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EFFECTS OF SMALL STRAIN STIFFNESS AND DAMPING ON CONSEQUENCES OF SOIL LIQUEFACTION

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Realistic analysis of permanent deformations in liquefiable saturated granular soils subjected to strong ground motions requires nonlinear constitutive models that are capable of representing the stress-strain response of soil skeleton under cyclic loading conditions. Unlike the traditional site response analyses where small strain stiffness and damping of the soil play very important roles, the focus of most liquefaction analyses is on the ability of the constitutive model to represent the shear-induced volume change of the soil at strain levels that are no longer small. Hence many existing constitutive models designed for liquefaction analysis ignore the small strain response of the soil and the analysts usually calibrate the model for cyclic loading regimes that cause medium level strains. The objective of this paper is to demonstrate the role of small strain stiffness and damping of sandy soils in liquefaction problems. To this end, a well-established elastoplastic constitutive model for sand is modified to incorporate the small strain dynamic characteristics of sands. The model is then used in the analysis of two practical geotechnical engineering problems involving soil liquefaction. The critical roles of the small strain stiffness and damping on the computed permanent displacements, accelerations, and excess pore pressure time histories are presented and discussed.