Project Summary

Texas Department of Transportation

0-5821: Develop Guidelines for Routine Maintenance of Concrete Pavement

Background

Heavy traffic accelerates pavement deterioration, necessitating more frequent and better maintenance activities. However, many concrete pavement repair guidelines focus only on serious structural deterioration and rehabilitation techniques, rather than regular maintenance or minor distress repairs. As a consequence, the "do nothing" approach and simple patching are the most popular solutions for minor distress repairs. These approaches can cover the problem temporarily but do not address further degradation of the pavement system. Moreover, many maintenance engineers miss the early signs of structural damage to the pavement because the decision process is based only on visual distress surveys. Sometimes, by the time a visual inspection shows distress, it is too late for cost-effective repair.

The purpose of this research is to identify distress types in concrete pavement and asphalt concrete (AC) overlaid pavement, and evaluate current pavement conditions using not only visual surveys but also nondestructive testing (NDT) methods. Based on the visual survey and NDT results, a simple decision process recommends cost-effective routine maintenance, details the selected repair methods, and provides guidelines for field maintenance personnel.

What the Researchers Did

This project developed the following training materials:
1) Pocket Field Manual – The pocket field manual describes distress types and possible causes, and provides a variety of pictures and schematic diagrams. It also provides guidance on the investigation requirements, maintenance strategies, and other considerations for each distress type.

2) Field Survey – In field tests, researchers identified the reasons that some pavements perform well and some pavements perform poorly. They also recommended possible improvements by proper repair methods and created field guidelines. They evaluated the effectiveness of full-depth repair, various joint repair techniques for AC overlay, joint resealing, and dowel bar retrofit with diamond grinding, using NDT and visual surveys.

3) Field Guidelines – The field guidelines introduce simple evaluation techniques using NDT, which is the key to selecting the proper routine maintenance activities. The guidelines recommend the optimal maintenance methods. Each maintenance stage includes the best standard plans and specifications used by state departments of transportation.

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What They Found

The project produced guidelines for a visual pavement condition survey, and recommendations for NDT testing where needed. The falling weight deflectometer (FWD) can evaluate the structural condition of pavement including the stiffness of each layer, load transfer efficiency (LTE), and loss of support below the slab. Ground penetrating radar (GPR) testing can evaluate conditions in the base, including voids under the slab and the presence of water in underlying pavement layers. A GPR survey can be used to estimate the thickness of the portland cement concrete (PCC) pavement layer, assess the condition of the layer interface, and evaluate dowel misalignment. Dynamic cone penetrometer (DCP) testing can evaluate the in-situ strength of base and subgrade soils.

Researchers created a step-by-step repair method decision process for selecting effective routine maintenance based on the visual survey and NDT information. The decision process has four maintenance levels:
1) Preservative maintenance – reseal joints and cracks and retrofit edge drains, for example.

2) Functional concrete pavement repair (CPR) – partial-depth repair, diamond grinding, and thin AC overlay.

3) Structural CPR – retrofit load transfer, cross stitching, and slab undersealing.

4) Remove and replace – full-depth repair.

What This Means

If proper maintenance is not employed when deterioration is minor, more rapid degradation of pavement serviceability will occur. The subsequent high cost of repair and additional traffic congestion could be the result. Therefore, preservative maintenance or minor repair should be executed in the early stages of pavement distress, which could be identified by routine pavement condition monitoring and a simple decision process. If the pavement age is more than 10 years for PCC or two years for AC overlaid pavement, an overall pavement condition survey and NDT testing to diagnose structural condition are highly recommended. Routine maintenance at the right time can extend pavement life in a cost-effective manner.

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