

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

**Grant No. DTRT13-G-UTC38  
Mountain-Plains Consortium, North Dakota State University  
Denver Tolliver, Director  
Denver.tolliver@ndsu.edu  
(701)231-7190**

**April 30, 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: October 1, 2013 – September 30, 2017**

**Reporting Period End Date: March 30, 2014  
Semi-Annual PPPR#1**

**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; and (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. Other program goals are to select projects and activities using peer review principles and procedures and client input that: (1) address the Secretary's five strategic goals, and (2) leverage UTC funds with matching funds from state and local governments and private industry. The chief operational goals 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 Competiveness, while addressing critical issues of the region and stakeholder groups.

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

#### **i. Project Selection**

More than 30 research projects for the 2013-2014 contract year are undergoing a peer review process for possible selection. The projects reflect substantial input and matching resources from state departments of transportation and MPOs in the region. Collectively, this set of projects addresses all five of the Secretary's strategic goals and several of USDOT's requested emphasis areas under State of Good Repair—e.g., (1) bridge condition monitoring, (2) locating critical infrastructure defects, (3) identifying tools to prevent and detect corrosion in transportation infrastructure, (4) analytical tools for infrastructure performance management, and (5) methods and criteria to measure performance of new materials and methods. Other research projects are related to the Secretary's strategic goals of Safety, Economic Competiveness, Livable Communities, and Environmental Sustainability.

#### **ii. Programmatic Milestones**

In addition to the programmatic milestones described below, several milestones embedded within individual projects have been achieved. Most of the research projects call for literature reviews. The literature reviews for those projects with the earliest starts are substantially complete. Interim reports are not required after the literature review stage. So, no publications have been produced at this time. At this time, all projects are on schedule to be completed as planned during the program period.

The accomplishments to date are summarized in Table 1 by reference to milestones.

**Table 1: Program Milestones**

<b>Milestone Event</b>	<b>Description</b>	<b>Start Date</b>	<b>End Date</b>
Development of Proposal Guidelines	Proposal guidelines were developed by the director, in consultation with other consortium members, to ensure a consistent solicitation and project selection process that facilitates peer review and links program activities to the Secretary's strategic goals. The research proposals guidelines are shown in Table 2. Similar but different guidelines were developed for education, workforce development, and technology transfer projects, to reflect the differences in tasks and outcomes associated with these projects. The proposal guidelines and related information have been posted on the Center's webpage.	09/1/2013	09/15/2013
Call for Proposals	The solicitation of proposals occurred on each university campus, using proposal guidelines developed by the director.	09/15/2013	11/15/2013
Execution of Grant Agreement	The grant was received from RITA and executed by NDSU's Sponsored Programs office. All of the necessary internal accounting and financial procedures were established, including subcontract agreements with consortium universities.	11/08/2013	11/08/2013
Center Directory	A directory of key center personnel was completed and published on the center's web page.	12/15/2013	12/15/2013
Center Webpage	The MPC webpage was updated and is fully functional for the current grant period	12/15/2013	12/15/2013
UTC/CUTC Meeting	The director and administrative staff attended the UTC/CUTC meeting at TRB and received guidance from RITA regarding the forthcoming grant.	01/11/2014	01/16/2014
Peer Review of Proposals	All project proposals were subjected to external and internal peer review.	01/15/2014	03/15/2014

Primary Focus	MPC's proposal targets the following MAP-21 research and technology deployment objectives under the goal of Improving Infrastructure Integrity: A) increase the reliability of life-cycle performance predictions used in infrastructure design, construction, and management; B) improve the ability of transportation agencies to deliver projects that meet expectations for timeliness, quality, and cost; C) reduce user delay attributable to infrastructure system performance, maintenance, rehabilitation, and construction; D) improve highway condition and performance through increased use of design, materials, construction, and maintenance innovations; and E) study vulnerabilities of the transportation system to seismic activities and extreme events and methods to reduce those vulnerabilities.	03/15/2014	12/31/2014
Selection of Projects	Projects were selected from the proposals received and awards were made to principal investigators, based on the peer reviews of proposals, stakeholder commitments, and the overall availability of funds.	03/15/2014	06/15/2014
Posting of Projects	The selected projects were posted on the MPC webpage and added to the Research in Progress database.	05/15/2014	08/15/2014
Site Visit	A site visit to all MPC Universities.	06/01/2014	06/01/2015
UTC/CUTC Summer Meeting	The center director and other key staff attended the 2014 summer UTC/CUTC meeting in Nebraska.	06/02/2014	06/05/2014

**Table 2: MPC Research Proposal Guidelines for Faculty**

<b>Title</b>	Provide a title that is descriptive of the project and includes key terms that will facilitate internet and library searches for the project.
<b>Universities</b>	If the project is a multi-university proposal, list each university involved.
<b>Principal Investigators</b>	If the project is a multi-university proposal, list a principal investigator from each university, with the university affiliations denoted in parentheses.

<b>Research Needs</b>	Provide a statement of the important issues and problems that give rise to the need for the project, including a brief literature review (if appropriate) that summarizes the state of knowledge in the subject area and identifies the knowledge gaps the project seeks to fill. It must be clear from the description that there are compelling needs for the study and it will address issues of national and regional importance.
<b>Research Objectives</b>	Provide a clear statement of the research objectives, including any hypotheses to be tested. At least some of the objectives must be measurable—i.e., at the conclusion of the project, it must be possible to ascertain whether the stated objectives have been achieved.
<b>Research Methods</b>	Provide a sufficient description so that reviewers can assess the appropriateness of the research approach and methods and the quality and reliability of data, including descriptions of any mathematical, statistical, operations research, and simulation techniques to be used, as well as surveys, lab tests, and field data.
<b>Expected Outcomes</b>	Provide a description of the expected outcomes in terms of potential findings and impacts, including advances in modeling, practices, and procedures; implications for future research; and how the results of the project can be used by practitioners. Describe any tangible products beyond the research report, including prototype software, equipment, guidebooks, or instructional manuals that may emanate from the project.
<b>Relevance to Strategic Goals</b>	Describe how the proposed project and its expected outcomes are related to one or more of the following goals: State of Good Repair, Safety, Economic Competiveness, Environmental Sustainability, and Livable Communities.
<b>Educational Benefits</b>	If applicable, describe how students will be involved in the project and any expected classroom or instructional uses of procedures, examples, or discoveries derived from the project.
<b>Work Plan</b>	Provide a description of the major tasks or steps in the project, along with an expected timeline. The tasks should be numbered and an expected completion date assigned to each one. Instead of calendar dates, the timeline should be expressed in months from the starting date. Typically, a work plan includes steps such as the completion (and testing) of questionnaires, lab tests, field tests or data collection efforts, input or focus group meetings, and critical steps such as the initial runs and calibrations of models. A draft report and other milestone events should be included, as well as a technology transfer plan that includes a research seminar via the Transportation Learning Network and/or plans to collaborate with an LTAP or TTAP center (if appropriate). If the research is basic in nature, other dissemination methods may be substituted for the TLN, LTAP, or TTAP distribution channels.

<b>Project Cost</b>	List the amount of MPC funds requested, the amount of the expected matching contributions, and the sources of the matching resources, including all agencies expected to contribute funds or in-kind resources to the project. MPC research projects require at least a dollar-for-dollar match. However, other federal funds (e.g., federal funds other than UTC funds) cannot be used as match, except for state planning and research funds and LTAP funds, which are eligible under exclusionary provisions of the authorizing legislation. The definition of “nonfederal funds” is based on the original source of funds.
<b>Potential Peer Reviewers</b>	Provide the complete contact information of at least three persons who are qualified to review and critically assess the proposal, including the person’s name, position title and organization, street address, city, state, zip code, and email address. Keep in mind that peer reviewers cannot have conflicts of interests, such as those that may arise if someone stands to personally or professionally benefit from the proposed project. Peer reviewers may include professionals at federal, state, metropolitan, or local agencies, as well as university and private-sector researchers. Given that at least three completed reviews are required for a proposal to move forward in the assessment process, the submission of more than three names may expedite the time frame for approval, in the event of one or more nonresponsive reviewers.
<b>TRB Keywords</b>	Provide a complete list of applicable TRB keywords
<b>References</b>	List the major references cited in the proposal and other seminal work in the field.

### iii. Educational Accomplishments

The transportation and transportation-related courses offered during Fall 2013 & Spring 2014 are listed in Table 3, 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 3: Transportation and Transportation-Related Courses Offered This Period**

<b>Major Subject Area</b>	<b>Course Title</b>
<b>Engineering &amp; Design</b>	CE 3500 Transportation Engineering
	CE 5585 Pavement Transportation System
	CE444-Steel Design
	CE446/646-Structural Dynamics
	CE447/647-Structural Stability
	CEE 3210 Introduction to Transportation Engineering
	CEVN 5602 Advanced Highway & Street Design
	CIVE 467 Design of Reinforced Concrete Structures
	CIVE 561 Advanced Steel Behavior and Design
	CIVE 562 Fundamentals of Vibrations
	CIVE 565 Finite Element Method

**Table 3: Transportation and Transportation-Related Courses Offered This Period**

<b>Major Subject Area</b>	<b>Course Title</b>
	CIVE 567 Advanced Concrete Design
	CON 370 Asphalt Pavement Materials and Construction
<b>Engineering &amp; Design</b>	CvEEN 3510 Civil Engineering Materials
	CvEEN 5510 Highway Design
	CvEEN 5570 Pavement Design
	CvEEN 6225 Concrete Science
	CvEEN 7225 Prestressed Concrete
<b>Engineering &amp; Design</b>	CvEEN 7250 Structural Earthquake Engineering
	CvEEN 7920 001 Advanced Materials Testing
	CVEN 3602 Introduction to Transportation Engineering
	CVEN 4602 Highway Engineering
	CVEN 5621 Highway Capacity Analysis
	CVEN 5800 Case Studies in Sustainable Transportation
	CVEN 5800 Prestressed Concrete (includes a major design project for a highway bridge using prestressed concrete girders and a literature review project as to the application of fiber reinforced polymer composites for transportation structures)
	CVEN5800 (Prestressed concrete in Spring 2014) includes a major design project for a highway bridge using prestressed concrete girders and a literature review project as to the application of fiber reinforced polymer composites for transportation structures.
<b>Freight &amp; Logistics</b>	None
<b>Planning &amp; Environment</b>	CEE 5240/6220 Urban and Regional Transportation Planning
	CvEEN 5560 Transportation Planning
	CvEEN 5920 Material Sustainability
	CVEN 5631 Transportation Planning and Methods
	CVEN 5640 Introduction to Sustainable Urban Infrastructure
	TL 752 Transportation Planning and Environmental Compliance
	URPL 5040 Natural and Built Environments
	URPL 5050 Urban Development
	URPL 6200 Land Development Regulations
	URPL 6300 Planning for Healthy Communities
	URPL 6350 Form and Function of Cities
	URPL 6355 Urban Redevelopment Strategies
	URPL 6370 Sprawl and Growth Management
	URPL 6400 Community Development
URPL 6405 Urban Housing	

**Table 3: Transportation and Transportation-Related Courses Offered This Period**

Major Subject Area	Course Title
	URPL 6550 Transportation Planning/Policy
	URPL 6555 Transportation and Land Use
<b>Planning &amp; Environment</b>	URPL 6645 Disaster/Climate Change Planning
	URPL 6650 Planning in the Dev. World
<b>Public Transportation</b>	None
<b>Traffic &amp; Operations</b>	CE 5535 Traffic Operation
	CE 5575 Intelligent Transportation System
<b>Traffic &amp; Operations</b>	CEE 5220/6220 Traffic Engineering
	CvEEN 3520 Transportation Engineering
	CvEEN 7920 Traffic Flow Theory
	CVEN 5622 Traffic Operations and Controls
	TL753 Transportation System Modeling
	TL755 Context Sensitive Solution
	TL785 Spatial Analysis in Transportation
<b>Transportation Safety</b>	CvEEN 7520 Transportation Safety
	CVEN 5611 Traffic and Safety Data Analysis
	PSY 3120 Cognitive Psychology
	PSY 3172 Human Performance and Engineering
<b>Transportation Systems</b>	CIVE 303 Infrastructure and Transportation Systems
	CvEEN 7920 003 Statistical and Econometric Analysis

Altogether, 60 transportation and transportation-related courses have been offered this reporting period, for a total of 60 total transportation courses offered this grant period. In addition to the courses listed in Table 3, foundational courses in engineering materials, mechanics, structural analysis, and geotechnical engineering were offered at most MPC universities.

#### **iv. Workforce Development Accomplishments**

**Training:** A list of training events provided for transportation professionals since the start of the grant is presented below.

1. Asphalt Paving
2. ATSSA Flagger Certification.
3. Access Management Training
4. ADA PROW Curb Ramps
5. APWA - MUTCD Training
6. APWA - PROW ADA Ramp Design
7. APWA Construction Inspector Training
8. Asphalt Maintenance II
9. Asphalt Paving Maintenance 1



10. Asphalt Paving Maintenance 2
11. ATSSA Flagger Certification
12. ATSSA Traffic Control Supervisor (TCS)
13. ATSSA Traffic Control Technician (TCT)
14. Basic Surveying / Grade Checking
15. Basics of a Good Road
16. Casper, Work Zone Safety
17. Communication Skills for Supervisors
18. Communication Skills Level 2
19. Concrete III
20. FHWA Work Zone Safety Grant Training Program
21. Fundamentals of PROW ADA Ramp Design, Layout, Inspection and Construction
22. Heavy Equipment Operation (Hands On)
23. Heavy Equipment Operations - Safety
24. Heavy Equipment Safety Operations
25. Heavy Equipment Training Workshop
26. Integrated Roadside Vegetation Management
27. Integrated Vegetation and Roadside Management
28. Intelligent Compaction
29. Intersection and Interchange Geometrics: Safer, Faster, Cheaper!
30. Loader Refresher Course
31. LPA Certification
32. MUTCD Training
33. OSHA 10 Hour Training
34. Registered Storm Water Inspector
35. Registered Storm Water Inspector Training
36. Retro Reflectivity for Signs
37. Roadway Drainage
38. Speed Limit
39. Speed Limits & School Zones
40. Survey & Grade Checking
41. TCT Course - Consolidated Paving
42. Tree Trimming
43. University of Utah American Concrete Institute Sixth Annual Spring Concrete Symposium
  
44. Utah Asphalt Conference
45. Winter Road Maintenance
46. Workplace, Equipment & Jobsite Safety

Conferences, workshops, and publications are summarized under “products.”

### **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. Because effective starting dates of most projects were after March 30, 2014, no tangible results have been produced at this time. Therefore, we have nothing to report.

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

No changes are foreseen to the accepted plan and implementation schedule.

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

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

**i. Key Conferences and Workshops**

- American Concrete Institute (ACI): Reno, NV; March 2014
- ACI-congress 2013, Minneapolis, MN,
- Aggregate Certification, December 9-11, 2013 Laramie, WY
- Aggregate Certification, January 6-8, 2014 Laramie, WY
- American Concrete Institute conventions in Mar 2014: Evaluation of concrete bridges and bridge elements (ACI-342); Concrete bridge construction, maintenance, and repair (ACI-345), Fiber reinforced polymer reinforcement (ACI-440), and FRP-prestressed concrete
- Asphalt Certification, December 11-13, 2013 Laramie, WY
- Asphalt Certification, January 8-10, 2014 Laramie, WY
- Concrete Certification, February 12-14, 2014 Laramie, WY
- Concrete Certification, March 17-19, 2014 Laramie, WY
- Concrete Certification, November 13-15, 2013 Laramie, WY
- Congress for the New Urbanism (CNU) Transportation Summit: Chicago, IL; November 2013
- ISEC 7th conference, Honolulu, Hawaii, 2013,
- Transportation Research Board (TRB): Washington, DC; January 2014

**ii. Key Publications**

- J. Y. Chen, P. R. Heyliger, E. Pan, Free vibration of three-dimensional multilayered magneto-electro-elastic plates under combined clamped/free boundary conditions, *Journal of Sound and Vibration*. (related to MEMS sensor projects)
- Koch, S.; Huntington, G.; and Ksaibati, K., "Performance of Reclaimed Asphalt Pavement on Unpaved Roads", Final MPC report, MPC-13-251, 2013.
- C.H. and Romero, P. Characterizing the Low-Temperature Viscoelastic Behavior of Asphalt Mixtures: A Comparative Study. *International Journal of Pavement Research and Technology*. ISSN 1996-6834. 6(5): 479-487. 2013.
- Ahmari S., Yang M.J., "Impact load identification through inverse analysis with bounded uncertain measurements", *Journal of Smart Materials and Structures*. 22(8): 085024. 2013.

- A. Saboori, S. Yazdani, A. Reberg, and D. Tolliver. Anisotropic Damage modeling in Concrete due to Freeze-Thaw Processes. *International Journal of Engineering Research* – Under review
- Bergen, B., Medeiros-Ward, N., Wheeler, K., Drews, F., & Strayer, D. L. The crosstalk hypothesis: Language interferes with driving because of modality-specific mental simulation. *Journal of Experimental Psychology: General*, 142: 119-130. 2014.
- Bronson, R. 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* (in press).
- Cooper, J. M., Medeiros-Ward, N., & Strayer, D. L. The impact of eye movements and cognitive workload on lateral position variability in driving. *Human Factors*, 55: 1001-1014. (2013).
- Coulter, Z. and Ksaibati, K. “Effectiveness of Various Safety improvements in Reducing Crashes on Wyoming Roadways,” Final MPC report, MPC-13-262. 2013.
- Fisher, D. L., & Strayer, D. L. Modeling situation awareness and crash risk, *Annals of Advances in Automotive Medicine*, 5: 33-39. 2014.
- Guangning Xu, Xiaoyue Liu, Yinhai Wang. Enabling Network-wide Tolling Strategy Assessment via Customized Route Choice Simulation Module. *ASCE Journal of Transportation Engineering*. In print.
- Ho, C.H. and Romero, P. Using Linear Viscoelastic Modeling to Evaluate the Low Temperature Properties of Asphalt Mixtures Prepared with Aggregates of Different Sizes. Paper ACEM-2012-0040.R1. *ASTM’s Journal of Advances in Civil Engineering Materials* 2(1): 122 – 139. 2013.
- Hua Wang, Wei Quan, Yinhai Wang, and Xiaoyue Liu. Safety Distance Modeling on the Basis of Vehicle-to-Vehicle Communication. *Transportation Research Record: Journal of the Transportation Research Board*. 2381: 28-35. 2014.
- Jinjun Tang, Hua Wang, Yinhai Wang, Xiaoyue Liu, and Fang Liu. Hybrid Predicting Approach Based on Weekly Similarity for Traffic Flow at Different Temporal Scales. *Transportation Research Record: Journal of the Transportation Research Board*. In print.
- Kim Y. J., Yoshitake I., and Yang M. J., “A Predictive Investigation Associated with Design Recommendations for CFRP-confined Concrete in Aggressive Service Environments”, *Construction and Building Materials*. 43: 69-79. 2013
- 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

- 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.
- Medeiros-Ward, N., Cooper, J. M., and Strayer, D. L. Hierarchical control and driving. *Journal of Experimental Psychology: General*. 142. In print.
- Mitra, S., Lee, E., DeHaan, C., Kayabas, P., and Itani, M. Integrating Supply Chain Models in Urban Freight Planning, MPC-13-259 (MPC-330). 2014.
- Musunuru, A. and Porter, R.J. “A Reliability-Based Geometric Design Approach to Freeway Number of Lanes Decisions,” *Transportation Research Record, Journal of the Transportation Research Board*. Accepted for publication.
- Regan, M. A., and Strayer, D. L. Towards an understanding of driver inattention: taxonomy and theory. *Annals of Advances in Automotive Medicine* 58: 5-13. 2014.
- Sanbonmatsu, D. M., Strayer, D. L., Medeiros-Ward, N., Behrends, A. A., and Watson, J. M. Why drivers use cell phones and why they support legislation to restrict this practice. Manuscript submitted for publication.
- Shinstine, D. and Ksaibati, K. Indian Reservation Safety Improvement Program, a Methodology and Case Study. *Transportation Research Record, Journal of the Transportation Research Board*. 2364: 80-89. 2013
- Shinstine, D. and Ksaibati, K., “Indian Reservation Safety Improvement Program: A Methodology and a Case Study”, FHWA and WYDOT Final Report, FHWA-WY-13/07F. 2013.
- Strayer, D. L., Cooper, J. M., Turrill, J., Coleman, J., Medeiros-Ward, N., and Biondi, F. Measuring cognitive distraction in the automobile. AAA Foundation for Traffic Safety. 2013.
- Stroud, N. and Ksaibati, K. “Quantifying the Impact of Energy Traffic on Local Unpaved Roads,” Final MPC report, MPC-13-263. 2013.
- 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. *Journal of Park and Recreation Administration*. Accepted for publication.
- Tasic, I., Zhou, X., and Zlatkovic, M. Using Spatio-Temporal Constraints to Quantify Transit Accessibility: Case Study of a Potential Transit Oriented Development Location in West Valley, Utah. *Transportation Research Record, Journal of the Transportation Research Board*. In print.
- Telste M. and Yang M.J., “A Deformation Distribution Based Bridge Health Monitoring Methodology.” *Journal of ACI-Congress*. Special Publication. 2013.
- Truong, L. and Wesley E. Marshall. Are Park-n-Rides Saving the Environment or Just Saving Parking Costs? A Case Study of the Denver

Light Rail System. *Transportation Research Record, Journal of the Transportation Research Board*. Accepted for publication.

- Xiaoyue Liu, Guohui Zhang, Carmen Kwan, Yin Hai Wang, and Brian Kemper. Simulation-Based Scenario-Driven Integrated Corridor Management Strategy Analysis. *Transportation Research Record: Journal of the Transportation Research Board*. 2396: 38-44. 2014.
- Yang M.J. and Akand L., "Small hidden object detection through bridge weigh-in-motion data for security purposes." *Journal of Advances in Civil and Environmental Engineering*. 1(1): 16-32. 2013

### iii. Key Conference Papers

- Guangning Xu, Xiaoyue Liu, and Yin Hai Wang. Simulation-Based Tolling Evaluation for Traffic Network through Customized Route Choice Module. Transportation Research Board. Washington, D.C. 2014.
- Huntington, G., Jones, J.; and Ksaibati, K., "Risk Assessment of Oil and Gas Drilling Impacts on County Roads," Transportation Research Board, Washington D.C., 2014.
- Luckey, K. and Wesley E. Marshall. Understanding the level of integration of light rail transit into communities in the Denver region. Transportation Research Board, Washington, D.C., 2014.
- Sa Xiao, Xiaoyue Liu, and Yin Hai Wang. Data-Driven Geospatial-Enabled Transportation Platform for Freeway Performance Analysis. Transportation Research Board, Washington, D.C., 2014.
- Saboori; S. Yazdani; Reberg; M. Yang, D. Toliver, and S. Mamani, Modeling Freeze and Thaw damage in Concrete Decks using Damage mechanics. , ASEA-SEC-II Conference, Bangkok, Thailand. 2014
- Saboori; S. Yazdani; Reberg; M. Yang, D. Toliver, and S. Mamani, Modeling of Concrete Behavior under Biaxial Fatigue Loading with Various Mean Stresses. ASEA-SEC-II 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., and Zlatkovic, M. Evaluating the Performance of Innovative Intersections in Potential Transit Oriented Development Environments. Paper accepted for presentation and publication at the 2nd Transportation and Development Institute Congress, Orlando, FL. 2014.
- Truong, L. and Wesley E. Marshall. Are Park-n-Rides Saving the Environment or Just Saving Parking Costs? A Case Study of the Denver Light Rail System. Transportation Research Board, Washington, D.C. 2014.

- Yang M.J., Ahmari S. Impact event identification through real-time strain measurements. SPIE Smart Structures and Materials+ Nondestructive Evaluation and Health Monitoring, 90610B-90610B-11. Publisher: International Society for Optics and Photonics. 2014
- Zlatkovic, M., and Stevanovic, Assessment of Impacts of Increased Train Frequency and Predictive Transit Priority on a LRT Corridor in Salt Lake City. Transportation Research Board, Washington D.C., 2014.
- Zlatkovic, M., and Zhou, X. Effective Coupling of Signal Timing Estimation Model and Dynamic Traffic Assignment in Feedback Loops: System Design and Case Study. Transportation Research Board. Washington D.C. 2014.

#### **iv. Key Presentations**

- Atadero, R., Ozbek, M.E., and Hesse, (2014) “Uncertainty in Bridge Inspection Results in Bridge Management and Inspection Planning.” Presented at ASCE Structures Congress April 2-5, Boston, MA
- Choi, J. (2014). “Integration of Road Information on the Fort Berthold Indian Reservation at the State of North Dakota using a GIS Framework.” 2014 Intermountain GIS Conference, April 7-11, Billings, MT (Project MPC-425).
- Huntington, G., Jones, J.; and Ksaibati, K., “Risk Assessment of Oil and Gas Drilling Impacts on County Roads”, Transportation Research Board Meeting, Washington D.C., 2014.
- Kubas, Andrew and Kimberly Vachal. 2014. "Oil County Traffic Safety: A Perspective of Western North Dakota Residents." Transportation Research Board, January 12-16. Washington, DC.
- Luckey, K. and Wesley E. 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, and Porter, R.J. A Reliability-Based Geometric Design Approach to Freeway Number of Lanes Decisions. Transportation Research Board, Washington, D.C. January 2014.
- Porter, R.J. Hitting the Ground Running: Choosing and Navigating a Successful Transportation Career Path in Academia. Transportation Research Board. Washington, D.C. January 2014.
- Porter, R.J. Preserving the Lost Art of Geometric Design for Design Decision Making: Performance-Based Design. Transportation Research Board. Washington, D.C. January 2014.
- Strayer, D. L. Driver Distraction: Past, Present, and Future. National Safety Council Congress and Exposition. Chicago, IL. September 2013.

- Tasic, I., Musunuru, , and Porter, R.J. Quantifying Accessibility of Non-Motorized Transportation Modes in Recreational Areas: Case Study of Mill Creek Canyon, Utah. Transportation Research Board. Washington. D.C. January 2014.
- Truong, L. and Wesley E. Marshall. Are Park-n-Rides Saving the Environment or Just Saving Parking Costs? A Case Study of the Denver Light Rail System. Transportation Research Board. Washington, D.C. January 2014.
- 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. Washington, D.C. January 2013.
- Yang M.J., Small hidden object detection through bridge weigh-in-motion data for security purposes. ISEC 7th conference, Hawaii. June 2013.
- Zlatkovic, M., and Porter, R. J. Lessons Learned – Pavement Marking Warranty Contract. 2014 ITE Utah Chapter Annual Conference, Salt Lake City, UT, January 2014 and 2013 UDOT Annual Conference, Salt Lake City, UT, November 2013.
- Zlatkovic, M., Tasic, I., Stevanovic, and Ostojic, M. 400 S Light Rail Transit Corridor Assessment. 2014 ITE Utah Chapter Annual Conference, Salt Lake City, UT, January 2014, and 2013 UDOT Annual Conference, Salt Lake City, UT, November 2013.
- Zlatkovic, M., Williams, J. R., and Martin, P. T. Integration of PTV VISSIM with Driving Simulator: Flex Lanes Scenario Development. 14th Annual North America PTV Vision Traffic User Group Meeting. Portland, OR. October 2013.

**v. Other Items Produced During this Period**

- A prototype of the detection system is developed and tested in the structural lab of NDSU. Initial results are positive.
- Developing two more journal papers for publication, S. Yazdani.
- Development of Class II and Class III data/statistics used by Sec of DOT to respond to Congress, D Benson
- Ph.D. dissertation proposed and ongoing from Small Railroad Financial needs project, E. Campbell

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

Nothing to report at this time.

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

The MPC website is fully operational at: <http://www.mountain-plains.org/>

The MPC Center Director can be found at: <http://www.mountain-plains.org/resources/downloads/KeyCenterDirectory.pdf?year=2014>

**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**

Nothing to report at this time.

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

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

Nothing to report at this time.

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

The timing of match funding and the commitments of collaborators vary widely and are still unfolding. At this time, we have identified potential collaborators, however, others may be added. Key participants from many organizations will be named at a later date, when their funding and personnel availability becomes more certain.

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

Nothing to report at this time.

**4. Impact**

Nothing to report at this time.

**5. Changes/Problems**

No changes are foreseen 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