DETECTION OF VOIDS UNDERNEATH CONTINUOUSLY REINFORCED CONCRETE PAVEMENTS

By

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SUMMARY REPORT 177-18(S)

SUMMARY OF
RESEARCH REPORT 177-18

PROJECT 3-8-75-177

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Foreword

Research Report 177-18 presents the results of an investigation in which three methods of detecting voids underneath CRC pavements (deflection, pumping, and vibration) are evaluated with respect to reliability of successful void detection. This report is the eighteenth in a series which describes work done by Project 3-8-75-177, Development and Implementation of the Design, Construction, and Rehabilitation of Rigid Pavements.

Introduction

In recent years, it has been found that one of the most significant factors in reducing the life of concrete pavements is the presence of voids beneath the pavement. In designing pavements, a basic assumption is made that full support is obtained throughout the length of the pavement. When a small void develops beneath the pavement, this support condition is lost, and, thus, the loads are not distributed as intended in design. Therefore, the stress level in a pavement with a void increases significantly, with the consequence that the fatigue life of the pavement is greatly reduced. More specifically, the occurrence of such voids beneath CRCP eventually results in punchouts and failures with consequent increase in maintenance cost. Thus, it is desirable to locate these voids for preventive maintenance.

The first problem with voids is to detect and fill them before the void condition has an excessively detrimental effect on the pavement. Over the past few years, a number of different methods have been proposed for investigation, including the use of density measuring equipment, vibratory equipment, and deflection measuring equipment and visual observation of distress manifestations, such as pumping. Various Districts in Texas have experimented on a very limited basis with these different techniques, but no detailed studies have been made or reported to date.

The objective of this study was to evaluate the feasibility and the practicality of various methods of detecting voids beneath concrete pavements, especially those having a high probability of success. Specifically, the purpose of this study was to evaluate in a controlled experiment the feasibility of using deflection devices, vibratory devices, and visual means for void detection and to recommend a detailed procedure for void detection which would incorporate the most reliable techniques.

Summary of Approach — Development of Void Detection Procedure

Proposed methods of using deflection, pumping, and vibration in the detection of voids are presented and identified briefly as to function. A tentative procedure for utilizing each of these methods was established and a basic experiment for testing the procedures was developed and implemented. These procedures were applied to a series of in-service pavements selected in locations where voids were likely to be present. Two sections of CRCP in Texas which were also to be used as experimental sections for evaluating the "undersealing" technique of void repair were chosen. They were selected through a joint inspection by representatives of the Austin Office Division of the SDHPT, the Center for Highway Research, and the respective District.

The locations for the test sections on IH-10 and IH-45 are shown in Fig 1. As may be seen, these sections are east of Columbus, Texas, and south of Fairfield, Texas, respectively. A cross section for the pavement structures on IH-10 consisted of 8 inches (20.32 cm) of CRCP and 6 inches (15.24 cm) of cement-stabilized base. The project on IH-45 has a cross section consisting of 8 inches (20.32 cm) of CRCP on a 4-inch (10.17-cm) asphalt-stabilized base. The evaluation of the capabilities of undersealing and its effect with regard to long term performance of pavements (after undersealing) is discussed in Research Report No. 177-19, "Undersealing for the Repair of Voids in CRCP."

For each of these test sections, then, field data were collected for each procedure candidate and

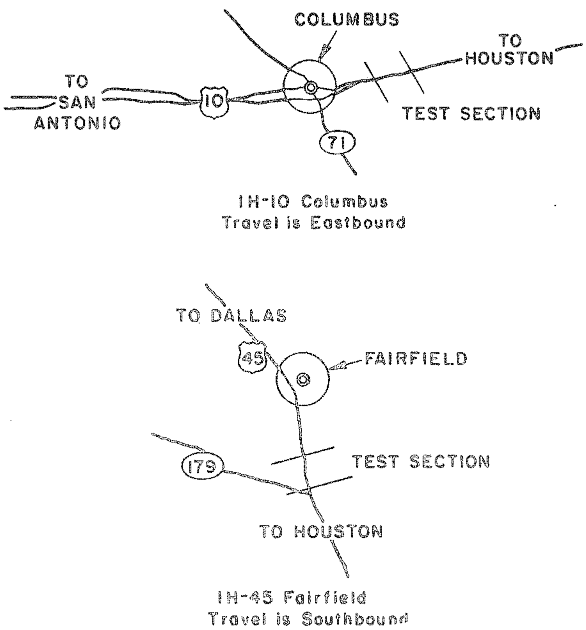

Fig 1. Location of test sections.

put into a factorial format for analysis. After analyzing these data and using coring and excavation for verification of the presence of voids, the method having the highest probability of successfully detecting voids was chosen. It was found that the deflection method was the most reliable, and a definitive procedure was thus established for its implementation.

Conclusions and Recommendations

Based on the results of this study, it can be concluded that deflection techniques can be used successfully to predict the presence of voids beneath CRC pavements. The Dynaflect deflection measuring device was used successfully in measuring deflection. However, the use of condition surveys, e.g., pumping, as an indicator indicated that the probability of successfully locating a void was only 50 percent. The Delam Tek vibratory equipment was found to be unsuccessful in predicting voids beneath the pavement.

Based on the successful application of the deflection procedure, it is recommended that the procedure outlined herein for the Dynaflect be utilized on highways where the development of punchout type failures is a continual problem. By successfully locating these voids in advance of failure and correcting them, the punchout problem can be severely reduced and the life of the pavement extended. Since it is not feasible to run a detailed deflection survey of the pavement, the procedure should be judiciously applied in areas where it is suspected that voids exist beneath the pavement.

KEY WORDS: continuously reinforced concrete pavements, void detection, Dynaflect, deflection measurements, pumping, Delam Tek, vibration, undersealing.

The full text of Research Report No. 177-16 can be obtained from Mr. Phillip L. Wilson, State Planning Engineer, Transportation; Transportation Planning Division; File D-10R; State Department of Highways and Public Transportation, P.O. Box 5051; Austin, Texas 78763.