Structural Code Review
Newton Senior Center
345 Walnut Street
Newtonville, Massachusetts

1.1 Introduction:

The Newton Senior Center is a partial two-story, 11,000 ft^2 building, with a full basement, located at 345 Walnut Street in Newtonville, Massachusetts being investigated for a full renovation and addition. The brick building was constructed in 1938 as a Library using typical construction material and techniques. The building underwent a renovation and addition project in 1993 to convert the building from the Library to a Senior Center; and to add an elevator and new entrance. The building is being investigated for full renovation and a sizeable addition to the rear of the building to support increased programing of the Senior Center. This report will describe the general conditions of the existing structure, as well as establish structural guidelines, in accordance with the Massachusetts State Building Code, that must be followed during a building renovation.

2.1 General Report Information:

This report presents the results of our Massachusetts State Building Code (MSBC) Structural review of 345 Walnut Street in Newtonville, Massachusetts. Our review has been completed in conformance with Chapter 34 of the Ninth Edition of the Massachusetts State Building Code, which became effective September 20, 2017 and the International Existing Building Code, 2015 Edition.

3.1 Basis of the Report:

- This report is based on visible observations during our site visit on 9/22/2020.
- Original 1938 Construction Drawings prepared by Robb & Little Architects and J.R. Worcester & Co. Engineers.
- Limited Construction Drawings from 1993 renovation/addition. Architectural drawings prepared by Schwartz/Silver Architects, Inc. were available, but no Structural Drawings were available.

Our observations of the existing building were limited to what was readily visible. We did not evaluate strengths of materials, remove finishes, or take measurements; therefore, we are unable to comment on any structural capacities or deficiencies of the existing structural systems beyond what was readily visible.

4.1 General Building Description:

The building is a partial two-story structure with a full basement. The second story is limited to a few offices and lobby for the elevator. The original building consists of concrete foundation walls, unreinforced brick bearing walls (exterior walls), concrete slab-on-grade at basement, steel wide-flange columns at center Hall, concrete encased steel floor beams, reinforced concrete floor slabs, and a steel framed roof with gypsum deck panels. The first-floor framing consists mainly of concrete encased structural steel wide-flange beams with one-way concrete slabs (4”-5 ½” thick slab with granolithic finish slab). The second-floor mezzanine framing is similar to the first floor with concrete encased beams and one-way concrete slabs. The roof structure consists of steel trusses, steel beam rafters and gypsum plank decking. The original slate roof appears to still be in use.

The structural systems for the 1993 addition are less clear due to the lack of Structural Drawings. The foundations appear to be concrete walls and the slab-on-grade also appears to be concrete. The exterior veneer of the addition is brick, similar to the original building, and the Architectural drawings indicate that the exterior back-up walls and elevator shaft consist of concrete masonry units (CMU). Architectural sections indicate that the entry roof is framed with steel framing and metal roof deck. The elevator cap/roof appears to be a concrete slab on steel decking. Also, there is a masonry parapet that surrounds the perimeter of the low roof.

The original building was designed with unreinforced brick exterior bearing walls at the exterior of the building, which was common at the time of construction, but are not allowed by the current building code. Since the proposed renovation will be fairly extensive, the building will be reviewed for conformance to Appendix 1 of the International Existing Building Code (IEBC). The intent of Appendix 1 of the IEBC is to reduce the inherent risk associated with unreinforced masonry (URM) wall during wind and seismic events.

5.1 General Existing Conditions:

***General Exterior**:*

In general, the exterior walls of the building are unreinforced brick masonry walls with a concrete foundation. The top of the concrete foundation terminates approximately mid-way between the basement floor level and the first floor level with the brick bearing wall starting above. The exterior brick wall appears to generally be 12”-16” thick with pilasters at beam/truss bearing locations. The exterior veneer appears to be in average condition for its age with minimal signs of settlement. There are several lintels at the first floor level that have rusted significantly and will require repair/replacement during future maintenance or renovations. At the same locations as the deteriorated lintels, many of the brick head joints have failed and require repointing and general

repair. The exterior wood trim is in average condition and requires general maintenance to paint and repair minor deterioration.

The roof of the main building appears to be the original slate roof. We were not able to view the condition of the roof, but we were told that pieces of the slate roof have been found on the ground at the perimeter of the building indicating that some level of deterioration has taken place and repair will be required. Also, we did notice some water staining in the ceiling of an office at the second floor as well as at the arched ceiling of the dining room near the main lobby indicating that there have been minor roof leaks. The roof leaks are a concern with the gypsum roof panels since water infiltration can quickly degrade the strength of the gypsum panels.

The exterior walls of the 1993 addition are brick veneer to match the original building, with CMU backup walls. The walls of the addition appear to be in good condition with no significant signs of deterioration or settlement.

There are two concrete stairwells leading from the basement to the exterior grade and one of the concrete stairwell walls has deteriorated to the point where it should be repaired/replaced. The stairwell in question is located at the north-west side of the building with a sizeable tree located directly adjacent to the wall. The wall appears to be degrading from water infiltration and freeze/thaw action breaking apart the concrete. The degradation of the wall has likely accelerated because the tree roots near the wall and water shedding off a low roof over the stairwell onto the area surrounding the wall.

General Interior:
The interior of the building appears to be in generally good condition. The structure is mostly covered by finishes, except a few areas of the basement where the exterior walls and underside of the first floor concrete slab were visible. In the Boiler room, we were able to view the concrete foundation wall and the brick bearing wall above it. There were a few minor shrinkage cracks in the exposed foundation wall, but otherwise the foundation wall and brick wall appeared to be in good condition.

The interior partitions are typically plaster on wood furring with masonry backup. The interior plaster is in generally good condition with a few locations of minor deterioration from the steam piping. The ceilings were in generally good condition with a few noticeable locations of previous roof water leaks.

6.1 Building Structure

The original 1938, partial two-story, building consists of:

- Foundations:
  - The exterior foundations walls are plain concrete walls with continuous spread footings. The concrete walls extend from the basement up to approximately mid-height between the basement and first floor. The exterior walls appear to be mainly unreinforced with some reinforcing at wall penetrations.
  - Foundations at the interior columns are plain concrete spread footings.
  - Concrete slab-on-grade thickness is unknown. Slab appears to have been poured during one of the renovations. The slab includes raised portions near the exterior wall at select locations, as well as a formed drainage trench and sump pit to collect water that comes through the exterior stone foundation along the west wall.
- Exterior Walls:
  - Unreinforced brick masonry walls. Thickness is 12”-16” at first floor with pilasters at beam and truss bearing locations.
- Columns:

  - Eight Wide-flange steel columns are located at the sides of the main Hall (2 columns each of 4 sides), otherwise steel framing bears directly on unreinforced masonry. Column sizes are 8WF31's and 10WF49's.
- Framed Floors:
  - Floors are framed with concrete one-way slabs spanning between brick bearing walls and structural steel beams spaced at roughly 9-feet on-center.
  - One-way concrete slabs are between 4" and 5" thick and are reinforced with 3/8" and ½" diameter reinforcing bars. A granolithic topping slab was added to most interior floors.
  - Steel floor beams are mostly wide-flange steel beams ranging from 8WF17 to 18WF47. Most steel floor beams are encased in the concrete slab pour with 2" of cover around flanges.
- Roof:
  - Gable roofs are framed with structural steel trusses, steel purlins, and 2" gypsum planks.
  - Roof at main Hall is framed with structural steel trusses, steel purlins and gypsum planks at lower hip roof, and steel framing for upper tower.
  - Flat roof over partial second floor is framed with steel beams, gypsum planks, and sloped cinder fill to drain roof.

The 1993, two-story, elevator and entry addition consists of (based on visual inspection and Architectural drawings, no Structural drawings available):

- Foundations:
  - The foundations include concrete walls at the exterior walls and at the perimeter of the elevator pit.
  - Concrete slab-on-grade.
- Exterior Walls:
  - 8" CMU walls with brick veneer.
- Elevator Shaft
  - 8" CMU wall shaft with concrete slab cap.
- Roof:
  - Structural steel beams at flat lower roof.
  - Metal roof deck.

In general, the construction of the original Library building is fairly typical for a 1930's era building, consisting of unreinforced masonry bearing walls, steel framing and concrete slabs. The unreinforced masonry bearing walls would not be permitted by current Building Codes, but may remain provided they conform to the International Existing Building Code (IEBC), as amended by the Massachusetts State Building Code, which will be reviewed in the following section.

7.1 Building Code Review- Structural:

This review presents our interpretation of the structural requirements of the International Existing Building Code (IEBC), as modified by the Massachusetts State Building Code. In general, the provisions of The IEBC are intended to maintain or increase public safety, health, and general welfare in existing buildings by permitting repair, alteration, addition, and/or change of use without requiring full compliance with the code for new construction except where otherwise specified.

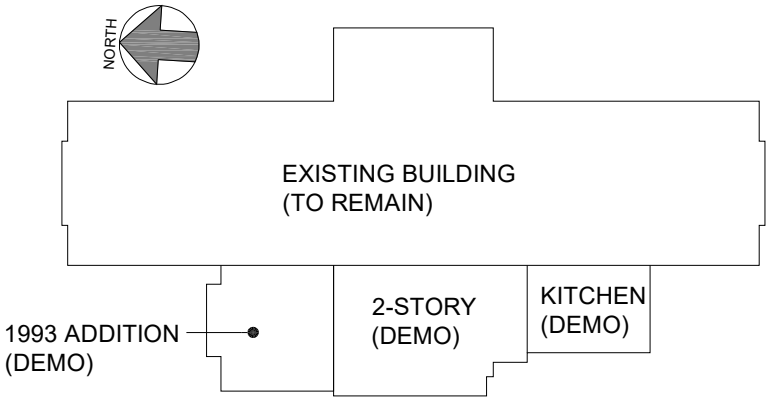
Renovation/Addition Assumptions:

In order to review the requirements of the IEBC for a renovation to 345 Walnut Street, the scope of the project must be defined. For this review we are assuming that the renovation will include:

- Complete renovation to interior finishes (Painting, flooring, wall finishes, partition locations, etc.) of existing building.
- Demolish the two-story portion of the existing building to provide space for a new three-story addition.
- Replace deteriorated lintels and repoint exterior brick at select locations.
- New mechanical/plumbing/electrical systems throughout building.
- Removal/replacement of finishes at exterior walls
- Occupancy/Use-Group to remain unchanged.
- Addition will be seismically isolated to avoid impacting the existing building, and the design of the addition will conform to the International Building Code (IBC), as modified by the Massachusetts State Building Code.

Occupancy Risk Category: II
Seismic Design Category: Category B
Site: Newtonville, MA

- Seismic Site Parameters
  - S_s = 0.208 (S_{DS} = 0.222)
  - S_1 = 0.068 (S_{D1} = 0.109)
  - Soil Site Class C (Per PSI preliminary Geotechnical Report)



FLOOR PLAN
NOT TO SCALE

Applicable Building Codes:

- Massachusetts State Building Code, 9th Edition.
- International Building Code (IBC), 2015 Edition.
- International Existing Building Code (IEBC), 2015 Edition.

Note: Building is an Unreinforced Masonry Bearing Wall Building, therefore IEBC Chapter A1 (Appendix A: Guidelines for the Seismic Retrofit of Existing Buildings) will also be reviewed.

IEBC Review

IEBC Chapter 1: Scope and Administration

IEBC 101.2 Scope: The provisions of the International Existing Building Code shall apply to the repair, alteration, change of occupancy, addition to and relocation of existing buildings.

- ❖ IEBC provisions will be followed during planned renovation/addition of 345 Walnut Street.

IEBC 101.4 Applicability: This code shall apply to the repair, alteration, change of occupancy, addition and relocation of existing building, regardless of occupancy, subject to the criteria of Sections 101.4.1 and 101.4.2.

- ❖ Occupancy provisions set forth in Sections 101.4.1 and 101.4.2 will be reviewed and followed.

IEBC 101.4.1 Buildings not previously occupied: A building of portion of a building that has not been previously occupied or used for its intended purpose in accordance with the laws in existence at the time of its completion shall be permitted to comply with the provisions of the laws in existence at the time of its original permit unless such permit has expired. Subsequent permits shall comply with the International Building Code or International Residential Code, as applicable, for new construction.

- ❖ The building is currently occupied, so this section does not appear to apply to the proposed renovation.

IEBC 101.4.2 Buildings previously occupied: The legal occupancy of any building existing on the date of adoption of this code shall be permitted to continue without change, except as is specifically covered in this code, the International Fire Code, or as is deemed necessary by the code official for the general safety and welfare of the occupants and the public.

- ❖ The building is currently occupied as a Senior Center and will remain in use as a Senior Center provided the provisions of the IEBC are followed.

IEBC Chapter 3: Provisions for all compliance methods

IEBC 301.1 General: The repair, alteration, change of occupancy, addition or relocation of all existing buildings shall comply with on of the methods listed in Section 301.1.1 through 301.1.3 as selected by the applicant. Sections 301.1.1 through 301.1.3 shall not be applied in combination with each other. Where this code requires consideration of the seismic force-resisting system of an existing building subject to repair, alteration, change of occupancy, addition or relocation of existing buildings, the seismic evaluation and design shall be based on Section 301.1.4 regardless of which compliance method is used.

- ❖ The IEBC allows choosing the compliance method for the renovation/addition from any of the three options. For this project, the provisions of 301.1.2 “Work area compliance method” will be followed.

IEBC 301.1.2 Work area compliance method: The provisions of the International Existing Building Code shall apply to the repair, alteration, change of occupancy, addition to and relocation of existing buildings.

- ❖ IEBC provisions will be followed during planned renovation/addition of 345 Walnut Street.

IEBC Chapter 5: Classification of Work

IEBC 501.1 Scope: The provisions of this chapter shall be used in conjunction with Chapters 6 through 13 and shall apply to the alteration, repair, addition and change of occupancy of existing structures, including historic and moved structures, as referenced in Section 301.1.2. The work performed on an existing building shall be classified in accordance with this chapter.

- ❖ Chapter 5 will be followed to classify the work to be performed during the renovation/addition.

IEBC 502.1 Repairs Scope: Repairs as defined in Chapter 2, include the patching or restoration or replacement of damaged materials, elements, equipment or fixtures for the purpose of maintaining

such components in good or sound condition with respect to existing loads or performance requirements.

- ❖ Existing structural elements will be reviewed after finishes are removed during the demolition phase to determine if additional repairs are required at unforeseen conditions.

IEBC 502.2 Repair Application: Repairs shall comply with the provisions of Chapter 6.

- ❖ Provisions of Chapter 6 will be followed for repairs.

IEBC 502.3 Repair Related Work: Work on nondamaged components that is necessary for the required repair of damaged components shall be considered part of the repair and shall not be subject to the provisions of Chapter 7, 8, 9, 10 or 11.

- ❖ Provision is self-explanatory that work on nondamaged components to complete a repair do not need to conform to other requirements specified in Chapter 7 through 11.

IEBC 505.1 Alteration- Level 3 Scope: Level 3 alterations apply where the work area exceeds 50 percent of the building area.

- ❖ The work area for the proposed project will exceed 50 percent of the building area and will be considered a Level 3 alteration.

IEBC 505.2 Alteration- Level 3 Application: Level 3 alterations shall comply with the provisions of Chapters 7 and 8 for Level 1 and 2 alterations, respectively, as well as the provisions of Chapter 9.

- ❖ The structural scope will follow the provisions of Chapters 7, 8 and 9 covering Levels 1 through 3 of alteration requirements.

IEBC 506.2 Change of Occupancy Application: Change of occupancy shall comply with the provisions of Chapter 10.

- ❖ It is our understanding that there will be no change of occupancy as part of this renovation/addition and the provisions of Chapter 10 will not apply.

Alteration Level 1 Structural Requirements:

IEBC 707.2 Addition or replacement of roofing or replacement of equipment: Where addition or replacement of equipment results in additional dead loads, structural components supporting such reroofing or equipment shall comply with the gravity load requirements of the International Building Code.

- ❖ The slate tile roof on the original building will need to be reviewed with the scope of work. The gypsum plank system below the slate tiles will likely need to be replaced to strengthen the roof diaphragm due to the affect that the scope of work has on the existing seismic force-resisting system, which will likely lead to replacing the slate tile roof with a new system. The new system will be reviewed with the gravity load requirements of the IBC.
- ❖ There are several exceptions that are permitted by the IEBC. One exception is “Structural elements where the additional dead load from roofing or equipment does not increase the force in the element by more than 5 percent.” We anticipate removing the slate tiles and gypsum planks and replacing with similar, or lighter, materials to avoid increasing the dead loads on the existing roof framing.

IEBC 707.3.1 Bracing for unreinforced masonry bearing wall parapets: Where a permit is issued for reroofing for more than 25 percent of the roof area of a building that is assigned to Seismic Design Category B, C, D, E or F that has parapets constructed of unreinforced masonry, the work shall include the installation of parapet bracing to resist the reduced International Building Code level seismic forces as specified in Section 301.1.4.2 of this code, unless an evaluation demonstrates compliance of such items.

- There are no unreinforced masonry parapets at the portion of the building scheduled to remain, so bracing is not required.

IEBC 707.3.2 Roof diaphragms resisting wind loads in high wind regions: Where roofing materials are removed from more than 50 percent of the roof diaphragm of a building or section of a building located where the ultimate wind speed is greater than 115 mph or in a special wind region, as defined in Section 1609 of the International Building Code, roof diaphragms, connections of the roof diaphragm to roof framing members, and roof-to-wall connections shall be evaluated for the wind loads specified in the International Building Code, including wind uplift. If the diaphragms and connections in their current condition are not capable of resisting at least 75 percent of those wind loads, they shall be replaced or strengthened in accordance with the loads specified in the International Building Code.

- Ultimate wind speed in Newton is 127 mph, so connections are to be reviewed if more than 50 percent of the roofing materials are removed/replaced. We anticipate removing the existing roofing and gypsum plank system and replacing with a metal deck and asphalt shingle system, so roof diaphragm and connections will be reviewed. The original construction drawings indicate that the roof trusses are anchored to the masonry bearing walls with anchor bolts, but intermediate beams bear on bearing plates only. We anticipate diaphragm anchorage will need to be coordinated with the new metal roof deck installation by installing additional support and anchorage for the new metal deck.

Level 2 Structural Requirements:

IEBC 807.2 New structural elements: New structural elements in alterations, including connections and anchorage, shall comply with the International Building Code (IBC).

- New structural elements will comply with the IBC.

IEBC 807.3 Minimum design loads: The minimum design loads on existing elements of a structure that do not support additional loads as a result of an alteration shall be the loads applicable at the time the building was constructed.

- Renovation will not change the minimum design loads on the structure. If element loads change, they will be reviewed for compliance with the IBC.

IEBC 807.4 Existing structural elements carrying gravity loads: Alterations shall not reduce the capacity of the existing gravity load-carrying structural elements unless it is demonstrated that the elements have the capacity to carry the applicable design gravity loads required by the International Building Code. Existing structural elements supporting any additional gravity loads as a result of the alterations, including the effects of snow drift, shall comply with the International Building Code. Exception includes structural elements whose stress is not increased by more than 5 percent.

- Design loads will be reviewed, but should remain unchanged at the existing structure.

IEBC 807.5 Existing structural elements resisting lateral loads: Except as permitted by Section 807.6, where the alteration increases design lateral loads, or where the alteration results in prohibited structural irregularity as defined by ASCE 7, or where the alteration decreases the capacity of any existing lateral load-carrying structural element, the structure of the altered building or structure shall be shown to meet the wind and seismic provisions of the IBC. Reduced IBC-level seismic forces in accordance with Section 301.1.4.2 shall be permitted. Exception: Any existing lateral load-resisting structural element whose demand-capacity ratio with the alteration considered is more than 10 percent greater that its demand-capacity ratio with the alteration ignored shall be permitted to remain unaltered.

- The existing unreinforced brick bearing walls provide lateral force resistance for the building. Based on the preliminary plans to demolish the rear two-story section of the

building, we anticipate that a full review of the seismic force-resisting system will be required. Based on previous experience, we anticipate that the remaining masonry walls will require reinforcement to resist IBC mandated wind and seismic loads.

IEBC 807.6 Voluntary improvement of the seismic force-resisting system: Alterations to existing structural elements and addition of new structural elements that are initiated for the purpose of increasing the lateral force-resisting strength or stiffness of an existing structure and that are not required by other sections of this code shall not be required to be designed for forces conforming to the IBC, provided that an engineering analysis is submitted to show that:

- The capacity of existing structural elements required to resist forces is not reduced;
- The lateral loading to existing structural elements is not increased either beyond its capacity or more than 10 percent;
- New structural elements are detailed and connected to the existing structural elements as required by the IBC;
- New or relocated nonstructural elements are detailed and connected to existing or new structural elements as required by the IBC; and
- A dangerous condition as defined in this code is not created. Voluntary alterations to lateral force-resisting systems conducted in accordance with Appendix A and the referenced standards of this code shall be permitted.

- The existing seismic force-resisting system consists of the unreinforced brick bearing walls. Based on the anticipated demolition of the rear two-story portion of the building, we anticipate a full review of the seismic force-resisting system will be required.

Level 3 Structural Requirements:

IEBC 907.2 New structural elements: New structural elements shall comply with Section 807.2.

- New structural elements will comply with the IBC, per 807.2.

IEBC 907.3 Existing structural elements carrying gravity loads: Existing structural elements carrying gravity loads shall comply with 807.4.

- Design loads will be reviewed, but should remain unchanged at the existing structure.

IEBC 907.4 Existing structural elements resisting lateral loads: All existing elements of the lateral-force-resisting system shall comply with this section.

- Alterations to the building structure are anticipated to remove the two-story portion of the building. The building will be reviewed for conformance to this section and we anticipate that the seismic force-resisting system will be upgraded to resist the code mandated wind and seismic loads.

IEBC 907.4.1 Evaluation and analysis: An engineering evaluation and analysis that establishes the structural adequacy of the altered structure shall be prepared by a registered design professional and submitted to the code official.

- Renovation to the interior finishes and systems is acceptable without a detailed analysis, but if lateral-force-resisting elements are modified to increase the seismic force in an element by 10 percent, an analysis will need to be completed. We anticipate altering the lateral-force-resisting system and expect that a detailed analysis will be required and will likely lead to installing a new seismic force resisting system, which may be cost prohibitive.

IEBC 907.4.2 Substantial structural alteration: Where more than 30 percent of the total floor and roof areas of the building or structure have been or are proposed to be involved in structural alterations within a 5-year period, the evaluation and analysis shall demonstrate that the altered building or

structure complies with the International Building Code for wind loading and with the reduced International Building Code level seismic forces in accordance with Section 301.1.4.2. The areas to be counted toward the 30 percent shall be those areas tributary to the vertical load-carrying components, such as joists, beams, columns, walls and other structural components that have been or will be removed, added or altered, as well as areas such as mezzanines, penthouses, roof structures and in-filled courts and shafts.

- ❖ Removal of the rear two-story section of the building will result in an alteration that exceeds the 30 percent threshold. Since the threshold will be exceeded, the remaining building will need to be reviewed for the ability to resist IBC mandated wind and seismic loads. We anticipate installing new seismic force resisting elements to resist the Code mandated loads.

IEBC 907.4.3 Seismic Design Category F: Where the building is assigned to Seismic Design Category F, the evaluation and analysis shall demonstrate that the lateral load-resisting system of the altered building or structure complies with reduced IBC-level seismic forces in accordance with Section 301.1.4.2 and with the wind provisions applicable to a limited structural alteration.

- ❖ The building is not assigned to Seismic Design Category F, and does not need to conform to the requirements of this section.

IEBC 907.4.4 Limited structural alteration: Where the work does not involve a substantial structural alteration and the building is not assigned to Seismic Design Category F, the existing elements of the lateral load-resisting system shall comply with Section 807.5.

- ❖ The building is not assigned to Seismic Design Category F, so limited structural alterations will comply with Section 807.5.

IEBC 907.4.5 Wall anchors for concrete and masonry buildings: For any building assigned to Seismic Design Category D, E, or F with the structural system consisting of concrete or reinforced masonry walls with a flexible roof diaphragm and any building assigned to Seismic Design Category C, D, E, or F with a structural system consisting of unreinforced masonry walls with any type of roof diaphragm, the alteration work shall include installation of wall anchors at the roof line to resist the reduced IBC-level seismic forces in accordance with Section 301.1.4.2, unless an evaluation demonstrates compliance of existing wall anchorage.

- ❖ The building is classified as Seismic Design Category B and does not need to conform to the requirements of this section. Anchorage at the roof level will be reviewed in accordance to the requirements of 707.3.2.

IEBC 907.4.6 Bracing for unreinforced masonry parapets: Parapets constructed of unreinforced masonry in buildings assigned to Seismic Design Category C, D, E, or F shall have bracing installed as needed to resist the reduced IBC-level seismic forces in accordance with Section 301.1.4, unless an evaluation demonstrates compliance of such items.

- ❖ The remaining portion of the building does not have unreinforced masonry parapets.

IEBC *Chapter A1: Seismic Strengthening Provisions for Unreinforced Masonry Bearing Wall Buildings*

IEBC *A101.1* Purpose: The purpose of this chapter is to promote public safety and welfare by reducing the risk of death or injury that may result from the effects of earthquakes on existing masonry bearing wall buildings.

The provisions of this chapter are intended as minimum standards for structural seismic resistance, and are established primarily to reduce the risk of life loss or injury. Compliance with these provisions will not necessarily prevent loss of life or injury, or prevent earthquake damage to rehabilitated buildings.

- ❖ Provisions of this chapter will be followed during renovation work. The building is unreinforced brick masonry, which is one of the more susceptible type of buildings to seismic forces.

IEBC A102.1: General: The provisions of this chapter shall apply to all existing buildings having at least one unreinforced masonry bearing wall. The elements regulated by this chapter shall be determined in accordance with Table A1-A. Except as provided herein, other structural provisions of the building code shall apply. This chapter does not apply to the alteration of existing electrical, plumbing, mechanical or fire safety systems.

- ❖ **IEBC *Table A1-A:*** Table indicated elements to be reviewed based on Seismic Parameter $S_{D1} = 0.109$. For this project, the following elements need to be reviewed:
  - Parapets
  - Walls, Anchorage.

IEBC A102.2 Essential and hazardous facilities: The provisions of this chapter shall not apply to the strengthening of buildings in Risk Category III or IV. Such buildings shall be strengthened to meet the requirements of the International Building Code for new buildings of the same risk category or other such criteria approved by the code official.

- ❖ The degree of earthquake risk reduction anticipated in Appendix A1 is not considered acceptable for buildings in Risk Category III and IV and additional measures would be required. The Senior Center building occupancy is included in Risk Category II and meets the requirements to follow Appendix A1.

IEBC *A113.1 Wall Anchorage*:

IEBC *A113.1.1* Anchor Locations: Unreinforced masonry walls shall be anchored at the roof and floor levels as required in Section A110.2. Ceilings of plaster or similar materials, when not attached directly to roof or floor framing and where abutting masonry walls, shall either be anchored to the walls at a maximum spacing of 6 feet, or be removed.

- ❖ Floor and roof framing consists of structural steel beams and trusses bearing on the unreinforced brick bearing walls. The steel beams at the floor level are noted to have (2) L6x4x3/8 wall anchors at each beam bearing on masonry. At the roof level, the trusses appear to bear on plates with anchor rods set in the masony. Regular purlins appear to bear on steel setting plates, but anchors are not noted and will need to be reviewed during re-roofing operations.

IEBC *A113.1.2 Anchor Requirements:* Anchors shall consist of bolts installed through the wall as specified in Table A1-E, or an approved equivalent at a maximum anchor spacing of 6 feet. All wall anchors shall be secured to the joists to develop the required forces.

- ❖ Trusses at the roof level are currently anchored to the masonry walls at approximately 9'-10' o.c., so we anticipate installing ½" diameter thru-wall anchors at purlins midway between trusses to cut down the space between anchors to 6'-0" o.c. (max) to resist the required loads at the and roof level.

IEBC *A113.1.3 Minimum Wall Anchorage*: Anchorage of masonry walls to each floor or roof shall resist a minimum force determined as $0.9S_{DS}$ times the tributary weight or 200 pounds per linear foot, whichever is greater, acting normal to the wall at the level of the floor or roof. Existing wall anchors, if used, must meet the requirements of this chapter or must be upgraded.

- ❖ Based on the weight of the 12" brick exterior walls, the design force is approximately 195 pounds per foot at the roof level. We anticipate using 200 pounds per foot at the roof level for anchorage design forces.

IEBC *A113.6 Parapets:* Parapets and exterior wall appendages not conforming to this chapter shall be removed, or stabilized or braced to ensure that the parapets and appendages remain in their original positions.

The maximum height of an unbraced unreinforced masonry parapet above the lower of either the level of tension anchors or the roof sheathing shall not exceed the height-to-thickness ratio shown in Table A1-F (2.5). If the required parapet height exceeds this maximum height, a bracing system designed for the forces determined in accordance with the building code shall support the top of the parapet. Parapet corrective work must be performed in conjunction with the installation of tension roof anchors.

- ❖ There are no parapets on this building that require anchorage.

8.1 Conclusions and Recommendations:

The purpose of this report is to identify any structural deficiencies and liabilities that will need to be addressed during the planned renovation. The report is based on the premise that the existing building will remain in use as a Senior Center and the structural systems will not be altered. We have reviewed the building in accordance to Chapter 34 of the Massachusetts State Building Code (Ninth Edition) and the International Existing Building Code (2015 Edition). We have reviewed the general conditions of the building, as well as the structural modifications that will need to be addressed as part of the renovation to increase the public safety of the building. This report, in its entirety, shall be used as the basis for the renovation. The following items are meant to highlight conditions or deficiencies noted in the report, but do not limit the work required.

General Information:

- Existing building area is approximately 11,000 ft^2.
- Renovation and addition includes demolition of approximately 3,300 ft^2 of building at the rear of the site to make space for the three-story addition.
- Scope of work within the existing building shall conform to the International Existing Building Code, as amended by the Massachusetts State Building Code, and specifically any requirements for Level 3 work and Appendix 1A of the IEBC.
- All new work within the existing building and the addition shall comply with the requirements of the International Building Code, as modified by the Massachusetts State Building Code.

Basic Building Existing Conditions:

- Exterior concrete wall at basement egress stairwell at north-west side of building has deteriorated to the point where the concrete is spalling and allowing water infiltration to the wall and accelerating deterioration. Wall should be repaired, replaced, or removed as part of regular maintenance, or as part of the proposed renovation and addition project.
- Exterior walls are 12”-16” unreinforced brick bearing walls with pilasters at beam and truss bearing locations. Exterior masonry veneer requires remedial work to replace deteriorated steel lintels and repair deteriorated brick at window heads, mainly at basement level.
- Framed floors consist of one-way concrete slabs on structural steel beams. Floors appear to be in good condition.
- Roof is framed with structural steel trusses, steel purlins, 2” metal banded gypsum plank decking, and slate roofing. Existing ceilings show signs of minor water leaks, so we anticipate roof repairs to the slate roof will be required as part of regular maintenance.

Structural Requirements for Renovation/Addition:

- Geotechnical exploration/review will be required for new the construction, as well as any foundation work to the existing building. A preliminary geotechnical report has been completed and indicates that shallow foundations would be appropriate for this site once some typical site improvements are completed.
- The gypsum roof planks do not provide an adequate roof diaphragm and will need to be replaced as part of any significant renovation project where seismic force resisting systems are reviewed for current IBC loads. The planks would need to be removed and replaced with metal roof decking. We anticipate that this would include removal of existing gypsum planks, installation of new metal roof deck, installation of new roofing system and asphalt shingles.
- The seismic force-resisting system for the building is currently unreinforced brick bearing walls. We anticipate the scope of the renovation to demolish a portion of the existing building will trigger a full review of the existing building for current International Building Code loads. In order to resist current lateral design forces, we anticipate new structural systems will need to be added to the building to resist the loads. New systems could include reinforced CMU walls, steel bracing, or alternative methods of reinforcing the existing masonry walls.
- Roof level anchorage to unreinforced brick bearing wall to be reviewed in accordance with Appendix A1 of the IEBC to resist code mandated load of 200 lb/ft. We anticipate installing 1/2" diameter through-bolt anchors at existing purlins (roughly 10 feet-on center) to combine with the existing truss anchorage to reduce the anchorage spacing to a maximum of 6-feet on center at the perimeter of the building.
- Roof snow loads to be included with new roof work at existing building:
    - Original: Unknown
    - Renovation: In accordance with Massachusetts State Building Code (P_g = 40 psf & P_f = 30 psf)

Based on our review of the existing conditions and the proposed renovation work, it is our professional opinion that the existing building is capable of being renovated for continued use as a Senior Center, but will require significant structural upgrades to the roof diaphragm and seismic force-resisting system due to the partial demolition of the building to make way for the addition. Renovations should be done with the understanding that structural upgrades noted in this report will only bring the building up to the minimum standards of the Building Code for existing buildings, and will not meet the Building Code requirements for new buildings.

Prepared by:

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