



January 8, 2014

Mr. Jeremy Underwood
Building Maintenance Superintendent
Town of Northfield
49 Caldwell Road
Northfield, MA 01360

RE: Assessment of Firehouse Structure, Northfield, MA. Report of Findings and Recommendations

Dear Mr. Underwood:

Background

On November 19, 2013, Joel Shattuck of our Albany office performed a site visit to the Northfield firehouse located on Main Street to review the extent of existing concrete slab and concrete beam distress at the elevated slab area areas. CHA observed that the existing concrete slab had displaced vertically in several areas and that several concrete support beams showed visible cracks, with reinforcing steel visible at several locations. Original construction drawings were received from firehouse personnel as well as findings and recommendations of 2 previous reports from 1978 and 1988. Existing slab and beam dimensions, details and material specifications were determined from engineering drawings of the original construction circa 1953.

While at the site, firehouse personnel supplied the gross vehicle weights (GVW) of several pieces of firefighting-related equipment, the most significant being:

- Engine #1: 38,400#
- Engine #2: 45,000#
- Water Tanker: 25,000#
- Brush Truck: 12,200#

Findings

Structural calculations were performed at critical load placement locations for both the concrete slab and concrete beams. For maximum axle loading from both Engines #1 and #2, analyses indicate that both the 6" concrete slab and its supporting beams are overstressed.

For the concrete support beams, calculations for Engines #1 and #2 would indicate that yielding of the reinforcing has occurred at the beam ends. This yielding at the beam ends would cause some loss of end fixity at the column supports, resulting in loads being transferred to the beam centers. Beam cracking

and exposed reinforcing is visible at several central (+/-) locations within the existing concrete support beams. Similar cracking had apparently been noted in the previous reports reviewed.

For the 6" slab, high end shears are indicated at the edges of the support beams for both Engines and the Water Tanker. This overstressed loading appears to be in agreement with cracks observed in the 6" slab parallel to and slightly off of the beam supports. Similar cracking had apparently been noted in the previous reports reviewed.

Conclusion

It is our opinion that with the current slab and beam distress observed, both Engines #1 or #2 and the Water Tanker should be restricted from parking within any areas of the elevated slab. All three of these vehicles should be relegated to parking on the ground floor only. The Brush Truck with its reported 12,200# GVW, 2 axles and single wheels should be considered the maximum vehicle allowed on the elevated slab at this time.

Recommendations

Structurally, there would appear to be no fix to the current observed beam and slab distress that would increase capacities to safely allow the parking of the 3 heaviest vehicles noted. Unfortunately, the existing member configurations, thicknesses, and materials are limited in their maximum allowable loads. However, performing repairs such as cleaning and patching at exposed reinforcing, cleaning and epoxy grouting of main beams and supports and sealing of all cracks to protect reinforcing from corrosion would help preserve what currently exists from future deterioration.

During the site visit, firehouse personnel pointed out that current elevated slab drainage patterns tend to the south and east corners of the building floor and into the walls. The cause for this sloping is beyond the scope of our investigation. However, ideally, it is not a condition that should continue. It is recommended that an analysis of the drainage pattern be conducted and minimal curbing and local drain or drains be installed and piped to the outside of the building.

Visually, the results of this poor drainage condition are apparent by the large triangular corner pieces of concrete which have cracked and pulled away from the concrete foundation wall. Without drainage mitigation, future freeze/thaw cycles will only make these areas worse. Similar to the beam repairs, it is recommended that all cracked concrete be removed, any damaged reinforcing repaired and the building wall corners be reconstructed along with the drainage mitigation.

Very Truly Yours,



Daniel J. DeGennaro, PE
Technical Leader

