EHLERT BRYAN
consulting structural engineers

May 8, 2020

Our Lady of Good Counsel Catholic Church
8601 Wolftrap Rd. SE
Vienna, VA 22182

Attn: Mr. Gerard Hall

RE: OLGC – Facade Masonry Investigation
EB#: 2040002.00.V

Dear Mr. Hall:

Ehlert Bryan is pleased to present this summary report concerning the observed masonry cracks at the church walls and the bell tower. This report presents the results of our survey along with our recommendations for repairs. Appendix A contains a repair probable cost breakdown which was provided as reference before the project is bid to obtain actual prices from contractors.

If you have any questions, please do not hesitate to contact me.

Yours truly,

Ehlert Bryan

Rod Seyidoglu, PE, SE
2020.05.08
20:40:18-04'00'

Rod Seyidoglu, PE, SE

SUMMARY AND OBSERVATIONS

Gravity and lateral load carrying systems of the church building and the bell tower, located at the southeast of the church, consists of steel beams and columns clad with exterior masonry. The approximately 50-ft tall bell tower was constructed with six 8-inch wide steel columns and concrete piers, placed over an 18-ft x 18-ft mat foundation as seen in Figure 1. Existing W8x67 columns and W8x24 beams were constructed as moment frames to resist the wind and earthquake loads acting on the trapezoidal masonry walls. Bases of the steel columns were designed and pins to allow rotation.

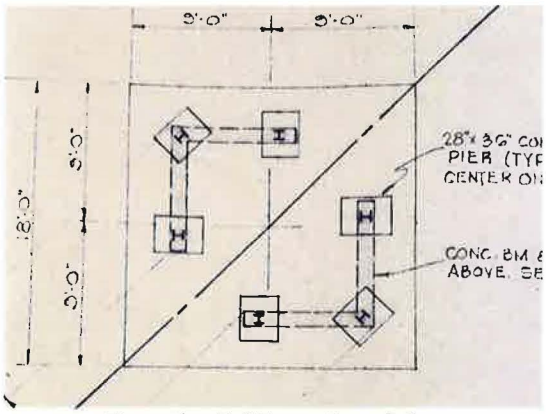


Figure 1 – Bell Tower Foundation

Similar to the bell tower, 1-sory church building's framing consists of moment frames, consisting of deep steel columns and tapered steel beams supporting the metal roof diaphragm. 8-inch deep columns were placed within the exterior brick walls support the roof framing at the southeast and northwest of the church structure as seen in Figure 2.

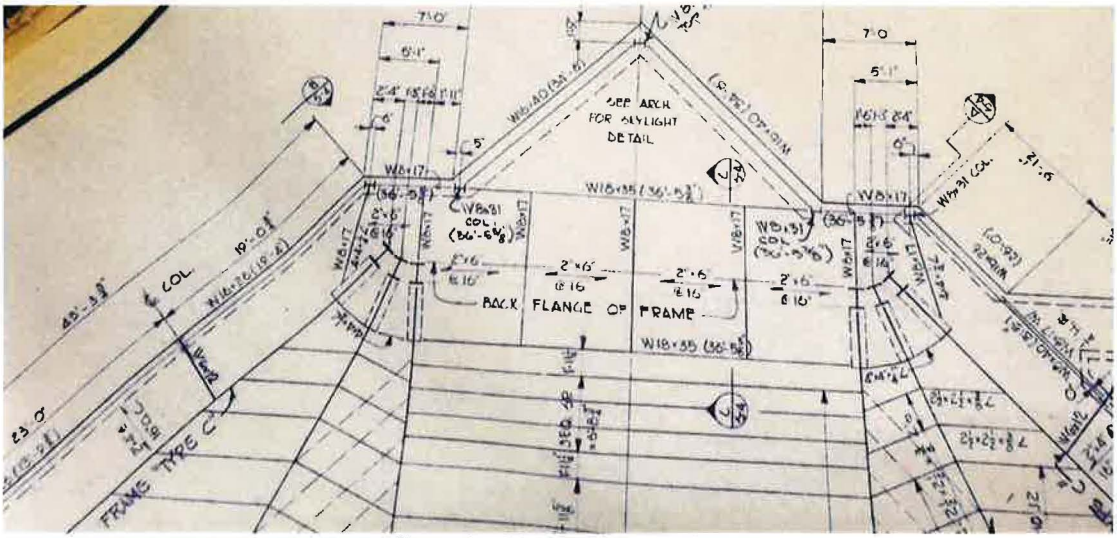


Figure 2 – Main Church Framing

Visual observations and intrusive investigation were performed at the church walls as well as the bell tower to better understand the reasons behind the reported masonry cracks. Per our conversation with the church maintenance staff, we understand that that the cracks have been present for several years; however have been worsening within the last year or so.

Bell Tower:

Full depth cracks through the bricks and mortar joints, approximately 0.007 to 0.06 in width, were observed primarily at the upper parts of the structure in front of the steel columns. Three openings were made to observe the condition of the steel framing behind the brick and find out how the masonry was connected to the steel frame at approximately 15-ft above the ground level.

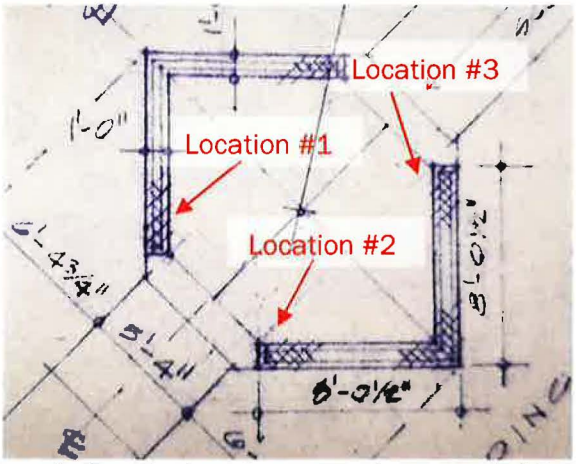


Figure 3 – Intrusive Investigation Locations at the Bell Tower

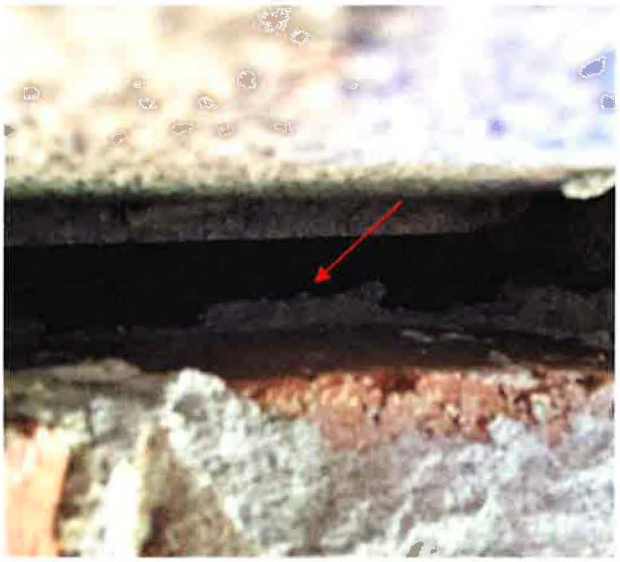
It was then observed that the steel columns were installed tight against the brick without any isolation gap to separate the main framing from the masonry cladding; furthermore, there are no expansion / control joints in the brick masonry to allow its movement. CMU blocks were positioned directly against the flanges of the steel columns (**Photograph 1**); we also noted that there are haphazardly placed bricks within the column flanges (between the CMU blocks and steel columns). Connection ties between the CMU and the steel columns could not be found at any the three openings.

Photograph 1 – Condition of the Wall at Location 1

Almost all of the cracks at the bell tower directly align with the column flanges as seen in **Photograph 2** below. Some of the cracks were previously repaired by re-pointing the cracked mortar joints and filling the cracked bricks with mortar.

***Photograph 2** – Observed Cracking along a Column*

Structural steel framing behind the brick cladding was observed with aid of a borescope camera to identify the degree of corrosion and determine type of the connectors used to tie the masonry to the steel framing. The borescope was extended as much as possible into the wall; however, presence of mortar, blocking the wall cavity, prevented the camera to be extended more than 24". No connectors were noted between the masonry and steel; furthermore, brick ties between the CMU and brick could not be seen. Approximately ¼" to ¾" gap was noted between the brick and CMU (**Photograph 3**).



***Photograph 3** – Gap between the CMU and Brick*

Church Walls:

Two intrusive investigation openings were made at the exterior walls at the west and north of the nave where the cracks are reported. Similar to the bell tower, cracks were found to be aligning with the steel columns placed within the exterior walls.

Figure 4 – Exploratory Opening at the West of the Nave (Location 4)

Figure 5 – Explanatory Opening at the West of the Sanctuary (Location 5)

While brick ties were found between the steel column and the brick (Photograph 4), they were not properly welded. As seen in Photograph 5, cracking was more pronounced where the column flanges were perpendicular to the wall. The air gap between the CMU and brick was inconsistent at these two openings, while the bricks were mortared to the CMU at Location 5, there was an approximately 1-inch air gap at Location 6.

We also noted that the rain leaders were discharging immediately adjacent to these 2 locations where the cracks were investigated (**Photograph 4**).

Photograph 4 – Rain Leader Next to Location 5

CONCLUSIONS AND RECOMMENDATIONS

The issues observed at the bell tower and the exterior walls appear to be related to original design and construction of the structures. Absence of expansion/contraction joints along with lack of isolation between the steel and masonry likely caused the exterior masonry to crack. Structures sustain considerable lateral movement due to wind and earthquakes and if the exterior cladding is not designed to accommodate this movement, cracks are unavoidable. Masonry cladding assemblies ae especially prone to cracking due to their brittleness. Typically exterior masonry wall systems are isolated from the main framing of the building structures to minimize cracking which was not done at the bell tower or the main church building. Furthermore, the observed widespread corrosion within the bell tower is leads us to believe that the cracks have been leaking for a long time.

Remedial repairs can be done to alleviate/control the cracks at this time; complete elimination of future cracking is not possible due to the original detailing of the walls. Recommended repairs to control/reduce future cracking are as follows:

Bell Tower:

- Remove and replace a 30" long strip of brick along the steel columns. Install new ties between the CMU and steel columns (which can accommodate movement).
- Provide vertical brick control joints along the columns to allow the brick to move.
- Install adjustable ties between the CMU and new brick.
- Remove and replace deteriorated bricks.
- Repoint deteriorated mortar joints.

Church Walls:

- Provide vertical control joints along the columns.
- Remove and replace deteriorated mortar and bricks.
- Extend the rain leaders further away from the exterior walls.

LIMITATIONS:

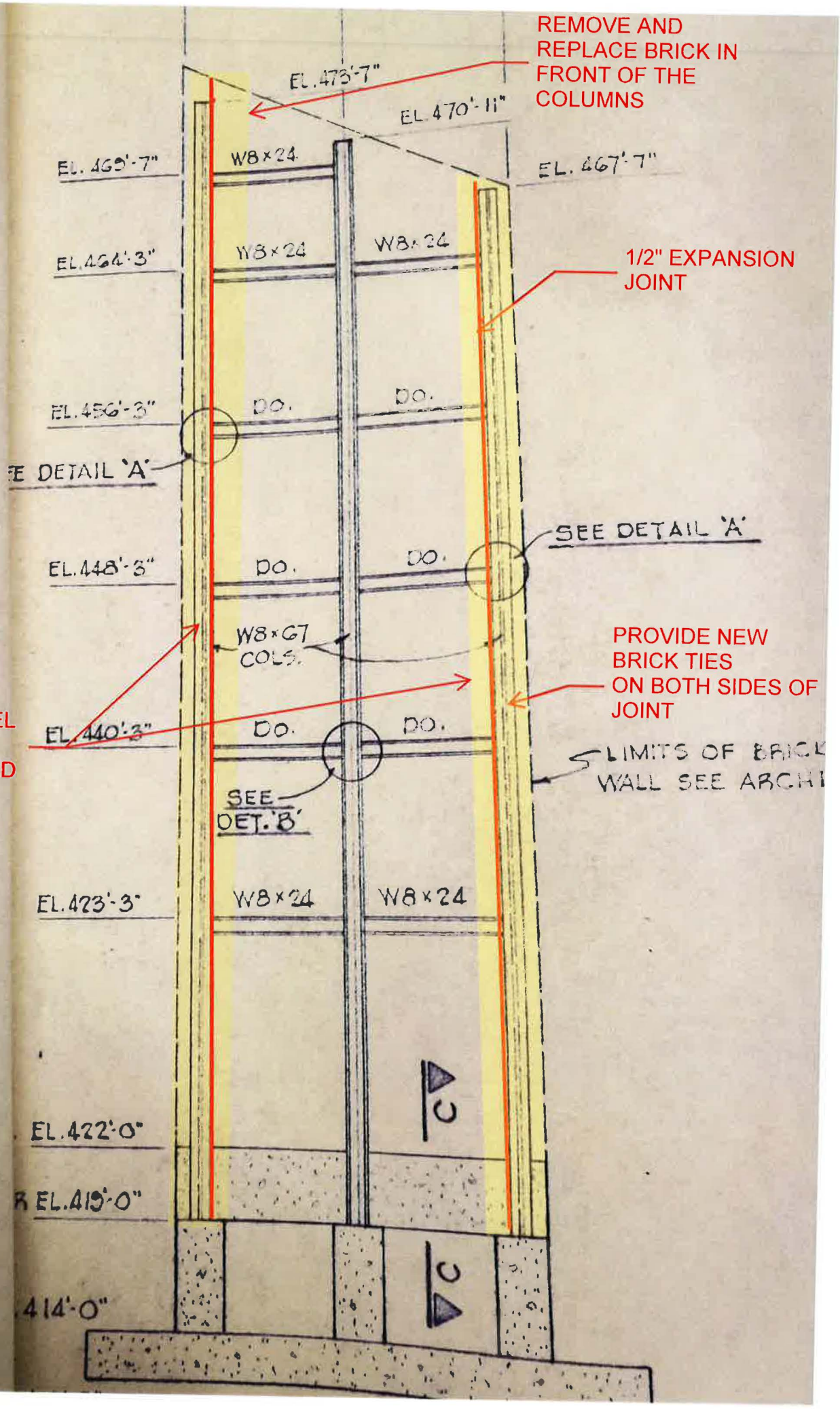
The scope of services is limited to visual observation of isolated building elements only. The actual sizes, strength and reinforcement of each structural element were not determined, and no analysis or calculations have been made to determine the adequacy of any of the existing structural members. Portions of the building and building systems are finished with materials which make them inaccessible and unobservable. In these areas, latent problems may exist which will not be identified.

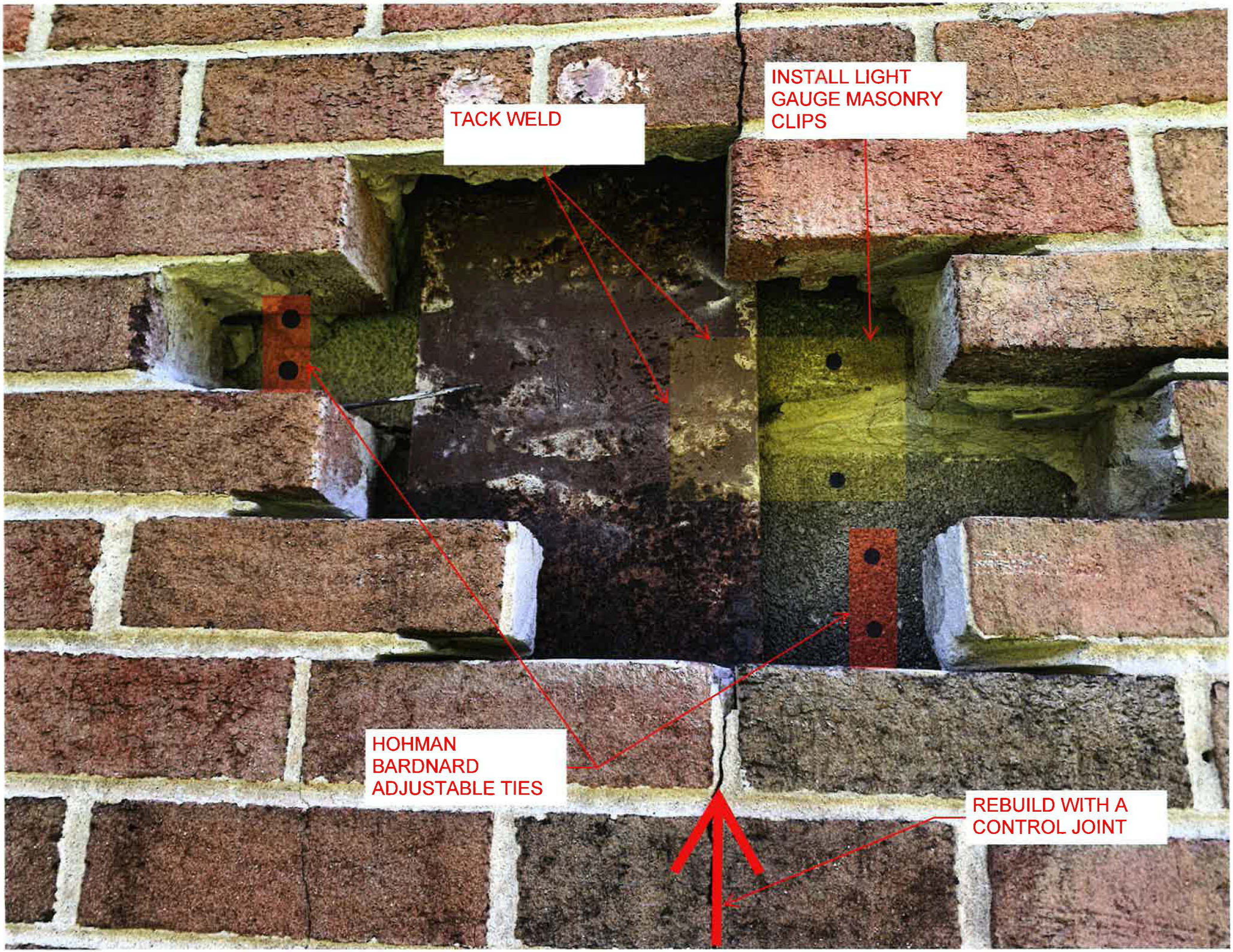
This report has been prepared solely and exclusively for the client to assist in the evaluation and rehabilitation of this project. It is not intended for use by others or for other than the stated purpose. The conditions reported are as visually observed on the denoted timeframes.

EB has strived to perform services under this agreement in a manner consistent with that level of care and skill ordinarily exercised by members of the architectural/engineering profession currently practicing in the same locality under similar conditions. No other representation, express or implied, and no warranty or guarantee is included or intended in this report.

The probable repaired breakdown, rendered as a service under this Agreement, is based on assumed labor costs and approximate quantities of material and equipment, and therefore is of a conditional character. Actual repair quantities and construction costs may significantly be different. EB is not a professional cost estimating firm and does not guarantee the quantities or the cost of work to be performed by others since market or bidding conditions can change at any time and changes in the scope or quality of the Project may affect estimates. Actual bids needs to be obtained from professional repair contractors to obtain exact pricing and quantities for budgeting the Project.

APPENDIX A


REMOVE AND REPLACE BRICK IN FRONT OF THE COLUMNS
EL. 473'-7"
EL. 470'-11"
EL. 469'-7"
EL. 467'-7"
W8×24
EL. 464'-3"
W8×24
W8×24
1/2" EXPANSION JOINT
EL. 456'-3"
DO.
DO.
E DETAIL 'A'
SEE DETAIL 'A'
EL. 448'-3"
DO.
DO.
W8×67 COLS.
PROVIDE NEW BRICK TIES ON BOTH SIDES OF JOINT
CONNECT CMU BACK-UP TO STEEL COLUMNS AFTER BRICK IS REMOVED
EL. 440'-3"
DO.
DO.
LIMITS OF BRICK WALL SEE ARCH
SEE DET. 'B'
EL. 423'-3"
W8×24
W8×24
C
EL. 422'-0"
R EL. 419'-0"
C
414'-0"


TACK WELD
INSTALL LIGHT GAUGE MASONRY CLIPS
HOHMAN BARDNARD ADJUSTABLE TIES
REBUILD WITH A CONTROL JOINT