Abstract

A road in-service requires maintenance or rehabilitation time to time. For a given pavement structure, the type of maintenance and their application timings need to be selected judiciously so that the pavement performs satisfactorily throughout its service life. The agency who is responsible for construction and maintenance of road, and the users who use the road may have conflicting interests – and the objective is to plan the maintenance activities in such a way that the best possible solution is chosen. This is the premise of the present study. Literature review suggests that the current practice of taking a decision on the timing of a structural rehabilitation is based on certain pavement condition indices, such as Pavement Serviceability Index (PSI), Pavement Condition Index (PCI) or roughness level or so on. However, it may be argued that decision on structural maintenance should be taken based on structural health condition only, and not on the functional or composite indices. This is kept in the focus in the present work. To this effect the predicted structural health is used as an indicator. The thesis work has three parts, (i) inter-relationship study between structural distresses, (ii) measurement of structural distresses and (iii) to find an optimal rehabilitation scheme based on structural distresses.

Results from the analysis have shown that the structural distresses are not inter-related to each other. Due to issues with rutting measurement methods, it is suggested to measure rut depth of an asphalt pavement from its original profile. To find the rehabilitation strategy based on structural distress, the problem has been formulated as an optimization problem. The objective function here is to minimize the total life cycle cost. This total cost comprises of cost of agency and cost of users' due to travel time delay. The decision variables used in the present optimization problem are; (i) stiffness modulus of asphalt concrete, (ii) design period of asphalt overlay, (iii) Critical level of bottom up fatigue cracking and (iv) number of work zone days required to finish the rehabilitation work. Genetic algorithm has been used to solve the problem. From the analysis, it was seen that the best rehabilitation strategy is to overlay the distressed asphalt pavement by asphalt concrete of very high stiffness modulus and the design period of asphalt overlay should be kept as high as possible. The restriction on the road for traffic movement should be kept at minimum level. However, the critical level of bottom up fatigue cracking at which an overlay would be provided is subject to analysis scheme.