Massachusetts State Building Code

7th Edition Update

SEAMass

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Seismic Advisory Committee

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- Kenneth Wiesner - Secretary
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Schedule

- Six year code cycle
- 6th Edition issued 28 February 1997
- Advisory Committees nearly done
- Building Code Coordinating Committee at work
- Target May 2007 Public Hearing
- Target August 2007 release
- History of 6 month overlap with prior edition

MSBC 7th Edition

- Based on 2003 International Building Code
  - Originally planned for 2000 IBC
  - Switched to 2003 IBC in early 2004
- Structural provisions developed by:
  - Loads Advisory Committee
  - Seismic Advisory Committee
- Foundation provisions developed by:
  - Geotechnical Advisory Committee

MSBC 7th Edition

- 2003 IBC structural provisions based on:
  - ASCE/SEI 7-02
- Concrete design provisions based on:
  - ACI 318-02
- Steel design provisions based on:
  - 1989 ASD Specification
  - 1999 LRFD Specification
  - 2000 HSS Specification
  - 2002 Seismic Provisions

MSBC 7th Edition

- "A substantial portion of this Chapter is unique to Massachusetts"
- "This Chapter is entirely unique to Massachusetts"
- 30 year history of "adapting" model codes
  - Good reasons in early versions based on significant time lag in structural provisions of BOCA
  - Initiative to adopt IBC as written has not to date prevailed
  - Long code cycle is a factor

MSBC 7th Edition

- Ground motion parameters based on Maximum Considered Earthquake – 2500 year return period (2% in 50 years)
- Ordinary Buildings designed for 2/3 MCE
- High Occupancy Buildings designed for 0.83 MCE
- Essential Facilities designed for MCE
- Ground motion parameters vary by city and town
- Very poor soil sites have higher amplification factors than in prior codes
- Seismic Design Categories B, C and D included
- Buildings in Seismic Design Category D must meet higher design standards than in prior codes

Chapter 16

- 2003 IBC Sections 1613 through 1623 address earthquake loads
- MSBC will replace these sections in their entirety
- Most of the replacement sections directly reference ASCE/SEI 7-02
- Some provisions of ASCE/SEI 7-05 are inserted where they represent significant advances
- Some unique Massachusetts provisions are included

Chapter 16

- Section 1613 is a statement of purpose including:
  - *The purposes of Sections 1613 through 1615 are to minimize the hazard to life of occupants of all buildings and non-building structures, to increase the expected performance of high occupancy assembly and education buildings as compared to ordinary buildings, and to improve the capability of essential facilities to function during and after an earthquake.*

Chapter 16

- Section 1613 continues:
  - *Absolute safety and prevention of damage, even in an earthquake event with a reasonable probability of occurrence, cannot be achieved economically for most buildings. The "design earthquake" ground motion levels specified herein may result in both structural and non-structural damage. For most buildings designed and constructed according to Sections1613 through 1615, it is expected that structural damage from a major earthquake may be repairable but the repair may not be economically feasible. For ground motions larger than the design levels, the intent of Sections 1613 through 1615 is that there be a low likelihood of building collapse.*

Chapter 16 – Section 1614

- Directs the engineer to ASCE/SEI 7-02
  - ASCE/SEI Sections 9.7 through 9.12 are not adopted
  - MSBC Chapters 18 through 23 address materials
  - MSBC Chapter 34 addresses additions and alterations
  - MSBC Chapter 17 addresses quality assurance

Chapter 16- Section 1615

- Includes specific modifications to ASCE/SEI 7-02
- Ground motion parameters updated per ASCE/SEI 7-05. These are provided in a table with spectral response accelerations listed by city and town
- Site classification procedure modified per ASCE/SEI 7-05 to address soil profiles less than 100 ft deep

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- Seismic Design Category
  - Mapped Spectral Acceleration
  - Site Classification

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City/Town	Ss	S_1
Amherst	0.23	0.067
Boston	0.29	0.068
Bourne	0.21	0.056
Brewster	0.18	0.052
Danvers	0.32	0.073
Ipswich	0.34	0.074
Lowell	0.31	0.074
Pittsfield	0.22	0.067
Springfield	0.23	0.065
Worcester	0.24	0.067

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- Six Site Classes – Progressively lower shear wave velocity
  - Class A – hard rock
  - Class B – rock
  - Class C – soft rock and very dense soil – N > 50
  - Class D – stiff soil - 15 < N < 50
  - Class E – soft clay – N < 15
  - Class F – soils susceptible to failure or collapse under seismic load

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VALUES OF F_a AS A FUNCTION OF SITE CLASS AND SHORT PERIOD MAXIMUM CONSIDERED EARTHQUAKE SPECTRAL ACCELERATION

Site Class	Tabulated Maximum Considered Earthquake Spectral Response Acceleration at Short Periods					
	$S_S \leq 0.26$	$0.27 \leq S_S \leq 0.29$	$0.30 \leq S_S \leq 0.32$	$0.33 \leq S_S \leq 0.35$	$0.36 \leq S_S \leq 0.38$	$S_S \geq 0.39$
A	0.8	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0	1.0
C	1.2	1.2	1.2	1.2	1.2	1.2
D	1.6	1.6	1.55	1.5	1.5	1.5
E	2.5	2.4	2.3	2.2	2.1	2.0
F	Note a	Note a	Note a	Note a	Note a	Note a

Note a: Site-specific geotechnical investigation and dynamic site response analyses shall be performed except that for structures with periods of vibration equal to or less than 0.5-seconds, values of F_a for liquefiable soils may be assumed equal to the values for the site class determined without regard to liquefaction in Step 3 of Section 9.4.1.2.2.

VALUES OF F_v AS A FUNCTION OF SITE CLASS

Site Class	Tabulated Maximum Considered Earthquake Spectral Response Acceleration at 1-Second Periods
	$S_1 \leq 0.1$
A	0.8
B	1.0
C	1.7
D	2.4
E	3.5
F	Note a

Note a: Site-specific geotechnical investigation and dynamic site response analyses shall be performed except that for structures with periods of vibration equal to or less than 0.5-seconds, values of F_v for liquefiable soils may be assumed equal to the values for the site class determined without regard to liquefaction in Step 3 of Section 9.4.1.2.2.

SEISMIC DESIGN CATEGORY BASED UPON SHORT PERIOD RESPONSE ACCELERATIONS

Value of S_{DS}	Seismic Use Group		
	I	II	III
$S_{DS} < 0.33g$	B	B	C
$0.33g \leq S_{DS} < 0.50g$	C	C	D
$0.50g \leq S_{DS}$	D	D	D

Seismic-Force-Resisting Systems

- Large number of recognized systems
- Systems not previously recognized
  - Prestressed masonry shear walls
  - Steel buildings not specifically detailed for seismic resistance (R=3 Buildings)
- MSBC continues to prohibit certain poor-performing systems prone to catastrophic failure
  - Plain and ordinary masonry systems
  - Plain concrete shear walls
  - Ordinary concrete moment-resisting frames
- MSBC includes restrictions on other systems with low ductility
  - Height limits on R=3 Buildings
  - Height limits and other restrictions on buildings with GWB shear walls

MSBC 7th Edition

- Chapter 17 – Structural Tests and Inspections
  - Similar to 6th Edition
- Chapter 18 – Soils and Foundations
  - Contains many provisions unique to Massachusetts
  - Includes updated Liquefaction screening charts
- Chapter 19 – Concrete
  - Closely follows 2003 IBC
- Chapter 21 – Masonry
  - Written based on ACI 530-02
- Chapter 23 – Wood
  - Closely follows 2003 IBC
- Chapter 34 Existing Buildings

Chapter 22 - Steel

- Closely follows 2003 IBC
- Clarifies that all buildings fall into SDC B, C or D
- Clarifies applicability of AISC 341-02
- Incorporates selected provisions of AISC 341-05

Special Concentrically Braced Frames

- AISC 341-05 provisions adapted
  - Slenderness ratios
  - Requirements for V-type and inverted V-type braced frames

Ordinary Concentrically Braced Frames

- R= 3-1/4
- K-type braced frames prohibited
- Local buckling limits consistent with AISC 341-05
- V-type and inverted V-type braced frames must meet provisions consistent with AISC 341-05
- Bracing connection strength consistent with AISC 341-05

R=3 Systems

- Height limitations
- Amplified connection design forces
- K-Type braced frames prohibited
- Beams in V-type and inverted V-type braced frames must meet provisions applicable to similar systems designed per AISC 341-02

Collapse prevention is worth the investment