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ST. ADALBERT CATHOLIC CHURCH

SOUTH BEND, INDIANA

FROST ENGINEERING & CONSULTING

Historical Records



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- + **1923**
Construction begins
- + **1926**
Construction completed
for cost of: \$23,000
- + **1940's**
Stained glass and mural
installations.
- + **1952**
Belltower corners rebuilt
by Schumacher & Sons
- + **1963**
Belltower corners rebuilt
by Hoffer & Associates
- + **2010s**
Cosmetic repair to
belltower corner cracks



STEEPLES UNDER CONSTRUCTION



SANTUARY BETWEEN 1940 & 1943

Architectural Assessment

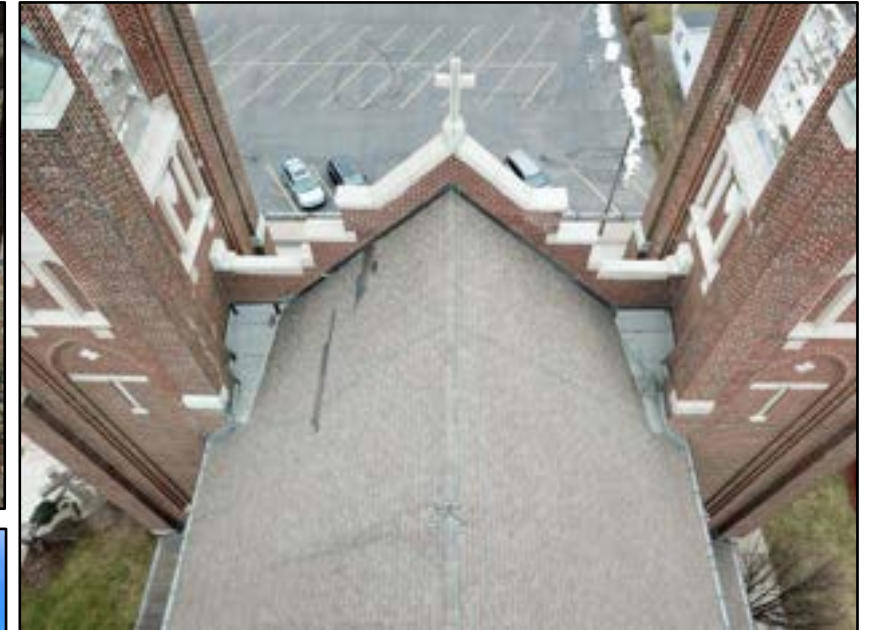


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Areas of Investigation:

- North & South Belltowers inside and out
- Overall Masonry
- Damage to plaster and interior finishes
- Roofing age and damage
- Window and stained-glass Restoration & Cleaning – Wood, steel, and stone frames.
- Mural Cleaning



RENOVATION & RESTORATION



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Overview:

- \$12-14 million total cost
- Restoration of stained-glass
- Conservation of interior artwork and decorative elements
- Mechanical and Electrical Systems upgrades
- Accessibility & Restroom upgrades.



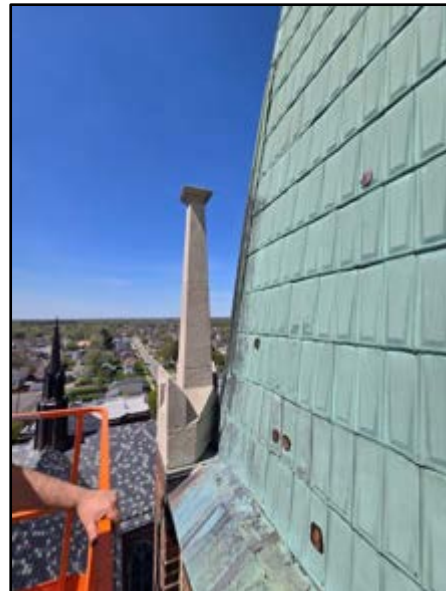
EXISTING CONDITION 2023



*RENDERING BY CONRAD SCHMITT STUDIOS

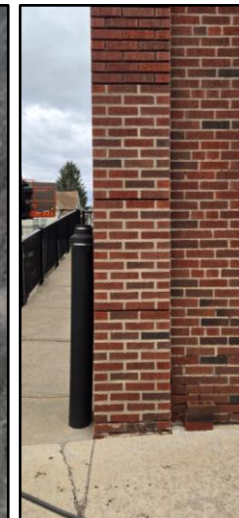
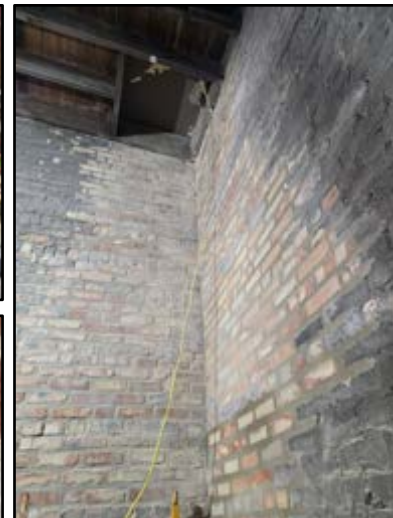
Key Points:

- Roof deck repairs
- 4" of rigid roofing insulation with ice & water Shield.
- Eco star synthetic Slate
- Belltower copper roofing repairs



Key Points:

- Brick and limestone repointing around building and inside towers
- Mortar color matching
- Limestone repair/patching
- Transept coping stone anchorage
- Fracture cracks at tower corner piers



Structural Investigation

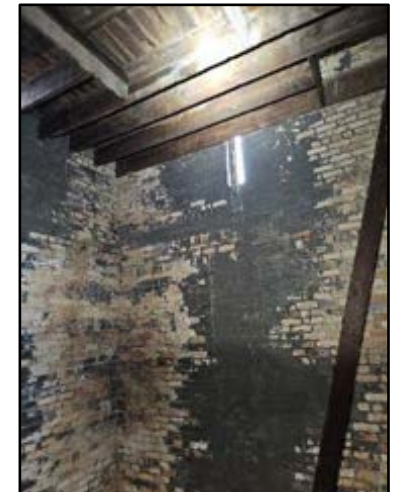
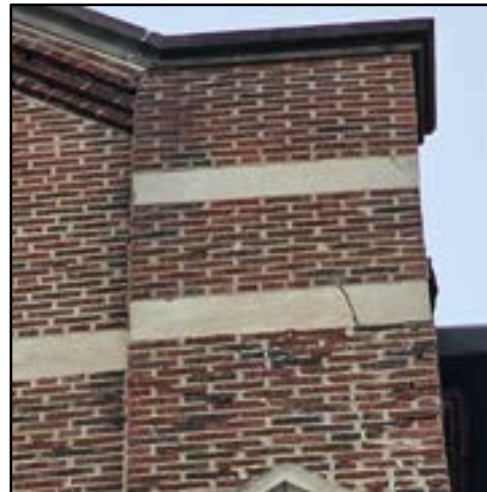


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Areas of Investigation:

- North & South Belltowers
- East & West Transept
- North Vestibule



Structural Investigation



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Suspected Causes:

- Thermal Expansion
- Moisture Expansion
- Frost Expansion
- Rust Jacking
- Portland Cement Mortars
- Wind



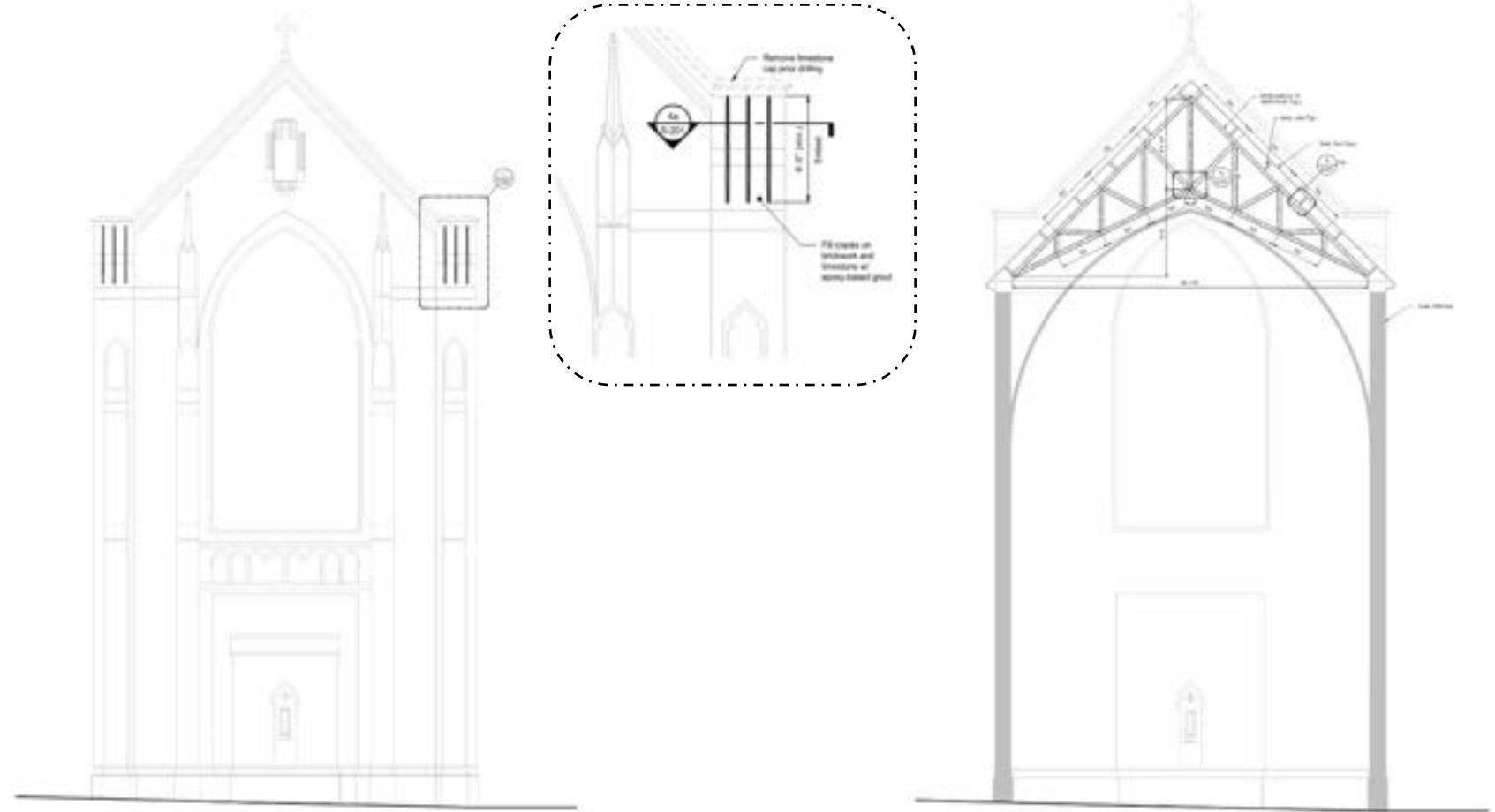
Methods:

- Field Investigation
- Historical Records Survey
- Analog and Digital Monitoring
- Exterior & Interior 3D Lidar Scan
- Mortar Sampling



Design Solutions:

- Increase strength via insertion of embedded steel dowels
 - Benefits:
 - Low **visual impact**
 - Increased **ductility**
- Decrease demands via interior truss
 - Benefits:
 - Uniform **stress redistribution**
 - **Redundant** load path



Construction Photos



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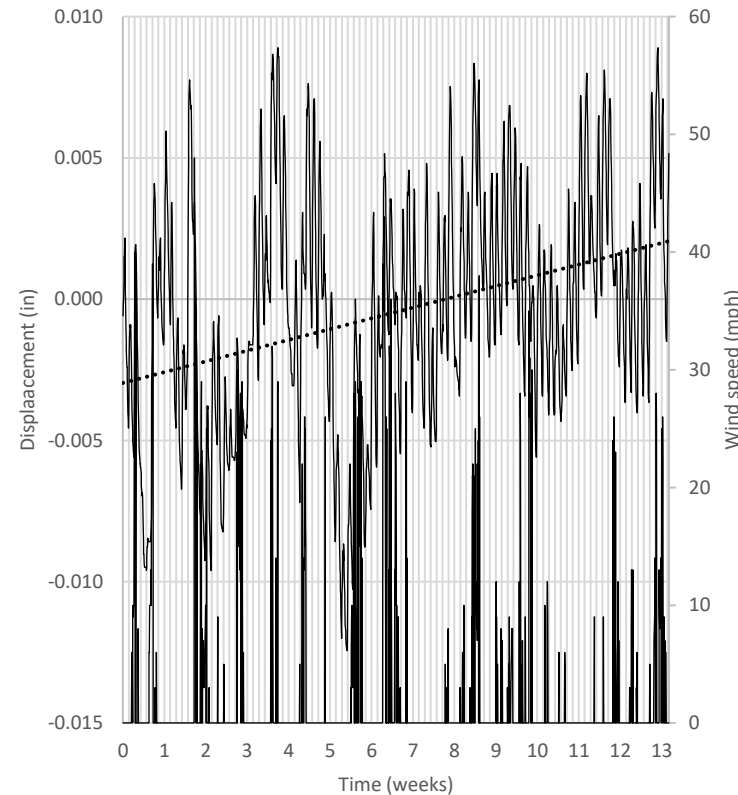
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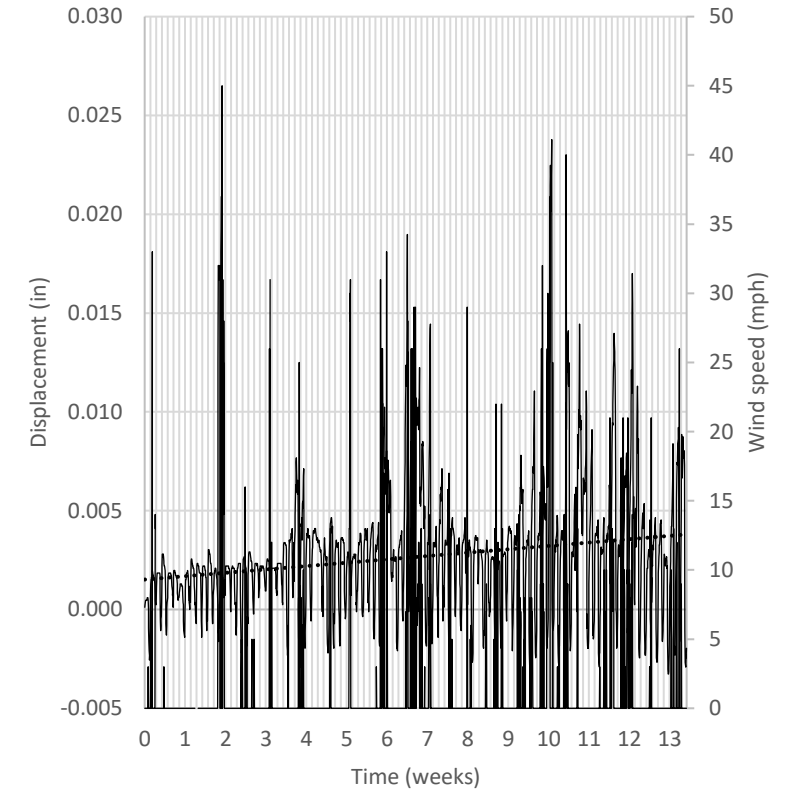
Crack & Wind Monitoring:

- Crack monitoring over the span of several months
- Retrieve wind gust data from nearby wind station (South Bend International Airport)
- Compare data to identify correlations

Evident correlation between wind gusts and crack openings



— Crack Displacement — Wind speed (mph)
..... Linear (Crack Displacement)

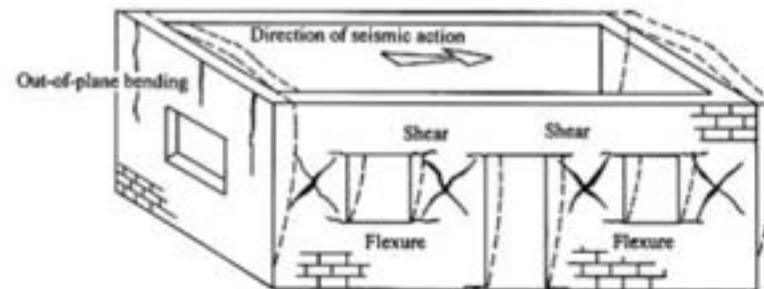
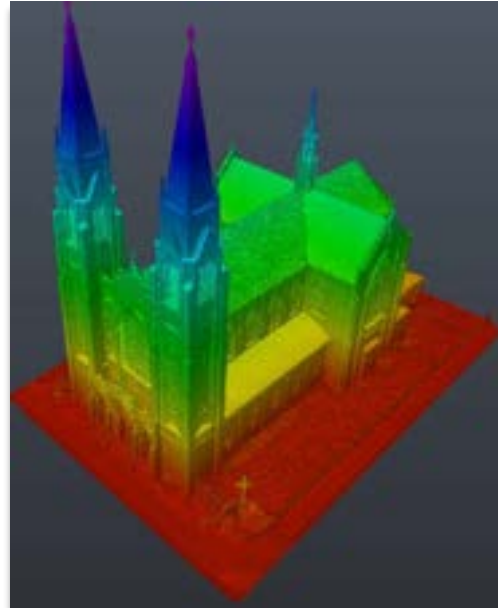


— Crack Displacement — Wind speed (mph)
..... Linear (Crack Displacement)

Modeling and Calibration:

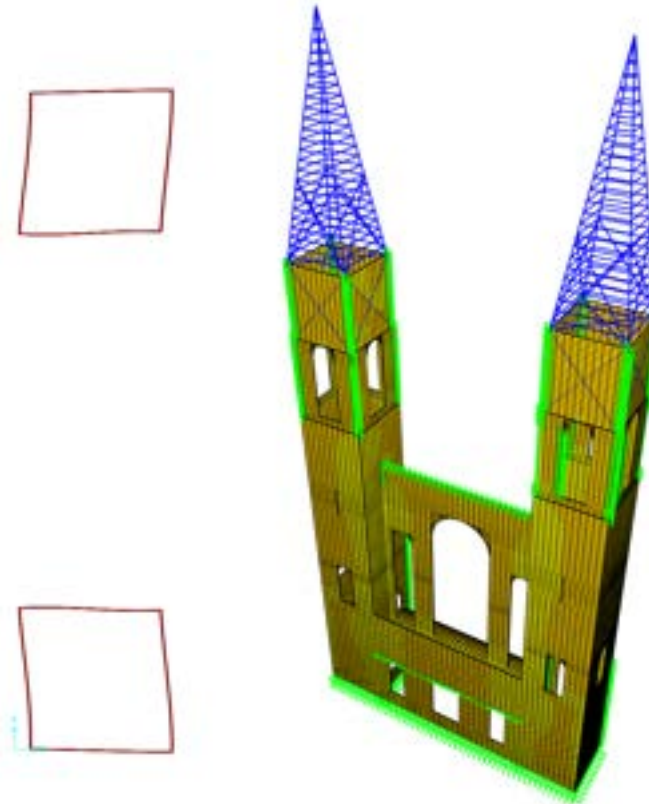
- Finite element model of the towers
- Calibration of the model based on crack/wind analysis
- Identification of the leading problem

Lack of stiffness causing severe torsion

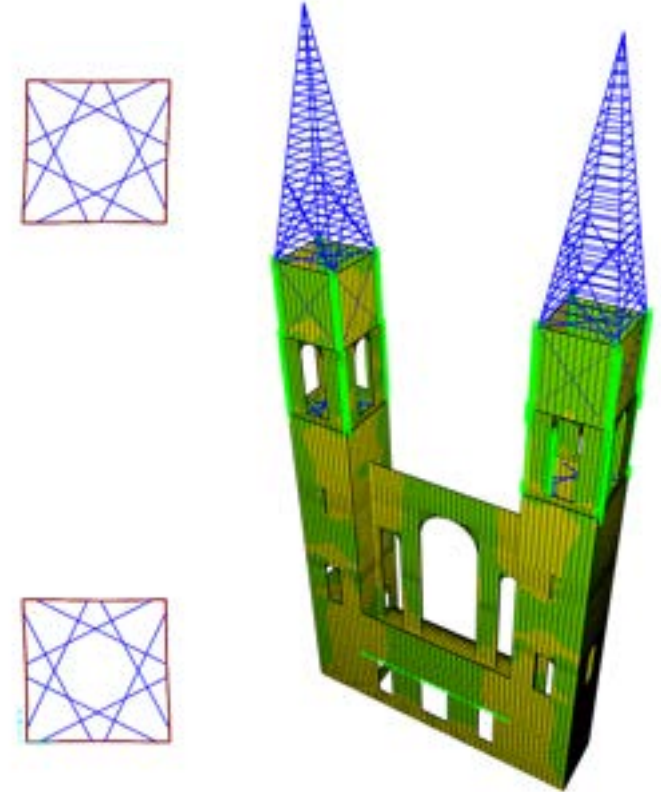


Validation:

- Reduced stresses at the corners
- Reduced deformation in the plan section
- Reduced likelihood of interior cracks
- Reconnection of the masonry piers to the structure



FEM results – Pre-Intervention



FEM results – Post-Intervention

STRUCTURAL ASSESSMENT

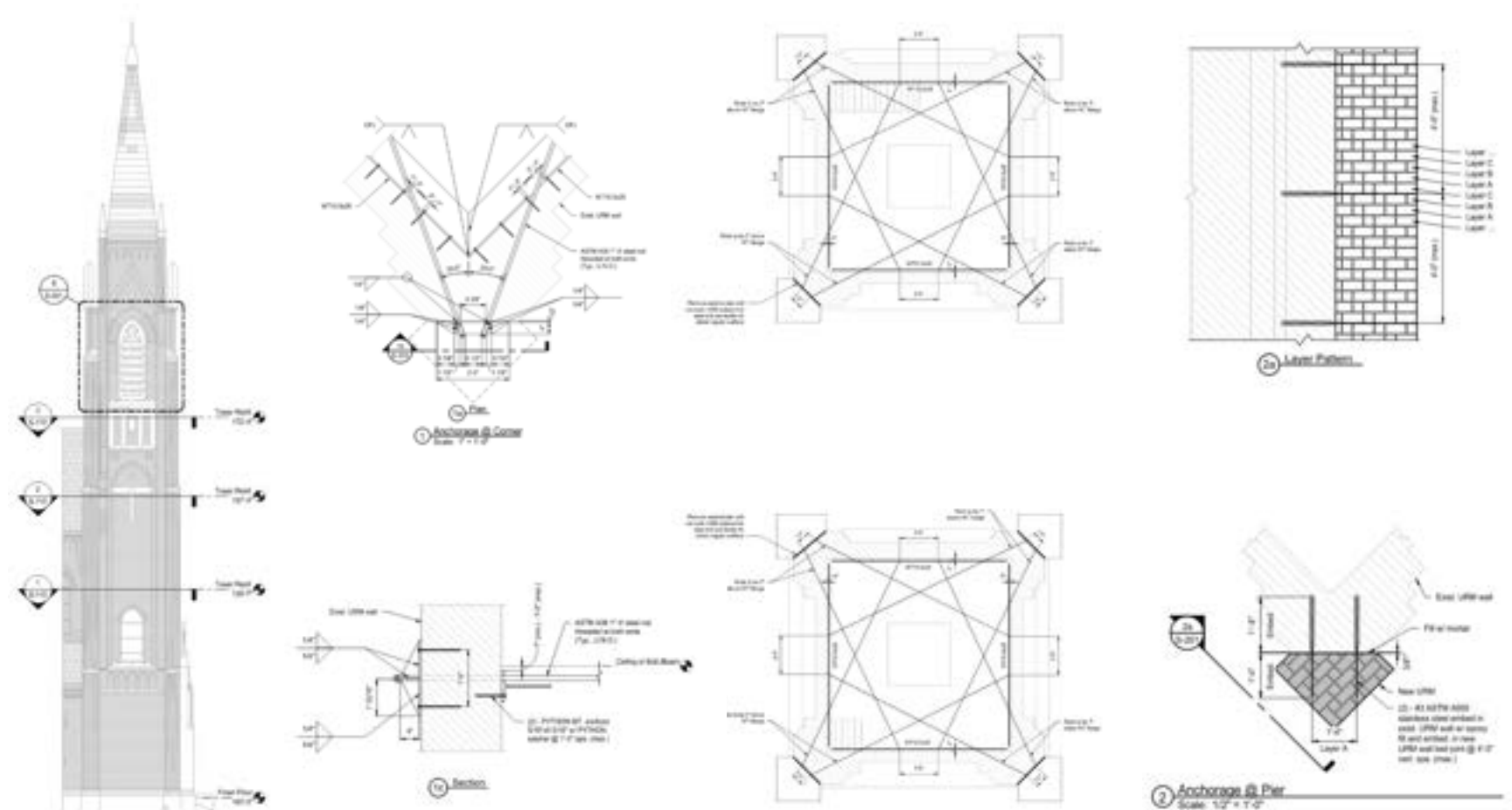


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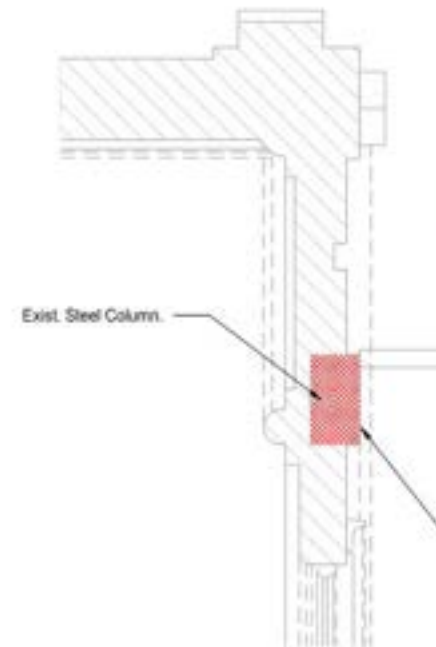
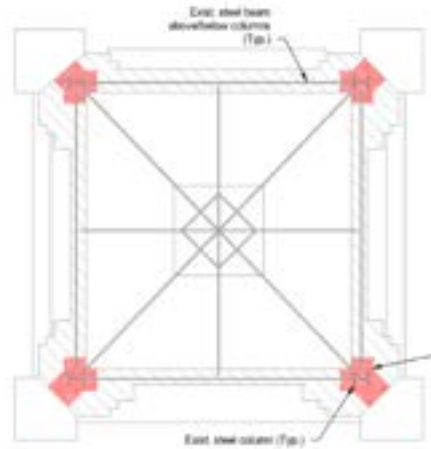
Design Solutions:

- Re-establish box-like behavior by providing stiffness at different levels
 - Benefits:
 - High **effectiveness/material ratio**
 - Low **visual impact**
 - Maintaining original **aesthetic**
- Re-construction of the piers with improved separation
 - Benefits:
 - Structural **integrity**
 - Structural **isolation**



Design Solutions:

- Re-tucking and repointing with lime-based mortar
 - Benefits:
 - Increased **breathability** of masonry
 - Increased **durability and longevity** of masonry
- Sanding of corroded elements
 - Benefits:
 - Prevent **rust-jacking** on masonry
 - Increased **durability and longevity** of steel







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THANK YOU QUESTIONS?

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