National Cooperative Highway Research Program



RESEARCH RESULTS DIGEST

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Subject Area: IIB Pavement Design, Management, and Performance

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Systems for Design of Highway Pavements

An NCHRP digest of the findings from the final report on NCHRP Project 1-32, "Systems for Design of Highway Pavements," conducted by ERES Consultants, Inc.
Dr. Michael I. Darter served as Principal Investigator.

INTRODUCTION

An interactive CD-ROM is available for use by pavement engineers and others interested in the design of flexible and rigid pavements. This digest describes this CD-ROM-based catalog and other products of a project, including a CD-ROM-based catalog that will help pavement engineers in identifying pavement design alternatives, reviewing and checking proposed designs, and updating agency design practices, and will also serve as a training tool for entrylevel pavement design engineers.

The objective of the design process is to identify pavement structures that will provide acceptable performance and economy over the intended design life. A rational pavement design must consider the effects of roadbed soil, climate, traffic loading, construction materials, and other design details and features on pavement performance and life-cycle costs.

In spite of similarities in environment, traffic, and roadbed soil within and among states, practices for design and construction vary widely. A catalog for pavement design that identifies recommended design structures and features for flexible and rigid pavements would help guide highway authorities in selecting suitable and reliable designs. Nearly all European highway agencies have developed and adopted such design catalogs. Supplementing such a catalog with a microcomputer-oriented, knowledge-based expert system would further enhance the catalog's use and facilitate its updating. NCHRP Project 1-32 was initiated to address this need.

The research was conducted under NCHRP Project 1-32, "Systems for Design of Highway Pavements," by ERES Consultants, Inc. The research, completed in 1997, provided (1) a catalog of current state pavement design features (2) a catalog of recommended (good practice) pavement design features, and (3) a prototype knowledge-based expert system.

The digest provides a summary of the work performed in this research. The material in this digest is extracted from the final report on the project.

FINDINGS

In this project, three practical and useful pavement design products were developed: the Catalog of Current State Pavement Design Features, the Catalog of Recommended Design Features, and a Prototype Knowledge-Based Expert System.

Catalog of Current State Pavement Design Features

This catalog provides a comprehensive summary of nearly all states' design practices for both rigid and flexible pavements. This information is organized into large synoptic tables of design features. The catalog also includes a state factorial design matrix of pavement design features that provides layer thickness for a wide range of traffic, subgrade, and climatic site conditions for major types of main highway pavement constructed by the state highway agencies.

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Catalog of Recommended Pavement Design Features

This catalog presents "good practice" recommendations for flexible and rigid pavement design features in an easy-to-use format for ranges of traffic loading, subgrade support, and climatic conditions. The recommendations for asphalt concrete and portland cement concrete pavements are presented in 36 and 26 "cells," respectively. These recommendations would help guide state highway agencies in selecting suitable and reliable designs. The catalog can also be used as a resource for training inexperienced personnel. Figures 1 and 2 show examples from the catalog illustrating structural design alternatives for flexible (asphalt concrete) and rigid (portland cement concrete) pavements, respectively.

Prototype Knowledge-Based Expert System

This expert system, dubbed "Designer," was developed to supplement the Catalog of Recommended Pavement Design Features; it compresses the printed catalog in an electronic format and adds further capabilities. "Designer" will help the pavement engineers to realize the full potential of the printed catalog. With "Designer," the pavement designer is more likely to obtain proper design inputs, to consider all feasible options for a given set of design inputs, and, thus, to make better pavement design decisions. "Designer" helps put pavement design expertise into the hands of less experienced personnel.

CONCLUSIONS

The benefits of pavement catalogs have been recognized by European highway agencies for many years. Such a catalog provides an effective means for identifying pavement design alternatives, reviewing and checking proposed designs, updating agency design practices, and training highway agency personnel. This project resulted in a Catalog of Recommended Pavement Design features for both flexible and rigid pavements, for the ranges of roadbed soil, climate, and traffic conditions encountered in the United States.

However, to facilitate use of the catalog by a highway agency, the agency needs to adopt portions of the catalog that cover prevailing roadbed soil and climatic conditions and incorporate appropriate changes to reflect proven practices concerning cross section design, thickness design procedure, materials specifications, mix design, and other standards. In this manner, the agency would have a "customized design catalog" that can be easily used for project-level design process.

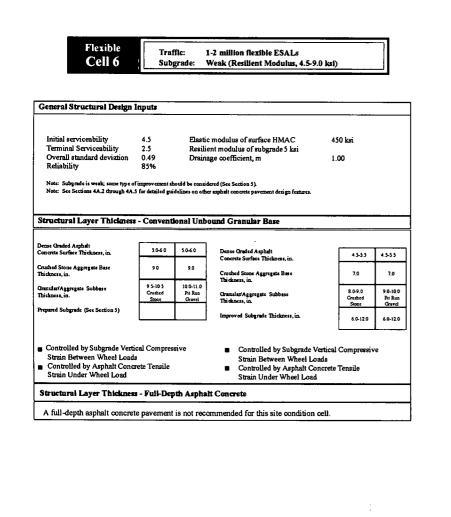
The project also produced "Designer," a prototype knowledge-based expert system to supplement the Catalog of Recommended Pavement Design Features. In addition, the project produced a Catalog of Current State Pavement Design Features that contains a comprehensive summary of states' design practices for both rigid and flexible pavements.

FINAL REPORT

The agency's final report on the project includes a summary report, the Catalog of Current State Pavement Design Features, the Catalog of Recommended Design Features, and a Prototype Knowledge-Based Expert System. The report has also been produced on a CD-ROM; copies of the report and the CD-ROM have been distributed to the NCHRP sponsors. Five copies of the CD-ROM have been sent to each member department's representative on AASHTO's Advisory Research Committee. The CD-ROM, titled "Design Tools," is available for purchase by writing to the TRB Publications Office, 2101 Constitution Avenue, N.W., Washington, D.C. 20418. The cost is \$25.00 including postage. Checks or money orders should be made payable to the Transportation Research Board. The CD may be purchased using MasterCard, Visa, or American Express by calling 202/334-3214, or faxing 202/334-2519.

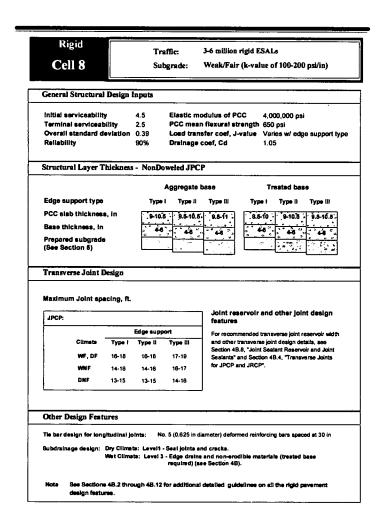
ACKNOWLEDGMENTS

The research summarized herein was performed under NCHRP Project 1-32 by ERES Consultants, Inc., Champaign, Illinois; Dr. Michael I. Darter served as principal investigator.



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Figure 1. Example from the Design Catalog illustrating structural design alternatives for flexible pavements.



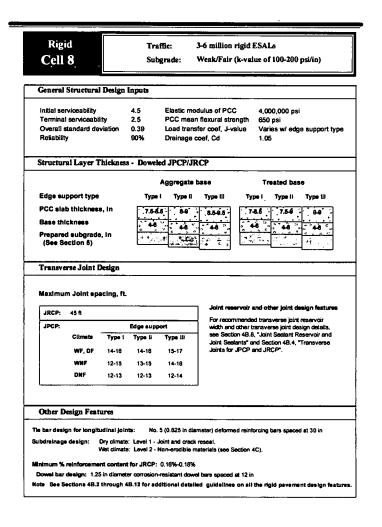


Figure 2. Example from the Design Catalog illustrating structural design alternatives for rigid pavements.

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