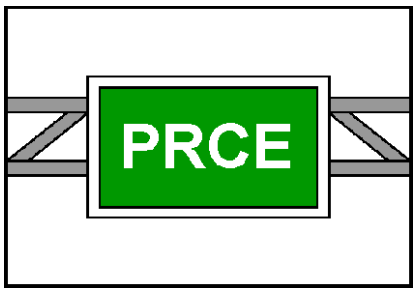
Michigan Department of Transportation	MDOT Michigan Department of Transportation
Michigan Asphalt Paving Association	M A P A

DETERMINING THE CAUSES OF TOP-DOWN CRACKS IN BITUMINOUS PAVEMENTS

Michigan State University
Pavement Research Center of Excellence
Department of Civil and Environmental Engineering
East Lansing, Michigan 48824-1226



August 2003

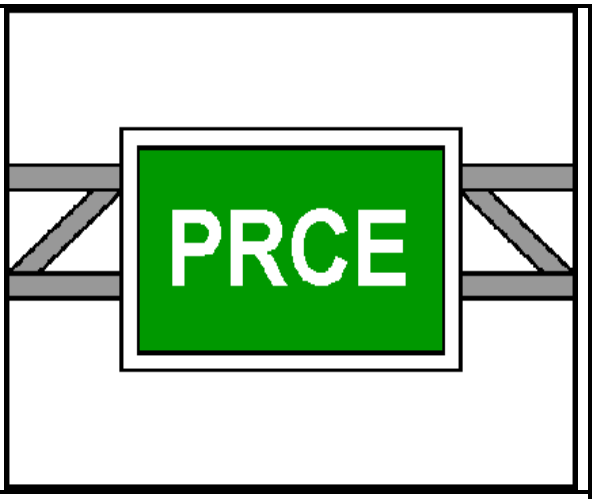
DISLAIMER

This document is prepared under the sponsorship of the Michigan Department of Transportation (MDOT) and the Michigan Asphalt Paving Association (MAPA) in the interest of information exchange. MDOT and MAPA assume no liability for its contents or use thereof.

The contents of this document reflect the views and opinions of the authors, which are responsible for the accuracy of the information presented herein. The contents do not necessarily reflect the views of MDOT and/or MAPA and do not constitute standards, specifications, or regulations.

PAVEMENT RESEARCH CENTER OF EXCELLENCE

Michigan State University
Department of Civil and Environmental Engineering
East Lansing, Michigan 48824-1226
(517) 355-5147
Fax (517) 432-1827
baladi@egr.msu.edu



Final Report

Report Number	Contract Number
MDOT - PRCE - MSU -2003 -110	)

Title and Subtitle

DETERMINING THE CAUSES OF TOP-DOWN CRACKS IN BITUMINOUS PAVEMENTS

Report Date

June 2002

Authors
Gilbert Y. Baladi, Ph.D., P.E.
Michael Schorsch
Tunwin Svasdisant

TAG Chairperson
Vernon T. Barnhart

Sponsoring Agencies
Michigan Department of Transportation
Construction and Technology Division
Michigan Asphalt Paving Association

Abstract

Top down cracks (TDC) are longitudinal or transverse cracks that initiate at the pavement surface and propagate downward and outward. They have been observed with increasing frequency on roads in Michigan. In this study, field and laboratory investigations were conducted to determine the factors that affect the load-induced tensile stresses at the pavement surface and the tensile strength of the AC mixes, and hence, affect the susceptibility of the pavement surface to TDC potential. Results of laboratory testing indicate that the AC mixtures used as surface courses in Michigan may be weakened by moisture damage. Further, segregation increases the susceptibility of the AC mixtures to moisture damage, and hence, increases TDC potential. Finally, a crack propagation model was developed as a function of pavement age and degree of segregation based on distress survey data.

Key Words: asphalt pavements, top-down cracks, asphalt mix, nondestructive deflection tests, segregation, and moisture damage.

ACKNOWLEDGEMENTS

The authors wish to thank the Michigan Department of Transportation, and the Michigan Asphalt Paving Association for their financial supports, which made this study possible. The comments made by the Technical Advisory Group members throughout the study are greatly appreciated.

Many thanks are due to MDOT personnel for their efforts in data collection, including Kurt Bancroft for FWD testing, Frederick Carian for his near encyclopedic knowledge of MDOT bituminous mixtures and Gerald Sweeney for his unique insights and assistance with laboratory testing.

The countless efforts and contributions of personnel of the Pavement Research Center of Excellence (PRCE) at Michigan State University are highly appreciated.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES