Assessment, Renewals and Design of New and Existing Natatoriums

By: David Fookes, PEng. and Al Martin RRO.

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OUTLINE

Evaluation of Interior Conditions

Assessment

- Mechanical System Review
- Visual Review of Envelope Components
- Condensation Potential
- Air Leakage Testing – IR Thermography and Smoke Testing
- Openings

New Construction Design

- Base Building Structure
- Interior Envelopes
- Wall Assemblies
- Roof Assemblies
- Glazing
- Transition Details

PSYCHOMETRICS

High potential for condensation – Humid Environment

- Temperature range 25-30 °C
- Relative Humidity of 50-60%
- ASHRAE recommends Natatoriums operate at 29°C and 50%RH

Relative humidity (vapour pressure)

- 60% RH @ 29°C ===> 20°C Dew Point
- 50% RH @ 28°C ===> 17°C Dew Point
- 50% RH @ 20°C ===> 9°C Dew Point

Vancouver Winter Design Temperature -5°C

Mechanical System Control

HVAC system ‘controls’ the indoor environmental conditions – envelope needs to be air tight

- Required ventilation levels determined by occupancy
- Thermal comfort for wet people in bathing suits - ASHRAE
- Dehumidification typically necessary – evaporation of water

Positive or Negative Pressurization of the Building

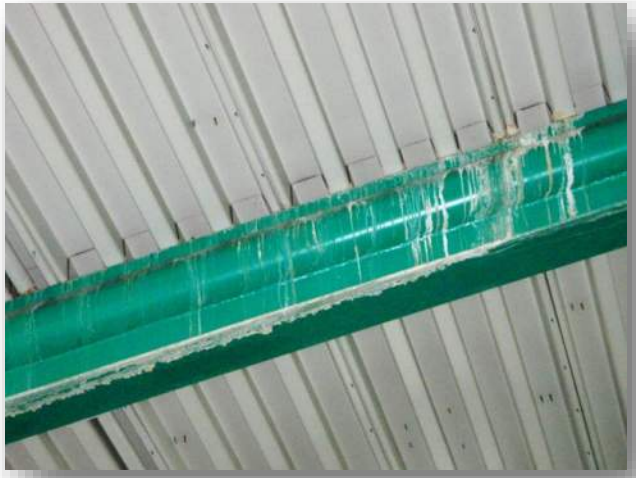
- Although recommended to operate at negative or neutral pressures, this is frequently not the case.

Corrosive Environment

- Vaporization of Chlorine used for water sanitization creates corrosive environment towards metals

Natatorium Assessment

- Morrison Hershfield has been involved in numerous assessments, repairs, renewals and the design and construction of new recreational facilities. Perhaps the most demanding of these buildings are those with swimming pools in cold climates.
- Our involvement typically starts because owners of the facilities are aware of significant issues with the staining, water migration and degradation of interior or exterior building components



Visual Evidence of problems

- Both in the initial assessment and during replacement and renewals of building assemblies we find evidence of moisture damage (rain penetration and condensation) causing staining, degradation, decay, corrosion and mold.
- Most of these events are not the result of one incident but persistent recurring moisture transport that accumulates; the result of wetting exceeding drying. Typically during cold winter days/ months

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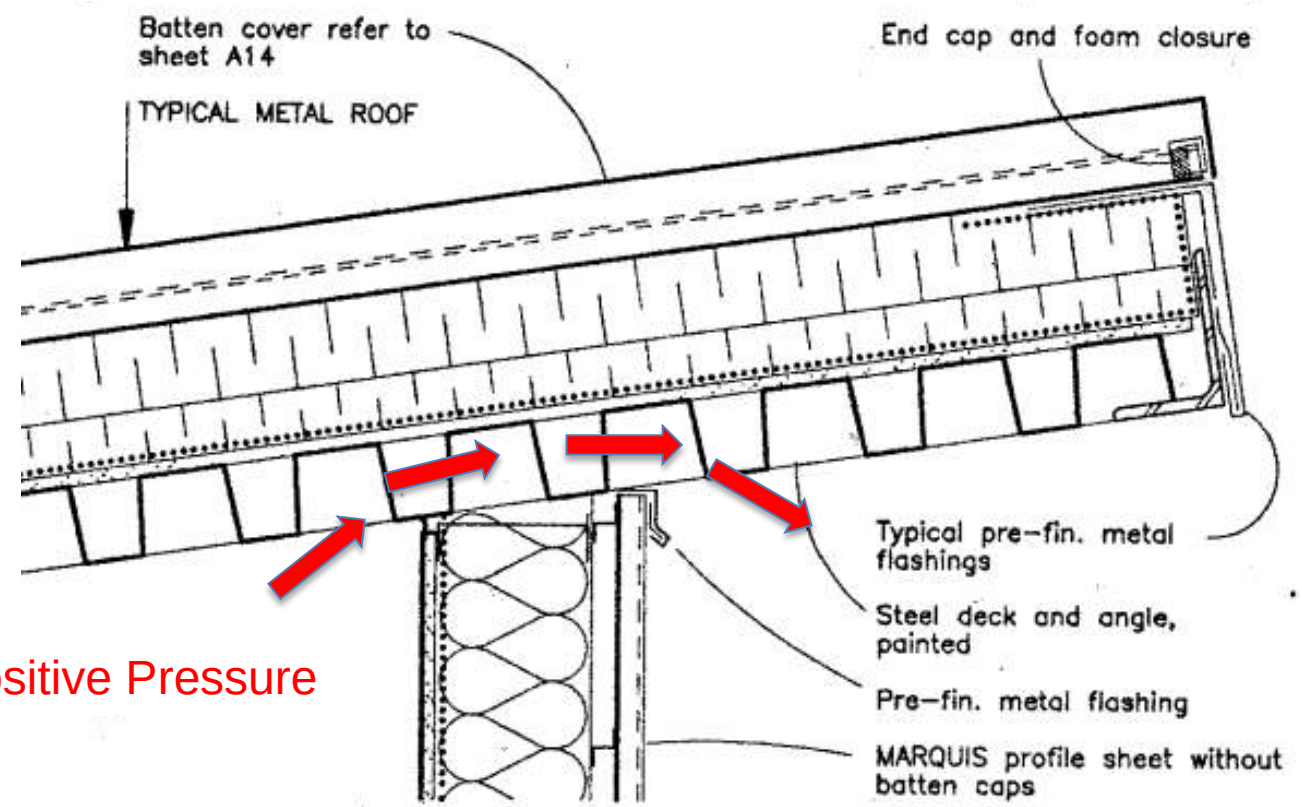
STAINING

Condensation Potential and Air Leakage



Positive Pressure

detail courtesy HCMA

What to do between the wall and roof? Insulation? Air Barrier?

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STAINING

STAINING

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Air leakage and Condensation

Air leakage and Condensation

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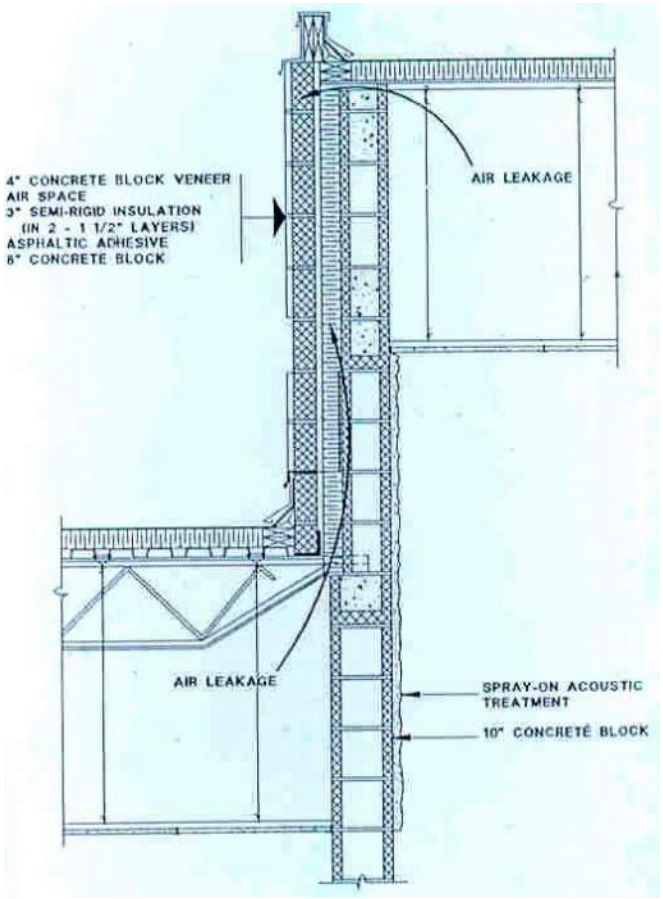
AIR LEAKAGE AND CONDENSATION



- Air leakage paths to insulated cavities
- Saturated freeze/thaw in masonry

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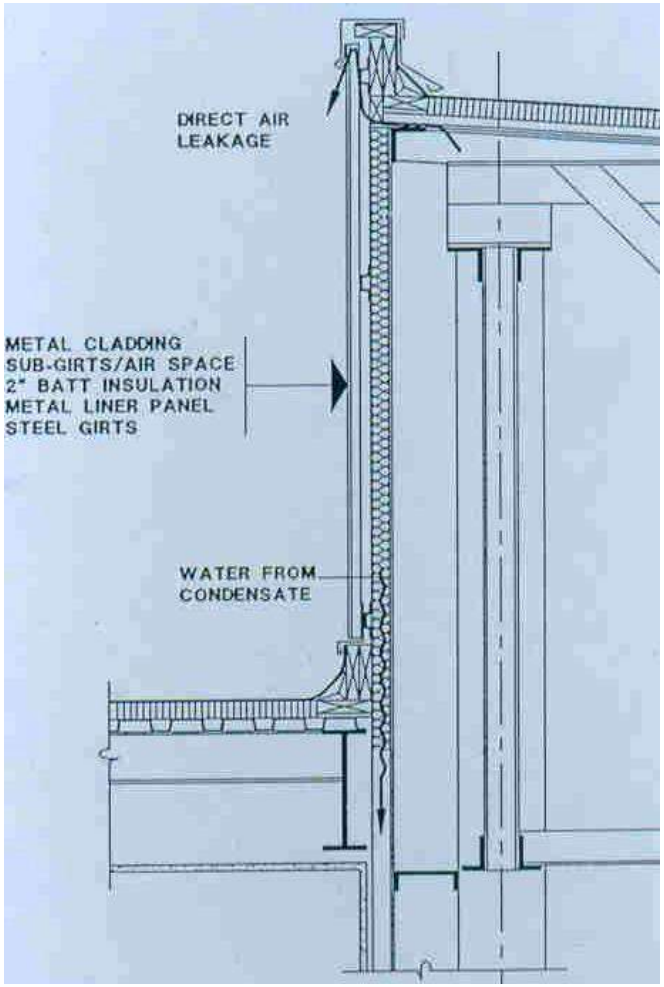
Air leakage and Condensation



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Air Leakage

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Corrosion and Degradation

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Corrosion and Degradation

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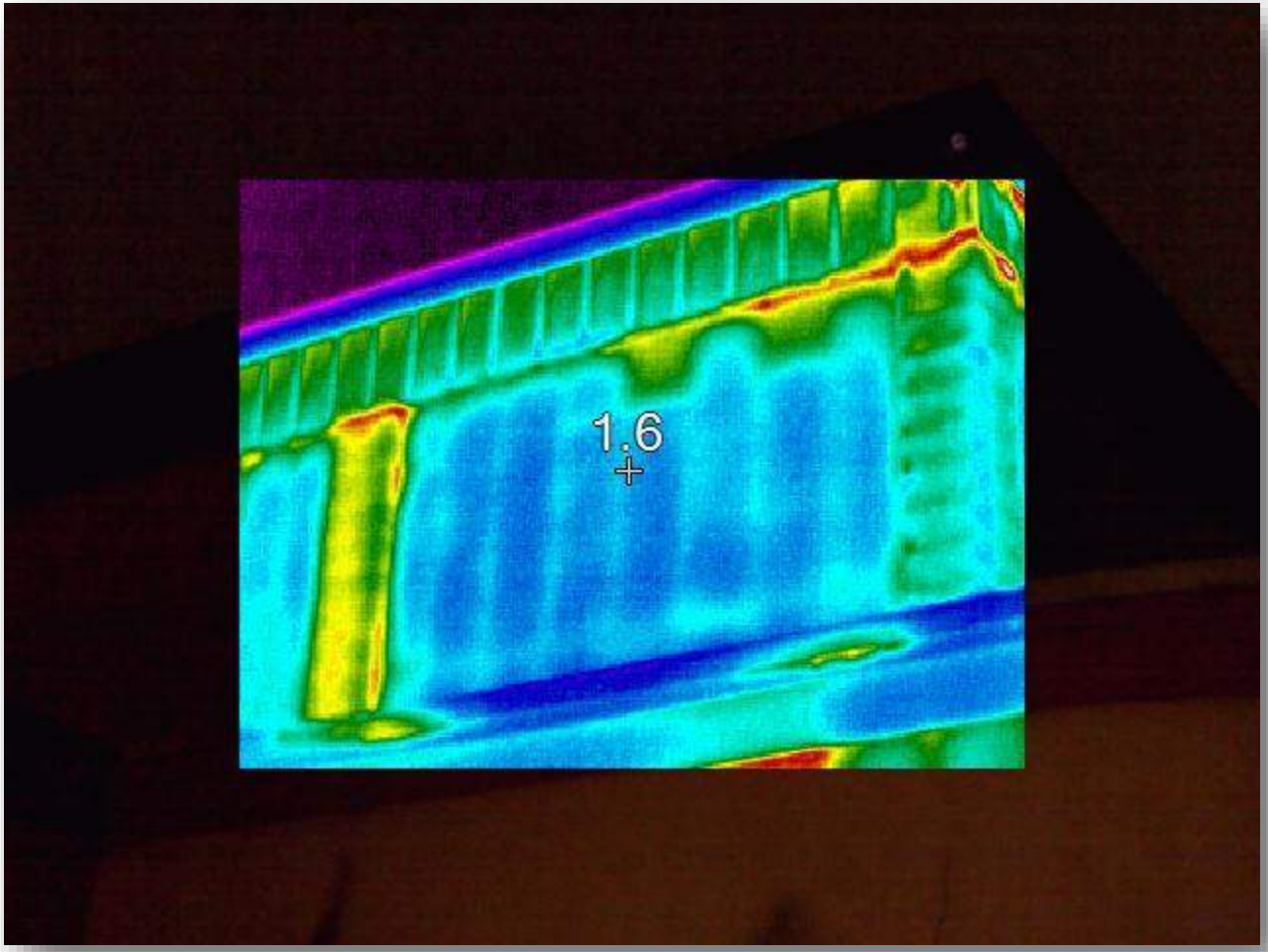
Exploratory Openings

- Exploratory Openings can provide information on the conditions of wall and roof assemblies.

IR Imaging



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SMOKE TESTING

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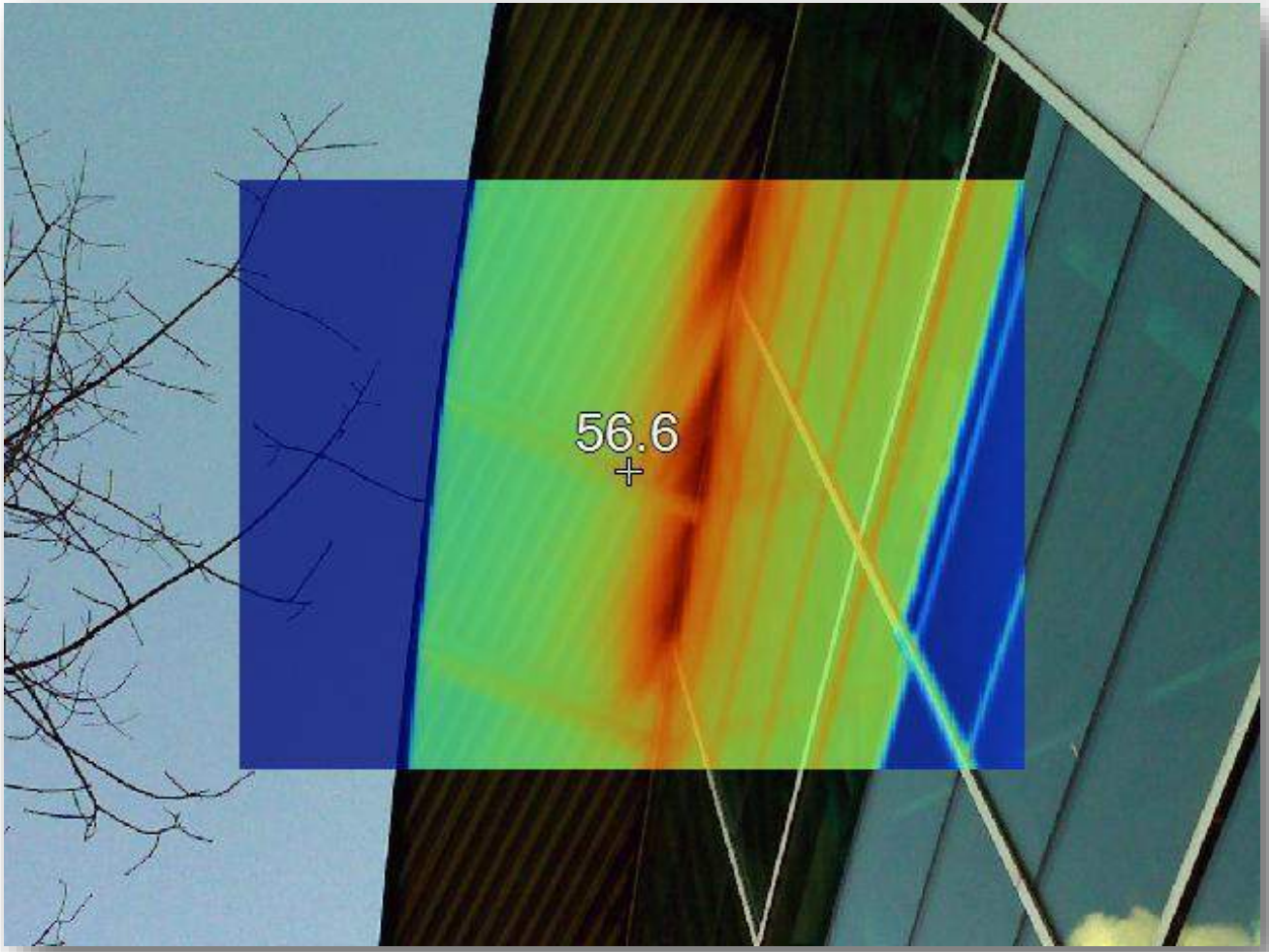
IR Imaging Before



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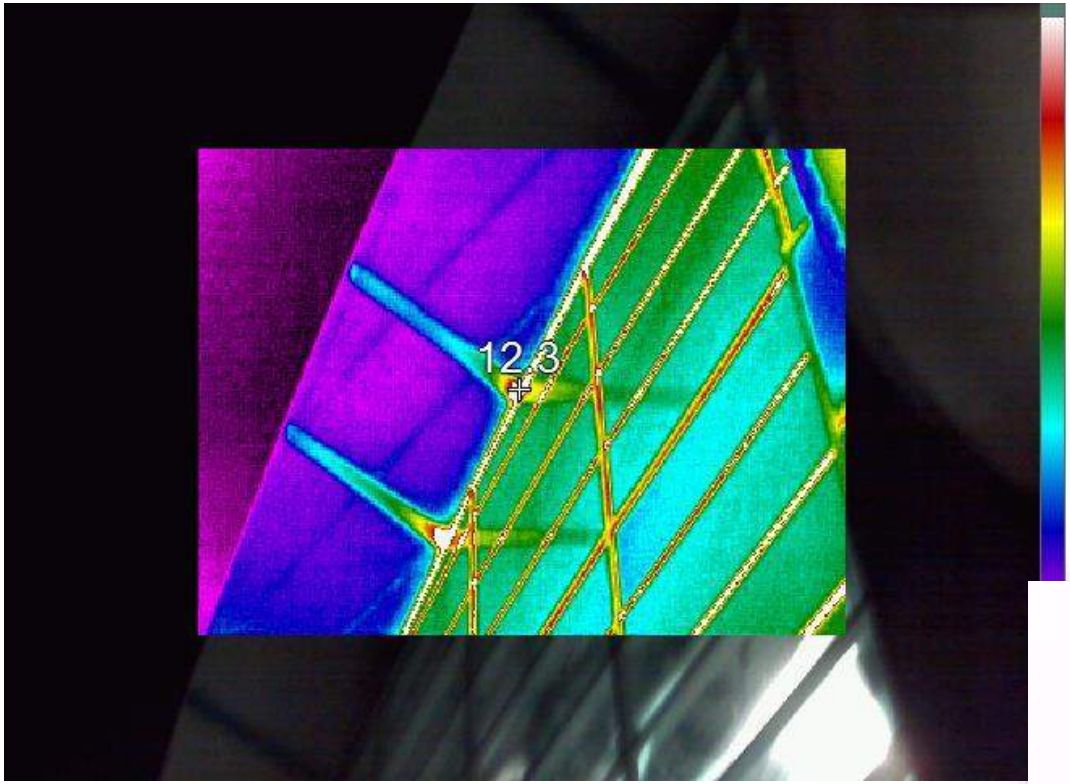
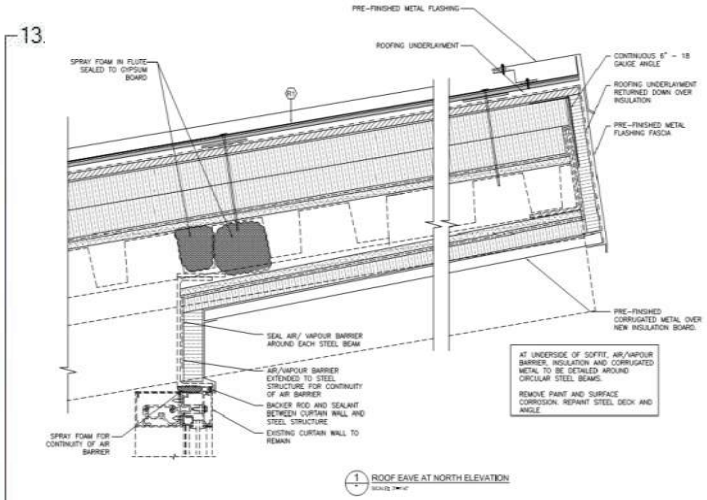
IR IMAGING AFTER





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New Construction Design

Design for durability and performance in both the selection of materials for base building structure, assembly components (interior and exterior) and detailing for warm, humid and sometimes corrosive environments. What materials to use? How should they be installed.

1. Understand the design intent(s) of space and each enclosure system
2. Understand the geometry of the building and use of each enclosure system
3. Review all transition details thinking in 2D then 3D
4. Identify missing details

Base Building Structure

Wood, Concrete or Steel

Steel – Corrosion resistance and thermal bridging

Deterioration, condensation, heat loss, air barrier continuity

Wood – Moisture absorption and fungi resistance

Deterioration and indoor air quality

Treated Wood – Moisture absorption

Fastener compatibility - Clear BluWood and others

Concrete – Thermal bridging

Condensation and heat loss. Only damage to interior finishes if not moisture tolerant

Base Building Structure

Structural Wood Roof Deck,
Concrete Walls and Columns

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Base Building Structure

Concrete Roof, Walls and Columns

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Interior Envelopes

Different envelopes within building. Different temperatures and moisture load.

Pool deck area, offices, change rooms, hot tub, sauna, steam, exercise/ work out, hot yoga!!!!

Concrete and concrete block walls and curbs. Spray foam, moisture tolerant sheathing, cementitious air and vapour barriers. Moisture tolerant finishes.

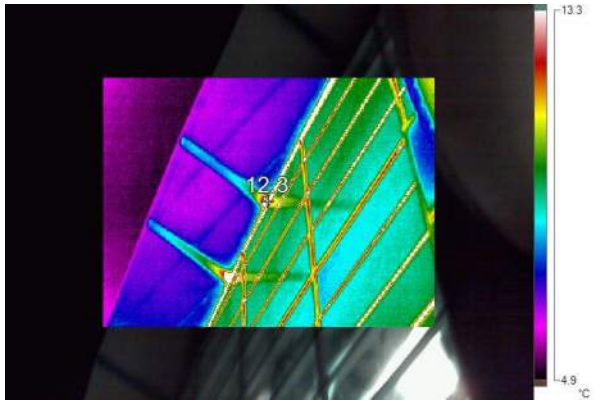
WALL ASSEMBLIES

What materials to use? **Moisture tolerant.**

Continuity of thermal, air and vapour barriers.
Exterior Insulated!!!!!!

Keep structure warm and dry. Building Science 101

Minimize non-thermally broken penetrations through plane of insulation. (Walls and Roofs)



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Wall Assemblies

What assemblies and materials to use? Exterior Insulated!!!!!!

- Keep structure warm and dry. Building Science 101

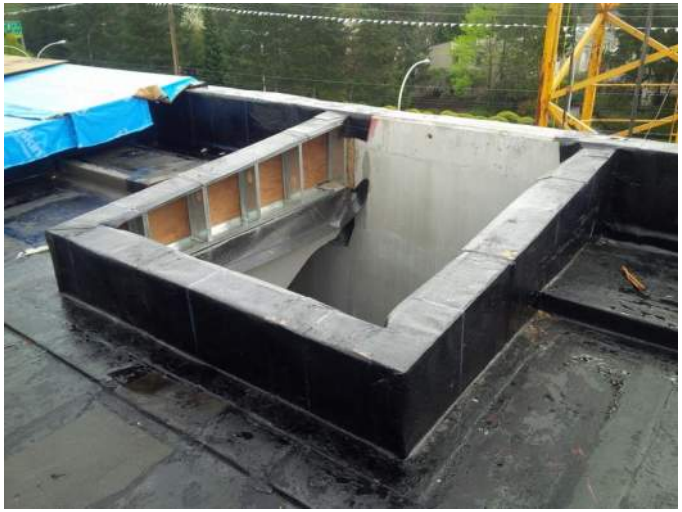
Wall Assemblies

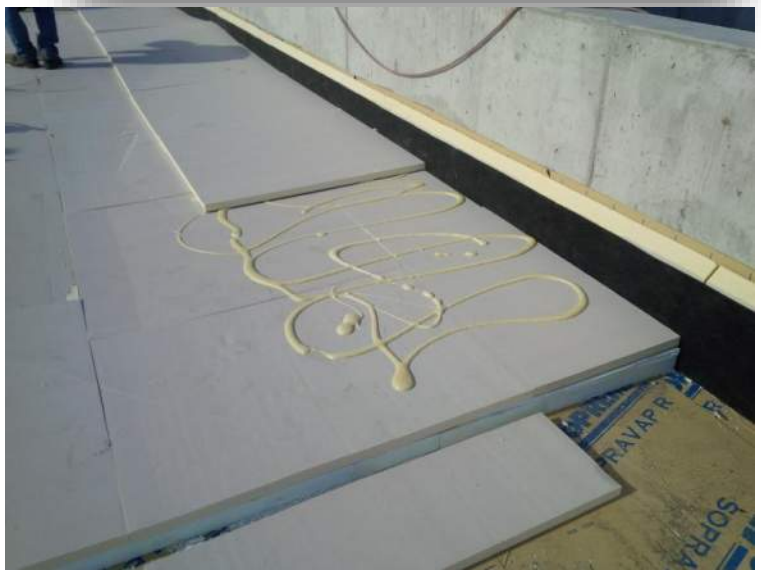
Chopped glass insulation, moisture tolerant sheathing, cementitious air and vapour barriers, textured acrylic finish

Roof Assemblies

Fully adhered air and vapour barrier on structural deck. Structure typically sloped. (Large spans)

Minimize penetrations through plane of insulation. Adhered insulation or inverted (PMR).





Roof Assemblies

Self adhered AB/VB installed on site as construction progress during dry periods only.

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Roof Assemblies

Bearing plates to minimize thermal transfer through the roof (Sloped metal). Need to pick up drag load.

Roof Assemblies

Base sheet, AB/VB of roof membrane installed in structural wood panel pre-manufactured facility. Keeps wood structure dry when building constructed during rainy season.

Panels stitched together on site

GLAZING SYSTEMS

Glazing assembly performance requirements with specific attention to condensation resistance (I value – 65 or better)

Dew Point

Temperature Index "I" is defined as:

$$\frac{\textbf{Coldest Surface Temp – Outside Temp}}{\textbf{Inside Temp – Outside Temp}} \textbf{ X 100}$$

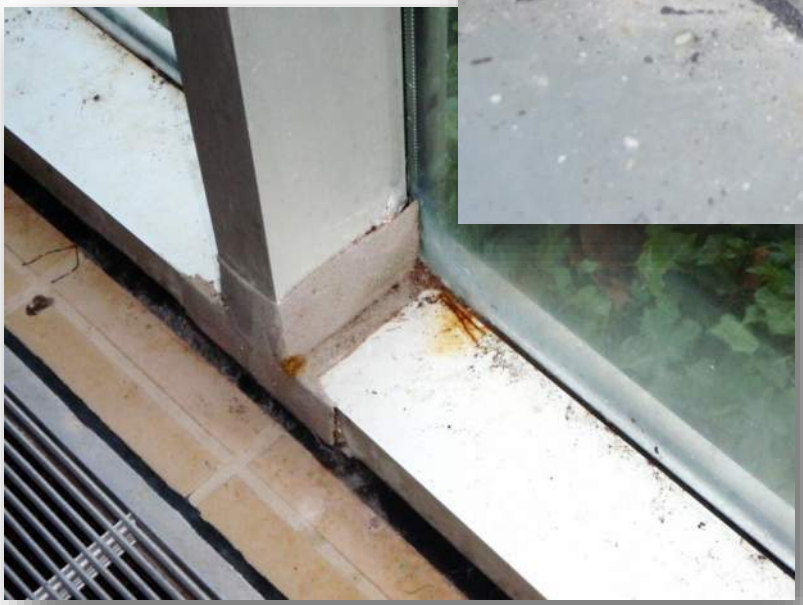
$$\frac{17 - (-5)}{29 - (-5)} \text{X } 100 = 65$$

Isolation of glazing framing from cold structure (Concrete or Steel).
Continuity of air barrier with opaque wall assemblies.

Anodized or coated aluminum framing sections.
No drywall or MDF millwork abutting glazing systems.

Air Leakage or Rain Penetration?

Air Leakage, Condensation or Rain Penetration?



GLAZING SYSTEMS

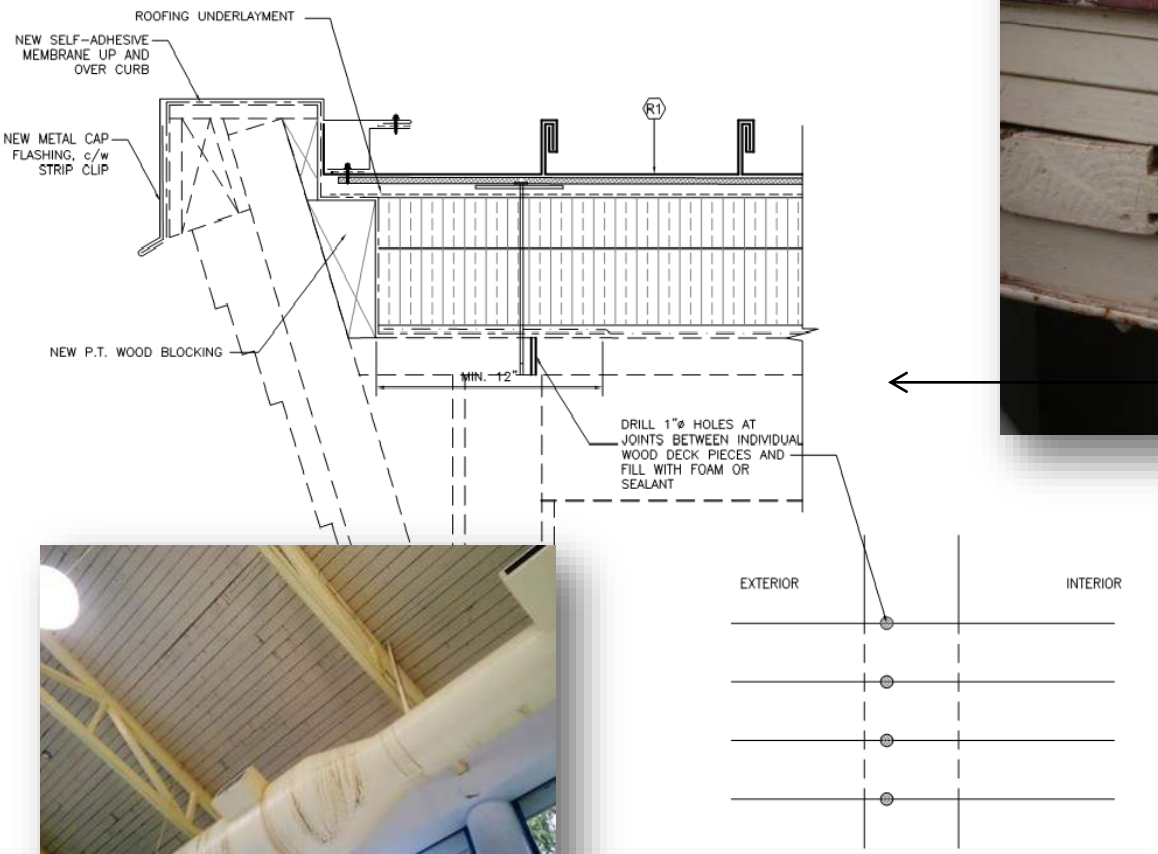
Corrosion resistance of reinforcement or structural fasteners?

Air Barrier Continuity

The number one location for air leakage is the wall-to-roof transition. There are many reasons for this:

1. The natatorium buildings are big open space with ceiling heights from 50 -100’
2. Stack affect resulting from the force of buoyant warm air
3. Positive air pressure created from the mechanical systems
4. Designs where building components such as beams and decks extend beyond the perimeter walls create difficult areas to ensure continuous air barriers
5. Corrugated metal deck with no defined AB

WALL / ROOF TRANSITION DETAILS



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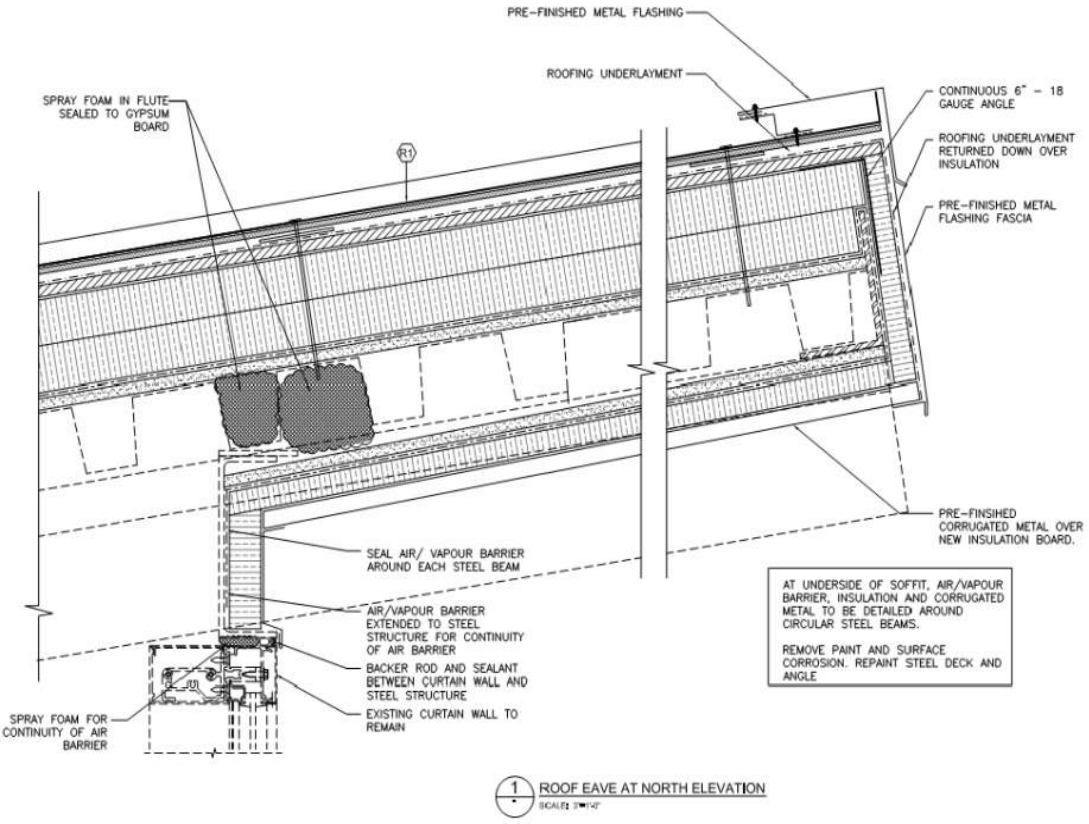
WALL / ROOF TRANSITION DETAILS



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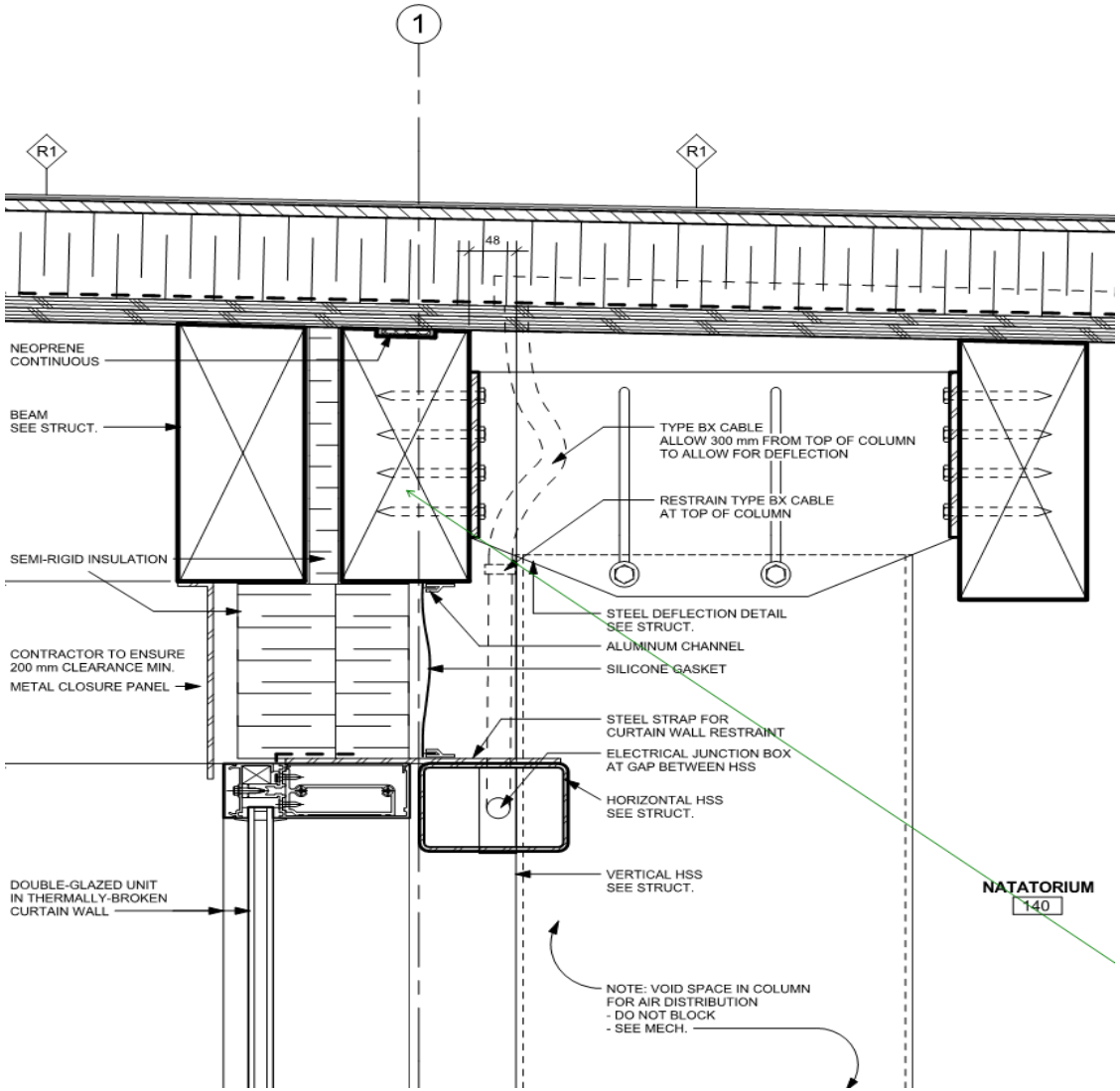

detail courtesy HCMA

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MATERIALS

Corrosion resistance and moisture tolerance

- For steel materials, galvanized and coated
- Wood materials – treated and coated
- Fasteners – Stainless steel

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Roofing Renewals

- Discuss improving air barrier at early stages of roof design
- Are the replacements going to affect the occupant use?
  - Falling material into water or occupied space below.
- Repair or replacement of deteriorated components.
- Common to install electrical wiring for lights above roof deck.
- Have light fixtures checked prior to any work on the roof.
- Is new roofing mechanically fastened or adhesively bonded?

Electrical Conduit

Light Fixtures

CURRENT DAY NATATORIUMS

renderings courtesy HCMA

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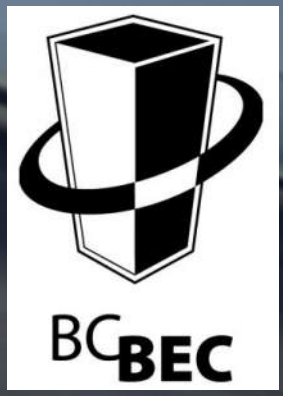
Thank You

Comments! Questions?



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