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Welcome from WisDOT North Central Region Director

It is with great pleasure that I welcome you to the quarterly issue of WHRP E-News.

It is fall and most of you are enjoying the beautiful colors and the transitioning temperatures. For us in northern Wisconsin, the lakes are already frozen over and the snow is a foot deep. Well, not yet, but the challenges of northern Wisconsin's climate often require special treatment and have specific research needs.

The Wisconsin Highway Research Program has helped us with many specialized research projects that include cold weather concrete pavement placement, northern aggregate testing, pavement tenting and cut/fill transition research to name a few. Whether it is this specialized research, statewide research or identification of national efforts, we have benefited from a partnership that has worked and continues to work.

The relationship built through WHRP between academia, the public sector and the private sector continues to be a significant asset for all of us at WisDOT. As we look for longer product service life, reduced impacts to the traveling public, cost effective projects and innovations in safety, we will continue to turn to WHRP for alternative processes, methods and materials that will meet these new and increasing demands.

Wisconsin is proud of its transportation infrastructure, and research is a major component of this tradition. Join me in making every effort to move our research efforts to implementation and continue this proud tradition.

Enjoy this issue of WHRP E-News and On Wisconsin!

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Daniel Grasser, WisDOT North Central Region Director

Implementing Research

WHRP results make a difference in state practice

The [June 2008](#) issue of the WHRP e-newsletter described the efforts of WisDOT Technology Teams, expert committees who help verify and revise such WisDOT documents as the [Standards Specifications](#), [Facilities Development Manual](#) and [Construction and Materials Manual](#).

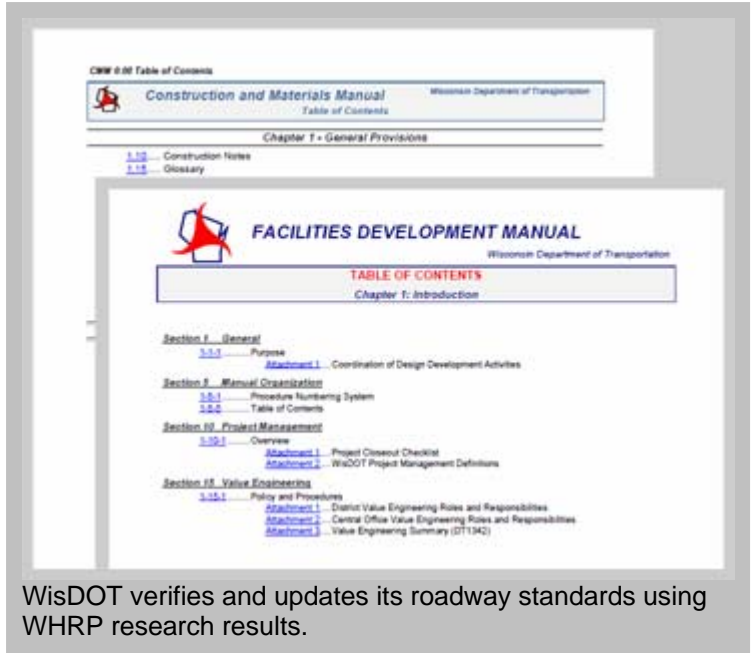
WHRP research results often play a key role in the Tech Teams' activities, representing a down-to-business type of implementation that has a real impact on Wisconsin practice. Two examples come from WisDOT's Hot Mix Asphalt Tech Team.

- Variations in HMA density as an asphalt pavement cools — and the resulting differences in measurement between contractors and WisDOT staff — had presented a challenge for WisDOT's quality acceptance program. Based on the findings of a WHRP project (“Determining a Temperature-Density Relationship after Completed Rolling of HMA,” Project [0092-00-06](#)), the Tech Team implemented changes to Standard Specifications (460.3.3) to modify density requirements.
- In establishing best practices, verification of current methods is just as important as finding new ones. The WHRP project “Development of Recommendations for Compaction Temperatures in the Field to Achieve Density and Limit As-Built Permeability,” (Project [0092-07-17](#)) provided critical data in confirming the adequacy of current HMA compaction standards in the Construction and Materials Manual and the Standard Specifications (450.3.2, 450.3.6).

The WisDOT HMA Tech Team and the WHRP Flexible Pavements Technical Oversight Committee mutually benefit from an overlapping membership. Among others, Tech Team co-chair Tom Brokaw of WisDOT, co-chair Tom Amon of B. R. Amon and Sons, and Federal Highway Administration representative Wes Shemwell have all served on the WHRP Flexible Pavements TOC.

For more information, please contact [Tom Brokaw](#) or [Tom Amon](#).

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Research in Focus

Accommodating Heavier Vehicles on Wisconsin Roads and Bridges

Project 0092-08-15, Analysis of Common Permit Vehicle Loads in Wisconsin

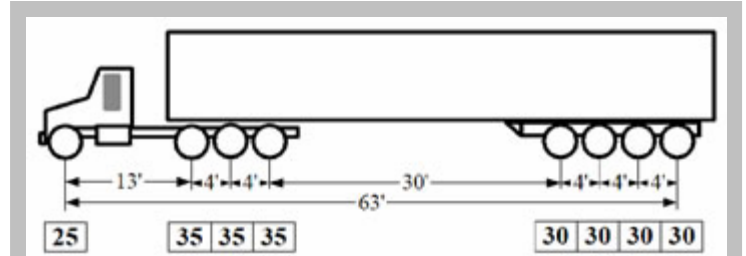
In Wisconsin, all structures must be designed to bear vehicles up to a certain weight, length, axle weight, and axle spacing, a limiting configuration defined as a "Standard Permit Vehicle." Trucks over these limits, or "oversized overweight" vehicles, require permits from WisDOT to travel within Wisconsin.

Because the size and weight of permit vehicles has steadily increased over the years, WisDOT needed to reevaluate whether these can be accommodated safely on its roads and bridges. Allowing heavier trucks to operate on its highways could help reduce shipping costs and benefit Wisconsin's economy.

To conduct this evaluation, researchers from UW–Milwaukee collected representative oversize overweight vehicle permit records for Wisconsin and created a database of corresponding weights and sizes. They also collected field data concerning the weights of overloaded trucks running on Wisconsin highways in 2007. This information was used to identify new Standard Permit Vehicle configurations that best accommodated these vehicles and to calculate the probable effects on Wisconsin bridges. A report due shortly will recommend changes to Standard Permit Vehicle specifications as well as changes to the Wisconsin Bridge Manual.

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

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Wisconsin's Standard Permit Vehicle establishes the size of truck that Wisconsin highways should be able to accommodate. Longer trucks spread their loads over a greater area, reducing axle weight and potential damage to infrastructure.

Reducing the amount of cement required in concrete mixtures

Project 0092-08-08, Reduction of Minimum Required Weight of Cementitious Materials in Concrete Mixes

The performance of concrete depends on the quantities of cement and water used to make it, as well as the gradation and quantity of the aggregate. These factors also determine the size of air voids between aggregate particles, which must be optimized to protect concrete pavements from damage caused by cycles of freezing and thawing.

Cement is a very costly component in the production of concrete, and pavement designers are interested in reducing the amount of cement in concrete mixtures. New chemical additives and knowledge of aggregate gradations have made it possible to make these reductions without compromising pavement quality.

To help Wisconsin develop more environmentally friendly cement mixtures, WHRP sponsored a project to determine the minimum amount of cementitious material that can be used by WisDOT in its pavement mixtures while preserving performance and strength. Researchers from Michigan Tech tested 28 cement mixes for durability and resistance to freeze-thaw.

A report due in December 2009 will make recommendations for mixtures that minimize cement content. Phase II of this project will optimize mixture designs using key variables identified during Phase I.

For details, see the WHRP study's [project page](#) or contact [Jim Parry](#), member of the WHRP Rigid Pavements TOC.

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Research helps reduce the amount of portland cement in concrete without compromising pavement durability.

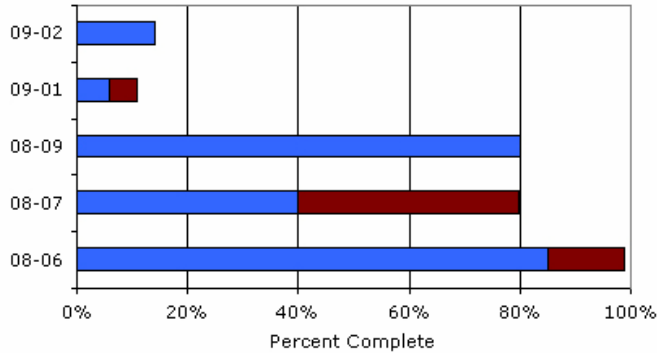
Program Update

All Projects at a Glance

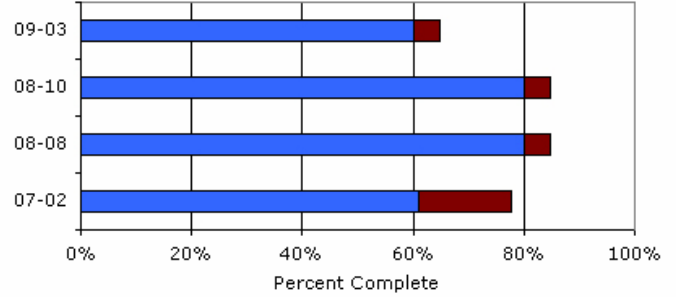
As of September 30, 2009, there were 28 active WHRP projects. One project was completed during the last three months.

■ Percent complete as of 6/30/09
 ■ Percent complete as of 9/30/09
 ★ Completed this quarter
 * Implementation activity

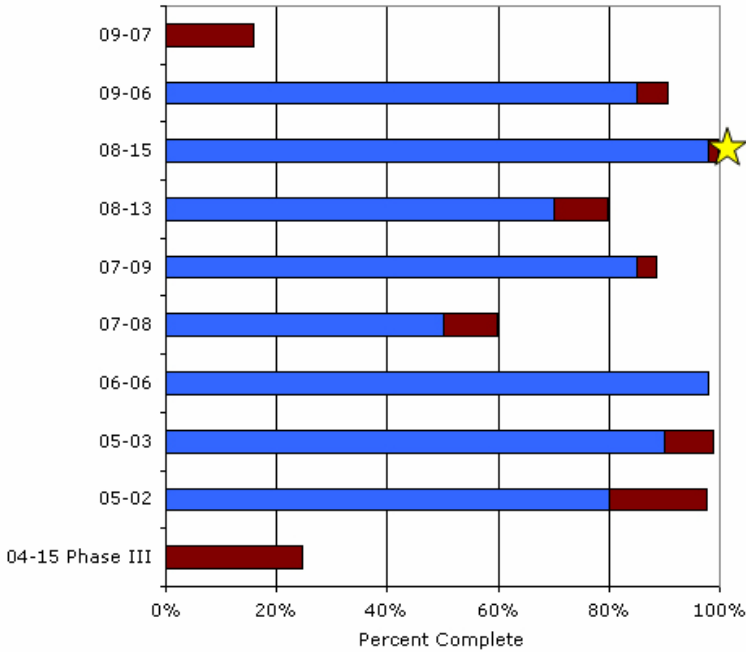
In-Progress Projects 2009 Q3: **Flexible Pavements**



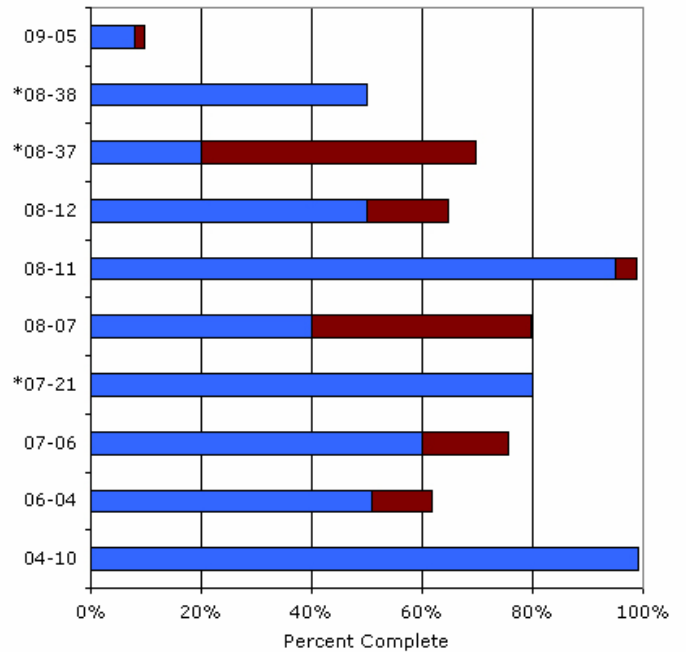
In-Progress Projects 2009 Q3: **Rigid Pavements**



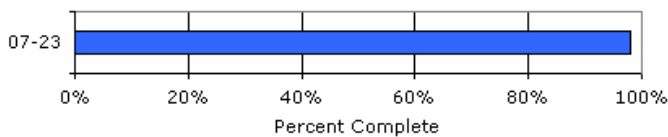
In-Progress Projects 2009 Q3: **Structures**



In-Progress Projects 2009 Q3: **Geotechnics**



In-Progress Projects 2009 Q3: **Data Integration**



Steering Committee reviews efforts and prepares for new strategic plan

The WHRP Steering Committee met on August 14 in Madison. WHRP Staff and the TOC chairs provided program updates and reviewed outreach activities, and the committee as a whole discussed strategic directions.

Implementing MEPDG. Among the program updates were WHRP efforts to aid WisDOT's implementation of the Mechanistic-Empirical Design Guide. WHRP and the TOCs continue to support MEPDG implementation by funding research projects to catalog the mechanical properties of paving materials and by assisting in a WisDOT-funded effort on local calibration of the MEPDG's pavement performance models.

Forwarding Lessons Learned. In the past year, WisDOT transitioned from participation in the completed North Central Pavement (or "Frozen Four") pooled fund to the [Transportation Engineering Road Research Alliance](#) pooled fund. Based in Minnesota, TERRA is a dynamic partnership of government, industry and academia from across the region and around the world that continuously advances innovations in road engineering and construction. WHRP summarized the lessons learned from Frozen Four participation for WisDOT representatives to share with TERRA leadership.

Strategic Planning. The August meeting also provided an opportunity for the Steering Committee to discuss the development of the WHRP 2011-2015 Strategic Plan, targeted for delivery in August 2010. Possible focus areas under consideration include environmental stewardship and safety; discussions will continue in the months ahead.

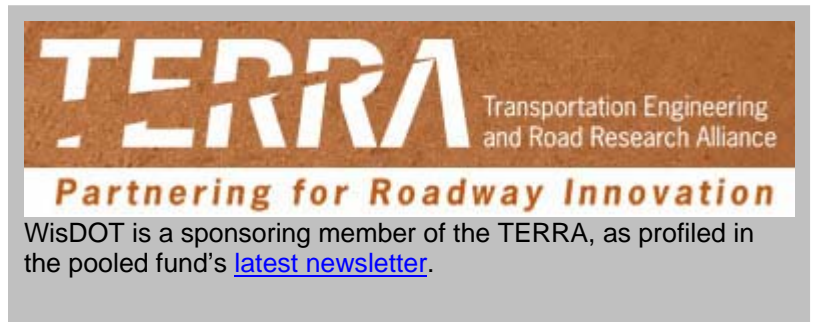
For more information about the WHRP Steering Committee, contact [Andrew Hanz](#).

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Video Brief on Subgrade and Subbase Improvement Projects

WHRP has published a video brief highlighting a number of research and implementation projects on subgrade and subbase stabilization. The research efforts by the Geotechnics TOC are described in [this article](#) in the May 2009 WHRP E-News. Find the [video brief](#) on WisDOT's Web Page.

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Regional and National

Center for By-Products Utilization

Two decades ago, the University of Wisconsin–Milwaukee founded the [Center for By-Products Utilization](#) to perform research and develop practical information on the use of recently discarded by-products from the industrial, commercial and public sectors. This encompasses a wide assortment of materials: ash resulting from the combustion of coal, coke, wood and tires; waste from the metal, paper and lumber industries; and used tires, plastics and glass.

The center's director, Tarun Naik, says that the center's activities intersect highway applications in a number of areas. Naik served as principal investigator for two WHRP projects in different areas: the Structures project "Reducing Shrinkage Cracking of Structural Concrete Through the Use of Admixtures" (Project [0092-04-13](#)) and the Rigid Pavements project, "Investigation of Concrete Properties to Support Implementation of the New AASHTO Pavement Design Guide" (Project [0092-06-03](#)).

The center has conducted research in response to the growing interest in green highways. Naik says that in recent years the center has performed extensive research on reducing emissions by sequestering carbon dioxide in concrete pavements. [This presentation](#) provides more details on this research approach.

For more information about the Center for By-Products Utilization, contact [Tarun Naik](#).

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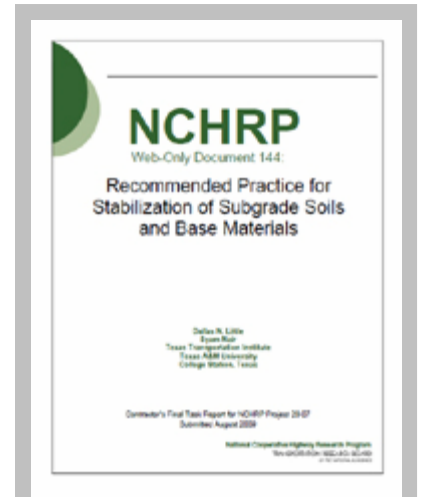
Chemically binding carbon dioxide in the concrete helps reduce emissions. Here, researchers test the depth of carbonation in a sample.

TRB Publications Related to WHRP Research

WHRP has identified a select list of Transportation Research Board publications from the past three months, primarily from the National Cooperative Highway Research Program, related to WHRP research areas.

- [Bridge Measurement Systems for Transportation Agency Decision Making](#), NCHRP Synthesis Report 397
- [Protocols for Collecting and Using Traffic Data in Bridge Design](#), NCHRP Web-Only Document 135
- [A Plan for Developing High-Speed, Nondestructive Testing Procedures for Both Design Evaluation and Construction Inspection](#), Second Strategic Highway Research Program Report S2-R06-RW
- [Recommended Practice for Stabilization of Subgrade Soils and Base Materials](#), NCHRP Web-Only Document 144
- [Construction and Maintenance Practices for Permeable Friction Courses](#), NCHRP Report 640
- [Recommended Practice for Stabilization of Sulfate-Rich Subgrade Soils](#), NCHRP Web-Only Document 145

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The recently published NCHRP Web-Only Document 144, *Recommended Practice for Stabilization of Subgrade Soils and Base Materials*, addresses a topic of particular interest to WHRP and its members.

Outreach

Asphalt pavement Expert Task Group meetings

The FHWA Expert Task Groups on asphalt binder, mixtures and modeling met in September in San Antonio. WHRP members participated in all three ETGs and provided these highlights.

- **Binder ETG.** The group focused on new tests to improve the PG grading system, including the Multiple Stress Creep Recovery test, and proposed limits for standard, high and very high traffic volumes. Discussions on a new binder fatigue test led the ETG to request that the Modified Asphalt Research Center at UW–Madison draft an AASHTO standard for the test method. WHRP Technical Director [Hussain Bahia](#) participated in this meeting.
- **Mixture ETG.** The group proposed modification to current mix standards and specifications to improve pavement performance and increase durability. In addition, the group discussed the use of the flow number parameter in the lab and field to compare the mechanical performance of mixtures. Finally, FHWA announced that it will conduct a survey on longitudinal joint specifications and practices to ensure that there is sufficient guidance in constructing quality longitudinal joints. Flexible Pavements TOC member [Erv Dukatz](#) of Mathy Construction participated in this meeting.
- **Modeling ETG.** The group focused on approaches to modeling asphalt mixture fatigue. A presentation on simplified fatigue testing and modeling led to recommendations for a future workshop on the topic. Other presentations featured the new modeling approach of chemo-mechanics, which is expected to link asphalt chemistry and modification to mechanical properties, and modeling of friction and noise to help make asphalt pavements quieter and safer. Hussain Bahia participated in this meeting as well.



The British Pendulum helps determine a pavement's mean texture depth, a factor in modeling friction and noise. (Image courtesy of UW–Madison Modified Asphalt Research Center)

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WCPA Concrete Pavement Preservation Workshop

On November 12, the Wisconsin Concrete Pavement Association hosted a Concrete Pavement Preservation Workshop, attended by Barry Paye, WisDOT pavement warranty and research engineer and member of the WHPR Rigid Pavements and Flexible Pavements TOCs. This practitioner-focused event presented up-to-date information on cost-effective concrete pavement preservation strategies.

Project-level maintenance and preservation techniques discussed in detail included:

- Slab stabilization and slab jacking
- Partial-depth repairs
- Full-depth repairs
- Retrofitted edge drains
- Load transfer restoration
- Diamond grinding and grooving
- Joint resealing and crack sealing

Paye reported that many of the questions asked during the workshop about current and emerging preservation techniques aligned with the research questions now under consideration by the Rigid Pavements TOC. He also said that the comprehensive meeting materials provided useful guidance and background research documenting the value of the different techniques presented.

For more information about this workshop or WCPA, contact WHPR Steering Committee member and WCPA president [Kevin McMullen](#).



The detailed manual from the workshop will be a valuable resource for pavement maintenance personnel.

2009 Mid-Continent Transportation Research Symposium

Several WHPR members took part in the [2009 Mid-Continent Transportation Research Symposium](#), held in Ames, Iowa on August 20-21. The conference topics covered a broad range of transportation issues, including the highway engineering and construction topics of immediate interest to the WHPR TOCs. Presentations by WHPR researchers included:

- [A Framework for Performance-Based Permeability and Density Acceptance Criteria for HMA Pavements in Wisconsin](#), by *Sam Owusu-Ababio and Robert Schmitt of the University of Wisconsin–Platteville*
- [Nanotechnology to Manipulate the Aggregate-Cement Paste Bond: Impacts on Concrete Performance](#), by *Jessica Sanfilippo, Jose Muñoz, Isabel Tejedor, Marc Anderson and Steven Cramer of the University of Wisconsin–Madison*

Wisconsin sponsors of the event included the Wisconsin Department of Transportation and the University of Wisconsin's National Center for Freight & Infrastructure Research & Education.



The symposium included research by Professor Steven Cramer of UW–Madison, the principal investigator of a current WHPR project.

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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

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Wisconsin Earthmovers Association

Beth Cannestra

WisDOT Bureau of Structures

James Crovetto

Marquette University

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