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Measurement of Liquefcation Resitance of Test Sands

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ABSTRACT

We present the liquefaction resistance curves for clean two test sands, which are Ottawa and Jumunjin Sand for different relative densities measured from a set of undrained cyclic simple shear tests. The data are fitted with two empirical models to develop representative liquefaction resistance curves. Comparisons illustrate that the slope of the widely used power law is highly dependent on the range of data it is fitted to and that the power law underestimates the resistance at high number of cycles (N). The alternative empirical model is demonstrated to provide favorable fit with the measurement over a wide range of data. We further evaluate the effect of silt content on liquefaction resistance curve for loose Ottawa sand and different percent of fines.

1. INTRODUCTION

Stress-controlled cyclic tests are routinely performed to produce an empirical relationship between applied uniform cyclic stress and number of cycles required to trigger liquefaction (N). The amplitude of the cyclic stress is typically normalized by the effective overburden stress (effective vertical stress for a simple shear test and effective mean stress for a triaxial test) to produce a cyclic stress ratio (CSR). CSR that triggers liquefaction in a specified number of cycles is termed the cyclic strength or the cyclic resistance ratio (CRR). The relationship between CRR and N is termed the cyclic strength curve ((Ishihara 1996); Kramer (1996)) or the liquefaction resistance curve (Towhata (2008)).

The liquefaction resistance curve is used as the weighting factor curve to calculate the equivalent number of uniform cycles (N_{eq}) from an irregular time series, as proposed by Seed et al. (1975). N_{eq} is also the underlying basis of the magnitude scaling factor and used with liquefaction triggering correlations that relate in-situ soil parameter with CRR to assess the liquefaction potential (e.g.(Boulanger and Idriss 2004), (2012); Idriss and Boulanger (2008), (2010); Seed et al. (1984), (1985)). (Seed et al. 1975) used the CRR versus N data of De Alba et al. (1976) as the weighting factor curve. Liu et al. (2001) used the compiled CRR versus N data measured from

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