THE OPTIMIZATION OF A FLEXIBLE PAVEMENT SYSTEM USING LINEAR ELASTICITY

SUMMARY REPORT 123-17(S)

SUMMARY OF
RESEARCH REPORT 123-17

PROJECT 1-8-69-123

Cooperative Highway Research Program
with U. S. Department of Transportation
Federal Highway Administration

TEXAS HIGHWAY DEPARTMENT

CENTER FOR HIGHWAY RESEARCH
THE UNIVERSITY OF TEXAS AT AUSTIN

TEXAS TRANSPORTATION INSTITUTE
TEXAS A&M UNIVERSITY

March, 1973

The Optimization of a Flexible Pavement System Using Linear Elasticity

by

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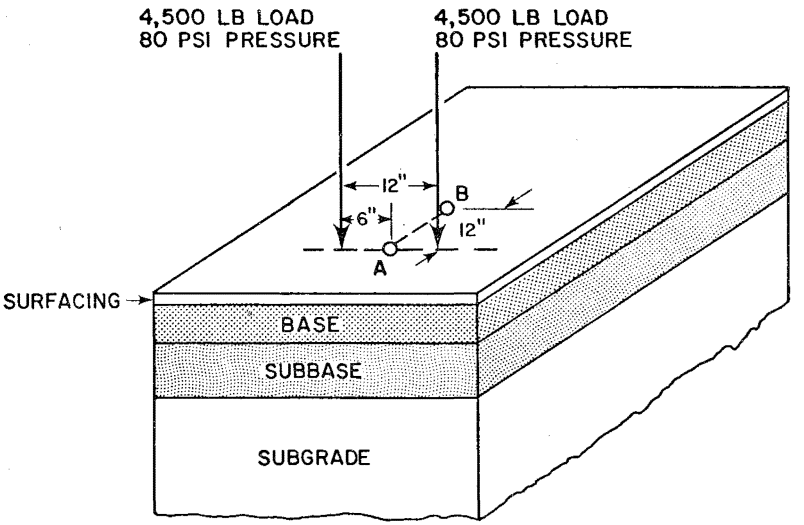
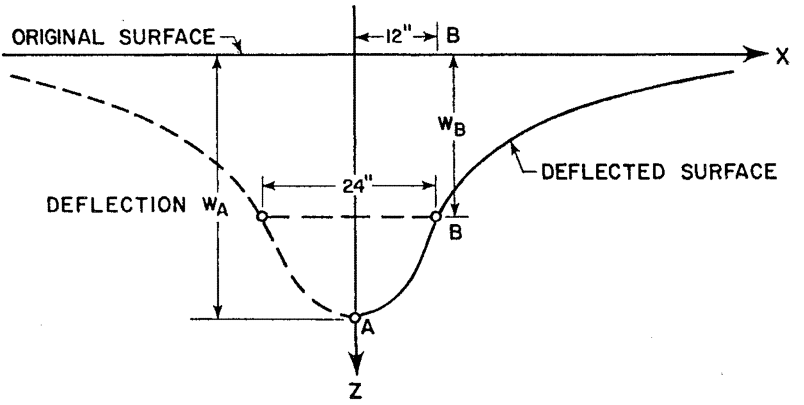
The Texas Flexible Pavement System (FPS) has integrated the concept of serviceability index, pavement deflections, traffic projections, and swelling clay effects, as well as cost information pertaining to initial construction, surface rehabilitation, and user's contribution, into a broad based optimization procedure. In FPS the estimation of structural feasibility is based on the growth of surface deterioration which, in turn, is assumed to depend mainly on the magnitude of the "surface curvature index" (SCI) measured by the Dynaflect. It is known, however, that in some cases pavement life predictions based solely on the SCI are obviously in error: what appears to be needed at this time is a means for screening all trial designs by comparing the computed stress caused by a heavy wheel load with measured material strength, and rejecting designs that are obviously too weak.

Linear elasticity has been widely applied to the description of the structural behavior of engineering materials. In the case of granular materials the computed stresses probably are only first approximations to the true stresses. But there appears to be no practical alternative, and many versions of computer programming routines have been developed for the analysis of



Dual-wheel load at one end of an 18-kip axle.



Typical deflection basin of the dual-wheel load as it would appear on a vertical plane through the points A and B. $W_A - W_B$ is proportional to the "surface curvature index."

layered flexible pavement structures. Such a program is BISTRO, developed by Shell Oil Co., Amsterdam, for determining stresses, strains and displacements in an ideally elastic multi-layer road system.

BISTRO has been integrated into FPS. In the resulting FPS-BISTRO System stress-strength comparisons are included in the economic optimization of flexible pavement design strategy. In order to economize the computation process, the original BISTRO has been revised and a multi-dimension spline interpolation routine has been developed.

Strengths (both tensile and compressive) are estimated from the Texas Triaxial Compressive Test because of the long and extensive use of this test by the Texas Highway Department to establish comparative strengths of base, subbase, and subgrade materials. Elastic moduli of typical materials are determined from Dynaflect data as described in previous reports (Research Reports 123-6 and 123-6A).

Two numerical examples are presented as illustrations of the application of the FPS-BISTRO System.

The published version of this report may be obtained by addressing your request as follows:

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