

TERRA

Transportation Engineering and Road Research Alliance



Annual Report 2008

**Partnering
for Roadway
Innovation**

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To the Reader

TERRA focuses on implementation of collaborative pavement and road engineering research innovations



Julie Skallman



Tim Worke

A strong transportation network is essential for competing in the global marketplace. But we must also compete for limited public funds while our infrastructure ages, construction costs rise, and the public demands a higher level of service.

Road infrastructure research and the implementation of research findings are key parts of the solution for meeting our infrastructure needs on a tight budget because of the tremendous return on the investment. Even small improvements have led to safer, more cost-effective, and environmentally sensitive infrastructure. Moreover, road research has helped lower costs for maintenance and repairs. It also has helped reduce user delays and congestion. Ultimately, the lesson is clear: we must invest in innovative solutions today for better roads tomorrow.

TERRA is a unique force for much-needed innovation. TERRA provides an unprecedented opportunity for stakeholders from government, industry, and academia to take advantage of the resources available through a variety of dynamic research partnerships and collaborations. In fact, the diverse membership of TERRA offers a broad perspective, representing the needs of everyone from county agencies to private industry to national road administrations. Most important, however, TERRA works to put research results into practice for the benefit of the public.

TERRA communicates road research—from a project's conception and development through implementation—in a variety of ways. Our quarterly *TERRA E-News* reports the latest findings on pavement, materials, and related transportation engineering challenges, including issues related to cold climates. Our ongoing series of one-page TERRA fact sheets, begun this year, highlights findings from TERRA research projects. Each fact sheet includes real-world examples of the implementation of those findings. Finally, the TERRA Innovation Series, established to facilitate knowledge transfer, exchange, and demonstration of innovative road research and practices, offers an excellent opportunity for transportation professionals, policymakers, and the public to see research results first-hand. Our first two events, at the Minnesota Road Research Project (MnROAD) facility and at the Highway 36 reconstruction site in North St. Paul, attracted more than two hundred participants.

We're pleased to share with you this summary of the highlights of TERRA efforts and activities during the past year.

*Julie Skallman, TERRA Co-Chair
Director, State Aid Division,
Minnesota Department of
Transportation*

*Tim Worke, TERRA Co-Chair
Director, Transportation and
Highway Division, Associated
General Contractors of Minnesota*

About TERRA

The Transportation Engineering and Road Research Alliance, or TERRA, is a research governance structure formed in 2004 to foster a comprehensive road research program. TERRA brings together government, industry, and academia in a dynamic partnership to advance innovations in road engineering and construction. TERRA's partnering efforts reach beyond Minnesota to include transportation organizations in other states and in Europe.

Mission

TERRA's mission is to develop, sustain, and communicate a comprehensive program of research on pavement, materials, and related transportation engineering challenges, including issues related to cold climates.

Strategic Directions

TERRA members have defined five major strategic directions for the organization through FY2013:

- **Define and launch a bold and synergistic research program** by creating a research agenda that expands beyond a MnROAD focus and leverages the power of the group. This agenda should utilize diverse funding sources and sponsors, engage TERRA members, and be nationally recognized.
- **Implement research results “on the ground.”** Implementation of transportation engineering and road research applications should be successful, visible, and include innovations that are also put into practice outside of the alliance.
- **Develop activities that enhance TERRA's role as a dynamic forum for research interchange.** Activities should provide continuous learning opportunities that enable members to educate each other, as well as adapt to a changing world through easily accessible information and ongoing exchange.
- **Expand TERRA's membership proactively** to increase the alliance's research breadth, depth, and resources by identifying, recruiting, and inviting new members.
- **Develop governance and operating structures that assure a thriving, changing, and sustainable organization** by constantly improving operational structures, roles, and agreements.

In late 2007, the TERRA Board gathered for a strategic planning session to assess the status of the alliance and make decisions about future strategic priorities for external action and internal operations. In support of a key long-term goal to have successful and visible “on-the ground” implementation of research results, the board in early 2008 renamed its research committee the Research and Implementation Committee.

TERRA Members

TERRA welcomed Michigan Technological University (Michigan Tech) as a new member organization during the past year. The TERRA Board includes representatives of industry associations, transportation agencies, and university research organizations who collaborate to set directions for TERRA's research and outreach activities. Organizations currently represented on the board are:

Industry Associations

Aggregate & Ready Mix Association of Minnesota
 American Concrete Pavement Association
 Associated General Contractors of Minnesota
 Caterpillar Global Paving
 Concrete Paving Association of Minnesota
 Minnesota Asphalt Pavement Association
 RMC Research & Education Foundation
 SemMaterials

National Transportation Agencies

Norwegian Public Roads Administration
 U.S. Federal Highway Administration

State and Local Transportation Agencies

Michigan Department of Transportation
 Minnesota Department of Transportation
 Minnesota Local Road Research Board

University Research Organizations

Iowa State University

- Center for Transportation Research and Education
- National Concrete Pavement Technology Center (CP Tech Center)

 Michigan Tech

- Michigan Tech Transportation Institute

 University of Minnesota

- Center for Transportation Studies
- Department of Civil Engineering

Board member representatives



Julie Skallman (Co-Chair), Director, State Aid Division, Minnesota Department of Transportation



Tim Worke (Co-Chair), Director, Transportation and Highway Division, Associated General Contractors of Minnesota



Bernard (Bernie) Arseneau, Director, Policy, Safety, and Strategic Initiatives Division, Minnesota Department of Transportation



Leif Baklokk, Senior Principal Engineer, Norwegian Public Roads Administration



Roberto Ballarini, Professor and Department Head, Department of Civil Engineering, University of Minnesota



Mike Barnes, Director, Engineering Services Division, Minnesota Department of Transportation



John Bukowski, Senior Pavement Engineer, Federal Highway Administration



E. Tom Cackler, P.E., Director for National Concrete Pavement Technology Center (CP Tech Center)



André Clover, Administrative Engineer of Research and National Best Practices, Bureau of Highway Operations, Michigan Department of Transportation



Fred Corrigan, Executive Director, Aggregate & Ready Mix Association of Minnesota



Julie Garbini, Executive Director, RMC Research & Education Foundation



Jacob Hiller, Assistant Professor, Michigan Tech



Robert Johns, Director, Center for Transportation Studies, University of Minnesota



Mark Maloney, Director of Public Works, City of Shoreview, Minnesota, and Minnesota Local Road Research Board (LRRB) representative



Shashi Nambisan, Director, Center for Transportation Research and Education, Iowa State University



Dean Potts, Engineering Manager, Caterpillar Global Paving



Keith Shannon, Director, Office of Materials and Road Research, Minnesota Department of Transportation



Mike Sheehan, County Highway Engineer, Olmsted County, Minnesota, and Minnesota Local Road Research Board (LRRB) representative



Larry Sutter, Professor, Construction and Materials; Director, Michigan Tech Transportation Institute; and Director, University Transportation Center for Materials and Sustainable Transportation Infrastructure, Michigan Tech



Gerald Voigt, President and CEO, American Concrete Pavement Association



Dan Wegman, Technical Marketing, SemMaterials



Rich Wolters, Executive Director, Minnesota Asphalt Pavement Association



Matt Zeller, Executive Director, Concrete Paving Association of Minnesota

Not Pictured

- **Calvin Roberts**, Engineer of Research and National Best Practices, Michigan Department of Transportation
- **Robin Schroeder**, Assistant Minnesota Division Administrator, Federal Highway Administration

Resource staff

- **Mike Darter**, Director, Pavement Research Institute, University of Minnesota
- **Maureen Jensen**, Manager, Road Research Section, Offices of Materials and Road Research, Minnesota Department of Transportation
- **Laurie McGinnis**, Associate Director, Center for Transportation Studies, University of Minnesota
- **Stephanie Malinoff**, Outreach and Education Coordinator, Center for Transportation Studies, University of Minnesota

Board member representatives who completed service in 2008

- **Richard (Rick) Arnebeck**, Minnesota Department of Transportation
- **Kevin Kosobud**, SemMaterials
- **Abby McKenzie**, Minnesota Department of Transportation
- **Karl Melby**, Norwegian Public Roads Administration
- **Tom Sorel**, Federal Highway Administration
- **Thomas Van Dam**, Michigan Technological University

Research

TERRA's research program is built on the principle of collaboration to meet research needs and focuses on transforming the Minnesota Road Research Project (MnROAD) facility from a Minnesota resource to a regional, national, and international research center. Research projects and initiatives administered by TERRA involve collaborations among agency, industry, and academic partners, including a series of pooled-fund projects initiated through the Federal Highway Administration's Transportation Pooled Fund Program.

TERRA-initiated research

Projects and initiatives are divided into two categories. TERRA-initiated research activities are planned and initiated through the TERRA Board. TERRA-related research activities are carried out by member and partner organizations and are related to TERRA strategic goals, but have no direct involvement with the TERRA Board.

The TERRA-initiated projects include a number of active pooled-fund projects through the FHWA Transportation Pooled Fund (TPF) Program (www.pooledfund.org). The pooled-fund program enables stakeholders to leverage their resources by working together on topics that have widespread interest.

The following TERRA-initiated projects are part of the Phase Two Research Initiative at MnROAD (project partners are listed in parentheses following the project title):

1. Composite Pavements Systems (Strategic Highway Research Program 2, Applied Research Associates, Inc., University of Minnesota, University of California Davis, MnDOT)
2. Concrete Pavement Optimization—Determining the Lower Threshold of Slab Thickness for High-Volume Roads (Mn/DOT)
3. Design and Construction Guidelines for Thermally Insulated Concrete Pavements* (California DOT, Mn/DOT, Washington DOT, Minnesota LRRB, Federal Highway Administration)
4. Development of Design Guide for Thin and Ultrathin Concrete Overlays of Existing Asphalt Pavements* (Mn/DOT, Mississippi DOT, Missouri DOT, New York DOT, Pennsylvania DOT, Texas DOT)
5. Field Investigation of Highway Base Material Stabilized with High Carbon Fly Ash (Bloom Consulting, University of Wisconsin, U.S. Department of Energy)
6. Stabilized Full-Depth Reclamation Study (SemMaterials, Mn/DOT)
7. HMA Surface Characteristics Related to Ride, Texture, Friction, Noise, Durability (Minnesota LRRB, Mn/DOT, Federal Highway Administration)
8. Investigation of Low Temperature Cracking in Asphalt Pavements—Phase II* (Connecticut DOT, Iowa DOT, Mn/DOT, New York DOT, North Dakota DOT, Wisconsin DOT, Minnesota LRRB)



9. MnROAD Field Investigation of Polyphosphoric Acid Modified Asphalt (Mn/DOT, Ergon Inc., ICL Performance Products, Innophos, Inc., Federal Highway Administration, MTE Services)
10. PCC Surface Characteristics–Construction (Mn/DOT, Federal Highway Administration)
11. PCC Surface Characteristics–Rehabilitation* (Mn/DOT, Texas DOT, International Grooving and Grinding Association, American Concrete Pavement Association, Federal Highway Administration)
12. Performance of Thin Unbonded Concrete Overlays on High-Volume Roads (Concrete Paving Association of Minnesota, American Concrete Pavement Association, Mn/DOT)
13. Permeable HMA Pavement Performance in Cold Regions (Minnesota LRRB, Mn/DOT)
14. Pervious Concrete Mix Design for Wearing Course Applications (Center for Transportation Research and Education, Mn/DOT)
15. Pervious Concrete Pavement Study (Minnesota LRRB, Mn/DOT)
16. Optimal Timing for Preventive Maintenance for Addressing Environmental Aging in HMA Pavements* (Maryland DOT, Mn/DOT, Ohio DOT, Texas DOT, Minnesota LRRB)
17. Asphalt Pavements with Higher RAP Content (Minnesota LRRB, Mn/DOT)
18. Recycled Unbound Pavement Materials* (California DOT, Michigan DOT, Mn/DOT, Ohio DOT, Texas DOT, Wisconsin DOT)
19. Long-Life Concrete Pavement—Performance Model Development (Mn/DOT)
20. The Effects of Implements of Husbandry “Farm Equipment” on Pavement Performance* (Iowa DOT, Illinois DOT, Mn/DOT, Minnesota LRRB, Professional Nutrient Applicators Association of Wisconsin)
21. Tie Bar Study (Center for Transportation Research and Education, Mn/DOT)
22. Use of Taconite Aggregates in Pavement Applications (Natural Resources Research Institute, Mn/DOT)

* denotes pooled-fund project

MnROAD, phase two

TERRA has been instrumental in guiding the second phase of operations at MnROAD and the substantial reconstruction and augmentation of the facility’s test sections. At present, MnROAD is home to eight pooled-fund projects totaling \$3.8 million and involving the participation of 17 states, the Federal Highway Administration (FHWA), the Minnesota Local Road Research Board (LRRB), and industry.

In 2008, the Minnesota Department of Transportation (Mn/DOT) launched a redesigned MnROAD Web site (www.dot.state.mn.us/mnroad). The site provides a comprehensive guide to research activities at MnROAD and links to a wealth of road-related online resources.

MnROAD has three road segments—a 3.5-mile interstate roadway carrying “live” traffic, a two-lane, 2.5-mile closed-loop low-volume roadway, and a new half-mile “farm loop”—that comprise more than 50 instrumented concrete and asphalt pavement test sections representing a broad range of materials and designs.



Featured research projects

Effects of implements of husbandry “farm equipment” on pavement performance

Over the past few decades, significant changes in both farm size and farm equipment have prompted the farm equipment industry to produce larger and larger application equipment. Innovations such as steerable axles, flotation tires (spreading the load over a much larger area), and new tire designs have been used on the equipment in recent years as well.

Testing began in spring 2008 on the MnROAD farm loop, constructed in 2007, to determine how the pavement responds to various configurations of agricultural equipment. The test roadway design is typical of many rural, low-volume county roads. Testing with several different vehicles will be done in the spring and fall seasons to capture the seasonal variation in pavement strength and response to heavy loading.

The current TERRA-initiated agricultural equipment study includes participation from the Minnesota Department of Transportation (Mn/DOT), the Iowa Department of Transportation, the Illinois Department of



Transportation, the Minnesota Local Road Research Board (LRRB), and the Professional Nutrient Applicators Association of Wisconsin. Several other partners also have joined the research effort at MnROAD, including the Wisconsin LTAP and equipment manufacturers, to determine how the effects of the agricultural equipment compares to those of a typical five-axle semi tractor-trailer.

Stabilized full-depth reclamation study

Full-depth reclamation (FDR) is a road rehabilitation technique that processes existing asphalt and base material on roads to create a stronger base—essentially recycling the road to make it stronger. During the process, a reclaimer pulverizes and blends portions of the existing asphalt and base, creating a dirt-thin mix that is graded, compacted, stabilized, rolled, and overlaid.

Three MnROAD mainline test cells are being constructed as part of the Phase Two Research Initiative to evaluate the properties and performance of three variations of FDR using asphalt



emulsion stabilization. The results will be used to develop the best-cost design procedures to achieve the strength and flexibility needed for a pavement. TERRA members Mn/DOT and SemMaterials, a large asphalt producer in the United States and Mexico, are the primary project partners.

PCC surface characteristics during rehabilitation

Diamond grinding is one way researchers have found to rehabilitate existing portland cement concrete (PCC) pavements to make them quieter without sacrificing friction. The grinding process removes much of the pavement roughness and restores texture and friction.

In late 2007, researchers brought the developments from the Institute for Safe, Quiet, and Durable Highways (SQDH) at Purdue to improve the performance of diamond grinding to MnROAD. Through a pooled-fund research project, Diamond Surfaces Inc. donated their time and equipment to grind test patterns into two 500-foot cells, each consisting of two 12-foot-wide lanes, on the MnROAD mainline carrying “live” interstate traffic. Research findings will enable transportation agencies to set standard specifications for diamond grinding that optimizes ride quality, quietness, safety against hydroplaning and splash/spray, and concrete durability. The development of the one-pass innovative grind is important, too, because it saves time for grinding contractors, often required to make the more expensive multiple passes.

This TERRA pooled-fund project, funded at \$275,000 over five years, is led by the Minnesota Department of Transportation (Mn/DOT) in partnership with the Texas Department of Transportation (TxDOT), the Federal Highway Administration (FHWA), the American Concrete Paving Association (ACPA), and the International Grinding and Grooving Association. Mn/DOT, FHWA, and ACPA are TERRA members.



Pervious concrete pavement study

Storm water runoff can have harmful effects on our streams, lakes, and wetlands. To reduce this problem, TERRA is leading the way with innovative research into the use of pervious pavements in northern climates. Pervious concrete, which is designed to increase infiltration, is used primarily

to control storm water runoff for parking lots, low-volume roads, and walking trails.

Because understanding of the performance of pervious concrete in northern climates is still limited, Mn/DOT is collaborating with the Aggregate & Ready Mix Association of Minnesota (ARM) and the Minnesota Local Road Research Board (LRRB) to evaluate this technology. This partnership resulted in constructing at the MnROAD facility a pervious concrete driveway, a pedestrian walkway, and two test cells on the low-volume road (LVR).

By evaluating pervious concrete in Minnesota’s climate, the LVR study also will provide long-term performance monitoring of changes in porosity and infiltration under standard measurable traffic loads, environmental effects, and deicing operation.



Pervious concrete placement on the MnROAD low-volume road.

Communications and Outreach Activities

TERRA has developed several ways to provide up-to-date information about ongoing research and communicate research results to a variety of audiences worldwide. In addition, TERRA is continually seeking new ways to engage stakeholders in a dialogue on road research and implementation activities and solicit input on future research needs.

TERRA Innovation Series

TERRA kicked off the new Innovation Series this past year with two events showcasing innovative construction techniques and the implementation of research findings. More than 260 people attended. The TERRA Innovation Series was created to address research results, trends that affect or improve productivity, innovative partnering and contracting models, and hot topics that may lead to new research related to TERRA priorities. More information is online at www.terraroadalliance.org/events.



Highway 36 tour

Highway 36 reconstruction, November 2007

The first TERRA Innovation Series event highlighted the reconstruction of Minnesota Trunk Highway 36 through North St. Paul. About 85 industry representatives, University researchers, and a variety of state and local agency personnel attended.

The Highway 36 reconstruction project was especially noted for its use of complete closure and intelligent compaction. It was also the first FHWA Highways for LIFE (HFL) demonstration project in the country. Though similar projects usually take two or more years, the Highway 36 construction was completed in six months and at an estimated 15 percent under budget.

The daylong event, held adjacent to the Highway 36 reconstruction site, featured several local, state, and national speakers and included panels about proj-

ect innovations, accelerated construction, and project communications, outreach, and market research. The program was capped with a tour of the construction area led by the Mn/DOT project engineer in charge of the reconstruction.



Highway 36, North St. Paul, Minnesota

MnROAD open house, July 2008

The second TERRA Innovation Series event was held at the MnROAD facility near Albertville. The daylong event showcased how materials and pavement engineering innovations are developed, tested, and implemented on Minnesota roads at this one-of-a-kind, live transportation laboratory.

The event attracted more than 175 researchers, consultants, and practitioners from the ranks of construction, local government, and academia. Presentation and discussion topics ranged from innovative hot-mix asphalt (HMA) compaction methods to concrete overlays and composite pavements. In addition, tour buses made loops through the MnROAD facility, stopping at various project locations to provide details of several innovative projects under way, including studies of full-depth reclamation, pervious pavements, the effects of farm implements, hard rock aggregate bases, pavement surface characteristics, and a variety of pavement designs.

Also at the July event, TERRA presented

Mn/DOT commissioner Tom Sorel with an appreciation award for his commitment to the TERRA Board and his leadership in guiding the TERRA Marketing and Communications Committee. Sorel, who had represented FHWA on the board before accepting the Mn/DOT post, was acknowledged especially for his dedication and support of TERRA as well as his recognition of the importance of partnerships.



Tom Burhnam leads a tour of FDR test cells at MnROAD.

Fact Sheets

TERRA launched an ongoing series of fact sheets to highlight findings from TERRA research projects, including the 2007 report *MnROAD Lessons Learned*. Each fact sheet shares examples of how the research has been implemented and lists more than a dozen resources for further information about the topic. Links to those resources—as well as the downloadable fact sheets listed below—are online at www.terreroadalliance.org/publications/factsheets.

- **Low-Volume Roads**, the first TERRA fact sheet published in January 2008, describes how extensive experiments and continuous data collection on test sections of the MnROAD low-volume road (LVR) have produced a number of benefits to Minnesota roadways and to the larger pavement community.
- **Implementation of New Technologies**, the second fact sheet, describes how MnROAD engineers have introduced, developed, and encouraged the use of new technologies and techniques for pavement engineers. The fact

sheet, published in April, highlights three technologies: the Dynamic Cone Penetrometer (DCP), Ground Penetrating Radar (GPR), and Intelligent Compaction (IC).

- **Full-Depth Reclamation (FDR)**, a third fact sheet published in July, provides an overview of the FDR process, research highlights, and several examples of how the pavement recycling technique has been implemented in Minnesota. In addition, the document lists more than a dozen resources for more information about FDR.
- **Pervious Concrete**, the fourth TERRA fact sheet, was published in November. Pervious concrete, through which water flows relatively unobstructed, is used primarily as a pavement system to control storm water runoff for parking lots, low-volume roads, and walking trails. The fact sheet lists several pervious concrete projects that have been implemented in Minnesota, including two new test cells on the MnROAD low-volume road.

Presentations

In January 2008, TERRA Board member and former co-chair Fred Corrigan made a presentation about TERRA during a session on innovative partnerships at the Transportation Research Board (TRB) annual meeting in Washington, D.C. Corrigan's presentation highlighted the success of TERRA research efforts with international partners and outlined opportunities for further international collaboration.

TERRA presentations also were featured at these events during the past year:

- In February 2008, TERRA, along with a number of other organizations, cosponsored the 12th Annual Minnesota Pavement Conference in St. Paul.
- In December 2007, TERRA participated in the 39th annual convention of the Aggregate & Ready Mix Association of Minnesota (ARM) in Minneapolis.



- In August 2007, TERRA participated in the Mid-Continent Transportation Research Symposium in Ames, Iowa, hosted by the Center for Transportation Research and Education (CTRE) at Iowa State University, a TERRA member.

TERRA electronically connects thousands around the world

The TERRA Web site, launched in mid-2006, has continued to play a key role in communicating the results of TERRA research projects to a broad audience of pavement stakeholders. During the past year, unique visits to the TERRA Web site increased tenfold, to more than 18,000.

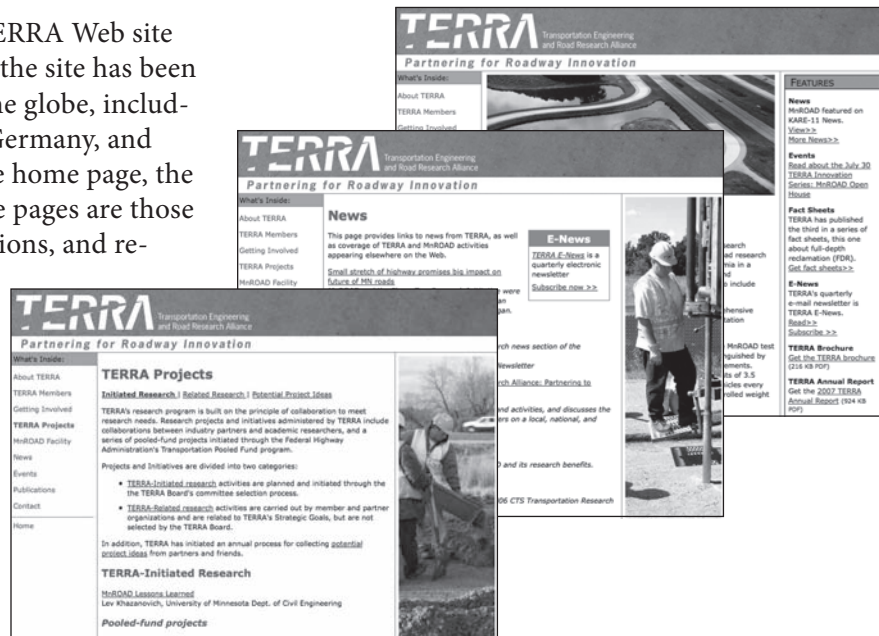
Though most visits to the TERRA Web site originate in the United States, the site has been drawing traffic from around the globe, including China, Singapore, Japan, Germany, and the United Kingdom. After the home page, the most popular TERRA Web site pages are those about TERRA events, publications, and research projects.

In addition to the Web site, eight issues of the quarterly *TERRA E-News* have provided news and information about research, publications, and events with the members of TERRA and others interested in transportation research. Since the first issue in January 2007, *TERRA*

E-News has attracted nearly 1,000 subscribers.

The current issue of *TERRA E-News*, subscription information, and an archive of past issues are on the TERRA Web site.

Connect to TERRA > www.terraroadalliance.org



Member and Partner Engagement

The collaborative, entrepreneurial approach to pavement and road research at TERRA offers many benefits. TERRA provides a framework for unprecedented collaboration among diverse stakeholder groups. The TERRA approach encourages new ways of thinking about research problems—emphasizing partnership and cooperation to address the large-scale challenges before transportation professionals and policymakers.

Project ideas moving ahead with TERRA leadership

TERRA collects project ideas to facilitate opportunities for research collaboration among those with similar interests, needs, and resources as part of a comprehensive program for addressing pavement, materials, and related transportation engineering challenges. In addition to facilitating project funding, the main TERRA goal is to move ahead projects that advance innovations in road engineering and construction.

TERRA received ten new project ideas during the past year from members and partners.

Once introduced, project ideas are honed through a communication process to prioritize objectives according to the needs of each partner involved.

Of the ten new proposals, two so far have progressed through the TERRA process. Following a presentation about each, the TERRA Board referred the two new ideas to the Research and Implementation Committee for further development. One, submitted by a software company, proposes to find ways to better monitor pavement performance for improved roadway condition, capacity, safety, and security. The other, submitted by a University of Minnesota researcher, proposes to examine performance-based contracts and develop guidelines for project letting and management.

In addition, two projects from 2007 have continued to progress. “Demonstrating the Asphalt Anti-Oxidant Benefits of Bio-Energy Co-Products,” which is examining bio-energy co-products as an



Tom Wood describes FDR research on the MnROAD mainline test cells.

alternative to using crude-oil-based products in asphalt materials, will be ready for field tests next year. “Stabilized Full-Depth Reclamation,” which is developing stronger recycled base materials so roads can use a thinner bituminous overlay and, as a result, incur lower life-cycle costs, is being addressed through several initiatives, such as the SemMaterials FDR project at MnROAD.

For more information or to share a project idea with TERRA, please visit the TERRA Web site at www.terreroadalliance.org.

Committees

The TERRA Board accomplishes its mission through the use of functional committees. The successes of the research, engagement, and communications efforts described in this report are largely due to the committed service of these individuals.

The three TERRA committees have been structured around the organization's strategic directions. The Member and Partner Engagement Committee focuses on proactively expanding TERRA membership. The Research and Implementation Committee

focuses on leading bold and synergistic transportation engineering and road research, implementing research findings “on the ground,” and providing a dynamic forum for research interchange. The Marketing and Communications Committee focuses on communicating research findings to ensure implementation “on the ground” and facilitate the dynamic and ongoing exchange of research ideas and findings. A fourth TERRA committee, the Coordinating Committee, provides leadership and strategic guidance to board activities.

Coordinating Committee

Members:

Bernie Arseneau, Minnesota Department of Transportation
Fred Corrigan, Aggregate & Ready Mix Association
Robert Johns, Center for Transportation Studies
Keith Shannon, Minnesota Department of Transportation
Julie Skallman, Minnesota Department of Transportation
Jean Wallace, Minnesota Department of Transportation
Tim Worke, Associated General Contractors of Minnesota

Resource Staff:

Maureen Jensen, Minnesota Department of Transportation
Stephanie Malinoff, Center for Transportation Studies
Laurie McGinnis, Center for Transportation Studies

Research and Implementation Committee

Members:

Mark Maloney (Chair), City of Shoreview and Minnesota Local Road Research Board
Roberto Ballarini, Department of Civil Engineering, University of Minnesota
Dean Potts, Caterpillar Global Paving
Larry Sutter, Michigan Tech
Matt Zeller, Concrete Paving Association of Minnesota

Resource Staff:

Maureen Jensen, Minnesota Department of Transportation
Stephanie Malinoff, Center for Transportation Studies

Affiliate Members:

Kelvin Howieson, Minnesota Department of Transportation
Sue Lodahl, Minnesota Department of Transportation
Kevin MacDonald, Cemstone
Derrell Pettis, LeSueur County
Ben Worel, Minnesota Department of Transportation

Marketing and Communications Committee

Members:

Keith Shannon (Co-Chair), Minnesota Department of Transportation
Fred Corrigan (Co-Chair), Aggregate & Ready Mix Association
Robert Johns, Center for Transportation Studies
Julie Garbini, RMC Research & Education Foundation
Julie Skallman, Minnesota Department of Transportation
Matt Zeller, Concrete Paving Association of Minnesota

Resource Staff:

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Laurie McGinnis, Center for Transportation Studies

Affiliate Members:

Tom Ravn, Minnesota Department of Transportation

Member and Partner Engagement Committee

Members:

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Mike Sheehan (Co-Chair), Olmsted County and Minnesota Local Road Research Board
Bernie Arseneau, Minnesota Department of Transportation
André Clover, Michigan Department of Transportation
Shashi Nambisan, Center for Transportation Research and Education
Gerald Voigt, American Concrete Pavement Association
Jean Wallace, Minnesota Department of Transportation
Dan Wegman, SemMaterials

Resource Staff:

Maureen Jensen, Minnesota Department of Transportation
Stephanie Malinoff, Center for Transportation Studies
Laurie McGinnis, Center for Transportation Studies

Focusing on implementation as well as research

In early 2008, the TERRA Board renamed its research committee the Research and Implementation Committee.

Mark Maloney, public works director for the City of Shoreview, Minnesota, succeeds Keith Shannon, director

of the Mn/DOT Office of Materials and Road Research, as committee chair. Maloney is one of two Minnesota Local Road Research Board representatives on the TERRA Board.



Transportation Engineering and Road Research Alliance

For information about working with TERRA, please contact any TERRA Board member or the key staff leaders:

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- Maureen Jensen, Manager, Road Research Section, Office of Materials and Road Research, Minnesota Department of Transportation, 651-366-5507, maureen.jensen@dot.state.mn.us

www.terraroadalliance.org