An Introduction to Earthquake-Resistant Design

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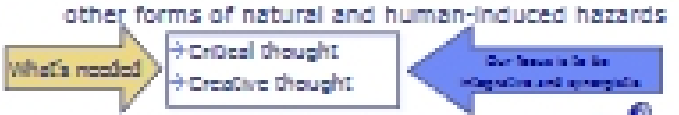
The Earthquake Challenge

- Earthquakes provide one of the most challenging problems facing the structural engineering profession
- Important social and economic problem
- Field is rapidly changing
  - ✓ Changing demands by society
  - ✓ New tools for design and analysis
  - ✓ New technologies
- → Basic concepts and tools relevant to design to resist other forms of natural and human-induced hazards



Today

- Course Organization
- Preview of the Course
- Sources of Earthquake Damage
- Trends in Earthquake Engineering
  - ✓ Evolution of building codes
  - ✓ Genesis of performance-based approaches to earthquake engineering

Basic Course Outline

- Introduction to Earthquake Engineering
- Engineering Characterization of Ground Motions
- Sensitivity of Seismic Response of Simple Systems to Ground Motion and Structural Characteristics
- Development of Design Earthquakes (for Linear & Nonlinear Response)
- Analytical Tools for Preliminary/Conceptual Design
- Design Issues and Approaches
  - ✓ Code-related issues - Interpretation and future trends
  - ✓ Performance-based Design /Displacement Based Design
  - ✓ Capacity Design / Damage Tolerant Design / Sustainable Design
- Applications
  - ✓ Moment Resisting and Braced Frames (mainly steel)
  - ✓ New construction ✓ Retrofit
  - ✓ Seismic isolation ✓ Supplemental Energy Dissipation
- Special topics

Course Organization

Contact Information

- Instructor:

Stephen Mahin
777 Davis Hall, 643-5972, mahin@berkeley.edu
Office Hours: Tentatively, M 2:15-3:00 PM & Tu 12:45-1:45 PM
or by appointment

- Teaching Assistant:

Wael Hassan
whassan@berkeley.edu
504 Davis Hall
Office Hours: TBD

- Grader:

Kelly Cronin
kcronin@berkeley.edu

Course Organization

Lectures

Tu-Th 11 AM -12:30 PM
534 Davis Hall

Review and Discussion Session

- Weekly session with Graduate Student Instructor or Professor.
- Clarify important points in class or carry out examples.
- Help with homework assignments.
- Time slot to make up missed classes.
  - → Wednesday, 2-3 pm, 534 Davis Hall

No Discussion Section This Week

Course Organization

Prerequisites

- Advanced course in structural analysis (CEE 220/121)
- Course in structural dynamics through modal analysis and use of linear response spectrum techniques for multiple degree of freedom systems (CEE 225/125).
- Some design background.
- Some familiarity with simple plastic analysis (e.g., CE 220).

Questions on student background:

- Capacity design concepts (CE 244); simple plastic analysis (CE 245); GeoTech Earthquake Engineering (CE 275); Protective Systems (CE 290D); Bdk.Eng. Analysis (CE 225)?
- Computer tools? FEDEAS, RAM, SAP, ETABS, OpenSees, CEE 221?

Class Web Page

URL:
http://web.mac.com/smahin/CE227-08/CE227.html

User Name: ce227
Password: Berkeley

Will be updated regularly

Useful References

See Suggested Reading Assignments

Frequent reference is made to:

- "Structural Dynamics and Earthquake Engineering," A. Chopra, Prentice Hall, 2000
- *Earthquake Engineering: From Engineering Seismology to Performance-Based Engineering, Yousef Bozorgnia and Vitelmo Bertero, Eds., CRC Press, 2004 (available from* http://melvyl.cdlib.org)

Various Technical Papers

- From course website or other provided URLs.