

## Town of Bolton, MA Old Fire House Structural Evaluation - Final

**TO:** Randy Heglin, DPW Director  
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Tighe & Bond completed a site visit in late February to observe and document the existing conditions of the Old Fire House building at 9 Wattaquadock Hill Rd in Bolton, MA. It is understood that the building has been used recently for storage of an antique fire truck on the ground floor and fire fighter training on the second floor. A structural assessment was recommended as part of the Bolton Municipal Buildings Conditions Assessment project when wood boring insect damage (BID) was observed in some of the visible structural members.

To determine the overall condition of the Old Fire House, observations were completed over two days and included inspection of select locations of the structure. On the first day, visual observations and 3D scans were completed of the exterior and visible / accessible areas of the interior to document the existing conditions. In addition, areas were identified for selective demolition to reveal load carrying members covered up by interior finishes. On the second day the selected openings were completed and a structural assessment of the building conditions within these areas was performed along with a supplemental scan to document the location of the openings.

### Exterior General Conditions

Reviewing the exterior of the building, visible sill rot by the side access stair was observed as well as cladding which was dislodged at this location due to rotted wood which was no longer able to support fasteners. The pulpwood of the sill has rotted away, and exterior portions of heartwood appear soft on the outer 1/2" when poked with an awl and flat head screwdriver.

Overall, the wood siding, corner boards, soffit and gable trim are generally in good condition (painted ~10 years ago according to maintenance staff). Patch work of siding is evident at the access door by the garage door as well as trim replacement around the door frame. It is likely that the door was replaced, and new trim was installed during this work (**Photo 1**).

Both exterior bearing walls, which support the roof rafters, were observed to be bowing outward. This displacement is visually greatest in the middle at the top of the wall along the eave gradually tapering back to the corners of the building. Consequently, the roof framing has sagged along the ridge; greatest at the center, tapering back to the gable ends. The exterior of the roof was not accessible during the visit, however its features and general condition were observed and documented through visual observation and laser scan. The laser scan was able to capture the roof and wall deflections.

At one time, two steel cable & turnbuckle assemblies were installed through two pairs of interior timber columns just below the second-floor framing. The cable system is not believed to be an engineered system. The cables appeared to be loose or not fully engaging to restrain the wall movement and above the second story floor framing the wall continues to lean outward.

## Interior General Conditions

At the ground level, a field stone foundation has been covered on the interior by concrete walls roughly between one and two feet thick. The concrete walls along the bearing walls provide base connections for six (6) 4" round tube steel columns spaced 9.75 ft apart on center. Each pair of columns connects to a steel beam assembly that in turn supports the second-floor joists that run parallel with the side bearing walls. Therefore, the side bearing walls that support the roof rafters do not carry the second-floor joists and associated loads. This framing condition was likely added when the second story floor was added and does not appear to be part of the original timber frame construction.

The ground level garage walls are mostly covered with interior finishes. Selective demo was done in four locations at the cable system connections to the columns to observe the structural condition of the building within these areas (Columns A3, A4, B3 & B4). See **Figure 1** for Floor Plan of lower level and column grid. The drywall and batt insulation were removed at these areas to expose the wood framing (**Photos 2 & 3**). Once the drywall and batt insulation were removed, the columns were scraped with light hand force using the back end of a hammer to remove BID. Note material that has been digested by wood boring insects will be powdery and what remains on the surface is paper thin, very little effort is needed to expose these areas (**Photos 4 & 5**). Three of the four columns (A3, A4 & B4) inspected had section loss of 1" or more +/- 1/2" due to BID. The fourth column (B3) also had evidence of BID, however, it was mostly sound and not significantly damaged in the area observed. While the columns observed on the ground floor had evidence of BID as described above, the partition wall framing and wide plank paneling appears to be in fair condition with little to no BID based on the limited view of these selectively demolished areas.

Moving up the stairs to the second floor, evidence of BID in the original structural members is prevalent in almost every visible original timber member. A flathead screwdriver was used to inspect the integrity of a select number of members including the top plate along column line A and corner column A5 at the stair landing (**Photo 6**). Column A5 had extensive BID on both interior faces of the column to a depth of about 3/4" +/- 1/4", though the center mass of the member appears to be sound when poked with the screwdriver insect boring holes are evident within the remaining portion.

Standing on the second floor observing the exposed roof beams and sheathing, evidence of BID is apparent on every original roof beam with varying degrees of extent. In some members, BID appears to be localized in a small area while others have significant visual section loss throughout its length (**Photo 7**). Dimensional lumber has been sistered to these original roof members in an effort to repair the roof framing (**Photo 8**). Carrying beams have been installed across the shed dormer roof line perpendicular to their sistered rafters intended to transfer some of the roof load away from the side bearing walls and into the steel beams and columns below. See **Figures 2 & 3**, lidar scan renderings, showing the roof framing conditions. Speaking with town maintenance staff, this work was completed around a similar time as the cable ties. This repair does not appear to be an engineered system. The members are simply nailed to the original members with a minimal nailing pattern and no connections to the supporting members below. For the time being, this assembly may assist the damaged members in supporting roof gravity loads, but it does not appear adequate to resist all applicable design loads, nor provide a code compliant construction for continued occupancy.

The wide plank roof sheathing attached to the roof framing appears to be in fair condition with isolated areas noted to have water damage with dark / black areas assumed to have been wet at one time. These areas were not wet at the time of the site visit. One small area, ~8-10 sf of roof decking, was noted to be heavily damaged with a board in the center of the area cracked and failed midspan between two beams.

## Conditions Summary

Work was completed over two days, including visual observations, 3D scans and selective demolition to document the existing conditions of the building and observe the extent of wood boring insect damage (BID) to structural members. Through the combined hands on and digital observations it's clear many of the building's structural members have been comprised due to wood boring insects, though secondary wall studs and wide plank paneling appears to be less affected.

## Occupancy Recommendations

With most of the load carrying members of the building heavily compromised due to BID, and previous repairs with questionable performance, the Old Fire House should not be occupied for trainings / storage or any other use. Any remaining materials or equipment stored within the building should be removed as soon as possible and stored elsewhere.

## Repair Recommendations

The intent of our structural assessment was to provide a phased approach of repairs to assist the Town in its decision-making process regarding the future use of the Old Fire House. With the extent of BID to the structural members, repairs for the building to remain in its current location requires the deconstruction of exterior and interior finishes to expose the original timber frame. Once the structural frame is exposed, elements that exhibit boring insect damage could then be replaced. Given the extent of boring insect damage observed during the assessment, the entire original timber frame will likely require replacement. This repair approach would require complete deconstruction down to the foundation and a full rebuild of the structure. It is estimated to cost between \$850,000 - \$1,500,000 based on 2022 dollars. From discussions with the Town, reconstruction of a similar building on the same site may not be favorable as the existing structure does not meet the current nor future needs of the towns rapidly growing Fire Department. Therefore, it is more practical to construct a new building to meet the Towns needs in lieu of repairing the existing structure.

The following may be offered as a solution to the Historical Committee for a proposed re-use of salvageable elements of the building:

There may be value, however, to deconstruct the architectural elements of the Old Fire House for re-use in the construction of a new building elsewhere on town-owned land. This effort would work to maintain the historical significance of the structure for future town use, capture architectural features that could be recreated with the trim, cladding and sheathing of the original structure. In turn, deconstruction of the Old Fire House would free up the site for further expansion of the municipal public safety complex which is forecasted to be needed in the near future.



Photo 1 – Old Fire House Southeast Exterior looking Northwest



Photo 2 – Column A3 before, note evidence of BID on exterior of column





Photo 3 – Column B4 as observed after selective demo, extreme BID evident without removal of material.



Photo 4 – Column A3 after scraping to remove surficial BID, note damage continues into member beyond loose material removal.



Photo 5 – Column A4 after scraping to remove surficial BID, note damage continues into member beyond loose material removal.



Photo 6 – Observed BID in top plate along Column Line A and in Corner Column A5





Photo 7 – Roof rafter with extreme BID along Column Line B Above Column B4



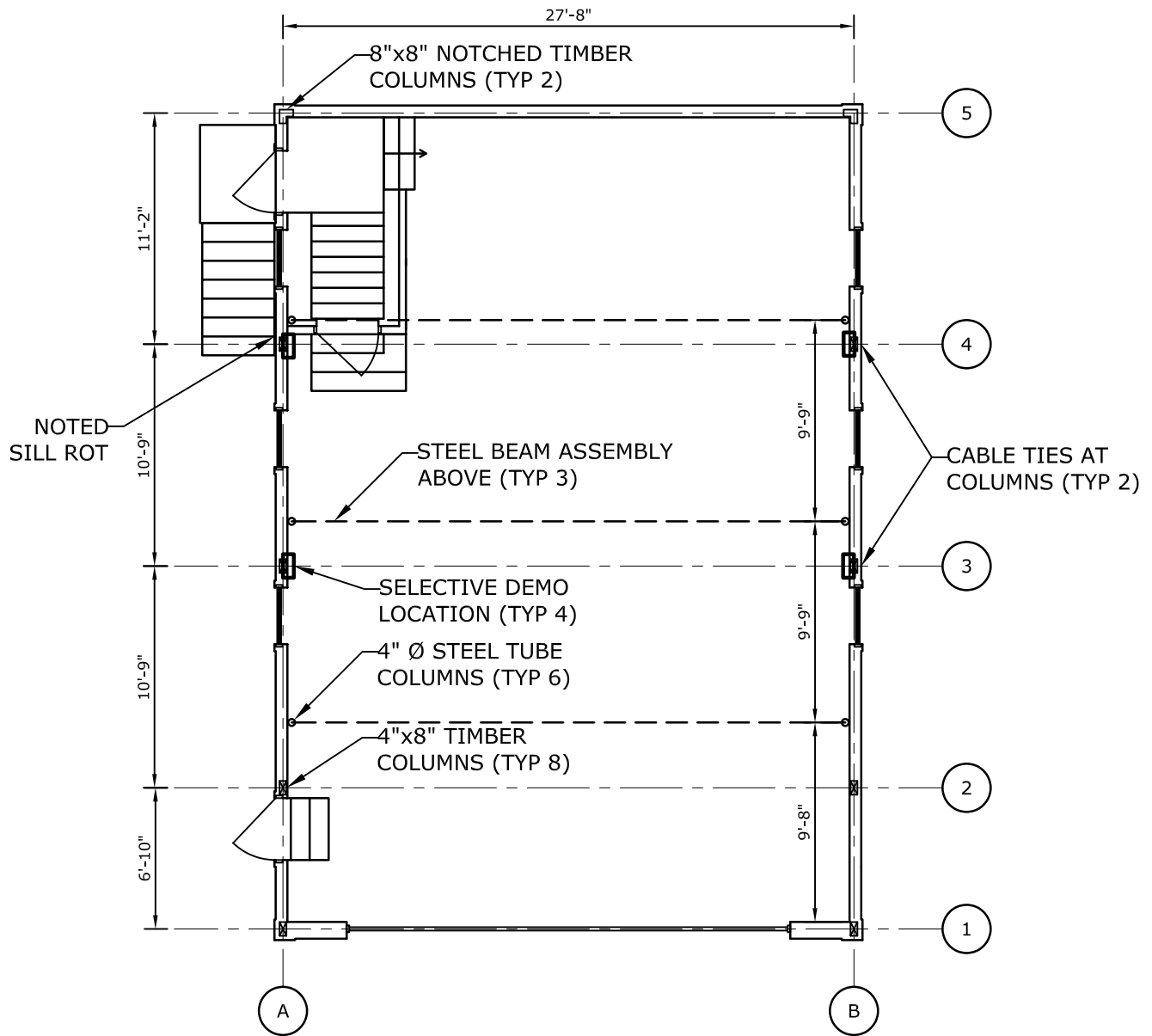
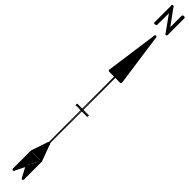
Photo 8 – Typical supplementary roof framing seen from second story floor. Note carrying beams background left and foreground right.



Figure 2 – Carrying beam along west side of roof framing



Figure 3 – Carrying beam along east side of roof framing.



OLD FIRE HOUSE  
STRUCTURAL EVALUATION  
BOLTON, MA

FIRST FLOOR PLAN

DATE: 5/19/2022

SCALE: 1/8" = 1'-0"

FIGURE 1

**Tighe&Bond**