Structural evaluation of in-service asphalt pavements by deflection measurements.

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Abstract

Many highways built in the Kingdom over the last decade have started showin signs of structural distress, much earlier than anticipated, primarily due to increasing traffic loads operating on them. These distressed highway pavements should be rehabilitated as early as possible by a suitable technique, such as by providing overlay, since rehabilitation, if deferred, costs a lot more in the long term. Overlay thickness design charts developed in the Western countries cannot be applied here directly due to variations in traffic loading, climate and materials.

This study examines the possibility of developing a suitable system for evaluating the structural adequacy of in-service pavements and to develop a suitable thickness design chart for asphalt overlays for structurally weak pavements in the Kingdom.

Nine typical test sections, representative of in-service pavements, were selected in Khobar-Dammam region. Benkelman beam deflection measurements were made on each test section at selected points under a 9 kip (4.1 ton) dual wheel load induced by the 18 kip (8.2 ton) rear axle of a loaded truck. The truck was moved with a creep speed and maximum rebound deflection was recorded following the AASHTO procedure. A number of cores from asphalt concrete layers were extracted from each test section and characterized in the laboratory under simulated repetitive traffic loading and in-service temperature. Subgrade strength was estimated from deflection data employing mechanistic approach for pavement analysis. BISAR (Bitumen Structures Analysis in Roads) and PDMAP (Probabilistic Distress Models for Asphalt Pavements) computer softwares were employed in the analysis. Applying the material properties as input to the above programs, and using appropriate pavement damage models, remaining service lives of sound pavements were determined. Further, the process of finding overlay thickness, which will keep the critical strains in pavement layers within limiting values, has been developed for the existing weak pavements. The results are presented in the form of an overlay design chart for easy application. Periodic monitoring of beam deflection, before and after the overlay placement, will be necessary to validate the model developed. Finally, a procedure to combine the various measured properties such as pavement structural capacity, distress manifestations, and skid resistance, into one rating scale, has been evolved to assist in overall ranking of roads from maintenance priority point of view.