National Cooperative Highway Research Program

RESEARCH RESULTS DIGEST

January 2003—Number 272

Subject Area: IIB Pavement Design, Management, and Performance

Responsible Senior Program Officer: Amir N. Hanna

A Process for Selecting Strategies for Rehabilitation of Rigid Pavements

This digest summarizes the findings from NCHRP Project 10-50A, "Guidelines for Selecting Strategies for Rehabilitating Rigid Pavements Subjected to High-Traffic Volumes," conducted by the Texas A&M Research Foundation. It was prepared by Dr. Amir N. Hanna, NCHRP Senior Program Officer, from the contractor's final report authored by Dr. Stuart D. Anderson, Dr. Gerald L. Ullman, and Mr. Byron C. Blaschke. Dr. Anderson served as principal investigator.

INTRODUCTION

This digest summarizes the findings of the research conducted under NCHRP Project 10-50A on the process for selecting strategies for rehabilitation of rigid pavements subjected to high traffic volumes and describes a process to help state highway agency decision makers identify the most appropriate maintenance, rehabilitation, and reconstruction (MRR) strategy for specific project conditions.

With increasing traffic on roadways, motorists are becoming less tolerant of delays during pavement MRR activities. To minimize delays, state highway agencies use strategies involving various traffic management and construction practices aimed at accelerating construction, minimizing traffic disruption, reducing accident risk, and improving public acceptance. Recent research has emphasized the engineering aspects of MRR of rigid pavements, but less attention has been paid to cost-effectiveness, public acceptance, and accident risk. Therefore, there has been a need to develop a process that considers these factors in the evaluation of potential MRR alternatives and selection of the optimum strategy. NCHRP Project 10-50A was conducted to address this need.

An initial phase of the research was conducted under NCHRP Project 10-50, "Strategies for Rehabilitating Rigid Pavements Subjected to High-Traffic Volumes," by Nichols Consulting Engineers, Chtd., of Reno, Nevada. This research, completed in 1998, included a review of the state of practice relevant to MRR strategy selection and recommended a selection process driven by either pavement condition or traffic volume. In this process, traffic conditions become dominant factors when user delay costs overwhelm other factors. The process first determines and optimizes available temporal and spatial work windows based on traffic demands (e.g., time of day and number of open lanes) and then evaluates pavement design and materials with the goal of reducing total construction time and maximizing pavement life. Also, alternative contracting methods are considered as means for expediting construction and minimizing lane closure. Finally, life cycle cost analysis (LCCA) is used to compare alternative MRR strategies and identify the most appropriate strategy.

A second phase of research was conducted under NCHRP Project 10-50A, "Guidelines for Selecting Strategies for Rehabilitating Rigid Pavements Subjected to High-Traffic Volumes," by the Texas A&M Research Foundation. Because the selection of a specific MRR strategy is influenced by many factors, detailed guidelines were not developed. However, the research, completed in February 2002, evaluated different highway agency processes for pavement analysis and design and developed an integrated MRR selection process that considers both pavement-related aspects of the strategy (i.e., pavement condition and causes of distress) and non–pavement-related aspects (i.e., traffic management, construction, and life cycle cost). This digest provides a summary of the work performed in this research. The materials in this digest are extracted from the project's final report.

FINDINGS

The research included a literature review of MRR selection processes used by highway agencies, interviews of personnel from five state highway agencies, and development of a rational MRR selection process that considers both pavement-related and non–pavement-related aspects of MRR.

MRR Selection Processes and Practices

Review of the literature revealed that current MRR selection processes focus on identifying pavement condition and selecting MRR strategies suited for the remedy of prevailing deficiencies. These processes recognize the importance of traffic and construction issues, but provide minimal information on how to assess these issues. Management approaches suitable for the MRR of rigid pavements and insights in constructability and contracting issues have been identified, but have not been integrated into the MRR strategy selection process. These processes often rely on LCCA to assist in selecting the preferred MRR strategy.

Interviews conducted with personnel from five state highway agencies (Pennsylvania, New York, Texas, Minnesota, and Georgia Departments of Transportation) to document and assess current practices relevant to the MRR strategy selection process revealed that many highway agencies have formal and documented processes for MRR strategy selection. These processes generally focus on the assessment of pavement condition and the selection of relevant treatments and do not differentiate high traffic volumes from other traffic levels. Also, MRR strategy selection is often driven by available funds (i.e., the selected strategy must fit within budget constraints).

Development of an Integrated MRR Selection Process

Using the findings of the literature review and subsequent interviews with state highway agency personnel, the research developed an integrated process for selecting MRR strategies for rigid pavements subjected to high traffic volumes. The process considers the following four factors:

- Current pavement performance (structural and functional condition),
- Traffic management needs (traffic control costs, road user impacts, and public perceptions),
- Construction needs (constructability, contracting, environmental impact, technology, and schedule), and
- Life cycle costs (construction costs, user costs, future MRR costs, and salvage value).

The MRR strategy selection process consists of four steps:

- *Step 1: Identify Candidate Sections*—The purpose of this step is to identify location and details (e.g., length, number of lanes, and availability of structures within project boundaries) of projects in need of MRR. These projects will be identified through a review and analysis of relevant information found in pavement management and maintenance systems, field observations, and crash history with consideration to network programming and budget matters.

- *Step 2: Assess Pavement Condition*—The goal of this step is to determine the condition of pavement (both structural and functional) and drainage provisions. This goal will be accomplished by performing pavement condition surveys, evaluating drainage provisions, conducting laboratory and field tests, and analyzing survey and test data to identify the mechanisms associated with each distress or functional deficiency.

- *Step 3: Identify and Screen Potential Strategies*—The goal of this step is to identify potential treatments or combinations of treatments for dealing with the identified structural and functional deficiencies. This goal will be accomplished by identifying and evaluating possible treatments or combinations of treatments. This evaluation will consider related potential traffic and construction issues, preliminary cost estimates, potential risk, compatibility with agency policies and practices, impact on public perceptions, and other related factors. Through this evaluation, strategies considered inappropriate will be identified and eliminated from further consideration. Strategies worthy of further consideration will form a pool of feasible strategies that will be further evaluated for determining the preferred strategy.

- *Step 4: Evaluate Feasible Strategies*—The goal of this step is to thoroughly evaluate the feasible strategies identified in Step 3 to determine the preferred strategy (i.e., the treatment or combinations of treatments that are best suited for dealing with the prevailing pavement condition). This goal will be accomplished by considering non–pavement-related issues (e.g., traffic, construction, constructability, contracting method, and life cycle costs) associated with each strategy in greater detail and comparing the key characteristics of each feasible strategy. The strategy that optimizes the relationship among life cycle costs (including delay costs, community impacts, worker and motorist safety, constructability, and traffic management capabilities) will then emerge as the preferred MRR strategy.

CONCLUSIONS

State highway agencies have recognized the need to identify an integrated process for selecting MRR strategies for rigid pavements subjected to high traffic volumes. This digest presented the results of a study designed to address

this need and identified a rational process for making this selection. The process is based on available MRR selection models and applies to all levels of traffic volumes. It identifies the information necessary for making decisions regarding the most appropriate strategy for a specific project. Ideally, sufficient project funds should be made available to allow implementation of this strategy. The process can be used by highway agencies in conjunction with existing processes for MRR strategy selection to focus decision makers' attention on key traffic and construction issues that are critical to projects subjected to high traffic volumes.

FINAL REPORT

The agency's final report, titled "A Process for Selecting Strategies for Rehabilitation of Rigid Pavements," gives a detailed account of the project, findings, and conclusions. The report, which was distributed to NCHRP sponsors (i.e., state departments of transportation), is available as *NCHRP Web Document 45* at www.trb.org.