LRRB
LOCAL
ROAD RESEARCH
BOARD

RESEARCH

FY2011 Local Road Research Board At-A-Glance

This publication provides a guide to the Local Road Research Board's Fiscal Year 2011 research activities. It includes a graphical account of progress on all active research projects during this period; a list of reports and research implementation products completed during this time; and an overview of LRRB, including the following strategic research goals that will guide LRRB research over the coming years.

LRRB MISSION

The mission of the LRRB is to serve local road transportation practitioners through the development of new initiatives, the acquisition and application of new knowledge, and the exploration and implementation of new technologies.

LRRB STRATEGIC GOALS

The LRRB sponsors research projects that improve Minnesota's local government road system with regard to:

1. **Design—**
   the determination of the need for and nature of a proposed road system project
2. **Construction—**
   the implementation of the plans and specifications from the road system design process
3. **Maintenance/Operations—**
   the operation and maintenance of the road system investment
4. **Environmental Compatibility—**
   the integration of the local road system into the community to minimize adverse environmental impacts while contributing to economic and social well-being

About LRRB

Since 1959, the LRRB has facilitated both new transportation research and the sharing of the latest knowledge among Minnesota city and county engineers. In the last 15 years, it has sponsored more than 200 projects in areas ranging from cold in-place recycling with foamed asphalt to the use of pervious concrete for stormwater management.

How the LRRB Works

Each year, the LRRB's 10-member board, including city and county engineers and key MnDOT decision-makers, approves and funds the most innovative research projects addressing the needs of local transportation practitioners. Once approved, research is conducted by investigators from MnDOT, regional universities and consulting firms, with the LRRB monitoring its progress and MnDOT providing administrative support and technical assistance.

Sharing the Results

Once research has been completed, the Research and Implementation Committee (www.lrrb.org/ric.aspx) communicates the results and facilitates their practical application. The RIC uses a variety of methods to reach engineers and others with new developments, including presentations, videos, written reports, pamphlets, seminars, workshops, field demonstrations, Web-based technologies and on-site visits.

Submit an Idea

The LRRB is continually on the lookout for new technologies that communicate results more cost-effectively and efficiently, and welcomes research ideas from Minnesota transportation practitioners. Please submit your research needs to the LRRB at www.lrrb.org/submitidea.aspx.

For more information about the projects listed in this publication, search for reports and Technical Summaries, and initiate queries, visit www.lrrb.org. The website lists LRRB members, provides news and events information, explains more about the LRRB's mission and plans, and provides links to a variety of Web-based tools to help in areas such as pavement design, management and rehabilitation; geosynthetics design; crash data analysis; connecting with local and national resources; and more.

LRRB BOARD MEMBERS

2012

Rick West (Chair), Otter Tail County
Julie Skallman, State Aid Division
Thomas Ravn, MnDOT Construction & Innovative Contracting Division
Linda Taylor, MnDOT Research Services
Bruce Hasbargen, Beltrami County
Lyndon Robjent, Carver County
Tim Stahl, Jackson County
Steve Koehler, City of New Ulm
John Powell, City of Savage
Laurie McGinnis, University of Minnesota CTS

2011

Rick West (Chair), Otter Tail County
Julie Skallman, State Aid Division
Thomas Ravn, MnDOT Construction & Innovative Contracting Division
Linda Taylor, MnDOT Research Services
Mitch Anderson, Stearns County
Bruce Hasbargen, Beltrami County
Sue Miller, Freeborn County
Deb Bloom, City of Roseville
Steve Koehler, City of New Ulm
Laurie McGinnis, University of Minnesota CTS

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2012

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Dave Robley, Douglas County
Tim Stahl, Jackson County
Walter Leu, MnDOT
Rick Kjonaas, MnDOT
Maureen Jensen, MnDOT
Nicole Peterson, MnDOT
Farideh Amiri, MnDOT
Jim Grothaus, University of Minnesota

2011

Rich Sanders, (Chair), Polk County
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Jeff Hulsether, City of Brainerd
Mitch Rasmussen, Scott County
Tim Stahl, Jackson County
Susan Miller, Freeborn County
Walter Leu, MnDOT
Rick Kjonaas, MnDOT
Maureen Jensen, MnDOT
Ben Worel, MnDOT
Farideh Amiri, MnDOT
Jim Grothaus, University of Minnesota

LRRB Completed Reports and Implementation Products in FY2011

FUNDING SOURCE KEY

LRRB	Local Road Research Board
SRP	State Research Program
SP&R	State Planning & Research (FHWA)

LRRB Identifier	Report Title	Report Number	Contractor	Investigator	Technical Liaison	Administrative Liaison	Start Date	End Date	Funding Source	Project Cost
INV 645	RIC: Minnesota Sign Retroreflectivity Toolkit	2010RIC02	SRF Consulting Group, Inc.	Mike Marti, Renae Kuehl	Michael Sheehan	Clark Moe	2/19/09	12/31/11	LRRB	$25,992
INV 645	RIC: Best Practices Guide for Removing Traffic Signs	2010RIC10	CH2M Hill	Howard Preston	Mark Vizecky	Clark Moe	1/13/10	1/31/11	LRRB	$70,327
INV 645	RIC: Decision Tree for Stormwater BMPs	2011RIC01	SRF Consulting Group, Inc.	Mike Marti	Michael Sheehan	Bruce Holdhusen	2/19/09	12/31/11	LRRB	$51,748
INV 645	RIC: DVD: Pavement Management Systems: Better Data, Better Decisions, Better Roads	TE220. P385 2011	SRF Consulting Group, Inc./ Greer & Associates/ Minnesota State University, Mankato	Mike Marti, Richard Kronick, W. James Wilde	Gary Danielson	Farideh Amiri	2/19/2009	12/31/2011	LRRB	$80,752
INV 768	Monitoring Geosynthetics in Local Roadways (LRRB 768) 10-Year Performance Summary	2011-20	MnDOT Office of Materials	Timothy Clyne	Luane Tasa	Daniel Warzala	10/1/00	9/1/11	LRRB	$25,000
INV 843-1	Predicting the Occurrence of Bumps in Overlays	2010-31	Minnesota State University, Mankato	W. James Wilde	John Brunkhorst	Daniel Warzala	8/8/06	9/30/10	LRRB	$31,040
INV 851	Allowable Axle Loads on Pavements	2011-02	University of Minnesota	Lev Khazanovich	Gerard Geib	Clark Moe	11/14/06	1/31/11	LRRB, SRP	$126,042
INV 855	A Property-Based Specification for Coarse Aggregate in Pavement Applications	2010-35	North Dakota State University	Magdy Abdelrahman	John Grindeland	Daniel Warzala	11/6/06	10/31/10	LRRB	$92,624
INV 868	TPF-5(134) MPR-6(029) MPR-6(021): Influence of Pavement on Traffic Noise—Statistical Pass-By Measurements of Traffic on Several Interstate Pavements	2010-40	HDR Engineering	Tim Casey	Bernard Izevbekhai	Nelson Cruz	6/16/09	9/30/10	LRRB, SP&R, Other State Funds	$62,118
INV 872	TFP-5(148): Improving MnROAD Temp	2010-26	University of Minnesota	Randal Barnes	Thomas Burnham	Shirlee Sherkow	4/7/08	7/31/10	LRRB, SP&R, SRP	$63,500
INV 872	TPF-5(148): 2008 MnROAD Unbound Quality Control Construction Report	2010-32	CNA Consulting Engineers, Inc.	D. Lee Petersen	John Siekmeier	Bruce Holdhusen	3/30/09	8/31/10	LRRB, SP&R, SRP, Partnership Funds	$49,656
INV 875	Improved Automatic Sampling for Suspended Solids	2010-38	University of Minnesota	John Gulliver	Marilyn Jordahl-Larson	Shirlee Sherkow	12/4/07	2/28/11	LRRB	$55,000
INV 877	Advanced LED Warning Signs for Rural Intersections Powered by Renewable Energy	2011-04	University of Minnesota – Duluth	Taek Kwon	Brian Boder	Alan Rindels	2/15/08	2/28/11	LRRB	$125,476
INV 880	Optimal Workforce Planning and Shift Scheduling for Snow and Ice Removal	2011-03	St. Louis County	Diwakar Gupta	Jim Foldesi	Alan Randals	7/17/07	4/30/10	LRRB	$45,000
INV 891	Performance Assessment of Oversized Culverts to Accommodate Fish Passage	2011-19	University of Minnesota	John Nieber	Petronella DeWall, Nicole Danielson-Bartelt	Nelson Cruz	8/7/09	8/31/11	LRRB, SRP, COPTRS	$78,917

FUNDING SOURCE KEY

LRRB	Local Road Research Board
SP&R	State Planning & Research (FHWA)
SRP	MnDOT State Research Program

LRRB RESEARCH

Active Research Projects in FY2011

LRRB Identifier	Title	Contract #	Contractor	Investigator	Technical Liaison	Administrative Liaison	Start Date	End Date	Funding Source	Total Cost	Amount Paid	% Paid
INV 645	RIC Implementation of Research Findings (FY2009-2011)	93463	SRF Consulting Group, Inc.	Michael Marti	Rich Sanders	Farideh Amiri	4/17/09	12/31/11	LRRB	$497,697	$449,234	90%
INV 645	RIC Implementation of Research Findings 2012-2014	98383	SRF Consulting Group, Inc.	Michael Marti	Rich Sanders	Farideh Amiri	6/20/11	7/31/14	LRRB	$465,497	$11,782	3%
INV 645	RIC: Best Value Procurement Development	93103 WO16	HNTB Corporation	Steve Howe	None	Farideh Amiri	8/5/09	7/30/12	LRRB, Partnership Funds	$179,074	$52,936	30%
INV 645	RIC: Best Practices for Recreation Trails Workshop	93463 Task 5	SRF Consulting Group, Inc.	Mike Marti	Tom Behn	Bruce Holdhusen	2/19/09	12/31/11	LRRB	$27,608	$27,608	100%
INV 645	RIC: LRRB Product Evaluation/Roadmapping	93463 Task 6	SRF Consulting Group, Inc.	Mike Marti	Rick Kjonaas	Clark Moe	2/19/09	12/31/11	LRRB	N/A	N/A	N/A
INV 645	RIC: LRRB Outreach and Marketing	93463 Task 7	SRF Consulting Group, Inc.	Mike Marti	Tom Colbert	Clark Moe	2/19/09	12/31/11	LRRB	$45,976	$30,647	67%
INV 645	RIC: Winter Maintenance Equipment Calibration Workshop	93463 Task 8	SRF Consulting Group, Inc.	Mike Marti	Rich Sanders	Farideh Amiri	2/19/09	12/31/11	LRRB	$50,933	$50,933	100%
INV 668	LTAP 0001(210): Local Technical Assistance Program (LTAP), FY2011	89261 WO225	University of Minnesota	Jim Grothaus	Julie Skallman	Farideh Amiri	8/30/10	10/31/11	LRRB, Other Federal Funds	$440,500	$440,500	100%

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LRRB Identifier	Title	Contract #	Contractor	Investigator	Technical Liaison	Administrative Liaison	Start Date	End Date	Funding Source	Total Cost	Amount Paid	% Paid
INV 675	FY2011 Research Services Positions	INV 675	None	None	None	None	7/1/10	6/30/11	LRRB	$160,000	$160,000	100%
INV 676	FY2011 Support of Mn/ROAD Low Volume Road	LAB676-11	MnDOT Office of Materials	Maureen Jensen	None	None	7/1/10	6/30/11	LRRB	$570,000	$285,000	50%
INV 745	FY2011 Library Services	INV 745	None	Sheila Hatchell	None	None	7/1/10	6/30/11	LRRB	$70,000	$70,000	100%
INV 825, INV 899	Performance Monitoring of Olmsted CR 117/104 and Aggregate Base Material Update	LAB899	MnDOT Office of Materials	Matthew Lebens	None	Alan Rindels	6/8/10	2/28/15	LRRB	$36,000	$0	0%
INV 840-1	Performance of PG 52-34 Oil on Local Roads	LAB840	MnDOT Office of Materials	Shongtao Dai	Brian Noetzelman	Daniel Warzala	6/22/06	12/31/11	LRRB	$56,200	$45,600	81%
INV 843-2	Predicting the Occurrence of Bumps in Overlays	INV 843-2	MnDOT Office of Materials	Eddie Johnson	None	Daniel Warzala	7/13/06	9/30/10	LRRB	$33,500	$25,401	76%
INV 854	TPF-5(148): Vibrating Wire and Horizontal Clip Data Analysis	89261 WO101	University of Minnesota	Ahmed Tewfik	Thomas Burnham	Bruce Holdhusen	6/10/08	12/31/11	LRRB, SP&R, SRP, Partnership Funds	$70,000	$63,000	90%
INV 854	TPF-5(148): Effects of Implements of Husbandry on Pavement Performance	89261 WO79	University of Minnesota	Lev Khazanovich	Shongtao Dai	Bruce Holdhusen	10/12/07	11/30/11	LRRB, SP&R, SRP, Partnership Funds	$275,239	$113,124	41%
INV 863	TPF-5(153): Optimal Timing of Preventive Maintenance for Addressing Environmental Aging in HMA Pavements	95099	Asphalt Institute	Mike Anderson	Thomas Wood	Bruce Holdhusen	3/30/10	11/30/13	LRRB, SP&R, Other Federal Funds	$286,185	$27,633	10%
INV 864	MPR-6(022): Recycled Asphalt Pavements	LAB864	MnDOT Office of Materials	Eddie Johnson	Gregory Johnson	Bruce Holdhusen	1/4/08	12/31/12	SP&R, LRRB, Other State Funds	$275,000	$25,000	9%
INV 865	TPF-5(132): Low Temperature Cracking in Asphalt Phase II	89261 WO103	University of Minnesota	Mihai Marasteanu	Timothy Clyne	Bruce Holdhusen	6/17/08	1/31/12	LRRB, SP&R, SRP	$475,000	$133,570	28%
INV 867	TPF-5(149): Composite Pavements Design and Construction Guidelines for Thermally Insulated Concrete Pavements	89261 WO90	University of Minnesota	Lev Khazanovich	Timothy Clyne	Nelson Cruz	1/30/08	7/31/12	SP&R, LRRB	$438,980	$219,490	50%
INV 868	MPR-6(029): HMA Surface Characteristics	LAB868	MnDOT Office of Materials	Timothy Clyne	Gregory Johnson	Bruce Holdhusen	9/18/07	6/30/13	SP&R, LRRB, Other State Funds	$326,632	$84,625	26%
INV 869	TERRA Board Support (FY2011)	89261 WO220	University of Minnesota	Laurie McGinnis	Julie Skallman, Mark Maloney	Benjamin Worel	7/20/10	11/30/11	LRRB	$35,000	$26,400	75%

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LRRB Identifier	Title	Contract #	Contractor	Investigator	Technical Liaison	Administrative Liaison	Start Date	End Date	Funding Source	Total Cost	Amount Paid	% Paid
INV 878	Porous Asphalt Pavement Performance in Cold Regions	LAB878	MnDOT Office of Materials	Matthew Lebens	Larry Matsumoto	Bruce Holdhusen	7/26/07	4/30/12	LRRB, SP&R, Other State Funds	$71,000	$22,400	32%
INV 879	MPR-6(027): Drainable Pavements at MnROAD Pervious Concrete and Porous Concrete Overlay Cells 39, 85, and 89	LAB879	MnDOT Office of Materials	Bernard Izevbekhai	Mark Maloney	Bruce Holdhusen	7/30/07	9/30/11	LRRB, SP&R, Other State Funds	$46,000	$39,000	85%
INV 885	Research Test Section Tracking—Phase II	INV 885	MnDOT Office of Materials	Melissa Cole	Luane Tasa	Farideh Amiri	12/21/09	12/21/14	LRRB	$55,000	$5,000	9%
INV 886	Cost-Effective Pavement Preservation Solutions for the Real World	94079, LRB886	Minnesota State University, Mankato, MnDOT Office of Materials	W. James Wilde, Thomas Wood	Gregory Coughlin	Nelson Cruz	9/8/09	2/29/12	LRRB, SRP	$109,984	$3,411	3%
INV 887	Structural Evaluation of Asphalt Pavements with Full-Depth Reclaimed Base	89261 WO156, LAB887	University of Minnesota, MnDOT Office of Materials	Joseph Labuz, Shongtao Dai	Merle Earley	Daniel Warzala	6/4/2009, 10/5/2009	11/30/2012, 3/31/2013	LRRB, Other State Funds	$79,808	$9,960	12%
INV 889	Performance of Recycled Asphalt and High RAP Asphalt Mix	89261 WO254	University of Minnesota	Mihai Marasteanu	Gregory Coughlin	Daniel Warzala	2/8/11	3/31/12	LRRB	$30,000	$0	0%
INV 889	Performance of Recycled Asphalt and High RAP Asphalt Mix	LAB889	MnDOT Office of Materials	Eddie Johnson	Gregory Coughlin	Daniel Warzala	2/22/10	2/28/13	LRRB	$30,000	$0	0%
INV 890	Speed Impacts of Occasional Hazard Residential Street Warning Signs	89261 WO139	University of Minnesota	John Hourdos	Amy Marohn	Shirlee Sherkow	6/30/09	2/28/12	LRRB	$79,647	$58,939	74%
INV 892	Develop Outreach Program for a Thoughtful Street Tree Master Plan	89261 WO187	University of Minnesota	Gary Johnson	Daniel Gullickson	Sandra McCully	4/8/10	9/30/11	LRRB	$20,000	$19,000	95%
INV 894	Assessing and Improving Pollution Prevention by Swales	89261 WO207	University of Minnesota	John Gulliver	Barbara Loida	Bruce Holdhusen	7/30/10	9/30/13	LRRB, SRP	$314,000	$46,000	15%
INV 895	Traffic Generating Developments and Roadway Life Consumption	95937	Minnesota State University, Mankato	W. James Wilde	Gary Danielson	Farideh Amiri	1/22/10	5/31/12	LRRB	$37,038	$22,772	61%
INV 896	Quantifying Moisture Effects in DCP and LWD Tests Using Unsaturated Mechanics	89261 WO190	University of Minnesota	Kimberly Hill	John Siekmeier	Nelson Cruz	9/24/10	11/30/12	LRRB	$109,900	$28,574	26%
INV 897	Developing Salt-Tolerant Sod Mixtures for Use as Roadside Turf in Minnesota	89261 WO211	University of Minnesota	Eric Watkins	Adam Popenhagen	Daniel Warzala	6/8/10	8/31/14	LRRB	$176,516	$44,128	25%
INV 898	Estimating the Crash Reduction and Vehicle Dynamic Effects of Flashing LED Stop Signs	89261 WO195	University of Minnesota	Gary Davis	Bradley Estochen	Shirlee Sherkow	6/28/10	12/31/11	LRRB, ITS Institute	$74,667	$37,333	50%

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LRRB Identifier	Title	Contract #	Contractor	Investigator	Technical Liaison	Administrative Liaison	Start Date	End Date	Funding Source	Total Cost	Amount Paid	% Paid
INV 900	Hennepin/Minneapolis LED Light Study	96737	None	Robb Luckow	Julie Skallman	Shirlee Sherkow	6/25/10	9/30/12	LRRB	$50,000	$46,000	92%
INV 901	Concrete Delivery Time Study	96033	American Engineering Testing, Inc.	Dan Vruno	Maria Masten	Shirlee Sherkow	3/29/10	1/31/12	LRRB	$99,998	$88,492	88%
INV 902	Material Control Testing Rates for Low Volume Roads	96885	Minnesota State University, Mankato	Brian Wasserman	Julie Skallman	Farideh Amiri	6/1/10	8/31/11	LRRB	$25,000	$10,000	40%
INV 903	RIC: Best Practices for Sign Reduction on the Local System	98039	CH2M Hill	Howard Preston	Mark Vizecky	Farideh Amiri	6/6/11	9/30/11	LRRB	$47,969	$1,480	3%
INV 904	Stripping of Hot Mixed Asphalt Pavements under Chip Seals	LAB904	MnDOT Office of Materials	Thomas Wood	Thomas Tesch	Daniel Warzala	7/19/10	9/30/12	LRRB	$40,000	$22,000	55%
INV 906	LTAP Gravel Road Maintenance Independent Online Distance Training (ODL)	89261 WO230	University of Minnesota	Jim Grothaus	Richard West	Daniel Warzala	11/3/10	12/31/11	LRRB	$40,000	$0	0%
INV 907	Impact of Garbage Haulers on Pavement Performance	98108	Minnesota State University, Mankato	W. James Wilde	Deb Bloom	Daniel Warzala	2/22/11	8/31/12	LRRB	$54,000	$2,000	4%
INV 913	LRRB Workshop: Shaping Research on Systems Planning for Local Roads	89261 WO258	University of Minnesota	Linda Preisen	Susan Miller	Farideh Amiri	2/4/11	11/30/11	LRRB	$22,093	$11,047	50%
INV 914	Research Using Waste Shingles for Stabilization or Dust Control for Gravel Roads and Shoulders	LAB914	MnDOT Office of Materials	Thomas Wood	Tim Stahl	Daniel Warzala	5/11/11	5/11/12	LRRB, SRP	$77,000	$0	0%
INV 915	Implications of Modifying State Aid Standards; Urban, New or Reconstruction (Mn Rules 8820.9936) to Accommodate Various Roadway Users	89264 WO7	University of Wisconsin – Madison	David Noyce	Paul Stine	Bruce Holdhusen	6/28/11	11/30/12	LRRB	$117,700	$0	0%
INV 917	Two-Lane Roundabout Field Research Regarding Signing and Striping	89261 WO271	University of Minnesota	John Hourdos	Kristin Asher	Shirlee Sherkow	6/30/11	10/31/13	LRRB	$105,000	$0	0%
INV 998	Operational Research Program for Local Transportation Groups, FY2010	89261 WO162	University of Minnesota	Jim Grothaus	Mark Maloney	Clark Moe	6/19/09	11/30/10	LRRB	$88,000	$88,000	100%
INV 998	FY2011 Operational Research Program for Local Transportation Groups (OPERA)	89261 WO210	University of Minnesota	Jim Grothaus	Mark Maloney	Farideh Amiri	9/9/10	9/30/11	LRRB	$90,000	$90,000	100%
INV 999	RSS Report Publication Services, 2010	89261 WO168	University of Minnesota	Gina Baas	Jake Akervik	Sandra McCully	7/17/09	7/31/10	LRRB, COPTRS	$49,597	$49,597	100%

For more than 50 years, the LRRB has helped local communities develop and maintain their transportation infrastructure. The LRRB offers tools to improve pavement management and rural safety; upgrade crash analysis software; evaluate the performance of stormwater treatment technology; explore the environmental benefits of porous pavements; and better calibrate snowplow sanders.

The impact of LRRB-sponsored research multiplies as more and more engineers see the potential applications through the LRRB RIC's technology transfer efforts.

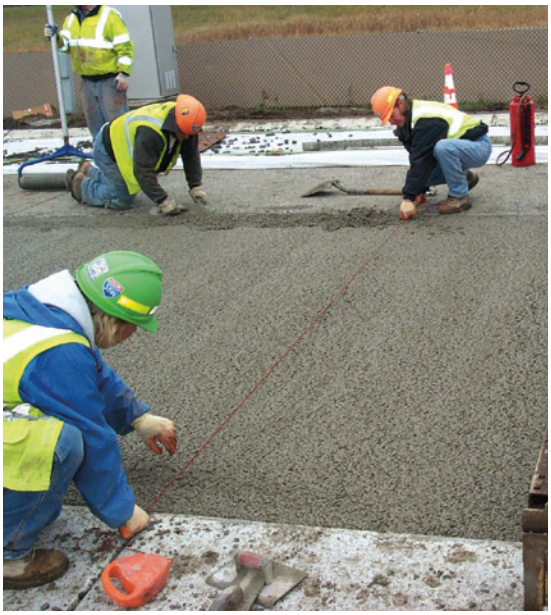
FY2011 LRRB Research Highlights

Helping Protect the Environment with Stormwater Management Solutions

Stormwater runoff from pavements can pollute streams, lakes and wetlands. To help combat this problem and protect the environment, the LRRB is sponsoring projects focused on developing stormwater management solutions, including:

A **decision tree tool** to assist practitioners in selecting appropriate best management practices for stormwater management. The tool (http://www.lrrb.org/pdf/2011RIC01.pdf) includes information about the BMPs most commonly used in Minnesota and provides a step-by-step decision-making process that narrows BMP choices according to physical constraints, the regulatory environment, capital costs and other factors. As the number of stormwater management practices continue to expand, this tool will help practitioners select the most cost-effective measures for protecting the environment.

A project exploring the use of **pervious pavement mixtures**, which can provide a solution for stormwater runoff management in urban areas, reducing runoff pollution by allowing water to filter through pavements and the underlying soil. Using MnROAD test cells such as the one shown at right, researchers are monitoring pervious pavements for stormwater volume, mechanical and structural properties, surface characteristics, noise and durability. Report 2010-16, "Drainable Pavements at MnROAD: Pervious Concrete and Porous Concrete Overlay Cells 39, 85, and 89," details the results to date, which show that pervious mixtures are performing well, have fewer freeze-thaw cycles and can be significantly quieter than impervious pavements while maintaining comparable friction.



GRASS-ROOTS INVOLVEMENT

The transportation practitioners who are responsible for county highways and city streets best understand the problems and challenges in providing safe, efficient roadways. The LRRB makes it easy for them to participate in setting the research agenda.

BENEFITING TRANSPORTATION PRACTICTIONERS

Transportation practitioners involved with LRRB projects have benefited by:

- Networking outside of the office and working with those who share similar interests.
- Keeping up-to-date on current topics within their area of expertise and learning about cutting-edge technologies.
- Working on real problems they otherwise wouldn't have the resources to address.

LRRB
LOCAL ROAD RESEARCH BOARD

www.lrrb.org

Produced by CTC & Associates for:

Minnesota Department of Transportation
Office of Policy Analysis, Research and Innovation
Research Services Section
MS 330, First Floor
395 John Ireland Blvd.
St. Paul, MN 55155-1800

www.research.dot.state.mn.us