

DESIGN

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SIMPSON GUMPERTZ & HEGER



Engineering of Structures
and Building Enclosures

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

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Emily R. Hopps, P.E.

Presentation Outline

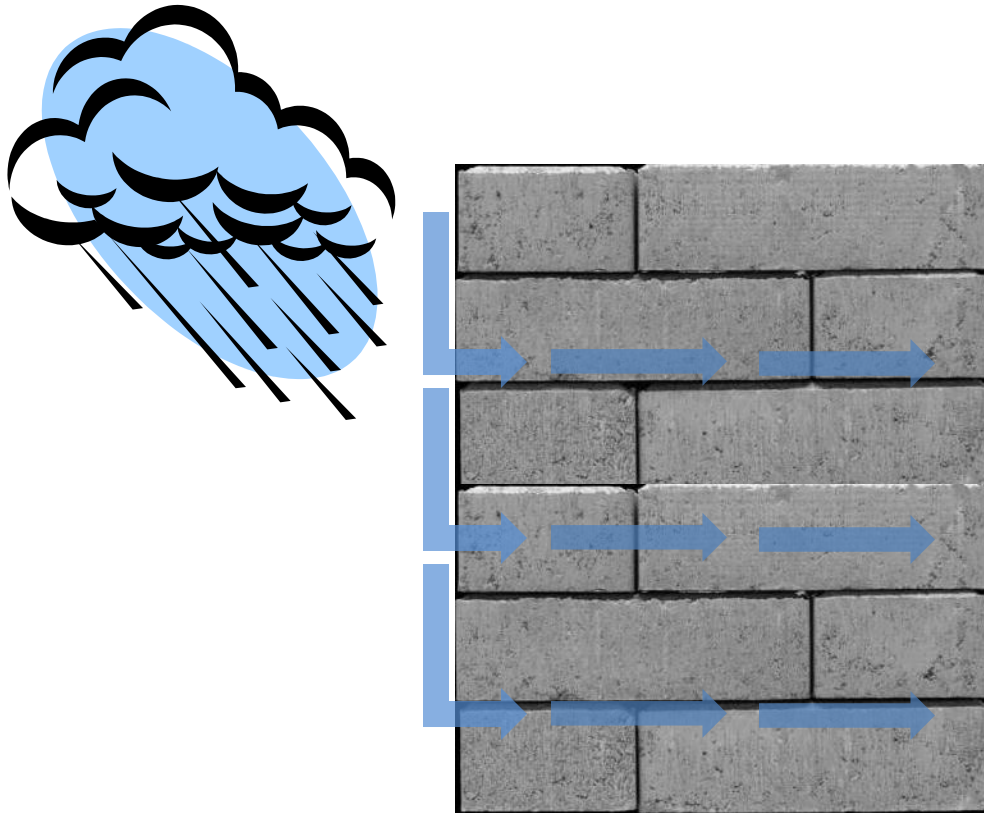
- Performance of Historic Masonry Buildings
- Strategies for Repair of Historic Masonry Buildings
- Advantages of Contemporary Materials and Details
- Case Studies: Contemporary Materials
- Case Studies: Contemporary Materials and Details

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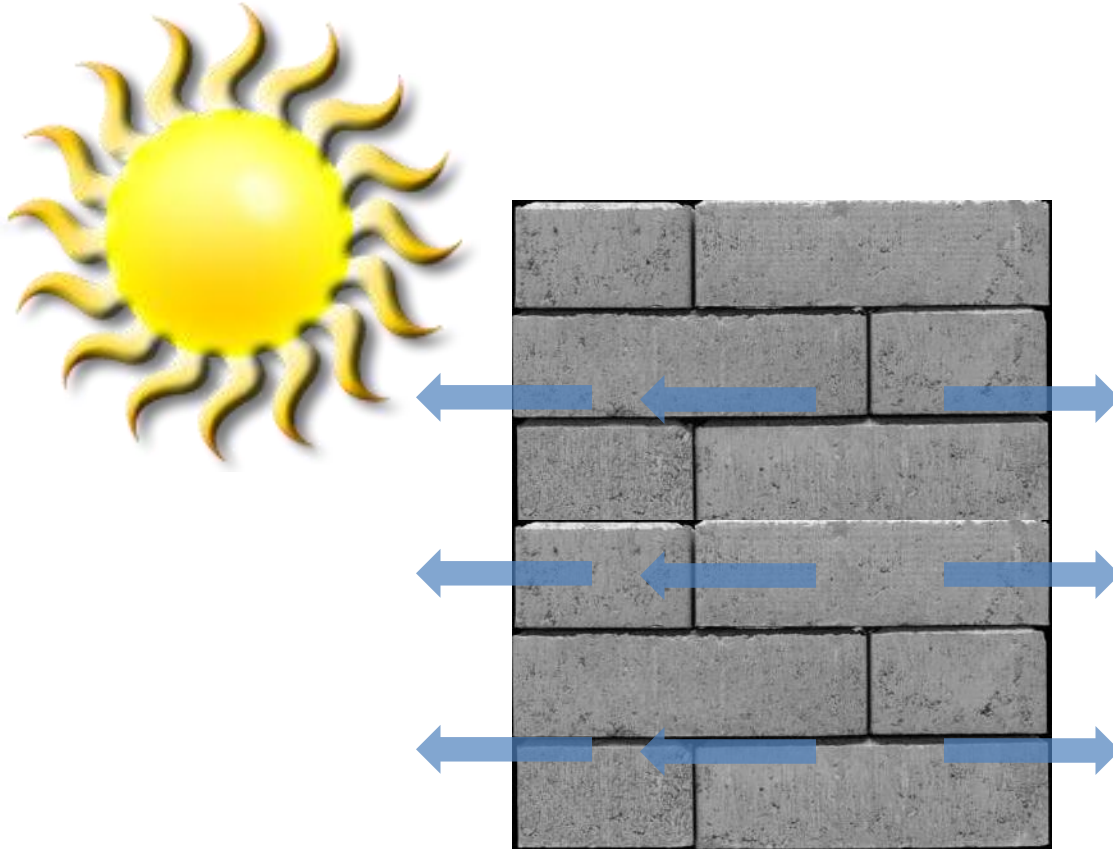
Performance of Historic Masonry Buildings

- Load-Bearing Masonry/Transitional Masonry
 - Rely on mass of wall to manage water



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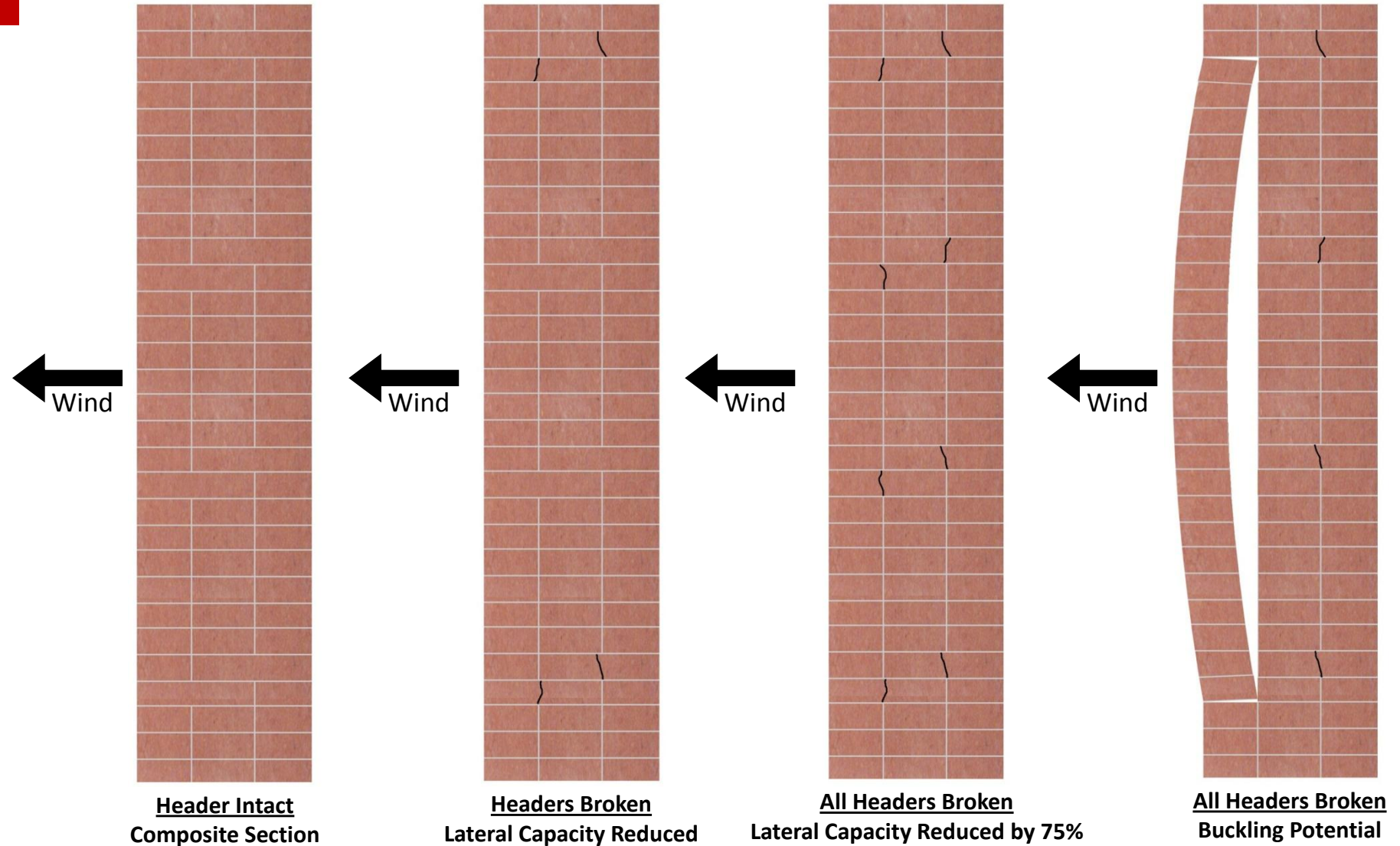
Performance of Historic Masonry Buildings

- 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

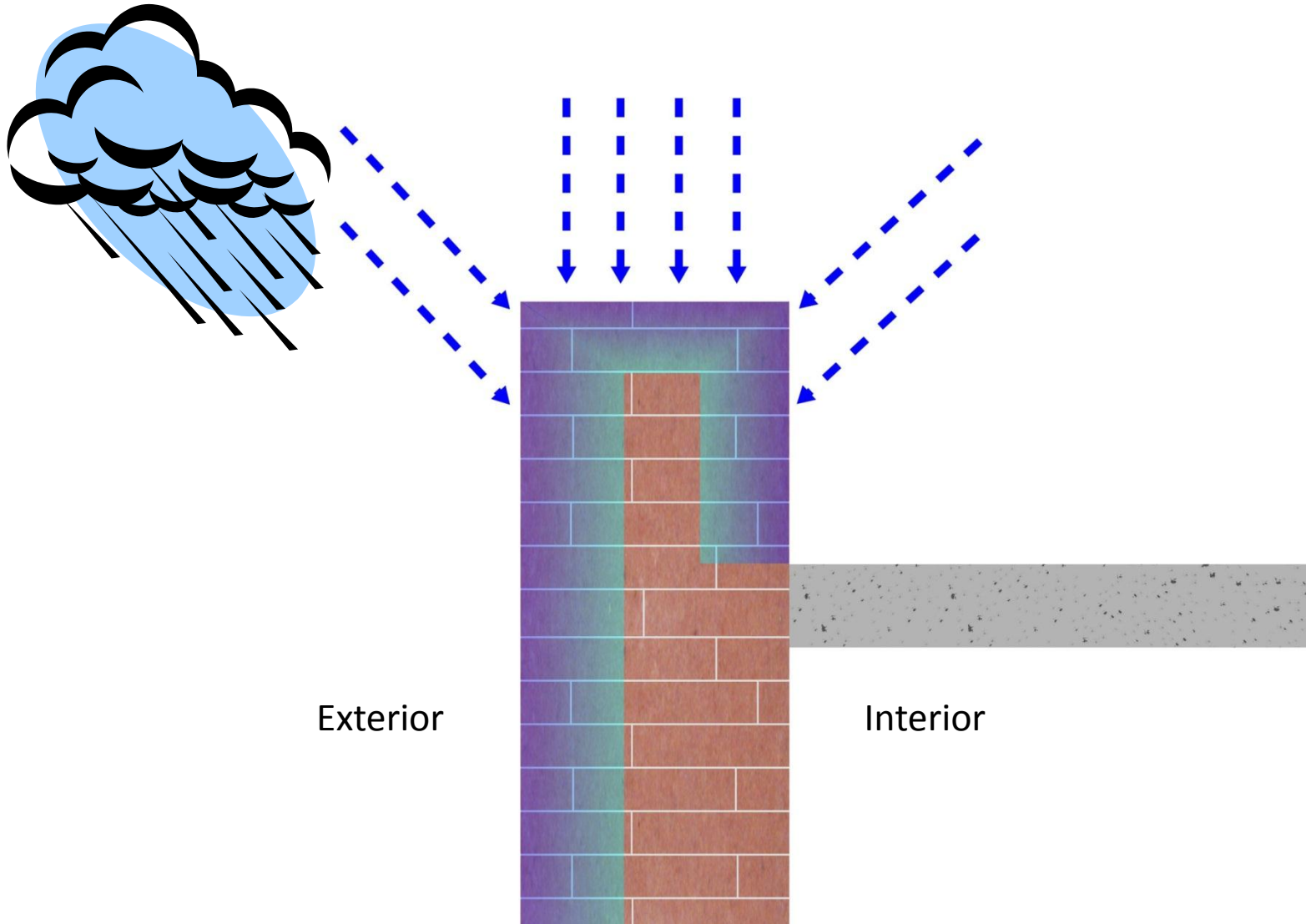
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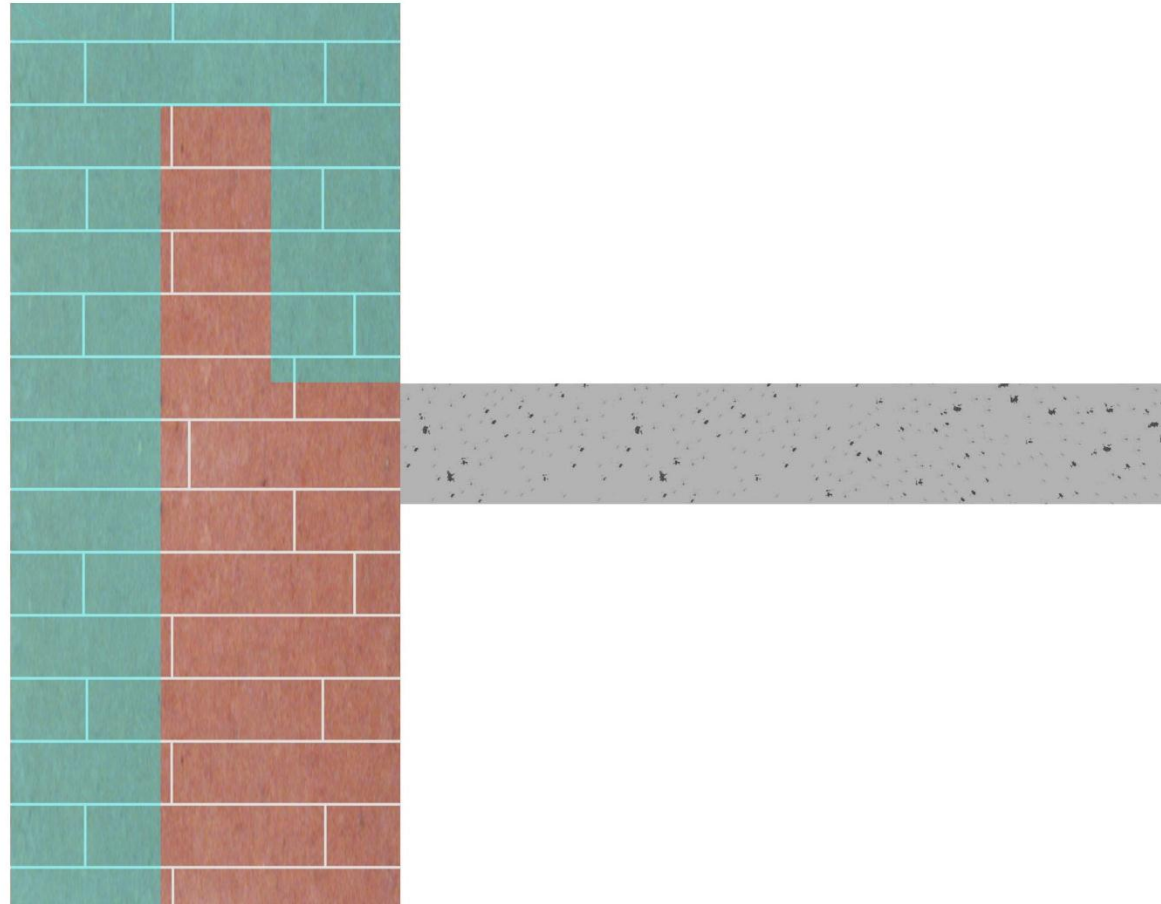
Performance of Historic Masonry Buildings

- Water Management Implications
 - Material deterioration
 - Leakage

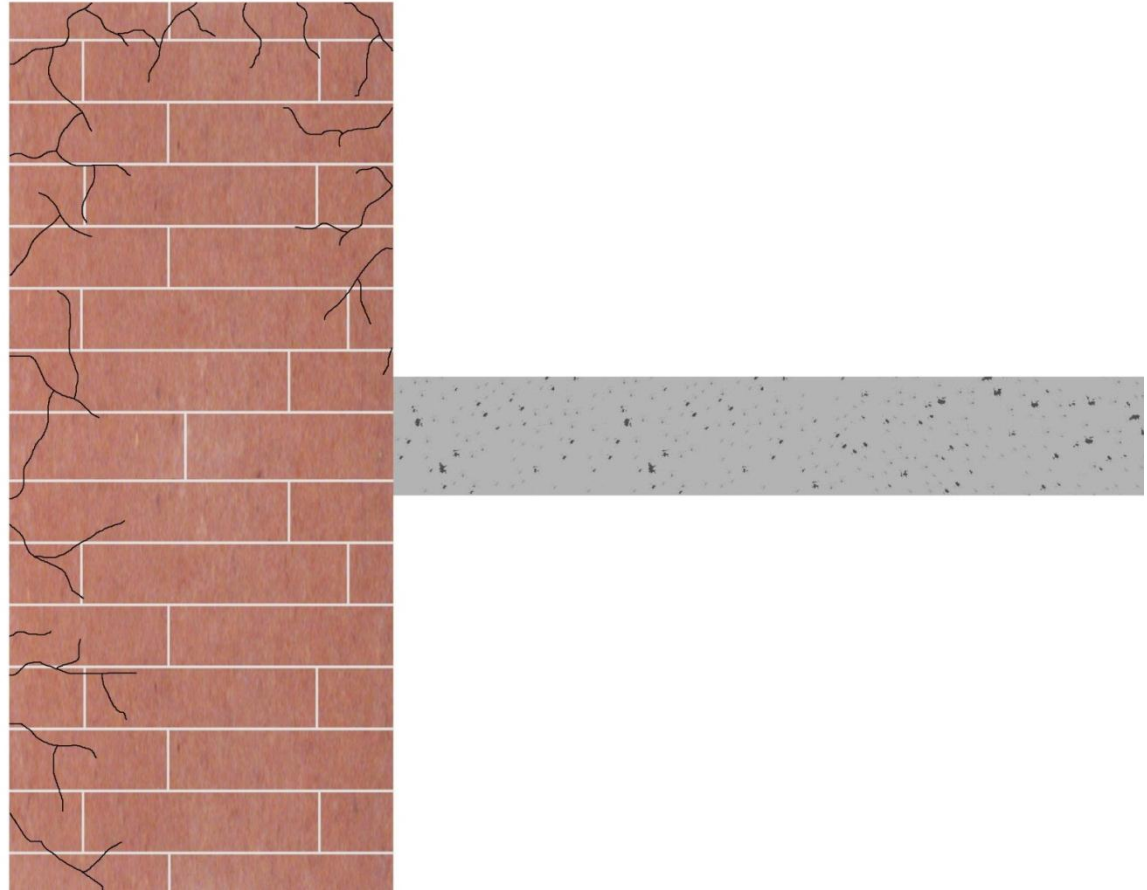
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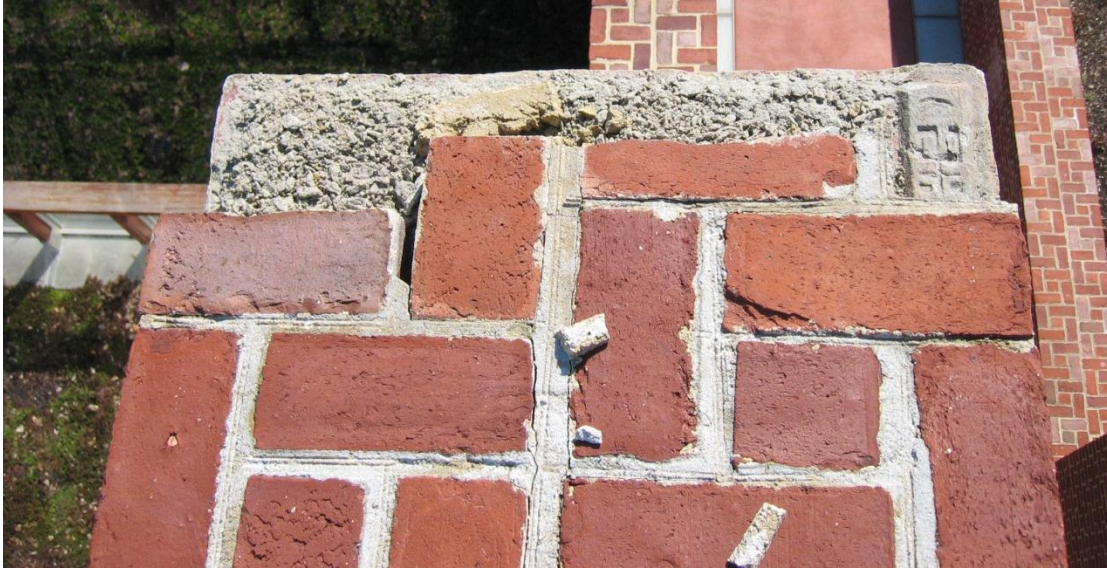
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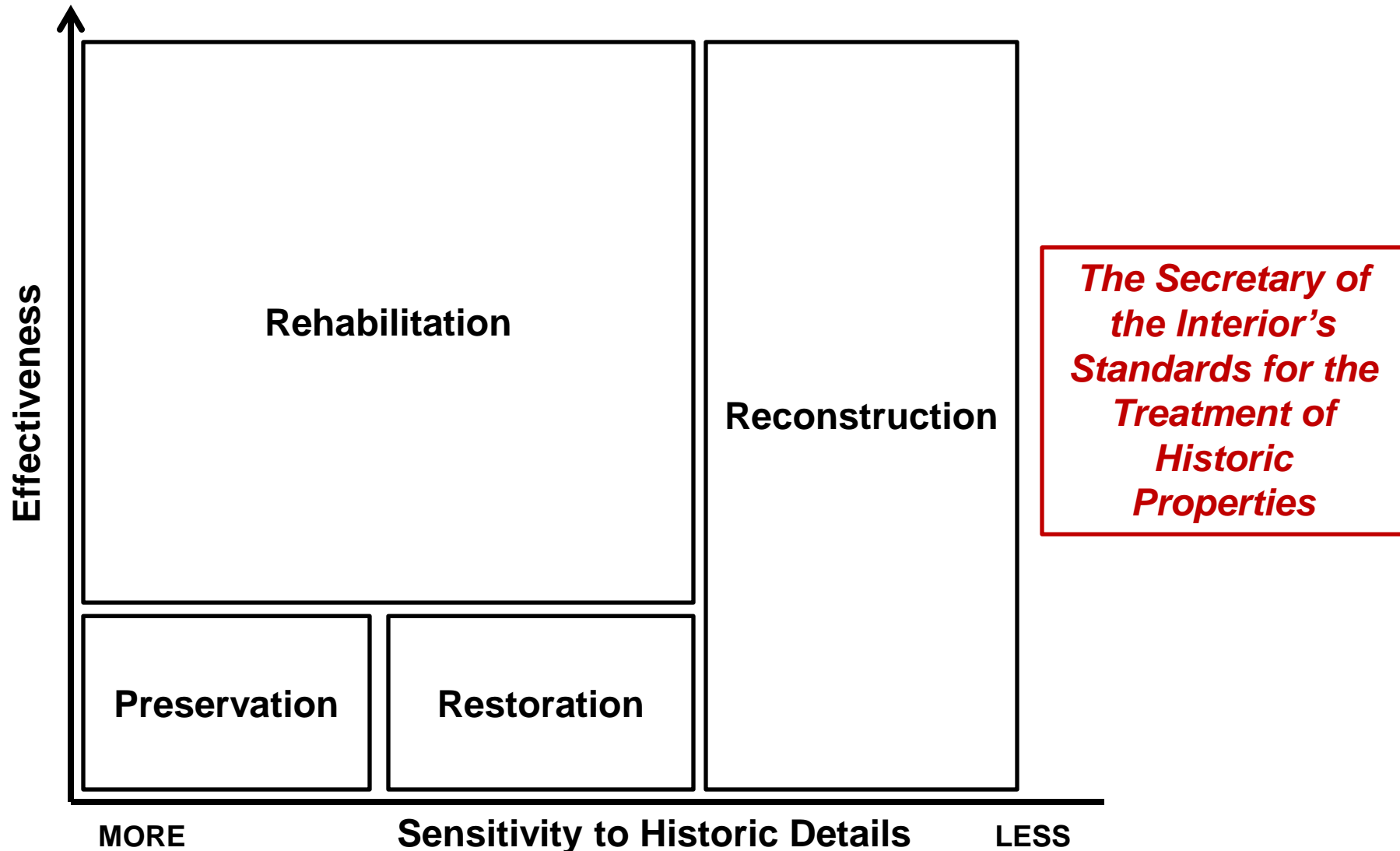
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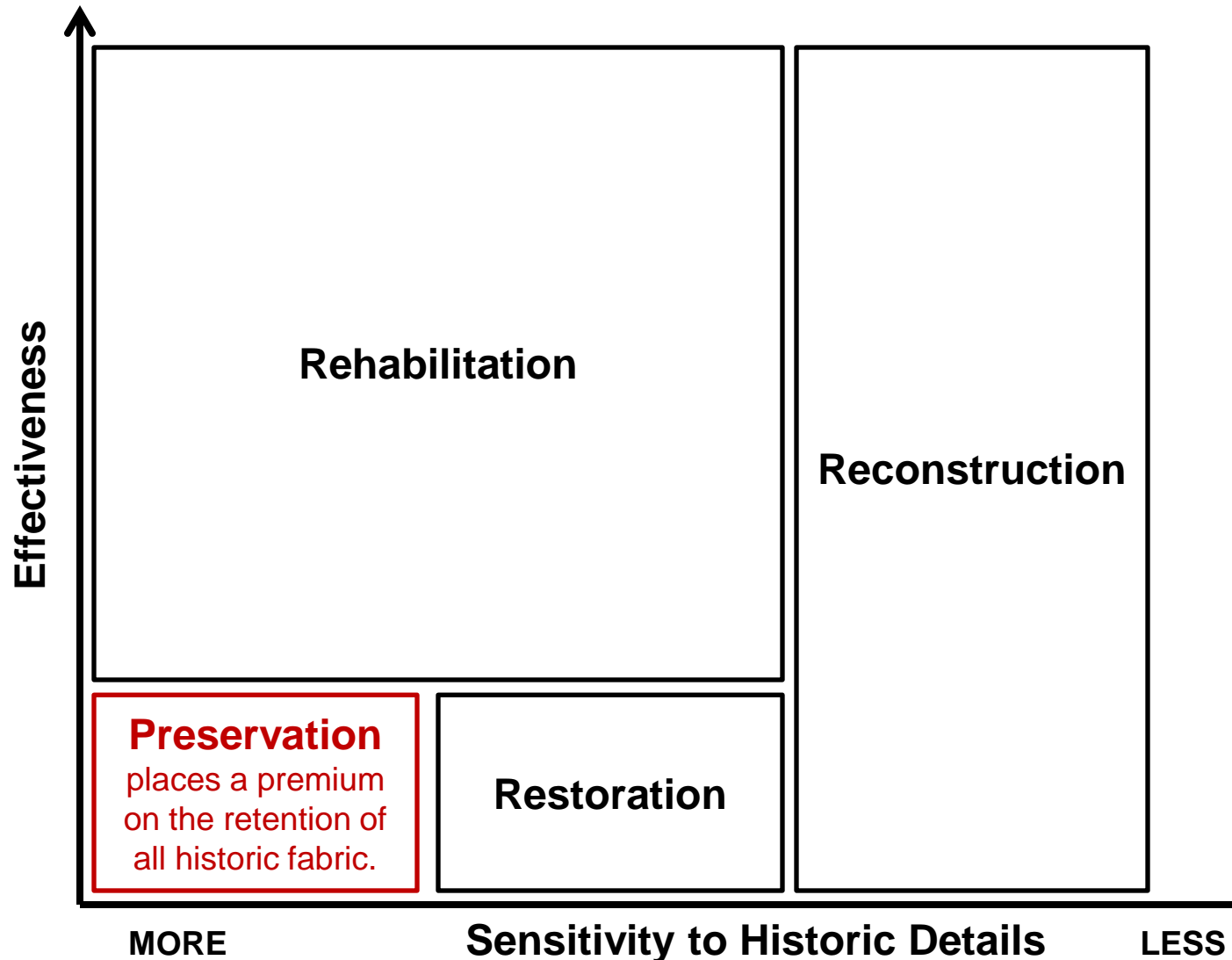
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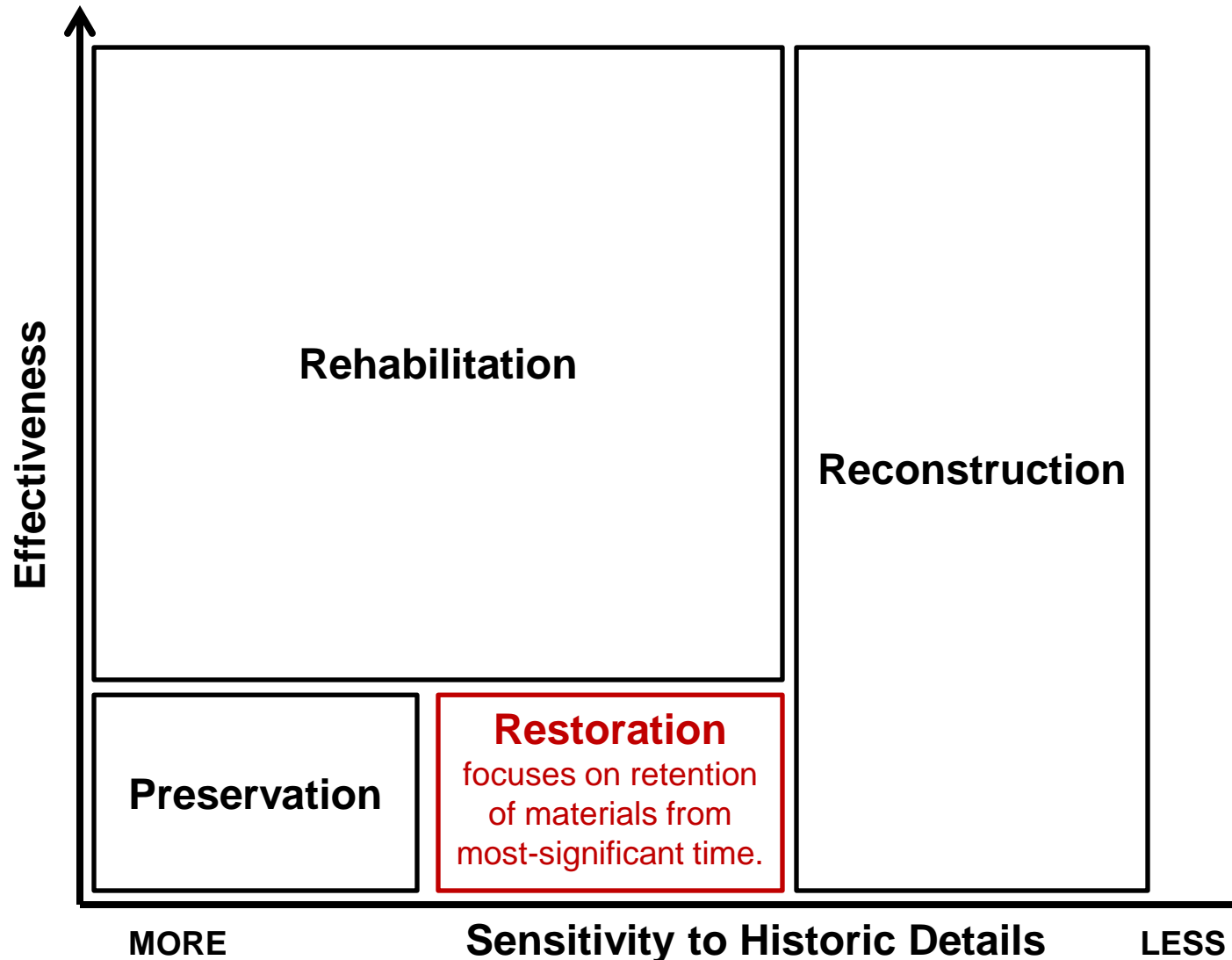
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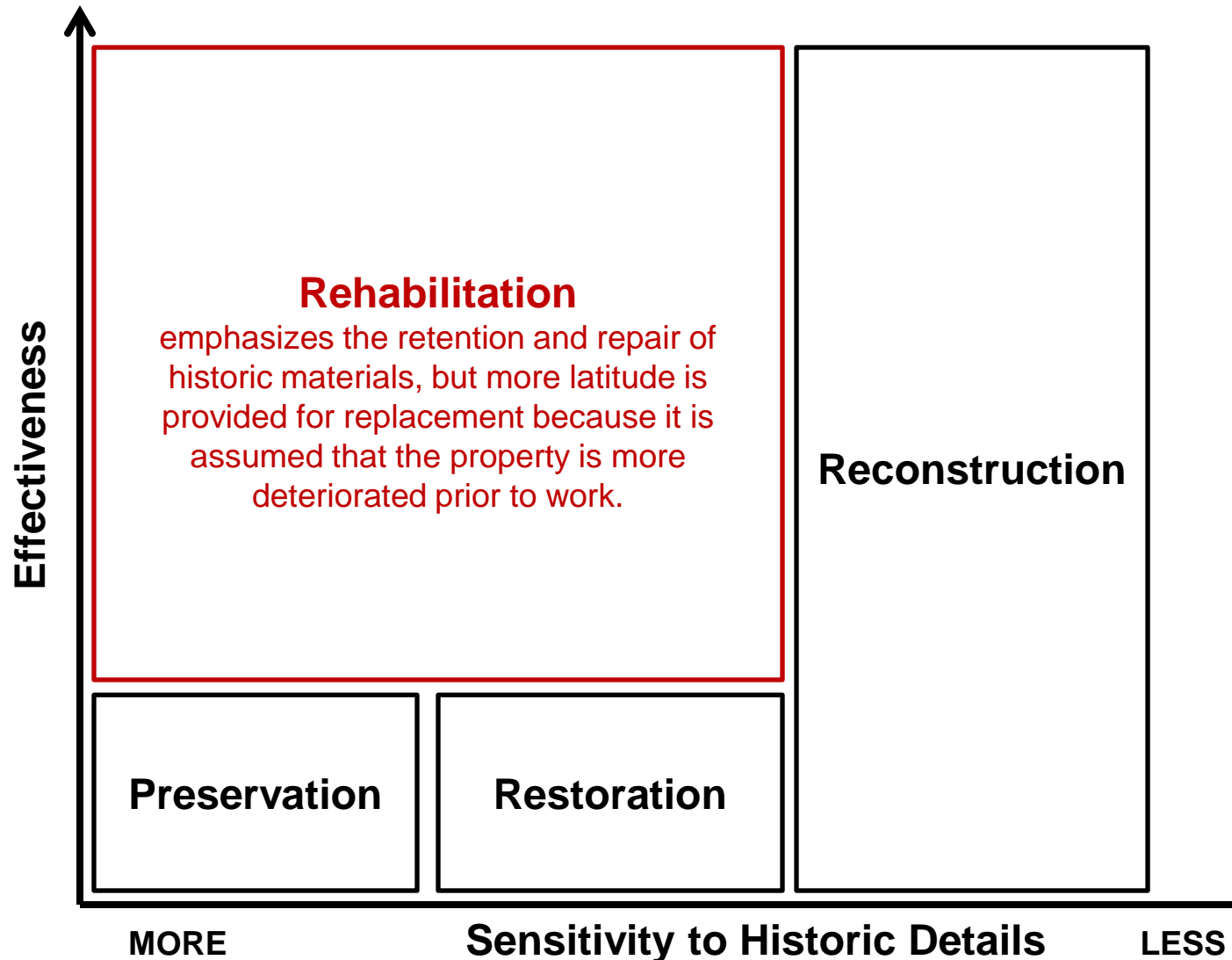
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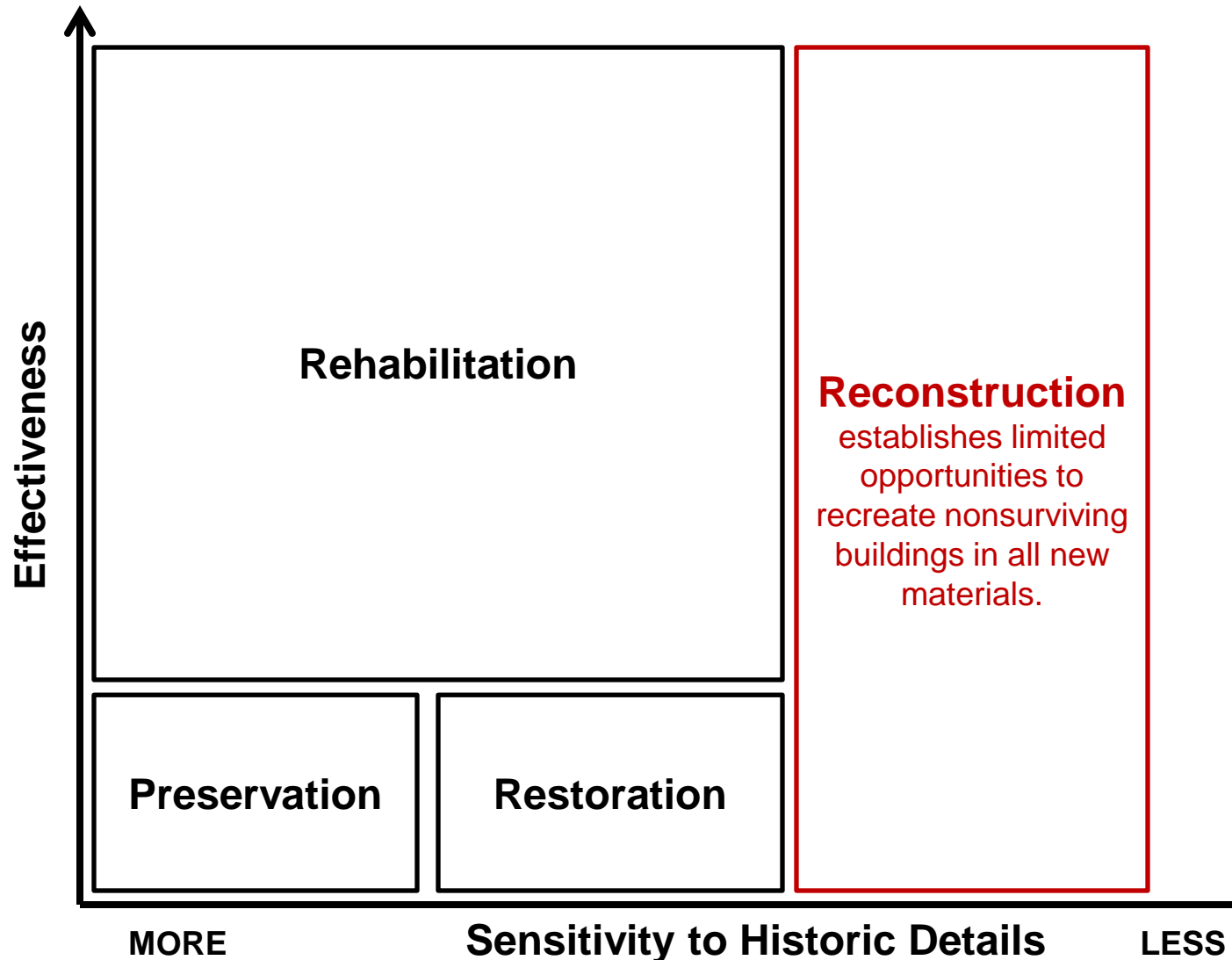
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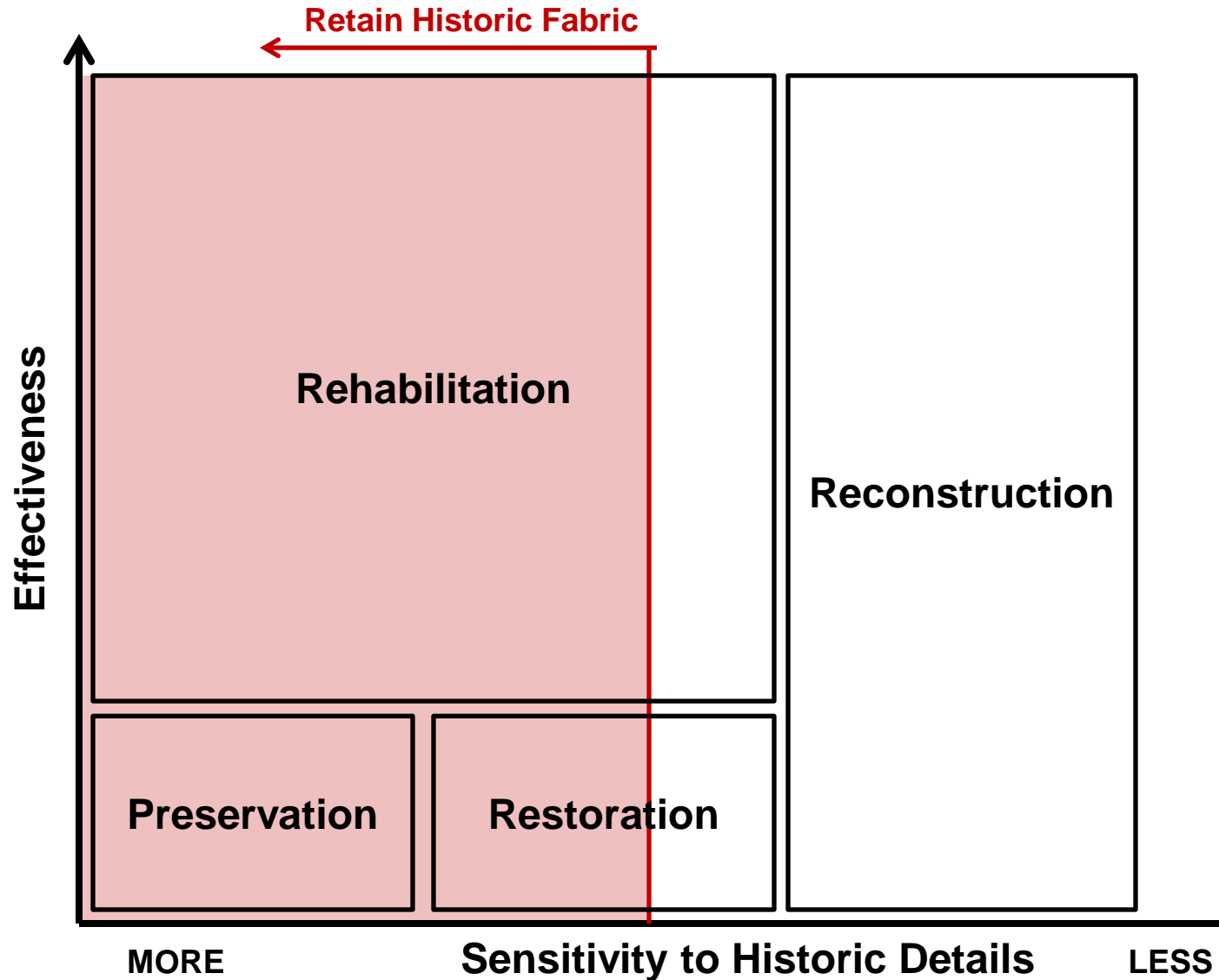
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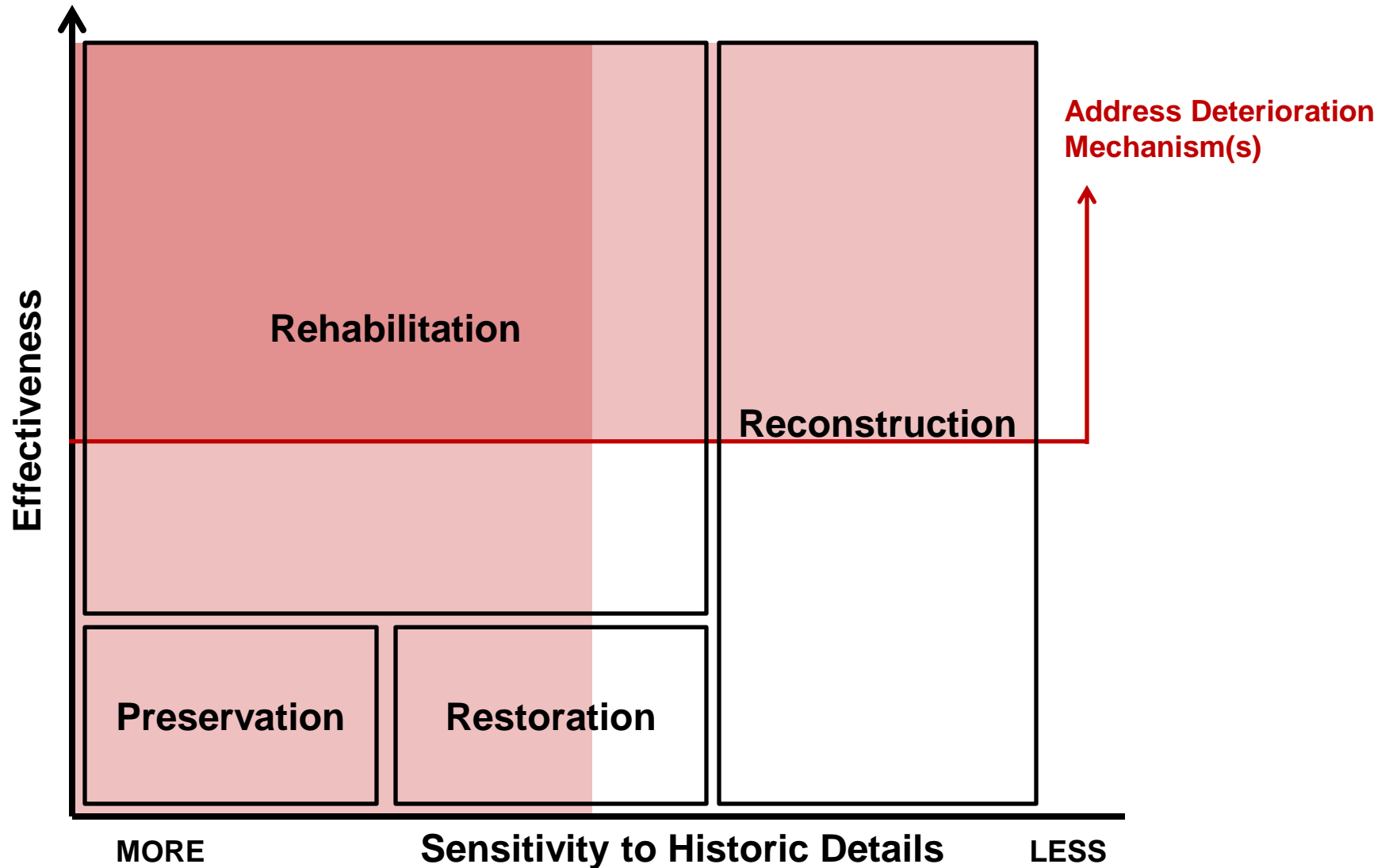
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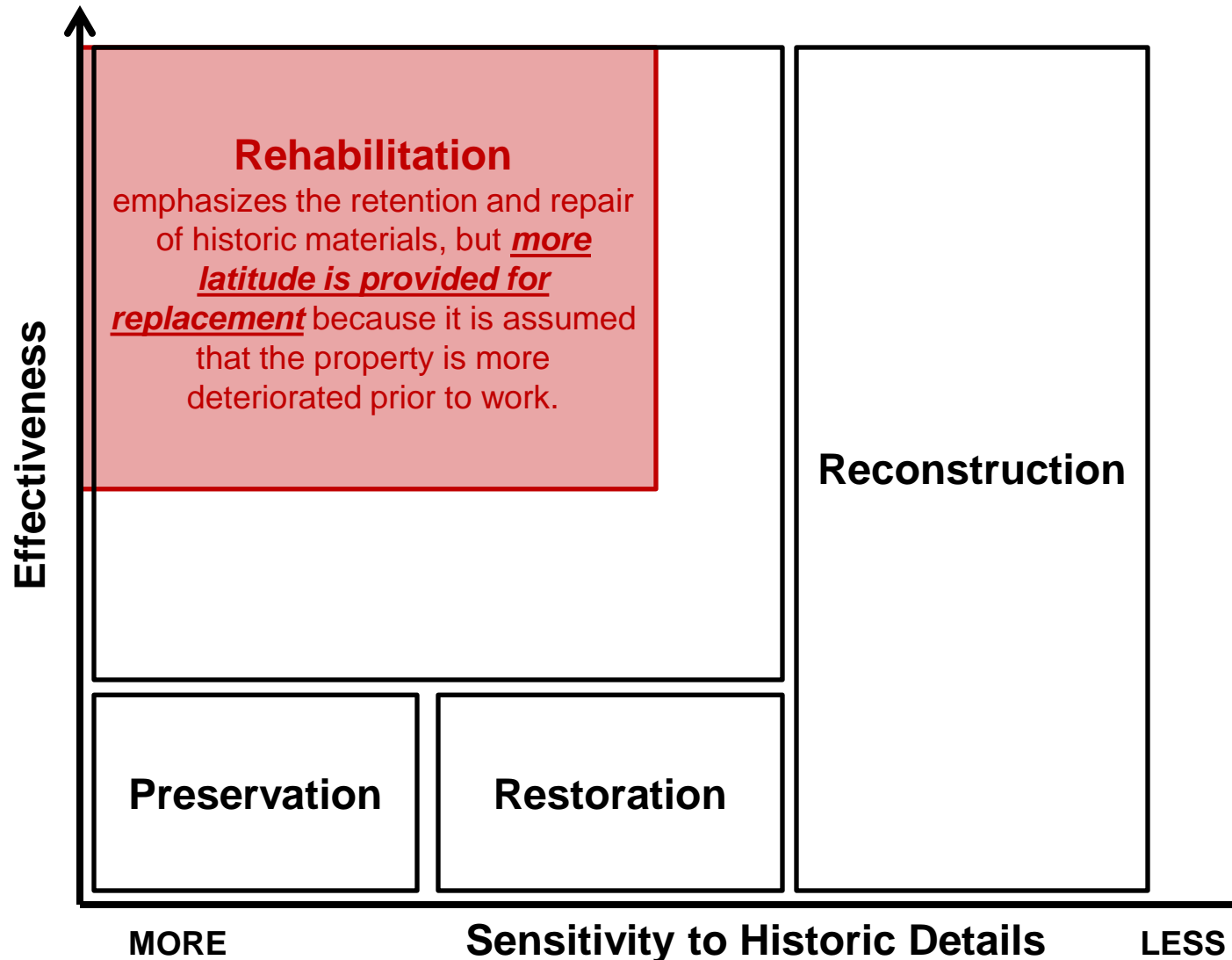
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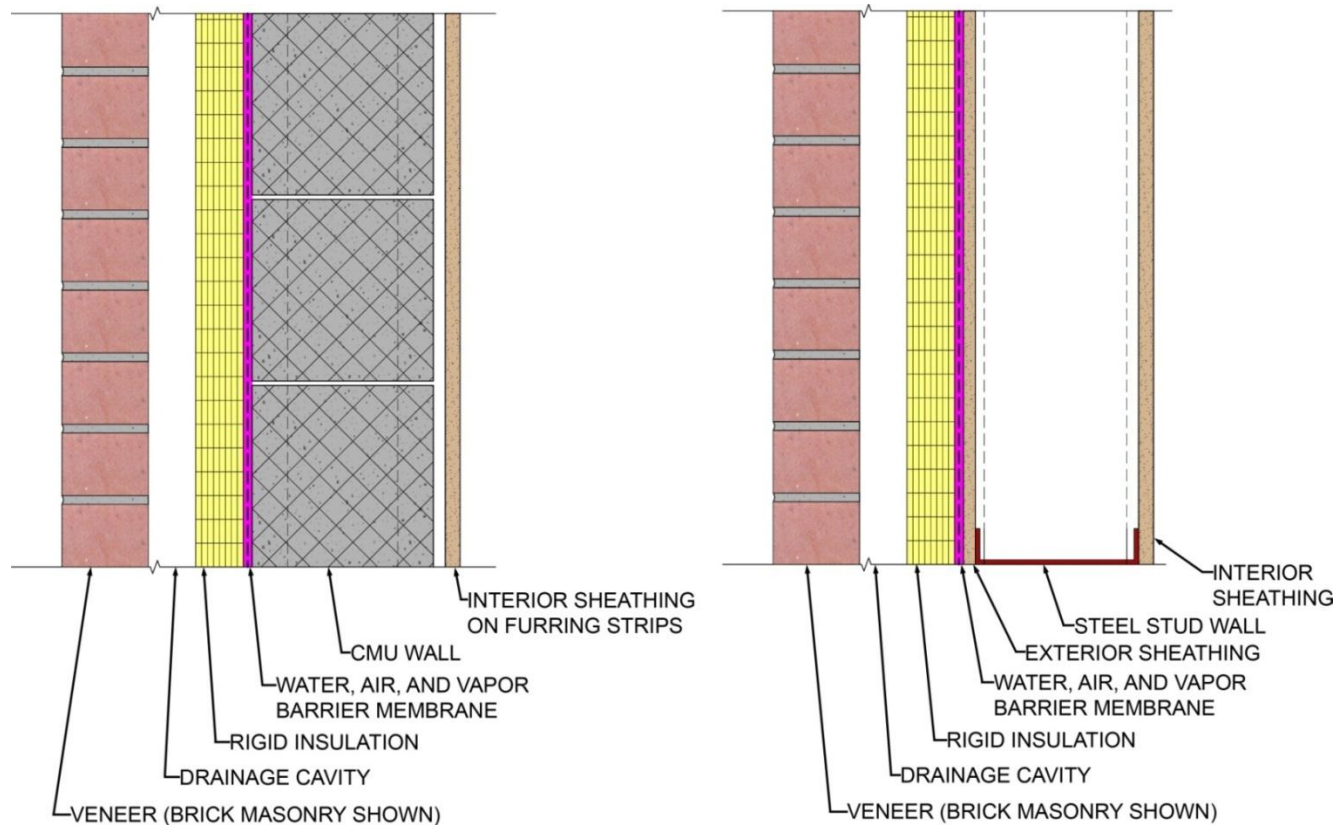
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- **Advantages of Contemporary Materials and Details**
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Advantages of Contemporary Materials and Details

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

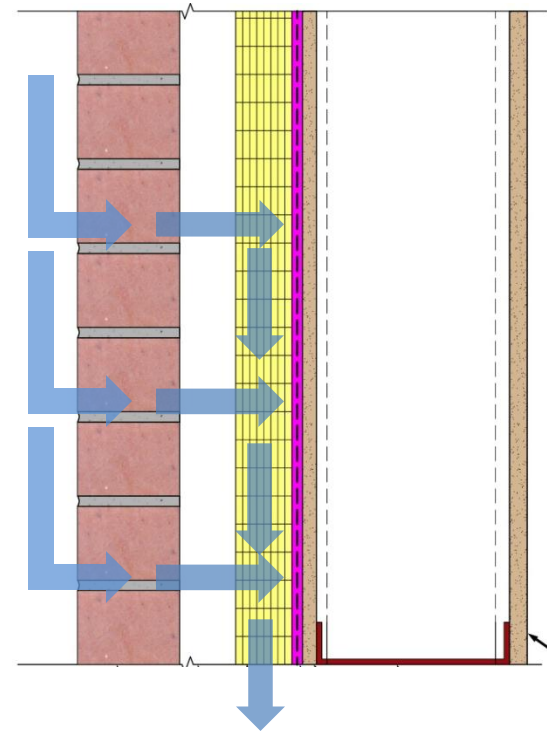
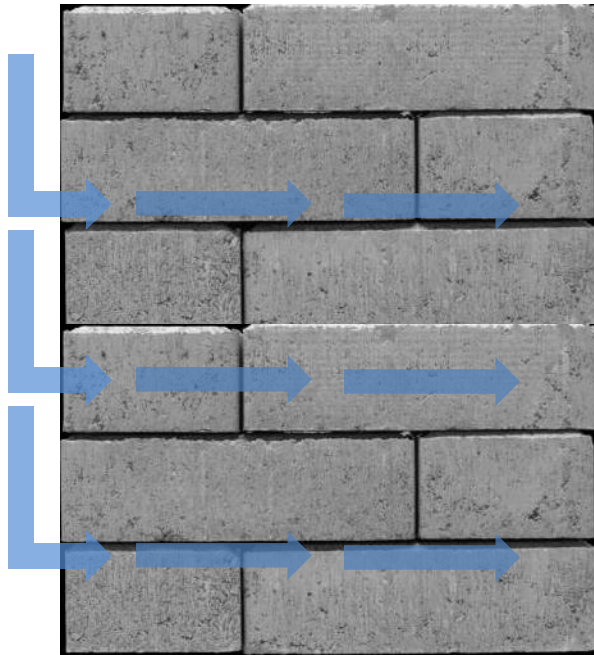
Advantages of Contemporary Materials and Details

- 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

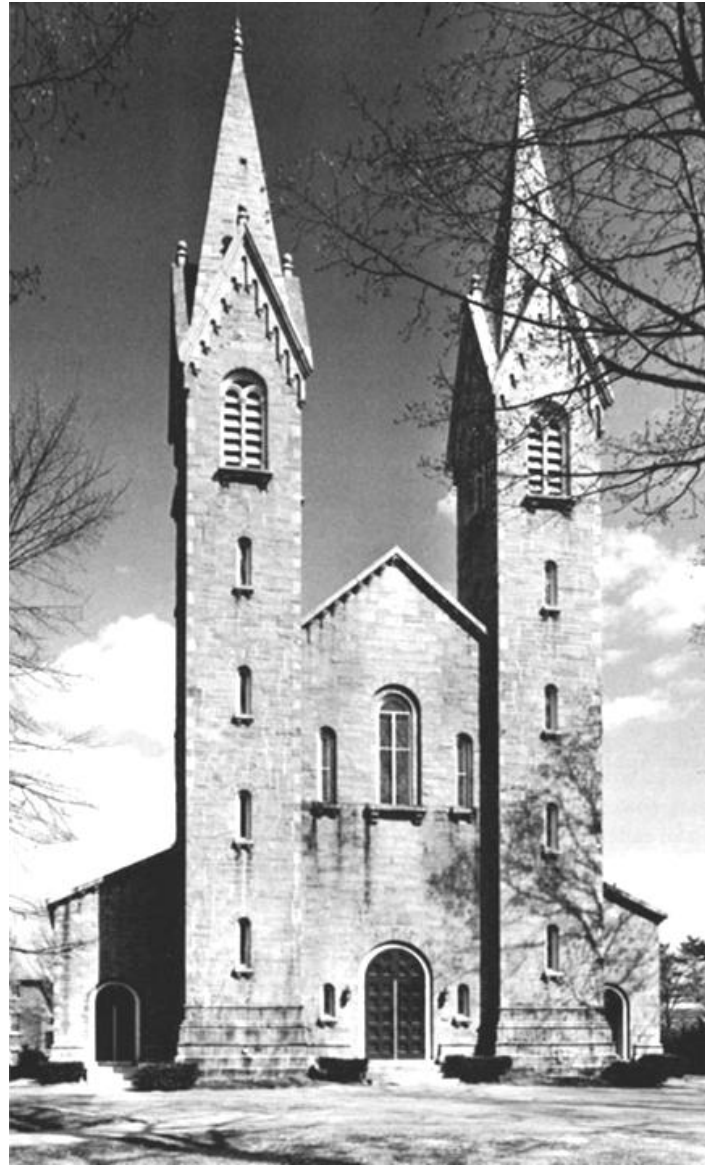
- Improved water infiltration resistance and durability



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Case Study: Rehabilitation of Bell Towers



Case Study: Rehabilitation of Bell Towers



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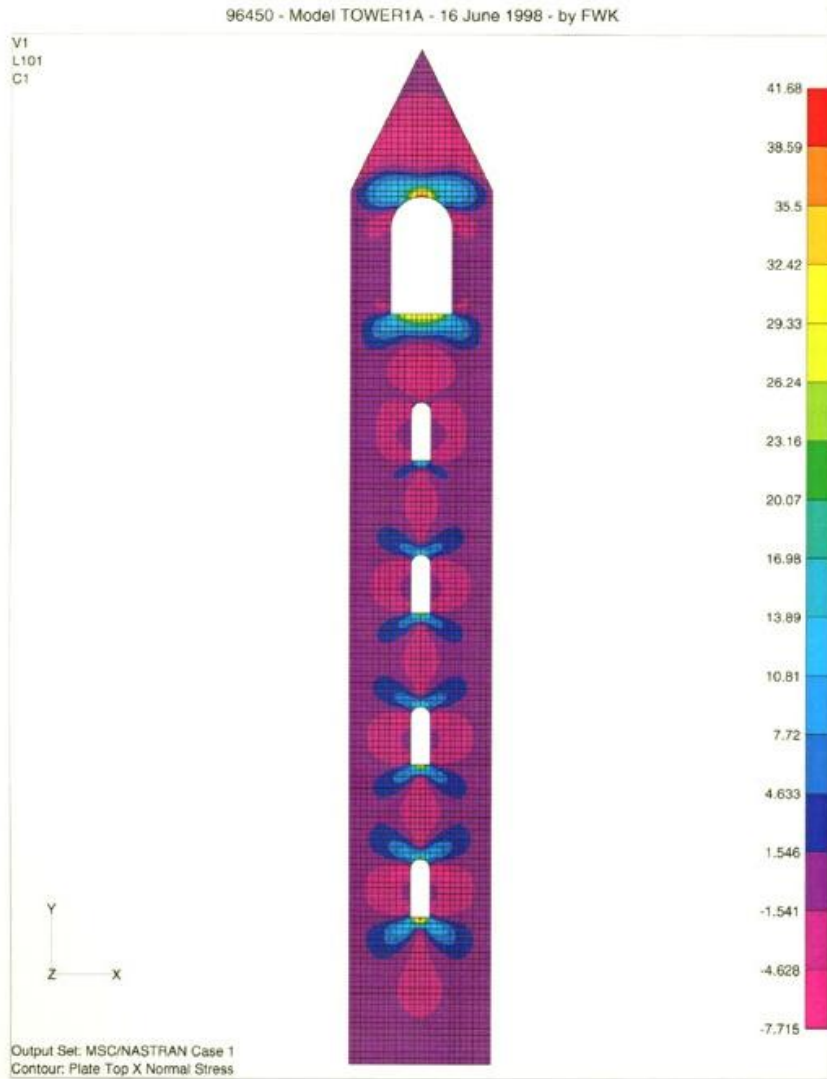


Fig. 1 - Horizontal Stress Resulting from Gravity Load

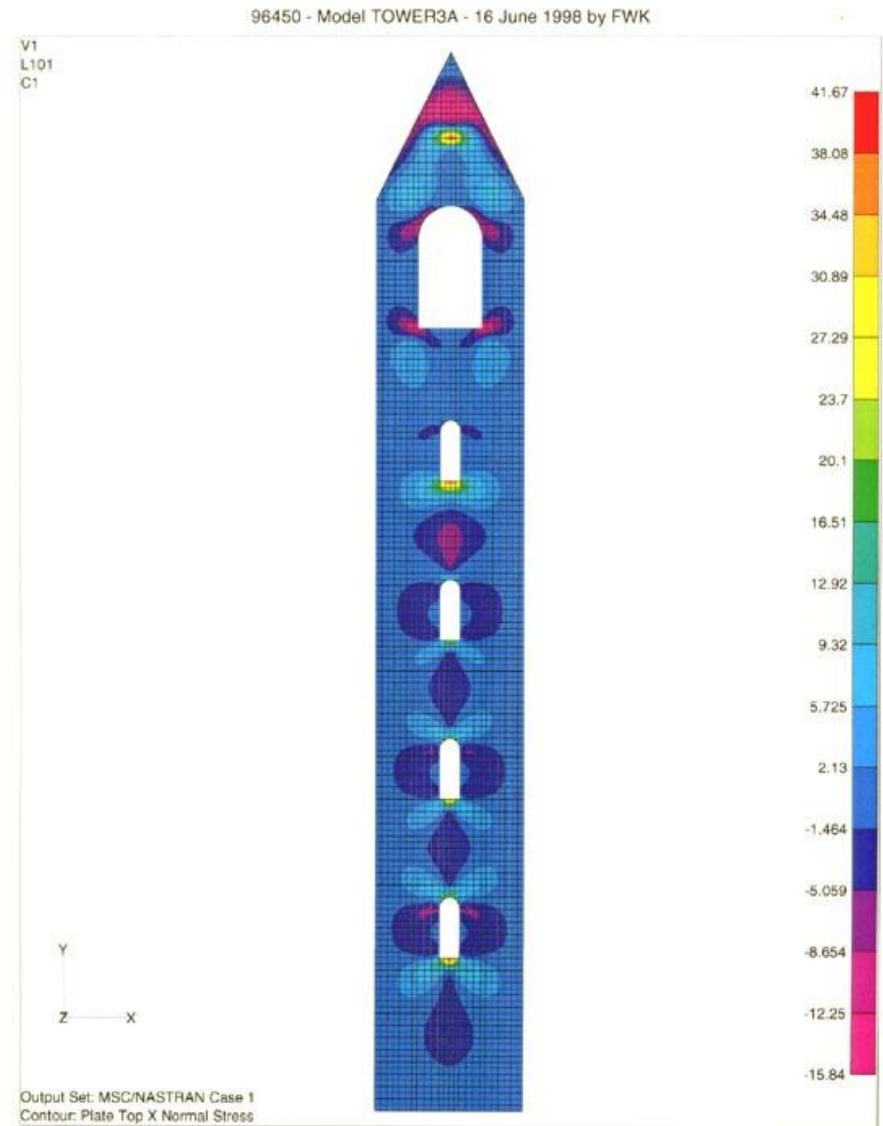
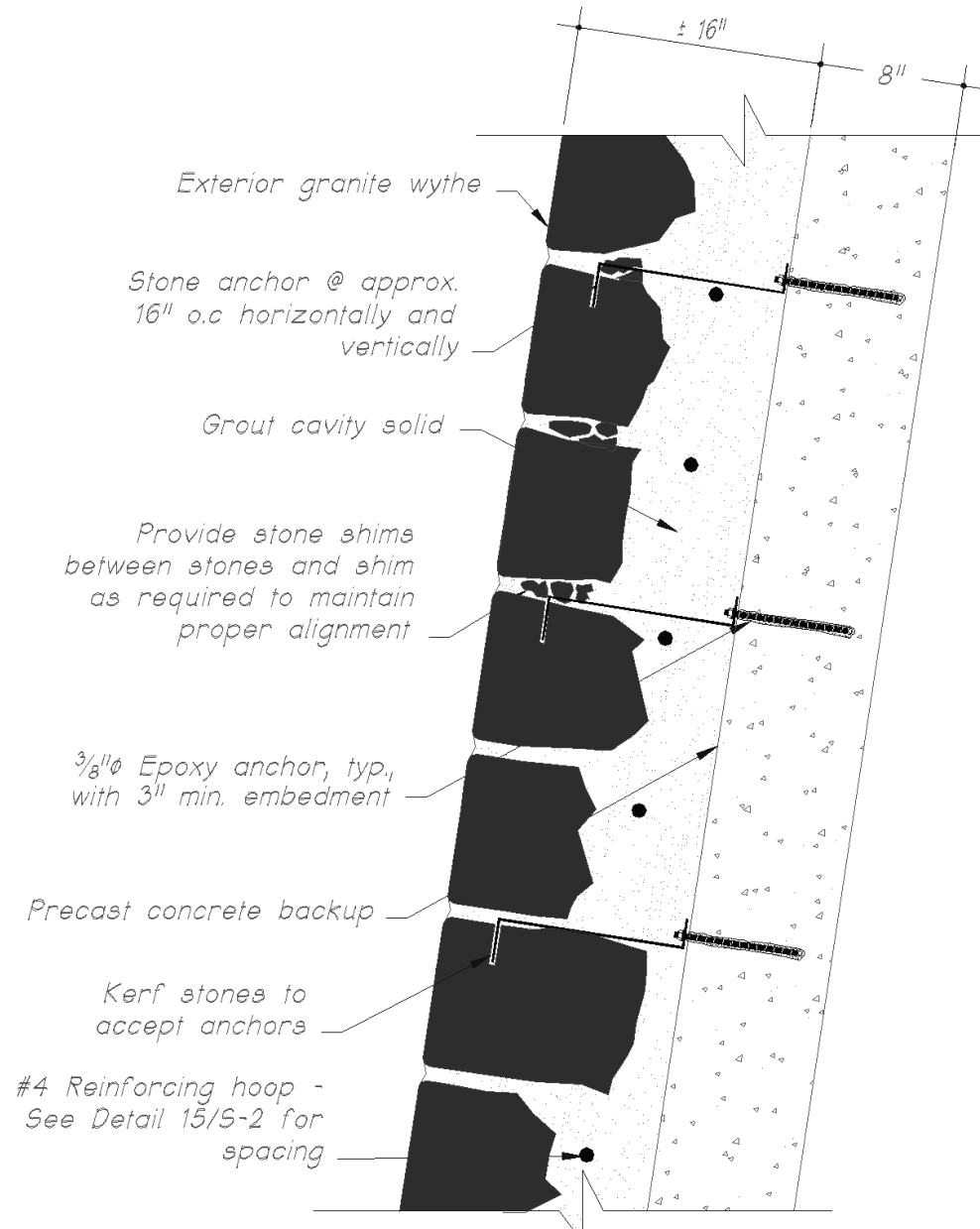


Fig. 2 - Horizontal Stress Resulting from Gravity Load w/ Through-Wall Crack Above & Below Belfry

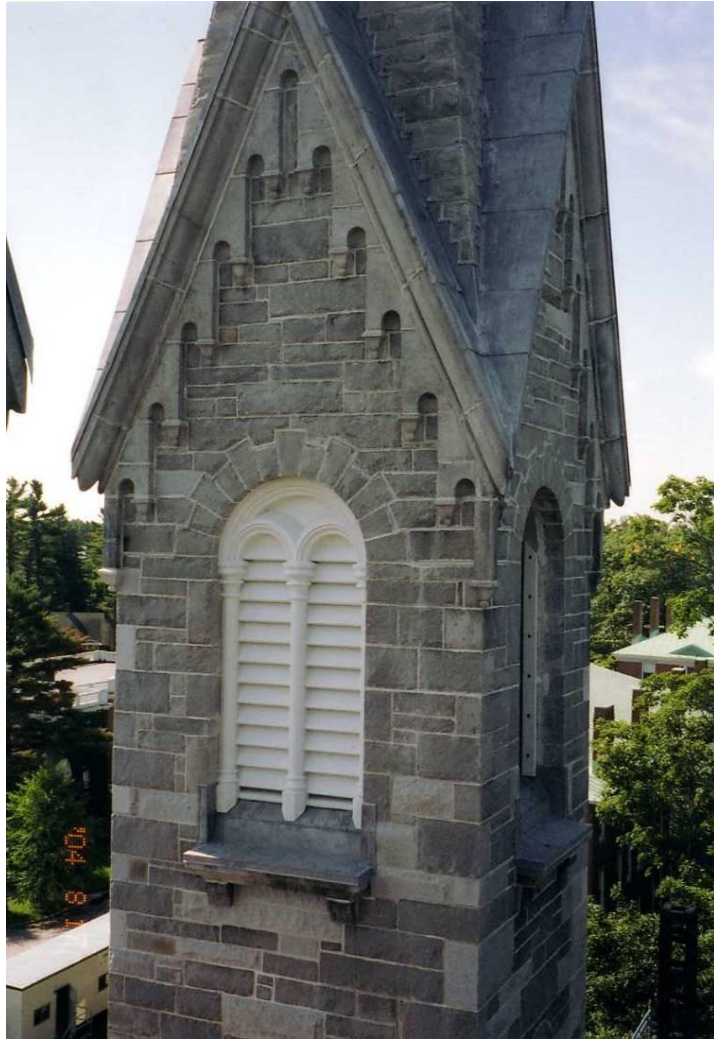
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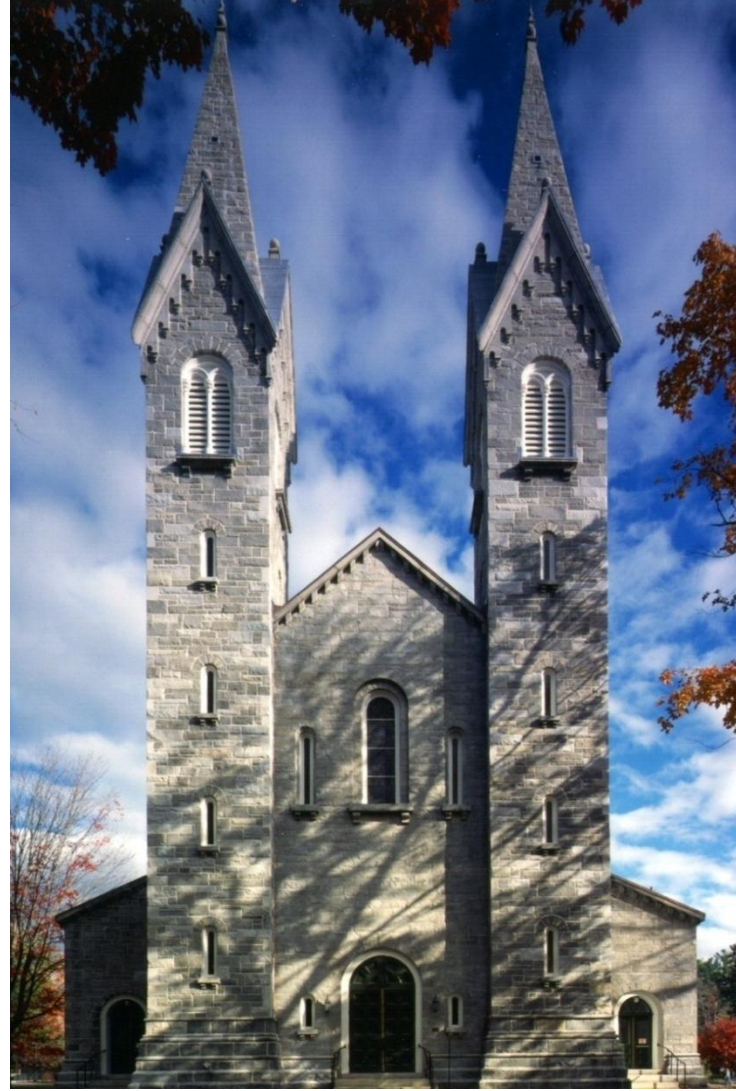
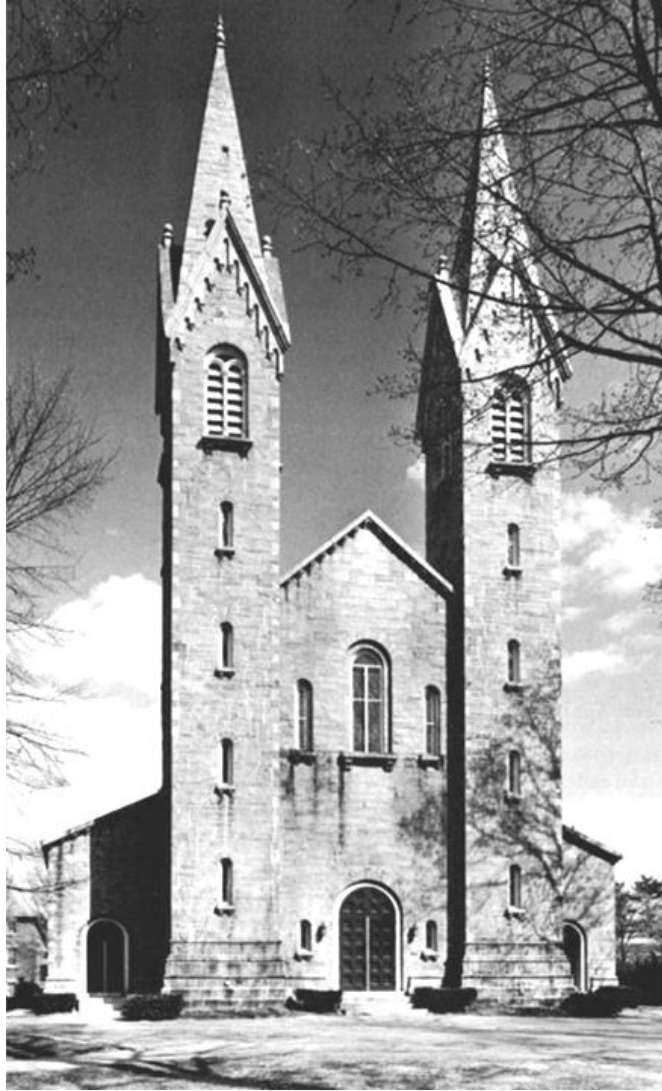
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Case Study: Rehabilitating Masonry Walls



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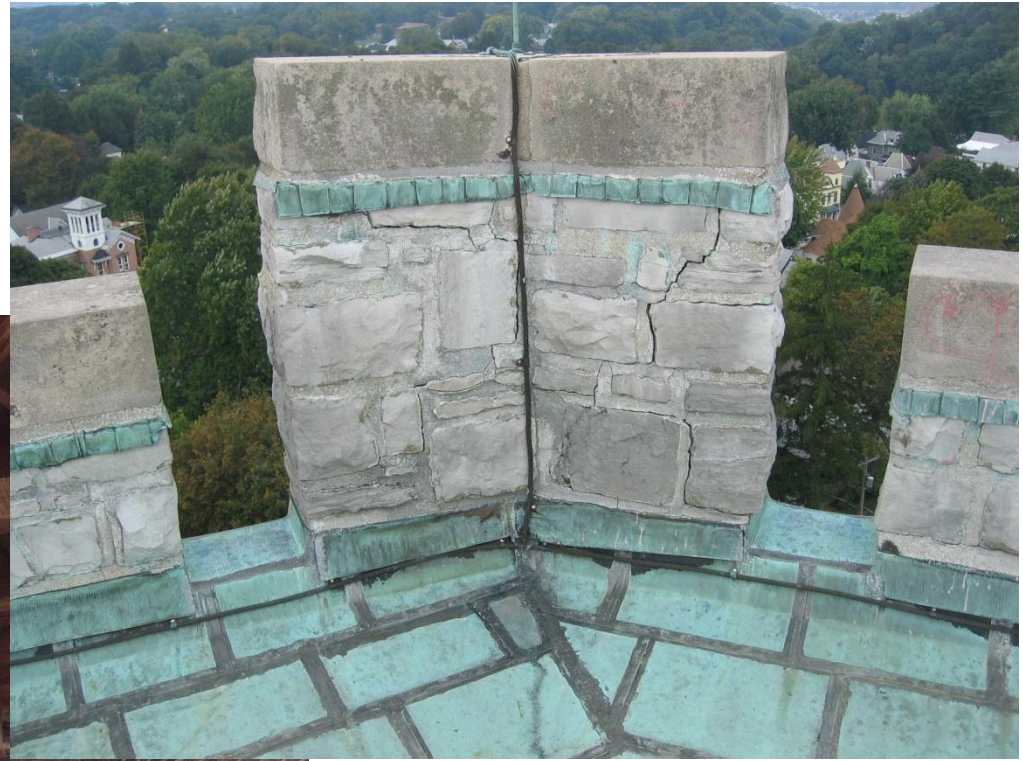
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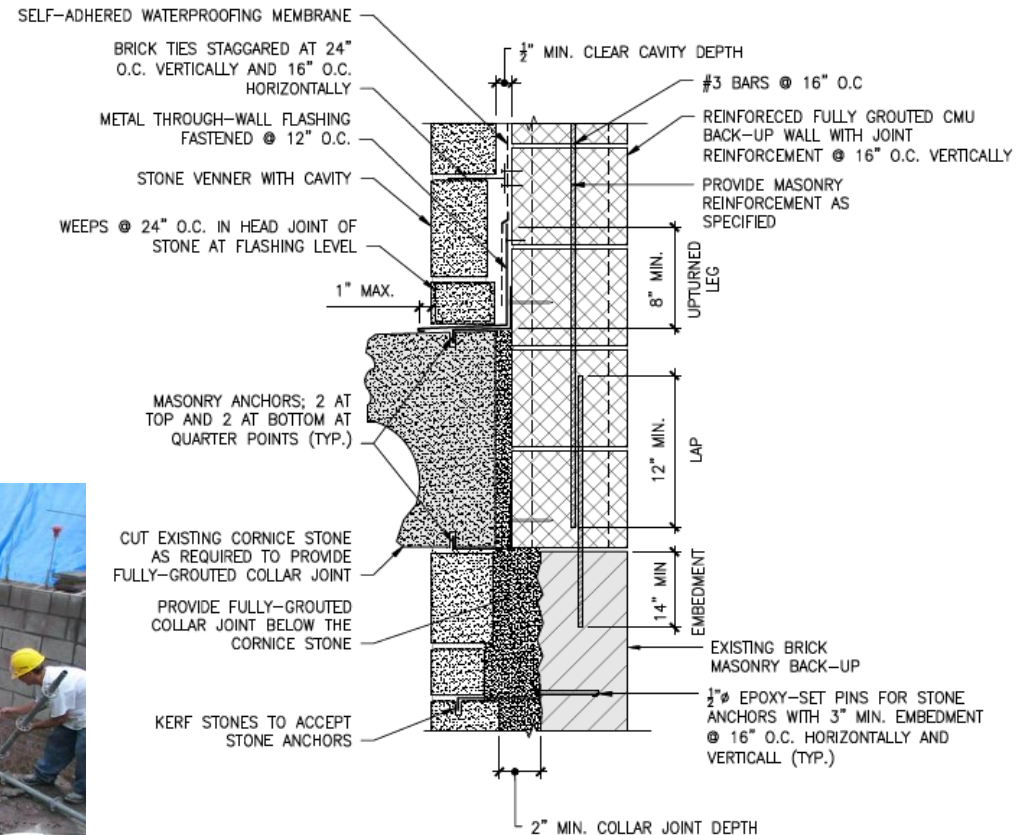
Case Study: Rehabilitating Iconic Tower



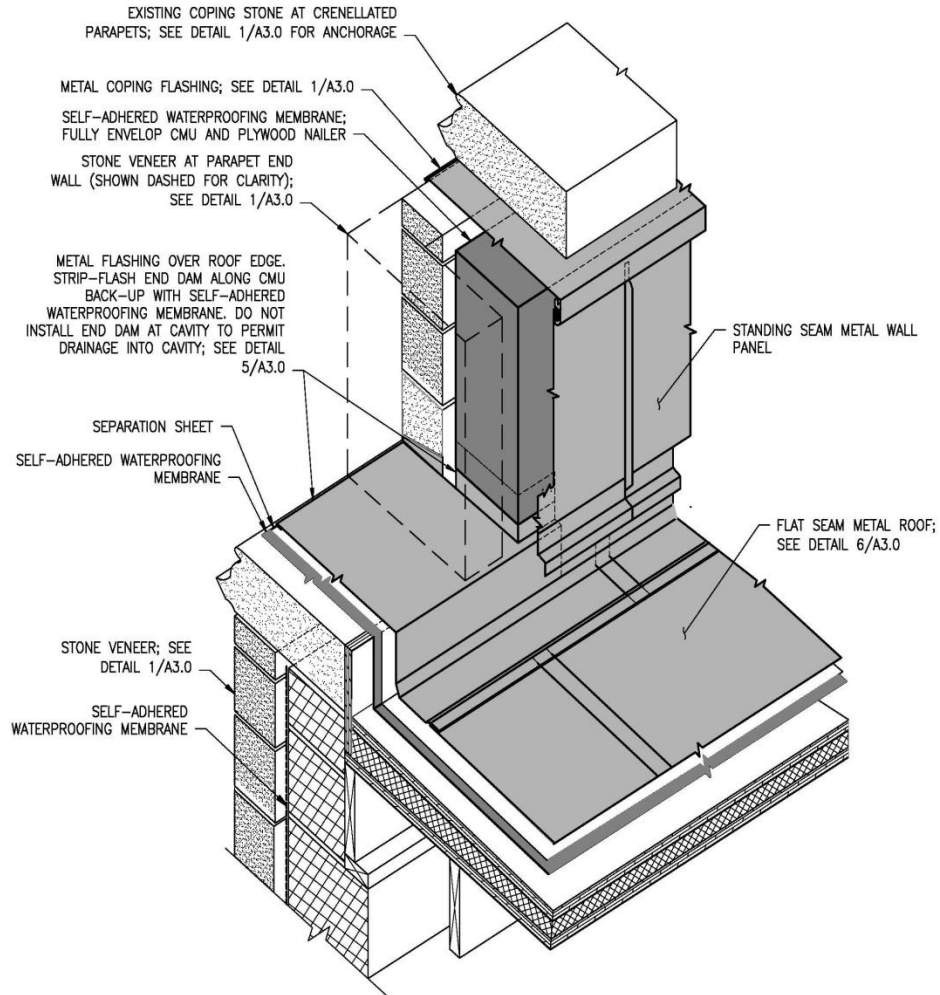
Case Study: Rehabilitating Iconic Tower



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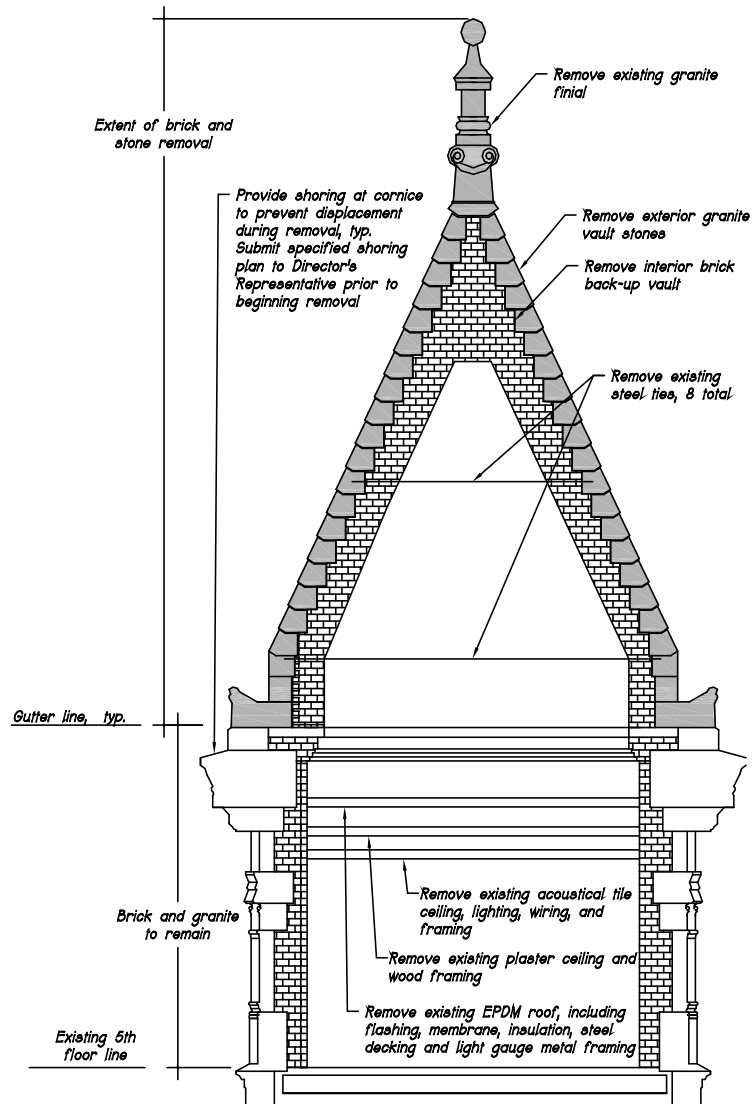
Case Study: Rehabilitating Iconic Tower



Case Study: Rehabilitating Stone Towers

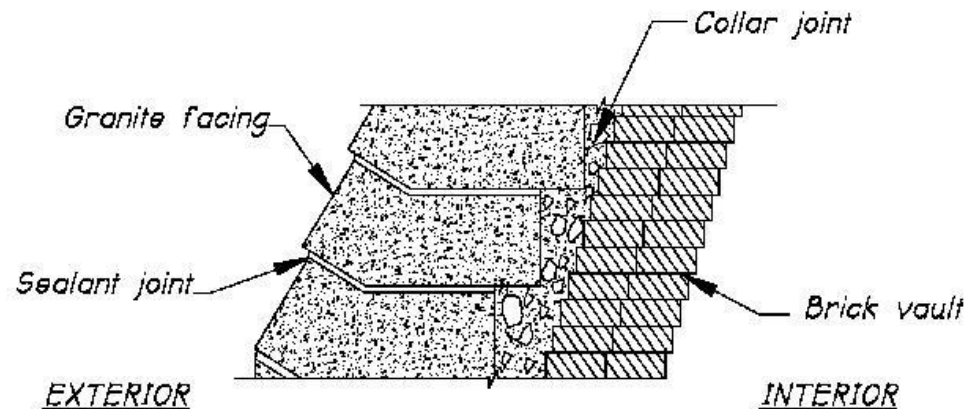


Case Study: Rehabilitating Stone Towers



Scope of Removal Work

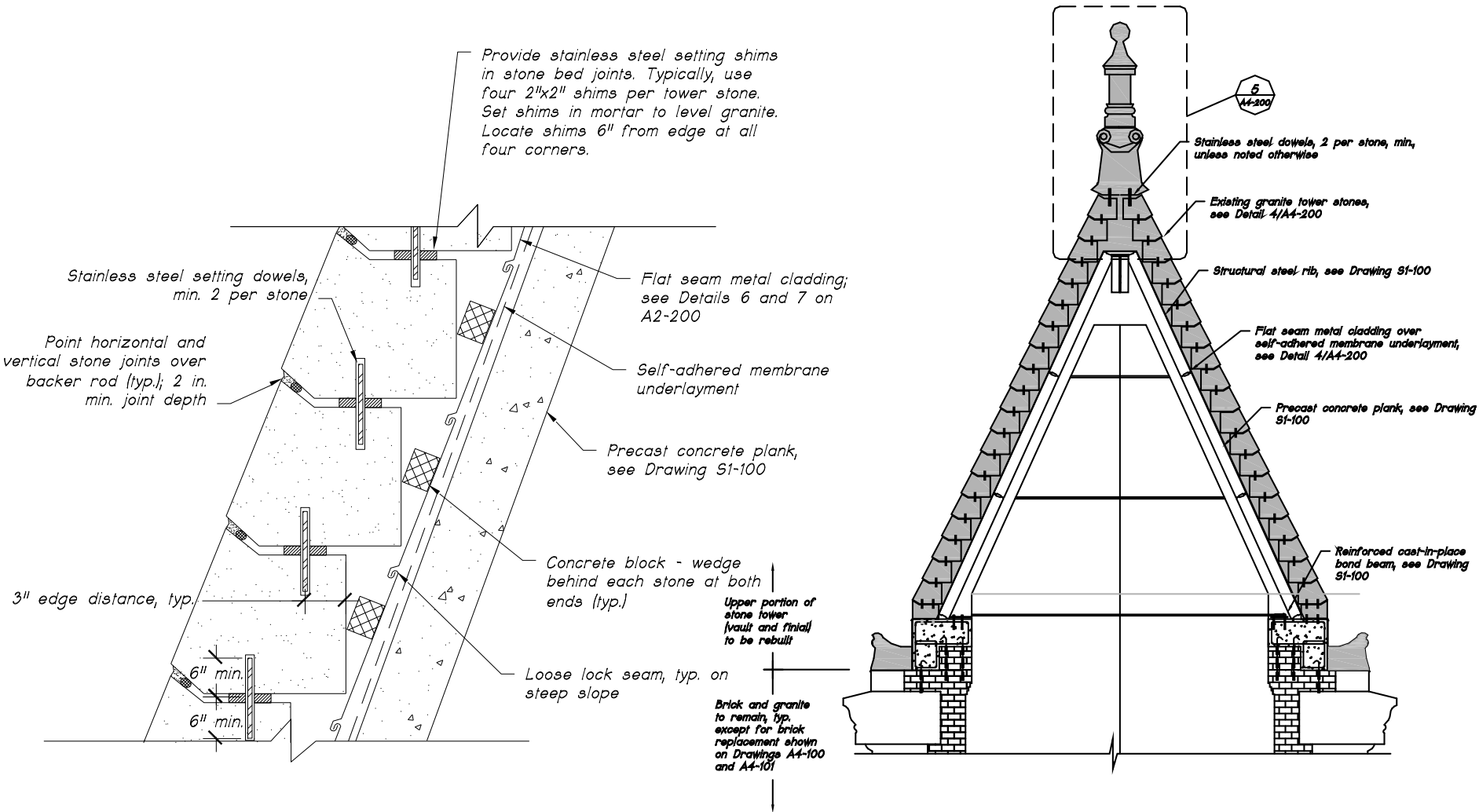
1. Document, remove, and store exterior granite vault stones.
2. Remove interior brick vault and tie rods.
3. Remove existing EPDM roof, plaster ceiling, acoustical tile ceiling, lighting, and wiring and all associated framing.



Case Study: Rehabilitating Stone Towers



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Case Study: Rehabilitating Stone Towers



Thank You.

Questions?