

SOIL LIQUEFACTION: To Drain or Not to Drain?

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ABSTRACT

Recent earthquakes in Tohoku, Japan, Christchurch, New Zealand and Muisine, Ecuador once again demonstrated the damaging effects of soil liquefaction. While much effort is focused on identifying the vulnerability of specific sites to liquefaction when subjected to earthquakes of a given magnitude, the actual consequences of soil liquefaction are still under-researched. For much of the previous half century, liquefaction was considered to be a largely undrained event, while recent research has clearly demonstrated that liquefaction is, in fact, a partially drained event and the consequences of partial drainage can be important in determining the performance of structures founded on liquefiable soils. Further many of the theoretical frame works and practical site specific assessments are based on experiences from undrained cyclic triaxial testing.

In this paper recent research at Cambridge using dynamic centrifuge modelling will be presented that highlights the importance of drainage during soil liquefaction events. It will be shown based on experimental data that the pore water drainage does occur both during the co-seismic period as well as in the post-seismic period. The short comings of the undrained assumptions will be brought to the fore. Results from novel centrifuge testing in which 'triaxial cells' were created within centrifuge models will be presented. In addition the role of introducing air into saturated sand beds and creating partial saturation as a liquefaction mitigation measure will be discussed.