

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

**Grant No. 69A3552348308
Center for Transformative Infrastructure Preservation and Sustainability (CTIPS)
North Dakota State University
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**North Dakota State University
Upper Great Plains Transportation Institute
NDSU Dept. 2880, P.O. Box 6050, Fargo, ND 58108-6050**

Grant period: December 1, 2023 – November 30, 2029

**Reporting Period End Date: March 31, 2024
SAPR#1**

Denver D. Tolliver



**Director, Center for Transformative Infrastructure Preservation and Sustainability
North Dakota State University**

1. ACCOMPLISHMENTS: What was done? What was learned?

a. What are the major goals of the program?

The goals of the Center for Transformative Infrastructure Preservation and Sustainability (CTIPS) aims to revolutionize the preservation of existing transportation systems through the integration of advanced sensing technologies and automation in data collection and analysis. Our research aligns with the statutory priority area of Preserving the Existing Transportation System and USDOT’s non-exclusive candidate topic area of “asset management – techniques and cost-effective inspection, preservation, and maintenance practices.” In addition, CTIPS’s research will address systemic equity issues in the region, especially inequities stemming from the relatively poor quality of Tribal and rural roads. Infrastructure Preservation through Autonomous Inspection and Artificial Intelligence and Infrastructure Preservation through Pavement Resilience and Bridge Management form the two focus areas of the research portfolio. Overall, the proposed research portfolio represents a transformative approach to preserving the existing transportation system. By integrating advanced technologies, automation, IoT, and AI, the research will revolutionize infrastructure condition monitoring and assessment, leading to safer, more reliable, and more sustainable transportation infrastructure. The research aligns with the statutory priority of Preserving the Existing Transportation System and with USDOT’s goal of innovation by expanding current practices and introducing transformative technologies into the transportation sector. By setting a new benchmark for the industry, the expected impacts of CTIPS’s research will benefit the transportation system and its users.

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) support the statutory priority area of Preserving the Existing Transportation System and USDOT’s research priorities of Asset Management and Resilience to include techniques and cost-effective inspection, preservation, and maintenance practices and (2) leverage UTC funds with matching funds from state and local governments and private industry. The chief operational goal is a comprehensive approach to address the aforementioned research priorities and systemic equity issues. The proposal is targeted at a future vision of system preservation and asset management. and other supporting objectives while addressing critical issues of the region and stakeholder groups.

b. What was accomplished under these goals?

i. Project Selection

Research projects selection for the 2023-2024 contract year are undergoing a peer review process for possible selection. The projects reflect substantial input and matching resources from state departments of transportation, MPOs in the region, and industry. 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 Strength and Global Competitiveness, Equity, Climate and Sustainability, and Transformation and other supporting objectives.

ii. Programmatic Milestones

In addition to the programmatic milestones described below, several milestones embedded within individual projects will be achieved as projects get selected. Most of the research projects call for literature reviews. The

literature reviews for those projects with the earliest starts are being completed. 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

Milestone Event	Description	Start Date	End Date
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 website.	12/01/2023	03/01/2024
Call for Proposals	The solicitation of proposals occurred on each university campus, using proposal guidelines developed by the director.	12/01/2023	11/30/2025
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.	12/01/2023	12/01/2024
Center Directory	A directory of key center personnel was completed and published on the center’s website.	12/01/2023	02/02/2024
Center Website	The CTIPS website was updated and is fully functional for the current grant period	12/01/2023	02/02/2024
CTIPS Kick-Off Meeting	The director and administrative staff attended the UTC/CUTC meeting at TRB and received guidance from RITA regarding the forthcoming grant.	04/09/2023	04/09/2024
Peer Review of Proposals	All project proposals were subjected to external and internal peer review.	03/01/2024	11/30/2025

<p>Primary Focus</p>	<p>Our research aligns with the statutory priority area of Preserving the Existing Transportation System and USDOT’s non-exclusive candidate topic area of “asset management – techniques and cost-effective inspection, preservation, and maintenance practices.” In addition, CTIPS’s research will address systemic equity issues in the region, especially inequities stemming from the relatively poor quality of Tribal and rural roads.</p> <p>Infrastructure Preservation through Autonomous Inspection and Artificial Intelligence and Infrastructure Preservation through Pavement Resilience and Bridge Management form the two focus areas of the research portfolio. The research aligns with the statutory priority of Preserving the Existing Transportation System and with USDOT’s goal of innovation by expanding current practices and introducing transformative technologies into the transportation sector.</p> <p style="text-align: center;">USDOT Strategic Goals:</p> <ul style="list-style-type: none"> • Safety – Make our transportation system safer for all people. Advance a future without transportation-related serious injuries and fatalities. • Economic Strength and Global Competitiveness – Grow an inclusive and sustainable economy. Invest in our transportation system to provide American workers and businesses reliable and efficient access to resources, markets, and good-paying jobs. • Equity – Reduce inequities across our transportation systems and the communities they affect. Support and engage people and communities to promote safe, affordable, accessible, and multimodal access to opportunities and services while reducing transportation-related disparities, adverse community impacts, and health effects. • Climate and Sustainability – Tackle the climate crisis by ensuring that transportation plays a central role in the solution. Substantially reduce greenhouse gas emissions and transportation-related pollution and build more resilient and sustainable transportation systems to benefit and protect communities. • Transformation – Design for the future. Invest in purpose-driven research and innovation to meet the challenges of the present and modernize a transportation system of the future that serves everyone today, and in the decades to come. 	<p>12/01/2023</p>	<p>11/30/2030</p>
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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 of funds.	04/01/2024	11/30/2025
Posting of Projects	The selected projects will be posted on the CTIPS website and added to the Research in Progress database.	04/01/2024	11/30/2025
Site Visit	A site visit to all CTIPS Universities will be conducted annually.	12/01/2023	11/30/2030
UTC/CUTC Summer Meeting	The center director and other key staff will attend the 2024 summer UTC/CUTC meeting in South Padre Island, Texas.	06/10/2024	06/13/2024
UTC/CUTC Winter Meeting	The director and administrative staff will attend the UTC/CUTC meeting at TRB and received guidance from RITA regarding the forthcoming grant.	01/05/2025	01/09/2025

Table 2: CTIPS Research Proposal Guidelines

Title	Provide a title that is descriptive of the project and includes key terms. Titles should be written in title case and limited to 20 words.
Universities	List CTIPS universities involved in the proposed project. It is highly encouraged to collaborate with other universities in the consortium (CTIPS) on project proposals.
Principal Investigators	If the project is a multi-university proposal, list a principal investigator from each university. For each principal investigator, include name, ORCID number, university affiliation, title, email address, and phone number.
Research Needs	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.
Research Objectives	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.
Research Methods	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.
Relevance to Strategic Goals	Select one (1) USDOT strategic goal (Safety; Economic Strength and Global Competitiveness; Equity; Climate and Sustainability; Transformation) that is primarily addressed by the proposed project. You also have the option to select one (1) secondary strategic goal related to the project. Describe how the project and expected outcomes/impacts relate to the selected goal(s). Also, describe how the project engages in breakthrough, advanced, or transformative research.
Educational Benefits	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. If not applicable, state Not Applicable below Educational Benefits.

Outputs through Technology Transfer	<p>Describe the results of the work performed including new research, technology or process that the project will produce. Outputs could include processes and methods; data, hardware, software, and databases; invention disclosures, patent filings, inventions, etc. Also describe any new partnerships outside of CTIPS that will be established through the project.</p> <p>Provide a technology transfer (T2) plan for your project. Describe the process you will use for transferring your findings/outputs to other researchers, professionals and practitioners. The goal should be further development, commercialization, and practical applications from 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.</p> <p>Technology transfer may occur through (but is not limited to): peer-reviewed research reports, peer-reviewed journal articles, peer-reviewed conference papers, newsletters, workshops, webinars, web pages, social media, YouTube clips, seminars, the CTIPS website, your university/department website, and other distance learning events.</p> <p>CTIPS T2 programs will primarily utilize three forms of engaging clients and disseminating research results: (1) virtual delivery via live webinars, recorded online modules, videoconferences; (2) in-person seminars or presentations; (3) conferences or workshops that organize related T2 topics into day-long or multi-day events.</p> <p>Please list how you intend to fulfill this requirement and remember to report your technology transfer activities in the SAPR (Semi-Annual Progress Report) for this project.</p>
Expected Outcomes and Impacts	<p>Provide a description of the expected outcomes in terms of potential findings and impacts, including advances in modeling, practices, and procedures and implications for future research. Describe the application of the output and any changes this output has or will make to the transportation system, or its regulatory, legislative, or policy framework, including a description of products or patents, or a change in practice, or instances of research results informing policy decisions. Discuss how this research output will positively impact the transportation system in terms of safety, reliability, durability, costs, etc. Describe any tangible products beyond the research report, including prototype software, equipment, guidebooks, or instructional manuals that may emanate from the project. Journal papers, other publications, and presentations are not sufficient to show impact.</p>
Work Plan	<p>Provide a description of the major tasks or steps in the project, along with an expected timeline. The tasks should be numbered with 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 (TLN) and/or plans to collaborate with an LTAP or TTAP center (if appropriate). If the research is basic</p>

	in nature, other dissemination methods may be substituted for the TLN, LTAP, or TTAP distribution channels.
Project Cost	List the amount of CTIPS 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. CTIPS projects require at least a dollar-for-dollar match. Note that 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 “non-federal funds” is based on the original source of funds.
Potential Peer Reviewers	<p>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, organization, and email address. Peer reviewers cannot have conflicts of interests, such as possibly benefiting, personally or professionally, from the proposed project. Peer reviewers may include professionals at federal, state, metropolitan, or local agencies, as well as university and private-sector researchers. At least three completed reviews are required for a proposal to move forward in the assessment process. Consequently, submitting more than three names may expedite the time frame for approval in the event of one or more nonresponsive reviewers.</p> <p>For select projects (e.g., those conducted for your state’s DOT), that have already been peer-reviewed (by DOT personnel), indicate the organization/committee that peer-reviewed the proposal. Include organization name, committee name, and provide information (name, title, and email) for at least 3 people who performed the peer review from that committee.</p>
Data Management Plan	The data management plan for CTIPS is posted online (view data management plan). The plan describes our strategies for developing, describing, and archiving digital data sets resulting from DOT-funded research to facilitate public access and sharing of data resources. If your project requires an additional or a different data management plan (including those from other funders), you will be asked to upload your plan.
TRB Keywords	List applicable TRB keywords
References	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 2023 & Spring 2024 are listed below, organized by major subject area. In some cases, courses with the same titles were offered at more than one CTIPS university. In these cases, the number of courses offered is shown in parenthesis.

Engineering & Design Courses:

- CE 3500 Highway Engineering
- CE 3600 Geotechnical Engineering
- CE 4510 Pavement Design
- CE 5585 Pavement Management System
- CE 5670 Rock Mechanics
- CEE 106/106L Elementary Surveying
- CEE 3020 Structural Analysis

- CEE 3080 Design of Reinforced Concrete
- CEE 311/311L Structural Materials Lab
- CEE 443/543 Matrix Analysis of Structures
- CEE 456 Adv Geotechnical Engineering
- CEE 456 Concrete Theory & Design
- CEE 467 Urban Transportation Engineering Design
- CEE 5070 Design of Steel Structures
- CEE 5190 GIS Civil Engineers
- CEE 5230/6230 Geometric Highway Design
- CEE 6040 Structural Reliability
- CEE 765 Pavement Design
- CEE 792 Advanced Topics in RC Design
- CIVE 508 Bridge Engineering
- CON 370 Asphalt Pavement Materials & Construction
- CVEEN 3210 Structural Loads and Analysis
- CVEEN 3310 Geotechnical Engineering
- CVEEN 3410 Hydraulics
- CVEEN 3510 Civil Engineering Materials
- CVEEN 3520 Transportation Engineering
- CVEEN 3610 Environmental Engineering I
- CVEEN 4221 Concrete Design I
- CVEEN 4222 Steel Design I
- CVEEN 5305 Introduction to Foundation Engineering
- CVEEN 5410 Hydrology
- CVEEN 5740 Horizontal Construction
- CVEEN 5780 Façade Engineering I
- CVEEN 6210 Structural Analysis II
- CVEEN 6220 Concrete Design II
- CVEEN 6240 Masonry/Timber Design
- CVEEN 6250 Structural Dynamics
- CVEEN 6510 Highway Design
- CVEEN 6530 Quantitative Methods in Transportation Operations
- CVEEN 6560 Transportation Planning
- CVEEN 6570 Pavement Design
- CVEEN 7225 Prestressed Concrete
- CVEEN 7250 Structural Earthquake Engineering
- CVEEN 7260 Seismic Rehabilitation
- CVEEN 7545 Traffic Operation Analysis
- CVEEN 7920 Joint Rock Mechanics and Stability
- CVEN 3602 Transportation Engineering
- CVEN 4427 Storm Water System Design
- CVEN 4575 Structural Steel Design
- CVEN 4585 Reinforced Concrete Design
- CVEN 4602 Advanced Highway Design
- CVEN 4612 Traffic Impact Assessment
- CVEN 4650 Urban Street Design

- CVEN 5111 Structural Dynamics
- CVEN 5427 Storm Water System Design
- CVEN 5602 Advanced Street & Highway Design
- CVEN 5612 Traffic Impact Assessment
- CVEN 5650 Urban Street Design
- URPL 5050 Urban Development
- URPL 6350 City Design Fundamentals

Freight & Logistics Courses:

- SCM 320 Integrated Supply Chain Management
- SCM 325 Managing Inventory and Materials
- SCM 330 Supply Chain Analysis and Analytics
- SCM 425 Procurement & Sourcing
- SCM 450 Supplier & Customer Relations
- SCM 453 Financing the Supply Chain
- SCM 460 Production & Operations Management
- SCM 462 Modeling the Supply Chain
- SCM 465 International Supply Chain Management
- TL 731 Supply Chain Decision Analysis
- TL 751 Supply Chain Transportation Security
- TL 787 Transportation and Distribution
- TRAN 4010 Introduction to Transportation Systems
- TRAN 4080 Transportation Law and Regulation: Domestic and International
- TRAN 4100 Fundamentals of Supply Chain Management
- TRAN 4120 Fundamentals of Supply Chain Execution
- TRAN 4130 Supply Chain Management Practicum
- TRAN 4140 Supply Chain Technology and Systems
- TRAN 4150 Supply Chain Finance
- TRAN 4160 Analytic Methods for SCM
- TRAN 4170 Industrial Engineering and Operations Management
- TRAN 4330 Principles of Supply Chain: Management and Technologies
- TRAN 4850 Transportation & Supply Chain Strategies
- TRAN 4860 Senior Management: Executives Issues Seminars (New Course)

Planning & Environment Courses:

- CEE 225 Principle Environmental Sci & Eng.
- CEE 422 Environmental Engineer Instrumentation
- CEE 424 Industrial Waste Treatment
- CEE 5240 Urban/Regional Transportation Planning
- CEE 726 Phys/Chem Principal Environ Engr
- CVEEN 5500 Sustainable Materials
- CVEEN 6560 Transportation Planning
- TRAN 4020 Transportation Economics
- TRAN 4060 Transportation Marketing and Sales Tools
- TRAN 4110 Fundamentals of SC Planning
- TRAN 4180 Sustainability and Supply Chain Management

- TRAN 4190 Import Export Supply Chain Management
- TRAN 4200 Capstone Project in SCM
- TRAN 4330 Principles of Supply Chain: Management and Technologies
- TRAN 4710 Transportation Finance
- URPL 5000 Planning History and Theory
- URPL 5010 Planning Methods
- URPL 5020 Planning Law and Institutions
- URPL 5030 Planning Practice and Technology
- URPL 5040 Urban Sustainability
- URPL 6200 Land Development Regulations
- URPL 6205 Plan Making
- URPL 6210 Planning Engagement
- URPL 6250 GIS for Urban Planning
- URPL 6265 Visualization for Planning
- URPL 6355 Urban Redevelopment Strategies
- URPL 6365 Parks and Public Spaces
- URPL 6397 Design Policy, Process, and Regulation
- URPL 6399 Sustainable Urban Infrastructure
- URPL 6400 Community Development
- URPL 6500 Environmental Planning/Management
- URPL 6555 Transportation, Land Use, and the Environment
- URPL 6599 Sustainable Transportation Systems
- URPL 6600 Regional Growth and Equity
- URPL 6615 Small Town, Rural, and Tourism Planning
- URPL 6645 Disaster/Climate Change Planning
- URPL 6650 International Development Planning: Theory and Practice

Public Transportation Courses:

- CEE 3210 Intro to Transportation Engineering
- CVEEN 5920 Smart City & Infrastructure
- URPL 6560 Transit, Pedestrian, and Bicycle Planning

Traffic & Operations Courses:

- CE 4565 Traffic Simulation
- CE 5565 Traffic Simulation
- CEE 467/567 Urban Transportation Engineering Design
- CEE 5220/6220 Traffic Engineering
- CVEEN 3520 Transportation Engineering
- CVEEN 6530 Quantitative Methods in Transportation Operations
- CVEEN 7545 Traffic Operations and Analysis

Transportation Safety Courses:

- CE 5700 Construction Safety
- CVEEN 5740 Horizontal Construction
- CVEEN 6250 Structural Dynamics
- CVEEN 6920 Infrastructure Sensing and Health Monitoring
- CVEEN 7260 Seismic Rehabilitation

- CVEEN 7920 Joint Rock Mechanics and Stability
- CVEN 5611 Transportation Engineering Statistics
- CVEN 5662 Transportation System Safety

Transportation Systems Courses:

- CIVE 303 Infrastructure and Transportation Systems
- CVEEN 7920 Data Science and Machine Learning
- CVEN 5633 Sustainable Transportation Systems
- TRAN 4010 Introduction to Transportation Systems
- TRAN 4050 Intermodal Transportation Systems
- TRAN 4080 Transportation Law and Regulation: Domestic and International
- TRAN 4320 Transportation Management, Leadership, and Values
- TRAN 4400 Excellence in Leadership for Transportation
- TRAN 4410 Executive Management Practices in Transportation Organizations
- TRAN 4420 Leading with Integrity
- TRAN 4460 Financial & Managerial Accounting in Transportation (New Course)
- TRAN 4800 Analysis of Freight & Passenger Transportation Business Segments
- TRAN 4840 Multimodal Passenger-Freight Transportation Systems
- TRAN 4850 International Transportation & Supply Chain Mgmt. Analysis (New Course)
- URPL 6230 Urban Data Science

Altogether, 153 transportation and transportation-related courses have been offered this reporting period, for a total of 153 total transportation courses offered this grant period. In addition to the courses listed above, foundational courses in engineering materials, mechanics, structural analysis, and geotechnical engineering were offered at most CTIPS universities.

iv. Workforce Development Accomplishments

Training: A list of 151 training events were provided for transportation professionals during this reporting period are presented below. Dates following training, are development dates.

- 6 Keys to Presentation Success (Jan 28, 2021)
- 6 Part Project Scheduling Series: #1 Planning for Success (Jan 10, 2023)
- 6 Part Project Scheduling Series: #2 The Basics (Jan 24, 2023)
- 6 Part Project Scheduling Series: #3 Submitting, Reviewing & Approving (Jan 31, 2023)
- 6 Part Project Scheduling Series: #4 Updating (Feb 7, 2023)
- 6 Part Project Scheduling Series: #5 Analyzing Delay (Feb 14, 2023)
- 6 Part Project Scheduling Series: #6 Concurrency (Feb 21, 2023)
- A Comprehensive Approach to the Analysis of CPM Schedules to Measure Delays on Construction Projects (Feb 23, 2021)
- A Discussion on Cutting Edges and Systems (Mar 30, 2022)
- A Healthy Workplace Culture is the "Secret Sauce" for Success (Apr, 13, 2023)
- Accessible Sidewalks, Shared Use Paths and Street Crossings (Dec 15, 2021)
- ADA Ramp Design
- Aggregate Certification
- Applying ADA in Temporary Work Zones (Feb 12, 2020)
- Asphalt & Paving 101
- Asphalt Certification
- Asphalt Maintenance

- ATSSA Flagger Instructor Training
- ATSSA Traffic Control Supervisor - 2 day (4)
- ATSSA Traffic Control Technician (11)
- ATSSA Flagger Certification
- Autonomous Equipment: The Future of Construction (Mar 1, 2022)
- Autonomous Vehicle Strategies for Transportation Agencies (Oct 18, 2018)
- Avoiding Construction Contract Claims (Feb 9, 2021)
- Backhoe, Skid Steer, Mini Ex, Front End Loader, Motor Grader, Excavator
- Basics of a Good Road
- Blending Salt Brine (Part 4, Snow & Ice Series)
- Bridge Deck Preventative Maintenance Best Practices (Mar 29, 2023)
- Bridge Preservation Series - Part 1: Deck Preparation for Overlays
- Bridge Preservation Series - Part 1: Deck Preparation for Overlays (Mar 7, 2024)
- Bridge Preservation Series - Part 2: Rigid Cementitious Concrete Overlays
- Bridge Preservation Series - Part 3: Preservation of Structure Components
- Build America Overview/Guidance
- Building Information Modeling (BIM) for Infrastructure
- Challenging Conversations (Jan 5, 2022)
- Change - Is It Your Friend or Foe?
- Clean Water Act - Overview (Mar 3, 2022)
- Coaching and Counseling (Feb 7, 2018)
- Concrete Certification
- Confined Space Training (3)
- Construction Field Inspection/Admin
- Construction Negotiating (Mar 28, 2023)
- Contract Negotiating - Change Orders (Apr 16, 2020)
- Controlling Silica Dust: New Standards and Strategies for Compliance (Mar 11, 2020)
- Crack Sealing & Patching Techniques
- Critical Conversations (Mar 16, 2023)
- Culvert Design Concepts & Computer Workshop (Part 2 of 3)
- Culvert Inspections, Rehab & Failures (Part 3 of 3)
- Dealing Effectively with Conflict
- Designing, Building and Maintaining Compliant Curb Ramps (Feb 12, 2020)
- Deterioration and Repair of Concrete Pavements (Nov 21, 2019)
- Determining the Costs Associated with Delay (Mar 9, 2021)
- Documentation for Construction Damages
- Documentation for Construction Delays
- Eat That Frog - Increase Your Productivity (Feb 22, 2023)
- Effective Communication Skills for Engineers and Technicians (Apr 14, 2022)
- Emotional Intelligence: Foundation for Your Future - Part 1 (Jan 8, 2020)
- Emotional Intelligence: Foundation for Your Future - Part 2 (Jan 17, 2020)
- Emotional Intelligence: Foundation for Your Future - Part 3 (Jan 31, 2020)
- Engineering Ethics - A Pragmatic Approach (Apr 27, 2022)
- Engineering Ethics: Managing Cognitive Bias and Fallacious Reasoning (Mar 15, 2023)
- Ensuring Compliance with the Contracts Scheduling Specification (Feb 15, 2022)
- Enviroproofing Your Operations with Liquids (Part 1, Snow & Ice Series)

- Ethical Home Runs: Achieving a Real Corporate Culture Win During and After the Pandemic
- Ethics - A Practical Decision Approach
- Ethics is for Everyone! (Apr 16, 2020)
- Feedback (Mar 2, 2022)
- Fiberglass Rebar and Dowels - Durable, Light, Strong and Affordable Solutions (Oct 6, 2020)
- Geohazard Mitigation (Jan 6,2021)
- Geosynthetic Stabilized Subgrades and Bases (Dec 17, 2019)
- Getting Things Done
- Handling Differing Site Conditions (Mar 2, 2021)
- Heavy Equipment Operation (Hands On) - 2 day (20)
- High Performing Teams (Feb 23, 2023)
- How to Handle Difficult Customers
- Identifying and Quantifying Contractor Inefficiencies (Mar 30, 2021)
- Identifying Asphalt Roadway Fatigue and Treatments Pavement Management and Preservation
- Improving Project Communication: Within and Outside of the Project Team (Dec 7, 2022)
- Interpersonal Skills (2)
- Intro to Culvert Design & Basic Hydraulics (Part 1 of 3)
- It's Not About the Drones: Organizational Considerations for UAS (Jan 29, 2020)
- Job Safety Analysis (Oct 16, 2018)
- Lean Mental Models and Problem Solving: Turning Organizational Deficiency to Efficiency
- Local Road Safety Plans (Feb 18, 2020)
- Local Rural Intersection Conflict Warning (Jan 28, 2020)
- Longitudinal Joint Construction (Dec 15, 2022)
- Maintaining A Safer Roadway (Feb 18, 2020)
- Managing the Design Process: Keeping on Schedule, Within Budget and Selecting the Right Resources - Day 1 of 3 (Oct 28, 2020)
- Mastering the Art of Highly Effective Human-Center Meetings
- Mechanical Snow Removal (Part 2, Snow & Ice Series)
- Navigating Difficult Conversations
- Nighttime Visibility for Safety
- Noxious Weed Identification and Management in Public Rights-of-Way (Apr 22, 2020)
- Off-The-Job Safety Innovation for Employees (Jan 12, 2021)
- OSHA 10 - Workplace, Equipment & Jobsite Safety - 2 day
- Pavement Surface/Vehicle Interaction (Apr 15, 2020)
- Paving Equipment Innovations: What's Available, What's Coming! (Mar 23, 2023)
- PCC Joint Sealing and Resealing Methods (Dec 12, 2019)
- Pipe Repair Options (Feb 19, 2020)
- Preventing and Treating Asphalt Burns (Apr 3, 2020)
- Primal Safety: A Gut Level Approach (Apr 20, 2023)
- Project Engineer to Project Manager: Look Before You Leap (Mar 21, 2023)
- Public Speaking for Engineers: Plan, Design and Deliver a Great Presentation (Feb 26, 2020)
- Quality: What is it and how do we achieve it? (Apr 13, 2022)
- Quantifying Delays When the Schedule is Poor (Jan 25, 2022)
- Reducing Roadway Departure Crashes (Feb 11, 2020)
- Registered Storm Water Inspector (6)
- Reinforced Concrete: Corrosion and Corrosion Mitigation (Nov 14, 2019)

- Retention & Recruitment Roundtable
- Reviewing, Approving and Getting Contractors to Submit Good Project Schedules (Dec 2, 2020)
- Risk Management 101 - Personnel (Dec 9, 2020)
- Roadway Drainage
- Safety Inspection of In-Service Bridges - Pre-Season Tips and Advice (Nov 4, 2020)
- Skills for Resiliency (Feb 9, 2023)
- Slips, Trips and Falls (Nov 18, 2020)
- Slope Stability Analysis & Stabilization - Case Studies and State of the Practice (Apr 12, 2023)
- Smart Paving: Using Technology to Improve Quality (Mar 10, 2021)
- Snow & Ice Control Webinar Series: Hydraulic Control Systems (Oct 28, 2021)
- Snow & Ice Webinar Bonus: An Industry Update on Cutting Edges & Systems (Jan 12, 2024)
- Snow & Ice Webinar Part 1: Enviroproofing Your Operations with Liquids (Nov 7, 2023)
- Snow & Ice Webinar Part 2: Mechanical Snow Removal (Nov 17, 2023)
- Snow & Ice Webinar Part 3: Using Winter Weather Technology (Dec 1, 2023)
- Snow & Ice Webinar Part 4: Blending Salt Brine (Dec 8, 2023)
- Snow & Ice Webinar Part 5: Using Mobile Data to Guide Roadway Treatments (Dec 15, 2023)
- Snow & Ice: An Industry Update on Cutting Edges & Systems
- Strategic Workforce Development
- Strategic Workforce Development (Mar 6, 2024)
- Stress Mastery (Mar 29, 2022)
- Target Overlay Pavement Solutions (TOPS)
- The Art and Science of Communication (Nov 1, 2018)
- The First 3 Rules of Construction: DOCUMENT, DOCUMENT, DOCUMENT!
- The Rules of Contract Interpretation (Jan 11, 2022)
- Think Outside the Building - Innovating Your Future (Apr 26, 2022)
- Tractor Mower Operator Safety (TMOST)
- Tractor Mower Safety (Mar 18, 2021)
- Transferring Knowledge Before It Walks Out the Door
- Tree Trimming
- Understanding and Interpreting Construction Contracting (Apr 2, 2020)
- Using Chemicals in Winter Maintenance (Mar 23, 2022)
- Using Mobile Data to Guide Roadway Treatments (Part 5, Snow & Ice Series)
- Using Winter Weather Technology (Part 3, Snow & Ice Series)
- Vampires at Work: Handling Difficult People and Conflict (Oct 30, 2018)
- Welding Maintenance Basics, Safety and Repair Techniques - 2 day
- Wildlife & Roads: Challenges and Opportunities
- Winter Road Maintenance
- Work Life Balance
- Work Zone Safety
- Work Zone Safety for Short Term Projects
- Work Zone Safety Roundtable (Apr 25, 2023)
- Work Zone Safety: Controlling Speed and Mitigating Intrusions in Work Zones (Nov 2, 2022)
- Writing a Complete, Correct, Clear, Concise and Consistent Specification (Jan 18, 2022)

v. Selected CTIPS projects

The following CTIPS projects have been peer reviewed and selection for implementation:

1. CTIPS-001: Advanced Air Mobility to Enhance Freight Logistics and Preserve Road Condition
2. CTIPS-002: Assessing Condition of Rehabilitated Concrete Pavement with Slab Fracturing and Asphalt Overlay Using Distributed Fiber Optic Sensors

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) website postings and displays, (7) Internet-based dissemination media, including broadcast emails and webinars, and (8) YouTube delivery.

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

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

2. PARTICIPANTS AND OTHER COLLABORATING ORGANIZATIONS: Who has been involved?

a. What organizations have been involved as partners?

- Nothing to Report.

b. Have other collaborators or contacts been involved?

- Nothing to Report.

3. OUTPUTS: What new research, technology or process has the program produced?

a. Publications, conference papers, and presentations

- Nothing to Report.

b. Journal publications

- Nothing to Report.

c. Books or other non-periodical, one-time publications

- Nothing to Report.

d. Other publications not identified above such as policy papers, etc.

- Nothing to Report.

e. Website(s) or other Internet site(s)

- The CTIPS website is fully operational with additional information added as needed at <https://www.ctips.org/>
- The CTIPS Key Personnel Directory can be found at <https://www.ctips.org/personnel/executive-committee.php>

f. Technologies, patent applications, and/or licenses

- Nothing to Report.

g. Inventions, patents, and/or licenses

- Nothing to Report.

h. Other products, such as data or databases, physical collections, audio or video products, application software, analytical models, educational aids, course or curricula, instruments, equipment, or research material.

- Nothing to Report.

4. OUTCOMES: What outcomes has the program produced? How are the research outputs described in section (3) above being used to create outcomes?

- a. **Increased understanding and awareness of transportation issues.**
 - Nothing to Report.
- b. **Passage of new policy, regulation, rulemaking, or legislation.**
 - Nothing to Report.
- c. **Increased in the body of knowledge.**
 - Nothing to Report.
- d. **Improved processes, technologies, techniques and skills in addressing transportation issues.**
 - Nothing to Report.
- e. **Enlargement of the pool of trained transportation professionals.**
 - Nothing to Report.
- f. **Adoption of new technologies or practices.**
 - Nothing to Report.

5. IMPACTS: What is the impact of the program? How has it contributed to improve the transportation system; enhance safety, reliability, durability, improve transportation education, and/or strengthen the workforce, etc.?

- a. **What is the impact on the effectiveness of the transportation system?**
 - Nothing to Report.
- b. **What is the impact of technology transfer on industry and government entities, on the adoption of new practices, or on research outcomes which have led to initiating a start-up company?**
 - Nothing to Report.
- c. **What is the impact on the body of scientific knowledge?**
 - Nothing to Report.
- d. **What is the impact on transportation workforce development?**
 - Nothing to Report.

6. CHANGES/PROBLEMS:

- a. **Changes in approach and reasons for change.**
 - Nothing to Report.
- b. **Actual or anticipated problems or delays and actions or plans to resolve them.**
 - Nothing to Report.
- c. **Changes that have a significant impact on expenditures.**
 - Nothing to Report.
- d. **Significant changes in use or care of human subjects, vertebrate animals, and/or biohazards.**
 - Nothing to Report.
- e. **Changes in primary performance site location from that originally proposed.**
 - Nothing to Report.

7. SPECIAL REPORTING REQUIREMENTS:

Nothing to Report.