

Constitutive Model for Analysis of Long-Term Municipal Solid Waste Landfill Settlement

Authors : Irena Basaric Ikodinovic, Dragoslav Rakic, Mirjana Vukicevic, Sanja Jockovic, Jovana Jankovic Pantic

Abstract : Large long-term settlement occurs at the municipal solid waste landfills over an extended period of time which may lead to breakage of the geomembrane, damage of the cover systems, other protective systems or facilities constructed on top of a landfill. Also, municipal solid waste is an extremely heterogeneous material and its properties vary over location and time within a landfill. These material characteristics require the formulation of a new constitutive model to predict the long-term settlement of municipal solid waste. The paper presents a new constitutive model which is formulated to describe the mechanical behavior of municipal solid waste. Model is based on Modified Cam Clay model and the critical state soil mechanics framework incorporating time-dependent components: mechanical creep and biodegradation of municipal solid waste. The formulated constitutive model is optimized and defined with eight input parameters: five Modified Cam Clay parameters, one parameter for mechanical creep and two parameters for biodegradation of municipal solid waste. Thereafter, the constitutive model is implemented in the software suite for finite element analysis (ABAQUS) and numerical analysis of the experimental landfill settlement is performed. The proposed model predicts the total settlement which is in good agreement with field measured settlement at the experimental landfill.

Keywords : constitutive model, finite element analysis, municipal solid waste, settlement

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