

the university of new mexico albuquerque

mary shanie victoria dustin milosz michael raleigh express team

team introduction



raleigh se



mary se



victoria ar



dustin cm



michael cm



shanie mep



milosz ar

owners



josh
california



holger
weimar



0h

+2h

+9h

express team

site

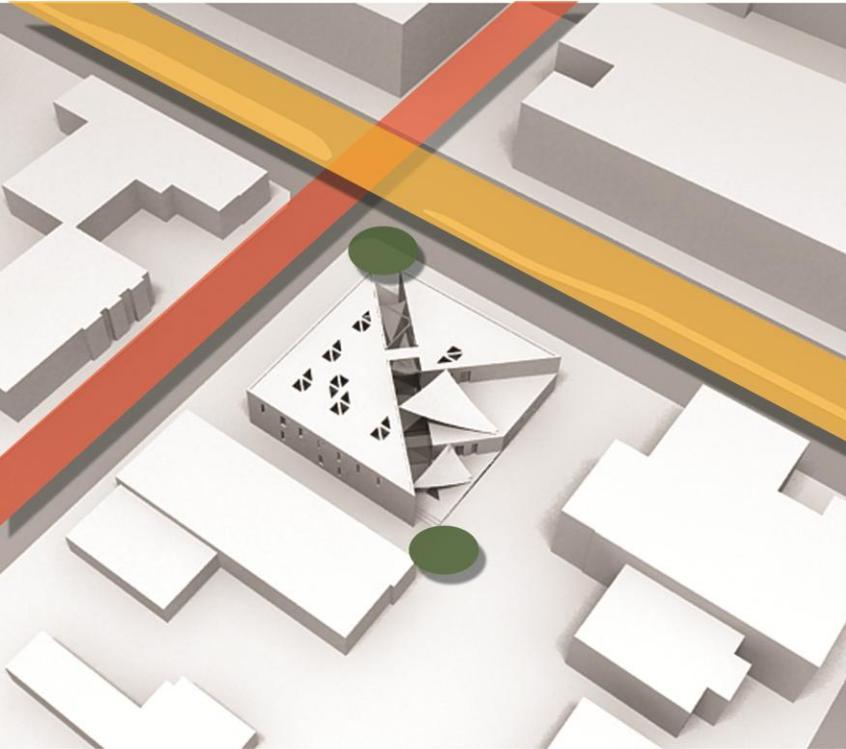


northern side- university buildings, crowded street, parking
surrounded by local architecture
urban grid

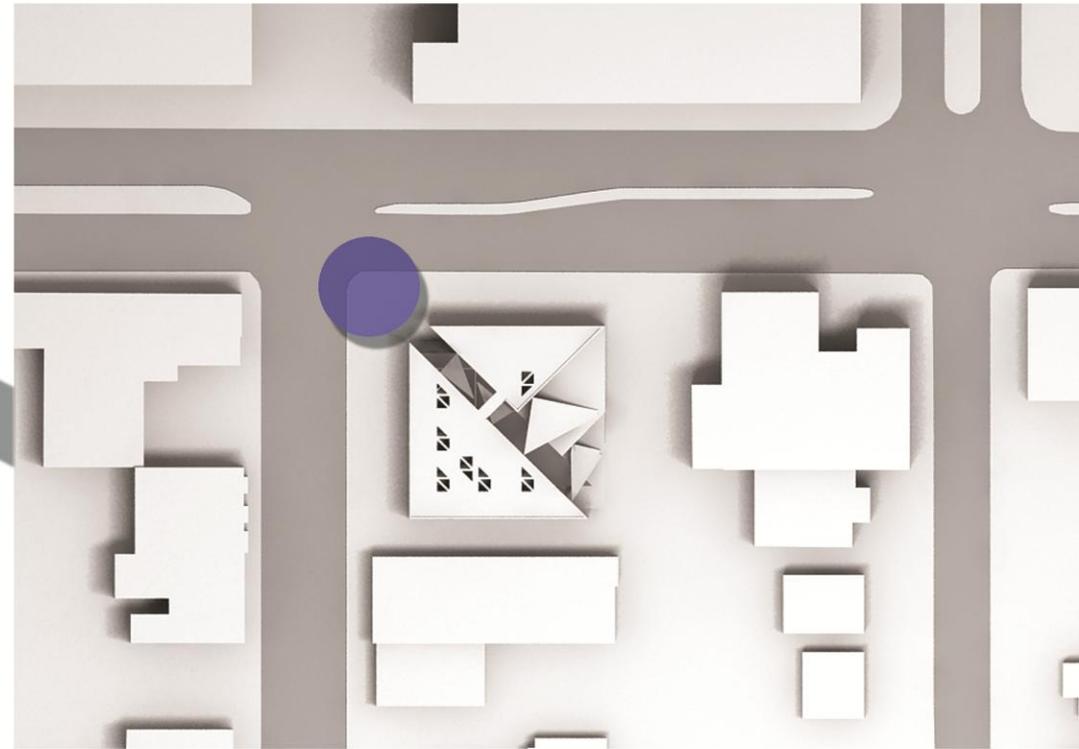
mary shanie victoria dustin milosz michael raleigh express team

site conditions

communication directions



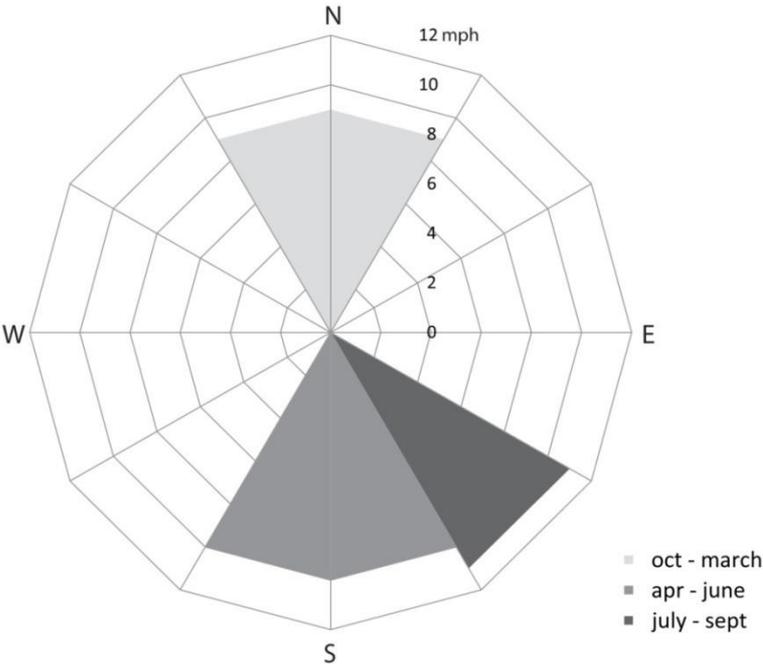
urban focal point



mary shanie victoria dustin milosz michael raleigh express team

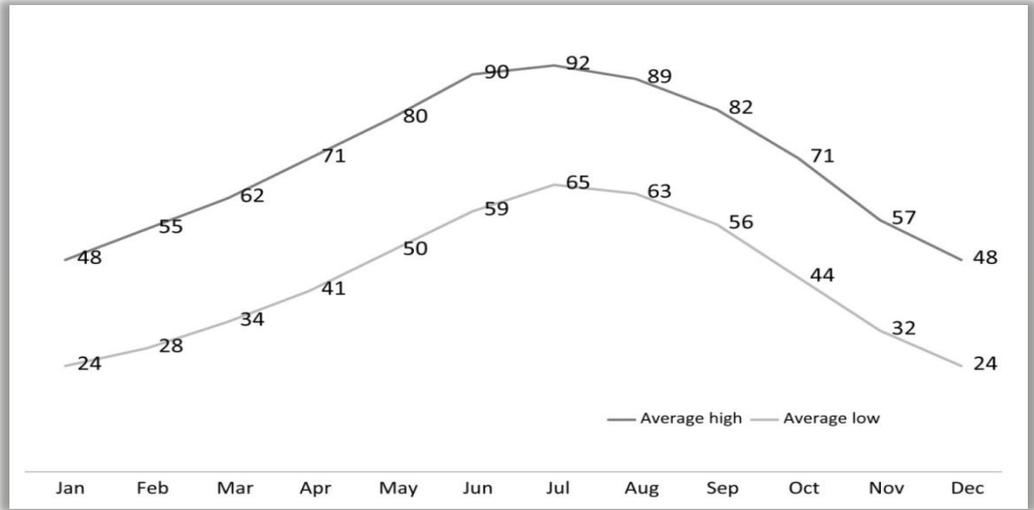
desert climate

Average Wind Load and Orientation in a Year

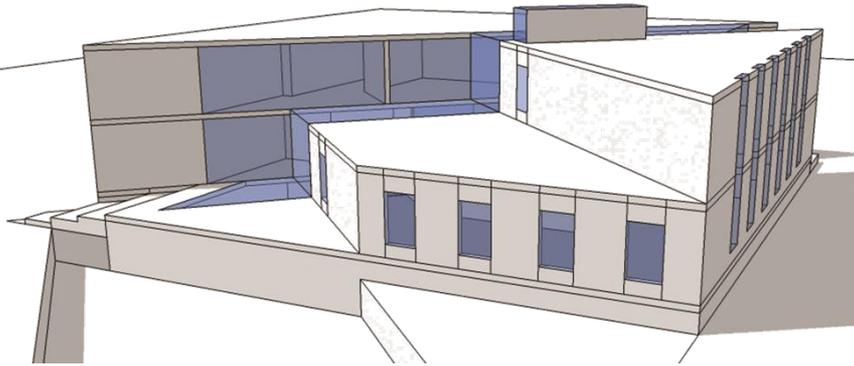


Average Morning Humidity: 45-68 %
Average Afternoon Humidity: 18-43 %

temperature variation

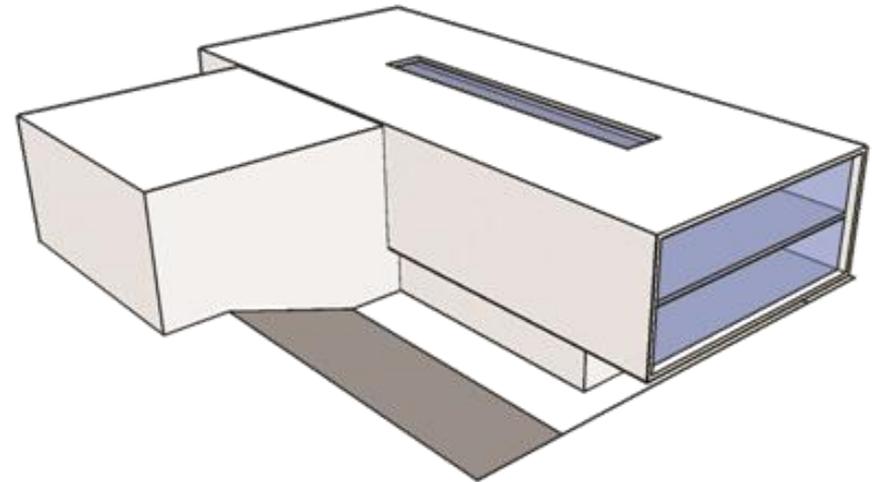


concept phase

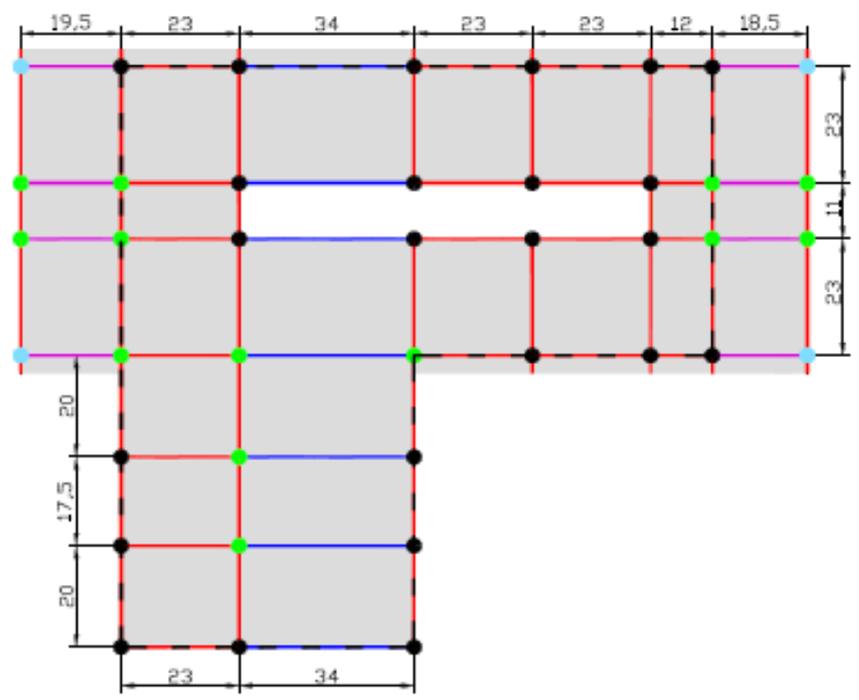
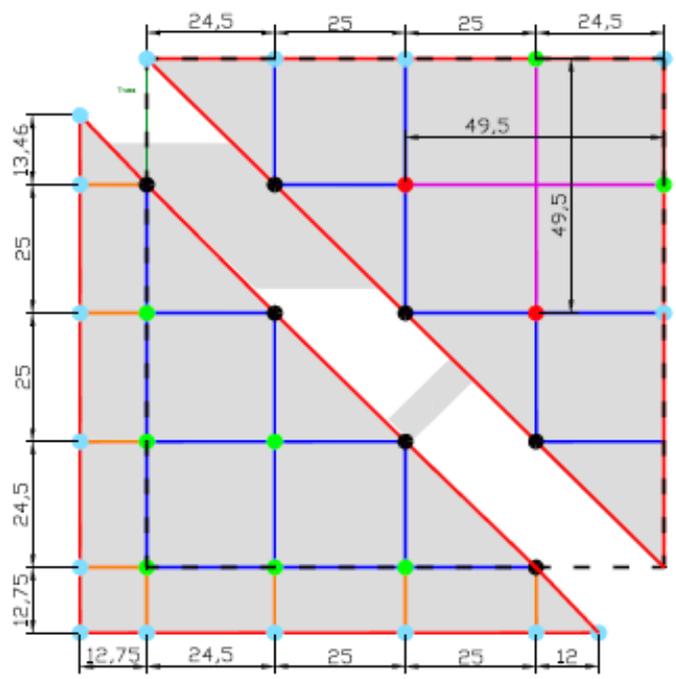


concept 1
square footprint
“open the box”

concept 2
L-shape footprint
“transparency”

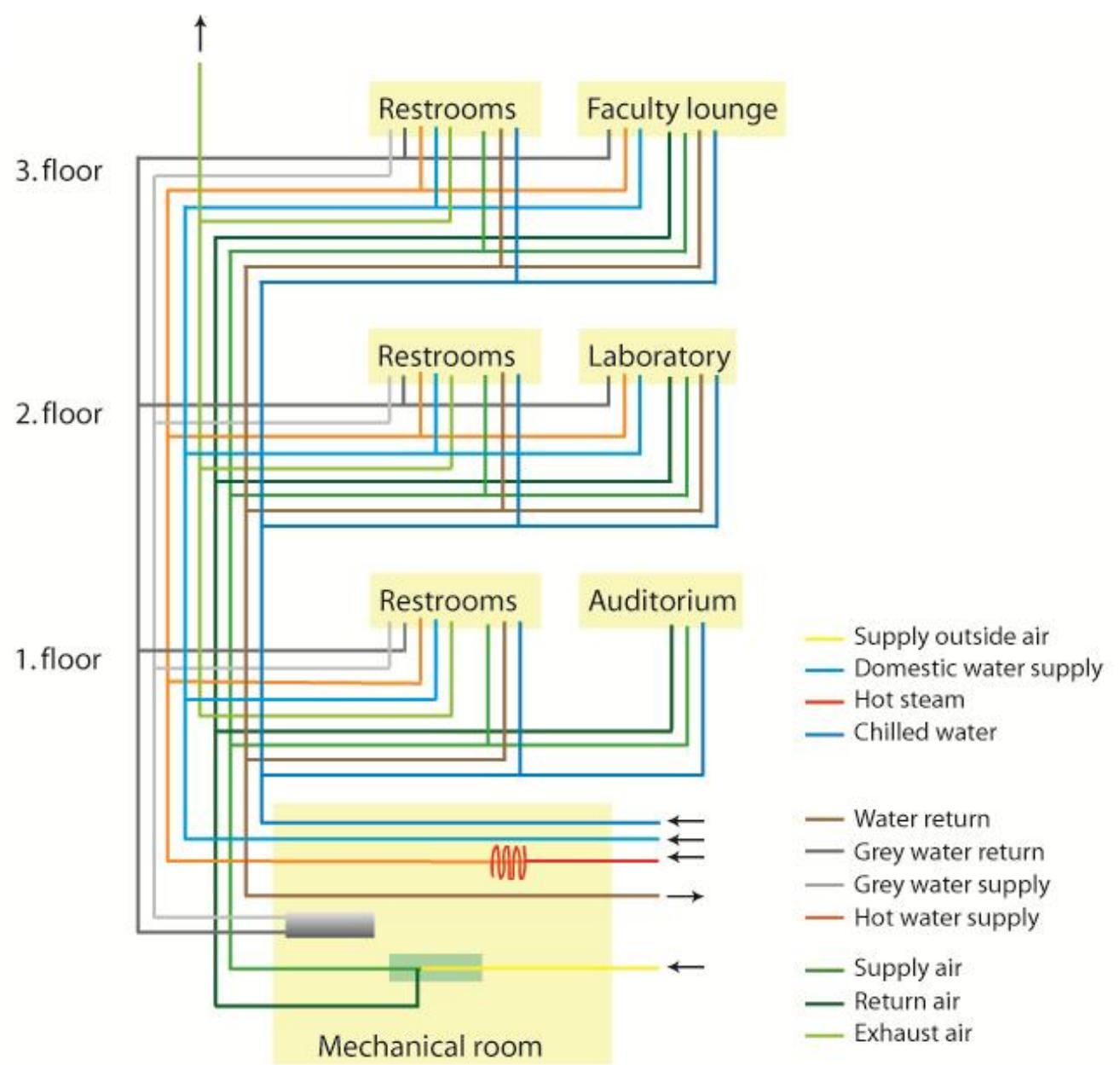


conceptual structural grids

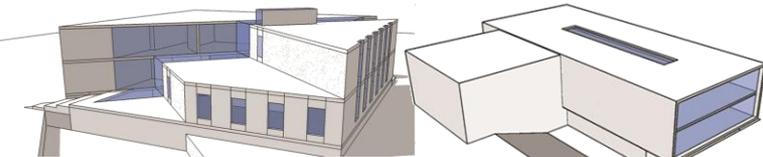


both steel and concrete
moment frame

vertical shaft

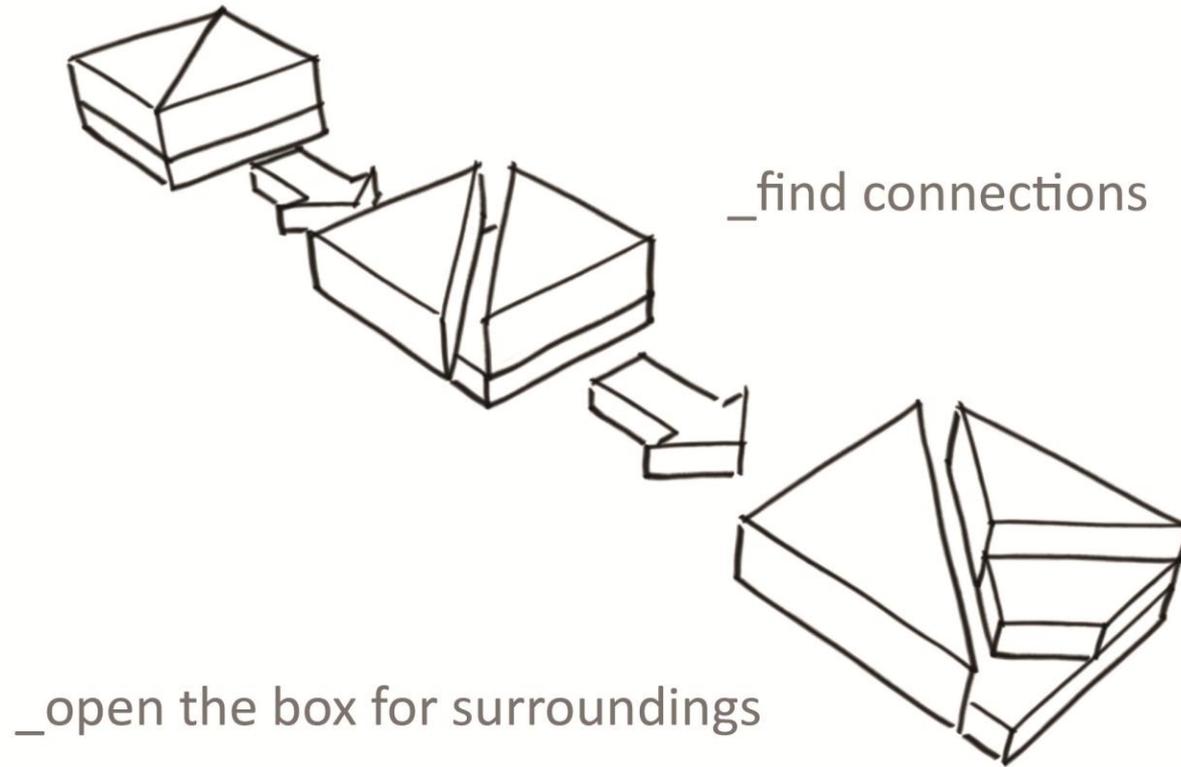


decision matrix

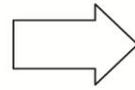
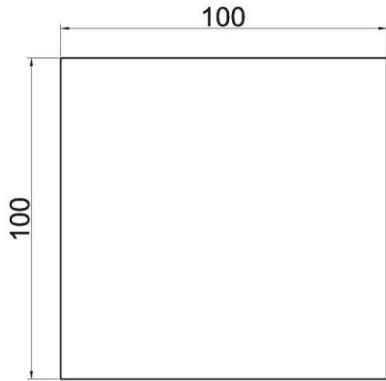


		Concept 1		Concept 2	
		Steel	Concrete	Steel	Concrete
Arch	Sunlight	+	+	-	-
	Circulation	+	+	+	+
	Façade	+	+	+	+
	Design/Form	+	+	-	-
Structural	Grid	+	+	-	-
	Weight	+	-	+	-
	Floor System Depth	+	+	-	-
	Reuse/Renovation	+	-	+	-
	Fire proofing	-	+	-	+
MEP	Mechanical difficulties	-	-	+	+
	Sun path	+	+	-	-
	MEP height	S	S	S	S
	Thermal mass	-	+	-	+
	Sustainable design	+	+	-	-
	Utilities	S	S	S	S
CM	Cost	-	+	-	+
	Schedule	+	-	+	-
	Constructability	-	-	+	+
	Site Plan	+	+	-	-
Owner	Owners' Preference	+	+	-	-
Total +		13	13	7	7
Total -		5	5	11	11
Total score		8	8	-4	-4

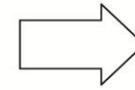
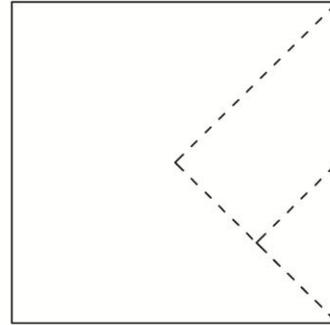
big idea



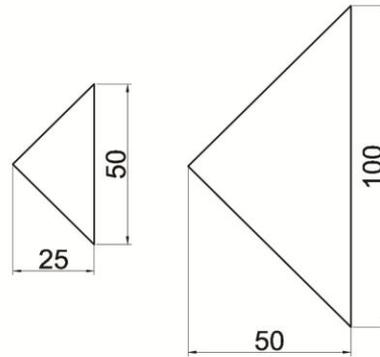
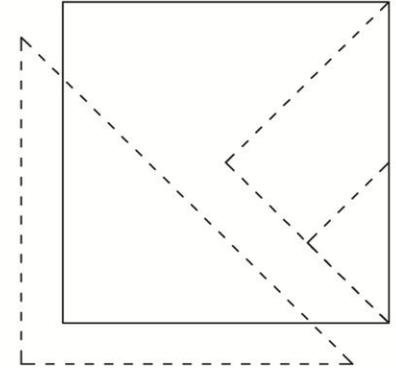
fast calculations



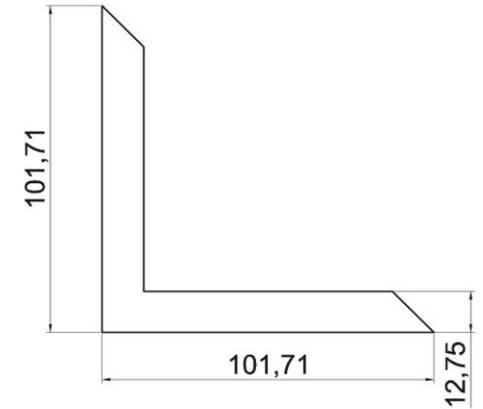
LOSS= 3125 sqf



GAIN= 4540 sqf



$$625 \text{ sqf} + 2500 \text{ sqf} = 3125 \text{ sqf}$$



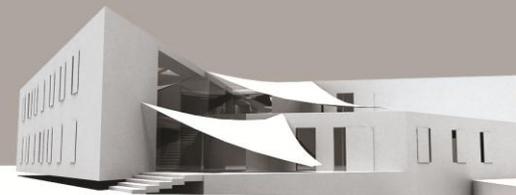
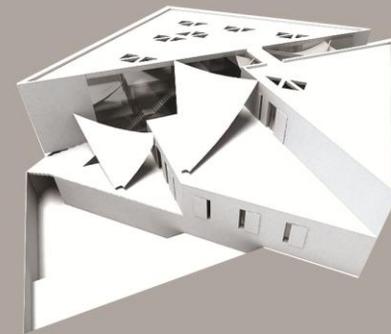
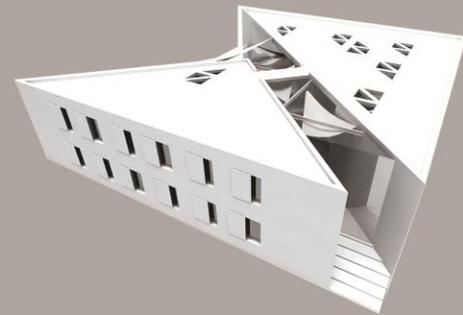
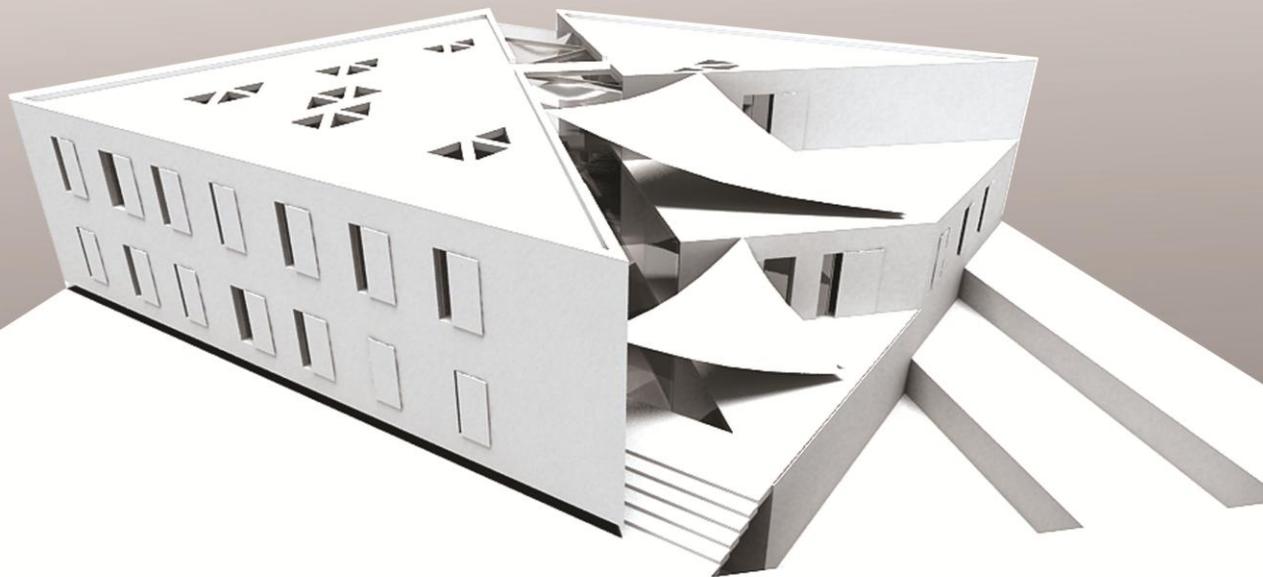
$$2270 \text{ sqf} \times 2 = 4540 \text{ sqf}$$

inspirations- acute angles



mary shanie victoria **dustin** milosz **michael** raleigh express team

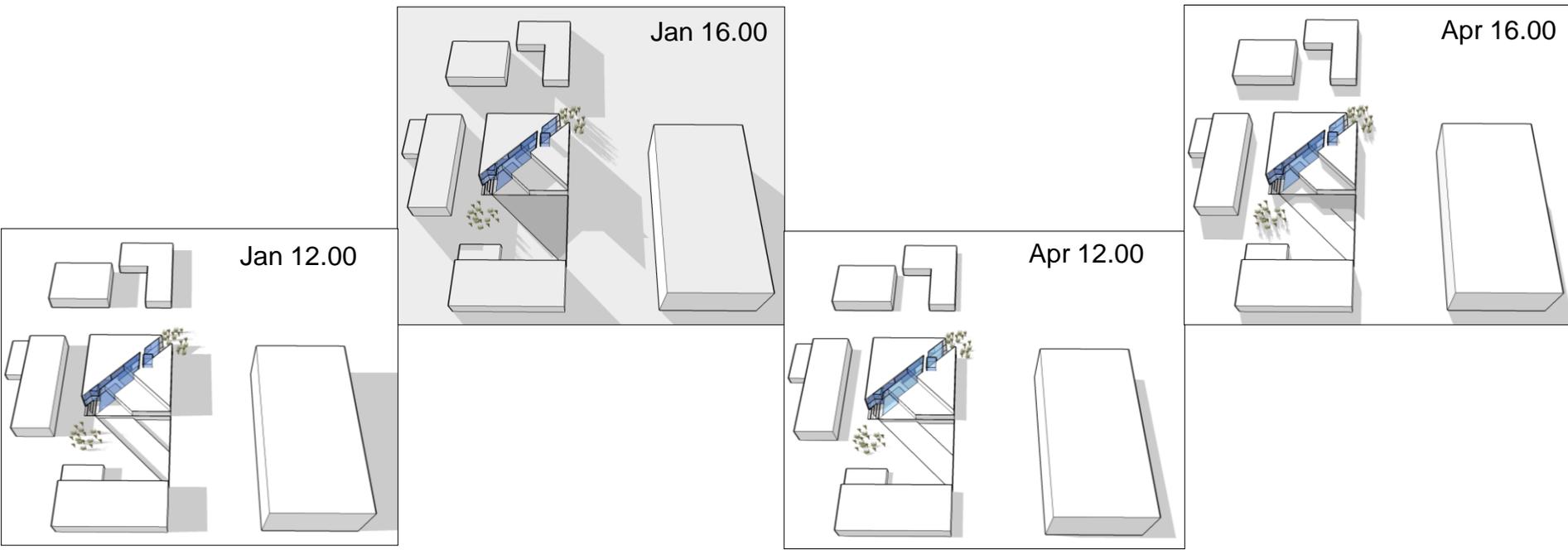
shape



mary shanie victoria **dustin** milosz **michael** raleigh express team

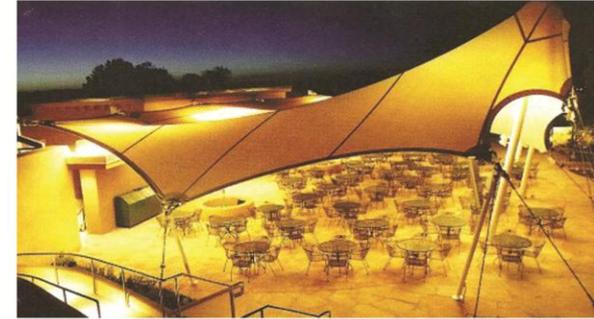
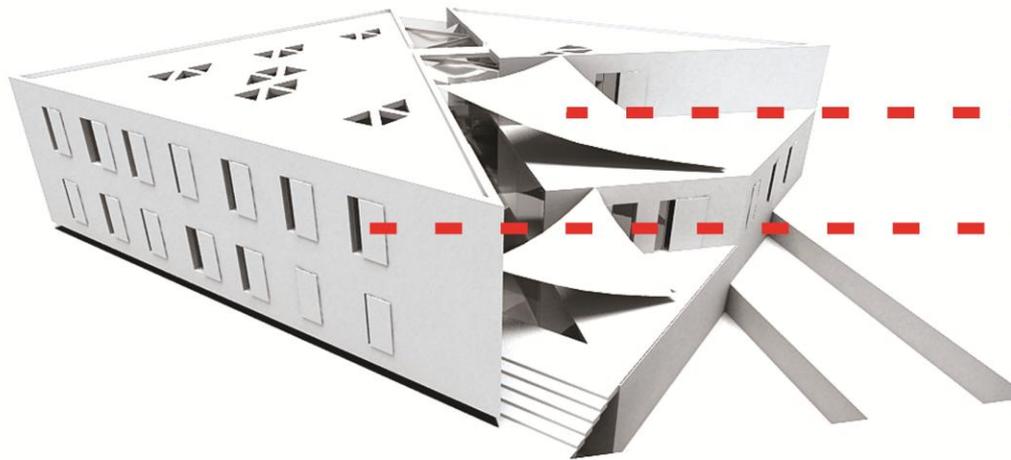
shadow diagrams

north →



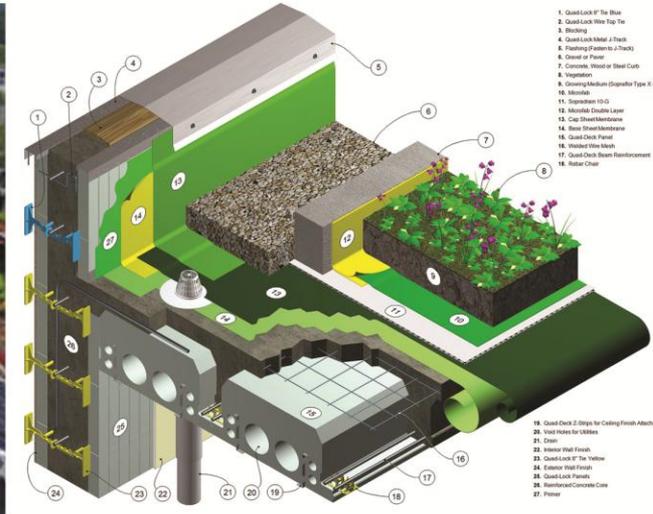
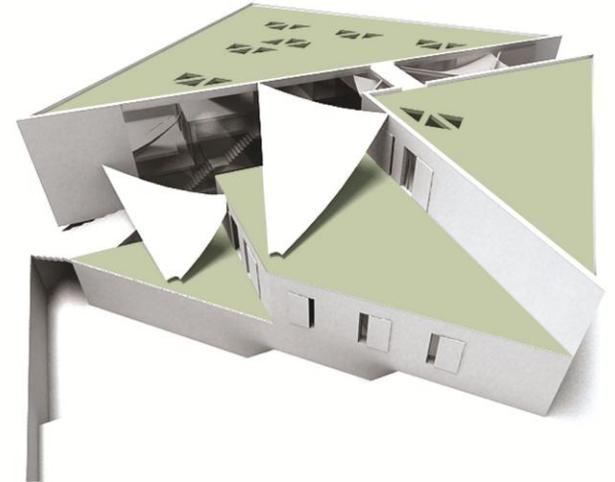
sun control

- shading fabric
- sliding shutters



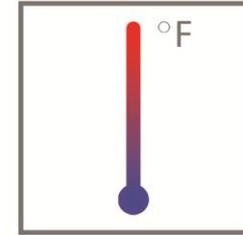
mary shanie victoria dustin milosz michael raleigh express team

green extensive roof- brown roof



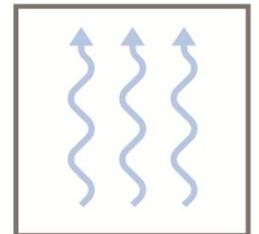
green roof benefits

-shields the roof from:

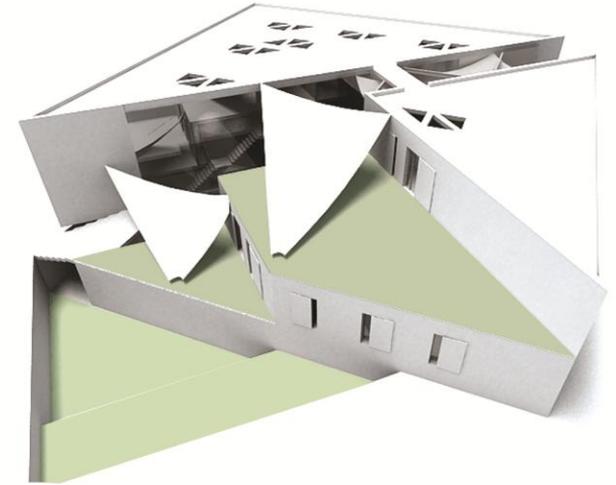


-prolongs roof life by over 20 years

-stores and returns water to atmosphere

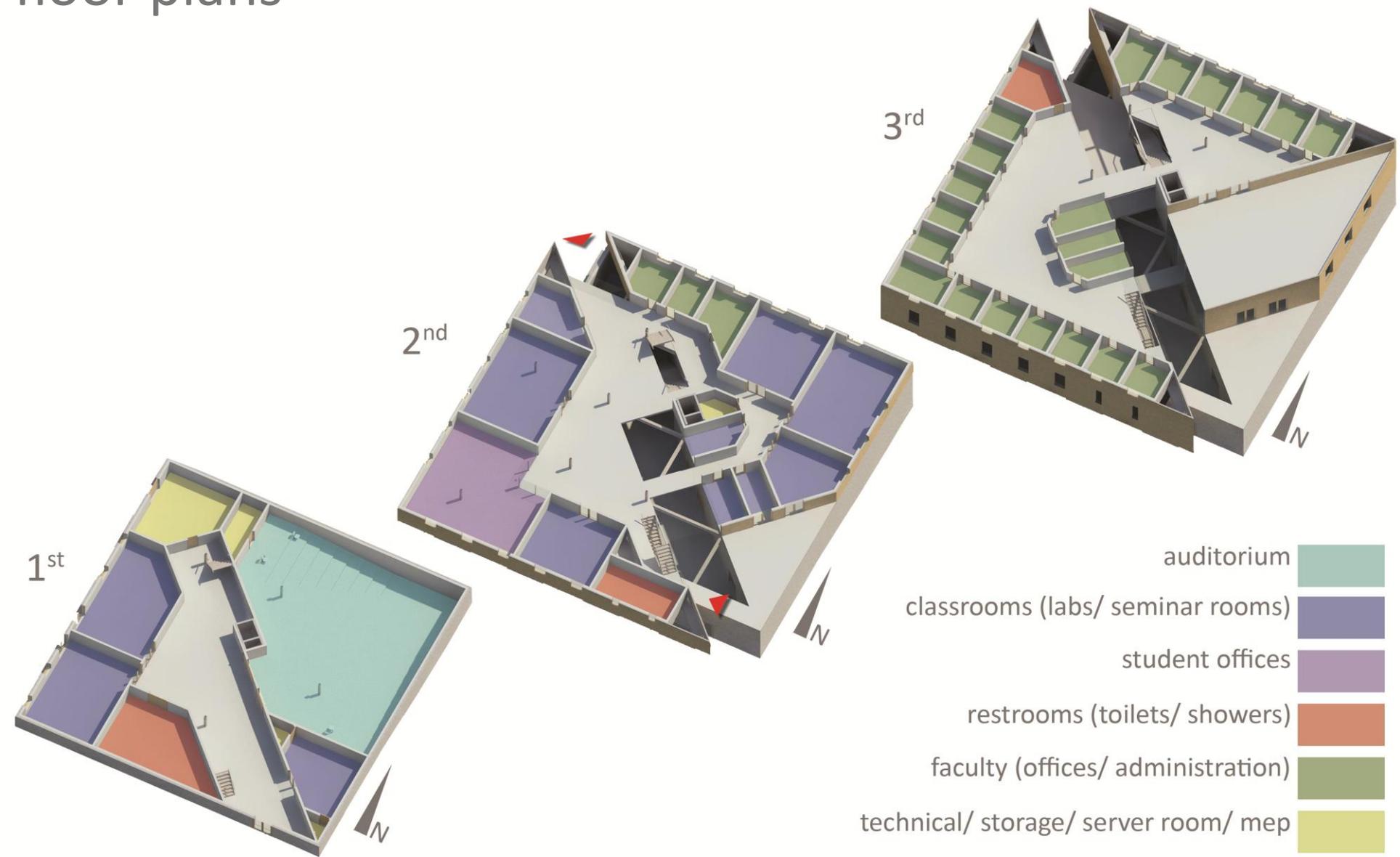


social space



mary shanie victoria dustin milosz michael raleigh express team

floor plans



social- nearly 40%



indoor

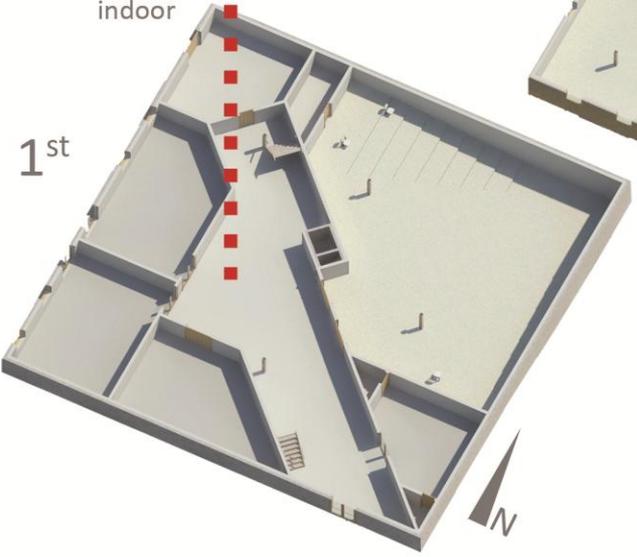


coffee corner

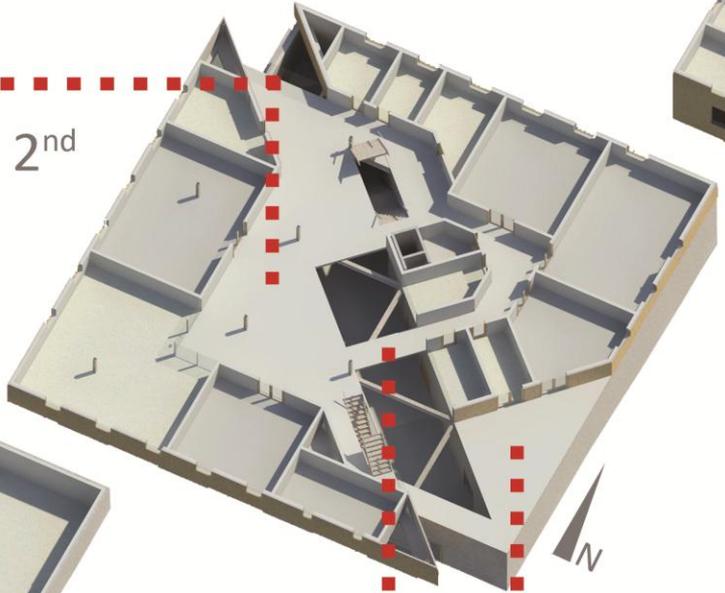


indoor

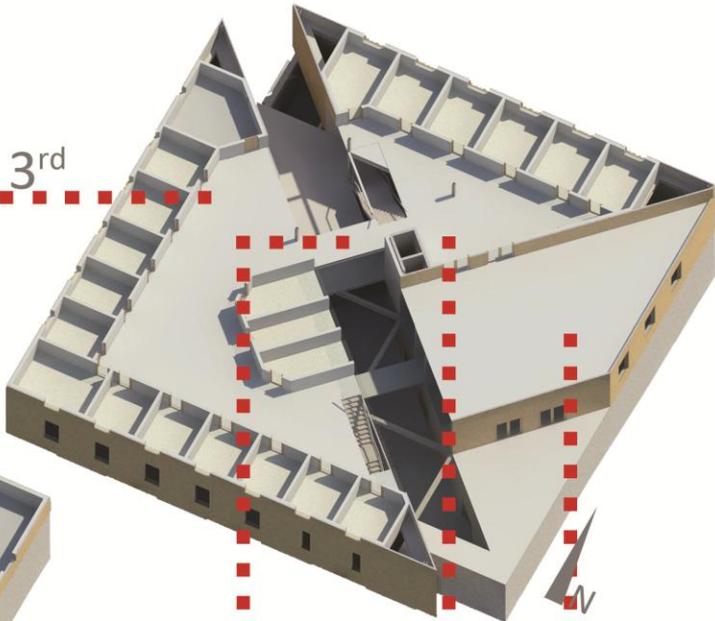
1st



2nd



3rd



focal



outdoor



focal



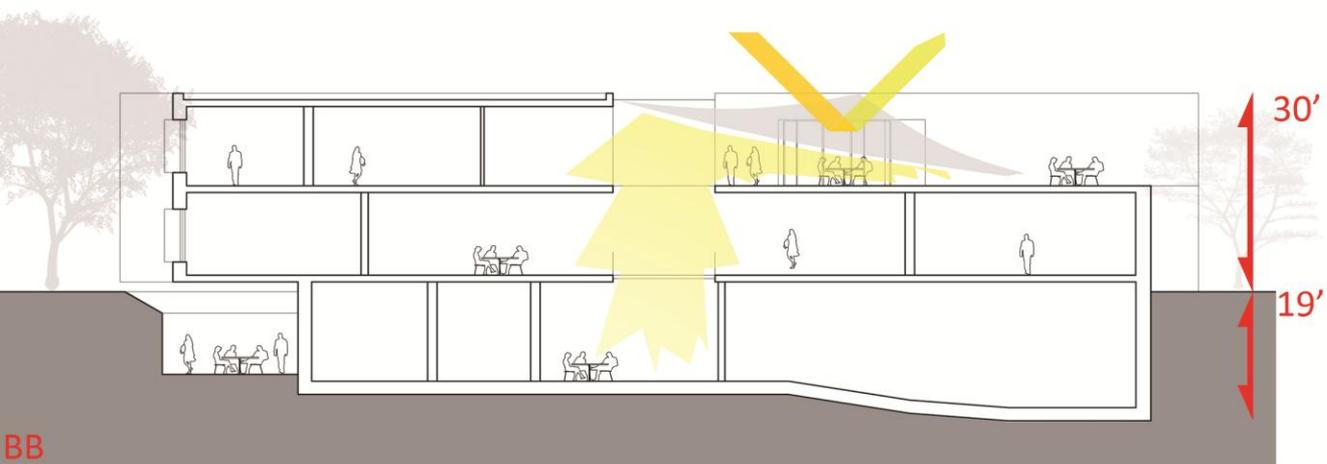
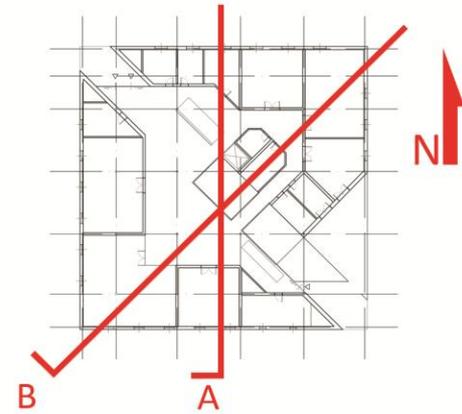
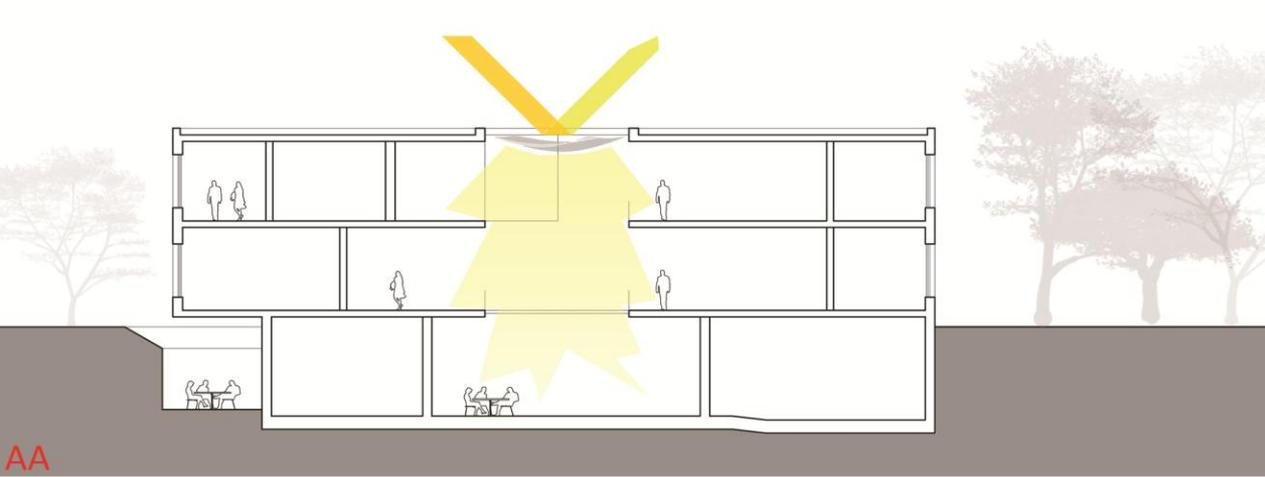
coffee corner



outdoor

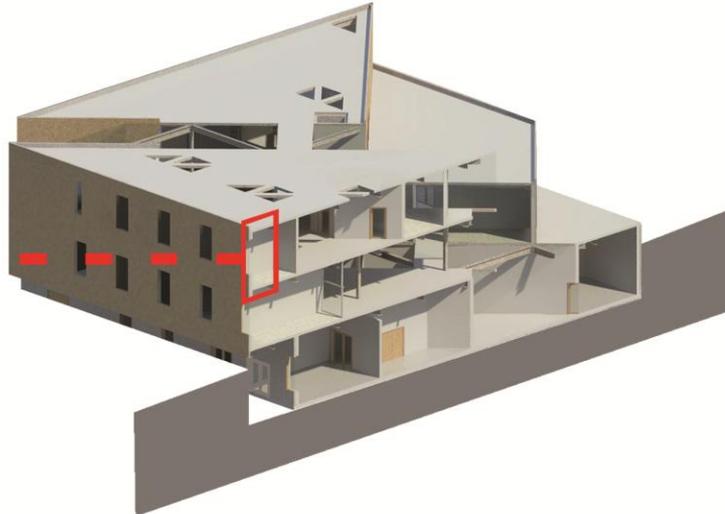
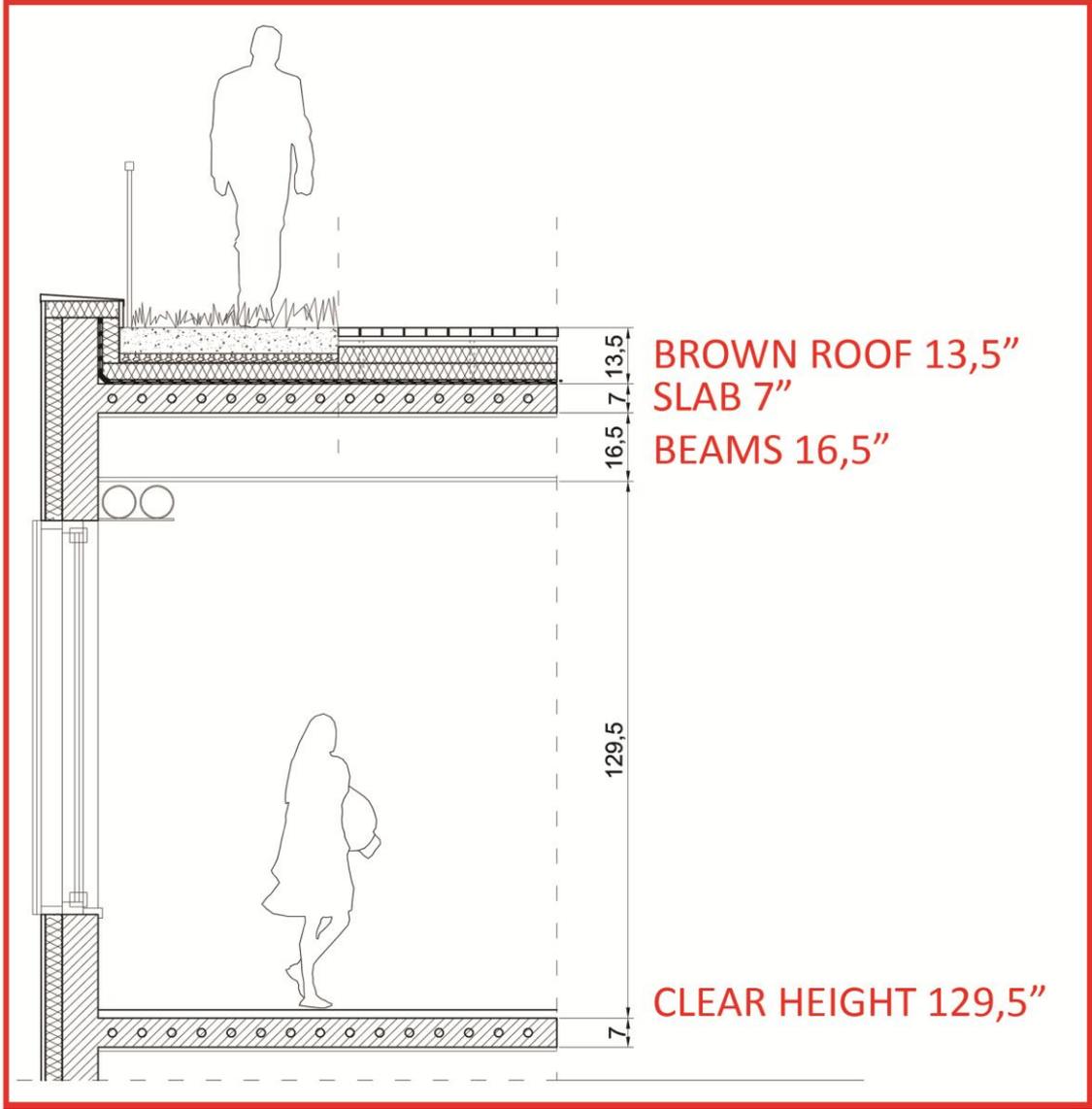
mary shanie victoria dustin milosz michael raleigh express team

section



mary shanie victoria dustin milosz michael raleigh express team

section



facades

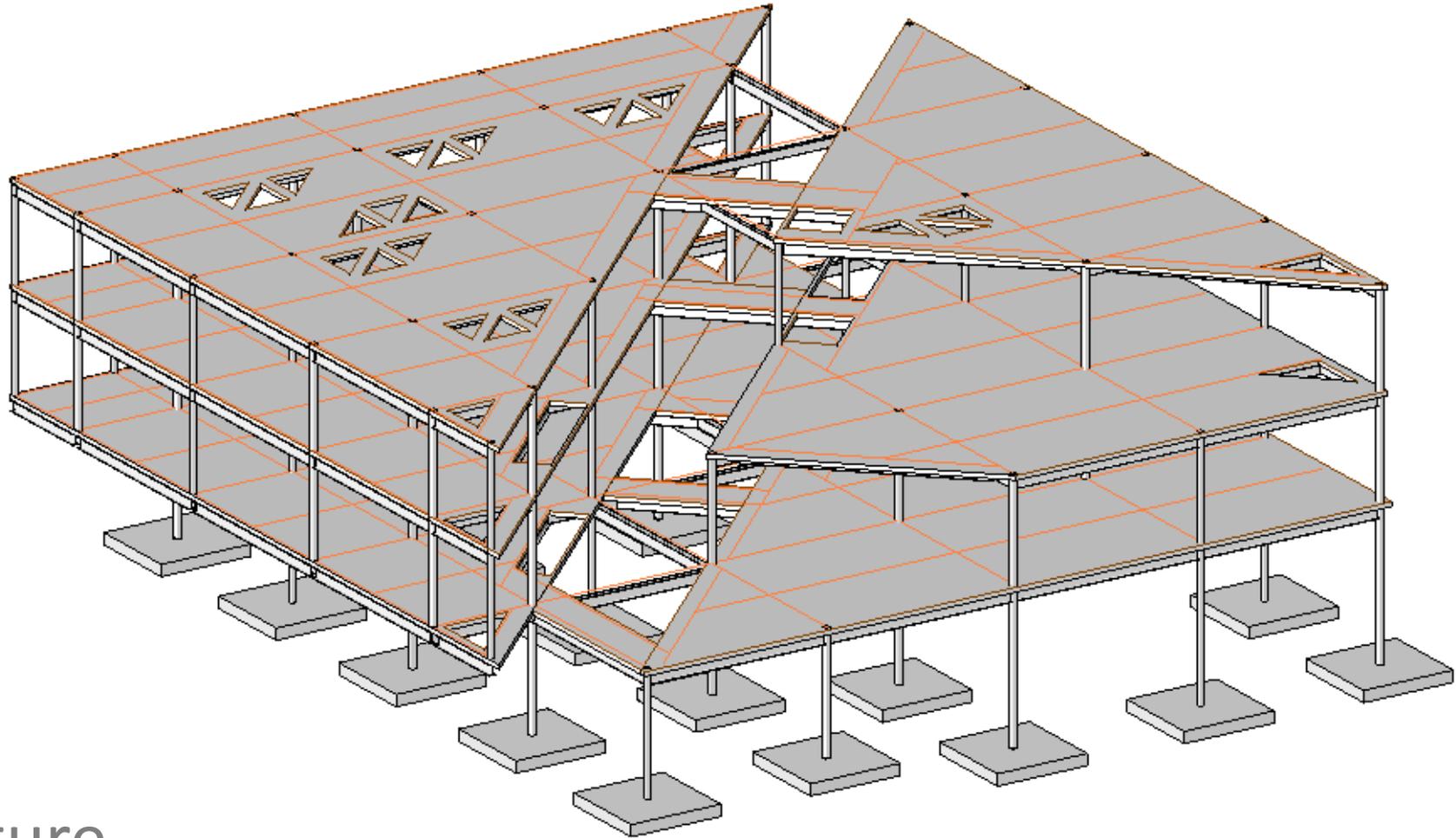


mary shanie victoria **dustin** milosz **michael** raleigh express team

night performance



mary shanie victoria dustin milosz michael raleigh express team



structure

mary shanie victoria dustin milosz michael raleigh express team

gravity loads

Occupancy Type	Live Load
Faculty Offices	50
Department Chair's Office	50
Senior Administration Office	50
Administrative Assistants	50
Faculty Lounge	100
Student Offices	50
Auditorium	40
Large Classrooms	40
For Flexibility Use	100

Occupancy Type	Live Load
Small Classroom	40
Seminar Rooms	40
Instructional Labs	100
Server Room	125
Technical Support	50
Storage Rooms	125
First Floor Corridors	100
Second Floor Corridors	80

cost/benefit of floor space flexibility

Live Load = 100 psf

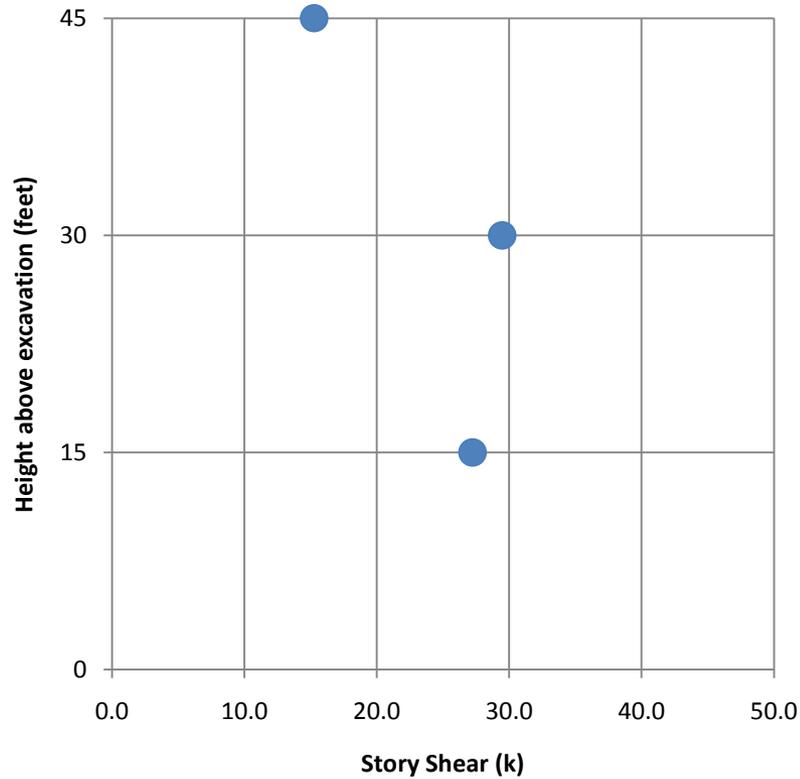
Member	Size Chosen	Total Length
Column	W14x43	60 ft
Girder	W16x40	50 ft
Filler Beam	W12x35	100 ft

Live Load = 80 psf and 50 psf

Member	Size Chosen	Total Length
Column	W14x30	60 ft
Girder	W16x26	50 ft
Filler Beam	W12x35	100 ft

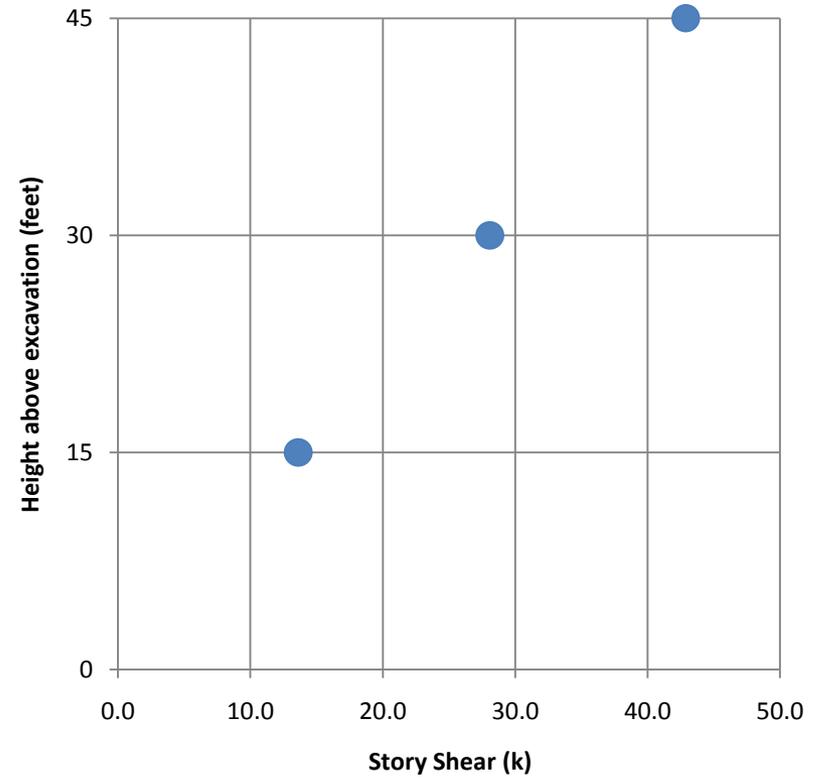
lateral loads

Wind Pressure



Earthquake (ELF)

[Cs = 0.051]

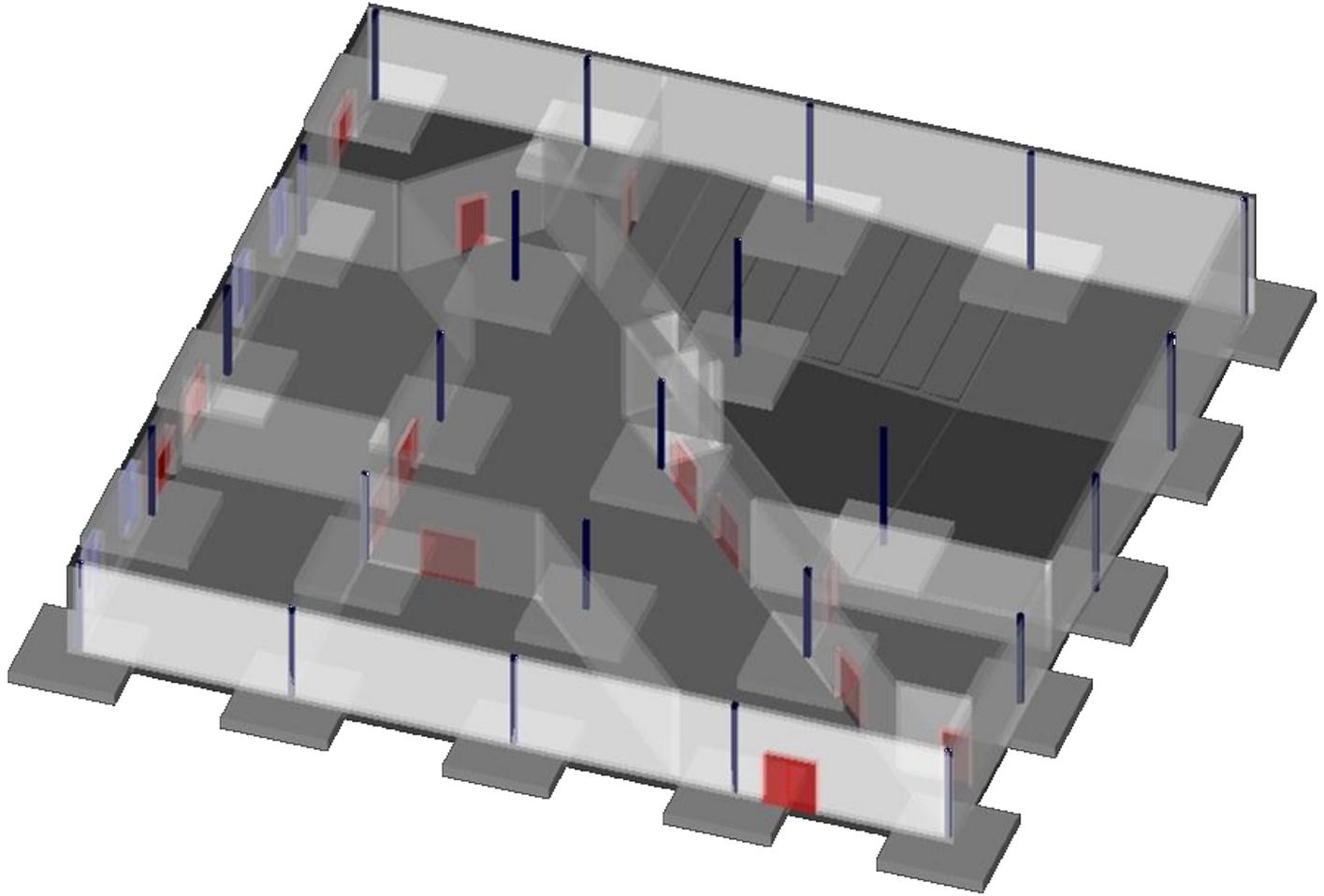


structural system decisions

- ConXR
 - HSS 8x8x3/8 Columns
 - with 115 pcf LW concrete
- lateral system
 - ConXtech moment frames
- floor system
 - full composite action between slab and beams
 - cast in place concrete on metal deck

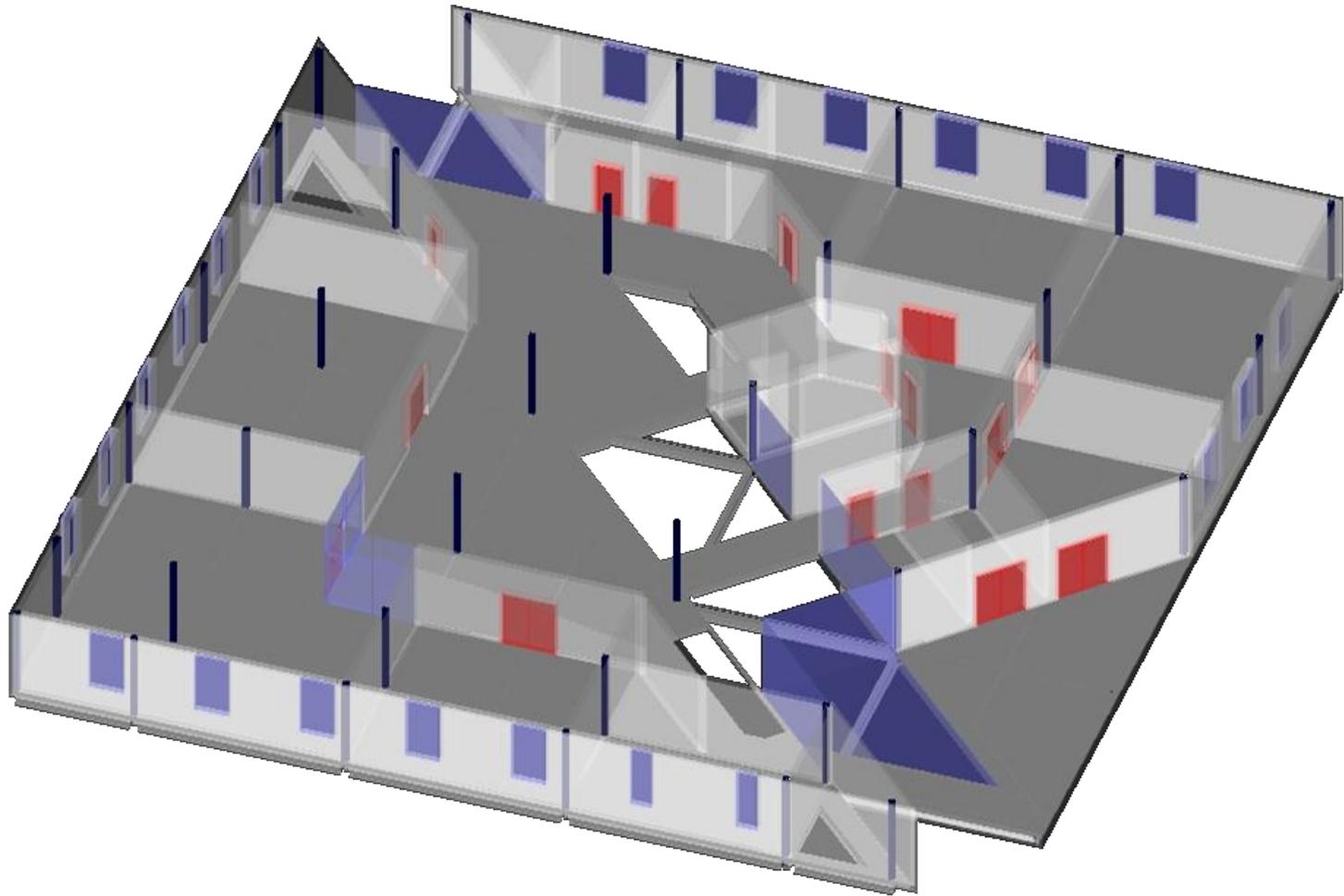


basement grid



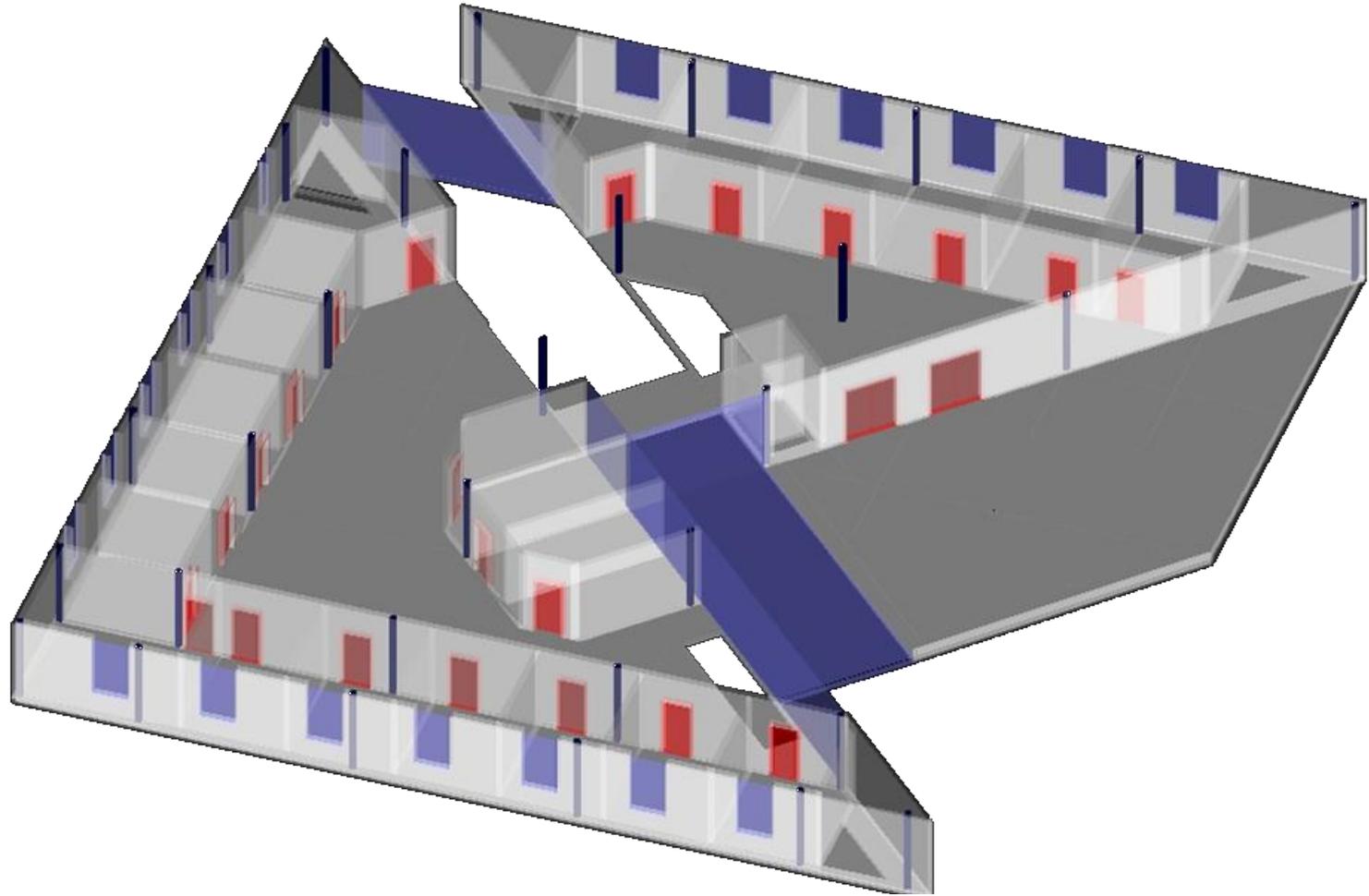
mary shanie victoria dustin milosz michael raleigh express team

first floor grid



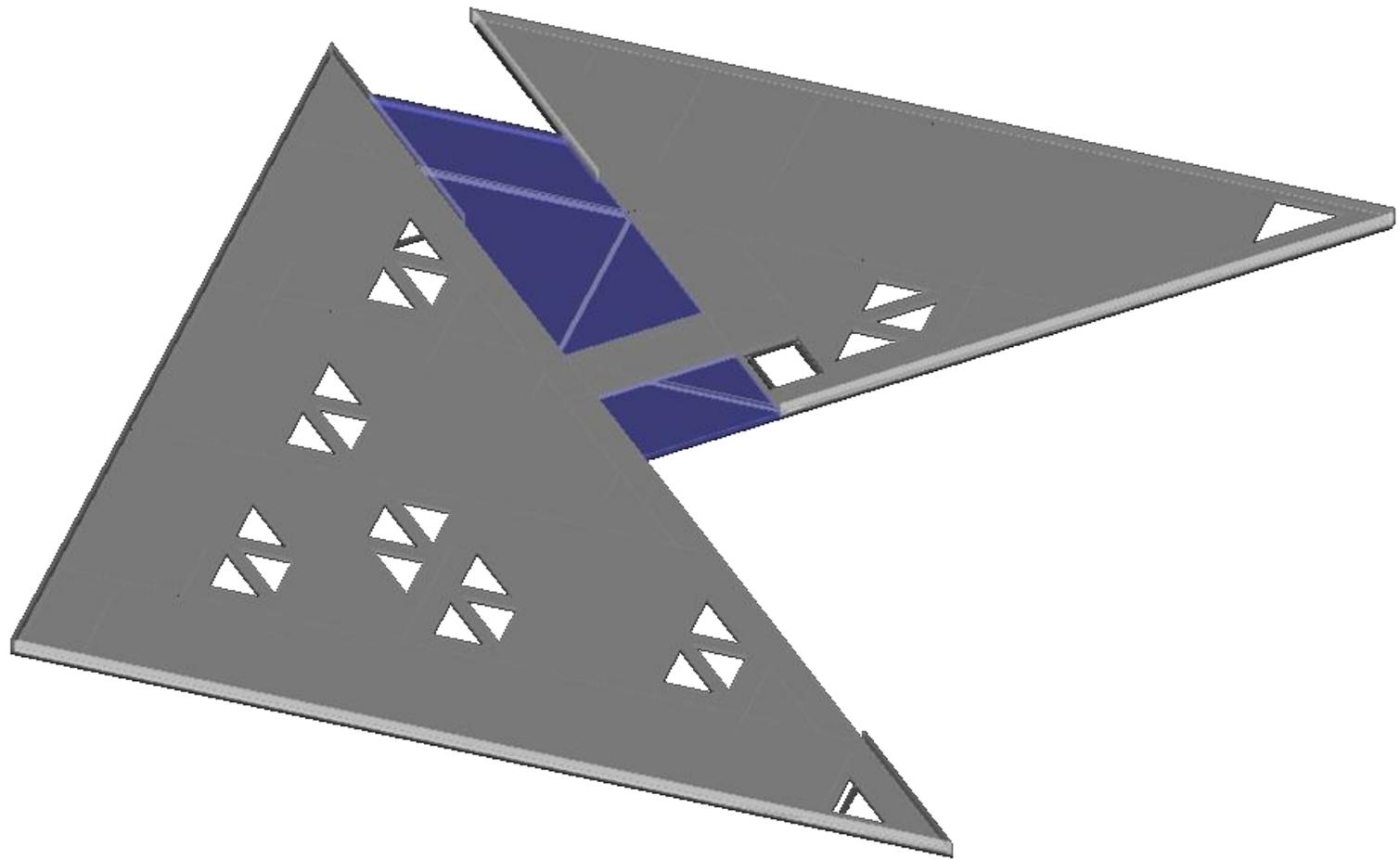
mary shanie victoria dustin milosz michael raleigh express team

second floor grid



mary shanie victoria dustin milosz michael raleigh express team

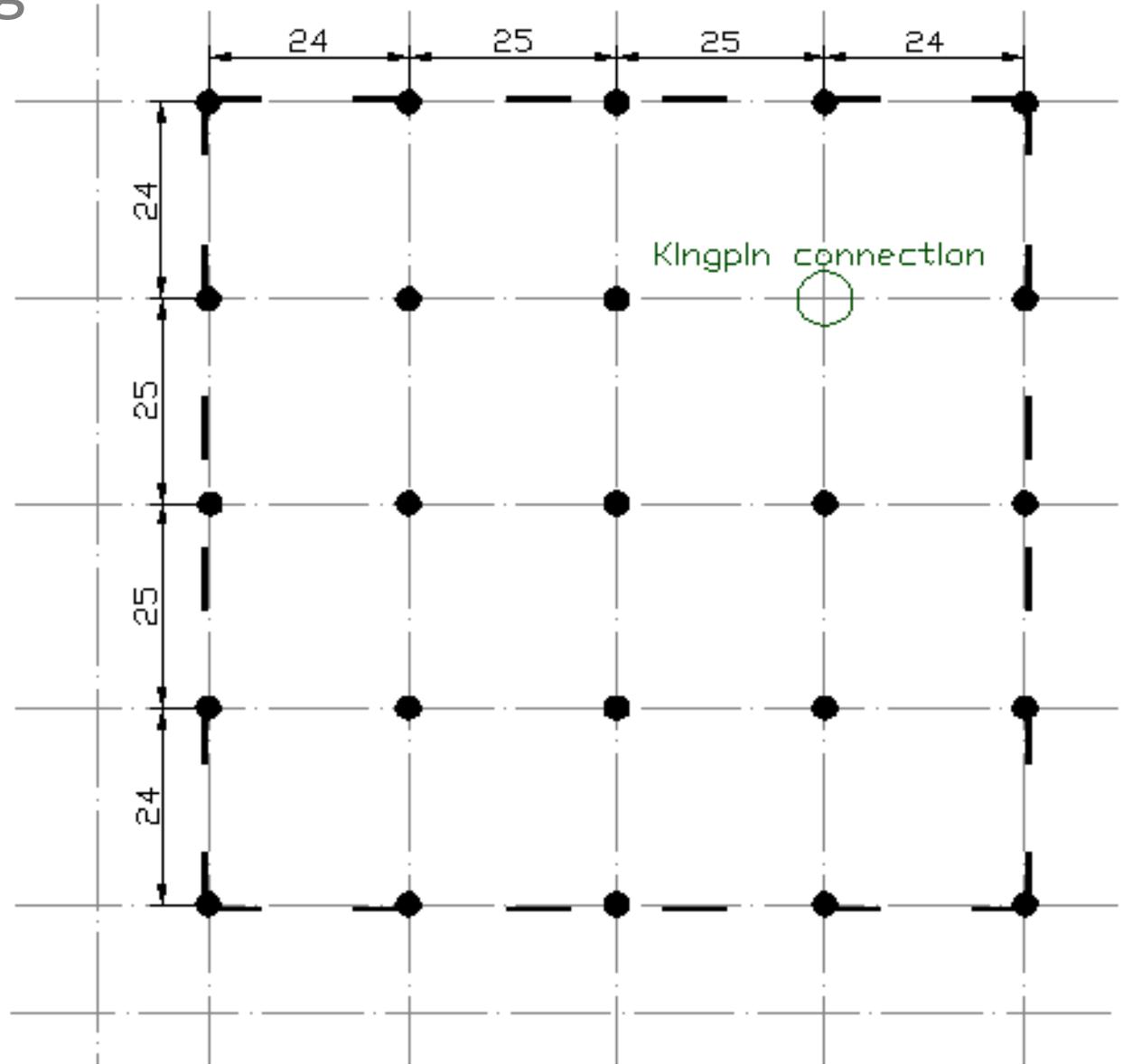
roof grid



mary shanie victoria dustin milosz michael raleigh express team

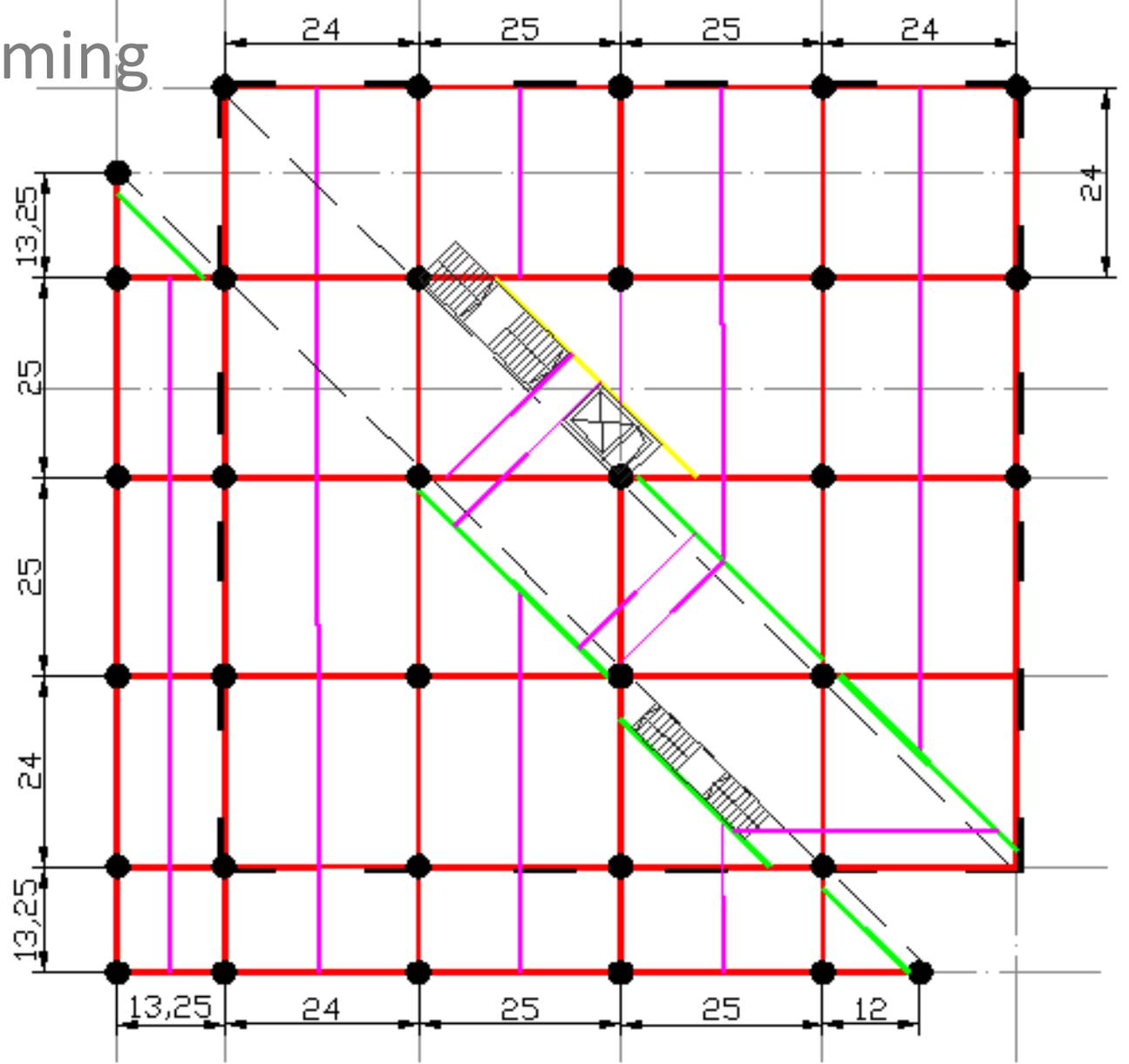
first floor framing

HSS 8x8x3/8"
lightweight
concrete filled
(115 pcf)



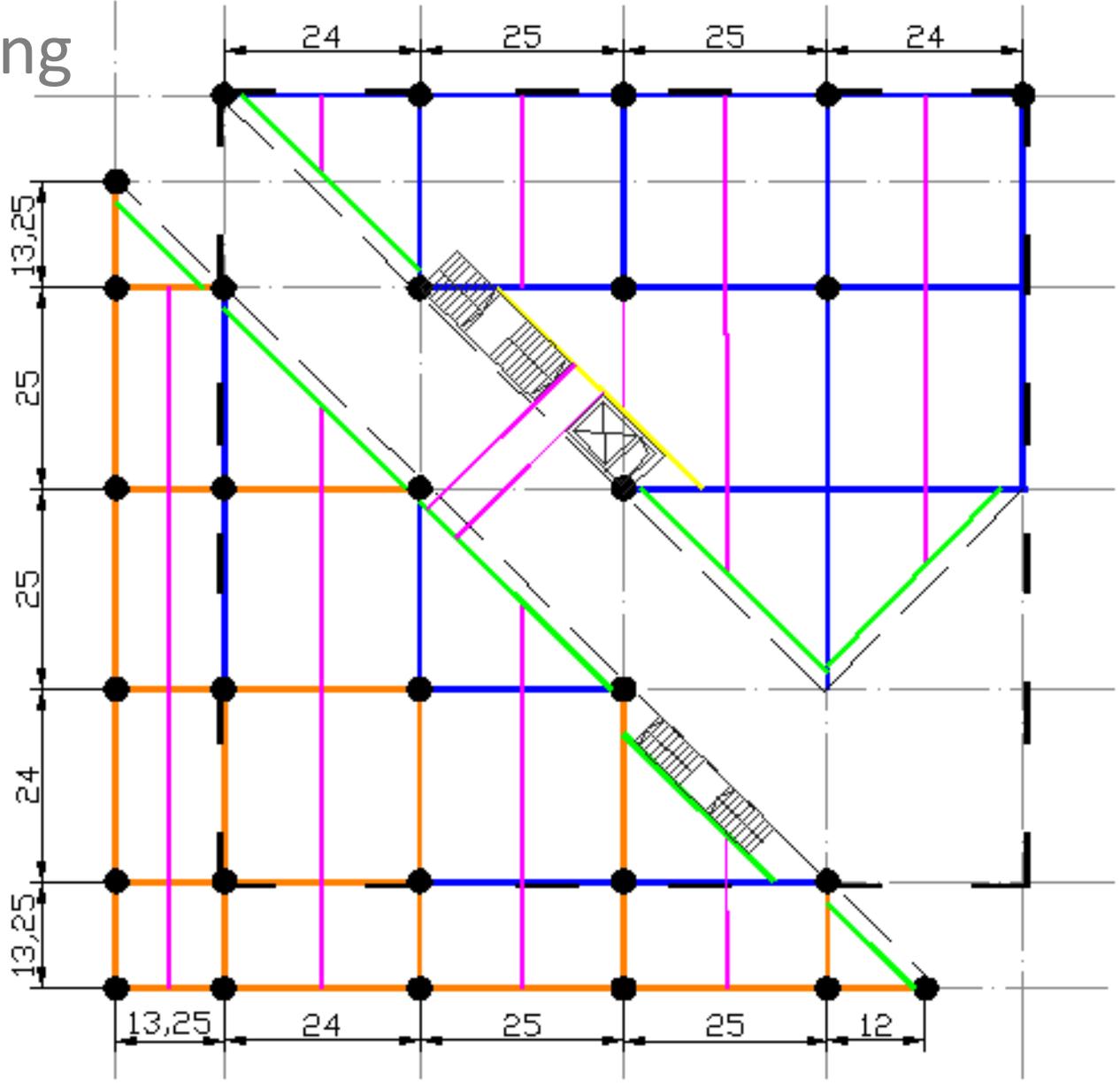
second floor framing

- W16x77
- W14x38
- W14x38
- W16x45



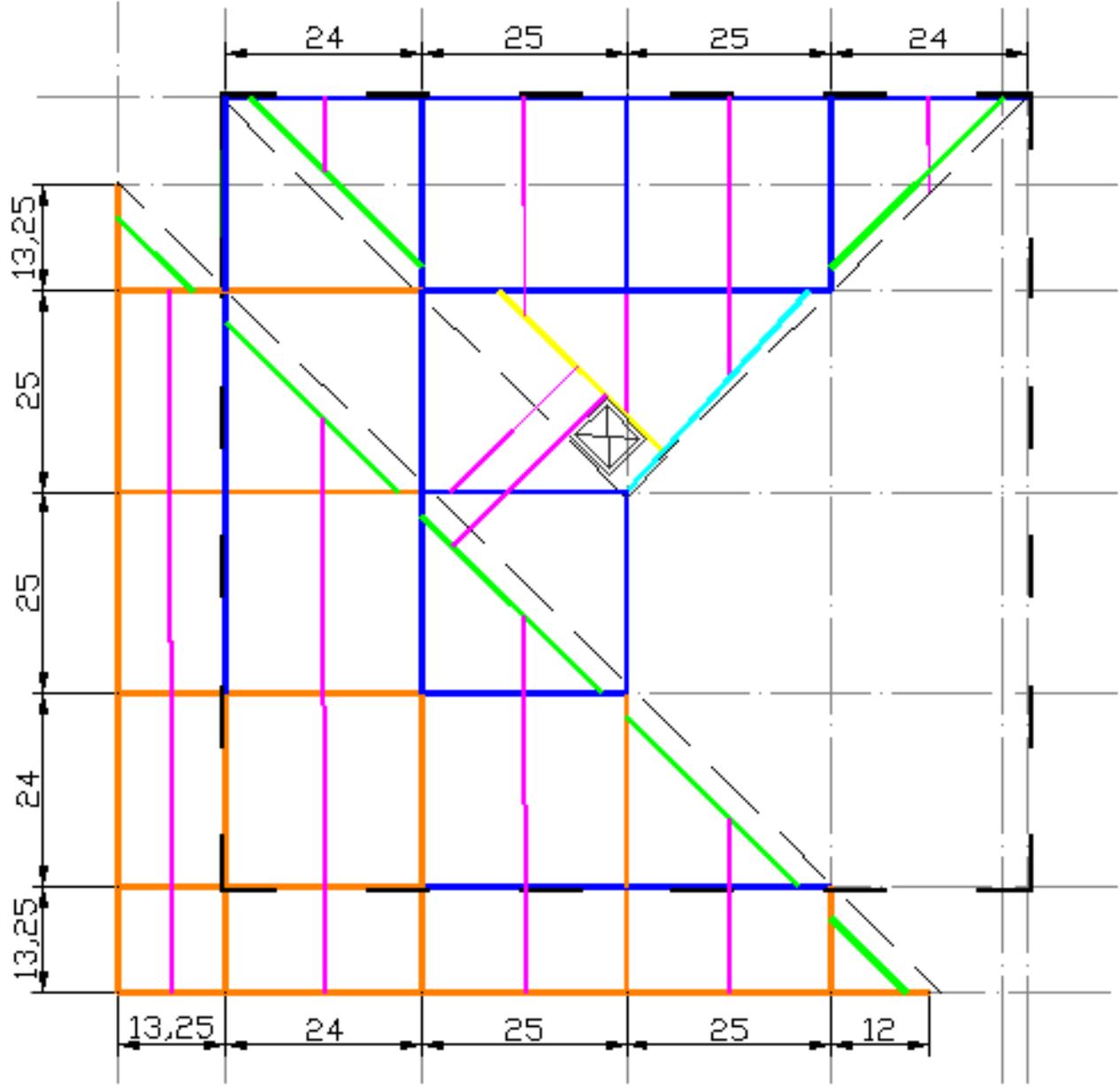
third floor framing

- W16x67
- W14x38
- W14x38
- W16x45
- W14x34

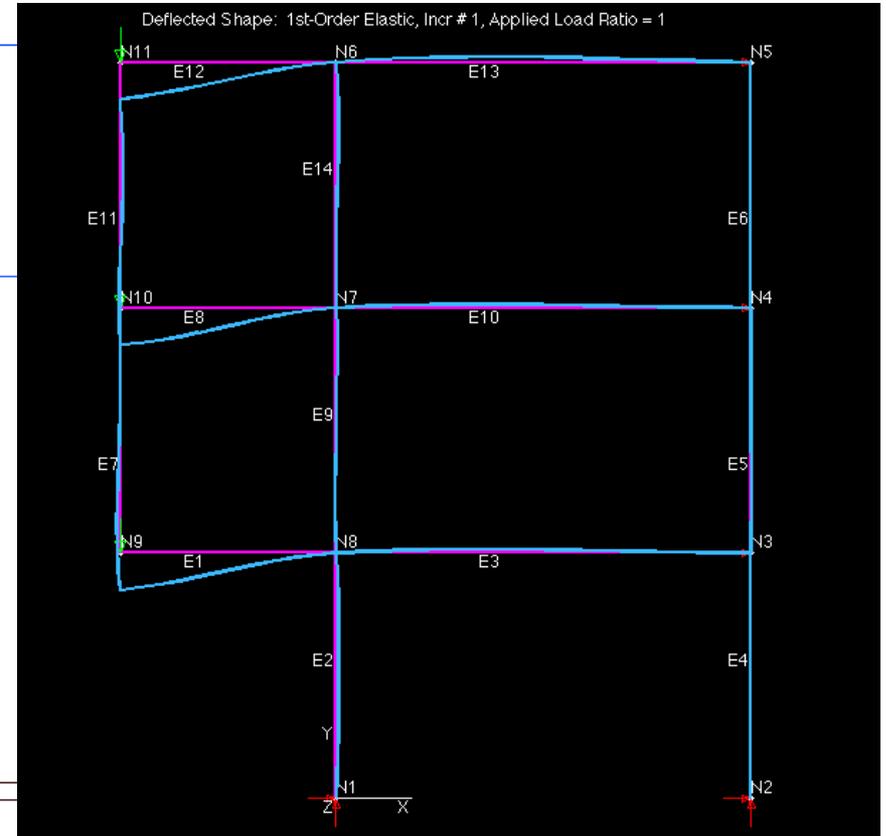
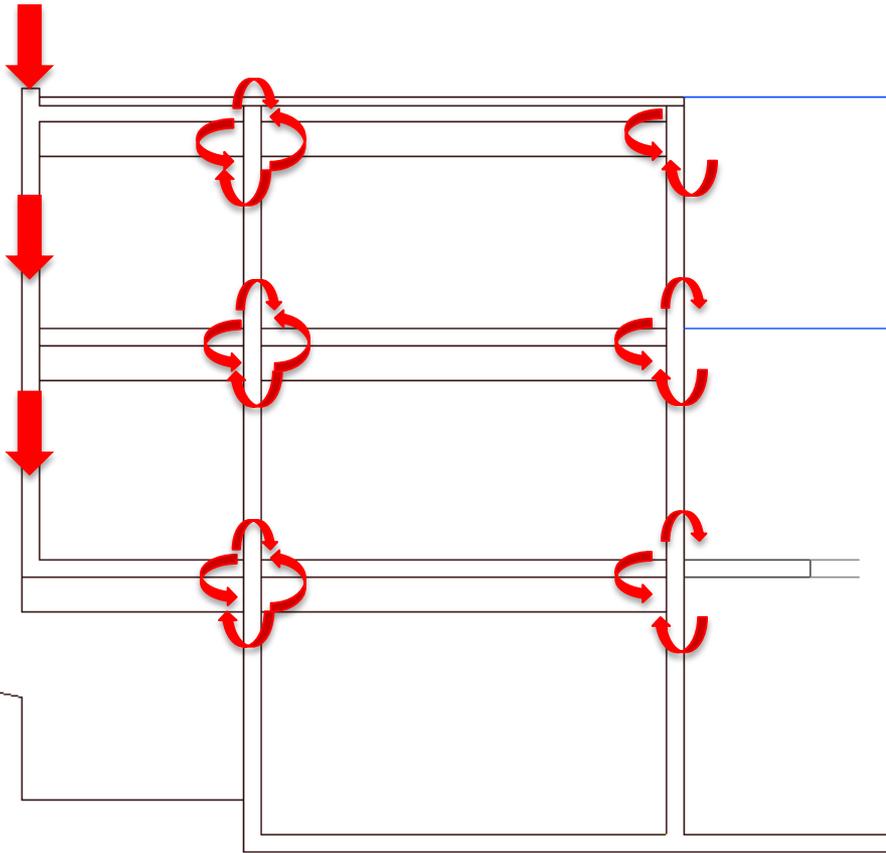


roof framing

-  W16x67
-  W14x38
-  W14x38
-  W16x45
-  W14x34



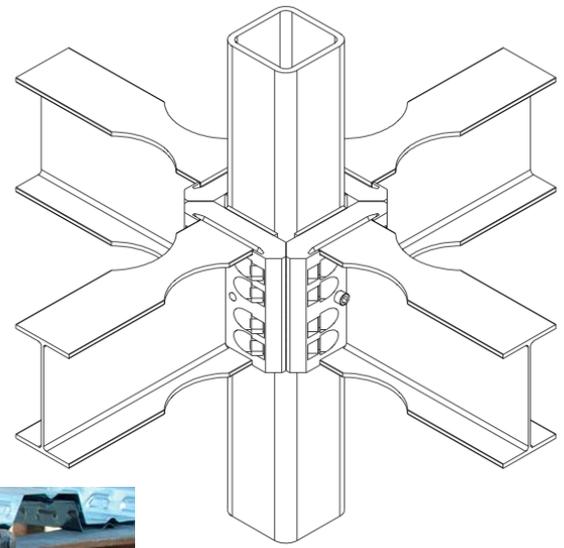
cantilever design



structural system for cantilever

bringing cantilever forces inside

- use two-way moment frames to bring the forces into the building

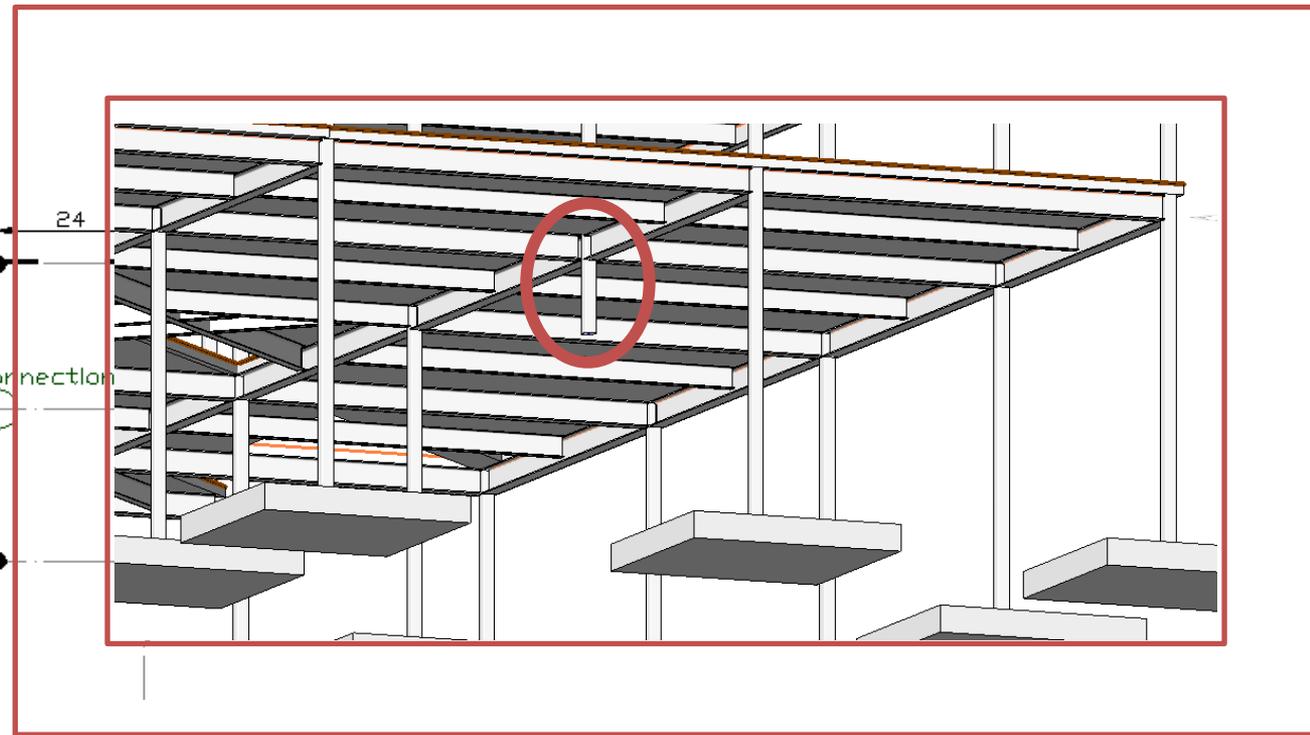
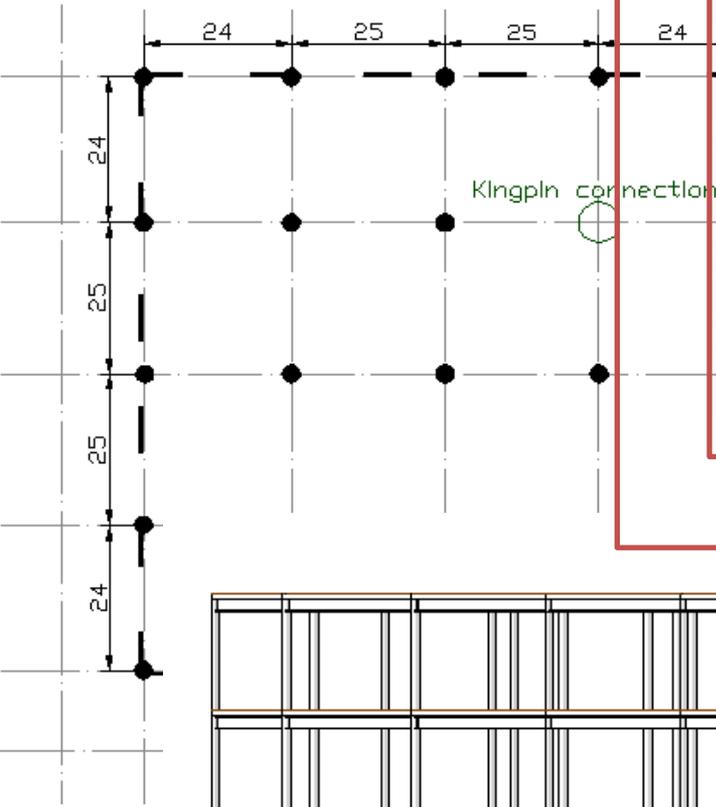


W16x67

HSS 8x8x3/8 filled with 115 pcf LW concrete

mary shanie victoria dustin milosz michael raleigh express team

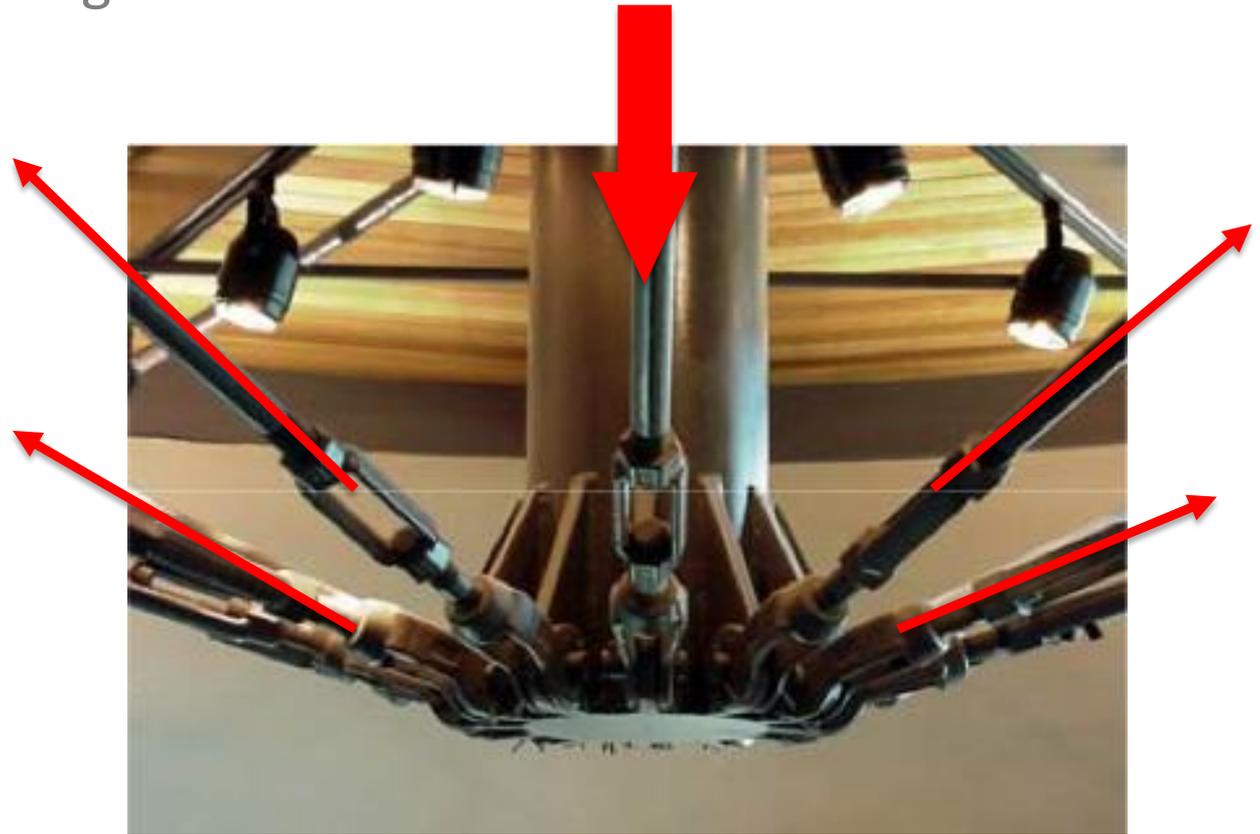
king pin truss



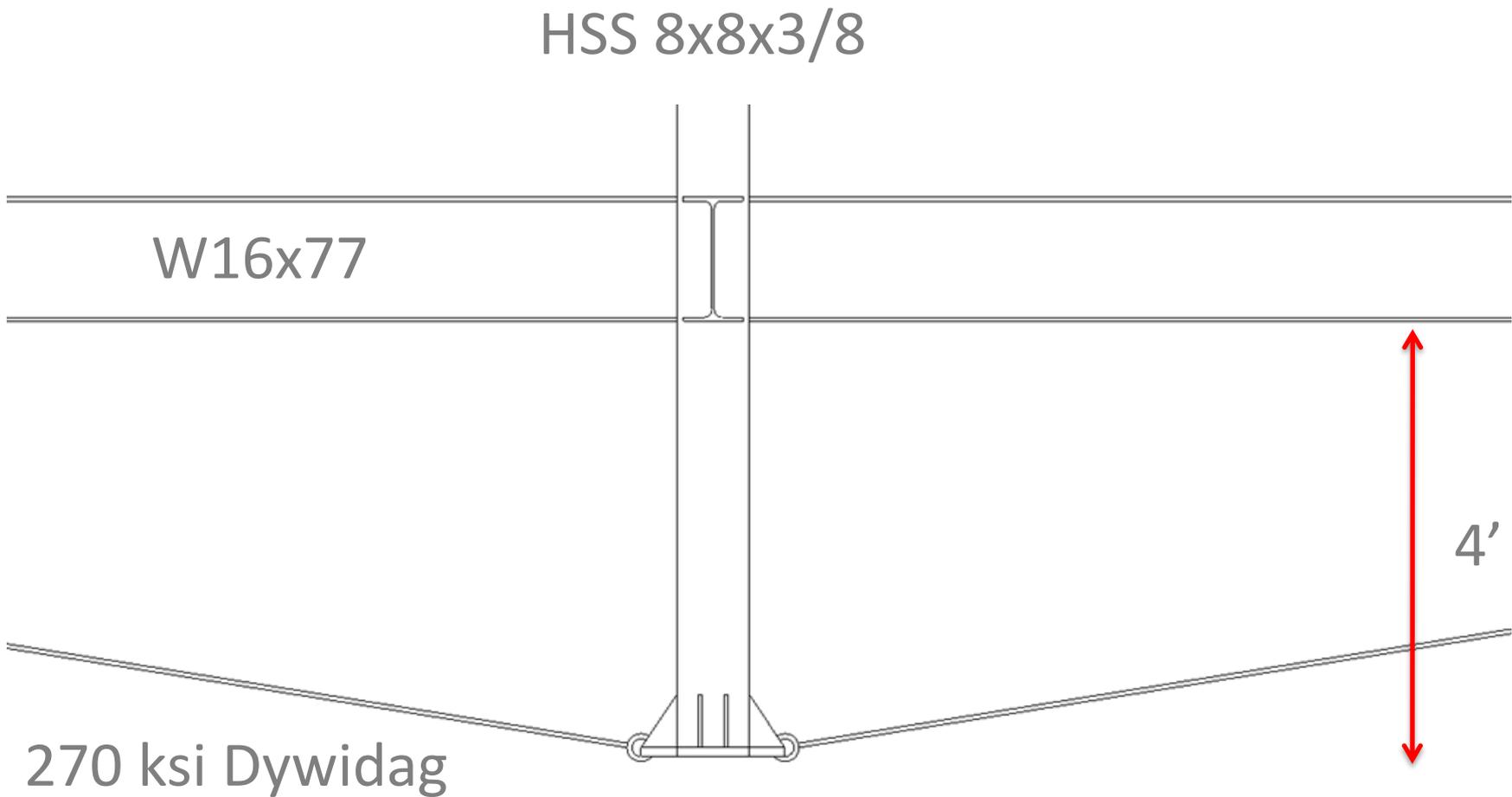
king pin truss

to provide columns above the auditorium

- HSS 8x8x3/8 column
- 270 ksi dywidag bars

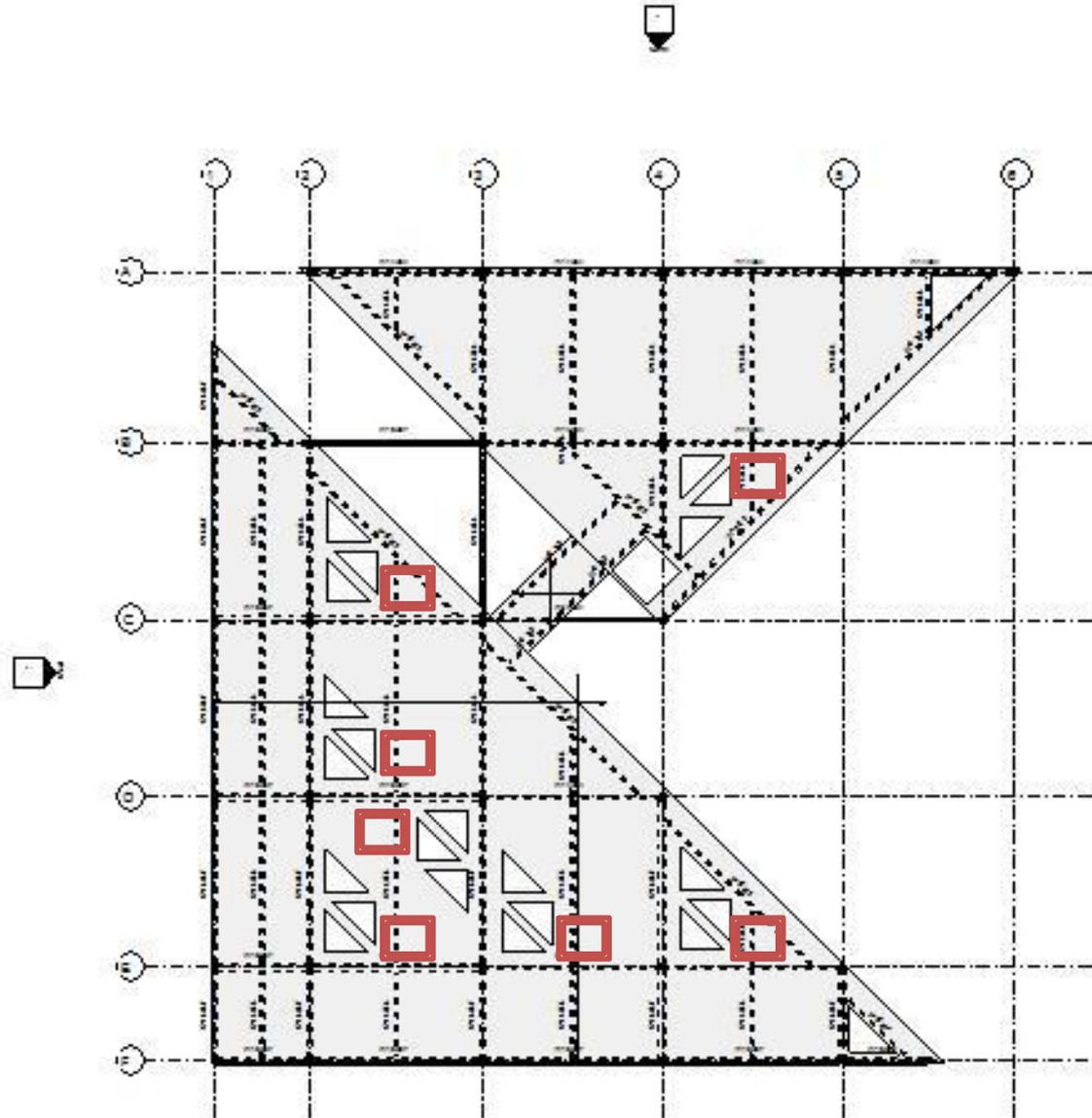


king pin truss – detail

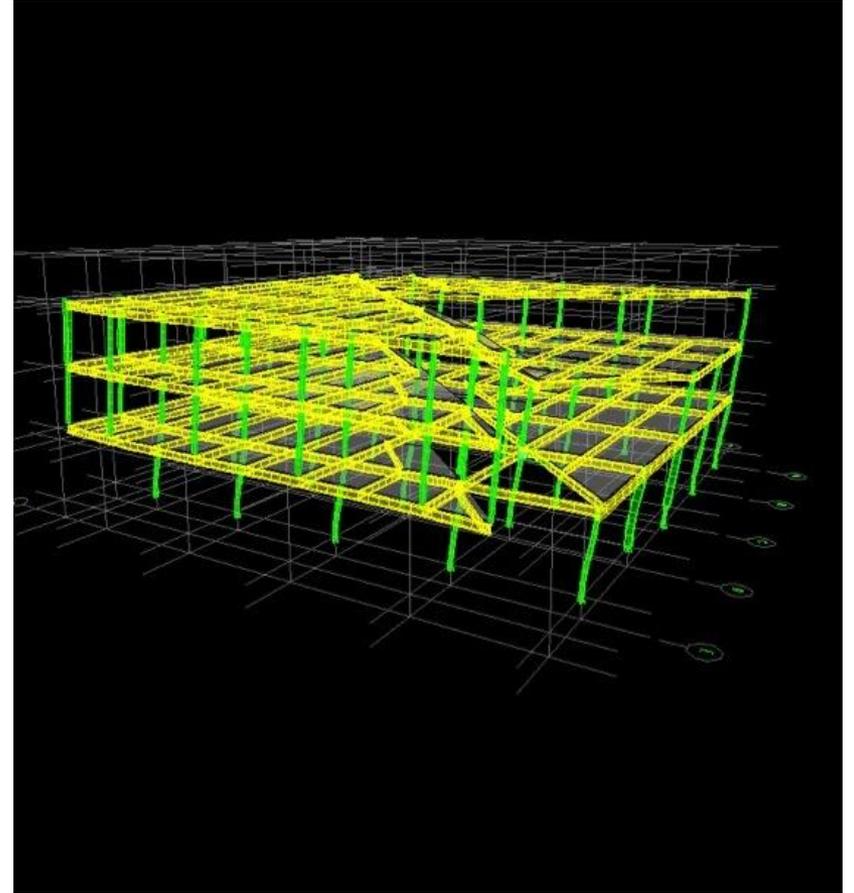
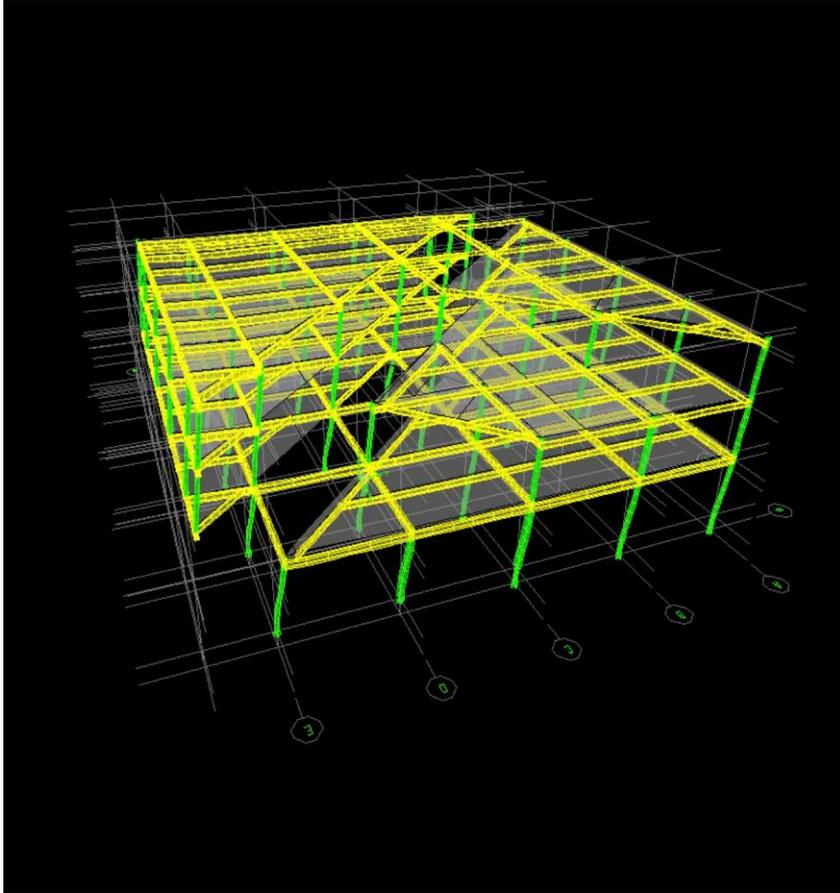


clash detection

- slab cuts and moment frame interference
- skylights on roof



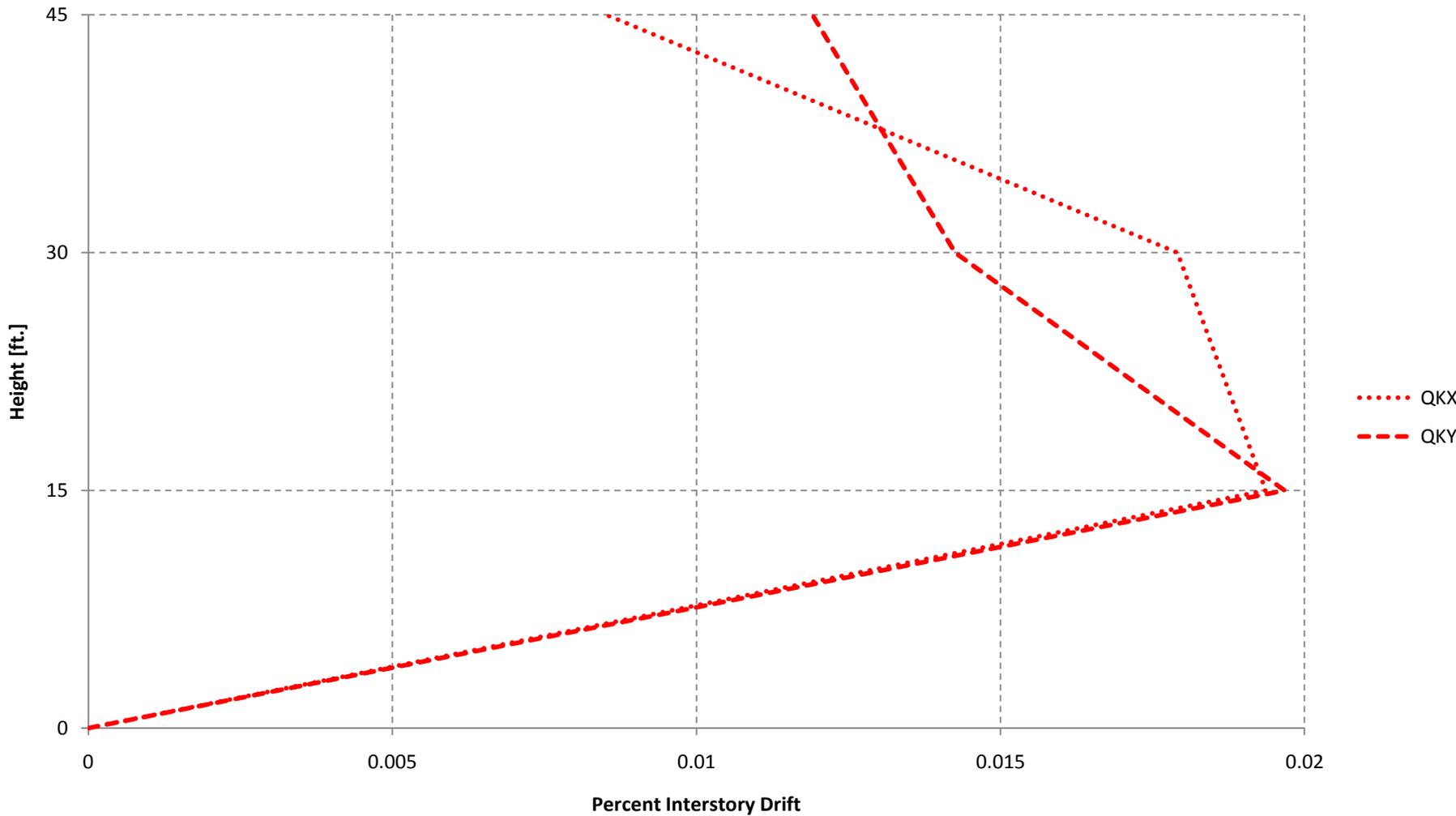
ETABS model verification and optimization



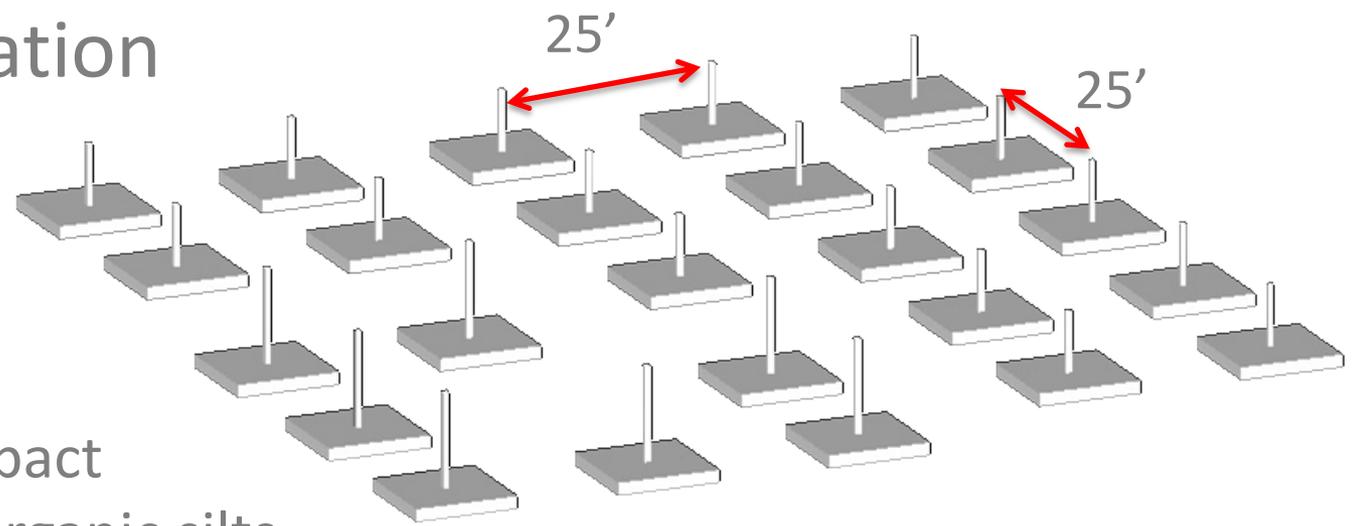
mary shanie victoria dustin milosz michael raleigh express team

ETABS model verification and optimization

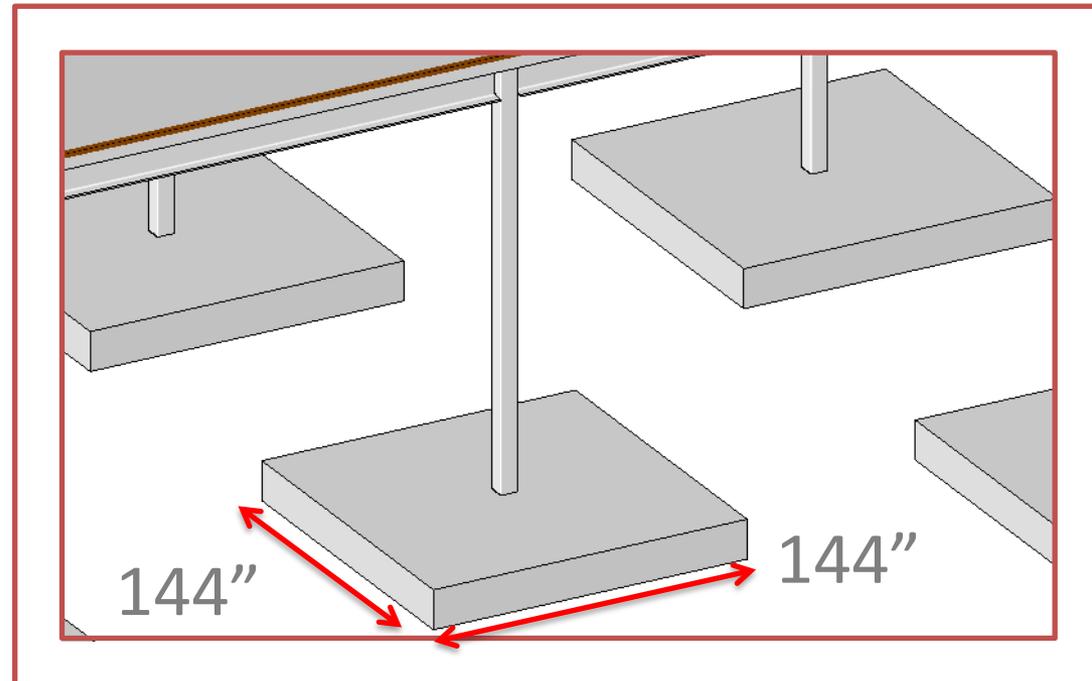
IDR



soil and foundation

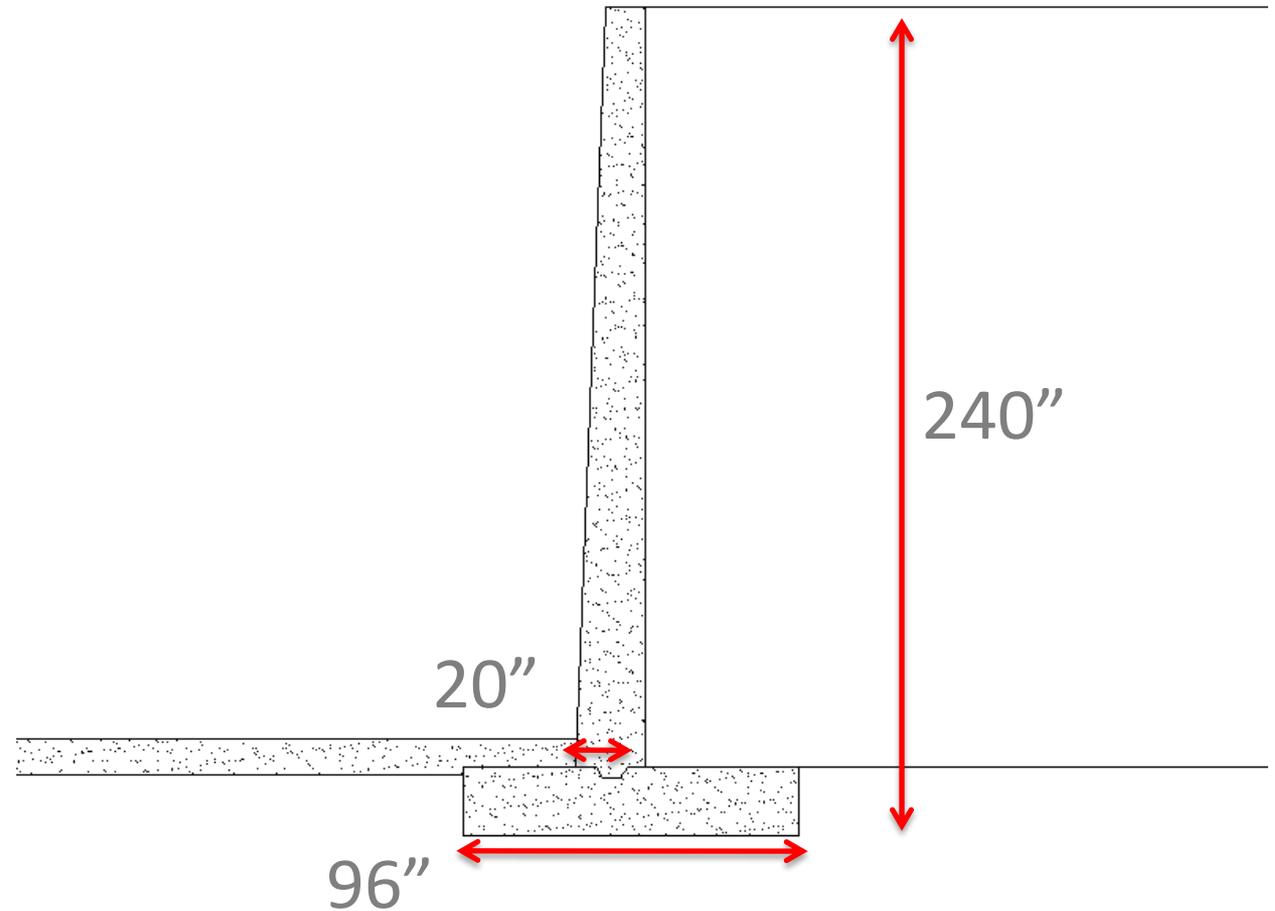


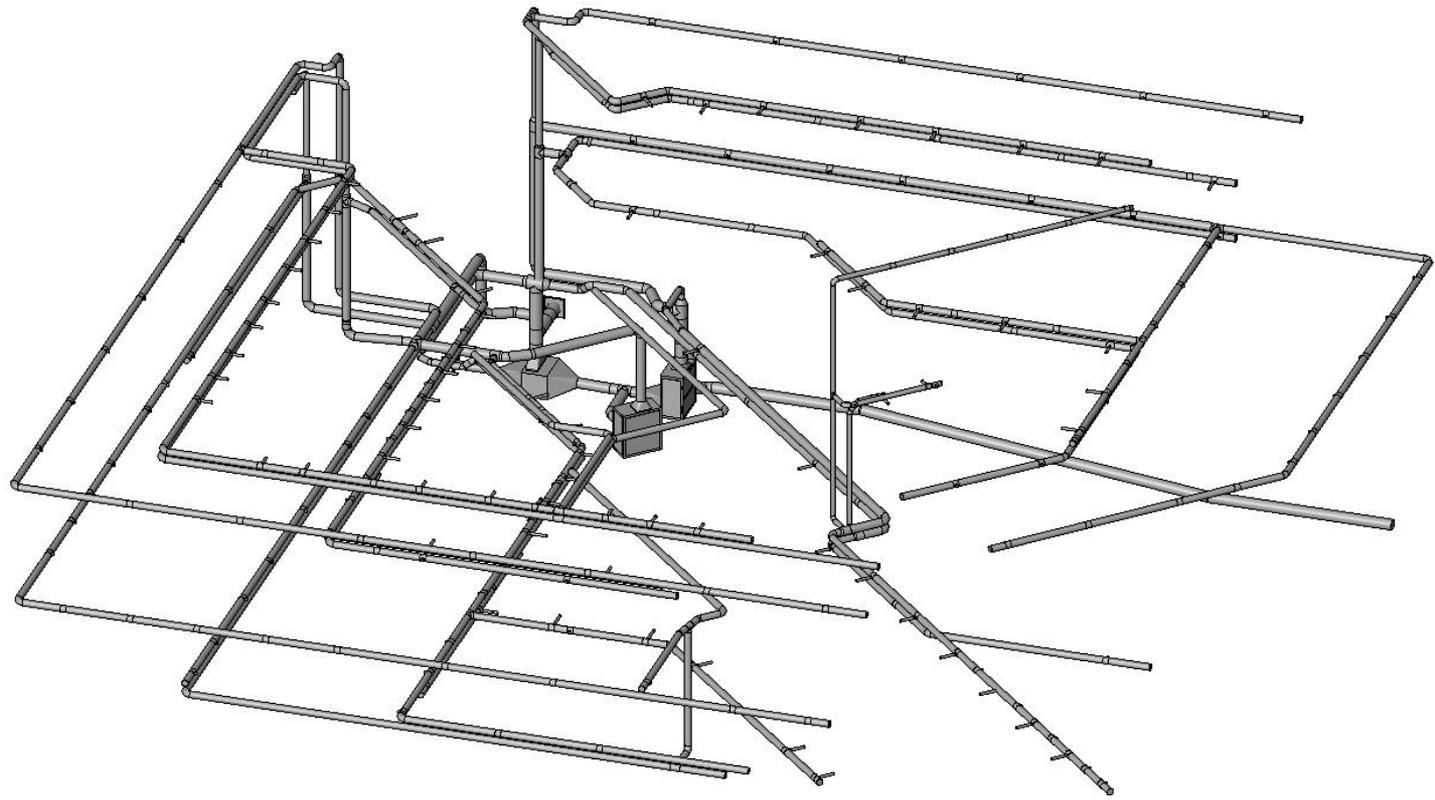
- soil conditions
 - medium compact sands and inorganic silts
 - 4 ksf bearing capacity
 - deep groundwater
- foundation selection:
square footing foundation
12' x 12' x 18"



retaining wall

- cantilever retaining wall designed to DM7

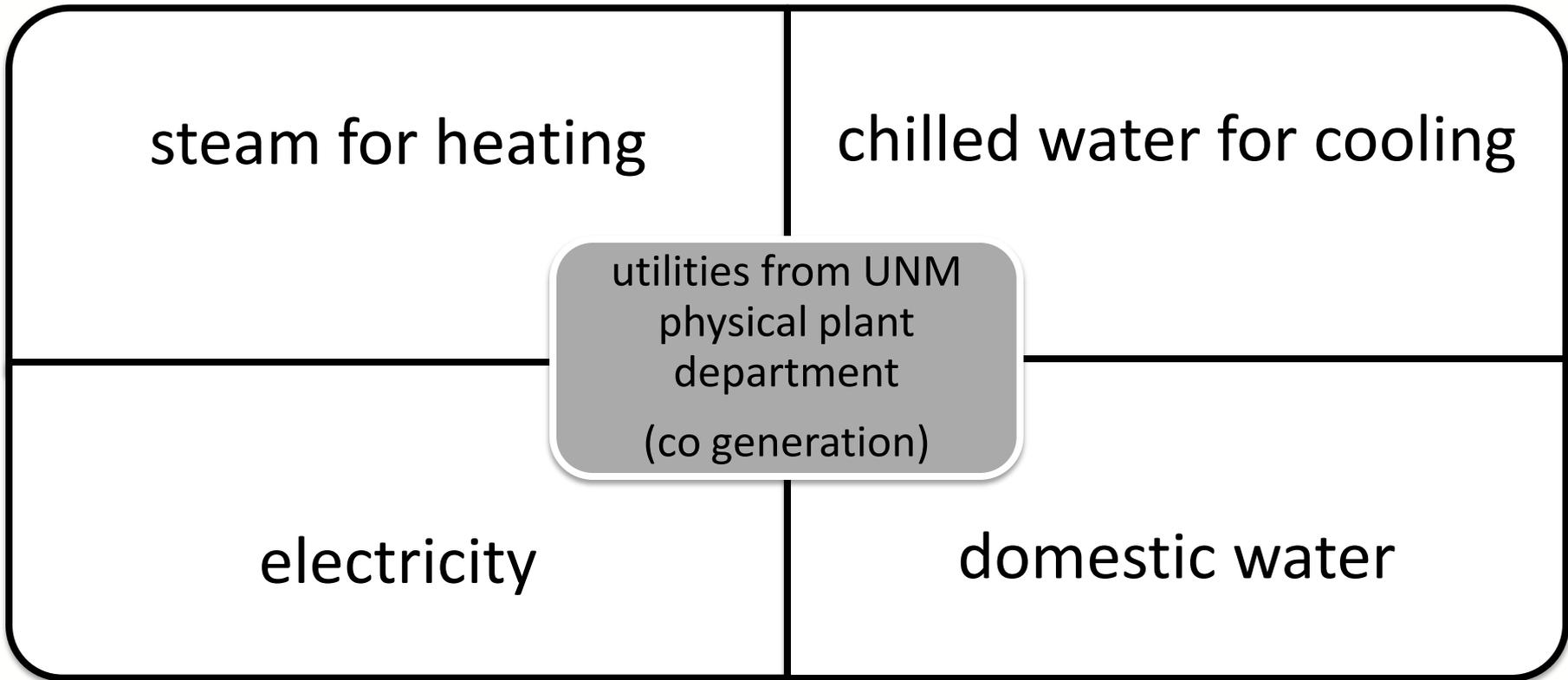




mechanical, electrical & plumbing

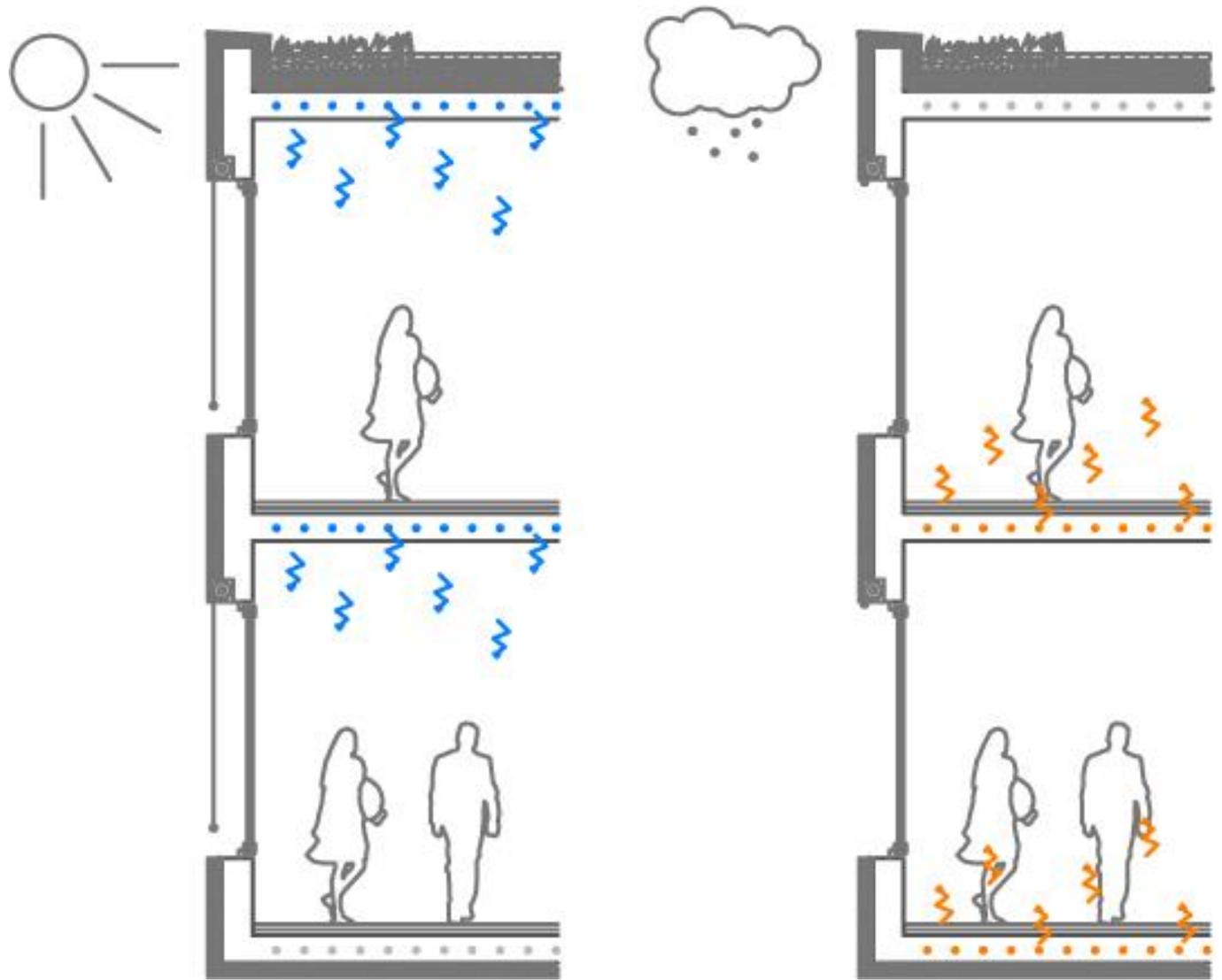
mary shanie victoria dustin milosz michael raleigh express team

utilities



Allows the building to be constructed without individual boiler and HVAC units

radiant heating and cooling



advantages

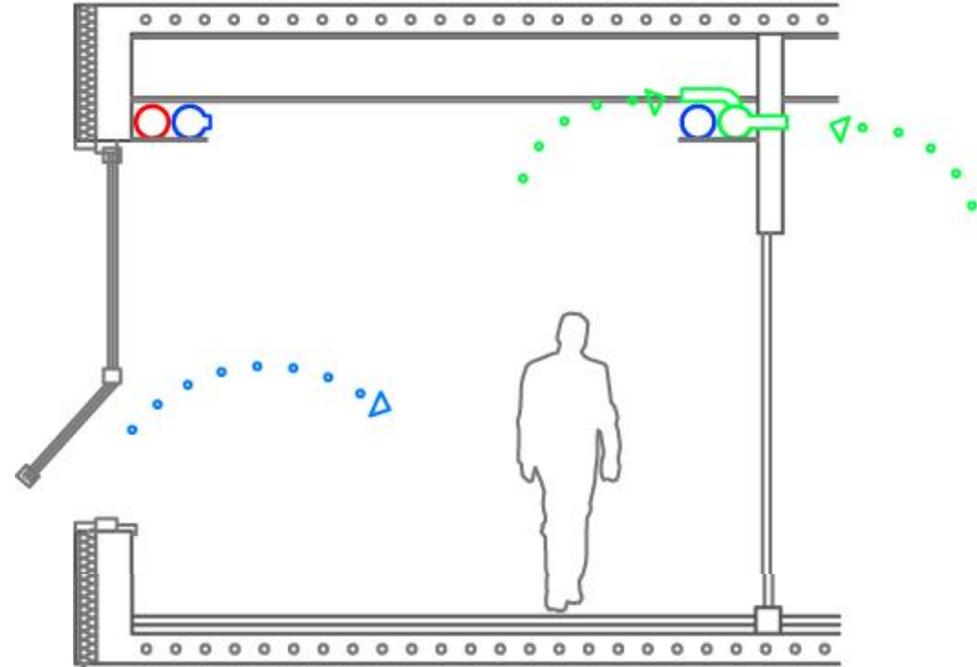
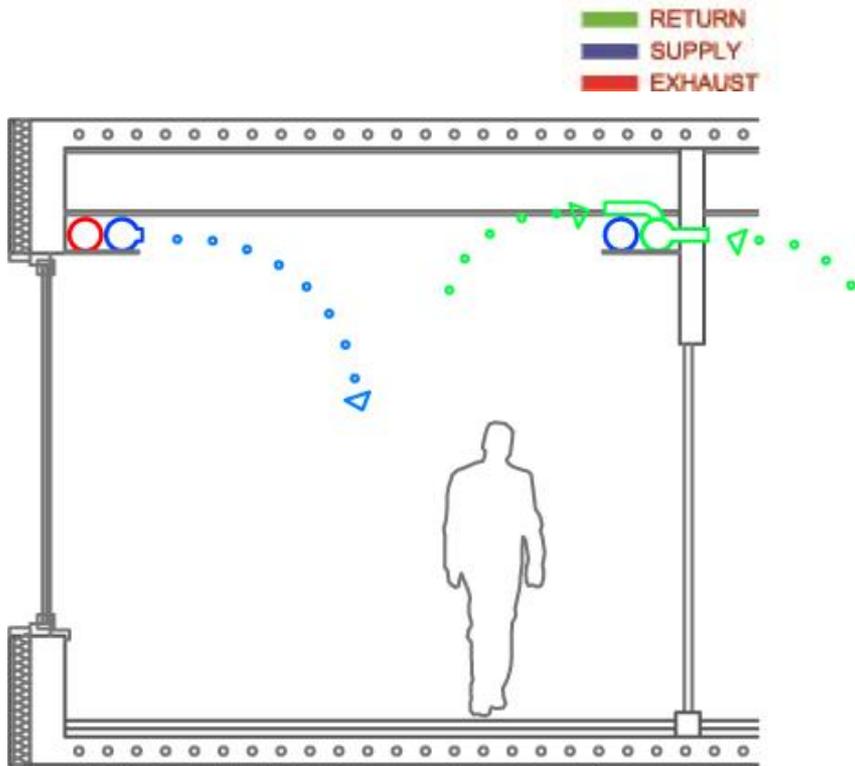
free use of space

no cleaning

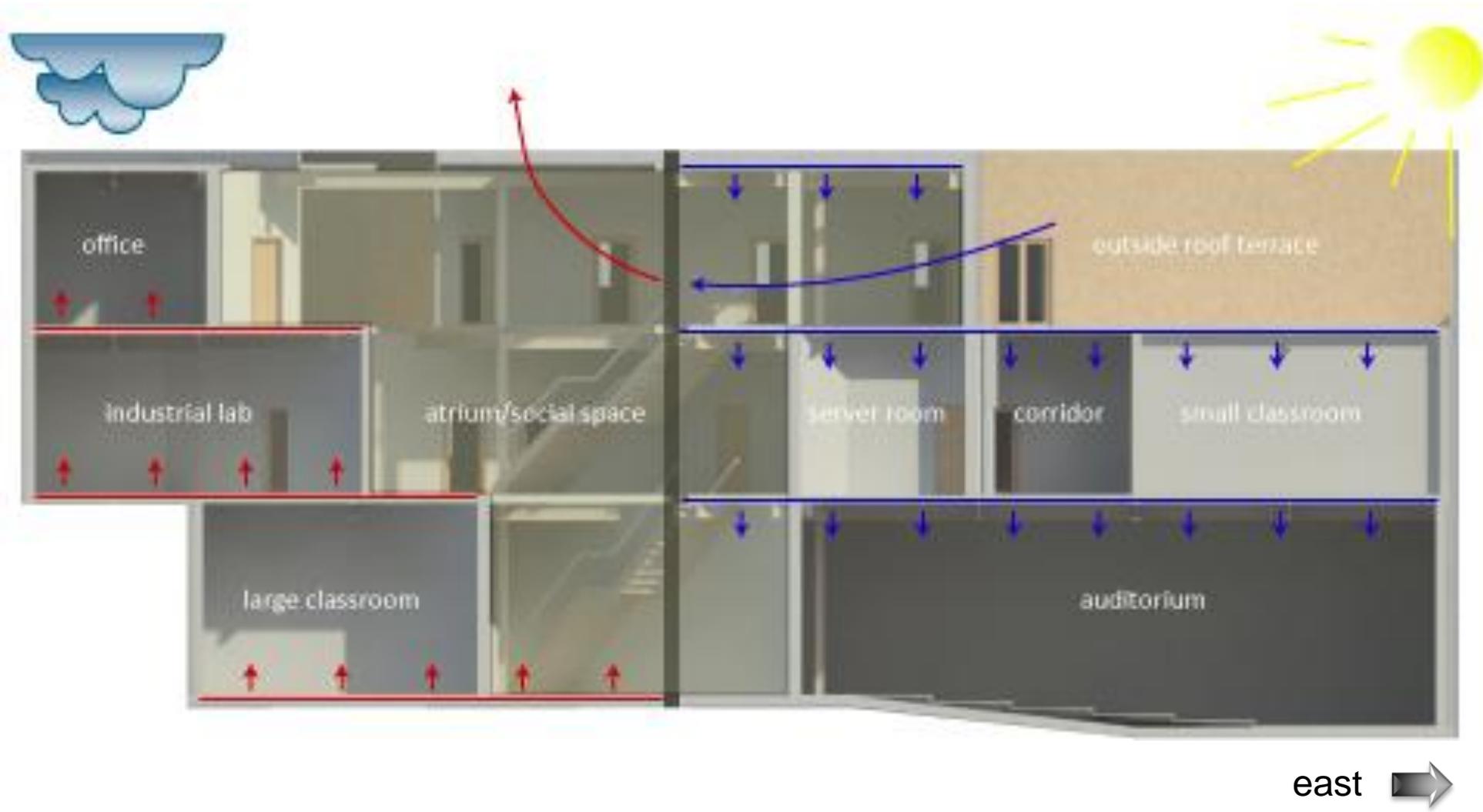
comfort

low energy

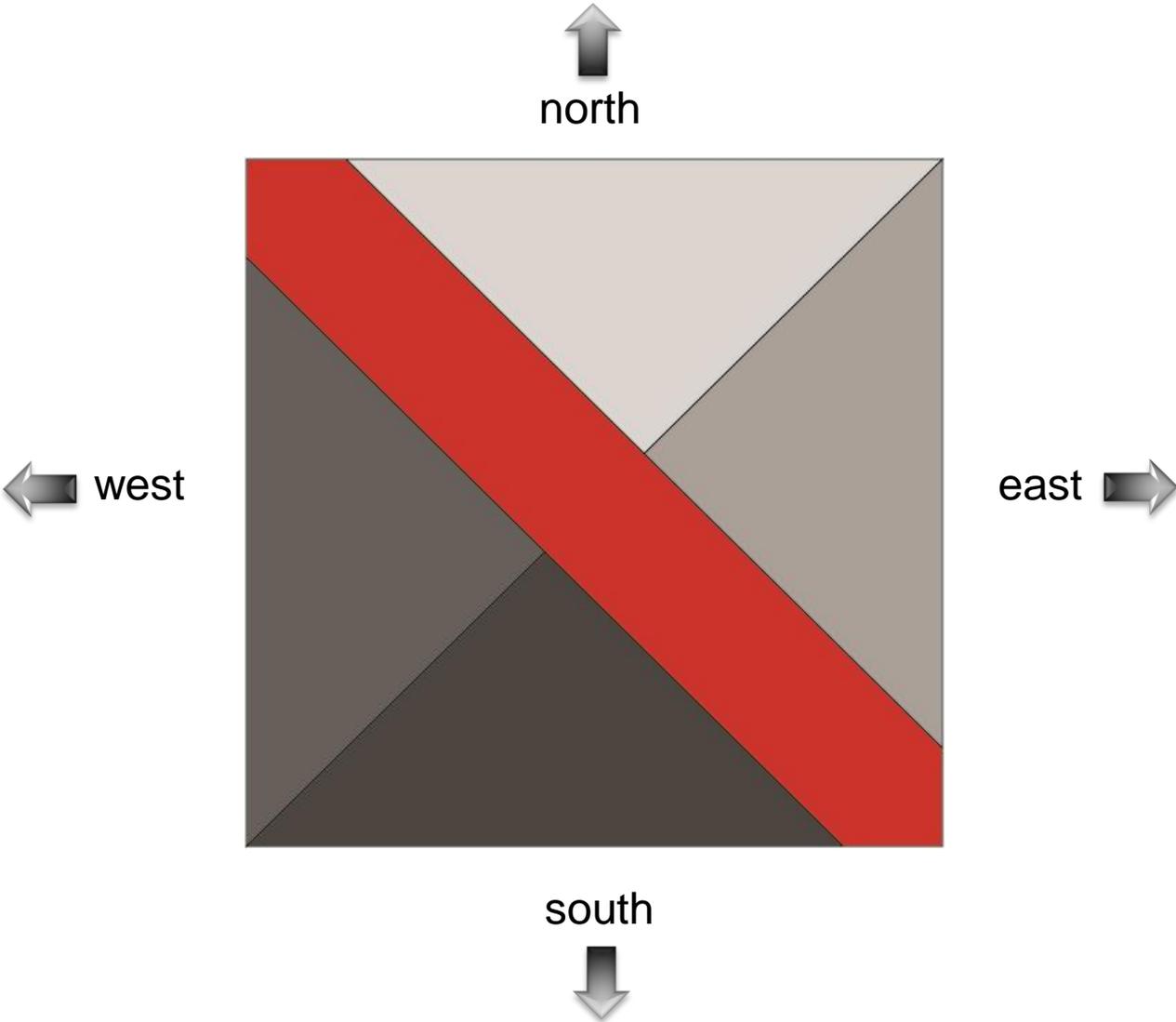
ventilation



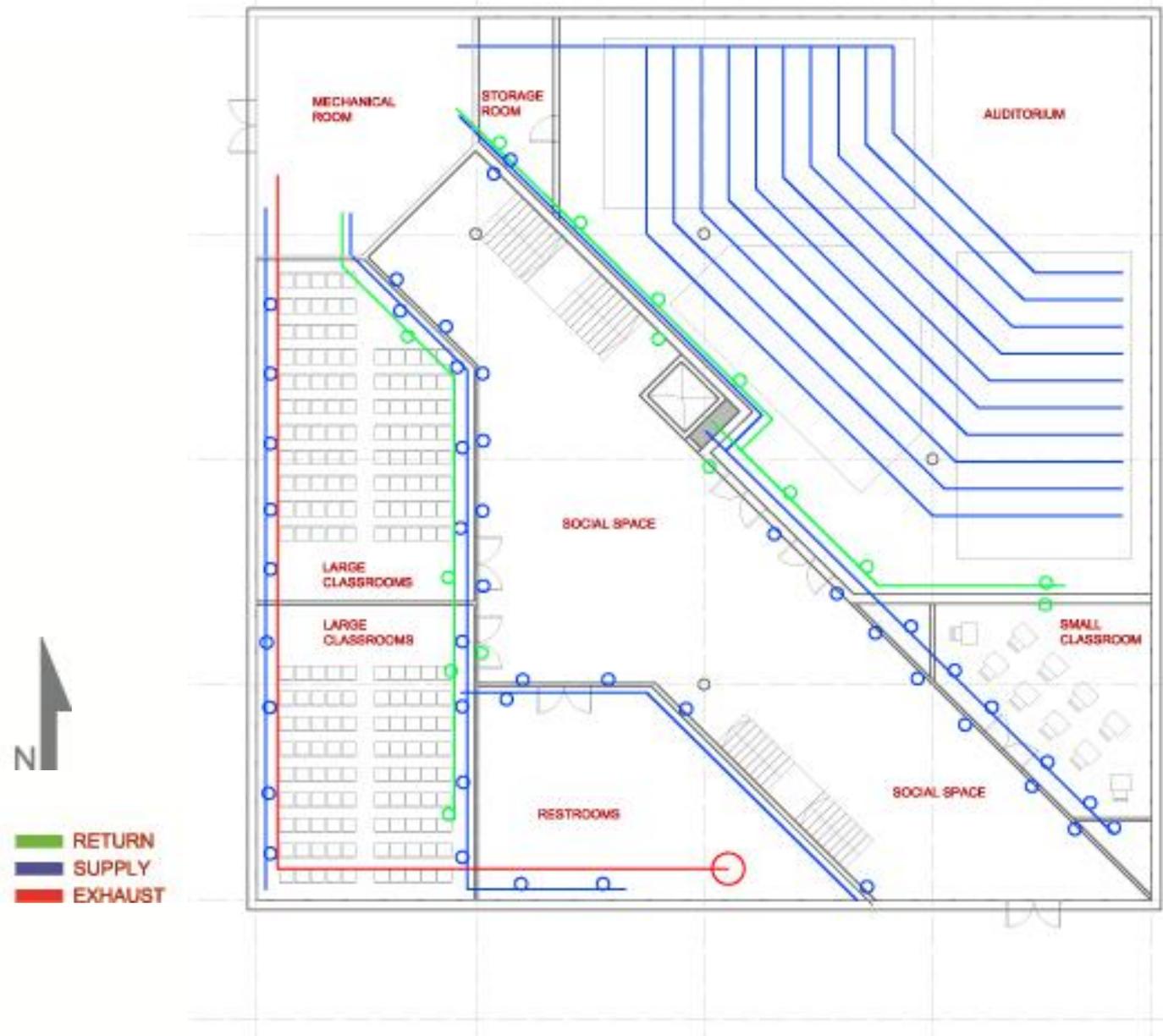
radiant heating and cooling



climate zones: independent control



1st floor plan ventilation



2nd floor plan ventilation



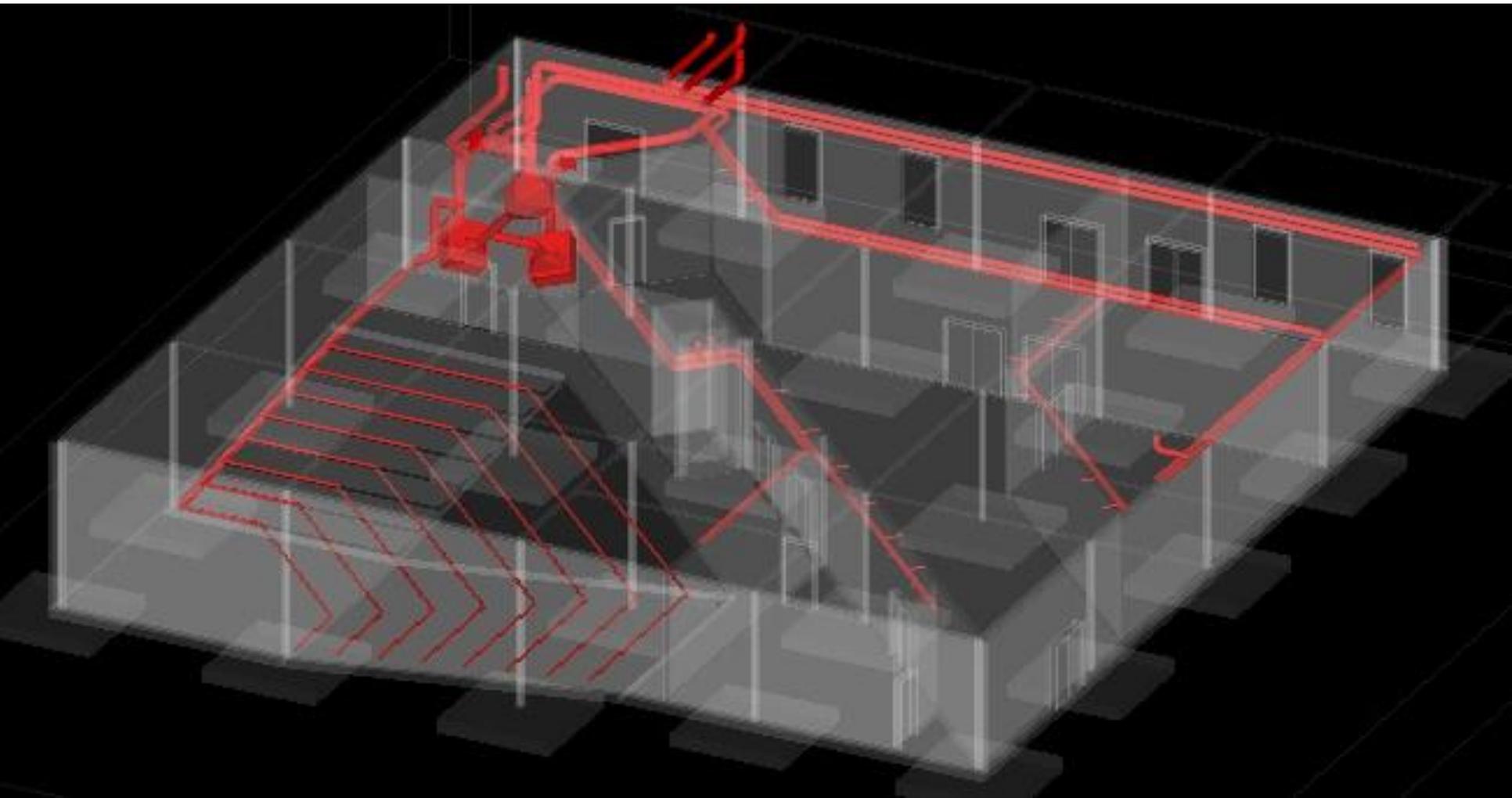
mary shanie victoria dustin milosz michael raleigh express team

3rd floor plan ventilation



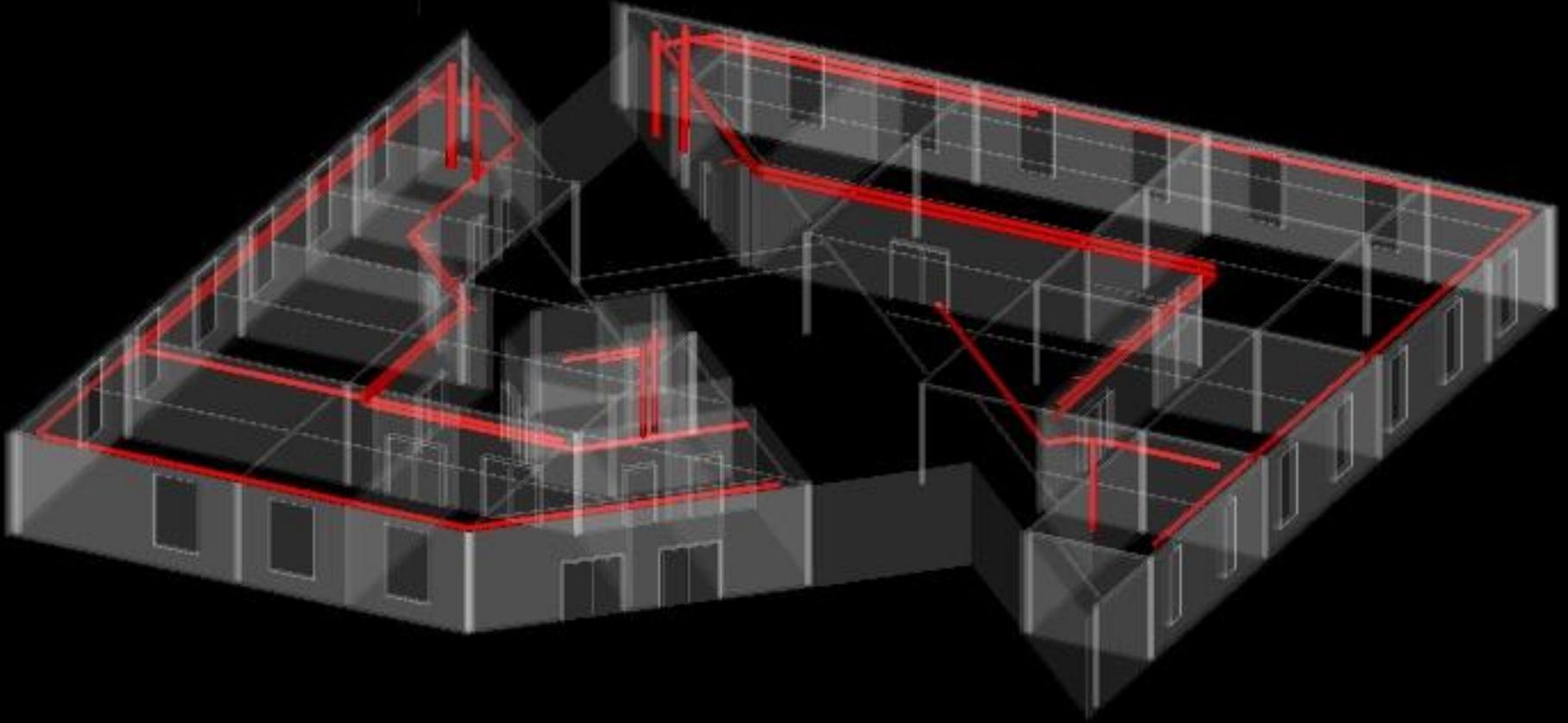
mary shanie victoria dustin milosz michael raleigh express team

3D ventilation system



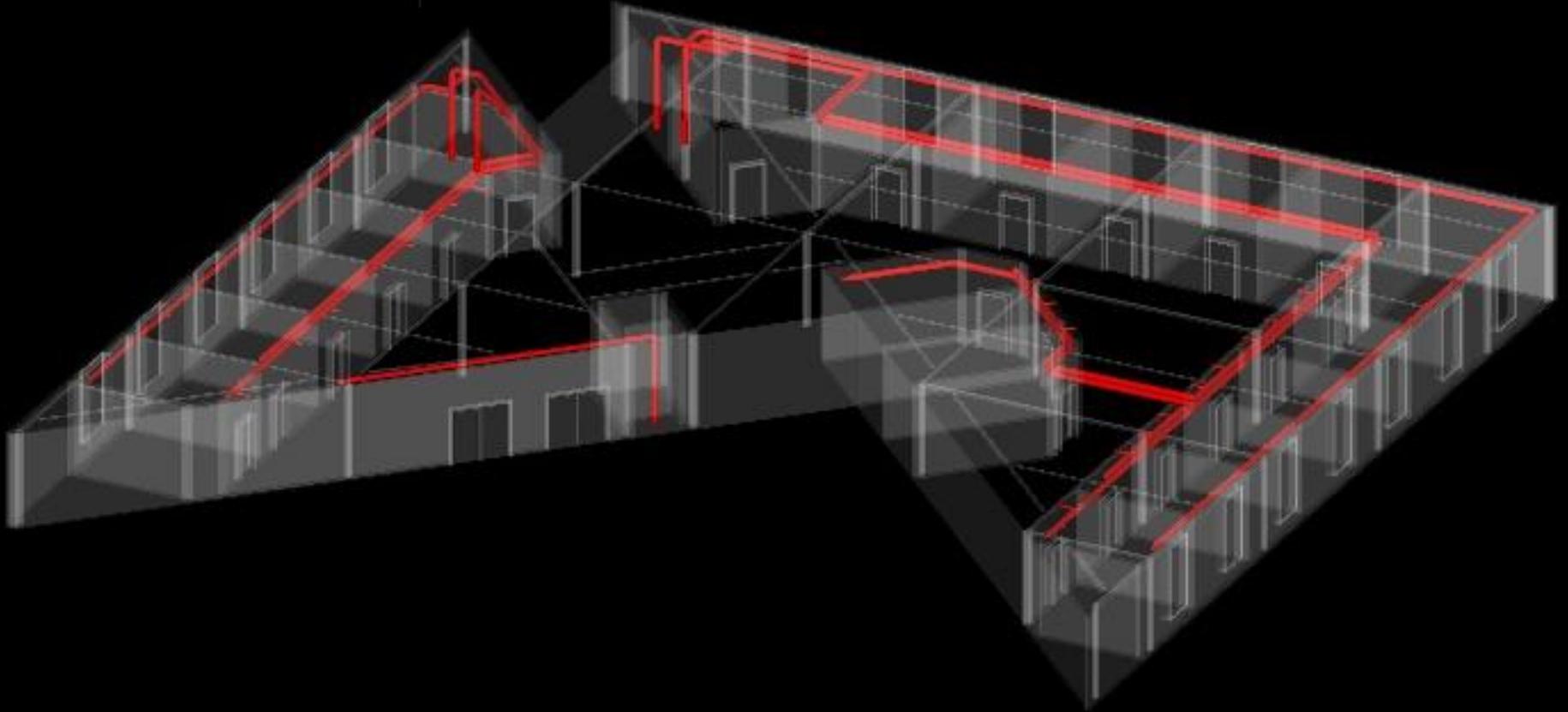
mary shanie victoria dustin milosz michael raleigh express team

3D ventilation system



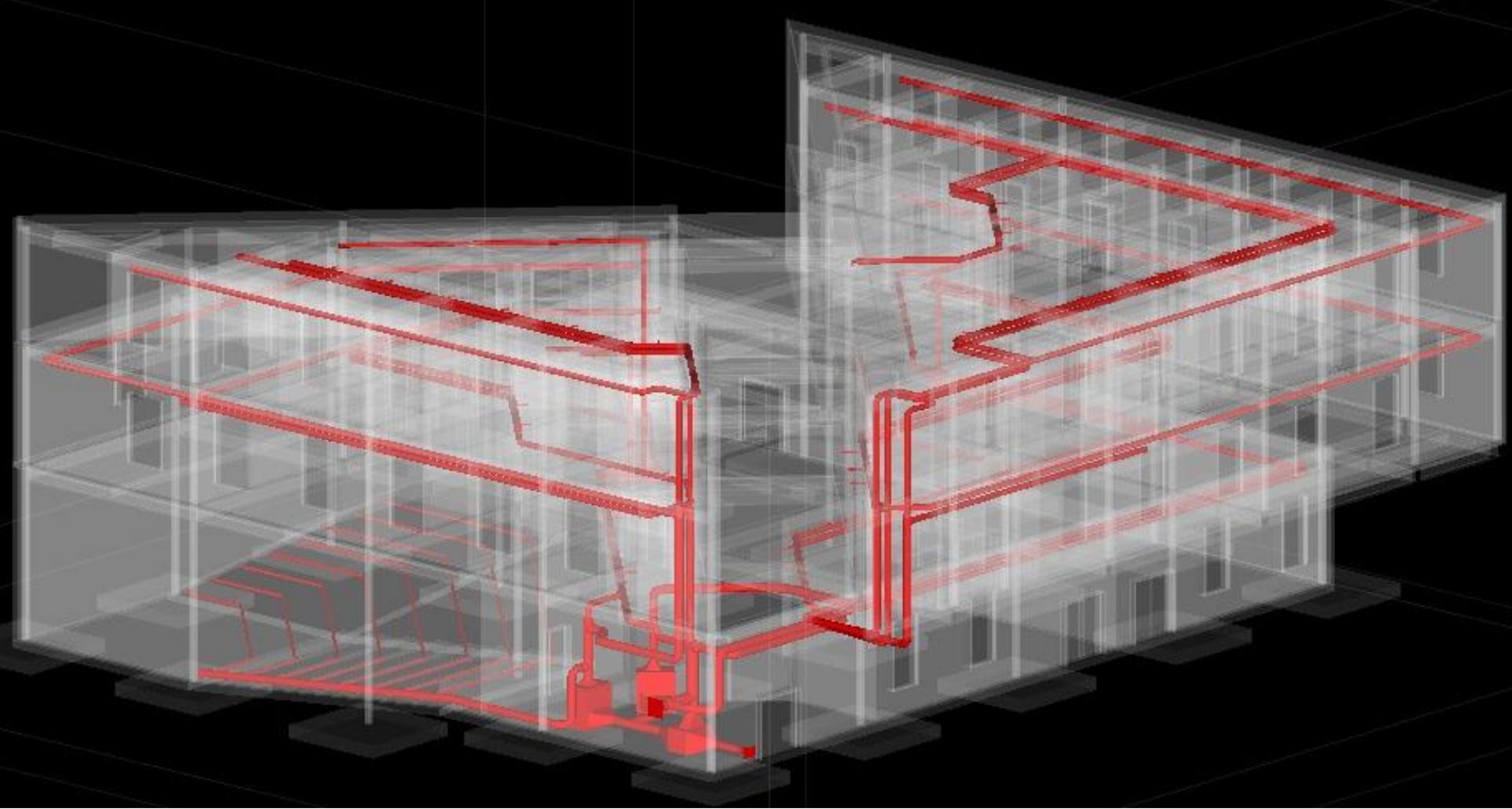
mary shanie victoria dustin milosz michael raleigh express team

3D ventilation system



mary shanie victoria dustin milosz michael raleigh express team

3D ventilation system

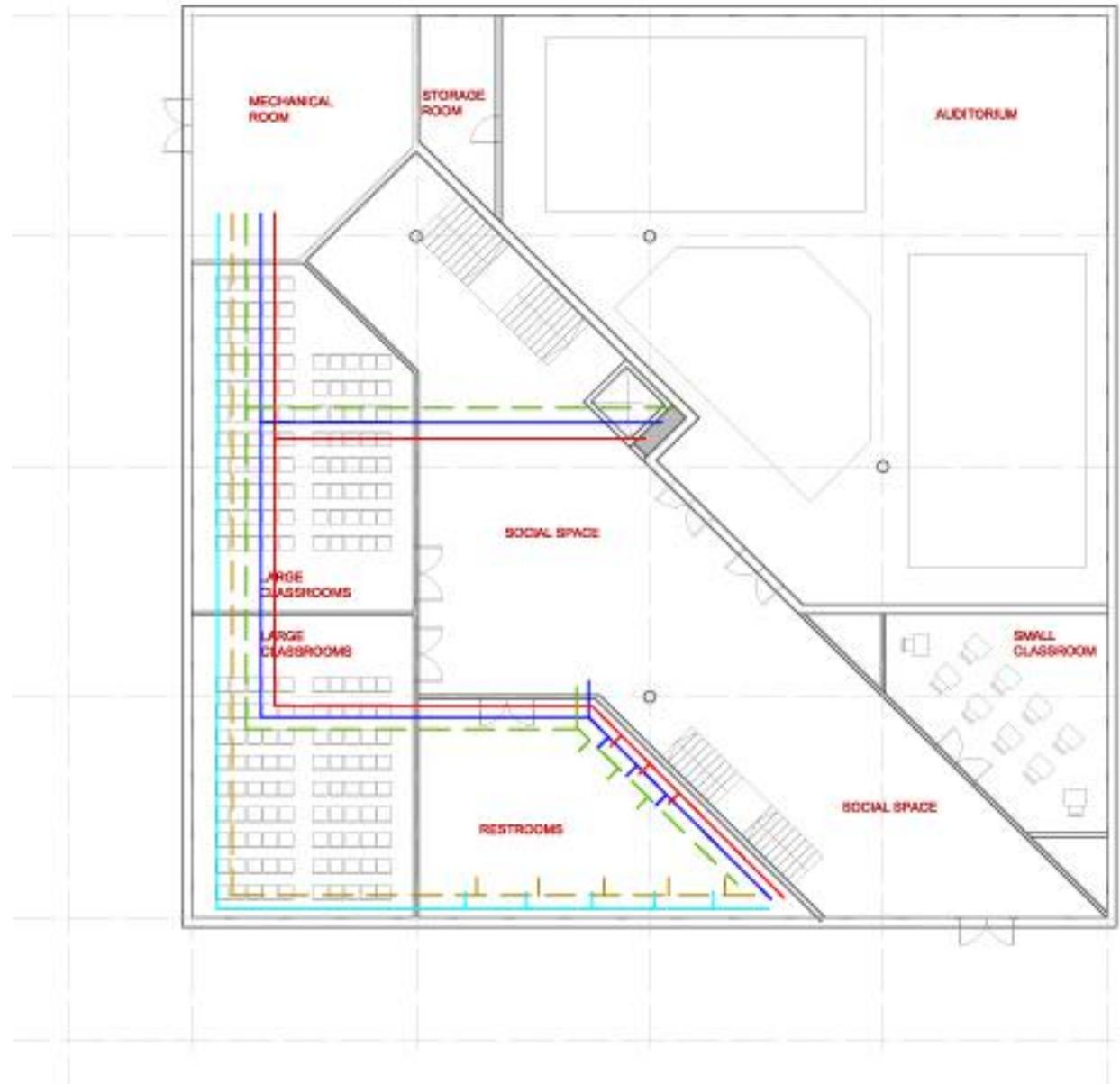


mary shanie victoria dustin milosz michael raleigh express team

1st floor plan water distribution



COLD WATER SUPPLY
HOT WATER SUPPLY
GREY WATER SUPPLY
GREY WATER RETURN
WASTE WATER



2nd floor plan water distribution



COLD WATER SUPPLY
HOT WATER SUPPLY
GREY WATER SUPPLY
GREY WATER RETURN
WASTE WATER

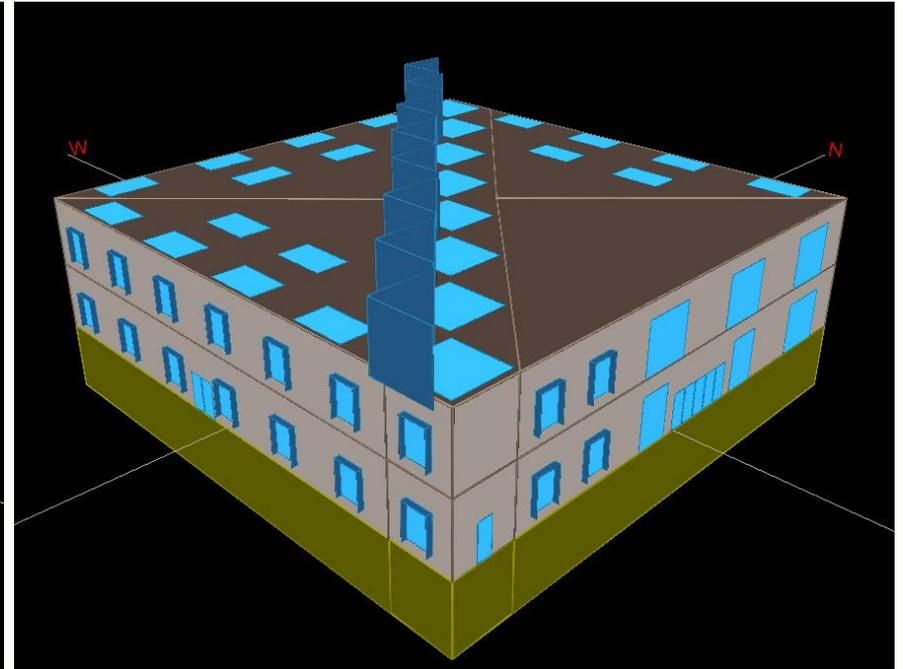
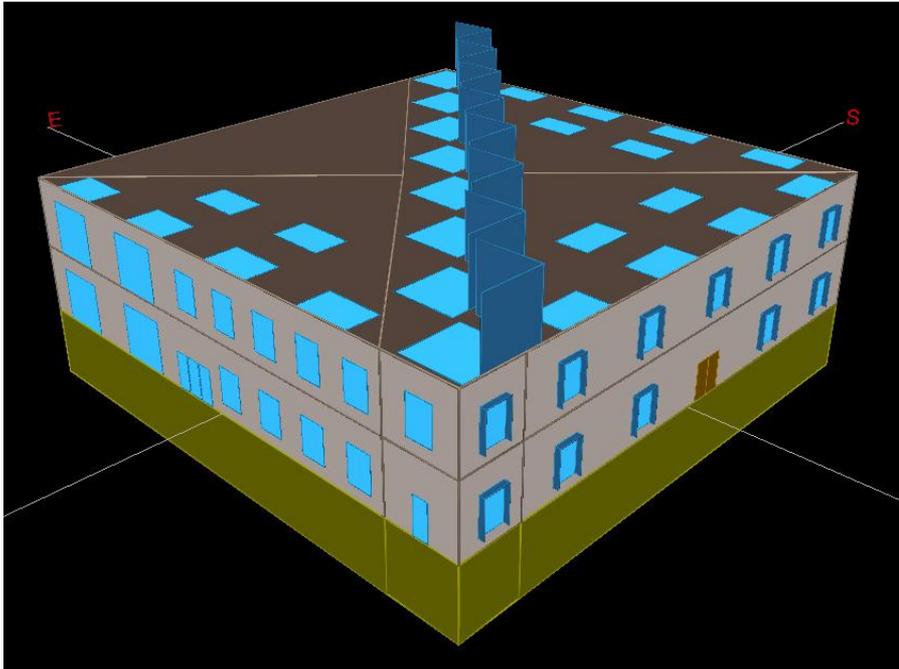


mary shanie victoria dustin milosz michael raleigh express team

3rd floor plan water distribution

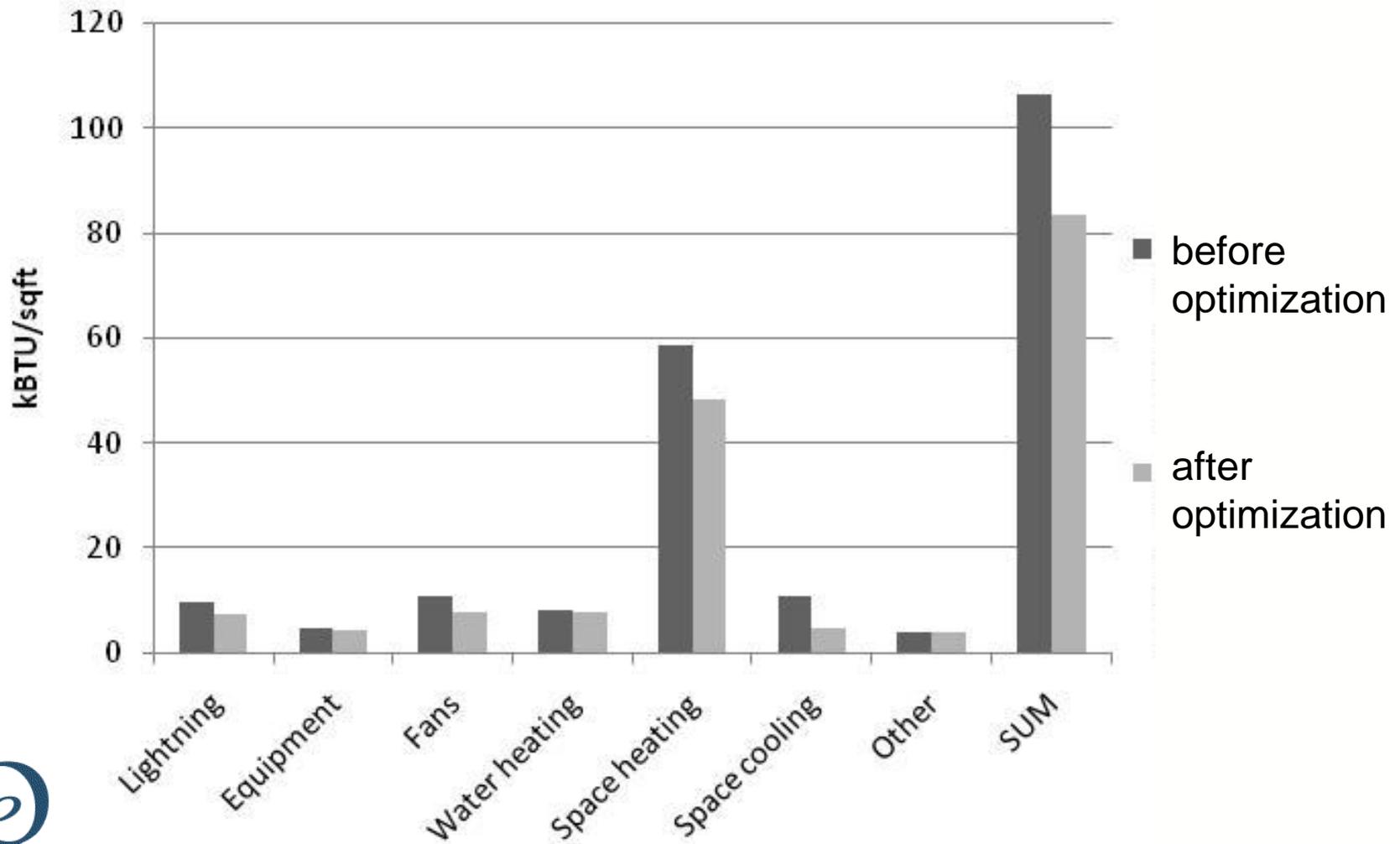


energy simulation

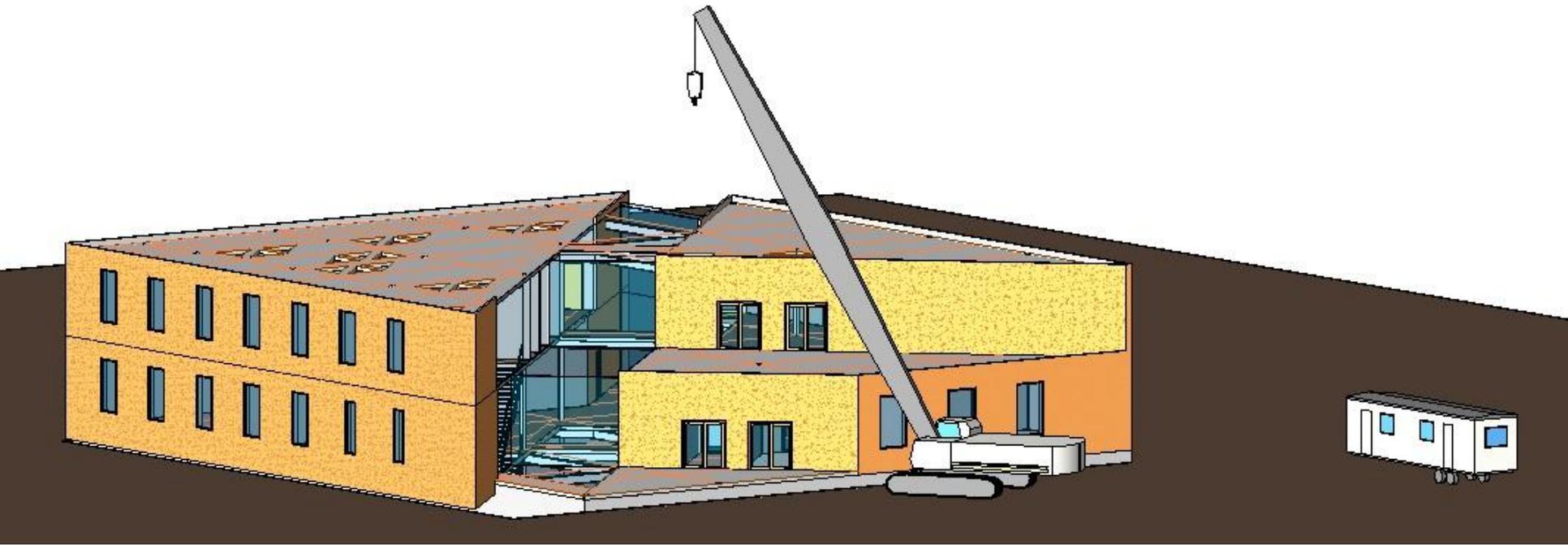


mary shanie victoria dustin milosz michael raleigh express team

interdisciplinary energy optimization



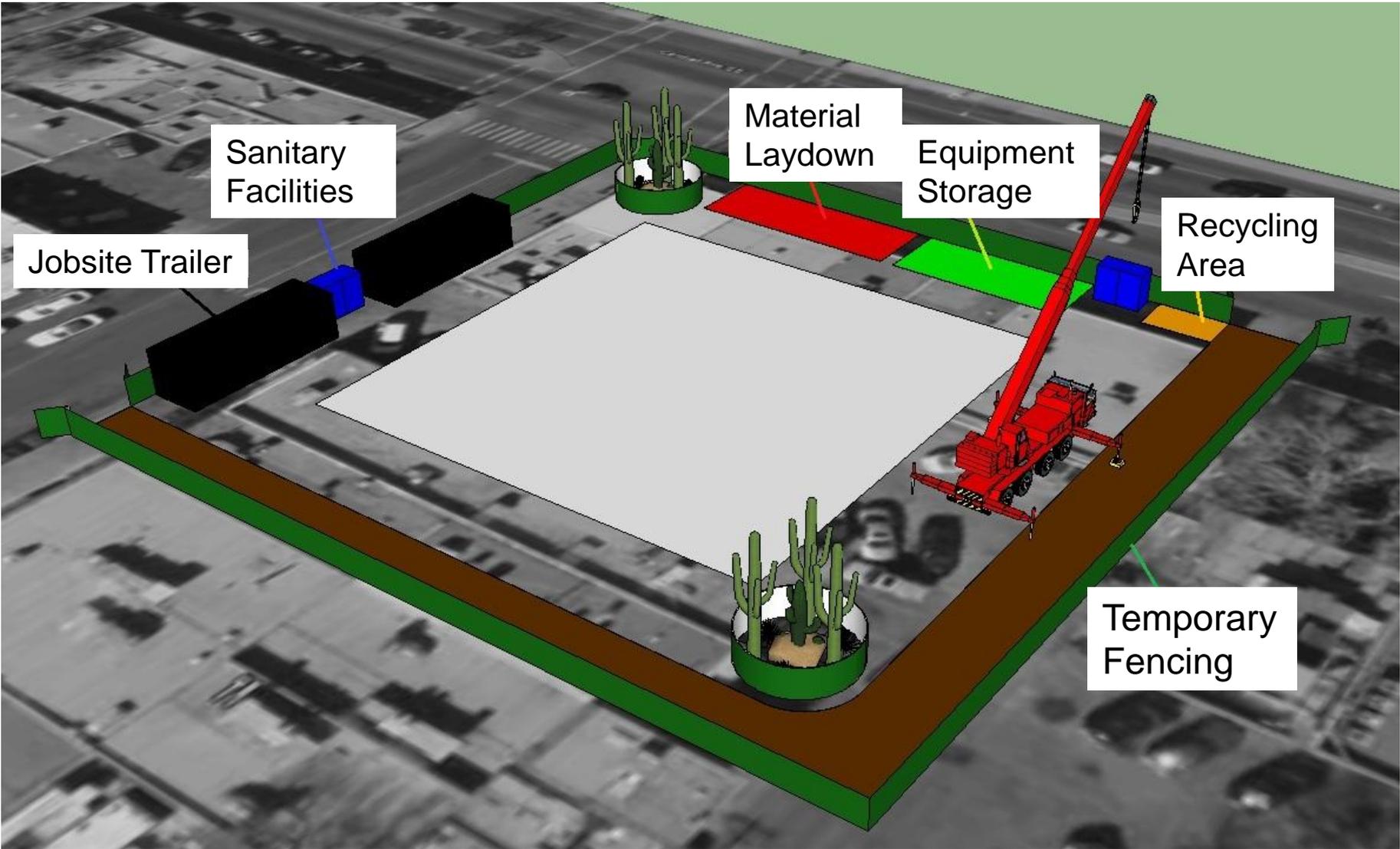
=> 21.4 % less energy



construction

mary shanie victoria dustin milosz michael raleigh express team

site layout



mary shanie victoria dustin milosz michael raleigh express team

access route



mary shanie victoria dustin milosz michael raleigh express team

employee parking



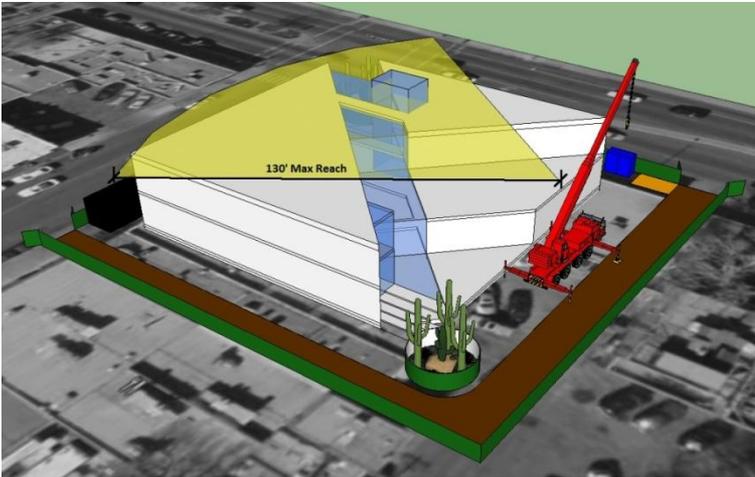
mary shanie victoria dustin milosz michael raleigh express team

employee parking

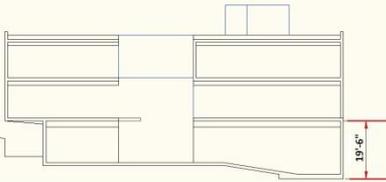


mary shanie victoria dustin milosz michael raleigh express team

equipment selection



all-terrain crane
135' max reach
19.9 ton capacity



20'-0" excavation



Komatsu PC200LC-8
hybrid excavator
20'11" max digging depth

sustainable performance



on-site recycling/waste management



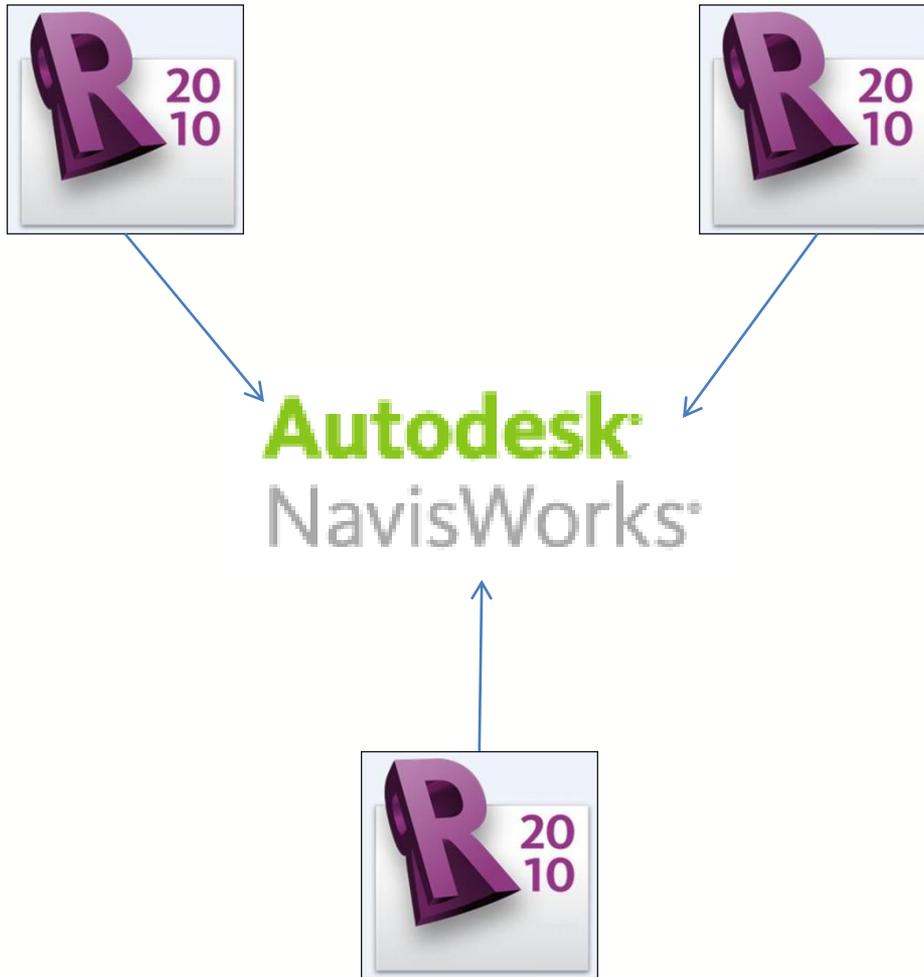
hybrid excavator



green job-site trailers

mary shanie victoria dustin milosz michael raleigh express team

virtual construction management



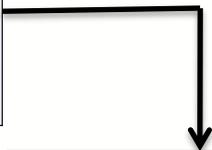
A/E/MEP coordination

- same initial file
- separated into 3 files
- separated to accommodate different time zones/working schedules
- brought together with Navisworks for coordination

virtual construction management



.IFC



Estimate

Schedule



4D Sequence



model

- quantities from the model
- WBS is made in the model

estimating

- quantities assigned to construction activities
- costs and production rates are also attached

scheduling

- production rates are exported to produce durations

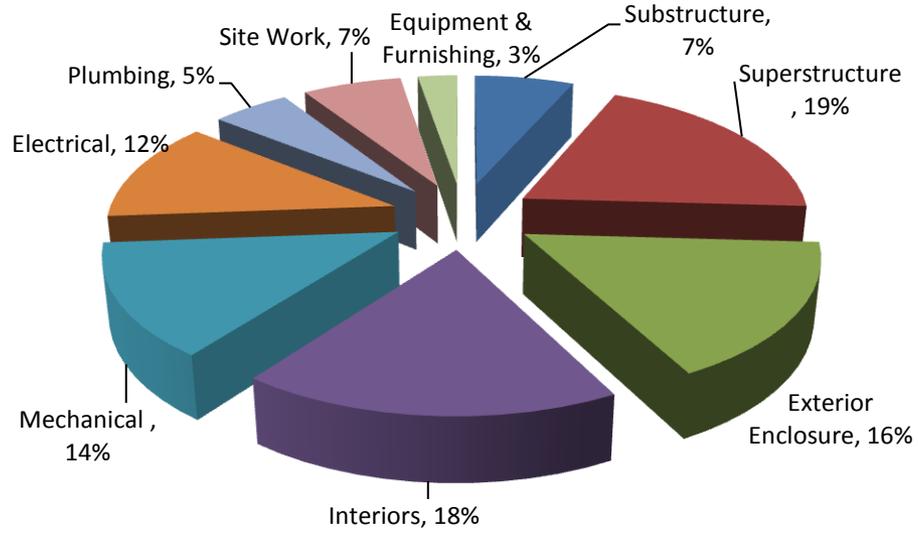
sequencing

- durations and relationships are attached to model elements

model based estimate

System	Cost / Sf	Total Cost
Substructure	\$ 12	\$ 350,211
Superstructure	\$ 36	\$ 1,042,343
Exterior Enclosure	\$ 31	\$ 881,328
Interiors	\$ 34	\$ 978,438
Mechanical	\$ 25	\$ 726,125
Electrical	\$ 22	\$ 643,631
Plumbing	\$ 10	\$ 275,269
Site Work	\$ 12	\$ 350,000
Equipment & Furnishing	\$ 5	\$ 140,069
Subtotal	\$ 188	\$ 5,387,414
Contractor fees (25%)	\$ 47	\$ 1,346,853
Architectural fees (7%)	\$ 13	\$ 377,119
Contingencies (10%)	\$ 19	\$ 538,741
Total Building Cost	\$ 267	\$ 7,650,128

steel system

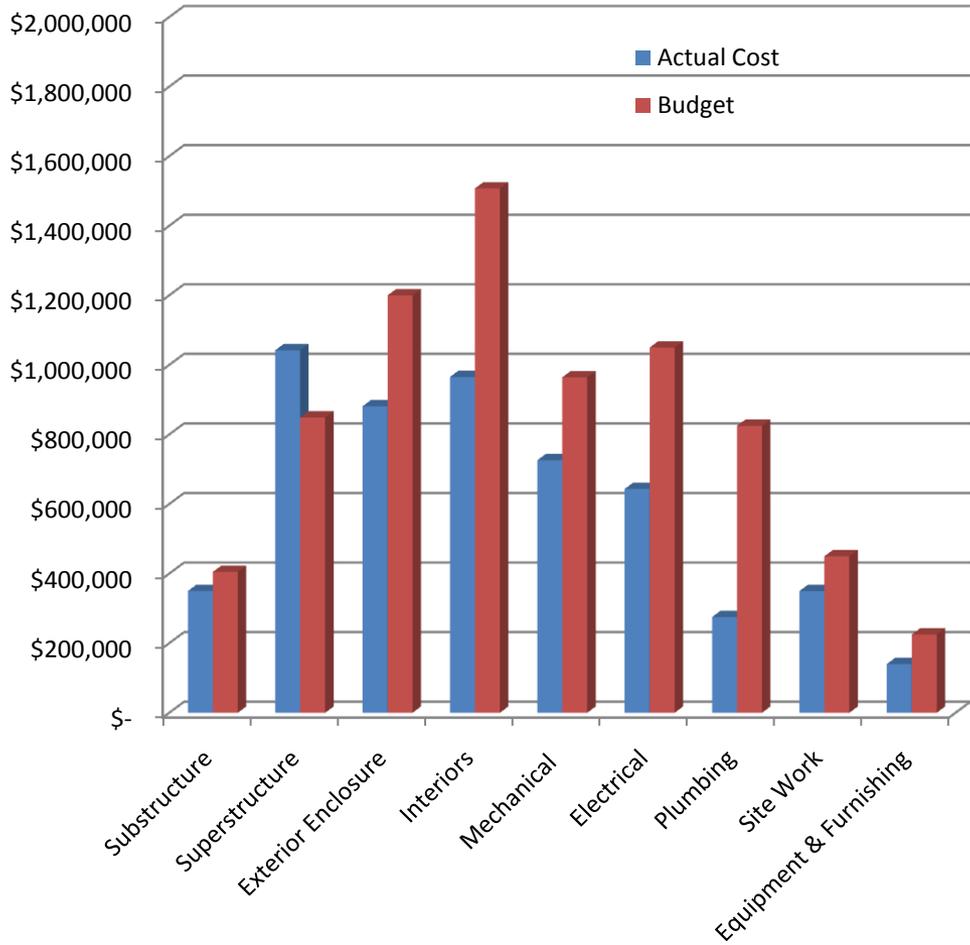


total cost (W/O&P) = \$7,651,000
or \$267/sq-ft

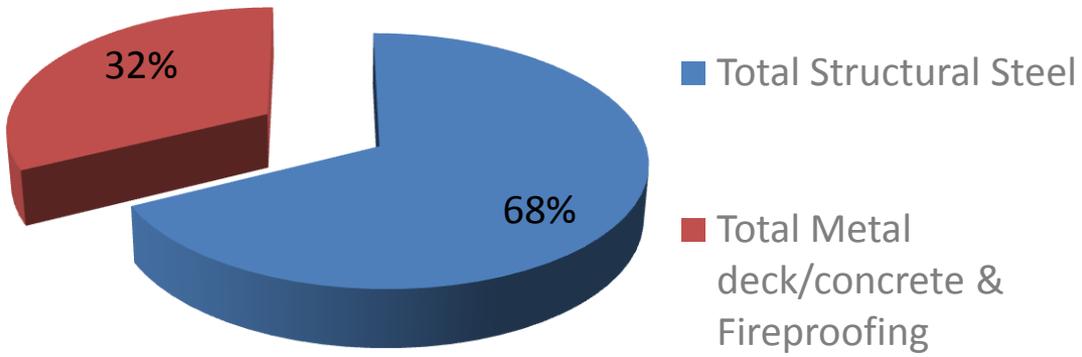
annual inflation rate of 10% over 5 years
2015 cost (W/O&P) = \$12,322,000
or \$430 / sq-ft

actual cost versus target budget

Actual Cost	Budget	Difference
\$ 350,211	\$ 405,000	\$ 54,789
\$ 1,042,343	\$ 849,000	\$ (193,343)
\$ 881,328	\$ 1,200,000	\$ 318,672
\$ 978,438	\$ 1,507,500	\$ 529,062
\$ 726,125	\$ 964,500	\$ 238,375
\$ 643,631	\$ 1,050,000	\$ 406,369
\$ 275,269	\$ 825,000	\$ 549,731
\$ 350,000	\$ 450,000	\$ 100,000
\$ 140,069	\$ 225,000	\$ 84,931



structural cost



Superstructure		
System	Description	Cost
Floor Construction	Structural Steel	\$ 515,592.00
	Metal Decking & Concrete	\$ 200,508.00
	Fireproofing	\$ 46,976.16
Roof Construction	Structural Steel	\$ 188,694.00
	Metal Decking & Concrete	\$ 73,381.00
	Fireproofing	\$ 17,192.12
		Program Budget
Total Structural Steel	\$ 704,286.00	\$ 750,000
Total Metal deck/concrete & Fireproofing	\$ 338,057.28	

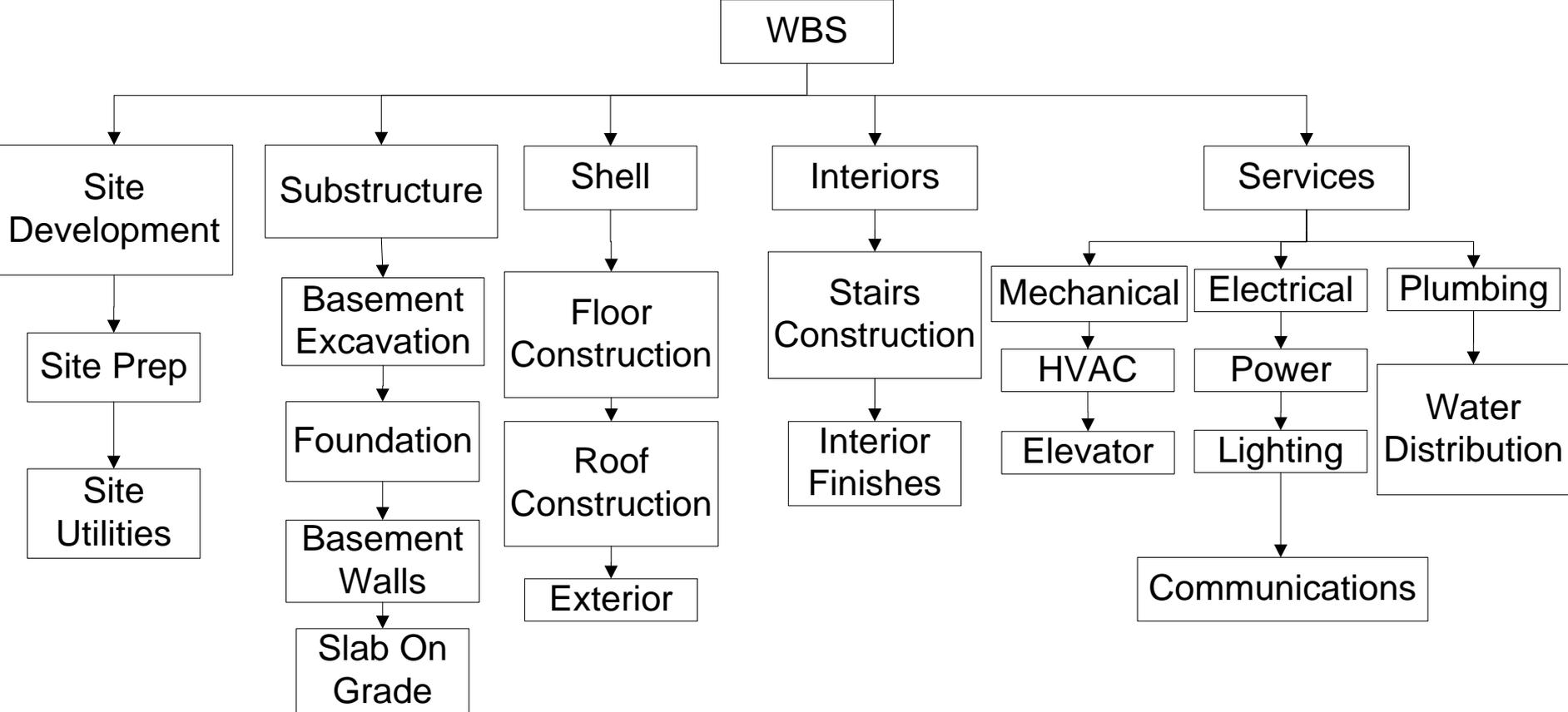
structural cost meets program requirement

material radius

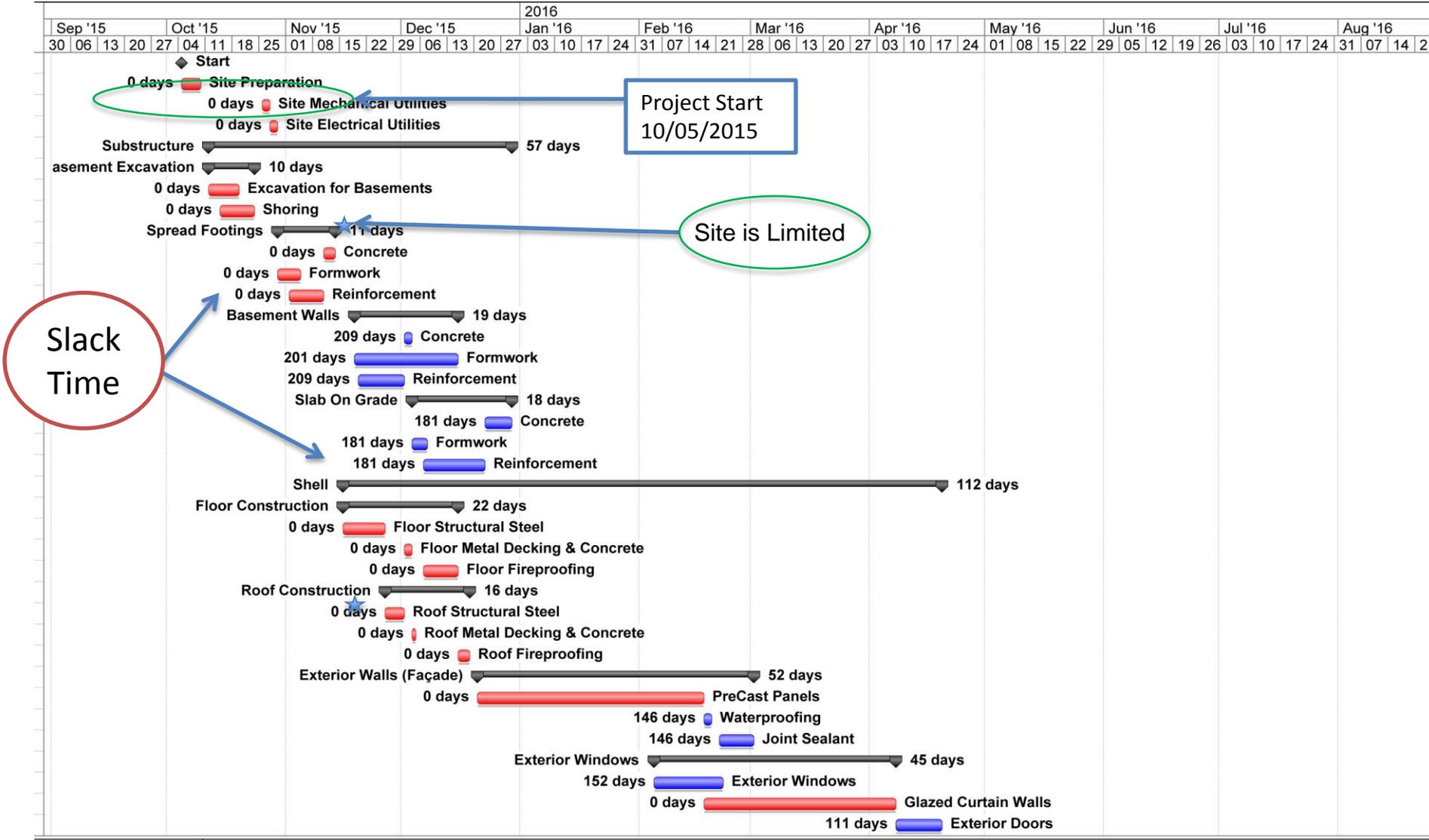


mary shanie victoria dustin milosz michael raleigh express team

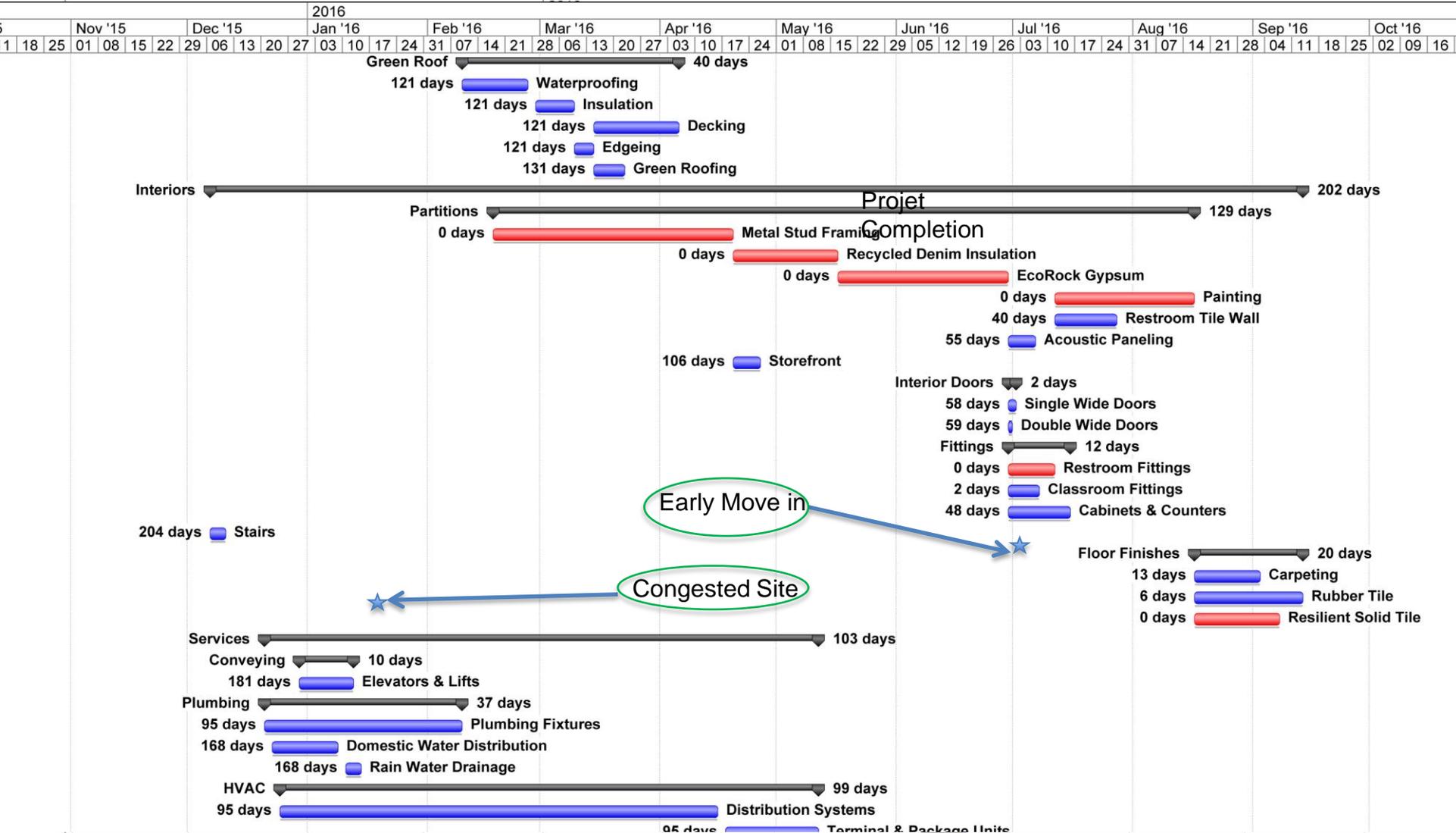
work breakdown structure



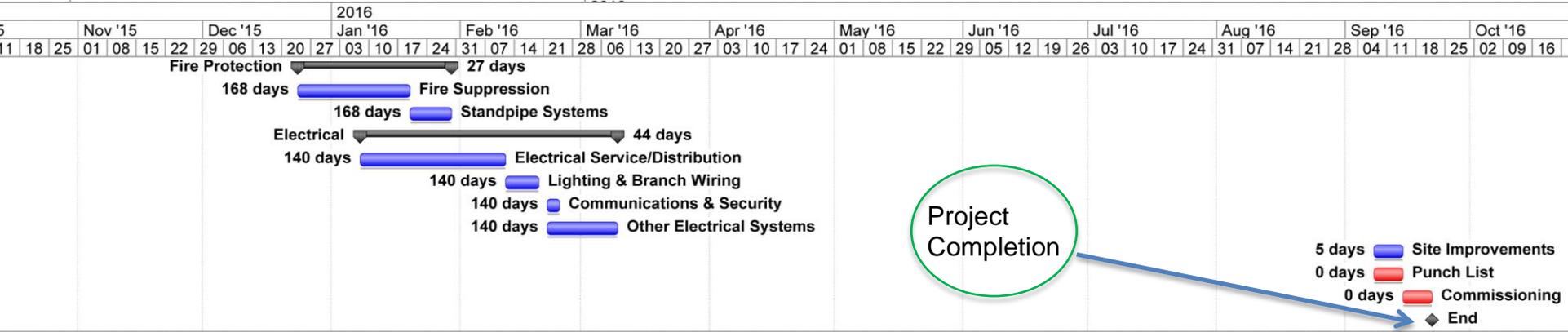
CPM schedule



CPM schedule



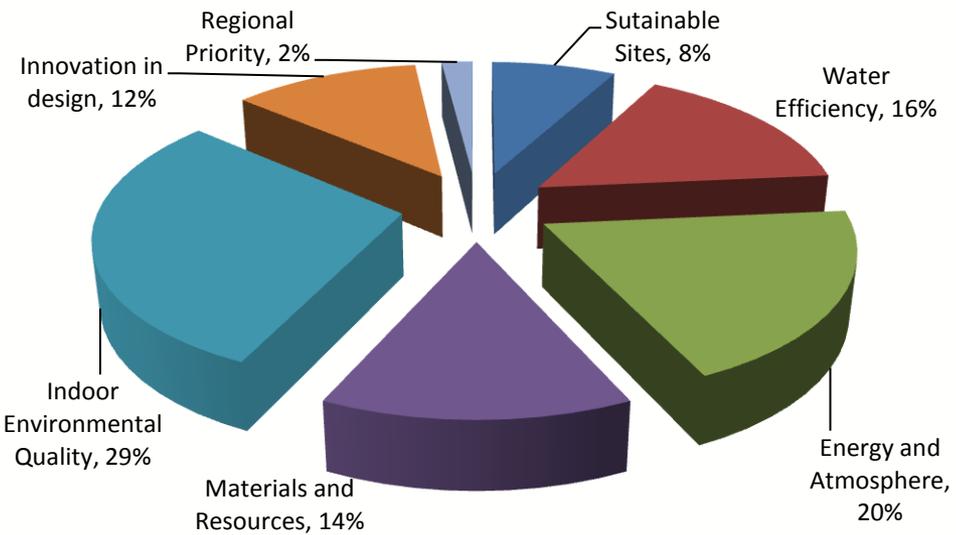
CPM schedule



sustainability



Category	Maximum Possible points	Actual Points
Sustainable Sites	26	4
Water Efficiency	10	8
Energy and Atmosphere	35	10
Materials and Resources	14	7
Indoor Environmental Quality	15	15
Innovation in design	6	6
Regional Priority	4	1
Total LEED points	110	51



brown roof

construction waste management

water efficiency landscaping

reduce co2 emissions

bicycle storage

regional materials

water use reduction

flexibility in structure and plan

roof heat island effect

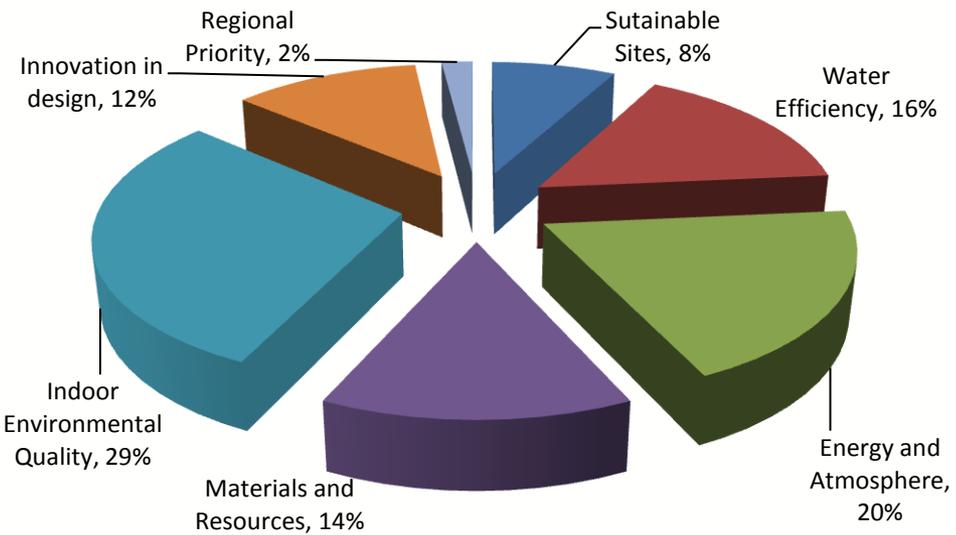
optimized energy performance

mary shanie victoria dustin milosz michael raleigh express team

sustainable performance over lifetime



Category	Maximum Possible points	Actual Points
Sustainable Sites	26	4
Water Efficiency	10	8
Energy and Atmosphere	35	10
Materials and Resources	14	7
Indoor Environmental Quality	15	15
Innovation in design	6	6
Regional Priority	4	1
Total LEED points	110	51



brown roof

construction waste management

water efficiency landscaping

reduce co2 emissions

bicycle storage

regional materials

water use reduction

flexibility in structure and plan

roof heat island effect

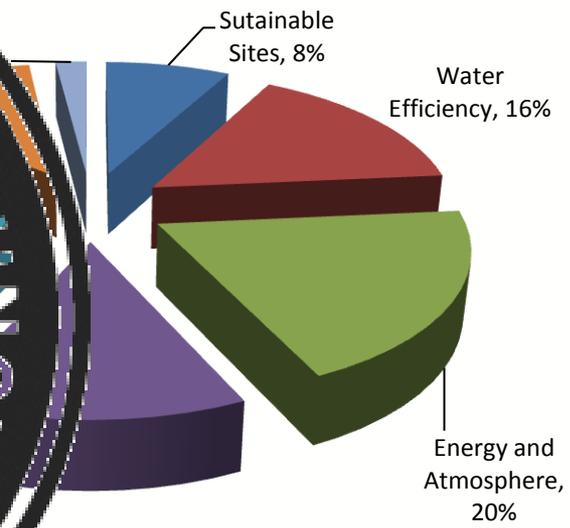
optimized energy performance

mary shanie victoria dustin milosz michael raleigh express team

sustainable performance over lifetime



Category	Maximum Possible Points	Points Earned
Sustainable Sites	4	4
Water Efficiency	8	8
Energy and Atmosphere	35	35
Materials and Resources	15	15
Indoor Environmental Quality	15	15
Innovation in design	1	1
Regional Priority	1	1
Total LEED points	89	89



brown roof

water efficiency landscape

management

reduce co2 emissions

bicycle storage

regional materials

water use reduction

flexibility in structure and plan

roof heat island effect

optimized energy performance

mary shanie victoria dustin milosz michael raleigh express team

communication protocol



START	0 days
1ST ARCHITECTURAL CONCEPT	8 days
ARCHITECTURE	8 days
CONTEXT	4 days
VISION	4 days
SKETCHES	4 days
RELATION EXTERIOR/INTERIOR	4 days
EC -IMPACT	4 days
FLOOR PLANS	1 day
ELEVATIONS	1 day
FUNCTIONAL SPACES - DISTRIBUTION	1 day
FACADES	1 day
MATERIALS/CLADDING	5 days
STRUCTURAL	8 days
LOADS	8 days
LOCAL CODE REQUIREMENTS	8 days
CLIMATE	8 days
SOIL PROFILE	8 days
FOUNDATION ALTERNATIVES	8 days



IPD – transparency

Action Items for this Week!

Mary added Victoria Mar 5

Mary: What? Two Structural Concepts for the Second Architectural Concept
For Whom? Milosz, Dustin, and Mike
By When? This Wednesday meeting
Why? So that we can try to start working out any architectural clashes and so that Dustin and Mike can price out our options for the decision matrix on march 12th presentation

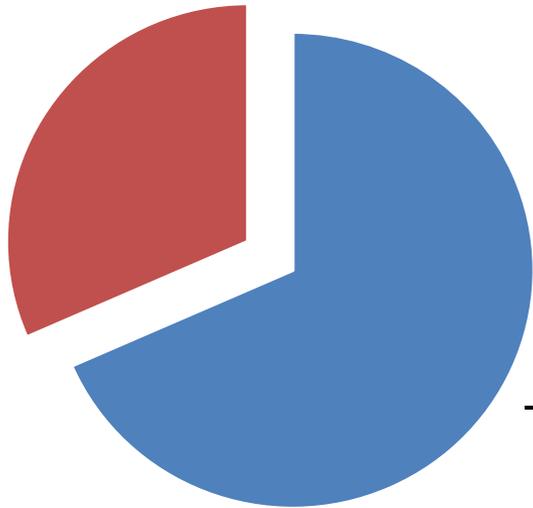
Milosz: Who? Milosz Feb 23
What? Facades
For Whom? For all
By When? This week meeting
Why? because its necessary

Who? Raleigh and Mary...
For the rest- look at Raleighs action items :)

Dustin: Who? Milosz, Victoria, Shanie, Dustin, Micheal Feb 26
What? Orientation of the Building
For Whom? Dustin and Micheal
By When? This weekend (Saturday Preferred)
Why? So we can continue with the site design

Mary Shanie Victoria Dustin Milosz Micheal raleigh express team

IPD – task tracking

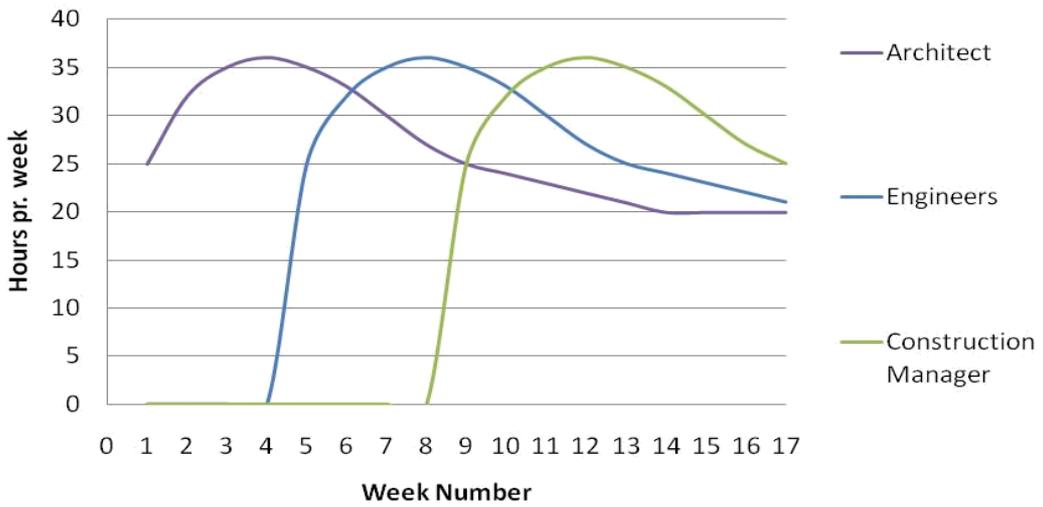
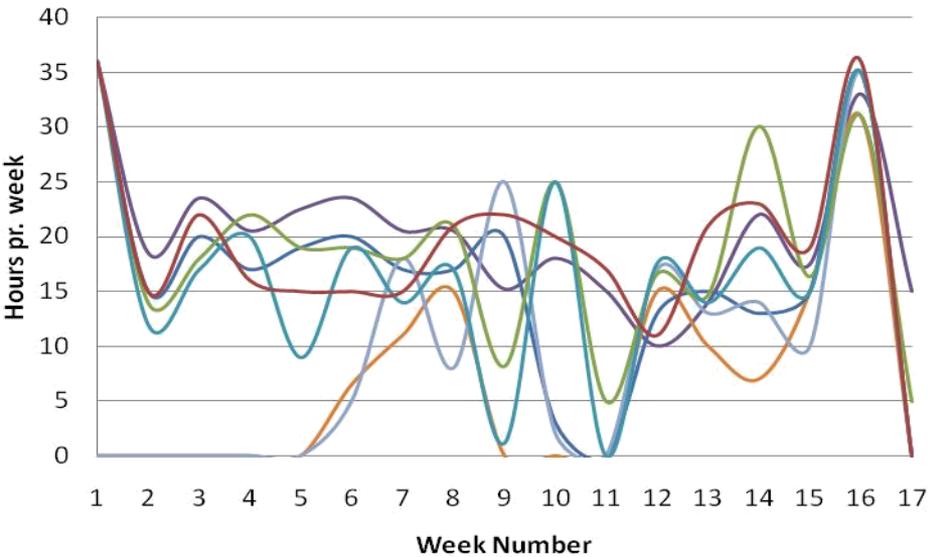


■ on time
■ late

ITEM	DESCRIPTION	RESPONSIBLE	DEPENDENT	DEADLINE	COMPLETED
1	Cost Benefit of the Live Loads - Why 100 psf?	Mary	Raleigh	2-Apr-10	1-Apr-10
2	Finalize Type of Materials	Mary	Mike	18-Mar-10	18-Mar-10
3	Finalize Connection Type	Mary	Mike	25-Mar-10	27-Mar-10
4	Redo the Framing	Mary	Raleigh	8-Apr-10	5-Apr-10
5	Design Slabs	Raleigh	Shanie	8-Apr-10	8-Apr-10
6	Design Filler Beams & Connections	Mary	Shanie	8-Apr-10	15-Apr-10
7	Calculate Moments in Beams/Columns	Raleigh	Mary	8-Apr-10	8-Apr-10
8	Design Beams	Raleigh	Shanie	8-Apr-10	15-Apr-10
9	Design Columns	Raleigh	Mike	15-Apr-10	15-Apr-10
10	Preliminary Revit Model	Mary	Dustin	18-Apr-10	16-Apr-10
11	Foundation Design	Mary	Mike	22-Apr-10	18-Apr-10
12	Etabs Model	Raleigh	Mary	22-Apr-10	27-Apr-10
13	Optimize	Raleigh	Mike	23-Apr-10	23-Apr-10
14	Revit Structure Model	Mary	Dustin	22-Apr-10	22-Apr-10
15	King Pin Finalized	Raleigh	Mike	25-Apr-10	27-Apr-10
16	Connection of Halves Finalized	Raleigh	Mike	25-Apr-10	27-Apr-10
17	Finalize Revit Model	Mary	Dustin	3-May-10	3-May-10
18	Finalize CAD Model	Mary	Raleigh	3-May-10	3-May-10
19	Make Presentation	Mary	Raleigh	3-May-10	3-May-10

mary shanie victoria dustin milosz michael raleigh express team

IPD – time tracking



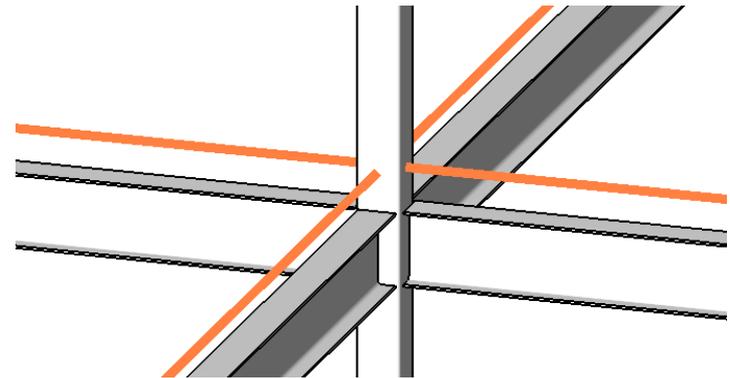
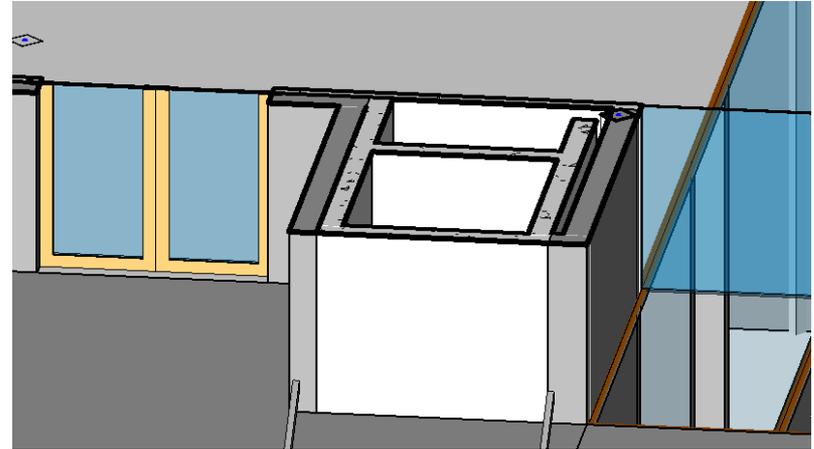
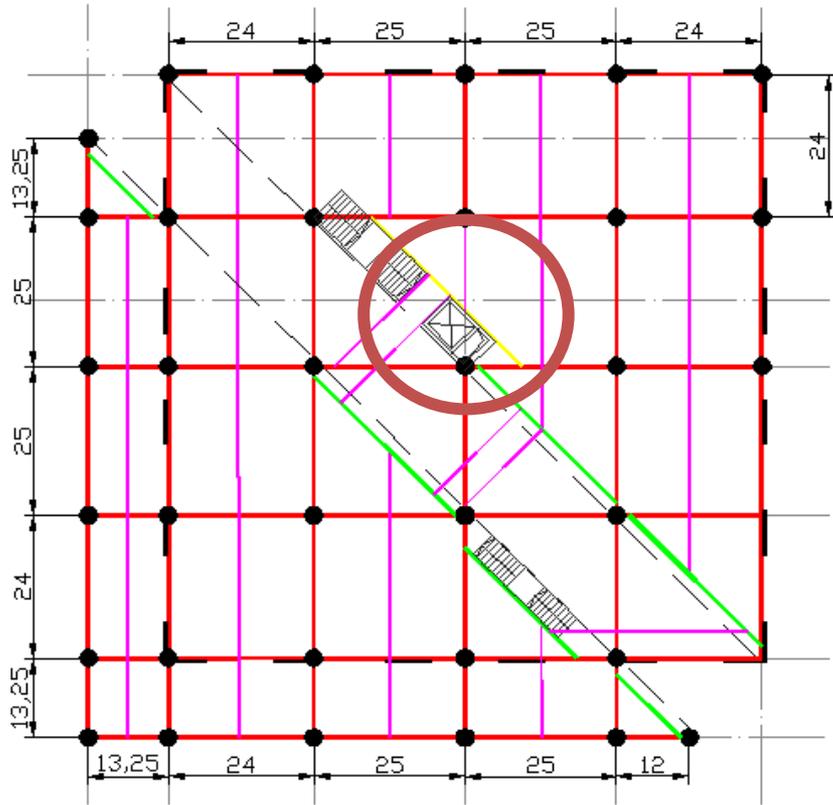
IPD – engaging client



experiencing the architecture

mary shanie victoria dustin milosz michael raleigh express team

elevator shaft, moment frame clash



lessons learned

“CMs think in four dimensions.
No, we *live* in four dimensions...”

“It can be done.”

“You need to mute your mic.”

“You can do what you like, just keep it cheap.”

“I’ve not only learned about other disciplines
but also about human characteristics.”

Thank you!

Josh Odelson

Holger Keitel

Prof. Ronaldo Borja

Cole Roberts

Nick Arenson

Afaan Naqvi

Prof. Helmut Krawinkler

Prof. Stefan Wrona

Prof. Renate Fruchter

Gregory P. Luth

ConXtech

Erik Kneer

Bjarne W. Olesen

Lotte Bjerregaard Jensen

Willem Kymmell

Forest Peterson

Flemming Vestergaard

John Nelson

Jan Slyk

Prof. Eduardo Miranda

Dan Gonzales

mary shanie victoria dustin milosz michael raleigh **express team**







