Overview

As fewer entirely new highway facilities are being constructed, the major emphasis in recent years has been on the rehabilitation and maintenance of existing highway facilities. If innovative and effective strategies for rehabilitation and maintenace are employed, these facilities can provide higher levels of service for a longer period of time, resulting in savings to both the highway agencies and the users.

Symposium Purpose

This symposium was organized to provide a forum to researchers and practitioners to present their experience with innovative and effective strategies for rehabilitation and maintenance of flexible payments. Pavement rehabilitation consists of restoration, resurfacing, recycling, and reconstruction. Restoration includes pothole patching and other surface rehabilitation techniques; resurfacing includes functional and structural overlays; recycling includes both hot and cold recycling; and reconstructing includes full depth reclamation. Flexible pavement maintenance may include operations such as chip seals, slurry seals, microsurfacing, thin hot mix asphalt overlays, and crack treatments.

Summary

This special technical publication (STP) has been organized into three main topic areas: (a) pavement evaluation, (b) pavement rehabilitation, and (c) pavement maintenance.

Pavement Evaluation: Two papers are presented in the pavement evaluation area. For formulating a proper rehabilitation and maintenance strategy, it is important to know how the pavement condition is affected by traffic loads at different ages and under different vehicular and environmental conditions. Traditionally, empirical relations have been used to estimate the performance of various rehabilitation and maintenance treatments for the purpose of allocating funds. The paper "Effect of Traffic Load on Pavement Serviceability" provides a rational technique to estimate the change in pavement serviceability caused by traffic loads under different pavement roughness and vehicle conditions. Once the condition is known at different times throughout the life of the pavement, a proper maintenance and rehabilitation strategy can be established.

The second paper "Pavement Evaluation of Roads in the Sub-Saharan Region" presents experience gained in the evaluation of pavement structures in Africa for the design of rehabilitation and maintenance alternatives. Pavements were evaluated using state-of-the-art equipment such as falling weight deflectometer and laboratory resilient modulus equipment to test soil and asphalt concrete samples. This paper discusses the limitations and advantages of backcalculation software and how the backcalculated moduli compare with laboratory measured resilient moduli of undisturbed samples. These data were then used to compare the AASHTO DARWin and mechanistic analyses methods of determining an overlay design thickness where the design criteria are based on fatigue cracking.

Pavement Rehabilitation: Five papers are presented in the area of pavement rehabilitation although some techniques such as chip seals can also be employed for pavement maintenance. If there is a potential for development of reflection cracks selected rehabilitation strategy should aim at minimizing or eliminating this potential. Geogrids have been used by

pavement engineers for this purpose. The paper "Effects of Geogrid in Enhancing the Resistance of Asphalt Concrete to Reflection Cracks" gives the evaluation of glass fiber geogrids of different strengths in reducing the reflection as well as fatigue cracks.

Recycling is one of various pavement rehabilitation alternatives. Cold recycling is one of the four main recycling processes for flexible pavements, which also include (a) hot mix recycling, (b) hot in-place recycling, and (c) full depth reclamation. Many highway agencies have used cold in-place recycling in the past. This recycling process involves milling the existing asphalt pavement, screening, crushing the oversize particles, mixing with new binder, and placing the material as an asphalt treated base for subsequent overlay with hot mix asphalt. A single pass of an equipment train is used to complete this process. However, only a few agencies have documented the performance of cold recycled pavements. The paper "Construction and Performance Using Cold In-Site Recycling in New Mexico" documents the performance of several projects constructed since 1984 by the New Mexico State Highway and Transportation Department. The paper also summarizes construction lessons learned, benefits of lime slurry additive, and costs. It is evident from the paper that cold in-place recycling is cost effective and provides excellent performance for a service life that is yet to be determined, certainly exceeding ten years.

Many highway agencies have used emulsified asphalts as binder in cold in-place recycling. However, some agencies are experimenting with various additives in conjunction with emulsified asphalt to gain early strength and to improve engineering properties of cold recycled asphalt mixtures. The paper "Evaluation of Hot Lime Slurry in Cold In-Place Recycling" involves laboratory evaluation of cold recycled mixes containing Type C fly ash, hydrated lime, and hot lime slurry in addition to emulsified asphalt. Cold recycled mixes containing hot lime slurry gave the best results in terms of tensile strength, rut resistance, and resistance to moisture induced damage.

Asphalt pavements which have low surface frictional resistance when wet need to be rehabilitated with a cost-effective hot mix asphalt (HMA) treatment. The paper "Construction and Performance of Ultrathin Asphalt Friction Course" describes a process called NOVACHIP developed in France and used by the Alabama Department of Transportation in 1992. This process utilizes a single piece of equipment to place a thin, gap-graded HMA onto a relatively thick layer of polymer modified asphalt emulsion tack coat. Based on the performance evaluation after 4½ years it has been concluded that this process is a potential alternate for chip seals, micro-surfacing, and open-graded friction course.

Chip seals are not generally used on pavements carrying high volumes of traffice because of potential (a) vehicle damage, (b) noise and roughness, and (c) short life-cycle costs. However, the paper "Design and Construction of Chip Seals for High Traffic Volume" indicates chip seals can be used on high traffic pavements (more than 7500 vehicles per day per lane) with minimal vehicle damage and acceptable life-cycle cost. Based on the performance of 20 experimental test sections it was concluded that equipment calibration, traffic control, proper materials, and construction practices must be followed.

Pavement Maintenance: Most highway agencies have a program of routine maintenance activities. However, very few employ a program strategy called preventive maintenance which is cost-effective and reduces the need for routine maintenance. The paper "Pavement Preventive Maintenance: Description, Effectiveness, and Treatments" gives an overview of this concept and its application in the field.

Pavement maintenance engineers have the option of using various maintenance techniques. However, there is a lack of comparative performance data for different techniques. The paper "Effectiveness of Highway Maintenance Treatments Used in Texas" involves such a comparison among asphalt-rubber chip seal, polymer-modified emulsion chip seal, latex-modified asphalt chip seal, and a microsurfacing treatment. Topics such as effective

combinations of treatments such as crack sealing followed by chip sealing as well as a number of individual preventive maintenance treatments are covered. Information on the selection of specific treatments for different pavement conditions and the appropriate application techniques are also included.

Some highway agencies including the Alabama Department of Transportation apply chip seal or seal coat (as an interlayer) to the existing asphalt pavement (with or without milling) before placing the HMA maintenance overlay. This is done to seal the existing pavement surface and minimize reflection cracking. A three-year evaluation of pavements with and without the chip seal interlayer reported in the paper "Effectiveness of Seal Coat Interlayers in Maintenance Overlays" indicates no significant improvements in pavement performance when the chip seal is used.

Crack sealing is a very common maintenance technique. Unfortunately, the materials used for sealing cracks do not always perform as expected. The paper "Considerations for a Performance-Based Specification for Bituminous Crack Sealants" indicates the divergence between the field conditions and test conditions employed in the standard tests used for evaluating bituminous crack sealants. An approach towards developing a peerformance-based specification for crack sealants has been proposed.

This STP will be helpful to pavement design engineers, construction engineers, and maintenance engineers in applying innovative and effective strategies for pavement evaluation, rehabilitation, and maintenance. Such strategies should result in flexible pavements which will provide higher levels of service for a longer period of time.

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