FUSION

AEI
ARCHITECTURAL
ENGINEERING
INSTITUTE

AEI TEAM 02-2018

FUSION

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CAMILLE STEFANI

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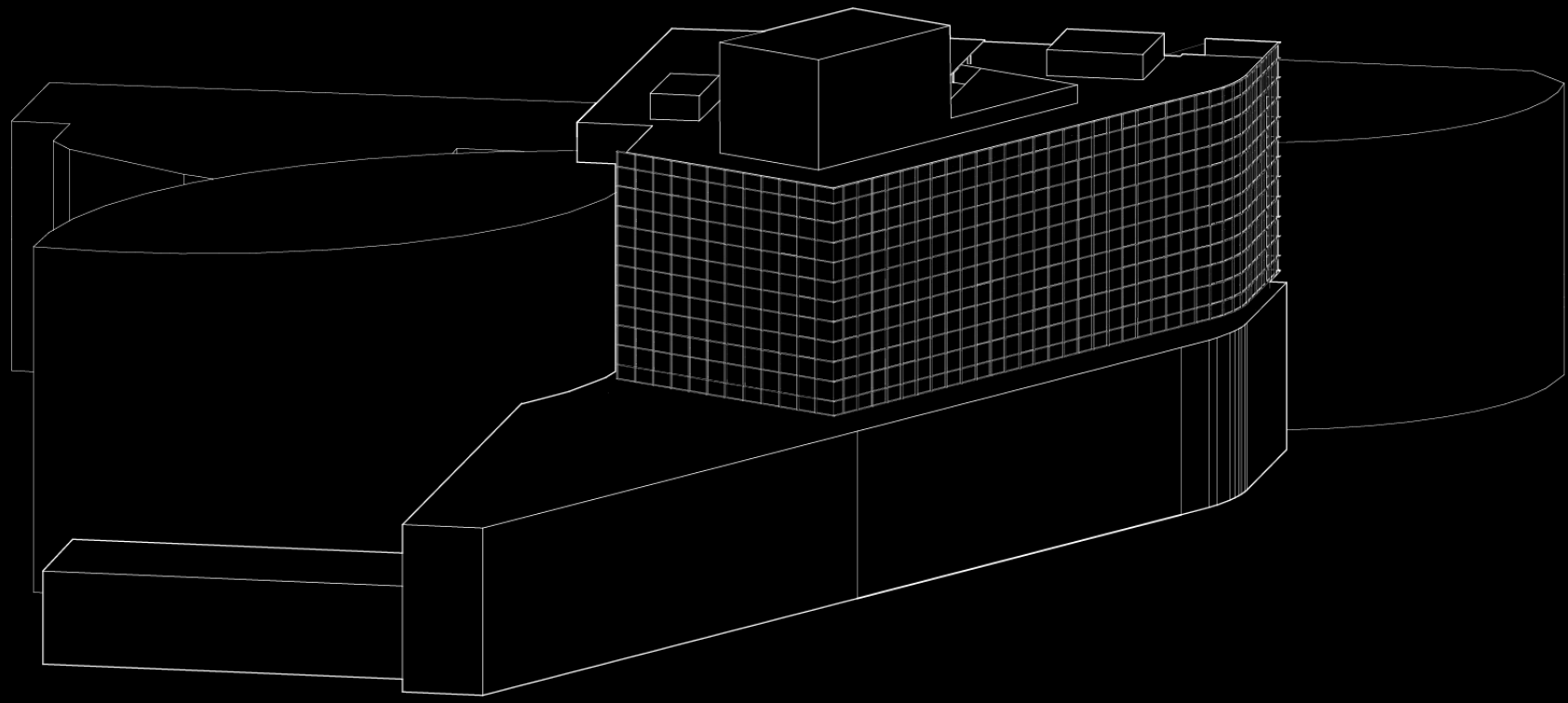
BRI BASILE

Through a collaborative team dynamic, Fusion delivered a state of the art medical center in line with the Children's Hospital and Medical Center's mission. The building facilitates exceptional clinical care to improve the life of every child. With a multi-disciplinary and integrative approach, the Team created a center of wellness that adapts to the changing needs of the hospital community.

PennState

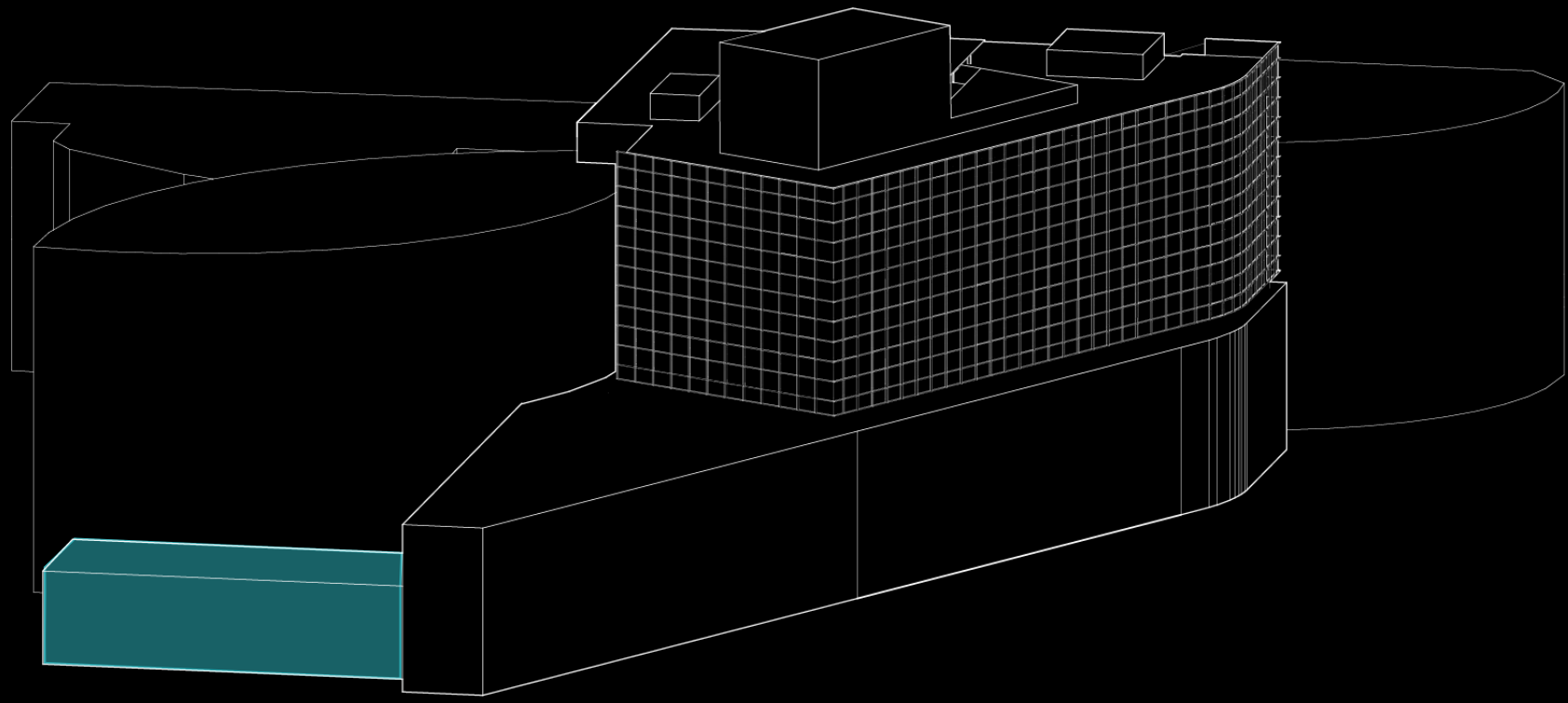
FUSION

Integrative Design Points of Focus



Integrative Design Points of Focus

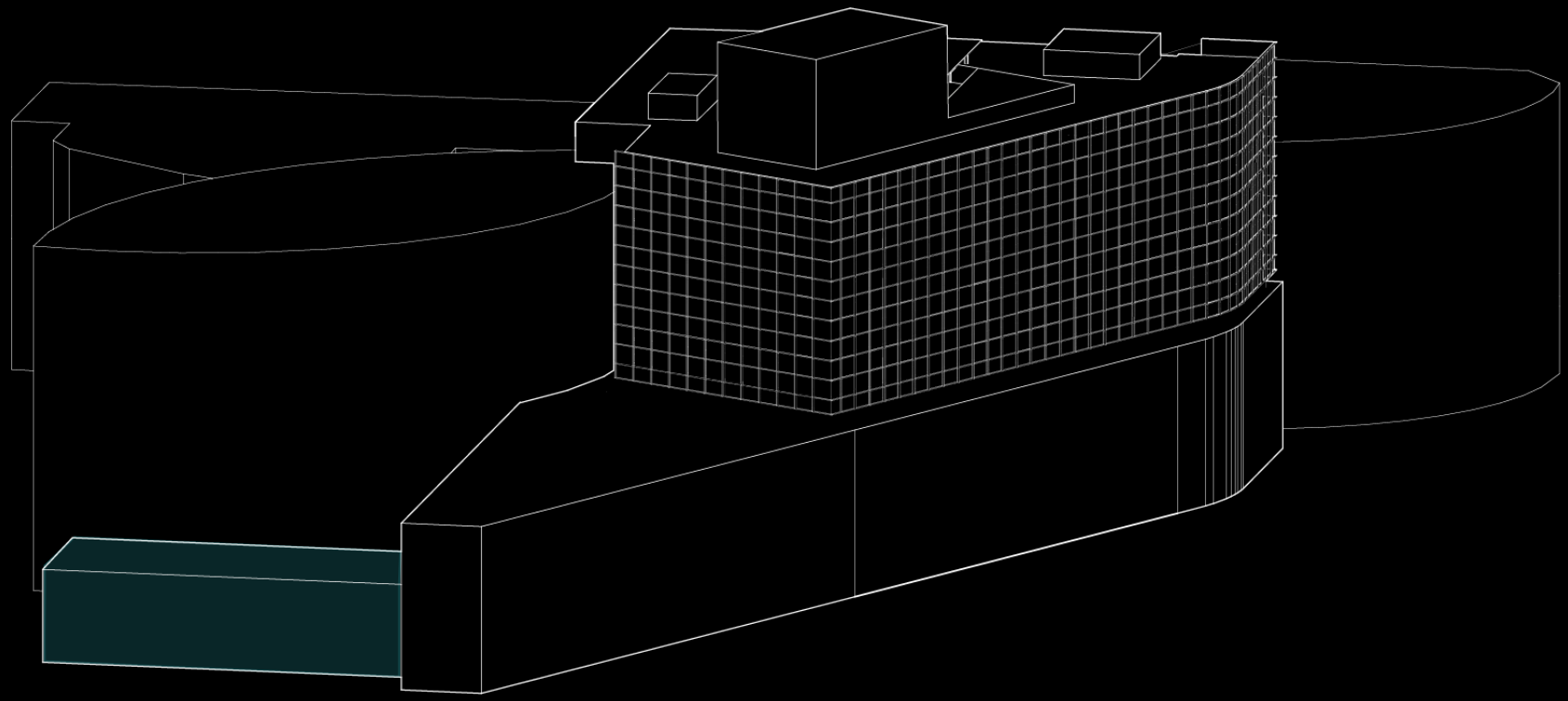
Central Plant



Integrative Design Points of Focus

Central Plant

Disaster Preparedness

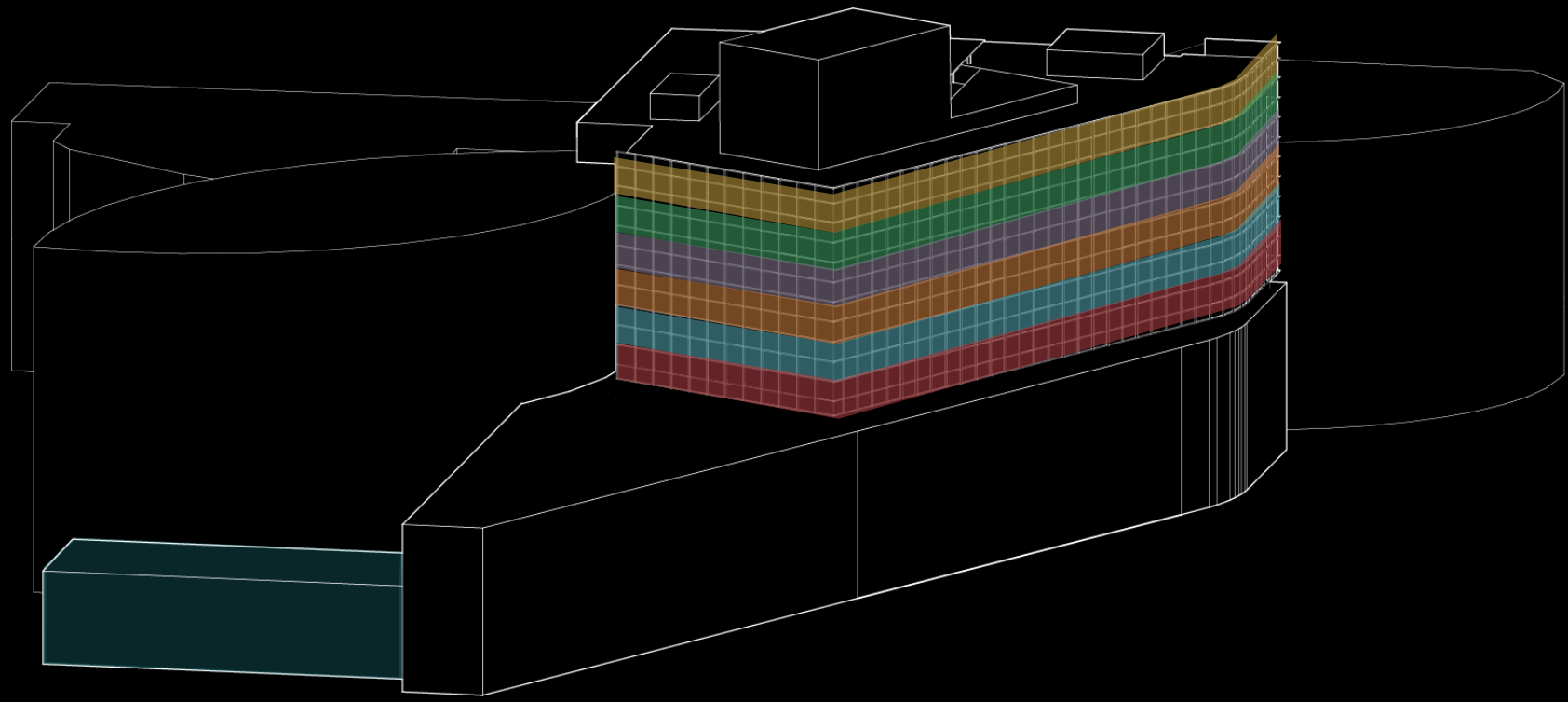


Integrative Design Points of Focus

Central Plant

Disaster Preparedness

Floor Reorganization

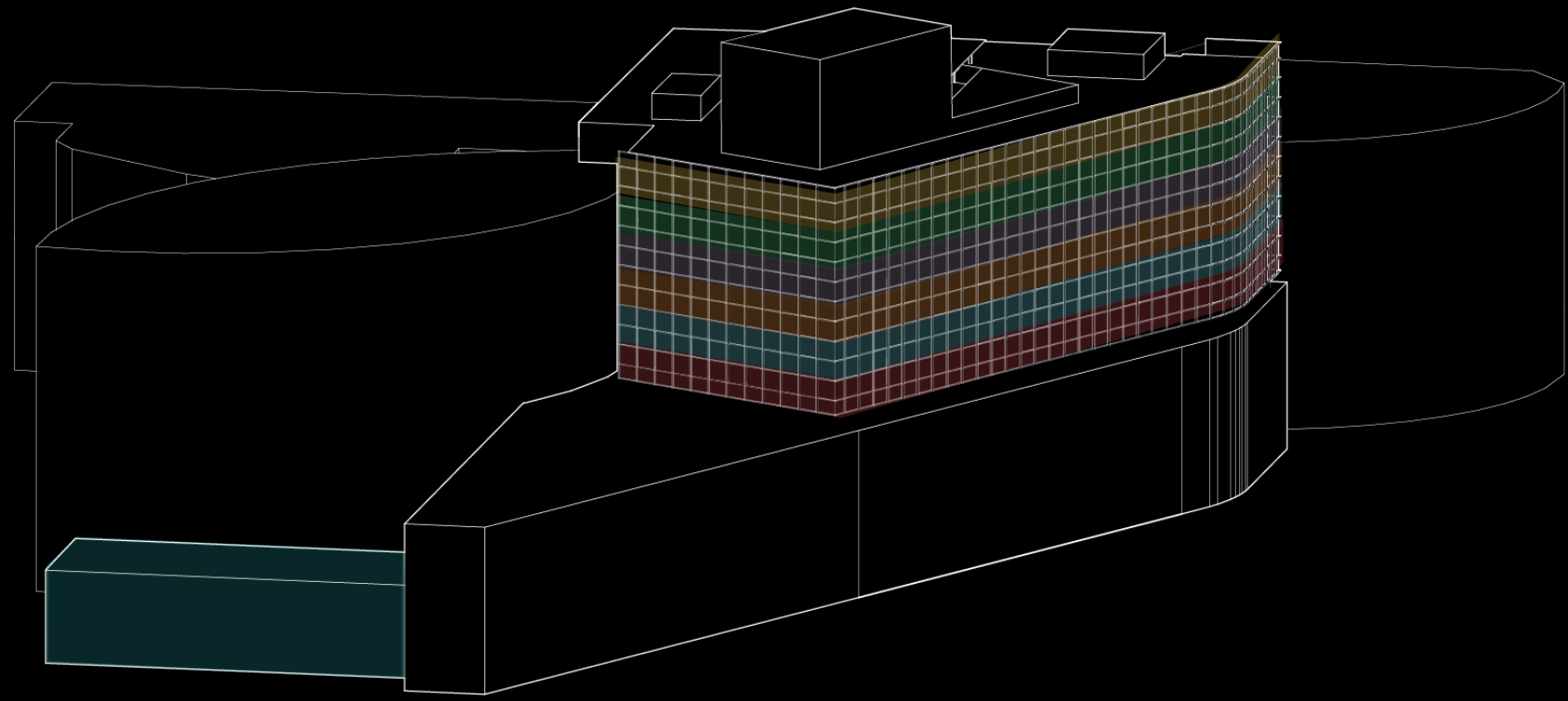


Integrative Design Points of Focus

Central Plant

Disaster Preparedness

Floor Reorganization



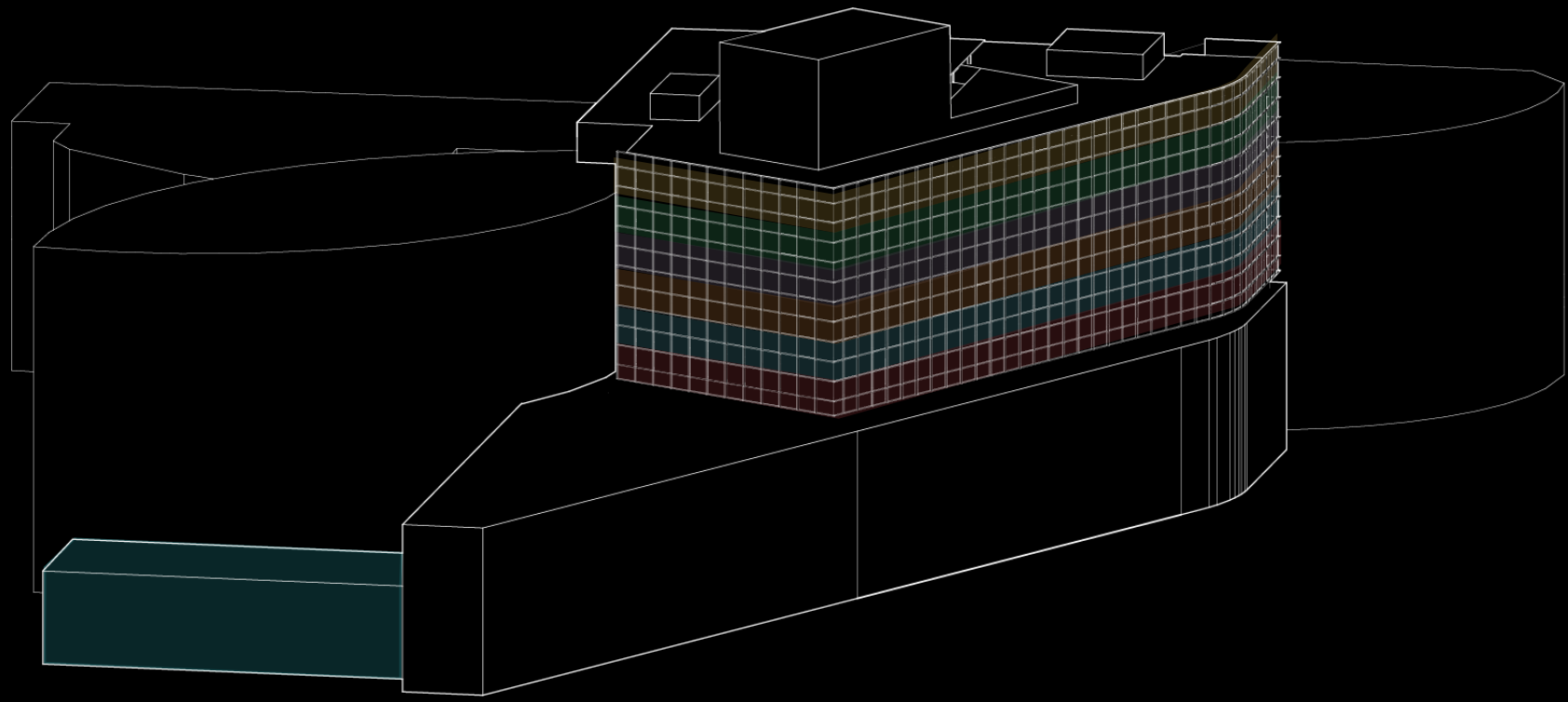
Patient Room

Integrative Design Points of Focus

Central Plant

Disaster Preparedness

Floor Reorganization



Patient Room

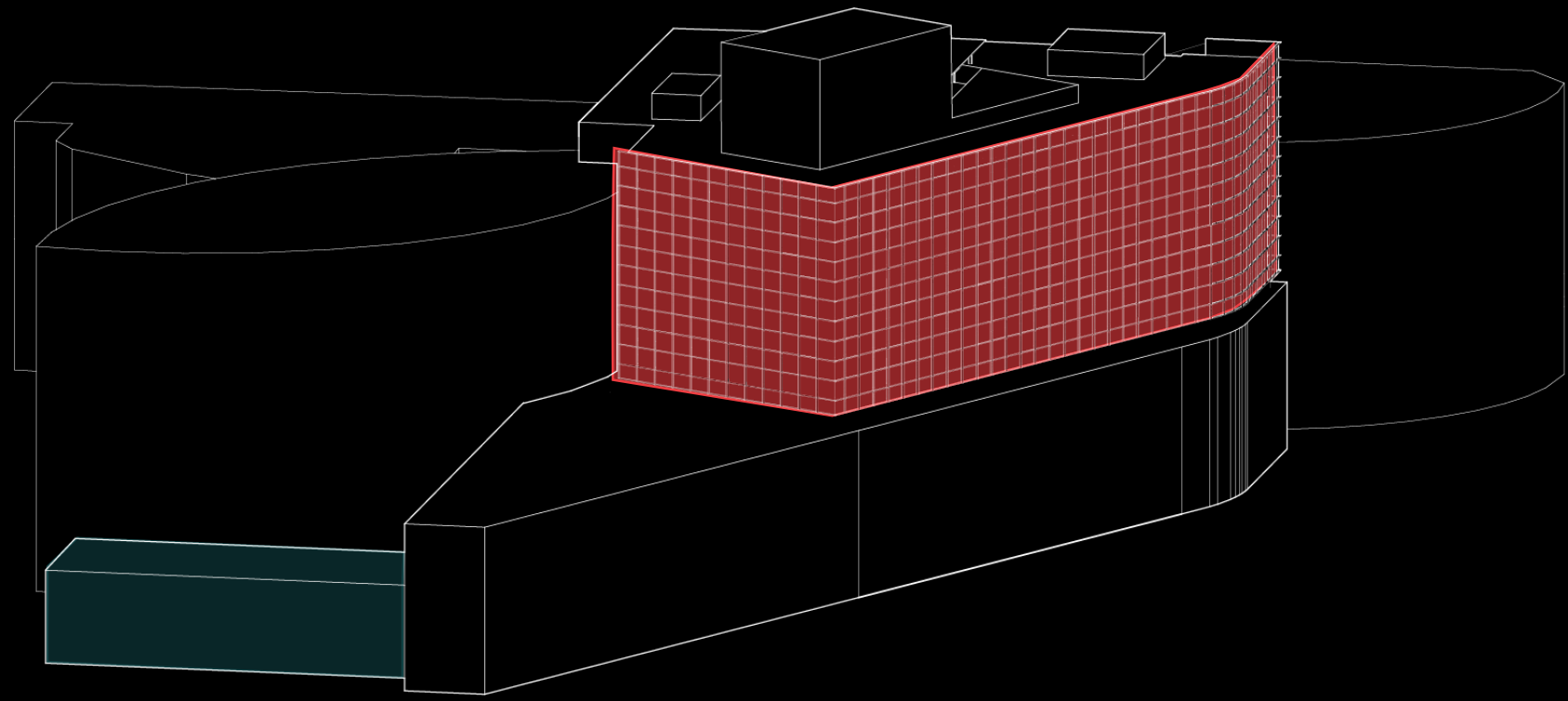
Hallway & Team Center

Integrative Design Points of Focus

Central Plant

Disaster Preparedness

Floor Reorganization

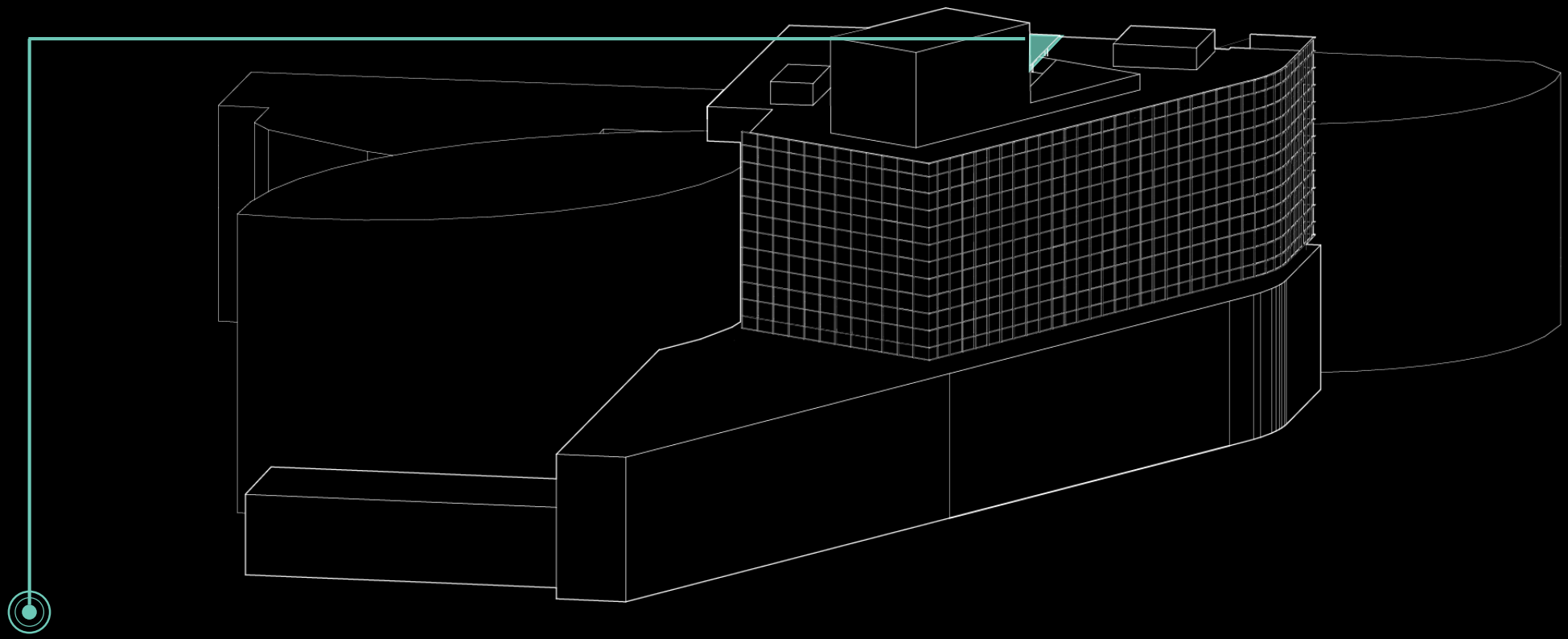


Patient Room

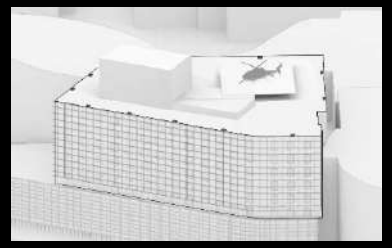
Hallway & Team Center

High-Performance Enclosure

Structural Design Points of Focus



Helipad Design



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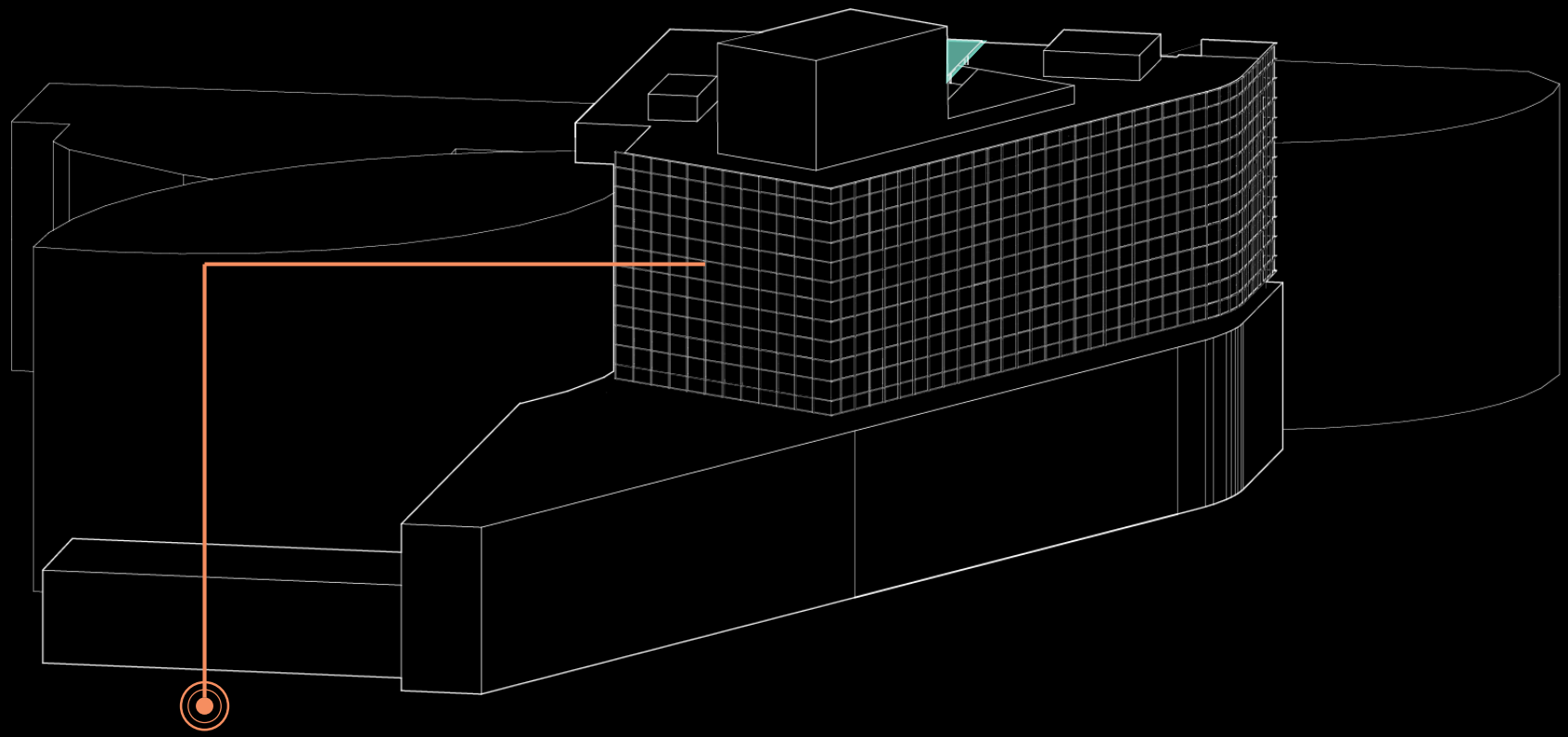
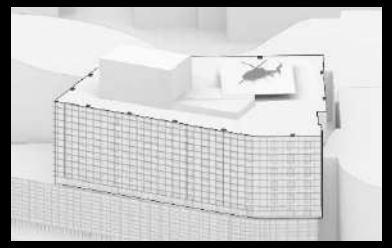
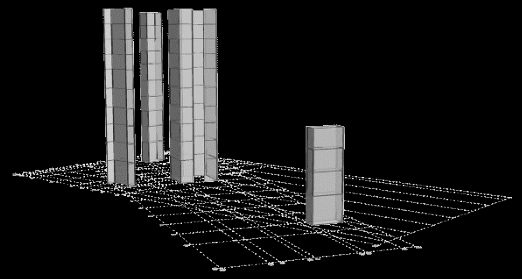


Helipad Design

Concrete CIP Shear Walls





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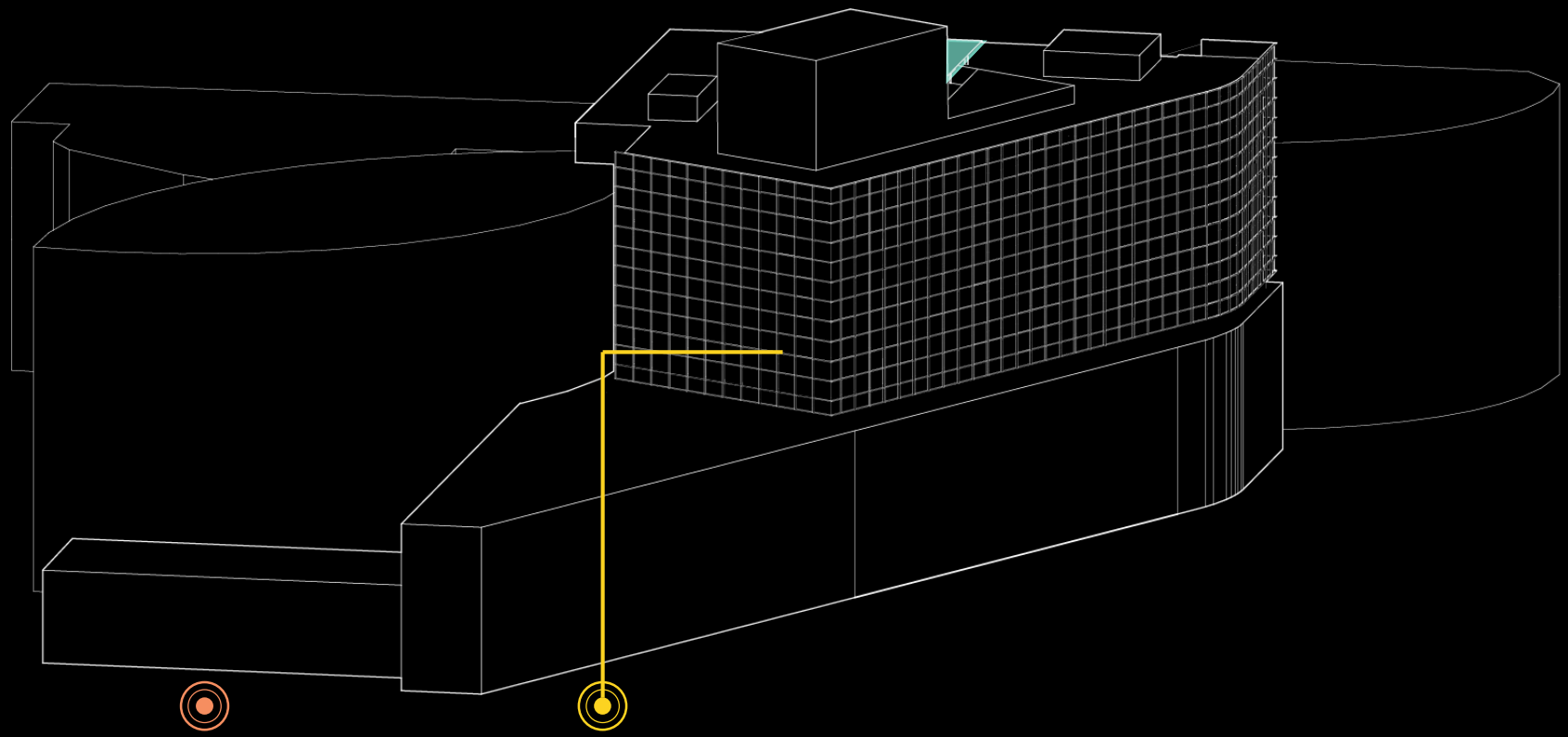

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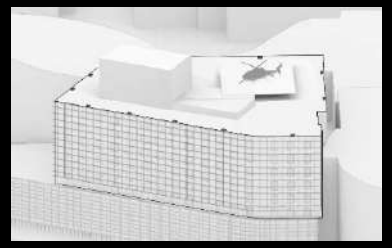

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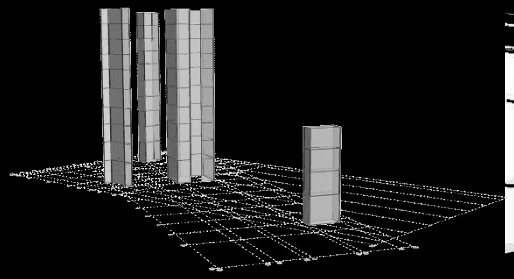
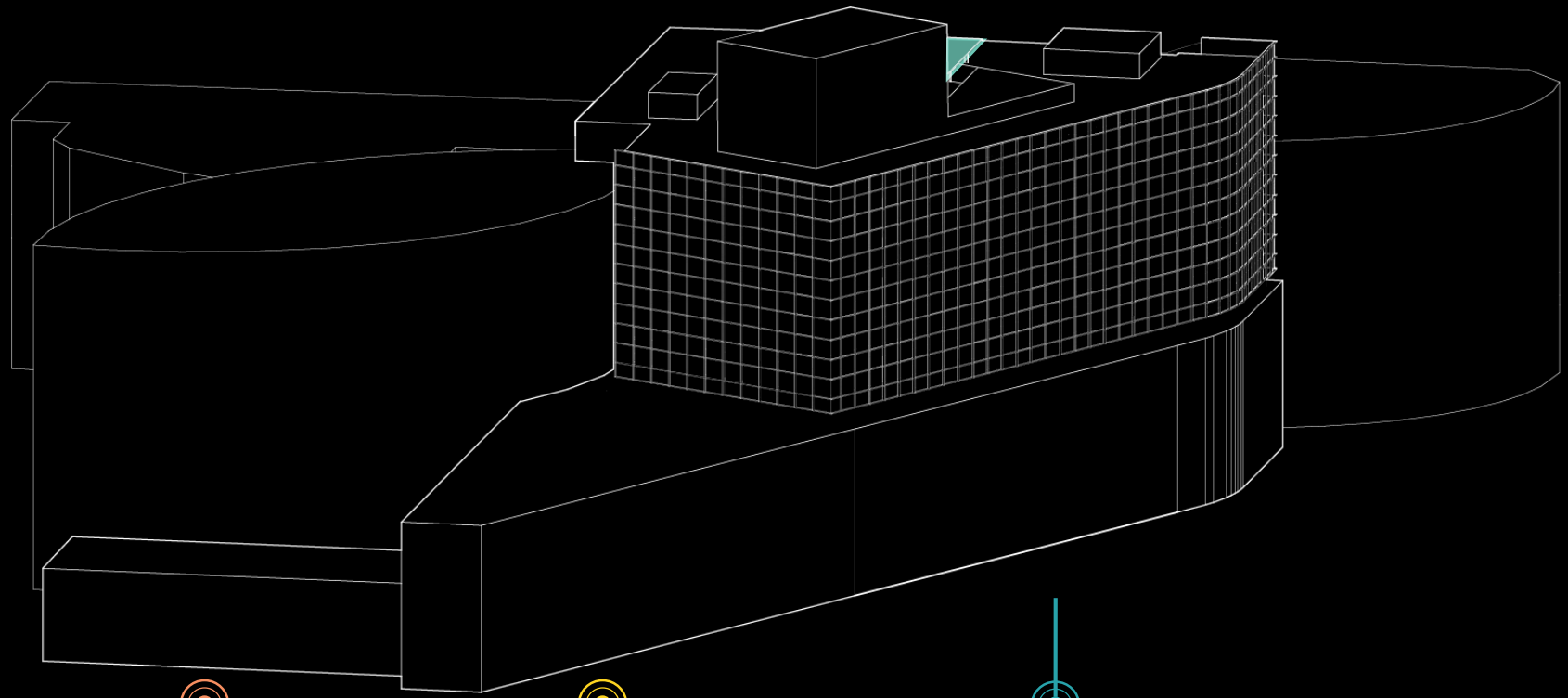


Patient Room Optimization

Structural Design Points of Focus



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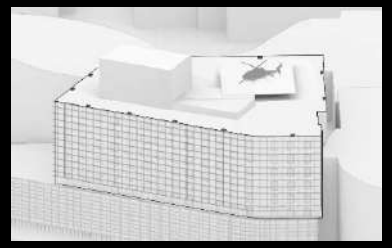

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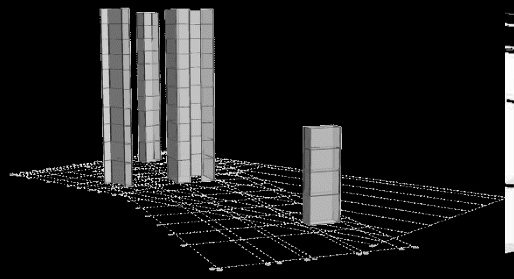
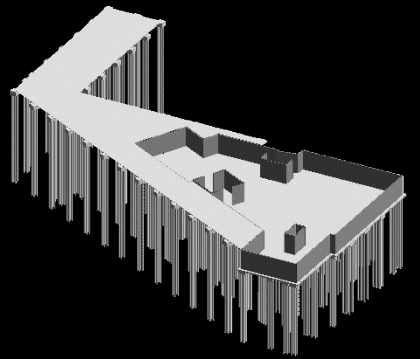
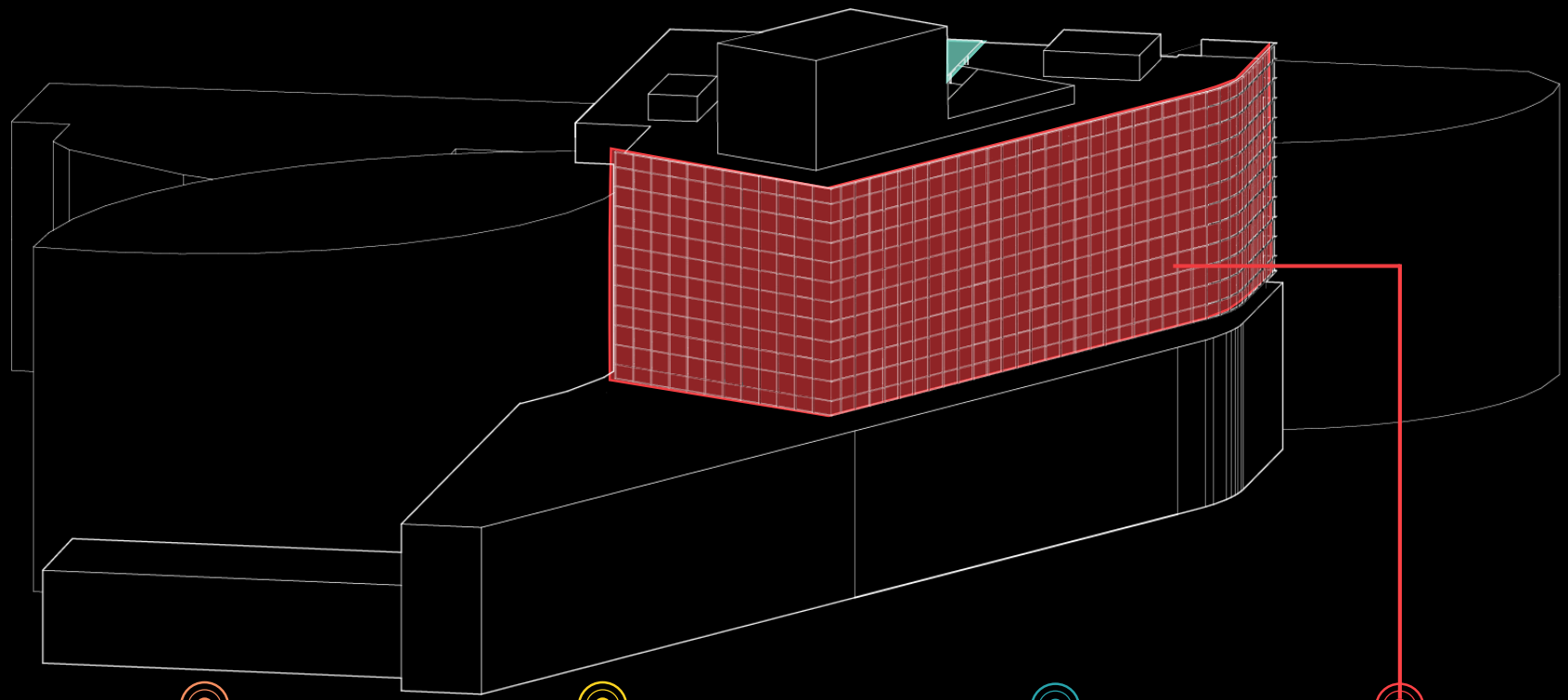


Patient Room Optimization

Auger CIP Pile Foundation



Structural Design Points of Focus



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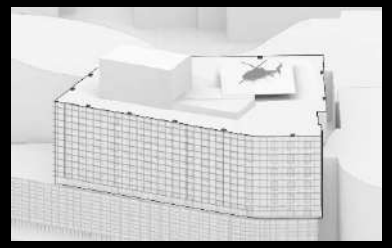

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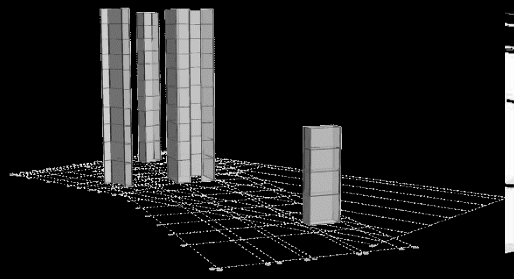

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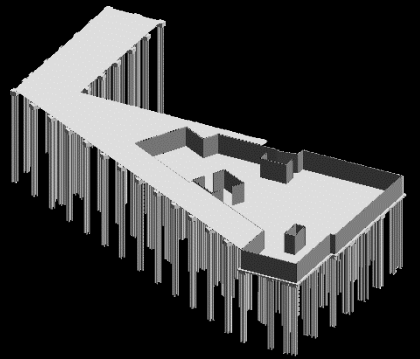
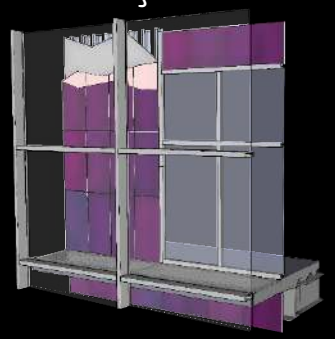
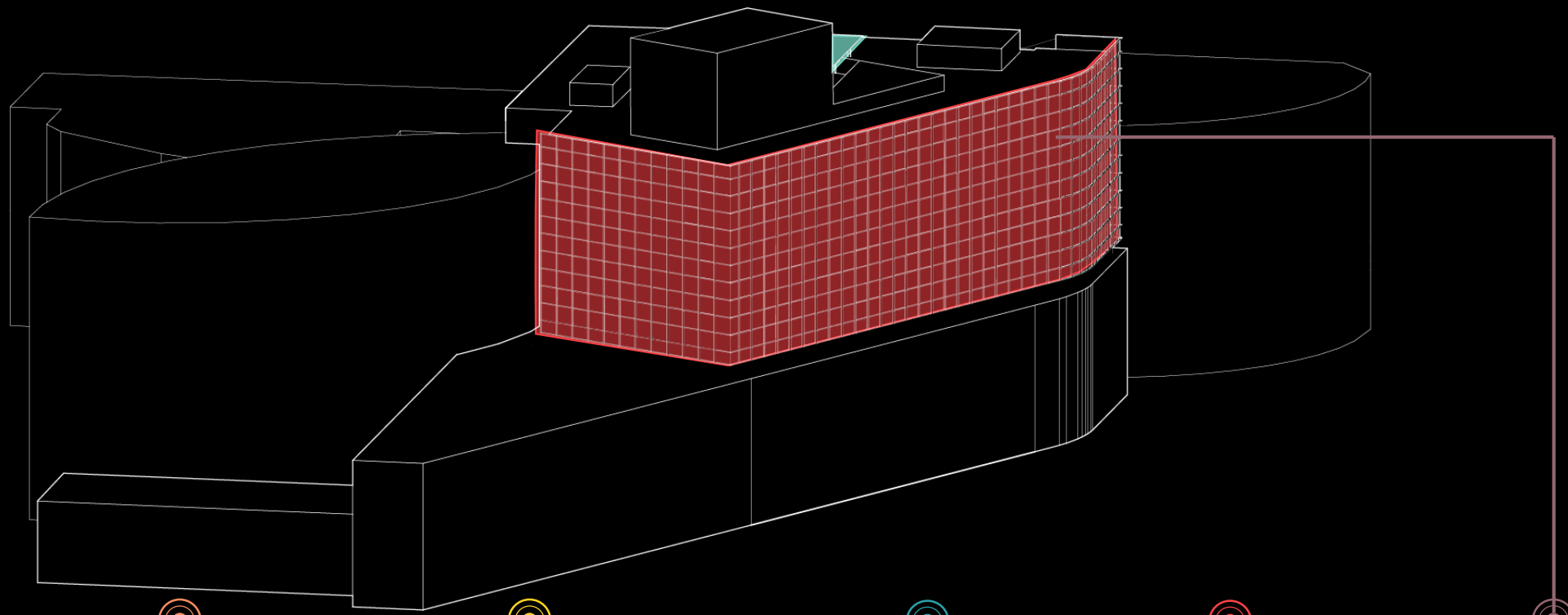


Impact Resistant Façade



Structural Design Points of Focus



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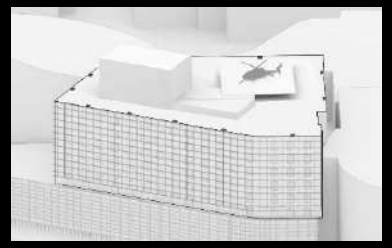

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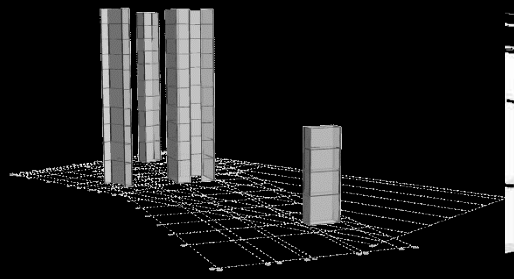

Patient Room Optimization

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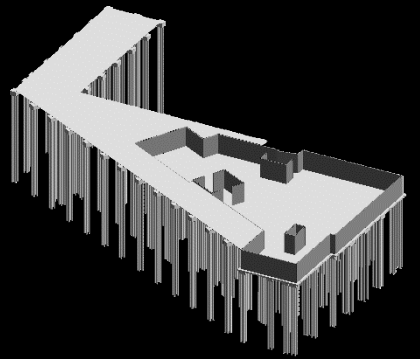

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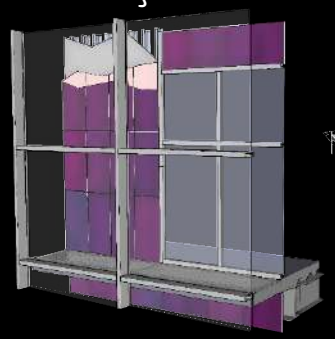
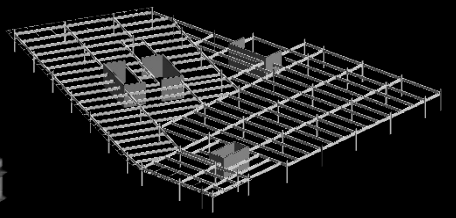
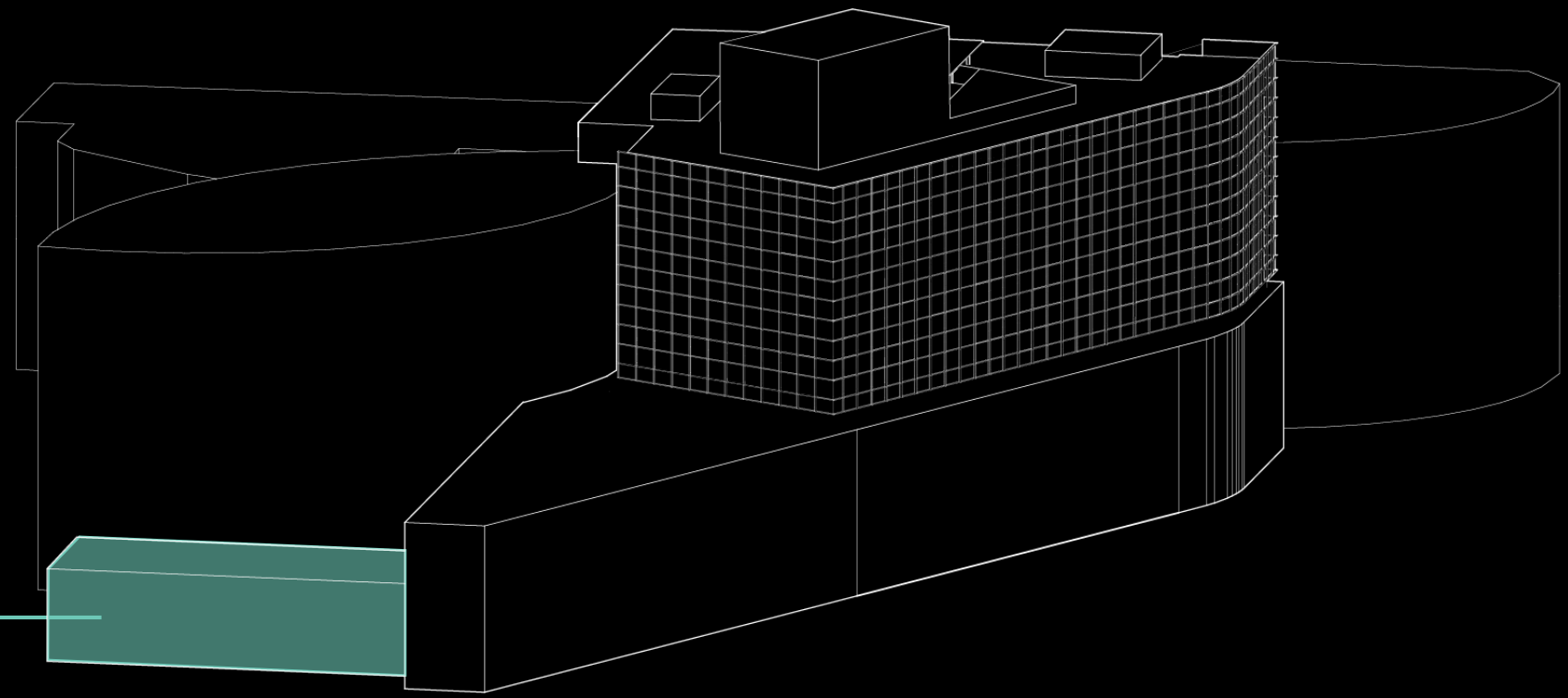


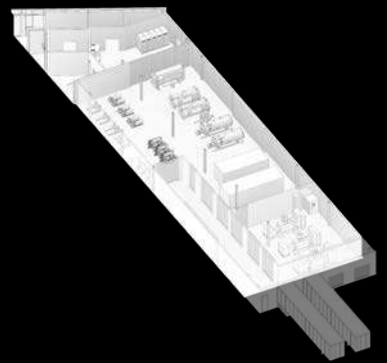
Composite Framing



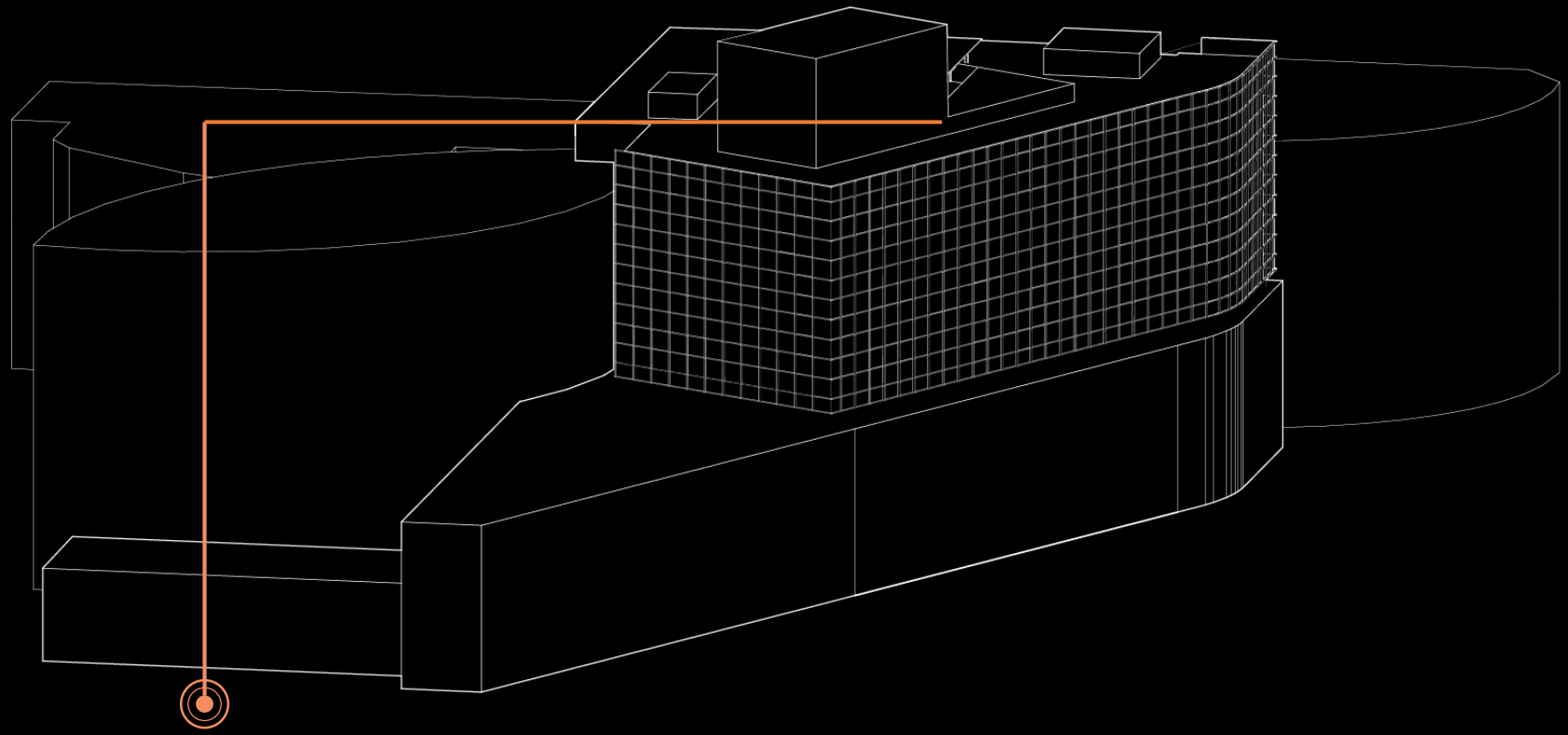
Mechanical Design Points of Focus



Combined Heat and Power



Mechanical Design Points of Focus



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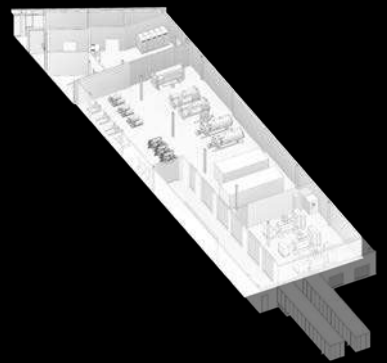
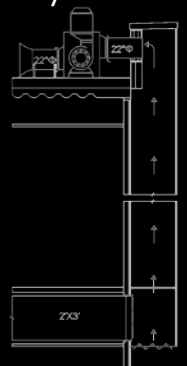
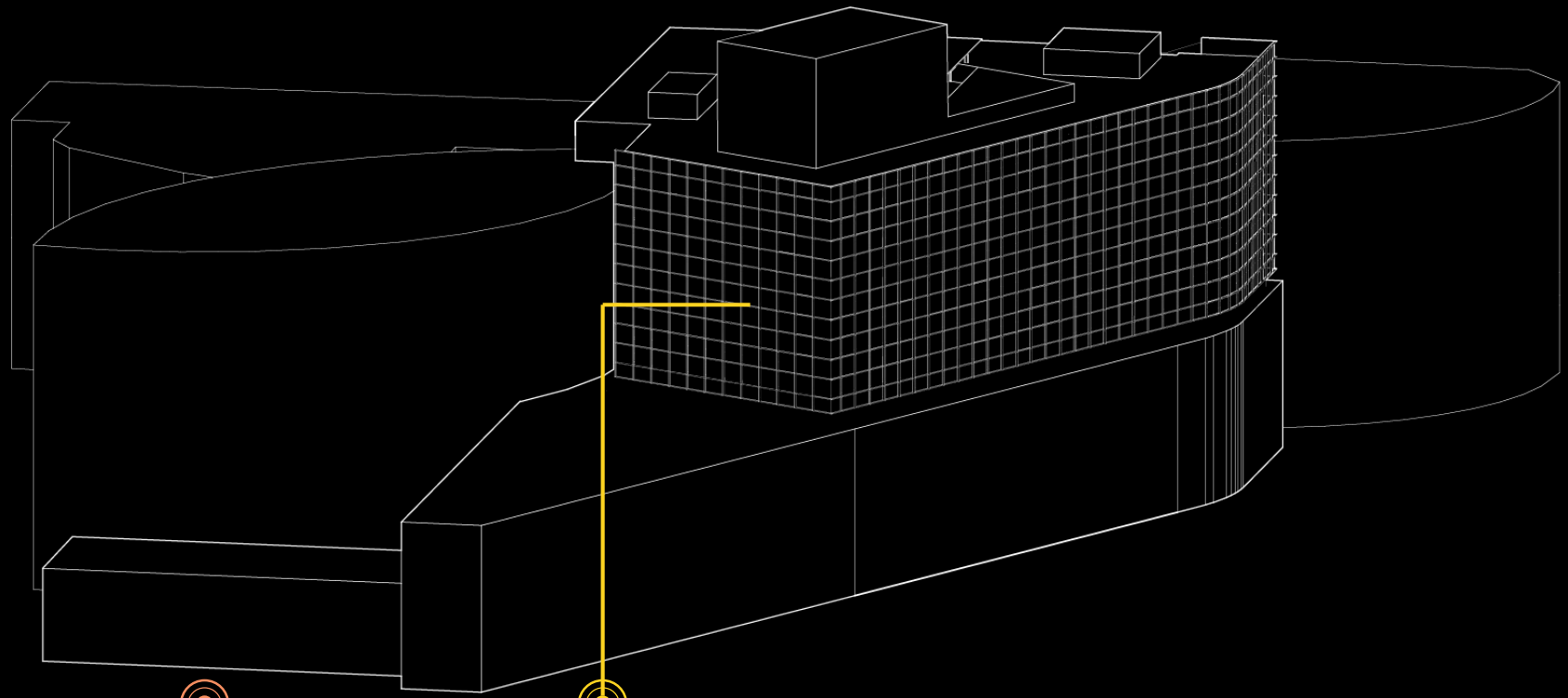


Fume Exhaust System



Mechanical Design Points of Focus



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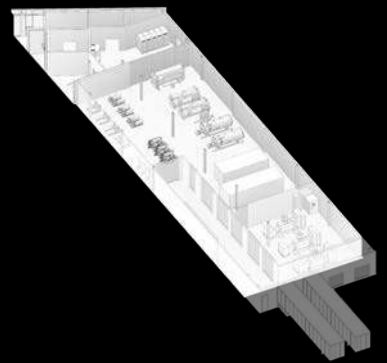

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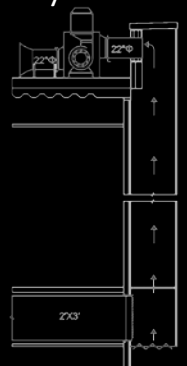
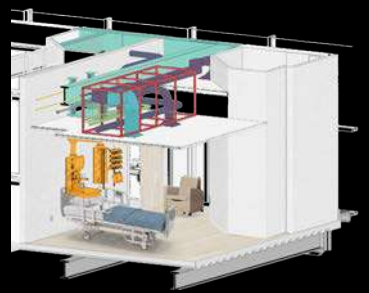
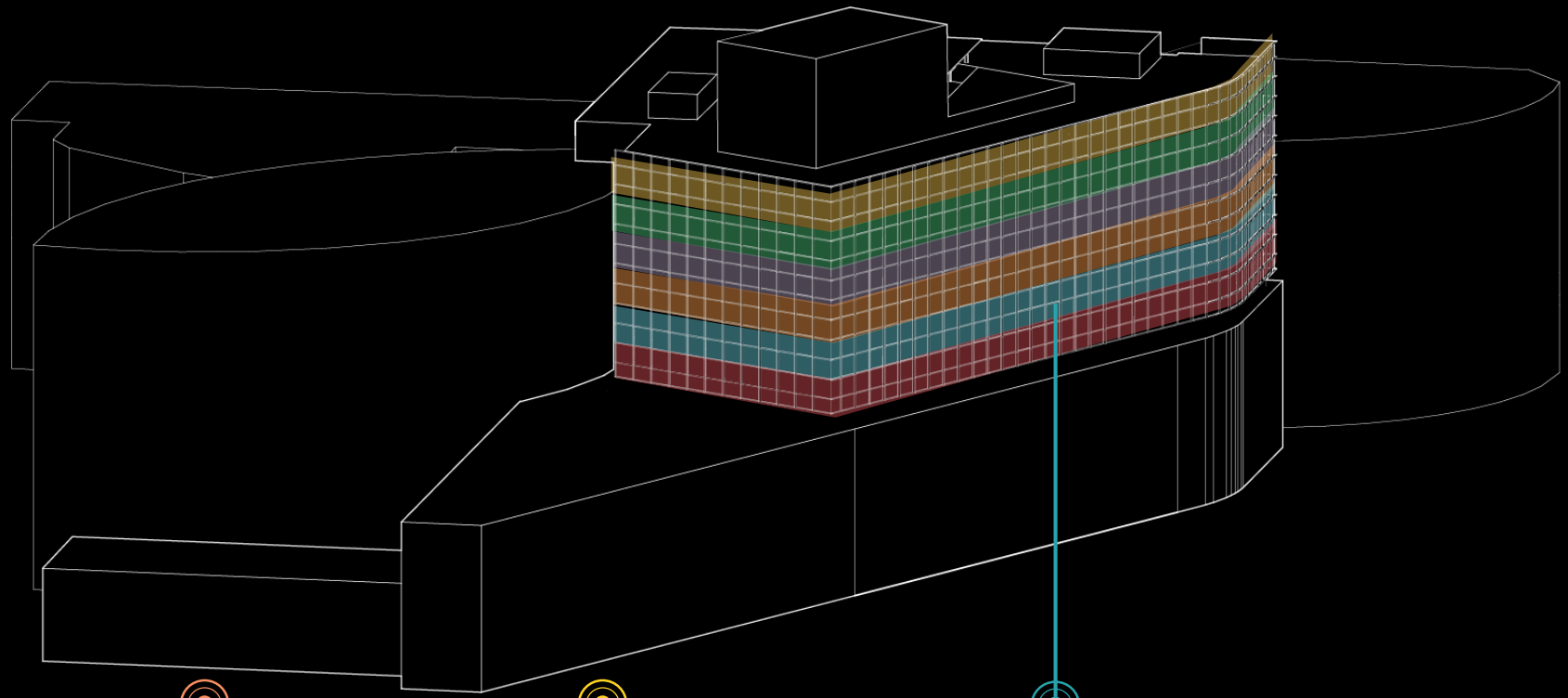


Patient Room Optimization



Mechanical Design Points of Focus



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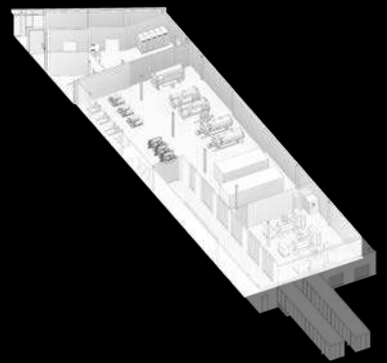

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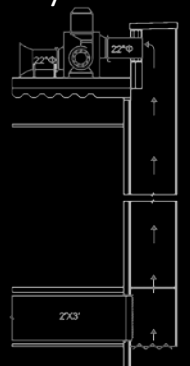

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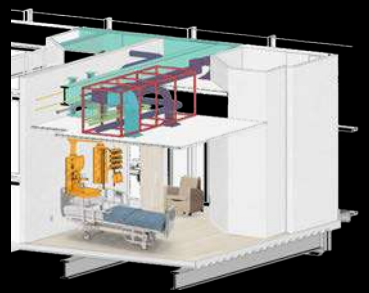
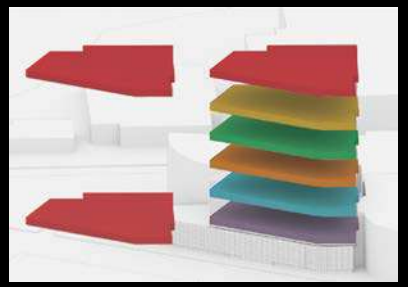
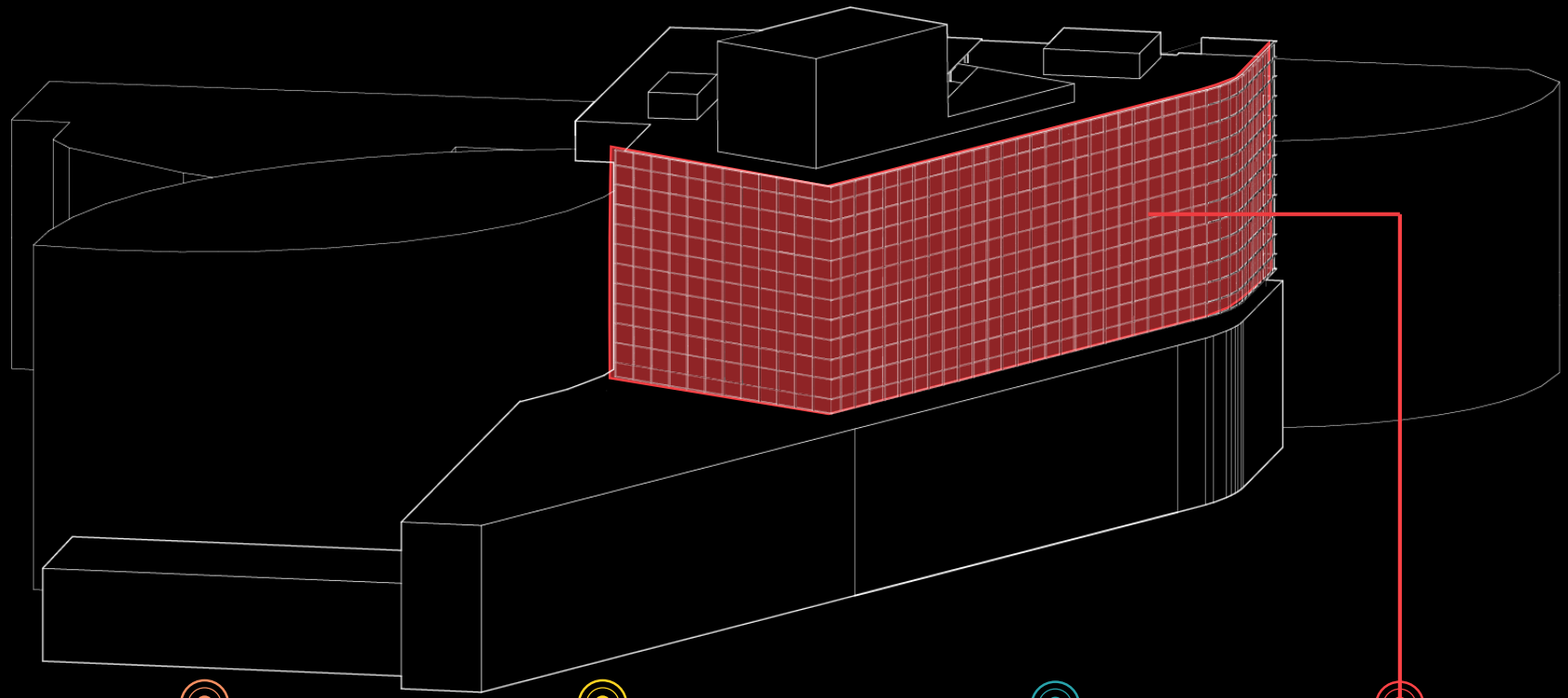


Mechanical Floor Move



Mechanical Design Points of Focus



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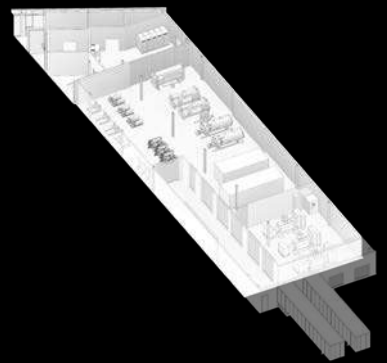

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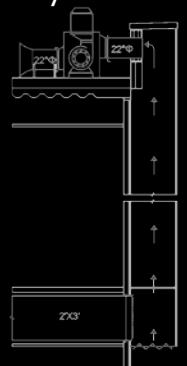

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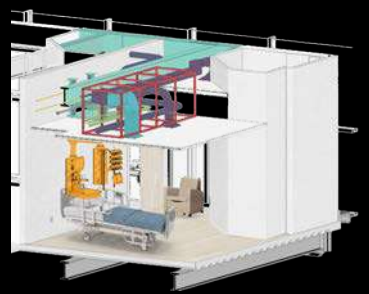

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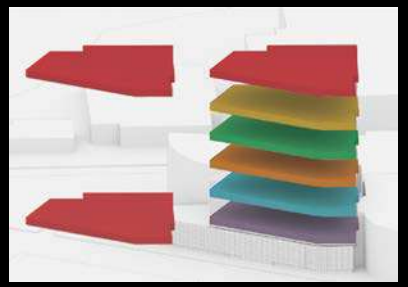
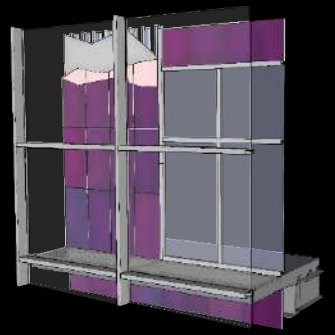
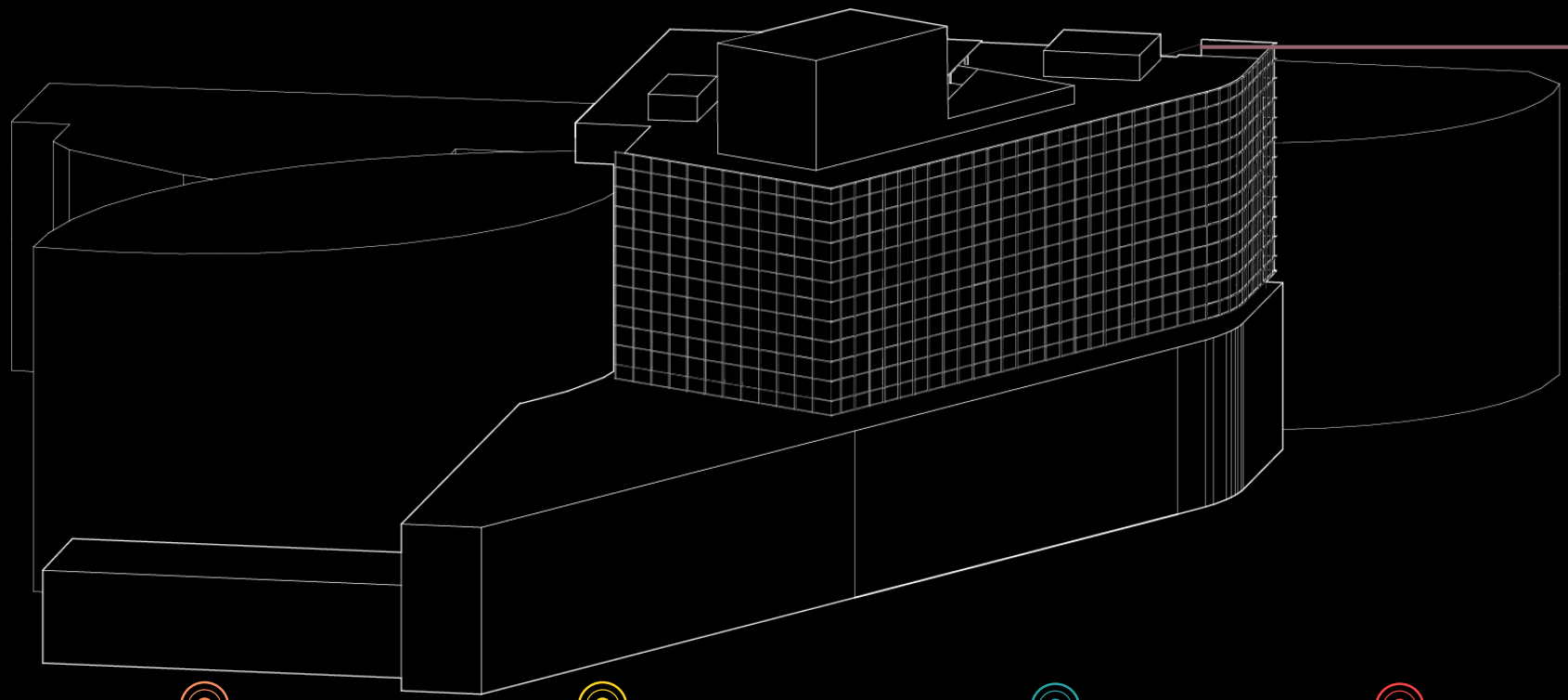


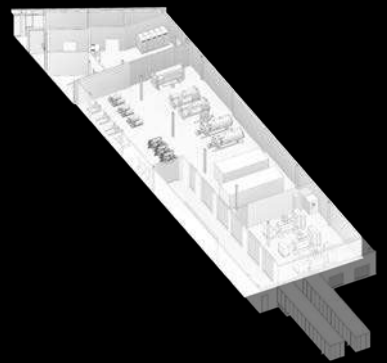
Active Double Skin Facade



Mechanical Design Points of Focus



Combined Heat and Power



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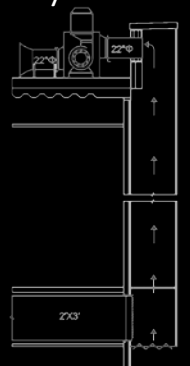

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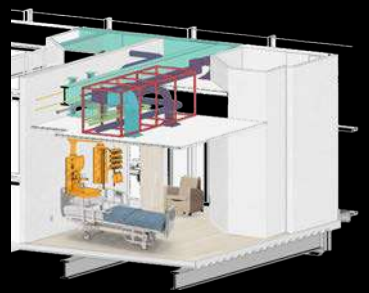
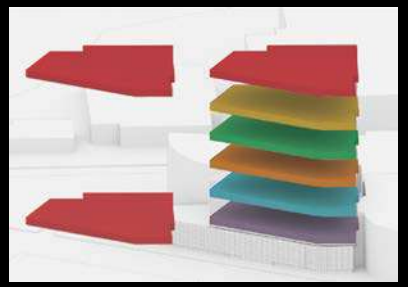


Mechanical Floor Move



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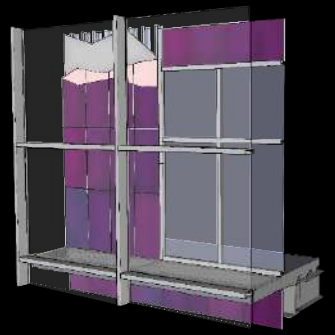
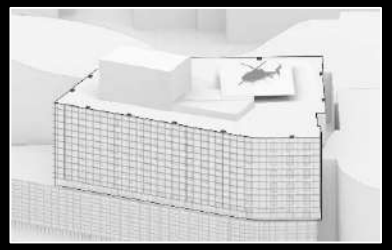
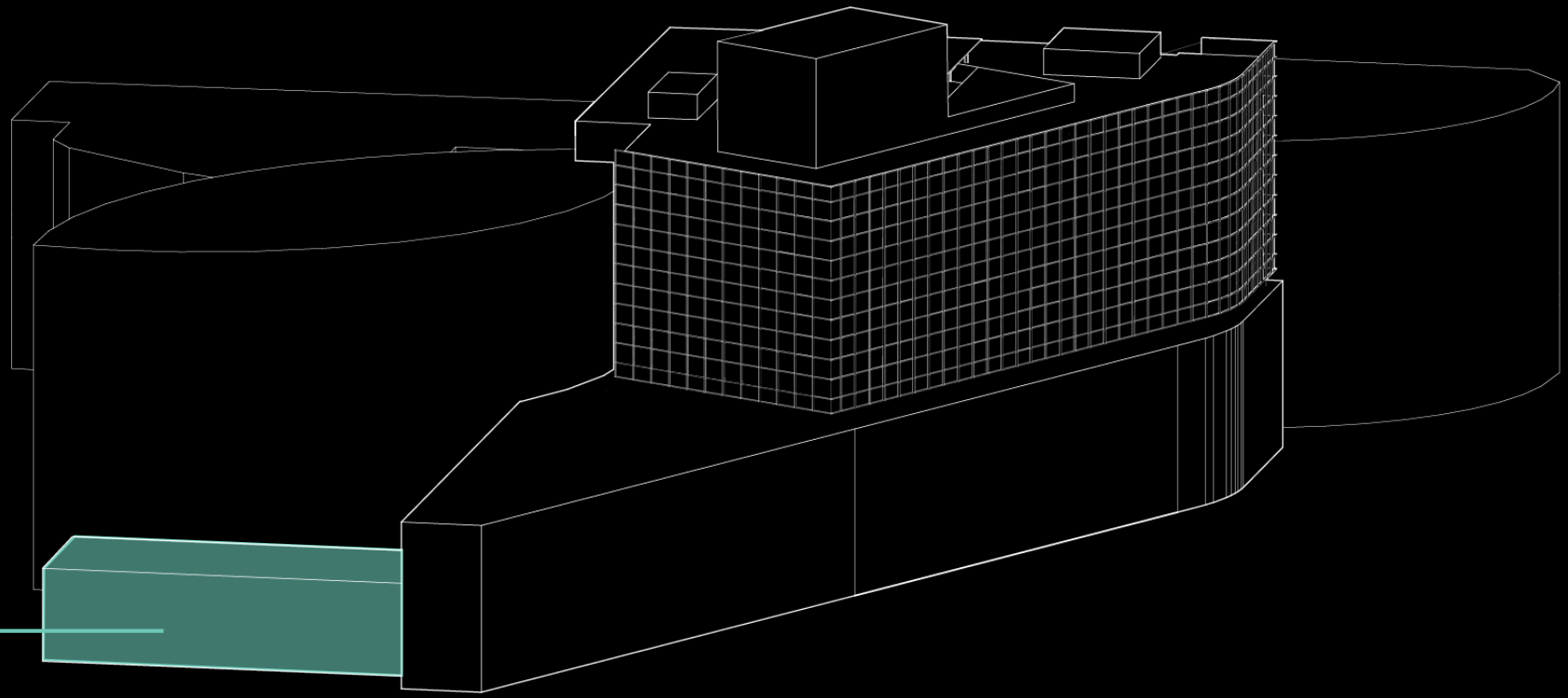


Rainwater Collection

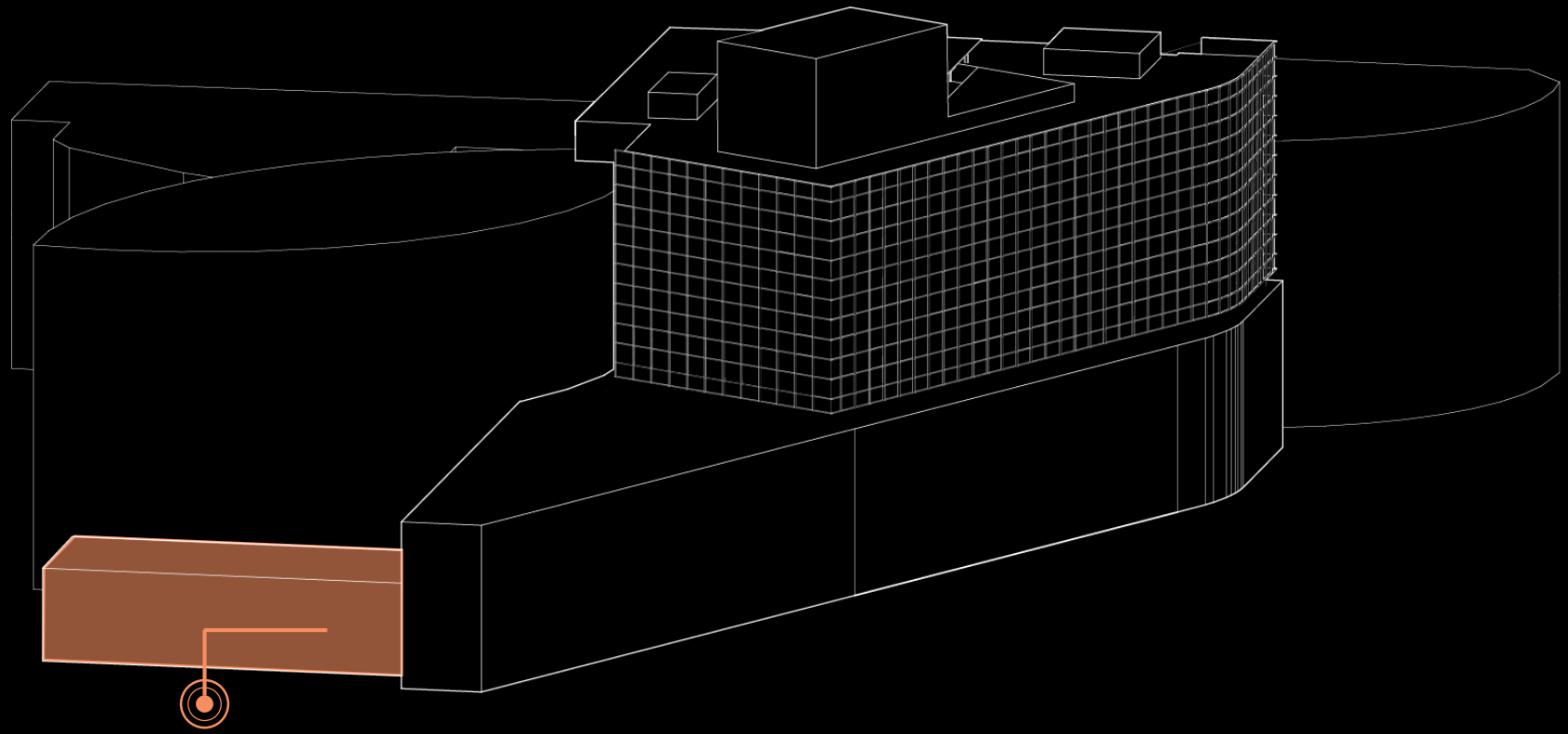


Lighting/Electrical Design Points of Focus



Redundant
Backup Power

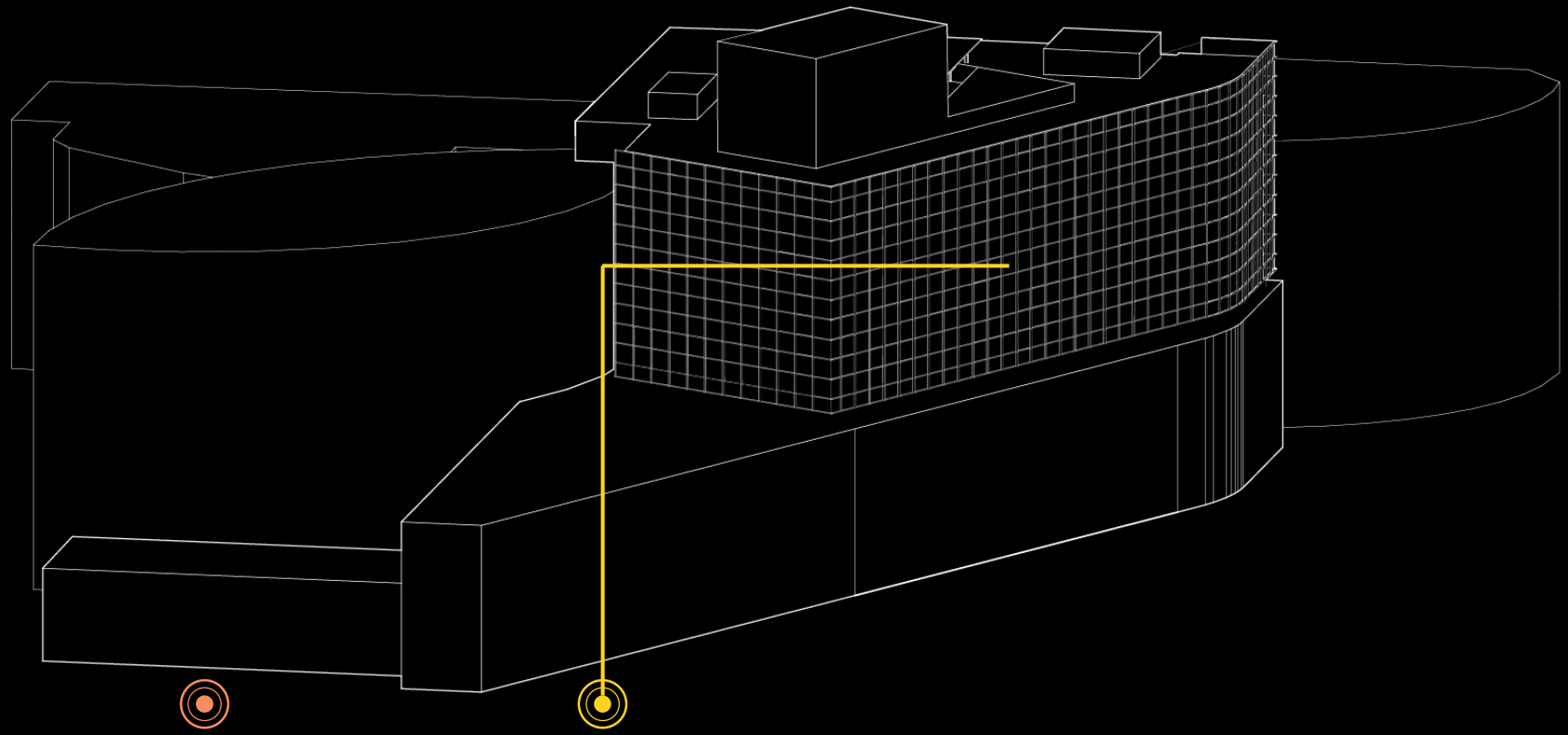
Lighting/Electrical Design Points of Focus



Redundant Backup Power

On-Site Generation

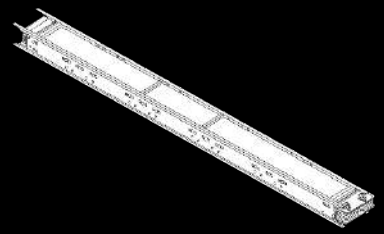
Lighting/Electrical Design Points of Focus



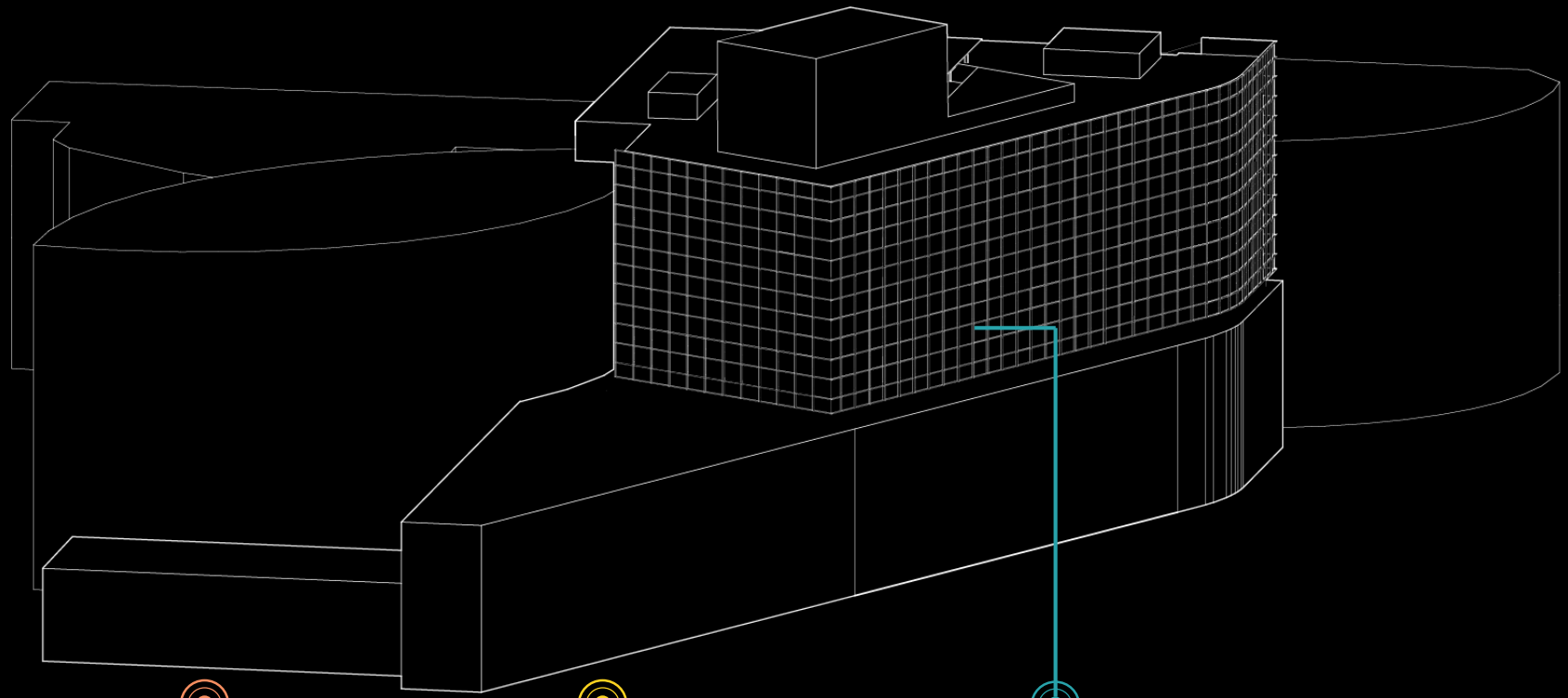
Redundant Backup Power

On-Site Generation

Power Delivery System



Lighting/Electrical Design Points of Focus

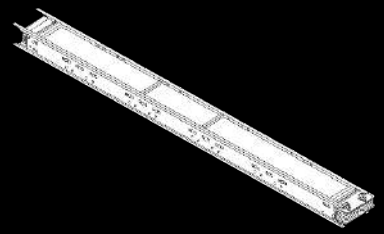


Redundant Backup Power

On-Site Generation

Power Delivery System

Lighting Design



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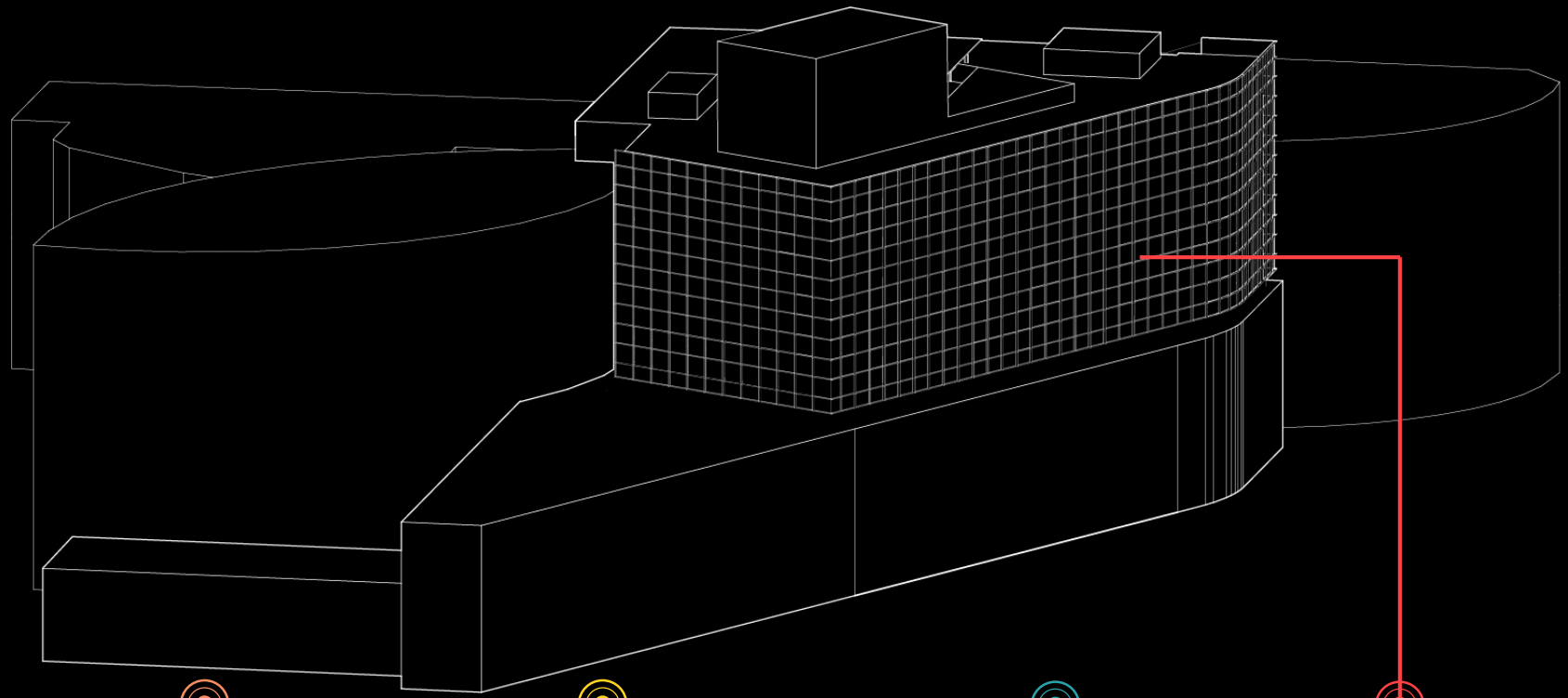


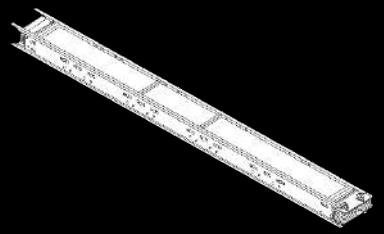
Redundant Backup Power

On-Site Generation

Power Delivery System

Lighting Design

Controls



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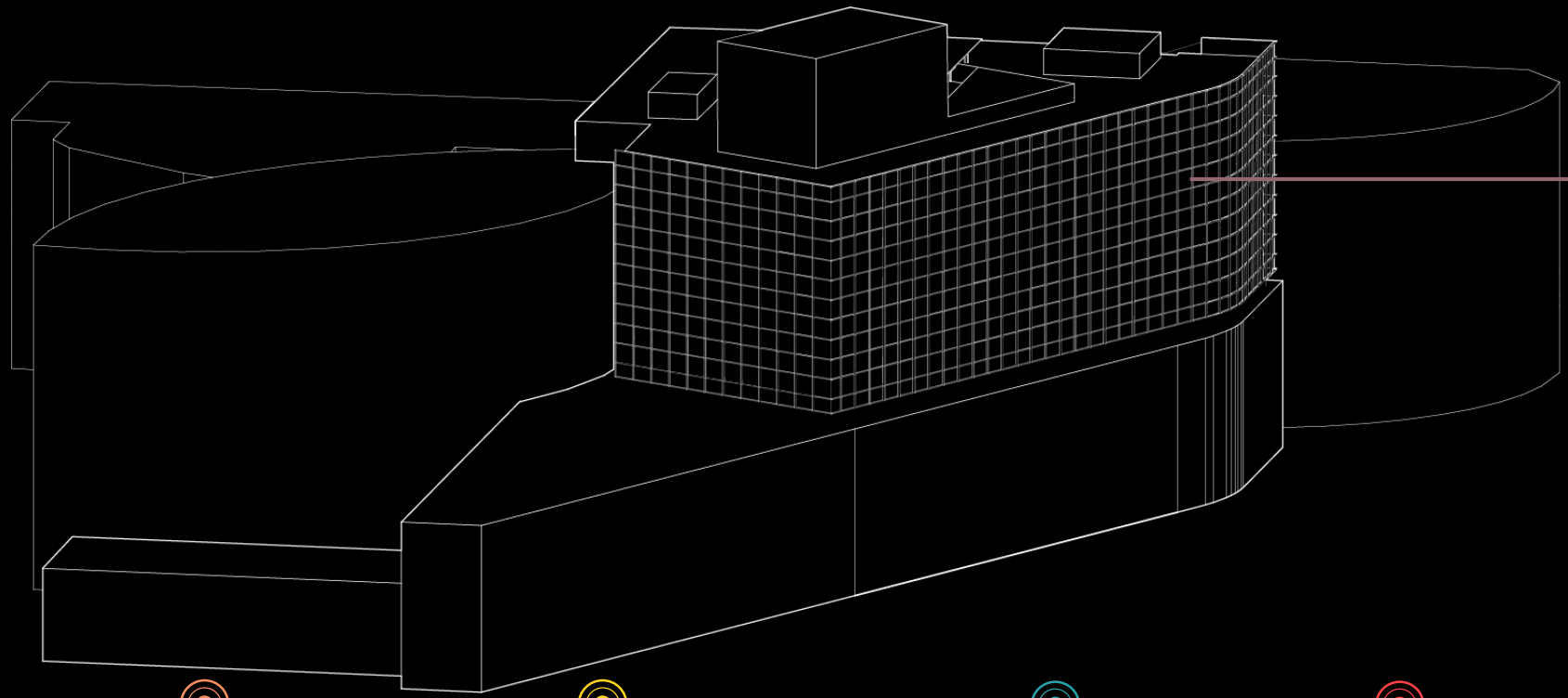


Redundant Backup Power

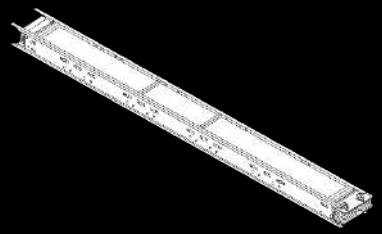
On-Site Generation

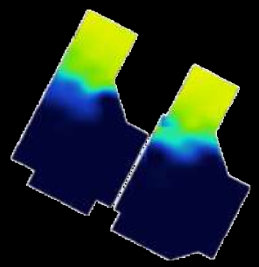
Power Delivery System

Lighting Design

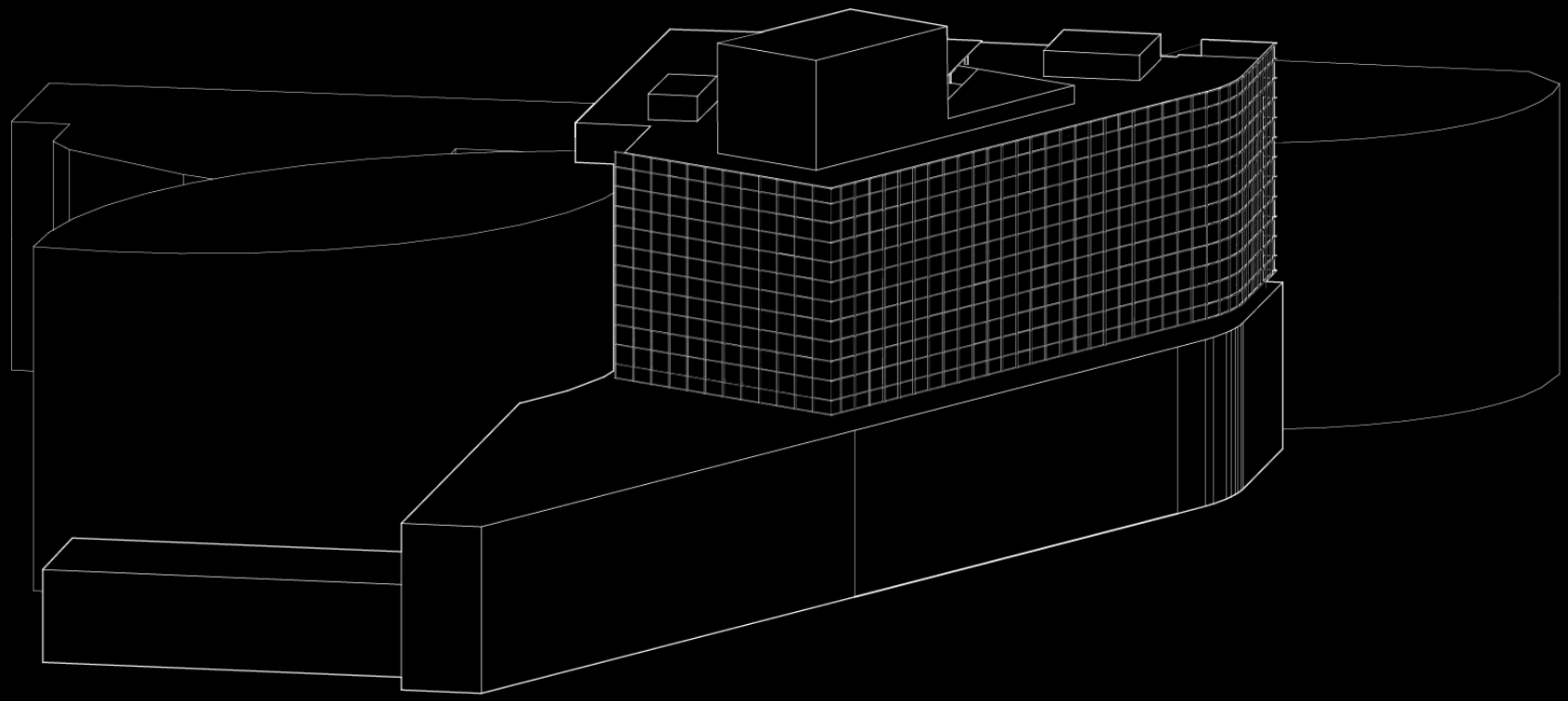
Controls

Daylighting

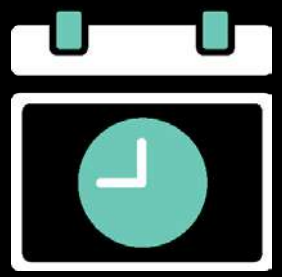




Construction Design Points of Focus



Schedule



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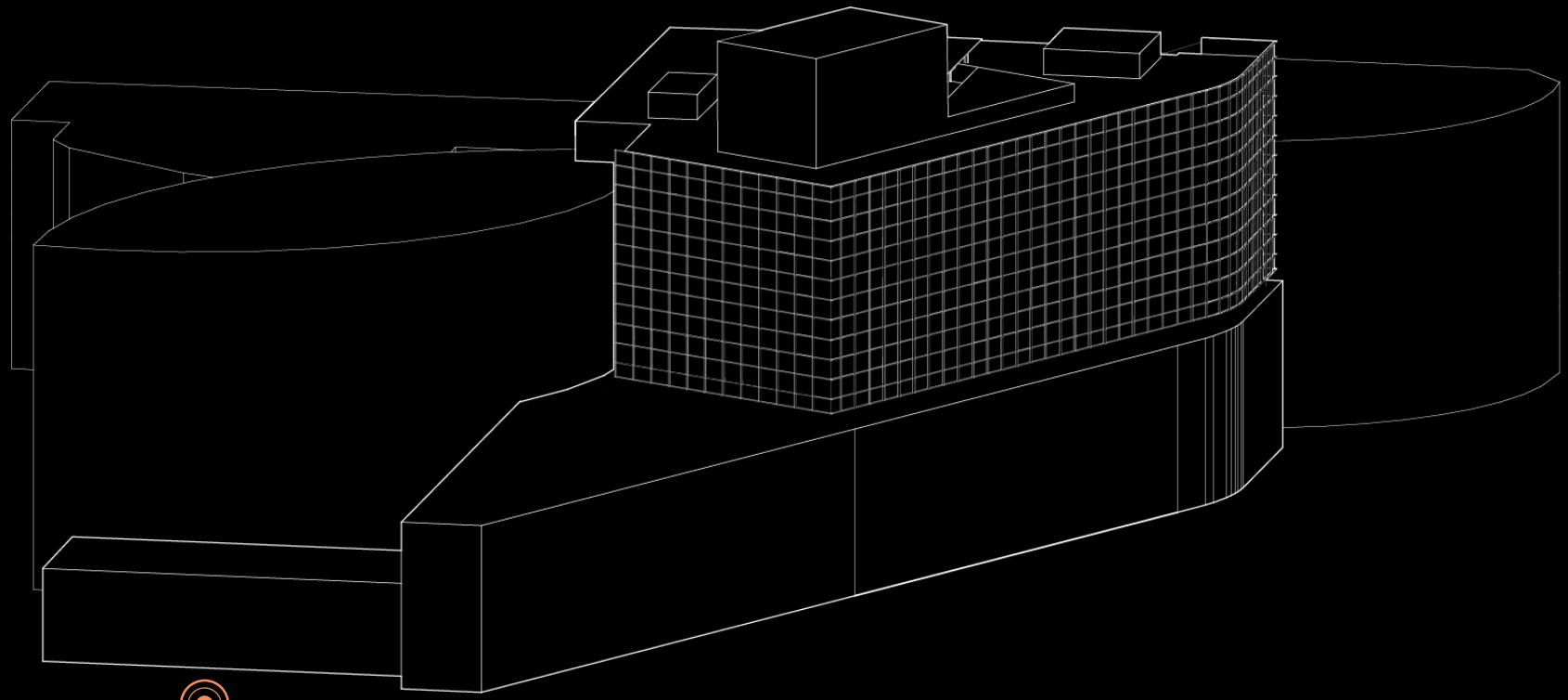
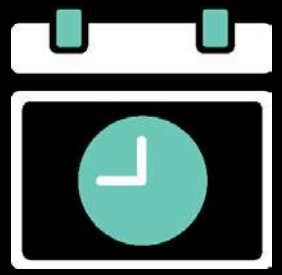


Schedule

Cost



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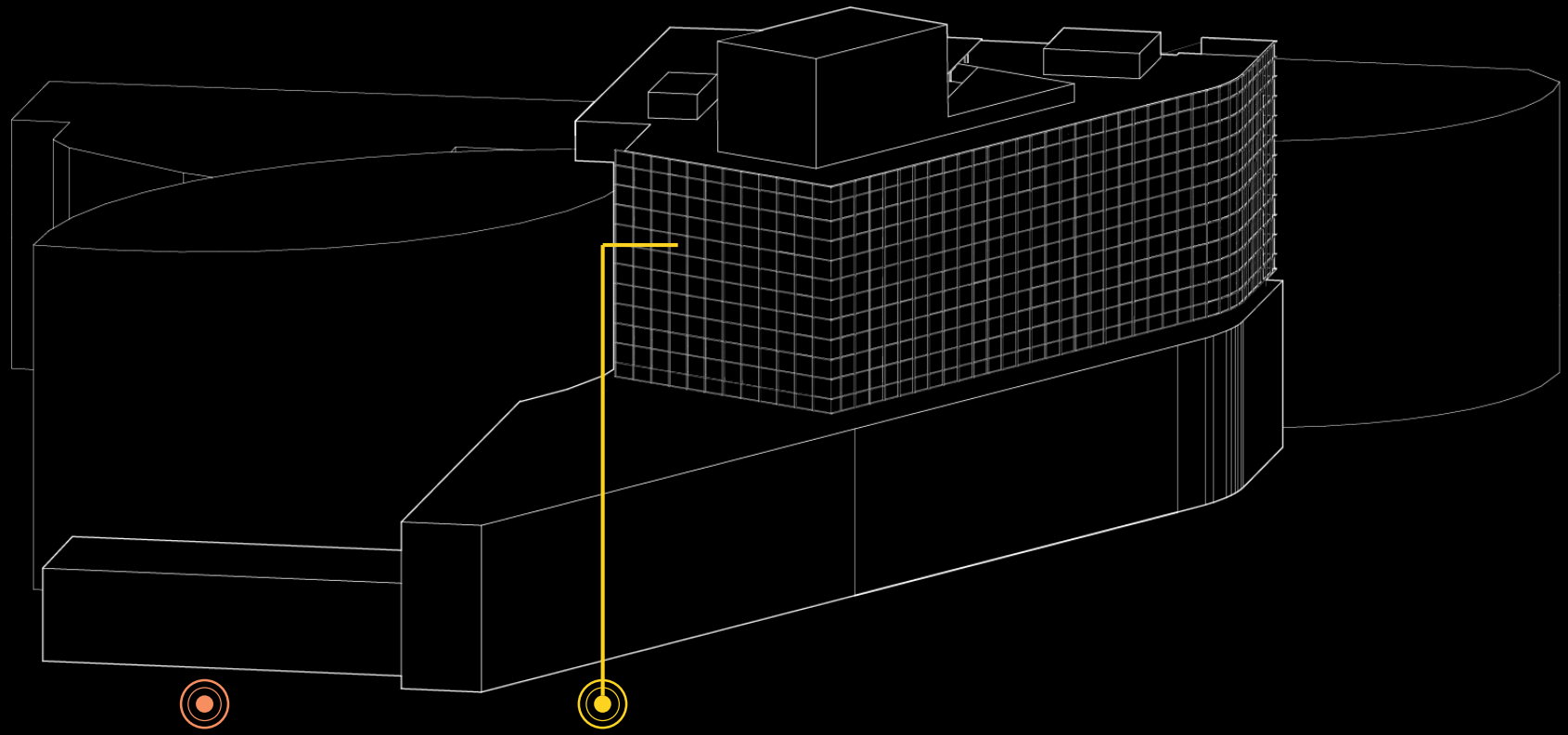
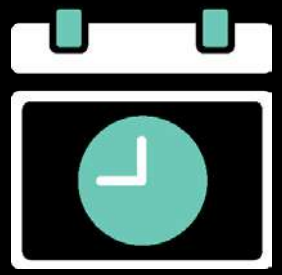
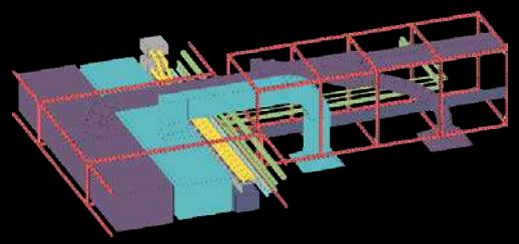


Schedule

Cost

Overhead Racks





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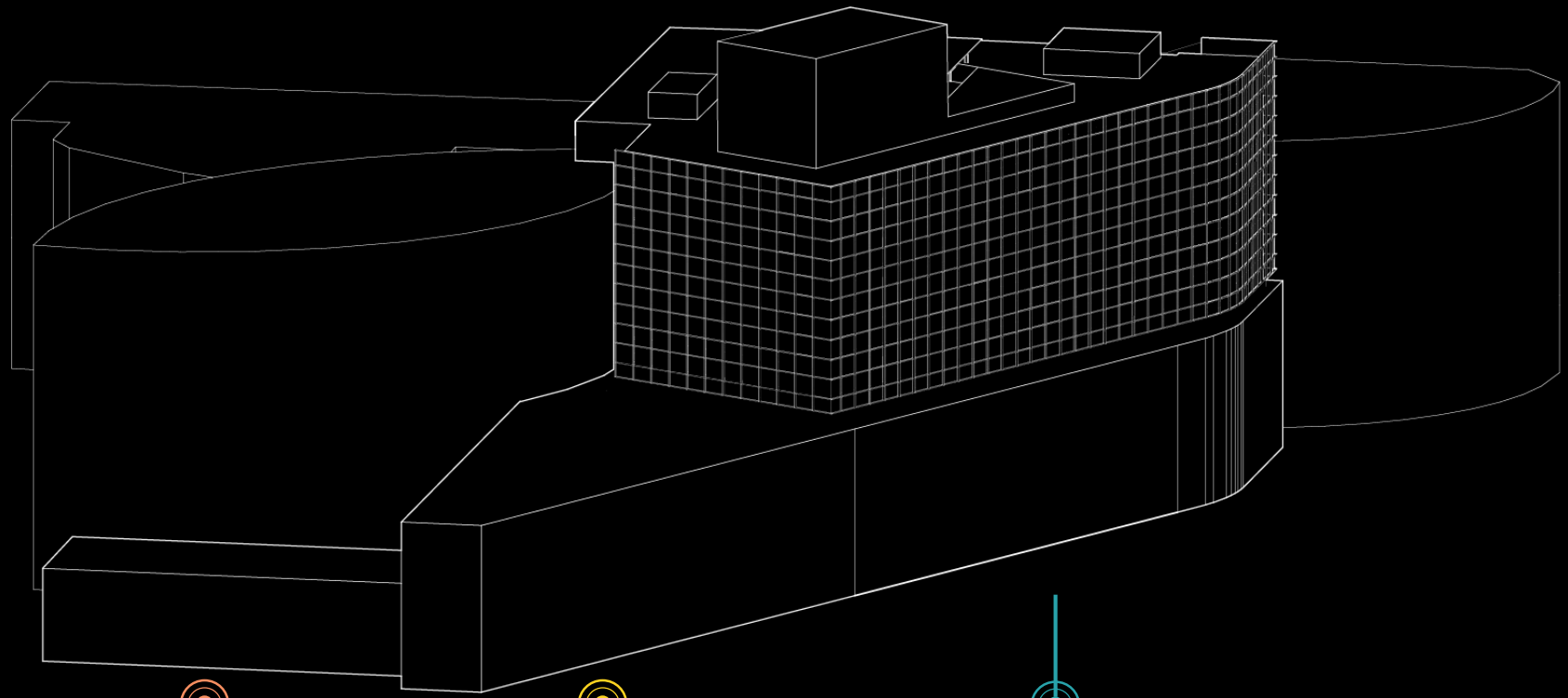

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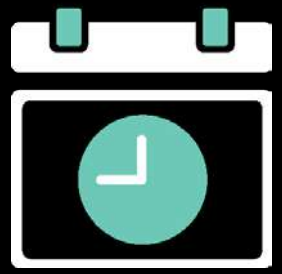

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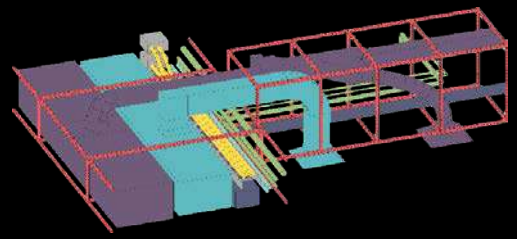
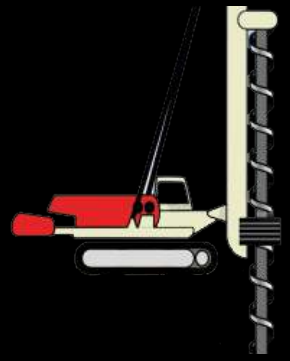
Overhead Racks



Auger CIP Pile Foundation



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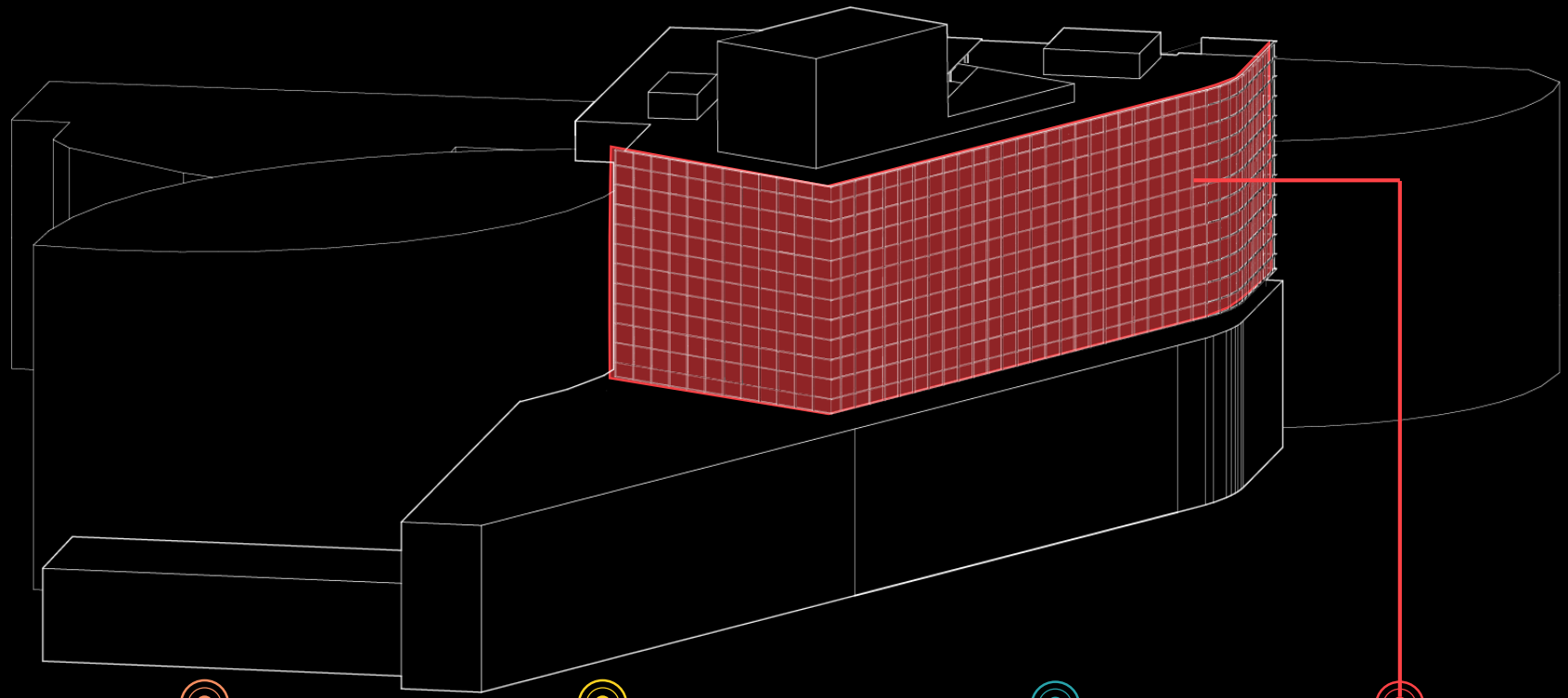

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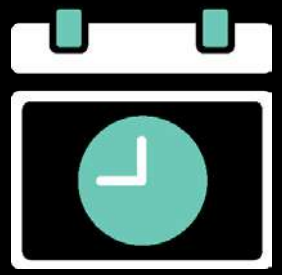

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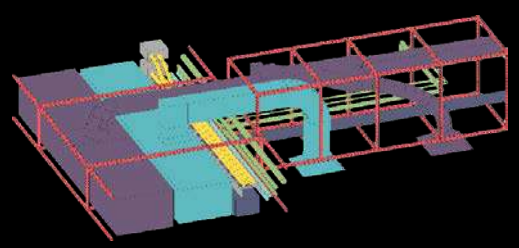

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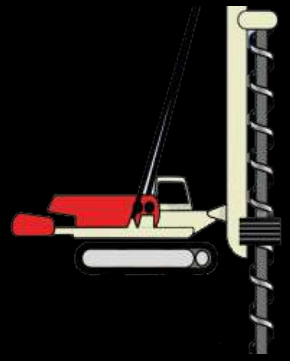
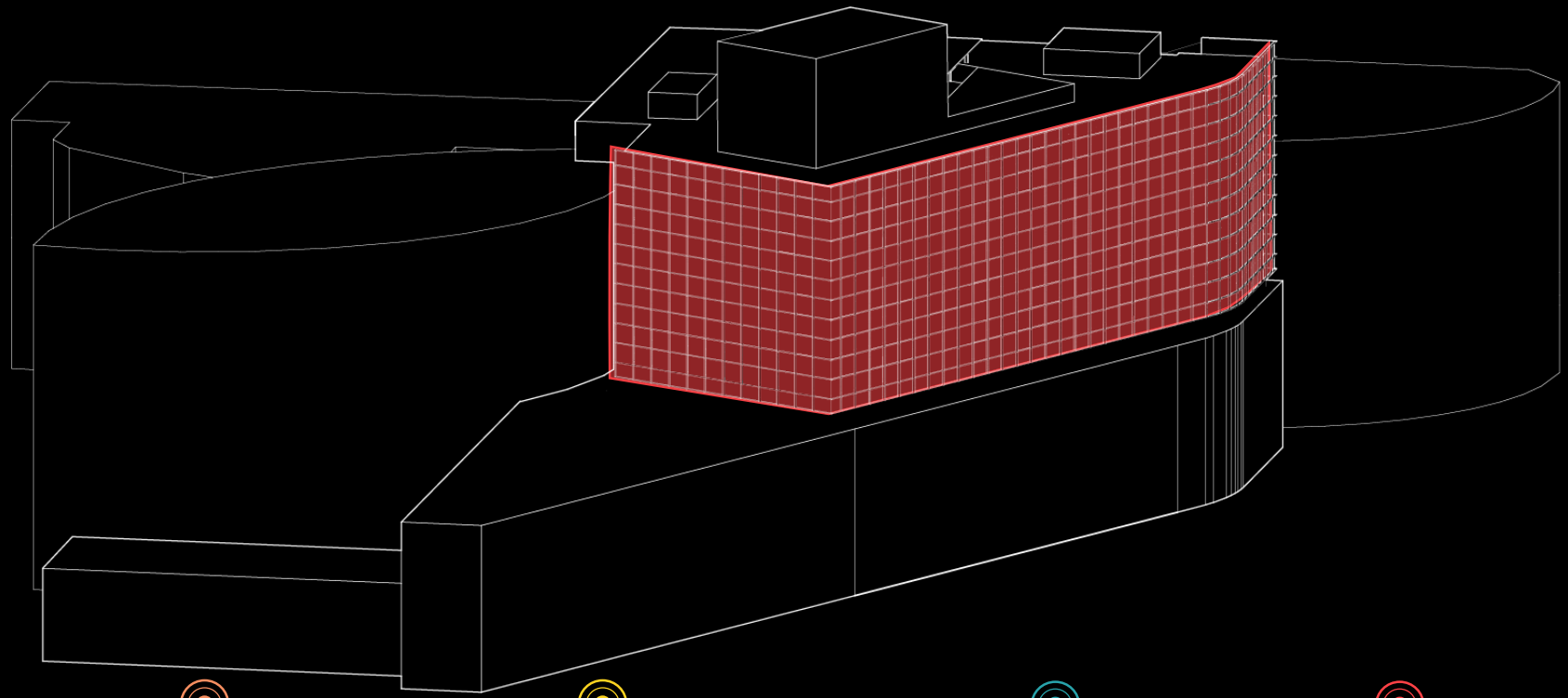
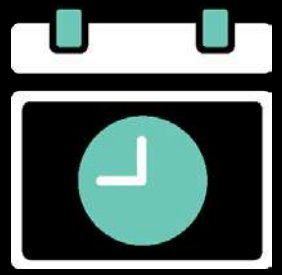


High-Performance Facade

Construction Design Points of Focus

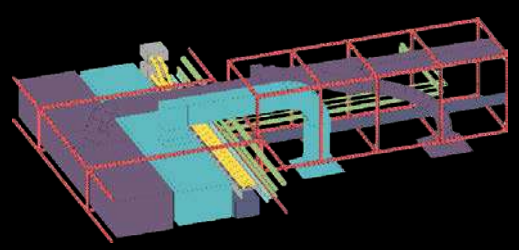


Schedule

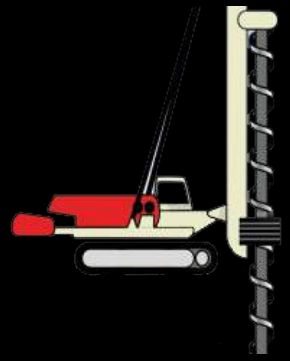


Cost

Overhead Racks

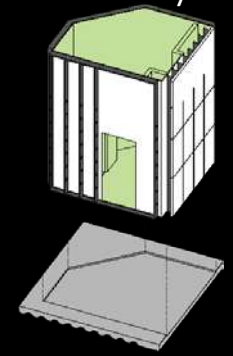


Auger CIP Pile Foundation



High-Performance Facade

Prefabrication Factory



Develop Project Goals and Themes

Establish Team Integration Strategies

Perform Site Analysis and Design Strategizing

Execute Design and Evaluation

Ensure Project Outcome

01 02 03 04 05

Slide Outline

Slide Heading

Team Disciplines

Architecture

Structural

Mechanical

Lighting/Electrical

Construction

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Reduce Energy Load

Community Icon

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Resilient Engineering

Dual Functionality Spaces

Community Shelter

Smart Building

Medical Staff Efficiency

Patient Security

Building Performance Monitoring

Project Themes

Integration

Meet Budget

Optimize Schedule

High-Performance Façade

Smart Building Technology

Adaptability

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Flexibility in Use

Community

Minimize Building Impact

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Disaster Relief

Patient Security

Wellness

Enhance Patient Experience

Efficiency of Care

High Air Quality Standards

Regulate Circadian Rhythm

02

Establish Team Integration Strategies

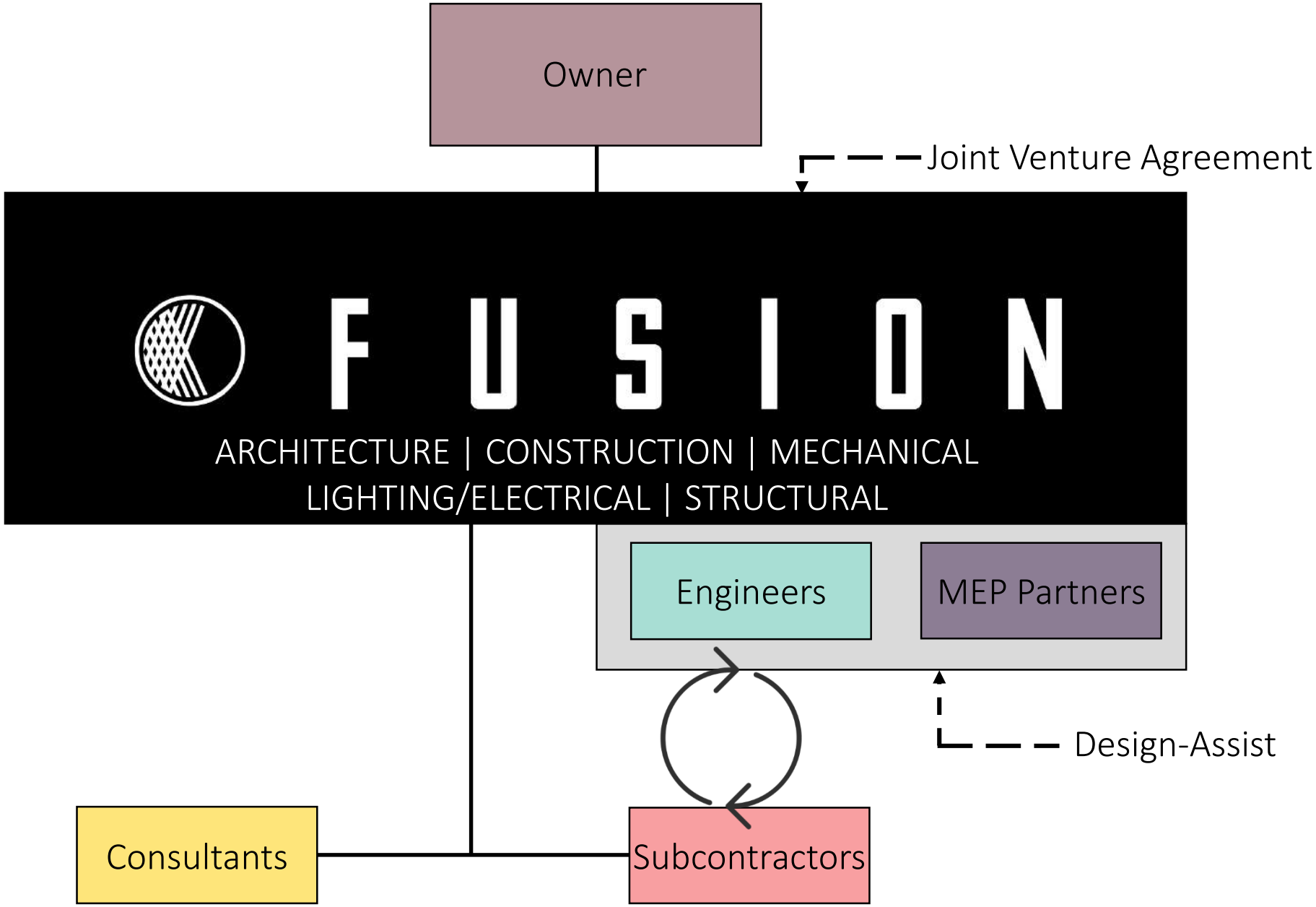
Project Delivery Method

Collaborative Environment

Workflow Organization

Decision Making

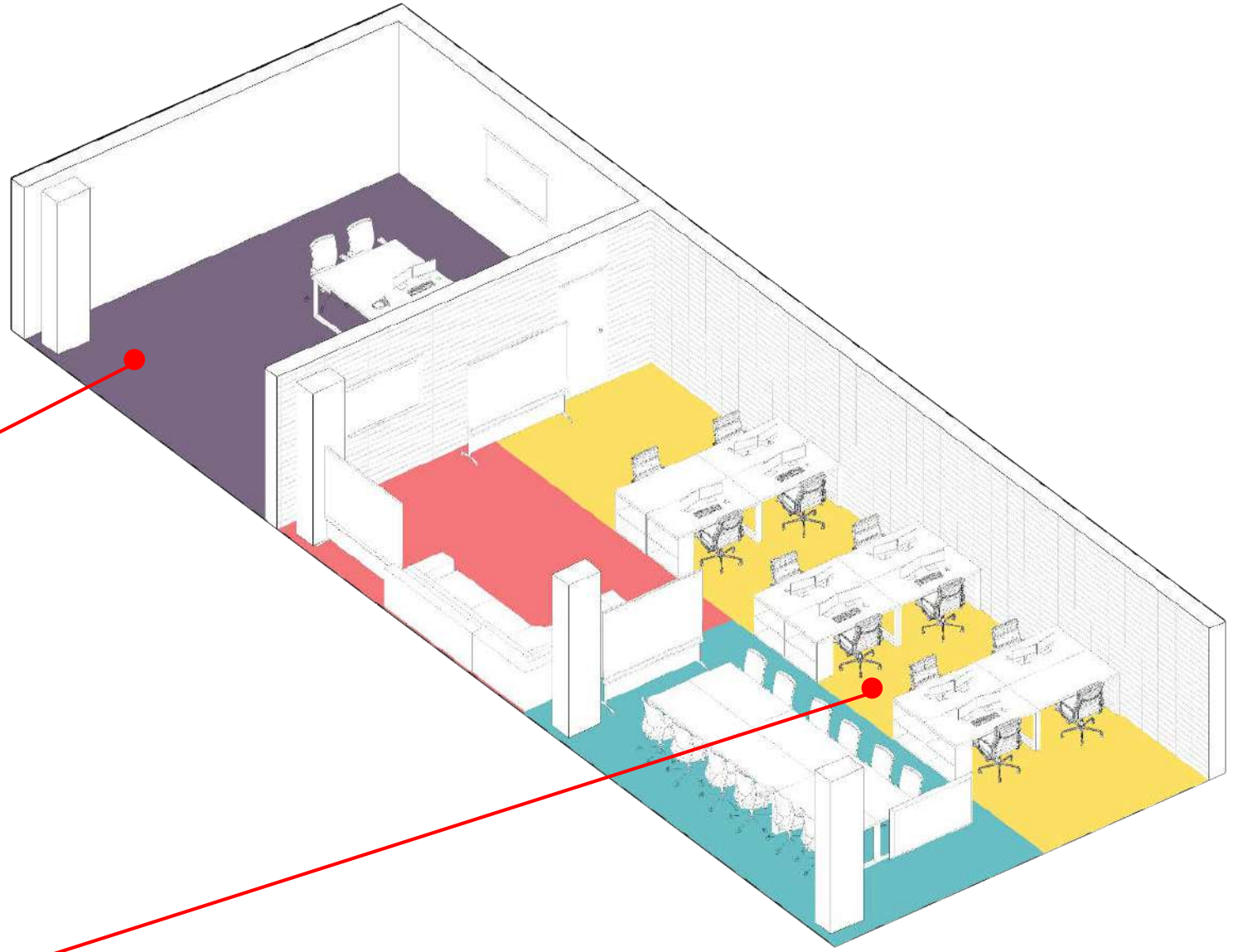
Project Delivery Method



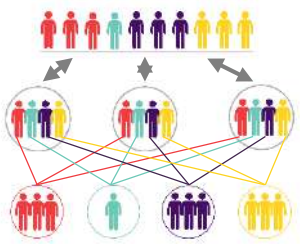
Collaborative Environment

Mock Up and VR Space

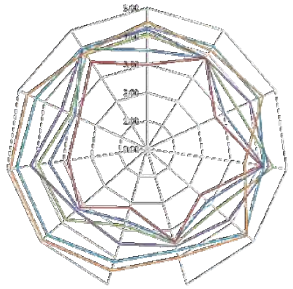
Collaborative Work Space



Workflow Planning

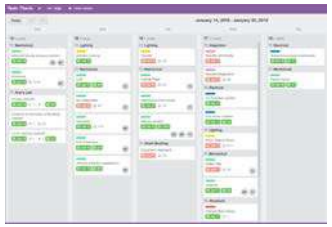


Subcommittee



Team Health and KPI Survey

Software Interoperability & BIM



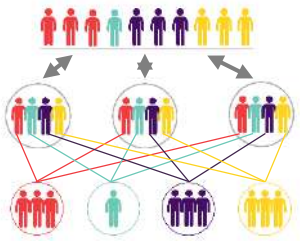
Online Pull Planning

Team Calendar

Studio

Bluebeam Studio

Workflow Planning



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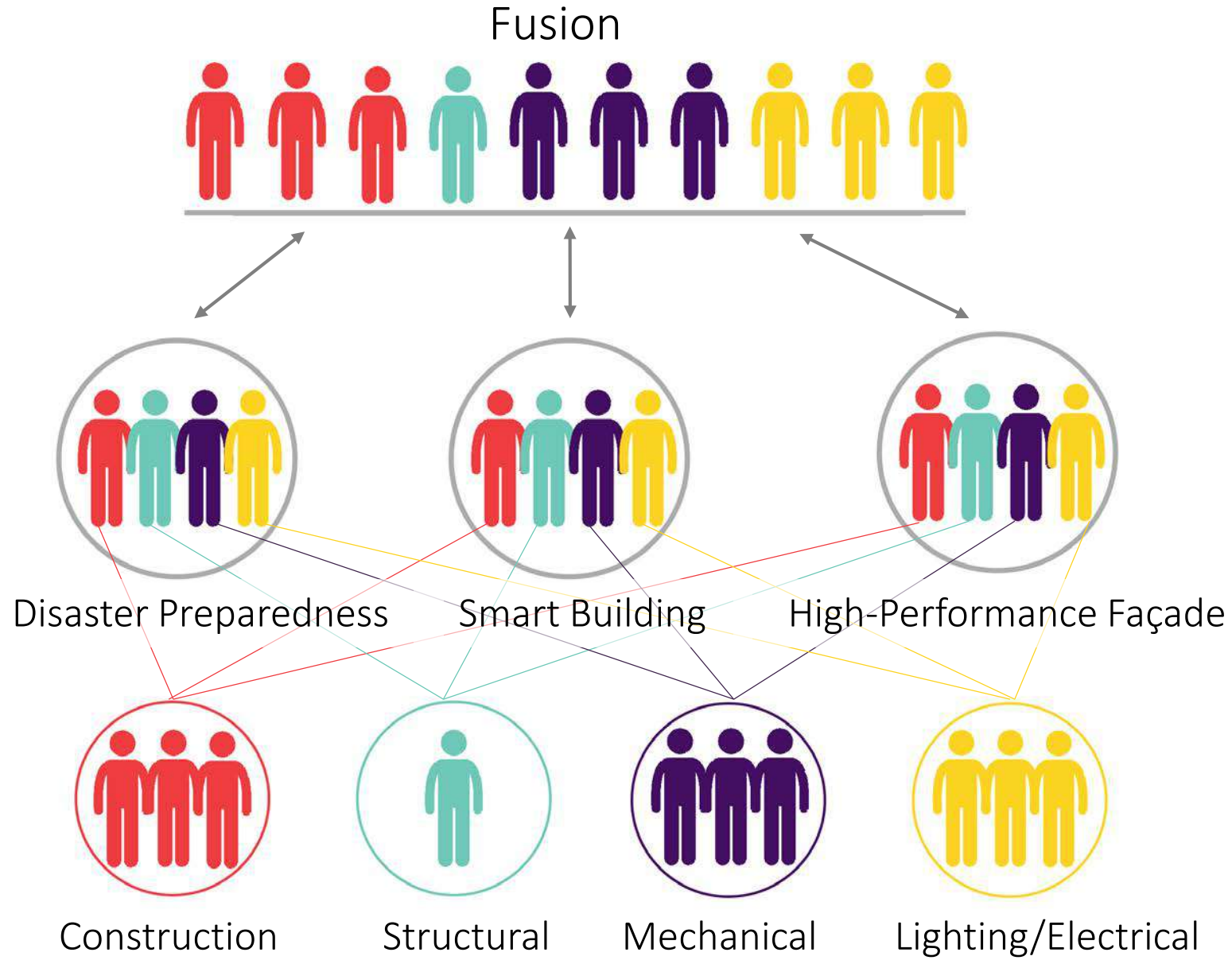

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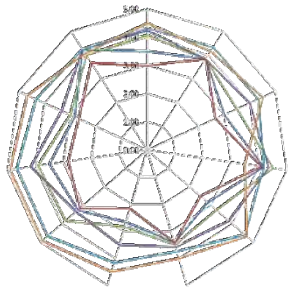

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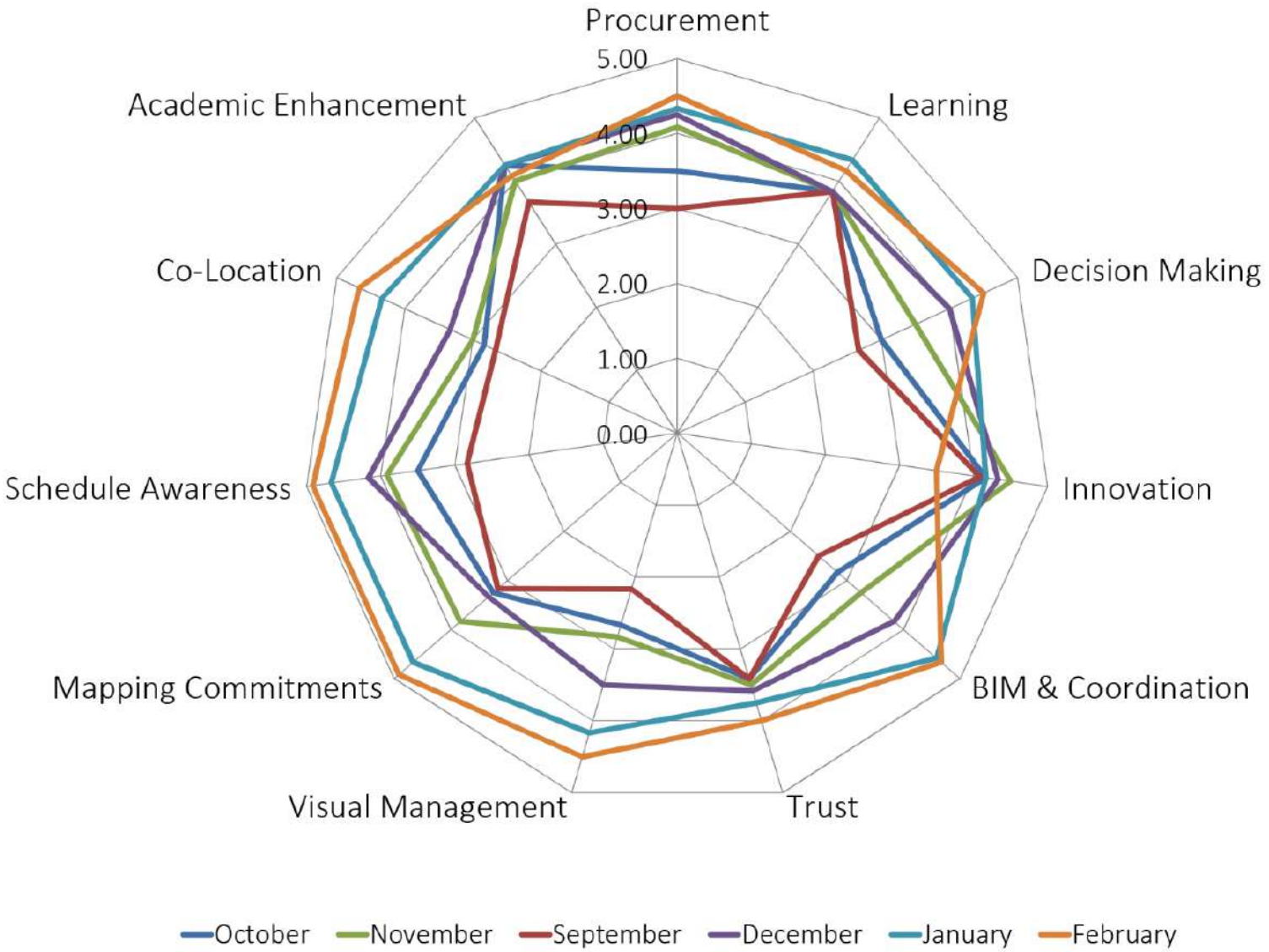

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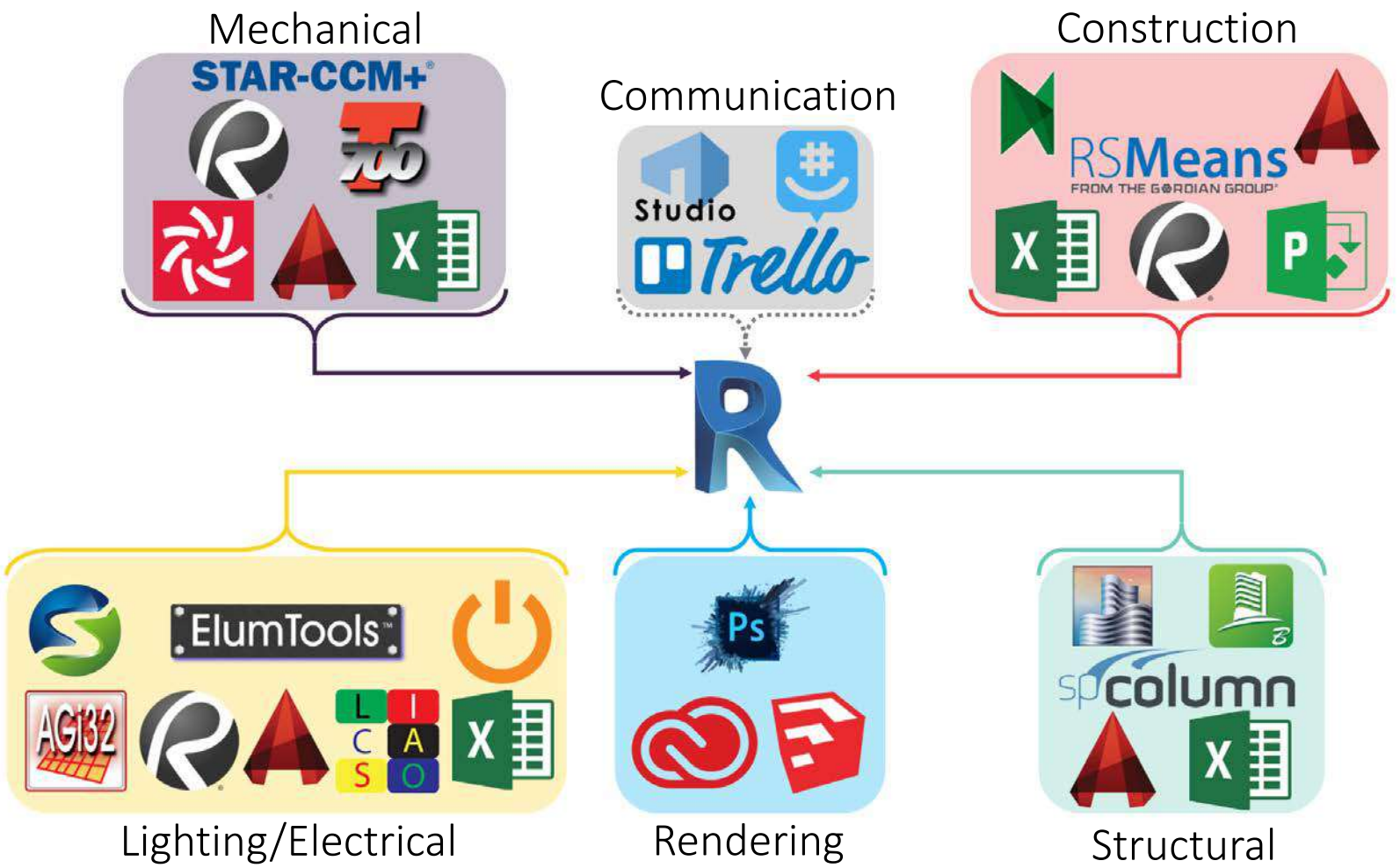

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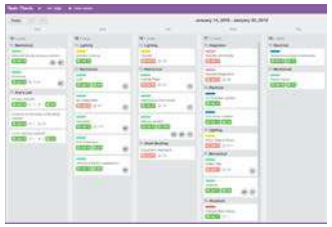

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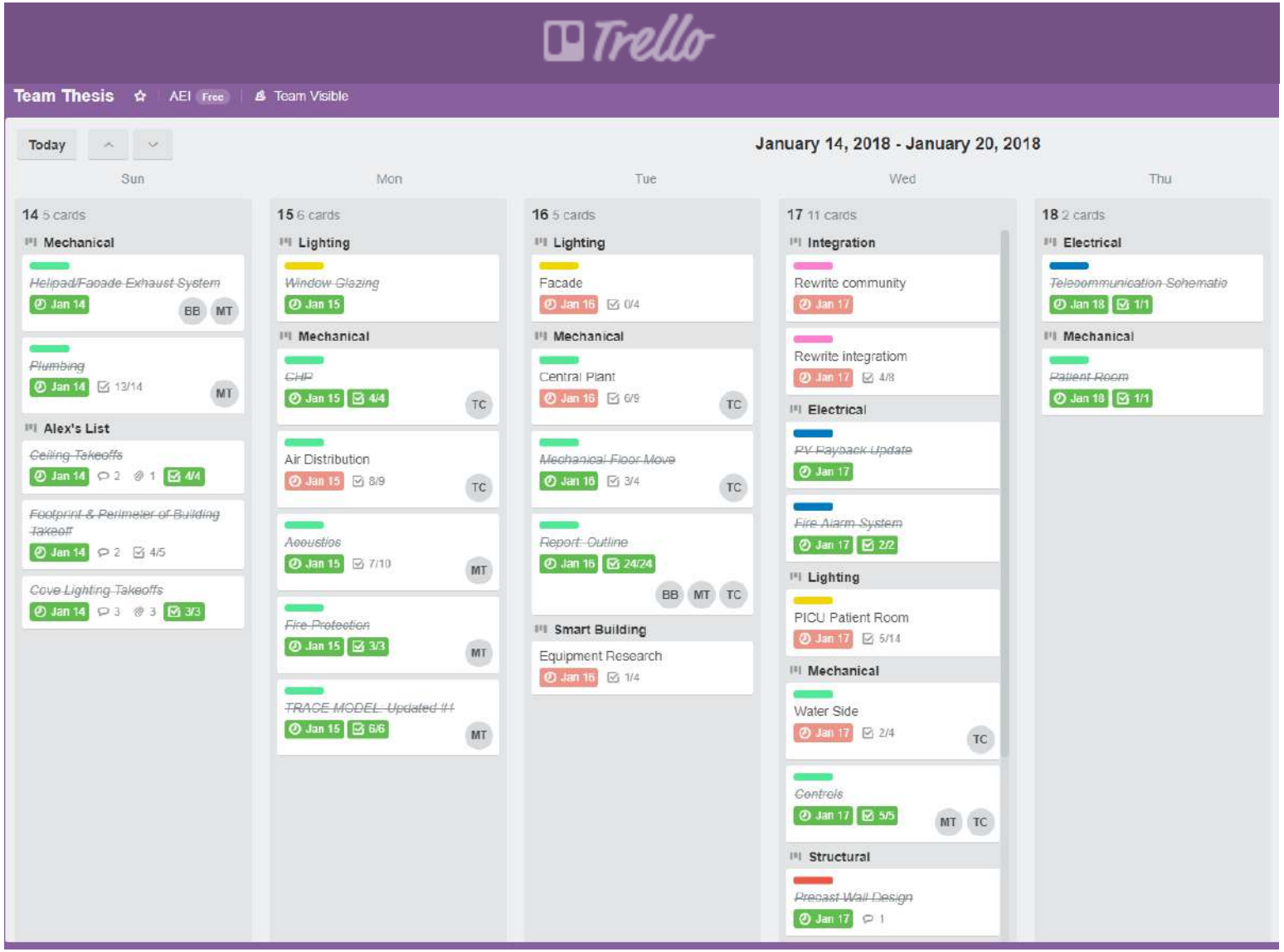

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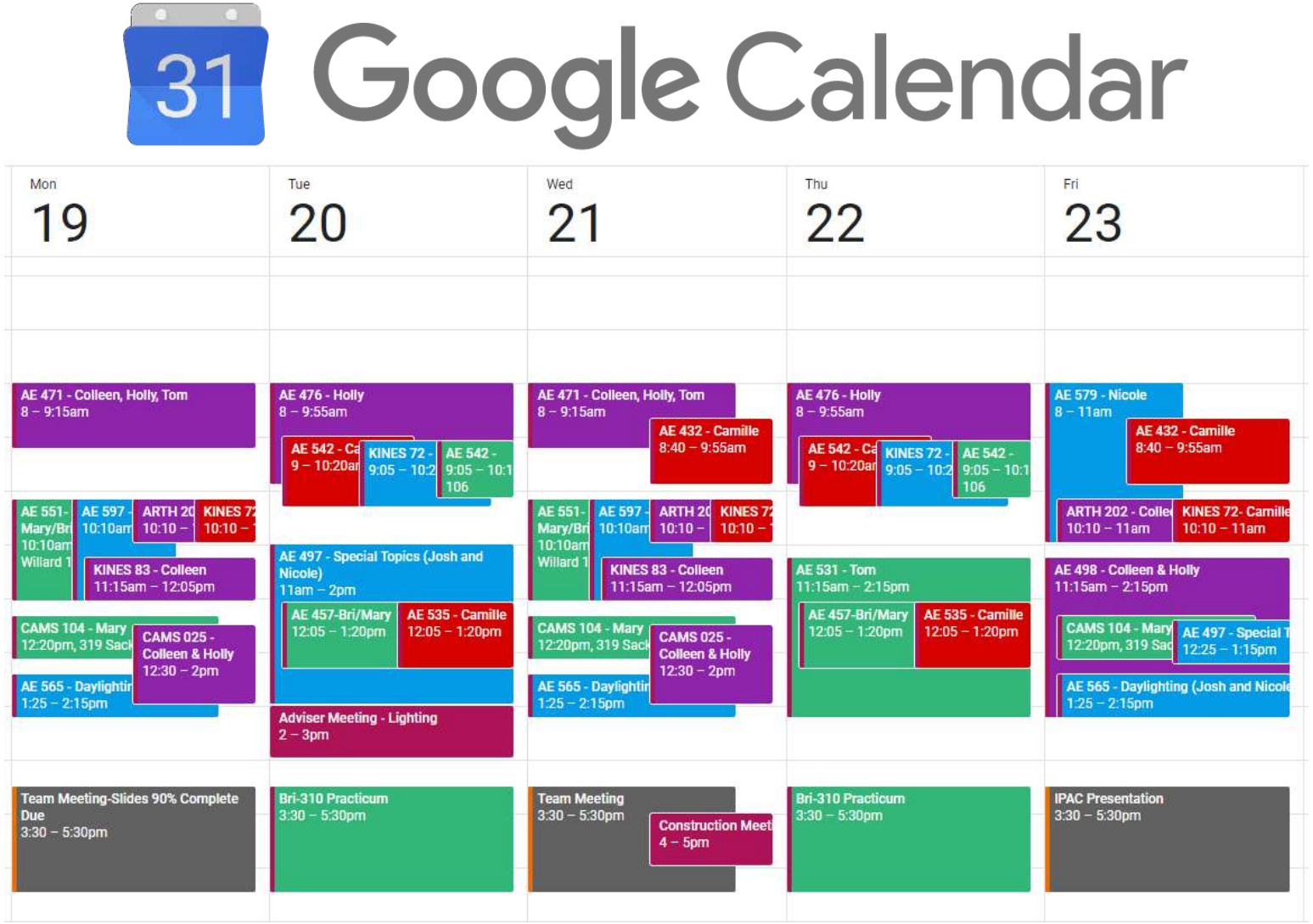

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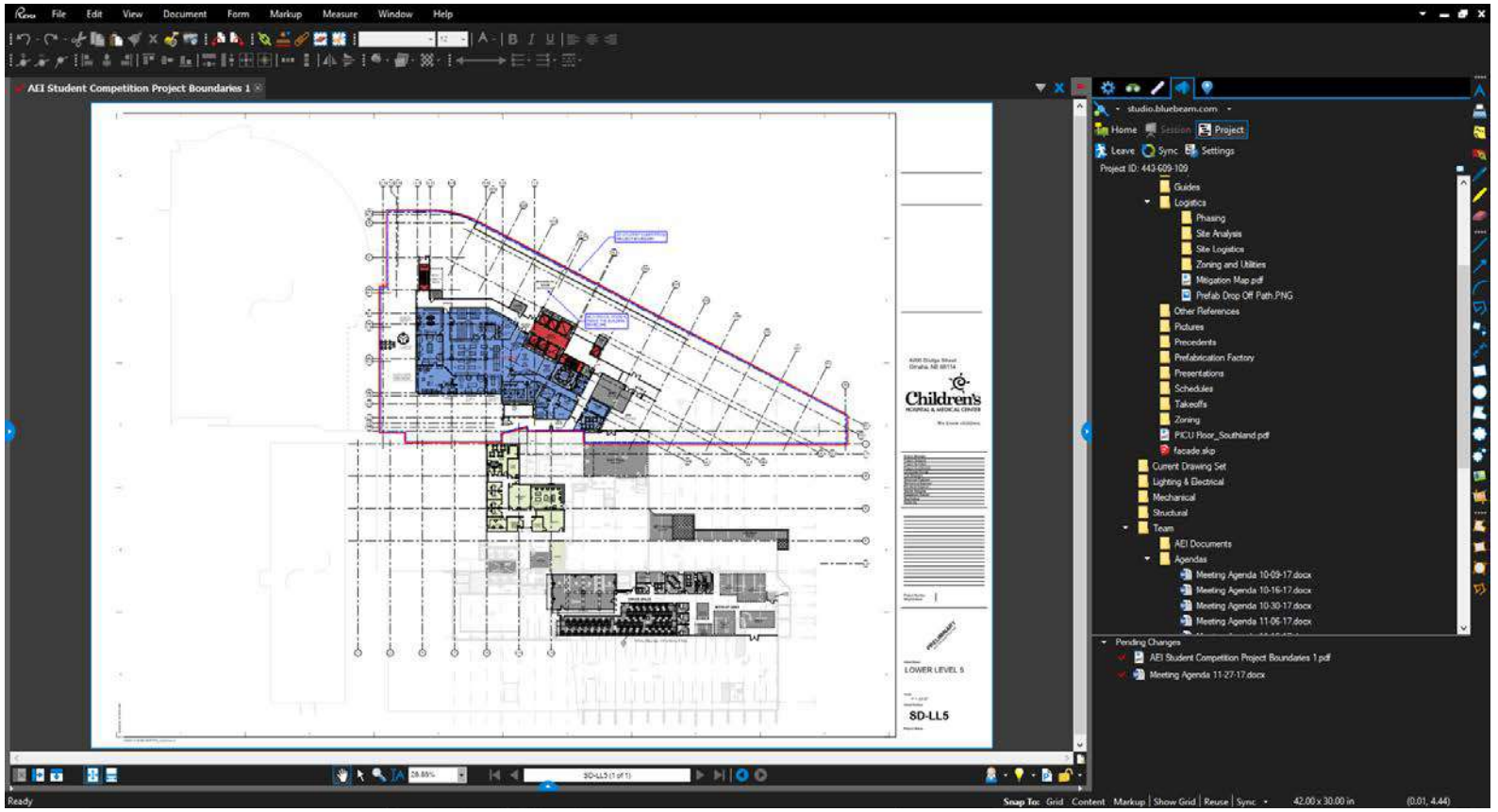


Decision Matrix

F U S I O N DECISION MATRIX: INTEGRATION

GOALS	ADAPTABILITY				WELLNESS					COMMUNITY				INTEGRATION				TOTAL
	DIASTER PREPAREDNESS	LONG LIFESPAN	ROOM FOR GROWTH	FLEXIBILITY IN USE	DAYLIGHTING	HIGH AIR QUALITY STANDARDS	ENHANCE PATIENT EXPERIENCE	MAXIMIZE EFFICIENCY OF CARE	REGULATE CIRCADIAN RYTHMS	MINIMIZE BUILDING IMPACT	AESTHETIC ICON	DISASTER RELIEF	SECURITY	COST	SMART BUILDING	SCHEDULE	INTEGRATED FAÇADE DESIGN	
MECHANICAL FLOOR MOVE																		
WEIGHT	5	3	2	4	3	3	5	4	3	5	1	3	4	3	2	4	5	
FLOOR 7	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	7
FLOOR 2	0	1	1	1	1	0	0	0	0	0	0	0	0	1	0	1	0	19
FINAL DECISION	MOVE MECHANICAL FLOOR TO FLOOR 2																	
COMMENTS	MOVING THE MECHANICAL FLOOR TO FLOOR 2 DECREASES THE COST OF MANY MAJOR ENGINEERING SYSTEMS AND INCREASED THE ABILITY TO ACCESS AND REPLACE MECHANICAL EQUIPTMENT, WHICH OUTWEIGHED THE VIBRATION IMPACTS TO TWO FLOORS ABOVE AND BELOW																	

Project Goals

Goal Categories

Weighting Scale:

5	High Importance
3	Medium Importance
1	Low Importance

03

Professional Input

Site Analysis

Resilient Strategies

Best Practices

Perform Site Analysis and Design Strategizing

Professional Input | Hershey Medical Center Staff

PennState Health
Milton S. Hershey
Medical Center

Michele Smith
Clinical Leader
Hershey Medical Center

Timothy Dunkle
Assistant Director of
Facilities
Hershey Medical Center

Eileen Wiley
Assistant Director, Facilities
Planning and Construction
Hershey Medical Center

Catherine Brower
Assistant Director, Facilities
Planning and Construction
Hershey Medical Center

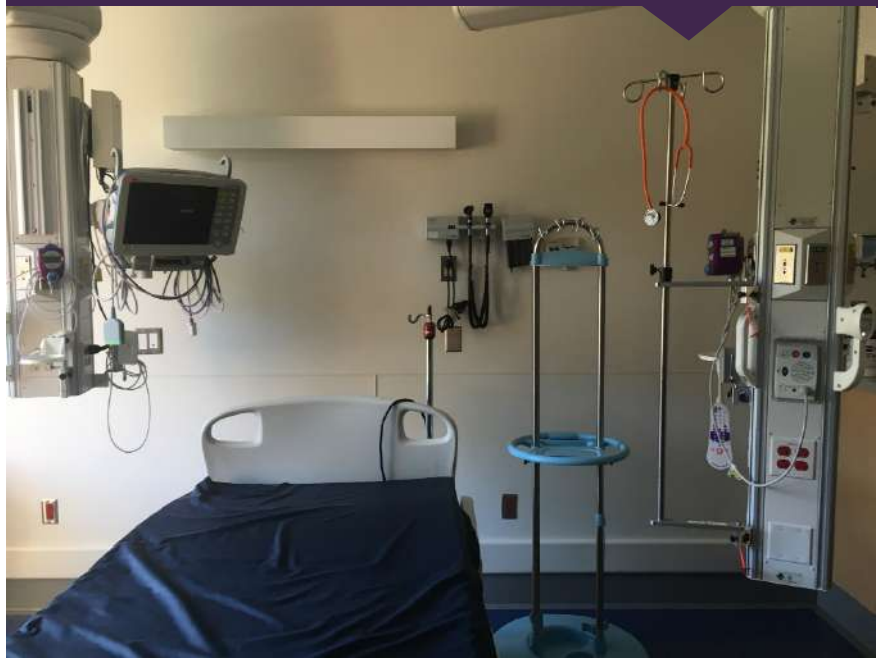
Concepts

- Line of Site to Patients
- Provide Room for Students
- Ease of Patient Treatment
- Family Spaces Close to Patients
- Efficient Access to Supply Rooms
- Remove Medical Staff Silos

Patient Room

Ease of Patient Treatment

Patient Control Over Environment



Professional Input | Hershey Medical Center Staff

Patient Room

Ease of Patient Treatment

Patient Control Over Environment

Hallway

Line of Site to Patients

Provide Room for Students

Professional Input | Hershey Medical Center Staff

Patient Room

Ease of Patient Treatment

Patient Control Over Environment

Hallway

Line of Site to Patients

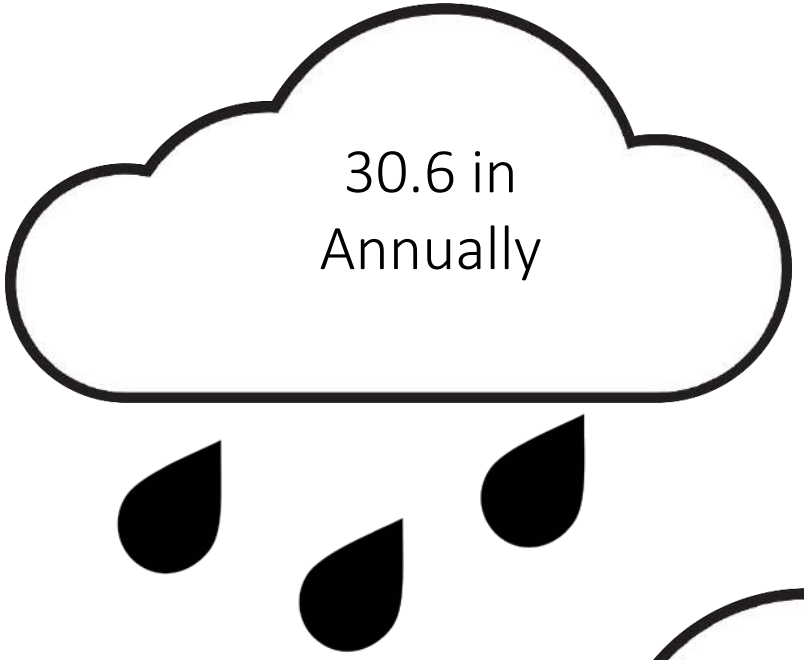
Provide Room for Students

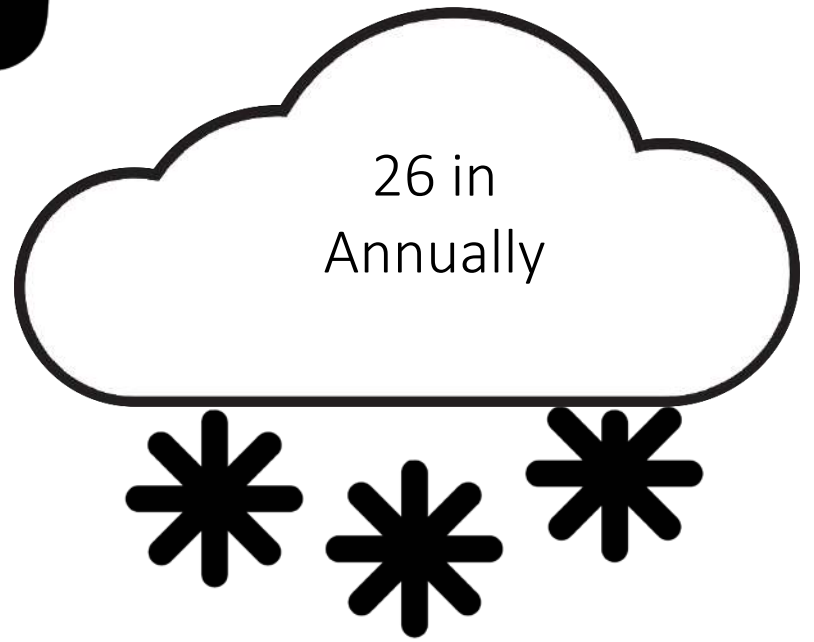
Open Concept Team Center

Remove Medical Staff Silos

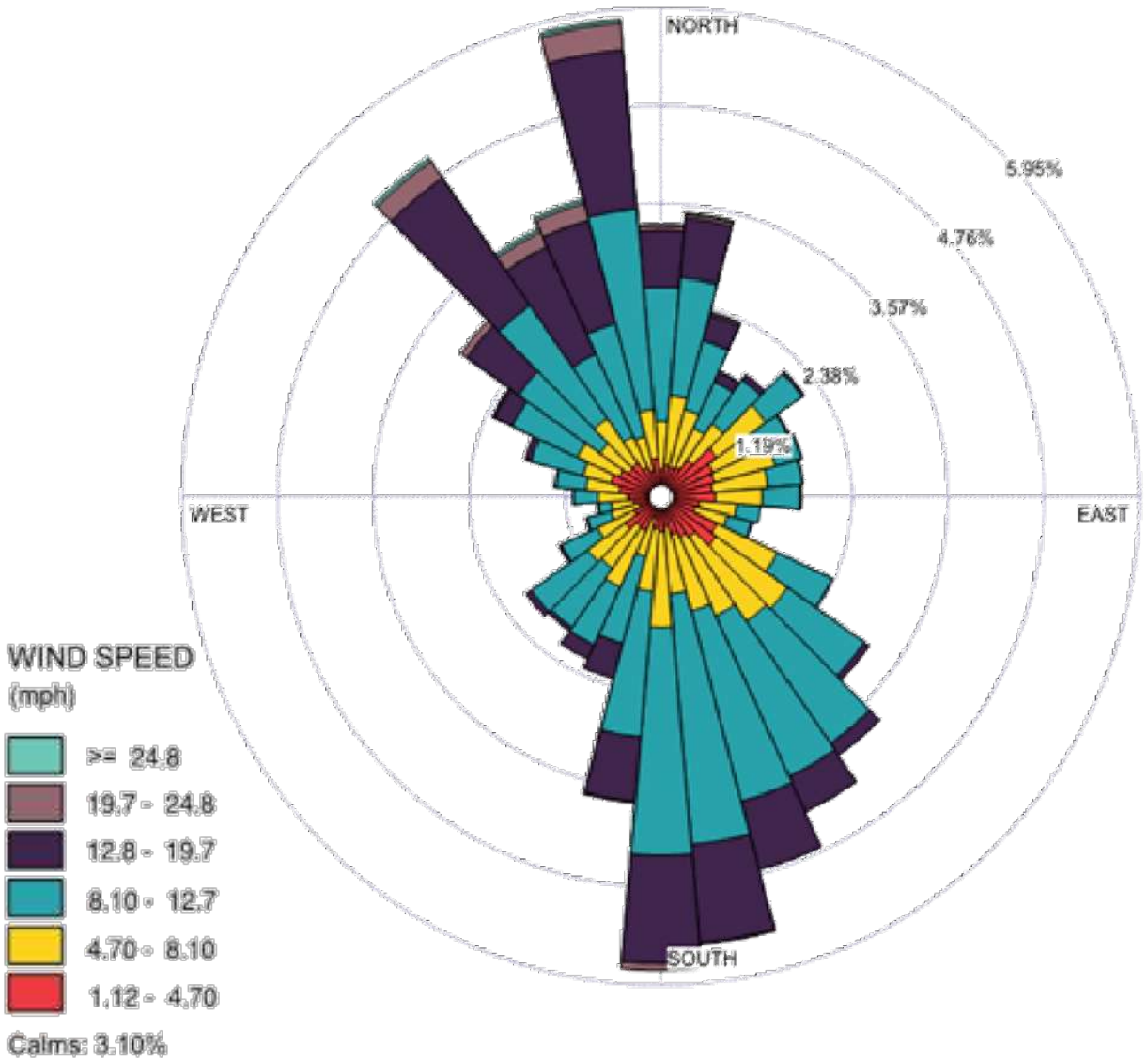
Efficient Access to Supply Rooms

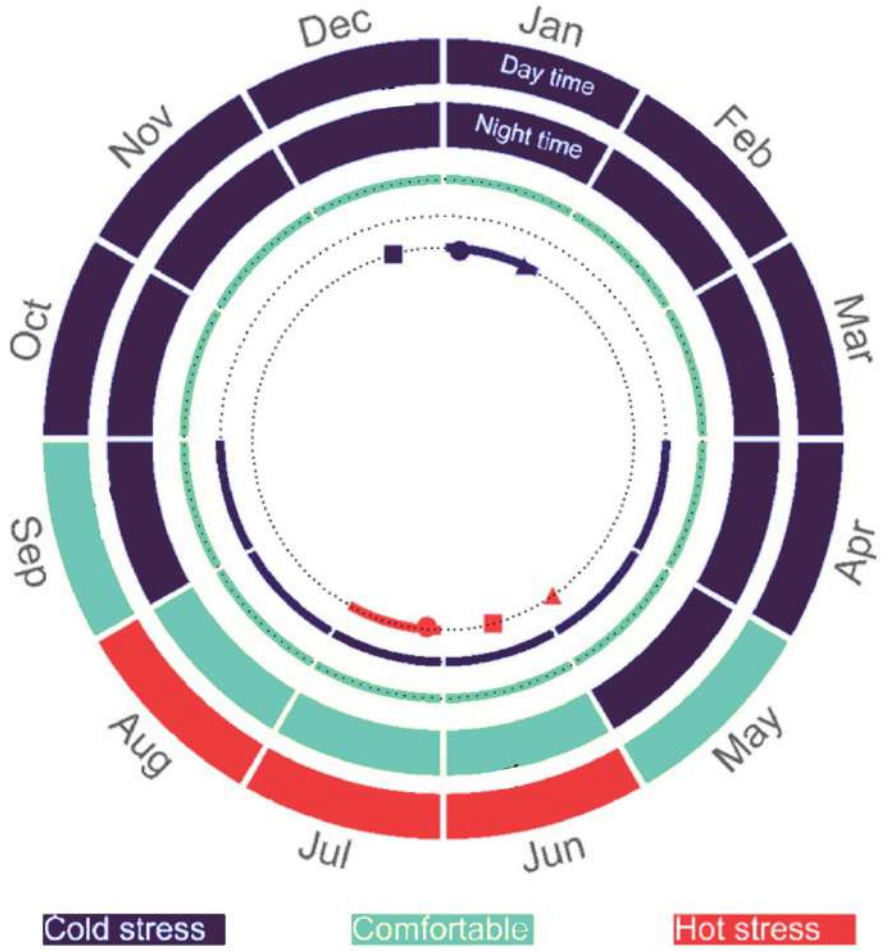
Site Analysis | Weather and Climate



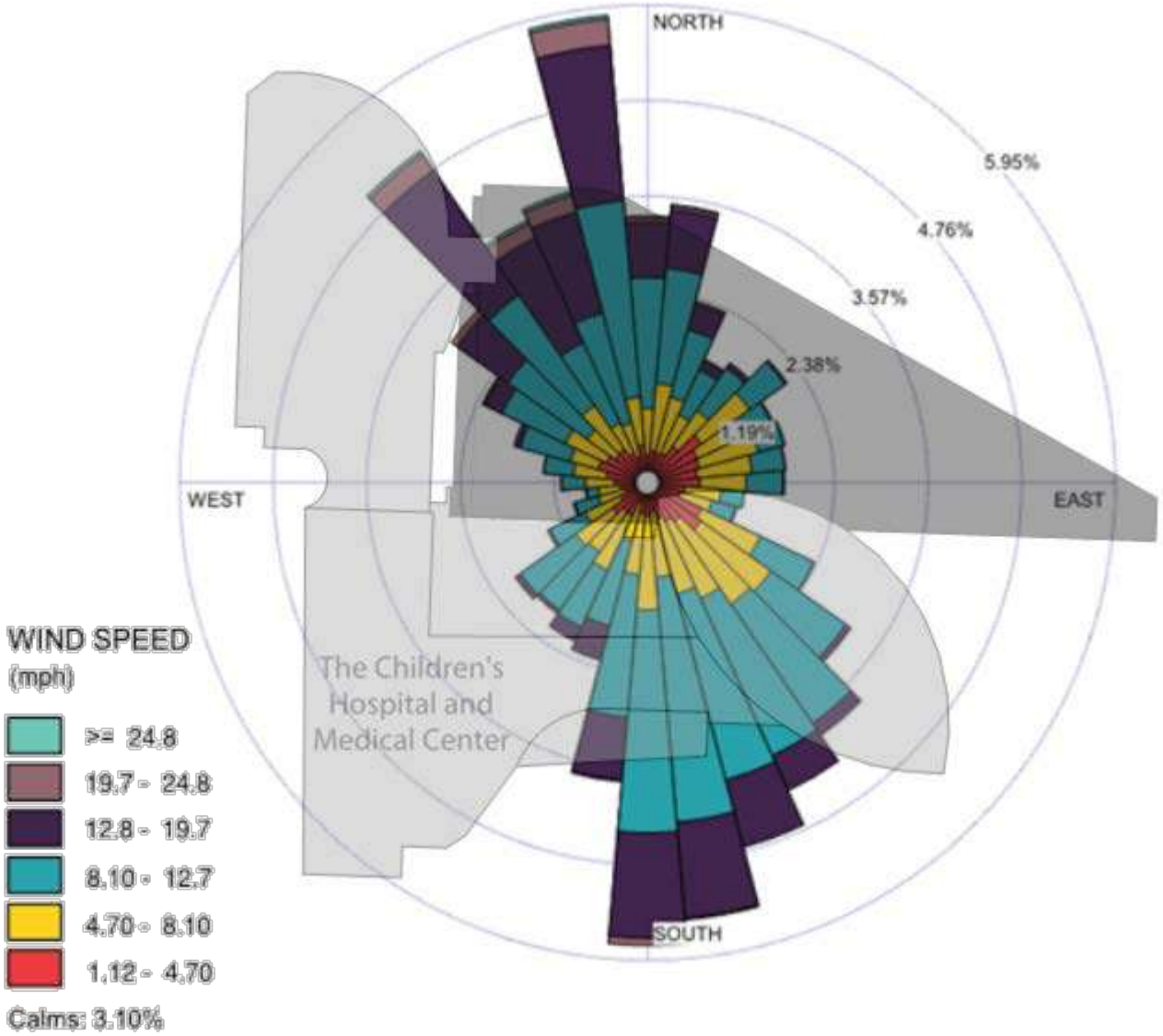


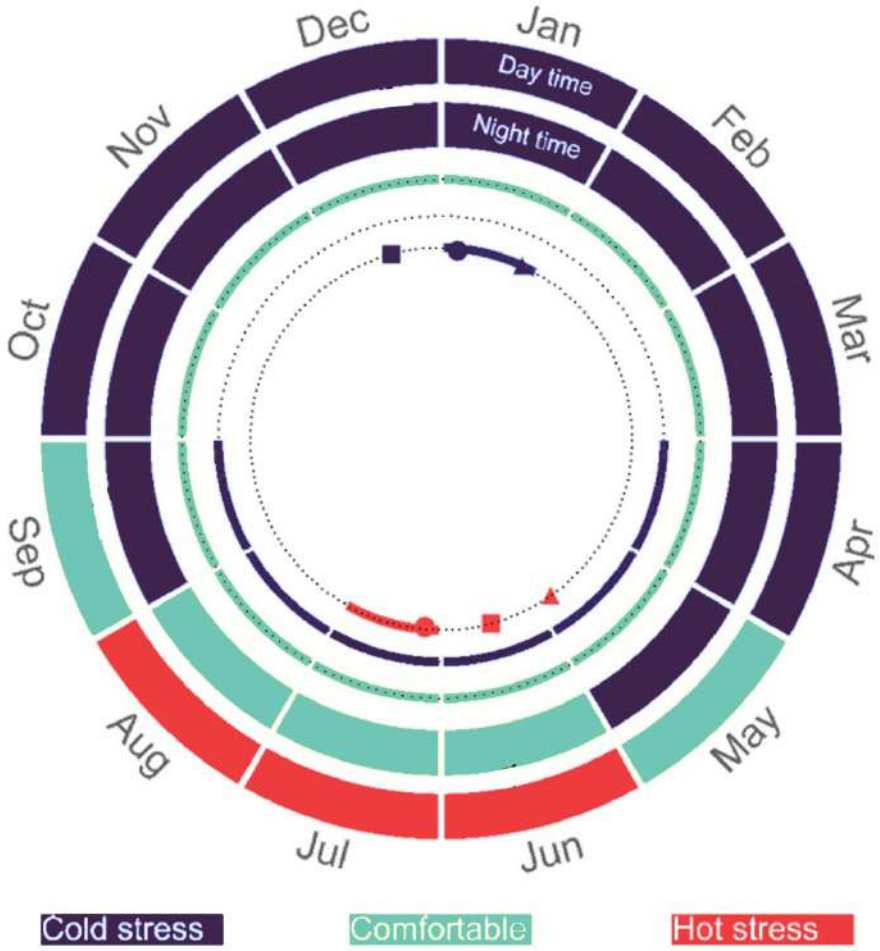
Site Analysis | Weather and Climate



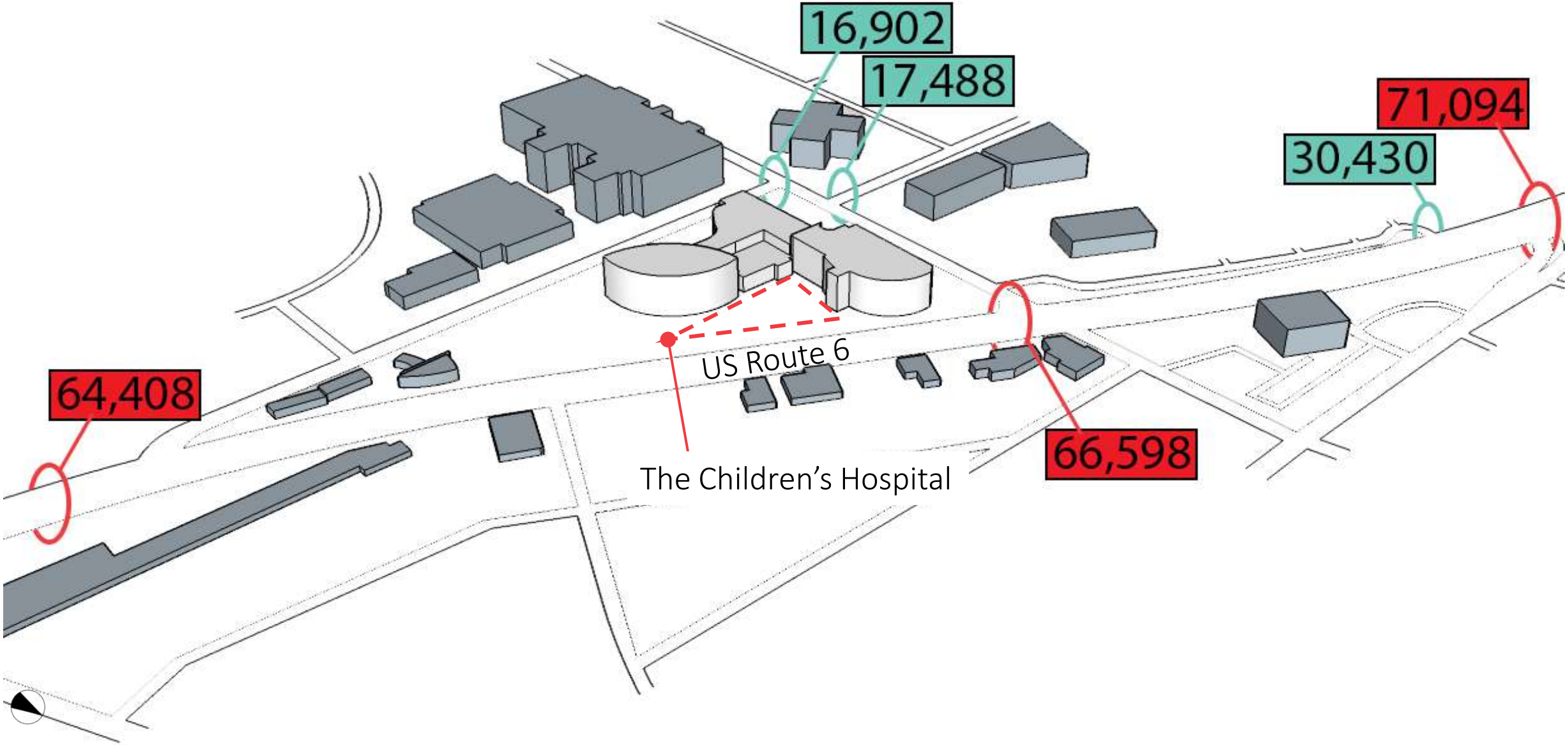


Site Analysis | Weather and Climate

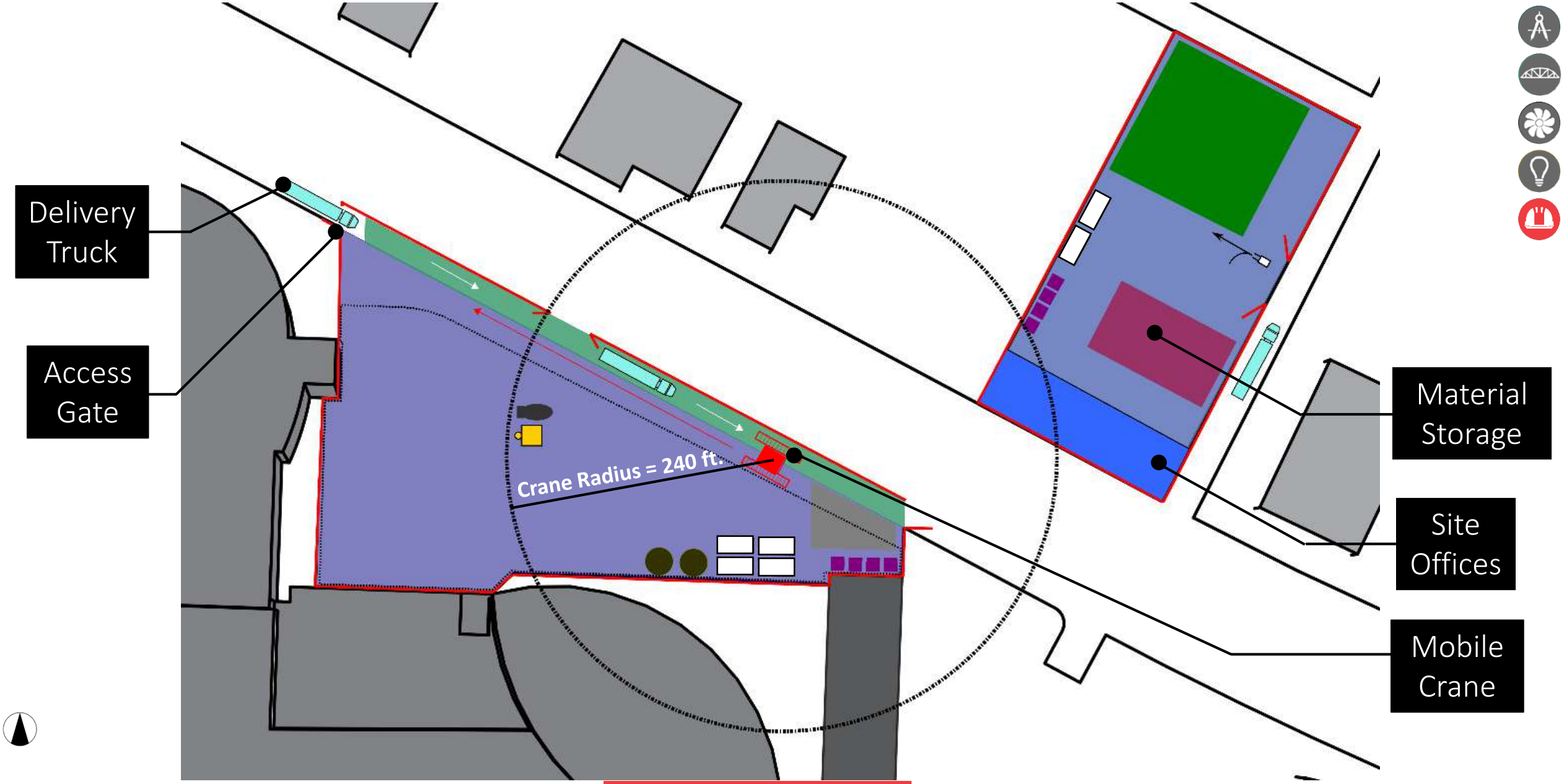




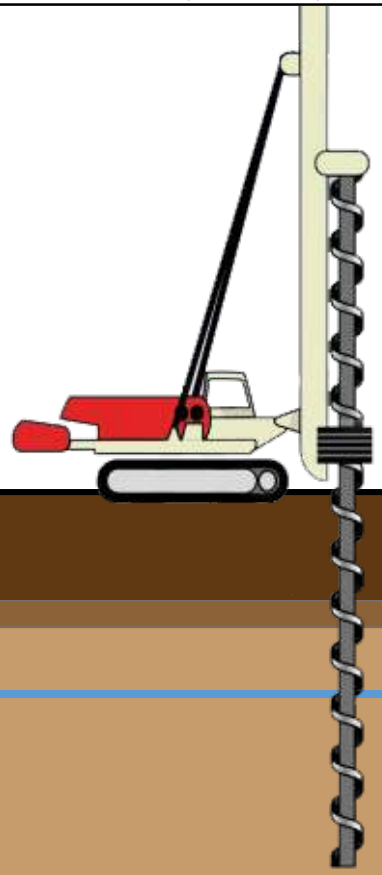
Site Analysis | Traffic



Site Analysis | Site Logistics



Site Analysis | Subsurface Analysis



Level 1

Lower Level 1

Lower Level 3

Lower Level 5

22’

Feet Below Grade

0’

16’

30’

87’

105’

Fill

Lean Clay

Water Table

Sand

Weathered Shale

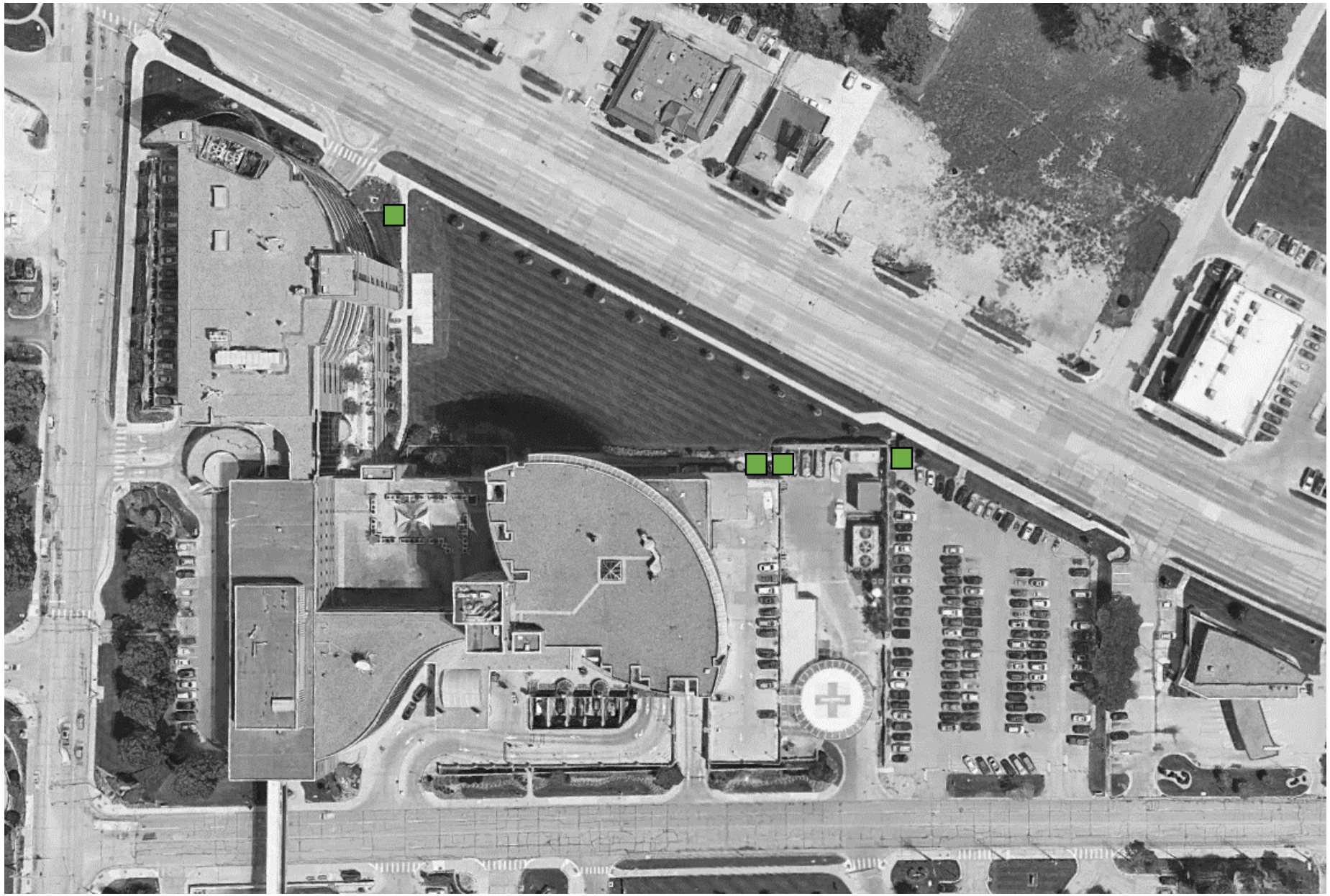
Limestone

Site Analysis | Utility Assumptions

Source: Google Earth Pro

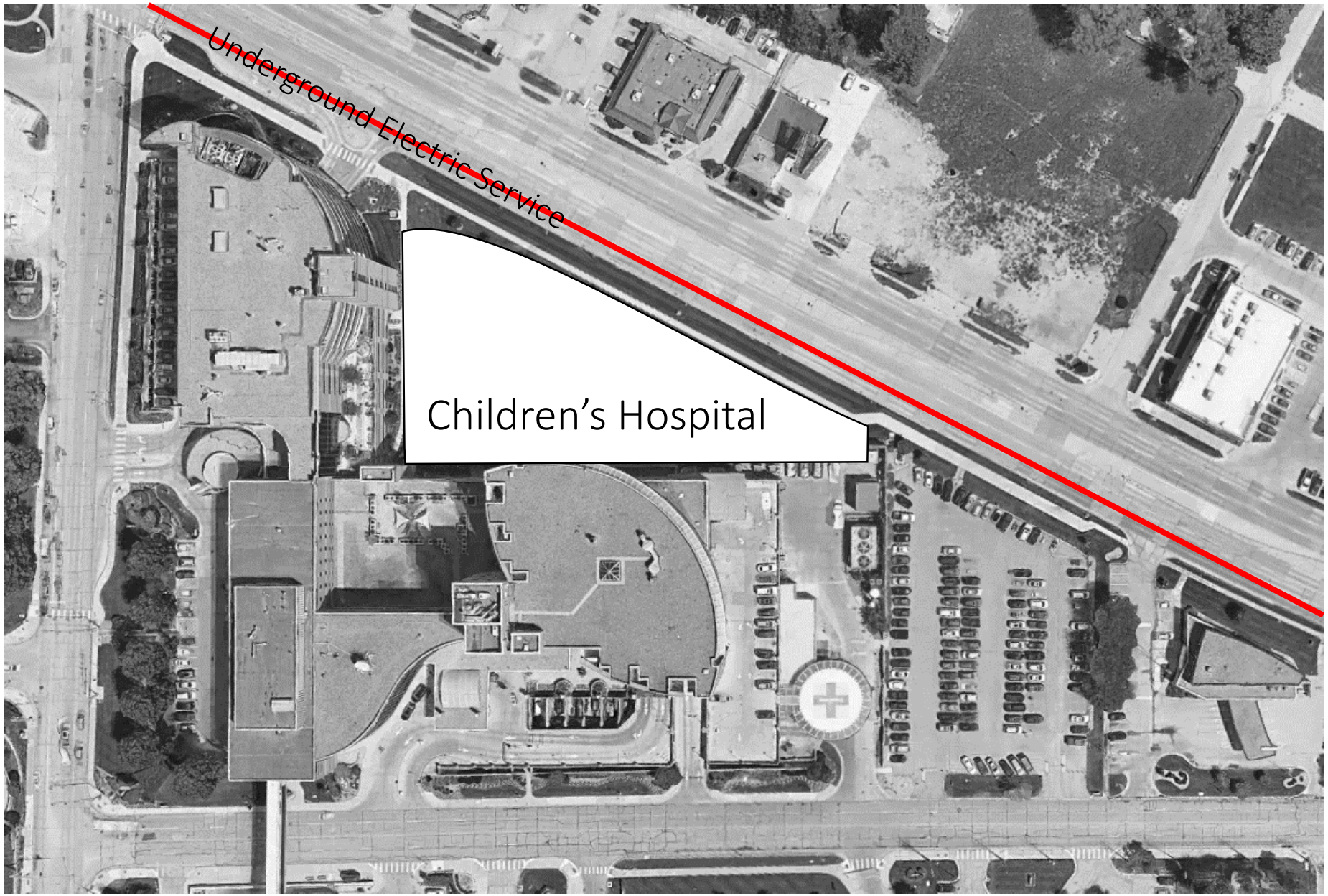
Site Analysis | Utility Assumptions

Existing Transformers



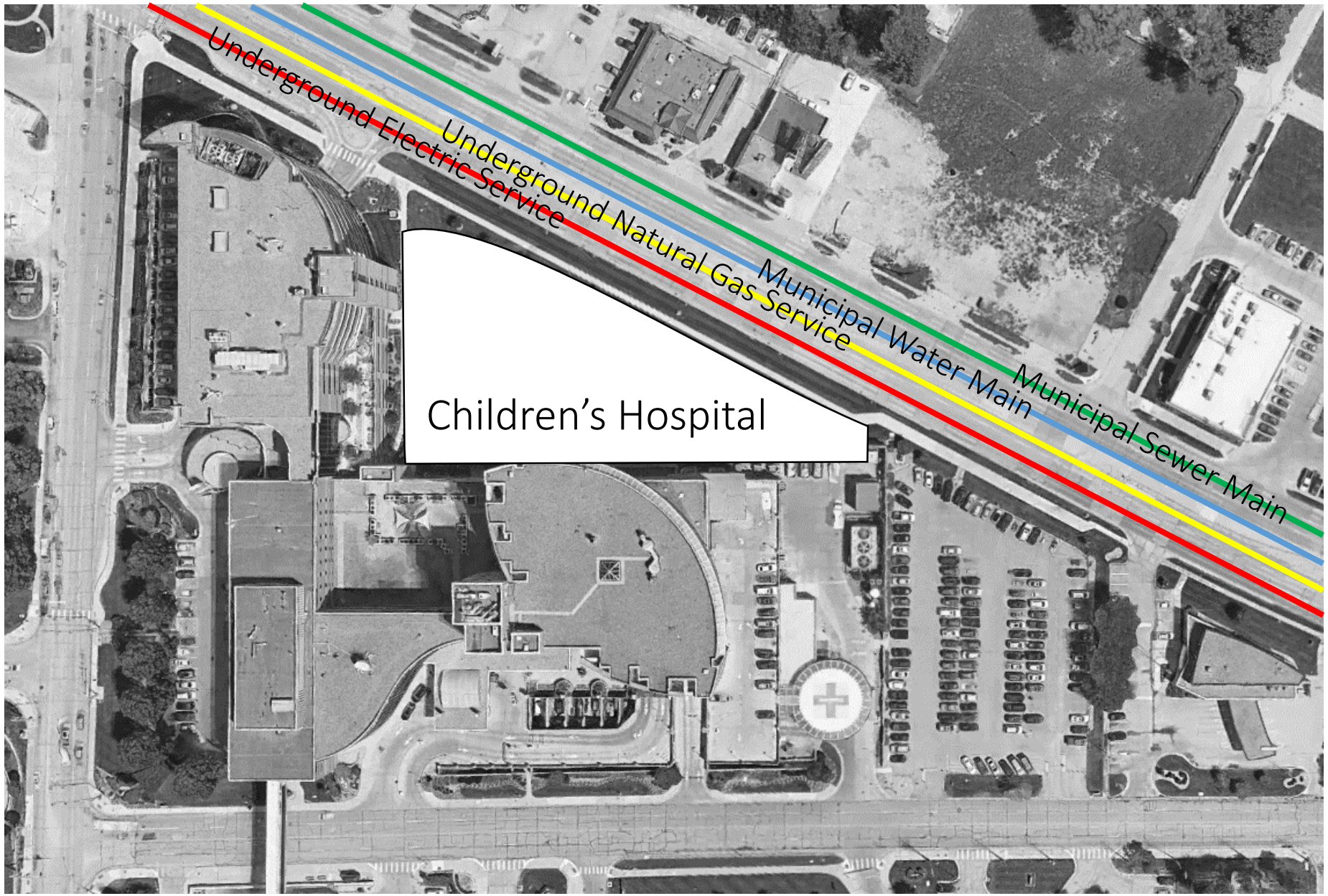
Source: Google Earth Pro

Site Analysis | Utility Assumptions



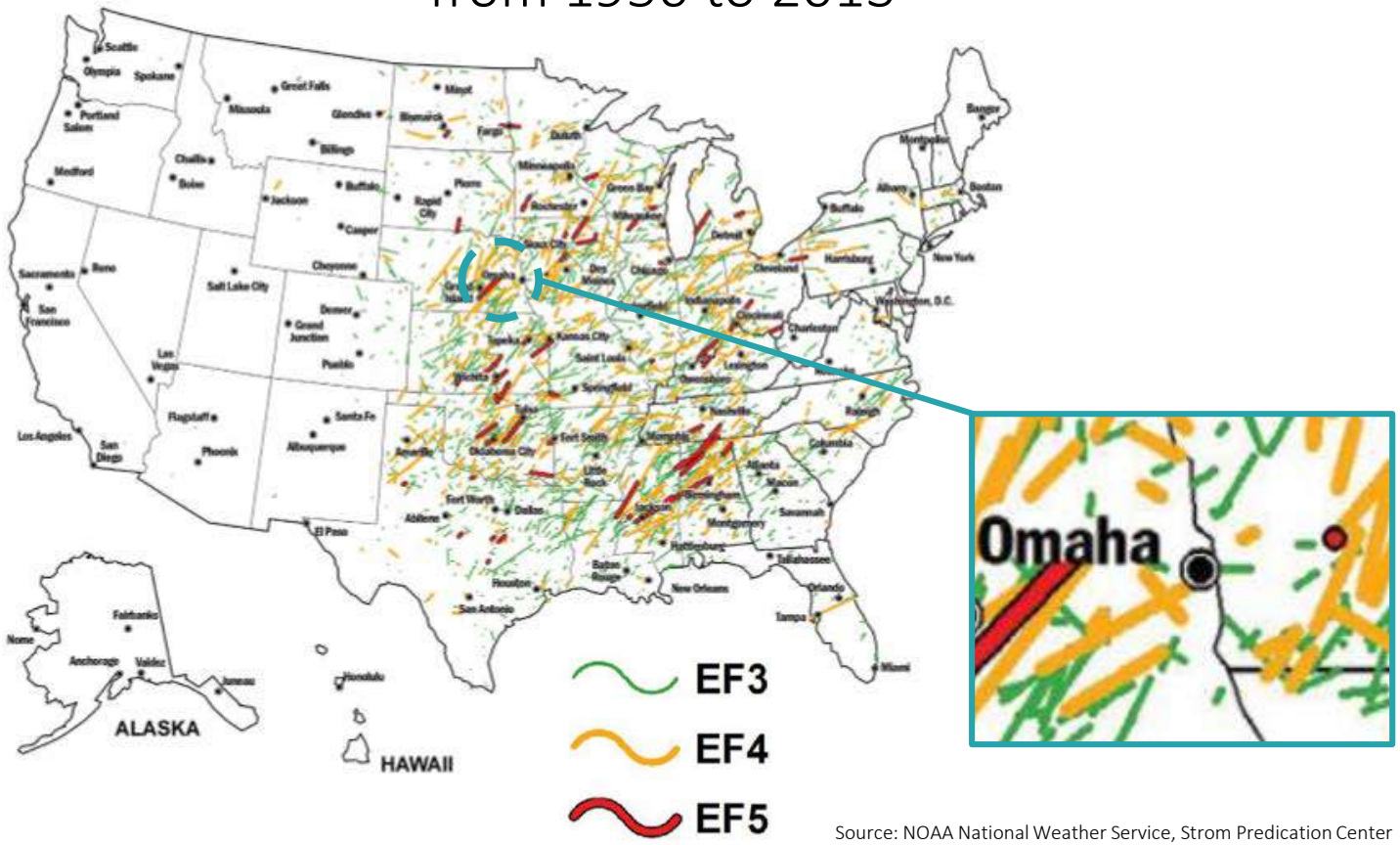
Source: Google Earth Pro

Site Analysis | Utility Assumptions



Source: Google Earth Pro

Recorded EF3, EF4, and EF5, Tornados in the United States from 1950 to 2013

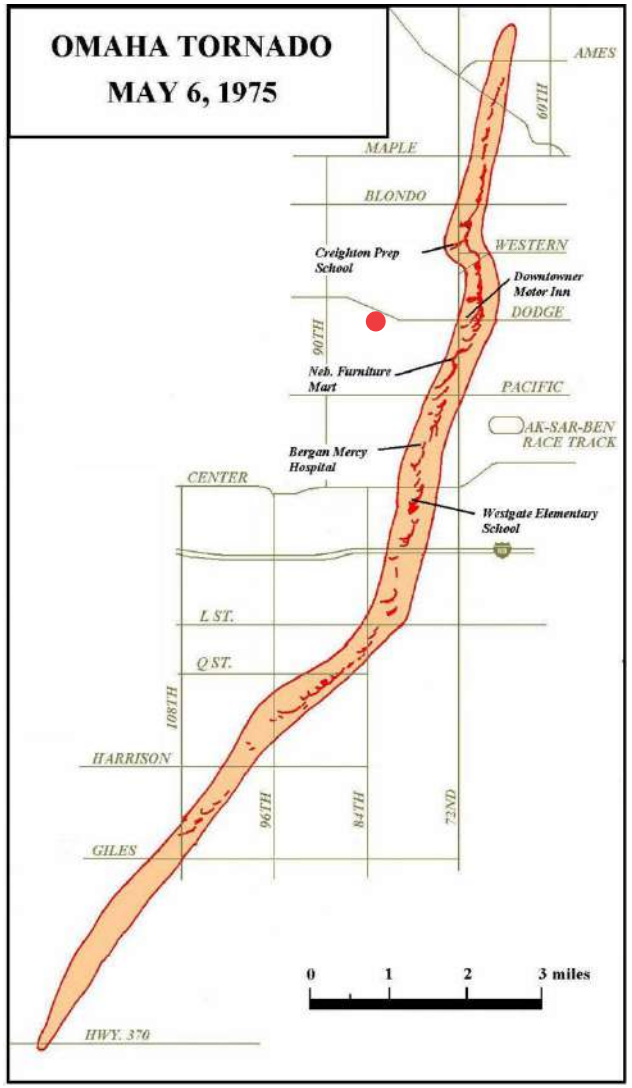


Source: NOAA National Weather Service, Strom Predication Center

Site Analysis | Natural Disasters

Recorded EF3, EF4, and EF5, Tornados in the United States from 1950 to 2013

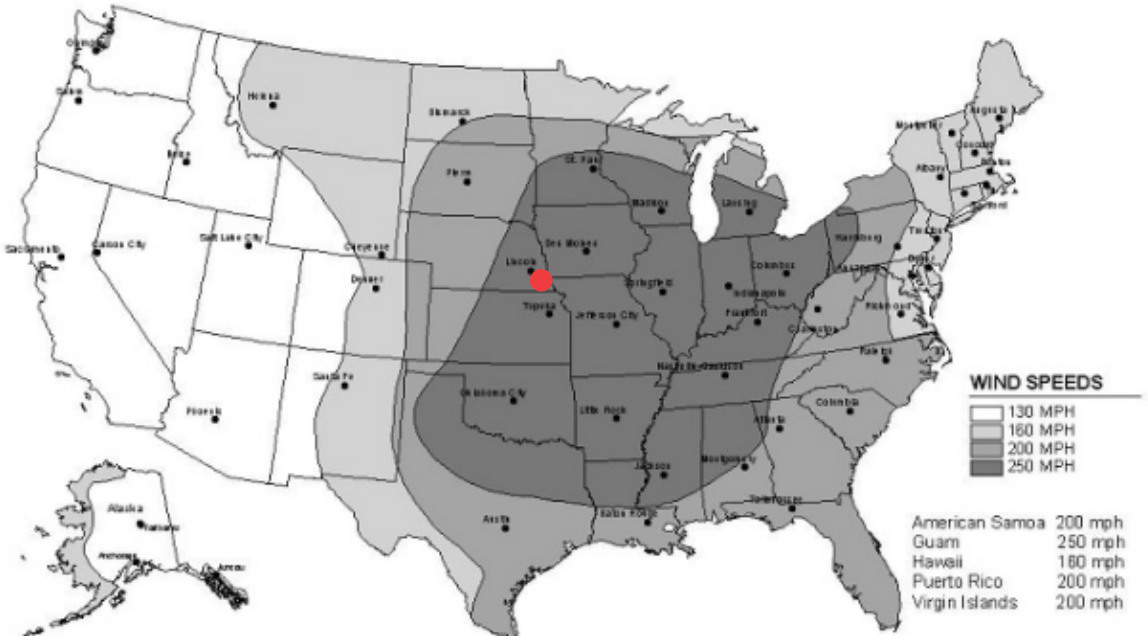
Source: NOAA National Weather Service, Strom Predication Center



● Children's Hospital and Medical Center of Omaha

Site Analysis | Natural Disasters

Storm Shelter Design Wind Speeds, per ICC 500 (2014)



- Omaha, Ne.

Tornado Intensity

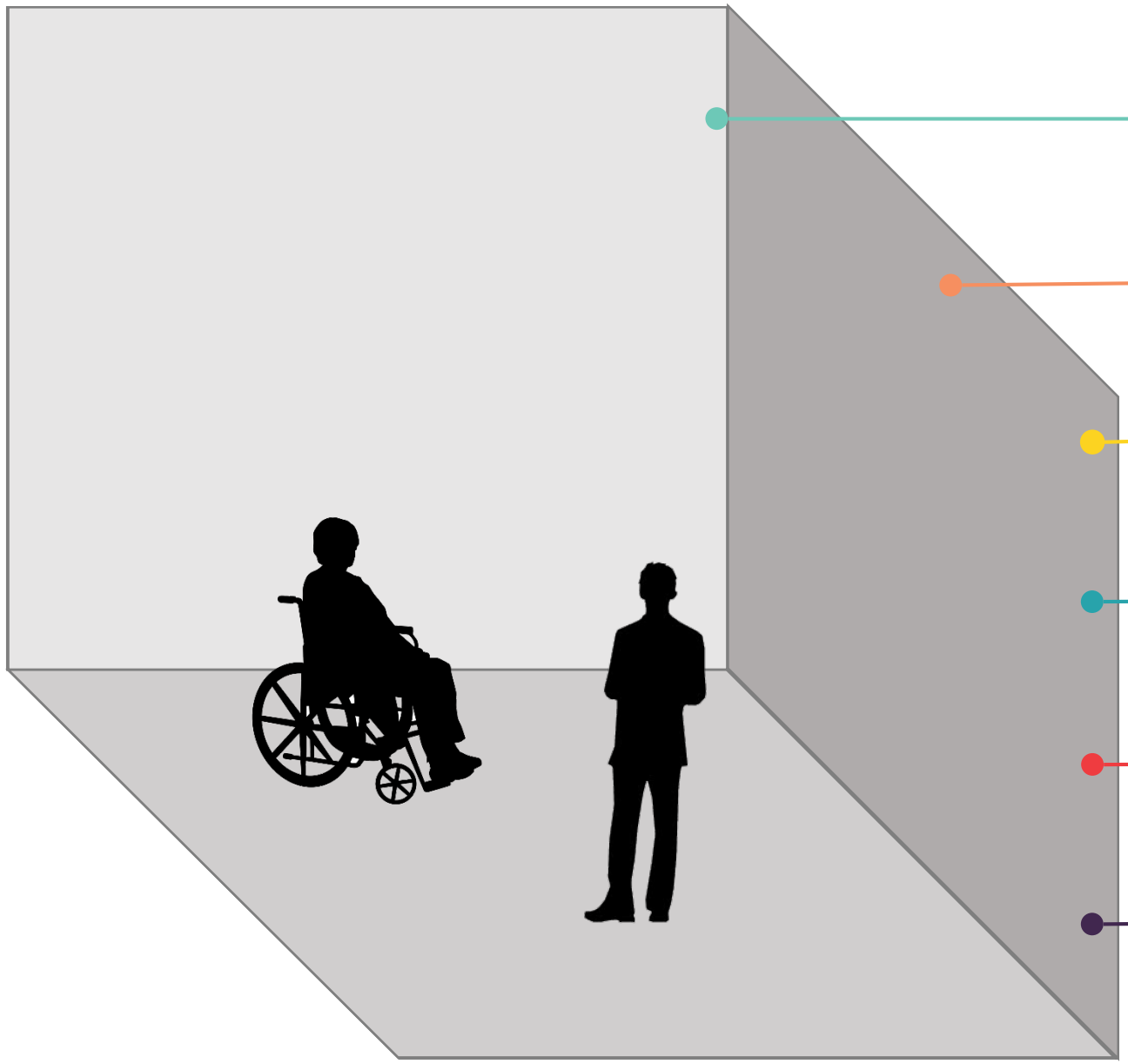
EF Number	Wind Speed (3 second gust)
EF0	65-85 mph
EF1	86-110 mph
EF2	111-135 mph
EF3	136-165 mph
EF4	166-200 mph
EF5	>200 mph

Source: NOAA

ASCE 7-10 Wind Speed
Risk Category IV:
120 mph

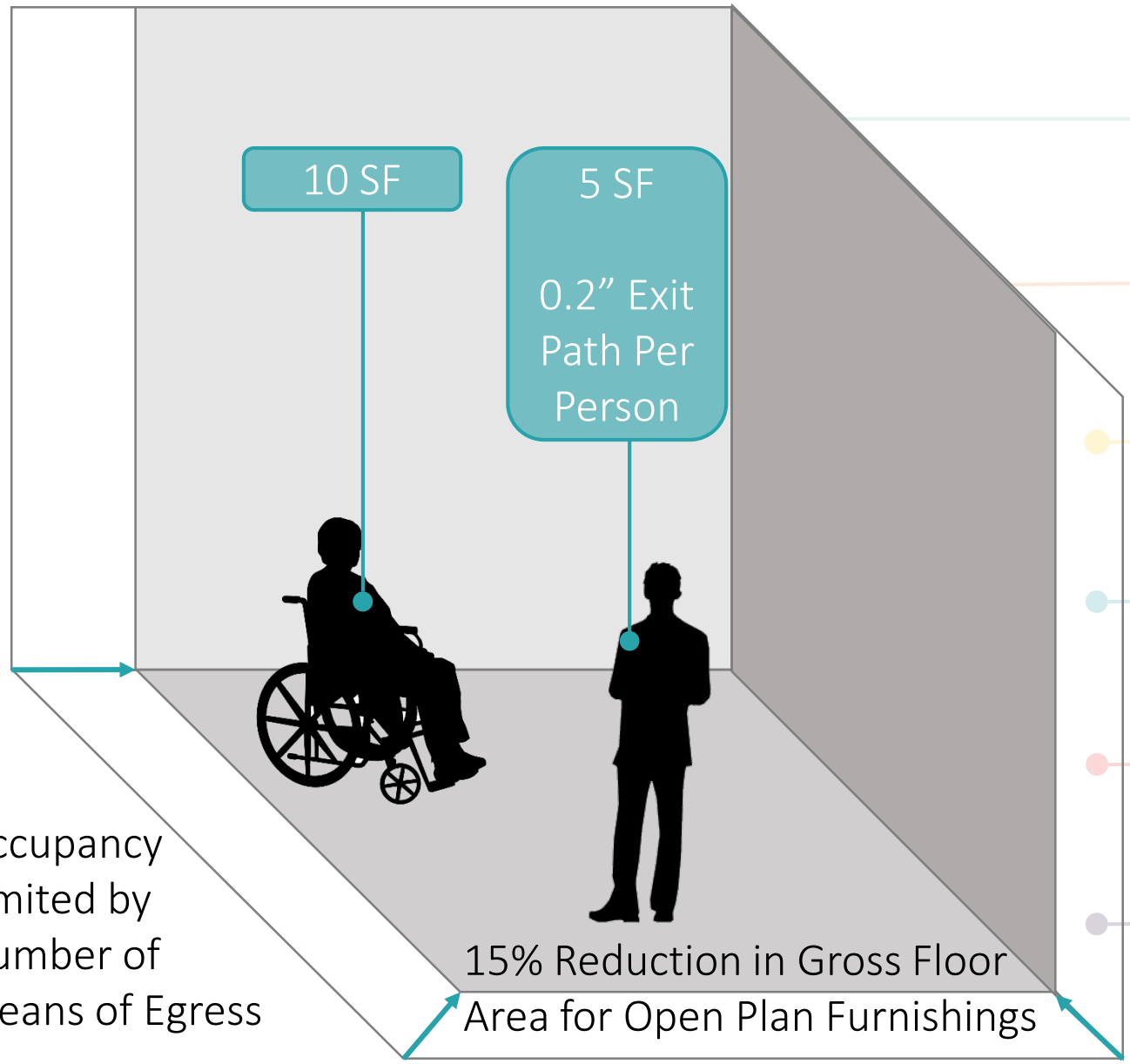
- Children's Hospital and Medical Center of Omaha

Site Analysis | Natural Disasters



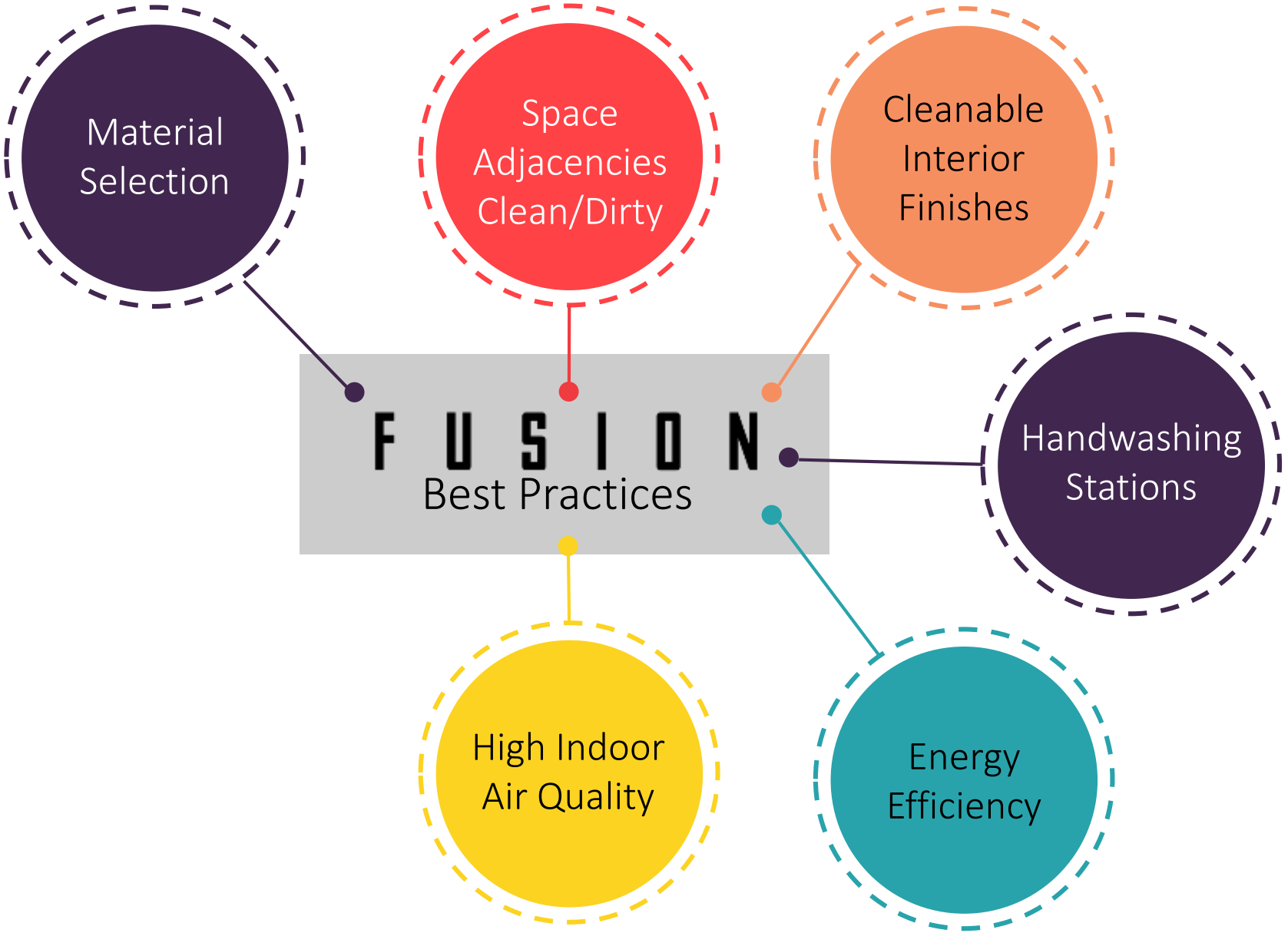
- Emergency Power
- Wind-Borne Debris
- Critical Support Systems
- Material Collapse on Roof
- Tornado Wind Loads
- Minimum Ventilation

Site Analysis | Natural Disasters

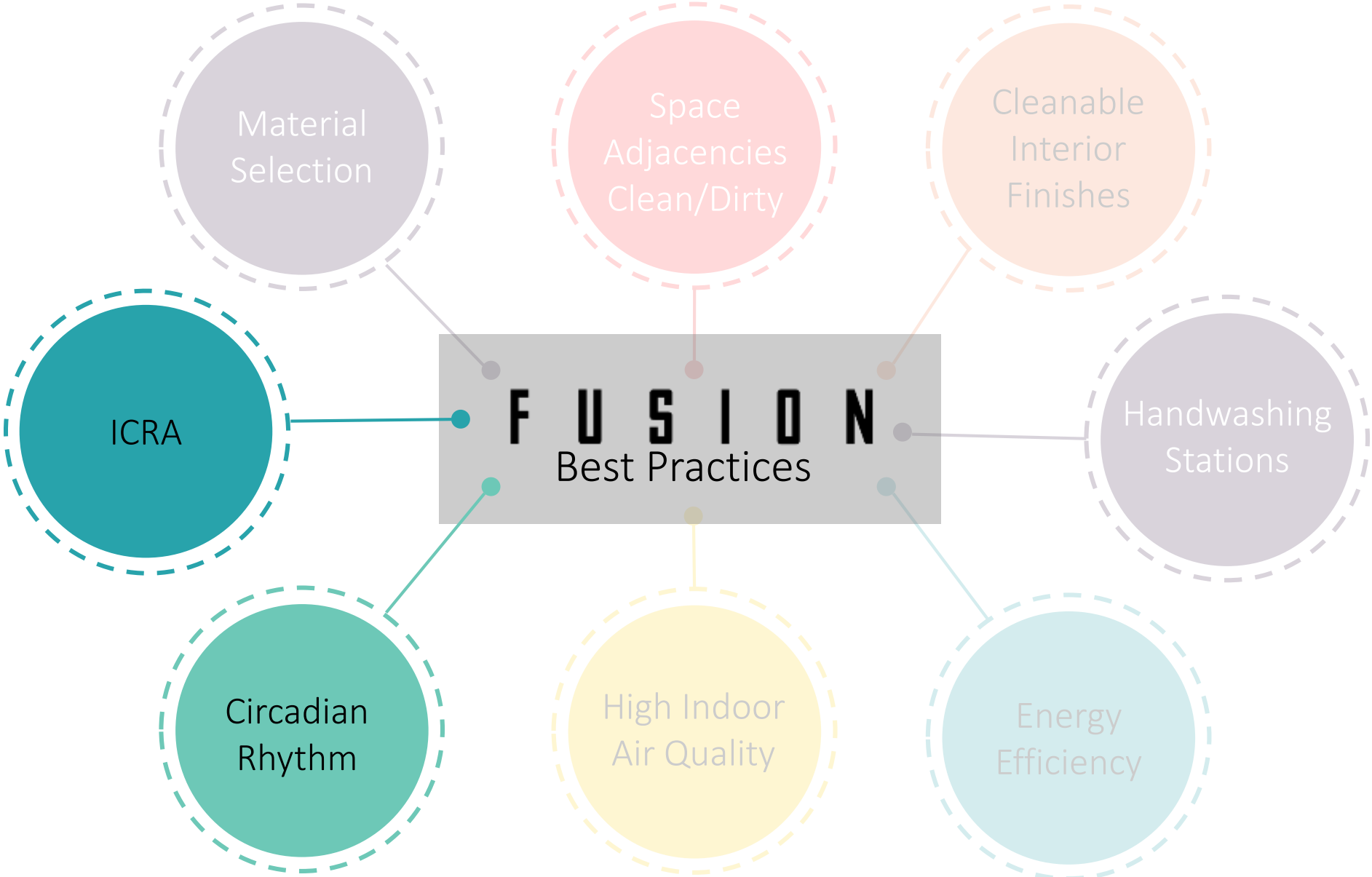


- Emergency Power
- Wind-Borne Debris
- Critical Support Systems
- Material Collapse on Roof
- Tornado Wind Loads
- Minimum Ventilation

Best Practices



Best Practices



04

Execute Design and Evaluation

Integration

Adaptability

Community

Wellness

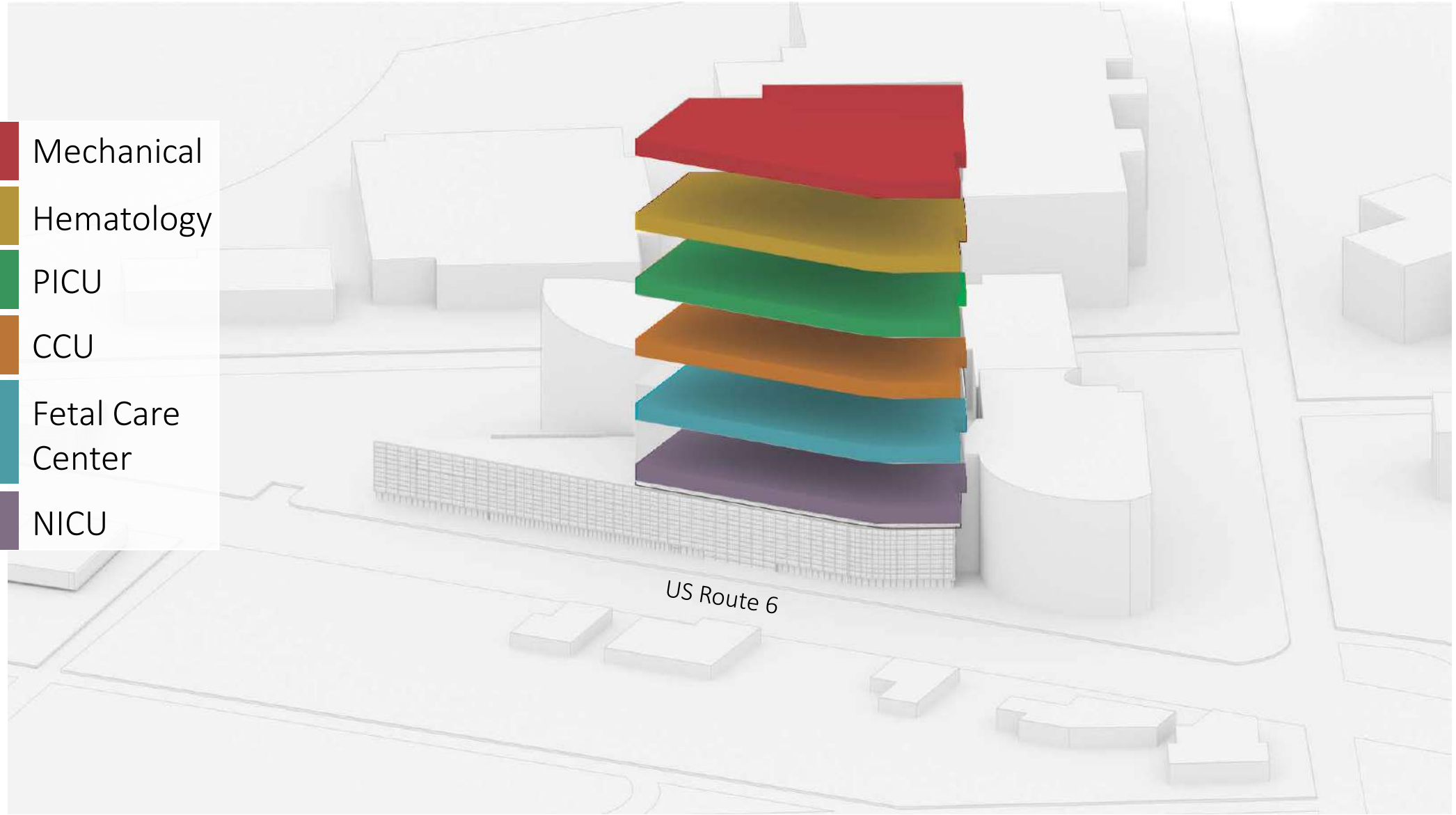
Integration

Floor Reorganization

Enclosure

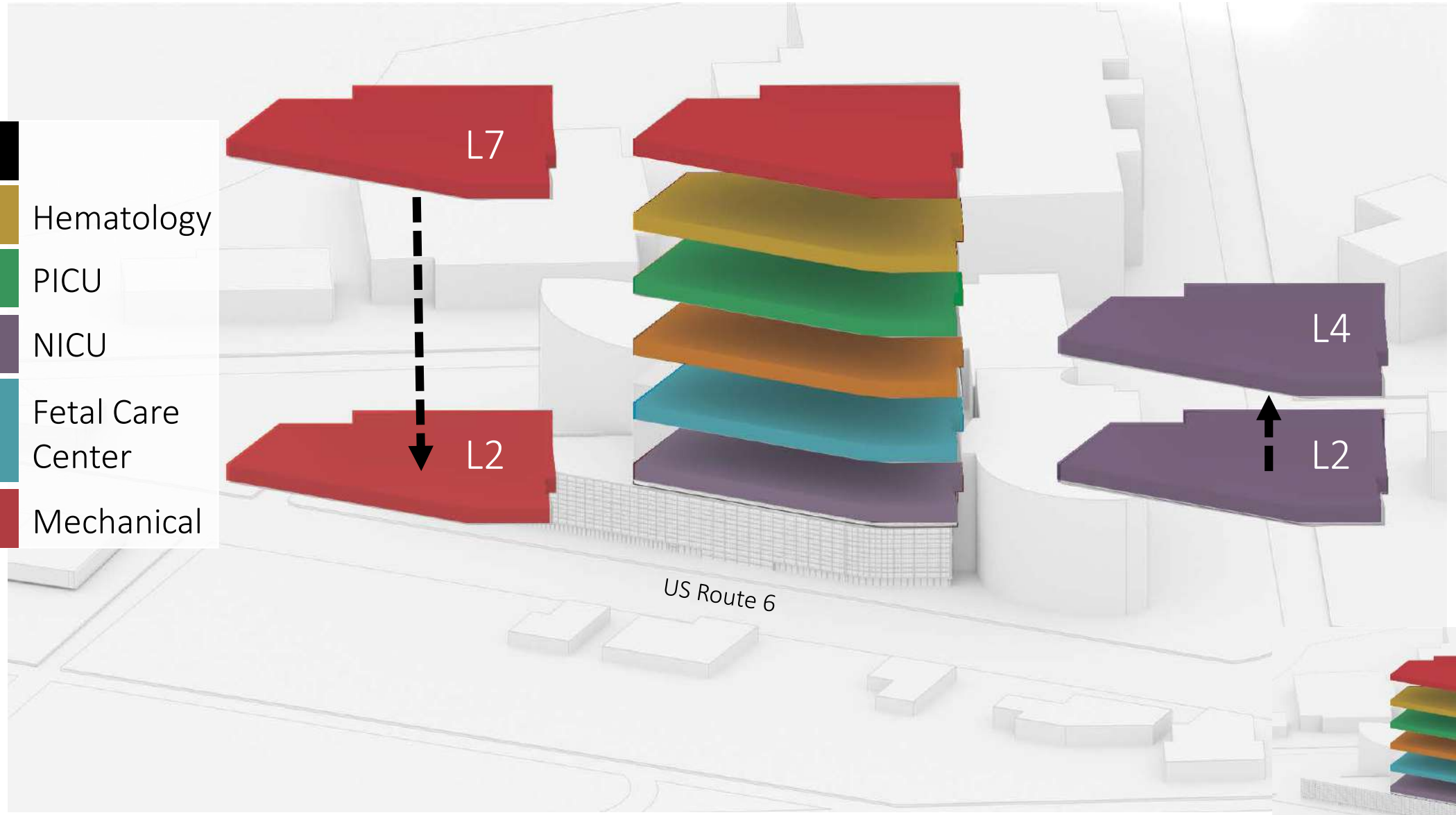
Floor Reorganization

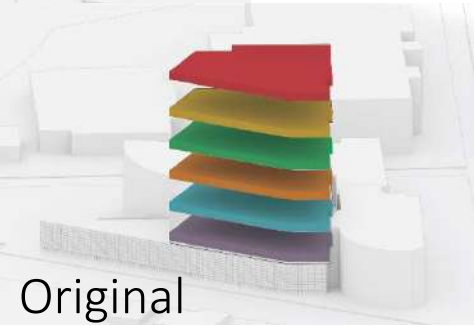
Level 7	Mechanical
Level 6	Hematology
Level 5	PICU
Level 4	CCU
Level 3	Fetal Care Center
Level 2	NICU



Floor Reorganization

Level 7	
Level 6	Hematology
Level 5	PICU
Level 4	NICU
Level 3	Fetal Care Center
Level 2	Mechanical

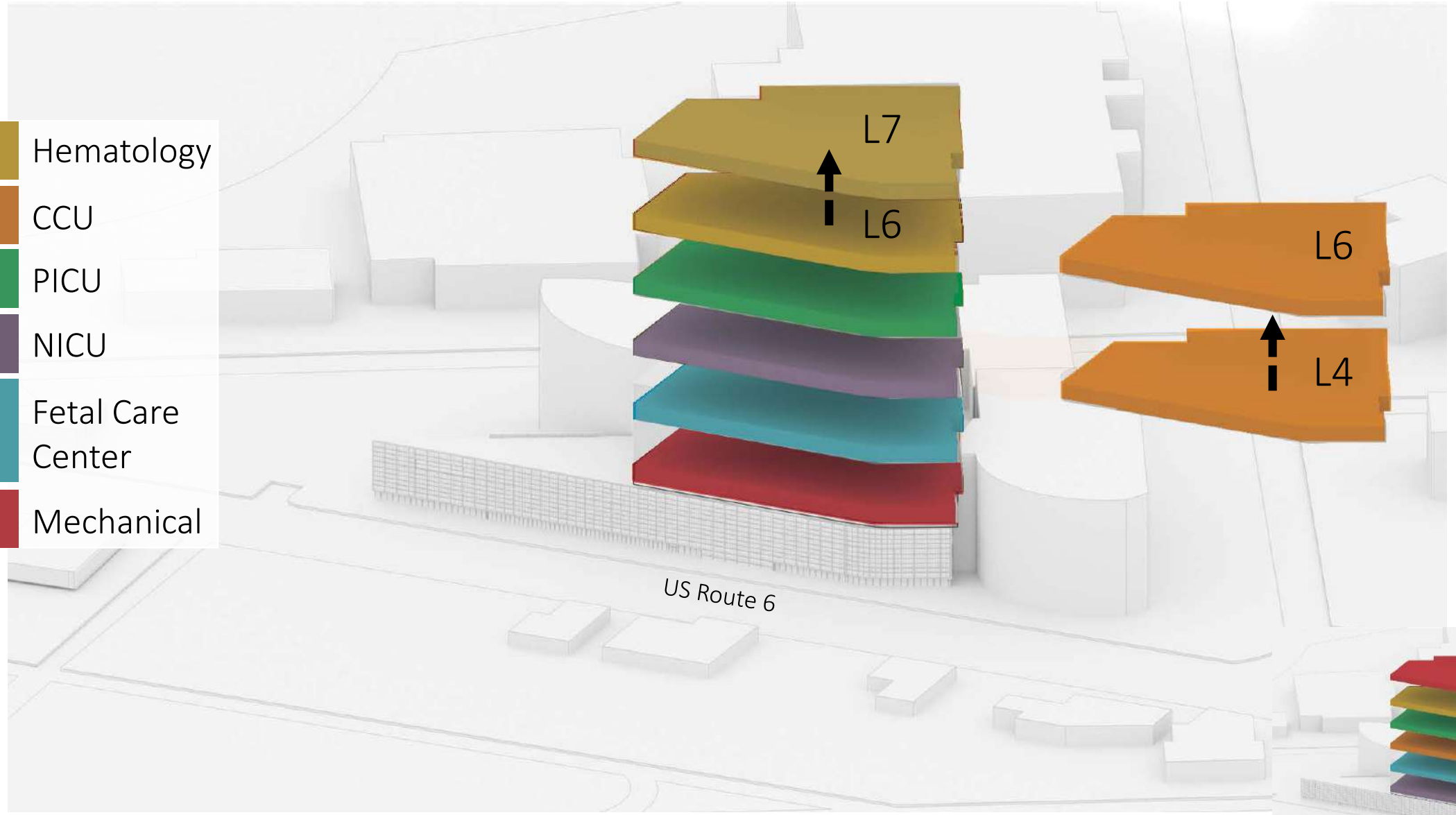


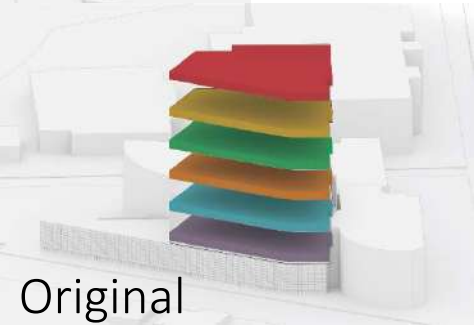


Original

Floor Reorganization

Level 7	Hematology
Level 6	CCU
Level 5	PICU
Level 4	NICU
Level 3	Fetal Care Center
Level 2	Mechanical

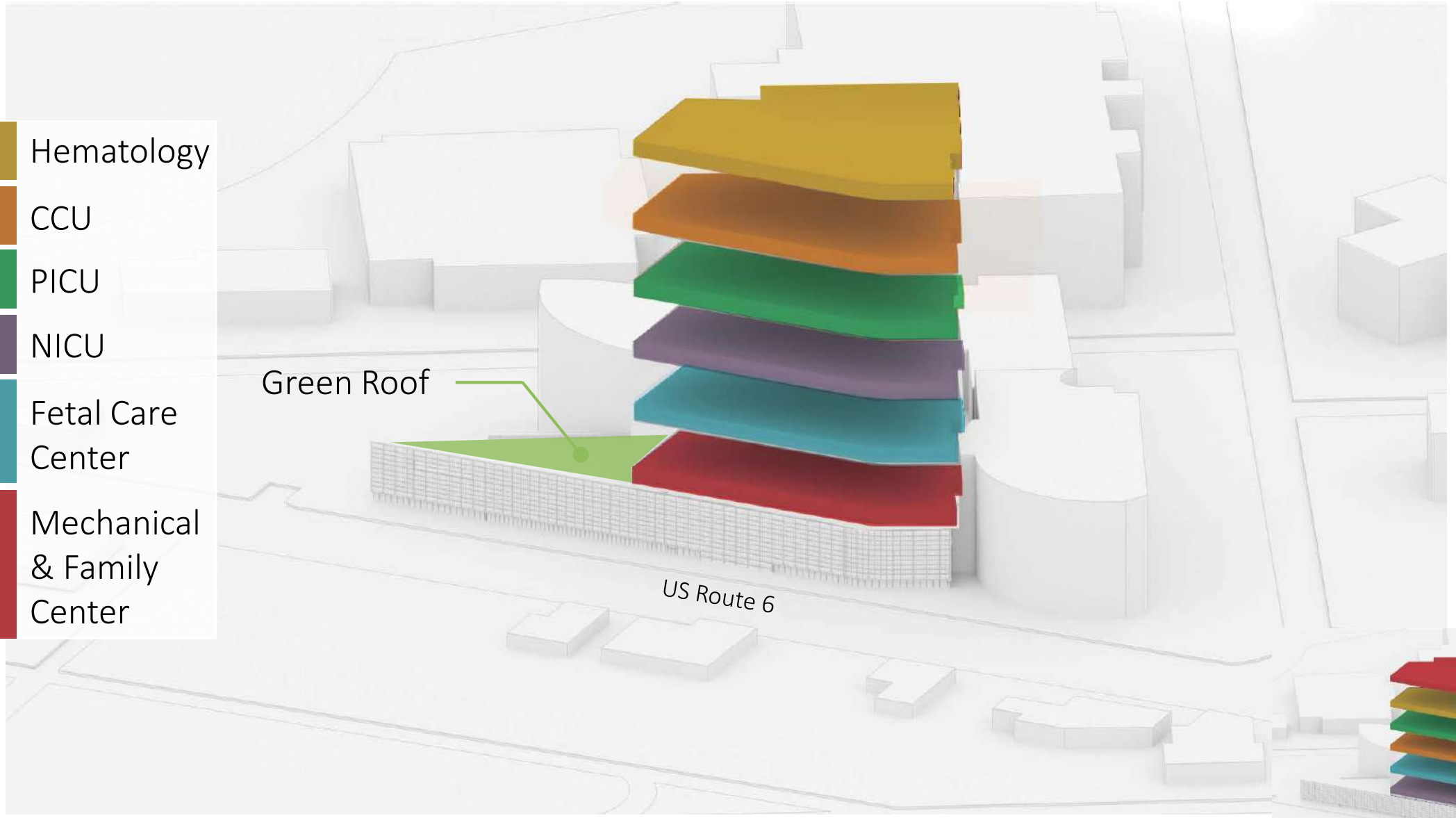




Original

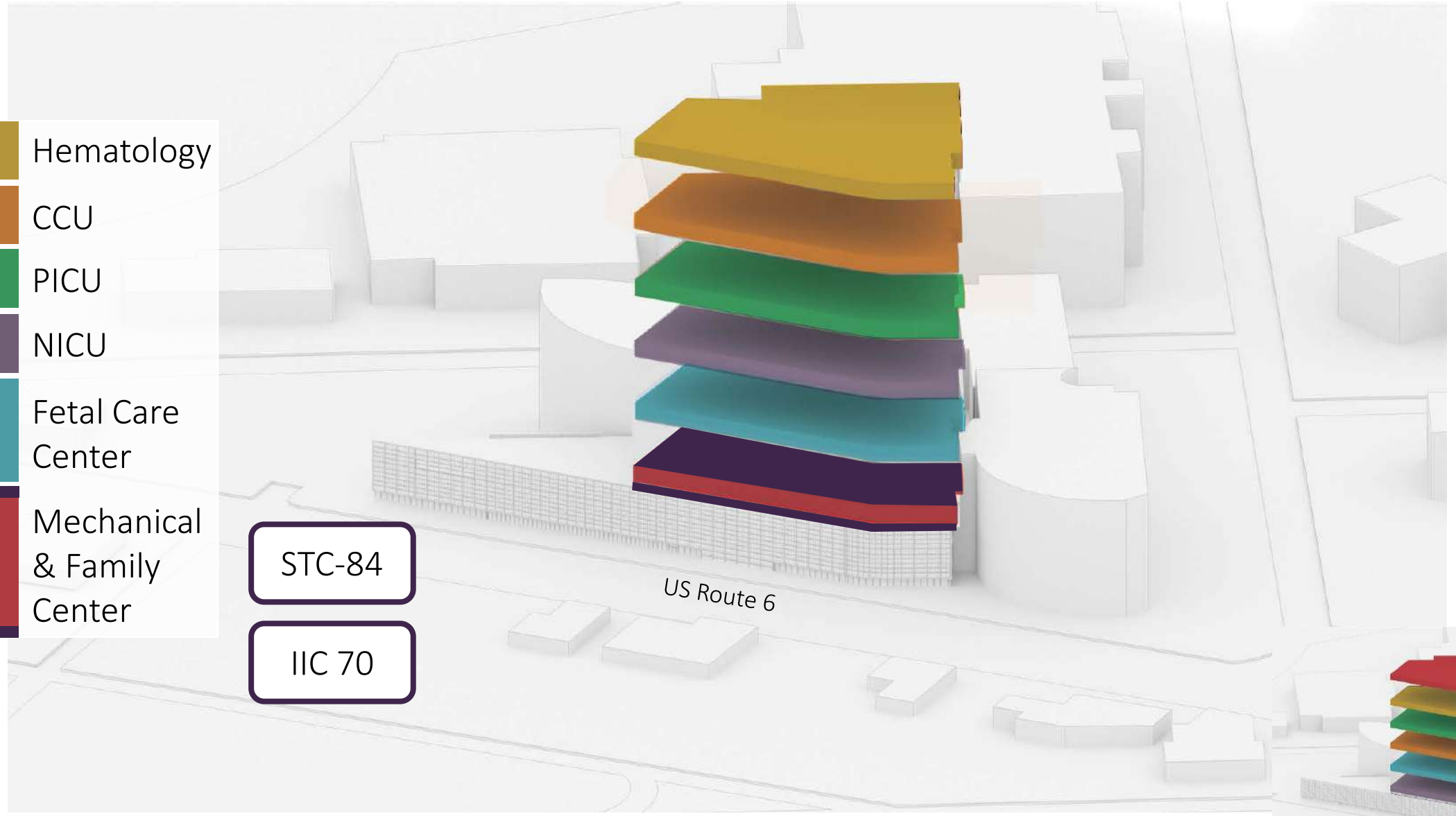
Floor Reorganization

Level 7	Hematology
Level 6	CCU
Level 5	PICU
Level 4	NICU
Level 3	Fetal Care Center
Level 2	Mechanical & Family Center



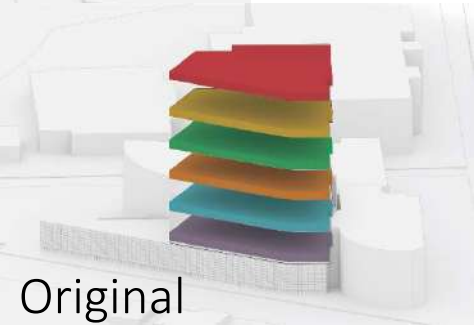
Floor Reorganization | Acoustic Analysis

Level 7	Hematology
Level 6	CCU
Level 5	PICU
Level 4	NICU
Level 3	Fetal Care Center
Level 2	Mechanical & Family Center



STC-84

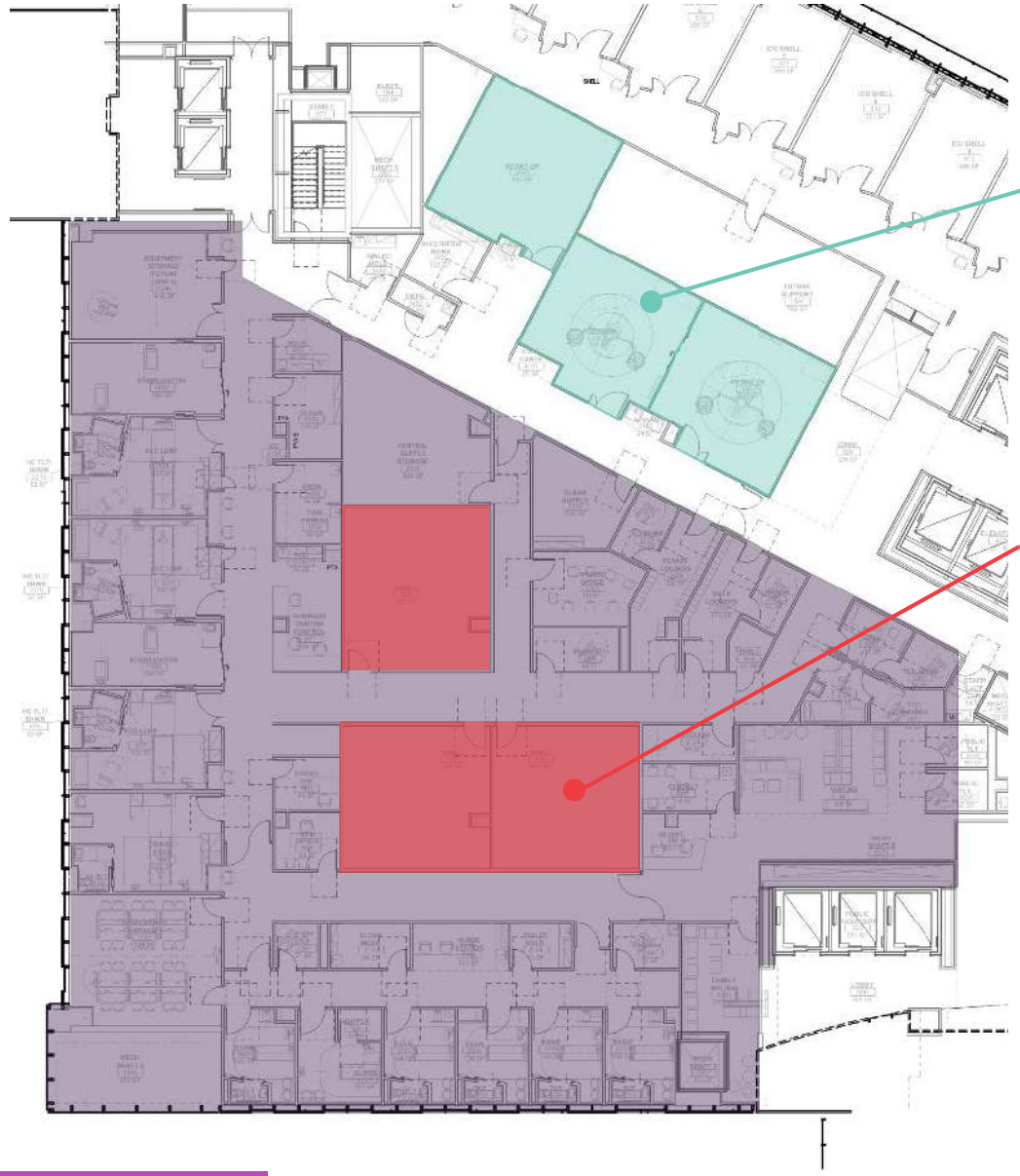
IIC 70



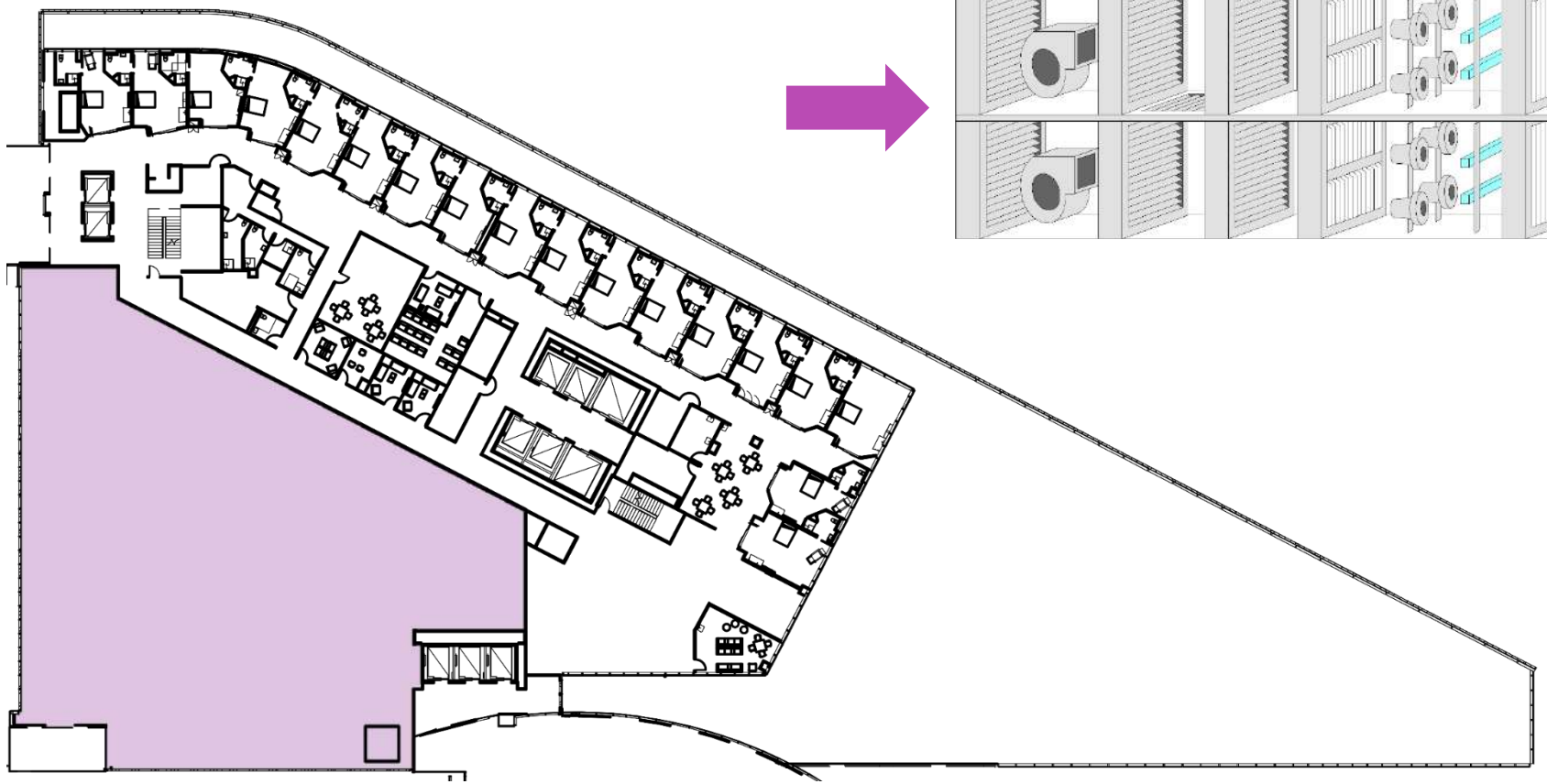
Original

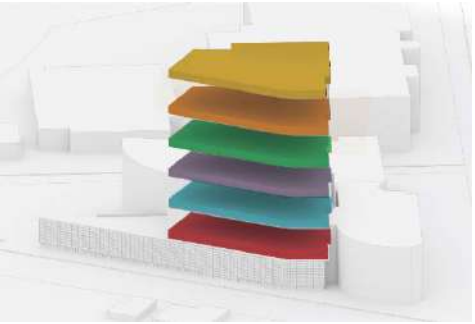
Floor Reorganization | Acoustic Analysis

Level 3



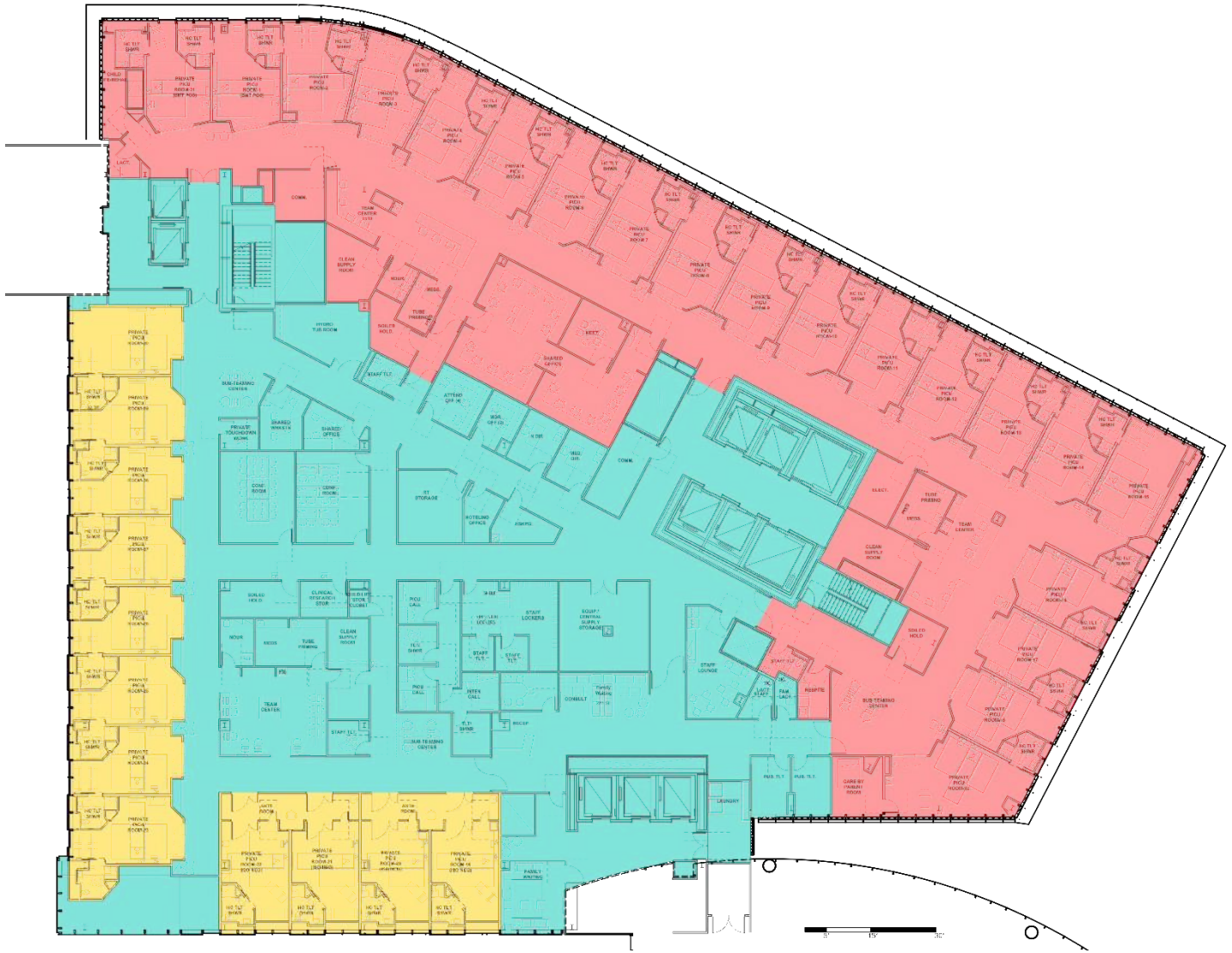
Floor Reorganization | Air Handling Units





Mechanical Room

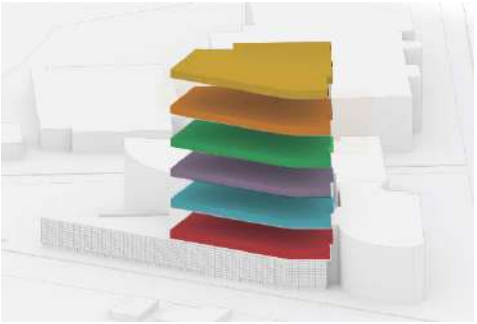
Floor Reorganization | Air Handling Units



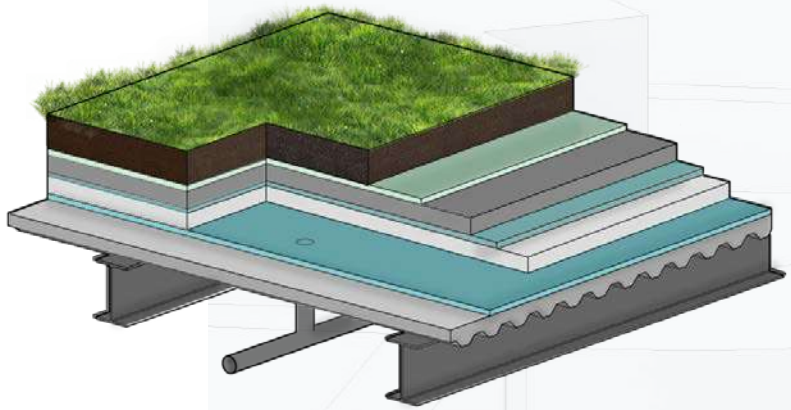
AHU-1

AHU-2

AHU-3

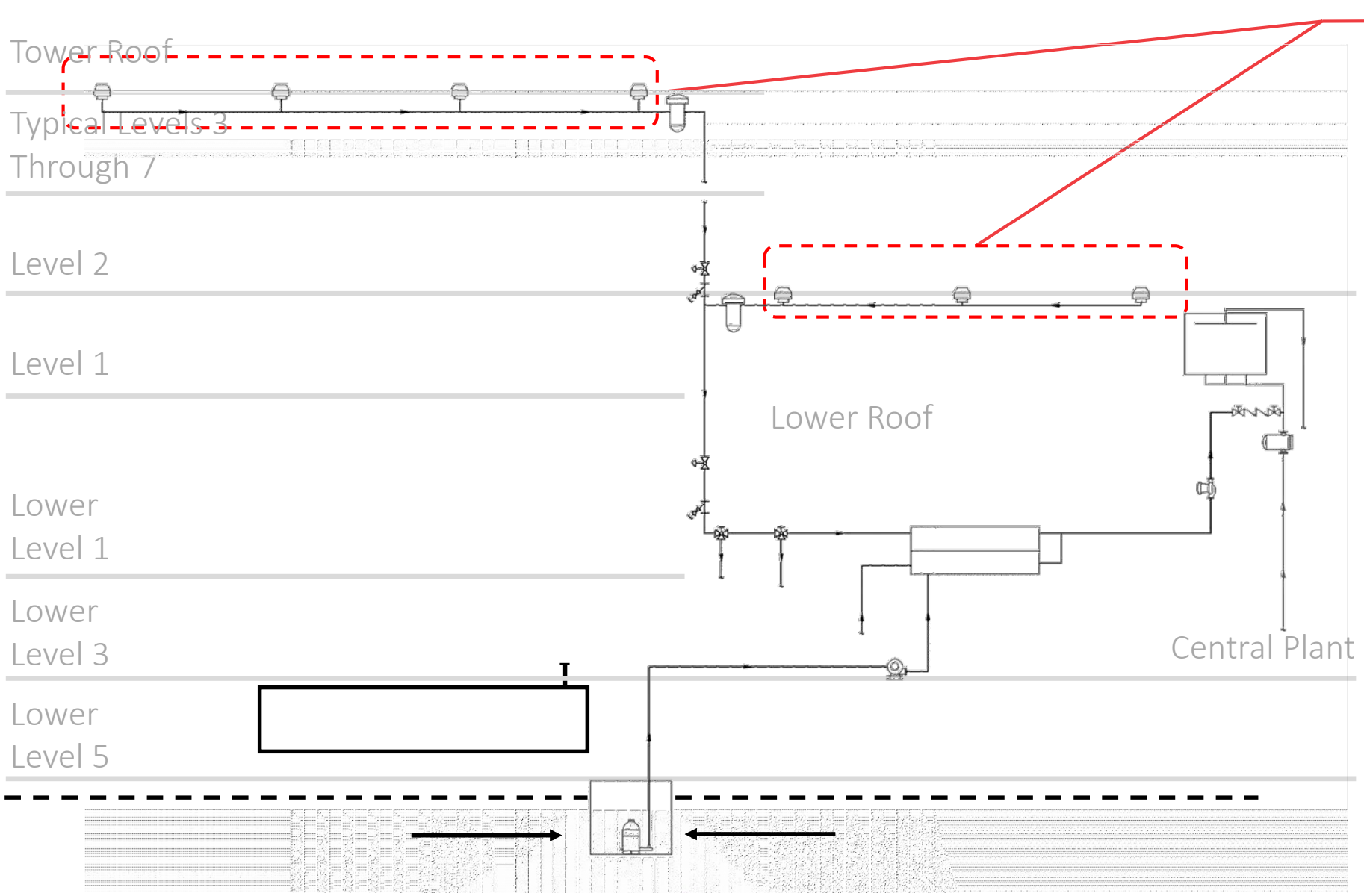


Floor Reorganization | Green Roof

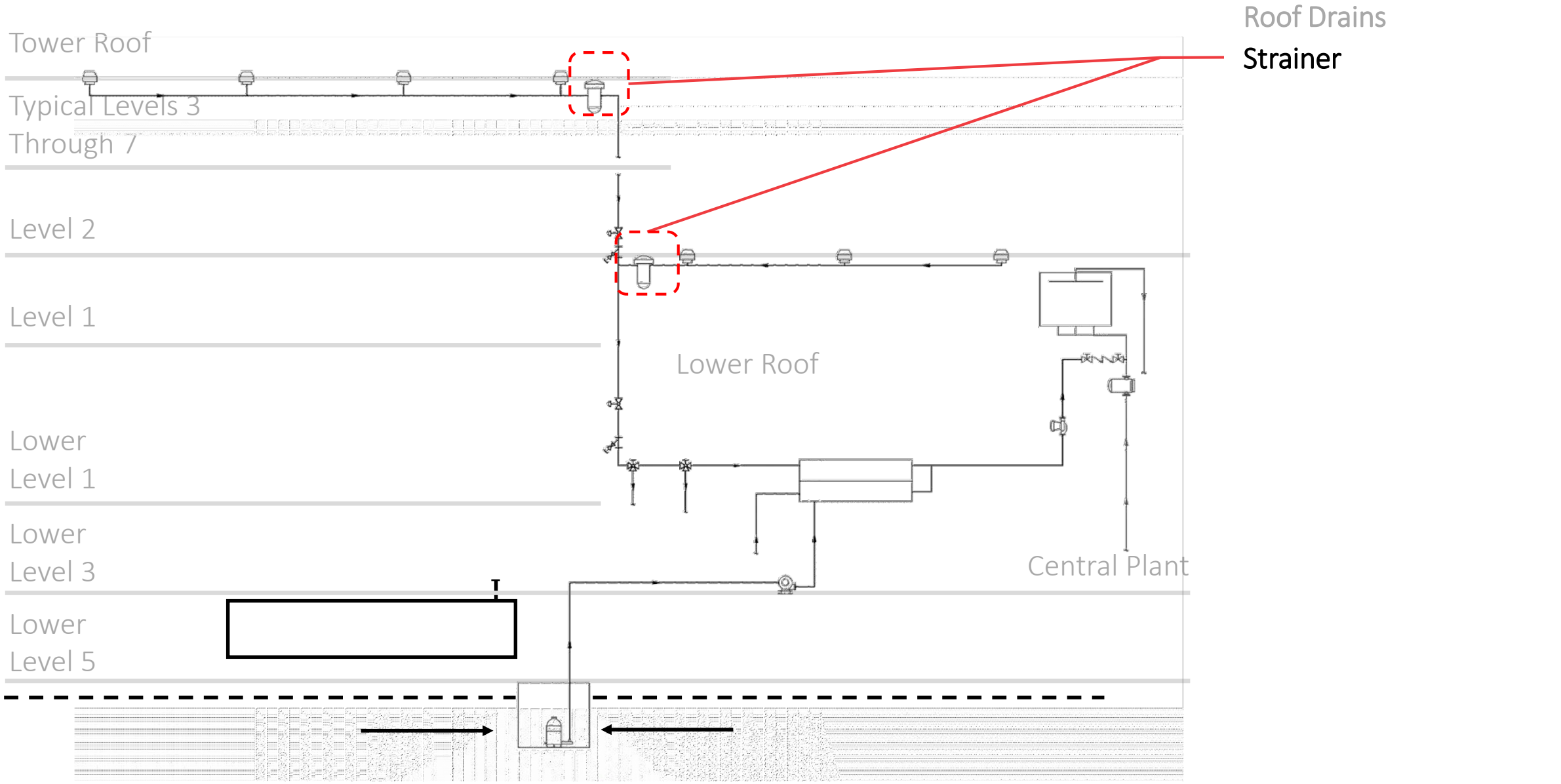


Green Roof Section

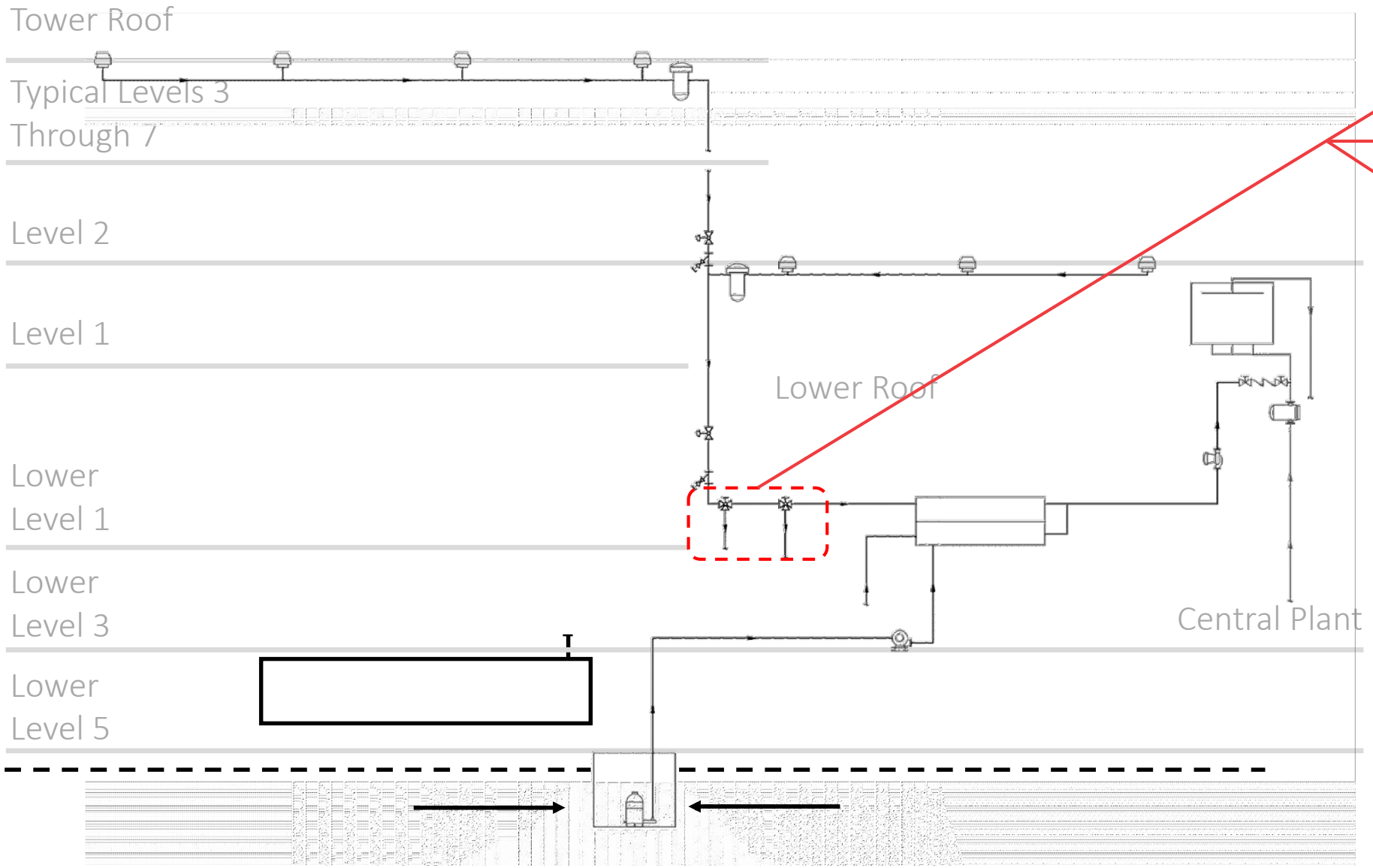
Green Roof | Rainwater Collection System



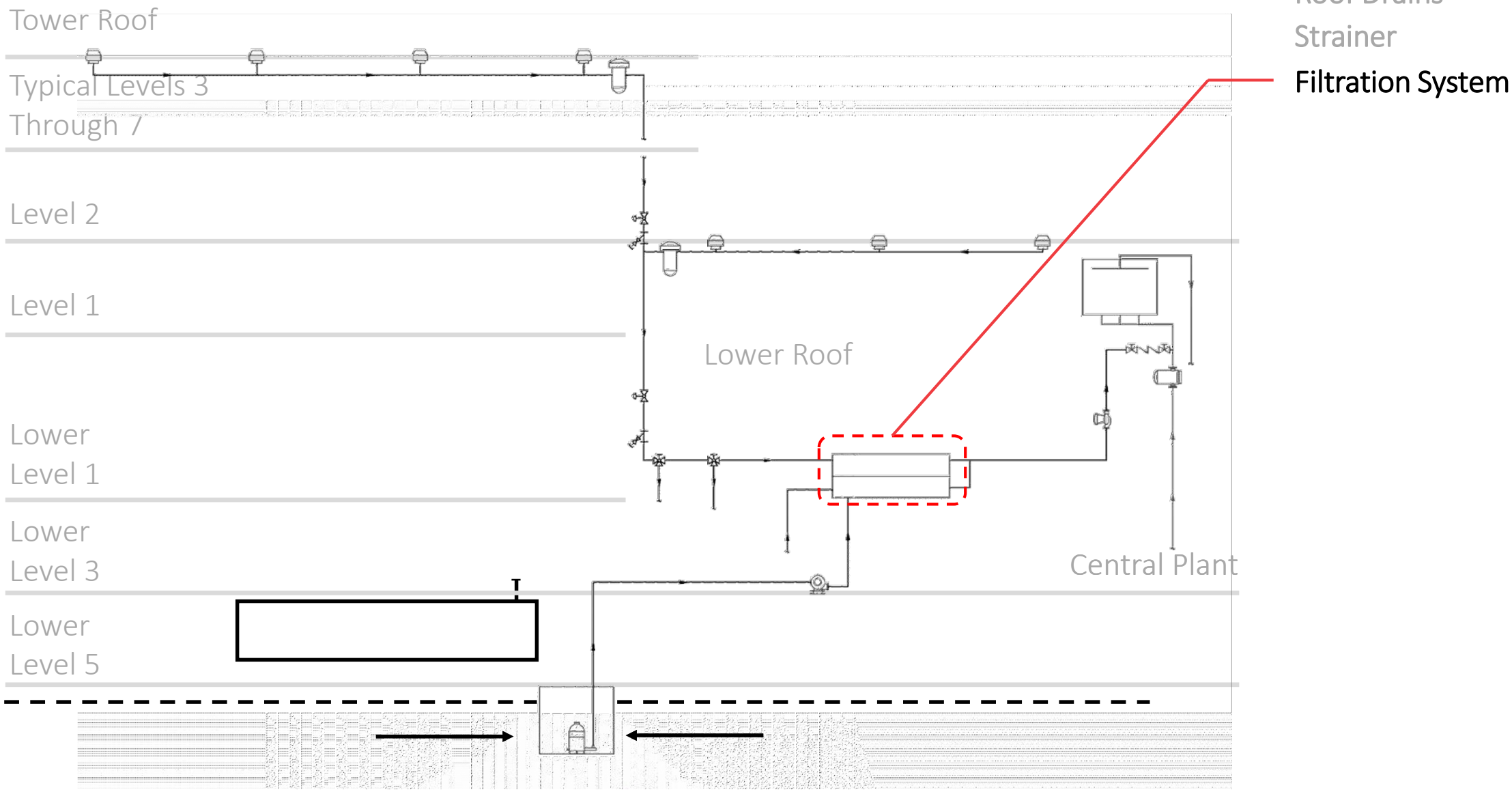
Green Roof | Rainwater Collection System



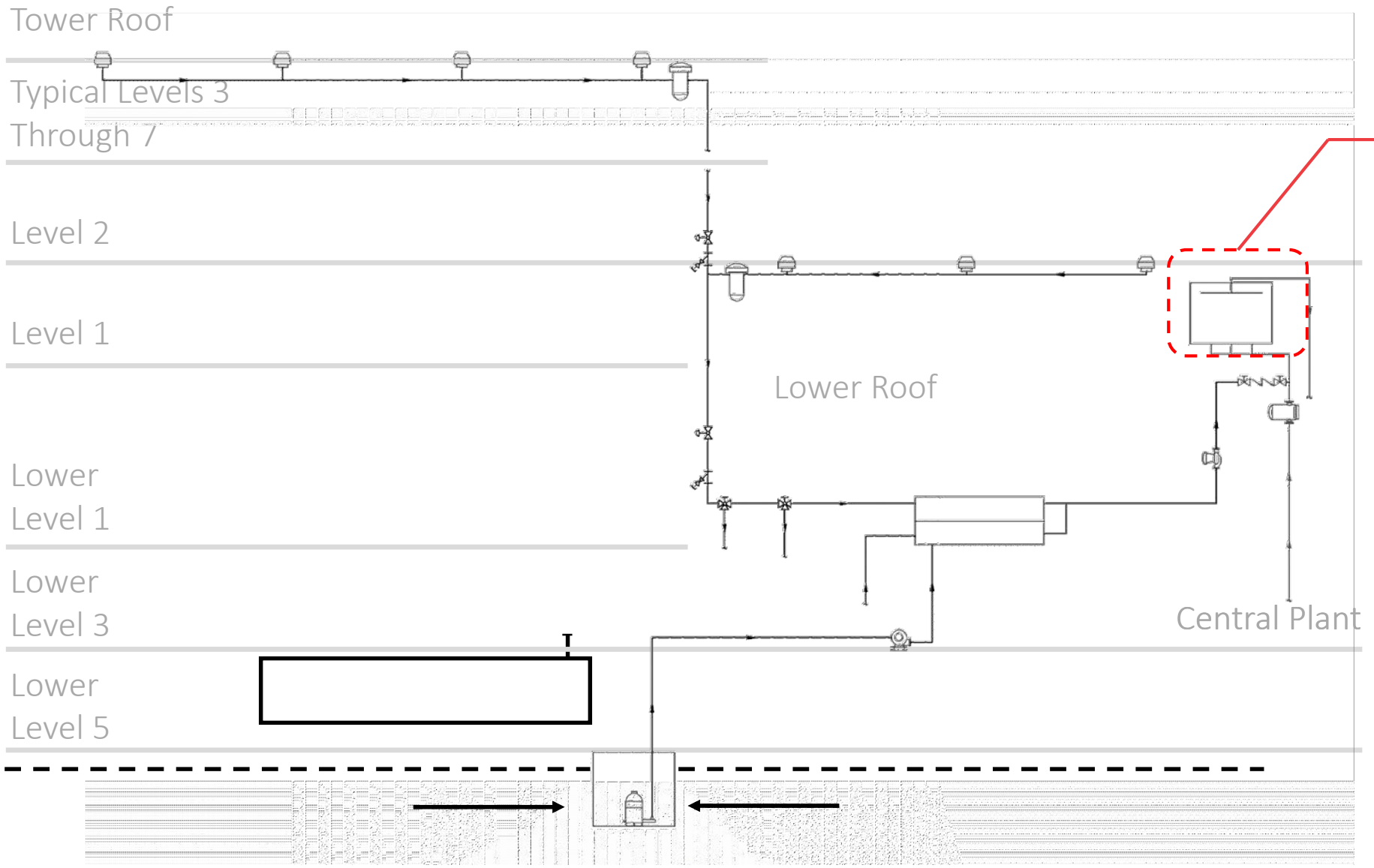
Green Roof | Rainwater Collection System



Green Roof | Rainwater Collection System



Green Roof | Rainwater Collection System



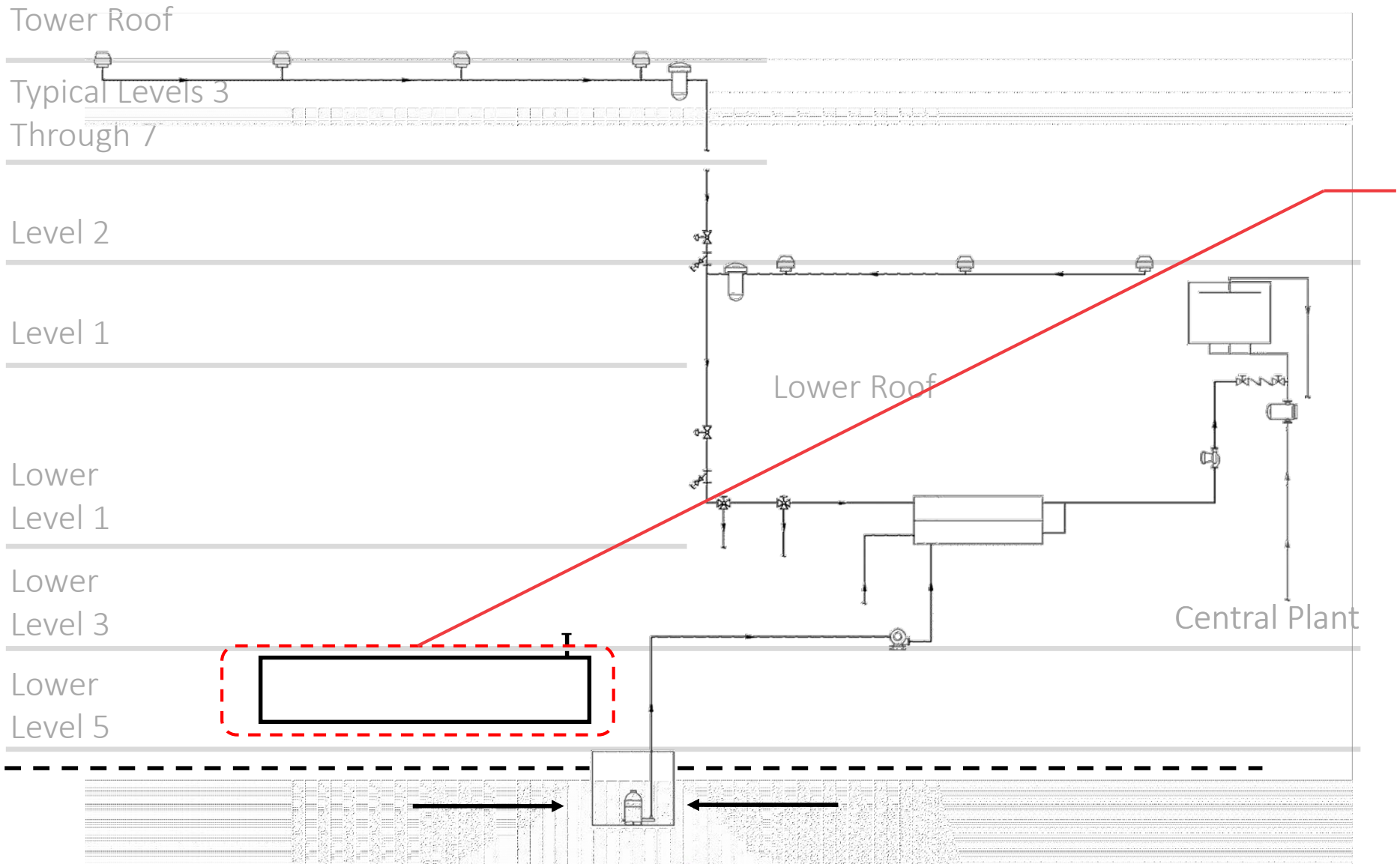
Roof Drains

Strainer

Filtration System

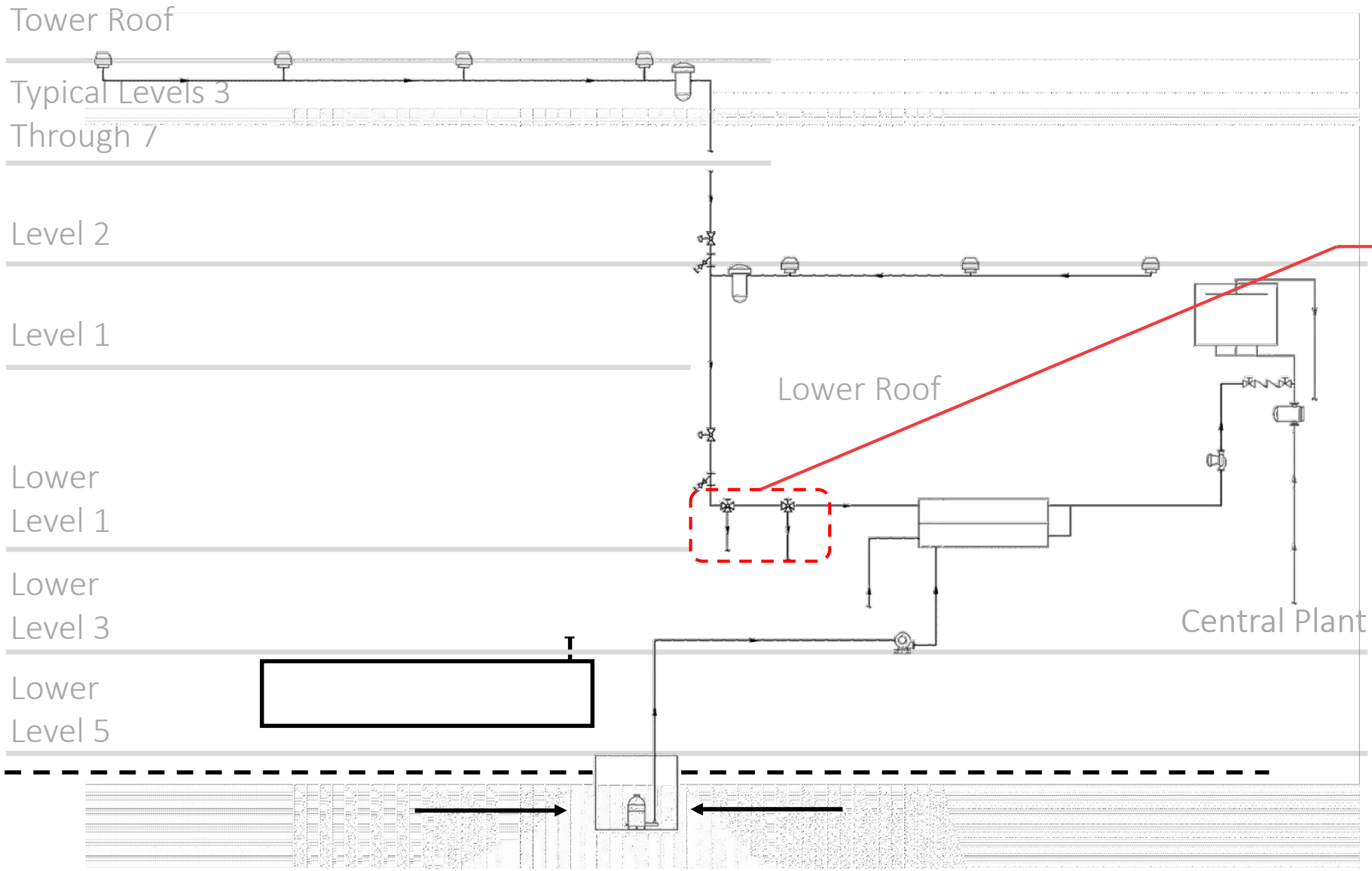
Cooling Tower

Green Roof | Rainwater Collection System



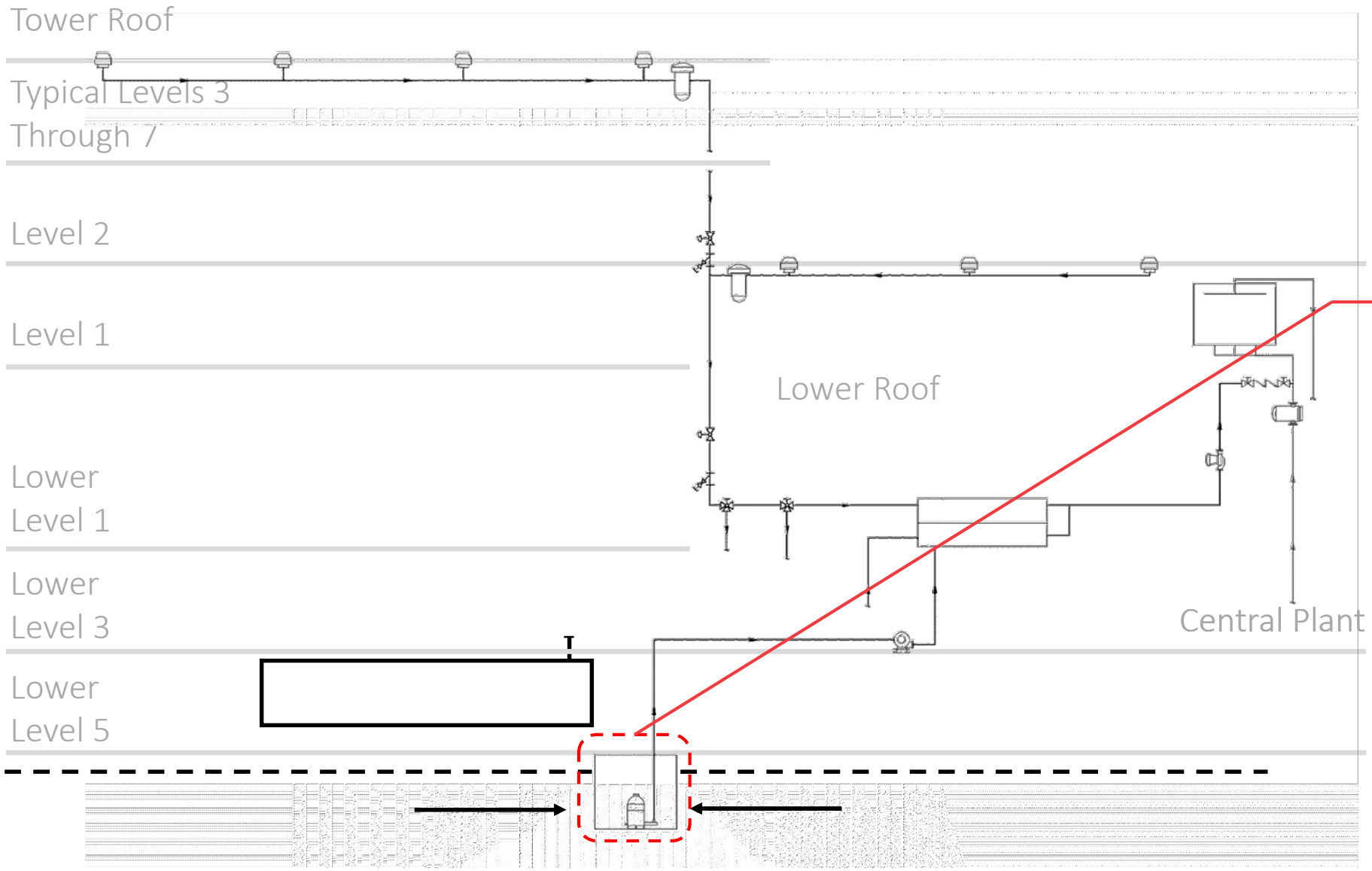
Roof Drains
Strainer
Filtration System
Cooling Tower
Storage Tanks

Green Roof | Rainwater Collection System



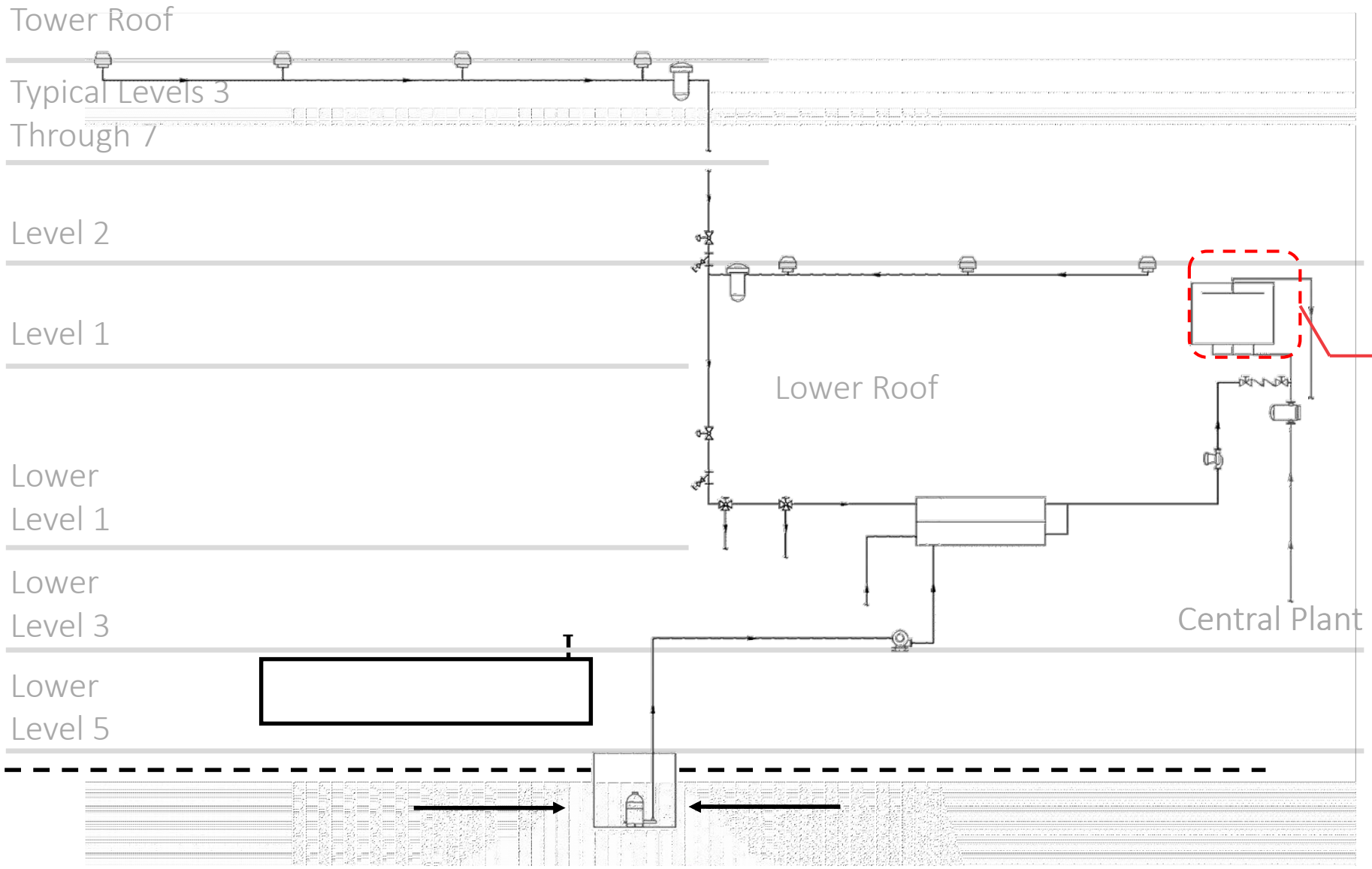
Roof Drains
Strainer
Filtration System
Cooling Tower
Storage Tanks
Overflow System

Green Roof | Rainwater Collection System



Roof Drains
Strainer
Filtration System
Cooling Tower
Storage Tanks
Overflow System
Collection Cistern

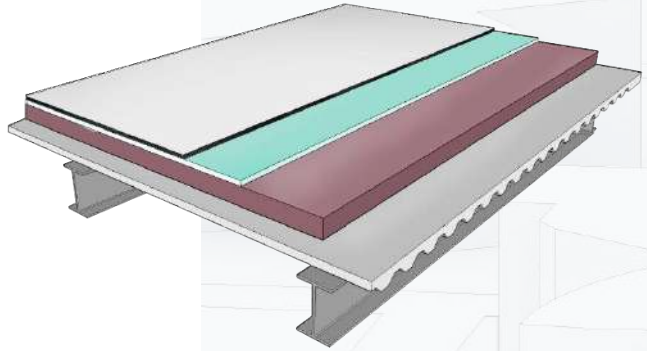
Green Roof | Rainwater Collection System



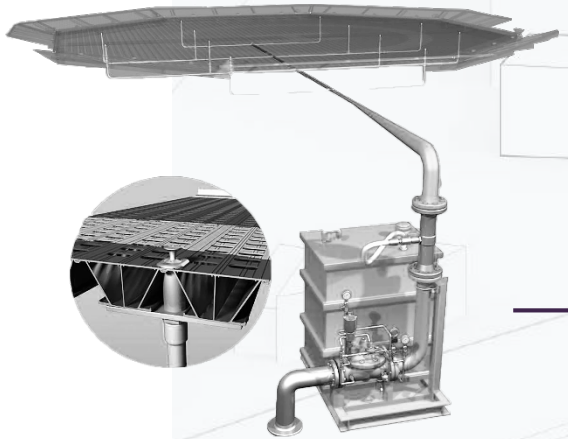
Roof Drains
Strainer
Filtration System
Cooling Tower
Storage Tanks
Overflow System
Collection Cistern
Cooling Tower

36% Make Up Water Savings

Helipad



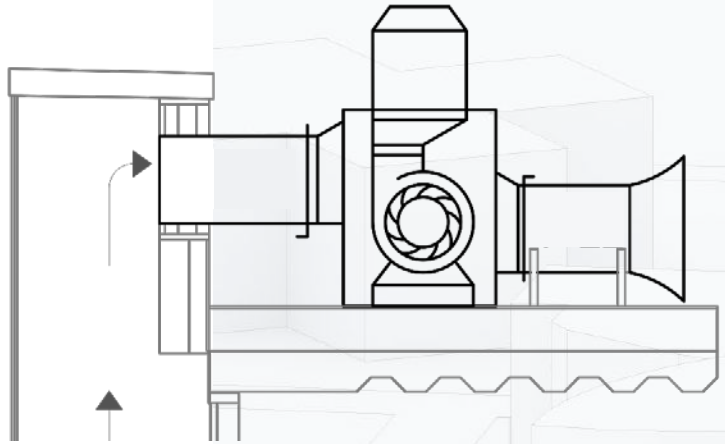
PVC Single-Ply Membrane



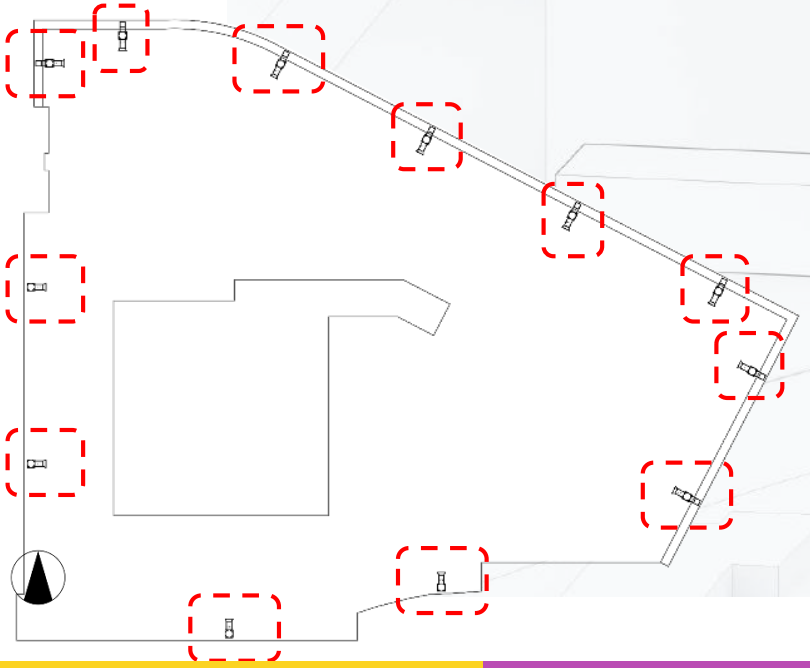
Integrated Fire Protection System

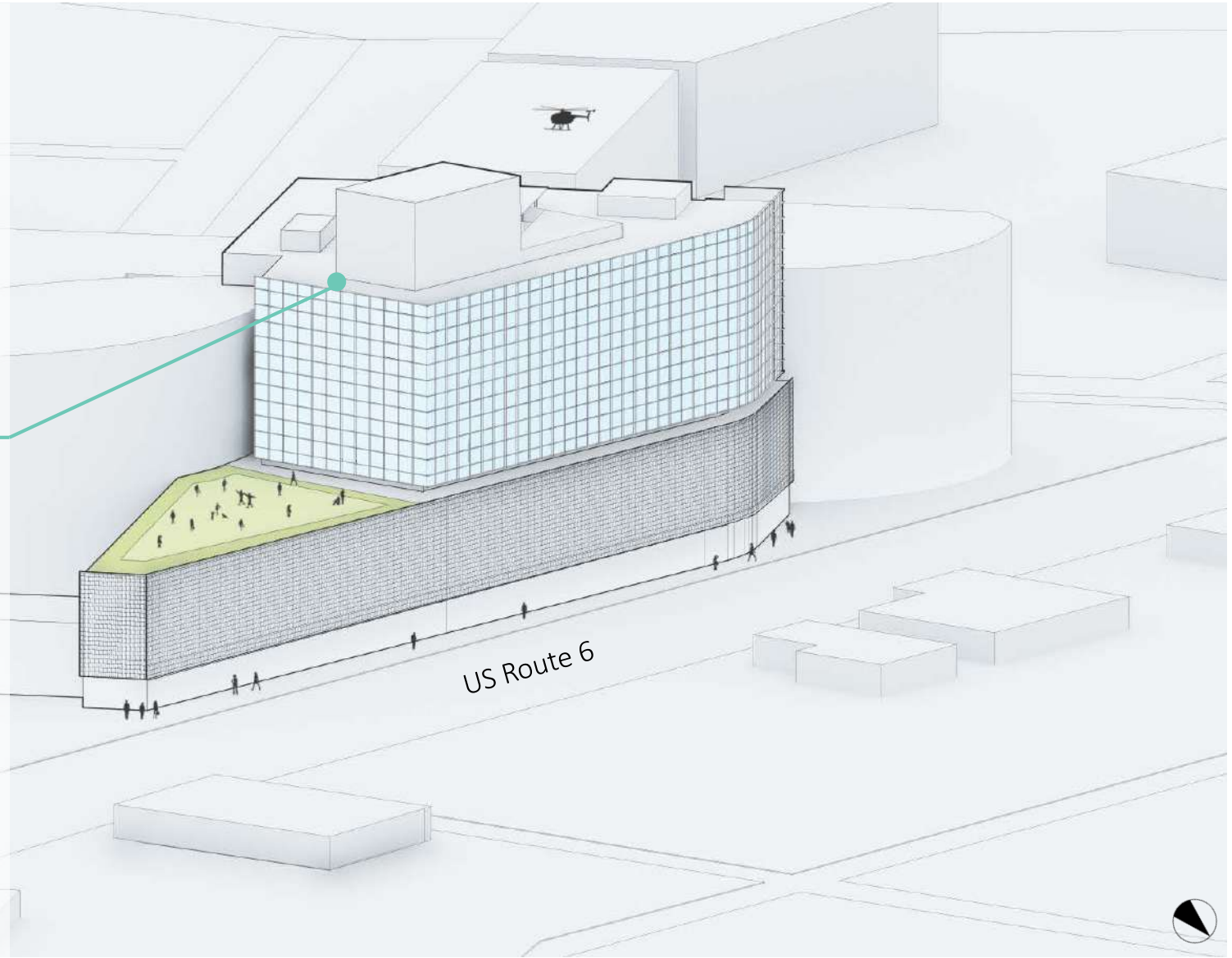
US Route 6

Helipad | Exhaust System

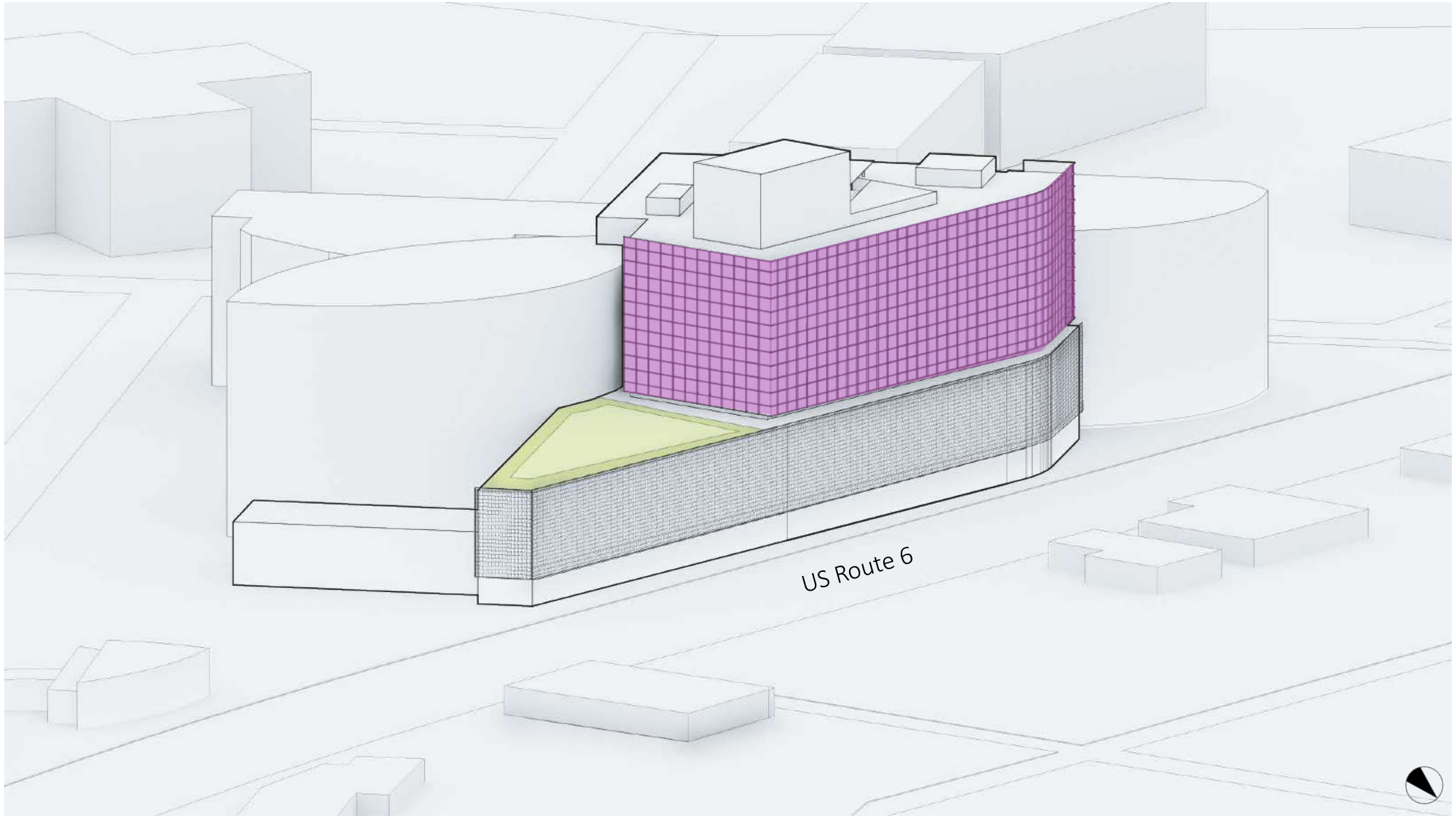


Helicopter Exhaust System

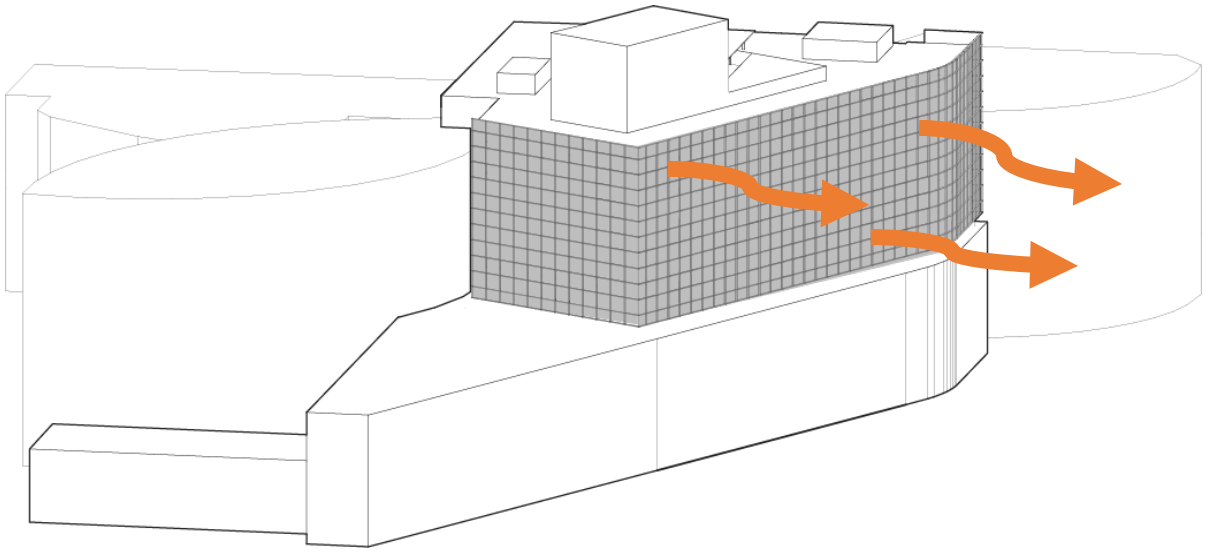




Double Skin Façade



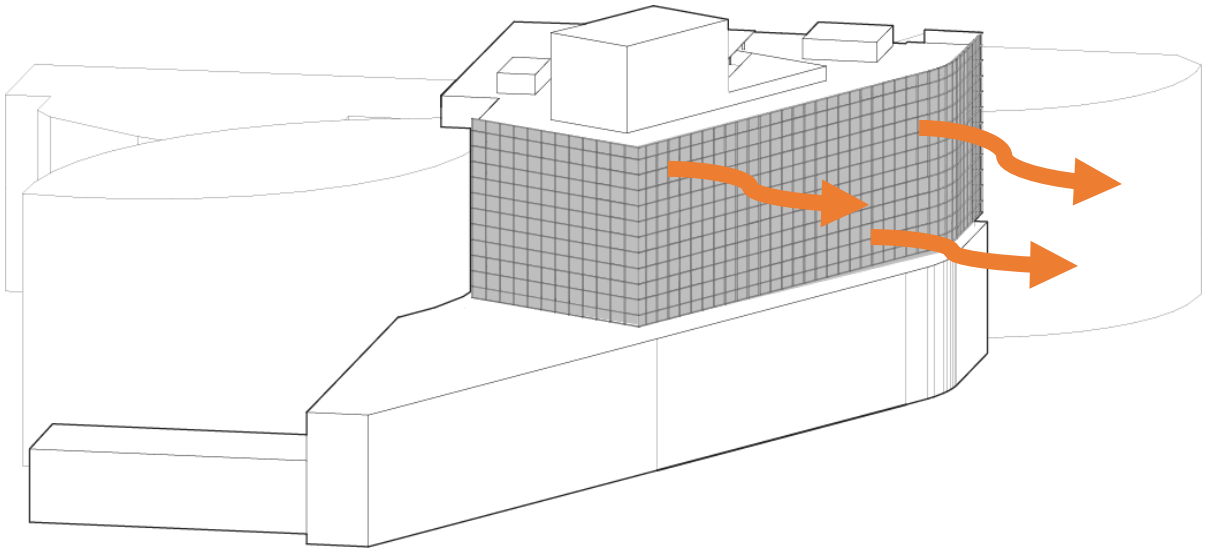
Double Skin Façade | Envelope Energy Loss

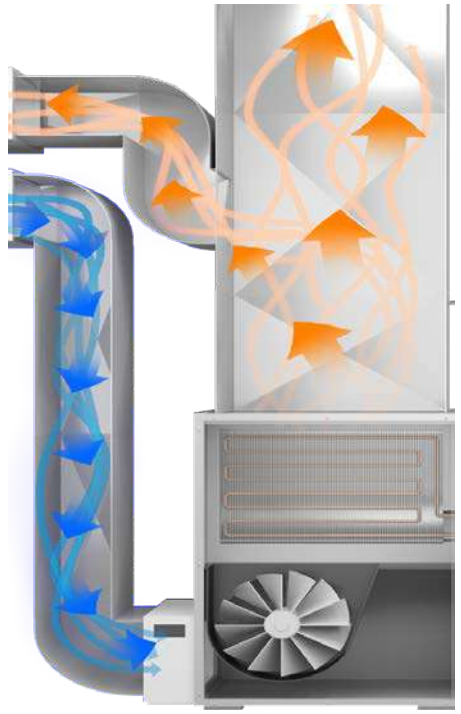


1.76 MMBtu/hr heating

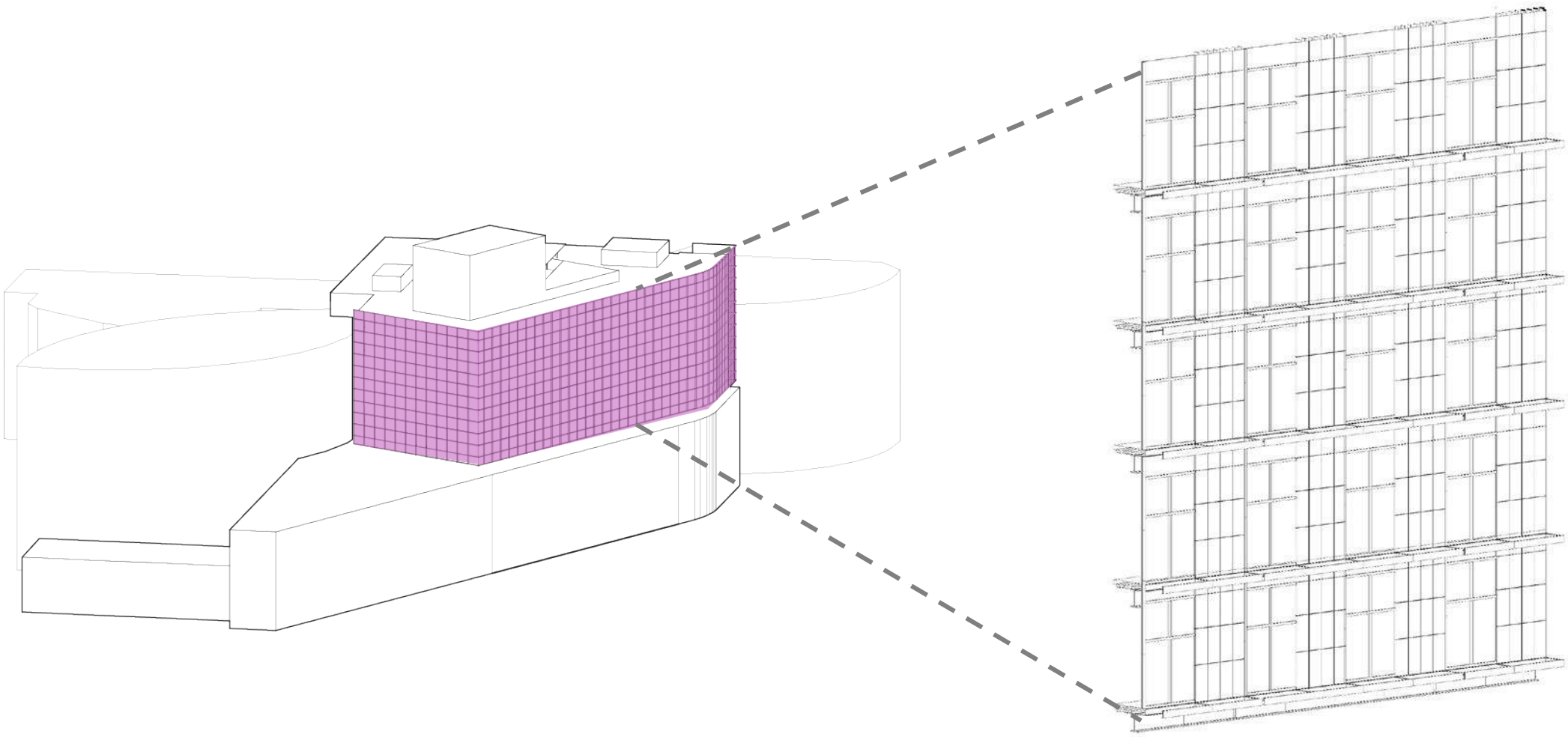
2.14 MMBtu/hr cooling

Double Skin Façade | Energy Within Relief Air

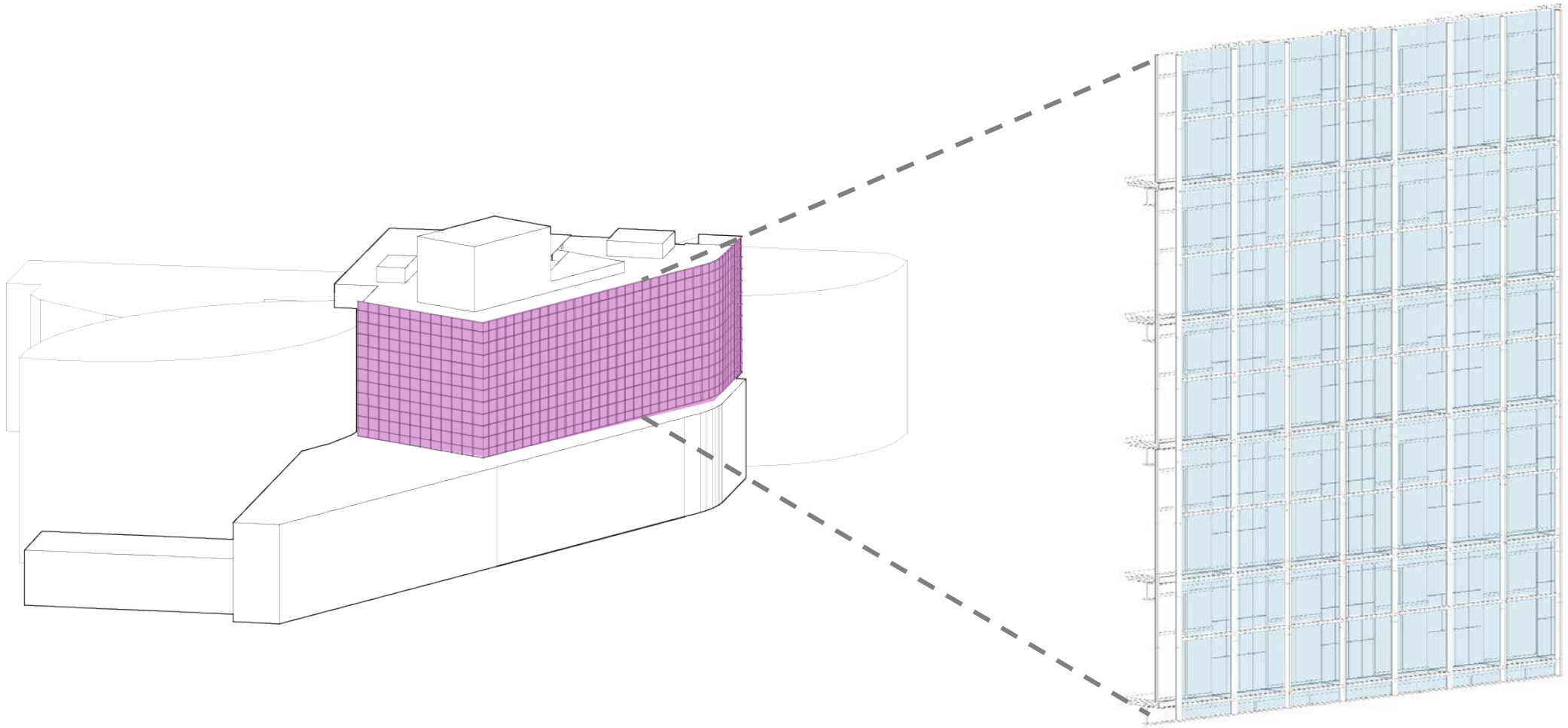




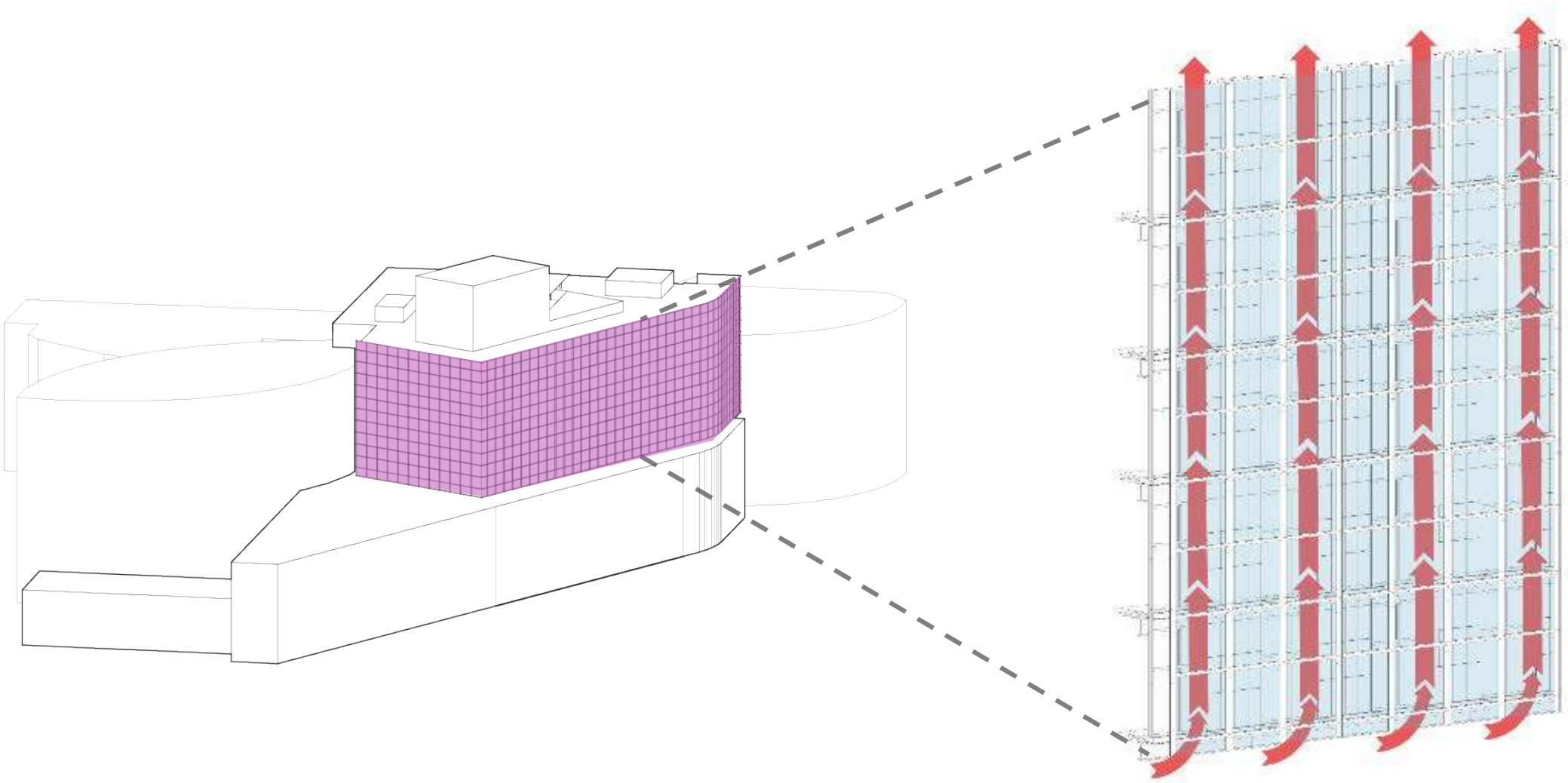
Double Skin Façade



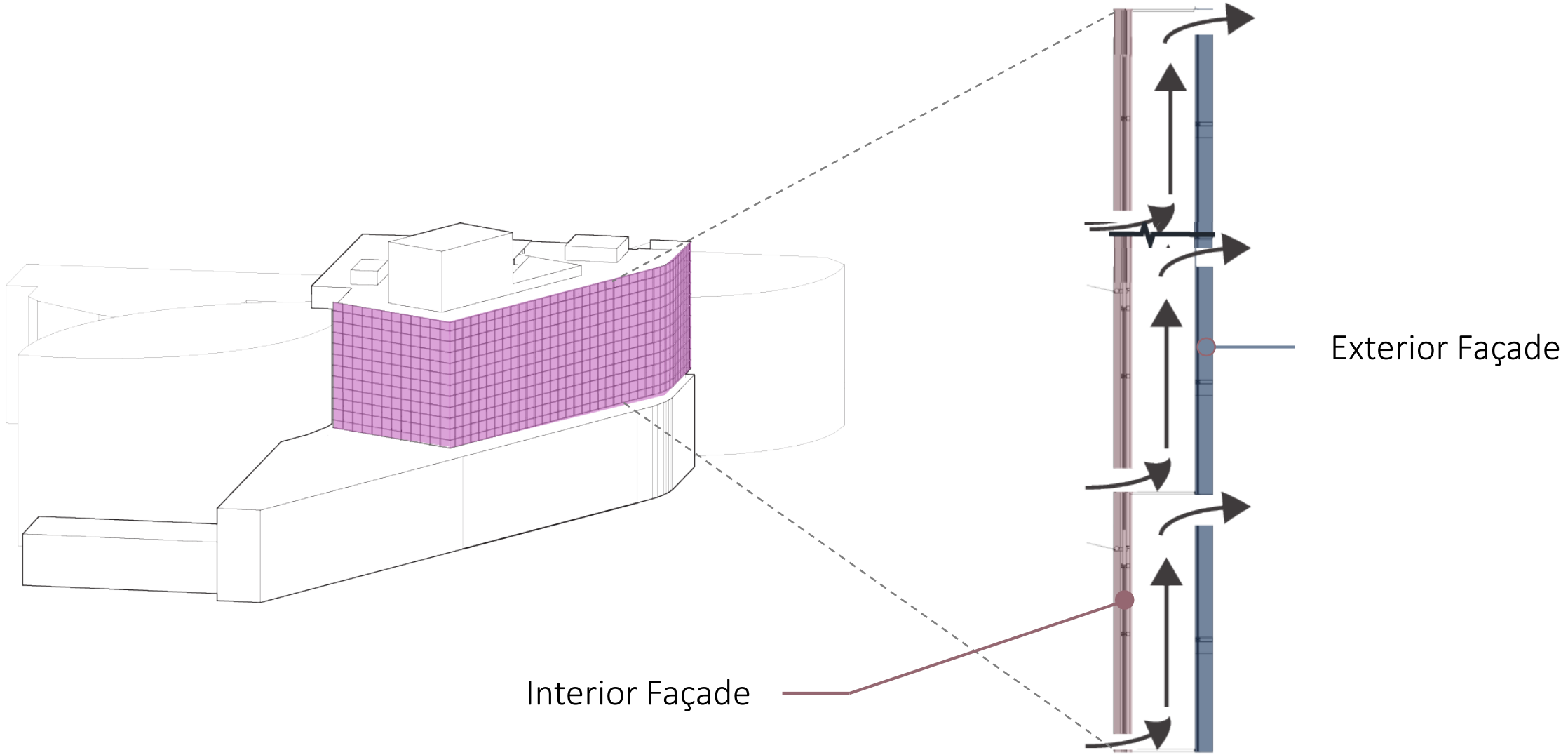
Double Skin Façade



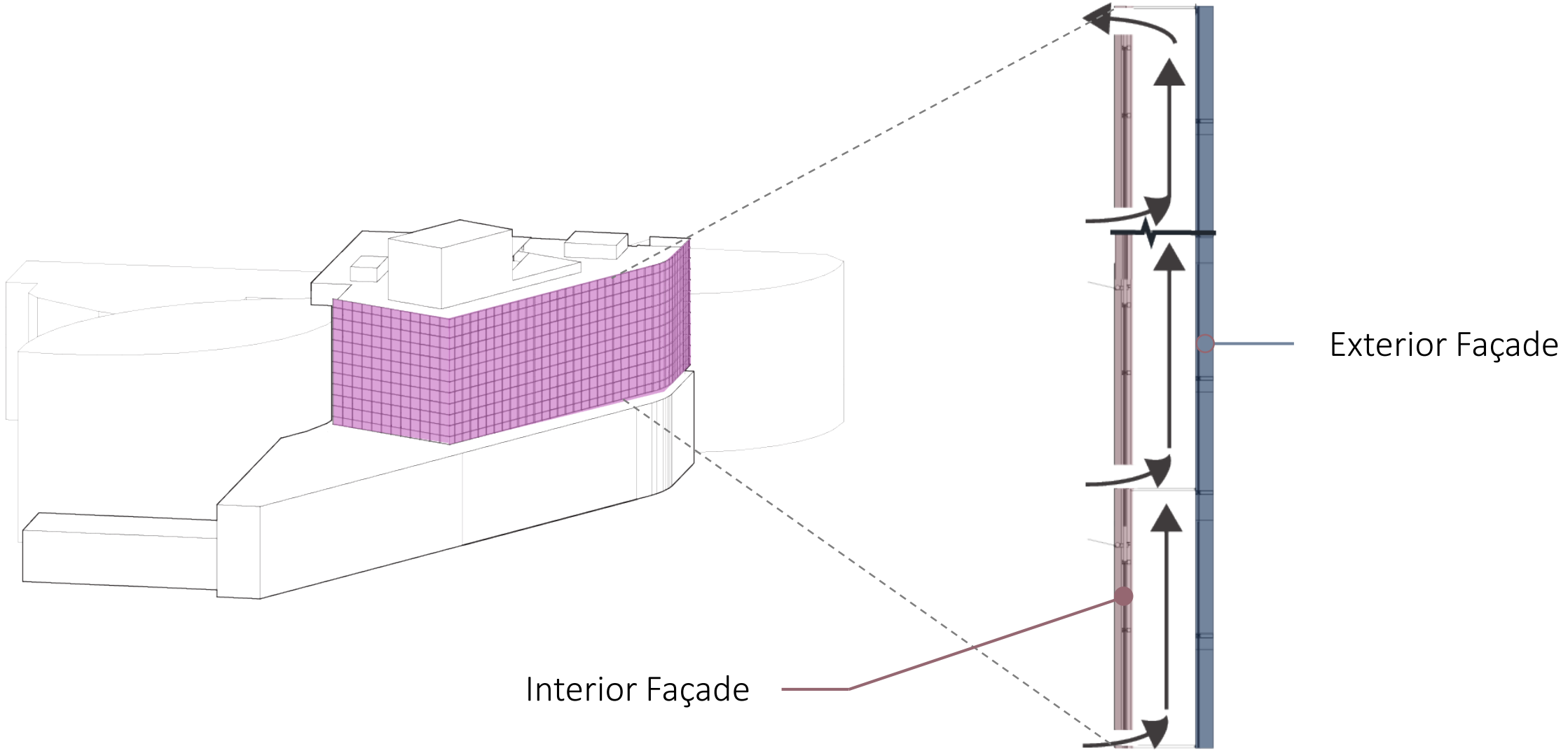
Double Skin Façade



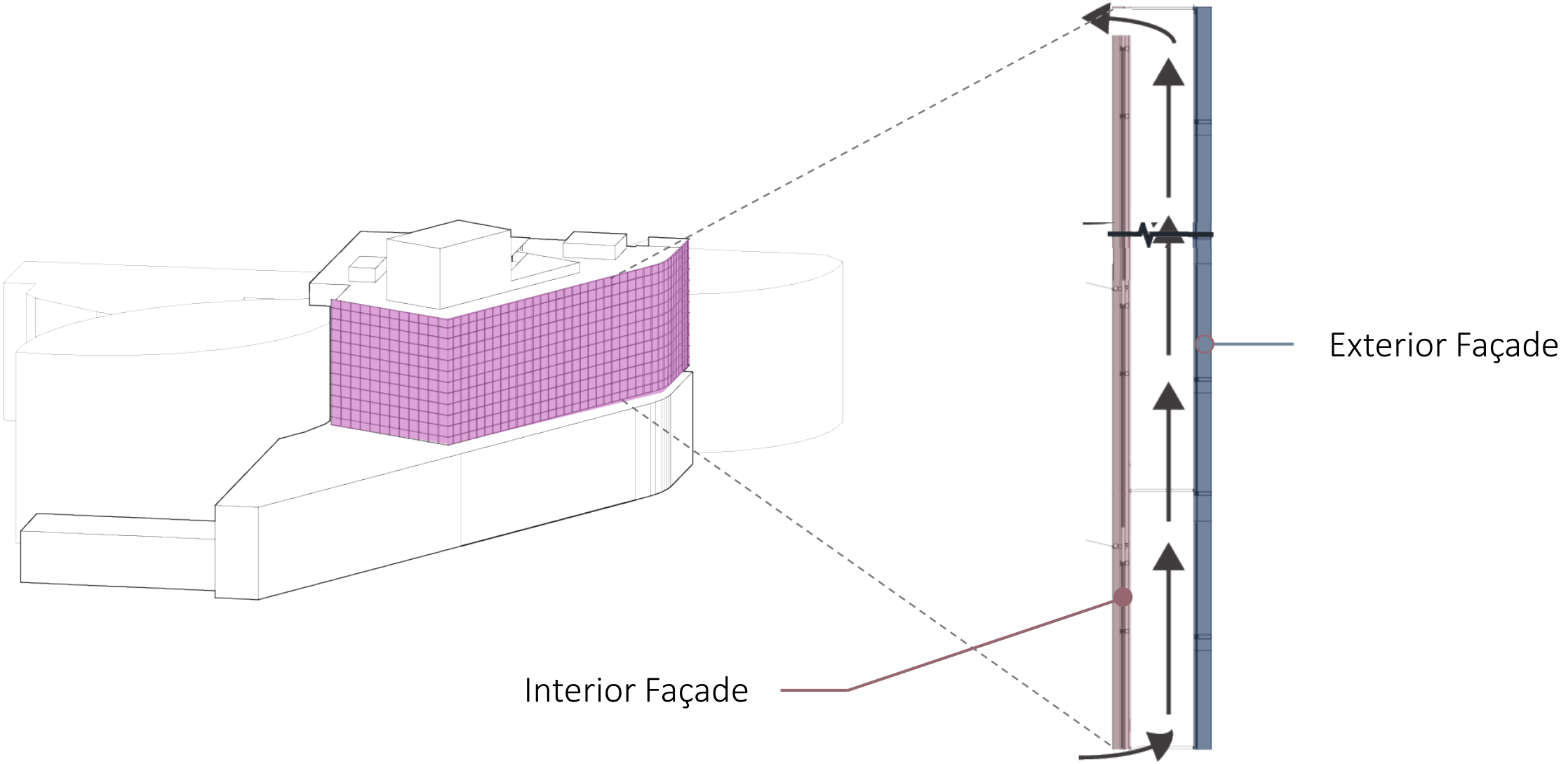
Double Skin Façade | Air Flow Option 1



Double Skin Façade | Air Flow Option 2

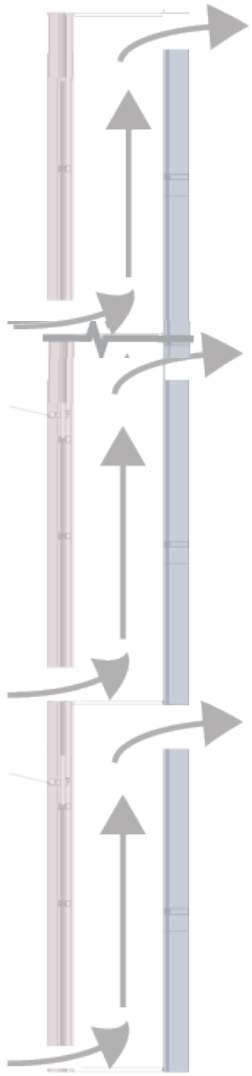


Double Skin Façade | Air Flow Option 3

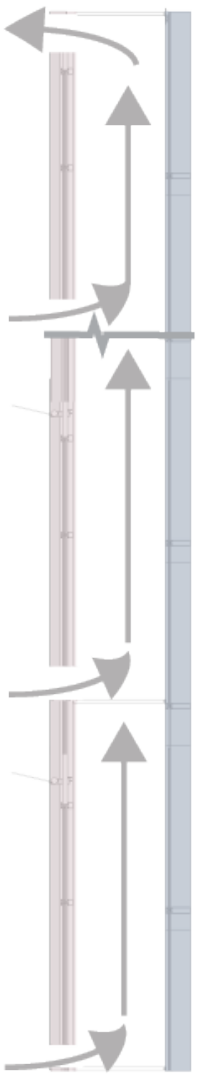


Double Skin Façade | Air Flow Options

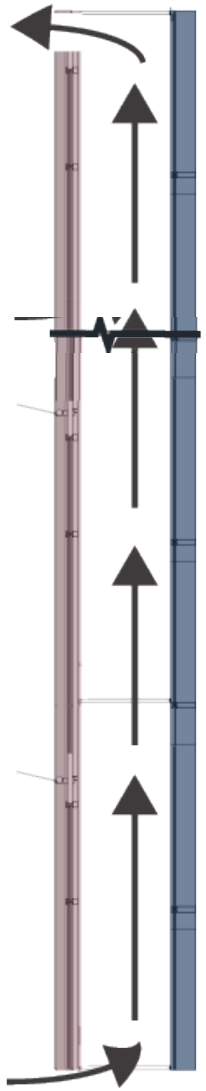
Option 1



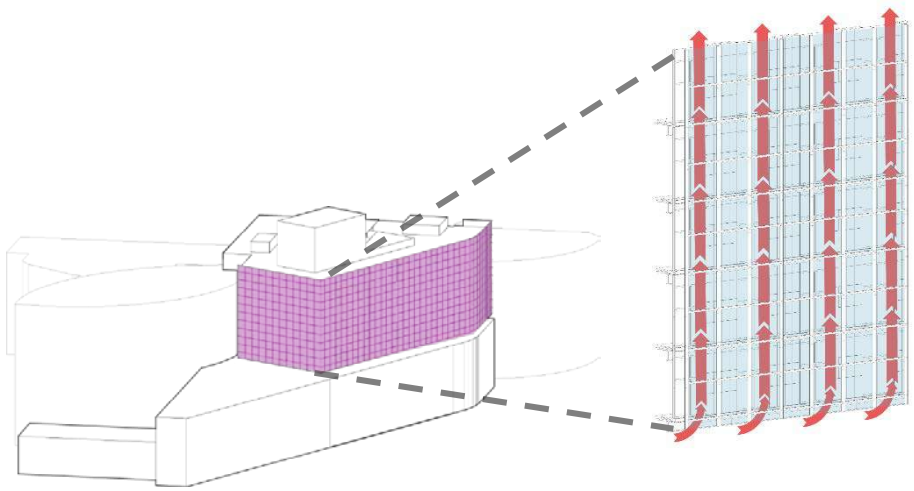
Option 2

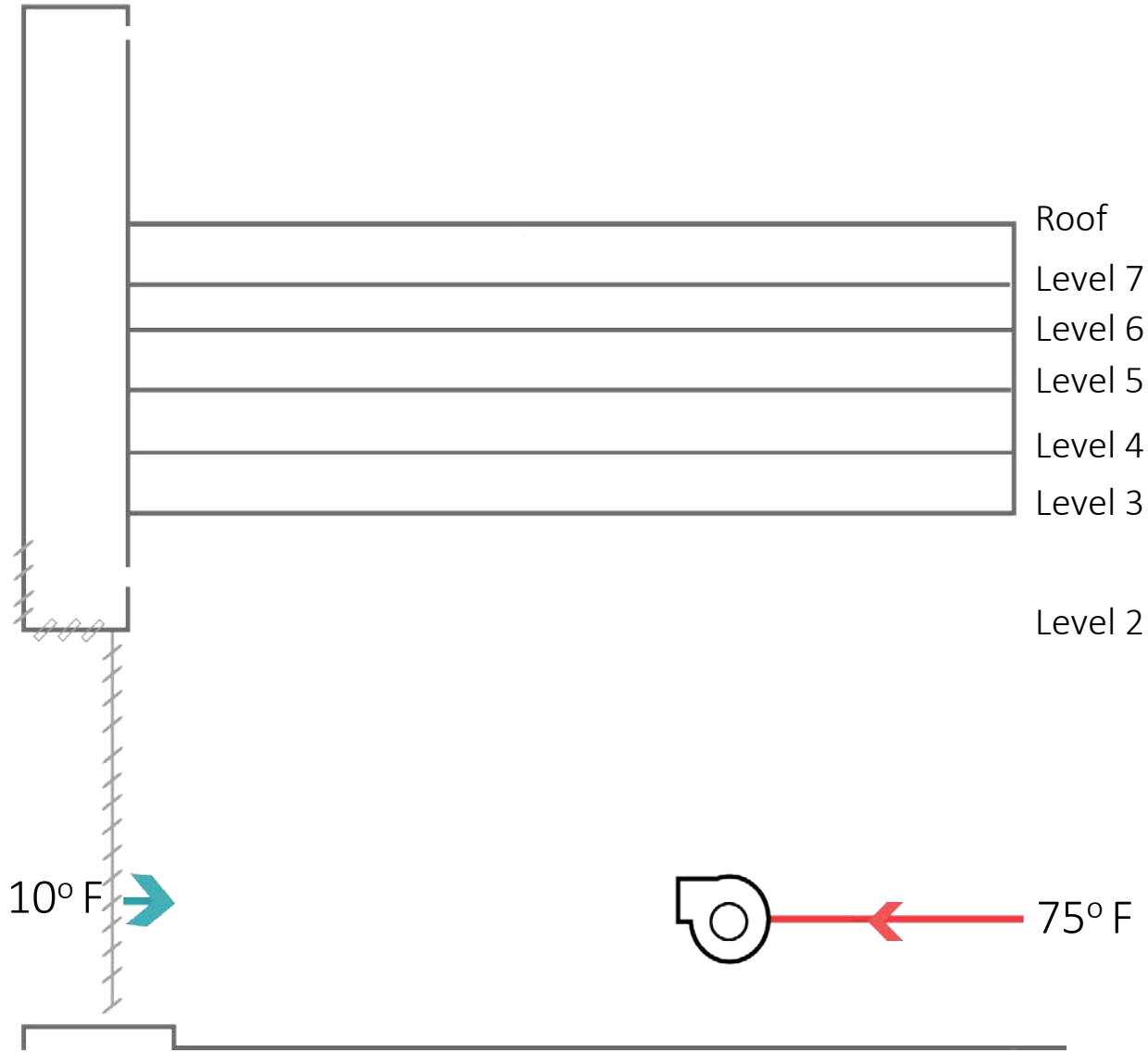


Option 3

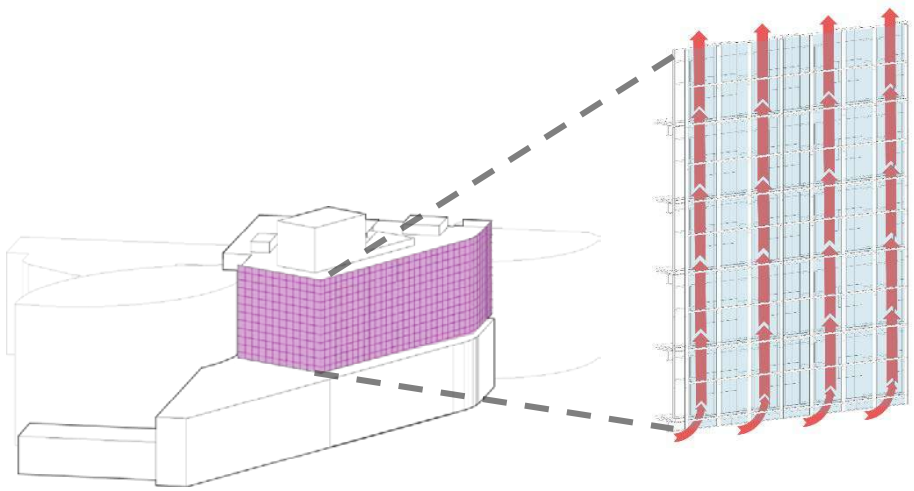


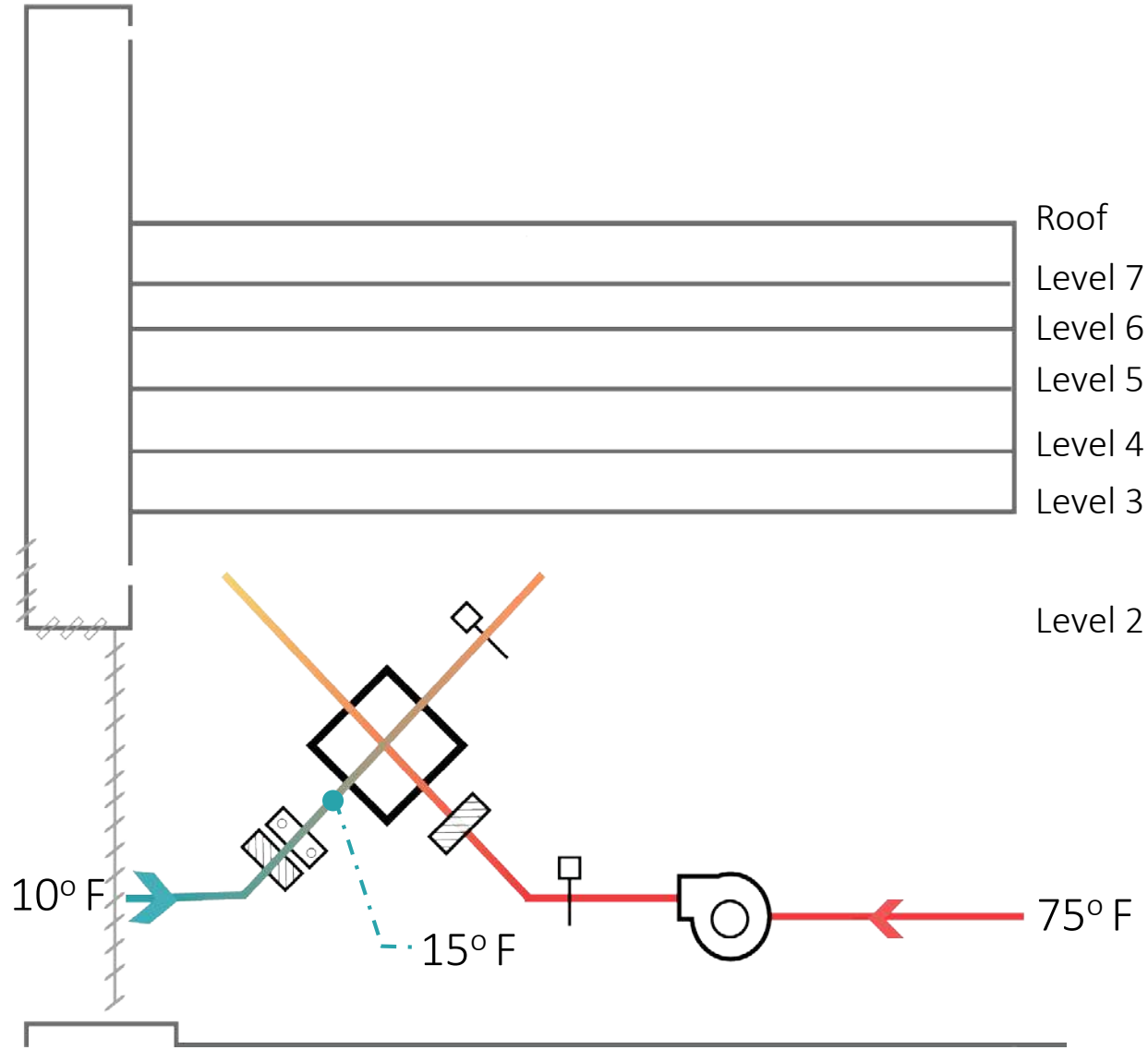
Double Skin Façade | Heating Mode < 55° F



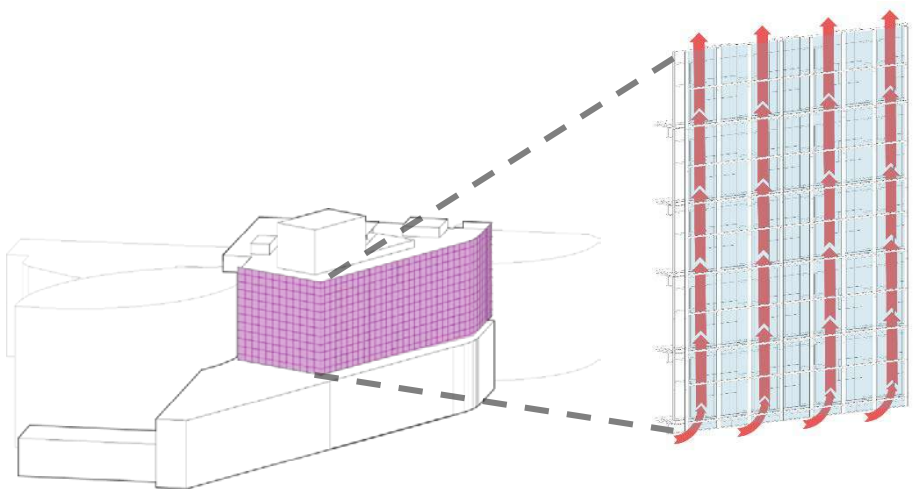


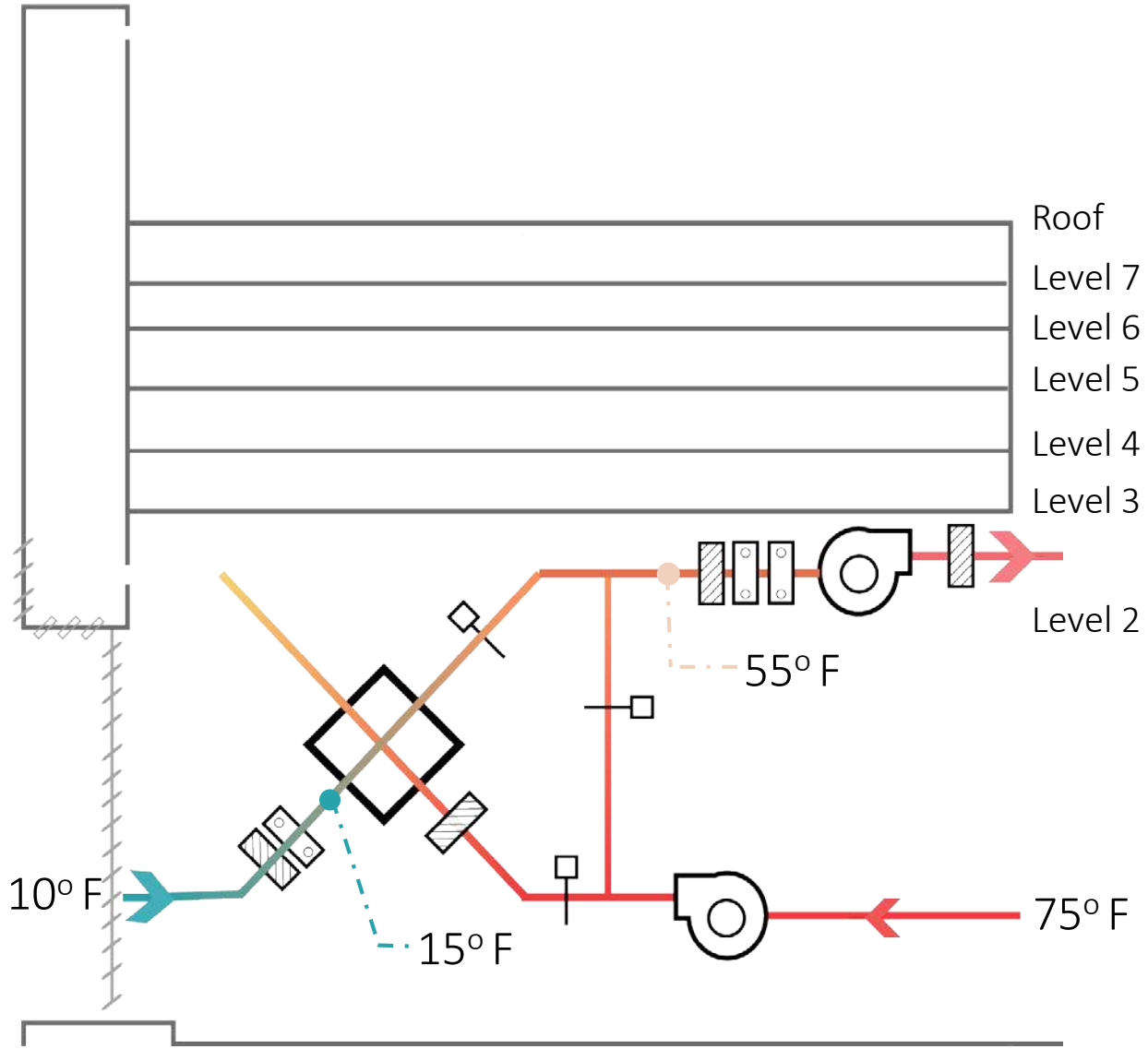
Double Skin Façade | Heating Mode < 55° F



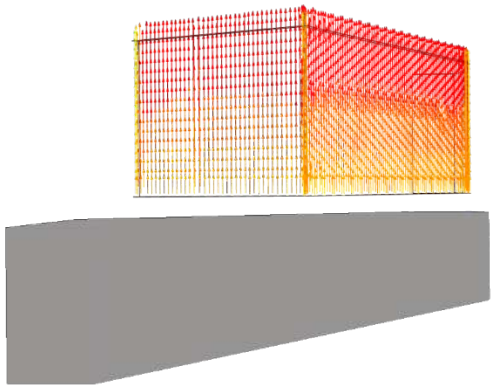


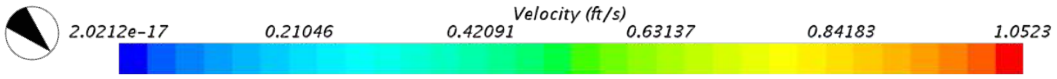
Double Skin Façade | Heating Mode < 55° F

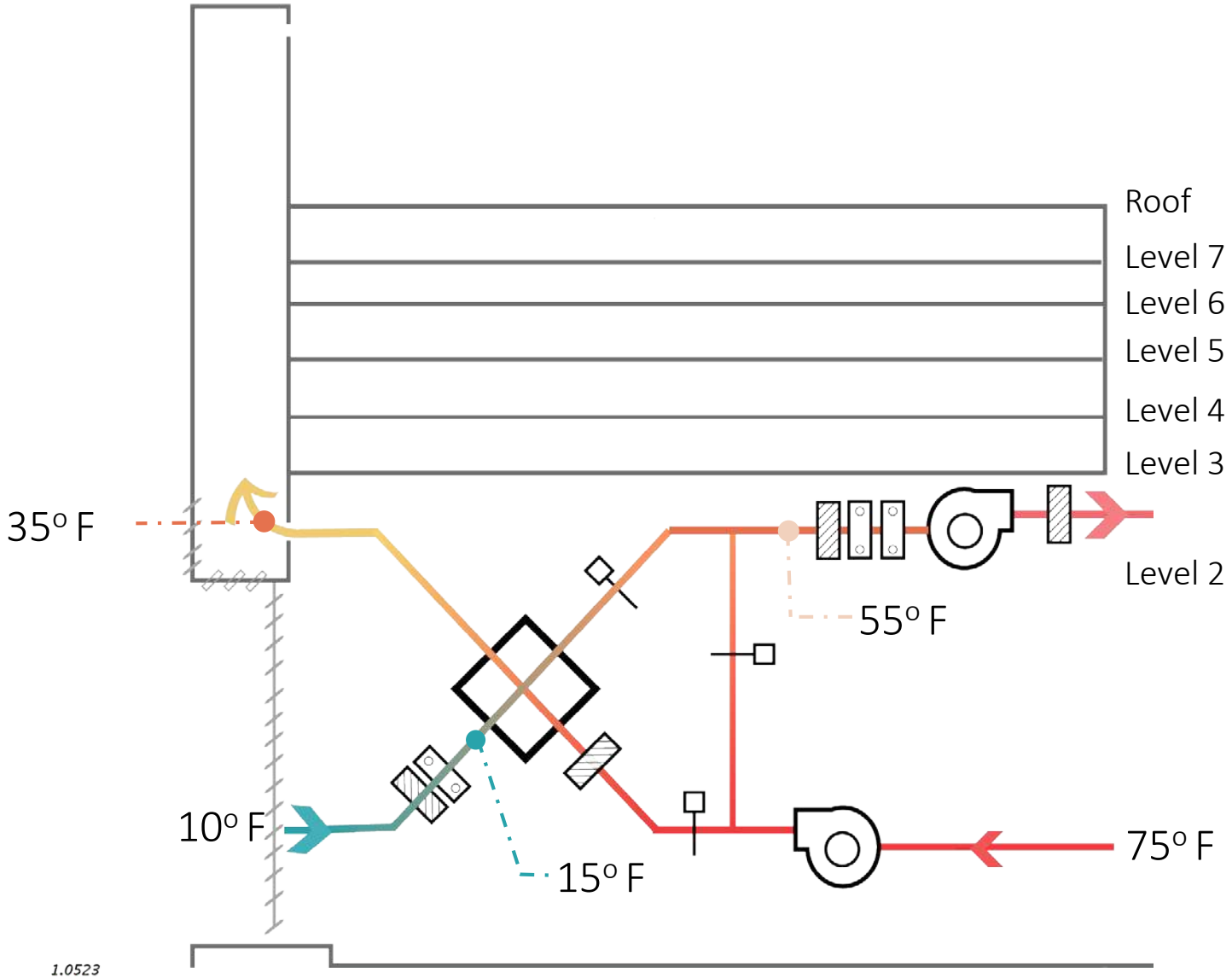




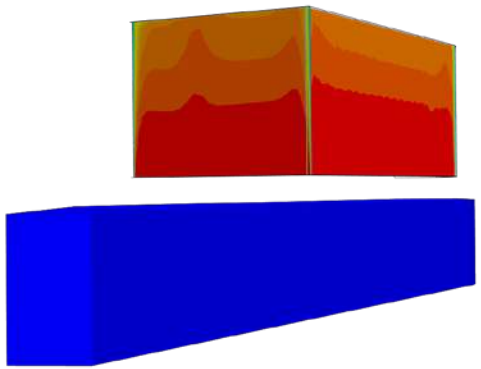
Double Skin Façade | Heating Mode < 55° F

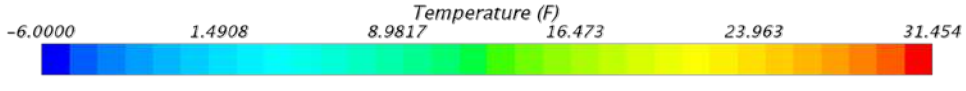


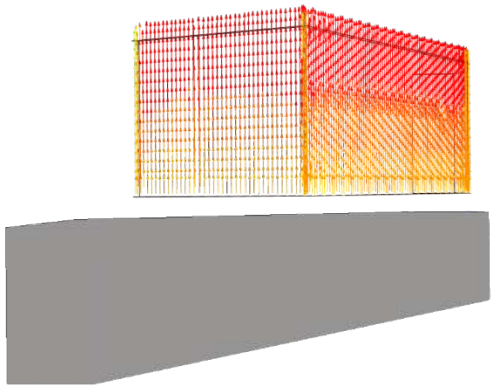


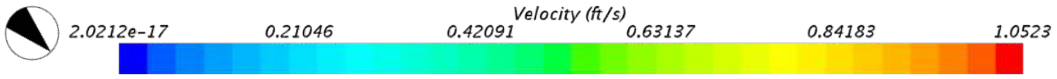


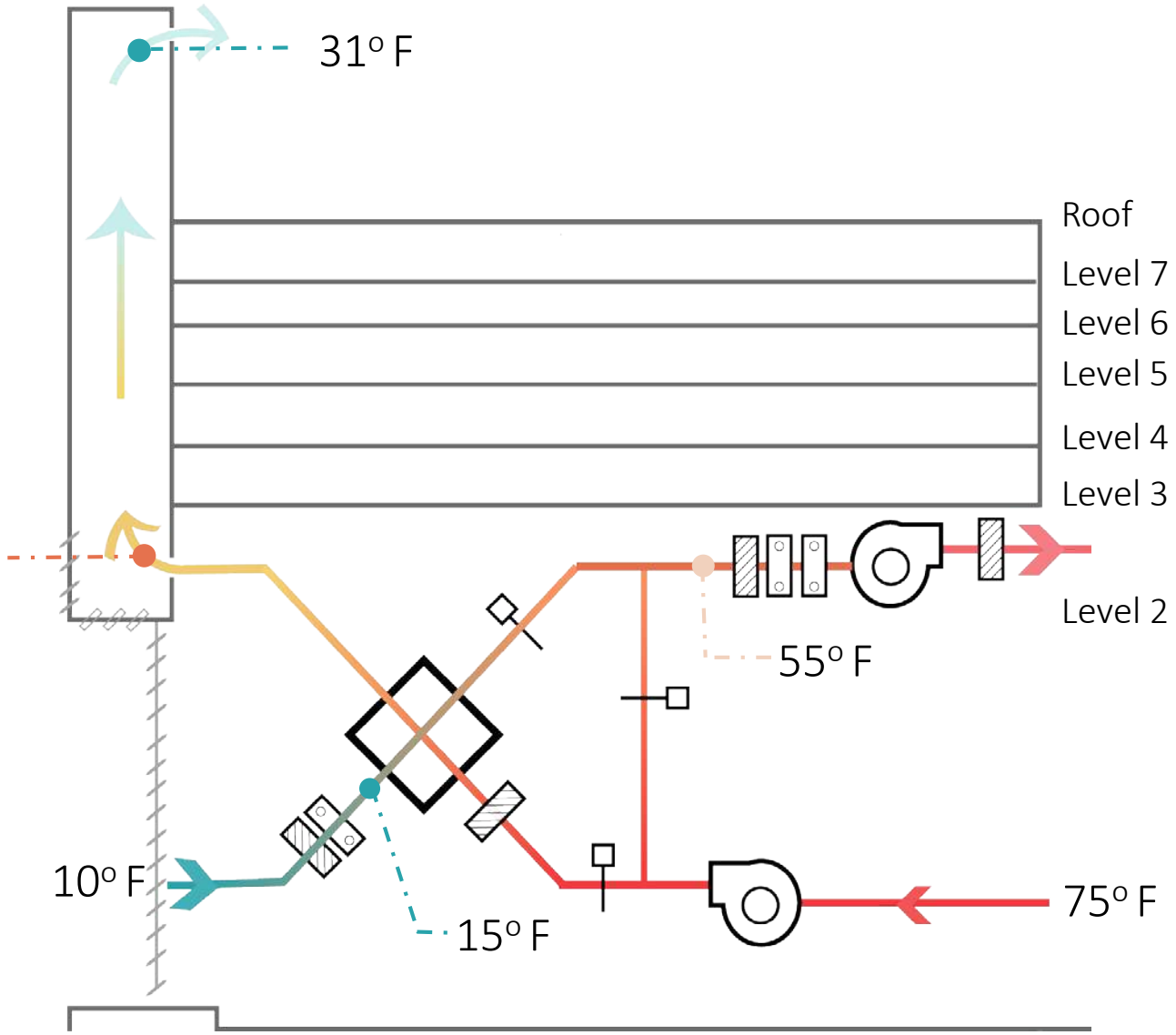
Double Skin Façade | Heating Mode < 55° F



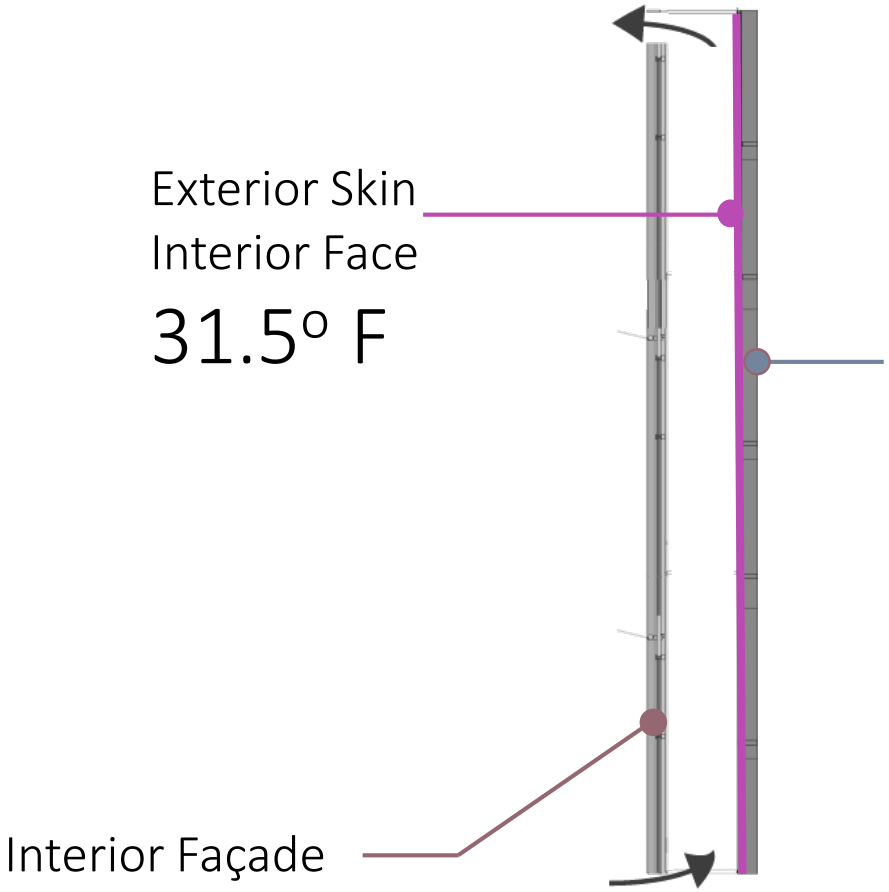


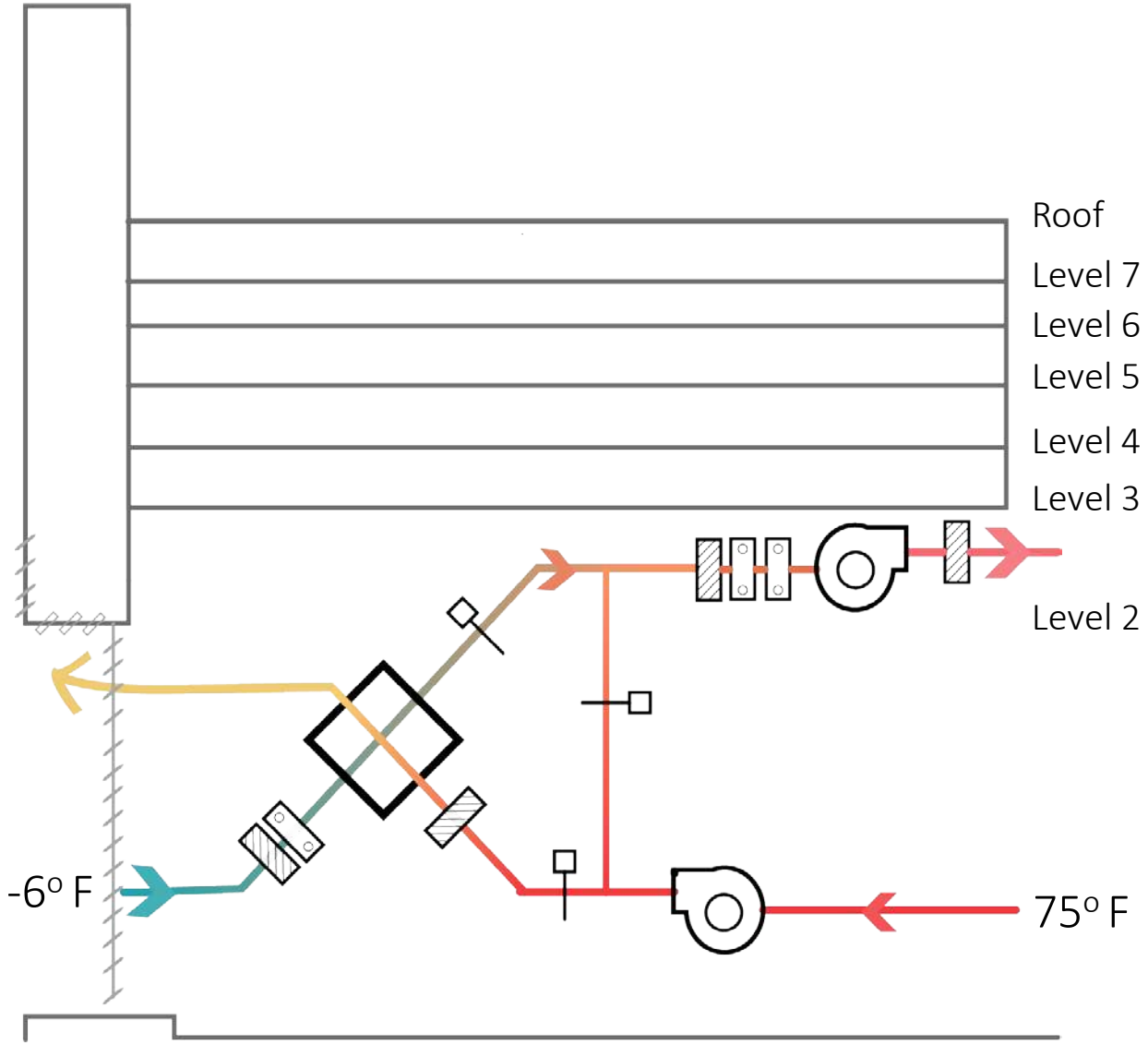




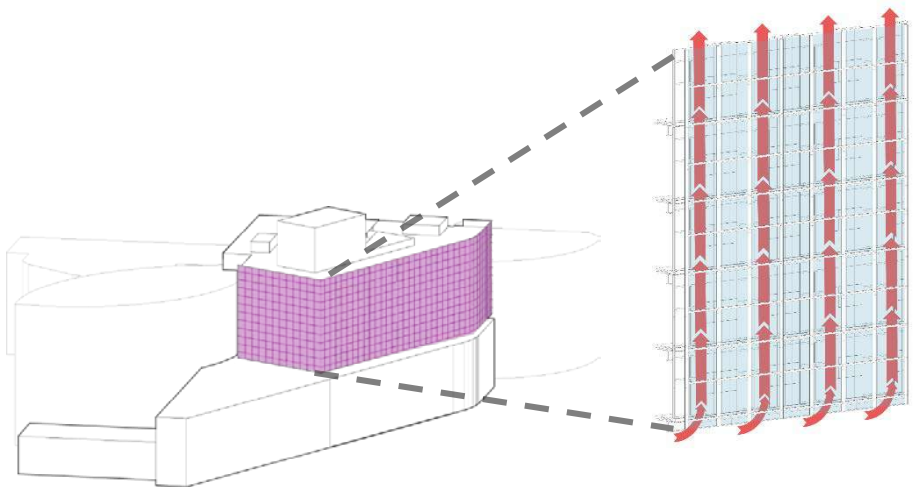


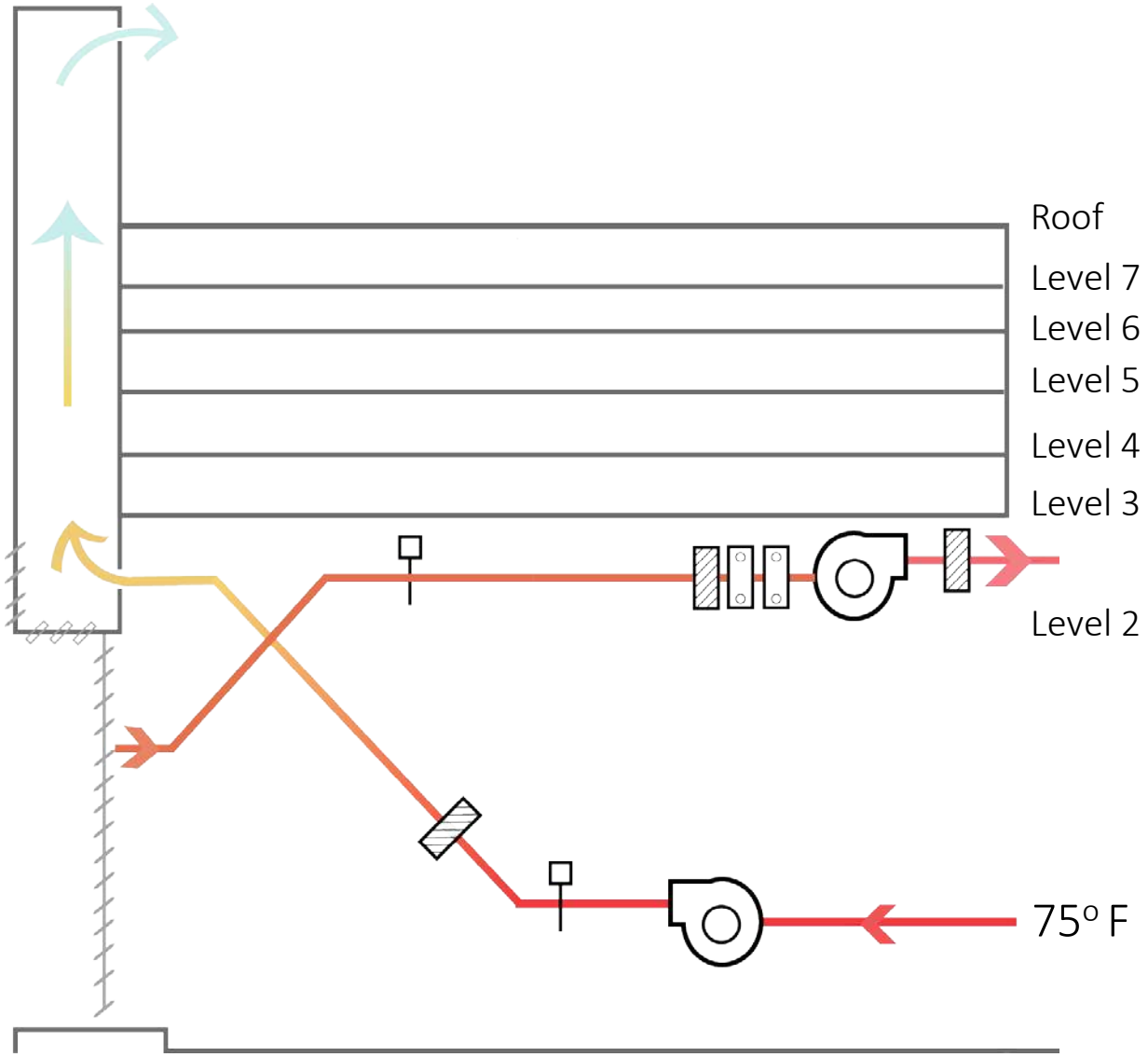
Double Skin Façade | Static Mode





Double Skin Façade | Economizer Mode

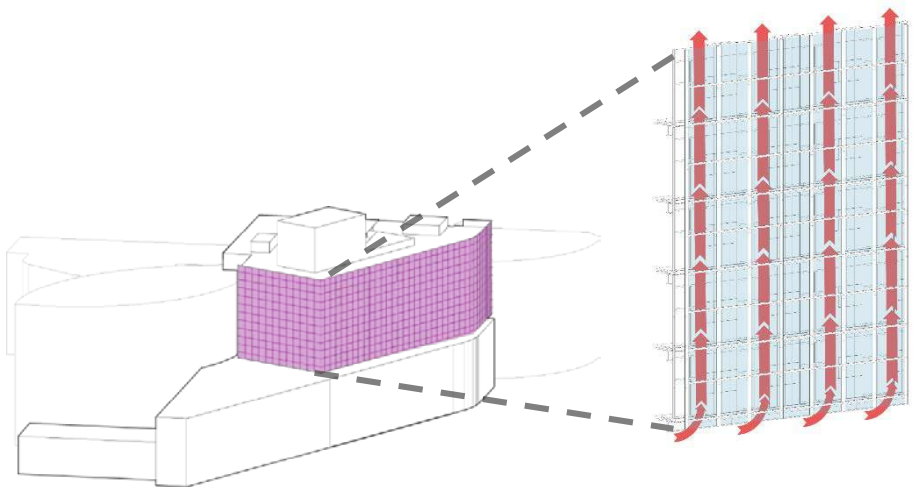


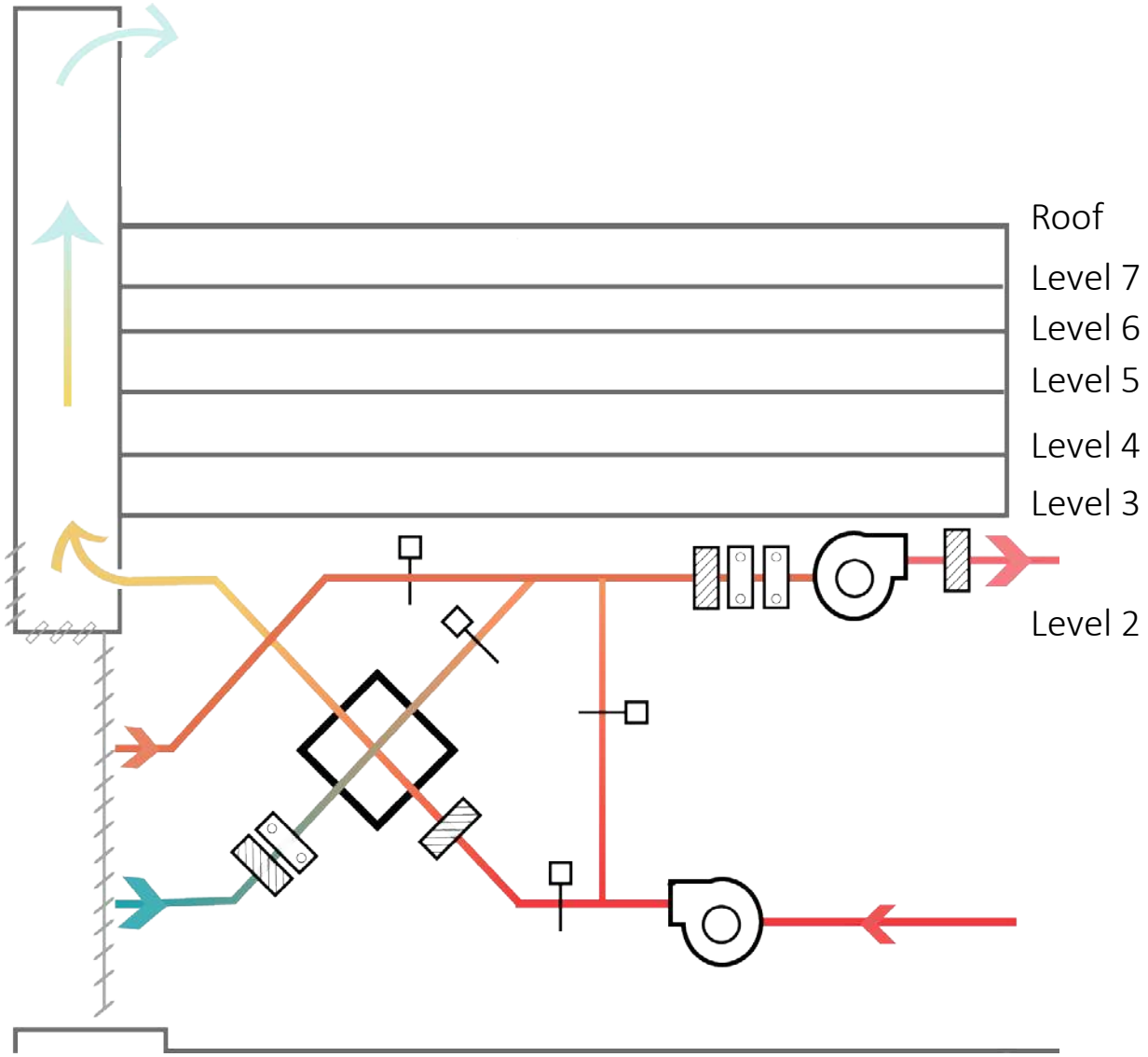


Double Skin Façade

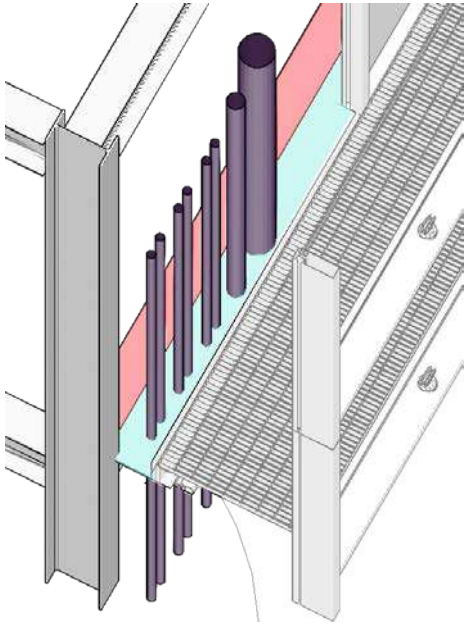
36% Cooling Savings

44% Heating Savings





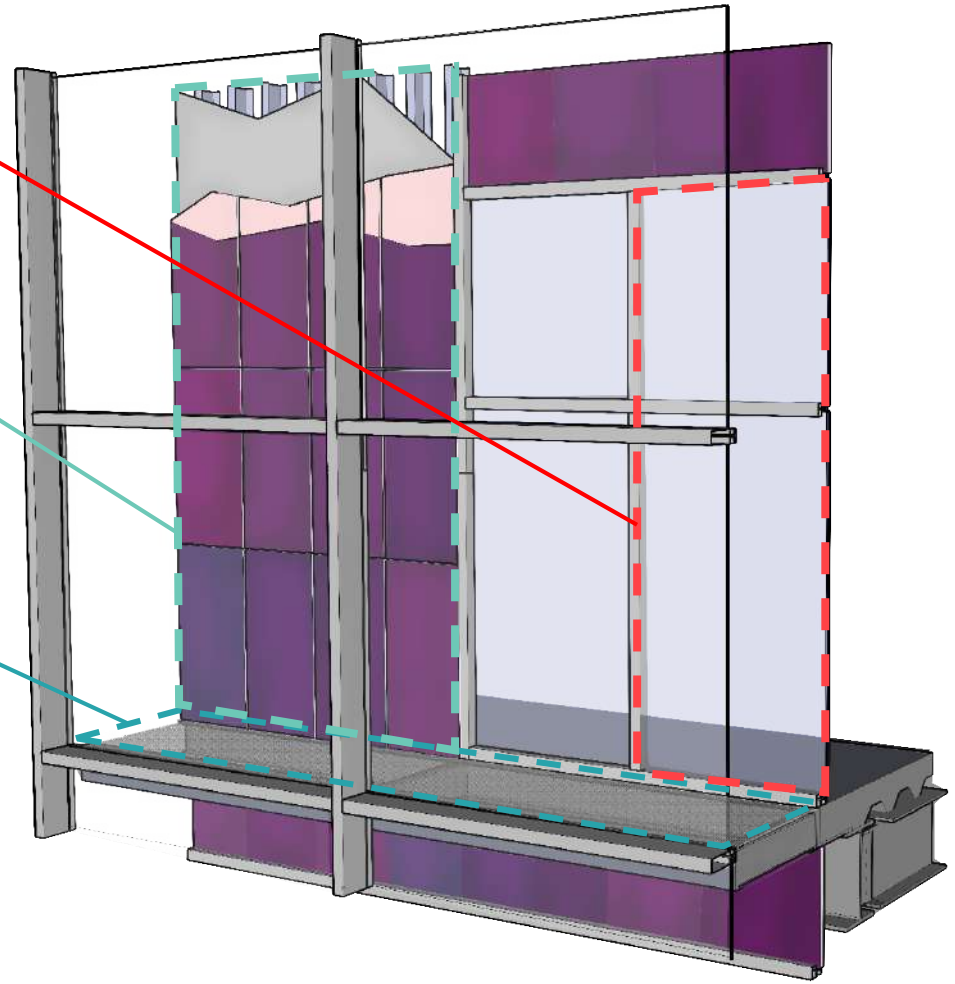
Double Skin Façade | Maintenance Walkway



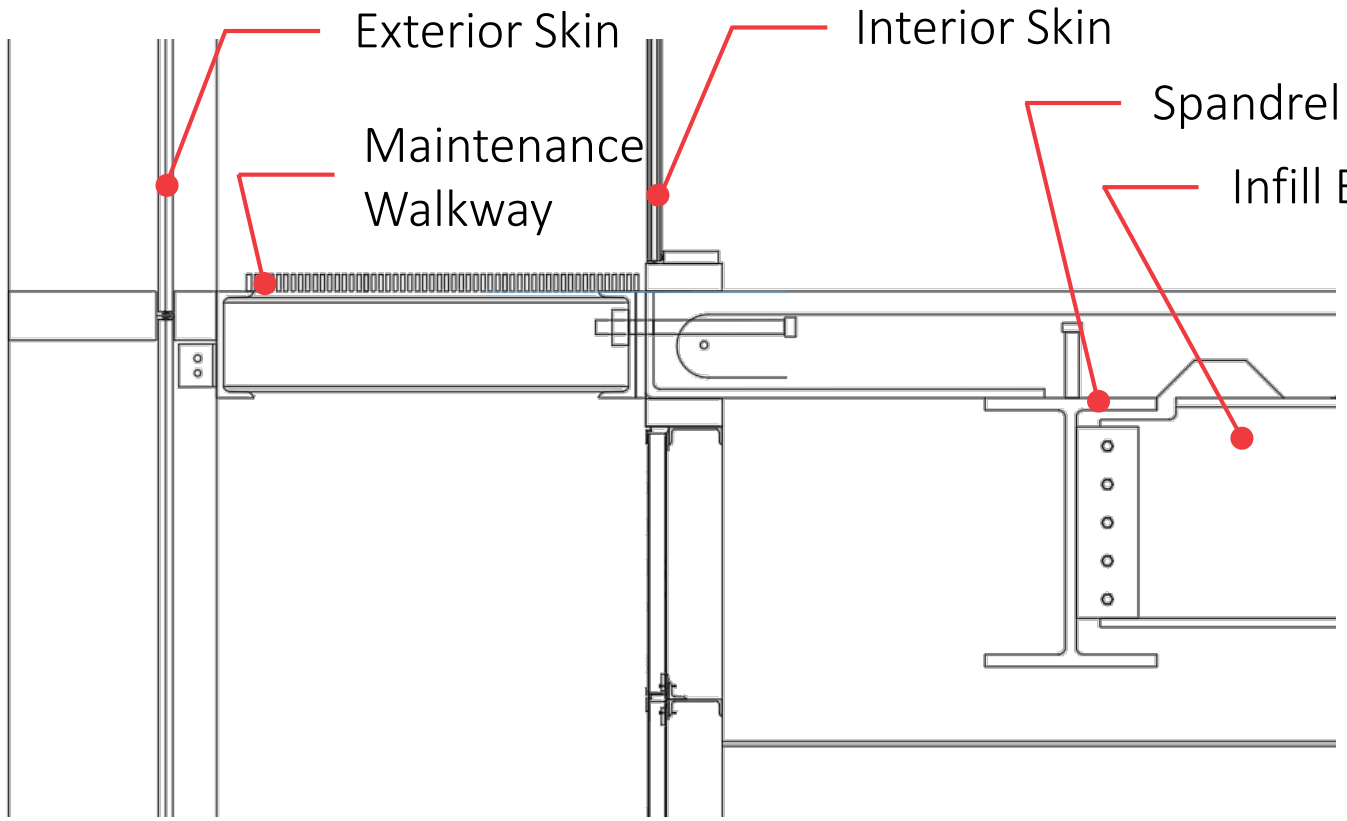
Double Skin Façade Access

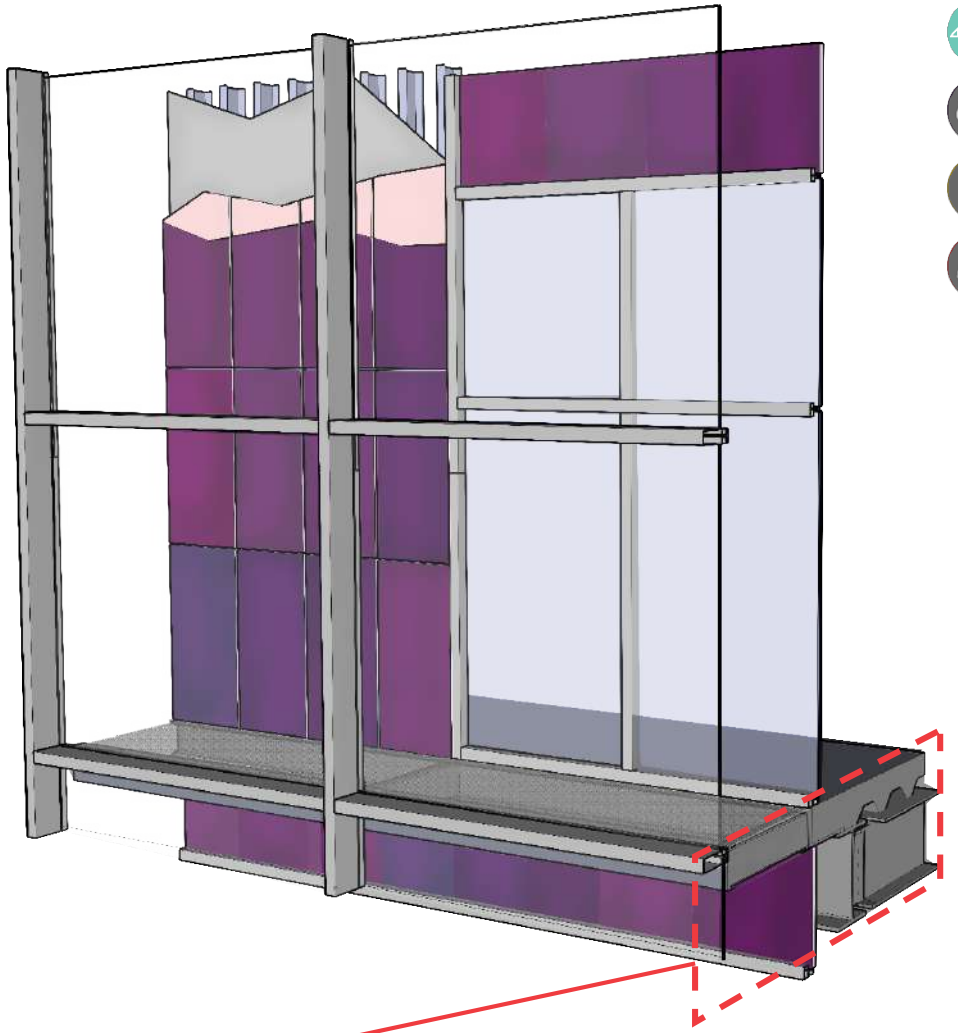
Patient Wet Wall

Maintenance Walkway



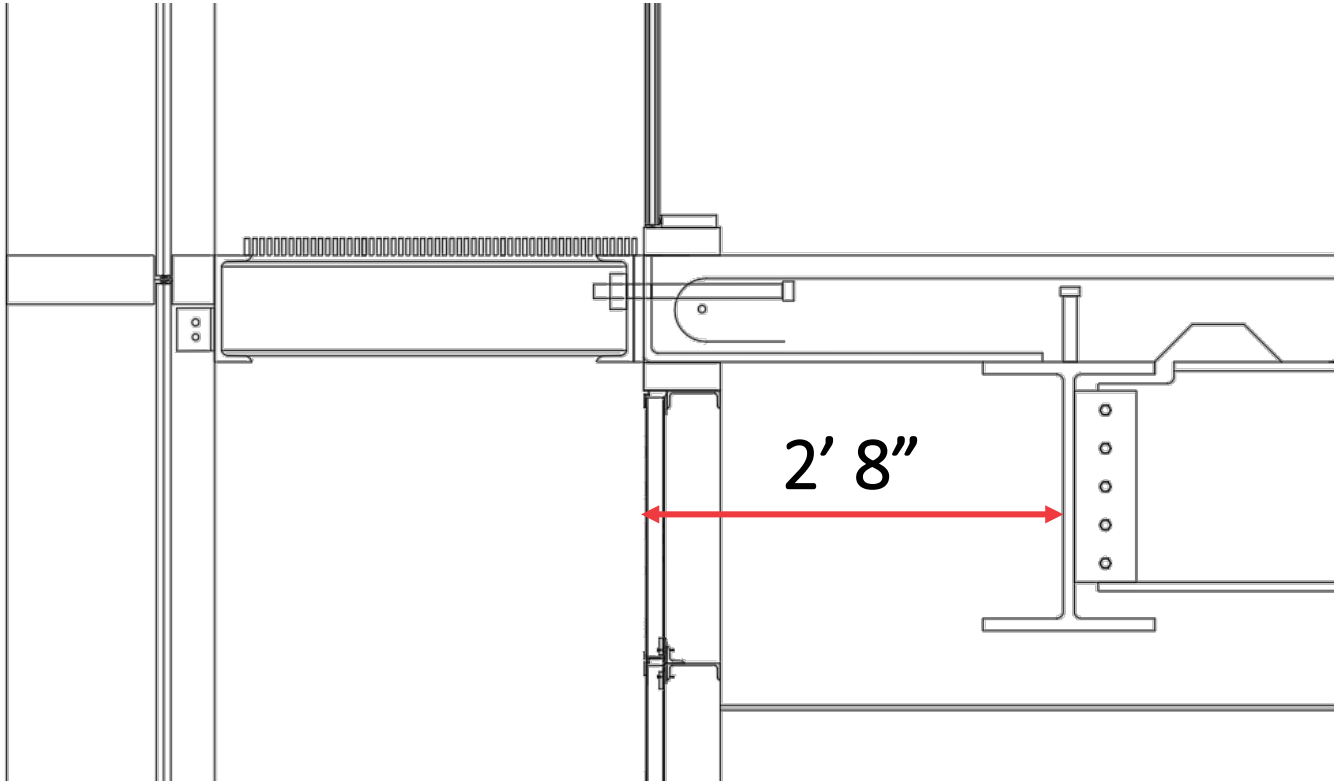
Double Skin Façade | Connection Detail

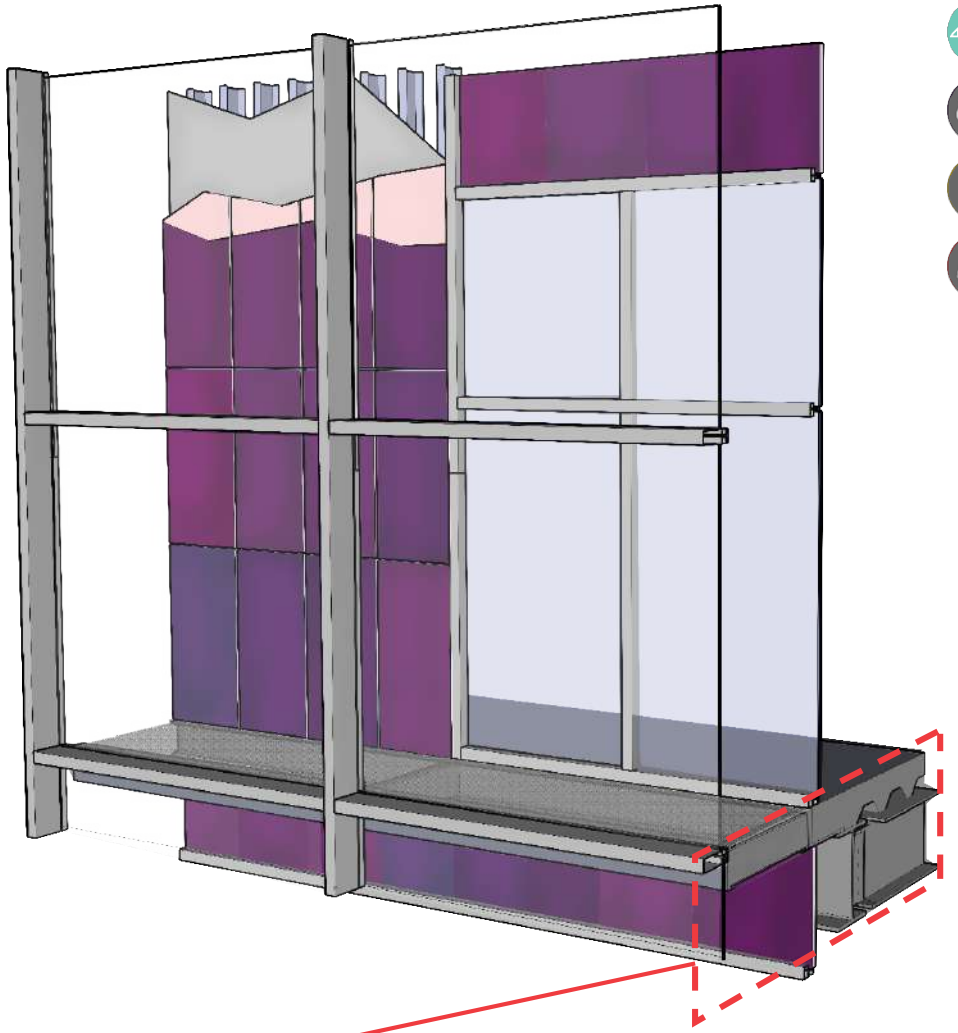




Original Structural Façade Connection

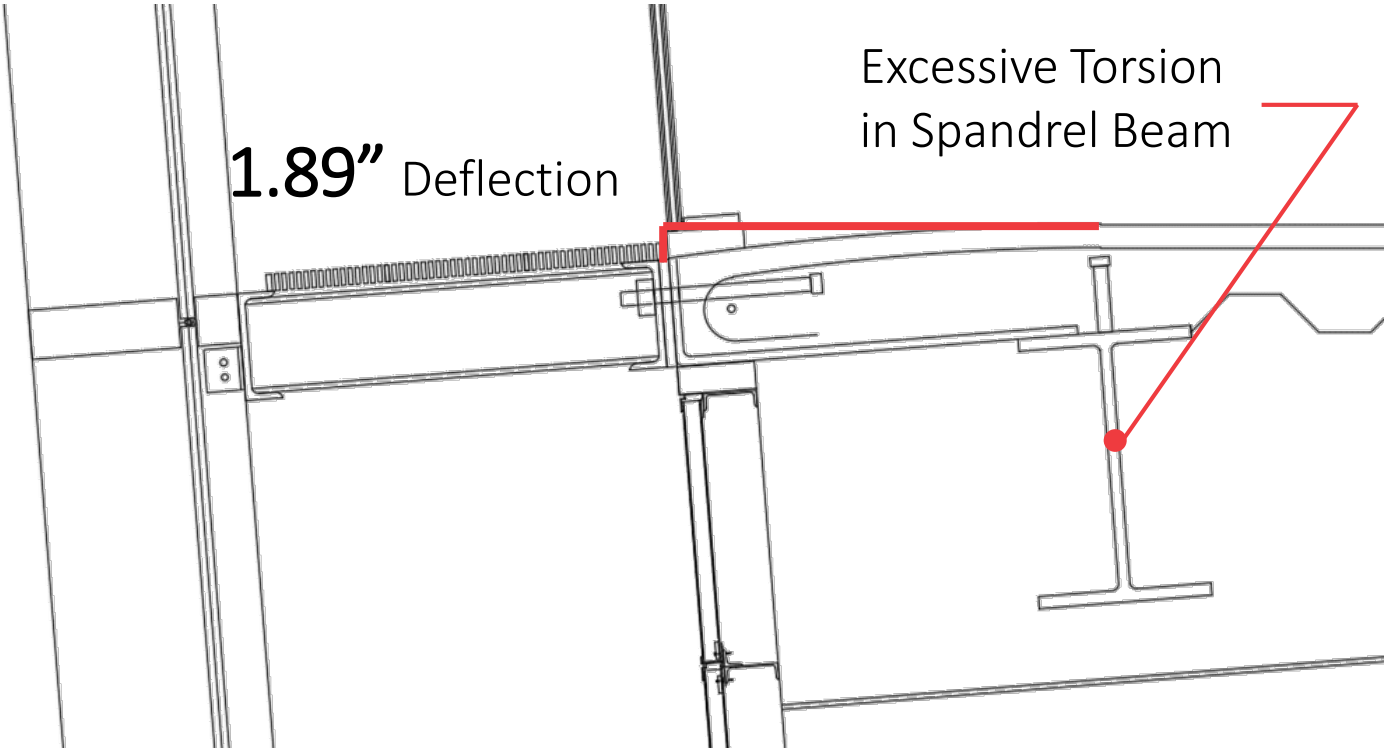
Double Skin Façade | Connection Detail

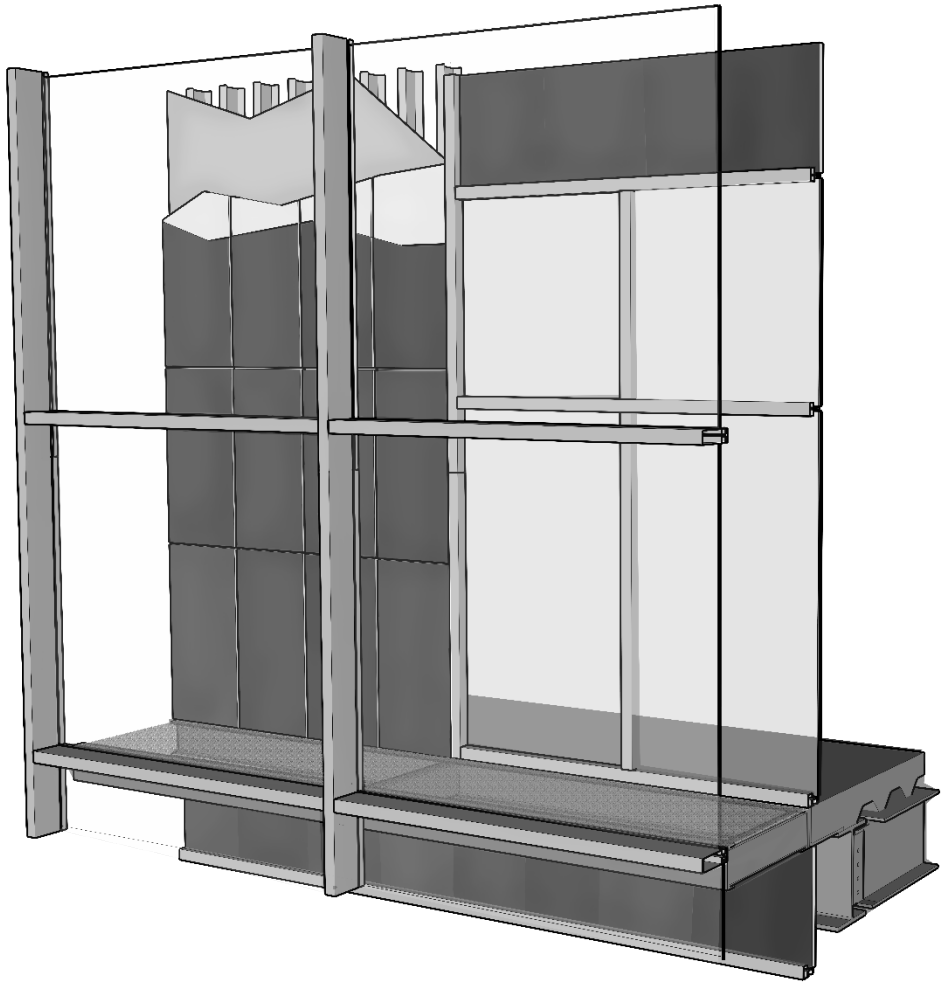




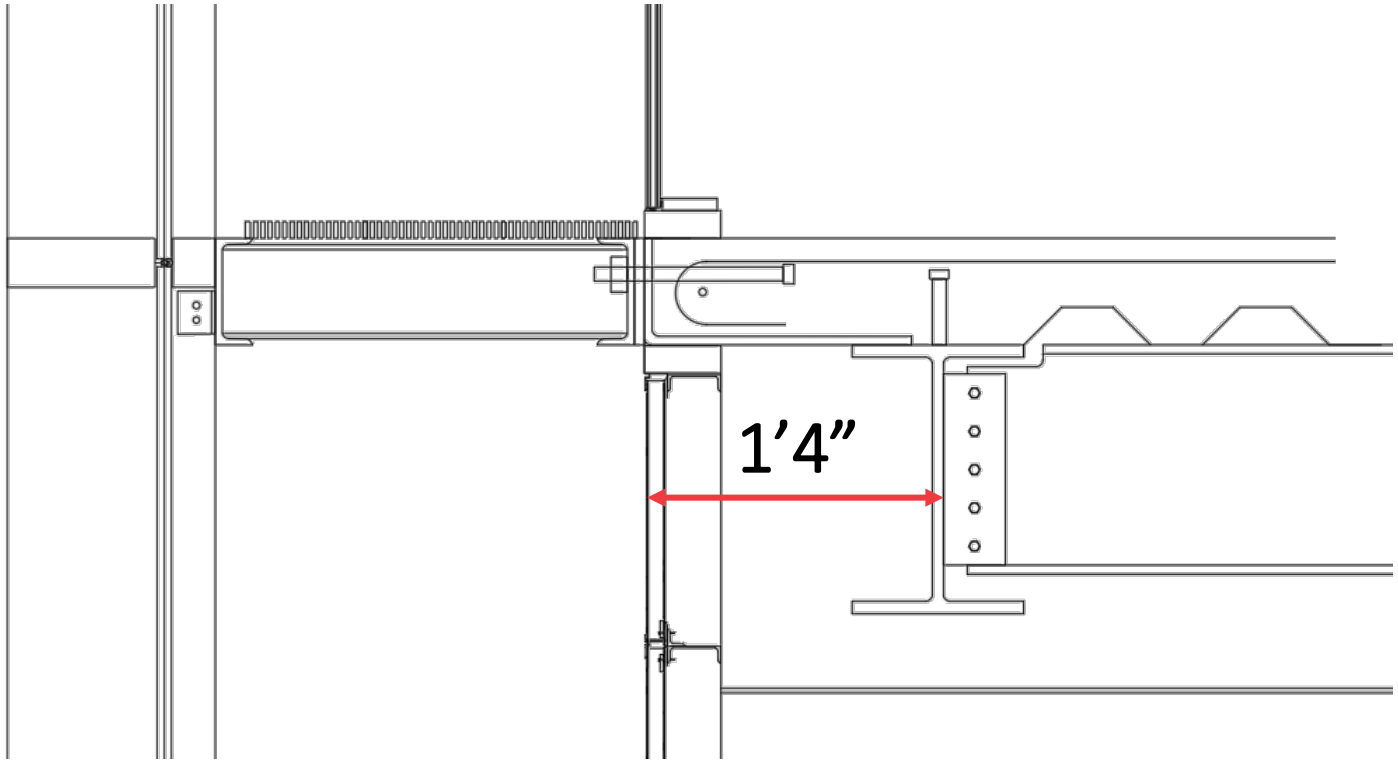
Original Structural Façade Connection

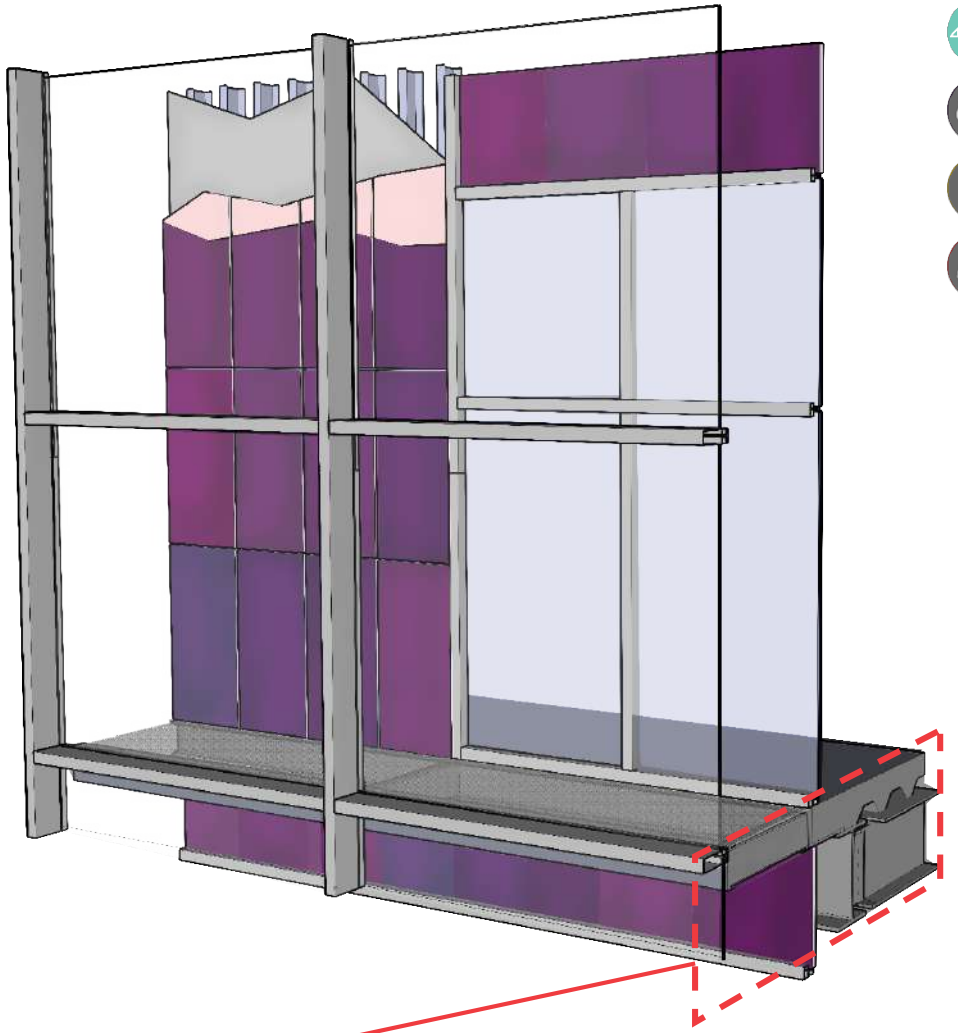
Double Skin Façade | Connection Detail





Double Skin Façade | Connection Detail

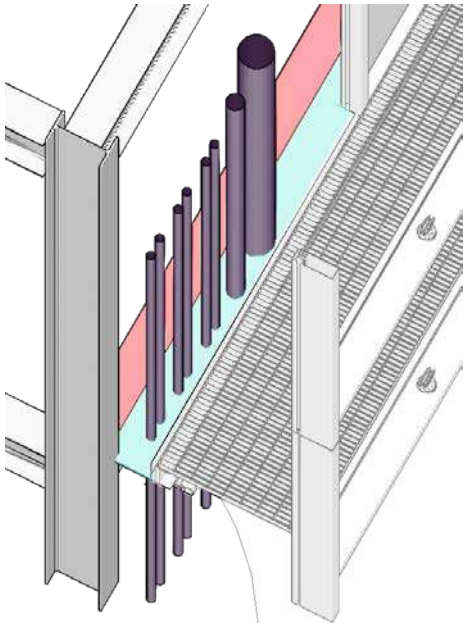


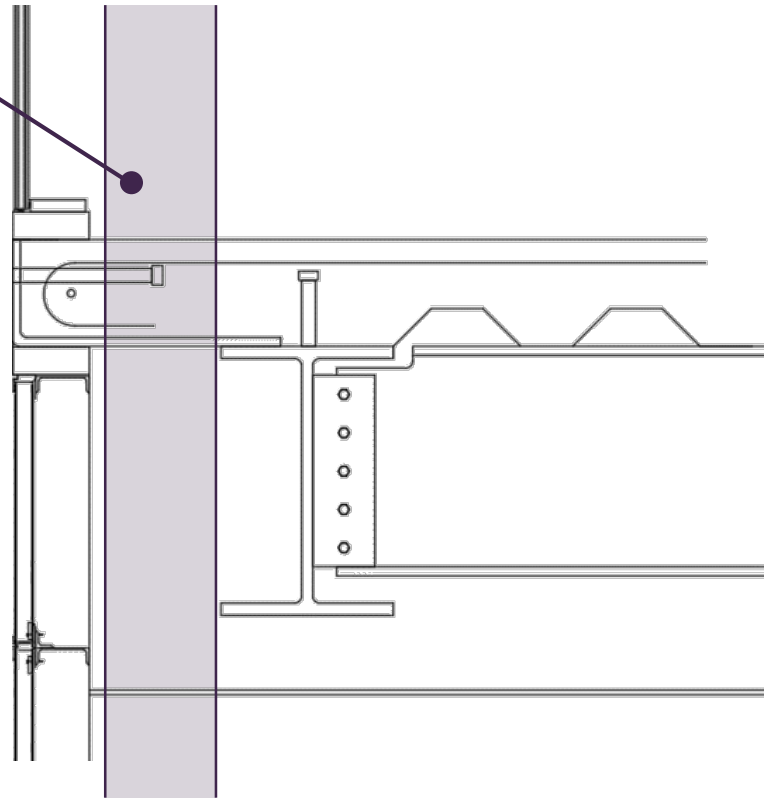


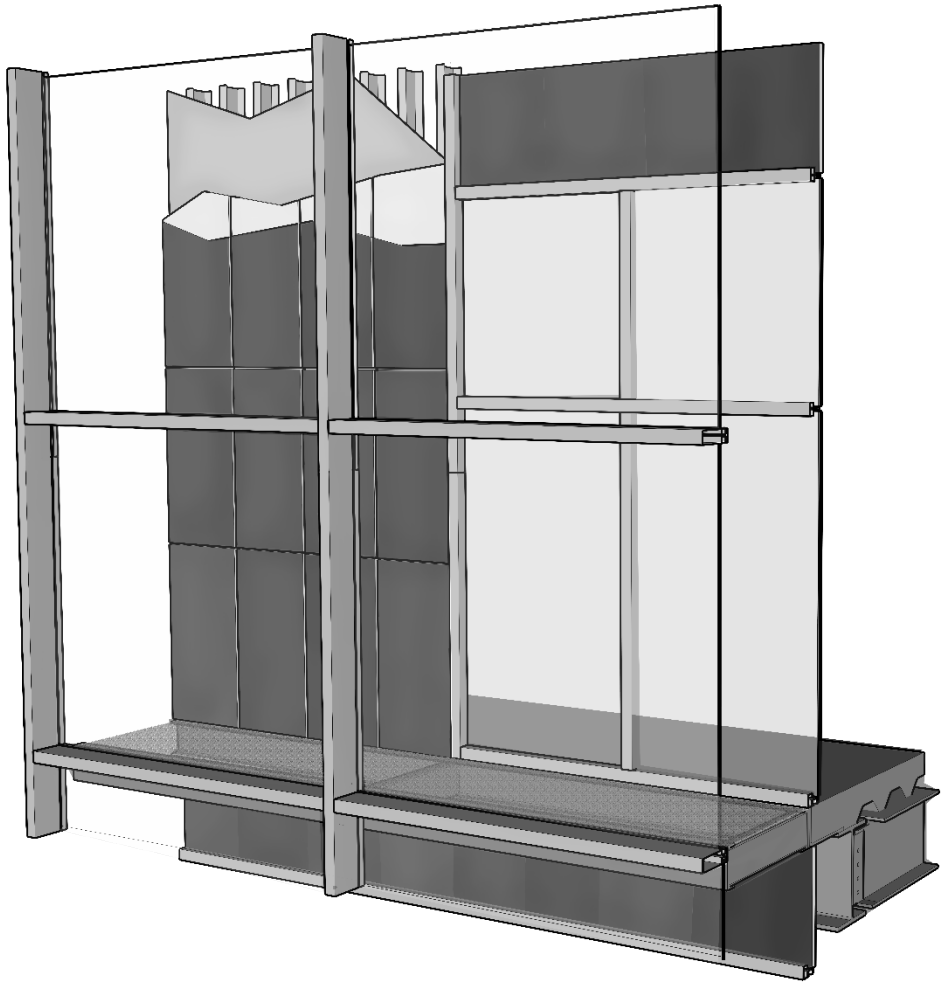
Structural Façade Connection

Double Skin Façade | Connection Detail

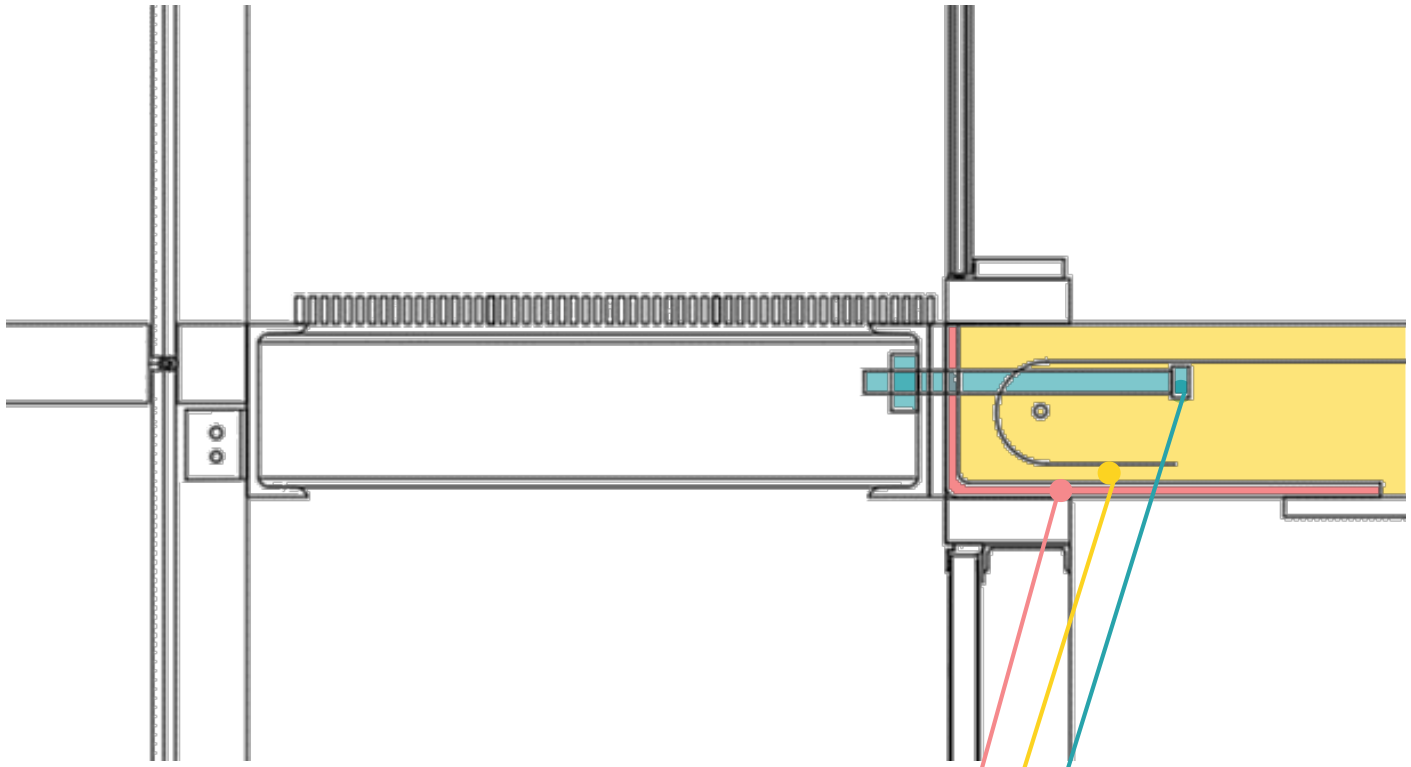
Through Pipe Penetration Coordination

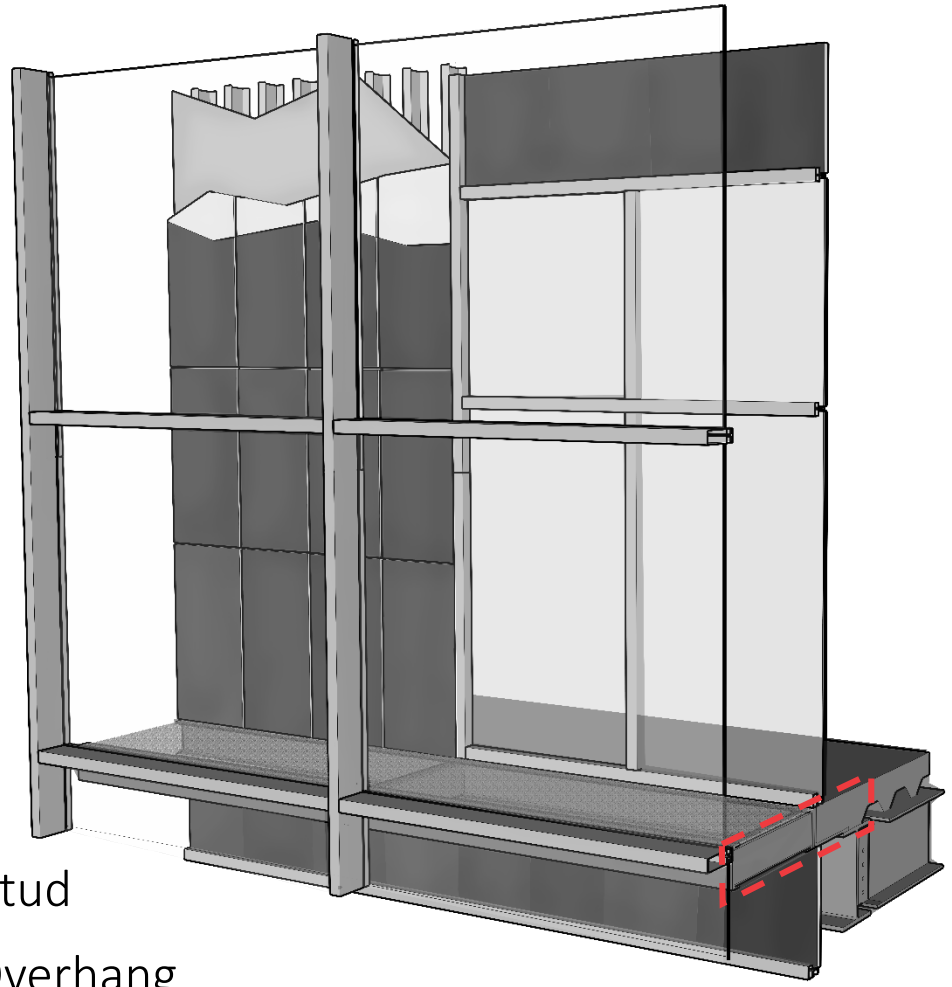






Double Skin Façade | Connection Detail



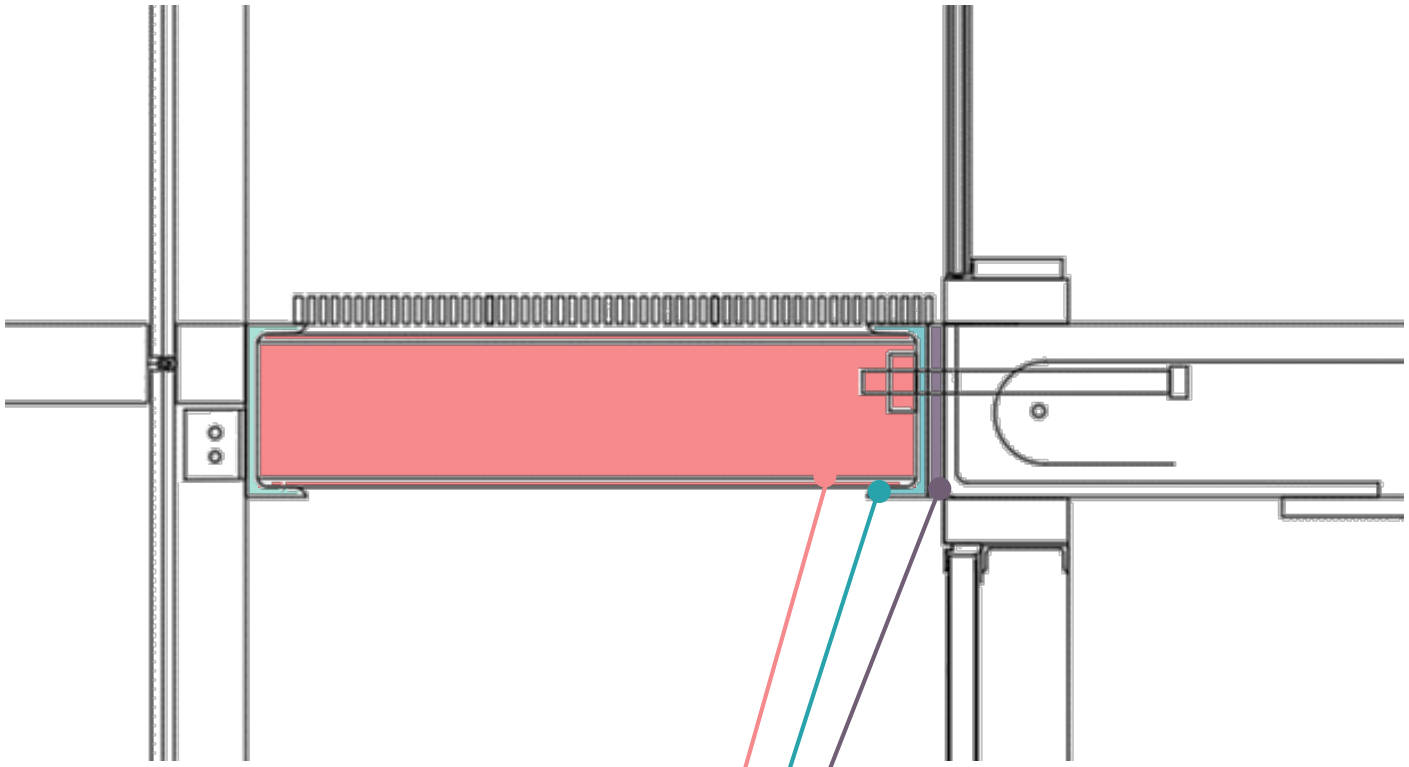


Embedded Stud

Concrete Slab Overhang

Steel Bent Plate

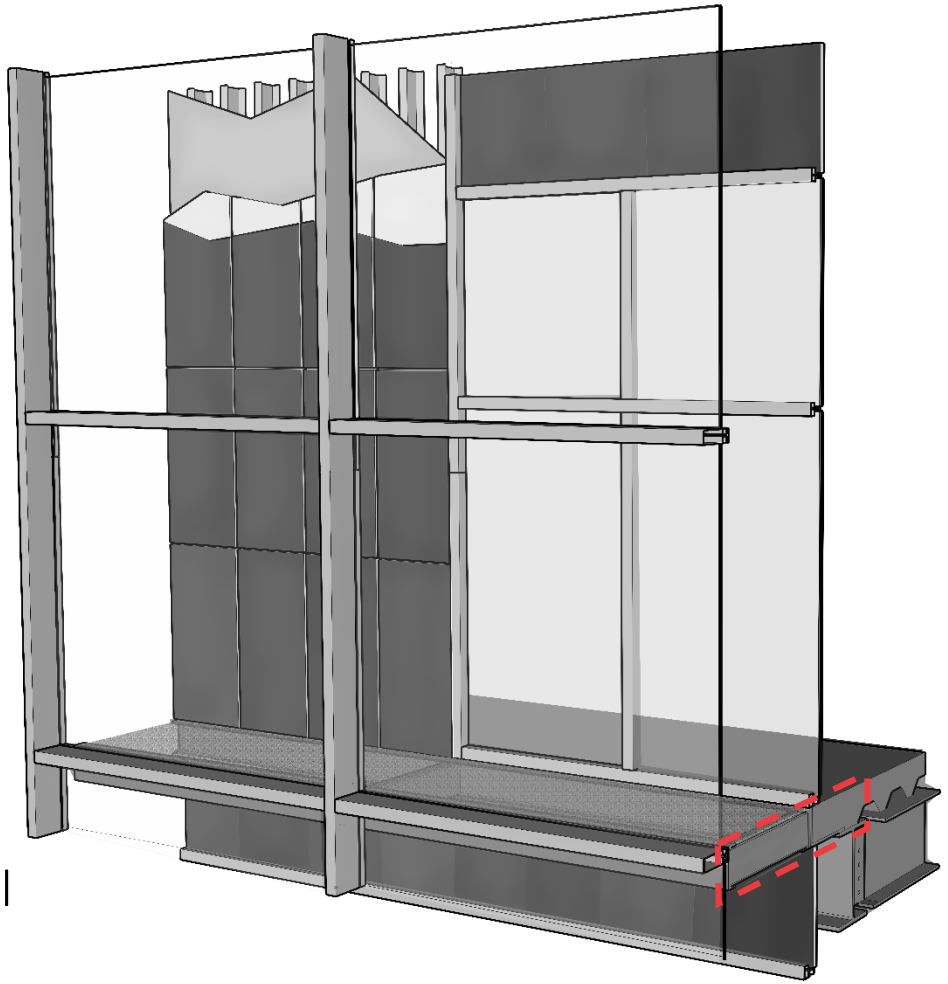
Double Skin Façade | Connection Detail



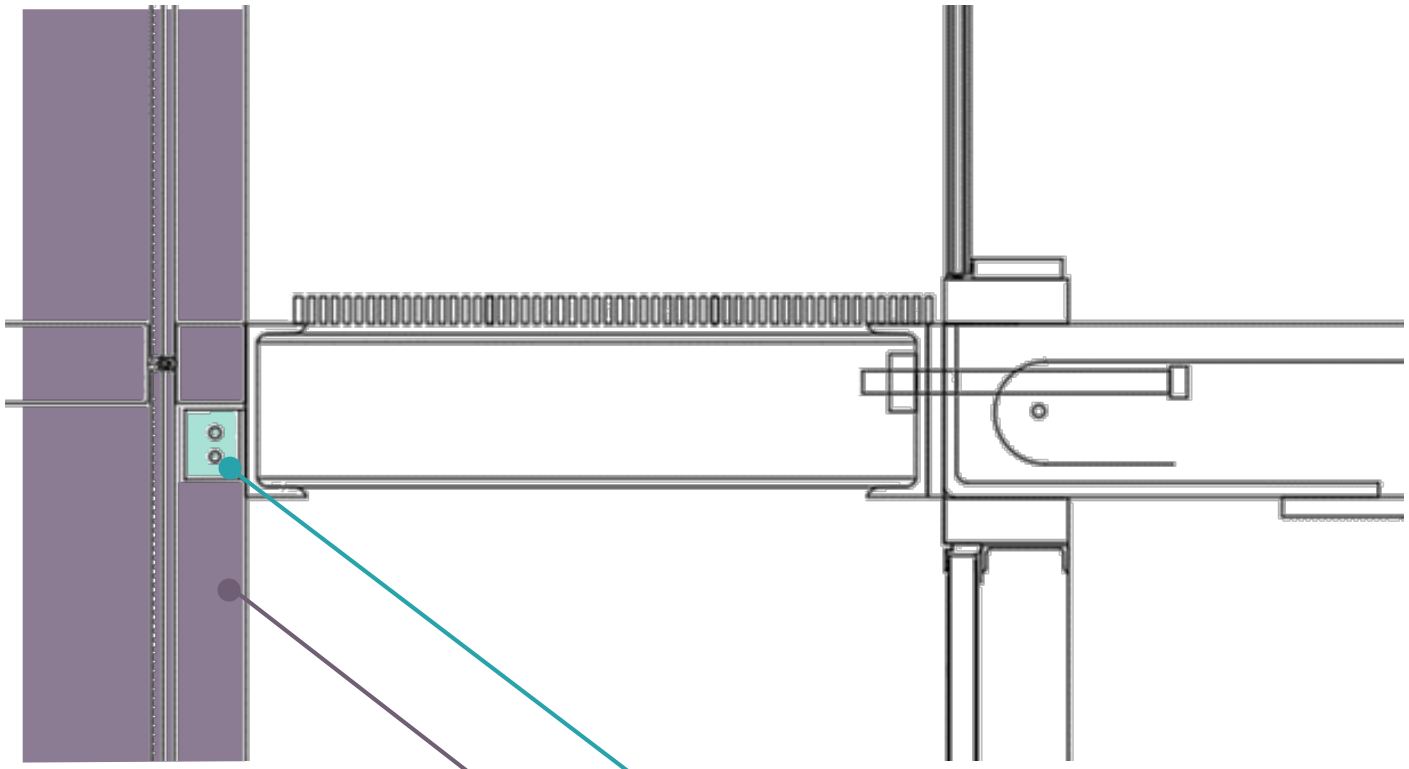
Thermal Break Material

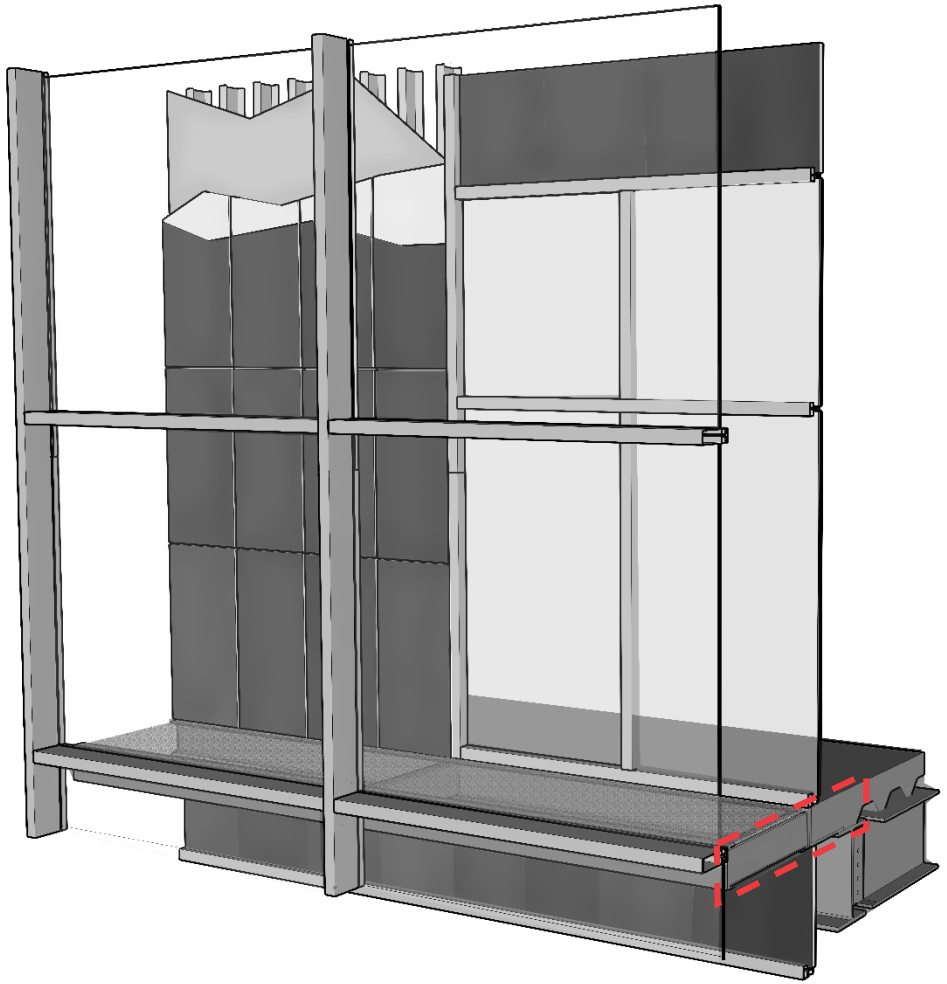
C6x13 Channel

C7x9.8 Channel



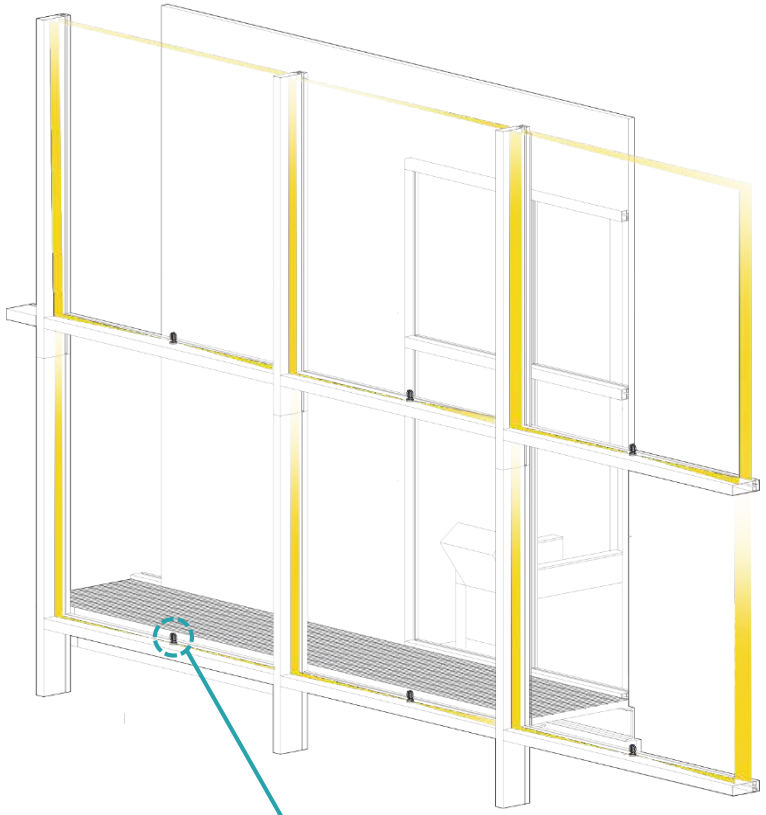
Double Skin Façade | Connection Detail





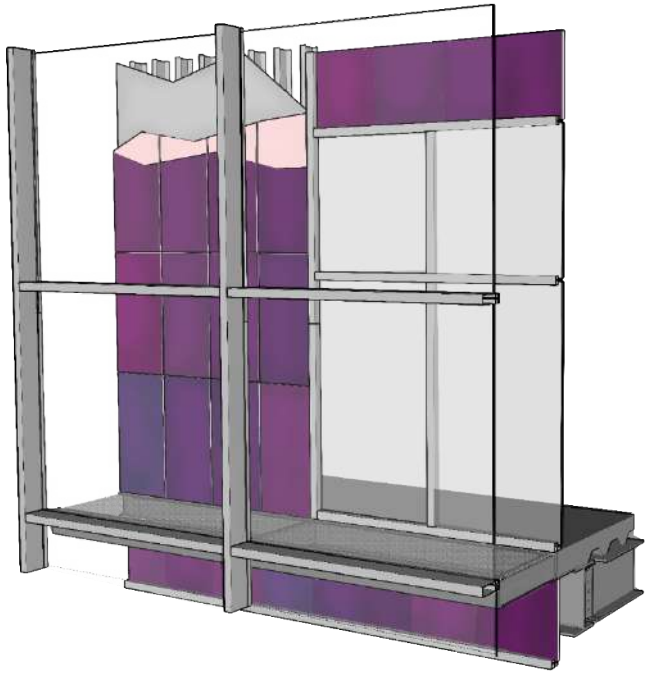
Double Skin Façade | Podium Lighting Scheme

Double Skin Façade | Tower Lighting Scheme



iGuzzini Trick 360

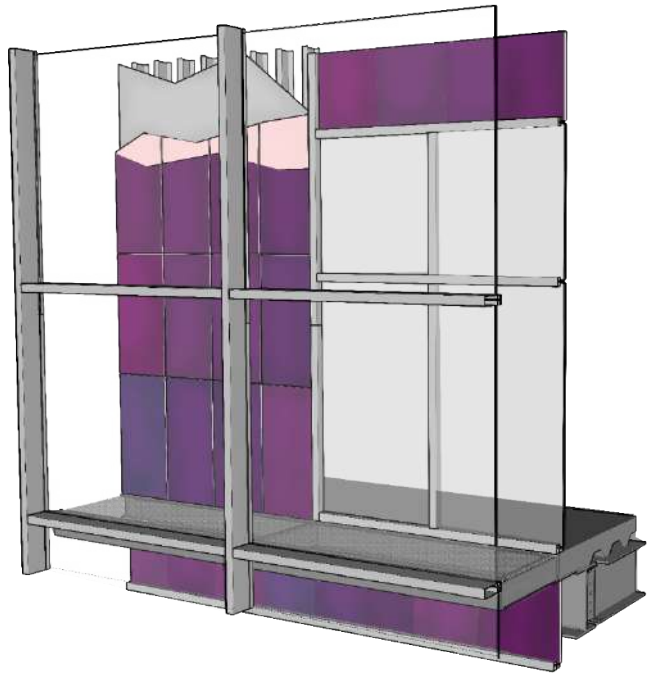
Double Skin Façade | Façade Options



Option 1

Minimal resistance to tornadic wind load and debris impact

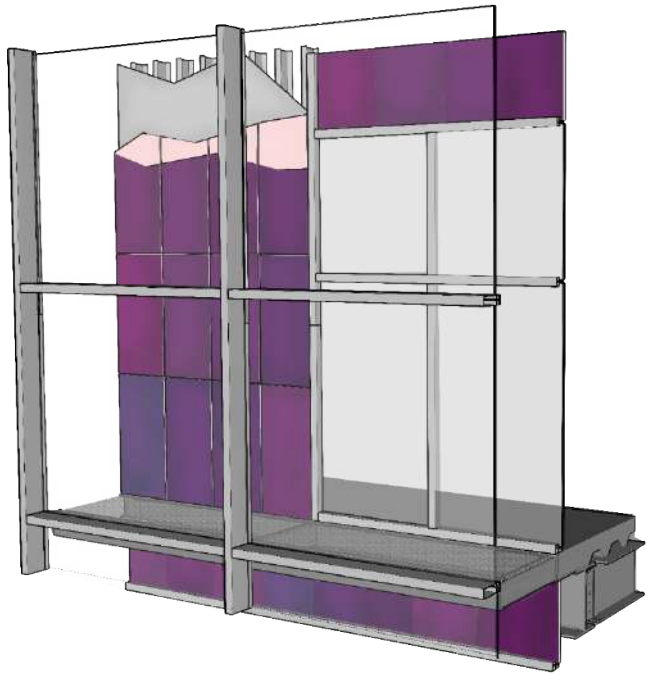
$78.81/SF



Option 2

Resistance to tornadic wind load, minimal resistance to debris impact

$82.65/SF



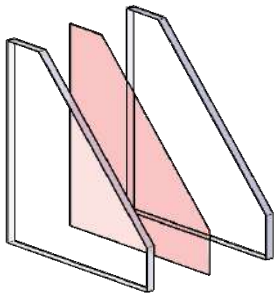
Option 3

Significant resistance to tornadic wind load and debris impact

$129.95/SF

Double Skin Façade | Façade Option 2

3/4” Laminated Glass

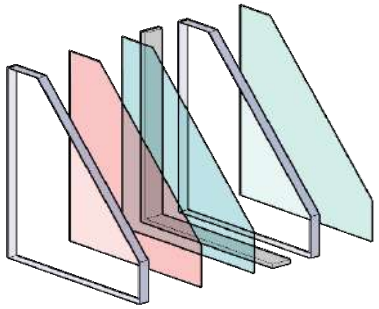


3/8” Glass

Lamination

3/8” Glass

1” Insulated Glazing Unit



1/4” Glass

Lamination

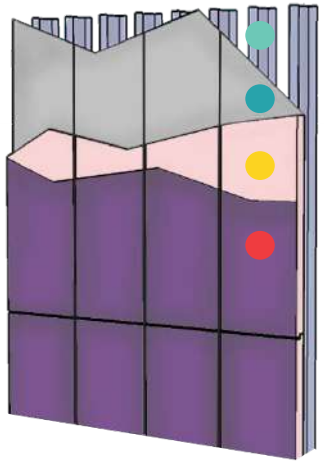
SNX 62/67

1/2” Air Gap

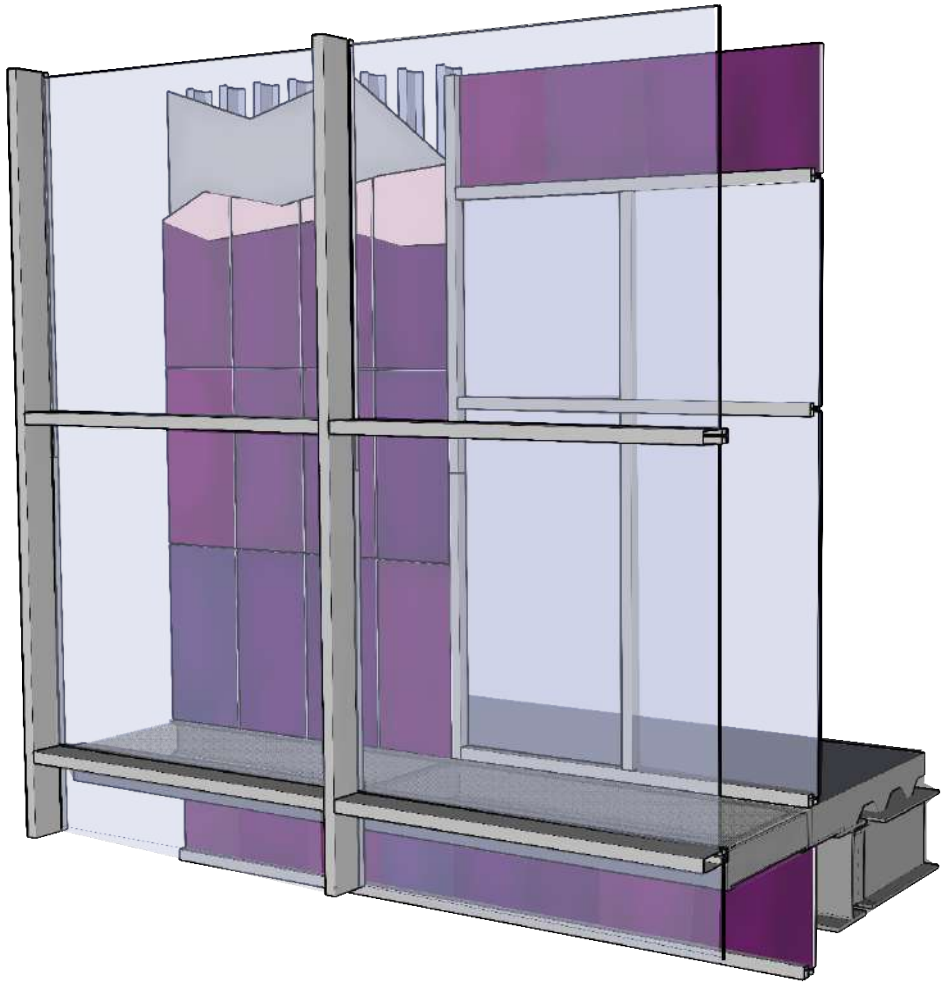
3/8” Glass

IS 20 Coating

Insulated Metal Panel

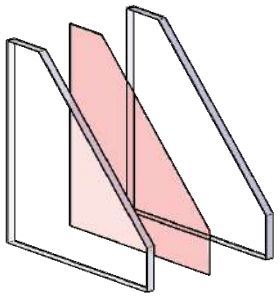


- Metal Stud Framing
- 22 ga. Steel
- Insulation
- 22 ga. Steel



Double Skin Façade | Façade Option 2

3/4” Laminated Glass



3/8” Glass

Lamination

3/8” Glass

1” Insulated Glazing Unit

1/4” Glass

Lamination

SNX 62/67

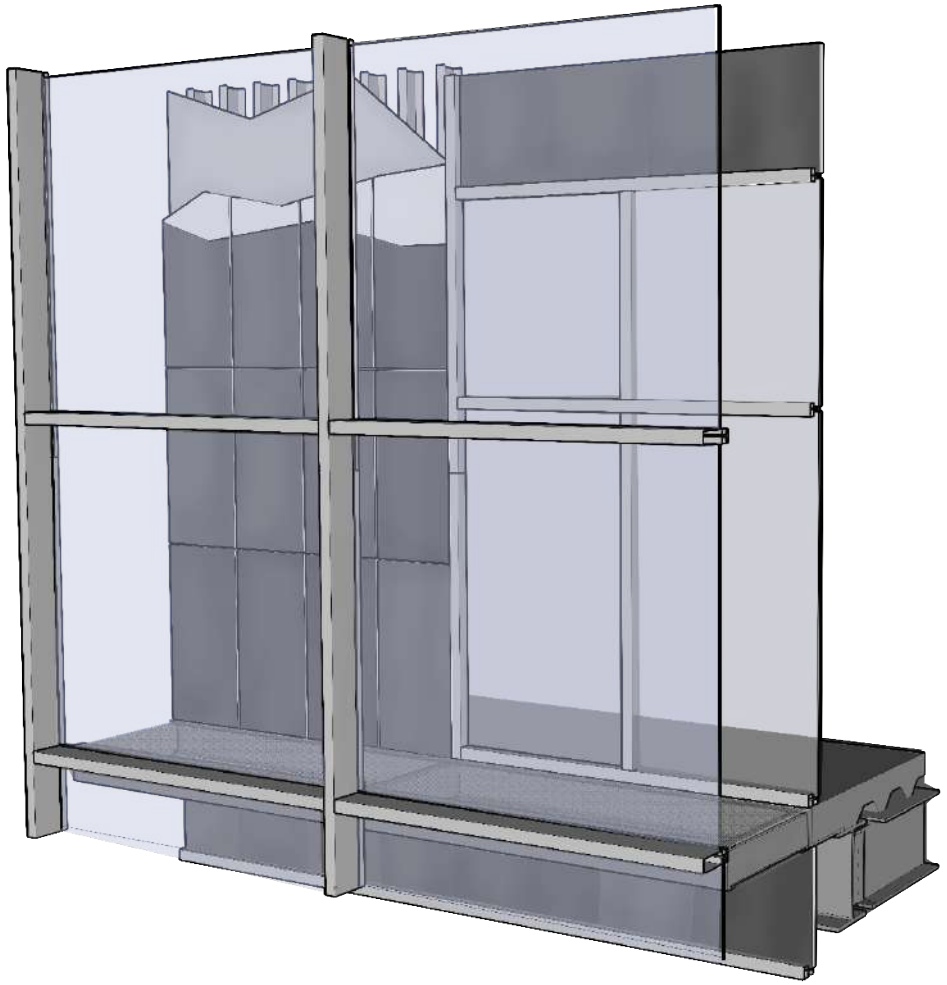
1/2” Air Gap

3/8” Glass

IS 20 Coating

Insulated Metal Panel

- Metal Stud Framing
- 22 ga. Steel
- Insulation
- 22 ga. Steel



Double Skin Façade | Façade Option 2

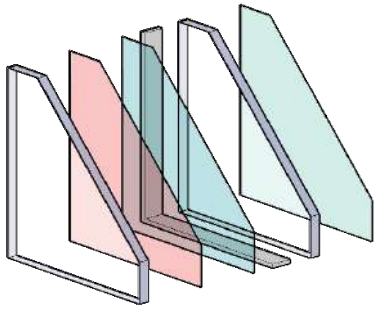
3/8” Laminated Glass

3/16” Glass

Lamination

3/16” Glass

1” Insulated Glazing Unit



1/4” Glass

Lamination

SNX 62/67

1/2” Air Gap

3/8” Glass

IS 20 Coating

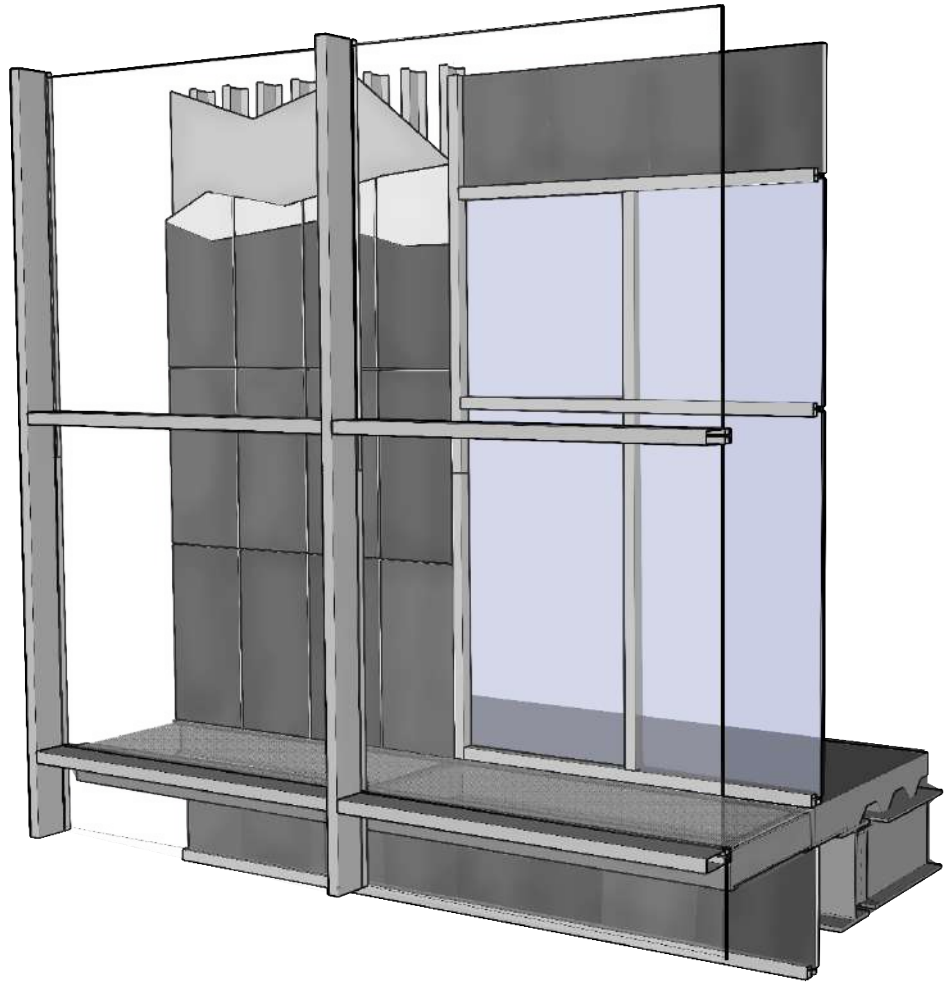
Insulated Metal Panel

Metal Stud Framing

22 ga. Steel

Insulation

22 ga. Steel



Double Skin Façade | Façade Option 2

3/8” Laminated Glass

3/16” Glass

Lamination

3/16” Glass

1” Insulated Glazing Unit

1/4” Glass

Lamination

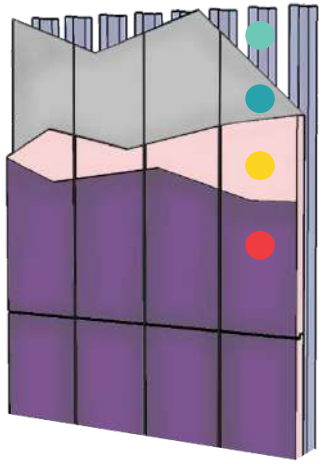
SNX 62/67

1/2” Air Gap

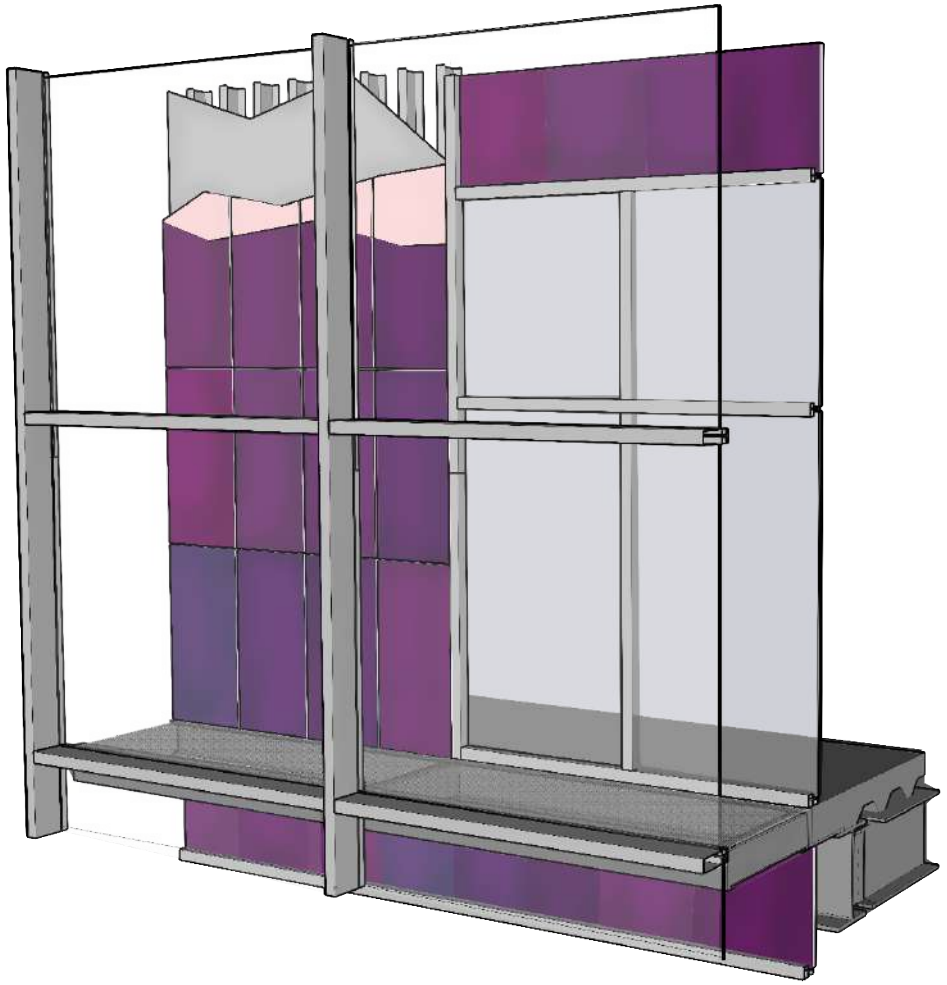
3/8” Glass

IS 20 Coating

Insulated Metal Panel

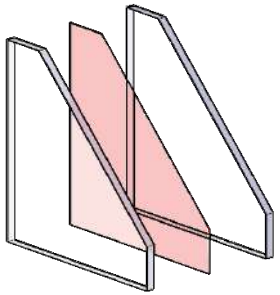


- Metal Stud Framing
- 22 ga. Steel
- Insulation
- 22 ga. Steel



Double Skin Façade | Façade Option 3

3/4” Laminated Glass

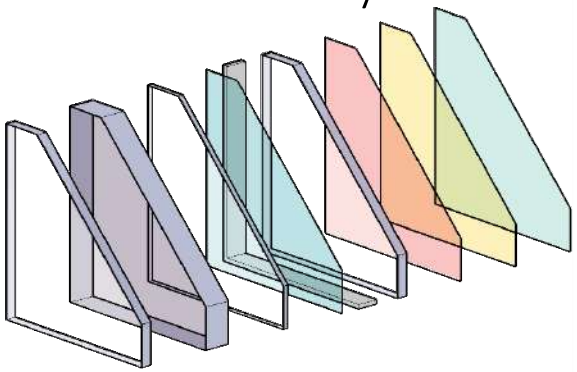


3/8” Glass

Lamination

3/8” Glass

Glass-Clad Polycarbonate



1/4” Glass

5/8” Polycarbonate

1/8” Annealed Glass

SNX 62/67

1/2” Air Gap

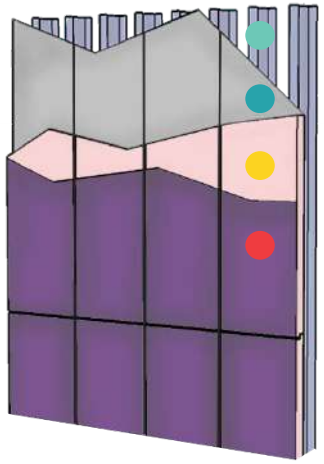
3/8” Glass

Lamination

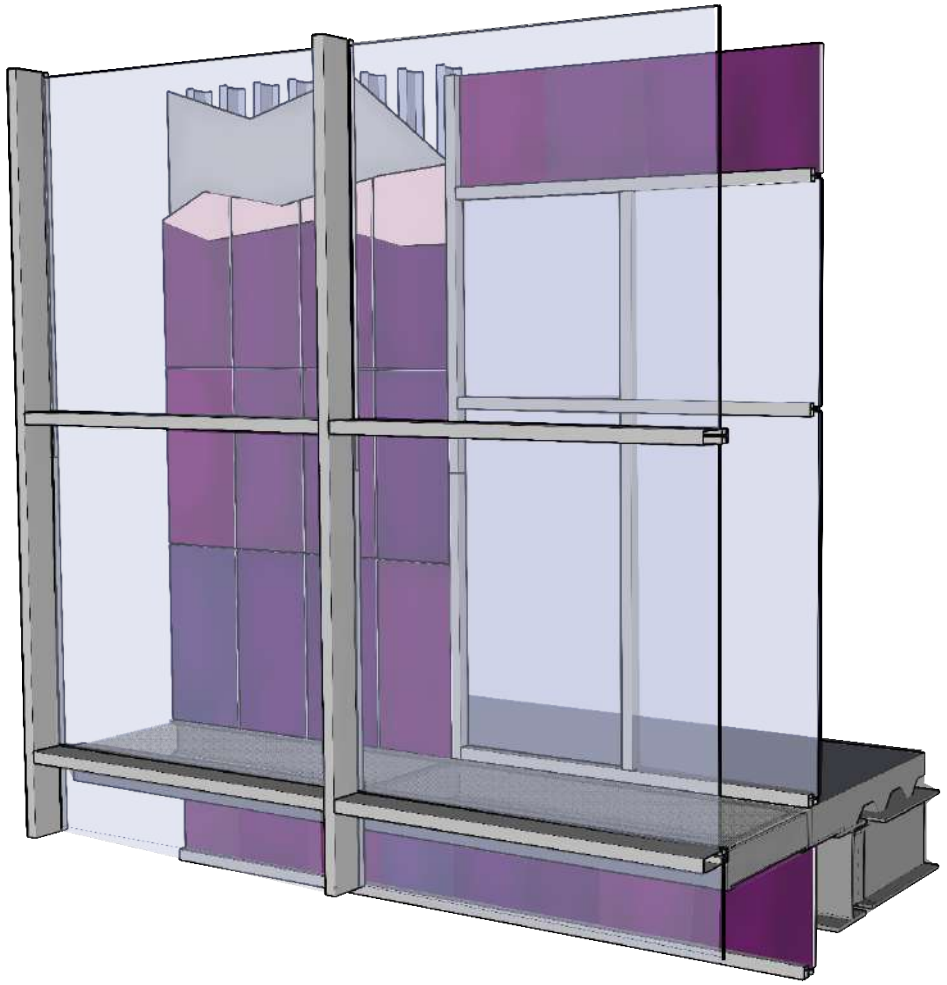
PET Sheet

IS 20 Coating

Insulated Metal Panel



- Metal Stud Framing
- 16 ga. Steel
- Insulation
- 16 ga. Steel



Double Skin Façade | Façade Option 3

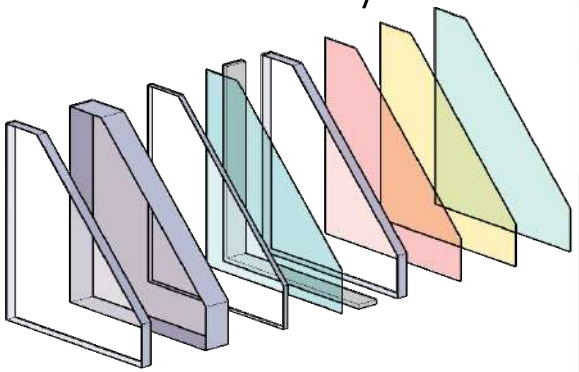
3/4” Laminated Glass

3/8” Glass

Lamination

3/8” Glass

Glass-Clad Polycarbonate



1/4” Glass

5/8” Polycarbonate

1/8” Annealed Glass

SNX 62/67

1/2” Air Gap

3/8” Glass

Lamination

PET Sheet

IS 20 Coating

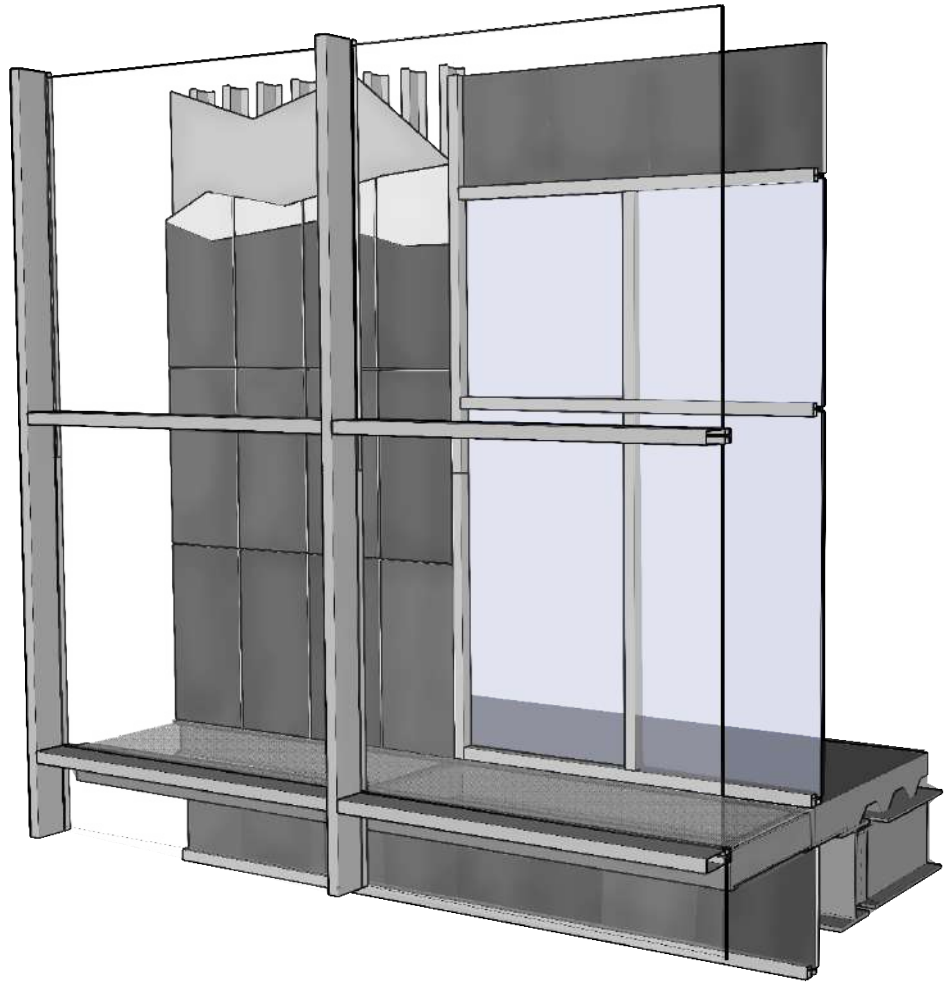
Insulated Metal Panel

Metal Stud Framing

16 ga. Steel

Insulation

16 ga. Steel



Double Skin Façade | Façade Option 3

3/4” Laminated Glass

3/8” Glass

Lamination

3/8” Glass

Glass-Clad Polycarbonate

1/4” Glass

5/8” Polycarbonate

1/8” Annealed Glass

SNX 62/67

1/2” Air Gap

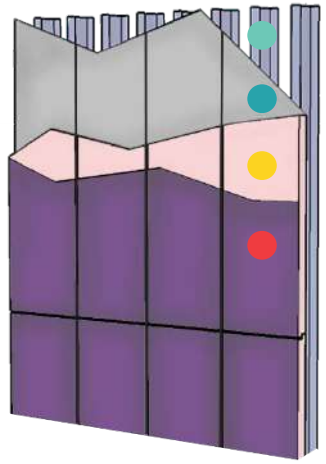
3/8” Glass

Lamination

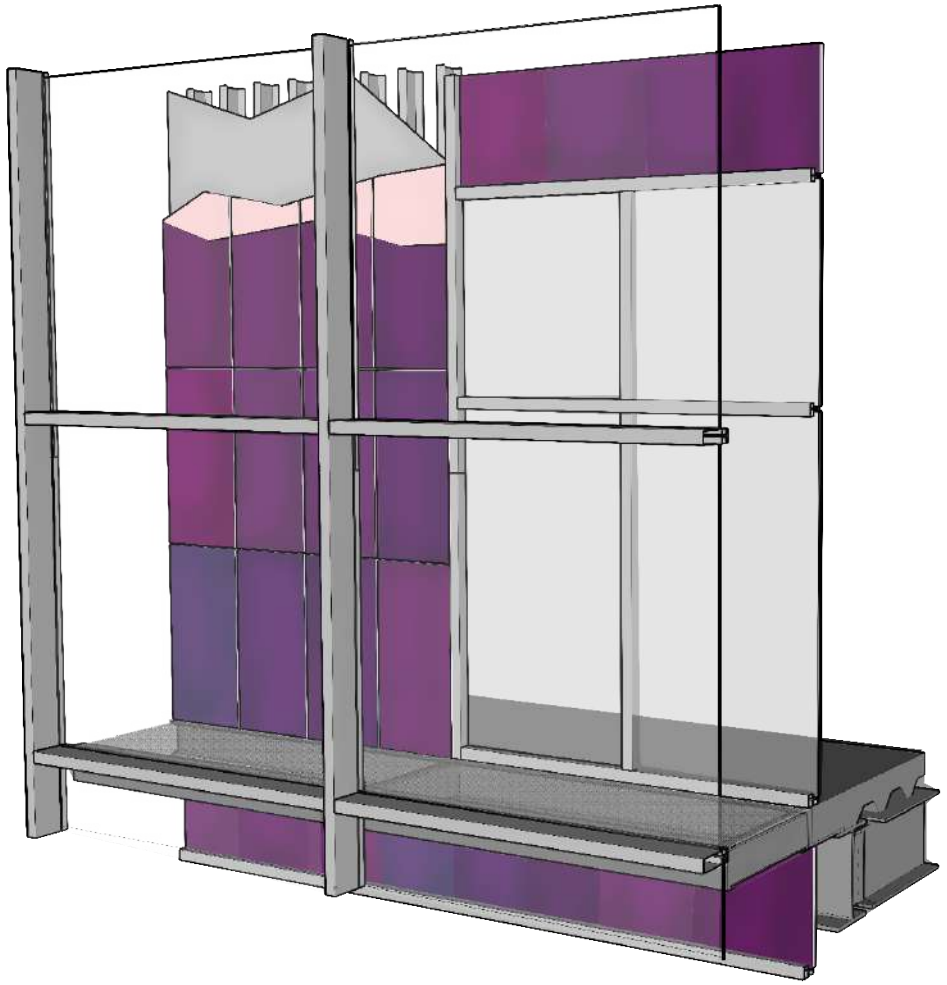
PET Sheet

IS 20 Coating

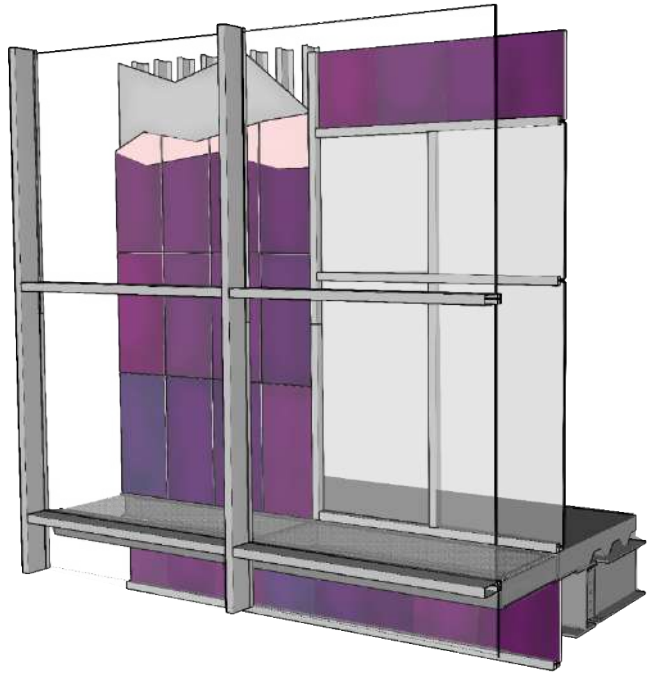
Insulated Metal Panel



- Metal Stud Framing
- 16 ga. Steel
- Insulation
- 16 ga. Steel



Double Skin Façade | Façade Options



Option 2

Resistance to tornadic wind load, minimal resistance to debris impact

$82.65/SF

Option 3

Significant resistance to tornadic wind load and debris impact

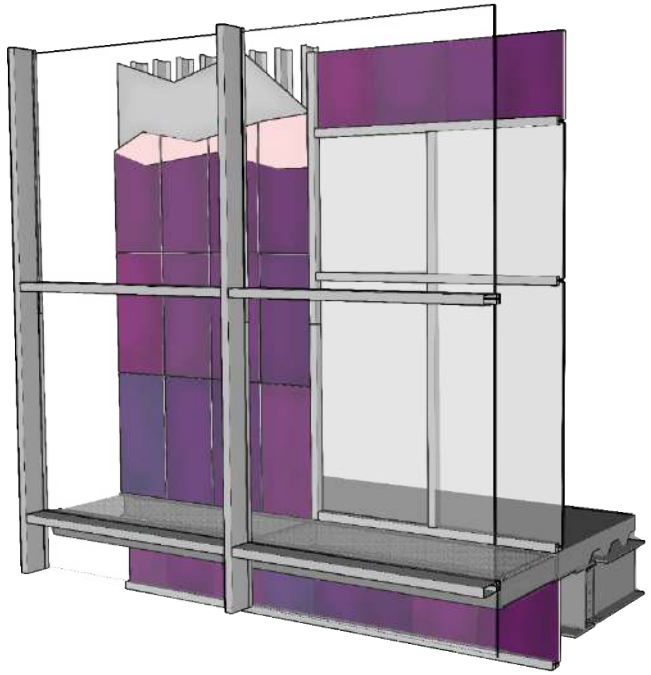
$129.95/SF

Double Skin Façade | Façade Options

Option 2

Resistance to tornadic wind load, minimal resistance to debris impact

$82.65/SF

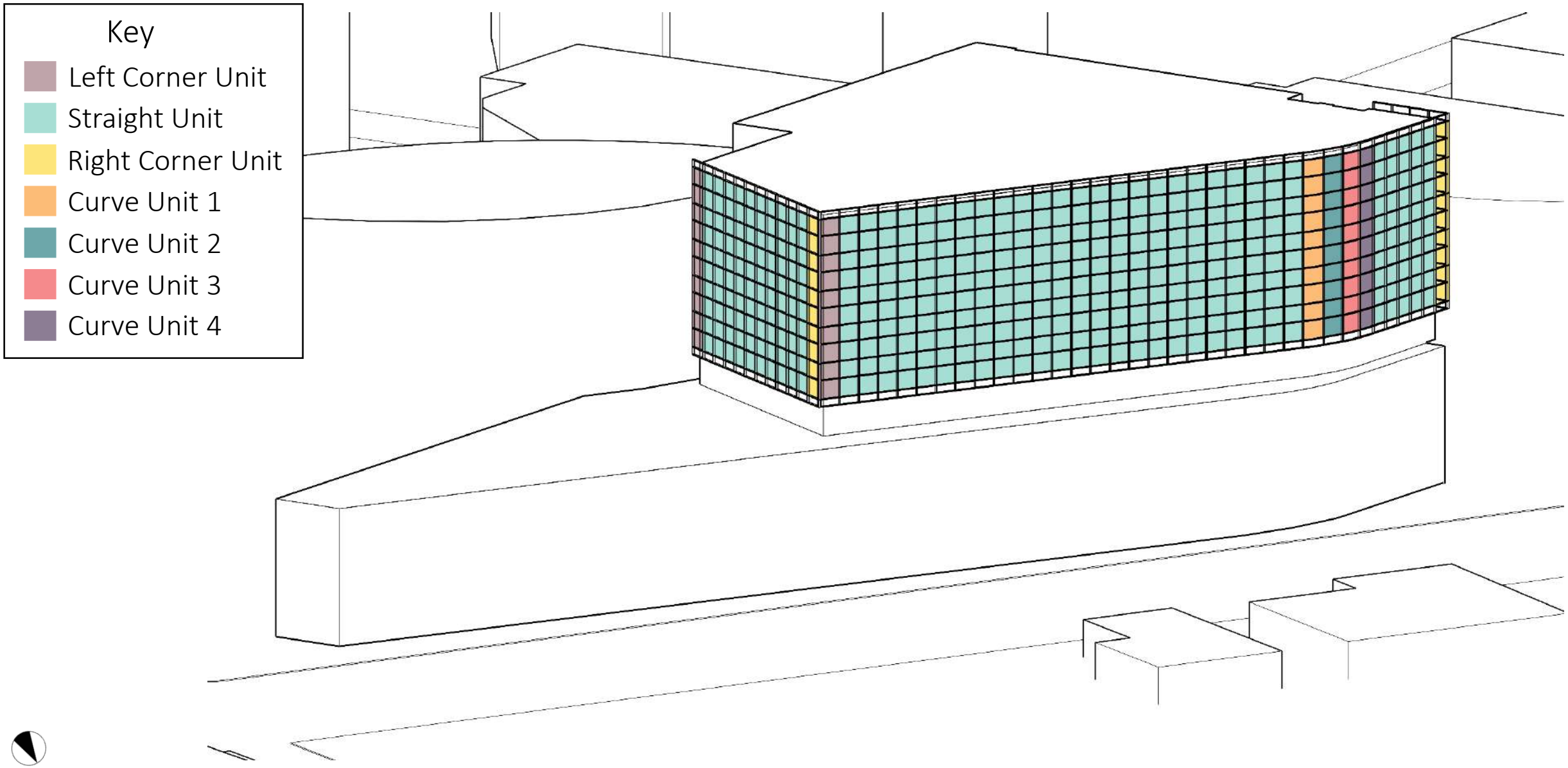


Option 3

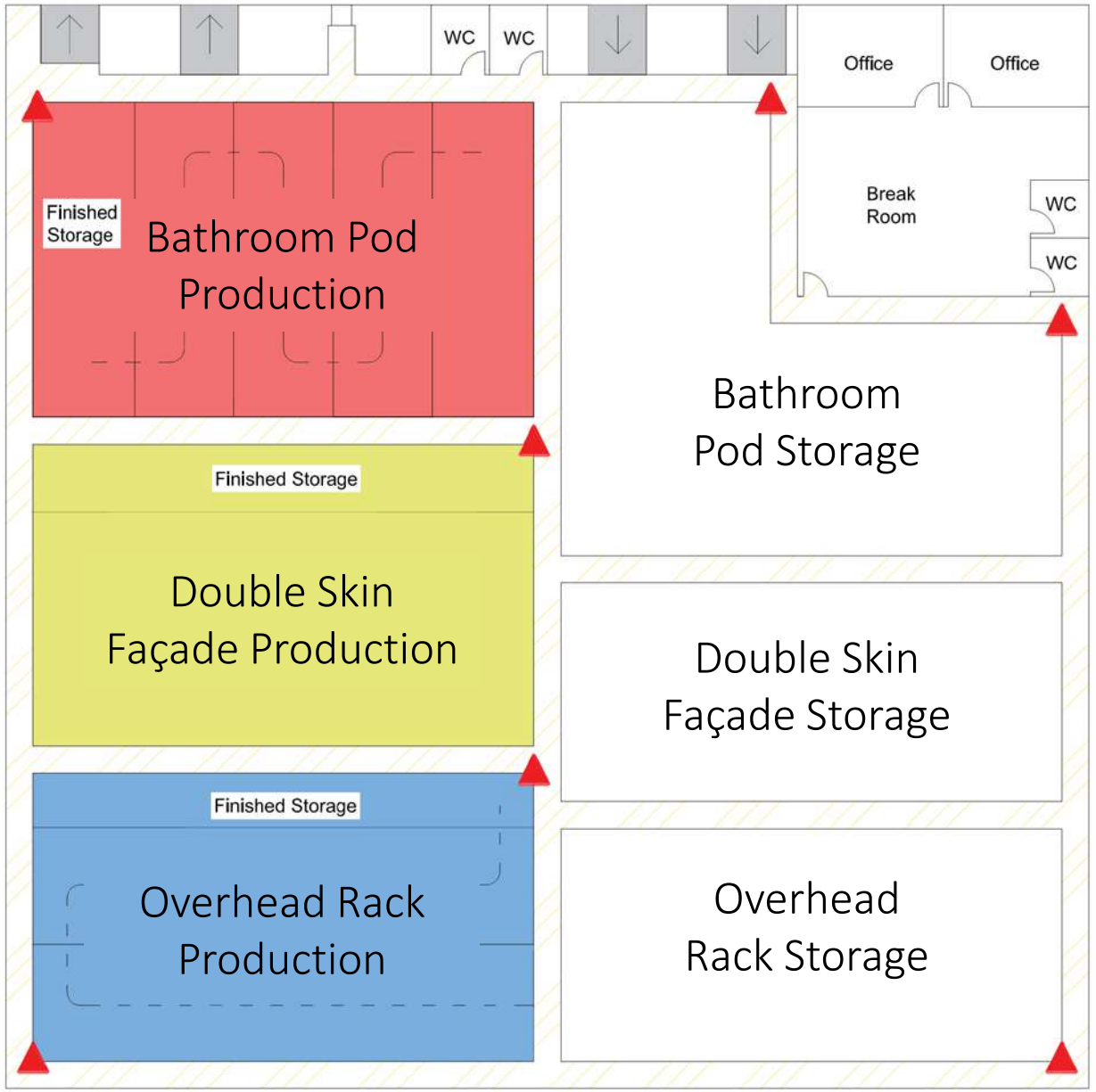
Significant resistance to tornadic wind load and debris impact

$129.95/SF

Double Skin Façade | Prefabricated Units

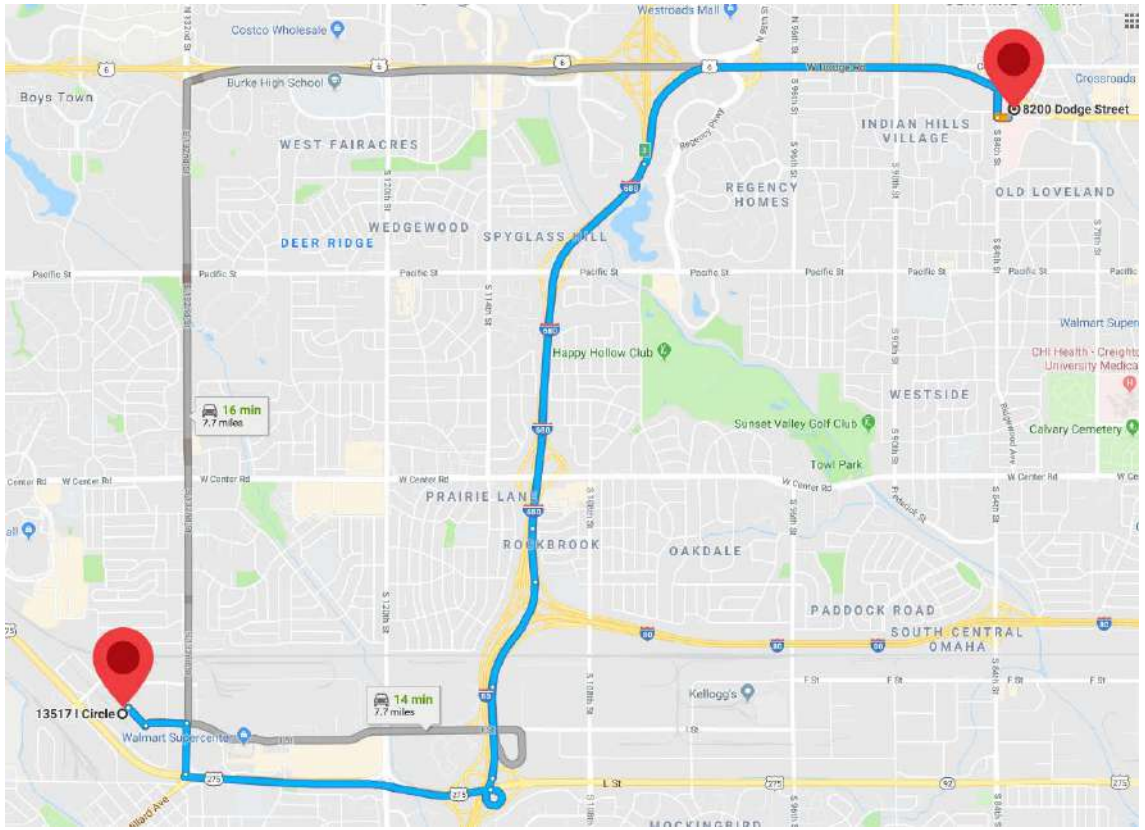


Double Skin Façade | Prefabrication Factory

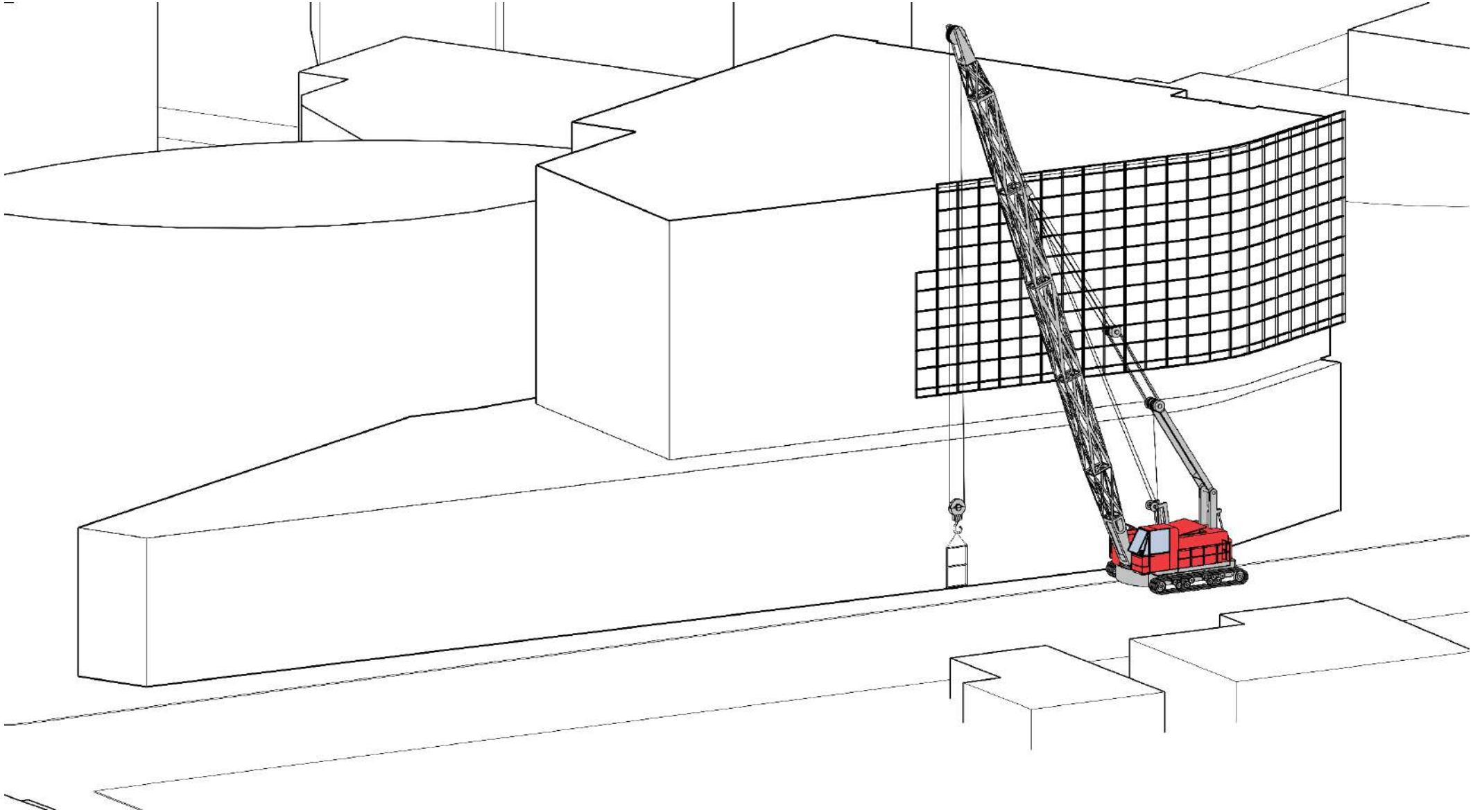


$345,000

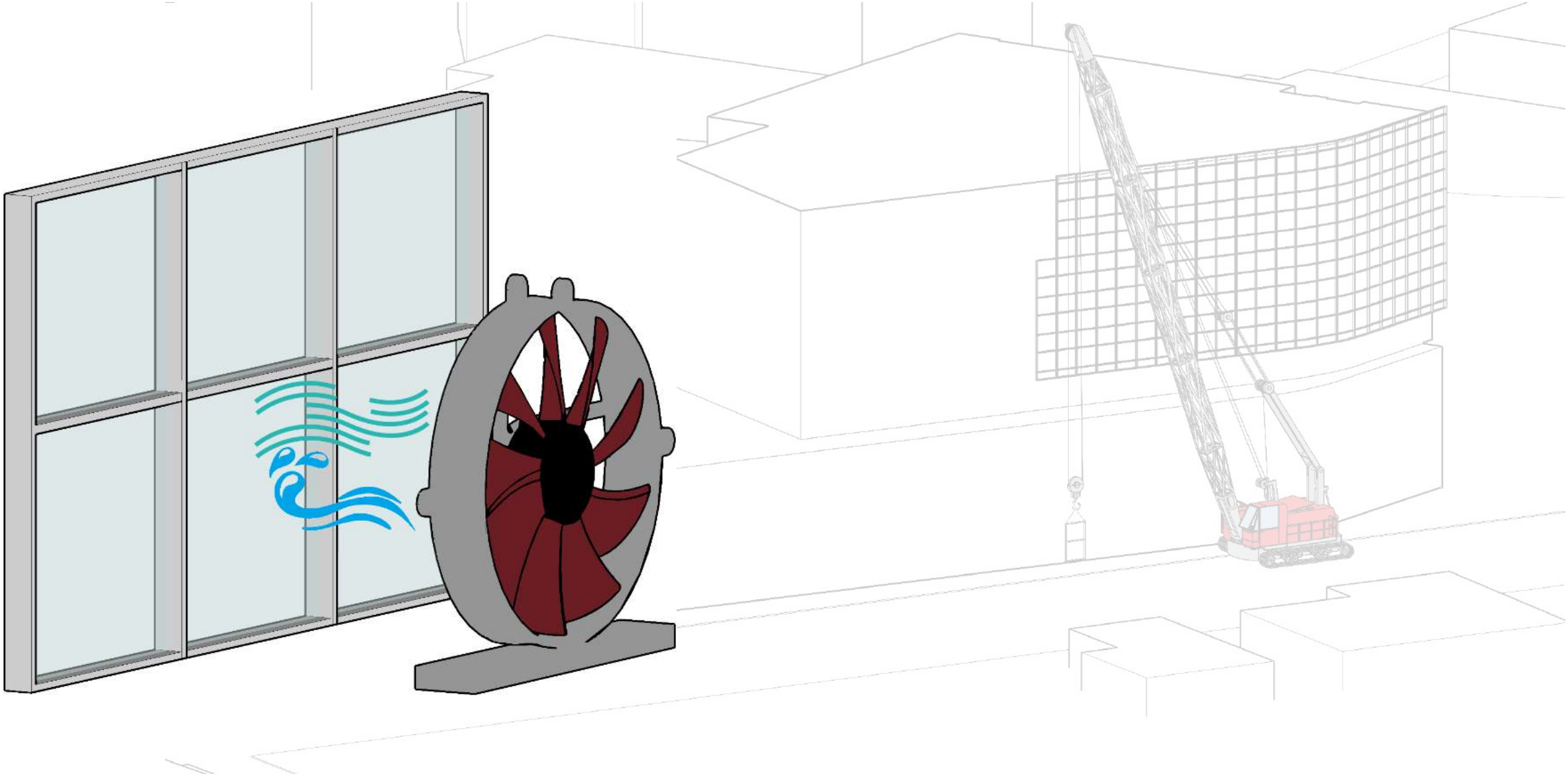
7.9 miles



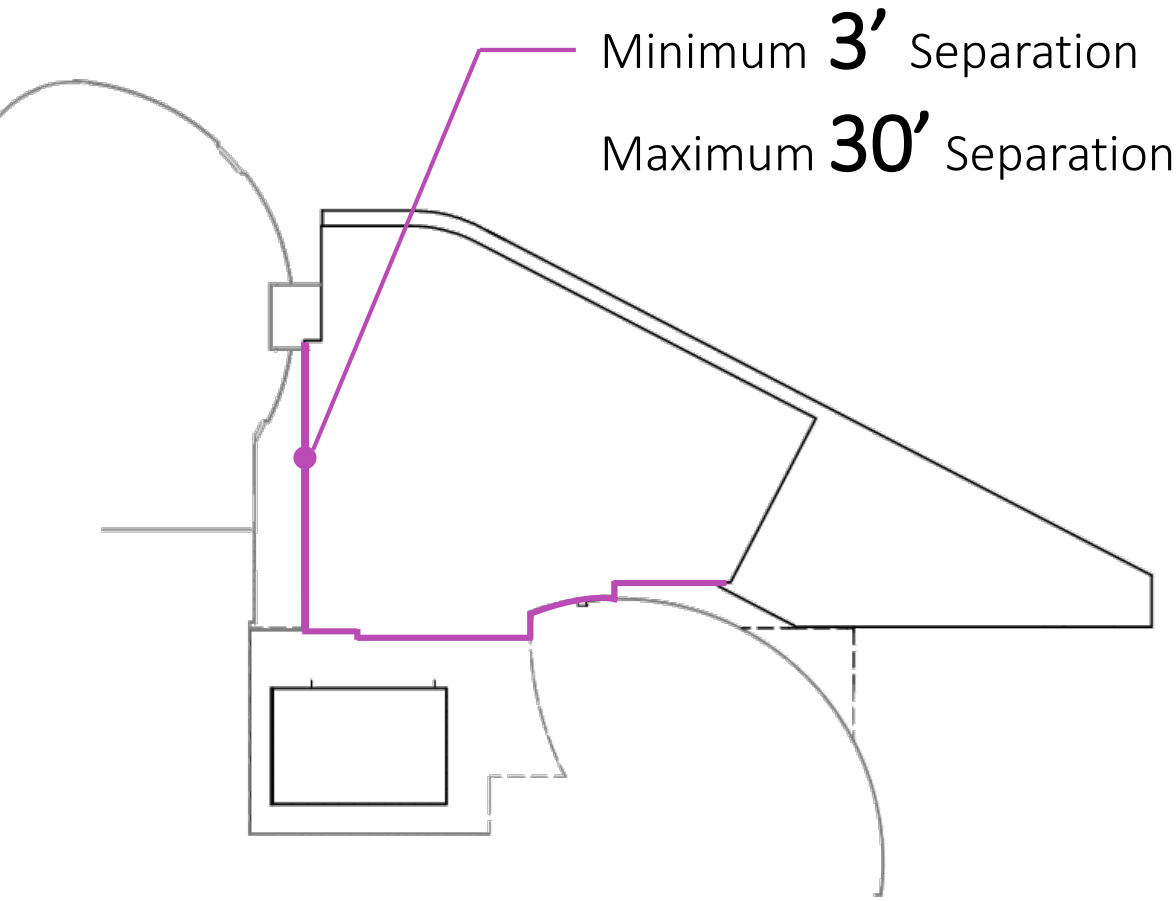
Double Skin Façade | Prefabricated Units Installation



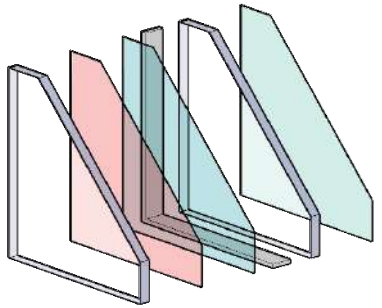
Double Skin Façade | Prefabricated Units Installation



Single Skin Façade



1” Insulated Glazing Unit



1/4” Glass

Lamination

SNX 62/67

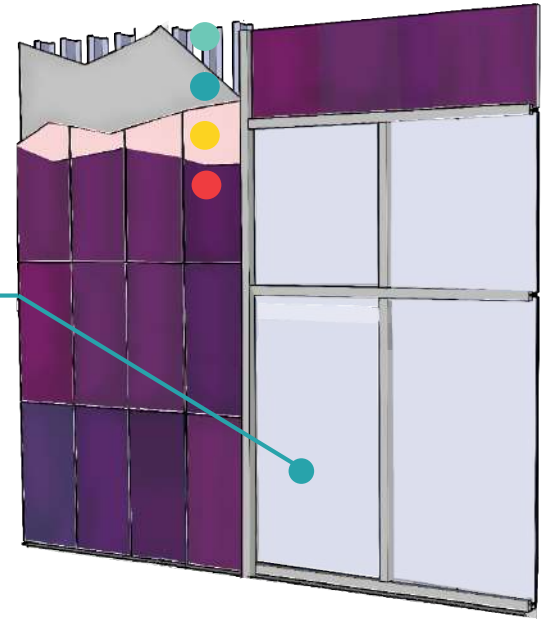
1/2” Air Gap

3/8” Glass

IS 20 Coating

Insulated Metal Panel

- Metal Stud Framing
- 22 ga. Steel
- Insulation
- 22 ga. Steel

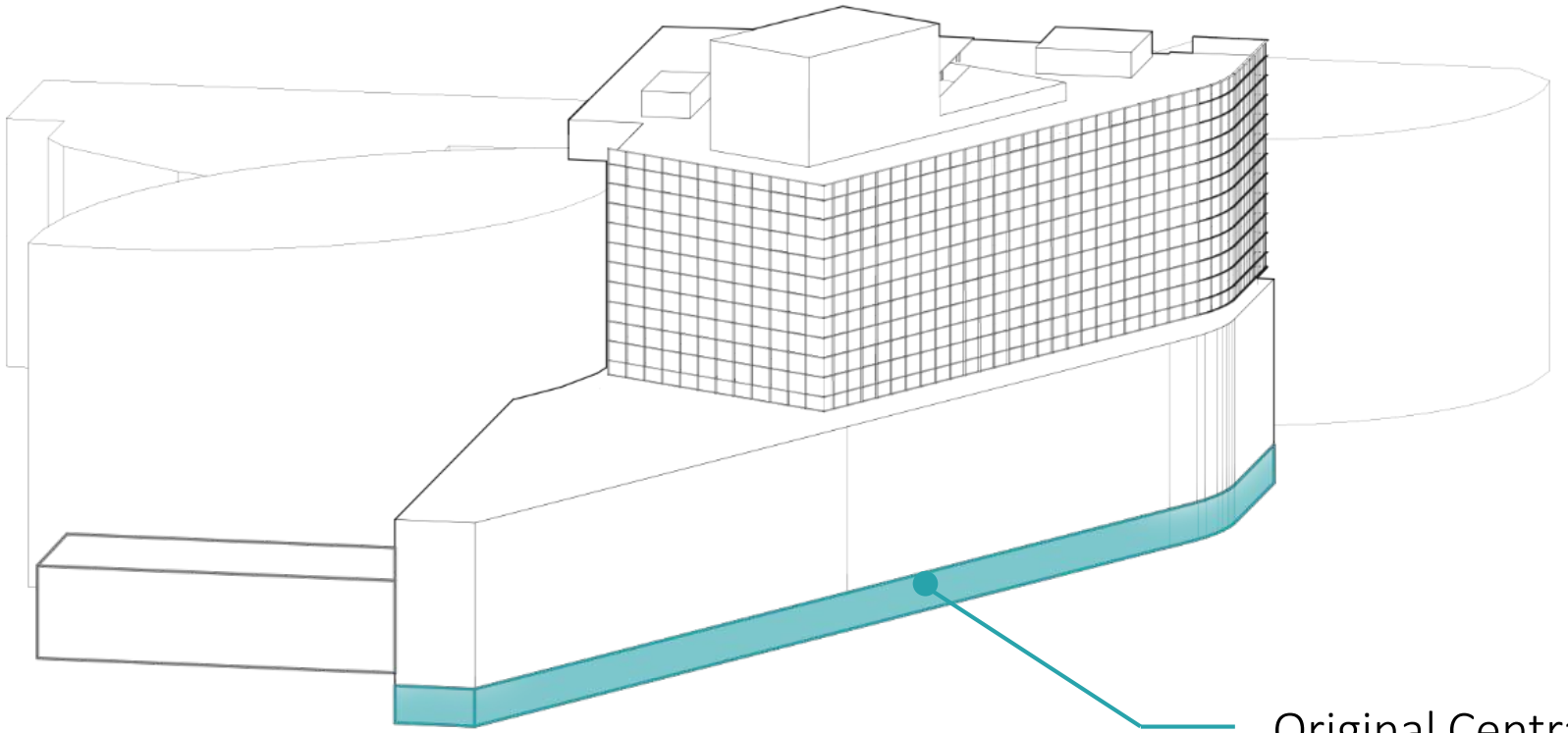


Adaptability

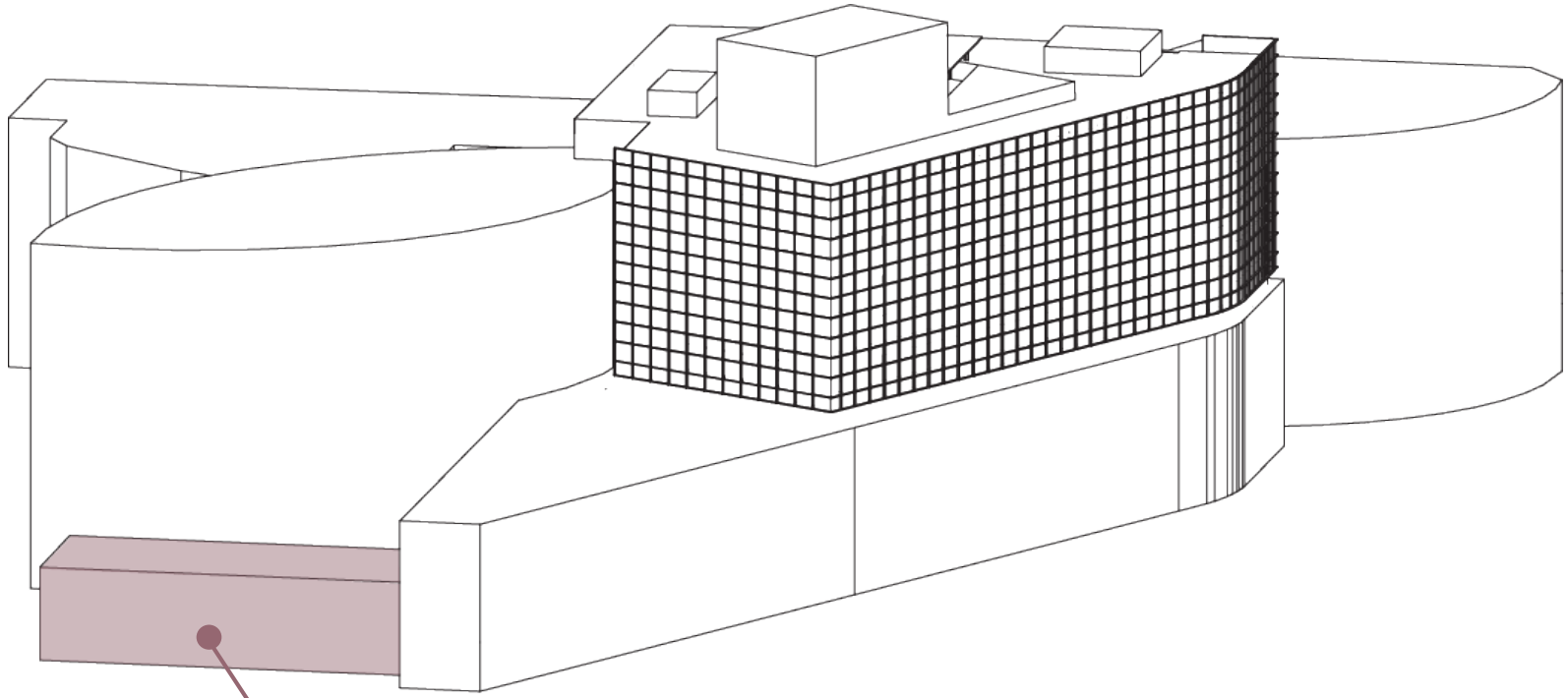
Central Plant

Disaster Preparedness

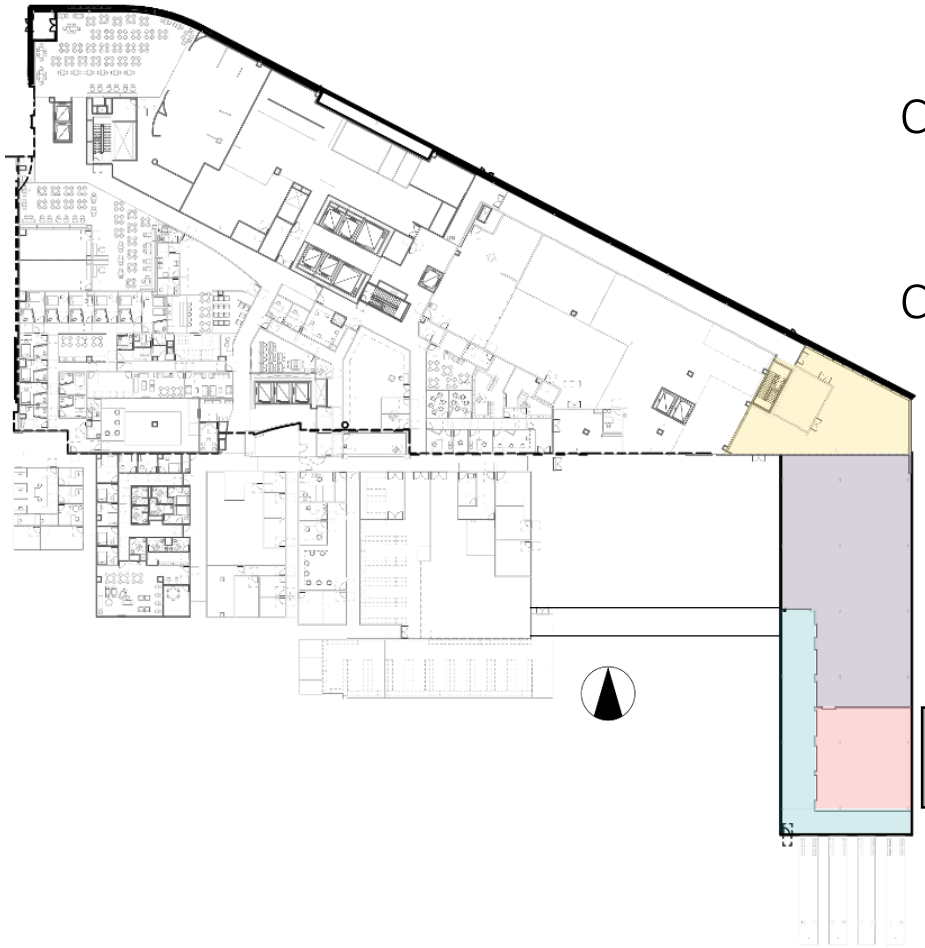
Central Plant

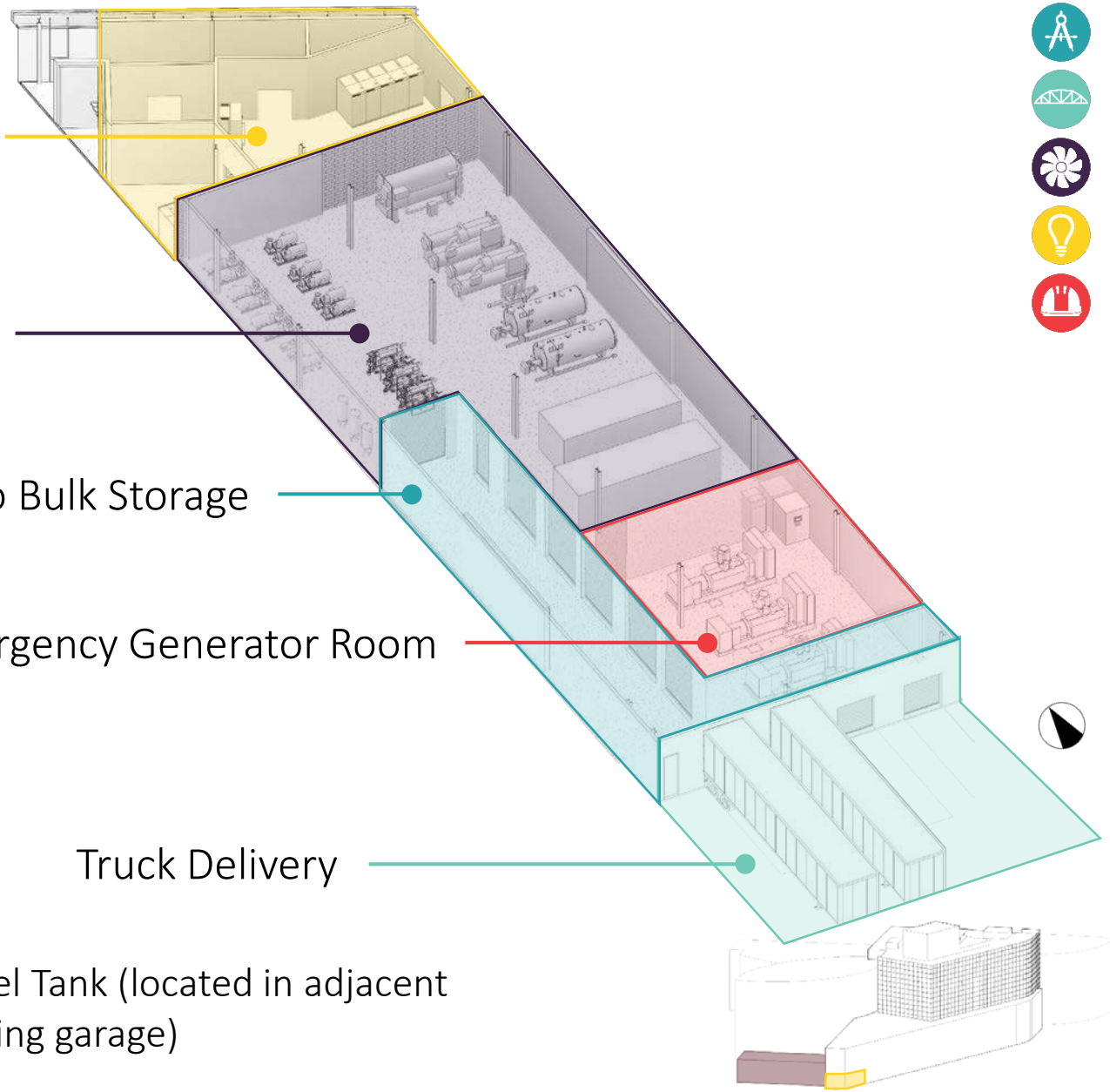


Central Plant

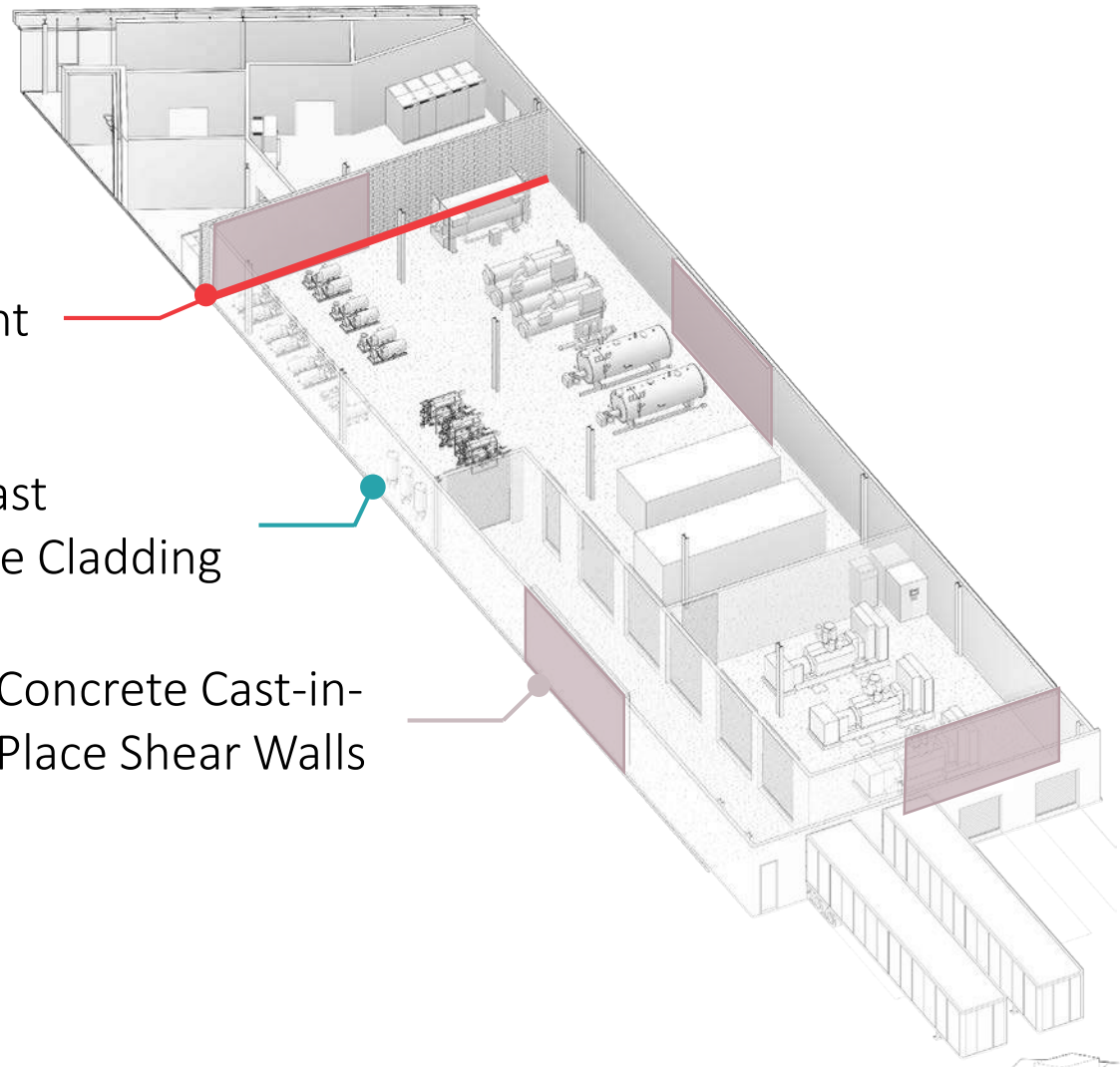


Central Plant

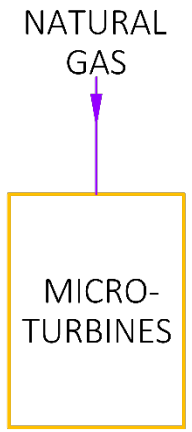


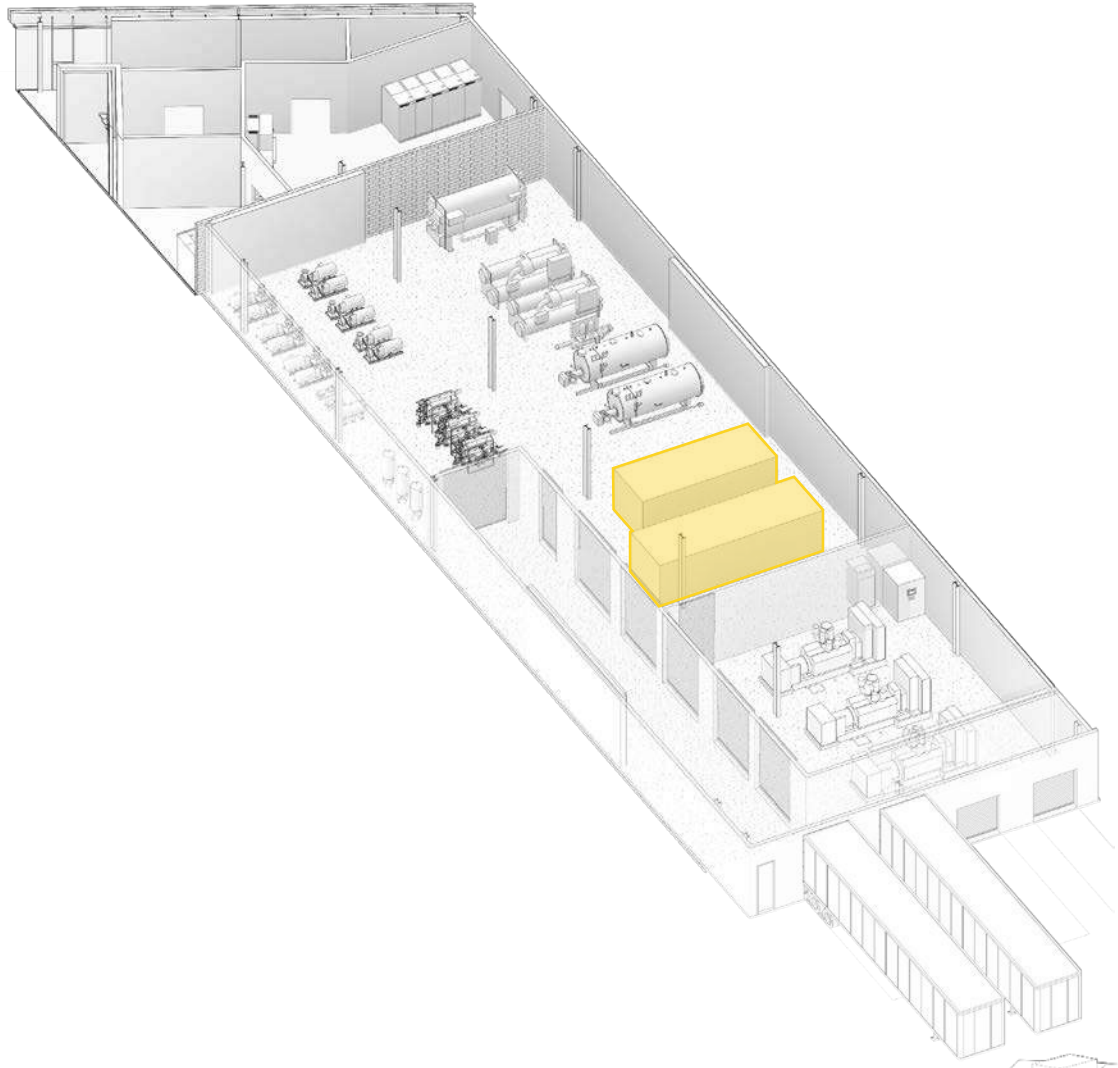


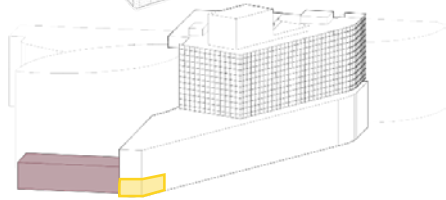
Central Plant | Structure



Central Plant | Mechanical System



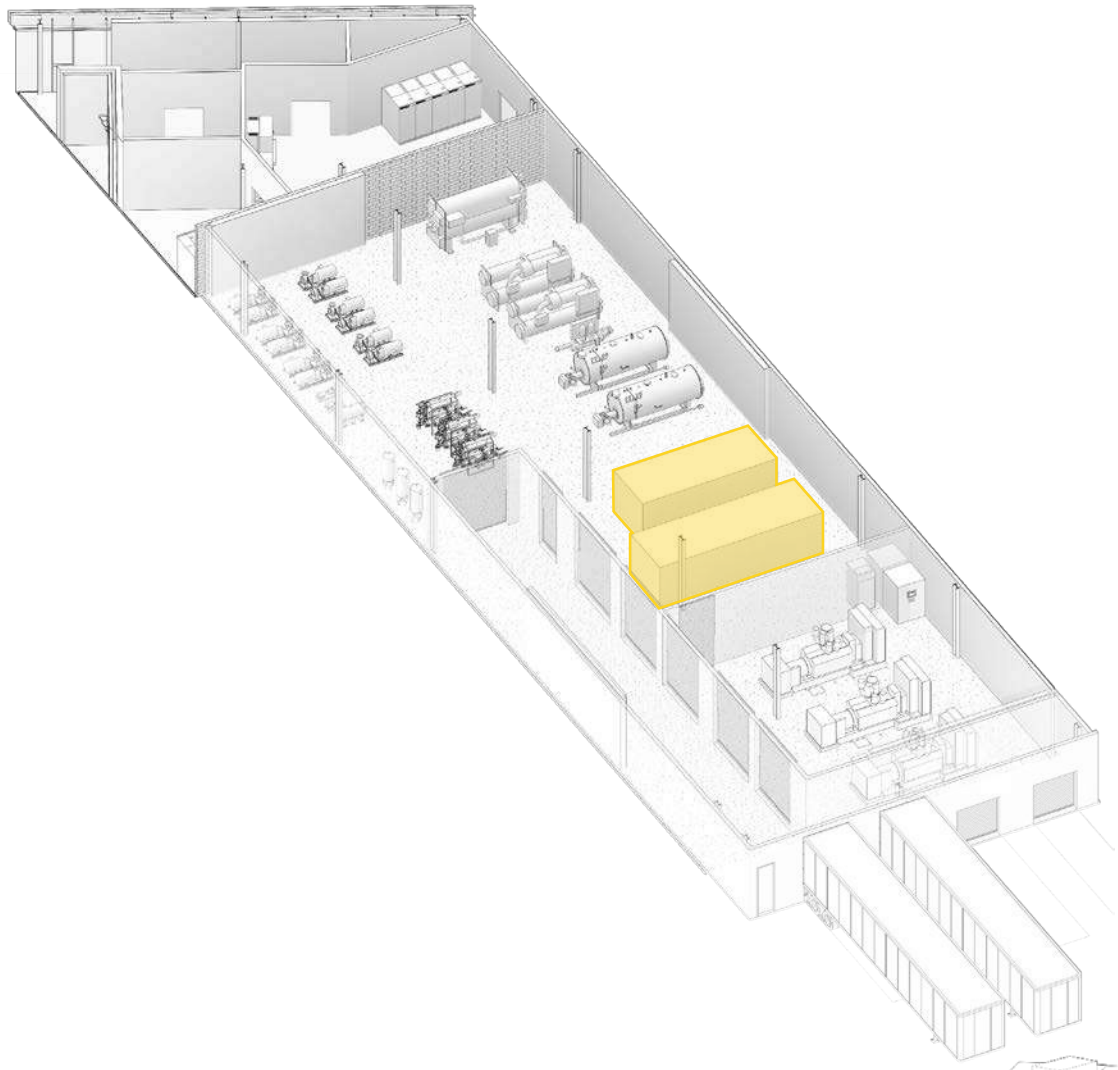


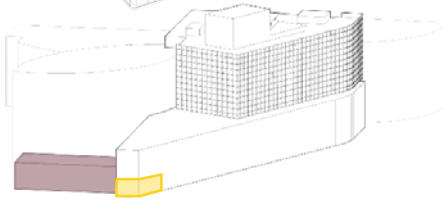


Central Plant | Mechanical System

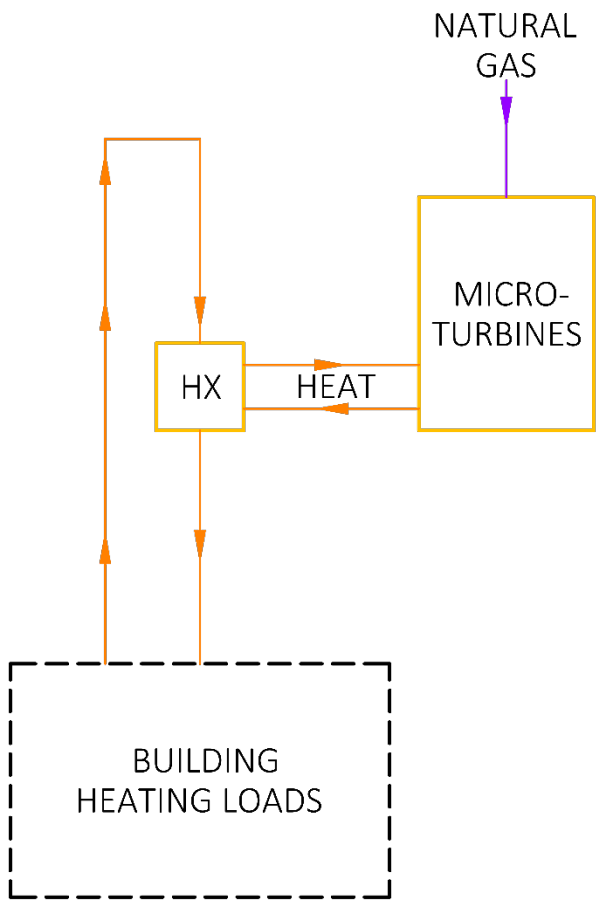
NATURAL GAS

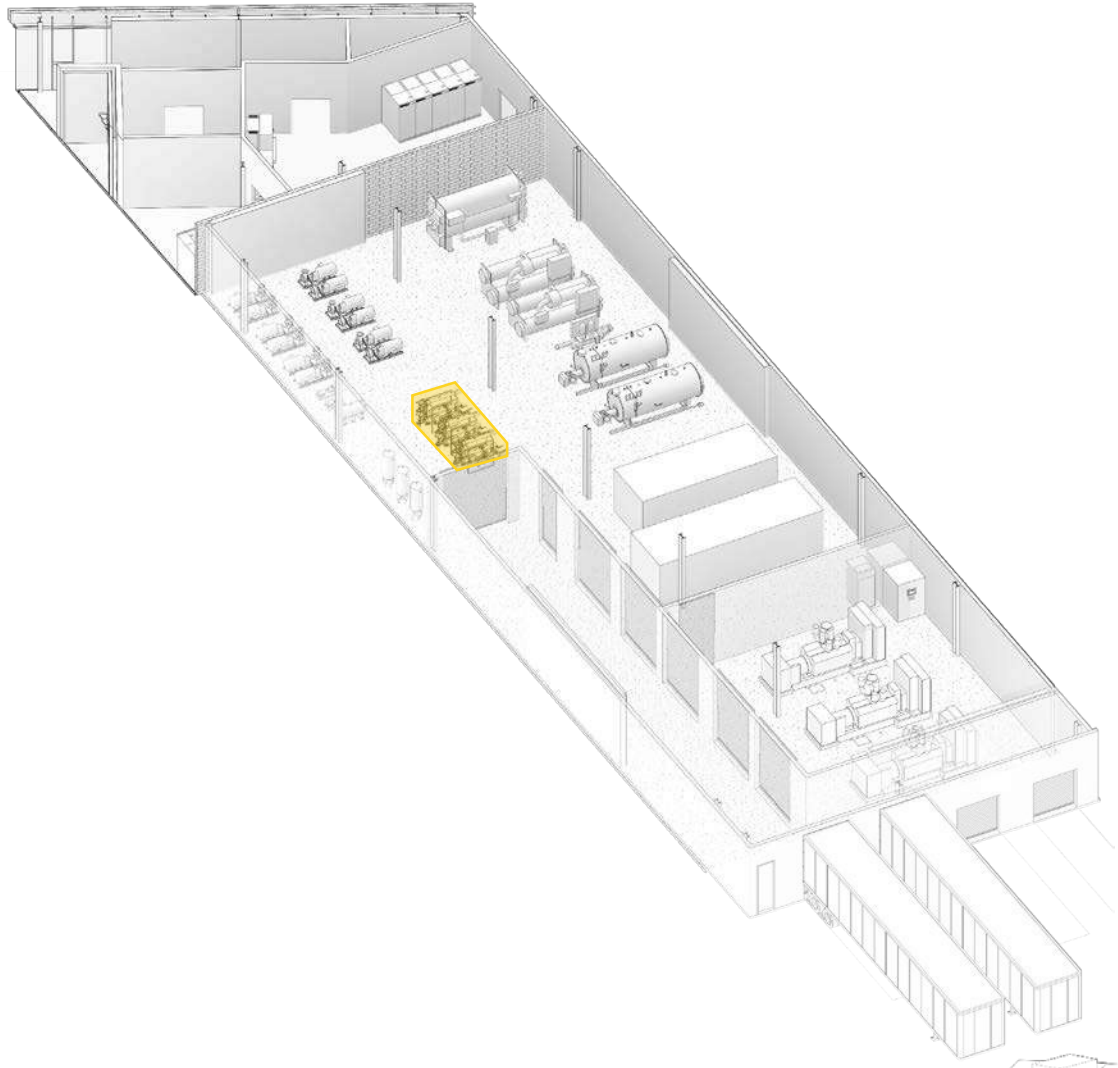
MICRO-TURBINES

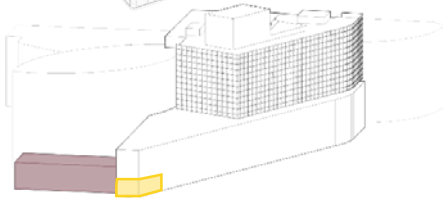




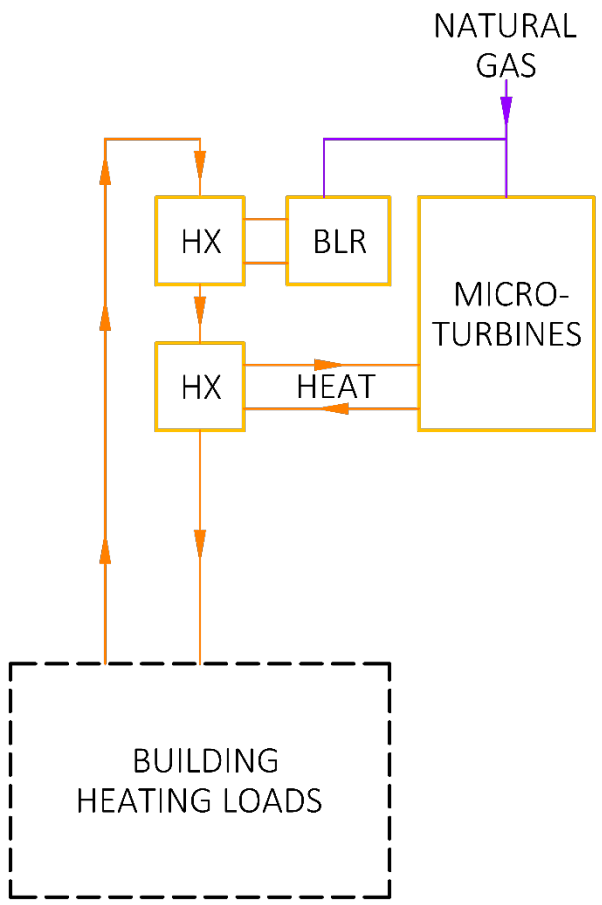
Central Plant | Mechanical System

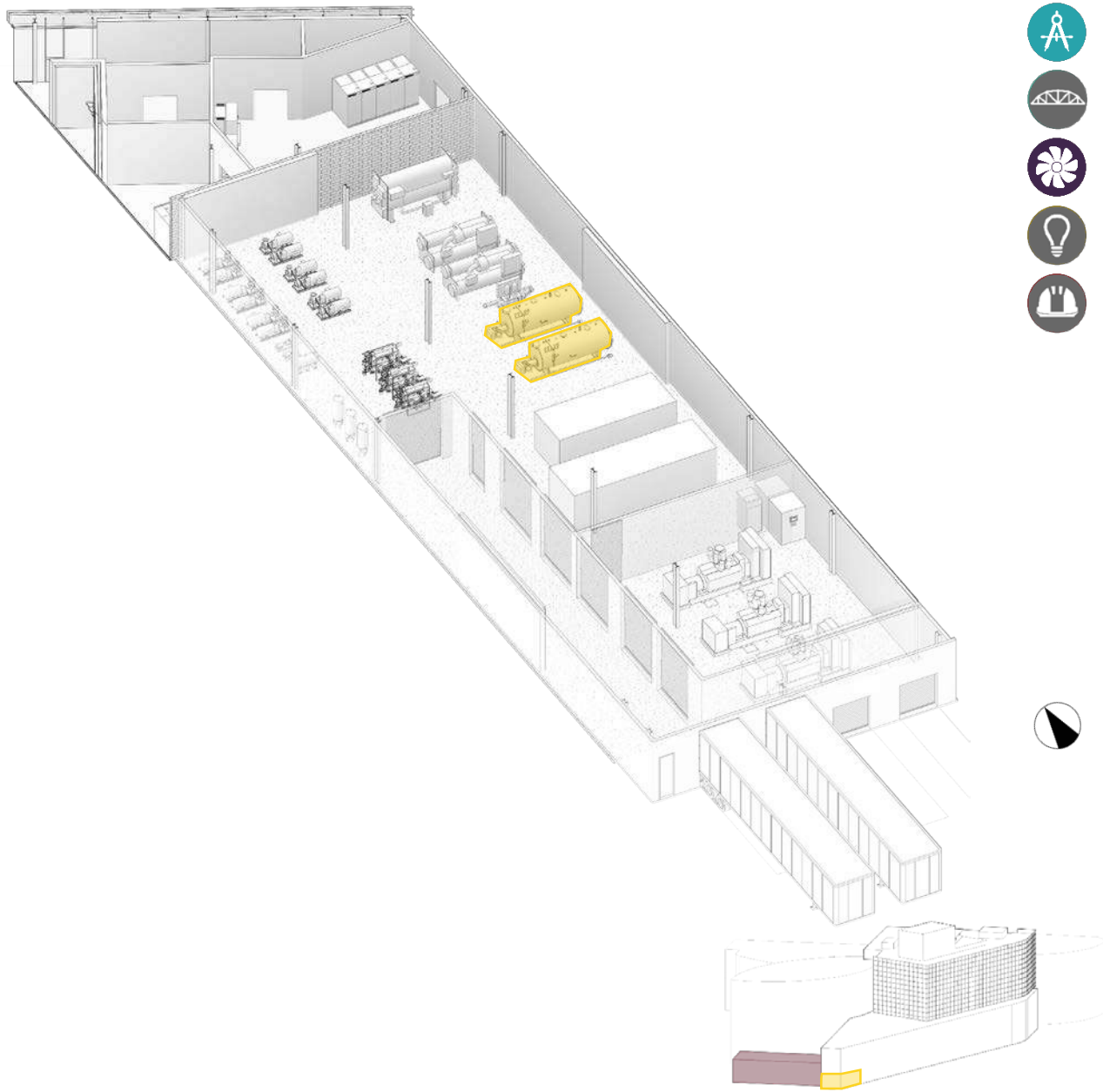




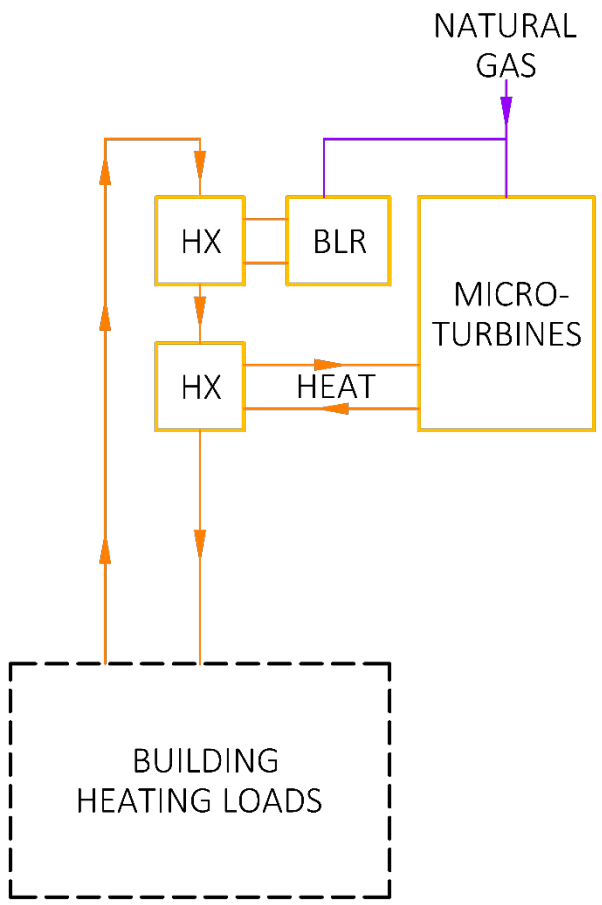


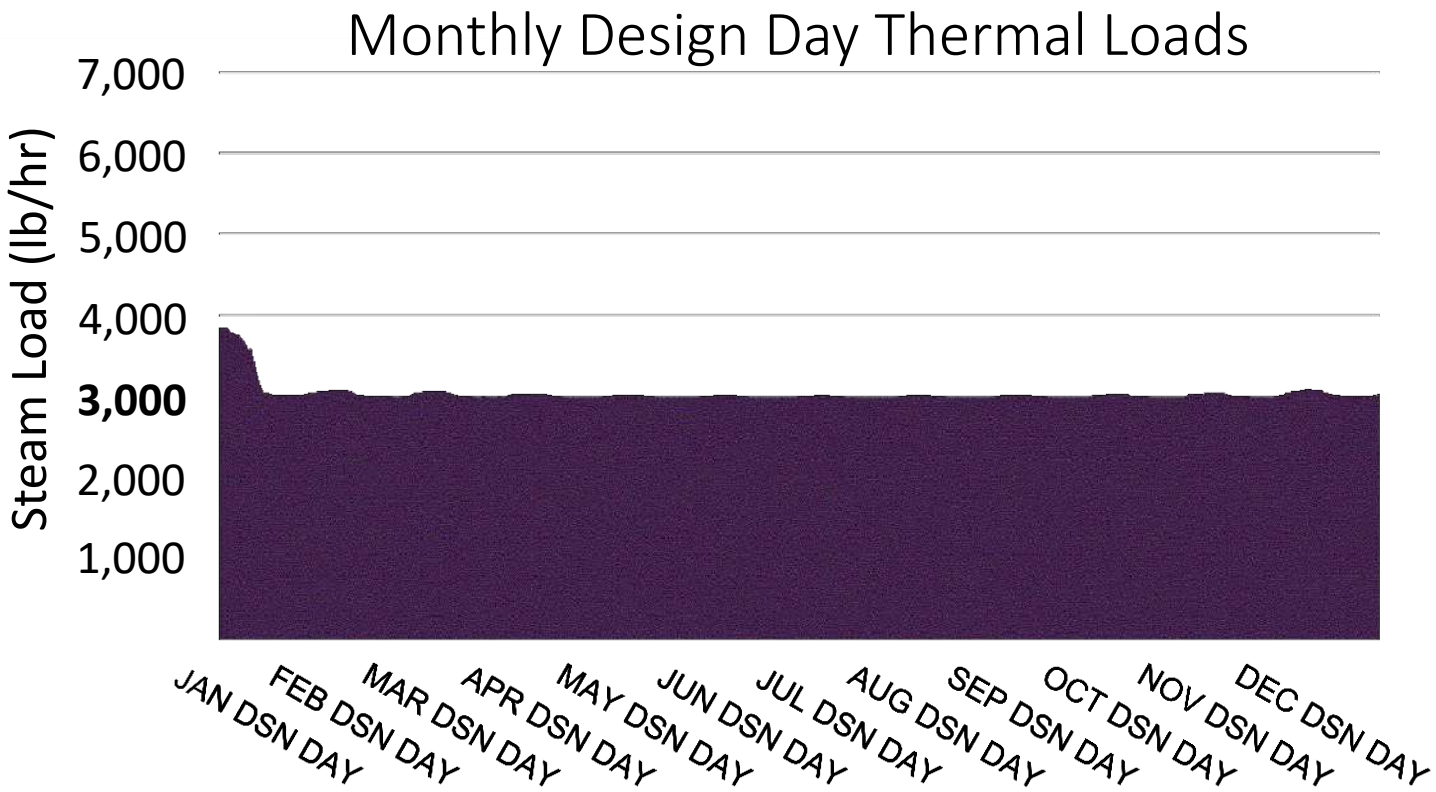
Central Plant | Mechanical System

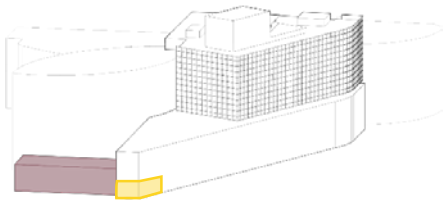




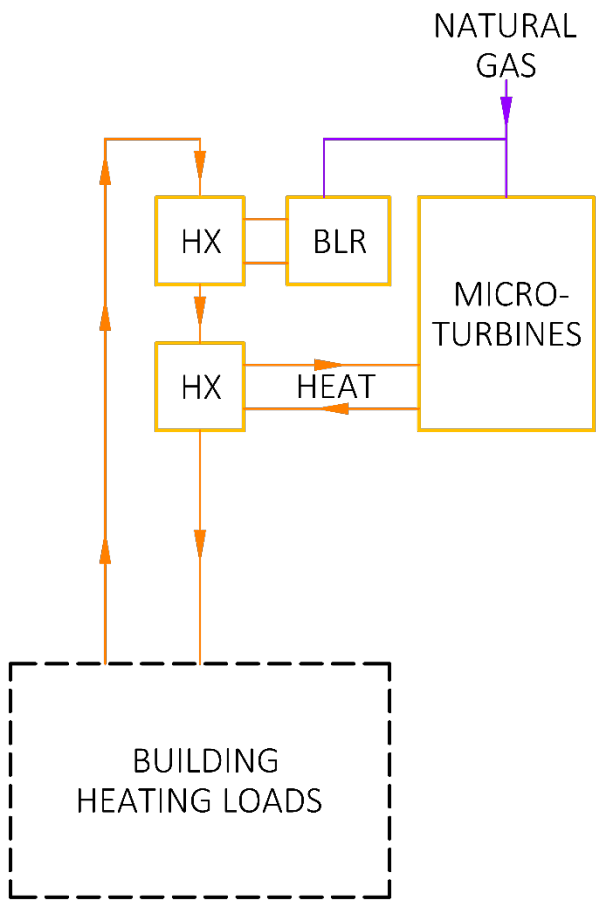
Central Plant | Mechanical System

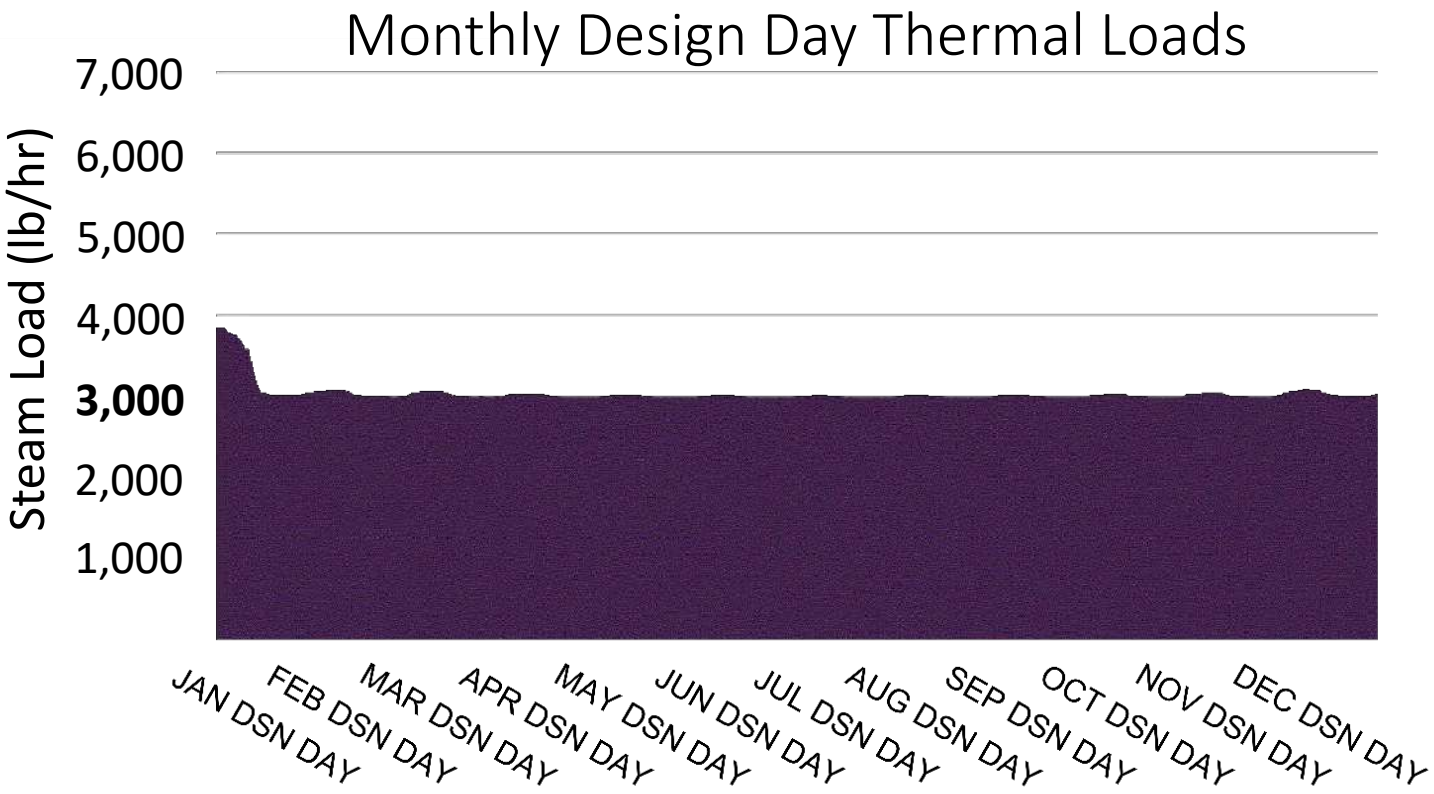




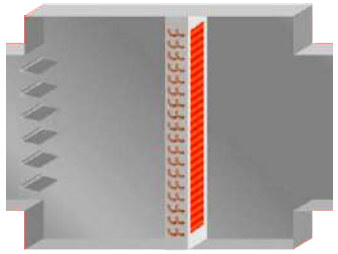


Central Plant | Mechanical System

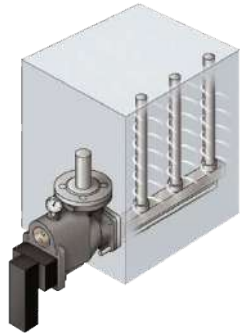




Space Heat



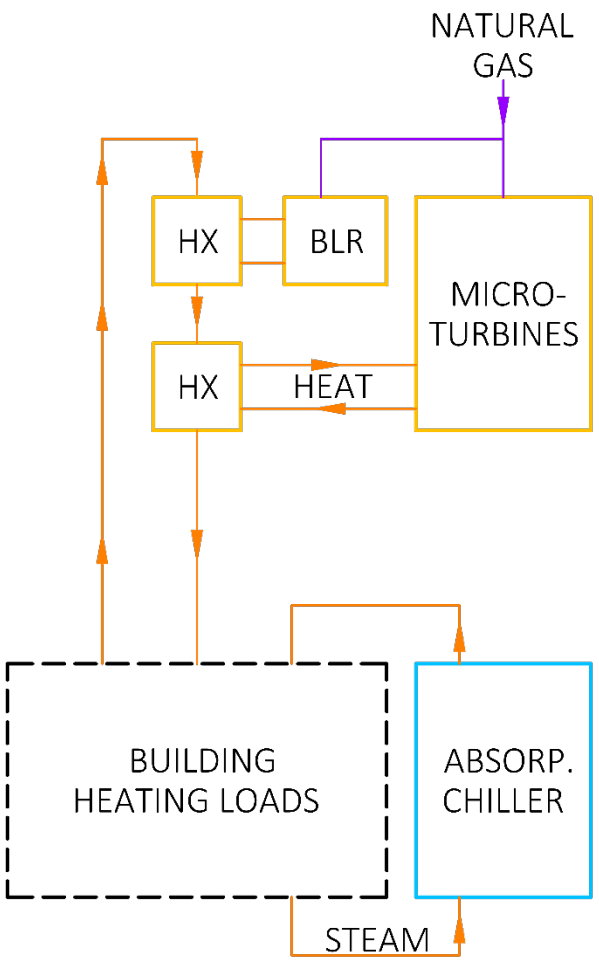
Reheat

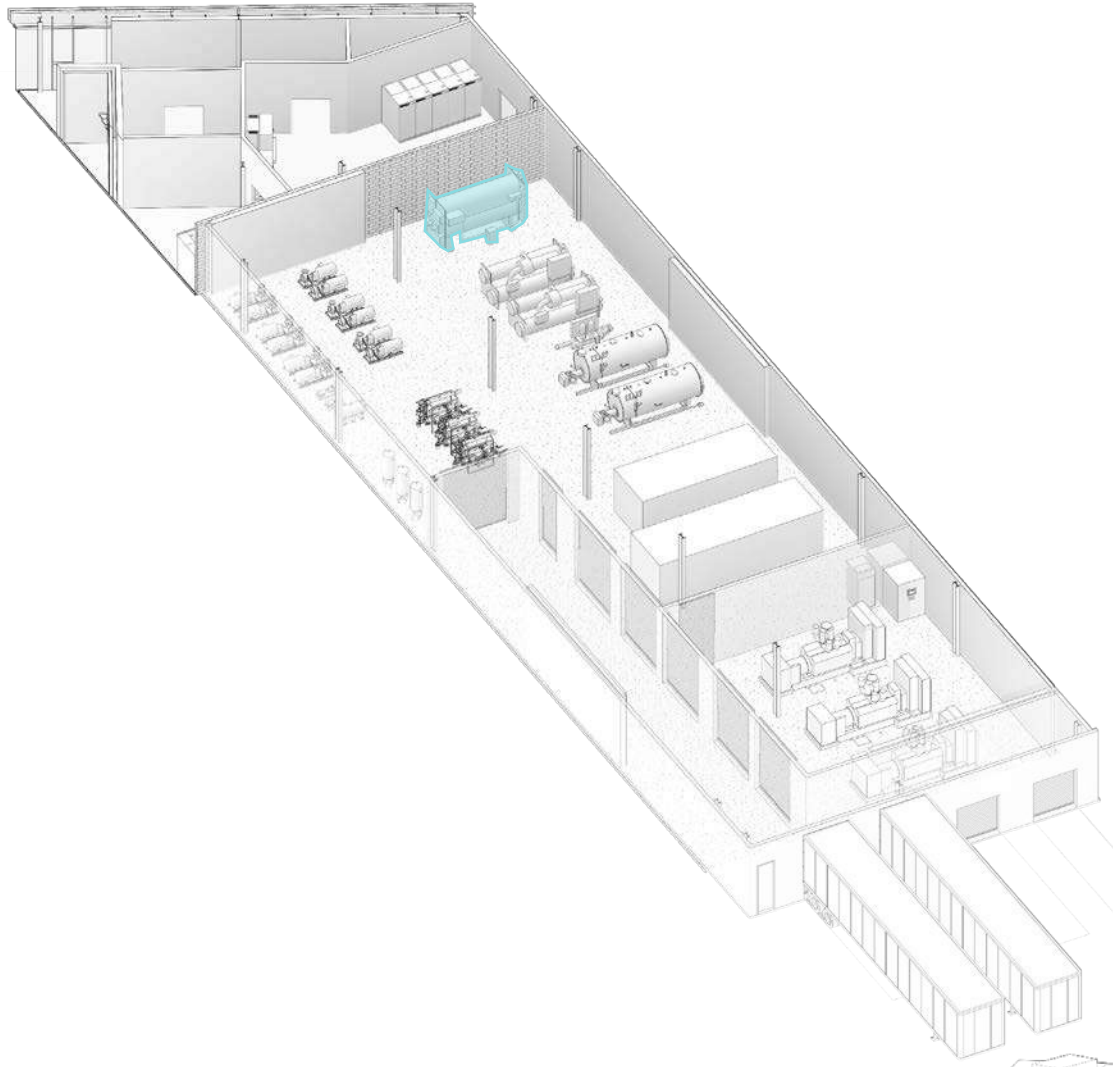


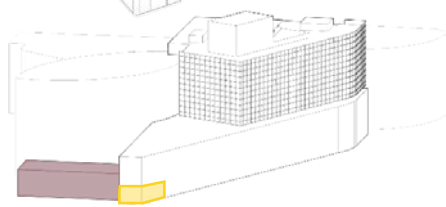
Humidification

Hot Water

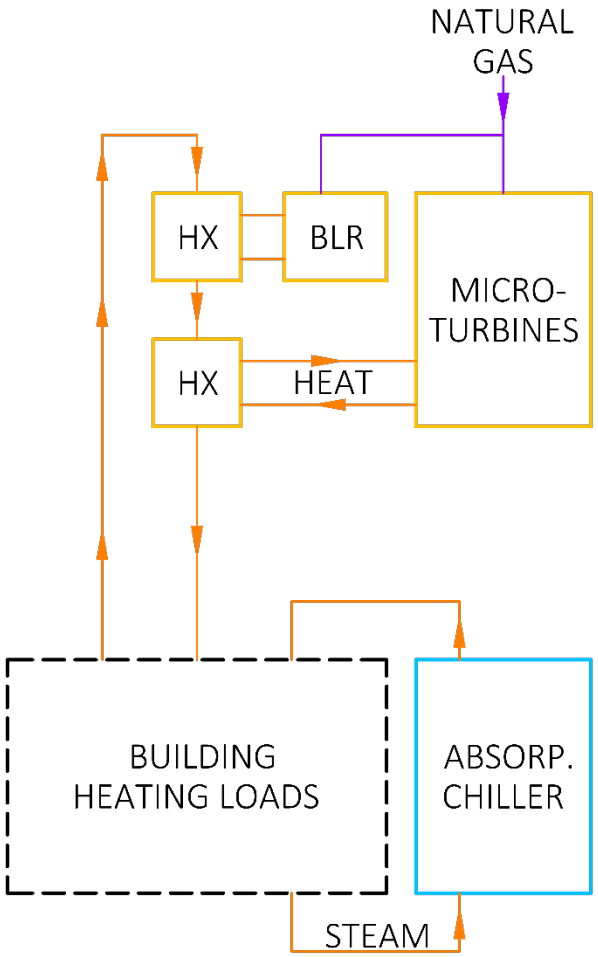
Central Plant | Mechanical System

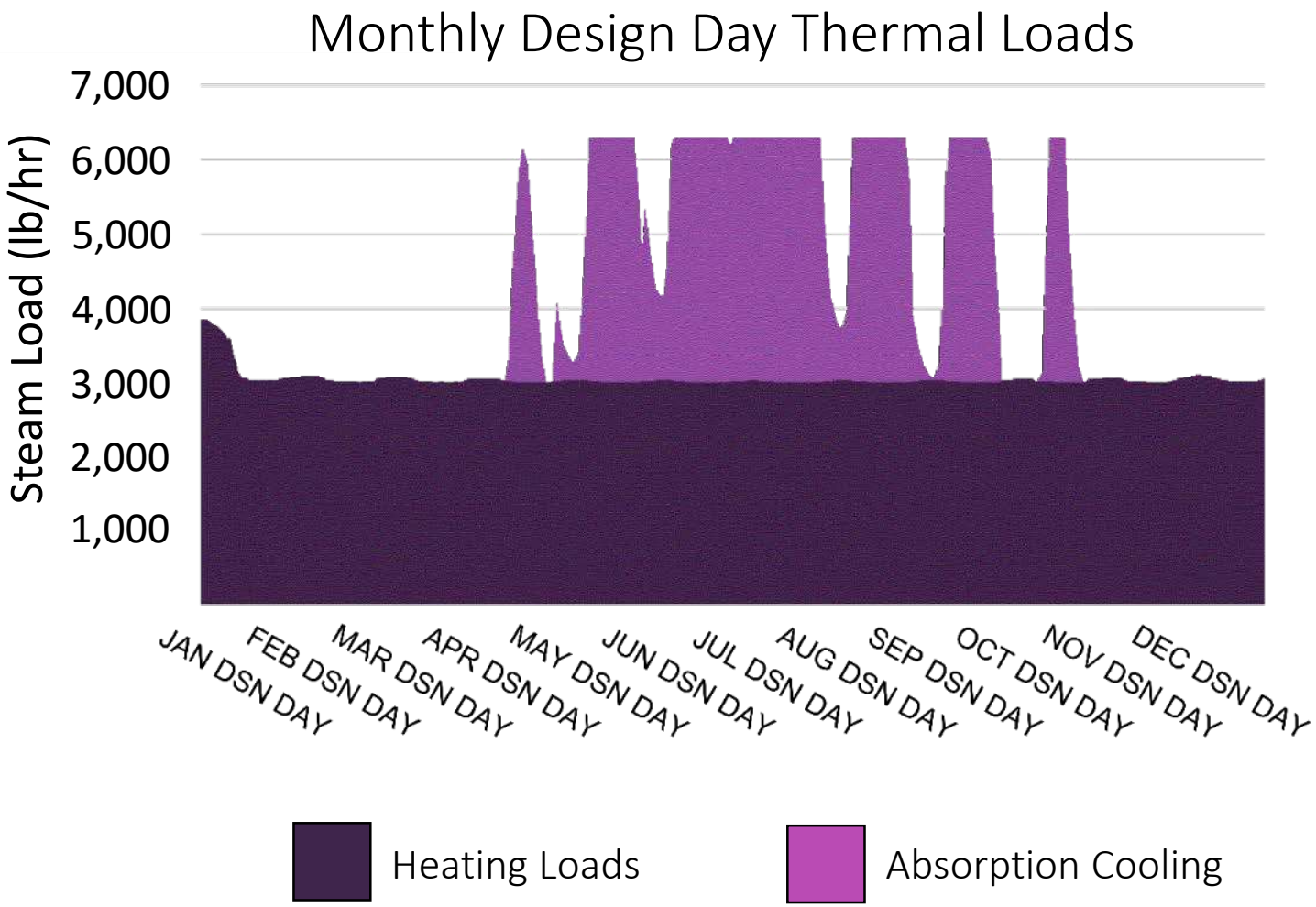


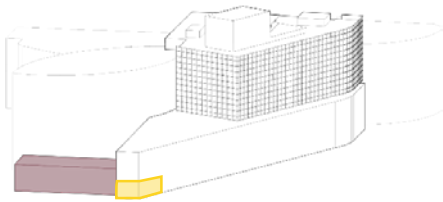




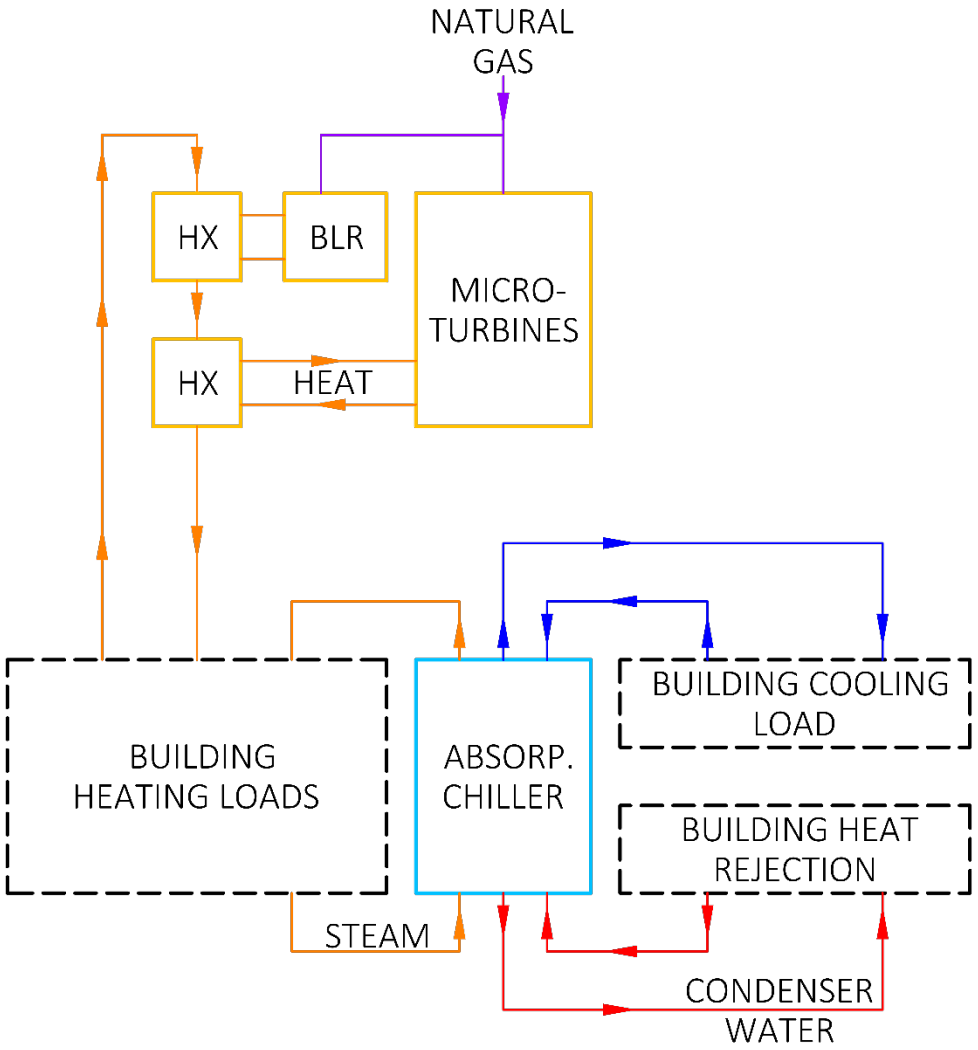
Central Plant | Mechanical System

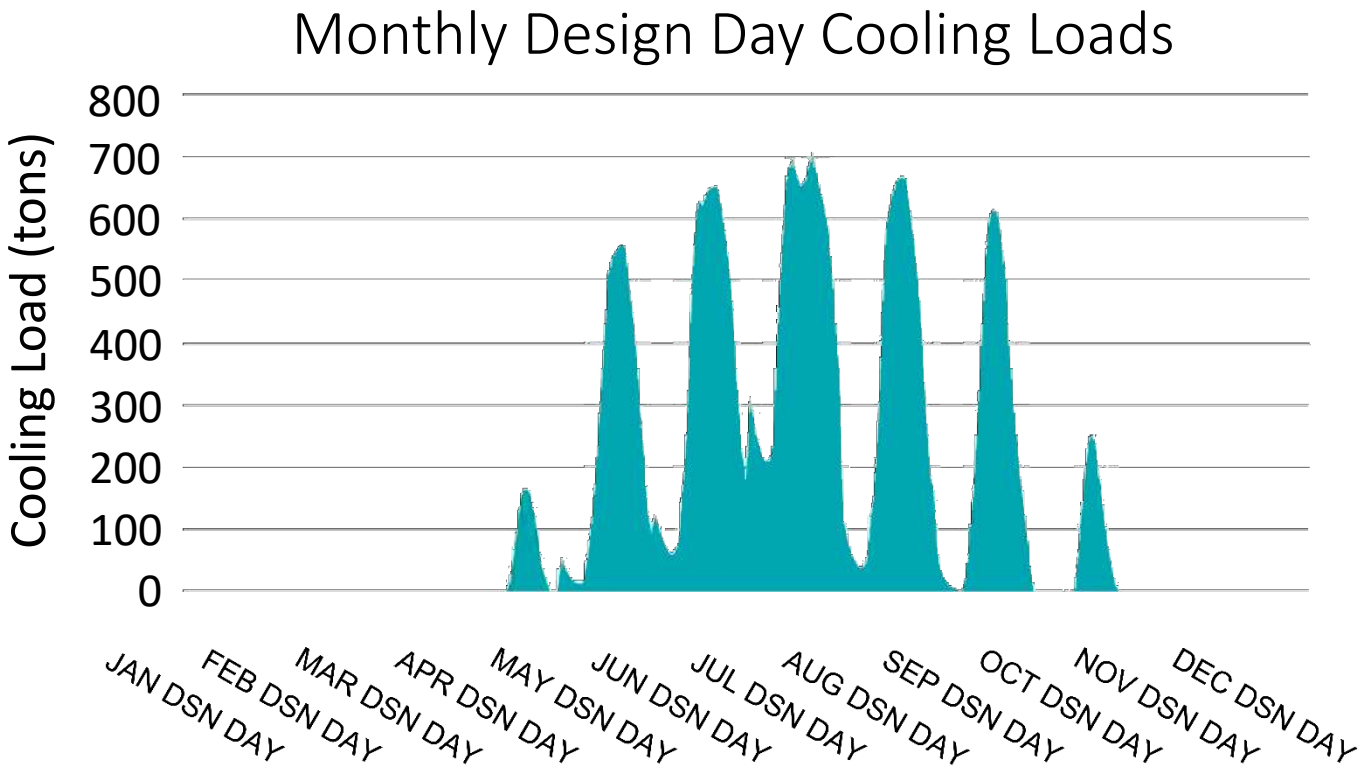


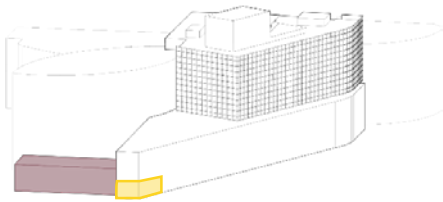




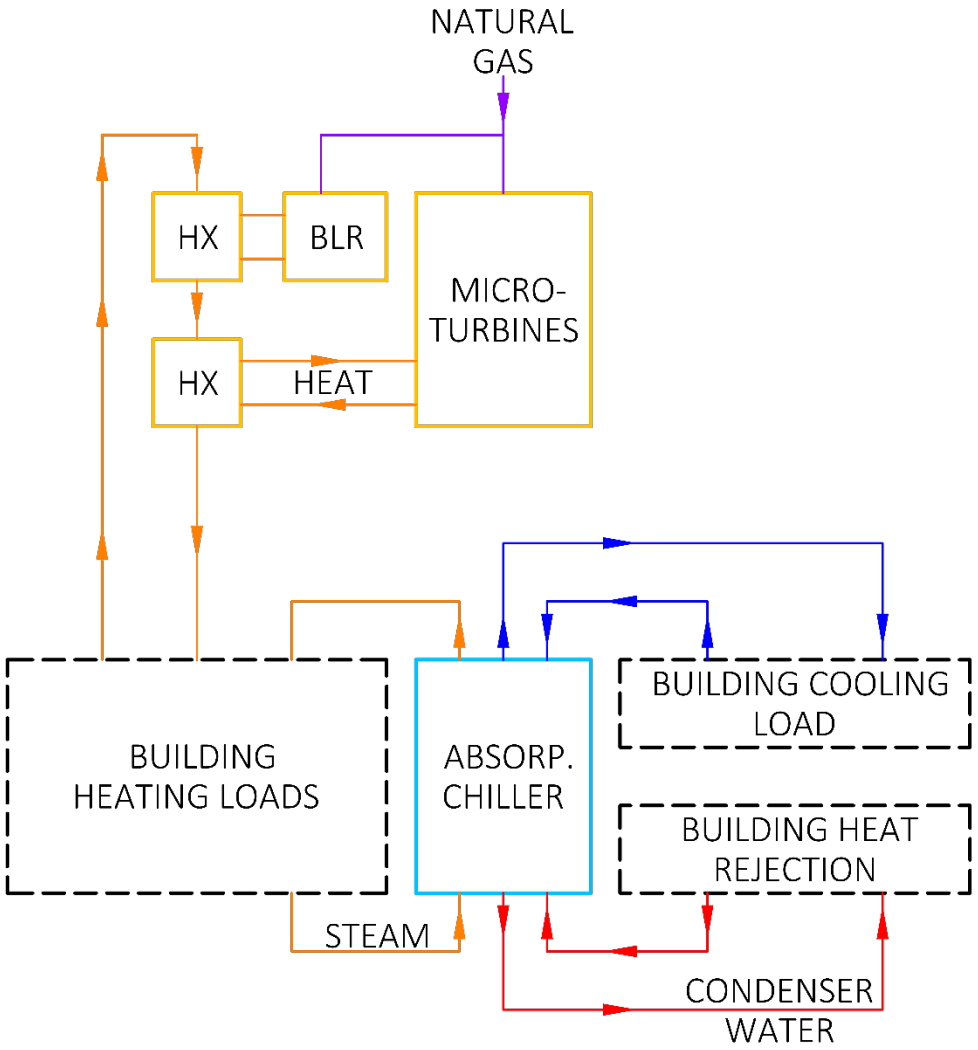
Central Plant | Mechanical System

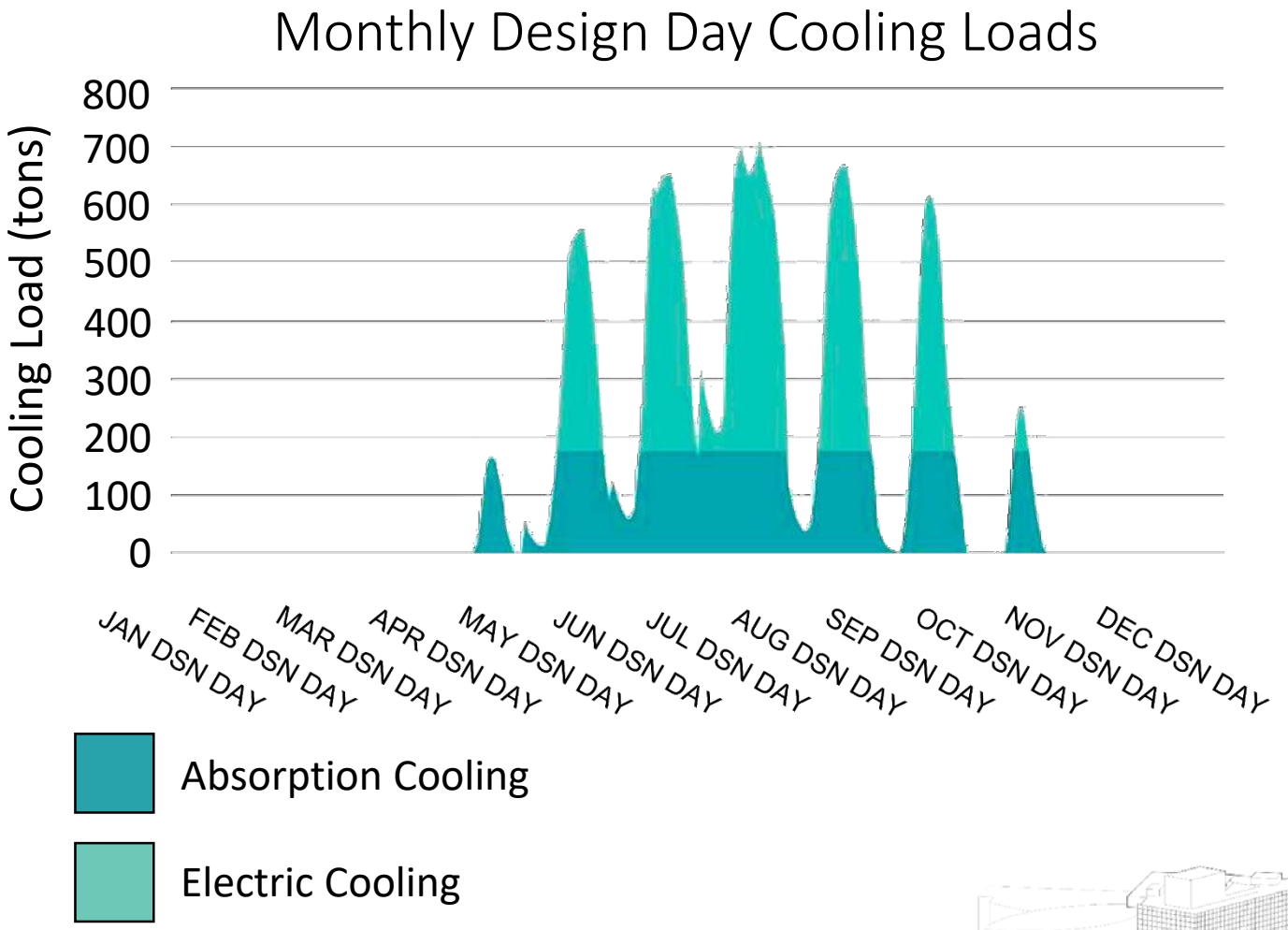


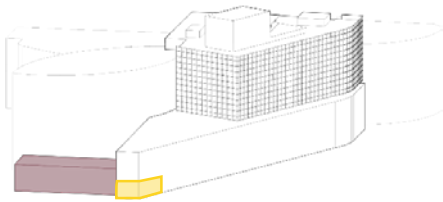




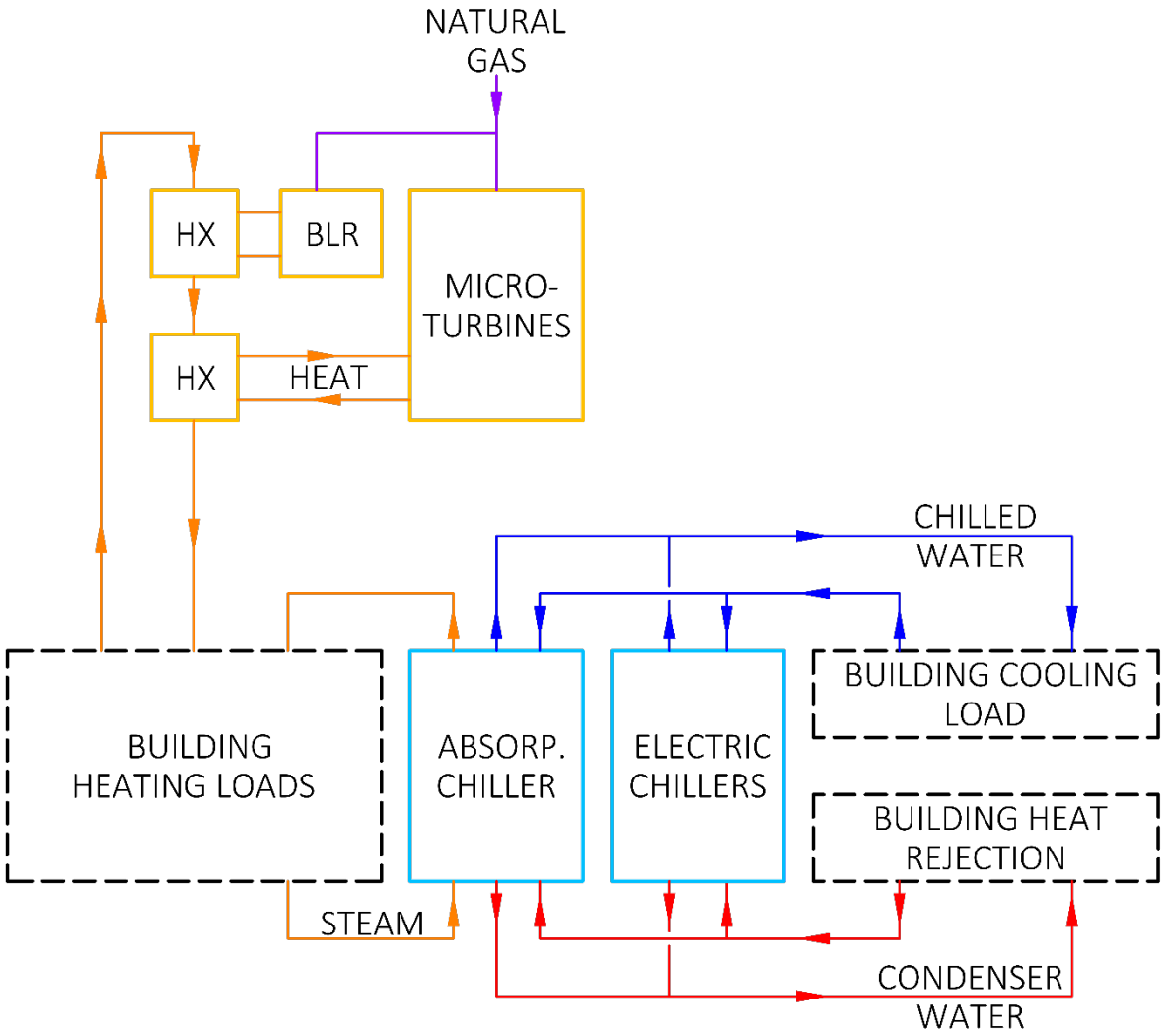
Central Plant | Mechanical System

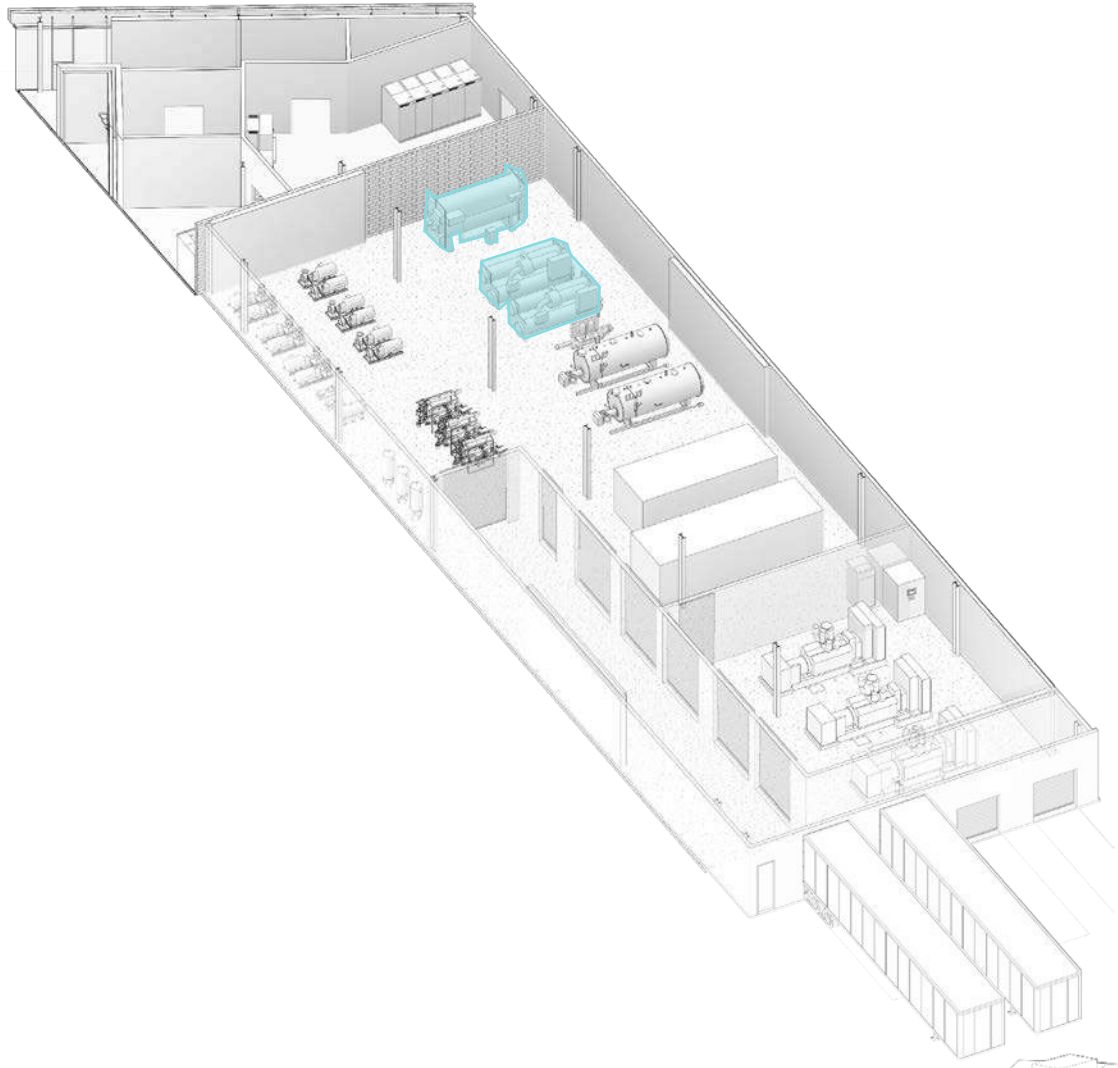


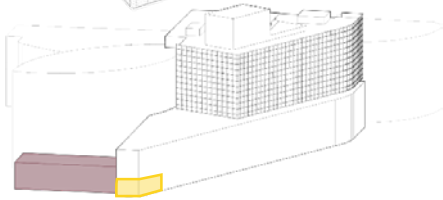




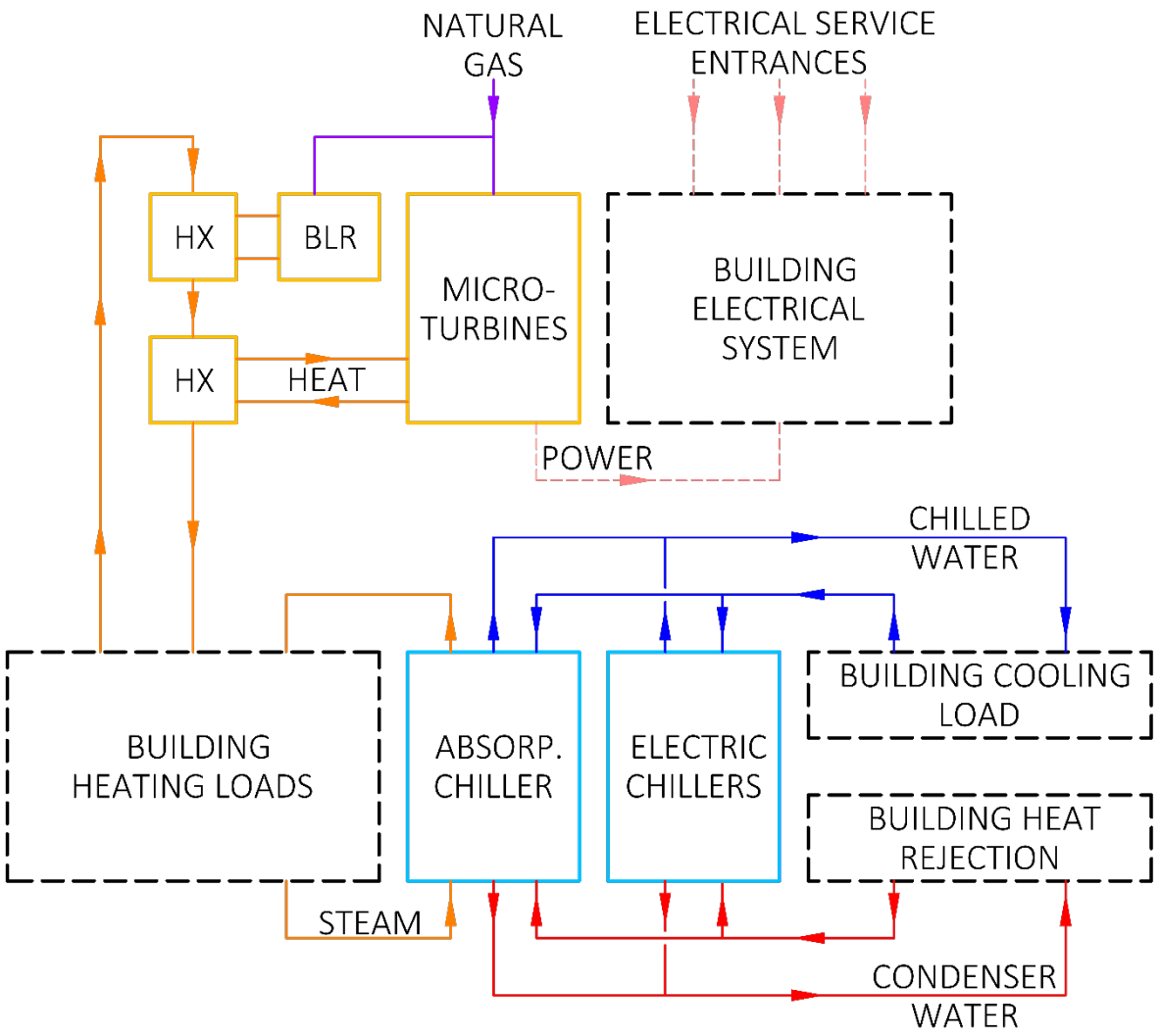
Central Plant | Mechanical System

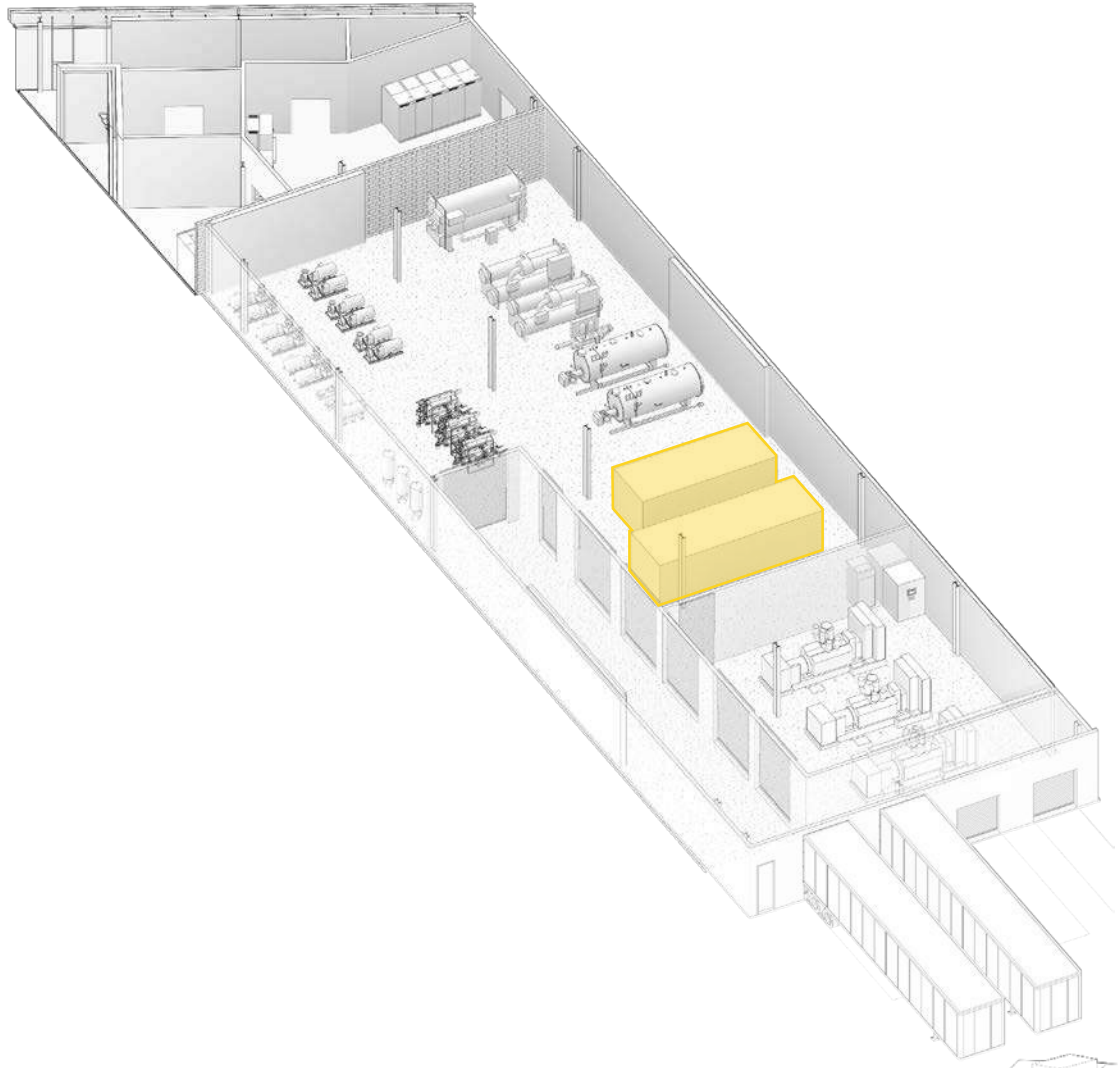


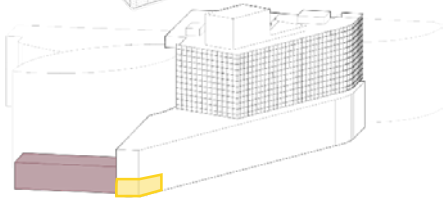




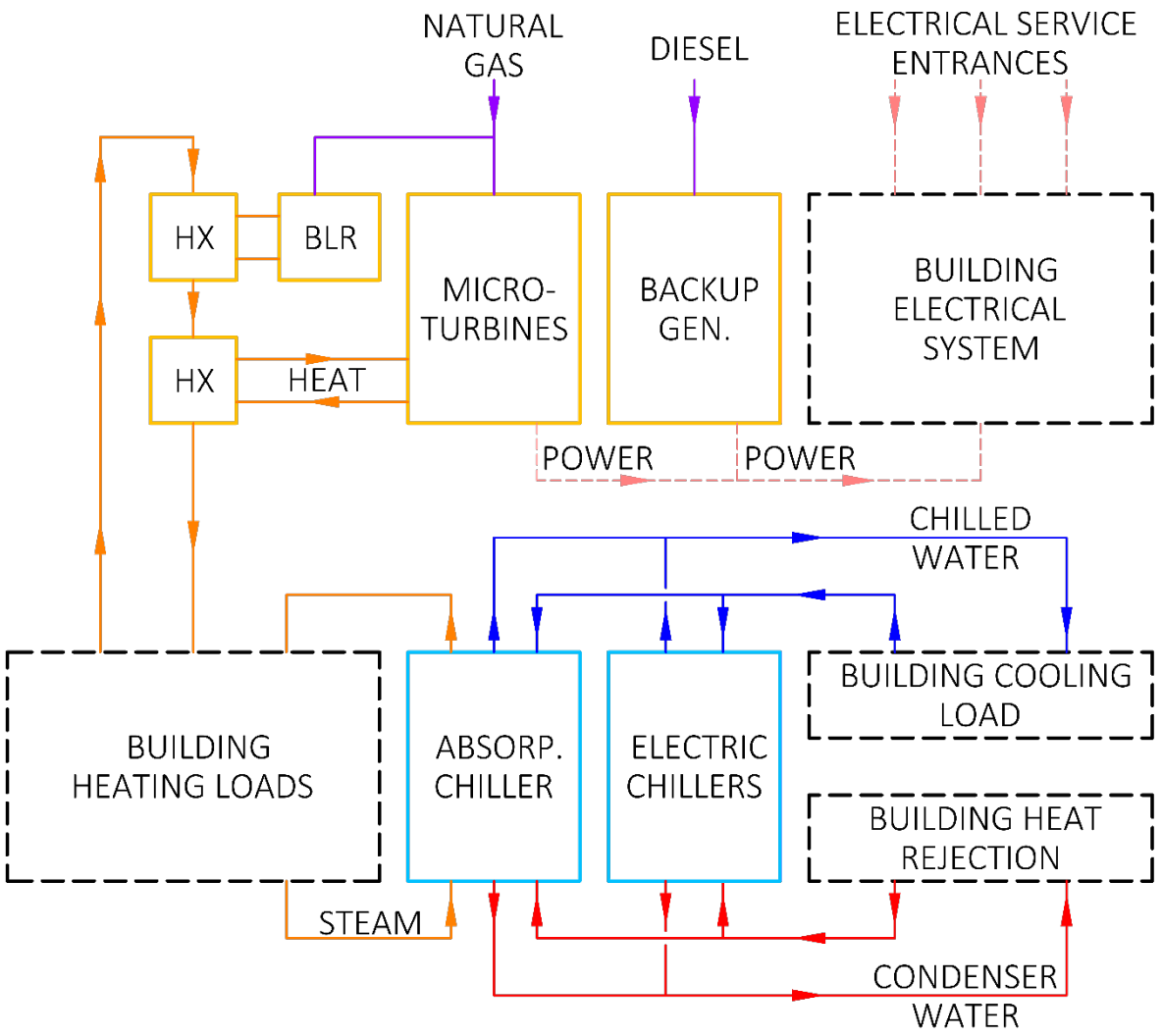
Central Plant | Electrical System

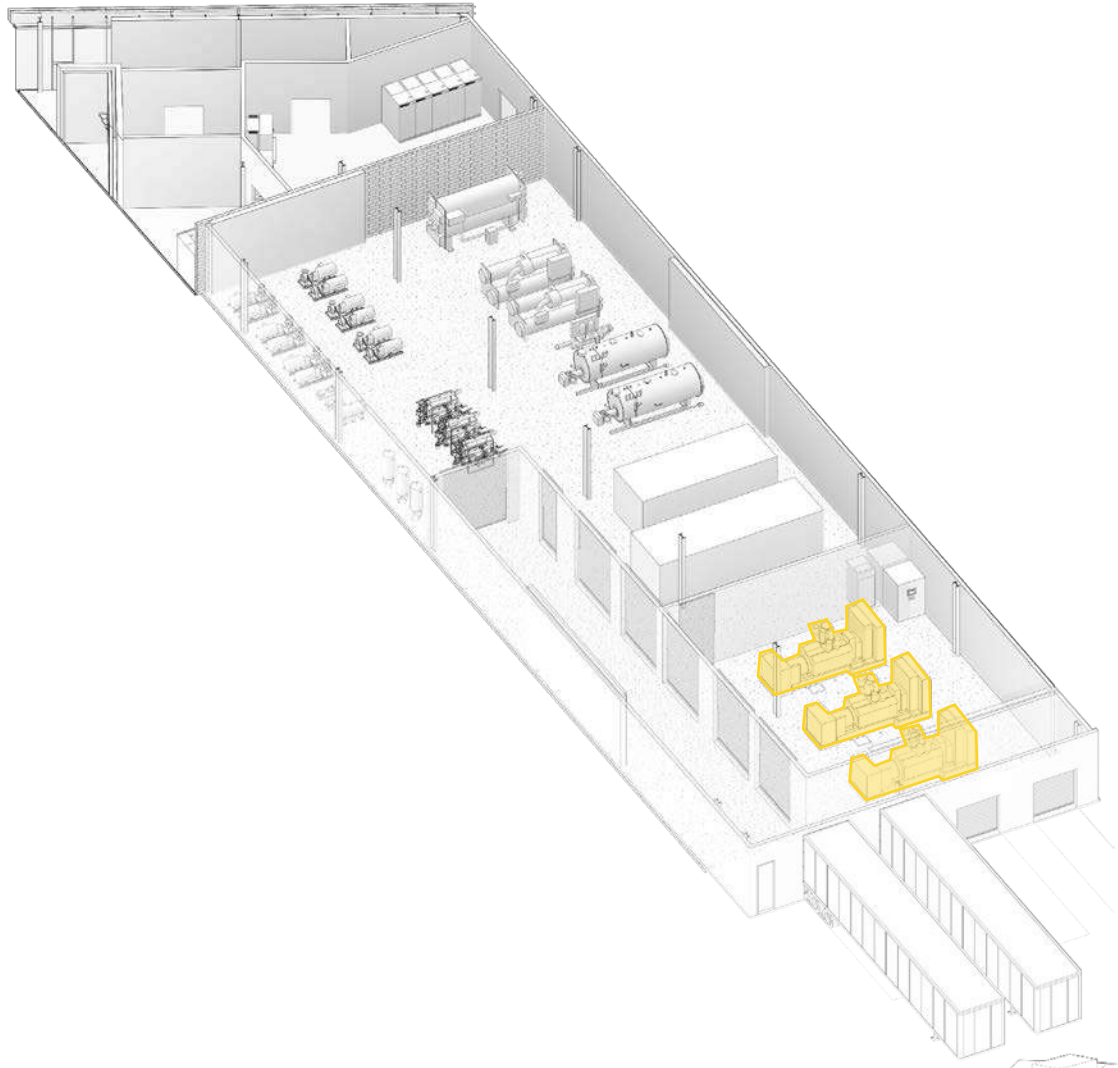


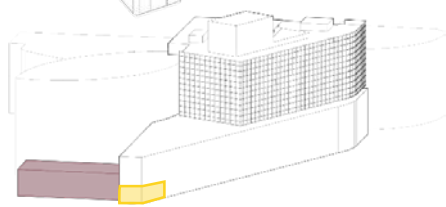




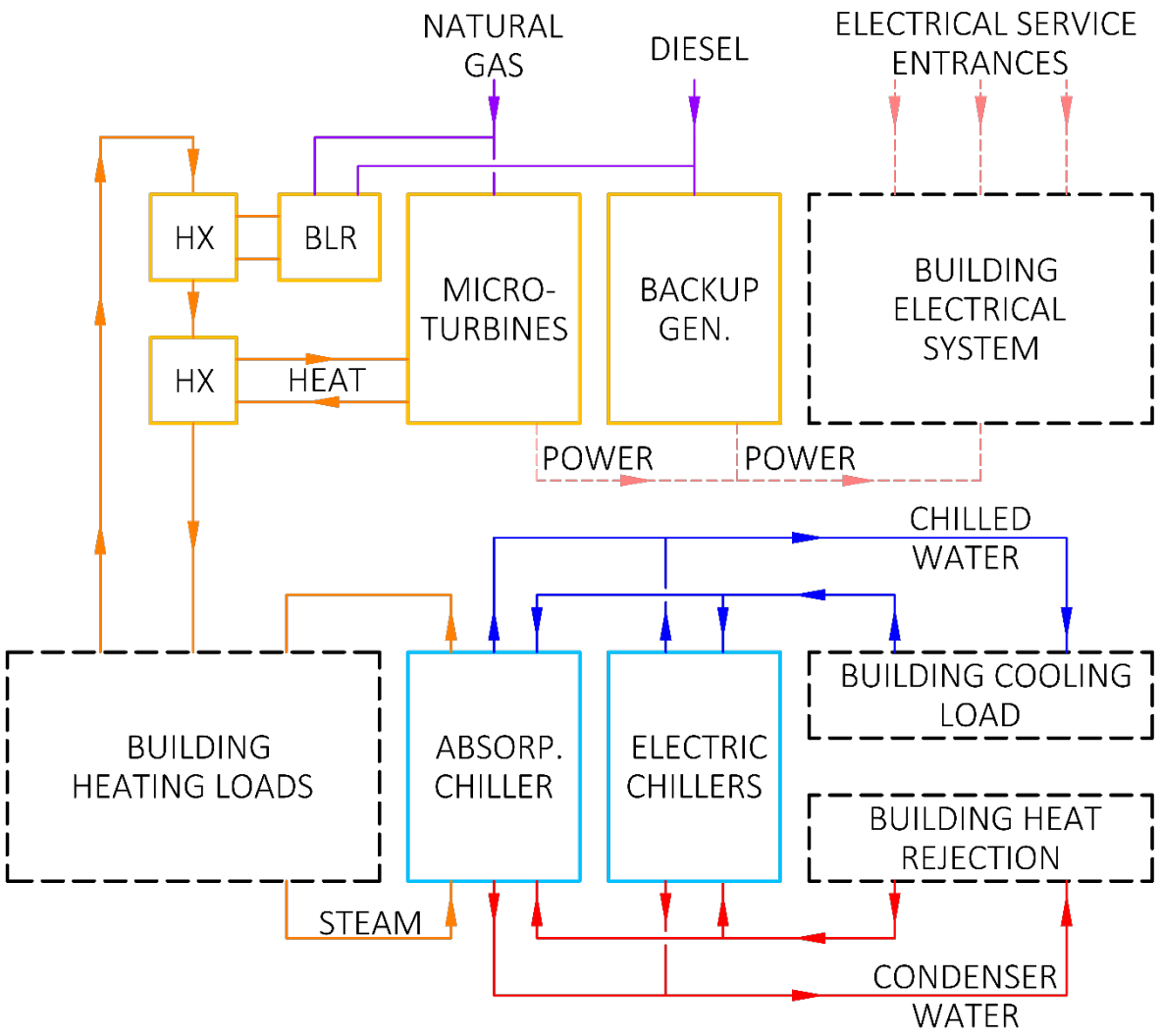
Central Plant | Electrical System

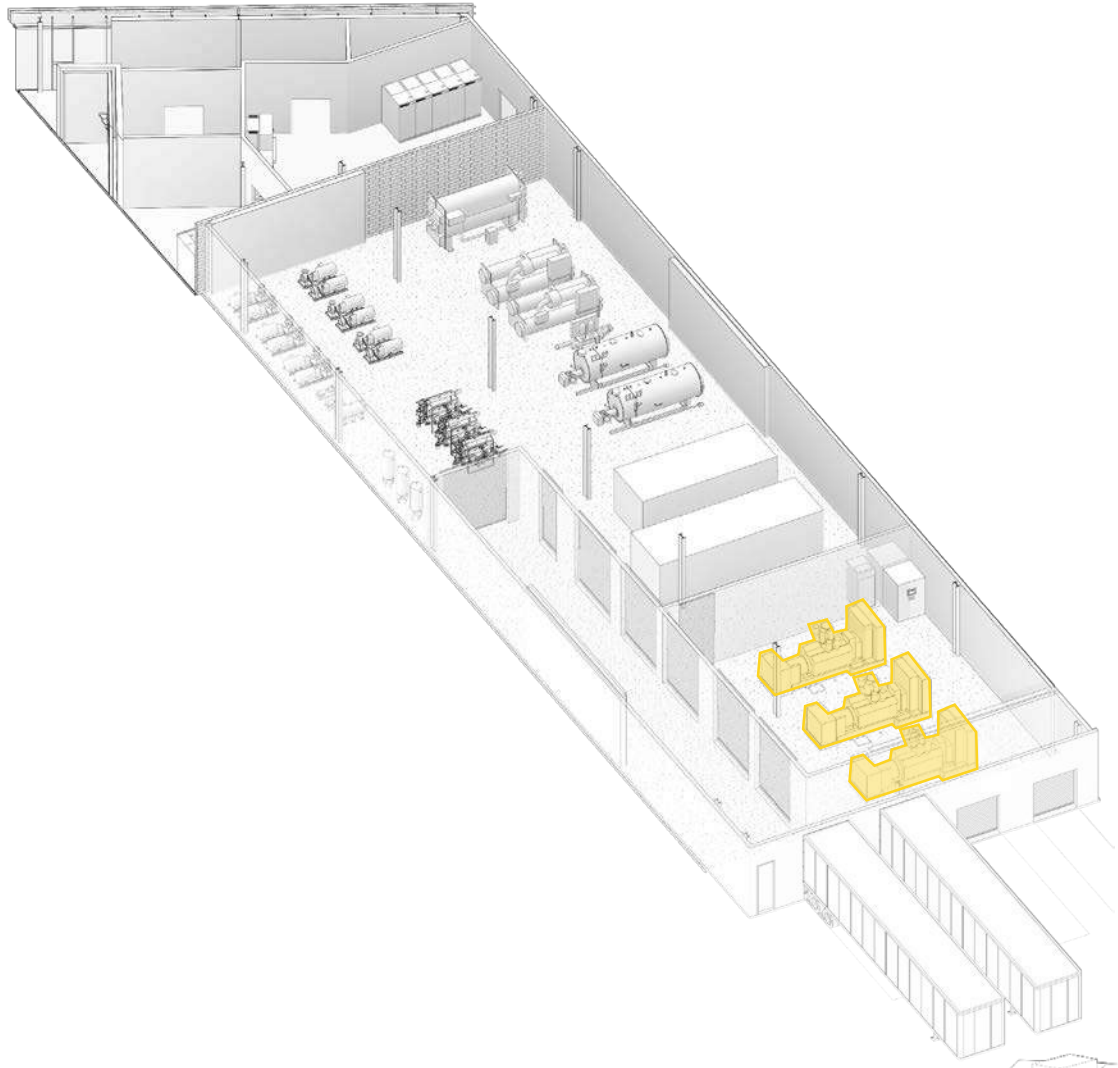


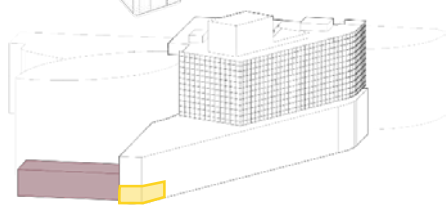




Central Plant | Electrical System





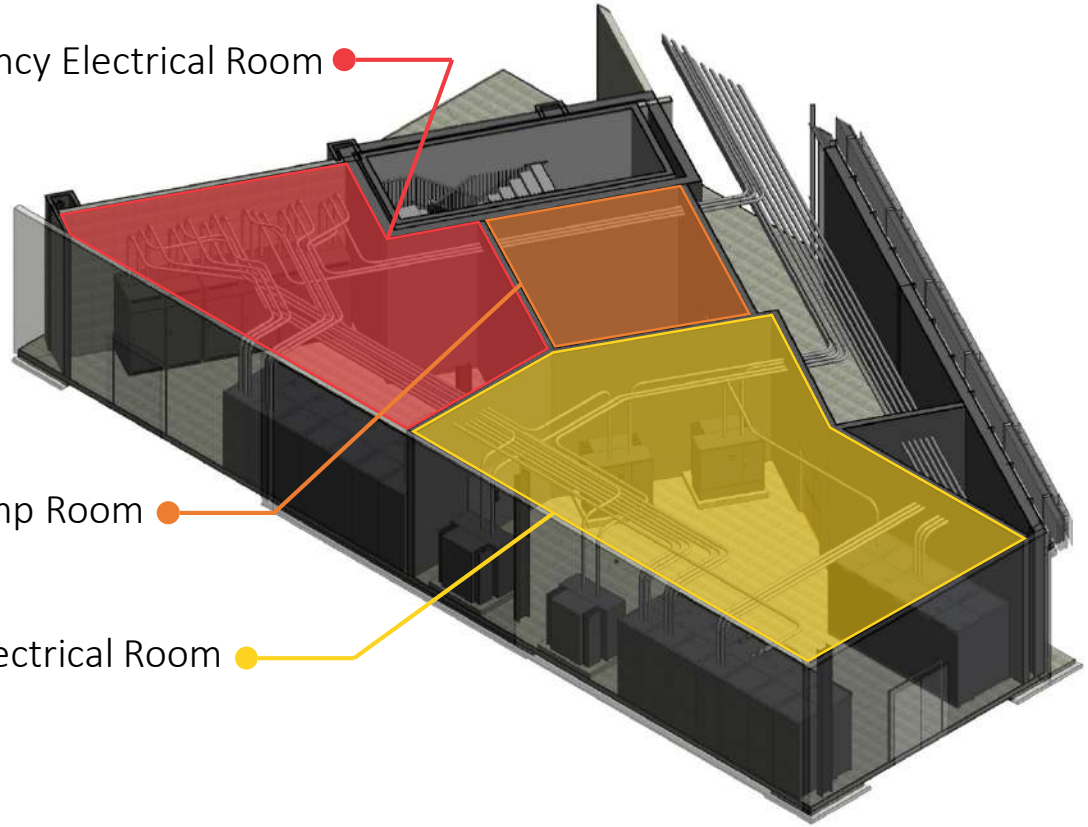


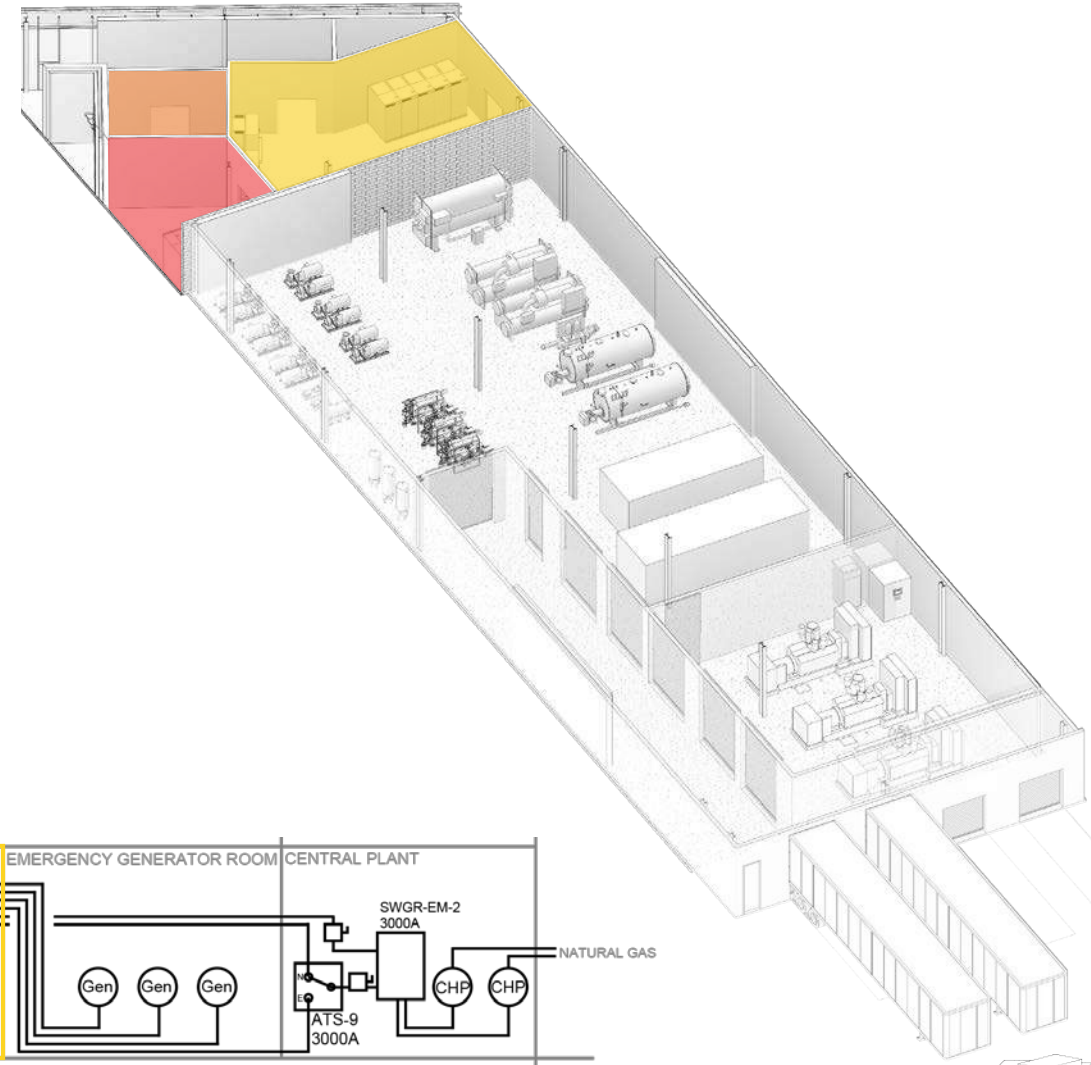
Central Plant | Electrical System

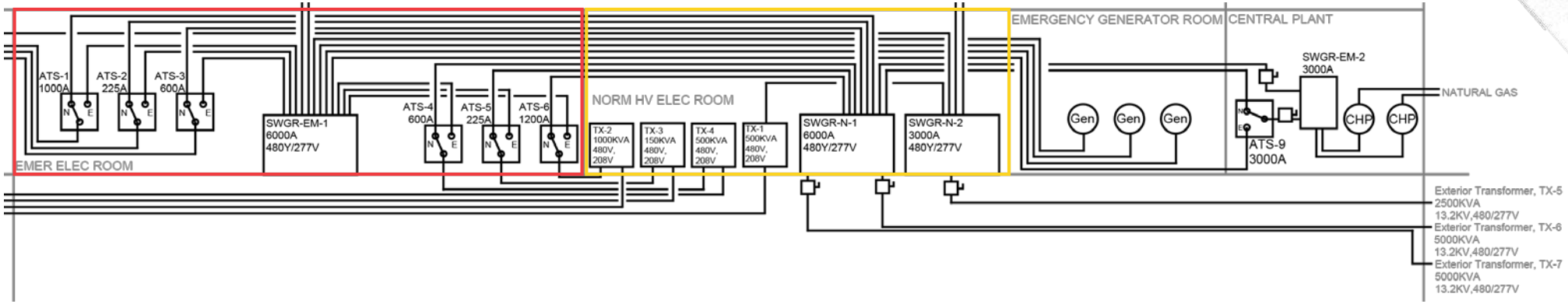
Emergency Electrical Room

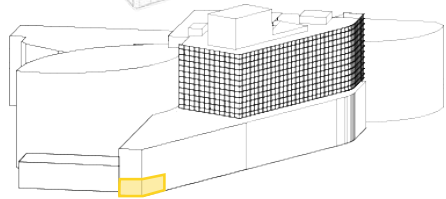
Fire Pump Room

Main Electrical Room

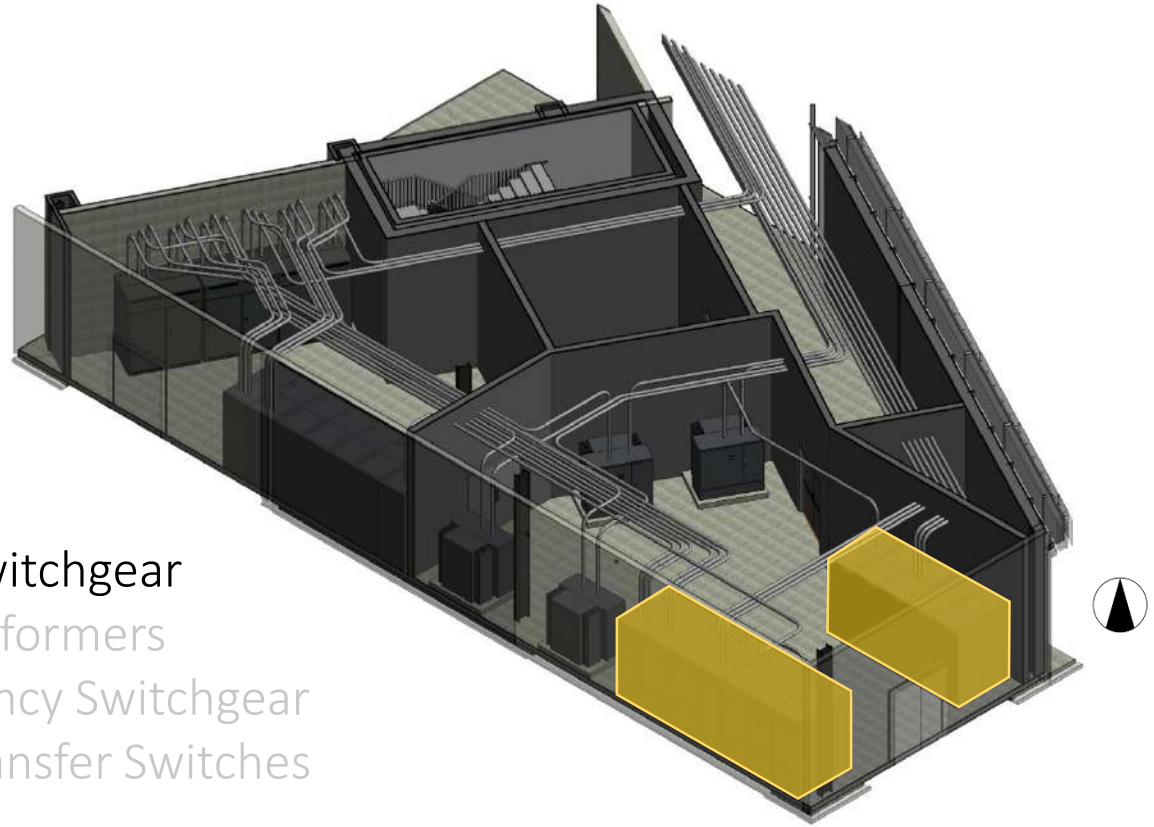








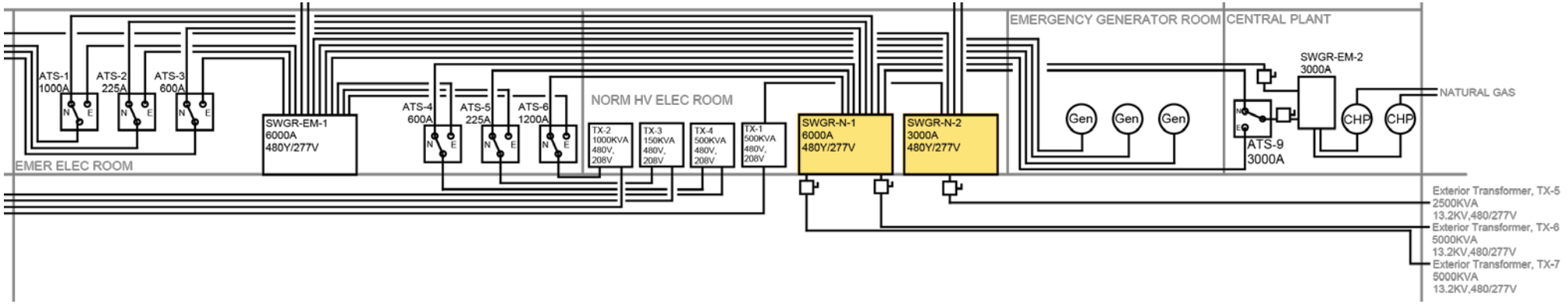
Central Plant | Electrical System

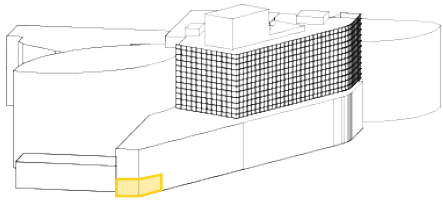


Main Switchgear
LV Transformers
Emergency Switchgear
Auto Transfer Switches

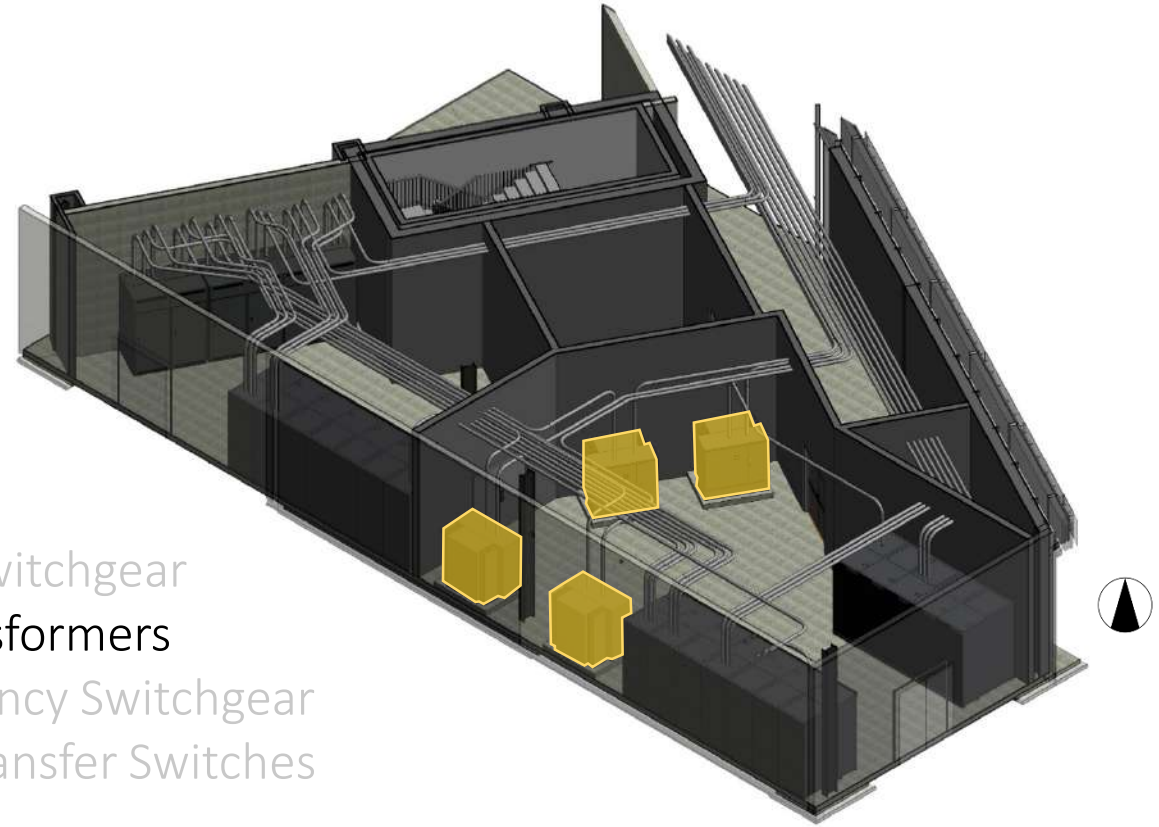
14.5VA/sf x 390,000sf (@ 0.85PF)

4.8MW Design Demand Load





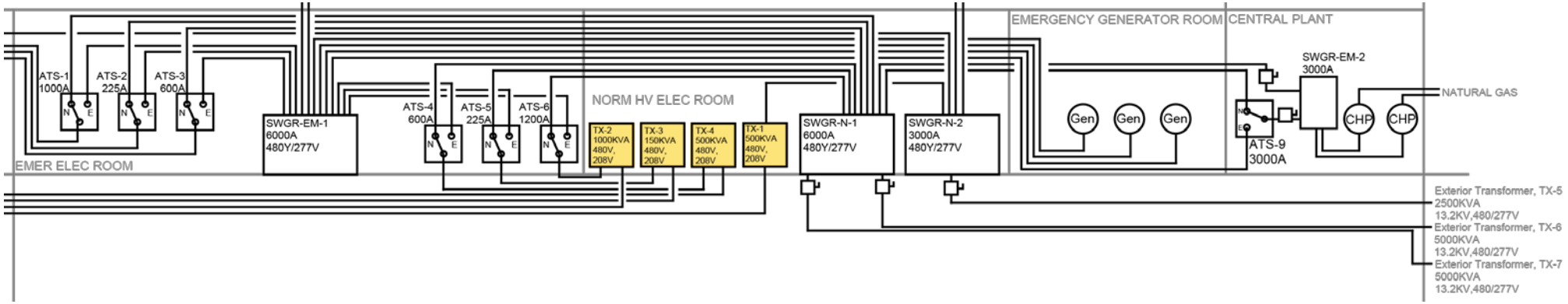
Central Plant | Electrical System

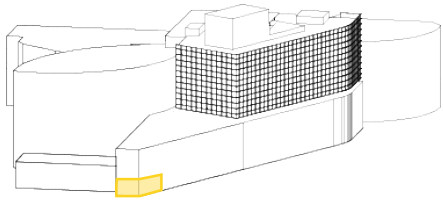


Main Switchgear
LV Transformers
Emergency Switchgear
Auto Transfer Switches

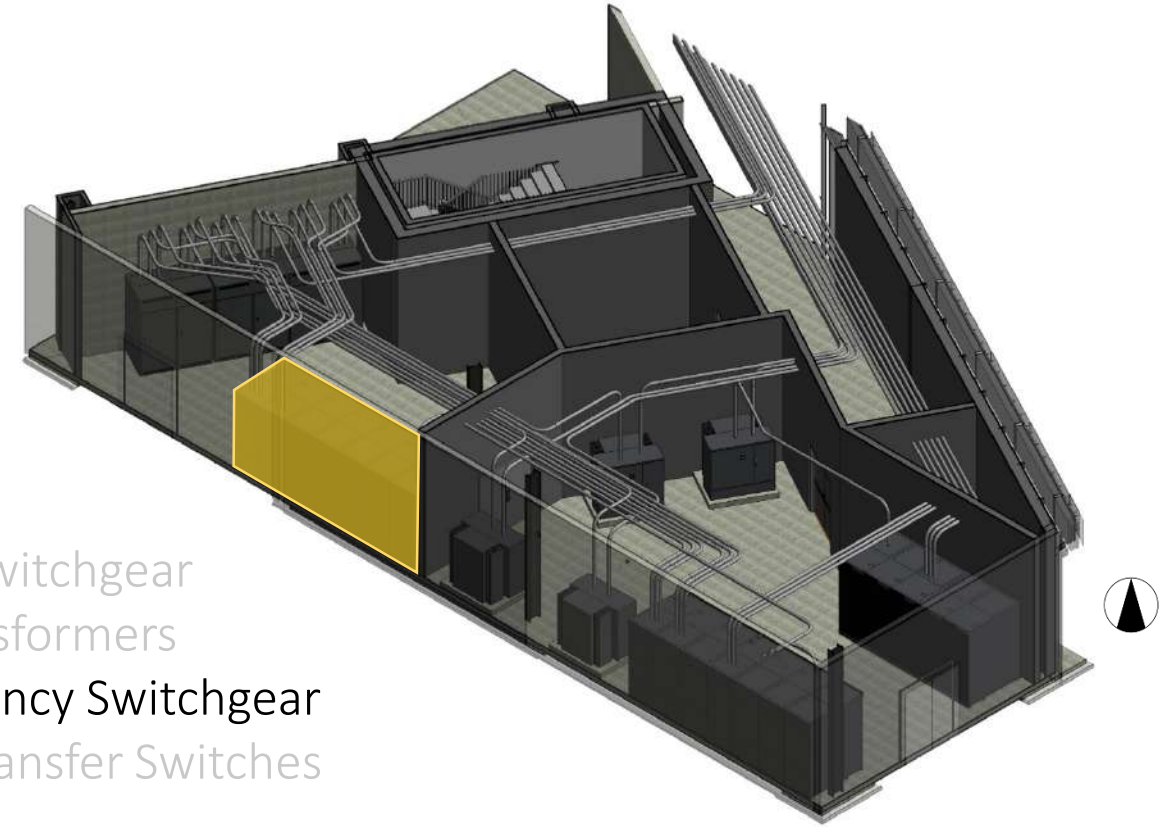
Voltage drop on cable and bus duct feeders was

limited to **2%**





Central Plant | Electrical System



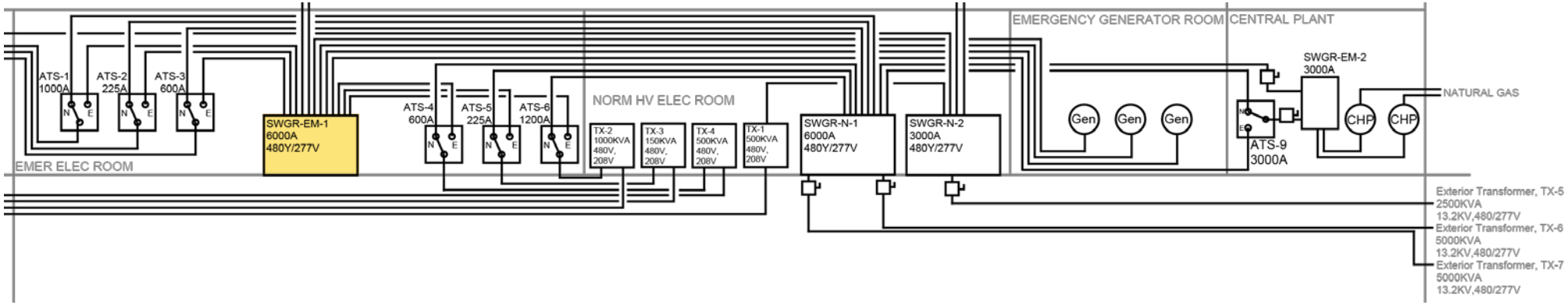
Main Switchgear
LV Transformers
Emergency Switchgear
Auto Transfer Switches

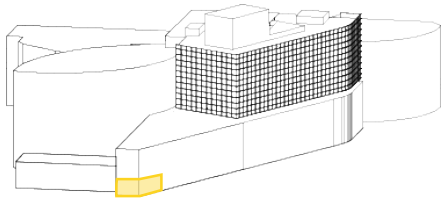
Essential Electrical System Design Load:

4MW

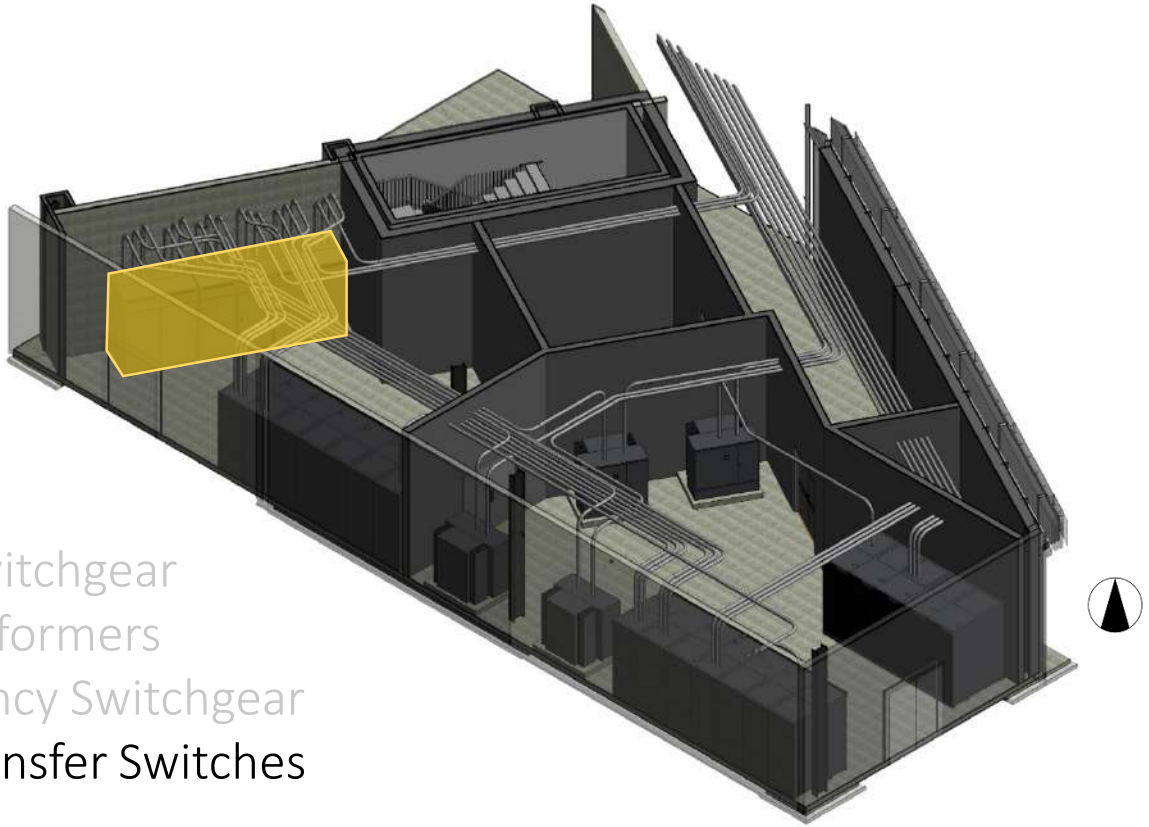
Hospital can be powered for

96 hours



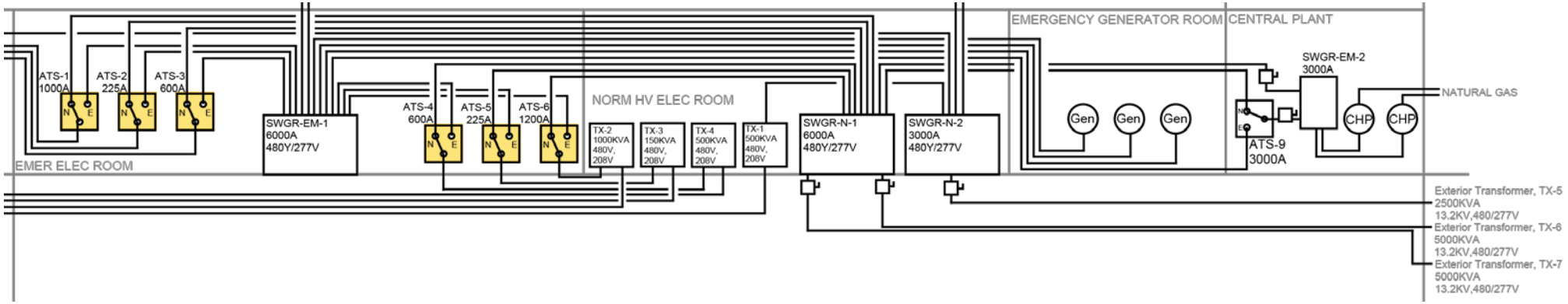


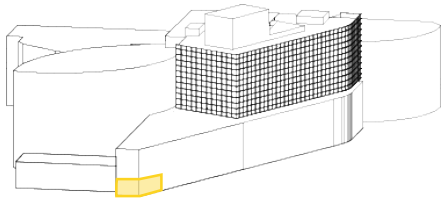
Central Plant | Electrical System



Main Switchgear
LV Transformers
Emergency Switchgear
Auto Transfer Switches

Each 480V and 208V branch of the EES are switched separately per **NEC 517.30(B)(2)**





Central Plant | Electrical System

Microturbine

480/277V
800kW/1000kVA

Microturbine

480/277V
1000kW/1250kVA

N

Gen #1

480/277V
1500kW/1875kVA

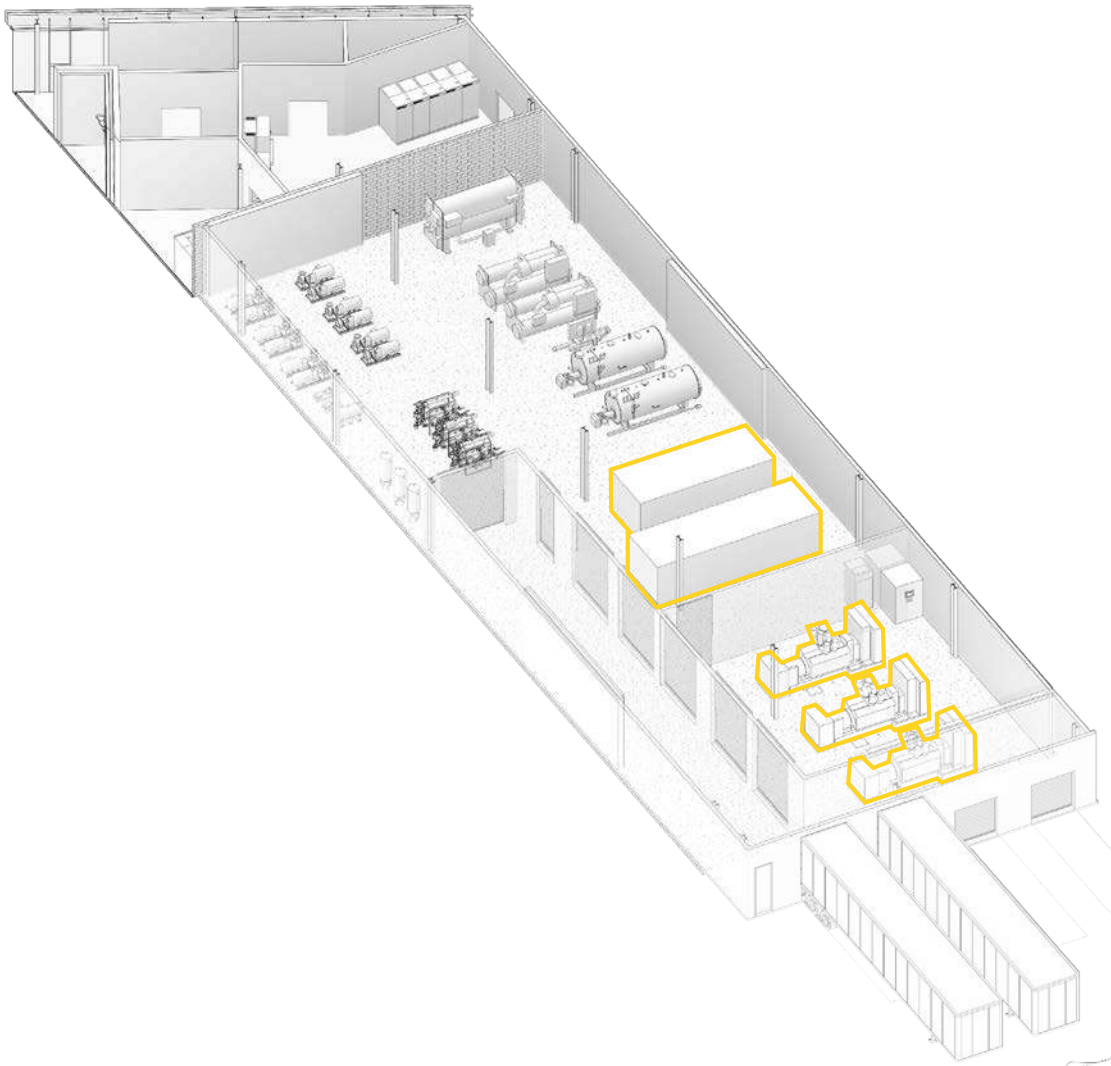
Gen #2

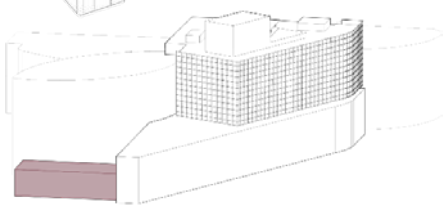
480/277V
1500kW/1875kVA

+1

Gen #3

480/277V
1500kW/1875kVA





Central Plant | Electrical System

Microturbine

480/277V
800kW/1000kVA

Microturbine

480/277V
1000kW/1250kVA

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Gen #1

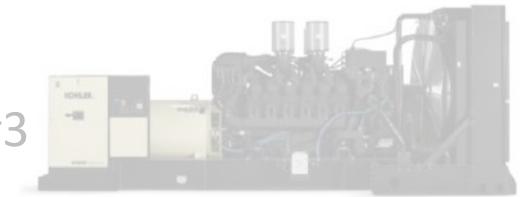
480/277V
1500kW/1875kVA

Gen #2

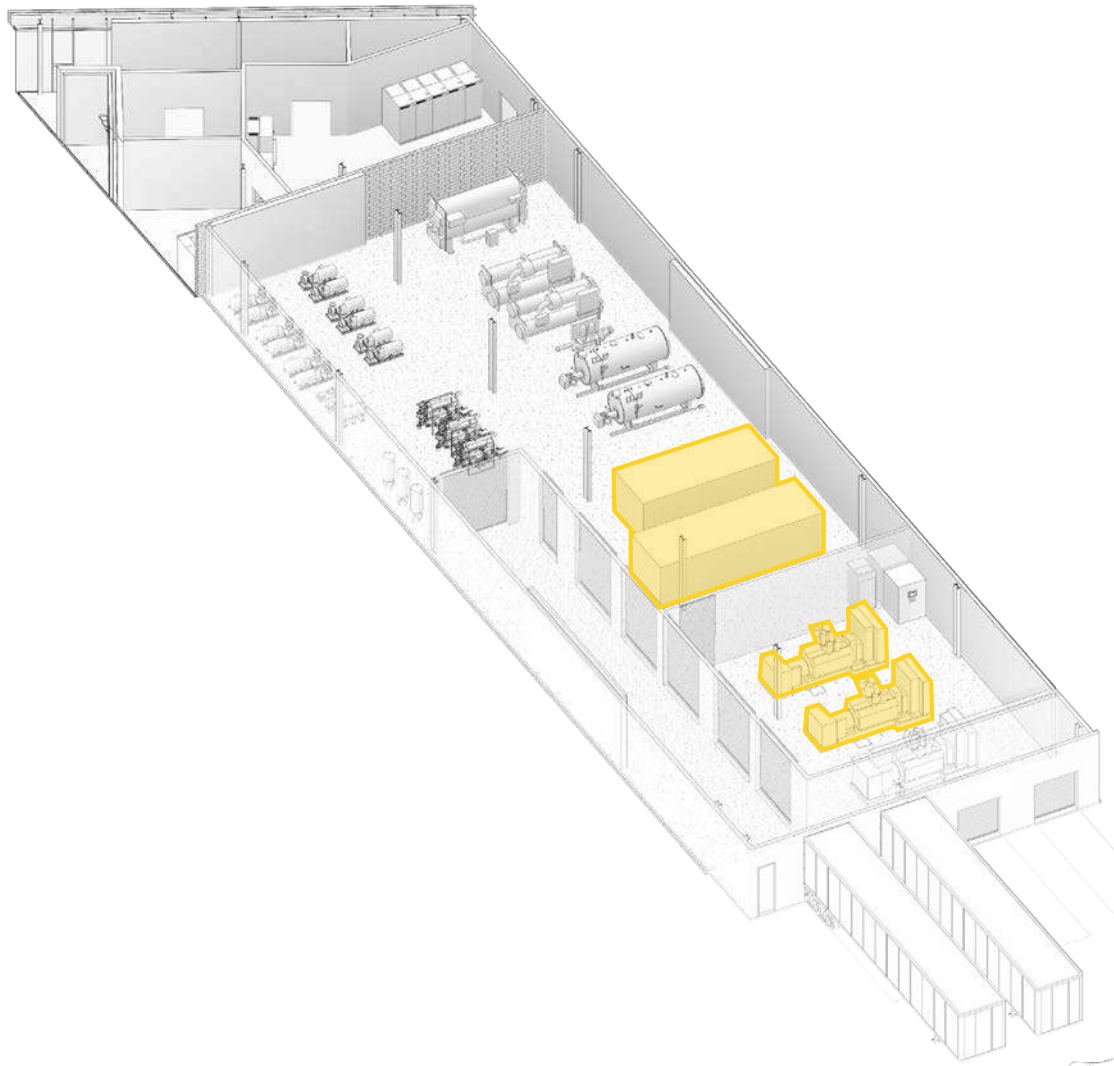
480/277V
1500kW/1875kVA

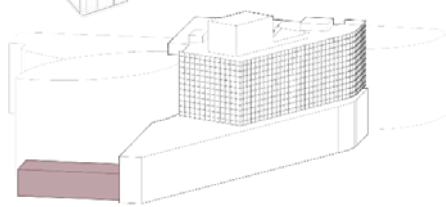
+1

Gen #3



480/277V
1500kW/1875kVA





Central Plant | Electrical System

Microturbine

480/277V
800kW/1000kVA

Microturbine

480/277V
1000kW/1250kVA

N

Gen #1

480/277V
1500kW/1875kVA

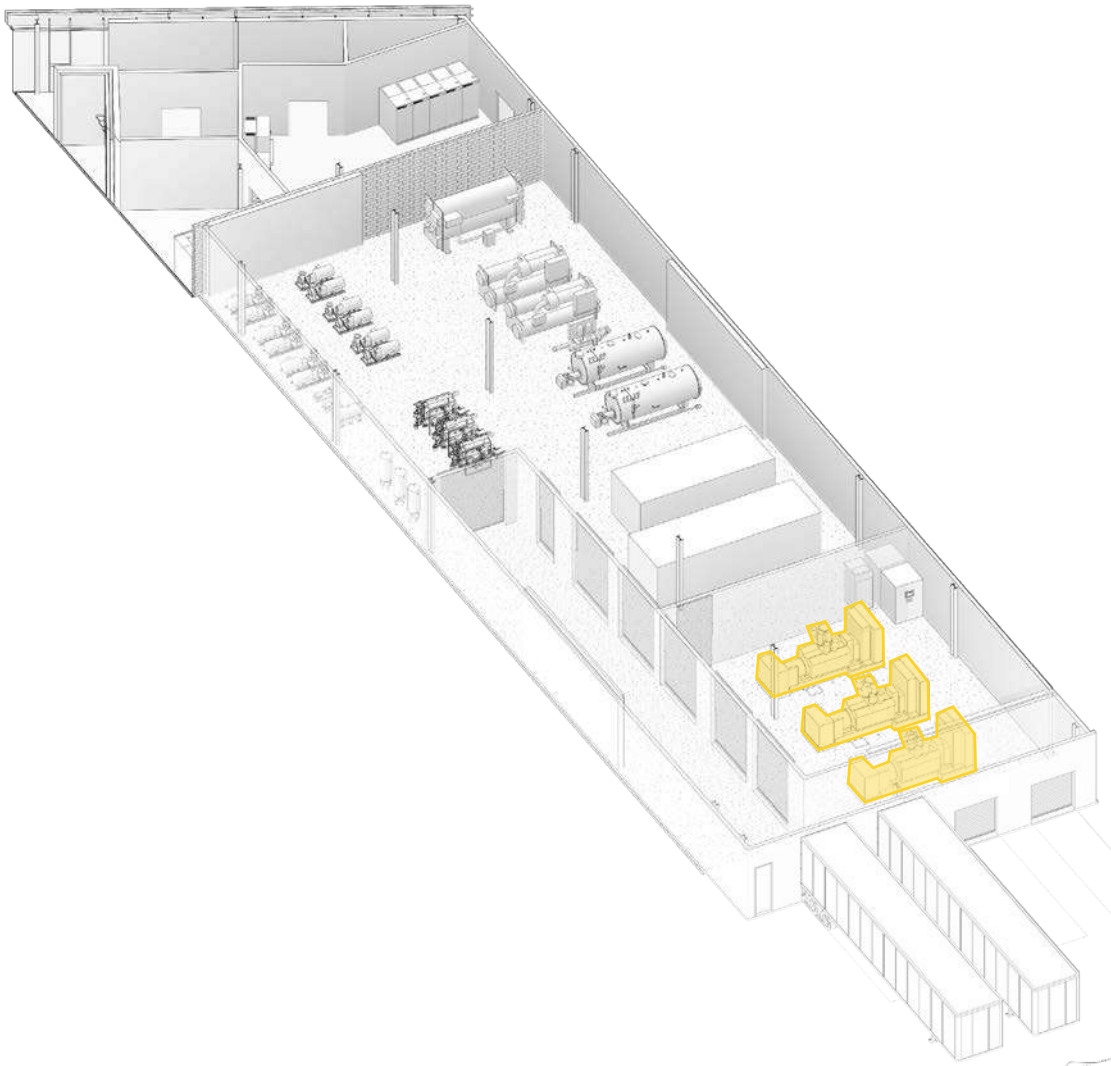
Gen #2

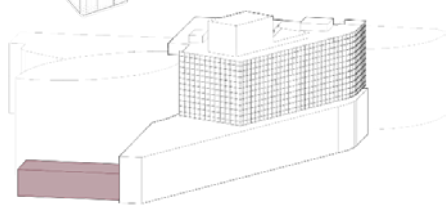
480/277V
1500kW/1875kVA

Gen #3

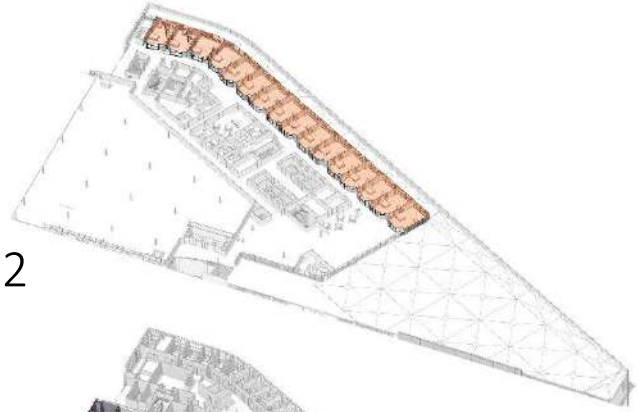
480/277V
1500kW/1875kVA

+1





Disaster Preparedness | Mass Casualty

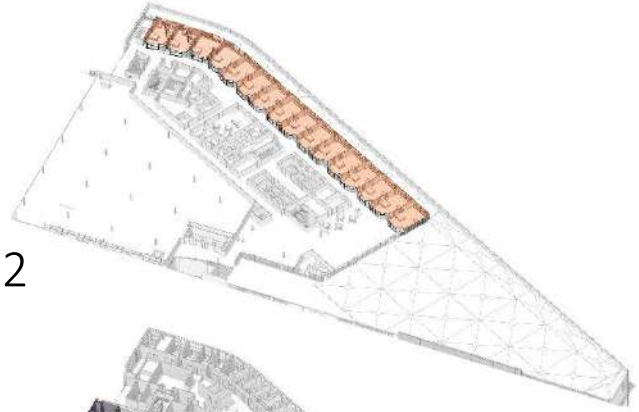


Level 2

Level 1

Lower Level 1

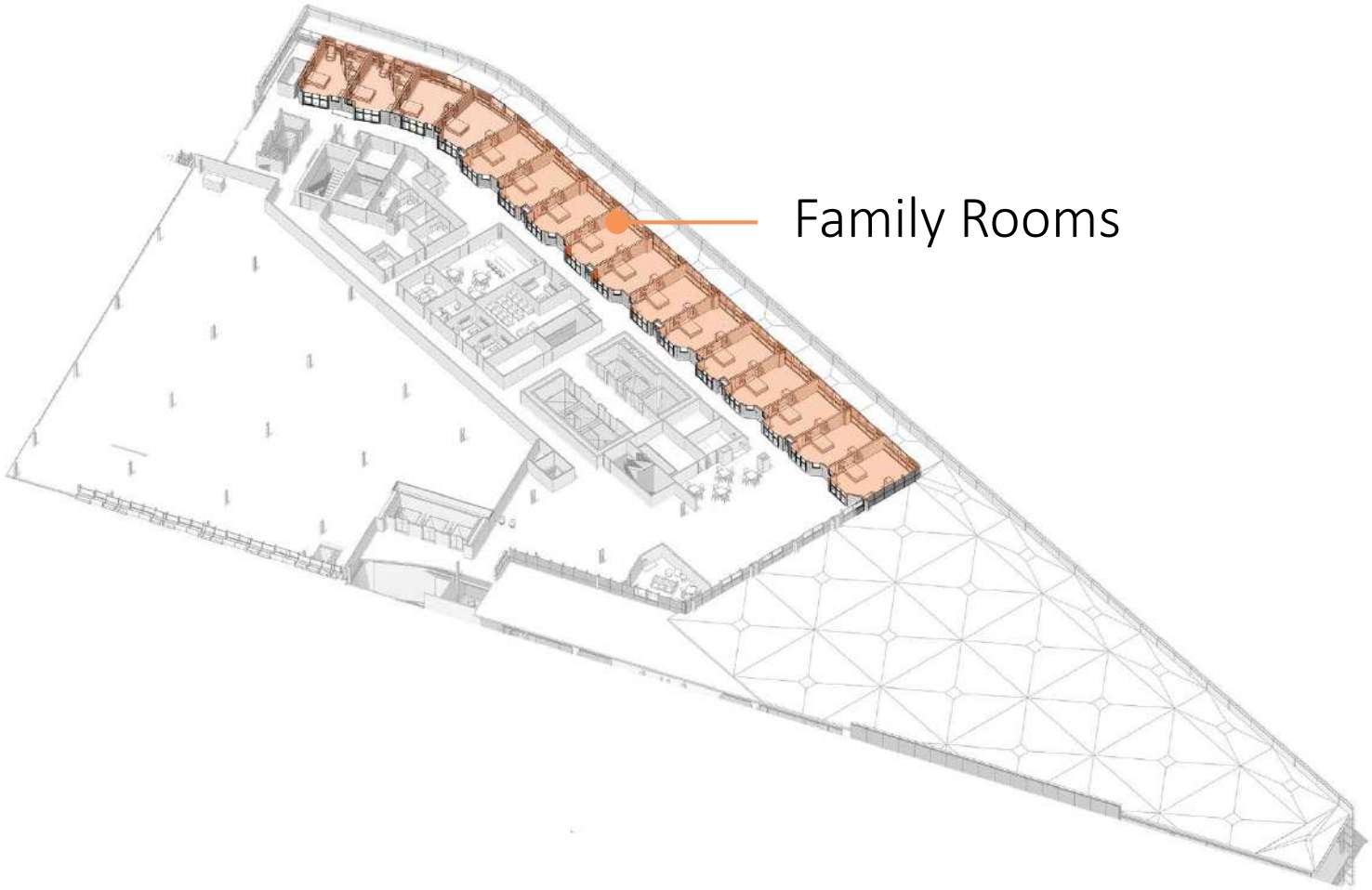
Disaster Preparedness | Mass Casualty

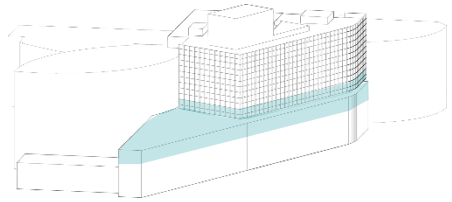


Level 2

Level 1

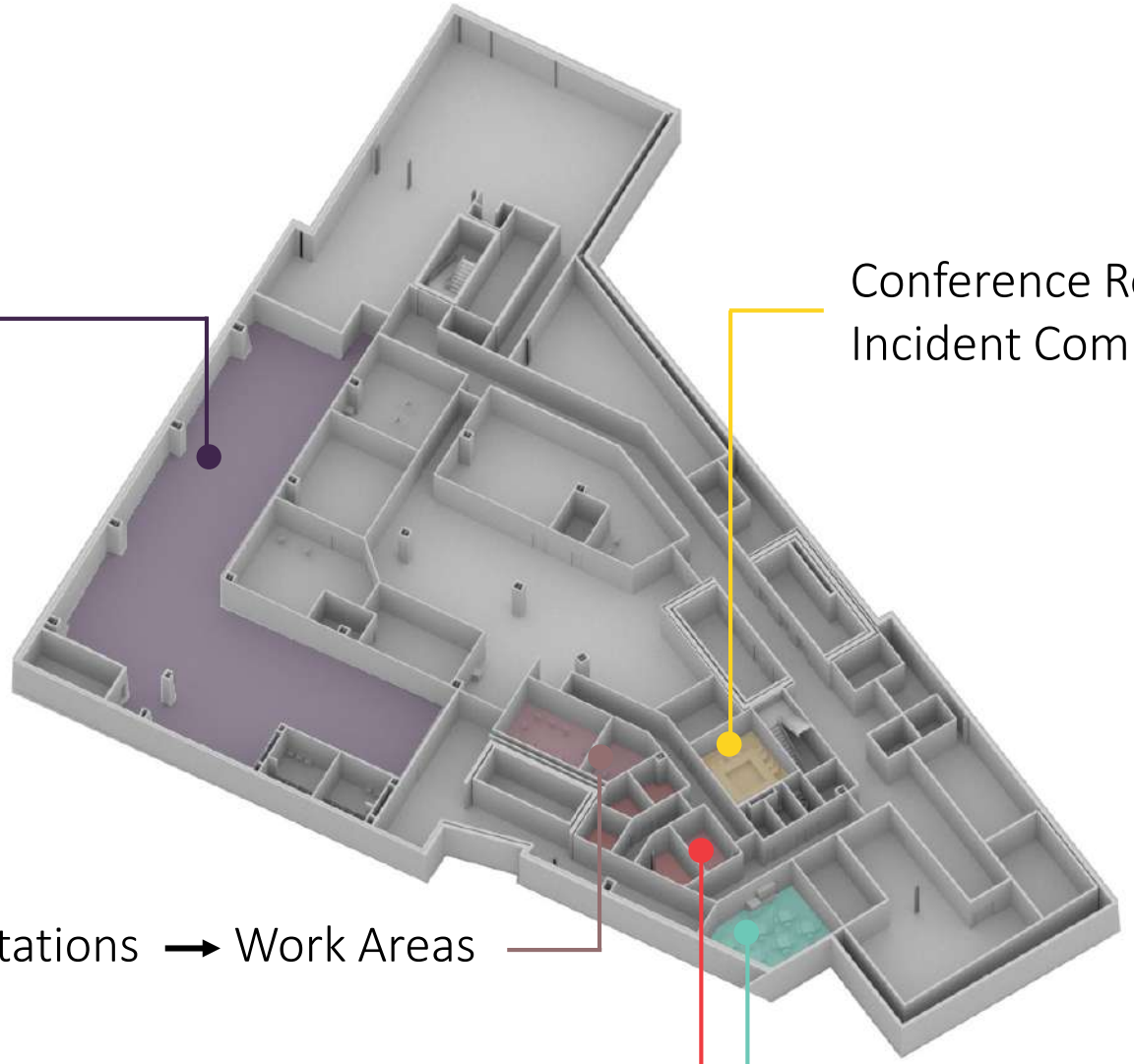
Lower Level 1





Disaster Preparedness | Emergency Operations Center

Gym → Storm Shelter

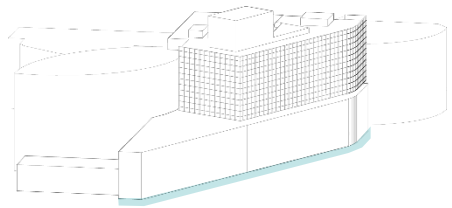


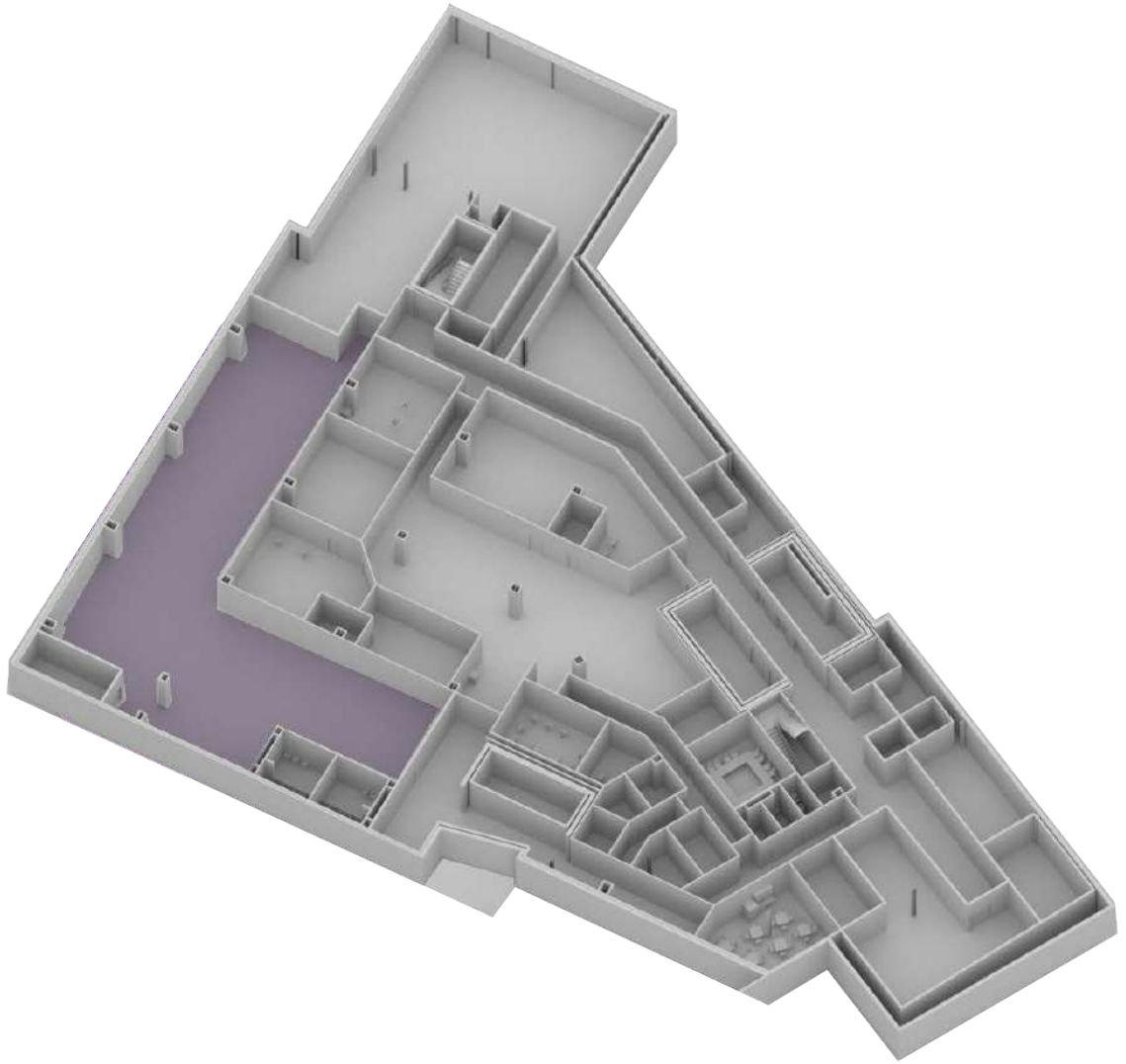
Conference Rooms →
Incident Command Center

Work Stations → Work Areas

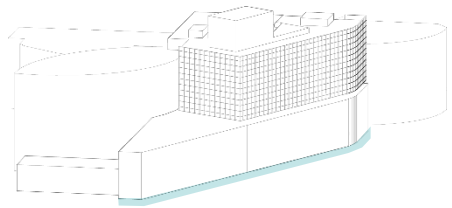
Private Offices → Break Out Areas

Staff Lounge →
Overflow Work Area

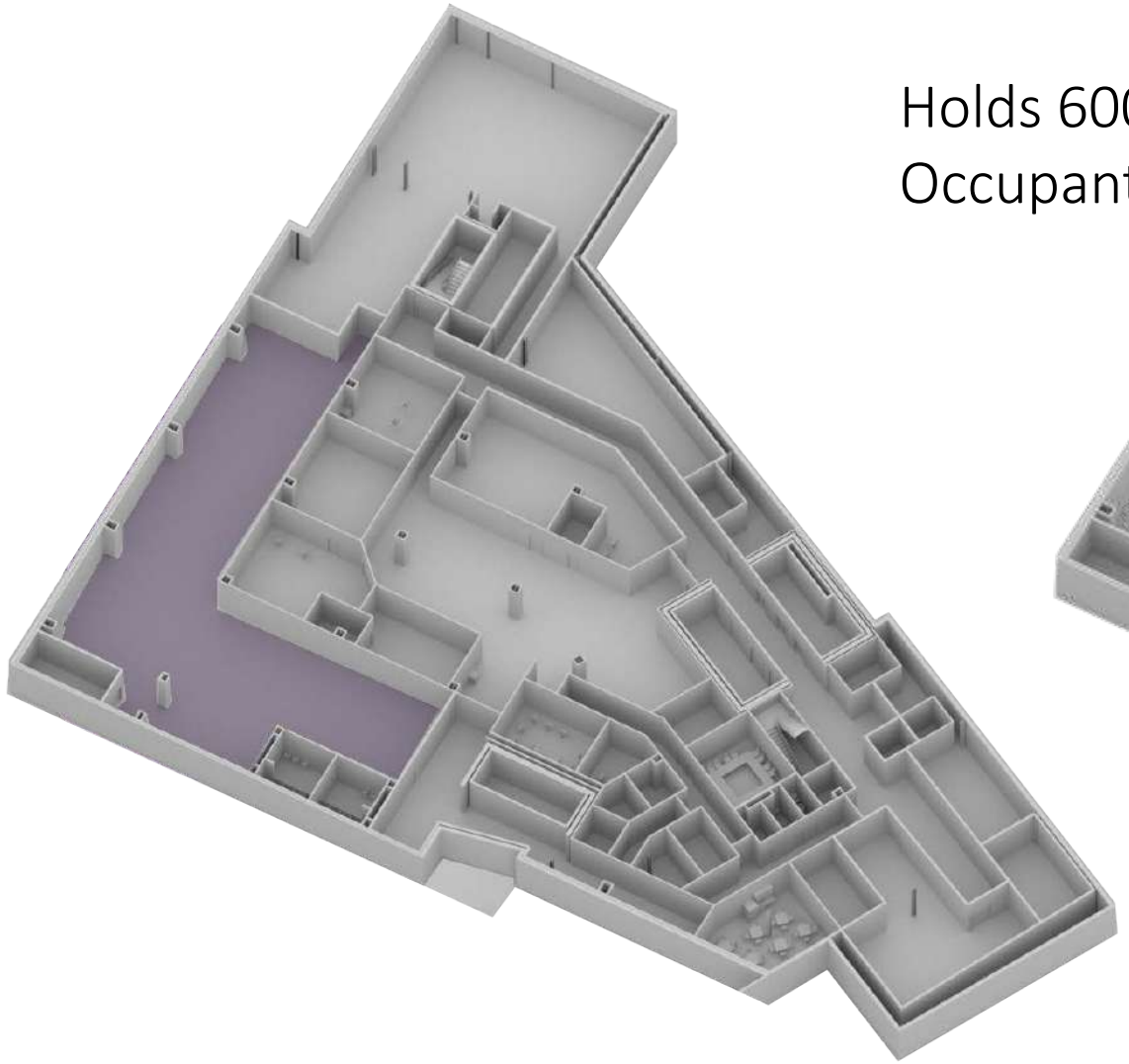




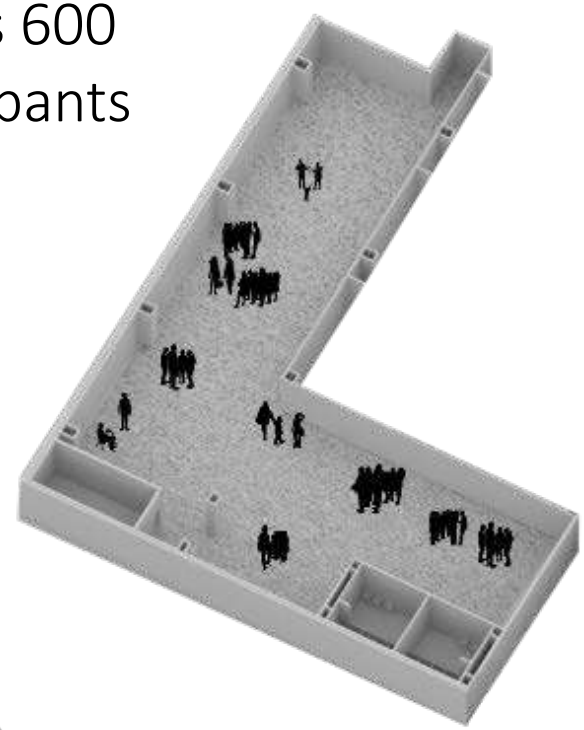
Normal
Operations



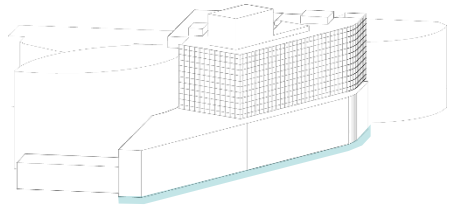
Normal Operations



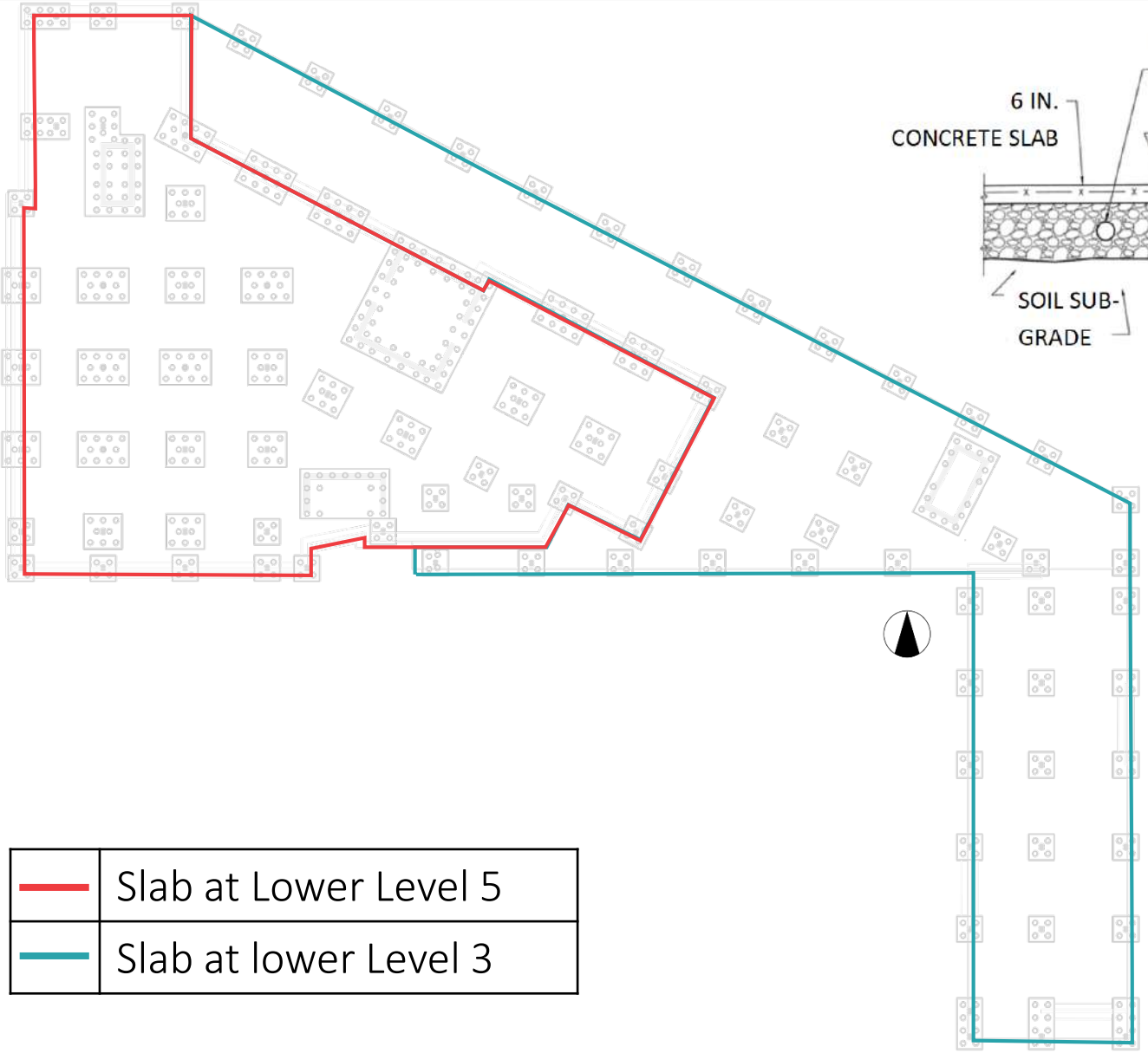
Holds 600 Occupants

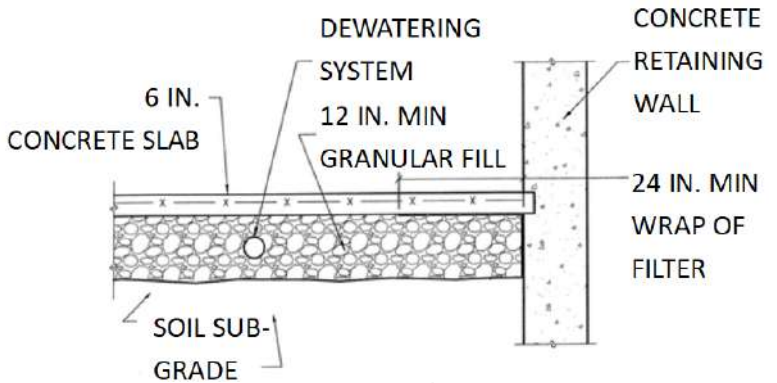


Community Shelter Operations

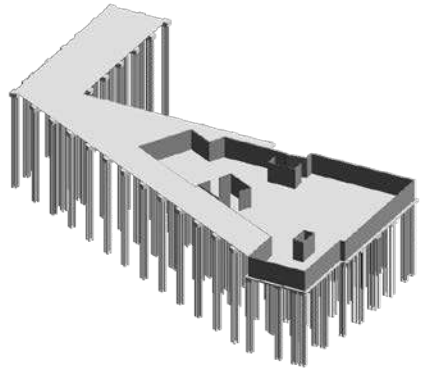


Foundation System

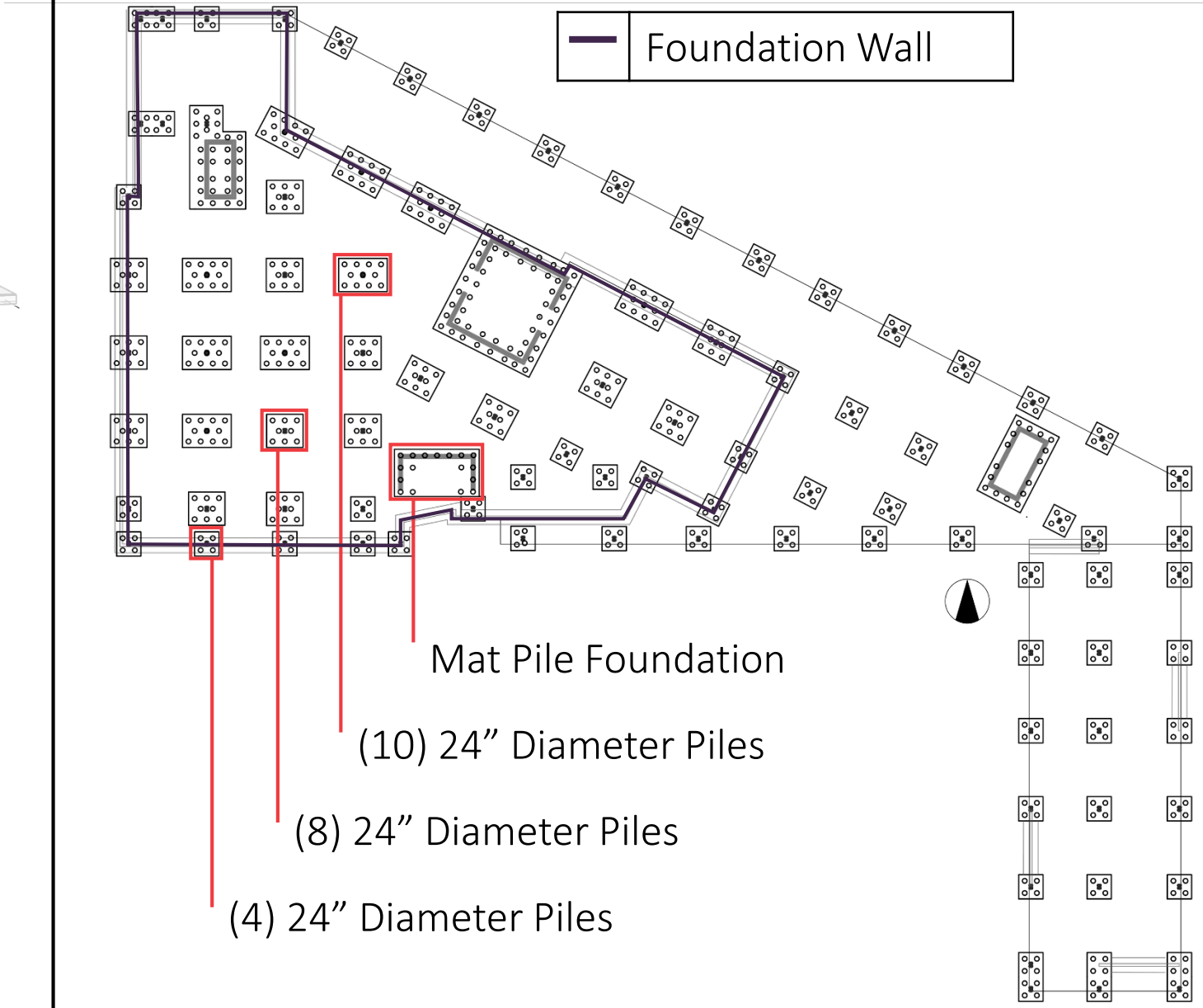


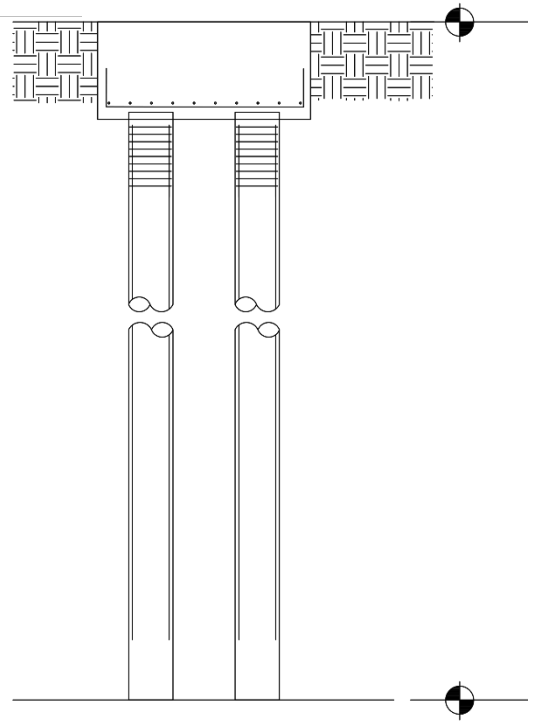


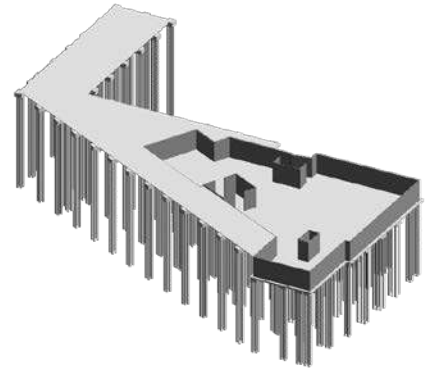
	Slab at Lower Level 5
	Slab at lower Level 3



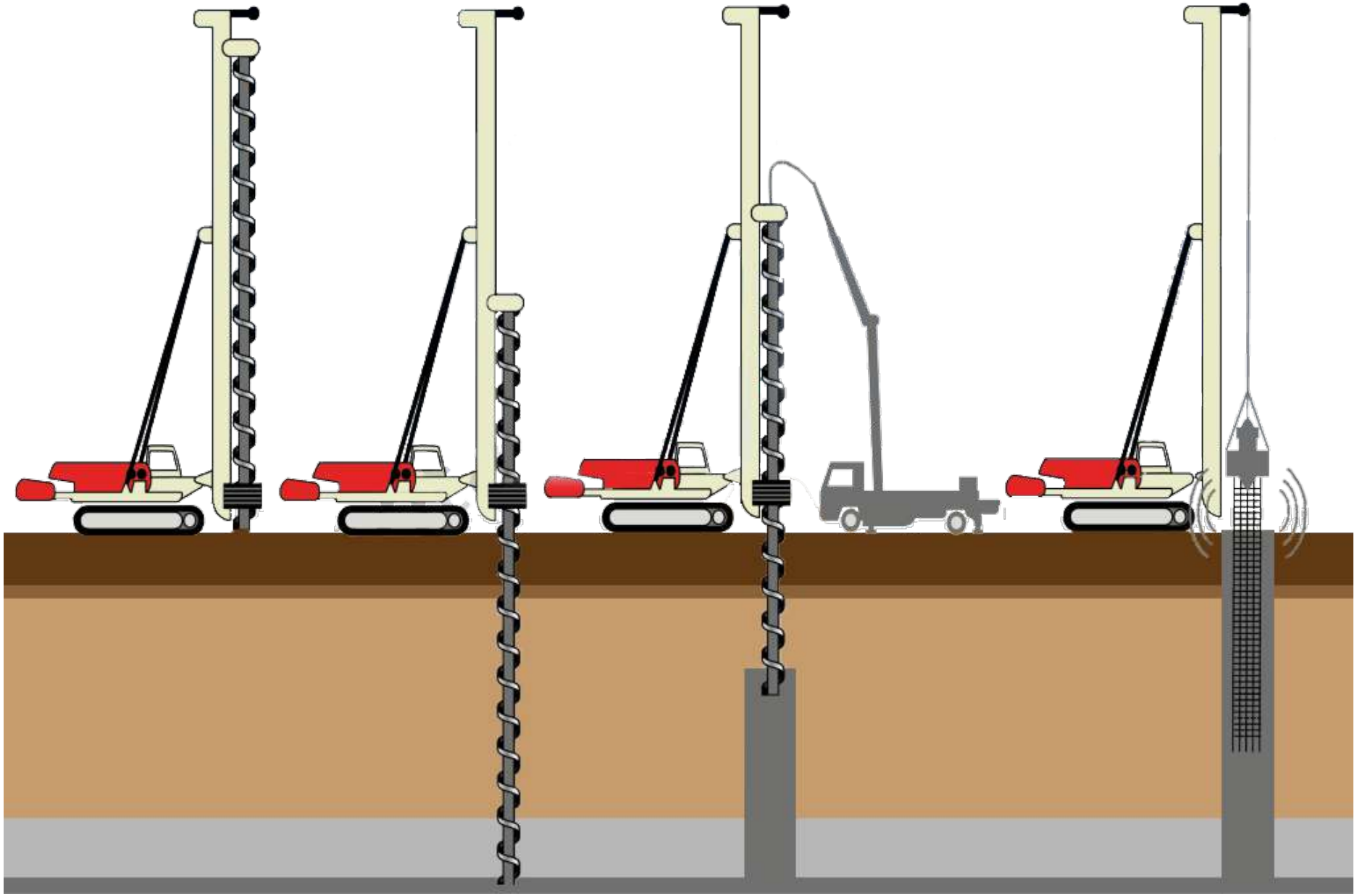
Foundation System

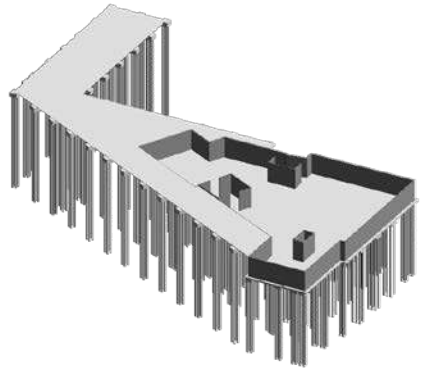


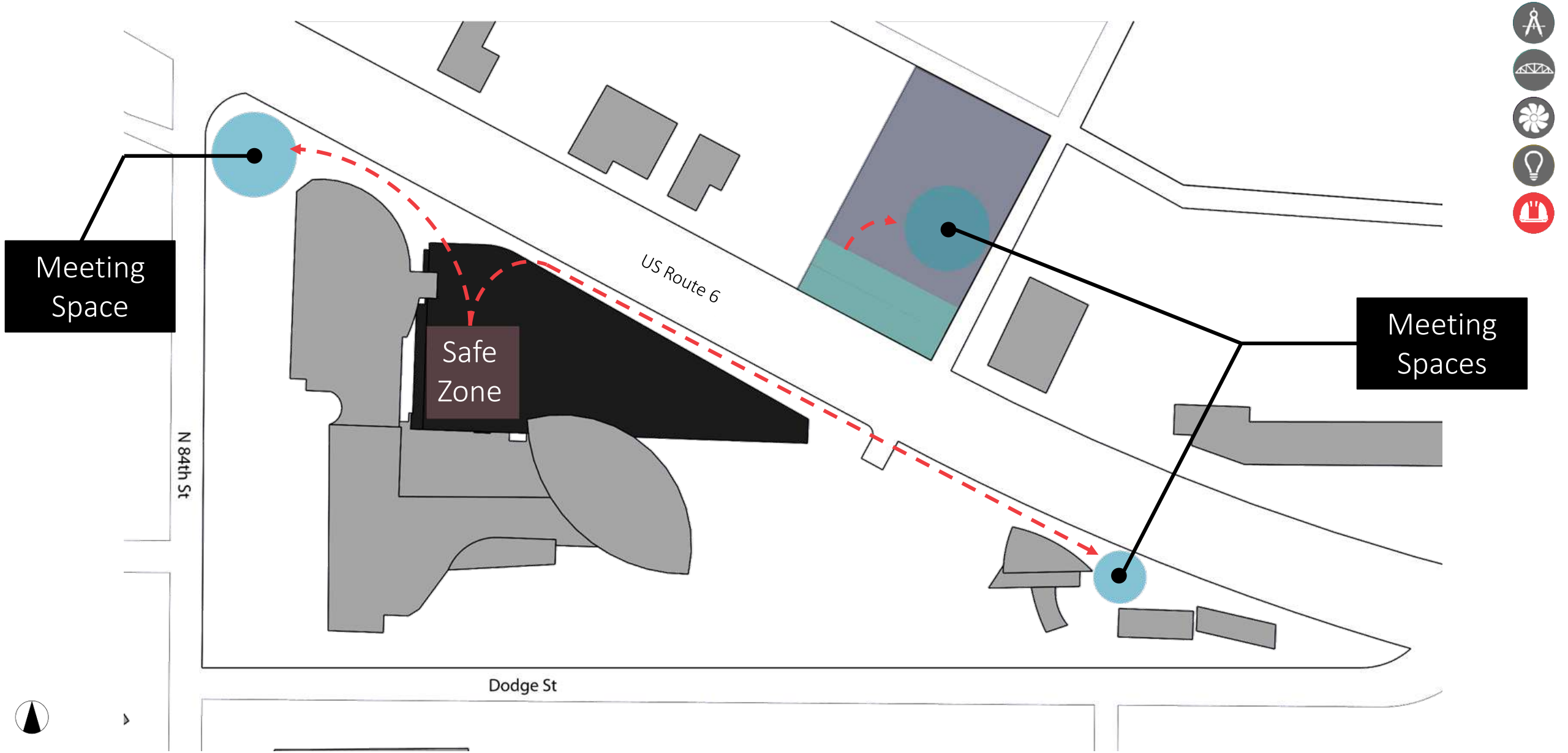




Foundation System | Constructability





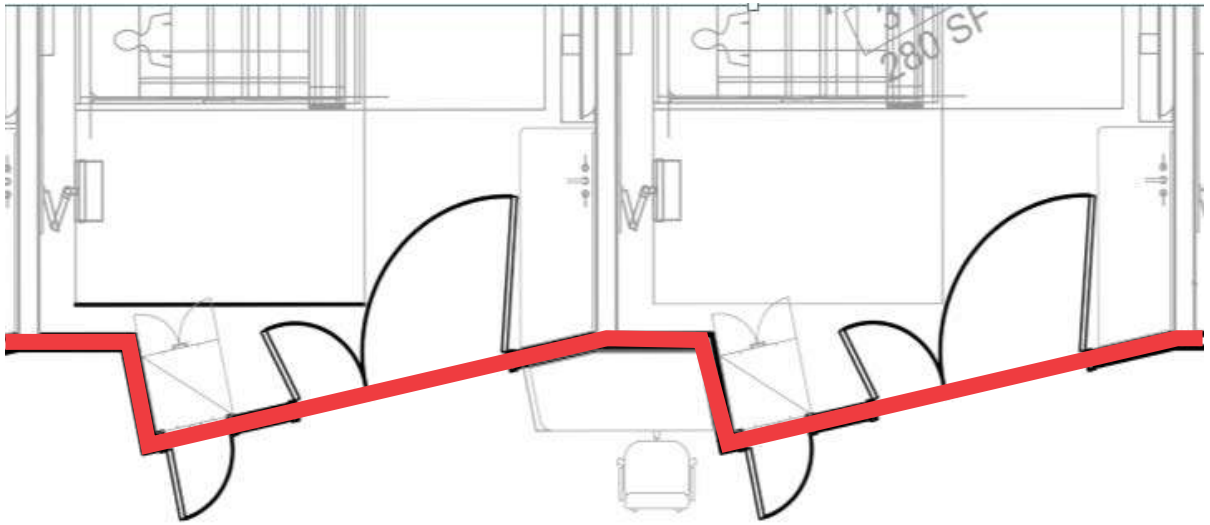

Meeting Space
Safe Zone
US Route 6
Meeting Spaces
N 84th St
Dodge St

Community

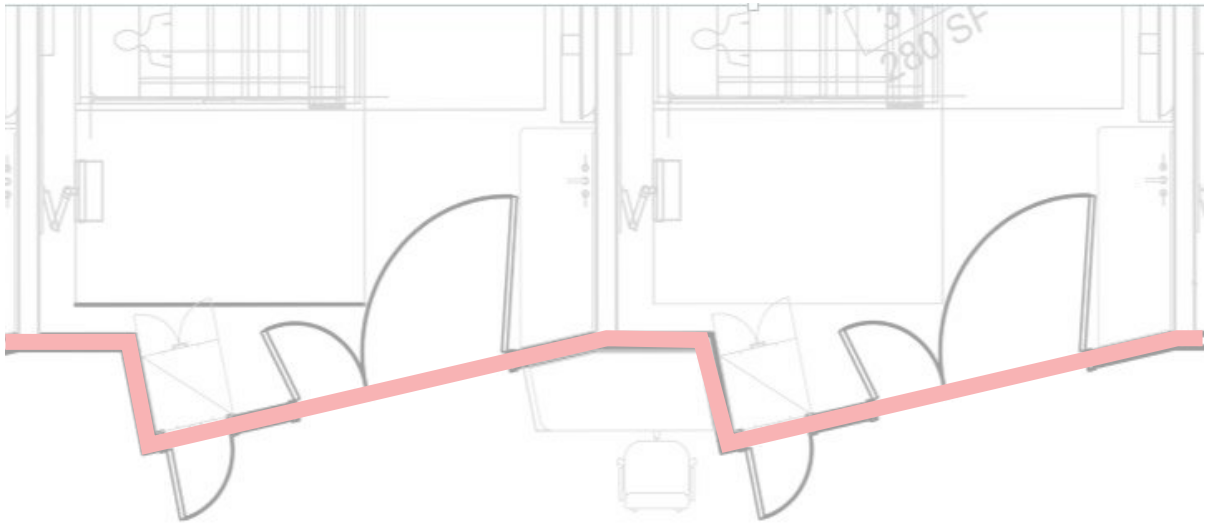
Hallway

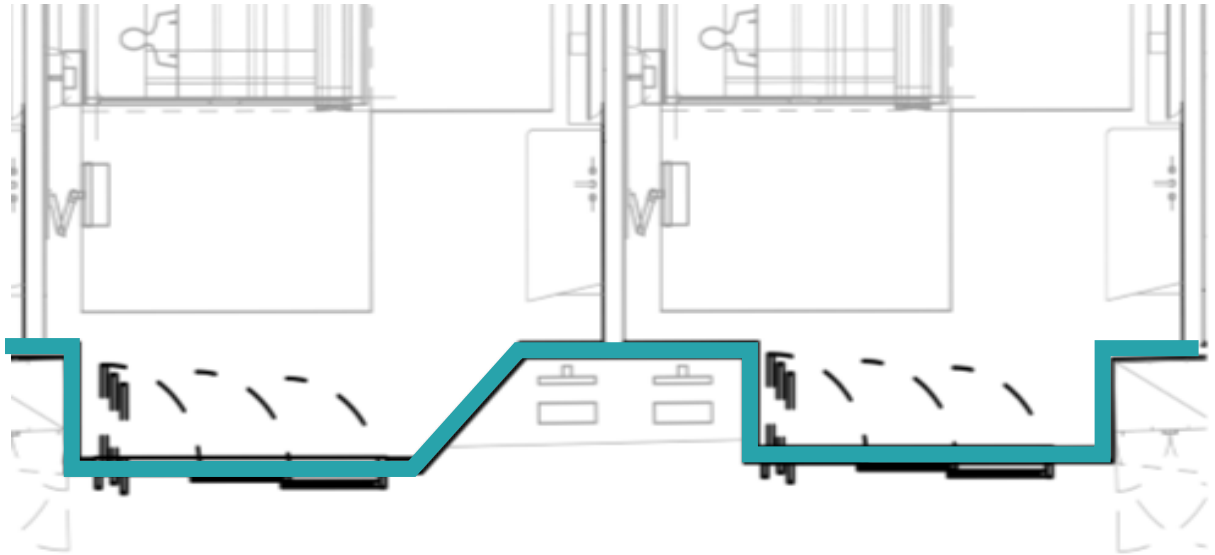
Team Center

Hallway | Original Design



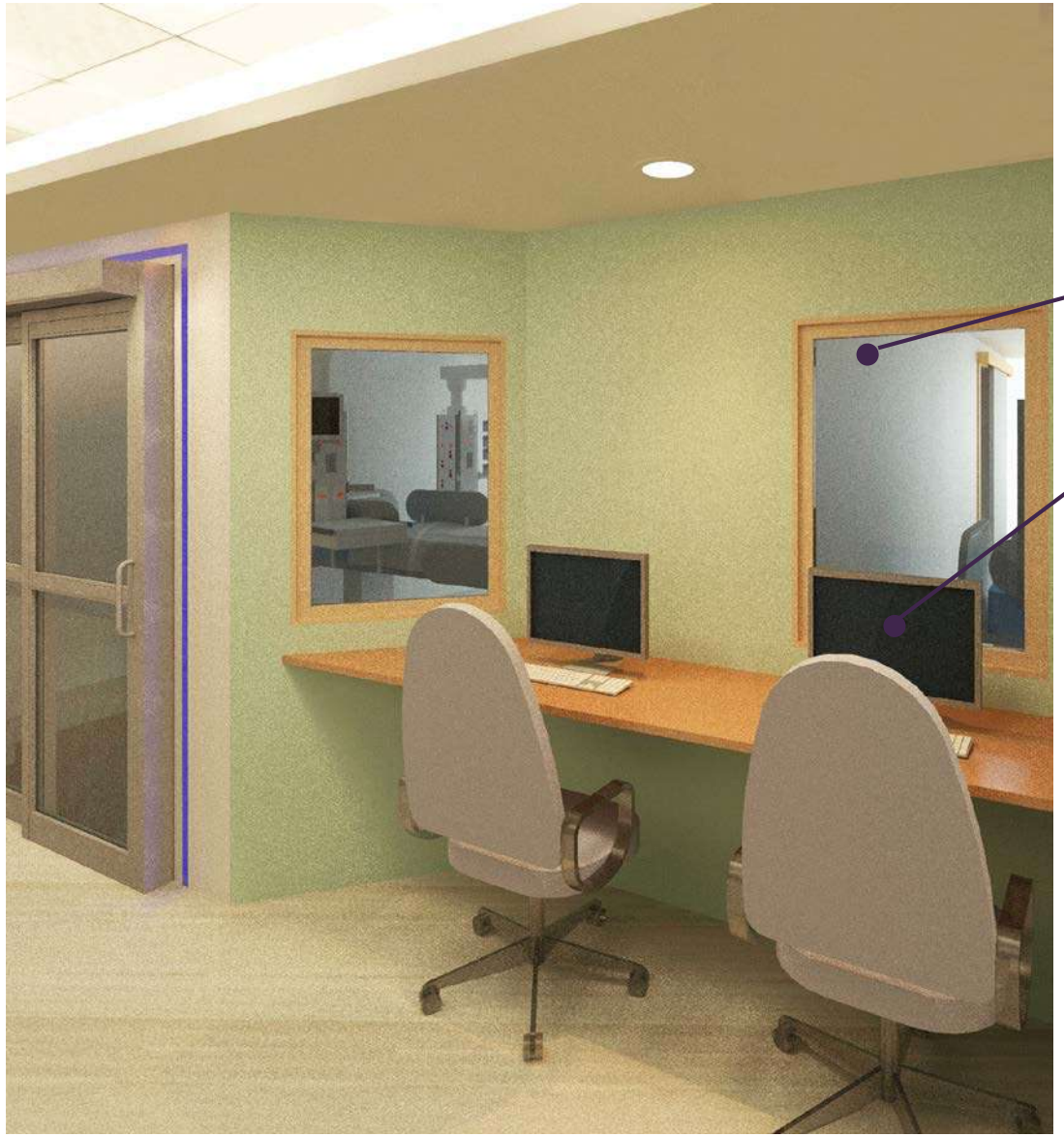
Hallway | Final Design





Telescoping Doors

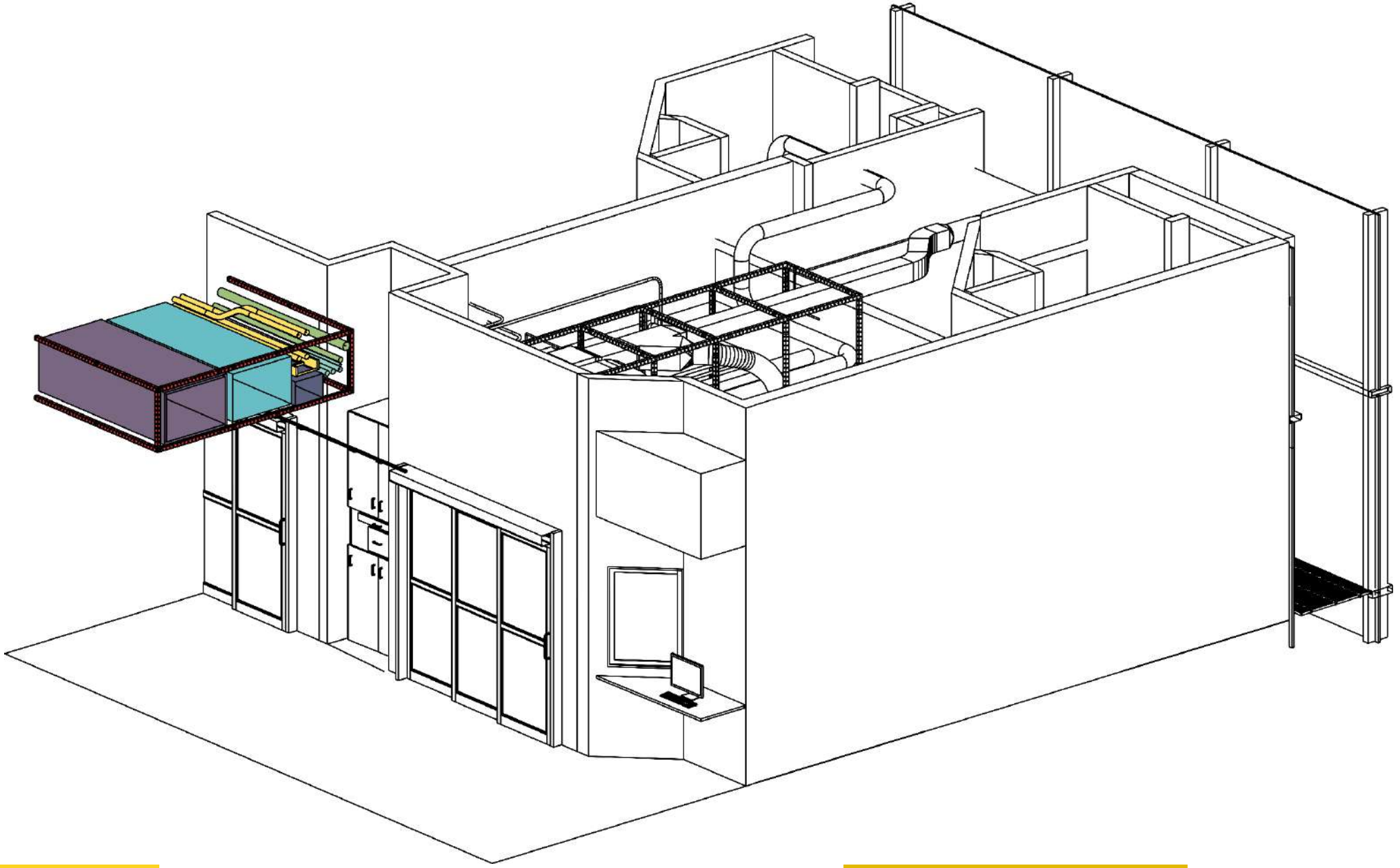
Hallway | Final Design



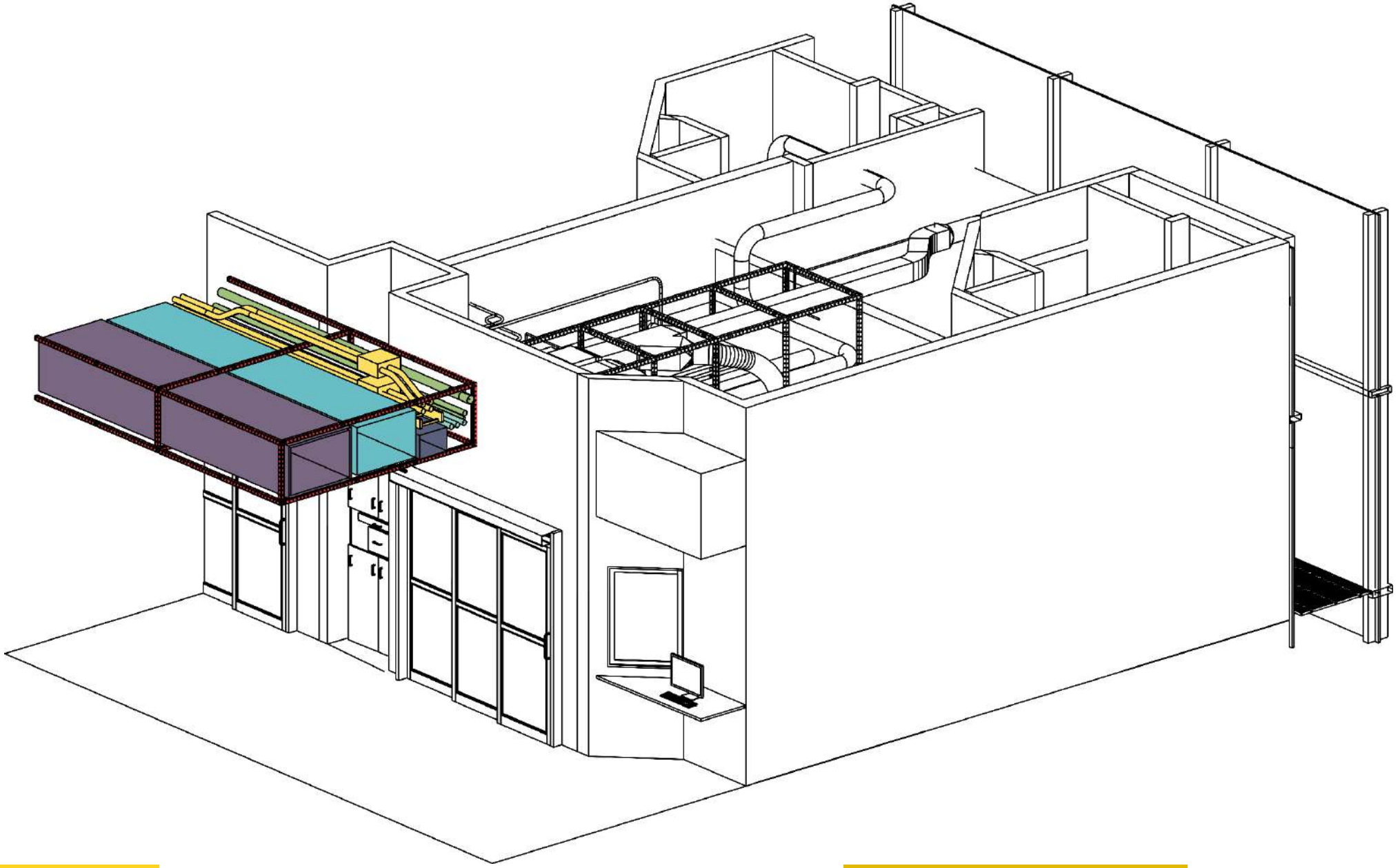
Nurse's Observation Windows

Two Seat Charting Station

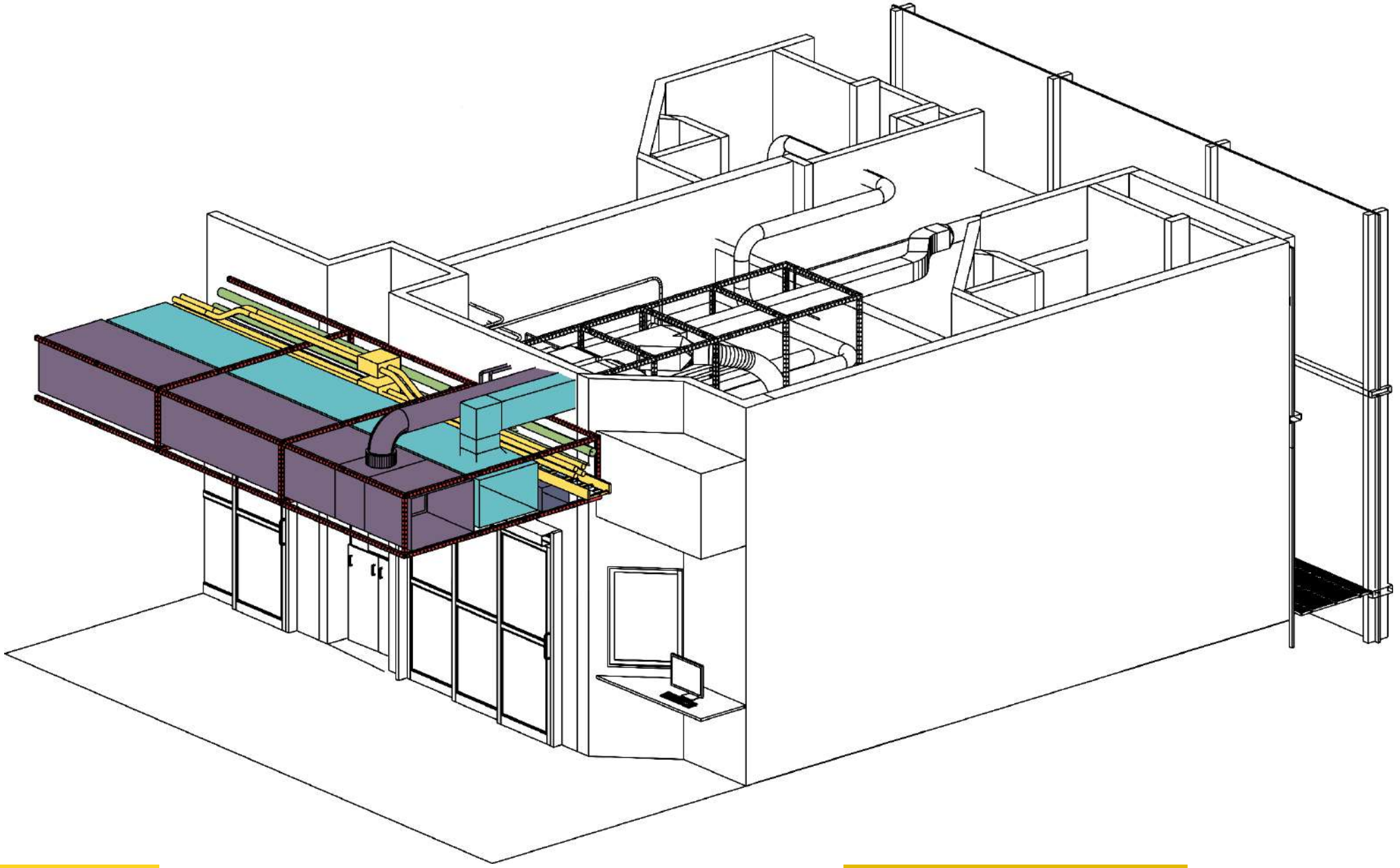
Hallway | Prefabricated Racks



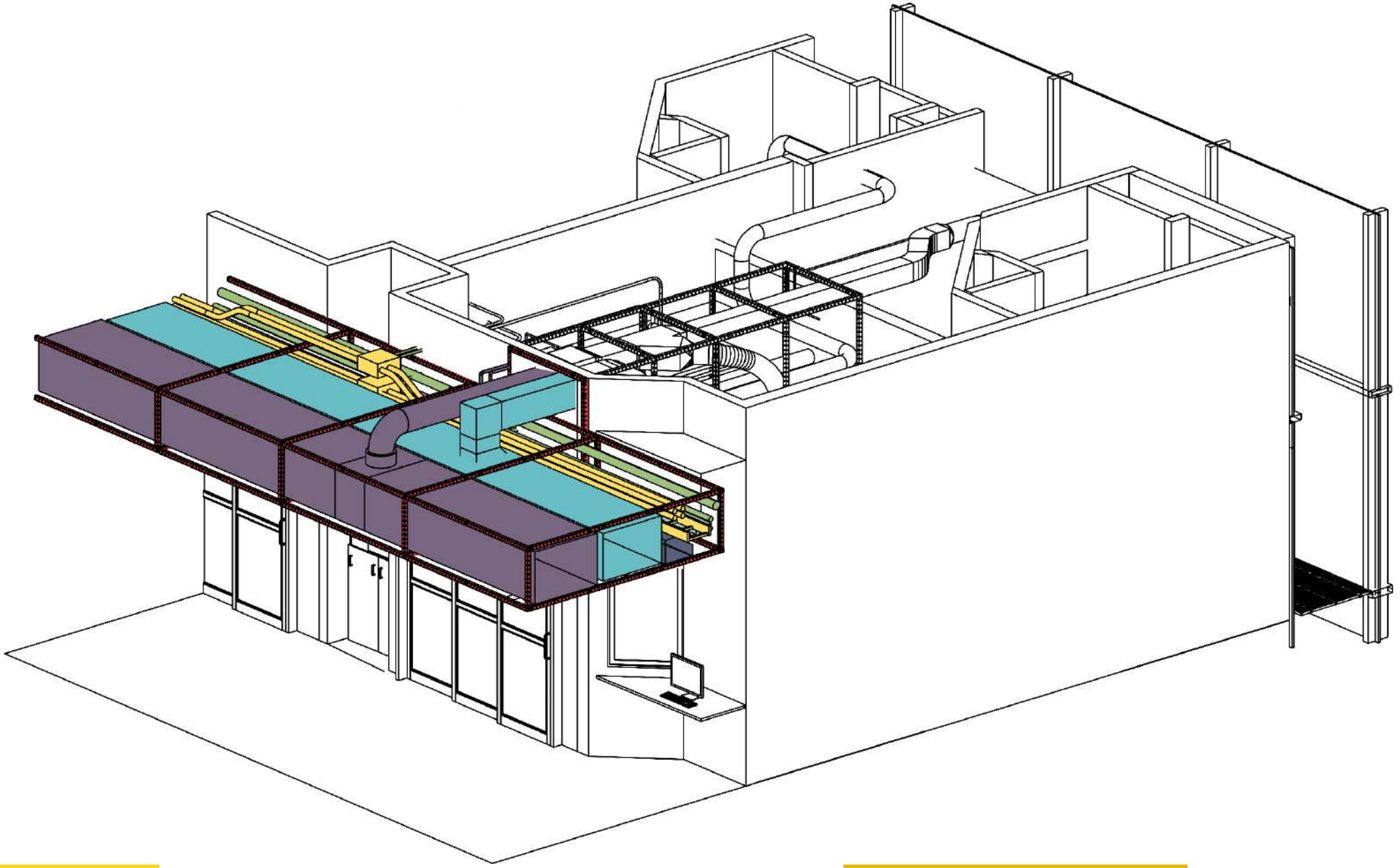
Hallway | Prefabricated Racks



Hallway | Prefabricated Racks



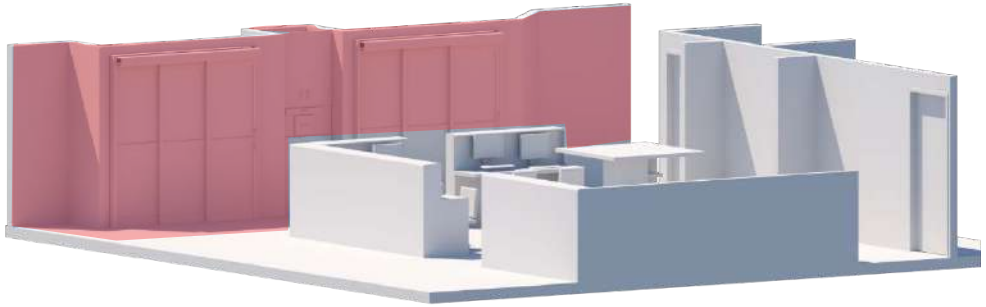
Hallway | Prefabricated Racks



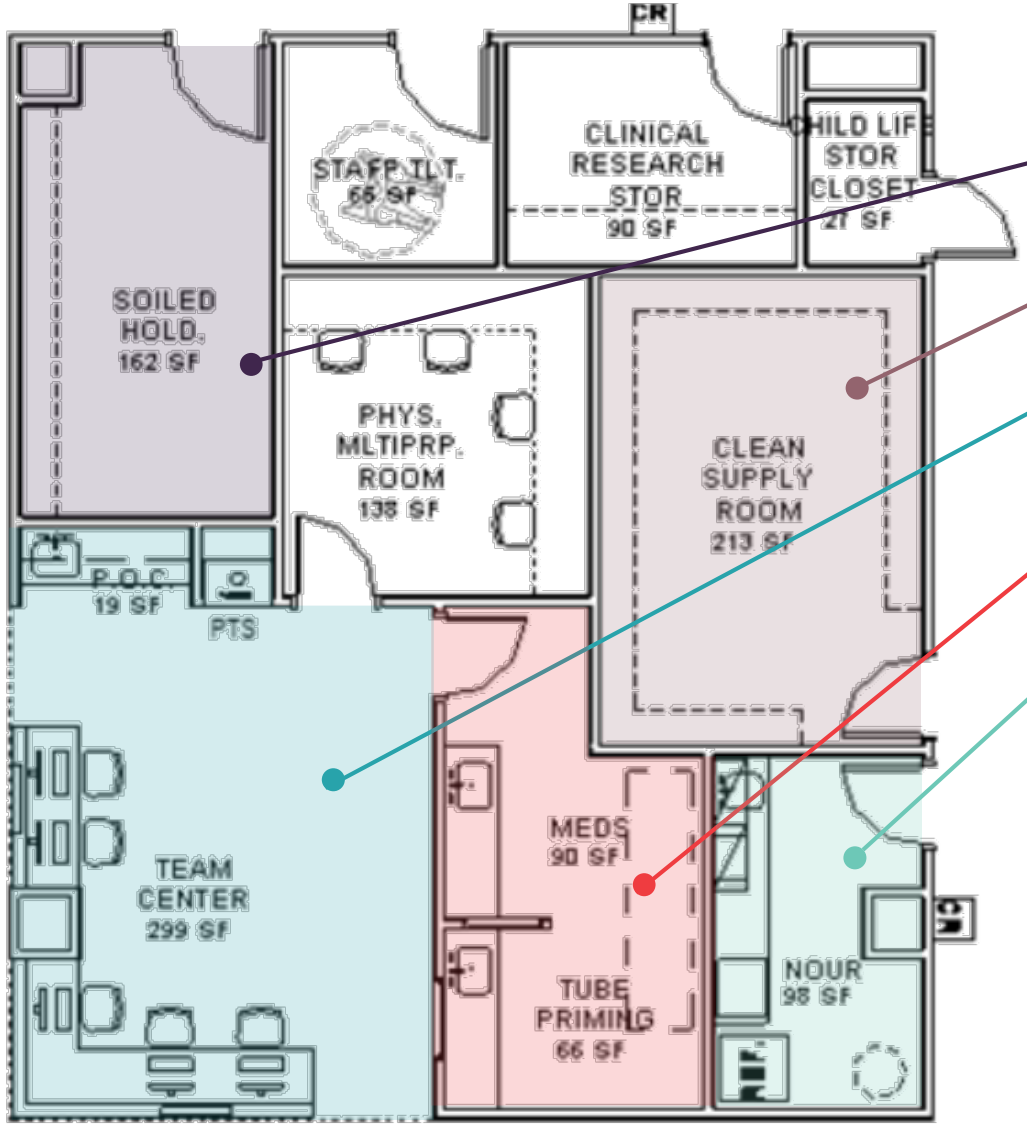
Hallway | Lighting Design

Moda Mini Cove

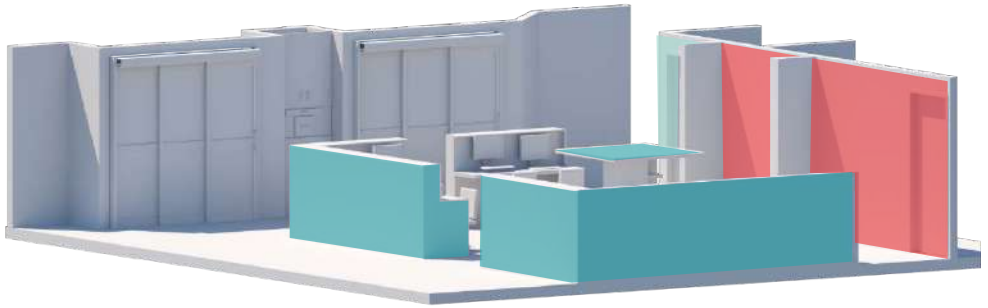
Acolyte W31



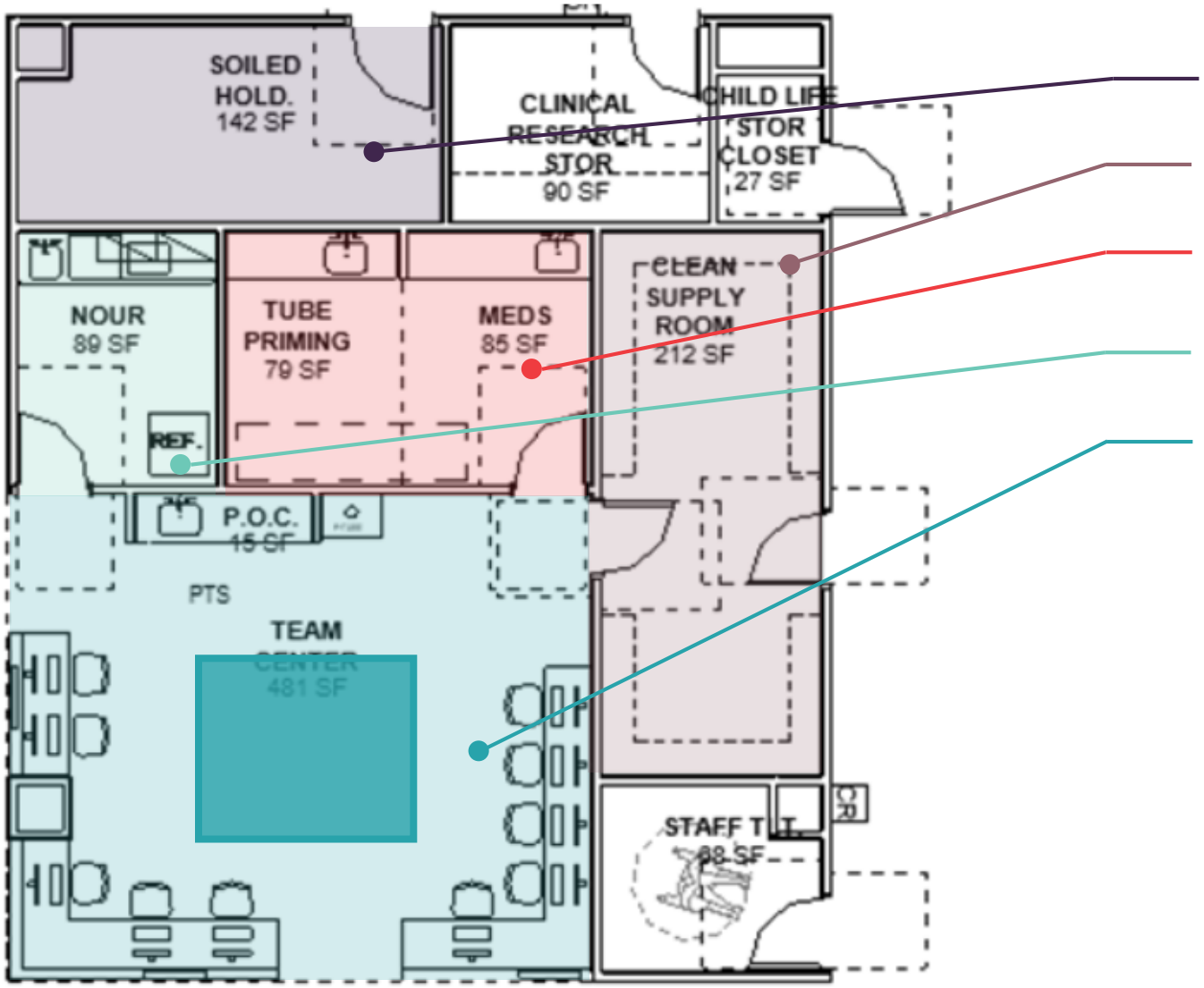
Team Center | Original Layout



- Soiled Hold
- Clean Supply Room
- Team Center and Collaboration Station
- Tube Priming and Medication
- Nourishment



Team Center | Final Layout



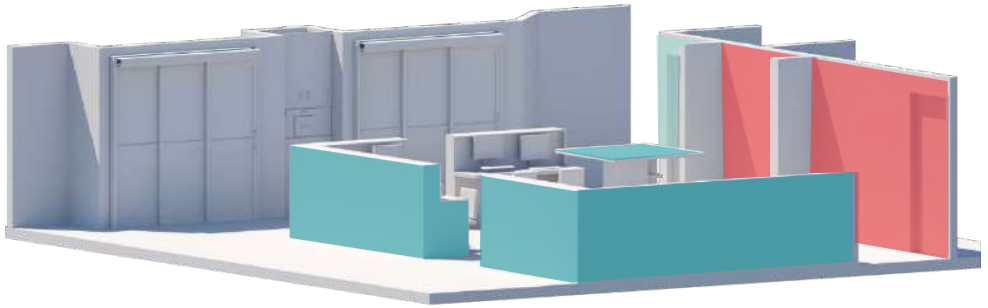
Soiled Hold

Clean Supply Room

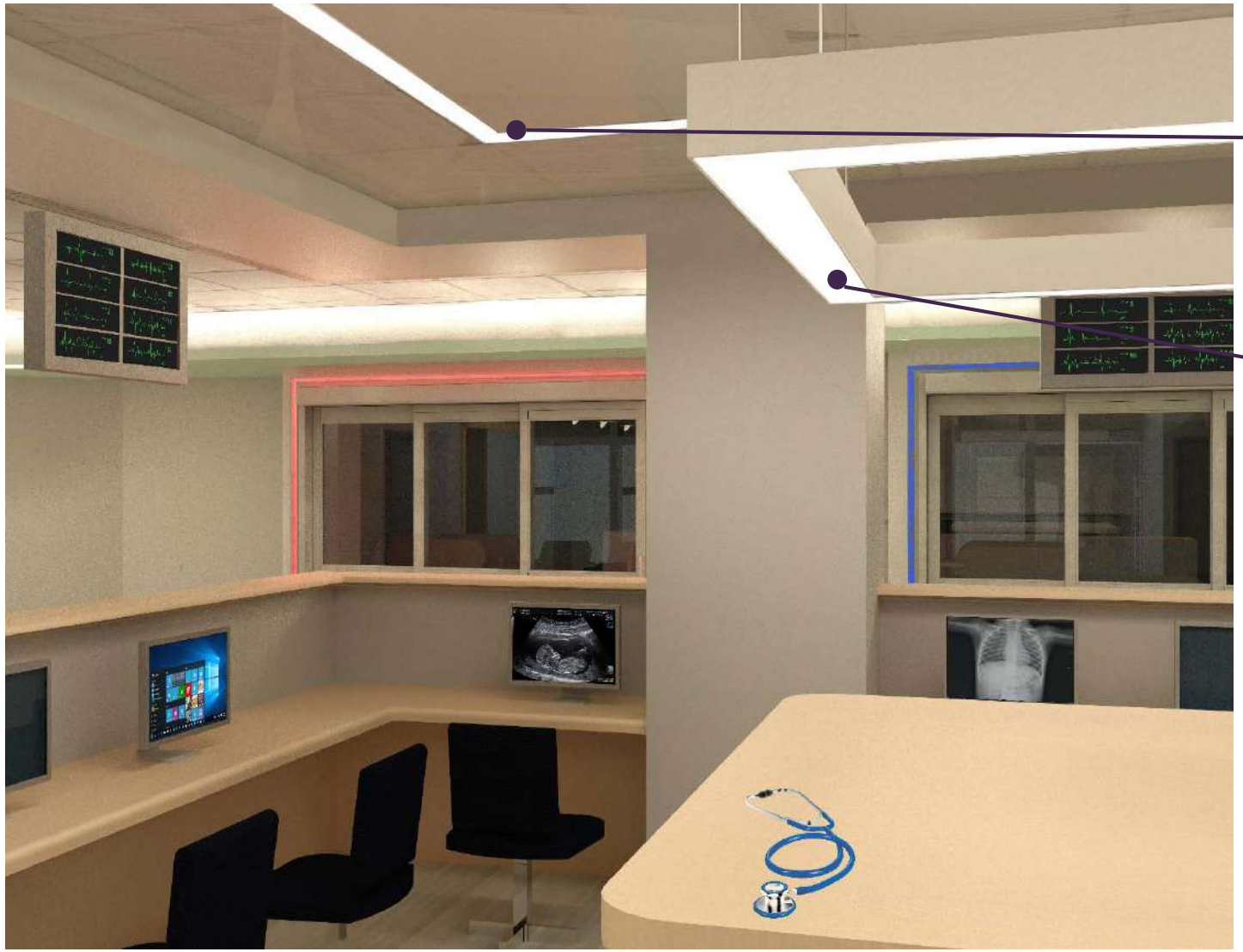
Tube Priming and Medication

Nourishment

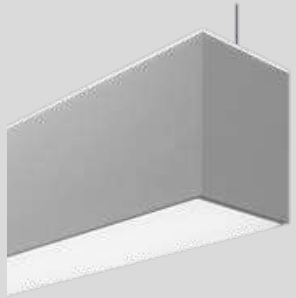
Team Center and Collaboration Station



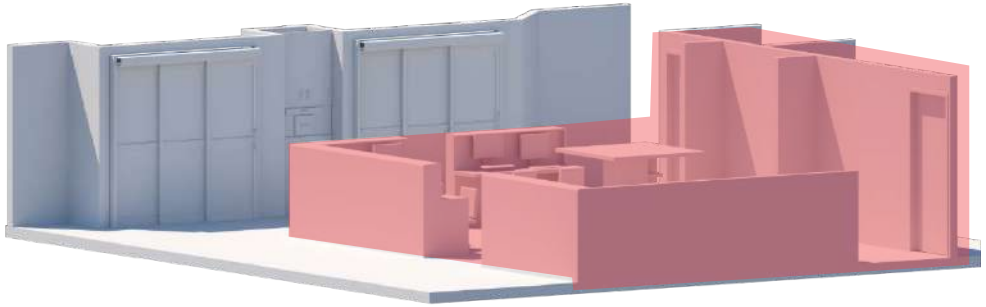
Team Center | Lighting Design



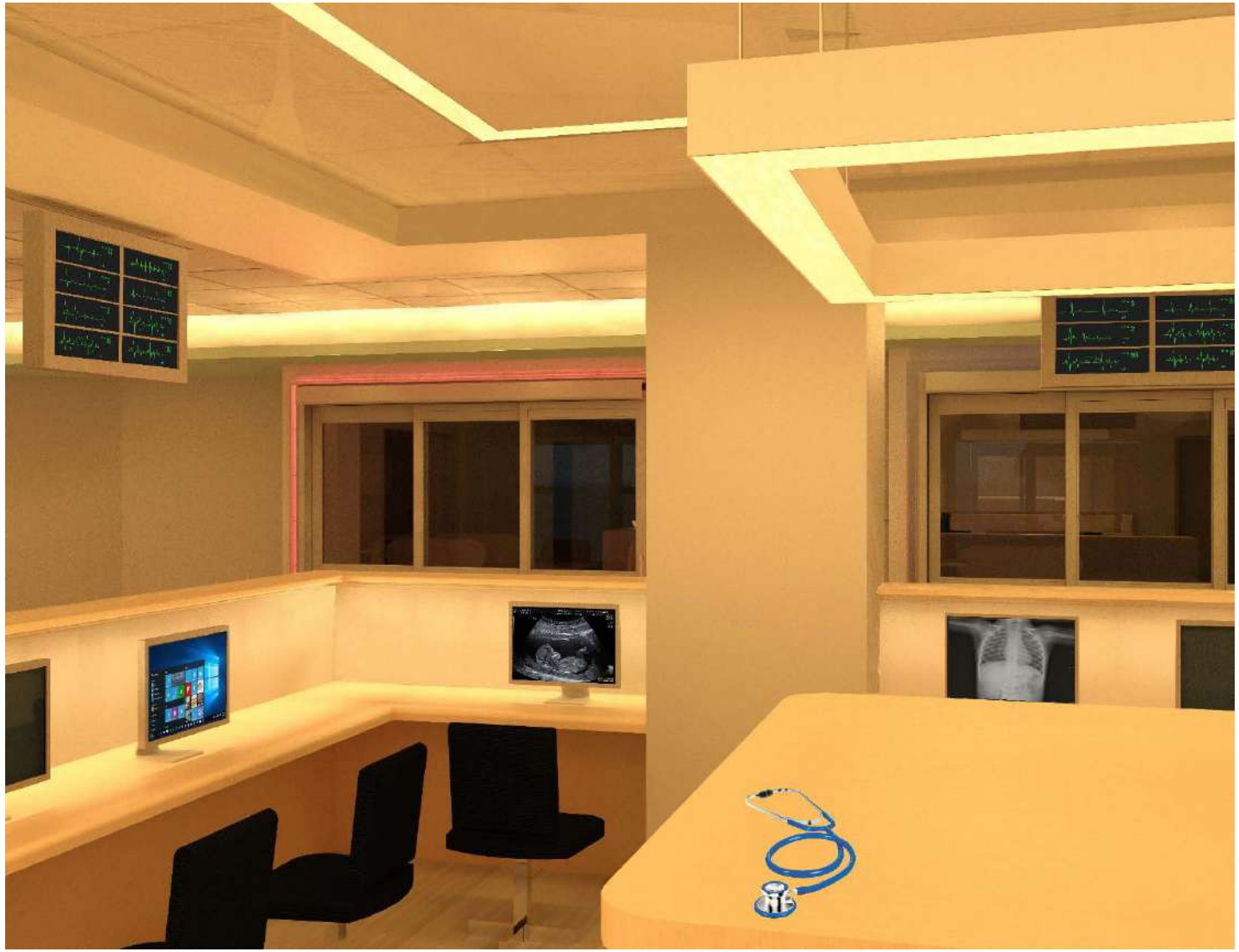
Finelite HP-4 Recessed

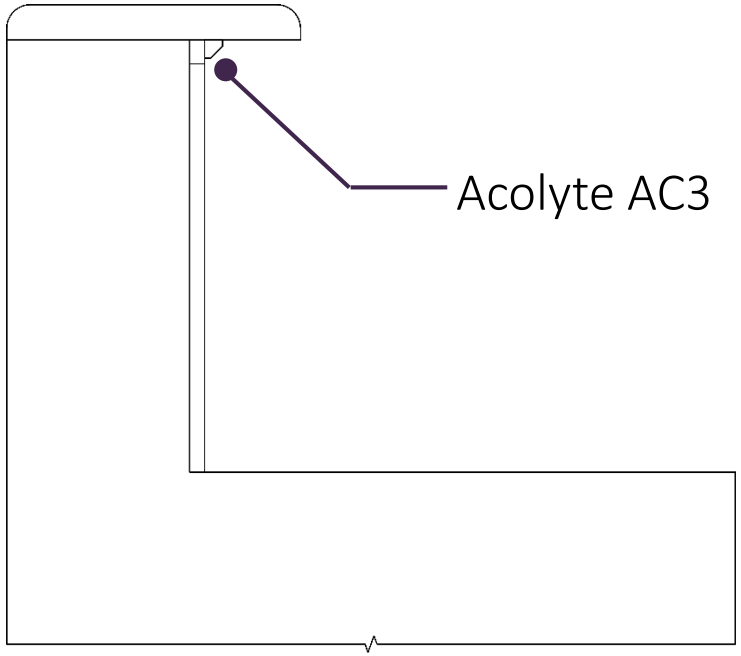


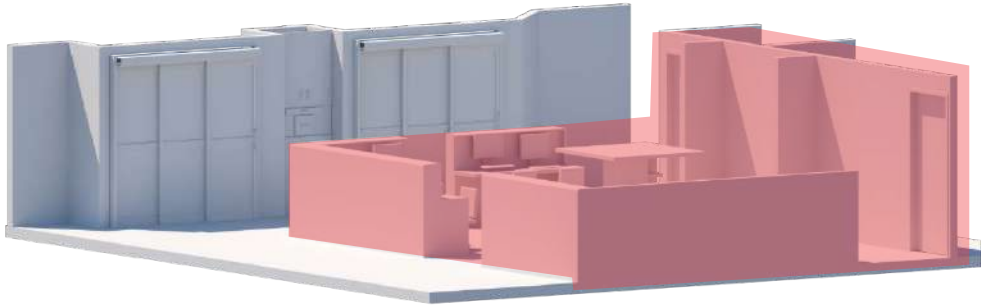
Finelite HP-4 Indirect/Direct

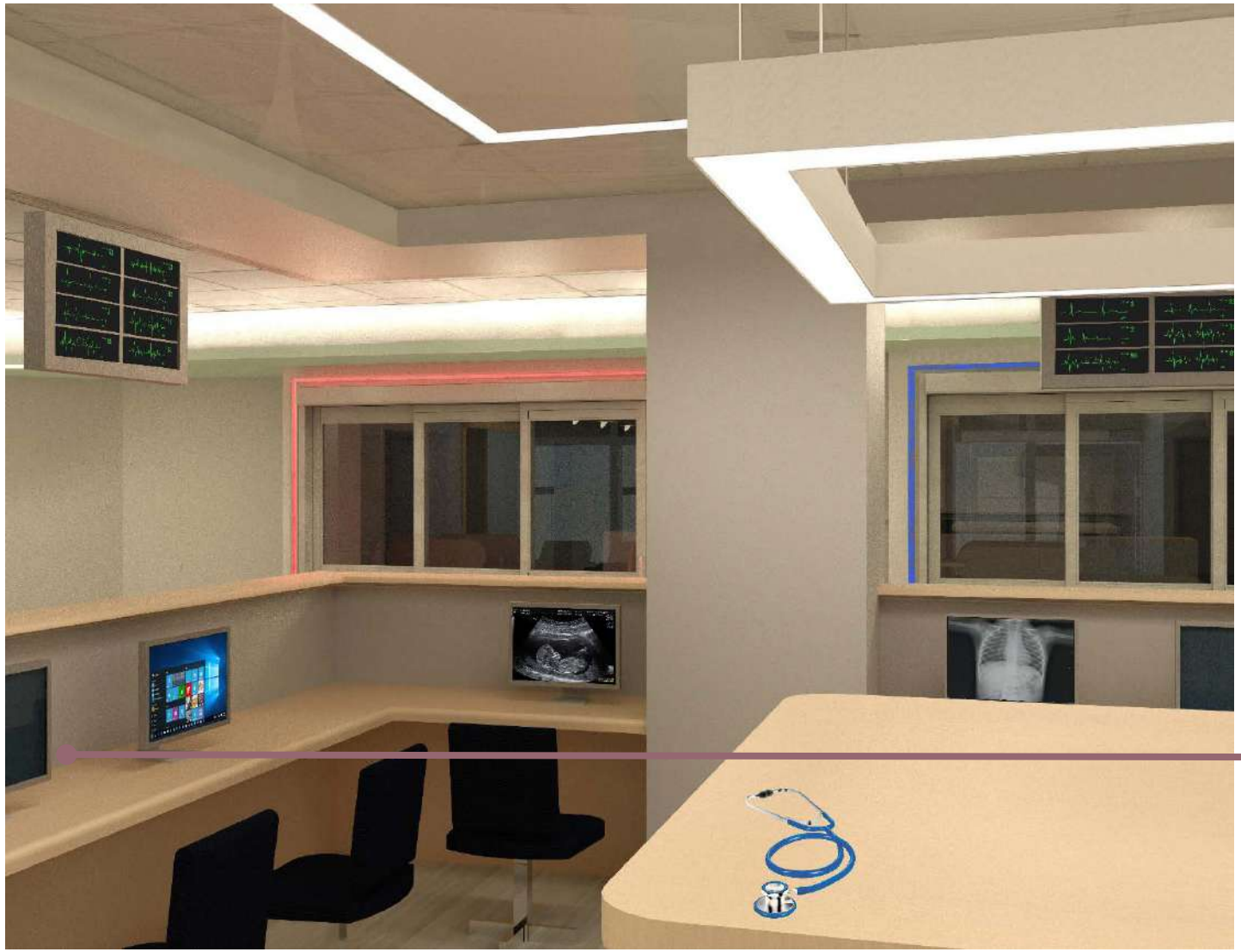


Team Center | Circadian Rhythms

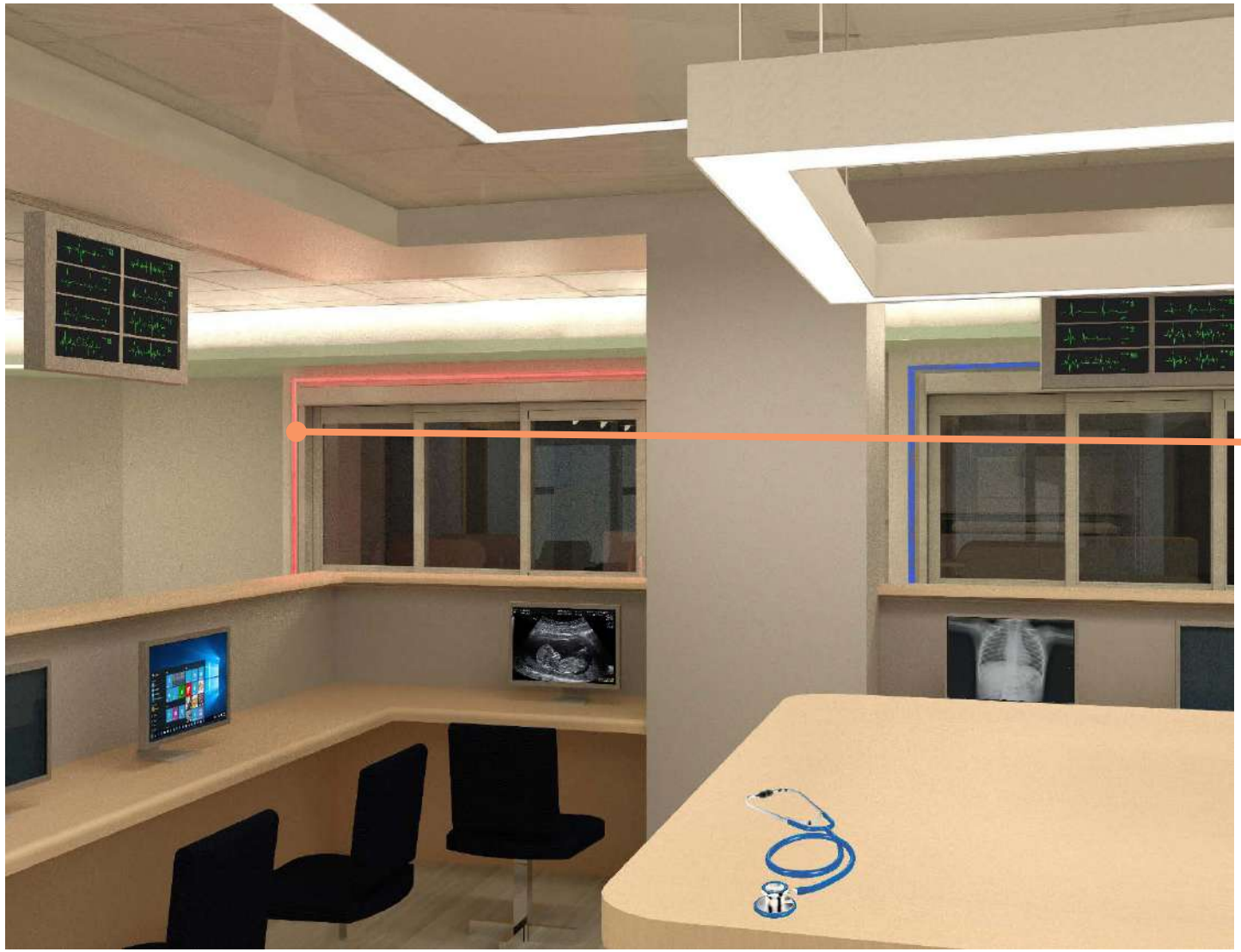


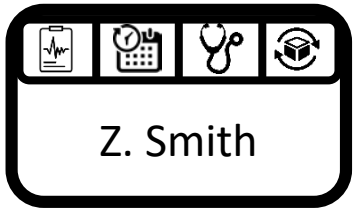






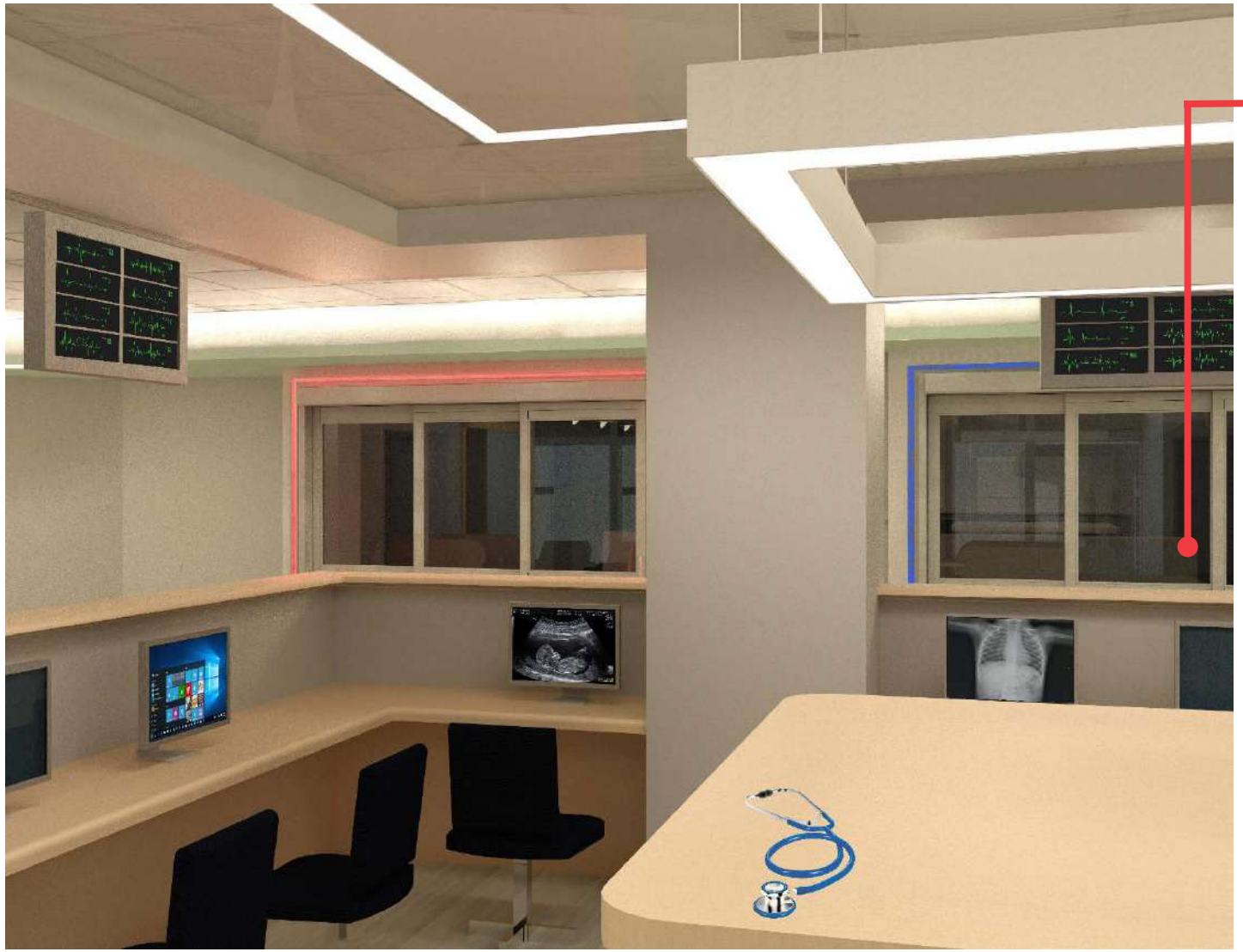
OR and Patient Room Scheduling Software





Patient Room Tags

OR and Patient Room Scheduling Software

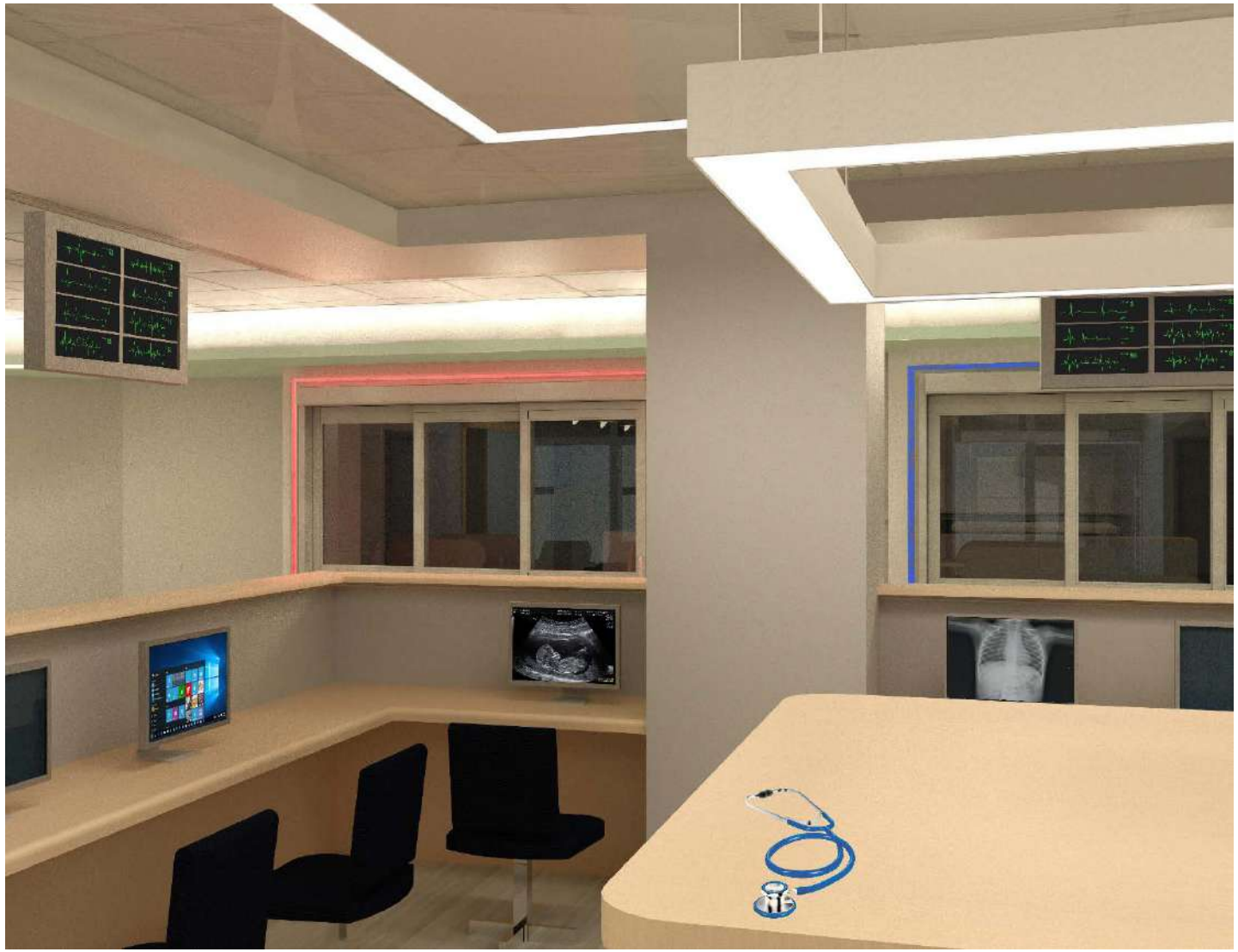


Wi-Fi Equipment Tracking

Patient Room Tags

OR and Patient Room Scheduling Software

Team Center | Smart Building



Wi-Fi Equipment Tracking

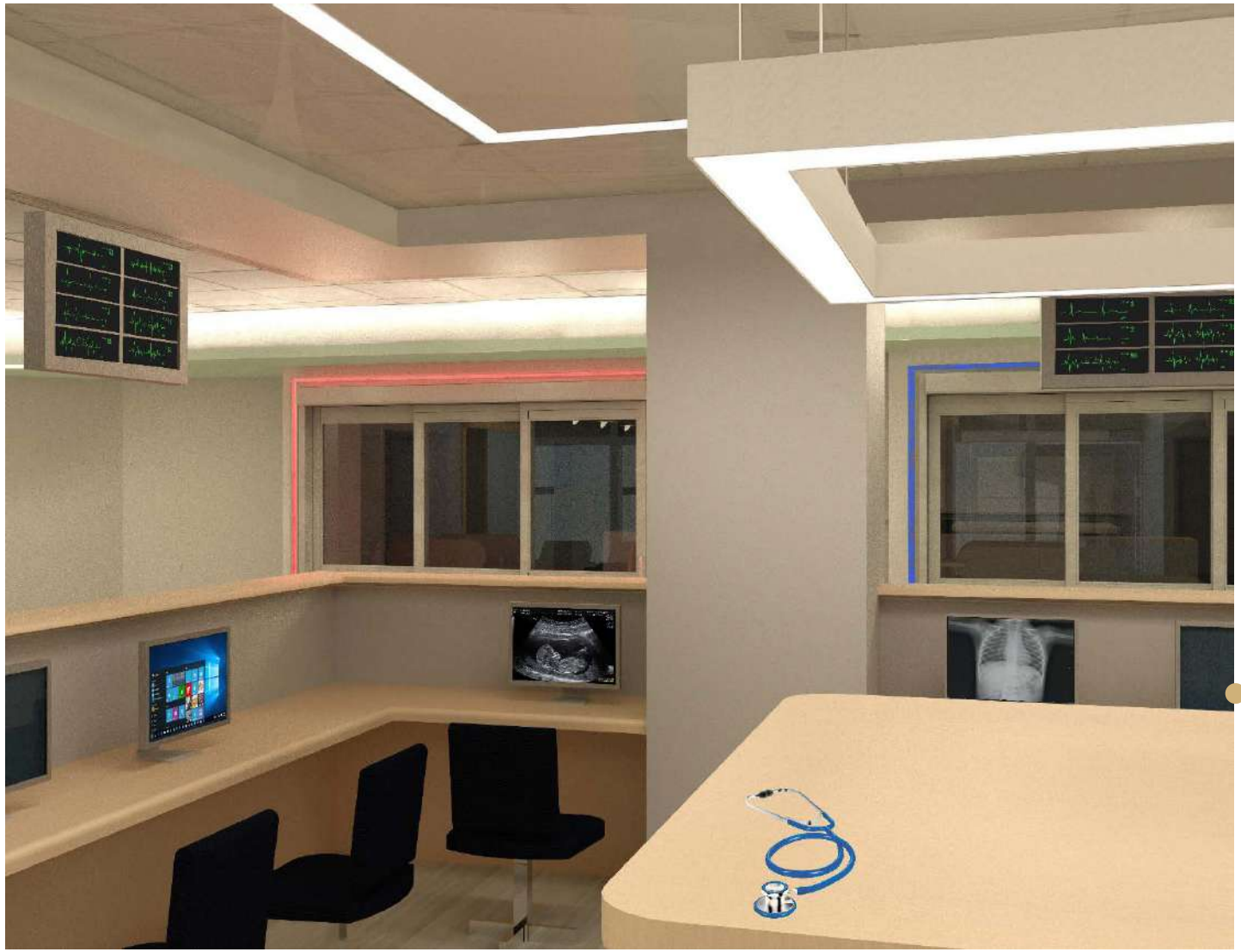
RFID

RFID Swipe for Secure Spaces

Z. Smith

Patient Room Tags

OR and Patient Room Scheduling Software



Wi-Fi Equipment Tracking

RFID

RFID Swipe for Secure Spaces

Z. Smith

Patient Room Tags

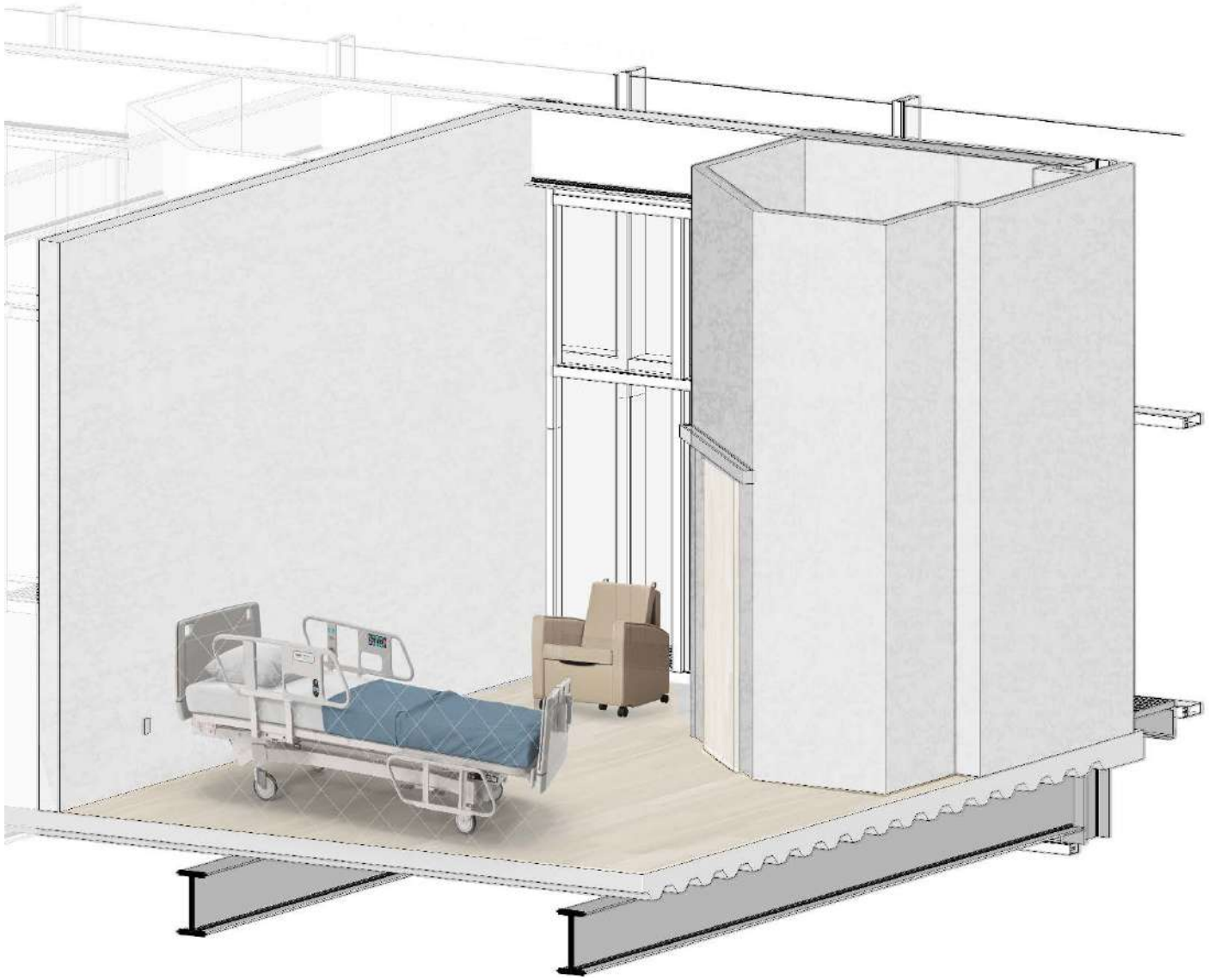
KanBan Restocking System

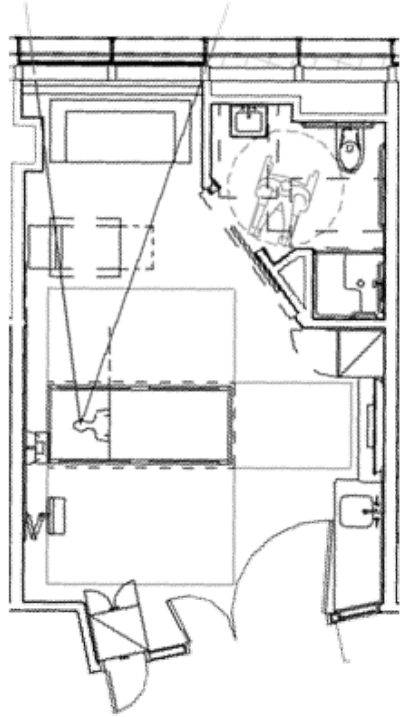
OR and Patient Room Scheduling Software

Wellness

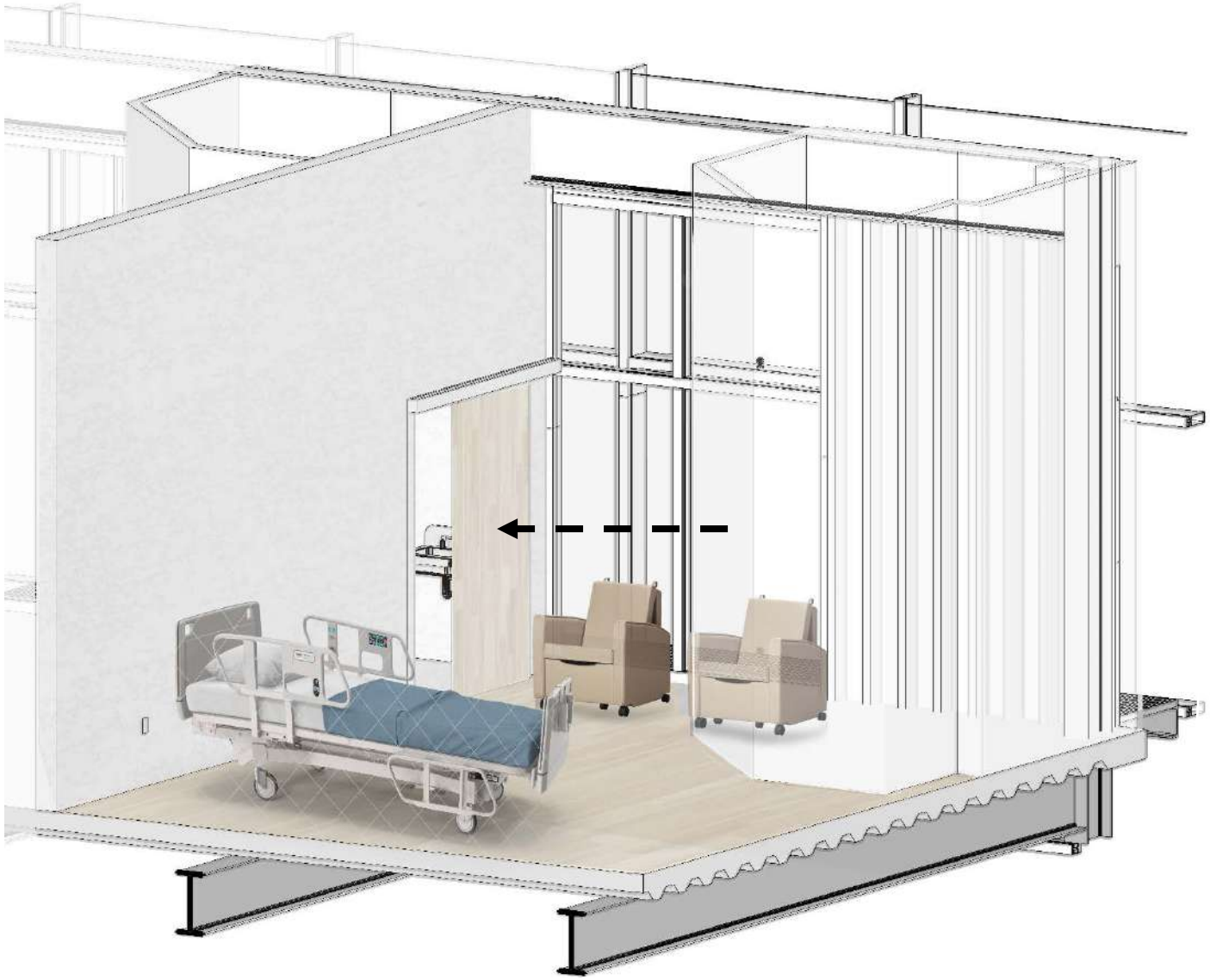
Patient Room

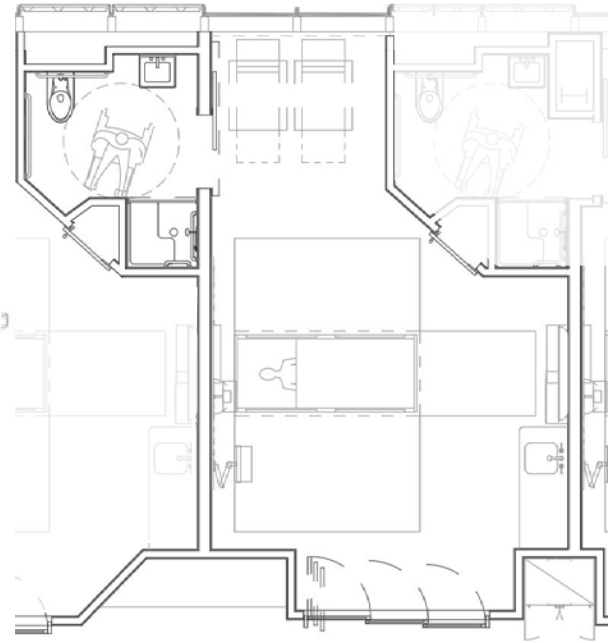
Patient Room | Original Design





Patient Room | Final Design





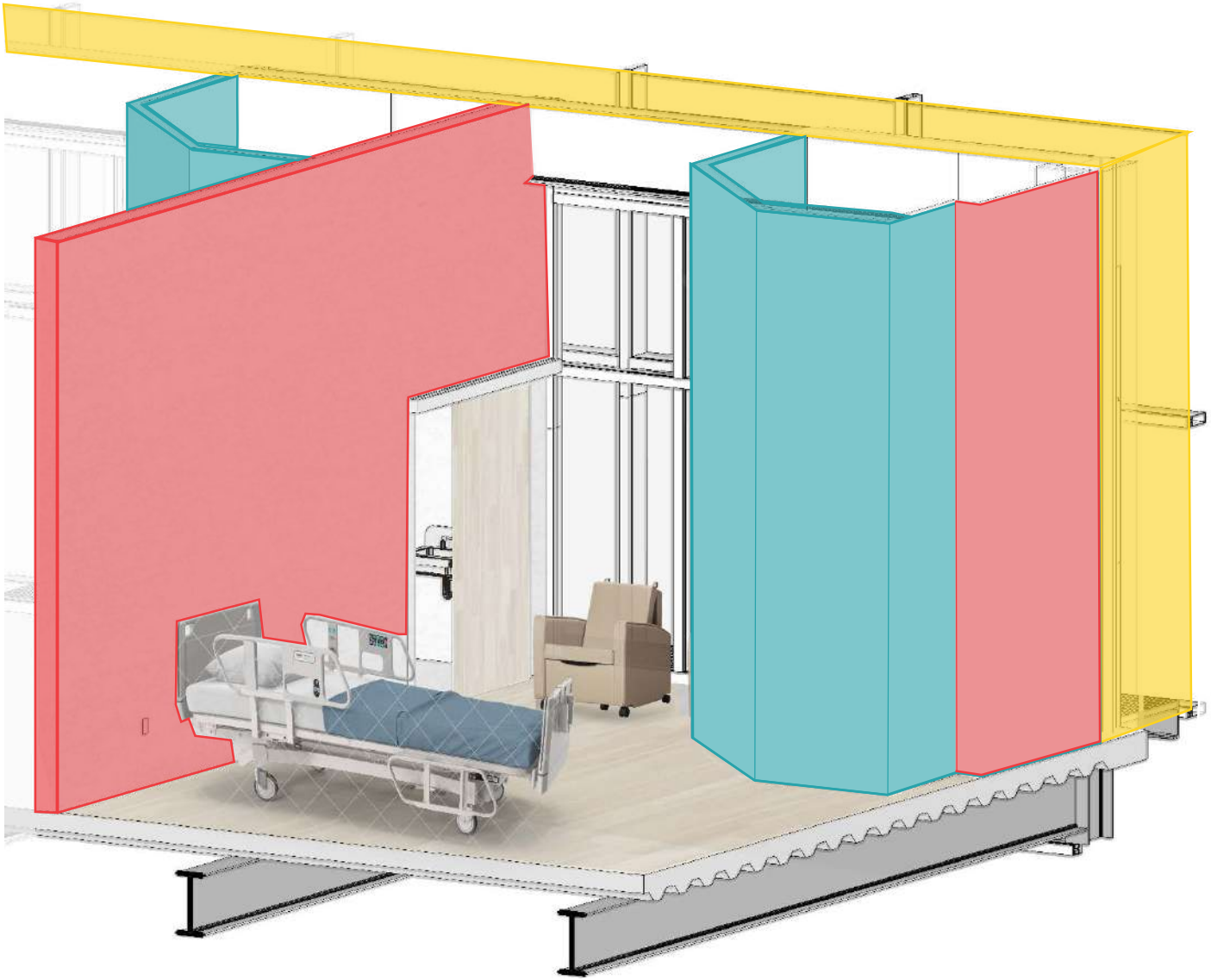
Patient Room | Acoustics

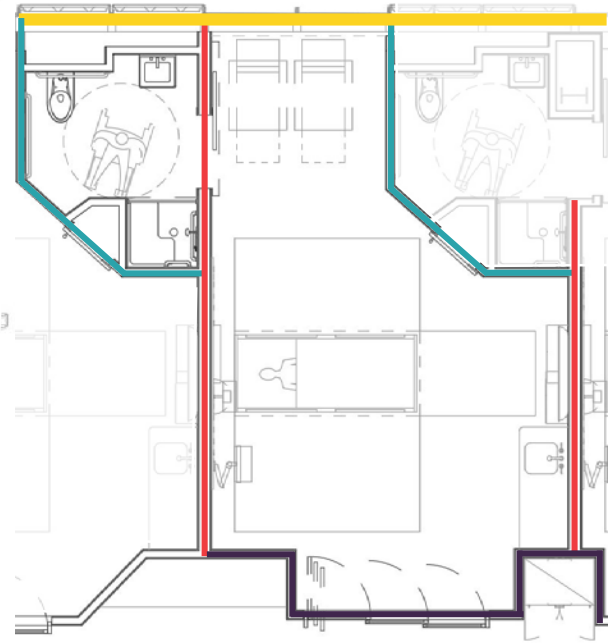
STC-52

STC-55

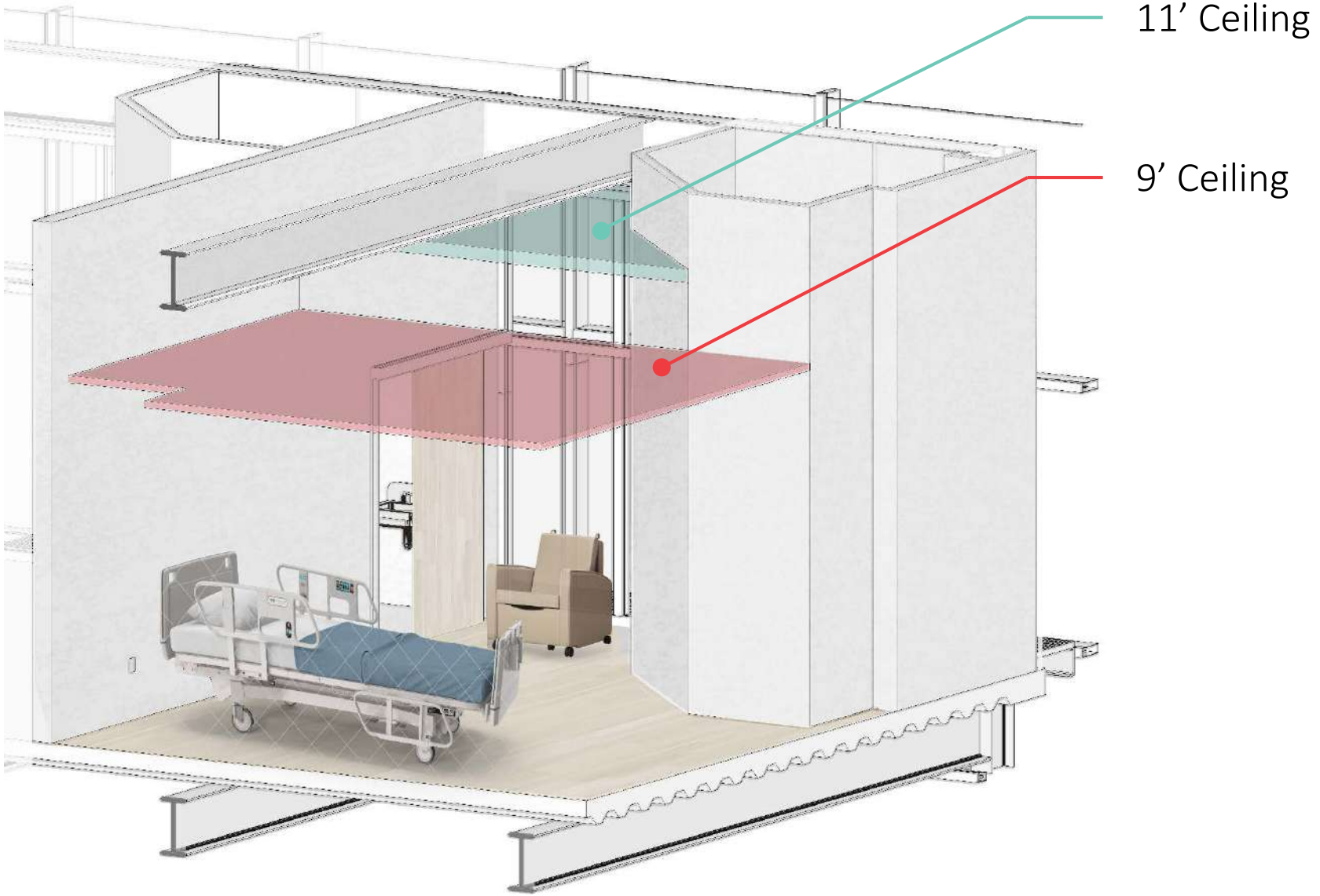
STC-49

STC-39

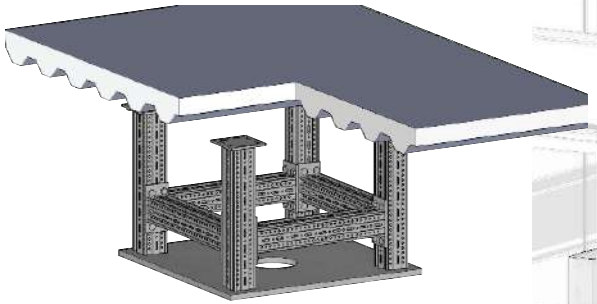




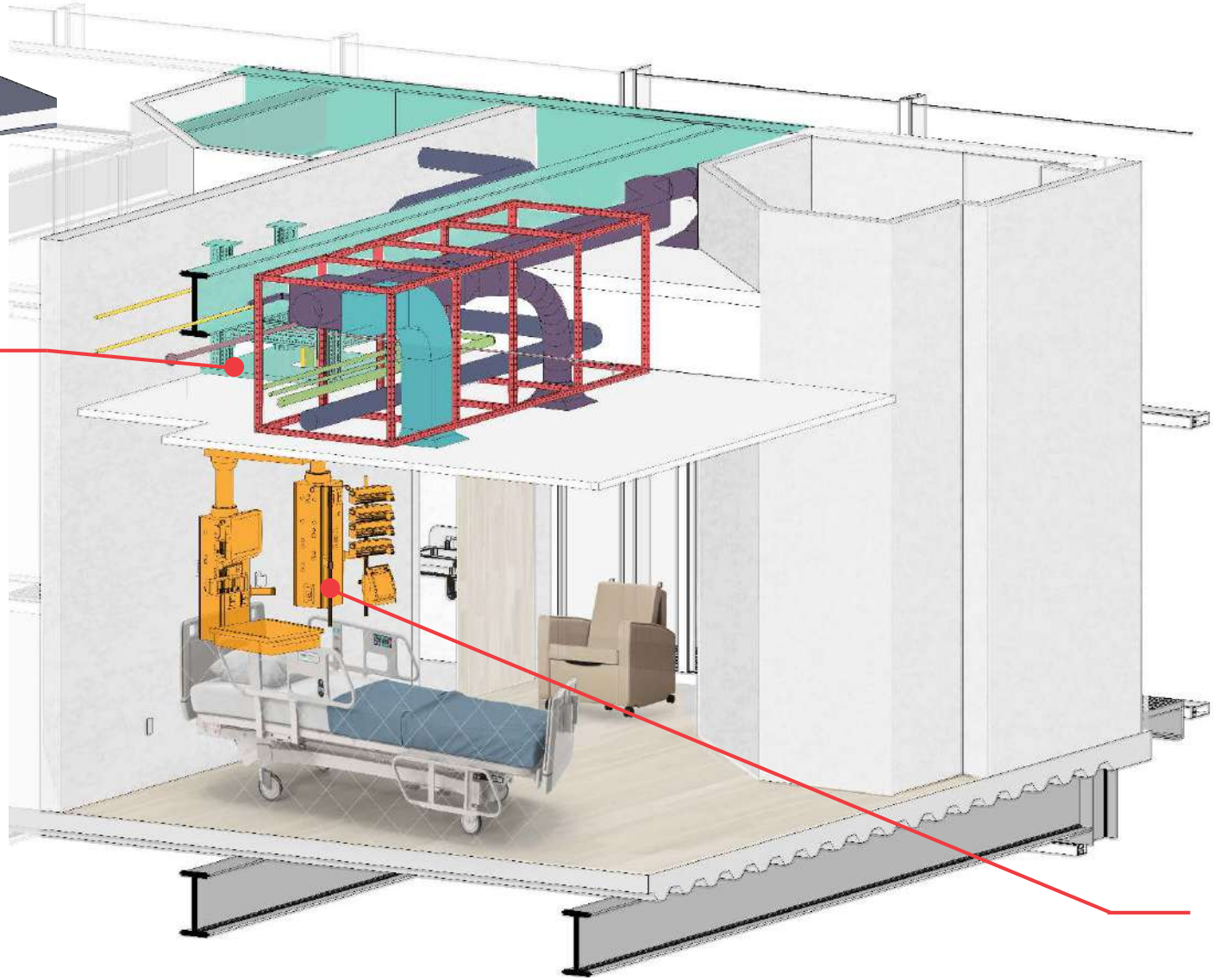
Patient Room | Ceiling Design



Patient Room | Medical Boom

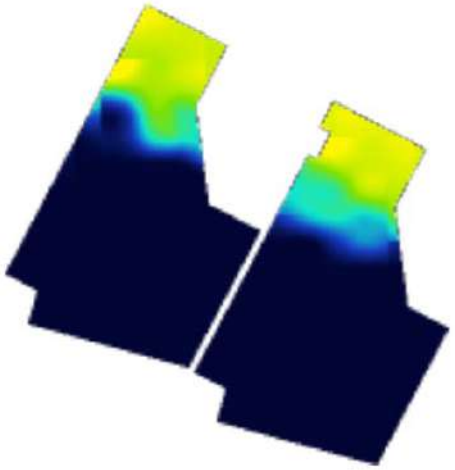


Medical Boom Sikla Support System



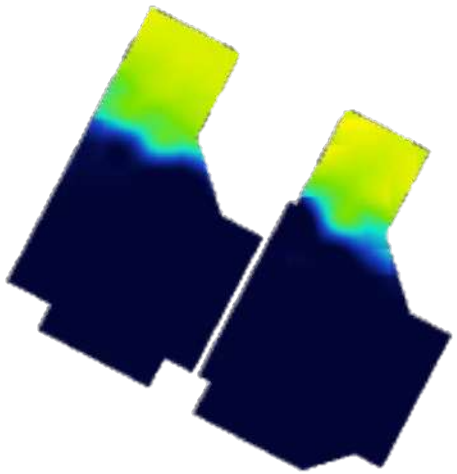
Dual Arm Patient Bed

Patient Room | Daylighting



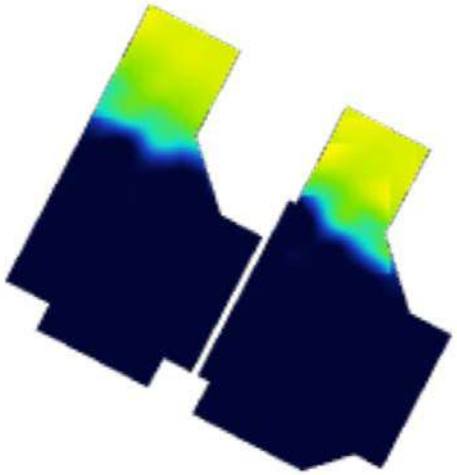
Original Design

sDA **27%**



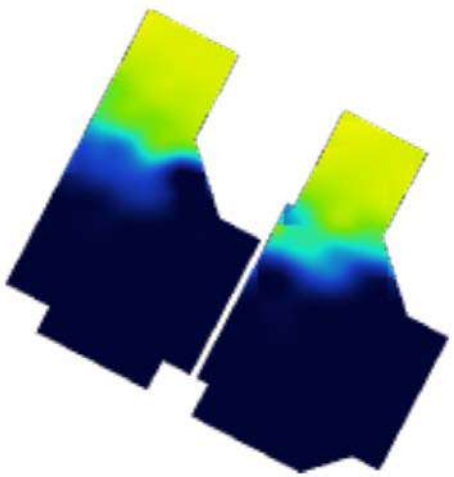
Double Skin Façade

sDA **27%**



Double Skin Façade with 9’ Window

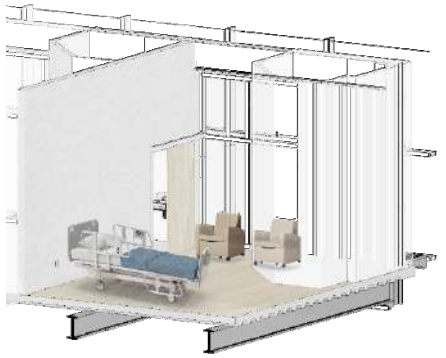
sDA **23%**



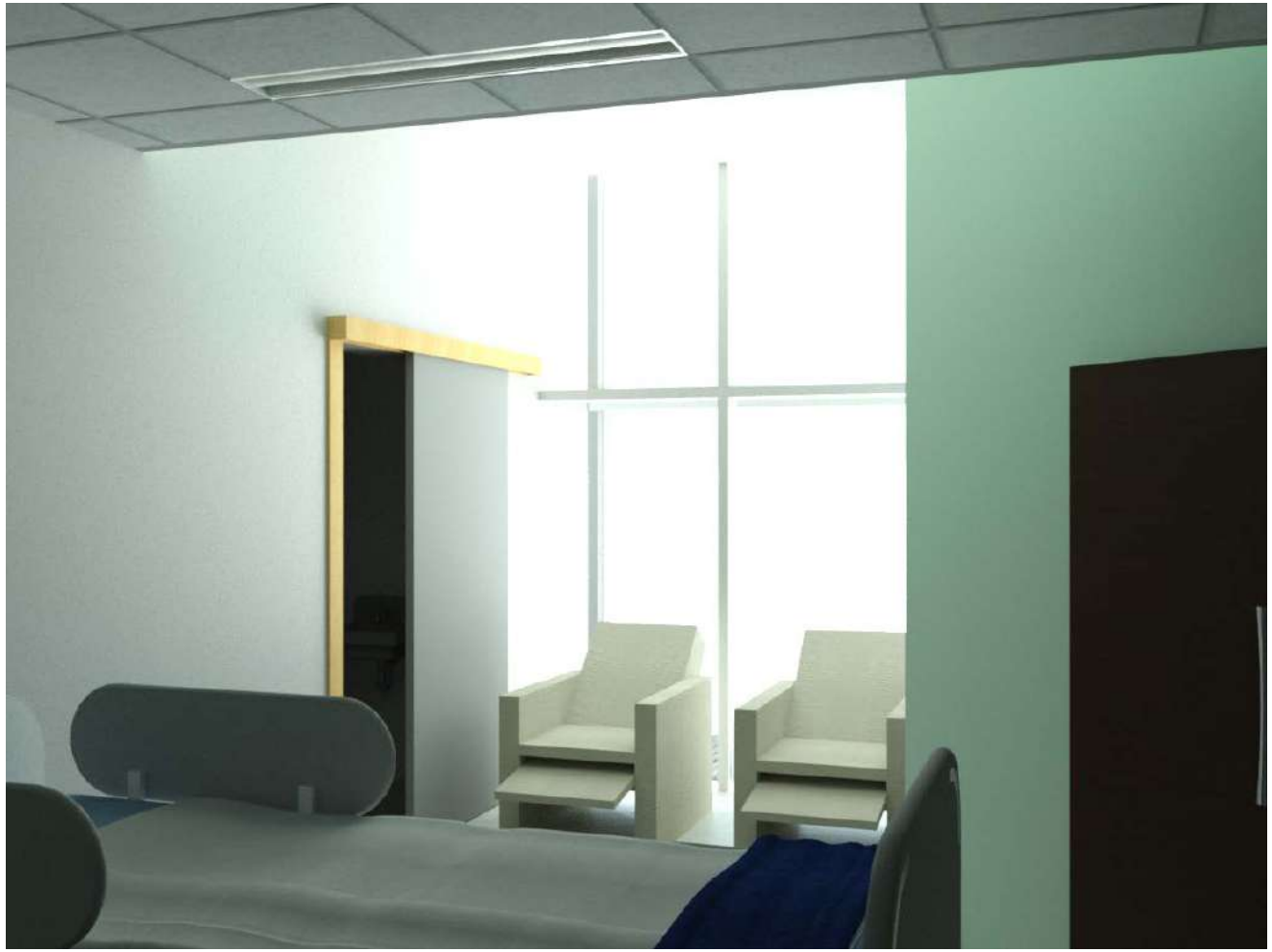
Optimized Design

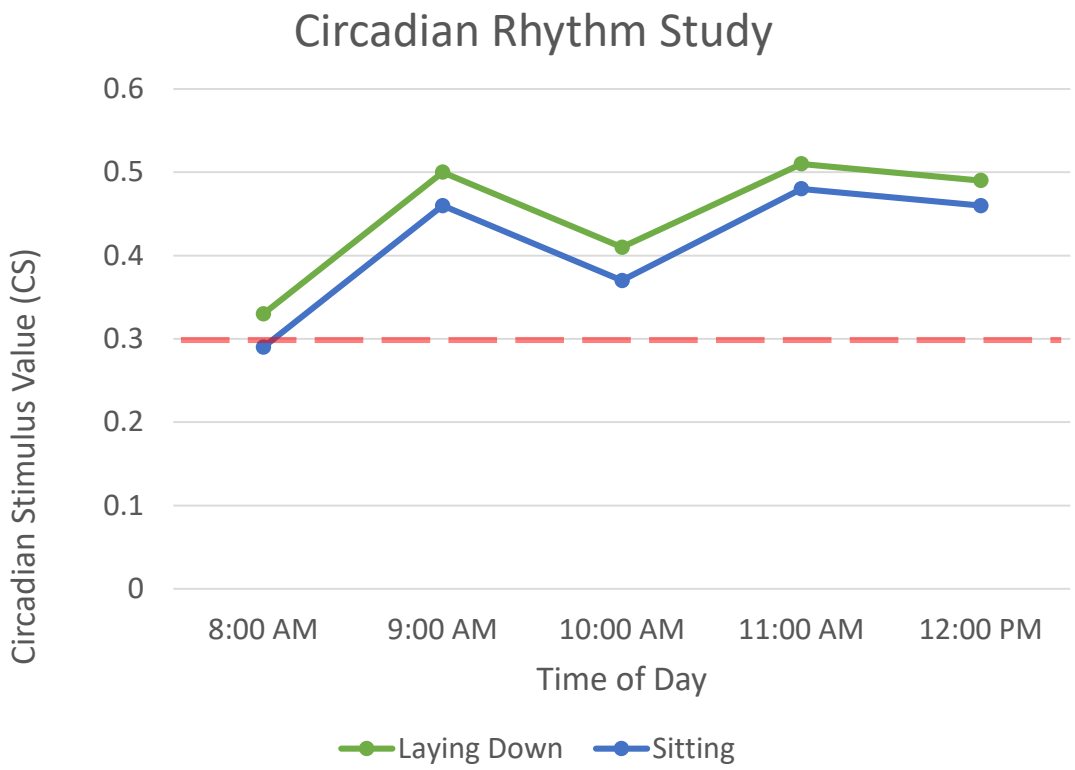
sDA **37%**

Percentage of occupied hours > 495 lux



Patient Room | Circadian Rhythm Study





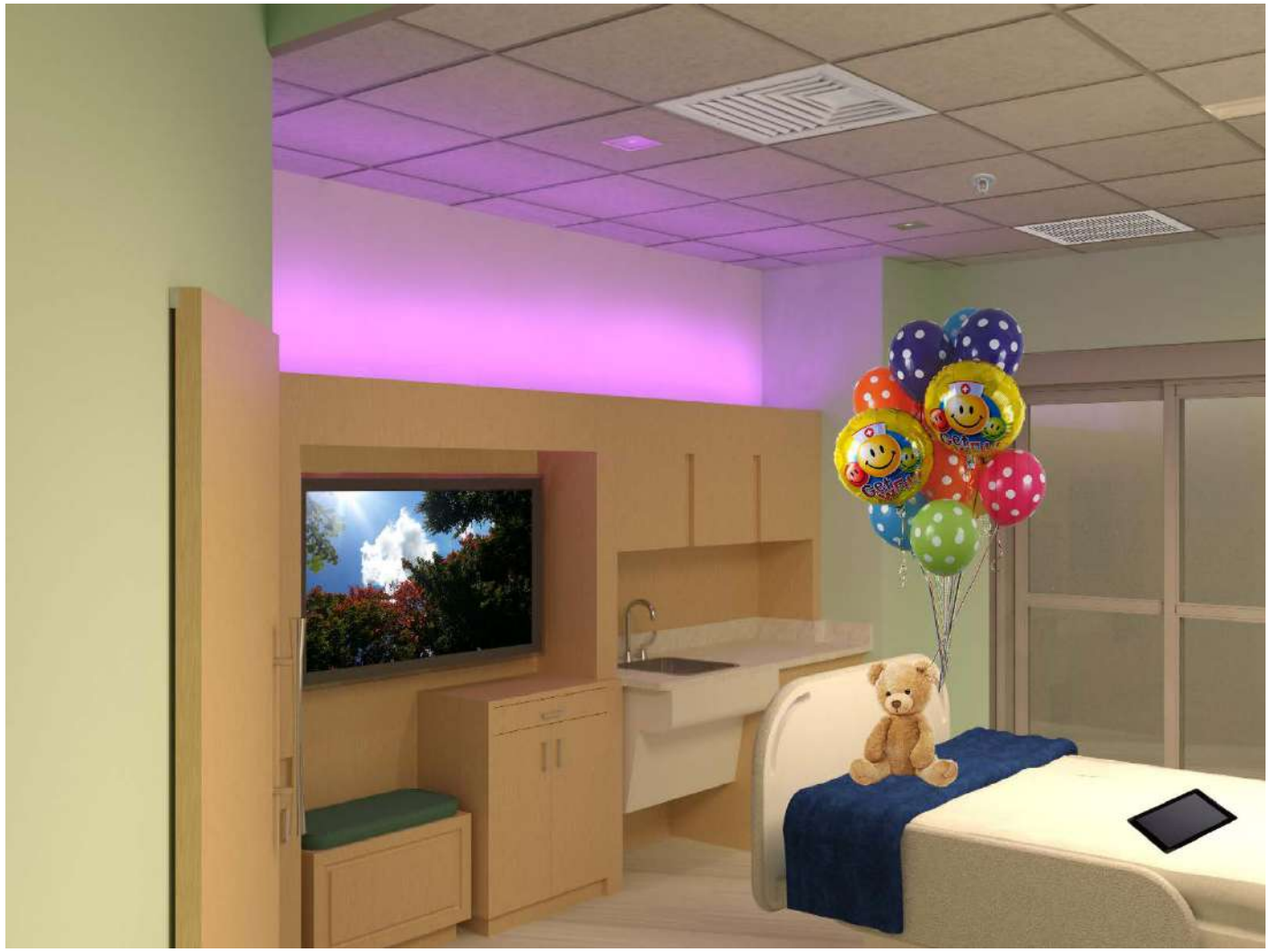
Patient Room | Lighting Design

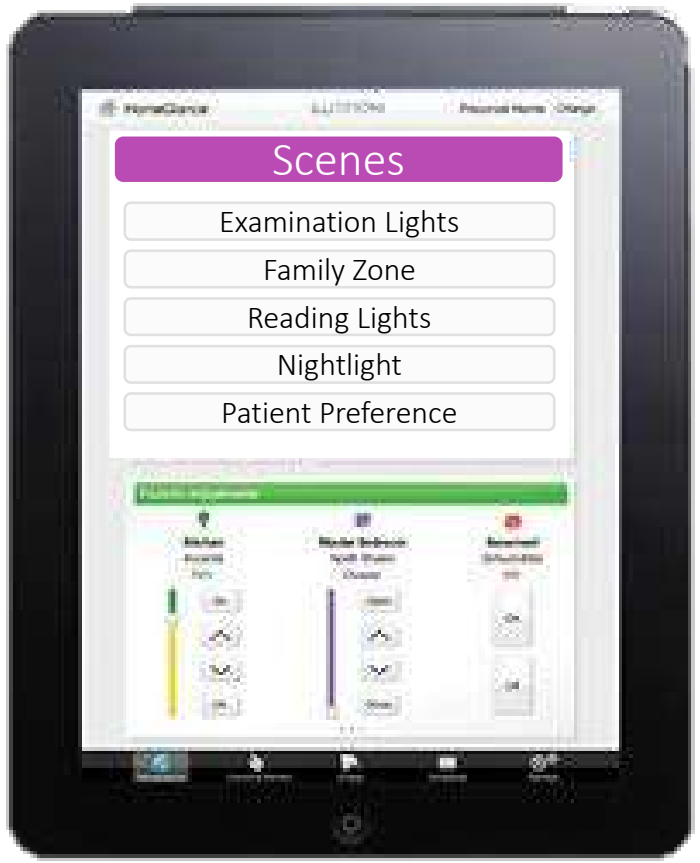
Focal Point Apollo 8

USAI Lighting BeveLED 2.1

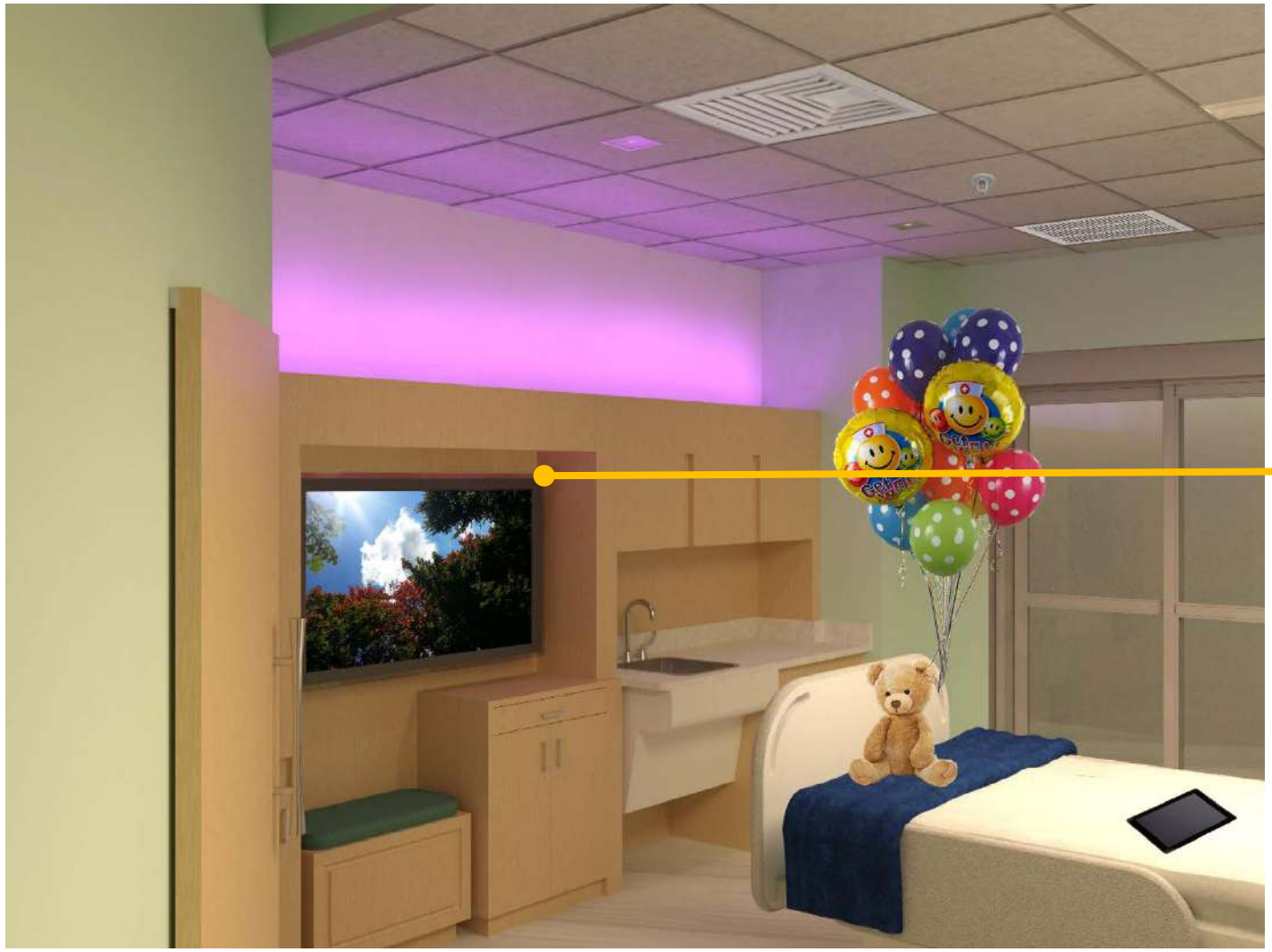
Lumenpulse Lumencove 2.0

Patient Room | Lighting Controls





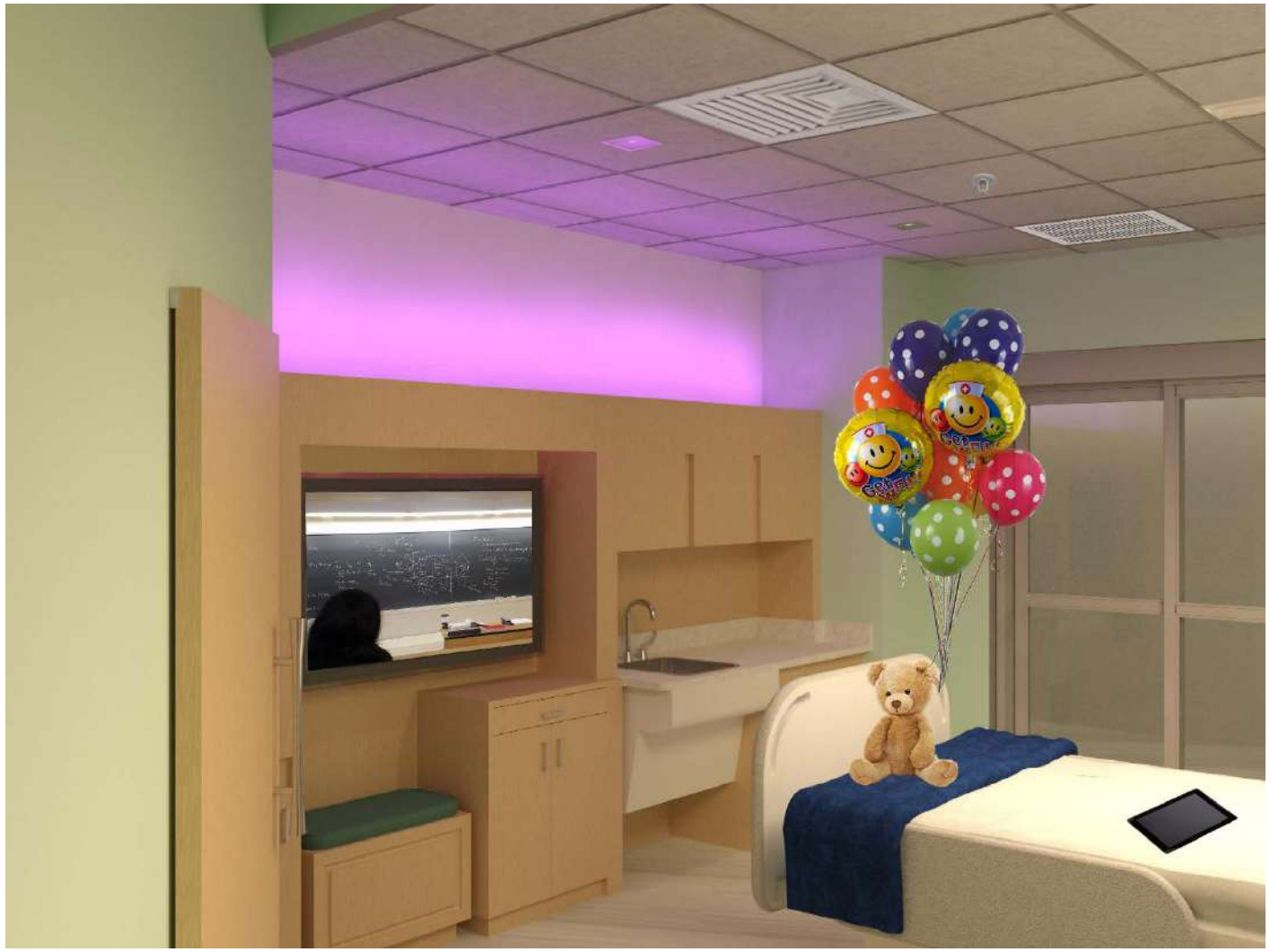
Tablet for Patient Control



Touch Screen
Television

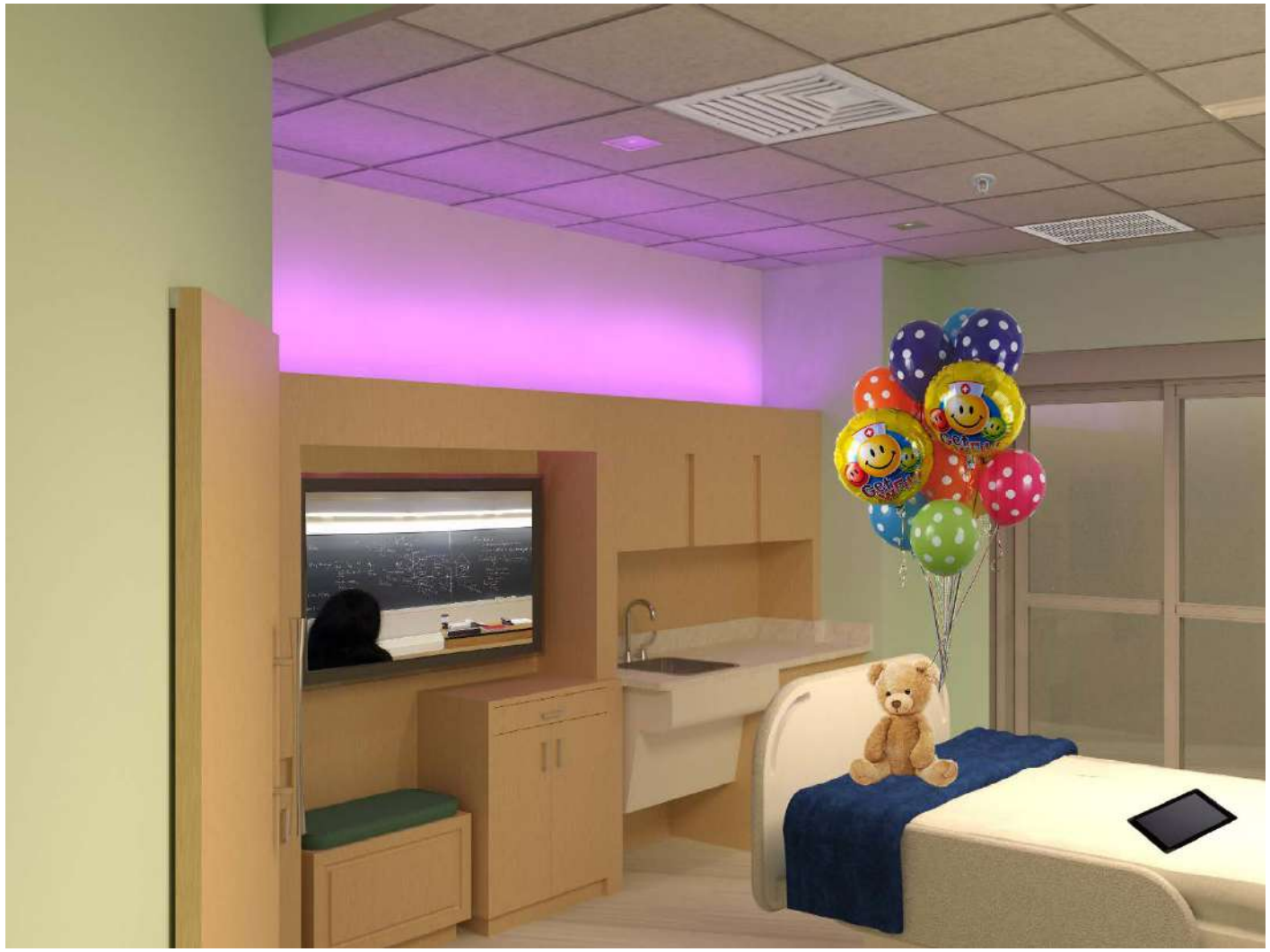
Video Call Capabilities

Patient Room | Smart Building



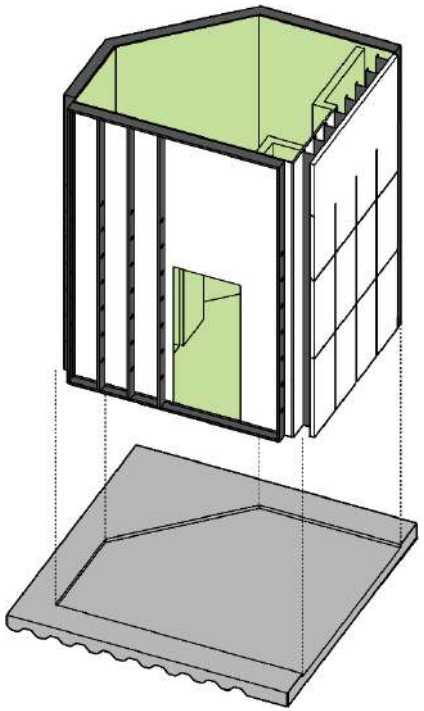
Wi-Fi Tracking
System for Staff

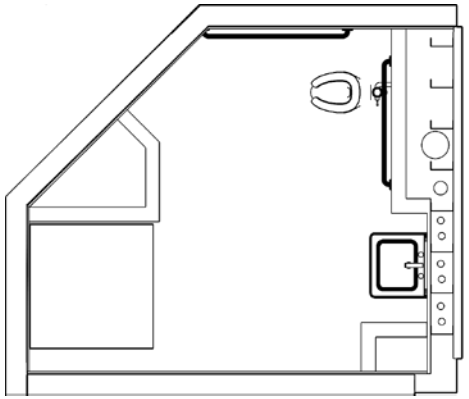
Patient Room | Smart Building



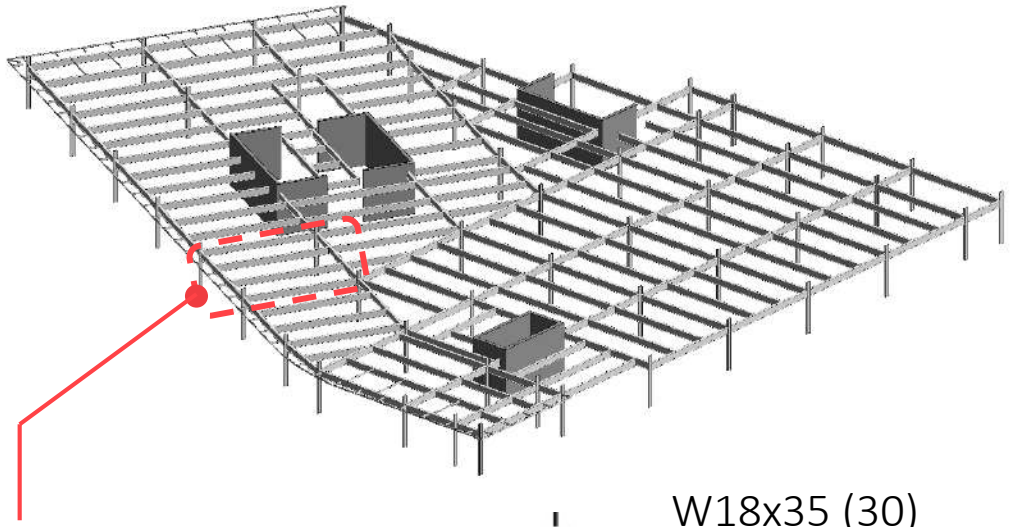
Infant Tracking System

Patient Room | Prefabricated Bathroom Pods

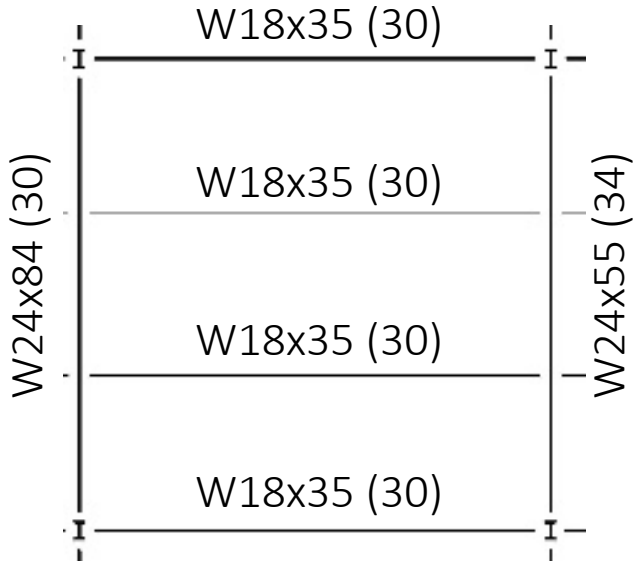


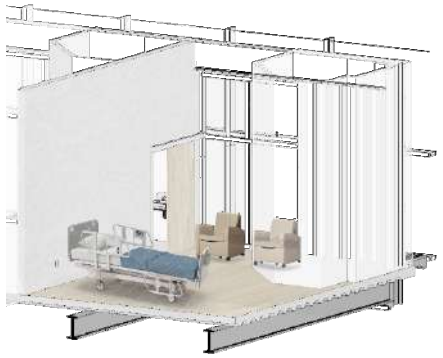


Composite Steel Framing with 4” Concrete Topping on Composite Metal Deck



Typical Bay Framing





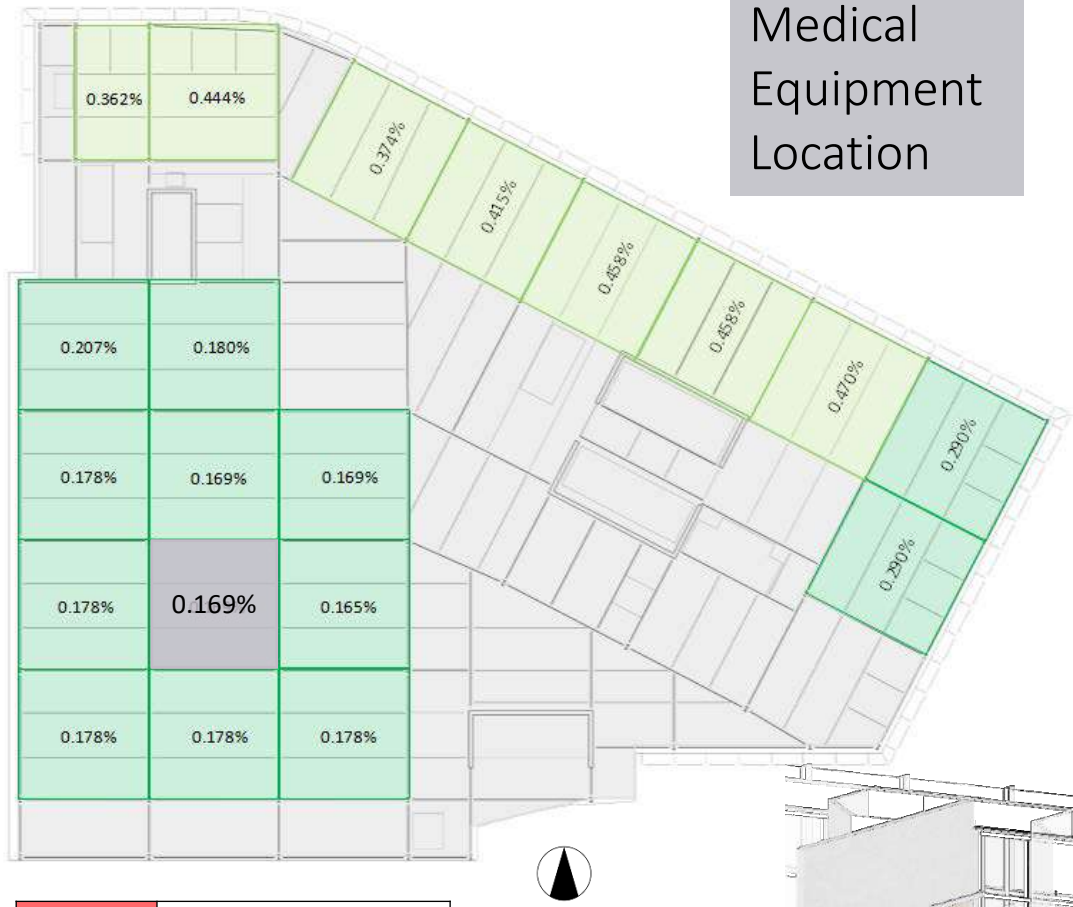
Patient Room | Floor Vibration Analysis

Composite Steel Framing with 4” Concrete Topping on Composite Metal Deck

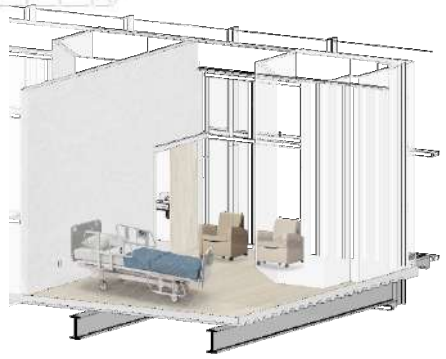
Typical Bay Framing

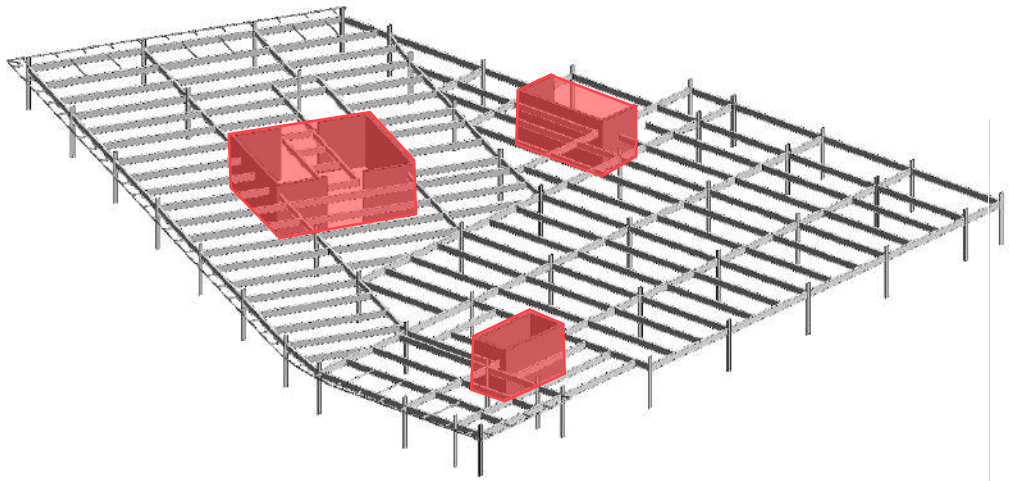
Vibration Analysis

Sensitive Medical Equipment Location

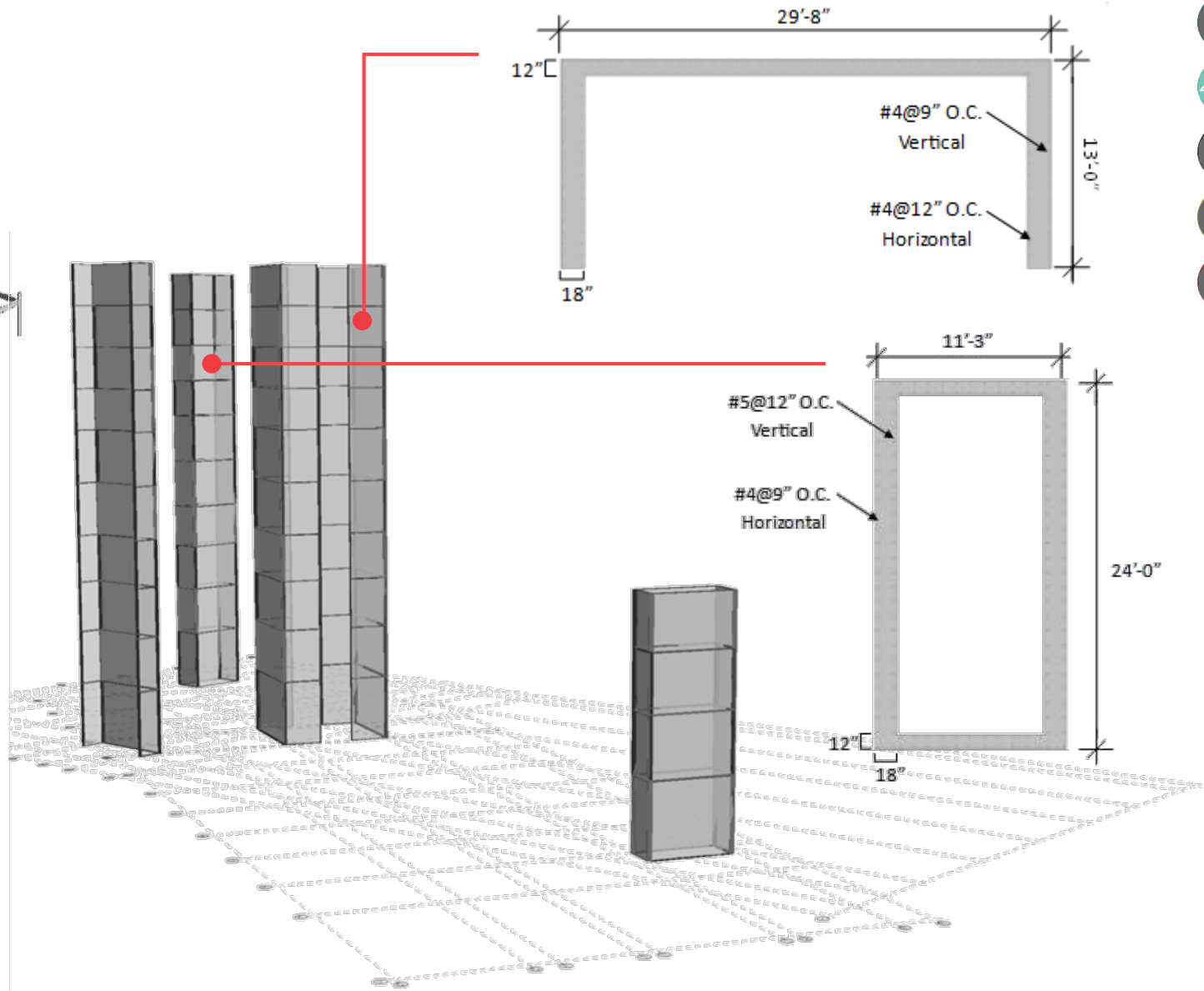


0.5%	Limit
0.4%	Acceptable
0.2%	Excellent

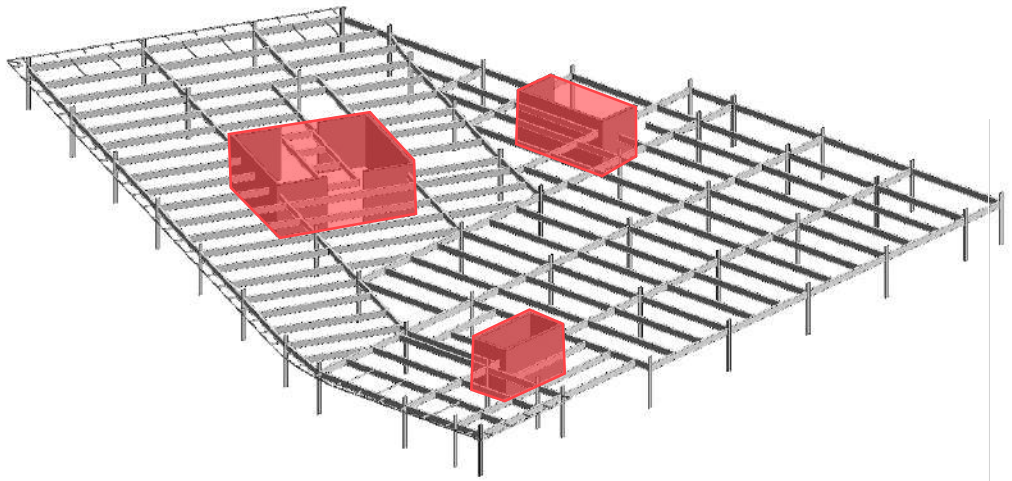




Concrete Cast-in-Place Shear Walls

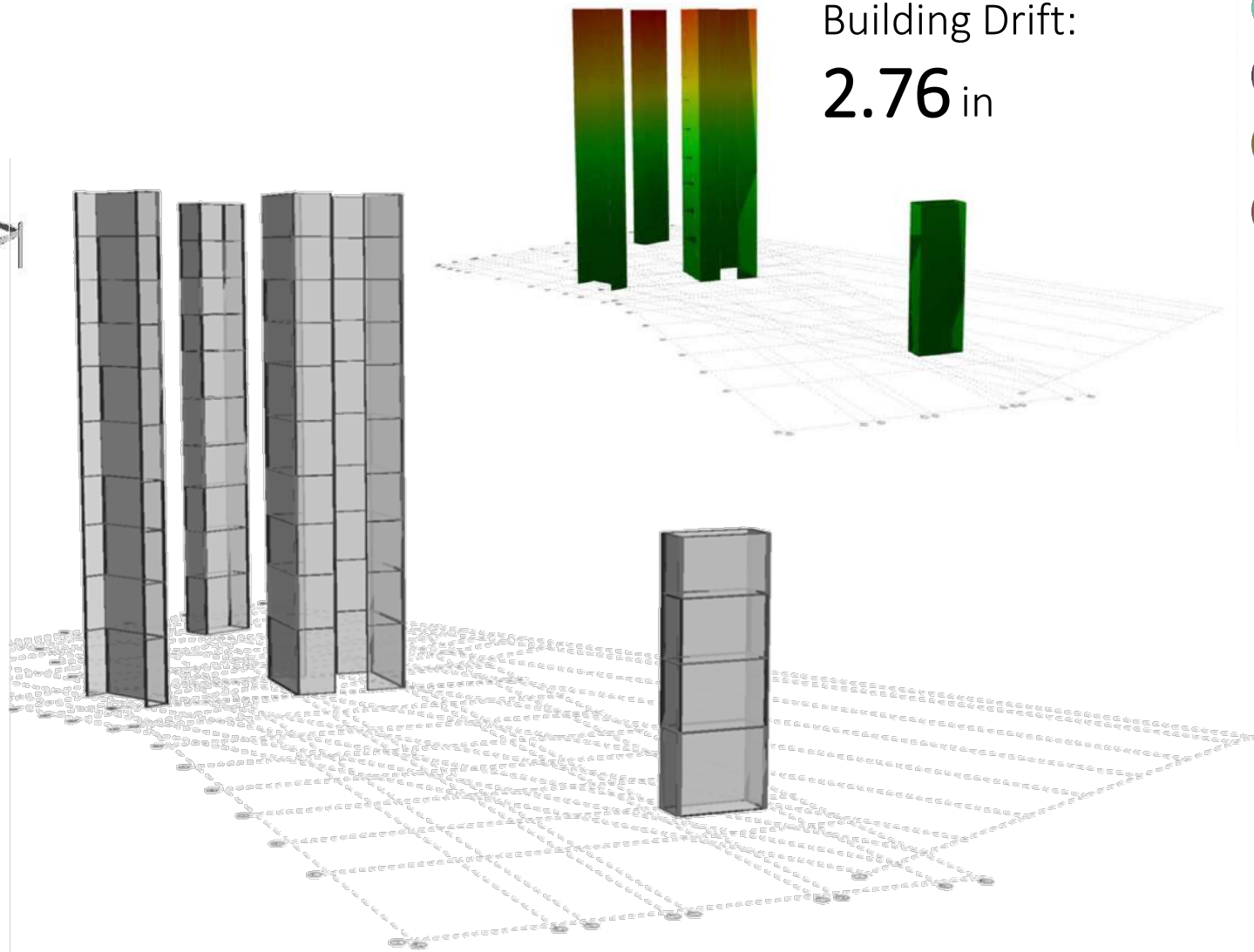


Patient Room | Lateral System



Concrete Cast-in-Place Shear Walls

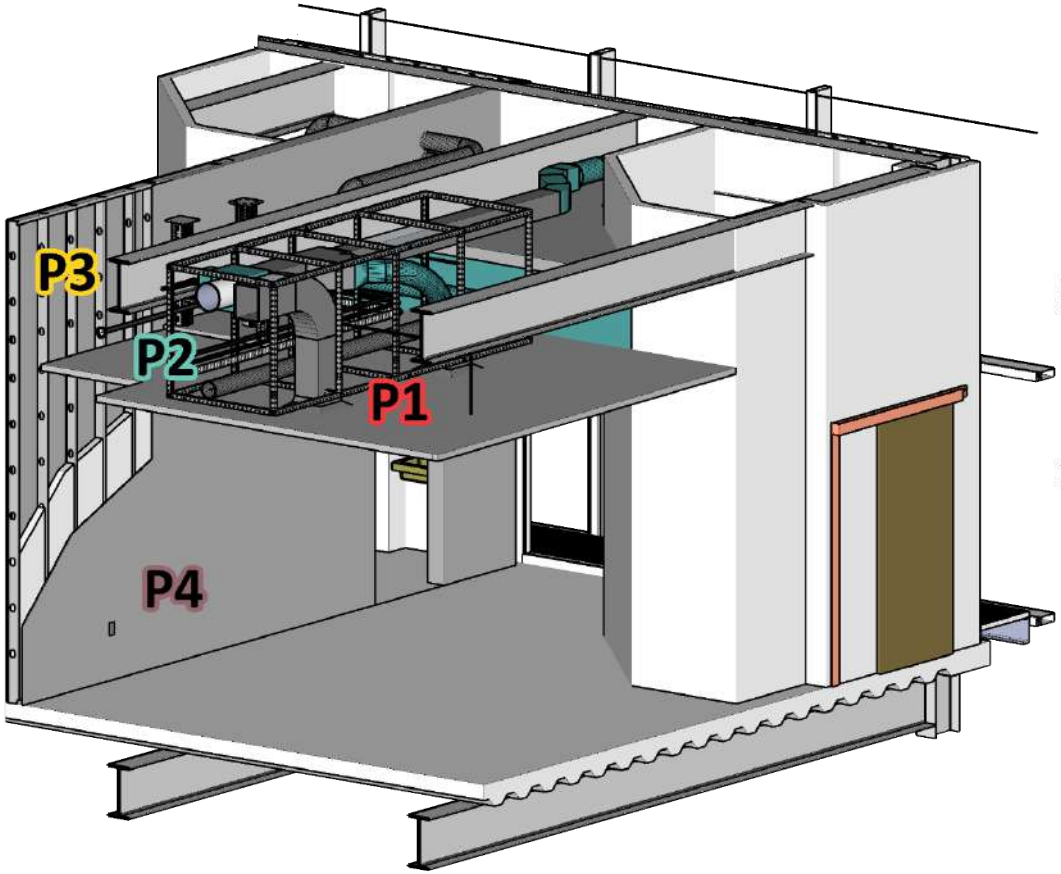
Building Drift

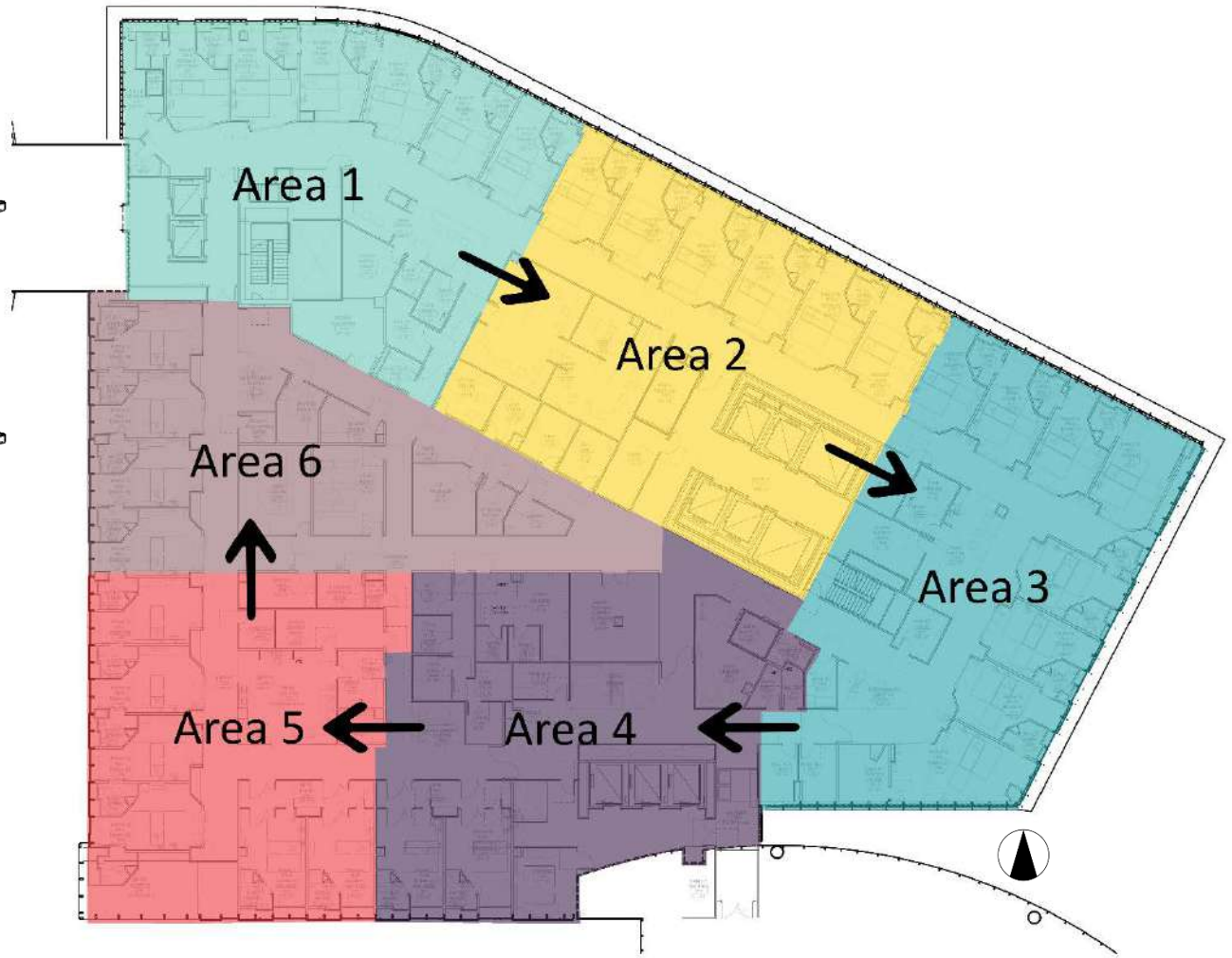


Max Total Building Drift:

2.76 in

Patient Room | Matrix Schedule





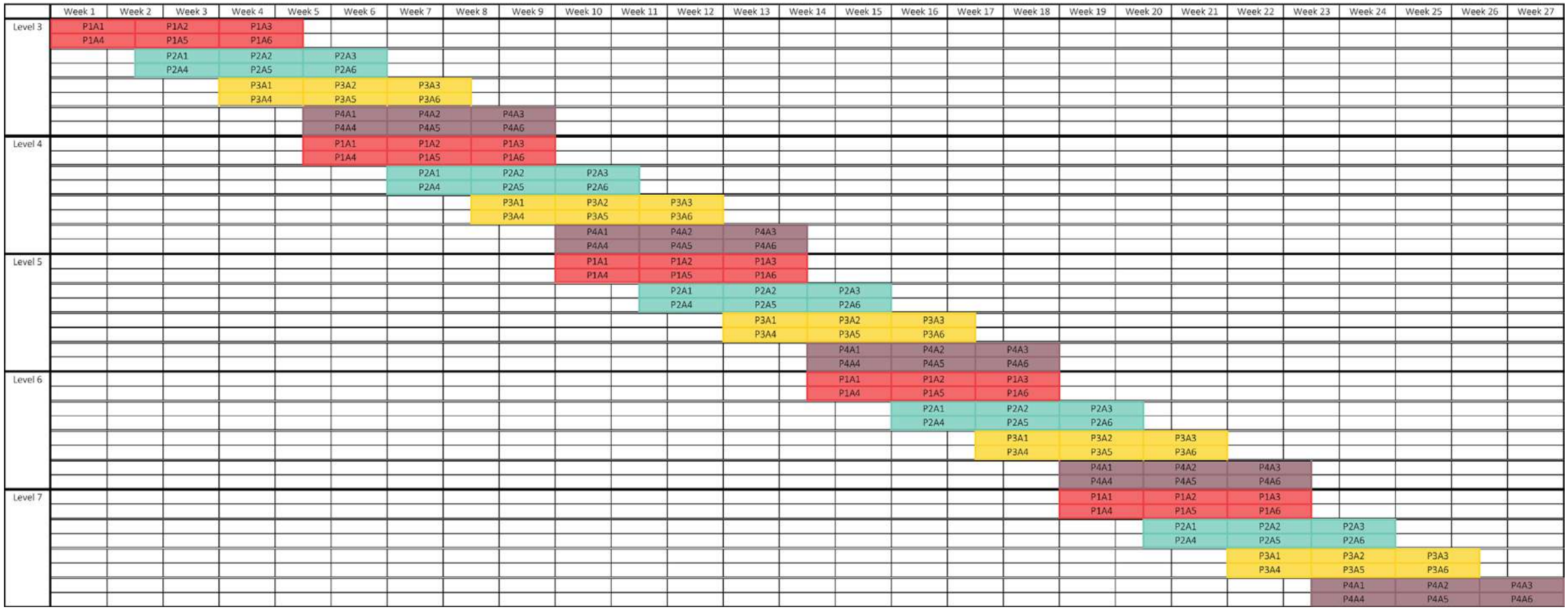
Phase 1	Install & Connect Overhead Racks
Phase 2	Sprinkler & Plumbing Rough-In
Phase 3	Wall Framing & Rough-In
Phase 4	Wall Inspection & Install Gypsum Board

Patient Room | Matrix Schedule

	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9
Level 3	P1A1		P1A2	P1A3					
	P1A4		P1A5	P1A6					
			P2A1	P2A2		P2A3			
			P2A4	P2A5		P2A6			
				P3A1		P3A2	P3A3		
				P3A4		P3A5	P3A6		
						P4A1	P4A2	P4A3	
						P4A4	P4A5	P4A6	

Phase 1	Install & Connect Overhead Racks
Phase 2	Sprinkler & Plumbing Rough-In
Phase 3	Wall Framing & Rough-In
Phase 4	Wall Inspection & Install Gypsum Board

Patient Room | Matrix Schedule



Phase 1	Install & Connect Overhead Racks
Phase 2	Sprinkler & Plumbing Rough-In
Phase 3	Wall Framing & Rough-In
Phase 4	Wall Inspection & Install Gypsum Board

05

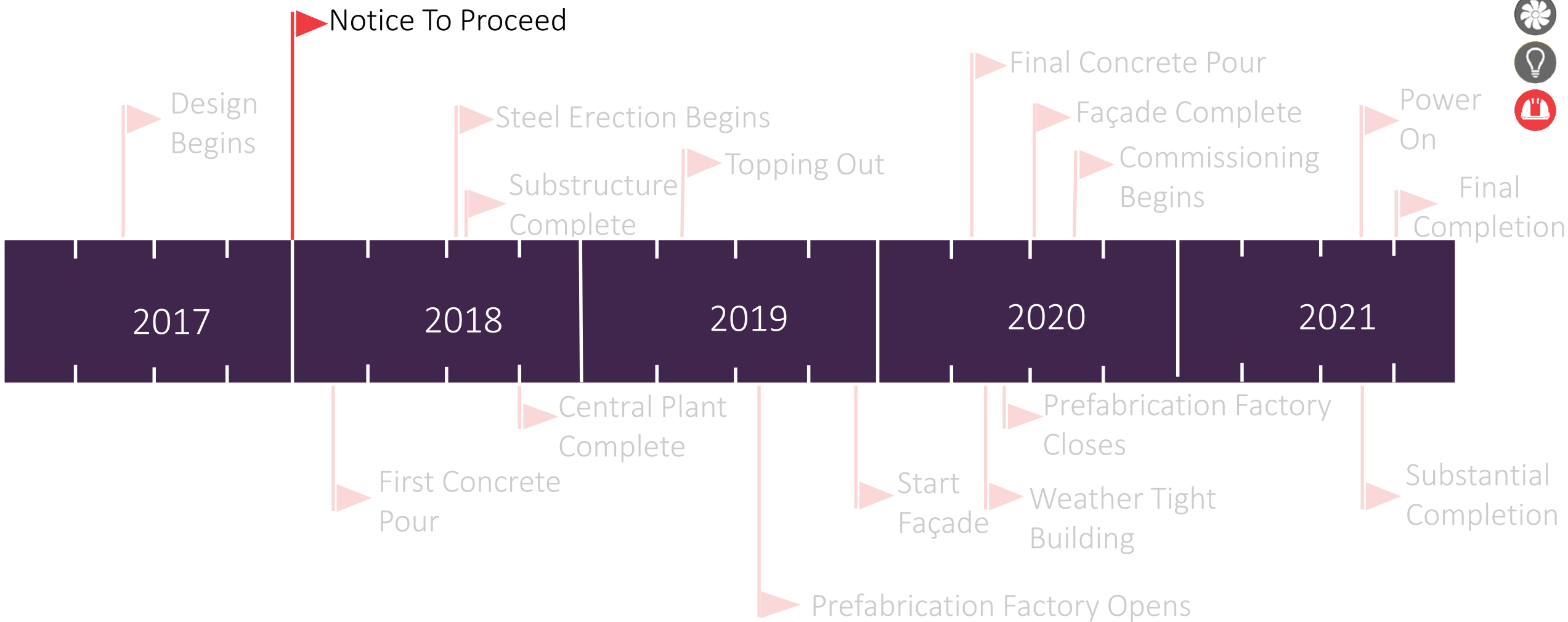
Ensure Project Outcome

Milestone Schedule

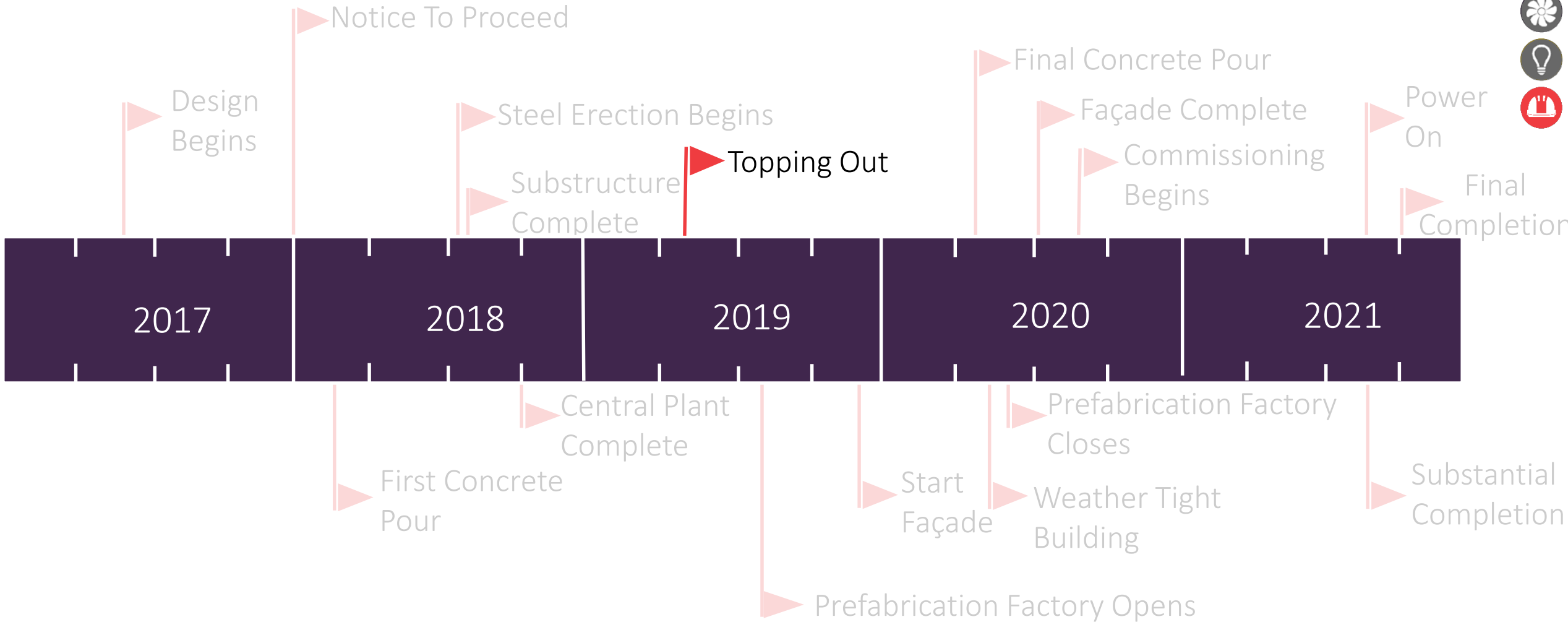
Project Budget

LEED

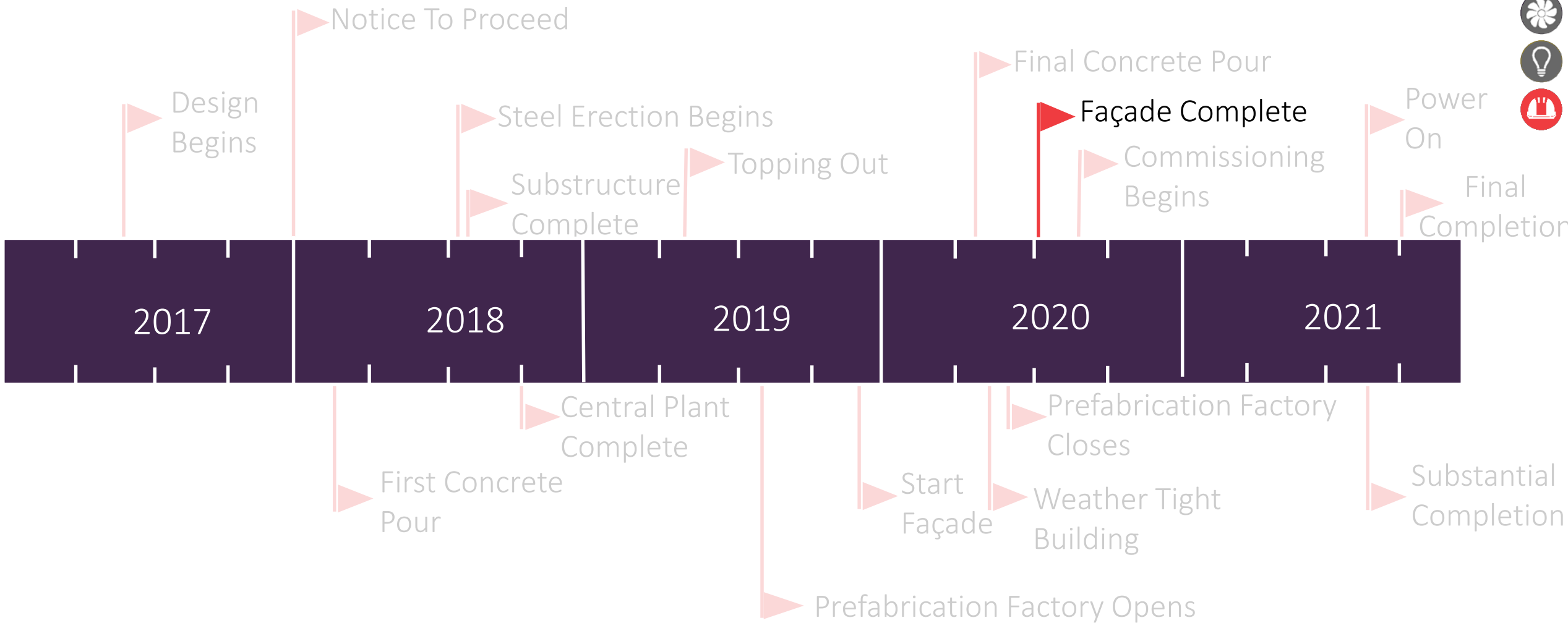
Milestone Schedule



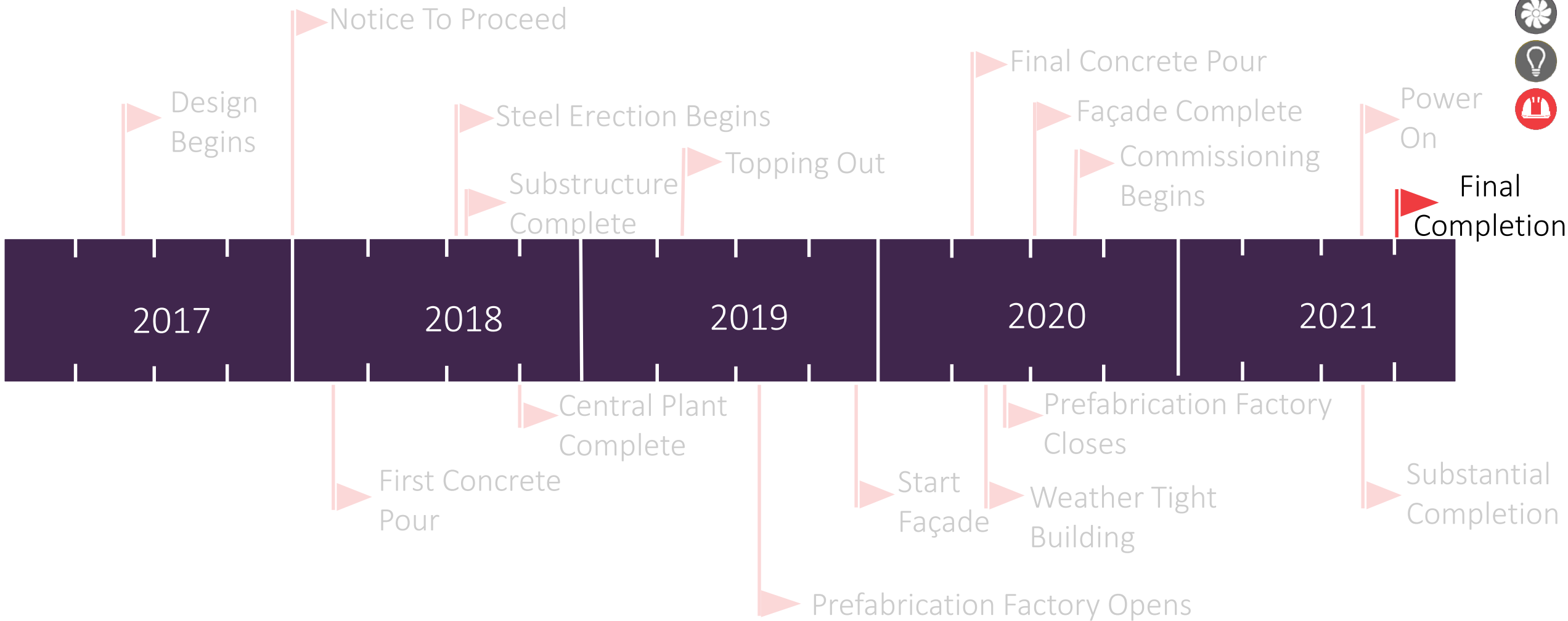
Milestone Schedule



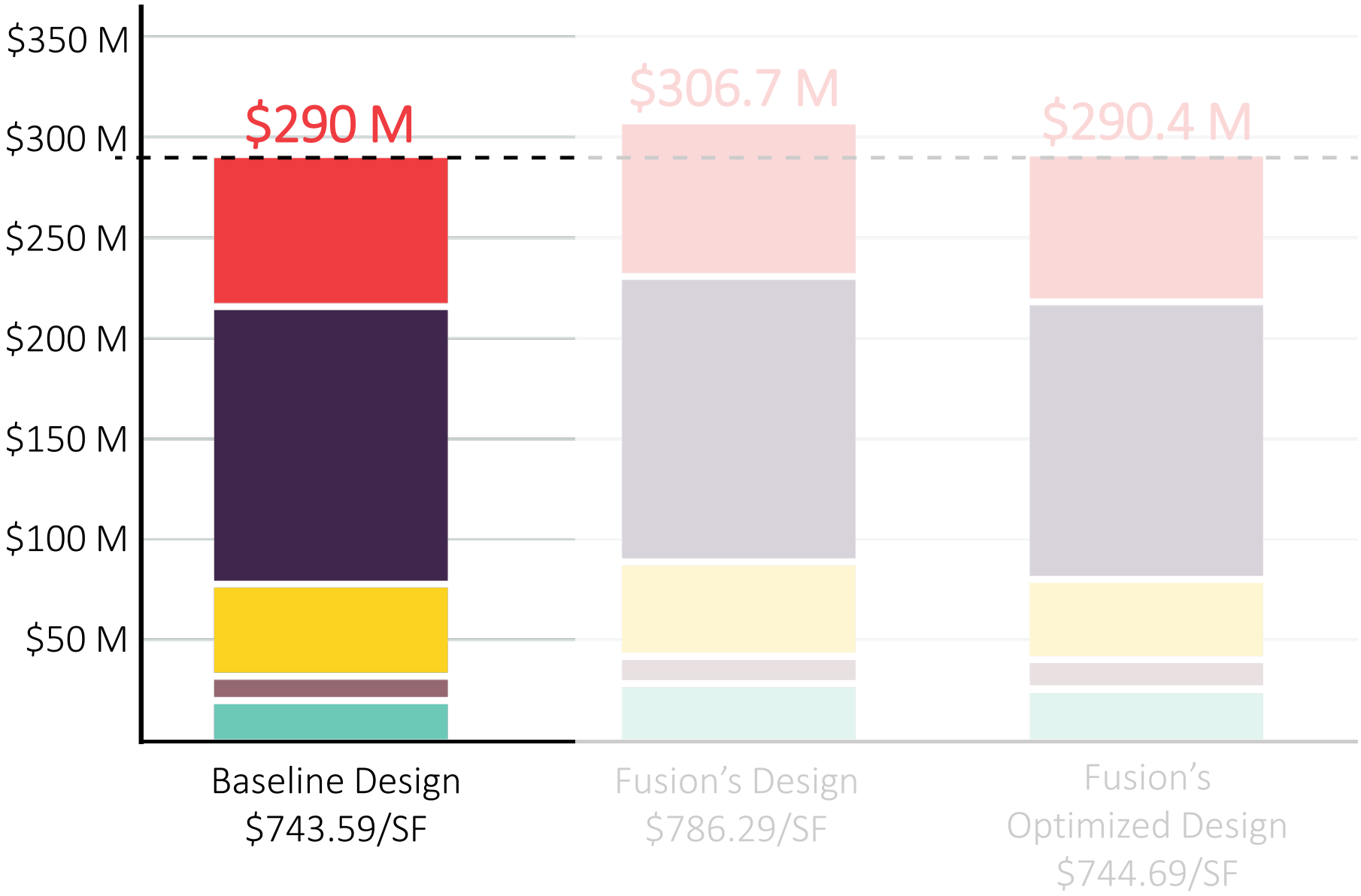
Milestone Schedule



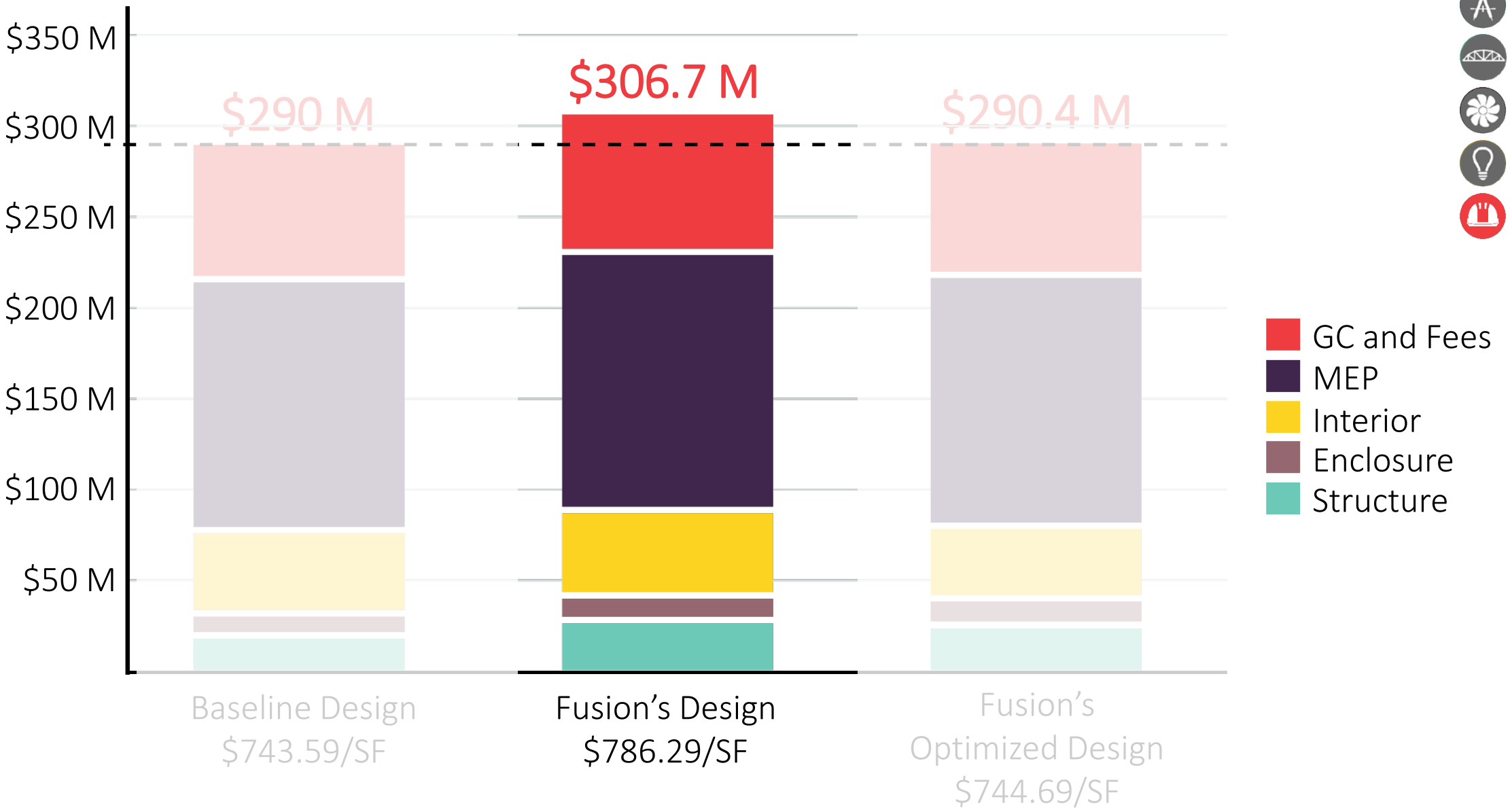
Milestone Schedule



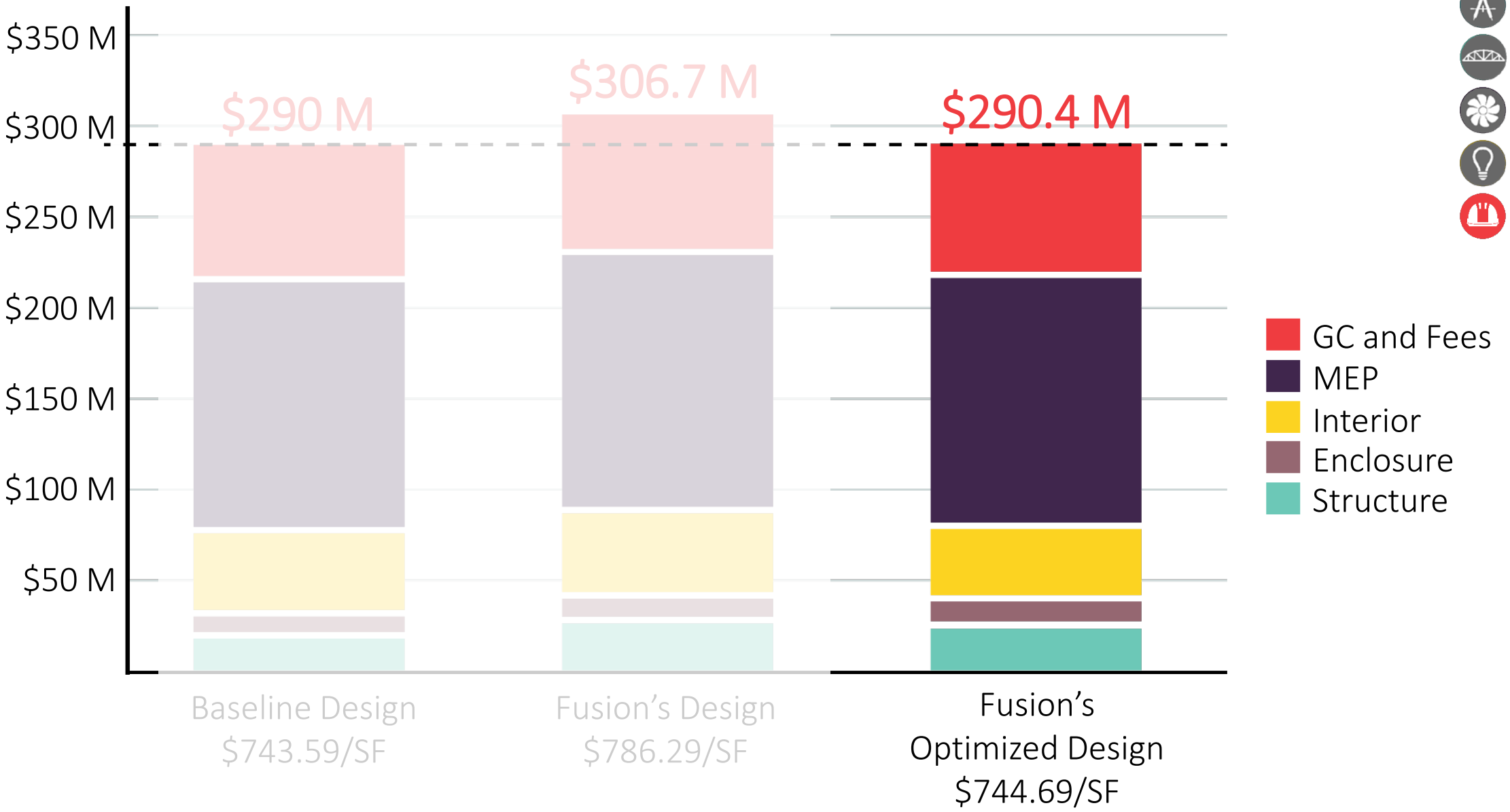
Cost | Tracking



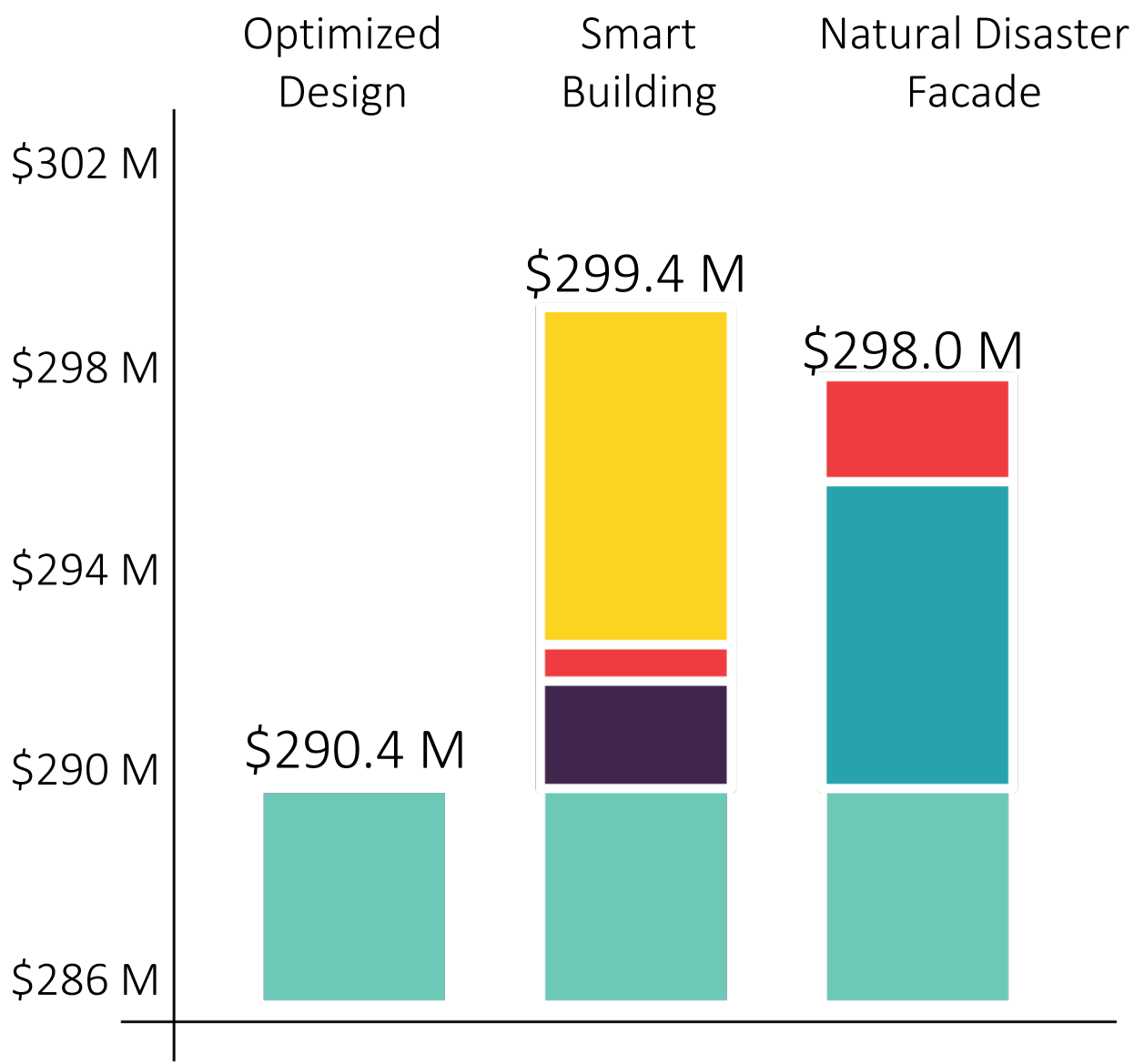
Cost | Tracking



Cost | Tracking



Cost | Add Alternates



FUSION'S OPTIMIZED DESIGN	SMART BUILDING TECHNOLOGY	NATURAL DISASTER FACADE
$290,400,000	$9,000,000	$7,700,000

Base Cost
MEP
GC and Fees
Enclosure
Smart Building Technology

Indoor Environmental Quality

12/16

Water Efficiency

05/11

Innovation

03/06

Energy Atmosphere

19/35

Total Points:

63

10/19

Materials and Resources

08/09

Sustainable Sites

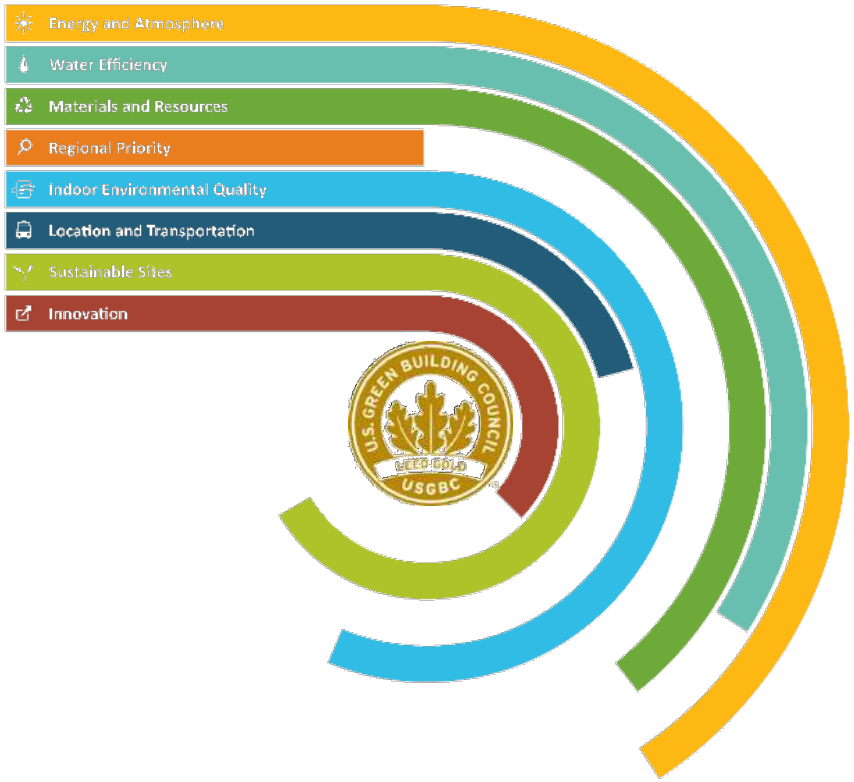
05/09

Location and Transportation

01/01

Integrative Process

LEED | Energy Savings



22%

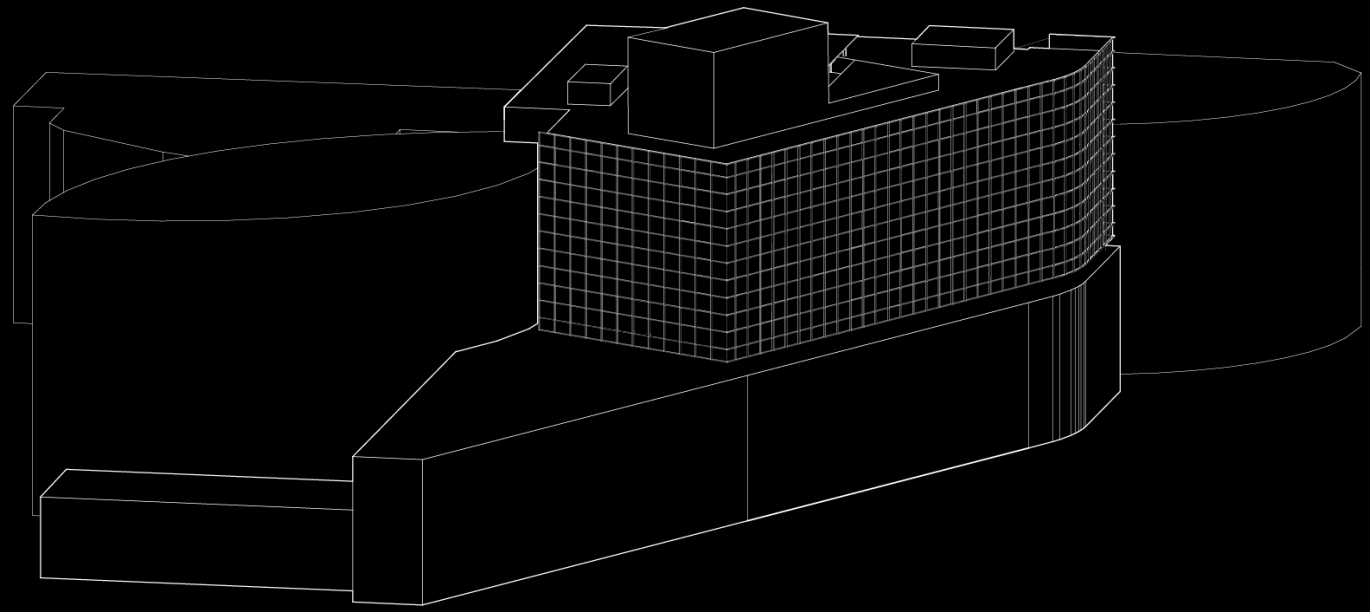
Primary Energy Savings

$$433\ \frac{kBTU}{ft^2}$$

45%

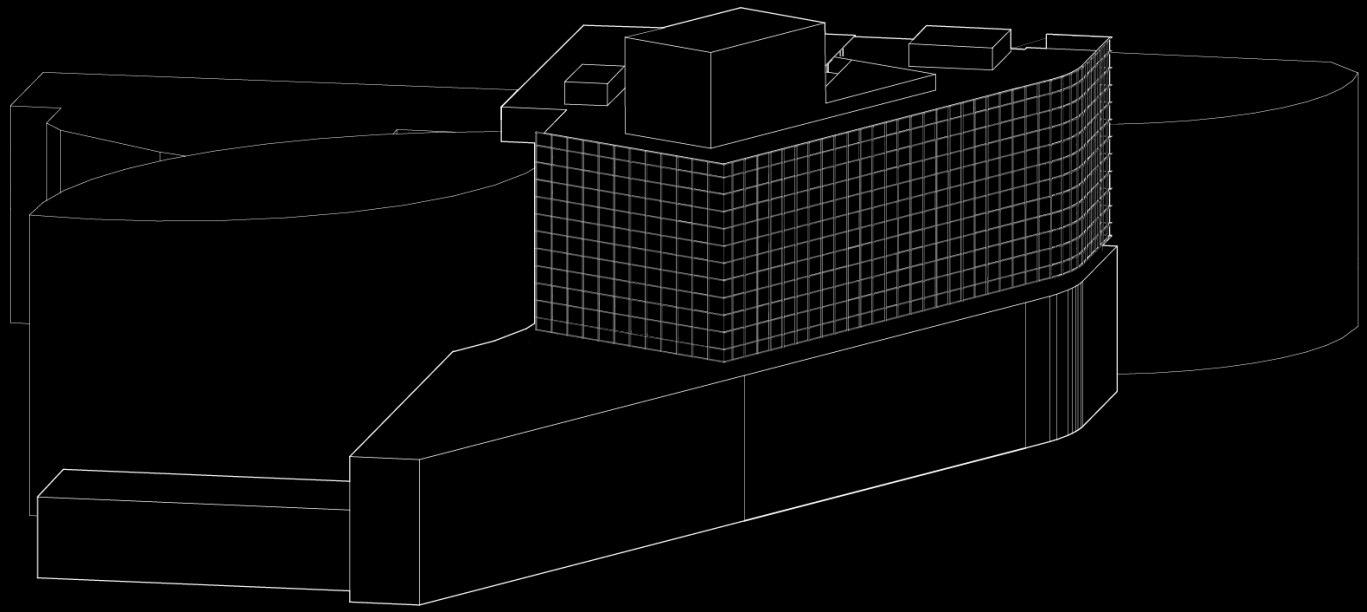
Yearly Utilities Savings

Integrative Design Points of Focus

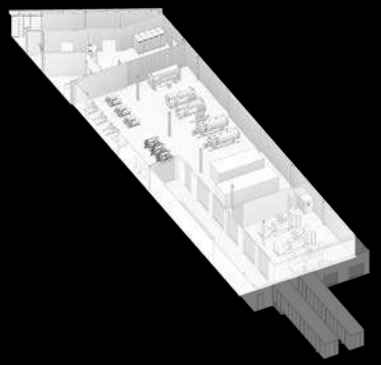


Integrative Design Points of Focus

Central Plant

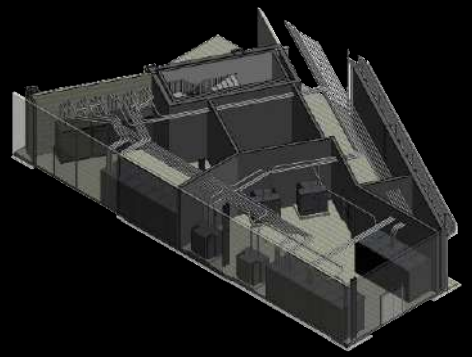


Central Plant Relocation

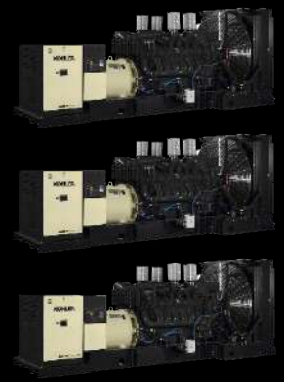


Combined Heat and Power System

Main Electrical Room

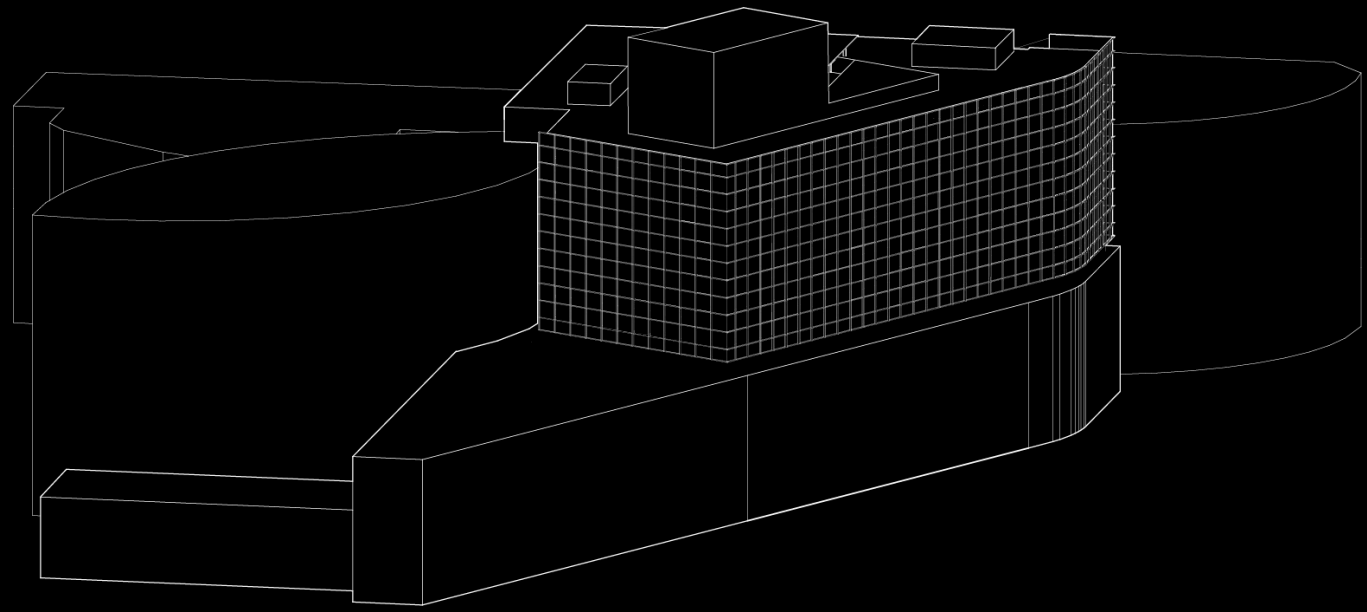


N+1 Backup Power

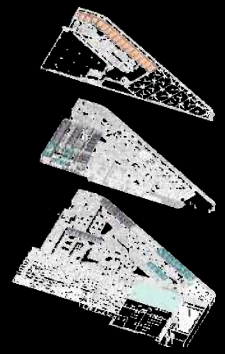


Integrative Design Points of Focus

Central Plant | Disaster Preparedness

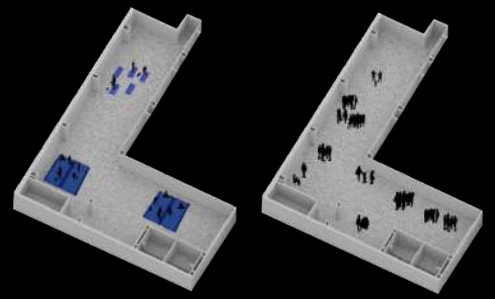


Mass Casualty
Dual Use Spaces

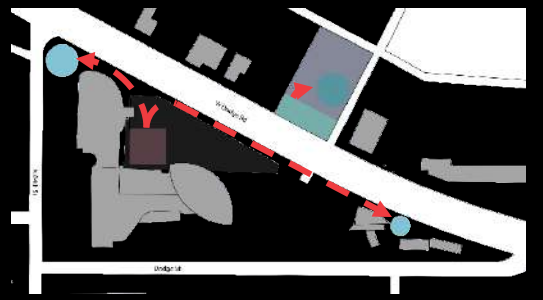


Emergency
Operation Center

Community
Shelter

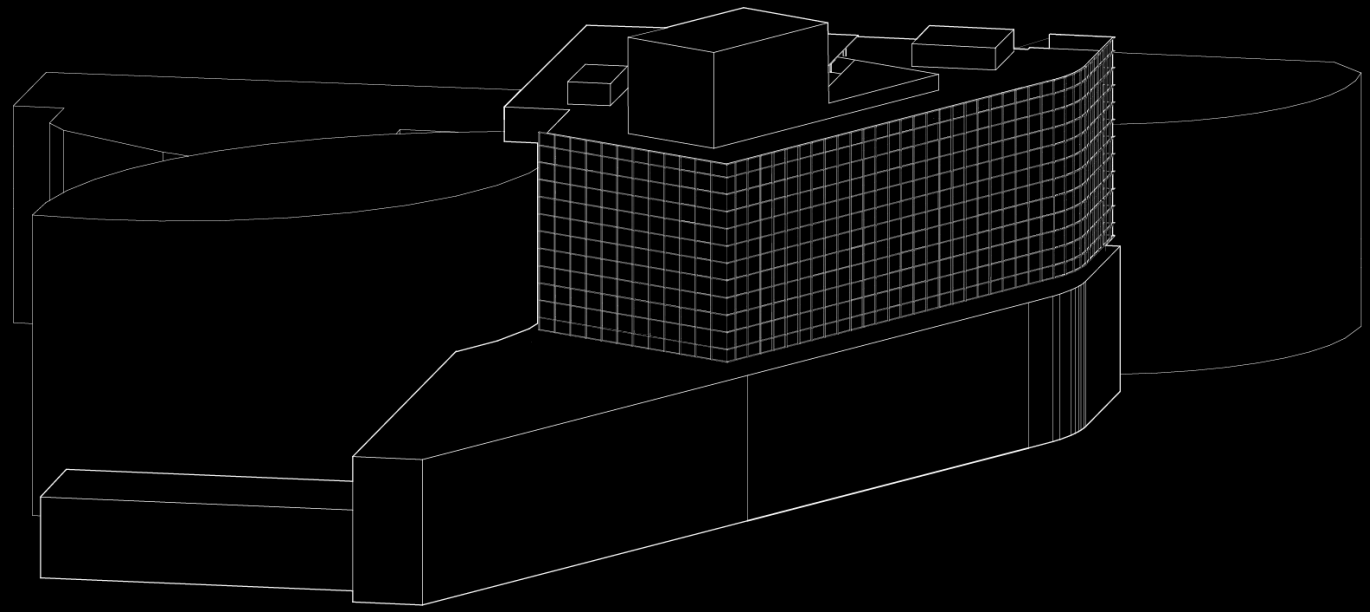


Construction
Disaster Plan



Integrative Design Points of Focus

Central Plant | Disaster Preparedness | Floor Reorganization



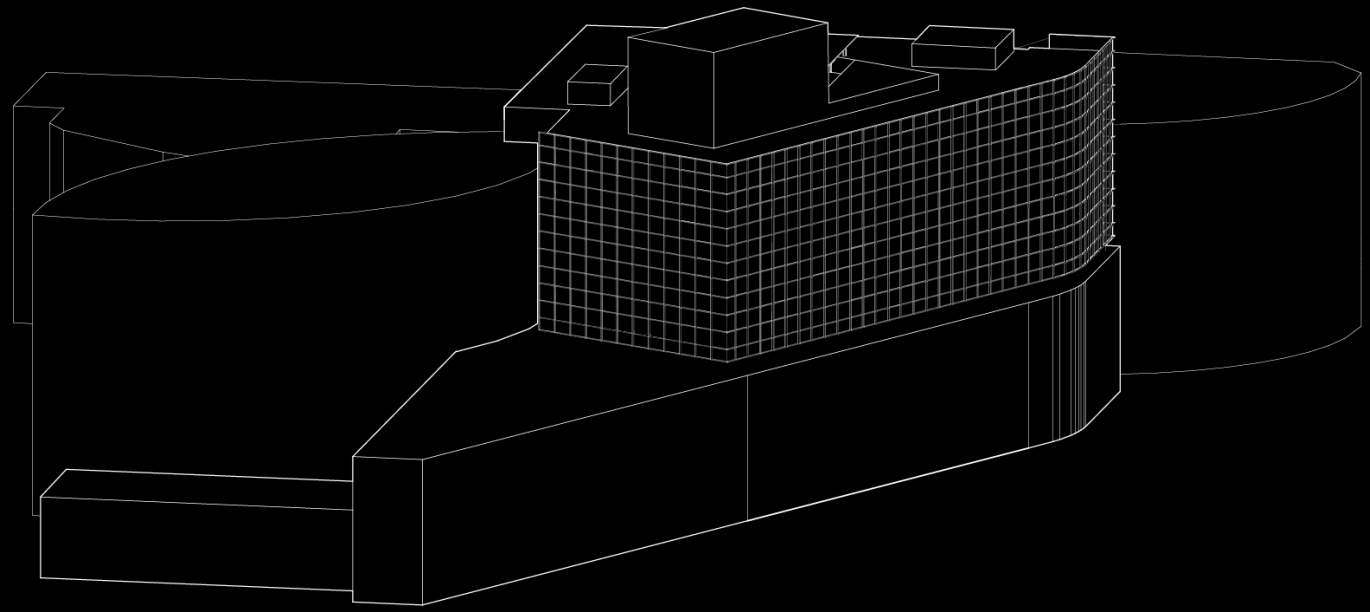
Mechanical Floor Relocation

Floor Adjacencies

Acoustical Considerations

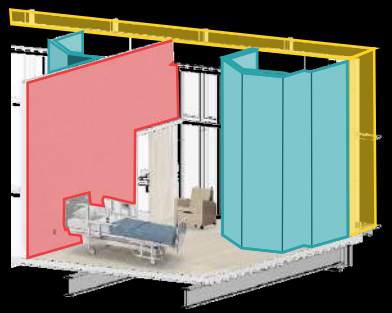
Integrative Design Points of Focus

Central Plant | Disaster Preparedness | Floor Reorganization | Patient Room

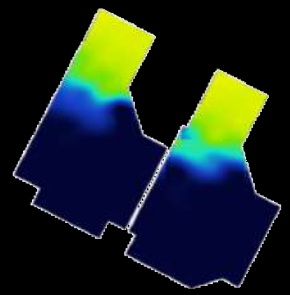


Patient Layout Optimization

Acoustical Considerations

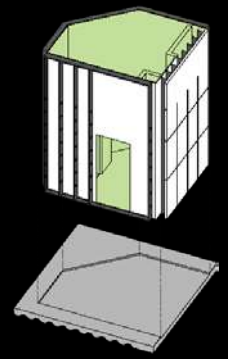


Daylight

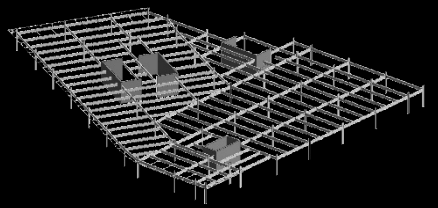


Smart Technology

Prefabricated Bathroom Pods

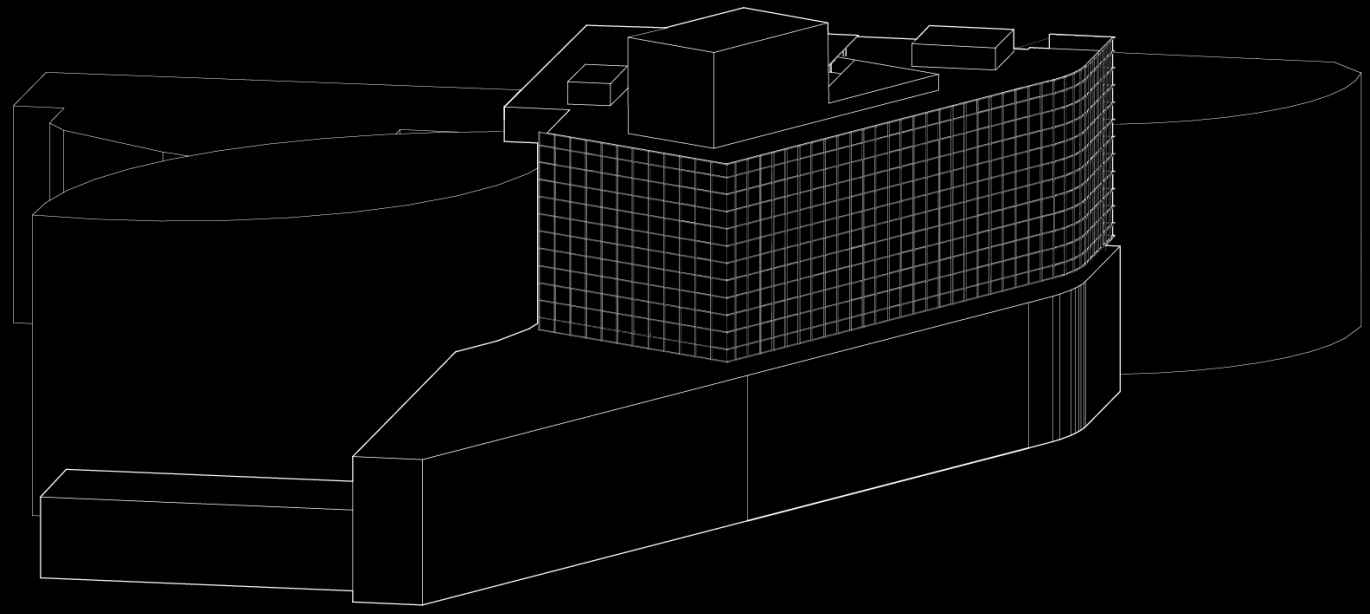


Limiting Walking Vibrations



Integrative Design Points of Focus

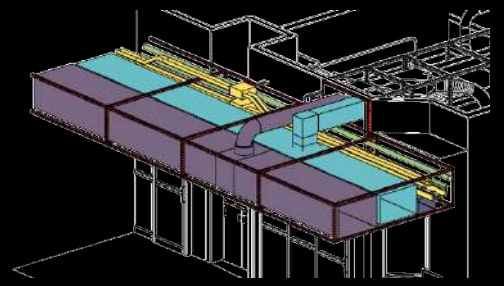
Central Plant | Disaster Preparedness | Floor Reorganization | Patient Room | Hallway & Team Center



Redesign for Increased Efficiency

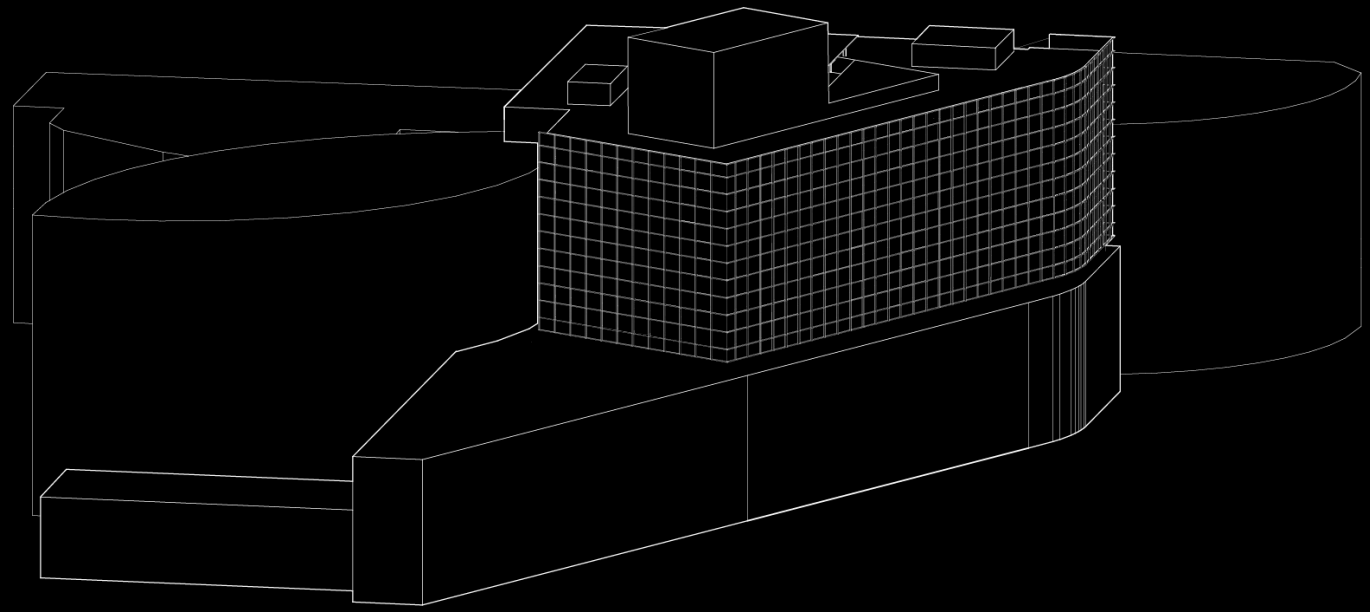
Circadian Rhythm

Prefabricated Overhead Racks

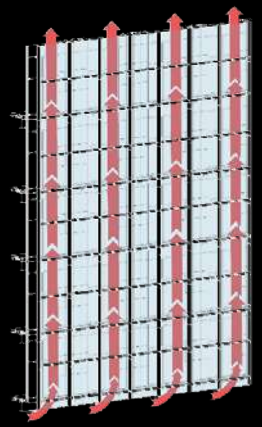


Integrative Design Points of Focus

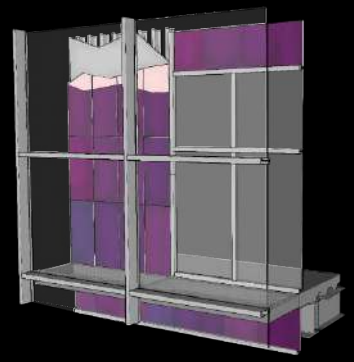
Central Plant | Disaster Preparedness | Floor Reorganization | Patient Room | Hallway & Team Center | High-Performance Enclosure



Active Double Skin

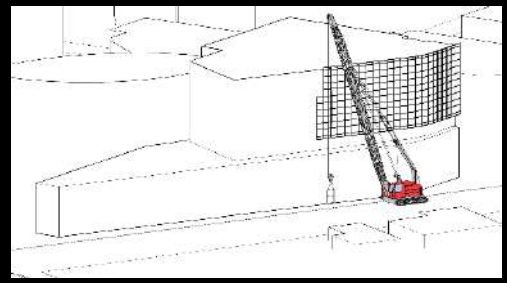


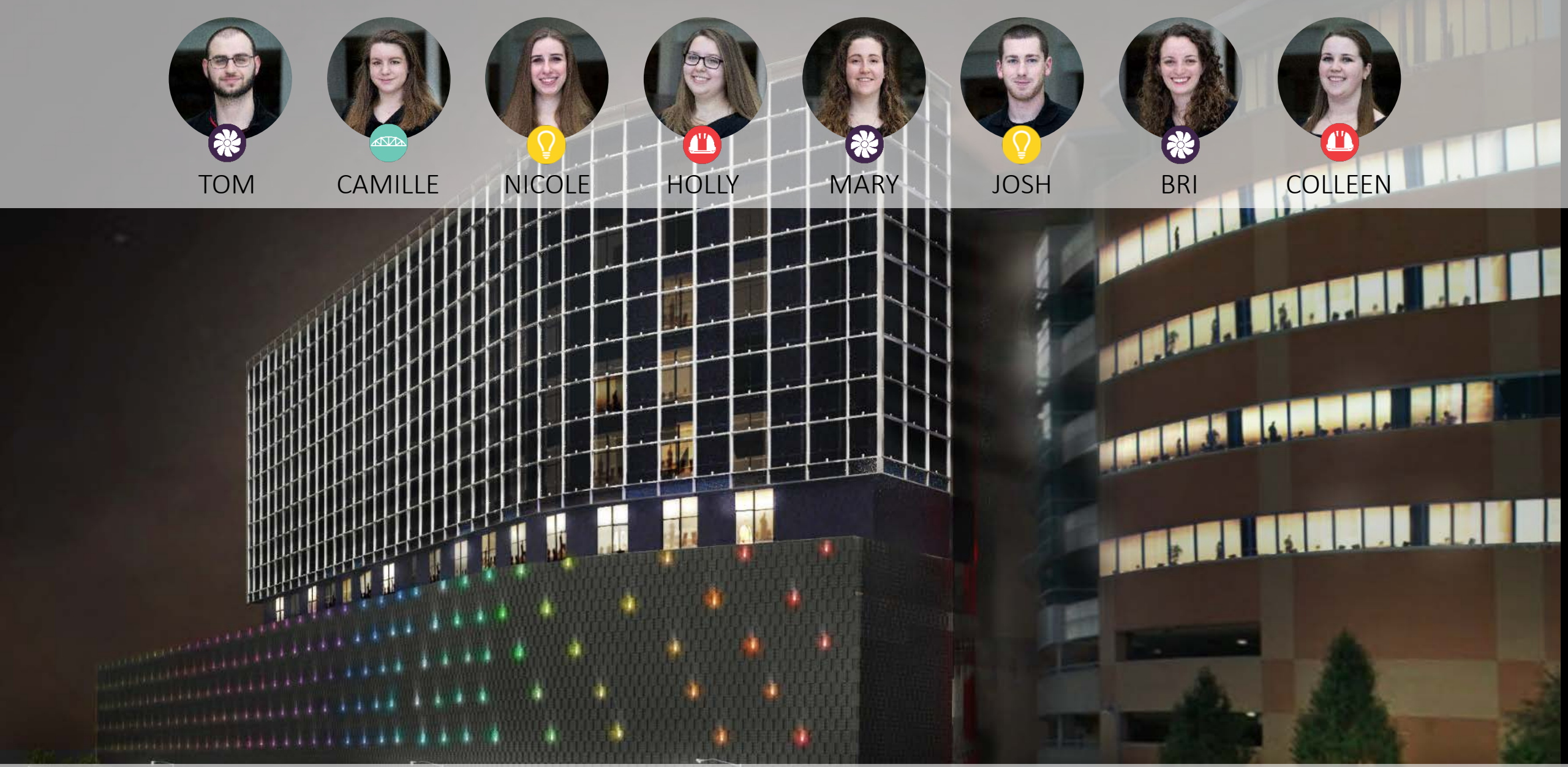
Impact Resistance



Dynamic Lighting

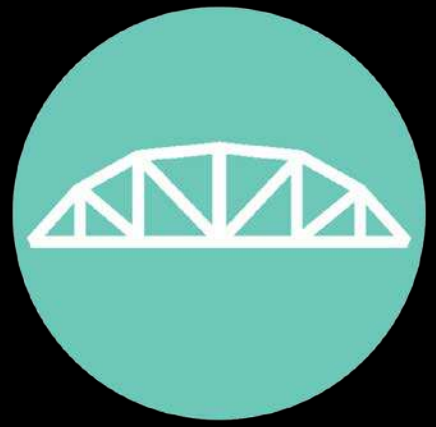
Prefabricated Units




TOM
CAMILLE
NICOLE
HOLLY
MARY
JOSH
BRI
COLLEEN

APPENDIX

Construction

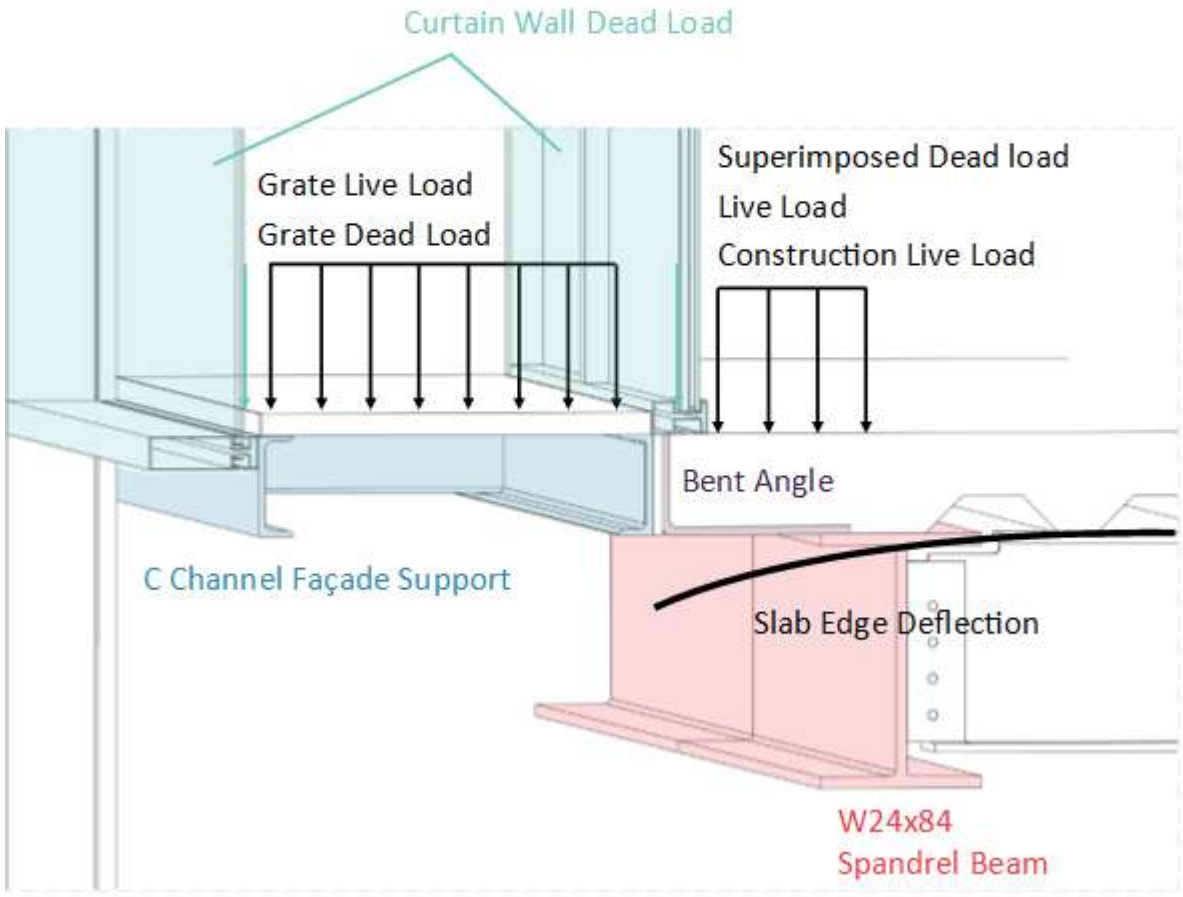


Structure

Mechanical

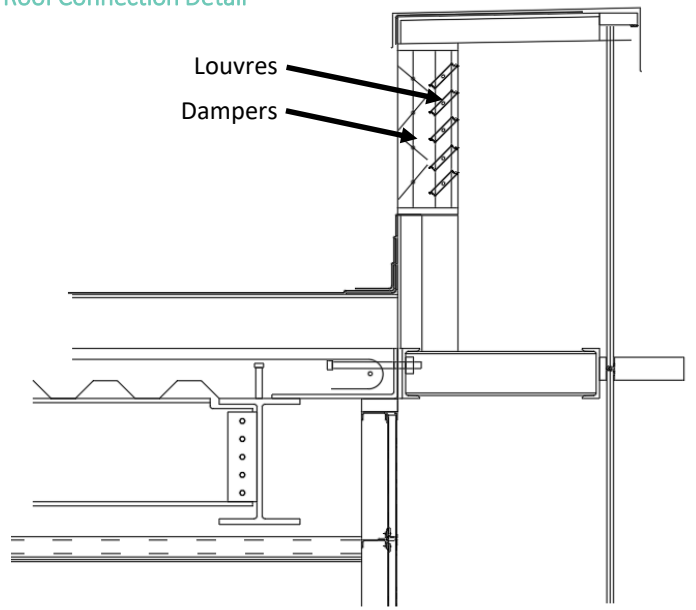
Lighting/Electrical

Structural Appendix| DSF Connection Details

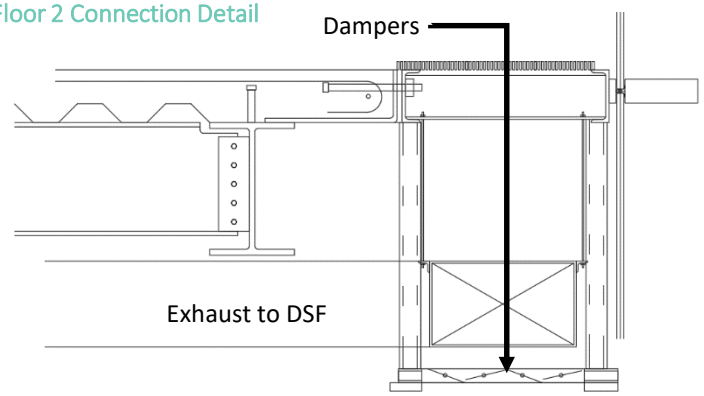


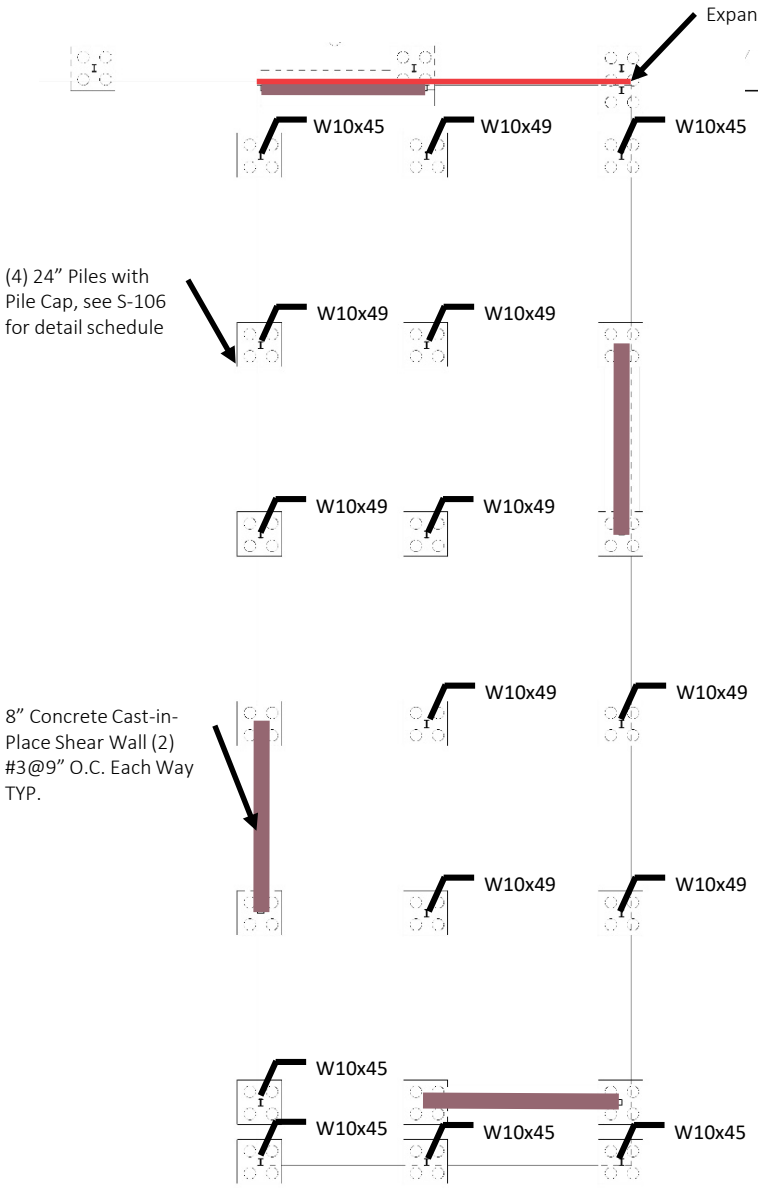
Calculations were performed in reference to AISC Design Guide 22 “Façade Attachments to Steel Framed Buildings” (2016)

Roof Connection Detail

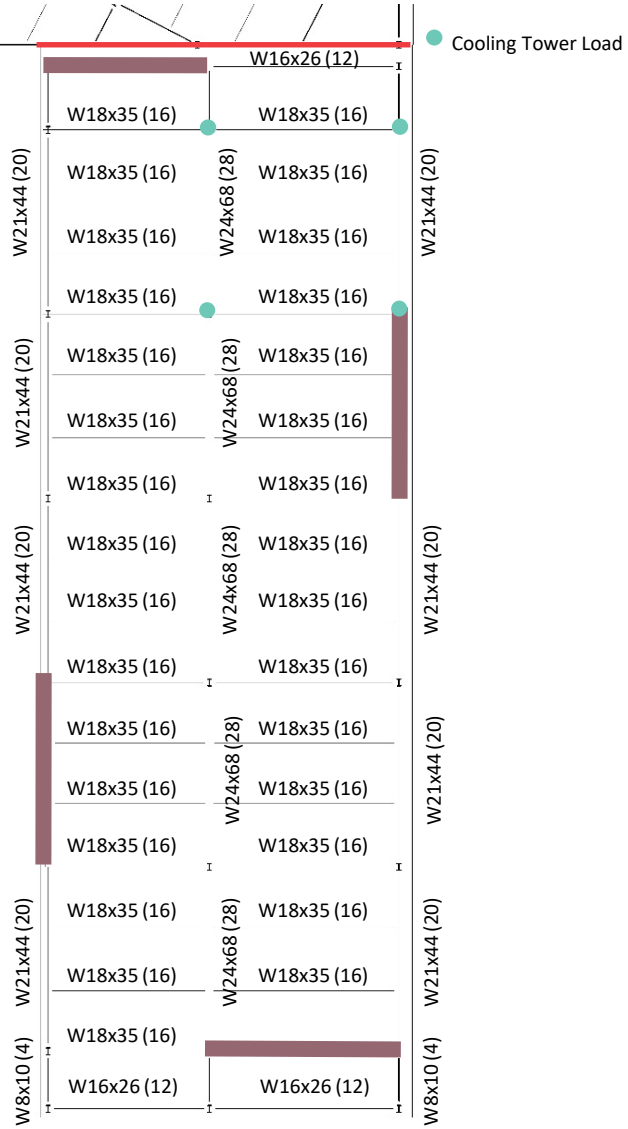


Floor 2 Connection Detail



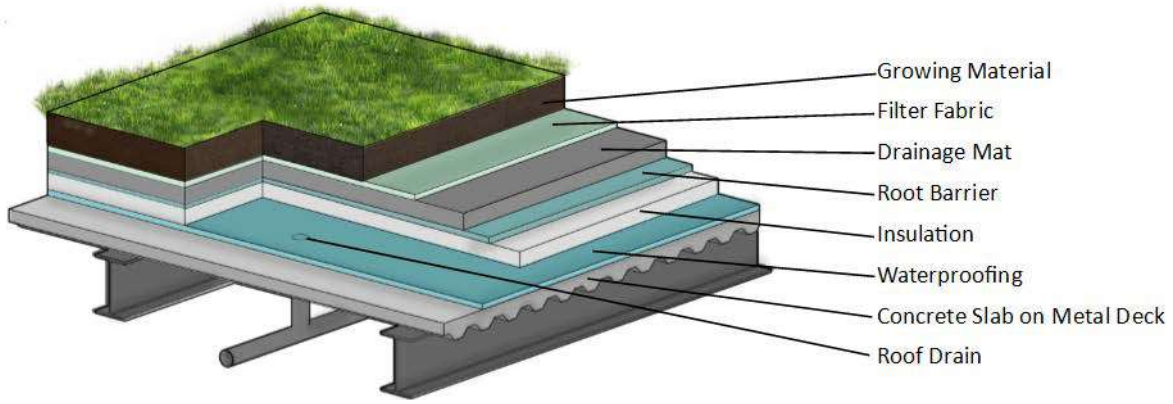


Lower Level 3 Floor Plan

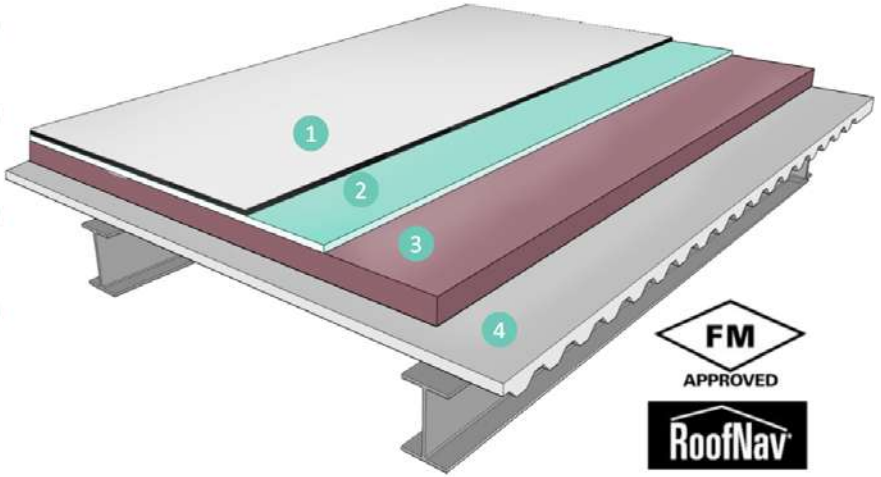


Level 1 Floor Plan

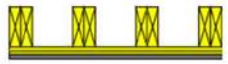
Structural Appendix| Roof Design

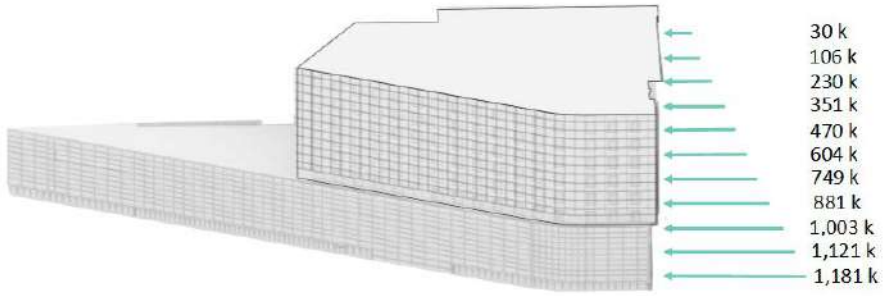


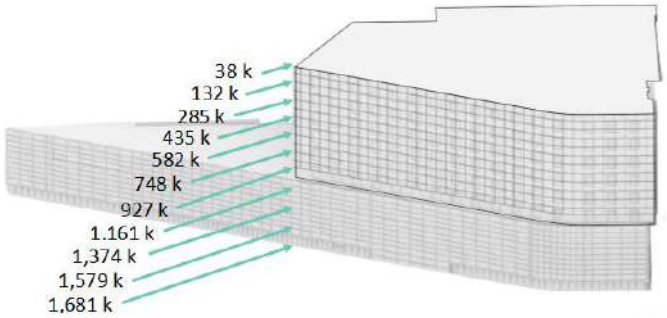
Sika Sarnafil G410 PVC Membrane 1
Sika Sarnafil Sarnacol 2170
Georgia-Pacific Gypsum DensDeck 2
Insulation Adhesive
Insulation 3
Insulation Adhesive
4" Concrete Slab on Metal Deck with 4
#4 @ 12" O.C. Each Way



Texas Tech Wind Science and Engineering Research Center Construction Material Threshold Testing Results

Assembly Description	Assembly	Threshold Missile Speed (mph)
2 layers of 3/4" plywood, one layer of 14 ga. steel and 4x4 ft, double stud frame		<112.8
4" thick pea-gravel concrete with #4 rebar reinforcement 12" O.C. each way		162.0





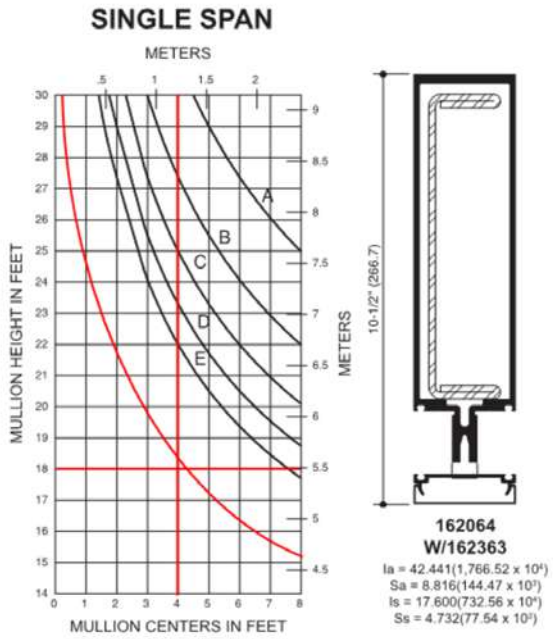
Level 9 Roof Pressure Loads (200 mph)				
Zone	p (Table 30.7-2)		Final Design Wind Pressure (psf)	
	(+)	(-)	(+)	(-)
1	NA	-187.64	NA	-131.348
2	NA	-294.49	NA	-206.143
3	NA	-401.44	NA	-281.008

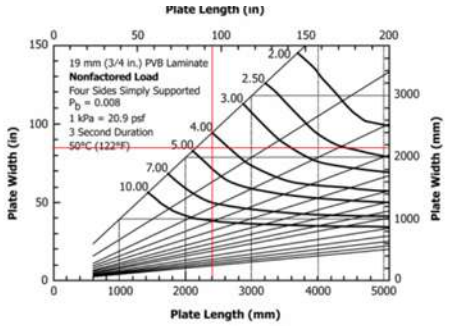
Elevation Wind Pressure Loads (200 mph)						
Level	FLOOR HEIGHT	Height above	Zone 4		Zone 5	
			(+)	(-)	(+)	(-)
Roof	14 ft	143.0 ft	89.789	-102.616	89.789	-141.09
Level 7	14 ft	129.0 ft	87.843	-100.392	87.843	-138.072
Level 6	14 ft	115.0 ft	85.75	-98	85.75	-134.76
Level 5	14 ft	101.0 ft	83.468	-95.392	83.468	-131.124
Level 4	18 ft	87.0 ft	80.871	-92.424	80.871	-127.044
Level 3	18 ft	69.0 ft	77.028	-88.032	77.028	-120.996
Level 2	16 ft	51.0 ft	72.24	-82.56	72.24	-113.544
Level 1	17 ft	35.0 ft	66.64	-76.16	66.64	-104.73
Lower Level 1	18 ft	18.0 ft	57.96	-66.24	57.96	-91.056
Lower Level 3	0 ft	0.0 ft	0.00	0.00	0.00	0.00

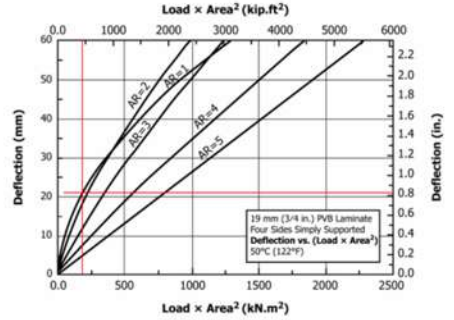
MULLION DESIGN

Typical mullions were designed as 2-1/2" by 10-1/2". The values on the vertical mullion design charts were extrapolated to the design load of 141 psf.

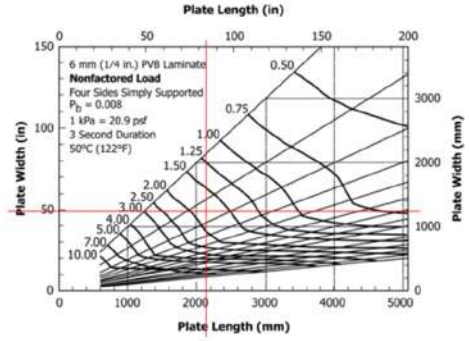
	Allowable Stress Design Load	LRFD Ultimate Design Load
A =	20 PSF (960)	33 PSF (1580)
B =	30 PSF (1440)	50 PSF (2400)
C =	40 PSF (1920)	67 PSF (3200)
D =	50 PSF (2400)	83 PSF (4000)
E =	60 PSF (2880)	100 PSF (4790)

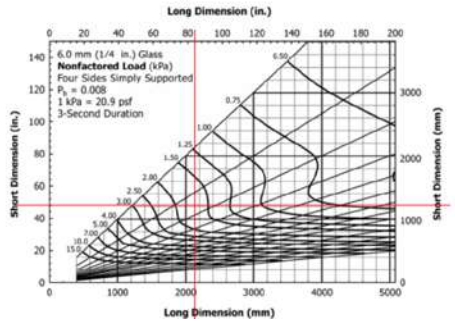






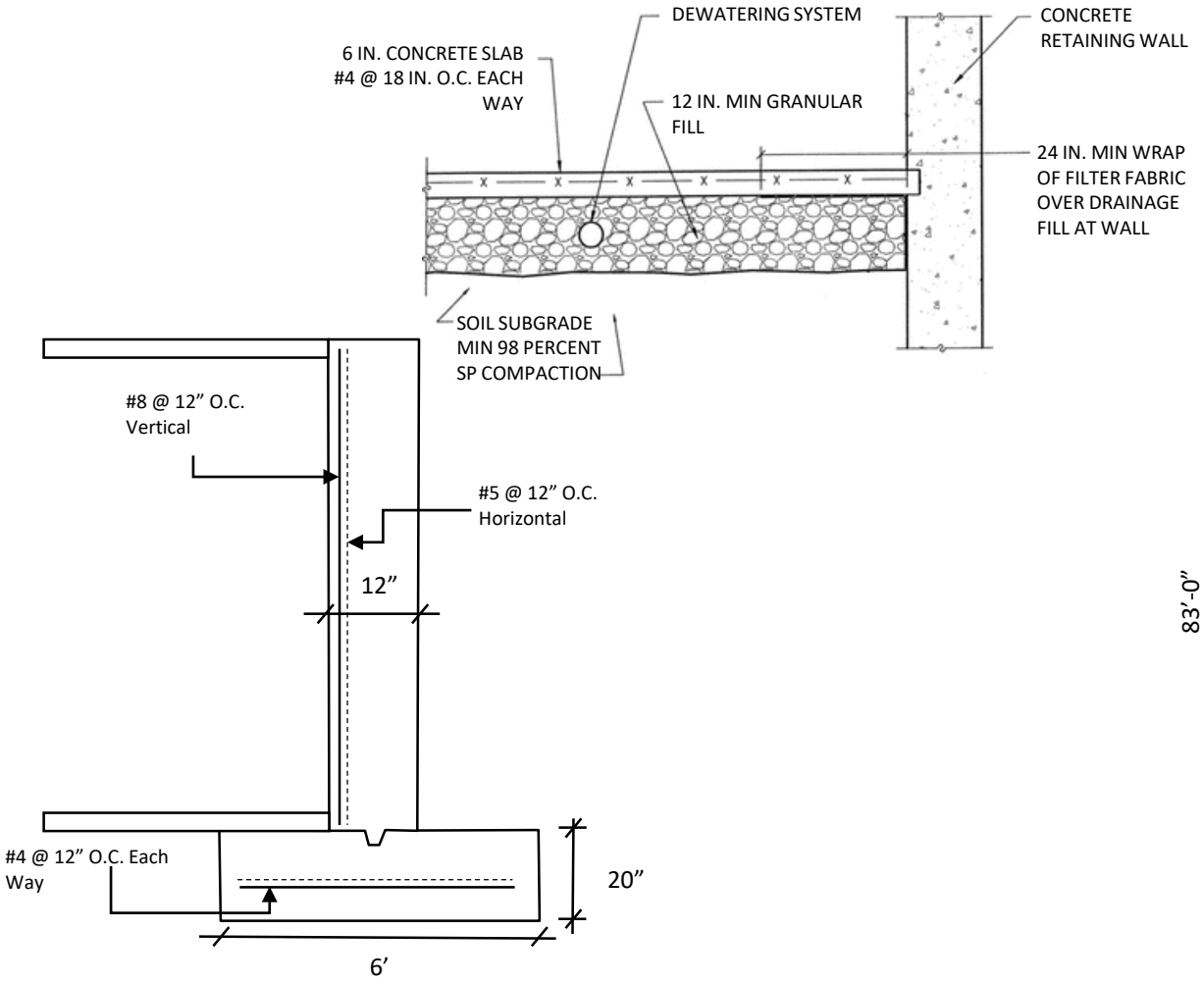
3/4" Monolithic Laminated Glass	
L (in)	96
W (in)	84
t (in)	0.75
NFL (kPa)	4.25
NFL (psf)	88.825
Glass Type Factors (Fully Tempered)	4
Load Share Factor	1
Load Resistance (psf)	355.3
IGU Unit Load Resistance (psf)	355.3
Required Load Resistance (psf)	141

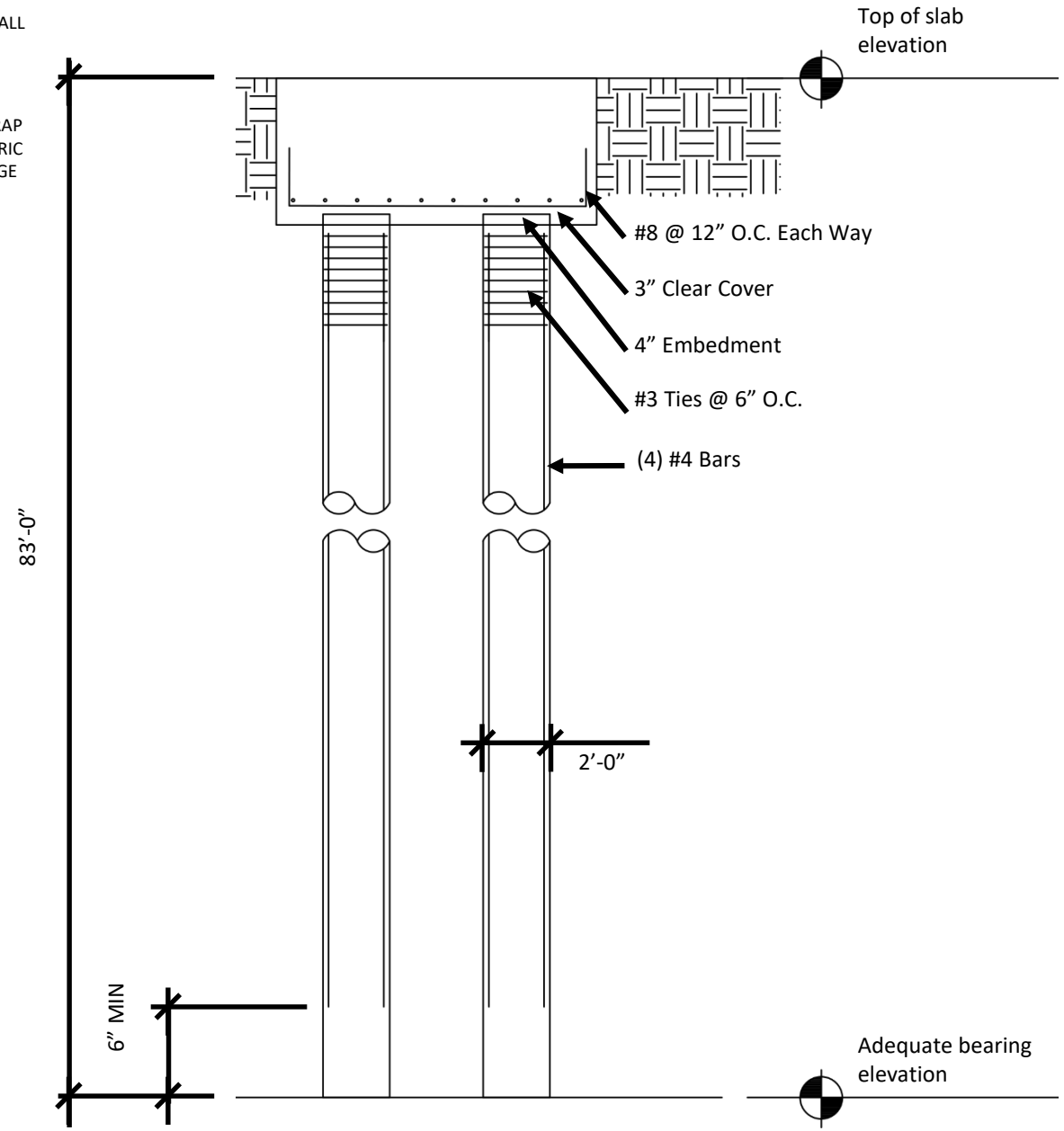




1" IGU		
	Lite 1 (mono)	Lite 2 (lami)
L (in)	48	48
W (in)	84	84
t (in)	0.25	0.25
NFL (kPa)	1.75	1.75
NFL (psf)	36.575	36.575
Glass Type Factors	3.6	3.6
Load Share Factor	0.5	0.5
Load Resistance (psf)	263.34	263.34
IGU Unit Load Resistance (psf)		263.34
Required Load Resistance (psf)		141

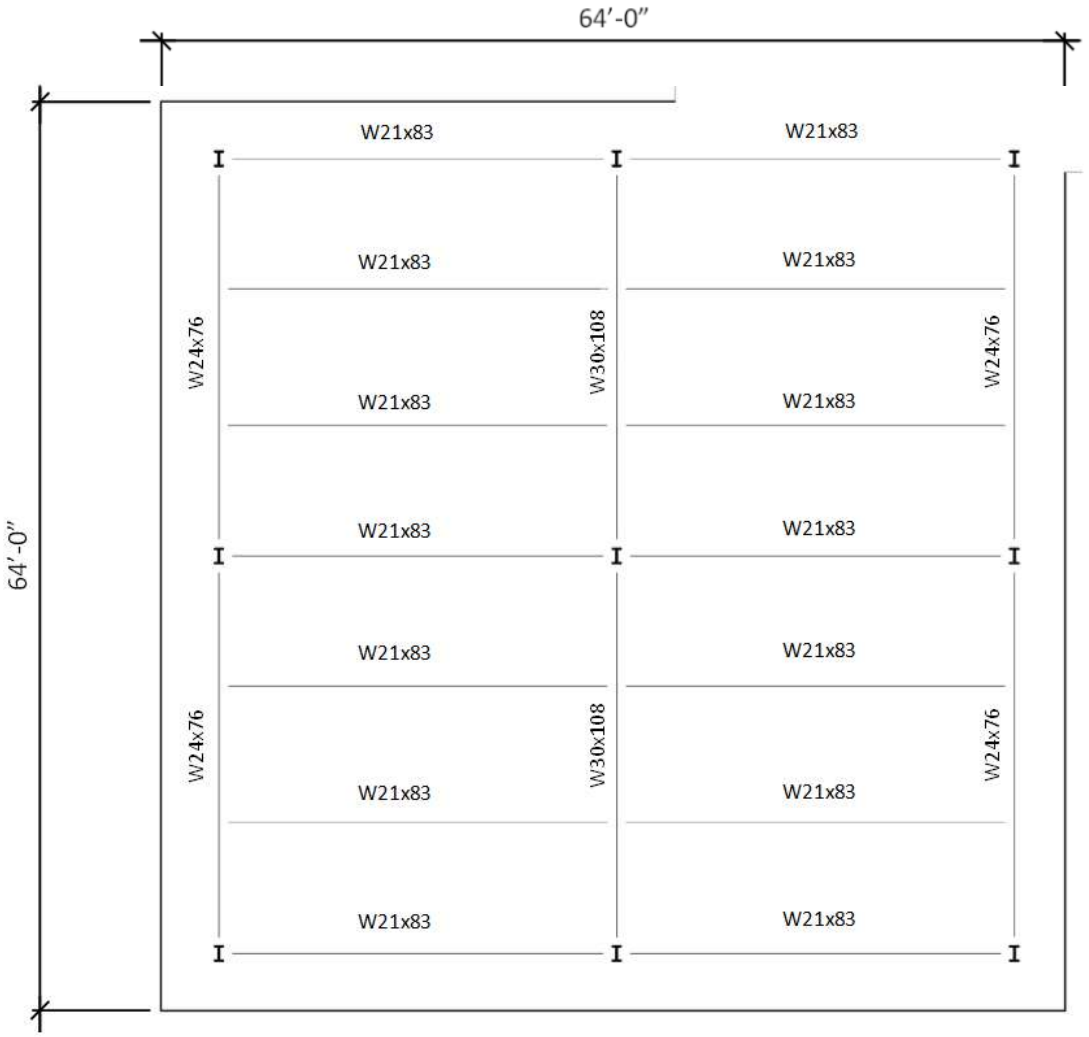
Structural Appendix| Foundation Design

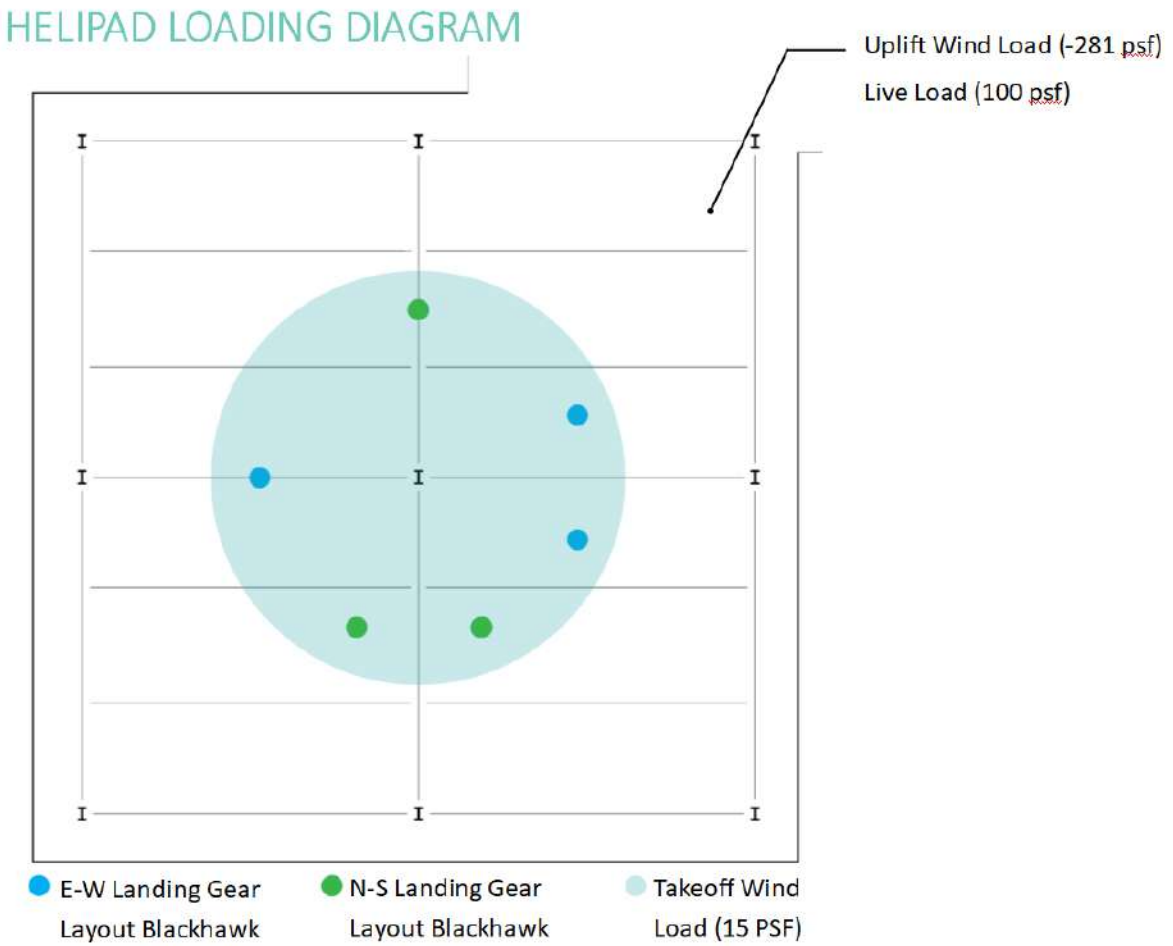




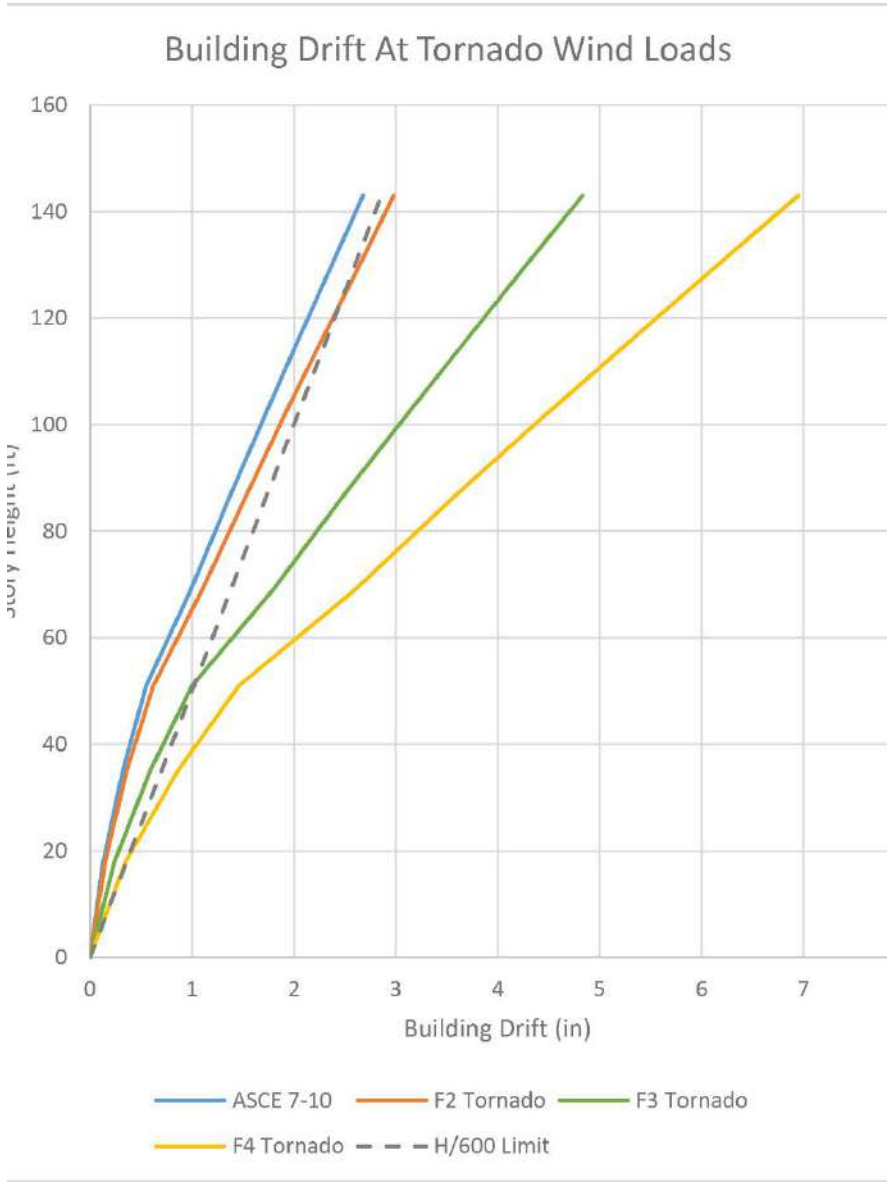
Pile Design Schedule									
Piles	Top of Piles	Length (ft) (per in field	Compressive Strength	Pile Reinforcing		Pile Cap			Number
				Vertical	Ties	Size	Thickness	Reinforcing	
	Lower Level 5	81'-0"	3000	(4) #8	#3 @ 6" O.C.	10'-0"x10'-0"	55"	#8 @ 12" O.C. Each Way	19
	Lower Level 3	103'-0"							41
	Lower Level 5	81'-0"				13'-6"x15'-0"			22
	Lower Level 3	103'-0"							7
	Lower Level 5	81'-0"				13'-6"x20'-0"			22
	Lower Level 3	103'-0"							0

Structural Appendix| Helipad Design





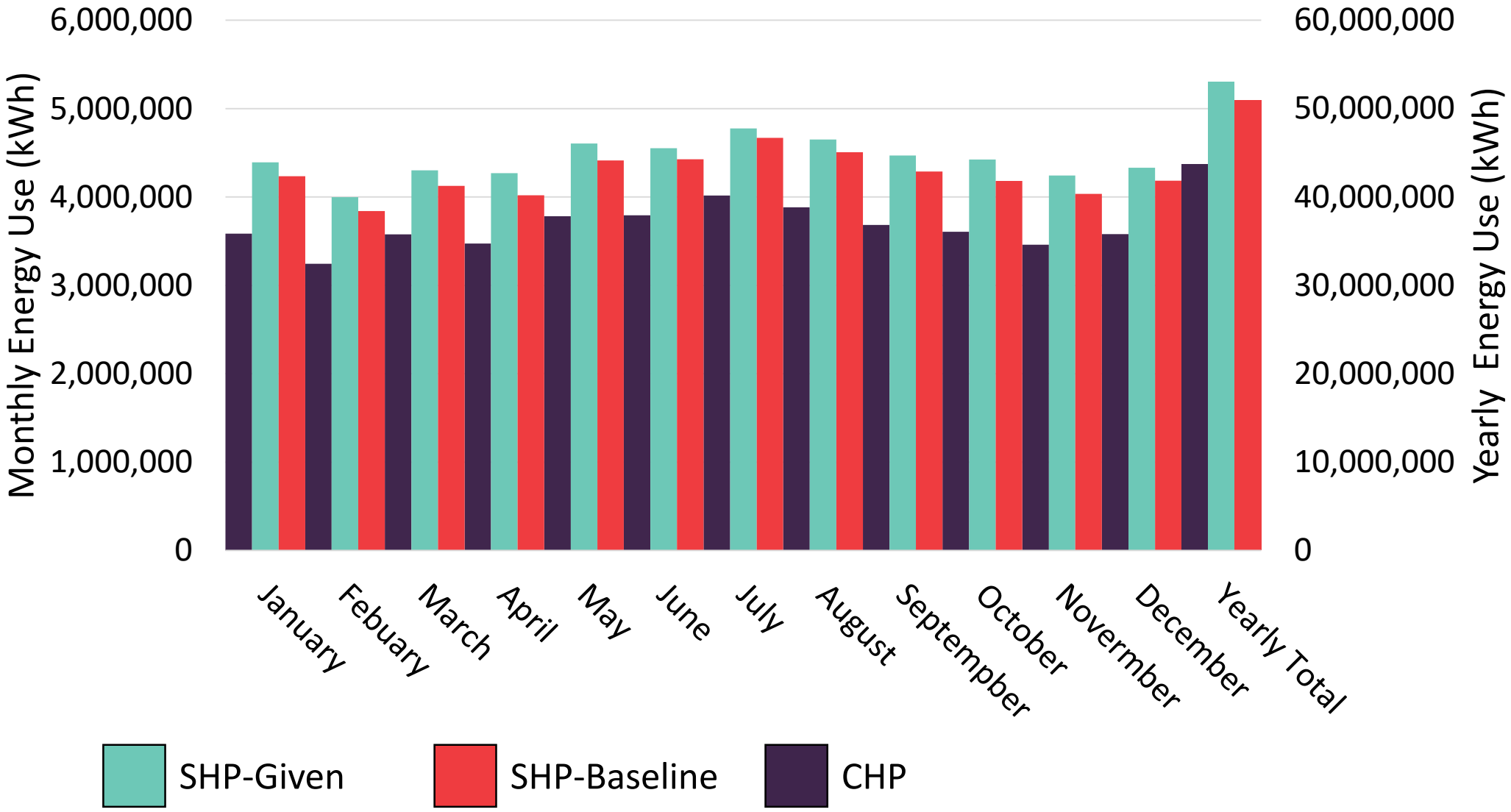
Structural Appendix | Lateral Deflection



Wind Deflections				
	Maximum Drift (in)		Interstory Drift (in)	
	X	Y	X	Y
Roof	1.02	2.68	0.12	0.33
Level 7	0.91	2.35	0.12	0.33
Level 6	0.79	2.02	0.12	0.32
Level 5	0.67	1.70	0.12	0.32
Level 4	0.55	1.38	0.15	0.39
Level 3	0.40	0.99	0.15	0.44
Level 2	0.26	0.55	0.10	0.23
Level 1	0.15	0.32	0.09	0.19
Lower Level 1	0.07	0.13	0.07	0.13
Lower Level 3	0.00	0.00	0.00	0.00
		Max	0.15	0.44

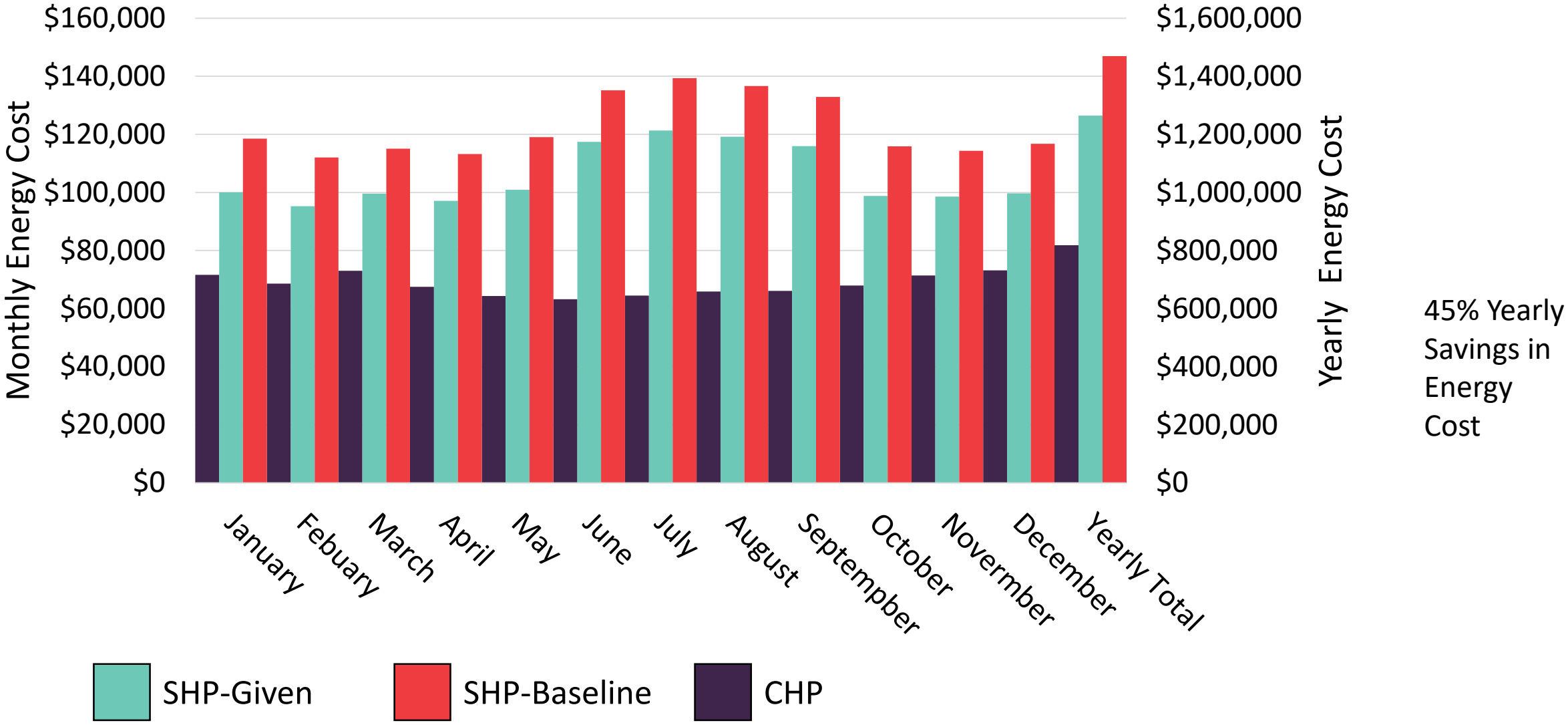
Maximum Building Drift at Tornado Wind Loads					
	Wind Speed (mph)	Maximum Drift (in)		Interstory Drift (in)	
		X	Y	X	Y
ASCE 7-10	120	1.02	2.68	0.15	0.44
F2	135	1.13	2.99	0.16	0.49
F3	165	1.72	4.83	0.25	0.79
F4	200	2.38	6.95	0.34	1.13

Mechanical Appendix| Primary Energy Use



18% Yearly Savings in energy Use

Mechanical Appendix| Energy Cost



45% Yearly Savings in Energy Cost

Mechanical Appendix| CHP

Design Option	Total HVAC First Cost	Yearly Operating Cost
Fusion SHP	$46,275,000	$1,260,000
Fusion CHP	$49,930,000	$835,000

	Per kW	Total Installed
Base Engine	$ 2,000	$ 4,500,000
Heat Recovery	$ 500	$ 900,000

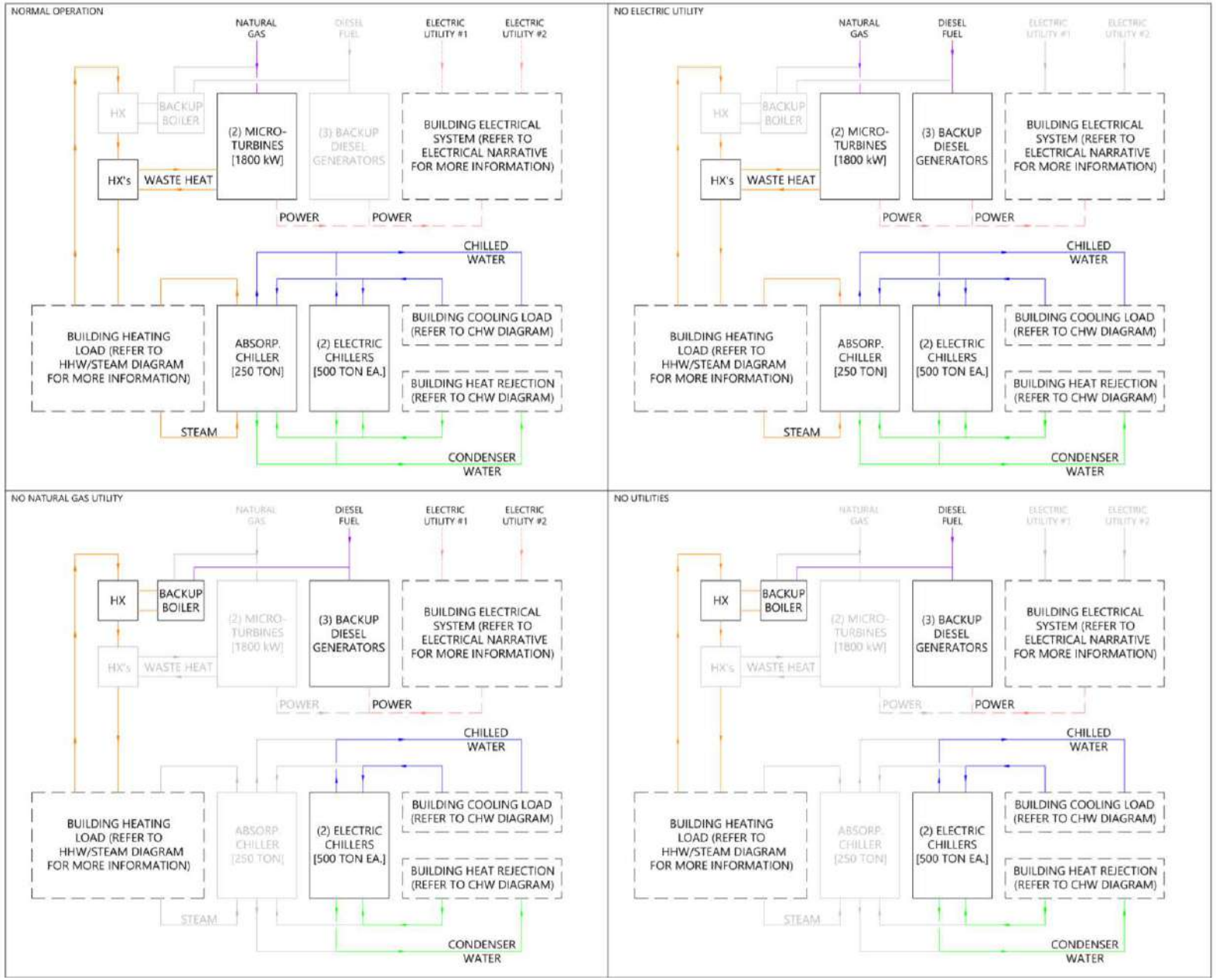
	Per kWh	Yearly Total
Maintenance Cost	$ 0.01	$ 150,000

Design Option	Equipment First Cost	Yearly Operating Cost	Simple Payback*
1	$ 5,295,000	$ 835,000	11.15
2	$ 6,855,000	$ 805,000	13.3
3	$ 3,850,000	$ 770,000	8
4	$ 5,850,000	$ 846,000	15.6
5	$ 7,350,000	$ 808,000	17.7

	Units	C800S	C1000S
Fuel Consumption	[BTU/hr]	8,800,000	11,000,000
Electrical Power Out	[kW]	760	950
Steam Production (9 psig)	[Lb/hr]	3,000	3,300
Electrical Efficiency	[%]	31	31
Recoverable Thermal Efficiency	[%]	39	34
Total Efficiency	[%]	70	65

Design Option	Microturbine 1	Mircoturbine 2	Mircoturbine 3	Chiller 1	Chiller 2	Chiller 3	Boiler 1*	Boiler 2*
1	1000 KW	800 KW	-	250 Ton (A)	500 Ton (E)	500 Ton (E)	3800 MBH	3800 MBH
2	800 KW	800 KW	800 KW	250 Ton (A)	500 Ton (E)	500 Ton (E)	3800 MBH	3800 MBH
3	1000 KW	-	-	400 Ton (A)	400 Ton (A)	400 Ton (A)	3000 MBH	3000 MBH
4	1000 KW	800 KW	-	400 Ton (A)	400 Ton (A)	400 Ton (A)	3800 MBH	3800 MBH
5	800 KW	800 KW	800 KW	400 Ton (A)	400 Ton (A)	400 Ton (A)	3800 MBH	3800 MBH

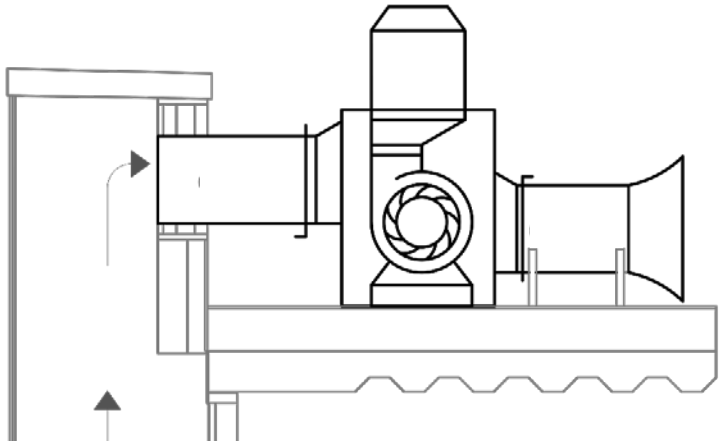
Mechanical Appendix| System Operation

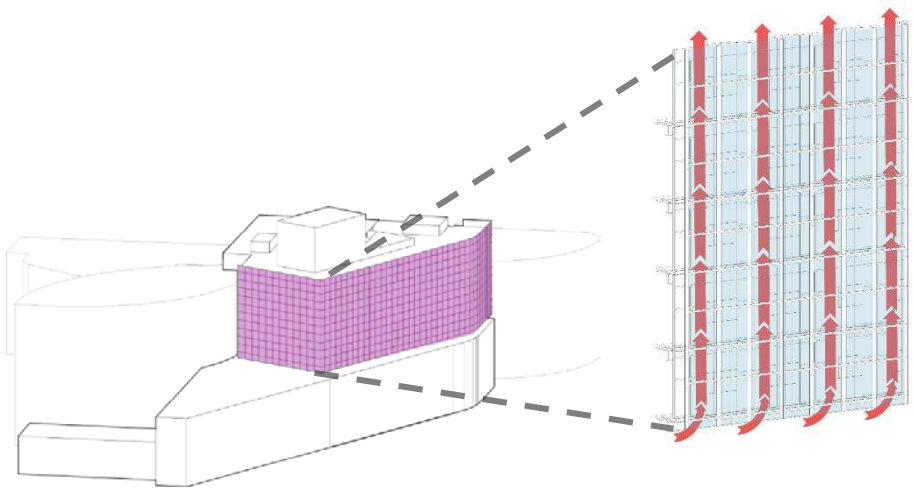


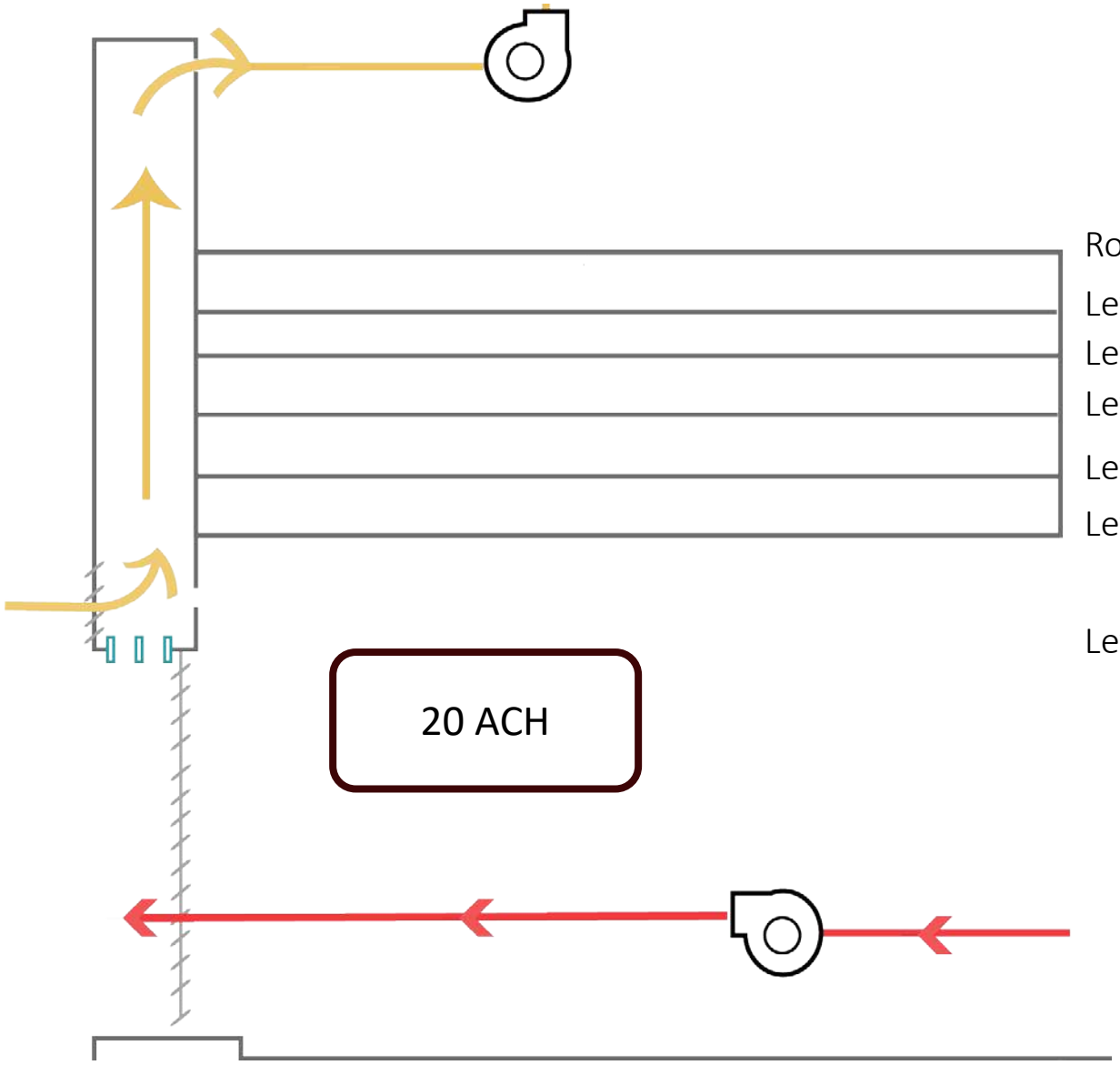
Mechanical Appendix| System Operation

		Normal Operations	No Natural Gas	No Electricity	No Natural Gas, Diesel	No Utilities	No Electricity, Diesel	No Utilities, Limited Diesel	No Utilities, Diesel
	Electric Utility	✓	✓	✗	✓	✗	✗	✗	✗
	Natural Gas Utility	✓	✗	✓	✗	✗	✓	✗	✗
	Diesel Supply	✓	✓	✓	✗	✓	✗	~	✗
Equipment	CHP Engines								
	Diesel Generator								
	Cooling Tower								
	Critical AHU Fans								
	Non-Critical AHU Fans								
	Backup Boiler								
	Electric Chillers								
	MRI Chiller								
	OR Chiller								
	Absorption Chiller								
Patient Service	MRI								
	Critical Power Receptacles								
	Life Safety								
	Lighting								
	General Receptacles								
	Room Pressurization								
	Data Servers								
	OR Cooling								
Non-Medical Support	Kitchen Refrigeration								
	Family Area								
	EOC								

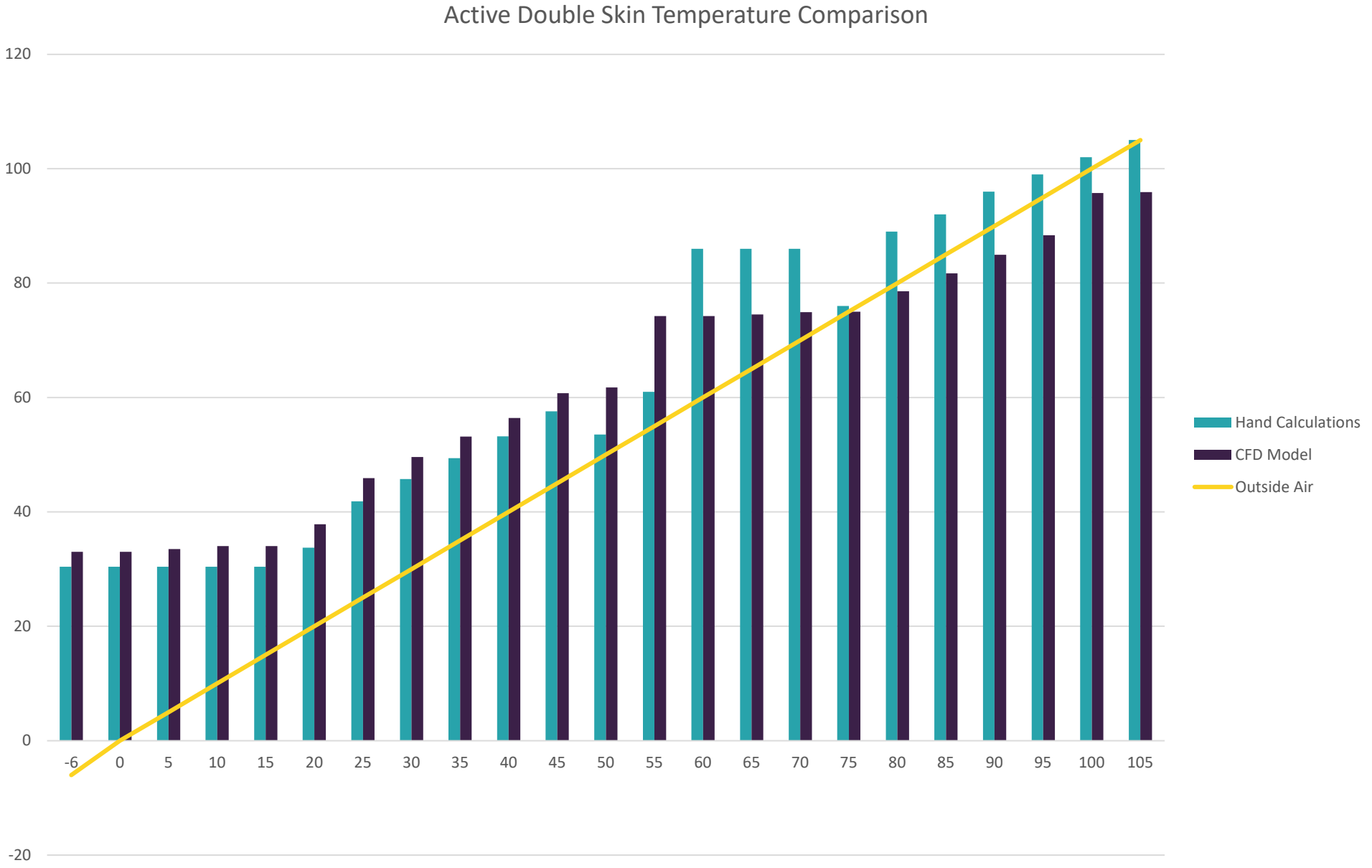
Double Skin Façade | Fire Mode







Double Skin Façade |Temperatures



Fire Suppression | Sprinkler Plan

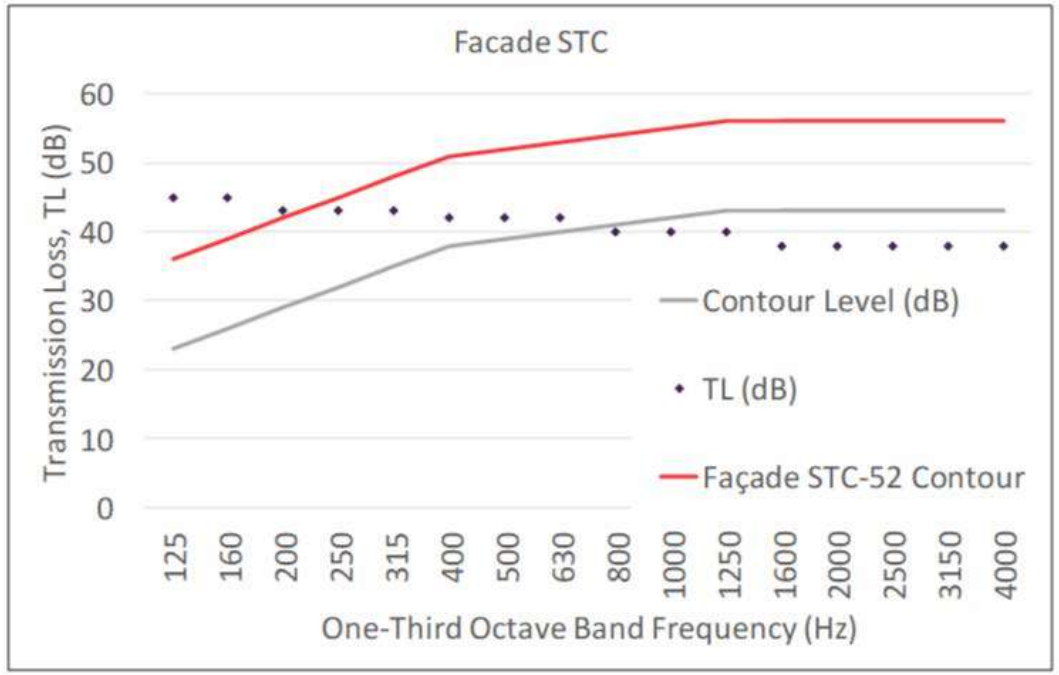
Acoustics| Patient Room

Source Room	Private PICU Room (473)
Source Room Floor Area	298
Receiver Room	Private PICU Room (472)
Receiver Room Floor Area	304
Common Partition Area	126.5
Receiver Room/Partition Area	2.4
Speech Privacy	9
R_R	4
NC	30
Sound Pressure Level	60
R_S	3
Field STC	38
STC Adjustment	8
STC	46

Source Room	Private PICU Room (473)
Source Room Floor Area	298
Receiver Room	Bathroom
Receiver Room Floor Area	53
Common Partition Area	176
Receiver Room/Partition Area	0.3
Speech Privacy	15
R_R	0
NC	30
Sound Pressure Level	60
R_S	3
Field STC	48
STC Adjustment	8
STC	56

Source Room	Private PICU Room (473)
Source Room Floor Area	298
Receiver Room	Corridor
Receiver Room Floor Area	589
Common Partition Area	164
Receiver Room/Partition Area	3.6
Speech Privacy	15
R_R	6
NC	40
Sound Pressure Level	60
R_S	3
Field STC	32
STC Adjustment	8
STC	40

Requirements	PICU to PICU	PICU to Corridor	PICU to Bathroom
Confidential & Worst Case	52	40	56
In Between	49	37	53
Normal	46	34	50
Type	Updated: Wall 6	Original	Updated: Wall 5
Construction		Interior Wall Type A6	1/2" Gypsum
	5/8" Gypsum	5/8" Gypsum	1/2" Gypsum
	3-5/8" Metal Stud	6" Metal Stud	3-5/8" Metal Stud
	3" FG	5/8" Gypsum	1.5" FG
	5/8" Gypsum		1/2" Gypsum
			1/2" Gypsum
STC	49	39	55
Price ($/sqft)	2.72	2.17	4.14



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Lighting/Electrical Appendix| Load Calculations

Electrical Assumptions				
Hospital	PF	Load Factor	VA/ft^2	Total SF
	0.85	55%	14.5	390,000

Estimated Demand Load		
Apparent Power	5655	kVA
Real Power	4807	kW

Essential Electrical System Demand		
Apparent Power	4807	kVA
Real Power	4087	kW

Generator Load - Paralleled With CHP			
		2 Generators	3 Generators
% Load	kVA	86%	57%
	kW	94%	63%

CHP Power Output				
	100%		70%	
	kW	kVA	kW	kVA
C800S	800	1000	560	700
C1000S	1000	1250	700	875
Total	1800	2250	1260	1575

Diesel Fuel Consumption Rate - 2 Generators @ 94% Load Paralleled With CHP

% Load	gph
100%	111.5
94%	105.3
75%	85.7

Fuel Consumption	gph	gpd (24hr)	48 hr	72 hr	96 hr
1 Generator	105.3	2527.4	5054.8	7582.2	10109.6
2 Generators	210.6	5054.8	10109.6	15164.4	20219.1

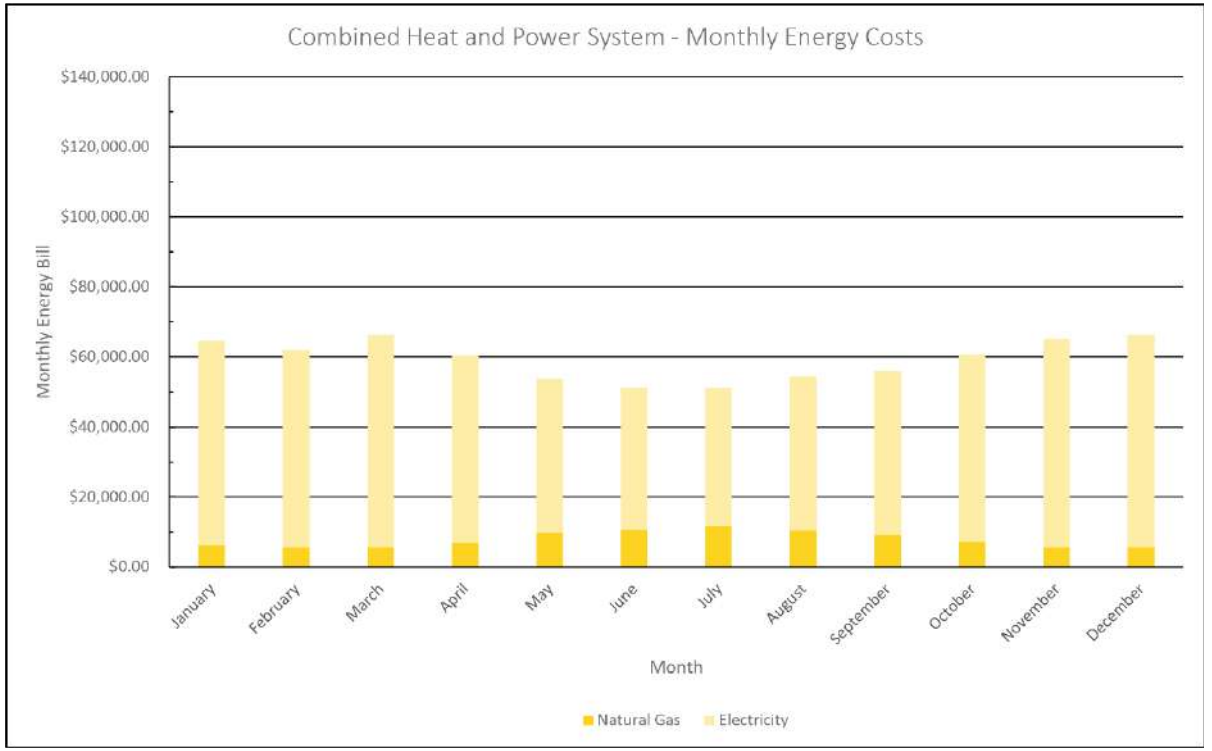
Lighting/Electrical Appendix| CHP System Energy Costs

Omaha Public Power District - Rate Schedule 232

Service Charge	
	Flate Rate
Total Charge	$115.31

Combined Heat and Power - Demand Charge		
	First 1,000 kW	Additional kW
Total Charge	$10,170.00	$30,578.65

Energy Charge Rates		
	First 300 kWh/kW	Remaining kWh
Summer	$0.0550	$0.0504
Winter	$0.0412	$0.0360

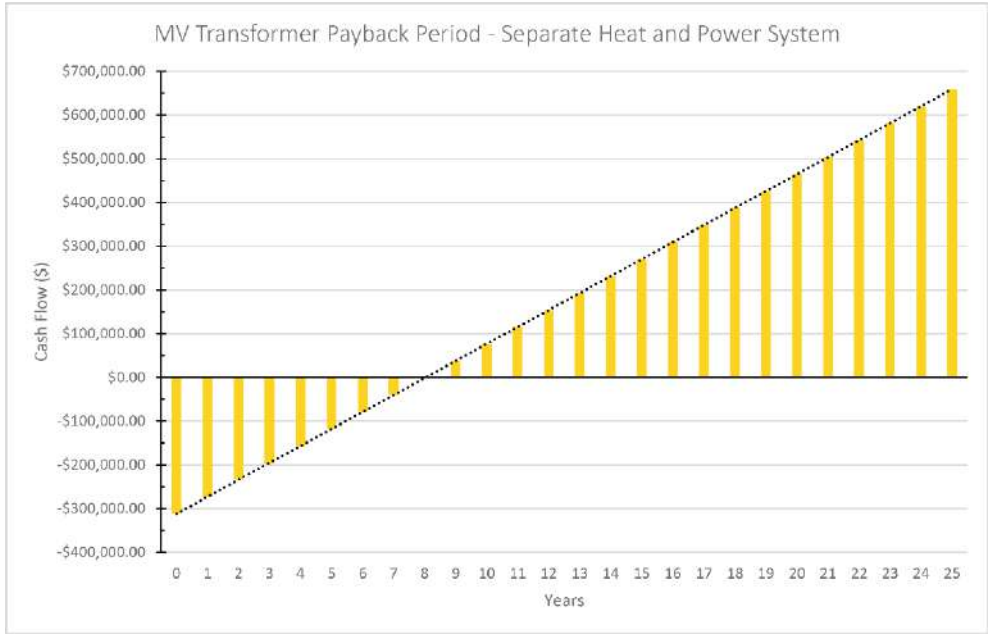


Combined Heat and Power - Energy Charge													
	Winter					Summer				Winter			
	January	February	March	April	May	June	July	August	September	October	November	December	Total
Cooling kWh/month	0.00	0.00	0.00	0.00	50,704.01	79,413.20	118,205.39	74,014.03	46,753.93	3,322.63	0.00	0.00	372,413.20
Hospital kWh/month	1,142,753.42	1,032,164.38	1,142,753.42	1,105,890.41	1,142,753.42	1,105,890.41	1,142,753.42	1,142,753.42	1,105,890.41	1,142,753.42	1,105,890.41	1,142,753.42	13,455,000.00
CHP Production	671,249.12	611,713.92	610,906.12	759,106.89	1,085,476.55	1,166,076.32	1,272,240.00	1,131,519.12	1,016,063.79	799,160.30	609,721.94	612,498.83	10,345,732.91
New kWh/month	471,504.30	420,450.46	531,847.31	346,783.52	107,980.88	19,227.30	0.00	85,248.34	136,580.55	346,915.76	496,168.47	530,254.59	3,492,961.47
Total Charge	$19,425.98	$17,322.56	$21,912.11	$14,287.48	$4,448.81	$1,057.50	$0.00	$4,688.66	$7,511.93	$14,292.93	$20,442.14	$21,846.49	$147,236.59

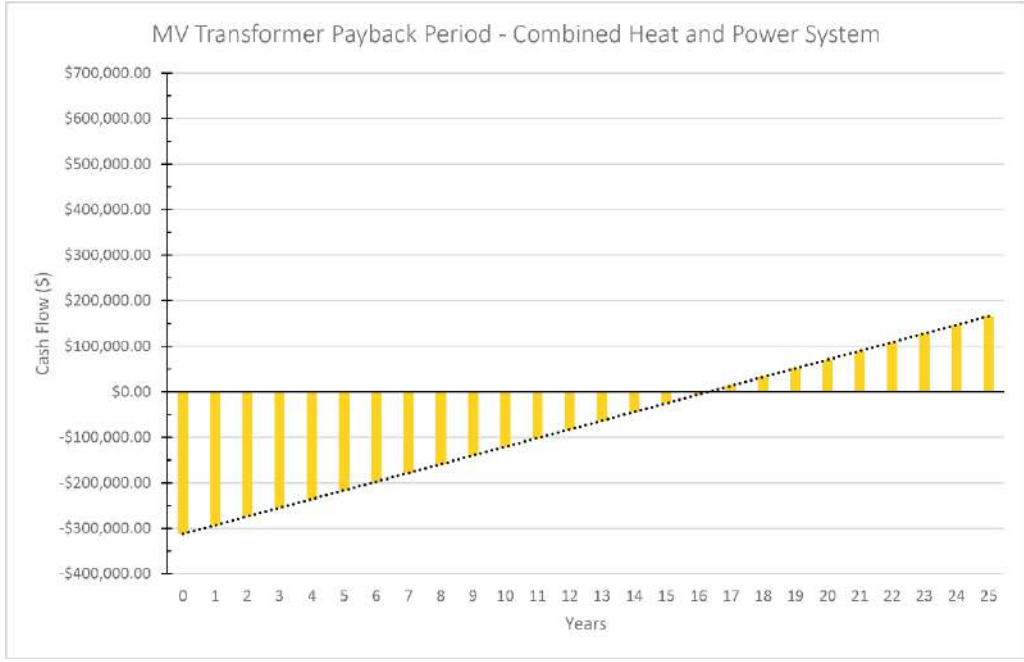
Combined Heat and Power - Total Energy Bill/Month													
	January	February	March	April	May	June	July	August	September	October	November	December	Total
Elec Bill/Month	$60,289.93	$58,186.52	$62,776.07	$55,151.44	$45,312.77	$41,921.46	$40,863.96	$45,552.62	$48,375.89	$55,156.89	$61,306.10	$62,710.45	**$637,604.08**
Elec With Primary Service Discount	$58,481.24	$56,440.92	$60,892.78	$53,496.90	$43,953.39	$40,663.82	$39,638.04	$44,186.04	$46,924.61	$53,502.18	$59,466.92	$60,829.13	**$618,475.96**
Fuel Bill	$6,099.85	$5,558.84	$5,551.50	$6,898.24	$9,864.07	$10,596.50	$11,561.24	$10,282.47	$9,233.29	$7,262.22	$5,540.73	$5,565.97	**$94,014.91**
Total Energy Cost	$64,581.09	$61,999.76	$66,444.28	$60,395.14	$53,817.45	$51,260.32	$51,199.28	$54,468.51	$56,157.90	$60,764.40	$65,007.65	$66,395.10	**$712,490.87**

Lighting/Electrical Appendix| CHP and MV TX Payback

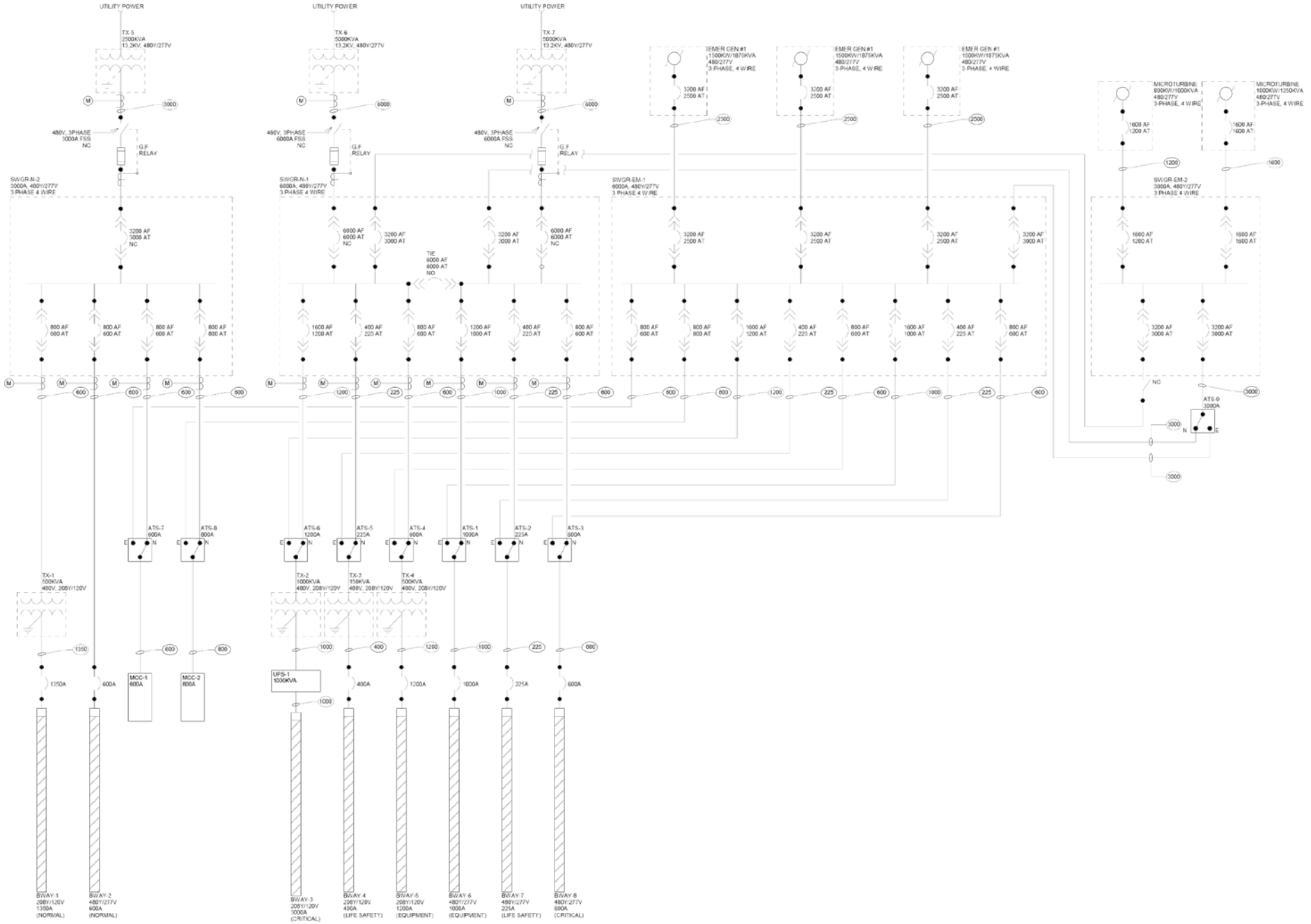
MV Transformers Life-Cycle: Separate Heat and Power System	
Estimated Annual Elec Bill	$1,294,848.65
With 3% Discount	$1,256,003.19
Difference	$38,845.46
Transformer Investment	$312,125.00
Payback Period (years)	8.0
Average Lifetime (years)	25
Profitable Life (years)	17.0
Total Profit	$659,011.48



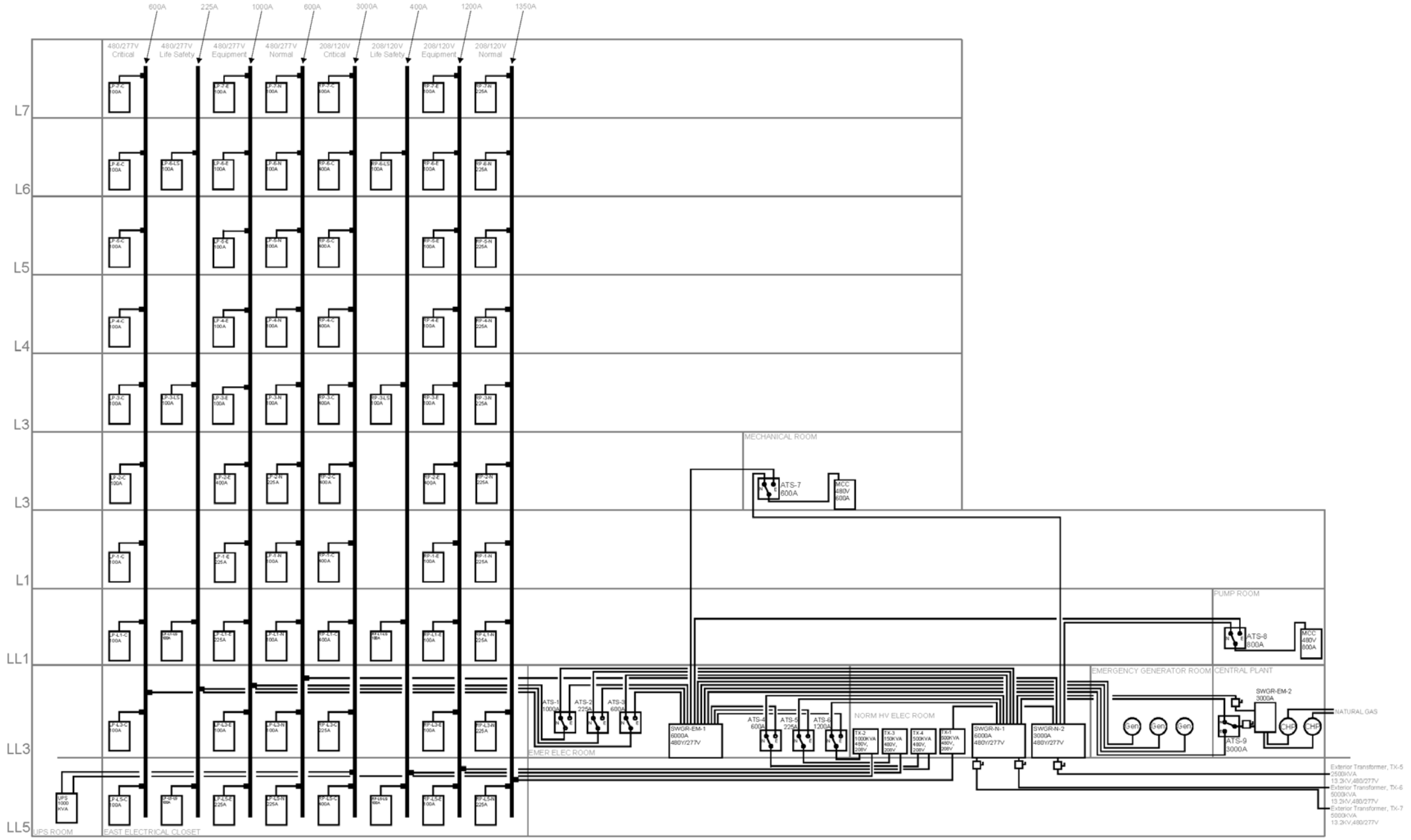
MV Transformers Life-Cycle: Combined Heat and Power System	
Estimated Annual Elec Bill	$637,604.08
With 3% Discount	$618,475.96
Difference	$19,128.12
Transformer Investment	$312,125.00
Payback Period (years)	16.3
Average Lifetime (years)	25
Profitable Life (years)	8.7
Total Profit	$166,078.06



Lighting/Electrical Appendix| Riser Diagram



Lighting/Electrical Appendix| Riser Diagram



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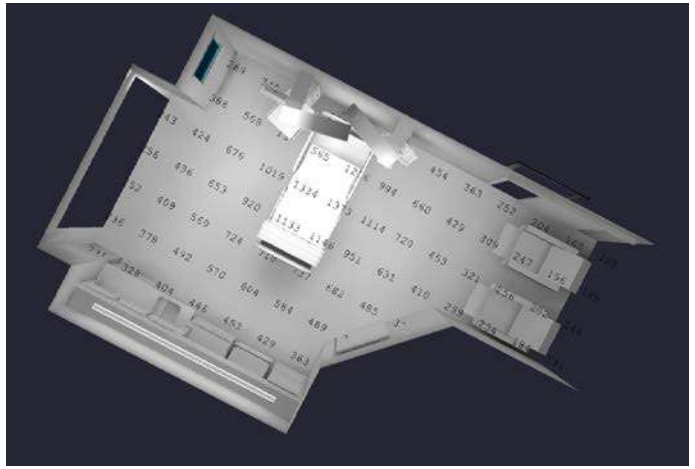
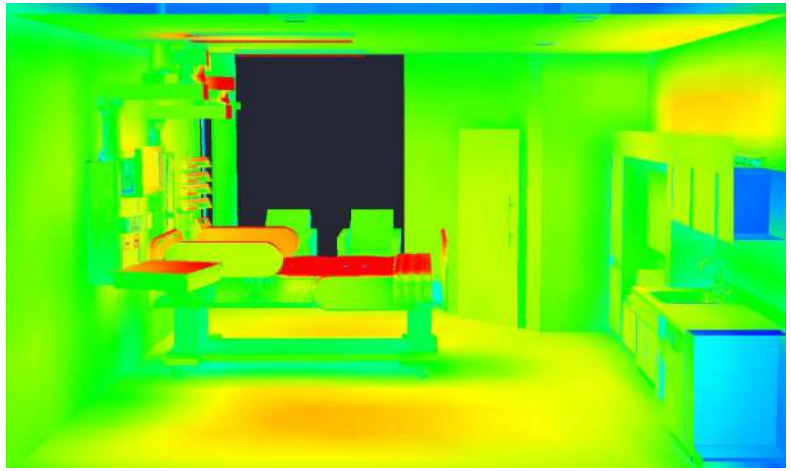
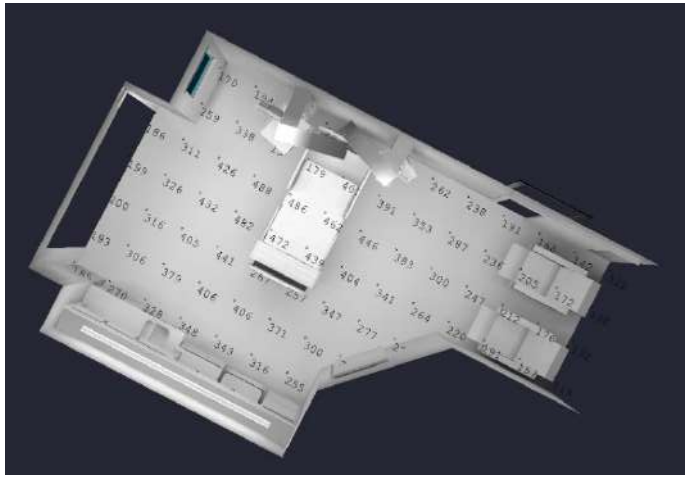
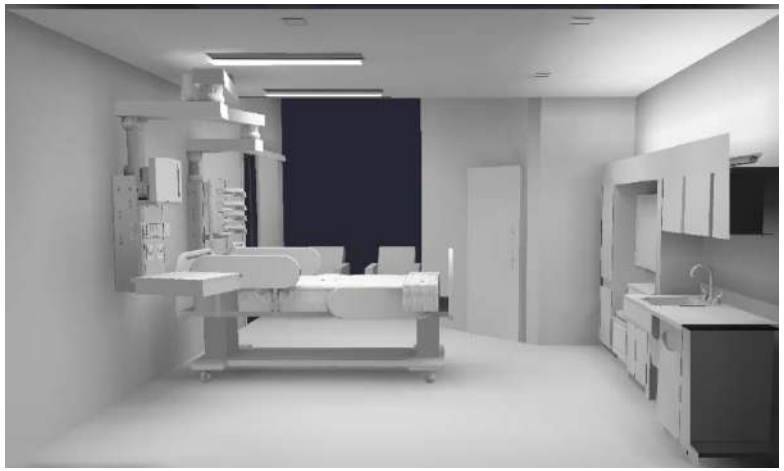
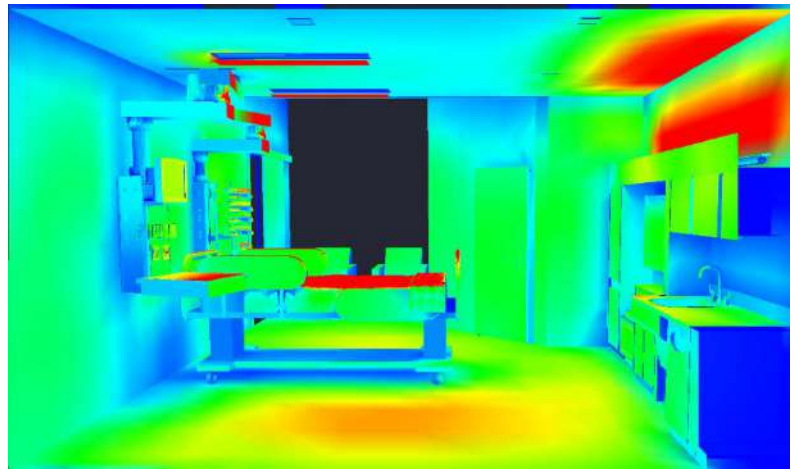
Illuminance Lighting Design Criteria			
Space	Zone	Task	Recommended Average (lux)
PICU Patient Room	Family	Casual Chair	150
	Patient (Intensive Care)	General	300 (150)
		Examination	1000
		Nightlight	2
Team Center	Work Station	Day	500
		Night	300
Corridor	General Circulation	Day	100
		Night	50
	Work Station	Day	500
		Night	300
Family Waiting	General Circulation	Day	200
		Night	100

Lighting Power Density (LPD) Design Criteria	
Space	Recommended (W/ft^2)
Patient Room	0.62
Team Center	0.87
Corridor	0.89
Family Center	1.07

Lighting/Electrical Appendix| Illuminance Results

Calculation Results															
Space	Task	# of Calculation Points	Calculation Point Spacing (ft)	Boundary Offset (ft)	Fixture			Horizontal Illuminance					LPD	Requirement Check	
					Fixture Type	Fixture Count	LLF	Average (lux)	Minimum (lux)	Maximum (lux)	Max/Min Ratio	Coefficient of Variation		Horizontal Illuminance	LPD
PICU Patient Room	Examination	27	1	-	G	2	.85	1048	766	1287	1.68	0.15	0.905	PASS	FAIL
					D	5	.85								
PICU Patient Room	General	288	1	-	G	2	.85	278	103	462	4.49	0.32	0.646	PASS	FAIL
					D	5	.85								
Family Waiting Area	General (Day)	63	2	0.25	B	8	.85	339	176	461	2.6	0.2	0.66	PASS	PASS
Team Center	Work Station (Day)	120	2	0.25	J	4	0.85	576	198	912	4.6	0.33	0.8	PASS	PASS
					B	12	0.85								
Team Center	Work Station (Night)	120	2	0	J	4	0.1	301	78	420	5.4	0.29	0.8	PASS	PASS
					B	12	0.72								
Corridor	General (Day)	296	2	0.25	A	127’	0.85	52	12	101	8.8	0.33	0.40	PASS	PASS
					C	4	0.85								

Lighting/Electrical Appendix| Patient Room Illuminance

	Calculation Points	Grayscale Rendering	Pseudocolor Rendering
Examination		 	 
Ambient			

Construction Appendix | Cost

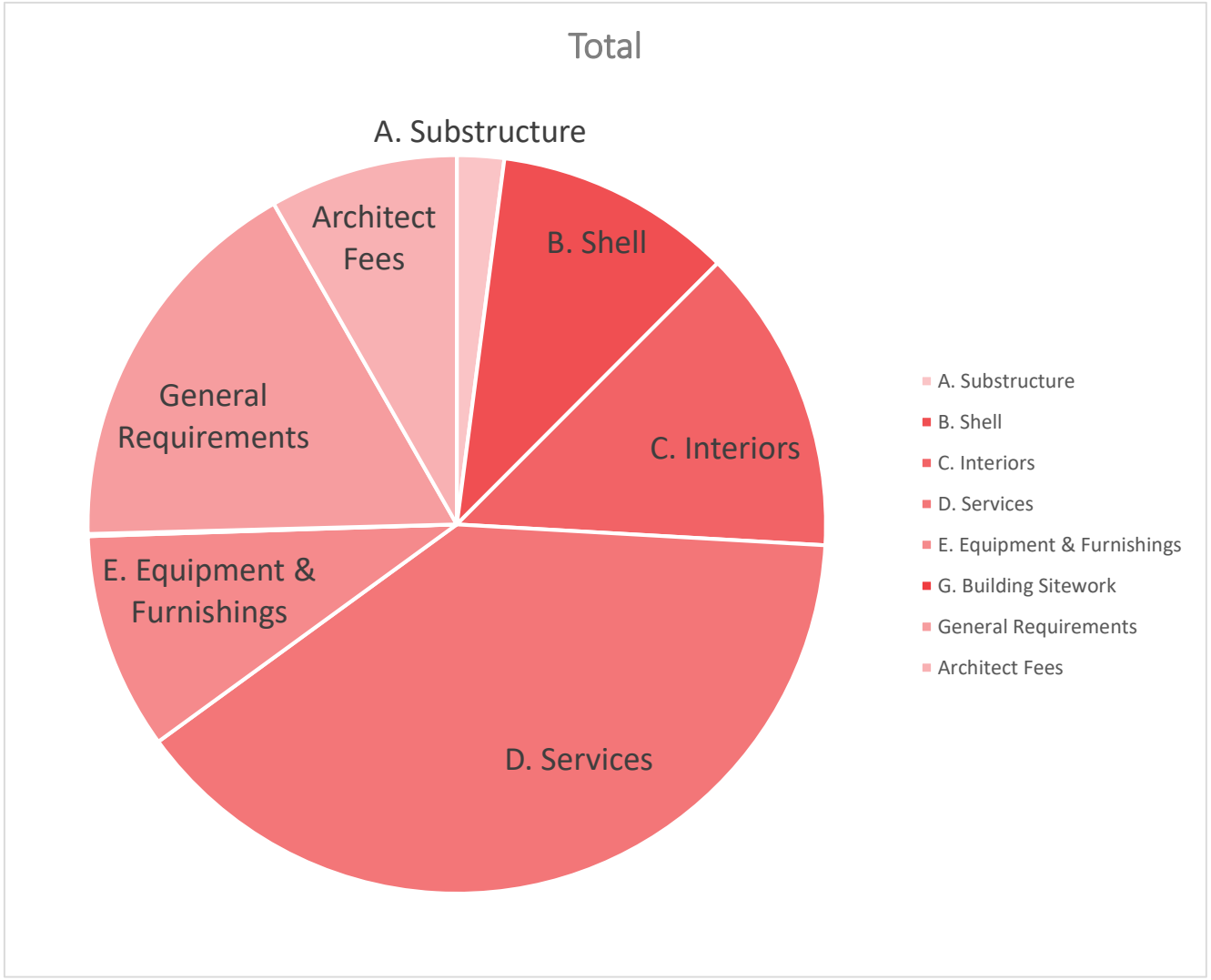
	Source	Cost Per S.F.	% Of Sub-Total	Total Amount	Total Amount	
A. Substructure						
1010	Proposed, RSMeans, 03 31 13.70 Placing Concrete, 03 31 13.35 Heavyweight Concrete	$ 0.41	3%	$ 160,869.22	$ 5,988,245.91	
1020	Auger Cast-in-Place Piles with Pile Caps	$ 13.68		$ 5,333,872.50		
1030	RSMeans, 30 30 53.40 Concrete In Place (Bldg Construction Costs, p. 76)	$ 0.62		$ 241,500.00		
2010	Proposed, Basement Excavation	$ 0.65		$ 252,004.19		
2020	N/A	$ -				
B. Shell						
B10 Superstructure						
1010	RSMeans, B1010 254 W Shape, Composite Deck, & Slab & B101 208 Steel Columns (As	$ 43.80	9%	$ 17,082,544.64	$ 19,179,732.04	
1020	RSMeans, B1010 254 W Shape, Composite Deck, & Slab & B101 208 Steel Columns (As	$ 5.38		$ 2,097,187.40		
B20 Exterior Enclosure						
2010	B2010 146 Metal Siding Panel (22 ga)	$ 6.71	5%	$ 2,617,888.80	$ 10,036,151.80	
2020	RSMeans, 08 44 13.10 Glazed Curtain Walls (Facilities Construction Costs, p. 318) (Bas	$ 18.89		$ 7,368,423.00		
2030	Exterior Doors C1020	$ 0.13		$ 49,840.00		
B30 Roofing						
3010	Single ply membrane, stone ballast	**$ 2.62**	0%	$ 1,021,800.00	$ 1,064,700.00	
3020	Roof hatches	$ 0.11		$ 42,900.00		
C. Interiors						
1010	Interior Partitions	$ 3.66	13%	$ 1,427,348.94	$ 28,954,122.94	
1020	Interior Doors (C1020)	$ 5.42		$ 2,112,624.00		
1030	Hospital curtains	$ 3.44		$ 1,341,600.00		
2010	Stair Construction (C2010)	$ 1.86		$ 727,150.00		+$10M allowance
3010	65% Paint, 35% ceramic wall tile	$ 20.14		$ 7,854,600.00		
3020	60% vinyl tile, 20% ceramic, 20% terrazzo	$ 23.90		$ 9,321,000.00		
3030	Acoustic ceiling tiles on suspended channel grid	$ 15.82		$ 6,169,800.00		

Construction Appendix | Cost

D. Services						
D10 Conveying						
1010	RSMeans D1010 Elevators & Lefts (Assemblies)	$ 11.52	2%	$ 4,494,405.00	$ 4,494,405.00	
1020	N/A	$ -		$ -		
D20 Plumbing						
2010	Medical, patient & specialty, supply and drainage	$ 19.59	10%	$ 7,639,229.87	$ 21,968,249.12	
2020	Electric water heater	$ 33.30		$ 12,987,000.00		
2040	Rain water collection system	$ 3.44		$ 1,342,019.25		
D30 HVAC						
3010	Fin Tube Radiation	$ 5.65	23%	$ 2,203,155.00	$ 49,929,805.00	
3020	Microturbines & Supplemental Boiler	$ 14.10		$ 5,500,000.00		
3030	Chillers & Cooling Towers	$ 2.54		$ 991,950.00		
3050	N/A	$ -		$ -		
3090	Hot water boilers, ductwork, VAV terminals, ventilation system	$ 105.73		$ 41,234,700.00		
D40 Fire Protection						
4010	Wet pipe sprinkler system	$ 8.30	2%	$ 3,237,000.00	$ 3,829,800.00	
4020	Standpipe	$ 1.52		$ 592,800.00		
D50 Electrical						
5010	MV Transformers, Switchgears, Busduct	$ 3.50	15%	$ 1,363,768.43	$ 33,293,961.69	
5020	Allowance	$ 71.79		$ 28,000,000.00		
5030	Addressable alarms, emergency lighting, internet and phone wiring	$ 6.88		$ 2,684,404.26		
5090	Generator, Auto Transfer Switch	$ 3.19		$ 1,245,789.00		
E. Equipment & Furnishings						
1010	N/A	$ -	13%	$ -	$ 27,600,000.00	
1020	N/A	$ 61.02		$ 23,799,268.03		
1030	N/A	$ -		$ -		
2020	N/A	$ 8.83		$ 3,444,768.67		
F. Special Construction						
1020	N/A	$ -	0%	$ -	$ -	
1040	N/A	$ -		$ -		
G. Building Sitework						
	Green Roof	$ 0.73	0%	$ 286,000.00	$ 286,000.00	

Construction Appendix | Cost

Sub-Total	$ 216,625,173.50			$ 216,625,173.50
Contractor Fees (Contingency: 6%, General Cond.: 6%, Overhead: 4%, Profit: 7%)	$ 49,823,789.91			
Architect Fees (9%)	$ 23,980,406.71			
Total Building Cost	$ 290,429,370.11			



Construction Appendix | Façade Costs

	Total	Area of Glazing	Area of Metal Panels	Total Area of Finishes	Cost/SF of Finishes	Cost Increase	
Option 1: (E) Average, single glazed (I) Average, double glazed, 22 g insulated metal panel	$ 9,521,991.40	56,530	64,290	120,820	$ 78.81	$ 464,320.40	5%
Option 2: (E) Average, double glazed (I) Average, double glazed, 22 g insulated metal panel	$ 9,986,311.80	56,530	64,290	120,820	$ 82.65	$ 5,713,816.80	57%
Option 3: (E) Average, double glazed (I) FEMA Rated glazing, 22 g insulated metal panel	$ 15,700,128.60	56,530	64,290	120,820	$ 129.95		

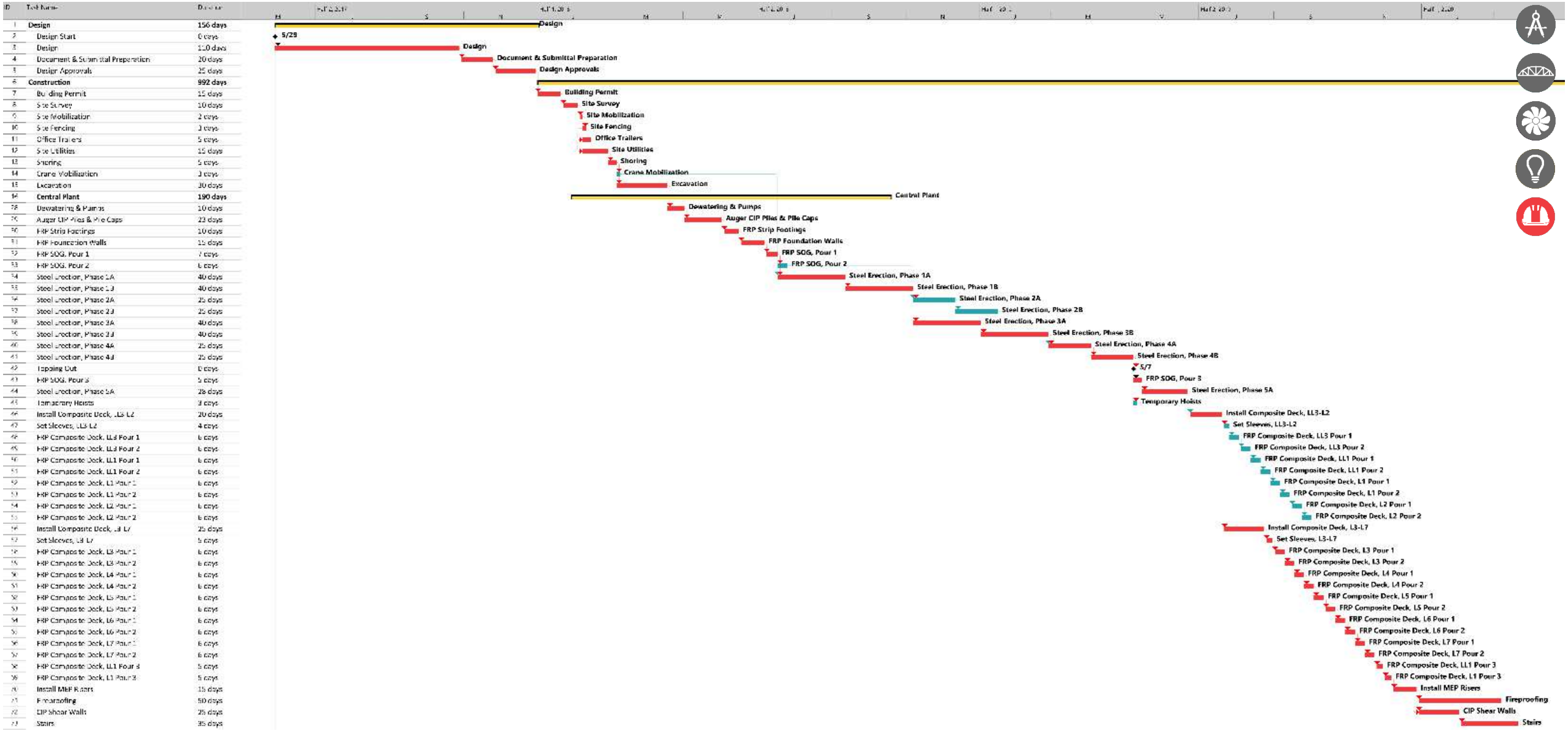
Auger Cast-in-Place Piles	Daily Output	Unit	Material	Total	Count	Depth	Depth (V.L.F.)	Total
18" diameter, 0.065 C.Y./L.F.	900	V.L.F.	$ 100.00	$ 100.00	406	81	32886	$ 3,288,600.00
					128	103	13184	$ 1,318,400.00
							Total	$ 4,607,000.00

	A1010 250 Pile Caps, RSMeans Assemblies Costs (p. 7)									
						Cost Each				
	No. Piles	Size (ft-in x ft-in x in)	Pile Capacity (ton)	Column Size (in)	Column Load (k)	Mat.	Inst.	Total	Count	Total
6600	14	11-6x10-9x55	80	29	2155	$3,425.00	$2,375.00	$5,800.00	60	$348,000.00
7000	18	13-0x11-6x56	80	33	2776	$4,375.00	$2,925.00	$7,300.00	29	$211,700.00
7150	20	14-6x11-6x52	40	24	1491	$4,698.75	$2,900.00	$7,598.75	22	$167,172.50
										$726,872.50

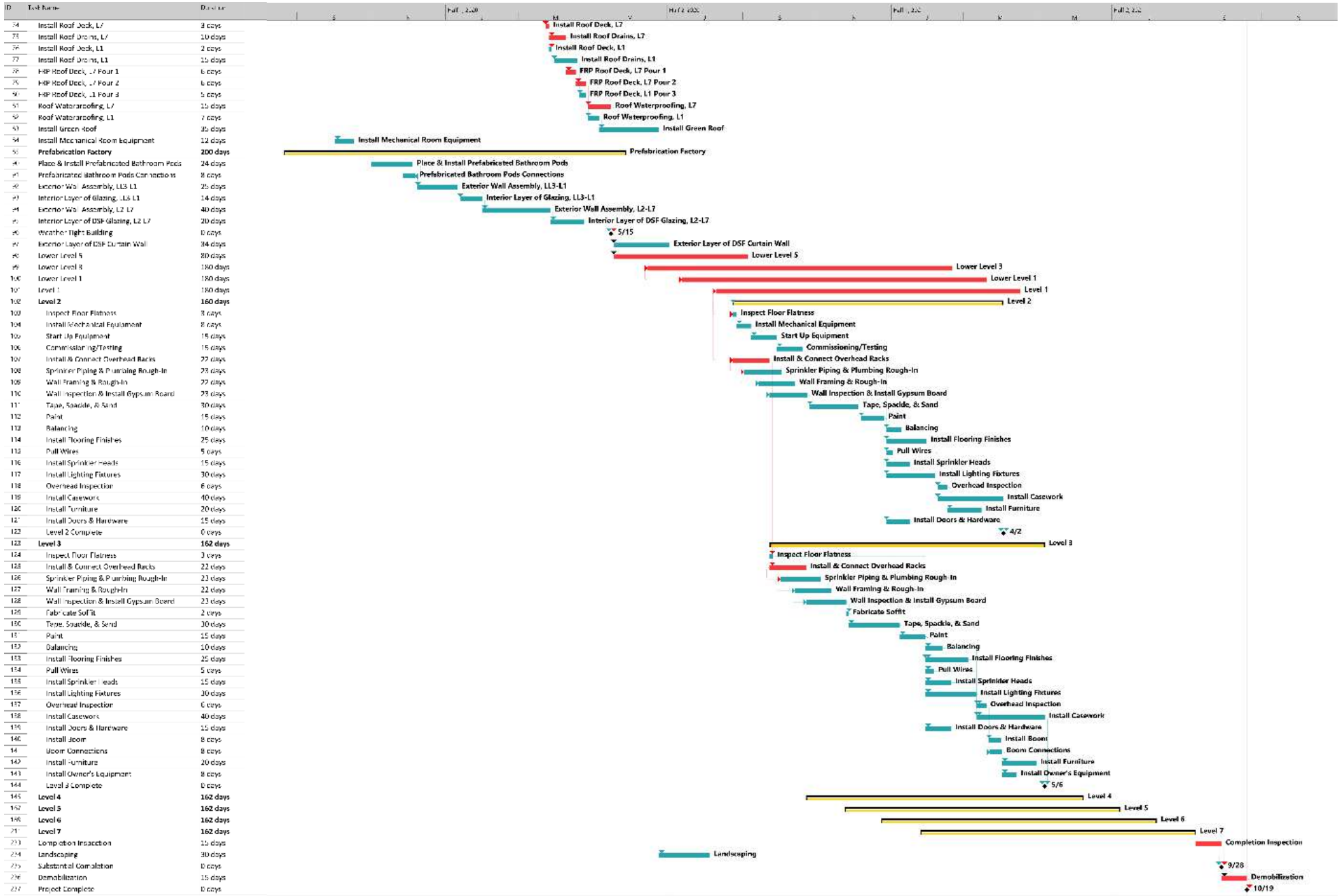
Total w/ Pile Caps	$ 5,333,872.50

31 63 26.13 Fixed End Caisson Piles (Bldg Construction Costs p. 645)												
	Open style, machine drilled, to 50' deep, in soft rocks and medium hard shales,	Crew	Daily Output	Labor Hours	Unit	Material	Labor	Equipment	Total	Count	Depth	Depth (V.L.F.)	Total
2700	36" diameter, 0.262 C.Y./L.F.	B-49	15	5.867	V.L.F.	$ 37.00	$ 275.00	$ 239.00	$ 551.00	16	85	1360	$ 749,360.00
										39	107	4173	$ 2,299,323.00
3000	72" diameter, 1.05 C.Y./L.F.	B-49	6	14.667	V.L.F.	$ 149.00	$ 690.00	$ 600.00	$ 1,439.00	28	85	2380	$ 3,424,820.00
										8	107	856	$ 1,231,784.00
												Total	$ 7,705,287.00
3900	For 50' to 100' deep, add				V.L.F.				7%			Total	$ 8,244,657.09

Construction Appendix | Schedule



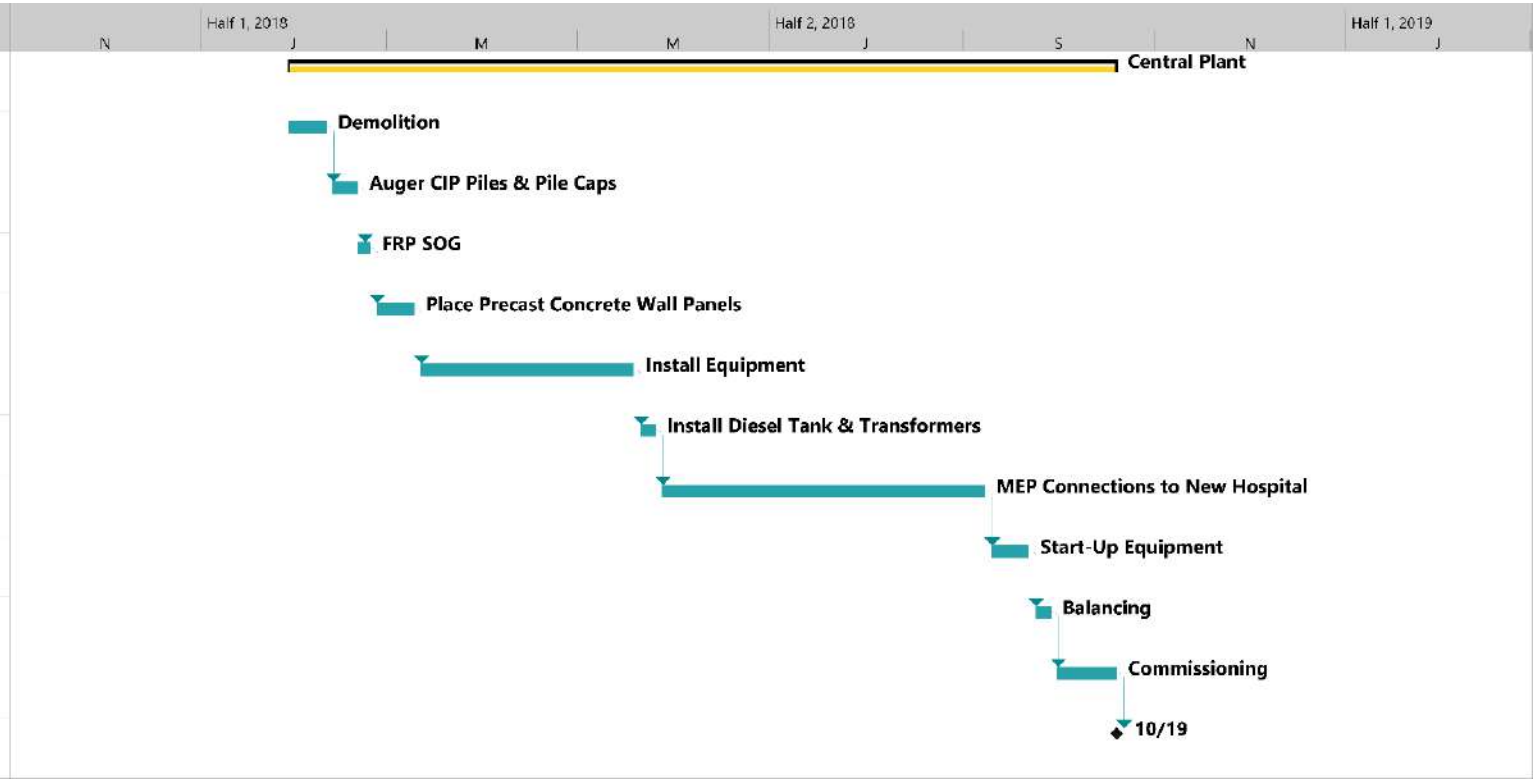
Construction Appendix | Schedule



ID	Task Name	Duration
74	Install Roof Deck, L7	3 days
75	Install Roof Drains, L7	10 days
76	Install Roof Deck, L1	2 days
77	Install Roof Drains, L1	15 days
78	FRP Roof Deck, L7 Pour 1	6 days
79	FRP Roof Deck, L7 Pour 2	6 days
80	FRP Roof Deck, L1 Pour 3	5 days
81	Roof Waterproofing, L7	15 days
82	Roof Waterproofing, L1	7 days
83	Install Green Roof	25 days
84	Install Mechanical Room Equipment	12 days
85	**Prefabrication Factory**	**200 days**
86	Place & Install Prefabricated Bathroom Pods	24 days
87	Prefabricated Bathroom Pods Connections	8 days
88	Exterior Wall Assembly, LL3-L1	25 days
89	Interior Layer of Glazing, LL3-L1	14 days
90	Exterior Wall Assembly, L2-L7	40 days
91	Interior Layer of DSF Glazing, L2-L7	20 days
92	Weather Tight Building	0 days
93	Exterior Layer of DSF Curtain Wall	84 days
94	Lower Level 5	20 days
95	Lower Level 3	180 days
96	Lower Level 1	180 days
97	Level 1	180 days
102	**Level 2**	**160 days**
103	Inspect Floor Flatness	3 days
104	Install Mechanical Equipment	8 days
105	Start Up Equipment	15 days
106	Commissioning/Testing	15 days
107	Install & Connect Overhead Racks	22 days
108	Sprinkler Piping & Plumbing Rough-In	23 days
109	Wall Framing & Rough-In	22 days
110	Wall Inspection & Install Gypsum Board	23 days
111	Tape, Spackle, & Sand	30 days
112	Paint	15 days
113	Balancing	10 days
114	Install Flooring Finishes	25 days
115	Pull Wires	5 days
116	Install Sprinkler Heads	15 days
117	Install Lighting Fixtures	30 days
118	Overhead Inspection	6 days
119	Install Casework	40 days
120	Install Furniture	20 days
121	Install Doors & Hardware	15 days
122	Level 2 Complete	0 days
123	**Level 3**	**162 days**
124	Inspect Floor Flatness	3 days
125	Install & Connect Overhead Racks	22 days
126	Sprinkler Piping & Plumbing Rough-In	23 days
127	Wall Framing & Rough-In	22 days
128	Wall Inspection & Install Gypsum Board	23 days
129	Fabricate Soffit	2 days
130	Tape, Spackle, & Sand	30 days
131	Paint	15 days
132	Balancing	10 days
133	Install Flooring Finishes	25 days
134	Pull Wires	5 days
135	Install Sprinkler Heads	15 days
136	Install Lighting Fixtures	30 days
137	Overhead Inspection	0 days
138	Install Casework	40 days
139	Install Doors & Hardware	15 days
140	Install Boom	8 days
141	Boom Connections	8 days
142	Install Furniture	20 days
143	Install Owner's Equipment	8 days
144	Level 3 Complete	0 days
145	**Level 4**	**162 days**
167	**Level 5**	**162 days**
189	**Level 6**	**162 days**
211	**Level 7**	**162 days**
233	Completion Inspection	15 days
234	Landscaping	30 days
235	Substantial Completion	0 days
236	Demobilization	15 days
237	Project Complete	0 days

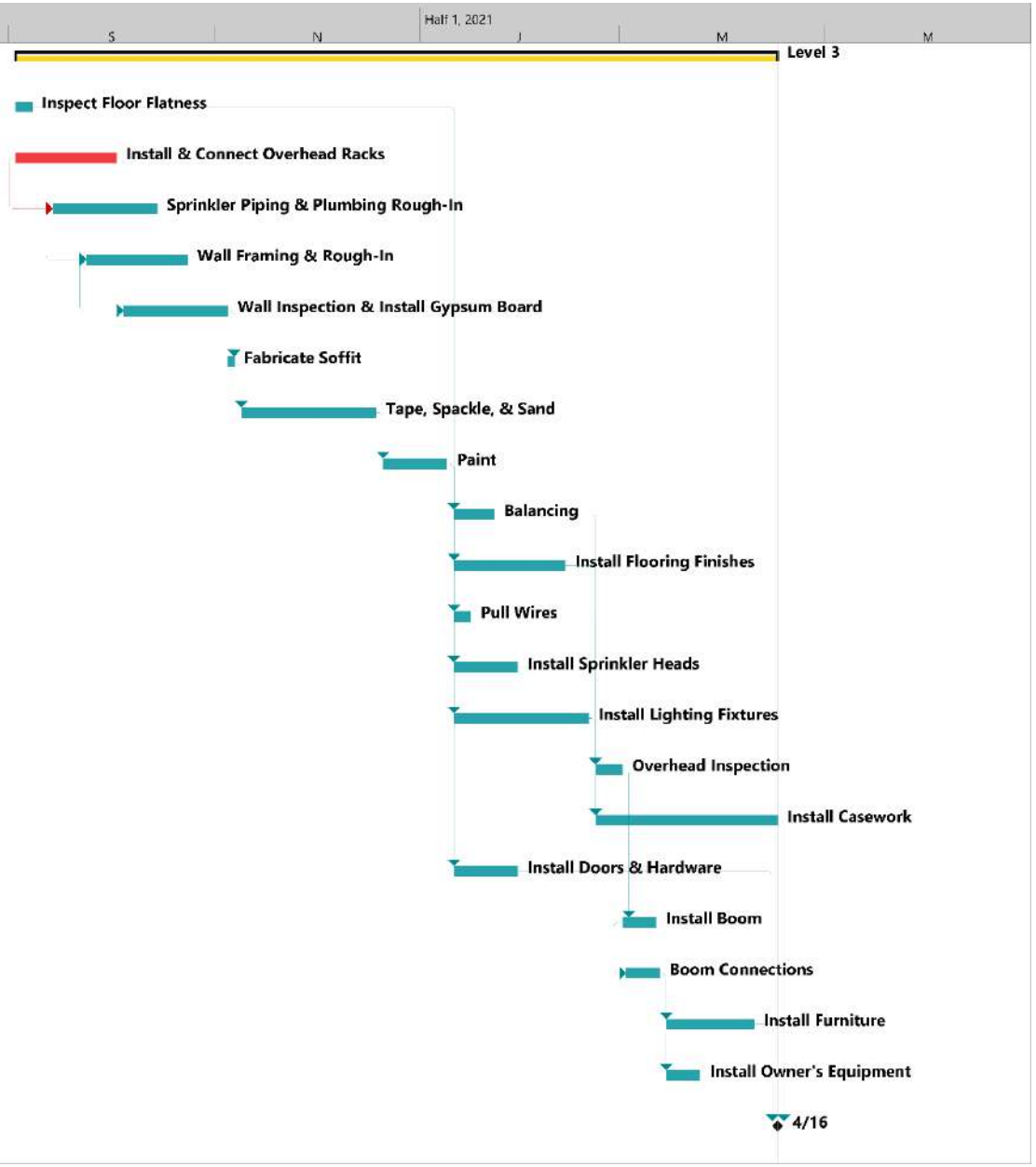
Construction Appendix | Schedule

ID	Task Name	Duration	Start	Finish
1	**Central Plant**	**190 days**	**Mon 1/29/18**	**Fri 10/19/18**
2	Demolition	10 days	Mon 1/29/18	Fri 2/9/18
3	Auger CIP Piles & Pile Caps	6 days	Mon 2/12/18	Mon 2/19/18
4	FRP SOG	4 days	Tue 2/20/18	Fri 2/23/18
5	Place Precast Concrete Wall Panels	10 days	Mon 2/26/18	Fri 3/9/18
6	Install Equipment	50 days	Mon 3/12/18	Fri 5/18/18
7	Install Diesel Tank & Transformers	5 days	Mon 5/21/18	Fri 5/25/18
8	MEP Connections to New Hospital	75 days	Mon 5/28/18	Fri 9/7/18
9	Start-Up Equipment	10 days	Mon 9/10/18	Fri 9/21/18
10	Balancing	5 days	Mon 9/24/18	Fri 9/28/18
11	Commissioning	15 days	Mon 10/1/18	Fri 10/19/18
12	Central Plant Operational	0 days	Fri 10/19/18	Fri 10/19/18



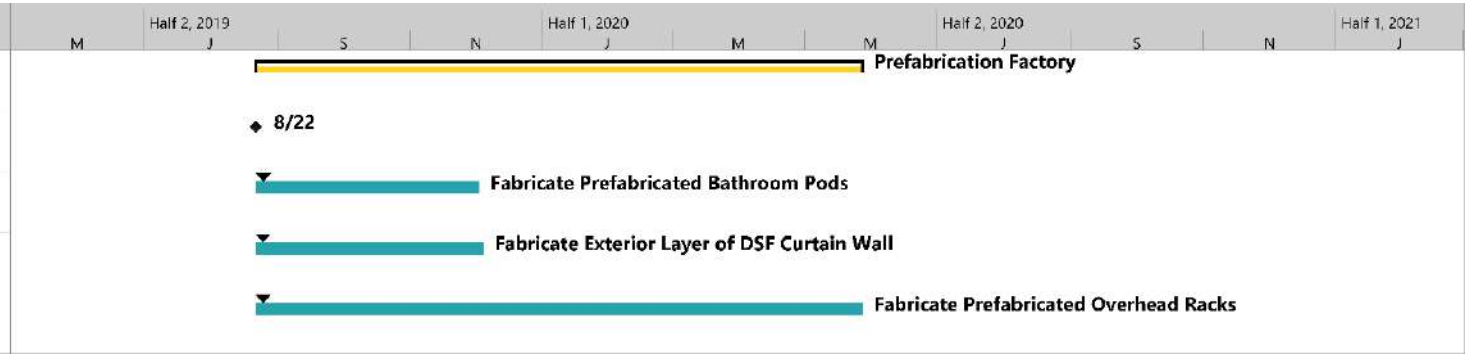
Construction Appendix | Schedule

ID	Task Name	Duration	Start	Finish
1	**Level 3**	**162 days**	**Thu 9/3/20**	**Fri 4/16/21**
2	Inspect Floor Flatness	3 days	Thu 9/3/20	Mon 9/7/20
3	Install & Connect Overhead Racks	22 days	Thu 9/3/20	Fri 10/2/20
4	Sprinkler Piping & Plumbing Rough-In	23 days	Mon 9/14/20	Wed 10/14/20
5	Wall Framing & Rough-In	22 days	Thu 9/24/20	Fri 10/23/20
6	Wall Inspection & Install Gypsum Board	23 days	Mon 10/5/20	Wed 11/4/20
7	Fabricate Soffit	2 days	Thu 11/5/20	Fri 11/6/20
8	Tape, Spackle, & Sand	30 days	Mon 11/9/20	Fri 12/18/20
9	Paint	15 days	Mon 12/21/20	Fri 1/8/21
10	Balancing	10 days	Mon 1/11/21	Fri 1/22/21
11	Install Flooring Finishes	25 days	Mon 1/11/21	Fri 2/12/21
12	Pull Wires	5 days	Mon 1/11/21	Fri 1/15/21
13	Install Sprinkler Heads	15 days	Mon 1/11/21	Fri 1/29/21
14	Install Lighting Fixtures	30 days	Mon 1/11/21	Fri 2/19/21
15	Overhead Inspection	6 days	Mon 2/22/21	Mon 3/1/21
16	Install Casework	40 days	Mon 2/22/21	Fri 4/16/21
17	Install Doors & Hardware	15 days	Mon 1/11/21	Fri 1/29/21
18	Install Boom	8 days	Tue 3/2/21	Thu 3/11/21
19	Boom Connections	8 days	Wed 3/3/21	Fri 3/12/21
20	Install Furniture	20 days	Mon 3/15/21	Fri 4/9/21
21	Install Owner's Equipment	8 days	Mon 3/15/21	Wed 3/24/21
22	Level 3 Complete	0 days	Fri 4/16/21	Fri 4/16/21



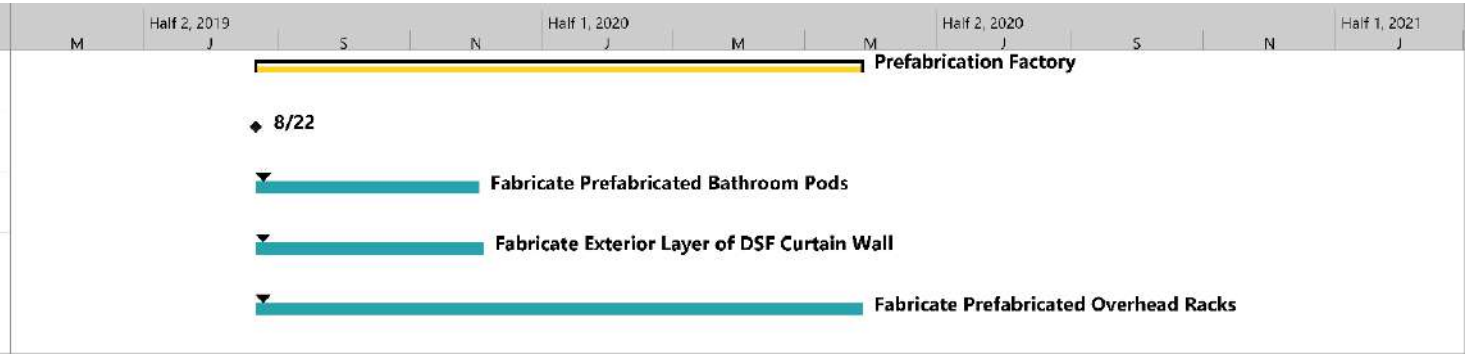
Construction Appendix | Schedule

ID	Task Name	Duration	Start	Finish
1	**Prefabrication Factory**	**200 days**	**Thu 8/22/19**	**Wed 5/27/20**
2	Prefabrication Factory Start-Up	0 days	Thu 8/22/19	Thu 8/22/19
3	Fabricate Prefabricated Bathroom Pods	73 days	Thu 8/22/19	Mon 12/2/19
4	Fabricate Exterior Layer of DSF Curtain Wall	75 days	Thu 8/22/19	Wed 12/4/19
5	Fabricate Prefabricated Overhead Racks	200 days	Thu 8/22/19	Wed 5/27/20

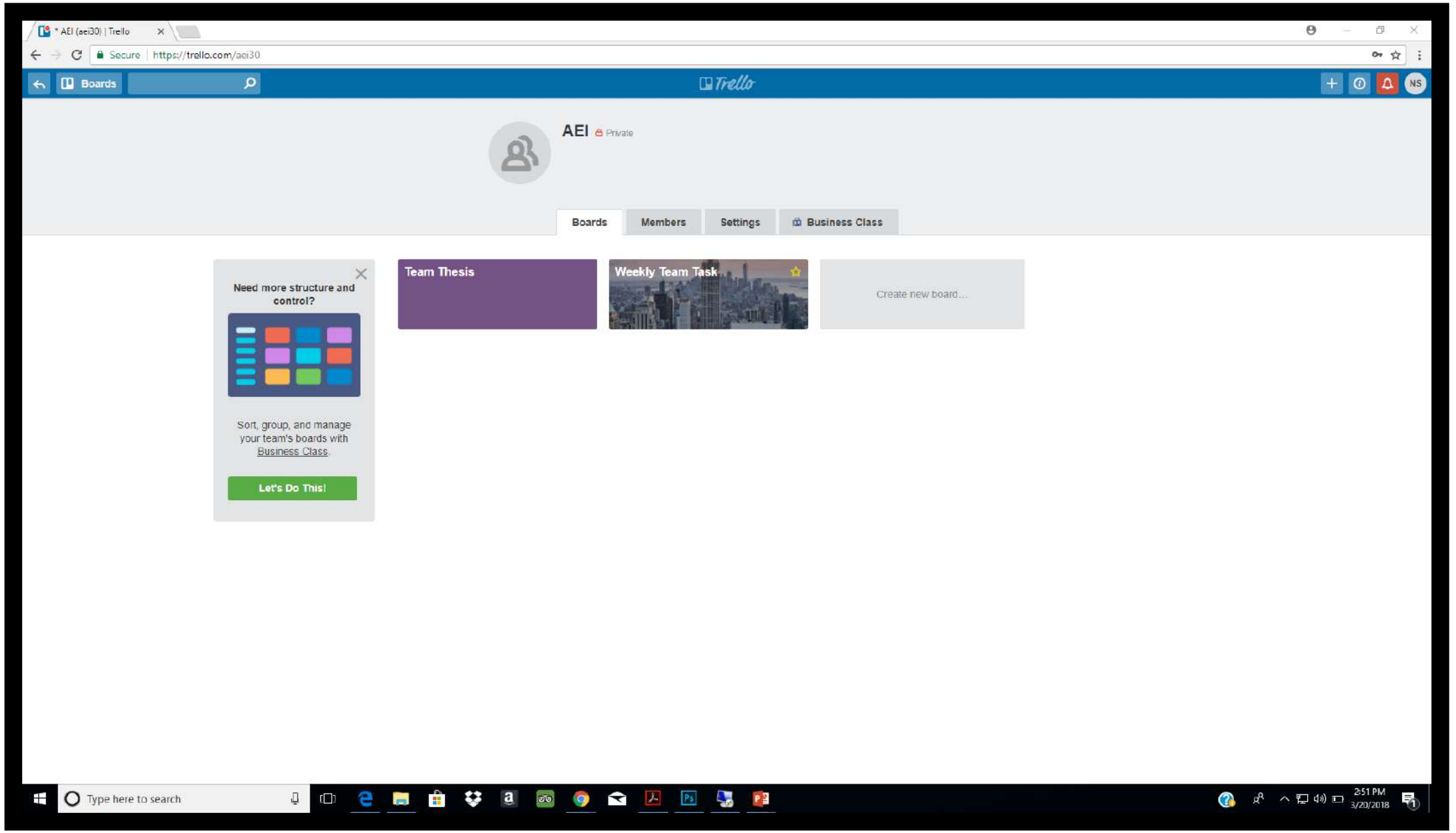


Construction Appendix | Schedule

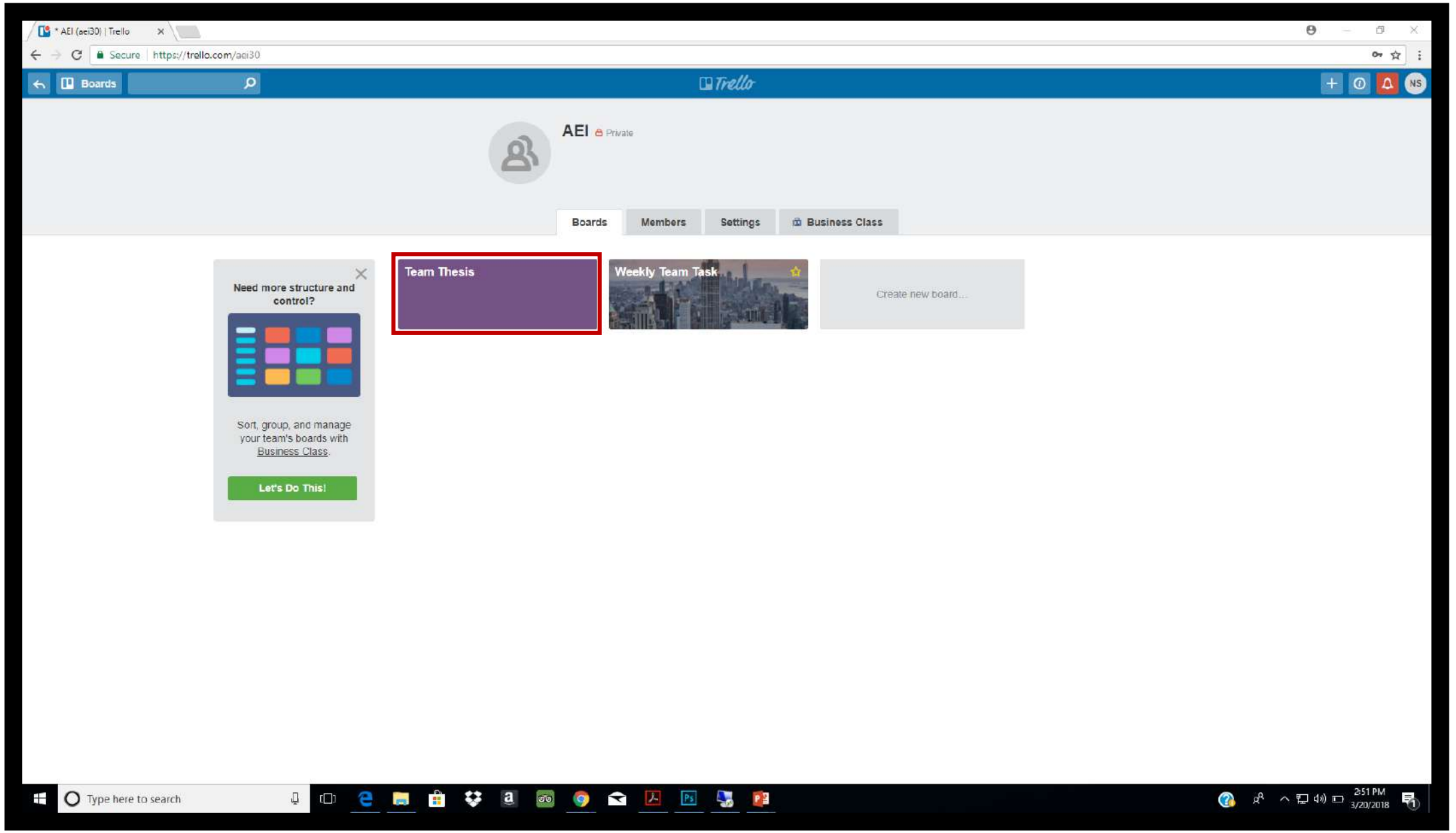
ID	Task Name	Duration	Start	Finish
1	**Prefabrication Factory**	**200 days**	**Thu 8/22/19**	**Wed 5/27/20**
2	Prefabrication Factory Start-Up	0 days	Thu 8/22/19	Thu 8/22/19
3	Fabricate Prefabricated Bathroom Pods	73 days	Thu 8/22/19	Mon 12/2/19
4	Fabricate Exterior Layer of DSF Curtain Wall	75 days	Thu 8/22/19	Wed 12/4/19
5	Fabricate Prefabricated Overhead Racks	200 days	Thu 8/22/19	Wed 5/27/20



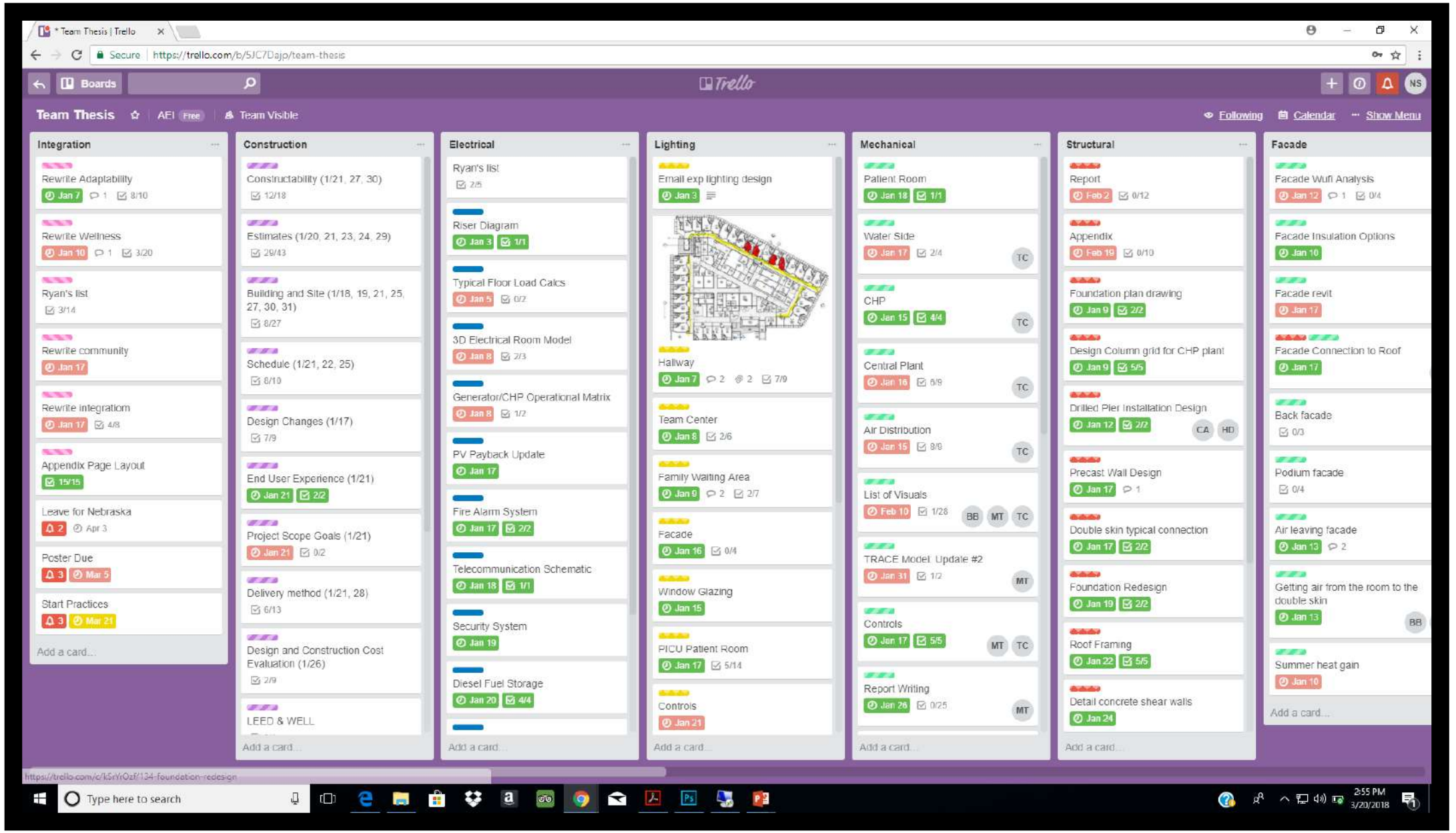
Workflow Planning |Trello



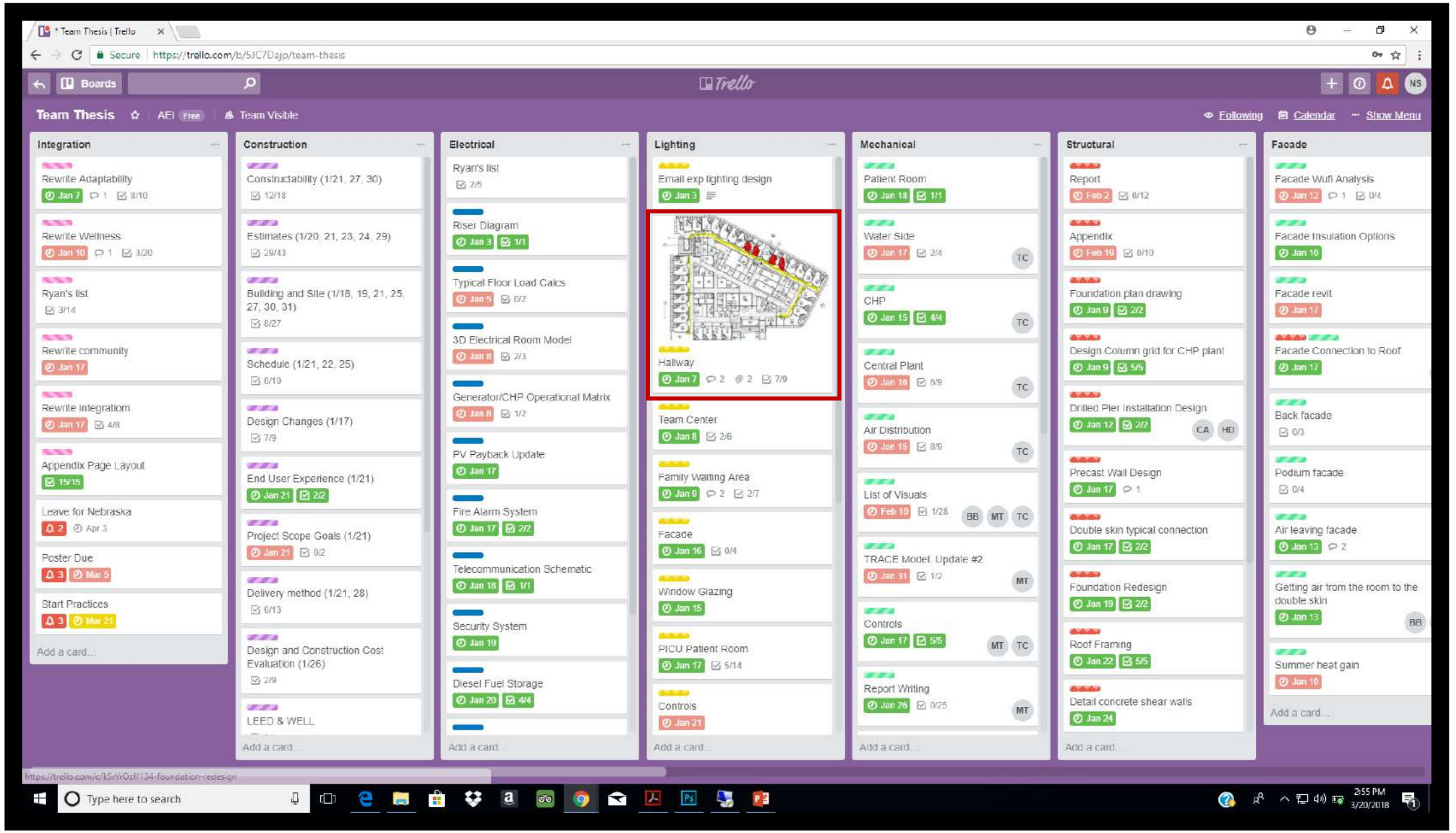
Workflow Planning |Trello



Workflow Planning |Trello



Workflow Planning |Trello



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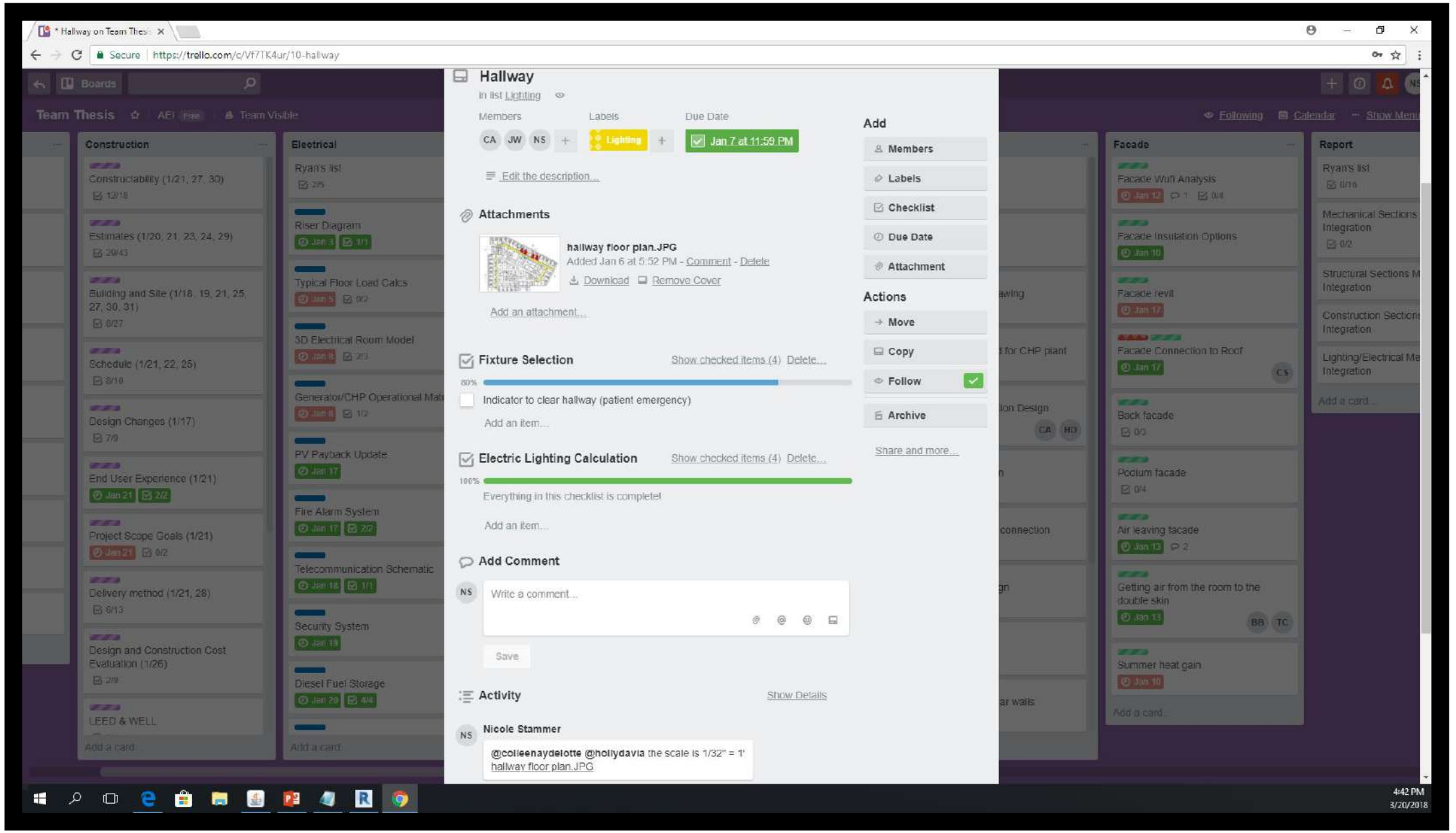
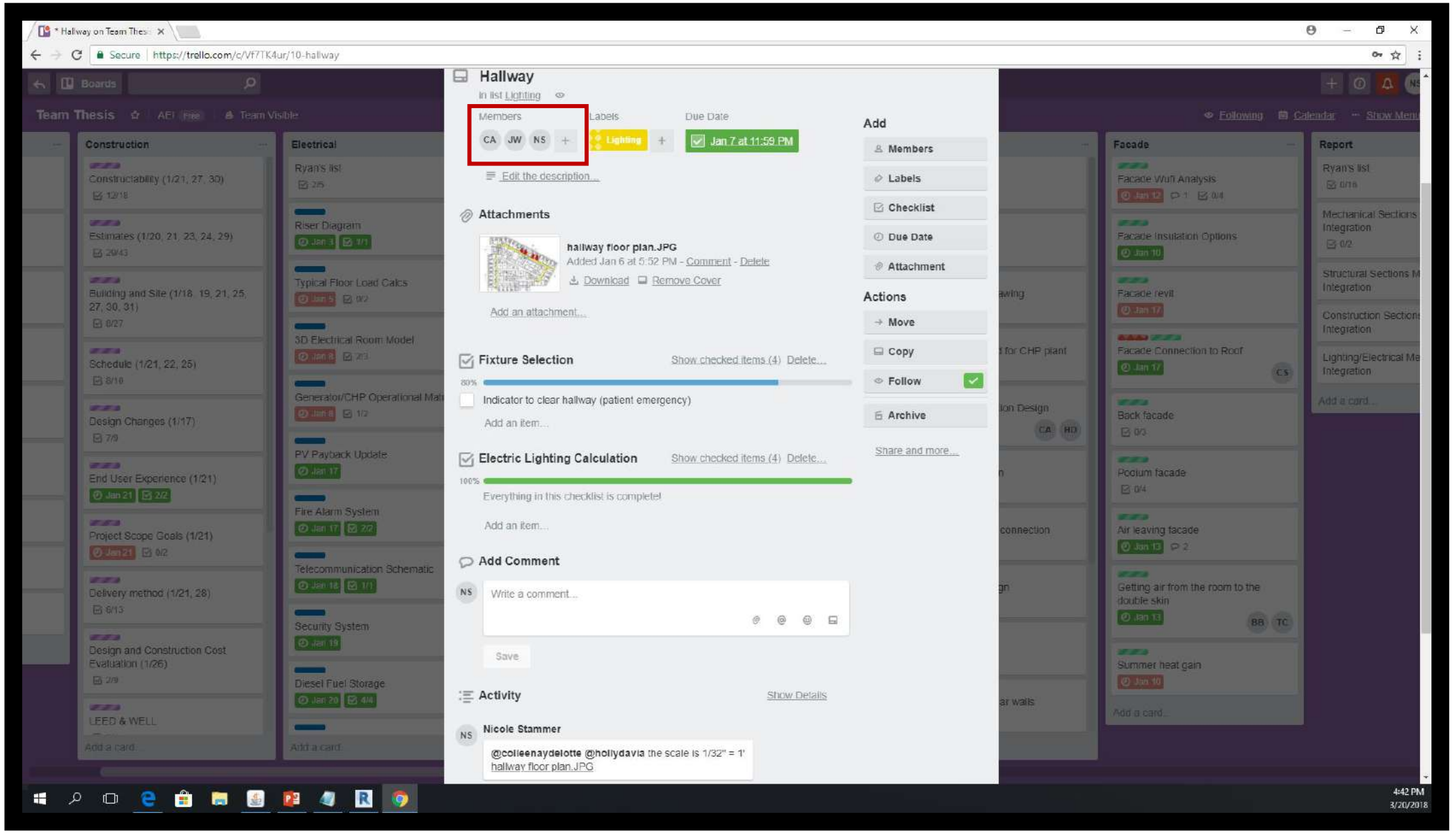
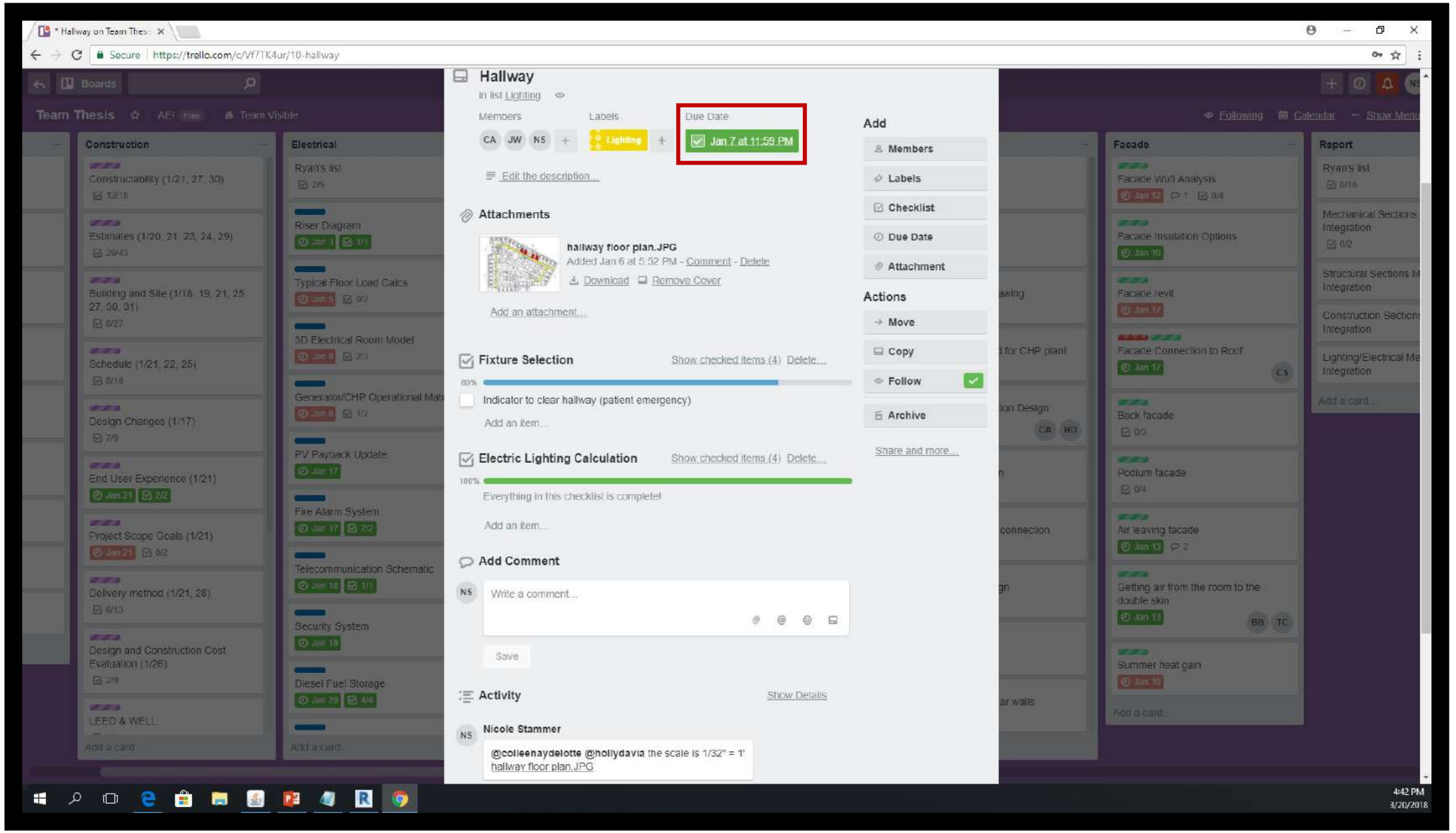


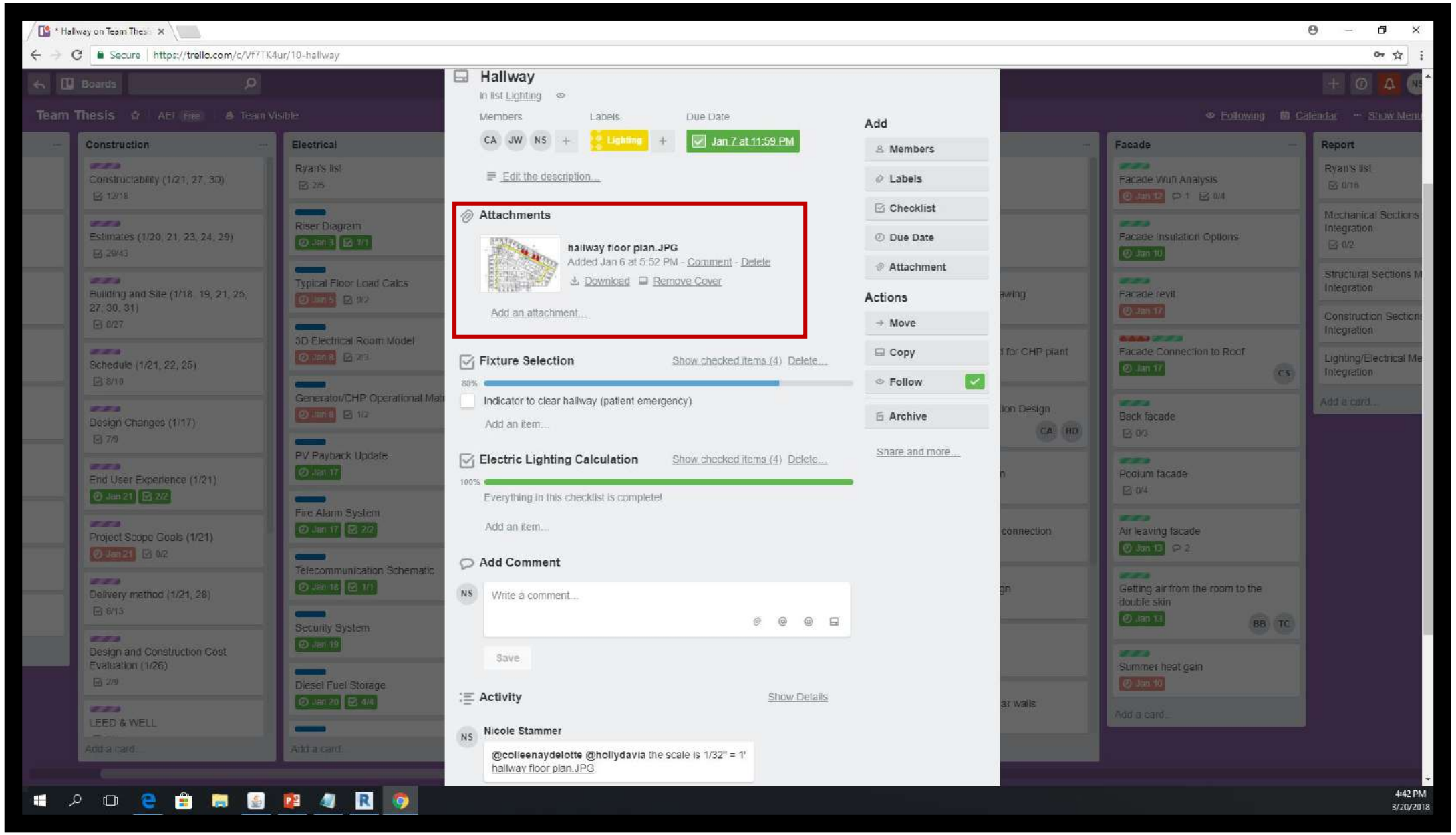
Workflow Planning |Trello



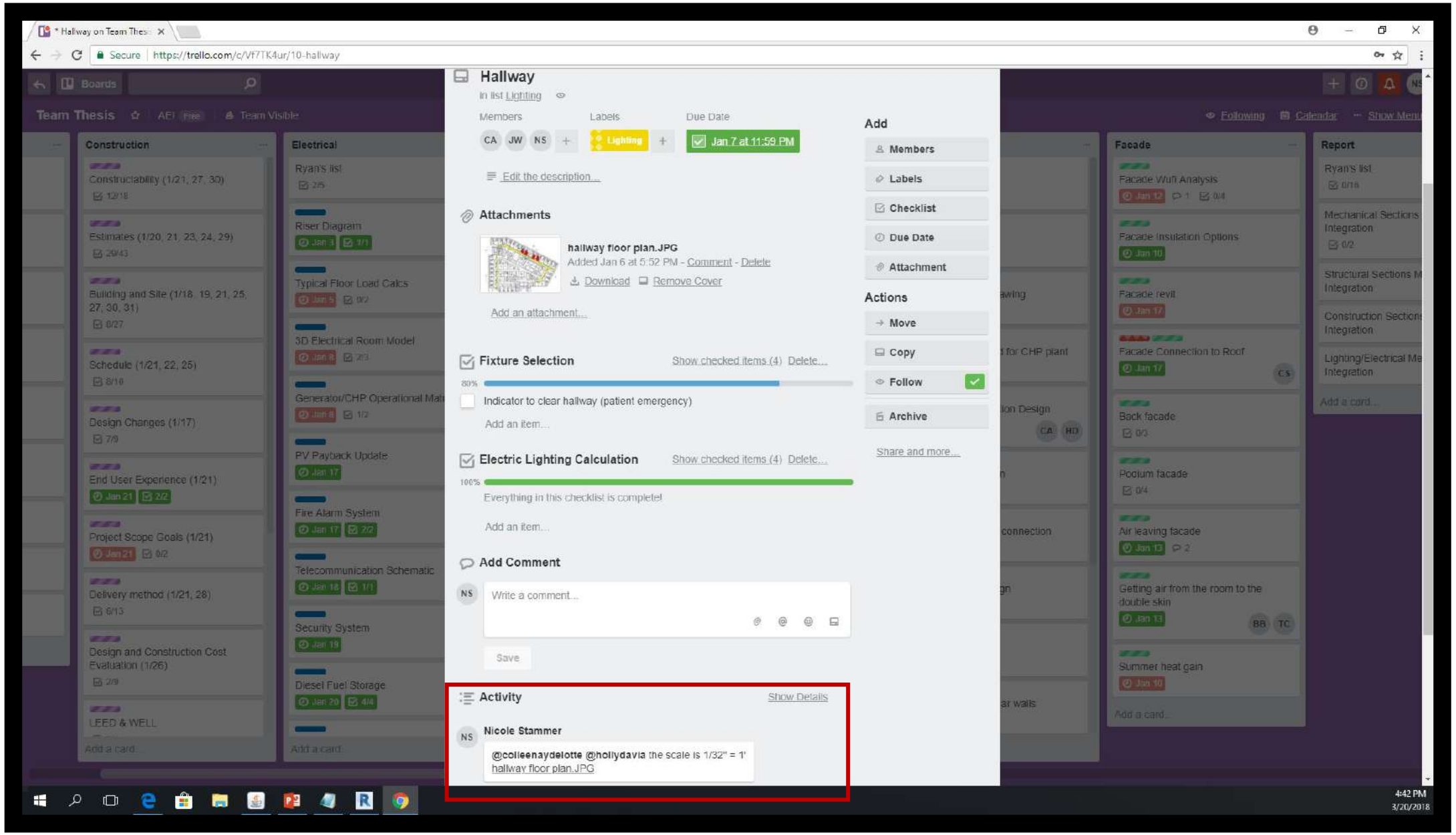
Workflow Planning |Trello



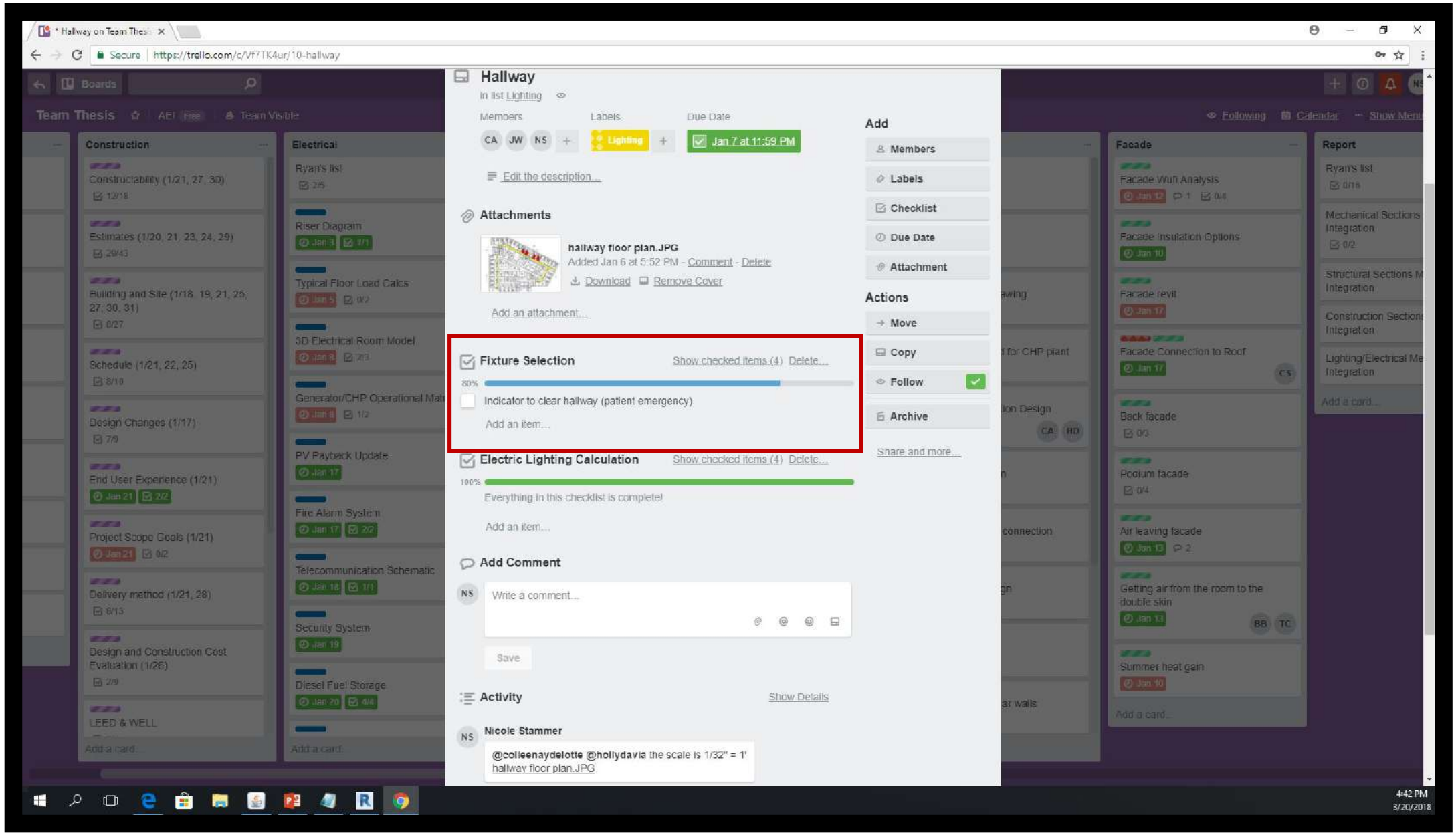
Workflow Planning |Trello



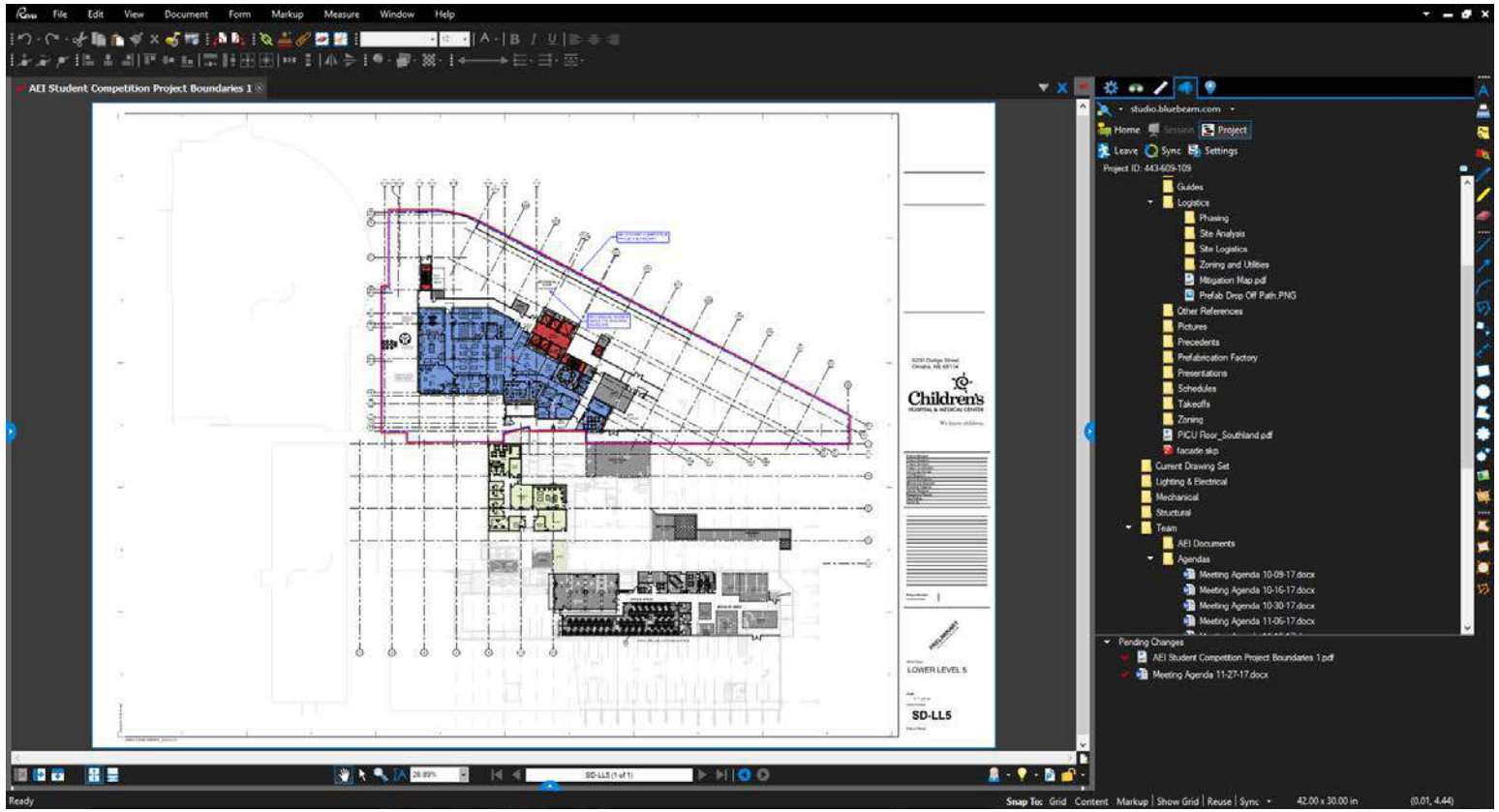
Workflow Planning |Trello



Workflow Planning |Trello

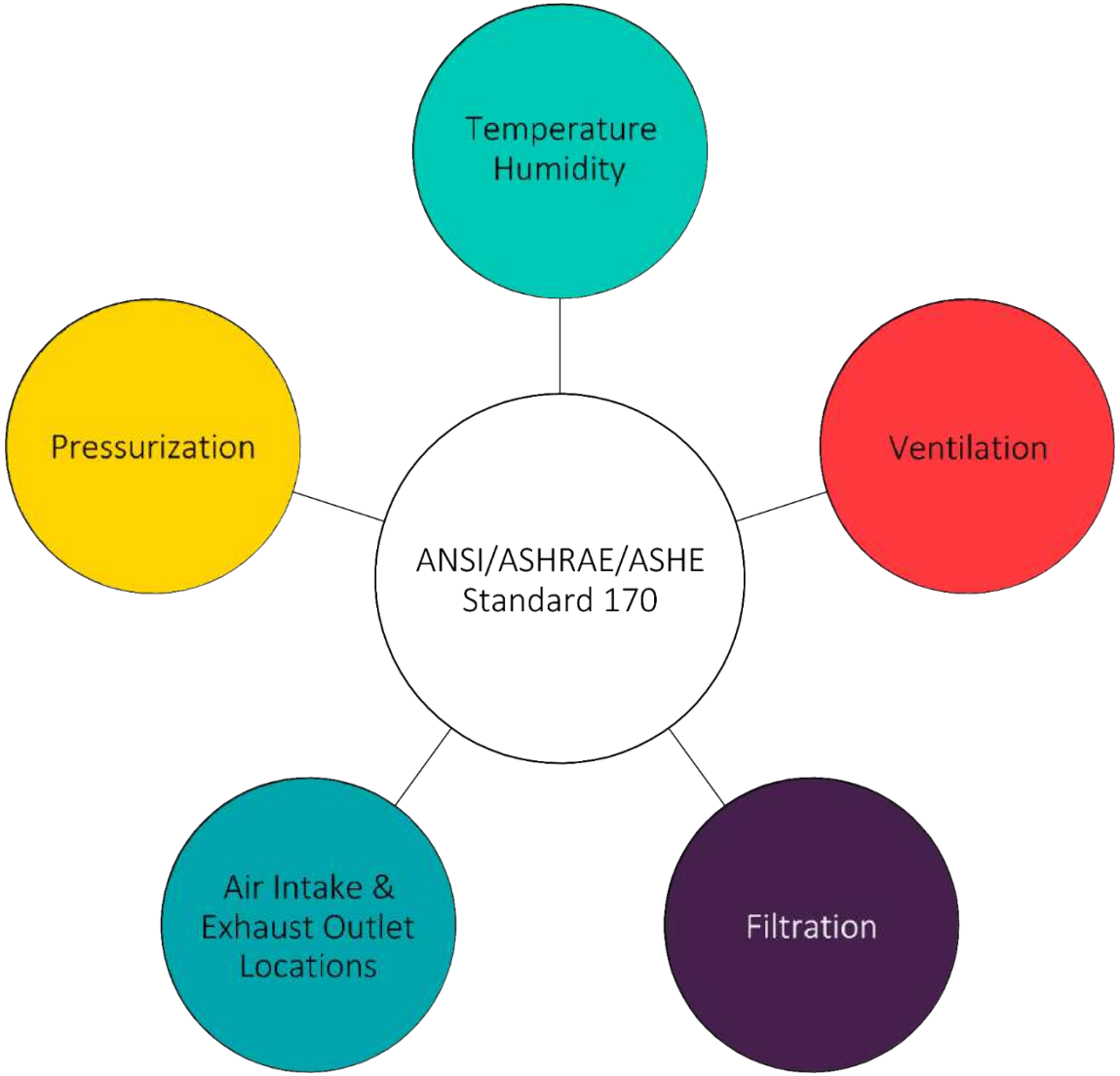


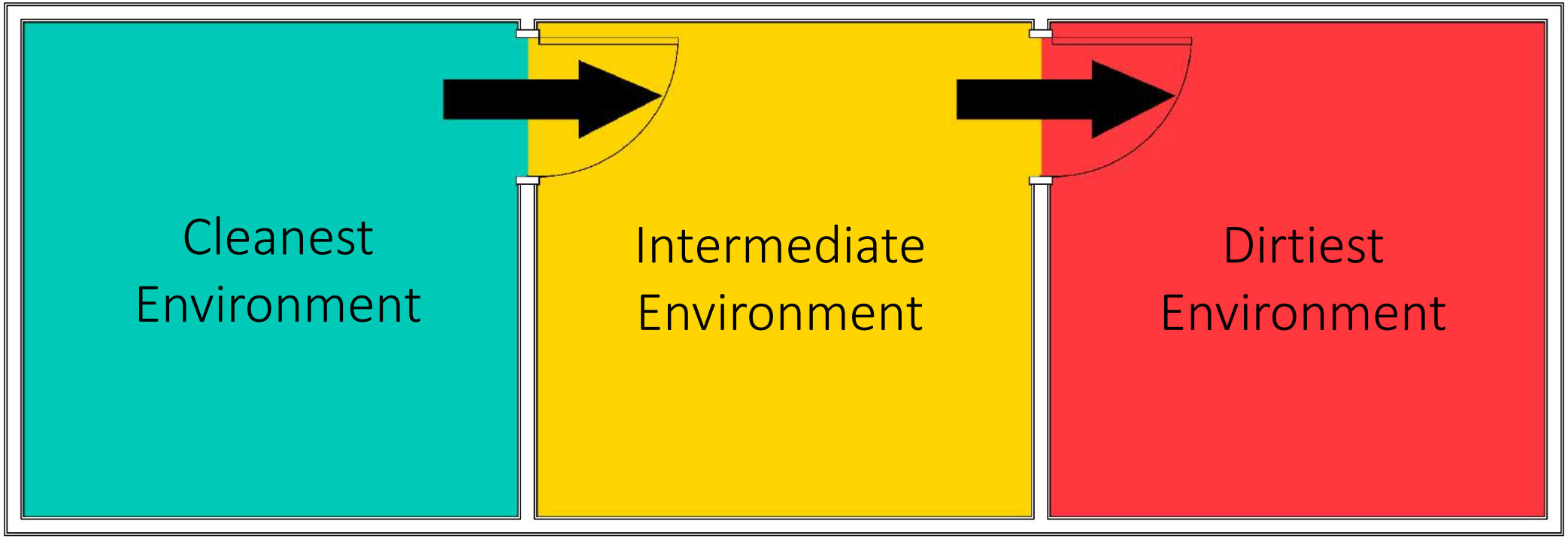
Workflow Planning |Bluebeam



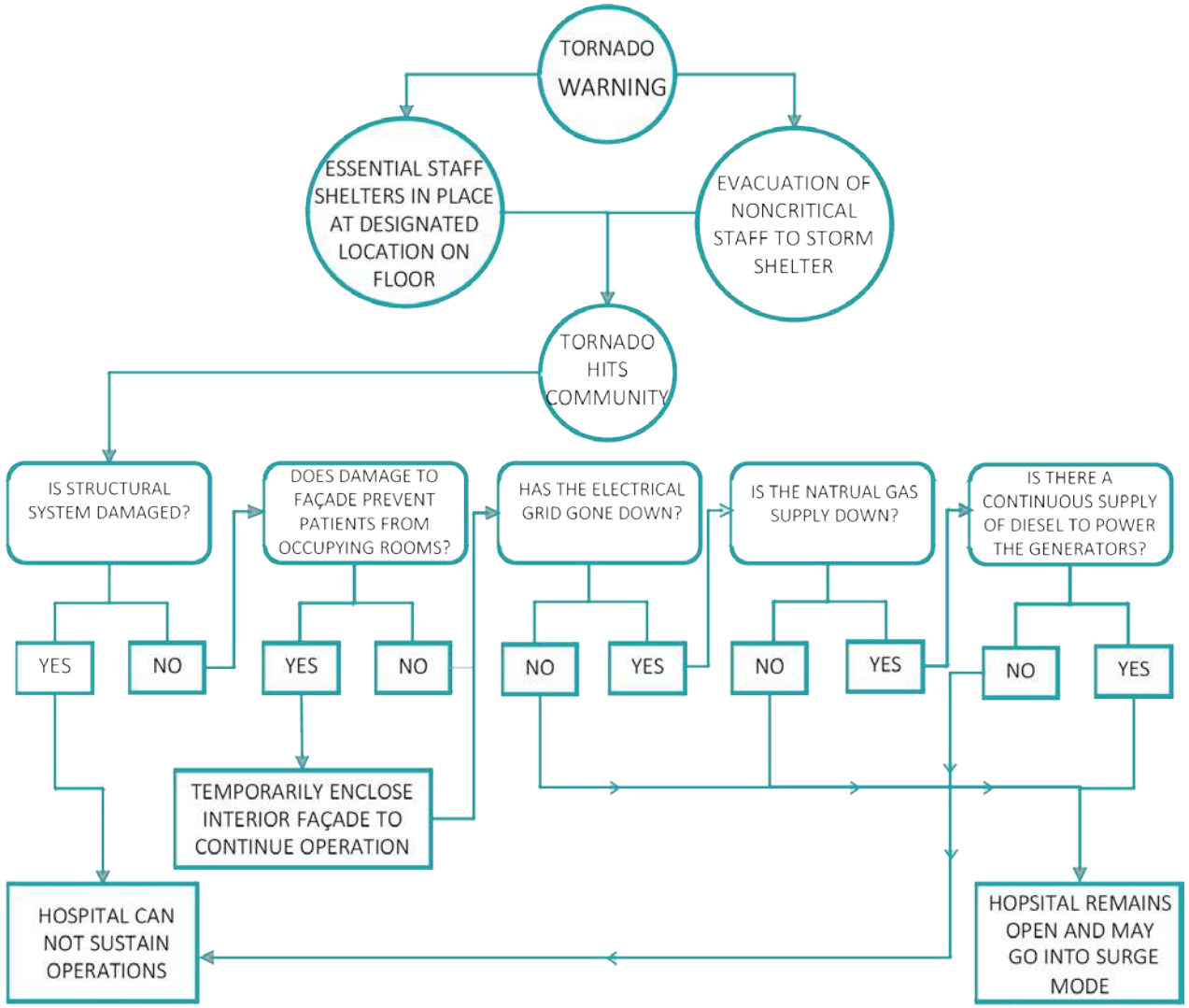
Bluebeam Studio

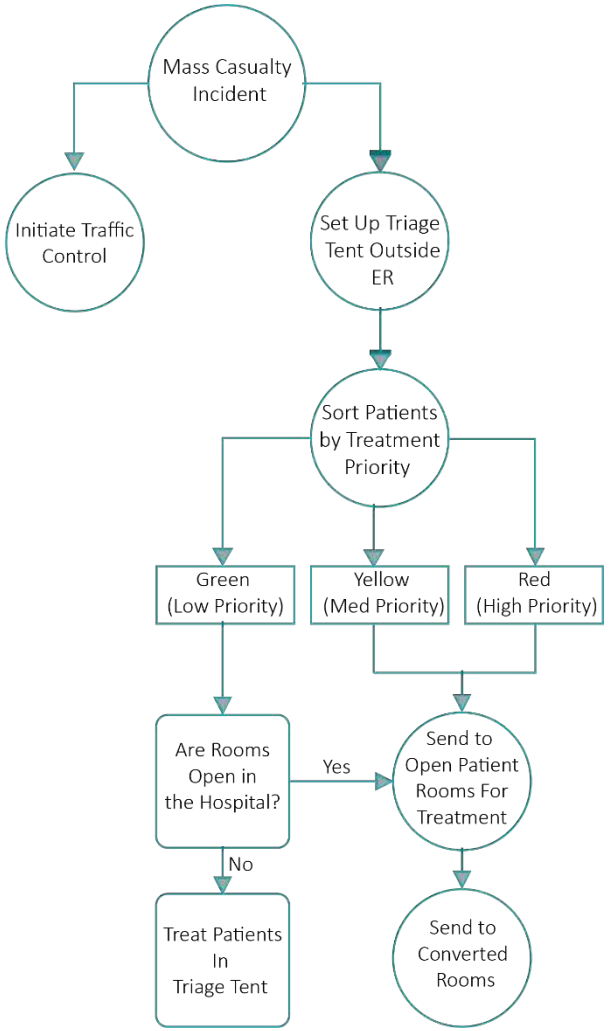
Bluebeam Studio, in collaboration with Box, was employed for document storage, sharing, and as a file backup system.


Temperature
Humidity
Pressurization
Ventilation
ANSI/ASHRAE/ASHE
Standard 170
Air Intake &
Exhaust Outlet
Locations
Filtration


Cleanest Environment
Intermediate Environment
Dirtiest Environment

Disaster Preparedness





Lighting

Distance	Degree of Opening Protection	Allowab
3’-5’	Unprotected, Not Sprinkle red	Not Per
5’-10’	Unprotected, Not Sprinkle red	15%

Interactive Wall

Distance	Degree of Opening Protection	Allowable area
3’-5’	Unprotected, Not Sprinkle red	Not Permitted
5’-10’	Unprotected, Not Sprinkle red	15%