Structural Engineering Narrative
MPLCP Level of Design
December 23, 2025

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Renovations to Whitinsville Library, Northbridge, MA

Preliminary Structural Narrative

December 22, 2025

1.0 Existing Structure

The existing 15,556 gsf building consists of a historic masonry, circa 1913 structure with a more recent addition. Structural information on the existing building was obtained from a site visit by RSE on December 18, 2025.

1.1 Foundations

The existing foundations appear to be cast-in-place concrete foundation walls at the exterior, and brick piers and masonry walls in the interior (Photo 1). The lowest floor is assumed to be a concrete slab on grade.

1.2 Superstructure

The elevated first and second floor levels appear to be concrete flat slabs with concrete beams in most of the historic portion. The stack area is a two-story structural stack system where the shelving units also support the floors between and around the shelves. (Photos 2 and 3) The small addition appears to be a concrete slab on deck supported on load bearing masonry walls with strategic use of steel angle for additional support. (Photo 4) Since the original floor to floor heights are relatively small, and the existing floor systems are thin, available depth of structure at the addition was also limited.

We were not able to confirm the construction of the gable roof, or the cupola, but have been told that the structure is wood. The original flat roof over the stacks may also be supported on the stacks system, or it may be a separate concrete flat slab. The addition roof appears to be metal roof deck on load bearing masonry and steek angles. Lateral resistance against wind and seismic loads is assumed to be provided by exterior and interior masonry walls. There are two large chimneys and no parapets.

The site slopes from front to back with an entrance at grade in the basement level, and the main entrance several steps up from grade at the first floor.

1.3 Design Criteria

No design criteria were provided for the existing building.

1.4 General Observations

The existing building appeared to be in good condition with few signs of damage or deterioration. Most observations are not structural issues but are related to water infiltration which can cause structural problems if they are not addressed. This is not intended to a thorough report on building envelope issues.

- Minimal cracking near in the concrete foundation wall near a window (photo 5). No signs of water infiltration, so no further action required.
- Failed gutter at the inside, northwest corner (Photo 6) causing staining on the concrete (Photo 7). Gutter should be repaired to avoid potential water damage.
- The subfloor below the carpet tiles in the lower stack area has buckled in some places causing tripping hazards. (Photo 8) This should be addressed by removing and replacing the sub floor locally. The moisture should also be mitigated for a long term repair.
- Portions of the large flat roof are no longer properly adhered. There are also reports of leaks below this roof. Ongoing water infiltration is a potential structural problem if it is left unaddressed. It is also a problem for contents or occupants below.
- Around one of the chimneys, there are indications of water infiltration. Flashing around the chimney should be reviewed and repaired as needed. (Photo 9)

2.0 Proposed Building

2.1 Overview of Renovations and Additions

Proposed renovations include removing the stack system with the flooring, the associated exterior walls, and the later addition. An existing star on the east side of the building will be infilled and some walls in that area will be reconfigured. The remainder of the historic portion will remain intact.

The proposed addition to rear will include two stories and a partial basement. A portion of the addition will infill the former stack area. This portion will be laterally tied into the historic building at the roof. The remainder of the addition will be seismically separated with an expansion joint.

Grade around the building will be raised to allow for exterior doors at the first floor on the west and north sides of the addition. Backfilled areas will also include the current basement at the stacks area.

2.2. Code Implications

Under the Massachusetts State Building Code, 10th edition (International Building Code and International Existing Building Code 2021 with Massachusetts Amendments), the scope of work within the existing building is classified as Work Area Level 2 since less than 50% of the area is involved in the renovations. Gravity load carrying elements supporting less than 30% of the total floor and roof areas will also be involved in this proposed alteration, so this scope is not classified as a Substantial Structural Alteration.

Removal of exterior walls along the stack area will impact the lateral capacity of the building by reducing the length of masonry shear wall available to resist north-south lateral loads.

Per section 1101.1: The proposed addition "shall comply to the International Codes as adopted for new construction". Per section 1103.2 IEBC 2021: "…Where the *addition* is not structurally independent of the *existing structure*, the *existing structure* and its *addition* acting together as a single structure shall meet the requirement of Sections 1609 and 1613 of the *International Building Code [IBC]* using full seismic forces." There is an exception for "Any existing lateral load-carrying structural element whose demand-capacity ratio with the *addition* considered is not more than 10 percent greater than its demand-capacity ratio with *addition* ignored shall be

permitted to remain unaltered. A portion of the addition will be tied into the existing building and, but this addition will fall below the 10% threshold, so the existing building will not need to meet the requirements of Sections 1609 and 1613 of the IBC using full seismic loads. The new construction beyond the expansion joint will meet the requirements of the IBC.

2.3 Design Criteria

Design Criteria for the Addition, Per Massachusetts State Building Code, 10th edition, and MBLC criteria

Live Load
- Floors 150 psf (shelving)
- Accessible Roof Deck 100 psf
- Mechanical 150 psf + weight of equipment pads

Snow Load
- Ground Snow Load 40 psf
- Minimum Flat Snow Load 35 psf

Wind Load
- Basic Wind Speed (V_{ult}) 119 psf
- Exposure B
- Risk Category II

Seismic
- S_s 0.207
- S_1 0.059

2.4 Structural Scope of Work

Foundations:
Foundations for the new addition shall be designed in accordance with the recommendations in the Geotechnical Report by Geotechnical Services, Inc, dated November 19, 2025.

- Footings will be designed for an allowable bearing capacity of 4 ksf.
- Typical column footings shall be 7'6" x 7'6" x 1'3" thick, reinforced with 8-#6 bars each way. Provide 24"x24" concrete piers at exterior columns.
- Foundation and frost walls shall be 12" thick, reinforced with #4@12 each way, each face on a 2'wide x 12" thick continuous wall footing reinforced with 3-#5 continuous bars, and #5@12 short bars.
- Bottom of all exterior footings shall extend a minimum of four feet below grade. Top of all interior footings shall be located a minimum of one feet below top of slab.
- Footings in the current stack area and in close proximity to the existing exterior walls will be dropped so as to avoid surcharging the walls. Concrete piers will be required below steel columns in those locations.
- Slab on grade shall be 5" thick, reinforced with 6x6-W2.9xW2.9 WWF over 10 mil vapor barrier, and 6" of compacted granular material.
- Provide perimeter and underslab drains at the new basement area.
- Elevator pit shall consist of 12" thick walls and slab, reinforced with #4@12 each face each way. Provide 2'x'2'x2' sump pit. Elevator pit shall be waterproofed

- Where grade is raised, existing masonry walls (exterior and interior) will become foundation walls retaining soil and may require reinforcement such as a new reinforced concrete wall cast against the outside of the masonry walls to remain.

Super structure:
New elevated floors will be steel framed with a lightweight composite slab on metal deck. The roof will be steel framed with metal roof deck.

Small infill areas in the historic building will be concrete slab on metal deck supported on new steel beams, or angles drilled and epoxy grouted into existing concrete beams and/or existing masonry walls.

A small portion of the addition will be tied into the existing structure. This may include drilling and epoxy grouting dowels into the existing masonry walls.

Lateral Systems:
Due to the removal of the stack area and existing masonry shear walls, provide supplemental lateral systems to the walls along the east and west sides of the stack area as follows:

- Reinforced concrete shear walls constructed against existing masonry walls with additional foundations,
- Supplemental steel braced frames, or
- Additional steel braced frames within the infill addition to support lateral loads from the existing portion.

The main portion of the addition will be seismically separate with an expansion joint. This will require double columns, or additional columns next to the existing building bearing walls. Lateral resistance at the addition will be provided by steel concentrically braced frames as well as steel moment frames.

Other items:
New elevator shaft shall be CMU reinforced with #5@32 vertical, #9 wire truss @16 horizontal, and bond beams at each floor level, and 8’ on center.
Provide relieving angles at the first floor of the addition, and below the high roof at the clerestory to support the brick façade.

Photo 1 – Brick pier, concrete and masonry wall beyond, concrete beam and flat slab

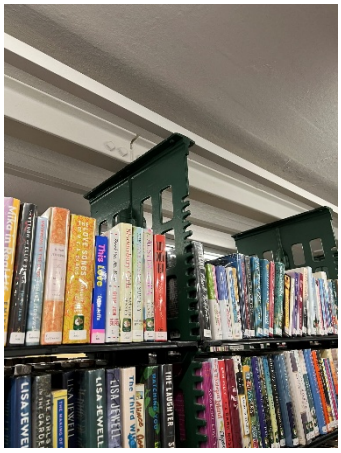

Photo 2 – Structural shelving system supporting floor

Photo 3 – Floor system at stacks supported at exterior wall

Photo 4 – Strutural floor system at addition

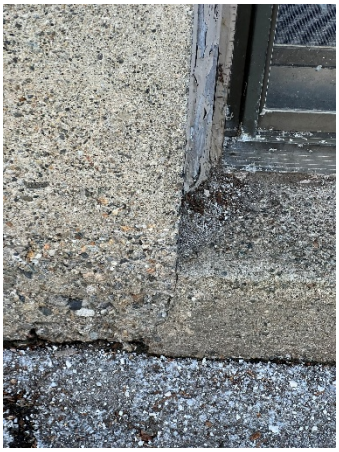

Photo 5 – Cracking in concrete foundation wall

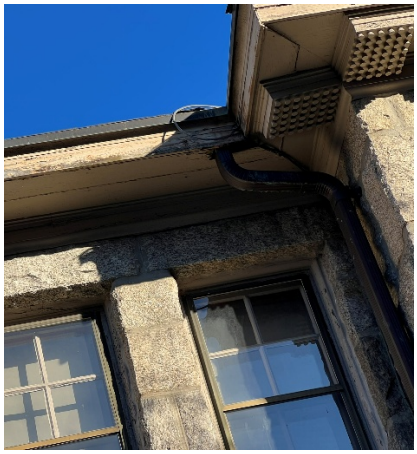

Photo 6 – Failed Gutter

Photo 7 – Water staining below damaged gutter

Photo 8 – Buckling in subfloor

Photo 10 – Water damage at chimney penetration through roof