Paving (or Re-Paving) America's Roads

Innovative SHRP2 Tools for the Road Ahead

Photo courtesy Willis and Timm 2007

PAVEMENT SOLUTIONS

Killer potholes. Long stretches of rough pavements. Delayed or deferred maintenance. Delamination, rutting, stripping. These are all daily challenges facing today's transportation agencies.

From maintaining a state of good repair to identifying and using new technologies to reconstruct existing roadways, pavement engineers, maintenance and materials staff, designers, and others are looking to maximize their limited resources.

Only 35 percent of U.S. roads are classified as being in good condition and states are reporting backlogs in maintenance that are estimated to exceed $392 billion nationally.[1] To provide faster, minimally disruptive, and longer-lasting improvements, a number of new processes, technologies, and innovations that specifically address pavements are now available through the second Strategic Highway Research Program (SHRP2).

Nine pavement solutions to help owners get the most out of their investments

Every transportation agency seeks better ways to evaluate the condition of their assets, extend the life of their existing pavements, and construct new pavements that will last longer and be more cost-effective over time.

Here are **nine solutions** to help your agency save lives, money, and time in your pavement selection, design, construction, and testing programs. Several of these products can be used in more than one category to maximize benefits.

Photos courtesy: James Bryant, TRB; FHWA

> *"Transportation agencies across the country are trying to keep up with the challenges of maintaining our aging transportation infrastructure, much of which was built more than 50 years ago. By using the pavement innovations developed through the SHRP2 program, public agencies have the opportunity to maximize the effective management of assets and utilize cost-effective strategies to keep in a state of good repair."*
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> —Malcolm Dougherty, Director, California Department of Transportation, Chair, AASHTO Subcommittee on Construction

SHRP2 SOLUTIONS TOOLS FOR THE ROAD AHEAD

U.S. Department of Transportation
Federal Highway Administration

AASHTO

Photo courtesy MnDOT

Solutions to Preserve Our Existing Infrastructure in a State of Good Repair

1 Preserving High-Traffic-Volume Roadways

Guidelines for selecting treatments that will preserve and maintain the nation's busiest highways and interstates.

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Stretching the time between major rehabilitation projects can save transportation agencies money, reduce congestion, and improve safety. By using many conventional pavement preservation techniques—and some new ones as well—high-traffic-volume roadways can be maintained to extend pavement life while avoiding disruptive and costly major rehabilitation and reconstruction projects.

Guidelines for the Preservation of High-Traffic-Volume Roadways (R26) is a comprehensive resource that includes a selection process and matrices that allow treatment options to be quickly identified by various categories, such as rural or urban roads, climate zones, work zone duration restrictions, traffic volumes, and relative costs. Specifics on more than 20 cost-effective treatments are available along with a new data collection guide.

Transportation departments in 15 states and the **District of Columbia** are currently implementing options for extending the life of heavily traveled roads. For helpful tools and information, visit: **http://shrp2.transportation.org/Pages/R26_HighTrafficVolRoadways.aspx**.

2 Providing Longer Pavement Life at Lower Cost

Proven models and procedures to design and construct low-cost, long-life pavement systems.

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Building pavements that can last 30 to 50 years would significantly save money for transportation agencies. To achieve this goal, existing pavements can be used on rehabilitation projects to reduce costs, speed project completion, and save resources. To help decide where and under what conditions to use this approach, highway agencies can now use an interactive web-based scoping tool, ***rePave***, to support the decision process for selecting any given pavement rehabilitation technique specific to the site conditions and desired outcome.

Washington State DOT estimates it achieved a 30 percent cost savings and a 50 percent reduction in user delay using the guidance in *rePave* compared to removing the existing pavement and constructing a new pavement.


Photo courtesy WSDOT

As part of ***Pavement Renewal Solutions*** (R23), the website offers five specific steps for selecting an appropriate rehabilitation treatment. Included are guidelines for data collection, testing, and other information needed for scoping, pavement design and construction specifications, as well as information on asphalt, concrete, and innovative materials.

The ***Pavement Renewal Solutions*** tools are being used in **Arizona, California, Kentucky, Louisiana, Minnesota, New Jersey, New York, North Dakota,** and **Utah**. For helpful tools and information, visit: **http://shrp2.transportation.org/pages/PavementRenewalSolutions.aspx**.

Solutions for Longer-Life Pavements

3 Using Composite Pavement Systems for Longer-Lasting Pavements

Practical recommendations for construction specifications and techniques, life-cycle costs, quality management procedures, and training materials.

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Longer-lasting composite pavements provide excellent surface characteristics (e.g., low noise, smoothness, and high friction), structural capacity, and more rapid renewal. They also enable a transportation agency to use recycled and lower-cost materials in the supporting layer of Portland Cement Concrete (PCC), as well as to make use of locally available materials.

New Composite Pavement Systems (R21) offers detailed performance data on existing composite pavement systems and step-by-step guidance on two types—Hot-Mix Asphalt (HMA) over Portland Cement Concrete (PCC), and PCC over PCC (constructed wet on wet). Training tools and case studies address design and construction issues and provide practical recommendations for construction specifications and techniques, life-cycle costs, and quality management.

States currently implementing these products through the FHWA/AASHTO Implementation Assistance Program (IAP) include **Tennessee** and **Texas**.

Solutions for Better Construction

4 Using Precast Concrete Pavement for Rapid Repair

Tools to match options to projects; specifications for design, fabrication, and installation of precast concrete pavement systems.

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Reconstructing critical roadways can wreak havoc on the traveling public. The resulting work zones generate congestion, which is costly and increases the exposure of workers and travelers to safety risks. Using precast concrete pavement (PCP) systems can speed reconstruction because they can be installed quickly, reopening roadway sections sooner while minimizing traffic disruption.

To enable transportation agencies to use best practices to enhance performance from PCP systems, SHRP2 developed the ***Precast Concrete Pavement*** product (R05), which includes guidelines and model specifications to help agencies effectively select projects for PCP, as well as design, fabricate, and install long-life jointed and prestressed PCP systems. Many states are using this product with success to replace shorter sections of existing pavements more quickly with reduced impacts.

States using this solution through the IAP are Hawaii, Illinois, Kansas, Texas, and Wisconsin. Direct technical assistance has been provided to a number of states that have made efforts to demonstrate and implement PCP technology.

5 Accelerating Innovation with Performance Specifications

Specifications to reduce claims and inspection costs and accelerate construction of aging infrastructure.

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Developing performance goals for rapid construction projects that focus on desired results can enable the construction industry to be more innovative in delivering projects faster, with minimum disruption and greater durability. Claims and inspection costs can be reduced and resources can be used more efficiently.

By using the suite of pavement material specifications included in ***Performance Specifications for Rapid Renewal*** (R07), transportation agencies can reduce costly construction oversight and change orders, and provide greater flexibility for contractors, less staff oversight by owners, a more efficient use of each contractor's individual strengths, and more reliable facility performance. The specifications include options for both rigid and flexible pavements, as well as options for various project delivery methods. These specifications address project selection, specification development, procurement, and changes that are necessary to achieve desired performance. Also included is a "how to" section for specification writers.

Photos courtesy: Iowa DOT, MDOT, VDOT

States serving as lead adopters include **Alabama, Maine, Missouri, Pennsylvania,** and **Vermont**, with field testing occurring in **Louisiana** and **Virginia**. For helpful tools and information, visit: **http://shrp2.transportation.org/Pages/R07_PerformanceSpecificationsforRapidRenewal.aspx**.

6 Improving PCC Pavement Surface Smoothness during Construction

Technologies to identify surface irregularities that can impact concrete pavement smoothness and provide opportunity for corrections in real time.

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Achieving the kind of smooth concrete pavements valued by motorists can best be addressed when surface irregularities are corrected during construction, while the concrete is in a plastic state. Smooth concrete roads are more durable and lead to lower maintenance and vehicle operating costs. Access to real-time information on pavement smoothness also helps paving contractors with quality control and enables them to meet the ride quality requirements of transportation agencies.

Through ***Tools to Improve PCC Pavement Smoothness during Construction*** (R06E), information and tools are available to evaluate pavement smoothness in real-time; complement existing quality control; and reduce must-grinds to reduce project delays and claims. Lessons learned from pilot projects conducted during the research are included as well as model specifications.

States implementing this technology include **Alabama, Idaho, Indiana, Nebraska, Ohio,** and **Pennsylvania**. Technical assistance is available to support additional agencies if requested.

Photo courtesy MnDOT


Photo courtesy MnDOT

"Pavement preservation is not about filling potholes, it's about preventing them. A pavement preservation strategy is crucial to keeping good highways in good condition. Through SHRP2's pavement renewal products, we can examine new products and techniques that can help everyone work smarter, faster, and safer."

—Larry Galehouse, Director of the National Center for Pavement Preservation

Solutions for Better Testing and Forensics

7 Identifying Unseen Asphalt Pavement Delamination

Tools to detect subsurface delamination in asphalt pavements.

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Delamination between asphalt layers results in initial cracking and surface tearing. Caused primarily due to layer debonding or stripping, delamination is often undetectable by visual inspection, particularly in the early stages. Nondestructive testing methods that properly identify potential asphalt pavement debonding issues help to reduce or limit the need for test cores; potentially provide better inventory for an agency's maintenance program; and extend pavement life by earlier identification of delamination.

Through ***Advanced Methods to Identify Pavement Delamination*** (R06D), three technologies have been identified that could make significant advances in detecting project-level pavement delamination and debonding before the deficiencies cause visual pavement distress. The technologies are Ground-Penetrating Radar (GPR), and Impact Echo (IE) technology, combined with the Seismic Analysis of Surface Waves (SASW) system.

States using these technologies as part of the FHWA/AASHTO Implementation Assistance Program are **California, Florida, Minnesota, New Mexico,** and **Texas**.

8 Enhancing Quality Control on Asphalt Pavements

Nondestructive techniques for detecting defect areas in asphalt pavements during construction.

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Real-time, high-speed, nondestructive testing of asphalt pavements during construction can greatly improve quality, durability, and performance, stretching highway dollars and extending service life. ***Rapid Technologies to Enhance Quality Control on Asphalt Pavements*** (R06C) offers two products aimed at providing real-time testing of potentially 100 percent of the pavement area, providing much more inspection coverage than existing methods in hot- or warm-mix construction.

The products tackle two of the most challenging construction quality indicators—thermal segregation measured using the infrared (IR) sensor bar system, and density measured using the Ground Penetrating Radar (GPR) system. An equipment purchase program, showcase, and targeted workshops will provide selected states with hands-on experience using these technologies under varying conditions. Testing protocols and guide specifications are also available.

States using IR technologies are Alabama, Alaska, Illinois, Maine, Missouri, New Jersey, North Carolina, Virginia, and West Virginia. The Federal Lands Highway Division is also using IR. States using GPR are **Nebraska** and **Maine**. For helpful tools and information, visit: **http://shrp2.transportation.org/Pages/R06C_RapidTechnologiestoEnhanceQualityControl.aspx**.

9 Saving Time by Testing Construction Materials On Site

Practical recommendations for construction specifications and techniques, life-cycle costs, quality management procedures, and training materials.

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Although essential to quality control, verifying that construction materials meet specifications can be both time-consuming and expensive. Portability to conduct quality analysis in the field is critical to determining whether materials are working on site. Identifying unique signatures found on many common construction materials used in transportation projects is also important. By matching their signatures to those on file using new portable equipment, construction staff can immediately confirm that materials meet contract specifications.

Techniques to Fingerprint Construction Materials (R06B) offers two market-ready technologies—X-ray Fluorescent Spectroscopy (XRF) and Fourier-Transform Infrared Spectroscopy (FTIR)—that have been identified in field trials with potential success. These technologies identify different and very specific materials using portable equipment; for example, asphalt binders, polymers, epoxies, cement, emulsions, structural steel, aggregate minerals, paints, and organic materials.

Through the FHWA/AASHTO Implementation Assistance Program (IAP), **Alabama, Maine,** and **Tennessee** will assess these technologies, using different methodologies on different materials under different field experiences.

What's Ahead?

Showcases, webinars, peer exchanges, and workshops are available for interested states and agencies to learn more about these products.

For information on any of these products, contact Pam Hutton at AASHTO, phutton@aashto.org; or Ken Jacoby at FHWA, Ken.Jacoby@dot.gov.

Photo courtesy FHWA

[1]*Alan E. Pisarski and Arlee T. Reno. 2015. 2015 AASHTO Bottom Line Report, Executive Version: Transportation Bottom Line. Available at http://bottomline.transportation.org/Documents/Bottom%20Line%202015%20Full%20FINAL%20w%20APTA.pdf. Prepared for the American Association of State Highway and Transportation Officials.*