AIR LEAKAGE: WHAT YOU SEE IS NOT WHAT YOU GET

VIDARIS

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SERVICE LINES

ENVELOPE

ENERGY

CODE ADVISORY

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ENGINEERING

COURSE DESCRIPTION

Air leakage is an important consideration in all construction. Tighter buildings are more energy efficient and comfortable. Although large buildings are rarely blower door tested, architects, enclosure consultants, manufacturers, and installers spend time and money to provide air tight buildings. Details within the contract documents and subsequent shop drawings indicate the intended location of the air barrier. However, over the course of mockup construction, mockup testing, and project construction, air leakage issues often arise that were not addressed prior, generally at unusual conditions and transitions. These locations can be difficult to detail and are typically overlooked. This presentation will first review the basics of air leakage detailing, and then provide specific examples where project documentation did not address air leakage sites, which were found in the field. Implemented field fixes will also be presented. Although project-specific, these case studies will demonstrate typical locations that must be carefully vetted during detailing.

LEARNING OBJECTIVES

At the end of the this course, participants will be able to:

1. Review the basic concepts of air leakage including measurement techniques.
2. Understand typical air barrier detailing for different construction types and transitions.
3. Review examples of typical and project-specific breaches in the air barrier, both during the drawings phase and during construction.
4. Review fixes and recommendations at these typical and project-specific breaches in the air barrier.

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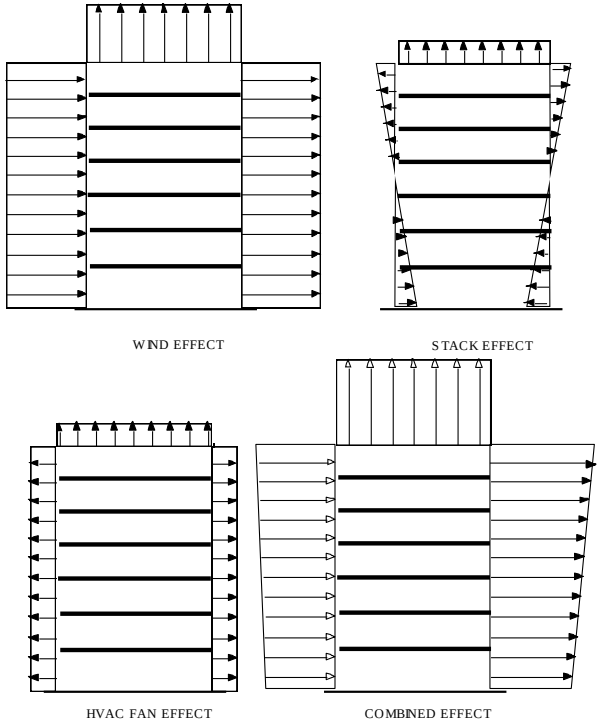
AIR LEAKAGE – THE BASICS

- Energy Transfer: Conduction, Convection, Radiation
- What is air infiltration? What is required for air infiltration to take place?
- What can create these conditions?

AIR LEAKAGE – THE BASICS

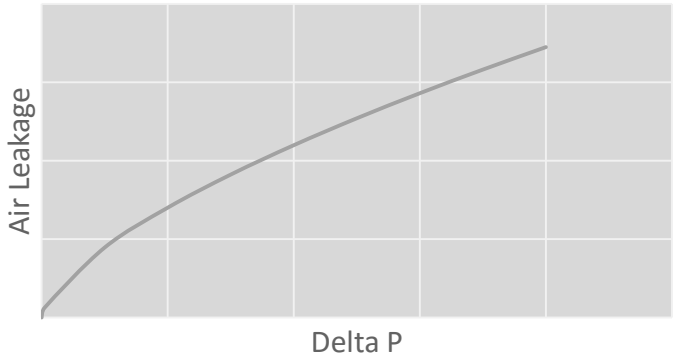


AIR LEAKAGE – THE BASICS

- Why do we care?

- Air leakage measurement
  - Material
  - Assembly
  - Whole building

AIR LEAKAGE – THE BASICS



How does pressure relate to air leakage?

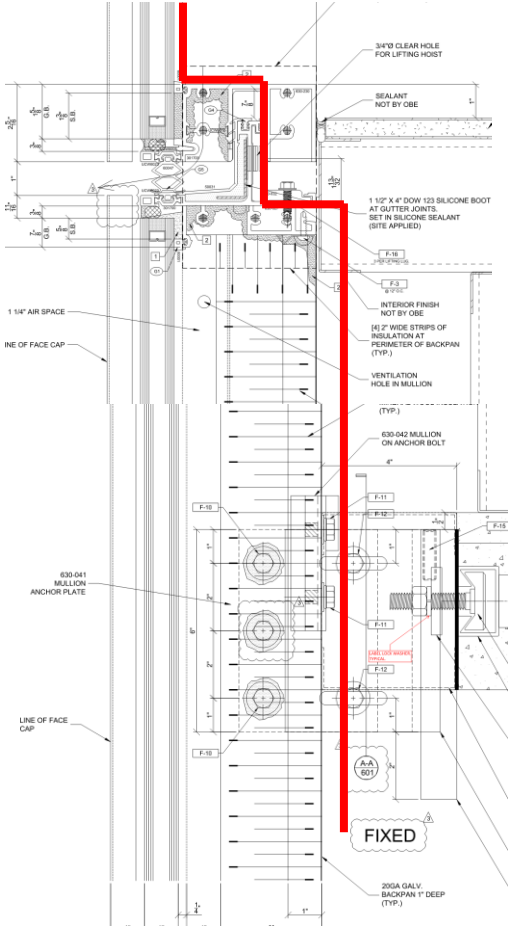
$Q = C \Delta P$ (ideal flow)

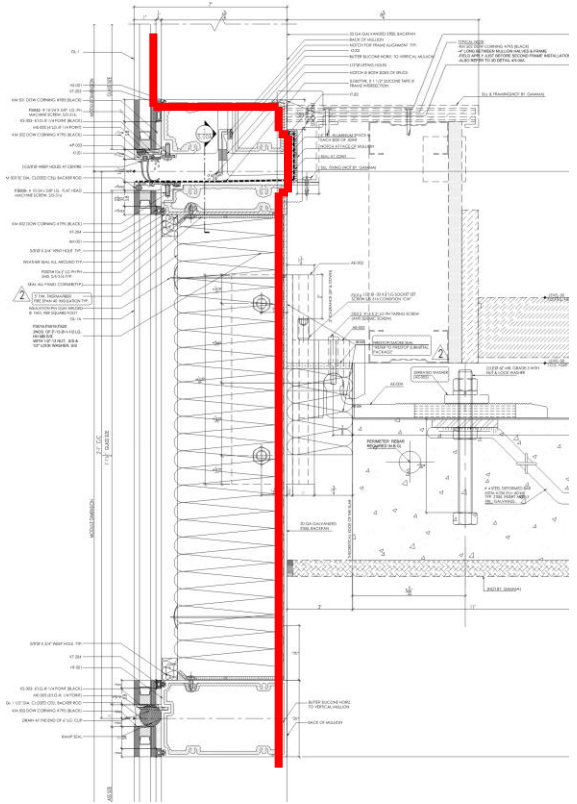
$Q = C (\Delta P)1/2$ (turbulent flow – Bernoulli)

TYPICAL DETAILING

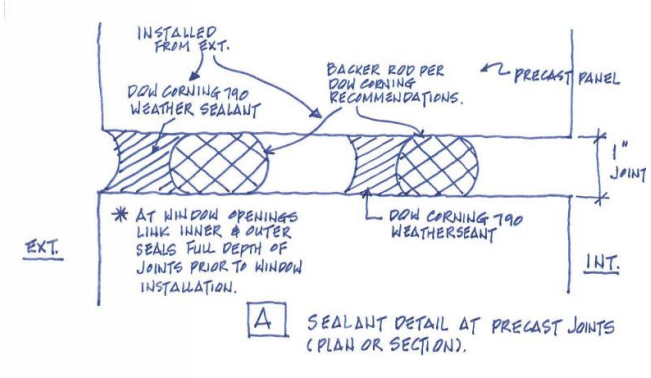
- Curtain Wall
- Precast
- Punched windows
- Stud / knee walls

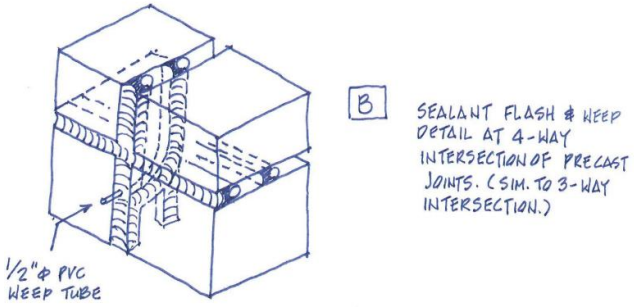
TYPICAL DETAILING - CURTAINWALL





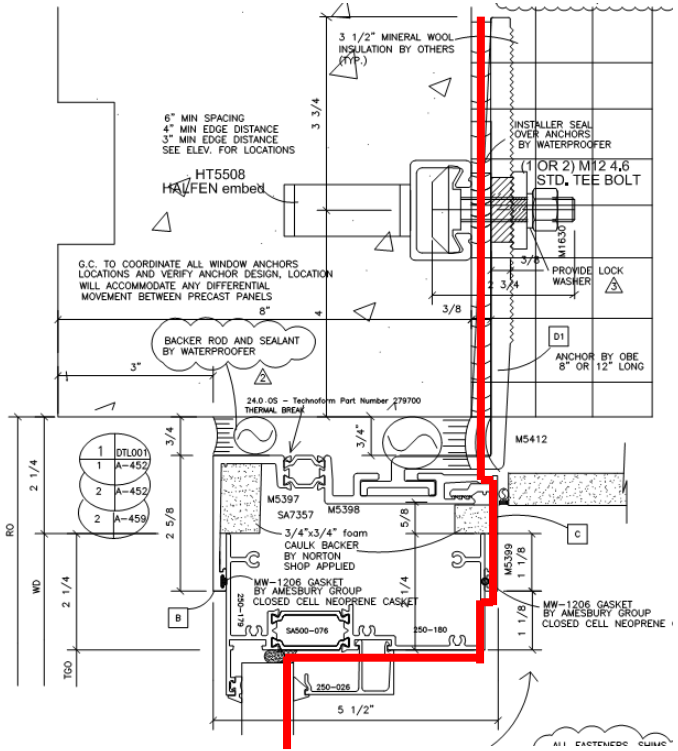
TYPICAL DETAILING - PRECAST



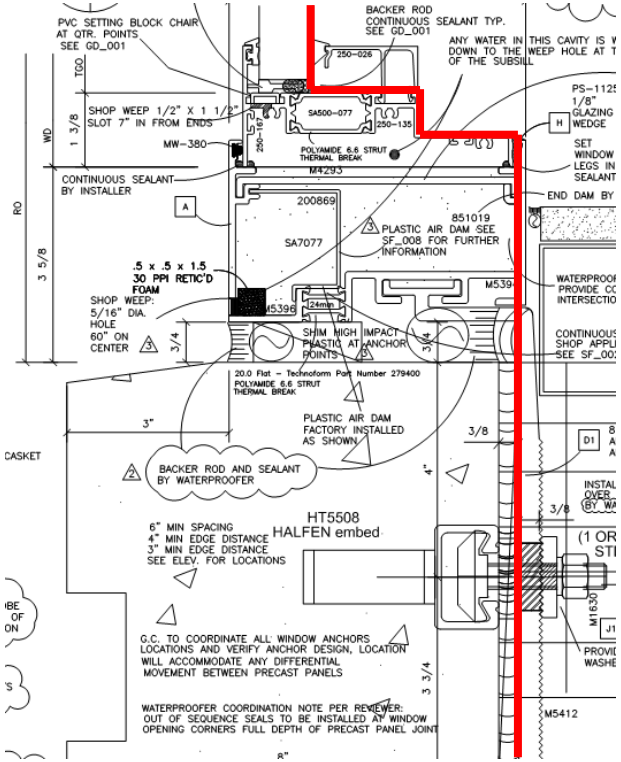


TYPICAL DETAILING – PUNCHED WINDOWS

Head



Sill



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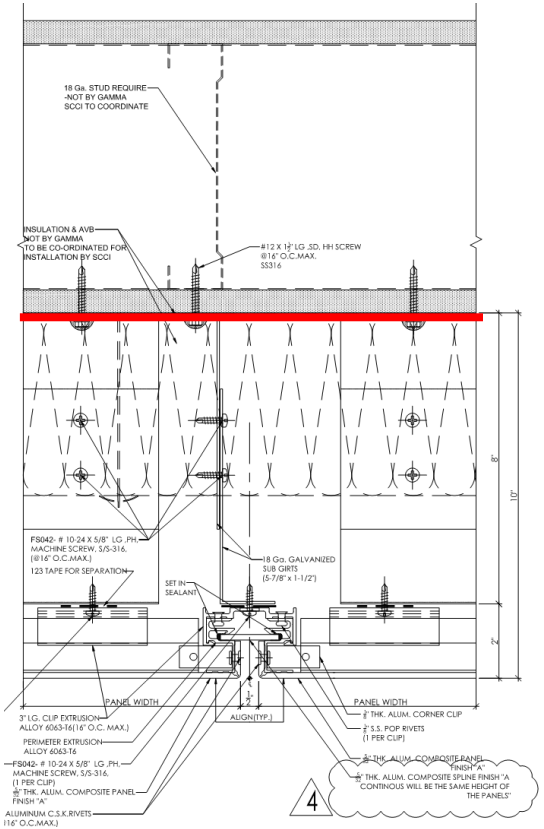
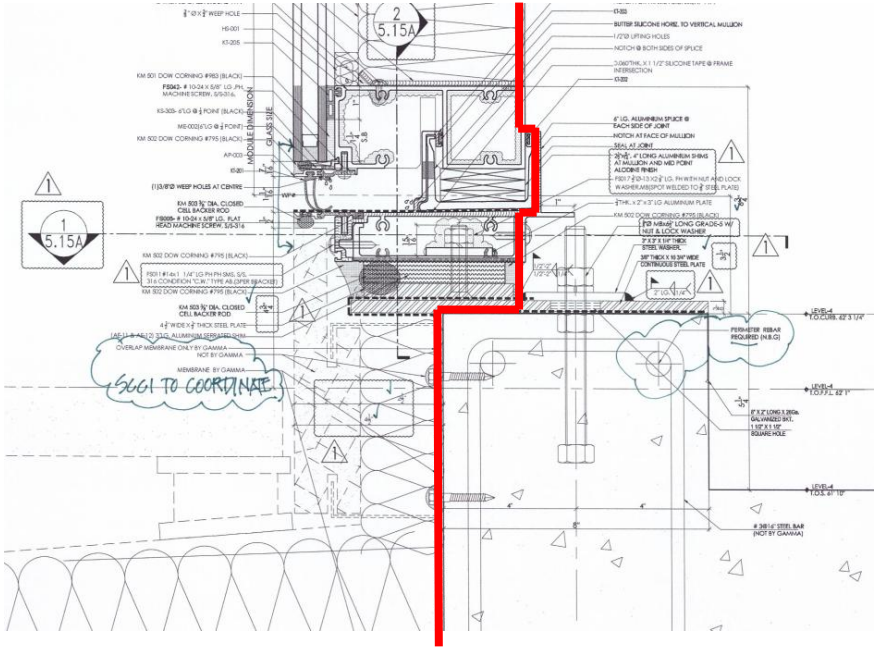
TYPICAL DETAILING – STUD/KNEE WALL





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MOCKUP CONSTRUCTION

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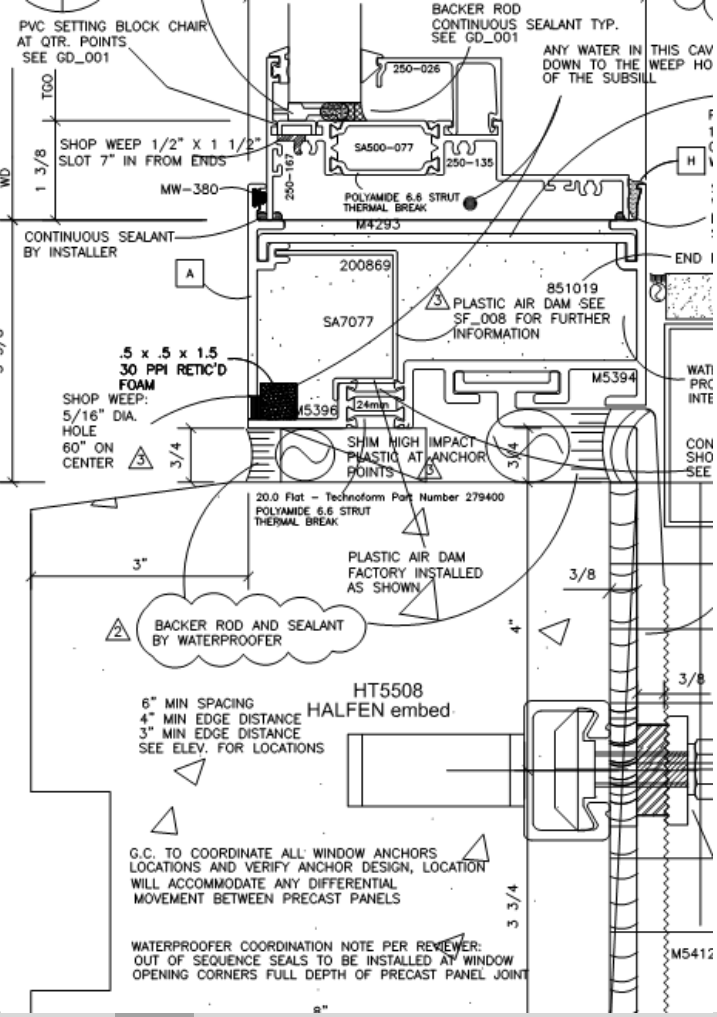

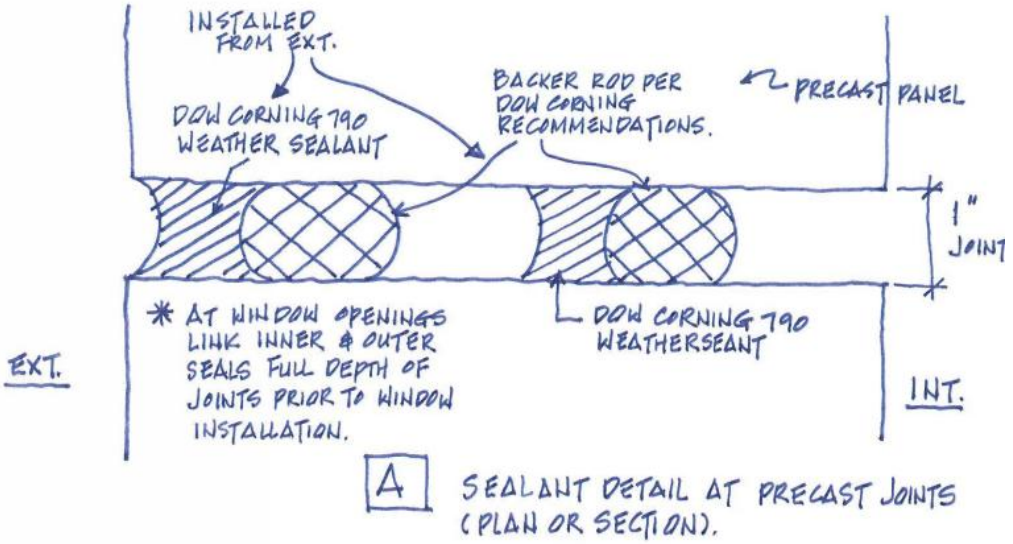

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MOCKUP CONSTRUCTION

APPLIED ON SITE

MOCKUP CONSTRUCTION, EXAMPLE #2

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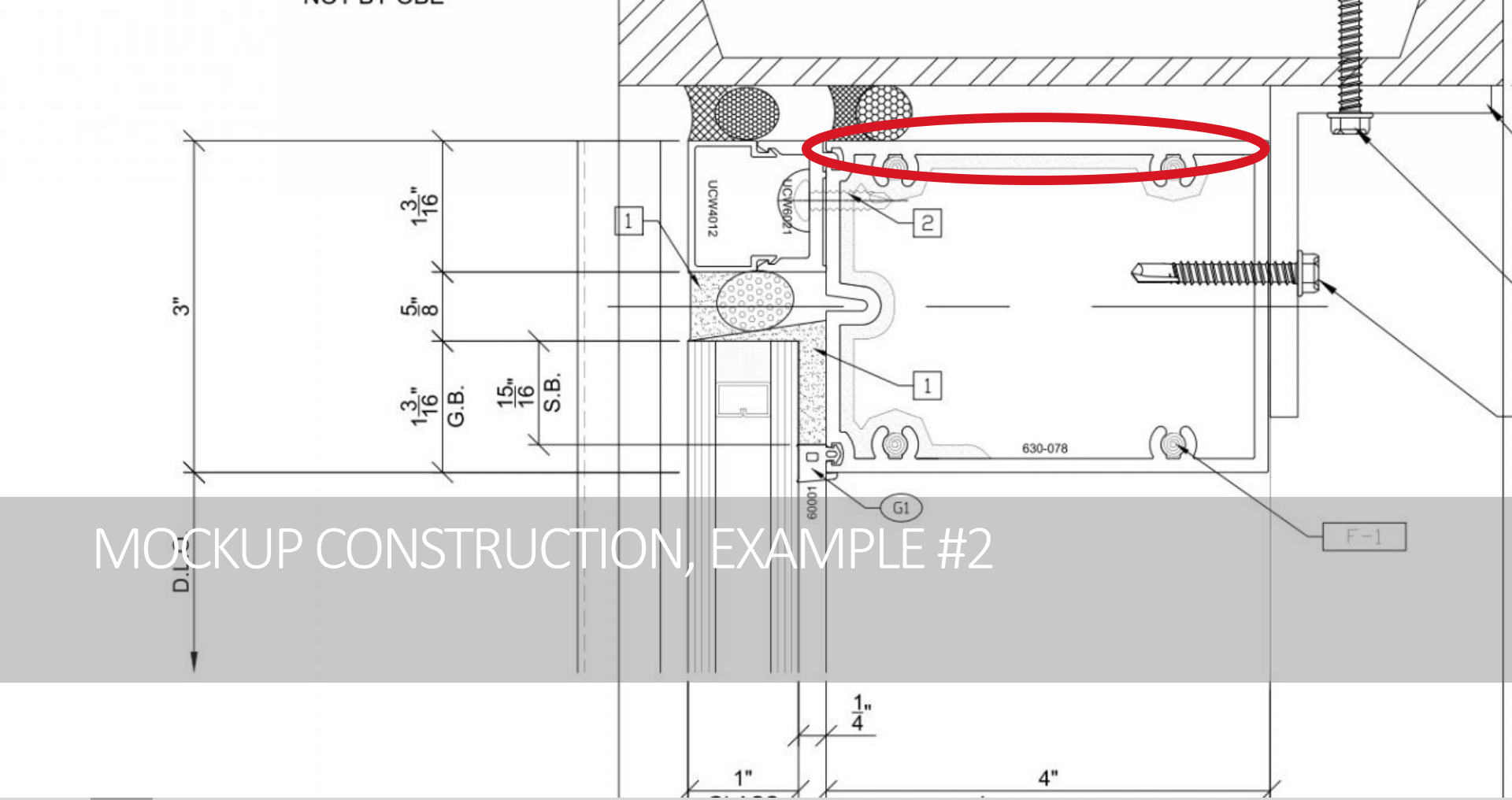

MOCKUP CONSTRUCTION, EXAMPLE #2

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NEW CONSTRUCTION

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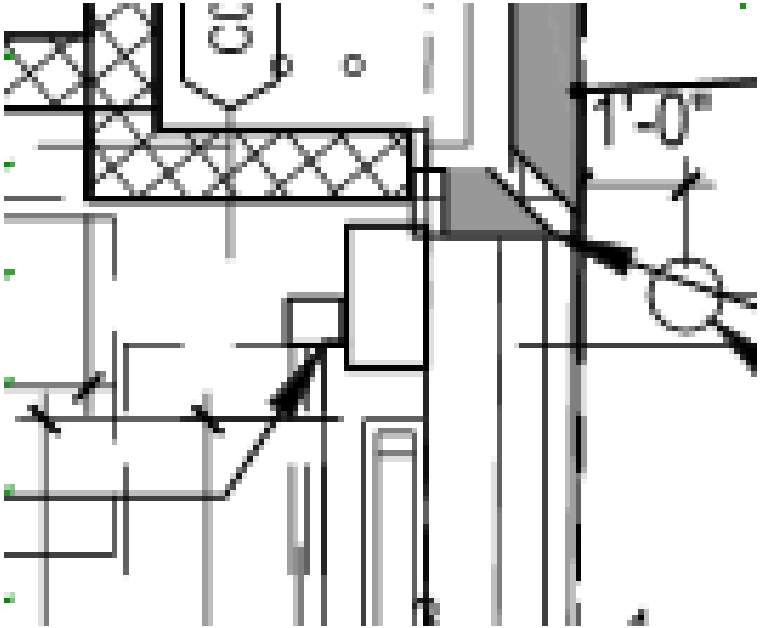
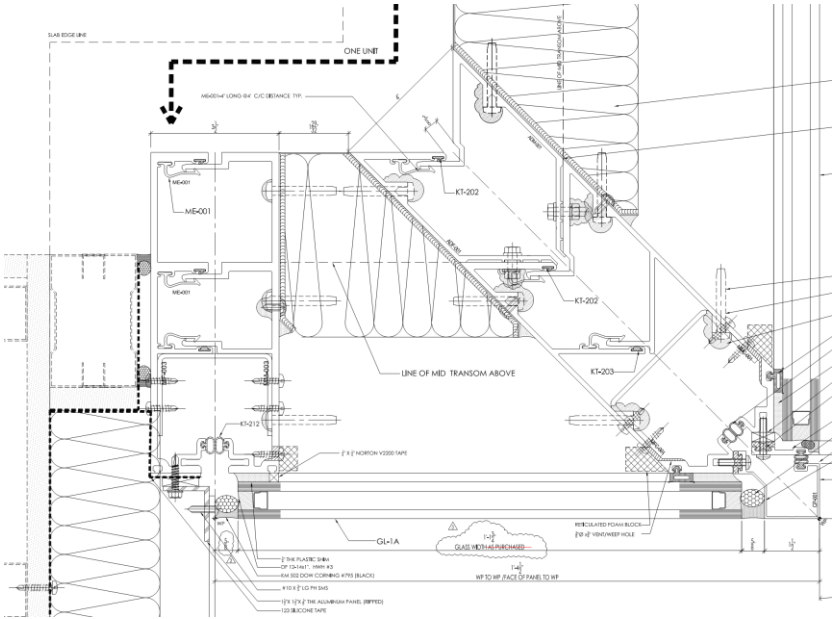
NEW CONSTRUCTION

Architectural



Shop Drawing



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NEW CONSTRUCTION

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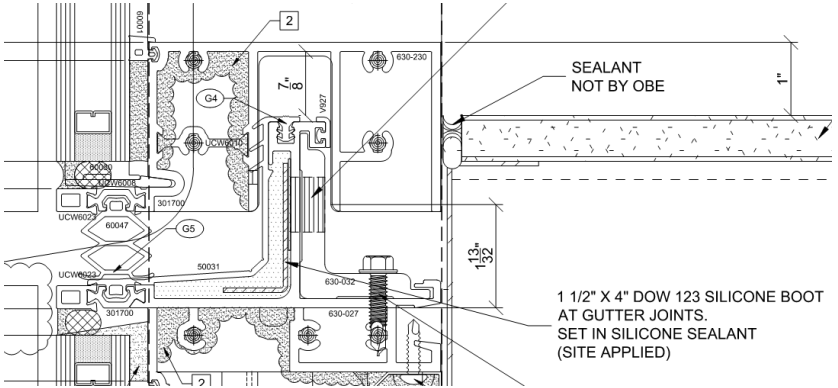
SMOKE SEAL AT CURTAIN WALL



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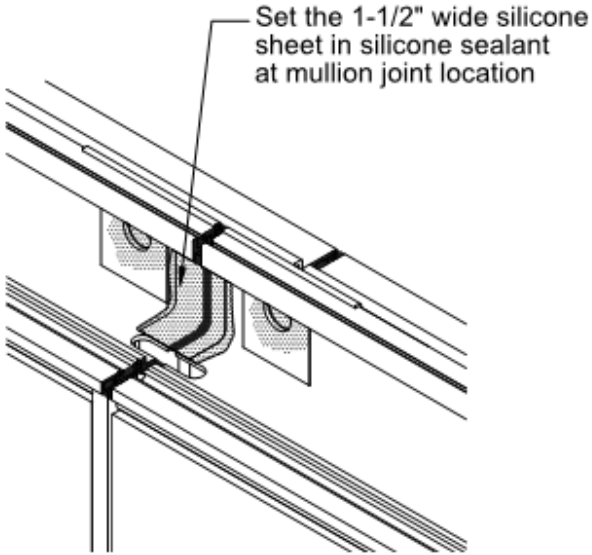
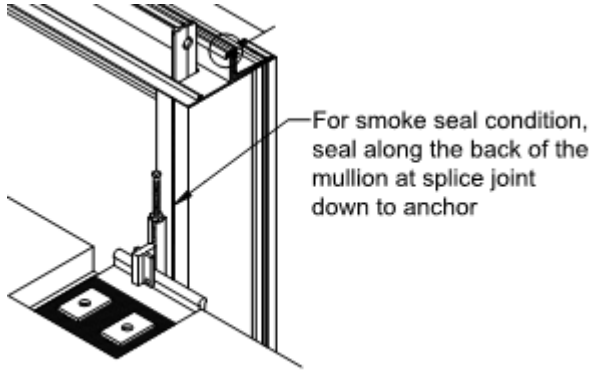
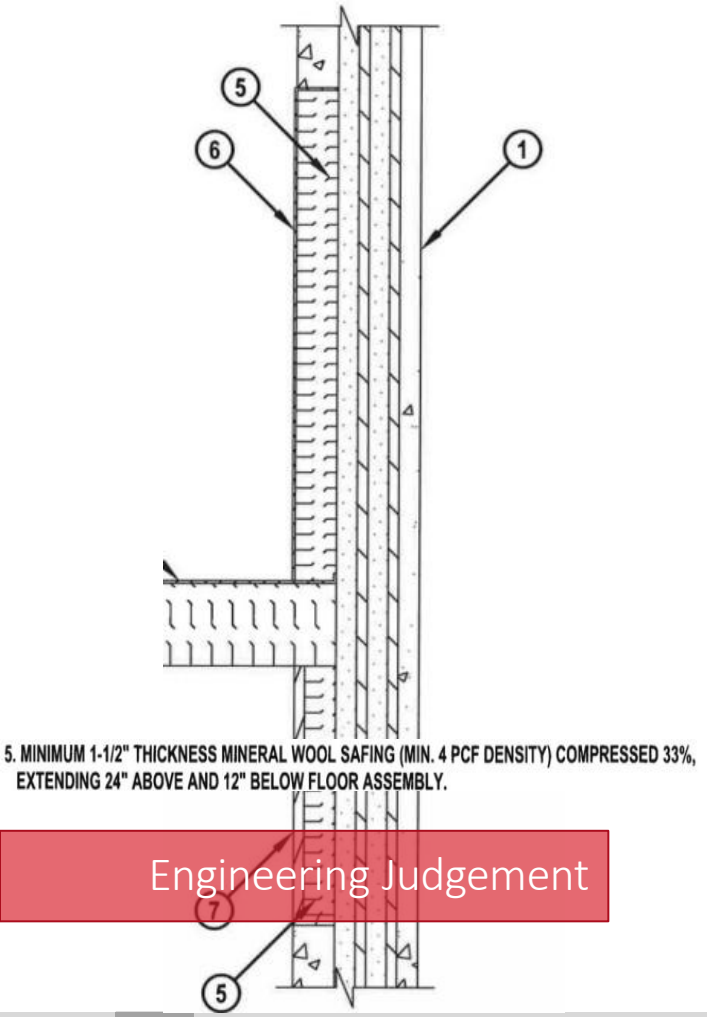
SMOKE SEAL AT CURTAIN WALL





SMOKE SEAL AT PRECAST

What's wrong with this solution?



Engineering Judgement

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INVESTIGATION – EXAMPLE 1

The Problem

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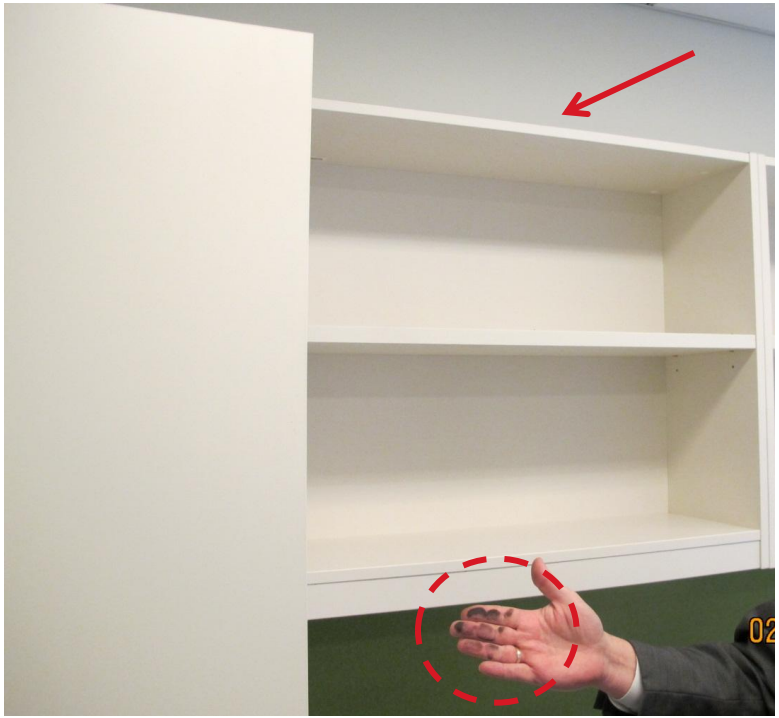
INVESTIGATION

Two floors above the lobby



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INVESTIGATION

The Exterior

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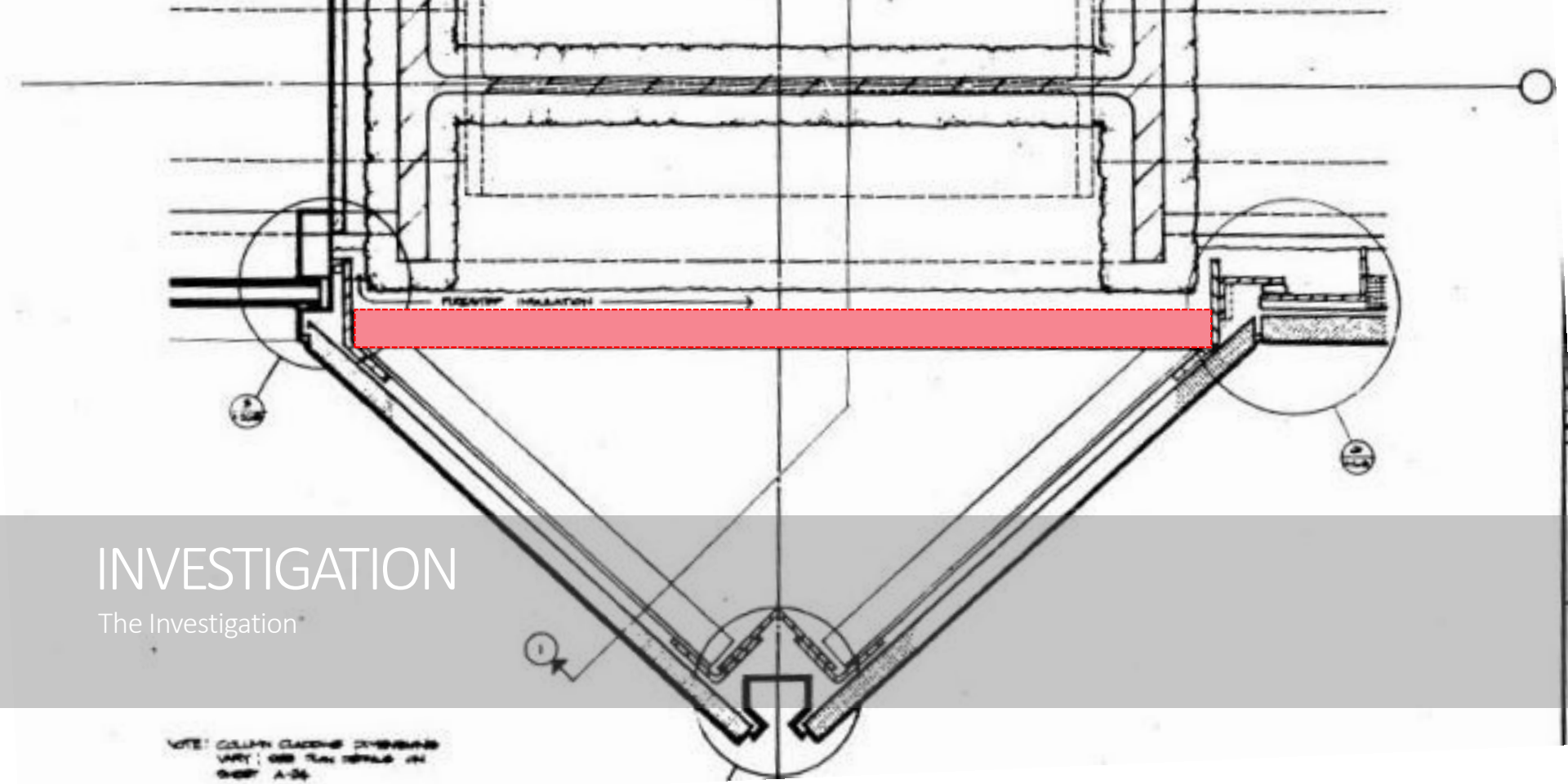
INVESTIGATION

The Investigation



INVESTIGATION

The Investigation

Conclusion

We concluded that air from the T Station and garage was moving through the exterior granite pilasters into building. The dust and dirt in the air settled on surfaces inside the office spaces above.

SOLUTIONS

Solution: Wire mesh to support spray foam insulation, followed by sprayed fibrous fire proofing.

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INVESTIGATION - EXAMPLE 2

The Problem: Water was pouring in above the window heads.

This problem occurred on a relatively warm day with no rain fall, after a period of cold weather.

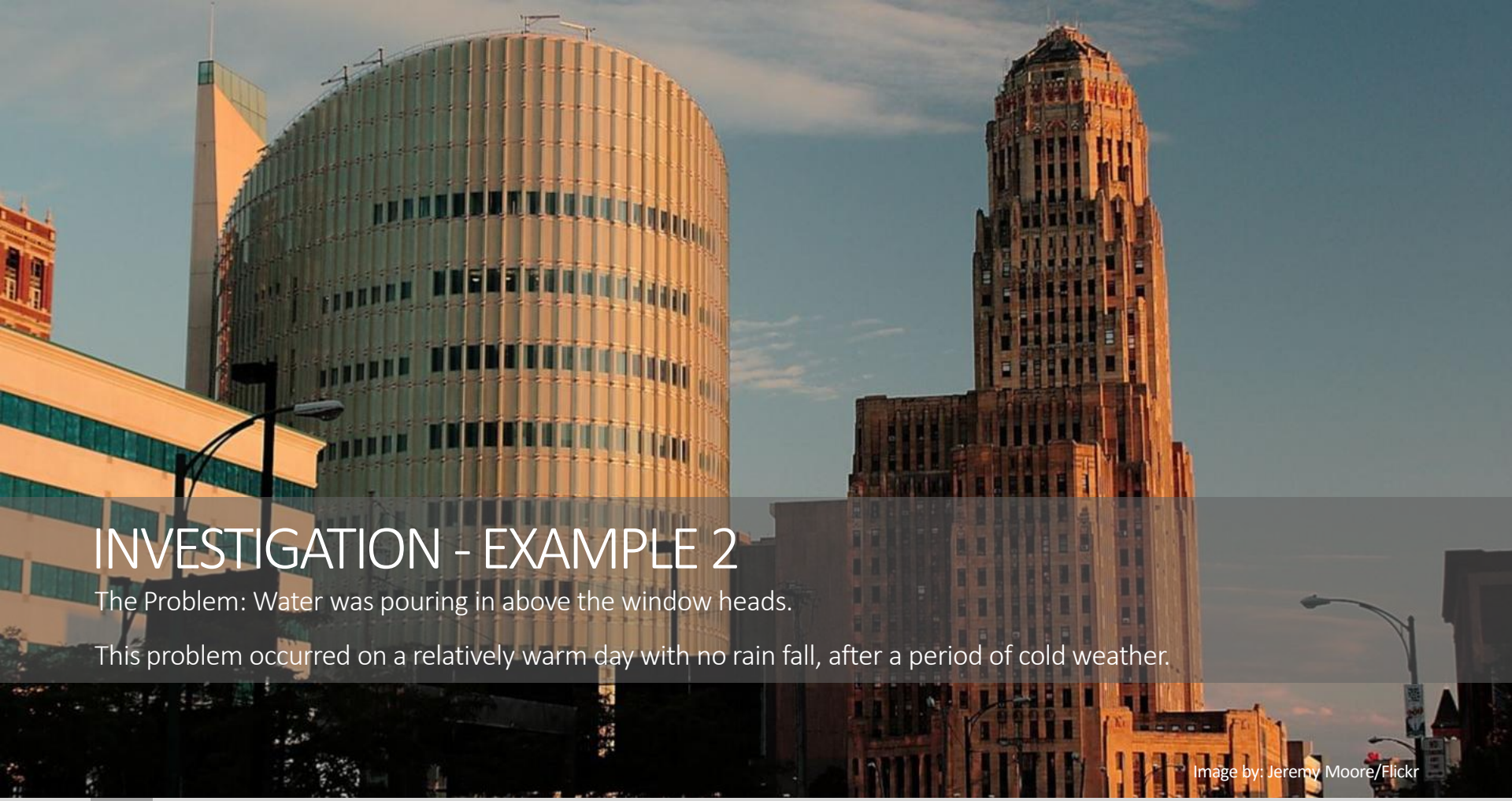

Image by: Jeremy Moore/Flickr

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INVESTIGATION

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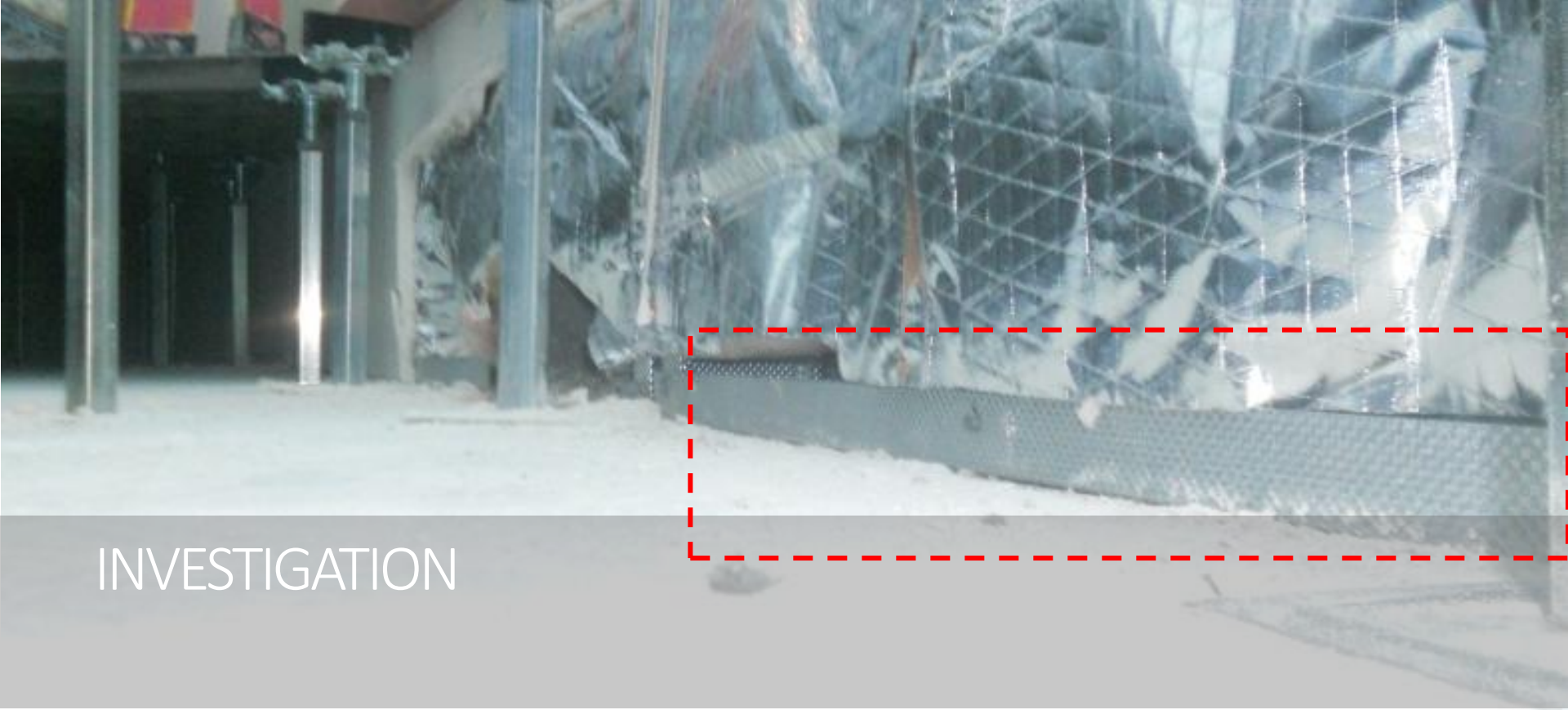

INVESTIGATION

INVESTIGATION

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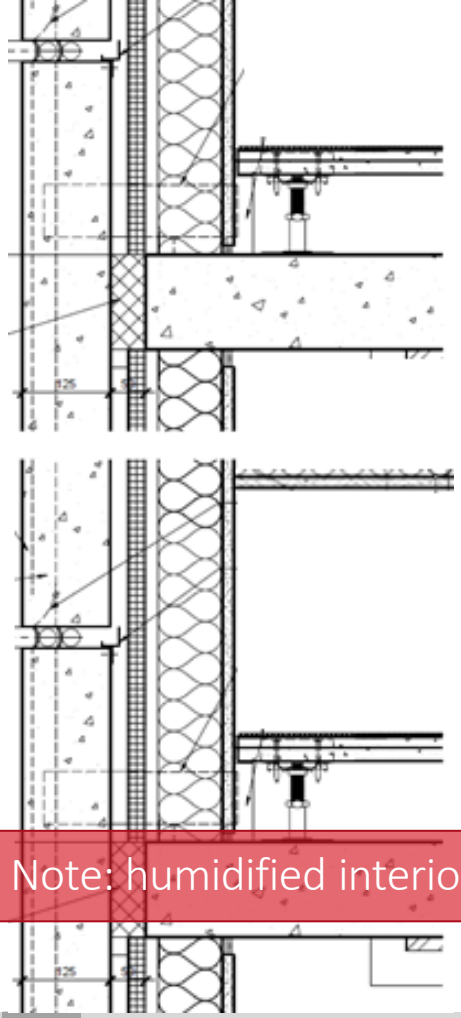


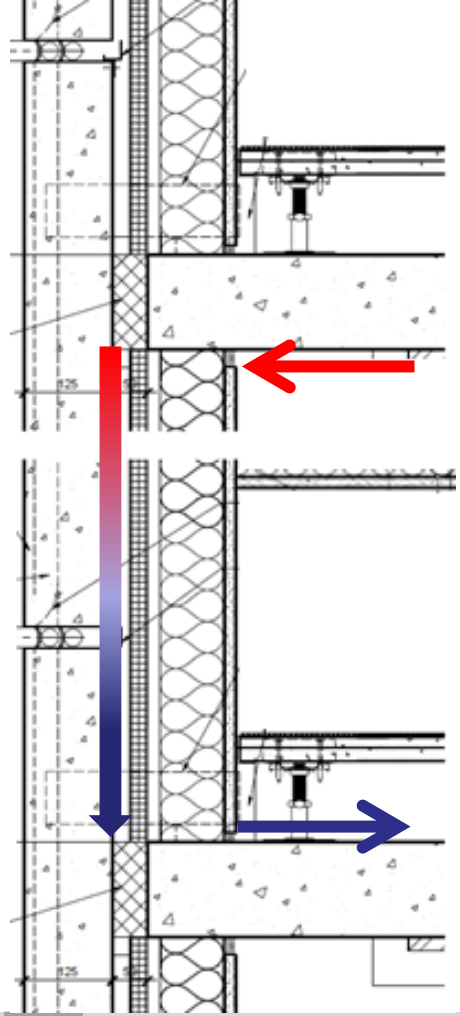
Note: humidified interior

INVESTIGATION

Exterior Wall

- Precast concrete, with double sealed joints
- 1” airspace
- 1” mineral wool
- 1” airspace
- Steel studs with foil faced fiberglass batt
- Gypsum wall board

Any thoughts? Where is the air barrier?



CONCLUSIONS

- The GWB was not installed as an air barrier because the sealant was not installed
- The foil-facing was not installed as an air barrier
- Interior air formed a convective loop, and moisture was deposited on the back of the concrete
- This moisture froze, then melted when the exterior temperature rose
- The water ran across the window head and pooled under the raised floor

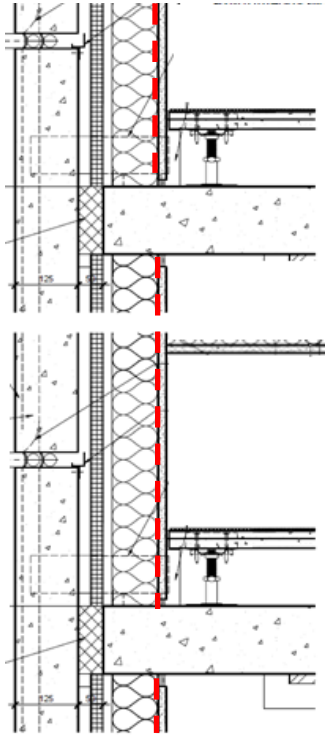
SOLUTIONS

Possible Solutions

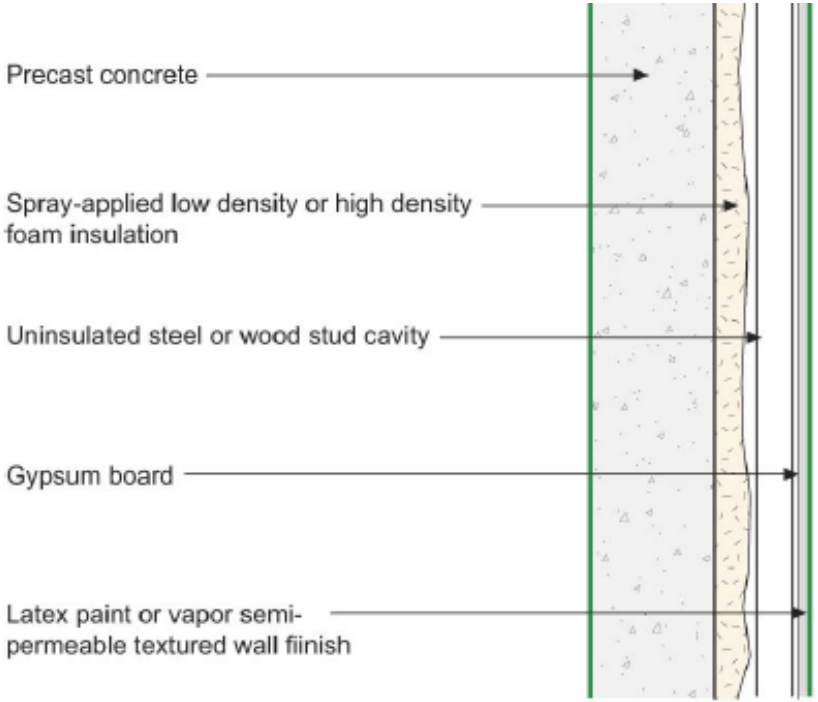
- Raise the temperature of the interior surface of the precast
- Eliminate movement of air flow laden with interior moisture into the wall cavity
- Align thermal, air, and vapor control layers

What do you think the client chose? What solution did we prefer?

CLIENT'S CHOICE: SALVAGED WALL



OUR CHOICE: ALIGN THE LAYERS



QUESTIONS?


THANK YOU