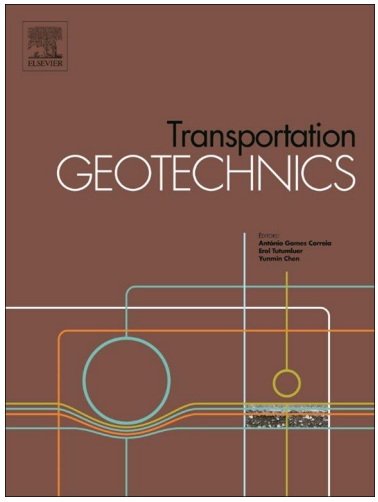

Resilient modulus of fine-grained soil and a simple testing and calculation method for determining an average resilient modulus value for pavement design

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RESILIENT MODULUS OF FINE-GRAINED SOIL AND A SIMPLE TESTING AND CALCULATION METHOD FOR DETERMINING AN AVERAGE RESILIENT MODULUS VALUE FOR PAVEMENT DESIGN

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Abstract

The resilient modulus has been recognised as an important property that governs the performance of pavement materials under the dynamic wheel loads. The resilient modulus can be obtained from a repeated load triaxial test with a series of a combination of deviator and confining stresses. It is traditionally reported as a function of the deviator and confining stresses, which can be a practical challenge in selecting the appropriate resilient modulus value for a pavement design. In this study, eight different Victorian fine-grained soils with different moisture contents were used for the determination of the resilient modulus and the evaluation of a proposed simplified method. The resilient modulus from the simplified method is reported as a single value, which is taken as the average value from the simplified testing method. It has been found that the resilient modulus obtained from the proposed simplified and the standard testing method are almost identical.

Keywords: Pavement; Resilient modulus; Fine-grained soils; Subgrade; repeated load triaxial.

1. Introduction

Generally, roadway pavements are very complex structures that can be categorised into two groups – flexible and rigid. A typical flexible pavement structure consists of the surface course and the underlying base and sub-base courses. A subgrade soil is the foundation of the pavement. For a long time, the behaviour of subgrade soils and pavement granular materials was evaluated based on a quasi-static property, such as the California Bearing Ratio (CBR). However, the CBR test is not representative of the dynamic response of the pavement structure under the actual traffic loading of moving vehicles.

With the introduction of the concept of the resilient modulus (M_r) as the material stiffness in the mid-1950s (Seed 1955), considerable attention has been devoted to evaluate the behaviour of subgrade soils as well as the base and sub-base granular materials under repeated dynamic loading. In the "AASHTO Guide for Design of Pavement Structures" (AASHTO 1993) and "AUSTROADS Pavement Design Guide" (Austroads 2012), M_r has been recognised as an important property that governs the subgrade and granular materials performance, and has been recommended for pavement design and analysis.

The resilient modulus can be obtained directly from the repeated load triaxial test in the laboratory and is defined as the ratio of the deviator stress to the recoverable elastic strain after a series of a combination of confining and deviator stresses applied to a specimen. The M_r is a function of the stresses applied. Therefore, the main parameter that can affect the value of M_r is the deviator stress and confining stress that is applied to the sample. In order to take into account the effect of these parameters, several constitutive models have been