PEER Tall Building Seismic Design Guidelines Looking Back & Ahead

Ronald O. Hamburger

Senior Principal

Simpson Gumpertz & Heger Inc.

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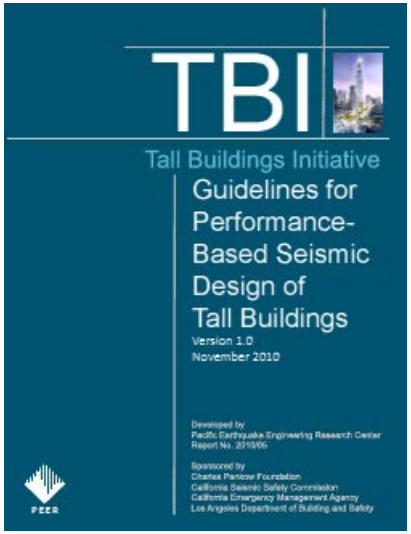
Discussion Items



- Original Intent
- New stuff
- Feedback from Users
- Future Work

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Original Intent

- Provide a complete performance-based design criteria for tall buildings that:
  - Are practical for use
  - Result in more reliable building performance
  - Provide guidance on the design and analysis of:
    - Foundations
    - Structures
    - Nonstructural systems

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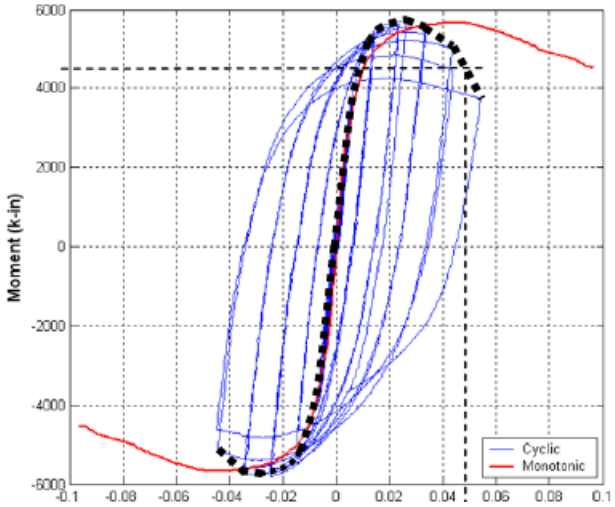
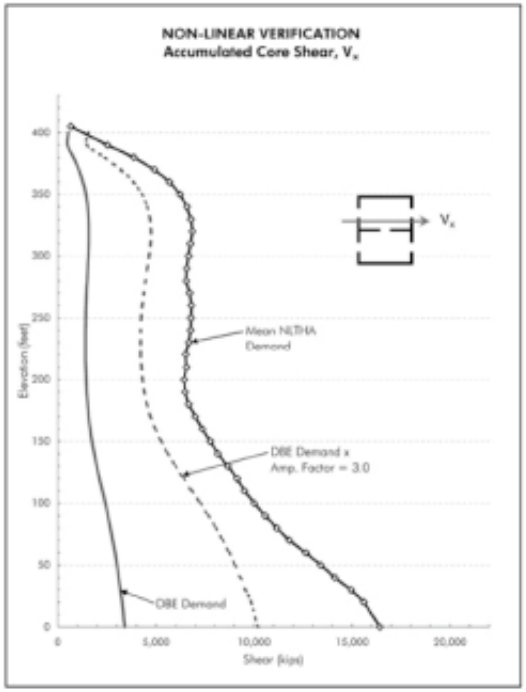
New Stuff





- Enhanced hysteretic behavior modeling guidance
- Relaxed “deformation-controlled” behavior limits
- Reliability-based force-controlled behavior criteria
- Maximum peak transient drift limits
- Residual Drift Limits
- Story strength loss Limits
- Service level earthquake

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User Feed-back

New Stuff	Used	Liked	Problem

Reliability-based Force Limits

$$F_u \leq \emptyset F_{n,e}$$

- F_u – demand obtained from statistical evaluation of analysis results
  - Limited by well-defined mechanism

    $$F_u = \bar{F} + 1.3\sigma \geq 1.2\bar{F}$$

    Not limited by mechanism

    $$F_u = 1.5\bar{F}$$

- $\phi F_{n,e}$ – code capacity, using "expected" material strength

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Problems

- Which behaviors are limited by yield mechanisms?
  - Shear in a moment frame beam?
  - Axial force in a column or pier?
  - **Shear in a shear wall?**

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Problems

- 1.5 Factor seems “high”
- Sources of demand uncertainty
  - Ground motion intensity
  - Modeling
    - Material strength - $\beta = 0.15$
    - Damping $\beta = 0.15$
    - Hysteretic behavior $\beta = 0.15$
  - Record to Record $\beta = 0.3\text{-}0.4$
  - Total demand uncertainty - .4 - .5
- Assuming these uncertainties are correct, this results in 10% failure rate at MCE

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We don’t know what we don’t know

- Record to record variability is a function of:
  - Records selected
  - Means of scaling / matching
  - No-one really knows the “correct” method of doing this

  Guidance on appropriate methods is badly needed
- ATC-82 is working on the problem . . . unlikely to solve it.

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Service Level Earthquake

- Return period picked arbitrarily
  - Approximates code requirements in some cities and some site classes
  - Not picked based on cost-benefit or other defensible criteria

  Studies justifying an appropriate return period would be helpful
- BSSC is presently evaluating this

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Other Issues

- Additional guidance needed on:
  - Design of nonstructural systems
  - Determination of story strength loss

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Summary

- PEER TBI Guidelines represent an improvement over prior practice
- Additional work is needed

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