

## PEER “Research Nuggets”

**Title:** PEER Workshop on Liquefaction Susceptibility

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**Motivation:** The typical progression of engineering analysis of soil liquefaction involves three steps: determination of liquefaction susceptibility, evaluation of liquefaction triggering for one or more earthquake scenarios, and assessment of the consequences of liquefaction triggering. Although each of these steps is associated with considerable epistemic uncertainties, the basic framework for engineering analyses of liquefaction triggering and the consequent deformations or instability has been established. However, these analyses hinge upon whether a particular stratum is deemed susceptible to liquefaction, with considerable risk or cost associated with incorrectly assessing susceptibility.

**Objectives:** The goals of the PEER Workshop on Liquefaction Susceptibility were to: (1) organize and conduct a one-and-a-half day long workshop fully-aligned with the ongoing efforts of the Next Generation Liquefaction (NGL) team that is focused on developing improved data resources and models related to liquefaction susceptibility and triggering; and (2) prepare a summary report describing the outcomes of the workshop and the specific consensus-based recommendations on the needed elements of the next-generation liquefaction models and the steps required to produce such models.

**Methodology:** The Workshop sought to identify challenges and research opportunities for improved assessments of liquefaction susceptibility, centered on three broad themes: (1) the current state-of-the practice and its limitations; (2) the linkage between laboratory observations, and field characterization and response; and (3) options for future susceptibility models that could be used, for example, in conjunction with liquefaction triggering models or hazard mapping. The approach for exploring these three themes included the solicitation of extended abstracts on the topic of liquefaction susceptibility in response to several prompts, a pre-Workshop poll of participants, and the Workshop itself, which included a mix of brief presentations, break-out sessions, and moderated discussion sessions. Participants included expert practitioners, governmental agency representatives, and academicians.

**Results:** The pre-Workshop poll served to help refine the Workshop Agenda. The Workshop discussions clearly identified that the term “susceptibility” could mean a variety of different things to different participants. Whereas most participants considered susceptibility to be a function of material characteristics alone, many linked the term and act of assessing susceptibility to triggering evaluations. The participants overwhelmingly concurred on the need to have a clear and unambiguous definition of liquefaction susceptibility. Several groups of participants identified preliminary forms of such a definition, however, the Workshop participants were unable to converge on a shared definition in the time available.

Participants clearly indicated a powerful belief that susceptibility assessment is fraught with uncertainty and there is a clear desire to see it characterized in a probabilistic manner.

Information derived from geologic investigations and cyclic laboratory tests were also viewed as having significant potential benefit in the assessment of liquefaction susceptibility. Strong support was also expressed for the establishment of a susceptibility database that could be used to develop improved susceptibility models.

The Workshop Organizing Committee synthesized three key issues identified over the course of the discussions and provided their interpretations on the: (1) need for a definition of liquefaction susceptibility, (2) means by which such a definition should be developed, and (3) the differences between current susceptibility models. A meaningful outcome of the Workshop is that a large amount of data that could populate a susceptibility database is available from both researchers and practitioners.

**Conclusions:** The Workshop report should serve as a valuable reference for professionals tasked with making liquefaction susceptibility assessments and guiding future research on liquefaction susceptibility in support of performance-based earthquake engineering.

**Keywords:** liquefaction, susceptibility, ground failure, testing, NGL