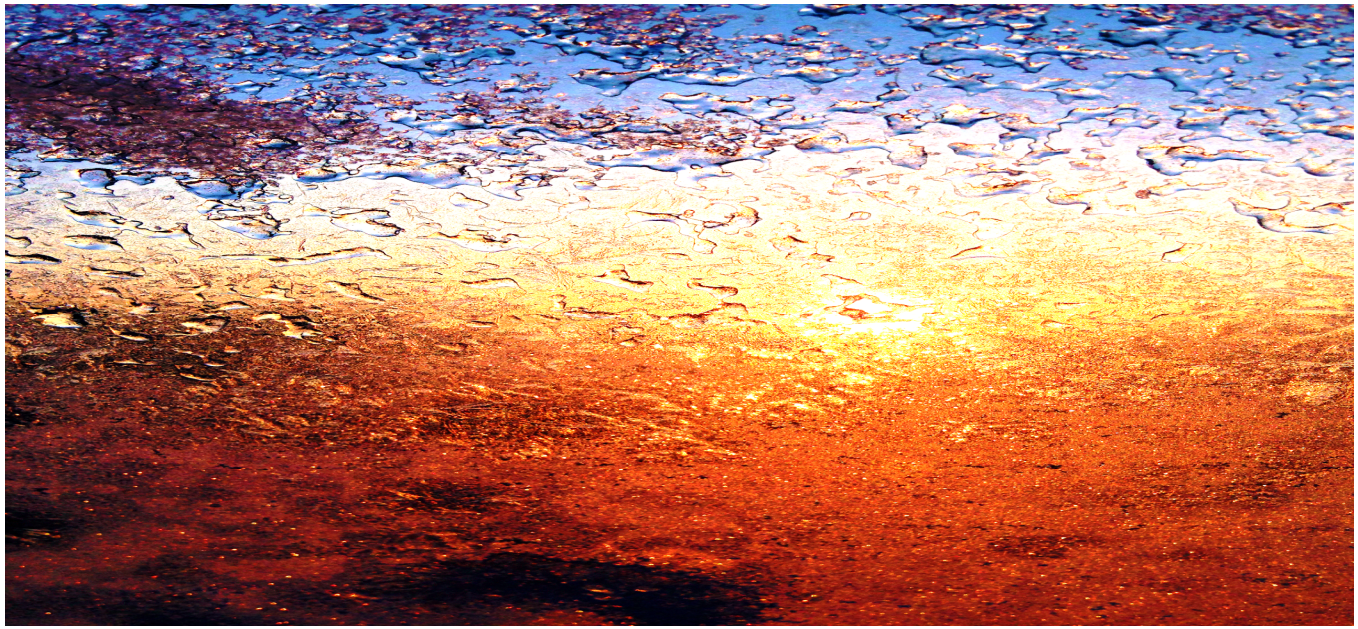
Building Enclosure Condensation Moisture Control from Air Transport in Cold Weather Climates



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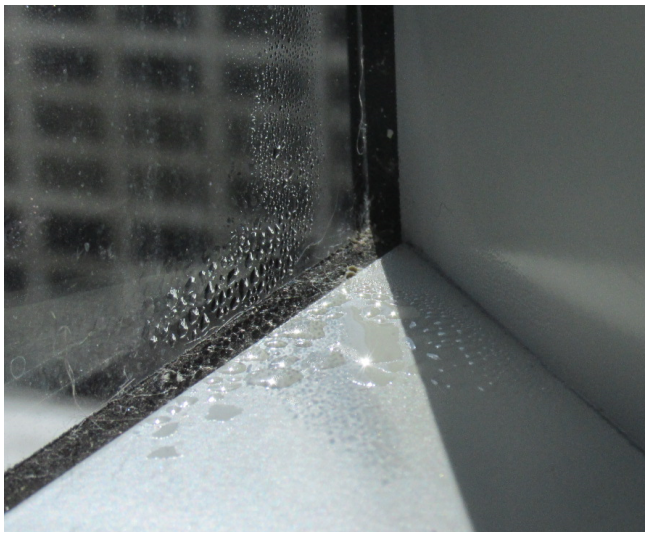
learning objectives

- discuss condensation problems caused by air transport
- understand air transport control and risk management strategies
- review case studies highlighting approaches to mitigate condensation potential

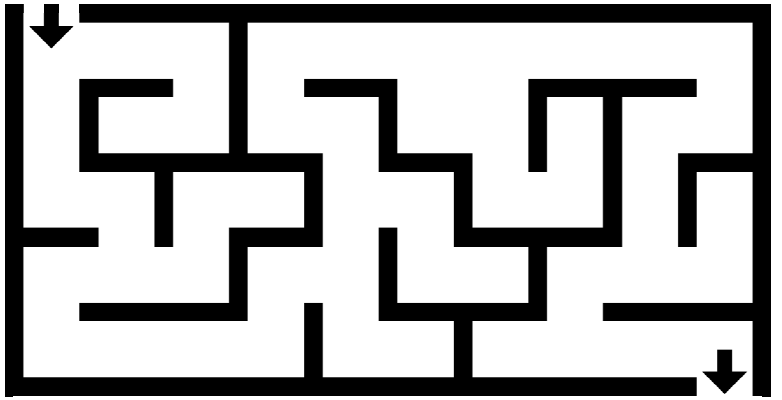
moisture problems



- building moisture problems:
  - water infiltration
  - deterioration
  - yucky organic things
  - etc…
- problem if:
  - inadequate drainage, management, and/or drying
  - materials susceptible to damage and beyond safe moisture storage

condensation from air transport

- water vapor transportation:
  - air movement – *can be lots!*
  - diffusion (vapor pressure differential)
- air movement needs **path** and **pressure differential**
- condensation: water vapor → liquid water
  - occurs on **surfaces** colder than ***dewpoint temperature*** of surrounding air



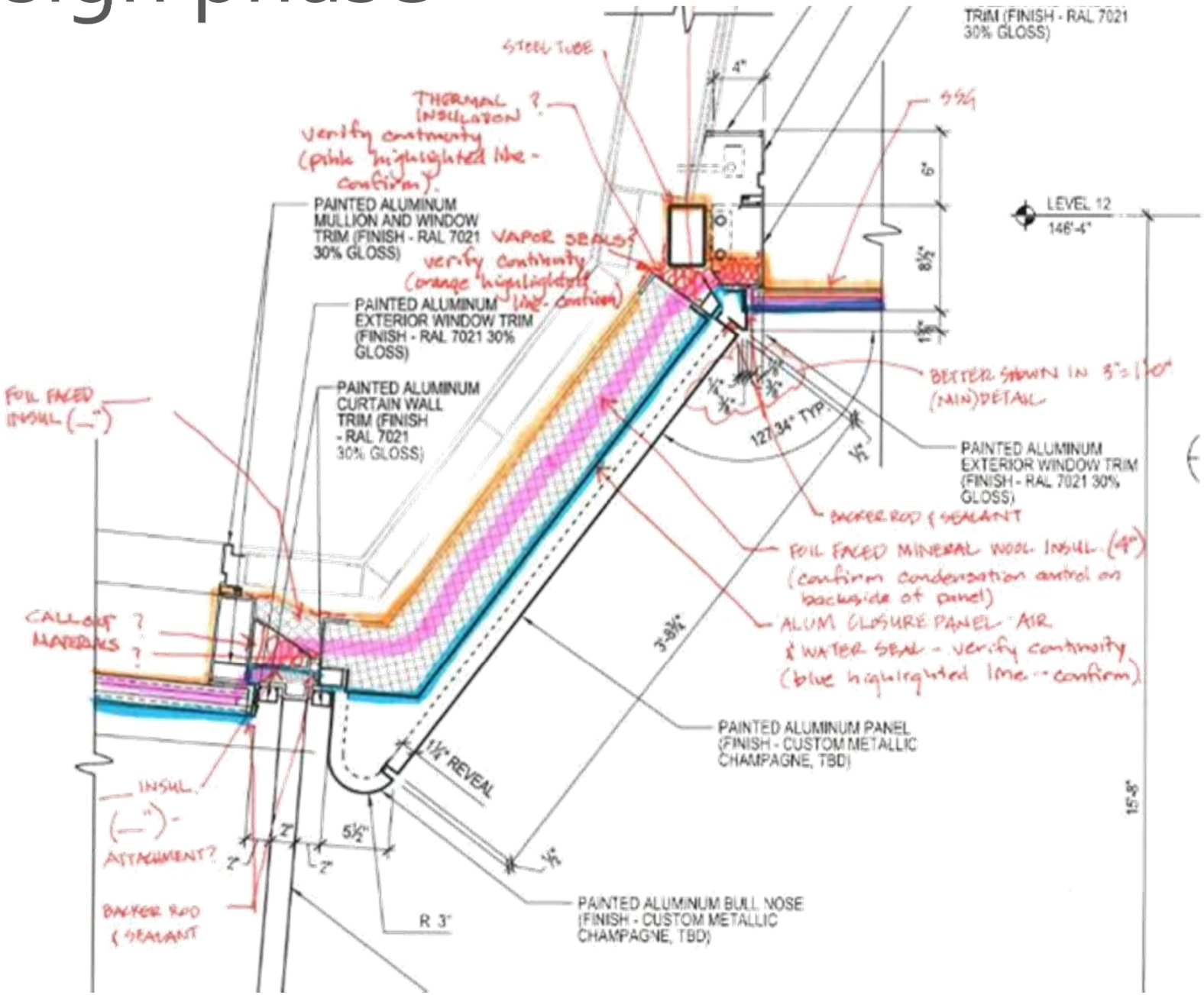
control layers

- **air barrier** – primary air control plane
  - **continuity!!!!!**
  - strength – resist loads
    - – diff pressure
    - – thermal movements
  - compatible
  - durable
  - impermeable

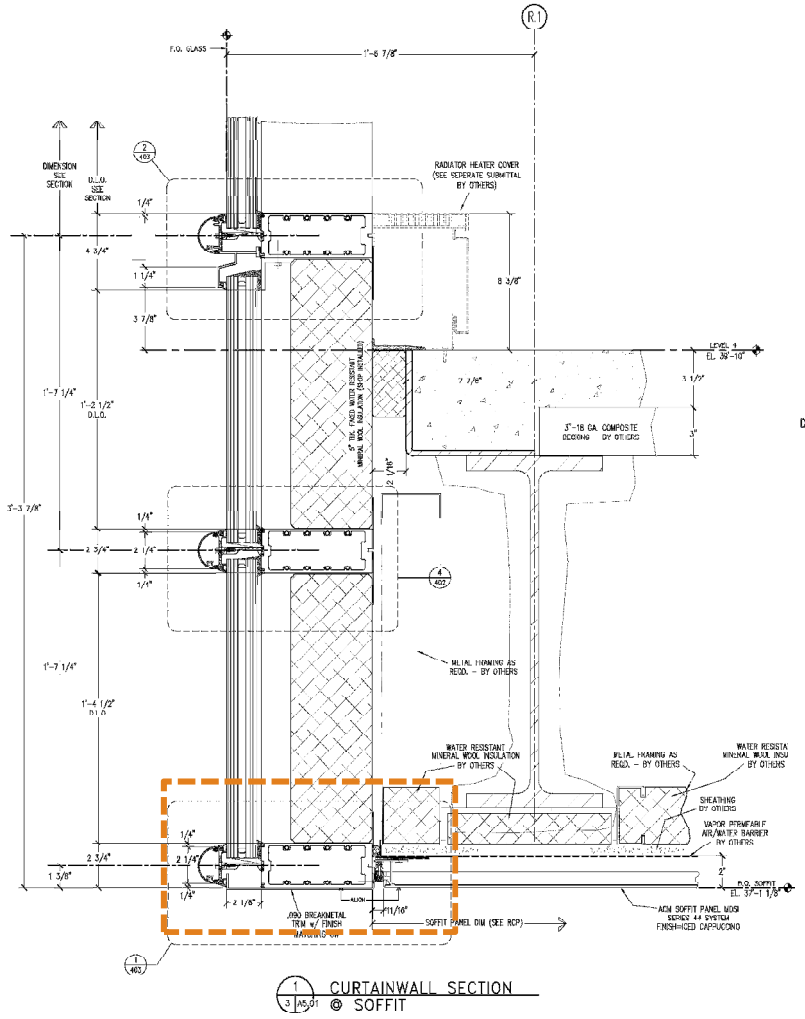
- **thermal control layer** – components (i.e., insulation) controlling thermal energy (heat) transfer through enclosure

managing air transport condensation risk

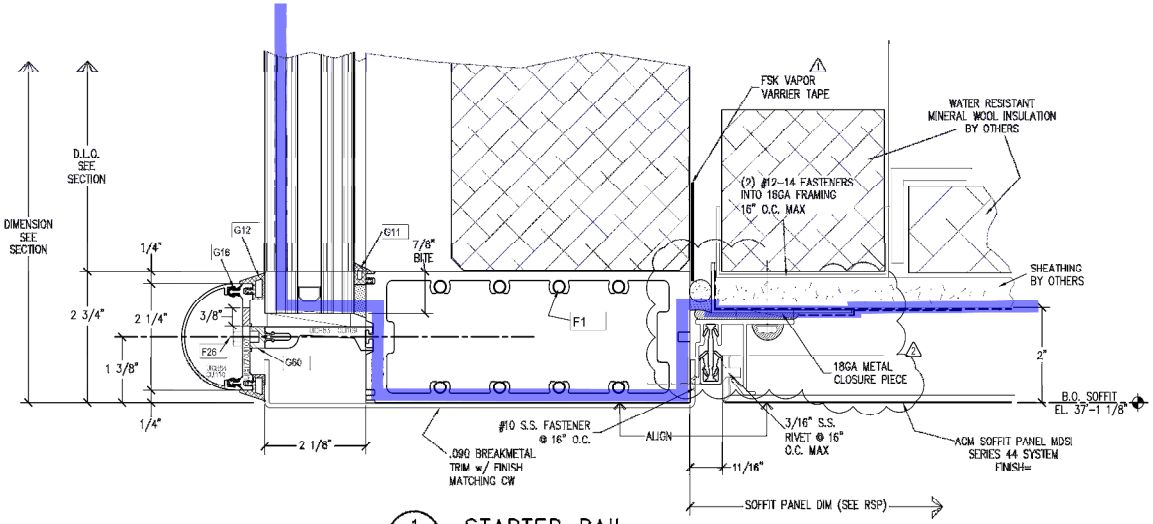
design phase



construction – shop drawing review



1 / 3 A5.01 CURTAINWALL SECTION @ SOFFIT



1 / 3 A5.01 STARTER RAIL SECTION

construction – **MOCK-UPS!!!**

- laboratory
- field first install

air leak testing

- quantitative
- qualitative

construction – field testing

- qualitative air leakage
  - chamber with smoke
  - bubble gun
- quantitative air leakage
  - pressurized chamber
  - whole building

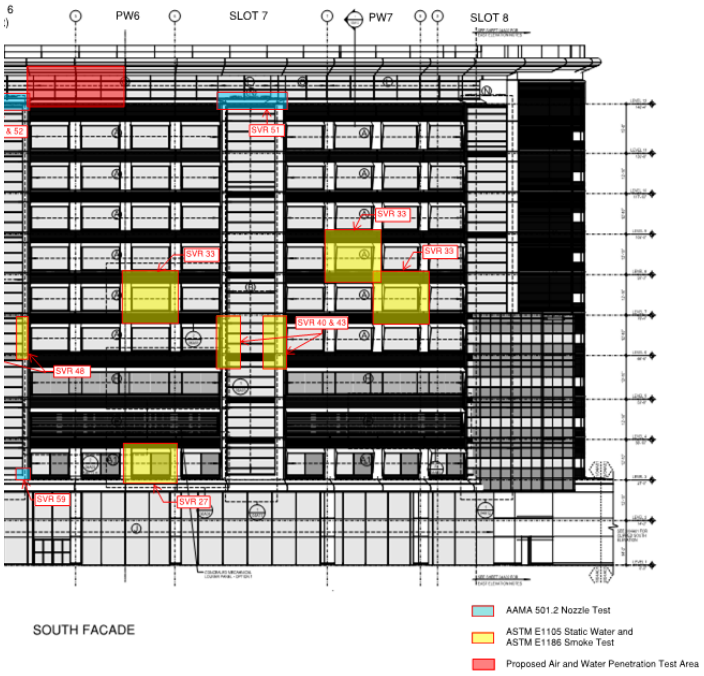
construction – field testing

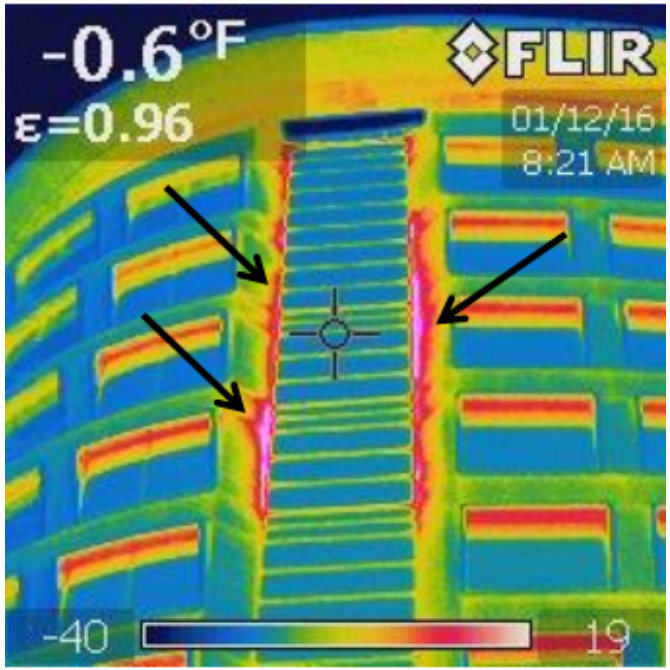
- infrared thermography
- adhesion testing

where?

when?

how often?





construction – site observations

vs details?

substrate?

sequencing?

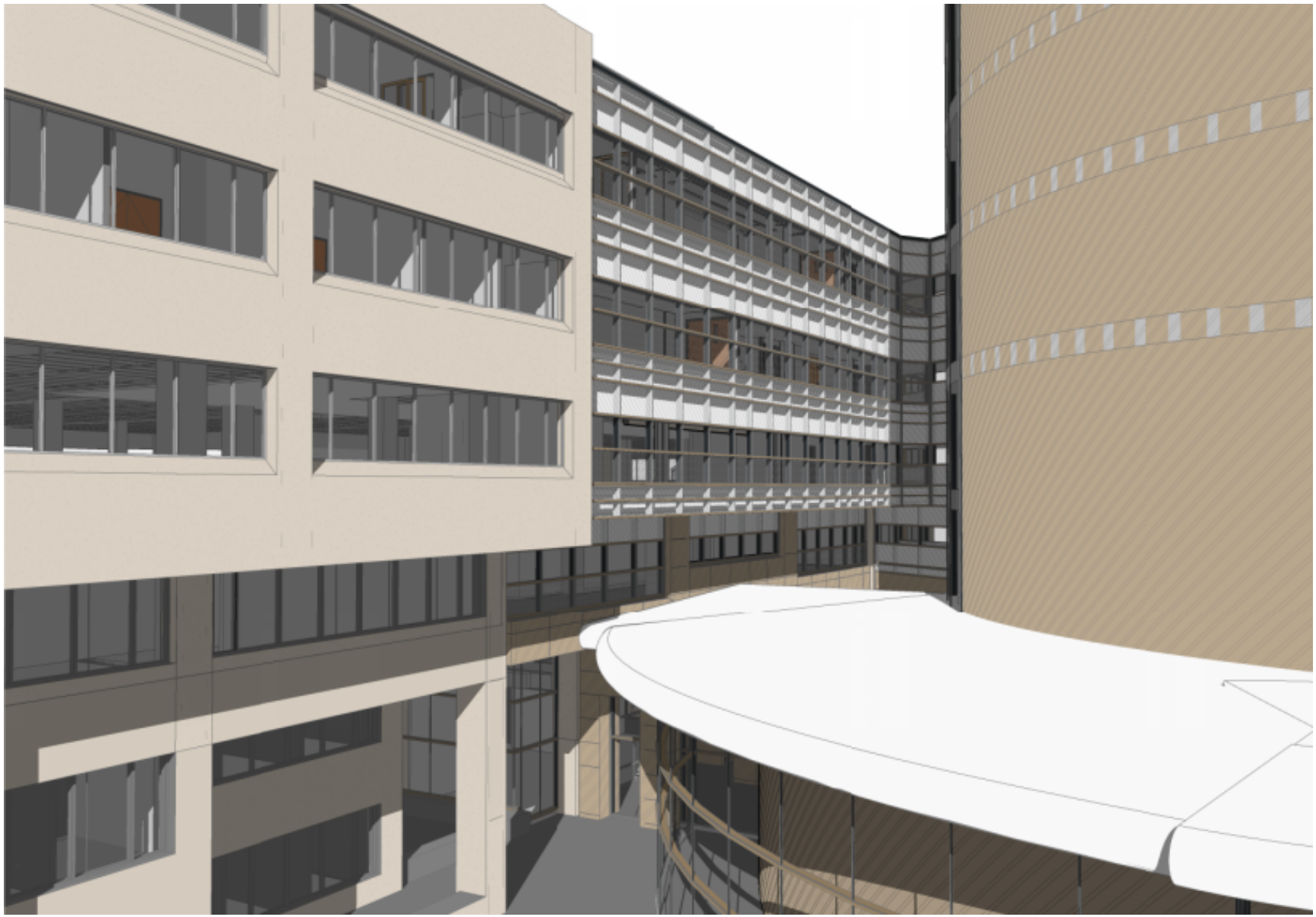
interfaces?

terminations?

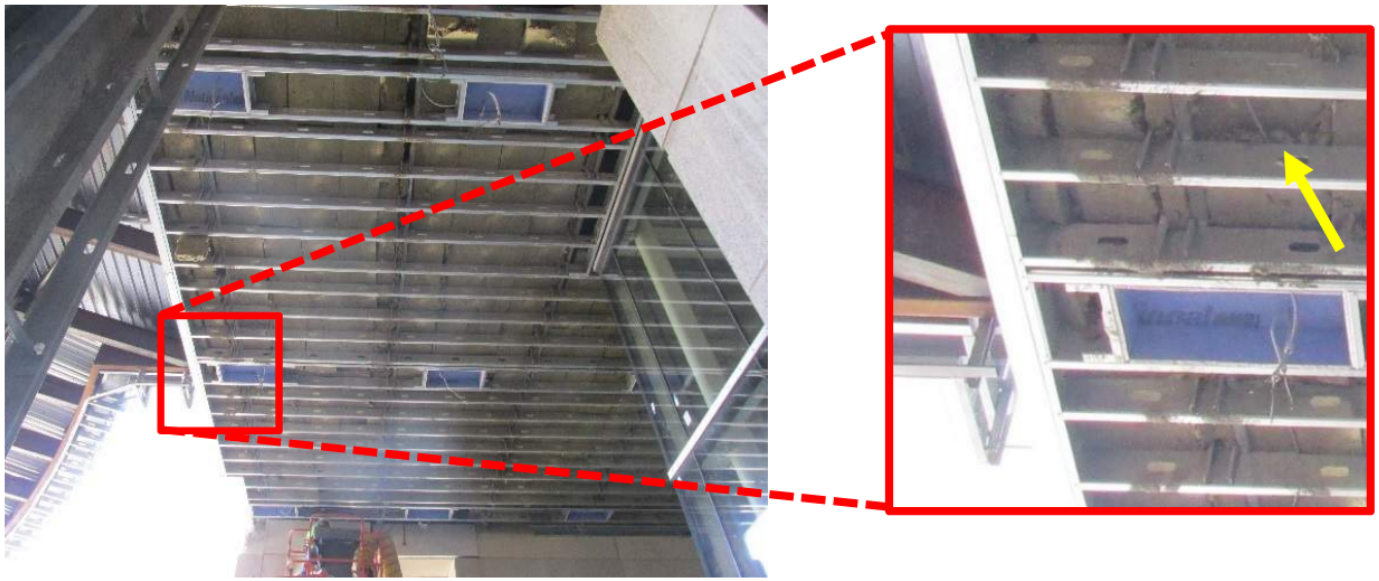
continuity?

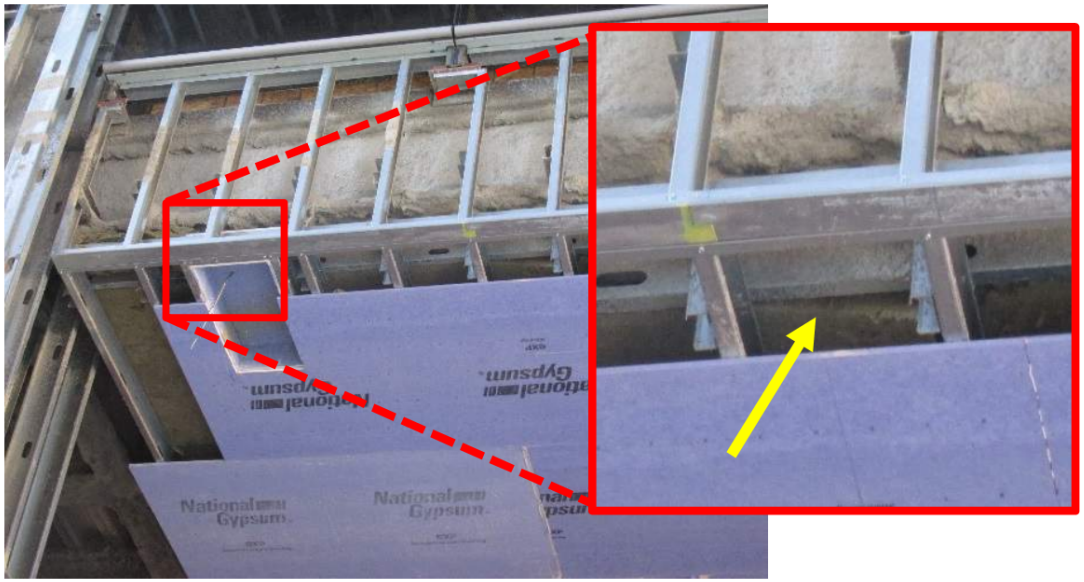
case studies

case study 1 – hospital addition



case study



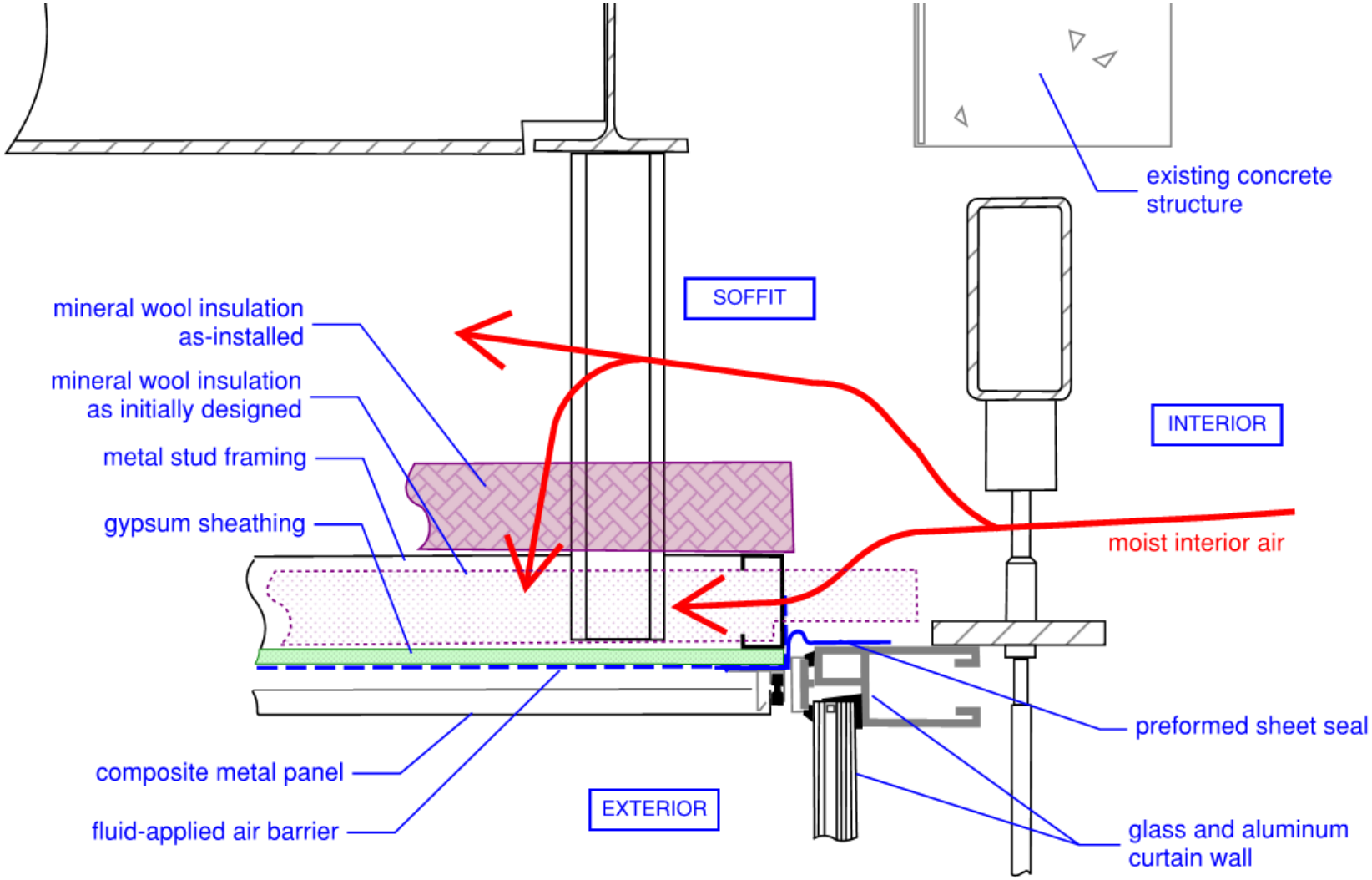


exterior: -10F

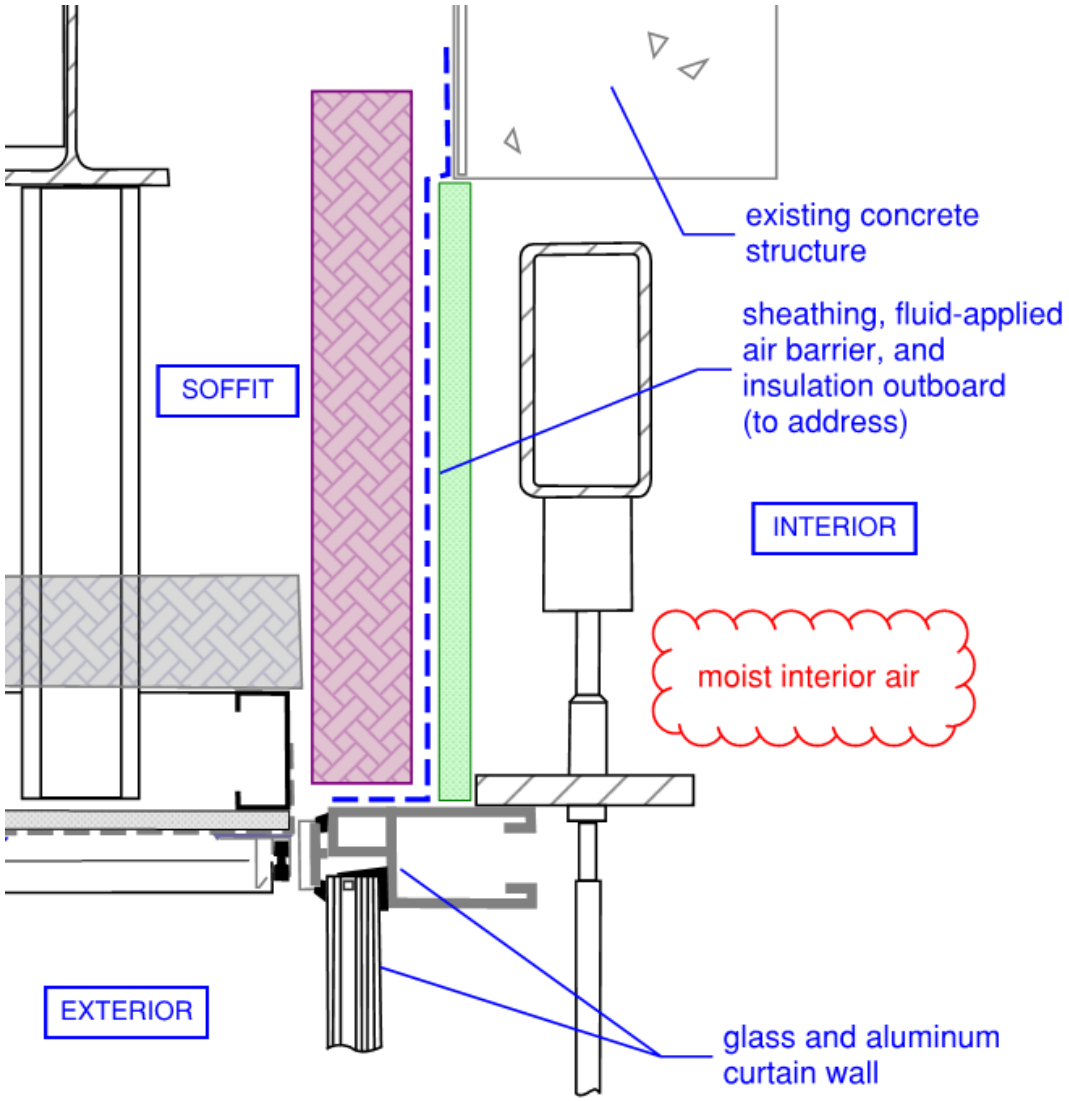
interior: 72F, 30% R.H.

dewpoint: 39F

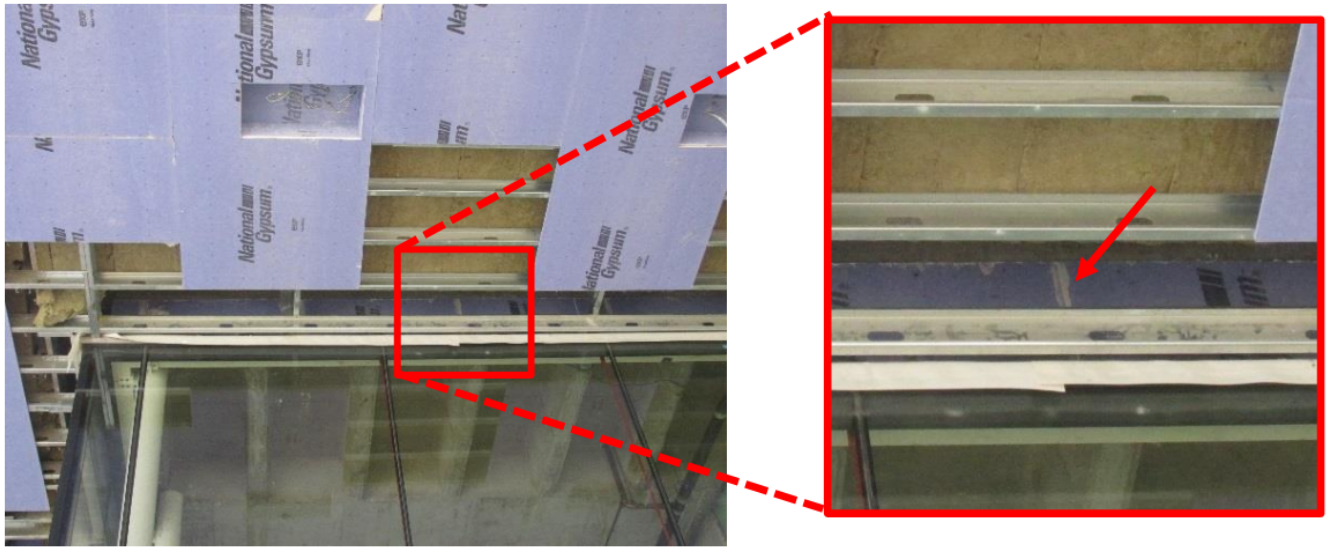
case study

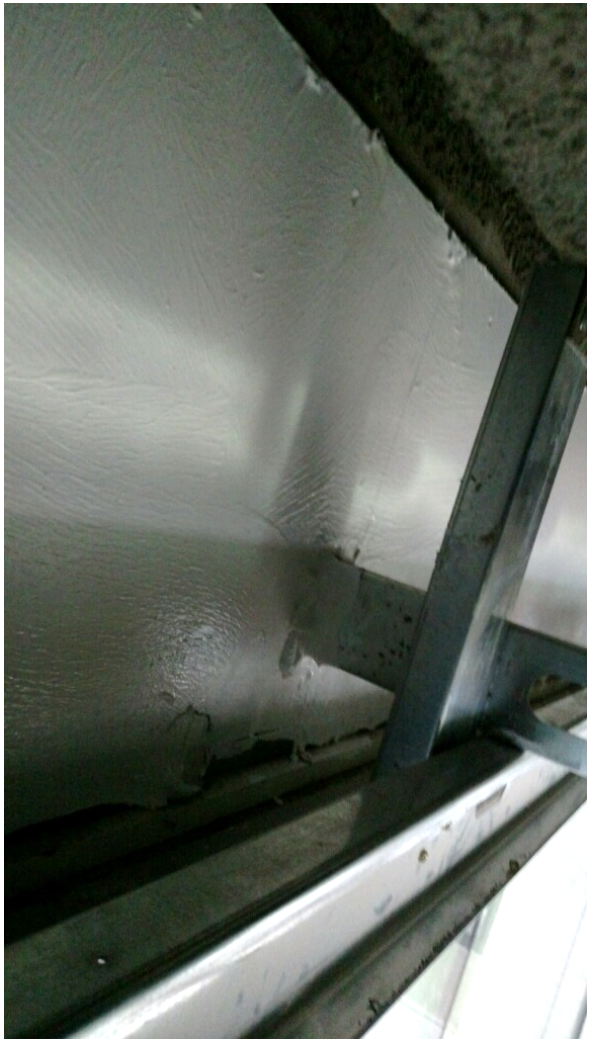

existing concrete structure
SOFFIT
mineral wool insulation as-installed
mineral wool insulation as initially designed
metal stud framing
gypsum sheathing
INTERIOR
moist interior air
preformed sheet seal
composite metal panel
fluid-applied air barrier
EXTERIOR
glass and aluminum curtain wall

case study


existing concrete structure
sheathing, fluid-applied air barrier, and insulation outboard (to address)
SOFFIT
INTERIOR
moist interior air
EXTERIOR
glass and aluminum curtain wall

case study



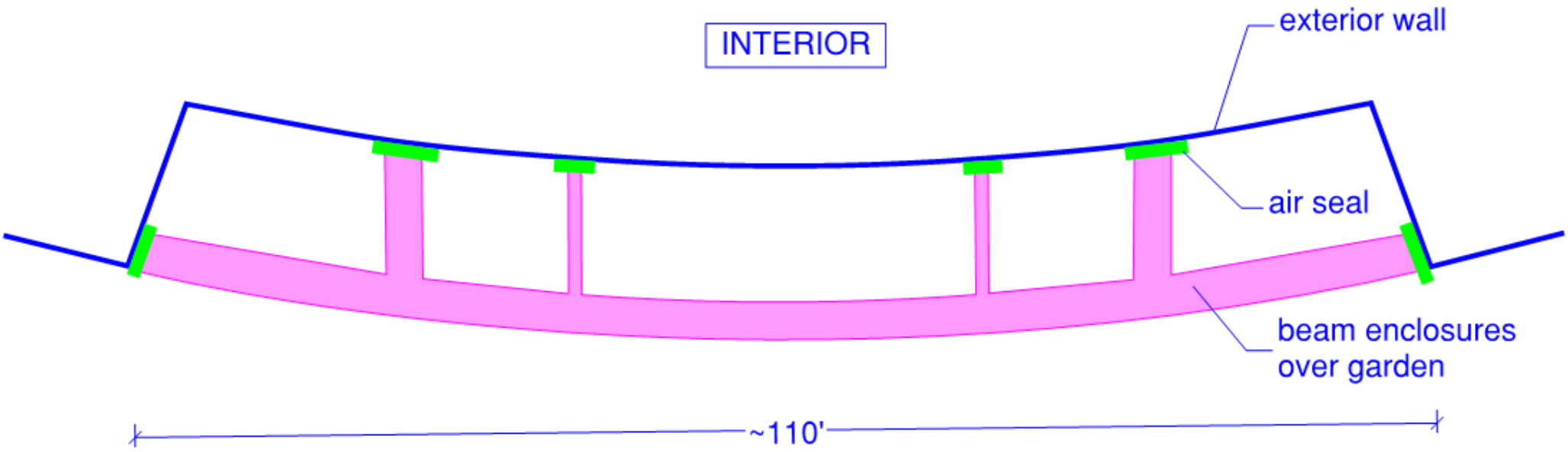


case study 2 – new hospital facility

case study

case study

case study


INTERIOR
exterior wall
air seal
beam enclosures
over garden
~110'

conclusions

1. Air carries and deposits moisture through complicated geometries. Cold weather condensation is problematic - especially with elevated interior humidity.
2. To minimize condensation potential, air barrier to be: continuous and airtight as possible; durable; and strong enough to resist and transfer loads. Consider sufficient thermal insulation and placement.
3. QA/QC measures ensures a quality air barrier, including: technical design reviews, submittal reviews, mock-ups, and field testing. Visual observations from periodic site visits are important to help identify additional air leak paths. Air barrier issues should be addressed.
4. Opportunities to simplify the air barrier line may be advantageous to mitigate the risk of condensation, including at unique conditions.

questions?

thank you!