The Role of the Building Façade – Curtain Walls

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Curtain Wall Definition

- A non-load bearing exterior skin (multiple substrates)
- Does not contribute to the structural support of the building
- Provides the air and water tightness of the building exterior
Tall Buildings – Glass Facade
Tall Buildings – Glass Facade
Tall Buildings – Stone Cladding
Health Care Buildings
Masonry Facades
Aviation Projects
Mixed-Use Projects
Due Diligence

Never hurts to look closely at the envelope
The Role of the Building Envelope

- Protect against the natural elements (environment)
- Provide aesthetic signatures to buildings
- Key area to focus on contribution and managing energy loads on building
- The shelf life of usable materials
- Maintenance is critical
Building Envelope Response

- Control air and water infiltration

- Control Light Transmittance in Vision Areas

- Need to maintain or reduce mechanical loads on the interior.

- Provide a comfortable interior space
Curtain Wall Background
Design Tools

- Building Codes
- Industry Standards
- Analytical Mechanics
- Installation Methods

EXPERIENCE & their Lessons !!
Literature Reference

BUILDING CODES
- IBC, ASCE 7
- LOCAL CODES
- WHOLE BUILDING DESIGN GUIDE

INDUSTRY STANDARDS
- AA ~ Aluminum Association
  - AAMA
  - GANA
  - ASTM
  - ASHRAE
Curtain Wall Design Considerations

SYSTEM DESIGN

- Framing Elements
- Design Pressures
- Connections
- Air Flow Control
- Controlled Water Flow
- Shop Assembly
- Field Installation
Typical Elevation

*Courtesy of Texas Wall Systems, Dallas, TX*
Examples of System Types

- Tubular Mullion
- Vision
- Spandrel

*Courtesy of Texas Wall Systems, Dallas, TX*
Examples of System Types

- Butt Glaze
- Mullion
- Vision

*Courtesy of Texas Wall Systems, Dallas, TX*
Examples of System Types

Butt Glaze
Mullion
Spandrel

*Courtesy of Texas Wall Systems, Dallas, TX
Stick System
Curtain Wall Installation Example

*Courtesy of AAMA
Unitized/Panelized System
Example of Panel Assemblage

* Courtesy of Old Castle Glass
Brick/Stone Truss Panels

* Courtesy of Atlantic Exterior Systems
EVALUATION

- Finite Element Analysis
- Dynamic Analysis (Blast)
- Wind Tunnel Study
- Mock-up Testing
- WUFI, THERM
- Fracture Mechanics
Curtain Wall Assessment Tools

- Finite Element Analysis
Thermal Simulation Test
Wind Tunnel Study

* Courtesy of CPP. Inc
Curtain Wall Testing

• Mock-up Testing
Curtain Wall Testing

- Missile Impact Testing
Forces and Movement

Anchors Must Accommodate Movement
Water Infiltration Concerns

- Need to control water infiltration
- Affect the mechanical load for controlling humidity
- Similar for air
Key Curtain Wall Components
Energy Related

- Glazing
- Gaskets
- Sealants
- Framing
- Shading
Types of Glass

- Annealed
- Heat Strengthened
- Tempered

**UNITS**

- Monolithic Glazing
  - Least efficient
- IG Unit
  - More efficient
- Laminated Unit
  - Interlayer added to retain glass
Glazing

MONOLITHIC GLAZING

- Some older buildings have monolithic glass which is not energy efficient
- Often these lites are not tinted for clearer visibility

INSULATING GLAZING UNITS

- Widely used and effective with tint or frit on the #2 surface to reduce the UV light.
- Flexibility to incorporate different glass combinations to make a unit (ex. Monolithic w/ laminated)
Gaskets

- Used as insulators and bearing surfaces for glazing
- Gaskets made from rubber and can be extruded.
- Full molded corner gaskets are very functional in the correct application.
**Try to avoid Gasket Problems**

**AGED PERIMETER GASKETS**
- Need to be replaced
- Poor air and water infiltration control

- Age sometimes cause shrinkage
Sealants

- EXTERIOR APPLIED @ Perimeter Joints
- INTERIOR APPLIED @ Structural Glazing
  @ Frame Connectivity
Framing

- Aluminum extrusions allow a lot of flexibility in adaptation to systems.
- Appendages can be added
- Challenging in existing conditions
Sunshades

- Offers Aesthetic Quality
- Offers energy relief to glazing
- Can be retrofitted on existing framing
- Dependent on the spandrel condition; glazing, stone, precast or metal panels.
- Connections have to be ideally co-ordinated thru caulk joints and waterproofed.
Sunshades

- Note the shading effect of the sunshade on the glazing
- Aesthetics are very important

- Zoom of the shading concept

Courtesy: Corgan
Larger scale shading

*Courtesy Thornton Tomasetti/ MGI
Example of Architectural Retrofit

OLD FAÇADE - OFFICE BLDG

NEW FAÇADE – CONDOMINIUMS/RETAIL

* Courtesy: Corgan
Summary

- The curtain wall needs to perform well

- Dependent on:
  - Level of design and computations
  - Workmanship, Erection, Quality assurance, Testing performed during construction
Summary (cont)

- Careful planning and staging is critical with relation to budgets and schemes.

- Technology advancements should be utilized where feasible.

- Primary elements related to energy: glazing, gaskets, framing and sealant performance.

- Accent elements such as sunshades can be introduced but detailing the interface requires co-ordination and design.
References

- ASTM (American Society of Testing Materials), Glass and Glazing Standards.
- ACI (American Concrete Institute), ACI-318-08, Building Code Requirements for Structural Concrete and Commentary.
- ASCE 7, American Society of Civil Engineers, Current Edition
- MIA (Mable Institute of America), Current Edition.
- WBDG (Whole Building Design Guide), www.wbdg.org
Why is the Building Envelope Important

We protect the public, family included 😊
Thank You

Questions?

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