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Effect of Modulus of Bituminous Layers and Utilization of Capping Layer on Weak Pavement Subgrades

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Abstract

The majority of the world's highways consist of a flexible pavement commonly built of several layers (both asphaltic and granular) that have been laid over a pavement foundation known as the subgrade. A subgrade that is considered to be of a satisfying bearing capacity is expected to restrict not only the immediate distresses occurring during the construction phases, but also later deformations appearing during the service life of the pavement as it subjected to traffic loads. If the subgrade proves to be structurally weak, the highway's flexible pavement can be supported by adding such modifications as a capping layer, which serves to greatly reduce the stress being applied to the pavement. This study aims to further our knowledge about maximum pavement functionality by investigating those parameters considered crucial to pavement design: the correspondence of material properties, the number of layers, and the layer thickness. These parameters were analyzed to determine the best performing composition, while also considering the financial aspects of road construction. To achieve such an aim, we chose to use KENLAYER software to assist us in determining the design of a flexible pavement in line with a specific Equivalent Single Axle Load (ESAL). The KENLAYER configuration provided us with the required ESAL targets for specific design lives. We next calculated the relative costs of these targets and chose those that proved to be most cost-effective and economical. The results indicate that when considering feasible pavements to meet a design of high ESAL applications, those utilizing high modulus asphaltic materials are most suitable for subgrade CBR of at least 3%, while weaker subgrade constructions must be provided with a capping layer.

Keywords: Pavement Design; Weak Subgrade; Capping Layer.

1. Introduction

In the past, processes of unsystematic consensus led many highway associations to rely on standard charts when determining the superstructures to be utilized for most of the pavements they were constructing. This means that typical highway pavements were constructed of standardized thicknesses, despite the fact that they may have been used as layering on various subgrade types. However, the inevitable increase in axle loads that began to appear in the late 1950s soon demonstrated that all pavements, regardless of type (either flexible or rigid), derive their ultimate performances not only from the unique characteristics of the materials utilized and from the surroundings in which they were being used, but also from the loading capacity of the underlying subgrades. It became evident that the road designers had to have direct knowledge of the stiffness modulus and shear strength of that highway's subgrade if they were to correctly calculate the thickness of the pavement layers to be utilized. Of course there are several factors on

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