Finite Element Modelling of GRS Bridge Abutment with Hypoplasticsoil Model

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ABSTRACT

Materials exhibit elastic behaviour during initial stages of deformation. With larger deformations, granular soils and soft soils exhibit irreversible displacements. The dense sands exhibit initially contraction and thereafter dilation during loading. The change of volume for increasing hydrostatic pressures can be specified in the plasticity models available in the commercial software available. However, the volume change should either be in the ascending or descending order. The reversing volume change characteristics of the sand are unable to be modelled using the in-built constitutive models. In order to model the contraction and dilation behaviour of sands appropriately, an user defined material model is used in the present study. New material models are formulated to represent the complex behaviour of granular soils. Hypoplastic model with intergranular strain concept is one such constitutive model which is exclusively used to represent the characteristics of sandy soils. This constitutive model has been used as VUMAT in the present study to analyse the stresses and strains in the GRS bridge abutments using finite element analyses. In order to assess the performance of the subroutine, the Founders Meadows GRS bridge abutment is modelled in FE and analysed under static loading conditions. The FE model and the VUMAT are observed to represent the behaviour of the prototype reasonably well. The FE model is also analysed under earthquake motion to study its response under seismic shaking.

Keywords: *Hypoplastic soil model; VUMAT; User material; GRS bridge abutment; static loads; seismic behaviour.*