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

Grant No. DTRT13-G-UTC38
DTRT13-G-UTC38, Mod 1, 2, & 3
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Upper Great Plains Transportation Institute
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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

Eighty-seven research projects were selected from 2013 to present under this grant. Projects have been selected for the original grant, Modification 1, 2, and 3. 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. MPC projects selected under this grant include; MPC-371, 409, 447, 451, 472 (Year 2), MPC-446 through MPC-531.

Table 1: MPC Research Projects Most Directly Correlated with Safety

1. MPC-453: Speed Selection Behavior during Winter Road Conditions
2. MPC-454: Regional Implementation of Tribal Transportation Safety Program
3. MPC-455: Why Are Bike-Friendly Cities Safer for All Road Users?
4. MPC-458: Application of a Multi-Agent System with the Large-Scale Agent-Based Model for Freight Demand Modeling
5. MPC-460: Technology and Workforce Development for Remote Sensing of the Transportation Infrastructure
6. MPC-461: Analytical Modeling for Progressive Failure Assessment of Curved and Skewed Highway Bridges Subjected to Seismic Hazards
7. MPC-462: Implementation of Aerial LiDAR Technology to Update Highway Feature Inventory
8. MPC-471: Enhancement of Mechanistic-Empirical Pavement Design Guide for Roadway Design, Construction and Rehabilitation
9. MPC-472: Developing an Optimization Model for Managing County Paved Roads
10. MPC-473: Bicycle and Pedestrian Design for Rural Communities
11. MPC-474: Highway Safety Manual Part D: Validation and Application in Wyoming
12. MPC-475: Analysis of the Relationship of Roadside Inspections on Large Truck Crashes
13. MPC-476: Highway-Rail Grade Crossing Traffic Hazard Forecasting Model

14. MPC-479: Modeling Multi-class Truck Traffic Assignment Method with Different Traffic Restraint Constraints
15. MPC-480: A Comprehensive Safety Assessment Methodology for Innovative Geometric Designs
16. MPC-483: Interaction Analysis of Girder Bridges and Traffic System subjected to Earthquakes
17. MPC-486: Sustainable Heated Pavements for Infrastructure Longevity, Safety and Economic Competiveness
18. MPC-487: Investigation of Cross Laminated Timber Bridge Decks as a Sustainable Solution for Repair of Deficient Rural Wood Bridges
19. MPC-502: Experimental and Computational Study of Self-Consolidating Concrete for Prestressed Bridge Girders
20. MPC-503: Characterization of Crushed Bases in Wyoming
21. MPC-504: Improved Element-Level Bridge Inspection Criteria for Better Bridge Management and Preservation
22. MPC-505: An Intelligent Transportation Systems Approach to Railroad Infrastructure Performance Evaluation
23. MPC-507: Automating Inspection and Damage Assessment of Transportation Infrastructure with Photographic Imaging
24. MPC-515: Redefining the Child Pedestrian Safety Paradigm
25. MPC-517: Route Planning for Enhanced Transportation Network Utilization: A System Optimization Approach for Route Planning in Advanced Traveler Information Systems
26. MPC-518: Tribal Crash Reporting in ND: Practices, Perceptions, and Systematic Implementation
27. MPC-519: Operational and Safety Analysis with Mitigation Strategies for Freeway Truck Traffic in WY
28. MPC-520: Financial Benefits of Proposed Access Management Treatments
29. MPC-521: Evaluating Relationships between Perception-Reaction Times, Emergency Deceleration Rates, and Crash Outcomes using Naturalistic Driving Data
30. MPC-531: Flood Hydrograph Generation for Predicting Bridge Scour in Cohesive Soils

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

1. MPC-447: Post-Fire Ground Treatments for Protection of Critical Transportation Structures
2. MPC-448: Reducing Flood Vulnerability of Communities with Limited Road Access by Optimizing Bridge Elevation
3. MPC-449: Determining the Uncertainty in the Current Condition of Bridges for Use in Risk Based Inspection and Management
4. MPC-451: Assessing the Cost-Effectiveness of Wyoming's CMAQ Unpaved Road Dust Suppression Program
5. MPC-452: Updating the Highway Safety Manual 2010 - Part C: Regional Consideration of the Rocky Mountains and Plain Regions
6. MPC-456: Performance of Steel Girders Repaired with Advanced Composite Sheets in a Corrosive Environment: A Multi-Physics Approach Leading to Practical Design Recommendations
7. MPC-458: Application of a Multi-Agent System with the Large-Scale Agent-Based Model for Freight Demand Modeling
8. MPC-460: Technology and Workforce Development for Remote Sensing of the Transportation Infrastructure
9. MPC-461: Analytical Modeling for Progressive Failure Assessment of Curved and Skewed

Highway Bridges Subjected to Seismic Hazards
10. MPC-462: Implementation of Aerial LiDAR Technology to Update Highway Feature Inventory
11. MPC-463: Rehabilitation Project Selection and Scheduling in Transportation Networks
12. MPC-464: Development of Network-Based Measures and Computational Methods for Evaluating the Redundancy of Transportation Networks
13. MPC-471: Enhancement of Mechanistic-Empirical Pavement Design Guide for Roadway Design, Construction and Rehabilitation
14. MPC-472: Developing an Optimization Model for Managing County Paved Roads
15. MPC-477: Characterizing the ductility of Portland cement stabilized soil
16. MPC-478: Long-Term Behavior of Precast Concrete Bridges
17. MPC-479: Modeling Multi-class Truck Traffic Assignment Method with Different Traffic Restraint Constraints
18. MPC-481: Incorporating River Network Structure for Improved Hydrologic Design of Transportation Infrastructure
19. MPC-482: Coupled Numerical Simulation of Debris Flow-Soil-Structure Interactions for Flexible Barrier Mitigation Systems
20. MPC-483: Interaction Analysis of Girder Bridges and Traffic System subjected to Earthquakes
21. MPC-486: Sustainable Heated Pavements for Infrastructure Longevity, Safety and Economic Competiveness
22. MPC-487: Investigation of Cross Laminated Timber Bridge Decks as a Sustainable Solution for Repair of Deficient Rural Wood Bridges
23. MPC-497: Compaction Testing of Granular Materials
24. MPC-500: Rehabilitation of Longitudinal Joints in Double-Tee Bridge Girders
25. MPC-501: Development of an Alternative to the Double Tee Bridge System
26. MPC-502: Experimental and Computational Study of Self-Consolidating Concrete for Prestressed Bridge Girders
27. MPC-503: Characterization of Crushed Bases in Wyoming
28. MPC-504: Improved Element-Level Bridge Inspection Criteria for Better Bridge Management and Preservation
29. MPC-505: An Intelligent Transportation Systems Approach to Railroad Infrastructure Performance Evaluation
30. MPC-506: Reliable Prediction of Shear Strength of Swelling Clays
31. MPC-507: Automating Inspection and Damage Assessment of Transportation Infrastructure with Photographic Imaging
32. MPC-511: Mechanical Bar Splices for Accelerated Bridge Construction of Columns
33. MPC-512: Pre-stress Losses and Development of Short-Term Data Acquisition System for Bridge Monitoring
34. MPC-516: Innovative Strengthening for Deteriorated Concrete Bridges Using Embedded Composite Sheets Bonded with Polyester-silica
35. MPC-519: Operational and Safety Analysis with Mitigation Strategies for Freeway Truck Traffic in WY
36. MPC-522: Development of a Guideline for Selection of Tack Coats in South Dakota
37. MPC-523: Methodology for Load Rating Double-Tee Bridges
38. MPC-530: Screening of South Dakota Asphalt Mixes for Moisture Damage using Conventional and Innovative Approaches
39. MPC-531: Flood Hydrograph Generation for Predicting Bridge Scour in Cohesive Soils

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

1. MPC-451: Assessing the Cost-Effectiveness of Wyoming's CMAQ Unpaved Road Dust Suppression Program
2. MPC-456: Performance of Steel Girders Repaired with Advanced Composite Sheets in a Corrosive Environment: A Multi-Physics Approach Leading to Practical Design Recommendations
3. MPC-460: Technology and Workforce Development for Remote Sensing of the Transportation Infrastructure
4. MPC-463: Rehabilitation Project Selection and Scheduling in Transportation Networks
5. MPC-464: Development of Network-Based Measures and Computational Methods for Evaluating the Redundancy of Transportation Networks
6. MPC-471: Enhancement of Mechanistic-Empirical Pavement Design Guide for Roadway Design, Construction and Rehabilitation
7. MPC-472: Developing an Optimization Model for Managing County Paved Roads
8. MPC-479: Modeling Multi-class Truck Traffic Assignment Method with Different Traffic Restraint Constraints
9. MPC-483: Interaction Analysis of Girder Bridges and Traffic System subjected to Earthquakes
10. MPC-486: Sustainable Heated Pavements for Infrastructure Longevity, Safety and Economic Competiveness
11. MPC-488: Effects of Infill Development and Regional Growth on At-Risk Populations' Exposure to Traffic Density
12. MPC-497: Compaction Testing of Granular Materials
13. MPC-498: Development of Mixed Media Filtration for Stormwater Runoff Treatment
14. MPC-499: Reuse of Aqueous Waste Streams in Transportation-Related Applications
15. MPC-500: Rehabilitation of Longitudinal Joints in Double-Tee Bridge Girders
16. MPC-501: Development of an Alternative to the Double Tee Bridge System
17. MPC-502: Experimental and Computational Study of Self-Consolidating Concrete for Prestressed Bridge Girders
18. MPC-503: Characterization of Crushed Bases in Wyoming
19. MPC-504: Improved Element-Level Bridge Inspection Criteria for Better Bridge Management and Preservation
20. MPC-505: An Intelligent Transportation Systems Approach to Railroad Infrastructure Performance Evaluation
21. MPC-509: Expansive Soil Mitigation for Transportation Earthworks by Polymer Amendment
22. MPC-511: Mechanical Bar Splices for Accelerated Bridge Construction of Columns
23. MPC-513: Optimal Deployment of Wireless Charging Facilities for an Electric Bus System
24. MPC-514: Impacts of Ridesourcing on VMT, Parking Demand, Transportation Equity, and Travel Behavior
25. MPC-516: Innovative Strengthening for Deteriorated Concrete Bridges Using Embedded Composite Sheets Bonded with Polyester-silica
26. MPC-517: Route Planning for Enhanced Transportation Network Utilization: A System Optimization Approach for Route Planning in Advanced Traveler Information Systems
27. MPC-519: Operational and Safety Analysis with Mitigation Strategies for Freeway Truck Traffic in WY
28. MPC-522: Development of a Guideline for Selection of Tack Coats in South Dakota
29. MPC-523: Methodology for Load Rating Double-Tee Bridges
30. MPC-530: Screening of South Dakota Asphalt Mixes for Moisture Damage using Conventional and Innovative Approaches

31. MPC-531: Flood Hydrograph Generation for Predicting Bridge Scour in Cohesive Soils

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

1. MPC-454: Regional Implementation of Tribal Transportation Safety Program
2. MPC-455: Why Are Bike-Friendly Cities Safer for All Road Users?
3. MPC-473: Bicycle and Pedestrian Design for Rural Communities
4. MPC-483: Interaction Analysis of Girder Bridges and Traffic System subjected to Earthquakes
5. MPC-485: Development of a Model to Assess the Feasibility of Transit-Oriented Development (TOD) Projects
6. MPC-489: The Unresolved Relationship between Street Trees and Road Safety
7. MPC-498: Development of Mixed Media Filtration for Stormwater Runoff Treatment
8. MPC-499: Reuse of Aqueous Waste Streams in Transportation-Related Applications
9. MPC-510: Business and Commute Optimization System: Development and Denver-Based Case Study
10. MPC-513: Optimal Deployment of Wireless Charging Facilities for an Electric Bus System
11. MPC-514: Impacts of Ridesourcing on VMT, Parking Demand, Transportation Equity, and Travel Behavior
12. MPC-515: Redefining the Child Pedestrian Safety Paradigm
13. MPC-517: Route Planning for Enhanced Transportation Network Utilization: A System Optimization Approach for Route Planning in Advanced Traveler Information Systems
14. MPC-518: Tribal Crash Reporting in ND: Practices, Perceptions, and Systematic Implementation
15. MPC-520: Financial Benefits of Proposed Access Management Treatments

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

1. MPC-447: Post-Fire Ground Treatments for Protection of Critical Transportation Structures
2. MPC-458: Application of a Multi-Agent System with the Large-Scale Agent-Based Model for Freight Demand Modeling
3. MPC-460: Technology and Workforce Development for Remote Sensing of the Transportation Infrastructure
4. MPC-471: Enhancement of Mechanistic-Empirical Pavement Design Guide for Roadway Design, Construction and Rehabilitation
5. MPC-472: Developing an Optimization Model for Managing County Paved Roads
6. MPC-473: Bicycle and Pedestrian Design for Rural Communities
7. MPC-477: Characterizing the ductility of Portland cement stabilized soil
8. MPC-485: Development of a Model to Assess the Feasibility of Transit-Oriented Development (TOD) Projects
9. MPC-486: Sustainable Heated Pavements for Infrastructure Longevity, Safety and Economic Competiveness
10. MPC-487: Investigation of Cross Laminated Timber Bridge Decks as a Sustainable Solution for Repair of Deficient Rural Wood Bridges
11. MPC-488: Effects of Infill Development and Regional Growth on At-Risk Populations' Exposure to Traffic Density
12. MPC-489: The Unresolved Relationship between Street Trees and Road Safety
13. MPC-498: Development of Mixed Media Filtration for Stormwater Runoff Treatment
14. MPC-499: Reuse of Aqueous Waste Streams in Transportation-Related Applications
15. MPC-503: Characterization of Crushed Bases in Wyoming
16. MPC-509: Expansive Soil Mitigation for Transportation Earthworks by Polymer Amendment

17. MPC-510: Business and Commute Optimization System: Development and Denver-Based Case Study
18. MPC-513: Optimal Deployment of Wireless Charging Facilities for an Electric Bus System
19. MPC-514: Impacts of Ride sourcing on VMT, Parking Demand, Transportation Equity, and Travel Behavior
20. MPC-517: Route Planning for Enhanced Transportation Network Utilization: A System Optimization Approach for Route Planning in Advanced Traveler Information Systems

iii. Educational Accomplishments

The transportation and transportation-related courses offered during fall 2016 and spring 2017 are listed in Table 6, 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 6: Transportation and Transportation-Related Courses Offered This Period

Major Subject Area	Course Title
Engineering & Design	CIVE 303 Infrastructure and Transportation Systems
	CIVE 355 Introduction to Geotechnical Engineering
	CIVE 455 Applications in 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
	CEE 106 Elementary Surveying and Lab
	CEE 443 Matrix Analysis of Structures
	CEE 792 Topics-Advanced Topics in Reinforced Concrete
	CEE 769 Bridge Design
	CEE 456 Theory and Design of Reinforced Concrete
	CEE 446 Theory and Design of Reinforced Concrete
	CEE 546 Advanced Geotechnical Engineering
	CEE 765 Pavement Design
	CEE 363 Highway and Traffic Engineering
	CEE 492 Introduction to Traffic Safety
	CEE 755 Advanced Reinforced Concrete
	CEE 455 Steel Design
	CEE 749 Advanced Geotechnical Testing
	CEE 458 Design of Timber Structures
	CVEN 3602 Transportation Engineering
	CVEN 4602 Highway Engineering
	CVEN 5602 Advanced Street & Highway Design
	CVEN 5682 Pavement Design
	CE 3500 Transportation Engineering
	CE 5585 Pavement Management System
	CE 5550 Pavement Materials
	CE 4550 Pavement Materials

	CEE 3210: Introduction to Transportation Engineering
	CE 4555 Geometric Design of Highways
	CE 5555 Geometric Design of Highways
	CEE 3080: Reinforced Concrete Design
	CEE 6930 Prestressed Concrete Design
	CEE 6130 Structural Dynamics and Seismic Design.
Planning & Environment	CVEN 5612 Traffic Impact Assessment
	CVEN 5460 Introduction to Sustainable Urban Infrastructure
	URPL 5040 Urban Sustainability
	URPL 5050 Urban Development
	URPL 6300 Planning Healthy Communities
	URPL 6350 Form and Formation of Cities
	URPL 6399 Introduction to Sustainable Urban Infrastructure
	URPL 6400 Community Development
	URPL 6550 Transportation Planning/Policy
	URPL 6645 Disaster/Climate Change Planning
	URPL 6370 Sprawl and Growth Management
	URPL 5000 Planning History and Theory
	URPL 5010 Planning Methods
	URPL 6650 Planning in the Developing World
	CE 5570 Transportation Planning
	CEE 5240: Urban and Regional Transportation Planning
Traffic & Operations	CVEN 5621 Highway Capacity Analysis
	CVEN 5622 Traffic Operations and Control
	CE 4530 Traffic Operation
	CE 5530 Traffic Operation
	CEE 5220 Traffic Engineering
Transportation Safety	CVEN 5611 Traffic and Safety Data Analysis
	CVEN 5662 Transportation System Safety
Transportation Systems	URPL 6555 Transportation and Land Use
	CEE 6290 Transportation Network Analysis
	CEE 6210 Transportation Systems Analysis

Altogether, 64 transportation and transportation-related courses have been offered this reporting period, for a total of 501 total transportation courses offered this grant period. In addition to the courses listed in Table 6, 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 is presented below.

- 10 Ways to Handle Your Overburdened Inbox
- Asphalt Maintenance: Crack Sealing/Pouring & Spot Surface Repairs
- Asphalt Paving Maintenance 1

- ATSSA Flagger Certification
- ATSSA Flagger Instructor Training
- ATSSA Traffic Control Supervisor
- ATSSA Traffic Control Technician
- Basics of a Good Road
- Communication Skills for Supervisors
- Concrete Pavement
- Confided Space Training
- Confined Space Awareness
- Confrontation Management & Conflict Resolution
- Construction Project Management/Contract Administration
- Creative Problem Solving
- Designing for Pedestrian and Bicycle Safety
- Designing, Constructing & Maintaining Facilities for All Users (inc ADA)
- Developing "Bench Strength" in Your Public Sector Organization
- Fork Lift Certification
- Fundamentals of PROW ADA Ramp Design, Layout, Inspection and Construction
- Heavy Equipment Operation (Hands On)
- Heavy Equipment Safety Operations
- High Strength Bolt Installation & Inspection
- How Great Organizations Create a Culture of Engagement
- Lead Effective Meetings
- Local Roadway Signing 101 On-site - Adams County
- Local Roadway Signing 101 On-site - Ramsey County
- Low Cost Safety Improvements
- LPA
- MUTCD Training
- Pavement Management: Full-Depth Reclaim & Stabilized Full-Depth Webinar
- Pavement Management: Hot-In-Place Recycling (HIP) Webinar
- Pavement Management: Micro-Surfacing & Slurry Seals Webinar
- PCCP Urban Joint Layout & Design
- Piling Basics - Design to Construction
- Preventing Runners and Backovers
- Preventing Runovers and Backovers
- Registered Stormwater Inspector
- Roadway Drainage
- Roadway Materials
- Seal Coat Workshop
- Selecting and Applying Asphalt Projects.
- Sign Truck Show N Tell Workshop On-site - Ramsey County
- Successful Public Speaking
- The Public Land Survey System - 1785 to Present - Part II
- Traffic Calming - Considerations, Applications & Impact

Workplace, Equipment and Jobsite Training **v. Research Accomplishments**

The following peer reviewed research reports were published during the rating period from grant DTRT13-G-UTC38.

Project #	Title	Date	Report No.
425	Building a Sustainable GIS Framework for Supporting a Tribal Transportation Problem	Mar 2017	MPC 15-287
441	Pavement Management System for City of Madison	Nov 2016	MPC 16-314
421	Seismic Rehabilitation of Skewed and Curved Bridges Using A New Generation of Buckling Restrained Braces	Dec 2016	MPC 16-315
444	Data-Driven Freeway Performance Evaluation Framework for Project Prioritization and Decision Making	Jan 2017	MPC 16-316
403	Simplified Web-Based Decision Support Method for Traffic Management and Work Zone Analysis	Jan 2017	MPC 16-317
418	400 South Corridor Assessment	Mar 2017	MPC 16-318
419	Cracking and Debonding of Thin Fiber Reinforced Concrete Overlay	Apr 2017	MPC 16-319
392	Evaluation of Grouted Splice Sleeve Connections for Precast Reinforced Concrete Bridge Piers	Apr 2017	MPC 16-320
405	Seismic Retrofit of Spliced Sleeve Connections for Precast Bridge Piers	Mar 2017	MPC 16-321
407	Cell Phone Use Diminishes Self-Awareness of the Adverse Effects of Cell Phone Use on Driving	Mar 2017	MPC 16-322
407	Why Drivers Use Cell Phones and Support Legislation to Restrict This Practice	Apr 2017	MPC 16-323
379	Plastic-Aluminum Composites in Transportation Infrastructure	Mar 2017	MPC 16-324

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.

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

- 2nd Serbian Road Congress
- ASCE GeoChicago 2016: Sustainability, Energy, and the Geoenvironment
- Asphalt Maintenance - Crack Sealing to Surface Repairs
- ATSSA Traffic Control Technican
- ATSSA Truck Mounted Attenuators
- Basic Construction Survey
- Basic Sign Installation
- Changing Perspectives
- Construction Project Management: Contract Administration
- Construction Research Congress
- Development of a Model to Assess the Feasibility of Transit-Oriented Development
- Electrical Plan Reading - Inspection & Installation
- Erosion Control Options
- Ethics Awareness for the Transportation Industry
- Evaluation of Grouted Spliced Sleeve Connections Reinforced Precast Concrete Bridge Piers -MPC Research Project
- Fundamentals of Geometric Design: Exploring the Green Book
- Gravel Roads Maintenance - New Manual Review
- Guardrail Installation & Inspection
- Guardrail Maintenance
- Highway Capacity Manual Overview & Related Software Changes 6th Edition 2015
- Highway Pipe Installation
- Hosted by Mineta Transportation Institute/San Jose State University
- Implementation of Low Temperature Tests for Asphalt Mixtures
- International Conference on Transport & Health
- ITE Colorado-Wyoming Section Transportation Symposium
- ITE Western District Annual Meeting
- John Maxwell: 15 Invaluable Laws of Growth
- John Maxwell: Sometimes You Win, Sometimes you Learn
- John Maxwell: Today Matters
- John Maxwell's Becoming A Person of Influence: How to Positively Impact the Lives of Others

- Joint Detailing for Improved Performance of Double Tee Bridge Systems - MPC Research Project
- Keyhole Technology for Urban Utility Excavations to Reduce the Impact of Pavement Cuts
- Leadership - Developing a Presence
- Leading a Successful Change Initiative
- Live Ride Share
- Technical Communication as a Writer & Presenter - 6 Sessions Webinar
- The Public Land Survey System - 1785 to Present - Part I
- Math for Survey and Construction
- Midyear Meeting of the TRB Geometric Design Committee (AFB10), Operational Effects of Geometrics Committee, and AASHTO Technical Committee on Geometric Design
- Midyear Meeting of the TRB Highway Safety Performance Committee (ANB25)
- Negotiation Strategies & Techniques to Improve Construction Project Mgmt
- Organized by the Transportation Public Health Link in Partnership with the
- PE Exam for Civil Engineers
- Pedestrian and Bicycle Safety
- Pipe Jacking for Culverts and Storm Sewers
- Practical Bridge Scour Analysis, Methods & Countermeasures
- Presenting the Story of Your Data
- Pro Walk/Pro Bike/Pro Place
- Reducing Roadway Departure Crashes
- Results Based Performance Mgmt
- Route & Preliminary Survey and LiDar 3-D Modeling
- Seal Coat Workshop
- SHRP2 Implementation Assistance Program Issues Resolution Workshop
- Stormwater Detention & Design
- The Balancing Act: Stress and Productivity
- The Transportation Research Board Innovations in Travel Modeling Conference
- Tier IV Regeneration & Digital Multi-Meter Principles
- Tractor Mower Safety Training
- Traffic Data Collection
- Trenching Safety Practices
- Understanding Linear Scheduling for Roadway Construction Projects
- United States Centers for Disease Control & Prevention
- Utah Society of Professional Engineers Continuing Education Conference

ii. Key Publications

- Bridgelall, R., Rafert, J. B., Tolliver, D., Lee, E., “Rapid hyperspectral image classification to enable autonomous search systems,” Journal of Spectral Imaging, 5(a5), DOI: 10.1255/jsi.2016.a5, pp. 1-8, November 11 2016.
- Eadelat, W.A. and Ksaibati, K., “Estimation of Pavement Serviceability Index through Android-based Smartphone Application for Local Roads”; Transportation Research Board, Transportation Research Record, Transportation, In press, 2017.
- Ethan Pickett. "The Short and Long-Term Effects of Temperature and Strain on a Concrete Bulb-Tee Girder Bridge." MS Thesis. 2017. Utah State University.

- Fei Yan and Zhibin Lin, Bond durability assessment and long-term degradation prediction for GFRP bars to fiber-reinforced concrete under saline solutions, Composite Structures, Volume 161, Pages 393–406, 2017.
- Fei Yan, Zhibin Lin, Xingyu Wang, Fardad Azarmi and Konstantin Sobolev Evaluation and prediction of bond strength of GFRP-bar reinforced concrete using artificial neural network optimized with genetic algorithm, Composite Structures, Vol. 161, pp. 441-452, 2017.
- Ferenchak, N. and Marshall, W. Redefining the Child Pedestrian Safety Paradigm: Identifying High Fatality Concentrations in Urban Areas. Injury Prevention (doi: http://dx.doi.org/10.1136/injuryprev-2016-042115).
- Guoqing Gui, Hong Pan, Zhibin Lin, Yonghua Li and Zhijun Yuan, Data-Driven Support Vector Machine with Optimization Techniques for Structural Health Monitoring and Damage Detection, KSCE Journal of Civil Engineering, Volume 21, Issue 2, pp 523–534, 2017
- Hafez, M.; Ksaibati, K.; and Atadero, R. "Best Practices to Support and Improve Pavement Management Systems for Low-Volume Paved Roads" ; The International Journal of Pavement Engineering, 2017.
- Henao, A. and Marshall, W. "A Framework for Understanding the Impacts of Ridesourcing on Transportation" in Disrupting Mobility by Editors S. Shaheen and G. Meyer, Springer Publishing, 2016.
- Hou, G.Y. and Chen, S. (2016). "Impact of Bent Connection and Geometric Configuration on Seismic Performance of SMC Concrete Bridges in Low-to-moderate Seismic Region", Practice Periodical on Structural Design and Construction, ASCE (Accepted).
- Katti, D. R.; Thapa, K. B.; Katti, K. S., Modeling molecular interactions of sodium montmorillonite clay with 3D kerogen models. Fuel 2017, 199, 641-652. -Published-Acknowledged Federal Support.
- Kim, Y.J., Bumadian, I., and Park, J.-S. 2016. Galvanic current influencing interface deterioration of CFRP bonded to a steel substrate, Journal of Materials in Civil Engineering, American Society of Civil Engineers (ASCE), 28(2), 04015129
  Kim, Y.J. and Bumadian, I. 2016. Electrochemical reaction for steel beams strengthened with CFRP sheets, Engineering Structures, Elsevier, 125, 471-480
- Marshall, W. and Ferenchak, N. Assessing Equity and Urban/Rural Road Safety Disparities in the U.S. Journal of Urbanism (doi: 10.1080/17549175.2017.1310748).
- Marshall, W., Piatkowski, D., and Johnson, A. Scofflaw Bicyclists: Illegal but Rational. Journal of Transport and Land Use (doi: http://dx.doi.org/10.5198/jtlu.2016.871).
- Nickless, K. and Atadero, R. Investigation of Mechanistic Deterioration Modeling for Bridge Design and Management. Submitted to the Journal of Bridge Engineering.
- Okok M.A., Saha. P., and Ksaibati, K. "Developing Performance Models for Gravel Roads to Evaluate the Cost-Effectiveness of using Dust Chemical Treatments." ; http://www.tandfonline.com/doi/full/10.1080/10298436.2017.1298105; The International Journal of Pavement Engineering, 2017.
- Piatkowski, D., Marshall, W., and Johnson, A. Bicycle backlash: A qualitative examination of aggressive driver-bicyclist interactions. Transportation Research Record (doi: 10.3141/2662-03).
- Piatkowski, D., Marshall, W., and Johnson, A. Steering Clear of Confrontation: The Role of Drivers' Bicycling Experiences in Mixed-Traffic Encounters. Transportation Research – Part F, Vol. 46, Part A, 137-148, 2017 (doi: http://dx.doi.org/10.1016/j.trf.2017.01.009).

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- Terrill, T. and Ksaibati, K.; “A Methodology to Assess and Compare the Safety of the State Highway System to the Local Roadway System on the Wind River Indian Reservation ”; Journal of Transportation Technology; 2017.
- Torres, Eduardo, Seo, J., and Lederle, R. “Experimental and Statistical Investigation of Self-Consolidating Concrete Mixture Constituents for Prestressed Bridge Girder Fabrication.” In press, ASCE Journal of Materials in Civil Engineering, 2017.
- Y. He, Z. Song, Z. Liu, Updating Highway Asset Inventory Using Airborne LiDAR, Measurement (2017), doi: http://dx.doi.org/10.1016/j.measurement.2017.03.026

iii. Key Conference Papers

- Alajmi, A. and Kim, Y.J. 2016. Bond behavior of CFRP sheets embedded in a concrete substrate, 2nd International Conference on Infrastructure Management, Assessment, and Rehabilitation Techniques, Sharjah, United Arab Emirates
- Golombek, Y. and Marshall, W. Remotely Sensed Data in Road Safety Research. Transportation Research Board; Washington, D.C.; January 2017.
- Katti, Dinesh and Katti, Kalpana, "Clay-Fluid Molecular Interactions: Impact on Engineering Properties", Submitted, 15th International Conference of the International Association for Computer Methods and Advances in Geomechanics (15th IACMAG), Wuhan, China, 2017.
- Katti, Dinesh and Katti, Kalpana, "The Role of Molecular Interactions on the Macroscale Properties of Swelling Clays: A Multiscale Modeling Approach", Submitted, 16th International Clay Conference, Granada, Spain, 2017.
- Katti, Dinesh, "Molecular Interactions Control Macroscale Properties in Swelling Clays", International Geotechnical Engineering Conference on Sustainability in Geotechnical Engineering Practices and Related Urban Issues, Mumbai, India, Published, KEYNOTE LECTURE, 2016.
- Katti, Kalpana and Katti, Dinesh,"Fourier Transform Infrared Spectroscopy in the Investigation of Geomechanical Clays: for New Applications in Geomaterials", Submitted, 15th International Conference of the International Association for Computer Methods and Advances in Geomechanics (15th IACMAG), Wuhan, China, 2017.
- Katti, Kalpana, "Applications of FTIR Spectroscopy in Flow and Swelling Behavior of Smectite Clays" International Geotechnical Engineering Conference on Sustainability in Geotechnical Engineering Practices and Related Urban Issues, Mumbai, India, Published, KEYNOTE LECTURE, 2016.
- Katti, Kalpana, Sharma, Anurag, and Katti, Dinesh, "Biomineralization inside nanoclay galleries: opportunities in regenerative medicine and cancer Therapy" Submitted, 16th International Clay Conference, Granada, Spain, 2017.
- Katti,Dinesh, Katti, Kalpana, Thapa, Keshab and Faisal,H. M. Nasrullah, "Modeling the Nanoscale Kerogen Inclusions in Green River Oil Shale", 6th BIOT Conference, Paris, France, 2017.
- Liu, Z., Song, Z., and Yi, H. (2017) Optimal deployment of dynamic wireless charging facilities for an electric bus system. Transportation Research Board 96th Annual Meeting Compendium of Papers CD-ROM.

- Okok M.A., Saha. P., and Ksaibati, K. “Developing Performance Models for Gravel Roads to Evaluate the Cost-Effectiveness of using Dust Chemical Treatments.” Transportation Research Board Meeting, Washington D.C., 2017.
- Piatkowski, D., Marshall, W., and Johnson, A. Bicycle Backlash: Qualitative Examination of Aggressive Driver-Bicyclist Interactions. Transportation Research Board; Washington, D.C.; January 2017.
- Strong, K.C., Ozbek, M. E., and Sharma, A. (2017). "A Decision Support Framework for Transit-Oriented Development (TOD) Projects." In: Proceedings of the 2017 TRB 96th Annual Conference, 15 pages, January 8-12, Washington D.C.
- Terrill, T. and Ksaibati, K;” Investigating Challenges Affecting the 4Es of Transportation Safety on the Fort Peck Reservation”; Transportation Research Board Meeting, Washington D.C., 2017.
- Yi, H., Song, Z., and Liu, Z. (2017) Highway asset inventory data collection using airborne LiDAR. Transportation Research Board 96th Annual Meeting Compendium of Papers CD-ROM.

iv. Key Presentations

- Alajmi, A. and Kim, Y.J. 2016. Bond behavior of CFRP sheets embedded in a concrete substrate, 2nd International Conference on Infrastructure Management, Assessment, and Rehabilitation Techniques, Sharjah, United Arab Emirates
- Bohn, L., Tazarv, M., and Wehbe, N., "Rehabilitation of Longitudinal Joints in Double-Tee Bridge Girders." South Dakota Department of Transportation, Dec. 06, 2016.
- Bond behavior of GFRP bar-concrete interface: from prediction, damage evolution assessment to durability, American Concrete Institute (ACI) Convention, Philadelphia, PA, Oct. 24, 2016.
- Carnahan, Z., Tazarv, M., and Wehbe, N. "Development of an Alternative to the Double Tee Bridge System – Timber Bridges." South Dakota Department of Transportation, Dec. 06, 2016.
- Czyzyk, K.A., S. Hassani, J.D. Niemann, and J. Gironás, “Incorporating Channel Network Type in a Nonlinear Synthetic Unit Hydrograph Method,” American Geophysical Union Hydrology Days, Fort Collins, Colorado, March 20, 2017.
- Eadelat, W.A. and Ksaibati, K., “Estimation of Pavement Serviceability Index through Android-based Smartphone Application for Local Roads”; at The Transportation Research Board (TRB) 96th Annual Meeting, 2017.
- Ferenchak, N. and Marshall, W. Redefining the Child Pedestrian Safety Paradigm: Identifying High-Fatality Concentrations Around Parks. University Transportation Center Spotlight Conference on Pedestrian and Bicycle Safety, Washington, DC; December 2016.
- Golombek, Y. and Marshall, W. Remotely Sensed Data in Road Safety Research. Transportation Research Board; Washington, D.C.; January 2017.
- He, Y., Z. Song, and Z. Liu. "Highway Asset Inventory Data Collection Using Airborne LiDAR." The Transportation Research Board (TRB) 96th Annual Meeting, Washington DC, January 8–12, 2017.
- Henao, A. and Marshall, W. Impacts of Ridesourcing on VMT, Parking, Mode Replacement, and Travel Behavior. Transportation Research Board, Washington DC, January 2017.

- Henao, A. and Marshall, W. Lyft & Uber Driver Perspective: Travel Times, Distances, and Earnings. Transportation Research Board, Washington DC, January 2017.
- Hua, G., Hansen, G., Min, K, Schmit, C., and Huft, D. "Reuse of Aqueous Waste Streams in Transportation-Related Applications." 29th Annual Environmental and Ground Water Quality Conference, Pierre, SD, March 9, 2017.
- Integrated Wireless Sensor Networks with UAS for Damage Detection and Monitoring of Bridges and Other Large-Scale Critical Civil Infrastructures, NDE/NDT for Highways & Bridges: Structural Materials Technology 2016, Portland, OR, Aug. 29-31, 201
- Katti, Dinesh, "Molecular Interactions Control Macroscale Properties in Swelling Clays", International Geotechnical Engineering Conference on Sustainability in Geotechnical Engineering Practices and Related Urban Issues, Mumbai, India, Published, KEYNOTE LECTURE, 2016.
- Katti, Dinesh, Sharma, Anurag and Katti, Kalpana, "Modeling of Nanocomposite Scaffolds and Interfacial Behavior During Tissue Regeneration and Scaffold Degradation: A Multiscale Mechanics Approach" TMS 2017, San Diego, CA, 2017.
- Katti, Kalpana, "Applications of FTIR Spectroscopy in Flow and Swelling Behavior of Smectite Clays" International Geotechnical Engineering Conference on Sustainability in Geotechnical Engineering Practices and Related Urban Issues, Mumbai, India, Published, KEYNOTE LECTURE, 2016.
- Liu, Z., Song, Z., and Yi, H. "Optimal deployment of dynamic wireless charging facilities for an electric bus system." The Transportation Research Board (TRB) 96th Annual Meeting, Washington DC, January 8–12, 2017.
- Marshall, W. and Ferenchak, N. The Relative (In)effectiveness of Bicycle Sharrows on Safety Outcomes. University Transportation Center Spotlight Conference on Pedestrian and Bicycle Safety, Washington, DC; December 2016.
- McAndrews, Carolyn. (2016). “Transportation and Land Use as Social Determinants of Health.” Planning for a More Sustainable Future: Symposium on the Integration of Transportation, Land Use, and Environmental Planning for Equity, Economic Development, and a Healthy Environment. Berkeley, CA, Oct. 2016.
- Mingo, M., Tazarv, M., and Wehbe, N. "Development of an Alternative to the Double Tee Bridge System – Precast Girders." South Dakota Department of Transportation, Dec. 06, 2016.
- Mohamed Ahmed, Sherif Gaweesh, Thomas Peel, Md Julfiker Hossain, and Sadia Sharmin. "Implementation of the Highway Safety Manual 2010 - Part C and D: Regional Considerations of the Rocky Mountains and Plain Regions", Highway Safety Management System, WYDOT, January 19, 2017.
- Okok M.A., Saha. P., and Ksaibati, K. “Developing Performance Models for Gravel Roads to Evaluate the Cost-Effectiveness of using Dust Chemical Treatments.” Transportation Research Board Meeting, Washington D.C., 2017.
- Piatkowski, D., Marshall, W., and Johnson, A. Bicycle backlash: A mixed-methods examination of aggression toward bicyclists. Association of Collegiate Schools of Planning Annual Conference; Portland, OR; November 2016.
- Powelson, Phillip and Barr, P.J. "Prestress Losses and Temperature Effect on the Ridgeline High School Bridge". Nibley City Mayor. December. 2017.
- Tazarv, M., Khazaie, M. "Methodology for Load Rating Double-Tee Bridge," South Dakota Department of Transportation, Jan. 31, 2017.

- Terrill, T. and Ksaibati, K;" Investigating Challenges Affecting the 4Es of Transportation Safety on the Fort Peck Reservation"; Transportation Research Board Meeting, Washington D.C., 2017.
- Terrill, T. and Ksaibati, K;" Technology Challenges within Transportation Safety Among Several Indian Reservations"; Annual National Tribal Transportation Conference, Anaheim, CA, 2016.
- Terrill, T. and Ksaibati, K;" Technology Transfer to Improve the Safety of the State Highway System on the Wind River Indian Reservation"; Annual National Tribal Transportation Conference, Anaheim, CA, 2016.
- Yi, H., Song, Z., and Liu, Z. "Highway Drainage Grate Detection and Recognition Based on Aerial Image Processing." The Transportation Research Board (TRB) 96th Annual Meeting, Washington DC, January 8–12, 2017.

v. Other Items Produced During this Period

- McAndrews, C. (2016). Transportation and Land Use as Social Determinants of Health: The Case of Arterial Roads. Under review.
- Rosenlieb, Evan, Carolyn McAndrews, Wesley Marshall, Austin Troy. (2016). "Urban Development Patterns and Exposure to Hazardous and Protective Traffic Environments." Under review.

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/

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?

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

Twelve principal investigators, faculty, and administrators participating in MPC projects at **Colorado State University** are: Christopher Bareither, Paul Heyliger, John W. van de Lindt, Bolivar Senior, Rebecca Atadero, Mehmet Ozbek, Suren Chen, Jeffrey D. Niemann, Hussam Mahmoud, Kelly Strong, Joseph Scalia and Scott Glick. In addition, fifteen students are working on MPC research projects at **Colorado State University**: Doctorate Students –Guangyang Hou, Luke Chen, Yufen Zhou, Chao Jiang; Masters Students – Kristen Peterson, Kayla Moden Taylor Ray, David Turner, Almotasem Maamon, Kelsey Czyzyk, Aliena Debelak, Avi Sharma, Xin Huang, Zana Taher and Trai Nguyen.

Eight principal investigators, faculty, and administrators participating in MPC projects at **North Dakota State University** are: Bruce J. Rafert, Raj Bridgelall, Brenda Lantz, Pan Lu, Denver Tolliver, Zhibin Lin, Dinesh Katti, and Kalpana Katti. In addition, twenty-four students are working on MPC projects at **North Dakota State University**: Bhavana Bakare, Leonard Chia, Christopher Dehaan, Neeraj Dhingra, Kenechukwa Ezekwem, Kathryn Ferguson, Fesseha Gebremikael, Mingwei Guo, Seyed Ali Haji Esmaeili, Md Daulat Hossain, Luke Holt, Chijioke Ifepe, Fecri Karanki, Poyraz Kayabas, Amin Keramati, Narendra Malalgoda, Dilip Mistry, Yong Shin Park, Ali Rahim Taleqani, Jinat Rehana, Yuan Xu, Fangzheng Yuan, Zijan Zheng, and Asif Arshid

Eleven principal investigators, faculty, and administrators participating in MPC projects at **South Dakota State University** are: Allen L. Jones, Guanghui Hua, Christopher Schmit, Kyungnan Min, Nadim Wehbe, Mostafa Tazarv, Junwon Seo, Mostafa Tazarv, Jonathan Wood, Rouzbeh Ghabchi, and Aaron Breyfogle. In addition, fifteen students are working in MPC research projects at **South Dakota State University**: Masters Students - Ghaem Hooshyari, Peng Dai, Gregory Hansen, Lucas Bohn, Michael Mingo, Zachary Carnahan, Eduardo Torres, William Augustus Schaffer, Abdullah Al Hashib, Puskar Kumar Duhal, Shaohu Zhang Buddhika Prasad, and Mohammad Khazaei; Undergraduate Students - Jason Weber and Sara Schoening.

Nine principal investigators, faculty, and administrators participating in MPC projects at the **University of Colorado Denver** are: Wesley Marshall, Carolyn McAndrews, Bruce Janson, Jimmy Kim, Austin Troy, Matthew Cross, Carolyn McAndrews, Yail Jimmy Kim, and Farnoush Banaei-Kashani. In addition, ten students are working on MPC research projects at the **University of Colorado Denver**: Doctorate Students - Nick Ferenchak, Ibrahim Bumadian, Yaneev Golombek, Alejandro Henao, Abdullah Alajmi, Rob Fitzgerald; Masters Students – Ahmed Ibrahim, Nick Coppola, Rosenlieb E, and Yifeo Chai.

One principal investigator, faculty, and administrators participating in MPC projects at the **University of Denver is**: Patrick Sherry. In addition, 2 students are working on MPC research projects at the **University of Denver**: Masters Students - Jessica Mantia and Clare Jinzhao Zhao.

Fourteen principal investigators, faculty, and administrators participating in MPC projects at the **University of Utah** are: Richard J. Porter, Milan Zlatkovic, Tiffany Hortin, Cathy Liu, David Sanbonmatsu, David Strayer, Joel Cooper, Pedro Romero, Amanda Bordelon, Chris P. Pantelides, Juan Medina, and Brendan Duffy. In addition, twenty-four students are working on MPC research projects at the **University of Utah**: Doctorate Students - Ivana Tasic, Jeff Taylor, Kiavash Fayyaz, Arwen Behrends, Yu Song, Catalina Arboleda, Joel Parks, MJ Ameli, Anurag Upadhyay, Ruoyang Wu, Min Ook Kim, Anusha Musunuru, Zhuo Chen, and M. Scott Shea; Masters Students - Jem Locquaio, Daniel Sudbury, Yang Li, Lingkun Li, James Holt, Martin Dinsmore, Siddartha Rayaprolu, , Ryan Betz, Ariel Froerer, Daniel Sudbury, Joseph Herkimer, Kyle Strayer, Sean Strayer, and Donald Godfrey.

Eight principal investigators, faculty, and administrators participating in MPC projects at the **University of Wyoming** are: Khaled Ksaibati, Bart Evans, Mohamed Ahmed, Rhonda Young, Dennis Trusty, Kam

Ng, Promothes Saha, and Milan Zlatkovic. In addition, thirteen students are working on MPC research projects at the **University of Wyoming**: Masters Students - Chris Chamberlin, Mohammed Okok, Rameshwor Chalise, Sandeep Thapa, Trenna Terrell, Melake Brhanemeskel, Waleed Mohammed Abd Allah Al Eadelat, Sadia Sharmin, Muhammad Tahmidul Haq, Sherif Gaweesh, Thomas Peel and Dawit Mebrahtom; Undergraduate Student - Nicole Peterson.

Twelve principal investigators, faculty, and administrators participating in MPC projects at **Utah State University** are: Anthony Chen, Xiangdong Xu, Sarawut Jansuwan, Jim Bay, John Rice, Paul Barr, Marv Halling, Ziqi Song, and Paul J. Barr. In addition, ten students are working on MPC research projects at **Utah State University**: Doctorate Students – Yi He, Zhaocai Liu, Yi He, Seungkyu Ryu, and Sohrab Mamdoohi; Masters Students - Nirdosh Gaire, Jen Ostrowski, Phillip Powelson, Ethan Pickett, and Holly Llyod.

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. Ajou University, Korea
2. Campbell County Road and Bridge Department
3. Campbell's Scientific
4. Colorado Department of Transportation
5. Consideration of the Rocky Mountains and Plain Regions
6. Converse County Road and Bridge Department
7. Crook County Road and Bridge Department
8. Denver Regional Transportation District
9. Digital Glove Foundation
10. East Dakota Water Development District
11. FHWA, Wyoming Division.
12. Inberg Miller Engineers, Casper WY
13. James River Water Development District
14. Key Laboratory of Road and Traffic Engineering, Tongji University, Shanghai, China.
15. Lincoln County Road and Bridge Department
16. Michigan Technological Research Institute
17. National Institute of Development Administration (NIDA), Bangkok, Thailand.
18. New Jersey City University
19. Nibble City (Utah), Campbell Scientific, Bridge Diagnostic Inc. (BDI)
20. North Carolina Pedestrian and Bicycle Information Center
21. North Dakota Department of Transportation
22. Penn State University
23. Roaring Fork Transportation Authority
24. Sisseton Wahpeton Oyate Reservation
25. South Dakota Department of Environment and Natural Resources
26. South Dakota Department of Transportation
27. Standing Rock Sioux Tribe Indian Reservation
28. Teton County Road and Bridge Department
29. University of Colorado Boulder
30. University of Nebraska-Lincoln
31. Utah Department of Transportation

32. Virginia Tech
33. Wisconsin Department of Transportation
34. Wyoming Technology Transfer Center
35. Yankton Sioux Tribe

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/ Expected Impacts

a. Impacts

North Dakota State University: Students supported by UTC funds here at North Dakota State University have gone onto very successful positions with fortune 500 companies, academia, federal, state, and local transportation agencies. Students continue to excel while building transportation skills that will enhance the transportation workforce now into the future. With the support of UTC funds, NDSU researchers have been able to focus on tribal needs throughout the state, infrastructure assessment, asset management, bridge strength analysis, and technology transfer. These efforts will continue to develop the skills and knowledge of the transportation workforce to face the challenges of the 21st century. NDSU researchers continue to move into sensor networks, smart city applications, and addressing the needs and challenges of public transportation in rural and metropolitan areas. Research findings are being disseminated through webinars, transportation learning network, newsletters, social media, and email blasts.

Wyoming: The MPC projects provided excellent learning opportunities to students at the graduate level as well as the undergraduate levels. Several students graduated from the program. The UW research projects helped in implementing PMS on county paved roads. In addition, the tribal safety studies helped several tribes in the region implement a safety improvement program.

Colorado State University:
Several graduate students working on MPC projects at CSU have earned their degrees and are now part of the civil engineering and transportation workforce. The journal paper on using BIM for tracking bridge structural condition has been a frequently downloaded paper for the Journal of Bridge Engineering, which suggests that it is having an impact on the research community.

South Dakota State University: The projects provided research and learning experience for 15 graduate students. Thirty-one engineers learned about a new detailing for longitudinal joints in double tee girders which will lead to the design of better and long lasting bridges on county roads in transportation Region 8. SDDOT will achieve efficiency with construction quality control of compaction activities. Potential reuse of MIEX brine for ice control at SDDOT which could lead to the implementation of beneficial reuse of this waste stream at SDDOT. Development of standard SCC mix design and new recommendations for prestressed SCC mix design.

University of Colorado Denver: For the Civil Engineering discipline, the MPC associated research and education efforts have been instrumental in helping grow our transportation program and establish a solid reputation. We have once again broadened our reach and brought in researchers from not only Urban Planning but also Geography, GIS, Computer Science, and Construction Engineering. Our efforts are helping build a transportation workforce with both technical skill and expertise as well as the ability to understand the larger context of their work. Our affiliation with the MPC and the UTC program is the improving national reputation of CU Denver's research and education work within the field of

transportation. This program period continues our successes with regard to publications, presentations, and popular press articles related to these efforts. The research activities address three important national issues - infrastructure deterioration, safety, and sustainability. Our educational program is also helping building better students in areas of national need.

University of Utah: The program already shows substantial support in the area of workforce development, with 24 undergraduate and graduate students heavily involved in the research projects.

Utah State University: We have a multi-disciplinary approach with transportation, structures and geotechnical engineering on these projects so the research impact is broad in terms of scope within civil engineering. Each project has at least one graduate student (at the MS or PhD level) and many also involve undergraduate students. We also hope and anticipate that the technology or research findings will be distributed through reports, conferences and journal publications.

b. Expected Impacts

North Dakota State University: NDSU transportation and logistics students will continue to infiltrate the transportation workforce bringing excellent data analysis and assessment skills to the organizations. Students continue to present and participate in industry workshops and conferences, and seek top level transportation positions around the world. NDSU researchers continue to disseminate the results of ongoing projects and research to transportation professionals around the state. Expected outcomes will continue to be shared through technology transfer opportunities, webinars, and social media.

Wyoming: The MPC funding will continue supporting graduate students who will join the transportation workforce after graduation. The research studies conducted will facilitate selecting maintenance and rehabilitation strategies on local paved roads, reduce crashes on tribal roads, enhance the effectiveness of air quality programs such as the CMAQ program, and reduce truck related crashes in rural areas.

Colorado State University: In addition to the educational impacts that are currently being realized, projects in the CSU program are expected to help engineering designers and decision makers make more effective choices in a variety of transportation related fields including design for resilience, planning, and asset maintenance and management.

South Dakota State University: Development of a low-maintenance, low-cost mixed-media filtration system for storm water treatment. This filtration system can be used to reduce the impact of highway runoff on surface waters and improve the environmental sustainability of transportation. Transform waste streams that are now environmentally and financially expensive to discard into valuable materials for transportation-related applications and improve the performance of ice and dust control on roadways. Reuse of waste streams for transportation applications in South Dakota. Development of new rehabilitation techniques for bridge girder joints. Extending the useful life and eliminating the need for replacement of many existing bridges on local roads. Final reports and digital brochures will be prepared to disseminate the findings to DOTs, bridge engineers, local governments, and bridge owners.

University of Colorado Denver: Expanding our portfolio of work has continued to help grow the UTC program at CU Denver. More importantly, the work we are doing is helping develop the next generation of transportation professionals and doing so in a way that will benefit society in many different fashions. These projects will be of particular benefit to those looking to provide and promote a safer and more resilient transportation system.

University of Utah: Results of the ongoing projects are expected to be implemented in state

transportation and transit agency policies, procedures, and practices related to road and transit infrastructure planning, design, construction, and operations. Example expected broader project outcomes include: the ability to more thoroughly assess innovative intersection/interchange designs; increase transit ridership through more accessible stations, improve infrastructure resiliency to earthquakes, gain greater insights to distracted driving behavior, extend pavement life, quantify benefits of transit signal priority implementations, and improve air quality. Expected outcomes will also include training of the next generation of the transportation workforce in these areas, by working with undergraduate and graduate students in the research and by incorporating results into existing and future transportation courses at the University of Utah. Chances of implementation and technology transfer have been maximized by including transportation agency practitioners in the formulation and review of research problem statements. Practitioners are also providing feedback to the research teams on a regular basis through technical advisory committees formed for each project.

Utah State University: The individual projects have addressed the specific impacts for their projects. From an overall prospective, the UTC funding is creating opportunities. These opportunities are within the university as well as with agencies outside the university. They are providing students with unique transportation related research that they would not have otherwise and giving them connections for potential jobs and mentoring after school. There is long term impacts of a growth in the transportation workforce through projects that are exciting for these students.

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