Bridging the Gap Between Input Motion Selection Protocols and Geotechnical Engineering Analyses

CABAS, ASHLY, North Carolina State University,
Raleigh, North Carolina, amcabasm@ncsu.edu

CHOWDHURY, ISHIKA, North Carolina State University,
Raleigh, North Carolina, ichowdh@ncsu.edu

KAKLAMANOS, JAMES, Merrimack College,
North Andover, Massachusetts, kaklamanosj@merrimack.edu

KOTTKE, ALBERT R., Pacific Gas and Electric Company,
San Francisco, California, arkk@pge.com

GREGOR, NICK, Consultant, Oakland, California, nick@ngregor.com

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ABSTRACT:

The importance of properly characterizing ground motion intensity measures for seismic hazard assessment is unequivocally large. Multiple protocols populate the literature concerning ground motion selection for building seismic design and performing response-history analysis; however, none of these guidelines has a particular focus on ground motions required for geotechnical engineering analyses. The overall goal of this study is to investigate the impact of input motion selection protocols on ground motion intensity measures that are most significant for geotechnical analyses, including site response, liquefaction, and seismic slope stability analyses. This study compares current practices for input motion selection, and investigates their impact on the uncertainty in critical ground motion intensity measures. Comprehensive ground response analyses are performed at two study sites, one in Seattle, WA, and the other in Boston, MA. These sites not only represent different geological and geotechnical conditions, but also different tectonic environments. Multiple sets of input motions are obtained from different definitions of the target spectrum (e.g., uniform hazard and conditional mean spectra). In addition, the effects of scaling and spectral matching techniques are explored, and insights are provided on the ground motion intensity measures most sensitive to the selection of the input motion. Finally, recommendations are provided for ground motion selection for geotechnical engineering applications, and suggestions for future research in this area are proposed.