

# **BUILDINGENERGY BOSTON**

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## **Rivermark: Occupied Rehab and Facade Replacement for Climate Resilient Communities**

**Jason Jewhurst (Bruner/Cott Architects)**

**Jackie Mignone (Bruner/Cott Architects)**

**Jack Sherman (Sunrise Erectors)**

**Susan Twomey (Homeowner's Rehab, Inc.)**

**Curated by Clay Tilton (Sustainable Comfort)**

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**Northeast Sustainable Energy Association (NESEA) | March 19, 2024**

# RIVERMARK

Occupied Rehab and Façade Replacement  
for Climate Resilient Communities



BRUNER / COTT  
ARCHITECTS

# Learning Objectives

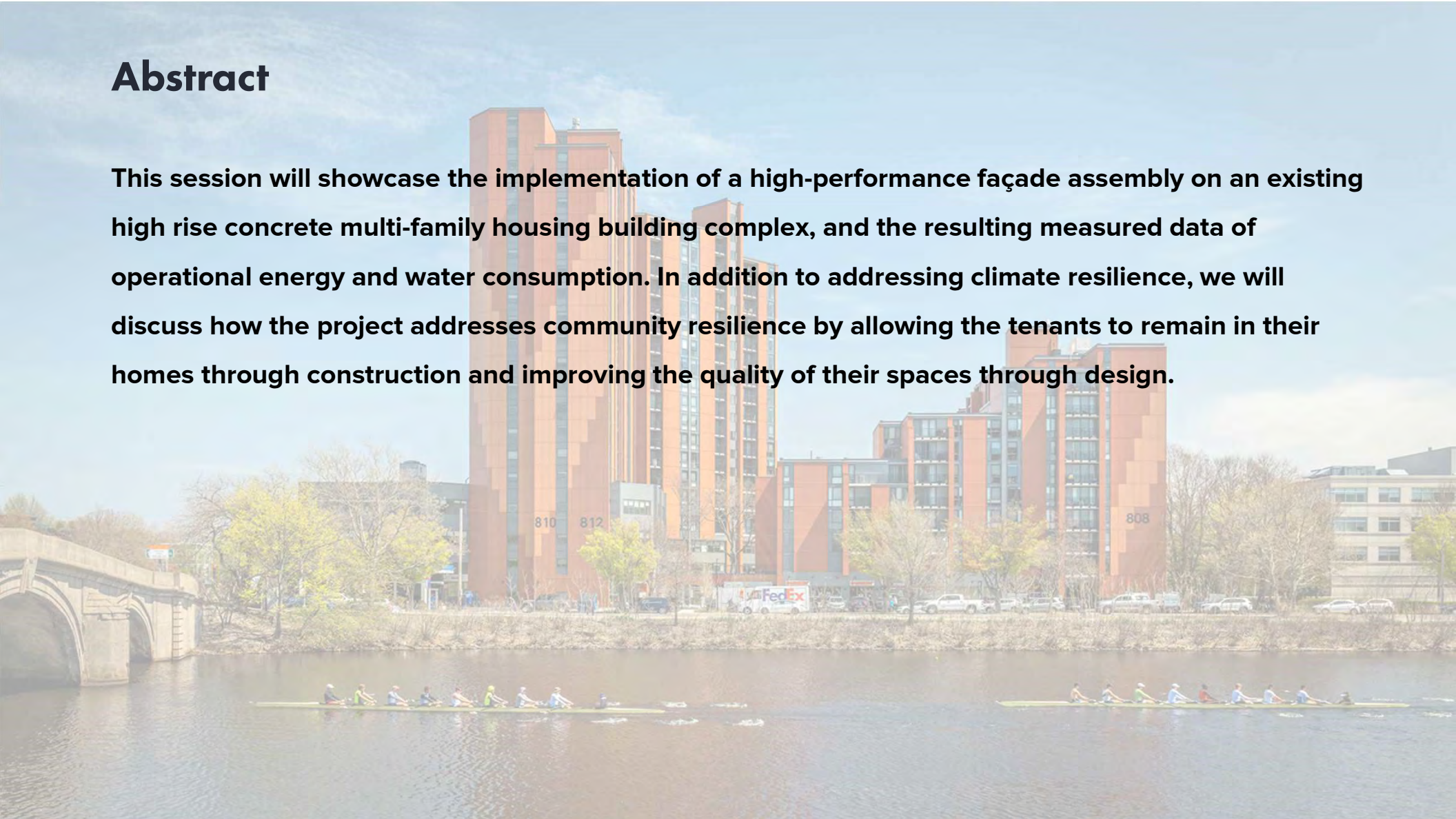
1. Discover a feasible solution to renovating existing 70's era high rise concrete structures that are prominent throughout the US.
2. Measure how an occupied renovation impacts building performance improvements, indoor air quality, embodied carbon, and community resiliency.
3. Recognize the benefits of a high performance, unitized facade system through energy modeling results and post-construction utility data analysis.
4. Explore the funding opportunities for affordable housing and how they affect design decisions.





# Abstract

**This session will showcase the implementation of a high-performance façade assembly on an existing high rise concrete multi-family housing building complex, and the resulting measured data of operational energy and water consumption. In addition to addressing climate resilience, we will discuss how the project addresses community resilience by allowing the tenants to remain in their homes through construction and improving the quality of their spaces through design.**





# Speakers



**Susan Twomey, AIA**  
Director of Construction &  
Sustainability  
Homeowner's Rehab., Inc.



**Jason Jewhurst, AIA**  
Partner, Principal  
Bruner/Cott Architects



**Jackie Mignone, AIA**  
Architect  
Bruner/Cott Architects



**Jack Sherman, LEED AP**  
Project Executive  
Sunrise Erectors



**HRI is a local non-profit affordable housing organization that develops and preserves affordable, high-quality rental housing, with robust resident services for individuals and families throughout our portfolio.**

**We have a strong focus on responsible and sustainable practices through deliberate energy efficiency and material selection practices to both reduce our carbon footprint and to create healthy and comfortable homes for our residents.**

## HRI Goals

In Massachusetts, homes create 24% of greenhouse gas emissions (MassCEC).

Worldwide, buildings release about 40% of emissions.

Cambridge Housing Authority has a 21,000-person waitlist.

Market Rent for a 2 BR apartment in Cambridge is more than \$3500/month – requires an income of \$140,000/annually.



**We Have a Climate Crisis and an Affordable Housing Crisis**

## Before it was Rivermark: 808-812 Memorial Drive

- 1974 Building construction was completed
- 1997 HRI Purchased and began initial capital improvements including new windows, a waterproofing coating on the masonry exterior, and new rubber roofs
- 2015 HRI issued RFP for more in-depth review of the building, including testing/investigation of the envelope, structure, MEP systems, elevators, and other issues
- 2016 Initial report received from Bruner/Cott Architects



1997 Window Replacement



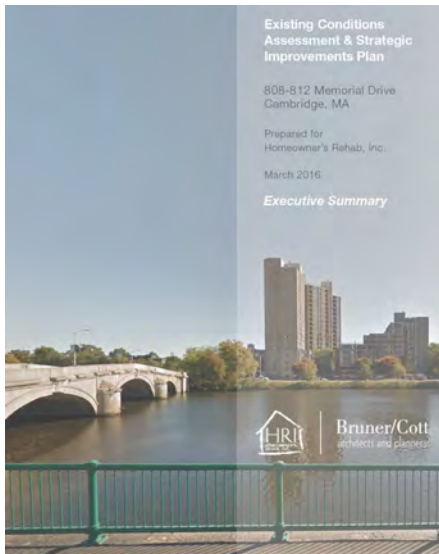
## 1974 STEFFIAN STEFFIAN & BRADLEY



## 808 – 812 Memorial Drive



# Framework of Investigation, Analysis, and Implementation



Assess progressive failures of the building skin that could have structural causes

Identify how and where water is infiltrating the building envelope

Investigate effectiveness and longevity of existing roofs, windows and wall assemblies

Exterior cladding alternatives that would improve building performance and energy efficiency

Current building systems and recommend strategies for energy & water efficiency and performance

Capital improvements and identification of cost implications.

Phasing unit and common areas, community courtyard improvements

Unit improvements: new bathrooms and kitchens, replacement fan coil units, and applicable accessibility upgrades



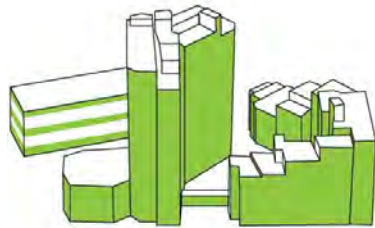
# Framework of Investigation, Analysis, and Implementation

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# Framework of Investigation, Analysis, and Implementation

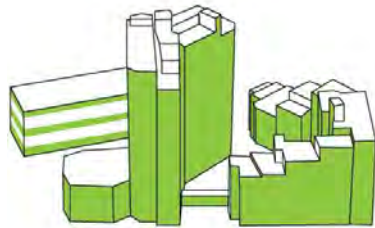


## Building Skin & Structural Components

### KEY QUESTIONS

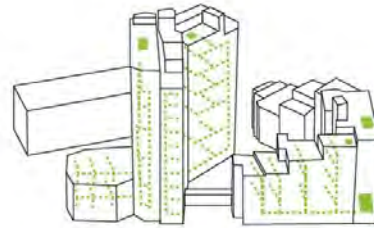
- Was it built as designed?
- How do we avoid costly code triggers?
- Overall integrity?
- Rate of deterioration?
- Hazardous materials?
- Appearance & Sustainability?

# Framework of Investigation, Analysis, and Implementation



## Building Skin & Structural Components

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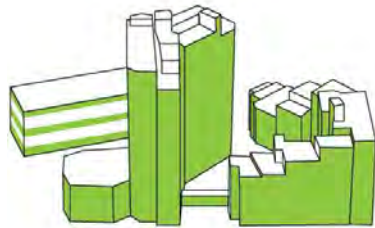


## Building Systems & Mechanical Distribution

- System selection criteria?
- Central boiler & future grades?
- Hydronic vs. air delivery?
- Metering & measurement?
- Zoning, Phasing & Controls?

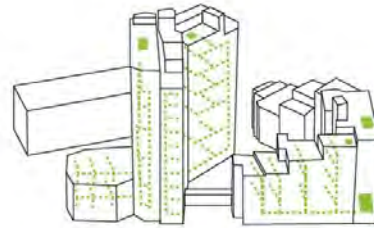


# Framework of Investigation, Analysis, and Implementation



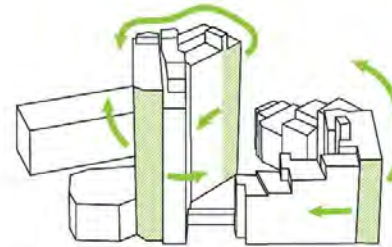
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## Building Systems & Mechanical Distribution

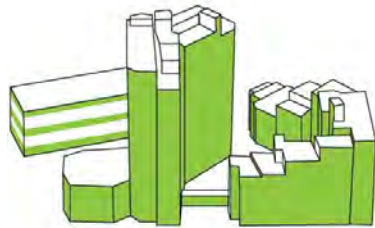
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## Implementation Phasing & Schedule

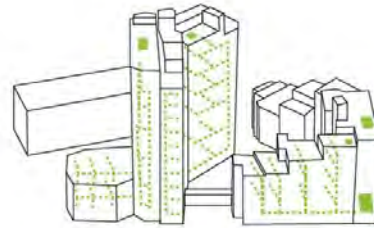
- % of occupancy?
- Turn-over of leases?
- Vacancy rates?
- Phasing & scheduling impacts?
- Lay-down space?

# Framework of Investigation, Analysis, and Implementation



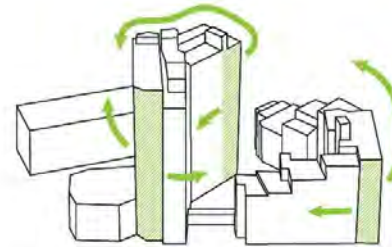
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## Implementation Phasing & Schedule

- % of occupancy?
- Turn-over of leases?
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- Phasing & scheduling impacts?
- Lay-down space?



## Livability, Expectations Management & Future

- What does the building look & feel like?
- Tenant interaction w/design & construction team?
- Range of dwelling improvements?
- Timing & duration of disruption?
- Outreach & methods of communication?

# 2016 Report Findings

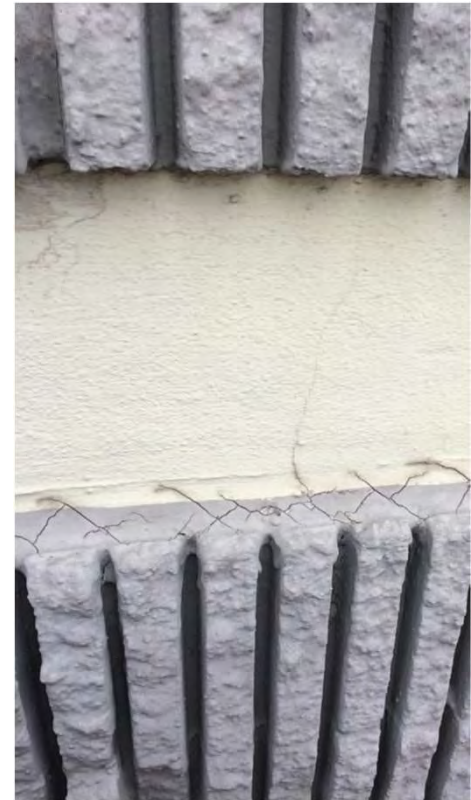
Envelope Assessment identified areas of concern



Window Sealant



Cracked pre-cast panel



Fractured CMU veneer



# Envelope Field Observations



3a



3b



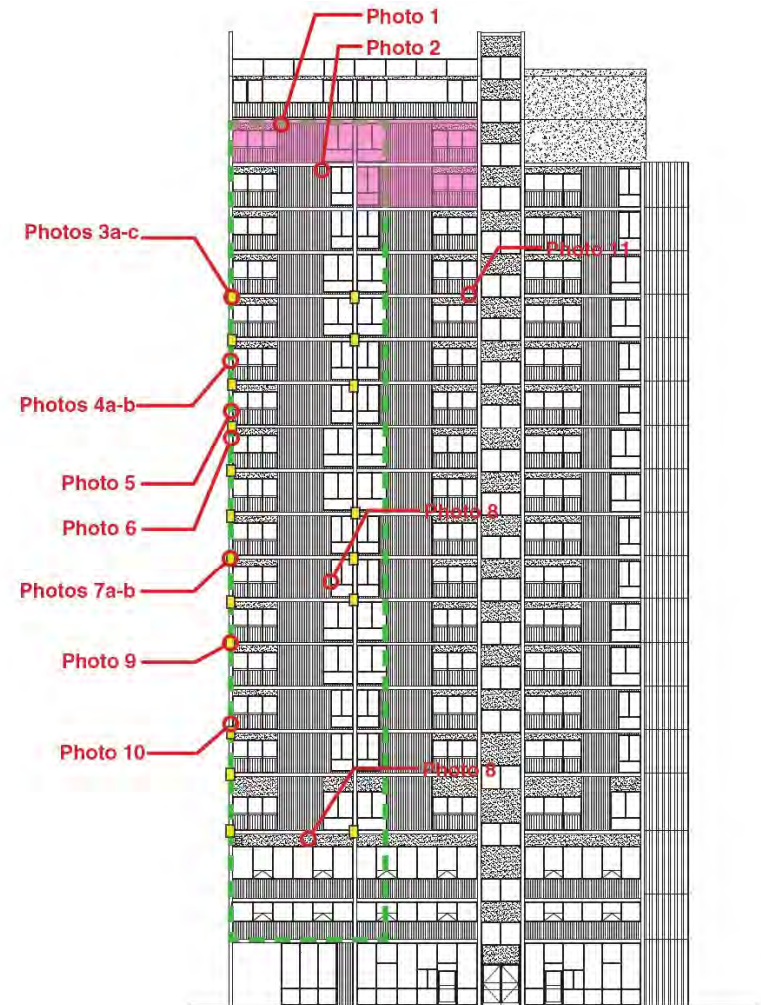
3c



1



2



Photos 3a-c

Photos 4a-b

Photo 5

Photo 6

Photos 7a-b

Photo 9

Photo 10

Photo 1

Photo 2

Photos 11

Photo 8

Photo 7

Approx. area of facade in swing stage drop

Unit w/ water infiltration per T & L Report

Concrete spall per T & L Report

# 2016 Report Envelope Options

## Overcladding Options



Option A  
Porcelain Rainscreen



Option B  
Insulated Metal Panel



Option C  
EIFS

# Project Goals

## Building Goals

- Improve envelope performance
  - Eliminate water leaks
  - Improve thermal and air sealing performance
- Replace (6) Elevators
  - (4) at residential buildings
  - (1) at commercial space
  - (1) at garage
- Add accessible apartments
- Reduce water usage
- Improve Heating efficiency

## Community Goals

- Improve community spaces
  - Renovation of interior community rooms
  - Improvements to outdoor courtyard areas
- Wayfinding and placemaking
- Occupied Renovation

## DEAL BASICS

- 300 Rental Units
  - 212 deed restricted LIHTC
- 2 Buildings – mixed use
  - Building A: 19 stories
  - Building B: 11 stories
- 38,000 sf of Commercial Space
- Mass Housing
  - \$61.5 million – tax exempt construction and permanent loan
  - Taxable and tax exempt bridge financing
- MA DHCD
  - \$36.9 million – equity financing

## BEYOND THE BASICS

- On-site Community Spaces
  - Community room
  - Computer lab
  - Activities room
  - Playground
  - Active Tenant Organization
- Since Construction
  - Over 40 young people take part in Steadfast Solutionz' youth programming.
  - Over 50 households have participated in tech classes.
  - A regular group of 15 seniors take part in weekly strength training and fall prevention clinics





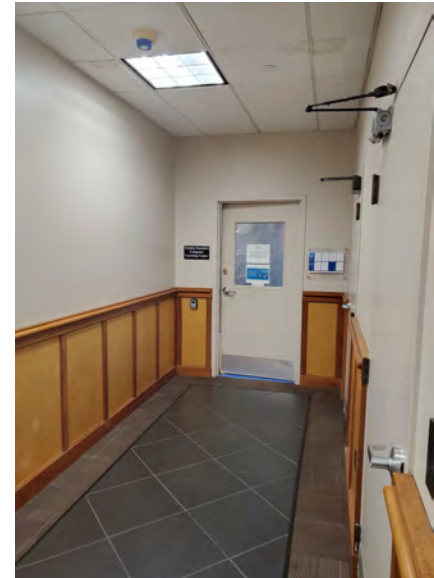
**2020 – 2022: Occupied REHAB**



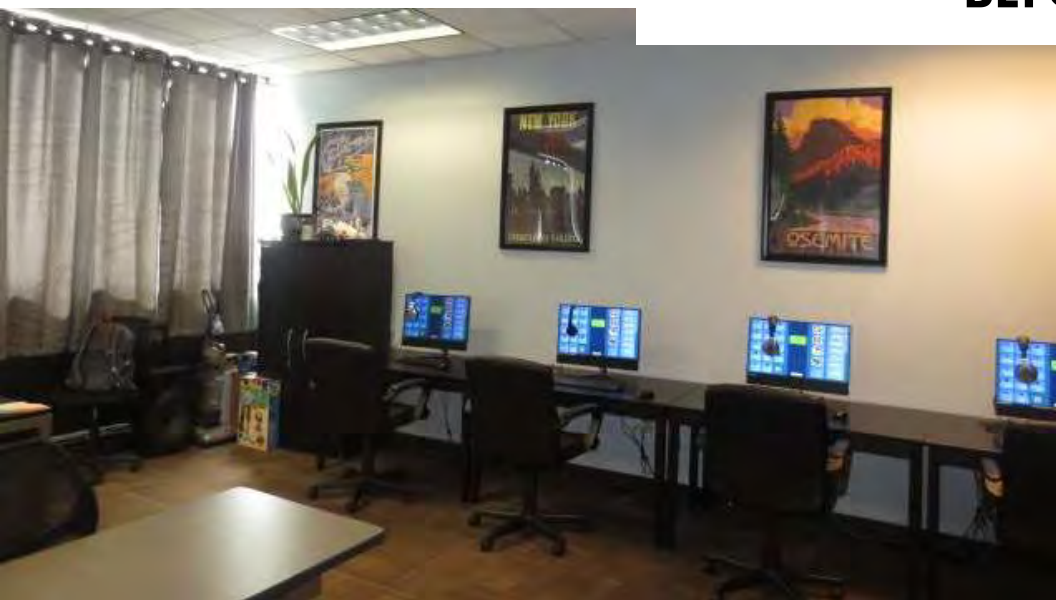


# Tenant Feedback

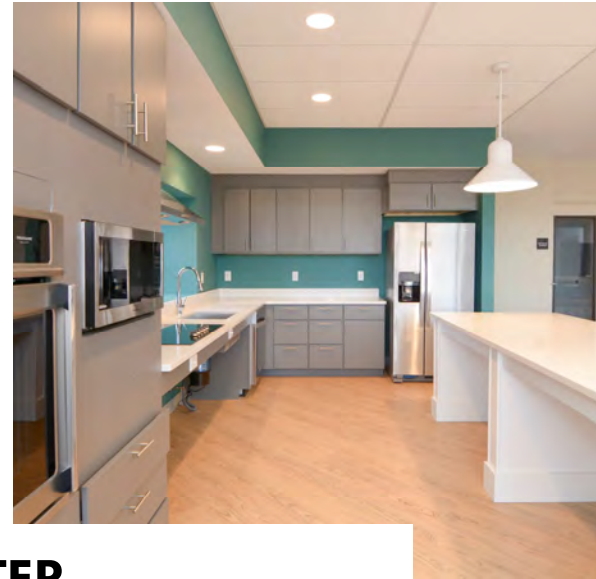




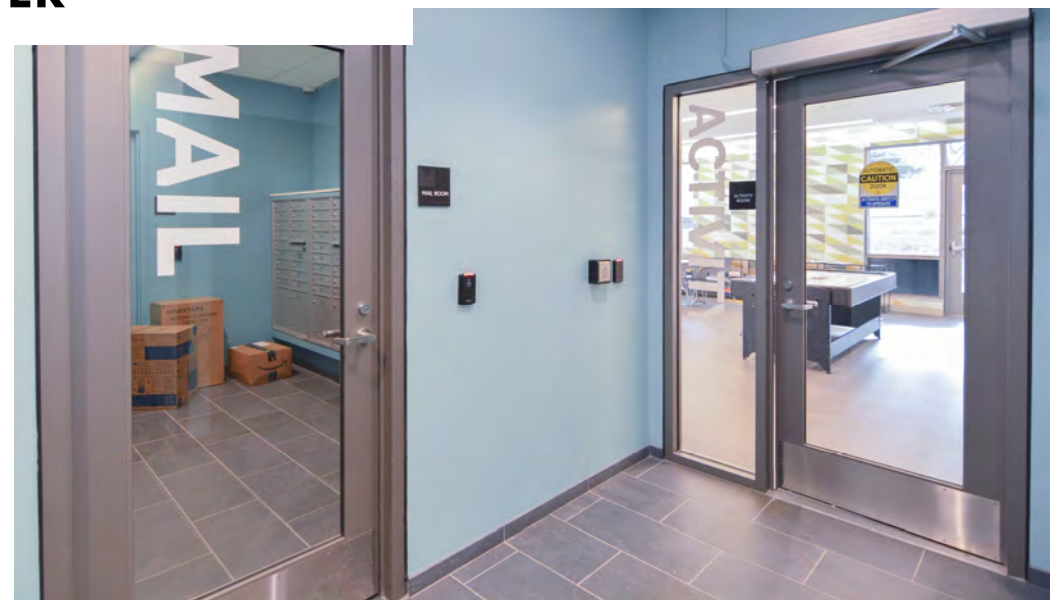
**BEFORE**



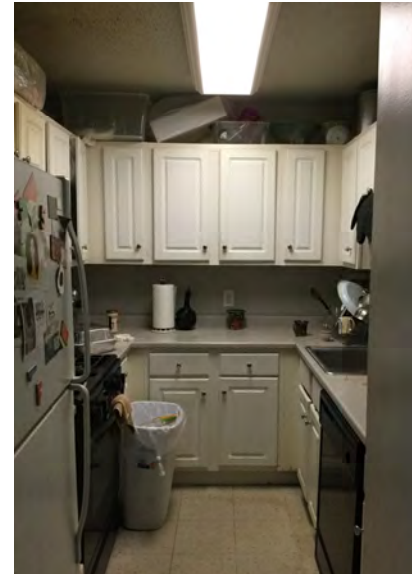
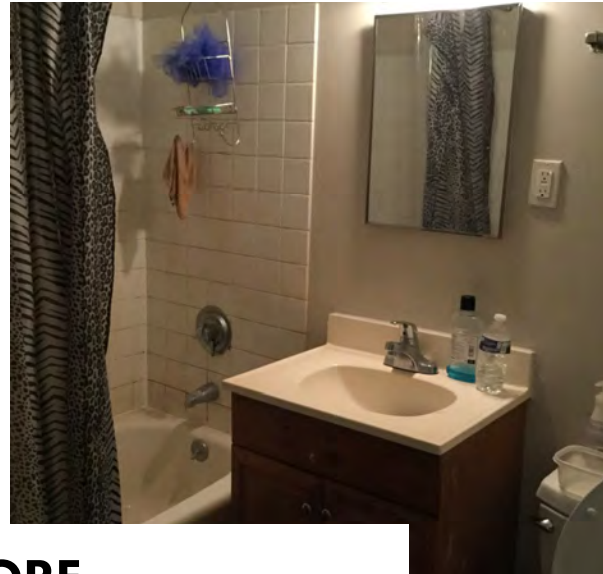




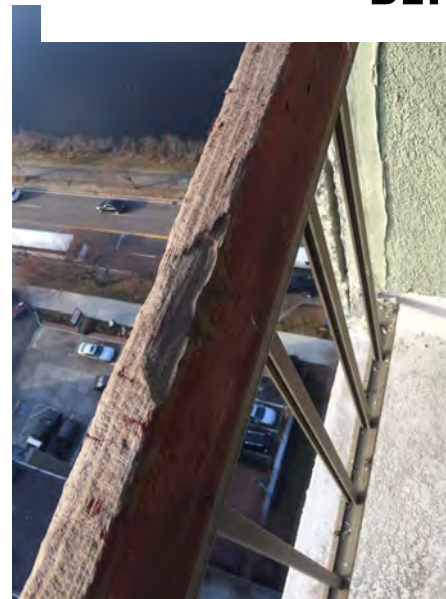
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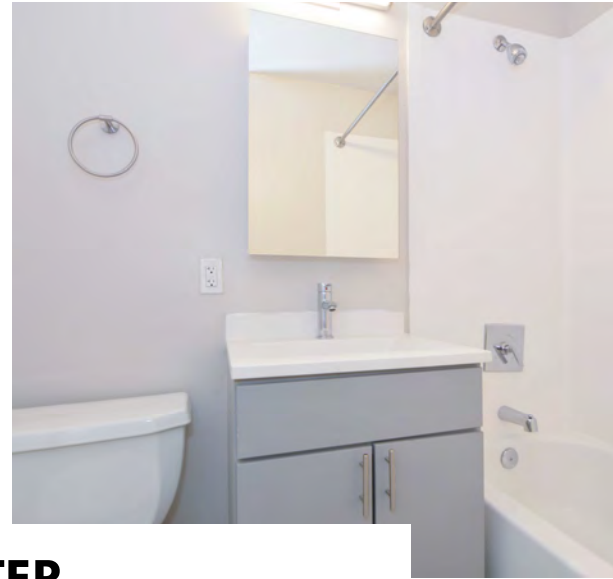




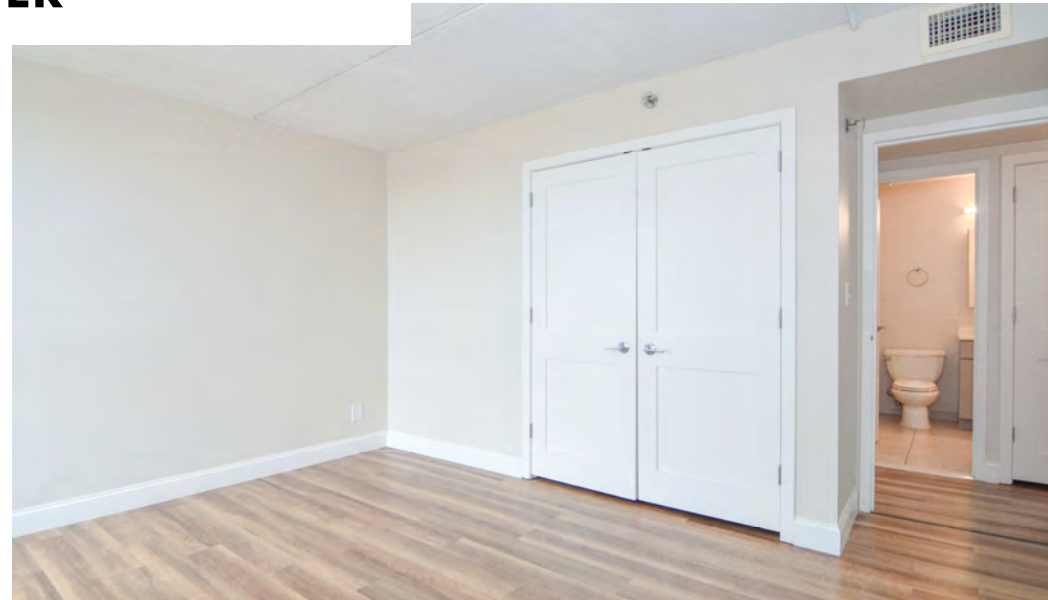
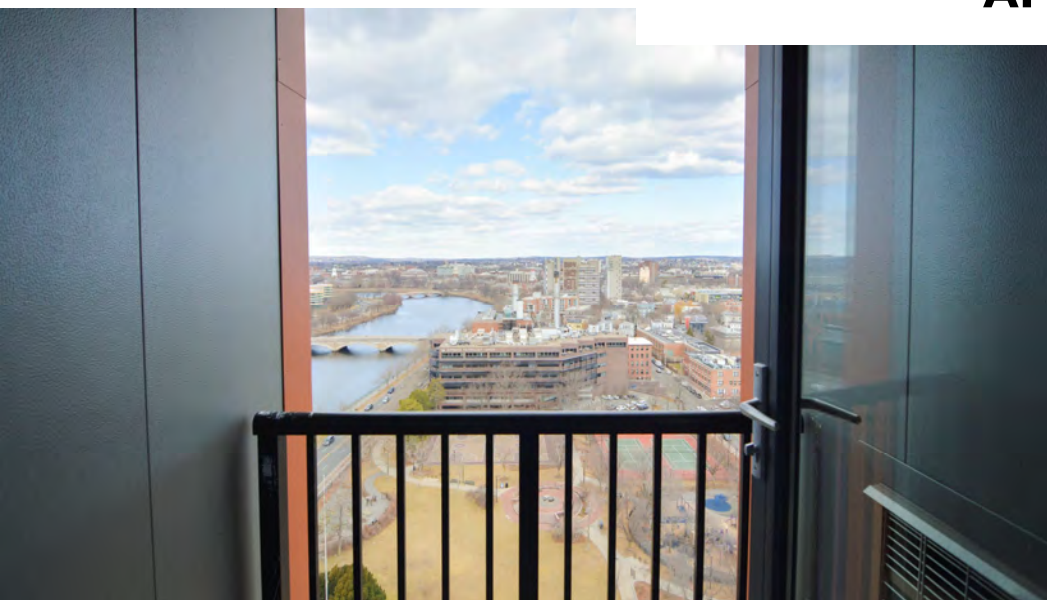


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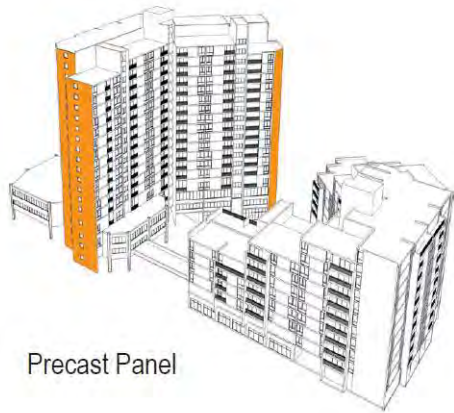


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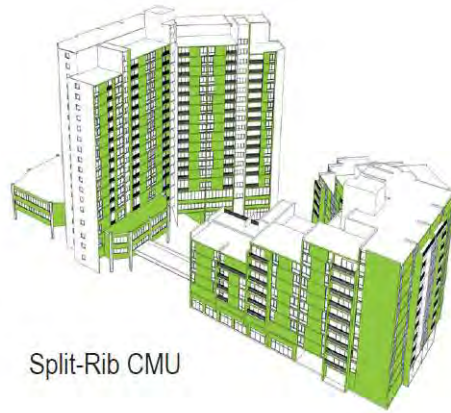




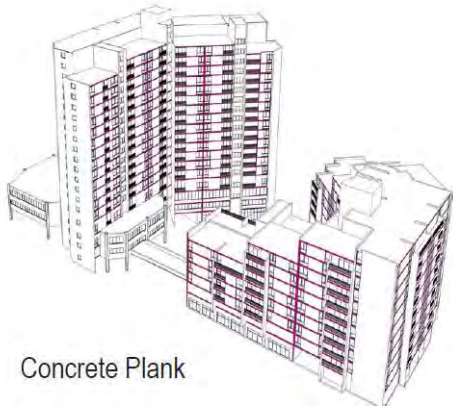
# Building Façade Systems Analysis



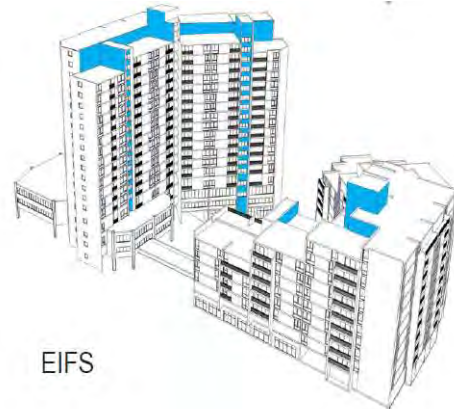
Precast Panel



Split-Rib CMU



Concrete Plank



EIFS

## Building A

Elevation	Precast Panels - SF	Split-Rib CMU - SF	Concrete Plank - SF	EIFS - SF	Overcladding Totals
1	425	6,750	1,524	1,125	9824
2	425	3,800	1,475	1,600	7300
3	11,350				11350
4		5,350	1,525	1,025	7900
5	4,500				4500
6	1,250	9,000	1,575	1,000	12825
7	11,350				11,350
<b>Totals</b>	<b>29,300</b>	<b>9,000</b>	<b>6,099</b>	<b>4,750</b>	<b>65,049</b>

## Building B

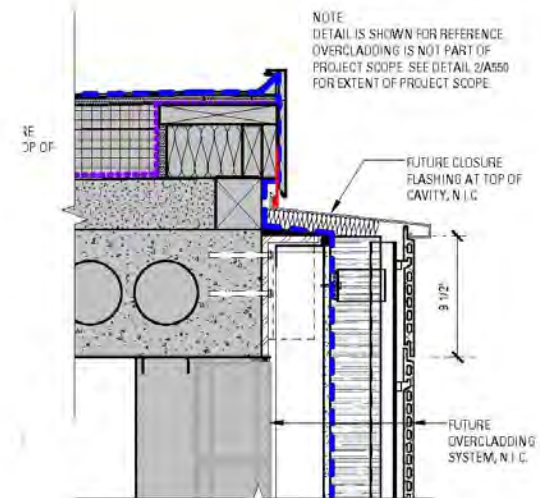
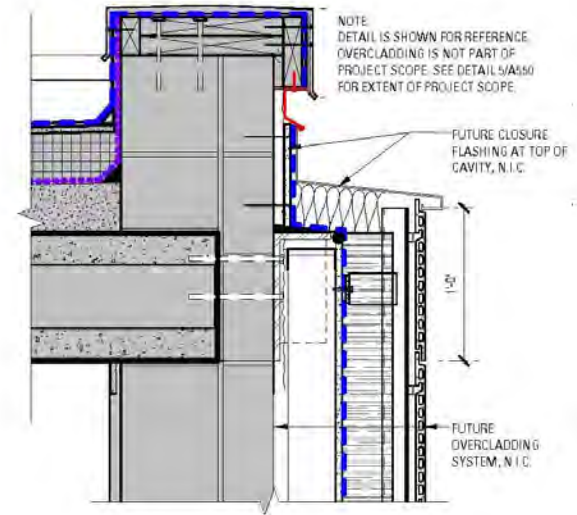
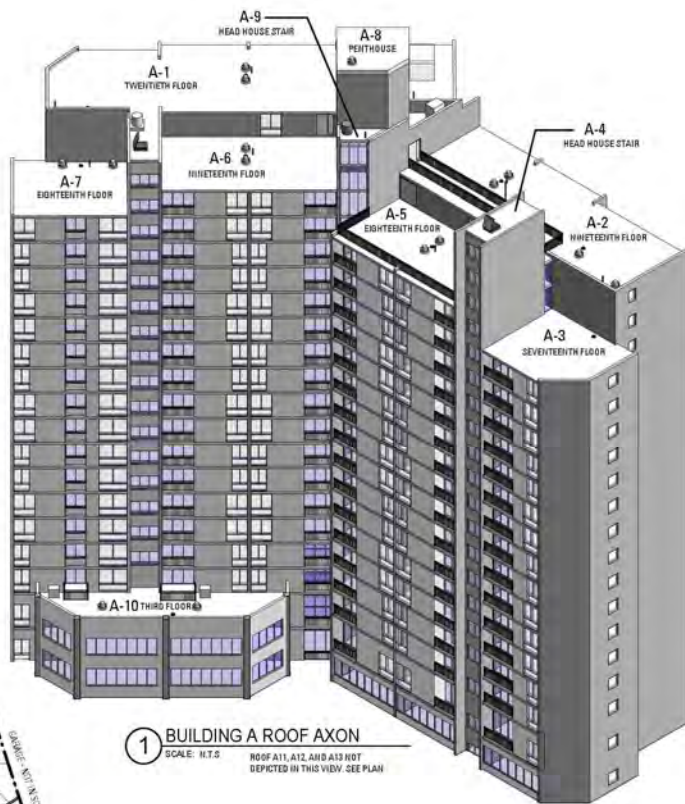
Elevation	Precast Panels - SF	Split-Rib CMU - SF	Concrete Plank - SF	EIFS - SF	Overcladding Totals
1		6,150	525	925	7600
2		6,000	575	825	7400
3		4,025		1,250	5275
4		6,000			6000
5		1,700	700	525	2925
6		1,200	750	425	2375
7		2,350	700	1,325	4375
8		6,275	125		6400
<b>Totals</b>		<b>33,700</b>	<b>3,375</b>	<b>5,275</b>	<b>42350</b>

## Project Total Estimate

Elevation	Precast Panels - SF	Split-Rib CMU - SF	Concrete Plank - SF	EIFS - SF	Overcladding Totals
<b>Totals</b>	<b>29,300</b>	<b>42,700</b>	<b>9,474</b>	<b>10,025</b>	<b>107,399</b>



# 2010 Roof Replacement



# Cladding Type Analysis



## 808-812 Memorial Drive Facade Study - Building A

### Panel Type Areas

Panel Type	Diagram Color	Approx Square Footage (ft <sup>2</sup> )	Total SF (ft <sup>2</sup> )
Typical Unit Panel @ New Infill Wall	Red	15,568	100,992
Bldg A Book Ends @ Existing Precast	Green	32,699	
Bldg B Book Ends @ Existing CMU	Orange	-	
Intermediate Verticals @ Fins	Cyan	15,289	
Intermediate Verticals Above Fins	Teal	5,710	
Balcony Return Panel	Maroon	6,496	
Stair Panel	Navy	1,225	
Ceiling Panel	Aqua	7,868	
Typical Commercial Panel	Purple	14,945	
Tunnel	Yellow	1,092	
Storefront	Grey	6,359	

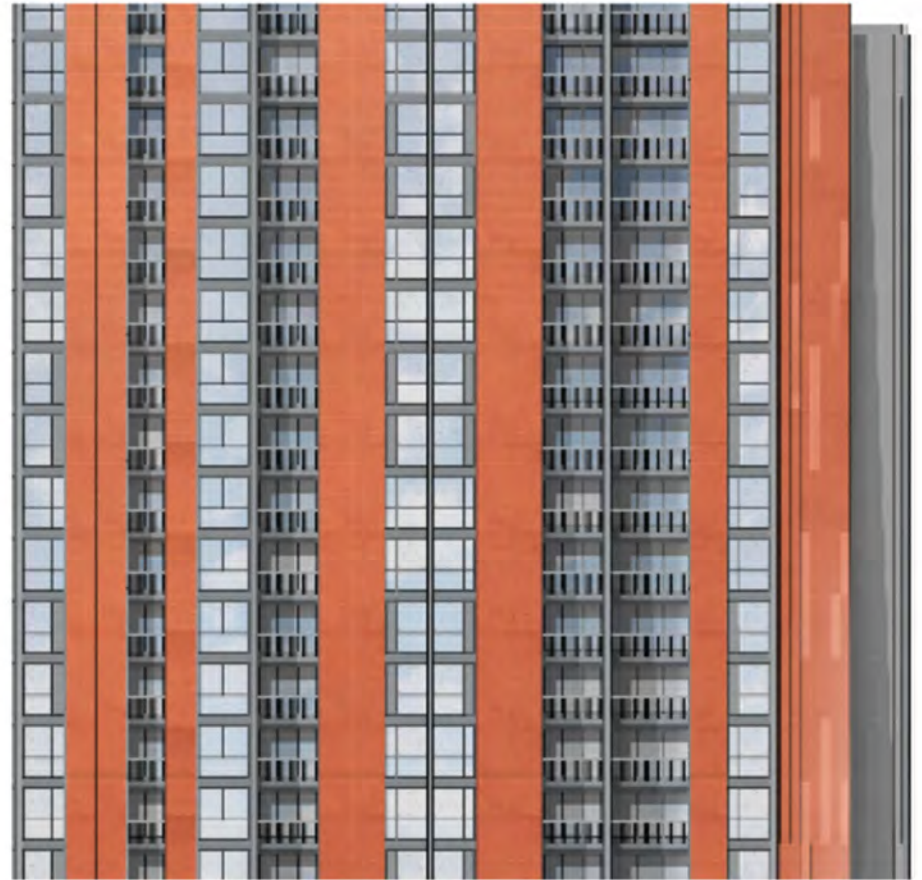
\*Building A includes bridge



## Cladding Goals

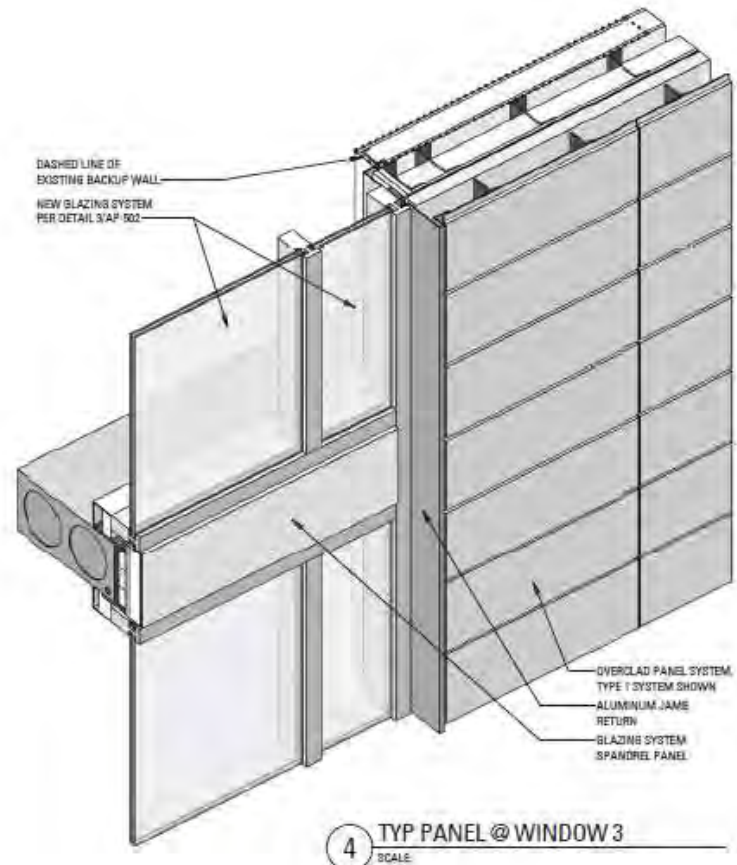
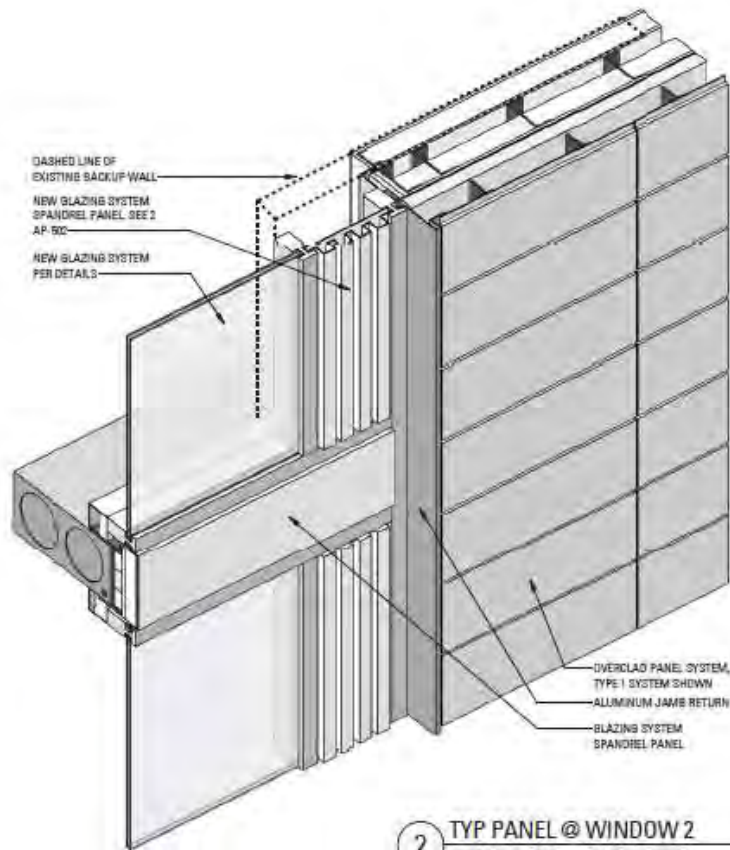


EXISTING EXTERIOR



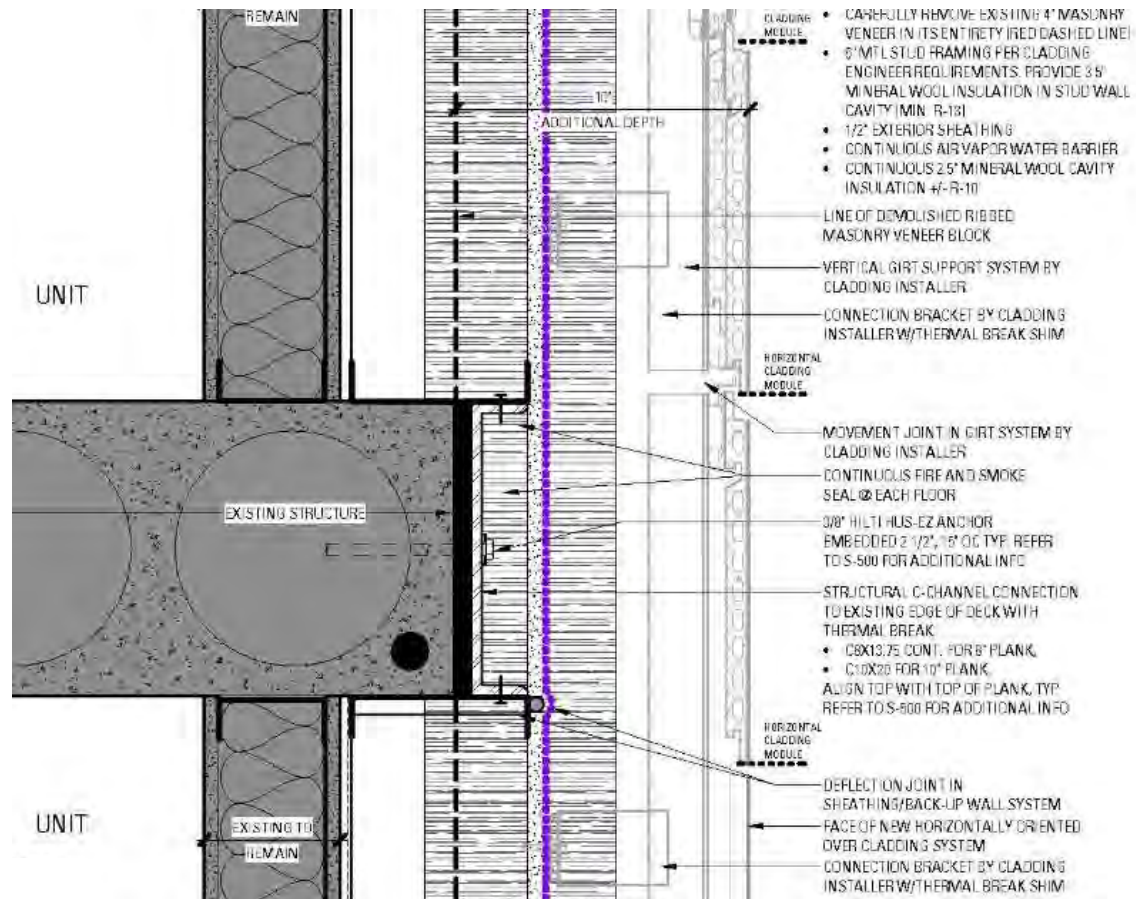
PROPOSED EXTERIOR

# Window Details

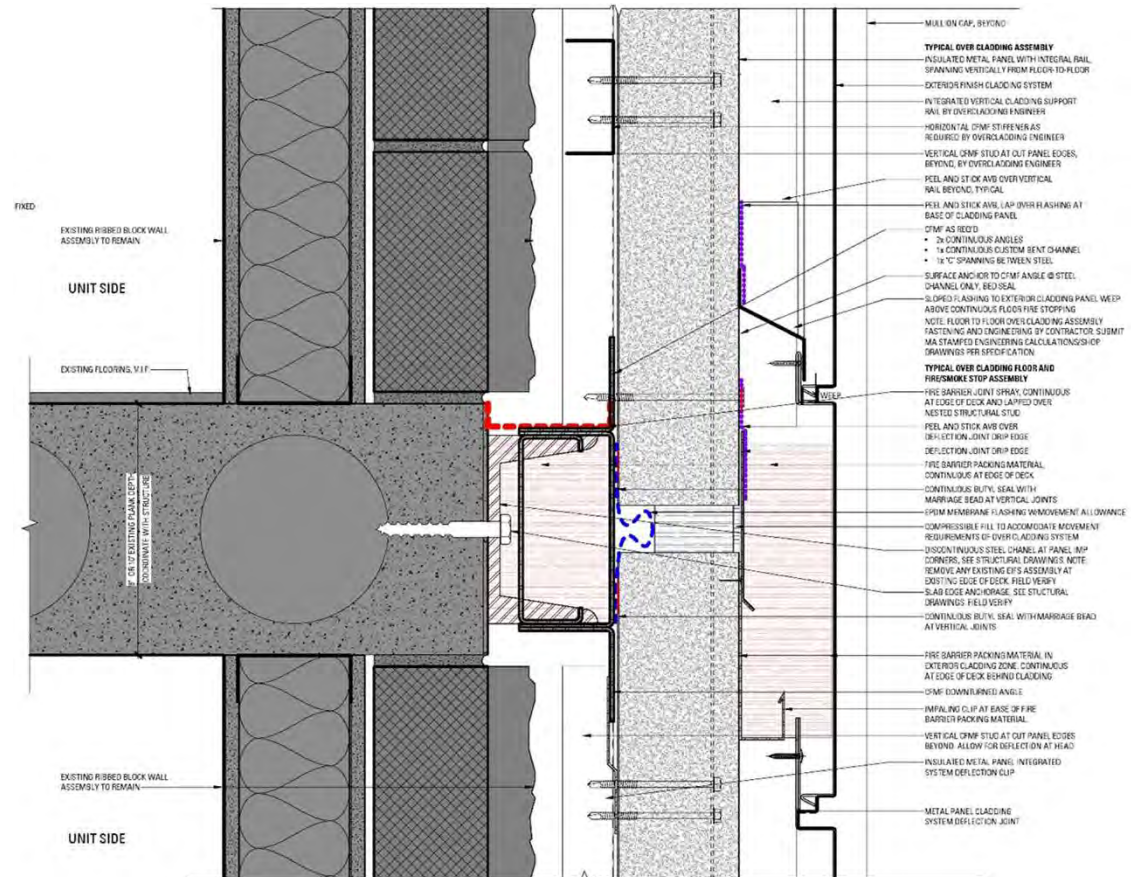




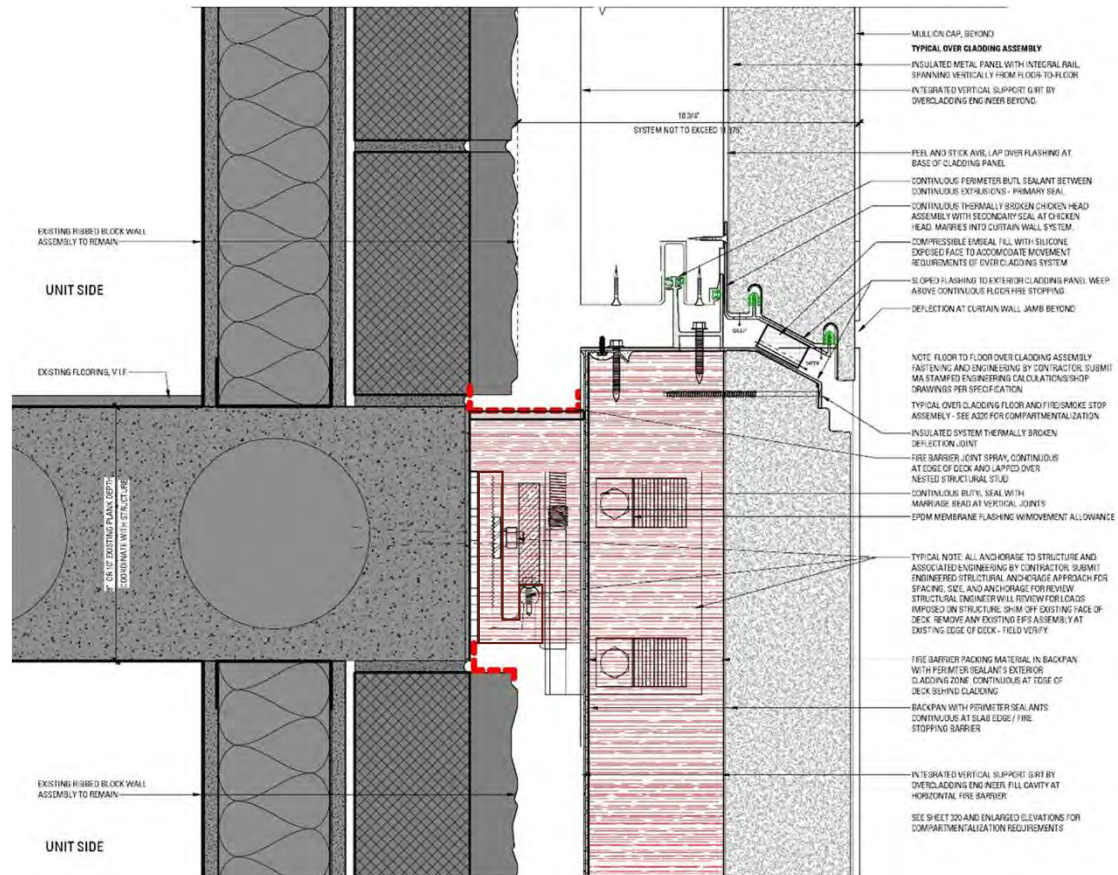
# Cladding Detail Evolution



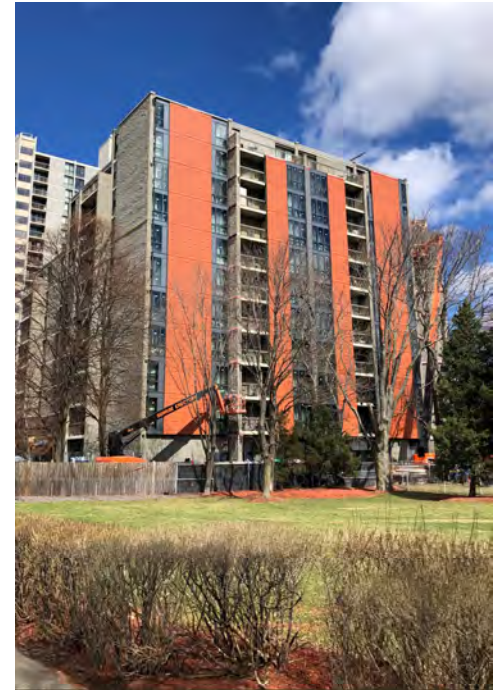
# Cladding Detail Evolution



# Cladding Detail Evolution









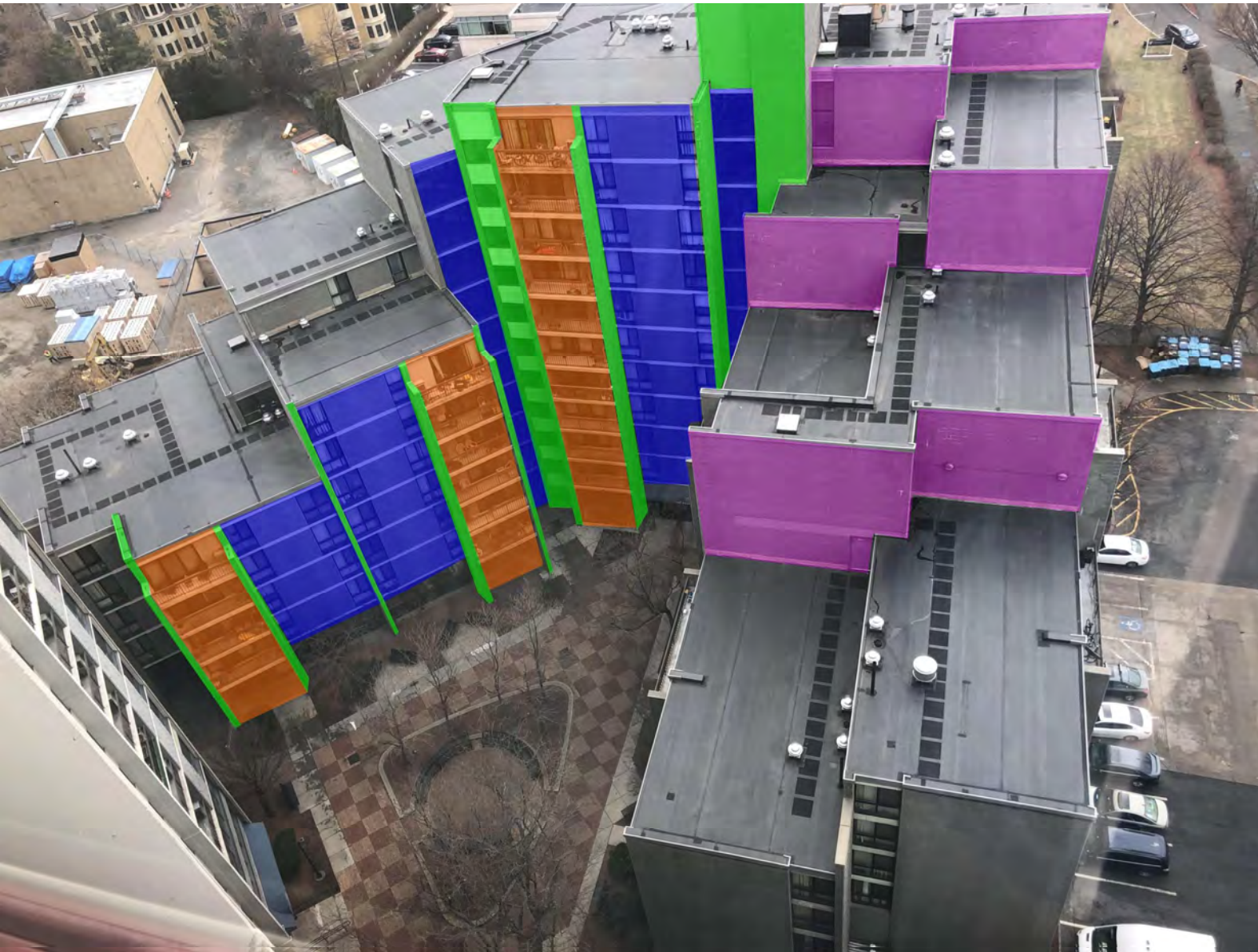






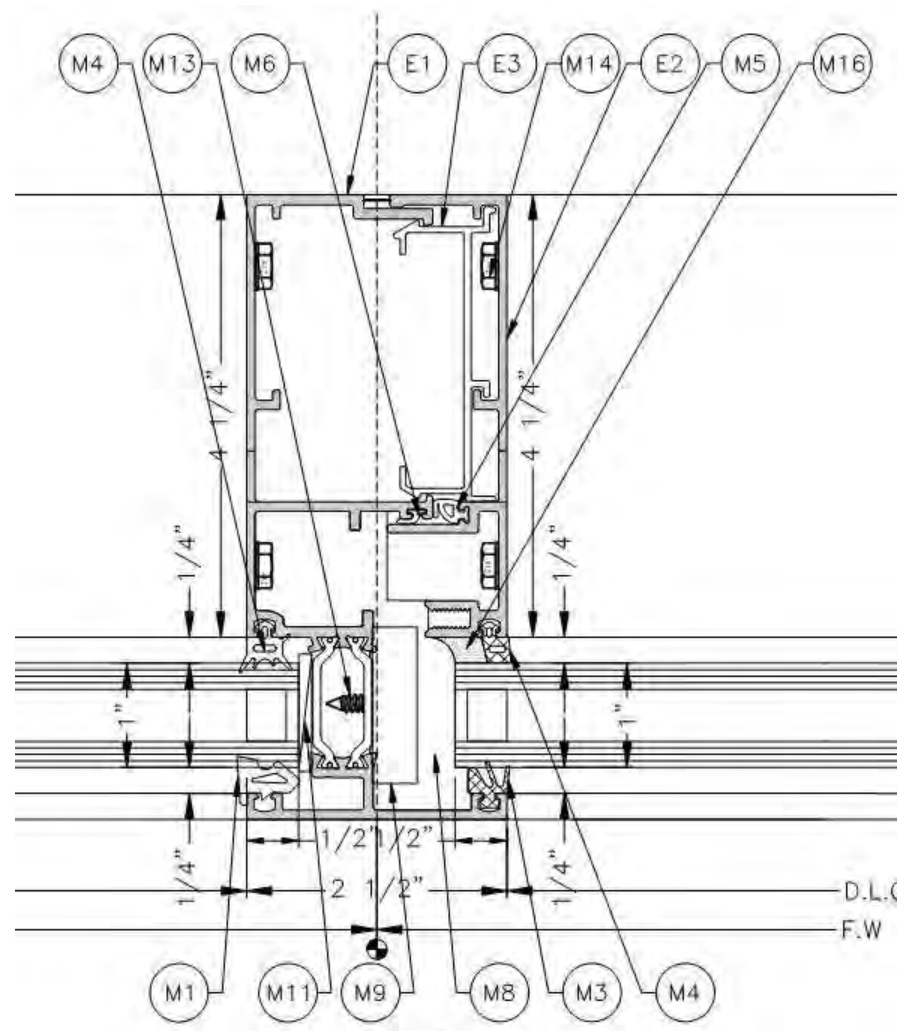
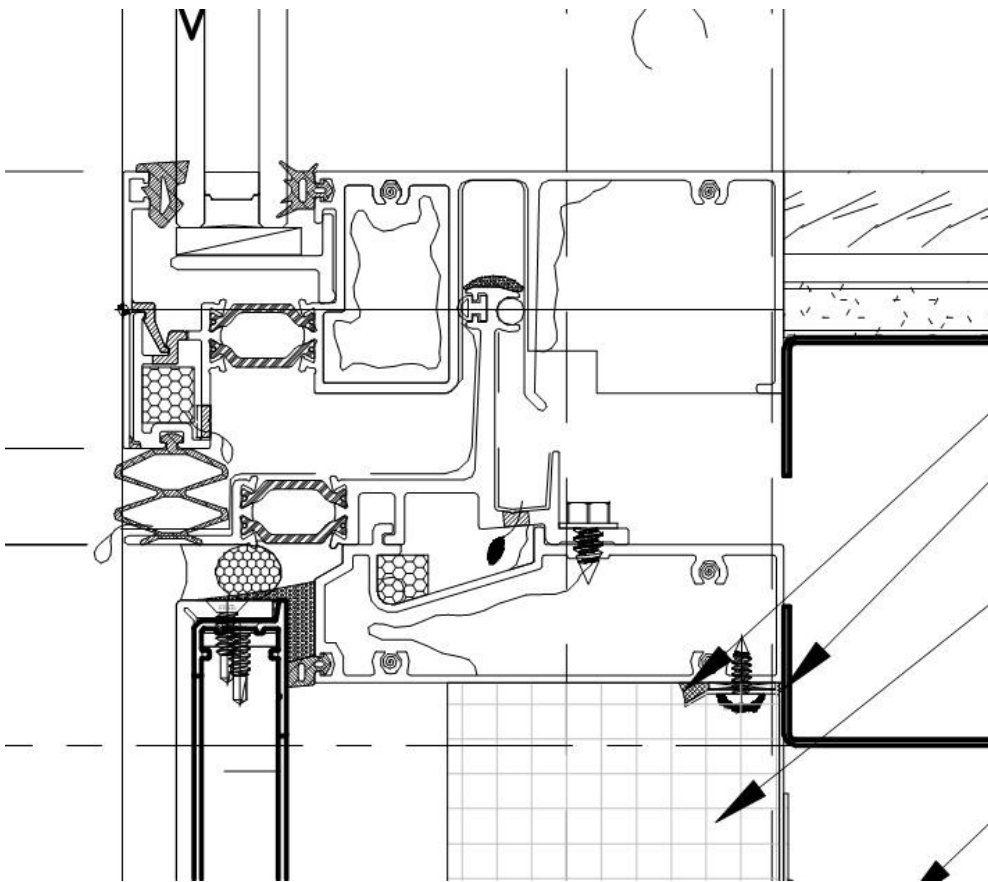
- **First Reactions**
- **DA Approach**



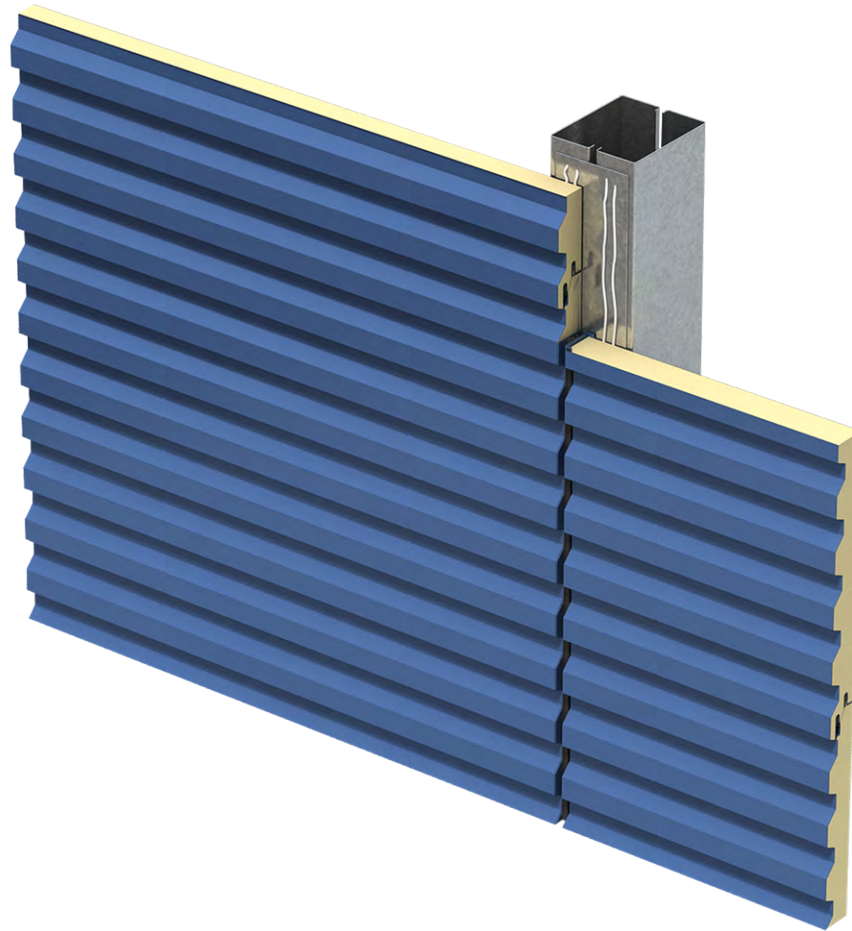


- **Site Logistics**
- **Unitized Approach**
- **Breaking Down the building**

# Unitized Panel System ESW UN-625



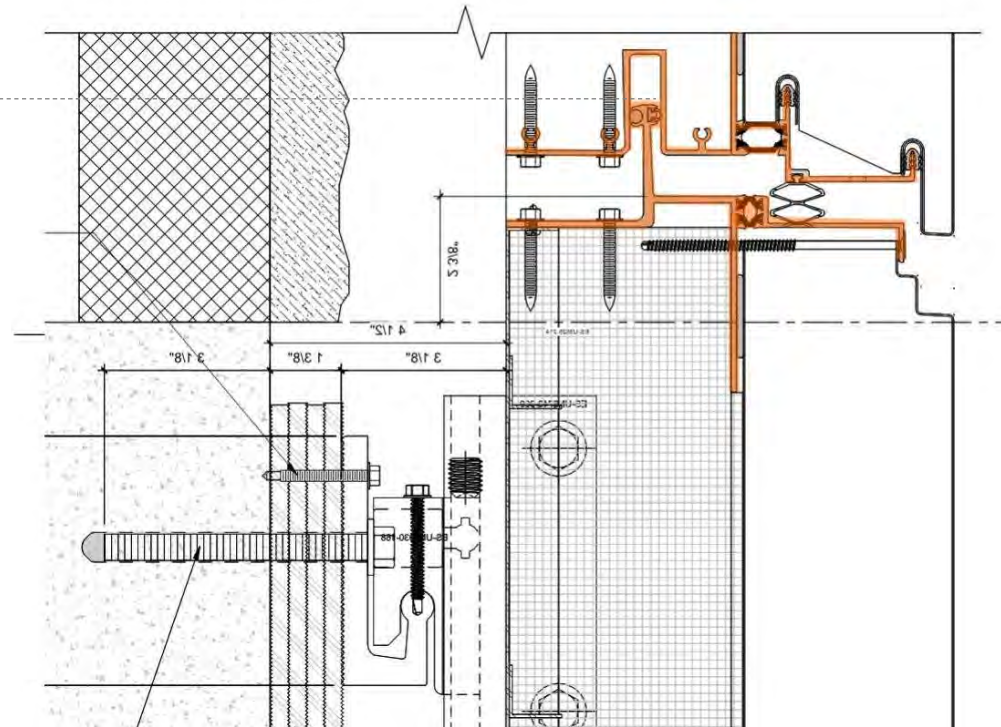
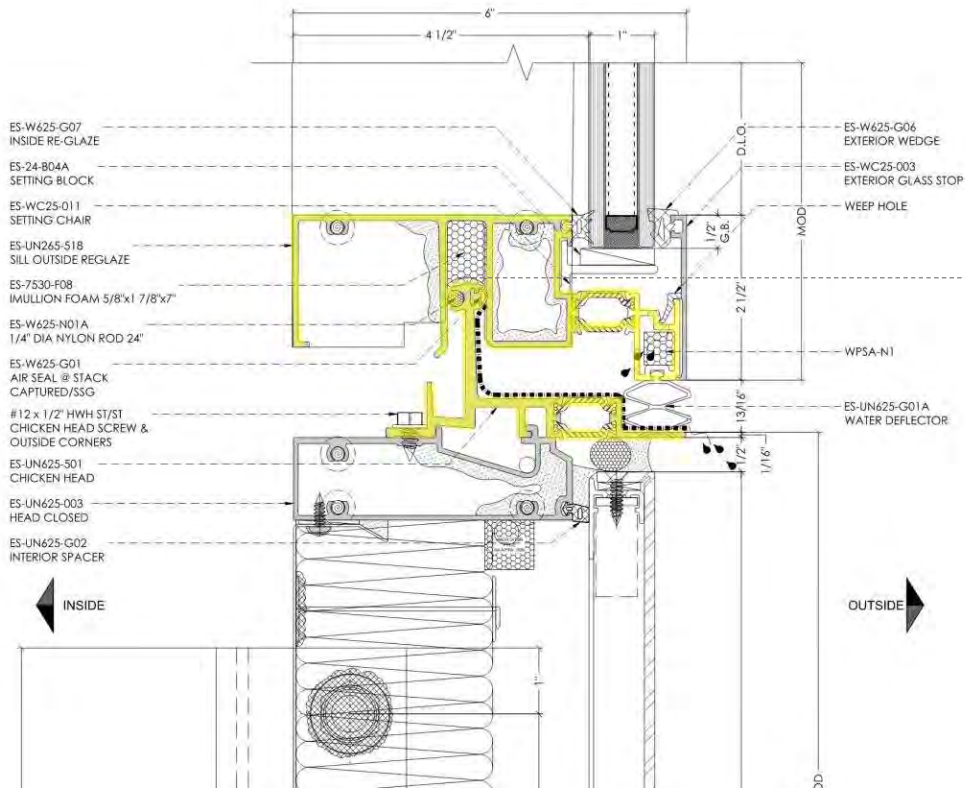
# Unitized Panel System Kingspan Designwall Panels

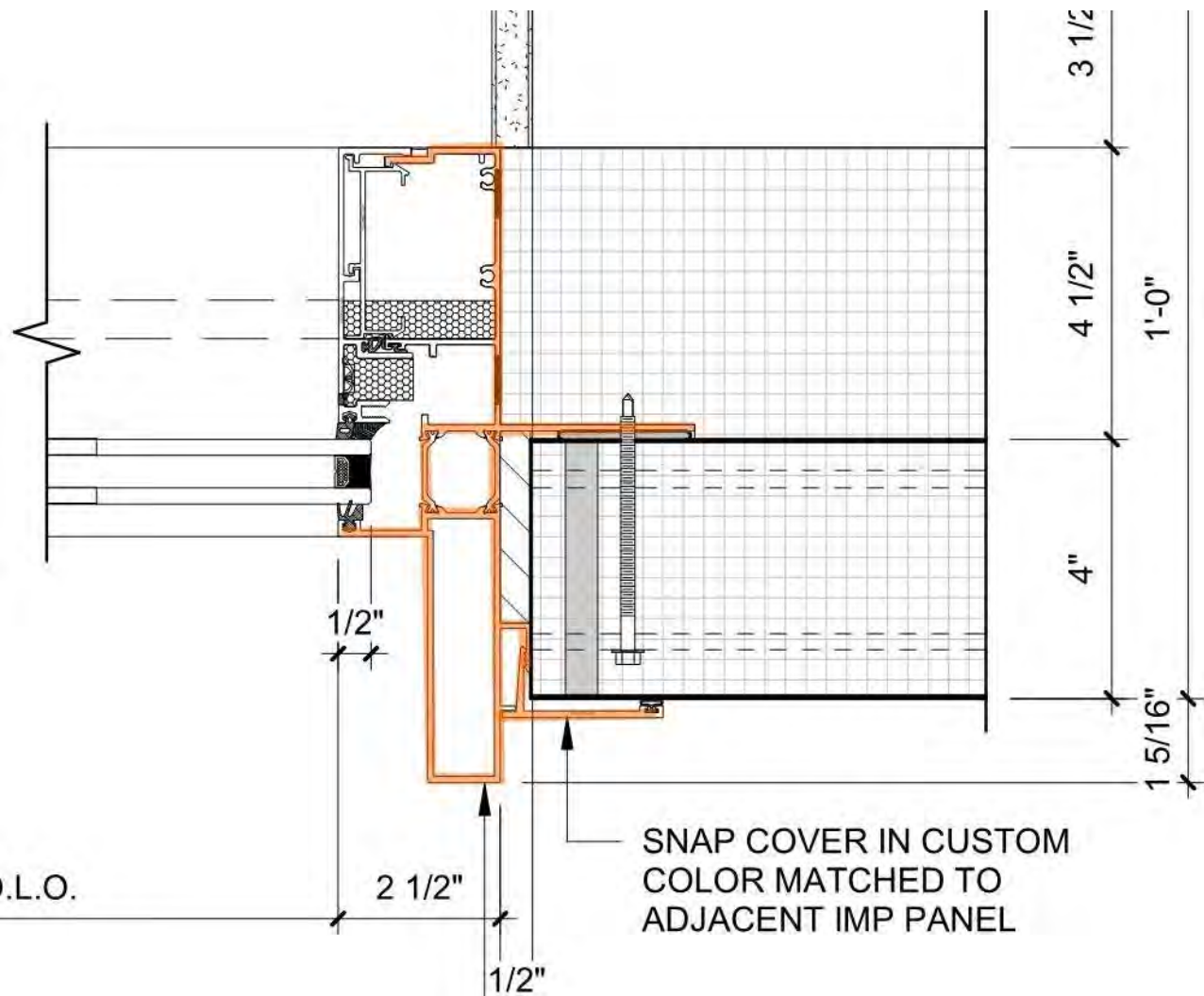




# Marriage Of Two Systems

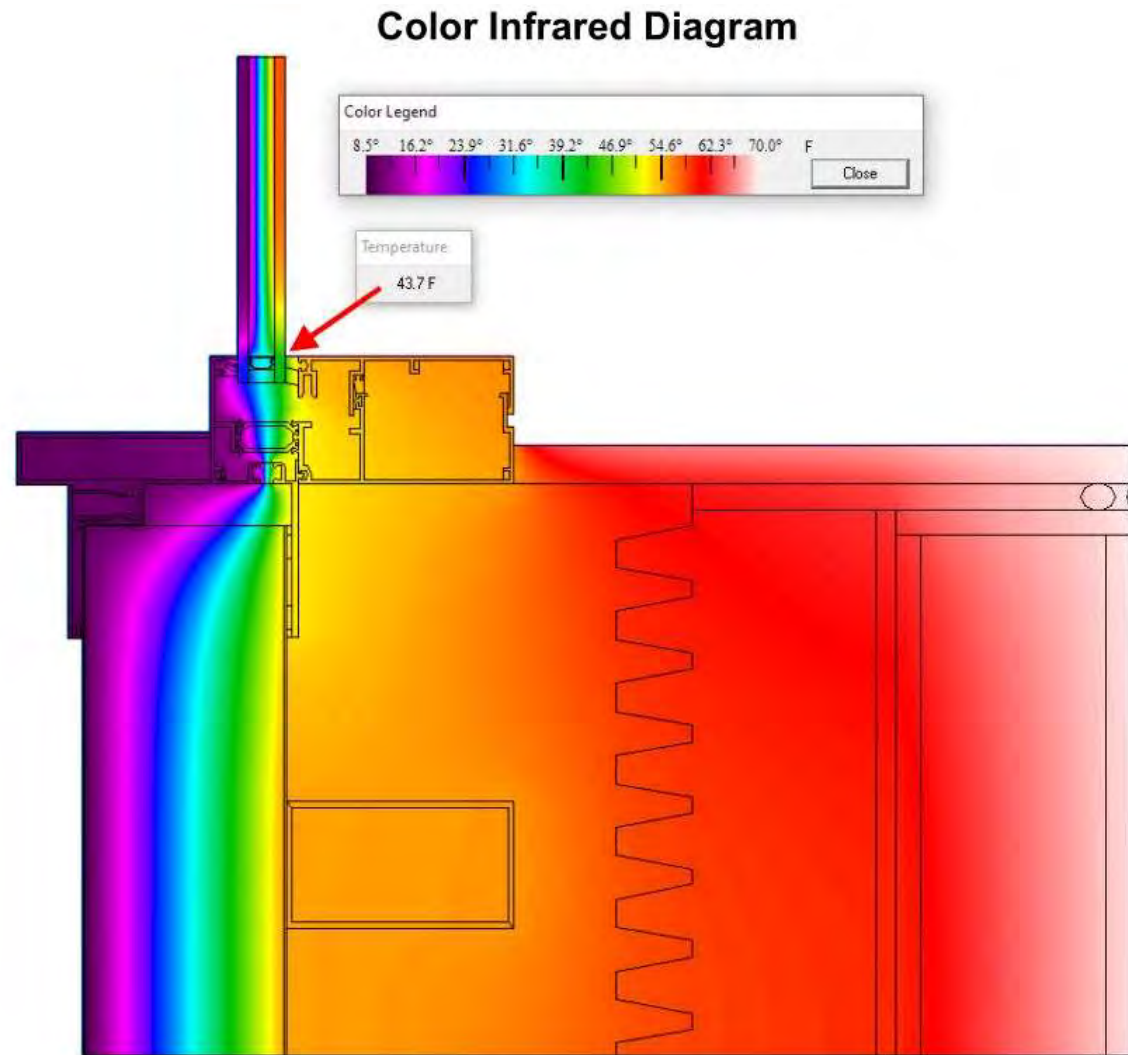
- CW Stack Joinery principles
- Compartmentalize panel areas





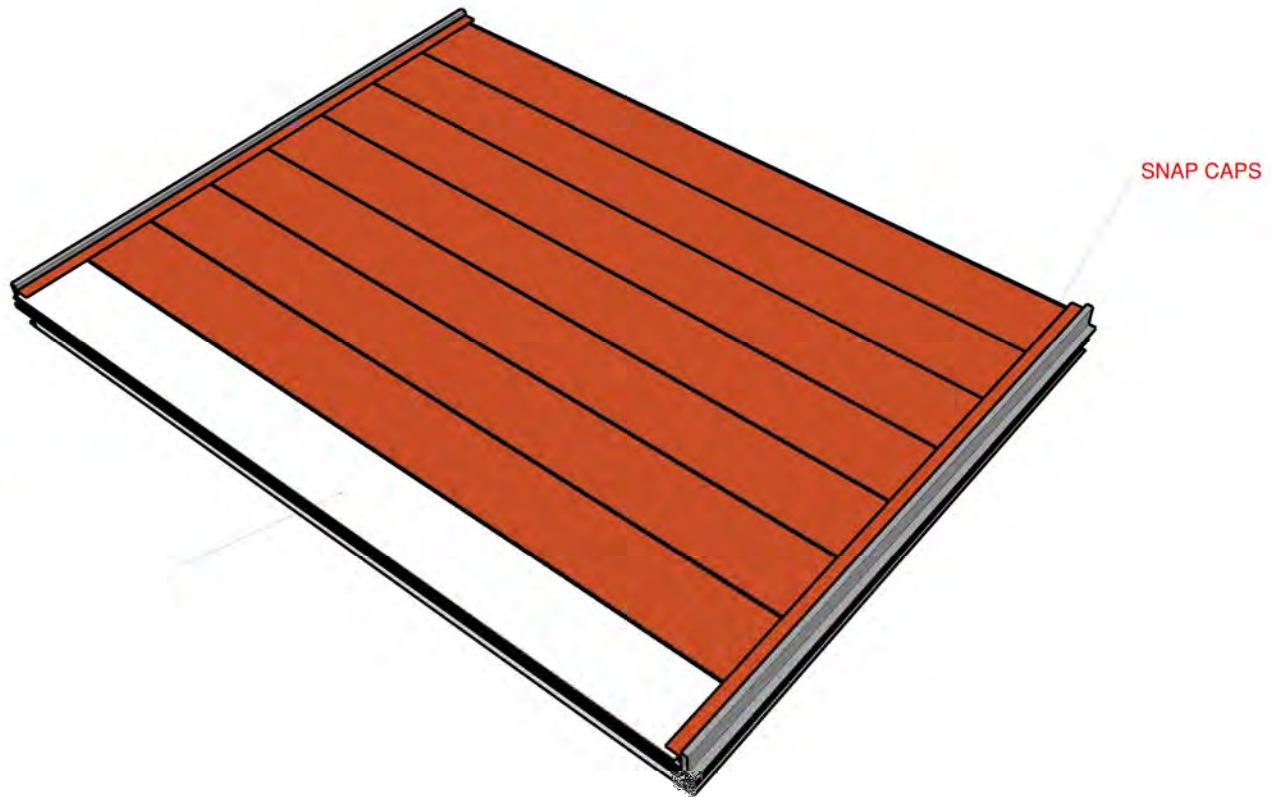
- The same principles apply to the vertical mating mullions.

- Every condition was substantiated through thermal modeling to evaluate any condensation risks.





# Unit Assembly



# Unit Assembly









## First Units

## Key Takeaways

- Flexibility
- Collaboration



## Positive Results and Performance



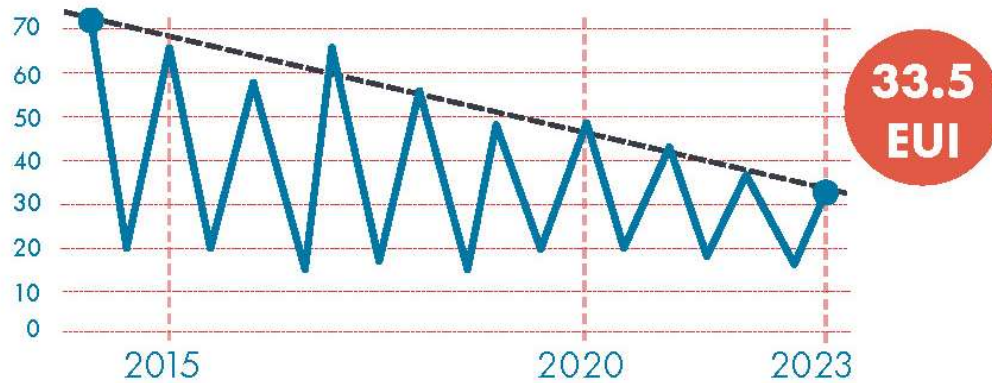


# Energy Performance

## TOTAL ESTIMATED ANNUAL SAVINGS FROM ENERGY CONSERVATION MEASURES

- Exterior facade replacement with integration of air sealing and increased insulating performance
- Replacement of central heating and domestic hot water systems with high-efficiency condensing boilers and fan coil units in residences
- New cogeneration plant
- All lighting converted to LED
- New central ventilation
- Appliance upgrades in all units

## MEASURED ENERGY PERFORMANCE DATA





# Water Usage Performance

## ANNUAL ENERGY AND WATER SAVING

- 💧 2,970,120 gallons of water
- ⚡ 141,659 kWh of electricity
- 🔥 7,053 therms of natural gas
- 💰 \$92,500 in utility cost saving for residents

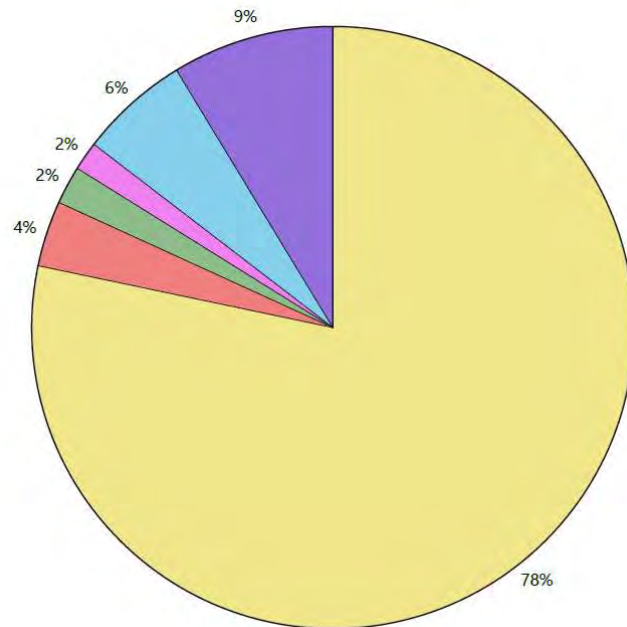
## 3 MILLION GALLONS OF WATER CONSERVED PER YEAR



-35%



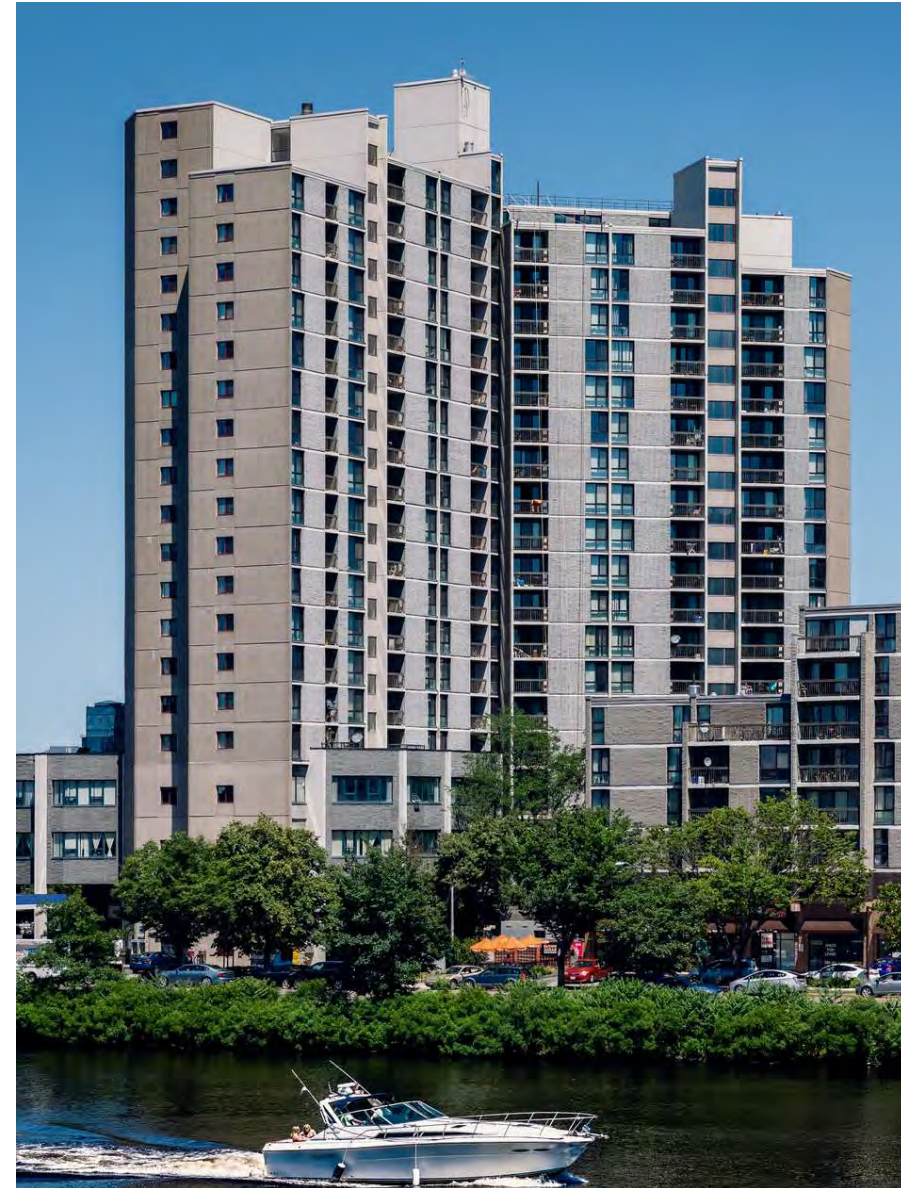
# Embodied Carbon



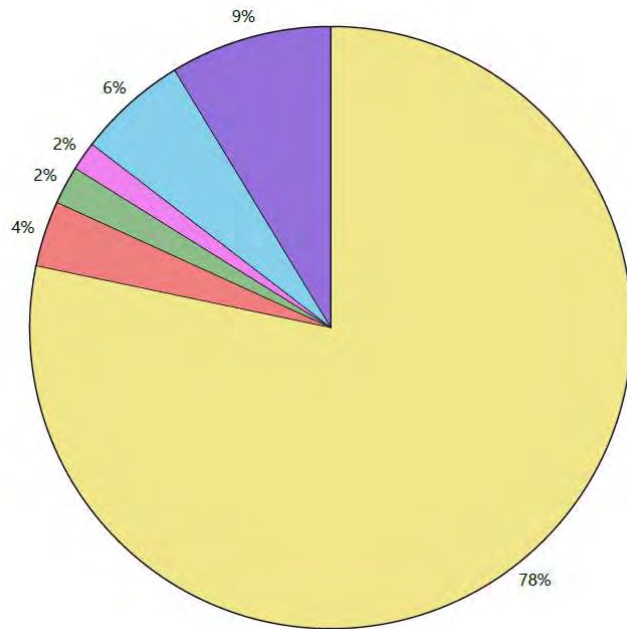
Existing Building

## MATERIALS LEGEND

- |   |   |
|---|---|
|  CONCRETE                    |  THERMAL AND MOISTURE PROTECTION |
|  MASONRY                     |  OPENINGS AND GLAZING            |
|  METALS (FRAMES AND SOFFITS) |  FINISHES                        |
|  WOOD/PLASTICS/COMPOSITES    |   |

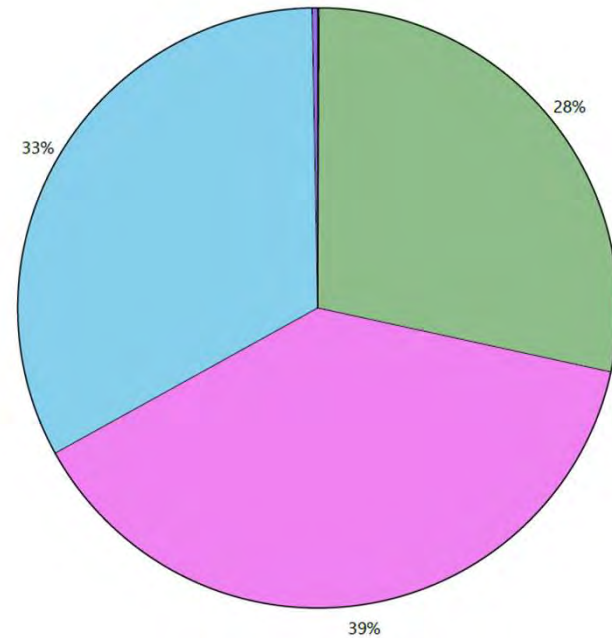


# Embodied Carbon



Existing Building

+



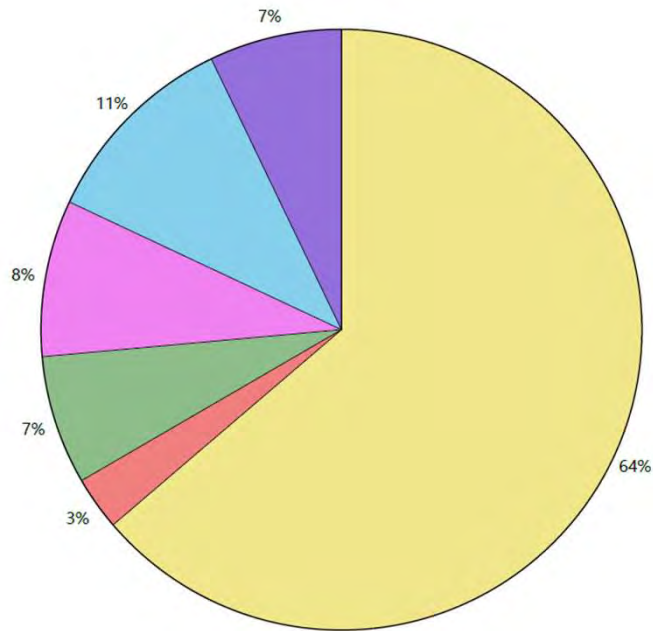
Overcladding

## MATERIALS LEGEND

- |   |   |
|---|---|
|  CONCRETE                    |  THERMAL AND MOISTURE PROTECTION |
|  MASONRY                     |  OPENINGS AND GLAZING            |
|  METALS (FRAMES AND SOFFITS) |  FINISHES                        |
|  WOOD/PLASTICS/COMPOSITES    |   |



# Embodied Carbon



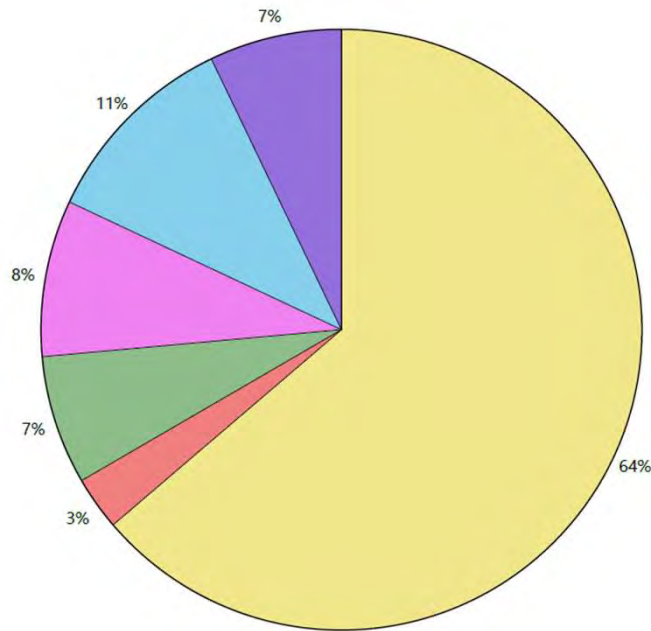
Existing Building + Overcladding

## MATERIALS LEGEND

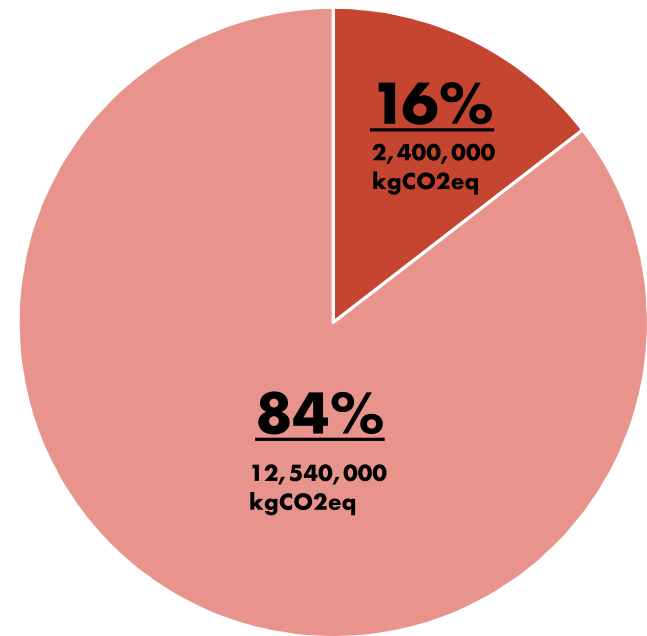
- |   |   |
|---|---|
|  CONCRETE                    |  THERMAL AND MOISTURE PROTECTION |
|  MASONRY                     |  OPENINGS AND GLAZING            |
|  METALS (FRAMES AND SOFFITS) |  FINISHES                        |
|  WOOD/PLASTICS/COMPOSITES    |   |



# Embodied Carbon





Existing Building + Overcladding



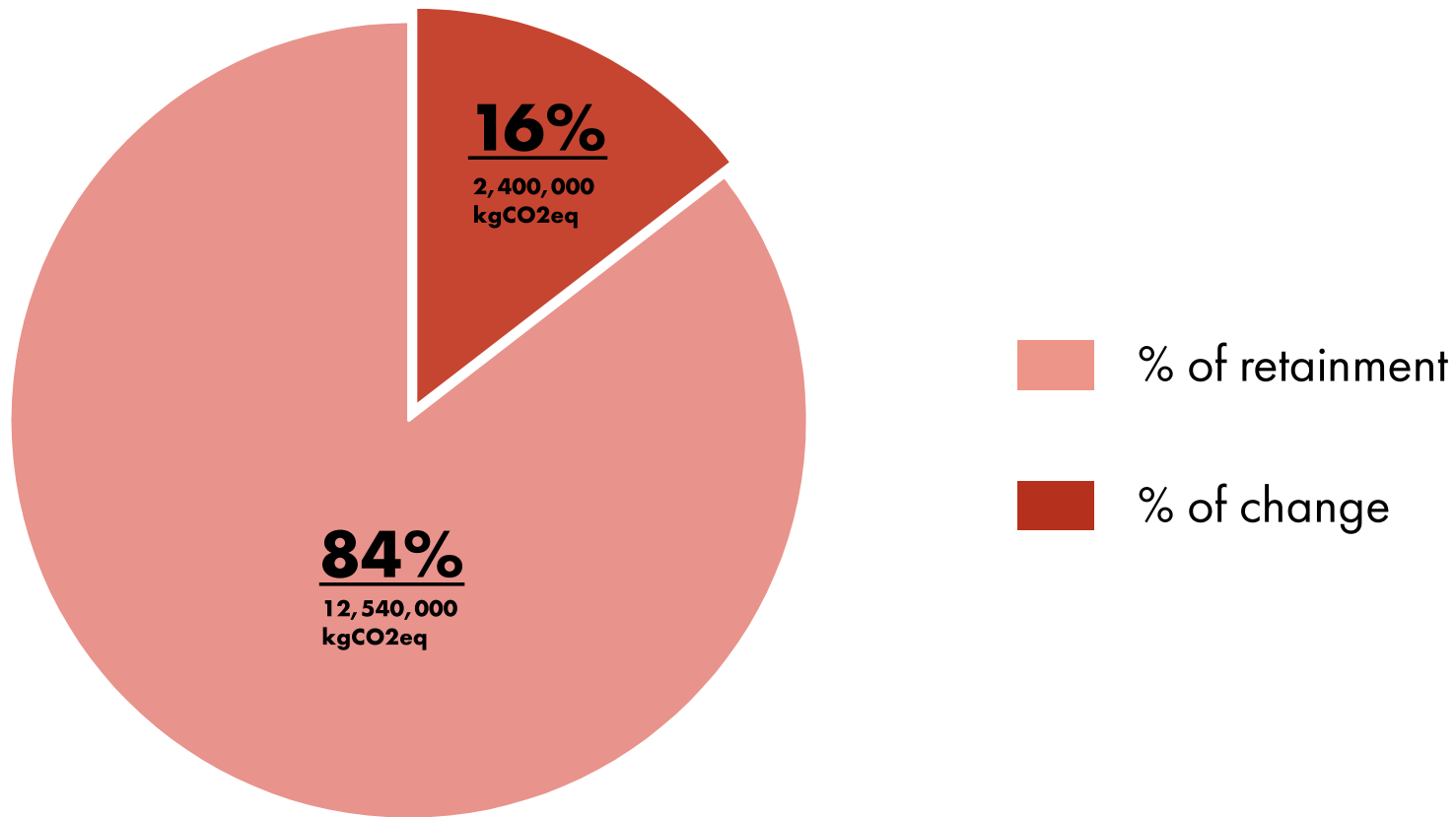
## MATERIALS LEGEND

	CONCRETE		THERMAL AND MOISTURE PROTECTION
	MASONRY		OPENINGS AND GLAZING
	METALS (FRAMES AND SOFFITS)		FINISHES
	WOOD/PLASTICS/COMPOSITES		

	% of retention
	% of change



# Embodied Carbon



# Community

