

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

**Grant No. 69A3551747108  
Mountain-Plains Consortium, North Dakota State University  
Denver Tolliver, Director  
Denver.tolliver@ndsu.edu  
(701)231-7190**

**June 20, 2017**

**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: November 30, 2016 – September 30, 2022**

**Reporting Period End Date: May 30, 2017  
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 seven 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, Economic Competiveness, Organizational Excellence, and Security Preparedness and other supporting objectives while addressing critical issues of the region and stakeholder groups.

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

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

More than 20 research projects for the 2017-2018 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 seven 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, Environmental Sustainability, Organizational Excellence, and Security Preparedness and other supporting objectives.

#### **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.	09/1/2016	12/30/2017
Call for Proposals	The solicitation of proposals occurred on each university campus, using proposal guidelines developed by the director.	12/1/2016	12/15/2017
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.	12/08/2016	12/08/2016
Center Directory	A directory of key center personnel was completed and published on the center's web page.	01/15/2017	01/15/2017
Center Webpage	The MPC webpage was updated and is fully functional for the current grant period	01/15/2017	01/15/2017
UTC/CUTC Meeting	The director and administrative staff attended the UTC/CUTC meeting at TRB and received guidance from RITA regarding the forthcoming grant.	01/07/2018	01/11/2018
Peer Review of Proposals	All project proposals were subjected to external and internal peer review.	02/15/2017	04/15/2018

Primary Focus	MPC's proposal targets the following FAST ACT 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.	11/30/2016	09/30/2022
Selection of Projects	Projects are being 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	05/15/2017	05/15/2018
Posting of Projects	The selected projects will be posted on the MPC webpage and added to the Research in Progress database.	05/15/2017	05/15/2018
Site Visit	A site visit to all MPC Universities will be conducted annually.	11/30/2016	09/30/2022
UTC/CUTC Summer Meeting	The center director and other key staff attended the 2017 summer UTC/CUTC meeting in New York.	07/19/2017	07/21/2017

**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>Technology Transfer</b>	Provide a technology transfer plan for your project. Describe the process you will use for transferring your findings to other researchers, professionals and practitioners. The goal should be further development, commercialization and practical applications for the results of your research. Ultimately, technology transfer should sustain economic growth and improve efficiency, safety, and/or cost effectiveness through the development and commercialization of new technologies and practices. Technology transfer may occur through (but is not limited to) conferences, workshops, web pages, social media, and seminars. Please list how you intend to fulfill this requirement and remember to report your technology transfer activities in the PPPR for this project.
<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 2016 & Spring 2017 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>	CIVE 355 Introduction to Geotechnical Engineering
	CIVE 467 Design of Reinforced Concrete Structures
	CIVE 508 Bridge Engineering
	CIVE 561 Advanced Steel Behavior and Design
	CIVE 565 Finite Element Method
	CIVE 580B1 Structural Inspection, Management and Repair
	CIVE 303 GIS in Civil and Environmental Engineering
	CEE 3080 Design of Reinforced Concrete
	CEE 5100 Infrastructure Renewal
	CEE 5190 GIS Civil Engineers
	CEE 6040 Structural Reliability
	CvEEN 3210 Structural Loads and Analysis
	CvEEN 3310 Geotechnical Engineering
	CvEEN 3315 Geotechnical Engineering Lab
	CvEEN 3520 Introduction to Transportation Engineering
	CvEEN 4221 Concrete Design
	CvEEN 4222 Steel Design
	CvEEN 4910 Professional Practice and Senior Design
	CvEEN 6210 Structural Analysis
	CvEEN 6220 Concrete Design II
	CvEEN 6239 Steel Design II
	CvEEN 6250 Structural Dynamics
	CvEEN 6270 Computer Aided Structural Analysis
	CvEEN 6305 Introduction to Foundation Engineering
	CvEEN 6310 Foundation Engineering
	CvEEN 6330 Soil Dynamics
	CvEEN 6340 Advanced Geotechnical Testing
	CvEEN 6510 Highway Design
	CvEEN 6525 Highway and Traffic Engineering
	CvEEN 6570 Pavement Design
	CvEEN 7225 Prestressed Concrete Design
	CvEEN 7230 Advanced Topics in Steel Design
	CvEEN 7235 Bridge Design
	CvEEN 7250 Structural Earthquake Engineering
CvEEN 7255 Advanced Dynamics of Structures	
CvEEN 7310 Advanced Foundation Engineering	
CvEEN 7330 Geotechnical Earthquake Engineering	
CvEEN 7350 Soil Improvement and Stabilization	
CvEEN 7360 Advanced Soil Mechanics	

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

<b>Major Subject Area</b>	<b>Course Title</b>
<b>Engineering &amp; Design</b>	CvEEN 7560 Advanced Materials
	CvEEN 7570 Pavement Maintenance and Rehabilitation
	TRAN 4010 Introduction to Transportation Systems
	TRAN 4330 Principles of Supply Chain: Management & Technologies
	TRAIN 4080 Transportation International
<b>Freight &amp; Logistics</b>	TRAN 4010 Introduction to Transportation Systems
	TRAN 4330 Principles of Supply Chain: Management & Technologies
	TRAIN 4080 Transportation Law and Regulation: Domestic & International
	TL 725 Technology Advances/ Logistics
	TL 711 Logistics Systems
	TL 754 Urban Transportation System Analysis
	TL 811 Modeling for Logistic Research
	TL 829 Supply Chain Risk Management
<b>Planning &amp; Environment</b>	CvEEN 6560 Transportation Planning
	PSY 3160 Human Error
	PSY 3171 Human Factors and Ergonomics
	TRAIN 4710 Transportation Finance
	TRAN 4020 Transportation Economics
	TRAN 4060 Transportation Marketing and Sales Tools
	TRAIN 4330 Principles of Supply Chain: Management and Technologies
	TRAIN 4320 Transportation Management, Leadership, and Values
	TL 715 Enterprise Resource Planning
	TL 721 International Logistics Mgmt
	TL 752 Transportation Planning & Environment Compliance
	TL 753 Transportation System Modeling
	TL 785 Spatial Analysis/ Transportation
	<b>Public Transportation</b>
TL 786 Public Transportation	
	TL 782 Transportation Systems I
	TL 756 Transportation Systems Lab
	TL 783 Transportation Systems II
<b>Traffic &amp; Operations</b>	CEE 3210 Intro to Transportation Engineering
	CvEEN 7920 Statistics and Econometrics



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

Major Subject Area	Course Title
	TL 789 Leadership, Ethics, & Conduct in Transportation
Transportation Safety	CEE 6250 Transport Data/Safety
	CvEEN 7520 Transportation Safety
	CvEEN 7545 Transportation Network Modeling

Altogether, 76 transportation and transportation-related courses have been offered this reporting period, for a total of 76 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 during this reporting period are presented below.

1. APWA Construction Inspector Training
2. Asphalt Paving Maintenance 1
3. Asphalt Paving Maintenance 2
4. ATSSA Flagger Certification
5. ATSSA Traffic Control Supervisor
6. ATSSA Traffic Control Technical
7. Basics of a good road
8. Civil and Environmental Engineering: American Society of Civil Engineers Career Fair
9. Communications Skills for Supervisors
10. Diverging Diamonds Design & Construction
11. Drilled Shaft Foundations
12. Glue for Gravel Roads & Cutting Tape- On-Site Devils Lake
13. Glue for Gravel Roads & Cutting Tape- On-Site Fryburg
14. Glue for Gravel Roads & Cutting Tape- On-Site Mandan
15. Heavy Equipment Operator Certification- On site- City of Bismarck
16. Heavy Equipment Operator Certification- On site- City of Dickinson
17. Heavy Equipment Preventive Maintenance
18. Heavy Equipment Safety Operations
19. Identifying Asphalt Roadway Fatigue & Treatment Pavement
20. Intelligent Work Zones Webinar
21. Introduction to Highway Construction for New Engs & Techs (ND) Onsite Bismarck
22. Local Roads Corrugated Metal Pipe Workshop- Onsite- Dickinson
23. Motor Grader Boot Camp- On site- Burleigh County
24. OSHA – Workplace, Equipment & Jobsite Safety
25. OSHA 10 Hour Mower Safety
26. OSHA 10 Hr Training Specifically for Roadway Construction Onsite- Stanley
27. Psychology: Human Factors Certificate Program

28. Registered Stormwater Inspector
29. Roadway Drainage
30. Roadway Materials
31. Roadway Safety- Work Zone Temp Traffic Control- Onsite- Bismarck
32. Roadway Safety- Work Zone Temp Traffic Control- Onsite- West Fargo
33. Tractor Mower Safety
34. Truck Weight Education Workshop Onsite Jamestown

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

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

The results will be 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.

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

Projects will be selected and research will begin, along with implementation of plan and grant schedule.

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

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

**i. Key Conferences and Workshops**

- Nothing to report at this time.

**ii. Key Publications**

- Nothing to report at this time.

**iii. Key Conference Papers**

- Nothing to report at this time.

**iv. Key Presentations**

- Nothing to report at this time.

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

- Nothing to report at this time.

**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/personnel/admin-personnel.php>

**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