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Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "Effects of relative density and accumulated shear strain on post-liquefaction residual deformation" *by* J. Kim et al.

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This study presents an excellent set of tests results that evaluate post-liquefaction residual deformations. The testing program was very detailed and required a high level of proficiency to accomplish, the authors should be commended for their lab work. In particular the testing flow path of consolidation, cyclic loading, monotonic loading, and drainage with careful measurements of volumetric and shear strains can be very difficult to perform accurately, but the authors have accomplished this. The test results are sound and and are useful to the field of liquefaction engineering. The context that these test results were presented in, however, is missing a key reference from a previous study, and therefore the manuscript should be revised.

Major Comment:

On page 1582, starting on lines 21, the authors state "In previous experimental approaches, most liquefaction tests have considered the characteristics of either residual volumetric strain or residual shear strain. However, few studies have simultaneously evaluated the two variables in a single test to determine a correlation between the two types of deformations. Furthermore, no experimental cases using this approach have provided results regarding evaluation methods."

Although the authors cited two studies by Shamoto, they failed to cite or review the paper Shamoto, Zhang, & Tokimatsu (1998) "New charts for predicting large residual post-liquefaction ground deformations." SDEE, 17, 427-438. In that paper Shamoto et al., (1998) develop a constitutive model relating post-liquefaction residual shear strains and volumetric strains from cyclic torsion liquefaction tests, provide design charts for these two correlated deformation variables, and validate the method using deformation case histories from previous earthquakes.

The data from the current study (Fig 16) provides additional confirmation of the Shamoto et al., (1998) constitutive model and the inverse relationship that exists between residual shear strains and volumetric strains. Given that Shamoto et al., (1998) previously explored this material in detail, it is recommended that the authors should rewrite the manuscript giving that study due consideration.

Minor Comment:

On Page 1581, Line 25, the authors cite Stewart et al., (2001, 2004) as justifying their liquefaction study. However, Stewart et al., evaluated the seismic compression of man-made fill, which is unsaturated and undergoes drained deformations, not liquefaction. Also the authors cite Wartman et al, 2003, for further justification which was a study on a particular earthquake that did have liquefaction, but presented other ground deformations such as seismic slope instability, seismic compression, etc. These references were curious and the authors are encouraged to present a stronger justification based

on better related references of liquefaction damage from earthquakes.

Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., 1, 1579, 2013.