DYNAMIC EXTERIOR WALL SYSTEMS
FOR SOLID MASONRY WALLS IN
HUMIDIFIED BUILDINGS

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Session 1.13 11:05am - 12:00pm
Outline

- Masonry Wall Basics
- Museum Environments
- “How Not to Do It” – Lessons Learned
- Dynamic Wall Systems
- Summary & Questions
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Managing the Elements: Solid Masonry
Managing the Elements: Contemporary Walls

**Barrier Wall**
- Direct-applied stucco
- Solid masonry

**Drained Walls**
- Stucco on furred lath
- Wood siding
- Brick veneer
- Metal panels
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“The Museum Standard”

- During WWI, artwork stored in slate quarry caves in Britain experienced greatly reduced levels of deterioration
  - 63°F and 58% RH (48°F dew point)

- 70°F +/- 2°F and 50% +/- 5% RH (46 to 55°F dew point)

- From *The Museum Environment* by Garry Thompson, © 1978
- Taken out of context from discussion about the capabilities of modern mechanical systems to maintain T/RH conditions
“The Museum Standard”

• Typical museums maintain positive pressure for contaminant control
  – Air is forced out of spaces to prevent infiltration of environmental contaminants that could damage artwork

• Air leakage is a significant concern
Exterior Temperature vs. Interior Dew Point
New York, NY

![Graph showing exterior temperature vs. interior dew point in New York, NY for the year 2010. The graph includes temperature data from January 2010 to December 2010, with temperature values ranging from 0°F to 100°F. The graph displays three lines: one for exterior temperature (blue), one for dew point (low) (green), and one for dew point (high) (red).]
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Freeze/Thaw Effects - Interior
Freeze/Thaw Effects - Interior
Freeze/Thaw Effects - Exterior
Condensation Issues

- Surface condensation is most common
- Lack of insulation makes fenestration installation difficult
- Need to retain “historic fabric” presents a unique challenge
Interior Condensation
Interior Condensation
Interior Condensation
Cold Climate Wall “Coupling” With Artwork

70°F / 50% RH
Dew point = 51°F

44°F

70°F
Condensation Behind Artwork
Art Hanging on Exterior Walls

• Condensation is the primary concern

• In the absence of condensation, “coupling” of artwork with exterior results in high temperature/moisture gradients through hangings
  – Museum conditions maintained globally
  – Highly variable conditions maintained locally
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Vented Exterior Wall Assembly

- Air seals at floor and roof joints
- New Interior Enclosure
- Air barrier (plaster)
- Negative Pressure in Cavity
- Restrictor plates

Positive Pressure on Room Side
Direction of Air Flow

Return
CFD Analysis of Return Wall
CFD Analysis of Return Wall
Finished Wall Assembly
Finished Wall Assembly
Vented Exterior Walls
Vented Wall System
Vented Wall System at Windows
Vented Wall System at Windows
Balancing Control
Interior “Storm” Windows
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Summary

• Specialized interior environments in museums create unique problem, especially in solid masonry construction

• Solutions are often non-traditional and require significant testing/evaluation

• Owners need to be aware of the costs and risks associated with these projects
Questions

Questions?

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