



Docket # 589

THE COMMONWEALTH OF MASSACHUSETTS  
William Francis Galvin  
Secretary of the Commonwealth

**Regulation Filing** *To be completed by filing agency*

CHAPTER NUMBER: 780 CMR 34.00

CHAPTER TITLE: Existing Structures

AGENCY: State Board of Building Regulations and Standards

SUMMARY OF REGULATION: *State the general requirements and purposes of this regulation.*  
**Modifies structural requirements for existing buildings.**

REGULATORY AUTHORITY: C. 802 of Acts of 1972, as amended and MGL C. 143 Sections 93-100

AGENCY CONTACT: Don Finocchio PHONE: 617-727-3200,  
x-25206

ADDRESS: 1 Ashburton Place, Boston, MA 02108

**Compliance with M.G.L. c. 30A**

EMERGENCY ADOPTION - *if this regulation is adopted as an emergency, state the nature of the emergency.*

PRIOR NOTIFICATION AND/OR APPROVAL - *If prior notification to and/or approval of the Governor, Legislature or others was required, list each notification, and/or approval and date, including notice to the Local Government Advisory Commission.*

**DHCD and MMA**

PUBLIC REVIEW - *M.G.L. c. 30A sections 2 and/or 3 requires notice of the hearing or comment period be filed with the Secretary of the Commonwealth, published in appropriate newspapers, and sent to persons to whom specific notice must be given at least 21 days prior to such hearing or comment period.*

Date of public hearing or comment period: BBRS Public Hearing on December 8, 2009

FISCAL EFFECT - Estimate the fiscal effect of the public and private sectors.

For the first and second year: \_\_\_\_\_

For the first five years: \_\_\_\_\_

No fiscal effect: None

SMALL BUSINESS IMPACT - State the impact of this regulation on small business. Include a description of reporting, record keeping and other compliance requirements as well as the appropriateness of performance versus design standards and whether this regulation duplicates or conflicts with any other regulation. If the purpose of this regulation is to set rates for the state, this section does not apply.

None

CODE OF MASSACHUSETTS REGULATIONS INDEX - List key subjects that are relevant to this regulation:  
**Structural requirements for existing buildings.**

PROMULGATION - State the action taken by this regulation and its effect on existing provisions of the Code of Massachusetts Regulations (CMR) or repeal, replace or amend. List by CMR number:

Amends 780 CMR 3408.00 and 3409.00.

ATTESTATION - The regulation described herein and attached hereto is a true copy of the regulation adopted by this agency. ATTEST:

SIGNATURE: [Signature] DATE: 1/13/10

Publication - To be completed by the Regulations Division

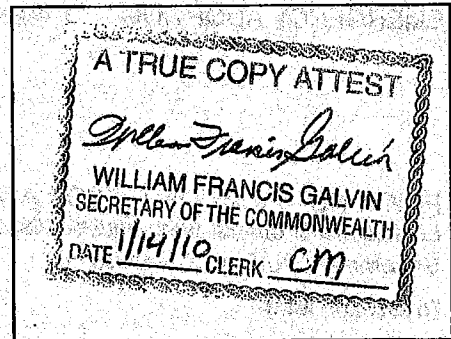
MASSACHUSETTS REGISTER NUMBER: 1149 DATE: 2/5/10

EFFECTIVE DATE: 2/5/10

CODE OF MASSACHUSETTS REGULATIONS

Remove these pages: | Insert these pages:

500.91 - 500.96	500.91 - 500.96
500.99 - 500.102	500.99 - 500.102



## THE MASSACHUSETTS STATE BUILDING CODE

included if any of these allowances are taken, except when zero is used.

**3408.4.2 Level 1 Work.** Work that is not specified for Levels 2, 3, 4, or 5.

**3408.4.3 Level 2 Work.** Work or change of use involving any of the following.

1. Change of use of an area which is more than 35% of the existing floor area of the building.
2. For Pre-1975 buildings, when rehabilitation or remodeling is accumulated over a floor area of 20,000 sf or 50% of the total floor area of the building, whichever is less, starting from January 1, 2007. The terms rehabilitation and remodeling for the purposes of this clause shall mean any of the following work: removal or repair of ceilings, partitions, or interior facing of exterior walls; new ceilings, partitions, or interior facing of exterior walls; reconstruction or repair of floors; new mechanical or electrical distribution systems within an area; or new elevators, escalators, or stairs within an area or serving an area.

3. Cumulative increase in total framed floor and roof area due to structurally attached additions up to a lifetime limit of 10% of the total framed floor and roof area of the building that existed on February 28, 1997, or on the date of the certificate of occupancy if the building was built thereafter.

4. Cumulative increase in effective seismic weight, with or without structurally attached additions, from 2.0% for one-story buildings and from 1.0% for buildings with more than one-story, to a lifetime limit of 10% of the effective seismic weight of the building that existed on February 28, 1997, or on the date of the certificate of occupancy if the building was built thereafter.

5. Structural work involving any of the following.

- A. More than 25% or 20,000 square feet, whichever is less, of the area of any existing framed floor or roof. Where the work involves existing beams or girders, the tributary area of the beams and girders shall be included in the count for framed floor and roof area.

- B. More than 25% of the total area of shear walls above the foundation.

- C. More than 25% of the total length of columns and diagonal braces measured to the intersection of the member centerlines.

- D. Openings in any framed floor or roof that have an area more than 5% of the area of the framed floor or roof.

- E. Changes to any structural wall that reduce its in-plane shear resistance by more than 15%.

- F. Changes to any floor or roof diaphragm that reduce its in-plane shear resistance by more than 15%.

- G. Removal or reconfiguration of lateral load resisting frames, or foundations supporting them.

6. **Exemption for Pile Foundations.** Structural repairs of pile foundations are exempt from Level 2 Work.

**3408.4.4 Level 3 Work.** Structural work involving any of the following:

1. Removal, or removal and reconstruction, of between 15% and 40% of the total existing framed floor and roof area. Where this work involves existing beams or girders, the tributary area of the beams and girders shall be included in the count of framed floor and roof area.

**Exception.** Demolition of a previous addition to the building; demolition of an appendage to the building such as a loading dock outside of the exterior wall line; or demolition of a mechanical penthouse; with the condition that the demolition does not reduce the existing lateral load resistance of the remaining portion of the building below that provided before demolition.

2. New shear walls and vertical frames which provide more than 35% of the lateral force resistance required for Level 2 Work, in either of two orthogonal directions.

**3408.4.5 Level 4 Work.** Work involving any of the following.

1. Increase in total framed floor and roof area due to structurally attached additions that is more than 10% of the total framed floor and roof area of the building that existed on February 28, 1997, or on the date of the certificate of occupancy if the building was built thereafter.

2. Increase in effective seismic weight, with or without structurally attached additions, that is more than 10% of the effective seismic weight of the building that existed on February 28, 1997, or on the date of the certificate of occupancy if the building was built thereafter.

**3408.4.6 Level 5 Work.** Work involving any of the following.

1. The removal, or the removal and reconstruction, of more than 40% of the total existing framed floor and roof area. Where this work involves existing beams or girders, the tributary area of the beams and girders shall be included in the count of framed floor and roof area.

**Exception.** Demolition of a previous addition to the building; demolition of an appendage to the building such as a loading dock outside of the exterior wall line; or demolition of a mechanical penthouse; with the condition that the demolition does not reduce the existing lateral load resistance of the remaining portion of the building below that provided before demolition.

2. Structurally attached additions that have a total framed floor and roof area greater than 100% of the total framed floor and roof area of the building that existed on February 28, 1997, or on the date of the certificate of occupancy if the building was built thereafter.

## 780 CMR 3408.0 STRUCTURAL REQUIREMENTS FOR EXISTING BUILDINGS

### 3408.1 General Requirements.

**3408.1.1 Basic Requirement.** The structural work for alterations, repairs, and additions to existing buildings shall be designed and constructed in accordance with the Code requirements for new construction for the loads specified in 780 CMR 3408.0, except as otherwise provided in 780 CMR 3408.0.

**3408.1.2 Prior Building Codes.** The structural systems of existing buildings shall, as a minimum, conform to the basic code. Structural systems and elements that do not so comply shall be reinforced so that they do so comply or, alternatively, so that they comply with the requirements for new construction of 780 CMR.

**3408.1.3 Structurally Separate Additions.** Additions to existing buildings which are structurally separate therefrom shall comply with the requirements for new construction.

**3408.1.4 Structurally Separate Portions of Existing Buildings.** Where portions of an existing building are structurally separate, each portion shall be considered a separate building for the purposes of 780 CMR 3408.0.

### 3408.2 Definitions.

**Basic Design Code.** The building code in-force on the date of the application for the building permit for the original building. If subsequent changes have been made to the lateral force resisting system of the building and the changed lateral force resisting system conforms to the requirements for new construction of the building code in-force on the date of the application for the building permit for said changes, the basic code shall be the building code for the latest of such structural changes.

**Box System.** Term used in the seismic provisions of the 1<sup>st</sup> to 5<sup>th</sup> Editions of the State Building Code. The meaning is the same as *Wall System, Bearing* as defined in ASCE 7, Section 9.2.1.

**Cladding.** Elements of the building envelope at the sides of a building which do not support any gravity load other than their own weight and are not designed to resist imposed in-plane forces.

**Dual Bracing System.** Term used in the seismic provisions of the 1<sup>st</sup> to 5<sup>th</sup> Editions of the State Building Code. The meaning is the same as *Frame System, Dual frame system*, as defined in ASCE 7, Section 9.2.1.

**Effective Seismic Weight.** Effective seismic weight shall be as defined by 780 CMR 1615.0, except as provided in 780 CMR 3408.4.1.

**Space Frame.** Term used in the seismic provisions

of the 1<sup>st</sup> to 5<sup>th</sup> Editions of the State Building Code. The meaning is the same as *Frame System, Space frame system*, as defined in ASCE 7, Section 9.2.1. (Used in definition of *Frame System, Building frame system* in ASCE 7, Section 9.2.1).

**Structural Engineer of Record (SER).** A registered design professional qualified in the structural design of buildings who is responsible for the structural engineering design of a construction project and whose professional seal and signature appear on the structural design documents submitted with the application for building permit.

**URM.** Unreinforced masonry.

### 3408.3 Classification of Existing Buildings.

**Post-1975 -** Buildings whose basic code has an effective date on or after January 1, 1975. (Governed by 780 CMR, the Massachusetts State Building Code).

**Pre-1975 -** Buildings whose basic code has an effective date prior to January 1, 1975, or for which there was no building code. (Prior to 780 CMR, the Massachusetts State Building Code).

### 3408.4 Levels of Work on Existing Buildings.

The work involved in alterations, repairs, and additions to existing buildings, and changes of use of existing buildings, shall be classified as described in 780 CMR 3408.4. For an existing building where more than one level of work applies, the requirements for the highest level of work shall apply.

**3408.4.1 Explanation of Terms.** The explanation of terms that follow are for the purposes of classifying the levels of work in 780 CMR 3408.4 and for use in Figure 3408-1, only.

1. Floor or roof area shall be measured to the inside face of exterior masonry or concrete walls, to the inside face of exterior wood stud walls, or to the inside face of the principal framing members of curtain walls.
2. *Effective seismic weight* shall include only that effective seismic weight above mean exterior grade, exclusive of slabs on grade, foundation walls, and framed floors that are laterally braced by foundation walls.
3. Effective seismic weight of existing buildings previously used for storage or manufacturing. For the purpose of determining the seismic weight before any renovations, the following allowances shall be used in lieu of both the 25% of storage live load and the operating weight of equipment: 30 psf of floor area if the unreduced live load capacity of the floor is 100 psf or more; 20 psf of floor area if the unreduced live load capacity of the floor is less than 100 psf but at least 80 psf; or zero, otherwise. Neither a partition allowance nor the weight of any in-place partitions shall be



3. Increase in effective seismic weight, with or without structurally attached additions, that is more than 100% of the effective seismic weight of the building that existed on February 28, 1997, or on the date of the certificate of occupancy if the building was built thereafter.

4. New shear walls and vertical frames which provide more than 90% of the lateral force resistance required for Level 3 Work, in either of two orthogonal directions.

#### 3408.5 Restricted Uses.

**3408.5.1 Restricted Uses Defined.** For the purposes of 780 CMR 3408.0, restricted uses shall be as follows:

1. Assembly Groups A-1 and A-2 for an occupant load of 600 or more.
2. Assembly Group A-3 for an occupant load of 1200 or more.
3. Assembly Groups A-4 and A-5 for an occupant load of 600 or more.
4. Hazardous Group H.
5. Institutional Group I-2 for an occupant load of 400 or more.
6. Institutional Group I-3.
7. Buildings in Seismic Use Group III, as defined in ASCE, Table 9.1.3.

**3408.5.2 Change of Use and Work for Restricted Uses.** Change of use of an existing building to a restricted use, or work above Level 2 for existing buildings with restricted uses, shall comply with the requirements for Level 5 Work.

#### 3408.6 Structural Investigation of Existing Buildings.

##### 3408.6.1 Level 1 Work.

**3408.6.1.1 Responsibility of the SER.** Whenever there is any structural work for Level 1 Work, the SER shall perform the following tasks.

1. Verify that the work to be performed is in fact Level 1 Work.
2. Make a field investigation of the areas and structural members affected by the proposed structural work.
3. Evaluate the capacity of existing structural elements affected by the proposed structural work.

##### 3408.6.1.2 Responsibility of the Architect.

The architect of record shall verify that the changes to the existing building are in fact Level 1 Work, and so certify on the construction drawings.

##### 3408.6.2 Levels 2, 3, 4, and 5 Work.

**3408.6.2.1 Initial Survey of Existing Building.** The SER shall make an initial survey of the existing building consisting of the following tasks. Alternatively, a registered architect, who will be the architect of record for the project, may substitute for the SER for the

parts of the investigative work that do not require a structural evaluation.

1. Gather and catalog relevant available information on the existing building, such as drawings, specifications, shop drawings, geotechnical engineering reports, previous condition appraisal reports, and building department records.

2. Perform a field survey to either verify the available drawings or to establish dimensions of the existing building, including layout and sizes, of relevant structural components.

3. Perform a field survey to visually assess the condition of the structural components of the existing building.

4. Identify load paths (or lack thereof) to the foundation for gravity load and lateral load, based on information gathered in the above tasks.

##### 3408.6.2.2 Foundation and Geotechnical Explorations.

**3408.6.2.2.1 Level 2 Work.** A foundation or geotechnical exploration is not required provided that: the work does not involve a structurally attached addition; that any increase in gravity load does not increase the gravity load on any foundation element by more than 10% of that which existed on September 1, 2008; the work does not involve new shear walls or vertical frames; or reinforcement of existing shear walls or vertical frames; and there is no indication of settlement or lateral movement of basement walls or foundations. Otherwise, explorations shall be performed as necessary to determine the foundation design parameters of the subsoils and the type, size, and condition of existing foundations.

**3408.6.2.2.2 Levels 3, 4, and 5 Work.** Explorations shall be performed as necessary to determine the foundation design parameters of the subsoils, the type, size and condition of existing foundations, and the potential for liquefaction of soils during an earthquake where required in 780 CMR 3408.9.11.

##### 3408.6.2.3 Structural Evaluation of the Existing Building.

**3408.6.2.3.1 Existing Structural Materials.** The SER shall determine the strengths of existing structural materials in accordance with 780 CMR 3408.9.2.3 and 3408.9.2.4.

**3408.6.2.3.2 Repairs.** The SER shall evaluate structurally hazardous conditions and determine which existing structural elements or systems are in need of repair or other remedial action, and determine the character and extent of the

repairs or remedial action.

**3408.6.2.3.3 Gravity Load Capacity - Level 2 Work.** Where there are structural changes to floors or roofs, the SER shall determine the total service load capacity, and the net unreduced service live load capacity or the net service snow load capacity, as applicable, in the affected areas.

**3408.6.2.3.4 Gravity Load Capacity - Levels 3, 4, and 5 Work.** The SER shall determine the total service load capacity of the floors and roofs, the net unreduced service live load capacity of the floors, and the net service snow load capacity of the roofs.

**3408.6.2.3.5 Lateral Load Capacity - Levels 2, 3, 4, and 5 Work.** The SER shall determine the lateral load capacity of the existing building and its lateral load components relative to the lateral load resistance required for the level of work to be performed, and determine what is needed to provide the required lateral load resistance.

**3408.6.2.4 Structural Details.** The SER shall evaluate the following details.

1. Connectivity of the structural elements.
2. Existence of anchors connecting floor and roof decks to concrete or masonry walls, and if they exist, their ability to provide lateral support to the walls and transfer in-plane shear from the decks to the plane of the walls.
3. Existence of unreinforced masonry parapets, how they are supported at the roof diaphragm, their height measured from the roof diaphragm, and their thickness.
4. For masonry walls, the ratio of the distance between lateral supports to the thickness of wall.
5. Existence of brittle connections of precast concrete cladding components.

**3408.6.3 Report on Structural Investigation.** The SER shall submit a report on his structural investigation to the building official with the application for the building permit.

**3408.6.4 Condition of Permit.** The submission of the SER's report on his structural investigation and review thereof by the building official shall be a condition for the issuance of the building permit. The building official shall maintain this report for future renovations of the building.

**3408.6.5 Field Observations During Construction.** The SER shall make periodic field visits during the progress of the construction work on the existing building in order to observe and verify the assumed conditions on which the structural design was based, and shall modify the design, as necessary, should the observed conditions differ in any significant manner from

those on which the structural design was based. The SER shall provide a written notification to the building official of changes to the contract documents submitted with the application for building permit.

**3408.7 Lateral Load for Existing Buildings with or without Structurally Attached Additions.**

**3408.7.1 Application of Lateral Load.** Where the work includes structurally attached additions to an existing building, the specified lateral loads in 780 CMR 3408.7 shall be applied to the existing building and additions acting together as a single structure.

**3408.7.2 Level 1 Work.** There are no requirements for lateral load for Level 1 Work.

**3408.7.3 Level 2 Work.** For Level 2 Work, each of the following lateral loads shall be applied to the building separately:

1.  $\frac{2}{3}$  of the wind load specified in 780 CMR 1609.0.
2. A lateral load in any direction which is 1% of the unfactored gravity load for Allowable Stress Design or 1.5% of the unfactored gravity load for Strength Design, distributed the same as the gravity load. For the purposes of this clause only, the gravity load shall be defined as  $D + 0.5S$ , where the notation is as defined in 780 CMR 16.00. Load combinations with these lateral loads shall be in accordance with the following (notation is defined in 780 CMR 16.00):

A. For Allowable Stress Design, the following load combinations shall be used in lieu of Equations 16-10, 16-11 and 16-12 in 780 CMR 1605.3.1:

**EQUATION 34-1**

$$\frac{2}{3} [1.2D + 0.015(D + 0.5S) + f_l L + 0.5(L_r \text{ or } S \text{ or } R) + 1.6H]$$

**EQUATION 34-2**

$$0.6D + 0.01(D + 0.5S) + H$$

B. For Strength Design or Load and Resistance Factor Design, the following load combinations shall be used in lieu of Equations 16-4, 16-5, and 16-6 in 780 CMR 1605.2.1:

**EQUATION 34-3**

$$1.2D + 0.015(D + 0.5S) + f_l L + 0.5(L_r \text{ or } S \text{ or } R) + 1.6H$$

**EQUATION 34-4**

$$0.9D + 0.015(D + 0.5S) + 1.6H$$

3. The wind load specified in the basic code, if any.

4. For Post-1975 buildings, the seismic load in accordance with the seismic provisions for new buildings of the basic code.

**3408.7.4 Level 3 Work.** For Level 3 Work, each of the following lateral loads shall be applied to the building separately:

1. The wind load specified in Section 1609.
2. 35% of the seismic load specified in 780 CMR 1614.0 and 1615.0, in accordance with the seismic criteria of 780 CMR 1614.0, 1615.0, and 3408.10, with a minimum seismic base shear of 0.015W.
3. For Post-1975 buildings, the seismic load in accordance with the seismic provisions for new buildings of the basic code.

**3408.7.5 Level 4 Work.** For Level 4 Work, each of the following lateral loads shall be applied to the building separately:

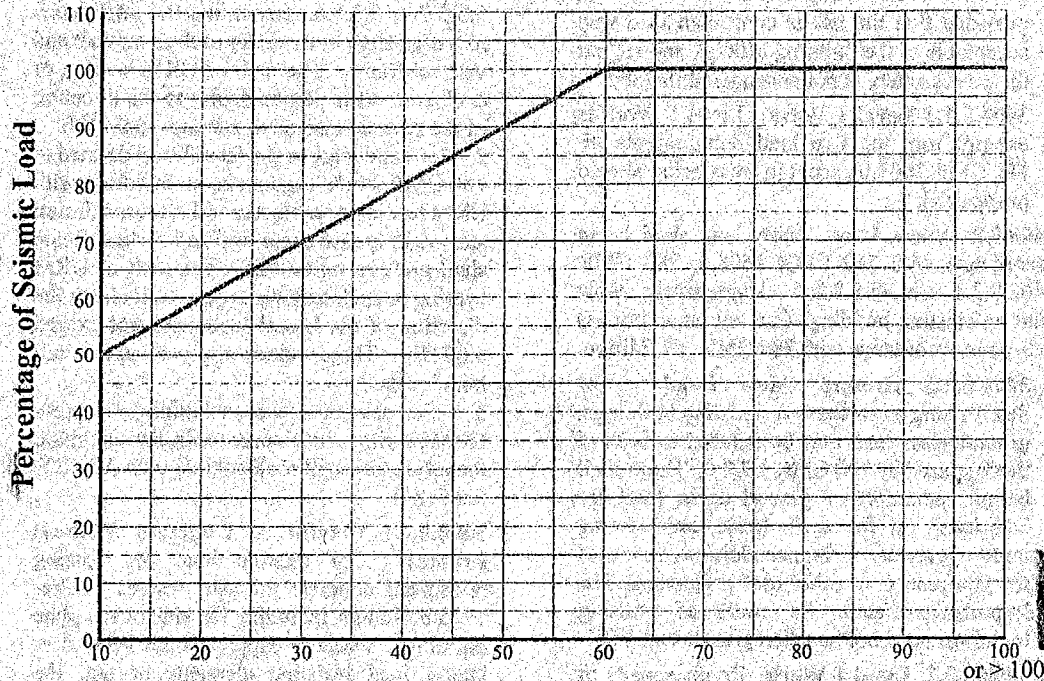
1. The wind load specified in 780 CMR 1609.0.
2. A percentage, given in Figure 3408-1, of the seismic load specified in 780 CMR 1614.0 and 1615.0, in accordance with the seismic criteria of 780 CMR 1614.0, 1615.0, and 3408.10. In Figure 3408-1, the meaning of the term *effective seismic weight* in the title of the abscissa shall be in accordance with Clauses 3408.4.1, Items 2. and 3.
3. For Post-1975 buildings, the seismic load in accordance with the seismic provisions for new buildings of the basic code.

780 CMR: STATE BOARD OF BUILDING REGULATIONS AND STANDARDS  
THE MASSACHUSETTS STATE BUILDING CODE

NON-TEXT PAGE



**FIGURE 3408.1 PERCENTAGE OF THE SEISMIC LOAD SPECIFIED  
IN 780 CMR 1614.0 AND 1615.0**



**3408.7.5.1 Buildings Designed for Additional Stories.** For Post-1975 buildings which have been designed for additional stories, the seismic load and seismic criteria for new buildings of the basic code may be used in lieu of the criteria in 780 CMR 3408.7.5, Items 2. and 3., with the following conditions:

1. The building (or an addition for which provision was made for the additional stories) was constructed under a building permit whose date is not more than 15 years prior to the date of the application for a building permit for the additional stories.
2. The number of additional stories shall not be more than the number of additional stories provided for in the original design.
3. The size of any story shall not be larger than the footprint of the story immediately below. For partial stories, account shall be taken of torsion induced by the eccentricity.
4. For buildings whose basic code was prior to the 6<sup>th</sup> Edition of the State Building Code and have rigid or semi-rigid diaphragms, new shear walls or frames shall be located as necessary such that the eccentricity of the shear center at each level from the center of mass at that level is not more than 20% of the building width in each of two orthogonal directions. Alternatively, new shear walls or frames shall be located as necessary so that the building complies with ASCE 7, Section 9.5.5.5.2, as modified by 780 CMR 1615.0. The mass at any level

shall be all of the mass of the building at and above that level.

5. Buildings whose basic code was prior to the 6<sup>th</sup> Edition of the State Building Code and which have weak stories, as defined in ASCE 7, Table 9.5.2.3.3, shall be reinforced as necessary so that the building meets the criteria of ASCE 7, Section 9.5.2.6.2.4.

**3408.7.6 Level 5 Work.** For Level 5 work, each of the following lateral loads shall be applied to the building separately:

1. The wind load specified in 780 CMR 1609.0.
2. The seismic load specified in 780 CMR 1614.0 and 1615.0, in accordance with the seismic criteria of 780 CMR 1614.0 and 1615.0.

**3408.7.7 Historic Buildings.** House museums are exempt from the lateral load requirements of 780 CMR 3408.7. Preserved historic buildings shall meet all of the lateral load requirements of 780 CMR 3408.7.

**3408.8 Gravity and Other Loads for Existing Buildings and Structurally Attached Additions.**

**3408.8.1 Live Load.** Live load shall be in accordance with 780 CMR 1607.0, with the following exceptions:

**3408.8.1.1 Reduced Live Load.** Except for Use Groups, F, I, and S, wherever there is a new use in an existing building, and the new use requires a live load in accordance with

## THE MASSACHUSETTS STATE BUILDING CODE

780 CMR 1607.0 that is greater than the original live load capacity, the floors may be posted for the original live load capacity, provided that the use is controlled in a way acceptable to the building official, and so that the public safety is not endangered thereby.

**3408.8.1.2 Level 1 Work.** Level 1 Work is exempt from the live load requirements of 780 CMR 1607.0 except in areas being altered or repaired.

**3408.8.2 Snow Load.** Snow load shall be in accordance with 780 CMR 1608.0, 780 CMR 3408.8.2.1 and 3408.8.2.2. Alternatively, snow load on existing buildings (but not on additions) may be in accordance with 780 CMR, 6<sup>th</sup> Edition.

**3408.8.2.1 Ground Snow Load.** For determining snow loads on existing buildings, ground snow load may be reduced to 85% of that required by 780 CMR 1608.0. There shall be no reduction of ground snow load for additions, or for drift loads on existing buildings created by higher additions, new roof top equipment, or other roof projections. The Importance Factor for roofs of existing buildings need not be taken greater than 1.0.

**3408.8.2.2 Level 1 Work.** Roofs or parts of roofs for Level 1 Work are exempt from the snow load requirements of 780 CMR 1608.0 provided that the roofs or parts of roofs do not support added gravity load and there are no changes to the roof framing.

**3408.8.2.3 Historic Buildings.** House museums are exempt from the snow load requirements of 780 CMR 3408.8.2.

**3408.8.3 Lateral Soil and Hydrostatic Loads.** For additions, lateral soil and hydrostatic loads shall be in accordance with 780 CMR 18.00. There are no requirements for lateral soil and hydrostatic loads for existing basement or foundation walls provided said walls and the structure supporting them laterally do not exhibit structural distress due to lateral soil or hydrostatic load; otherwise, lateral soil and hydrostatic loads shall be in accordance with 780 CMR 18.00.

**3408.8.4 Flood Loads.** Flood load shall be in accordance with 780 CMR 1612.0 for Level 4 and Level 5 Work. There are no flood load requirements for Levels 1, 2, and 3 Work.

**3408.8.5 Dead Loads.** Dead loads shall be in accordance with 780 CMR 1606.0.

### 3408.9 Structural Design and Construction.

**3408.9.1 Stiffness and Deflection Control.** For Levels 2, 3, 4, and 5 Work, except for Level 2 Work where there are no changes to the existing lateral load resisting system, the building design shall comply with the following deflection criteria.

1. For seismic load on buildings with URM bearing or enclosure walls, the maximum inelastic story drift in the direction of the

seismic load shall not exceed  $0.007h$ , where  $h$  is the story height. Inelastic story drift shall be calculated in accordance with ASCE 7, Section 9.5.5.7 or 9.5.6.6, except that the drift determination shall be made for each shear wall and vertical frame. The drift of URM bearing or enclosure walls perpendicular to the direction of the seismic load shall not exceed  $0.010h$ .

2. For wind load, or the lateral load defined in 780 CMR 3407.7.3, Item 2., on buildings with URM bearing or enclosure walls, the maximum story drift at each shear wall and vertical frame shall not exceed  $0.002h$ . The drift of URM bearing or enclosure walls perpendicular to the direction of the lateral load shall not exceed  $0.0025h$ . These values apply to unfactored load levels.

3. For seismic loads on buildings without URM bearing or enclosure walls, the maximum inelastic story drift shall comply with ASCE 7, Section 9.

**3408.9.1.1 Reinforced Concrete Moment Frames.** For seismic load on existing reinforced concrete moment frames of Pre-1975 buildings, including flat slab or flat plate buildings, whether supplemented with new lateral load resisting elements or not, the inelastic story drift shall not exceed 0.01 times the story height.

### 3408.9.2 Existing Structural Members and Systems.

**3408.9.2.1 Strength of Existing Structural Members and Systems.** Strength of existing systems, members, and connections shall be determined in accordance with the Code requirements for new construction and currently accepted engineering practice, using the actual strength and other physical properties of the existing materials, except as provided in 780 CMR 3408.9.2.2 and 3408.9.2.4.

**3408.9.2.2 Compliance with Previous Codes.** For evaluating capacity of existing structural systems, members, or connections for compliance with the basic code, structural design codes and standards in effect at the time of the basic code may be used.

**3408.9.2.3 Strength of Materials.** The strength of existing materials shall be determined by tests or from generally accepted historical records.

**3408.9.2.4 Archaic Materials.** Strength of existing systems, members, and connections made from materials no longer produced (archaic materials) may be evaluated from the archaic material codes and engineering practices at, or later than, the time said existing systems and elements were constructed. Existing systems and elements made from archaic materials shall not be used to resist seismic load.

Deflection Amplification Factor,  $C_d$ , for systems not permitted in 780 CMR 1615.0 shall be in accordance with Table 3408-1. Except as provided

in Table 3408-1, there are no specific seismic design or detailing rules for the systems listed in the table.

**TABLE 3408-1 DESIGN COEFFICIENTS AND FACTORS FOR SEISMIC FORCE RESISTING SYSTEMS NOT PERMITTED IN 780 CMR 1615.0**

Basic Seismic Force Resisting System <sup>1</sup>	Response Modification Coefficient, R	System Overstrength Factor, $\Omega_0$	Deflection Amplification Factor, $C_d$
<b>Bearing Wall Systems</b>			
Steel concentrically braced frame (CBF) with diagonal <sup>a</sup> or X-bracing			
CBF per 6th Ed SBC <sup>2</sup> except AISC 1992 Seismic Provisions, Sect 9.5	3.5	2	3.5
Otherwise <sup>4</sup>	3	3	3
Steel CBF with V, inverted V, or K bracing			
V or Inverted V bracing per 6th Ed. SBC <sup>2</sup>	3	3	3
V or Inverted V bracing, otherwise <sup>4</sup>	3	3	3
K bracing	1.25	1.25	1.25
Reinforced concrete shear walls with boundary elements and without coupling beams, in accordance with 780 CMR 1113.5.1.4a, 5th Ed.	5	2.5	5
Reinforced concrete shear walls with reinforcing steel less than required by, or spaced further apart than, that required in ACI 318, Sec. 11.10.9	1.5	1.5	1.5
Unreinforced concrete shear walls	1.25	1.25	1.25
Reinforced masonry shear walls classified in accordance with 780 CMR 3408.10.2.1			
Class A	4.5	2.5	3.5
Class B	2.25	2.25	2.25
Class C	1.25	1.25	1.25
Unreinforced masonry shear walls	1.25	1.25	1.25
Light-framed walls sheathed with wood structural panels or diagonal sheathing	4	2.5	3
Other light-framed walls sheathed with materials permitted in 780 CMR 3408.10.6	2	2	2
<b>Building Frame Systems</b>			
Steel concentrically braced frame (CBF) with diagonal <sup>a</sup> or X-bracing			
CBF per 6th Ed SBC <sup>2</sup> except AISC, 1992 Seismic Provisions, Sect 9.5	4	2	3.5
Otherwise <sup>4</sup>	3	3	3
Steel CBF with V, inverted V, or K bracing			
V or Inverted V bracing per 6th Ed. SBC <sup>2</sup>	3	3	3
V or Inverted V bracing, otherwise <sup>4</sup>	3	3	3
K bracing	1.5	1.5	1.5
Reinforced concrete shear walls with boundary elements and without coupling beams, in accordance with 780 CMR 1113.5.1.4a, 5th Ed.	6	2.5	5
Reinforced concrete shear walls with reinforcing steel less than required by, or spaced further apart than, that required in ACI 318-02, Sec. 11.10.9	1.5	1.5	1.5
Unreinforced concrete shear walls	1.5	1.5	1.5
Reinforced masonry shear walls classified in accordance with 780 CMR 3408.10.2.1			
Class A	5	2.5	4
Class B	2.25	2.25	2.25
Class C	1.5	1.5	1.5
Unreinforced masonry shear walls	1.5	1.5	1.5
Light-framed walls sheathed with wood structural panels or diagonal sheathing	4	2.5	3
Other light-framed walls sheathed with materials permitted in 780 CMR 3408.10.6	2.5	2.5	2.5

**TABLE 3408-1 DESIGN COEFFICIENTS AND FACTORS FOR SEISMIC FORCE RESISTING SYSTEMS NOT PERMITTED IN 780 CMR 1615.0 - continued**

Basic Seismic Force Resisting System <sup>1</sup>	Response Modification Coefficient, R	System Overstrength Factor, $\Omega_0$	Deflection Amplification Factor, Cd
<b>Moment Resisting Frame Systems</b>			
Steel moment frames			
Special Moment Frame per 6th Ed. SBC <sup>2</sup>	8	3	5.5
Ordinary Moment Frame per 6th Ed. SBC <sup>2</sup>	3.5	3.5	3.5
Moment frame, otherwise <sup>4</sup>	3	3	3
Reinforced concrete moment frames classified in accordance with 780 CMR 3408.10.2.2			
Class A	5	3	4.5
Class B	2.5	2.5	2.5
<b>Dual Systems (See ASCE 7, Section 9.5.2.2.1)</b>			
Steel concentrically braced frame (CBF) with steel moment frames (MF)			
CBF and Special MF, per 6th Ed. SBC <sup>2</sup>	5	2.5	4.5
CBF and MF, per 1st-5th Ed. SBC <sup>2</sup> , except V, Inverted V, or K Bracing	3.5	2.5	3.5
CBF and MF, per 1st-5th Ed. SBC <sup>2</sup> , with V or Inverted V Bracing	3	2.5	3
Otherwise	1.5	1.5	1.5
Reinforced concrete shear walls with boundary elements and without coupling beams, in accordance with 780 CMR 1113.5.1.4a, 5th Ed., with reinforced concrete moment frames in accordance with 780 CMR 3408.10.2.2, Class A.	6	2.5	5
Ordinary reinforced concrete shear wall, as defined in 7th Ed. SBC, with reinforced concrete moment frames in accordance with 780 CMR 3408.10.2.2, Class A.	5.5	2.5	4.5

**Notes:**

1. Systems of previous editions of the State Building Code that meet the ductility requirements of the 7th Edition of the Code are not included in this table.
2. SBC = State Building Code.
3. A diagonal brace is one that frames from a beam to column connection diagonally to another beam to column connection or to a column at its base plate.
4. The seismic resistance of the frame shall be based on its seismic connections being subject to two times the computed forces and moments resulting from seismic load.

**3408.10.2.1 Classification of Reinforced Masonry.** Existing reinforced masonry shear walls shall be classified for Table 3408-1, as follows:

**Class A** Minimum total cross-sectional area of reinforcement in the vertical and horizontal direction is 0.002 times the gross cross-sectional area of wall, with a minimum in each direction of 0.0007 times the gross cross-sectional area of wall. Maximum spacing of reinforcing steel bars in grouted cells or bond courses is 6'-0" in one direction and 4'-0" in the other direction, but not less than 1/3 of the length or height of the wall, whichever is smaller, in each direction. Otherwise meets requirements for reinforced masonry of the basic code.

**Class B** Same as Class A, except spacing limits for the reinforcing steel bars are exceeded.

**Class C** Less than the minimum cross-sectional area of reinforcement required for

Class A.

**3408.10.2.2 Classification of Reinforced Concrete Moment Frames.** Existing reinforced concrete moment frames shall be classified for Table 3408-1, as follows:

**Class A** Design in accordance with 780 CMR-1113.5.1, 1113.5.1.1, 1113.5.1.2 and 1113.5.1.3, 5<sup>th</sup> Edition; and ACI318-83, Sections 11.12.1.1 and 11.12.1.2 for reinforcing of the beam-column joints.

**Class B** Does not meet all the requirements for Class A.

**3408.10.3 Alternate Methods of Analysis and Design.** In lieu of the requirements of 780 CMR 1615.0 and 780 CMR 3408.10.2, analysis and design for existing buildings may be in accordance with SEI/ASCE 31 for the loading specified in 780 CMR 1614.0, except that sheathing over light-framed wood walls that is not permitted in 780 CMR 3408.9.3 shall not be used to resist in-plane shear for shear walls, and wood foundations other than piles and poles shall not be used to resist any load. The SER shall document



the use of SEI/ASCE 31 in a report to the building official, and include in said report the assumptions, the methods of analysis, and a description of the analytical results

### 780 CMR 3409.0 HISTORIC BUILDINGS

**3409.1 Scope.** The provisions of 780 CMR 3409.0 shall govern all buildings and structures in the Commonwealth which are legally designated as *historic buildings*. 780 CMR 3409.0 shall preempt all other regulations of 780 CMR governing the reconstruction alterations change of use and occupancy, repairs maintenance and additions for the conformity of historic buildings and structures to 780 CMR, with the exception of 780 CMR 122.0 for appeals, or unless otherwise specified (see 780 CMR 120.Y). There is no obligation for owners of historic properties to apply for 780 CMR 3409.0.

**3409.1.1 Key Definitions.** The following five definitions are found in 780 CMR 3401.1, but are also presented here as such definitions form a significant portion of 780 CMR 3409.0.

**Historic Buildings.** (a) Any building or structure individually listed on the National Register of Historic Places or (b) any building or structure evaluated by MHC to be a contributing building within a National Register or State Register District. (c) any building or structure which has been certified by the Massachusetts Historical Commission to meet eligibility requirements for individual listing on the National Register of Historic Places. *Historic building* shall be further defined as a *house museum* or *preserved buildings*. All entries into the *house museum* list shall be certified by the Massachusetts Historical Commission. The Board of Building Regulations and Standards shall ratify all buildings or structures certified by the Massachusetts Historical Commission to qualify for *house museum* listing (see Appendix 780 CMR 120.Y).

**Preserved Buildings.** (a) Any building or structure individually listed on the National Register of Historic Places or (b) any building or structure certified as a *historic building* by the Massachusetts Historical Commission and not designated a *house museum* in Appendix 780 CMR 120.Y).

**Restoration.** *Restoration* is the process of accurately reconstructing or repairing the forms and details of a building or structure or portion thereof as it appeared at a particular period or periods of time by means of removal of later work/or the replacement of missing original work

**House Museum.** A *house museum* is an *historic building* or structure. The principal use of such a building or structure must be as an exhibit of the building or the structure itself which is open to the public not less than 12 days per year, although additional uses, original and/ or ancillary to the principal use shall be permitted within the same

building up to maximum of 40% of the gross floor area. *House museums* shall be those listed in Appendix 780 CMR 120.Y. All entries into the *house museum* list shall be certified by the Massachusetts Historical Commission. The Board of Building Regulations and Standards shall ratify all buildings or structures certified by the Massachusetts Historical Commission to qualify for *house museum* listing (See Appendix 780 CMR 120.Y).

### 3409.2 House Museum.

**3409.2.1 State Building Code Exceptions.** A *house museum* shall be subject to the following exceptions:

1. Repairs, maintenance and restoration shall be allowed without conformity to 780 CMR generally, if the provisions of 780 CMR 3409.2.2 have been met.
2. In case of fire or other casualty to a *house museum*, said building may be rebuilt, in total or in part, using such techniques and materials as are necessary to restore it to its original condition and use group.
3. If a *historic building* or structure, as a result of proposed work, would become eligible for certification as a *house museum* and the Massachusetts Historical Commission so certifies by affidavit, such affidavit is submitted to the building official with the permit application, and the building official shall then allow the work to proceed under the provisions of 780 CMR 3409.2.

**3409.2.2 Mandatory Safety Requirements.** All *house museums* shall comply to the following requirements.

**3409.2.2.1 Fire Protection Equipment.** Fire protection equipment shall be provided according to the following requirements:

1. **Manual Fire Extinguishing Equipment.** All use groups, other than Residential R-3 and R-4, shall have approved manual fire extinguishing equipment, as determined by the head of the local fire department.
2. **Fire Protective Signaling Systems (Fire Alarm Systems).** All residential buildings in use groups R-1, R-2 and R-3 shall conform to the applicable requirements of 780 CMR 918.0 and 919.0 as applicable. All other use groups shall comply with 780 CMR 3409.2.2.1 items 2. (a) and (b).

(a) **Locations.** Provide smoke detectors in accordance with manufacturers listing and spacing requirements, but not less than one, for every 1200 square feet of floor area per level. In addition, all lobbies, common corridors, hallways and exitway access and discharge routes shall be provided with approved smoke detectors installed in accordance with the

## THE MASSACHUSETTS STATE BUILDING CODE

manufacturers listing and spacing requirements but not more than 30 feet spacing between detectors. All required smoke detectors shall have an alarm audible throughout the structure or building.

(b) Single station and multiple station smoke detection devices. Smoke detectors of single station and multiple station types shall meet the requirements of UL 217 and be listed or approved by a nationally-recognized fire-testing laboratory. All other smoke detectors shall be listed in accordance with UL 268.

**3. Manual Pull Stations.** A manual fire alarm pull station shall be provided in the natural path of egress in all use groups except R-3 and R-4. Manual pull stations shall be connected to the building fire warning system in conformance with NFPA 72.

**3409.2.2.1.1 Supervision.** Fire protective signaling systems required by 780 CMR 3409.2.2.1 shall be supervised in accordance with the requirements of 780 CMR 9.00.

**Exception.** Residential single and multiple station smoke detectors.

**3409.2.2.2 Exit Signs and Emergency Lights.** Approved exit signs and emergency lighting, where designated by the local building official, shall be provided in compliance with 780 CMR 10.00.

**Exception.** All *house museums* need not comply with 780 CMR 10.00 if not occupied after daylight hours, except that paths of egress shall have exit signs.

**3409.2.2.3 Maximum Occupancy.** Occupancy shall be limited by the actual structural floor load capacity as certified by a qualified Massachusetts *registered professional engineer* or *architect* or in accordance with 780 CMR 10.00, whichever is less. Said floor load shall be posted in accordance with the procedures set forth in 780 CMR 120.0, 780 CMR 10.00 and 780 CMR 1617.2. The owner shall submit evidence of this certification and related computations to the building official upon request.

**3409.2.2.4 Limited Egress.** Where one or more floors of a *house museum* are limited to one *means of egress*, the occupancy load shall be computed as follows:

1. **Floors below the First Story.** Not more than one occupant per 100 square feet of gross floor area with a maximum occupancy of 49.
2. **First Story.** Not more than one occupant per 50 square feet of gross floor

area.

**3. Second Story and Above.** Not more than one occupant per 100 square feet of gross floor area, or 30 occupants per unit of egress width, whichever condition results in the lesser occupancy load.

**3409.2.2.5 Inspections.** The *building official* and the fire official shall inspect all *house museums* not less frequently than once every year in order to determine that the building or structure continues to conform to 780 CMR 3409.2. A qualified Massachusetts *registered professional engineer* or *architect* shall certify every five years thereafter as to the exact floor load capacity of the building or structure. The building official shall certify all *house museums* not less frequently than once every year. Fees shall be established at \$25.00 per building per inspection.

**3409.2.2.6 Accessibility for Persons with Disabilities.** Accessibility requirements shall be in accordance with 521 CMR.

**3409.2.2.7 Energy Conservation.** House museums are exempt from the requirements of 780 CMR 3407.0 and the energy conservation requirements of 780 CMR. Muntins, glazing, sills, molding, shutters) shall be permitted without requiring energy code compliance.

**3409.2.2.8 Structural Requirements.** House museums need not comply with the wind load and seismic load requirements of 780 CMR 3408.0.

### 3409.3 Preserved Buildings.

**3409.3.1 State Building Code Provisions.** A *preserved building* shall be subject to the following provisions.

1. **Existing Systems** - individual components of an existing *building system* may be repaired or replaced in kind without requiring that system to comply fully with the code for new construction. (See 780 CMR 34.00, 780 CMR 3404.3. *New Systems*.)
2. **Replacement in Kind** - when the repair of historic materials including patching, splicing, piecing-in, consolidating or reinforcing is not possible, compatible materials may be substituted which closely convey the form and design as well as the visual appearance of the existing feature.

**3409.3.2 State Building Code Exceptions.** A *preserved building* shall be subject to the following exceptions. Repairs or in kind replacement of the following features will be allowed on partially preserved buildings so as not to compromise the architectural integrity of the historical characteristics and qualities which contributed to the eligibility for listing in the National Register of Historic Places.