



January 8, 2019

Alan Benson
Town Administrator
Boxford, MA

Re: Peer Review of Gale Associates report titled *EXTERIOR WALL/WINDOW EVALUATION AT BOXFORD TOWN HALL/LIBRARY*, dated April 10, 2018.

Building Envelope Specialists (BES) was retained to provide professional document peer review services to include a second opinion of the aforementioned report. BES's services included a review of the report's methodology, technical observations, conclusions, and recommendations. Additionally, BES conducted a non-forensic, visual building inspection which included interviews with the building's maintenance staff and occupants. Mr. John Dold PE, Superintendent of the Department of Public Works, and Mr. Tom Duval of the Permanent Building Committee, accompanied BES's project inspector, Tim Dean PE during the investigation and provided valuable building performance information regarding the aging history of the building.

Project History

In the spring of 2018, Gale Associates evaluated the "as-built" condition of the Town Hall's building envelope. The evaluation provided concentrated focus on locations with reported water and air infiltration. Their evaluation included a review of existing construction documents and specifications, building staff interviews, interior and exterior visual observations, destructive masonry cuts (14 total), and infrared scans. The report documents forty-two (42) "as-built" conditions of the assembly in bulleted format and provides documentation to include existing conditions, design, construction, and performance deficiencies (moisture infiltration, air infiltration/movement & discontinuous thermal insulation) as associated with the building envelope components. The report also includes a Discussion and Conclusion section followed by Recommendations and a Preliminary Cost Estimate. Recommendations provided:

- Option #1: Complete removal and rebuilding of the assembly's masonry façade. Estimated to carry a cost of \$3,935,100.00
- Option #2: Focused repair of "active" leak locations, estimated to carry a cost of \$255,100.00

Gale Associates recommended Option #1 as the preferred approach, likely due to the fact it is the most comprehensive and eliminates most, if not all variables. Additionally, the report includes appendices A-E as backup data for their report.

Peer Review of Gale Associates Report

BES found the Gale Associate's report to be focused on the masonry assembly (flashings, lintels, mortar joints, gutters & wall insulation) with recommendations that were well founded and responsibly backed up with existing conditions data. BES feels Gale Associates should have explored the installation of existing window units as noted by their own observations on pages 1 and 8 of the April 10th report. "The majority of these leaks appear to be concentrated at or adjacent to window locations." BES is concerned that a detailed inspection of the window



installation was not included, and several window units must undergo a water infiltration test. BES feels all attempts to remove the word “appear” should have been made prior to outlining all the bulleted items under Option #1. Note that, Gale in Option #1 recommended adding thickness to the insulation which would bring the face of masonry out proud of the foundation wall. Additionally, BES noted one exception in the report in that some of the identified fifteen (15) active leaks have had repairs made that stopped the moisture infiltration. Two of these were repairs to mechanical louvers on the north side. BES confirmed this in discussions with occupants in the vicinity and staff. There are three (3) major ongoing leaks that require active water cleanup whenever it rains. These leaks are in the Assistant Town Administrator’s office, Assistant Treasure/Collector’s office and the Building Inspector’s office.

BES’s Recommendations

Although there are merits to Option #1 and Option #2 that Gale Associates suggested, BES feels an approach that will create a water-tight facade exists somewhere between these options. BES feels the town should consider a surgical repair approach, if you will. This would be a less invasive approach than outlined in Option #1 and allow for the cost effectiveness of Option #2. BES recommends considering all items in Option #2 that have not already been addressed such as replacing deteriorated lintels, designated window perimeter sealants, and air/vapor barriers at the windows. Based upon this approach, BES recommends the following:

- Window Testing: Several windows should undergo water infiltration testing in accordance with ASTM-E2128 to better define the source of moisture infiltration in and around existing window units. BES feels this information is essential for the success of the facade repairs to the building.
- Window Flashing: The second-floor window and horizontal precast entablature flashing are missing. Also, there is deteriorated flashing at some first-floor windows. BES recommends adding through-wall flashing at these locations.
- Exterior Masonry: The mortar joints in the precast soffit panels and horizontal entablatures at the gable ends are deteriorated and/or missing. BES recommends all deficient mortar joints be repaired in these areas with new pointing mortar, sealant and/or a lead joint protector depending on exposure.
- Roof/ Wall Interfaces: Roof edges with precast concrete exposed at the rakes requires a new flashing detail. The eaves have been flashed, but the interior corner walls still get very wet due to the volume of water running off from the valleys. BES recommends installing a gutter system to redirect the water properly.
- Interior Spaces: Much of the damage due to moisture infiltration presents as blistered latex paint. Staff noted that the front elevation (South) with the predominant wind direction has been the worst. The sides have exhibited lesser problems. Because the interior environment has been conditioned to low humidity, the blistering may be resolved by removing the impermeable latex paint and replacing it with a permeable mineral paint. This will allow some moisture to migrate through the wall coating and dissipate into the conditioned interior space.



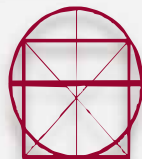
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Report filed by:

Timothy S Dean PE

Timothy S Dean

Structural Engineer & Project Manager



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BOXFORD TOWN HALL/ LIBRARY



BOXFORD TOWN HALL

Boxford, Massachusetts



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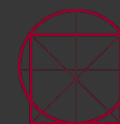
Project History:

In the spring of 2018, Gale Associates performed evaluation of the “as-built” condition of the town hall’s building envelope with specific focus on reported water and air infiltration issues and locations. Their review included a review of existing construction documents and specifications, building staff interviews, interior and exterior visual observations, destructive masonry cuts (14 in total), and infrared scans.

- The report documents forty-two (42) “as-built” conditions of the assembly.
- Report reviews:
 - existing conditions.
 - Design.
 - Construction.
 - Performance:
 - Moisture infiltration
 - Air infiltration/movement.
 - Discontinuous thermal insulation.

Gale Associates Recommendations:

- **Option #1:** Complete removal and rebuilding of the assembly’s entire masonry façade down which was estimated to carry a cost of \$3,935,100.
- **Option #2:** Focused repair of “active” leak locations only which was estimated to carry a cost of \$255,100



South elevation has most exposure to prevailing winds and worst active leaks at 2nd floor windows



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East elevation has the least moisture problems. Note that the corners have significant roof runoff. Add gutters?



North elevation has had some repairs that have mitigated some of the moisture problems. Note, precast has been discolored.



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West elevation is generally in good shape.



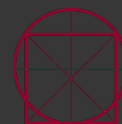
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Failed mortar joint in precast
concrete rake.



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Additional failed mortar joints at eave and rake.





Walls at roof valleys are receiving significant runoff water during rain events.



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BES's Recommendations

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- Window Testing: Several windows should undergo water infiltration testing in accordance with ASTM-E2128 to better define the source of moisture infiltration in and around existing window units. BES feels this information is essential for the success of the facade repairs to the building.
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BES's Recommendations (Continued)

- **Exterior Masonry:** The mortar joints in the precast soffit panels and horizontal entablatures at the gable ends are deteriorated and/or missing. BES recommends all deficient mortar joints be repaired in these areas with new pointing mortar, sealant and/or a lead joint protector depending on exposure.
- **Roof/ Wall Interfaces:** Roof edges with precast concrete exposed at the rakes requires a new flashing detail. The eaves have been flashed, but the interior corner walls still get very wet due to the volume of water running off from the valleys. BES recommends installing a gutter system to redirect the water properly.
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