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Research Project Highlight

NGL: Next Generation Liquefaction Database Development and Implications for Engineering Models

Project: Lifelines Task 1

Principal Investigators

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Research Team

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Start-End Dates:

06/01/16 - 08/31/18

Abstract

Procedures for engineering assessment of liquefaction hazards are typically empirical or semi-empirical because they are based on the interpretation of field performance information from sites that have or have not experienced ground failure attributable to liquefaction. However, the number of case histories supporting liquefaction procedures is remarkably small. As a result, existing databases are incomplete, meaning they cannot constrain important components of engineering predictive models. In this project, this situation is being addressed with substantial increase in the size and quality of field performance data sets available for model development.

The Next-Generation Liquefaction (NGL) project is developing a transparent, open-source, community database of liquefaction case histories. The NGL case history database is accessible via a web interface where registered users can upload, view, and download data. The database was developed using the My Structured Query Language relational database management system. The NGL database contains data from recent earthquakes (last 20 years) in California, Chile, Italy, Japan, New Zealand, Taiwan, and Turkey, which caused a great deal of damage attributable to liquefaction and its effects, but which is not

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considered in most of the currently used models. Also included in the database are legacy case-histories that were used in the development of existing semi-empirical models.

Deliverables

Journal and conference papers describing the NGL database structure and presenting relevant liquefaction case-histories.

Database and web portal for uploading, visualizing, and analyzing data. Hosted at UCLA and mirrored at DesignSafe.

Research Impact

The Next-Generation Liquefaction project has three broad objectives: (1) substantially improve the quality, transparency, and accessibility of case history data related to ground failure; (2) provide a coordinated framework for supporting studies to augment case history data for conditions important for applications but poorly represented in empirical databases; and (3) provide an open, collaborative process for model development in which developer teams have access to common resources and share ideas and results during model development, so as to reduce the potential for mistakes and to mutually benefit from best practices. This approach is motivated in part by the success of the Next-Generation of Attenuation (NGA) models for ground motion prediction, which has followed this approach and has had substantial global buy-in and broad application.

This project is contributing towards the database element of NGL. The project as a whole is anticipated to have substantial impact on the profession, dramatically improving the quality and consistency of models that are available to assess liquefaction susceptibility, triggering, and effects.

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Project Images



(a) Screenshot of the NGL website homepage.



(b) Example of high-quality post-earthquake liquefaction data from a site in Japan following the 2011 Tohoku earthquake (from Stewart et al., 2016).