

OVERVIEW OF STRUCTURAL ENGINEERING STANDARDS

The Basic Implementation of the 2003 *NEHRP Recommended Provisions*



Instructional Material Complementing FEMA 451, Design Examples

Overview of Standards 8b - 1

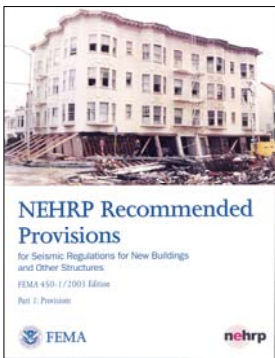
Scope

- Brief description of standards for design of basic building structures that implement the 2003 *NEHRP Recommended Provisions*
- Does not include standards referenced for design of nonstructural components and anchorages
- Does not include standards referenced for design of nonbuilding structures



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Overview of Standards 8b - 2



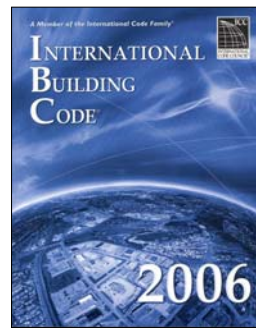
NEHRP Recommended Provisions

- Fundamentally a resource document
- Produced at the Building Seismic Safety Council
- 2003 edition influences many standards
- 3 year cycle till now



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Overview of Standards 8b - 3



IBC 2006

- Sets some basic requirements, but mostly cites structural design standards by reference.
- A distinct change from the UBC, more like SBC and NBNC.



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Overview of Standards 8b - 4



ASCE/SEI 7 2005 edition with Supplement 1

- Includes the bulk of 2003 *NEHRP Provisions* for its seismic chapters
- Reorganized and strongly edited



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Overview of Standards 8b - 5

ASCE 7

- Developed by ASCE-SEI using ANSI standard consensus process
- Publication cycle varies (1988, 1993, 1995, 1998, 2002, 2005)
- Latest Version ASCE 7-05 Including Supplement 1 includes references to latest (2005 editions) material standards
- Extensive errata – go to www.seinstitute.org & click on publications



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Overview of Standards 8b - 6

Vision of the Future

- Code “evolution” should slow somewhat (next edition of ASCE 7 in 2010/2011)
 - Standards are more difficult to change than codes – ASCE 7-10/11 should be adopted by 2012 IBC
 - Less rapid fire adoption of major changes
- However, IBC Code Supplements will still occur every 18 months with new full editions every 3 years.

ASCE 7-05 Reorganization

Goals of seismic section reorganization:

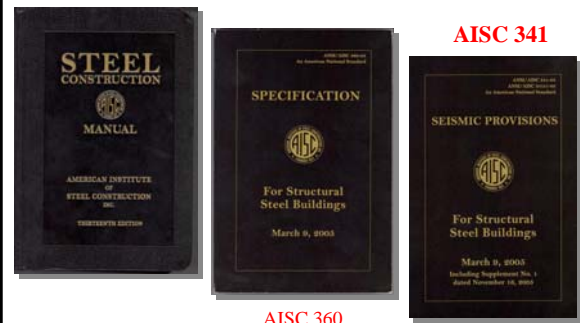
- To improve clarity and use
- Reduce depth of section numbering from 6 max typical to 4 max typical (i.e., Sec. 9.5.2.5.2.2 is now Sec. 12.5.3)
- Create logical sequence of provisions aim at the structural engineering community
- Improve headings and clarify ambiguous provisions

ASCE 7-05 Chapter 14: Material Specific Design and Detailing

- 1 – Steel
- 2 – Concrete
- 3 – Composite Steel and Concrete
- 4 – Masonry
- 5 – Wood

IBC 2006 does not cite Chapter 14 by reference; it includes the same information in its chapters dealing with the material of construction

Structural Steel



Structural Steel

- Can ignore AISC 341 (seismic provisions) in Seismic Design Categories B, C if use $R = 3$
- Seismic provisions (341) required for all other situations
 - Special, intermediate, ordinary moment resisting frames
 - Special, ordinary concentrically braced frames
 - Eccentrically braced frames
 - Buckling restrained braced frames
 - Steel plate shear walls
 - Composite steel and concrete systems

Cold Formed Steel



Cold Formed Steel

New lateral design standard covers:

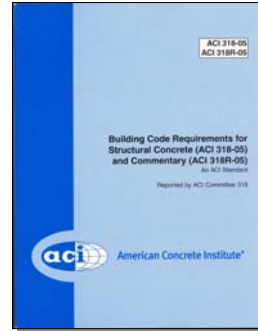
- Diaphragms and walls sheathed with structural wood panels
- Walls sheathed with light gage steel sheet
- Walls braced with diagonal steel straps

No specific reference for untopped steel deck acting as a diaphragm.



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ACI 318-05

- Seismic requirements are primarily found in Chapter 21
- Composite steel and concrete is covered in AISC 341



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Overview of Standards 8b - 14

Structural Concrete

- Special, intermediate, ordinary moment resisting frames
- Special, ordinary shear walls (structural walls)
- Special, intermediate, ordinary precast concrete shear walls
- Special precast concrete moment frames
- Provisions for concrete structure not designed as part of seismic force resisting systems



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TMS 401-05 ACI 530-05 ASCE 5-05 (MSJC Code)

- Mostly incorporated into IBC chapter 21 by transcription as opposed to citation by reference



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Overview of Standards 8b - 16

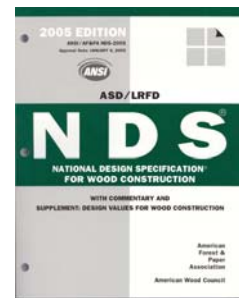
Masonry

- Five types of masonry shear walls
 - Special, intermediate, ordinary reinforced walls
 - Detailed, ordinary plain walls
- Seismic provisions somewhat buried and convoluted (2008 edition will be better!)
- Prestressed shear walls
- Autoclaved aerated concrete (AAC) masonry



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Overview of Standards 8b - 17



Wood (Timber)



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Overview of Standards 8b - 18

Timber Structures: Seismic Supplement

- Diaphragms and shear walls
- Various sheathing types
- Framing and configuration requirements
- Note that much of this information was formerly included directly in the model building code rather than a design standard.



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Overview of Standards 8b - 19

Structural Standards: Summary

- IBC 2006 cites ASCE 7-05; based on 2003 *NEHRP Recommended Provisions*
- Both IBC and ASCE 7 cite and supplement the 2005 material design standards:
 - AISC for structural steel and composite steel/concrete
 - AISI for cold formed steel
 - ACI for concrete
 - TMS 402 (MSJC) for masonry
 - AF&PA NDS for timber



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