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May 1, 2019

Warrenstreet Architects
c/o Kyle Barker
27 Warren Street
Concord, NH 03301

Property: Tilton-Northfield Fire District
Park Street Fire Station
149 Park Street
Northfield, NH 03276

Re.: Engineering Consultation for Feasibility of Structural Renovations at the above referenced property

Dear Kyle,

At your request an engineering consultation regarding the above property was performed on April 25, 2019. The primary purpose of our engineering services and this report is comment on the feasibility of modernizing the existing structure to meet current Building Code requirements.

This inspection was performed, and report written by Dan Martel, P.E. Furthermore, this report has been reviewed by John Turner, P.E.

SUMMARY

The building appears to have performed adequately for the loads it has experienced in its life, with some exceptions. Substantial modifications would be needed for the structure to meet current building code requirements.

LIMITATIONS

This report is the complete response to your request for a study or an inspection of this property. It is for your use and other stakeholders involved in the impending remodel of the property only.[1] If you have any questions about this report or our inspection, please call the undersigned for clarification.

As you requested, these engineering services are limited in scope, focusing on the visible and accessible structural elements only. Structural analyses are not part of this scope.

[1] Should other(s) need to rely on this report, please contact us to request permission.

As Professional Engineers, it is our responsibility to evaluate available evidence relevant to the purpose of this inspection. We are not, however, responsible for conditions that could not be seen or were not within the scope of our service at the time of the inspection.

DESCRIPTION & BACKGROUND

This building is a single-story wood-framed with a cast concrete foundation built in 1986. It is used by the Tilton-Northfield Dire District as a garage to primarily store its emergency vehicles.

As we understand it, the Tilton-Northfield Fire District is assessing expanding their facilities at the Park Street Station. They are considering significant renovations and/or additions to the existing building, and they would like to understand the structural renovations required should the building need to be modernized to meet the current building code (2009 International Building Code).

For the purposes of this report the building is assumed to generally face Park Street to the east. All directions are from the point of view of an observer standing in the front of the building and facing it or the points of the compass.

OBSERVATIONS AND COMMENTS

During our visit, we walked the building with you, District Fire Chief Mike Sitar, and Barret Salta of Bonnette, Page and Stone (construction manager). Chief Sitar provided access to the exterior, interior main floor including all rooms (bathrooms and storage), and the attic. The attic is unfinished, allowing us to see the trusses and gable end walls, except for the loose insulation on the floor. The interior walls are entirely finished with wallboard, such that none of the framing is visible.

The building is about 60 feet wide and 80 feet deep, and the interior floor to ceiling height is about 14 feet. The structure includes timber trusses that clear span the width of the building, 2x6 exterior stud walls, cast concrete frost walls and a cast concrete floor slab. The roof contains asphalt composition shingle-style surfacing, and the exterior walls are clad primarily with vinyl lap siding.

In general, the structure appears to be performing adequately for the loads it has experienced in its lifetime with some exceptions:

1. The concrete floor slab contains significant cracks that are likely an indication that the slab has been overloaded by the heavy emergency equipment. Chief Sitar believes the slab is about 5 inches thick.
2. There is staining on the interior ceiling and walls clearly matching the truss and wall stud spacing. The staining could be a result of the timber structure experiencing excessive moisture, which over time compromises its structural integrity. The staining may also be a simple function of the typical lower insulating values of framing relative to adjacent

insulated wall cavities. We did not observe any other signs of excess moisture in the attic, despite limited ventilation (only soffit and ridge vents).

There are several deficiencies that would need to be addressed should the building need to be modernized to meet the 2009 IBC and the intended vehicle loads:

1. Gravity load-carrying capacity of the roof trusses
   The design ground snow load in 1986 was 40psf, whereas today it is 75psf in Northfield.[2] While we did not perform structural analyses to determine the gravity load-carrying capacity, our experience is that "pre-engineered" systems like wood trusses are efficiently designed very close to the design loading. Options to upgrade include sistering similar trusses to every existing truss or replacing the roof structure completely with adequately designed wood trusses.

2. Lateral load capacity of the front wall
   We presume the lateral force resisting system for the building is wood shear walls. We were not able to observe the walls to determine if they are built adequately (including adequately sized plywood sheathing and its proper nailing to the wood studs). However, the sides and rear wall appear to have adequate size (including limited openings) to resist prescribed lateral (seismic and wind) loading. With the four large overhead doors, the front wall has an obviously high opening to wall area ratio that would not be adequate for 2009 IBC shear wall requirements. Perhaps there is a steel moment frame on this wall, if not that is the most practical strategy for upgrading this wall the meet 2009 IBC requirements.

3. Inadequate roof diaphragm
   Similarly, we could not observe the details of the ceiling construction, but it appears to be only wallboard attached to strapping fastened to the truss bottom chords. That is not adequate to act as a diaphragm to transfer lateral loads from the roof trusses to the walls below. The most practical strategy is to replace it with plywood sheathing properly nailed. Furthermore, proper connections are needed between the roof truss bottom chord and exterior walls, which could likely be achieved with the steel connectors like those manufactured by Simpson Strong-Tie.

4. Hurricane ties and foundation anchorage to resist uplift
   While we did not observe the connections between the roof trusses and wall, and the walls and foundation walls, it is unlikely that they are adequate to resist uplift forces from current design lateral loads. Design lateral loads have increased substantially since 1986. Proper anchorage hardware would need to be installed at the roof truss-wall and wall-foundation connections. The size of the foundation walls needs to be confirmed to determine if its weight is adequate to resist uplift forces.
   Additionally, the bottom of the foundation needs to be at least 5 feet below finished grade for frost protection to meet the 2009 IBC.

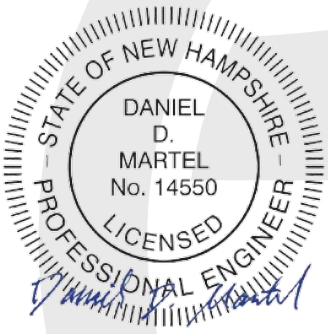
[2] "Ground Snow Loads for New Hampshire", ERDC/CREREL TR-02-6, US Army Corps of Engineers, February 2002

5. Cracking floor slab
   The concrete floor slab is obviously underperforming for the loads it has experienced from the emergency equipment. The slab should be removed and replaced with an adequately designed slab, which will likely be 8 inches thick or more with a mat of steel reinforcing bars.

If you have any questions concerning this report or the inspection, please contact the undersigned or this office.

Thank you for the opportunity to be of assistance to you.

Sincerely,



Daniel D. Martel, P.E.
Senior Engineer

John P. Turner, P.E.
Senior Engineer/Reviewer

Enclosures: Photos

Distribution: kb@warrenstreet.coop

Photo: 1

Location:
149 Park Street
Northfield, NH

Date: 4/25/2019

Description:
Front and left elevations from Park Street

Photo: 2

Location:
149 Park Street
Northfield, NH

Date: 4/25/2019

Description:
Right and rear elevations

Photo: 3

Location:
149 Park Street
Northfield, NH

Date: 4/25/2019

Description:
Concrete slab cracks at the front middle

Photo: 4

Location:
149 Park Street
Northfield, NH

Date: 4/25/2019

Description:
Typical concrete slab cracking at the front corners

Photo: 5

Location:
149 Park Street
Northfield, NH

Date: 4/25/2019

Description:
Staining on the walls and ceiling at every stud and truss could be indicative of excessive moisture or differences in insulation between framing and insulation

Photo: 6

Location:
149 Park Street
Northfield, NH

Date: 4/25/2019

Description:
View of the middle portion of the roof trusses from the attic