



We are the Ridge team, which from now on, stands for awesome.

Spring Presentation

May 10th, 2013



University of Ljubljana



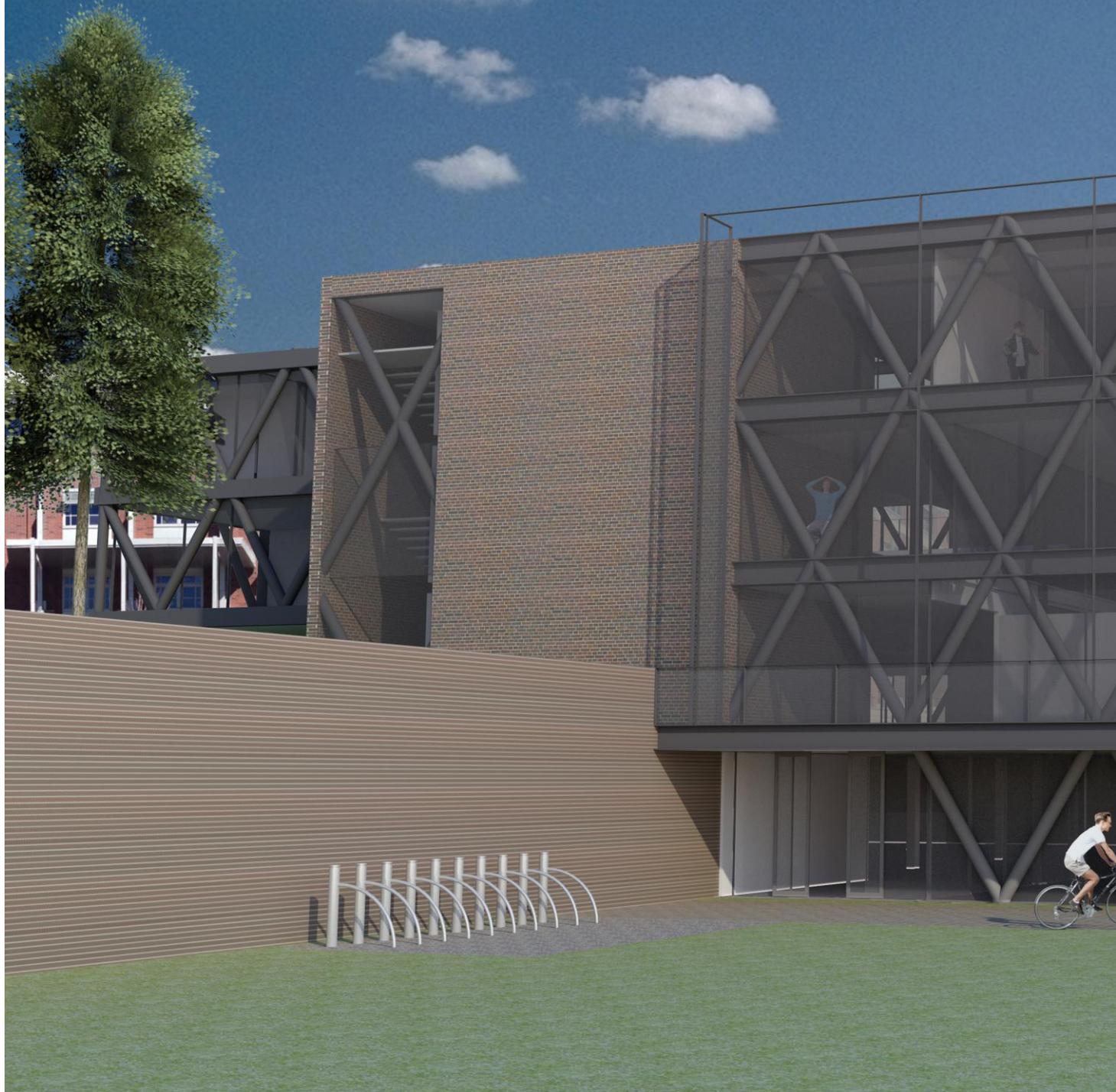
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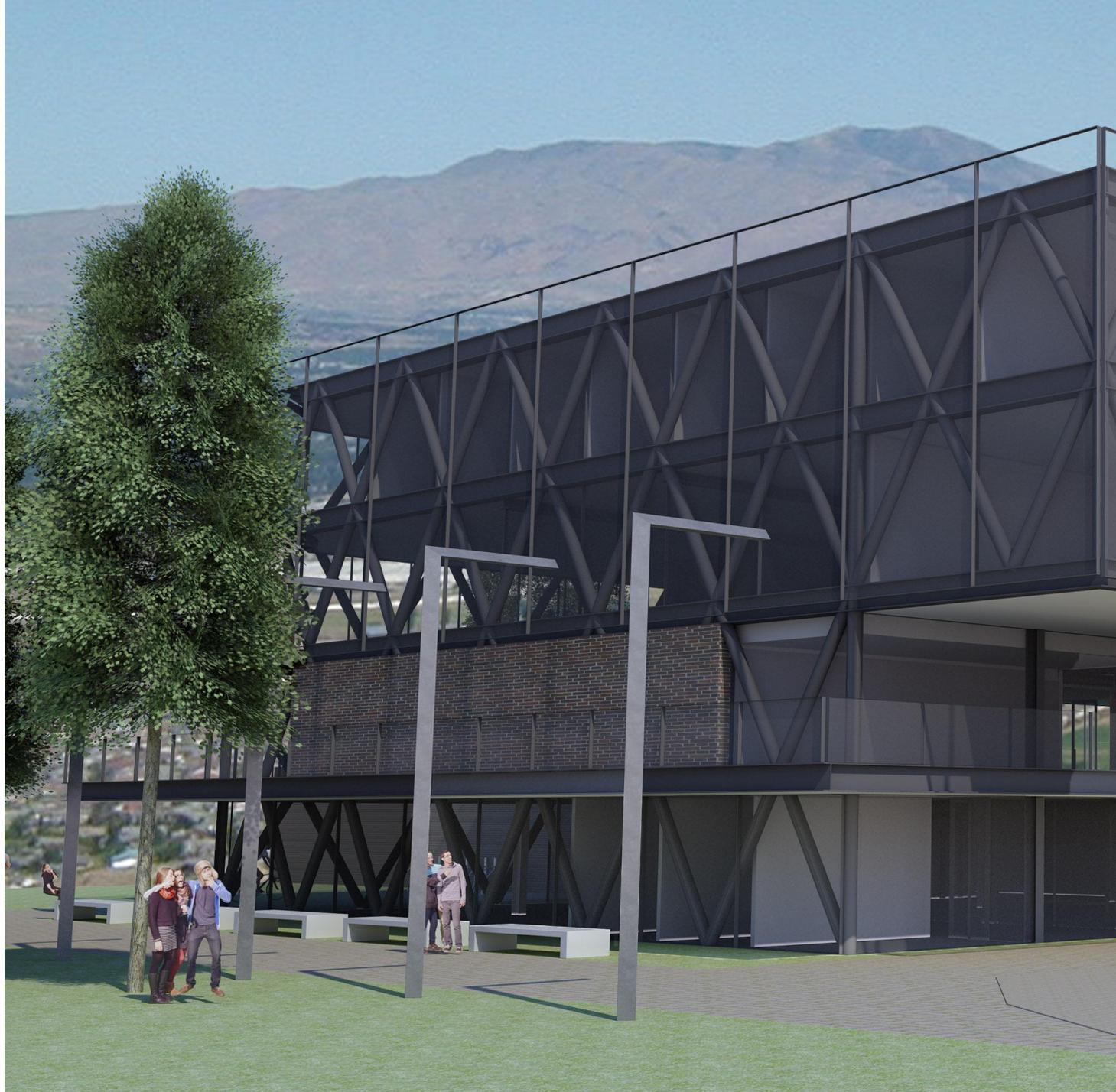
CM

MEP

LCFM



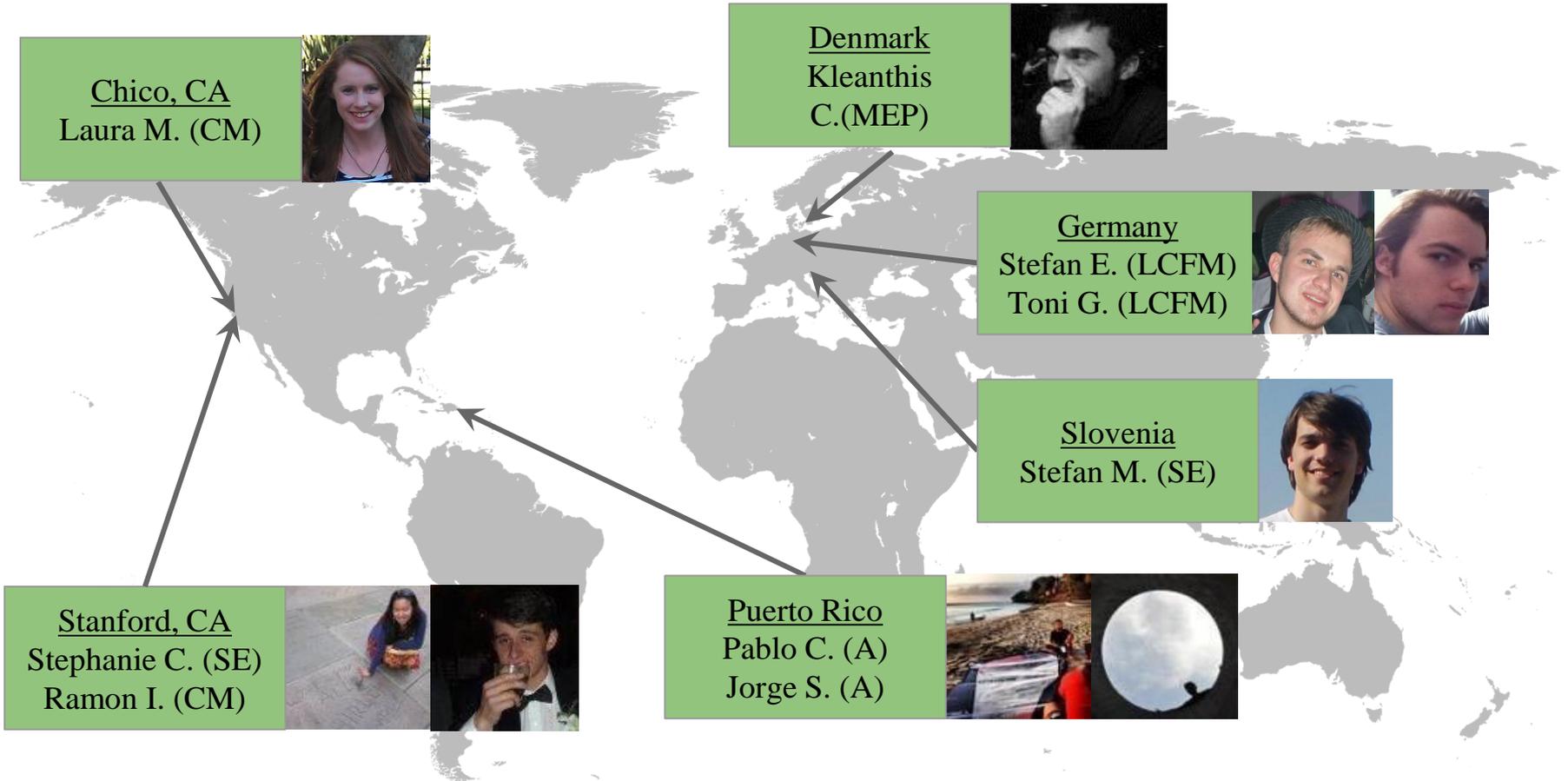






Ridge Team 2013

Owners: Sinan M. (SLO), Anirudh R. (CA), & Maria S. (MN)



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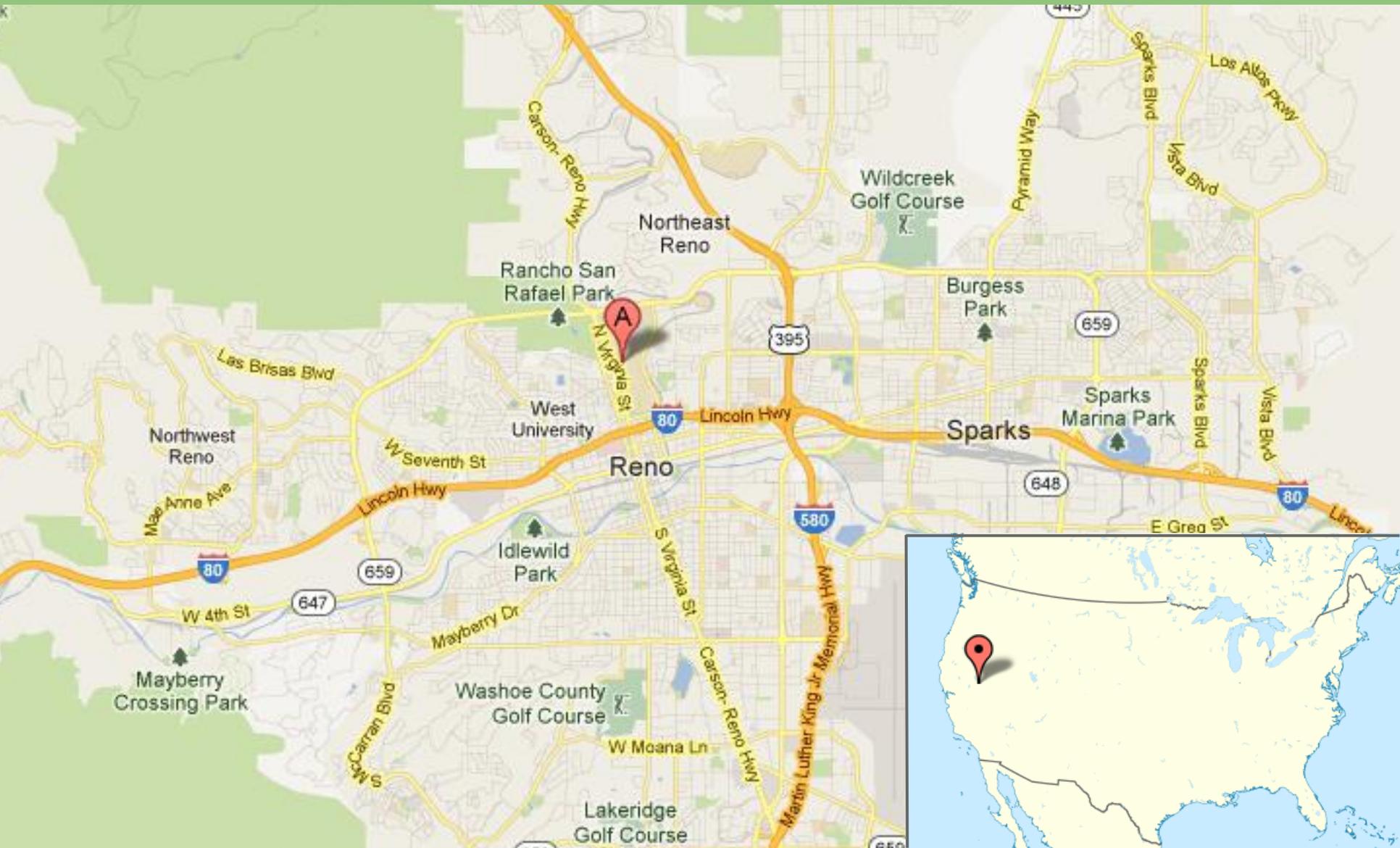
SE

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MEP

LCFM

Location: Reno, Nevada



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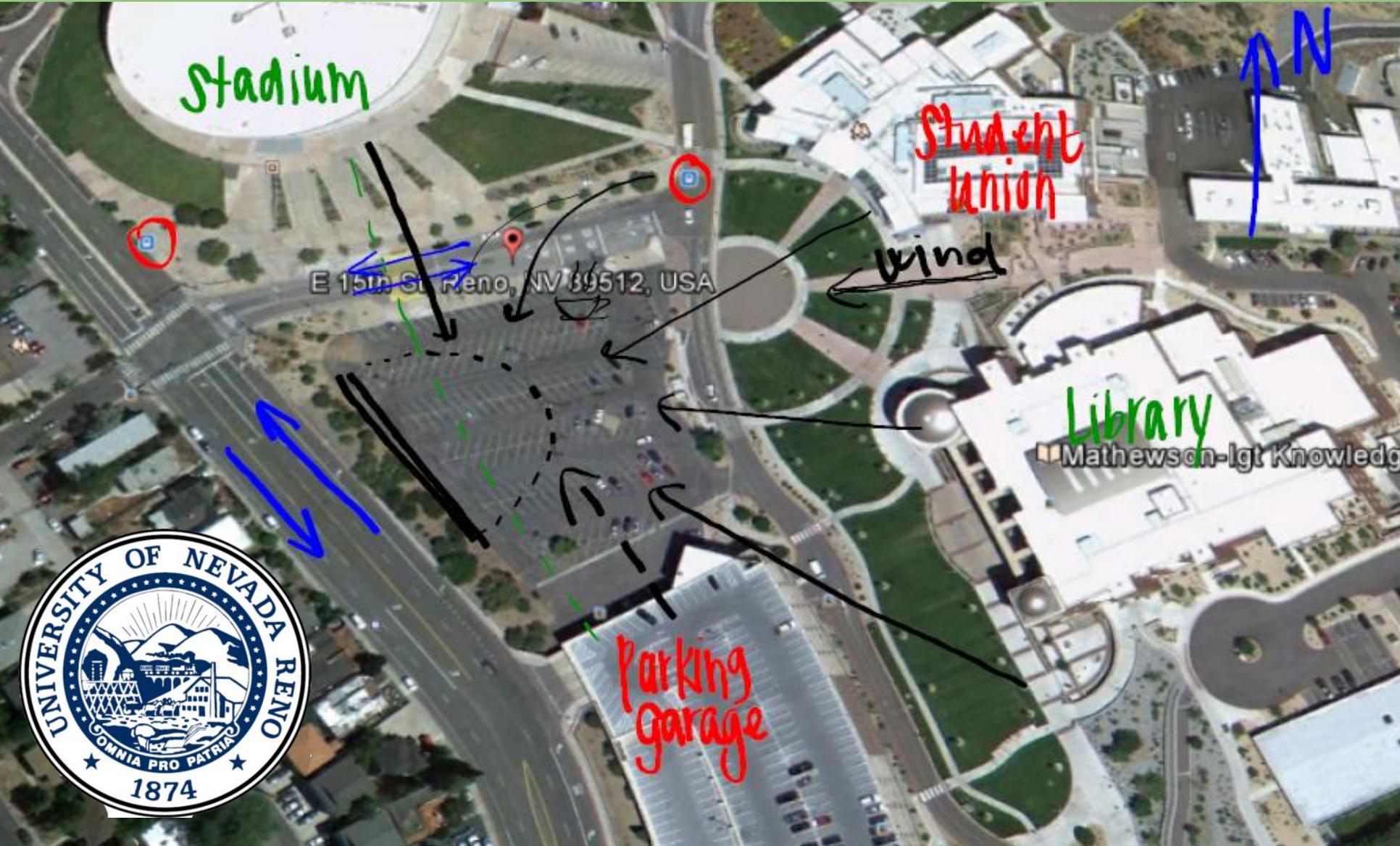
SE

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LCFM

Location: UN Reno



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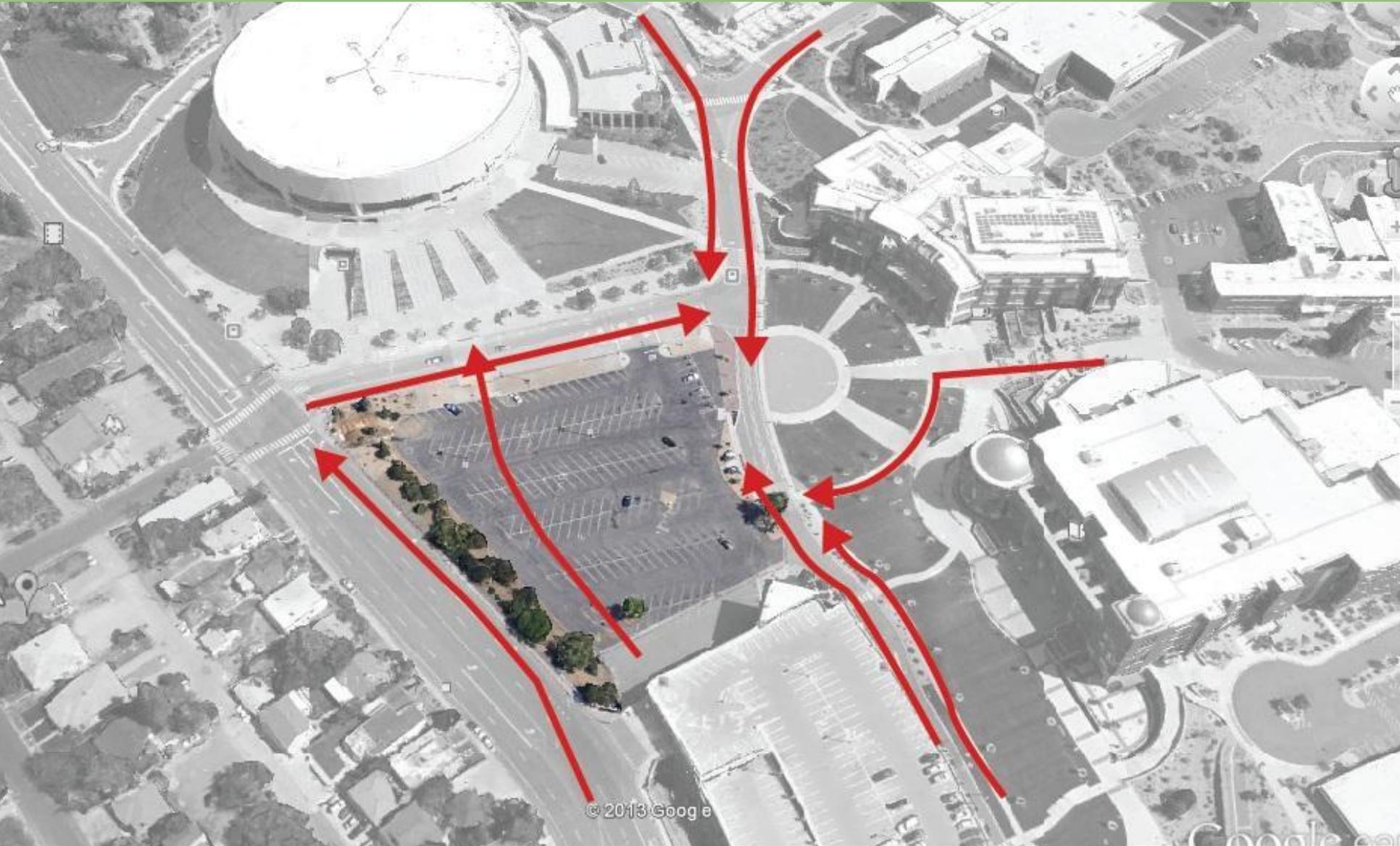




Site Context



Site Context



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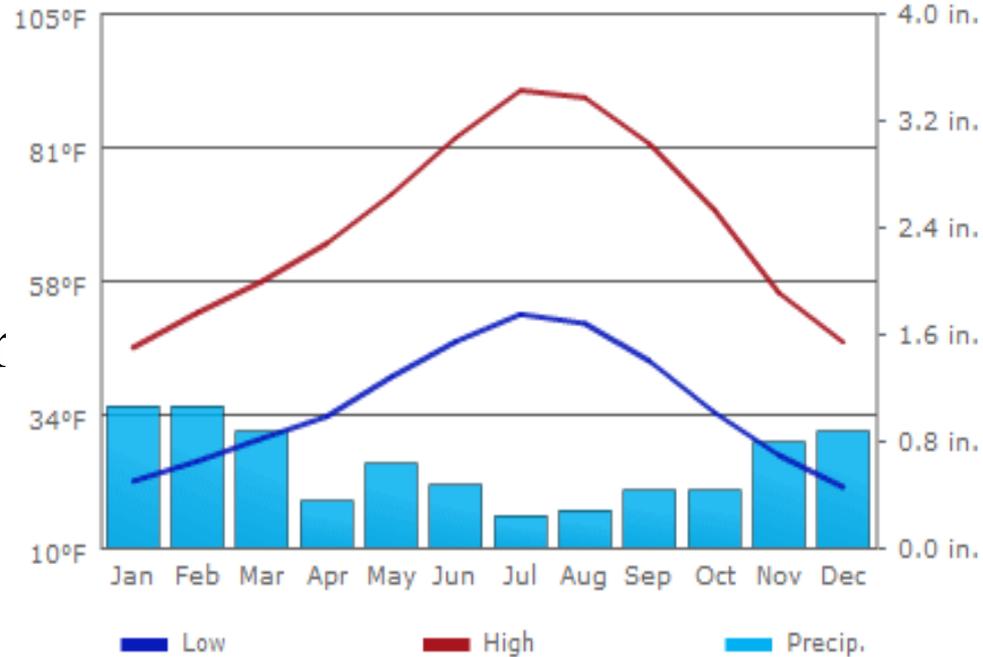
LCFM

Site Challenges

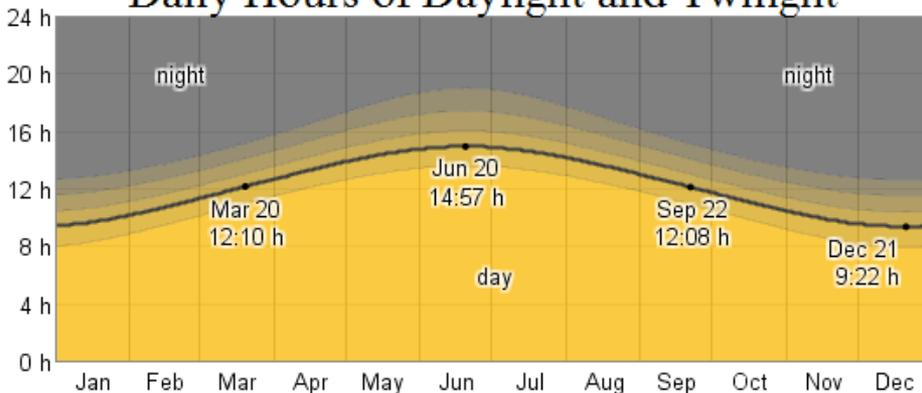
Min. temperature 23.3 °F

Max. temperature 92.2 °F

Avg. precipitation 7.3 in/yr



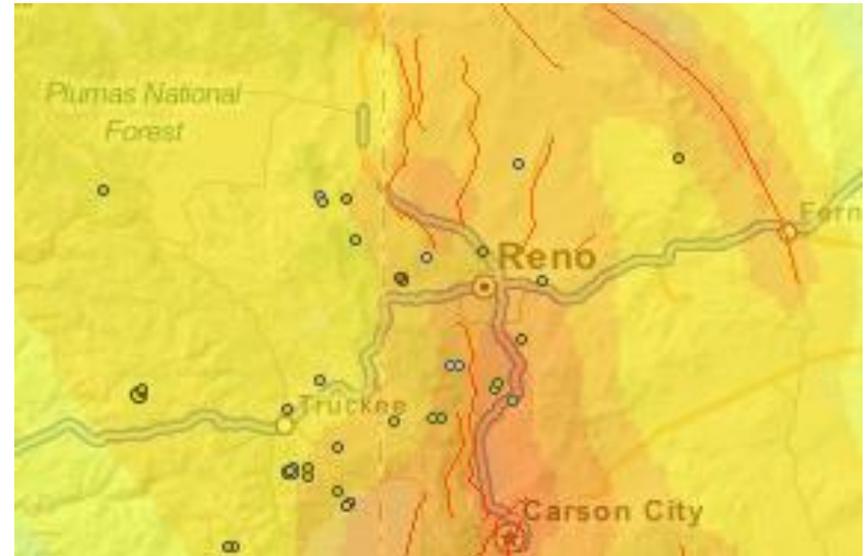
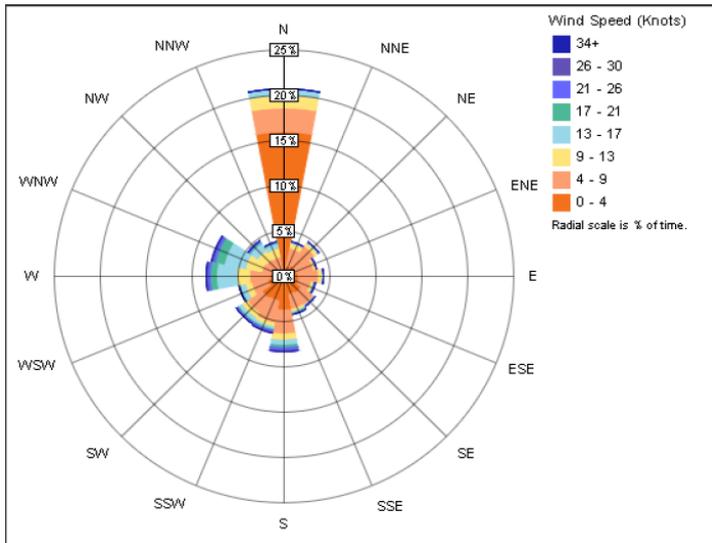
Daily Hours of Daylight and Twilight



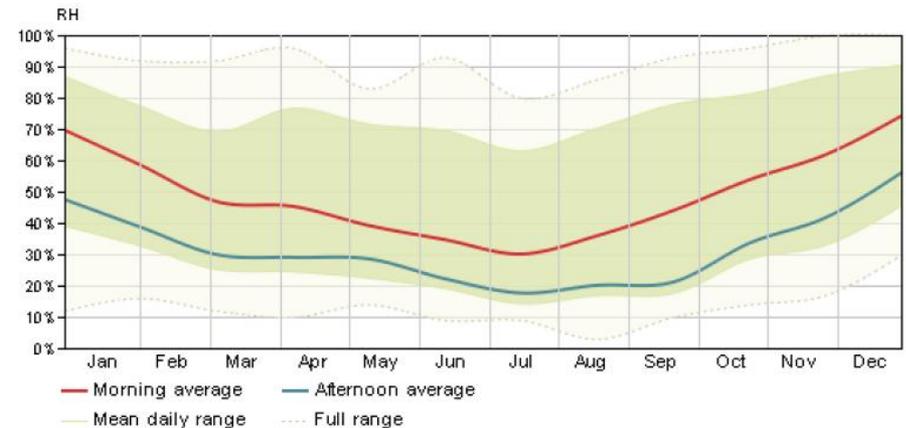
Mean sunshine 3650 hr/yr

Site Challenges

Average wind speed 5.7 knots Seismically active zone



Average humidity 55 %



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Design Challenges

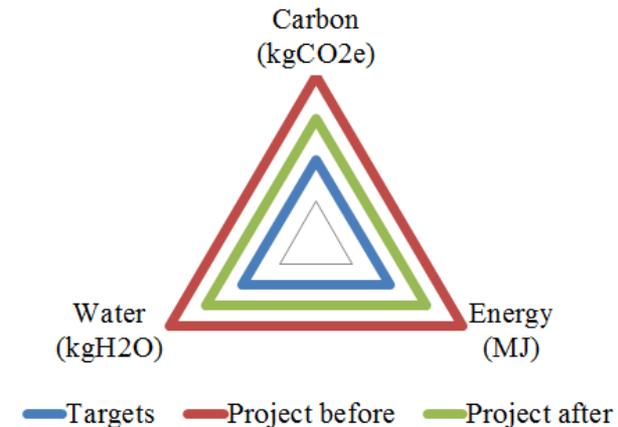
Swinerton:
Leapfrog
Challenge



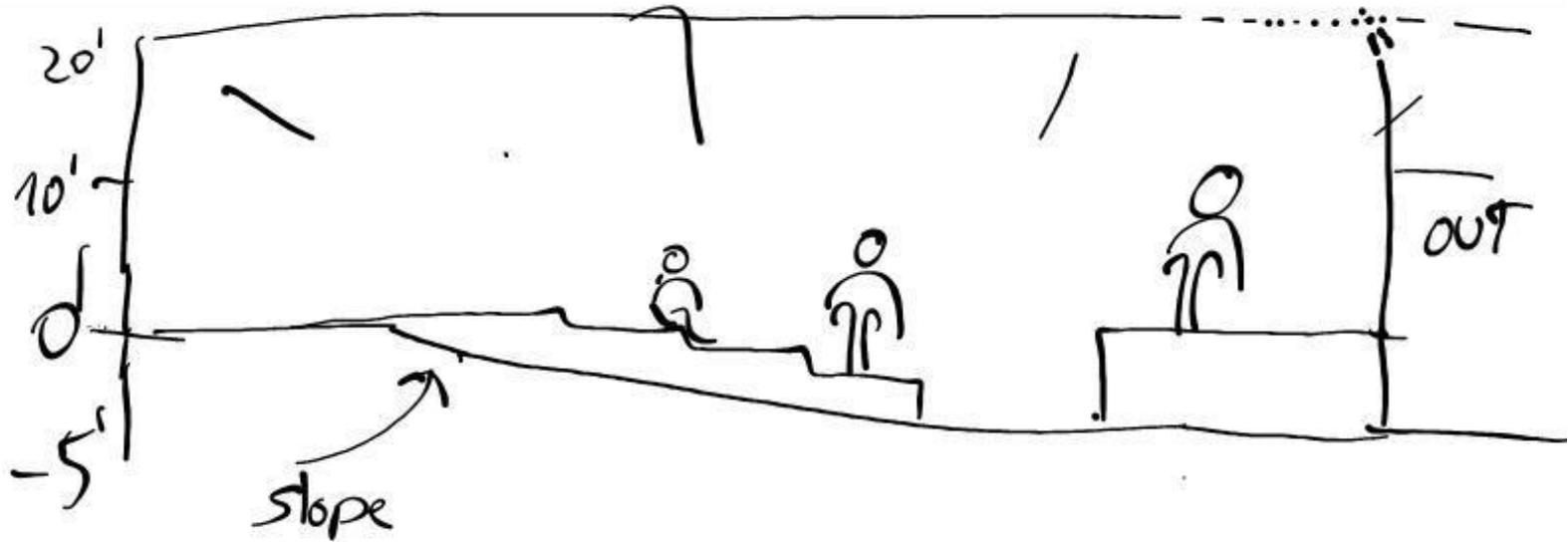
DPR:
Whole Life
Cycle Challenge



STV:
Sustainable
Target Value



Big Idea



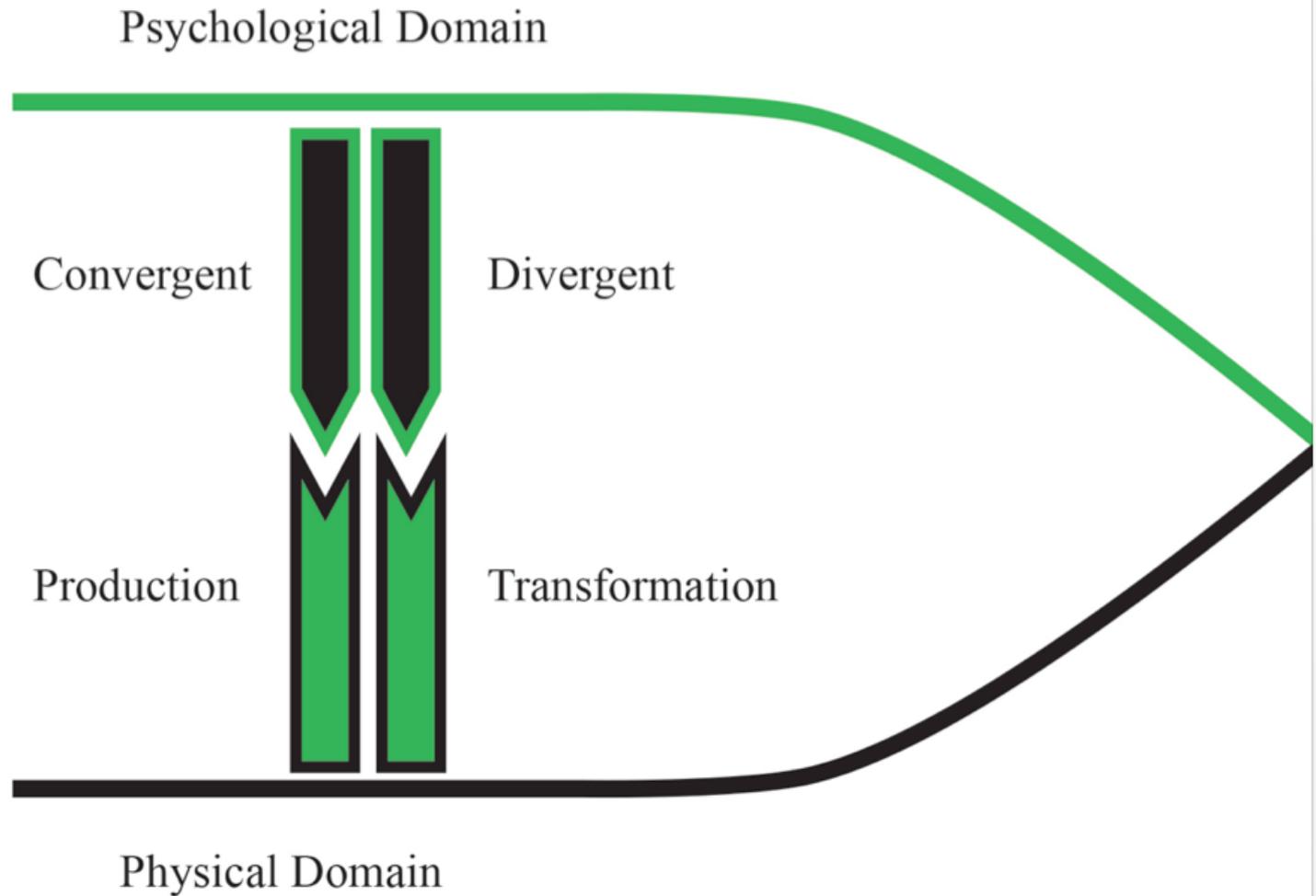
↳ smart building (security, SHM, etc.)

↳ collaborate **IN** the building

Energy/Environment ideas/gods?

Big Idea

Industrial Evolution



A

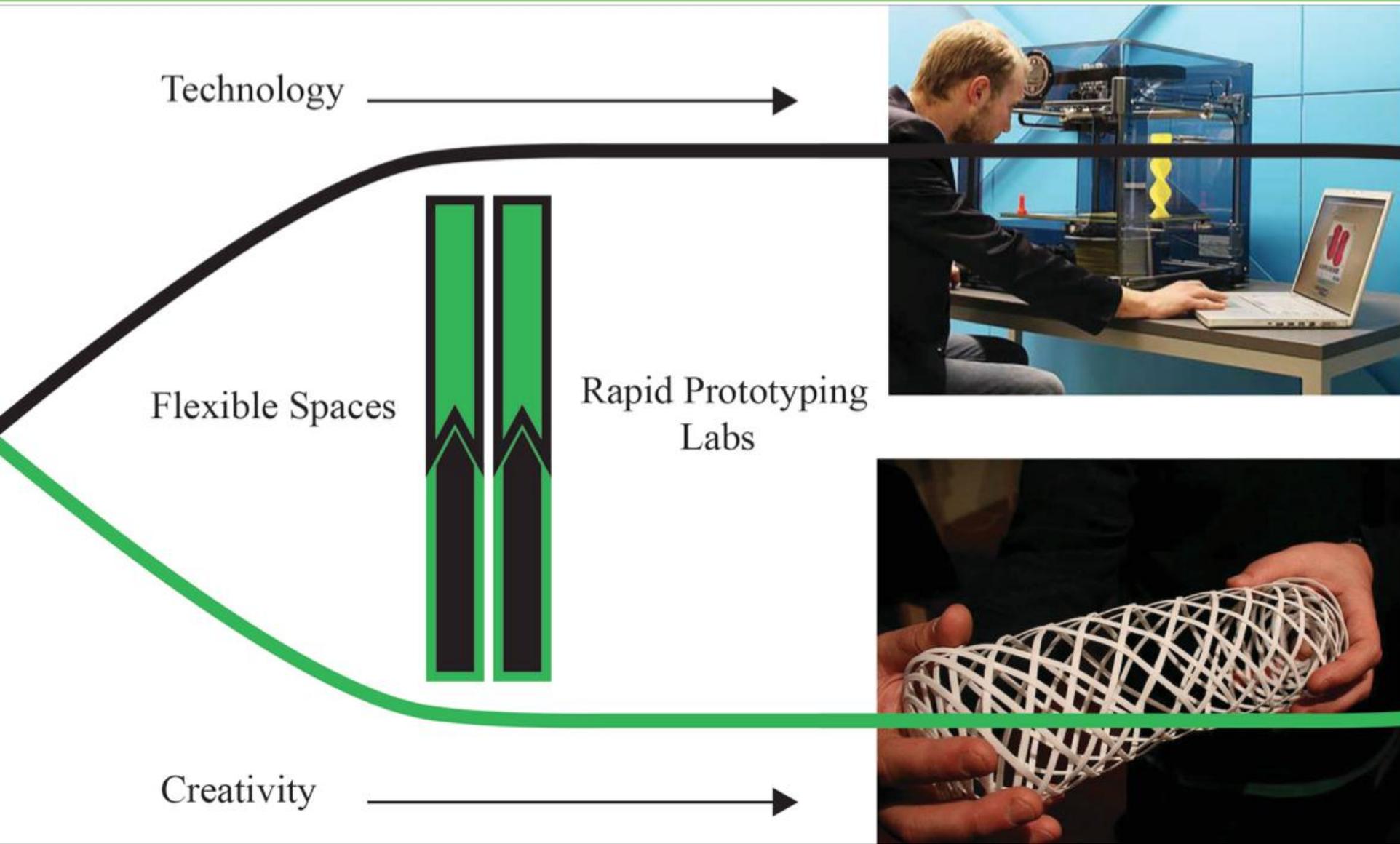
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Big Idea



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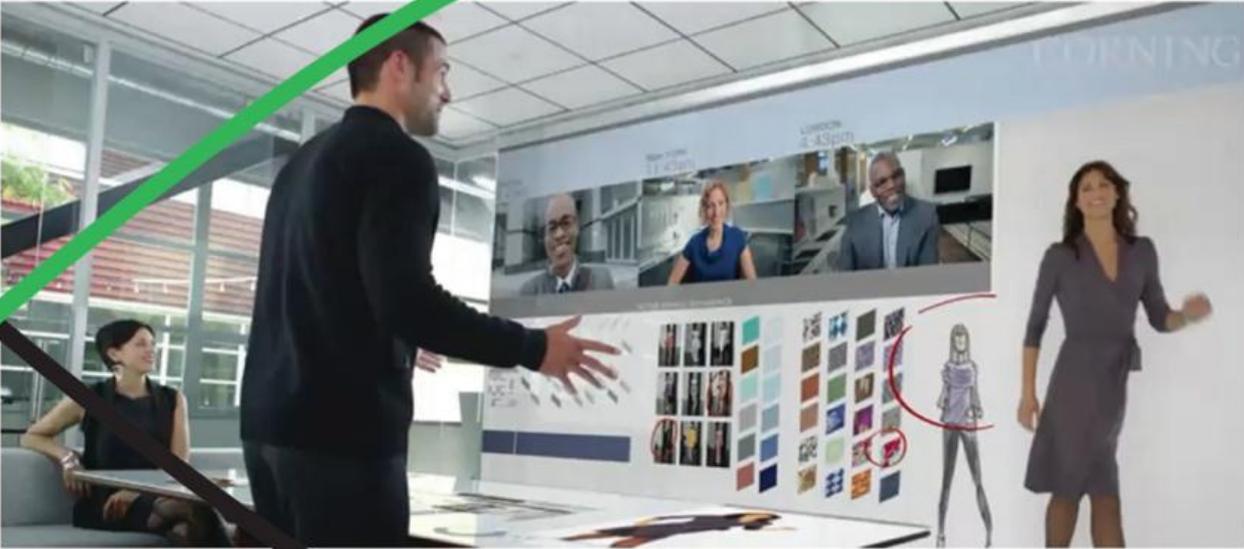
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LCFM

Big Idea

Students



Collaboration
Platform

Profesors



| | | | | |
|---|----|----|-----|------|
| A | SE | CM | MEP | LCFM |
|---|----|----|-----|------|

Big Idea

Rapid Prototyping Lab



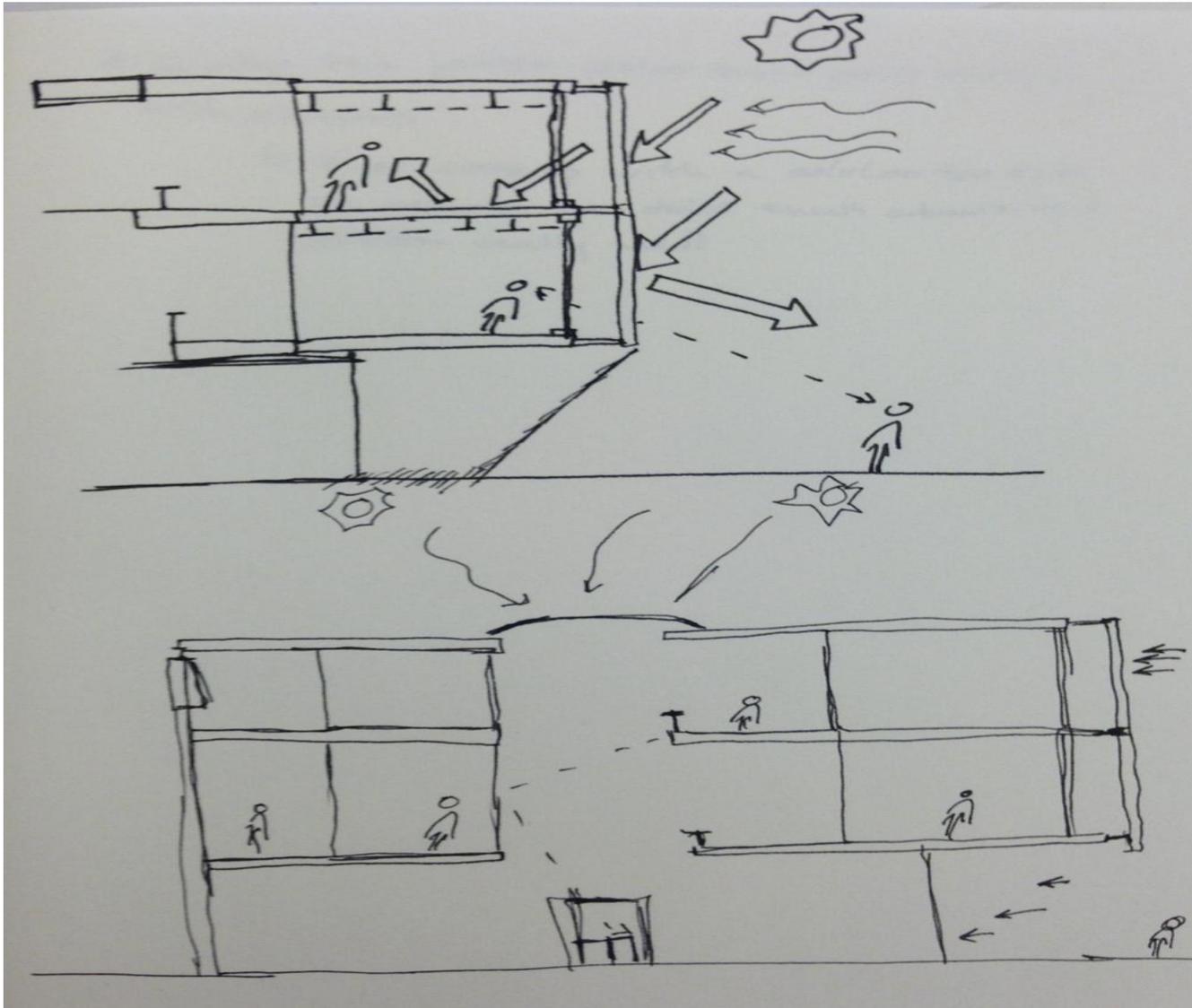
Creative Problem Solving
+
Production

Cafe & Lounge



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| A | SE | CM | MEP | LCFM |
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Big Idea



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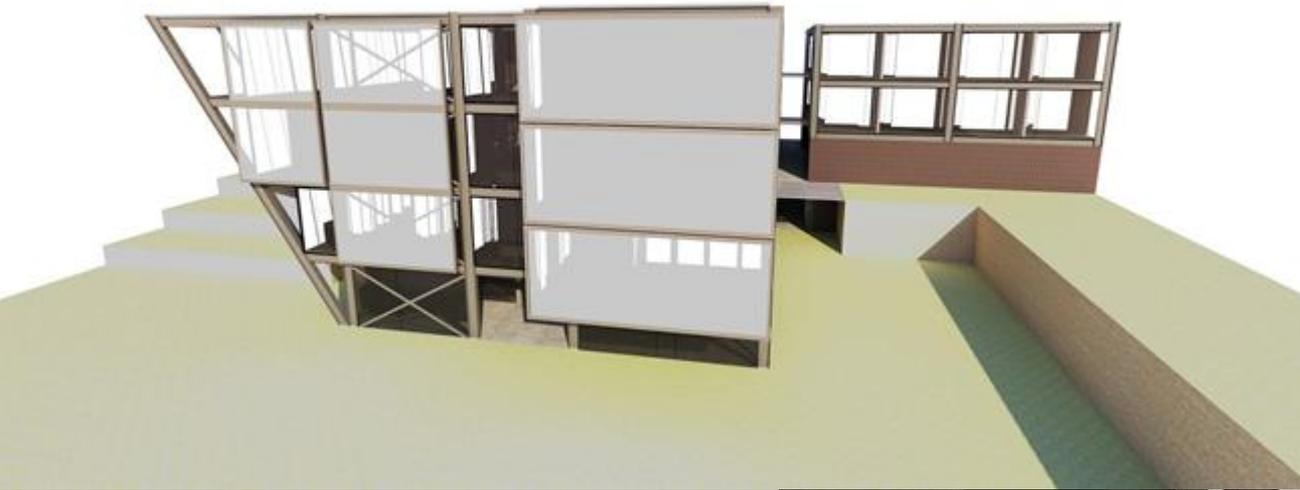
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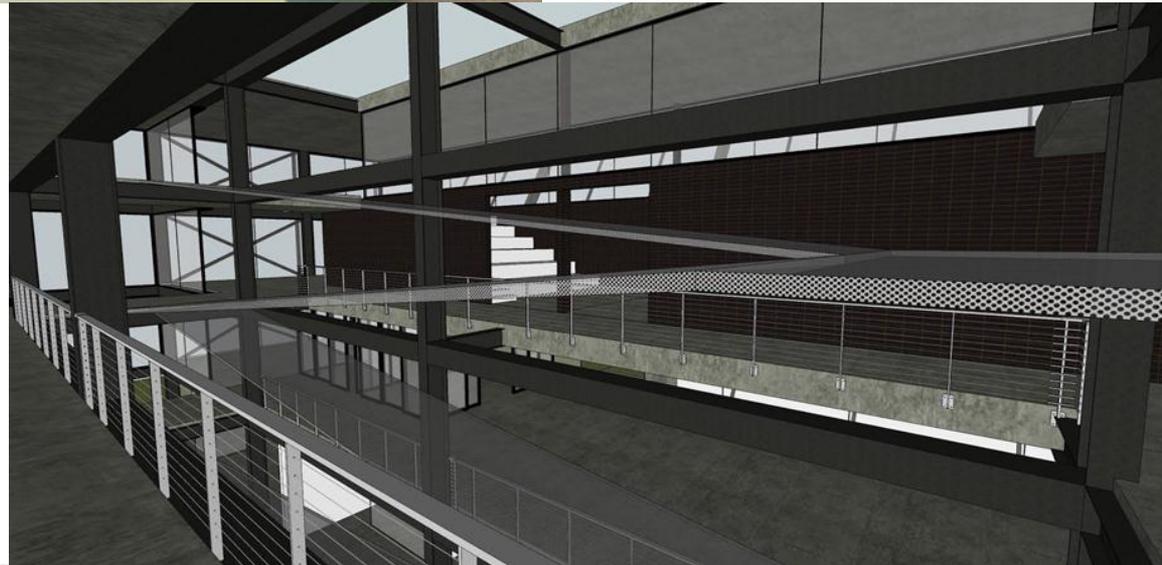
LCFM

L Concept



Transparent
Engineering
Building (TEB)

in steel & concrete



A

SE

CM

MEP

LCFM

DD Concept



Central

X-Lattice



A

SE

CM

MEP

LCFM

Decision Matrix

| Criteria | Subcriteria | Description | Weighting [100 points] | DD-Cylinder | DD-X | L-Shape-Steel | L-Shape-Concrete |
|----------------------------|-------------------------------|--|---------------------------|---------------------|--------------|---------------|------------------|
| Points available | | | 1,33 | [Scale from 1 to 5] | | | |
| Economical | | | 31,7 | 115,0 | 102,7 | 109,3 | 90,0 |
| | Construction Costs | Calculation of the construction costs by RSMMeans. | 7,7 | 4,0 | 4,0 | 3,0 | 3,0 |
| | Operation & Maintenance Costs | Includes expenses for cleaning, energy and administration as well as | 7,3 | 3,0 | 3,0 | 4,0 | 4,0 |
| | NEA/GEA | The ratio of net external area to gross external area to determine | 4,3 | 3,0 | 3,0 | 3,0 | 3,0 |
| | Construction Time | Required construction time according to the work schedules of | 7,0 | 4,0 | 3,0 | 4,0 | 2,0 |
| | Constructability | How the building will be built and what techniques will be used | 5,3 | 4,0 | 3,0 | 3,0 | 2,0 |
| Environmental (STV) | | | 21,3 | 58,7 | 58,7 | 64,3 | 69,7 |
| | CO2-Emission | CO2-Emission in tons per year. | 5,3 | 2,0 | 2,0 | 3,0 | 4,0 |
| | Renewable Energy | Usage of renewable energy (e.g. PV, wind turbine, earth heat). | 6,3 | 3,0 | 3,0 | 3,0 | 3,0 |
| | Life Cycle of Material | Life span of used materials. | 5,0 | 3,0 | 3,0 | 4,0 | 4,0 |
| | Recycled Material | Usage of recycled materials. | 4,7 | 3,0 | 3,0 | 2,0 | 2,0 |
| Social | | | 31,7 | 97,7 | 107,7 | 101,3 | 101,3 |
| | Comfort | Comfort of the users and employees (mostly depending on the | 7,7 | 4,0 | 4,0 | 3,0 | 3,0 |
| | Flexibility | Flexibility describes how spaces can be customized to different | 5,3 | 3,0 | 3,0 | 3,0 | 3,0 |
| | Student/Faculty Collaboration | Interaction and collaboration between students and faculty mem | 6,3 | 3,0 | 3,0 | 4,0 | 4,0 |
| | Design/Iconicity | Attractiveness and iconicity of the design/building. | 5,0 | 2,0 | 4,0 | 3,0 | 3,0 |
| | Innovation | In which extend innovations are included in the construction pr | 7,3 | 3,0 | 3,0 | 3,0 | 3,0 |
| Discipline specials | | | 14,0 | 42,0 | 48,7 | 35,3 | 35,3 |
| | Architectual/structural unity | Clarity of the structural and architectual concepts throughout t | 6,7 | 3,0 | 4,0 | 2,0 | 2,0 |
| | Context connection | How the design of the building connects with surroundings an | 7,3 | 3,0 | 3,0 | 3,0 | 3,0 |
| Total Score | | | | 313,3 | 317,7 | 310,3 | 296,3 |

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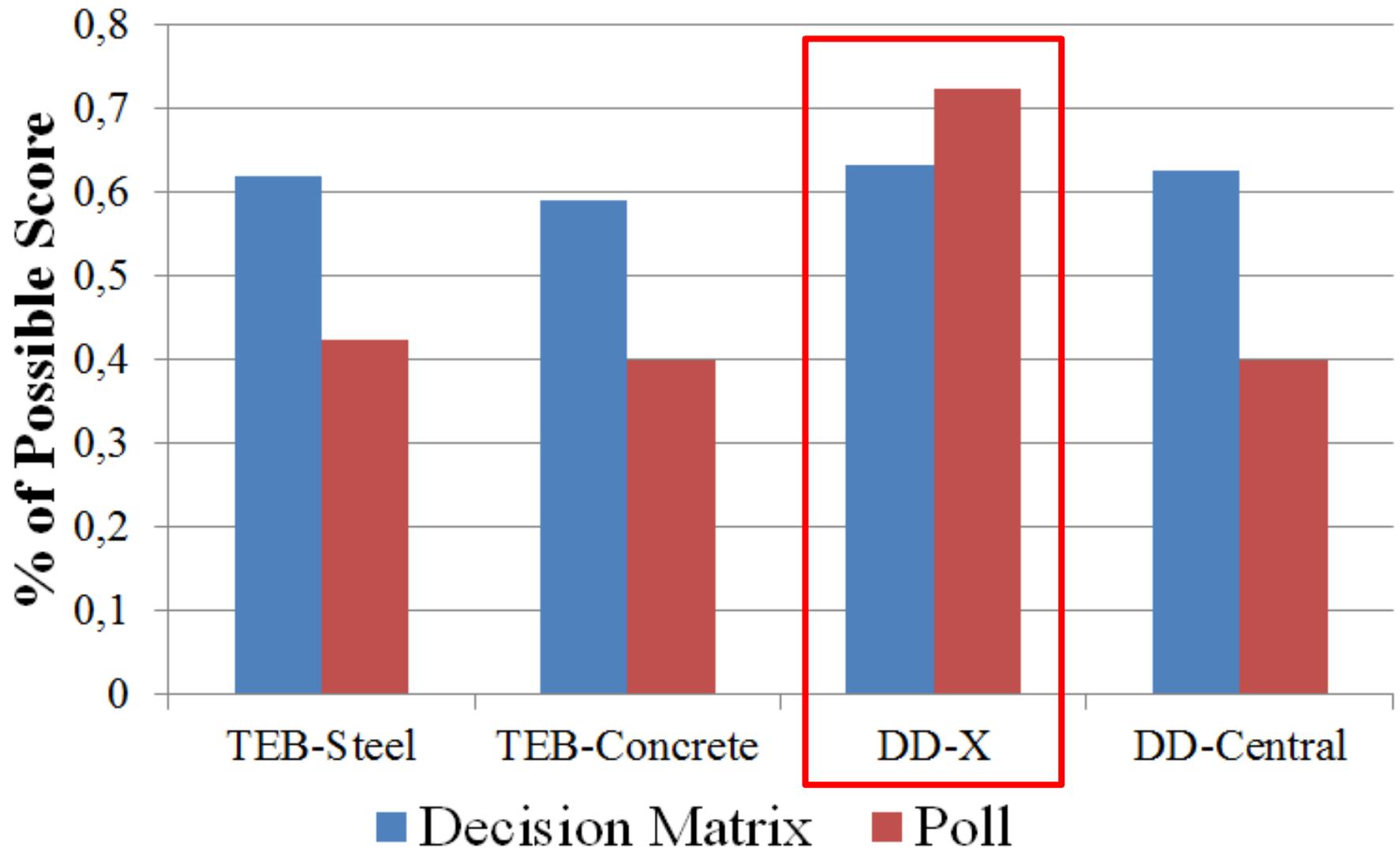
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Chosen Concept



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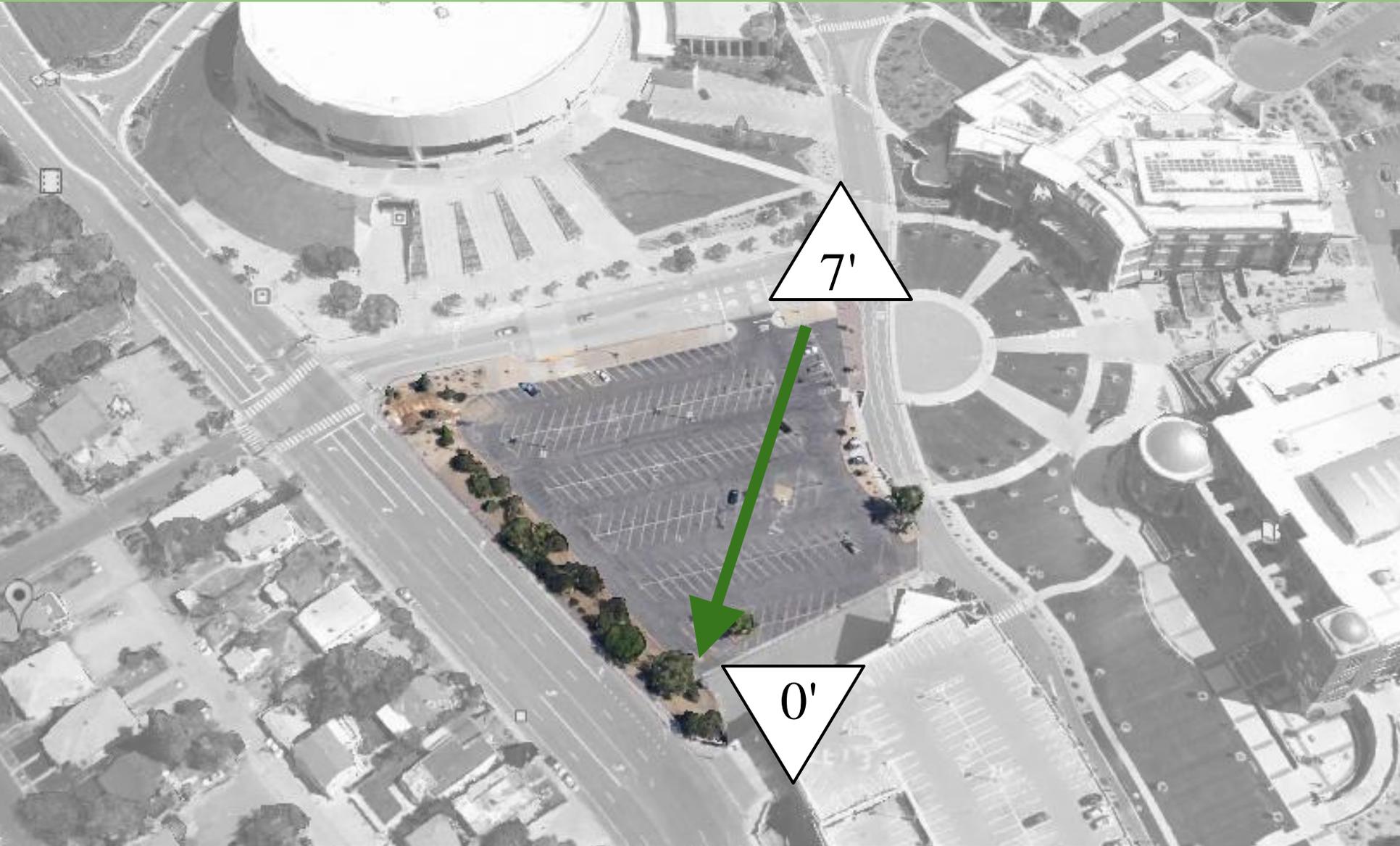
SE

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MEP

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Site Topography



7'

0'

A

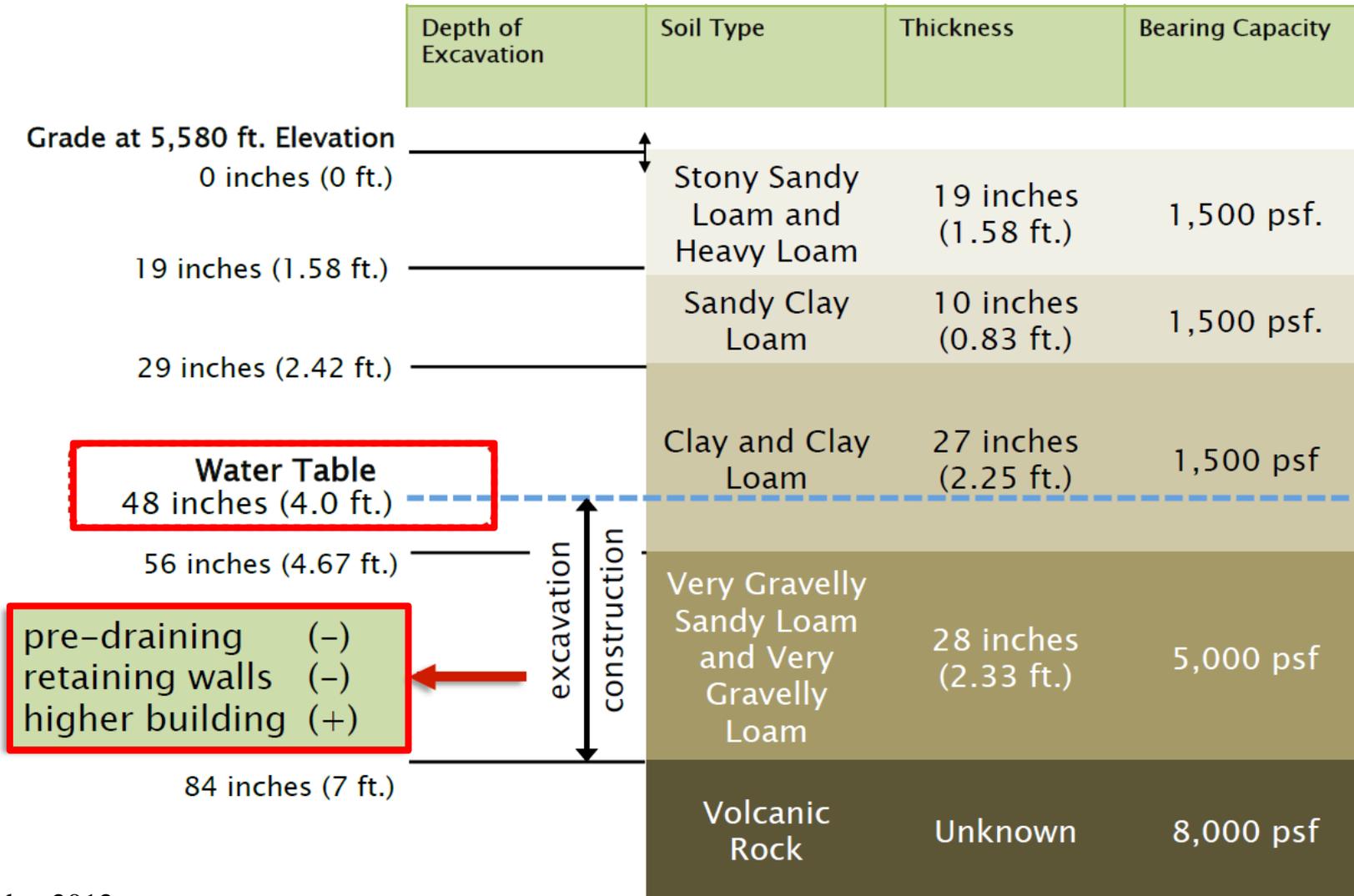
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Soil Properties



Source: Ridge 2012

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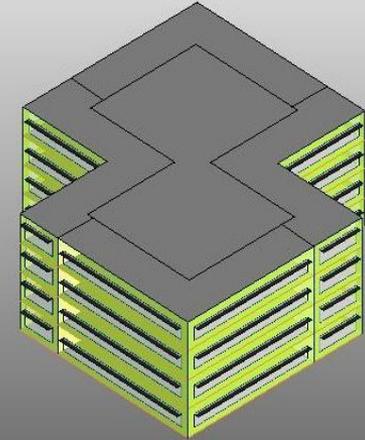
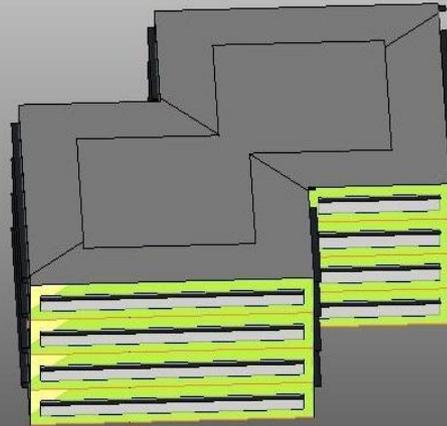
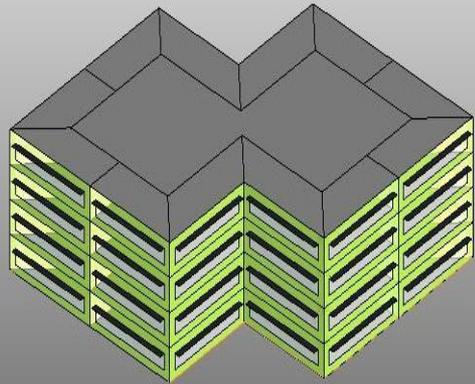
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Orientation



Total EUI (kBtu/sf/yr)

70

68

71

Life Cycle Energy Cost (\$)

630,000

615,000

650,000

Net CO₂ (tn/year)

155

145

165

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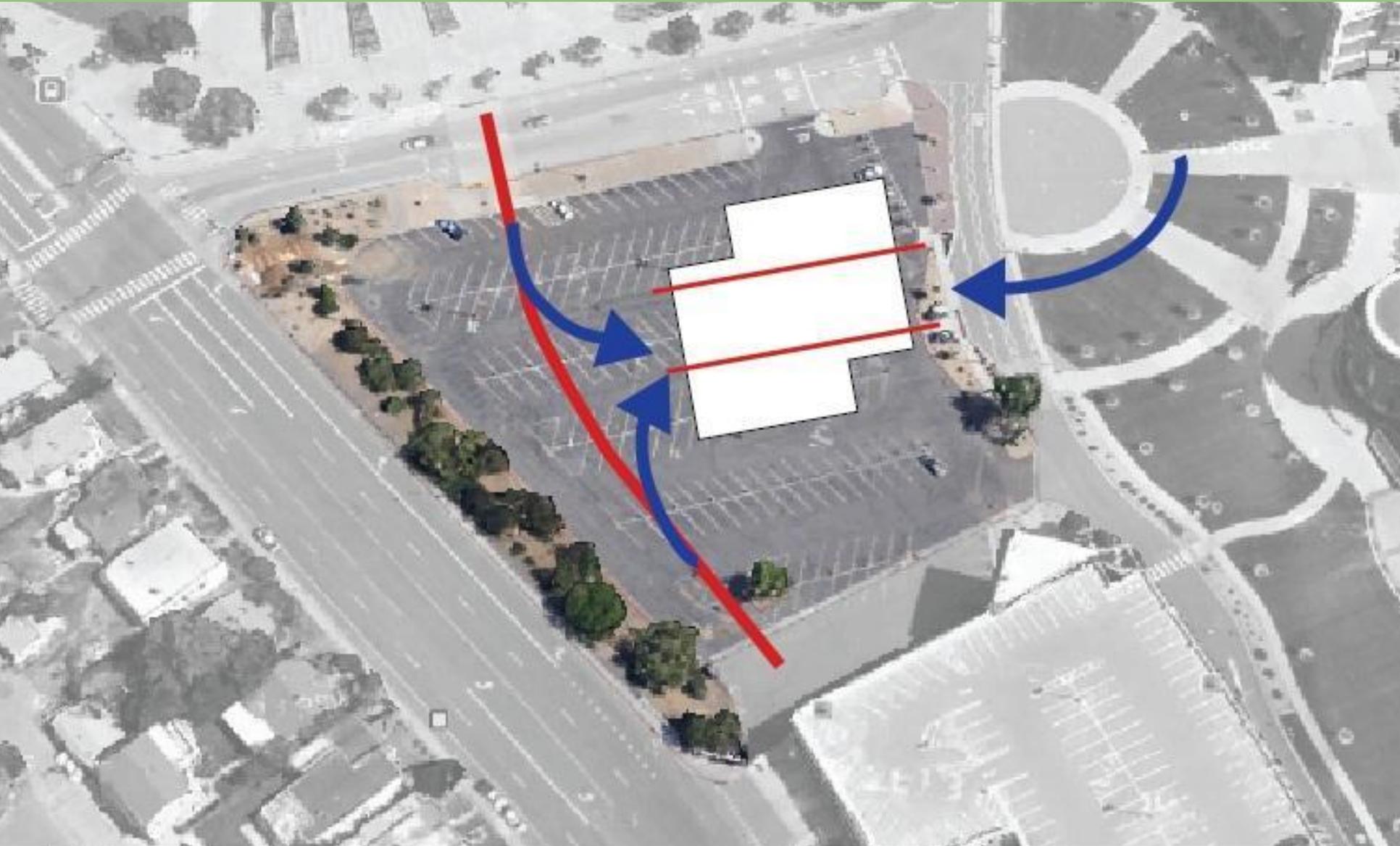
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Building Placement



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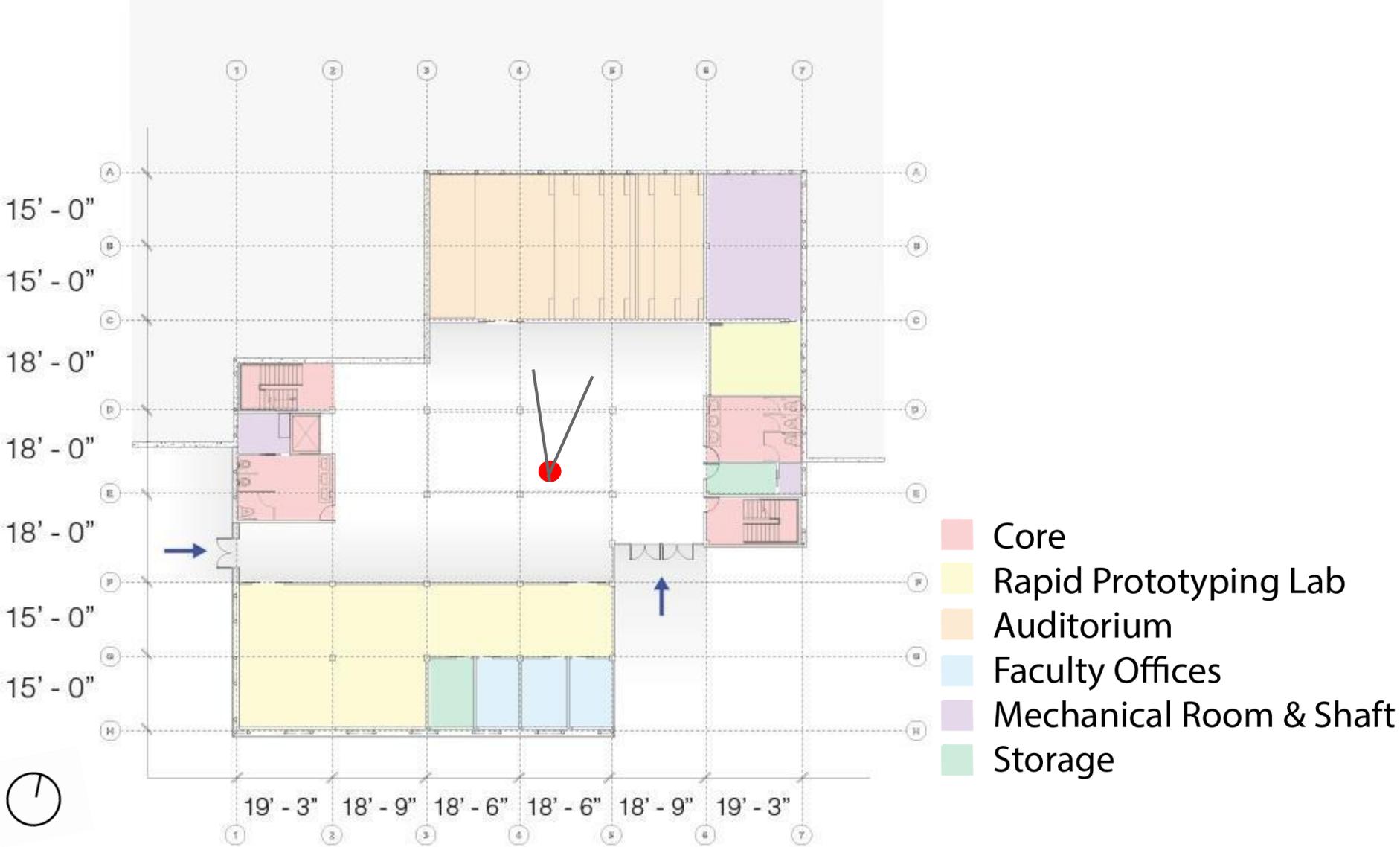
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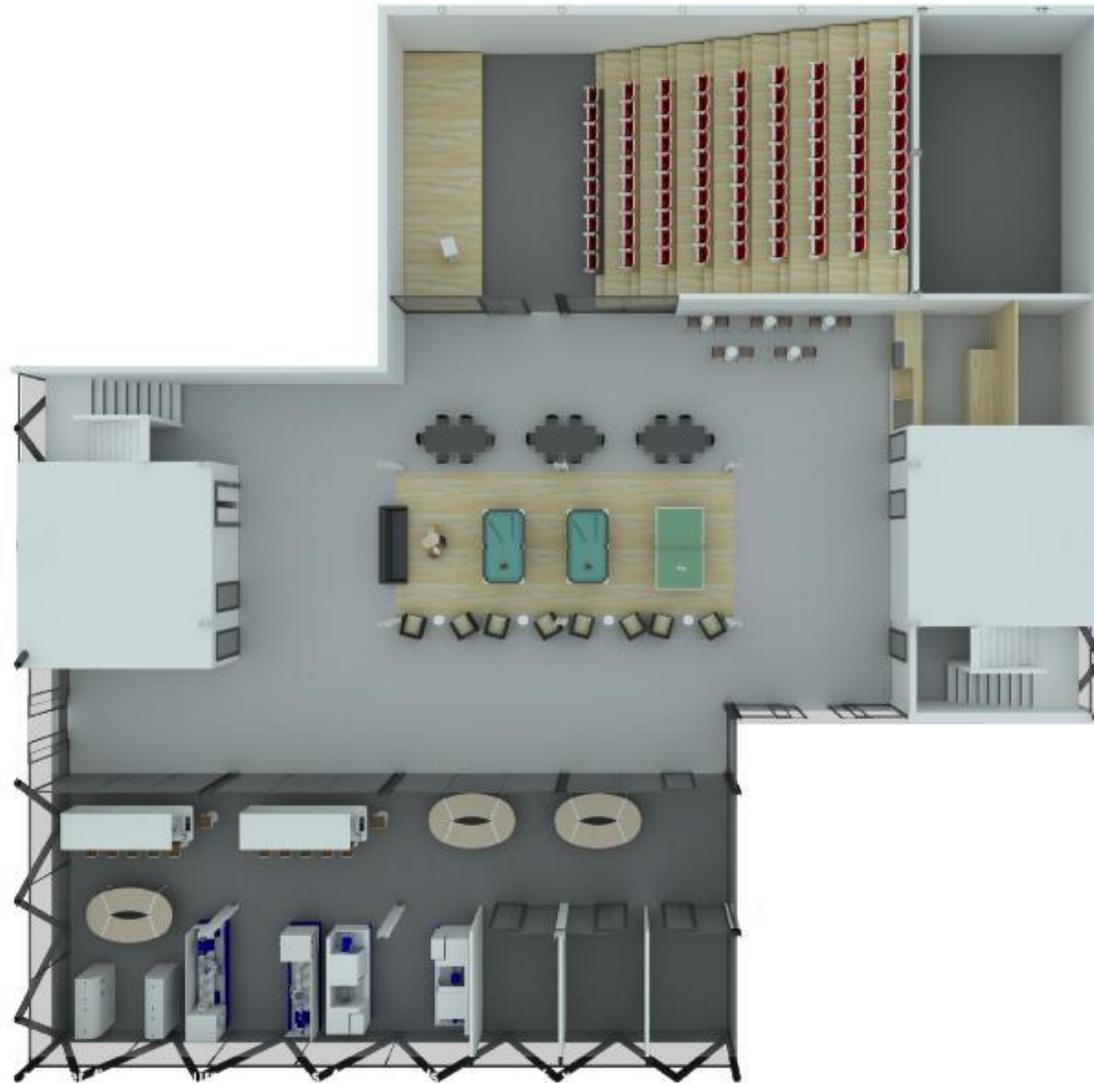
MEP

LCFM

Basement Level - Floor Plan



Basement Level - Furnished



A

SE

CM

MEP

LCFM

Basement Level



A

SE

CM

MEP

LCFM

Basement Level



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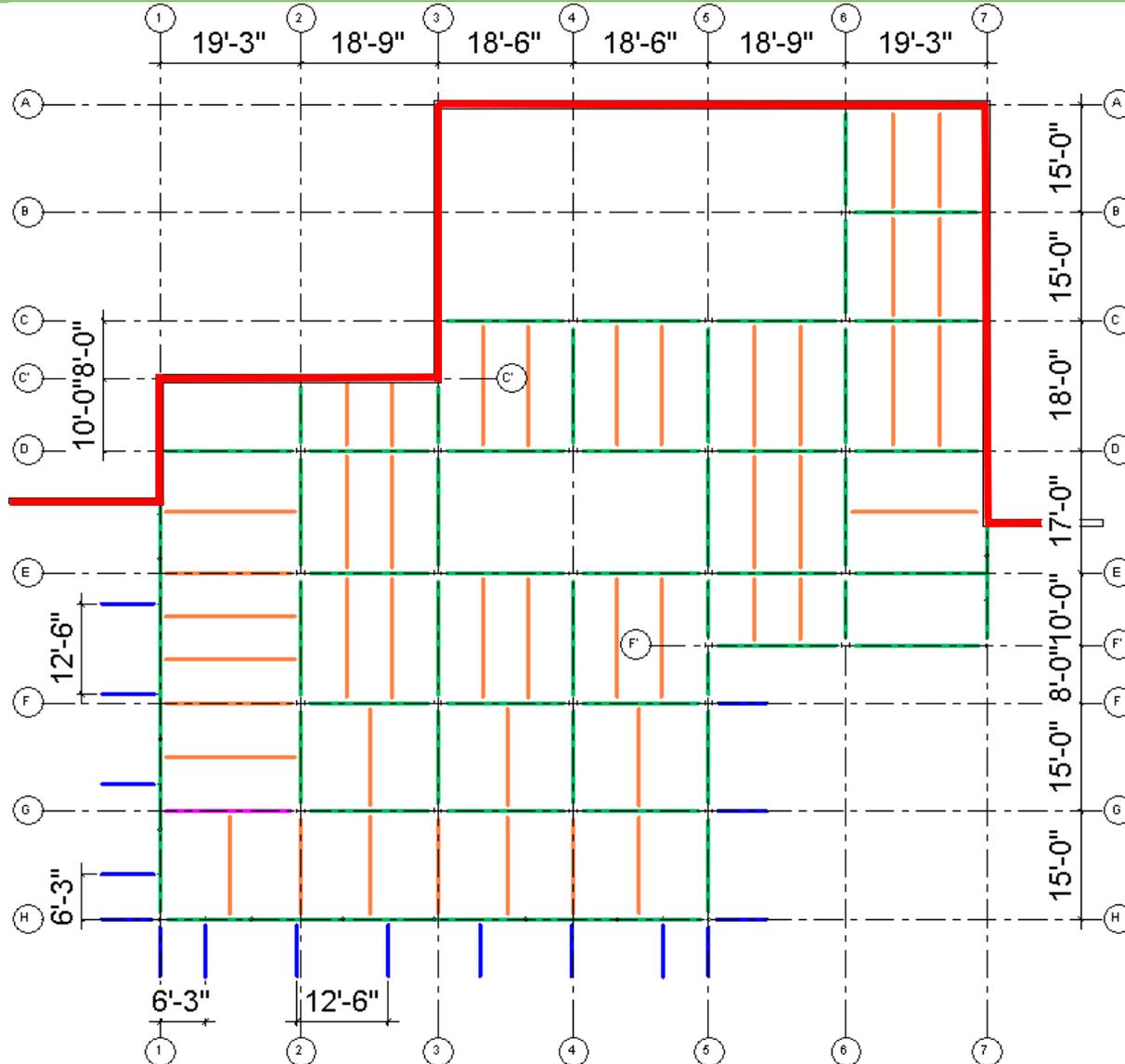
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Basement Level - Structure



Legend:

- W8x24
- W8x40
- W12x30
- W12x50
- retaining wall



A

SE

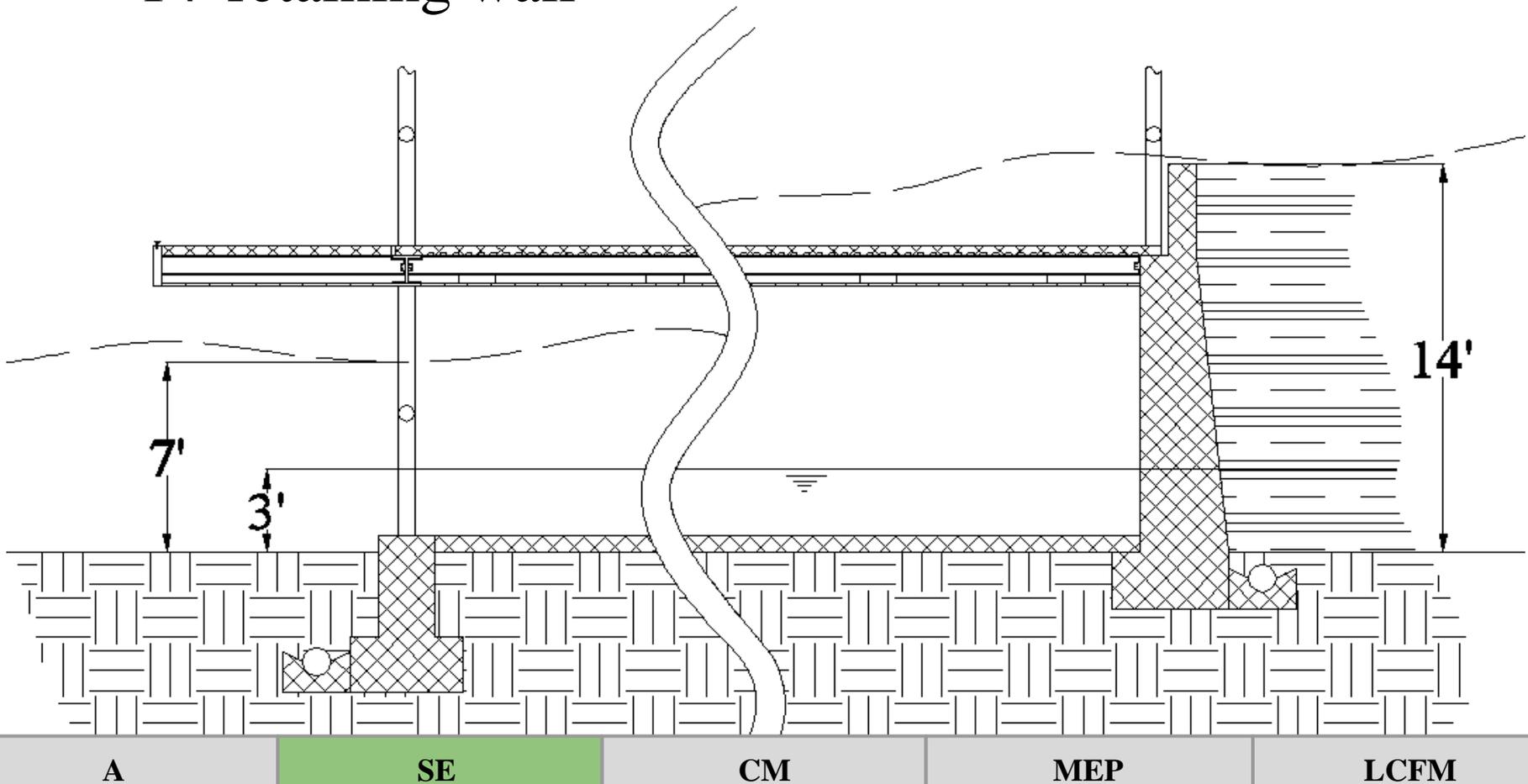
CM

MEP

LCFM

Foundations and Retaining Wall

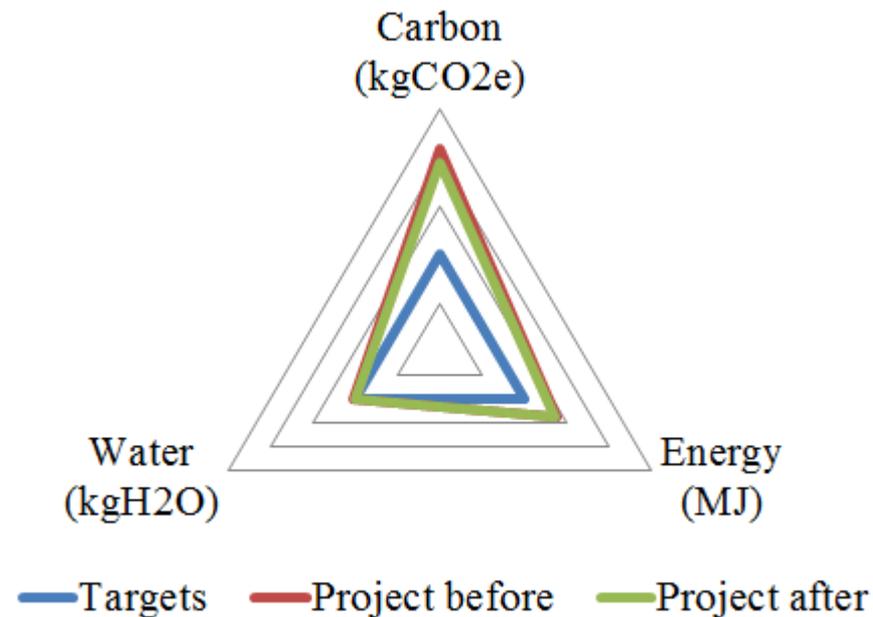
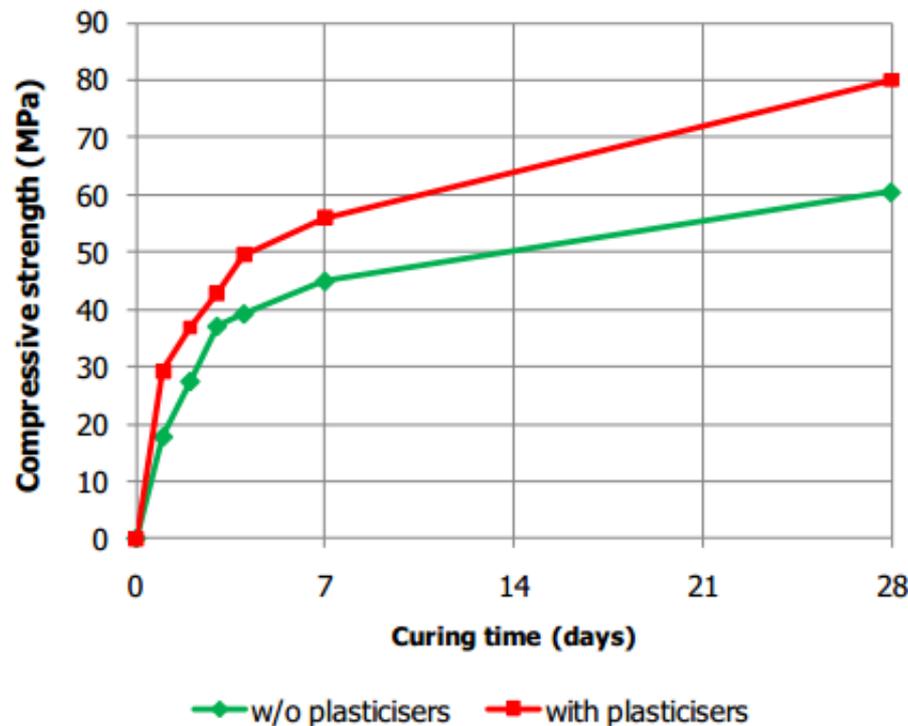
- pad footings
- foundation slab
- 14' retaining wall



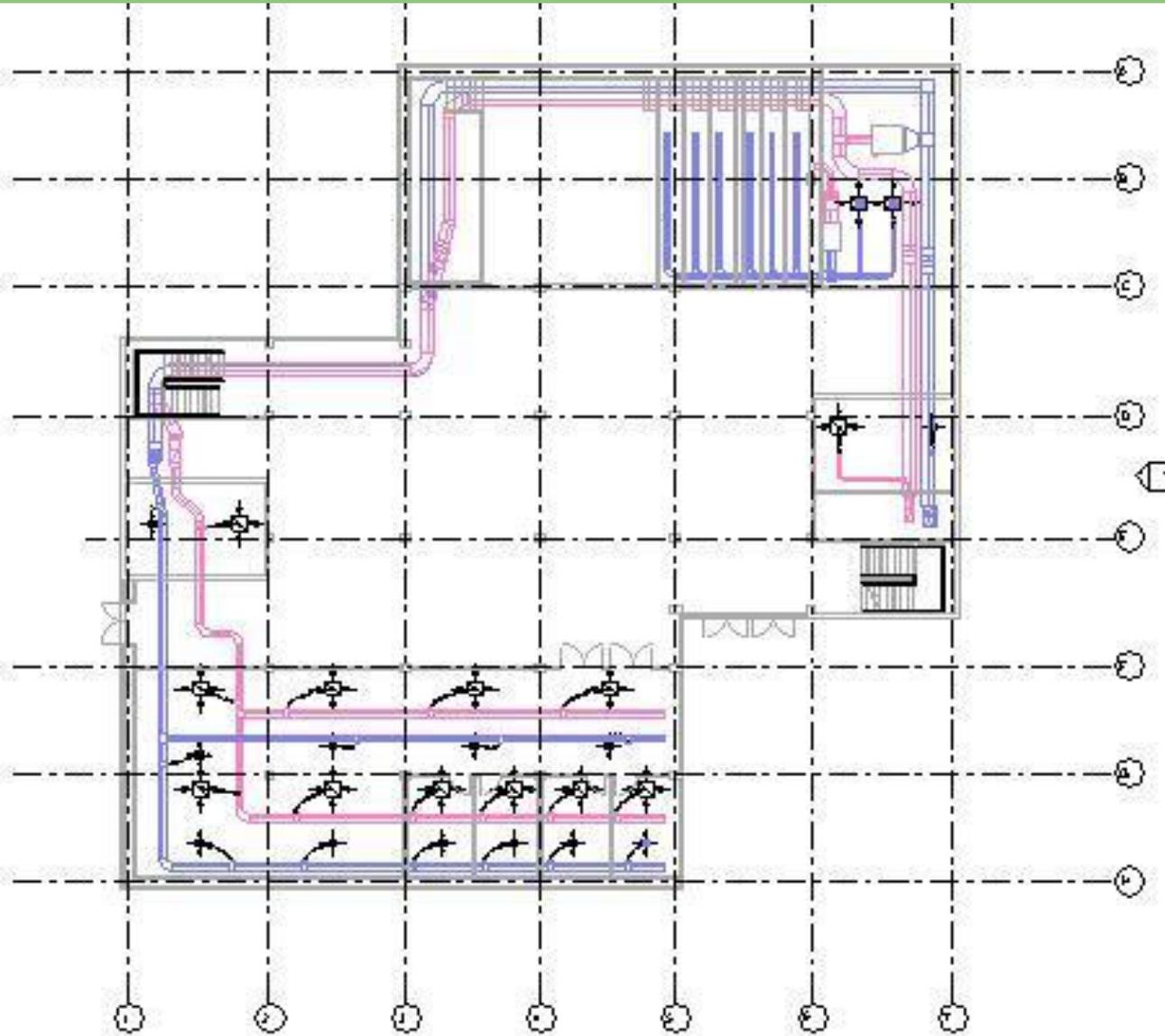
Concrete



- Production of 1 tonne of cement absorbs up to 100 kg more CO₂ than it emits
- Strength and cost parity with traditional concrete



Basement Level - Duct Network



Overhead
System VAV

 Supply
 Return



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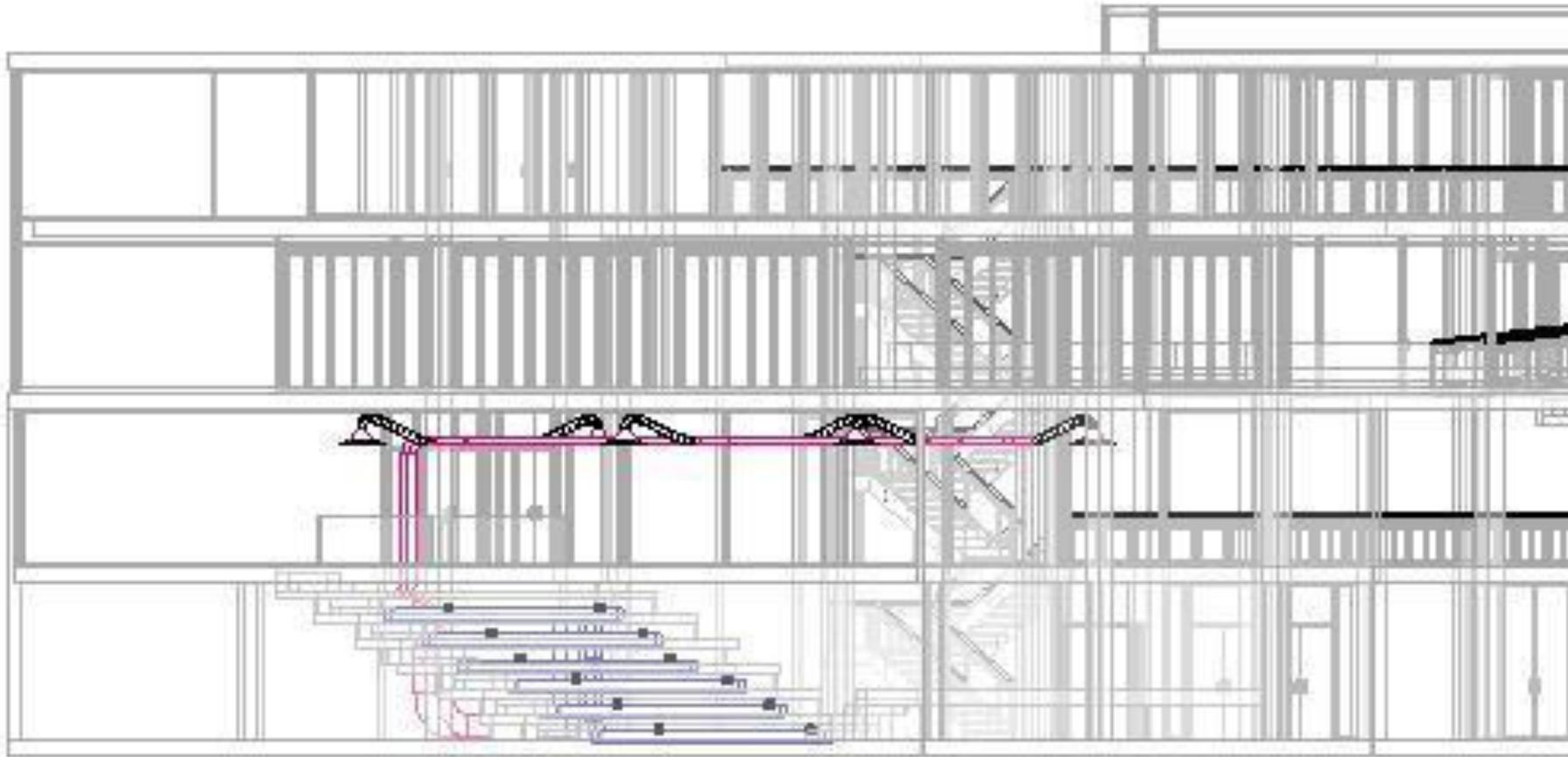
SE

CM

MEP

LCFM

Auditorium 3D



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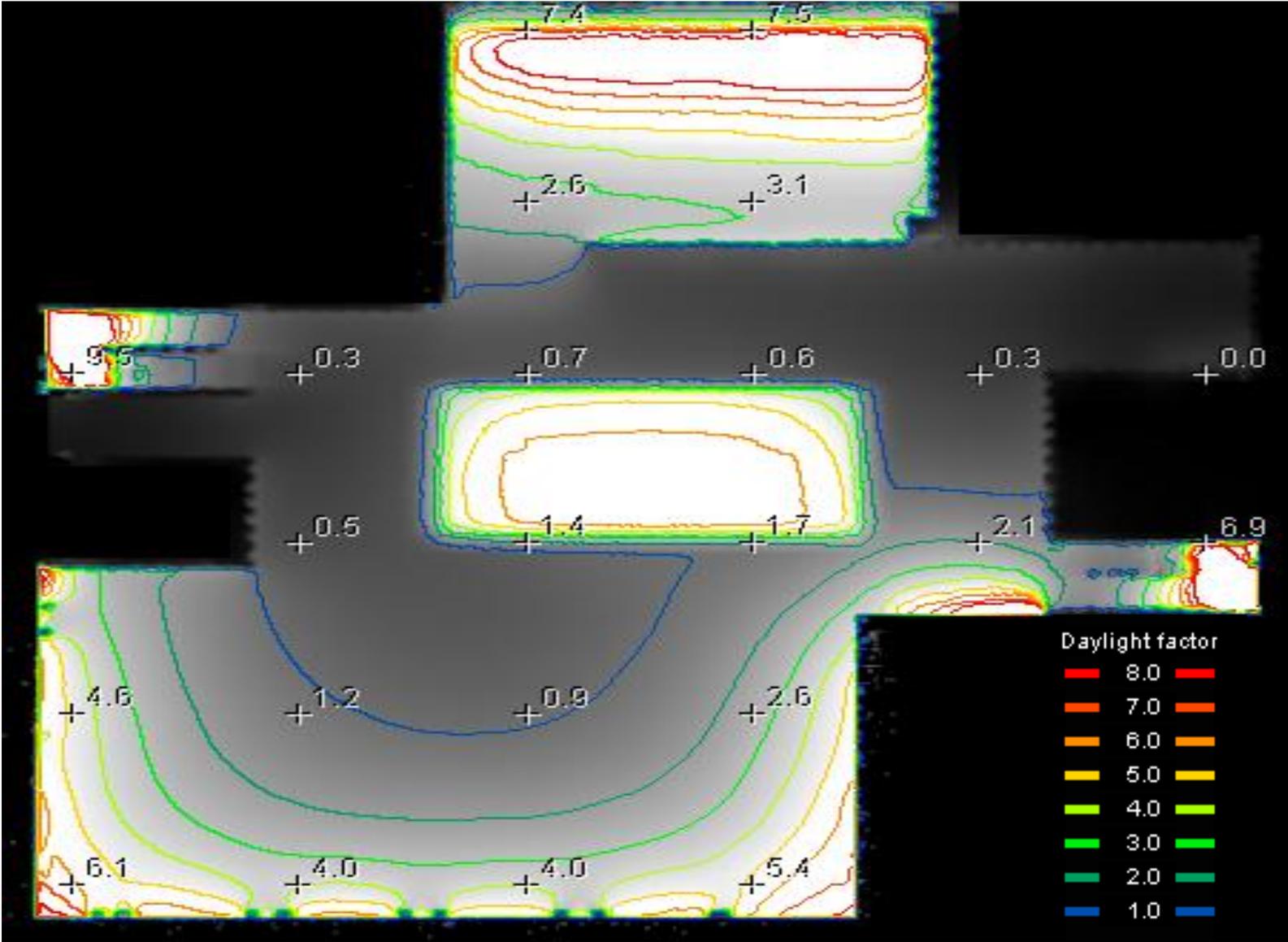
SE

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MEP

LCFM

Basement Level - Daylight



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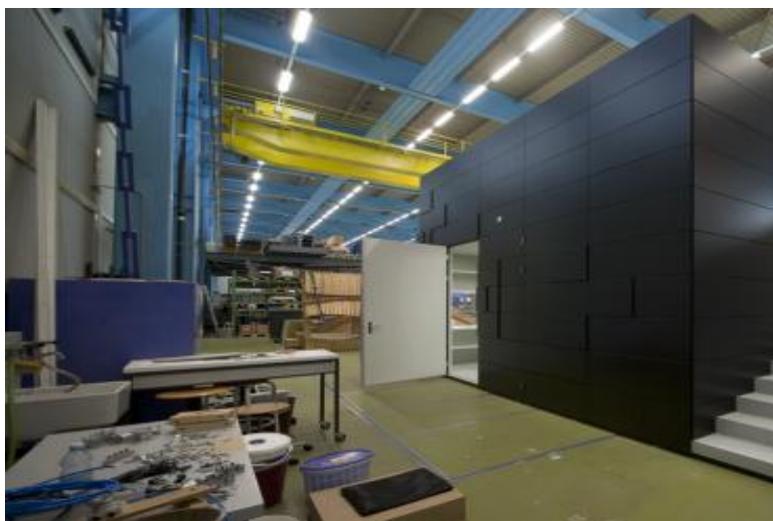
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Additional Income

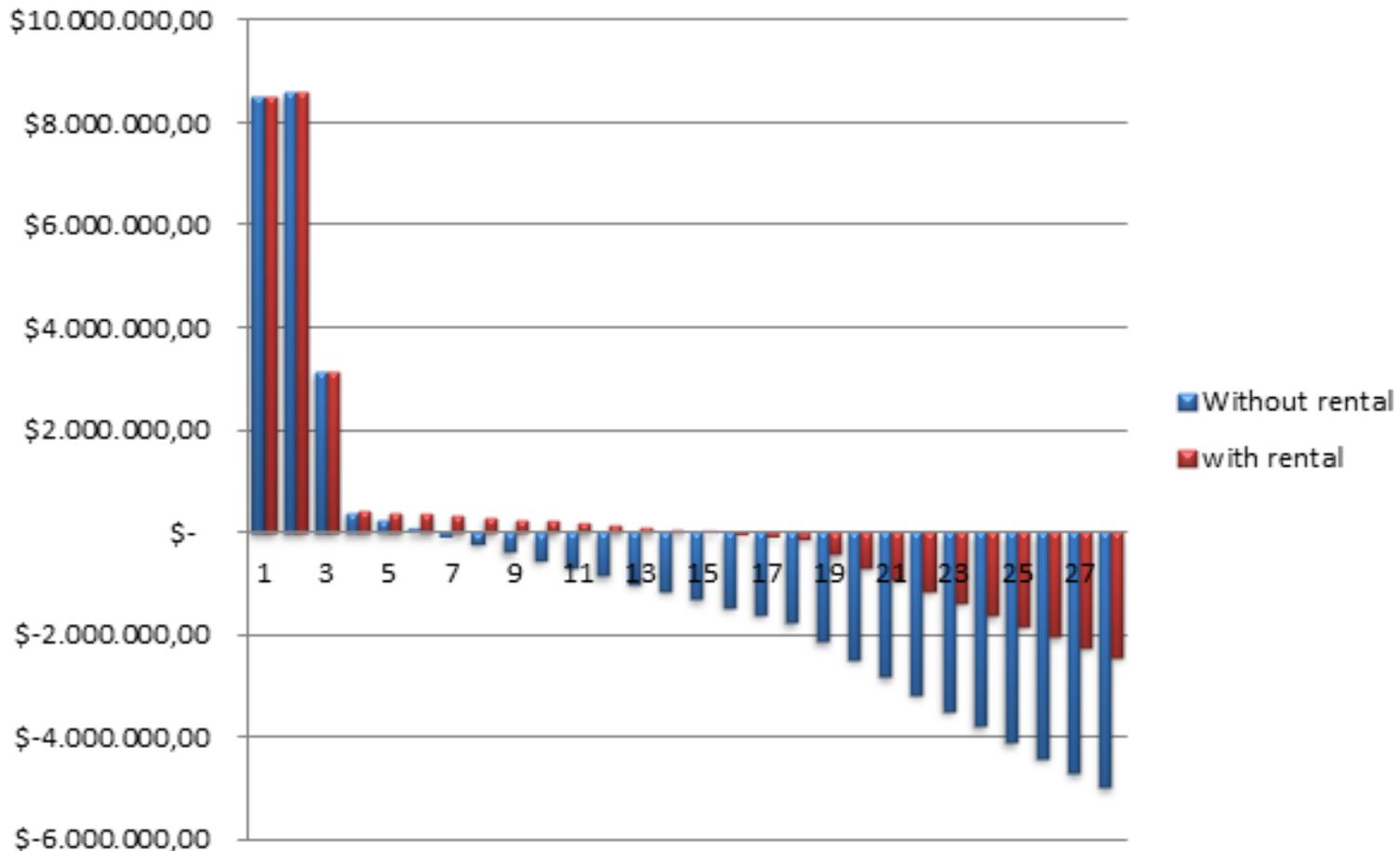


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| A | SE | CM | MEP | LCFM |
|---|----|----|-----|------|

Additional Income



NPV: \$9 820 000 with rental / \$11 700 000 without rental



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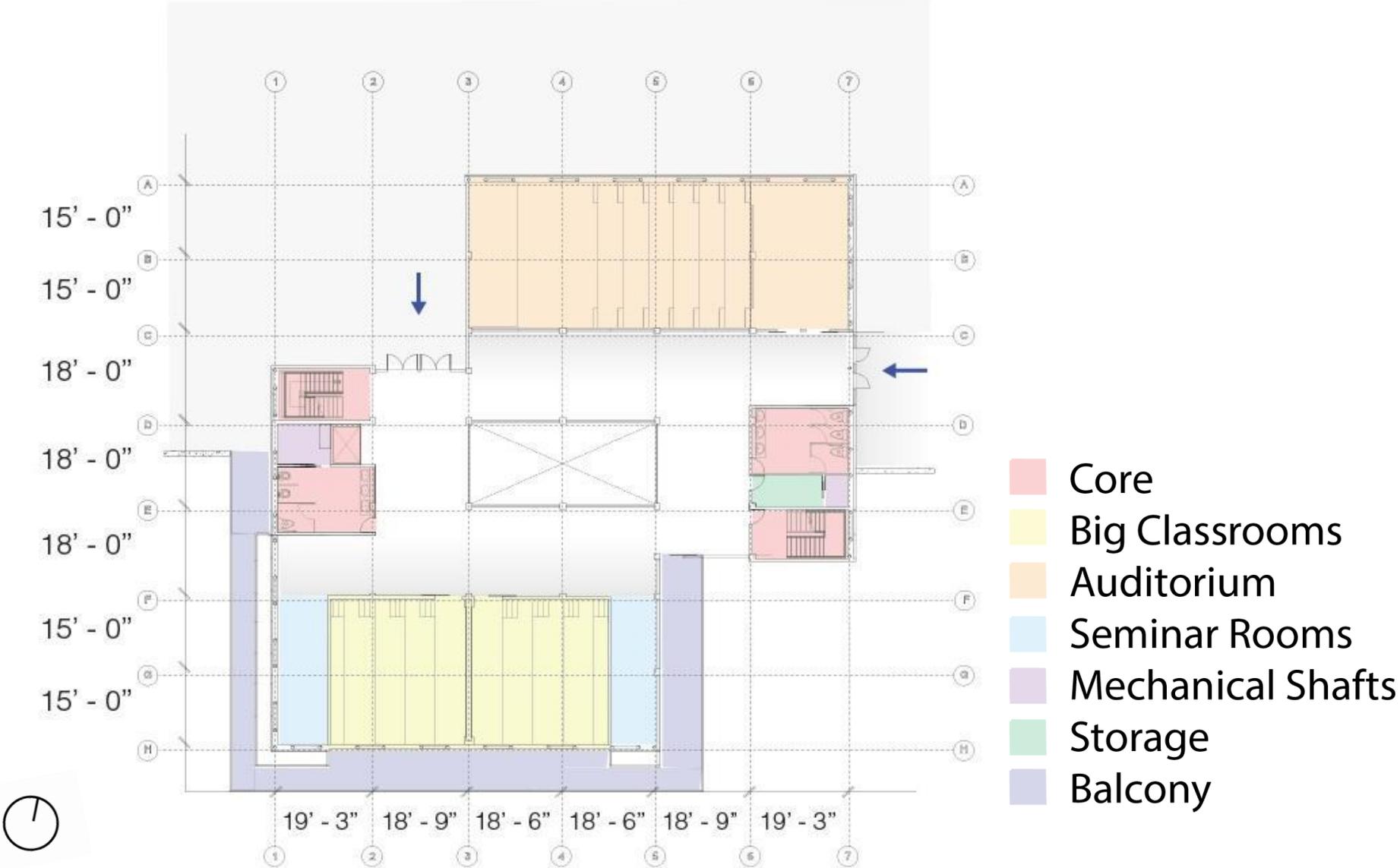
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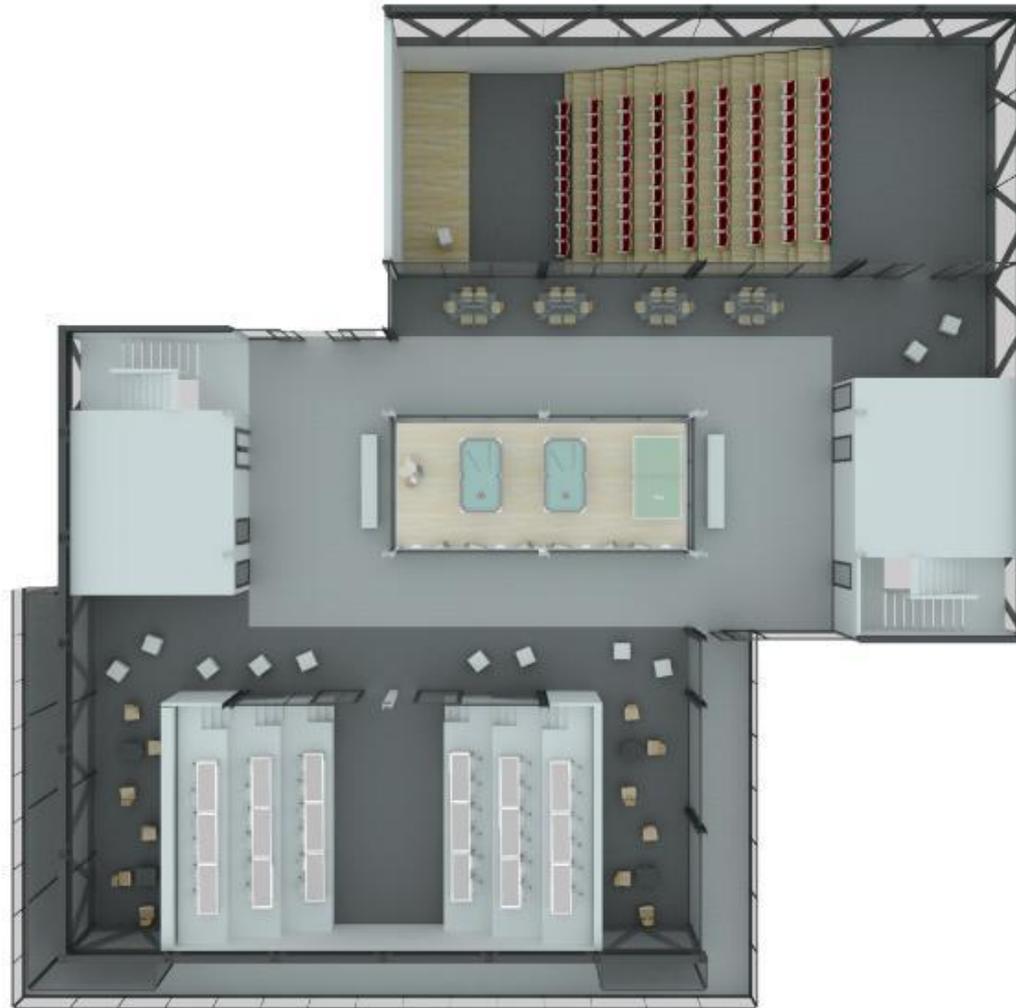
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First Level - Floor Plan



First Level - Furnished



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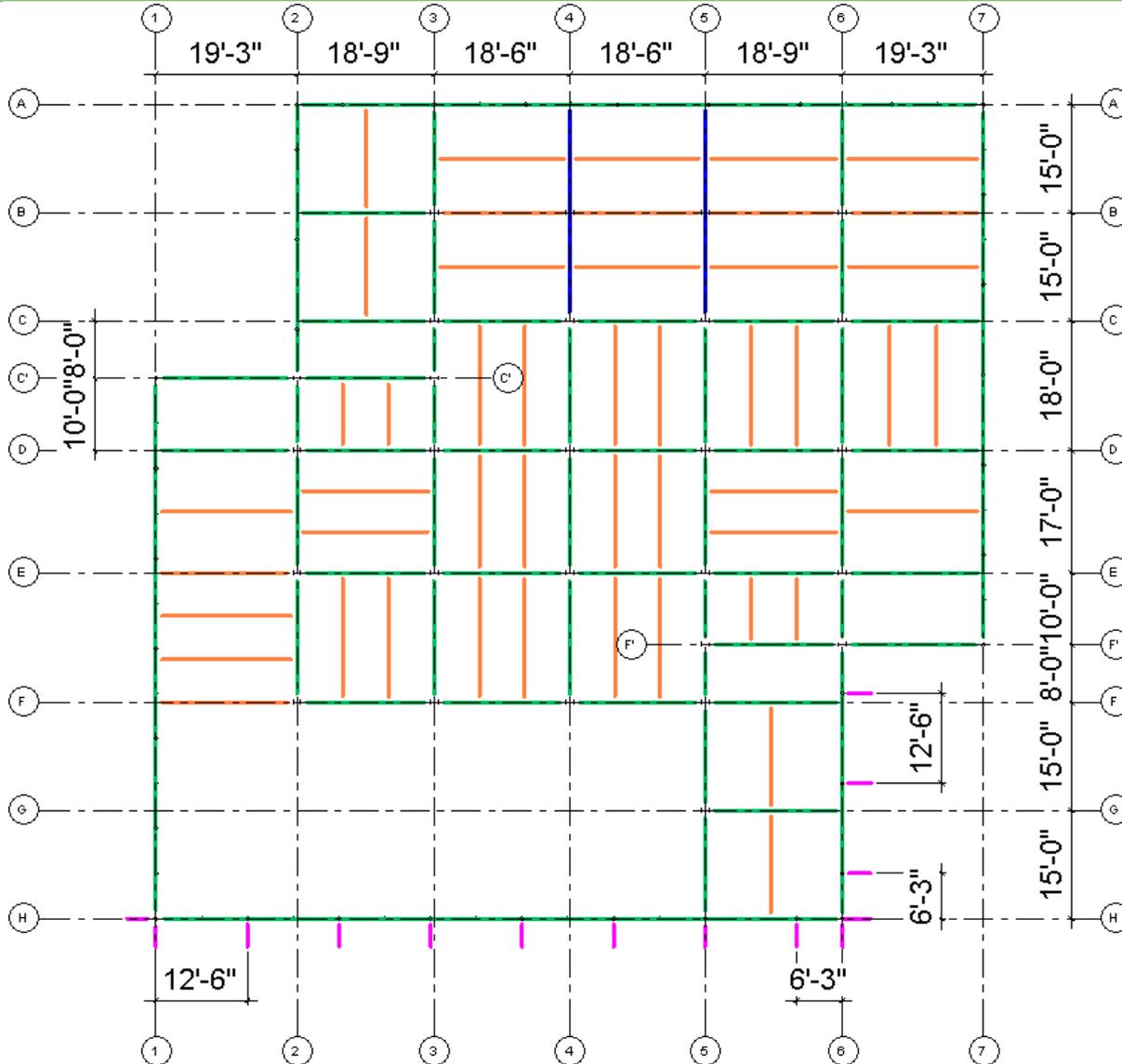
SE

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LCFM

First Level - Structure



Legend:

- W8x18
- W8x24
- W12x50
- W27x129

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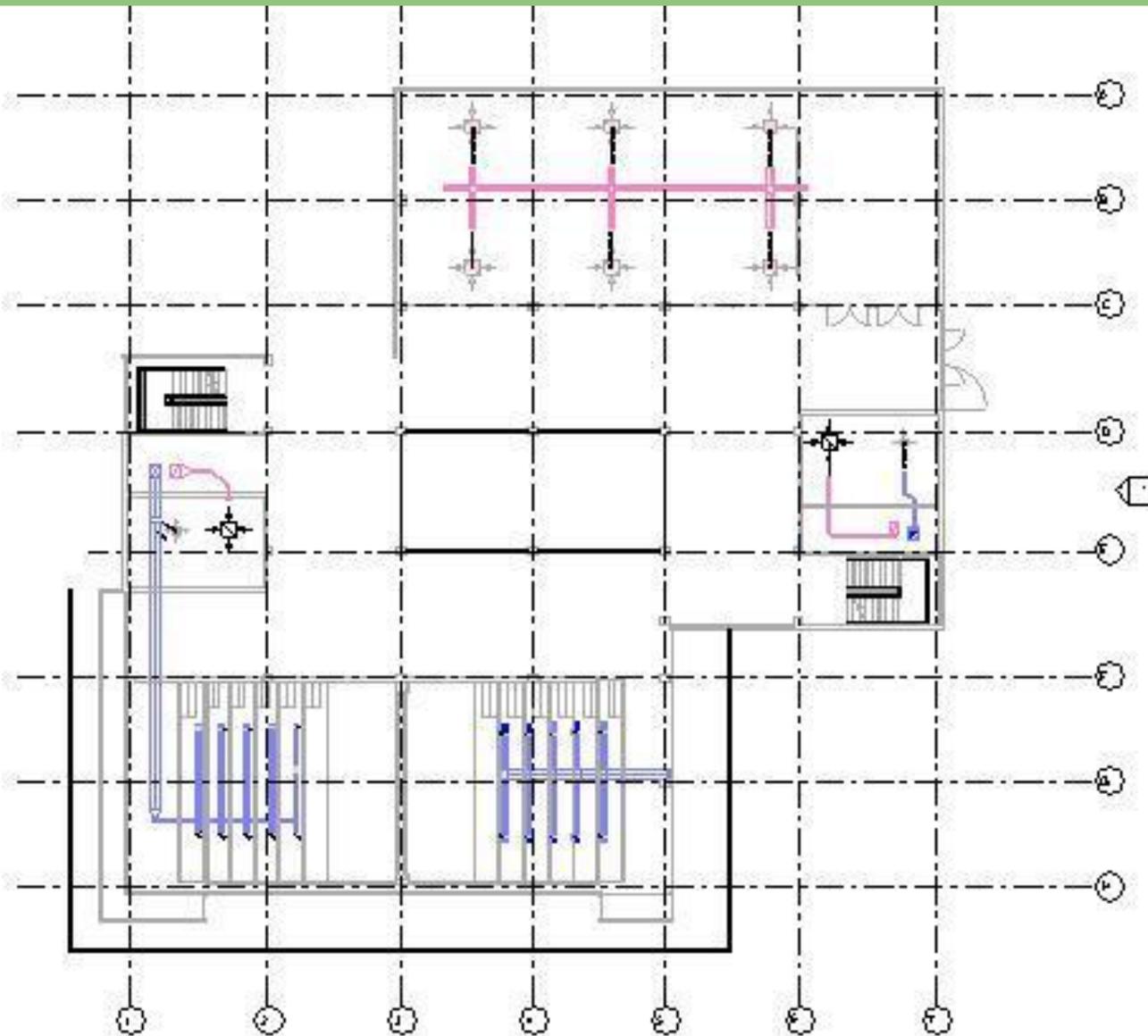
SE

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First Level - Duct Network



Sensors

- CO₂
- Temperature

Supply
Return

A

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Big Classrooms 3D



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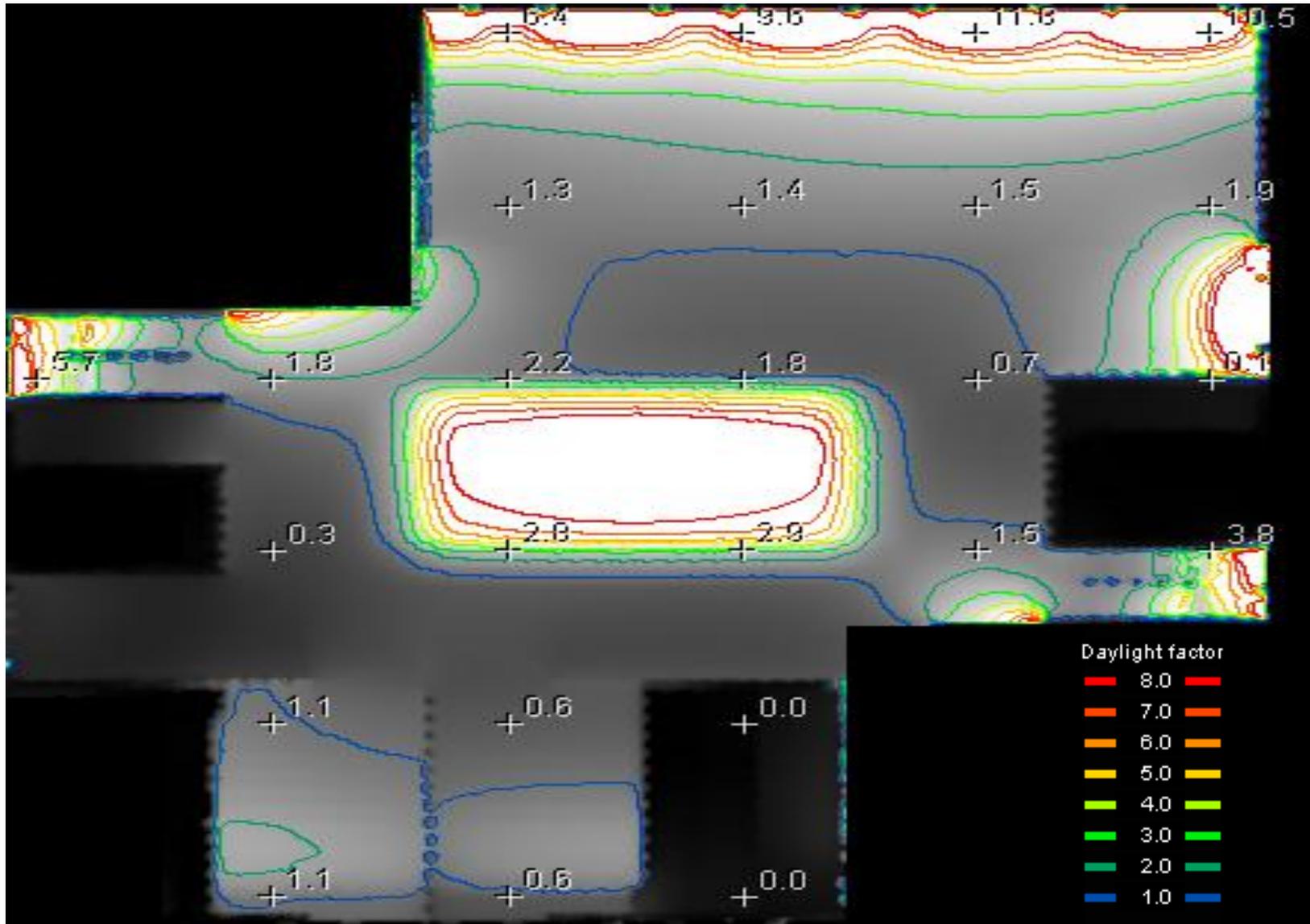
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First Level - Daylight



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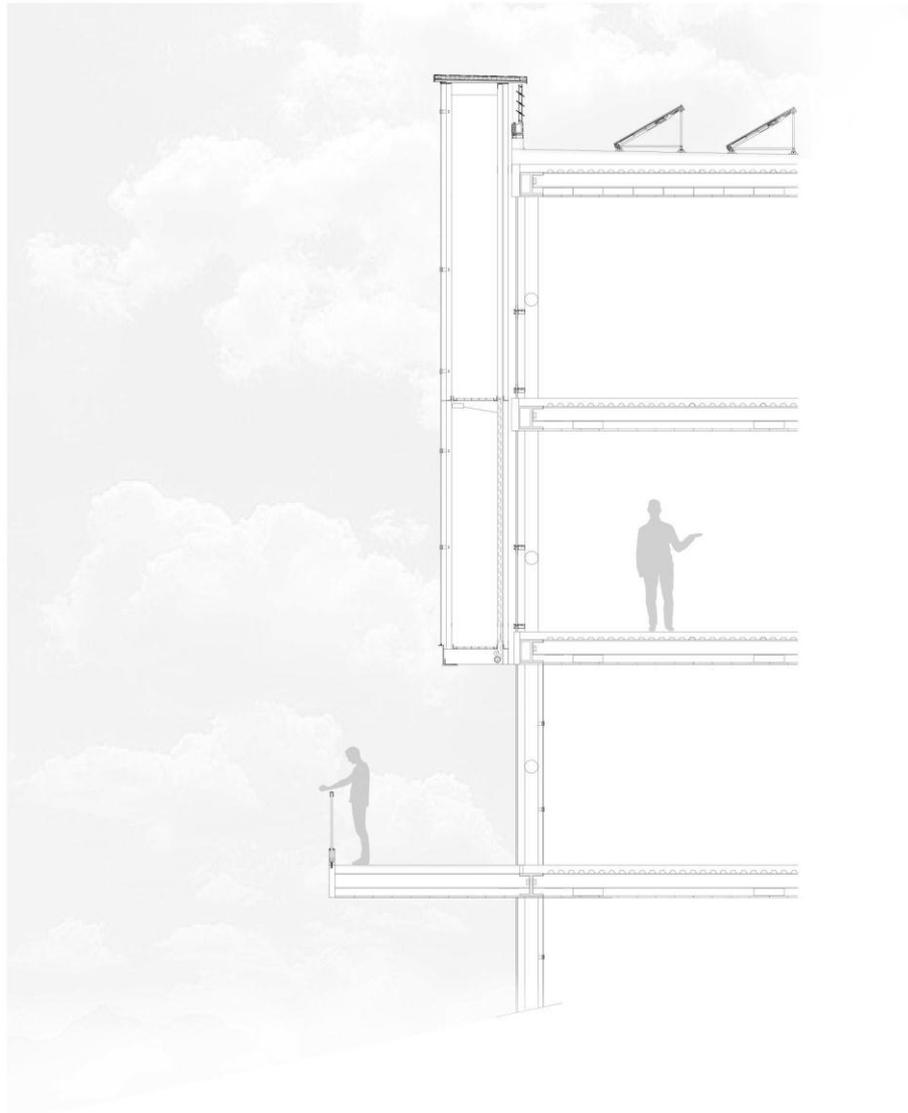
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Floor Sandwich



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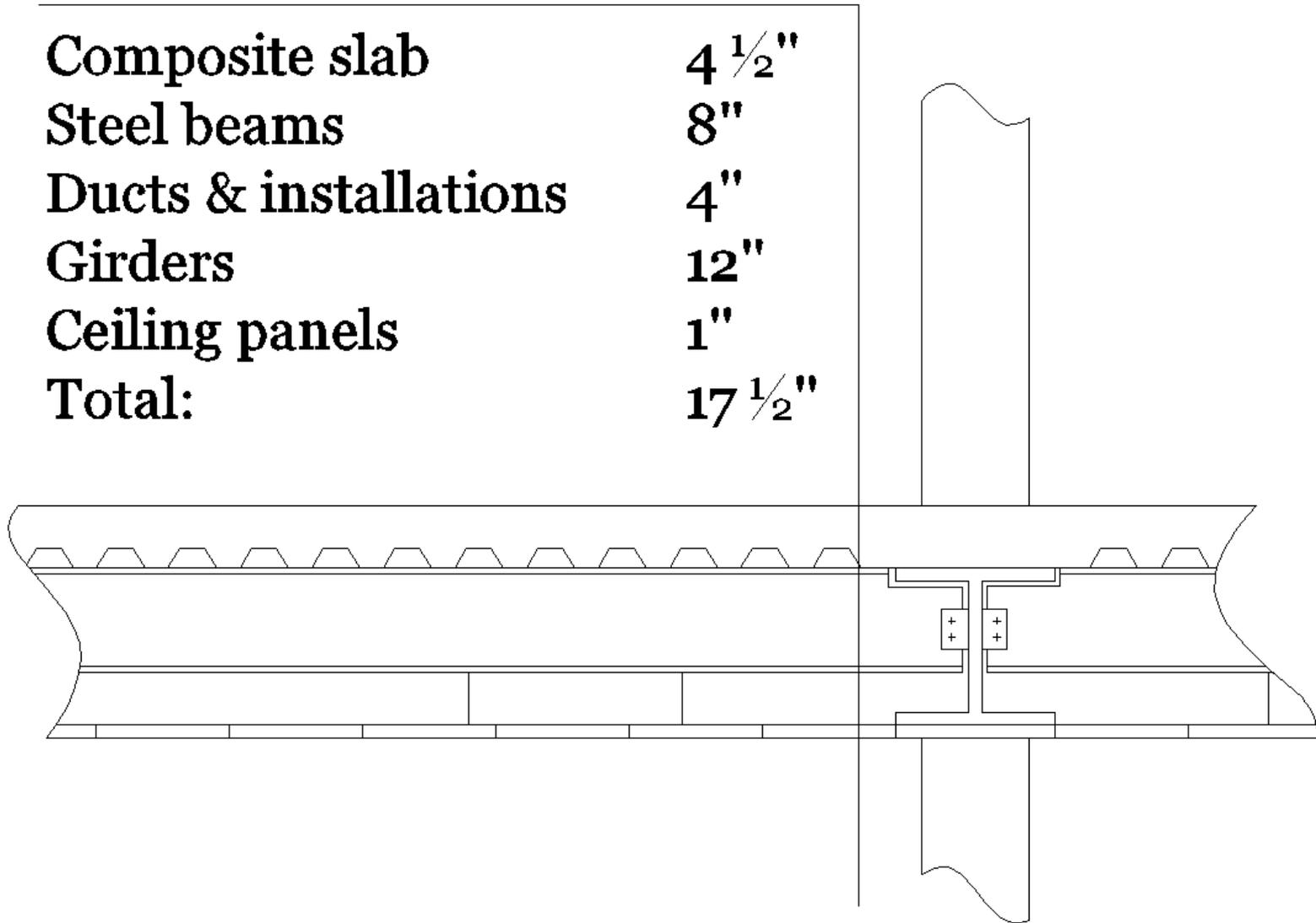
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Floor Sandwich

| | |
|-----------------------|---------|
| Composite slab | 4 1/2" |
| Steel beams | 8" |
| Ducts & installations | 4" |
| Girders | 12" |
| Ceiling panels | 1" |
| Total: | 17 1/2" |



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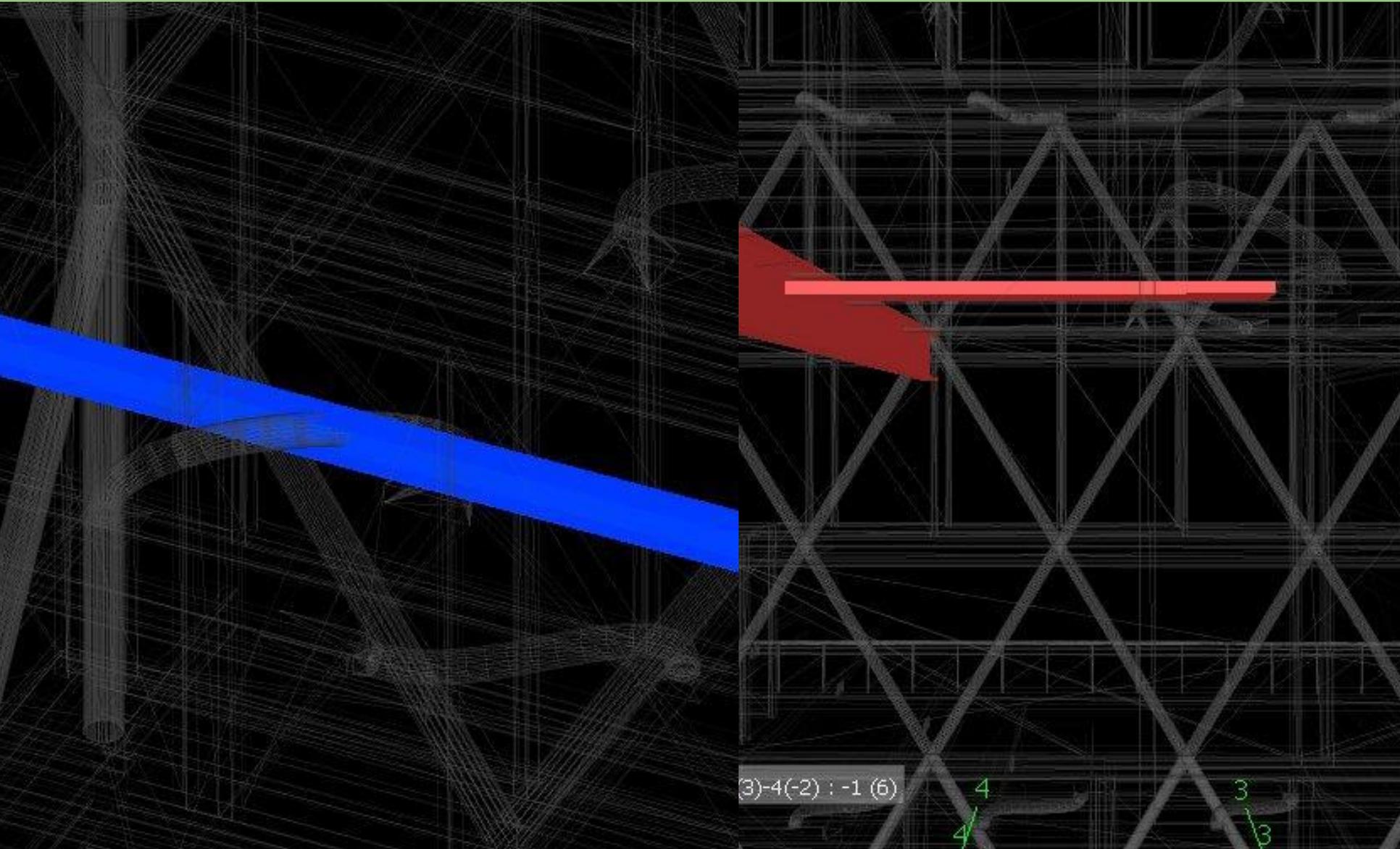
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Clash Detection



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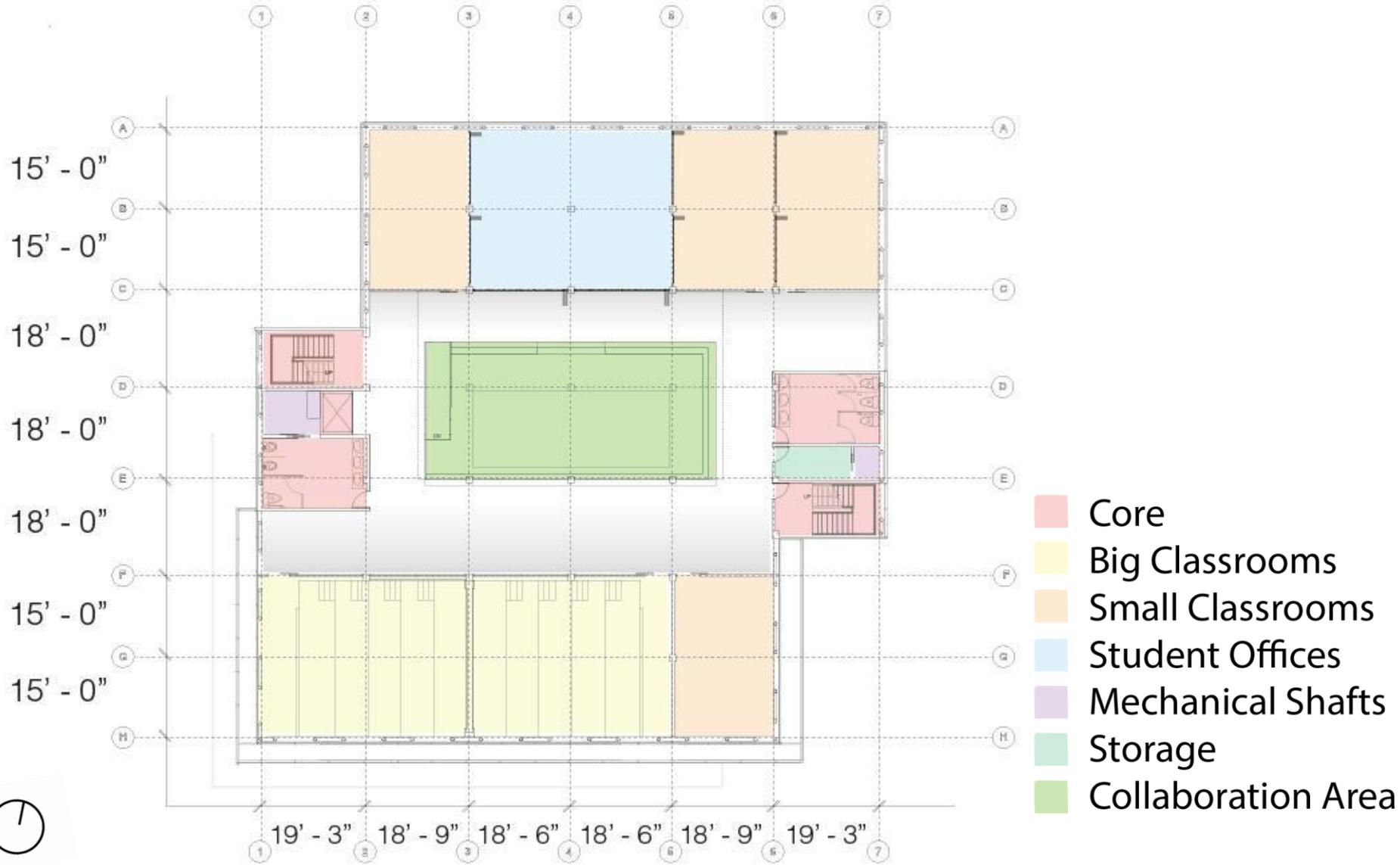
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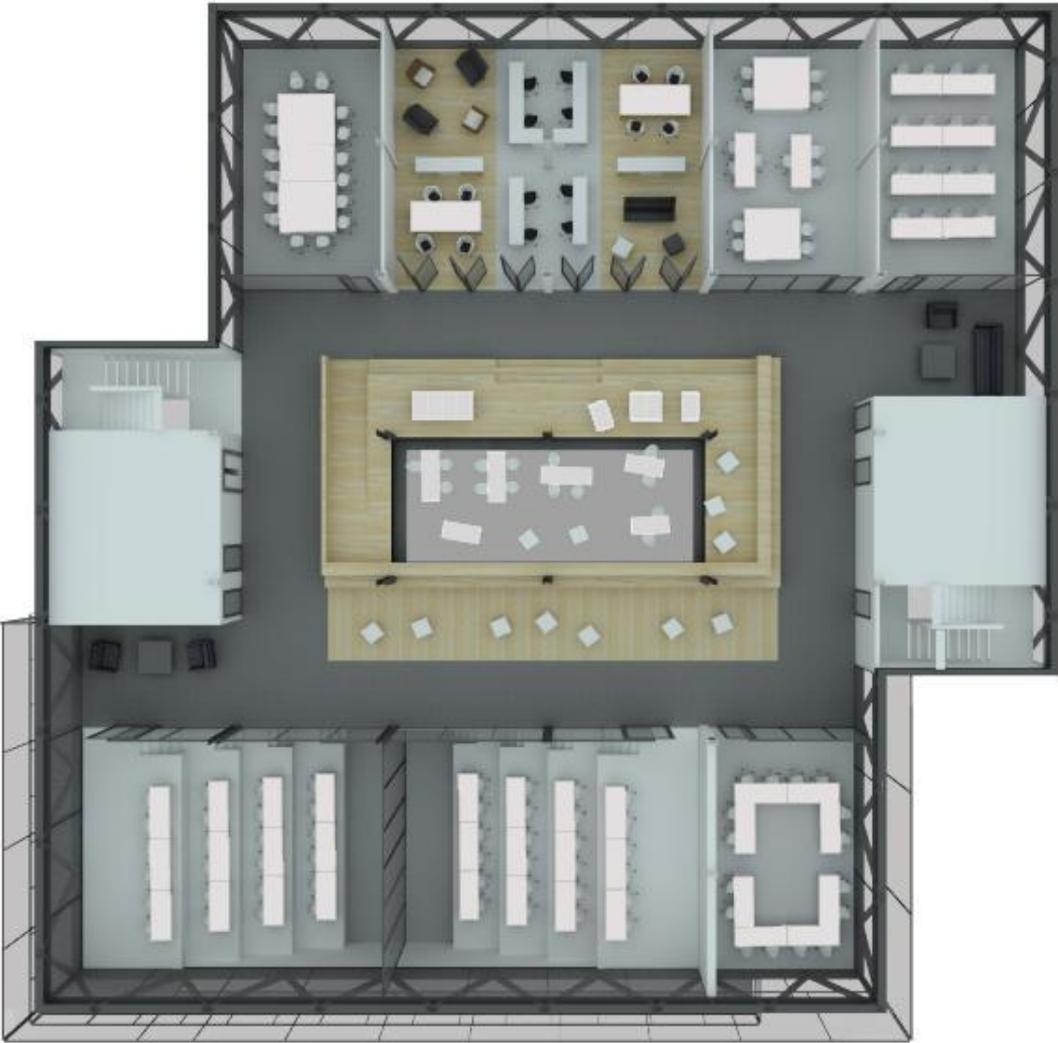
MEP

LCFM

Second Level - Floor Plan



Second Level - Furnished



| | | | | |
|---|----|----|-----|------|
| A | SE | CM | MEP | LCFM |
|---|----|----|-----|------|

Second Level



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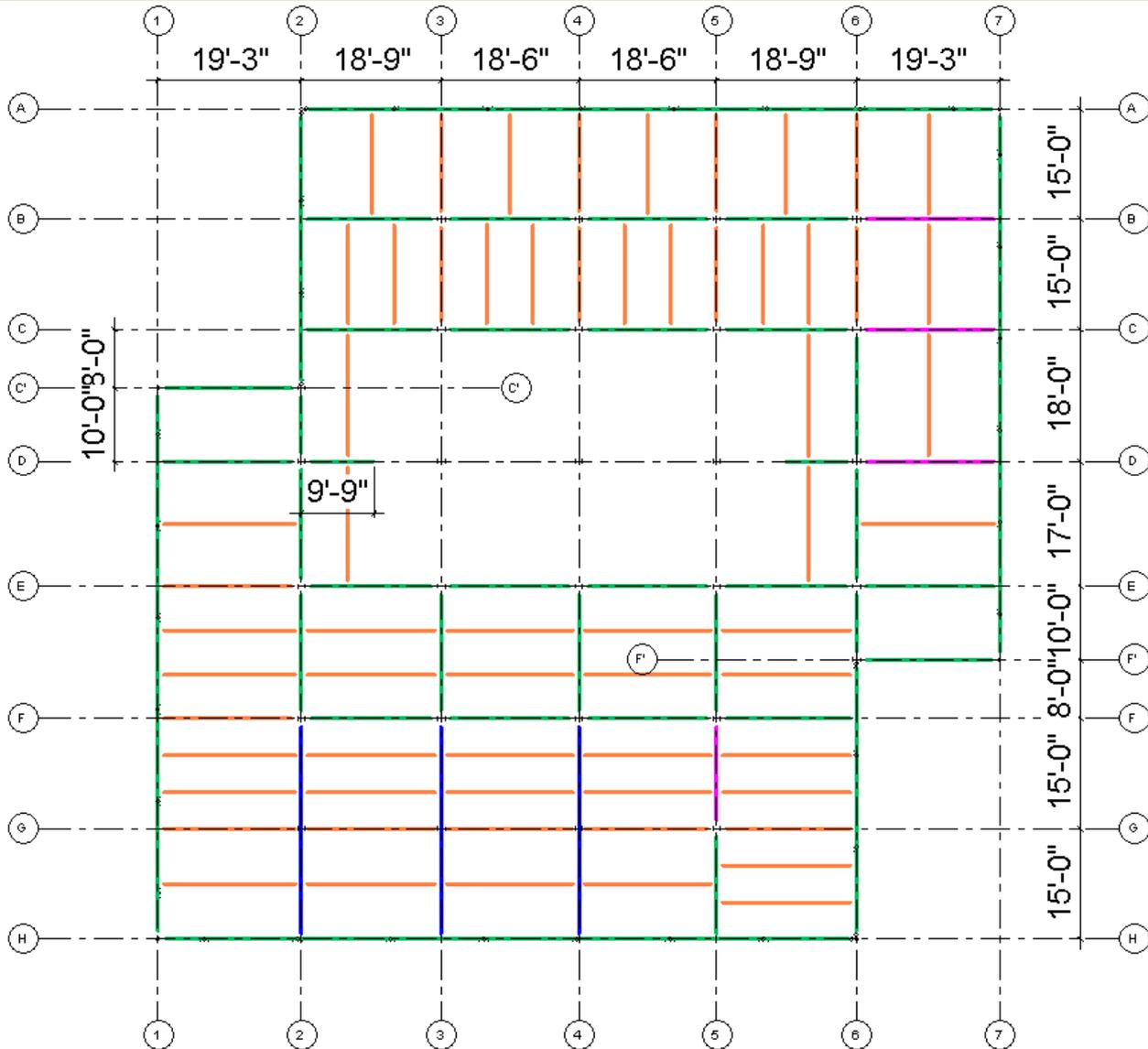
SE

CM

MEP

LCFM

Second Level - Structure



Legend:

- W8x24
- W8x40
- W12x50
- W27x129

A

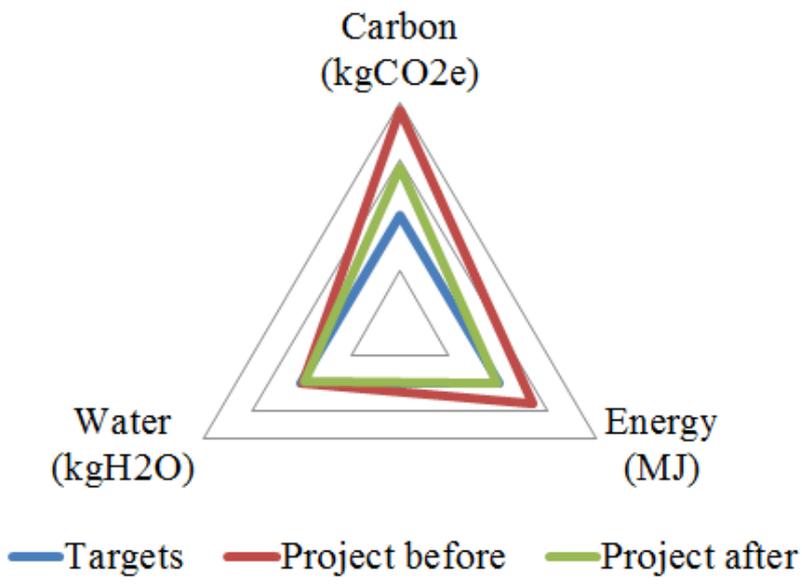
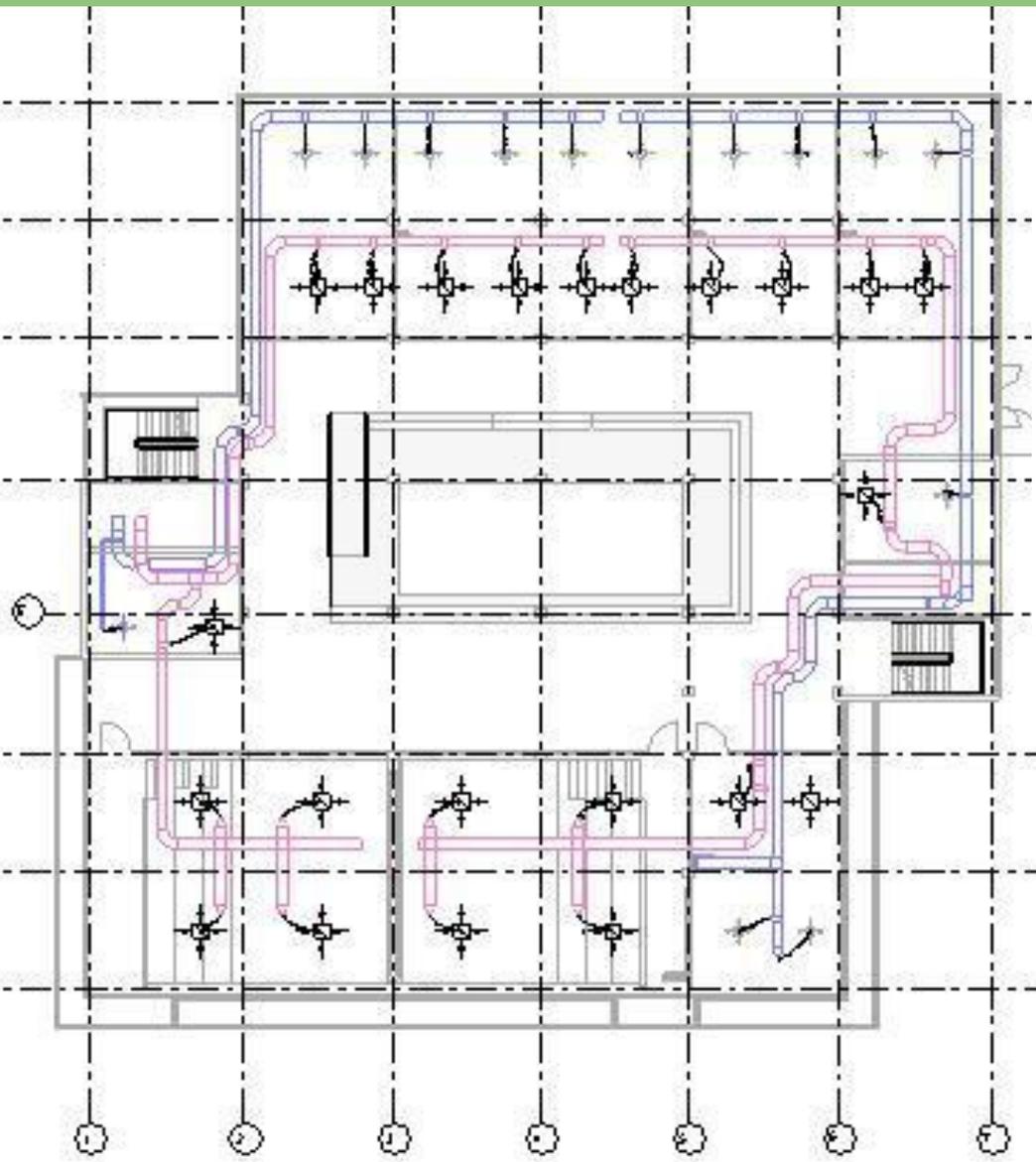
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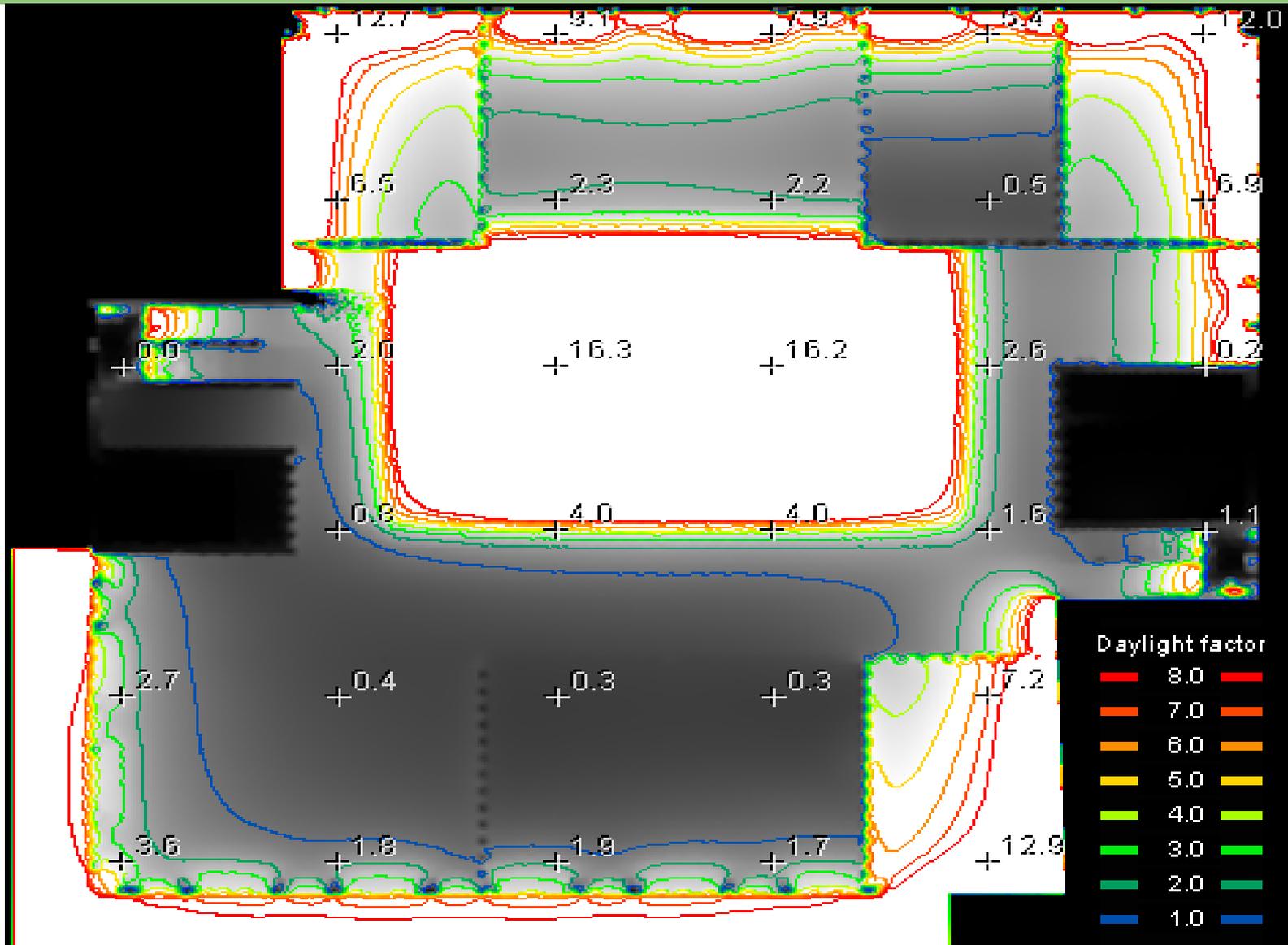
LCFM

Second Level - Duct Network



Supply
Return

Second Level - Daylight



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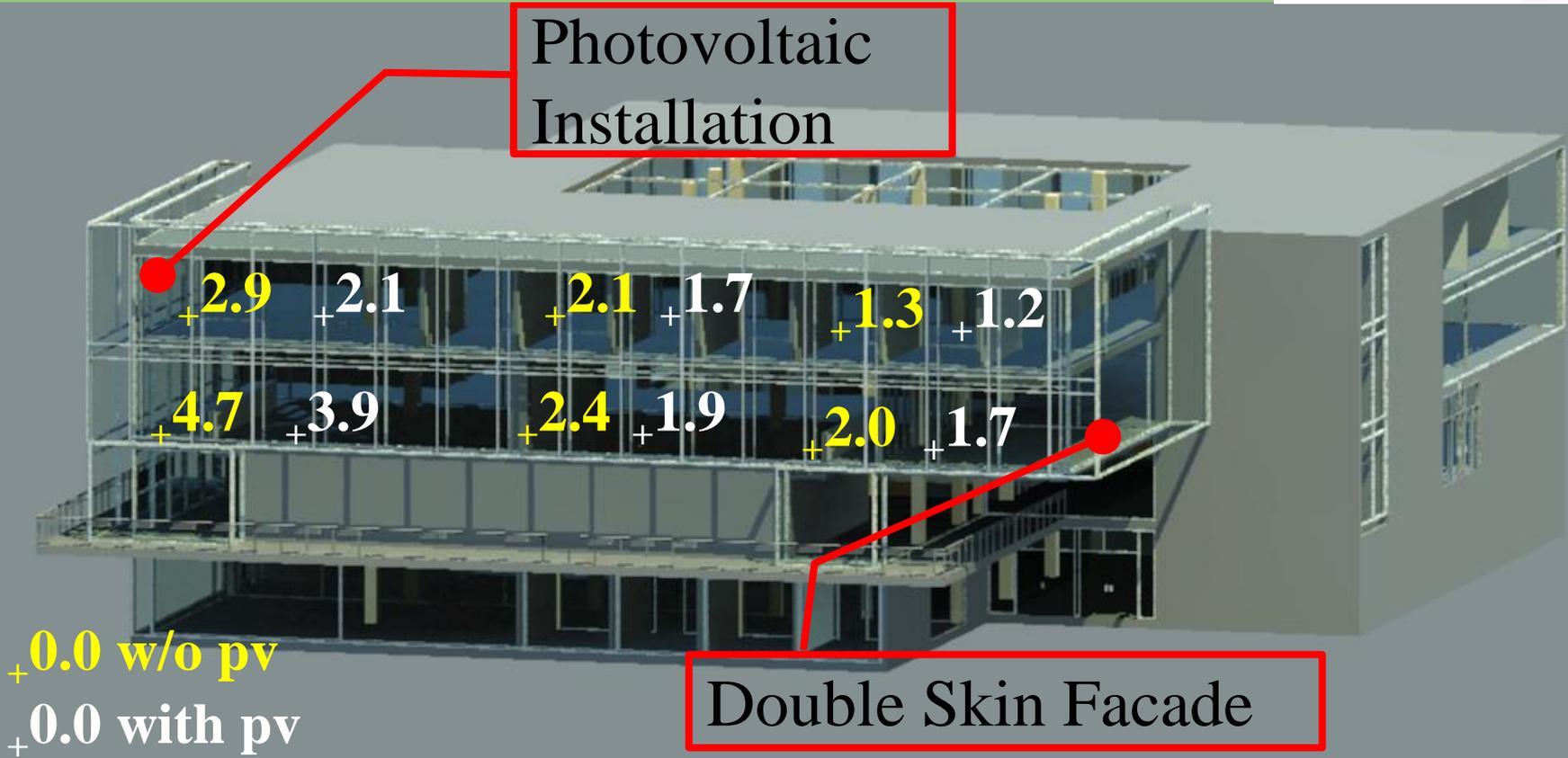
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Sustainability



Double Skin Facade (DSF)

- improved IAQ
- reduced energy consumption

Photovoltaics

- energy production
- reduced CO₂

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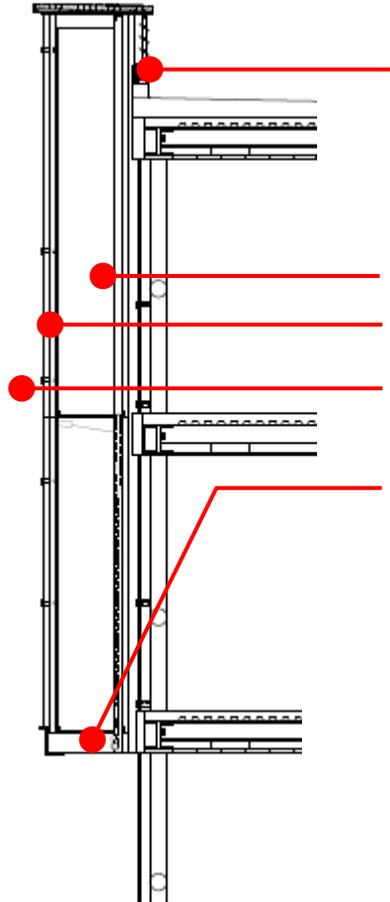
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DSF Details



Exhaust vent with operable glass louvers

Inner skin with 2-pane glass

Outer skin - Fritting shading

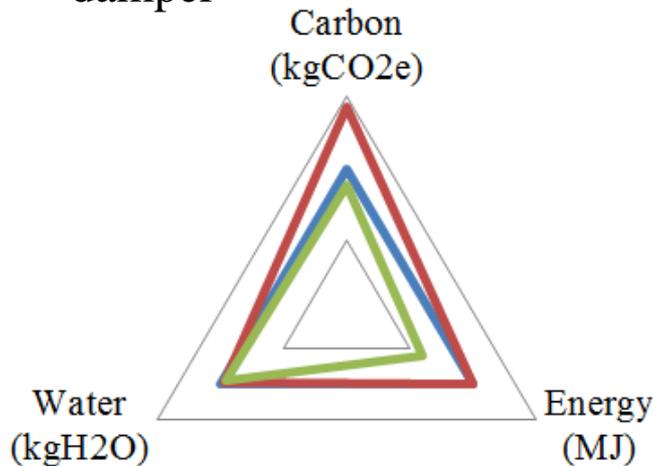
Outer skin - Transparent PV

Intake trench with operable damper



Transparent PV

- 50.1 MWh
- 20.1 %



— Targets — Project before — Project after

Spring/Fall Air Flow

1. Outer and inner skins can act together or apart to regulate temperature or only
2. Operate without sun shade variation

Summer Air Flow

1. High angled sun is caught by horizontal louvers, heating the double skin space and providing shade to building
2. Cooler air is drawn into double skin cavity through open lower vents
3. Air heats up and flows within cavity creating chimney effect and drawing hot air away from building mass



*Cambridge Public Library, Cambridge MA

Double Skin Facade



- decision between single facade and double skin facade
- additional costs through DSF
- added annual savings & increased energy efficiency



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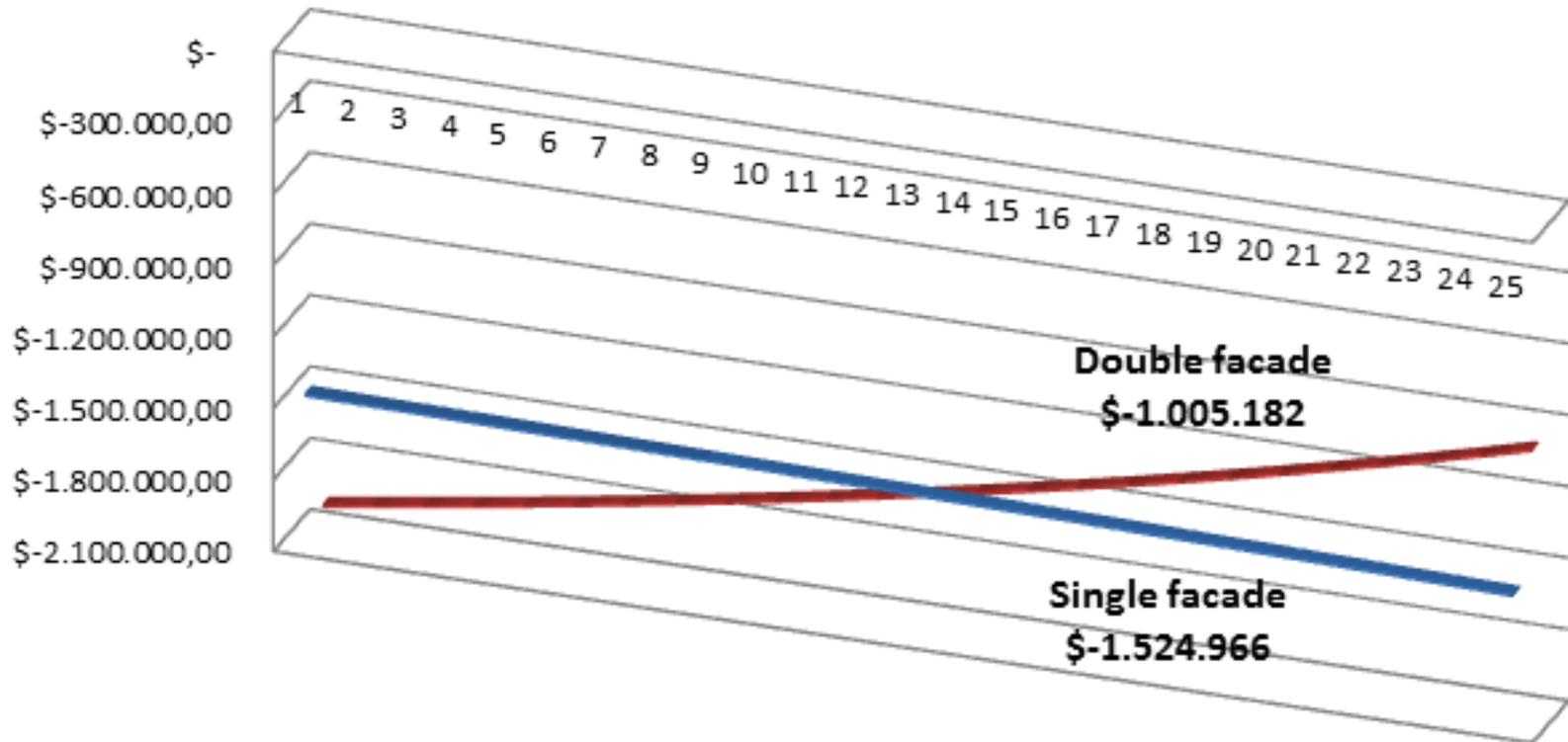
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Double Skin Facade



Alternative life cycle

Savings \$1 150 000



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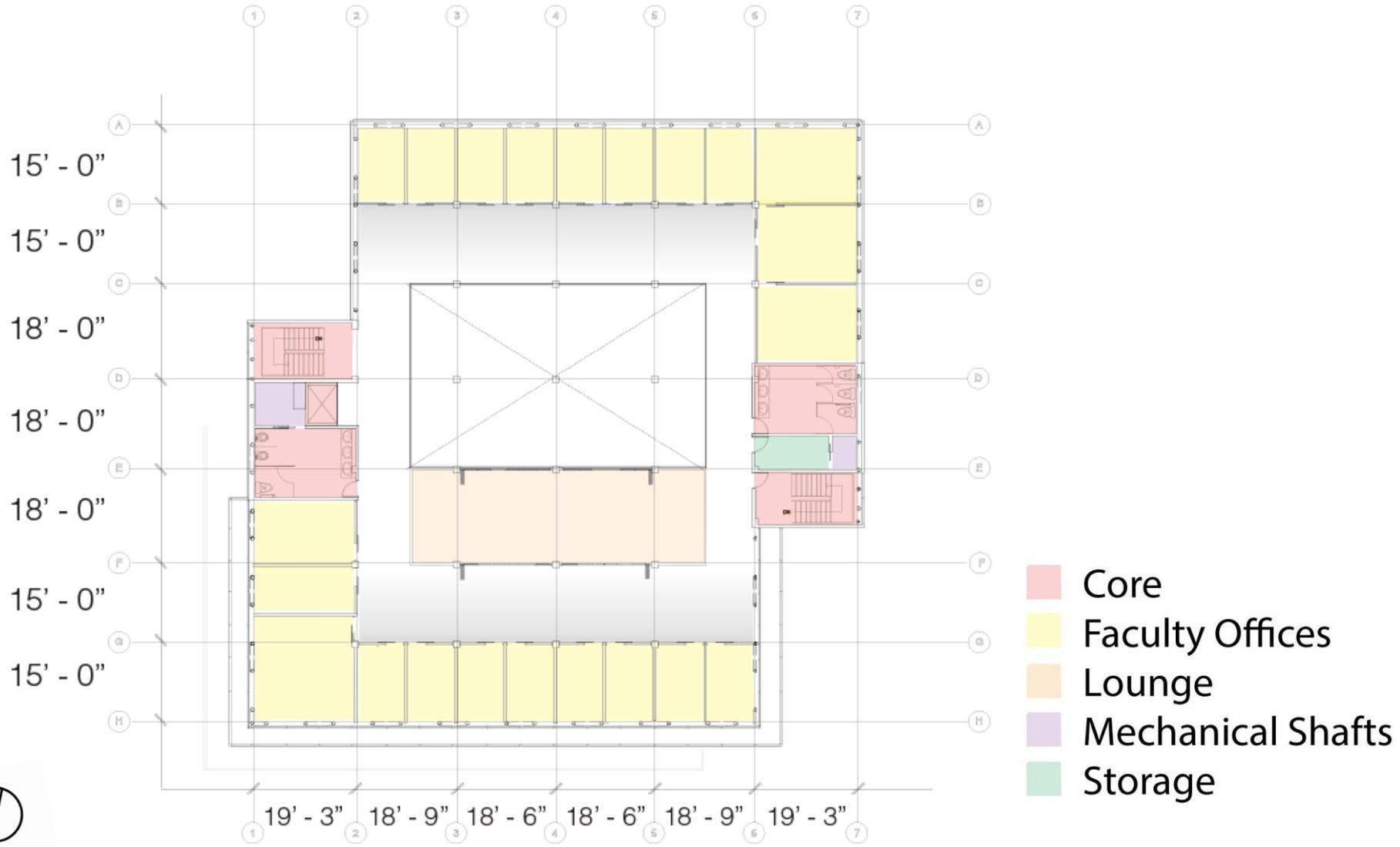
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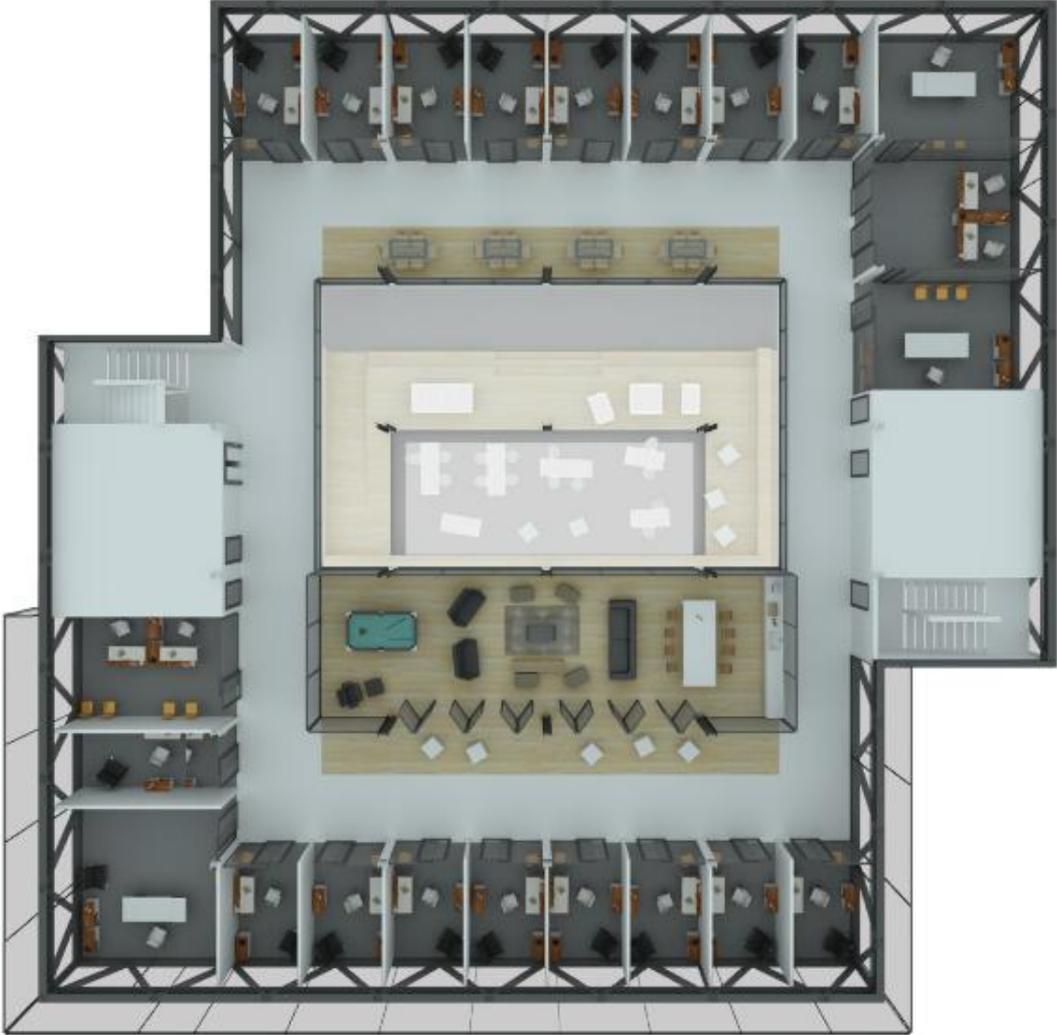
MEP

LCFM

Third Level - Floor Plan



Third Level - Furnished



| | | | | |
|---|----|----|-----|------|
| A | SE | CM | MEP | LCFM |
|---|----|----|-----|------|

Third Level



A

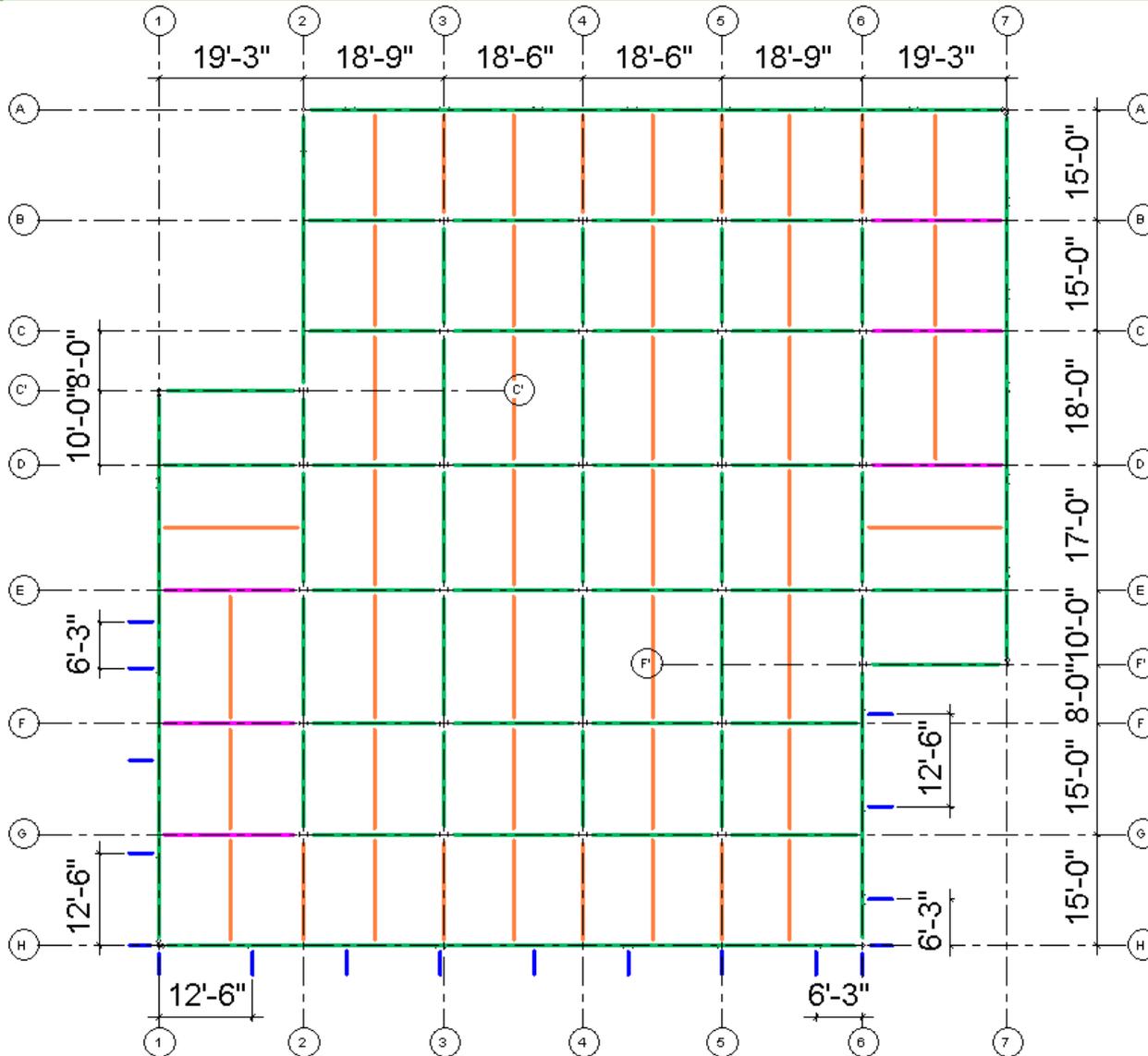
SE

CM

MEP

LCFM

Third Level - Structure



Legend:

- W8x18
- W8x24
- W8x40
- W12x50

A

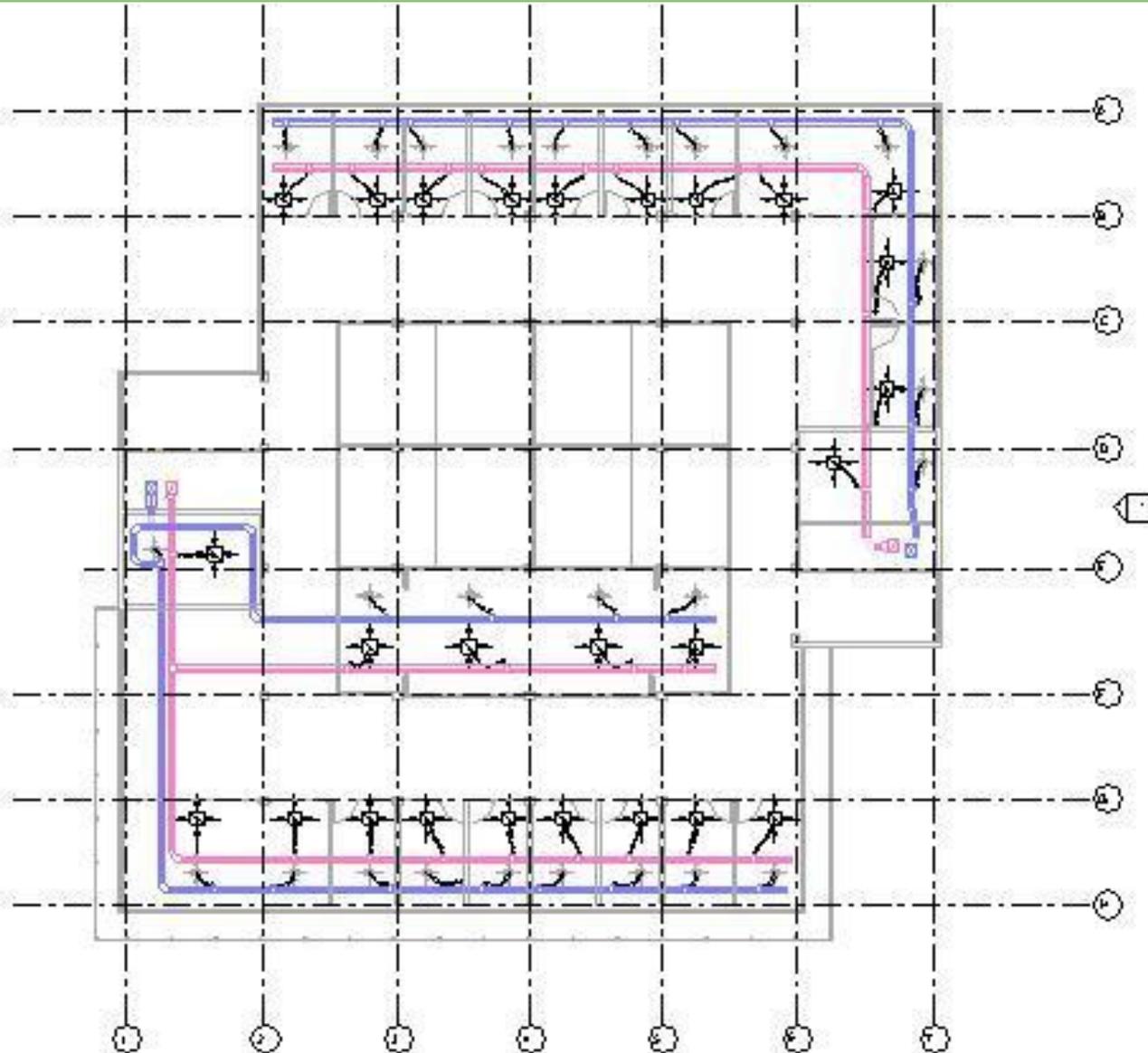
SE

CM

MEP

LCFM

Third Level - Duct Network



Velocity

- Main Ducts
 - 21.3 fps
- Branch Ducts
 - 11.5 fps

Supply
Return



A

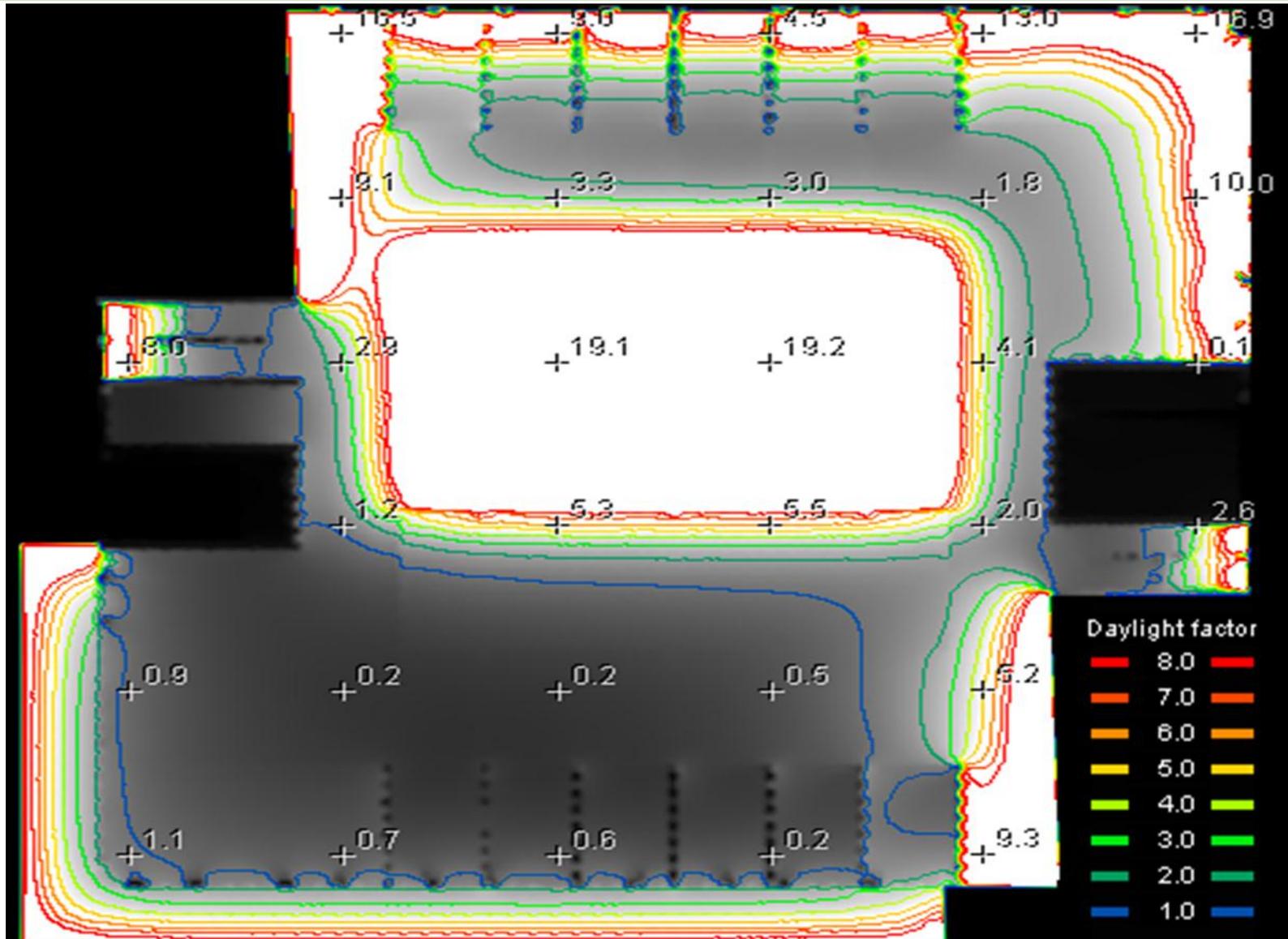
SE

CM

MEP

LCFM

Third Level - Daylight



A

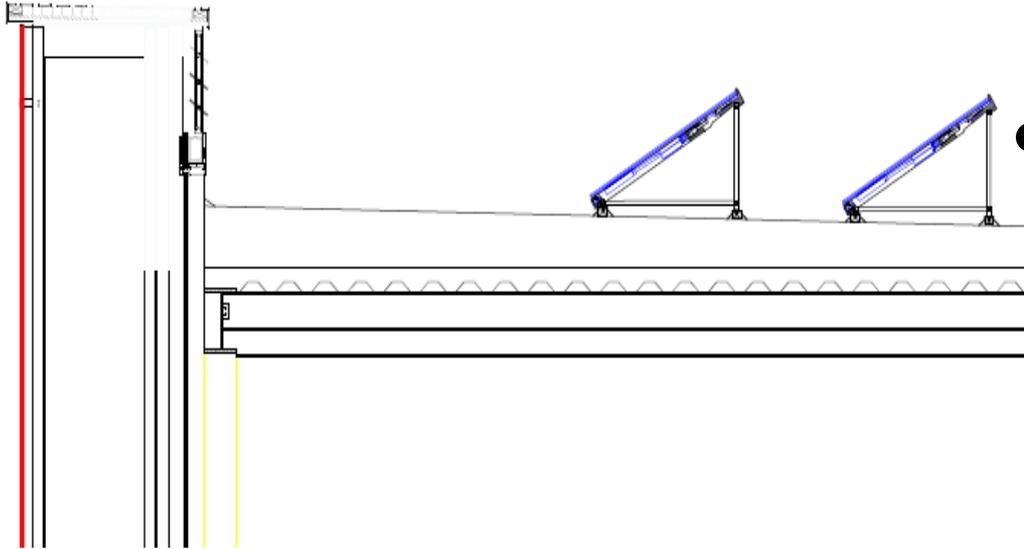
SE

CM

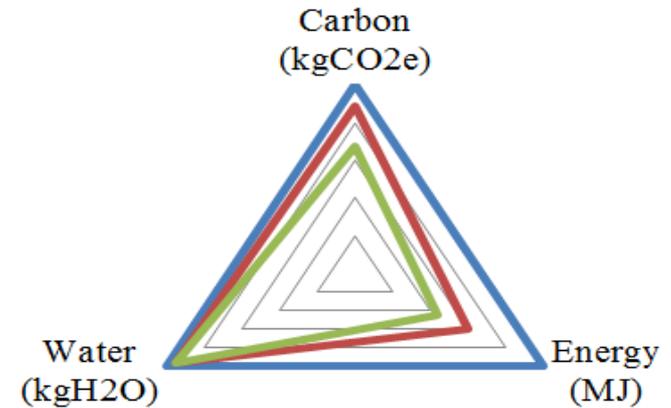
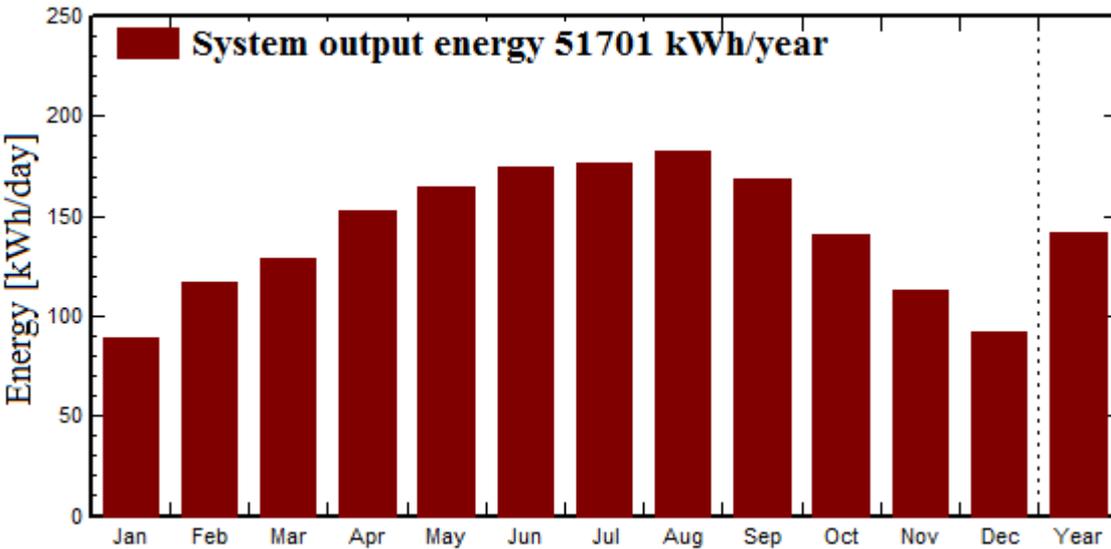
MEP

LCFM

Photovoltaics



- Tilt 30°
- Nominal Power 30 kW
- Area 250 m²
- System Output 141.6 kWh/day



— Targets — Project before — Project after

A

SE

CM

MEP

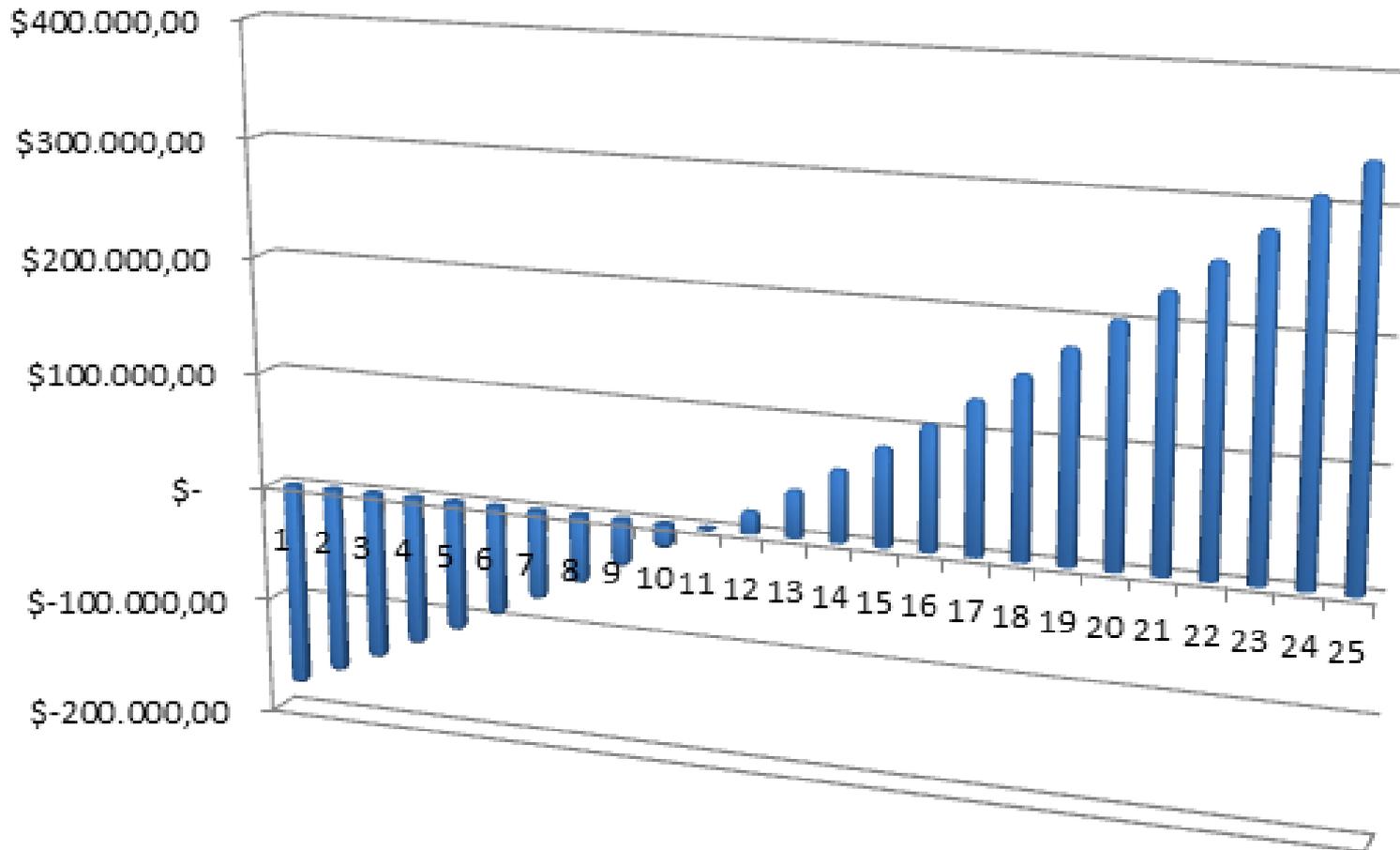
LCFM

Photovoltaics



Life cycle PV roof

Savings \$1 350 000



A

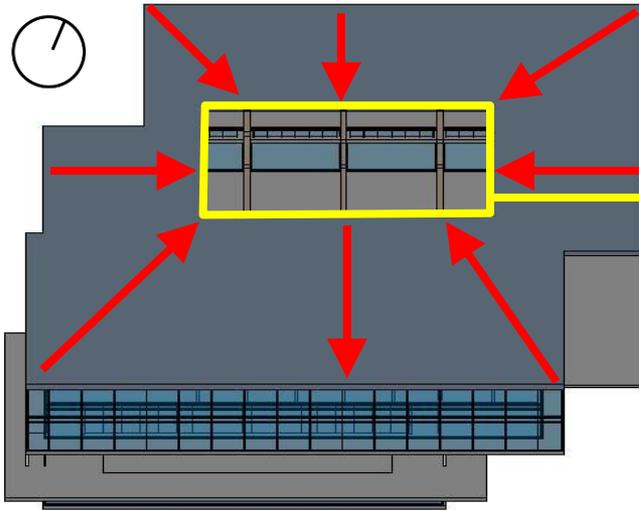
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CM

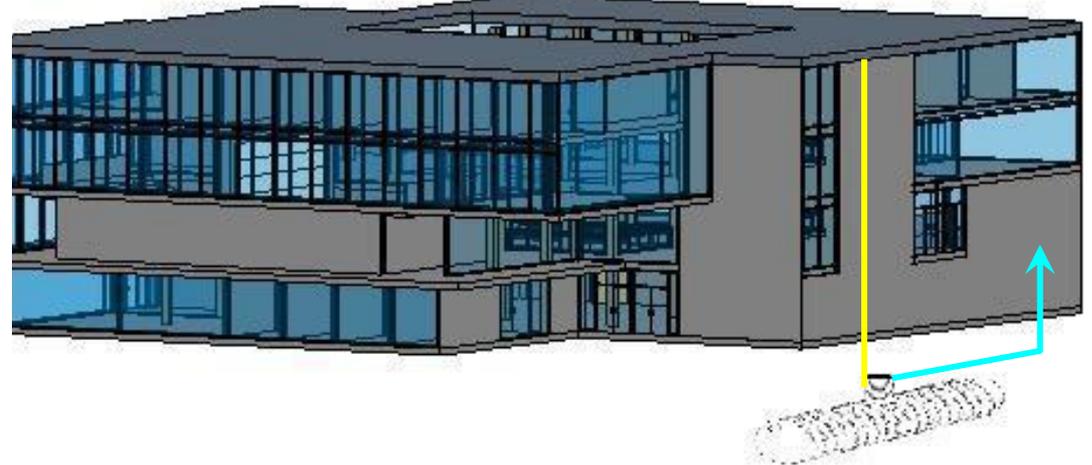
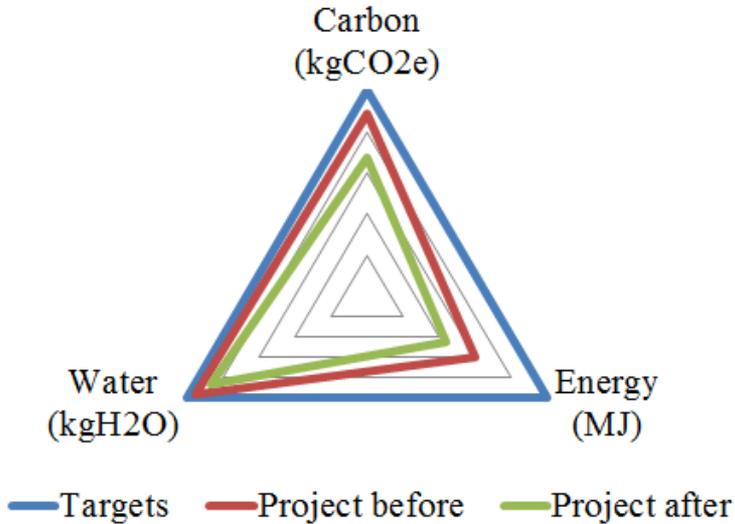
MEP

LCFM

Rainwater Harvesting



- Collectable rainwater/snow
 - 72200 gal/year
- Underground tank
 - 8000 gal (7' d x 30' l)
 - first-flush diverter



A

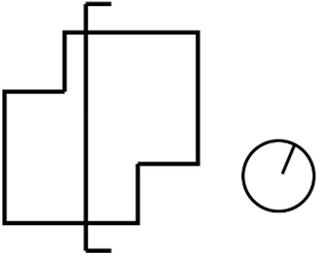
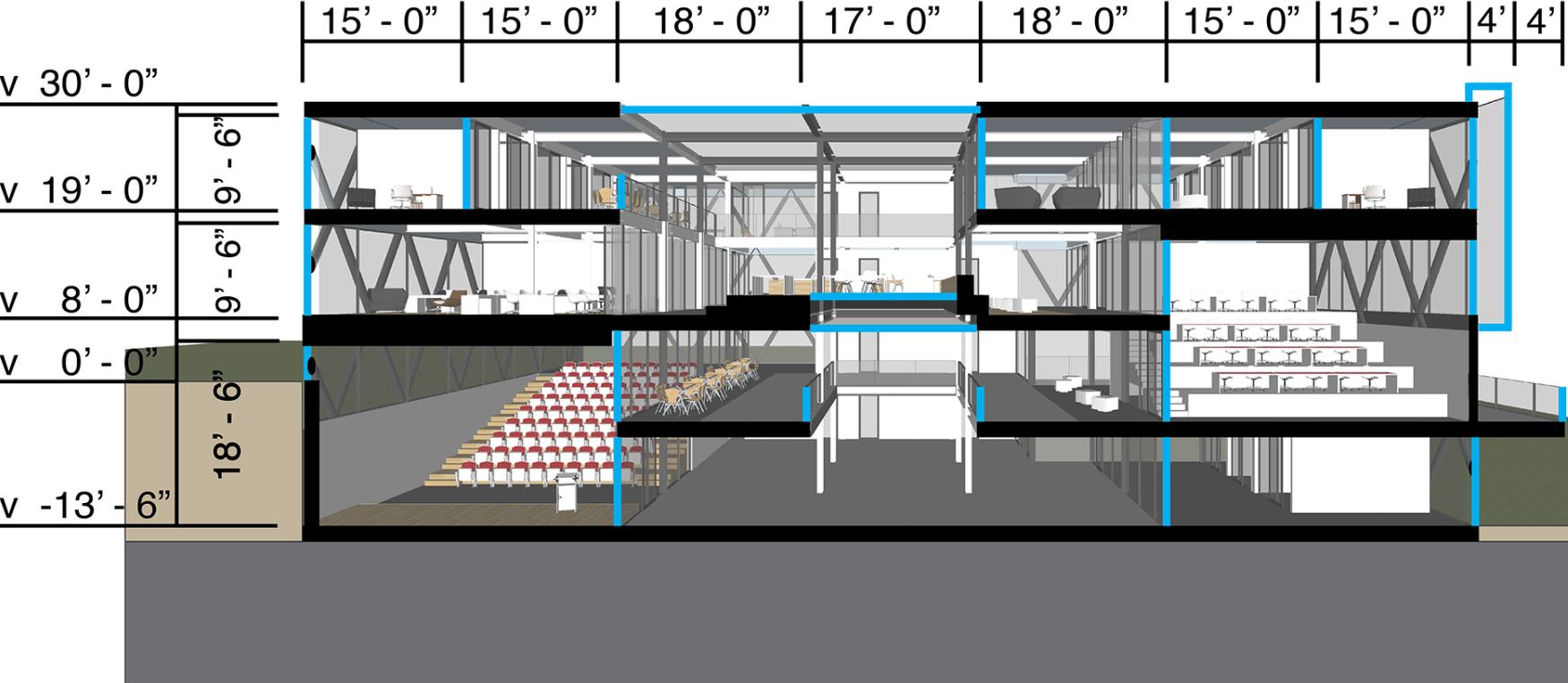
SE

CM

MEP

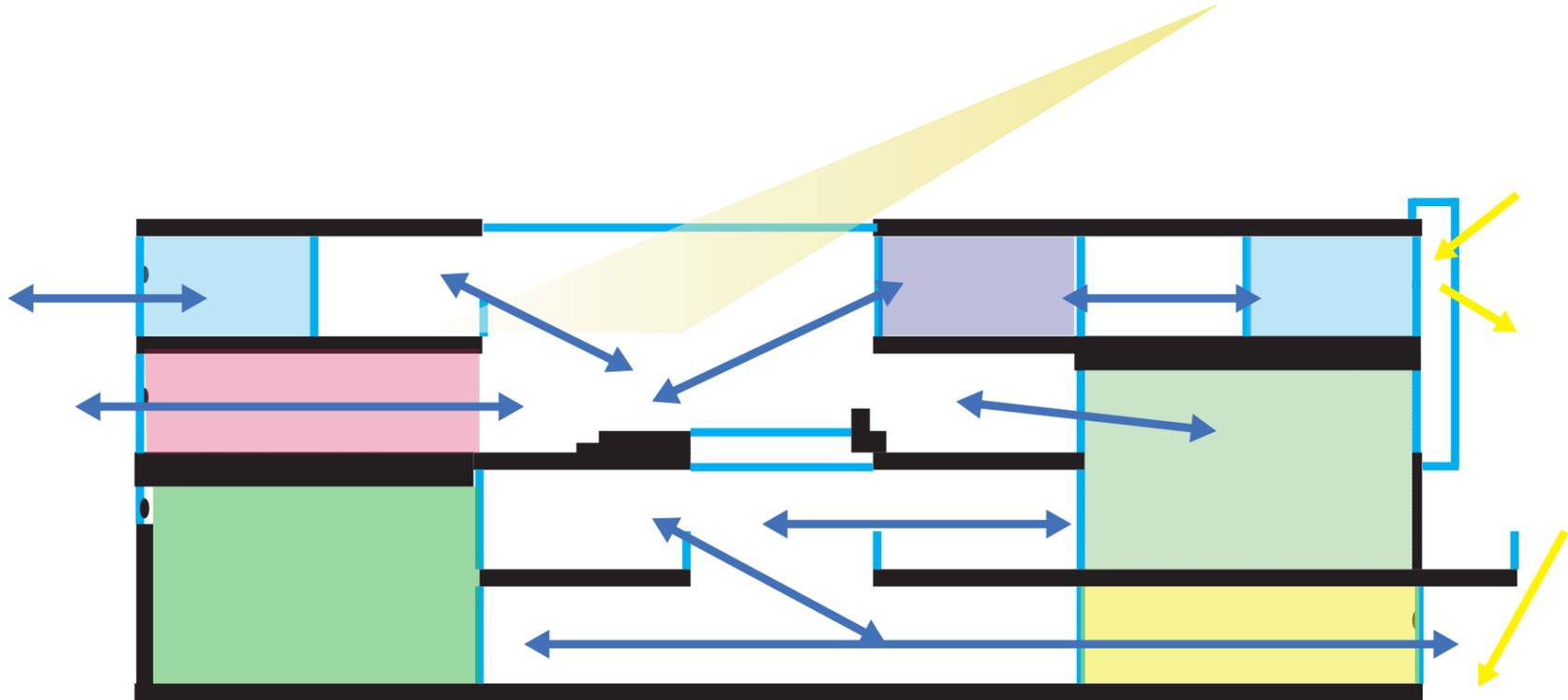
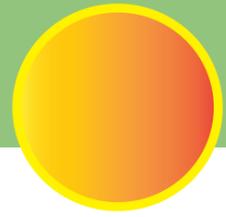
LCFM

Section AA



| | | | | |
|---|----|----|-----|------|
| A | SE | CM | MEP | LCFM |
|---|----|----|-----|------|

Section AA Diagram



 Auditorium

 Student Offices

 Faculty Office

 Rapid Prototyping Lab

 Large Classrooms

 Faculty Lounge

 Sun Radiation

 Visual Connectivity

 Daylight

A

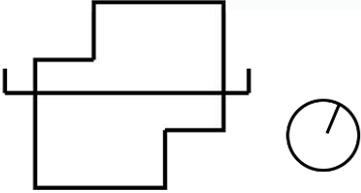
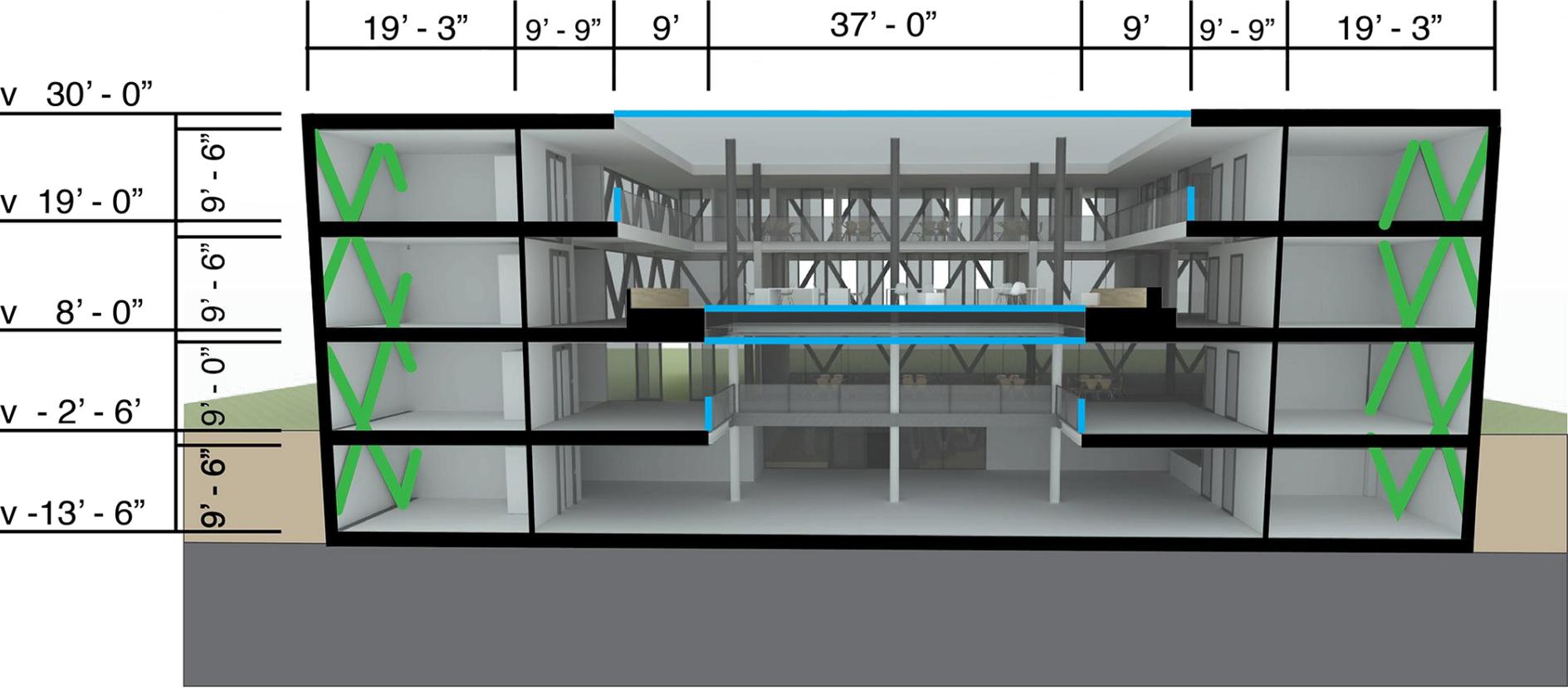
SE

CM

MEP

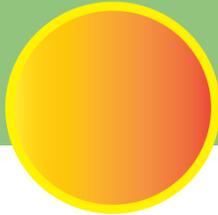
LCFM

Section BB

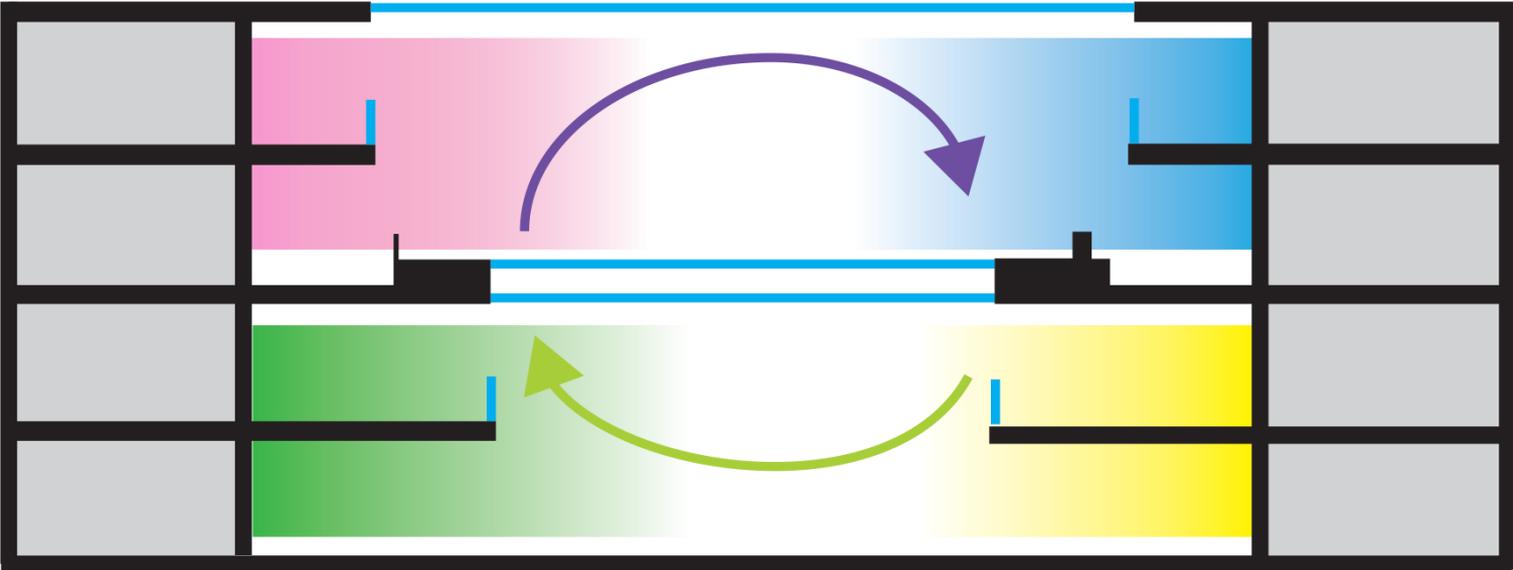


| | | | | |
|---|----|----|-----|------|
| A | SE | CM | MEP | LCFM |
|---|----|----|-----|------|

Section BB Diagram



Creativity / Colaboration

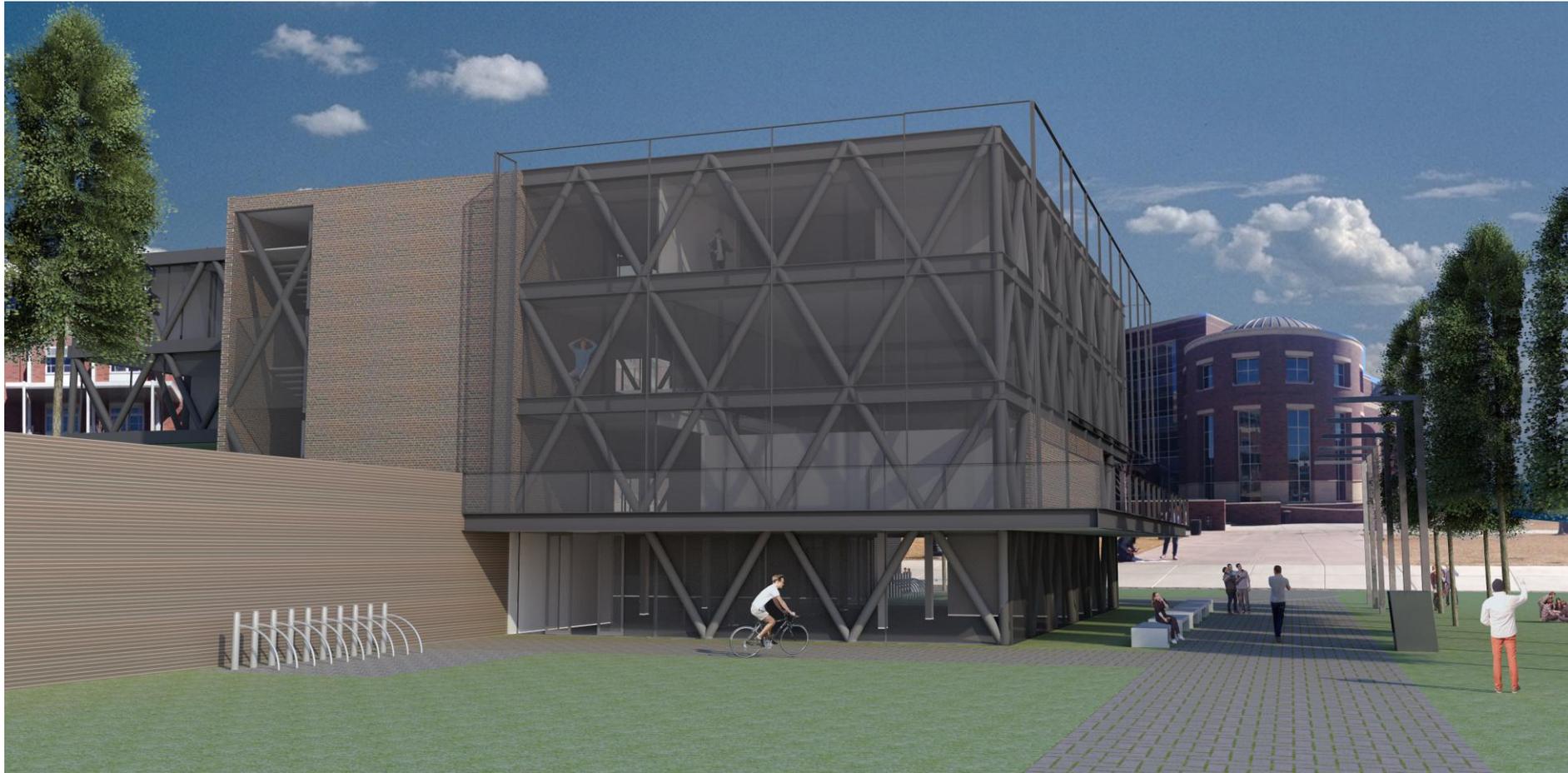


Production

 Bathroom / Core

| | | | | |
|---|----|----|-----|------|
| A | SE | CM | MEP | LCFM |
|---|----|----|-----|------|

Southwest Elevation



A

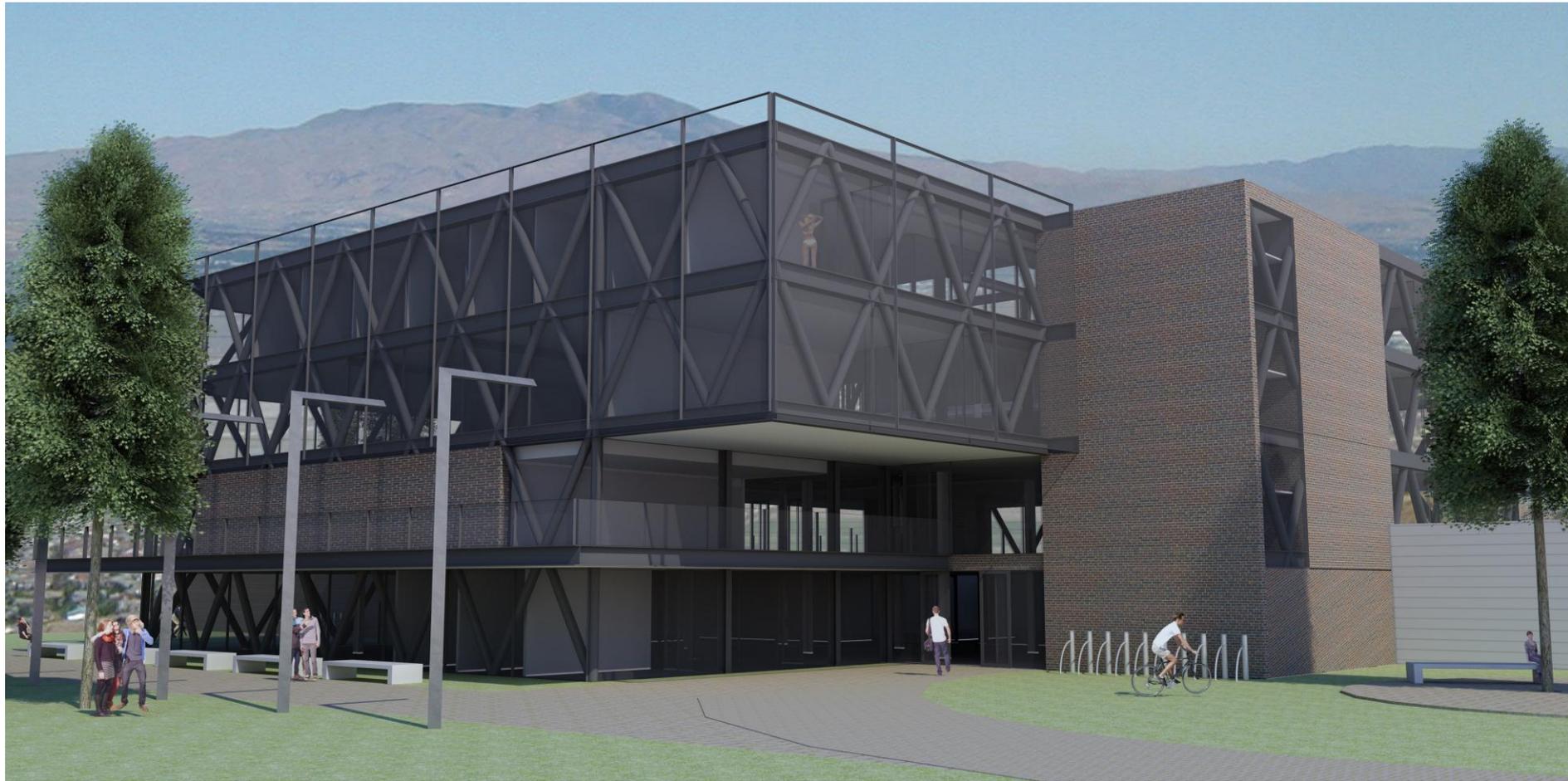
SE

CM

MEP

LCFM

Southeast Elevation



A

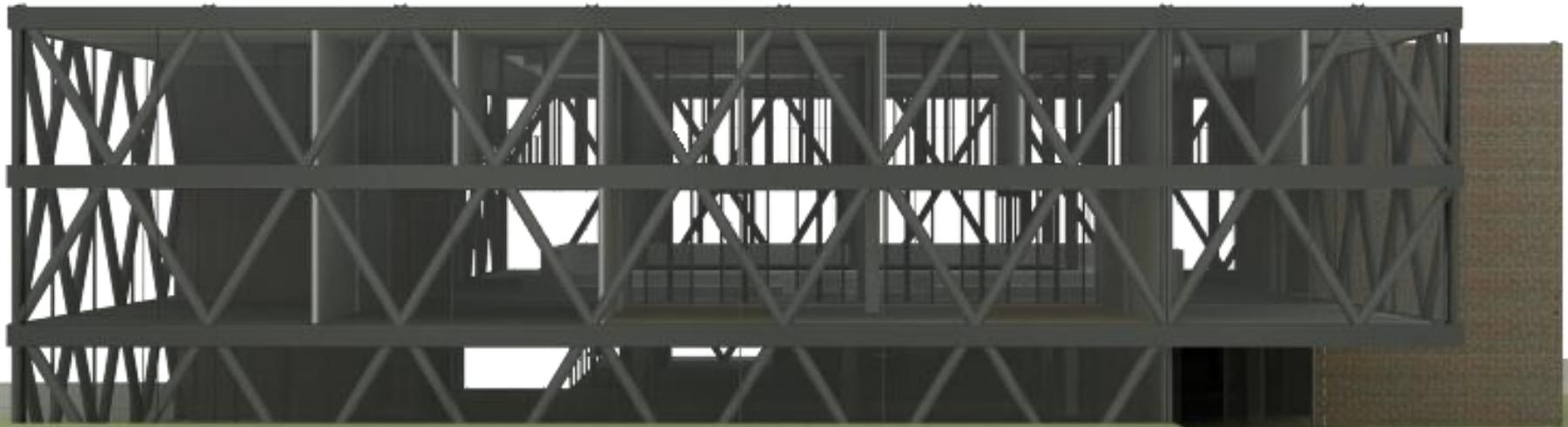
SE

CM

MEP

LCFM

North Elevation



A

SE

CM

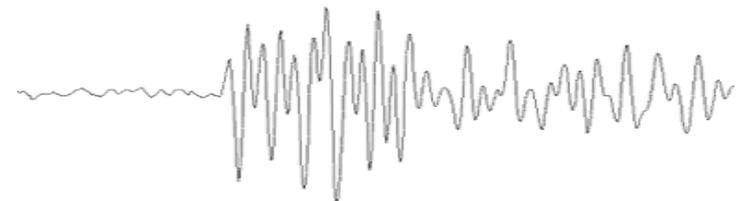
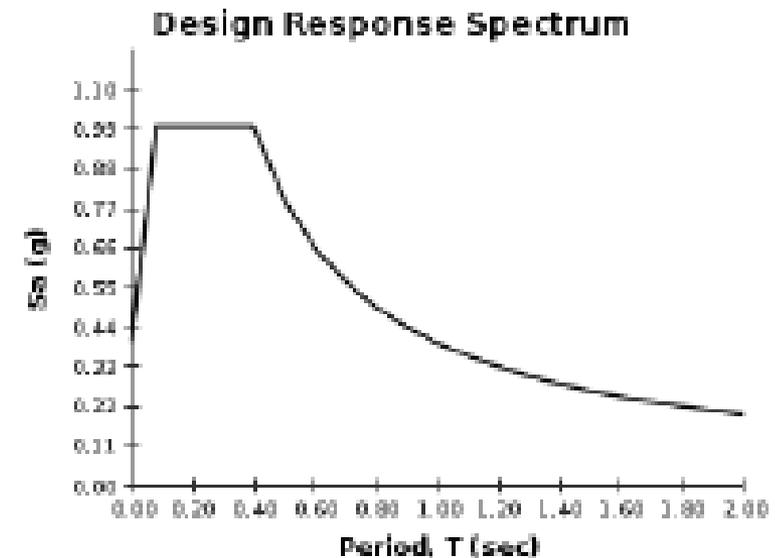
MEP

LCFM

SE Load Conditions

| | IBC 2006 |
|-------------------------------|----------------------------|
| Roof Dead Load | 90 psf |
| Roof Live Load | 20 psf |
| Roof Snow Load | 40 psf |
| Other Floor Dead Loads | 75 psf |
| Other Floor Live Loads | 60-100 psf |
| Wind Shear | 100 mph => 1.5 kips / foot |
| Earthquake Shear | R=3.25 => 1900 kips |
| Retaining-soil Shear | 4.7 kips / foot |

| | |
|------------|----------|
| Site Class | B - Rock |
| Occupancy | I |



A

SE

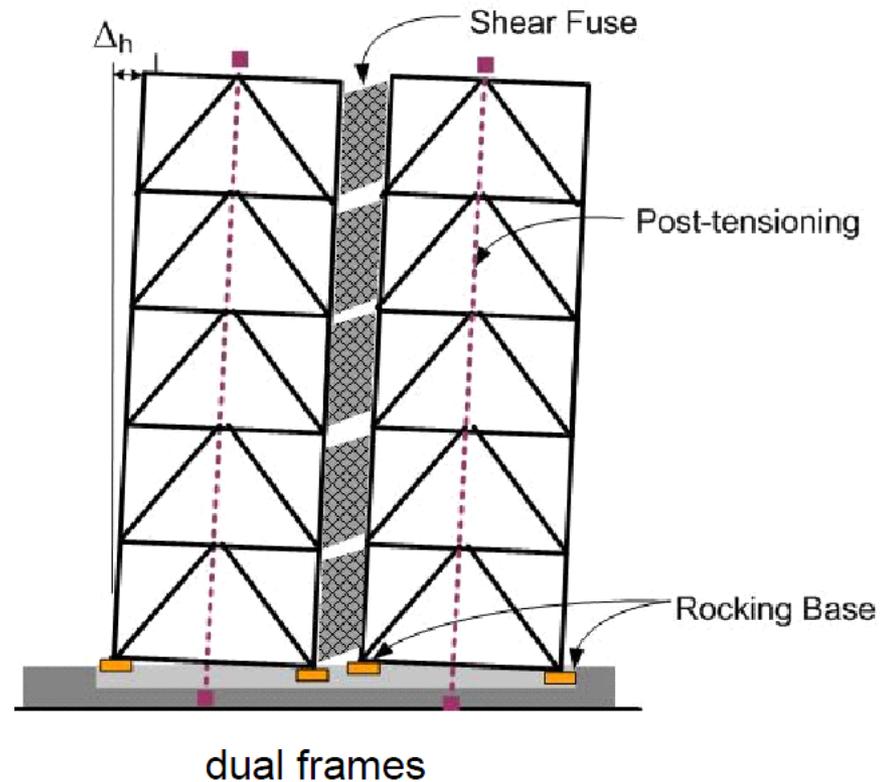
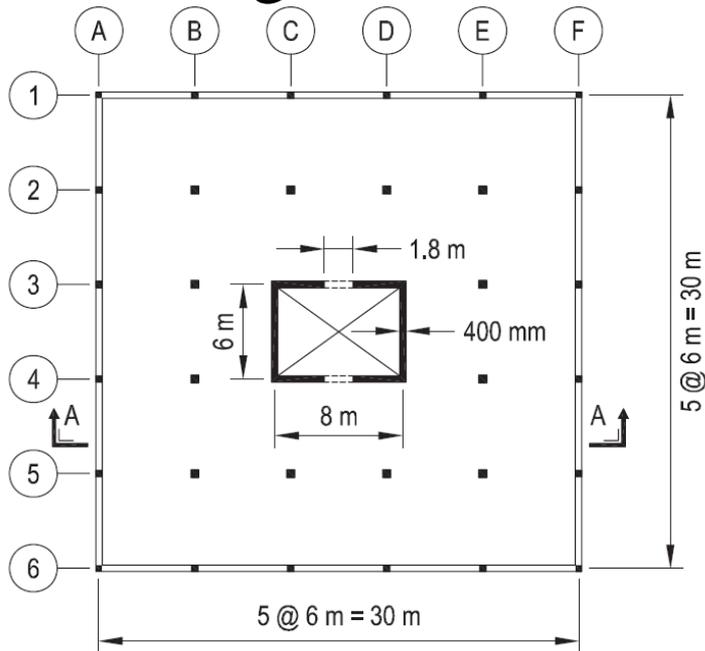
CM

MEP

LCFM

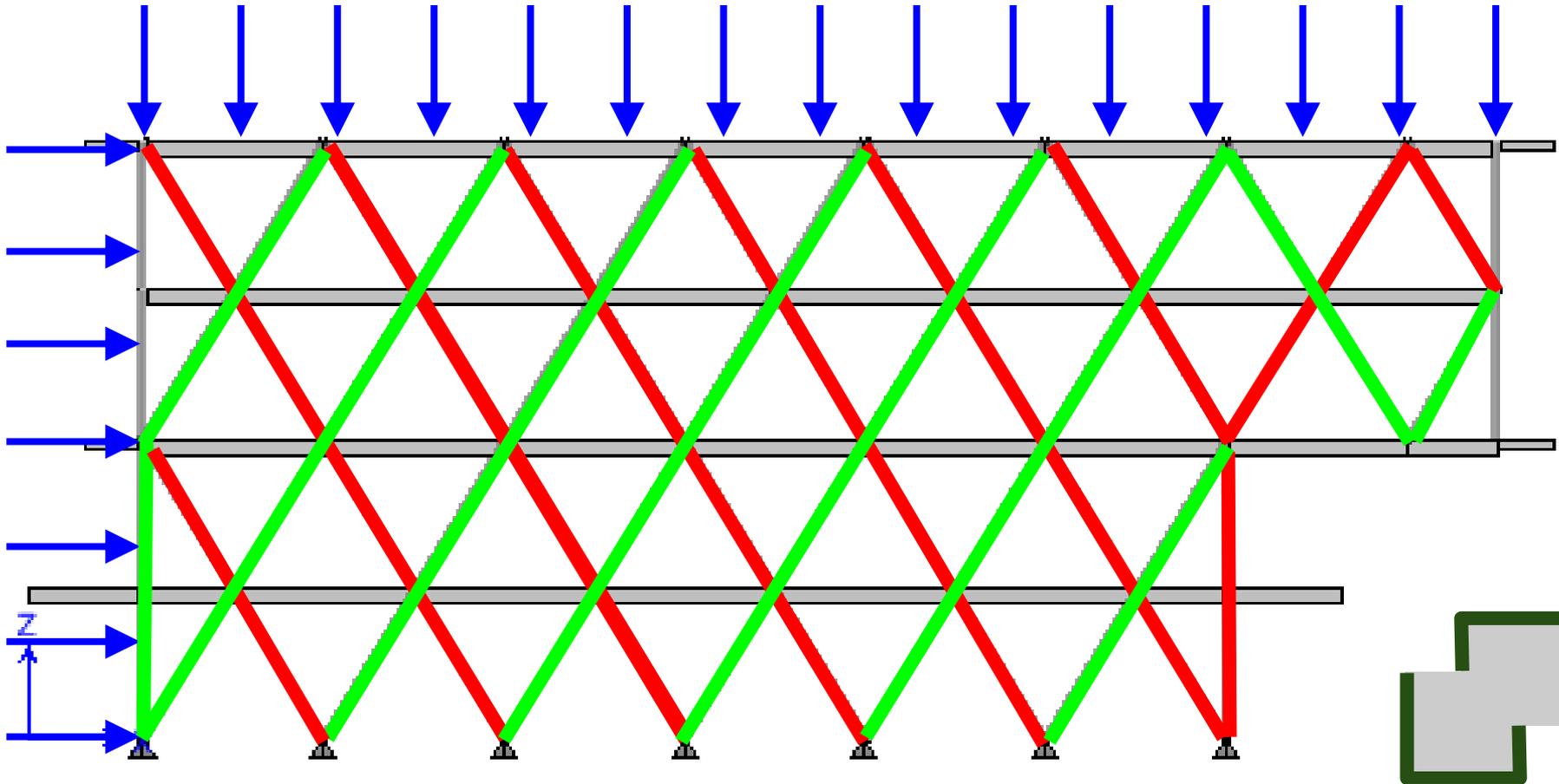
Lateral Support

- Earthquake shear: prevailing load
- Options considered
 - Shear walls
 - Rocking frames
 - Diagrid



Shape & Load Paths

 tension  compression



A

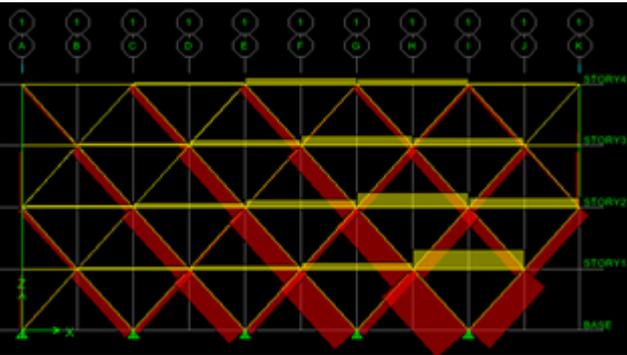
SE

CM

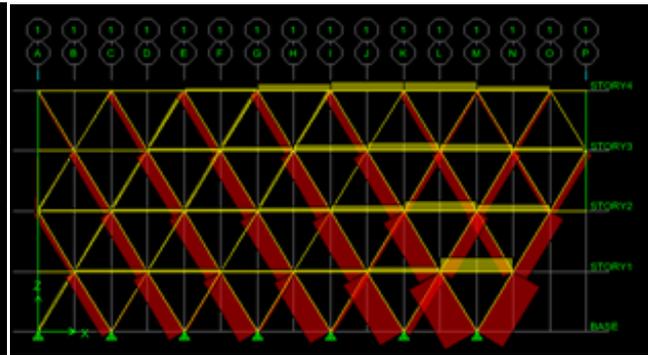
MEP

LCFM

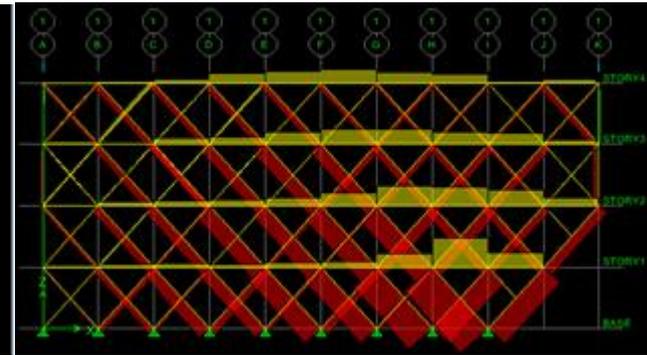
Diagrid Shape



1



2



3

| | No. Diag | Length (ft.) | No. Joints | Max Comp. (k) | Max Tens. (k) | Avg. Force (k) | Avg. Area (sq. in.) | Est. Weight (lb) |
|---|----------|--------------|------------|---------------|---------------|----------------|---------------------|------------------|
| 1 | 39 | 14.1 | 27 | -285.9 | 127.6 | 69.3 | 1.39 | 2592 |
| 2 | 57 | 12.2 | 38 | -185.5 | 70.2 | 46.3 | 0.93 | 2198 |
| 3 | 77 | 14.1 | 91 | -189.9 | 146.5 | 36.4 | 0.73 | 2691 |

A

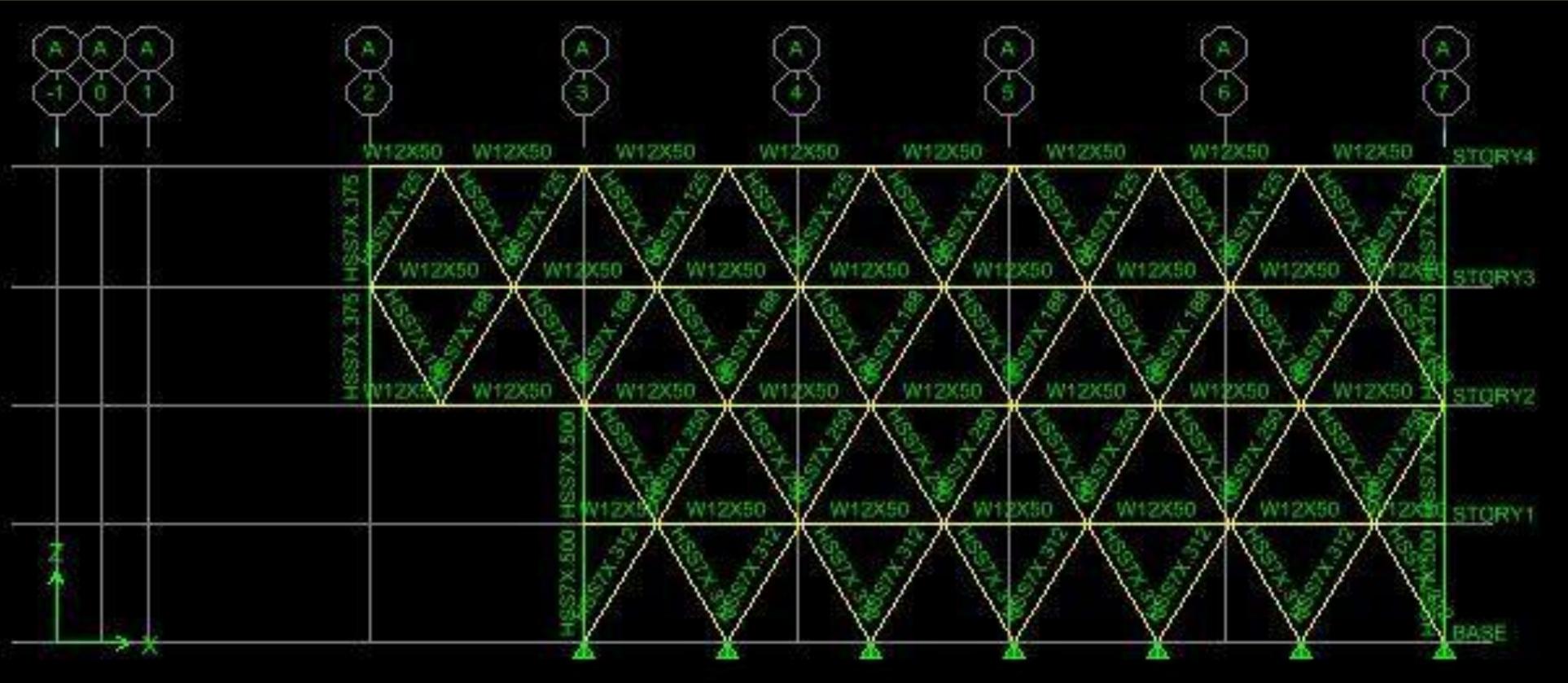
SE

CM

MEP

LCFM

Diagrid Optimization



Maintain constant diameter to keep constant appearance among floors, but vary HSS thickness to optimize for weight

A

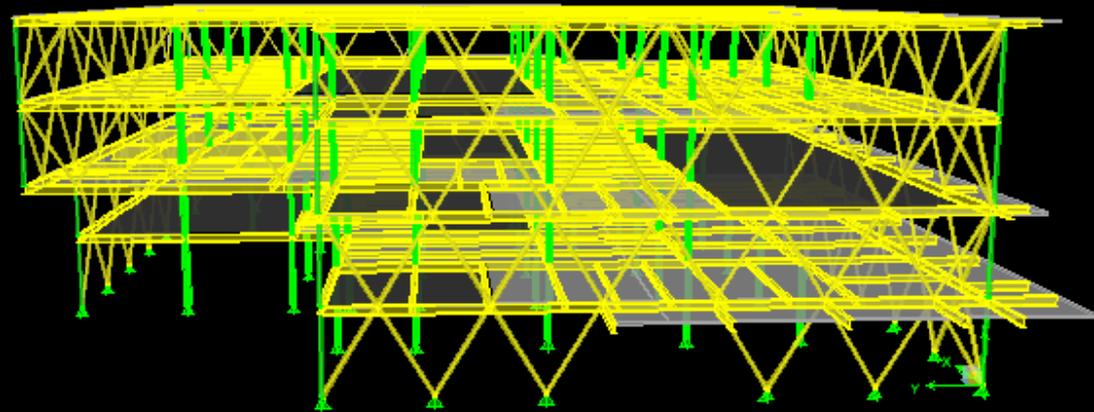
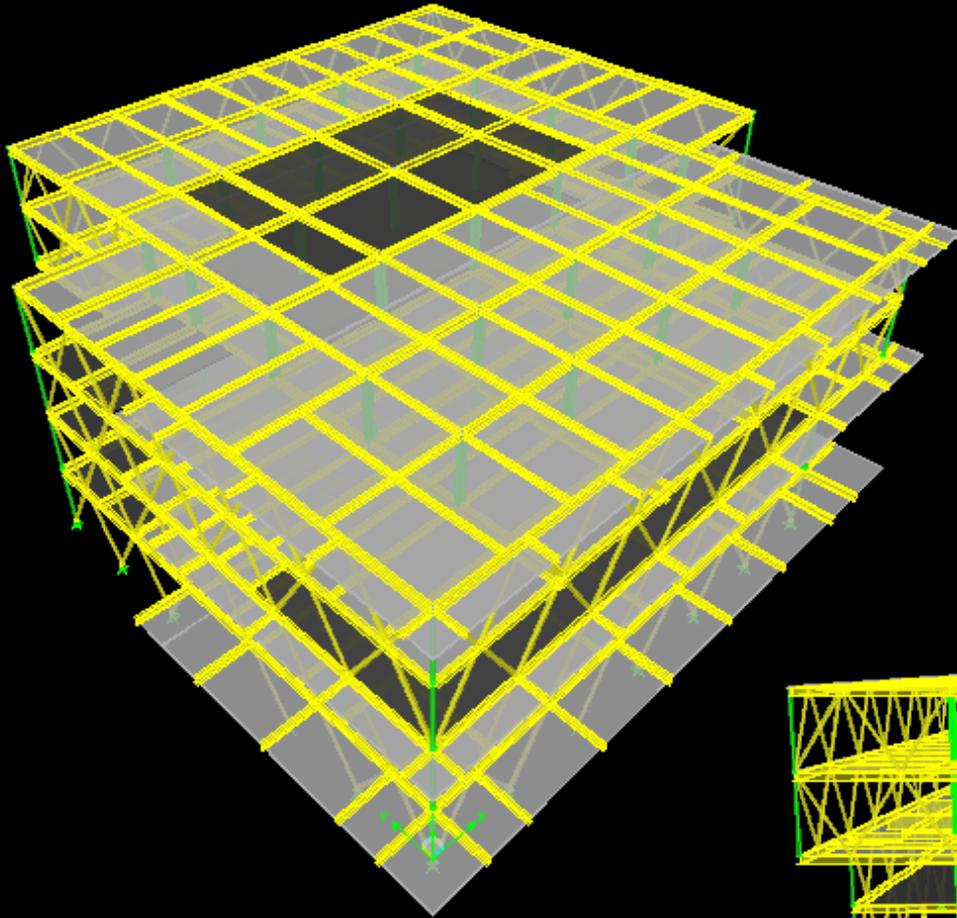
SE

CM

MEP

LCFM

ETABS Analysis



A

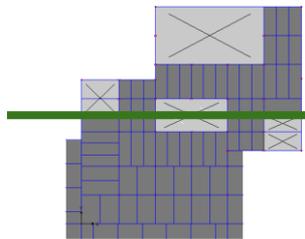
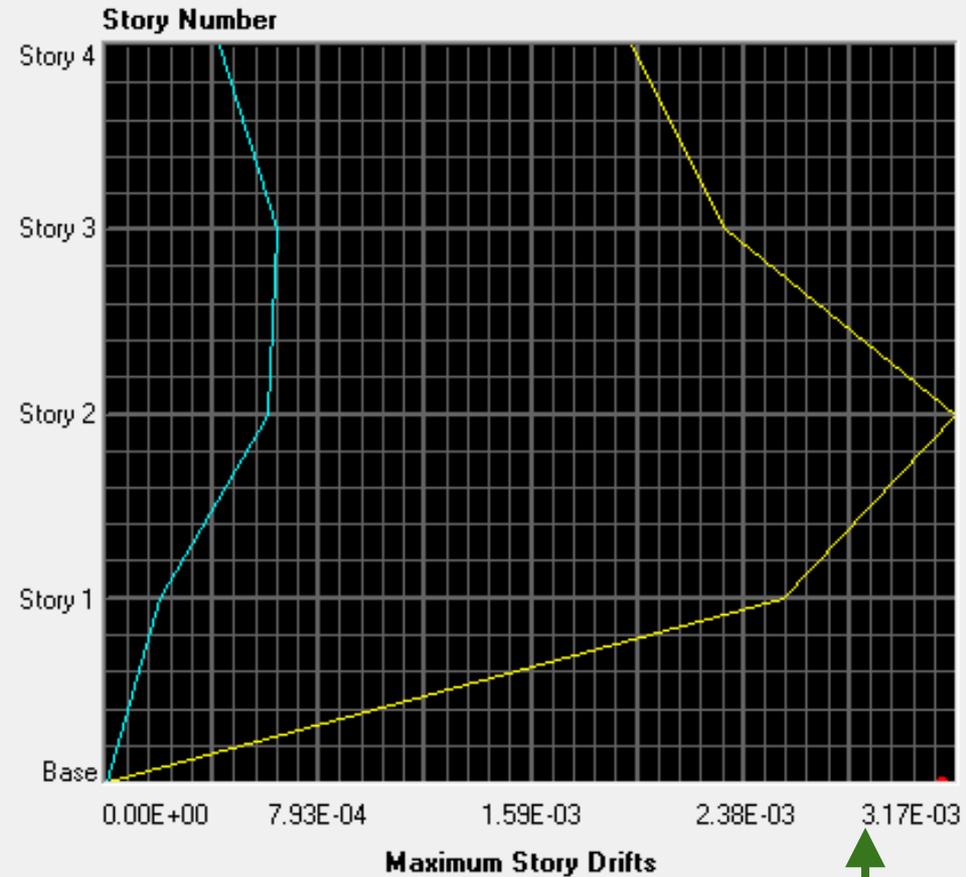
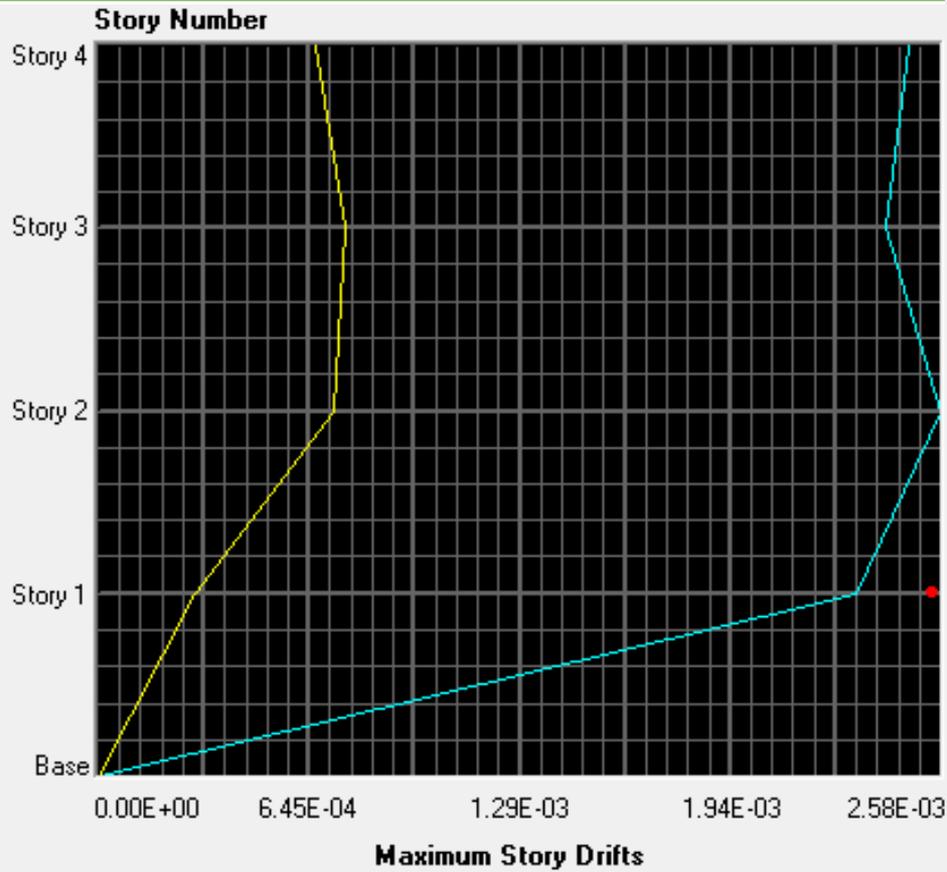
SE

CM

MEP

LCFM

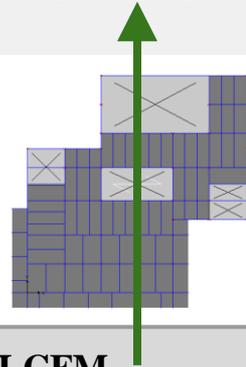
Seismic - Story Drifts



Max = 0.26%

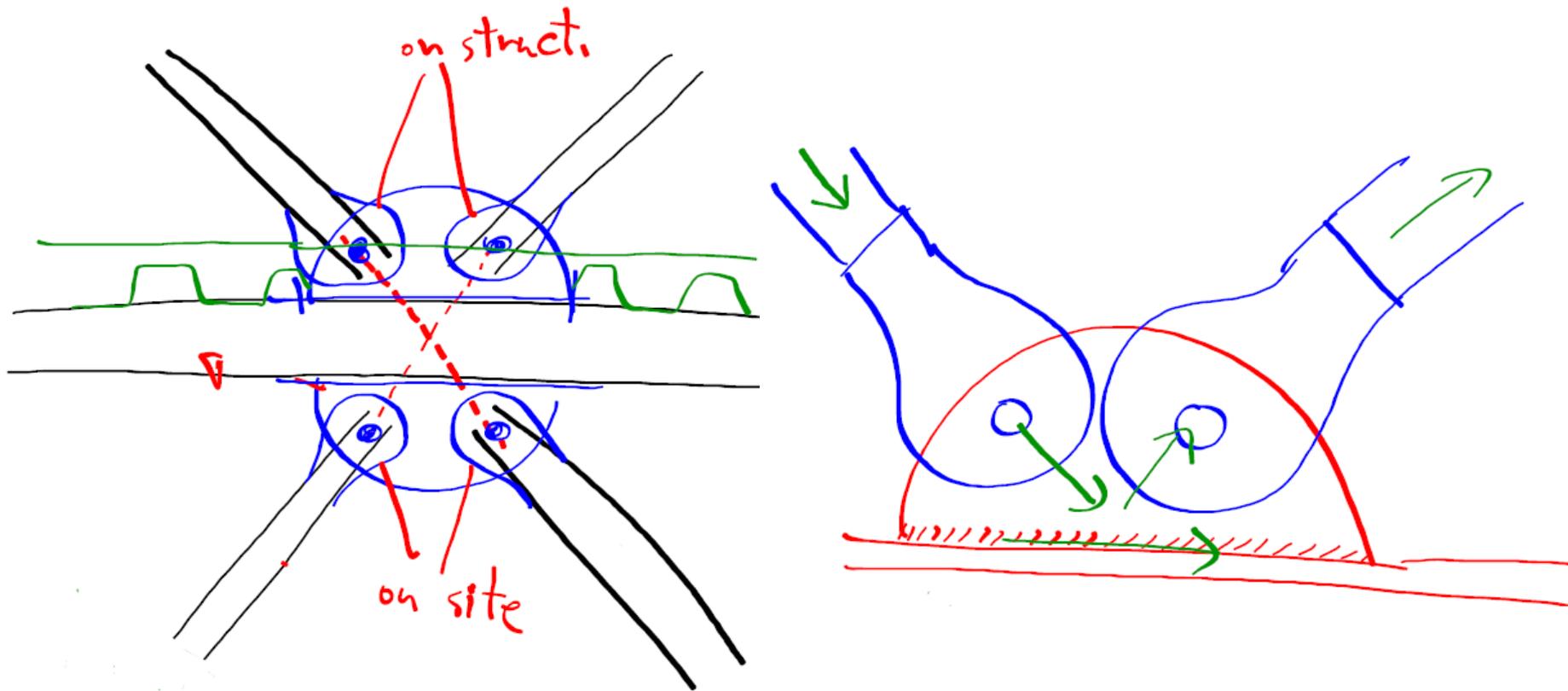
| | | |
|--------------------|-------|--|
| Global X-Direction | Color | |
| Global Y-Direction | Color | |

Max = 0.32%



Connection Detail

- Bolt the diagonals to gusset plate
- Weld the gusset plate to the flange of the girder

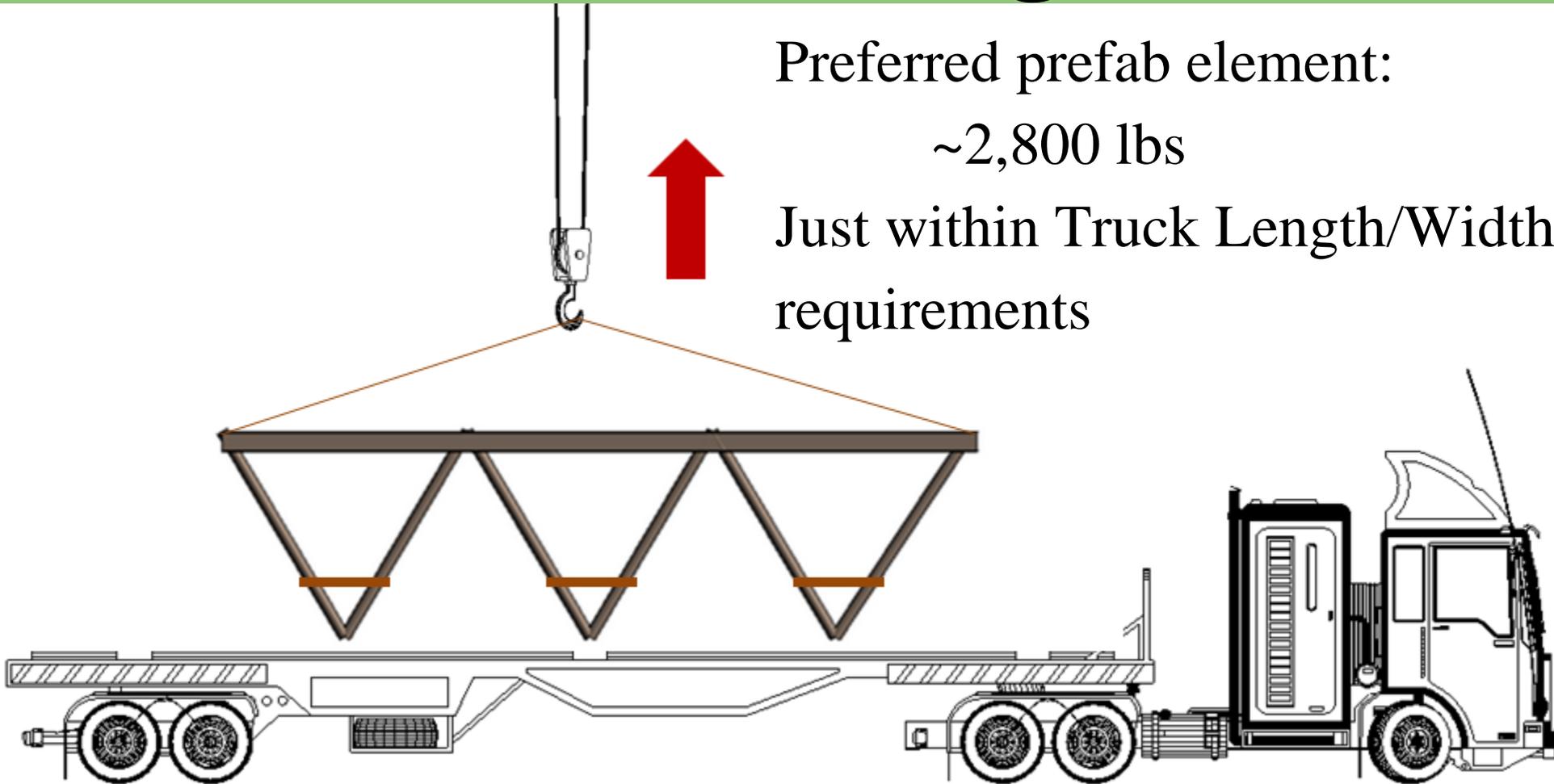


The Rise of the Diagrid

Preferred prefab element:

~2,800 lbs

Just within Truck Length/Width requirements



A

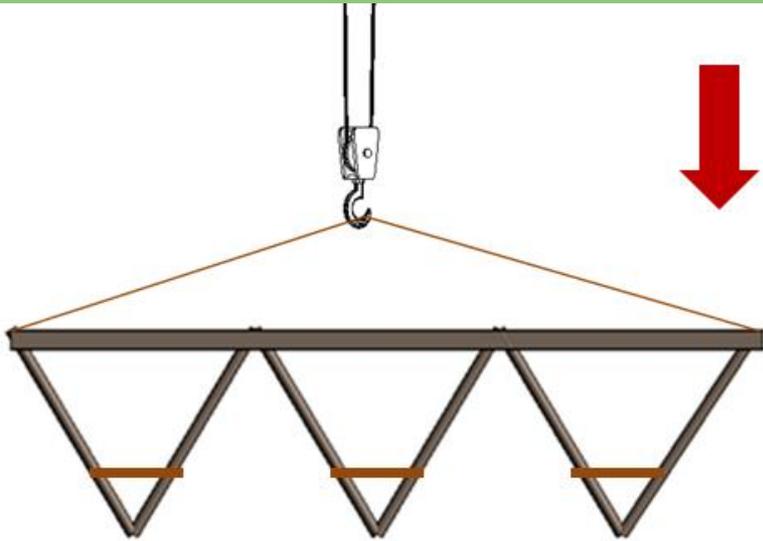
SE

CM

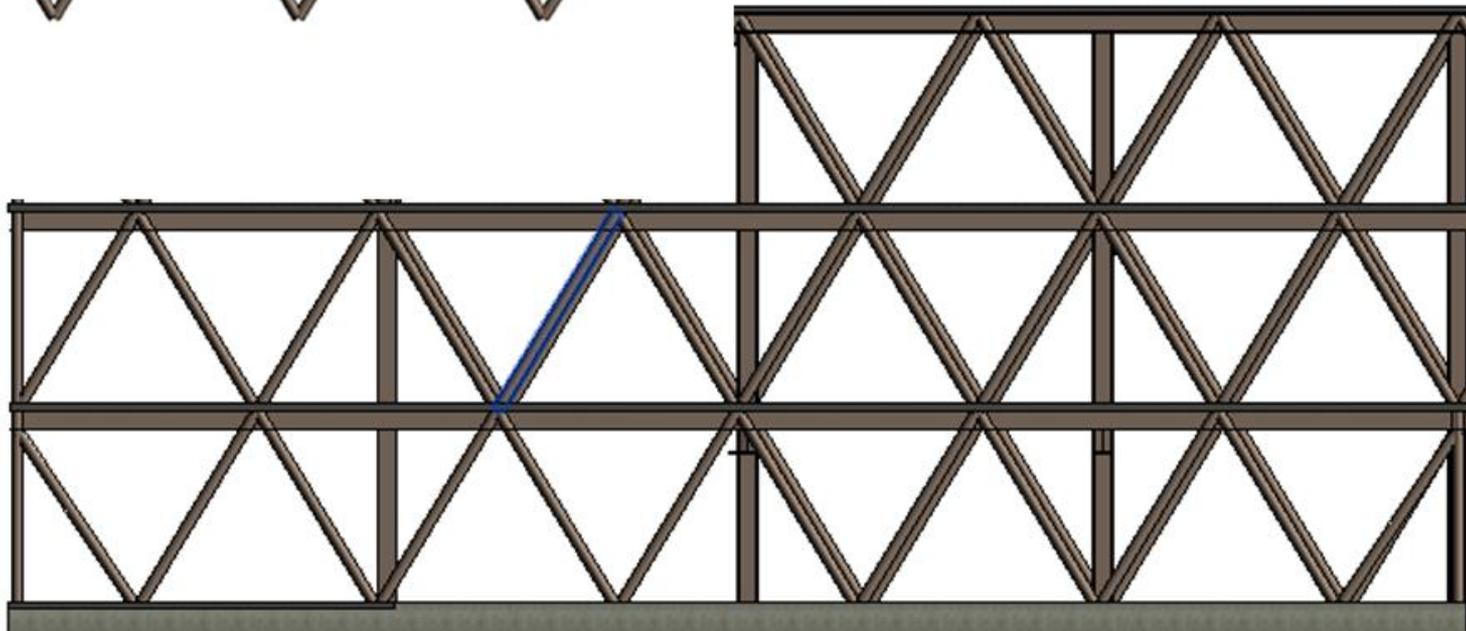
MEP

LCFM

The Rise of the Diagrid



1. Bolt HSS to Girder
2. Bolt Girder to Girder
3. Remove Temporary Structure



A

SE

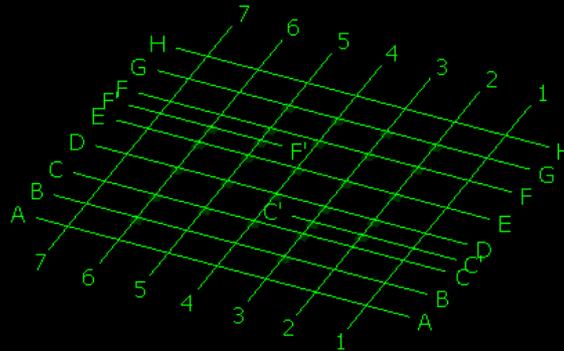
CM

MEP

LCFM

4D Sequence

Thursday 9:00:00 AM 5/9/2013 Day=1 Week=1



A

SE

CM

MEP

LCFM

Construction Site Access



A

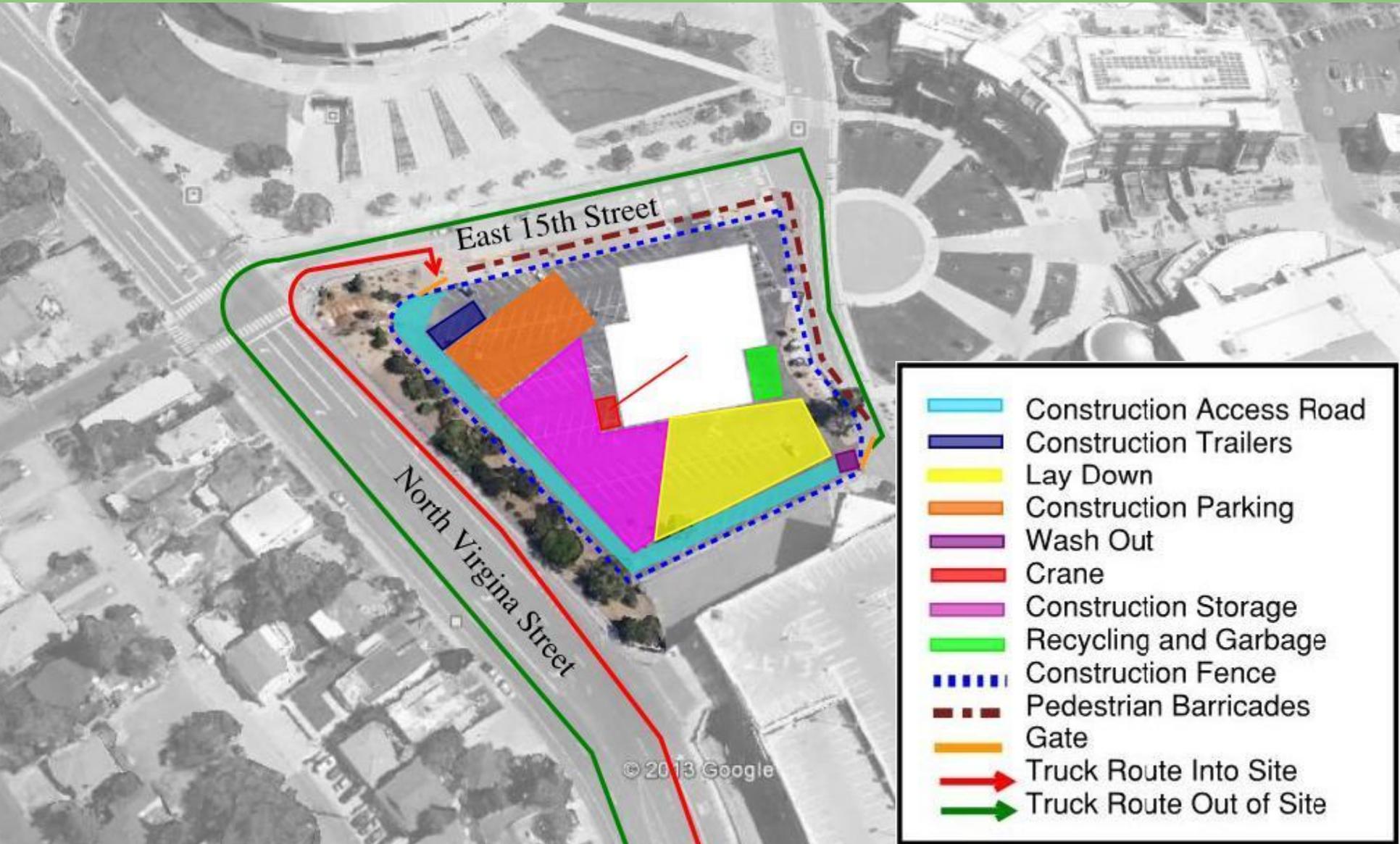
SE

CM

MEP

LCFM

Construction Site Logistics



A

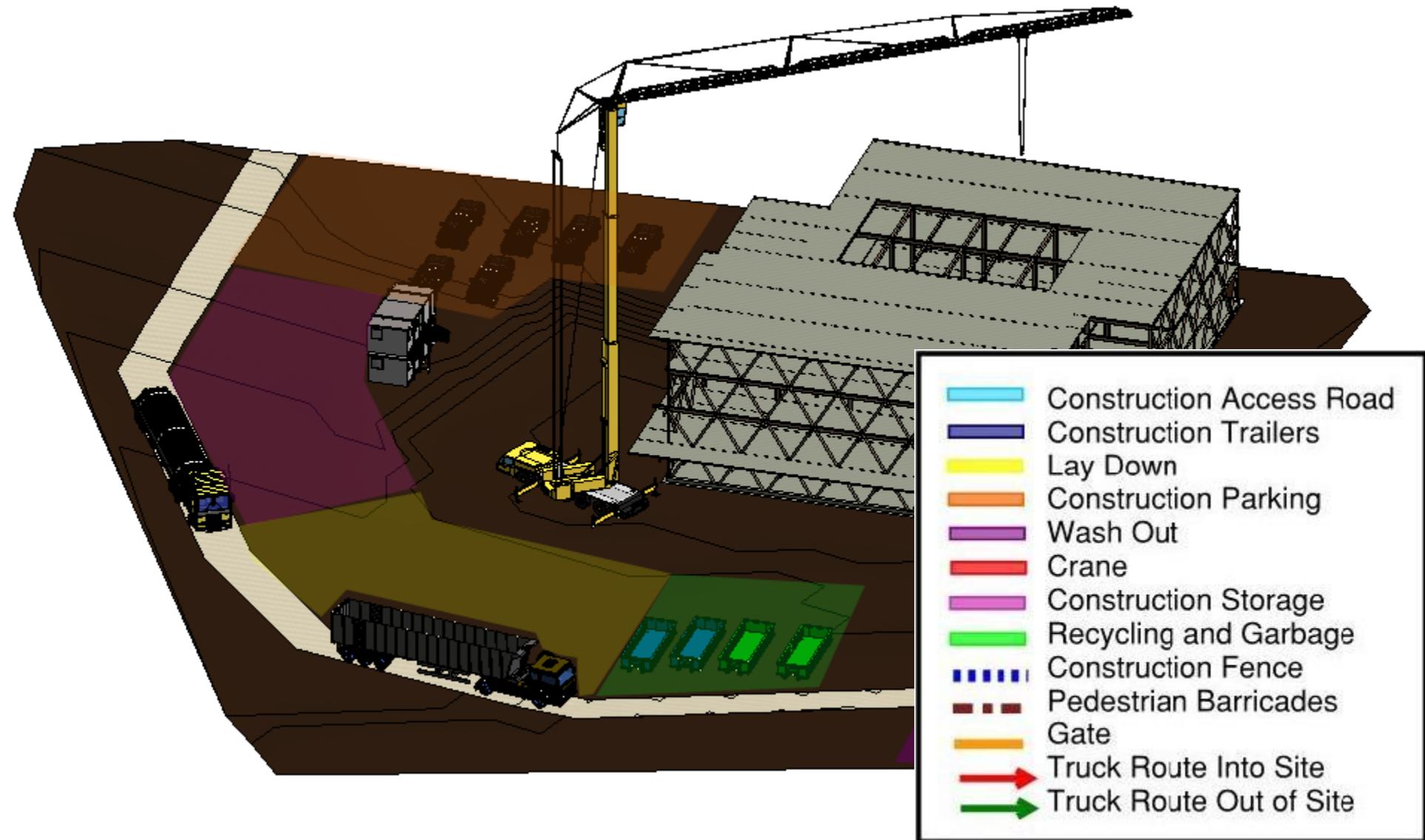
SE

CM

MEP

LCFM

Construction Site Logistics



A

SE

CM

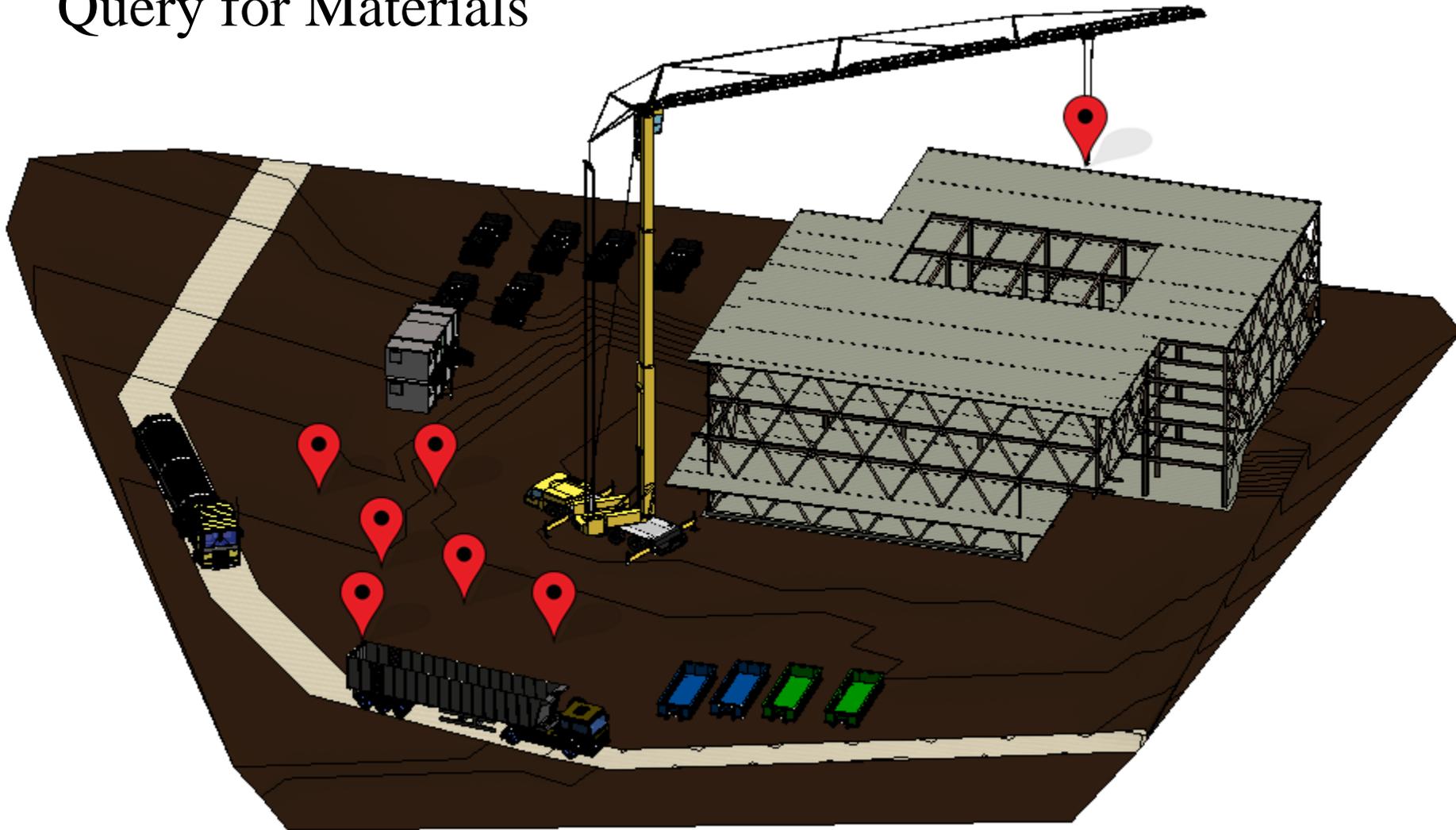
MEP

LCFM

Construction Tracking



Query for Materials



A

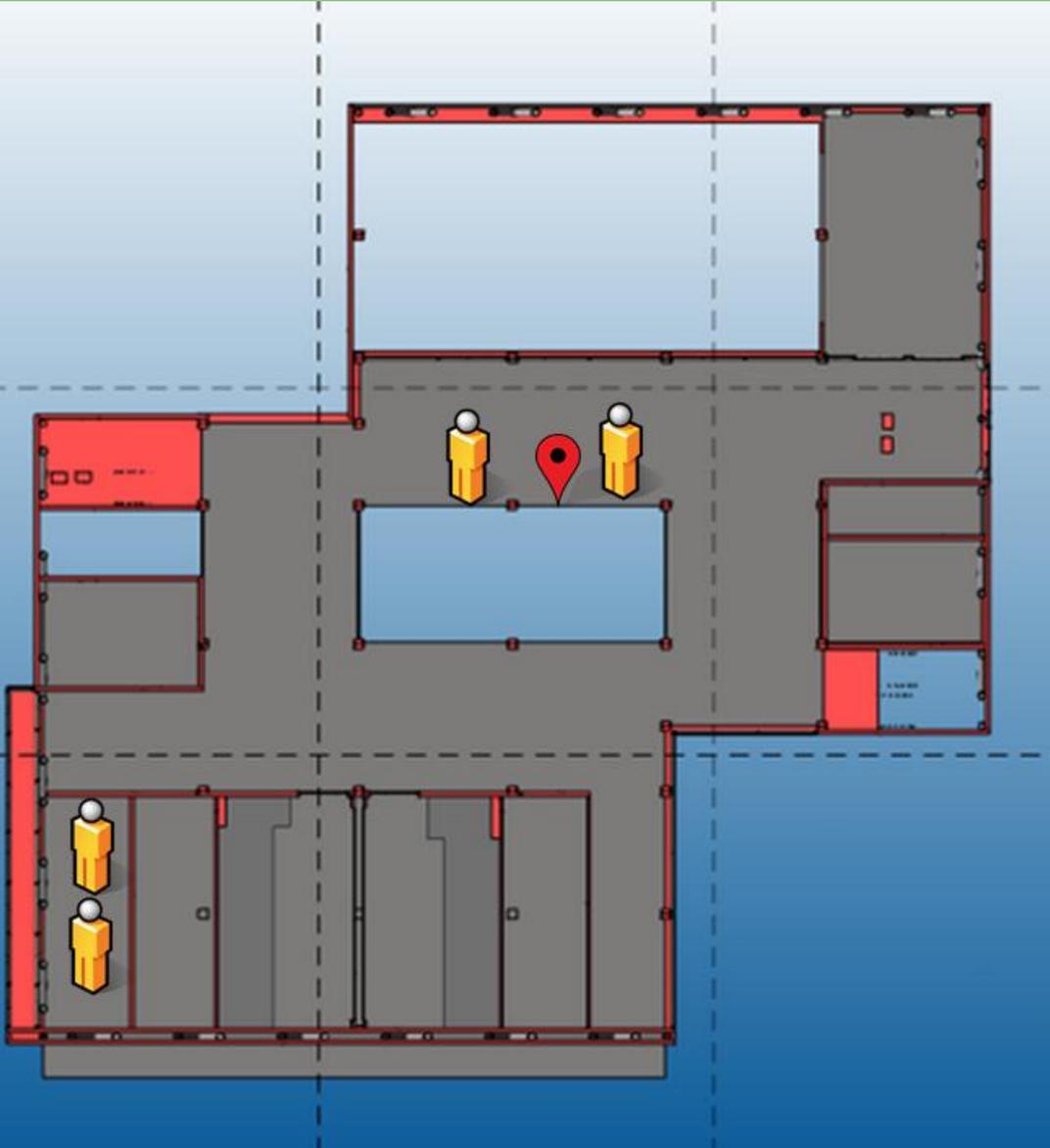
SE

CM

MEP

LCFM

Construction Tracking



Monitor activities and resources in real time

A

SE

CM

MEP

LCM

Construction Tracking



People: Helmet worn unit with GPS, WiFi and IMU



Material: Slim chip uses WiFi and GPS, integration with MEP and Structural sensors



Equipment (crane): Integration of built-in software with GPS

A

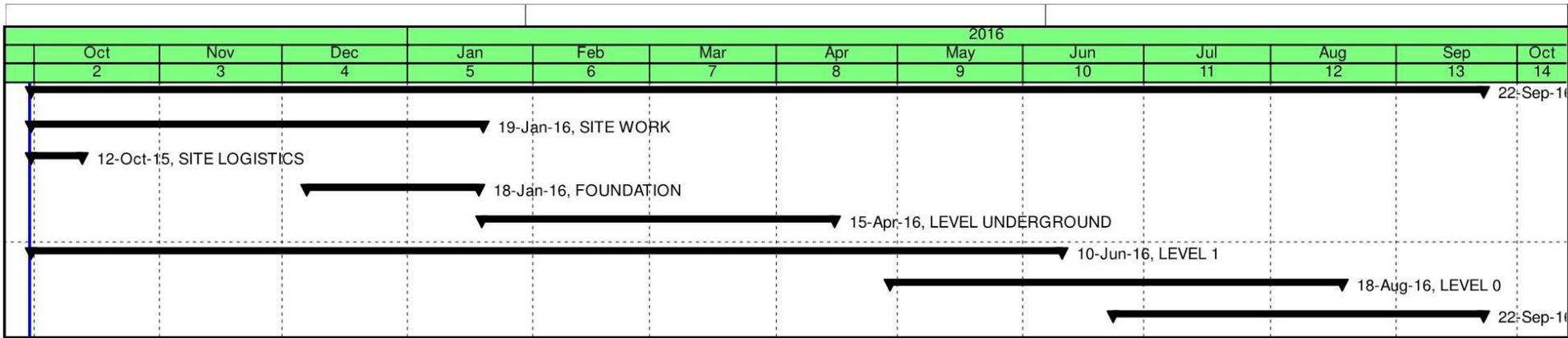
SE

CM

MEP

LCFM

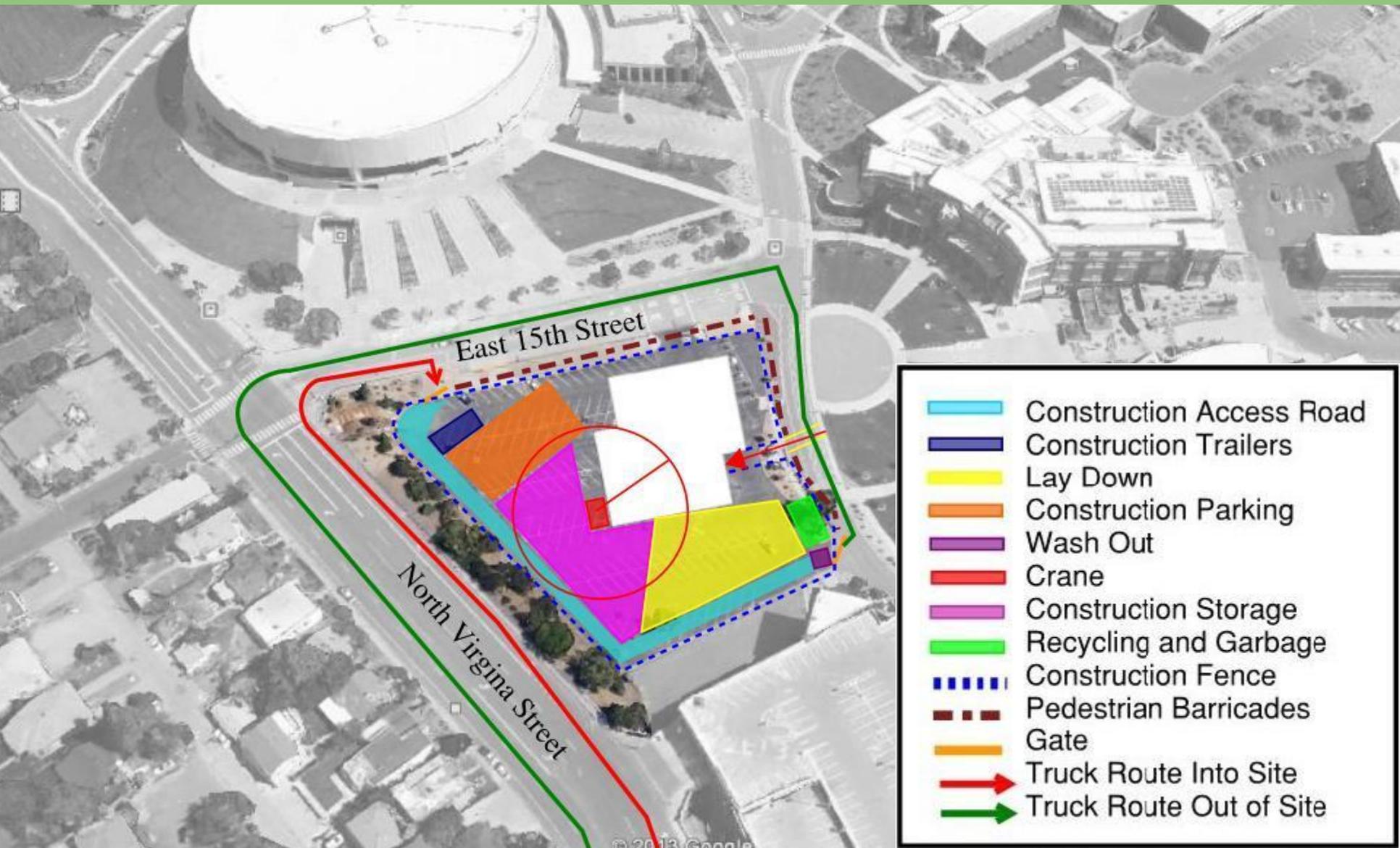
Construction Schedule



Milestones:

- Retaining wall
- Finishing the computer labs (April 15th 2016)
- Installation of the diagrid

Access to Computer Labs



A

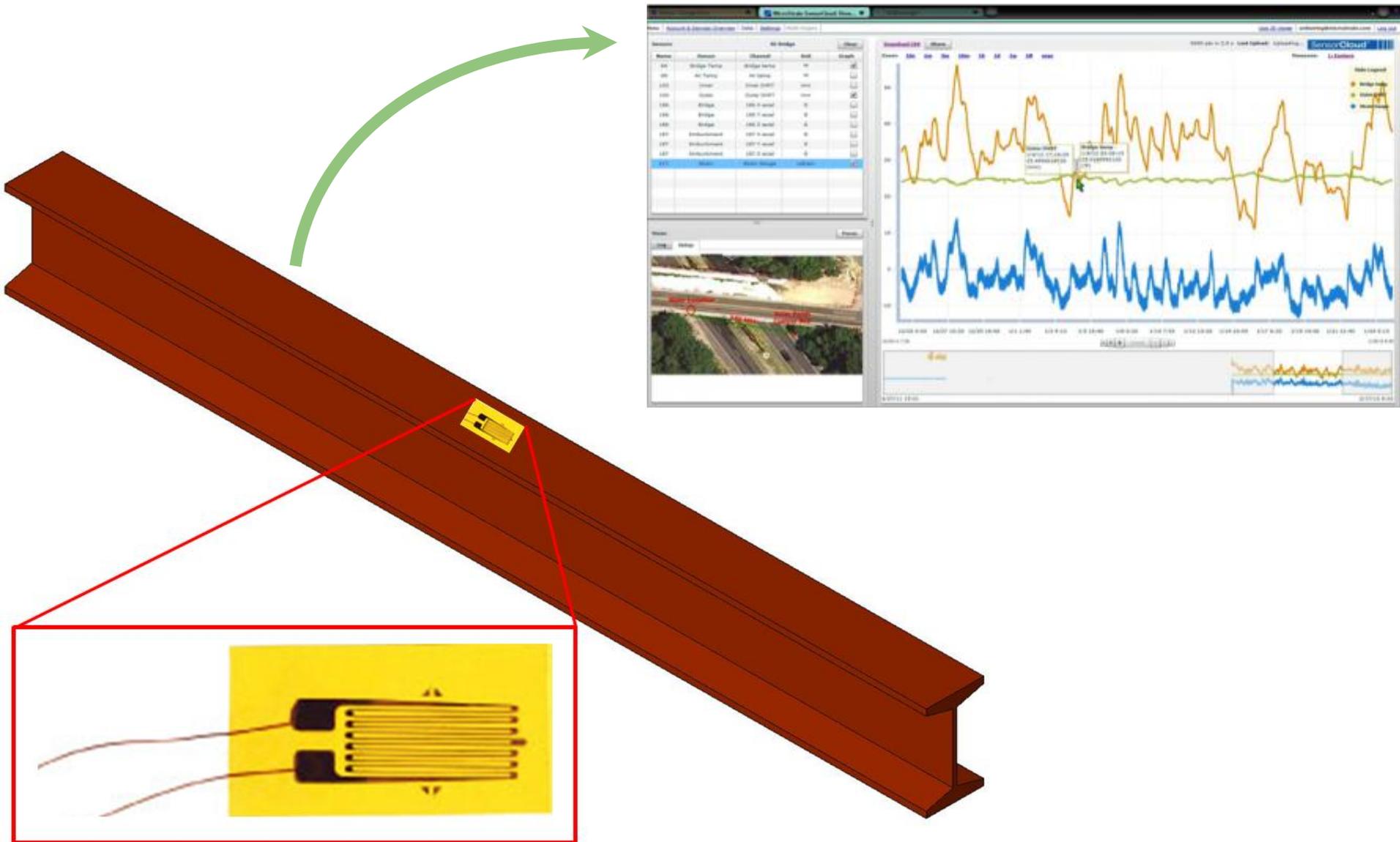
SE

CM

MEP

LCFM

Structural Health



A

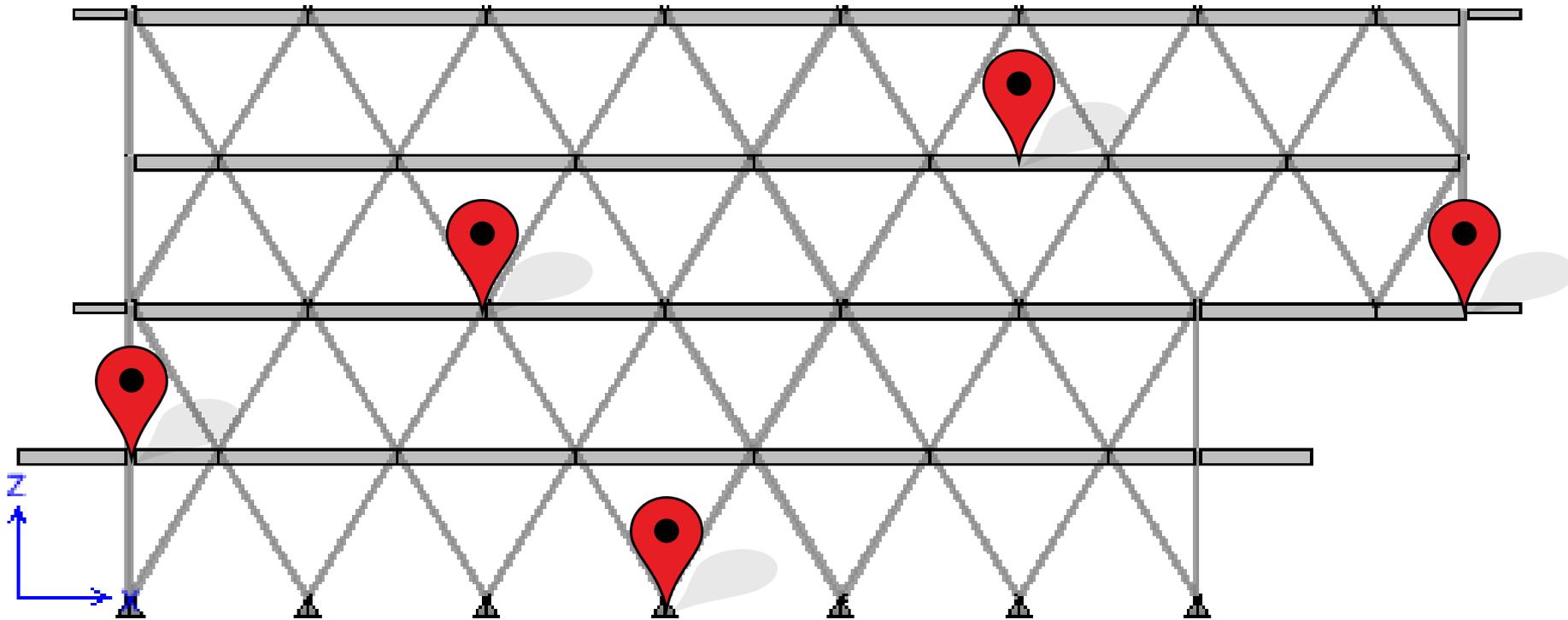
SE

CM

MEP

LCFM

Structural Health



Approx. 500 strain gauges at critical locations on steel framing (i.e. diagrid connections, center of girders)

At \$ 50/sensor, total cost = \$ 25 000

Occupancy Sensors



Low

Medium

High

Low Level - Motion detectors used to control lighting

Medium Level - Count the number of occupants in a zone to refine estimates for HVAC and lighting needs.

Potential to identify presence in case of emergency

High Level - Activity monitoring or ability to identify specific persons for best estimate of HVAC needs and security

Owners request sensors capable of a rough estimate of the number of people in a room (+/- 5)

HVAC & Light Sensors



Room controllers with batteryless sensors



Energy harvesting from surroundings

A

SE

CM

MEP

LCFM

HVAC & Light Sensors



investment costs ~ \$ 34 000

annual savings \$ 16 000

overall productivity increase up to ~ 30 %



A

SE

CM

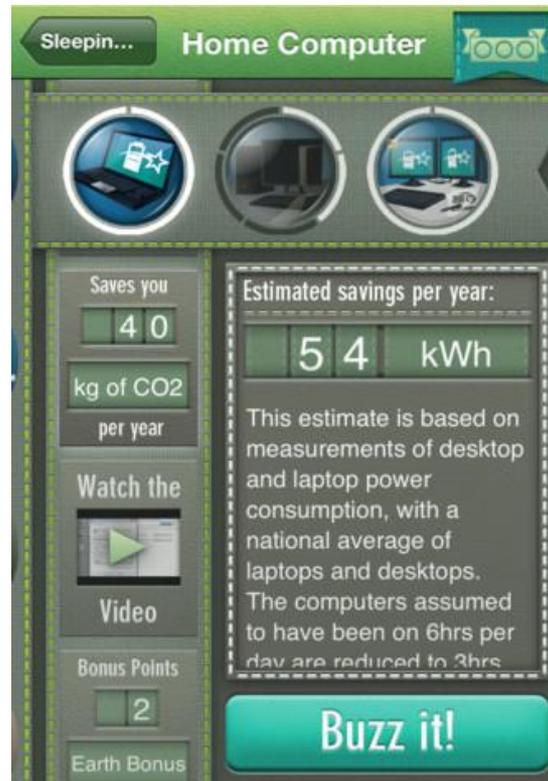
MEP

LCFM

Sustainability App



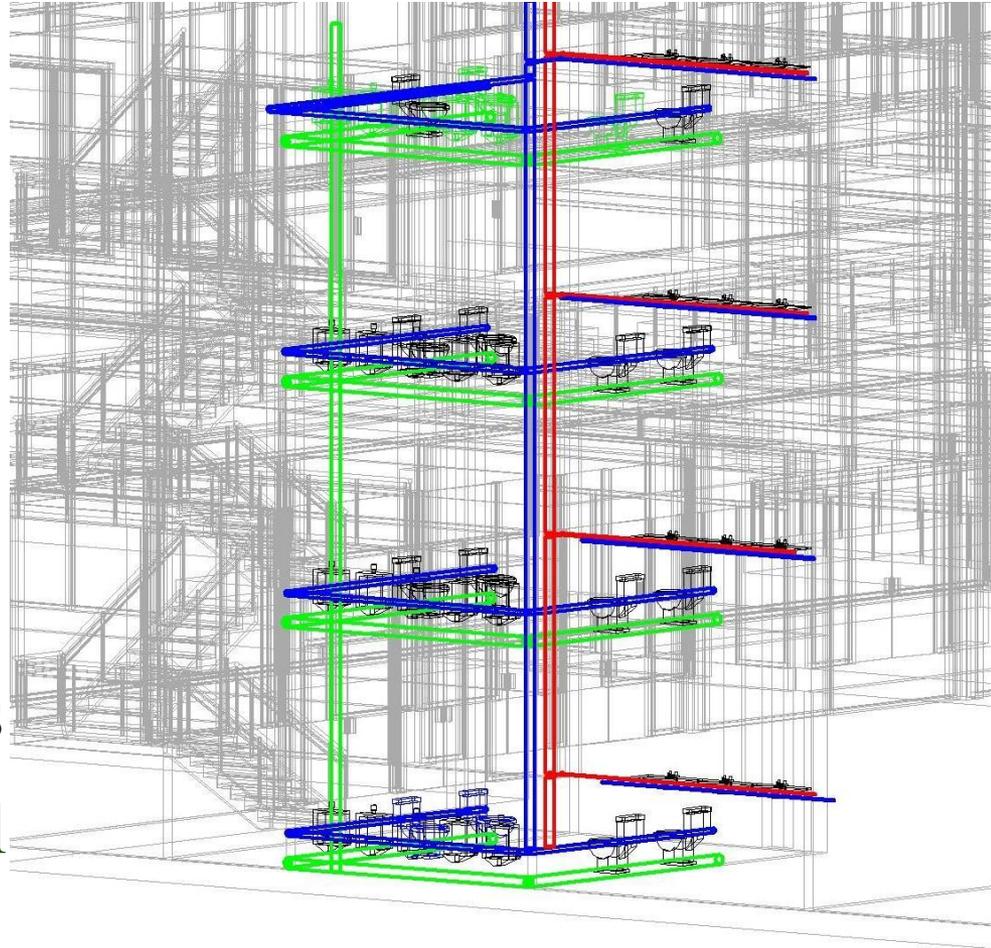
- Encourage occupants to act more sustainably
- Provide sensor data in an easy-to-understand format



Water Management

Water savings

- Dual mode toilets
 - 72 % in partial mode
 - 59 % in full mode
- Waterless urinals
 - 375 gal./per day
- Sensor bathroom faucets
 - 60 % to conventional



Plug Load & Solar Pads



7020 kWh/year through
mobile devices &
laptops lead to
about \$ 3750 a year
for electricity



80 solar pads with the total cost of \$ 9920 preserve
those expenses

Delivered Energy Overview

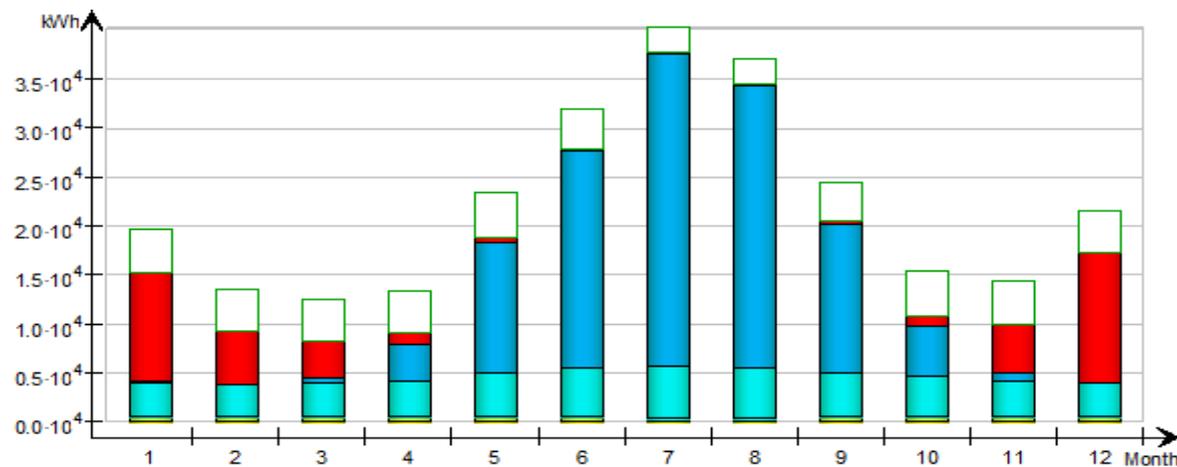
| | | Delivered energy | |
|---|---------------------------------|------------------|--------------------|
| | | kWh | kWh/m ² |
| ■ | Lighting, facility | 5749 | 1.7 |
| ■ | HVAC aux | 50576 | 15.1 |
| | Total, Facility electric | 56325 | 16.8 |
| ■ | District cooling | 121537 | 36.3 |
| ■ | District heating | 41679 | 12.4 |
| | Total, Facility district | 163216 | 48.7 |
| | Total | 219541 | 65.5 |
| □ | Equipment, tenant | 48366 | 14.4 |
| | Total, Tenant electric | 48366 | 14.4 |
| | Grand total | 267907 | 80.0 |

Natural Gas 163216 kWh

Electricity 104691 kWh

PV production 101801 kWh

49.6 kWh/m²



A

SE

CM

MEP

LCFM

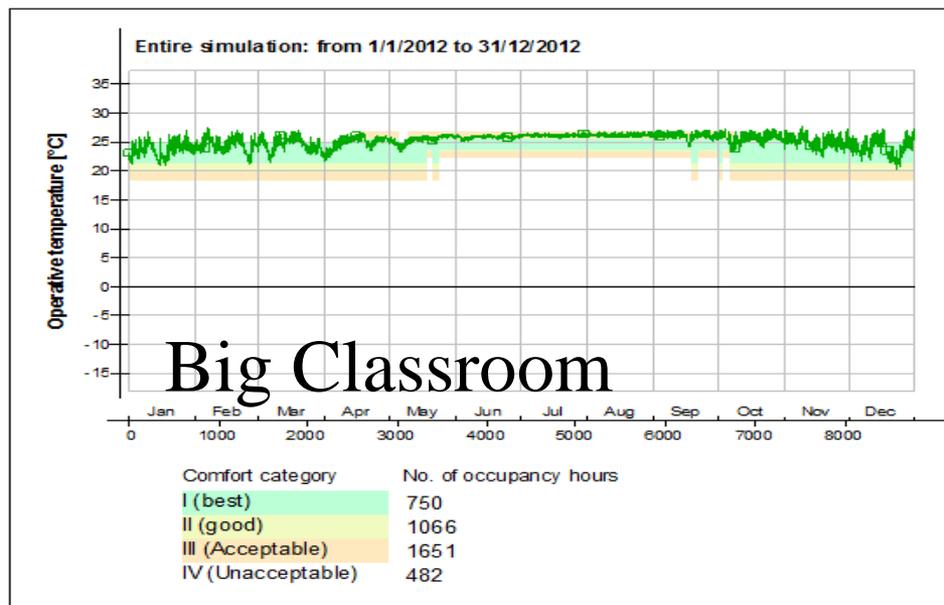
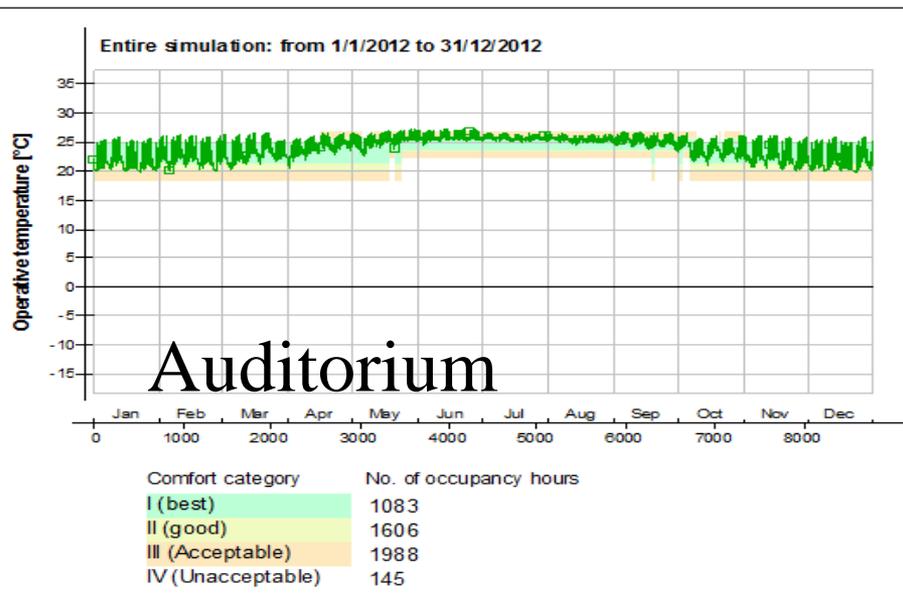
Building Indoor Comfort

% of hours when operative temperature is above 27 °C

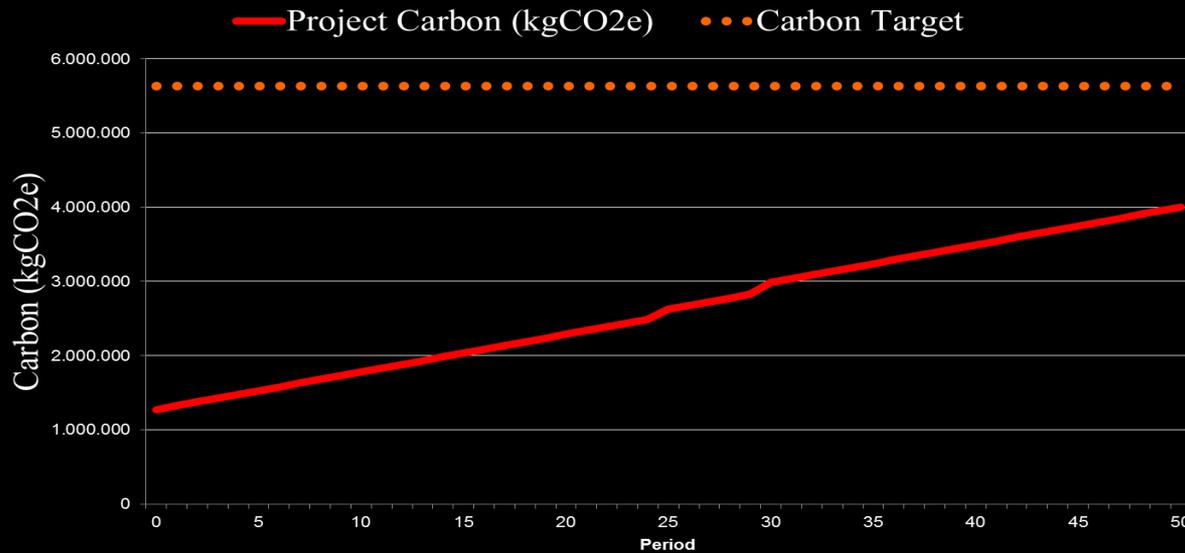
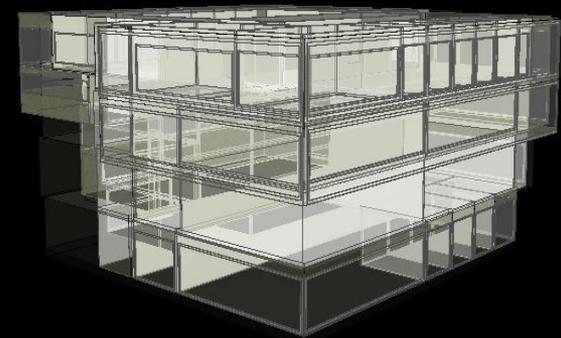
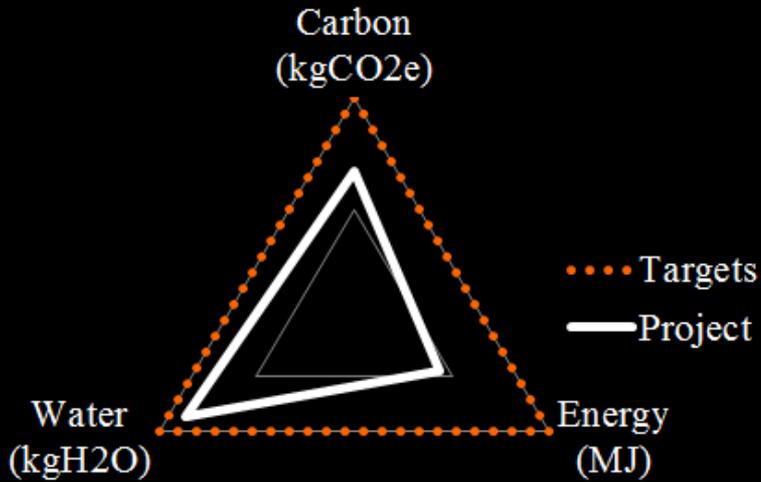
7 %

% of total occupants hours with thermal dissatisfaction

10 %



Sustainable Target Value



A

SE

CM

MEP

LCFM

LEED Scorecard

- LEED for New Construction
- LEED Gold



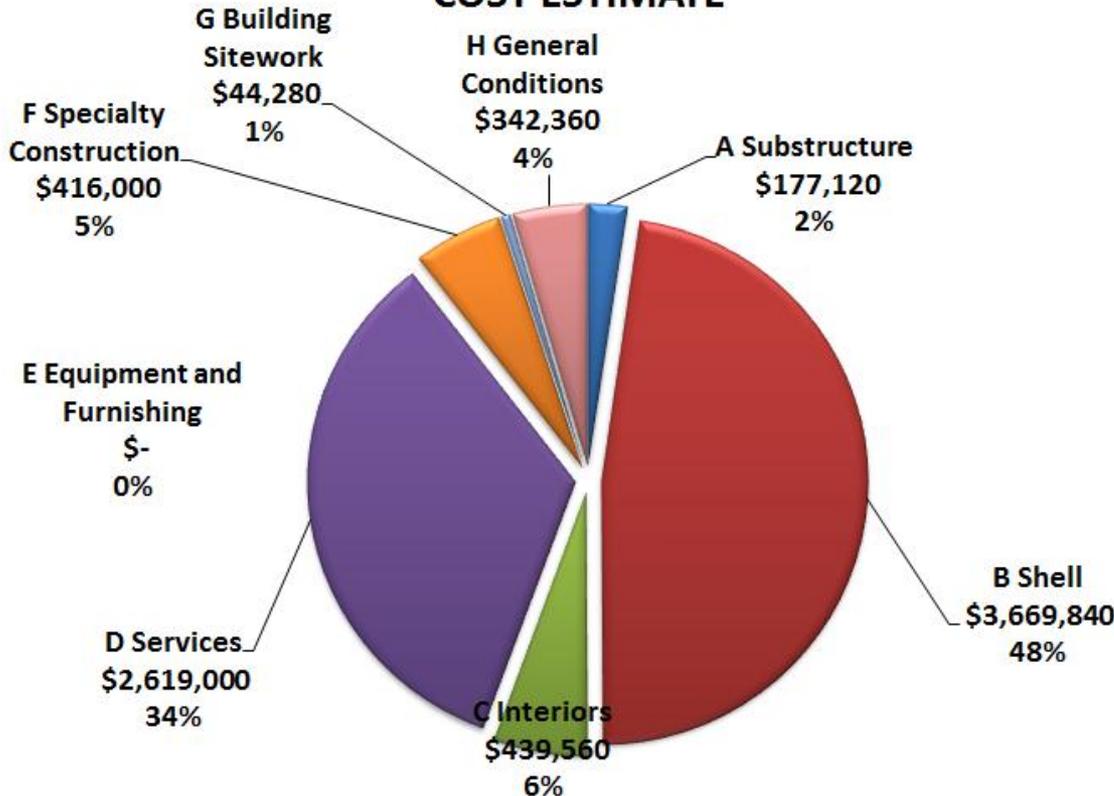
| | |
|------------------------------|----------|
| Sustainable Sites | 17 to 21 |
| Water Efficiency | 10 |
| Energy & Atmosphere | 27 |
| Materials & Resources | 5 |
| Indoor Environmental Quality | 13 to 15 |
| Total | 72 to 78 |

Construction Cost Estimate

Final Cost: \$8,391,000

Target Budget: \$8,382,000

COST ESTIMATE



Glazing is ~24% of total cost!

A

SE

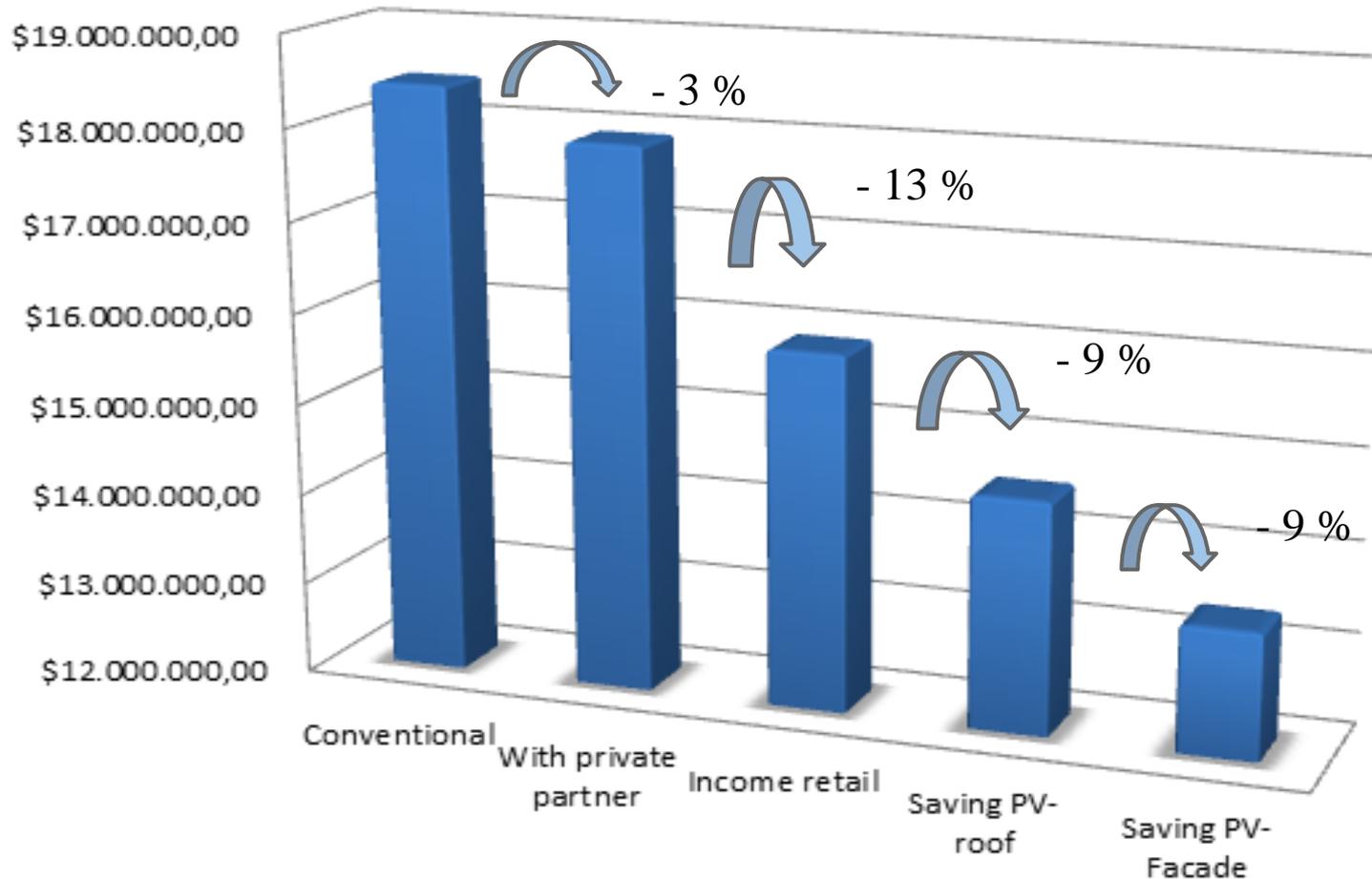
CM

MEP

LCFM

Life Cycle Process Savings

Summed up for whole life cycle savings of 34 %



A

SE

CM

MEP

LCFM

Team Process & Interactions

- emails not needed
 - except for with owners/mentors
- team & subgroup meetings
- discussion and links
- file sharing
- modeling and analysis
- graphic communication



Ramon Iglesias

to Stephanie, Stefan, Laura

Damn, an email!

Voting Room Title: Big Idea

The brighter (orange) the ideas are, the more popular they are!
6 people contributed their ideas.
5 people voted.

6 User(s) in Room:
Laura Mighetto (Room Moderator)
Ramon Iglesias
Stephanie Chen
Stefan Markic
Kleanthis Chasapis
JORGE SILEN

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[Return to Home Page](#)

Sort by Country Sort by Ranking

| | | | |
|--------------------|--|-----|---------------|
| Ramon Iglesias | Smart chips in all building components for process and product performance optimization | 100 | United States |
| Ramon Iglesias | Flexible spaces that adapt to different scenarios | 92 | United States |
| Ramon Iglesias | A design that is easy to renovate, and maintain | 68 | United States |
| Kleanthis Chasapis | Control systems(automated)for heating/cooling depend on data that collected from sensors | 53 | Denmark |
| Stefan Markic | dismantable parts, that allow everything to be reorganized | 51 | Slovenia |
| Kleanthis Chasapis | energy production not only for our building but as a source of money | 50 | Denmark |
| Stephanie Chen | sensors, PV, etc, embedded into the fabric of the building | 49 | United States |
| Stephanie Chen | net zero! sustainability goals | 49 | United States |
| Ramon Iglesias | inspiring building that entices students to pass from social discussion to rapid prototyping in the labs | 44 | United States |

Modes of Communication

| | Primary | Secondary |
|---|---|---|
| Text, images, videos, links to other websites, etc. |  |  |
| Instant messaging |  |  |
| Voice |  |  |
| File Sharing |  Google Drive |  |

A

SE

CM

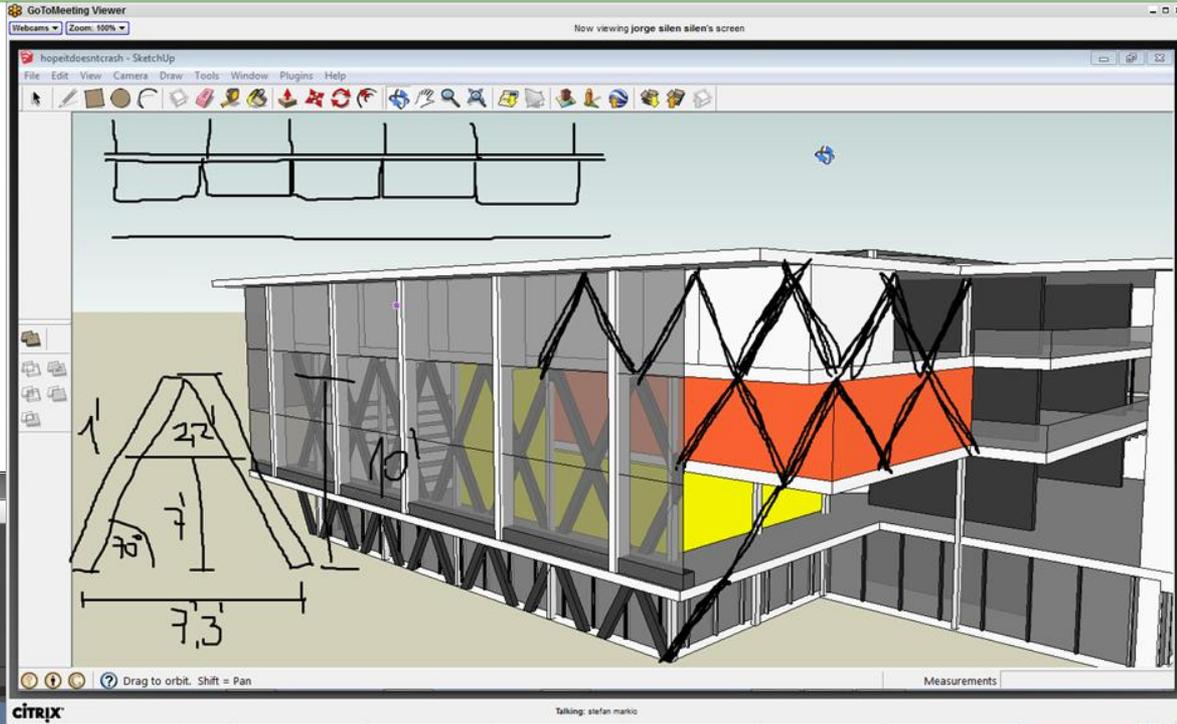
MEP

LCFM

Team & Subgroup Meetings



for walkthroughs



Screen sharing & sketching in



A

SE

CM

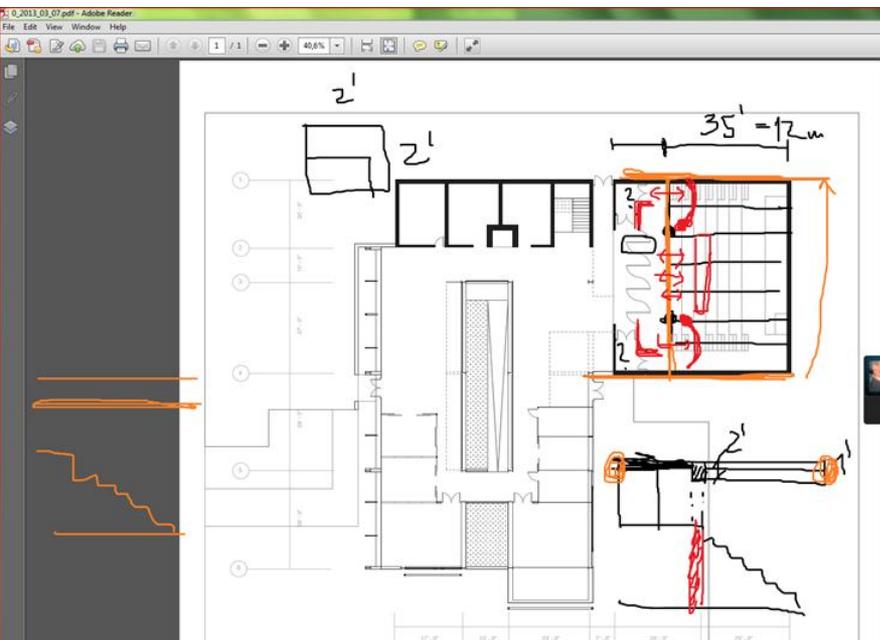
MEP

LCFM

Discussion and Links



for 2 person meetings



Stefan Markic

For the "water pipe going from roof through the building" idea, here is a solution of staying nice (also applicable in other water sculptures):
www.youtube.com/watch?feature=player_embedded&v=IPM8OR6W6WE



The Official Ultra-Ever Dry Product Video - Superhydrophobic and oleophobic coating

www.youtube.com

Ultra-Ever Dry is a superhydrophobic (water) and

Like · Comment · Follow Post · Share · February 9 at 5:15am

Jorge A. Silén, Kleanthis Mhnsenoiazei and Sinan Mihelčič like this. Seen by everyone



Kleanthis Mhnsenoiazei impressive!!

February 9 at 9:24am · Like



Write a comment...

Idea sharing and discussions in

facebook

A

SE

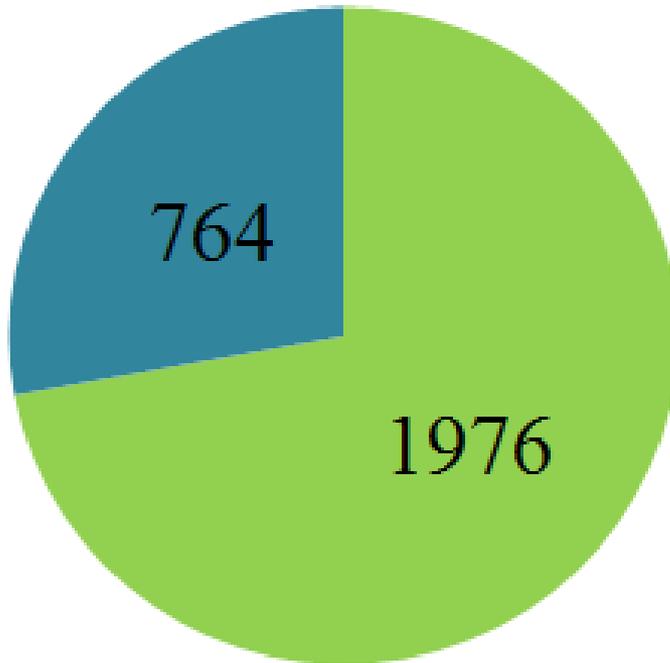
CM

MEP

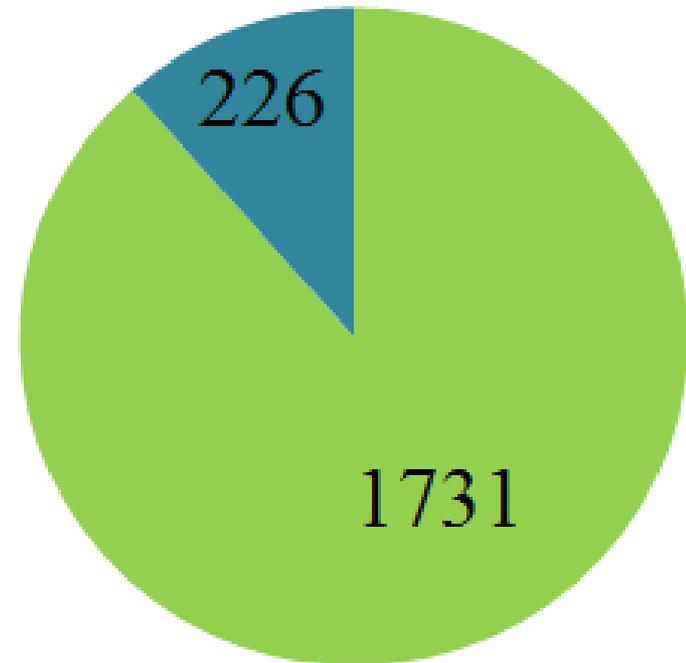
LCFM

File Sharing

Usage in Megabytes



Usage by Number of Files



Discussion Forum/Feedback

Ridge Team Open door building design.

Sidebar ▾ | Home

Cultural Profile 4

The PBL Challenge

CAN THIS PROF... 25

Hello World! 3

The PBL Challenge

Welcome to the Ridge Team Blog!

Have you ever wondered how a building is designed? Curious on how the future building construction might look like? Or just looking for some new material to procrastinate with? Then you are in the right place! We are an excited group of student engineers and architects who have just embarked in the tricky journey of designing a building from scratch, with an extra spin: we are all spread out across the world. Curious? Go on.

This is a product of the Problem Based Learning (PBL) class called Computer Integrated Architecture/Engineering/Construction Global Teamwork (let's just call it PBL) hosted by Stanford University but actually a collaboration of several universities (more information at <http://pbl.stanford.edu/>). The idea is to have students of different

www.ridgeteam.com

A

SE

CM

MEP

LCFM

Modeling and Analysis

Architecture



Structure



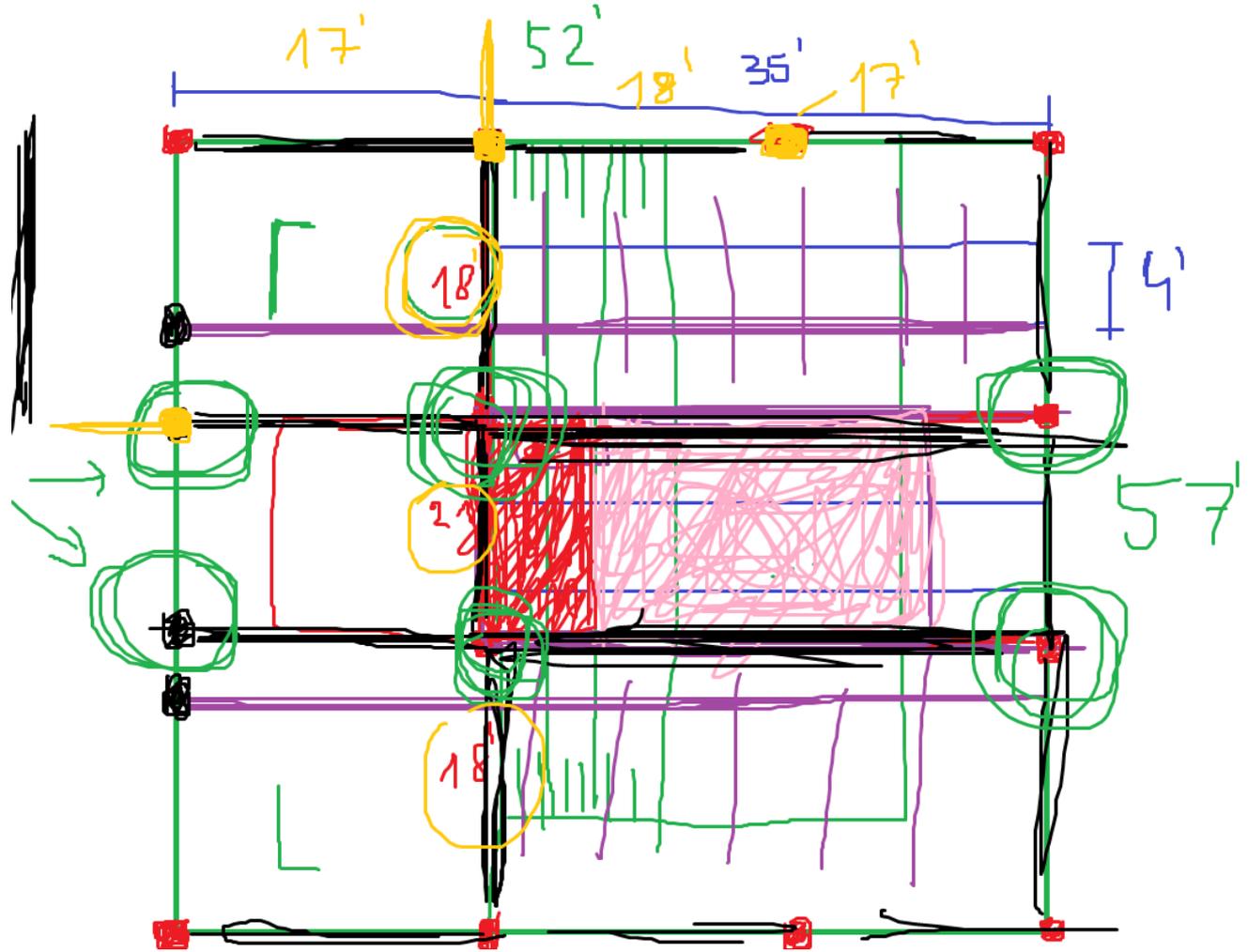
Construction

MEP

| | | | | |
|---|----|----|-----|------|
| A | SE | CM | MEP | LCFM |
|---|----|----|-----|------|

Graphic Communication

MS Paint



A

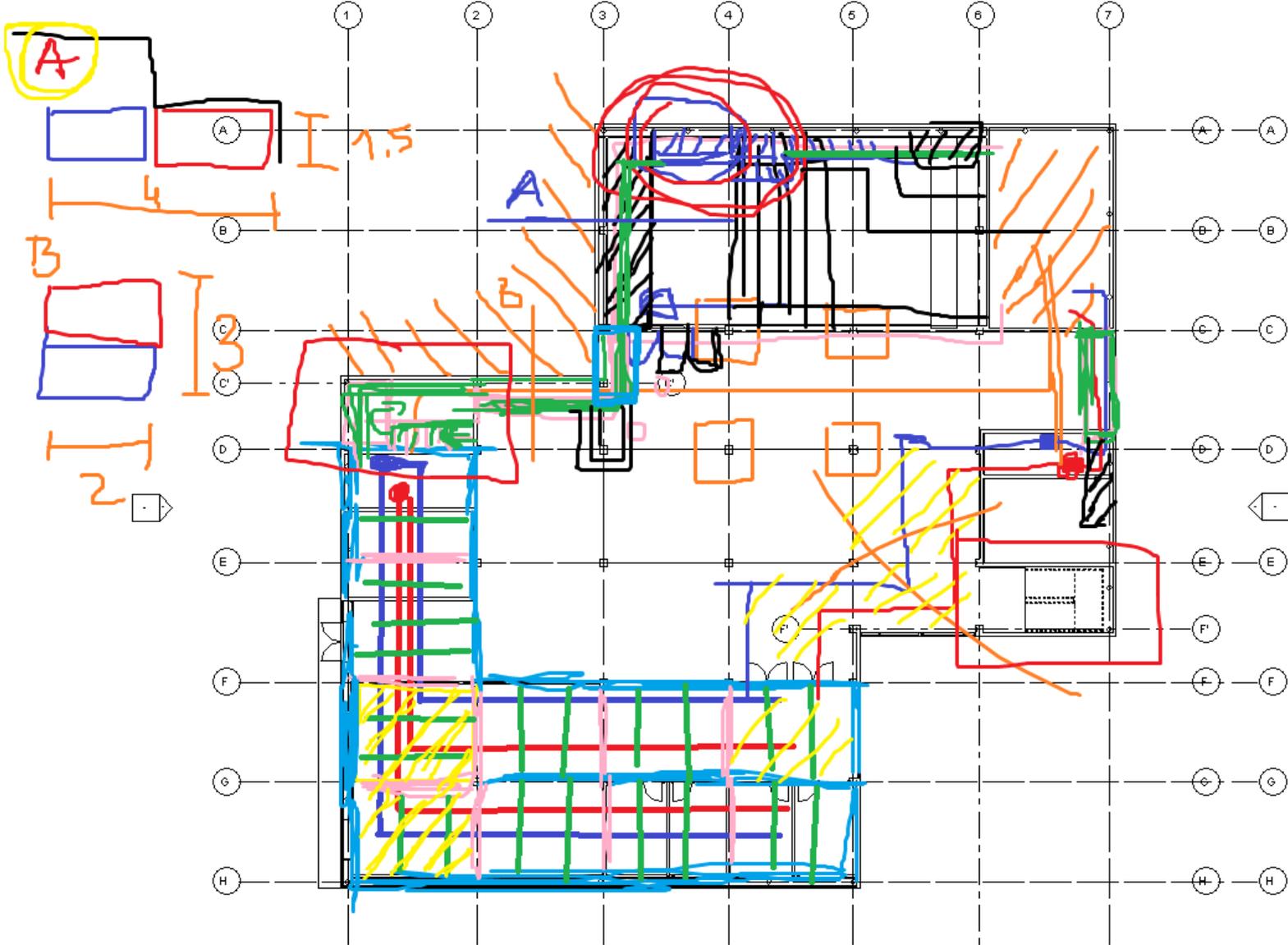
SE

CM

MEP

LCFM

Duct Network - Basement



A

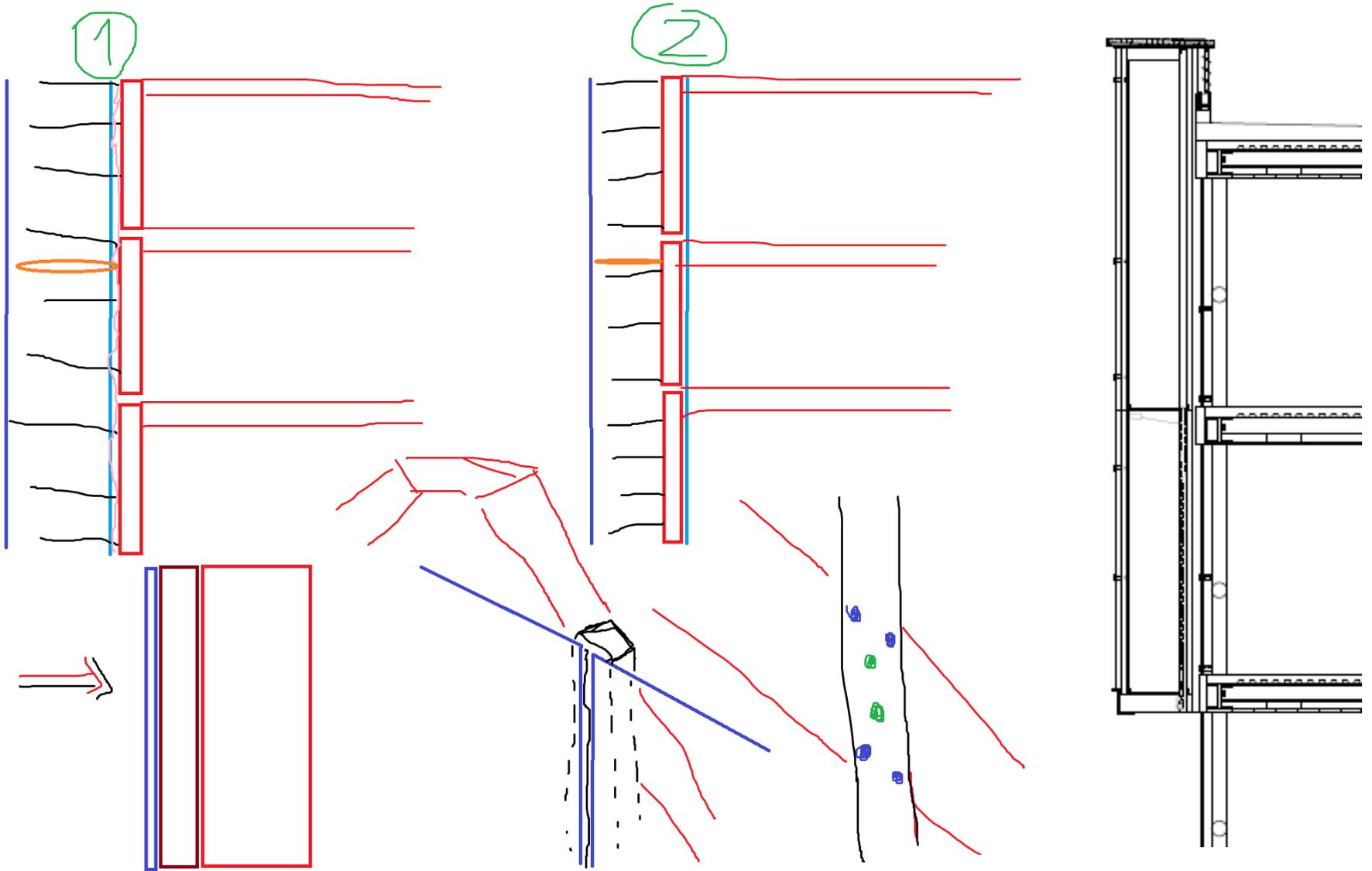
SE

CM

MEP

LCFM

Double Skin Facade



A

SE

CM

MEP

LCFM

Lessons Learned



Laura M: Flexibility is key.

Stephanie C: Sometimes it is better NOT to be colocated (... that way one infection can't decimate an entire team).



Kleanthis C: When nine individualists set a common goal, that is the key for a successful team.

Lessons Learned



Stefan M: Time zones are logical. But imperial ...

Ramon I: In low context, high latency communication, clarity and specificity are essential.



Pablo C: Love your engineer as much as you love yourself.

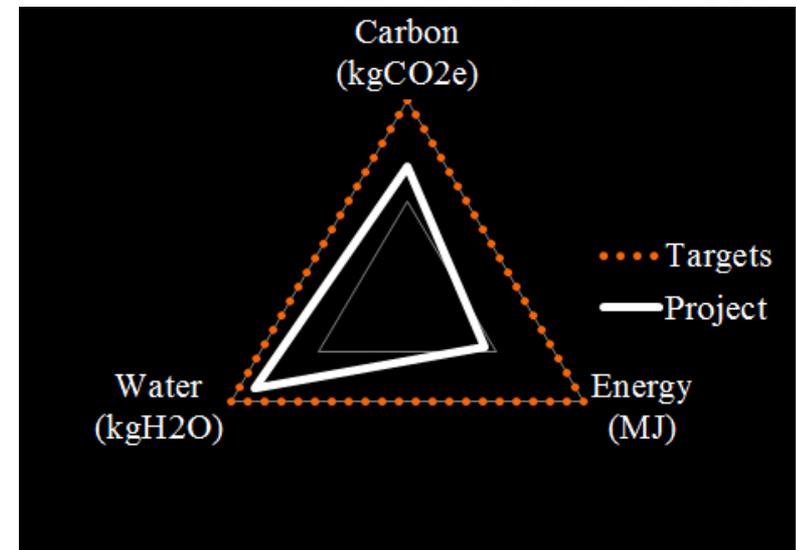
Jorge A: See things from a new perspective.



Summary

- innovative technology
- user friendly facility
- "smart" building

- LEED Gold
- constructed on schedule
- final cost = \$8 391 000



Thanks!



Special thanks to Renate, Maria, Sinan, Anirudh and the mentors we've worked with:

Humberto Cavallin, Greg Luth, Justin Bocian, Prof. Jon Wren, Prof. Eduardo Miranda, Prof. Hamid Aghajan and AIR Lab, John Nelson, Sarah Russell-Smith, Luis Rivera





