

Mike



Ana



Sebastian

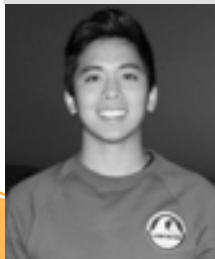
Six Cultures



Amy - MEP



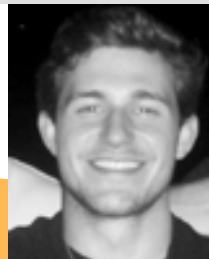
Albert - Ap



Bjorn - A



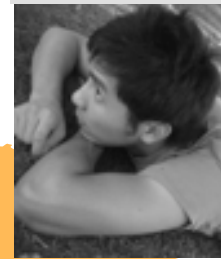
Tim - LCFM



Olga - CM



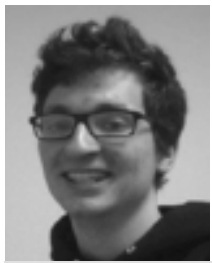
Chris - SE



Sophia - SE



Five Disciplines



Mike



Ana



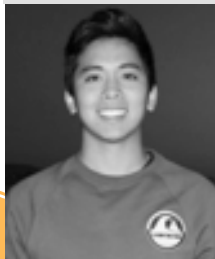
Sebastian



Amy - MEP



Albert - Ap



Bjorn - A



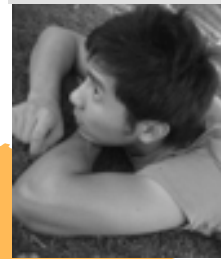
Tim - LCFM



Olga - CM



Chris - SE



Sophia - SE



Three Time Zones



Mike



Ana

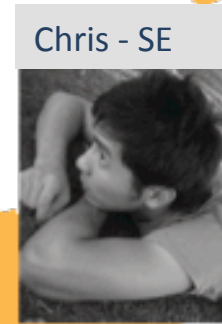
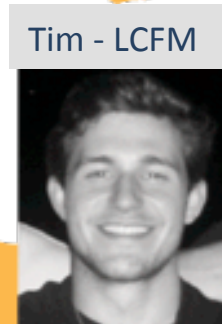
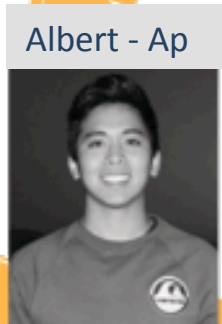
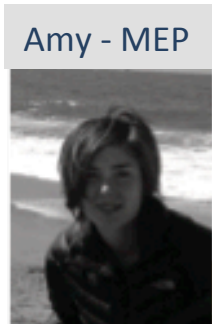


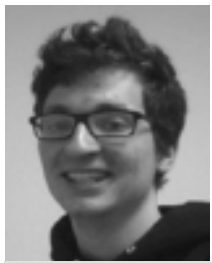
Sebastian

PST

EST

CET





Mike

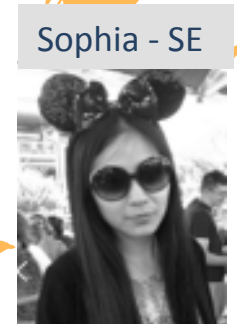
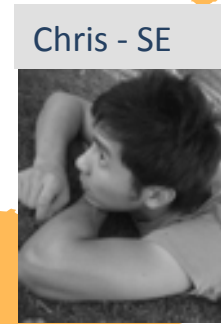
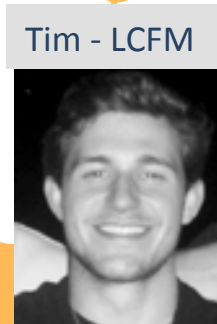
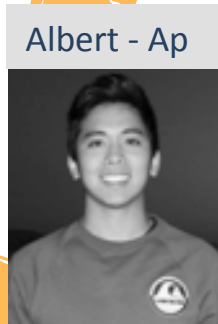
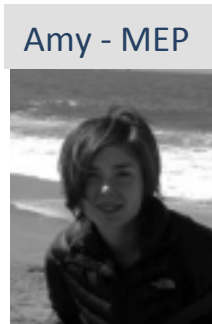


Ana



Sebastian

TEAM CENTRAL



Conventional

Design
Bid
Build

Innovative

Public Partner

Risk allocation

Private Partner

Design
Build
Finance
Operate

Know how
Project success







LOCAL HAZARDS:

EARTHQUAKES

- 1994 - Northridge EQ – M6.7
- 2014 – La Habra EQ – M5.1

CLIMATE:

TEMPERATURE

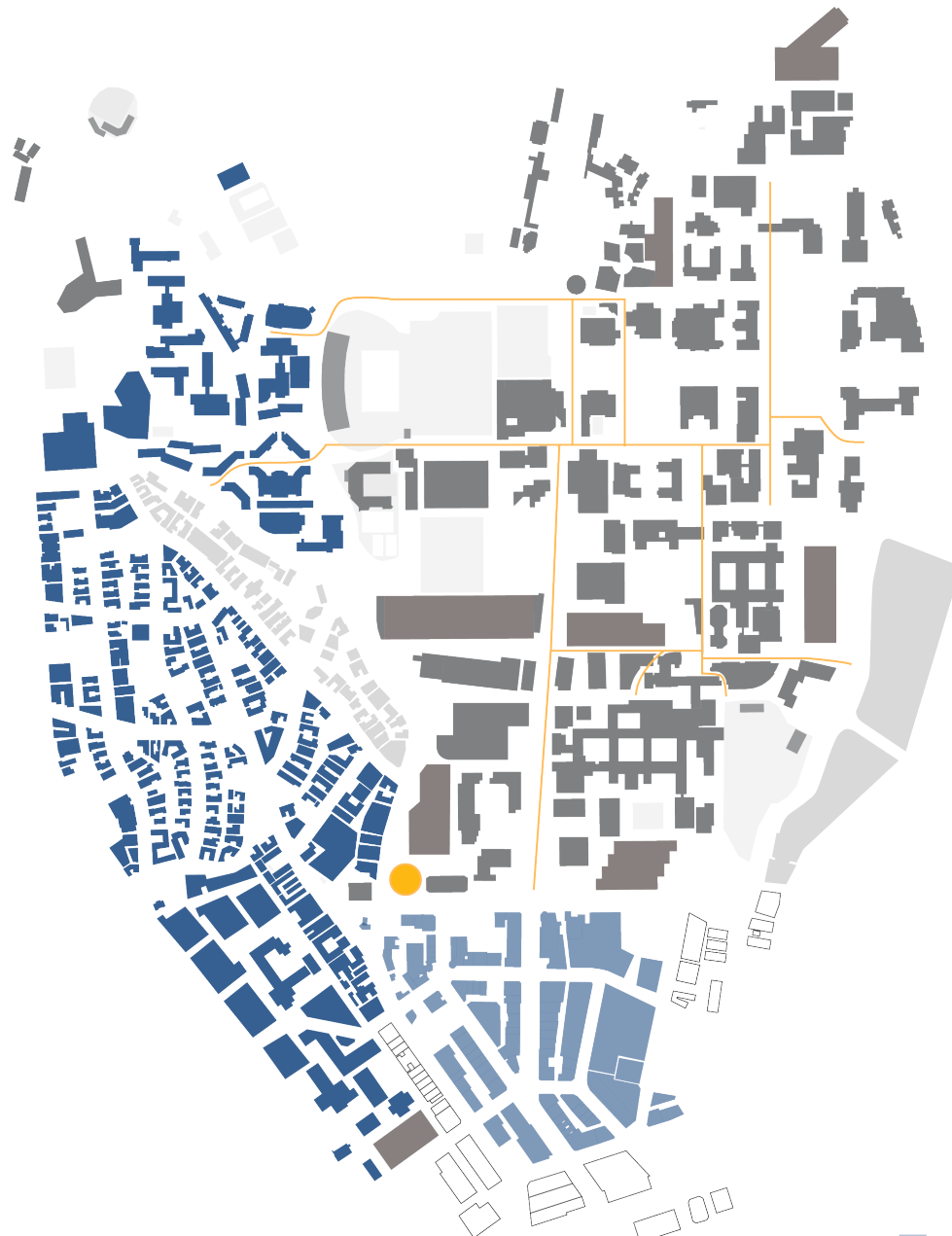
- Avg. High 67°F - 83°F
- Avg. Low 47°F - 64°F

RAINFALL

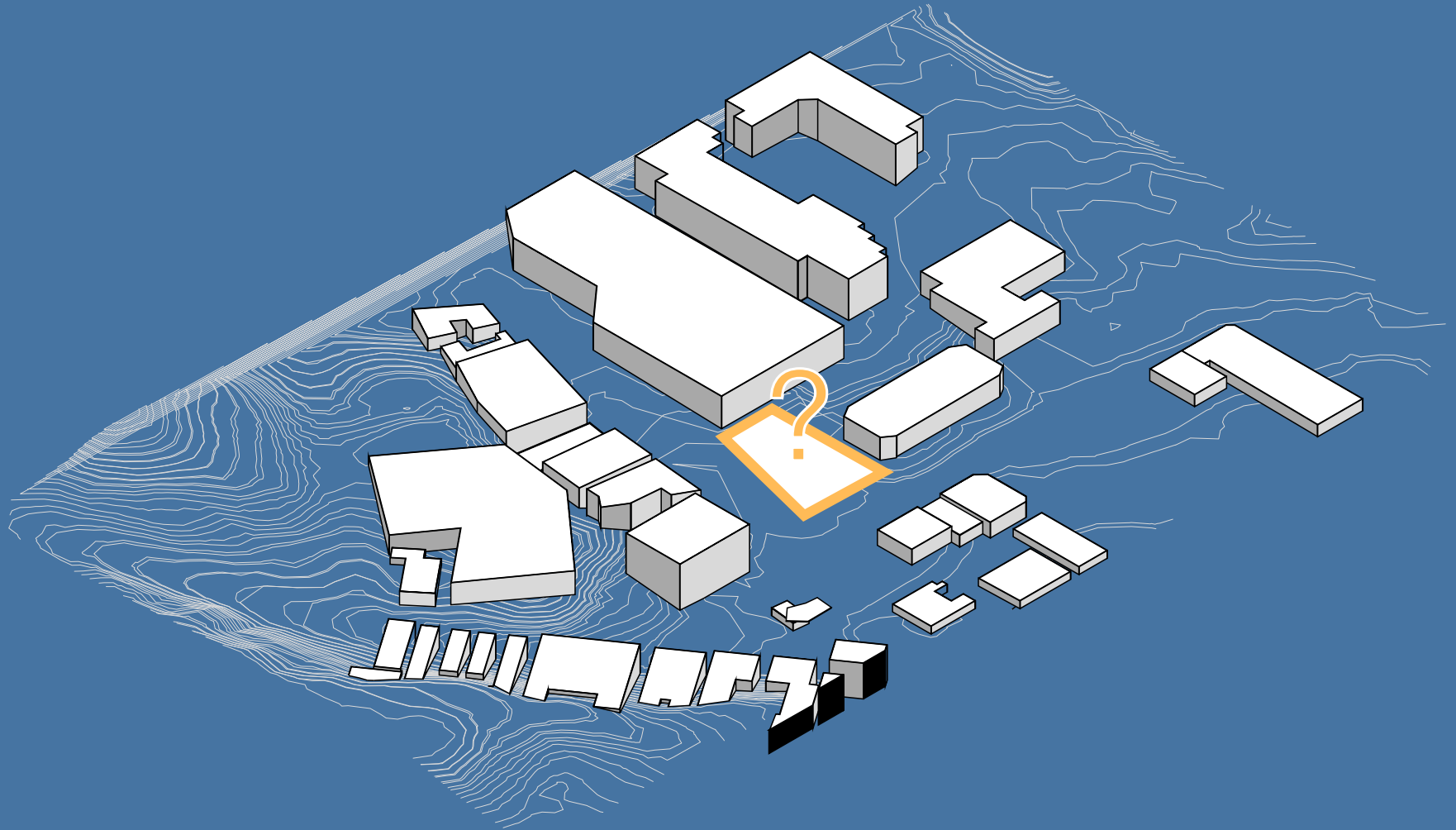
- 15" Annual - LOW

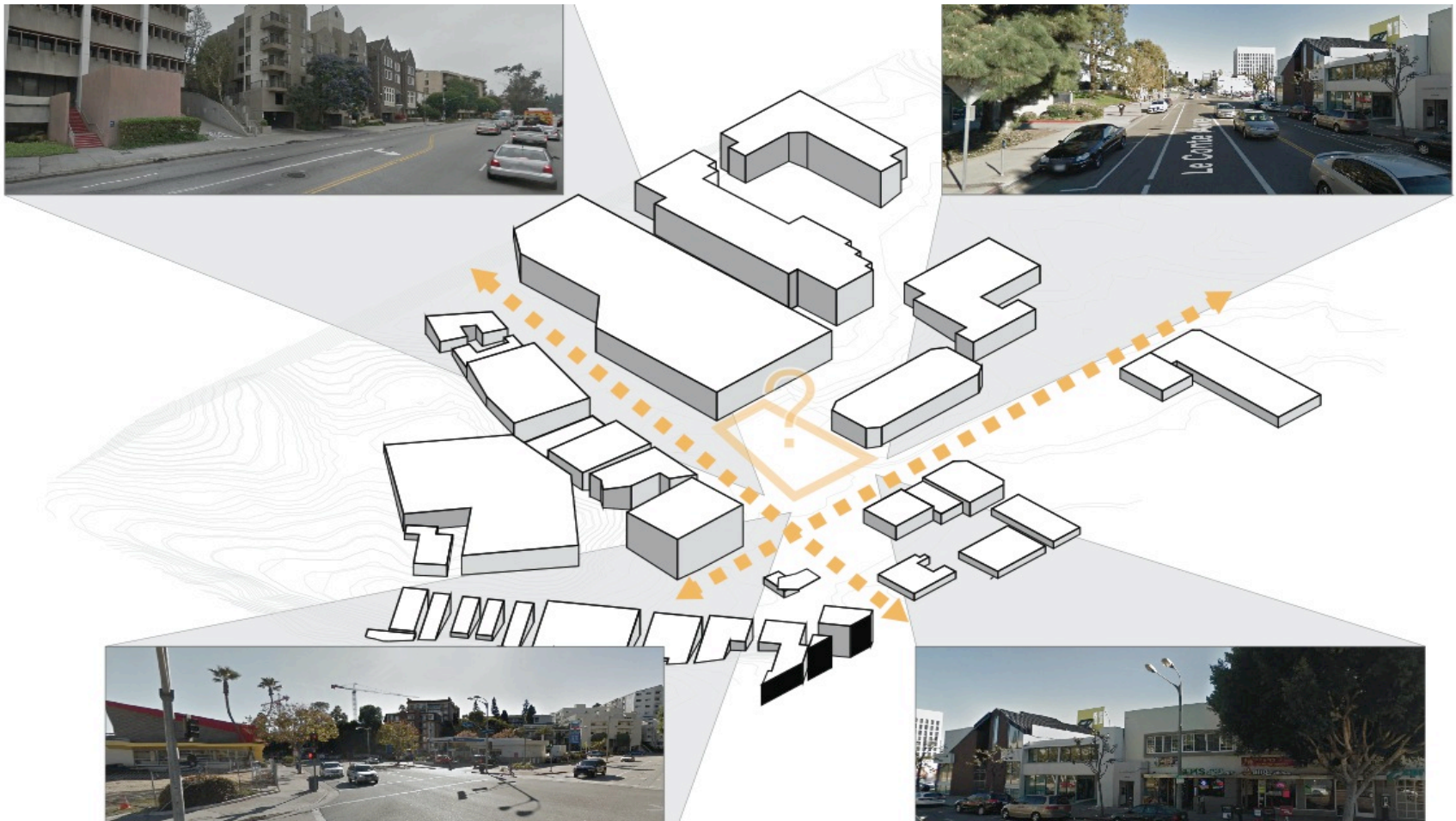
HIGH SOLAR AVAILABILITY





- Working Path
- Site
- UCLA Campus Buildings
- Parking
- Leisure
- Greek Life
- Residences/Dorms
- Westwood

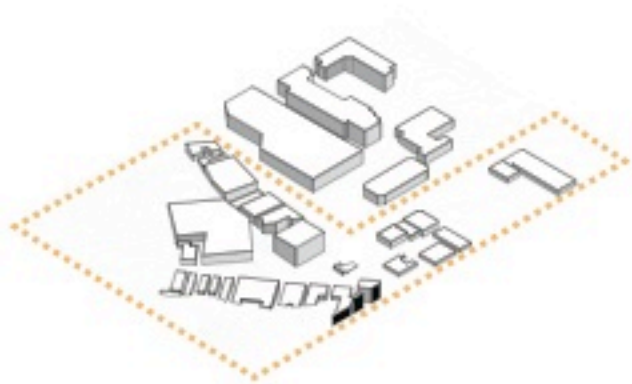


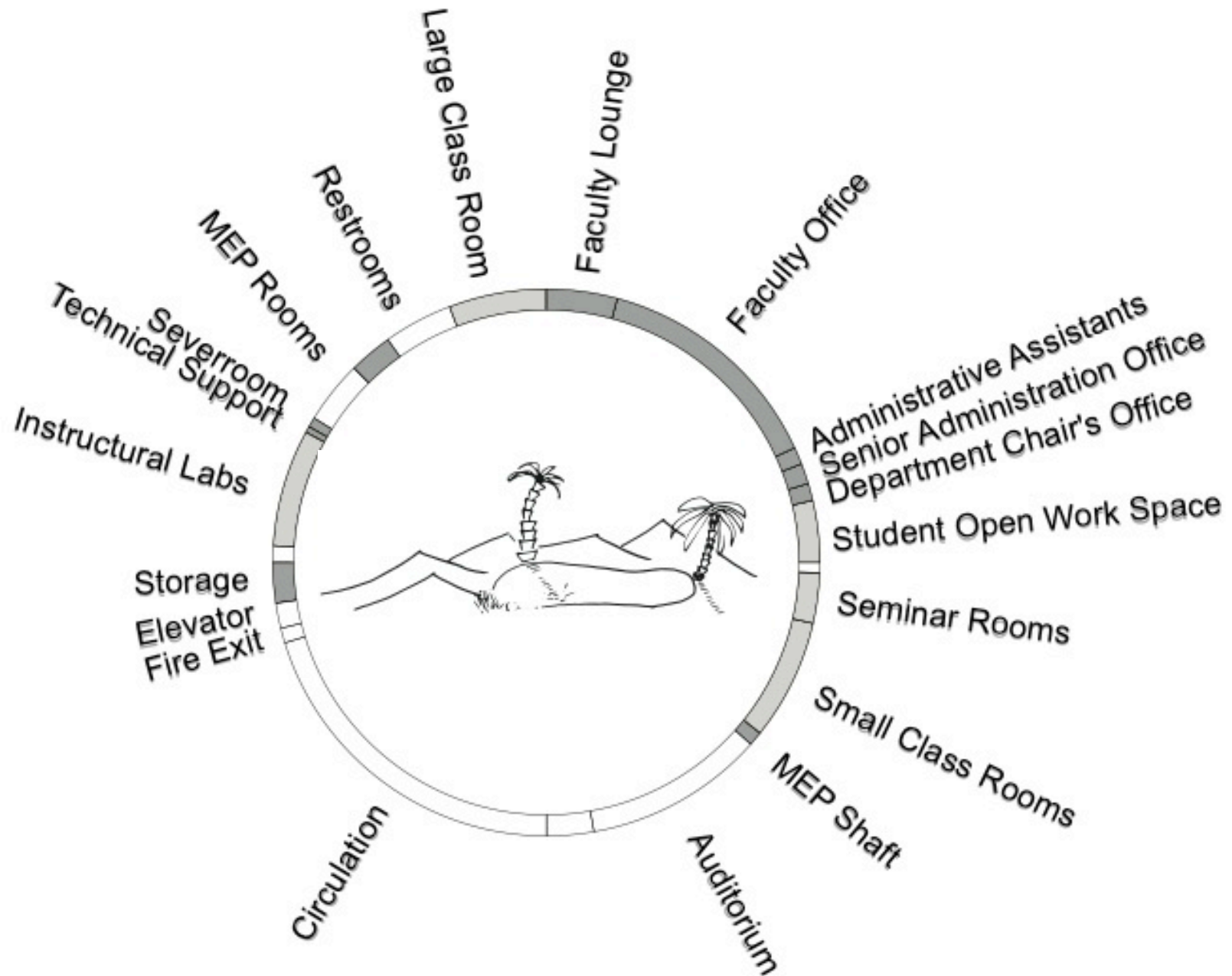


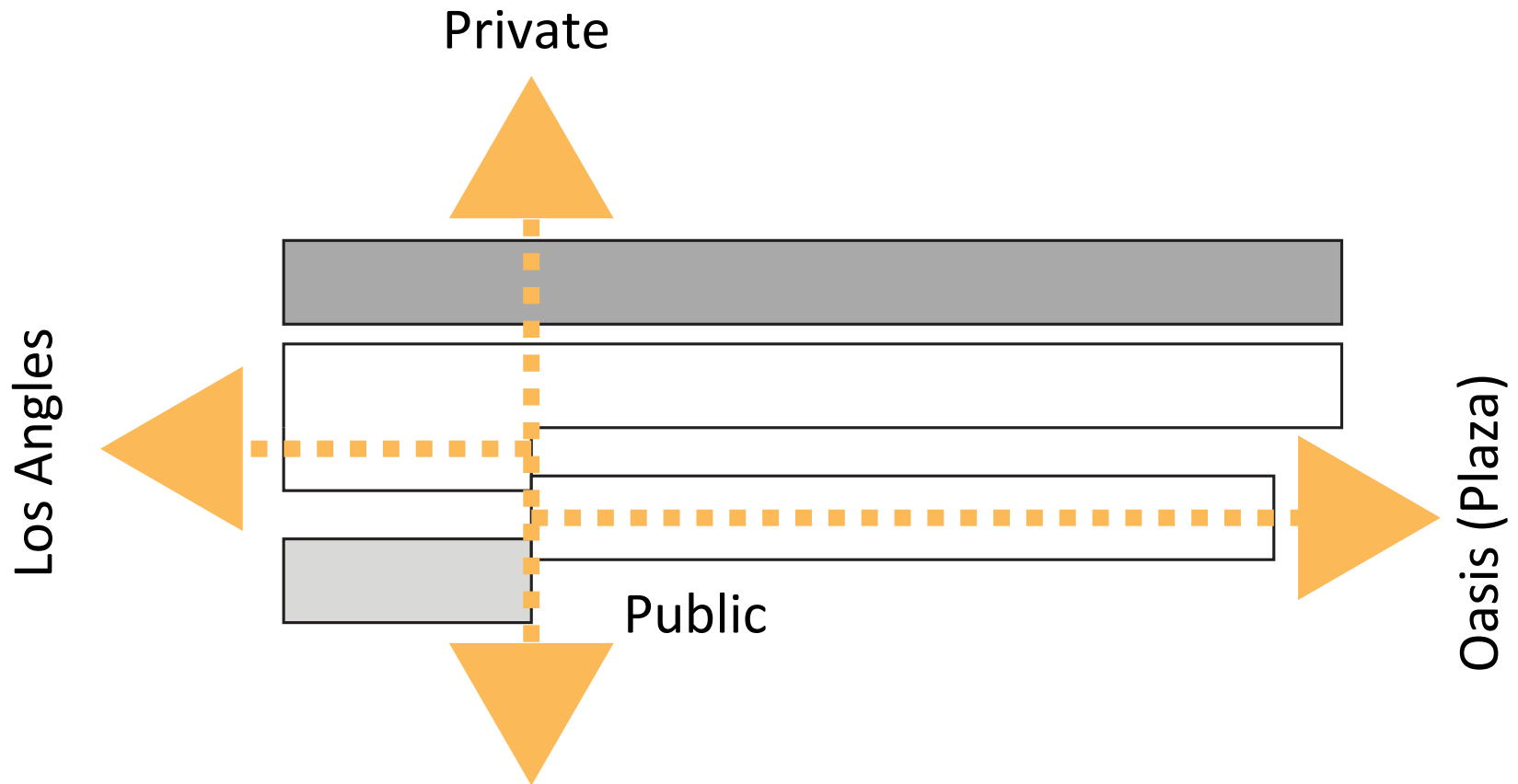
Point skala	
terrible	1
poor	2
average	3
very good	4
excellent	5

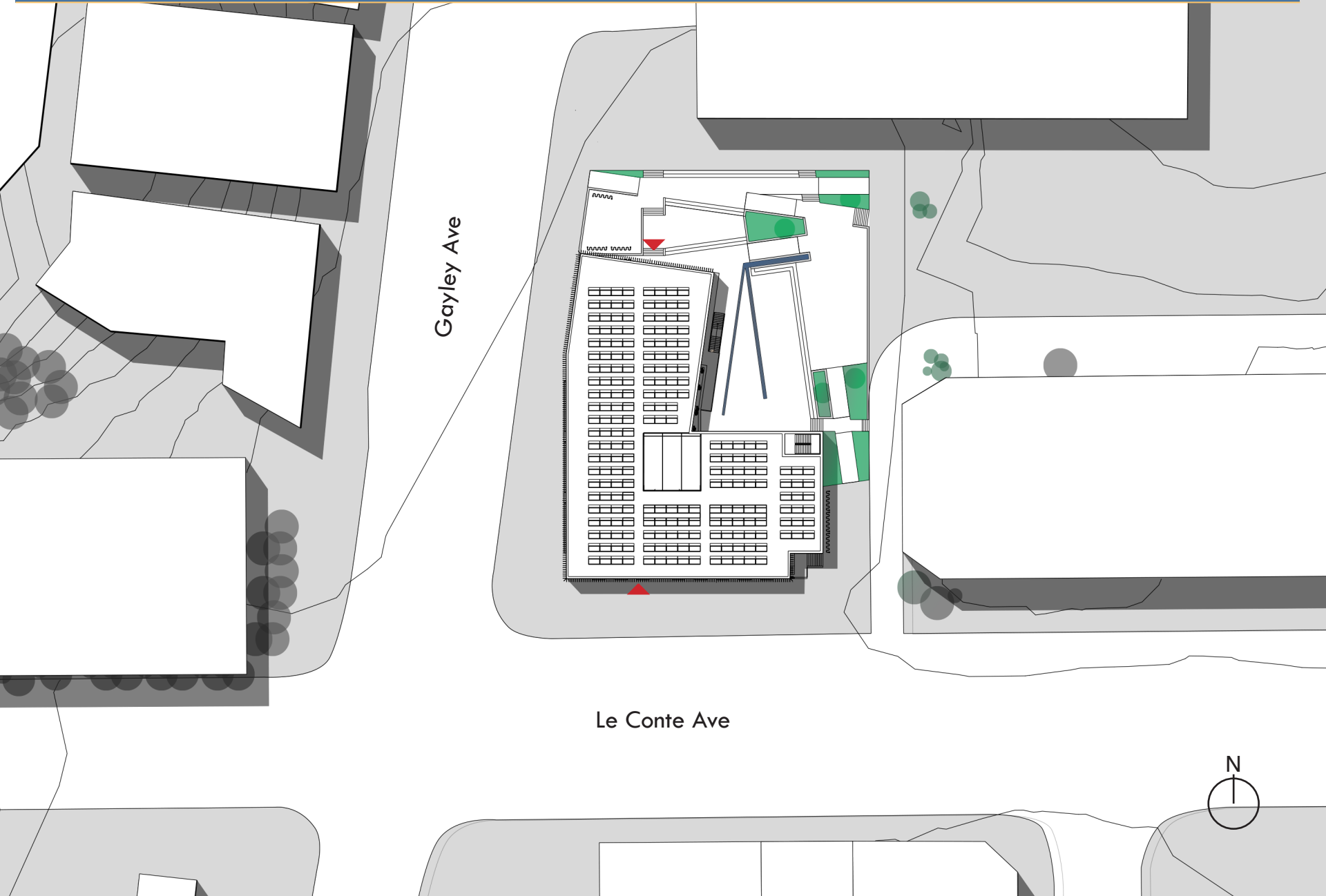


		AVG. WEIGHT	L-Shape Concrete		L-Shape Steel		DD-Shape Timber		DD-Shape (B) Steel	
		100	POINTS	WEIGHTED POINTS	POINTS	WEIGHTED POINTS	POINTS	WEIGHTED POINTS	POINTS	WEIGHTED POINTS
1	Building program	13	4	52	4	52	3	39	3	39
2	Funkonality & Flexibility	8,5	2	17	4	34	3	25,5	4	34
3	Building quality	13	4	52	4	52	4	52	4	52
4	Construction	7	3	21	5	35	5	35	4	28
5	Operation	6	4	24	4	24	3	18	3	18
6	Ecologic	11,5	1	11,5	3	34,5	4	46	3	34,5
7	Sustainability goals	9,5	4	38	4	38	5	47,5	3	28,5
8	Earthquake safety	13,5	2	27	5	67,5	3	40,5	5	67,5
9	Big idea	5	4	20	4	20	4	20	4	20
10	Building design	13	3	39	4	52	3	39	4	52
REACHED POINTS			31	301,5	41	409	37	362,5	37	373,5
MAXIMUM POINTS			50	500	50	500	50	500	50	500
RATIO TO MAX POINTS			60%		82%		73%		75%	
CONSTRUCTION COST			MIO. \$	7	MIO. \$	7,5	MIO. \$	7,8	MIO. \$	7,9
VALUE FOR COSTS			POINTS	43	POINTS	55	POINTS	46	POINTS	47











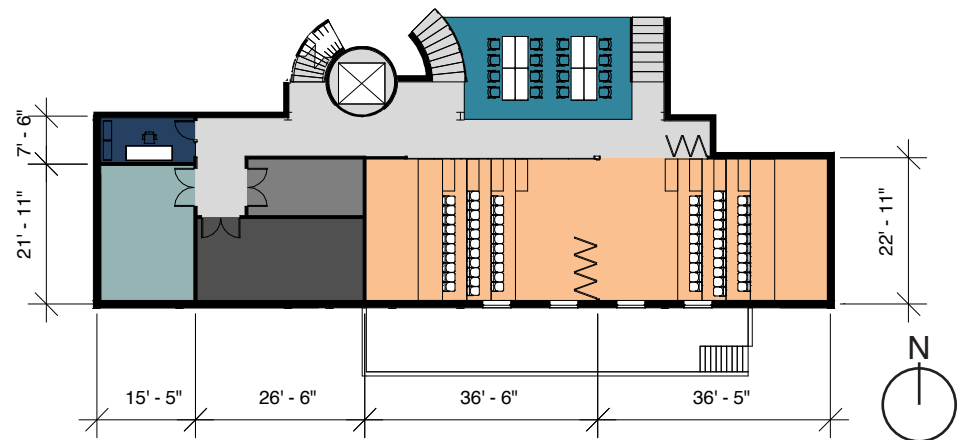
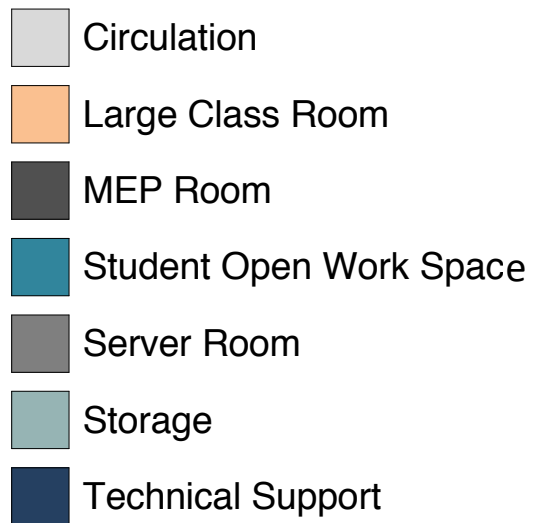
**Building Program Requirements**

Assignable Sqft	18,000	60%
Total Sqft	30,000	100%

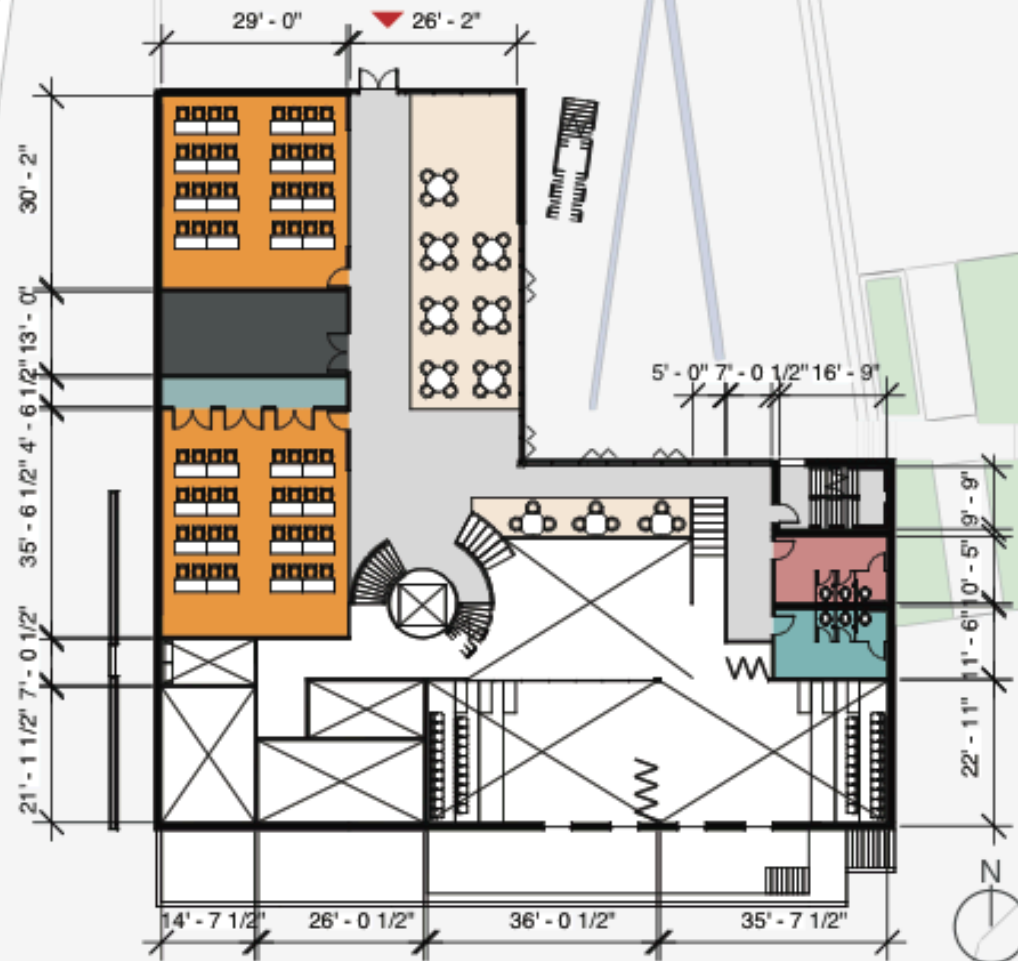
**Building Program L-Shape**

Assignable Sqft	18684	62%
Total Sqft	30570	100%

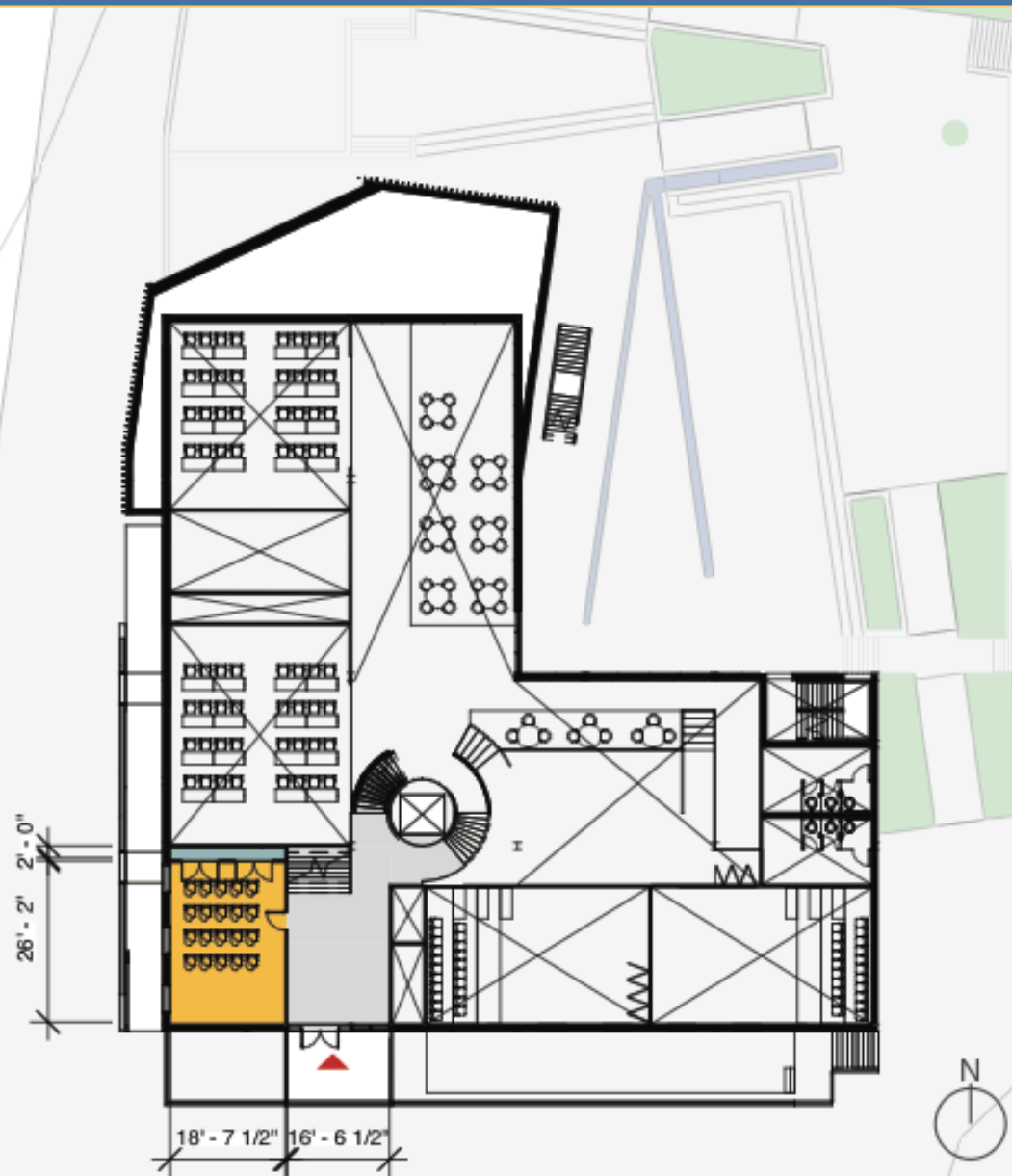
**LOWER RENT****VALUE FOR THE OWNER****Lower O&M costs****Less waste**



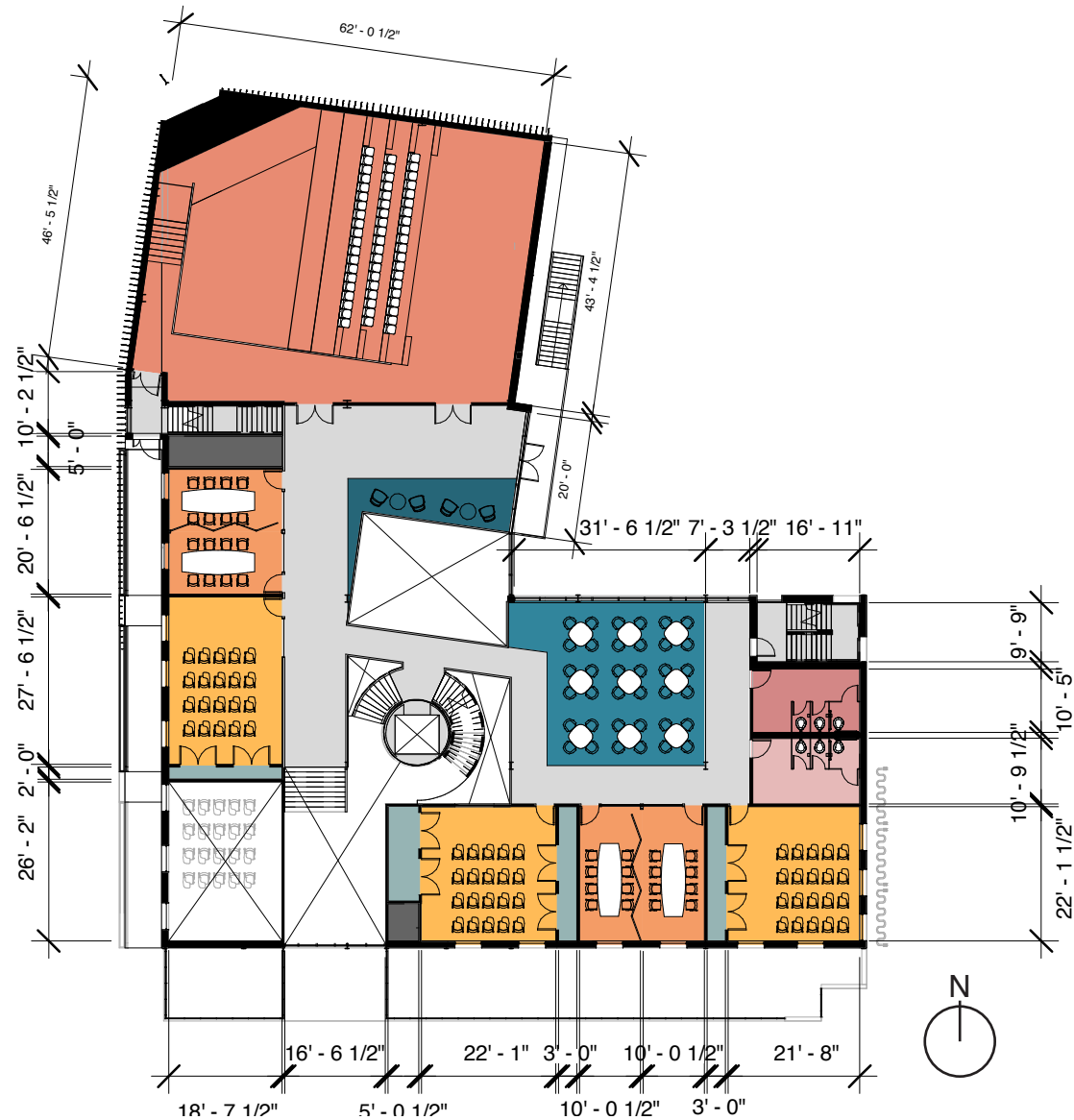




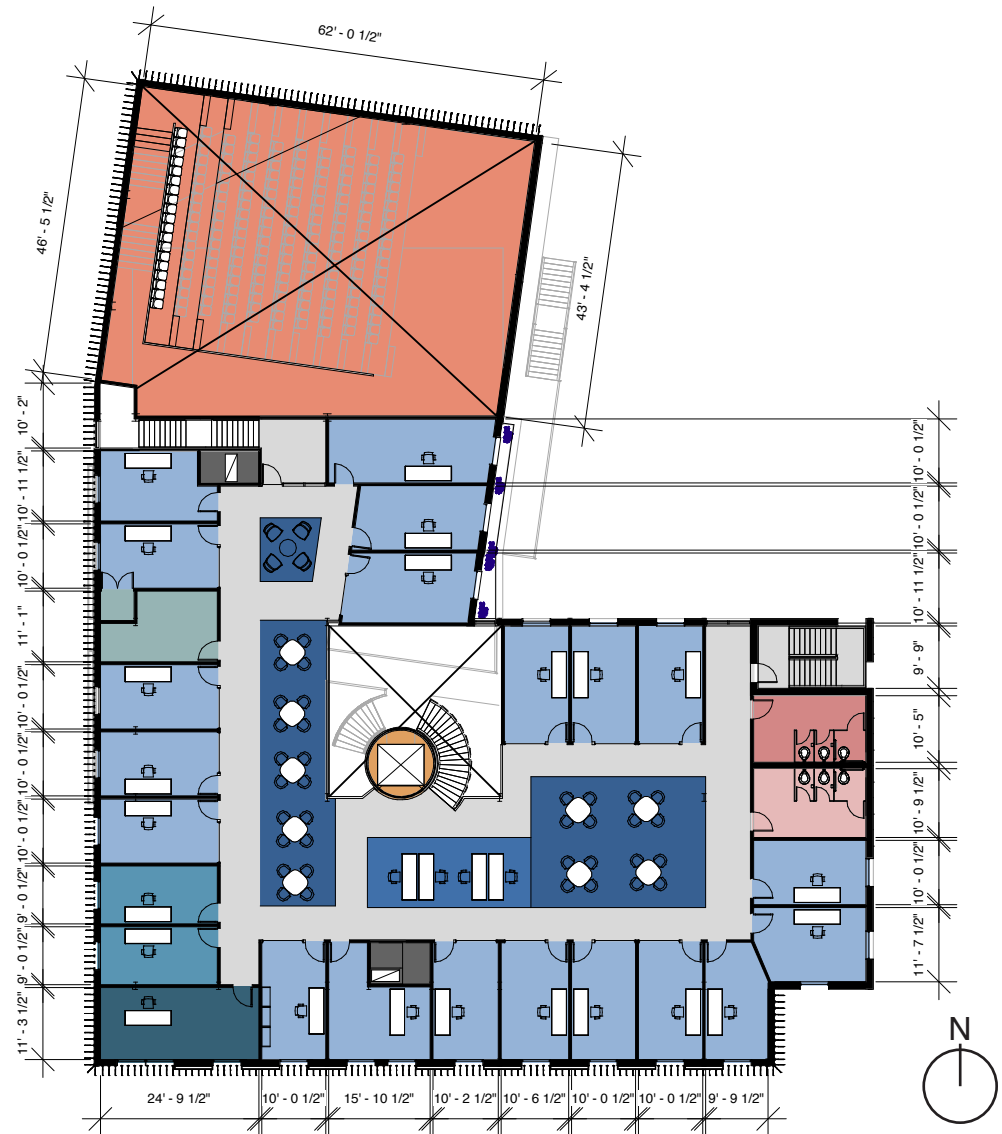
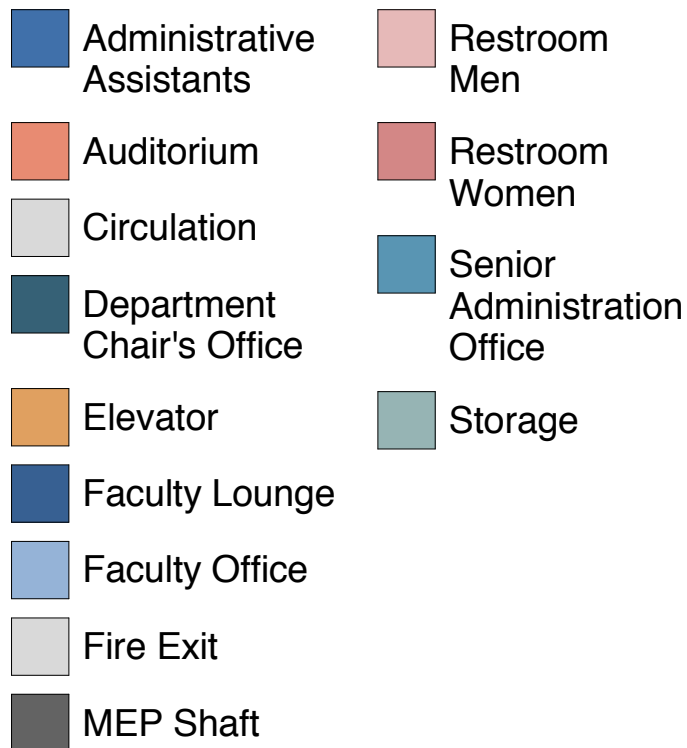
- Café
- Circulation
- Instructional Lab
- MEP Room
- Restroom Men
- Restroom Women
- Storage



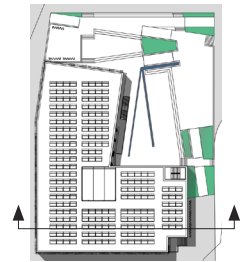
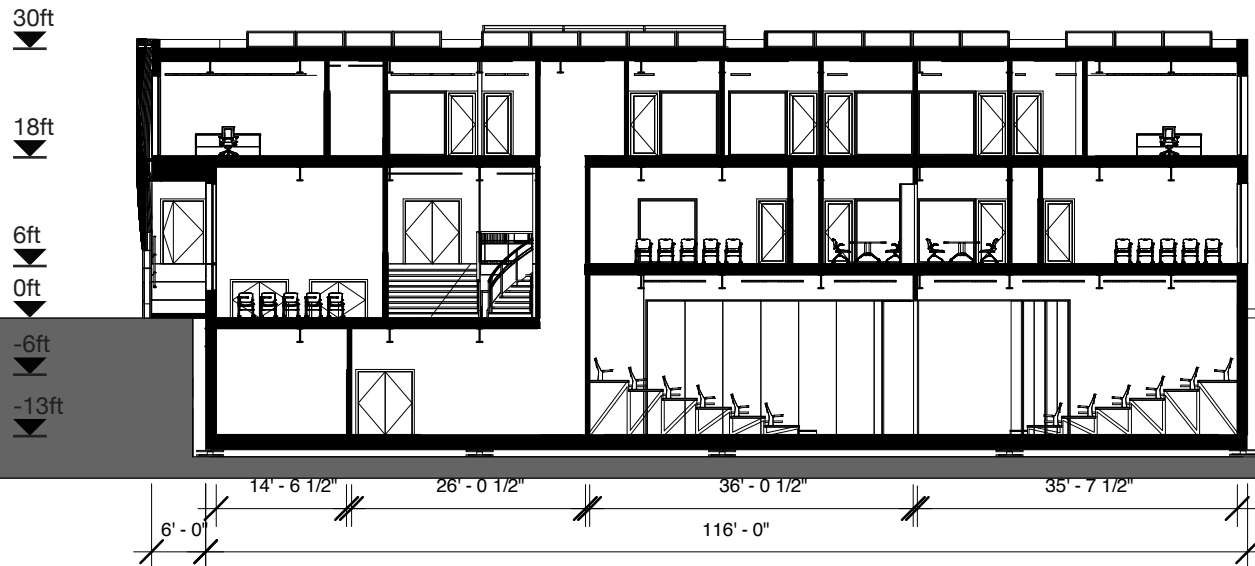
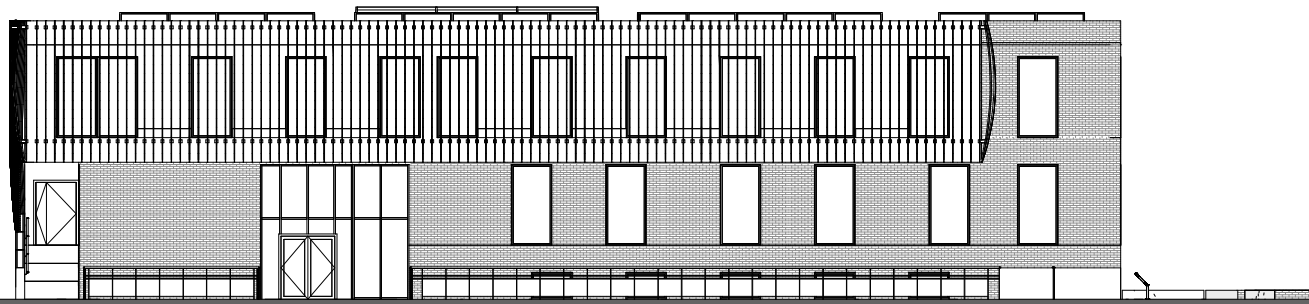
- Auditorium
- Circulation
- Fire Exit
- MEP Shaft
- Open Student Work Space
- Restroom Men
- Restroom Women
- Seminar Room
- Small Class Room
- Storage





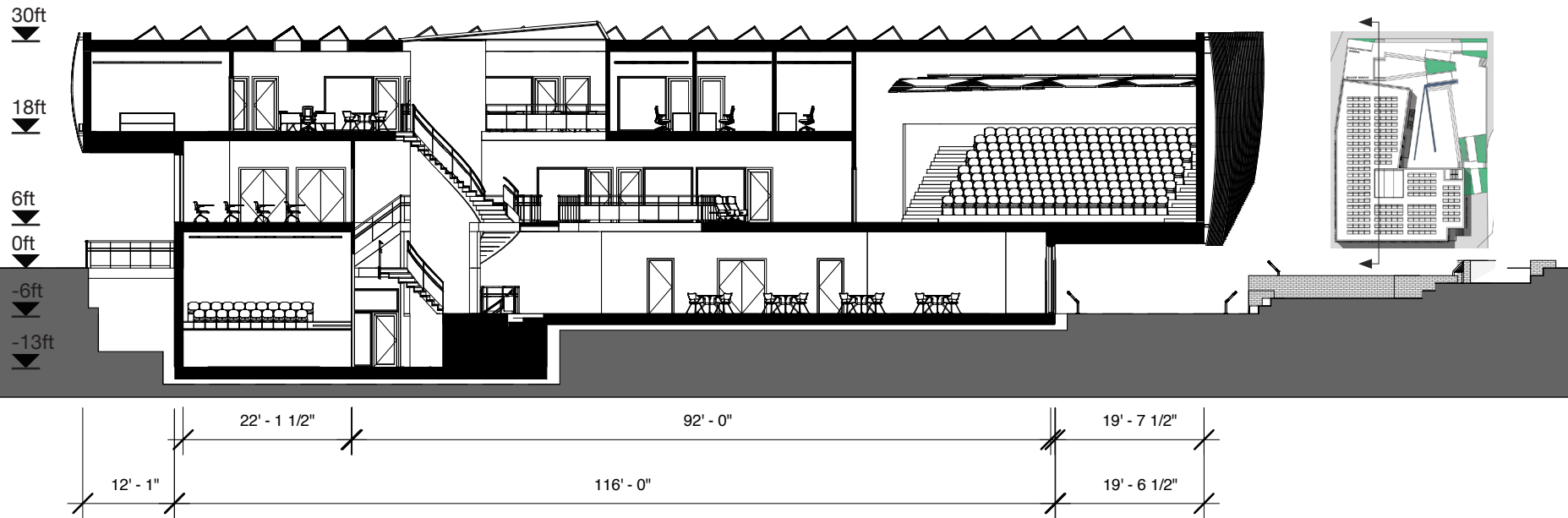


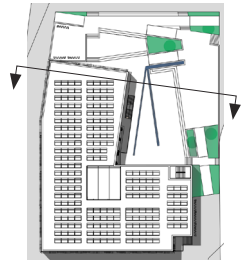
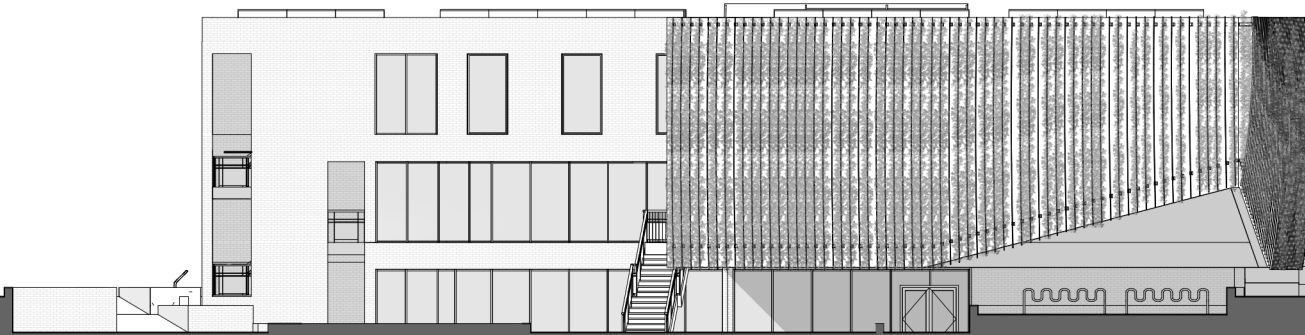


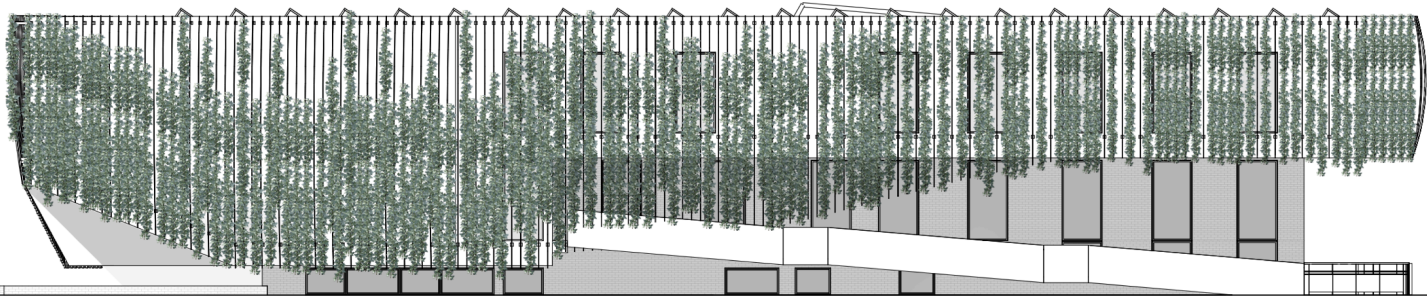


27 Elevation and Section East

A







Summer 8AM



Winter 8AM



Summer 12PM



Winter 12PM



Summer 3PM



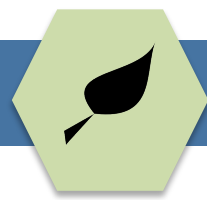
Winter 3PM

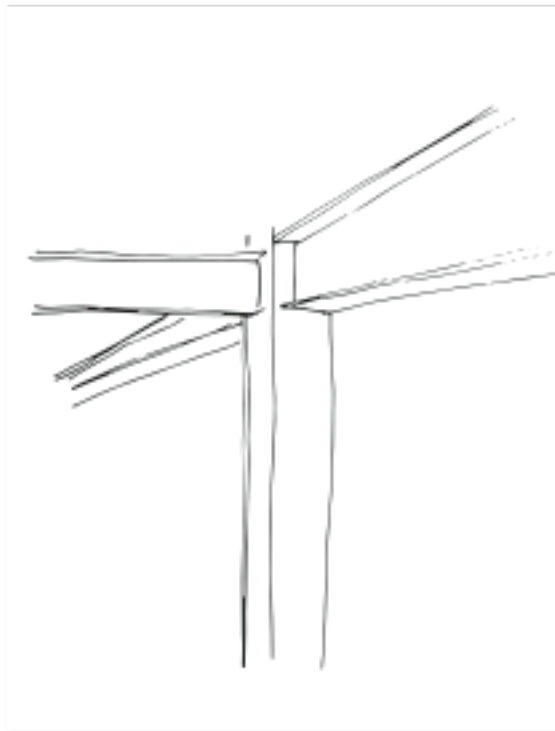


Summer 6PM

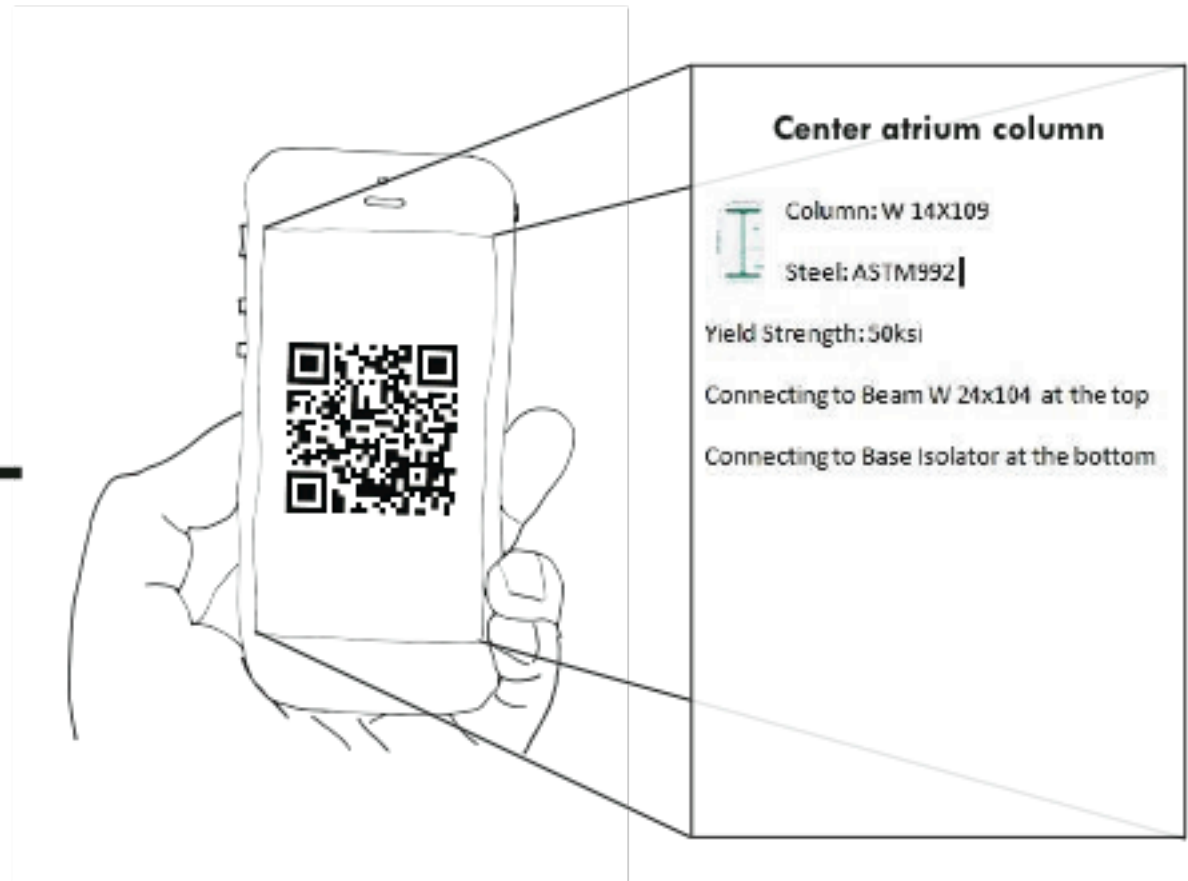


Winter 6PM





+



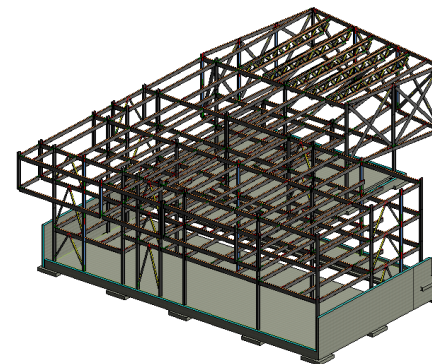
Building Structure

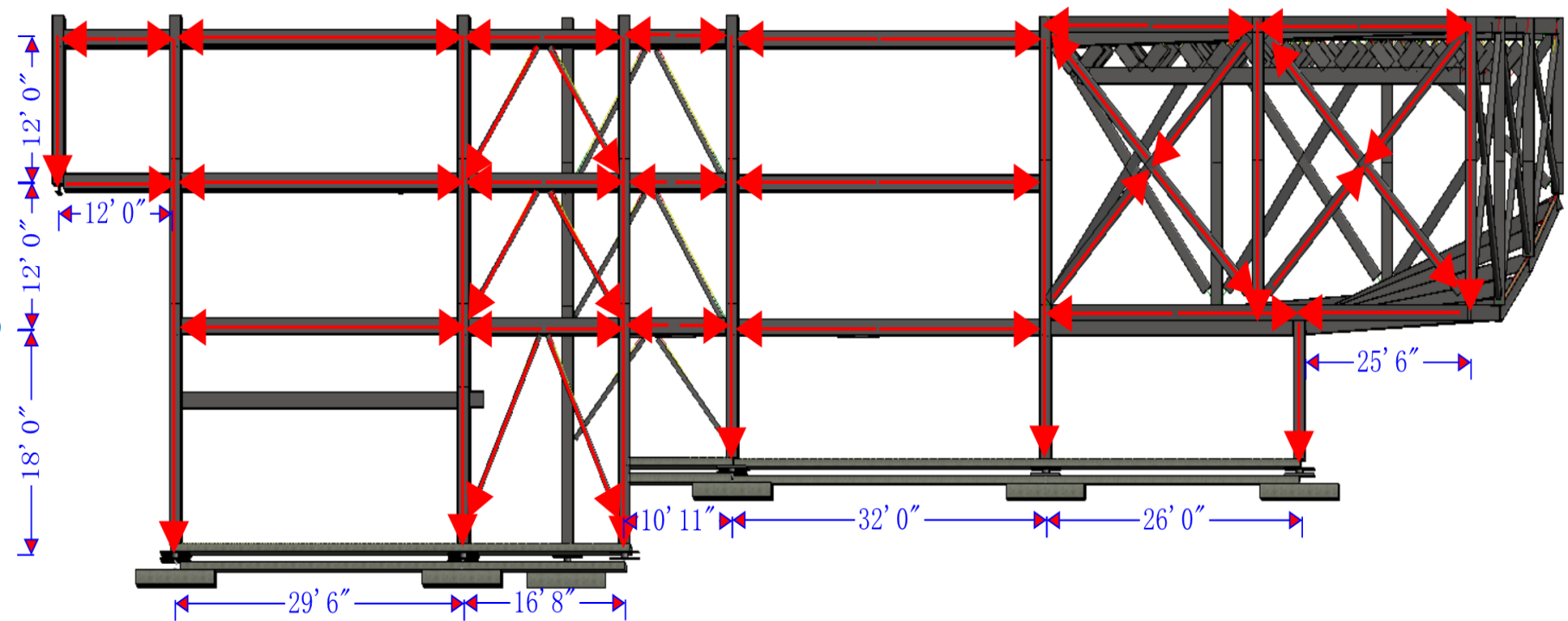
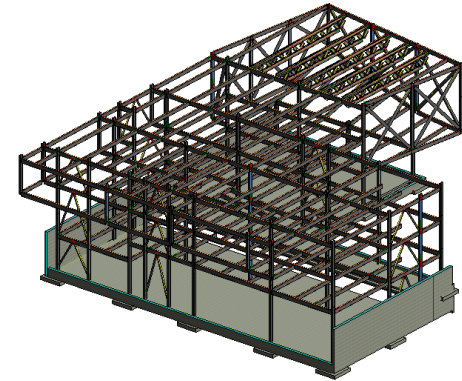
QR Codes on elements there links to element information's

	Live (psf)	Dead (psf)	Earthquake (kips)
Roof	20	5	519
2 nd Level Ceiling	60	90	750
1 st Level Ceiling	60	90	808
Corridors	100		

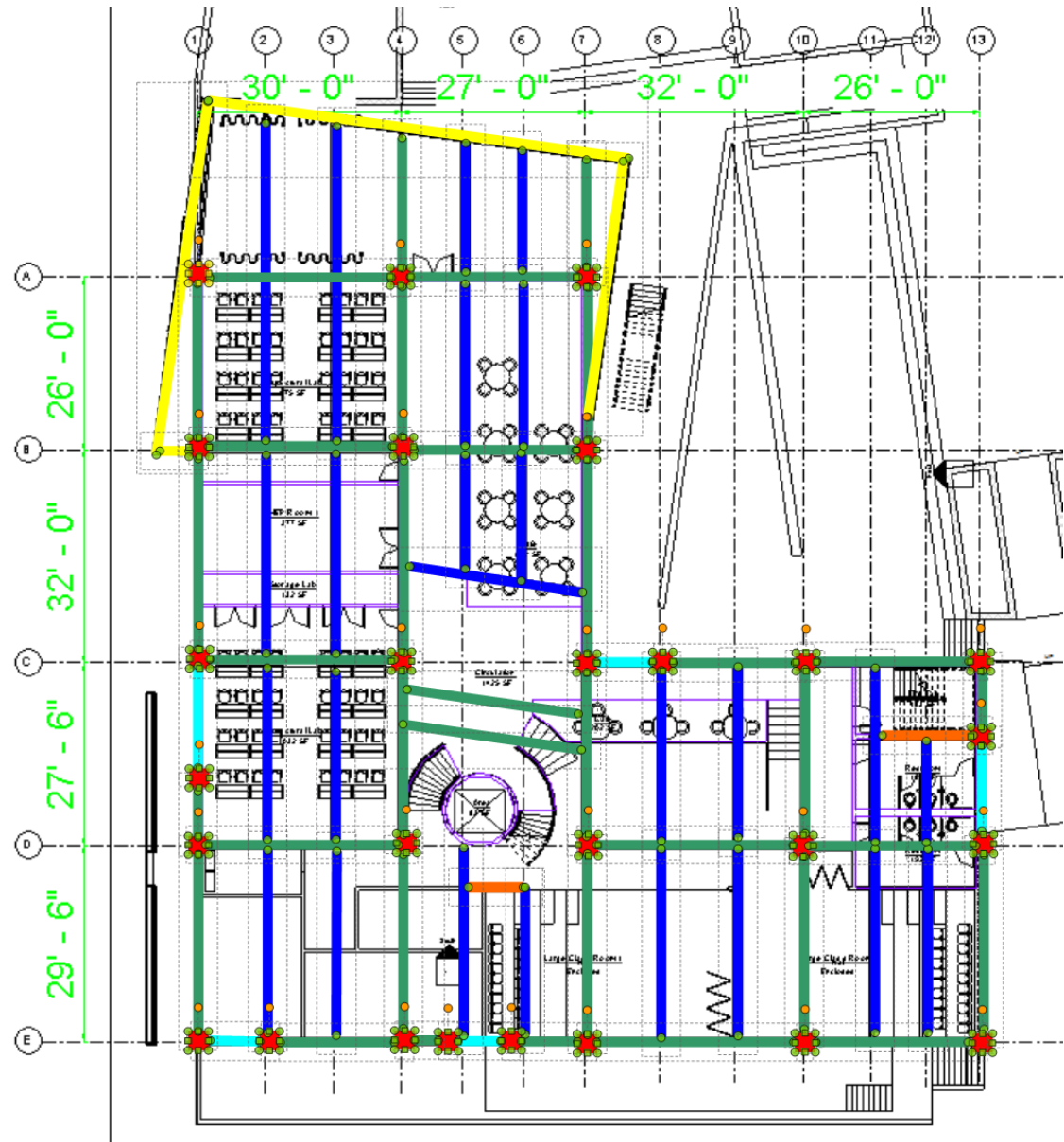
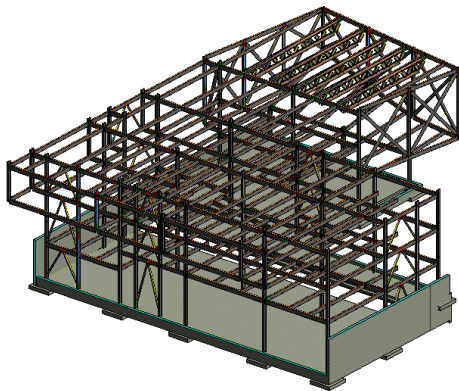
Load Combination:

- $1.2D+1.6L$
- $1.2D+1.0L+1.0E$

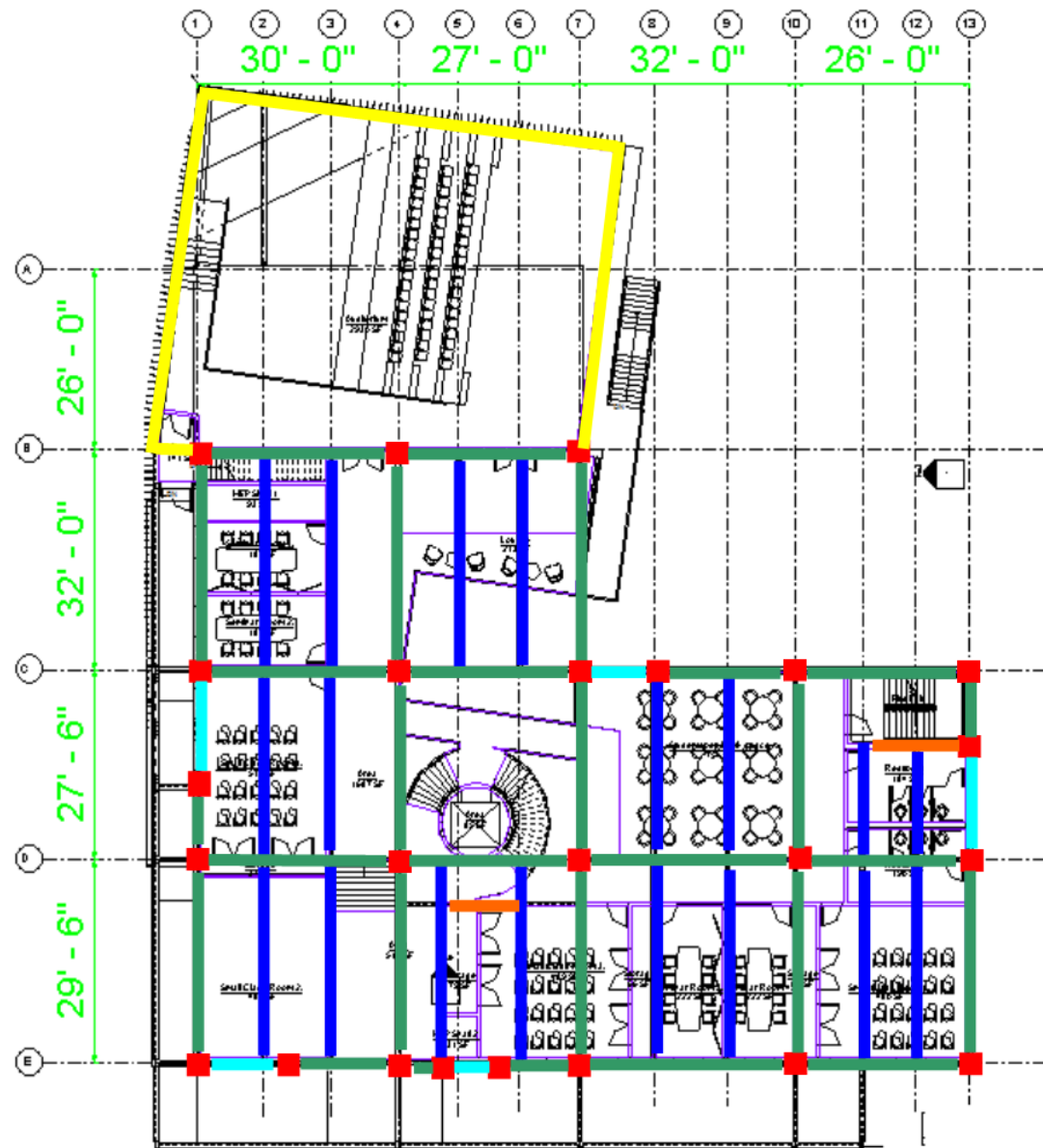
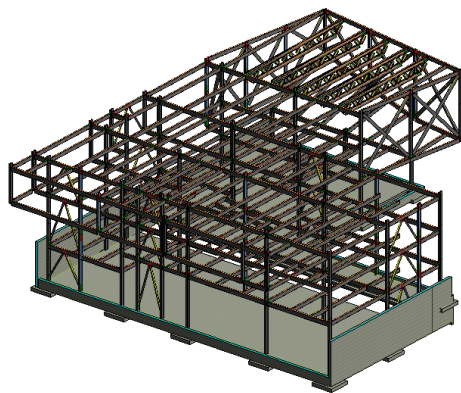




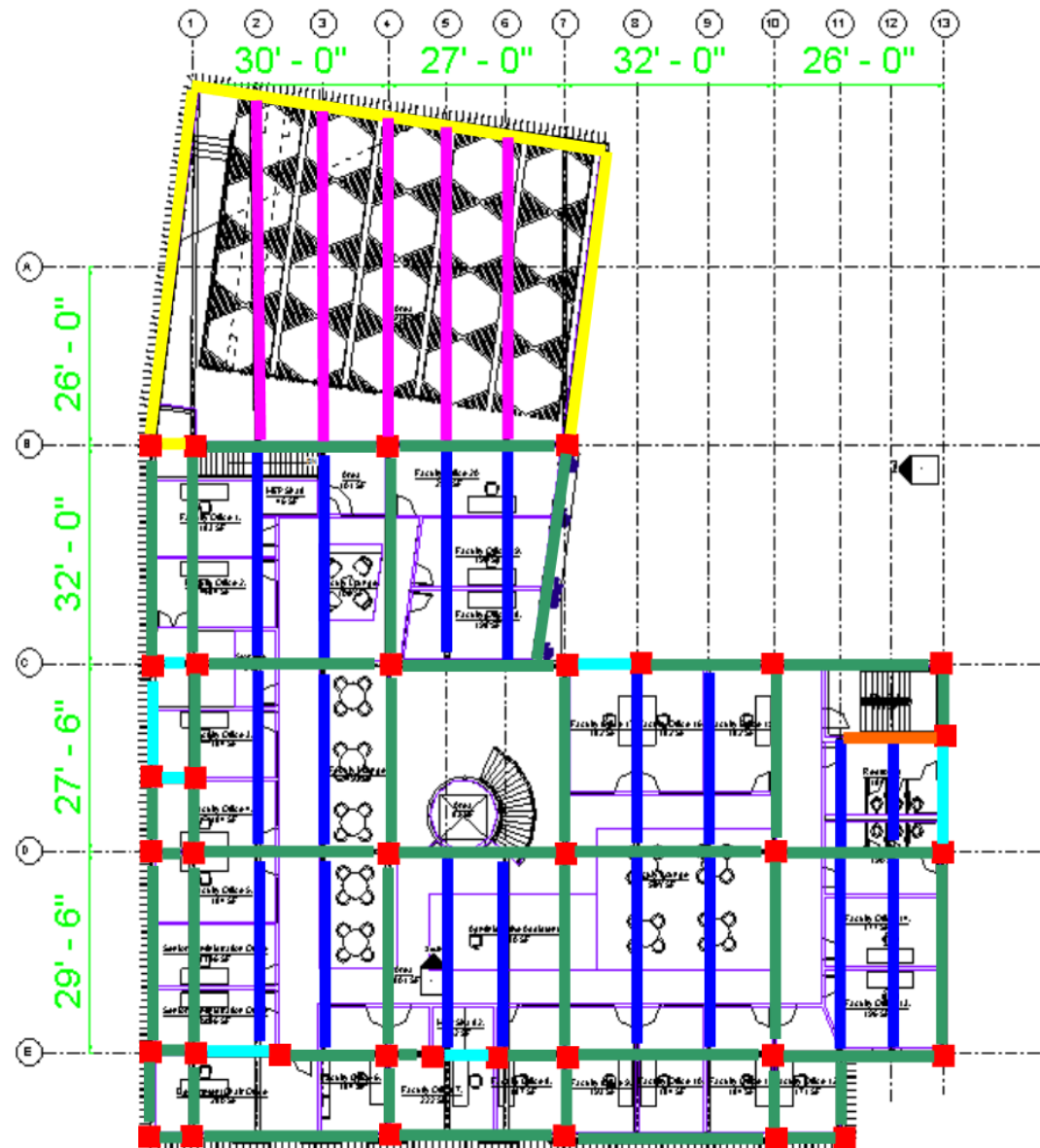
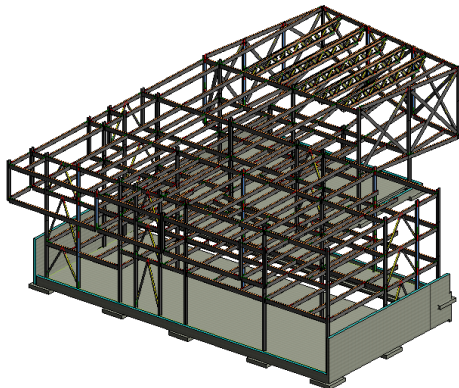
-  Column W14x109
-  Beam W16x31
-  Girder W24x104
-  Bracing HSS 8x8x5/8
-  Bracing HSS 10x10x5/8
-  Bearing Wall



-  Column W14x53
-  Beam W16x31
-  Girder W18x40
-  Bracing HSS 8x8x5/8
-  Bracing HSS 10x10x5/8
-  Bearing Wall



- Column W14x53
- Beam W16x31
- Girder W18x40
- Bracing HSS 8x8x5/8
- Bracing HSS 10x10x5/8
- Bearing Wall
- Steel Joist 36LH07

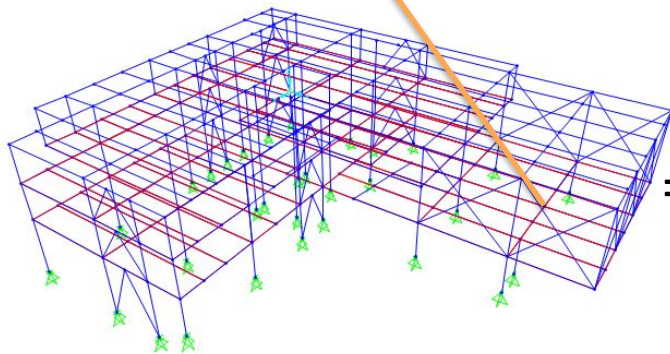


Based on ASCE 7

If $A_x = \frac{\delta_{max}}{1.2\delta_{avg}} < 1.0$ No Torsional irregularity

δ_{max} = the maximum displacement at Level x computed assuming $A_x = 1$ (in)

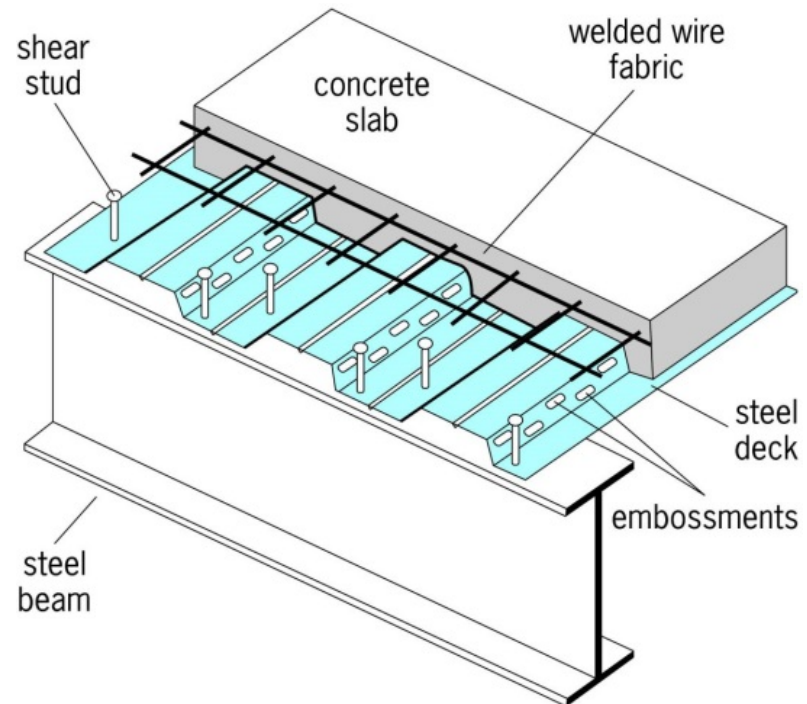
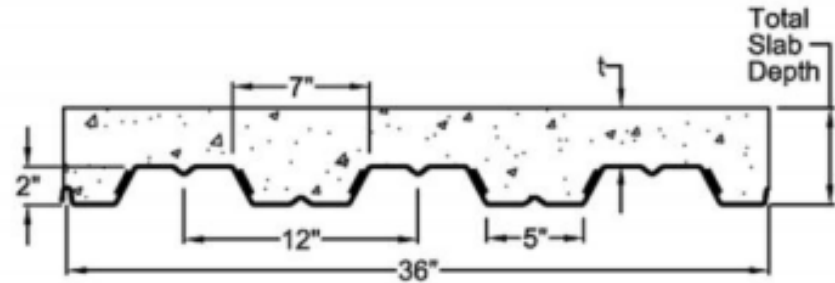
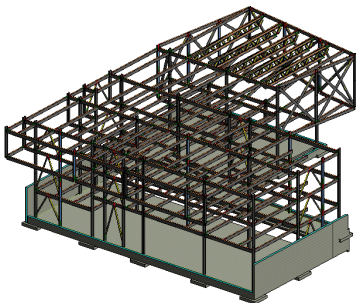
δ_{avg} = the average of the displacements at the extreme points of the structure at Level x computed assuming $A_x = 1$ (in)

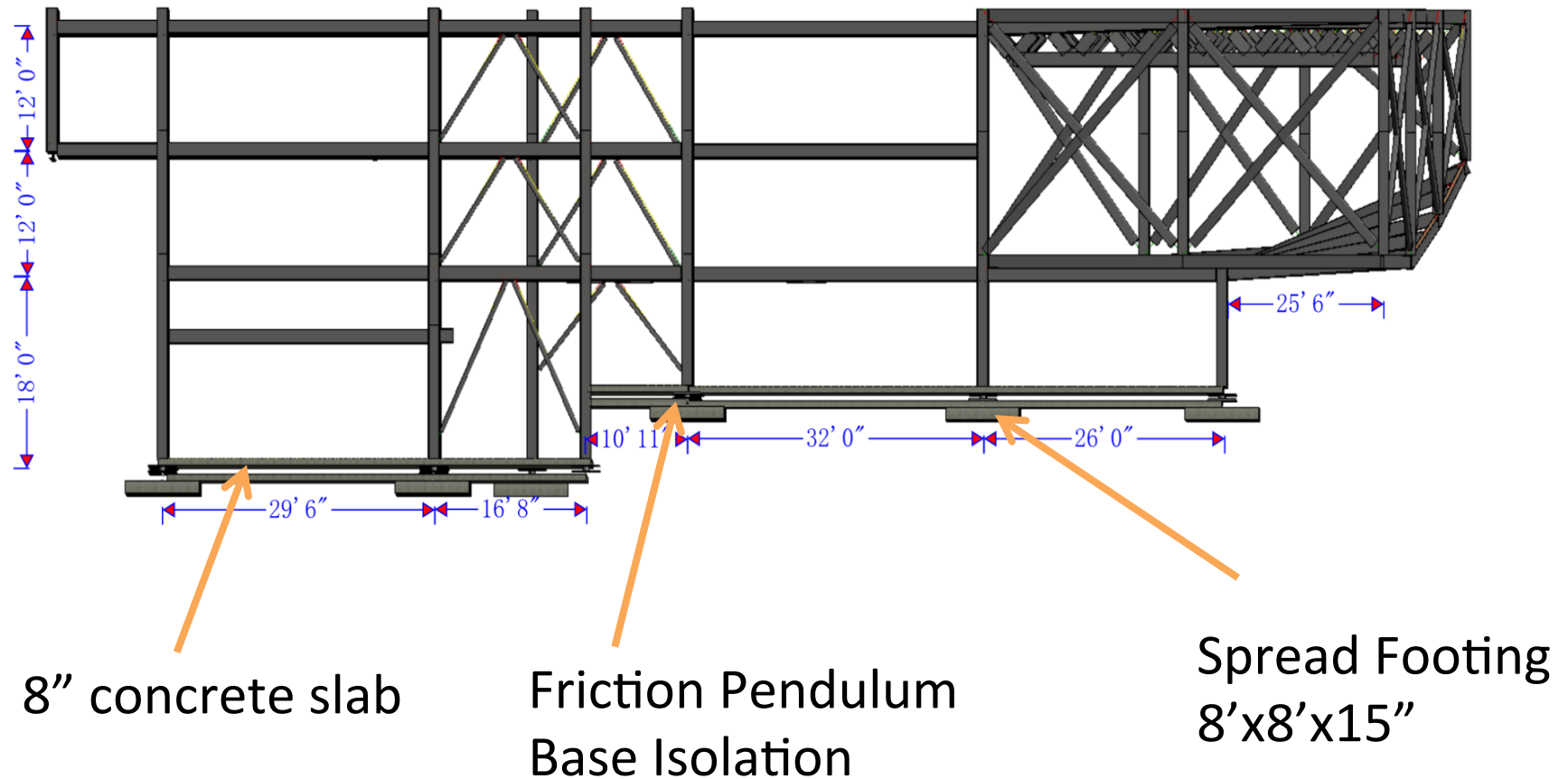


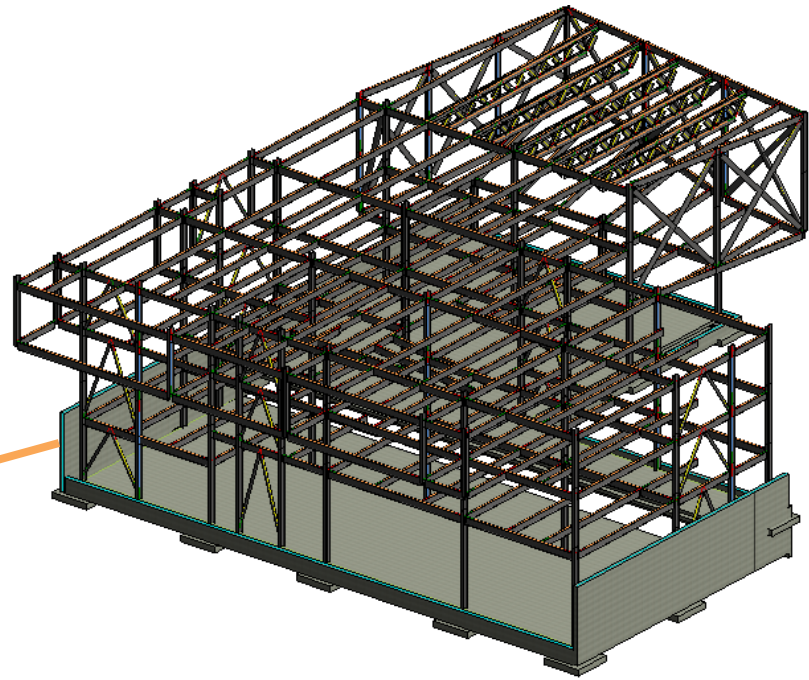
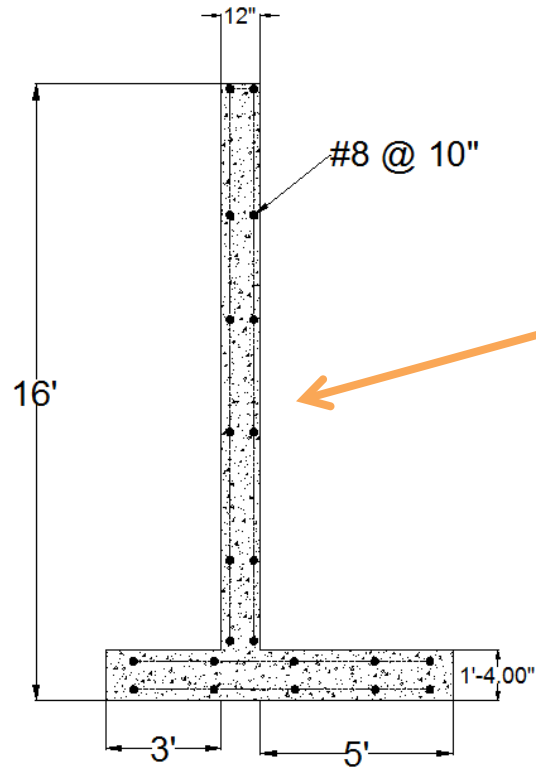
$= 0.895 < 1.0$ ✓

Fully Composite Slab system

- 2VLI19 slab
3.25" LWC + 2" steel deck
total deck depth = 5.25"
- W16x31 beam
with 1.25" camber &
54 shear studs
- W18x40 Girder
with 1.5" camber &
64 shear studs

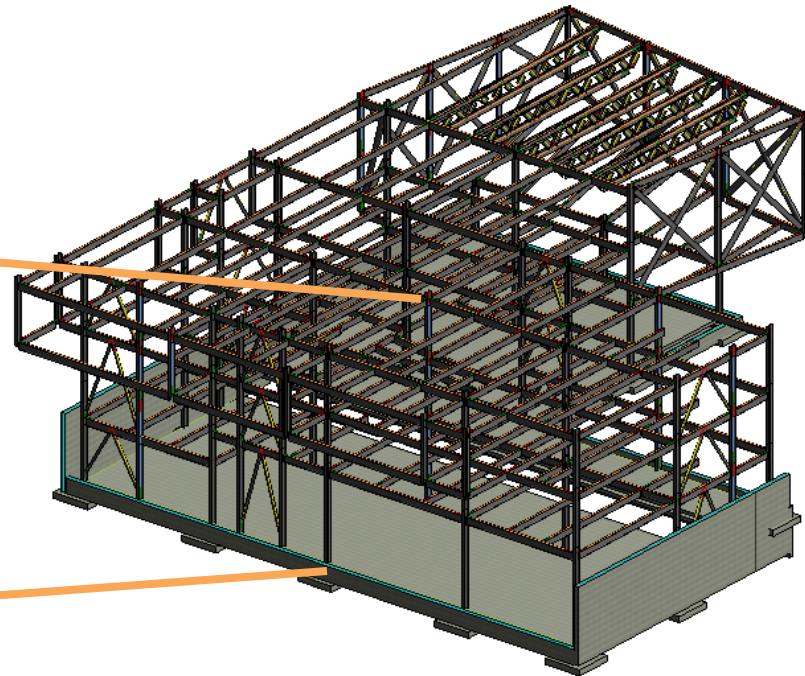
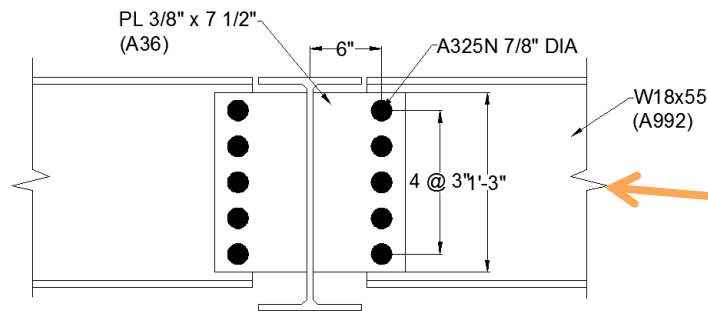




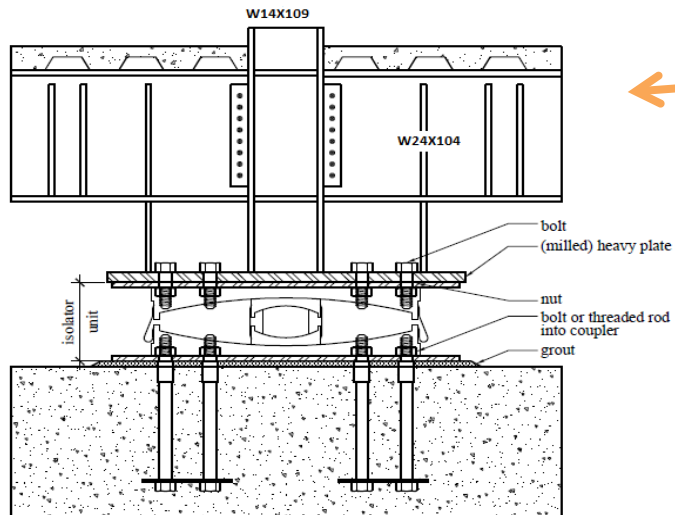


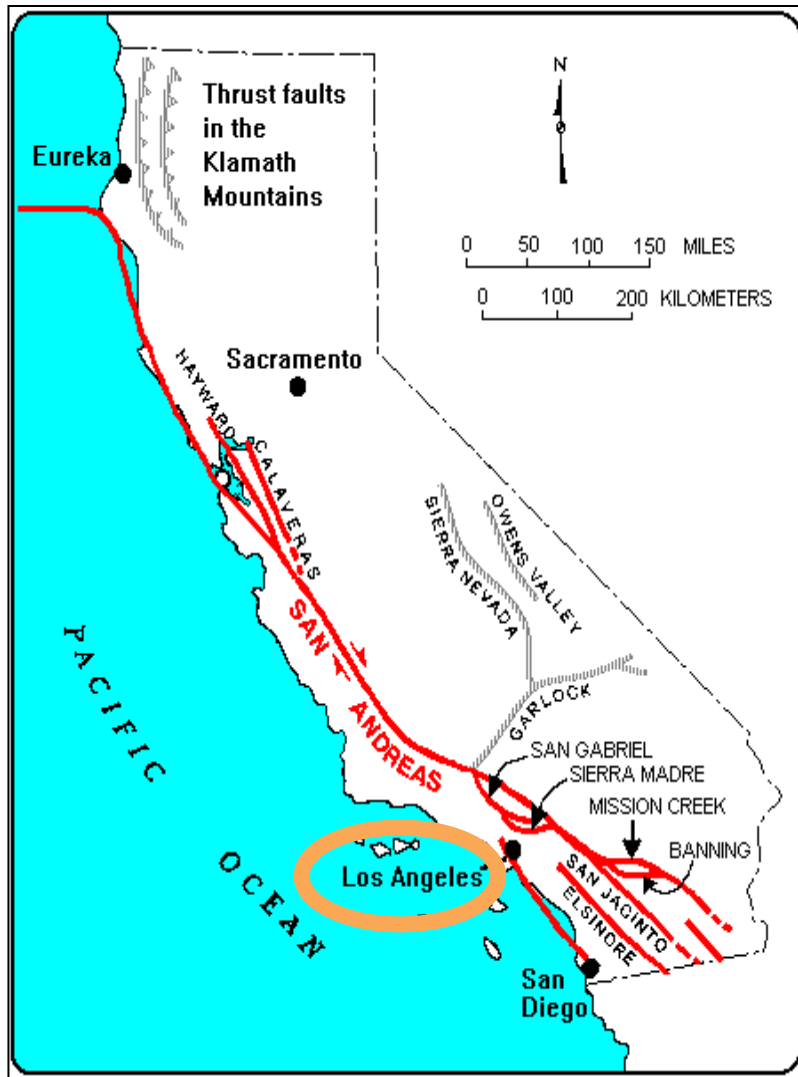
- $M_{resist}/M_{over} = 2.74 > 2.0$ ✓
- Bearing Stress = 2.36ksf < 5.0ksf ✓

Simple Connections



Moment Connection





Close to San Andreas Fault

In the next 30 years:

6.7 Magnitude: 99.7%

7.5 Magnitude: 46%

Northridge Earthquake

January 17th, 1994

Mw=6.7 Peak Sa=1.8g



- Structural Material Saving
- Life Cycle Saving

	Floor Shear [kip]	Total Weight of Steel Used in Beams and Columns [tons]	Building Damage [% of the building value]	Down Time
Without Base Isolator	638.5 1064.2 1277.3	210	40%-60%	Several Months
With Base Isolator	519.6 750.5 808.2	154 (save 26%)	5%	Several Days

Site Class D

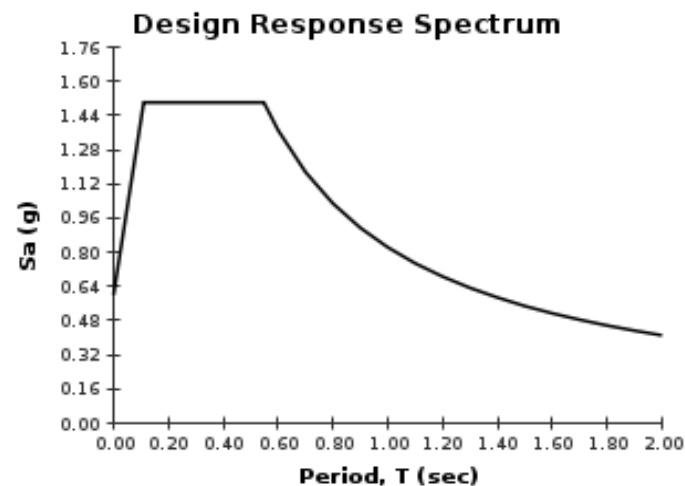
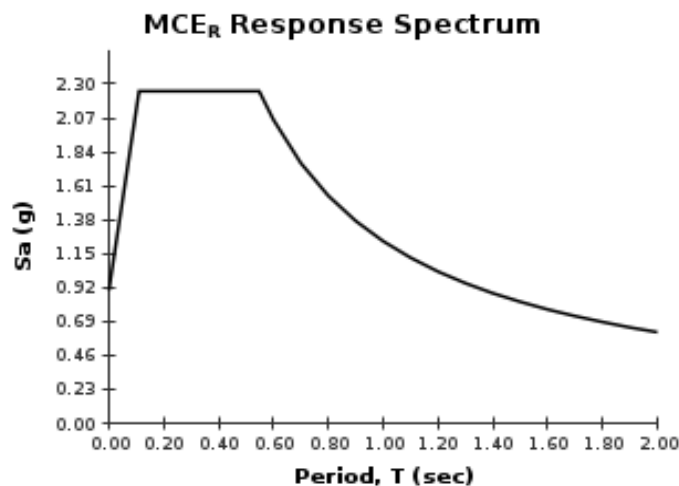
15 ft of Sandy Soil (Suitable for Base Isolator)

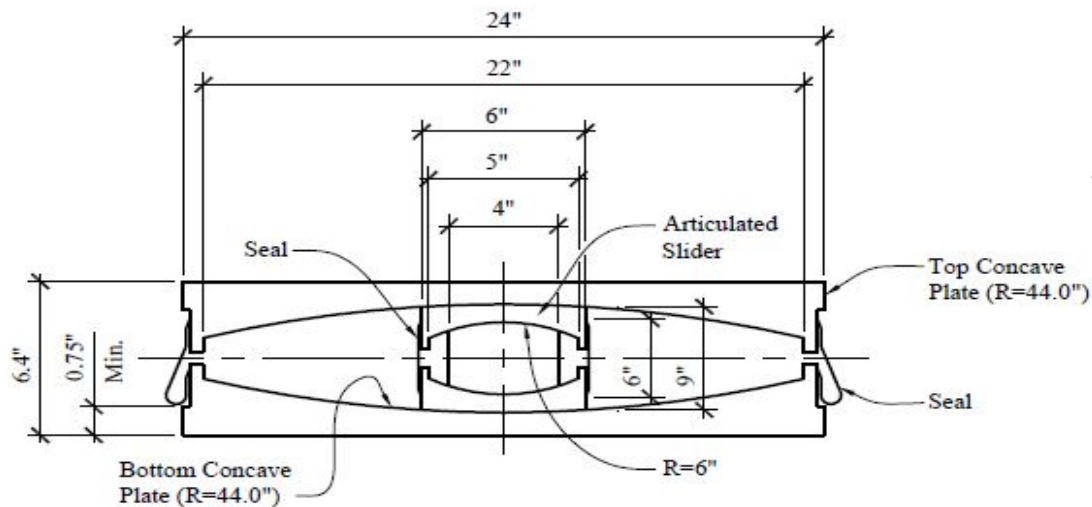
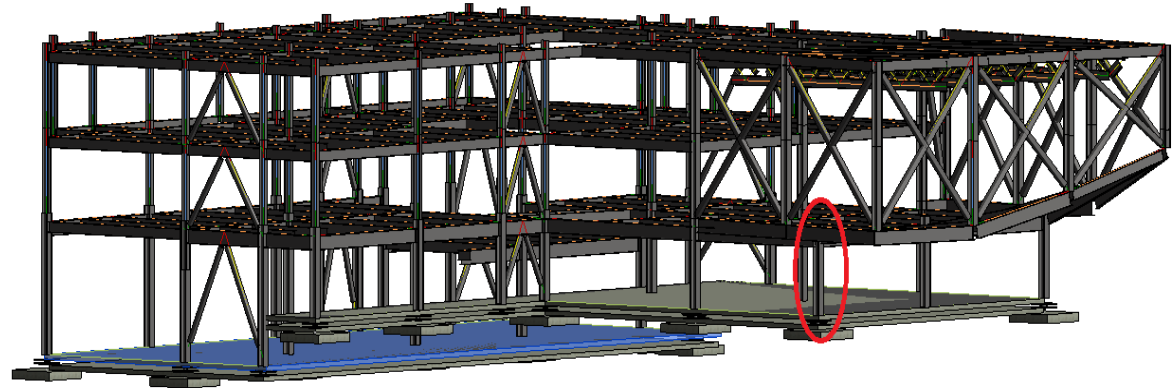
Importance Category II

Design for MCE (Maximum Considered Earthquake)

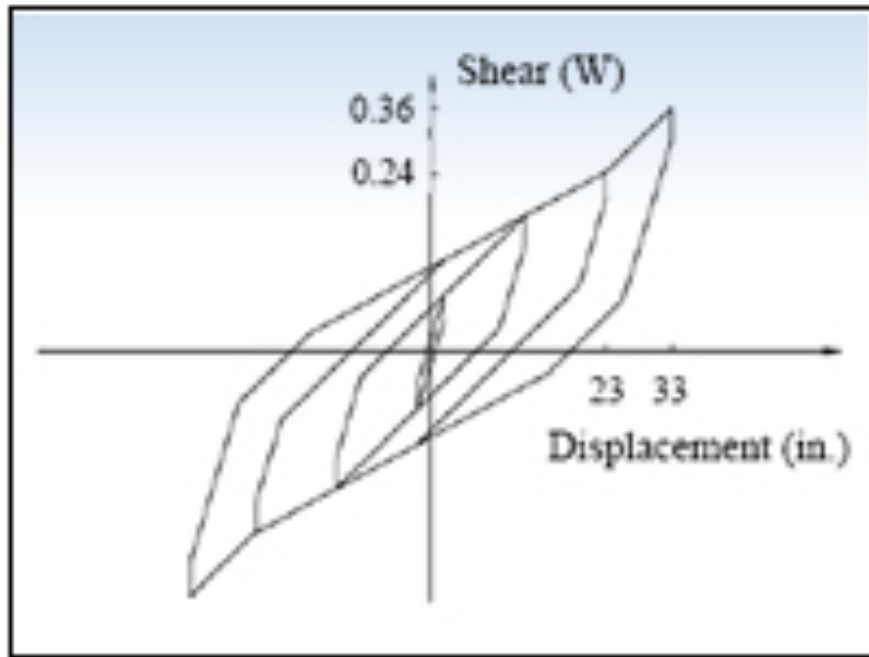
Reduction Factor 2 for Superstructure

Reduction Factor 1 for Substructure (Foundation)





Preliminary Size governed
by the vertical load it
takes: 459 kip



**Triple Pendulum Force Displacement
Hysteretic Loop**

FTP Manufacturer

http://www.earthquakeprotection.com/triple_vs_single_pendulum.html

$$k_{eff} = \frac{|F^+| + |F^-|}{|\Delta^+| + |\Delta^-|}$$

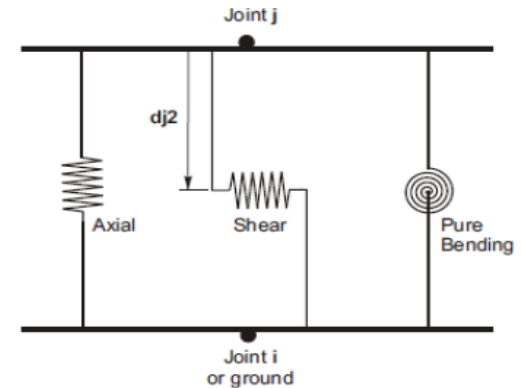
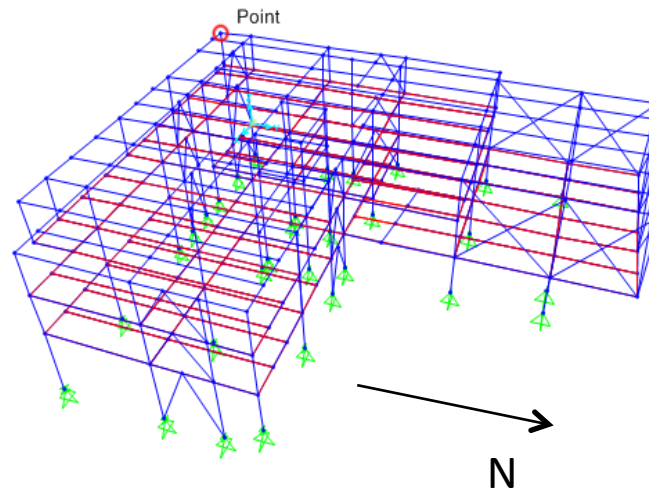
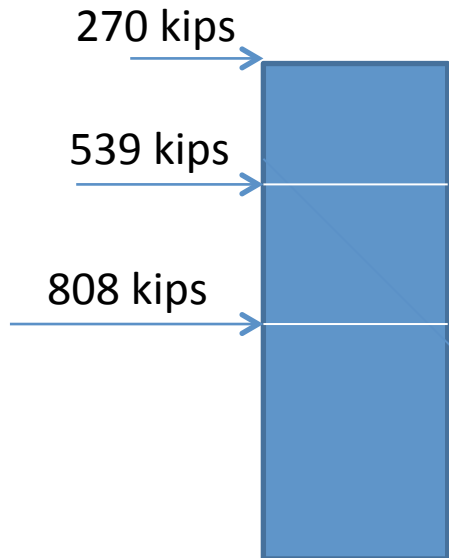
k_{eff} : 52kip/in

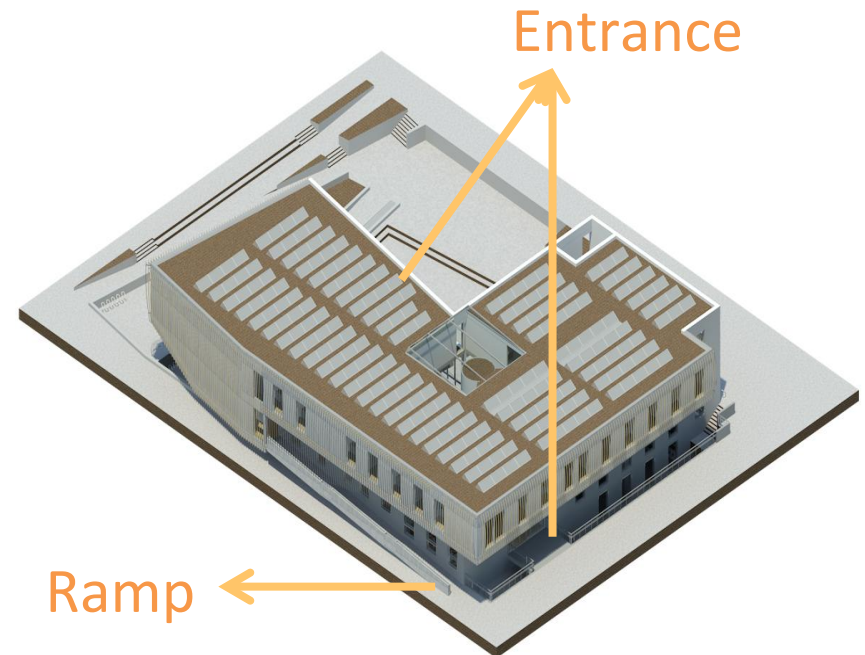
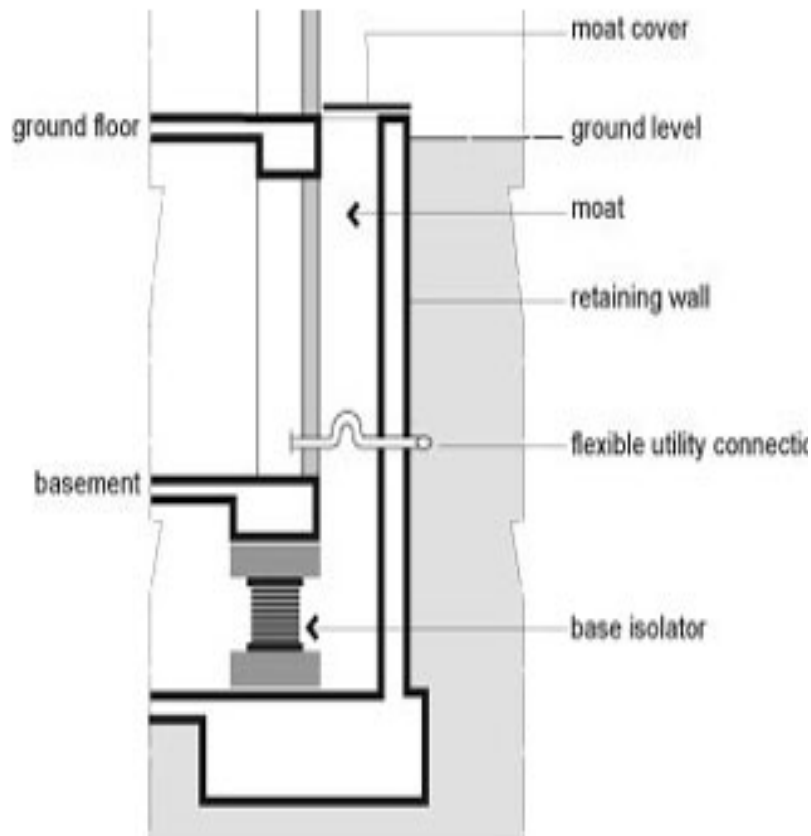
T_n : 2.1s

ζ_{eff} : 35%

Displacement including
accidental eccentricity: 2ft

- ELF was used to select the preliminary size of elements (Equally distributed force)
- Two Point Link elements were used to model the base isolator





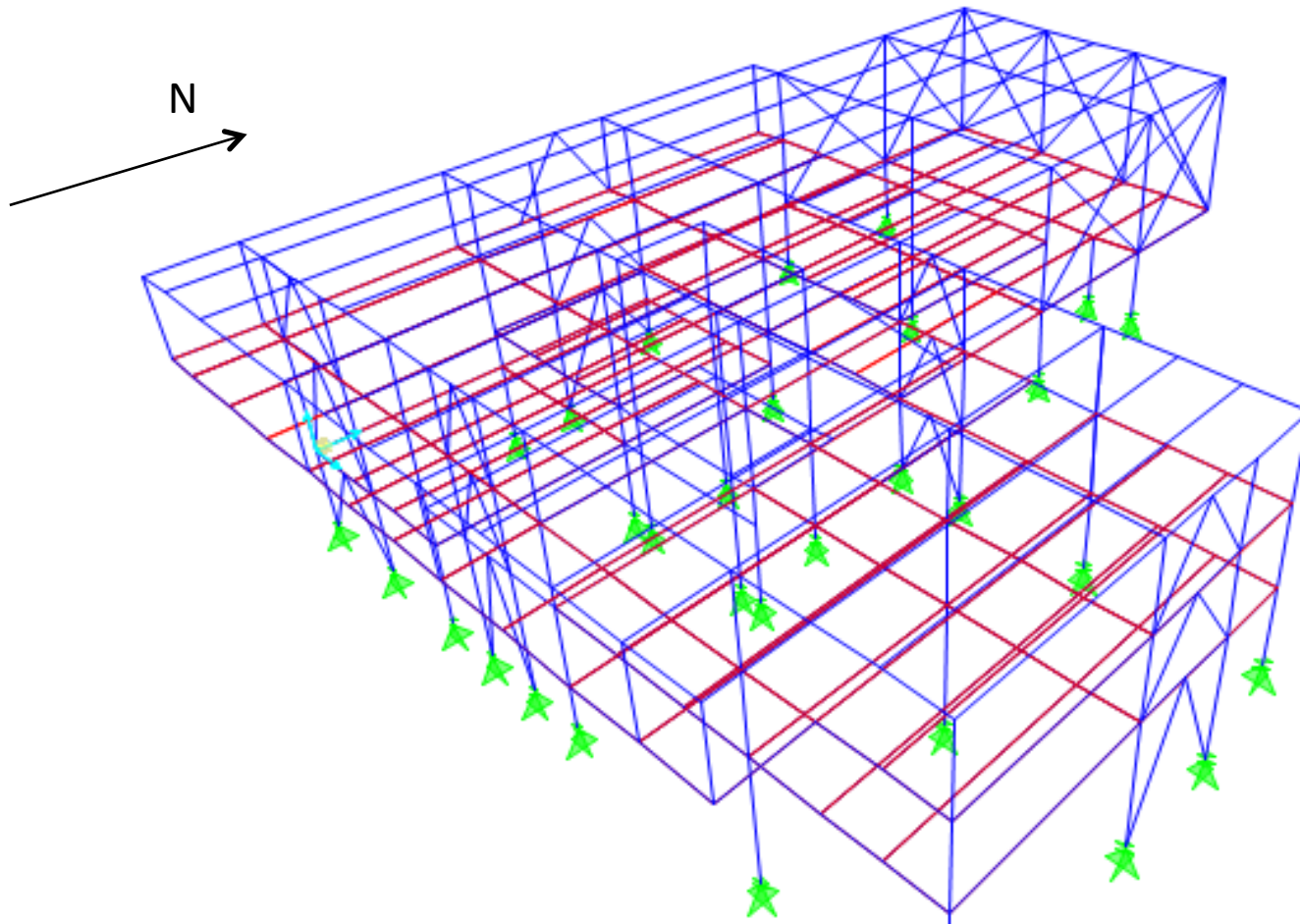
Moat Area: 2.5ft

Solution for the Entrance:

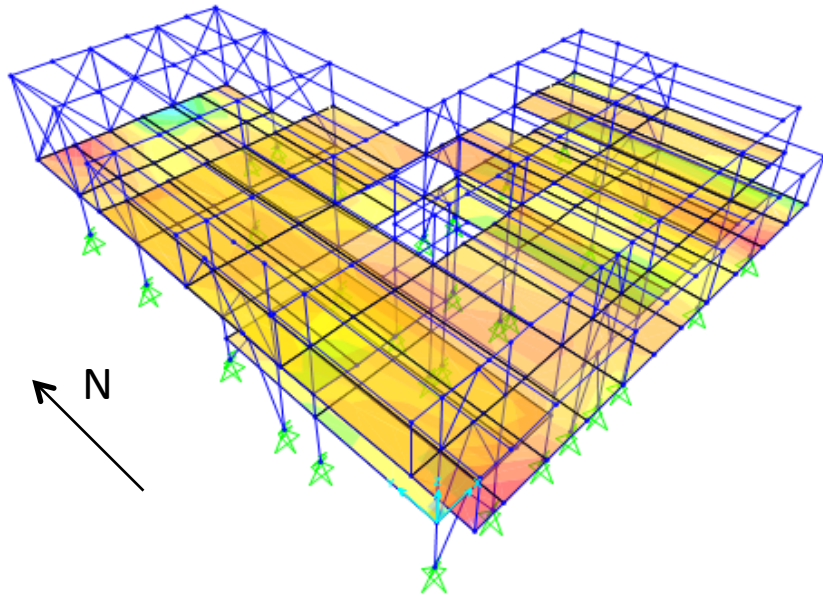
- Moat Cover: Expansion Joint
- Slider underneath the Ramp



	w/o Base Isolation	w/ Base Isolation
Period [s]	0.35	2.1

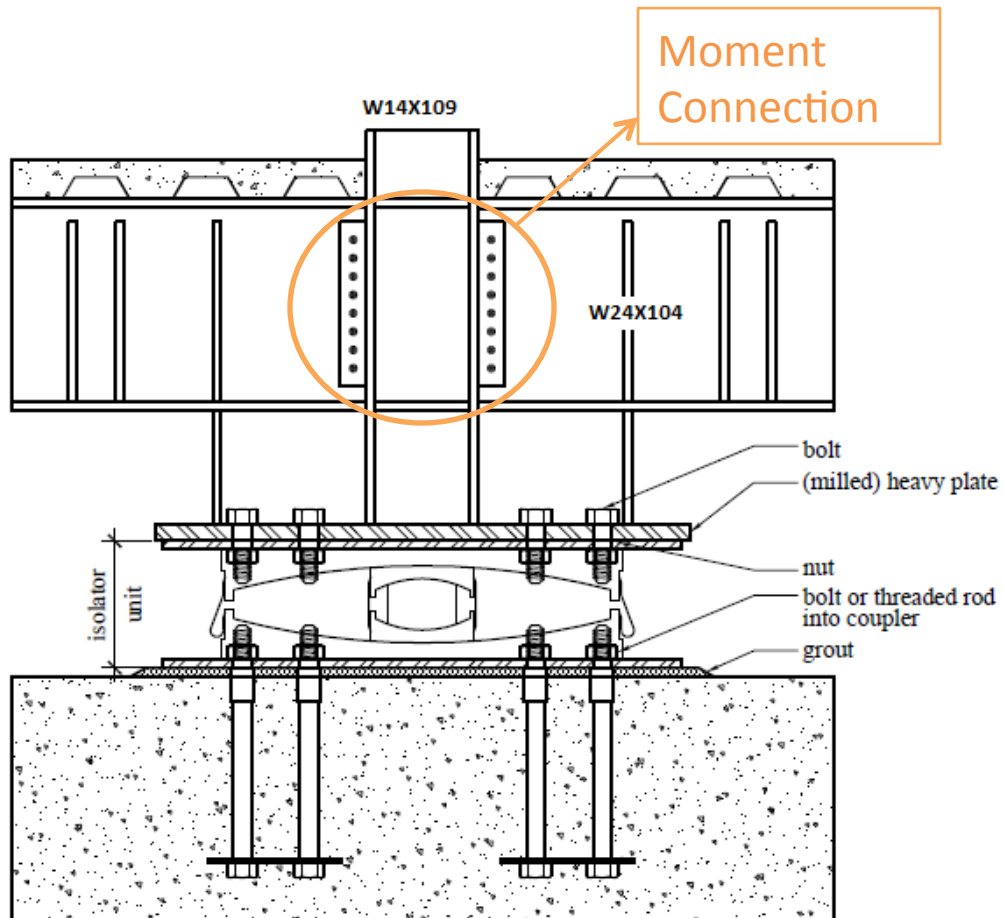
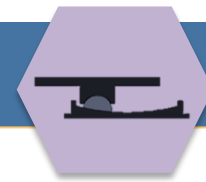


Response Spectrum Analysis



	Max Demand	Capacity
Moment [kip*ft]	550	675
Shear [kip]	160	207
Axial Force [kip]	459	1440
Deflection [in]	0.85	1.3
Interstory Drift Ratio [%]	0.34%	2%

Response History Analysis: Uplift of the isolator units and p-delta effects on the isolated structure can be analyzed



Column



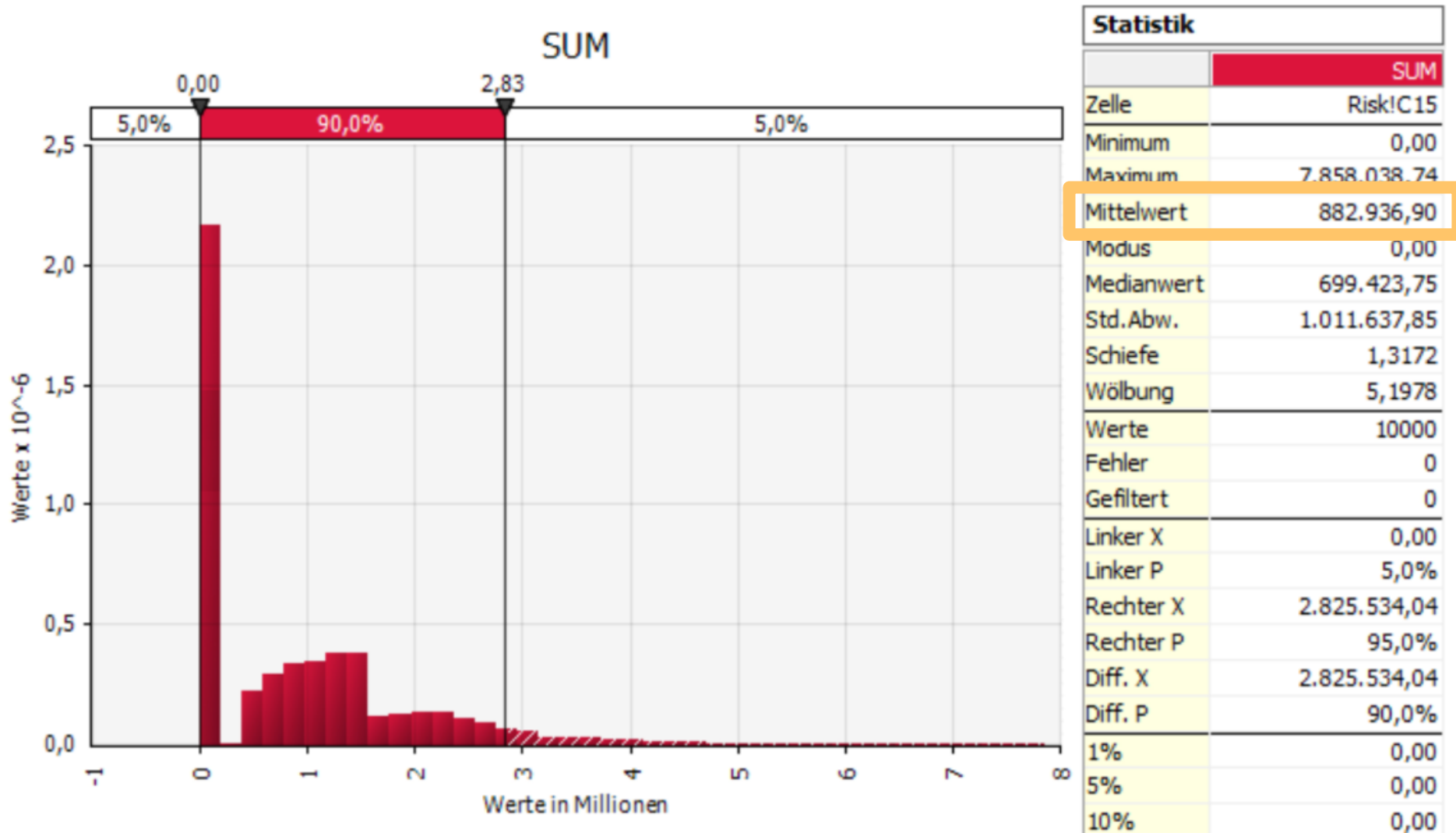
Stiffened Base Plate



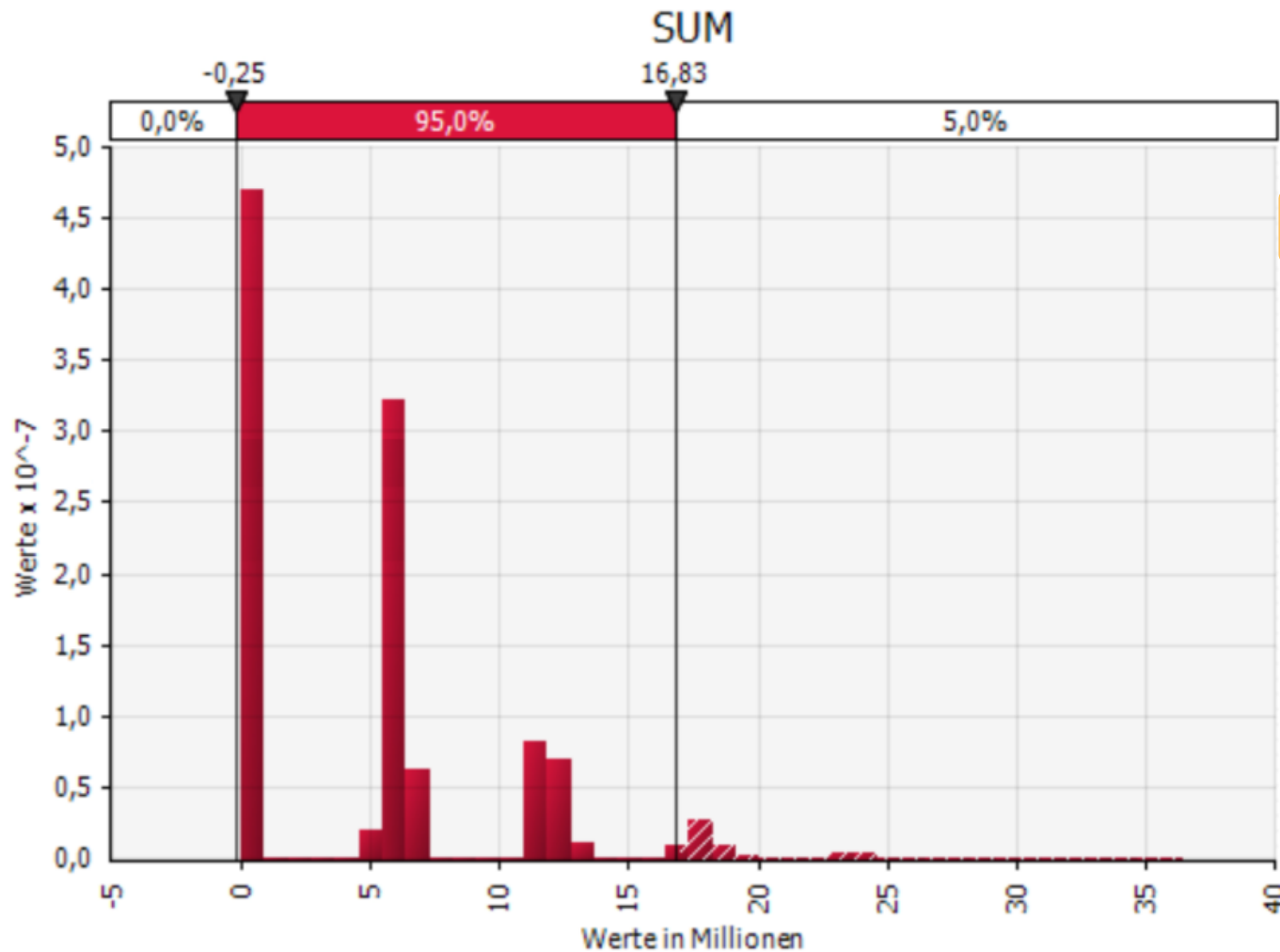
Base Isolator



Foundation

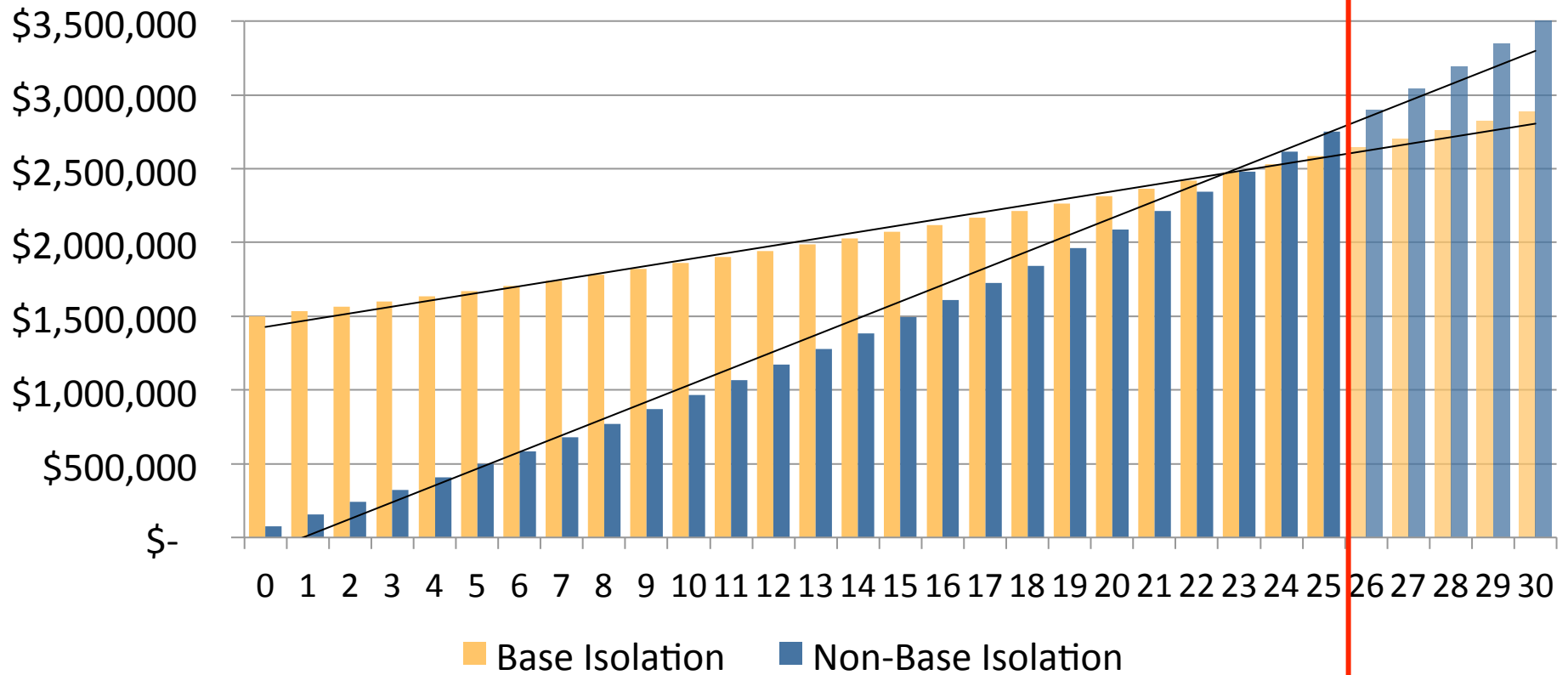


Mean Value earthquake damage
\$ 885,000



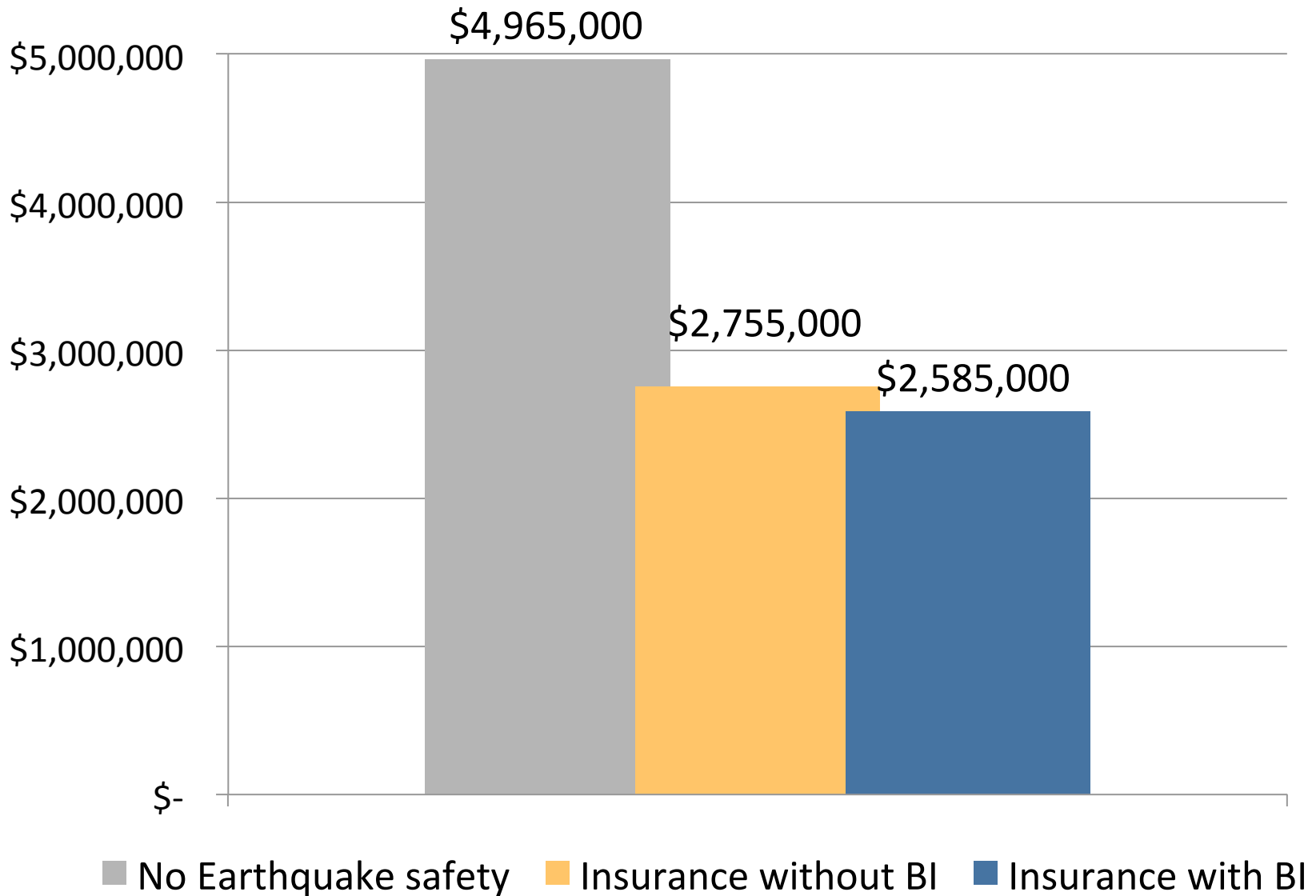
Statistik	
	SUM
Zelle	RiskIC15
Minimum	0,00
Maximum	36.520.901,60
Mittelwert	4.966.220,67
Modus	0,00
Medianwert	5.604.666,57
Std. Abw.	5.383.017,62
Schiefe	1,0602
Wölbung	4,0305
Werte	10000
Fehler	0
Gefiltert	0
Linker X	-250.000,00
Linker P	0,0%
Rechter X	16.828.890,02
Rechter P	95,0%
Diff. X	17.078.890,02
Diff. P	95,0%
1%	0,00
5%	0,00
10%	0,00

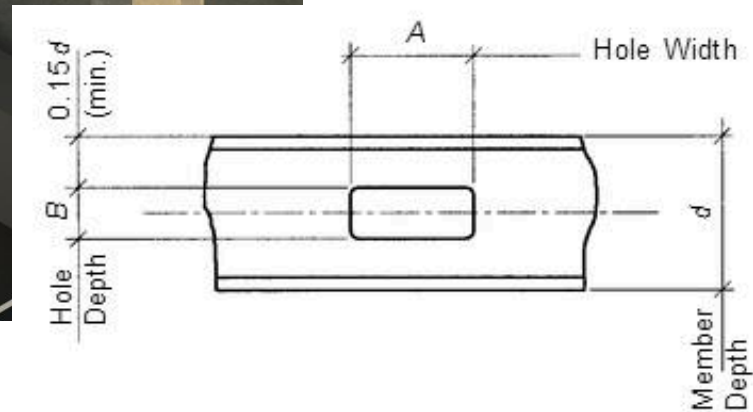
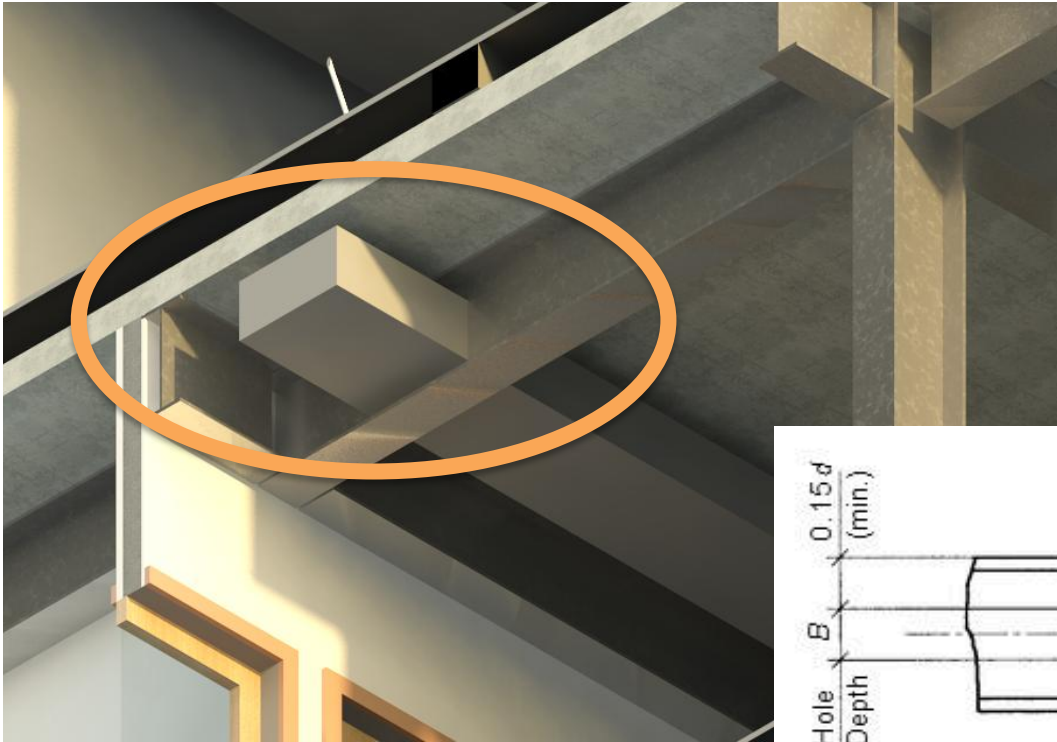
Mean Value earthquake damage
\$ 4,965,000



Benefit in PPP period
\$ 170,000

Next 5 yrs
\$ 500,000





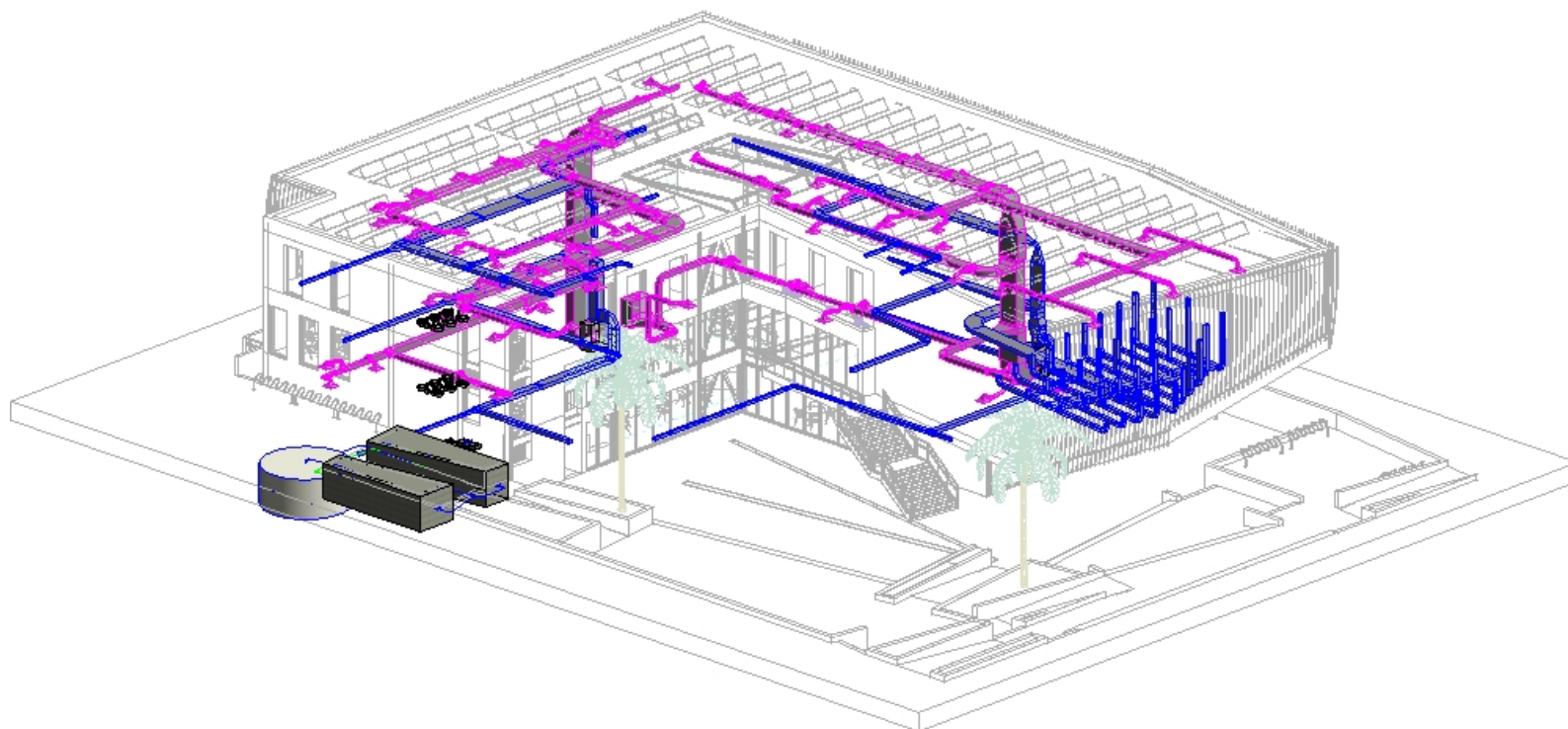
CONCENTRIC WEB PENETRATION

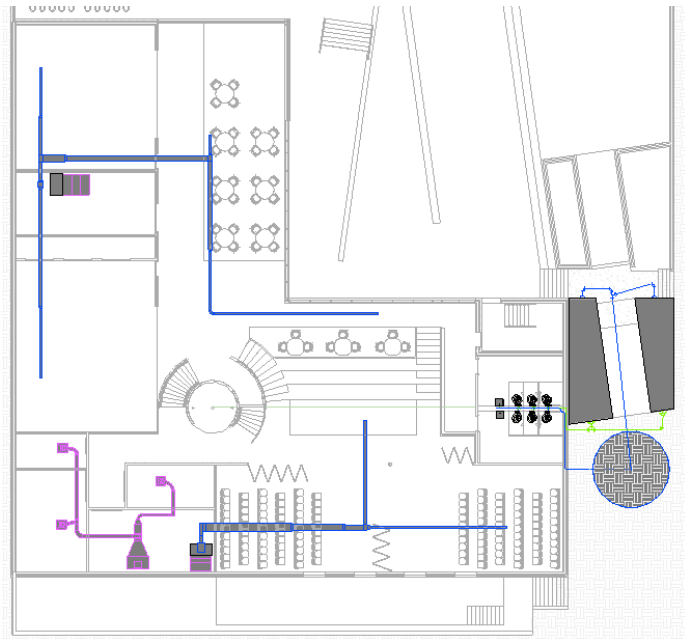
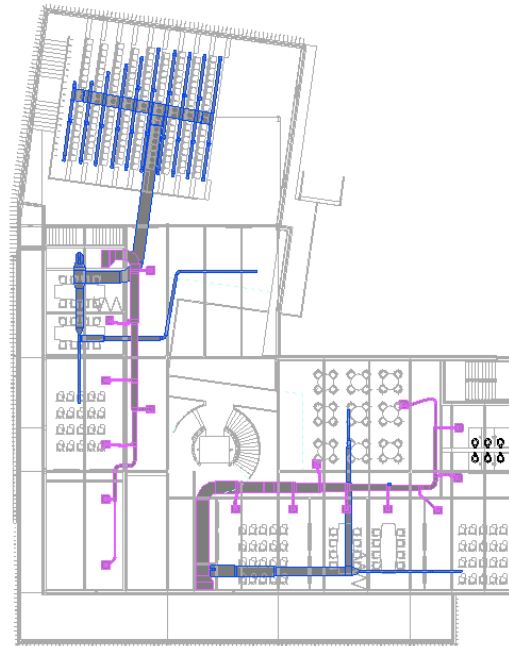
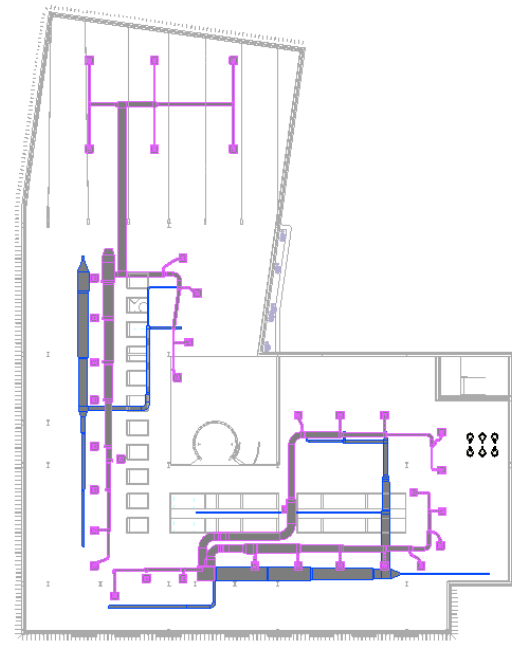
- Ducts had to be a maximum of 10" x 39" in order to penetrate ducts



- Max depth of 2.6' → raises our clear height to 9'3"
- Exposed structure adds 18" to clear height between beams

Heating	Cooling	Ventilation	Supply	Return
Conditioning of DOAS supply Heating Coil	Conditioning of DOAS supply Cooling Coil	DOAS	Plenum	Ducted

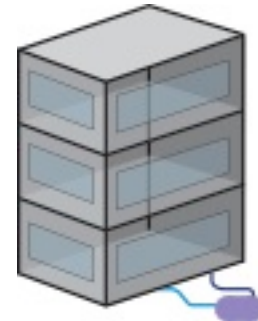


1st Floor2nd Floor3rd Floor

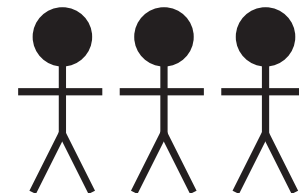
1. Optimize the Envelope

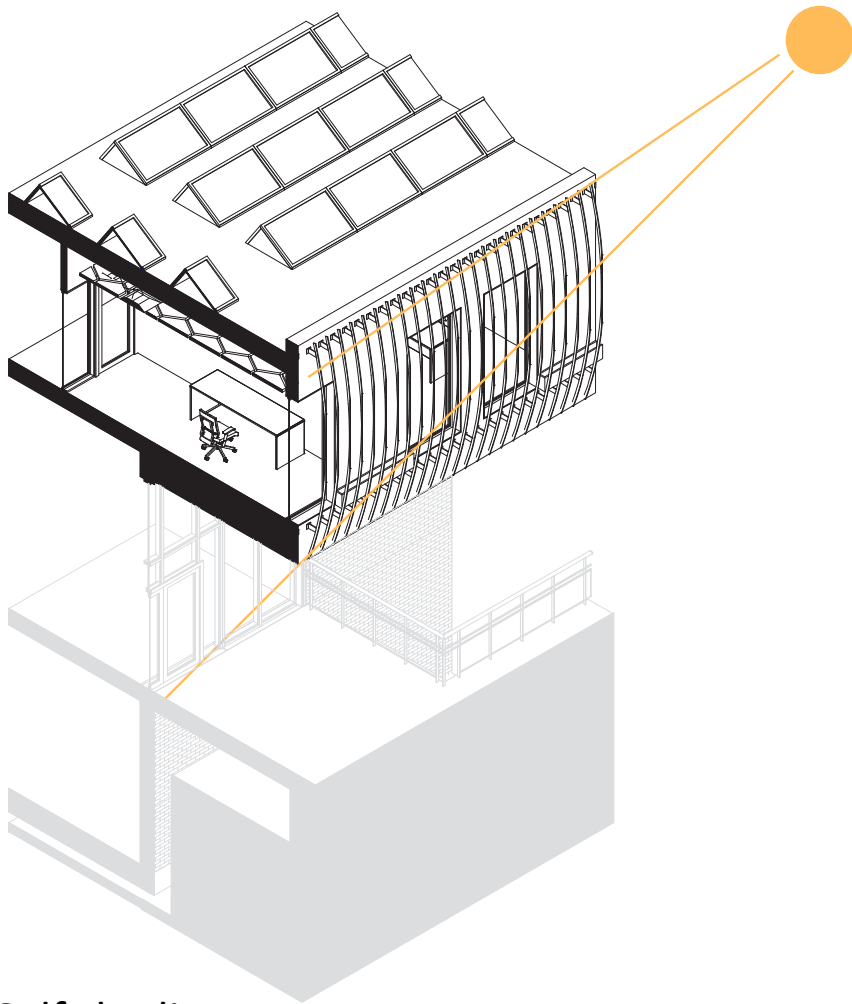


2. Optimize the Systems

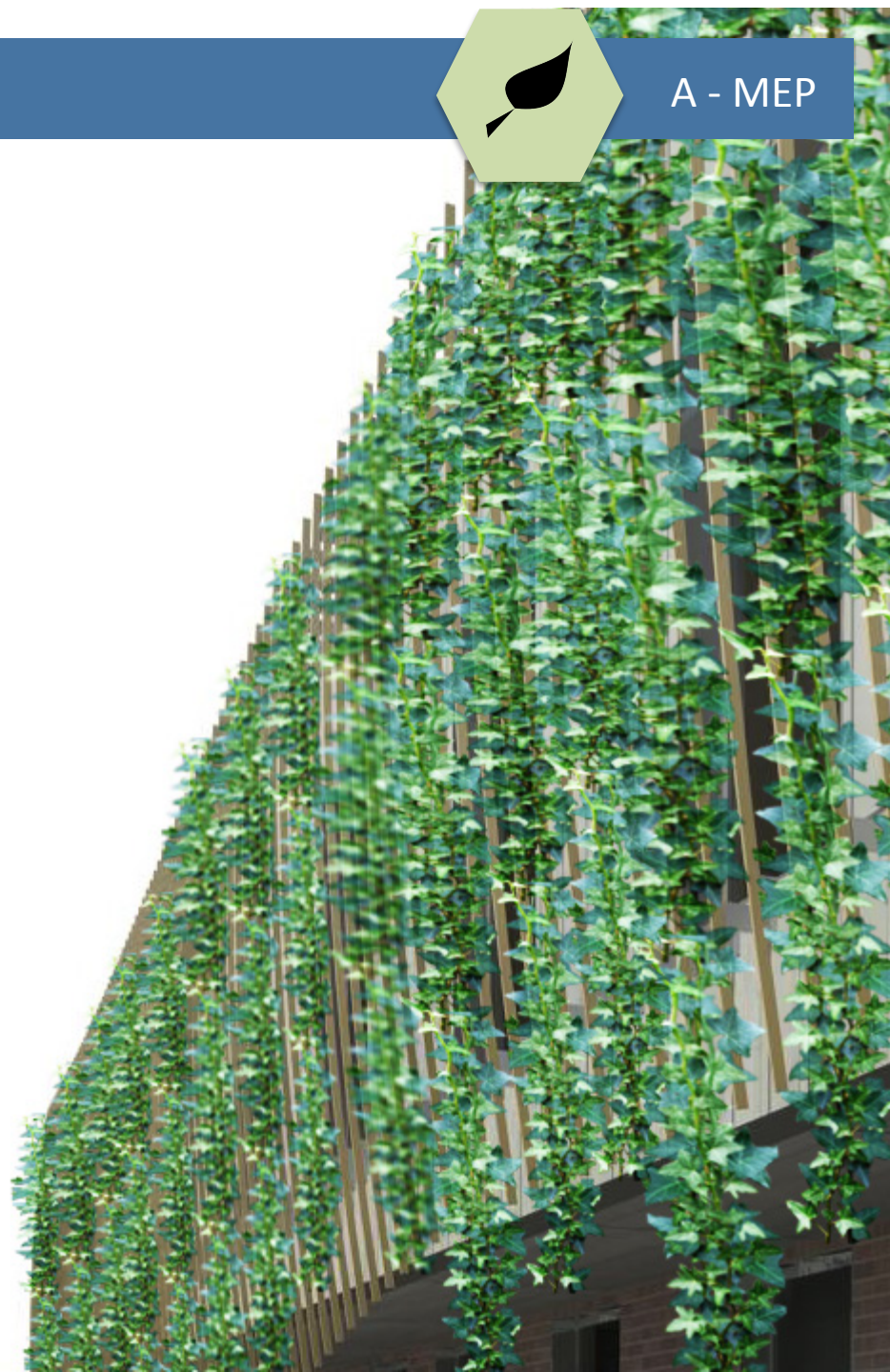


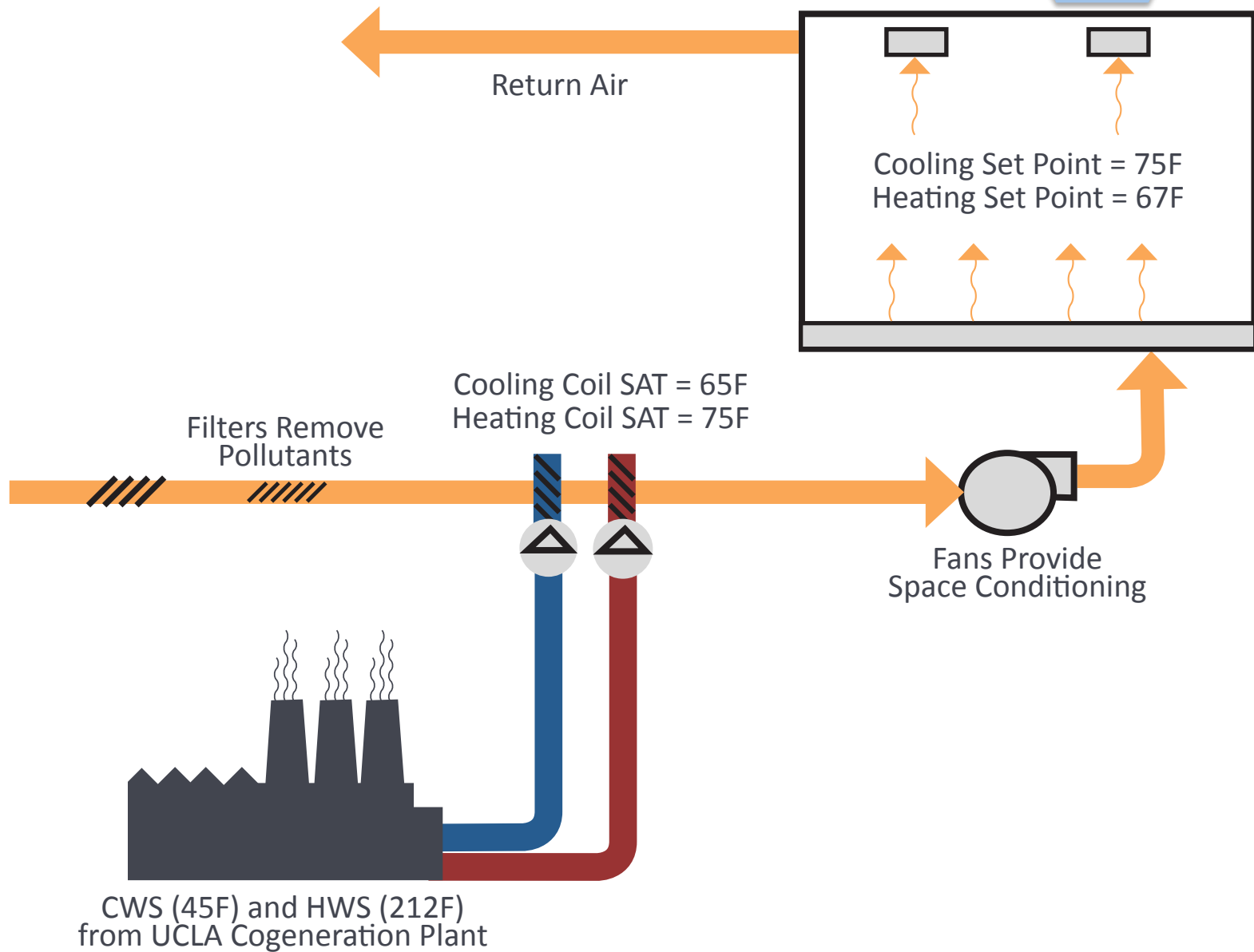
3. Optimize the People

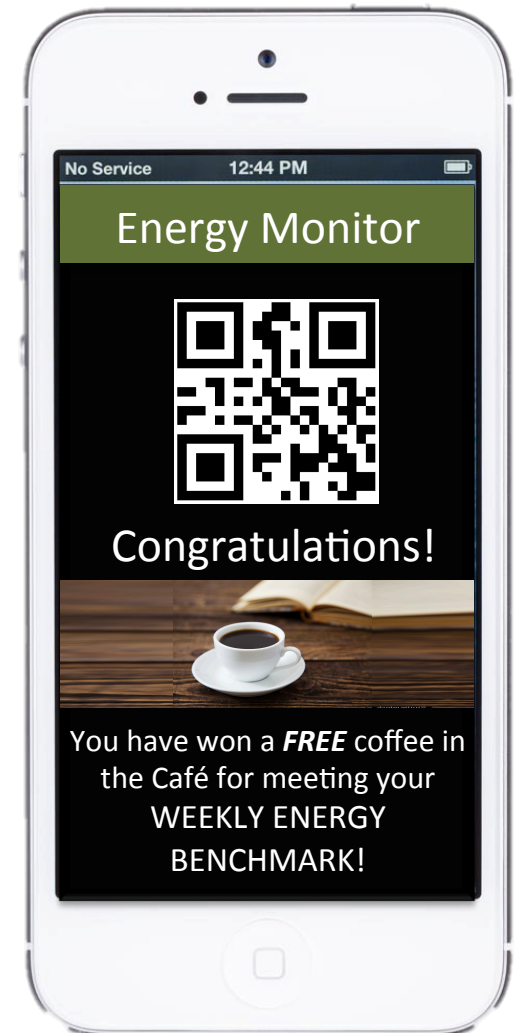
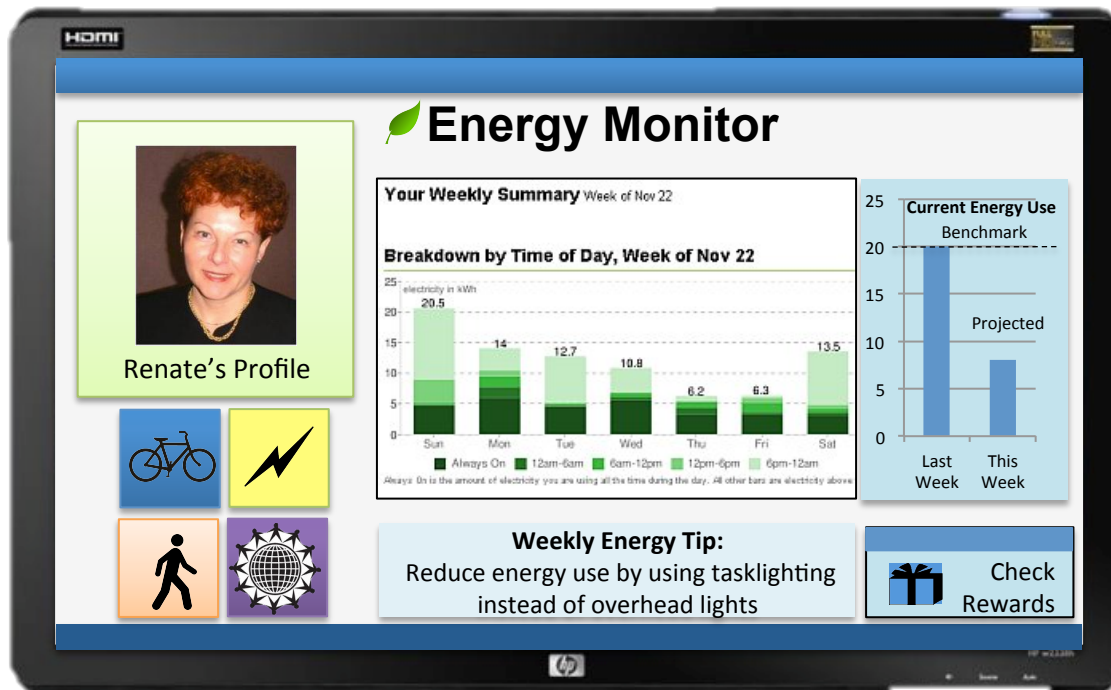


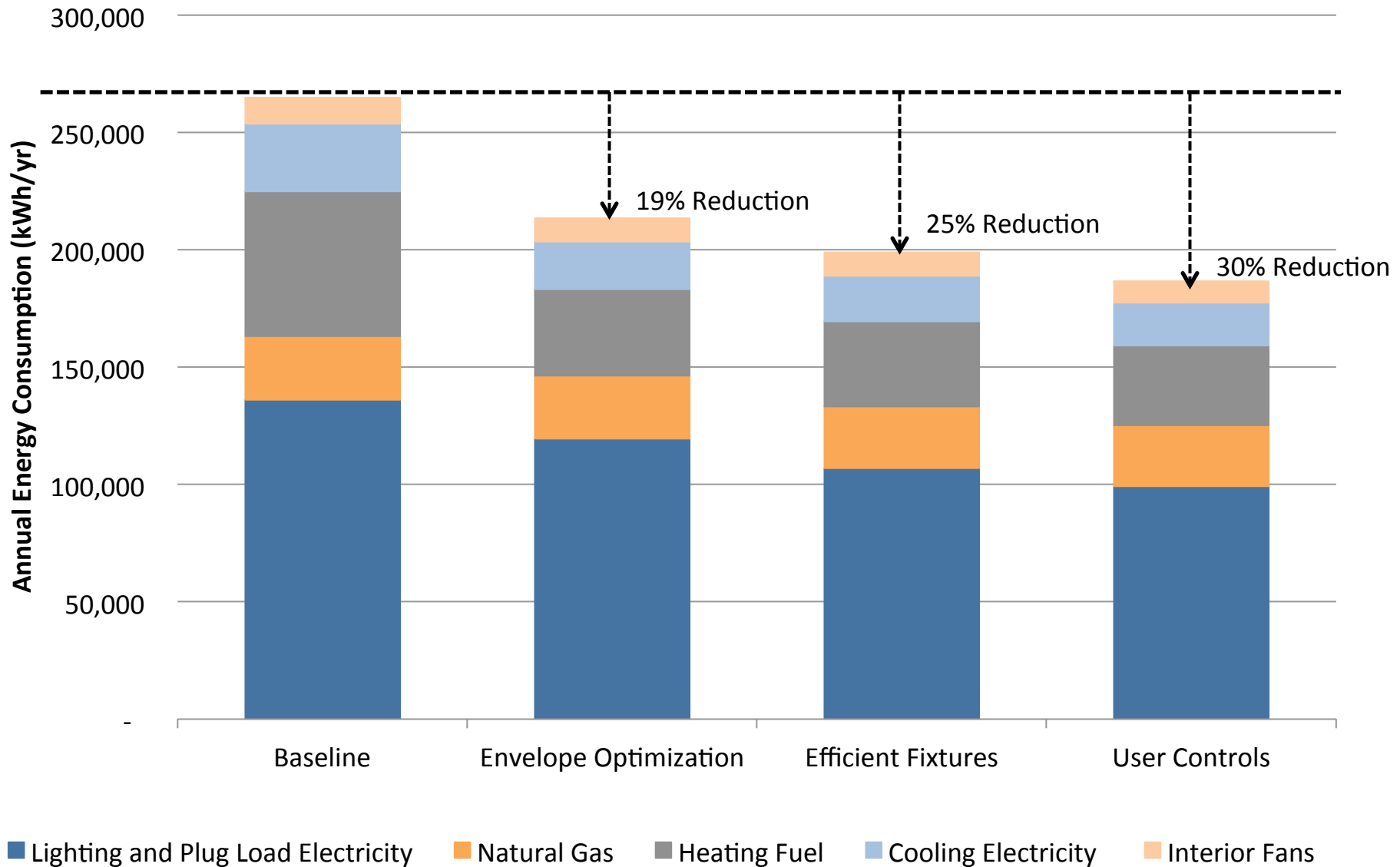
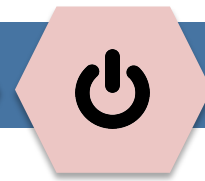


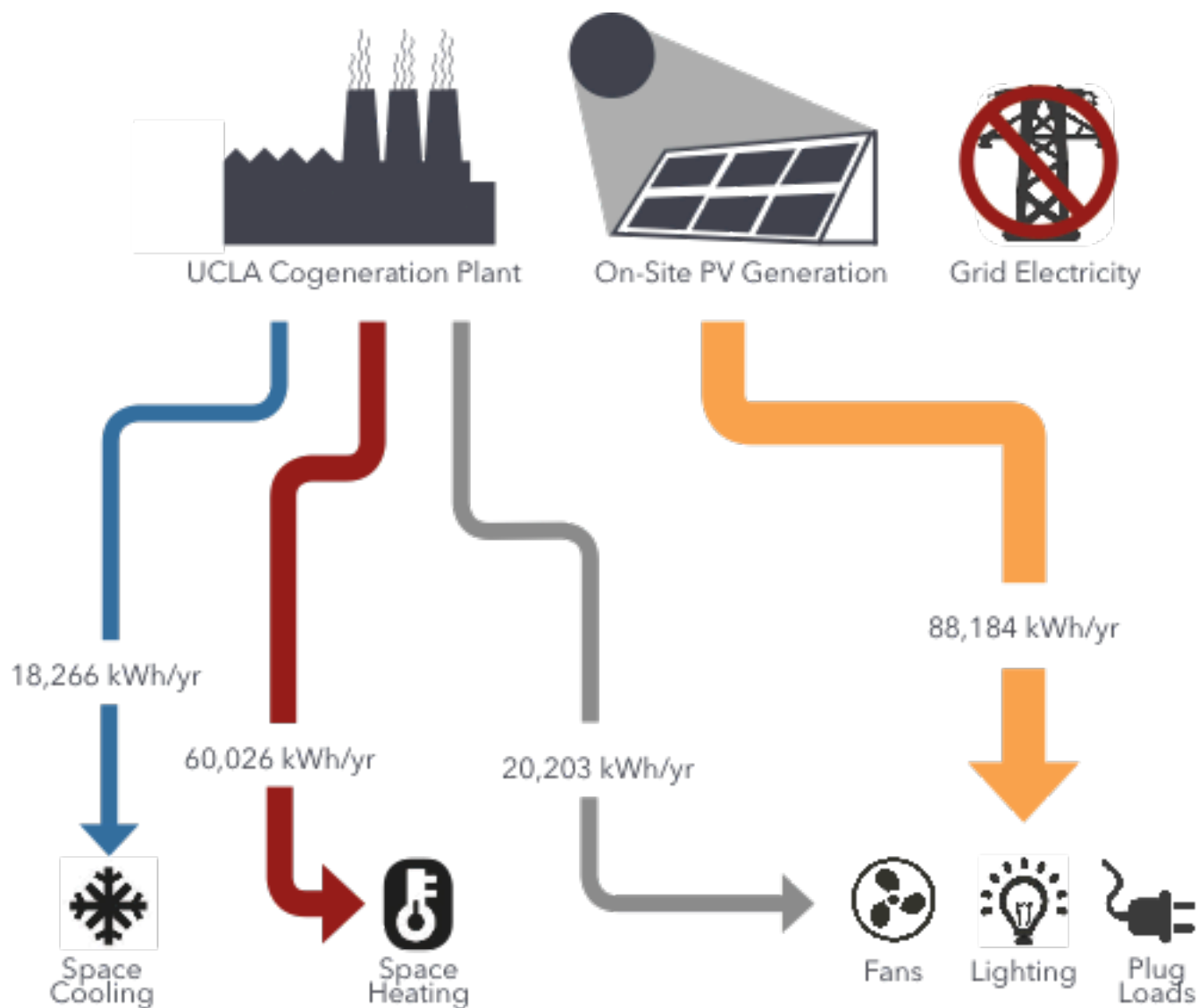
Self shading

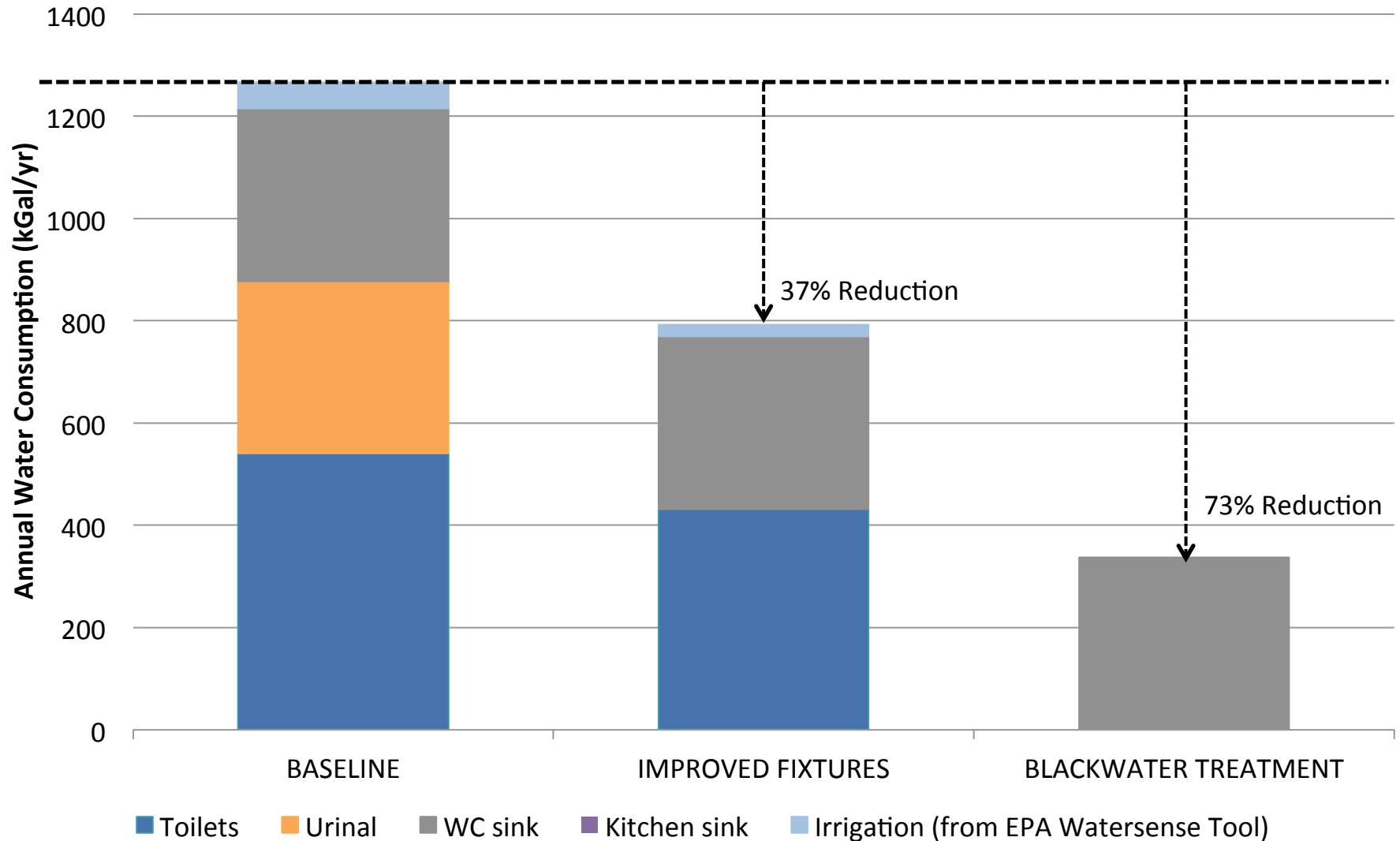


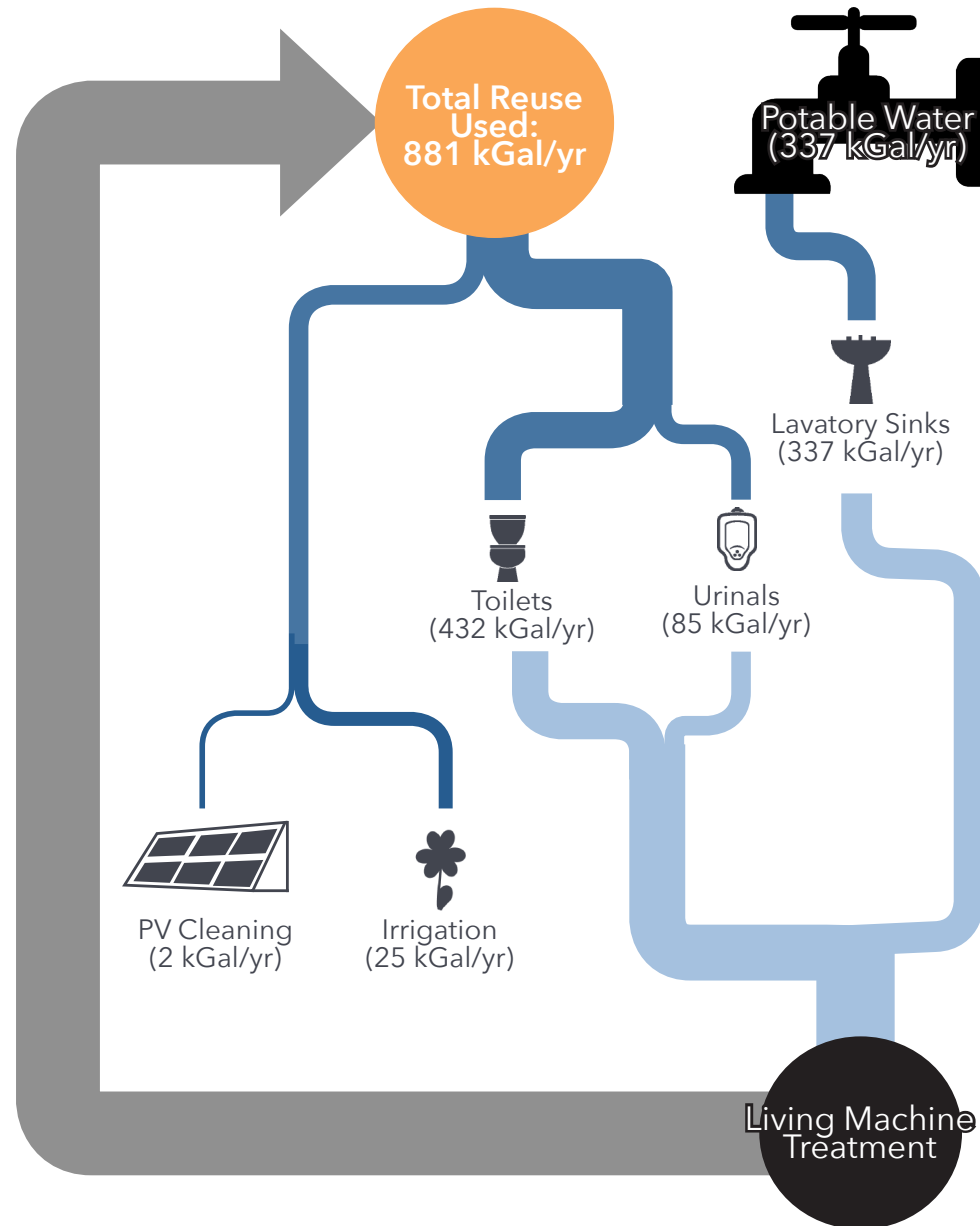












STV Progress		GWP (kgCO2e)	Energy (MJ)	Water (kg)	ODP (kgCFC11e)	\$/yr Maintenance	Grid Electricity Rate	\$ 0.22	\$/kWh
Target	3,034,347	84,832,768	36,673,973	(minimize)	6.0E-02	Use Phase Energy Cost:	Cogen Electricity Rate	\$ 0.08	\$/kWh
Embodied	1,713,341	23,086,251	19,243,449	-	-	\$ 1,676.85	Natural Gas Rate	\$ 0.01	\$/MJ
Used%	56.5%	27.2%	52.5%	-	-	Use Phase Water Cost:	Water Rate	\$ 0.00	\$/kg
Use Phase	413,284	8,022,809	136,305,052	5.18E-02	-	\$ 4,624.93			
Used%	13.6%	9.5%	371.7%	-	-	Total Use Phase Utilities:			
Total%	70.1%	36.7%	424.1%	-	-	\$ 6,301.77			
Annual Impacts		GWP (kgCO2e)	Energy (MJ)	Water (kg)	ODP (kgCFC11e)				
in from Grid:	0 kWh	0	0	0	0.00E+00				
able Electricity:	88,184 kWh	0	0	0	0.00E+00				
Fuel Type	Natural Gas								
Electricity	20,203 kWh	1,718	34,083	342	2.22E-04				
Electricity Split	30%								
Heating	216,095 MJ	5,106	101,294	1,016	6.60E-04				
Heating Split	30%								
Cooling	18,266 kWh	1,036	20,549	206	1.34E-04				
Cooling Split	20%								
Water	0 m³	0	0	0	0.00E+00				
		GWP (kgCO2e)	Energy (MJ)	Water (kg)	ODP (kgCFC11e)				
Water Use:	0.0 gal/flush	0	0	0					
Water Use:	0.0 gal/flush	0	0	0					
Water Rate:	1.0 gal/min	405	4,520	2,724,536					
Water Rate:	0.0 gal/min	0	0	0					
Water Rate:	0.0 gal/min	0	0	0					
Water Rate:	0.0 gal/min	0	0	0					
Water Use:	0 gal	0	0	0					
		GWP (kgCO2e)	Energy (MJ)	Water (kg)	ODP (kgCFC11e)				
Water Use:	0 gal	0	0	0					

\$/yr Maintenance	Grid Electricity Rate	\$	0.22	\$/kWh
	Cogen Electricity Rate	\$	0.08	\$/kWh
Use Phase Energy Cost:	Natural Gas Rate	\$	0.01	\$/MJ
\$ 8,175.11	Water Rate	\$	0.00170	\$/kg
Use Phase Water Cost:		\$	0.006	
\$ 2,193.75				
Total Use Phase Utilities:				
\$ 10,368.86				

- How can we streamline O&M costs?
 - MEP changes energy model → has to tell LCFM = LATENCY

Which floor finish?



Concrete:

GWP (kgCO ₂ e)	Energy (MJ)	Water (kg)	ODP (kgCFC11e)	\$ First Cost	\$/yr Maintenance
4,207	67,065	135,039	2.8E-04	0	0
32,893	451,719	350,036	9.3E-05	72,437	3,779
253,937	2,263,654	3,211,264	6.4E-03	349,481	12,177

Reclaimed Wood:

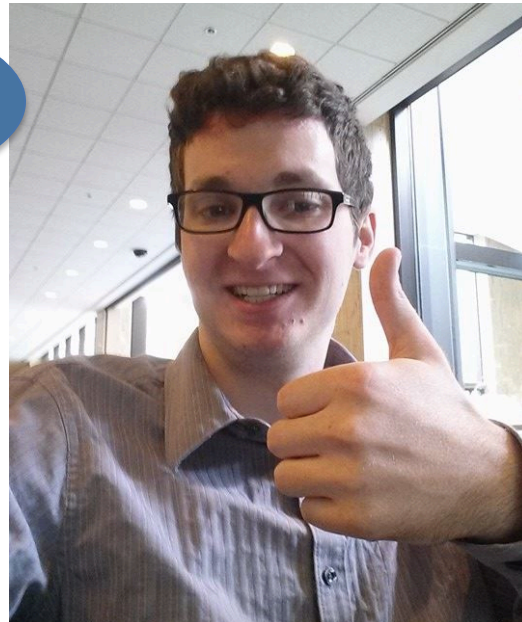
GWP (kgCO ₂ e)	Energy (MJ)	Water (kg)	ODP (kgCFC11e)	\$ First Cost	\$/yr Maintenance
4,207	67,065	135,039	2.8E-04	0	0
32,893	451,719	350,036	9.3E-05	72,437	3,779
169,664	2,329,995	1,805,505	4.8E-04	373,635	19,495

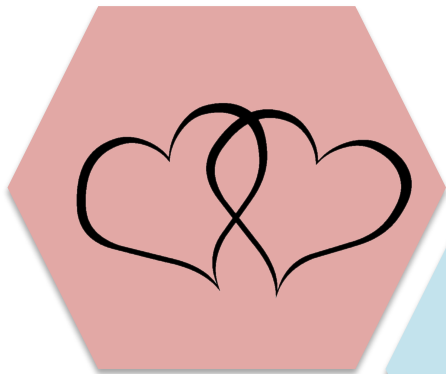
Carpet:

GWP (kgCO ₂ e)	Energy (MJ)	Water (kg)	ODP (kgCFC11e)	\$ First Cost	\$/yr Maintenance
4,207	67,065	135,039	2.8E-04	0	0
32,893	451,719	350,036	9.3E-05	72,437	3,779
41,658	703,415	61,068	7.9E-04	322,968	13,806

Concrete is cheaper, but more environmentally impactful.

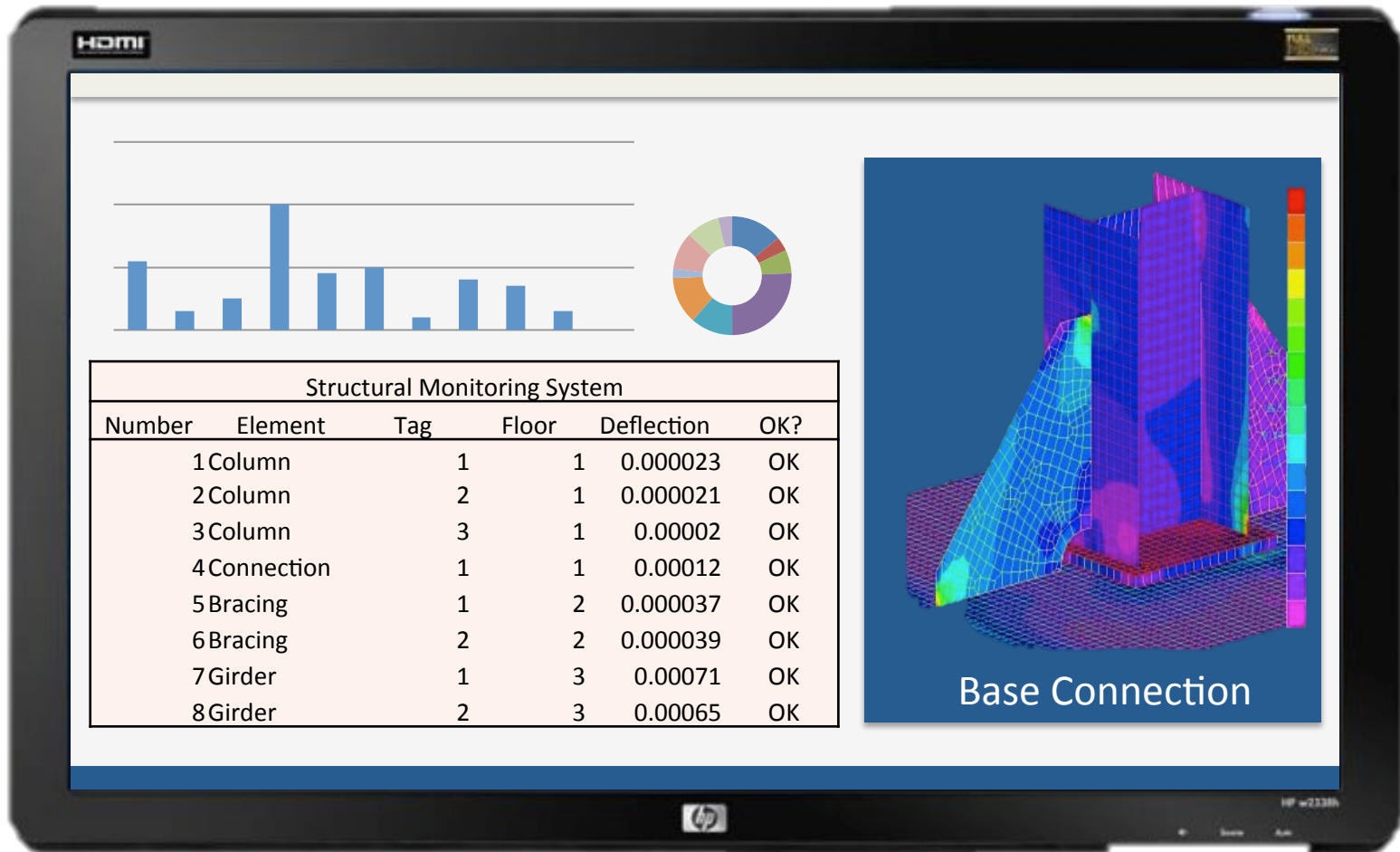
Wood provides our owners with more **VALUE for MONEY**.





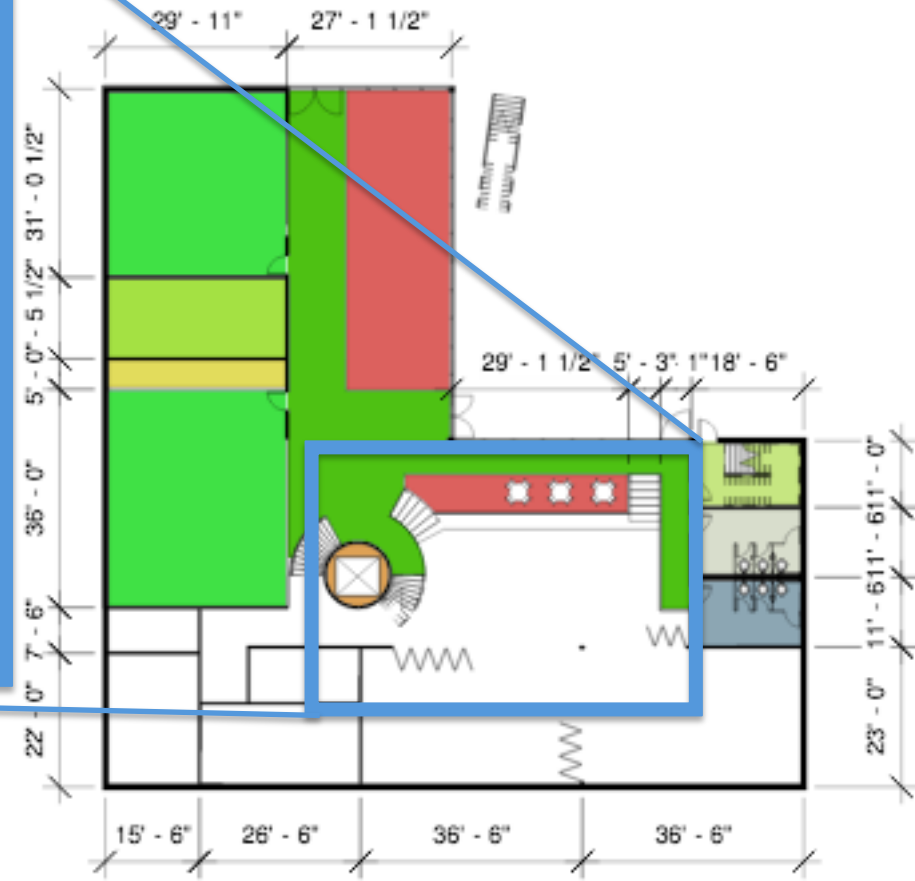
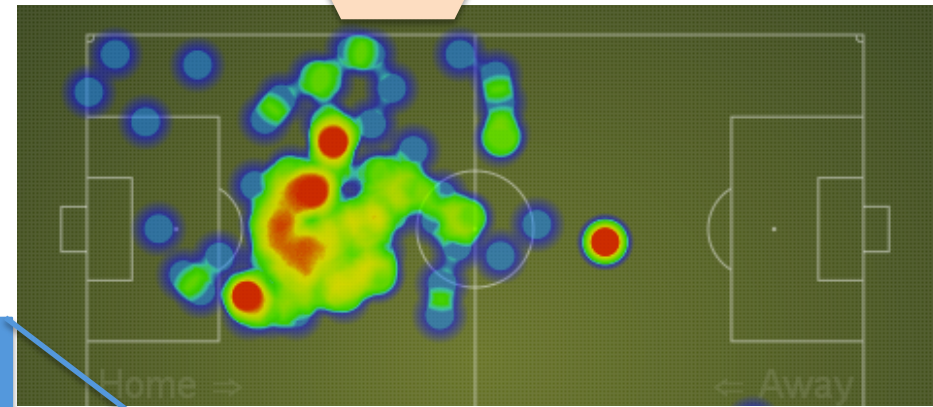
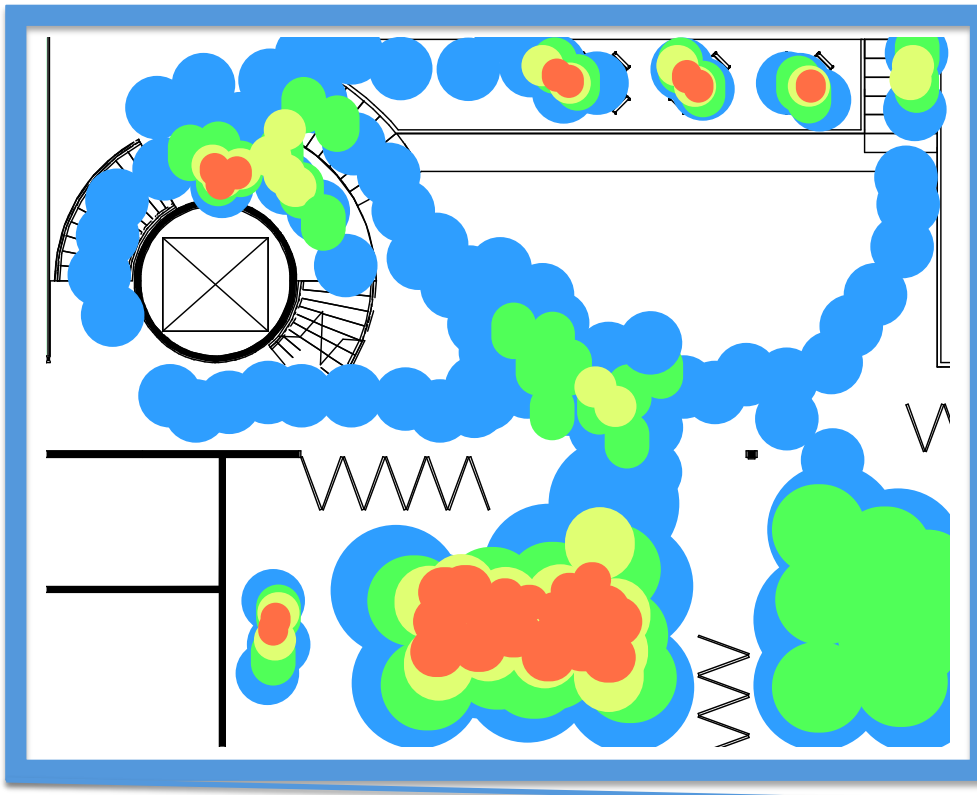
Building Health

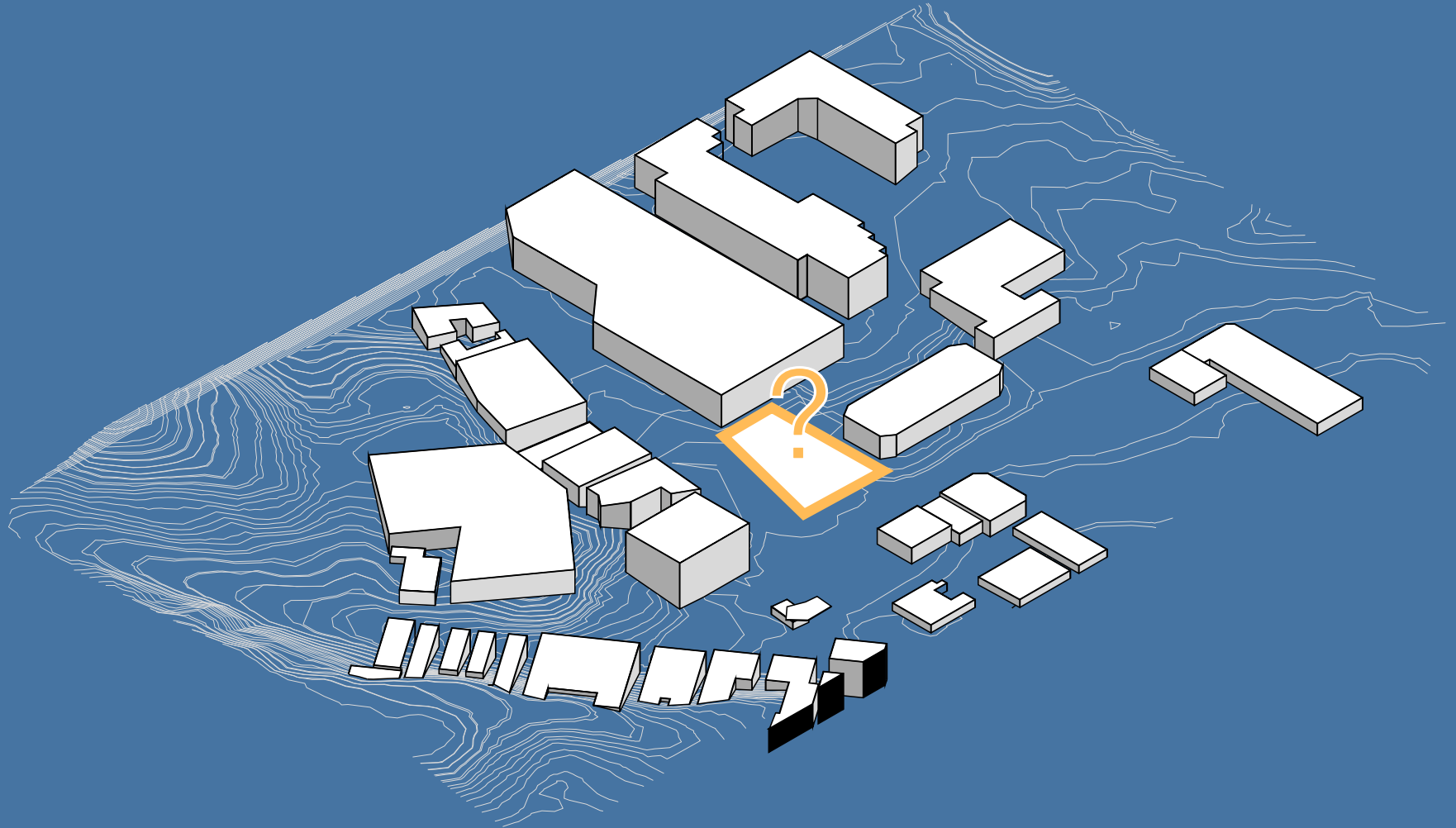


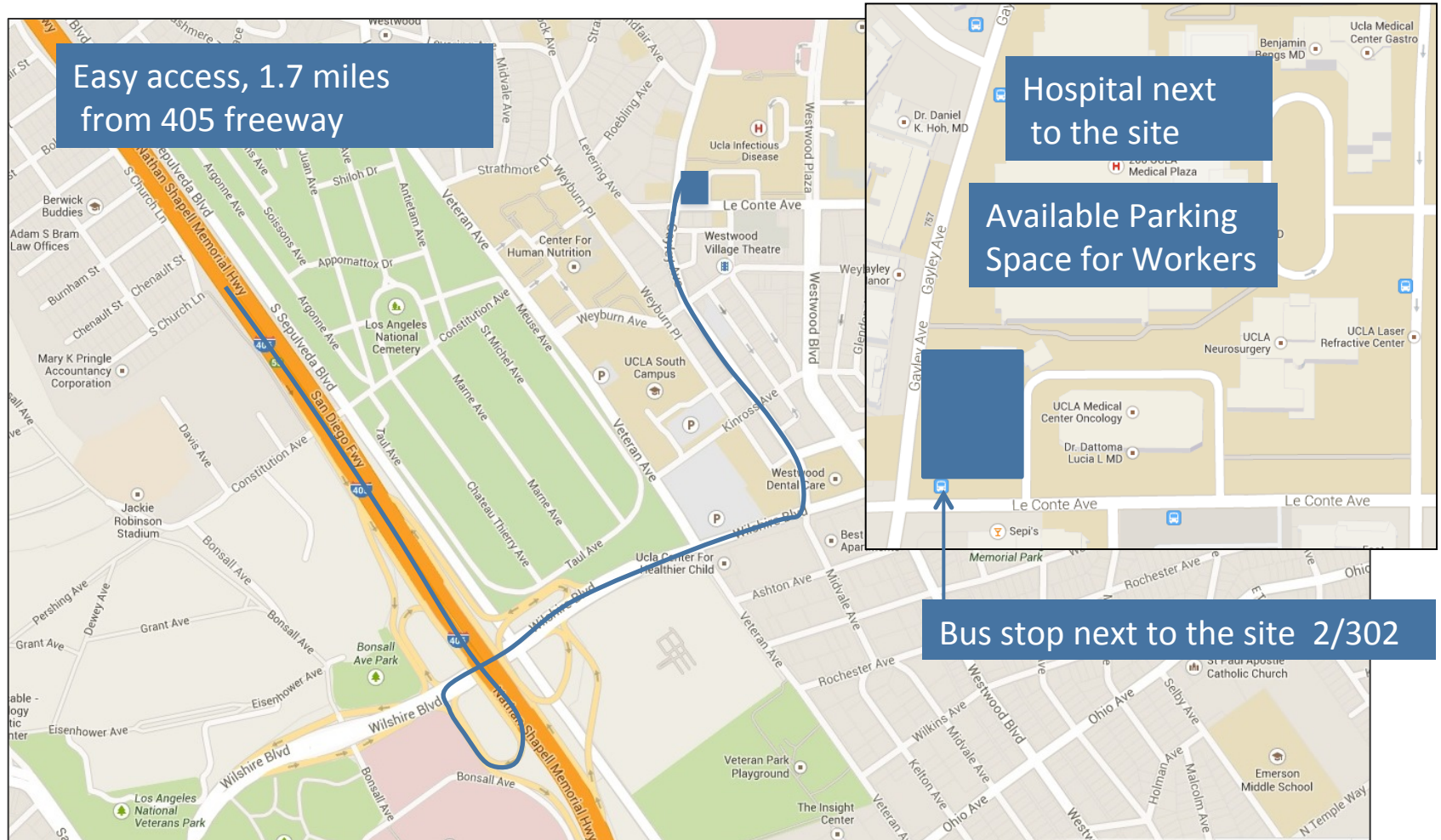


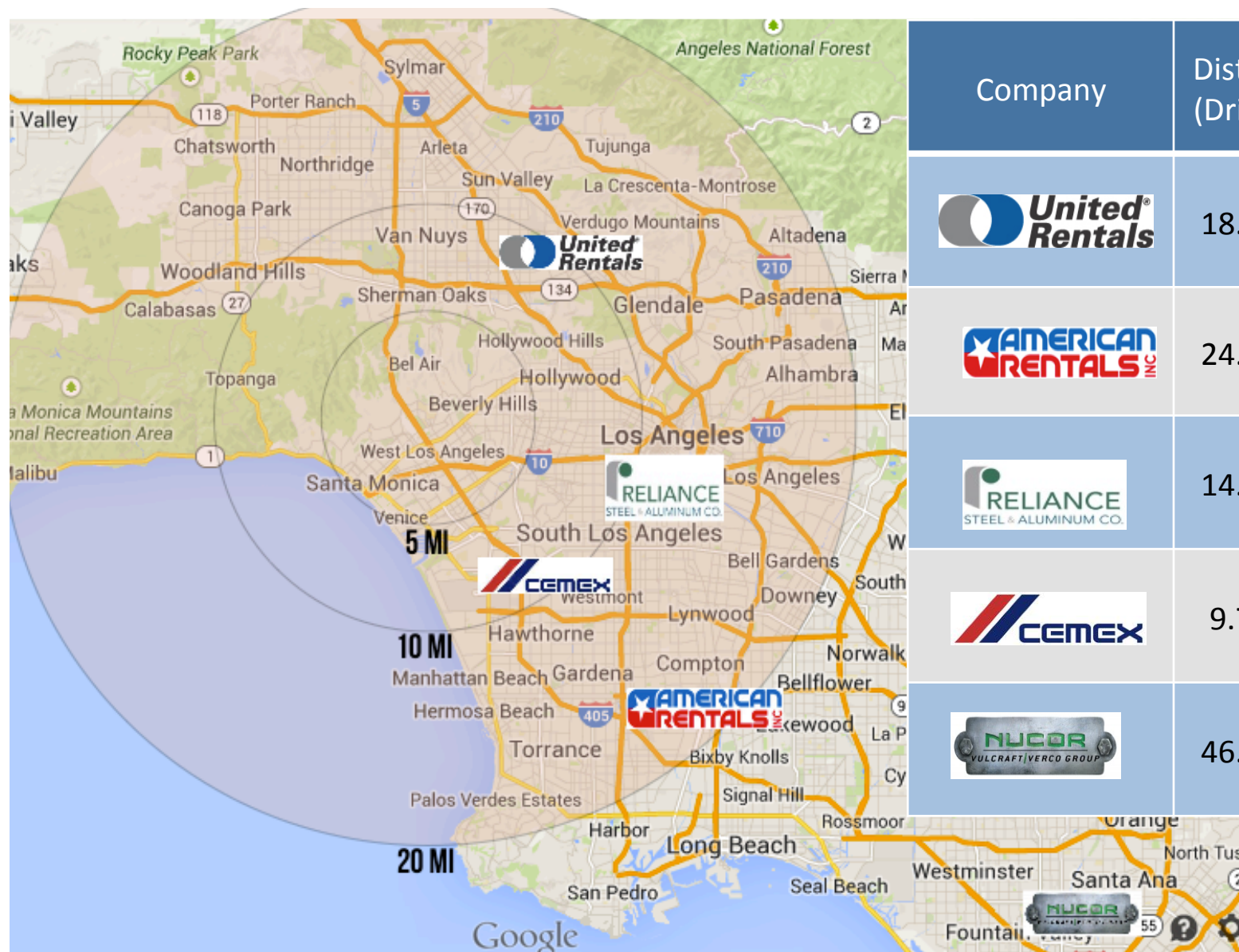


- Safety after seismic events
- Energy reductions

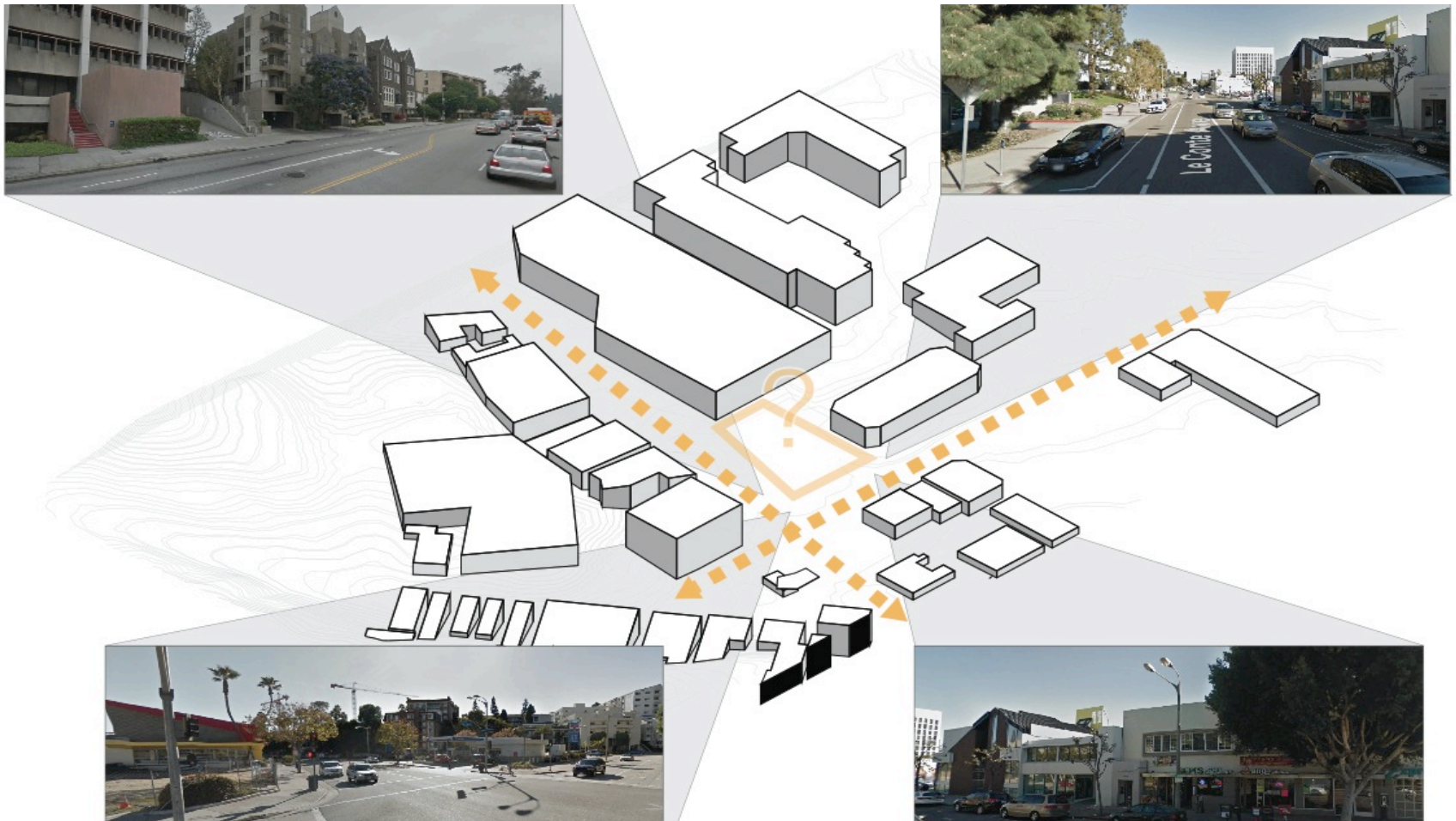


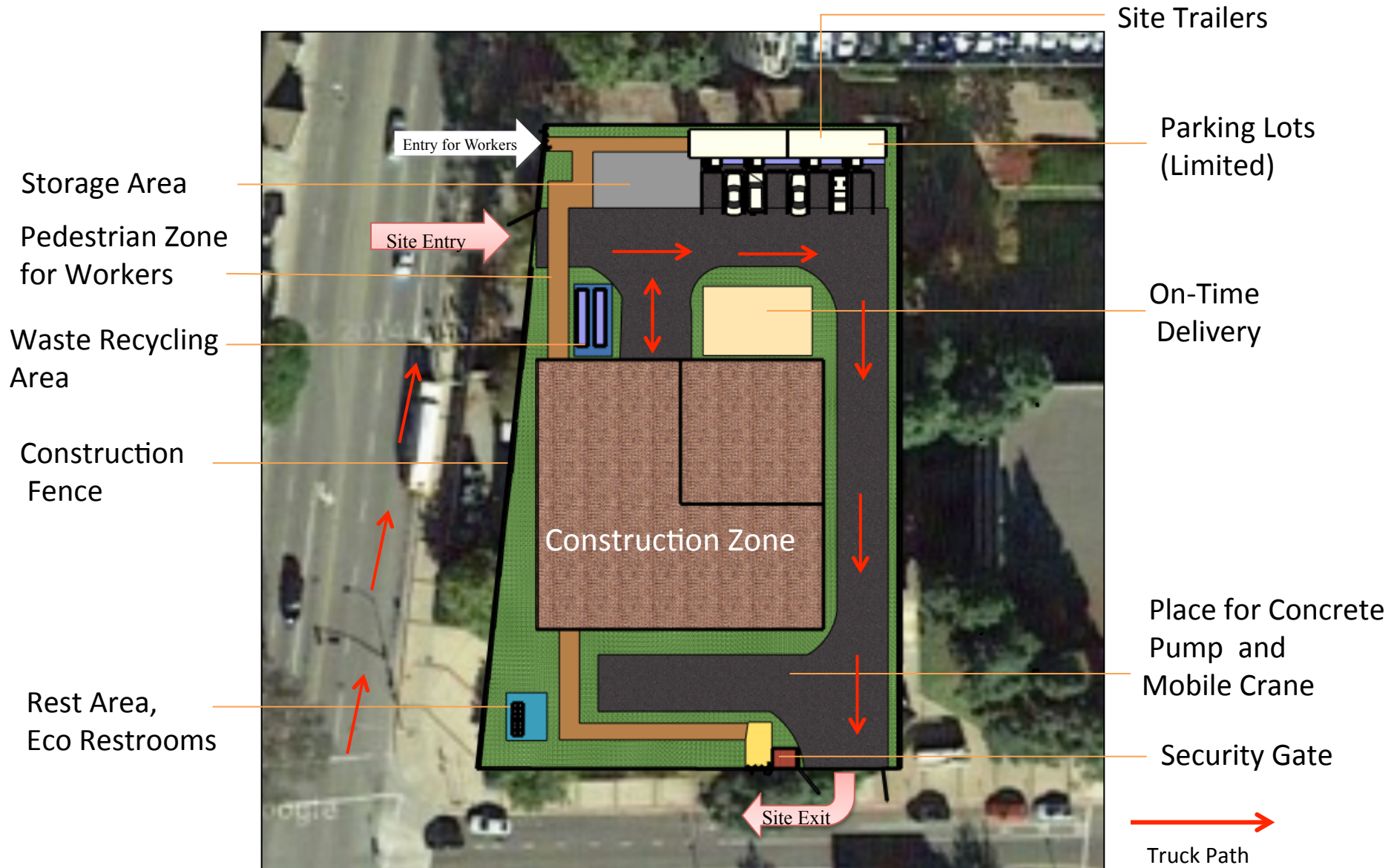


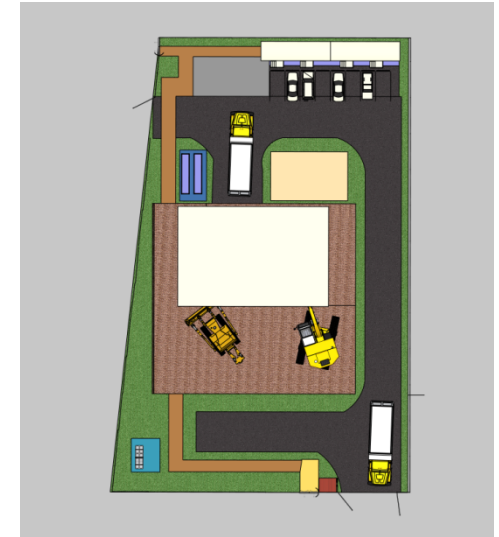


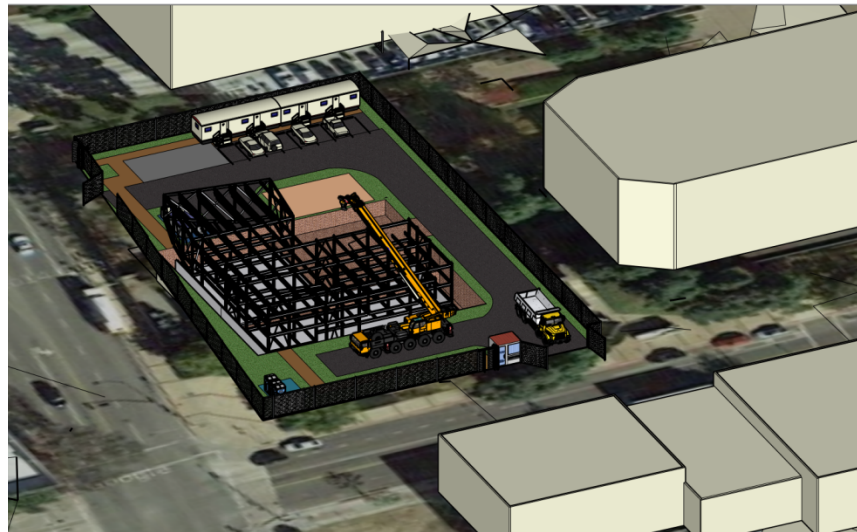
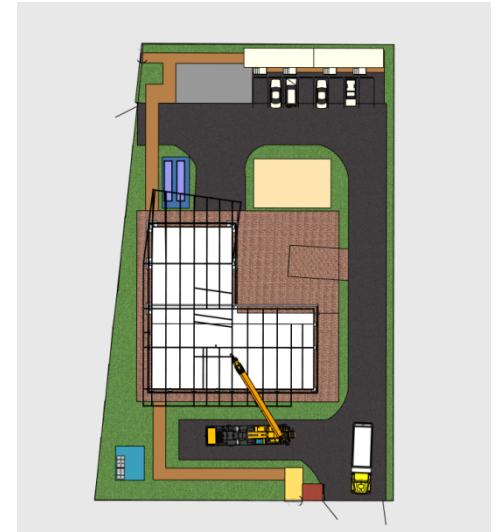
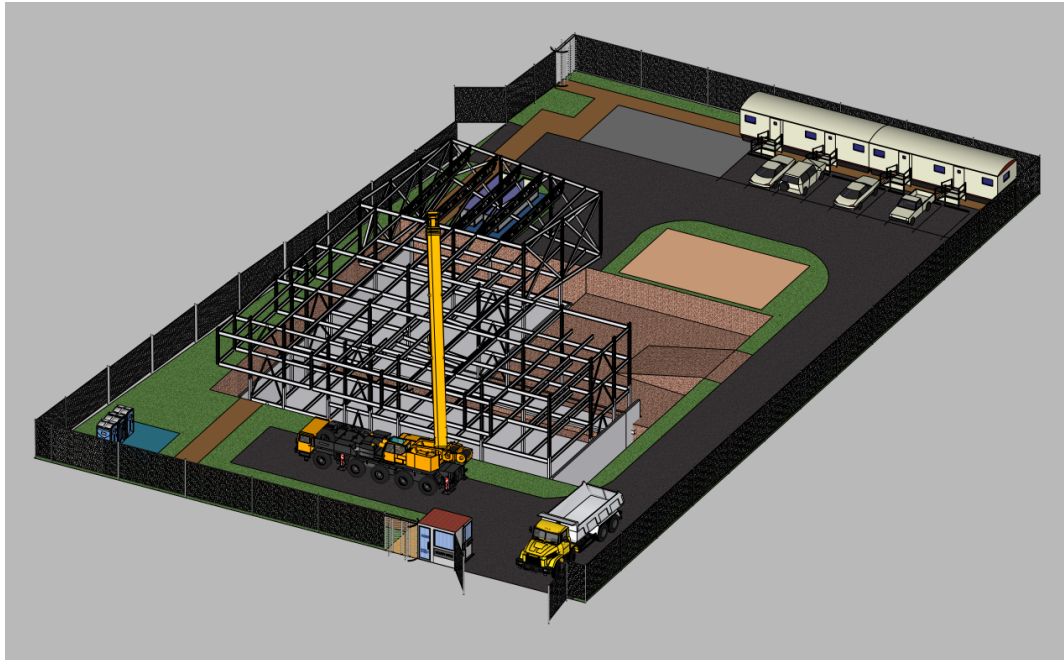


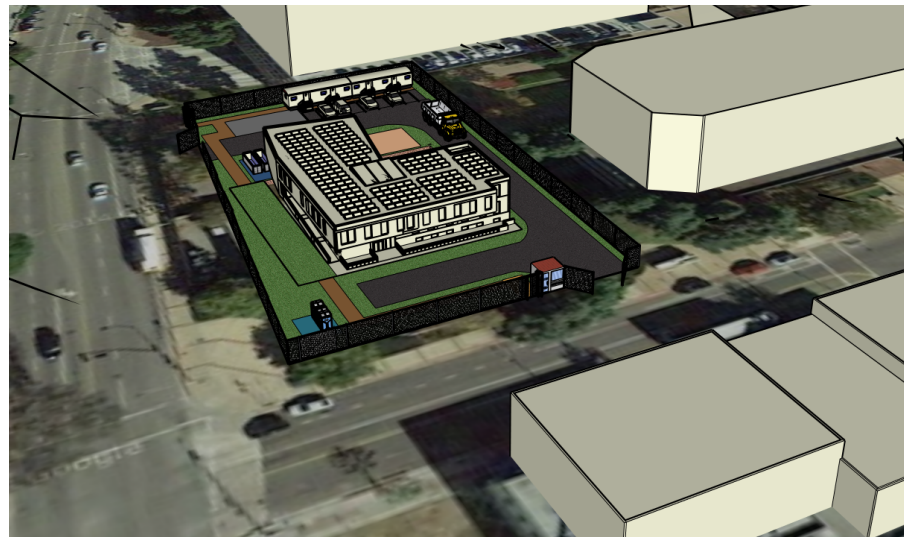
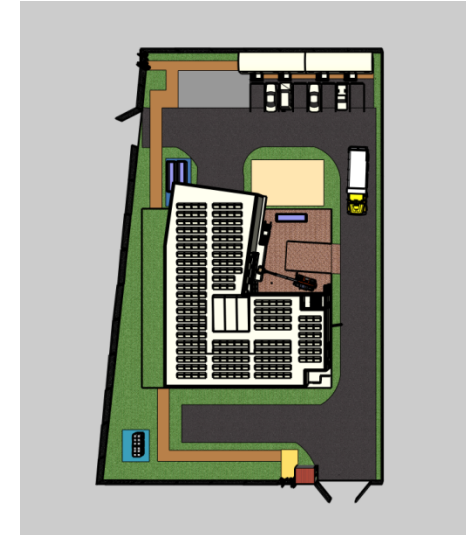
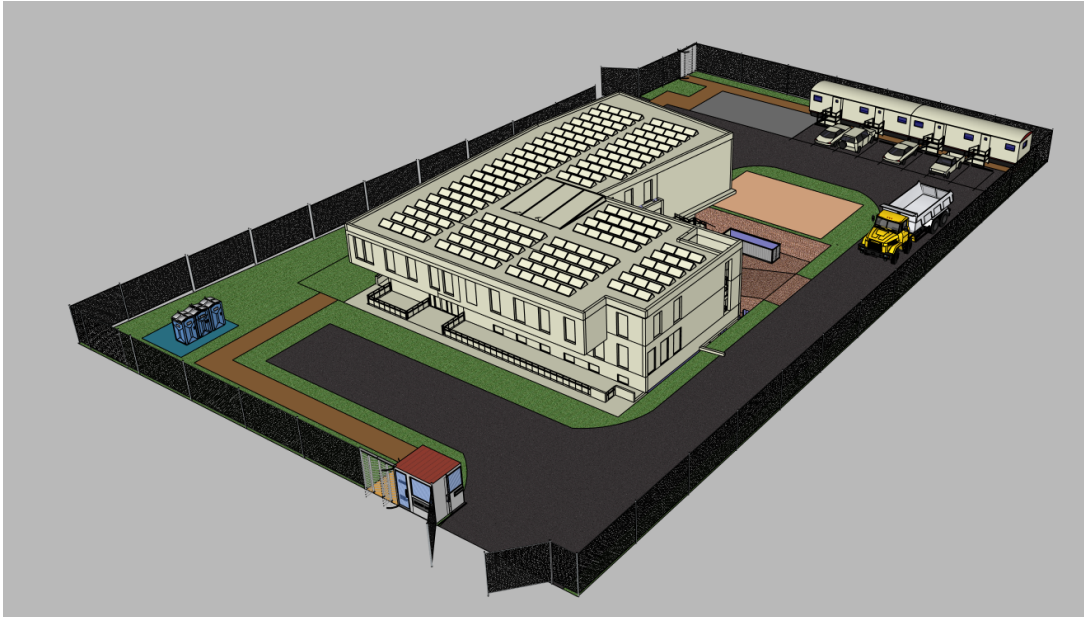
Company	Distance (Driving)	Time
 United Rentals	18.8 mi	28 min
 AMERICAN RENTALS INC.	24.9 mi	31 min
 RELIANCE STEEL & ALUMINUM CO.	14.7 mi	24 min
 CEMEX	9.7 mi	16 min
 NUCOR VULCRAFT/VERCO GROUP	46.4 mi	53 min











Dump truck: 16 ton, 12 C.Y. payload, 400 H.P.

Type: Various manufacturers

Monthly rate: \$2,900 per month
or per load if owner-operated

Pump Size : 32-38 m boom

Rate charged : \$160.00 per hour

Cub meter pumped: \$7.00 per cubic m



32 XL Standard Equipment

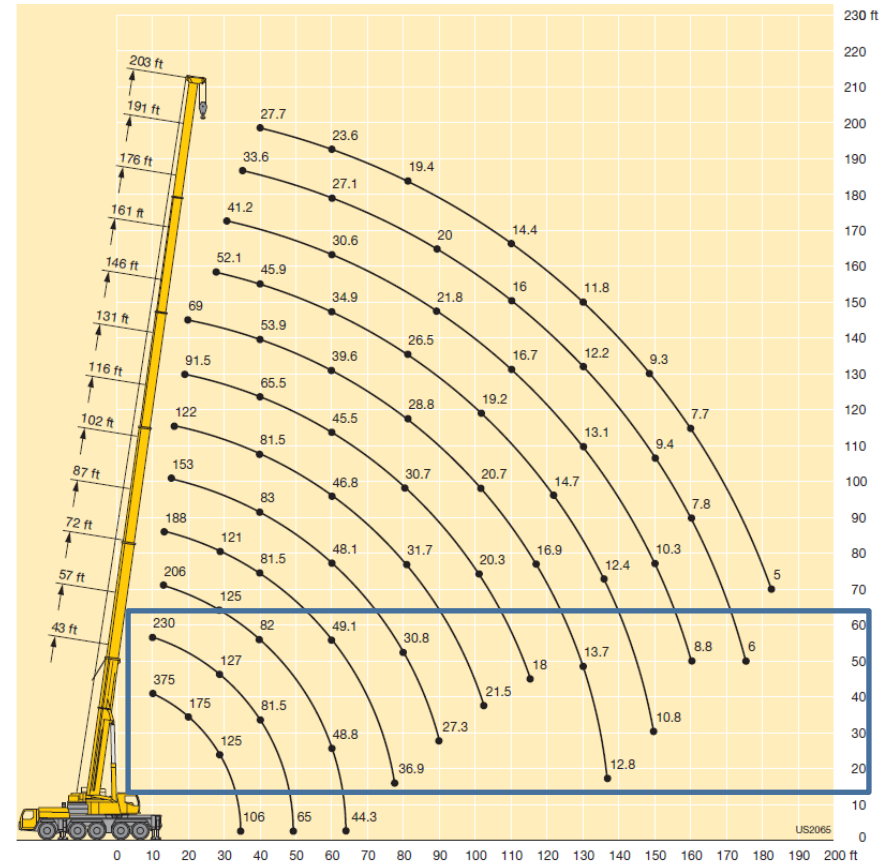
- 2025-5 120/80 MPS Pump Kit
- Radio Remote
- Carbide Wear Parts
- Super 3000 Pipe
- Proportional Boom Controls
- Big Rock™
- Night Light Kit





Liebherr LTM 1160

Main advantages	Flexibility, mobilization
Max. lifting capacity	352,700 lbs at 10 ft radius
Telescopic boom	43 ft - 203 ft
Monthly Rate	\$29,250





Excavator & Mini-Excavator
Bucket Capacity: 1-1/2 C.Y.
Fuel Type: Diesel, 325 HP
Monthly Rate: \$8,175



Capacity: 2,600 lbs
Bucket size: 1 C.Y.
Net engine power: 85 hp
Monthly Rate: \$2,500



Max Lift Capacity: 30k lbs
Fuel Type: Diesel
Options: 30k lbs / 17'-19' Dig
Monthly Rate: \$4,733



Supplier: PERI USA

Type: Aluminium/Steel/Wood

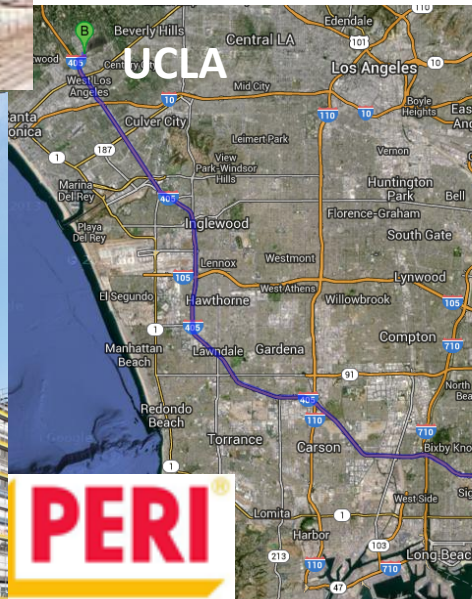
Slab/Wall Formwork System: Maximo or Trio

Scaffolding System: Up

Column System: Vario or Trio

Monthly Rental Rate: \$TBD

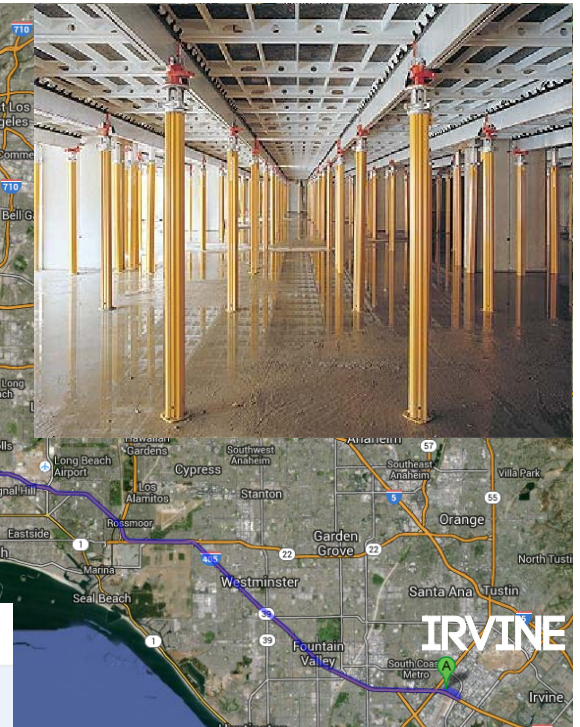
Distribution: Rental / Truck



Suggested routes

I-405 N

49.1 mi, 53 mins





Follow local mandates

(Example: Los Angeles)

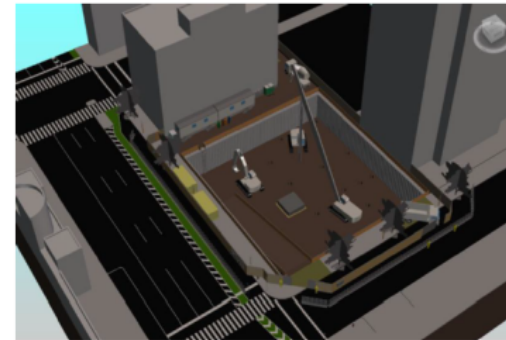
On site PM has many stakeholders present, but also needs to include safety and Safe-BIM



MAY 2012

SERVICE UPDATE

Submit 3D Site Safety Plans Electronically



- Use 3D safety plans
- Create sophisticated, modernized site safety plans to enhance construction safety
- Promote collaboration , between property owners, architects, engineers



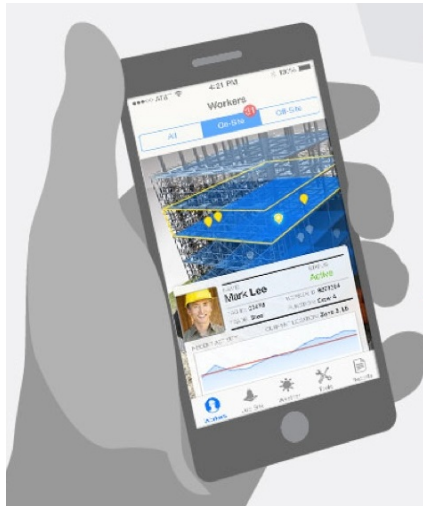
The entire team endorses safety

Owner +Architect / Engineer: Safety at the project front-end eliminates hazards already in the design phase

Sub Contractor : Early involvement in safety and safe construction planning ensure safe project execution

Facility Manager: Safety and decision making in the early phases of a project decide on the “safety outcome” during the O&M phase





QR CODE IMPRINT



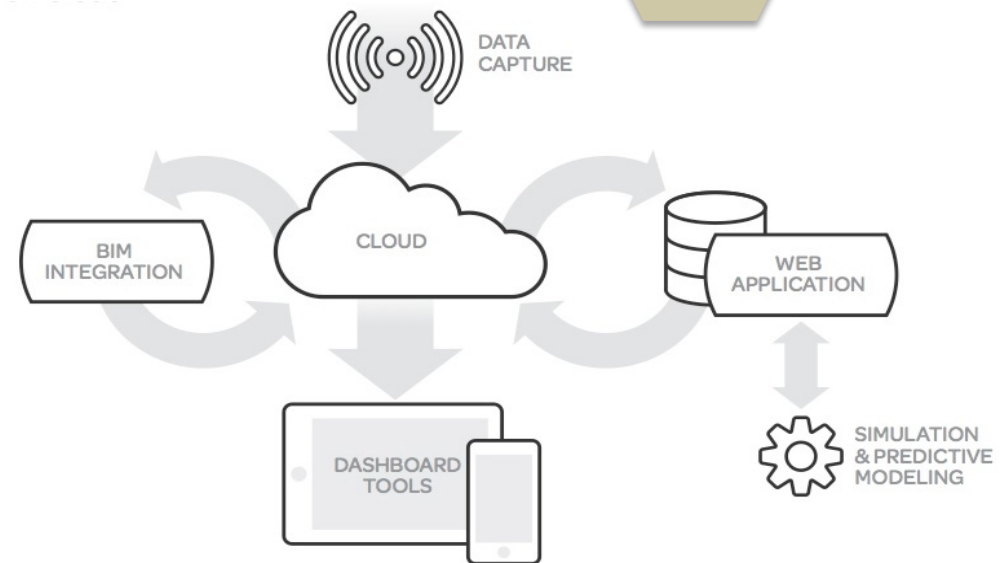
RFID TRANSPONDER INLAY

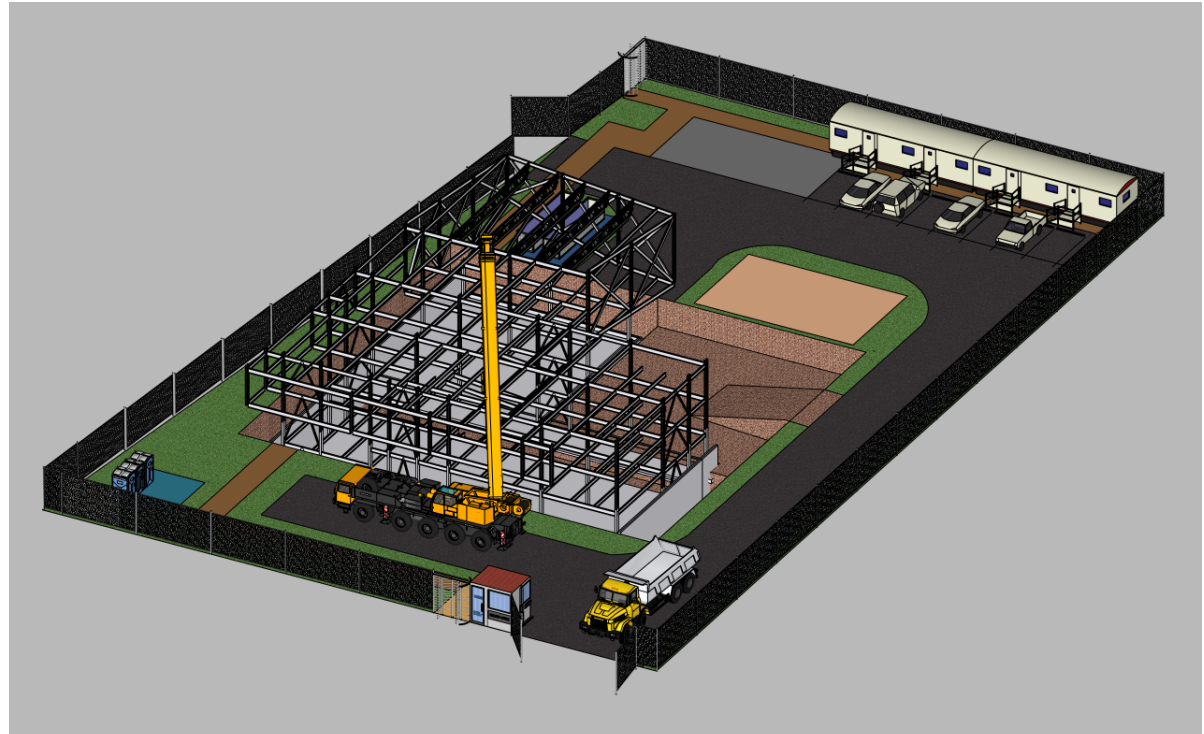
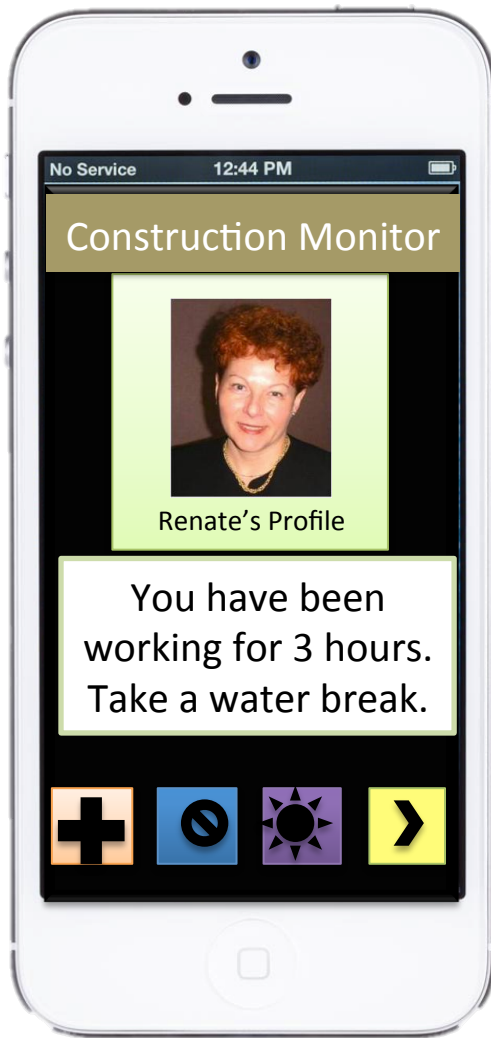


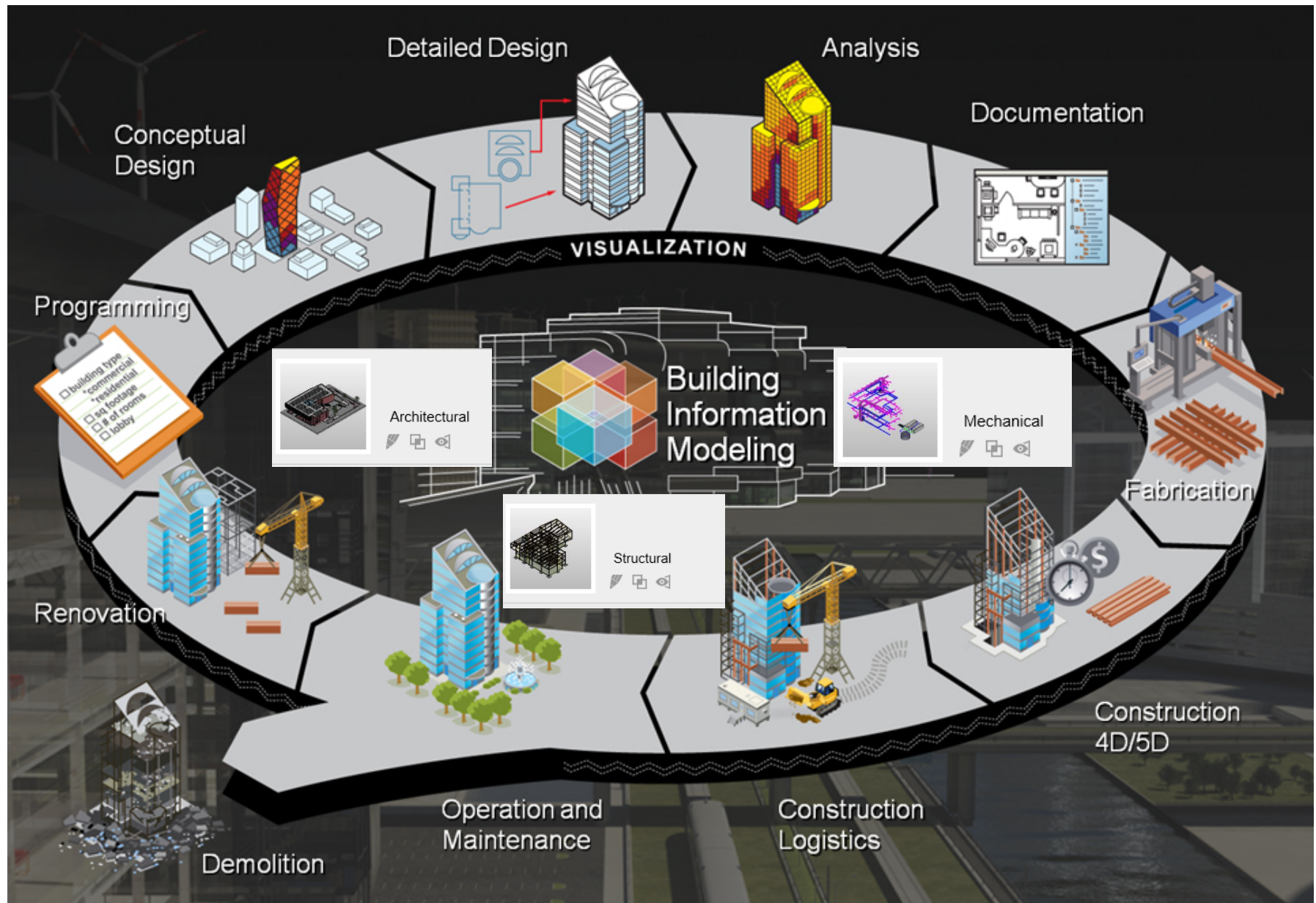
COLOR CODED ROLE IDENTIFICATION

FUTURE ENHANCEMENTS

- Real-Time Location Services (RTLS)
- Visual and Auditory Alerts (Vandalism Alarm, Safety Beacon, Job Site Notifications)
- Motion Sensing and Charging



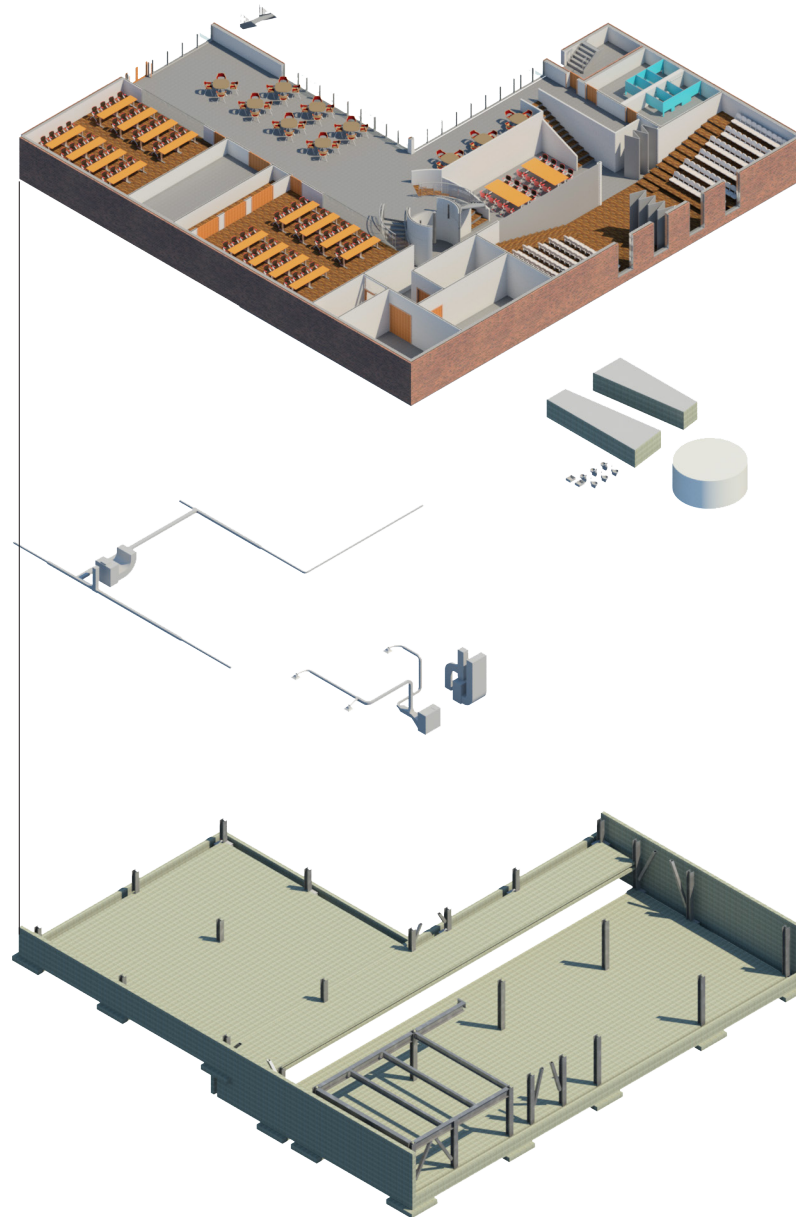




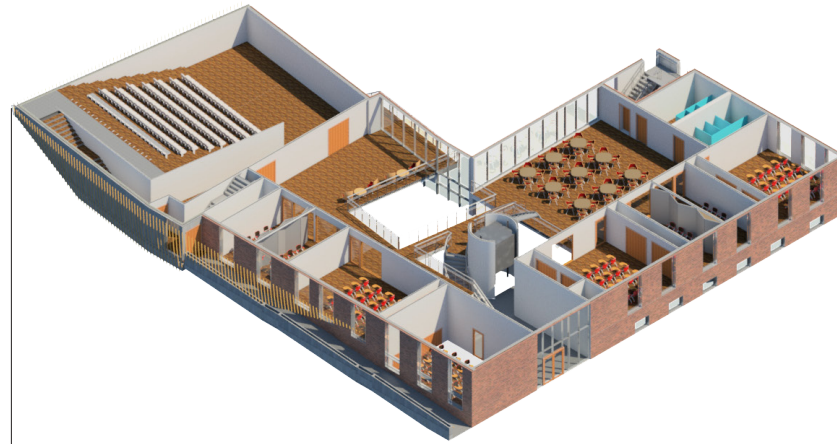
Architecture

MEP

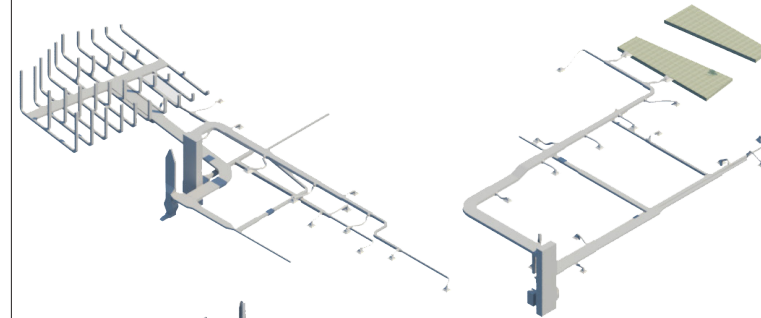
Structure



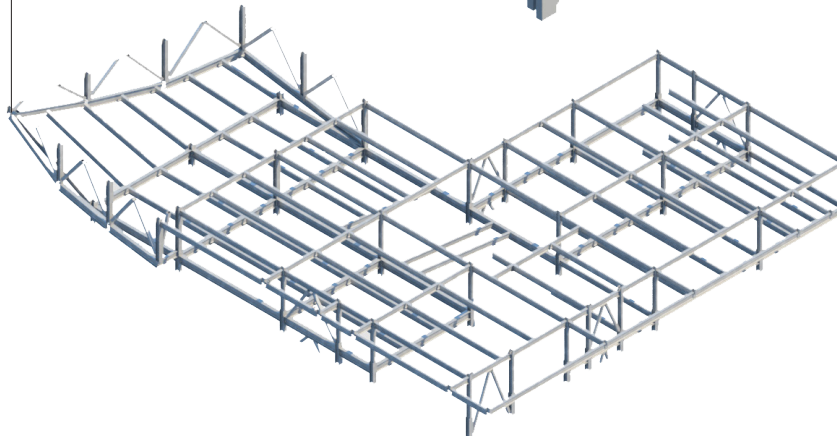
Architecture



MEP



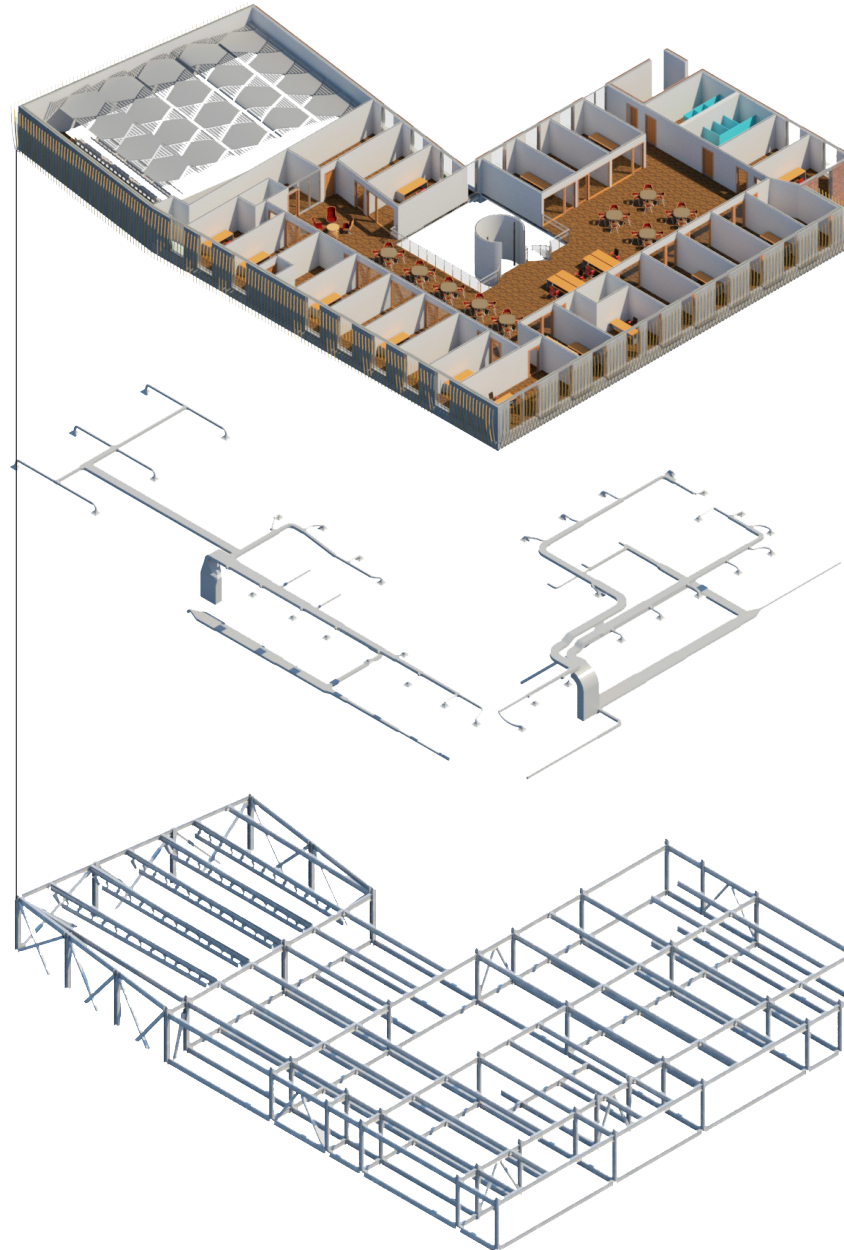
Structure

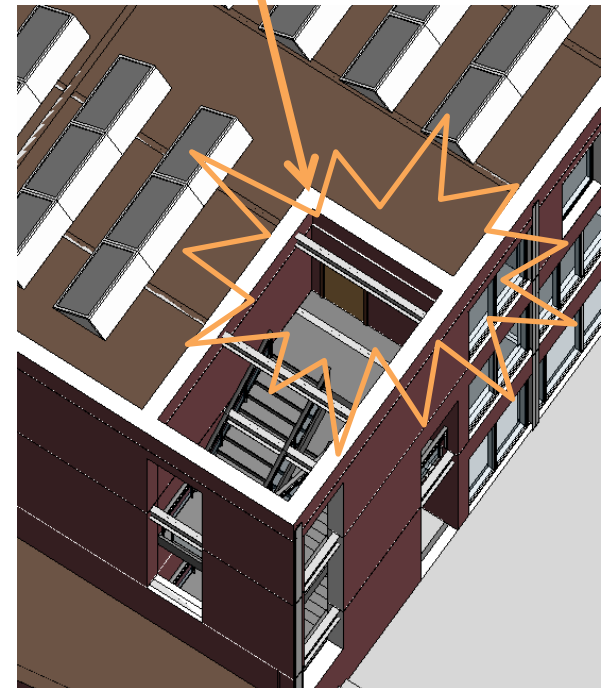
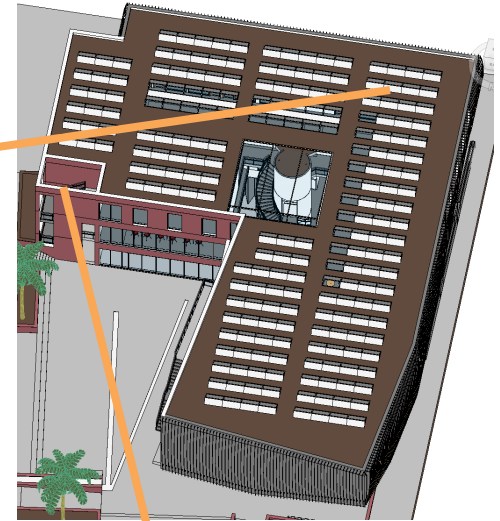
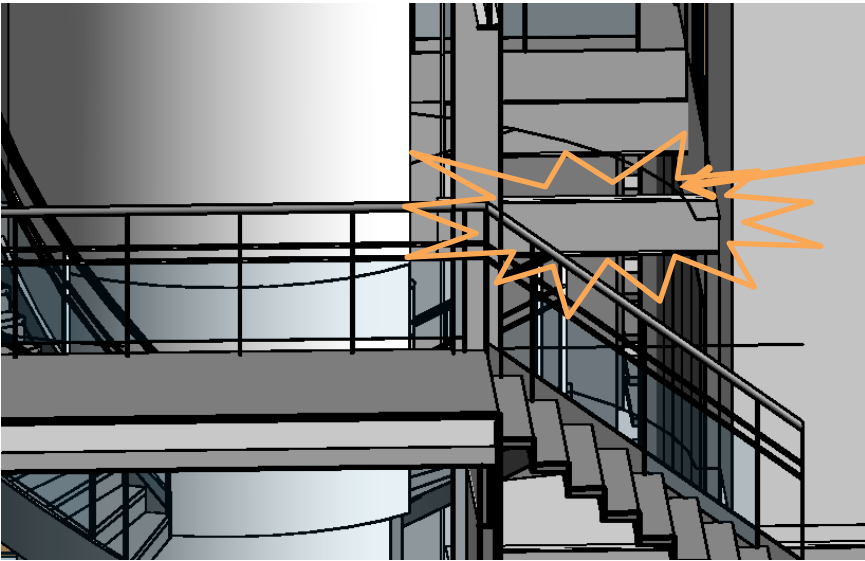


Architecture

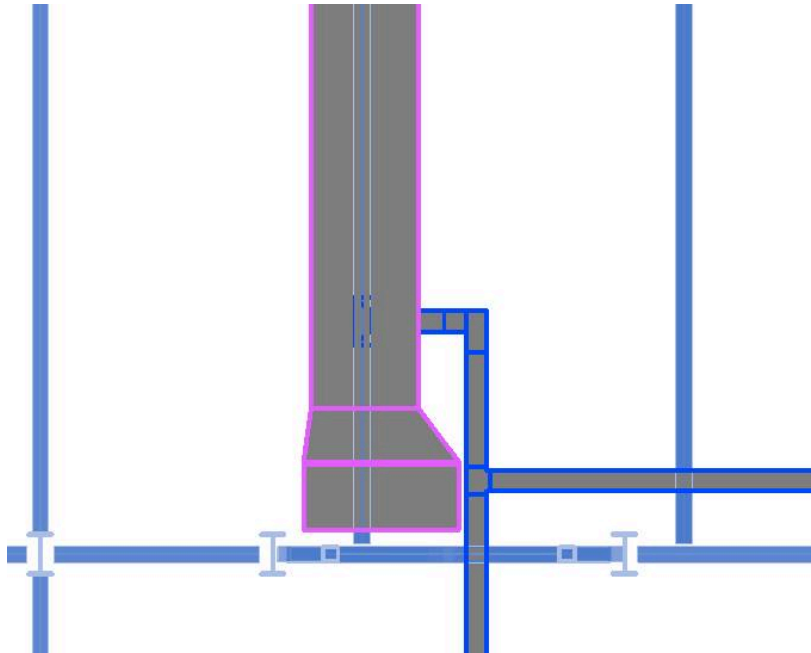
MEP

Structure

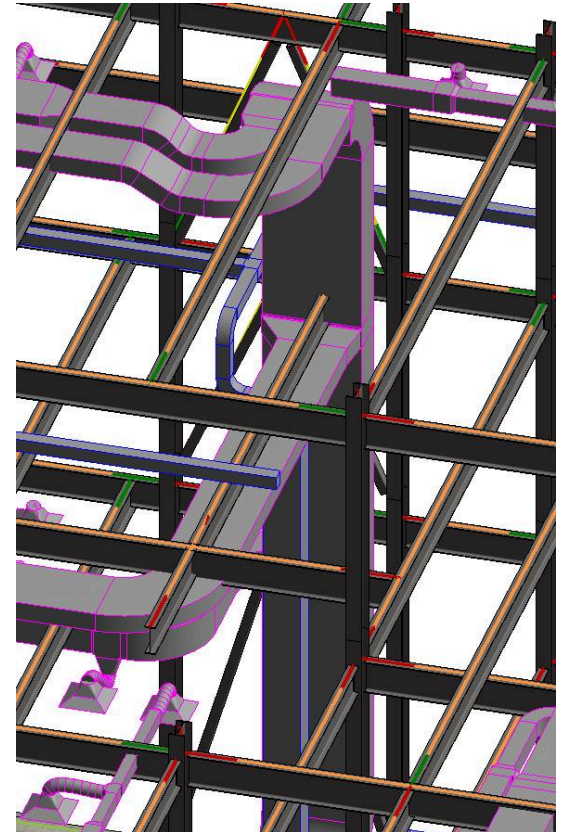




- Beams exposed in outside stairwell
- Beams blocking the stairwell



- Beams penetrating the MEP Shaft



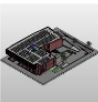
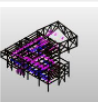
AUTODESK® BIM 360™ GLUE® GlobalTeamWork > Clashes

Clashes



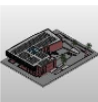
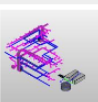
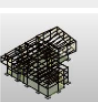
Merged Models

+ New merged model

-  A SE MEP
-  SE MEP

Models

+ Upload models

-  Architectural
-  Mechanical
-  Structural

[More...](#)

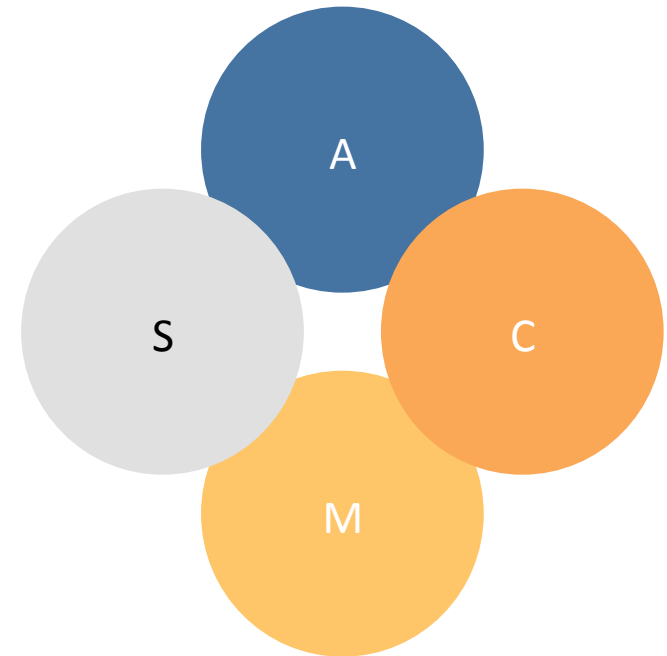
Activities

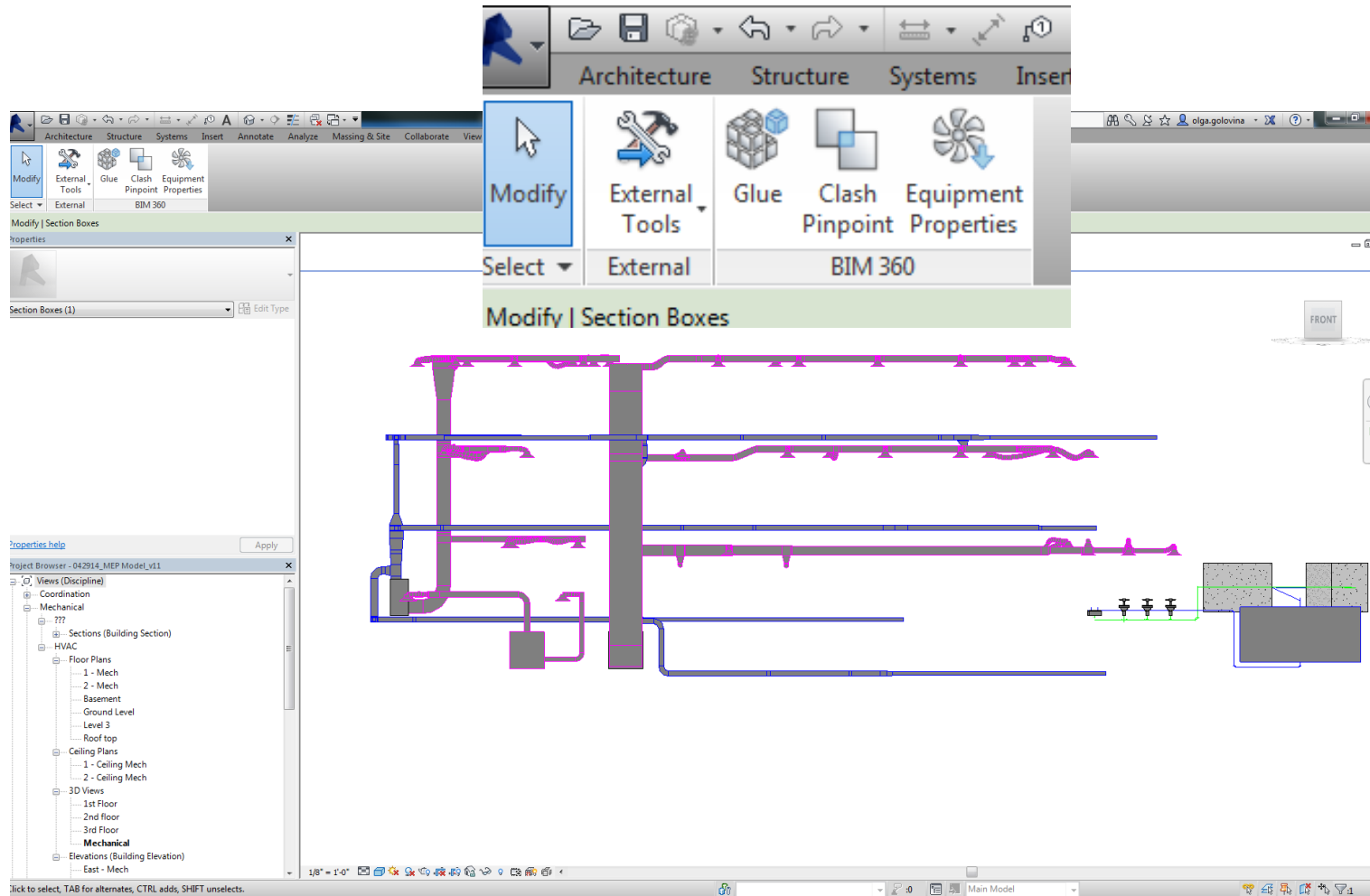
-  Olga Golovina renamed merged model 'Clash' to 'A SE MEP' 1 minutes ago
-  Olga Golovina deleted Merged Model A-M 1 minutes ago
-  Olga Golovina renamed merged model '0428' to 'SE MEP' 2 minutes ago
-  Olga Golovina created Clash Result Set 'CL' 05/02/14 6:15 PM
-  Olga Golovina created merged file 'A-M' 05/02/14 6:14 PM
-  Olga Golovina updated model 'Architectural' to version 5 05/02/14 6:12 PM
-  Olga Golovina updated Clash Result Set 'SE MEP' 05/02/14 6:06 PM
-  Olga Golovina updated model 'Mechanical' to version 15 05/02/14 6:05 PM
-  Olga Golovina updated Clash Result Set 'SE MEP' 05/02/14 5:57 PM
-  Olga Golovina updated model 'Mechanical' to version 14 05/02/14 5:56 PM

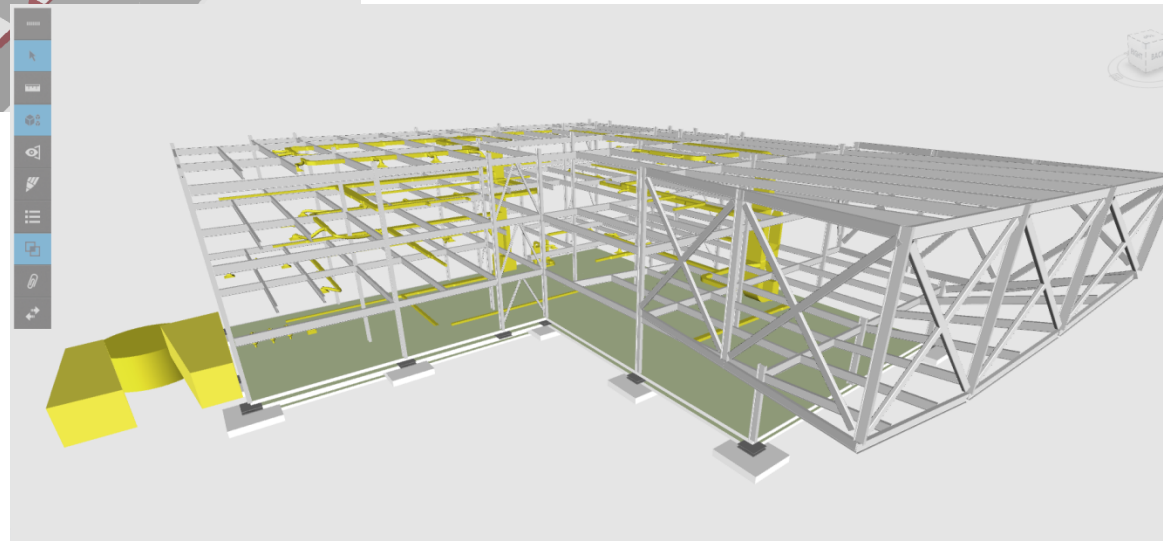
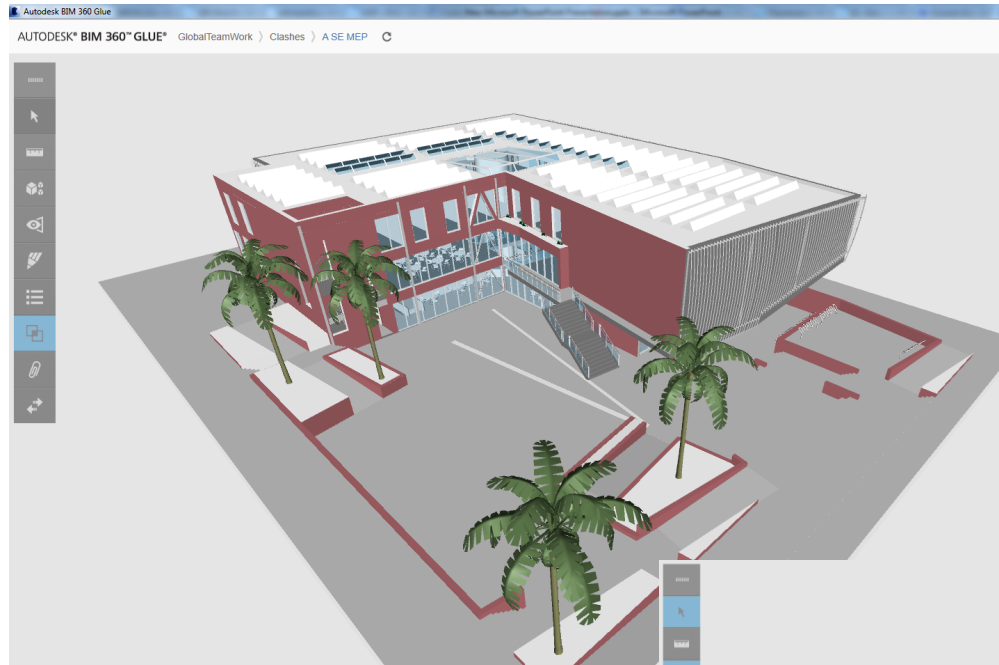
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Coordination







AUTODESK® BIM 360™ GLUE® GlobalTeamWork > Clashes > SE MEP

Clashes

Result Sets 05/05/14 3:09 PM

SE MEP (40)

Group By: Ungrouped (40)

Notifications: All (40)

Notify Comment

Clash	Magnitude
☐ Clash27	0ft 4in 15/16
☐ Clash28	0ft 4in 13/16
☐ Clash29	0ft 4in 9/16
☐ Clash30	0ft 3in 3/8
☐ Clash31	0ft 2in 3/16
☐ Clash32	0ft 1in 11/16
☐ Clash33	0ft 1in 1/8
☐ Clash34	0ft 1in 1/16
☐ Clash35	0ft 0in 15/16
☐ Clash36	0ft 0in 5/8
☒ Clash37	0ft 0in 3/8
☐ Clash38	0ft 0in 3/16
☐ Clash39	0ft 0in 3/16
☐ Clash40	0ft 0in 1/16

Clash37

Magnitude: 0ft 0in 3/8

- W-Wide Flange [284641]
 - Structural
 - Segment
 - Structural Framing (275)
 - W-Wide Flange (228)
 - W16X31 (174)
 - W-Wide Flange [284641]
- Flex Duct Round [643787]
 - Mechanical
 - Segment
 - Flex Ducts (52)
 - Flex Duct Round (52)
 - Flex - Round (52)
 - Flex Duct Round [643787]

Notify Project Members

Notify project members of Clash37

To:

Name	Email
☐ Shunkai Yang	yangsk1990@hotmail.com
☐ Olga Golovina	olga.mgsu@gmail.com
☐ sophie zhou	sophiaz@stanford.edu
☒ Amy Egerter	egerter@stanford.edu
☐ Bjørn Bull	bbha10@student.aau.dk

Message: (optional)

Air Duct needs to be shifted

Cancel Send

Clashes Overview

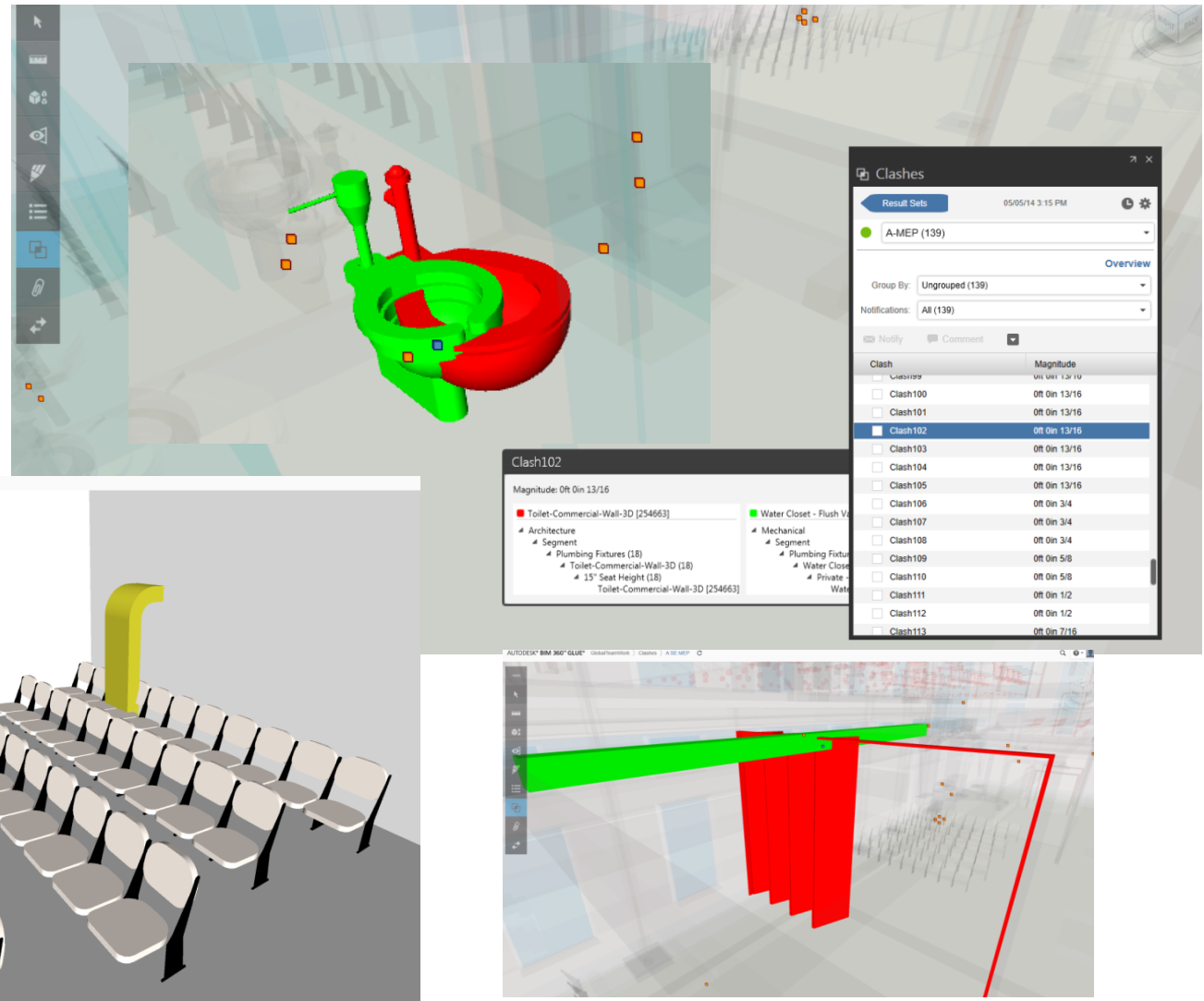
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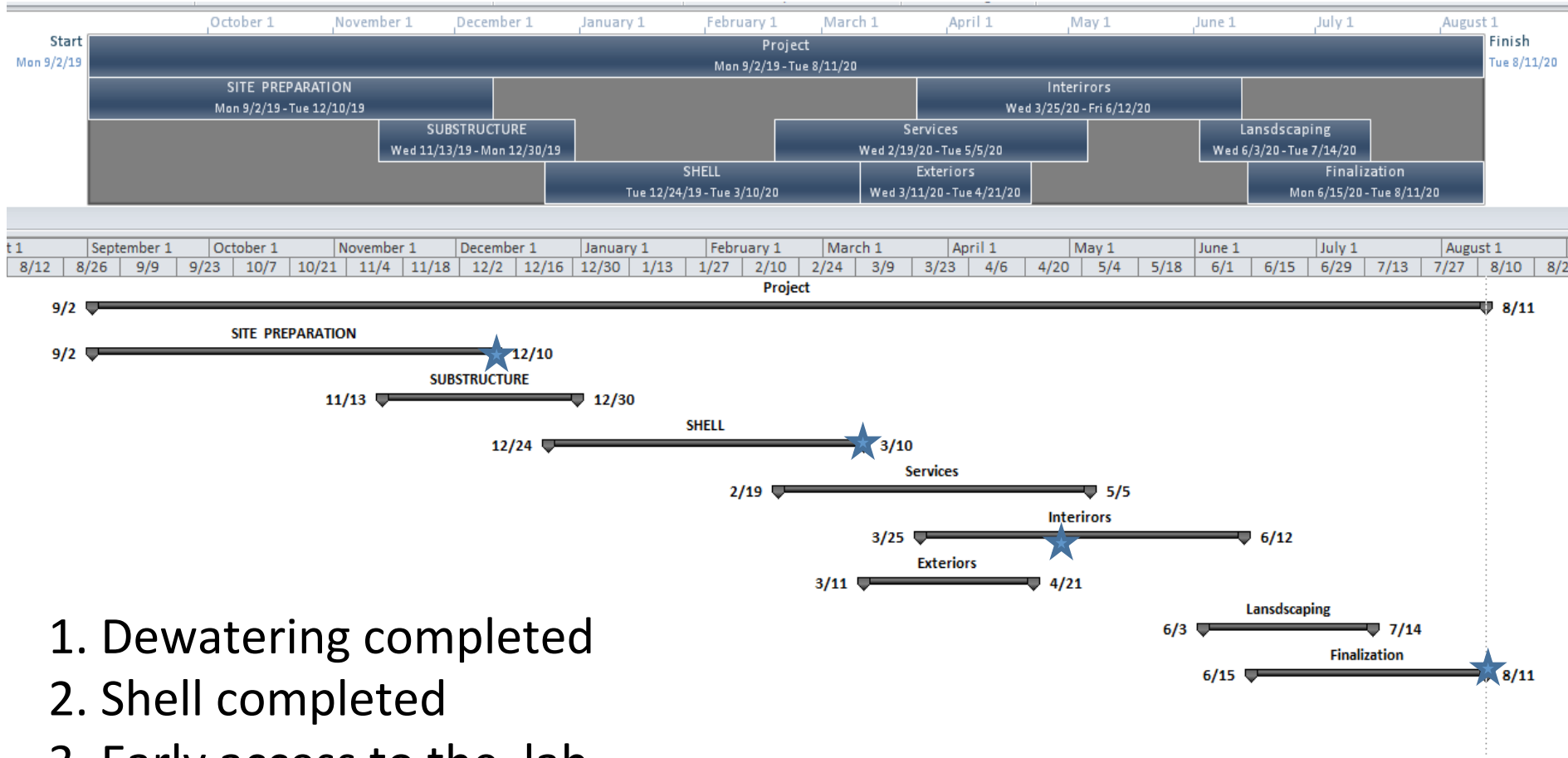
Structural Clashes

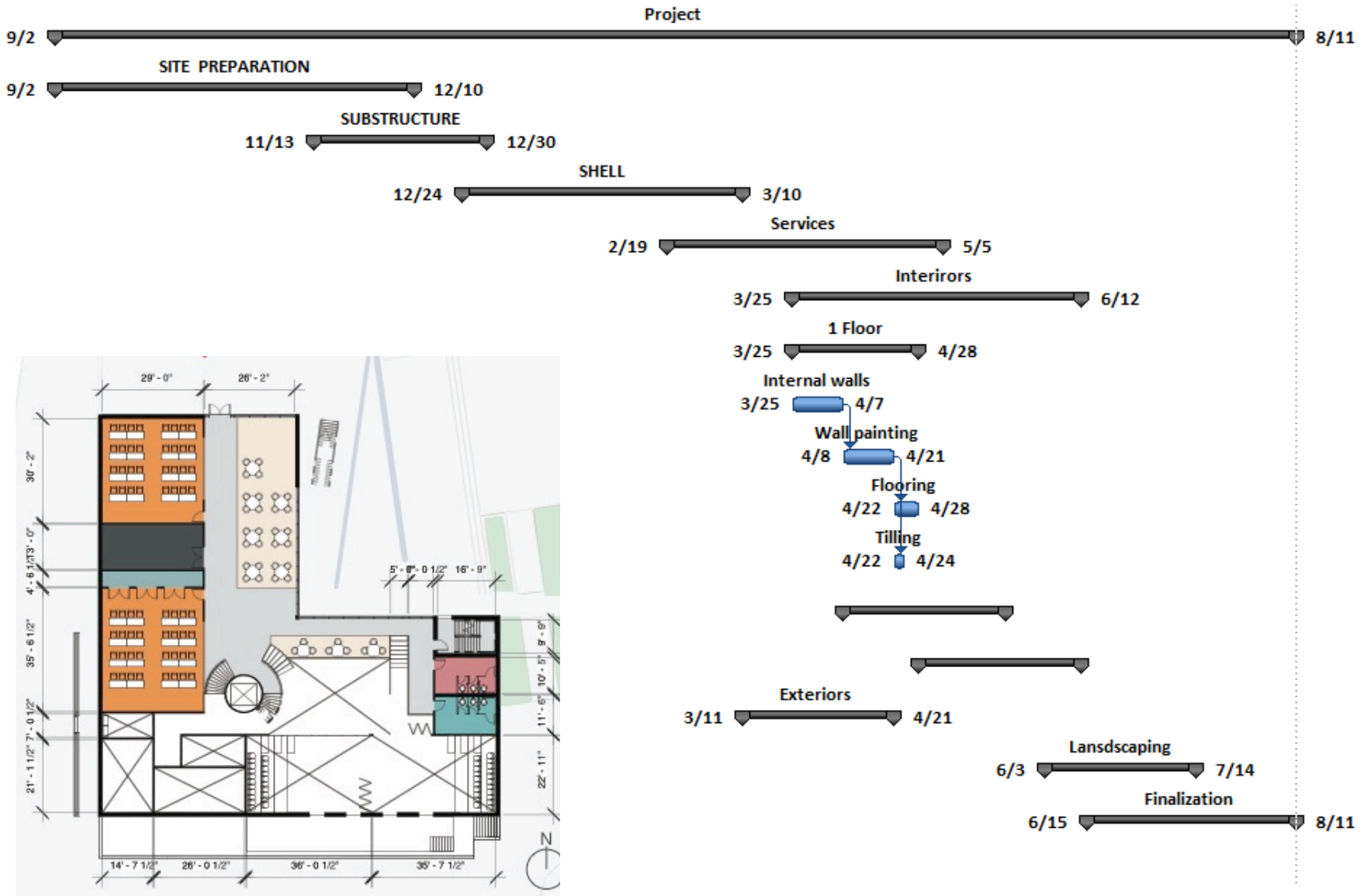
vs. All Models	Clashes
vs. Mechanical	40

Mechanical Clashes

vs. All Models	Clashes
vs. Structural	40







Team: Central		STV Progress						
		Target	GWP (kgCO2e)	Energy (MJ)	Water (kg)	ODP (kgCFC11e)	CONSTRUCTION	LCC (per year)
		Embodied	3,034,347	84,832,768	36,673,973	(minimize)		
		Used%	1,663,764	22,476,498	19,007,220	5.8E-02	\$ 4,059,611.71	\$ 28,995.71
		Use Phase	413,284	8,022,809	136,305,052	5.2E-02	\$ -	\$ 10,368.86
		Used%	13.6%	9.5%	371.7%	-		
		Total%	68.5%	36.0%	423.5%	-	\$ 4,059,611.71	\$ 39,364.57
Assembly	Material/Type	Amount	GWP (kgCO2e)	Energy (MJ)	Water (kg)	ODP (kgCFC11e)	\$ First Cost	\$/yr Maintenance
Foundation	Novacem Mat and Pile (cy)	40	4,207	67,065	135,039	2.8E-04	0	0
Floor	Novacem Concrete (sf)	4,144	23,666	348,925	543,065	5.2E-04	0	2,361
Floor	Wood System (sf)	21,375	169,664	2,329,995	1,805,505	4.8E-04	373,635	0
Roof	Green Roof (sf)	11,362	52,277	705,969	243,544	2.3E-03	340,860	631
Energy	Photovoltaics (sf)	3,739	154,784	2,002,971	2,848,704	2.0E-03	218,000	611
Exterior Wall	Brick on Metal Stud (sf)	22,795	574,430	7,645,164	6,164,020	2.1E-02	540,242	1,855
Interior Wall	Steel Studs and Painted Gypsum (sf)	19,785	391,413	5,638,320	4,883,133	1.4E-02	222,581	0
Interior Wall	Curtain Wall (sf)	478	6,624	90,545	91,782	1.1E-04	25,334	30
Window	Double Pane Aluminum Frame (sf)	4,110	52,559	601,686	310,050	4.1E-03	246,600	1,593
Exterior Wall	Curtain Wall Double Pane (sf)	1,934	36,910	487,957	444,908	1.3E-03	62,952	750
Roof	EPDM Membrane (sf)	11,362	1,645	76,060	226	1.0E-05	49,084	631
Columns	Steel Column (kg)	1,716	2,655	30,118	16,374	6.1E-06	216,216	0
Beams	Steel Beam (kg)	5,321	8,958	103,605	61,605	1.9E-05	300,620	0

Floor	Wood System (sf)	21,375	169,664	2,329,995	1,805,505	4.8E-04	373,635
Roof	Green Roof (sf)	11,362	52,277	705,969	243,544	2.3E-03	340,860
Energy	Photovoltaics (sf)	3,739	154,784	2,002,971	2,848,704	2.0E-03	218,000
Exterior Wall	Brick on Metal Stud (sf)	19,301	486,382	6,473,319	5,219,204	1.8E-02	457,434
Interior Wall	Steel Studs and Painted Gypsum (sf)	19,785	391,413	5,638,320	4,883,133	1.4E-02	222,581
Interior Wall	Curtain Wall (sf)	478	6,624	90,545	91,782	1.1E-04	25,334
Floor	Wood System (sf)	21,375	169,664	2,329,995	1,805,505	4.8E-04	373,635
Roof	Green Roof (sf)	11,362	52,277	705,969	243,544	2.3E-03	340,860
Energy	Photovoltaics (sf)	3,739	154,784	2,002,971	2,848,704	2.0E-03	218,000
Exterior Wall	EIFS on Metal Stud (sf)	19,301	483,559	7,044,754	5,293,339	2.3E-02	396,636
Interior Wall	Steel Studs and Painted Gypsum (sf)	19,785	391,413	5,638,320	4,883,133	1.4E-02	222,581
Interior Wall	Curtain Wall (sf)	478	6,624	90,545	91,782	1.1E-04	25,334

Construction and Materials

Use Phase

Results

Cogen Data

LCA Data

Lists

COST DATA

TVD Owners

Sustainable Target Value

TVD

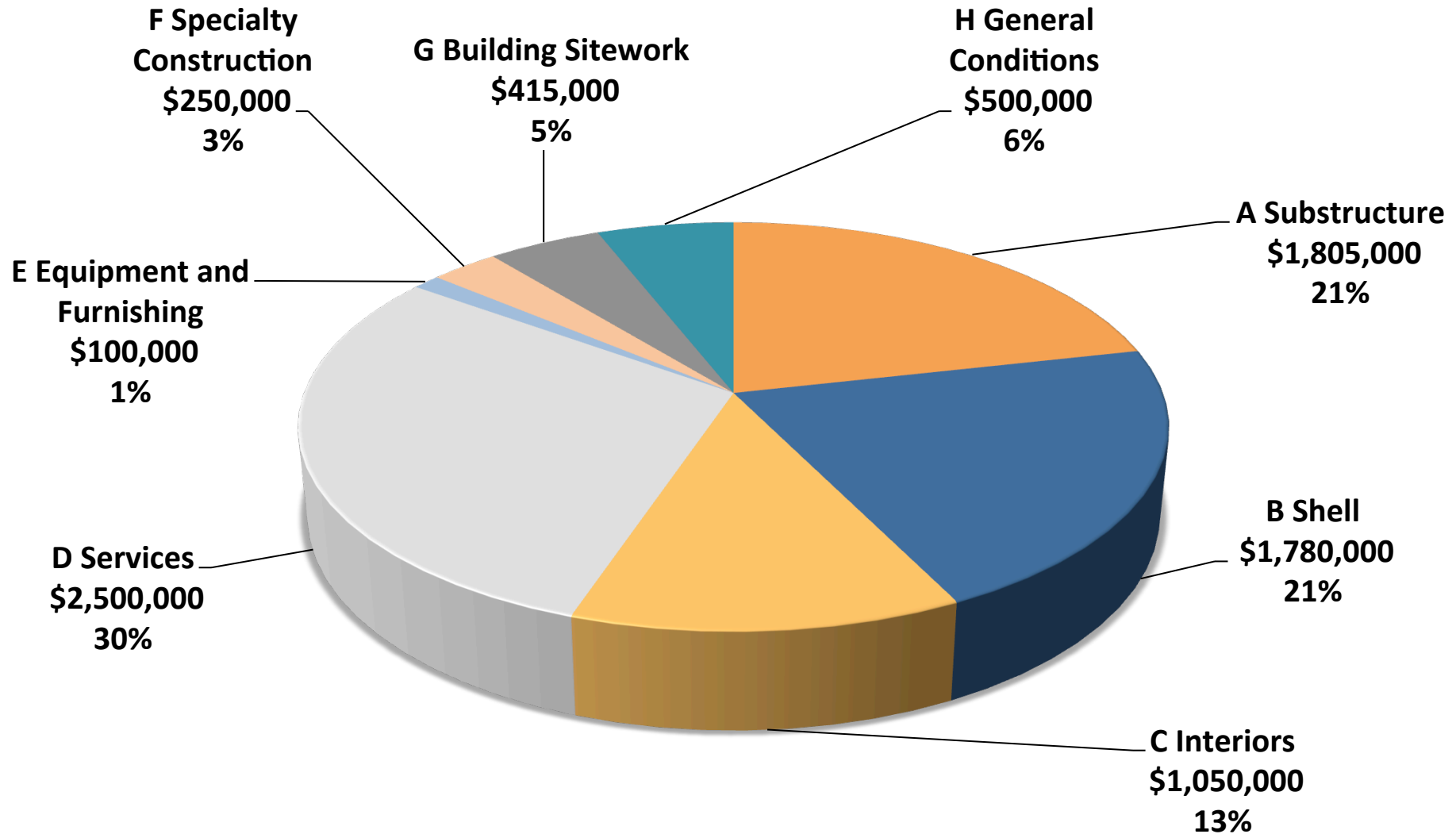
CATEGORY		LINE ITEM DESCRIPTION		COST DATA			QUANTITY		ESTIMATE RELIABILITY			ESTIMATE	
	Identification Number	Description	Unit	Material O&P	Installation O&P	Total O&P	Quantity	Unit	Quantity Reliability	Cost Data Reliability	Overall Reliability	% of Total	ESTIMATED COST
B. SHELL													
B1010 Floor Construction													
	B1010256	Composite Beams, Deck & Slab	S.F.			\$ 17.80	27244	S.F.	1	2	2	20%	\$ 1,764,813
	RS means	Steel Beam W16 x 31	L.F.			\$ 56.50	4201	L.F.	1	2	2	11%	\$ 985,185
	RS means	Steel Beam W18x 40	L.F.			\$ 73.00	1309	L.F.	1	2	2		\$ 484,943
	RS means	Steel column W14 x 28	L.F.			\$ 126.00	178	L.F.	1	2	2		\$ 237,357
	RS means	Steel column W14 x 53	L.F.			\$ 126.00	1150	L.F.	1	2	2		\$ 95,557
B1020 Roof Construction													
	B10201244350	Steel joists& Beams& Deck on Columns 25 x 30	S.F.			\$ 7.11	11362	S.F.	2	2	3	1%	\$ 80,784
B2010 Exterior Walls													
	B20101305100	Brick Veneer/ Metal Stud Backup	S.F.			\$ 23.70	19301	S.F.	1	2	2	5%	\$ 457,434
B2020 Exterior Windows													
		Aluminium windows, incl. frame and										2%	\$ 155,098

B2010 Exterior Walls	B20101305100
-----------------------------	---------------------

\$ 23.70	19301
-----------------	--------------

5%	\$ 457,434
	\$ 457,434

Wall Schedule Family and Type	Type	Area	Comments
Basic Wall: L-Shape concrete wall	L-Shape concrete wall	335	Level 1
Basic Wall: L-Shape concrete wall	L-Shape concrete wall	394	Level 1
Basic Wall: Generic - 200mm	Generic - 200mm	57	Level 1
Basic Wall: Generic - 200mm	Generic - 200mm	72	Level 1
Basic Wall: Generic - 200mm	Generic - 200mm	124	Level 1
Basic Wall: Generic - 200mm	Generic - 200mm	598	Level 1
Basic Wall: L-Shape concrete wall	L-Shape concrete wall	57	Level 1
Basic Wall: L-Shape concrete wall	L-Shape concrete wall	113	Level 1
Basic Wall: L-Shape concrete wall	L-Shape concrete wall	156	Level 1
Basic Wall: L-Shape concrete wall	L-Shape concrete wall	217	Level 1
Basic Wall: L-Shape concrete wall	L-Shape concrete wall	276	Level 1
Basic Wall: L-Shape concrete wall	L-Shape concrete wall	285	Level 1
Basic Wall: L-Shape concrete wall	L-Shape concrete wall	312	Level 1
Basic Wall: L-Shape concrete wall	L-Shape concrete wall	320	Level 1
		1451	Level 3
		19301	



L-Shape Steel Winter Quarter

	ESTIMATED VALUE	TARGET VALUE	VALUE DELTA
TOTAL	\$ 7,500,000	\$ 9,000,000	\$ 1,500,000
A Substructure	\$ 300,000	\$ 720,000	\$ 420,000
B Shell	\$ 2,800,000	\$ 2,810,000	\$ 10,000
C Interiors	\$ 1,000,000	\$ 1,350,000	\$ 350,000
D Services	\$ 2,000,000	\$ 2,520,000	\$ 520,000
E Equipment and Furnishing	\$ 60,000	\$ 180,000	\$ 120,000
F Specialty Construction	\$ 340,000	\$ 360,000	\$ 20,000
G Building Sitework	\$ 400,000	\$ 450,000	\$ 50,000
H General Conditions	\$ 600,000	\$ 630,000	\$ 30,000

L-Shape Steel Spring Quarter

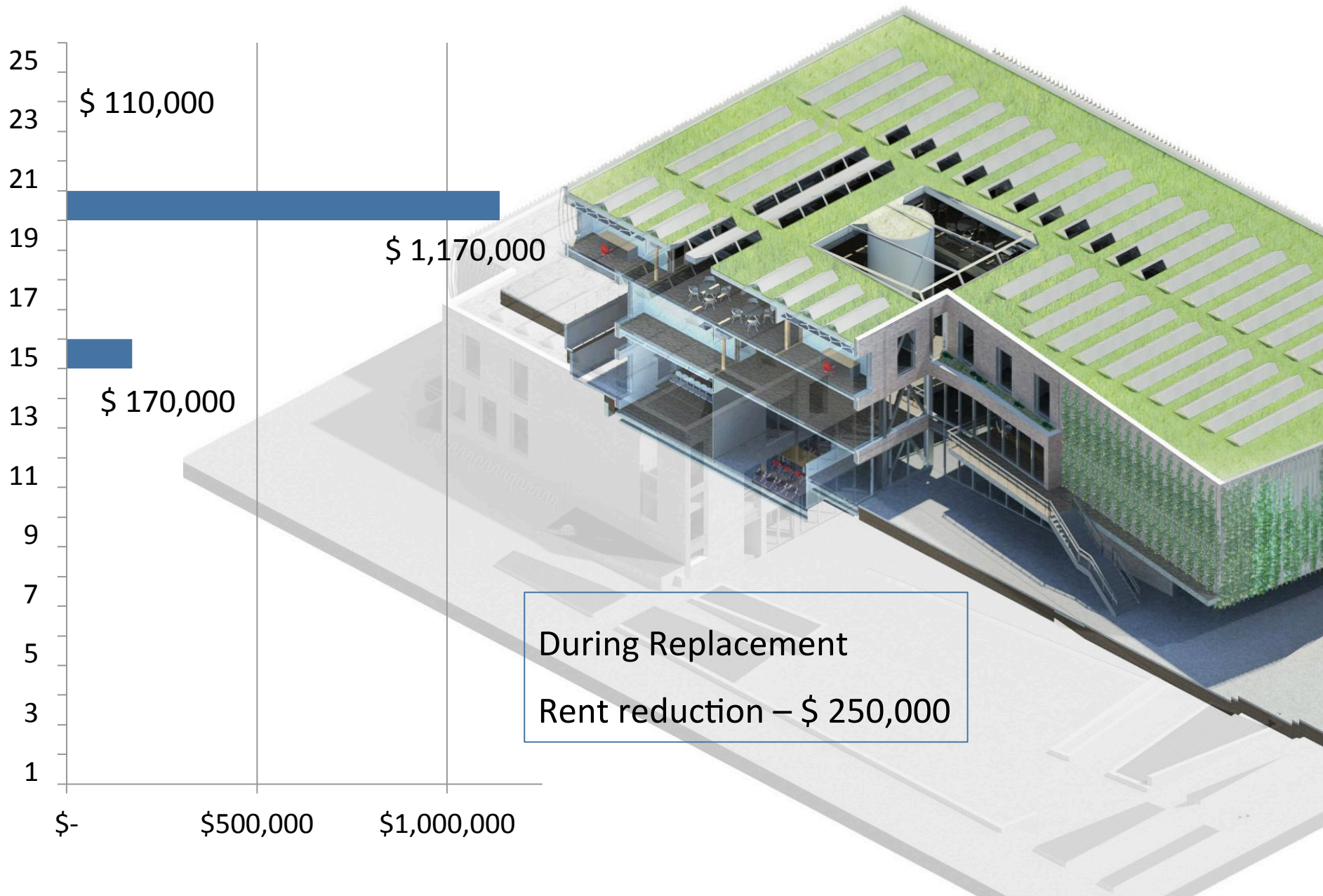
	ESTIMATED VALUE	TARGET VALUE	VALUE DELTA
TOTAL	\$ 8,400,000	\$ 9,000,000	\$ 600,000
A Substructure	\$ 1,805,000	\$ 1,710,000	\$ (95,000)
B Shell	\$ 1,780,000	\$ 1,800,000	\$ 20,000
C Interiors	\$ 1,050,000	\$ 1,170,000	\$ 120,000
D Services	\$ 2,500,000	\$ 2,790,000	\$ 290,000
E Equipment and Furnishing	\$ 100,000	\$ 90,000	\$ (10,000)
F Specialty Construction	\$ 250,000	\$ 360,000	\$ 110,000
G Building Sitework	\$ 415,000	\$ 450,000	\$ 35,000
H General Conditions	\$ 500,000	\$ 630,000	\$ 130,000

Nr	Construction element	After start of operation phase	After expiration of contract
1	Static construction	60	-
2	Floor construction	60	-
3	Roof construction	60	-
4	Roof covering	40	15
5	Facade	45	-
6	Windows	40	15
7	Doors to the outside	20	10
8	Inner partitions, openings	20	10
9	Interior fittings	15	5
10	Ceilings	20	10
11	Doors inside	20	10
12	Fittings, fixtures	15	5
13	Sanitary equipment	20	10
14	Mechanical equipment	20	10
15	Electrical equipment	20	10
16	Monitoring system	20	5
17	Fire installations	20	10
18	Elevator	20	5
19	Dewatering system	60	-
20	PV Panels	25	-
20	Exterior	20	10
		\$	1,418,313.19

Yr 25 – PV replacement

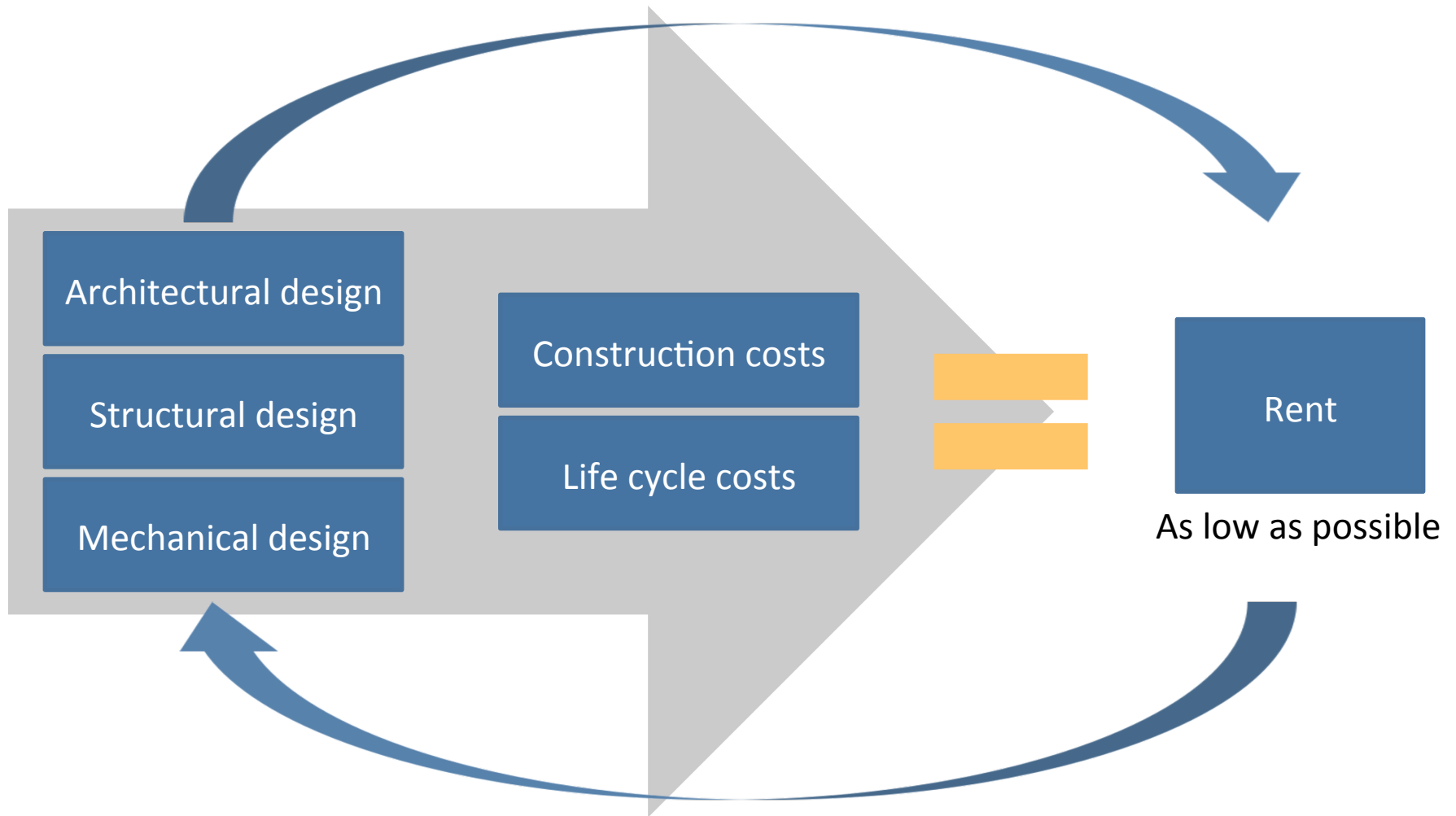
Yr 20 – Major replacement

Yr 15 – Interior fittings

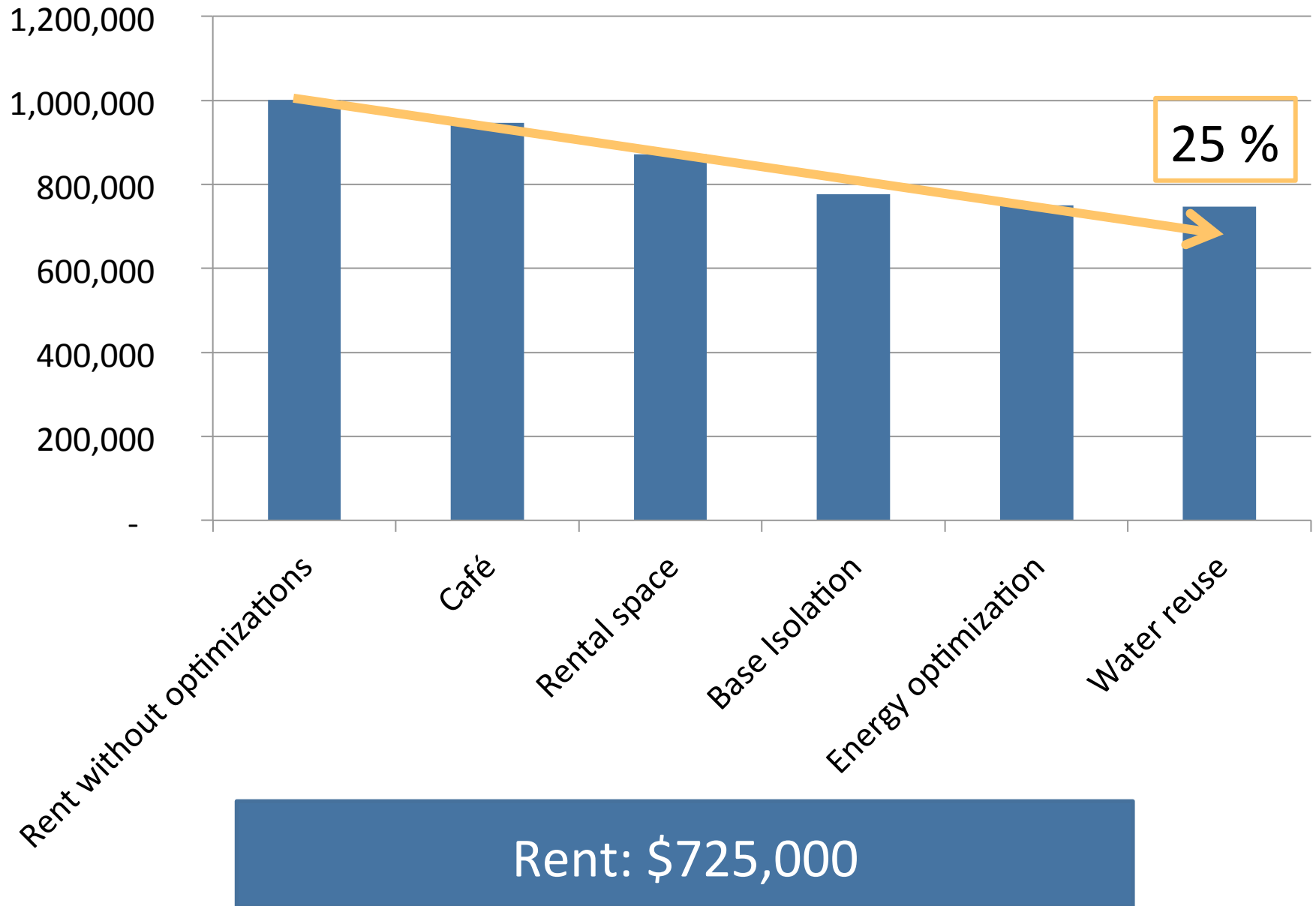


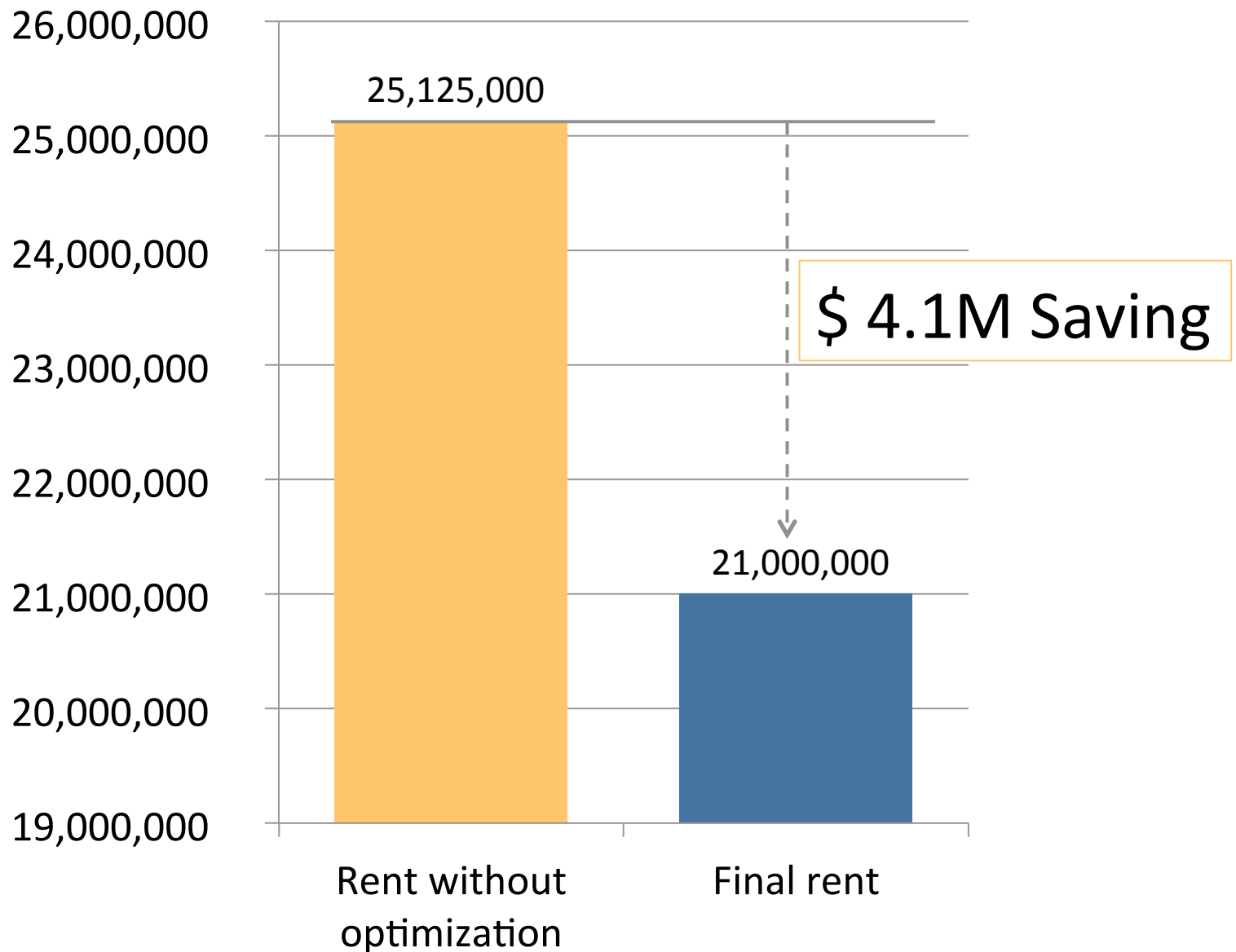


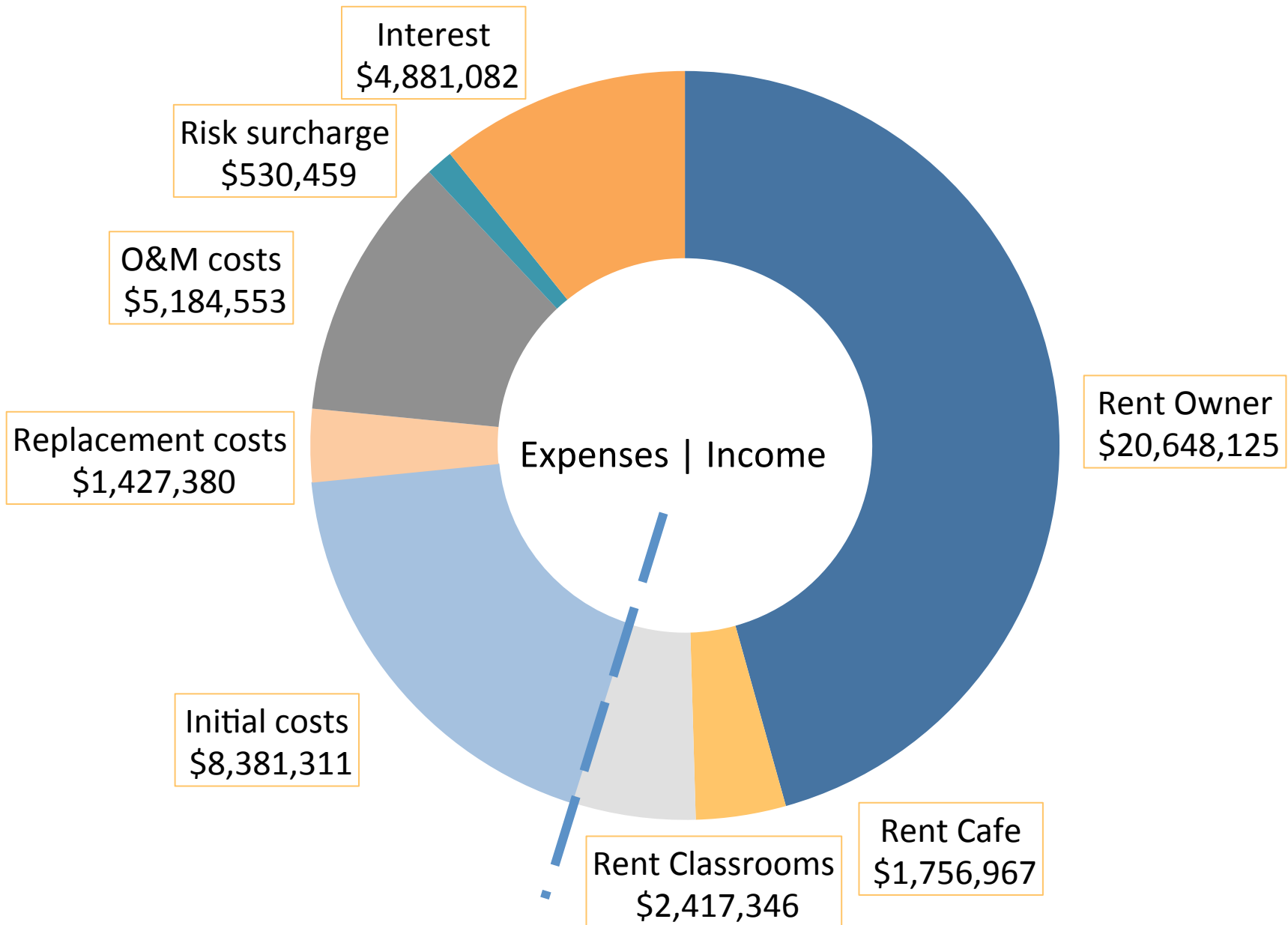
Design effects

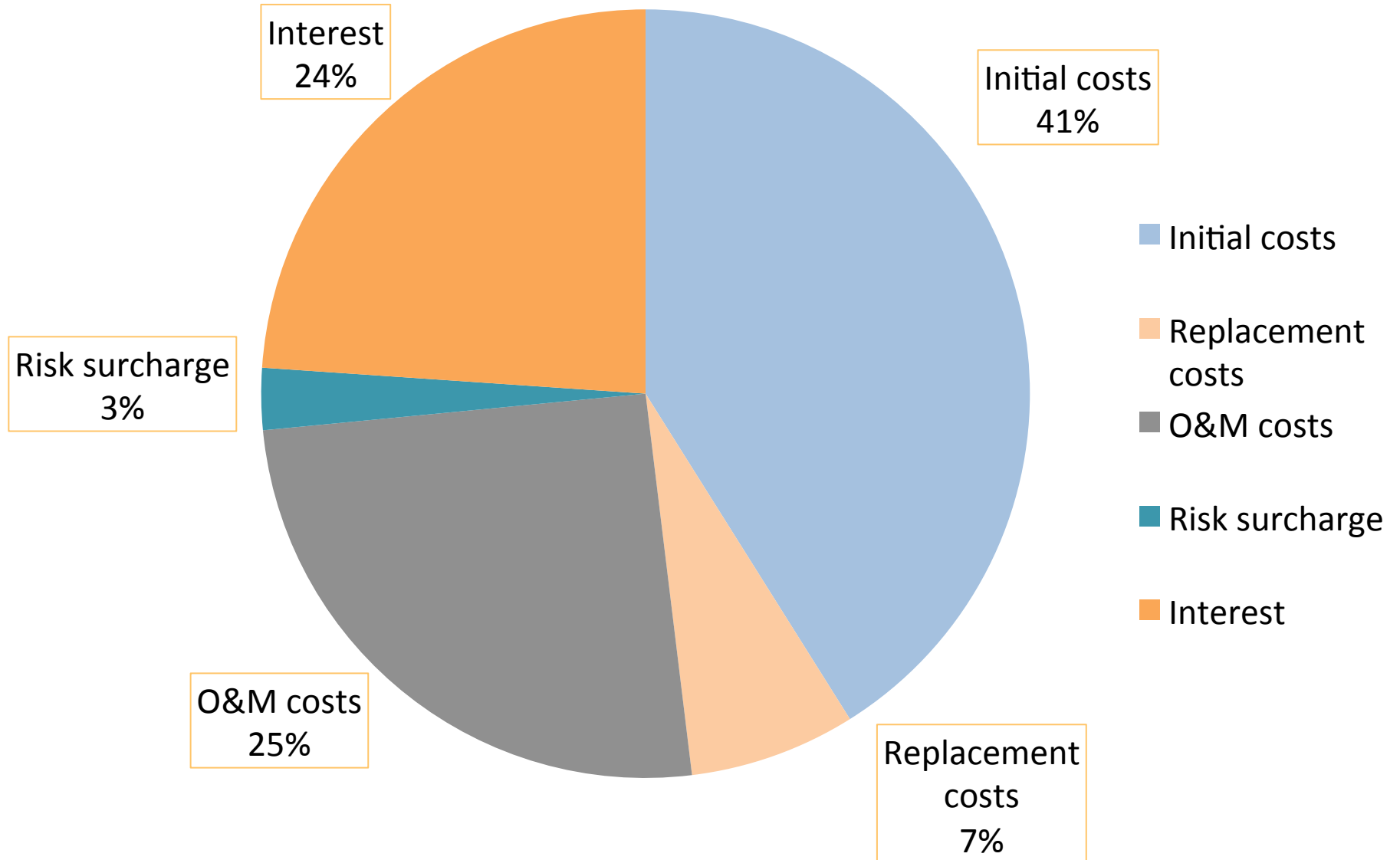


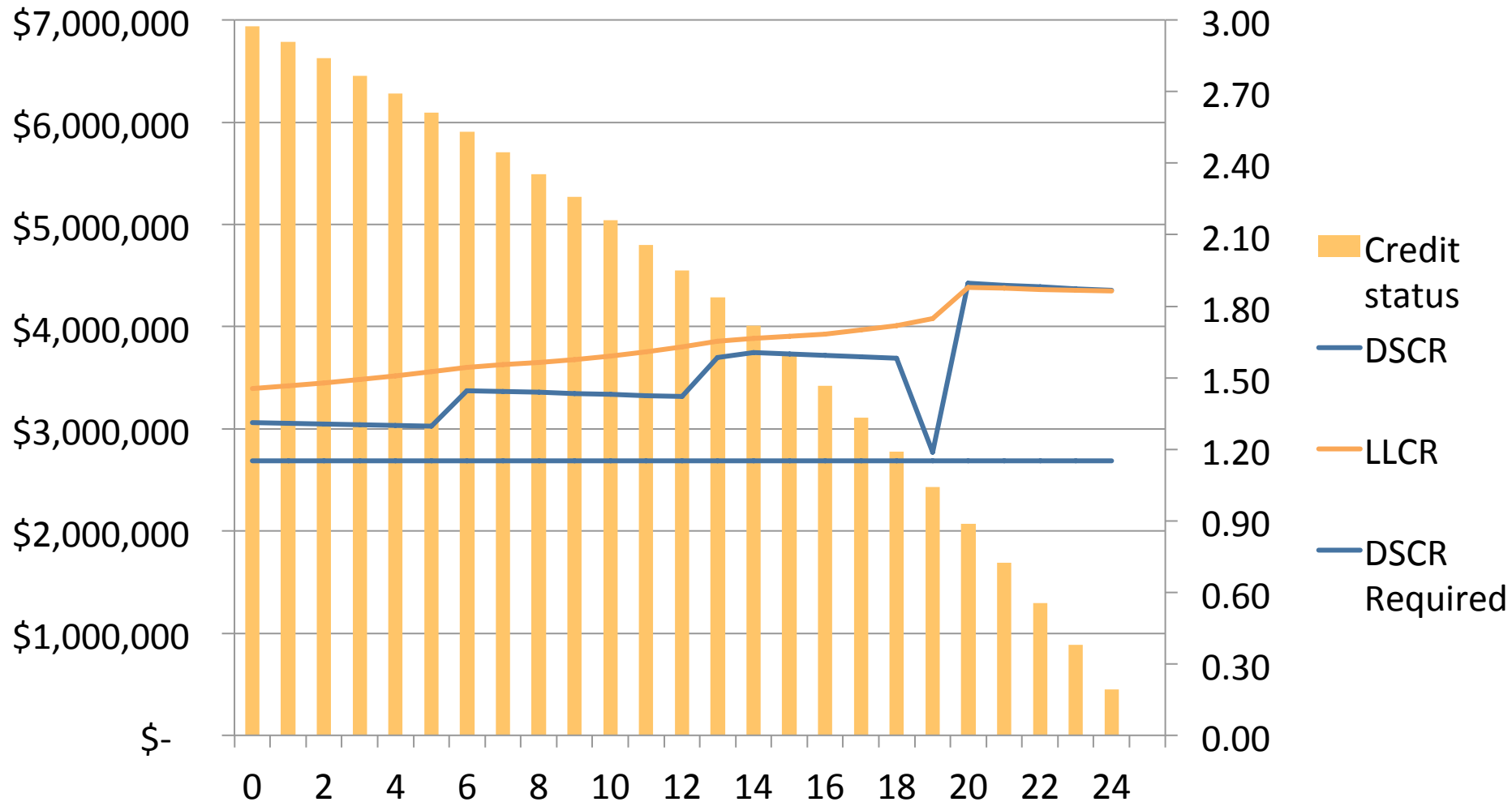
Cost feedback





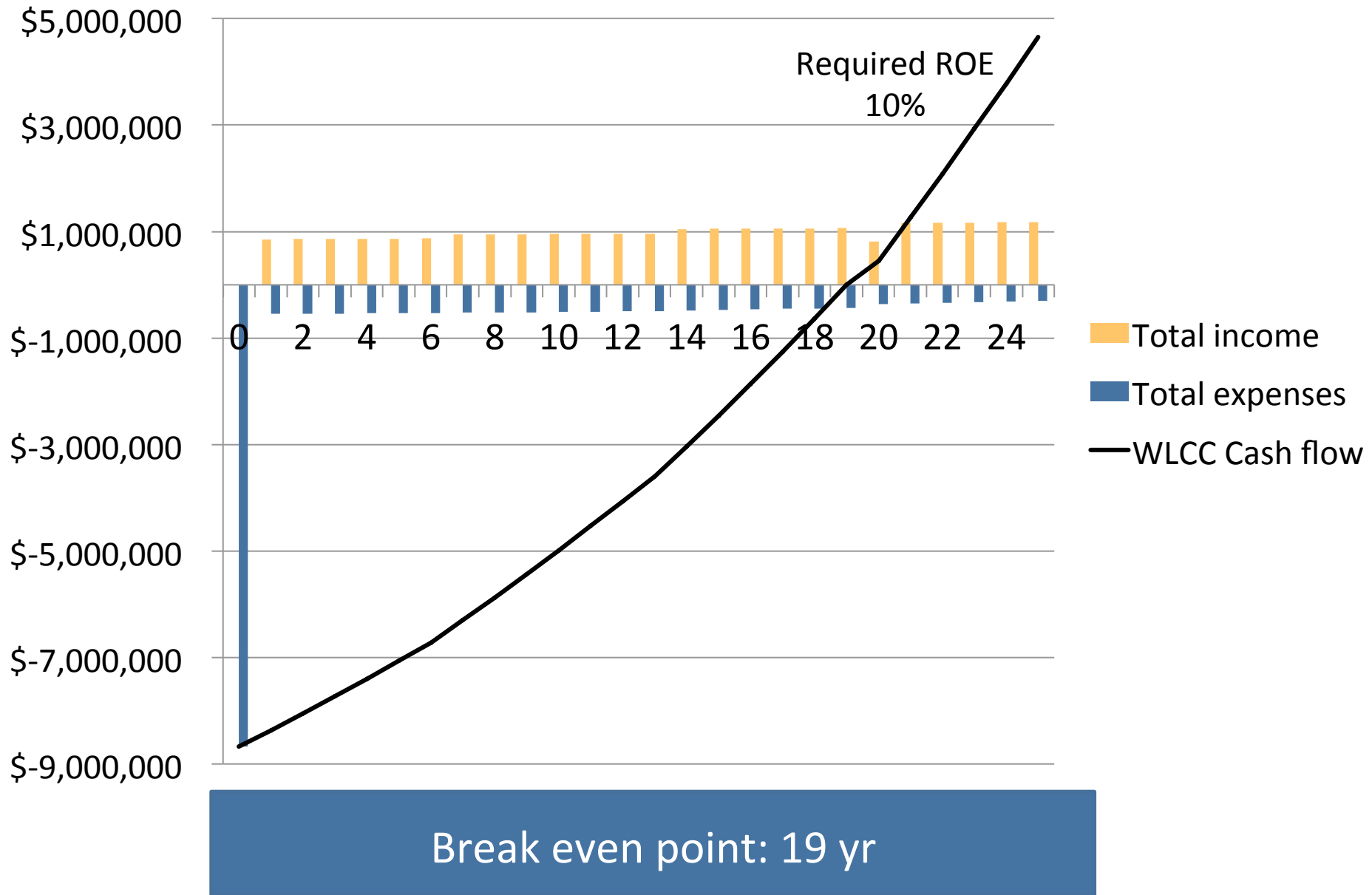






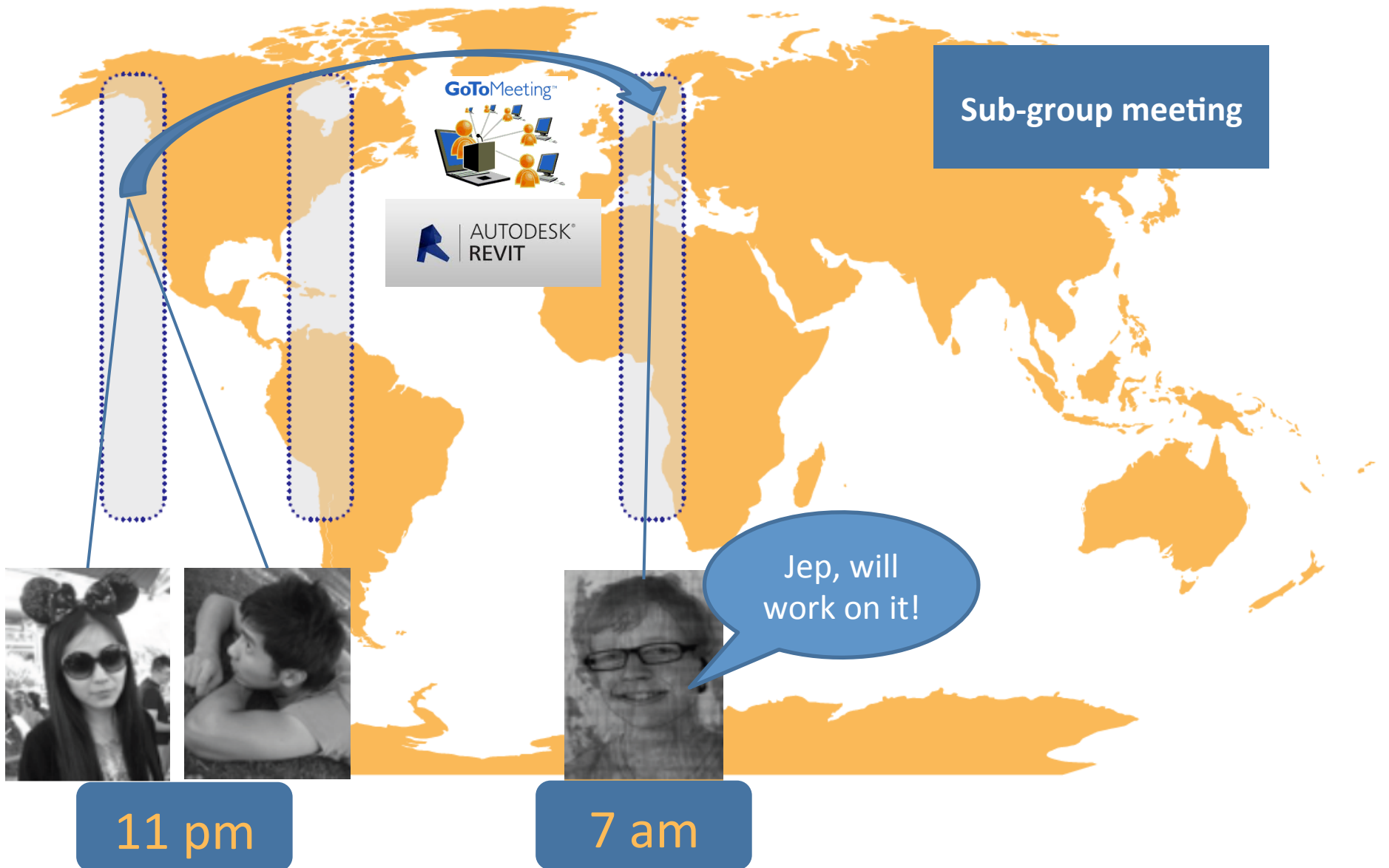
Equity: 20%

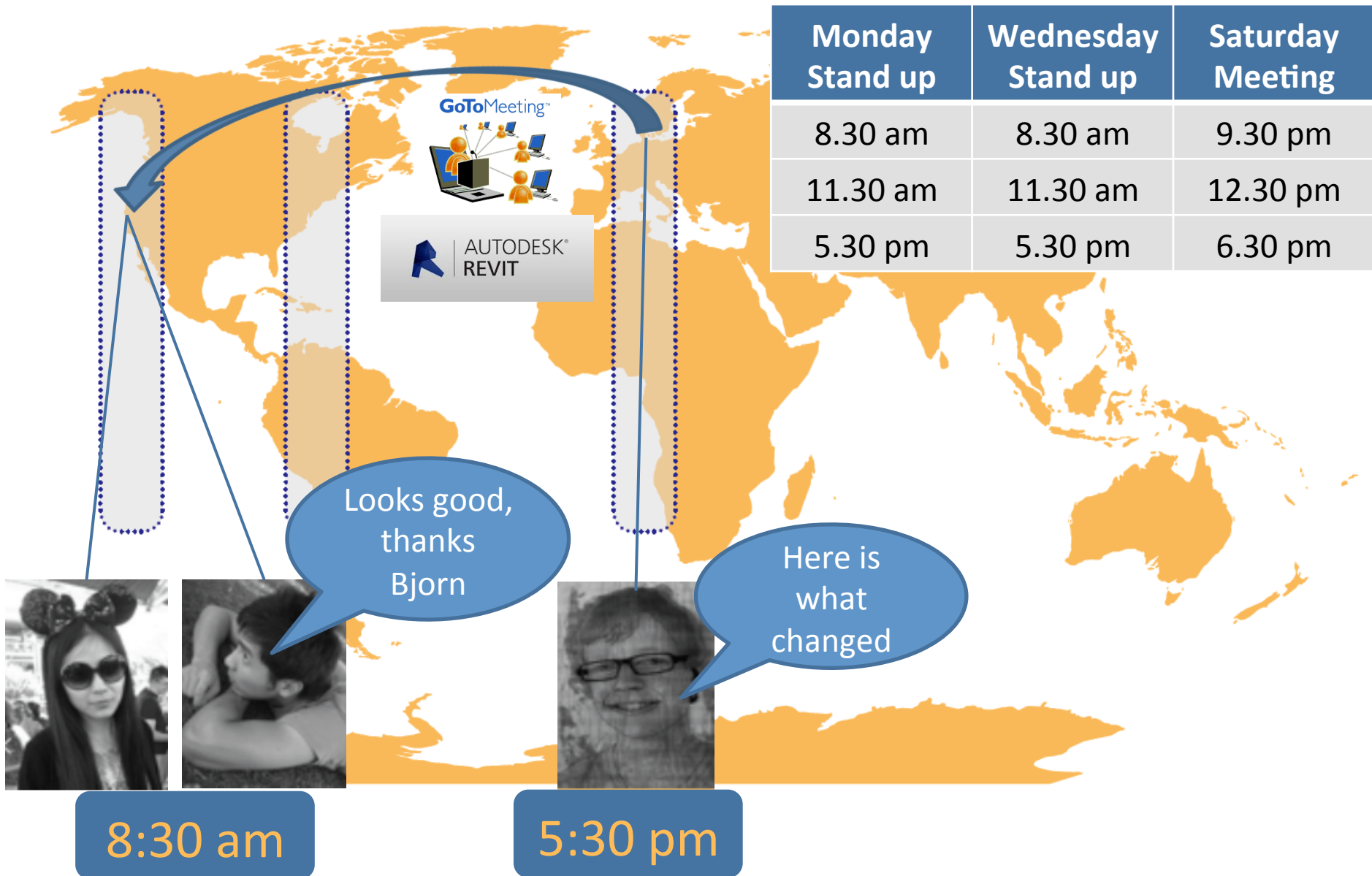
Debt: 80%





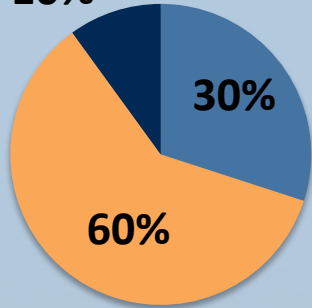






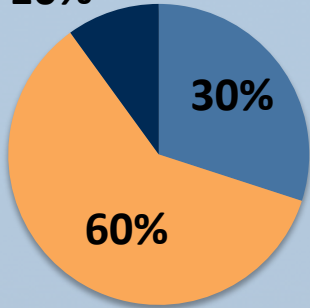
Weekly Meetings

10%

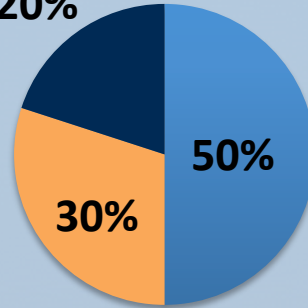
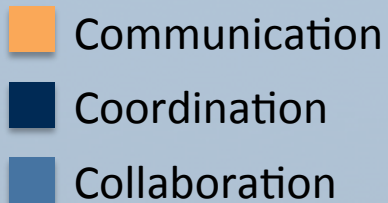
**KICKOFF****WINTER
PRESENTATION****FISHBOWL****SPRING
PRESENTATION** Communication Coordination Collaboration

Weekly Meetings Stand Up Meetings

10%

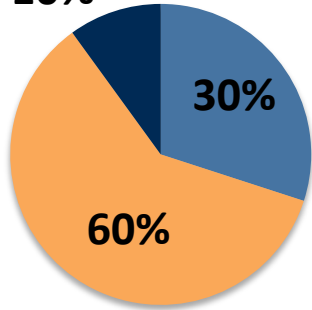


20%

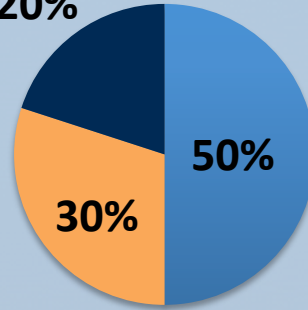
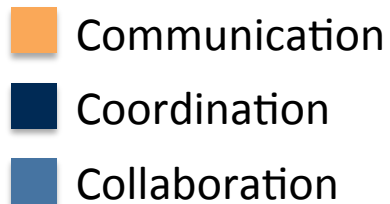
**KICKOFF****WINTER
PRESENTATION****FISHBOWL****SPRING
PRESENTATION**

Weekly Meetings

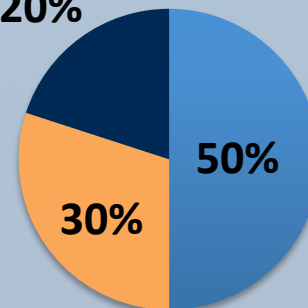
10%

**Stand Up Meetings**

20%

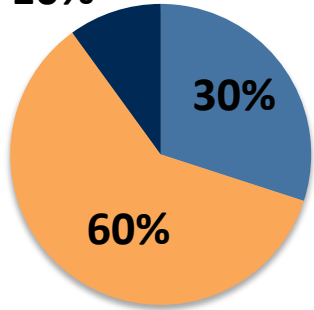
**KICKOFF****WINTER
PRESENTATION****FISHBOWL****SPRING
PRESENTATION****Weekly Meetings**

20%



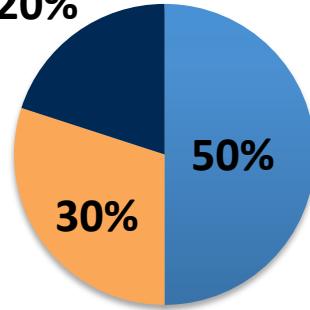
Weekly Meetings

10%



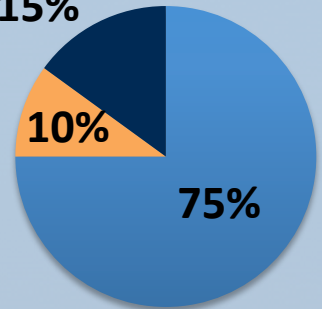
Stand Up Meetings

20%



Stand Up Meetings

15%



KICKOFF

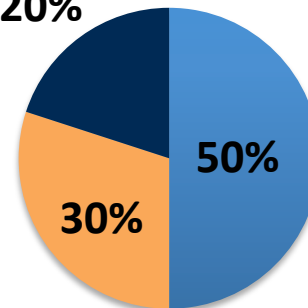
WINTER
PRESENTATION

FISHBOWL

SPRING
PRESENTATION

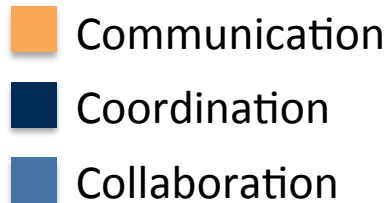
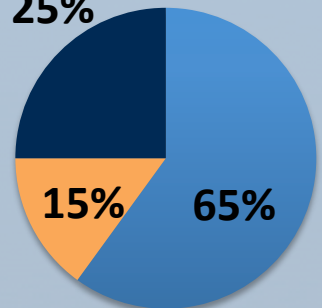
Weekly Meetings

20%



Weekly Meetings

25%



Chris: "Think more for others, better return you will receive."

Amy: "The key is patience and flexibility"

Bjørn: "When you are thinking in 3D other might be thinking in 2D – meaning clashes!"



Olga: "Can you hear me? Can you see my screen?"

Sophia: "Project = Fun"

Albert: "What are you sinking about?"

Tim: "Don't underestimate the importance of communication, collaboration and coordination."

THANK YOU MENTORS

Kyle Adams, John Nelson, Sarah Russell-Smith, Charles Bovet, David Bendet, Eduardo Miranda, Greg Luth, Wendy Taniwangsa, Adhamina Rodriguez, Erik Kolderup, Living Machine Inc., Willem Kymmel, Humberto Cavallin, David Bendet, Karolina Ostrowska, Michael Luring, Björn Wuendsch, Matthias Ehrlich, Maria Frank

And our owners: Ana Sofia Cardona, Mike Muller,
Sebastian Schönbach

AND special thanks to Renate Fruchter