GEO-INSTITUTE 7th ANNUAL LIVE STREAMING WEB CONFERENCE

The Geo-Institute Earthquake Engineering and Soil Dynamics Technical Committee will live-stream the session "Seismic Hazard Evaluation for the Western, Central, and Eastern US" on Monday, December 5 at 11 AM EST. The topics include:

"Developments and Challenges for Seismic Hazard Assessment in the Central and Eastern United States,"

***Glenn J. Rix**, Ph.D., P.E., M. ASCE, and **Christie Hale**, Ph.D., M. ASCE*

Over the past decade, there have been significant advancements in the understanding of seismic hazard in the Central and Eastern United States (CEUS), where our brief seismic record is a poor guide to quantifying the potential for strong ground shaking. Landmark studies in seismic source characterization and ground motion characterization have produced regional models that greatly improve our ability to quantify the mean seismic hazard and its associated uncertainty in the region, while advancements in site response analysis allow better characterization of local site effects. Despite these advancements, significant challenges remain, including the lack of regional shear wave velocity characterization and the development of ground-motion time histories from a dataset with poor magnitude and distance coverage. This presentation will provide an overview of developments in seismic hazard assessment in the CEUS, including available approaches, seismic source models, and ground motion models used to evaluate seismic hazard, and how these approaches, models, and the resulting ground motions differ from those in the Western United States (WUS). Available methods for accounting for local site effects will be discussed, including developments in simplified site adjustment models and site-specific site response analysis.

"Regional ergodic site amplification models for the U.S.," ***Jonathan P. Stewart**, Ph.D., P.E., M.ASCE*

Essentially, this would cover the main attributes of VS30-scaling and nonlinearity for site amp models being used in the USGS National Seismic Hazard Model. The models used for active regions (like CA) and for stable continental regions (east of Colorado) are based on work we have done, and similar models for Cascadia will likely be implemented in the next NSHM. The talk would discuss how these models were developed, how they are different, and why they are different.

"Characterization of Epistemic Uncertainty in Site Response," ***Adrian Rodriguez-Marek**, Ph.D., M.ASCE*

Site-specific probabilistic seismic hazard analysis (PSHA) generally requires the conduct of site response analyses to quantify the site amplification at a site. Consistent with the conduct of modern PSHA, the site response analyses must incorporate all sources of epistemic uncertainty. For site response, this has traditionally been achieved by creating a logic tree with branches for alternative shear-wave velocity (V_S) profiles. However, the distribution of amplification factors obtained from a small number of weighted V_S profiles will often be quite narrow at some oscillator frequencies. We propose an alternative approach to capturing epistemic uncertainty in site response in order to avoid such unintentionally constricted distributions of amplification factors using more complete logic-trees for site response analyses. Nodes are included for all the factors that influence the calculated amplification factors, which may include shallow V_S profiles, deeper V_S profiles, depth of impedance contrasts, low-strain soil damping, and choice of modulus reduction and damping curves. Site response analyses are then executed for all branch combinations to generate a large number of frequency-dependent amplification factors. Finally, these are re-sampled as a discrete distribution with enough branches to capture the underlying distribution of amplification factors (AFs). While this approach improves the representation of epistemic uncertainty in the dynamic site response characteristics, modeling uncertainty in the AFs is not automatically captured in this way, for which reason it is also proposed that a minimum level of epistemic uncertainty should be imposed on the final distribution.

"Performance-Based Assessment of Structures on Liquefiable Soils: from Triggering to Mitigation,"

Shideh Dashti, Ph.D., M.ASCE

Effective liquefaction mitigation requires an improved fundamental understanding of triggering in terms of excess pore pressures and shear strains in realistically stratified deposits that experience cross-layer interactions as well as performance-based consequence procedures that account for 3D soil-structure interaction (SSI), all mechanisms of deformation, total uncertainty, and the impact of mitigation. In this presentation, I first describe a series of centrifuge experiments to evaluate site response in layered liquefiable deposits, SSI, and the impact of ground densification as mitigation on SSI and performance. Second, experimental results are used to validate 1D and 3D, fully-coupled, nonlinear, dynamic finite element analyses of layered sites and soil-structure systems with and without mitigation. Third, numerical parametric studies (exceeding 167,000 1D and 63,000 3D simulations) help identify the functional forms for predicting liquefaction triggering in the free-field based on a newly proposed factor, the capacity cumulative absolute velocity (CAV_c) required to achieve a threshold excess pore pressure ratio (r_u), settlement of unmitigated structures on mat foundations, and the relative impact of ground densification on foundation's permanent settlement. And finally, a limited case history database is used to validate the models, accounting for field complexities not captured numerically or experimentally. This integrative approach yields a set of procedures that are the first to consider variations in soil layering and geometry, layer-to-layer cross interactions, foundation and structure properties (in 3D), contribution of all mechanisms of deformation below unmitigated structures, geometry and properties of densification, ground motion's cumulative characteristics, total inherent model uncertainties, and the explicit conditionality of structural settlement on free-field triggering—which are necessary to realize the benefits of performance-based engineering in liquefaction assessment.