

Simulated Ground Motions for Building Code Response History Analysis?

SCEC Ground Motion Simulation Validation (GMSV) Technical Activity Group Coordination Workshop

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USGS

2010 ASCE 7 Standard (“ASCE 7-10”)

Chapter 16

SEISMIC RESPONSE HISTORY PROCEDURES

16.1 LINEAR RESPONSE HISTORY PROCEDURE

Where linear response history procedure is performed the requirements of this chapter shall be satisfied.

16.1.1 Analysis Requirements

A linear response history analysis shall consist of an analysis of a linear mathematical model of the structure to determine its response, through methods of numerical integration, to suites of ground motion acceleration histories compatible with the design response spectrum for the site. The analysis shall be performed in accordance with the requirements of this section.

16.1.2 Modeling

Mathematical models shall conform to the requirements of Section 12.7.

16.1.3 Ground Motion

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 distance, and source mechanisms that are consistent with those that control the maximum considered earthquake. Where the required number of recorded ground motion pairs is not available, appropriate simulated ground motion pairs 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 the 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 in the period range from $0.2T$ to $1.5T$, the average of the SRSS spectra from all horizontal component pairs does not fall below the corresponding ordinate of the response spectrum used in the design, determined in accordance with Section

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Chapter 21

SITE-SPECIFIC GROUND MOTION PROCEDURES FOR SEISMIC DESIGN

21.1 SITE RESPONSE ANALYSIS

The requirements of Section 21.1 shall be satisfied where site response analysis is performed or required by Section 11.4.7. The analysis shall be documented in a report.

21.1.1 Base Ground Motions

A MCE_R response spectrum shall be developed for bedrock, using the procedure of Sections 11.4.6 or 21.2. Unless a site-specific ground motion hazard analysis described in Section 21.2 is carried out, the MCE_R rock response spectrum shall be developed using the procedure of Section 11.4.6 assuming Site Class B. If bedrock consists of Site Class A, the spectrum shall be adjusted using the site coefficients in Section 11.4.3 unless other site coefficients can be justified. **At least five recorded or simulated horizontal ground motion acceleration time histories shall be selected** from events having magnitudes and fault

site coefficients in Section 11.4.3 consistent with the classification of the soils at the profile base.

21.1.3 Site Response Analysis and Computed Results

Base ground motion time histories shall be input to the soil profile as outcropping motions. Using appropriate computational techniques that treat nonlinear soil properties in a nonlinear or equivalent-linear manner, the response of the soil profile shall be determined and surface ground motion time histories shall be calculated. Ratios of 5 percent damped response spectra of surface ground motions to input base ground motions shall be calculated. The recommended surface MCE_R ground motion response spectrum shall not be lower than the MCE_R response spectrum of the base motion multiplied by the average surface-to-base response spectral ratios (calculated period by period) obtained from the site response analyses. The recommended surface ground motions

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site coefficients in Section 11.4.3 consistent with the classification of the soils at the profile base.

21.1.3 Site Response Analysis and Computed Results

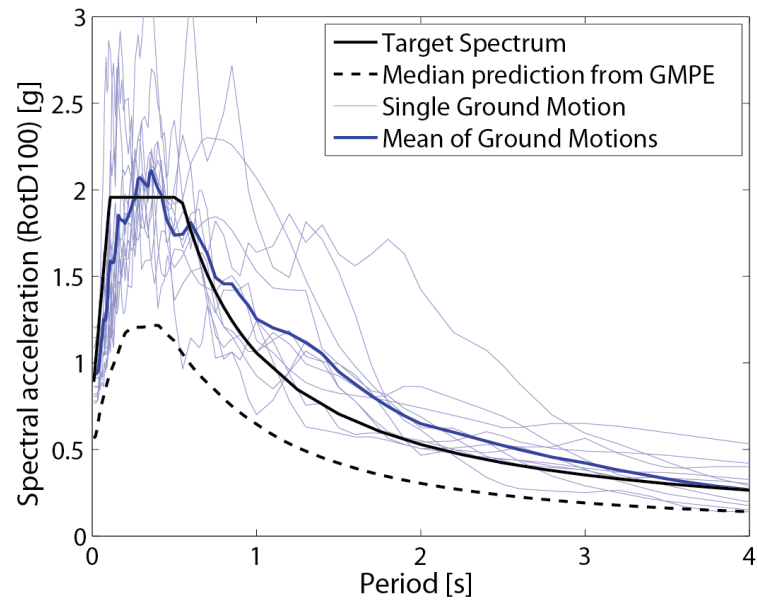
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21.2 RISK-TARGETED MAXIMUM CONSIDERED EARTHQUAKE (MCE_R)

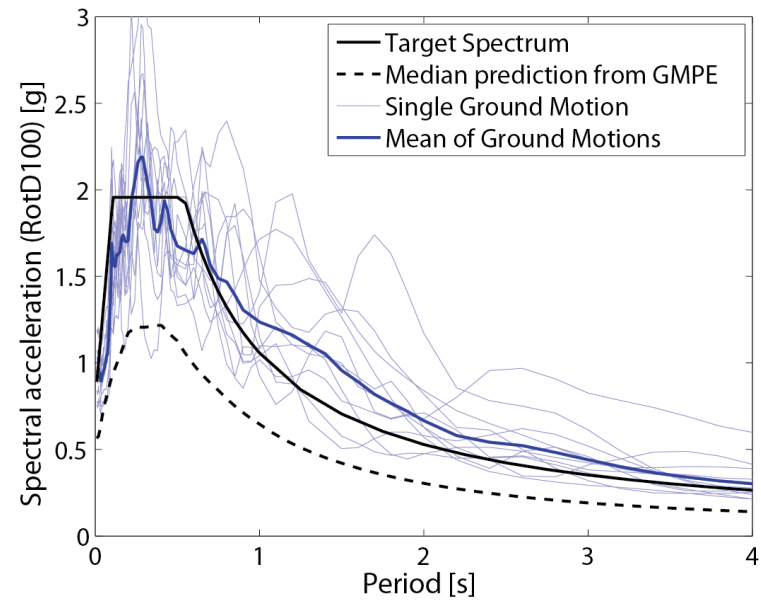
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Selected simulations and recordings

Recordings

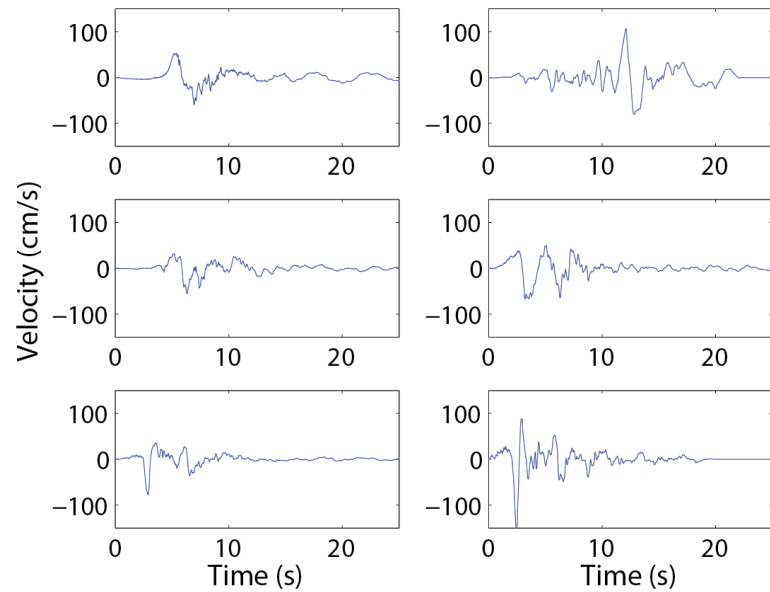


Simulations

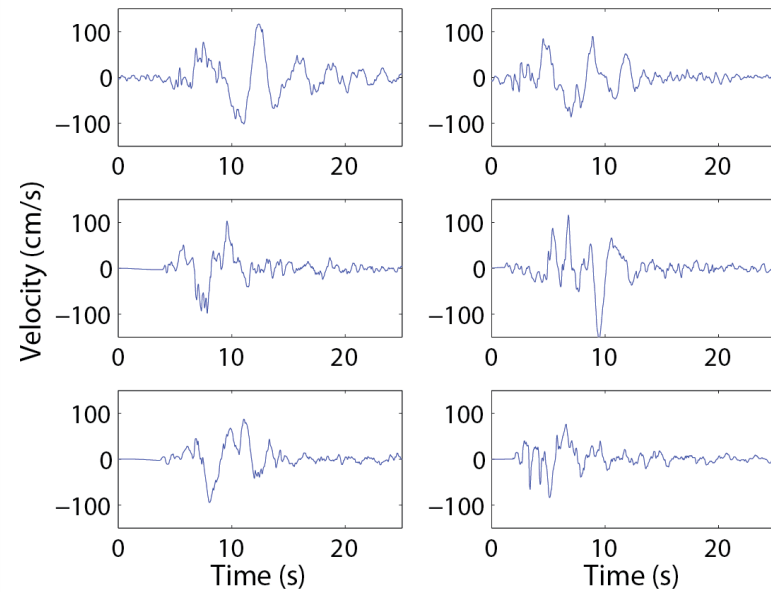


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Simulations



Future GMSV TAG Effort?

- Report on use of simulated ground motions from SCEC for building code “response history” and/or site response analysis
- Comparison of building and/or site response to selected and scaled simulated vs. recorded ground motions
- Should/could include how to access simulated ground motions