A SHRP 2 Renewal Project Brief

Pavements for Rapid Renewal: Get In, Get Out, Stay Out

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Advanced pavement technologies offer highway agencies better options for pavement rehabilitation. These rapid construction methods not only can produce long-lasting pavements, they can significantly minimize traffic congestion and reduce risks to road users and road builders. These advanced technologies have been used successfully in recent years by a relatively small number of transportation agencies.

The second Strategic Highway Research Program (SHRP 2) has developed tools that make it easier for road owners to use advanced pavement technologies and gain the benefits of rapid renewal. The tools, briefly described here, include model design specifications for modular pavement technology, guidelines for constructing composite pavements, a new design that uses part of the existing pavement "structure" in place, preservation guidelines for high-traffic-volume roadways, and a web-based decision support tool for selecting geotechnical solutions to stabilize the base of roadways. Road builders can use these tools to get in, get out, and stay out.

Published reports for SHRP 2 projects are available at www.TRB.org/SHRP2/publications.

Modular Pavement Technology

Over the last 10 years, several transportation agencies—including California DOT, Illinois Tollway Authority, New Jersey DOT, New York State DOT, and Utah DOT—have implemented precast concrete pavement (PCP) systems; and Delaware, Missouri, Michigan, and Hawaii have constructed demonstration projects. The production use of PCP technology in the United States is, however, of recent origin, and information on modular pavement practices and performance is not well documented. Lacking this information, many highway agencies and industry partners have not fully embraced the technology.

To develop the necessary information and guidelines to encourage the rapid and successful adoption of this technology, SHRP 2 initiated project R05 (Modular Pavement Technology). Modular pavement technologies can deliver rapid repair and rehabilitation that also result in durable, longer-lasting pavements. This project conducted a review of the available modular pavement technologies, principally PCP systems, and summarized applications to date. The products of this research include model design specifications, and guidelines for the installation and inspection of PCP systems.

PCP systems are used in highway corridors with high-volume traffic and where lane closures are a challenge. For production use, the PCP work is performed at night with short closures, typically from about 9 PM to about 5 AM. The production rate per lane closure is about 15 to 20 repair locations and about 30 to 40 continuously placed panels (about 400 to 600 ft lengthwise).

SHRP 2
STRATEGIC HIGHWAY RESEARCH PROGRAM
Accelerating solutions for highway safety, renewal, reliability, and capacity

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Figure 1: SHRP 2 narrow-mouth slot system installed by Illinois Tollway Authority

Figure 2: Close-up of a finished exposed aggregate concrete texture that was constructed in Germany

The Illinois Tollway Authority worked on the initial pilot for one of the technologies developed in this project: narrow-mouth surface slot technology. Because of its success, the Tollway is already implementing the product in a 700-panel repair project. This will be one of the largest full-depth intermittent repair projects using PCP. The Tollway estimates savings of $500 per panel by using PCP and the narrow-mouth surface slot technology instead of conventional repair methods.

Availability: The final report for this project will be available late 2012.

Composite Pavements

Composite pavements have been proven in Europe and in the United States to have long service life with excellent surface characteristics, structural capacity, and rapid renewal when needed. Composite pavements also reflect the current direction of many highway agencies to build economical, sustainable pavement structures that use recycled materials and locally available materials.

However, while many transportation agencies may have performance data and models for conventional pavement systems, the behavior of new composite pavements is not well understood. Models for the performance of these hybrid systems are needed for design, performance prediction, and life-cycle cost analysis. Guidance on specifications, construction techniques, and quality management procedures are also needed.

In SHRP 2 Project R21 (Composite Pavement Systems), the design and construction of new composite pavement systems for all levels of highway and urban streets were investigated. This included determining the behavior, material properties, and performance for each type of composite pavement under many climate and traffic conditions. The project evaluated, improved, and further validated applicable structural, climatic, material, and performance prediction models, as well as design algorithms. To facilitate implementation, the project developed practical recommendations for construction specifications and techniques, life-cycle costing, and training materials. The recommendations focus on two types of composite pavement design strategies:

1. High-quality, relatively thin hot-mixed asphalt surfacing over a new portland cement concrete (PCC) structural layer; and
2. High-quality, relatively thin PCC surfacing over a thicker, structural PCC layer.

In May 2008, a survey of in-service composite pavement sites in the Netherlands, Germany, and Austria was conducted to assess the design, construction, and performance of composite pavement systems. The results of this survey were published as First Fruits Report S2-R21-RW-1 (*2008 Survey of European Composite Pavements*). The survey focused on the field performance of two types of composite pavements: asphalt over concrete; and two-lift, wet-on-wet concrete. It found that both types of composite pavements performed well under heavy traffic loading during the 10 to 20 years that they had been in service. Observations from this report were used to develop the field design, construction, testing, and evaluation plan for test pavement sections that were constructed in the United States.

Availability: The First Fruits report is available now as a web-only document. The final report will be published in 2013 as two volumes that will share a web-only appendix.

Achieving Long Life with In-Place Pavements

Renewal can be greatly accelerated and costs reduced when existing pavement can be incorporated into rapid renewal projects without having to be removed from the project site. To achieve long life under conditions of service likely not considered in the original design, however, requires the appropriate solution for specific circumstances. Project owners would benefit from comprehensive guidance and reliable procedures to identify when an existing pavement can successfully be used in place and how to incorporate it into the new pavement structure.

Project R23 (Using Existing Pavement in Place and Achieving Long Life) developed procedures that reliably identify when existing pavements can be used in place and the methods necessary to incorporate the original material into the new pavement structure while achieving long life (50 years or more). This project created decision matrices, design tables, and resource documents that provide valuable information regarding all aspects of a renewal project from project assessment, renewal selection, design, specifications, and construction.

This project provides guidelines for selecting, designing, and constructing long-life pavements using existing pavement structure. The guidance has been incorporated into a web-based pavement design scoping tool that is meant to complement a transportation agency's normal design and pavement type selection processes. The final report and the supporting documentation will encourage longer lasting designs; provide realistic, easy-to-use pavement thickness scoping assessments; and guide users through the data-gathering process needed to for input in designing and constructing a long-life pavement using the existing pavement structure.

Figure 3: Photo of 35-year-old unbonded PCC overlay on I-90 in Washington

Availability: The final report will be published in early 2013; the report will be available electronically and in hardcopy with a web-only appendix. The web-based tool will be available in early 2013 as well.

Preserving High-Traffic-Volume Roadways

For several years, pavement preservation has been an important strategy to extend the life of roadways. As transportation agencies grapple with decreased capital budgets, pavement preservation will continue to be an important strategy. Relatively small investments for preservation activities, if properly timed and applied, can significantly increase infrastructure life. Several transportation agencies apply preservation strategies on lower-volume roadways; however, the application of these strategies on high-volume roadways has lagged behind.

The application of preservation strategies to high-traffic-volume roadways presents a complicated set of challenges. Many of the products and approaches that are acceptable on lower-traffic-volume roadways are not acceptable or workable on high-traffic-volume roadways. Often, the use of a particular product or application has too great an impact on traffic, or the treatment is not successful under high-traffic conditions. To address these challenges, SHRP 2 developed guidance for more effectively matching the pavement condition and other considerations with suitable treatments for high-traffic-volume roadways.

SHRP 2 Report S2-R26-RR-1 (*Preservation Approaches for High-Traffic-Volume Roadways*) documents the state of the practice for preservation treatment on asphalt and concrete pavements. Although the focus of the project was on treatments suitable for application on high-volume roadways, this report also discusses current practices for low-volume roadways. The information presented is derived from a detailed survey of transportation agencies and a review of national and international literature. In addition, the report provides a general framework for how best practices are identified. Finally, general guidelines were developed on the application of preservation treatments on high-volume roadways. Presented as a separate document, SHRP 2 Report S2-R26-RR-2 (*Guidelines for the Preservation of High-Traffic-Volume Roadways*) considers traffic volume, pavement condition, work-zone requirements, environmental conditions, and expected performance.

Availability: Both reports are available as electronic copies on the SHRP 2 website and in hardcopy through the TRB bookstore.

Geotechnical Solutions

Pavements need a stable base. Because soils may be unstable, geoconstruction technologies are sometimes used to stabilize roadways. Many geoconstruction technologies, however, face both technical and nontechnical obstacles that prevent broader and effective application in transportation infrastructure projects.

SHRP 2 Project R02 (Geotechnical Solutions for Soil Improvement, Rapid Embankment Construction, and Stabilization of the Pavement Working Platform) identified and assessed methods to advance the use of these geoconstruction technologies. Several of the identified technologies, although underused in current practice, offer significant potential benefits. Transportation agencies and other infrastructure industries, such as energy development, can use the products of this research to confidently select and use appropriate geotech solutions. The SHRP 2 products include design procedures and guidance; model specifications for geotechnical materials and systems; and Geotechnical Solutions for Transportation Infrastructure, a web-based information and guidance system.

Geotechnical Solutions for Transportation Infrastructure was developed to access critical information on geoconstruction technologies and to provide a tool that can help practitioners decide which technologies are applicable to site-specific conditions. The system is based on three project elements: (1) construction of new embankments and roadways over unstable soils, (2) widening and expansion of existing roadways and embankments, and (3) stabilization of the working platform. Geotechnical Solutions for Transportation Infrastructure includes 46 ground improvement and geoconstruction technologies and processes applicable to the three elements. It contains a technology catalog and a technology selection assistance tool, as well as sections on geotechnical design philosophy and a geotechnical glossary. The catalog includes eight end-user products for each of the geoconstruction technologies: Technology Fact Sheets, Photographs, Case Histories, Design Procedures, Quality Control/Quality Assurance Procedures, Cost Estimating Tools, Specification Guidance, and Bibliography. The primary value of this system is that it collects, synthesizes, integrates, and organizes a vast amount of important information about geotechnical solutions into a system that makes the information readily accessible to state transportation agency personnel.

Availability: The final report will be available in mid-2013. Geotechnical Solutions for Transportation Infrastructure will be available in late 2012.

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