Allied Engineering

A Salas O'Brien Company

Structural Evaluation

Sabattus Fire Department
72 Main Street
Sabattus, Maine

September 1, 2023
AEI Project: 14027

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September 1, 2023

Dr. Timothy Kane
Town Manager
Sabattus, ME 04280

Re: Sabattus Fire Department, Structural Condition Review

Dr. Kane:

At your request, I met with the chief and other building committee members to walk the facility in order to discuss options for the possible renovation of this facility versus construction of a new facility elsewhere in town. This effort was intended as an initial step toward determining whether the structural condition of the station was worth looking into for upgrading and/or renovating.

Options discussed included the possibility of adding another bay (difficult to property line and setback constraints), adding a second story, or a whole new facility on a different site.

The evaluation that follows focuses on the conditions of the building structure and finish elements and discusses the potential issues that the current building elements such as the CMU reinforcing, current roof structure's capability to serve as a second floor, capacity of the original roof and the truss overbuilds, and the design conditions to which the renovation would be subject to comply with going forward.

To summarize, I believe that the CMU of this building could support a second-floor wall and roof load, but testing to determine presence of wall reinforcement will be necessary to confirm the Wall system capabilities relative to current IBC seismic and wind design parameters.

The original roof system was not constructed to accommodate a second-floor construction. In order to develop a second-floor system, a whole new floor system would need to be constructed, whether comprised of wood or steel framing supporting concrete deck. The roof trusses were designed and installed in 1998, but confirmation through measurement and analysis will be necessary to confirm they are capable of meeting current unbalanced snow loading condition requirements.

Also, we expect that a stair and elevator tower as well as secondary stair egress would be required with a second-floor system design.

I believe the next step in this process would be to bring on an architect to review programming and square footage requirements to support said programming. With this information a concept could be developed for reuse of this facility either as is or with an additional story. Another option that could result is a floor plan that would be positioned on another site. Conceptual budgets would be developed and presented for discussion after this evaluation was complete.

The following represents our findings:

<u>Exterior Finish and Conditions:</u>

- The main firehouse front façade for both the apparatus bays and 3 sides of the single-story office wing are sided with solid brick masonry veneer. The condition of the brick is good and serviceable with no signs of significant wear.

- The gable end walls of the apparatus/office are sided with an exterior insulation and finish system (EIFS) which is in fair to poor condition and in some cased separated and hanging or has fallen off all together. This leaves the existing CMU wall exposed to the elements and unpainted for protection. There was discussion on site as to why there was water accumulation above the slab in the base od the CMU wall. I believe much of is is from water that is being absorbed by either the exposed CMU block or water that is getting behind the applied EIFS. As it hits the bottom of the masonry wall it contacts the top of the solid concrete and depending seeping in. The calcium accumulation at the bottom of the CMU is likely drawn out from the mortar and/or CMU composition as it seeps into the bay sides of the wall and dries.
- The overbuild roof truss gable end walls are sided with vinyl clapboard siding which remains in good condition.

<u>Foundation:</u>

- Main Apparatus bays has a cast-in-place (CIP) slabs-on-grade. Thickness and reinforcement for this slab is unknown. CIP slab slopes to 12" diameter inlet grades at the center of each of the bays. Drains reportedly are directed to a oil/water separator located beneath the office front lawn before existing to the town storm drain system. There are no visible signs of distress or settlements in these CIP slabs.
- Smaller vehicle bay has a CIP slab-on-grade as well. Thickness and reinforcement for this slab is unknown. There are no visible signs of distress or settlements in these slabs. This slab was installed as part of an addition to the building, date of which was not confirmed during our visit. There are no visible signs of distress or settlements in these CIP slabs.
- Office and common areas make up the left end of the main building plus a single-story gable addition to the front of the building. This houses bunkrooms, conference space, kitchen, restrooms and 911 communications operations for the facility. The office and common areas are CIP slab-on-grade. Thickness and reinforcement for this slab is unknown. There are no visible signs of distress or settlements in these CIP slabs.

<u>Building Structure Components</u>

- The original building structure consists of 8" concrete masonry unit (CMU) walls along the perimeter of the building. The original building was a 3-bay building. An addition was constructed sometime later using CMU block exterior walls as well.
- The original roof structure consisted of a steel bar joist system spanning the short span of the building (front-to-back) at approximately 5' on-center joist spacing. Bar joists are 24" deep. These joists bear on the top of the CMU wall. These joists supported a 1 ½" metal roof deck, insulation, and a tar/gravel roof surface application.
- At what appears to be coincidental with the timing of the single bay addition, a new roof was installed over top of the existing. Pre-engineered roof trusses were installed at 2' on-center spacing and clear spanned between short parapet walls at the front and back of the apparatus bays. Reportedly, the tar and gravel roof were left in place with hie roof overbuild which is not typically acceptable to the state Fire Marshal's office as it presents a fire hazard. The trusses are visible from the addition side as they serve as the rated drywall ceiling support system for this space.
- The wood trusses are strapped with 1' boards at 2' on-center over top chord of the trusses, with the metal light-gage metal roof deck applied directly to this system. The original building has a steel deck and joist system which offered the roof diaphragm rigidity necessary to transfer lateral wind/seismic loading to the walls. The wood truss system with the strapping and the thin metal roofing does not offer much resistance. As such, it is simply working as a cover from the elements for the roof below.
- Standard steel beams were utilized for the apparatus bay door headers. Each header bears on CMU at their bearing ends.
- At some point after the addition was constructed, a make-shift bell tower was constructed at the building. Support for this structure appears to be atop the provided 2'-0" on-center roof trusses. It does not appear that

any supplemental reinforcement was offered for strengthening the truss system beneath this added loading condition.

- There is a wood framed mezzanine at the addition end wall section fo the building for storage of turnout gear and other incidental support elements. AEI did not spend the time gathering information on the framing for this mezzanine and therefore cannot comment on a capacity rating for these spaces. There is significant height limitations on this level which limits the usable space at that level.

Code considerations for design and upgrades:

AEI believes that the 1973 building was designed to 1970 BOCA Code or a slightly earlier version.

Lateral Wind and Seismic:

- Lateral framing systems for this building consist only of the 8" CMU walls. Without the benefit of the original drawings is impossible to visually determine whether there is reinforcement present in the vertical cores of the CMU cells.
  - A search of the town archives for building plans for both the original building and the addition would be useful in determining the lateral capabilities available from the CMU wall system, specifically if it is reinforced with rebar in the vertical cells.
  - If drawings are not available, it is possible for a radar scan by a testing company to determine actual size and spacing of any present reinforcement in the cores.
  - My guess given the condition of the walls, having not seen any cracking or settlement, that these walls are in fact reinforced with rebar and would offer the majority of what is currently required by adopted local codes. Supplemental steel reinforcement at door opening walls may be required bu is a viable option to consider.
  - The 1973 BOCA Building Code reference standards for design of Reinforced Masonry walls. It States that 'Reinforced load-bearing concrete masonry shall conform to the provisions of "Specification for the Design and Construction of Load-Bearing Concrete Masonry, NCMA-1970.'" Further research will need to be performed to confirm 1) whether reinforcement does exist through testing and 2) whether what is present meets current building code standards. There is insufficient information available to decide currently.

Wind:

- The 1970 BOCA Building Code design wind load is not defined.
- 2015 IBC requires evaluation based on a design 90 mph (50 year).
- In summary, AEI does not expect that modifications based on wind will be required.

Seismic:

- In the 1970 BOCA Building code, there is discussion on Seismic requirements, but again not to the degree today's building codes reflect.
- 2015 IBC identifies standards and methodology of design that is specifically defined that were not identified or required in the 1970 BOCA Building Code. The current building reinforced concrete masonry walls will each need to be reviewed for their capacities. AEI anticipates that these CMU systems will be able to be modified for compliance.

Snow Load:

- The 1970 BOCA Building Code identified a design snow load value of 30 psf.
    - Since the overbuilt truss roof system is supporting the snow load considerations for this building, the 1993 International Building Code was likely the code in effect at that time of the addition and overbuild truss installation. 1993 IBC requires a Ground Snow load requirement of 70 psf. With design adjustments the applied Flat Roof Design Snow Load would be 58.8 psf assuming a 0.7 exposure factor and a 1.2 Importance factor given that this facility is for fire and rescue services.

- Current 2015 IBC snow load requirements dictate a ground snow load for Sabattus ME of indicates a 70 psf Ground Snow Load requirement as well, with same exposure and Importance factors applied for a current Flat Roof Design snow load requirement of 58.8 psf. We determined that the addition was constructed, and the building reroofed in 1998 with a design by Lincoln-Haney. We assume at that time it was determined that reroofing of the existing building was appropriate. An evaluation at that time of the roof capacity to support the then current snow loading identified that the current flat roof system was deficient by more than 20 psf from snow loading. Either a structure upgrade to the current roof system or a continuation of a new truss roof overbuild would have been compared and wood trusses construed.

Second Floor:

- There was a question posed on site as to whether the roof was originally designed for a second floor. Given the type of installed metal deck, which is a standard wide flute roof deck, AEI does not believe that this system was intended to hold a second floor. If the intent would be to gain a second-floor level on this building, it is likely that the masonry wall could support the load but that additional floor joists would need to be installed, metal deck specific for concrete floor slab applications applied and either a wood framed, or continuation of the masonry considered up to a new roof system.

- It is also possible that a center Steel beam/column line could be provided with columns between bays, with two wood framed spans to create a second-floor system.

- The trusses could be removed, stored, and reused for this new roof elevation. However, this depends on whether the roof trusses were designed with capable of supporting an unbalanced snow loading conditions dictated by current IBC code requirements.

- An elevator/stair tower would need to be installed for access and a secondary means of egress provided from the second-floor level.

Regards,
Allied Engineering, Inc.

William P. Faucher, PE, SECB, RRC
Principal

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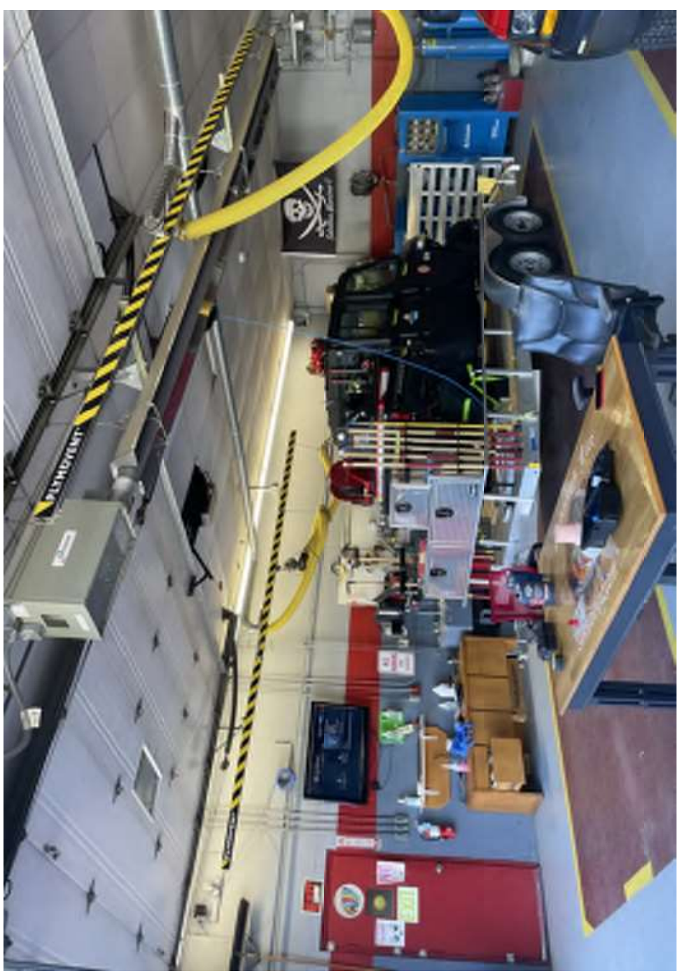

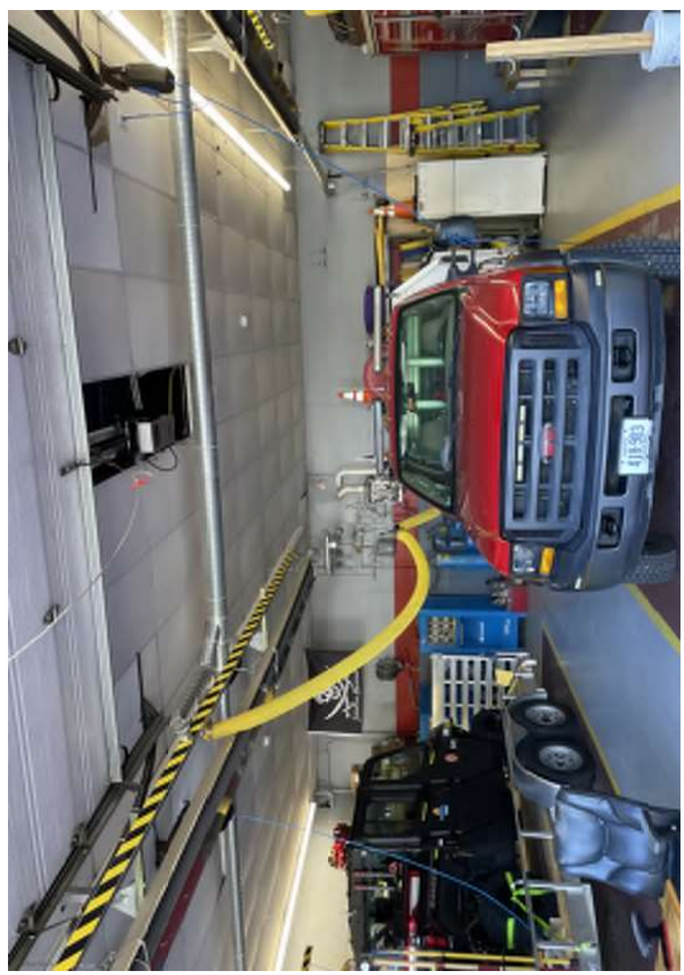






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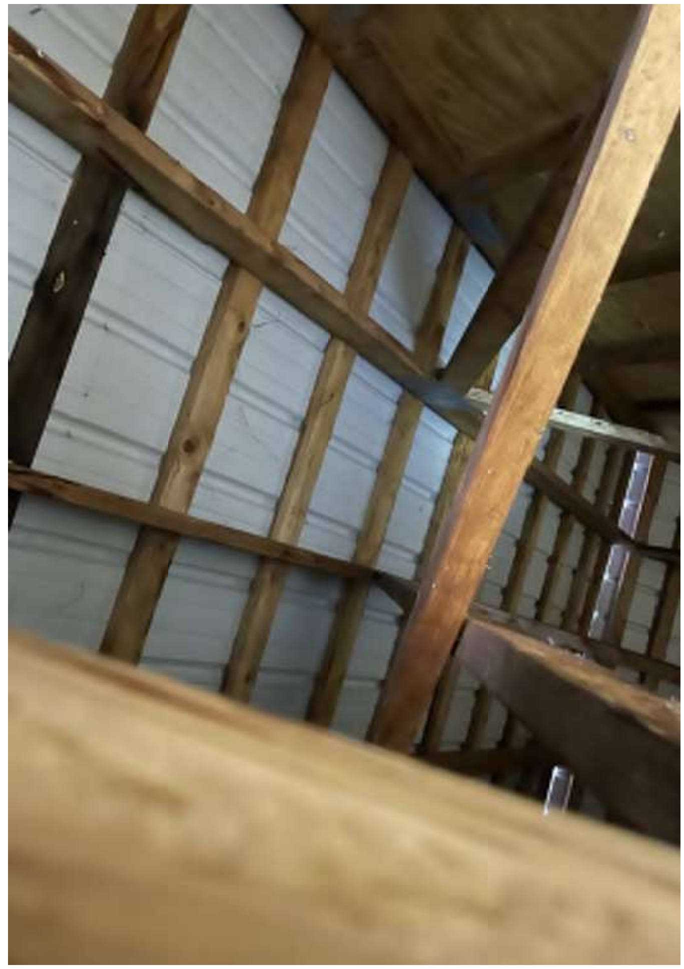

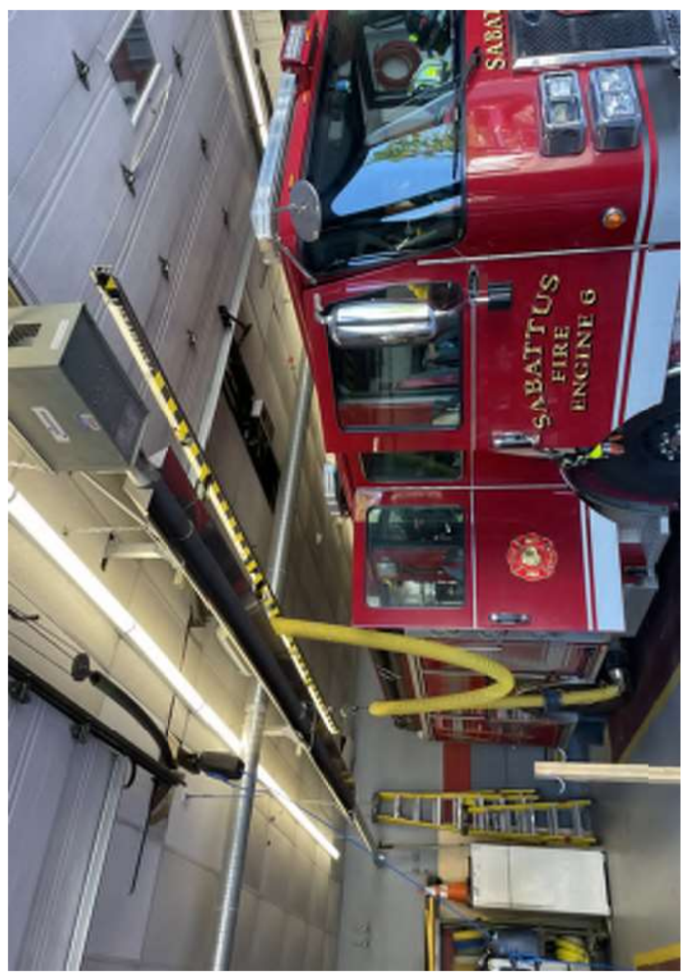
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