

**U.S. Department of Transportation Research and  
Innovative Technology Administration University Transportation  
Center Grant Agreement**

**Grant No. DTRT12-G-UTC08  
Mountain-Plains Consortium, North Dakota State University Denver Tolliver,  
Director [Denver.tolliver@ndsu.edu](mailto:Denver.tolliver@ndsu.edu)  
(701)231-7190**

**July 31, 2014**

**DUNS: 803882299 and EIN: 45-6002439**

**North Dakota State University  
Upper Great Plains Transportation Institute NDSU Dept. 2880,  
P.O. Box 6050, Fargo, ND 58108-6050**

**Grant period: January 1, 2012 – January 31, 2016**

**Reporting Period End Date: June 30, 2014 Semi-Annual  
PPPR#5**

**Denver D. Tolliver**



**Director, Mountain-Plains Consortium North Dakota  
State University**

## 1. Accomplishments: What was done? What was learned?

### a. What are the major goals of the program?

The overall objectives are to: (1) conduct basic and applied research, the products of which are judged by peers or other experts in the field of transportation to advance the body of knowledge in transportation; (2) offer an education program in transportation that includes multidisciplinary course work and participation in research; (3) conduct workforce development activities and programs to expand the workforce of transportation professionals; (4) provide an ongoing program of technology transfer to make transportation research results available to potential users in a form that can be readily used; and (5) provide planning and technical assistance to Native American tribes, especially those heavily impacted by energy development. Other program goals are to select projects and activities using peer review principles and procedures and client input that: (1) address the Secretary's strategic goals, and (2) leverage UTC funds with matching funds from state and local governments and private industry. The chief operational goals for grant DTRT12-G-UTC08 are to make important contributions to research and technology transfer in key areas related to the Secretary's goals of State of Good Repair, Safety, and Economic Competitiveness, while addressing critical issues of the region and stakeholder groups—especially issues in the rapidly growing Bakken oil production region. Under grant DTRT13-G-UTC38, the focus will shift more toward State of Good Repair. However, some safety emphasis is still necessary, given the issues posed by the transportation of Bakken crude oil by rail and truck.

### b. What was accomplished under these goals?

#### i. Project Selection and Peer Review

Under grant DTRT12-G-UTC08, 47 research projects have been selected from federal fiscal year (FY) 2011 funds—which were received in 2012. An additional 37 research projects have been selected from FY 2012 funds—which were received in 2013. All projects have been selected through a peer review process that reflects substantial input and matching resources from state departments of transportation and other transportation agencies in the region. The projects selected under grant DTRT12-G-UTC08 are listed in Tables 1-6, under the primary strategic goal addressed by the project. Please note that many of the projects address several goals simultaneously. In particular, many projects that address State of Good Repair have potential Safety and Economic Competitiveness benefits.

**Table 1: MPC Research Projects Most Directly Correlated with Safety**

1. MPC-354: Geotechnical Limit to Scour at Spill-through Abutments (Year 2)
2. MPC-366: Structural Health Monitoring of Highway Bridges Subjected to Overweight Trucks, Phase I – Instrumentation Development and Validation
3. MPC-367: Developing Statistical Models for Crash Severity Comparing Statewide, County and Indian Reservation Roads
4. MPC-368: Effectiveness of Advisory Letter in Preventing At-Risk Teen Driver Crashes: Pilot Project
5. MPC-369: ND Motor Crash Analysis and Rider Assessment for Improved Conspicuity
6. MPC-370: Anticipatory Guidance for Older Drivers
7. MPC-371: Decision Support for Strategic Truck Safety and Weight Enforcement Planning
8. MPC-373: Damage Assessment, Characterization, and Modeling for Enhanced Design of Concrete Bridge Decks in Cold Regions
9. MPC-374: An Integrated Real-Time Health Monitoring and Impact/Collision Detection System for Bridges in Cold Remote Regions
10. MPC-375: Small Railroad Capital Investment Needs and Financial Options
11. MPC-378: MEMS Sensors for Transportation Structures
12. MPC-380: Investigation of Interactions between Traffic Law Enforcement and Driving Behavior on Rural Highways in Colorado
13. MPC-381: Performance-based Interaction Analysis of Damage on Bridge Expansion Joints and Heavy Traf

14. MPC-382: Seismic Behavior of Steel Bridges with Fatigue-prone Details
15. MPC-386: Use of Travel Time, Travel Time Reliability, and Winter Condition Index Information for Improved Operation of Rural Interstates
16. MPC-397: Evaluation and Mitigation of Vehicle Impact Hazard for Overpass Bridges in South Dakota
17. MPC-401: Review of Road User Costs (RUC) and Methods
18. MPC-402: Seismic Performance of SCC Bridge Columns
19. MPC-406: Risk- and Reliability-Based Approaches to Analyzing Road Geometric Design Criteria
20. MPC-407: The Effect of Multi-tasking on Self-Assessments of Driving Performance Center for the Prevention of Distracted Driving
21. MPC-408: Exploring Unique Plastic-Reinforced Bridge Decks: Phase I
22. MPC-416: Development and Testing of Crashworthy Ipe Bridge Rails
23. MPC-418: 400 South Corridor Assessment
24. MPC-423: Impact of Energy Sector Growth on Perceived Transportation Safety in the Seventeen County Oil Region of Western North Dakota: A Longitudinal Analysis
25. MPC-425: Building a Sustainable GIS Framework for Supporting a Tribal Transportation Program
26. MPC-431: Connected Vehicle Weather Data for Operation of Rural Variable Speed Limit Corridors
27. MPC-438: Calibration of HSM Predictive Methods on Rural State and Local Highways
28. MPC-445: A Sensor Fusion Approach to Assess Pavement Condition and Maintenance Effectiveness

**Table 2: MPC Research Projects Most Directly Correlated with State of Good Repair**

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1. MPC-354: Geotechnical Limit to Scour at Spill-through Abutments (Year 2)
2. MPC-365: Improved Understanding of Pavement Impacts and Cost-Effective Designs Based on Mechanistic Empirical Methods
3. MPC-366: Structural Health Monitoring of Highway Bridges Subjected to Overweight Trucks, Phase I – Instrumentation Development and Validation
4. MPC-371: Decision Support for Strategic Truck Safety and Weight Enforcement Planning
5. MPC-372: A Novel Methodology for Quantifying the Performance of Constructed Bridges in Cold Regions: Development, Assessment, and Repair
6. MPC-373: Damage Assessment, Characterization, and Modeling for Enhanced Design of Concrete Bridge Decks in Cold Regions
7. MPC-374: An Integrated Real-Time Health Monitoring and Impact/Collision Detection System for Bridges in Cold Remote Regions
8. MPC-375: Small Railroad Capital Investment Needs and Financial Options
9. MPC-376: Improved Understanding of Pavement Impacts and Cost-Effective Designs Based on Mechanistic-Empirical Methods
10. MPC-378: MEMS Sensors for Transportation Structures
11. MPC-379: Plastic-Aluminum Composites in Transportation Infrastructure
12. MPC-382: Seismic Behavior of Steel Bridges with Fatigue-prone Details
13. MPC-383: Seismic Performance of Highway Embankments
14. MPC-387: Comprehensive GIS-Based Rural Regional Transportation Planning Models
15. MPC-390: Design and Construction Monitoring of Surcharged Embankment
16. MPC-391: Implementation of Low Temperature Test for Asphalt Mixtures to Improve the Longevity of Road Surfaces
17. MPC-395: Accelerated Bridge Construction in South Dakota: Pilot Study for Implementation Strategy
18. MPC -394: Quantifying Uncertainty in Nondestructive Bridge Inspection Methods for use in P B I
19. MPC-396: Extent, Severity, and Location of Chip Seal Loss on the South Dakota State Road Network
20. MPC-397: Evaluation and Mitigation of Vehicle Impact Hazard for Overpass Bridges in South Dakota
21. MPC-398: Selection of Discount Rates for Infrastructure Investment
22. MPC-400: Evaluation of Ice Loads on Bridge Piers in South Dakota (Years 2 & 3)
23. MPC-401: Review of Road User Costs (RUC) and Methods
24. MPC-402: Seismic Performance of SCC Bridge Columns

25. MPC-404: Seismic Performance of Concrete Filled Steel Tube (CFST) Bridge Columns For Accelerated Bridge Construction
26. MPC-405: Seismic Retrofit of Spliced Sleeve Connections for Precast Bridge Piers
27. MPC-406: Risk- and Reliability-Based Approaches to Analyzing Road Geometric Design Criteria
28. MPC-410: Predicting Fatigue Service Life Extension of RC Bridges with Externally Bonded CFRP Repairs
29. MPC-411: Re-Use of Mine Waste Materials Amended with Fly Ash in Transportation Earthwork Projects
30. MPC-412: Fatigue Strength of CFRP-repaired Reinforced Concrete Bridge Girders under Service Temperature
31. MPC-413: A Pilot Case Study to Evaluate the Potential Impact and Benefit of Adopting and Implementing BIM on Bridge and Infrastructure Projects
32. MPC-414: Quantifying Sustainability Metrics for Trunkline Bridges in the Mountain Plains Region
33. MPC-415: Framework of Performance-Based Earthquake Design of Curved and Skewed Bridges
34. MPC-419: Experimental and Numerical Study for the Debonding Interface Between an Existing Pavement and a New Concrete Overlay
35. MPC-421: Seismic Rehabilitation of Skewed and Curved Bridges Using a New Generation of Bulking Restrained Braces
36. MPC-422: Highway Structures Supported on Expanded Polystyrene (EPS) Embankment without Deep Foundations
37. MPC-423: Impact of Energy Sector Growth on Perceived Transportation Safety in the Seventeen County Oil Region of Western North Dakota: A Longitudinal Analysis
38. MPC-425: Building a Sustainable GIS Framework for Supporting a Tribal Transportation Program
39. MPC-427: Fire Performance of Bridge Members Retrofitted with Near-Surface-Mounted Carbon Fiber Reinforced Polymer Composites
40. MPC-428: Using Recycled Concrete Aggregate in New Concrete Construction
41. MPC-429: A Methodology for Developing a Replacement Strategy for County/City Owned Bridges
42. MPC-430: Implementation of Intelligent Compaction Technologies for Road Constructions in Wyoming
43. MPC-437: Fiber Reinforced Concrete for Structure Component
44. MPC-439: Precast Bridge Girder Details for Improved Performance
45. MPC-440: Tolerances for Placement of Tie Bars in Portland Cement Concrete Pavements
46. MPC-441: Developing a Pavement Management System for Small Communities
47. MPC-442: Improving Rural Emergency Medical Services (EMS) through Transportation System Enhancements, Phase II
48. MPC-443: Bridge Structure Alternatives for Local Roads
49. MPC-444: Data-Driven Freeway Performance Evaluation Framework for Project Prioritization and Decision Making
50. MPC-445: A Sensor Fusion Approach to Assess Pavement Condition and Maintenance Effectiveness

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**Table 3: MPC Research Projects Most Directly Correlated with Economic Competitiveness**

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1. MPC-354: Geotechnical Limit to Scour at Spill-through Abutments (Year 2)
  2. MPC-366: Structural Health Monitoring of Highway Bridges Subjected to Overweight Trucks, Phase I – Instrumentation Development and Validation
  3. MPC-375: Small Railroad Capital Investment Needs and Financial Options
  4. MPC-379: Plastic-Aluminum Composites in Transportation Infrastructure
  5. MPC-380: Investigation of Interactions Between Traffic Law Enforcement and Driving Behavior on Rural Highways in Colorado
  6. MPC-381: Performance-based Interaction Analysis of Damage on Bridge Expansion Joints and Heavy Traffic
  7. MPC-382: Seismic Behavior of Steel Bridges with Fatigue-prone Details
  8. MPC-384: Understanding Public Perceptions of Different Revenue Generation Systems for Highway Construction and Maintenance
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9. MPC-387: Comprehensive GIS-Based Rural Regional Transportation Planning Models
10. MPC-395: Accelerated Bridge Construction in South Dakota: Pilot Study for Implementation Strategy
11. MPC-396: Extent, Severity, and Location of Chip Seal Loss on the South Dakota State Road Network
12. MPC-397: Evaluation and Mitigation of Vehicle Impact Hazard for Overpass Bridges in South Dakota
13. MPC-398: Selection of Discount Rates for Infrastructure Investment
14. MPC-401: Review of Road User Costs (RUC) and Methods
15. MPC-402: Seismic Performance of SCC Bridge Columns
16. MPC-408: Exploring Unique Plastic-Reinforced Bridge Decks: Phase I
17. MPC-418: 400 South Corridor Assessment
18. MPC-422: Highway Structures Supported on Expanded Polystyrene (EPS) Embankment without Deep Foundations
19. MPC-425: Building a Sustainable GIS Framework for Supporting a Tribal Transportation Program
20. MPC-426: Does the Livability of a Residential Street Depend on the Characteristics of the Neighboring Street Network?
21. MPC-427: Fire Performance of Bridge Members Retrofitted with Near-Surface-Mounted Carbon Fiber Reinforced Polymer Composites
22. MPC-437: Fiber Reinforced Concrete for Structure Component
23. MPC-439: Precast Bridge Girder Details for Improved Performance
24. MPC-440: Tolerances for Placement of Tie Bars in Portland Cement Concrete Pavements
25. MPC-443: Bridge Structure Alternatives for Local Roads
26. MPC-445: A Sensor Fusion Approach to Assess Pavement Condition and Maintenance Effectiveness

**Table 4: MPC Research Projects Most Directly Correlated with Livable Communities**

1. MPC-361: Building a Framework for Transportation Resiliency and Evaluating the Resiliency Benefits of Light Rail Transit in Denver, Colorado
2. MPC-376: Improved Understanding of Pavements Impacts and Cost-Effective Designs Based on Mechanistic-Empirical Methods
3. MPC-379: Plastic-Aluminum Composites in Transportation Infrastructure
4. MPC-380: Investigation of Interactions between Traffic Law Enforcement and Driving Behavior on Rural Highways in Colorado
5. MPC-381: Performance-based Interaction Analysis of Damage on Bridge Expansion Joints and Heavy Traffic
6. MPC-387: Comprehensive GIS-Based Rural Regional Transportation Planning Models
7. MPC-392: Evaluation of Spliced Sleeve Connections for Precast Reinforced Concrete Bridge Piers
8. MPC-393: Traffic Modeling of Transit Oriented Development
9. MPC-399: Improving Rural Emergency Medical Services (EMS) through Transportation System Enhancements
10. MPC-408: Exploring Unique Plastic-Reinforced Bridge Decks: Phase I
11. MPC-417: Evaluation and Development of Livability and Sustainability Programs for Indian Reservations
12. MPC-418: 400 South Corridor Assessment
13. MPC-425: Building a Sustainable GIS Framework for Supporting a Tribal Transportation Program
14. MPC-426: Does the Livability of a Residential Street Depend on the Characteristics of the Neighboring Street Network?
15. MPC-436: Using Flocculation to Reduce Turbidity of Construction Site Runoff
16. MPC-438: Calibration of HSM Predictive Methods on Rural State and Local Highways
17. MPC-444: Data-Driven Freeway Performance Evaluation Framework for Project Prioritization and Decision Making

**Table 5: MPC Research Projects Most Directly Correlated with Environmental Sustainability**

1. MPC-411: Re-Use of Mine Waste Materials Amended with Fly Ash in Transportation Earthwork Proj

2. MPC-414: Quantifying Sustainability Metrics for Trunkline Bridges in the Mountain Plains Region
3. MPC-416: Development and Testing of Crashworthy Ipe Bridge Rails
4. MPC-417: Evaluation and Development of Livability and Sustainability Programs for Indian Reservations
5. MPC-418: 400 South Corridor Assessment
6. MPC-421: Seismic Rehabilitation of Skewed and Curved Bridges Using a New Generation of Bulking Restrained Braces
7. MPC-428: Using Recycled Concrete Aggregate in New Concrete Construction
8. MPC-436: Using Flocculation to Reduce Turbidity of Construction Site Runoff
9. MPC-441: Developing a Pavement Management System for Small Communities
10. MPC-442: Improving Rural Emergency Medical Services (EMS) through Transportation System Enhancements, Phase II

**Table 6: MPC Education Projects**

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1. MPC-385: Educational and Workforce Development Proposal: STEM Outreach at Colorado State University
  2. MPC-403: Web-based Decision Support Tool for Traffic Management and Work Zone Analysis
  3. MPC-424: Educational and Workforce Development: Ethics and Academic Conduct

**ii. Educational Accomplishments**

The transportation and transportation-related courses offered during Spring & Summer 2014 are listed in Table 7, organized by major subject area. In some cases, courses with the same titles were offered at more than one MPC university. In these cases, the number of courses offered is shown in parenthesis.

**Table 7: Transportation and Transportation-Related Courses Offered This Reporting Period**

<b>Major Subject Area</b>	<b>Course Title</b>
<b>Engineering &amp; Design</b>	Advanced Concrete Design
	Advanced Foundation Engineering
	Advanced Steel Behavior and Design
	Advanced Street and Highway Design
	Concrete Science
	Design of Timber Structures
	Finite Element Method
	Geotechnical Engineering and Lab
	GIS in Civil and Environmental Engineering
	Highway Design
	Highway Engineering (2)
	Hydraulics Engineering
	Pavement Design
	Prestressed Concrete
	Soils
	Steel Design
Structural Dynamics	
Structural Earthquake Engineering	

<b>Freight &amp; Logistics</b>	Adaptive Planning/Logistics Systems
	Advanced Supply Chain Planning/Enterpr
	Logistics Decision Analysis
	Supply Chain Strategy
<b>Planning &amp; Environment</b>	Context Sensitive Solutions
	Crisis Analysis/Homeland Security
	Form and Formation of Cities
	Natural and Built Environments
	Planning for Healthy Communities
	Spatial Analysis/Transportation
	Sustainable Materials
	Transportation and Land Use
	Transportation Planning
	Transportation Systems Modeling
	Urban Development
	Urban Planning and Site Impact Development
<b>Traffic &amp; Operations</b>	Highway and Traffic Engineering
	Quantitative Tools for Transportation Management
	Traffic Impact Assessment
	Traffic Operation
	Transportation Management
<b>Transportation Safety</b>	Cognitive Psychology
	Human Performance and Engineering
	Traffic and Safety Data Analysis
	Transportation Safety
<b>Transportation Systems</b>	Freight Transportation Systems
	Infrastructure and Transportation Systems
	Passenger Transportation Systems
	Sustainable Transportation Systems
	Transportation Finance
	Transportation Law and Regulation: Domestic and International
	Transportation Marketing and Sales Tools
	Transportation Systems II
	Transportation Systems Lab

Altogether, 52 transportation and transportation-related courses have been offered during this reporting period. Altogether, 255 transportation courses have been offered during the grant period thus far. In addition to the courses listed in Table 7, foundational courses in engineering materials, mechanics, structural analysis, and geotechnical engineering have been offered at most of the MPC universities.

### iii. Workforce Development Accomplishments

**Training** events provided for transportation professionals during this reporting period are listed below.

1. Access Management (Webinar)
2. Ethics in the Workplace, Community Transportation Association of America
3. ADA - Designing, Constructing & Maintaining Pedestrian Facilities in the Public Right-of-Way
4. Aggregate Testing Certification (2)

5. American Concrete Institute Sixth Annual Spring Concrete Symposium
6. Asphalt Crack Sealing
7. Asphalt Pavement Maintenance
8. Asphalt Testing Certification (2)
9. ATSSA Traffic Control Technician
10. Automated Pavement Distress Data Collection Round-Table Discussion
11. Basic Concepts of Pavement Preservation
12. Basic Full Depth & Partial Depth Concrete Pavement Repair Methods (2)
13. Basic Surveying Methods for Local Highway Departments (3)
14. Big Block Segmental Retaining Walls - Applications for Restricted Right-of-Way (Webinar)
15. Bridge Construction Inspection
16. Concrete Slab & Bridge Deck Curing Methods (Webinar)
17. Construction - Guardrail Installation & Inspection
18. Construction Project Management / Contract Administration
19. Developing Personal Leadership
20. EDC - Intelligent Compaction: Understanding the Technology (Webinar)
21. Franklin Covey 7-Habits Version 4; Electronic Version of Planner
22. Gravel Road Maintenance (2)
23. Gravel Roads Academy - On-Site Stanley and Bowman
24. Guardrail Maintenance
25. Highway Pipe Installation (2)
26. Highway Wildlife Crossings - State of the Practice - Research, Applications and Usage
27. Incorporating Road Safety Analysis into the Transportation Project Development Process
28. Recent Advancements, Utah Society of Professional Engineers Annual Conference
29. Introduction to Highway Construction for Engineers & Engineering Technicians (ND Only)
30. Introduction to Project Management Concepts
31. Managing Organizational Communication
32. ND Asphalt Conference Bismarck On-Site
33. NDDOT - Construction Project Management Training Program
34. Pavement Design & Construction for Base & Subgrade Stabilization
35. Pavement Markings for Maintenance Employees
36. Prose for Pros: Avoiding Grammar Gaffes, Limp Language & Other Writing Blunders
37. Shale Oil Exploration & Production Impacts on Roads
38. Shop Mechanic - Engines & Hydraulics
39. State of the Guardrail Industry: Advancements in Longitudinal Barriers (Webinar)
40. Tractor Operator Safety: Roadside Mower Training
41. Training in Concrete Certification (3)
42. Transportation and Safety Congress
43. Truck Weight Education & Outreach (8)
44. Ultra-Thin Whitetopping Materials, Design & Construction
45. Utah Asphalt Conference
46. Warm Mix Asphalt: Mix Design, Construction & Performance
47. Women in Transportation

#### **iv. Research accomplishments**

The following peer reviewed research reports/presentations were published in 2014 from grant DTRT12-G-UTC08 or previous grants.

Project #	Title	Date	Report No.
330	Integrate Supply Chain Model in Urban Freight Planning	Dec 2013	MPC 13-259
335	Misinformation Contributing to Safety Issues in Vehicle Restraints for Children	Dec 2013	MPC 13-264



355	Quantifying the Impact of Very High Heavy Vehicle Proportion on Rural Freeways	Dec 2013	MPC 13-265
Tech Trf	Pilot-Scale Implementation of a Gravel Roads Management System	Dec 2013	MPC 13-263
356	Truck Size and Weight Education Presentation	Jan 2014	Presentation
Education	Railway Models for Educational Purposes	Jan 2014	CE 456/656 Draft Textbook, Freight Railway Planning
363	A two-stage approach for estimating a statewide truck trip table	May 2014	MPC 14-269
372	A novel methodology for quantifying the performance of constructed bridges in cold regions: development, assessment, and repair	May 2014	MPC 14-266
377	Assessing Existing Transportation Sustainability Rating Systems for use in the Mountain Plains Consortium States	May 2014	MPC 14-268
399	Improving Rural Emergency Medical Services (EMS) through Transportation System Enhancements	May 2014	MPC 14-267

**c. How have the results been disseminated?**

The results are being disseminated in a variety of ways, including: (1) workshops and conferences, (2) videoconferences, (3) online modules, (4) presentations at conferences, (5) publications, (6) webpage postings and displays, and (7) Internet-based dissemination media, including broadcast emails and webinars. These accomplishments are summarized under the products section of this report.

**d. What do you plan to do during the next reporting period to accomplish the goals/objectives?**

(1) Continue to offer the multidisciplinary multimodal catalogue of courses described in the prospectus and teach those courses scheduled during the academic year (2) Continue to deliver extensive programs of technical training, similar to the programs illustrated in b.iii. (3) With the guidance of the recently established North Dakota Transportation Safety Advisory Group, identify a two-year work plan to conduct safety research and technical training that addresses key Bakken-related issues, including motor carrier, railway, and pipeline safety. (4) In conjunction with tribal partners, develop a two-year plan for tribal transportation research and technical assistance to include: a) the development of an emergency management/response guidebook, b) GIS modeling and technical assistance in traffic forecasting; and c) help in implementing road safety procedures and countermeasures on tribal roads. (5) Continue the strong MPC research programs, which will result in many new publications and journal papers. (6) Participate in 4 or more conferences and workshops on transportation and energy development. (7) Collaborate with other UTCs to promote greater exchange of information and explore partnering possibilities in railway and waterway transportation. (9) Continue to involve graduate students in MPC research projects.

**2. Products: What has the program produced?**

**a. Publications, conference papers, presentations**

**i. Participation in key conferences and workshops**

- 2014 TRB 93<sup>rd</sup> Annual Conference
- 10<sup>th</sup> National Conference on Earthquake Engineering (NCEE)
- 2014 ASCE Geocongress

- 2014 Intermountain GIS Conference
- 2014 ITE Utah Chapter Annual Conference
- 2<sup>nd</sup> T&DI Congress of the American Society of Civil Engineers
- ACI 2014 Spring Convention
- ACI Spring Convention
- American Society of Civil Engineers Annual Structures Congress
- Annual Meeting of the American Psychological Science Association
- ASCE T&DI Congress 2014
- ASCE-EWRI Water-Resources & Environment Conference
- Association of Logistics and Supply Chain Management
- Community Transportation Association of America
- Congress for the New Urbanism Annual Meeting
- Federal Highway Administration's Massive Data Convening Panel
- FHWA: Intelligent Compaction Data Management Workshop
- Future Concrete Institute (ACI) 2014
- Geo-Congress 2014, Geo-Characterization and Modeling for Sustainability, Geo-Institute of the American Society of Civil Engineers
- Global Waste Management Symposium
- ITE Colorado-Wyoming Section Transportation Symposium
- ITE Intermountain Section 54<sup>th</sup> Annual Meeting
- ITE Western District Annual Meeting 2014
- IX International Conference on Structural Dynamics
- Law Enforcement Summit
- ND Motor Carrier Association Annual Meeting
- Non-Destructive Surface Analysis of Composites and Polymers by Handheld FTIR (Webinar)
- North Dakota Strategic Highway Safety Plan Conference
- SPIE: Sensors and Smart Structures Technologies for Civil, Mechanical, and Aerospace Systems, Smart Structures/ NDE 2014
- Traffic Modeling of Transit Oriented Development
- Utah Asphalt conference
- Utah Society of Professional Engineers Annual Conference
- Wind River Indian Reservation: Livability Stakeholders Meeting
- Wind River Indian Reservation: Safety Fair
- Women in Transportation Workshop

## ii. Key Journal Articles or Conference Publications

- Al Wakeel, S., Kim, Y.J., Deng, Y.J. Performance of bridge decks in a cold region and a high-fidelity sensing system for damage detection, American Concrete Institute (ACI) Special Publication on Advanced Materials and Sensors toward Smart Concrete Bridges: Concept, Performance, Evaluation, and Repair, 187-206, 2014
- Bronson, Rachael. and Wesley E. Marshall. Alternative and adaptive transportation: What household and neighborhood factors support recovery from a drastic increase in gas price? International Journal of Environmental Science and Technology, (doi: 10.1007/s13762-014-0583-2), 2014.
- Chen, J. Y., Heyliger, P. R. and Pan, E. Free vibration of three-dimensional multilayered magneto-electro-elastic plates under combined clamped/free boundary conditions. Journal of Sound and Vibration, Volume 333, Issue 17, 18 August 2014, Pages 4017–4029.
- Clevenger, C., Fanning, B., Ozbek, M.E., Mahmoud, H.N. "Implementing BIM on Infrastructure: A Comparison of Two Bridge Construction Projects" has been accepted for publication by ASCE's Practice Periodical on Structural Design and Construction.

- Ettema, Robert, Kam Ng, Ram Chakradhar, Joshua Fuller, and Edward W. Kempema. Failure of Spill-through Bridge Abutments during Scour: Flume and Field observations. *ASCE Journal of Hydraulic Engineering*.
- Goetz, Andrew R. 2014. Book Review of *The Economics and Politics of High-Speed Rail: Lessons from Experiences Abroad*, by D. Albalade and G. Bel. *Journal of Transport Geography* 35: 158-159.
- Goetz, Andrew R. and Lucy Budd, eds. 2014. *The Geographies of Air Transport*. Transport and Mobility's Series. Abingdon UK: Ashgate Publishers.
- Kim, Y.J. Moment-shear interaction mechanism for CFRP-strengthened RC beams in flexure, *ACI Structural Journal*, American Concrete Institute (ACI) (submission number-S-2013-043: in-press) 2014.
- Kim, Y.J., Hyun, S.W., Yoshitake, I., and Kang J.Y. 2014. Residual performance of a silyl-modified polymer adhesive for CFRP-steel interface exposed to thermally-induced stress states, *International Journal of Adhesive and Adhesion*, Elsevier ,51, 117-127.
- Kim, Y.J., Siriwardanage, T., and Kang, J.Y. Debonding-mitigation for CFRP-strengthened steel beams with silyl modified polymer and CFRP-wrap anchorage, *Journal of Composites for Construction*, American Society of Civil Engineers (ASCE) (submission number-CCENG-986: in-press) 2014.
- Kim, Y.J., Siriwardanage, T., Hmidan, A., and Seo, J. Material characteristics and residual bond properties of organic and inorganic resins for CFRP composites in thermal exposure, *Construction and Building Materials*, Elsevier , 50, 631-641, 2014.
- Kubas, Andrew and Kimberly Vachal. Oil County Traffic Safety: A Perspective of Western North Dakota Residents. *Transportation Research Record*. Accepted. 2014.
- Musunuru, A. and Porter, R.J. A Reliability-Based Geometric Design Approach for Selecting the Basic Number of Freeway Lanes, *Transportation Research Record*, *Journal of the Transportation Research Board*, 2014, accepted for publication.
- Namrou, A.R. and Kim, Y.J. An experimental investigation into the behavior of concrete elements retrofitted with NSM composite strips at elevated temperatures, *American Concrete Institute (ACI) Special Publication on Advanced Materials and Sensors toward Smart Concrete Bridges: Concept, Performance, Evaluation, and Repair*, 225-239, 2014.
- Namrou, A.R. and Kim, Y.J. Residual Performance of Concrete-adhesive Interface at Elevated Temperatures, *ACI Structural Journal* (submitted: submission number-S-2014-207).
- R. Bridgelall, "Inertial Sensor Sample Rate Selection for Ride Quality Measures," *Journal of Infrastructure Systems*, American Society of Civil Engineering, DOI: 10.1061/(ASCE)IS.1943-555X.0000225, in press.
- R. Bridgelall, "Precision bounds of pavement deterioration forecasts from connected vehicles," *Journal of Infrastructure Systems*, American Society of Civil Engineering, DOI: 10.1061/9 (ASCE) IS.1943-555X.0000218, April 23, 2014.
- R. Bridgelall, "Precision bounds of pavement distress localization with connected vehicle sensors," *Journal of Infrastructure Systems*, American Society of Civil Engineering, ISENG-655, in review June 3, 2014.
- Saboori, Ashkan, Siamak Yazdani, Andrew Reberg, and Denver Tolliver: Anisotropic Damage Modeling of Concrete subjected to freeze-thaw. *International Journal of Civil and Structural Engineering*. In review.
- Savan, C., Ng, K.W., and Ksaibati, K. (2014). "Intelligent Compaction for roadway Construction and Quality Assurance." *The 65th Annual Geology Symposium*, Laramie, WY.
- Taylor, J., Zhou, X., Roupail, N.M., and Porter, R.J. Method for Investigating Intradriver Heterogeneity using Vehicle Trajectory Data: A Dynamic Time Warping Approach, submitted to *Transportation Research Part B*, 2014, under review.
- Tucker C, and Ibarra L (2014) Seismic Performance of Circular Concrete Filled Tube Columns For Accelerated Bridge Construction. 10th National Conference on Earthquake Engineering (NCEE). Anchorage, Alaska. July 21-25, 2014.

- Werbelow, W. and Ksaibati, K., “Developing a Methodology to Assess and Prioritize Culvert Conditions on County Roads”, Accepted for publication by the Transportation Research Board, Low Volume Roads Conference, 2014.
- Z. Zhang, Y. Huang, L. Palek, and R. Strommen, “Glass fiber reinforced polymer packaged fiber Bragg grating sensors for ultra-thin unbonded concrete overlay monitoring”, Submitted to International Journal of Structural Health Monitoring, May 14, 2014.

### iii. Key Conference Papers

- Ameli, M.J., Parks, J.E., Brown, D.N., Pantelides, C.P., and Reaveley, L.D. "Evaluation and Repair of Precast RC Bridge Column Connections Utilizing Grouted Splice Sleeves." Proceedings Eurodyn2014, IX International Conference on Structural Dynamics, Porto, Portugal.
- Ameli, M.J., Parks, J.E., Brown, D.E., Pantelides, C.P., and Reaveley, L.D. "Evaluation and Repair of Precast RC Bridge Column Connections Utilizing Grouted Splice Sleeves." Eurodyn2014, IX International Conference on Structural Dynamics, Porto, Portugal, 2014.
- Gorakhki, M. R. H. and Bareither, C. A. "Salinity effects on the geotechnical characterization of mine tailings," Tailings and Mine Waste 2014.
- Jehring, M. M. and Bareither, C. A. "Effect of tailings composition on the shear behavior of co-mixed mine waste," Tailings and Mine Waste 2014.
- Kim, Y.J., Hyun, S.W., Yoshitake, I., Kang, J.-Y, and Seo, J. A composite-bonded steel substrate with silyl-modified polymer exposed to thermal distress, Probabilistic Safety Assessment and Management (PSAM 12), Honolulu, HI, 2014.
- Luckey, K. and W. Marshall. Understanding the level of integration of light rail transit into communities in the Denver region. Transportation Research Board, Washington, D.C., January 2014.
- Musunuru, A. and Porter, R.J. A Reliability-Based Geometric Design Approach to Freeway Number of Lanes Decisions, Compendium of Papers from the 93rd Annual Meeting of the Transportation Research Board, Washington, D.C., January 12-16, 2014.
- Ng, K., Chakrahda, R., Ettema, R. and Kempema, E. (present in 2014), “Laboratory Investigation of Embankment Soil Strength Influence on Abutment Scour: Early Findings.” ASCE-EWRI Conference, Portland, Oregon, June 1-5.
- R. Bridgelall, “A participatory sensing approach to characterize ride quality”, Proc. SPIE 9061, Sensors and Smart Structures Technologies for Civil, Mechanical, and Aerospace Systems 2014, 90610A (March 8, 2014).
- Saboori, Ashkan, Siamak Yazdani, Andrew Reberg, Mijia yang, Denver Tolliver, and Sara Mamani "Modeling freeze and thaw damage in concrete decks using damage mechanics." Proceedings of the Second ASEA-SEC Conference, Bangkok, Thailand, 2014.
- Saboori, Ashkan, Siamak Yazdani, Andrew Reberg, Mijia yang, Denver Tolliver, and Sara Mamani: Modeling of Concrete behavior under biaxial fatigue loading with various mean stresses.” Proceedings of the Second ASEA-SEC Conference, Bangkok, Thailand, 2014.
- Simpson, S., Clevenger, C.M., Ozbek, M. E., Rabbani, E., and Atadero, R. (2014). "A Framework for Assessing Transportation Sustainability Rating Systems for Implementation in U.S. State Departments of Transportation." In: Proceedings of the 2014 TRB 93rd Annual Conference, 18 pages (Electronic Proceedings with no page numbers), January 12-16, Washington D.C.
- Tasic, I., X. Zhou, M. Zlatkovic. Using Spatiotemporal Constraints to Quantify Transit Accessibility: Case Study of Potential Transit-Oriented Development Location in West Valley, Utah. In press: Transportation Research Record, Journal of the Transportation Research Board of the National Academies.
- Y. Huang, L. Palek, and R. Strommen, B. Worel, and G. Chen, “Real-time weight-in-motion measurements using fiber Bragg grating sensors”, Proc. SPIE 9061, Sensors and Smart Structures Technologies for Civil, Mechanical, and Aerospace Systems 2014, 906109 (March 8, 2014).
- Zlatkovic, M., and A. Stevanovic. "Assessment of Impacts of Increased Train Frequency and Predictive Transit Priority on a LRT Corridor in Salt Lake City." Proceedings of the 93rd TRB Annual Meeting,

Washington D.C., 2014.

- Zlatkovic, M., and X. Zhou. "Effective Coupling of Signal Timing Estimation Model and Dynamic Traffic Assignment in Feedback Loops: System Design and Case Study." Proceedings of the 93rd TRB Annual Meeting, Washington D.C., 2014.

#### iv. Key Presentations

- Atadero, R., Ozbek, M. and Hesse, A. "Uncertainty in Bridge Inspection Results in Bridge Management and Inspection Planning." ASCE Structures Congress, Boston, MA, April 4, 2014.
- Bronson, R. and W. Marshall. City Resilience and Active Transportation Infrastructure. Congress for the New Urbanism Annual Meeting, Buffalo, NY, June 2014.
- Debbie Shinstine and Khaled Ksaibati "Indian Reservation Safety Improvement Program", 2014 Inter tribal Transportation Association Mid-Year Meeting", Polson, Montana, June 5, 2014.
- Debbie Shinstine and Khaled Ksaibati "Indian Reservation Safety Improvement Program", 2014 Inter tribal Transportation Association Mid-Year Meeting", Polson, Montana, June 5, 2014.
- Debbie Shinstine and Khaled Ksaibati "Safety Improvement Programs for Indian Reservations", Advisory Board Meeting for the Northern Plain TTAP Center, Fort Morgan, SD. South Dakota Tribal Safety Summit, May 21, 2014.
- Debbie Shinstine and Khaled Ksaibati "Safety Improvement Programs for Indian Reservations", Advisory Board Meeting for the Northern Plain TTAP Center, Fort Morgan, SD. South Dakota Tribal Safety Summit, May 21, 2014.
- Debbie Shinstine and Khaled Ksaibati "Strategic Plans for Indian Reservations", Round table discussions, Standing Rock Safety Meeting, Standing Rock Indian Reservation, North Dakota. June, 18, 2014.
- Debbie Shinstine and Khaled Ksaibati "Strategic Plans for Indian Reservations", Round table discussions, Standing Rock Safety Meeting, Standing Rock Indian Reservation, North Dakota. June, 18, 2014.
- Debbie Shinstine, Sanjay Pokharel and Khaled Ksaibati "Livability on Indian Reservations" Livability Stakeholders Workshop, Ft. Washakie, Wyoming, March 19, 2014.
- Fisher, C., Marshall, W., and McAndrews, C. Street Vitality and Urban Design. ITE Colorado-Wyoming Section Transportation Symposium, Denver, April, 2014.
- Mitchell, L. C., Marshall, W., and McAndrews, C. Measuring the Livability of Streets: Community Surveys. ITE Colorado-Wyoming Section Transportation Symposium, Denver, April, 2014.
- Garriott, P. & Mazotta, E. "Factors affecting high school girl's interest in transportation related careers." A paper presented to the Annual Southeastern Transportation Research, Innovation, Development and Education Center (STRIDE) Conference, Atlanta, GA. March 24, 2014.
- Goetz, A., & Perl, A. (2014) Getting Up to Speed: Assessing the Usable Knowledge from Global High Speed Rail Experience for the United States (with Anthony Perl), Transportation Research Forum, San Jose, California, March 13, 2014.
- Henao, A. and W. Marshall. Effects of Fuel Price Shocks in Transportation Economic Resilience and Affordability. ITE Colorado-Wyoming Section Transportation Symposium, Denver, April, 2014.
- Jaesung Choi. "Integration of Road Information on the Fort Berthold Indian Reservation, ND." 2014 Intermountain GIS Conference, Billings, Montana, April 7-10, 2014.
- Kim, Y.J., Hyun, S.W., Yoshitake, I., Kang, J.-Y., and Seo, J. A composite-bonded steel substrate with silyl-modified polymer exposed to thermal distress, Probabilistic Safety Assessment and Management (PSAM 12), Honolulu, HI, 2014.
- Kubas, Andrew and Kimberly Vachal. "Oil County Traffic Safety: A Perspective of Western North Dakota Residents." 93rd annual meeting of the Transportation Research Board,

Washington, DC, January 14, 2014.

- Luckey, K. and W. Marshall. Understanding the level of integration of light rail transit into communities in the Denver region. Transportation Research Board, Washington, D.C., January 2014.
- McMullen, M., Pei, S., and Wehbe, N. "Accelerated Bridge Construction in South Dakota: Pilot Study for Implementation Strategy." Final presentation of the research results has been presented to the SDDOT Research Review Board.
- Mulholland, R. "Factors Affecting Women's Intent to Pursue and Accept Careers in the Transportation Industry." A paper presented at the Rocky Mountain Psychological Association Annual Convention. Salt Lake City, Utah. April 26, 2014.
- Musunuru, A. and Porter, R.J. A Reliability-Based Geometric Design Approach to Freeway Number of Lanes Decisions, Session C7 of the 2nd T&DI Congress of the American Society of Civil Engineers, Orlando, FL, June 11, 2014.
- Musunuru, A. and Porter, R.J. A Reliability-Based Geometric Design Approach to Freeway Number of Lanes Decisions, Session 582 of the 93rd Annual Meeting of the Transportation Research Board, Washington, D.C., January 14, 2014.
- Ng, K., Chakrahda, R., Ettema, R. and Kempema, E. (present in 2014), "Laboratory Investigation of Embankment Soil Strength Influence on Abutment Scour: Early Findings." ASCE-EWRI Conference, Portland, Oregon, June 1-5.
- Porter, R.J. Hitting the Ground Running: Choosing and Navigating a Successful Transportation Career Path in Academia, Session 107 of the 93rd Annual Meeting of the Transportation Research Board, Washington, D.C., January 12, 2014.
- Porter, R.J. Preserving the Lost Art of Geometric Design for Design Decision Making: Performance-Based Design, Session 111 of the 93rd Annual Meeting of the Transportation Research Board, Washington, D.C., January 12, 2014.
- R. Bridgelall, "A participatory sensing approach to characterize ride quality", Sensors and Smart Structures Technologies for Civil, Mechanical, and Aerospace Systems 2014, 90610A (March 8, 2014).
- R. Bridgelall, "Roads – Supporting the Weight of the Supply Chain," Association of Logistics and Supply Chain Management, University of North Texas at Dallas, February 25, 2014.
- Romero, P., and Anderson, H. "Development of Low-Temperature Performance-Based Specifications for Asphalt Pavements. 2014 Utah Asphalt Conference, February 2014.
- Sherry, P. "Fatigue Countermeasures for Shortline Railroad Operations." A paper presented to the Annual Meeting of the ASLRRA in San Diego CA. April 23, 2014.
- Sherry, P. "The Impact of Suicide by Train on the Community, First Responders and Rail Workers." A paper presented at the Annual Meeting of the Public Rail Safety Conference, Anaheim, CA. April 10, 2014.
- Sherry, P. & Zucker, K. "Effects of Suicide Prevention Training on Rail Transit Workers Knowledge and Attitudes." A paper presented at the Annual Meeting of the American Association of Suicidology, Los Angeles, CA. April 10, 2014.
- Sherry, P., & Zucker, K. (2014) "The Efficacy of Pedestrian Suicide Prevention and Safety Promotion Interventions in the Public Transit Industry" A paper presented at the Rocky Mountain Psychological Association Annual Convention. Salt Lake City, Utah. April 25, 2014.
- Sherry, P., Hedman, B., Garriott, P., & Mulholland, R. (2014). "Workforce Development: Recruitment, Retention & Turnover." A paper presented at the 55th Annual Transportation Research Forum, San Jose, CA, March 13, 2014.
- Sherry, P., Zucker, K., Bondanza, A., Trujillo, L., & Colarossi, D. (2014) "Safety Culture and Employee Health in the Transit Industry." A paper presented at the 55th Annual Transportation Research Forum, San Jose, CA, March 13, 2014.
- Tasic, I., Musunuru, A., and Porter, R.J. Quantifying Accessibility of Non-Motorized Transportation Modes in Recreational Areas: Case Study of Mill Creek Canyon, Utah, Session

436 of the 93rd Annual Meeting of the Transportation Research Board, Washington, D.C., January 13, 2014.

- Tucker C, and Ibarra L (2014) Seismic Performance of Circular Concrete Filled Tube Columns for Accelerated Bridge Construction. 10th National Conference on Earthquake Engineering (NCEE). Anchorage, Alaska. July 21-25, 2014.
- Wehbe, N. and Pauly, T. "Square SCC Bridge Columns under High Lateral Drifts," American Concrete Institute (ACI) 2014 Spring Convention. Reno, NV.
- Wehbe, N. and Tigges, B. "Vulnerability of Concrete Bridge Columns to Truck Collision Loads," Future Concrete 2014 Conference. Beirut, Lebanon.
- Xiaoyue Liu. Congestion Pricing and Managed Lanes: 20 Years of Learning – Where have we been, where are we now, and where are we going? Invited Talk. Transportation Research Board Annual Meeting, Washington, D.C. January 12th, 2013.
- Xiaoyue Liu. Operational Analysis of I-5 Express Lane. UDOT Research Workshop. Salt Lake City, UT, April 30th, 2014.
- Xiaoyue Liu. Statistical Analysis and Sampling Standards for Maintenance Management Quality Assurance (MMQA). UDOT Research Workshop. Salt Lake City, UT, April 30th, 2014.
- Y. Huang "Real-time weight-in-motion measurements using fiber Bragg grating sensors", Proc. SPIE 9061, Sensors and Smart Structures Technologies for Civil, Mechanical, and Aerospace Systems 2014, 906109 (March 8, 2014).
- Zlatkovic, M., and A. Stevanovic. "Assessment of Impacts of Increased Train Frequency and Predictive Transit Priority on a LRT Corridor in Salt Lake City." 93rd TRB Annual Meeting, Washington D.C., January 12-16, 2014.
- Zlatkovic, M., and X. Zhou. "Effective Coupling of Signal Timing Estimation Model and Dynamic Traffic Assignment in Feedback Loops: System Design and Case Study." 93rd TRB Annual Meeting, Washington D.C., January 12-16, 2014.
- Zlatkovic, M., I. Tasic, A. Stevanovic, and M. Ostojic. "400 S Light Rail Transit Corridor Assessment." 2014 ITE Utah Chapter Annual Conference, Salt Lake City, UT, January 9, 2014.
- Zlatkovic, M., I. Tasic, A. Stevanovic, and M. Ostojic. "Assessment of LRT and TSP Impacts on Urban Corridors in Salt Lake City." ITE Intermountain Section 54th Annual Meeting, Jackson, WY, May 15-17, 2014.
- Zucker, K., & Mulholland, R.A. "Women in Transportation: A Model for Job Seeking & Acceptance in the Transportation Industry." A paper presented to the Annual Southeastern Transportation Research, Innovation, Development and Education Center (STRIDE) Conference, Atlanta, GA. March 24, 2014.
- Zucker, K., Bondanza, A., & Sherry, P. (2014). "The Effects of Shift Work on Women's Health." A paper presented at the Annual Meeting of the Amalgamated Transportation Workers Union, Orlando, FL. May 23rd, 2014.

#### **b. Books or other non-periodical, one-time publications**

- D. Harrington, G. Fick., A. Bordelon, J. Cable, D. DeGraff, N. Parks, R. Riley, R. Rodden, J. Roesler, J. Vandenbossche. "Guide to Concrete Overlays: Sustainable Solutions for Resurfacing and Rehabilitating Existing Pavements." 3rd edition. National Concrete Pavement Technology Center (CP Tech Center): Ames, IA, May 2014. Book. Published. Support from non-federal source: American Concrete Pavement Association.

#### **c. Website(s) or other internet site(s)**

- The MPC website is fully operational at: <http://www.mountain-plains.org/>
- MPC-403: Web-based Decision Support Tool for Traffic Management and Work Zone Analysis; <http://code.google.com/p/nexta/>

- MPC-369 ND Motor Crash Analysis and Rider Assessment for Improved Conspicuity, April 2014, [www.ugpti.org/rtssc/briefs/downloads](http://www.ugpti.org/rtssc/briefs/downloads)

#### **d. Technologies or Techniques**

Nothing to report at this time.

#### **e. Inventions, patent applications, and/or licenses?**

Nothing to report at this time.

#### **f. Other**

- MPC-375(Small Railroad Capital Investment Needs and Financial Options) provided small railroad data to FRA; advice FRA on report to OST and Congress
- MPC-390(Design and Construction Monitoring of Surcharged Embankment) held interim technical advisory committee meeting with UDOT
- MPC-422(Highway Structures Supported on Expanded Polystyrene (EPS) Embankment without Deep Foundations) developed software (analytical) model to evaluate the seismic stability
- MPC-354(Geotechnical Limit to Scour at Spill-through Abutments (Year 2), Ram Chakradhar. "Laboratory Investigation of Geotechnical and Hydraulic Processes in Abutment Scour." MS Thesis, University of Wyoming and produced a NCHRP-AASHTO Problem Statement that was included in the SCOR list of such statements.
- MPC-367(Developing Statistical Models for Crash Severity Comparing Statewide, County, and Indian Reservation Roads) developed models which were presented in a seminar at the University of Wyoming, December 1, 2013
- MPC-428(Using Recycled Concrete Aggregate in New Concrete Construction) thesis published by Mr. Darby Hacker
- MPC-430(Implementation of Intelligent Compaction Technologies for Road Construction in Wyoming) produced WYT2 Newsletter, Issue 2, 2013

### **3. Participants and Other Collaborating Organizations: Who has been involved?**

#### **a. What individuals have worked on the program?**

The principal investigators, faculty, and administrators participating in MPC project:

Six principal investigators, faculty, and administrators participating in MPC projects at **Utah State University** are: Kevin Heaslip, University Program Coordinator and PI; Anthony Chen, PI; Ryan Bosworth, Co-PI; Michael Thomas, PI; Rebecca Winstead, TIMELab Administrator; Patricia Cramer, PI; and Thidapat (Tam) Chantem, PI. In addition, nine students are participating in MPC research projects at **Utah State University**: Doctorate Students - Ali Soltani Sobh, Donghyung Yook, Sarawut Jansuwan, Seunkyu Ryu, Masters Students - Joesph Flower, Divya Desiraju, Niranjan Chandrappa, Undergraduate Students - Eric Meissner and Jaque Johansen. Others participating in MPC projects at **Utah State University** include Hugh Boyle (a consultant).

Nine principal investigators, faculty, and administrators participating in MPC projects at the **University of Wyoming** are: Khaled Ksaibati, University Program Coordinator and PI; Robert Ettema, PI; Rhonda Young, PI; Richard J. Schmidt, PI; Kam Ng, Co-PI; Jennifer Tanner, PI; Debbie Shinstine, Post Doctorate; Ed Kempema, Lab Director; and James Branscomb, Engineer. Thirteen students participating in MPC research projects at the **University of Wyoming**: Doctorate Students: Edward Offet, Vijay Sabawat, Promoths Saha, Zhuo Chen; Masters Students - Ram Chakradha, Mike Jung, McKenzie Danforth, Darby Hacker, Nicholas Owen, Christopher Savan; Undergraduate Students - Chris Leclerc, Mingde Lin, and Britton Hammit.



Sixteen principal investigators, faculty, and administrators participating in MPC projects at the **University of Utah**: Richard Porter, University Program Coordinator and PI; Steven Bartlett, PI; Peter Martin, PI; Chris Pantelides, PI; Lawrence Reaveley, Co-PI; Pedro Romero, PI; Xuesong Zhou, PI; David Strayer, PI; Luis Ibara, PI; Evert Lawton, PI; Ivana Tasic, PI; Cathy Liu, PI; Milan Zlatkovic, PI; Muhammad Farhan, PI; Amanda Bordelon, PI; and Jan Vaslestad, Co-PI. Twenty graduate and undergraduate students are working on MPC research projects at the **University of Utah**: Doctorate Students – M.J. Ameli, Ivana Tasic, Tie Shi, Ramesh Newpane, Min Ook Kim, M. Scott Shea; Masters Students - Crystal R. Clendennen-Pierce, Joel Parks, Dylan Brown, Jonna Turrill, Anush Musunuru, Catherine Tucker, Jeffrey Taylor, James Coleman, Arwen Behrends, Shannon Moore, Anurag Upadhyay, Zach Gibbs, and Francesco Biondi, Visiting Scholar; Undergraduate Students- Dillon Lee

Seven principal investigators, faculty, and administrators are participating in MPC projects at **South Dakota State University**: Nadim Wehbe, University Program Coordinator and PI; Allen Jones, PI; Xiao Qin, PI; Zhiguang Wang, PI; Guanghui Hua, PI; Junwon Seo, Co-PI; and Seyed Ardakani, Co-PI. In addition, sixteen graduate and undergraduate students are working on MPC research projects at **South Dakota State University**: Masters Students - Brittney Ahrenstorff, Chase Cutler, Todd Pauly, Kai Wang, Zhao Shen, Zhaoxiang He, Jacob Humburg, Micah Underberg, Zhi Chen, Md. Michael Konrad, Walker Olson, and Kofi Oppong, Melissa McMullen, Brett Tigges, Abdullah Boudaqa, Kofi Oppong and Md. Razaur Rahman Shaon.

Ten principal investigators, faculty, and administrators are participating in selected projects from **Colorado State University**: Rebecca Atadero, University Program Coordinator and PI; Paul Heyliger, PI; Suren Chen, PI; Hussam Mahmoud, PI; Mehmet Ozbek, PI; Caroline Clevenger, PI; John vande Lindt, PI; Ward Johnson, NIST, Collaborator; Christopher Bareither, PI; and Bolivar A. Senior, PI. In addition, fourteen graduate and undergraduate students are working on MPC research projects at **Colorado State University**: Doctorate Students Xiaoxiang Ma, Kristen Peterson, Luke Chen; Masters Students –Patrick Sanders, Chris Bright, Mohammad Reza Hassanzadeh Gorakhki, Sultan Abdulaziz Alhomair, Sherona Simpson, Tyler Sobieck, Nasser Alberuti, Blaine Fanning, Thomas Wilson, and Robert Lankford; Undergraduate Students - Vaishak Gopi.

Altogether, sixteen principal investigators, faculty, and administrators are participating in selected projects at **North Dakota State University**: Kimberly Vachal, University Program Coordinator and PI; Andrea Huseeth, PI; Andrew Bratlien, Co-PI; Brenda Lantz, PI; Frank Yazdani, PI; Mijia Yang, PI; Doug Benson, PI; EunSu Lee, PI; Pan Lu, PI; Alan Dybing, Co-PI; Raj Bridgelall, PI; Ying Huang, Co-PI; Denver Tolliver, Director; Donald Malchose, Project Researcher; Laurel Benson, Research Specialist; Andrew Kubas, Ph.D. In addition, twenty-five graduate and undergraduate students are working on MPC projects at **North Dakota State University**: Doctorate Students- Oz Khan, Mohammad Molla, Poyraz Kayabas, Anne Campbell, Elvis Ndembe, Jaesung Choi, Qianli He, Nimish Dhamadhikari, Zijian Zheng, Yolanda Carson, Vu Dang, Chris DeHaan, Fesseha Gebremikael, Luke Holt, Chijioke Ifepe, Maher Itani, Yasaman Kazemi, Dilip Mistry, Ju Dong Park, Yong Shin Park, Azadeh Jaberri (CE), Niloy Saha (CE), Saeed Ahmari (CE), Debbie Shinstine (Univ of Wyoming); Masters Students- Mike Telste.

One principal investigators, faculty, and administrators participating in MPC projects at the **University of Denver** include Patrick Sherry, University Program Coordinator and PI. Three graduate and undergraduate students working on MPC projects at **University of Denver** include: Doctoral Students - Keaton Zucker; Masters Students Rachel Mulholland and Yifan Shi.

Four principal investigators, faculty, and administrators participating in MPC projects at the **University of Colorado Denver** include: Wesley Marshall, University Program Coordinator and PI; Jimmy Kim, PI; Carolyn McAndrews, PI; and Bruce Janson, PI. Seven graduate and undergraduate students working on MPC projects at **University of Colorado Denver** include: Doctorate Students- Shahlaa AlWakeel Masters Students - Alejandro Henao, Rachael Bronson, Abdul Namrou, Thushara Siriwardanage, Laia Mitchell, and Craig Fisher.

**b. What other organizations have been involved as partners?**

The timing of match funding and the commitments of collaborators vary widely throughout the life of the grant. During this period, we have the following committed collaborators.

1. AAA Foundation for Traffic Safety
2. AAR; John Gray, Frank Hardesty, Shannon Stare
3. American Short Line Railroad Association
4. ASLRRA; Scott Sullivan, Elizabeth Petty, Richard Timmons
5. City and County of Denver
6. City of Madison, South Dakota
7. City of Salt Lake Transportation Division
8. Colorado DOT
9. Denver Regional Council of Governments
10. Denver Regional Transportation District
11. Department of Public Safety, Sanford Trauma
12. Florida Atlantic University, Boca Raton, FL
13. Fort Berthold Reservation
14. FRA Administrators
15. Metrolink; Los Angeles, SCRRA
16. Mineta Transportation Institute
17. Minnesota DOT
18. MnROAD Research Facility
19. National Cooperative Highway Research Program
20. National Institute of Standards and Technology, Boulder
21. NCAR
22. NCHRP
23. North Dakota Highway Patrol
24. North Dakota DOT
25. Northern Plain TTAP Center
26. Norwegian Public Roads Administration
27. Regional Transportation District
28. Sean Vonfeldt, Triunity
29. South Dakota DOT
30. Tailings and Mine Waste (TMW) Conference Committee
31. Tegracore, Industrial Partner
32. Utah DOT
33. Utah Transit Authority
34. Wasatch Front Regional Council
35. Wind River Indian Reservation
36. Wyoming Division of FHWA
37. Wyoming DOT

**c. Have other collaborators or contacts been involved?**

The list of collaborating organizations in 3(b) is complete, as of this grant period.

**4. Impact**

The impacts of the program will become clearer in future years. The implementation of research findings often lags project selection and completion. However, certain impacts are emerging. The benefits of the program are already being felt in many respects.

- 1. Graduate Education.** Collectively, the MPC universities offer one of the most diverse and comprehensive multimodal multidisciplinary graduate education programs in the nation. As shown earlier, 52 courses were offered in the spring & summer 2014 and 255 courses have been offered since the inception of the program. The impact of the educational program will increase in future years, as the MPC universities expand the number of courses offered through their existing exchange program, in which students from any MPC university can take courses from other universities. These courses must be placed online for the collaborative exchange to work most effectively. Considerable progress has been made, thus far, in converting classroom courses to online courses and increasing the reach of the program. The Master of Transportation and Urban Systems degree is offered fully online at NDSU.
- 2. Workforce Development.** MPC's technical training program is having a major impact in the region. Online modules, short courses, webinars, and on site/videoconferencing events are reaching state and local transportation department employees and tribal transportation planners. By harnessing the capabilities of the four LTAP centers located at the MPC universities and the multimedia capabilities of the Transportation Learning Network (which was founded and is partly funded by MPC) more than 45 technical training events were offered in the first half of 2014. These training modules and short courses are critical to transportation agencies that need to improve or renew the skills of engineering technicians and other frontline workers. Many MPC courses or training events result in the certification of workers. Even when certification is not required, TLN's online learning management systems allow employees and employers to set learning goals and monitor progress towards these goals.

MPC is making another major impact in workforce development. Altogether, 107 graduate students are working on MPC research projects under the tutelage of faculty researchers.

These graduate students represent the researchers and technical analysts of tomorrow. Without the MPC program and the stipend funds that it provides, these students may not be specializing in transportation; but, instead would be seeking career opportunities in other fields. The MPC research program allows faculty to mentor graduate students while allowing the students to work on projects for federal and state transportation agencies—thereby, gaining valuable practical experience.

- 3. Tribal Transportation Technical Assistance.** The program is already having a major impact in terms of providing tools and assistance for Native American tribes in the region, especially those impacted by energy development in Wyoming and North Dakota. To better coordinate and plan tribal-related activities, NDSU has designated a tribal transportation program coordinator to help the director identify critical needs and leverage resources to meet those needs. Technical assistance is already being provided in road safety, GIS transportation model building, forecasting heavy truck traffic attributable to energy development, and facilities planning. An emergency response planning guidebook (to help tribes plan for and respond to natural disasters that impact the transportation system and the delivery of life-saving services) is currently under development and will be disseminated within the region and the western United States when completed.
- 4. Research.** Twenty-three research projects have been completed thus far that address critical regional and national issues. Multiple journal articles and conference papers have been derived from each project, increasing their reach and impact. MPC's strategy of requiring journal articles and presentations at national conferences (such as TRB and the Transportation Research Forum) is greatly magnifying the impacts of the research projects and MPC reports.
- 5. Leadership.** MPC researchers and program administrators are having a major impact through participation in TRB, TRF, ITE, and other national organizations and conferences. Moreover, MPC is a leader in responding to the dynamic and sometimes unprecedented transportation demands and issues posed by shale energy development. MPC research projects in Wyoming and North Dakota are helping impacted states and local/tribal governments develop long-term road and bridge investment strategies. The newly formed North Dakota Transportation Safety Advisory Group (which includes representation from NDDOT, North Dakota Highway Patrol, FRA, PHMSA, and FMCSA) is identifying critical

research projects for 2014-2015 and leveraging technical assistance and training for transportation operators, emergency responders, and state and local planners. Even though MPC's primary focus is State of Good Repair, MPC has responded quickly to urgent requests for safety training and research in light of the unprecedented issues associated with the transportation of Bakken crude oil via rail, pipeline, and truck.

**5. Changes/Problems -** Nothing to report at this time.

**5a. Additional Information Regarding Products and Impacts** -Nothing to report at this time.

**PROGRAM OUTPUTS:** Nothing to report at this time.

**PROGRAM OUTCOMES:** Nothing to report at this time.

**PROGRAM IMPACTS:** Nothing to report at this time.

**6. SPECIAL REPORTING REQUIREMENTS:** None