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Welcome from WisDOT's Daniel Yeh

I am pleased to present to you the WHRP E-News, a quarterly update from the Wisconsin Highway Research Program.

Last October, I accepted the position of Chief for WisDOT's Research & Communication Services Section. I have 18 years of experience with WisDOT, first in our planning division and then later in our Executive Offices. My previous assignments have included multimodal initiatives (including high-speed rail), economic development, minority business support and outreach coordination on high-profile projects including the Marquette Interchange and the I-94 North-South Corridor. I hope that I can use the range of contacts and experiences from my past work to broaden the impact of WHRP and the department's other research programs.

I am still learning about transportation research and am becoming more acquainted with programs and stakeholders. However, I would like to share some initial observations that I have about WHRP:

- First, WHRP is a well-run program, thanks to Dr. Hussain Bahia and Andrew Hanz at UW-Madison and Peg Lafky at WisDOT. I am profoundly grateful for their excellent work organizing the program, projects, procedures and budgets and making my personal transition to WHRP very smooth.
- Second, WHRP is a much-needed program. Motorists and businesses in this state are becoming more aware of the need for safe and reliable infrastructure, and WHRP can play a major role in finding better products and methods to build and maintain our highways and bridges.
- Third, WHRP will be challenged by the current conditions in state government. WisDOT and public agencies face staff constraints even as new project dollars flow in from the American Recovery and Reinvestment Act of 2009. While the agency needs to focus on delivering projects and creating jobs in the present, it is also important to support research programs that will keep us on track for the future.

Thank you for your involvement with WHRP. I look forward to working with you and continuing our partnerships.

Daniel Yeh, Section Chief
WisDOT Research & Communication Services
Chair, WHRP Steering Committee
daniel.yeh@dot.wi.gov
(608) 267-6977



Daniel Yeh, WisDOT Research & Communication Services Section Chief

Program Update

Steering Committee Approves Investigators for FY 2010 Research

Last year, WHRP piloted a new research proposal evaluation process (described in this [article](#) in the June 2008 WHRP E-News). Used on a trial basis for Fiscal Year 2009 proposals, the process incorporates state of Wisconsin vendor selection practices. With some changes and improvements, the new scoring and selection process was fully implemented for the upcoming FY 2010 research program.

During its quarterly meeting April 17 in Madison, the Steering Committee approved the Technical Oversight Committees' selection of the following FY 2010 projects and investigators:

Flexible Pavements

- "Effect of Recovered Binders from Recycled Shingles and Increased RAP Percentages in Resultant Binder PG," Ramon Bonaquist, Advanced Asphalt Technologies
- "HMA Fatigue and Low Temperature Properties to Support MEPDG," Ramon Bonaquist, Advanced Asphalt Technologies
- Amendment to 0092-08-09, "Pre-Overlay Repair of Existing Concrete and Asphalt Pavements—Phase II," Haifang Wen, Washington State University, and Hani Titi, UW–Milwaukee

Rigid Pavements

- "Laboratory Study of Concrete Properties to Support Implementation of the New AASHTO Mechanistic-Empirical Pavement Design Guide," Steven Cramer and Marc Anderson, UW–Madison
- Pooled Fund TPF-5(159), "Technology Transfer Concrete Consortium," Carol Culver, Iowa DOT (lead agency), Tom Cackler, Iowa State University
- Pooled Fund TPF-5(205), "Implementation of Concrete Pavement Mixture Design and Analysis (MDA) Track of Concrete Pavement Road Map," Carol Culver, Iowa DOT (lead agency)
- Pooled Fund TPF-5(179), "Evaluation of Test Methods for Permeability (Transport) and Development of Performance Guidelines for Durability," Tommy Nantung, Indiana DOT (lead agency), Jason Weis, NEXTRANS, Purdue University

Structures

- "Finite Element Analysis of Deep Wide-Flanged Prestressed Girders," Mike Oliva, UW–Madison
- "Development of a Bridge Construction Live Load Analysis Guide," Michael Garlich, Collins Engineers
- Amendment to 0092-04-15, "Bridge Integrated Analysis and Case Studies," Al Ghorbanpoor, UW–Milwaukee
- Continuation of 0092-09-07, "Fatigue Risks in Sign Support Structures—Phase III," Chris Foley, Marquette University

Geotechnics

- "Investigation of Testing Methods to Determine Long Term Aggregate Durability of Various Types of Wisconsin Aggregate Sources," Habib Tabatabai and Hani Titi, UW–Milwaukee
- "Comparison of LRFD and LFD Cast-in-Place Pile Design and Construction Methods," Jim Long, University of Illinois at Urbana-Champaign
- "Cone Penetrometer Comparison Testing," James Schneider, UW–Madison
- Pooled Fund TPF-5(128), "Intelligent Compaction," Victor Gallivan, FHWA (lead agency), George Chang, The Transtec Group

For more information, contact WHRP Program Manager [Andrew Hanz](#).



The Steering Committee selected investigators for a new program year at its April meeting.

TOCs Appoint Co-chairs

In addition to approving the selection of investigators at its April meeting, the WHRP Steering Committee approved the appointment of co-chairs for three of the TOCs. The newly appointed co-chairs will succeed the current chairs when their terms expire. This move to a co-chair system will ensure continuity in each TOC as leadership passes from chair to co-chair.

The new TOC co-chairs are:

- **Flexible Pavements**, Judie Ryan, WisDOT Bureau of Technical Services
- **Rigid Pavements**, Deb Bischoff, WisDOT Bureau of Technical Services
- **Geotechnics**, Jeff Horsfall, WisDOT Bureau of Technical Services

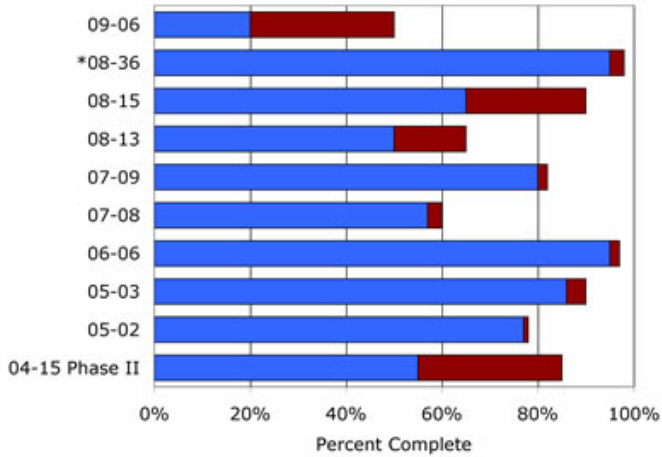
Leadership of the Structures TOC recently passed from Scot Becker to Travis McDaniel, so the committee has not appointed a co-chair at this time. WHRP thanks Scot for his years of service as Structures TOC Chair and looks forward to his continued participation on the committee.

All Projects at a Glance

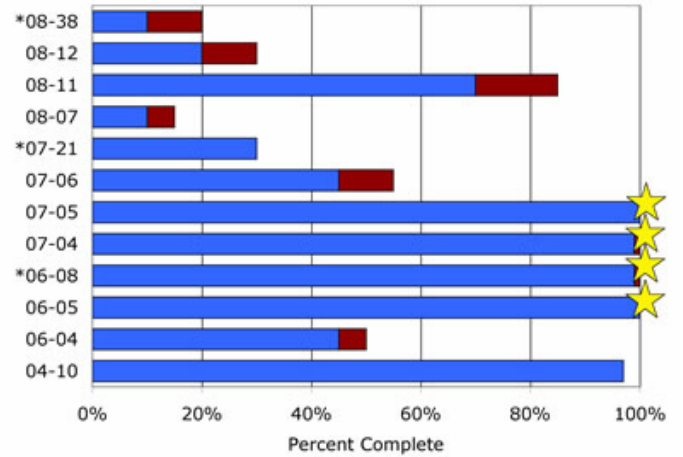
As of March 31, 2009, there were 29 active WHRP projects. Six projects were completed during the last three months.

■ Percent Complete as of 12/31/2008 ■ Percent Complete as of 3/31/2009 ★ Implementation Activity

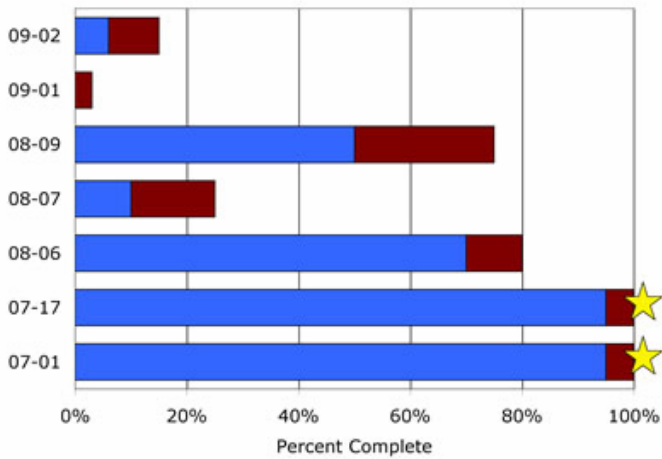
Summary of In-Progress Projects 2009 Q1: Structures TOC



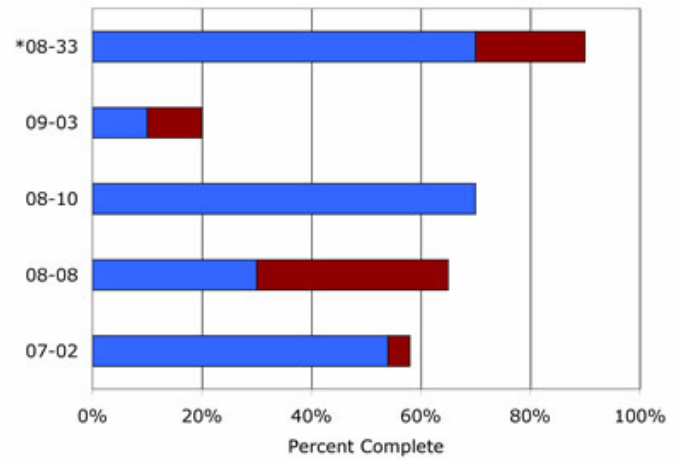
Summary of In-Progress Projects 2009 Q1: Geotech TOC



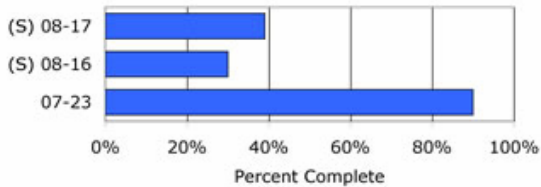
Summary of In-Progress Projects 2009 Q1: Flex TOC



Summary of In-Progress Projects 2009 Q1: Rigid TOC



Summary of In-Progress Projects 2009 Q1: Data Integration TOC



(S) Suspended Activity.

Research in Focus

WHRP Leads the Way on Subgrade Stabilization

By initiating research projects and taking part in regional collaborative efforts, WHRP is playing a leadership role in developing the science of stabilizing soil and designing the layers that underlie pavements.

Through a number of WHRP research efforts, investigators have rigorously tested, quantified and analyzed a range of stabilization methods and materials available across Wisconsin. Based on this work, researchers have developed an equivalency table—a design tool to help highway engineers build subgrade layers using any of a variety of materials while ensuring equivalent performance. WisDOT is evaluating the new equivalency table for possible inclusion in its Facilities Development Manual.

An [article](#) in the November 2008 WHRP E-News described several related implementation projects led by UW–Madison professor Tuncer Edil. As additional stabilization implementation work wraps up in Wisconsin, WHRP is preparing a video Research Brief that will highlight the importance of this work and discuss the implications for future design specifications. The video will feature the perspectives of investigators and WisDOT staff. Look for an e-mail announcement from WHRP in the weeks ahead.

In addition to these research efforts, WHRP hosted a workshop on soil stabilization through the North Central Pavement Research Partnership pooled fund study to learn about new and best practices in the Midwest (see the [article](#) in the November 2008 WHRP E-News). The proceedings from this meeting have been published on the workshop [Web page](#). As a follow-up to the workshop, WHRP also conducted a literature search on soil stabilization techniques. The findings include citations and further information on 51 research studies on this topic.

For more details on WHRP's stabilization research efforts, contact [Bob Arndorfer](#), chair of the Geotechnics TOC, at (608) 246-7940.



Use of foundry slag is one of many subgrade improvement options in Wisconsin.

Reliability-Based Inspection Cycles for Sign Support Structures

0092-08-14, Fatigue Risks in the Connections of Sign Support Structures: Phase I

Wisconsin has many sign support structures in service that were designed before 2001, when fatigue provisions became part of AASHTO's design specifications. WisDOT would like to develop statistically reliable estimates of when these older sign support structures are likely to begin to show signs of fatigue-induced cracking. The department will then set appropriately timed, short-interval inspection cycles to identify at-risk support structures prior to failure.

To understand performance and set inspection intervals that mitigate the risk of fatigue failure, professor Christopher Foley and a team of Marquette University researchers completed the initial phase of a three-phase WHRP research study to assess fatigue-induced fracture risk in WisDOT's sign support structures.

Investigators gathered and synthesized fatigue-testing data, looking for connection details similar to those found on Wisconsin sign support structures. Historical wind speed and direction data for eight Wisconsin cities were analyzed to assess stress and strains caused by wind and identify optimal locations for instrumentation of signs in the field.

Next, researchers will conduct lab tests to strengthen the statistical models used to predict fatigue life and determine the effectiveness of retrofit measures. Data from field instrumentation will assess the effects of sustained winds on sign structures and will be used to validate the results of a probability model for average wind speed distribution.

The project's final phase, expected to conclude by fall 2011, will produce a handbook of reliable retrofit mitigation strategies and recommended inspection cycle frequencies.

For details, see the WHRP study's [project page](#) or contact [Travis McDaniel](#), chair of the Structures TOC, at (608) 266-5097.



Researchers are assessing the fatigue-induced fracture risk of sign support structures like this one off I-94 in Milwaukee.

Regional and National Collaboration

Low-Temperature Cracking Pooled Fund, Phase II

A variety of WHRP participants were involved in the first phase of the “Investigation of Low Temperature Cracking in Asphalt Pavement” pooled fund study. WisDOT contributed funding to the study, Flexible Pavements TOC Chair Len Makowski served on the technical advisory panel, and WHRP researchers from UW–Madison and Iowa State University were among the co-authors for the study’s [final report](#).

Pooled fund lead state Minnesota is now proposing a follow-up Phase II for this project, and WisDOT is again positioned to co-sponsor the research. As described in further detail on this [summary page](#), the work plan for Phase II would include selecting materials and mix designs for the construction of two pavement test sections at MnROAD, Minnesota’s cold weather road research facility.

These test sections would be monitored over time for rutting, distress and ride quality, with special laboratory tests and monitoring to analyze fracture mechanics of asphalt binders and mixtures based on findings from the first phase of the pooled fund. Through this research, participants hope to better understand low-temperature pavement cracking and to validate the models developed in the Phase I study and in the Mechanistic-Empirical Pavement Design Guide.

For more information, contact Flexible Pavements TOC Chair [Len Makowski](#).



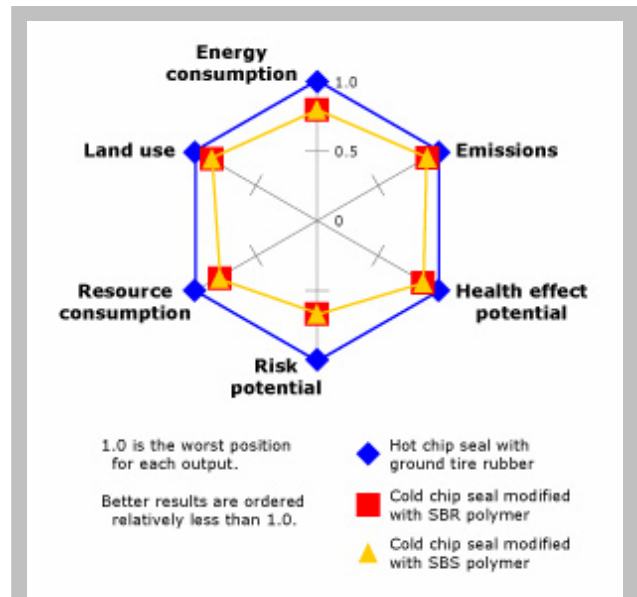
Phase II of this pooled fund would continue important research on asphalt pavement cracking caused by low-temperature loading.

Modified Asphalt Research Center—MARC

The research team at UW–Madison’s [Modified Asphalt Research Center](#) released a white paper addressing the potential for asphalt pavements to become a sustainable transportation infrastructure solution. Authored by Timothy Miller and professor Hussain Bahia, the paper “[Sustainable Asphalt Pavements: Technologies, Knowledge Gaps and Opportunities](#)” addresses challenges in defining and measuring asphalt pavement sustainability; highlights available tools and models; and discusses next steps to further develop knowledge for the asphalt paving industry in the areas of energy consumption, emissions and environmental impacts.

One of the tools that MARC is using is BASF’s eco-efficiency model. In this approach, a spider graph (shown at right) is used to compare different technologies in six different aspects of sustainability. MARC projects address several of these areas:

- **Energy consumption.** MARC is conducting research on reduced-energy asphalt mixtures, such as warm-mix asphalt and asphalt emulsion technologies.
- **Resource consumption.** MARC research is helping define the contribution of recycled asphalt pavement to pavement performance; the goal is optimizing RAP use and minimizing consumption of virgin resources.
- **Risk potential.** Increased pavement life helps lower investment risk. By characterizing asphalt material properties, MARC research seeks to improve pavement performance and extend service life.
- **Emissions.** To fully determine the benefits of using reduced-temperature asphalts, MARC is studying the emissions that result from heating asphalt materials.



BASF’s eco-efficiency spider graph compares six different factors related to sustainability. MARC is conducting research across these areas. (Image adapted from BASF)

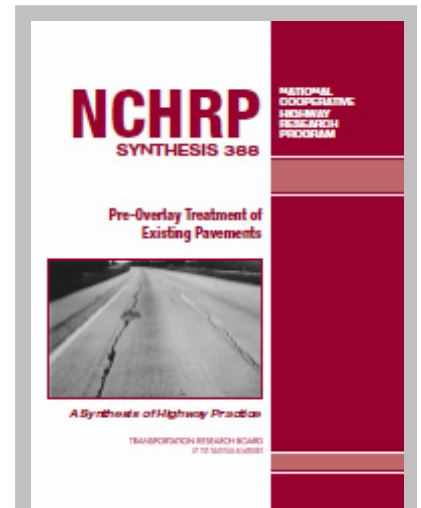
MARC is currently seeking input and feedback on this white paper from the asphalt community.

For more information about these or other MARC research projects, contact [Hussain Bahia](#) or [Carl Johnson](#).

TRB Publications Related to WHRP Research

The Transportation Research Board typically publishes a few dozen reports each month on topics ranging across all areas of transportation. WHRP has identified a select list of TRB publications from the past three months, primarily from the National Cooperative Highway Research Program, related to WHRP research areas. This list includes:

- [Preserving and Maximizing the Utility of the Pavement Performance Database](#), TRB publication
- [Self-Consolidating Concrete for Precast, Prestressed Concrete Bridge Elements](#), NCHRP Report #628
- [An Experimental Plan for Validation of an Endurance Limit for HMA Pavements](#), NCHRP Web-Only Document #134
- [Measuring Tire-Pavement Noise at the Source](#), NCHRP Report #630
- [Protocols for Collecting and Using Traffic Data in Bridge Design](#), NCHRP Web-Only Document #135
- [Pre-Overlay Treatment of Existing Pavements](#), NCHRP Synthesis Report #388



NCHRP Synthesis Report 388, *Pre-Overlay Treatment of Existing Pavements*, is one of several recent TRB publications related to WHRP research.

Outreach

WCPA's Annual Concrete Pavement Workshop

The Wisconsin Concrete Pavement Association hosted its [Annual Concrete Pavement Workshop](#) February 11 and 12 in Appleton. Several WHRP members and WisDOT staff participated in the event. WisDOT Statewide Bureaus Operations Director Rory Rhinesmith gave an opening address titled "Transportation in Wisconsin."

During the workshop's WisDOT update, a number of WisDOT staff members gave presentations:

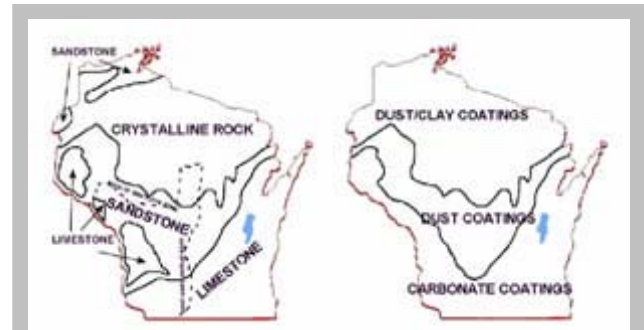
- "Concrete Pavement Repair Details," by Deb Bischoff
- "Concrete Barriers," by Erik Emerson
- "Implementation of MEPDG," by Laura Fenley
- "Quality Management Specification," by Wayne Chase
- "Colored Concrete Specifications," by Jim Parry

Additional presentations during the workshop by WHRP members and WisDOT staff included:

- "Jointing of Concrete Pavements," by WCPA's Kevin McMullen
- "Cement Technologies: Finding the Right Combination," by Lafarge North America's Andrea Breen
- "MEPDG Software," by WisDOT's Laura Fenley

Two WHRP researchers also presented at this workshop: UW–Madison's Steve Cramer and Michigan Tech's Larry Sutter. Cramer gave a presentation on WHRP research addressing the effect of aggregate quality on concrete strength and durability.

For more on WCPA or this conference, contact [Kevin McMullen](#).



Ongoing WHRP research by workshop presenter Steve Cramer includes a geographic survey of aggregate and coating types across Wisconsin.

Asphalt Binder Expert Task Group

WHRP Technical Director Hussain Bahia participated in a meeting of FHWA's Asphalt Binder Expert Task Group in Irvine, Calif., on February 24 and 25. Key among the wide variety of topics discussed were:

Proposed grading for modified PG binders. The Multiple Stress Creep and Recovery test is proposed as the basis for a new grading system for polymer-modified binders. The MSCR results include two new parameters: nonrecoverable creep compliance and percent recovery. The major change in grading is the replacement of high grades, such as PG 70, PG 76 and PG 82, with the climatic grade plus a letter designating the traffic level.

A new binder fatigue test. A plan was presented for testing some 30 Long-Term Pavement Performance program binders with known fatigue performance. The task group met in April to discuss test procedures and a new binder fatigue parameter.

Challenges of polyphosphoric acid as a binder modifier. A team from FHWA gave a presentation on PPA, addressing the possibility of loss of PPA's modification effects caused by anti-stripping additives or certain mineral surfaces. The Workshop on Polyphosphoric Acid (PPA) Modification of Asphalt Binders held April 7 and 8 in Minneapolis further addressed this still uncertain issue.

Asphalt Binder Cracking Device. A presentation on the ABCD demonstrated the progress in ruggedness testing of this device. The ABCD is expected to replace the direct tension test and provide a simple, effective measure of resistance to low-temperature thermal cracking.



In the Asphalt Binder Cracking Device, binder is poured into thin rings and monitored as it is cooled to very low temperatures. A prototype is on loan at UW–Madison's asphalt laboratory. (Image courtesy of FHWA)

For more information, contact [Hussain Bahia](#).

Implementation Report

Promising New Sealants for Concrete Decks

0092-08-36, Implementation of Evaluation of Bridge Deck Crack Sealers—Phase II

During the winter, WisDOT maintenance crews use deicing salts to melt snow and ice on roads. When used on bridge decks, chloride ions from this salt can seep through concrete and corrode the reinforcing bars within it. The chloride ions can also cause deterioration of the steel and concrete substructure.

Since 2003, WHRP has been conducting a series of studies to evaluate deck and crack sealers for preventing chloride ion penetration. The first study—0092-03-09, “Evaluation of Concrete Deck and Crack Sealers”—helped WisDOT expand its list of approved sealants, but it also showed that freeze-thaw cycles reduced their effectiveness. In a subsequent WHRP implementation study—0092-07-22, “Implementation Project for Bridge Deck Crack Sealers”—professor José Pincheira led a team at UW–Madison to further expand the list of approved sealants by testing samples for bond strength at manufacturer-recommended crack widths.

WHRP recently expanded upon this implementation to test sealants for crack widths other than those specified by the manufacturers. The final report, to be published this spring, shows that there are a number of excellent sealants for use at manufacturer-recommended crack widths. Lower performance was observed for some sealants only outside these widths. One sealant discussed in the research is particularly promising; decks treated with it showed only minor strength reductions following freeze-thaw cycles and had no sealant failures over a wide range of crack widths. Another sealant that received the highest rating by investigators showed even greater strength and performed very well on cracks of small to medium widths.

For more information, see the Phase II implementation project [Web page](#), the Phase I implementation project [Web page](#) or the original study's [Web page](#). The Phase II implementation report will be available by June 30, 2009.



Crack sealant tests included bond strength and durability. One failure mode, cracking between the sealant and the concrete, is indicated by the red arrows.

About WHRP

www.whrp.org

The Wisconsin Highway Research Program was established in 1998 by the Wisconsin Department of Transportation to conduct research on highway materials and construction methods. WHRP is administered by the UW-Madison Department of Civil and Environmental Engineering. A Steering Committee chaired by the WisDOT Research Administrator provides policy direction to the WHRP Technical Director, Program Manager and four Technical Oversight Committees chaired by WisDOT engineers. The TOCs focus their work on Flexible Pavements, Rigid Pavements, Geotechnics and Structures. The Steering Committee and TOCs are composed of representatives from WisDOT, FHWA, academia and industry.

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WisDOT Research & Communication Services Section

Don Miller

WisDOT Bureau of Project Development

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WisDOT Bureau of Technical Services

Jeff Horsfall, Co-Chair

WisDOT Bureau of Technical Services

Structures

Travis McDaniel, Chair

WisDOT Bureau of Structures

PROGRAM DEVELOPMENT

Hussain Bahia, Technical Director

UW-Madison

Andrew Hanz, Program Manager

UW-Madison

Carl Johnson, Program Assistant

UW-Madison