FLEXIBLE PAVEMENT DESIGN

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***ABSTRACT*: A highway pavement is designed to support the wheel loads imposed on it from traffic moving over it. Additional stresses are also imposed by changes in the environment. It should be strong enough to resist the stresses imposed on it and it should be thick enough to distribute the external loads on the earthen sub grade, so that the sub grade itself can safety bear it.**

***KEYWORDS*: SUB GRADE SOIL, METHODOLOGY, CBR METHOD.**

INTRODUCTION

The state of the art in flexible pavement design is manifested in mechanistic, or mechanistic- empirical (ME) based design procedures that incorporate the treatment of life-cycle costs and design reliability. State of-the-practice methods, however, rely on empirical correlations with past performance, index-value characterizations of material properties and engineering judgment for design strategy selection. In addition, these procedures have been used for traffic load levels and environments well beyond their observational base. The AASHTO Guide for Design of Pavement Structures is commonly used to design pavements with traffic loadings greater than 50 million equivalent single axle loads (ESALs), while the basic design equations were developed from traffic loadings of less\ than 2 million ESALs. Mechanistic procedures can have several important advantages.

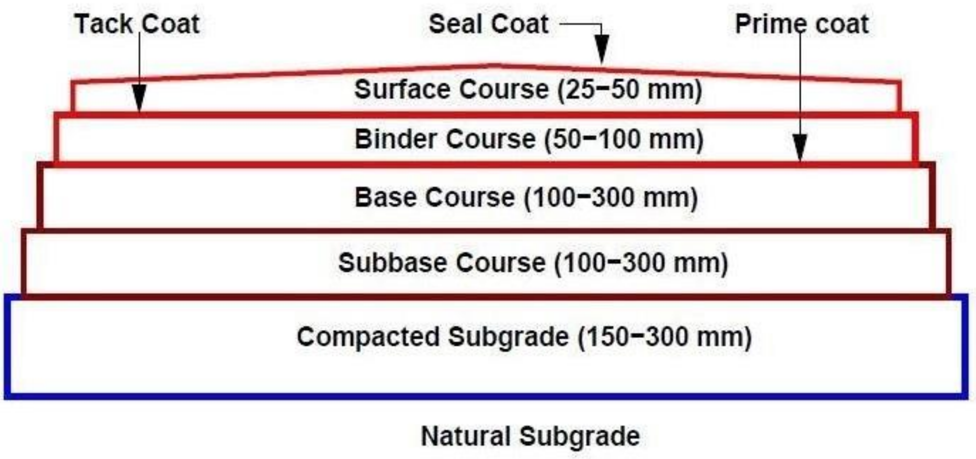
SUBGRADE SOILS

In the design of -flexible pavements, the first requisite is to adequately classify the subgrade soil so that its behavior under load in all seasons of the year may be predicted. How best to accomplish this objective is a matter on which little agreement is found as evidenced by the fact that some two dozen methods of flexible pavement design in use by various states and agencies have been listed (1). This list could probably be extended.
Most of these methods use some arbitrary and empirical test or method to rate the subgrade soil (2). Thus, one method in use classifies the subgrade soil by means of grain size and liquid and plastic limit tests. Another method evaluates subgrade strength by means of measuring the resistance offered to the penetration of a cylinder having an end area of three square inches, and expressing the result as a percentage of the resistance of a standard crushed stone.
Plate-loading tests are also used to determine strength of the subgrade soil. The results of these tests are applied to design strictly in an empirical fashion, often by means of design curves in which the subgrade rating is related to total thickness of pavement required by curves for different wheel loads. Intensity of traffic and moisture and frost conditions may also receive consideration empirically in these methods.

METHODOLOGY

For many years, empirical method of AASHTO has been used for design of pavements. AASHTO empirical method is one of the most used methods in many countries like Iran. This procedure is based on the results of the extensive AASHO Road Test conducted in Ottawa, Illinois, in the late 1950s and early 1960s. The AASHO Committee on Design first published a temporary design guide in 1961. It was revised in 1972 and 1981. In 1984-85, under the project of NCHRP Project 20-7/24; the guide expanded [1, 4]. This procedure has some limitations, because the original equations were developed under a given climate condition with a specific set of pavement materials and subgrade soils. The proposed AASHTO Mechanistic Empirical Pavement Design Guide (MEPDG) developed under National Cooperative Research Program (NCHRP)

Projects 1-37A and 1-40D has been developed to eliminate some of the limitations of the empirical method and to provide the highway community with a state-of-the-practice tool for the design of new and rehabilitated pavement structures. Unlike empirical procedure, the mechanistic empirical format of MEPDG provides a framework for continuous improvements to keep up with changes in trucking, materials, construction, design concepts, computers, and others. The Mechanistic part of the procedure refers to the mathematical modeling that relates performance criteria (e.g. stress and strains of critical locations of pavement) to distresses suchas fatigue or permanent deformation while empirical calibration factors are needed to relate mentioned equations to laboratory results. Empirical transfer functions are also needed to develop relationships between laboratory tests to field results with a specific set of conditions (pavement materials, traffic in addition to climatic situation).



Typical cross section of a flexible pavement

Design Of Flexible Pavement By California Bearing Ratio Method

The following points describe the various variables and parameters involved in design of flexible pavement of road as per IRC 37 - 2001.

- **Traffic- CV/Day Annual traffic census 24 X 7**

For structural design, commercial vehicles are considered. Thus vehicle of gross weight more than 8 tonnes load are considered in design. This is arrived at from classified volume count.

- **Wheel loads**

Urban traffic is heterogeneous. There is a wide spectrum of axle loads plying on these roads. For design purpose it is simplified in terms of cumulative number of standard axle (8160 kg) to be carried by the pavement during the design life. This is expressed in terms of million standard axles or msa.

- **Design Traffic**

Computation of design Traffic In terms of cumulative number of standard axle to be carried by the pavement during design life.

$$N = \frac{365\,A\,[(1+r)^n - 1]}{r} \times F \times D$$

Where

N = The cumulative number of standard axles to be catered for in design in terms of million standard axles - msa.

A = Initial traffic in the year of completion of construction duly modified as shown below. D = Lane distribution factor

F = Vehicle damage factor, VDF n = Design life in years

- r = Annual growth rate of commercial vehicles {this can be taken as 7.5% if no data is available}

CONCLUSION

The pavement is designed as a flexible pavement upon a black cotton soil sub grade, the CBR method as per IRC 37-2001 is most appropriate method than available methods.

The pavement is designed as a flexible method from which each method is designed on the basis of their design thickness from which each method has different cost analysis of a section, from which CBR as per IRC is most appropriate in terms of cost analysis.

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