Report Overview

Seismic compression is the accrual of volumetric strains in unsaturated soils caused by cyclic loading and has caused significant damages to buildings and other structures during earthquakes. To date, the available methods for predicting the severity of seismic compression have mainly been "simplified" procedures, in which a number of equivalent cycles is used to represent the duration of earthquake loading. Often, however, the number of equivalent cycles is computed inconsistently with the underlying mechanics of seismic compression. Proposed herein is a "non-simplified" procedure for predicting the severity of seismic compression. The procedure is based on a modified version of the Richart-Newmark cumulative damage hypothesis, wherein volumetric strain is used as the damage metric. The proposed model was calibrated using data from 460 constant amplitude sinusoidal strain-controlled cyclic simple shear tests performed on clean sand and validated using test data from samples subjected to variable amplitude sinusoidal and earthquake loadings. In addition to predicting the severity of seismic compression, the proposed model can be used to compute number of equivalent shear strain cycles for use in simplified models, consistent with the seismic compression phenomenon. In comparison with other proposed “non-simplified” models for computing seismic compression, the proposed model gives good agreement with the measured seismic compression.