EFFECT OF ENVIRONMENTAL FACTORS AND LOADING POSITION ON DYNAFLECT DEFLECTIONS IN RIGID PAVEMENTS

Victor Torres-Verdin and B. Frank McCullough

SUMMARY REPORT 249-4(S)

SUMMARY OF

RESEARCH REPORT 249-4

PROJECT 3-8-79-249

CENTER FOR TRANSPORTATION RESEARCH

BUREAU OF ENGINEERING RESEARCH

THE UNIVERSITY OF TEXAS AT AUSTIN

NOVEMBER 1982

SUMMARY REPORT 249-4(S)

Research Report Number 249-4 is the fourth in a series of reports which describe work done on Project 3-8-79-249, "Implementation of Rigid Pavement Overlay and Design System." This report discusses several of the factors that affect Dynaflect deflections in rigid pavements and provides a recommended procedure for Dynaflect deflection measurements which can be implemented in the rigid pavement overlay design procedures.

Study Findings

In the report, several of the factors that affect Dynaflect deflections in rigid pavements are analyzed. Findings from this study are incorporated into a recommended procedure for the use of the Dynaflect.

The Slab-49 program was used to model a continuously reinforced concrete pavement with various support conditions. Cracks and longitudinal joints were also considered.

The simulated Dynaflect load was placed at different positions to account for the effect of the pavement edge when there is a void underneath the slab as well as for the full support condition. A discussion of the effect of environmental factors based on a literature review is presented.

Statistical analysis was used to estimate the number of Dynaflect deflections that are necessary to obtain representative results. This was based on measurements taken in the state of Texas for continuously reinforced concrete pavements.

Some of the most important conclusions that stem from this study are the following:

(1) When deflection measurements of a given pavement section are to be compared, the influence of environmental factors, such as temperature and moisture, should be accounted for.

(2) The purpose of the deflection measurement program should always be defined. Deflections may be required for void detection, materials characterization, or load transfer evaluation.

(3) If the Dynaflect device is used to detect voids underneath the pavement surface layer, the Dynaflect sensors should be aligned parallel to the pavement edge at approximately one foot from it. If the pavement layers are to be characterized, the Dynaflect should be placed between cracks (or joints), at 3 to 9 feet from the pavement edge.

(4) The Dynaflect placement error should always be kept as small as possible, without at any time exceeding 5 inches. It is extremely important to record the distance from the edge at which the Dynaflect is placed in order to compare deflections. For void detection and materials characterization the maximum placement errors are 5 and 10 inches, respectively.

(5) The effectiveness of undersealing operations could be evaluated by means of the percent of void area filled using the procedure outlined in Chapter 3 and the criteria in Table 3.3 of the report.

(6) For evaluating joint or crack load transfer, the Dynaflect wheel loads should be placed both at the crack or joint and between cracks or joints.

(7) To divide the roadway into sections, the variation of both sensor 1 and sensor 5 deflections along the highway should be considered. This can be accomplished by plotting such deflection parameters to subjectively select the road sections.

(8) It was found that once the division of the roadway is made, systematic sampling can be used to obtain representative results in an inexpensive way. The spacing between measurements could be determined by analyzing existing deflection data.

(9) If it is valid to assume a normal distribution for the Dynaflect deflections, a simple expression can be used to determine the number of deflections required in a given section of the road, based on a selected allowable error. Allowable errors of 2.5 percent and 5.0 percent in the

sensor 1 mean deflection were studied and converted to equivalent variation in thickness of the pavement surface layer.

The findings from this study are grouped together in a recommended procedure for Dynaflect deflection measurements, which is described in Appendix C of the report.

KEYWORDS: Dynaflect, deflection, continuously reinforced concrete pavement, void detection, materials characterization, sampling.

The research reported here was conducted for the Texas State Department of Highways and Public Transportation in cooperation with the U.S. Department of Transportation Federal Highway Administration.

The full text of Research Report 249-4 can be obtained from Mr. Phillip L. Wilson, State Transportation Planning Engineer; Transportation Planning Division, File D-10R; State Department of Highways and Public Transportation; P.O. Box 5051; Austin, Texas 78763.