Rehabilitation of Historic Masonry Buildings Using Contemporary Cementitious Materials and Construction Details

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Presentation Outline

• Performance of Historic Masonry Buildings
• Strategies for Repair of Historic Masonry Buildings
• Advantages of Contemporary Materials and Details
• Case Studies: Contemporary Materials
• Case Studies: Contemporary Materials and Details
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Performance of Historic Masonry Buildings

• Load-Bearing Masonry/Transitional Masonry
  – Rely on mass of wall to manage water
Performance of Historic Masonry Buildings

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Performance of Historic Masonry Buildings

- Typical Problem Details
  - Parapets with masonry exposed on both sides
  - Unheated elements above roofline
  - Skyward-facing mortar joints (copings)
Performance of Historic Masonry Buildings

• Structural Implications
  – Material deterioration
  – Freeze/thaw cracking
  – Lateral-capacity reduction
Performance of Historic Masonry Buildings

- **Header Intact**
  - Composite Section

- **Headers Broken**
  - Lateral Capacity Reduced

- **All Headers Broken**
  - Lateral Capacity Reduced by 75%

- **All Headers Broken**
  - Buckling Potential

Wind direction indicated by arrows on each section.
Performance of Historic Masonry Buildings

- Water Management Implications
  - Material deterioration
  - Leakage
Performance of Historic Masonry Buildings
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• Case Studies: Contemporary Materials and Details
Strategies for Repair of Historic Masonry Buildings

The Secretary of the Interior’s Standards for the Treatment of Historic Properties

- Preservation
- Restoration
- Rehabilitation
- Reconstruction

Effectiveness

Sensitivity to Historic Details

MORE

LESS
Preservation places a premium on the retention of all historic fabric.
Strategies for Repair of Historic Masonry Buildings

- **Restoration** focuses on retention of materials from most-significant time.
- **Preservation**
- **Rehabilitation**
- **Reconstruction**

**Effectiveness**

**Sensitivity to Historic Details**

MORE | LESS
Strategies for Repair of Historic Masonry Buildings

Rehabilitation emphasizes the retention and repair of historic materials, but more latitude is provided for replacement because it is assumed that the property is more deteriorated prior to work.

- Preservation
- Restoration
- Reconstruction

Effectiveness

Sensitivity to Historic Details

MORE

LESS
Strategies for Repair of Historic Masonry Buildings

Rehabilitation

Reconstruction establishes limited opportunities to recreate nonsurviving buildings in all new materials.

Preservation  Restoration

Effectiveness

MORE  Sensitivity to Historic Details  LESS
Strategies for Repair of Historic Masonry Buildings

Retention of Historic Fabric

Preservation

Rehabilitation

Restoration

Reconstruction
Strategies for Repair of Historic Masonry Buildings

- Preservation
- Restoration
- Rehabilitation
- Reconstruction

Effectiveness

Address Deterioration Mechanism(s)

Sensitivity to Historic Details

MORE

LESS
Rehabilitation emphasizes the retention and repair of historic materials, but more latitude is provided for replacement because it is assumed that the property is more deteriorated prior to work.
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Advantages of Contemporary Materials and Details

- Cementitious Materials (e.g., precast concrete, reinforced concrete masonry, shotcrete, etc.)
  - Faster installation
  - Lighter-weight materials
  - Similar properties to historic masonry
  - Commonplace construction practices
Advantages of Contemporary Materials and Details

- Cavity Wall Construction
  - Economic pressures and desire to build taller buildings
  - Now the most-common type of exterior wall construction
Advantages of Contemporary Materials and Details

• Improved water infiltration resistance and durability
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• Case Studies: Contemporary Materials and Details
Case Study: Rehabilitation of Bell Towers
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- Exterior granite wythe
- Stone anchor @ approx. 16" o.c horizontally and vertically
- Grout cavity solid
- Provide stone shims between stones and shim as required to maintain proper alignment
- 3/8" Epoxy anchor, typ., with 3½ min. embedment
- Precast concrete backup
- Kerf stones to accept anchors
- #4 Reinforcing hoop - See Detail 15/9-2 for spacing
Case Study: Rehabilitation of Bell Towers
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Case Study: Rehabilitating Masonry Walls
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• **Case Studies: Contemporary Materials and Details**
Case Study: Rehabilitating Iconic Tower
Case Study: Rehabilitating Iconic Tower
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Case Study: Rehabilitating Iconic Tower
Case Study: Rehabilitating Iconic Tower
Case Study: Rehabilitating Stone Towers
Case Study: Rehabilitating Stone Towers

Scope of Removal Work:
2. Remove interior brick vault and tie rods.
3. Remove existing EPDM roof, including flashing, membrane, insulation, steel decking, and light gauge metal framing.
4. Remove existing acoustical tile ceiling, lighting, and framing.
5. Remove existing plaster ceiling and wood framing.

Provide scaffolding at cornice to prevent displacement during removal, typ. Submit specified scaffolding plan to Director’s Representative prior to beginning removal.

Remove existing granite facing.
Remove exterior granite vault stones.
Remove interior brick back-up vault.
Remove existing steel ties, 8 total.

Granite facing
Sealant joint
Brick vault
Collar joint

EXTERIOR
INTERIOR
Case Study: Rehabilitating Stone Towers
Case Study: Rehabilitating Stone Towers

Provide stainless steel setting shims in stone bed joints. Typically, use four 2"x2" shims per tower stone. Set shims in mortar to level granite. Locate shims 6" from edge at all four corners.

Stainless steel setting dowels, min. 2 per stone

Point horizontal and vertical stone joints over backer rod (typ.), 2 in. min. joint depth

Concrete block - wedge behind each stone at both ends (typ.)

Loose lock joint, typ. on steep slope

Upper portion of stone taper (base and finial) to be rebuilt

Brick and granite to remain, typ. except for brick replacement shown on Drawings A4-100 and A4-101

Precast concrete plank, see Drawing S1-100

Flat seam metal cladding over self-adhered membrane underlay, see Detail 4/A4-200

Self-adhered membrane underlay

Flat seam metal cladding; see Details 6 and 7 on A2-200

Structural steel rib, see Drawing S1-100

Existing granite coping stones, see Detail 4/A4-200

Stainless steel dowels, 2 per stone, min., unless noted otherwise

Reinforced cast-in-place bond beam, see Drawing S1-100
Case Study: Rehabilitating Stone Towers
Case Study: Rehabilitating Stone Towers
Thank You.

Questions?