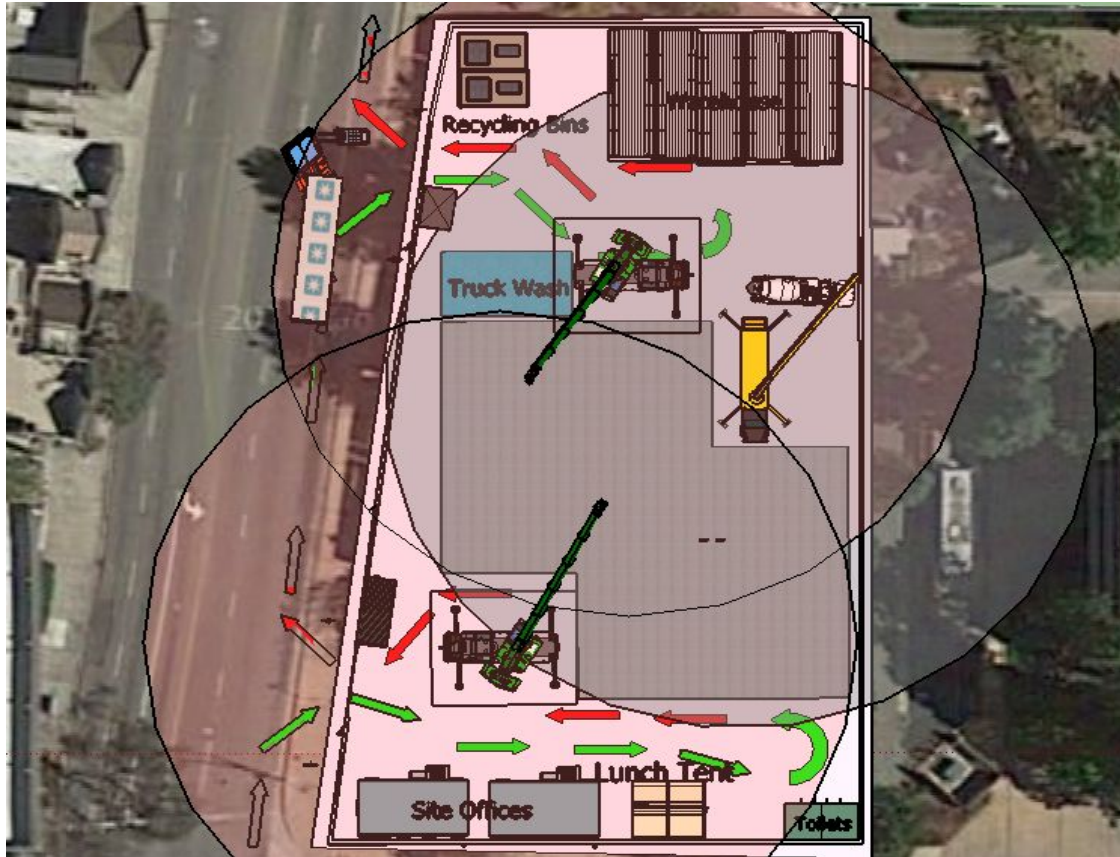
Final Delivery  
15 weeks

05/03/2016



Start	09/01/2019
Preliminaries completion	09/17/2019
Structural frame completion	03/10/2020
Instrumental lab delivery	04/24/2020
Whole building completion	06/01/2020
Landscaping completion	08/24/2020

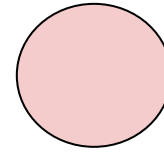




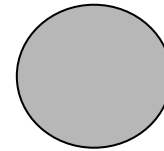
Way-in



Way-out



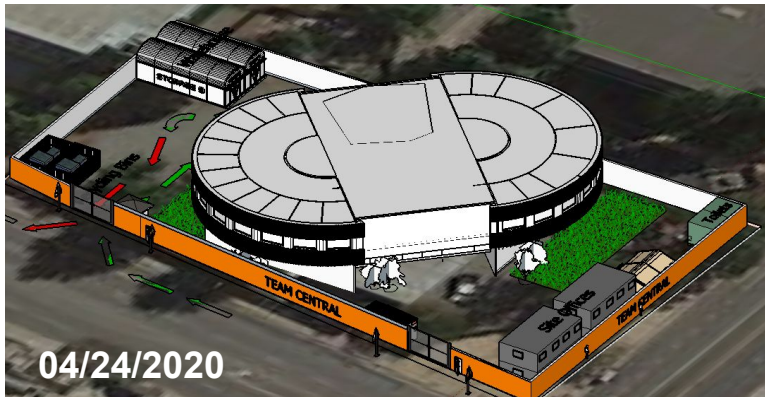
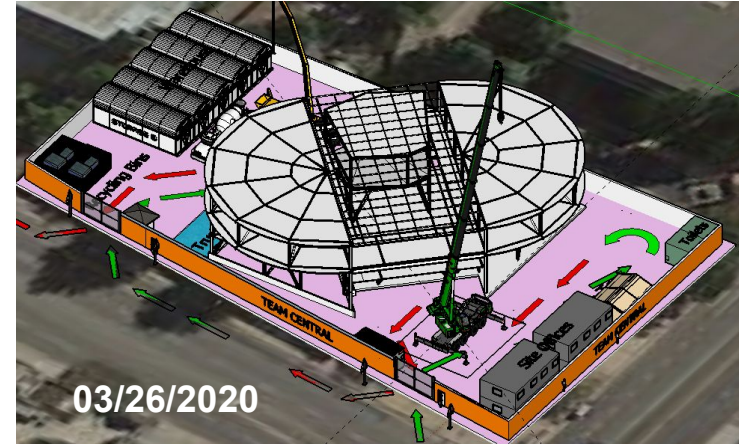
Crane  
Range



Pump  
Range





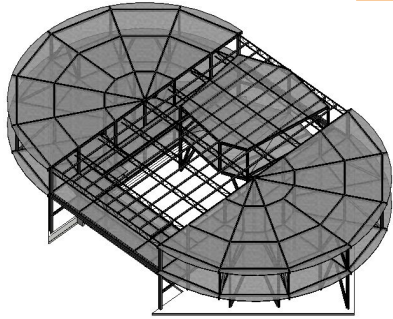


CM

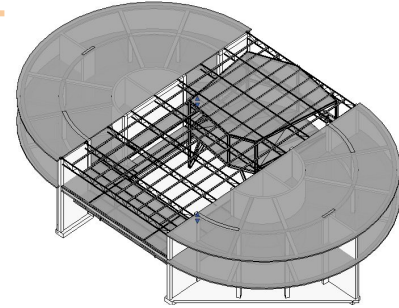
Lung-Steel	
Preliminaries completion	10/15/2019
Structural frame completion	03/26/2020
Instructional lab delivery	04/24/2020



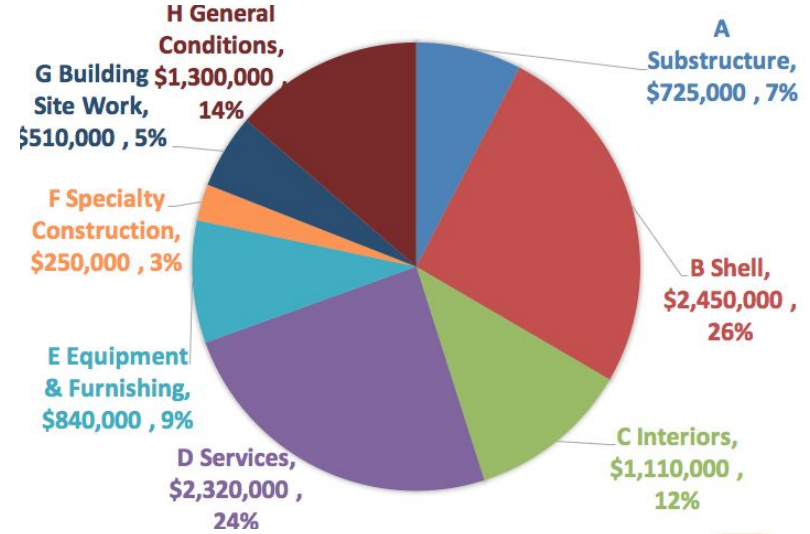
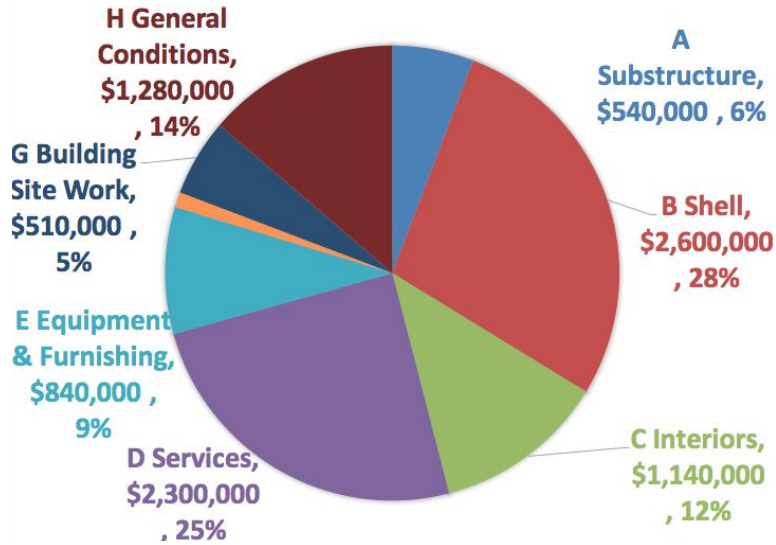
# COST ESTIMATE



**Steel**  
**\$9.3 mil**



**Concrete**  
**\$9.5 mil**



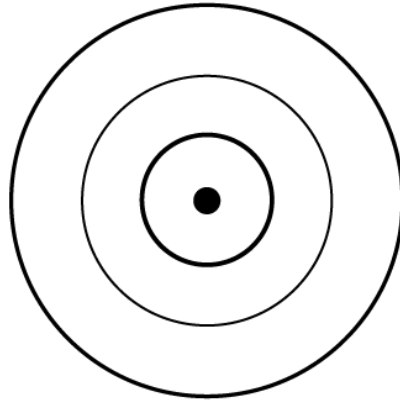
CM





EPICENTER

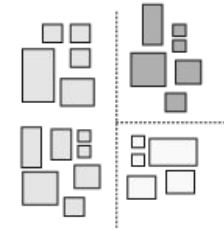
EVA // HAN // MELISSA // ALES // TAWA // NICOLAJ // BIRTHE



LA: THE MOST DIVERSE CITY IN  
USA

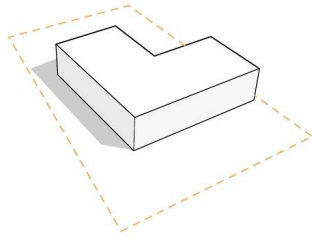


EARTHQUAKE ZONE

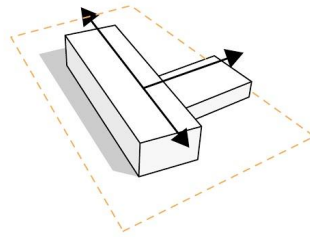


INTERSECTION OF  
COMMUNITIES

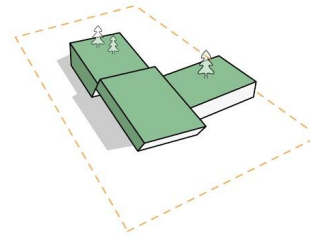




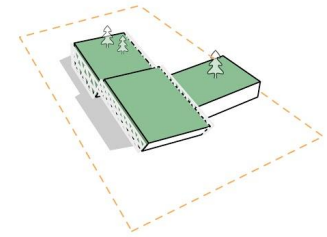
L-SHAPE ON SITE



ADJUSTED TO CONTEXT  
POINTING TOWARDS COMMUNITY



INTRUDUCING GREEN ELEMENTS  
SHADING, FLOW AND VIEWS



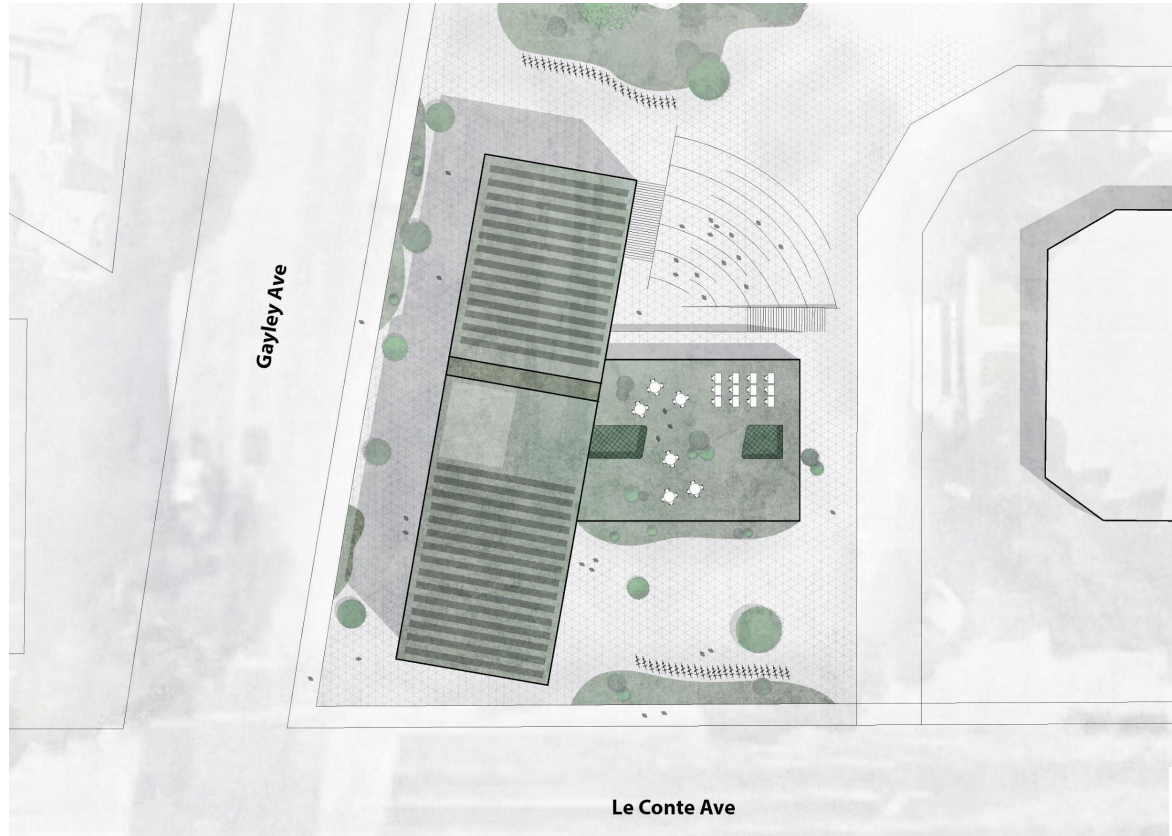
PLACEMENT OF AIR-CLEANING  
FACADE



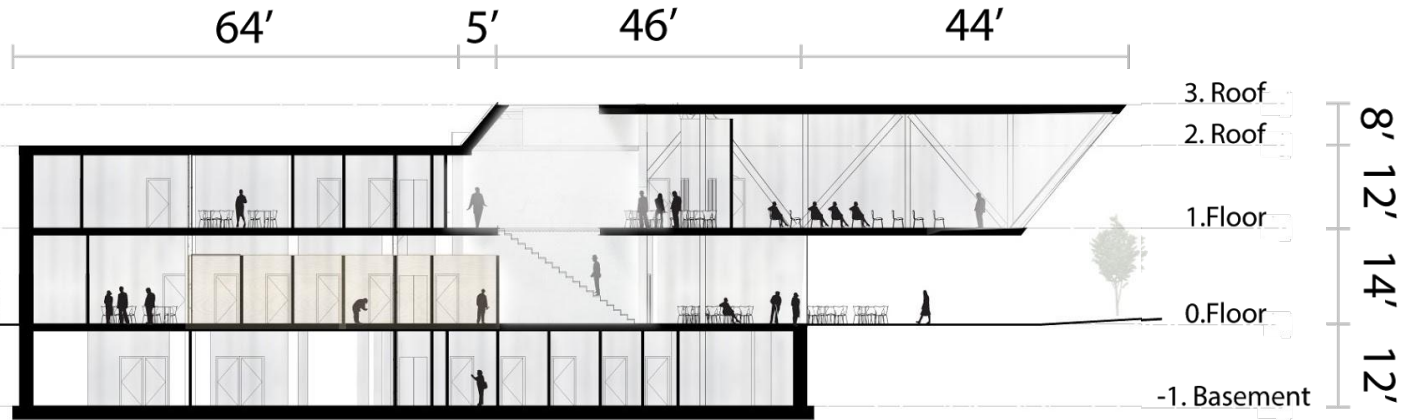
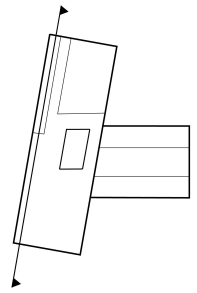
# THE BUILDING AT THE EPICENTER OF IT ALL!



# ROOF PLAN



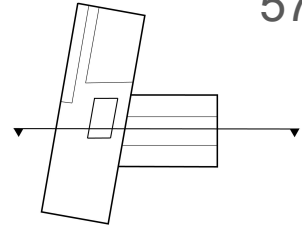
# SECTION OF EDUCATIONAL AREA





# SECTION OF ADMINISTRATION AREA

57



14      63'      51'



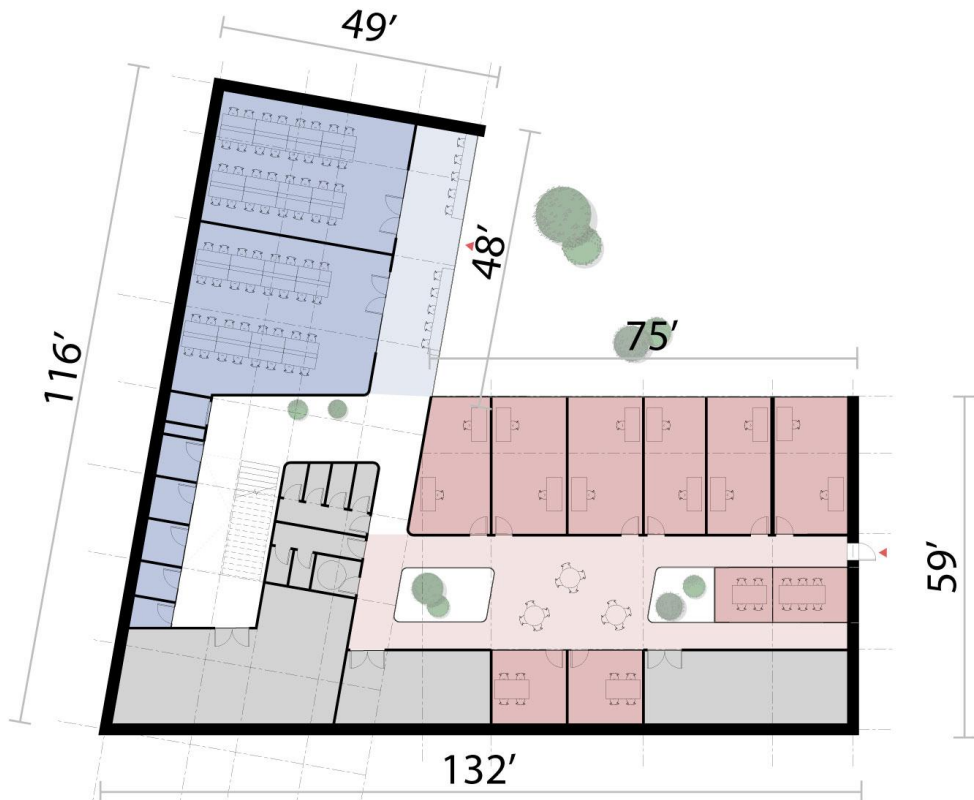
3. Roof  
2. Roof  
1. Floor  
0. Floor  
-1. Basement

8'  
12'  
14'  
12'

A



# BASEMENT

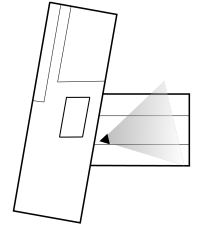


- 2 x Instructional lab
- 5 x Student Office
- Collaborative Space
- 6 x Restroom
- 1 x Handi. Restroom
- Technical Room
- 6 x Faculty Office
- 2 x Meeting Room
- 2 x Seminar Room
- Faculty lounge

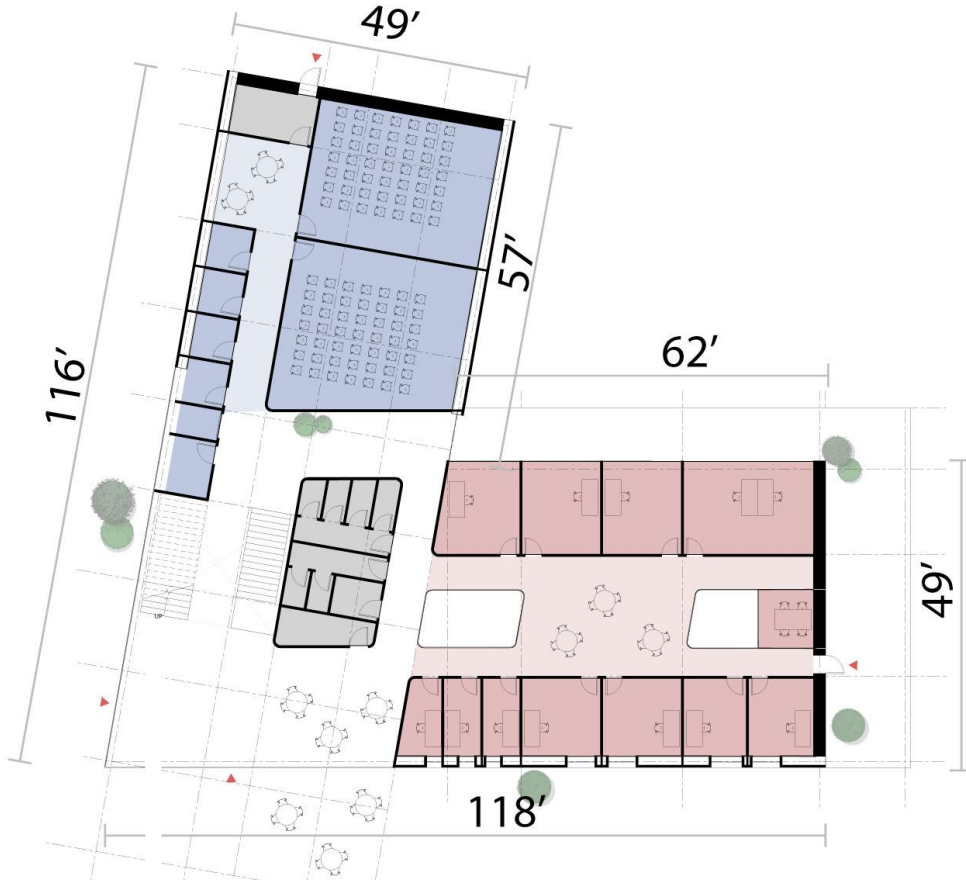


# VIEW OF ADMINISTRATION AREA

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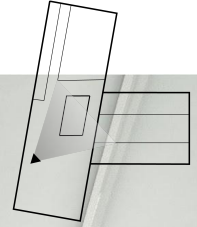
# GROUND FLOOR



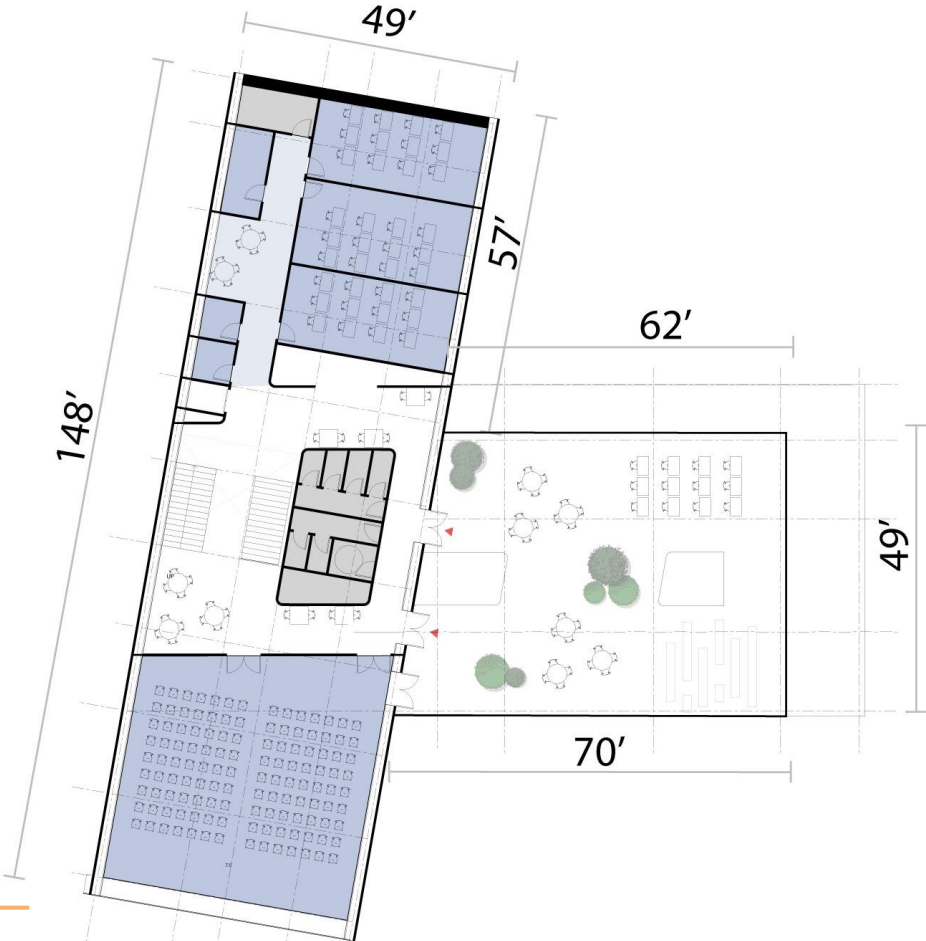
- 2 x Large Classroom
- 4 x Student Office
- Seminar Room
- Collaborative Space
- 6 x Restroom
- 1 x Handi. Restroom
- 6 x Faculty Office
- 2 x Senior Office
- 3 x Admin. Assist. Chair's Office
- Faculty Lounge



# VIEW OF LOBBY



# FLOOR 1

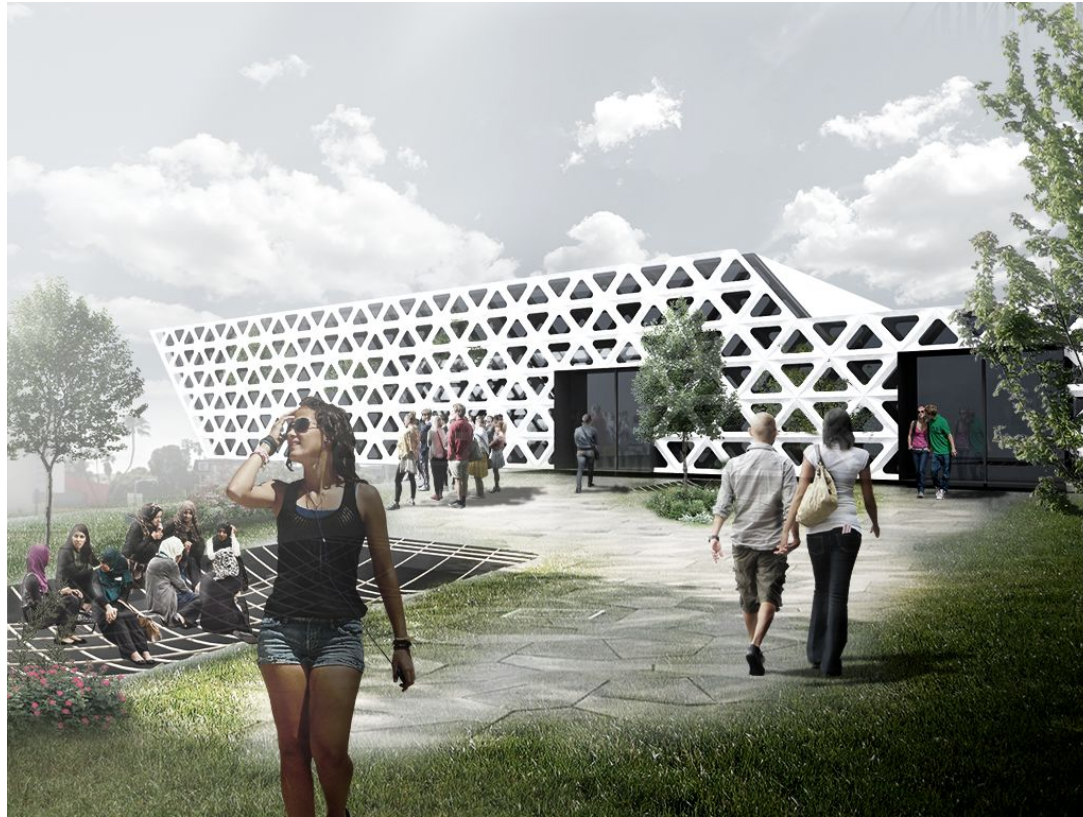
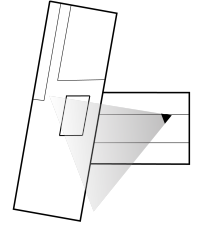


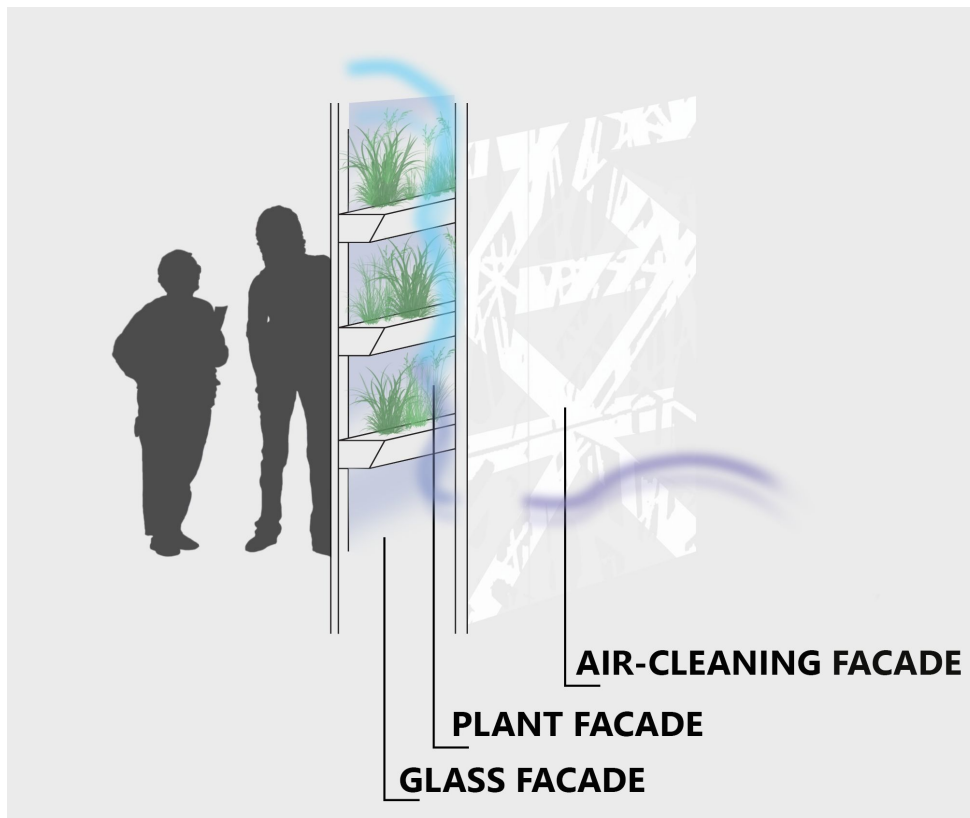
- 3 x Small Classroom
- 2 x Student Office
- Seminar Room
- Auditorium
- Collaborative Space
- 6 x Restroom
- 1 x Handicap. Restroom



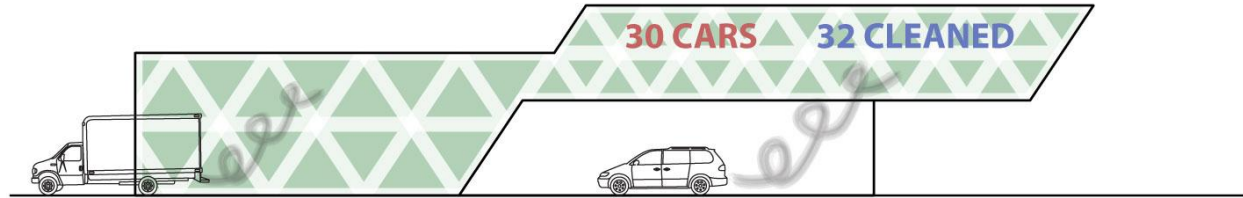
# VIEW OF ROOF TERRACE

---









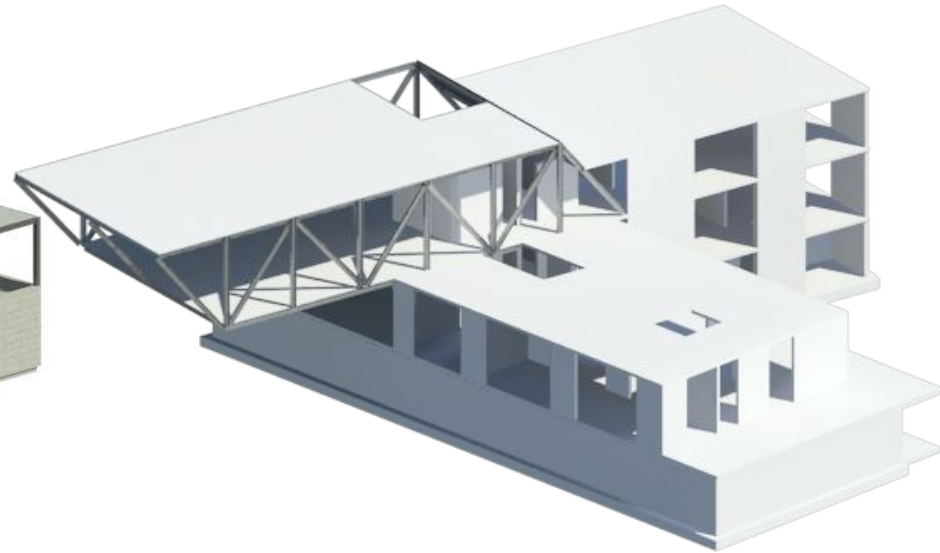
The facade cleans the air of every car that passes the building



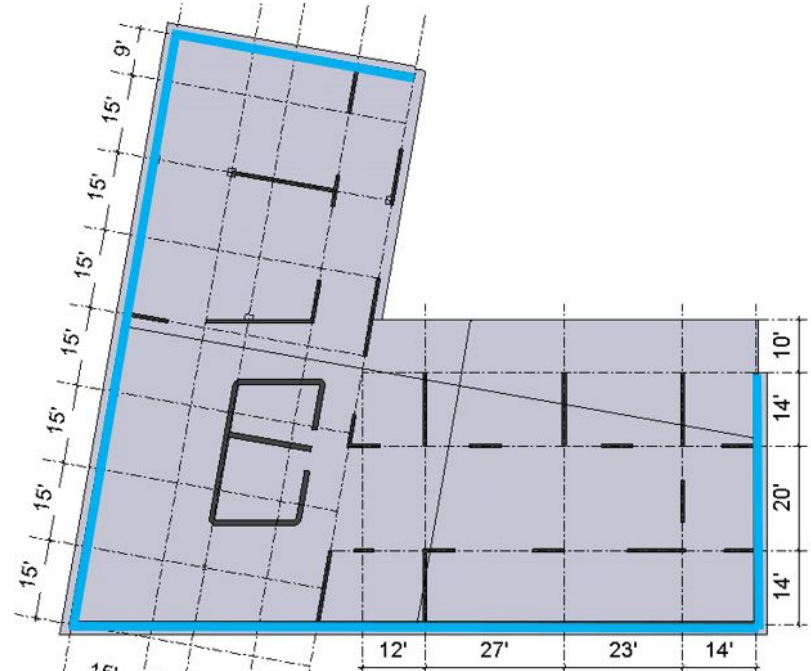
Steel design



Concrete and steel design



# BASEMENT



- Shear walls 10"
- Retaining walls 12"

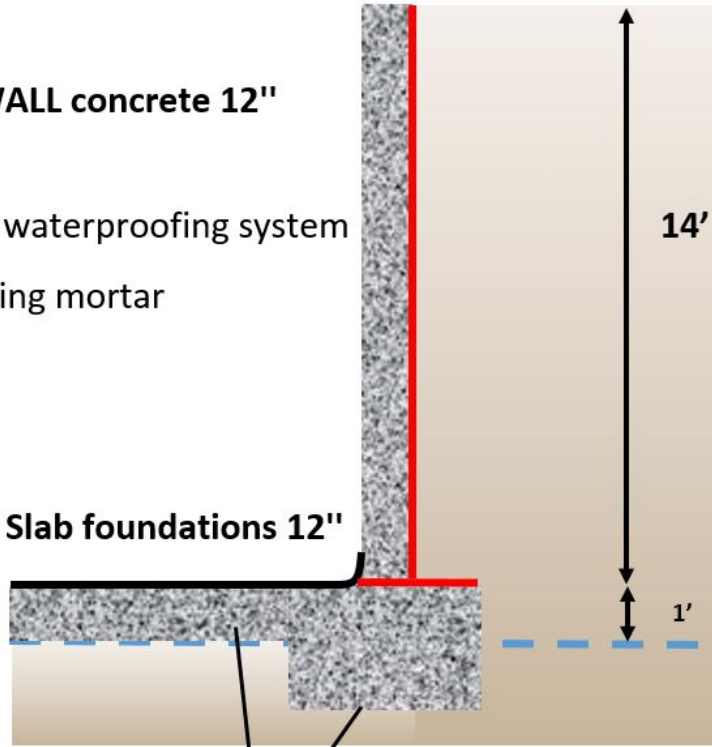


SE

**RETAINING WALL concrete 12"**

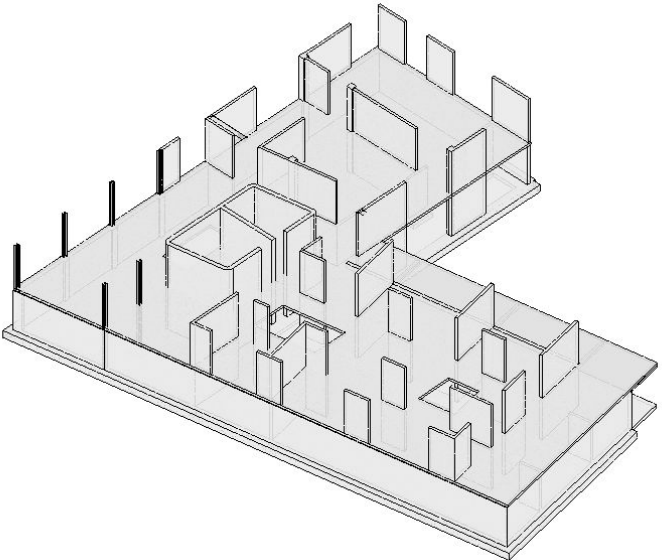
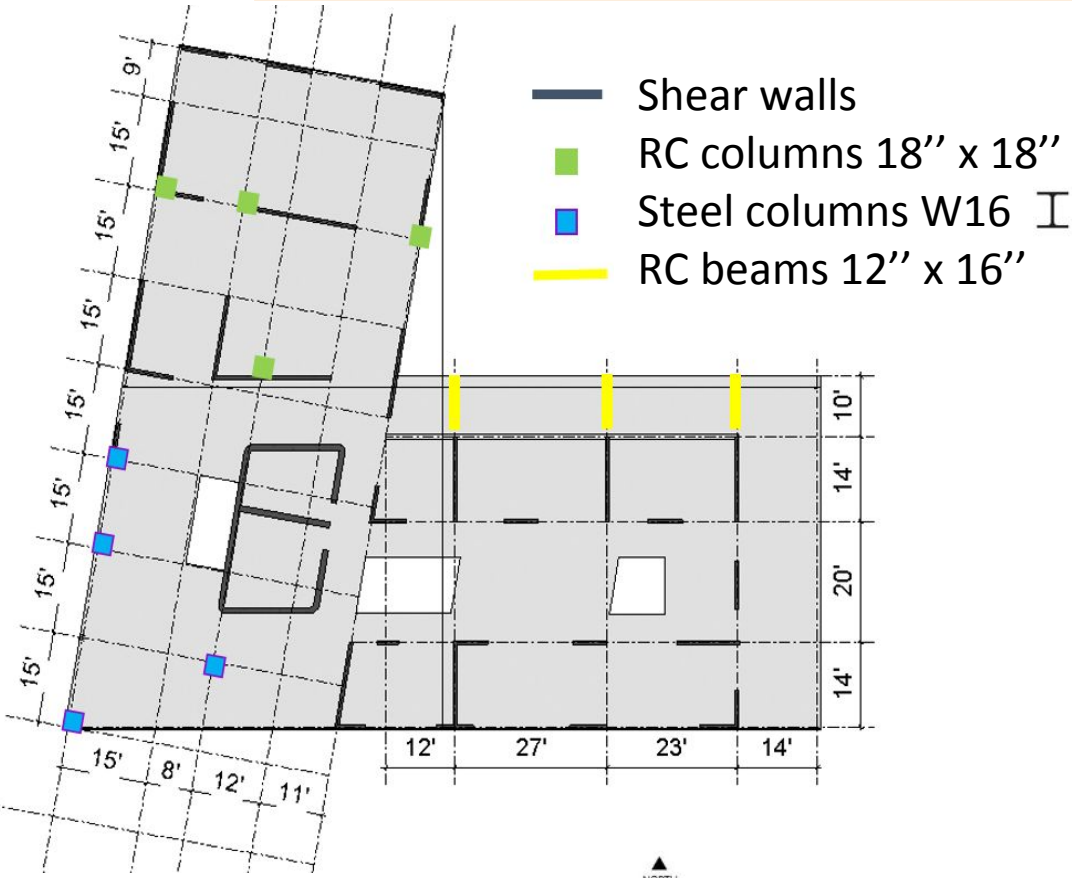
- membrane waterproofing system
- waterproofing mortar

**Slab foundations 12"**

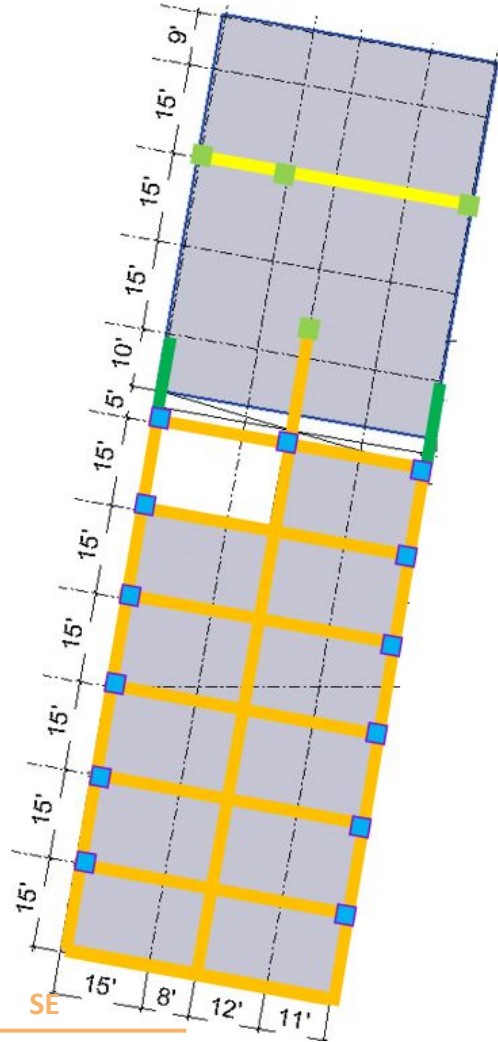







**Waterproof concrete**

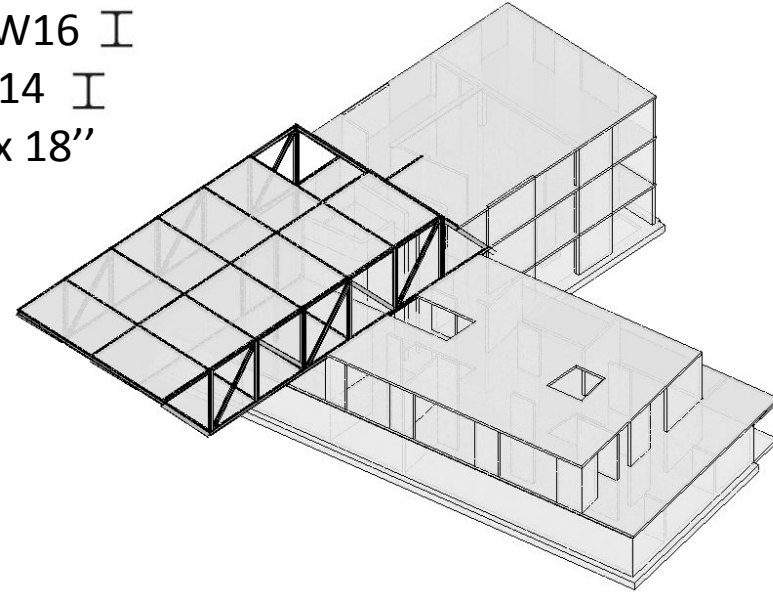




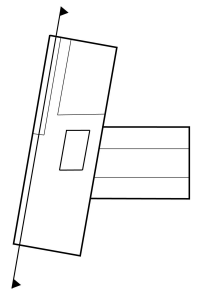
# CONCRETE ROOF



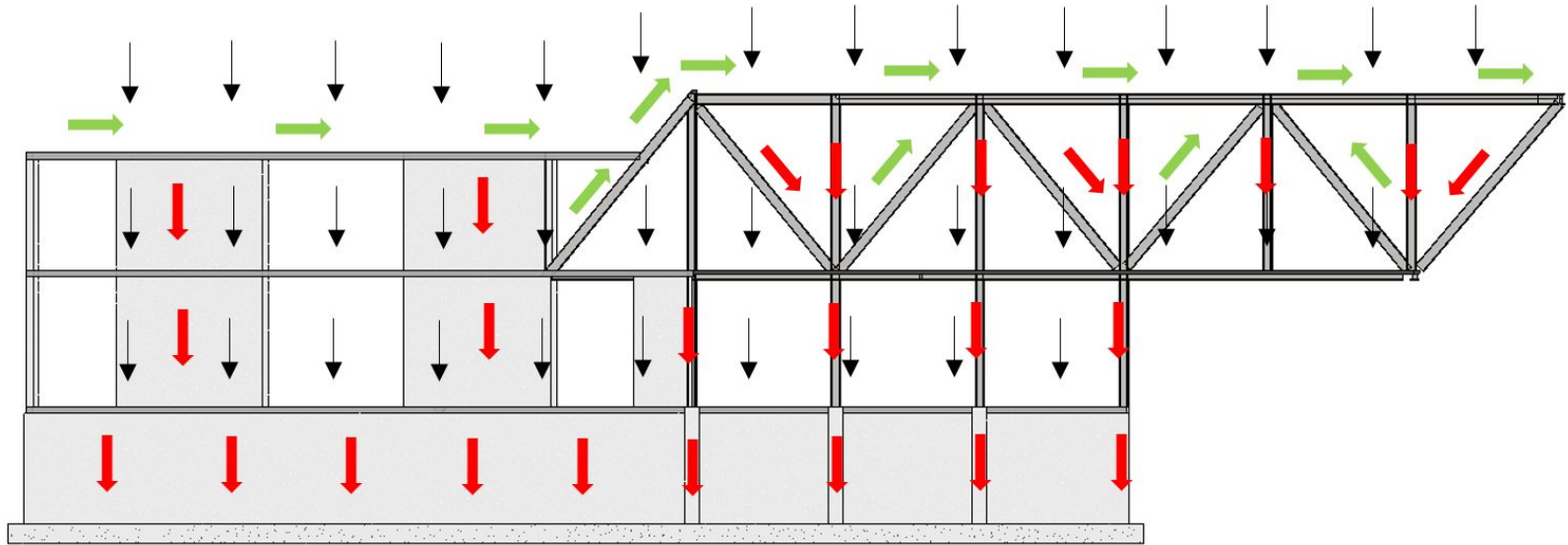
-  Steel diagonals W14  $\text{I}$
-  RC columns 18" x 18"
-  Steel columns W16  $\text{I}$
-  Steel beams W14  $\text{I}$
-  RC beams 18" x 18"



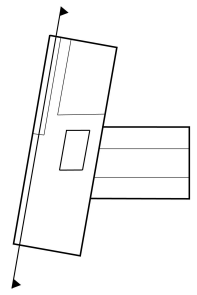
# VERTICAL LOAD PATHS



← tension      ← compression

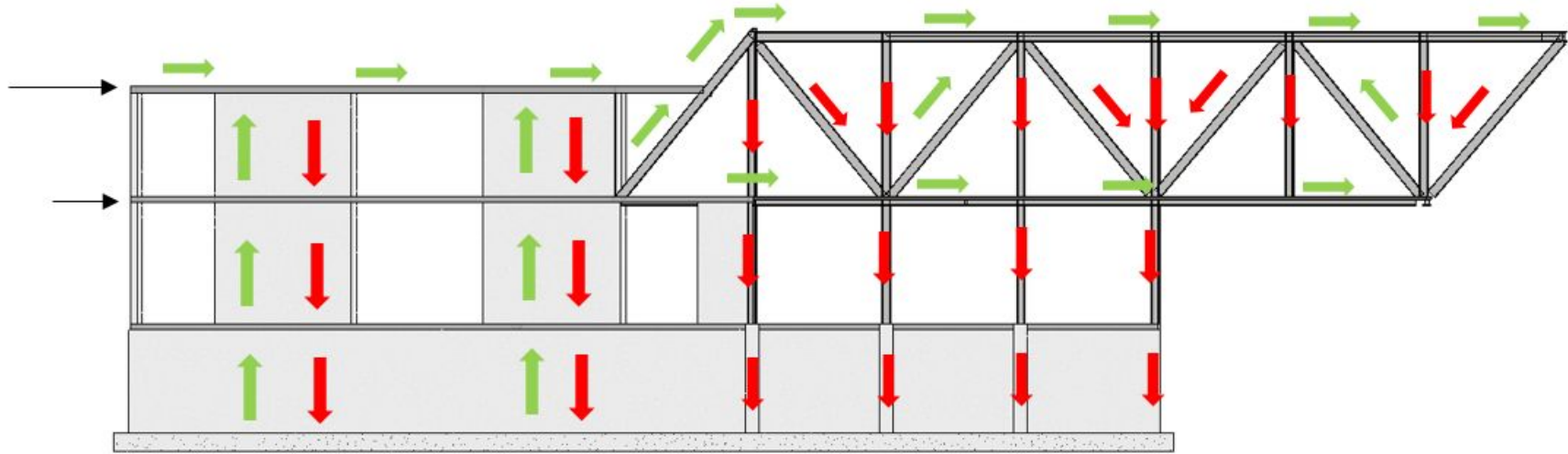


# HORIZONTAL LOAD PATHS

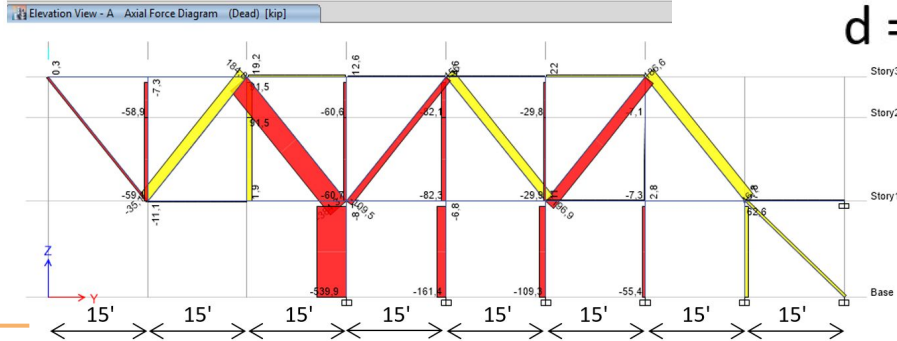
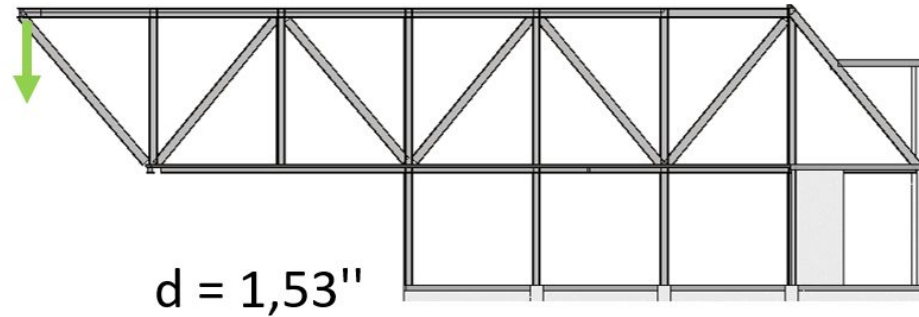
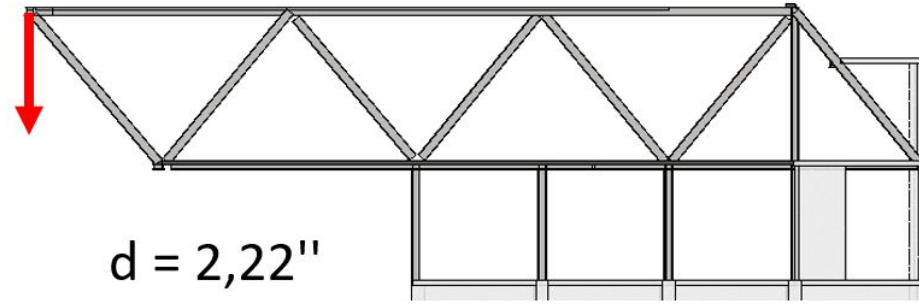
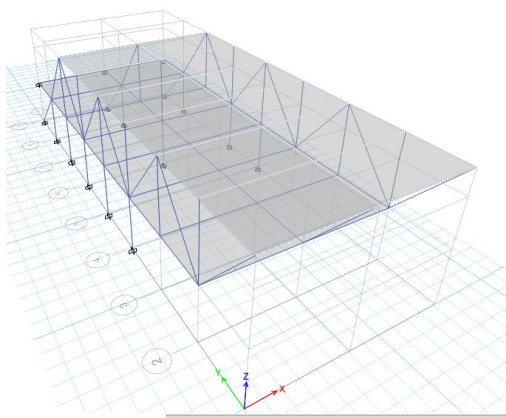


← tension

← compression



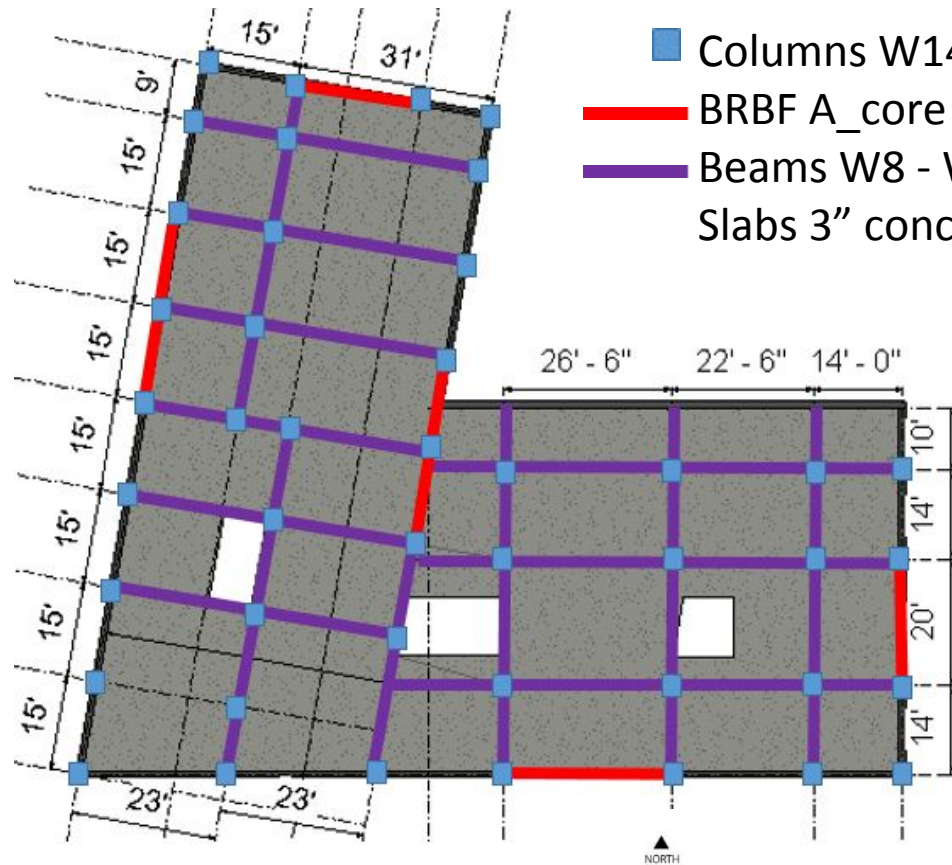
- Adding vertical columns
- 31% displacement reduction



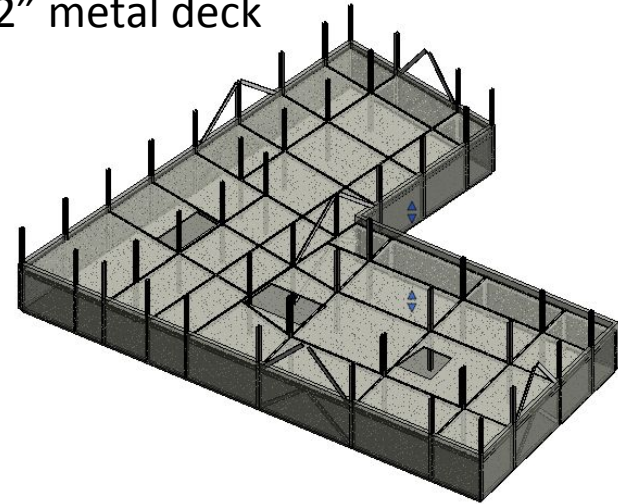
SE



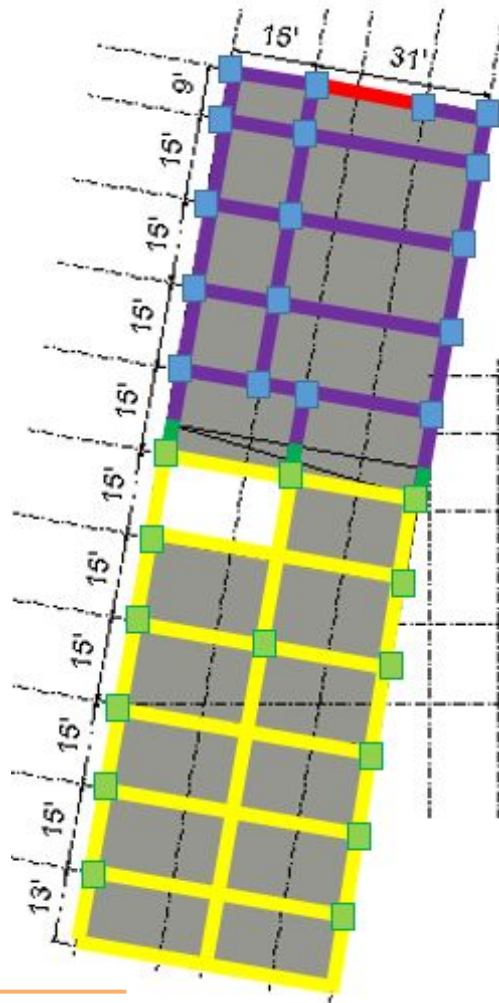




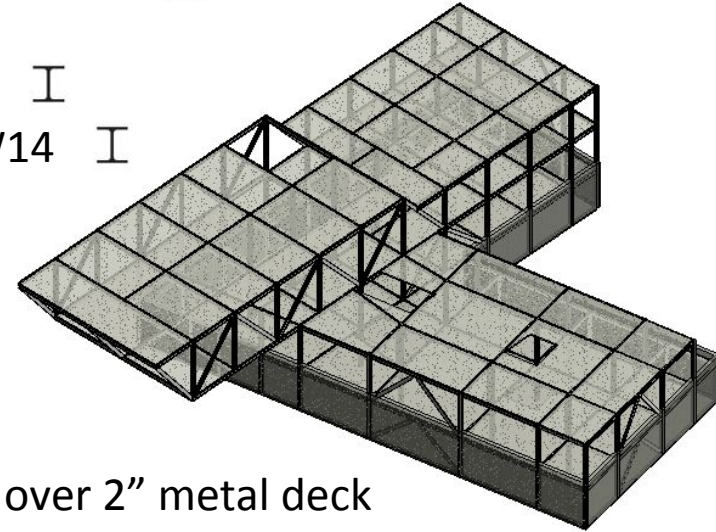
- Columns W14 I
- BRBF A<sub>core</sub> = 6.5 in<sup>2</sup>
- Beams W8 - W14 typical I
- Slabs 3" concrete over 2" metal deck



# STEEL ROOF



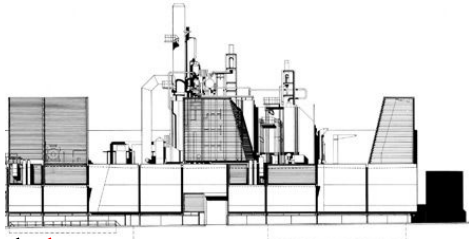
- Columns W14 I
- BRBF  $A_{core} = 6.5 \text{ in}^2$
- Beams W8 - W14 typical I
- Columns W16 I
- Steel Beams W14 I
- Steel Diagonals W14 I



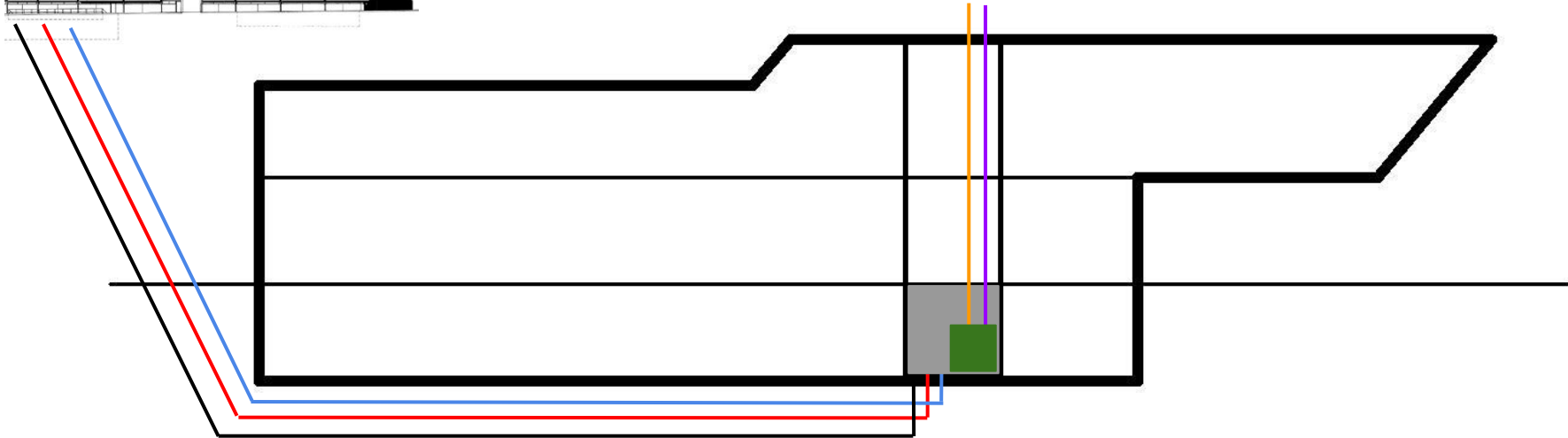
Slabs 3" concrete over 2" metal deck

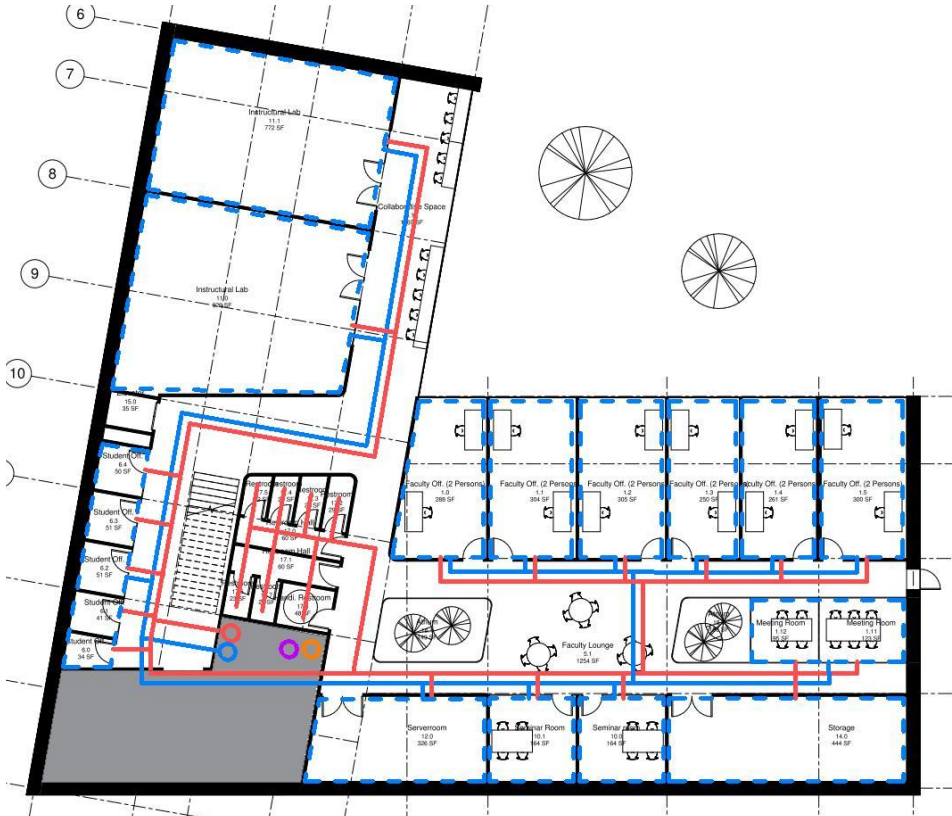


UCLA cogeneration plant



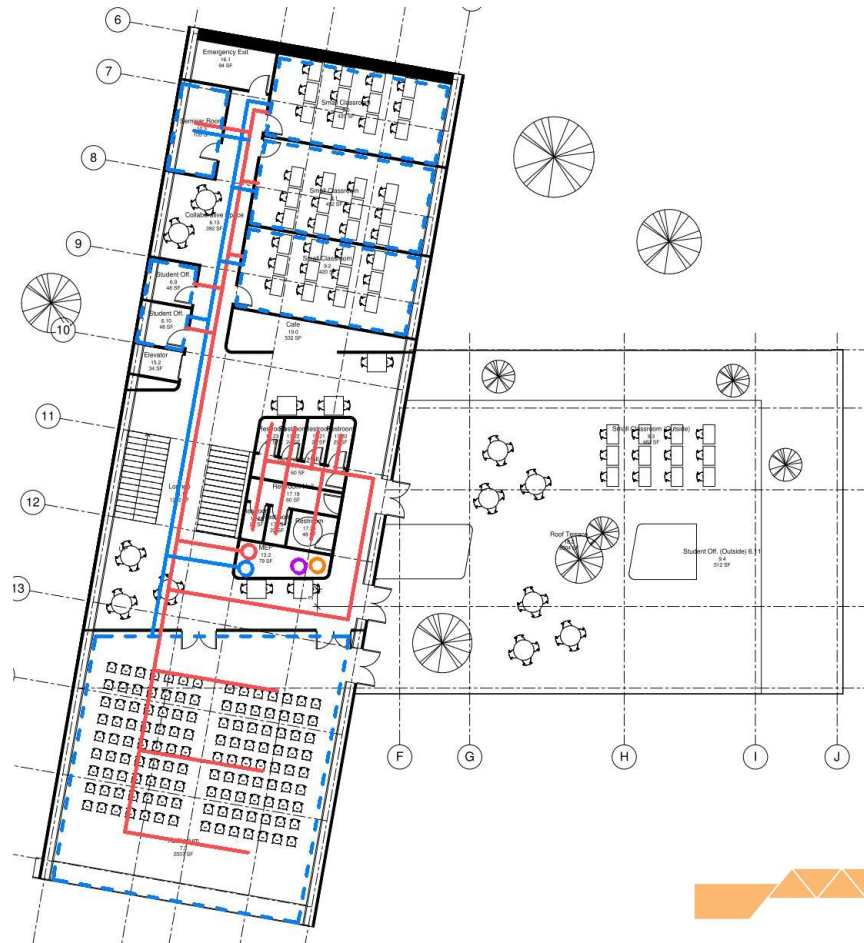
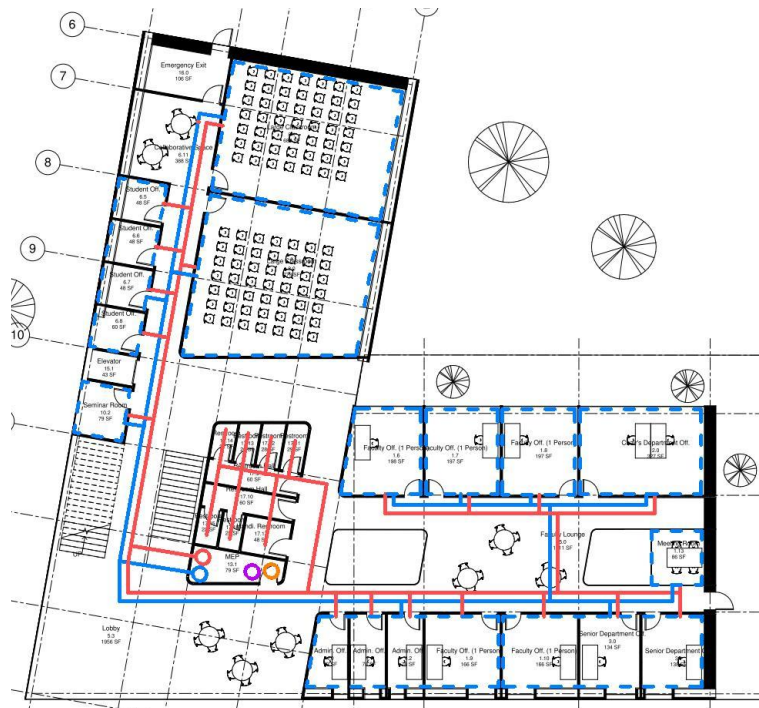
- Heating
- Cooling
- Electricity
- Inlet
- Exhaust
- AHU
- MEP room



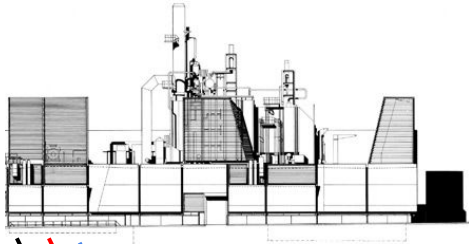


- Supply duct
- - - Outline of plenum
- Return duct
- Vertical supply duct
- Vertical return duct
- Vertical inlet
- Vertical exhaust
- MEP room

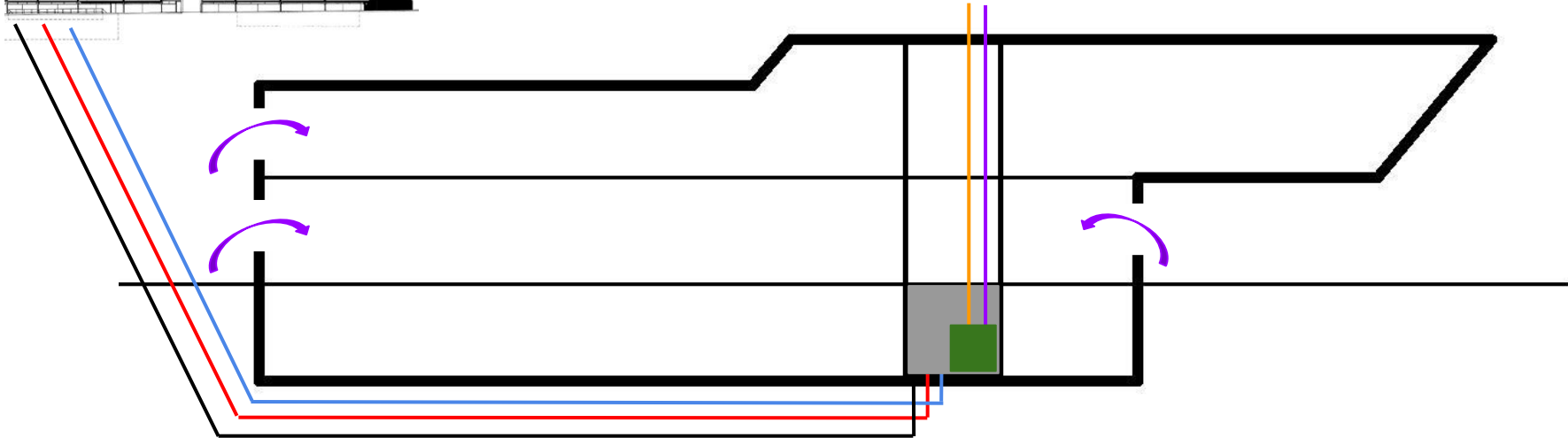


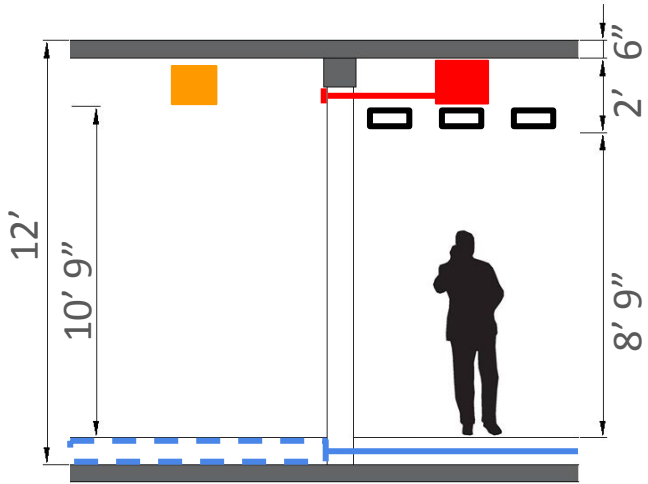


UCLA cogeneration plant



- Heating
- Cooling
- Electricity
- Inlet
- Exhaust
- AHU
- MEP room





	UFAD	Hybrid
<b>Air quality</b>	Controlled	Uncertain
<b>Cost</b>	\$14.51/SF	\$14.51/SF
<b>User control</b>	Diffuser	Diffuser and window
<b>System control</b>	Standard	Complex

- Supply
- Return
- Radiant ceiling
- Cooling, sprinkling, cable tray

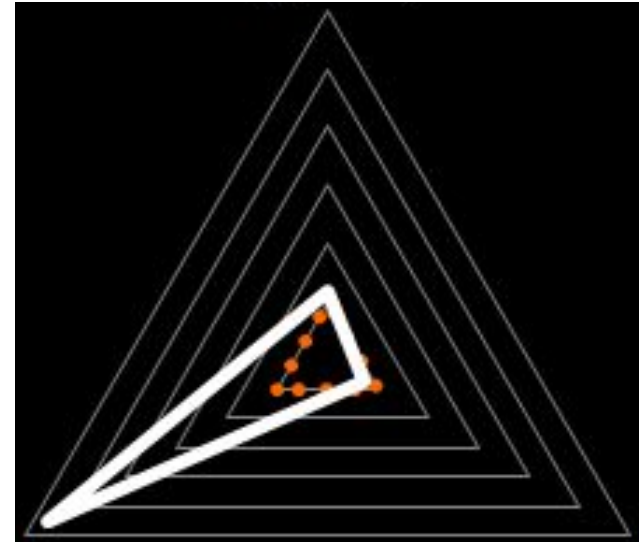
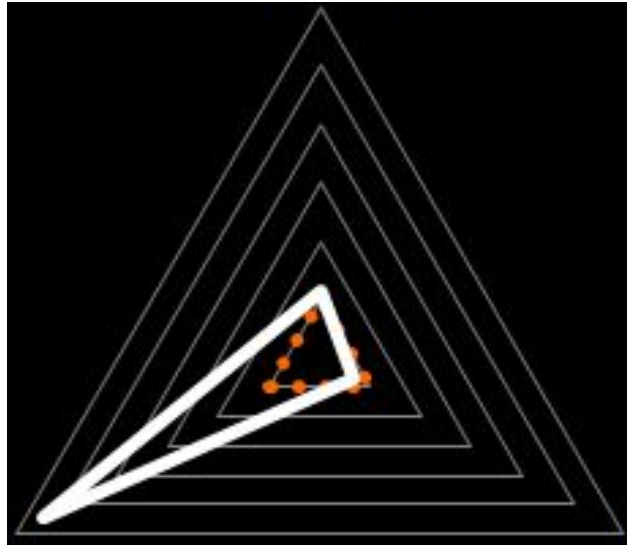


Steel

Concrete

Carbon (kg CO<sub>2</sub>-eq)

Carbon (kg CO<sub>2</sub>-eq)



Water (kg H<sub>2</sub>O-eq)

Energy (MJ)

Water (kg H<sub>2</sub>O-eq)

Energy (MJ)





# SCHEDULE-EPICENTRE STEEL

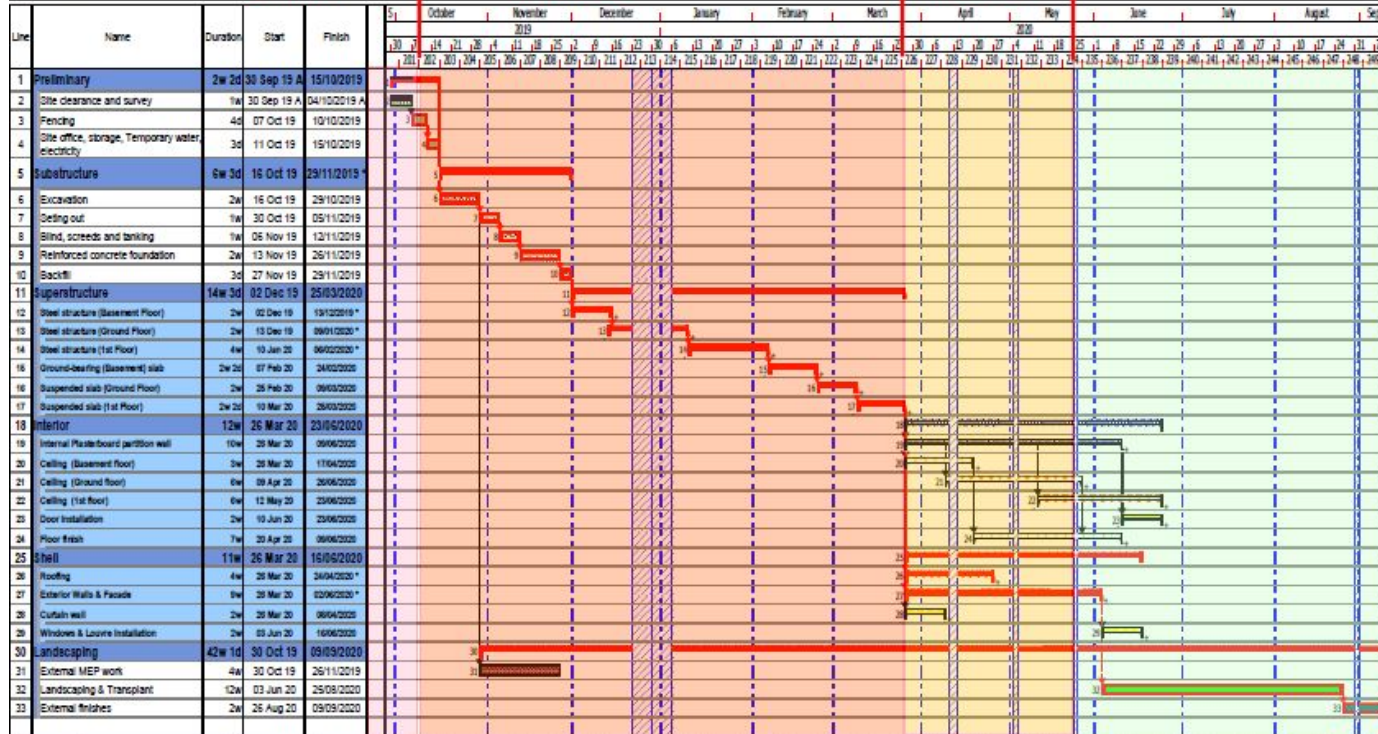
05/03/2016

Preliminaries  
3 weeks

Epicentre - Steel Frame  
Structural Frame Construction  
22 weeks

Early  
Delivery  
8 weeks

Final Delivery  
15 weeks



Start	09/30/2019
Preliminaries completion	10/15/2019
Structural frame completion	03/25/2020
Instrumental lab delivery	04/28/2020
Whole building completion	06/21/2020
Landscaping completion	09/09/2020



# SCHEDULE-EPICENTRE CONCRETE

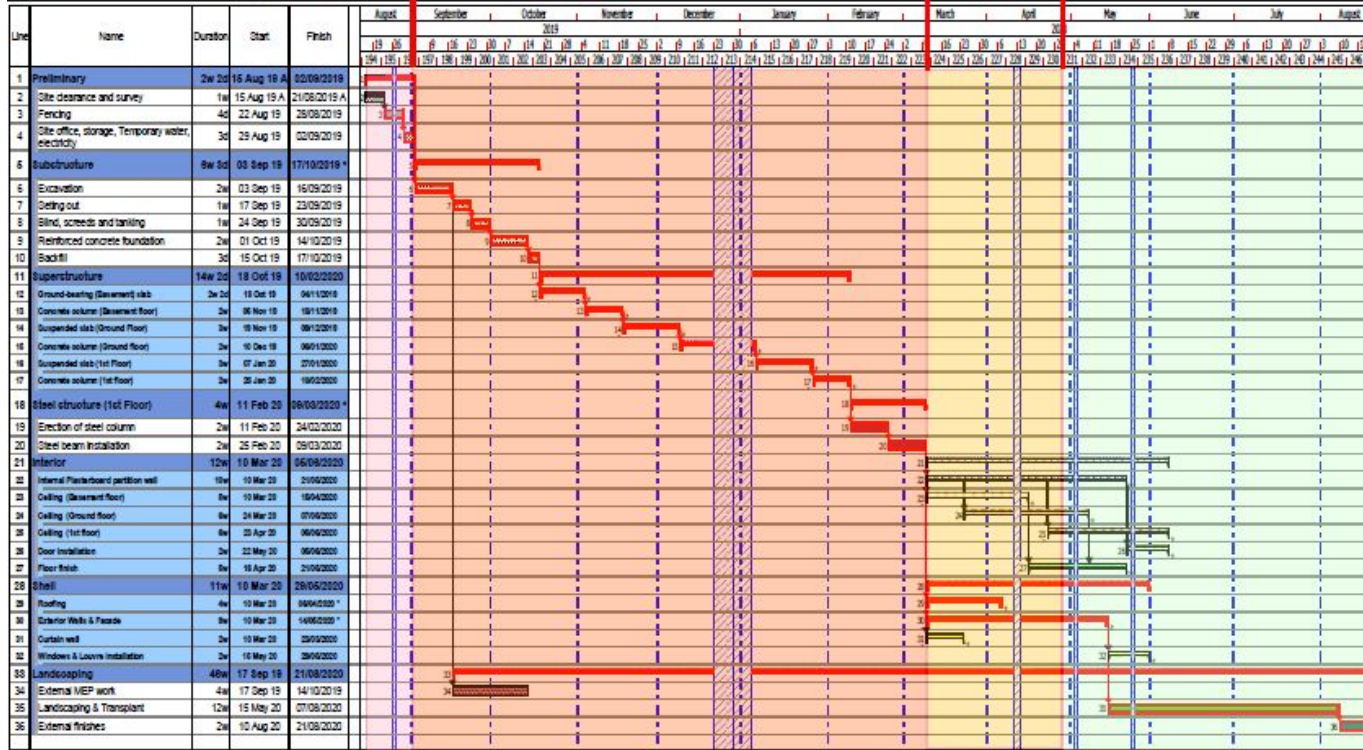
05/03/2018

Preliminaries  
3 weeks

Epicentre - Concrete Frame  
Structural Frame Construction  
26 weeks

Early  
Delivery  
7 weeks

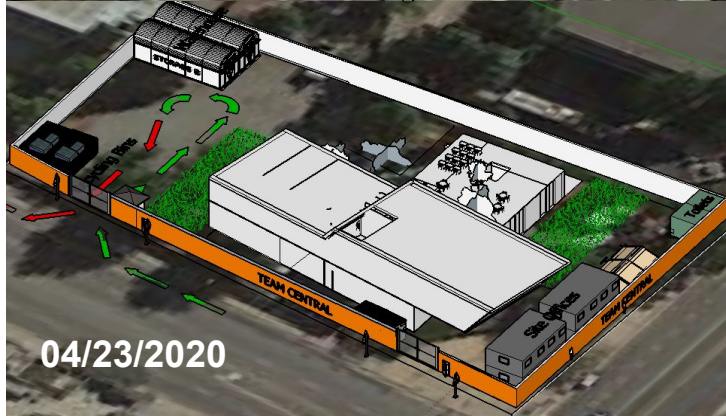
Final Delivery  
16 weeks



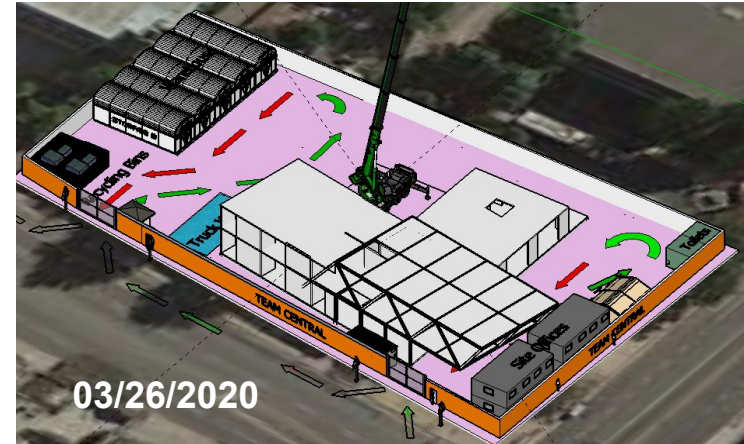
Start	09/08/2019
Preliminaries completion	02/09/2019
Structural frame completion	03/09/2020
Instrumental lab delivery	04/23/2020
Whole building completion	05/23/2020
Landscaping completion	08/21/2020



09/02/2019



04/23/2020



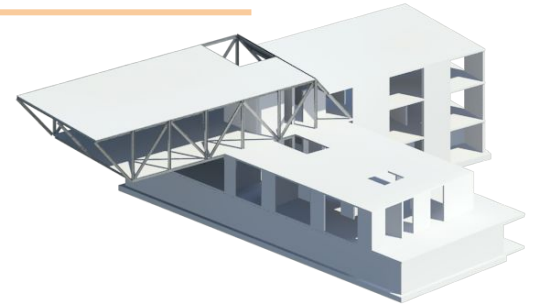
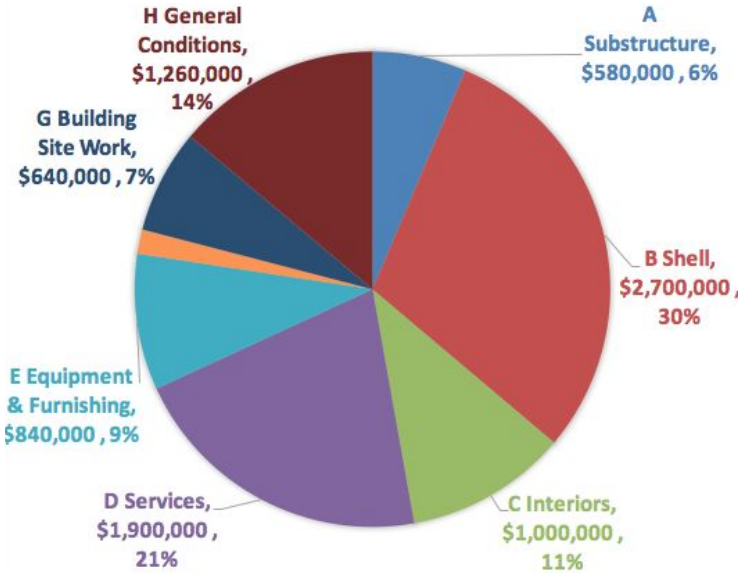
03/26/2020

## Epicentre-Concrete

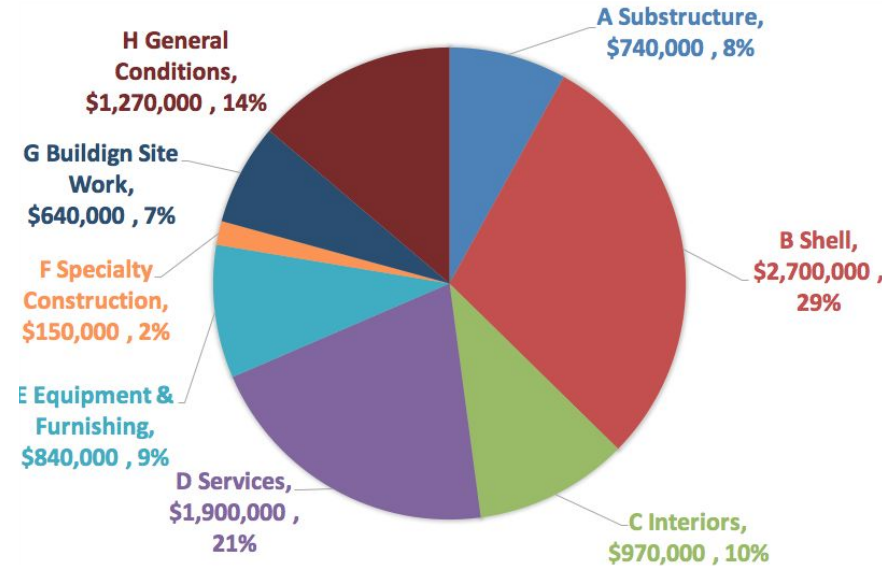
Preliminaries completion	09/02/2019
Structural frame completion	03/26/2020
Instructional lab delivery	04/23/2020



## Steel \$9.0 mil



## Concrete \$9.2 mil





THE LUNGS

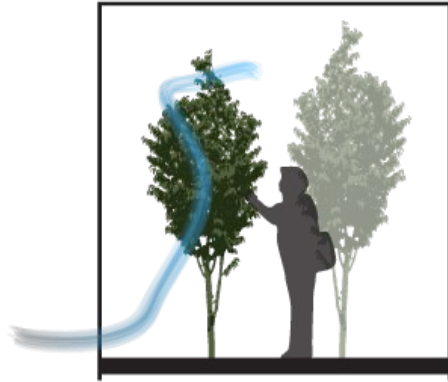
EVA // HAN // MELISSA // ALES // TAWA // NICOLAJ // BIRTHE

VS.

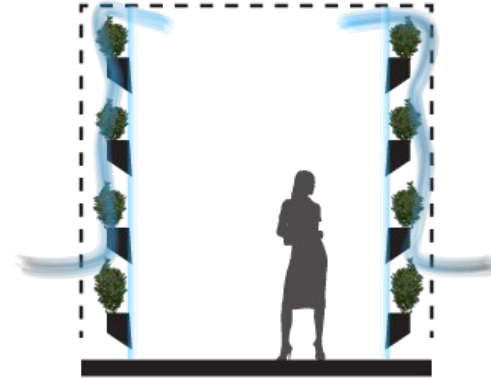


EPICENTER

EVA // HAN // MELISSA // ALES // TAWA // NICOLAJ // BIRTHE



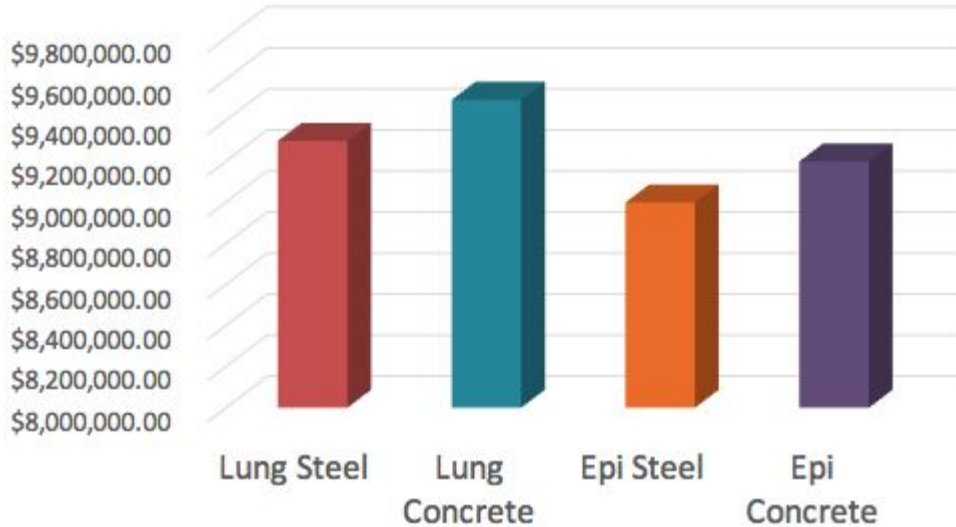
THE LUNG  
Outside in



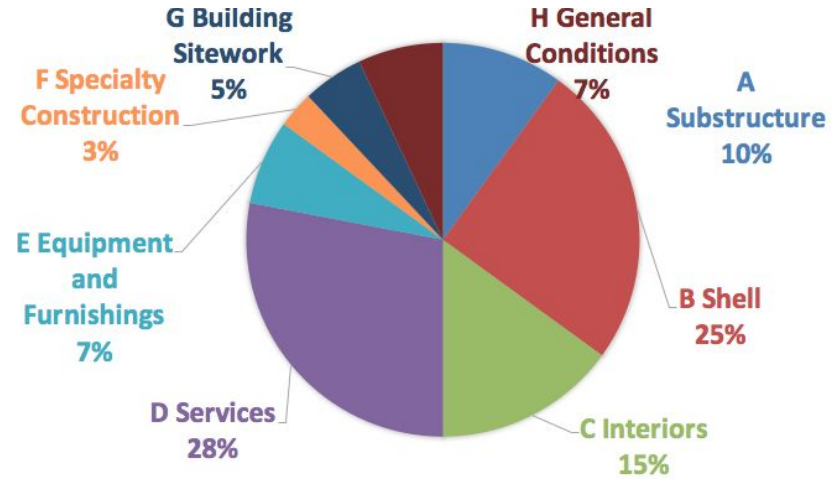
THE EPICENTER  
Outside out



### Construction Cost Comparison



### Updated TVD





Risk Assessment Matrix				PROBABILITY			
				Frequency of Occurrence Over Time			
				A	B	C	D
				Likely	Probable	May	Unlikely
SEVERITY		I	Project Failure	0	1	2	3
		II	Degraded Project	1	2	3	4
		III	Impact to Project objectives	2	3	4	5
		IV	Little impact to project	3	4	5	6





# QUALITATIVE RISK ANALYSIS

				
	Steel	Concrete	Steel	Concrete
Material Procurement	C,II	C, III	B,II	B,III
Construction Cost	B,II	B,II	B, III	B, III
Constructability & Delays	B, II	B,II	C, III	C, III
Occupancy Delays	C,III	D,III	C,III	D,III
Accidents	D,III	D,III	C, III	C,III
<b>Points</b>	16	18	17	<b>19</b>



*Pull Planning*



*Sustainability*



*Safety Walks*



*Collaboration*



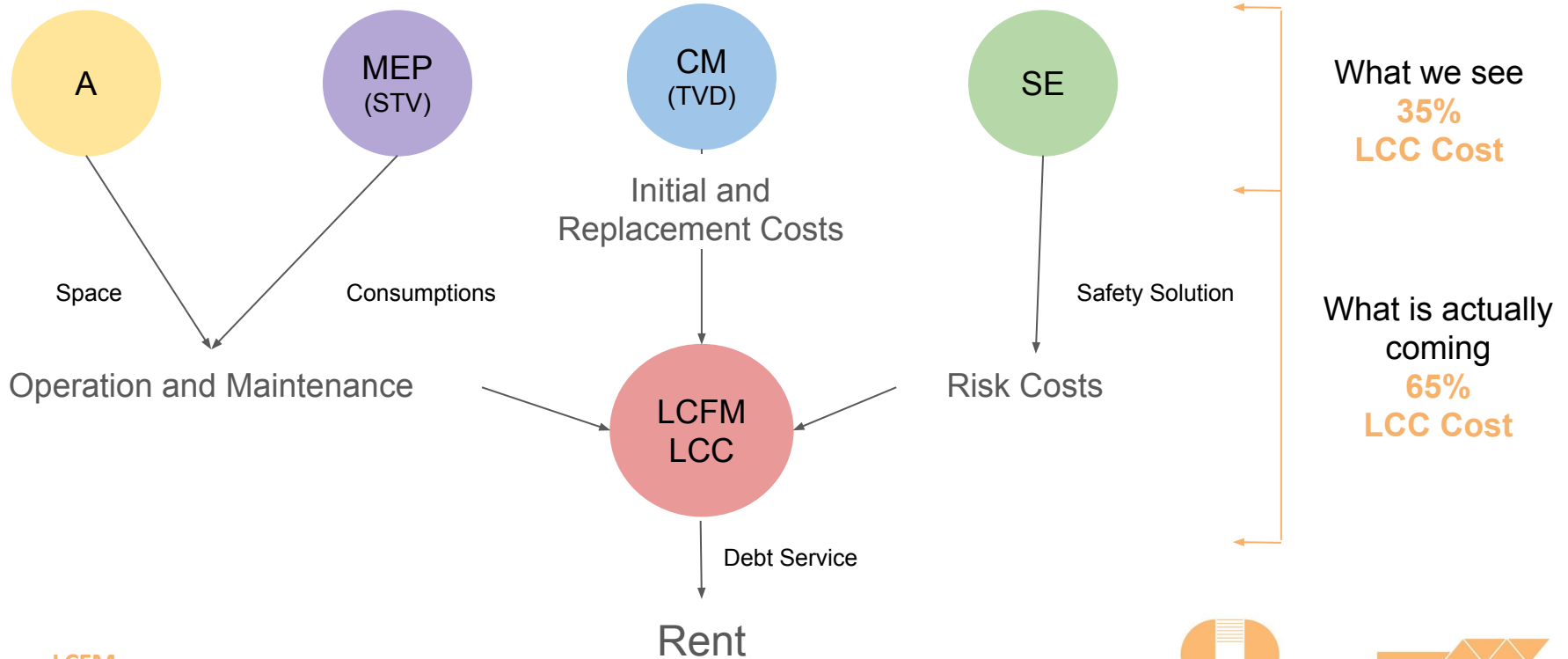
*4D & 5D Technology*



*etc.....*



# LIFE CYCLE COST



LCFM

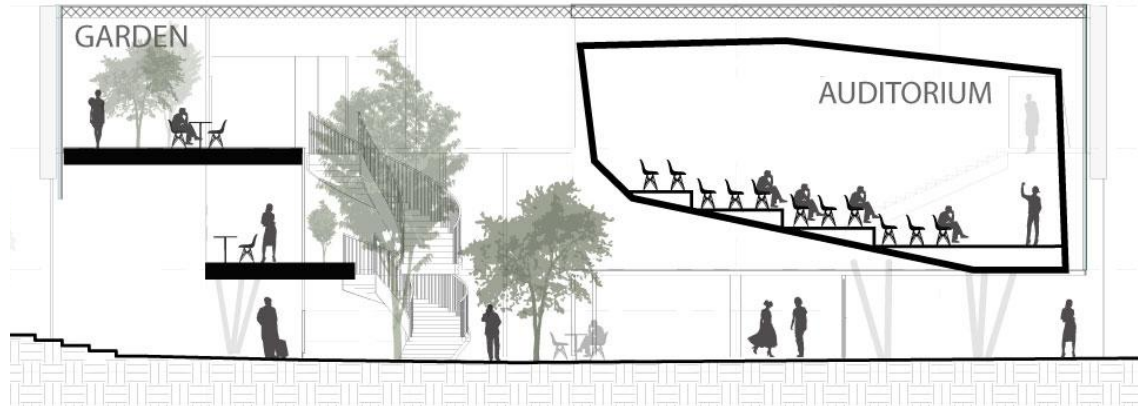




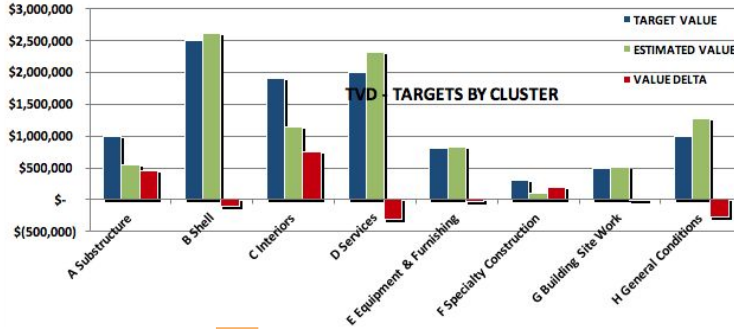
*Green Cafe*



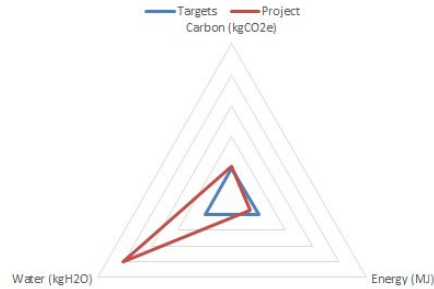
*Rent the auditorium to public*



TVD = \$9,300,000



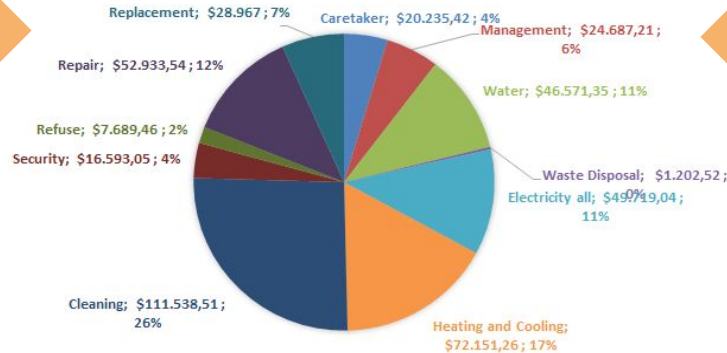
STV = GWP: 111 %



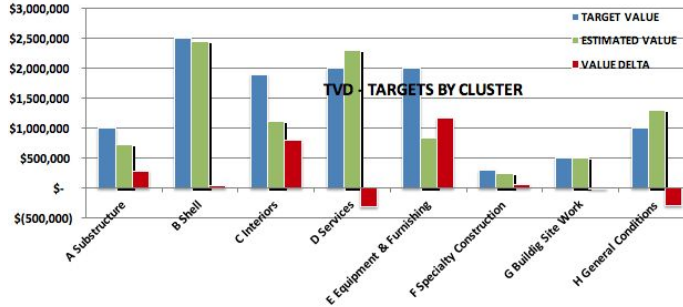
Rent Lung Steel  
= \$885,000

## Total O+M+R Costs

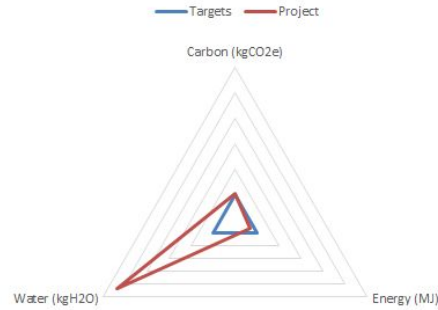
LUNG STEEL - \$ 432.288,32



TVD = \$9,500,000



STV = GWP: 154 %

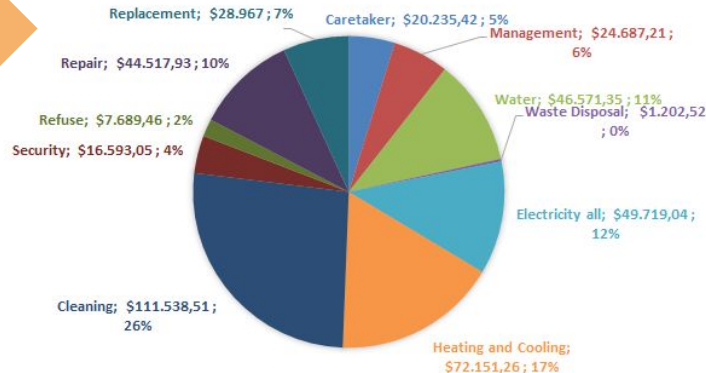


Rent Lung Steel  
= \$885,000

Rent Lung Concrete  
= \$895,000

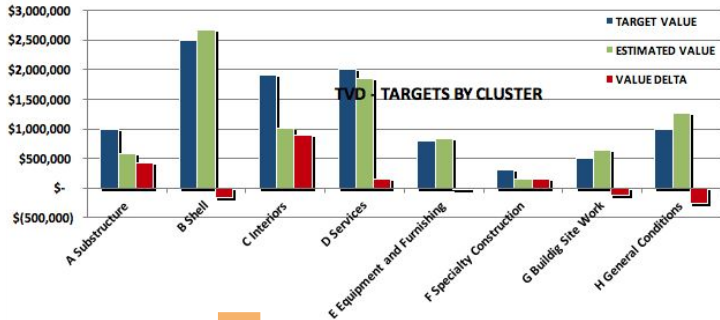
## Total O+M+R Costs

LUNG CONCRETE - SUM \$ 423.872,71

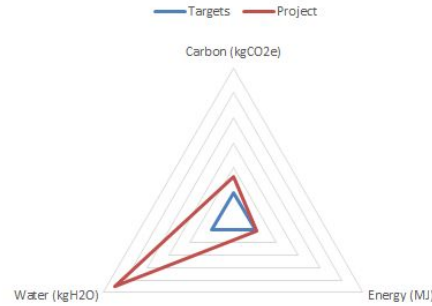


# TARGET RENT - EPICENTER STEEL

TVD = \$9,000,000



STV = GWP: 161 %



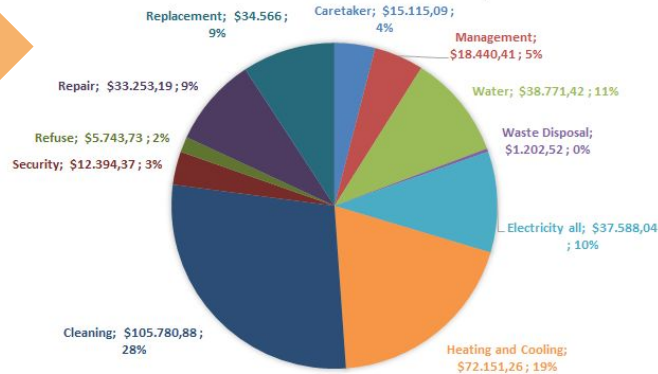
Rent Lung Steel  
= \$885,000

Rent Lung Concrete  
= \$895,000

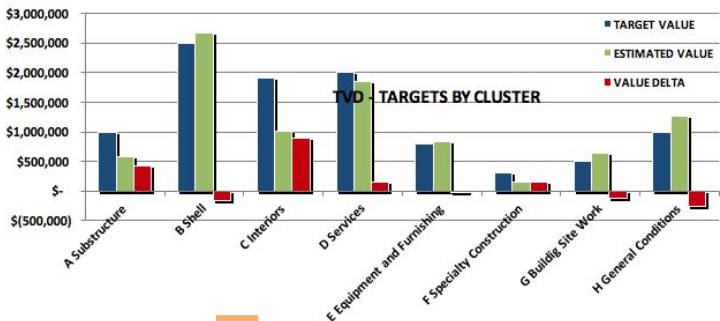
Rent Epicenter Steel  
= \$820,000

## Total O+M+R Costs

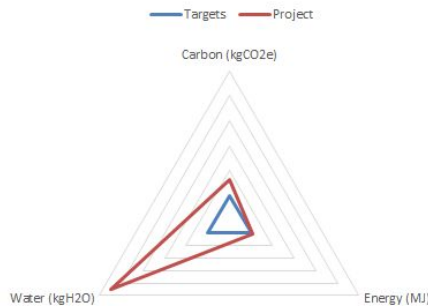
EPI CENTER STEEL - SUM \$ 375.007,32



TVD = \$9,110,000



STV = GWP: 197 %



Rent Lung Steel = \$885,000

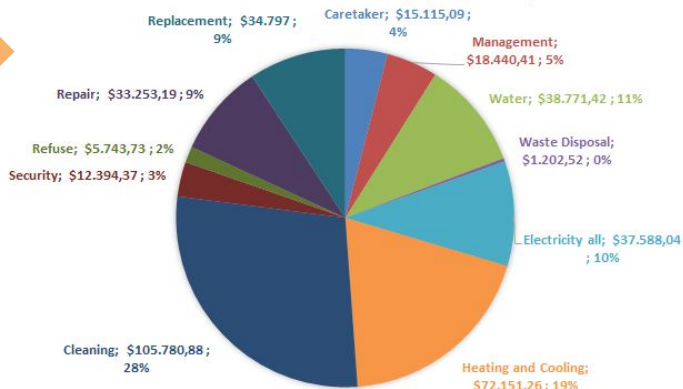
Rent Lung Concrete = \$895,000

Rent Epicenter Steel = \$820,000

Rent Epicenter Concrete = \$830,000



## Total O+M+R Costs

EPI CENTER CONCRETE - SUM \$ 375.237,54



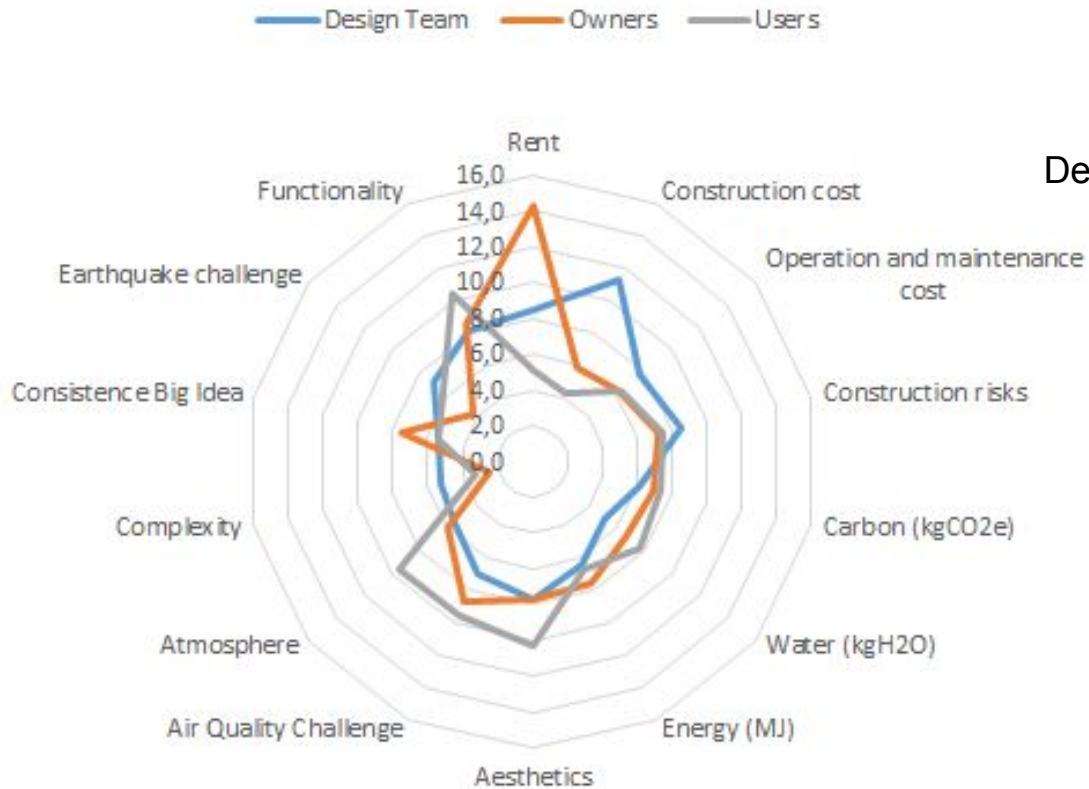


# SUMMARY

				
	Steel	Concrete	Steel	Concrete
<b>Construction time</b>	48 weeks	48 weeks	48 weeks	51 weeks
<b>Early Occupancy Date</b>	April 28	April 24	April 28	April 23
<b>Construction risk</b>	16	18	17	19
<b>Construction cost</b>	\$9,300,000	\$9,500,000	\$9,000,000	\$9,200,000
<b>GWP</b>	113%	117%	112%	116%
<b>Energy (MJ) 50 years</b>	107,114,158	109,216,392	104,645,905	106,378,151
<b>Water (kgH<sub>2</sub>O-eq) 50 years</b>	396,805,056	400,207,452	401,373,496	404,714,683
<b>Life cycle cost</b>	\$432,000	\$423,000	\$375,000	\$375,200
<b>Rent</b>	\$885,000	\$895,000	\$820,000	\$830,000

# CRITERIA FOR DECISION MATRIX

## Scoring of the criteria



Decision weighting:

50% Owners

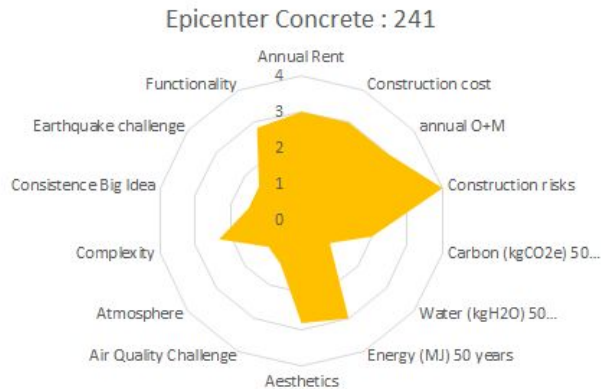
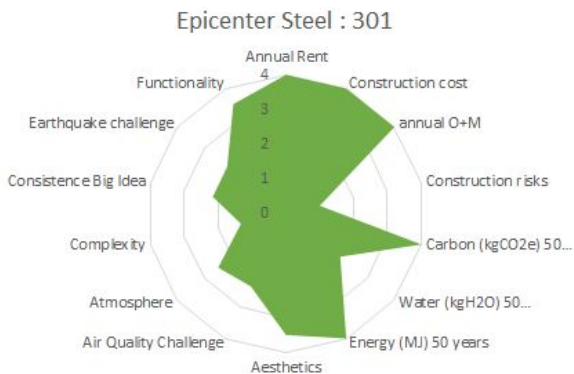
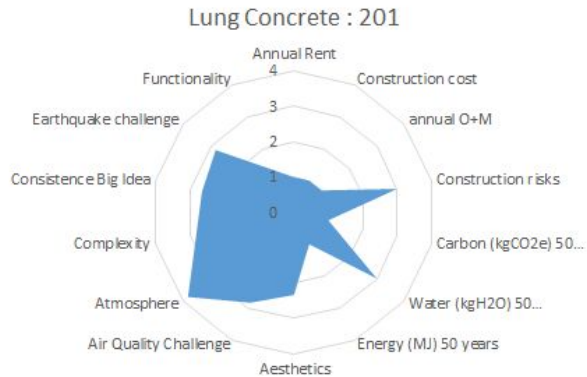
45% Design Team

5% User

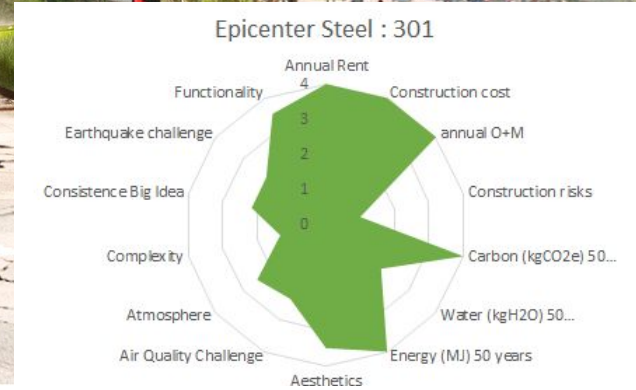


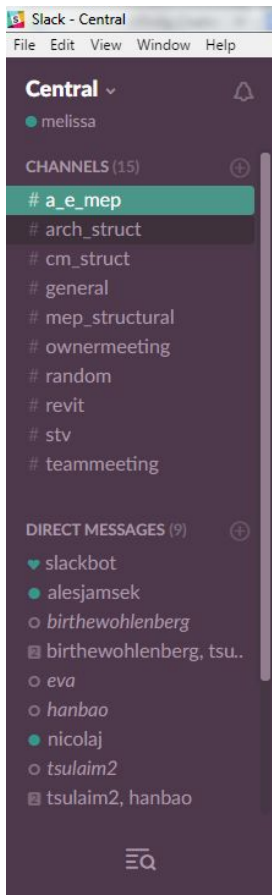
# DECISION MATRIX

Best - 4 Points  
Worst - 1 Point

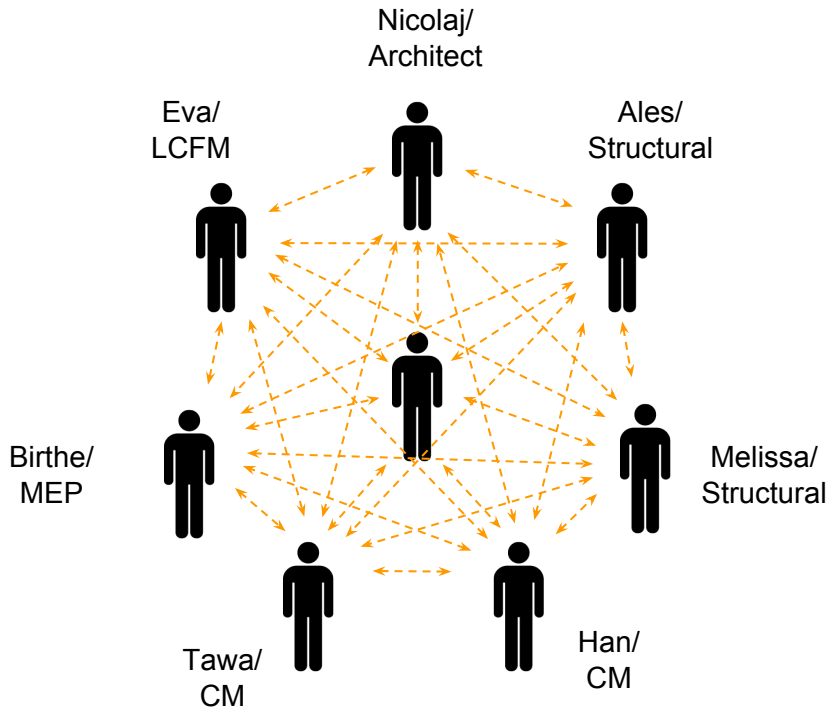






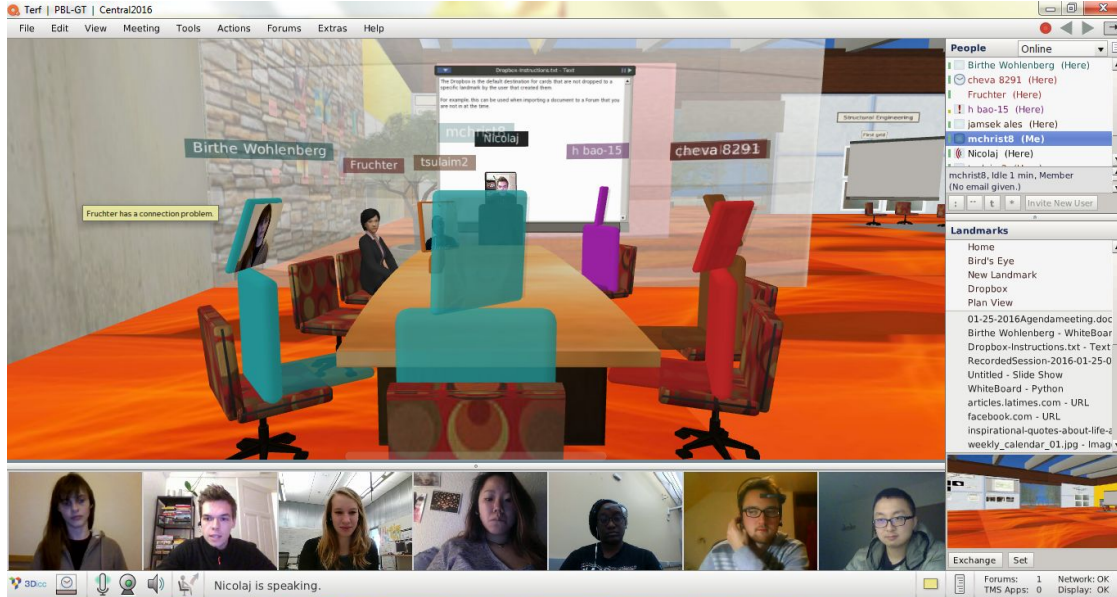


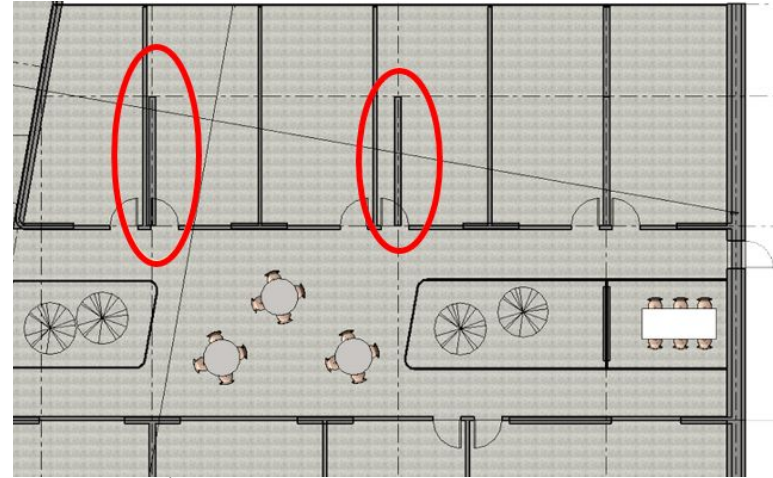
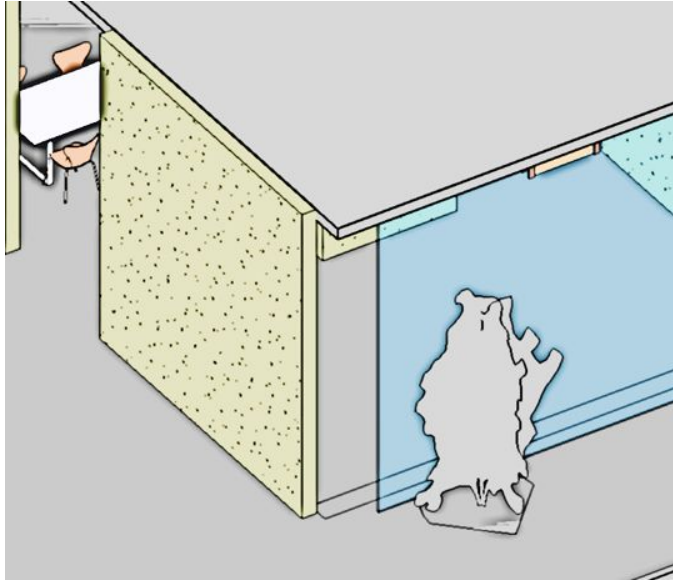
No Emails!



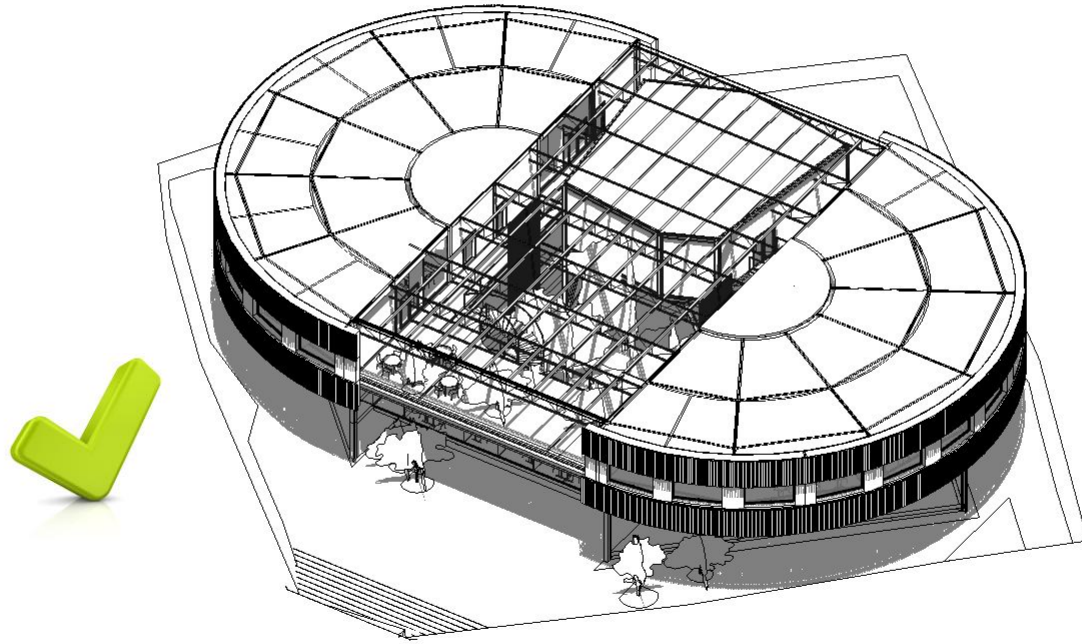
ALL





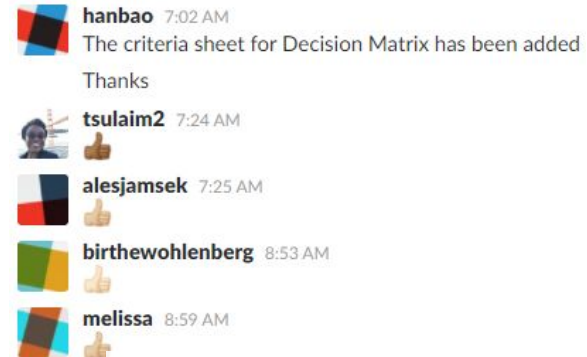






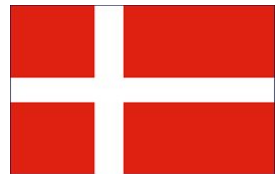
## Team Process Example: **Peer Review**

- **Issue**
  - no designated person to submit
  - delayed response in Slack
- **Conflict Resolution**
  - team meeting agenda item
  - listen to each perspective
  - brainstorm solutions
- **Solution**
  - new role = submission lead
  - thumbs up



# THANK YOU!

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NICOLAJ

A



HAN

CM



MELISSA

SE



ALEŠ

SE



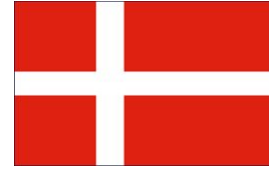
TAWA

CM



EVA

LCFM



BIRTHE

MEP