KAESE & LYNCH
ARCHITECTURE AND ENGINEERING LLP

8 September 2016

Mr. Angelo Rubbo
Assistant Superintendent for Business
Pelham Free School District
575 Colonial Avenue
Pelham, NY 10803

Re: Conditions Report
Hutchinson Elementary School

Dear Mr. Rubbo:

At your request, K&L personnel conducted a visual conditions survey of the facades of the Hutchinson Elementary School from the ground using binoculars and up close inspections on 29 June 2016. Based on the findings of the initial observations additional close-up examinations were made from lifts and pipe scaffolds on 18, 19, 20 and 27 August 2016. We documented our observations with photographs and field notes on building elevations. All observations were made on hot summer days with temperatures varying from the low 80's to mid-90's. The following is a summary report of our findings with photographic documentation of representative conditions. The report does not specifically identify all observed locations.

BACKGROUND AND CONSTRUCTION HISTORY
The existing Hutchinson Elementary School replaced the North Pelham School building on this same site which was destroyed by fire in 1912. The District provided us with their archive of architectural plans for this school. From those plans and other source information we have compiled the following building chronology.

The original section of the school was built in 1914. At this writing the name of the architect is unknown. The school was expanded with additions on the west and east ends. The archive drawings dated 1924 indicate additions to the east and west ends of the school, designed by Starrett & Van Vleck, Architects, of New York City. A variation of the west addition was built but the east addition was not. Two years later Starrett & Van Vleck designed a different addition to the east, the gymnasium wing, which was constructed and opened in 1928.

Over the past thirty years the District has conducted several maintenance, repair and alteration projects. We also reviewed those drawings; the scopes of work are as follows:

- In 1980 the brick parapets of the 1914 and 1924 sections were shown to be rebuilt and localized repointing was executed on all elevations. Allan Anderson, Architects & Planners of Rye, NY were the project architects for this work.
- In 1992 the low-slope roof was replaced and extensive repointing executed on all elevations.

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- Some areas of parapet on the 1928 section were rebuilt; Fuller and D'Angelo P.C., Architects and Planners of White Plains, NY prepared the drawings for this work.

EXTERIOR BUILDING DESCRIPTION

The Hutchinson Elementary School is designed in a very simple eclectic style that incorporates elements of Classical Revival (yellow brick, the original 1914 building had a balanced facade), Gothic (pointed arched windows in the 1928 wing), and the Arts & Crafts (rubble stone foundation).

The building consists of two major components that in plan basically create the letter "L": the central block (original building) and west wing (1924) form the vertical stem of the "L", and the east wing crosses it (1928). The walls appear to be load-bearing masonry, and the drawings show only steel angles for lintels over windows and doors, no vertical steel elements or structural spandrel beams. However, the pattern of cracks in the 1928 wing is consistent with steel columns. The foundation is rubble stone. The upper two stories are faced with yellow brick in a common bond pattern. The trim is limestone and/or cast stone. The roof is rubber membrane.

All windows are aluminum replacement of unknown date, but may date from a District-wide window replacement program in the late 1980s.

OBSERVATIONS

Note: observations of the existing school are presented from the northeast corner of the building counterclockwise; allowing for two west and two south elevation sections.

<u>North Elevation</u>

1. New parapets of varying heights have been constructed at the majority of the north facades. Different types of brick were used for the parapet replacement at different locations.
2. Out-of-plane bricks, horizontal cracks and open joints were observed at the lintel line of several of the top story windows (Photo 1 and 2).
3. A second horizontal piece of steel extends the length of these window openings above the original steel lintel. There is rust atop the steel lintel. The observed opening was previously filled with mortar. The gaps we observed from the ground are locations where replacement mortar fell out and/or new displacement occurred adjacent to the upper steel (Photo 3). The mortar and brick at the underside of the original lintel appears to have been displaced northward approximately ½ in. (Photo 4)
4. A vertical crack was observed in the new parapet approximately over the entrance door. This crack was previously ground out and filled with sealant.
5. Towards the east end of the north facade the upper window lintels exhibited significant bowing and displacement (Photo 5).
6. Replacement brick was observed at some of the ground floor window lintels. The steel lintels were significantly deteriorated (Photo 6).
7. Bulged brick was observed at the east end of the north elevation (Photo 7 and 8).
8. Additional bulged brick was observed in the spandrel area between the top floor and the middle floor of the protruding portion of the north elevation (Photo 9).

9. The upper floor window sills at this location are set so that the upper portion of the sill is almost level and in one case water appears to be ponding against the building rather than draining off the sill (Photo 10).
10. One vertical window cap was significantly bowing just to the east of the entrance at the middle set of windows (Photo 11). Attempts to remove the panning by hand were unsuccessful. Interior gypsum board finishes are exposed where the panning has bowed (Photo12).
11. There are open and deteriorating mortar joints in the remaining sections of original brick (Photo 13).
12. Biological growth, including moss, was observed in both newer and original mortar joints at the walls on the north side of the building (Photo 14).

<u>West Elevation</u>

1. The upper and middle floor single window lintels are significantly deteriorated.
2. Both four-part window lintels are significantly deteriorated (Photo 15).
3. Bulging of the masonry was observed at the spandrel area above both of the four-part windows (Photo 16).
4. Cracks in the brick and mortar joints were observed at the bulges above the four-part windows (Photo 17).
5. An inspection opening was made at the northernmost four-part window (Photo 18). The opening revealed that the spandrel was composed of two, 15 in. high (toe-to-toe) C channels. The outermost channel had a 6.5 x 2.5 in. angle anchored with a rivet as a lintel. The rivet was significantly deteriorated. The C channel had ½ to ¾ in. rust scale on the face of the C channel; ¼ in. rust was observed atop the channel. On the angle ½ in. rust was found on the horizontal leg, ½ to ¾ in. rust was observed on the vertical leg of the angle (Photos 19, 20). The vertical leg of the angle is also deformed.
6. There is approximately a 1-½ in. separation between the face and back up brick wythes large enough to insert my hand (Photo 21).

<u>South Elevation</u>

1. New parapets of varying heights have been constructed at the majority of the south facades; portions of the rebuilt areas extend to the top of the upper window lintel.
2. Vertical cracks were observed at several locations in the rebuilt parapets (Photo 22).
3. Horizontal cracks and open mortar joints were observed at the lintel line of several of the top story windows (See Photo 22).
4. Areas of the new brick had open mortar joints.
5. Displaced and bulging areas of brick were observed above the top floor windows as well as at the spandrel area between the middle and top floor windows (Photos 23 and 24).
6. The displaced and bulging areas of brick were observed in both the original brick installations and the replacement brick (Photo 25).
7. The two single window lintels to the west of the main entry exhibited significant bowing and displacement.
8. Rusted window panels were observed at the top floor windows in the main entrance bay (Photo 26).
9. A cracked window sill was observed to the east of the main entrance at the middle set of windows (Photo 27).

10. Several step cracks originating at the upper corners of windows were observed (Photo 28).
11. New window lintels have been installed in the bay to the east of the main entrance.

<u>West Elevation</u>

1. The parapet at this elevation has been rebuilt with different bricks than the adjacent south elevation.
2. At the lintel level of the six large windows there is a continuous crack; the brick above the crack is displaced to the west (Photo 29).
3. The corner area that includes the two large pilasters and the fenestrated area between has numerous vertical cracks, fractured bricks and areas of displacement (Photos 30, 31).
4. The face bricks of the pilasters are fractured and cracked in seemingly random patterns.
5. The cast stone sills exhibit cracking (Photo 32).

<u>South Elevation</u>

1. The vertical cracking of the southern pilaster is also found around the corner to the south side of the pilaster (Photo 33).
2. The eastern pilaster exhibits similar vertical cracking and displacement of the masonry (Photo 34).
3. Vertical and step cracks were observed in the mid-level panels located to the west and east of the three arched brick recesses.
4. The face bricks of the pilasters and panels are fractured and cracked in a seemingly random patterns.
5. Cracks were also observed at the returns of the pilasters (Photo 35)
6. The three top floor windows above the main entrance have step cracks that emanate from the window corners (Photo 36).
7. The two smaller pilasters on either side of the windows have open mortar joints, cracks and displacement of the masonry (See Photo 36) as well as fractured bricks.
8. Portions of the cast stone entryway have been replaced. Some additional stones have surface deterioration and missing sections.

<u>East Elevation</u>

1. The corner pilasters exhibit vertical cracking and areas of brick displacement (Photos 37 and 38).
2. The face bricks of the pilasters exhibit both vertical cracks (Photo 39) and are fractured and cracked in seemingly random patterns (Photo 40).
3. Cracks and open joints were observed between several of the upper floor window lintels to the south of the entry. Additional cracking was observed at pilasters between the windows. The lintels were bowed. (Photo 41)
4. The masonry above the entry stair exhibits numerous types of deterioration (Photo 42). The brick and the cast stone window surrounds and ornamentation is fractured with both vertical and horizontal cracks (Photo 43).
5. The north side of the stairwell is bowed (Photo 44).
6. We observed masonry displacement, open joints, and spalled cast stone elements (Photos 45, 46).

7. There are enlarged joints above the window lintels at the middle floor to the north of the entry. The southern cast stone lintel was removed. A deteriorated steel angle was found behind the cast stone. The next two lintels to the north were removed. No steel was found behind the cast stone lintels. The remaining two cast stone window lintels at the north end were left undisturbed. The adjacent open joints were repointed.
8. Efflorescence was observed at the rebuilt northeast corner, top floor.
9. The fence at the retaining wall to the right of the northeast corner is rusted and in some locations not connected to the cast stone base below (Photo 47).

<u>General</u>

1. Window sealant was typically found to be embrittled, exhibiting surface and full depth cracks, splits and holes. Separation from either the window or the adjacent masonry or both was common (Photo 48).
2. Windows were found to be out-of-plane, with detached spring balances, and unable to close fully and/or lock.
3. Five different types of bricks were observed on the facades.
   A. Original (a solid brick)
   B. A slightly orange brick at the lintels on the north and south elevations
   C. Yellow brick at the northeast corner repairs
   D. A variegated brown brick at the east parapets (with frogs)
   E. A second yellow brick that was used for the parapet and lintel repairs/rebuilding on the north and south elevations (with frogs)
4. Exposed portions of the window and door lintels are not painted.
5. Flashing (membrane or metal) was not observed at window and door lintels except for one location at the five top floor windows, east elevation.
6. A bituthene membrane has been installed at the top of the remaining original decorative brick corbelling at the spandrel level (See Photo 18).

DISCUSSION

Based on the different types of bricks observed, this building has seen at least 4 different repair campaigns. The original brick is a high-fired yellow brick that had extensive use in the early 20^{th} century. It's use in school buildings is very common. Because of its very dense nature, the brick is very resistant to moisture and weathers well unless water manages to get behind the brick through open joints, cracks, leaking roofs etc. When that occurs the density of the brick is a problem because water cannot readily escape. If this brick becomes saturated it has a tendency to internally fracture resulting in cracking, creating seemingly random patterns of cracked bricks. This pattern is different from two other issues, ice lensing and mortar joint cracking.

It is likely that some of the masonry displacement and bulging we observed is due to the presence of water behind the brick that freezes and expands causing a cavity to develop between the face brick and the backup brick. Over the years as the water continues to collect and expand, the cavity grows large enough for the ice to actually push out sections of the face brick. Portions of the east stair clearly exhibit this phenomenon.

Because the brick is laid a common bond, there appears to be no headers tying the outer wythe of brick to the back-up masonry. This could have been done with metal wall ties or with angled, cut bricks. Metal wall ties, even galvanized ones, do not last 100 years, nor is their use common in load bearing masonry walls. Ties of this nature are typically found after WWII as the types and shapes of wall backup commonly started to vary and cavity walls became more common. There is no indication on the 1980 or 1992 repair drawings what, if any, reinforcement or wall ties were used to rebuild the parapets, which might also explain some of the bulging in those rebuilt areas.

The bricks used in the 1980 and 1992 rebuilt parapets are cored (frogged). The original bricks were solid masonry. During construction cores are never fully filled. When cored bricks are placed over solid masonry, water can condense on the sides of the frogs and start to run. When the water hits the solid masonry, there is nowhere for it to go other than to be absorbed into the adjacent backup masonry and surrounding mortar joints. The excessive amount of water will cause premature deterioration of the both the brick and the mortar joints. Biological growth like that observed on the north wall is also common. The north wall is almost fully shaded allowing additional biological growth because the wall doesn't dry effectively and the sun never heats the wall enough to kill off the biological elements.

Another typical cause of bulging masonry is excessive pressures in the wall. We often can associate the pressures with deteriorating steel elements. A simple rule of thumb is that one inch of steel (if left unrestrained) can produce ten inches of rust. In spandrel locations and in locations around lintels rust jacking is the typical cause of the pressure and resulting masonry deterioration. Rust jacking from deteriorated lintels also is exhibited through step cracks and open joints, both of which are found at Hutchinson. Note that the separation at the west wall between the face and back up masonry was large enough to insert my hand.

Although we do not know the specific structural systems used in the construction of the various phases of the Hutchinson school, it is likely that the large "decorative" corner pilasters at the south and east elevations actually encase steel columns. The numerous cracks at these corners are typical of both the water-based cracking described above as well as cracking of the masonry due to the deterioration of the steel columns. The vertical cracks that roughly line up typically indicate the presence of steel. The cracks follow the edges of the steel, the first areas of the steel to deteriorate.

The cast stone on the building has typically come to the end of its useful life. We see cast stone in water-shedding locations such as sills and parapets function adequately for 60 to 80 years. In non-water shedding locations, it can last up to 100 years without significant deterioration. You can see this difference in the southernmost entryway along Lincoln Avenue where the upper stones, those exposed to the most water, have been replaced. Pieces of the more sheltered stone are now reaching the end of their useful life and need replacement. In places where the cast stone has steel reinforcing to allow for thin profiles such as the window tracery above the east entrance, the amount of cover over the steel elements and chemical changes to the cast stone over time allow water to reach and affect the steel elements. The steel deteriorates causing cracks and delamination.

The archive drawings indicate that a significant amount of repair work was done in the two repair campaigns in 1980 and 1992. These campaigns addressed the most vulnerable areas of transitional masonry buildings, parapets and steel lintels. The repairs were called out with minimal details possibly indicating that many repair decisions were made in the field. Building science and the understanding of the mechanisms that cause deterioration is an ever-changing field of study – as are repairs to address the findings. While we can see that masonry above steel lintels was replaced, the steel lintels were not replaced and flashing was not installed. Neither of these repairs (while commonplace today) were typical for the time period. We have learned though time that leaving the deteriorating steel lintel in place causes premature failure of the repair because the source of the problem hasn't been addressed. Is the source of the problem the construction materials, building orientation, detailing, the surrounding masonry, a leaking roof? The issue may be some, one, or all of these factors and the same deterioration result may have causes that differ at each location.

The other phenomenon that should be addressed is the acceleration of damage over time. Buildings can essentially remain stable with the same cracks and issues for many years. At some point they literally turn a corner and the deterioration seemingly appears to accelerate. In essence, the deterioration reaches a critical level where the building can no longer continue to safely function.

Unfortunately, we have no timetable for this process and it is very difficult to read this process without consistent observations and documentation. One bad weather season could make all the difference. Accelerated damage can be continually pushed back with regular repairs as has been done at Hutchinson to maintain a useful and functioning building. Kaese & Lynch began monitoring this building in 2011and recommended small-scale repairs as leaks occurred, however, based on the recent inspection, it appears that the rate of deterioration is increasing and significant work needs to be done over the next few years to maintain a safe facade.

With proper precautions the amount of work that needs to be done can be addressed in phases but no elevation and opening will go untouched. The original brick has largely been replaced, what remains is in need of removal and replacement. The newer brick installations were done in a manner that was standard of the industry at the time but we have learned that some of these repair decisions and methodologies were relatively shortsighted.

RECOMMENDATIONS

At Hutchinson Elementary School the amount and severity of deterioration of the facades requires significant intervention. The areas of largest concern are those that affect the safety and well-being of the public and users of the school. We recommend the following short-term actions:

1. The conditions of the masonry along Lincoln Avenue and the returns to the north require rebuilding. A full-width sidewalk bridge should be erected along Third Avenue and Lincoln Avenue as well as the returns on the west side over the main stairway. We will continue to monitor these facades. Temporary stabilization of portions of the masonry may be appropriate.
2. The north wall (opposite the south auditorium elevation) has a significant bulge. This area should continue to be cordoned off so that it is not accessible to the public or to students/maintenance personnel etc. This will also temporarily address the deteriorated fence atop the retaining wall.
3. The loose window panning on the north elevation should be removed, shortened and reinstalled to provide a weathertight window.
4. Temporary stabilization of the west wall masonry above the four-part windows.

5. Infill of the open mortar joints at the two north windows with the dropped bricks and open mortar joints.

In addition to these short-term repairs, the remainder of the building needs significant work. Additional repairs will include:

1. The replacement of all steel window lintels
2. Repairs/reinforcement to the underlying steel including spandrels
3. Repointing or more likely, replacement of all outer wythe of original brick
4. Replacement of most cast stone elements
5. Rebuilding of all bulged areas of masonry
6. Deep repointing of the rubble foundation
7. Replacement of windows

As part of this report we have provided a very rough cost estimate for the work described above using prevailing wage rates. We have made assumptions that will cause this estimate to likely be on the high side. With the preliminary estimates coming in above 5 million, we strongly suggest that a professional cost estimator look at the repairs outlined and provide a more nuanced estimate from which serious discussions and subsequent decisions can be had/made.

Sincerely,

Diane Kaese R.A.