

DGM Consultants, P.A.

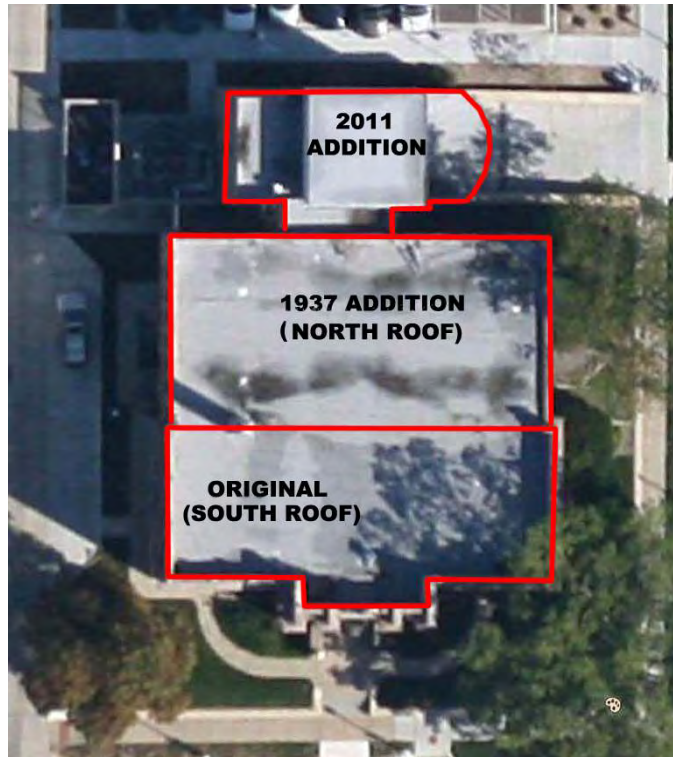
Structural Engineering and Masonry Consulting

FIELD REPORT #01

Project	Carnegie Library	Date	5/15/2012 DGM Project # 2012014
Location	9 th and Vermont Lawrence, Kansas 66044	Contractor	The Garland Company, Inc
To	Mr. Lynn Applegate , Bldg & Aquatics Sup City Of Lawrence 6 East 6th Street Lawrence, Kansas 66044	Owner	City of Lawrence
FAX		Weather	Sunny, 60-84°F
		Present	Greg Leslie Lynn Applegate
		PN	PO 005556

I. INTRODUCTION

- A. This site visit was a followup visit to the initial one made on 4/27/2012 with Greg Leslie.
- B. City of Lawrence issued a PO on 5/7/2012 as an initial step to:
1. Visit site, photograph conditions, review photos, and develop a summary of recommendations as a minimal effort toward getting a handle on all the repair types and the extent of repairs anticipated.
 2. Summary explanation of findings was given to staff (Lynn Applegate) during the second site visit.
- C. Some masonry repairs are necessary prior to reroofing the entire roof.
- D. History
1. 1904: The Carnegie building was constructed with a grant worth approximately \$27,000 from Andrew Carnegie.
 2. 1937: An addition was built. Building served as a public library until a new library was constructed in 1972.
 3. 1975: Building was added to the National Register of Historic Places as the "Old City Library"
 4. 1975-2002: The Lawrence Arts Center inhabited the building.
 5. 2000 - 2010 Three-phase rehabilitation design by Treanor Architects.
 6. 2011: Phase III renovation completed & Lawrence Parks and Recreation Department began operating the facility to make it available for public use.



II. ITEMS DISCUSSED

A. 4/27/2012 Site Visit

1. Coping stones have open head joints that allow water to enter the top of wall.
2. Masonry, directly below the coping stones, is severely deteriorated and exposed above the roofing termination.
3. The backs of the parapet walls have been covered so they can no longer breath and dry out rom the back side.
4. Masonry behind the roofing covering installed on the roof side of the parapet walls is unattached and I suspect that the masonry wall behind the roofing is severely deteriorated.
5. The south facing parapet walls appear to be leaning inward at the top and may not be structural adequate in their present condition.
6. Open head joints at watertables are another location for moisture infiltration.
7. Moisture infiltration is accelerating the deterioration of the masonry walls.

B. 5/15/2012 Site Survey

1. Scope of investigation
 - a. 393 digital photos to document finding.
 - b. Reviewed seven original drawings.
 - c. Reviewed eleven sheets for 1937 Addition.
 - d. Reviewed information available online to develop history section.
2. Original building's parapet walls (from south roof)

a. General

- (1) Noted lengths of wall segments "(xx'-x")" is based on length of wall at first floor from the drawings reviewed.
- (2) Parapet walls extend about 4 feet above the roofing surface (based on measurements taken along the south wall) to the top of the terra cotta caps. The higher center portion is 6 feet to the bottom of the caps.
- (3) The back side of the parapet wall is typically covered with roofing that is not fully adhered, but appears to be hung, in some locations, from the termination bar.

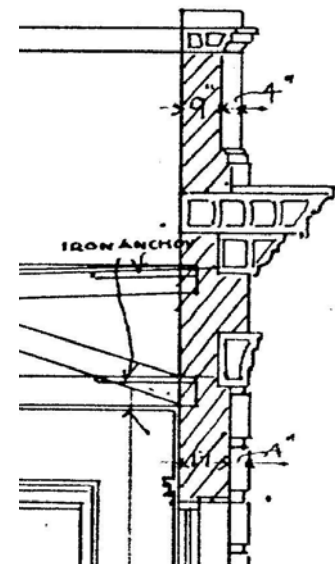
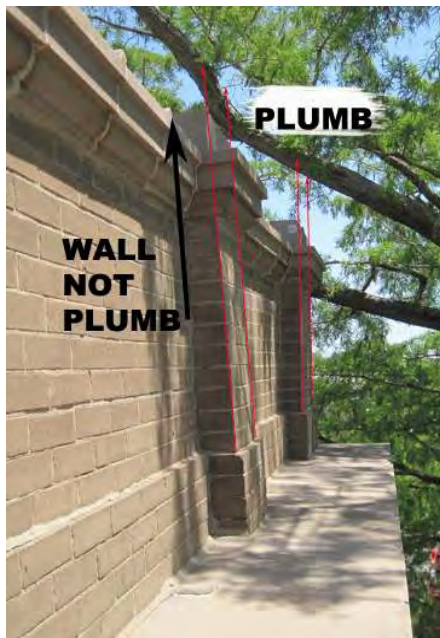
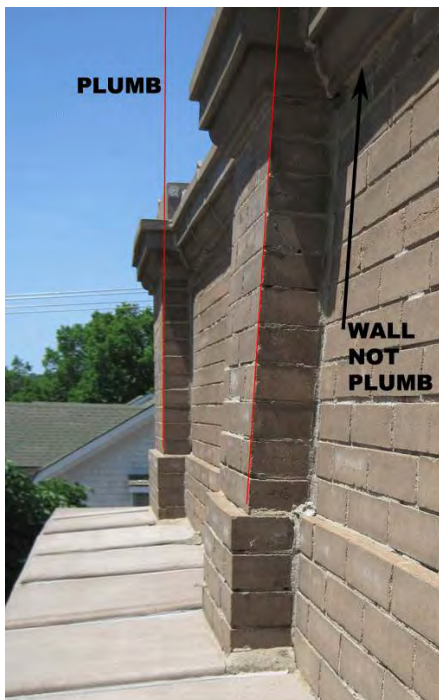


- (4) Lynn recalled photos from the period of the reroofing project that showed the back sides of the walls sealed with an asphalt coating prior to the present cap sheet. Some of this membrane is still exposed above the termination bar, as documented in later photographs.

- b. Inward leaning south parapet walls
- (1) The most concerning condition is the two inward leaning parapet walls along the south wall.
 - (2) We pulled a string line along the left section (east) and measured the intermediate conditions to get a relative offset measurement (repeated at west section). We determined that both parapet walls were leaning inward about 2.625".



- (3) We later accessed the exterior south face of the south parapet walls, that flank each side of the area above the south porch. Both sections were noticeably out of plumb. (Portion of original drawing #5 below).



- (4) The original drawing shows the extent of the terra cotta cornice (watertable) as extending all the way through the wall. This was not verified.
- (5) The remainder of our findings, along the south wall, will be discussed in the next section.

c. Tops of walls

(1) The second most concerning condition is the masonry deterioration and open joint conditions noted near the top of walls.

(2) South parapet wall (76'-6")

(a) This portion of the building has three sections that were first viewed from the roof.

(b) The east and west sections are similar. They are constructed with a corner section and two intermediate pilasters. The pilasters are capped with a terra cotta cap stone that sets



above the rest of the cap stones. The back of the pilasters are brick between the upturned terra cotta cap stone edges. The brick is partially exposed from behind an asphalt coating that was applied over the masonry. The bricks are deteriorated to varying degrees. West parapet series of pilaster caps shown below.

West parapet series of pilaster caps shown below.



Eastern parapet's series of pilaster caps shown below.



(c) The center section (27'-8") above the south entrance is taller and consists of a west wall, a south wall, and an east wall.



- i) The west wall was surveyed first. Most vertical joints between stones are open and the previously covered brick is deteriorated.



The original mortar joints are severely deteriorated or open and the previous pointing is failing.

- ii) The south wall was looked at next. Back side is covered with a weathered asphalt coating above the termination bar to “seal” the exposed brick. The joints above in the back of the terra cotta finial are displaced and open. One crack was noted along the vertical joint.



East of the center section, similar conditions were noted.



- iii) East wall, at the inside corner, did not appear to be as deteriorated as the opposite condition at the west wall, but joints were noted as being partially open.



- iv) From the south face, the terra cotta finial on top of the wall looks to be in good condition, except for numerous open joint lines and a few cracks (highlighted in red).



- (d) East parapet wall (31'-4")
 - i) Starting at the north end of this wall we noted a slight inward lean (bow) in this wall.
 - ii) The north end of the wall has similar covered brick issues and gaps above the



termination bar.

- (3) West parapet wall (31'-4"): The deteriorated conditions along this wall are

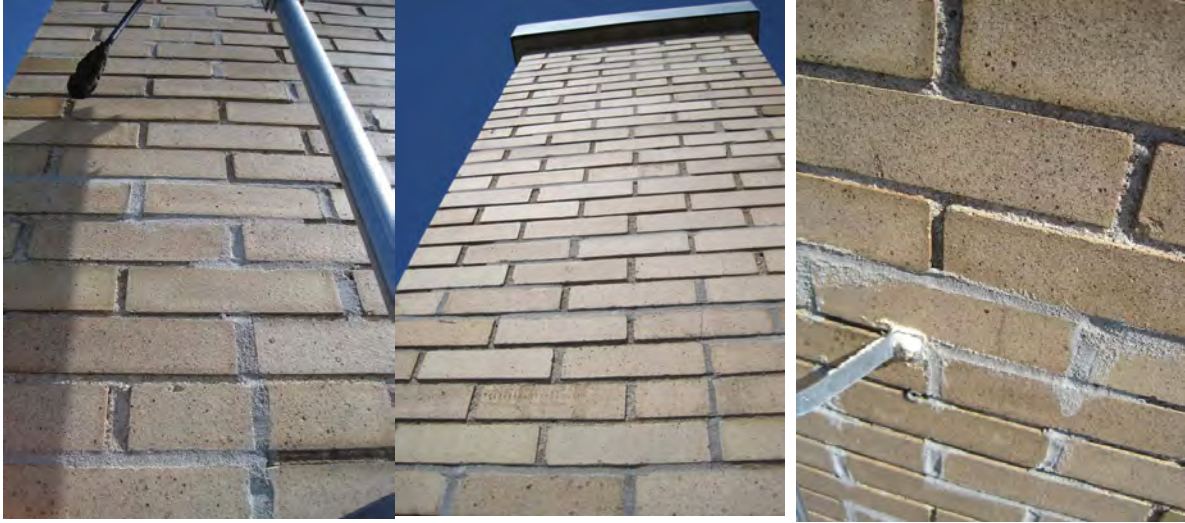


similar to the other walls.

- (4) Terra cotta coping: Copings appear to be a very durable material, based on the noted condition in most locations. We noted several chips, open joints, and gaps under the coping. Several of the open joints noted were a direct result of the leaning walls. Refer to pictures on next page.



- d. Chimney: The original chimney extends above the roof quite a ways. The mortar joints are weathered and some joints appear to have been pointed, but others not at all. Pointing appeared to be improper at several locations.



- e. South parapet wall investigation: We opened up two sections of roofing that had been applied to the back of the parapet wall (with the assistance of Greg Leslie).

- (1) The first was at the center section. After folding the roofing down we noted the wall to be visibly wet from the glistening surface moisture. The brick backup wall had been coated with an asphalt coating subsequent to some pointing and the bricks were spalling.



- (2) The second was the east parapet section.
- (3) The mortar original mortar joints were wider than the exterior joints and they were severely deteriorated. Previous pointing attempts appeared to be just shallow joint fills that were not



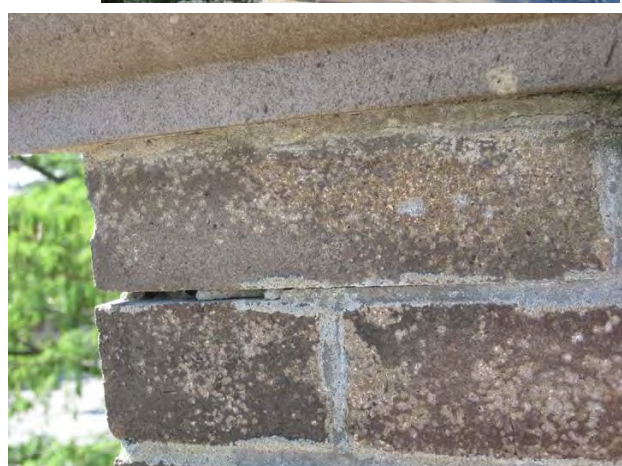
bonded to the brick well or deep enough.



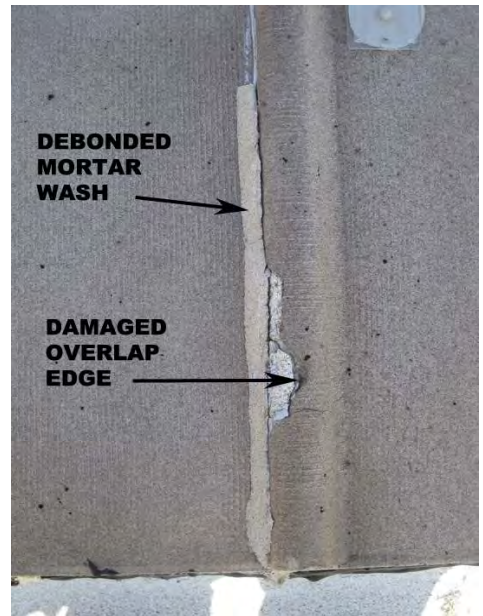
3. 1937 Addition's parapet walls (from north roof)
 - a. This addition has three sides and is centered along the north remaining portion of the original building. The parapet walls are much shorter than the original building.
 - b. East wall (36'-5"): Wall is capped with 24 terra cotta coping units salvaged from the original building, that was replaced by this addition. These terra cotta coping units are in good condition.



- (1) At the end of the original return wall we noted some open mortar joints in the brick.



- c. West wall (36'-5"): Wall is capped with 25 terra cotta coping units, plus three pieces at the corner, from the original building that was replaced by this addition. These terra cotta coping units are in good condition, except for several chipped units and open joints.



The coping at the northwest corner has been made by mitering three original pieces.

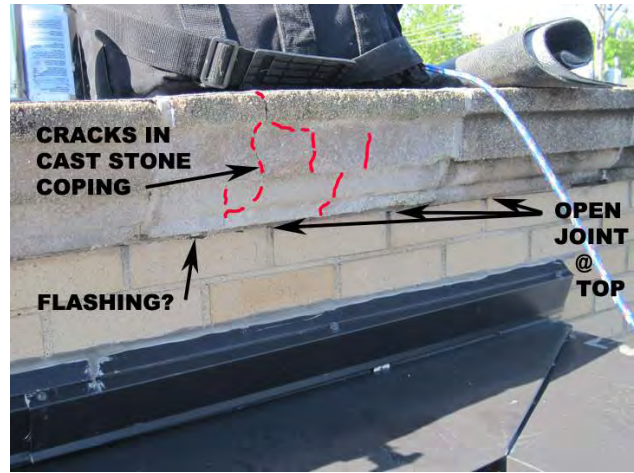
d. North wall (72'-8")

(1) The copings on the north wall are cast stone units that are of a similar cross section as the original, but 24 of the 47 units are severely deteriorated and joints are cracked.



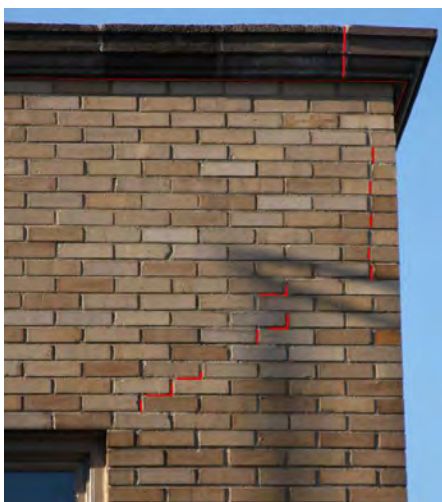
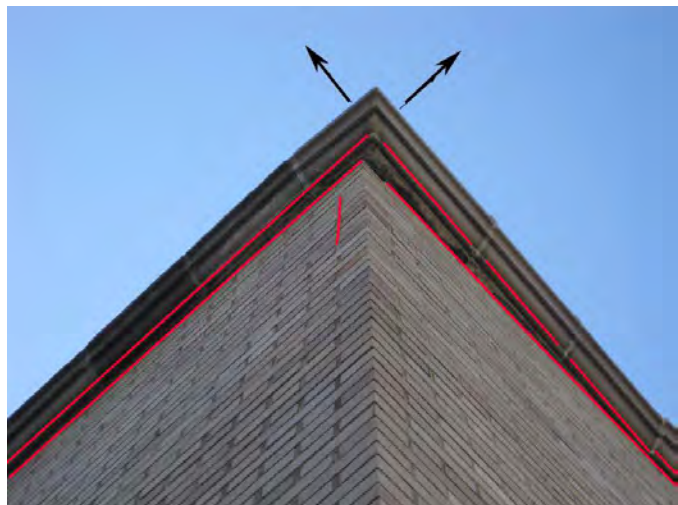
(2) The north face of this coping wall was reviewed from the 2011 Addition roof. Cracked units and gaps in brick wall below were noted.





Flashing appears to be projecting from under the coping. The 1937 drawings show a “fabric waterproofing” sheet under the coping. The cracked mortar joints allow moisture to enter the wall.

- (3) At the northwest corner (from the ground), we noted that the coping was being pushed off the wall in both direction but more toward the west since the north wall is twice as long. The expansion toward the west has also cracked the brick wall below.



4. Review of exterior elevations.

a. General

- (1) Review of exterior elevations was made from the ground and from a ladder at three locations.
- (2) The elevations will be divided between the original building, the 1937 Addition, and the 2011 Addition.

b. South elevation

- (1) General: This elevation is the front of the original building. Discussions will include the east and west portions of the entrance.



- (2) Parapets

- (a) Some parapets were accessed with a ladder
- (b) Eastern
 - i) Accessed with a ladder.
 - ii) Narrow mortar joints are weathered. Some pointing has failed. Watertable is in good condition, but some open joints were noted.



- iii) Pointing at base of parapet wall (at watertable) appears to be installed



improperly and holes were noted in mortar joints.



At top of wall (east central portion), open joints were noted from ladder.

- (c) Center section: Masonry appears to be in good condition, except for some open joints between the bricks and the inlaid panels and mortar joints.



- (d) Western parapet
 - i) Accessed with a ladder
 - ii) Narrow mortar joints are weathered.



Some pointing has failed. Watertable is in good condition, but some open joints were noted. Pointing at base of parapet wall (at watertable) appears to be installed improperly and holes were noted in mortar joints.



- iii) Displaced units were noted near the top of wall (photo right).



- iv) At top of wall (west central portion), open joints were noted from ladder (photo left).

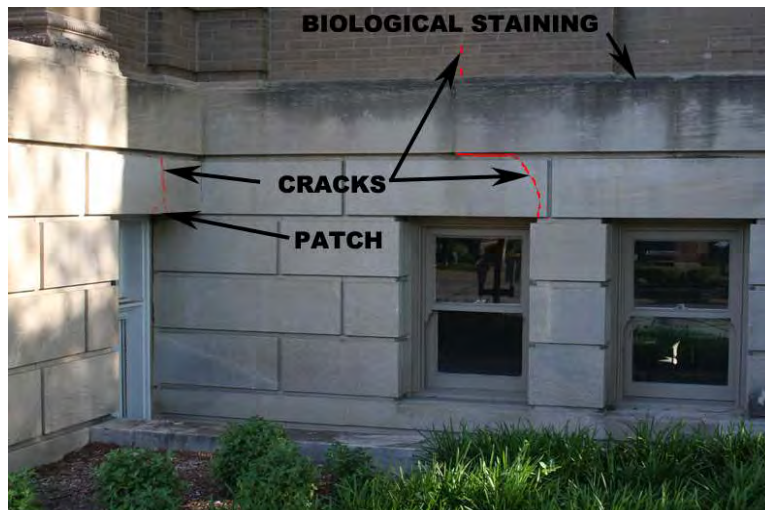


- (3) Eastern wall
 - (a) Looks relatively good, except for some biological staining below the window and along the top of the foundation wall. Some joint discoloration was

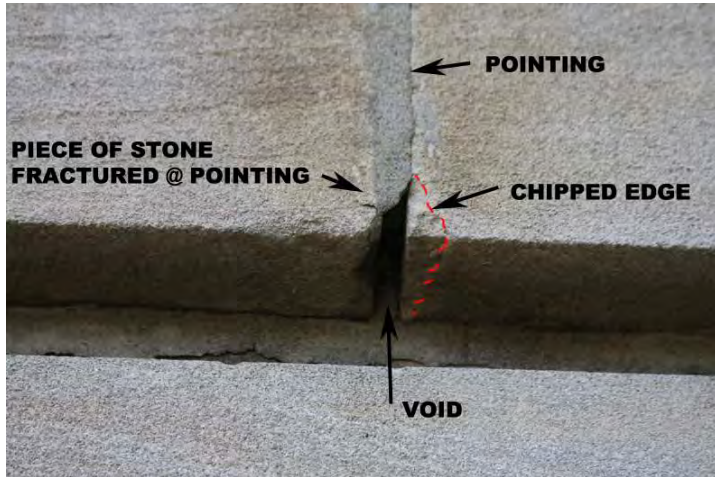


noted at upper left of window, suggesting a leak.

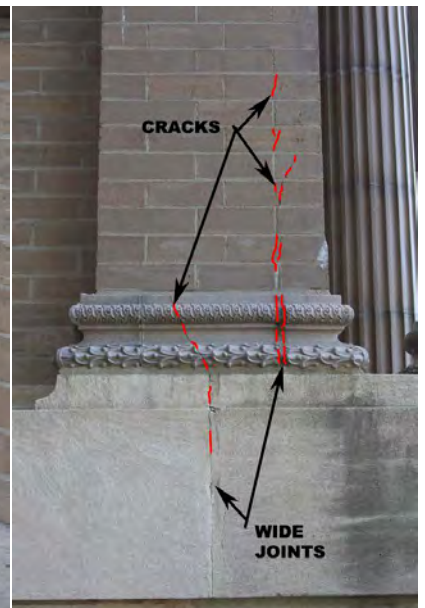
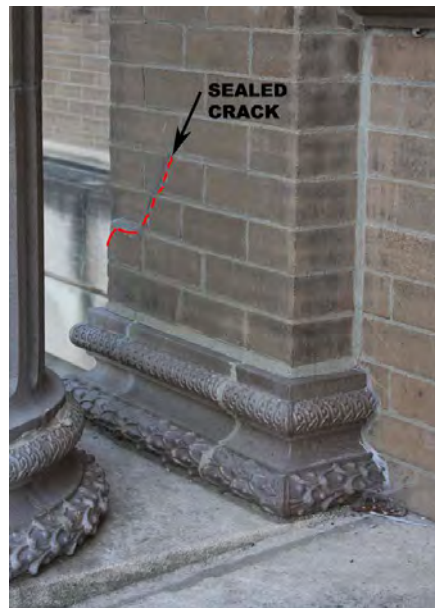
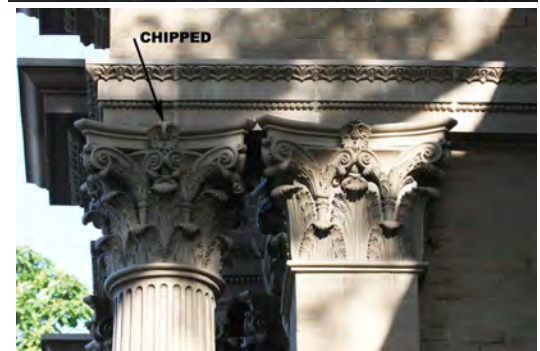
- (b) Signs of moisture coming through terra cotta joints were noted at the inside corner below the watertable.
- (c) Cracked lintels were noted at two basement openings. One crack extends up into the brick wall. Previous pointing and crack repairs,



near this location, are a concern. The pointing repair seems to be too shallow and as a result the edges of the stone foundation wall are cracked and chipped. Reference photos at the top of the next page. No guardrail at lower level stairwell.



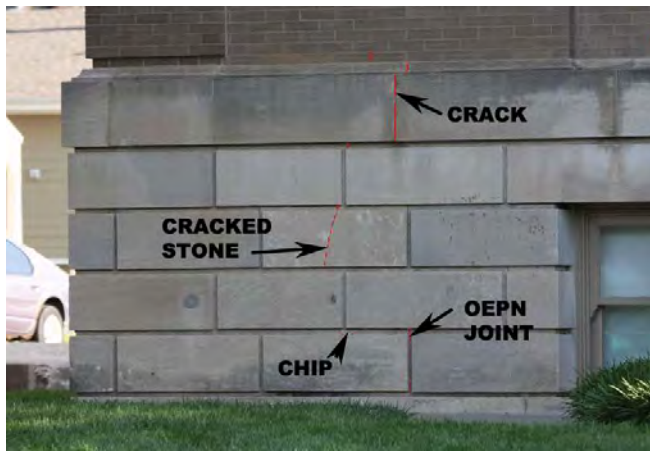
- (4) South Entrance
 - (a) The right terra cotta column capitals appear to be in excellent condition. One slightly chipped detail was noted.
 - (b) The base of the left wall corner is cracked on the west and south faces. Previous repairs have addressed the older cracks, but some cracks appear to be newer than the last repairs.



(c) The sills are also in good condition, except for a few broken terra cotta joint laps.

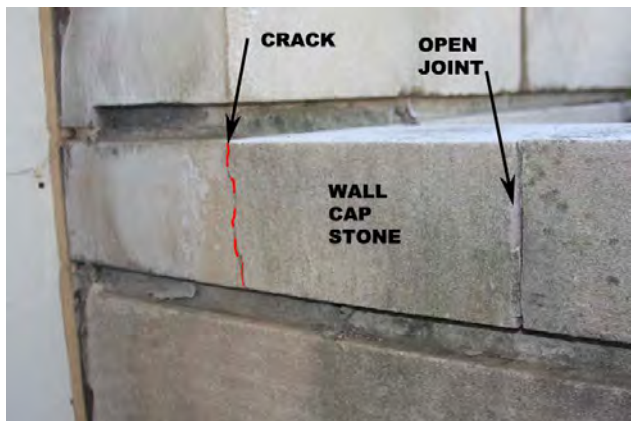


(5) Western wall
(a) Noted a few cracked joints and

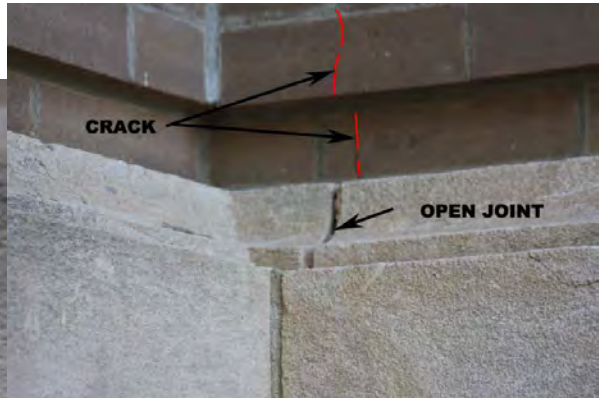


cracked stones in the foundation wall. Biological staining was also noted along the top of the foundation wall.

(b) Abandoned stairwell on the west side of the entrance has a bowed foundation wall. The top two courses are displaced and cracked. No guardrail at lower level stairwell.



(c) Cracks and open



joints were noted at the inside corner.

c. West elevation

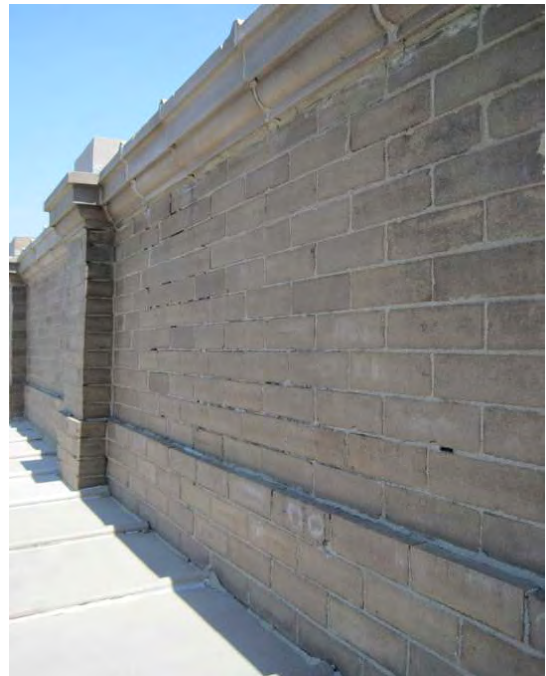
(1) General

(a) This elevation is left side of remaining original building and the west elevation of the 1937 Addition.

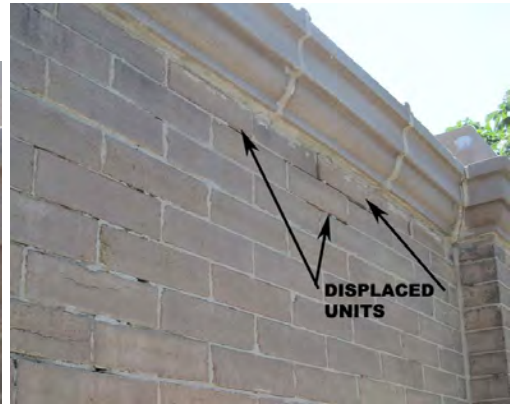
(b) Repaired movement cracks were noted.

(2) Original building parapet

(a) The parapet was accessed with a ladder
(b) Mortar joints appears to be deteriorated in several locations.

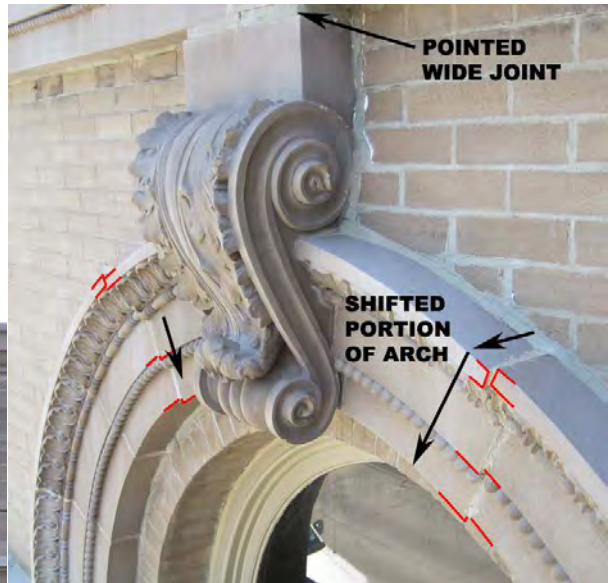


(c) Displaced bricks were



noted at another location.

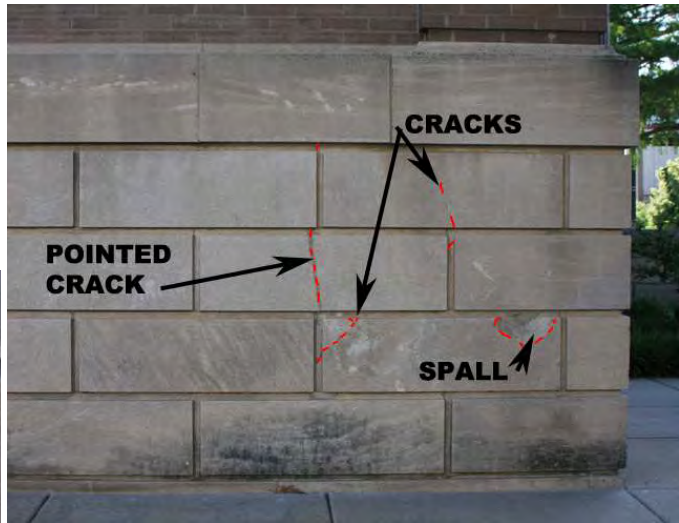
- (3) Original building foundation settlement:
(a) Displacement of arch stones at window head.
(b) Repaired crack at top of wall.



(c) Repaired crack in brick wall below window.



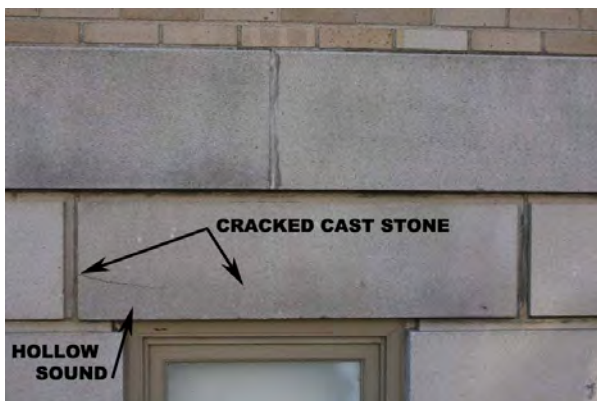
- (d) Cracks in foundation wall near corner and at basement window.



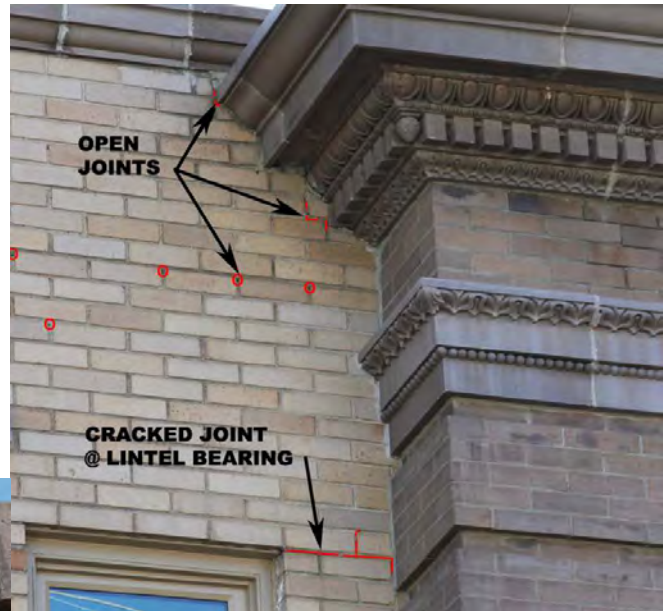
(4) 1937 Addition



- (a) Cracks noted at northwest corner
- (b) Foundation was made with cast stone units. Two cast stone lintels are cracked and one of them sounds hollow (noted in photo).



- (c) Open mortar joints were noted in brick wall near original building's northwest corner. The mortar joint, at the lintel bearing, is cracked.
- (d) Deteriorated



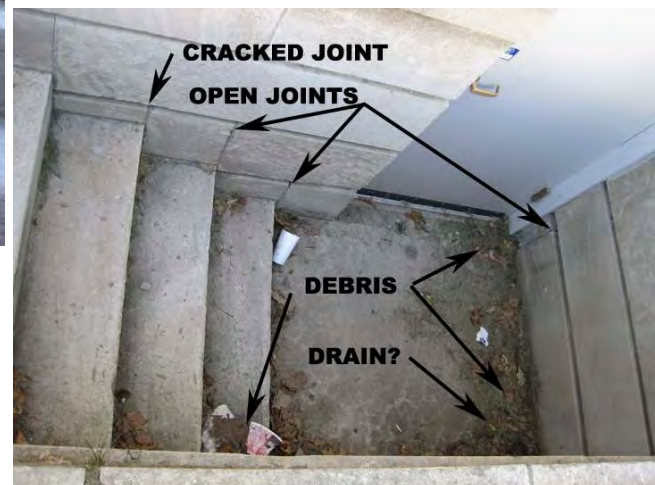
rowlock window sill and cracked joint at jamb were noted.

- (e) Cracked cast stone sill, at head of basement stair, is cracked
- (f) A stones in the stairwell

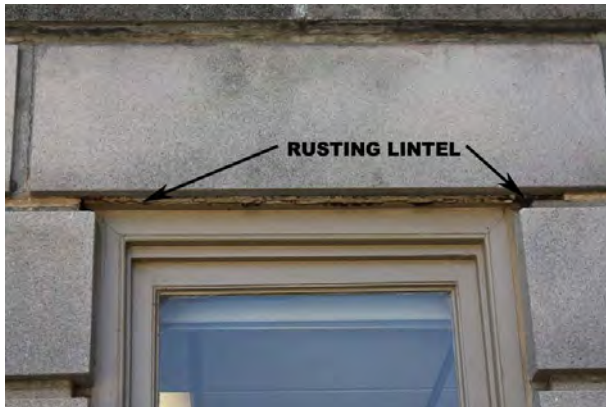


foundation wall is severely deteriorated.

- (g) Deterioration at base of stairwell was noted.



- d. North elevation
 - (1) 1937 Addition
 - (a) Western portion of elevation is partially visible from the northwest. Noted concerns were previously discussed.
 - (b) Eastern portion of north elevation is more visible from the northeast. Lintels were noted to be rusted along this elevation.



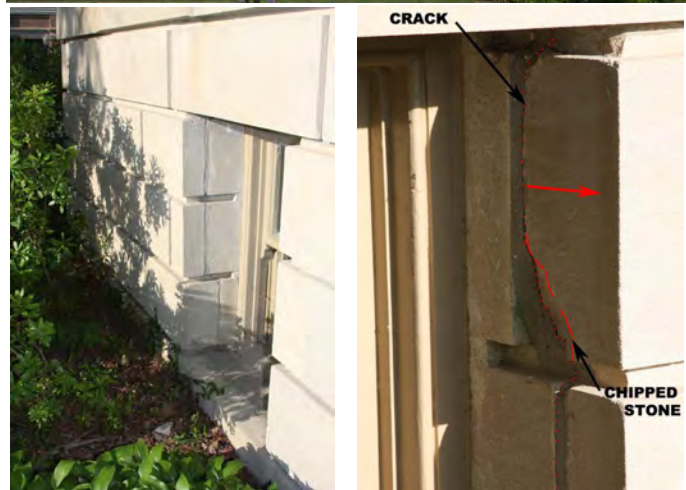
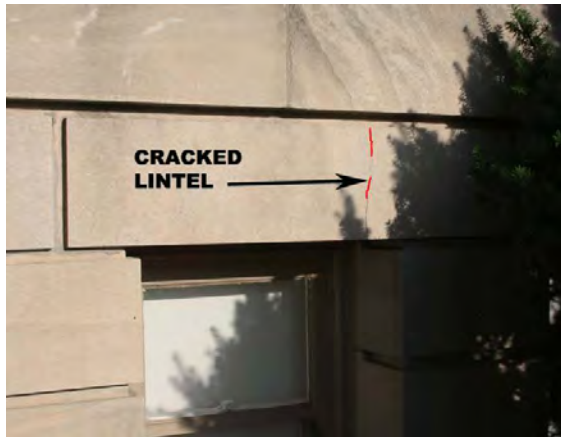
- (2) 2011 Addition: The foundation waterproofing has been improperly terminated above grade. This material will degrade with UV exposure.



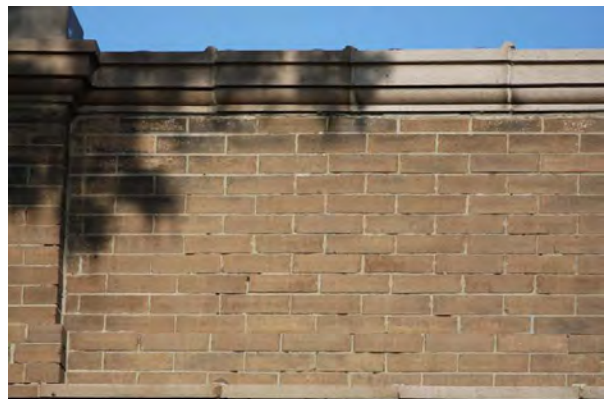
- e. East Elevation
 - (1) General: This elevation is right side of the remaining original building and the east elevation of the 1937 Addition.



- (2) Original building
 - (a) Cracked lintel was noted in the stone foundation wall.



- (b) Repaired jamb conditions were reviewed and previous repairs are cracked.
 - (c) Parapet wall is like the others, except only open mortar joints were noted.



- (d) Signs of moisture coming through terra cotta joints were noted at the inside corner below the watertable. Joints above need to be reviewed and repaired.

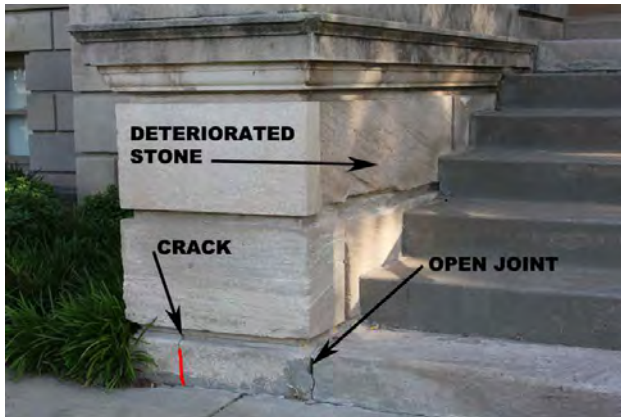


- (3) 1937 Addition: Deteriorated mortar joints at rowlock window sills and a cracked joint next to jamb were noted.



5. Site conditions

- a. Original south entrance stair walls: Some stones are cracked and deteriorated.



- b. Stone wall along walk at southeast corner.
(1) The wall extends a long ways to the corners beyond. No movement joints were noted, except for a resulting crack at the southeast corner.



- (2) South entrance stair walls: Some stones are deteriorated.



- c. Trees: The original building has two trees at the south elevation. The trees are located just off of the two corners about 16 to 17 feet (at about a 45 degree angle). The southeast tree is about 36 inches in diameter and the southwest tree is about 24 inches in diameter.



III. CONCLUSIONS AND RECOMMENDATIONS:

- A. Reroofing Project:** We understand that the relatively new roofing system has failed already and is scheduled to be replaced with a better roofing system. DGM Consultants has not evaluated the roofing. The following recommendations assume that this roofing project will be coordinated with the selected masonry repairs.
- B. Leaning South Parapet Walls**
1. These walls are leaning considerably. Without dismantling the walls completely one cannot be certain of what has caused these walls to lean backwards toward the roof. In our opinion, we suspect that the mortar joints on the roof side are severely deteriorated and have allowed the thicker joints to loose their ability to support the back of the wall. As the walls try to span to the corners horizontally, the joints open in the coping corners

as the walls lean.

2. Repair options
 - a. The long term solution:
 - (1) Dismantle these two leaning walls down to the top of the watertable. Salvage face brick and copings. Clean asphalt coating off of copings.
 - (2) Below watertable replace deteriorated masonry and point remaining joints on the roof side.
 - (3) Install flashing at the top of the watertable to receive counter flashing at the roofing base flashing.
 - (4) Rebuild the parapet walls with new backup bricks and salvaged face brick, including reinforcing and grout to strengthen the wall
 - (5) Flash the top of walls below the copings and include a stainless steel drip flashing on the roof side.
 - (6) Reinstall terra cotta copings.
 - (7) Leave the backs side of the new walls exposed so they can dry out from both sides.
 - b. Short term solution
 - (1) Remove roofing from back side of wall.
 - (2) Rake all mortar joints to the proper depth and point the joints properly.
 - (3) Remove asphalt coating from the face of wall and copings as best as possible.
 - (4) Remove deteriorated bricks from the top of wall and relay to provide a good base for the work above.
 - (5) Flash the top of walls below the copings and include a stainless steel drip flashing on the roof side.
 - (6) Reinstall terra cotta copings.
 - (7) Install a breathable metal panel system to deflect rain, but allow the masonry wall to dry out. This should be properly detailed to tie into the replaced roofing

C. Parapet Walls

1. Remaining parapet walls also need to be exposed on the back sides to allow the walls to dry out to reduce further damage. Based on the condition of the two south areas opened up, we assume that the backs of all walls are deteriorated and should be pointed. The tops of walls are also deteriorated based on the exposed portions and need to be rebuilt so that the top of wall can be flashed and the copings be reinstalled. The slight curvature of these walls is similar to that of the south walls, but is not expected to be as deteriorated. All walls should be reviewed to establish the full extent of the required repairs.
2. Repair options: The two options presented for the severely leaning walls could also be applied to all original building walls to produce the best solution for these severely exposed walls.

D. Copings

1. The original terra cotta coping material is in excellent condition. The finial pieces above the south entrance are in good conditions, but appear to be unstable as a result of joint deterioration.
2. The 1937 cast stone copings have not fared as well. About 50 percent of the 47 units are deteriorated as a result of freeze-thaw cycles. The cast stone units have lasted about 75 years and all units should be replaced.

3. Repairs
 - a. All terra cotta units: Carefully removed, cleaned, and salvaged for reinstallation. This included the finial pieces above the south entrance.
 - b. Cast stone units
 - (1) Option 1
 - (a) Replace all units with wet-cast air-entrained coping units that match the original profile. The top of the coping units should be treated with a clear breathable water-repellant every 10 years.
 - (b) Install units with movement joints every 10 feet and caulk all head joints with non-staining silicone sealant.
 - (2) Option 2
 - (a) Replace all units with Indiana limestone units milled to match the original profile. The top of the coping units should be treated with a clear breathable water-repellant every 10 years.
 - (b) Install units with movement joints every 10 feet and caulk all head joints with non-staining silicone sealant.
 - (3) Option 3
 - (a) Remove deteriorated units and install blocking, metal coping, and counter flashing to cover the brick wall above the adjacent 23 feet wide 2011 Addition connection roof.

E. Mortar Joints

1. The original building mortar joints are thin and have weathered the 108 plus years of exposure well. The severely weathered locations (especially the parapet walls) allow moisture to enter the walls and contribute to further deterioration of the masonry walls and possibly interior finishes.
2. The 1937 Addition has a few areas that need to be pointed to address holes and weathered joints.
3. Repairs: Point all deteriorated or improperly pointed mortar joints with the appropriate mortar according to Preservation Brief No. 2.

F. Cracked Lintels

1. Stone lintels in the original building that are cracked should be properly repaired and patched. Some cracked lintels have been repaired, but the method used has not been evaluated. The patching used at previous repairs may not be done with an appropriate material. Since these units are responsible for carrying a portion of the masonry wall above the opening they need to be structurally repaired and properly patched to help seal the crack.
2. Repair
 - a. Original building: Pin the stone to improve the structural capacity of the units, grout the crack, and patch the surface of the joint to keep moisture out of the wall.
 - b. 1937 Addition: Replace cracked units if they cannot be restored. Further investigation is needed to determine the cause of the spalling.

G. Cracked Masonry Walls

1. There are a few cracks in the masonry walls of both buildings. Most of the cracking appears to be a result of foundation movement or cracked lintels. Cracks in the masonry walls that are open will allow moisture to enter the wall and cause further deterioration.
 - a. The most severe crack is in the west wall of the original building and previous

- repair efforts have filled this crack. No subsequent movement was noted, but the displaced arch units above the window needs to be monitored.
- b. The crack at the northwest corner of the 1937 Addition appears to be the result of brick expansion and the lack of sufficient movement joints. This crack is presently open and should be addressed.
 - c. Other cracks noted in sills, jambs, and other localized conditions should be stabilized and repaired so that moisture cannot enter the wall through the cracks.
2. Repairs
 - a. Minor cracks in walls should be repaired after the cause of the movement has been addressed. Repairs include replacing the cracked masonry units and anchoring units that are not adequately anchored in the wall.
 - b. Original building: The previous repairs should be evaluated and necessary additional repairs made.
 - c. 1937 Addition: Install expansion joint to control movement near the corner and repair cracked corner.

H. Rusted Lintels

1. The rusted lintels on the 1937 Addition cannot be easily corrected without opening the wall up and replacing the lintel, which is not necessary now. The mortar at the lintel bearing conditions should be removed and the joint sealed to keep water out of the wall.
2. Repair
 - a. Remove mortar from in front of steel lintels, clean and prime steel, then caulk joint with a non-staining silicone sealant.
 - b. Clean, prime and paint all exposed portions of steel lintels.

I. Exposed Foundation Waterproofing

1. 2011 Addition: Review foundation waterproofing along the north wall of this addition and address the improperly terminated foundation waterproofing and ensure that it is not exposed to UV rays.
2. Repair
 - a. Adjust elevations of termination so it will be below grade and below the existing flashing and weeps.
 - b. Properly terminate rubberized asphalt membrane with a termination bar and seal the top of the termination bar with mastic.
 - c. Regrade mulch to adequately cover foundation waterproofing system.

J. Foundation Settlement

1. The two large trees on the south side of the building are likely desiccating the soil (drying it out) deep below the surface and even under the building beyond the tree's drip line. This in turn causes the soil to shrink and expand depending on the soil moisture content. The type of cracking on the west wall of the original building indicates that the corner of the building near the tree has settled enough to cause the southwest corner of the building to rotate southward, cracking the top of wall, opening the width of the window opening enough that the arch has partially failed, and cracking the wall below the window.
2. Repair
 - a. Option 1: Maintain consistent moisture content especially around trees.
 - b. Option 2: Remove trees

K. Stone Site Walls

1. The use of deicing salts has likely caused the stone deterioration at stone walls adjacent to site steps. The lack of movement joints in the long site walls at the southeast corner force the horizontal expansion in the wall to accumulate at the corner and crack the stones.
2. Repairs:
 - a. Stairwells: Replace deteriorated stone units and minimize the usage of deicing salts during the cold months.
 - b. Site walls: Install movement joints in the site wall and replace cracked units.

L. Guardrails at Stairwells: The stairwells may need new guardrails to protect these three locations. The two original stair wells along the south wall have not guardrails. Another option might be to install bushes to provide some protection. The north stairwell at the 1937 Addition provides some protection, but may need to be modified to infill large openings.

IV. PRIORITIES

A. Short Term

1. Remove unstable decorative finial units at the top of the south entrance wall and reinstall when wall below is repaired.
2. Prior to reroofing
 - a. Repair leaning walls.
 - b. Rebuild tops of all walls and reinstall terra cotta copings units and new cast units.
 - c. Coordinate flashing with flashing work proposed in roofing project.
3. Repair cracked lintels and cracked masonry walls.
4. Address foundation waterproofing exposure/termination concerns at north wall of 2011 Addition.

B. Long Term Repairs

1. Repair cracked lintels, sills, and cracked masonry walls.
2. Point parapet walls.
3. Point rest of building.
4. Evaluate south foundation movement and implement approved moisture stabilization plan then monitor foundation.
5. Repair site stone walls.
6. Review exterior lower level stairwells and repair cracked, deteriorated, and displaced stone units.
7. Review the stairwells and evaluate guardrail needs.

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Signed Donald G. McMican

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