PROPOSAL 2-8 (2009)

SCOPE: Sec. 16.1.3.2 of 2009 *Provisions*

PROPOSAL FOR CHANGE:

Introduce new material to Part 1 to replace 16.1.3.2 of ASCE-7 as indicated below:

16.1.3.2 Three-Dimensional Analysis. Where ~~3-D~~ three-dimensional ~~analysis is~~ analyses are performed, ground motions shall consist of pairs of appropriate horizontal ground motion acceleration components that shall be selected and scaled from individual recorded events. Appropriate ground motions shall be selected from events having magnitudes, fault distances, and source mechanisms that are consistent with those that control the maximum considered earthquake. Where the required number of recorded ground motion pairs ~~are~~is not available, appropriate simulated ground motion pairs ~~shall~~ are permitted to be used to make up the total number required. For each pair of horizontal ground motion components, a square root of the sum of squares (SRSS) spectrum shall be constructed by taking the SRSS of the 5-percent-damped response spectra for the scaled components (where an identical scale factor is applied to both components of a pair). Each pair of motions shall be scaled such that for each period between 0.2*T* and 1.5*T*, the ratio of the average of the SRSS spectra from all horizontal component pairs ~~does not fall below1.3 times~~ and the corresponding ordinate of the target design response spectrum, determined in accordance with Section 11.4.5 or ~~21.2~~11.4.7, is not less than 1.0 and averages not less than 1.1.~~, by more than 10 percent.~~

REASON FOR PROPOSAL:

Introduction. A proposal from Project '07's Seismic Design Procedure Reassessment Group (SDPRG-2) proposed that MCE ground motions required for design should represent the strongest direction of shaking. For consistency, revisions were proposed to both probabilistic and deterministic MCE criteria to reflect required use of maximum direction ground motions.

Seismic Design Values Maps. A related proposal (SDPRG-5) addressed use of the maximum direction of response for design values maps. If adopted, the USGS would prepare seismic design values maps that represent spectral response in the maximum direction of horizontal response. The USGS is currently updating seismic hazard and design values maps using the new NGA relations (for WUS sites). The new NGA relations are based on the GMRotI50 direction of response which has a complex definition, but is similar to the geomean of the two horizontal components of ground motions (i.e., geomean is calculated as the square root of the product of the two horizontal response spectral accelerations at each period of interest).

A recent study, "NGA relationships, USGS seismic hazard maps, near-fault ground motions and site effects" (Huang, Whittaker and Luco, 2007) found ground motion spectral response accelerations of the new NGA relations are somewhat less than those in the maximum direction of response. Probabilistic MCE ground motions in the maximum direction of response are about 110 percent of 5 percent damped, short-period spectral response acceleration, and about 130 percent of 5 percent damped, 1-second spectral response acceleration of PSHA results using the new NGA relations (GMRotI50 direction). These factors also apply to deterministic MCE ground motions based on the new NGA relations.

This proposal. This proposal specifically changes the requirements in Chapter 16 (Seismic Response History Procedures) to account for ground motions based on the maximum direction of response for analysis using two components of horizontal ground motions (e.g., for explicit three-dimensional analysis). Studies of ground motions indicate that the maximum direction of ground motion is slightly less that the SRSS of the two components by a factor of approximately 1.1. This proposal makes minor grammatical improvements, closes an existing loophole in the scaling procedure by requiring the average scaled SRSS spectra to be not less than 1.1 times the target design spectrum, and simplifies phrasing of existing language by replacing 10% less than 1.1 times the target design spectrum with 1.0 times the target design spectrum (similar to the improvements originally developed in proposal 2-7). The 1.0 comes from $(0.9)(1.1) = 0.99 \approx 1.0$.

TS 2 VOTE:

YES =7 *Yes with Reservations = 1* *No = 0* *Not Voting = 1*

Constantineau: Yes with Reservations

The reservation being that the language needs improvement to clearly communicate the intent. An option is to clearly explain this using a graph describing the ratio and the "average" relative to the target design spectrum in the Commentary