10th International Conference on Low-Volume Roads

July 24–27, 2011
Hilton–Walt Disney World
Lake Buena Vista, Florida

Hosts
Florida Transportation Technology Transfer (T2) Center at the University of Florida
Florida Association of County Engineers and Road Superintendents
International Union of Forest Research Organizations
University of Naples Federico II, Italy

Sponsors
Bureau of Indian Affairs, U.S. Department of the Interior
Federal Highway Administration, U.S. Department of Transportation
Fish and Wildlife Service, U.S. Department of the Interior
Forest Service, U.S. Department of Agriculture
U.S. Army Corps of Engineers, Engineer Research and Development Center
U.S. Environmental Protection Agency
On behalf of the conference steering committee, it is my honor to welcome you to Lake Buena Vista, Florida, and TRB’s 10th International Conference on Low-Volume Roads. Orlando—often called “a city built on imagination”—truly has something to offer everyone, from its famous theme parks to arts, culture, and history.

This 10th Conference continues the long tradition of low-volume roads conferences held every four years since 1975 to provide a forum for the exchange of information and innovative ideas on all aspects of low-volume road planning, financing, design, construction, maintenance, and operations.

Sunday, the conference offers four half-day workshops whose subjects vary from exploring simple low-cost soil testing to working together to make roads safer by conducting road safety audits. The day concludes with a reception, and a welcome session begins the conference on Monday morning. The remainder of the conference includes 90 technical presentations, a choice of three field trip options, exhibitions, and two interactive sessions that explore the current issues facing low-volume roads managers.

The technical presentations offer information and insight from 44 presenters from the United States and 46 presenters from eighteen other countries. The three field trip options provide the opportunity to (1) visit the Hubbard Construction Company Asphalt Plant and learn about the full-depth reclamation process, (2) visit the Stormwater Management Academy at the University of Central Florida to explore stormwater-related issues, or (3) learn about Road Safety Audits (RSAs) by conducting one at a field site. Additionally, two interactive sessions, facilitated by key experts, will engage in informal small group discussions on current issues facing low-volume roads managers. Each discussion will offer valuable information on best practices and lessons learned as well as provide helpful resource material. The conference concludes with a conference banquet on Wednesday evening. Additionally, however, participants have the option to participate in a post-conference field trip to the Florida Department of Transportation’s State Materials Office in Gainesville to tour the asphalt mix design lab, foundations lab, and soil compaction lab. They will also view both the van that operates the pavement condition survey process and the heavy vehicle simulator.

In today’s environment of critical funding shortfalls, the challenges—more than ever—center around planning, designing, constructing, maintaining, and operating large networks of low-volume roads with ever-declining budgets. Increasingly, transportation engineers and planners are asked to do more with less in sustaining this important road asset. This 10th International Conference on Low-Volume Roads provides a unique forum for effective technology transfer among transportation practitioners, professionals, and academics from around the world to help address today’s challenges.

I encourage you to participate in this prestigious conference.

—Jolanda Prozzi, Chair, Conference Committee
Center for Transportation Research, University of Texas at Austin
## Agenda at a Glance

### Saturday, July 23

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
<th>Location</th>
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</thead>
<tbody>
<tr>
<td>2:00 p.m.–6:00 p.m.</td>
<td>Registration</td>
<td>North Registration</td>
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<tr>
<td>2:00 p.m.–6:00 p.m.</td>
<td>Speaker Ready Room</td>
<td>Crystal Room</td>
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### Sunday, July 24

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<thead>
<tr>
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<tbody>
<tr>
<td>8:00 a.m.–5:00 p.m.</td>
<td>Registration</td>
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<td>Speaker Ready Room</td>
<td>Crystal Room</td>
</tr>
<tr>
<td>9:00 a.m.–noon</td>
<td>Low-Volume Roads and Earthquakes</td>
<td>Camellia–Dogwood</td>
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<td></td>
<td>Simple Low-Cost Soil Testing</td>
<td>Fuchsia–Gardenia</td>
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<tr>
<td>Noon–1:30 p.m.</td>
<td>Lunch Break (lunch on your own)</td>
<td></td>
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<tr>
<td>1:30 p.m.–4:30 p.m.</td>
<td>Low-Volume Roads Best Practices and Gravel Management</td>
<td>Camellia–Dogwood</td>
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<td></td>
<td>Road Safety Audits: Working Together to Make Your Roads Safer</td>
<td>Fuchsia–Gardenia</td>
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<tr>
<td>5:30 p.m.–7:30 p.m.</td>
<td>Reception</td>
<td>International Ballroom North</td>
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### Monday, July 25

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<thead>
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<th>Time</th>
<th>Event</th>
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<tbody>
<tr>
<td>7:00 a.m.–8:00 a.m.</td>
<td>Continental Breakfast</td>
<td>International Foyer</td>
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<tr>
<td>7:00 a.m.–6:00 p.m.</td>
<td>Registration</td>
<td>North Registration</td>
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<tr>
<td>7:00 a.m.–6:00 p.m.</td>
<td>Speaker Ready Room</td>
<td>Crystal Room</td>
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<tr>
<td>8:00 a.m.–9:45 a.m.</td>
<td>Opening Session</td>
<td>International Ballroom Center</td>
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<tr>
<td>9:45 a.m.–10:15 a.m.</td>
<td>Break</td>
<td>International Foyer</td>
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<tr>
<td>10:15 a.m.–noon</td>
<td>Cementitious Stabilization, <strong>Part 1</strong></td>
<td>International Ballroom Center</td>
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<td>Hot-Mix Asphalt</td>
<td>International Ballroom North</td>
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<td>Pavement Management Systems</td>
<td>International Ballroom South</td>
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<td></td>
<td>What’s New in Low-Volume Road Pavement Design and Performance?</td>
<td>Iris–Hibiscus</td>
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<tr>
<td>Noon–1:00 p.m.</td>
<td>Conference Lunch (NOTE: Afternoon sessions start promptly at 1:00 p.m.)</td>
<td>Salons 1, 2, and 3</td>
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<tr>
<td>1:00 p.m.–3:15 p.m.</td>
<td>Geogrids</td>
<td>International Ballroom Center</td>
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<td>Pavement Management Case Histories</td>
<td>International Ballroom South</td>
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<td></td>
<td>Potpourri of New Tools for Enhancing Low-Volume Road Design</td>
<td>International Ballroom North</td>
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<tr>
<td>3:15 p.m.–3:45 p.m.</td>
<td>Break</td>
<td>International Foyer</td>
</tr>
<tr>
<td>3:45 p.m.–5:30 p.m.</td>
<td>Cementitious Stabilization, <strong>Part 2</strong></td>
<td>International Ballroom Center</td>
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<td></td>
<td>Erosion and Sediment Control for Native and Aggregate Surfaced Roads</td>
<td>Iris–Hibiscus</td>
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<tr>
<td></td>
<td>Hot-Mix Asphalt, Warm-Mix Asphalt, and Chip Seals</td>
<td>International Ballroom South</td>
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<tr>
<td></td>
<td>Planning, Financing, and Economics of Low-Volume Roads</td>
<td>International Ballroom North</td>
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<tr>
<td>6:00 p.m.–7:30 p.m.</td>
<td>Rural Roads Safety Policy, Programming, and Implementation Joint Subcommittee</td>
<td>Iris–Hibiscus</td>
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### Tuesday, July 26

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
<th>Location</th>
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<tbody>
<tr>
<td>6:30 a.m.–6:00 p.m.</td>
<td>Registration</td>
<td>North Registration</td>
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<tr>
<td>6:30 a.m.–6:00 p.m.</td>
<td>Speaker Ready Room</td>
<td>Crystal Room</td>
</tr>
<tr>
<td>8:00 a.m.–noon</td>
<td>FIELD TRIP OPTION 1: Hubbard Construction Company Asphalt Plant</td>
<td>Attractions Entrance</td>
</tr>
<tr>
<td>8:00 a.m.–noon</td>
<td>FIELD TRIP OPTION 2: Stormwater Management Academy at the University of Central Florida</td>
<td>Attractions Entrance</td>
</tr>
<tr>
<td>Noon–1:30 p.m.</td>
<td>Lunch</td>
<td>International Foyer</td>
</tr>
<tr>
<td>1:30 p.m.–3:15 p.m.</td>
<td>Developments in Nontraditional Stabilizers</td>
<td>International Ballroom Center</td>
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<td></td>
<td>Effects of Roadway Geometry on Low-Volume Road Safety</td>
<td>International Ballroom North</td>
</tr>
<tr>
<td>3:15 p.m.–3:45 p.m.</td>
<td>Break</td>
<td>International Foyer</td>
</tr>
<tr>
<td>3:45 p.m.–5:30 p.m.</td>
<td>Current Issues Facing Low-Volume Roads Managers, <strong>Part 1</strong></td>
<td>Salons 1, 2, and 3</td>
</tr>
<tr>
<td>6:00 p.m.–7:30 p.m.</td>
<td>Low-Volume Roads Committee</td>
<td>Crystal Room</td>
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### Wednesday, July 27

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
<th>Location</th>
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<tbody>
<tr>
<td>7:00 a.m.–8:00 a.m.</td>
<td>Continental Breakfast</td>
<td>International Foyer</td>
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<tr>
<td>7:00 a.m.–6:00 p.m.</td>
<td>Registration</td>
<td>North Registration</td>
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<tr>
<td>7:00 a.m.–6:00 p.m.</td>
<td>Speaker Ready Room</td>
<td>Crystal Room</td>
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<tr>
<td>8:00 a.m.–9:45 a.m.</td>
<td>Full-Depth Reclamation and Recycled Pavement Materials</td>
<td>International Ballroom Center</td>
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<td></td>
<td>Pavement Materials</td>
<td>International Ballroom South</td>
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<tr>
<td></td>
<td>Speed Characteristics and Management on Low-Volume Roads</td>
<td>International Ballroom North</td>
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<tr>
<td>9:45 a.m.–10:15 a.m.</td>
<td>Break</td>
<td>International Foyer</td>
</tr>
<tr>
<td>10:15 a.m.–noon</td>
<td>Geotechnical Engineering</td>
<td>International Ballroom South</td>
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<td>Rural Roads Maintenance and Management</td>
<td>International Ballroom Center</td>
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<td></td>
<td>Safety Assessment Tools for Low-Volume Roads</td>
<td>International Ballroom North</td>
</tr>
<tr>
<td>Noon–1:30 p.m.</td>
<td>Lunch Break (lunch on your own)</td>
<td>International Foyer</td>
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<tr>
<td>1:30 p.m.–3:15 p.m.</td>
<td>Pavement Assessment</td>
<td>International Ballroom South</td>
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<td>Pavement Design</td>
<td>International Ballroom North</td>
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<td></td>
<td>Use of Chip Seals and Thin Pavement for Low-Volume Roads</td>
<td>International Ballroom Center</td>
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<tr>
<td>3:15 p.m.–3:45 p.m.</td>
<td>Break</td>
<td>International Foyer</td>
</tr>
<tr>
<td>3:45 p.m.–5:30 p.m.</td>
<td>Current Issues Facing Low-Volume Roads Managers, <strong>Part 2</strong></td>
<td>Salons 1, 2, and 3</td>
</tr>
<tr>
<td>6:00 p.m.–7:00 p.m.</td>
<td>Social Hour</td>
<td>International Foyer</td>
</tr>
<tr>
<td>7:00 p.m.–9:00 p.m.</td>
<td>Conference Banquet</td>
<td>International Ballroom North</td>
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### Thursday, July 28

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<tr>
<th>Time</th>
<th>Event</th>
<th>Location</th>
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<tbody>
<tr>
<td>8:00 a.m.–5:00 p.m.</td>
<td>Postconference Field Trip: Florida Department of Transportation, State Materials Office, Gainesville, Florida</td>
<td>Crystal Room</td>
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</table>
Saturday, July 23

2:00 p.m.–6:00 p.m., North Registration
Registration

2:00 p.m.–6:00 p.m., Crystal Room
Speaker Ready Room

Sunday, July 24

8:00 a.m.–5:00 p.m., North Registration
Registration

8:00 a.m.–5:00 p.m., Crystal Room
Speaker Ready Room

9:00 a.m.–noon, Camellia–Dogwood
Low-Volume Roads and Earthquakes: the Experiences in Chile, Haiti, and New Zealand
Robert Andrew Douglas, Golder Associates, Inc., presiding

Experience in Chile
Guillermo Thenoux, Pontificia Universidad Católica de Chile

Experience in Haiti
Gary Morris-Iveson, Golder Associates, Inc.

Experience in New Zealand
Neil Bennett, Fulton Hogan Ltd., New Zealand

Each Speaker to Compare and Contrast Their Experiences
Guillermo Thenoux, Pontificia Universidad Católica de Chile; Gary Morris-Iveson, Golder Associates, Inc.; Neil Bennett, Fulton Hogan Ltd., New Zealand

9:00 a.m.–noon, Fuchsia–Gardenia
Simple Low-Cost Soil Testing: How To Do It and How To Use the Results
Anand J. Puppala, University of Texas at Arlington, presiding

Elementary Soil Testing for Gravel Roads
Lynne H. Irwin, Cornell University

The South African Gravel Roads Test Kit
Philip Paige-Green, CSIR, South Africa

Break

The USACE Rapid Soils Analysis Kit
Ernest S. Berney, U.S. Army Corps of Engineer Research and Development Center

Performance-Related Gravel Road Design Using Results from Simple Tests
David Jones, University of California, Davis
Noon-1:30 p.m.
Lunch Break (lunch on your own)

1:30 p.m.–4:30 p.m., Camellia–Dogwood
Low-Volume Roads Best Practices and Gravel Management
Mark J. Nahra, Woodbury County, presiding

Overview of Low-Volume Roads Best Practices and Drainage Issues
Gordon Rex Keller, USDA Forest Service

Geosynthetic Reinforced Soil Bridge Abutments and Integrated Bridge System
Daniel Enrique Alzamora, Federal Highway Administration

Best Practices for Erosion Control and Water Quality Protection
Clayton T Gillies, FPInnovations

Break

Gravel Roads Design and Maintenance
Ken Skorseth, South Dakota State University

Gravel Roads Management Strategies
George Huntington, University of Wyoming

1:30 p.m.–4:30 p.m., Fuchsia–Gardenia
Road Safety Audits: Working Together to Make Your Roads Safer
Christina A. Fogt-Boulnois, VHB, Inc., presiding

Introductions to Road Safety Audits
Daniel Nabors, Vanasse Hangen Brustlin, Inc.

Benefits of Road Safety Audits (RSA)
Daniel Nabors, Vanasse Hangen Brustlin, Inc.

RSA Process
Frank Gross, Vanasse Hangen Brustlin, Inc.

Brief Review of Field Review Site on Day Two
Christina A. Fogt-Boulnois, Vanasse Hangen Brustlin, Inc.

5:30 p.m.–7:30 p.m. International Ballroom North
Reception
Monday, July 25

7:00 a.m.–8:00 a.m., International Foyer
Continental Breakfast

7:00 a.m.–6:00 p.m., North Registration
Registration

7:00 a.m.–6:00 p.m., Crystal Room
Speaker Ready Room

8:00 a.m.–9:45 a.m., International Ballroom Center
Opening Session
Jolanda P. Prozzi, University of Texas at Austin, presiding

Welcome and Introduction
Jolanda P. Prozzi, University of Texas at Austin

Welcome
The Honorable John L. Mica, United States House of Representatives

Relevance of Low-Volume Roads in Iraq for Today, Tomorrow, and the Future
The Honorable Istawraq Ibrahim Abdul Wahab Al-Shouk, Senior Deputy Minister, Ministry of Construction and Housing, Iraq

Every Day Counts
Greg Nadeau, Federal Highway Administration

Keynote Address: The Promise of Rural Roads
Asif Faiz, Consultant, World Bank

9:45 a.m.–10:15 a.m., International Foyer
Break

10:15 a.m.–noon, International Ballroom Center
Cementitious Stabilization, Part 1
(Part 2 is on Monday, July 25, from 3:45 p.m.–5:30 p.m.)
Anand J. Puppala, University of Texas at Arlington, presiding

Use of Cementitious High-Carbon Fly Ash to Stabilize Recycled Pavement Materials as Base Course
Haifang Wen and Jingan Wang, Washington State University; Jeremy Baugh and Tuncer B. Edil, University of Wisconsin–Madison

Stabilization of Flue Gas Desulfurization By-Products with Fly Ash, Cement, and Sialite
Xiaoming Liu, Beijing Municipal Commission of Communications, China; Haifang Wen, Washington State University; Tuncer B. Edil and Craig H. Benson, University of Wisconsin–Madison

Stabilization Effectiveness of Treatment with T-Shaped Deep-Mixing Column for Low-Volume Roads
Guojun Cai, School of Transportation, Southeast University, China; Songyu Liu and Liyuan Tong, Southeast University, China

Filippo Giammaria Praticò, University Mediterranea of Reggio Calabria, Italy; Sireesh Saride, Indian Institute of Technology Hyderabad; Anand J. Puppala, University of Texas at Arlington
10:15 a.m.–noon, **International Ballroom North**

**Hot-Mix Asphalt**
Alondra Chamorro, University of Waterloo, Canada, *presiding*

**Kansas’s Experience with Thin Superpave Mixture Overlay of Small Aggregate Top Size**
Farhana Rahman and Mustaque Hossain, Kansas State University; Stefan A. Romanoschi, University of Texas at Arlington; Cliff Hobson, Kansas Department of Transportation

**Laboratory Evaluation of Hot-Mix Asphalt Containing Petroleum-Contaminated Soil as a Surface Mix for Low-Volume Roads**
Hossam Farouk Hassan and Amer Ali Al-Rawas, Sultan Qaboos University, Oman

**Effect of Fine Aggregate Physical Properties on the Engineering Properties of Conventional and Polymer-Modified Bituminous Mixtures**
Yasreen Gasmalkhalig Suliman, Madzlan Napiah, and Ibrahim Kamaruddin, Universiti Technology Petronas

**Performance Evaluation and Environmental Impact Assessment of Asphalt-Treated Mixtures Used in Low-Volume Roads**
Louay N. Mohammad, Louisiana State University; Munir D. Nazzal, Ohio University, Athens

10:15 a.m.–noon, **International Ballroom South**

**Pavement Management Systems**
Steve Saboundjian, Alaska Department of Transportation and Public Facilities, *presiding*

**Decision Support Models for Asset Management of Low-Volume Roads**
Amirthalingam Veeraragavan, Indian Institute of Technology, Madras; Murali Krishna P, Feedback Ventures Pvt. Ltd.

**Unsealed Gravel Roads Management Implementation Guide**
George Huntington and Khaled Ksaibati, University of Wyoming

**Development of Roughness Prediction Models for Low-Volume Road Networks in Northeast Brazil**
Fernando Silva Albuquerque, Federal University of Sergipe, Brazil; Washington Peres Núñez, Federal University of Rio Grande do Sul, Brazil

**Appropriate Pavement Maintenance and Rehabilitation Management System for Local Governments**
Robert Andrew Douglas, Golder Associates, Inc.

10:15 a.m.–noon, **Iris–Hibiscus**

**What’s New in Low-Volume Road Pavement Design and Performance?**
Michael T. Long, Oregon Department of Transportation, *presiding*

**Mechanistic–Empirical Pavement Design Guide–Based Pavement Design Catalog for Low-Volume Roads in Arkansas**
Qiang Li, University of Delaware; Danny X. Xiao and Kevin D. Hall, University of Arkansas, Fayetteville

**Performance Criterion for Thin-Surface Low-Volume Roads**
Umesh Chandra Sahoo, Birla Institute of Technology; K. Sudhakar Reddy, Indian Institute of Technology, Kharagpur

**Impacts of Reduced Tire Pressure on Strain Response of Low-Volume Thaw-Weakened Roads in Manitoba, Canada**
Qingfan Liu, Leonnie Kavanagh, and Ahmed Shalaby, University of Manitoba, Canada
Road Performance Evaluation Using Geometric Consistency and Pavement Distress Data  
Gianluca Dell’Acqua and Francesca Russo, University of Naples Federico II, Italy

Noon-1:00 p.m., Salons 1, 2, and 3  
Conference Lunch  
Michael T. Long, Oregon Department of Transportation, presiding

Yoder Award Presentation  
G. P. Jayaprakash, Transportation Research Board

The Challenges of Low-Volume Roads  
Ramon D. Gavarrete, Highlands County, Florida

1:00 p.m.–3:15 p.m., International Ballroom Center (NOTE: Afternoon sessions start promptly at 1:00 p.m.)  
Geogrids  
Khaled Sobhan, Florida Atlantic University, presiding

Accelerated Pavement Testing of Geocell-Reinforced Unpaved Roads Over Weak Subgrade  
Sanat Kumar Pokharel, Jie Han, Xiaoming Yang, and Robert L. Parsons, University of Kansas; Chandra Bahadur Manandhar, Kansas State University; Dov Leshchinsky, University of Delaware; Izhar Halahmi, PRS Mediterranean Ltd., Israel

Characterization of Mechanically Stabilized Layer by Resilient Modulus and Permanent Deformation Testing  
Mark H. Wayne, Tensar; Richard L. Boudreau, Boudreau Engineering Inc; Jayhyun Kwon, Tensar

Stress Analysis on Triangular-Aperture Geogrid-Reinforced Bases over Weak Subgrade Under Cyclic Loading: An Experimental Study  
Yu Qian, University of Illinois at Urbana Champaign; Jie Han, Sanat Kumar Pokharel, and Robert L. Parsons, University of Kansas

Matting Solutions for Low-Volume Roads  
Timothy Wallace Rushing, U.S. Army Corps of Engineers; Isaac L. Howard, Mississippi State University

1:00 p.m.–3:15 p.m., International Ballroom South  
Pavement-Management Case Histories  
Robert Andrew Douglas, Golder Associates, Inc., presiding

Operational Service Management System of Forest Roads  
Janis Kivilands and A. Strezis, Road Expert Ltd.

Network-Level Pavement Management: Case of Serbian Low-Volume Roads  
Goran Mladenovic, University of Belgrade, Serbia; Jelena Cirilovic, Institute IMS; Cesar A.V. Queiroz, University of Belgrade

Direct Measurement of the Impact of Heavy Loads on Thin-Membrane Pavements  
Lynne Gradon Cowe Falls, A’arif Hamad, and Ahmed Abdelfattah, University of Calgary, Canada; Linda Clary, Suncor Energy

Infrastructure Impacts of Iowa’s Renewable Energy  
Konstantina Gkritza, Iowa State University; Inya Nlenanya, Center for Transportation Research and Education; Weiwei Jiang, Robert Sperry, and Duane E. Smith, Institute for Transportation at Iowa State University

Performance Evaluation of Whitetopping and Ultrathin Whitetopping Pavements  
Xiaojun Li and Haifang Wen, Washington State University
1:00 p.m.–3:15 p.m., International Ballroom North
Potpourri of New Tools for Enhancing Low-Volume Road Design
Maureen A. Kestler, USDA Forest Service, presiding

Delivery of a Low-Volume Road in the Pilbara Region of Western Australia by Alliance Contracting
Geoffrey Colin Cocks, Coffey Geotechnics Pty. Ltd.; Jacqueline M. Scott, Bateman Engineering;
Terry Pearce and Mark Hazebroek, Main Roads Western Australia; Paul Fisher, GHD Pty. Ltd.; Robert
Wilson, Coffey Geotechnics Pty. Ltd.

Storm Damage Risk Reduction: Stormproofing Low-Volume Roads
Gordon Rex Keller and Gary Ketcheson, USDA Forest Service

Stream Simulation for Aquatic Organism Passage at Road–Stream Crossings
Daniel A. Cenderelli, Kim Clarkin, Robert A. Gubernick, and Mark Weinhold, USDA Forest Service

Stream Simulation e-Learning Training
Greg S. Napper, U.S. Department of Agriculture Forest Service

Models of Operating Speeds for Low-Volume Roads
Paolo Discetti, Gianluca Dell’Acqua and Renato Lamberti, University of Naples Federico II, Italy

3:15 p.m.–3:45 p.m., International Foyer
Break

3:45 p.m.–5:30 p.m., International Ballroom Center
Cementitious Stabilization, Part 2
(Part 1 is on Monday, July 25, from 10:15 a.m.–noon)
David Jones, University of California, Davis, presiding

Accelerated Moisture Conditioning Process of Lime-Stabilized Clays
Manuel Celaya, Maryam Veisi, and Soheil Nazarian, University of Texas, El Paso; Anand J. Puppala,
University of Texas at Arlington

Combined Lime–Cement Stabilization for Longer Life of Low-Volume Roads
Chakkrit Sirivitmaitrie, Laureano R. Hoyos, and Anand J. Puppala, University of Texas at Arlington;
Sireesh Saride, Indian Institute of Technology Hyderabad

Evaluation of Chemical Stabilization of a Highly Expansive Clayey Soil
E. Mutaz, Mosleh Shamrani, Anand J. Puppala, and Muawia A. Dafalla, King Saud University,
Saudi Arabia

Performance of Full-Scale Test Section of Low-Volume Road with Reinforcing Base Layer
of Soil–Lime
Leonardo Behak, Universidad de la Republica, Uruguay

3:45 p.m.–5:30 p.m., Iris–Hibiscus
Erosion and Sediment Control for Native- and Aggregate-Surfaced Roads
Asif Faiz, Consultant, World Bank; Michael T. Long, Oregon Department of Transportation, presiding

Evaluation of Erosion Prediction for Forest Roads
Arne Edward Skaugset and Christopher G. Surfleet, Oregon State University; Matthew W. Meadows,
University of California, Merced; Joseph Amann, Herrera Environmental Consultants, Inc.

Reducing Sediment Production from Forest Roads During Wet-Weather Hauling
Elizabeth Myers Toman, Ohio State University; Arne E Skaugset, Oregon State University
Environmentally Sensitive Road Maintenance Practices: Sediment Reduction with Use of Driving Surface Aggregate
Steve Michael Bloser and Barry Scheetz, Pennsylvania State University

Modeling Road Erosion in Upper Torreon Wash, New Mexico
Krista M. Schultz, New Mexico Environment Department

3:45 p.m.–5:30 p.m., International Ballroom South
Hot-Mix Asphalt, Warm-Mix Asphalt, and Chip Seals
Clark C. Martin, Federal Highway Administration, presiding

Evaluation of Effects of Recycled Concrete Aggregate on Volumetrics of Hot-Mix Asphalt
Sushanta Bhusal, Xiaojun Li, and Haifang Wen, Washington State University

Late-Season Paving of Low-Volume Road Using Warm-Mix Asphalt: An Alaskan Experience
Steve Saboundjian, Alaska Department of Transportation and Public Facilities; Juanyu Liu and Peng Li, University of Alaska, Fairbanks; Bruce Brunette, Alaska Department of Transportation and Public Facilities

Performance of Warm-Mix Asphalt Mixtures Containing Recycled Coal Ash and Roofing Shingles with Moist Aggregates for Low-Volume Roads
Punith Veeralinga Shivaprasad, Feipeng Xiao, and Serji N. Amirkhanian, Clemson University

Chip Seal with Lightweight Aggregates for Low-Volume Roads
Md Shahidul Islam and Mustaque Hossain, Kansas State University

3:45 p.m.–5:30 p.m., International Ballroom North
Planning, Financing, and Economics of Low-Volume Roads
Kumares C. Sinha, Purdue University, presiding

Planning, Design, and Construction of Low-Cost Roads and Bridge Accessibility: Conflict and Natural Disasters in Haiti and Selected Areas in Africa and Latin America
Jacob Greenstein, U.S. Agency for International Development

Financing Low-Volume Road Improvements
Gregory H. Clemmons and Victoria Saager, Washington County

Maintenance Impact on Economic Evaluation of Upgrading Unsealed Roads
Rodrigo Archondo-Callao, World Bank

Rapid Response Stimulus Package for Improving Local Roads and Creating Jobs in Armenia
Satoshi Ishihara, World Bank, Vientiane, Laos; Christopher R. Bennett, World Bank; Alexander Bakhtamyan, Armenia Road Department; Jiangbo Ning, World Bank, Baku, Azerbijan; Asif Faiz, Consultant, World Bank

6:00 p.m.–7:30 p.m., Iris–Hibiscus
Rural Roads Safety Policy, Programming, and Implementation Joint Subcommittee
Keith K. Knapp, Iowa State University, presiding
Tuesday, July 26

6:30 a.m.–6:00 p.m., North Registration
Registration

6:30 a.m.–6:00 p.m., Crystal Room
Speaker Ready Room

8:00 a.m.–noon, depart from Attractions Entrance
Field Trip Options

1: Hubbard Construction Company Asphalt Plant
2: Stormwater Management Academy at the University of Central Florida
3: Trip to a Road-Safety Audit Site

1:30 p.m.–3:15 p.m., International Ballroom Center
Developments in Nontraditional Stabilizers
Roger W. Surdahl, Federal Highway Administration, presiding

Toward Establishment of Industry Associations to Represent Nontraditional Road Stabilizer Suppliers
David Jones, University of California, Davis

Soil Stabilization in Low-Volume Roads: Obstacles to Product Implementation from Additive Suppliers’ Standpoint
Alex E. Campbell, Anyway Solutions; David Jones, University of California, Davis

Use of Various Additives as Alternative to Conventional Road Construction: Case Study of Main Road 269
James Robert Uys, Consulting Engineering Services (I) Pvt. Ltd.; Llewellyn Truter, Western Cape Provincial Administration; Gerhardt Daniel van Zyl, Consulting Services

Evaluation of Sustainability of Low-Volume Roads Treated with Nontraditional Stabilizers
Wynand Jacobus van der Merwe Steyn and Alex T. Visser, University of Pretoria, South Africa

1:30 p.m.–3:15 p.m., International Ballroom North
Effects of Roadway Geometry on Low-Volume Road Safety
Nicholas J. Garber, University of Virginia, presiding

Correspondence of Horizontal and Vertical Alignment with Safe Driving Conditions on Low-Volume Roads
Daiva Zilioniene and Viktoras Vorobjovas, Vilnius Gediminas Technical University, Lithuania

Estimation of Safety Effectiveness of Widening Shoulders and Adding Passing Lanes on Rural Two-Lane Roads
Steven D. Schrock, Robert L. Parsons and Huanghui Zeng, University of Kansas

Traffic Sign Sight Distance for Low-Volume Roads
Paolo Discetti and Renato Lamberti, University of Naples Federico II, Italy

Guardrail Optimization for Rural Roads
Carl M. Ochoa and Tania A. Ochoa, Vista Engineering Services, Inc.
Materials
Mustaque Hossain, Kansas State University, presiding

Use of Aeolian Sands in the Provision of Low-Volume Roads
Philip Paige-Green, CSIR, South Africa; Michael Ian Pinard, InfraAfrica Consultants; Martin Bizaliele Mgangira, Council for Scientific and Industrial Research, South Africa

Rational Approach to the Evaluation of Soils for Low-Volume Roads
Washington Peres Núñez, Jorge Augusto Ceratti, Matheus Lemos Nogueira, and Luiz Antônio Bressani, Federal University of Rio Grande do Sul, Brazil; Rinaldo Barbosa Pinheiro, Federal University of Santa Maria; Vinicius Peraça, UFRGS

Decreasing Moisture Susceptibility of Gravel Road Surface Aggregate by Hydrophobic Treatment Agent: Case Study
Kari Pylkkänen and Maria Sjöberg, Tampere University of Technology, Finland

Soil and Water Road Condition Index
Carolyn Napper, U.S. Forest Service

3:15 p.m.–3:45 p.m., International Foyer
Break

3:45 p.m.–5:30 p.m., Salons 1, 2, and 3
Current Issues Facing Low-Volume Roads Managers, Part 1
(Part 2 is on Wednesday, July 27, from 3:45 p.m.–5:30 p.m.)
Ann Johnson, University of Minnesota, presiding

Engage in informal small group discussions on timely low-volume road “hot topics” facilitated by key experts. Each round table discussion will offer valuable information on best practices and lessons learned as well as provide helpful resource material. Ask questions, share experiences, learn from others, and gain practical information to apply to your low-volume road needs. Participants will have the opportunity to rotate among their selected table topics to gather information, receive expert assistance, and expand their resource network for a wide range of timely topics. Table topics for this session will focus on management issues such as tools and methods for road management, low cost safety improvements, financing, technology transfer, and energy industry effects on low-volume roads.

1. Road Management
   Discussion leader: George Huntington, Wyoming Technology Transfer Center
   Key topics:
   • Tools and methods needed for managing gravel roads
   • Development and implementation of a rural road management program

2. Low-Cost Road Safety Improvements
   Discussion leader: Howard Preston, CH2M Hill
   Key topics:
   • Minnesota’s county road safety plan
   • Safety indicators on low-volume roads
   • Implementation of low-cost safety improvements

3. Energy Industry Effects on Low-Volume Roads
   Discussion leader: Mark J. Nahra, Woodbury Iowa County Engineer
   Key topics:
   • Results of effects of energy industry on roads
   • Other indicators of the effects of the industry on roads
   • Addressing the impacts seen

4. Finance and Revenue
   Discussion leader: Asif Faiz, Consultant
Key topics:
- Impacts of low-volume roads on local economy
- Funding opportunities
- Availing state and federal funds for low-volume roads

5. Technology Transfer
Discussion leader: Hesham Mahgoub, South Dakota LTAP Center
Key topics:
- New and existing technologies for technology transfer
- Educating those in need of information on low-volume road issues and management
- T2 Centers’ and agencies’ efforts on reaching their audiences

6. Structures
Discussion leader: David P. Orr, Cornell University
Key topics:
- Available new methods for design of structures (bridges, culverts, retaining walls)
- Innovative products and materials used
- Best maintenance techniques for these structures
- Economic considerations during design and maintenance

6:00 p.m.–7:30 p.m., Crystal Room
Low-Volume Roads Committee
Michael T. Long, Oregon Department of Transportation, presiding
Wednesday, July 27

7:00 a.m.–8:00 a.m., International Foyer
Continental Breakfast

7:00 a.m.–6:00 p.m., North Registration
Registration

7:00 a.m.–6:00 p.m., Crystal Room
Speaker Ready Room

8:00 a.m.–9:45 a.m., International Ballroom Center
Full-Depth Reclamation and Recycled-Pavement Materials
Jeb S. Tingle, U.S. Army Engineer Research and Development Center, presiding

Project Selection Guidelines for Road Rehabilitation Through Full-Depth Reclamation with Foamed Asphalt
David Jones and Pengcheng Fu, University of California, Davis

Comparison of Test Sections of Low-Volume Roadways Reconstructed with Conventional Techniques and Full-Depth Reclamation
Heather Miller and Meghan Amatrudo, University of Massachusetts, Dartmouth; Maureen A. Kestler, USDA Forest Service; Robert A. Eaton and Andrew Hall, New Hampshire Department of Transportation

Linn Run Road Improvements: Case Study on the Turn-Back of Asphalt-Paved Road Surface to Maintainable Gravel Road Surface
David Shearer, Center for Dirt and Gravel Roads; Barry Scheetz, Pennsylvania State University

Performance of Recycled Asphalt Pavement in Gravel Roads
Scott B. Koch, Khaled Ksaibati and George Huntington, University of Wyoming

8:00 a.m.–9:45 a.m., International Ballroom South
Pavement Materials
Lynne H. Irwin, Cornell University, presiding

Performance of Hot-Mix Asphalt Containing Recycled Asphalt Pavement
Binh Thanh Tran and Rayya A. Hassan, Swinburne University of Technology

Study of the Application of Cashew Nut Shell Liquid in Bituminous Priming of Low-Traffic Volume Roads in the State of Ceará, Brazil
Suelly Barroso, Antônio Rabêlo, and Jorge Soares, LMP/UFC

Use of Recycled Materials to Build Paver Blocks for Low-Volume Roads in Developing Countries
Maria Fernanda Serrano-Guzman, Universidad Pontificia Bolivariana; Diego Dario Perez-Ruiz, Pontificia Universidad Javeriana

8:00 a.m.–9:45 a.m., International Ballroom North
Speed Characteristics and Management on Low-Volume Roads
Anthony R. Giancola, National Association of County Engineers, presiding

Speed Distribution on Low-Volume Roads in Italy: From Inferences to Rehabilitation Design Criteria
Filippo Giammaria Praticò and Marinella Giunta, University Mediterranea of Reggio Calabria, Italy
Speed Table Evaluation and Speed Modeling for Low-Volume Crosstown Roads
Ana Tsui Moreno, Alfredo Garcia, and Mario Alfonso Romero, Polytechnic University of Valencia, Spain

Reducing Traffic Injuries Resulting from Excess Speed: Low-Cost Gateway Treatments in Italy
Gianluca Dell’Acqua, University of Naples Federico II, Italy

Safety of Driving Behavior on Low-Volume Roads in China: Case Study of Qinghai-Tibet Highway
Jiang-bi Hu and Yang Yang, Transportation Research Center of Beijing University of Technology

9:45 a.m.–10:15 a.m., International Foyer
Break

10:15 a.m.–noon, International Ballroom South
Geotechnical Engineering
Ernest S. Berney, U.S. Army Corps of Engineer Research and Development Center, presiding

Investigation of Design and Construction Practices for Bridge Pile Foundations in Iowa County Jurisdictions for LRFD Calibration
Matthew John Roling, Stanley Consultants, Inc.; Sherif AbdelSalam, The British University in Egypt; Sri Sritharan, Iowa State University; Muhammad T. Suleiman, Lehigh University

Repair of Storm-Damaged Slopes, Lower Mount Wilson Road, Los Angeles County, California
Jeffrey R. Keaton, David L. Perry, and Philip W. Kim, MACTEC Engineering and Consulting, Inc.

Warm Lake Road Frost Heave Monitoring Report
Gary L. Evans, Federal Highway Administration; Mark Truebe, Willamette National Forest; Gordon Hanek, Umpqua National Forest

Application of Coal Gangue in Low-Volume Roads in China
Dongwei Cao, Research Institute of Highway Ministry of Transport; Jie Ji, Beijing Institute of Civil Engineering and Architecture, China; Qingquan Liu, Research Institute of Highway Ministry of Transport; Zhaoyi He, Chongqing Jiaotong University, China; Hainian Wang, Chang’an University, China; Zhanping You, Michigan Technological University

10:15 a.m.–noon, International Ballroom Center
Rural Roads Maintenance and Management
Elizabeth M. Dodson, University of Montana, presiding

Analysis of Factors Causing Corrugation of Gravel Roads
Hesham Mahgoub, South Dakota State University; Christina Bennett, South Dakota Department of Transportation; Ali A. Selim, South Dakota State University

Blading Optimization: Reverting from Theory to Practice
Gerhardt Daniel van Zyl, Mycube Asset Management Systems

Condition Performance Models for Network-Level Management of Unpaved Roads
Alondra Chamorro and Susan Louise Tighe, University of Waterloo, Canada

Application of Highway Development and Management Tool in Rural Road Asset Management
Amirthalingam Veeraragavan, Indian Institute of Technology, Madras; Rathnakara Reddy KB, Infra Support Engineering Consultants Pvt. Ltd.
10:15 a.m.–noon, *International Ballroom North*

**Safety Assessment Tools for Low-Volume Roads**
Abishai Polus, Technion - Israel Institute of Technology, *presiding*

**Evaluation of Safety Identification Methods for Low-Volume Roads Using Monte Carlo Simulation**
Salvatore Cafiso and Giacomo Di Silvestro, University of Catania, Italy

**Safety Inspections as Supporting Tool for Safety Management of Low-Volume Roads**
Salvatore Cafiso and Grazia La Cava, University of Catania, Italy; Alfonso Montella, University of Naples Federico II, Italy

**Field Traffic Sign Handbook for Local Highway Agencies**
David Paul Orr, Cornell University

**Resources and Tools for Local Road Safety**
Ronald W. Eck, West Virginia University

Noon-1:30 p.m.

**Lunch Break (lunch on your own)**

1:30 p.m.–3:15 p.m., *International Ballroom South*

**Pavement Assessment**
David Paul Orr, Cornell University, *presiding*

**Mechanistic-Based Nondestructive Structural Asset Management Testing to Optimize Low-Volume Road Structural Upgrades**
Curtis F. Berthelot and Diana Podborochynski, University of Saskatchewan, Canada; Anna Anthony, Saskatchewan Department of Highways & Transportation; Brent L. Marjerison, Saskatchewan Ministry of Highways and Infrastructure, Canada

**Indirect Skid Resistance Measurement for Porous Asphalt Pavement Management**
Gianluca Dell’Acqua, Mario De Luca, and Renato Lamberti, University of Naples Federico II, Italy

**Keeping Springtime Low-Volume Road Damage to a Minimum: Toolkit of Practical Low-Cost Methods for Road Managers**
Maureen A. Kestler, USDA Forest Service; Richard L. Berg, FROST Associates; Heather Miller, University of Massachusetts, Dartmouth; Bryan C. Steinert, Haley & Aldrich, Inc.; Robert A. Eaton, New Hampshire Department of Transportation; Gregg Larson, Applied Research Associates, Inc.; John E. Haddock, Purdue University

**Improvement Recommendations for Unsealed Gravel Roads**
George Huntington and Khaled Ksaibati, University of Wyoming

1:30 p.m.–3:15 p.m., *International Ballroom North*

**Pavement Design**
Glen Legere, FPInnovations, *presiding*

**Evaluation of Gravel-Loss Deterioration Models: Case Study**
James Robert Uys, Consulting Engineering Services (I) Pvt. Ltd.

**New Economical and Practical Design Approach for Suburban Streets**
Rafeek Moegamat Louw, CSIR, South Africa

**Evaluation of Safety Identification Methods for Low-Volume Roads Using Monte Carlo Simulation**
Salvatore Cafiso and Giacomo Di Silvestro, University of Catania, Italy

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**New Economical and Practical Design Approach for Suburban Streets**
Rafeek Moegamat Louw, CSIR, South Africa
Integrated Mechanistic-Based Framework for Sustainable “Green Street” Rehabilitation of Urban Low-Volume Roads
Curtis F. Berthelot, Diana Podborochynski, Colin Wandzura, and Daryl Cherry, University of Saskatchewan, Canada; Rielle Haichert, Pavement Scientific International, Canada; Brian Taylor, Consultant, Canada; Duane Guenther, City of Saskatoon, Canada

Mechanistic Design and Nondestructive Structural Validation of a “Green Street” Test Section Using Recycled Rubble Materials
Curtis F. Berthelot, Diana Podborochynski, Colin Wandzura, and Daryl Cherry, University of Saskatchewan, Canada; Rielle Haichert, Pavement Scientific International, Canada; Brian Taylor, Consultant, Canada; Duane Guenther, City of Saskatoon, Canada

1:30 p.m.–3:15 p.m., International Ballroom Center
Use of Chip Seals and Thin Pavement for Low-Volume Roads
Mark J. Nahra, Woodbury County, presiding

Simple Dynamic Hammer for Evaluation of Physical Conditions of Pavement Structures
Warat Kongkitkul, Sompote Youwai, Pornkasem Jongpradist, Saravut Moryadee, and Thitikorn Posribink, King Mongkut’s University of Technology Thonburi; Koonnamas Punthutaecha and Chakree Bamrungwong, Department of Rural Roads, Thailand; Daiki Hirakawa, National Defense Academy

Preservation of Low-Volume Flexible Pavement Structural Capacity by Use of Seal Treatments
Isaac L. Howard, Mississippi State University

Nine Steps to Constructing High-Quality Chip Seals
Thomas John Wood, MNDOT; Roger C. Olson, Minnesota Department of Transportation

Evaluation of North Dakota’s 4.75-mm Superpave Mixes for Thin Overlay Applications
Nabil Suleiman, University of North Dakota

3:15 p.m.–3:45 p.m., International Foyer
Break

3:45 p.m.–5:30 p.m., Salons 1, 2, and 3
Current Issues Facing Low-Volume Roads Managers, Part 2
(Part 1 on Tuesday, July 26, from 3:45 p.m.–5:30 p.m.)
Ann Johnson, University of Minnesota, presiding

Engage in informal small group discussions on timely low-volume road “hot topics” facilitated by key experts. Each round table discussion will offer valuable information on best practices and lessons learned as well as provide helpful resource material. Ask questions, share experiences, learn from others, and gain practical information to apply to your low-volume road needs. Participants will have the opportunity to rotate among their selected table topics to gather information, receive expert assistance, and expand their resource network for a wide range of timely topics. Table topics for this session will focus on design issues such as dust control, geometric standards, erosion control, materials, and base stabilization.

1. Dust Control
   Discussion leader: Roger Surdahl, FHWA
   Key topics:
   • Environmental Certification of dust suppression and surface stabilization products
   • Best way of selecting a dust palliative or surface stabilizer for a specific application
   • Use of additives without any formal specifications
   • Incorporation of dust palliatives and surface stabilizers in low-volume road management
2. Operational Effects of Low-Volume Road Design
Discussion leader: Ronald W. Eck, West Virginia LTAP
Key topics:
• Design consistency and its relationship to safety
• Design vehicles for low-volume roads
• Relationship between cross section elements and safety
• Accommodation of nonmotorized users

3. Cut and Fill Slopes: Stability, Drainage, and Erosion Control
Discussion leaders: Gordon Keller, U.S.D.A. Forest Service; and Clayton Gillies, FP Innovations
Key topics:
• Critical shallow slope stabilization and erosion control issues for LVR engineers and managers
• Range of options and solutions that are most cost-effective and environmentally friendly
• Corresponding erosion control and related drainage issues associated with critical shallow slope stabilization
• Newest techniques and best methods for increasing slope stability

4. Pavement Design and Materials
Discussion leader: Mark Nahra, Woodbury Iowa County Engineer
Key topics:
• Current best practices and resources in pavement design methods for LVR with regard to materials
• Research related to materials selection
• New tools to assist with pavement design for LVRs

5. Materials Construction Use and Design Issues
Discussion leaders: Roger Olson and Eddie Johnson, Minnesota Department of Transportation
Key topics:
• New research done on the use of recycled materials in LVR construction
• Use of more recycled aggregates
• Construction issues associated with the use of recycled aggregates

6. Road-Base Stabilization
Discussion leader: David Jones, University of California, Davis
Key topics:
• Existing new technologies for full-depth reclamation
• Best way to stabilize road-base layers on LVRs
• Available geosynthetic products that are appropriate for use in low-volume roads

6:00 p.m.–7:00 p.m., International Foyer
Social Hour

7:00 p.m.–9:00 p.m., International Ballroom North
Conference Banquet
**Thursday, July 28**

**Postconference Field Trip:** Florida Department of Transportation, State Materials Office, Gainesville, Florida
8:00 a.m.–5:00 p.m., assemble in *Crystal Room*

| Jolanda P. Prozzi, Center for Transportation Research, University of Texas at Austin, *Chair*  
| Elizabeth M. Dodson, University of Montana  
| Ronald W. Eck, West Virginia University  
| Francis B. Francois, Consultant  
| Nicholas J. Garber, University of Virginia  
| Anthony R. Giancola, National Association of County Engineers  
| Lynne H. Irwin, Cornell Local Roads Program  
| David Jones, University of California, Davis  
| Michael T. Long, Oregon Department of Transportation  
| Mark J. Nahra, Woodbury County, Iowa  
| Anand J. Puppala, University of Texas at Arlington  
| Kumares C. Sinha, Purdue University |  

| **Liaisons**  
| Nina Maria Barker, University of Florida  
| Ernest S. Berney, IV, U.S. Army Engineer Research and Development Center  
| James Kozik, U.S. Department of Agriculture Forest Service  
| Clark C. Martin, Federal Highway Administration  
| Christopher Solloway, U.S. Environmental Protection Agency  
| Steven Suder, U.S. Fish and Wildlife Service  
| I. Paul Sunwoo, Bureau of Indian Affairs |  

| **TRB Staff**  
| G. P. Jayaparakash  
| Michael DeCarmine |
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Conference attendees may receive PDH credit for attending applicable sessions or workshops during the conference by following the steps outlined below.

1. As you check in on-site at the conference registration desk, notify a member of the conference registration staff that you wish to receive PDH credit.

2. Provide your PE number for the registration staff to record.

3. Look for the sign-in sheet provided at the back of the room in each session and workshop that is eligible for PDH credit. The number of credit hours will be indicated on the sign boards in front of each eligible session and workshop room.

4. Moderators will remind participants to sign the sign-in sheet in the back of the room at the beginning of each PDH-eligible session and workshop. However, it is the responsibility of the attendee to do so.

5. After the conference has ended, information from the sign-in sheets will be transferred to an electronic tracking system to total the number of PDH credits for all conference attendees who provided their PE numbers and attended at least one of the eligible sessions or workshops.

6. Once the totals have been calculated, each person who provided their PE number and attended at least one eligible session or workshop will receive a certificate of attendance with their total PDH credits for all eligible sessions or workshops attended.

Questions about PDH may be directed to the conference host agency at Florida Transportation Technology Transfer (T2) Center at the University of Florida by email t2cttassist@ce.ufl.edu or by calling 352.273.1669.
A new report, *Rockfall Characterization and Control*, edited by A. Keith Turner and Robert L. Schuster, will be available in print from TRB by the end of 2011. The report contains 18 chapters prepared by internationally recognized experts. The first five chapters describe the fundamentals of rockfall phenomena; the next five discuss the scientific and technical aspects of rockfall investigations; and the final eight describe rockfall mitigation and management options, with special reference to rockfall protection provided along transportation routes.

The report will interest transportation engineers responsible for rockfall investigations throughout the world, students in geosciences and geotechnical fields interested in rockfall, and researchers needing a definitive reference on rockfall evaluation and control.

For purchasing information, visit the TRB Bookstore at http://books.trbbookstore.org/
Transportation Research Board
91st Annual Meeting

January 22–26, 2012
Washington, D.C.

2012 Annual Meeting Spotlight Theme

Transportation: Putting Innovation and People to Work

www.TRB.org/AnnualMeeting2012

Registration Begins Early September
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