Attachment I

NORTH HAMPTON LIBRARY

Foley Buhl Roberts & Associates
Preliminary Structural Review and Assessment

2014 Aug 29

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August 29, 2014

Lavallee Brensinger Architects
155 Dow St.
Manchester, NH 03101

Attn: Ron Lamarre

Re: North Hampton Library, 237A Atlantic Avenue, North.Hampton, NH
Preliminary Structural Review and Assessment

Dear Ron,

I visited the North Hampton Public Library on behalf of Foley Buhl Roberts & Associates (FBRA) on the morning of August 12, 2014 and conducted a 2 hour review of the building structure. This assessment was conducted per request of Lavallee Brensinger Architects in conjunction with an overall review of this facility.

During this visit I spoke with the Library Director, Susan Grant, who provided me with access to various areas of the building.

Methodology

The library has the original construction drawings of this facility on file and those drawings were reviewed for this assessment. The on-site inspection was conducted by visual means, using a tape measure and a digital camera. No exploratory demolition or materials sampling or testing was conducted for this assessment.

Building Description

The Library is a one-story building with plan dimensions (out-to-out) of 74' x 74', reportedly built circa 1973. The building has a gross floor area of approximately 5180 square feet. The stack room/reading room occupies the eastern side of the building and comprises roughly 60% of the building footprint. The western sections of the building include office spaces, a meeting room, a presentation room, bathrooms and various utility and support spaces.

The main entry vestibule is on the south side of the building, facing the parking lot and Atlantic Avenue. There is a secondary staff entrance (single door, no vestibule) on the west side of the building.

The entire floor is a grade-supported concrete slab. The exterior walls are comprised of 8" concrete masonry, with a 4" brick veneer (12" total thickness of masonry). The east and west exterior walls of the building are load-bearing and they support a roof structure comprised of a plywood roof deck on dimensional lumber rafters, supported on structural steel trusses. There is a single interior bearing line of structural steel beams supporting the interior ends of the roof trusses. The steel beams are supported by steel pipe columns contained within the masonry wall behind the circulation desk.

The exterior walls of the building are comprised of a 4" brick veneer with an 8" concrete masonry inner wythe. The interior walls are non-load bearing and are typically comprised of 4" concrete masonry.

The windows on the east, north and west elevations extend across 40% to 60% of the length of those walls. However window and door openings on the south elevation extend across approximately 90% of that elevation (those window openings include the tall windows in the reading area, the entry vestibule, the director's office and the meeting room). This is a significant observation that will be commented on later in this report with regard to wind and seismic loads.

Roof

The building has a flat, central roof area measuring approximately 48 feet square, surrounded on all four sides by a sloped roof (approximately 7V:12H) pitch. (this is sometimes described as a "mansard" roof configuration, although a true mansard roof would have a low pitched (not flat) upper section). I was not able to access the flat roof area, however several small air conditioning condensers are visible from the ground, positioned on the northerly end of the flat roof. The pitched roof areas have asphalt shingle roofing. There are gutters in the immediate vicinity of the exterior doors (south and west sides) and electric heating elements have been installed over the asphalt shingles on the eave lines over those gutters.

Generally, the exterior brick veneer and the concrete masonry walls are in good condition. There is no evidence of step cracking or settlement induced cracking.

The top outer faces of the perimeter foundation walls are visible above grade and below the brick veneer. There has been some scaling and delamination of the concrete immediately below the brick shelf (see photo). This damage appears to be superficial and may be due to segregation of the concrete during placement.

The building has attic space, contained within the depth of the roof trusses. There is a spiral staircase that accesses two small, finished storage rooms, but the majority of the attic space is unfinished and has no floor structure. There are 5 lines of structural steel roof trusses, with each line comprised of a 42' eastern truss and a 30' western truss. The eastern and western trusses meet and bear upon the interior structural steel beam line. The steel trusses are spaced at 12 feet on centers, measured perpendicular to the direction of span. The trusses are generally of a Pratt truss configuration. The top and bottom chords are comprised of WT5 steel sections. All web members, verticals and diagonals, are comprised of double angles. The bottom chords are straight horizontal sections for the full length of each truss. The top chord is sloped to follow the roof pitch in the outermost panel of the truss, and then becomes horizontal for the remainder of the truss span. Overall depth (out-to-out) of the roof trusses was measured at 7'-3". Steel angle "X" bridging has been installed between the trusses and straight-line bottom chord C4 bridging has been installed in the plane of the truss bottom chords. Similar straight-line C4 bridging is believed to exist in the plane of the top chords, however this bridging was not visible due to the insulation blanket. The steel trusses are welded shop assemblies. Field connections at the bearings and bridging connections are comprised of high strength bolts. The supporting interior steel beams are W14 sections, installed in a continuous span arrangement over steel pipe columns.

In general, the steel trusses and related bridging and framing that comprise the primary roof structure reflect all the characteristics of an engineered steel structure. The one exception to this statement is that the shorter span trusses on the west side of the building have a single Vierendeel panel (second panel of the truss from the west end), meaning that the truss panel has no web diagonal element and therefore transfers all loads via flexural stresses, as opposed to the axial force transfer that occurs when web diagonals are present. This is not necessarily a defect in the construction. It appears the Vierendeel panel was deliberate and was intended to allow a large duct to traverse the building at that location. I observed no evidence that a web diagonal had been removed at this location, and the original construction drawings confirm that this panel has no web diagonal by design. The Vierendeel panel is also shorter in length (horizontally) than the typical panel dimensions elsewhere in these roof trusses.

The top chord of the steel trusses is wholly contained within paper-faced fiberglass batt insulation. This insulation layer is taped at the seams and it conceals the wood roof rafters and plywood deck from view. The wood rafters are 2x8 sections, spaced at 24" on centers, and bearing on wood plates that are bolted to the top chords of the steel trusses. The original construction drawings call for 1500 psi stress grade lumber, Douglas Fir or Southern Yellow Pine, for the rafters. These 2X8 rafters are probably the limiting factor with regard to roof snow load capacity. On the basis of the rafter size and the stress grade information on the original construction drawings, I estimate the roof snow load capacity to be approximately 45 pounds per square foot. This load capacity exceeds the current design snow load requirements for North Hampton.

According to the original construction drawings the roof deck is comprised of 5/8" plywood, however the deck was entirely concealed from view during my inspection.

Analysis of the steel trusses is beyond the scope of this preliminary assessment. The visible components of the steel trusses were observed to be in good condition, with no deficiencies noted.

With the exception of the wood framed floor in the two small attic storage room, access to the rest of the attic is provided by walking on a series of loose 2x12 boards placed over the bottom chord truss bridging.

The entire main floor of the library has a suspended tile ceiling comprised of 4x2 acoustic fiber tiles in a suspended metal grid. Additional blown-in insulation has been added on top of that ceiling. Viewed from the attic, the top of the white blown-in insulation is immediately below the bottom chords of the steel trusses. The blown-in insulation presents a maintenance issue, since the ceiling tiles cannot be removed from the grid without causing insulation to fall into the library below.

Floor Slab

The main floor slab is entirely concealed by finish flooring. The original construction drawings call for a 4" concrete slab, reinforced with 6"x6" – W10/W10 welded wire fabric and placed over an 8" coarse gravel subgrade. The actual slab composition could not be determined by on-site inspection. This is a relatively lightly constructed floor slab for a library stack room, however I did not observe any issues with the flooring that would be indicative of structural issues with the floor slab.

Walls and Lateral Load Aspects

The details of the building structure are consistent with the reported 1973 vintage construction date and are reflective of a relatively high level of architectural and structural engineering involvement.

The building predates any building code requirements related to seismic design. The details of the exterior masonry wall construction cannot be determined by the means employed for this assessment. On the basis of the plan review, it appears that the masonry is not reinforced. The building is dependent on the perimeter exterior masonry walls acting as shear walls in order to transmit lateral loads (i.e., wind and seismic loads) to the foundation. The windowless wall panels that exist on the east, north and west sides of the building are subjectively judged to be sufficient for this purpose. However the south wall has no large, uninterrupted masonry panels and therefore is of little value as far as its capacity to transfer lateral loads from the roof to the foundation. This potential vulnerability is somewhat mitigated by the shape of the roof, the relatively light roof construction, the square footprint of the building, and the available shear walls on the other three elevations of the building. The building remains code-compliant in a "grandfathered" status for its current Risk Category and use (reference the International Building Code, Table 1604.5). I would recommend further analysis of the roof diaphragm, attachment details, masonry wall construction and shear wall arrangement if the building were to be repurposed to a use that involved a change to a higher Risk Category.

A second seismic vulnerability exists in connection with the interior non-load bearing masonry walls. The tops of these partitions are not effectively restrained to the roof structure, leaving them vulnerable to overturning in a seismic event.

Commentary

From a structural perspective, this building appears to have been designed in accordance with the building codes in general use circa the 1973 date of construction. The building structure has performed well and is relatively free of structural issues.

The building has several features that do make it potentially vulnerable to seismic damage. This vulnerability is the result of the number of windows in the south wall, the use of unreinforced masonry construction and the absence of partition top restraints on the interior masonry walls.

I understand that the Town is considering possible repurposing of this building as a town office or as a storage facility. The nature of this structure is such that the building cannot be easily modified or reconfigured to accommodate other uses or changes in its configuration. The steel roof trusses are particularly limiting in this respect and accordingly augmenting the roof load capacity would be particularly difficult. Aside from interior repartitioning, the building would most likely have to be repurposed in its present configuration. Any proposed change in use should result in a lower or equal Risk Category, as defined by Table 1604.5 of the International Building Code.

This report is intended to address structural conditions only. Architectural, mechanical and electrical evaluation of the facility is to be conducted by others.

Photographs of several of the conditions noted in this report are attached.

Very truly yours,
FOLEY BUHL ROBERTS & ASSOCIATES, INC.

Richard E. Roberts, P.E.
Vice President

Photo 1: South Elevation, main entry, reading room windows.

Photo 2: Southwest corner.

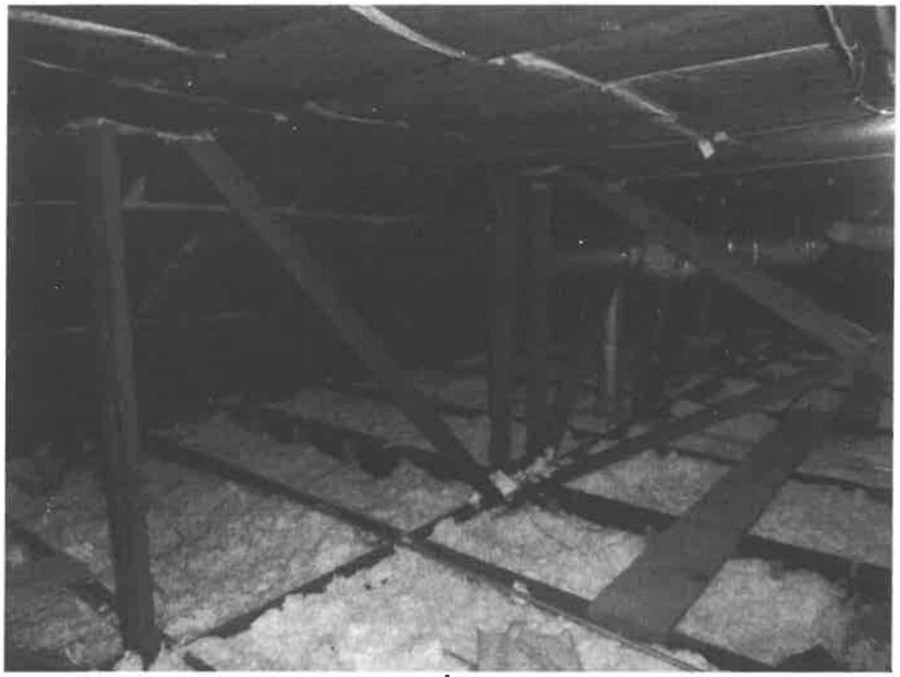

Photo 3: Attic space within the steel roof trusses.

Photo 4: Steel trusses bearing on interior steel beam line.

Photo 5: Note top of unrestrained masonry wall (east wall of main entry vestibule).

Photo 6: Spalled concrete surface on exterior foundation wall, west side.