# ABSTRACT

## Thesis Title : A Comprehensive Design Approach for Asphalt Pavements using Mechanistic-Empirical Framework

The present work is based on Mechanistic-Empirical (M-E) framework for structural design of asphalt pavements. Fatigue, rutting, low-temperature cracking and thermal fatigue cracking are considered as various modes of structural failure. This thesis attempts to develop a comprehensive cost-optimal asphalt pavement design approach based on design reliabilities of the individual modes of failure.

In this work, an effort has been made to calibrate/ develop the phenomenological fatigue and rutting equations so that it can predict the pavement life with greater confidence. It is observed that the predictions of pavement lives by the proposed equations are better than some of the other existing equations.

Thermal cracking of asphalt pavements are caused due to temperature stress. A theoretical approach for estimation of temperature stress has been presented based on theory of viscoelasticity. This approach considers the effect of previous stress history and can be used for any temperature profile. Using the proposed approach, a frictional model has been developed to predict the low temperature cracks spacing. The present study has also attempted to develop a thermal fatigue equation based on field observation. These models are validated using field data.

Various parameters associated with the pavement design show significant variability. It is, therefore, important to consider the reliability in pavement design. This work describes the estimation of reliability of pavement section for various modes of failure, considering the variability of relevant input parameters. A relationship between the deterministic approach and the probabilistic approach has been established for various possible probability distributions of the parameters. This would help a designer to design the pavement section without calculating reliability or performing simulation at each design iteration.

A typical pavement design offers multiple design alternatives in the form of various combinations of layer thicknesses, for a given set of input. The costs of these alternatives are expected to be different. An attempt has been made to obtain the cost-optimal design solution, while satisfying the reliability requirements of the individual failure modes. The pavement design problem has been formulated as an optimization problem and a simple methodology is suggested for automated identification of the cost-optimal design solution.