BC BEC | 2025

BC Building Envelope Council
Conference & AGM

ADAPTING BUILDING ENCLOSURE DESIGN FOR A RESILIENT FUTURE

Building Enclosure Commissioning, BECx Best Practices

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Consulting Engineers | BCxA

Speaker Background

Experience:

- 13 years of experience in the construction and envelope industry.
- Delivered commercial, institutional, government and residential projects across North America, Asia and Europe.
- Focus in envelope material behaviour, structural and energy performance, fabrication, assembly design, testing and installation.
- Lectured at various institutions – University of British Columbia, BCIT, Rensselaer Polytechnic Inst. , Illinois Institute of Tech.

*Various works / projects performed at previous firm and current firm | Photos courtesy of respective project collaborations

Brief

1. Given the enclosure represents the boundary to protect users and operators functioning unimpeded by the variations in climate, our focus as enclosure engineers, mechanical engineers and architects is delivering a continuous envelope to mitigate risks of thermal discomfort, early material deterioration, unsafe maintenance operations, and uncoordinated control systems. Building Enclosure Commissioning Providers are integral players in verification measures, which start in design and continue into the early service life of buildings, especially when planning for 50-100 year design service life criteria. A collaborative process has to be maintained between the designers, builders, and key owner/user stakeholders from substantial completion to end of service life for the systems involved.

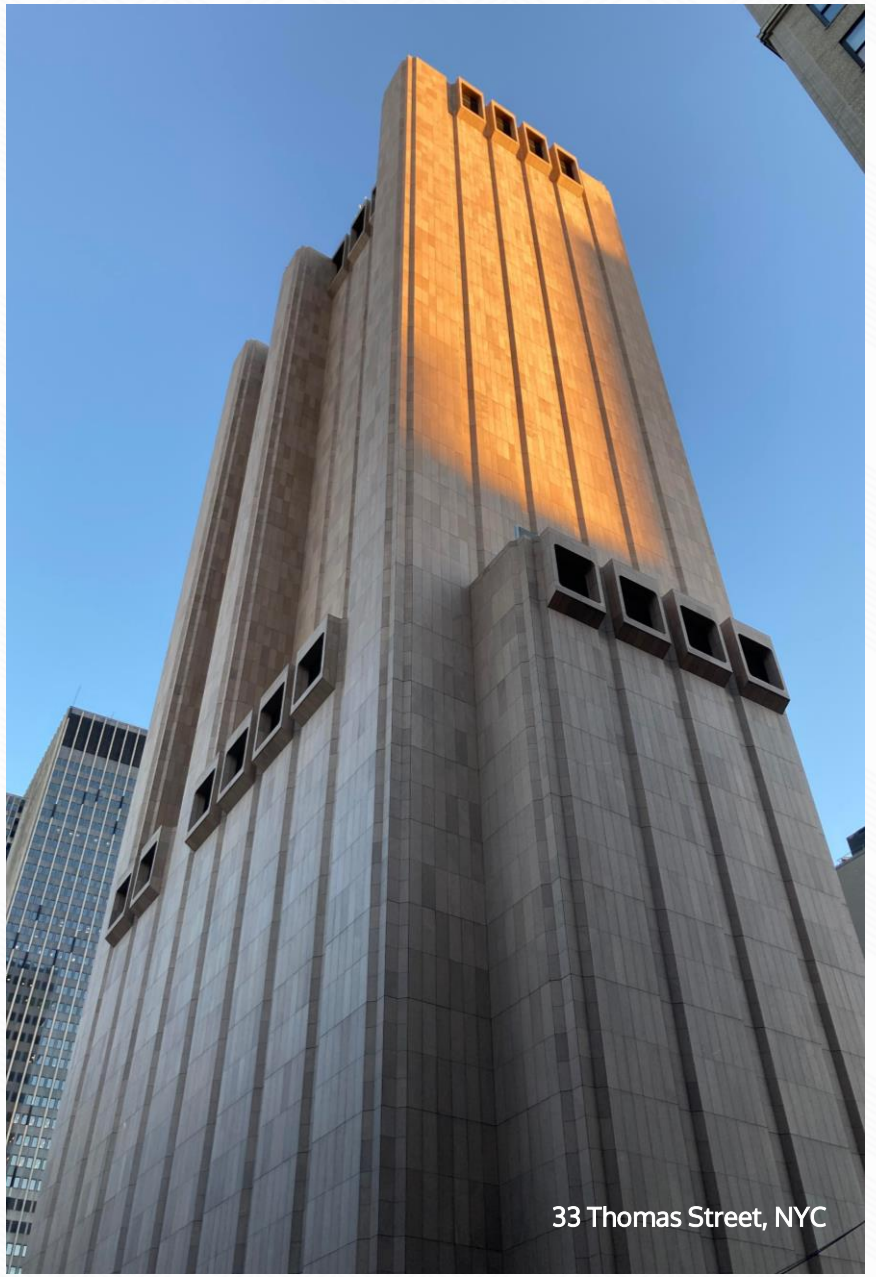
Learning Objectives

1. Describe the role of the Building Enclosure Commissioning Provider for clients, consultants, users and builders.
2. Detail the importance of leveraging experienced building envelope knowledge standards to deliver an integrated workflow in the commissioning process.
3. List the advantages of a streamlined documentation process to generate and adapt to the design and changes in the project requirements during expedited delivery timelines.
4. Describe the current resources available for developing an Enclosure Commissioning implementation standard when pursuing LEED accreditation or other owner-driven mandates.
5. Discover the best practice standards and guideline publications available to date regarding certification and training.

Perfect Enclosure?

Is it achievable?

- Perfection in the design, fabrication and construction of the building envelope does **not** exist.
- Some of the most common and costliest sources of building failure involve building envelopes.
- Risk is inherent in every building design


33 Thomas Street, NYC

Stakeholders

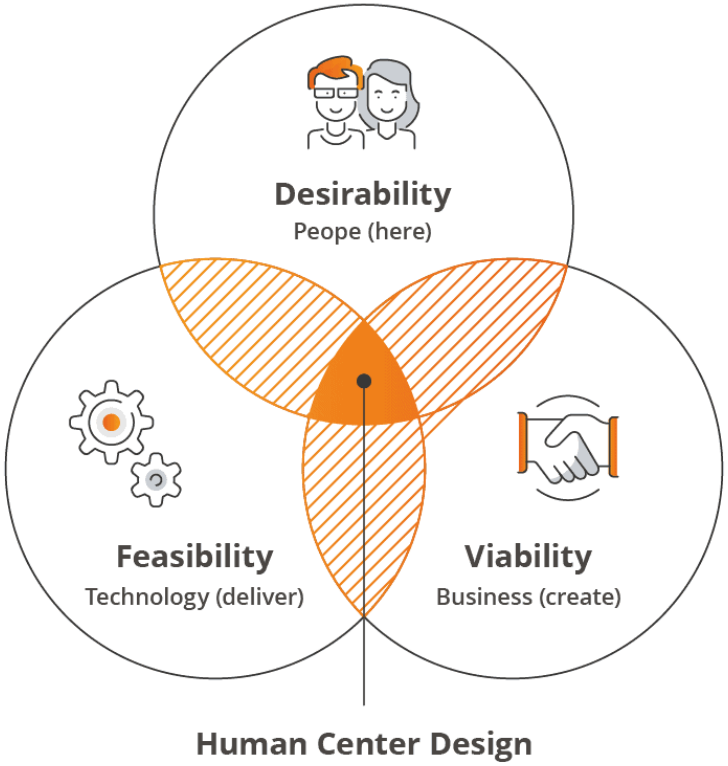
- Government
- Institutional Authorities
- Compliance and Standards Authorities
- Community and Users
- Builders and Trades
- Designers and Consultants
- Operators
- **Commissioning Providers**

Where Are We Today?

A focus on the User

- Building design has responded to the users while balancing business efficiency and relative feasibility
- Our design teams strive to lead environmentally with an understanding of energy balancing and occupant comfort and satisfaction.

Human-Centered Design Principles



Future Processing, 2022

Some Major Design Principles

1. Resilience for instant recovery after major environmental events
2. Independence of grid-connected systems for durability.
3. Rapid and safe equipment assembly and vehicle exiting.
4. Interior layout synchronized with how the operations team is organized.
5. Comfortable, stress-reducing staff quarters.
6. Exterior design that fits the community.
7. Safe site circulation for work vehicles and bulk material handling.
8. Safe storage and circulation of maintenance vehicles.
9. Efficiency of operation for rapid response to users in a crisis.
10. Infection control as it relates to science and healthcare typologies.
11. Applied environmental psychology and / or trauma-informed design for healthcare.
12. **Many more.**

Referenced from Soderstrom Architects

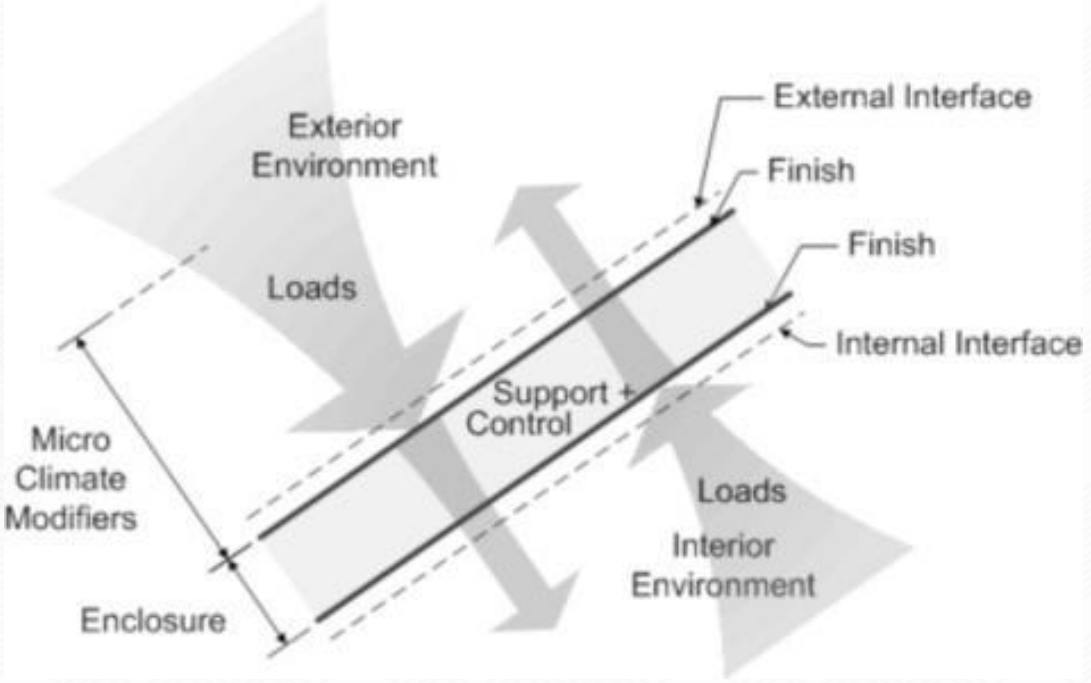
Emphasis on Emissions

A departure from the monolithic structures of the past.

- Closely knitted design with environmental targets dictated by region.
- Openness in design paralleled with controlled access.
- Energy balancing and renewables on site or linked to larger grids.
- +50 year design service life

Leverage Building Science Experience

1. Knowledge of integrated enclosure systems.
2. Awareness of the building physics as it relates to heat, air and moisture.
3. Knowledge of the testing standards to verify the physical performance of the enclosure materials.
4. Knowledge of the testing standards to verify the **installed** performance of the enclosure systems.



Building Science Corporation – John Straube

Best Practice Standards

1. Structured Quality Assurance Process with all parties at the table.

2. Risk-Management strategy for stakeholders.

3. Not an “instance” or “checklist” Not a short-term “task. It is a workflow.

4. Consistent Terminology and Roles and Responsibilities.

ASHRAE, NIBS, BCxA

Case Study – FIS Headquarters, Jacksonville, FL

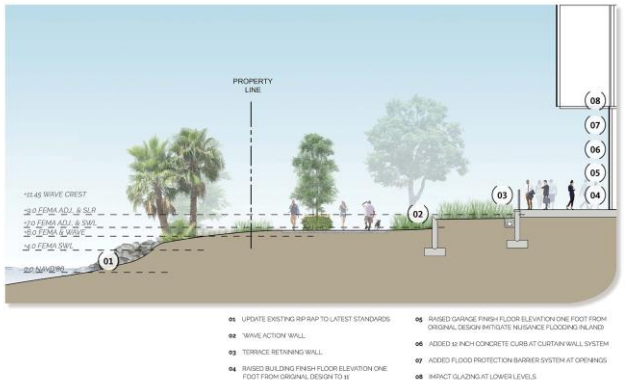
Primary Stakeholders

1. FIS (Owner)
2. Hines (Developer)
3. Gilbane (General Contractor)
4. Gensler (Architect)
5. Cogent (CxA)
6. Entuitive (BE & BECxP)
7. FIS Employees and Clients (Users)

Project Challenges & Opportunities

1. Coastal flooding resilience design strategies.
2. Critical timeline for design and construction in order to temporarily shift employee workforce to adjacent buildings prior to completion of the headquarters.
3. Florida Building Code standards for hurricane design resistance.
4. Attached parkade and significant green roof areas above the podium.
5. Desire to incorporate innovation lighting approaches to the exterior façade while also balancing solar control.
6. Owner as final end-user.

Unique Site and Landscape Positioning



1. The project is a 12-storey office tower sitting atop an amenity focused podium.
2. Tower is setback from the river to facilitate river walk and provide sufficient coastal buffer.
3. Detached parkade and utilities building to support workforce on the campus.

Design Aspects in Construction

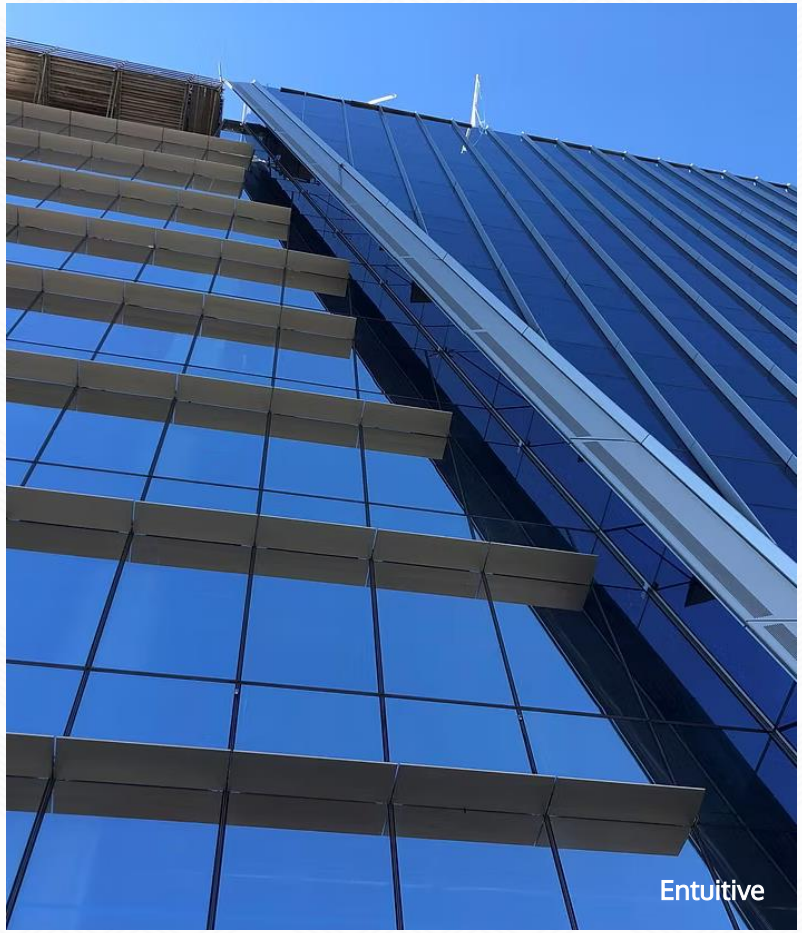
1. Tanked foundations for below grade waterproofing

Design Aspects in Construction

1. Custom unitized curtain wall to incorporate lighting design and solar shading. As well as the unique sloped fin expression of the façade “wrapping” the elevation.

Design Aspects in Construction

1. Field verification and installation of the unitized wall system along with tie-ins at corners, curves, roofing and podium waterproofing.



Design Aspects in Construction

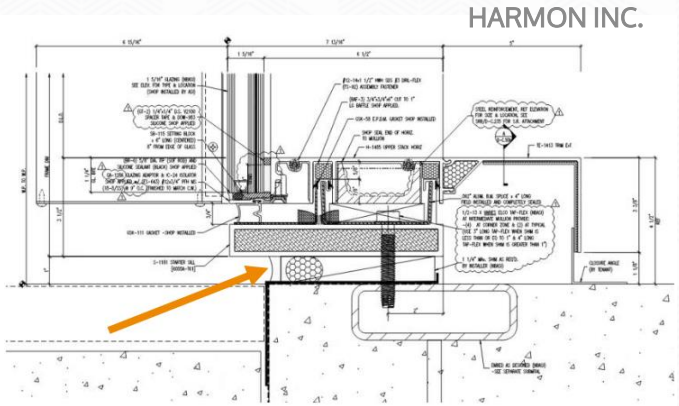
1. Field verification of the glazing systems through pressurized testing and spray rack testing.
2. Review of the façade elements attached to the exterior as well as penetrations for lighting fixtures.

Design Aspects in Construction

1. Field verification of the air barrier bonding to the substrates either sheathing or CMU block wall.

Design Aspects in Construction

1. Review of condensation control on the interior and exterior given mechanical balancing and the high performance curtain wall adjacent to a high humidity and elevated temperature climate.
2. Review of potential air and water leakage sites.



Design Aspects in Construction

1. Field verification through EVFM and testing of the green roof assemblies on the podium above critical amenity spaces.

Case Study – Royal Columbian Hospital Phase 2

Primary Stakeholders

1. Fraser Health Authority (Owner)
2. Ellisdon (Design Builder)
3. HDR (Architect of Record)
4. Parkin (Healthcare Architect)
5. JLL (CxA)
6. Entuitive (BE & BECxP)
7. HHA (Compliance CxA)
8. Arcadis (Compliance Architect)
9. Healthcare Professionals and Patients (Users)

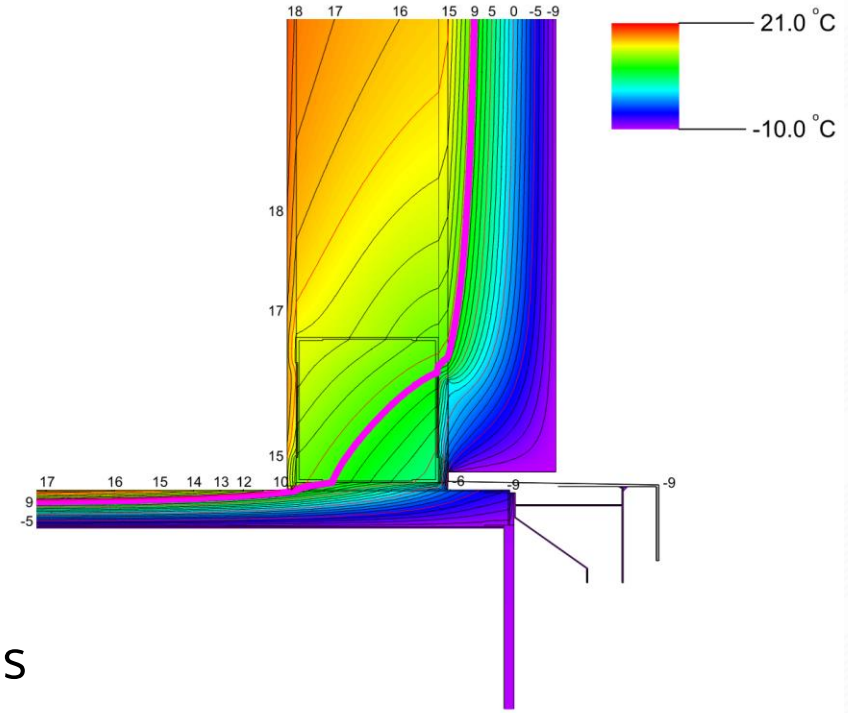
Project Challenges & Opportunities

1. Rapid Construction Timeline Pressures (2019 – 2024)
2. Impacted by COVID site closures and quarantine measures
3. Active hospital facility adjacent to site with many connections to the existing buildings (i.e. Service tunnel connecting to the existing infrastructure of the hospital campus).
4. Designed for Post-Disaster compliance with BC Building Code.
5. Large full-height mechanical floor levels and plenum spaces interrupting the enclosure and thermal boundary.
6. Specific enclosure performance for specialty medical spaces adjacent to the exterior.
7. +50 year Design Service Life

Unique Architectural Expression

Prescriptive Energy Performance

1. Effective R-18 to R-20 Wall Performance
2. Effective R-34 Roof Performance
3. Effective R-19 Soffit Performance
4. Average U-0.38 for Glazing Performance
5. Thermal Bridging analysis performed to ensure cold bridges were eliminated early on in the design.
6. Glazing Ratios:
   A. Range between 13% to 23% across various elevations



Design Aspects in Construction

1. Early enclosure mock-ups prior to construction were key in setting up the quality control measures both for interiors and exteriors.

Design Aspects in Construction

1. Deep excavations adjacent to the existing building foundations made for challenging waterproofing detailing below grade.

Design Aspects in Construction

1. Due to expedited schedule, build team proceeded with pre-fabricated steel stud walls, this was done for the main tower but ultimately standard site built walls were implemented for the rest of the site.

Design Aspects in Construction

1. Multiple rainscreen cladding types were implemented on the project for the design intent. Frequent membrane, insulation and cladding review was necessary.
2. Contractor trade checklists are absolutely required.
3. Pressurized chamber glazing tests were performed on windows.

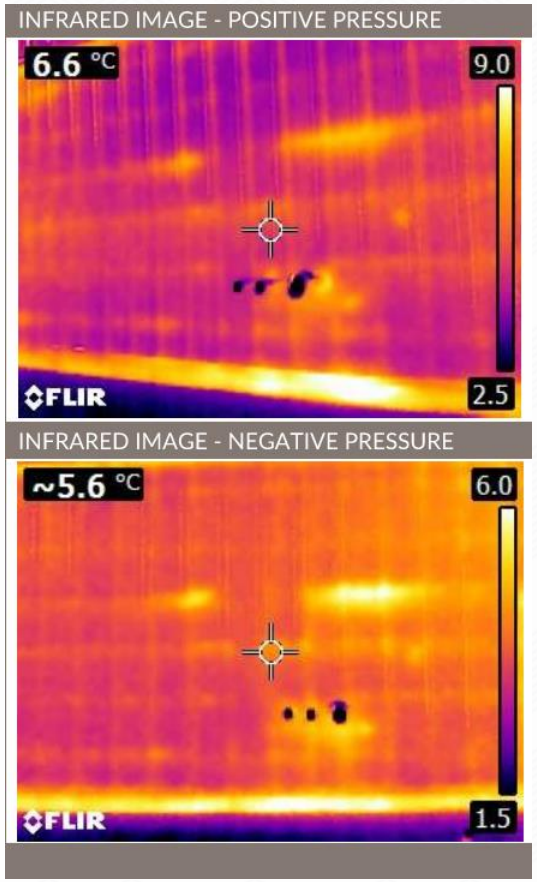
Design Aspects in Construction

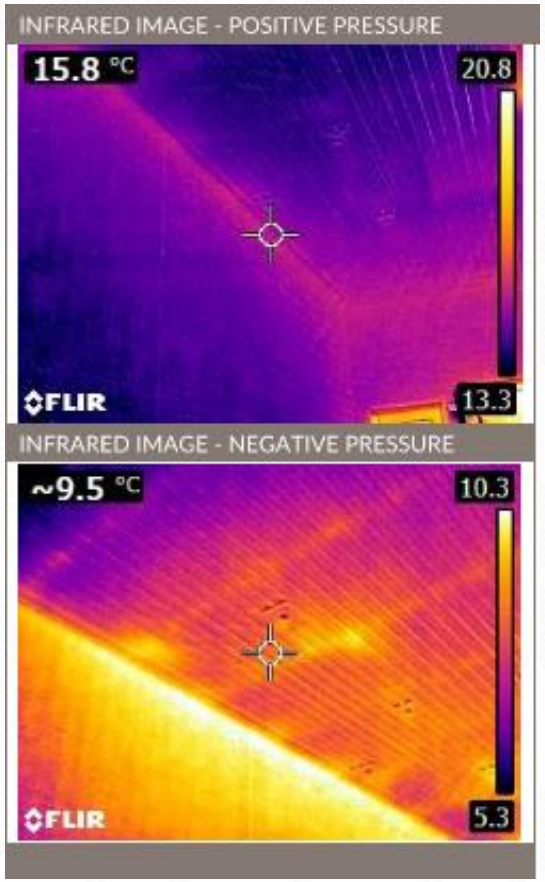
1. Multi-story glazed timber curtain wall at the ground floor entry. Care was taken to evaluate any potential condensation risks with the timber mullion framing.
2. Field testing of installed sections of curtain wall was performed.

Design Aspects in Construction

1. Given height of the tower, frequently the roofs were used as staging areas for material.
2. Complex scheduling for phasing the base and final cap layers of roofing.
3. Constant diligence in protecting the roofing membrane from damage.
4. EFVM testing was performed on every roof plane.

Thermal Imaging





Case Study – BMO Centre Expansion

Calgary Municipal Land Corporation

Primary Stakeholders

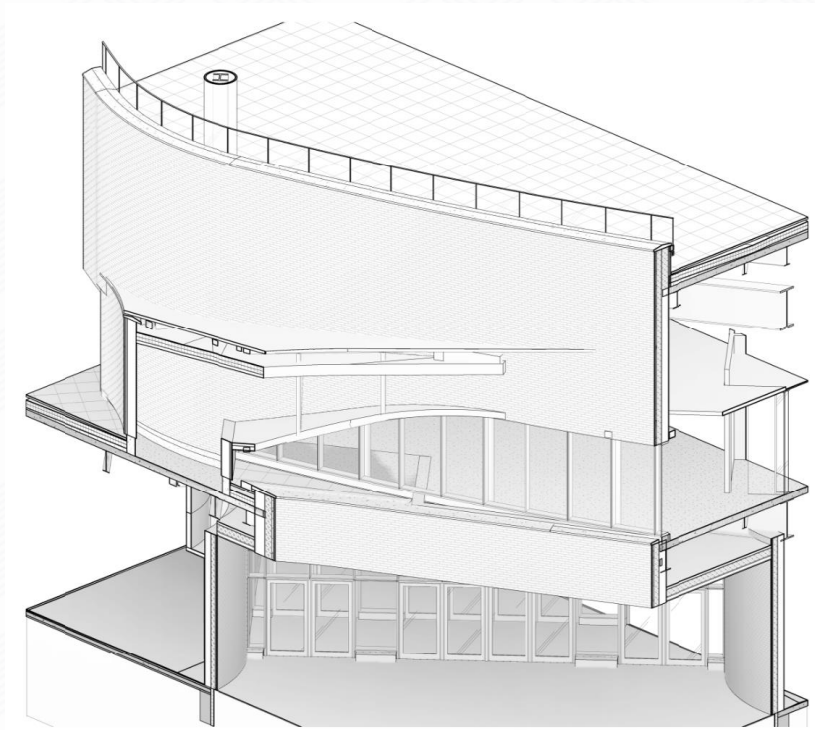
1. Calgary Municipal Land Corporation & Calgary Stampede
2. M3 (Project Developer)
3. Stantec (Architect of Record)
4. Populous (Design Architect)
5. CFMS Alberta Ltd. (CxA)
6. Entuitive (BE & BECxP)
7. PCL (General Contractor)
8. City of Calgary (Users)

Project Challenges & Opportunities

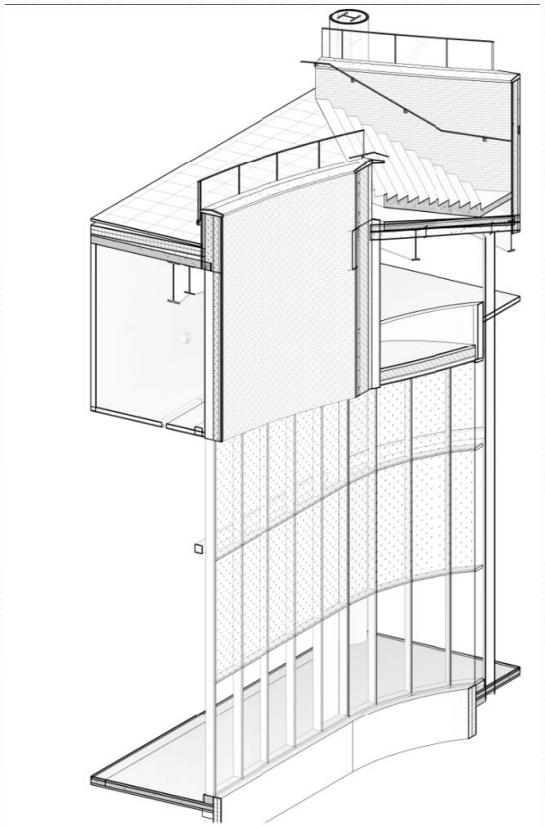
1. Rapid Timeline for a large facility (2019 – 2024)
2. Project was not originally designed to be post-disaster proof but there is growing sentiment by the city to support that all community centers need to be or serve as temporary emergency facilities (TEF).
3. Unique and playful architectural design.
4. Robust enclosure to withstand any climate extremes (high winds, prolonged heat, hail, etc…)
5. Durable enclosure and finishes to service events like the Calgary stampede which this year consisted of 1.4 M attendees.
6. Existing BMO and Stampede stay active during construction.

Challenging Form through Design

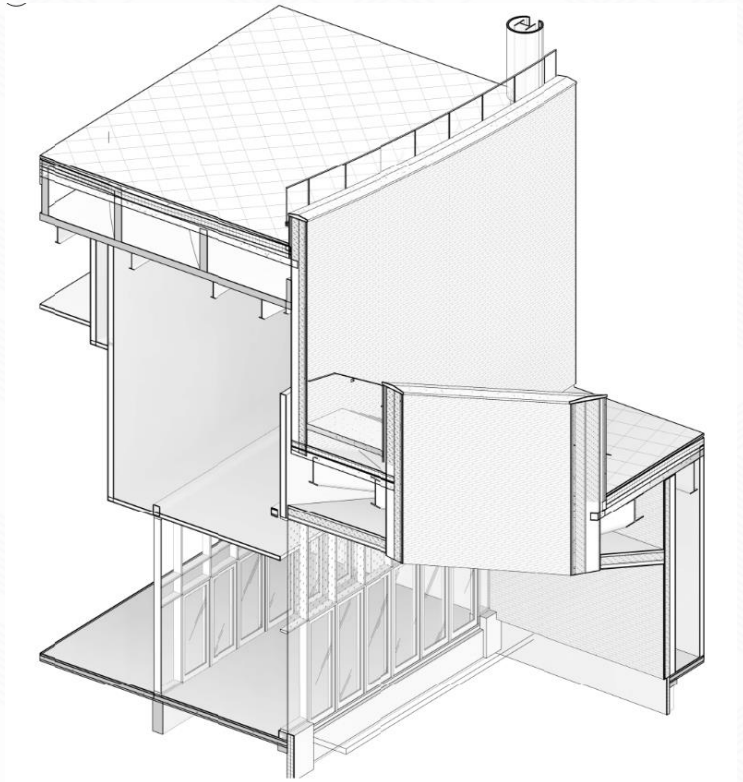
STANTEC ARCHITECTURE



4 A4.3.4 AXON- SECTOR B THIN VENEER-2 (FOR REFERENCE ONLY)



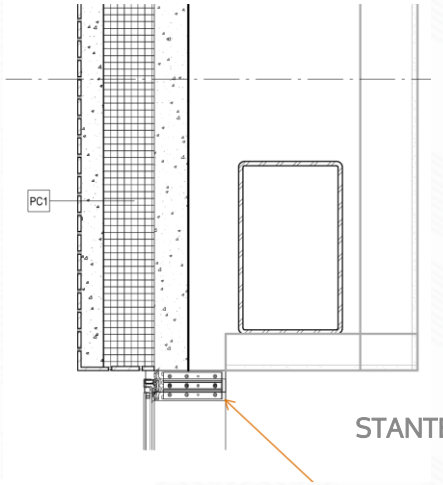
1 A4.3.2 AXON - THIN VENEER MASONRY WALL SECTION SECTOR B WEST (FOR REFERENCE ONLY)



6 A4.3.2 AXON THIN VENEER MASONRY WALL SECTION SECTOR B WEST (FOR REFERENCE ONLY)

Design Aspects in Construction

1. Large sandwiched precastconcrete panels with insulation and brick



STANTEC

Entuitive

Design Aspects in Construction

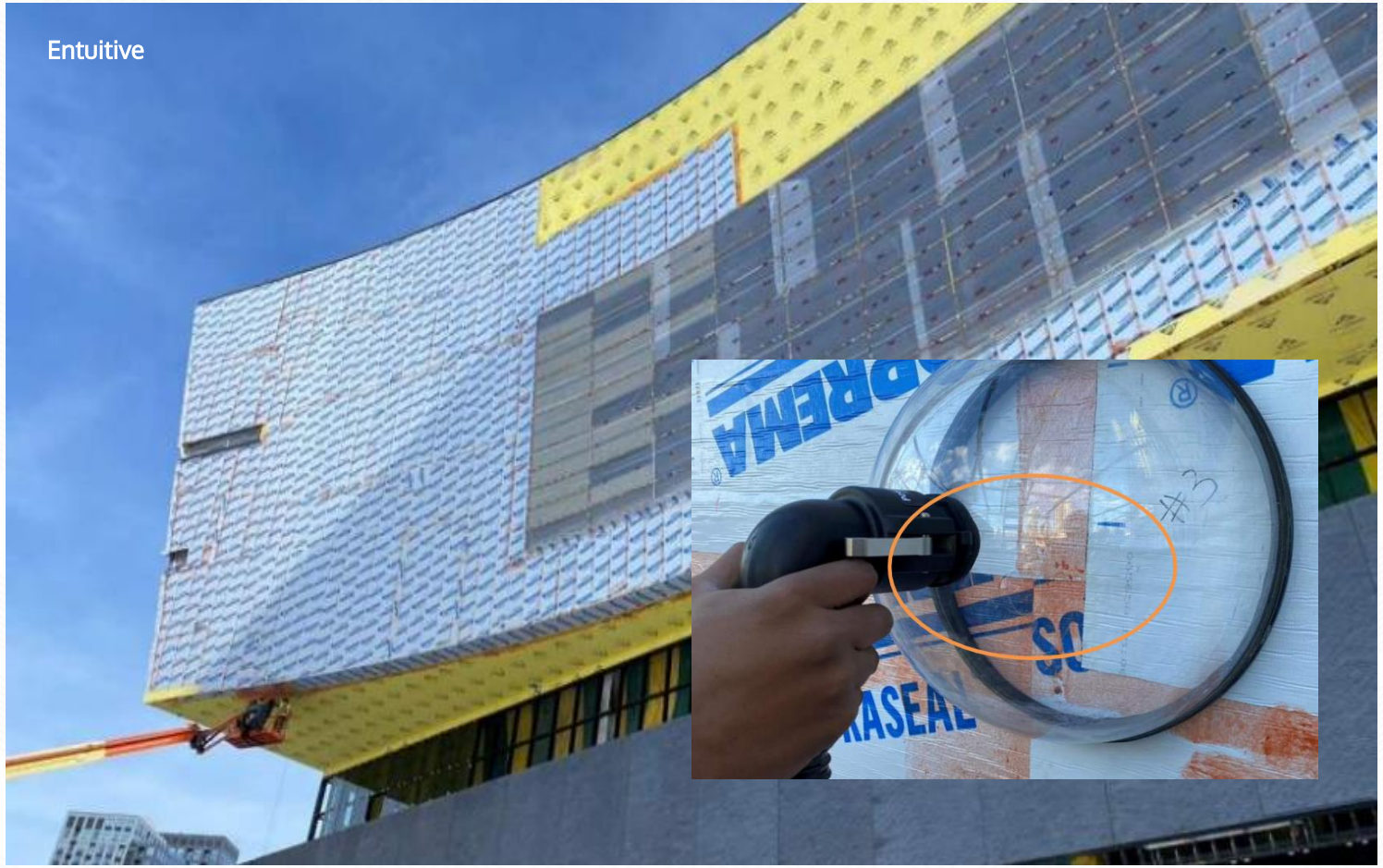
1. Inverted roof assemblies with overburden to create terraces and flexible gathering spaces outdoors.
2. Unique geometries and interfaces with curb design.

Design Aspects in Construction

1. Standing seam canopy roof with unique sloping geometry.
2. Saddle geometry and extents of roofing application were expansive.

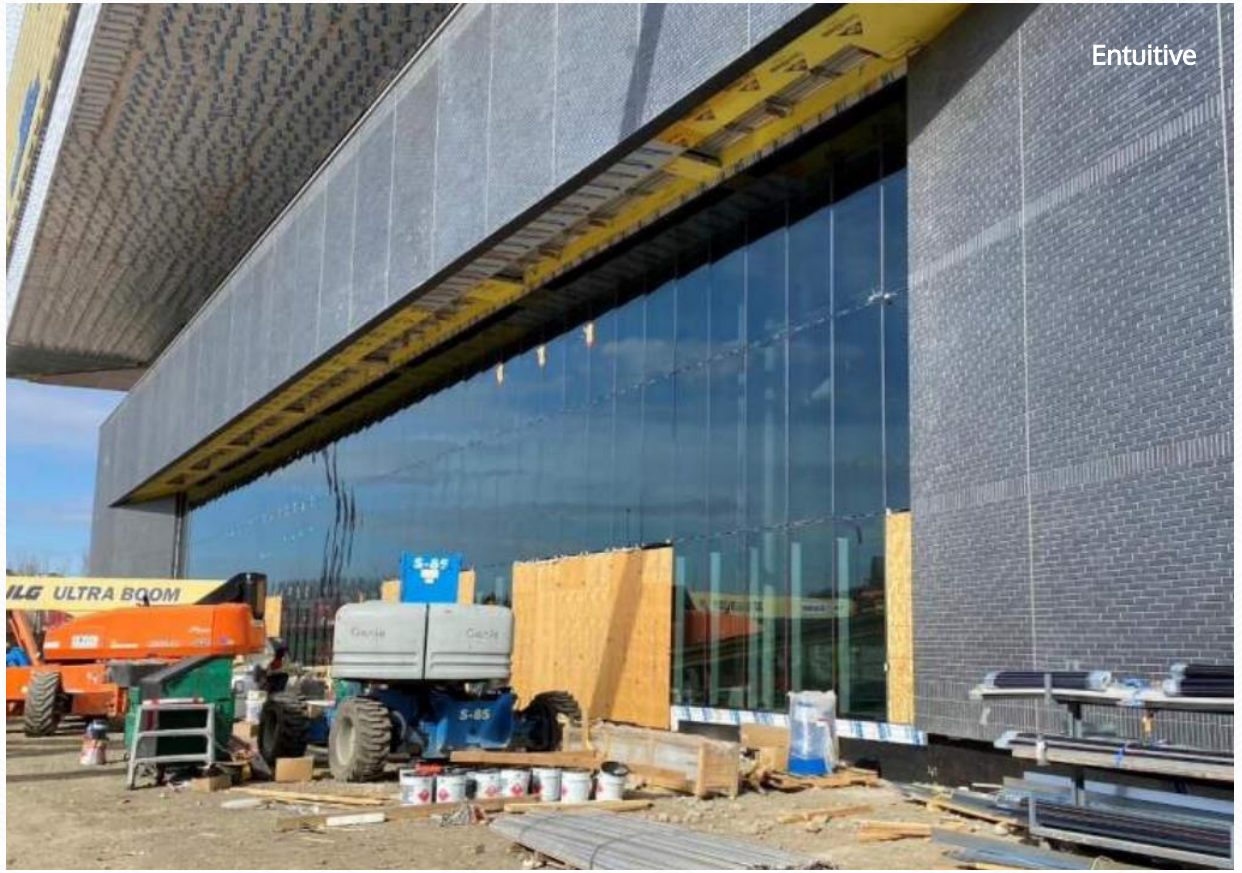
Design Aspects in Construction

1. Expansive areas of membrane across uneven or curved substrates.
2. Multiple cladding panel types and returns with soffit conditions.
3. Contractor trade checklists are absolutely required.



Design Aspects in Construction

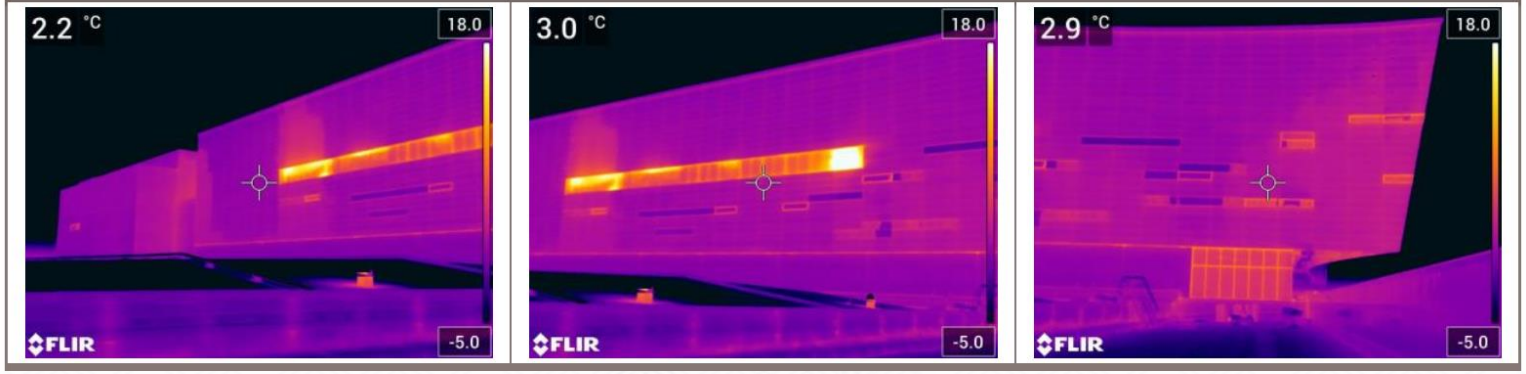
1. Large areas of multi-story height glazing systems.
2. Field testing of installed sections of curtain wall was performed.



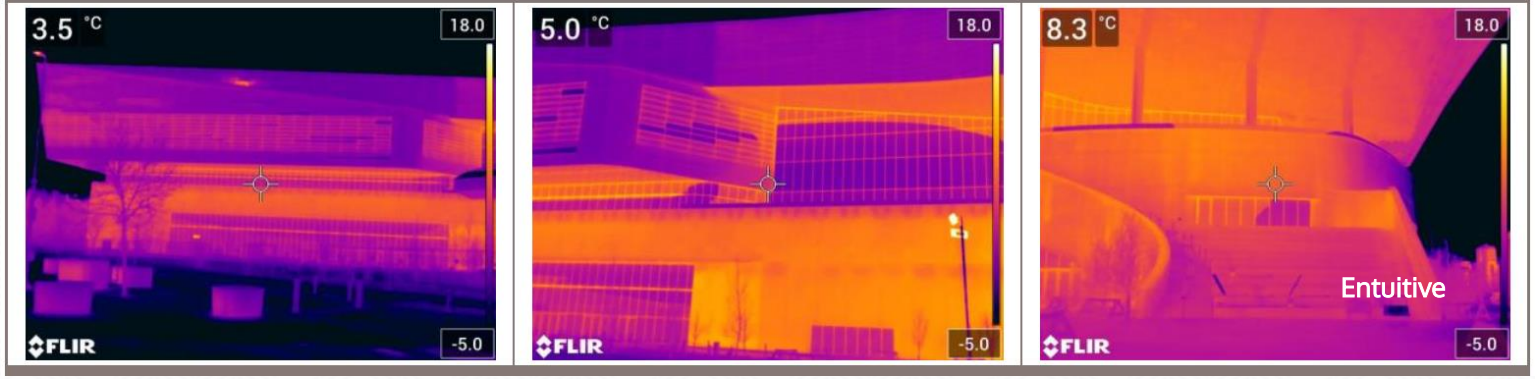
Thermal Imaging

ITEM 3.2.12 – BUILDING ELEVATIONS

ITEM 3.2.12.1 – NORTH ELEVATION



ITEM 3.2.12.2 – SOUTH ELEVATION



Key Takeaways & Lessons Learned

1. Consistent design review Q&A at milestones to avoid design changes later in the process.
2. Avoid duplication of efforts in documentation, early engagement with the design team and ownership.
3. Collaborative teaming between the CxA and the BECxP to ensure documentation control is succinct and consistent.
4. Early budgeting for testing and verification measures to control cost escalation and /or scheduling concerns.
5. **Reminder:** design risks still lie with the Architect and Engineer of Record.
6. BECxP and CxA are responsible for the verification process **not** the execution or implementation.

References

The Community Continues to Expand

- (NIBS) Guideline 3-2012, ASTM 2947
- CSA Guideline Z320-11 – Building Commissioning Standard
- ASTM E2813 – Standard Practice for Building Enclosure Commissioning
- BCxA Enclosure Best Practices 2025
- Reach out to your Envelope Consultant!

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