



Building Envelope Commissioning

Presented to:

ACG – AABC Commissioning Group

Presented by:

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collaborāte / formulāte / innovāte

The Commissioning Process

ASHRAE Guideline 0-2005

“Quality-Oriented Process”

The Commissioning Process

Pre-Design Phase

- Owner's Project Requirements (OPR)
- Commissioning Plan (CP)

The Commissioning Process

Design Phase

- Basis of Design (BOD)
- Verify/Update OPR & CP

The Commissioning Process

Construction Phase

- Shop Drawing Reviews
- Construction Checklists

The Commissioning Process

Construction Phase (cont)

- Testing
- System Manuals & Training
- Verify/Update OPR & CP

The Commissioning Process

Occupancy & Operations Phase

- Verification
- Final Commissioning Process Report

The Commissioning Process

Technical Commissioning Guidelines

- ASHRAE Guideline 1-200X
 - HVAC&R
- Guidelines 2-200X through 8-200X
 - Structure, Electrical, Lighting, Interiors, Plumbing, Fire Protection

The Commissioning Process

Technical Commissioning Guideline

- NIBS Guideline 3-2006
 - Exterior Enclosure

Building Envelope Commissioning

NIBS Guideline 3-2006

Exterior Enclosure

Technical Requirements

For the Commissioning Process

Building Envelope Commissioning

Exterior Walls

Exterior Glazed Windows, Curtainwalls
and Storefronts

Exterior Doors

Exterior Below-Grade Walls

Roofs

Skylights

Slabs-On-Grade

Building Envelope Commissioning

Pre-Design Phase

- Owner's Project Requirements (OPR)
 - Owner's Vision
 - Project Budget and Schedule
 - Owner Directives

Building Envelope Commissioning

- OPR (cont)
 - Occupant Requirements
 - Thermal Comfort
 - Visual Comfort
 - Indoor Air Quality
 - Acoustics
 - Special Indoor Environmental Requirements
 - Level of Occupant Control (Operable Windows, Etc)
 - Life Safety

Building Envelope Commissioning

- OPR (cont)
 - System Performance
 - Heat Flow Control
 - Air Flow Control
 - Water Vapor Flow Control
 - Rain Penetration Control
 - Light, Infrared, Ultraviolet, and Other Radiation Control
 - Noise and Vibration Control
 - Fire Control

Building Envelope Commissioning

- OPR (cont)
 - System Performance (cont)
 - Structural Performance
 - Snow
 - Wind
 - Seismic
 - Blast Impact
 - Ballistic

Building Envelope Commissioning

- OPR (cont)
 - System Performance (cont)
 - Durability
 - Aesthetic / Value
 - Maintainability
 - Sustainability

Building Envelope Commissioning

- OPR (cont)
 - Systems Integration Requirements
 - Fire
 - Life Safety
 - Structural
 - Day-lighting Control
 - Mechanical Ventilation
 - Natural Ventilation
 - Heating and Cooling
 - Security
 - Advanced Technologies

Building Envelope Commissioning

- OPR (cont)
 - Site Information
 - Restrictions and Limitations
 - Training Requirements
 - Warranty Requirements
 - Quality Requirements
 - Systems
 - Materials
 - Construction

Building Envelope Commissioning

- OPR (cont)
 - Statistical and Quality Tools
 - Benchmarking Requirements
 - Operation and Maintenance
 - Allowable Range of Operation
 - Applicable Codes and Standards
 - Insurance Requirements
 - Owner Safety Requirements
 - Constructability

Building Envelope Commissioning

Design Phase

- Basis of Design (BOD)
 - Owner's Preference For Materials Or Systems
 - Initial Cost
 - Impact On Schedule
 - Acoustical Performance
 - Thermal Performance

Building Envelope Commissioning

- BOD (cont)
 - Air Leakage
 - Water Leakage
 - Fire Resistance
 - Structural Criteria
 - Reliability
 - Sustainable Design
 - Life Cycle Cost
 - Security
 - Warranty
 - Glare Control
 - Condensation Control
 - Installation Methods
 - Glazing Methods
 - Durability
 - Redundancy
 - Ease of Repair

Building Envelope Commissioning

Construction Phase

- Shop Drawing Reviews
- Construction Checklists
- Testing
- System Manuals & Training

Building Envelope Commissioning

Construction Phase

- Shop Drawing Reviews
- Construction **Checklists**
- Testing

Building Envelope Commissioning

Construction Phase

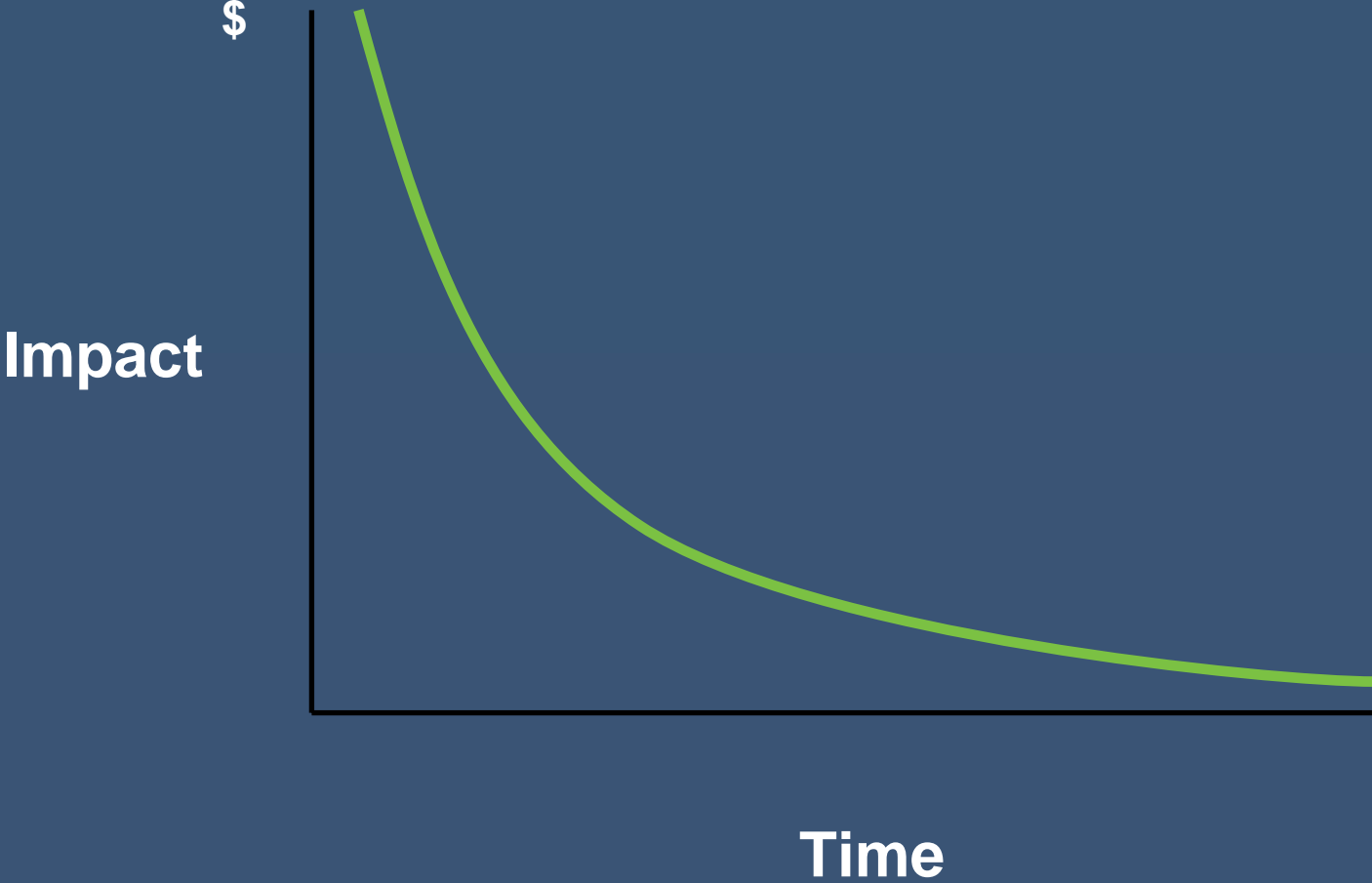
- Shop Drawing Reviews
- Construction Checklists
- Testing

Building Envelope Commissioning

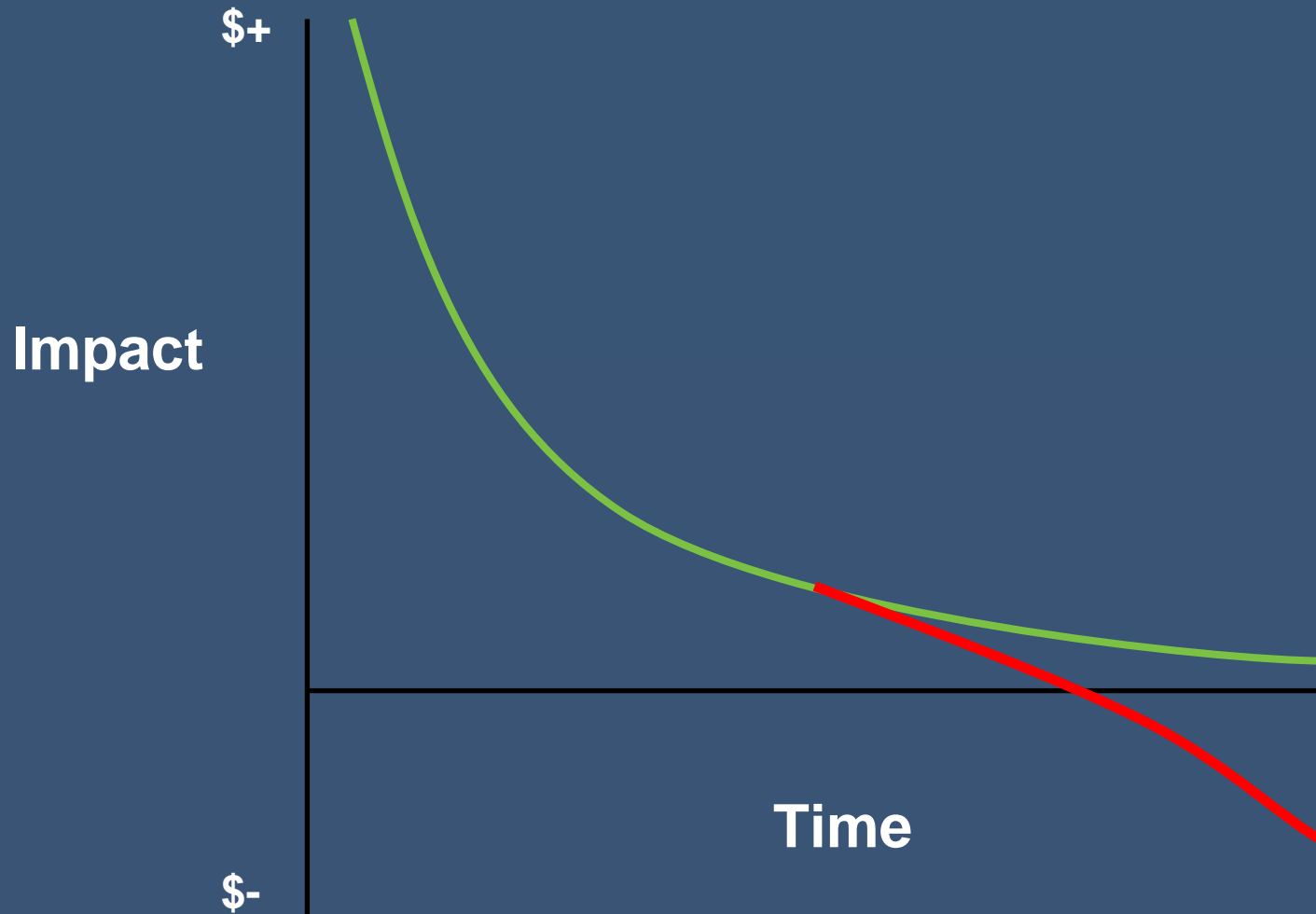
Construction Phase

- Shop Drawing Reviews
- Testing (laboratory / field mock-up)
- Construction Checklists
- Testing (in situ) - verification

Commissioning Impact



Commissioning Impact



Building Envelope Design

“Avoiding Wall Problems by
Understanding Structural Movement”

(December 1981, Dr Charles Thornton)

Building Envelope Design

Structurally-Related Failures of Building Envelopes

- Major Design Errors
- Incompatibility Between Structure & Wall
- Absence or Lack of Coordination
- Material Deficiency
- Lack of QC During Construction

Building Envelope Design

“Overwhelming majority (about 90%)
of all building problems
is associated with water in some way.”

(“Minimum Requirements and Guidelines for
the Exterior Building Envelope.” February 2001,
State of Wisconsin, Div of State Facilities)

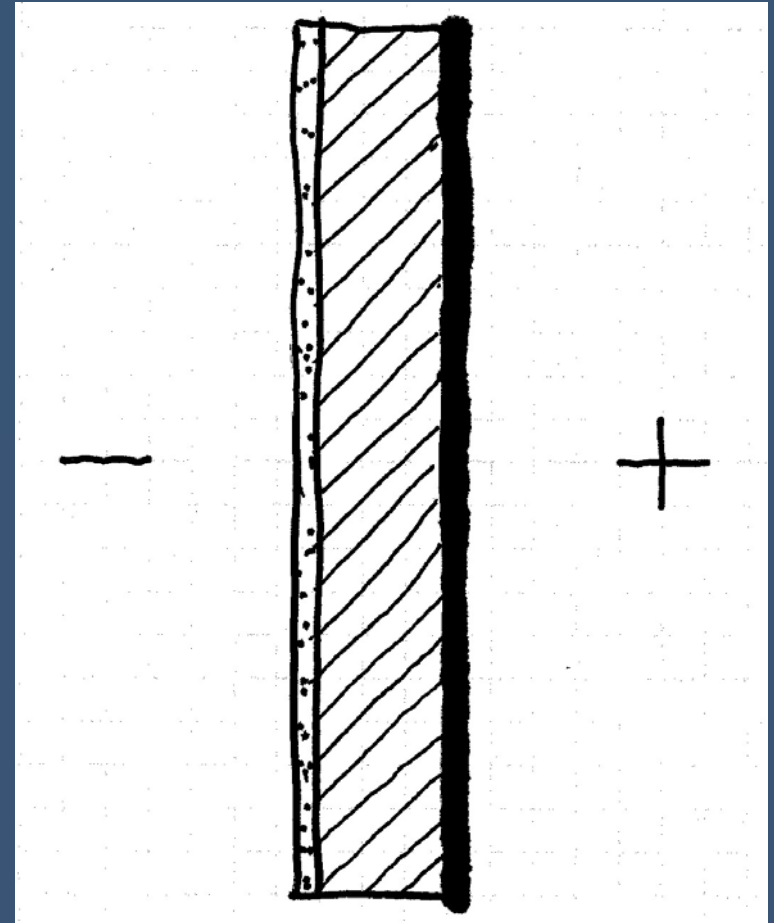
Building Envelope Design

Three Wall Types

- Barrier Wall
(poor)
- Drainage Wall
(better)
- Rain Screen Wall
(best)

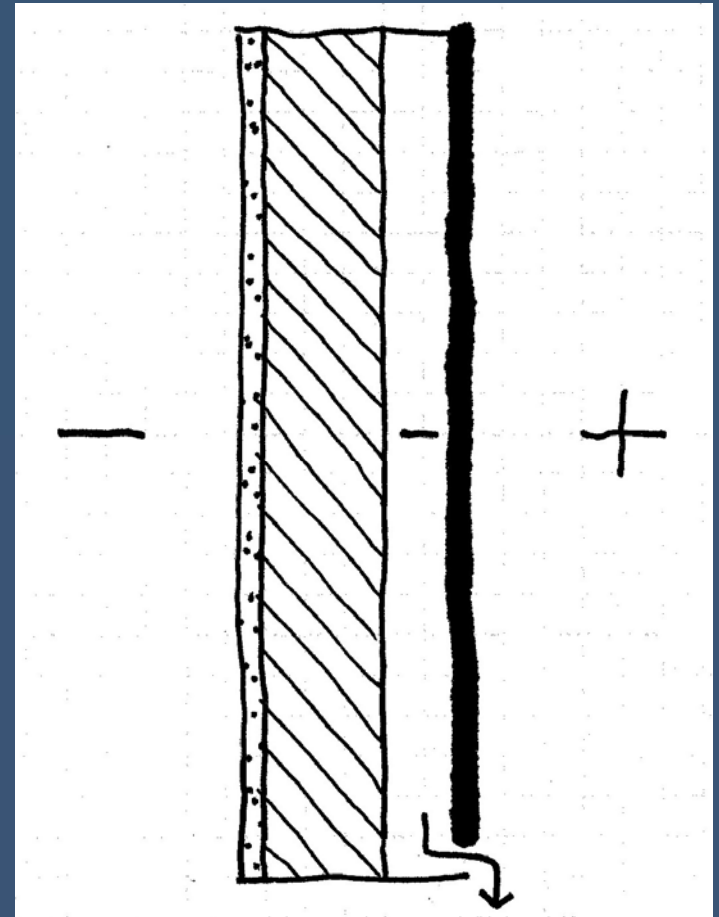
Building Envelope Design

- Barrier Wall
 - Mass (historic)
 - Skin (contemporary)



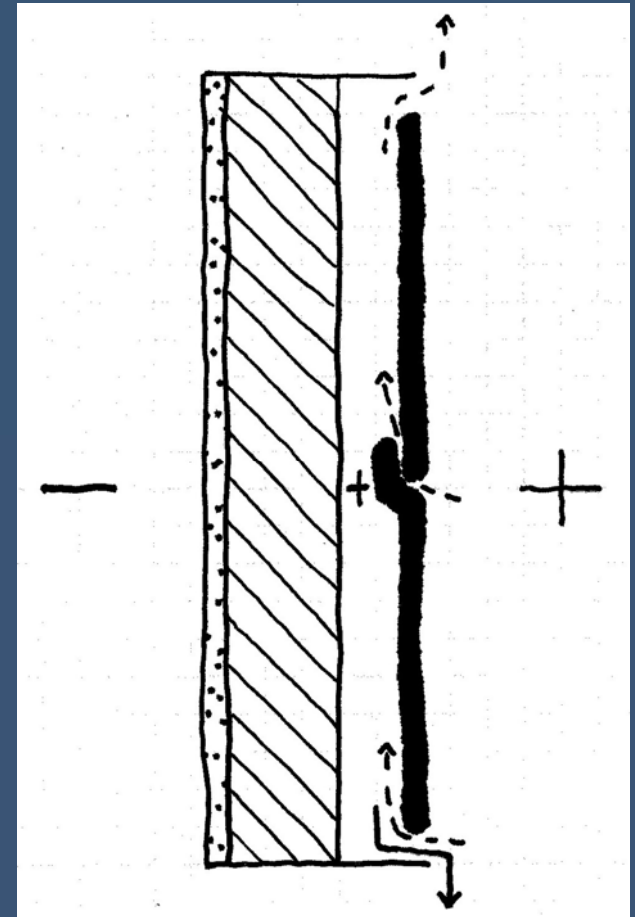
Building Envelope Design

- Drainage Wall
 - Guttered
 - Cavity



Building Envelope Design

- Rain Screen Wall
 - Modified (joints only)
 - Pressure-Equalized (complete surface)



Building Envelope Design

Looks Can Be Deceiving – Brick Masonry



Building Envelope Design

Looks Can Be Deceiving – Stone Curtainwall



Building Envelope Design

Looks Can Be Deceiving – Metal Curtainwall



Building Envelope Design

Looks Can Be Deceiving
(All Walls Are Not Created Equal)

Beauty is Only Skin Deep
(It's What's Inside That Counts)



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