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# Development of 3-D Finite Element Models for Geo-Jute Reinforced Flexible Pavement

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**Abstract**

In this study, three dimensional (3-D) finite element analysis are performed to evaluate the effect of geo-textile interlayer on the performance of flexible pavement. The main objective of this study is to evaluate the improvement in stress distribution of flexible pavement due to the application of geo-jute at three specific positions i.e., subgrade-base interface, base-asphalt layer interface, and within asphalt layers. Stress, strain and displacement values are investigated and compared for the application of geo-jute interlayer on various positions. Moreover, to better understand the mechanistic behavior of geo-jute on pavement subgrade, a separate 3-D finite element model is developed to simulate the California bearing ratio (CBR) test on geo-jute reinforced soil. Results showed that the inclusion of geo-jute on flexible pavement significantly improves the pavement performance by producing lower stress, strain, and displacement at top of the subgrade. Moreover, the bearing capacity of subgrade soil increased more than 20% due to the inclusion of geo-jute.

*Keywords:* Finite Element Model; Flexible Pavement; Geotextile; Stress Distribution; California Bearing Ratio.

## 1. Introduction

The flexible pavement under wheel loads is considered as a homogeneous and elastic half-space in Boussinesq's theory, which can be used to determine the stresses, strains, and deflections in the subgrade if the modulus ratio between the pavement and the subgrade is close to unity [1]. As Poisson's ratio has little influence on stresses and deflections, a half space can be assumed as incompressible with a Poisson's ratio of 0.5 [2]. However, pavements are layered systems with better materials on top, and it cannot be assumed as a homogeneous mass. To overcome this limitation, Burmister developed two- and three-layer system, where tangential and radial stresses are considered as identical on the axis of symmetry [3, 4]. The vertical stress on the top of the subgrade is a crucial factor in pavement design, which can decrease significantly with the increase in modulus ratio in layer system. As the Burmister's theory is only applicable for idealized conditions, numerical procedures are often adopted for complicated pavement systems. In 1968, Duncan et al. first introduced the finite element method for pavement analysis [5].

Both functional and structural performance are considered to design pavement sections [6, 7]. During the past three decades, the use of geosynthetics in pavement has increased dramatically to enhance the structural and functional

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