

TERRA E-News

TERRA E-News is a quarterly electronic newsletter of the Transportation Engineering and Road Research Alliance. TERRA E-News brings you the latest research on pavement, materials, and related transportation engineering challenges, including issues related to cold climates.

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Member News

New Members: NYSDOT joins newly established TERRA membership pooled fund

The [New York State Department of Transportation \(NYSDOT\)](#) this week has joined TERRA through a pooled fund recently established to provide more state DOTs the opportunity to become a member of the alliance. "Given the realities of scarce resources, collaborating through organizations like TERRA is how states need to function in the future," said Gary Frederick, NYSDOT director of transportation research and development. "The TERRA pooled fund enables states to participate so that collaboration will become the norm."

A TERRA solicitation for organizations to join the alliance was posted on the Transportation Pooled-Fund (TPF) Program website in mid-January (see [TPF Solicitation 1226](#) for details). Interested organizations will be able to participate in and benefit from a unique, comprehensive program of research on pavement, materials, and related transportation engineering challenges, including issues related to cold climates. Though TERRA currently does not have dedicated research funding, members already have helped secure funding for a \$10 million program of TERRA-initiated research. Current membership includes industry, academia, and government agencies ranging from cities and counties to national road administrations. For more information, contact Maureen Jensen at 651-366-5507 or maureen.jensen@state.mn.us.

Member Profile: Iowa State University's CP Tech Center

TERRA's reputation for creating fruitful research partnerships between national transportation leaders has led to collaboration with the [National Concrete Pavement Technology Center \(CP Tech Center\)](#) at Iowa State University (ISU).

ISU, which is also home to the [Center for Transportation Research and Education \(CTRE\)](#), has been a TERRA member since TERRA was founded in 2004. CTRE, the focal point for transportation at Iowa State University, performs transportation research for public and private agencies and companies, manages its own education program for transportation students, and conducts local, regional, and national transportation services and continuing education programs.

CTRE director Shashi Nambisan and Tom Cackler, CP Tech Center director and associate director for construction research and advanced technology at CTRE, represent ISU on the TERRA board.



Shashi Nambisan

CP Tech Center works with a variety of regional and national partners to improve pavement design, mix and materials, construction, and maintenance to produce durable, cost-effective concrete pavements.

Cackler said ISU's ongoing relationship with MnDOT and MnROAD made joining TERRA a natural next step. "We wanted to participate in the program of activities that are possible at that facility," he said.

CP Tech Center was founded initially as the Center for Portland Cement Concrete Pavement Technology in 2000, which then evolved into its current form in 2005 with the support of the American Concrete Pavement Association. Research, which has remained the cornerstone of the Center's mission, now totals more than \$8.5 million and 30 different projects.

Cackler said the Center is tackling many challenges in concrete development and effective technology transfer to make safe and effective concrete technology more available. "There are many innovative approaches and ideas that are used in one area but are not widely known," he said. "Therefore, accelerating the acceptance and use of new products and concepts is our primary focus."



Tom Cackler

To that end, the Center has established four focus areas—strategic planning, research of long-term planning projects, technology transfer through ongoing transportation training events and materials, and accelerating implementation from research to tangible results.

Through the partnership with TERRA, Cackler said he hopes to accomplish three goals: "Foster partnerships with leading researchers and public agencies, coordinate research efforts so that duplication is eliminated, and leverage funding so when we are involved with research efforts there are other partners to help sponsor the project."

Staffed by a small group of professionals and sustained by countless researchers, advisory groups, and research sponsors, CP Tech Center is sure to continue making great strides in advancing concrete pavement technology, Cackler added.

"We want to create sustainable infrastructure and pavements. This is much more than rhetoric, it really is an opportunity and challenge to all of us involved in civil infrastructure to develop processes, approaches, and materials that will provide a long performance life while minimizing the impact to the environment," he said.

Member Highlights

[Michigan Tech Transportation Institute \(MTTI\)](#) published the report *The Deleterious Chemical Effects of Concentrated Deicing Solutions on Portland Cement Concrete* (Study SD2002-01) in April 2008 for the South Dakota Department of Transportation. The research found significant evidence that magnesium chloride and calcium chloride chemically interact with hardened portland cement paste in concrete, resulting in expansive cracking, increased permeability, and a significant loss in compressive strength. But both coal fly ash and ground granulated blast furnace slag were found to be effective at mitigating the chemical attack caused by the deicers tested. The project was conducted as Pooled Fund Study TPF-5(042) through the cooperation of the Federal Highway Administration and the financial support of California, Colorado, Idaho, Illinois, Iowa, Montana, Texas, and Wyoming. [Download reports and more online.](#)

[RMC Research & Education Foundation](#) announced the publication of the *Guide for the Construction Team*, a companion to the report published in September, *New Technology-Based Approach to Advance Higher Volume Fly Ash Concrete with Acceptable Performance*. The new guide complements the original study, which demonstrates that ready-mixed concrete producers may use a greater amount of fly ash—recycled material—in concrete mixtures while maintaining strength and performance and while still being able to attain the early-age strengths required for the application. This new guide will assist the entire construction team in their efforts to integrate more fly ash in a variety of construction projects. The publications, also available as a CD, may be downloaded from the foundation's [website](#).

Projects and Initiatives

Warm-mix asphalt may help roads better endure cold climates

Researchers at the Minnesota Department of Transportation (MnDOT), a TERRA member, are studying warm-mix asphalt (WMA) at the MnROAD facility to explore the potential of the material for better low-temperature cracking performance. Thermal cracking is the predominant mode of distress of hot-mix asphalt (HMA) pavements in Minnesota, and researchers hypothesize that the reduced level of oxidation at the mix plant will lead to better long-term pavement performance. The study also is monitoring other performance measures such as rutting, fatigue cracking, top-down cracking, and ride.

The study grew from a desire among researchers at MnDOT to demonstrate the potential benefits of WMA. Testing WMA at MnROAD also will help disseminate results to a wider audience of city, county, and state engineers, consultants, contractors, and researchers throughout Minnesota and the entire country.

Six test cells were paved with WMA on the MnROAD mainline, which sees just under a million equivalent single axle loads (ESALs) per year. The mix is a high-traffic Superpave with PG 58-34 binder and 20 percent recycled asphalt pavement (RAP). The 2008 construction contract left it up to the contractor, Hardrives, to decide the particular process for paving with WMA. Hardrives chose the easy-to-use Evotherm 3G product, a chemical-based additive that does not use any water but still promotes coating at lower temperatures.



Lowering the temperature of asphalt mixes may decrease both fuel usage and emissions, preserving

resources while addressing growing environmental concerns. Specifically, lower temperatures promise to benefit the asphalt industry by providing:

- Earlier start dates
- Late season paving
- Longer haul distances when needed
- Cooler working conditions
- Reduced plant wear
- Decreased binder aging
- Improved compaction with stiff mixes

Though the Europeans had a head start on the technology, the United States has rapidly gained ground with 14 warm-mix technologies currently available and more in development. As a signatory to the Kyoto Accord, a treaty whereby countries have agreed to reduce their greenhouse gas emissions, the European Union was compelled to look for ways to reduce emissions in many ways—including in its paving methods. By the year 2000, the EU had introduced new paving strategies, including warm-mix asphalt, defined as mixes produced and placed between 200° and 275° F. At least 72 WMA field trials have now been conducted in the United States, according to Dave Newcomb of the National Asphalt Pavement Association.



Preliminary data from a research project on I-70 in Colorado, in which WMA was compared side-by-side with conventional HMA, showed that WMA had about the same optimum asphalt content, lower air voids in field-produced mixes, comparable tensile strength, and generally favorable rutting characteristics.

Related resources:

- [Warm-Mix Asphalt Association](#)
- [Warm Mix Asphalt: Best Practices \(NAPA\)](#) (1.7 MB PDF)
- [National Asphalt Pavement Association](#)
- ["Is 'green' the new look of pavement?"](#) (Minnesota LTAP *Technology Exchange*, Spring 2008)
- [MnROAD Phase Two Initiative projects](#)

Project demonstrates hot-mix asphalt intelligent compaction technology

According to the Federal Highway Administration (FHWA), the era of intelligent compaction (IC) has arrived. IC has become an increasingly popular tool to better control the compaction process. Often as a result of more uniform compaction, highway repair costs are lowered and productivity is increased.

In an effort to further the knowledge and understanding of IC, FHWA has teamed with the Minnesota Department of Transportation (MnDOT) and transportation departments in 12 other states for the Transportation Pooled-Fund study "Accelerated Implementation of Intelligent Compaction Technology for Embankment Subgrade Soils, Aggregate Base, and Asphalt Pavement Materials" (TPF-5(128)). MnDOT and FHWA are TERRA members.

A field demonstration of hot-mix asphalt (HMA) intelligent compaction conducted for MnDOT involving three road construction projects near Willmar, Minnesota, was the first under the TPF study. The HMA IC demonstrations using a Sakai SW880 double-drum vibratory roller with the Sakai Compaction Information System (CIS) were conducted over the course of three weeks in June 2008 on Trunk Highway 71 (Renville County), Kandiyohi County Road 40, and Kandiyohi County Road 4.



Both Highway 71 and County Road 40 were asphalt overlay projects while County Road 4 was a new asphalt pavement project. The first two projects represent the majority of the asphalt paving in the United States, while the new construction on County Road 4 provided an opportunity to study IC technology for new pavement construction. Though the Highway 71 and County Road 40 demonstrations tracked roller passes and temperatures, the final report summarizing the MnDOT field demonstration emphasizes the County Road 4 project for the wealth of field data provided.

Objectives of the study include demonstrating HMA IC technology to MnDOT personnel and contractors, evaluating the benefits and effectiveness of IC rollers compared to conventional rollers, assisting MnDOT in accelerating the development of IC quality control specifications for HMA pavement materials, and identifying and prioritizing needed improvements and further research for IC equipment.

According to the final report for the MnDOT HMA IC field demonstration, the demonstration of IC in all three locations accomplished the study objectives. The Sakai IC roller successfully used the Sakai CIS system to track roller passes and asphalt surface temperatures. It also demonstrated how the roller operator was able to improve the rolling pattern through the use of the CIS system. In addition, the project showcased the ability of the IC roller to map the compaction of the sub-base, asphalt base course, and asphalt wearing course.

The MnDOT HMA IC field demonstration also allowed MnDOT and FHWA to make some recommendations for the future use of IC. They include: validating the IC Global Positioning System (GPS) setup prior to the compaction operation; making sure IC measurements (i.e., creation of a base map) are collected

immediately prior to asphalt paving; and standardizing an IC data storage format, an independent software tool, and detailed data requirements to facilitate the management of IC data from all vendors.

Related resources:

- [MnDOT HMA IC Demo Site](#)
- [Final report for the MnDOT HMA IC field demonstration \(11 MB PDF\)](#)
- [TPF-5\(128\): Accelerated Implementation of Intelligent Compaction Technology for Embankment Subgrade Soils, Aggregate Base and Asphalt Pavement Material](#)
- [TERRA fact sheet: Implementation of New Technologies](#)

TERRA members collaborate to fund research into cold-weather performance of pervious concrete

The Aggregate & Ready Mix Association of Minnesota (ARM) partnered with the University of Minnesota Department of Civil Engineering to obtain a \$50,000 research grant from the Ready Mixed Concrete RMC Research & Education Foundation for a study of the cold-weather performance of pervious concrete.

TERRA board members Fred Corrigan (ARM) and Julie Garbini (RMC Research & Education Foundation) helped to guide the application for this grant. Lev Khazanovich, associate professor of civil engineering at the University of Minnesota, is the principal investigator of the study along with co-investigator Kevin MacDonald of Cemstone.



In their June 2008 grant application to study the "Performance of Pervious Concrete Pavement in a Cold Weather Climate," the researchers suggested a number of changes to the creation and installation procedures of pervious concrete, which will be further explored during their 12-month study.

Pervious concrete is widely used in moderate climates to reduce storm water runoff. Its permeable structure allows water to filter into the groundwater. But its ability to withstand freeze-thaw cycles in cold climates needs to be investigated.

That's why the University of Minnesota Department of Civil Engineering began testing the strength of pervious concrete—to find out if the technology may be successfully implemented in states with extreme weather fluctuations.

The study will make use of existing local pervious concrete installations, including segments at the MnROAD facility in Albertville, Minnesota, to determine performance criteria for materials, design methods, and construction. The testing site includes a pervious concrete driveway, pedestrian walkway, and two test cells on the low-volume road, which will provide a variety of different conditions for scientific evaluation.

Researchers suggest the most important step to ensure pervious concrete's durability is the careful mixing and installation of the material. Because optimum performance depends on the balance of void ratio and strength, quality control during the mix design, compaction, and curing often determines the success of a pervious concrete project.



The benefits of pervious concrete include replenishing ground water tables, decreasing the amount of runoff and pollution entering streams during large storm events, reducing flooding, and absorbing tire-pavement noise.

Related resources:

- ["Performance of Pervious Concrete Pavement in a Cold Weather Climate" grant application \(704 KB PDF\)](#)
- [TERRA fact sheet and links on pervious concrete](#)
- [Pervious Concrete Research Compilation \(RMC Research & Education Foundation, 2008\) \(472 KB PDF\)](#)
- [Pervious Concrete \(NRMCA\)](#)
- [RMC Research & Education Foundation](#)

Announcements

TERRA sponsors upcoming pavement conference

TERRA is sponsoring the [13th Annual Minnesota Pavement Conference](#), scheduled for February 12, 2009, at the University of Minnesota Continuing Education and Conference Center in St. Paul, Minnesota. Cosponsors include MnDOT, the Minnesota Local Road Research Board (LRRB), the Minnesota Local Technical Assistance Program (LTAP), the University of Minnesota Department of Civil Engineering, and several others.

This year's conference will highlight innovative construction practices, infrastructure investment strategies, and sustainable pavements. This one-day conference typically looks at current practices that implement new pavement research and technology, and national and local trends and innovations are examined to expand understanding of pavement challenges and solutions. The conference is intended for researchers, city engineers, county engineers, public works officials, maintenance superintendents, design engineers, consulting engineers, and others interested in pavement issues. For more information about the Minnesota Pavement Conference, contact Shirley Mueffelman at 612-624-4754, cceconf2@umn.edu.



2009 Concrete Technology Forum to focus on performance prediction

The 2009 Concrete Technology Forum: Focus on Performance Prediction, sponsored by the National Ready Mix Concrete Association (NRMCA), is scheduled for May 13-15, 2009, in Cincinnati. This symposium and product expo will bring researchers and practitioners together to discuss the latest advances, technical knowledge, continuing research, tools and specifications that involve test methods and modeling to predict concrete performance and service life of concrete structures. For online registration, or more information, visit www.ConcreteTechnologyForum.org.

Mid-Continent Transportation Research Symposium call for abstracts

Researchers wishing to present a paper at the [7th Annual Mid-Continent Transportation Research Symposium](#) (August 20–21, 2009, at Iowa State University in Ames, Iowa) are invited to submit an abstract of the paper. Symposium organizers are especially interested this year in implementable solutions for challenges experienced by federal and state departments of transportation, cities, and counties. The symposium covers a broad spectrum of transportation issues, ranging from current advances in infrastructure design to transportation policy. Several concurrent sessions will be offered, each focused on a specific topic. The full call for abstracts, which is online, includes information about potential topics, review criteria, and formatting. Abstracts, due by February 27, 2009, are accepted online. For more information, see the [symposium home page](#).

TERRA E-News is produced quarterly by the Center for Transportation Studies at the University of Minnesota.

Comments?

We would like to hear what you think of *TERRA E-News*. Please e-mail us at mpmccarthy@umn.edu.

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