OVERVIEW OF STRUCTURAL ENGINEERING STANDARDS

The Basic Implementation of the 2003 NEHRP Recommended Provisions
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
NEHRP Recommended Provisions
for Seismic Regulations for New Buildings and Other Structures
FEMA 450-1/2003 Edition

NEHRP
Recommended
Provisions

• Fundamentally a resource document
• Produced at the Building Seismic Safety Council
• 2003 edition influences many standards
• 3 year cycle till now
IBC 2006

- Sets some basic requirements, but mostly cites structural design standards by reference.
- A distinct change from the UBC, more like SBC and BNBC.
ASCE/SEI 7
2005 edition
with Supplement 1

• Includes the bulk of 2003 *NEHRP Provisions* for its seismic chapters

• Reorganized and strongly edited
ASCE 7

• Developed by ASCE-SEI using ANSI standard consensus process
• 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
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

AISC 360

AISC 341
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.
ACI 318-05

- Seismic requirements are primarily found in Chapter 21
- Composite steel and concrete is covered in AISC 341
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
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
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
Wood (Timber)
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.
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