

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 Member: Braun Intertec

[Braun Intertec](#) joined TERRA in January. Braun Intertec provides geotechnical engineering, environmental consulting, building envelope consulting, and materials and analytical testing services. Senior engineer Matthew Oman will represent Braun Intertec on the TERRA board.

Member Research Spotlight: Base stabilization using engineered emulsion

[Road Science, a division of ArrMaz Custom Chemicals](#), provided details about this edition's featured research project.

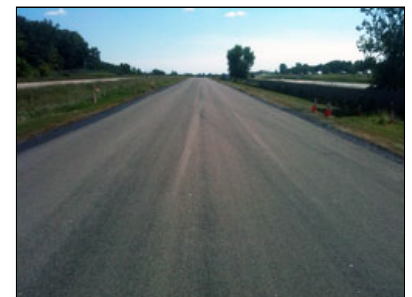
Problem

Recycling existing pavements in place has become a key strategy in many rehabilitation projects at the state and local levels. However, for agencies to make the most effective use of in-place rehabilitation strategies, research is needed to provide insight into the proper use of materials, placement, and performance attributes of base stabilization on high- and low-volume pavements.

Solution

In 2008, Road Science (formerly SemMaterials) designed and constructed three full-depth reclamation sections on MnROAD mainline test cells using asphalt emulsion stabilization. Since their construction, the research cells have seen more than 75 percent of the 3 million equivalent single-axle loads (ESALs) in the pavement design, and none of the cells have experienced cracking in the pavement. Overall results indicate that this rehabilitation strategy provides improved base strength and fatigue resistance.

In 2011, a low-volume test cell was constructed at MnROAD using the same technology with only a chip



seal placed over the stabilized base. Road Science expects the cell to demonstrate that this alternative rehabilitation solution can help local agencies address their expansive low-volume road network needs. The ultimate goal is to provide all agencies with more and better tools for their rehabilitation toolbox.

Implementation

Many additional projects have been completed using this recycling technology. Minnesota counties such as Chisago, LeSueur, Washington, and Blue Earth have helped champion the development. The Minnesota Department of Transportation is now building on that work by expanding the use of recycling on more roadways. Performance measures are now in the works to quantify the years of life added to a pavement by using this continually improving technology.

Project Partners

Many partners were involved on these projects. In addition to the agencies mentioned above, additional partners include Midstate, LaFarge, Hardrives, Astech, WSB, AET, and Hall Bros. Construction.

More Information

- [MnROAD project description](#)
- Contact: Shongtao Dai, 651-366-5407, shongtao.dai@state.mn.us

Each TERRA member organization has an opportunity to briefly share and showcase a specific research project or initiative in the Member Research Spotlight. Profiles of most TERRA member organizations, previously published here, remain available through the [TERRA E-News archives](#).

Member Update: Road Science, a division of ArrMaz Custom Chemicals

Road Science, a division of ArrMaz Custom Chemicals, specializes in recycling, preservation/maintenance, and materials science for the road paving industry. Formerly SemMaterials, the company transitioned to Road Science in 2009.

Throughout its history, Road Science has been dedicated to working with government and academia to develop meaningful research programs, and that commitment will continue, says Dan Wegman, an account manager at Road Science and TERRA co-chair.

"Our commitment to research efforts is one of our core values and continues to strengthen as we work with organizations like TERRA," Wegman says.

Road Science is specifically focused on research that investigates and develops new pavements, materials, and engineering techniques that lengthen the life of asphalt pavement. The company's performance testing laboratory and capabilities are also an important research resource that public agencies, academia, and commercial entities rely on to provide critical validation testing and reporting.

Member Highlights

The [Minnesota Department of Transportation \(MnDOT\)](#) was recently awarded two National Roadway Safety Awards from the Federal Highway Administration and the Roadway Safety Foundation. The department was recognized with Wright County for the County Roads Safety Plans Program for collaborating with several counties to involve local highway agencies in the safety planning process, providing agencies with the assistance to successfully apply for state and federal funding. Other awards recognized the department for reducing crashes on wet roads by using micro surfacing, which decreased wet-weather crashes by 76 percent during a 20-year study period. "These projects are specific examples of how Minnesota is a national leader in reducing roadway fatalities and serious injury crashes," MnDOT commissioner Tom Sorel said.

Projects and Initiatives

Wind farms and other major traffic generators inspire tools to mitigate damage

Wind power is the fastest-growing source of electrical energy in the country. Not only do wind farms promise clean energy, the construction provides jobs and wind production generates revenue in the form of state and local taxes and permitting fees. In fact, wind energy has become a significant source of new income for a growing number of rural areas and is especially important for those left struggling from declines in traditional sources of revenue. But major road damage can be an unintended consequence of the development of wind and other forms of energy.

In response, the Minnesota Local Road Research Board (LRRB) has developed an online tool for local agencies to quantify the impact of major traffic generators on local roads and to provide guidelines on how to interact with developers regarding road-related issues.

County and township roads were never intended to carry the multiple large loads involved in the wind farm construction. For example, the gross weight of a truck carrying wind turbine tower sections can vary from 134,000 pounds to 232,000 pounds. Enormous cranes and other heavy equipment can weigh 100,000 pounds. Large amounts of concrete, rebar, and gravel also are hauled in to construct wind farms. Intersections also must be widened to safely accommodate



Photo courtesy of Jackson County

Top 10 states for overall wind power

1. Texas
2. Iowa
3. California

the large turning radii of the trucks. The effects of these heavy loads can be even worse during the spring thaw, when local roads typically become weaker and more vulnerable to damage.

In Minnesota, now ranked fifth in overall U.S. wind power, Jackson County Engineer Tim Stahl has wrangled with a number of problems related to the impact of wind farm development over the past several years in the southwestern Minnesota county. At one point, he compared the load placed on county roads in one Jackson County township by hauling crops with the loads placed on those same roads by wind farm construction. The results were stunning, revealing 10 to more than 60 times the number of equivalent single-axle loads for the wind farm construction.

It became clear that significant hauling of heavy loads put roadway surfaces at risk of damage. In particular, the construction, operation, and maintenance of such energy-producing developments raised several concerns, including pavement damage, the indirect impact to the immediate area surrounding the roads, and the related costs to local governments to repair and maintain the roads and to mitigate other effects.

In 2009, Stahl and county engineers from several other southwestern counties formed a committee that applied for and received a research grant from the Minnesota Local Road Research Board (LRRB), a founding member of TERRA.

The next year, the group, with MnDOT and regional planners, had developed an [online resource](#) presenting step-by-step guidelines for Minnesota county engineers on how to interact with developers of wind farms, or large wind-energy conversion systems (LWECSs), regarding road-related issues. The resource, which includes a spreadsheet tool for quantifying the impacts to local roads, also provides county engineers with guidance on how to work with LWECS developers to preserve the roadway surfaces.

The resource, [Best Practices: Managing Interactions between Local Authorities and Major Traffic Generators](#), contains a wide range of information in a single, downloadable interactive document. The document allows easy access to the following content:

- Web links and reports
- Sample ordinances, permits, agreements, and maps
- Traffic calculator to quantify the traffic impact on roads
- Policy options to recapture roadway maintenance costs
- Experience from current or past projects
- Research information

The Minnesota LRRB hopes county engineers in other states, other road authorities, and wind power developers also may find this information valuable. While the tool is focused on LWECSs, it is broad enough that it could also be used when a county is dealing with any other enterprise that affects the roads under its jurisdiction. The LRRB also is encouraging users to send comments and/or updates to any member of the technical advisory committee listed within the document.

Related resources:

- [Best Practices: Managing Interactions between Local Authorities and Major Traffic Generators](#) (Minnesota LRRB, 2010)
- [Road Maintenance: Damaging wind farms](#) (*Roads&Bridges*, May 2011)
- [Road damage: the unintended consequence of wind farm development](#) (Minnesota LTAP Exchange, Fall 2010)
- [Effects of Major Traffic Generators](#) (Minnesota Department of Transportation, January 2010, TRS 1001)
- [When large loads travel local roads: tips for managing big projects](#) (1.0 MB PDF, Wisconsin LTAP Transportation Information Center *Crossroads*, Spring 2009)

4. Illinois
5. Minnesota
6. Washington
7. Oregon
8. Colorado
9. Oklahoma
10. North Dakota

Source: [American Wind Energy Association](#)

Tips for managing big projects

1. Schedule early planning session.
2. Identify local concerns.
3. Establish single point of contact.
4. Designate all staging areas and routes.
5. Issue permits for all access points.
6. Issue blanket moving permits.
7. Conduct daily inspections.
8. Inspect all routes after project completion.

Source: [Wisconsin LTAP TIC](#)



Oil boom weighs on North Dakota roads and more

North Dakota is the fastest-growing producer of oil in the country and could become the second-largest oil-producing state—just behind Texas—within a few years. The boom is largely due to new technology for extracting oil and gas trapped in rock formations and the selling price of those fossil fuels reaching levels that make the extraction process worthwhile—worthwhile to the tune of tens of millions of dollars per day.

Without a doubt, the increase in oil and gas production has been a positive factor in the state's economy, generating jobs and much-needed revenue. But North Dakota is also struggling to keep up with the high

demands the booming production has placed on its infrastructure. Its transportation system and everything else supporting oil and gas production in 17 northwestern counties of the state have been overwhelmed.

"There's been nothing of this magnitude of development in the United States before," said Jack Olson, assistant director of planning and asset management with the North Dakota Department of Transportation (NDDOT) and scheduled speaker at the 2012 TERRA Pavement Conference. "How do you provide the transportation services the industry needs?"

The U.S. Geological Survey recently has estimated there may be 300 to 400 billion barrels of oil in the formations under the state. Various sources estimate that 3.5 to 24 billion barrels from the oil patch may be recoverable.

By August 2011, North Dakota had 6,708 active wells, and production had increased to more than 13.8 million barrels a month, or 446,000 barrels a day—an increase of 150 percent since 2008.



The new technology for extracting the oil and gas, known as hydraulic fracture mining or "fracking," requires lots of heavy equipment and manpower. Several loads involve oversize and overweight movements. In fact, of the 40 to 50 loads necessary to move a drilling rig, almost half require permits since they exceed legal weights, and three out of every four loads also are oversized. The weight of a work-over rig, for example, is approaching 110,000 pounds.

Fracking a well also requires an average of 3 million gallons of freshwater, which is the equivalent of 446 truckloads, and 4 million pounds of sand, or about 96 truckloads. Salt water, a byproduct of fracking, is transported from wells either by pipeline or trucks to permitted disposal sites. In addition, about 70 percent of the crude oil extracted is trucked from wells to pipeline transfer locations and rail transload facilities, an increase from 35 percent in 2008.

Upgrading North Dakota's transportation infrastructure, much of which was originally constructed in the 1950s, has become a priority at the state level. Within the past year, the state legislature provided \$229 million for state highway projects in the oil zone, as well as \$142 million for city, county, and township roads in the region. And there are plans for more.

Even so, North Dakota's booming oil production has overloaded more than just roads, pipelines, and the rail system. The state's population, especially near the oil patch, has swelled with new workers, stretching demand for basic needs, from electricity, water, and supplies to housing, schools, and law enforcement.



Olson's office, which first started in August 2008 to track oil production and its associated impacts, is responsible for developing plans for additional transportation infrastructure to accommodate the changes. Some estimate as many as 30,000 to 40,000 more oil wells are possible. "It's a very, very dynamic, changing industry," he said.

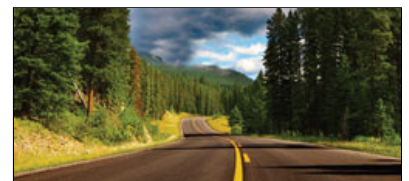
Photos provided courtesy of the North Dakota Department of Transportation

NDDOT's Jack Olson will be presenting "North Dakota's Experience with Heavy Loads on Low-Volume Roads" at the 2012 TERRA Pavement Conference in St. Paul on February 9.

Norwegian Public Roads Administration research program strives for durable roads

Norway has a lot of roads to maintain. In fact, the country has 93,214 kilometers (57,920 miles) of public roads. And since Norway is a mountainous country cut apart by deep fjords, it is costly to build and manage an effective road network.

In an effort to increase the service life of pavements and reduce the cost of resurfacing and maintaining roads, the Norwegian Public Roads Administration (NPRA) has launched the four-year Durable Roads research program. The program, which runs from 2011 through 2014, focuses on road surfacing, structural design and strengthening, and knowledge dissemination and implementation.



As part of its ongoing research, the NPRA hopes to work with the whole Norwegian engineering community and the international road engineering community, including other TERRA partners and

members.

"Most of the TERRA members deal with the same problems that we are dealing with when it comes to building durable roads," said Leif Bakløkk, leader of the Durable Roads program and TERRA board member. "As such most of the program's goals can be of interest to the other members."

Because Norway's cold climate is similar to that of several TERRA members, the NPRA feels it shares common challenges in building and maintaining roads with many TERRA members. The NPRA already collaborates with TERRA partners such as the Minnesota Department of Transportation and the University of Minnesota through information exchange meetings.

"The basic challenge is to find materials and solutions that are economical and that can withstand the cold climate and have satisfactory service life," Bakløkk said. For example, the NPRA is interested in MnROAD research about frost penetration and would like to use that information as it revises design methods through the Durable Roads program.

"We would like to cooperate with MnROAD on this and related topics in the program," he concluded. "We would, of course, like to work with all TERRA members, but the exact topics for cooperation have yet to be worked out."

Of its 30 billion NOK (\$5.1 billion USD) annual budget, the NPRA uses about 2 billion NOK (\$340 million USD) to resurface roads. Because there is a lot of distress and damage on a large part of the road network, the NPRA has found that repairs and maintenance could be done more efficiently and durably. In addition, changes in traffic loading, climate, materials, and advances in methods and equipment mean that guidelines need to be revised.

The Durable Roads research program, which is estimated to cost 20 million NOK (\$3.4 million USD) over four years, has seven goals aimed at improving pavement condition, reducing costs, decreasing traffic delays, and enhancing accessibility of Norway's roads.

The first goal is to improve quality assurance and methods for assessing performance. To assess performance, researchers will use a variety of methods for measurement of pavement profile, thickness, and bearing capacity. Researchers will also document quality during production with profile scanners, geo-radars, thermal cameras, intelligent compaction equipment, and GPS.

The second goal focuses on exploring material properties, such as resistance to deformation and filler quality, and setting new requirements. The third goal is to support the ongoing research on the effect of climate on road durability and to establish a cooperative program with other stakeholders.

A fourth goal seeks to improve the Norwegian pavement design system by improving adjustment to the subgrade condition, giving more consideration to freeze-thaw cycles, updating axle-load data, and testing new materials. The fifth goal is to do a cost/benefit analysis of building more robust roads.

For the sixth goal, researchers will adjust current pavement performance models to Norwegian conditions as well as document the effects of new interventions for pavement maintenance and performance. The seventh and final goal is to implement current best practice standards and guidelines for pavement installation and maintenance.

The Durable Roads program is being conducted in cooperation with the regional offices of the NPRA, contractors, suppliers, the Norwegian University of Science and Technology (NTNU) and other colleges, other Nordic transport authorities, research institutes, and consultants. A broad-based reference group also was established to give advice and suggestions on the work of the program.

Photos provided courtesy of the Norwegian Public Roads Administration

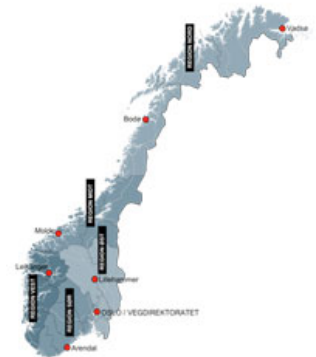
Related resources:

- [Norwegian Public Roads Administration](#)
- [Member Profile: Norwegian Public Roads Administration](#) (TERRA E-News, May 2009)

Announcements

TERRA cosponsors Feb. 7 seminar about low-temperature performance specs

TERRA is partnering with the University of Minnesota Center for Transportation Studies to sponsor a seminar on February 7 titled "[Towards a Low-Temperature Performance Specification for Asphalt Mixtures](#)," from 2: 45 p.m. to 3:45 p.m. (Central). Civil engineering associate professor Mihai Marasteanu will be summarizing work performed in two studies dealing with the low-temperature behavior and performance of asphalt pavements, highlighting his team's laboratory and field data.



Concepts of a performance-based specification for asphalt mixtures will be explained as well as successful steps to an implementation of such a specification. This seminar will be broadcast live on the web and available for later viewing.

Registration still open for the TERRA Pavement Conference on Feb. 9

Registration is still open for the [TERRA Pavement Conference](#), scheduled for February 9, 2012, at the University of Minnesota Continuing Education and Conference Center in St. Paul, Minnesota. This one-day conference provides practical information to practitioners and others interested in pavement design, construction, rehabilitation, and maintenance. The emphasis of the conference is new materials and methods that can assist decision makers in providing the most cost-effective strategies for building, repairing, and maintaining pavement infrastructure. This year's conference will feature sessions on pavement preservation, low-volume roads, and alternative bid projects.



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 2012 TERRA Pavement Conference, visit the [TERRA Pavement Conference event web page](#). To view information from previous conferences, visit the [TERRA events page](#).

TERRA publishes 2011 highlights

TERRA has published a two-page report highlighting the organization's activities and accomplishments during the past year. The document provides a brief overview of research and implementation, engagement, and communications efforts, crediting the committed service of its members, the TERRA board, and three active committees structured around the organization's strategic directions. *TERRA 2011 Highlights* and other TERRA news are available for download from the [TERRA website news page](#).



Mid-Continent Transportation Research Forum proposals due Mar. 16

The [2012 Mid-Continent Transportation Research Forum](#) will take place on September 6-7, 2012, in Madison, Wisconsin. The annual forum, hosted this year by the Wisconsin Transportation Center and the Wisconsin Department of Transportation, 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. Researchers are encouraged to focus their efforts on projects that demonstrate a significant return on the investment of the sponsoring agencies, specifically state DOTs. Submitters are also encouraged to partner and jointly present their material with practitioners. The deadline for submitting proposals is March 16, 2012.

ATSSA-Northland Chapter upcoming events

The [Northland Chapter of the American Traffic Safety Services Association \(ATSSA\)](#) calendar includes these upcoming events:

- [American Traffic Safety Services Association \(ATSSA\) 42nd Annual Convention and Traffic Expo](#), February 12-16, 2012
Tampa Convention Center, Tampa, Florida
- ['How-to' Training & Workshop: Saving Lives by Design](#), March 13 -14, 2012
Fargo, North Dakota

MAPA upcoming events

The [Minnesota Asphalt Pavement Association \(MAPA\)](#) calendar includes these upcoming events:

- [56th Annual Asphalt Contractors' Workshop/Quality Initiative Workshop](#), March 6, 2012
Earle Brown Heritage Center, Brooklyn Center, Minnesota
Info: info@mnapa.org
- [World of Asphalt Show & Conference](#), March 13-15, 2012
Charlotte Convention Center, Charlotte, North Carolina
- [AAPT 87th Annual Meeting](#), April 1-4, 2012
Omni Austin Hotel Downtown, Austin, Texas
Info: aaptinfo@gmail.com

CPAM upcoming events

The [Concrete Paving Association of Minnesota \(CPAM\)](#) calendar includes these upcoming events:

- [Quality in Concrete Paving Workshop](#), March 7, 2012
Mankato, Minnesota
- [CPAM Annual Concrete Paving Workshop](#), March 8-9, 2012

More upcoming events

- [FHWA Intelligent Compaction National Workshop](#), May 3, 2012
Bloomington, Minnesota
- [APWA Minnesota Chapter Spring Conference](#), May 9-11, 2012
Grand View Lodge, Nisswa, Minnesota

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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