Steel Seismic Design Post-Northridge: Changes in Practice

Thomas A. Sabol, PhD, SE
Principal, Englekirk Institutional
Adjunct Professor, UCLA Department of Civil & Environmental Engineering

January 16-17, 2014 - University of California, Los Angeles
Introduction

- Body of Knowledge
- Analysis Phase
- Design and Documentation Phase
- Construction Phase
Body of Knowledge – Pre-Northridge

  - 17 members of the AISC Subcommittee (Deierlein, Engelhardt and Saunders remain)
  - 59 pages of provisions (included references and a lot of material now found in other sources)

- SEAOC Blue Book
  - Strong Column-Weak Beam (just a suggestion)

- Uniform Building Code Chapter 22
  - Blue Book minus the “Commentary”
Body of Knowledge – Post-Northridge

- 2010 AISC Seismic Provisions
  - 28 members of the AISC Subcommittee
  - 133 pages of provisions (not including references and material found in other sources)
- AISC Connection Prequalification Standard
- FEMA/SAC, NIST/NEHRP publications
- SEAOC Blue Book
- 2012 International Building Code Chapter 22
  - Just refers to Seismic Provisions
Analysis Phase

- Software Sophistication (?)
  - Improved interface and output
  - Still mostly elastic
  - Centerline-to-centerline models more common than models with rigid offsets (reasonable estimation of panel zone deformation)
  - Nonlinear analysis available via Perform, etc.
Analysis Phase

- “Behavior-Based” Analysis
  - “Hierarchical” design approaches (e.g., EBF, SCWB, brace connections, etc.)
  - Explicit consideration of brace buckling for CBF
- Performance-Based Design for Steel – not so much
Design and Documentation Phase

- Connection Prequalification for Moment Frames (AISC 358)
  - Generic and Proprietary Connections
  - Connection design procedures
  - No weak-axis frames
  - No HSS frames

- Use of deep moment frame columns more common
  - Approximately 2 – 3 psf weight savings but “architectural blowback” due to column depth
Design and Documentation Phase

- Redundancy Factor (rho)
  - Building code’s special interest in moment frames (now via drift)
  - More bays of frames?

- More required information on the drawings
  - Explicit identification of SFRS members and connections
  - Explicit identification of backing bar removal
  - Identification of “protected zones” and “demand critical welds”
Design and Documentation Phase

- Braced Frames
  - Elimination of “all tension” frames
  - Stricter brace member proportion requirements
  - Connection capacity requirements
  - Net section requirements

- New Systems
  - Buckling Restrained Braced Frame
  - Special Plate Shear Walls
Construction Phase

- Higher Expectations
  - Union card vs. WPS
  - Follow the welding procedure specification (WPS)
  - Fabricator/Erector Certification

- Inspection
  - AISC 360 Chapter N and AISC 341 Chapter J
  - Pre-construction meetings
  - Increased reliance on visual inspection
  - Shop fabrication waiver for approved fabricators (?)