Abstract

Highway pavements consist of multiple layers such as subgrade, sub-base, base course etc., made up of different types of materials having varying shapes and sizes of granular materials. So, voids of different shapes, sizes and orientations are generated inside these layers. Therefore for analysis purposes, pavement layers can be assumed as porous media. In the present work, a numerical study is conducted to predict the equivalent elastic stiffness of porous media as a function of voids with different shapes, sizes, and orientations. In this study, the models of fractured rock have been adopted with possible modification. Finally, the results obtain by the developed expressions are verified by the finite element method (FEM) simulation results. Though the analysis is carried out for granular material layer considering as porous media, these results are also applicable to other layers as they are also considered porous media. A multiplication factor is proposed to replace linear fracture with elliptical voids so that a non-persistent fractured rock mass layer can be idealized as porous pavement layer. In the final leg of the study we randomly vary the pore sizes to determine a generalized expression of equivalent elastic stiffness.

Aim of the present study Firstly, is to analyse the elastic response of granular material using FEM modelling and to determine its dependency on the various voids parameters (such as shape, size, orientation etc.) of voids present in it. And Secondly, to derive an expression for effective modulus of elasticity of granular material containing elliptical shape voids of variable orientations and sizes and its verification by FEM modelling.

For this. Firstly, Detailing of the literature review of the relevant research in the area. Literature review includes discussions on various theories on elasticity of granular materials, theories used in other fields to determine effective modulus of elasticity such as homogenization theories and effective modulus of elasticity of fractured rock mass are analysed and studied. And then, the numerical modelling of granular materials and com-

parison of results obtained by analytical and numerical modelling are done for the verification of the proposed theory.