Appendix 7.1
Structural Report

ROOME & GUARRACINO, LLC

Consulting Structural Engineers

48 Grove Street Somerville, MA 02144
Tel: 617.628.1700 Fax: 617.628.1711

Structural Condition Assessment and Feasibility Report on Council on Aging Building at 5 Broad Street

Salem, Massachusetts

Prepared for:

LDa Architecture and Interiors
222 Third Street, Suite 3212
Cambridge, MA 02142

ROOME & GUARRACINO, LLC
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Tel: 617.628.1700 Fax: 617.628.1711

Date: October 26, 2009
To: Mr. Dean Hofelich, LEED AP – LDa Architecture and Interiors
From: Carmine Guarracino, P.E.
Project: 5 Broad Street
Location: Salem, MA
Reference: Structural Conditions Assessment Report
R & G File No. 9256

Overview

This letter summarizes our findings regarding the present condition of the structure for the "Council on Aging Building" located at 5 Broad Street in Salem, Massachusetts, as well as, our recommendations regarding future uses of this structure. These observations and recommendations are based on information provided to us by your office, as well as, our field observations of October 13, 2009. No existing structural drawings are available for the original building, and as such, our comments are based solely on our field observations and experience. Our field observations were only visual surface observations and we have not cut any holes in building finishes to verify structure, nor have we done any testing to determine the structures underlying condition.

Existing Conditions

On Tuesday, October 13, 2009, I toured the existing building with you and Kyle Sheffield of LDa Architecture and Interiors. The original building was a former school built in the mid – 19th century and consists of a two story masonry structure with a basement and a partially finished third floor space. The framing consists of wood joists and timber beams and wood stud bearing walls supported onto timber beams over cast iron columns or brick piers. The exterior walls are multi-wythe masonry bearing walls over stone foundations with a slab on grade at the basement floor. The roof is a hip roof with a flat roof in the center, multiple dormers and a center bell tower. The main roof is framed with story deep timber trusses with the bottom chord at the third floor supported by steel hanger rods from the top chord panel points.

The building is comprised of three sections: The middle section or the "stair core" has bearing walls on each side and is the narrowest part of the three sections. The other two sections are the "east" and "west" sections which are the larger sections. The framing is symmetrical about the stair core with the joists spanning parallel to Broad Street. (See attached schematic framing diagrams)

I proceeded into the basement toward the east section to view the framing. I noted two interior beam and column lines. The beams and posts consisted of newer steel, which was part of an earlier renovation. At the "east" section, the framing bears from the exterior masonry walls to an interior beam and column line about 12 feet away, then approximately 16 feet to another beam and column line and lastly another 16 feet to the stair core walls. (See attached schematic framing diagrams) Floor joists were not visible in this area due to finished ceiling.

In the west section of the basement, the floor joists were exposed since there is no ceiling. Again, the joists span 12 feet from end wall to interior timber beam and columns and 16 feet twice to the stair core wall. The framing connections are mortise and tenon, which was standard construction for that period of time. The beams are heavy timbers spanning over masonry piers. The spacing of masonry piers ranges from 7 to 10 feet. I noted some locations where joists are split (See Picture 1.) and the bases of the masonry piers are deteriorated (See Picture 2.). I noted an area of framing whereby a joist is interrupted by a header, which is smaller in size than the joist and adjacent framing. (See Picture 3.) Lastly, some joists and timber beams have developed horizontal splits as a result of shear stresses developed in the reduced sections of the mortise and tenon connections. See Pictures 4. and 5.

Picture 1.

Picture 2.

The basement at the time of the visit appeared to be relatively dry. The basement floor is a concrete slab on grade which appears to be worn with some cracks and settlement in some areas. I noted that the foundations consist of stones of various sizes for the lower half with brick for the upper half of the walls. At several basement windows, signs of efflorescence is noted, which is indicative of water and moisture infiltration. See Picture 6. The mortar around the windows also appears to be deteriorated and loose.

Figure 3.

Picture 4.

Figure 5.

Figure 6.

A walk through the upper floors (first, second and third floors) revealed little or no structural information, since most of the structure is covered by finish and ceilings. The floors in various areas exhibit sags and dips. Several posts are noted within the first floor space called the Social Hall to support the second floor framing, however, the second floor framing was not visible due to the intact ceiling. Ceiling tiles were removed and I noted deeper beams installed below the second floor as part of a renovation which took place in the late 1990s. The columns and beams noted are consistent with report and drawings prepared by Structures North, who was the consultant hired to investigate the removal of bearing walls in the first floor space.

After reviewing the report prepared by Structures North, it appears that the walls were not intended to be bearing and that the second floor joists spanned 32 feet from the bearing line 12 feet away from the exterior wall to the wall adjacent to the stairs. This seems to be the case on the west side as well, where a ceiling tile was removed and I noted a beam line with posts 12 feet away from the exterior wall and no indication of support between the aforementioned beam line and the stair core.

Figure 7.

Picture 8.

Upstairs on the second floor (bingo room), the space is column free with floors which are noticeably sagging. In the third floor exercise room, evidence of water and moisture is noted in the ceiling with some cracks in the plaster ceiling.

Near the Veterans Office on the third floor, I proceeded up a ladder and through a ceiling hatch into the attic space to view the roof framing. The space was tight and confined and I noted 2x8 rafters and ridge with several beams and collar ties. See Picture 7. No evidence of damage or distress is noted in the framing.

Picture 9.

In the closet spaces on the third floor, steel tubes are noted to be in place below the existing roof hips. The tubes are anchored to the exterior masonry walls (See Picture 8.) and appears to run directly up to the top of the roof just below the existing hip rafter. See Picture 9. The tube supports at the hips may have been an attempt to limit roof deflection, which may have occurred in the past.

I proceeded outside and around the perimeter of the building to view the exterior conditions and noted that the masonry walls are three wythes of brick or12 inches thick. I noted only some step cracking in the masonry joints at the front, sides and rear of the building. I noted some cracks in the cast stone lintels above windows. See Picture 10. Signs of deterioration and spalling of cast stone around door openings are also noted. See Picture 12. The soffit conditions at the eaves are in poor condition. The wood trim and pediments below the overhanging eaves appear to be wet with significant rot and deterioration.

Picture 10.

Picture 11.

Picture 12.

Assessment of Existing Conditions

While the structure of most of building is not visible from inside, as walls and ceiling finishes cover the framing, there is no evidence of major structural distress and generally the building appears to be in good condition. However, the major structural concern is regarding the deficiencies noted in the first floor framing described above. Reinforcing damaged joists and beams, re-building masonry piers and adding face mount joist hangers to all flush framed mortise and tenon connections is required to properly fix the existing deficiencies in the framing.

The framing for the first floor has the capacity to support 100 psf live load, however, it appears from the information gained in the Structure North report, the upper floor framing with the longer spans, appear to have been designed for classroom loading of 50 psf. The deflection of this framing, however, is an issue, which is clearly evident from the sags and dips viewed in the floors. The walls below appear to provide additional support, thus reducing the deflection. If the walls below the framing are acting as true “bearing walls”, then these loads must be accounted for in the design of the framing below.

Since deficiencies were noted in the first floor framing, the same may be true for the upper floors as well. In order to evaluate the framing properly, the entire ceiling must be removed to expose all the framing at all floors. Only then can a proper determination and evaluation of the existing framing can be performed.

There are two options for reinforcing the floor: Reinforcing in place or replacement and re-building. Reinforcing the joists and or adding supplemental beams, posts and footings may be accomplished, however, the deflection in the floor will still exist, unless all the decking is removed and

supplemental framing is installed in such a way that a level floor is achieved. Removal and replacement of the existing framing is also, an alternate solution, which may be more cost effective.

The other issues we see require repairs, such as the exterior cracks located around the perimeter of the exterior masonry walls could be repaired by re-pointing and the cracked cast stone lintels and door jambs could be replaced to match.

Addition/Renovation Feasibility

It is our understanding that the City of Salem is interested in a number of possible options for renovating and/or adding to the existing structure, for re-using the existing structure for various possible future uses. Our review of the existing structure indicates that minor renovations to the existing structure are possible as long as the exterior masonry bearing walls of the building are basically left in tact. Any additions attached directly to the existing structure would have to be kept small, so as to not trigger a complete seismic upgrade of the building. (see below) Any larger addition would need to be separated from the existing structure by an expansion joint.

Generally, minor structural changes required to add or modify stairs, elevators, add mechanical openings, or add roof skylights are fairly simple, and do not have a major impact on the structure. However, any additions and alterations to the existing structures must be kept to less than 10% of the existing building's area and mass, or a major seismic upgrade would be required by the Massachusetts State Building Code. Such an upgrade to the structure would be prohibitively expensive, and must be avoided. This is one reason why any proposed new additions will have to be separated from the existing building structure by an expansion joint. Any new structure could then be as large as desired and still be in accordance with the latest codes. The architecture, location, and intended use of any new addition will influence the structural framing system, whether timber or structural steel. Based on the information that we were able to glean from our visit to the site, it appears that any new foundations would be spread footings.

Based upon the gravity load capacities of the floors noted above, it appears that the first floor is capable of supporting the live loads required for assembly type uses. However, the load carrying capacity of the upper floors is significantly below that required for assembly type uses. Without additional structure or reinforcing, the floors in question are suitable for residential uses only.

If you have any further questions, or if we can be of any further assistance, please feel free to call.

Very truly yours,
ROOME & GUARRACINO, LLC

Carmine Guarracino, P.E.
Principal

Enclosures