

November 11, 2003

United Evangelical Church  
3200 Dillon Street  
Baltimore, Maryland 21224  
ATTN: Mr. William Meyers

**Subject: Report of Engineering Consulting Services  
United Evangelical Church - Survey of Facade Bulging Above Upper Floor  
Windows of the Original Portion of the Building  
3200 Dillon Street  
Baltimore, Maryland  
Gardner Engineering Project 956**

## **INTRODUCTION**

Gardner Engineering, Inc. is pleased to submit this report of our engineering services for the above referenced project. The purpose of our services was to provide visual observations of selected portions of the exterior masonry and associated systems (sealants, copings, windows, lintels, sills, etc.) of the facade for indications of existing deterioration and conditions that might cause long term deficiencies of the structural system. We have included herein our understanding of the project background information, a listing of our scope of services, a summary of our findings, and our recommendations for repair and maintenance of various conditions. Please refer to Appendix A for photographs of representative conditions observed during our survey and Appendix B for a cost estimate summary of recommended repair and maintenance items.

## **PROJECT BACKGROUND**

The original portion of the four-story building at the referenced property was reportedly constructed in 1936 and consists of a concrete framed structure with exterior masonry walls. The walls are constructed as a barrier type system and consist of three wythes of brick masonry. Lateral support between the three wythes is provided by brick headers, which are installed at about every sixth course. Overall dimensions of the original portion of the building are approximately forty-five feet by seventy-five feet.

The roof appears to consist of an aluminized, built-up membrane. Low parapets with metal copings were observed on the north, south and east elevations. The parapet at the main entrance (west elevation) has a tapered profile and varies in height from approximately three to five feet. The center of the parapet is the highest point and is crowned with a precast concrete pediment. Precast concrete is utilized to provide decorative parapet coping at the perimeter of the roof along the main entrance façade. The rear portion of the roof contains communication equipment of a local cellular phone service provider.

Various signs of water infiltration, brick and mortar cracking, facade movement/displacement, steel lintel deterioration, and other signs of deterioration are readily apparent from the exterior of the building.

### **SCOPE OF SERVICES**

Gardner Engineering performed our services for this project in accordance with our Proposal 956 dated August 6, 2003, which was authorized by Mr. William Meyers of United Evangelical Church on October 9, 2003. We were on site on October 20 through 22, 2003 to perform the fieldwork. Drawings were not available for review. Our services performed for this project consisted of the following:

#### Field Services

- Reviewed available history of the original portion of the building to determine the details of construction. We also reviewed the roof communication equipment/platform for possible indications of the equipment/platform contributing to the deterioration of the facade.
- Performed a visual assessment of the facade with emphasis on areas above the upper floor windows of the original portion of the building from ground level, the roof, and via aerial platform.
- Observed the interior space in several locations beneath the roof on the four facades of the original portion of the building.
- Worked with your qualified repair contractor, Structural Preservation Systems, Inc., who provided access to several locations of the facade in order to remove existing brick in two to three locations of bulging (the removed areas were approximately 2 feet by 2 feet). We observed the condition of the wall at the openings and in the vicinity of the openings.

#### Report

- Provided this written report of our findings, conclusions, and our recommendations and opinion of costs for repair options.

## EXECUTIVE SUMMARY

The facade cracking, movement and general deterioration that was observed at the referenced building appeared to be the result of long-term water infiltration into the facade system. This water infiltration is the likely cause of the corrosion of steel lintels and cyclic freeze/thaw deterioration of various precast concrete and masonry components. The observed deteriorated conditions on the north and west elevations were the most significant, and should be addressed immediately to avoid possible facade failures, further water infiltration into exterior walls and the building interior, and danger to pedestrians from falling debris.

## OBSERVATIONS AND FINDINGS

### **I. Roof and Parapet (Refer to Photos 1 through 4 in Appendix A)**

The flat roof appeared to be covered by a built-up membrane that had been covered with an aluminum coating. According to available information, the roof membrane is approximately six years old. The roof membrane was turned up the inside wall of the parapet and terminated beneath the existing metal coping on the north, south and east sides of the building (elevations), and on top of the precast concrete coping along the west elevation and a portion of the south elevation.

The existing metal coping on the north, south and east elevations consisted of light gauge, painted steel. The paint was observed to be peeling and flaking in many areas and the metal had begun to corrode. Corrosion staining was observed at various locations on the facade beneath the metal coping.

The existing decorative precast concrete coping was observed along the west and portions of the south elevations, at locations visible from the main entrance of the building. The precast concrete components had been partially covered by the new roof waterproofing membrane. Portions of the precast concrete coping that were visible showed signs of heavy erosion, spalling, and pitting. In many cases, the joints between each section of precast concrete coping had failed and were allowing water to infiltrate the masonry parapet.

A steel framed platform that was used to support a series of communications equipment had been installed on the east side of the roof. The support posts were framed into post pockets that appeared to bear directly onto existing interior columns. There was no readily apparent indication that the platform or the communications equipment had contributed to the observed facade deterioration. It should be noted however, that we observed several locations where connections (i.e., nuts and bolts) of structural framing for the platform were either loose or missing. These components should be installed or tightened to meet the original design criteria.

There was no readily apparent indication that the interior side of the parapet wall had shifted or become displaced as a result of the bulging and movement observed on the exterior facade.

## **II. Lintel Deterioration (Refer to Photos 5 through 9 in Appendix A)**

The referenced building was constructed with a barrier wall system. The system consisted of three wythes of brick masonry set in mortar, and the joints between the wythes were filled solid with mortar or grout. If water enters the wall through roof failures, brick and mortar cracks and failed sealant joints, it can accumulate within the wall, enter interior living space, evaporate, and/or be expelled to the building exterior. Water that accumulates within the wall can cause ferrous steel reinforcing to corrode. As reinforcing steel corrodes, it expands. The expanded material increases in volume and introduces forces into the surrounding masonry that cause it to shift, bulge and crack.

Steel angle lintels are used at the referenced property to support masonry wall sections above window and door openings. Lintels are structural members (usually steel, reinforced concrete, stone, or wood) that are placed horizontally across the top of door and window openings to provide support to the portion of the walls immediately above the openings. When lintels are designed improperly or become structurally deficient, they may deflect or fail. Results of deflection or failure may include distorted or inoperable windows and doors, cracked wall sections and wall failures. The type of construction encountered at the building generally requires that two to three steel lintels placed back to back be used at each opening to support the three courses of masonry within the wall section.

The majority of the steel lintels on the top floor and directly beneath the flat roof parapet were observed to exhibit advanced steel corrosion. We also observed lintels at lower levels that are beginning to corrode beyond a condition that might normally be considered acceptable. The expansion of the lintels has resulted in shifting, bulging, and cracking of areas of the exterior side of the roof parapet and portions of the facade in the vicinity of the corroding steel lintels. In addition, the lintels have begun to deflect significantly. This is an indication of structural yielding to the forces caused by corrosion expansion and the bearing weight of the brick masonry above the lintel. The noted deflection can cause window and door distortion, racking, and breakage.

Our observations were primarily limited to the steel lintels that could be observed from the building exterior. Steel lintels within the wall or on the interior side of the wall are concealed by masonry and wall finishes respectively. We removed finishes in selected locations to observe the interior face of the wall in several locations on each side of the building. Only minor movement and brick deterioration was observed. This indicates that the facade deterioration as a result of lintel corrosion is likely concentrated to the exterior side of the wall. One location observed at the southwest corner of the building did exhibit advanced interior wall cracking and movement. This area will likely require that portions of the interior finishes be removed and selective portions of the interior face of the wall be dismantled and reconstructed or stabilized as necessary.

Replacement of the upper floor lintels, and replacement of other areas of advanced lintel deterioration at lower levels, will generally require that the brick masonry directly above the window lintel be removed and reset to accommodate removal of the deteriorated lintel and replacement with a new lintel. Severe cases of deterioration will require that a larger area of the exterior brick masonry facade be dismantled and reconstructed in order to bring the facade back to acceptable construction tolerances. In such cases, supplementary lateral support may also be required. During our field observations, we located three areas on the exterior of the facade, which are in need of dismantling and reconstruction. Supplementary lateral support will likely be required. These areas are as follows:

- Central portion of the west elevation main entrance
- North elevation above the window lintels
- Southeast corner of the east elevation above the window lintels

Lintels at lower levels that appeared to be in acceptable condition were painted in the past and have now begun to rust. It is important that these lintels be maintained to help prevent the onset of conditions similar to those discussed above.

### **III. Brick and Brick Mortar (Refer to Photo 10 in Appendix A)**

Brick at all elevations appeared weathered, and miscellaneous freeze/thaw cracks were observed throughout each of the facades. Brick on the west (main entrance) elevation appeared to be rough-cut while the brick at the remaining elevations appeared to be smooth with a sealed exterior facing pore structure. We performed several masonry absorption tests on the east and west elevations to help us determine the tendency of the brick and mortar to readily absorb moisture as a result of wind driven rain. Our findings indicated that the rough-cut brick on the west elevation are more susceptible to water absorption than the smooth surface brick on the east elevation; however, the findings for both types of brick appeared to indicate a dense material with fair to good resistance to water absorption.

Vertically cracked brick were observed at all elevations at locations where the facade had shifted as a result of lintel deterioration, and at the corners of the building where brick expansion of the perpendicular and opposing walls had caused relief cracks to form. Cracks in the brick permit water to enter the wall and lend to the various failure mechanisms previously discussed.

The condition of the brick mortar varied throughout the building elevations observed. The main entrance (west elevation) mortar appeared to be original on the lower half of the elevation. The upper half appeared to have been cut out and replaced with new mortar (tuckpointed) at some point in the past. The original mortar appeared to have eroded and was soft as a result of exposure and freeze/thaw deterioration. Cracks were also observed within the mortar of the upper half of the elevation as a result of freeze/thaw deterioration and wall movement as discussed above. Masonry absorption tests were performed on the original mortar of the west elevation and indicated that the mortar readily absorbed water.

Mortar of the south elevation appeared to be in relatively good condition with the exception of locations directly beneath the parapet and other miscellaneous locations throughout the elevation. Areas beneath the parapet are usually more susceptible to deterioration because of greater exposure to the elements and greater potential for water infiltration from the parapet and roof. Mortar in this location appeared to be original.

Mortar of the north elevation appeared to be similar in condition to that of the south elevation, with the exception of the mortar beneath the parapet where the amount of deterioration appeared to be more substantial as a result of advanced lintel deterioration and wall movement.

Mortar of the east elevation appeared to have been tuckpointed in the past. Evidence of additional maintenance included brick and lintel replacement/repair at several locations. The tuckpointed joints had eroded in many cases. However, the masonry absorption tests performed indicated that the mortar provides good resistance to water infiltration.

#### **IV. Other Items Noted (Refer to Photos 11 through 15 in Appendix A)**

- Precast concrete windowsills were present on the west elevation. The sills exhibited spalling, weathering, cracking, erosion, and general deterioration in various locations. These conditions can permit water to enter the wall and promote the various failure mechanisms discussed previously.
- Various sealants were observed throughout the building, with the majority being observed at the perimeter of windows and doors. Most of the sealants were observed to be cracked, dry, and at the end of their useful service life. These conditions can permit water to enter the wall through the joint at the perimeter of the window or door opening and promote the various failure mechanisms discussed previously.
- Architectural precast concrete at the periphery of the main entrance door was cracked in one location. The crack allows water to enter the wall system at the periphery of the door and also detracts from the appearance of the precast concrete.
- A large amount of mortar residue on the north elevation indicated that a component of the building (i.e., chimney) had been removed at some point in the past. The mortar residue detracts from the overall appearance of the building.
- An area of brick on the east elevation had been removed and infilled with concrete masonry units (block). The block detracts from the overall appearance of the building.
- Wood windows on the lower floor of the west elevation are in poor condition and should be restored.
- All building elevations exhibited a build-up of soil from roof run-off and years of environmental exposure. The soiling detracts from the overall appearance of the building.

APPENDIX A  
PHOTOGRAPHS



PHOTO 1 - Overview of the west elevation main entrance



PHOTO 2 - Facade stains from the corroded metal roof parapet coping



PHOTO 3 - Existing cracked and spalled precast concrete coping



PHOTO 4 - Existing cracked and spalled precast concrete coping



PHOTO 5 - Example of existing lintel deterioration with associated spalled and cracked brick



PHOTO 6 - Example of existing lintel deterioration



PHOTO 7 - Bulging portion of the facade above deteriorated lintel



PHOTO 8 - Heavily corroded lintel with deteriorated steel rivets



PHOTO 9 - Heavily cracked interior back-up wall at southwest corner of the west elevation



PHOTO 10 - Deteriorated mortar beneath precast windowsill



PHOTO 11 - Cracked and spalled precast concrete windowsill



PHOTO 12 - Cracked precast concrete above the west elevation entrance door



PHOTO 13 - Corner of the north elevation with mortar residue from the previous chimney



PHOTO 14 - Concrete block infill within the brick masonry wall of the east elevation

APPENDIX B  
COST ESTIMATE

- As a result of the long-term water infiltration into the building facade and possibly the interior space, there may be additional conditions within the wall system that were not accessible, could not be observed, or were outside the scope of our survey. In addition, environmental conditions may be present that require the expertise of an environmental consultant.

### **RECOMMENDATIONS AND OPINION OF COST**

We recommend that an immediate repair and maintenance plan be developed to address the various deficiencies and water infiltration described herein (and other possible deterioration that may be encountered during the necessary repairs). The repairs and maintenance should be performed in order to assure safety for pedestrians passing beneath the various building elevations, long-term serviceability of the building components, and to avoid the possibility of advanced structural deterioration and distress.

The existing deterioration can be repaired through a strategic exterior restoration program. The program should be defined by a detailed engineered specification, and carried out by a qualified repair contractor. The majority of the repairs can be performed from the exterior of the building; however, the condition observed at the southwest corner of the west elevation will likely require that interior space be entered and partially occupied by the repair contractor to make the needed repairs.

The following repair items are recommended.

1. Remove the existing precast concrete coping on the west elevation and applicable portions of the south elevation. Install new precast concrete coping roof flashing, and metal counter flashing.
2. Inspect the roof and replace deficient roof membrane and base flashings. Replace the existing metal parapet coping with a new aluminum coping
3. Remove brick above windows with distressed exterior steel lintels as necessary to remove the lintel. Inspect the central steel lintel (if any) for signs of deterioration and remove if necessary. Remove any masonry associated with removal of the central lintel. Inspect the interior steel lintel (if any) for signs of deterioration and remove if necessary. Remove any masonry associated with removal of the interior lintel. Removal of the interior most lintel will require that the repair Contractor enter interior space to access the lintel and make necessary repairs. Removal of lintels will also require support of the remaining façade as previously discussed. Replace existing distressed lintels with new steel lintels that are resistant to corrosion.
4. Prepare, prime and paint all existing lintels that are not replaced as part of Item #3 above.
5. Remove and reconstruct bulging, displaced or otherwise distressed portions of the masonry facade and exterior face of roof parapet. Remove interior finishes of the southwest corner of the west elevation to fully inspect the interior masonry wall. Rebuild portions of the interior masonry wall as encountered.

6. Install epoxied dowels or other form of additional lateral support between masonry wythes during reconstruction of locations defined by Item #5.
7. Remove and replace damaged or deteriorated brick and brick mortar throughout the facades.
8. Tuckpoint the north and west elevations 100%.
9. Selectively tuckpoint the east and south elevations.
10. Install masonry expansion joints at each building corner to accommodate masonry expansion and thermal variations within the exterior wythe of brick masonry.
11. Repair/replace damaged, cracked, spalled, or otherwise deficient precast concrete windowsills on the west elevation. Coat all precast concrete windowsills and exposed portions of the pediment with a breathable cementitious coating.
12. Remove existing window and door sealants and other miscellaneous sealants within the facade and replace with new sealants.
13. Epoxy inject cracks in architectural precast concrete at the perimeter of the door on the main entrance (west elevation).
14. Clean the north elevation of mortar residue remnants.
15. Remove concrete masonry units (block) within the wall of the east elevation and replace with brick masonry to match the existing.
16. Restore wood windows on the lower floor of the west elevation.
17. Use low-pressure water and selected cleansers to wash all elevations.
18. Install clear penetrating sealer on the north and west elevations.

### OPINION OF COSTS

*Our opinion of costs* to perform the recommended repairs is on the order of \$300,000.00 to \$400,000.00 depending upon the various repairs selected. Our opinion of costs is provided for rough budgeting purposes only. These costs are based upon estimated quantities derived during our survey and our experience of the actual costs received for work on similar projects. They do not include fees for contingencies, bonds, engineering, construction monitoring or other administrative services. We believe the best way to obtain an accurate cost estimate is to solicit prices from several qualified contractors using a detailed specification.

We understand that the church has budget constraints any may select to repair only the immediately necessary items at this time. We recommend, at a minimum, that items 3 through 8 above be repaired immediately and the remaining items be repaired in the near future as budgets allow. Our opinion of costs for the repair of items 3 through 8 is \$175,000.00 to \$225,000.00

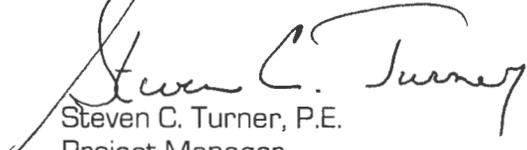
## FINAL COMMENTS

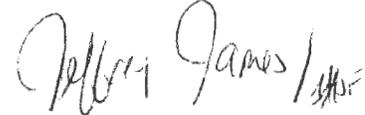
Gardner Engineering can perform the necessary engineering consulting for the repairs discussed within this report. Upon your request, a proposal for design, bidding, contract administration and construction observation services will immediately follow this report.

Our services did not include the evaluation for the presence of mold or other hazardous materials or a structural evaluation of the building or its components.

We appreciate your consideration of Gardner Engineering for this work and look forward to our continued service to you as your engineering consultant.

Sincerely,  
**GARDNER ENGINEERING, INC.**

  
Steven C. Turner, P.E.  
Project Manager  
Restoration and Repair Division

  
Jeffrey A. James, P.E.  
Vice President

Appendices: Appendix A Photographs  
Appendix B Cost Estimate

**United Evangelical Church  
Recommended Facade Repairs  
Rough Budget Cost Estimate  
Gardner Engineering Job No. 956**

Item #	Repair Item	Unit	Rough Quantities	Estimated Unit Cost	Estimated Total
1	Remove Existing Precast Concrete Coping, Replace with New Precast Concrete and Install New Parapet Flashing	LF	75	\$ 150.00	\$ 11,250.00
2	Replace Existing Metal Coping with New Aluminum Coping	LF	200	\$ 15.00	\$ 3,000.00
3	Remove Existing Deteriorated Steel Lintels and Replace With New Steel Lintels Including Brick Removal and Replacement	LF	150	\$ 200.00	\$ 30,000.00
4	Prepare, Prime and Paint Steel Lintels to Remain and Remove Sealant at the Face of the Lintel	LF	250	\$ 12.00	\$ 3,000.00
5A	Rebuild Portions of Exterior Brick Masonry Facade	SF	190	\$ 100.00	\$ 19,000.00
5B	Open and Inspect and Rebuild Back-up Wall at Southwest Corner	SF	150	\$ 85.00	\$ 12,750.00
6	Install Epoxy Pins	EA	425	\$ 30.00	\$ 12,750.00
7	Replace Damaged Brick	EA	90	\$ 22.00	\$ 1,980.00
8	Tuckpoint North and West Elevations 100%	SF	4,200	\$ 25.00	\$ 105,000.00
9	Tuckpoint East and South Elevations	LF	4,000	\$ 4.50	\$ 18,000.00
10	Install Masonry Expansion Joints	LF	240	\$ 25.00	\$ 6,000.00
11A	Replace Damaged Precast Sills	EA	1	\$ 225.00	\$ 225.00
11B	Repair Damaged Sills on West Elevations	LS	1	\$ 150.00	\$ 150.00
11C	Coat Sills on West Elevation	SF	75	\$ 5.00	\$ 375.00
12	Remove Existing Window Sealants and Replace With New Sealants	LF	2,500	\$ 4.25	\$ 10,625.00
13	Epoxy Inject Architectural Precast Concrete Cracks	LF	6	\$ 60.00	\$ 360.00
14	Remove Chimney Parging at North Elevation	SF	75	\$ 15.00	\$ 1,125.00
15	Remove Existing Block and Reset with Brick on the East Elevation	SF	7	\$ 30.00	\$ 213.33
16	Restore West Elevation Wood Windows	LS	1	\$ 2,000.00	\$ 2,000.00
17	Wash All Elevations	SF	12,000	\$ 1.00	\$ 12,000.00
18	Install Clear Penetrating Sealer on the North and West Elevations	SF	4,200	\$ 2.50	\$ 10,500.00
19	Mobilization	LS	1	\$ 15,000.00	\$ 15,000.00
<b>TOTALS</b>					
				<b>Sub-Total</b>	\$ 275,303.00
				<b>Add 15% for General Conditions</b>	\$ 41,295.00
				<b>TOTAL</b>	\$ 316,598.00
<b>OPTIONS</b>					
Option	Tuckpoint East and South Elevations 100%	SF	4,200	\$ 25.00	\$ 105,000.00
Option	Install Clear Penetrating Sealer on East and West Elevations	SF	4,200	\$ 2.50	\$ 10,500.00