Seismic Requirements for Arch, Mech, and Elec. Components

2005 Infrastructure Systems Conference

Track 14, Session 14C
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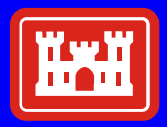


Presentation Outline

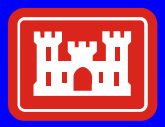
- Purpose
- Criteria Overview
- UFC 3-310-04 Requirements
- UFC vs. ASCE
- Design Considerations
- Specifications (01492, 13080, 15070, 16070)
- Future directions
- Q & A

Purpose

- New Criteria (UFC)
- Plans and Specs conflict
- Design vs. Performance Spec
- Least design attention, Most RFI's
- Criteria conflict/confusion
- Circular references
- Roles & Responsibilities not clear

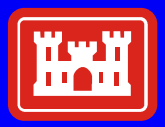
Criteria Overview

- UFC 1-200-01 (Gen. Bldg. Req.)
- UFC 3-310-01 (Structural Load Data)
- UFC 3-310-04 (Draft Seismic Design)
- IBC 2003
- ASCE 7-02
- UFGS
- FEMA, NEHRP, TI 809-04?



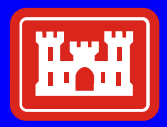
UFC 1-200-01

- "Design: General Building Requirements"
- 20 June 2005 (supercedes 31July 2002)
- Rescinds TI-809-04
- Directs IBC 2003 for Seismic
- Directs UFC 3-310-01 for site data and bldg category
- Directs Seismic design per IBC Chapter 16 as modified by UFC 3-310-04.



IBC 2003, Chap. 16

- Section 1621 "A/M/E Component Seismic Design Requirements"
- Directs to use ASCE 7-02, Section 9.6, "A/M/E Components and Systems"
  - Based on NEHRP 2000 (FEMA 368)



UFC 3-310-01

- "Structural Load Data"
- 25 May 2005
- Ss, S1 values for CONUS/OCONUS installations
- New SUG IV and Occupancy Category V

UFC 3-310-04

- "Seismic Design for Buildings"
- 24 June 2005 *(draft)*
- Modifications to IBC 2003, Chap 16
- In general, Supplemental Info and Optional Designs
- Provides criteria for new SUG IV "Strategic Assets"

UFC 3-310-04

- App B: Modifications to IBC Chap 16.
- App C: Alternate, Simple Systems
- App D: Alternate, for SUG III
- App E: Design for SUG IV
- App F: Guidance for A/M/E Components

UFC 3-310-04, App B

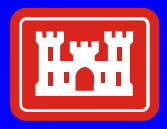
- Modifications to IBC Chap 16.
- A/M/E Comp: Additions to ASCE 7, Section 9.
- Generally, adds wording for SUG IV requirements
- "All provisions for components having an Ip=1.5 shall also apply to SUG IV components.

UFC 3-310-04, App C

- "Simplified Alternative Structural Design Criteria for Simple Bearing Wall or Building Frame Systems"
- Simplifies Lateral Force Analysis Procedure
- No change for A/M/E components, same as conventional analysis

UFC 3-310-04, App D

- Alternate Design Procedure for SUG III
- Optional non-linear analysis
- May provide more economical designs
- Apply only with approval of authorizing design agency
- Modifies ASCE 7, Sec 9.6 equations considering MCE and SE, using NSP and NDP.



UFC 3-310-04, App E

- Design for SUG IV
- i.e. Key defense assets & NBC facilities
- Components remain elastic, operational, for MCE
- ASCE 4-98, “Seismic Analysis of Safety-Related Nuclear Structures”.
- A/M/E components based on in-structure response spectra, developed from models of primary structures and MCE.

UFC 3-310-04, App E

- Classify all components as MC1, MC2, or NMC
- MC1: Mission Critical, operable immediantly. Certified.
- MC2: Mission Critical, minor damage (repair in 3 days).
- NMC: Non-mission critical, will not have falling hazards or impede egress.

UFC 3-310-04, App F

- Guidance for A/M/E Components
- The “Commentary to ASCE 7-02, Section 9.6”
- Details for veneer, floor mounts, suspended systems, and pipe supports
- Walk-down inspections and equipment qualifications (III, IV)

UFC vs. ASCE

- **ASCE**: A/M/E Comp. design based on SDC and Ip.
- **UFC**: A/M/E Comp. design based on SUG

- **SUG**: I, II, III, IV (Bldg importance)
- **SDC**: A, B, C…SDC is a function of SUG, Site Class (A, B…), and Ground Motion (Ss, S1)
- **Ip**: Component Importance Factor (1.0, 1.5)

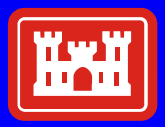
UFC vs. ASCE

- **ASCE**: Ip of the component determines if design is necessary
- **UFC**: Implies that SUG III, IV of the bldg applies to the components as well.

Example: Fire station, Camp Dodge, IA

SUG=III, Ss=0.07, S1=0.04, Site Class=D

>>>SDC=A<<<



UFC vs. ASCE

SUG	III	III	III	III
SDC	C	C	A	A
Ip	1.0	1.5	1.0	1.5
ASCE	Exempt	Design	Exempt	Exempt
UFC	Design	Design	Design	Design

Design Considerations

- In-house, Government designer
- A/E designed
- Contractor designed

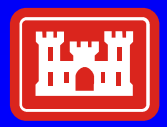
Design Considerations

In-house, A/E Design

- Based on assumed equipment and layout
- Objective/defined
- One detail for all cases
- Consider for small/simple projects

Contractor (A/E hired)

- Based on as-built condition
- Subjective/debatable
- Can choose best for job
- Burden/cost for small companies



Project Documents

- Coordinate with specs
- Coordinate with other disciplines
- What is intent of showing details?
- Fully designed, or suggested details?
- Add notes to cover contingencies
- Quality Assurance (see next track)
  - ASCE 7-02, Table 9.6.1.7
  - Walk down inspections
  - Component certification
  - Roles of inspectors/EOR/owner

Specifications

- Currently reference TI-809-04, FEMA 302
- SUG, but not SDC
- Ip needs to be defined
- 01492: Special Inspection for Seismic-Resisting Systems
- 13080: Seismic Protection for Misc. Equip.
  - Used as baseline for 15070 and 16070.
  - Misc. Equipment or Architectural?
  - Items not covered: partitions, veneer, ceilings
- 15070: Seismic Protection for Mech. Equip.
- 16070: Seismic Protection for Elec. Equip.

Future Directions

- Review draft UFC (3-310-04).
  - Clarify SUG vs. SDC, Ip.
  - Tools, checklists, flowcharts (App G)
- Update Specs (13080, 15070, 16070).
  - Incorporate IBC & UFC
  - Establish multi-discipline proponents
  - Master Spec
- Communities of practice (CoP).
  - Arch, Mech, Elec, and Struct.

Questions?

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