Unified Facilities Criteria: Seismic Design for Buildings

(UFC 3-310-04)

2005 Infrastructure Systems Conference

Track 14, Session 14C
Wednesday 3 August 2005

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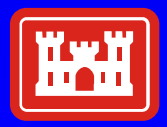
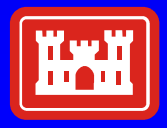


Presentation Outline

- Brief history
- Today's focus and philosophy
- Approach to document development
- Major features (de facto document outline)
- Training & future directions
- Q & A (*time-permitting*)



Brief (Rich) History

- Tri-Services developed comprehensive seismic design criteria long before national model codes did (only the UBC and its predecessors were close), e.g.:
  - TM 5-809-10/NAVFAC P-355/AFM 88-3 Ch 13 (1982, 1992)
  - TM 5-809-10-1/NAVFAC P-355.1/AFM 88-3 Ch 13 Sec A (1986)
  - TM 5-809-10-2/NAVFAC P-355.2/AFM 88-3 Ch 13 Sec B (1988)
  - TI 809-04 (1998)
  - TI 809-05 (1999)
  - TI 809-07 (1998)
- Pioneers: Sig Freeman (*WJE*), Joe Nicoletti (*URS*) , Jim Tanouye, Ralph Strom & Ray Decker (*USACE*)

Brief History (Continued)

- Evolution of FEMA's NEHRP "recommended provisions" in 1990's and beyond led to including more comprehensive seismic design guidelines in ASCE 7, and thence in the IBC.
- Tri-Services, via UFC 1-200-01, have mandated maximum reliance on the IBC as the national model code (IBC adopts ASCE 7 & all material codes, e.g. ACI 318).
- Funding for DoD criteria development continues to shrink.

Focus & Philosophy

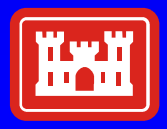
- Incorporate provisions of 2003 *International Building Code* (IBC) by reference, to maximum extent possible.
  - ∴ Adopt ASCE 7-02 and material-specific codes (e.g. ACI 318-02) by reference, to maximum extent possible.
- Provide DoD-unique criteria and guidance where necessary & appropriate.
- "Look ahead" in a few places and adopt ASCE 7-05 provisions, if they provide some advantage over ASCE 7-02 provisions (ASCE 7-05 is currently under ballot and seismic provisions will be adopted almost *in toto* by 2006 IBC).

Approach to Document Development (1)

- Tri-Service Structural Discipline Working Group (SDWG) oversees development – Caulder (AF), Hewitt (NAVFAC), Rossbach (USACE).
- UFC is primarily developed by CEERD CERL (Hayes, Sweeney, Wilcoski).
- OCONUS seismicity data are developed by USGS (Leyendecker).
- Tri-Service technical review is provided by SDWG, CENWK (Wright, Sivakumar), CENPD (Petersen), & CEHNC (Grant).

Approach to Document Development (2)

- Outside mentoring & peer review are provided by:
  - Bob Bachman (Chair, ASCE 7 Seismic Task Committee)
  - Ron Hamburger (Chair, BSSC Provisions Update Committee - PUC)
  - Jim Harris (Chair, ASCE 7)
  - Bill Holmes (Past Chair, BSSC PUC)
  - Harold Sprague (Member ASCE 7, BSSC PUC)
  - EV Leyendecker (USGS, Member ASCE 7, BSSC PUC)

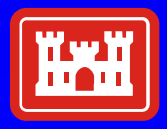


Approach to Document Development (3)

- Replace TI 809-04 and TI 809-05 with UFC 3-310-04.
- Retain unique guidance features of TI 809-04 in updated form (diaphragms, architectural / mechanical / electrical components, masonry (passed to masonry UFC), & flow charts / reference tables.
- Review each section/paragraph of 2003 IBC and determine if it could be used as written or needed modification.
- Transfer CONUS & OCONUS seismicity data (spectral accelerations, not zones) to UFC 3-310-01 (25 May 05).

Major Features (1)

- UFC directs designers to use provisions of 2003 IBC, except where changes are required. This is covered by Appendix B of the UFC and will apply to conventional DoD buildings. "Default" values are to use IBC provisions. Where changes are required, designer is told to:
  - Add a new section to the IBC provisions;
  - Delete the referenced IBC section;
  - Replace the referenced IBC section with new provision; or,
  - Supplement the referenced IBC section with additional information.

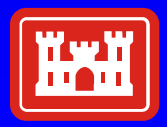


Major Features (2)

- Appendices B, D, & E direct designers to UFC 3-310-01 for spectral acceleration data, including OCONUS data.
- Appendix B creates new DoD-unique Seismic Use Group (SUG) IV, for nationally strategic military assets (e.g. NMD).
- Appendix B addresses existing buildings via reference to ASCE 31-03 (evaluation) & FEMA 356 (rehabilitation).
- Appendix C substitutes a new optional "simplified" design procedure for regular, low-rise buildings. This replaces "simplified analysis" provisions of 2003 IBC (§ 1616.6.1) with a new procedure that will be in ASCE 7-05. Many DoD buildings should fall into this category.

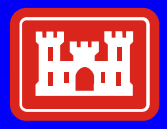
Major Features (3)

- Appendix D provides designers with an optional, alternate design procedure for buildings in SUG III (UFC does not have SUG IIIE and IIIH of TI 809-04):
  - Specifies nonlinear analysis (static or dynamic) for two performance levels: Life Safety at 2%/50, or MCE; and, Immediate Occupancy at 10%/50, or SE;
  - Adopts acceptance criteria from FEMA 356 for LS and IO performance objectives; and,
  - Somewhat restricts use of seismic force-resisting systems to those that are considered to be "good performers" in earthquakes.



Major Features (4)

- Appendix E provides design procedure for SUG IV buildings:
  - Requires buildings to remain elastic and all critical installed equipment to remain operational at MCE (2%/50 yrs) ground motion;
  - Adds vertical motion component to design & provides method of deriving vertical spectrum from horizontal spectrum (from USGS);
  - Further restricts use of structural systems;
  - Encourages use of supplemental energy dissipation and base isolation in appropriate situations; and,
  - Requires formal peer review.



Major Features (5)

- Appendix F provides guidance for design of architectural, mechanical, & electrical systems:
  - Includes details for ceilings, piping, non-structural walls (based largely on guidance found in TI 809-04); and,
  - Includes certification / testing procedures for equipment, with sample reports.

Major Features (6)

- Appendix G provides design process flow charts and cross-reference tables that relate UFC provisions to 2003 IBC and ASCE 7-02 provisions (emulates TI 809-04).
- Appendix H provides guidance on diaphragm analysis & design (emulates TI 809-04).
- Note: TI 809-04 guidance on masonry design is transferred to masonry UFC 3-310-06 (see Track 14, Session 14D).
- Note: TI 809-04 guidance on reinforced concrete & structural steel design is dropped, with references to public sector documents provided in Appendix G.

Training & Future Directions

- PROSPECT Course 027, *Seismic Design for Buildings*, is planned for 22-26 May 06.
- Revised version of UFC 3-310-04 is planned for ~ FY07:
  - 2006 IBC will delete most seismic provisions and simply adopt ASCE 7-05 (ala NFPA);
  - ASCE 7-05 seismic provisions are completely reformatted from ASCE 7-02;
  - Hopefully, FEMA 356 (*Prestandard and Commentary for the Seismic Rehabilitation of Buildings*) will evolve into ASCE 41-xx;
  - Design provisions for non-building structures are not thorough; and,
  - The UFC will move toward direct inclusion in master structural design UFC (see Track 14, Session 14B).

Questions?

Electronic copy of draft UFC 3-310-04 is available.

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