December 8, 2014

WILKES-BARRE AREA SCHOOL DISTRICT
STRUCTURAL EVALUATION OF JAMES M COUGHLIN HIGH SCHOOL

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December 8, 2014

Wilkes-Barre Area School District
730 South Main Street
Wilkes-Barre, PA 18702

Re: Structural Evaluation of Coughlin High School

Please find enclosed our structural evaluation of Coughlin High School. Per our proposal to the District, our comprehensive study of the entire structure was terminated upon the conclusion that the original building cannot be feasibly restored.

Our team has spent many hours inspecting the building and I would like to stress that, with the scheduled continued monitoring, the school is currently safe for the students to occupy. Recent additions of code-compliant entrance protection ensure this is true on the building exterior as well.

The enclosed report explains the current conditions of the 105 year-old original school and why the structure cannot be feasibly renovated to meet current codes. A review of the Annex structure is also included.

Please call me with any questions.

Sincerely,

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Original High School Overview

The original portion of Coughlin High School was constructed in 1905, with an annex added in the mid-1950's. A maintenance garage was also added in the northwest corner of the building (date unknown).

The original structure is approximately 148' x 227' in overall plan and contains a basement, four floors and a partial attic. The four-story portion of the school measures approximately 148' x 155' in plan, with a 2-level auditorium extending 70' to the west and accessible from the first and second floors. An interior courtyard space rises three stories above the centrally located first floor library and basement shop. No original design drawings were available for review for this evaluation.

It was determined that the library roof originally contained a large skylight in the center of the space, which had been covered with steel framing and roofed some time ago. The walls surrounding the interior courtyard contain a narrow attic space along three of the four sides. The fourth (western) side of the courtyard contains only an inaccessible space above the fourth floor biology labs. The lower portion of the western side also contains the school auditorium, with the stage being located below third and fourth floor classrooms. The three-story high auditorium seating area extends westward from the four-story classroom portion of the structure, with an attic area located at the main school third floor level.

Building Structural Components

The original structure was constructed with load-bearing brick walls of varying thickness located at the building outside perimeter, interior courtyard walls and the interior hallway walls. The floors and roof were framed with steel beams that span between the bearing walls, spaced at approximately six feet on center. The beams support concrete floor and roof slabs. No vertical steel columns were discovered in the four story portion of the framing. The exception was the library floor which appears to have been reinforced with a series of posts and beams visible in the basement shop below. The approximately 70' x 62' library roof is framed with steel trusses that span between the interior courtyard walls.

The floors are spaced at 15'-0" vertically and are accessible via three sets of stairs. The main stair consists of two open flights which rise in opposite directions from a center landing. This stair is located in the east corridor at the main entrance off Washington Street and extends from the first floor to the fourth floor. The enclosed switchback stairs located near the center of the north and south corridors each extend from the basement to the attic levels. The south stair also serves as the connecting corridor to the 1955 Annex at the second and third floor levels.

The majority of the building exterior is faced with granite masonry panels, ornate water tables and decorative rooftop cornices. The western wall, which forms the rear of the auditorium, is finished with common brick. The interior courtyard walls are also faced with common brick and topped with stone caps.

Structural Deficiencies - Courtyard Walls

The load-bearing perimeter and courtyard brick walls have been exposed to the elements for over a century and are exhibiting signs of extensive deterioration. During a routine roof inspection in the spring of 2014, school officials discovered that a number of bricks in the upper courtyard walls appeared to be loose and pulling away from the wall. A more detailed investigation was performed and it was determined the mortar in the top portion of the wall had been seriously weakened, due to water infiltration and freeze/thaw cycles.

The long-term moisture exposure has also taken its toll on the steel lintels above the numerous courtyard windows. The lintels have corroded, delaminated and expanded to the extent the face brick bearing on them has begun to bulge away from the backing courses. Because the water likely entered the walls through deteriorated joint seals in the stone caps, this condition is most severe in the attic windows and becomes less pronounced at the lower levels. Upon discovery of the precarious condition of the brick and the potential for displaced sections to fall, the library was closed and the second floor windows were covered with plywood. The plywood was installed because the bases of the windows are located only a few inches above the library roof, and therefore brick falling from the roof area had the potential to bounce and break the glass.

In the summer of 2014, a short-term parapet repair and brick containment project was completed to allow the students to safely occupy the school for the 2014-2015 year. The most severely deteriorated portions of the courtyard parapet, located in the northwest and southeast corners, were removed down to the tops of the steel roof beams and re-constructed with reinforced concrete masonry units and face brick. Upon removal of the stone cap in these areas it was discovered the mortar had completely failed through the entire width of the walls. Since the mortar had disintegrated, the brick parapets were easily removed by hand.

Because of the poor conditions of the mortar at and below the roof steel bearing, the new parapets were anchored to the roof beams with welded rods.

Since all areas of the courtyard parapets were suspected of similar mortar deterioration, the entire interior perimeter was reinforced with wood plates that were thru-bolted on the interior and exterior wall faces of the wall, The plates were installed at the top of the parapet, top of the attic windows and top of the fourth floor windows. In addition to restraining the walls from further separation and preventing the outer wythe of brick from falling, the boards provided anchorage to a netting system designed to catch any dislodged brick or mortar pieces anywhere between the boards above the fourth floor windows. Bricks above the classroom level courtyard windows, which exhibited less severe bulging due to lintel corrosion and water infiltration, were covered with wire mesh to prevent any bricks from dislodging and falling to the library roof during the 2014-2015 school year.

The partial removal of the parapet revealed that the ends of the steel roof beams, which bear on the inner two wythes of brick, had corroded similarly to the exposed window lintels. In some areas the outermost portion of the beams and their steel bearing plates were severely corroded and delaminated. The expansion of these members produced jacking forces in the brick walls, resulting in movements and cracking. This, in turn, has created more paths for storm water to infiltrate the wall and accelerate the deterioration process. The potential damage of the roof beams was noted during the containment design process and the affected beams were shored with built-up wood studs bearing on the attic slab. This was done to protect the roof from localized failure.

Our investigation of the walls revealed that the majority of extensive structural brick damage is limited to top portion of the wall and has not yet migrated to the floor bearing levels. The outer wythe of brick at the floor levels has been affected primarily in the areas of the window lintels. The lower levels and roof shoring will be monitored during the 2014-2015 winter season to verify any wall movements or downward migration of the wall deterioration.

See the façade evaluation report prepared by MPS in Appendix B for additional pictures and information on the recently completed courtyard repair and containment project.

Interior Bearing Walls

Since they have always been protected by the main roof, the interior walls have not been exposed to moisture infiltration through leaking stone caps or wind-driven rain as the courtyard and outside perimeter walls have been. Therefore these walls were found to be in good condition throughout the attic where they are fully exposed.

While the lower levels of the interior bearing walls are finished with plaster, it can be reasonably assumed that they, too, have not been affected by moisture and that they are structurally sound with regards to the brick and potential mortar deterioration. Locations where movements due to foundation settlements or overloading would be revealed, such as large openings in the walls or at door locations were investigated throughout the school. Inspections of these walls revealed some minor cracking, which is to be expected in a structure of this age, but no areas of immediate concern.

Roof Framing

The roof framing of the original school structure is exposed throughout the attic and the inaccessible spaces between the interior bearing walls and the perimeter walls. With the exception of the ends bearing on the courtyard walls, the roof steel is in fair to good condition. There are areas where previous roof leaks have caused surface corrosion to form on the beam flanges, although not to the extent where section loss is a concern.

The concrete roof slabs also appear to be in fair to good condition with no deteriorated areas discovered. During the 2014 courtyard containment project, the roof was monitored as many areas were loaded with substantial weights of construction equipment, materials and debris. These loads were placed above the interior load bearing walls. The bearing legs of the swing stages (access platforms used to reach the courtyard walls) were placed on the roof slab just behind the courtyard parapet. The roof slab and steel framing performed well under these loads with no signs of movement or cracking noted.

Exterior Facade

An inspection of the exterior stone face and parapets was performed by our historic masonry consultant, Masonry Preservation Services. The MPS study revealed that there are many loose pieces of grout and potential additional spalls of stone in front of deteriorated panel connectors. No large panels were determined to be in danger of imminent failure. However, the steel beams supporting the stone lintels above the larger windows have begun to corrode and minor movements were noted at the ends of these lintels. A more detailed façade evaluation is presented in the next section of this report.

The perimeter sidewalks and entrances to the school are currently protected again falling mortar or stone spalls by sidewalk sheds and fencing. However, it was noted during the façade inspection that the protective scaffolding at the entrances was not compliant with the state code requirements for pedestrian protection adjacent to a demolition project. While this is not a demolition site, the loose mortar and potential stone spalls are consistent with the dangers anticipated for a demolition site safety program. Therefore it was strongly recommended that the existing front and side entrance scaffolding systems were replaced with demolition site-compliant ones. New code-compliant protective "sidewalk sheds" were being installed during the completion of this study. It is our opinion that the other existing sidewalk protection, offset from the building, is adequate and should remain in place until the façade is renovated or the school is abandoned.

Occupant Safety of Coughlin High School

The current porous and loose conditions of the courtyard walls and perimeter parapets will allow continued storm water infiltration and the brick and mortar deterioration will continue. For this reason the roof beams supported by the upper portion of the courtyard walls were shored and the courtyard walls are scheduled to be closely monitored for additional deterioration during the 2014-2015 school year.

While loose pieces of the façade continue to present danger on the exterior of the building, the existing sidewalk pedestrian barricades and protective entrance sheds constructed at the time of this evaluation will be sufficient to prevent injuries to occupants in the event of a stone spall.

One minor interior deficiency noted during our inspections was a number of loose granite stair treads on the various stair cases. Numerous times we observed treads that had slid forward and were easily moved back into their proper location. Unimpeded movement may lead to a tread extending to the point it will become a tripping hazard or even potentially tipping and falling under traffic.

Overall, it is our opinion that is currently safe for students to continue occupying the structure. Should any findings or events during our monitoring of the structure during the 2014-2105 in any way adversely affect the safety of the students, the issue will be immediately brought to the attention of the District.

Recommendations

Immediate Actions/Repairs (1 year continued occupancy)

Immediate modifications to the original building include:

1. Install code-compliant pedestrian protection at the building entrances (currently underway).
2. Repair numerous loose treads throughout the three stairs.
3. Monitor the Courtyard exterior walls

Short-Term Repairs (5 years continued occupancy)

Repairs to allow extended short-term occupancy will include:

1. Shore all roof beams bearing on the courtyard walls, including lateral bracing, to allow wall removal.
2. Remove the damaged top portion of the courtyard enclosure walls. The extent of the mortar damage must be field verified at the time of repair. At the time of this investigation, it was estimated that the extensive mortar loss had migrated from the parapet caps down to approximately the mid-height of the attic level (6 to 8 feet).
3. Install extensions to and/or reinforcing of the corroded ends of the steel roof beams that bear on the courtyard walls.
4. Reconstruct the bearing walls and parapets with reinforced concrete masonry units and face brick.

Preliminary cost estimates for the above short-term repairs range from $1million to $1.5 million and will require the school to be vacated for an undetermined amount of time. These repairs do not address the exterior perimeter stone façade issues which may progress to the extent that the long term repairs noted below are necessary.

Long-Term Repairs (20+ years)

Long-term renovations of the original structure include, at a minimum, the following items:

1. Extensive or complete removal and reconstruction of the interior courtyard walls
2. Extensive repairs to the limestone façade as detailed in the attached MPS report.
3. Repairs to exterior load bearing walls. Extents of the damages to be determined during the façade repairs.
4. Design and installation of a lateral bracing system to bring the structure into conformance with current code requirements.

Design of the lateral (wind/seismic) bracing system and estimating its cost are beyond the scope of this report. Due to the mass masonry construction (no columns), age of the structure and condition/strength of the brick mortar, it is assumed that an internal steel-framed bracing system would be the only method capable of meeting the current wind and seismic code requirements. The system would include the installation of footings and steel columns to tie into the existing steel floor beams, extending from the basement up to the roof level. The frames would also include chevron or X-bracing to provide lateral stability.

Original School Structure Conclusions:

The 1905 school structure is in poor condition and continues to deteriorate. Although it is currently structurally stable, further deterioration is imminent without the implementation of the recommended short or long-term renovations. Left unchecked, the deterioration will begin to create unsafe conditions that will be expensive to repair and may require the school to be closed for extended periods of time. As a part of the overall 2014 Parapet Repair and Containment Project, Leonard Engineering will be performing monthly monitoring of the structure during the 2014-2015 school year.

It is obvious that the installation of the steel lateral bracing system would be an extremely expensive and intrusive endeavor. In addition to the costs of several million dollars, the interior of the school would be disrupted with columns and braces. It is also apparent that the time to install such a system would require the school to be closed for an extended amount of time affecting two or more academic school years. Taking into account the age of the structure and the required improvements in the architectural, mechanical, electrical, and plumbing systems, it is our opinion that a long-term renovation of this building is not feasible. Total costs associated with the required structural renovations cannot be accurately estimated due to the unknown quantities of bearing wall replacement or the detailed configuration of a seismic bracing system.

For order of magnitude costs, shown below is a preliminary estimate of façade repairs only prepared by MPS. These costs do ***not*** include structural wall repairs/replacement or a seismic bracing system:

• Mobilization / Access / General Conditions	$900,000
• Disassemble and rebuild the upper 20 feet of the stone veneer	$3,200,000
• Re-flashing the steel lintels at the stone veneer	$800,000
• Patching of the spalled limestone	$100,000
• 100% repointing of the stone and brick mortar joints	$950,000
• Replacement of the steel lintels (courtyard elevations)	$120,000
• Brick rebuilding	$600,000

- Replacement of building sealants $90,000
- Restoration cleaning $70,000

TOTAL: $6,830,000

It is our opinion that the total costs to implement the required long-term structural improvements to the original Coughlin structure may exceed $25 Million. This figure excludes work required by all other disciplines (architectural, mechanical, plumbing, electrical, etc.)

Per our original proposal to the WBASD Board of Education, the detailed evaluation of this structure was terminated upon the conclusion that long-term renovations are not feasible. While no detailed investigation of the internal floor systems was performed, the structure was inspected thoroughly for indications of any weakened/overstressed members or connections, structural movements or other potential issues. The interior portion of the framing, which has not been affected by years of water infiltration, is in fair to good condition. The exterior portions of the structure will continue to be monitored during the 2014-2015 school year for any signs of further structural deterioration. The District will be immediately notified if any items affecting the safety of the occupants are discovered.

Coughlin High School Annex Overview

The Annex portion of Coughlin High School was constructed in the mid-1950's. This structure contains three floors of classrooms, a cafeteria and gymnasium. There is also a partial basement which contains the wrestling, weightlifting & equipment rooms and the boiler room. A pipe tunnel from the wrestling area to the stair in the area of the Annex main entrance provides a second exit from the basement. The Annex is connected to the original school at two points. There is a single story portion adjacent to the Auditorium and a bridge that extends from an original building stair tower to the Annex at the second and third floor levels.

Because renovations to the original school were determined to be infeasible, the detailed evaluation of Coughlin was terminated and the evaluation of the Annex was reduced to a conditional assessment.

Existing Annex Structural Conditions

No original design drawings for the Annex were available for review for this study. The building was inspected to verify the type of construction and condition of the framing and exterior facade.

It was determined that the Annex classroom areas are framed with conventional steel beams and columns along with open web steel floor and concrete slabs. The gymnasium roof is framed with long-span steel trusses. Based upon the construction time period, it is assumed that the framing is supported by conventional concrete spread footings and reinforced foundation walls.

The Annex was observed to be in much better condition than the original structure. No signs of excessive storm water infiltration were noted and the exterior walls were found to be stable. No cracking associated with foundation settlement was noted in the exterior façade or inside the building. No areas of concern were noted in steel framing or floor slab construction.
During the façade inspection, it was noted that the areas of the joints in the stone panels and brick are failing and in need of maintenance. While the large stone panels protect the steel support structure better

than brick, it is possible that water is infiltrating where the mortar joints are beginning to drop out. In order to determine whether or not corrosion is beginning to attack the steel, a more in-depth destructive evaluation would be required. This would include cutting access holes in the brick and removing stone panels to allow inspection of the steel. We recommend having this study performed if long-term renovation and occupancy of the Annex structure is anticipated.

Recommendations

Immediate Repairs (1 year continued occupancy):
No immediate structural repairs are recommended.

Short Term (2-5 years continued occupancy):
If the Annex is to be occupied for another 2 to 5 years, it is recommended that a façade maintenance program is implemented as soon as possible. This will include the repointing of the brick and re-grouting of the stone panel joints. Maintaining the exterior façade will greatly improve the lifespan of the building and will maintain its future value should the District sell the Annex upon completion of the short-term occupancy. Estimated cost: $250K

Long Term (20 years continued occupancy):
If it is determined the District will continue to occupy the Annex on a long-term basis, a comprehensive façade evaluation to determine the underlying steel conditions should be performed as soon as possible. This study will determine if the above recommended joint maintenance will preserve the integrity of the structure or if steel repairs and/or stone panel connection replacements are necessary. Estimated cost of the comprehensive evaluation is $25K to $35K. The costs to replace or repair the steel and connections may reach $1 million if hidden corrosion has begun.

Coughlin Annex Conclusions

The 1995 Annex was inspected in a cursory manner for structural condition and signs of deterioration, settlements and damages. Original design drawings or previous studies were not available for our review.

Our inspections did not reveal any items of immediate concern. The structure has performed well and should continue to do so providing the recommended maintenance items are implemented.

APPENDIX A - PHOTOGRAPHS

See Appendix B for additional façade/exterior photos

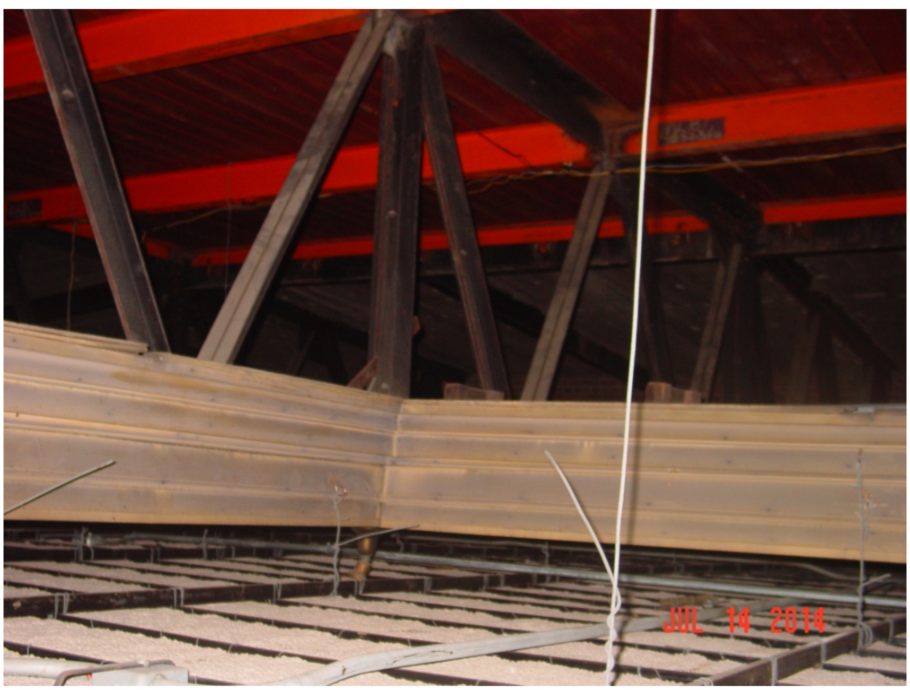
Brick at top of southeast corner of Courtyard wall prior to repairs

Parapet Steel Reinforcing Bars Added During Courtyard Wall Repairs.

Exposed End of typical roof beam at courtyard wall.

Roof shoring installed in Attic during 2014 courtyard wall repair and containment project

View above library ceiling showing steel framing (orange) in-filled above original skylight.



View of former Library skylight window frames and the replacement plaster ceiling hung below.

Existing interior Attic brick walls and steel lintels are in sound condition.

Interior 4th floor beam bearing on Courtyard wall was exposed and found to be in sound condition.

Top of Courtyard parapet prior to repairs in Summer of 2014. Note the deteriorated mortar. The missing bricks were easily removed by hand.

Courtyard wall prior to 2014 repairs. Note top corner of window where heavy corrosion in steel window lintels caused the steel to delaminate, expand and push the brick outwards.

Bowing of brick above an Attic window due to corrosion and expansion of the steel lintel.

Badly damaged sections of the Courtyard parapets were removed and rebuilt in the 2014 repair/containment project.

View of re-built section of parapet during 2014 repair/containment project.

Anchorage of containment netting on rear of existing parapet.

View of completed containment netting installation.

View of completed repair/containment netting in northwest corner of Courtyard. Existing parapet was rebuilt at lower elevation on west side where roof elevation drops above Auditorium stage.

Bridge Connecting Annex (left) to Original School (right)

Annex Main Entrance on Washington Street

Southeast corner of Annex (Gymnasium). Note the loss of mortar is numerous stone panel joints.

Brick / window joint on south wall of Gymnasium. Joint is failing and allow water to infiltrate which may be initiating internal corrosion. The Annex façade should be maintained if short or long-term continued occupancy is anticipated.

West wall of Annex is in fair to good condition. There is currently no visible lintel corrosion. Brick re-pointing is recommended to maintain the condition of the joints and supporting steel.

Single story tie-in of Annex and original school Auditorium area. Note corner joints beginning to fail.

APPENDIX B -

MASONRY PRESERVATIONS SERVICES, INC.

FAÇADE EVALUATION

James M. Coughlin High School
Cursory Evaluation

MPS Job No.: 201440

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1.0 GENERAL INTRODUCTION

The James M. Coughlin High School in Wilkes-Barre, PA is a mass masonry building with a stone veneer on the front and side elevations and a brick veneer on the rear and courtyard elevations. Construction on the building started in 1909. The building has four floors along with an attic and a basement. MPS was hired by Leonard Engineering to complete a cursory masonry evaluation of the building façade. The intent of the cursory evaluation is to provide recommendations for what would be required for masonry restoration of the exterior walls including an order of magnitude budget estimate. MPS provided a revised proposal dated September 8, 2014 which was approved, forming the basis of this review. This was a cursory evaluation, without any exploratory probes, and was not in accordance with ASTM E-2270, *"Standard Practice for Periodic Inspection of Building Facades for Unsafe Conditions"*, ASTM E-2841, *"Standard Guide for Conducting Inspections of Building Facades for Unsafe Conditions"* and ASTM E-2128, *"Standard Guide for Evaluating Water Leakage of Building Walls"*, the industry standards used to complete detailed evaluations of masonry facades. Our review did not include interior investigation with regard to corrosion of structural members which support the building's floor and roof loads. Based on our observations at the courtyard, extensive repair to the structural system will also be required which is not included in our recommended repairs or budget.

2.0 OBSERVATIONS

Observations were completed from grade, from the roof of the building and from a 120-foot boom lift. The attached photographs provide additional information regarding our observations on-site. Following is a summary of our observations:

2.1 <u>Limestone</u>

The stone veneers on the building were constructed from Indiana Limestone. The limestone has recently begun showing signs of distress. Multiple locations of spalls, several of which have come loose from the building, have developed over the last couple of years. The spalls have prompted the installation of fencing and overhead protection to prevent harm to pedestrians. The spalls are evidence of several deficiencies that are driving the accelerating deterioration of the building. The deficiencies of note are as follows:

The mortar joints between the limestone pieces were generally in poor condition. The majority of the joints on the top two floors of the building had failed along with numerous joints on the lower levels. Properly functioning mortar joints are vital in mass masonry walls. The mortar joints reduce the amount of water that infiltrates the wall which allows the wall to dry between periods of rain. If the wall cannot dry out and remains constantly saturated the rate of corrosion of embedded steel increases and the assembly becomes susceptible to freeze-thaw and sub-efflorescence damage.

Sub-efflorescence damage occurs when masonry wall assemblies retain liquid water in sufficient quantities and duration to allow for the entrapped moisture to solubilize salts. When the liquid water eventually evaporates, the solubilized salts recrystallize at or near the masonry surface. This process causes an expansion of the salts that can cause wide spread spalling of individual units. There were plants growing out of the mortar joints in the parapet wall at a minimum of four locations, a clear indication the wall is saturated.

The building's parapets have large limestone copings that do not have any flashing underneath. The lack of flashing below the copings contributes to the excessive amount of moisture entering the exterior wall assembly. The joints between the copings currently have multiple generations of sealant, most of which have failed. The horizontal orientation of the joints makes them susceptible to allowing large quantities of bulk rain water to pass once the sealants have failed.

Cramp anchors are used to mechanically attach the decorative veneer to the masonry back-up in mass masonry construction. Typically in building construction from the late 1800's and early 1900's the anchors were made from ferrous metals, iron or steel. Often times the anchors were protected from corrosion with molten lead, a cementitious cover, or through galvanizing; however, in many buildings the anchors were not protected and were simply embedded in a lime-based mortar. The high ph of the mortar initially creates a protective environment for the steel anchors, but as the mortar cures, carbonation reduces the ph of the mortar, and the steel becomes susceptible to corrosion. At many of the spall locations a corroded steel cramp anchor was embedded in mortar at a kerf cut in the top of the limestone piece. No protection of the anchors was present at any of the corroded anchors we observed.

The remaining spall locations were at the heads of the windows. The limestone pieces spanning the window opening were supported by a structural steel member. Without drawings we were unable to determine the size and shape of the structural members; however, we were able to view the ends of what appeared to be angles or beam flanges and found that many of them had developed significant surface corrosion. Several of the limestone pieces spanning the openings had cracks or spalls. At many of the spalls the steel members were heavily corroded.

Corrosion threatens any ferrous metal (iron, steel, etc.) component, particularly where embedded and in direct contact with adjacent material (stone, mortar, etc.). In the presence of water, steel will corrode (rust), and expand with significant pressure created by the exfoliating rust (the corroding steel combined with exfoliating rust will occupy a larger volume of space than the original steel alone). The pressure generated produces stress in adjacent materials, oxide jacking, and in many building assemblies, can cause severe damage. The stress caused by the corroded cramp anchors and structural steel members directly contributed to the observed spalls.

The building façade has suffered from a lack of maintenance that increased the rate of water penetration. As more water enters the wall assembly and the embedded steel corrodes at an accelerated rate, the deterioration of the wall increases. Increased deterioration creates more opportunity for water to enter the wall assembly and the cycle continues.

2.2 Brick

The rear elevation of the building, including the lower level additions, and the courtyard elevations were constructed with multi-wythe brick walls. At all the locations we observed the mortar joints were in poor condition. On the rear elevations and the lower level additions the window openings had stone lintels. We did not observe any areas of significant brick displacement and only minor areas of brick cracking, even on the brick chimneys. We did note that one of the stone window lintels was cracked, but the surrounding masonry was not distressed.

On the courtyard elevations, the brick was in terrible condition. The deterioration of these walls was so advanced that stabilization efforts were required, including rebuilding portions of the parapet, installing containment netting and anchoring with stainless steel mesh restraints, a project in which MPS provided consulting services. See attached project updates in *Appendix B: Courtyard Stabilization Field Reports* for more information on the measures that were taken. These temporary measures were completed to prevent brick from falling onto the lower roof below. Large areas of the masonry walls were displaced and cracked. At some locations brick had already come loose from the wall.

At the courtyard elevations the brick above the window openings were supported by steel lintels. The lintels were heavily corroded, leading to the observed displacement and cracking of the brick. If allowed to continue corroding, the structural capacity of the window lintels will eventually be compromised.

2.3 Wood and Copper Window Panels

At the ends of each of the stone elevations there were large window openings in the masonry to accommodate individual window systems separated by panels constructed using copper sheet metal over wood framing. The copper had been painted, possibly multiple times, and the paint was peeling, but otherwise the copper was in good condition. We did not note any holes or tears in the sheet metal. We were unable to review the wood below the copper sheet metal, but based on the amount of moisture we observed at other locations of the façade, it is likely the wood has been regularly subjected to moisture.

2.4 Sealants

Sealant was installed at the window and door perimeters. The existing sealants were cracked, hardened, split open, de-bonded, squeezed-out, and generally deteriorated at several areas. Many openings were wide enough to easily allow water to pass.

2.5 Annex

We briefly reviewed the Annex Building adjacent to the 1909 building. The building façade is a combination of stone and brick, with ribbon window systems supported by steel lintels. The stone and brick appear to be in good condition with no major areas of cracking, spalling or displacement; however, we did note several failed mortar joints. The exposed portions of the steel lintels supporting the stone at the window openings have been painted and appear to be in good condition but we were unable to see the unexposed portions of the steel. There were no drip edges at the steel indicating that if there is any flashing it was not installed properly and cannot direct water to the exterior and therefore is susceptible to cyclically exposing the steel lintels to water.

3.0 RECOMMENDATIONS

The James M. Coughlin High School has functioned for over 100 years with little maintenance to the exterior façade, but the lack of maintenance has allowed advanced deterioration to develop which will require substantial repairs to address. Deterioration occurs at an exponential rate and without proper long-term repairs it should be expected that the spalls wills continue to develop at an increasing rate. To restore the exterior walls to function for the next 25 years, we would recommend the following repairs.

3.1 Access & Site

In order to safely and effectively access the different work areas, heavy-duty frame scaffolding will need to be utilized. The scaffolding will need to be integrated with overhead protection at each of the entrances and the sidewalk at the front of the building. Significant coordination and scheduling efforts will be required due to the use of the building and the noise and dust that will be generated during the project. Due to the extent of rebuilding required it may not be possible to use the school during rebuilding.

3.2 Limestone Wall Rebuilding

The top 20 feet of the three elevations with stone veneers, from the top of the parapet down to the large cornice, will need to be disassembled and rebuilt.

- Using cranes and hoists, remove the limestone veneer pieces, label locations and store on-site. Portions of the back-up wall may also require removal. The large limestone pieces that comprise the cornice may require shoring once the limestone pieces above, which act as counterbalance to the cantilever of the cornice, are removed. This will need to be reviewed by an engineer.
- It appears the windows at this level will need to be removed during this work. The windows should be reviewed by a design professional with window replacement experience to determine if the windows could be reused.
- Provide engineering evaluation of the exposed steel elements to determine if the steel needs to be replaced or can be cleaned and coated with a rust preventative coating system.

- At the portions of the back-up wall that were removed, installed new masonry to match the profile of the adjacent portions of the back-up wall.
- Design and install new through-wall flashing, where appropriate, to protect the steel and properly manage future water infiltration into the wall assembly. At a minimum install new through-wall flashing under the copings and at the head of the windows. Install the new through-wall flashing with stainless steel drip edges that extend out beyond the face of the stone veneer.
- Re-install the existing limestone pieces to match the original profile of the façade. This will require the design of a new stainless steel anchoring system. The mortar used to relay the pieces should match the characteristics of the original building mortar.

3.3 Stone Veneer Window Lintel Flashing

The corroded steel lintels at the remaining windows on the elevations with stone veneers need to be addressed.

- Remove the limestone pieces at each window head to fully expose the steel member. This will also require the use of cranes and hoists. Salvaging many of the exiting limestone pieces, particularly those already cracked or spalled, will not be possible. Pieces that can be salvaged should be labeled and stored on-site. New limestone pieces will need to be ordered to replace any pieces that are deemed unusable. Extensive shoring will be required to support the surrounding limestone pieces.
- Provide engineering evaluation of the exposed steel elements to determine if the steel needs to be replaced or can be cleaned and coated with a rust preventative coating system.
- Install new thru-wall flashing including a stainless steel drip edge and a rubberized asphalt flashing terminated onto the back-up wall with a termination bar and sealant.
- Re-install the existing and new limestone pieces to match the original profile of the façade. This will require the design of a new stainless steel anchoring system. The mortar used to relay the pieces should match the characteristics of the original building mortar.

3.4 Limestone Patching

The spalls at the corroded anchors should be repaired.

- Saw-cut spalled areas square will a minimum ¼” edge at all sides to avoid feathered edges.
- Remove exposed portions of the corroded anchor and install new stainless steel anchor.
- Apply a proprietary repair mortar in accordance with the manufacturer’s recommendations. Mock-up repairs should be completed to determine an acceptable color and finish for the patches.

3.5 Masonry Repointing

100% repointing of the limestone and brick mortar joints is required.

- Repointing should be completed in accordance with applicable portions of the Brick Industry Association guidelines.
- Cut out areas of deteriorated mortar consistently and comprehensively. Ensure that all existing mortar is removed from the edges of the masonry units.
- Install new mortar applied in multiple layers/lifts as each previous layer becomes “thumbprint” hard, tool the last layer to match the original mortar joint profile.
- Complete a restoration cleaning of the masonry surfaces to remove atmospheric pollution and improve appearance.

3.6 Brick Veneer Window Lintel Replacement and Reflashing

The lintels above the openings in the brick wall at the courtyard elevations are heavily corroded and need to be replaced.

- Remove brick above the lintel, including shoring as required.
- Remove lintel and install a new galvanized angle, sized to match the existing lintel.
- Install flashing to include a stainless steel flashing extension and end dams. Include properly terminated rubberized asphalt membrane flashing inboard.
- Relay new brick with full head joint weeps.

3.7 Selective Brick Rebuilding

Several large areas of deteriorated brick, most notably at the courtyard elevation parapets, will need to be removed and replaced. Some of these areas will be addressed during flashing repairs, but many are outside of those repair areas.

- All deteriorated, cracked, loose, spalled and displaced sections of brick should be removed to sound masonry. Brick above removal area to be temporarily supported with masonry braces. Clean the sides of the remaining bricks.
- Rebuild the brick areas with brick masonry to match originals.

3.8 Sealant Replacement

The sealants on the building are beyond their useful service life and have failed in many locations. All of the sealant joints on the building should be removed and replaced.

- Remove all existing sealant at windows and doors.
- Clean substrates and prepare surfaces in accordance with manufacturer’s recommendations.
- Install backer rod or bond breaker tape and a new high quality silicone sealant.

3.9 <u>Annex</u>

The Annex needs to have the mortar joints repointed and the sealant joints replaced. Due to the lack of proper flashing at the steel lintels, we anticipate that at some point corrosion of the lintels will cause distress to the surrounding stone panels, but at this point we did not see any visual signs of deterioration. A more detailed evaluation of the existing steel will be required to determine if reflashing the steel would be warranted. This would be a costly endeavor as it would require the removal and reinstallation of numerous stone panels.

4.0 SUMMARY

MPS completed the cursory evaluation of the masonry façade at the James M. Coughlin High School. The purpose of our evaluation was to perform an assessment of the masonry condition, identify the cause/causes of deterioration and provide recommendations for repairs to extend the structure's service life.

Multiple deficiencies were observed leading to extensive recommended repairs. The observed deteriorated masonry wall components, coupled with exposed conditions, allowed the deterioration to accelerate. The constant presence of water trapped within the wall caused by a lack of flashing and failed mortar joints lead to the corrosion of the embedded steel members. The corroded steel in turn caused masonry displacement, cracking and spalling.

Based on the observed deficiencies, extensive repairs will be required to address the deterioration and to implement industry recommended enhancements to help address some of the causal effects impacting the wall assembly. Proper detailing with quality materials in accordance with the Brick Industry Association and other standards are critical to the long-term effectiveness of the repairs. The following recommended repairs are intended to address deficient detailing and limit future deterioration:

- Rebuilding the upper 20 feet of the stone veneer
- Reflashing the steel lintels at the stone veneer
- Patching of the spalled limestone
- 100% repointing of the stone and brick mortar joints
- Replacement of the steel lintels at the brick veneer on the courtyard elevations
- Brick rebuilding
- Replacement of building sealants
- Restoration cleaning

As requested, MPS performed this cursory evaluation of the exterior masonry façade, documented deficiencies, recommended repairs and a course of action, and provided this summary report for guidance. This report has been prepared based on our site observations, information presented to us, interviews with on-site personnel, and our experience with similar projects. If any information becomes available which is not consistent with the observations or conclusions presented in this report, please present it to us for our evaluation. The contents of this report are intended to convey information compiled by MPS as relevant to the project outlined within and for the agreed-upon intent, and for no other purposes.

Prepared By:

Scott Siegfried
Project Manager

Reviewed by:

Jeffrey L. Erdly
CEO

APPENDIX A:

Photographs

Photograph 1:

Overview of the east (front) elevation of the building. Note the fencing and overhead protection in place.

Photograph 2:

Overview of the north (side) elevation of the building.

Photograph 3:

Typical crescent shaped spall ready to fall from the building.

Photograph 4:

One spall that already came loose from the building and one that is ready to fall.

Photograph 5: Multiple spalls in close proximity to each other.

Photograph 6:

MPS removed several pieces of stone from the building that were ready to fall. This picture does not include the multiple pieces of stone that have already fallen to the ground. The falling stone pieces prompted the installation of the fencing and overhead protection.

Photograph 7:

Deterioration of the mortar joints between the limestone panels is allowing excessive water to enter the wall assembly. Slate shims were exposed behind the failed mortar joint.

Photograph 8:

This joint with missing mortar is wide open, allowing large amounts of bulk rain water to enter the wall assembly.

Photograph 9:

Open mortar joint above an insipient spall.

Photograph 10:

The presence of plant growth is an indication the wall assembly is saturated.

Photograph 11:

An original wood shim at a failed mortar joint.

Photograph 12:

More plant growth in an open mortar joint.

Photograph 13:

There was no evidence of flashing below the copings. Without proper flashing, large quantities of bulk rain water can enter the wall assembly.

Photograph 14:
The roof counterflashing on the rear elevation of the parapet extends into the masonry less than one inch.

Photograph 15:
Most of the sealant joints between the coping pieces were failed.

Photograph 16:

Even newly replaced sealant joints were already beginning to fail.

Photograph 17: The crescent shaped spalls were typically associated with corroded cramp anchors. The cramp anchors provide lateral support to the stone.

Photograph 18: Corrosion of the cramp anchor put pressure on the stone, eventually causing the spall.

Photograph 19: Most of the anchors at the spall locations were heavily corroded.

Photograph 20: The corrosion of the anchors is caused by water within the wall. As the walls take on more water the rate of corrosion of the anchors increases.

Photograph 21: All of the stone at the window heads was supported by a steel member, even the massive pieces above the large window openings at the ends of each elevation.

Photograph 22: Corrosion of the steel under the massive stone pieces. Some displacement of the stone pieces was noted, which will continue as the steel continues to corrode.

Photograph 23: Cracked stone pieces were noted above some of the windows.

Photograph 24: Some of the cracks were significant, indicating the stone was under significant stresses caused by the corrosion of the steel below.

Photograph 25:
At other locations the corrosion of the steel caused the stone to spall.

Photograph 26:
The spalls tended to occur above the window jambs, were the steel was fully embedded in the masonry, and therefore, subjected to more trapped water.

Photograph 27: Cracks in the molding just above a window opening appeared to be caused by the same steel assembly that supports the stone above the window openings.

Photograph 28: This molding piece was ready to fall. Without drawings we do not know the configuration of the steel at the window heads, but the proximity of the steel directly above the window to the steel behind the molding indicates they may be part of the same assembly.

Photograph 29:
The entire molding piece was removed by hand without the use of any tools.

Photograph 30:
The steel behind the molding piece was heavily corroded.

Photograph 31: View of the rear elevation of the building. Note the stone lintels over the window openings.

Photograph 32: View of a one of the chimneys on a lower level at the rear of the building.

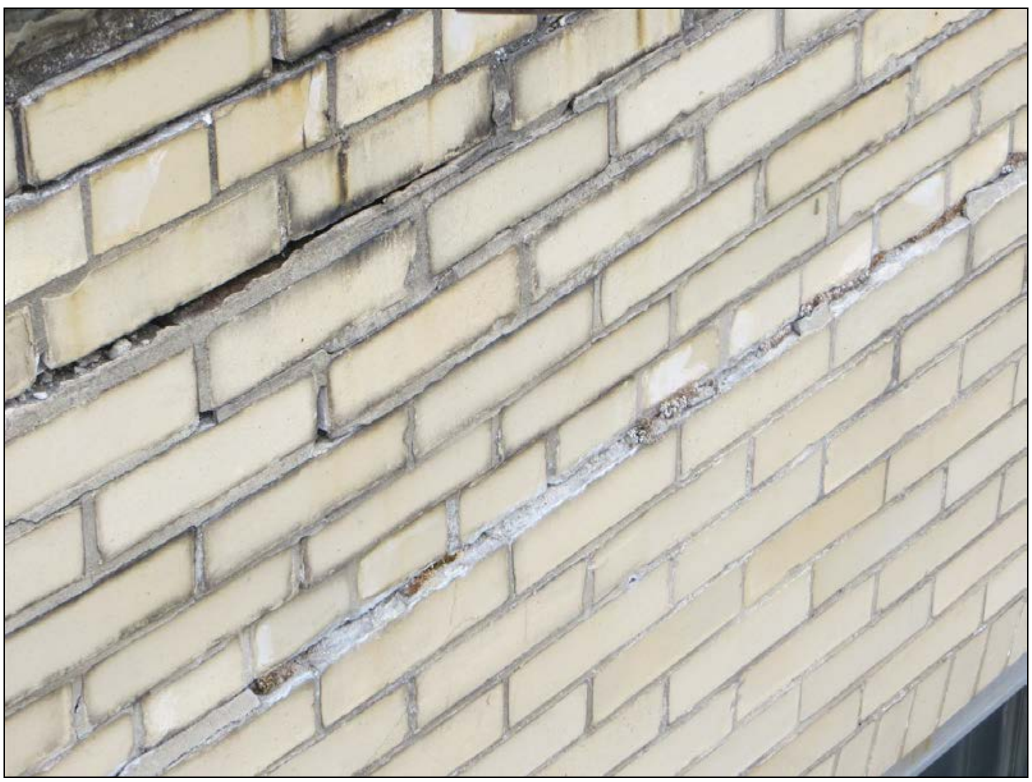
Photograph 33: Chimney at an addition to the building.

Photograph 34: The chimney was in fair condition, but we did not some cracking and displacement at the upper corner.

Photograph 35: The mortar joints on the rear of the building were in poor condition.

Photograph 36: The weathered joints expose the tops of the brick, which creates a lip to catch water, increasing the rate of water penetration.

Photograph 37: The brick veneer on the courtyard elevations was in poor condition, particularly at the parapets. Note the missing brick under the coping.



Photograph 38: Cracked and displaced brick were observed at multiple locations.

Photograph 39: Corrosion of the window lintels is causing the brick cracking and displacement.

Photograph 40: The heavy corrosion of the lintels caused substantial damage to the surrounding masonry.

Photograph 41: At this lintel a brick was pushed off the wall from the corroding lintel.

Photograph 42: The brick above the lintel has displaced outward.

Photograph 43:
Copper sheet metal over wood framing was used at the large windows at the end of each elevation.

Photograph 44:
The copper sheet metal was painted. The paint is now peeling at most locations.

Photograph 45: Failed sealant at the window perimeter.

Photograph 46: Sealant was not installed at a section of the window perimeter.

Photograph 47: Poorly installed sealant has lost adhesion to the stone.

Photograph 48: Sealant has failed the entire height of the window jamb.

Photograph 49: Failed sealant on the rear elevation of the building.

Photograph 50: Sealant on the window sill was never properly tooled, greatly reducing the performance of the sealant.

APPENDIX B:

Courtyard Stabilization Field Reports

MPS
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F I E L D R E P O R T #1

PROJECT INFORMATION

Project: Coughlin High School Courtyard Masonry Walls
Brick Containment and Masonry Repairs
MPS Project No.: 201426
Prepared by: Jeffrey L. Erdly
Site Visit: August 29, 2014

PRESENT

- Jeffrey Erdly - MPS
- Patrick VanWert – D&M Construction
- Tom Leonard – LEI

OBSERVATIONS

- MPS was on-site to review masonry stabilization, demolition and containment efforts underway.

a) Brick parapet demolition had started along the south and intersecting east parapets. Reportedly, only hand tools were required to remove the brick masonry components. Refer to Photograph 1.

b) A majority of the masonry brick ties were consumed by rust. Refer to Photograph 2.

c) The attic level window relief angle exhibited advanced oxide jacking and/or was consumed by rust contributing to vertical displacement of the parapet's outer wythe of brick. Refer to Photograph 3.

d) The 7" X 3 5/8" roof slab support beam end exhibited complete section loss at its interface with the parapet's outer brick wythe. The corroded section (beam flange) measured in excess of 2½" which is approximately 7 times its original thickness of 3/8". This expansion displaced the parapet masonry both vertically and horizontally. Refer to Photograph 4.

e) The original parapet coursing included headers from both the exterior and interior wythes directly below the coping, along with additional interior headers below. Refer to Photograph 5.

f) The coping stones were removed along the north and intersecting west parapets. Remedial flashing and interior counterflashing was observed. Refer to Photograph 6.

g) Again, as observed on the southeast corner, the northwest corner parapet is unbonded, vertically and horizontally displaced and can be removed by hand. This indicates complete loss of mortar/cementitious bond which is required for masonry assemblies to act as a monolithic wall. Refer to Photograph 7.

h) Mr. VanWert requested that the void at the parapet interior wythe where original face brick header was located be filled with grout during repairs. MPS directed him to use brick to fill this space due to additional shrinkage of grout. Refer to Photograph 8.

i) MPS requested that reused brick be cleaned and pre-wetted prior to reinstallation into the new parapet masonry. We also requested that specific care was used to ensure all brick masonry head joints be filled completely with mortar to achieve maximum bond and moisture resistance. Refer to Photograph 9.

- As MPS nor LEI will be on-site full-time, the contractor must enforce adherence to specifications and good masonry practice.
- Items included in this field report were discussed during the on-site visit.
- MPS will return on-site as construction progresses, as notified by LEI.

Distribution: Tom Leonard, LEI for his distribution to any additional parties

Photograph 1:

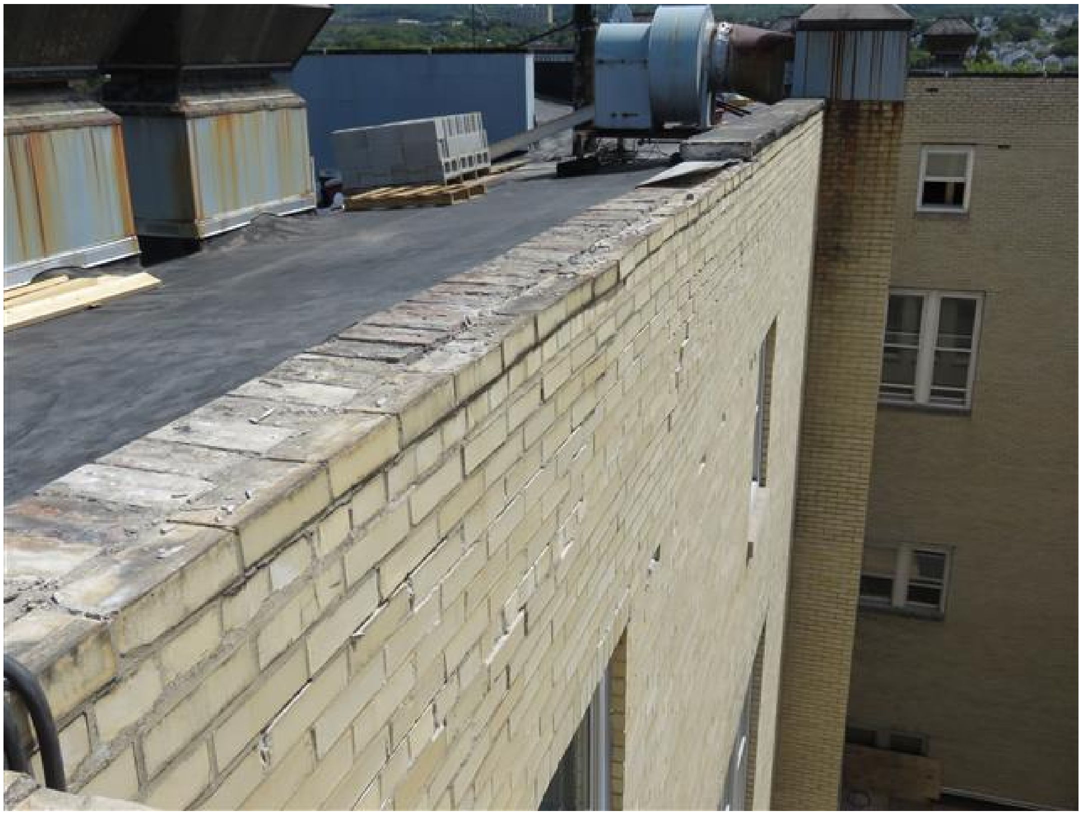
Photograph 2:

Photograph 3:

Photograph 4:

Photograph 5:

Photograph 6:



Photograph 7:

Photograph 8:

Photograph 9:

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FIELD REPORT #2

PROJECT INFORMATION	
Project:	Coughlin High School Courtyard Masonry Walls Brick Containment and Masonry Repairs
MPS Project No.:	201426
Prepared by:	Jeffrey L. Erdly
Site Visit:	September 4, 2014

PRESENT

- Jeffrey Erdly - MPS
- Patrick VanWert – D&M Construction
- Tom Leonard – LEI

OBSERVATIONS

- MPS was on-site to review masonry stabilization, demolition, uncovered corroded structural steel components and containment efforts underway.
- MPS was provided access via swing stage along the project's south elevation adjoining the east return starting at the library roof extending to the attic parapet.

a) Portions of the steel channel/lintel attic floor window head support steel were removed during demolition. Refer to Photograph 1.

b) The relief angles had lost significant original section and in some cases, were completely consumed by corrosion. Refer to Photograph 2.

c) Portions of the angle's horizontal leg exhibited complete section loss (a phenomenon known as knifing). Refer to Photograph 3.

d) Overview of the area reviewed via swing stage including floors 2, 3, 4 and attic. Refer to Photograph 4.

e) The 2nd floor window head exhibited corrosion build-up (oxide jacking) above the window head relief angle and compressive displacement of masonry above and below the lintel at bearing areas. Refer to Photograph 5.

f) More severe oxide jacking was noted at the 3rd floor window head including crushing of jamb brick beneath the lintel's bearing area. Refer to Photograph 6.

g) Corrosion build-up exceeding ½" was noted at the 3rd floor. Refer to Photograph 7.

h) Masonry displacement, both vertical and horizontal, along with exasperated brick spalling was noted at the 4th floor masonry window heads. Refer to Photograph 8.

i) Corrosion build-up exceeding 13/16" was noted at the 4th floor. Refer to Photograph 9.

j) Masonry was removed to the attic level window head. Along the south elevation, both lintel/channel assemblies were removed due to loss of original steel section. Also note original wood window framing exposed behind the metal replacement window. See Photograph 10.

k) The attic level window head along the east elevation while corroded did not require removal. Also note the corroded brick anchors and poor condition of back-up common brick wythes beneath the removed face brick. See Photograph 11.

l) Extensive corrosion was noted at the outer most exposed portion of the steel girder which intersects at a 45° angle the south/east elevation corner. After removal of surrounding masonry, limited sound steel was identified. Mr. Leonard will direct that shoring of these girders will also be required. See Photograph 12.

m) The poor condition of the masonry back-up precludes anchoring dowels into the existing wall to provide lateral anchorage of CMU.

n) Field conditions preclude dowel installation detailed at section J/S-3 on the contract drawings. Based on these conditions, LEI will issue new detailing that will require removing an additional course of back-up brick to the top of the intersecting steel beams. The contractor will be directed to weld bar onto the beam flange directly over the web to provide lateral connection of the CMU. LEI sketch to be provided separately. See Photograph 13.

- Items included in this field report were discussed during the on-site visit.
- MPS will return on-site as construction progresses, as notified by LEI.

Distribution: Tom Leonard, LEI for his distribution to any additional parties

Photograph 1:

Photograph 2:

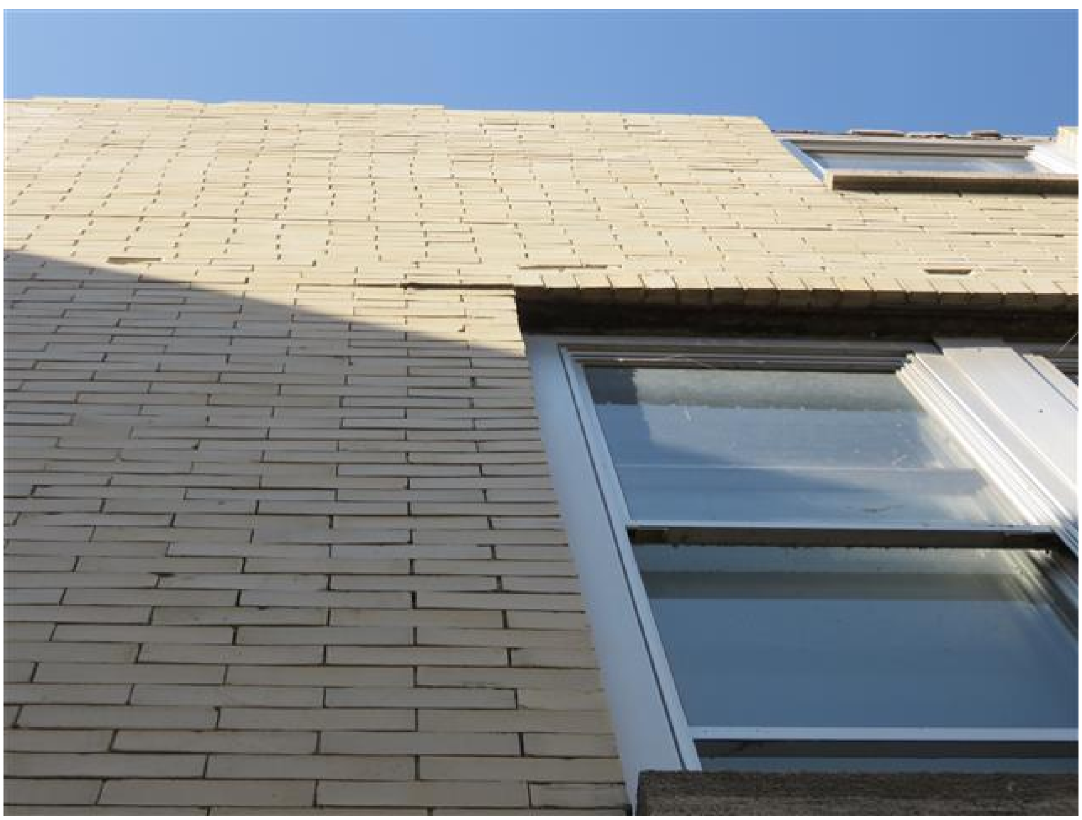
Photograph 3:

Photograph 4:

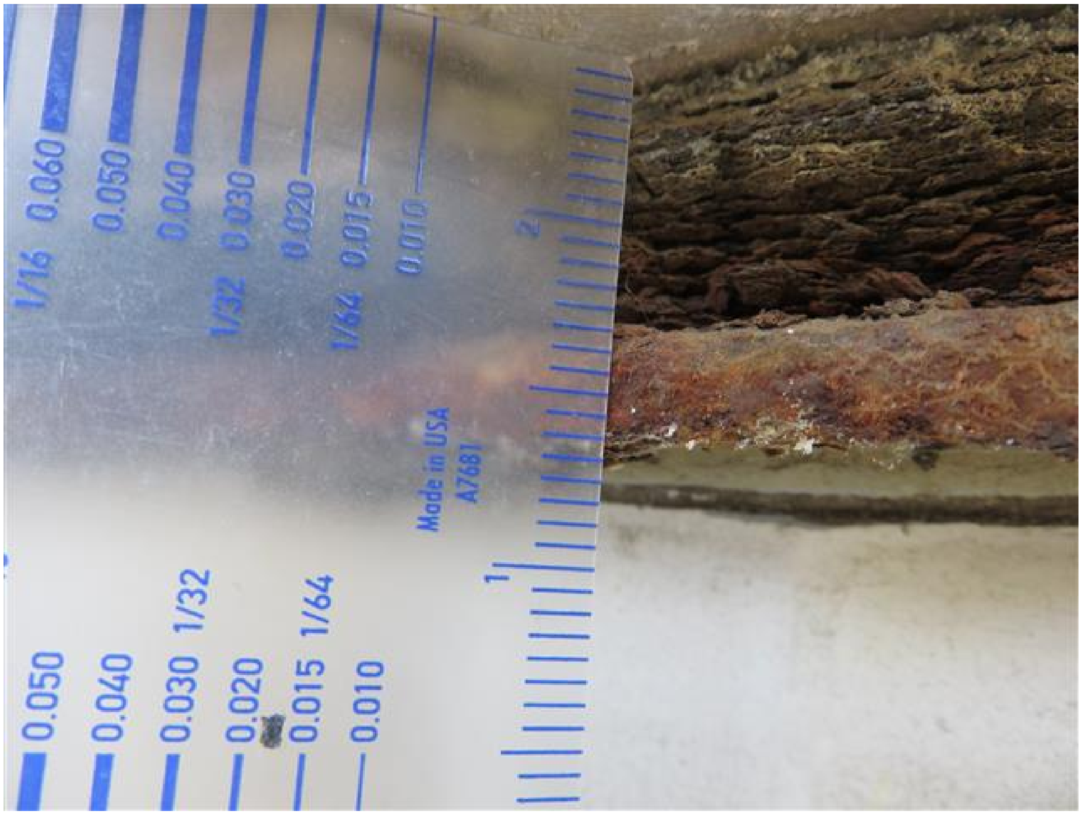
Photograph 5:

Photograph 6:

Photograph 7:



Photograph 8:



Photograph 9:

Photograph 10:

Photograph 11:

Photograph 12:

Photograph 13:

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FIELD REPORT #3

PROJECT INFORMATION	
Project:	Coughlin High School Courtyard Masonry Walls Brick Containment and Masonry Repairs
MPS Project No.:	201426
Prepared by:	Jeffrey L. Erdly
Site Visit:	September 18, 2014

PRESENT

- Jeffrey Erdly - MPS
- Mike Simonson – City of Wilkes-Barre
- Patrick VanWert – D&M Construction
- Tom Leonard – LEI

OBSERVATIONS

- MPS was on-site to inspect ongoing netting installation and wire mesh installation.
- No masonry installation has started as of this date. A discussion regarding acceptable brick ties occurred and Tom Leonard sent catalog cuts of acceptable anchor configurations to the contractor.

a) Netting installation was completed at the following areas:
South Elevation, western side - Refer to Photograph 1.
North Elevation, eastern side – Refer to Photograph 2.
East Elevation, center and northern side – Refer to Photograph 3.

b) The extended netting termination detail at the 4th floor was installed at all three bays along the east elevation. Refer to Photograph 4.

c) Mesh attachment at 2nd and 3rd floor window heads was continuing with reportedly good engagement of the specified tapcon fasteners into mortar joints. Refer to Photograph 5.

d) Reportedly when the treated wood braces are installed and shored up to attach netting, the assembly seems to stabilize. MPS noted that these top parapet areas were not to be over tightened so as to displace the compromised upper parapet sections. This installation appears satisfactory. Refer to Photograph 6.

e) Where the vertical net perimeter adjoins a projecting masonry vent stack, vertical wood nailers have been installed. We recommend that for the remaining areas, only one 2 X 4 is required sized to fit tight against the wall between the intersecting horizontal bracing components. All existing areas are acceptable as constructed. Refer to Photograph 7.

f) We noted that at some locations, the vertical dimension of the netting procured precluded being able to wrap the net along the bottom termination as detailed on the drawings. Tom has approved terminating without wrapping the netting but required anchoring the 2 X 4 at 6" o.c. above the net perimeter rope. Tom will review areas closely. Refer to Photograph 8.

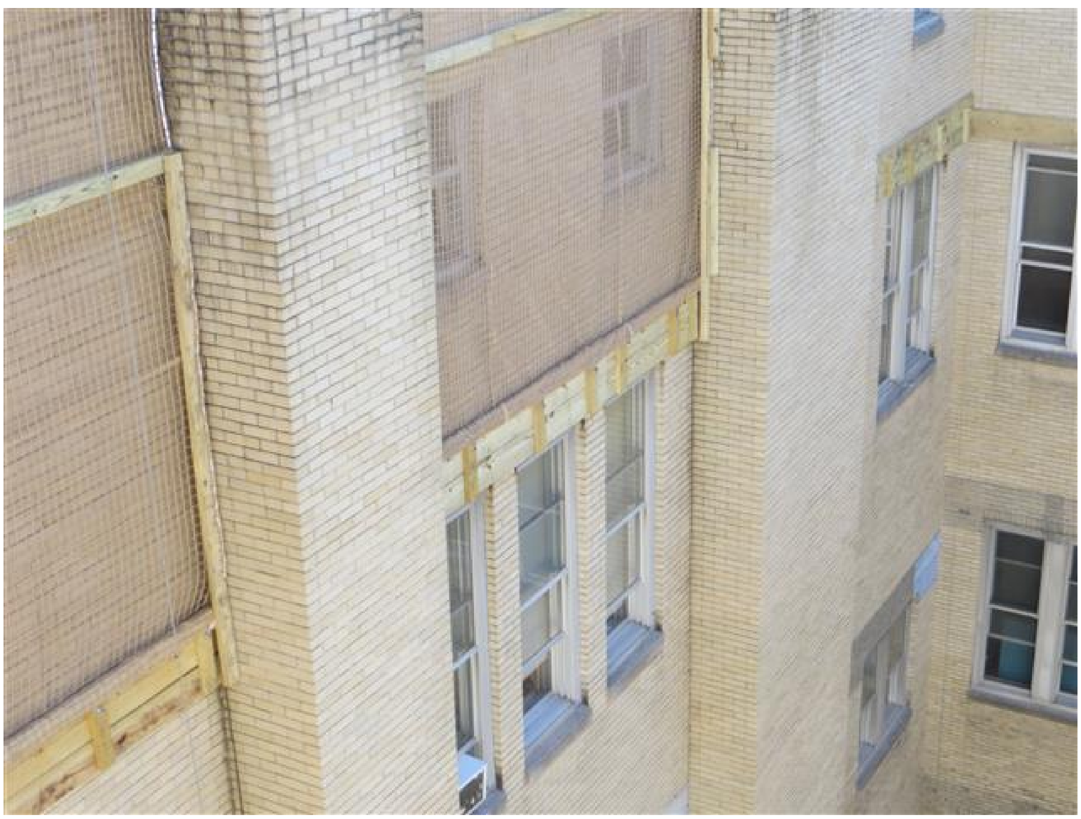
- Items included in this field report were discussed during the on-site visit.

Distribution: Tom Leonard, LEI for his distribution to any additional parties

Photograph 1:

Photograph 2:

Photograph 3:



Photograph 4:

Photograph 5:

Photograph 6:

Photograph 7:

Photograph 8:

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F I E L D R E P O R T #4

PROJECT INFORMATION	
Project:	Coughlin High School Courtyard Masonry Walls Brick Containment and Masonry Repairs
MPS Project No.:	201426
Prepared by:	Jeffrey L. Erdly
Site Visit:	September 30, 2014

PRESENT

- Jeffrey Erdly - MPS
- Patrick VanWert – D&M Construction
- Tom Leonard – LEI

OBSERVATIONS

- MPS was on-site to inspect ongoing netting installation, wire mesh installation and masonry parapet rebuilding.

a) Netting installation was completed or being finished except for the northwest corner where masonry parapets were being rebuilt. Refer to Photograph 1.

b) The parapet west elevation north end was rebuilt including CMU back-up. Refer to Photograph 2.

c) The back-up parapet masonry included through wall stainless steel all thread and adjustable veneer anchors. Refer to Photograph 3.

d) Reinforcing bar had been welded onto the projecting roof support beam end along the north elevation where masonry demolition and rebuilding is scheduled to continue this week. Refer to Photograph 4.

e) A new steel window head lintel had been installed along the west elevation in preparation for the installation of the face brick. Refer to Photograph 5.

f) A discussion regarding the parapet rebuild area included measurements to extend the rebuild to engage the 3rd projecting steel beam east of the northwest parapet intersection so the end CMU will engage a projecting welded vertical rebar. Refer to Photograph 6.

g) Photograph of the structural netting prior to installation. Refer to Photograph 7.

h) The rebuild parapet’s heights were reduced to accommodate the netting securement requirements and lower the parapets to work with CMU coursing. The contractor will infill the parapet ends where projecting original masonry interfaced with the old parapet. Refer to Photograph 8.

- Items included in this field report were discussed during the on-site visit.

Distribution: Tom Leonard, LEI for his distribution to any additional parties

Photograph 1:

Photograph 2:

Photograph 3:

Photograph 4:

Photograph 5:

Photograph 6:

Photograph 7:

Photograph 8:

F I E L D R E P O R T #5 – F I N A L

PROJECT INFORMATION

Project:	Coughlin High School Courtyard Masonry Walls Brick Containment and Masonry Repairs
MPS Project No.:	201426
Prepared by:	Jeffrey L. Erdly
Site Visit:	October 21, 2014

PRESENT

- Jeffrey Erdly - MPS
- Gary Salijko – Apollo Group
- Tom Leonard – LEI

OBSERVATIONS

- MPS was on-site to inspect the completed project. Persons viewing this final review are encouraged to also review Field Reports #1 thru #4 completed and submitted as the work progressed. All work as originally designed and specified by LEI was complete at the time of the inspection.

a) Interior shoring posts located beneath roof slab support beams were in place. At most locations, the shoring posts were erected to interface with the attic window 2" X 12" interior bracing timber diaphragms. Refer to Photograph 1.

b) At angled corner girders, steel shoring posts were added after extensive steel section loss was identified during exterior wythe brick demolition. This additional bracing was intended to augment loss of bearing surface noted during exterior demolition. Refer to Photograph 2.

c) Around the perimeter of the light well, 2" X 12" or 2" X 10" lumber was placed continuously and thru bolted at the existing or rebuilt masonry parapets. This diaphragm was compressed by placing thru bolts at 36" centers to brace the masonry assembly. Refer to Photograph 3.

d) At both the attic level window head and 4th floor window head elevations, continuous lumber diaphragms were installed and thru bolted to capture deteriorated and/or displaced masonry adjacent to steel lintel/girder assemblies built into the masonry walls to span the masonry openings. Refer to Photograph 4.

e) Sections of the parapets intersecting north/west and south/east corners were demolished and rebuilt prior to installation of the timber compression diaphragms. Refer to Photograph 5.

f) After the parapets, attic and 4th floor window level diaphragms were installed, double level structural debris netting was attached. The netting was installed along the rear of the parapet and continued uninterrupted over the coping down to the 4th floor window heads. All netting was attached to the thru bolted timber diaphragms at three levels. Refer to Photograph 6.

g) The timber diaphragms were compressed using ½" diameter stainless steel all thread with washers and nuts located at the maximum spacing of 36" on center. Refer to Photograph 7.

h) The remaining 3rd floor and 2nd floor window head assemblies were covered with galvanized diamond mesh cut to wrap around the window head masonry and preclude significant brick masonry spalls from becoming dislodged. This mesh was attached using ¼" X 1 ¾" tapcon fasteners. Refer to Photograph 8.

- Summary. The attached masonry debris netting installation, along with associated timber diaphragms and mesh, must be inspected on a monthly basis through the fall/winter of 2014/2015 by a qualified professional. Any significant brick spalling that is contained within the netting, must be removed by early spring 2015 as part of the continued observation/inspection process. This brick containment repair was designed as a temporary measure to extend usage of the facility through the end of the 2014/2015 school year.

- It is our opinion that the temporary bracing and netting, as installed, will capture expected brick spalling that may occur through the 2014/2015 school year. Again, we caution that the areas must be visually inspected by a competent professional on a monthly basis. As with any masonry assembly of this age and condition, small brick or mortar shards could become dislodged as the result of cyclical thermal expansion and contraction and freeze-thaw cycling.
- Final review submitted 10-21-2014.

Distribution: Tom Leonard, LEI for his distribution to any additional parties

Photograph 1:

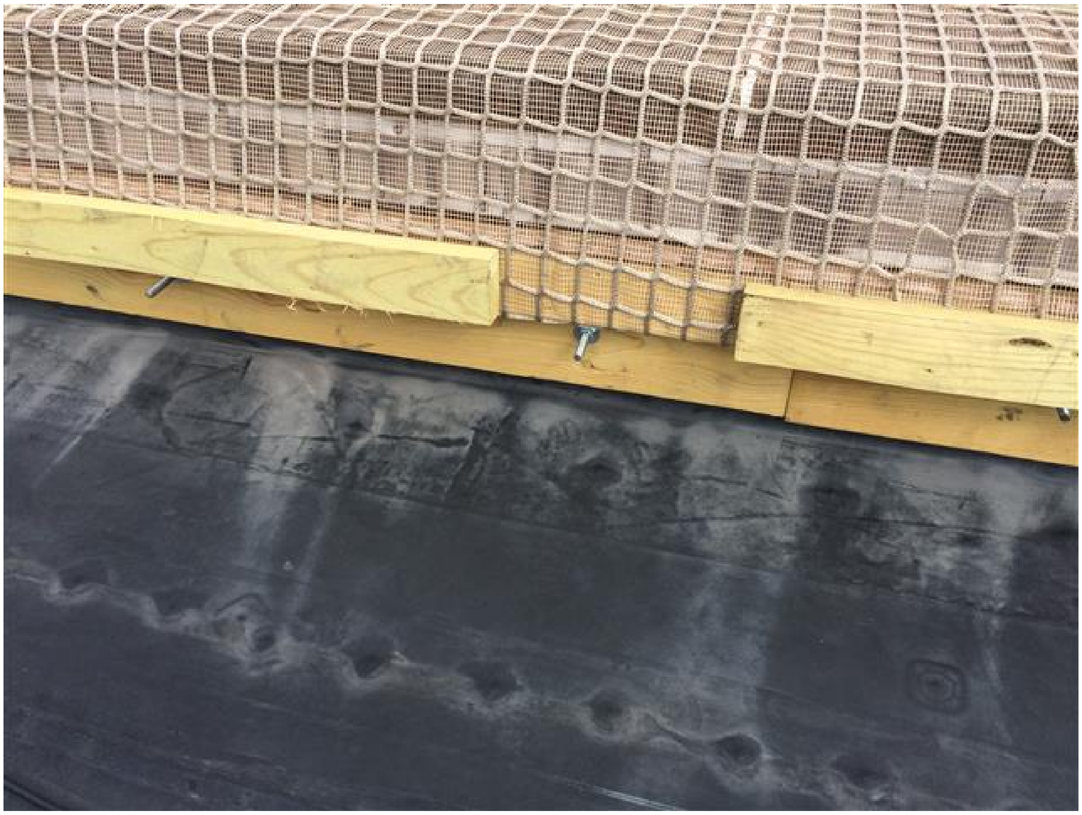
Photograph 2:

Photograph 3:

Photograph 4:

Photograph 5:

Photograph 6:



Photograph 7:

Photograph 8: