

KLUBER PROJECT NO. 26-508-1715

E. Wilson Morrison Elementary School

Structural Façade Assessment
40 Crescent Street
Front Royal, Virginia 22630

■ August 31, 2026

SUBMITTED TO

Randy Jones
ZMM Architects and
Engineers
1116 South Main Street
Blacksburg, Virginia 24060

SUBMITTED BY

**Kluber Architects +
Engineers**
41 W. Benton Street
Aurora, IL 60506
Phone: 630.406.1213
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August 31, 2026

Randy Jones
Director of Virginia Operations, Project Management
ZMM Architects and Engineers
1116 South Main Street
Blacksburg, Virginia 24060

Re: E. Wilson Morrison Elementary School
Structural Façade Assessment
Kluber Project No. 26-508-1715

Dear Mr. Jones,

Per your request, a field survey on the subject property was performed on August 24, 2026. The purpose of the survey was to gather information pertaining to the apparent movement of the building's masonry façade. The aspects surveyed include the physical conditions visually observable. Prior to our arrival, portions of the façade were removed/opened for our observations. Additionally, our office is in receipt of construction documentation prepared by Eubank & Caldwell, Inc. dated between 1935 and 1945. The documentation received details of the construction for the two traditional colonial revival masonry structures. The information obtained while on site and through review of the existing building construction documents allowed our office to render our professional opinion regarding the evident movement in the building's facade system.

DESCRIPTION

The original school building constructed on Crescent Street was erected in 1910. In 1935, the school underwent re-building and expansions which included the 2-story masonry traditional colonial revival structure on the east end of the site and a gymnasium. Around 1942, the original 1910 school suffered a fire which led to its demolition. In 1945, a second 2-story colonial revival structure was constructed on the west end of the site which mimicked the construction of the original 1935 building. Sometime between 1945 and 1960, additional 2-story masonry additions were added to connect the two revival buildings, refer to **Figure No. 001**.

In review of the existing documentation, the colonial revival buildings (1935 & 1945 construction) are supported on conventional shallow reinforced concrete spread footings with an assumed allowable bearing capacity of 6,000 pounds per square foot. The second floor is framed with reinforced concrete beams and one-way structural slabs supported on a series of concrete columns masonry bearing walls. The roof structure is comprised of structural steel truss and beam framing with pre-cast concrete planks. The bearing walls utilized what is referred to as "mass-wall" construction, which is composed of multiple wythes of brick masonry grouted solid and tied together by various bond-laying methods to create one large mass-wall. Refer to **Figure No. 002** for bond descriptions. Based on review of the existing documentation, the revival colonial buildings appear to utilize 3 brick wythe walls constructed using an American common bond with a Flemish style header course every 6th course, see **Figure No. 003**.

The additions added post 1945 connecting the two colonial revival structures appear to have been constructed in a similar manner utilizing reinforced concrete beam and slab construction for the second level. As stated previously, no documentation for the construction of these areas was available for review, however, portions of the façade were opened for our observations. The wall construction observed at these building locations appears to utilize a cinder block masonry unit structural wall with a brick veneer that is tied back to the load bearing cinder block wall rather than the “mass-wall” construction. This appears to be an early rendition of what is known as “cavity-wall” construction. Additionally, the roof structure observed at the post 1945 additions utilize steel bar joist roof framing in-lieu of steel wide-flange beams.

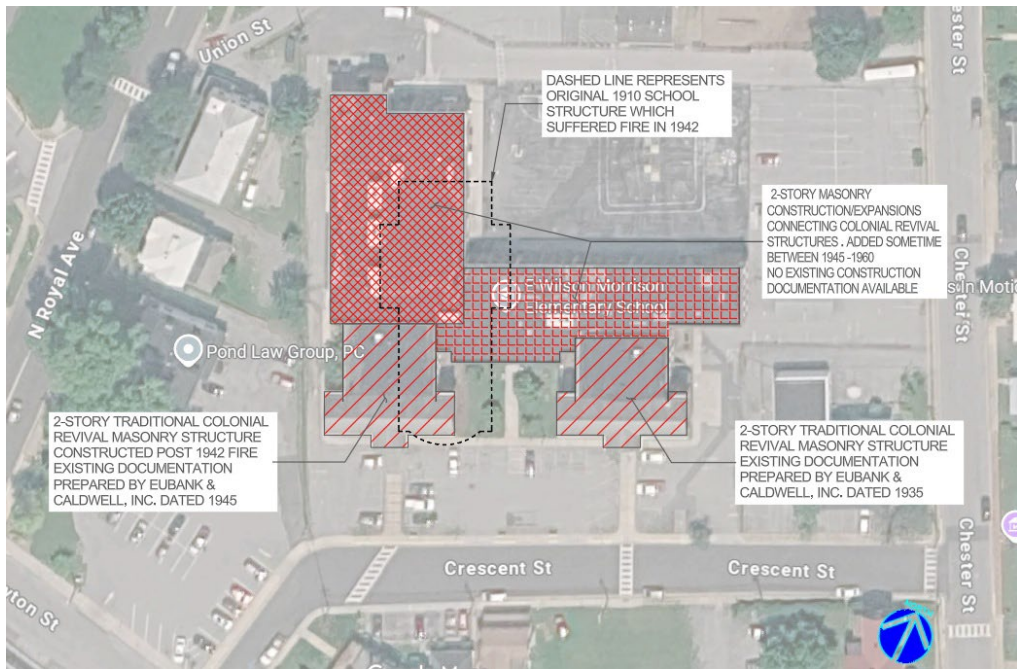
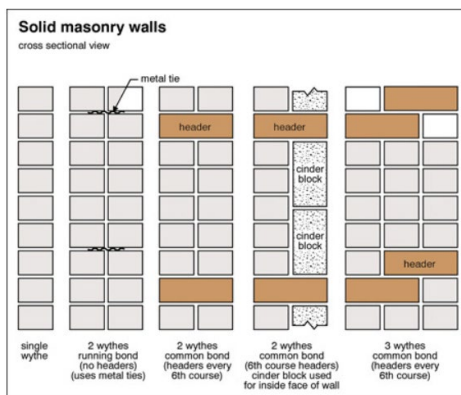
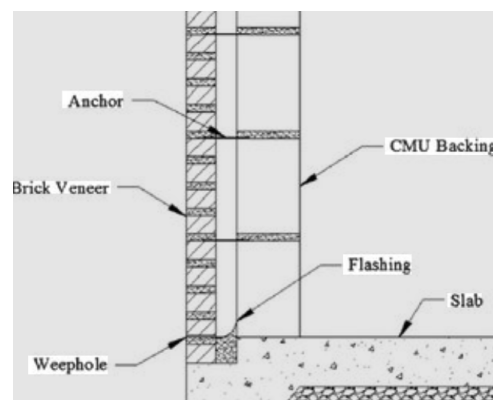


Figure No. 001
Site Plan Construction History



Mass Wall Construction



Cavity Wall Construction

Figure No. 002
Mass Masonry Wall Construction Versus Cavity Wall Construction



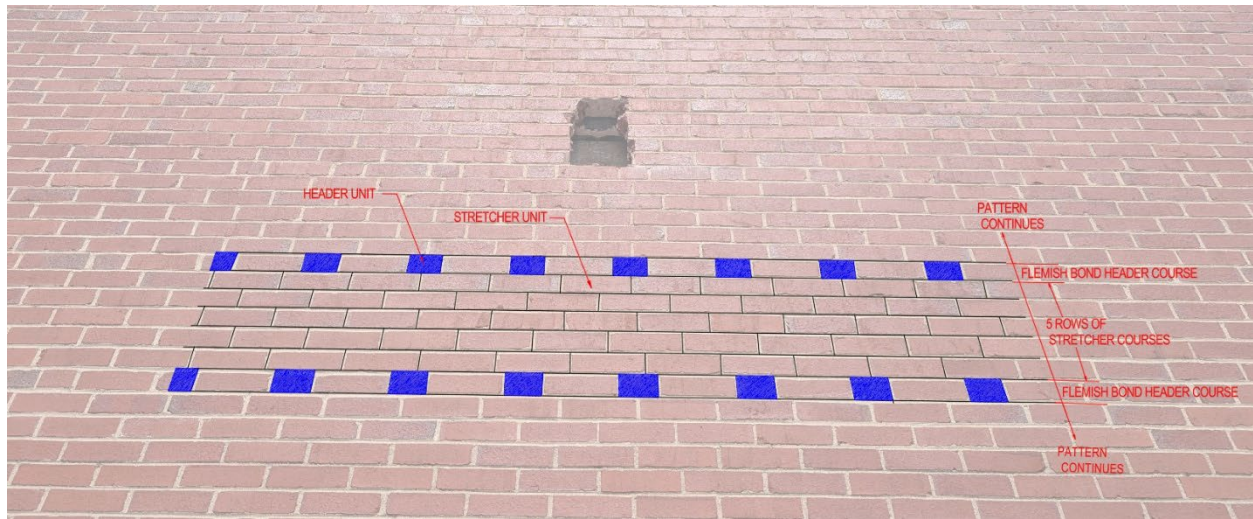


Figure No. 003
Façade Coursing Layout

*Original 1935 and 1950 buildings appear to utilize this façade layout, but with a “mass-wall” construction type as shown in **Figure No. 002** - 3 wythe construction. The post 1945 construction replicates this design architecturally as seen above. Rather than the header courses tying directly into the masonry construction beyond with a full unit turned 90 degrees, these units have been cut, and metal ties have been provided for lateral stability to the cinder block construction beyond, typical for cavity wall construction.*

OBSERVED/ EXISTING CONDITIONS

The movement of masonry façade at the school was first observed at the main southern entrance identified in **Figure No. 004** (below). As observed in **Photos No. 003 – 005 & 12**, the masonry veneer wall has visibly displaced away from the structure approximately 2 to 3 inches near the second-floor line. In observing the opened areas, the wall construction for the connecting additions is clearly a “cavity-wall” construction in lieu of “mass-masonry”, reference **Photos No. 013 – 018 & Photo No. 034**. We were unable to locate any drainage weeps for the cavity construction, which is critical for the long-term performance of cavity-wall construction. Refer to **Photos No. 002 – 020**, **No. 032 – 041 & No. 051** for observations made at the south façade of the post 1945 construction. Also reference **Photos No. 022 – 031** for observations made of the roof area along the southern façade wall. Our office completed a walk-around the entire site and determined that the bulging and pulling away of masonry façade was also evident along the northern and eastern facades of the post 1945 construction. Refer to **Photos No. 042 – 048** for the northern façade observations and **Photos No. 049 & 050** for the eastern façade.

Looking at the interior of the building, concrete columns, beams and floor slabs were identified for supporting the second level. We note that no visible degradation, cracking or structural deficiencies were identified within this part of the superstructure. Refer to **Photos No. 052 – 065** for the interior photographs. The bulging of the façade appears localized to the cavity wall construction. Additionally, the piping crawl space that is below the first floor along the length of the southern façade revealed a concrete foundation wall with no apparent distress or settlement. Refer to **Photo No. 062**.





Figure No. 004
Localized area of bulging facade

DISCUSSION, OPINIONS AND RECOMMENDATIONS

Cavity wall construction was not only developed for economic reasons but also in efforts to control thermal efficiency and moisture mitigation through “mass-wall” construction. The airspace between the exterior brick veneer and interior structural cinder block allows water to drain downwards and not through the wall construction. However, this leaves the brick façade to self-support itself off the foundation with no lateral restraint. In mass wall construction, every header unit gets tied back into the structural wall thus relying on self-weight of the entire wall to hold it in place laterally. Because cavity-wall construction completely separates the wythes of construction with an airspace, use of metal ties is introduced to hold the veneer in place laterally. It is very important that the airspace within cavity wall construction can drain and stay dry. Excess moisture build-up can begin to deteriorate the metal ties which ultimately causes them to fail. In addition to moisture degradation, it is also important to note that brick masonry and cinder masonry respond to thermal effects differently with brick masonry being more expansive when it heats up. It's important to note that the southern wall is essentially fully exposed to the effects of the sun throughout the year, causing more thermal movement than other facades of the building. Tie degradation from excess moisture exposure coupled with the expansive thermal stresses is likely what has led to failure of the metal ties within the cavity-wall system over time. Once enough tie failures occur, the masonry veneer essentially has no lateral support from the backup structural wall. This leads to buckling of the brick under its own weight or the “bulging” and “pulling-away” effect observed. Our office attempted to identify weep vents within the wall construction while on site and were unable to locate any means of wall drainage.

Based on review of the site investigation, photographs and existing construction documentation, we conclude that the façade instability is related to the construction of the masonry cavity wall and its inability to drain effectively. Cavity space within the construction observed was minimal and essentially clogged up with excess mortar. With the inability for the construction of the airspace to effectively stay dry, is what has led to the failure of metal tie-back supports. Apart from the façade movements observed and discussed, we believe that the concrete superstructure and roof framing appeared in good working condition.



Our current recommendations are as follows:

1. Continue to restrict access to the building as already enforced.
2. Provide temporary shoring of the roof framing above the second level to alleviate any loading to the exterior walls.
3. Expose larger openings at select locations through the existing façade (interior and exterior) to gather additional connection information for veneer and cinder block construction. Our office will advise on locations to be opened.
4. Once the supplemental site investigation is performed, potential retrofit/repairs/replacement of the exterior façade can be assessed to determine an estimated cost for the façade improvements.

DISCLAIMERS AND QUALIFICATIONS

This report does not express or imply any warranty of the building but only addresses the conditions of the portion that was accessible and observed at the time of our site survey. The opinions of this report are limited to the observed conditions only as viewed from the ground, lifts and ladders present. No physical testing/sampling of the building materials of the existing building components was performed. No structural analysis of the building framing systems or the façade system have been performed at this time. The information contained in this report represents our professional opinion based on the observed conditions. Reviews of architectural, electrical, and mechanical components are expressly excluded and not reviewed.

Please feel free to call if you have any questions regarding the above information.

Sincerely,

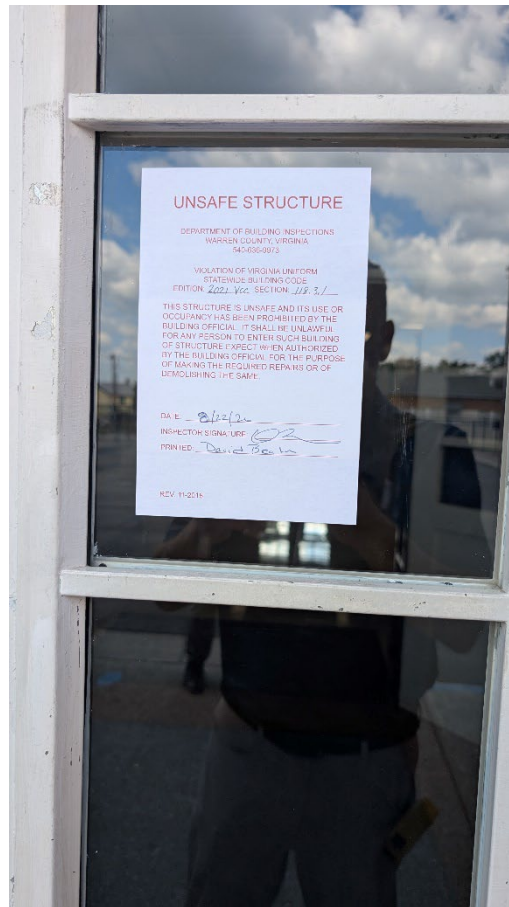


Jeffrey M. Bruns, SE, LEED AP
Kluber Architects + Engineers



Attachments: Photos (65)





SURVEY PHOTO

LOCATION: E. Wilson Morrison Elementary School

NUMBER: 001

COMMENTS:

Department of Buildings unsafe structure notice, issued August 22, 2026.

DATE: August 24, 2026





SURVEY PHOTO

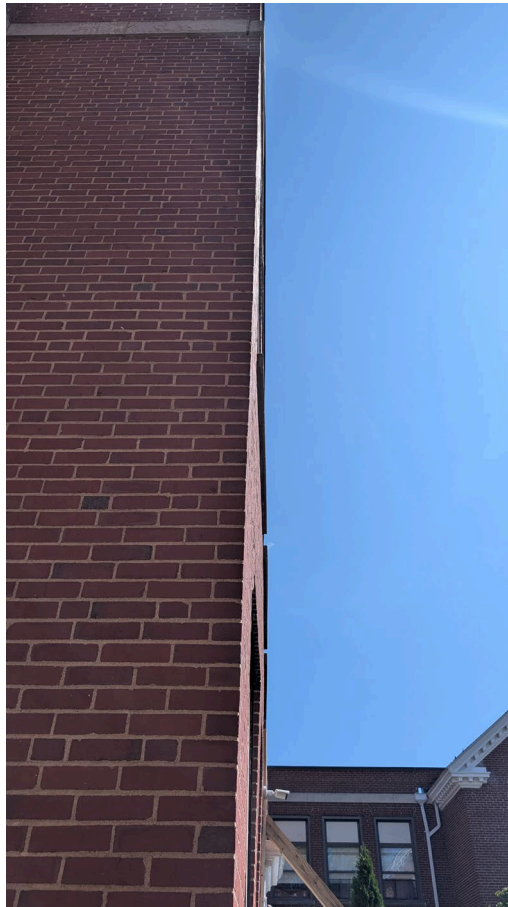
LOCATION: E. Wilson Morrison Elementary School

NUMBER: 002

COMMENTS:
South elevation view of main entrance.

DATE: August 24, 2026





SURVEY PHOTO

LOCATION: Southwest corner of post 1945 construction

NUMBER: 003

COMMENTS:

West elevation view showing masonry brick veneer pulling away from structure.

DATE: August 24, 2026





SURVEY PHOTO

LOCATION: Southwest corner of post 1945 construction

NUMBER: 004

DATE: August 24, 2026

COMMENTS:

West elevation view showing masonry brick veneer pulling away from structure. Temporary means of support to prevent facade from further movement has been installed.





SURVEY PHOTO

LOCATION: Southwest corner of post 1945 construction

NUMBER: 005

DATE: August 24, 2026

COMMENTS:

West elevation view showing masonry brick veneer pulling away from structure. Temporary means of support to prevent facade from further movement has been installed.





SURVEY PHOTO

LOCATION: Southwest corner of post 1945 construction

NUMBER: 006

DATE: August 24, 2026

COMMENTS:

View looking up the southern face of building where façade is pulling away. Visible movement can be seen at window frame where the sealant joint has separated.





SURVEY PHOTO

LOCATION: South facade of post 1945 construction, west of main entrance

NUMBER: 007

DATE: August 24, 2026

COMMENTS:

View looking up the southern face of building where façade is pulling away. Portal holes have been opened exposing the cavity wall construction and the cinder block masonry load bearing wall.





SURVEY PHOTO

LOCATION: South facade of post 1945 construction, east of main entrance

NUMBER: 008

DATE: August 24, 2026

COMMENTS:

View looking up the southern face of building where façade is pulling away, just right of main entrance.





SURVEY PHOTO

LOCATION: South facade of post 1945 construction, east of main entrance

NUMBER: 009

DATE: August 24, 2026

COMMENTS:

View looking up the southern face of building where façade is pulling away, just right of main entrance. Portal holes have been opened exposing the cavity wall construction and cinder block masonry load bearing wall.





SURVEY PHOTO

LOCATION: Southeast corner of post 1945 construction

NUMBER: 010

DATE: August 24, 2026

COMMENTS:

View looking up the southern face of building where façade is pulling away, east end.





SURVEY PHOTO

LOCATION: Southeast corner of post 1945 construction

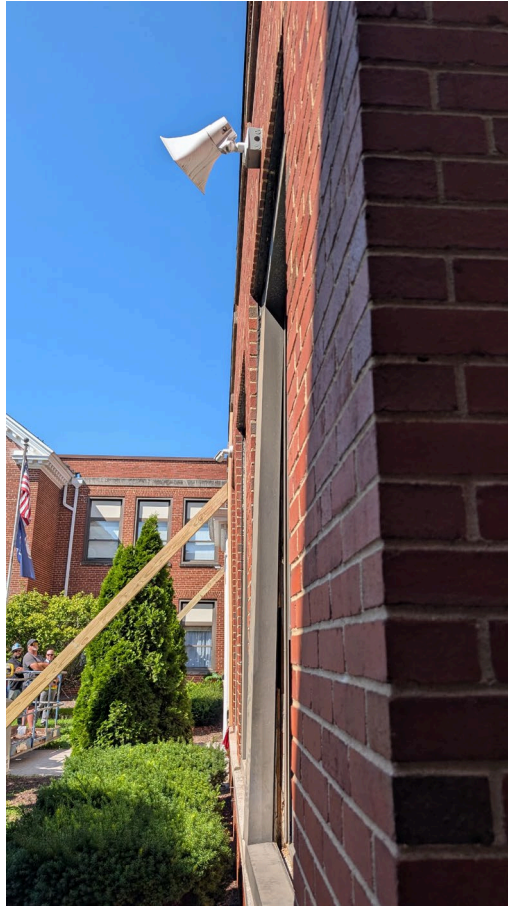
NUMBER: 011

DATE: August 24, 2026

COMMENTS:

View looking up the southern face of building “notch” east of main entrance. Movement of façade here not apparent.





SURVEY PHOTO

LOCATION: Southeast corner of post 1945 construction

NUMBER: 012

DATE: August 24, 2026

COMMENTS:

East elevation looking along face of south main entrance where façade is pulling away. Gaps and movement clearly visible at window frames & stone sills.





SURVEY PHOTO

LOCATION: South façade wall post 1945 construction

NUMBER: 013

DATE: August 24, 2026

COMMENTS:

Portal hole in facade south wall, west end. Cinder block structural wall and brick façade veneer clearly seen indicating a cavity wall type construction. Air-space between wythes appears minimal to none and filled with mortar.





SURVEY PHOTO

LOCATION: South façade wall post 1945 construction

NUMBER: 014

DATE: August 24, 2026

COMMENTS:

Portal hole in facades south wall. Cinder block structural wall and brick façade veneer clearly seen indicating a cavity wall type construction. Air-space between wythes appears minimal to none and filled with mortar. Green arrow pointing at corrugated veneer tie for anchoring the brick veneer to the cinder block load bearing wall.





SURVEY PHOTO

LOCATION: South façade wall post 1945 construction

NUMBER: 015

DATE: August 24, 2026

COMMENTS:

Measurement (+/- 4½") of cavity wall construction from façade face back to structural cinder block.





SURVEY PHOTO

LOCATION: South façade wall post 1945 construction

NUMBER: 016

DATE: August 24, 2026

COMMENTS:

Measurement (+/-8") of cavity wall construction from the exterior face of the brick veneer to the face of the structural concrete floor slab.





SURVEY PHOTO

LOCATION: South façade wall post 1945 construction

NUMBER: 017

DATE: August 24, 2026

COMMENTS:

Portal hole in facades south wall. Cinder block structural wall and brick façade veneer clearly seen indicating a cavity wall type construction. Air-space between wythes appears minimal to none and filled with mortar. Green arrow pointing at corrugated veneer tie for anchoring the brick veneer to the cinder block load bearing wall.





SURVEY PHOTO

LOCATION: South façade wall post 1945 construction

NUMBER: 018

DATE: August 24, 2026

COMMENTS:

Measurement of the cinder block load bearing wall measured to be a nominal 8".





SURVEY PHOTO

LOCATION: South façade parapet wall - post 1945 construction

NUMBER: 019

DATE: August 24, 2026

COMMENTS:

Underside view of cast concrete parapet cap. Cap has since been wrapped with metal coping likely during re-roofing of the structure.





SURVEY PHOTO

LOCATION: South façade parapet wall - post 1945 construction

NUMBER: 020

DATE: August 24, 2026

COMMENTS:

Underside view of cast concrete parapet cap. Cap has since been wrapped with metal coping likely during re-roofing of the structure.





SURVEY PHOTO

LOCATION: Roof of southern post 1945 construction

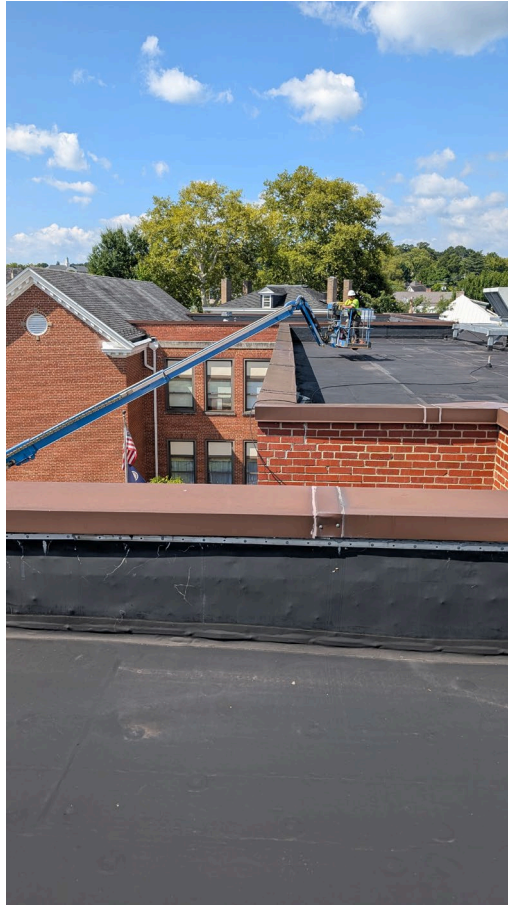
NUMBER: 021

DATE: August 24, 2026

COMMENTS:

Backside of parapet wall viewed from roof surface. Coping with flashing up backside of parapet wall appeared in good working condition.





SURVEY PHOTO

LOCATION: Roof of southern post 1945 construction

NUMBER: 022

DATE: August 24, 2026

COMMENTS:

East view of parapet wall along its length. Parapet at roof line appeared relatively straight. Main bulging / pulling-away in façade appear to be concentrated at the second-floor line of the structure.





SURVEY PHOTO

LOCATION: Roof of southern post 1945 construction

NUMBER: 023

DATE: August 24, 2026

COMMENTS:

View of parapet wall façade near southeast corner. Step cracking and joint separation observed likely due to facades movement away from structure (green arrows).





SURVEY PHOTO

LOCATION: Roof of southern post 1945 construction

NUMBER: 024

DATE: August 24, 2026

COMMENTS:

View of parapet wall façade near southeast corner. Step cracking and joint separation observed likely due to facades movement away from structure (see green arrows on **Photo 023**).





SURVEY PHOTO

LOCATION: Roof of southern post 1945 construction

NUMBER: 025

DATE: August 24, 2026

COMMENTS:

East view of parapet wall along its length. Parapet at roof line appeared relatively straight. Main bulging / pulling-away in façade appear to be concentrated at the second-floor line of the structure.





SURVEY PHOTO

LOCATION: Roof of southern post 1945 construction

NUMBER: 026

DATE: August 24, 2026

COMMENTS:

Sealant of coping joints observed over south wall parapet. No visible distress observed.





SURVEY PHOTO

LOCATION: Roof of southern post 1945 construction

NUMBER: 027

DATE: August 24, 2026

COMMENTS:

West view of parapet wall along its length. Parapet at roof line appeared relatively straight. Main bulging / pulling-away of façade appear to be concentrated at the second-floor line of the structure.





SURVEY PHOTO

LOCATION: Roof of southern post 1945 construction

NUMBER: 028

DATE: August 24, 2026

COMMENTS:

West view of parapet wall along its length. Parapet at roof line appeared relatively straight. Main bulging / pulling-away of façade appear to be concentrated at the second-floor line of the structure.





SURVEY PHOTO

LOCATION: Roof of southern post 1945 construction

NUMBER: 029

DATE: August 24, 2026

COMMENTS:

West view of parapet wall facade. Mortar joints along parapet appear thicker/ lighter in color indicating this area may have been recently tuckpointed. Separation in corner head joint indicates movements likely occurred post-tuckpointing attempts (see green arrow).





SURVEY PHOTO

LOCATION: Roof of southern post 1945 construction

NUMBER: 030

DATE: August 24, 2026

COMMENTS:

Parapet coping sealant at southwest corner. No visible distress observed.





SURVEY PHOTO

LOCATION: Roof of southern post 1945 construction

NUMBER: 031

DATE: August 24, 2026

COMMENTS:

Parapet coping sealant at northwest corner. No visible distress observed.





SURVEY PHOTO

LOCATION: Window along south façade of post 1945 construction

NUMBER: 032

DATE: August 24, 2026

COMMENTS:

View of window frame along south main entrance façade – south end. Vertical sealant at frame appears dried out and has failed showing separation. This can allow water to enter the cavity wall causing deterioration to the metal tie-backs.





SURVEY PHOTO

LOCATION: Window along south façade of post 1945 construction

NUMBER: 033

DATE: August 24, 2026

COMMENTS:

View of window frame along south main entrance façade – south end. Vertical and horizontal sealants around window frame appear dried out and has failed showing separation. This can allow water to enter the cavity wall causing deterioration to the metal tie-backs.





SURVEY PHOTO

LOCATION: South façade wall of post 1945 construction, eastern end

NUMBER: 034

DATE: August 24, 2026

COMMENTS:

Portal hole in facades south wall. CMU structural wall and brick façade veneer clearly seen indicating a cavity wall type construction. Air-space between wythes appears minimal to none and filled with mortar.





SURVEY PHOTO

LOCATION: Window along south façade of post 1945 construction

NUMBER: 035

DATE: August 24, 2026

COMMENTS:

South façade has noticeable outward displacement relative to window frame.





SURVEY PHOTO

LOCATION: Window along south façade of post 1945 construction

NUMBER: 036

DATE: August 24, 2026

COMMENTS:

South façade has noticeable outward displacement relative to window frame.

