Texas SPR

Work Program
Part II

September 1, 2023 – August 31, 2024

Certification and Disclaimer Statements

State Planning & Research Program
Part II – Research
Texas Department of Transportation
Research and Technology Implementation Division
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In cooperation with:
U.S. Department of Transportation
Federal Highway Administration

Research Program - SPR 0511(224)
Implementation Program - SPR 2024(322)
Innovation Program – SPR 2024(300)

Fiscal Year 2024
(September 1, 2023 – August 31, 2024)

Certification Statement

"I Kevin Pete, Director, of the Research and Technology Implementation Division (RTI), Texas Department of Transportation (TxDOT), do hereby certify that the State is in compliance with all requirements of 2 CFR 200 Uniform Guidance, 23 U.S.C. 505 and its implementing regulations with respect to the research, development, and technology transfer program, and contemplate no changes in statutes, regulations, or administrative procedures, which would affect such compliance."

DocuSigned by:
Kevin Pete
D77263CBF1F9429...

Director

7/24/2023

Date

Disclaimer Statement

The Federal Highway Administration's (FHWA) approval of reports constitutes acceptance of such reports as evidence of work performed but does not imply endorsement of a report's findings or recommendations. This report is prepared for FHWA-funded work and includes appropriate credit references and disclaimer statements. The preparation of this report has been financed in part through grant(s) from the Federal Highway Administration, U.S. Department of Transportation, under the State Planning and Research Program, Section 505 of Title 23, U.S. Code. The contents of this report do not necessarily reflect the official views or policy of the U.S. Department of Transportation.

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1. Texas Department of Transportation Mission, Goals, and Values

The Research and Technology Implementation Division is an office in the Texas Department of Transportation (TxDOT) and supports the department's Mission, Goals and Values, and the TxDOT 2023-2027 Strategic Plan adopted by the Texas Transportation Commission.

TxDOT's Mission, Goals, and Values guide RTI in their desire for excellence. They are as follows:

Mission Statement

Connecting You with Texas.

Goals

- Deliver the Right Projects
- Focus on the Customer
- Foster Stewardship
- Optimize system Performance
- Preserve our Assets
- Promote Safety
- Value our Employees

Values

- People
- Accountability
- Trust
- Honesty

2. Approval and Authorization Process

2.1. Funding Research-23 CFR 420.115(b)

The Code of Federal Regulations (CFR)—specifically 23 CFR 420.115(b)—says that the federal government is contractually obligated to authorize work funded by the Federal Highway Administration in whole or in part, pursuant to 23 U.S. Code (USC) 106. The CFR requires that appropriate funds be available for the full federal share of the cost of work authorized.

TxDOT funds research through its Research and Implementation Program, overseen by the TxDOT RTI Division. RTI and the Texas state-supported universities conducting the research or implementation executes all project agreements.

RTI provides the fiscal year (FY) 2024 State Planning and Research (SPR) Part II Work Program to the Texas FHWA Division Office for review and approval. After the FHWA division administrator for the SPR program gives authorization, RTI executes the project agreements.

2.2. Reporting Requirements-23 CFR 420.117

The CFR, specifically 23 CFR 420.117, requires that TxDOT issue a report for FHWA approval to continue the agreement between TxDOT and FHWA to carry out statewide transportation planning activities as authorized.

According to 23 CFR 420.117, RTI is responsible for program monitoring and reporting requirements. RTI assigns a team of project managers to monitor the activities and performances of all sub-recipients (state-supported universities) to assure that they are managing and performing the work satisfactorily and that they are meeting deadlines.

3. Program Overview

RTI executes a Cooperative Research and Implementation Agreement (CRIA) with each university or university system to conduct research projects. A CRIA contains a set of standard provisions required by state or federal law or agreed to between TxDOT and universities. To participate in the program, each must first execute a CRIA with TxDOT. RTI also publishes the Research Manual and the University Handbook. These two documents and the CRIA outline the provisions and processes of TxDOT's Research and Implementation Program. These documents can be found on our internet Site: http://www.txdot.gov/inside-txdot/forms-publications/publications/research.html

3.1 Types of Projects: Research, Implementation, and Innovation

Detailed information on the types of projects can be found in the Research Manual.

Both types of projects are conducted by Texas state-supported universities. The university identifies a Research Team that consists of a Project Supervisor and other university researchers, or graduate students who will conduct the project's work plan.

Each university participating in the program assigns a central point of contact (Liaison) to handle communication and administration for their projects.

3.1.1. Research Projects

A Research Project is a systematic controlled inquiry, often involving analytical or experimental activities, which seek to gain new knowledge, and which may involve development of new or revised products. The research types includes Basic Research - the study of phenomena, and of observable facts, without specific applications towards processes or products in mind; the primary purpose of this kind of research is to increase knowledge; Applied Research - the study of phenomena to gain knowledge or understanding necessary for determining the means by which a recognized need may be met; the primary purpose of this kind of research is to answer a question or solve a problem; or Development - the systematic use of the knowledge or understanding gained from research, directed toward the production of useful materials, devices, systems or methods, including design and development of prototypes and processes.

3.1.2. Implementation Projects

An Implementation Project is the adoption of a product for use, including Technology Transfer activities that lead to the adoption of a new technique or product by users and involves dissemination, demonstration, training, and other activities that lead to eventual innovation.

3.2. RTI Personnel and Contact Information

Table 1. RTI Personnel

Name	Position Title	Phone Number	Email Address
Kevin Pete	RTI Director	512-416-4730	Kevin.Pete@txdot.gov
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M Renee Suaste	Contract Administrator	512-416-4740	Renee.Suaste@txdot.gov
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Name	Position Title	Phone Number	Email Address
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Martin Dassi	Project Manager	512-416-4738	Martin.Dassi@txdot.gov
Vacant	Project Manager		

3.3 RTI Guidance Documents

RTI executes a Cooperative Research and Implementation Agreement (CRIA) with each university or university system to conduct research projects.

RTI has also published the *Research Manual* and the *University Handbook*. These two documents and the CRIA outline the provisions and processes of TxDOT's Research and Implementation Program.

3.4 Obligation of Funds

Table 2. Shows how the federal funds appropriated to the Texas SPR II program are obligated.

Table 2. Obligation of Federal Funds to SPR

Program	Funding Available	Federal Project	80% Federal	20% Estimated TDCs*
Research Program	$24,805,315.00	SPR 0511(224)	$19,844,252.00	$4,961,063.00
RTI Division Program Management	$2,419,561.00	SPR 0511(224)	$1,935,648.80	$483,912.20
Subtotal - Research Program	**$27,224,876.00**	**SPR 0511(224)**	**$21,779,900.80**	**$5,444,975.20**
Implementation Program	$2,700,000.00	SPR 2024(322)	$2,160,000.00	$540,000.00
Innovation Program	$2,048,856.00	SPR 2024(300)	$1,639,084.80	$409,771.20
Grand Total	**$31,973,731.00**	Click or tap here to enter text.	**$25,578,984.80**	**$6,394,746.20**

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Table 3. Contracting Entities Receiving SPR Funds

Entity That Received SPR Funds	SPR Contribution
National Cooperative Highway Research Program (NCHRP)	$5,745,962.00
Pooled-fund projects (lead agencies), including TxDOT's Transportation Research Board (TRB) dues	$2,237,335.00

3.5 Distribution of Funds to Universities

Figure 1: Distribution of Funds shows the funds budgeted for the Research Program.

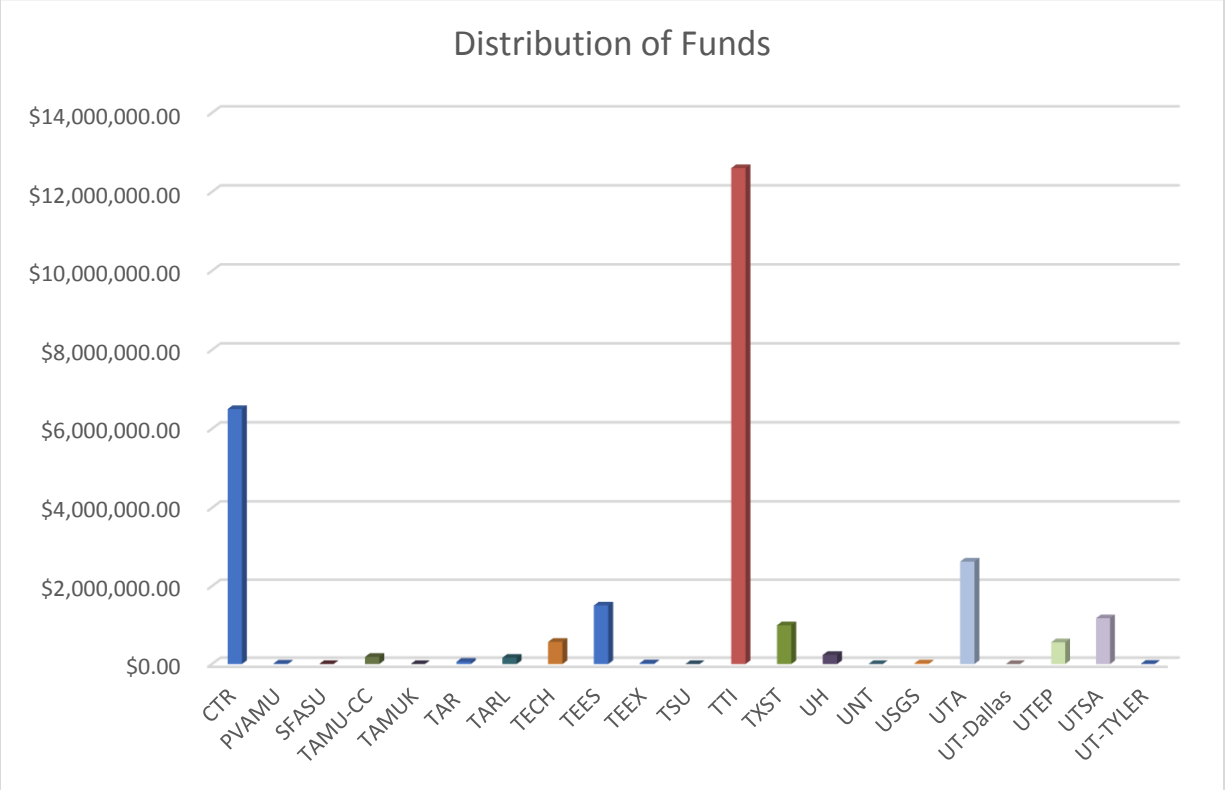


Table 4. Awards by University

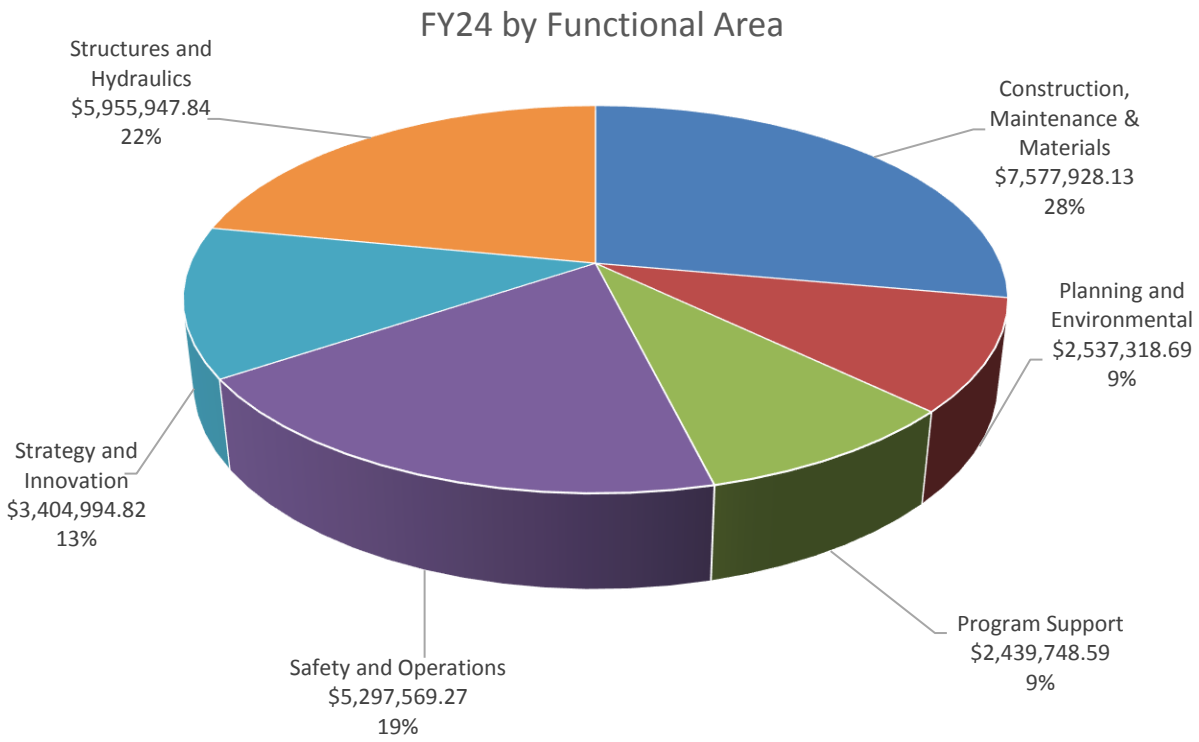
University	Budget for FY24
CTR	$6,500,163.44
PVAMU	$11,202.50
TAMUCC	$183,576.00
TAR	$57,440.00
TARL	$161,505.00
TECH	$568,110.12
TEES	$1,503,743.00
TEEX	$19,402.38
TTI	$12,598,189.25
TXST	$993,871.33
UH	$234,339.00
USGS	$14,776.95
UTA	$2,628,565.87
UTEP	$557,495.00
UTSA	$1,173,805.00
UT-TYLER	$7,322.50
Grand Total	**$27,213,507.34**

3.6 Distribution of Funds by Functional Area

Table 5. Shows the funds budgeted to each research area for projects in FY24

Functional Area	Continuing	New	Grand Total
Construction, Maintenance & Materials	$4,702,561.88	$2,875,366.25	$7,577,928.13
Planning and Environmental	$1,219,152.00	$1,318,166.69	$2,537,318.69
Program Support	$775,579.21	$1,664,169.38	$2,439,748.59
Safety and Operations	$3,324,857.09	$1,972,712.18	$5,297,569.27
Strategy and Innovation	$1,463,599.69	$1,941,395.13	$3,404,994.82
Structures and Hydraulics	$4,782,660.30	$1,173,287.54	$5,955,947.84
Total	**$16,268,410.17**	**$10,945,097.17**	**$27,213,507.34**

Figure 2: Annual SPR Work Program Budget by Functional Area



3.7 Acronyms and Abbreviations

Table 6. Lists acronyms used in this document.

Click or tap here to enter text. Acronym	Definition
APER	Annual Performance and Expenditures Report
CFR	Code of Federal Regulations
CRIA	Cooperative Research and Implementation Agreement
CTR	University of Texas at Austin's Center for Transportation Research
FHWA	Federal Highway Administration
FY	Fiscal Year
LAMAR	Lamar University
PVAMU	Prairie View A&M University
RTI	Research and Technology Implementation Division
SHSU	Sam Houston State University
SFASU	Stephen F. Austin State University
SPR	State Planning and Research
TAMU	Texas A&M University
TAMU-C	Texas A&M University at Commerce
TAMU-CC	Texas A&M University at Corpus Christi
TAMUK	Texas A&M University–Kingsville
TAR	Texas A&M AgriLife Research
TARL	Tarleton State University

Acronym	Definition
TECH	Texas Tech Univ Ctr for Multidisciplinary Transportation Research
TEES	Texas A&M Engineering Experiment Station
TEEX	Texas A&M Engineering Extension Service
TSU	Texas Southern University
TTI	Texas A&M Transportation Institute
TxDOT	Texas Department of Transportation
TxState	Texas State University
UH	University of Houston
UNT	University of North Texas
USC	U.S. Code
USGS	United States Geological Survey
UTA	University of Texas at Arlington
UTEP	University of Texas at El Paso
UTHSC	University of Texas Health Science Center
UTSA	University of Texas at San Antonio
UT-Tyler	The University of Texas at Tyler
WTAMU	West Texas A&M University
TDC	Transportation Development Credits

3.8 University Contact Information

Contact information for the contact persons from universities participating in the RTI research program.

Table 7. Personnel from Participating Universities

Name (Liaison**)	University	Phone#	Email Address
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Name (Liaison**)	University	Phone#	Email Address
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Edlyn Achiu Walsh**, Constantine Tarawneh	UTRGV	956-665-5008, 956-665-2607	sponpro@utrgv.edu, constantine.tarawneh@utrgv.edu

4. Fiscal Year 2024 Research and Implementation Program

RTI will execute additional projects identified in the FY 24 Request for Proposals (RFP) and hold project kick-off meetings for new projects. RTI Project Managers will oversee active projects to ensure the project's work plans are being executed by the awarded universities. Throughout the year, project progress meetings are held to discuss project status and gain advisement and guidance from the project monitoring committees. Close-out meetings will also occur throughout the year as projects close and contracts terminate. RTI will perform annual calls for research ideas and conduct project selection meetings with the various research committees consisting of subject matter experts throughout the state. Universities will also be invited to hear information regarding the Program and discuss potential research ideas. RTI will also publish video summary reports for most research projects, research digests, newsletters and a Program Book detailing information about the project's research results. In December, the Annual Performance and Expenditures Report (APER) will be developed and submitted to FHWA.

4.1 General Overview

4.1.1. Research Program

- There are seventy-five (75) Research Projects that are continuations of active projects.
- There are thirty-three (33) new project starts.
- There are five (5) Implementation Projects that are continuations of active projects, and three (3) new.
- There are forty-four (44) Pooled Fund Projects; two (2) are Texas-led.

4.1.2. RTI Administration and University Support Projects

- There is one project that funds the Administration of the SPR Program (0-0050)
- There is one project that funds the Local Technical Assistance Program (5-7097-24)
- There is one project that funds the Research Transportation Library (0-9902-23)
- There is one project that funds the Digital Publication and Outreach Services in Support of Research (0-6974)

4.1.3. RTI Administration and FHWA Grant Supported Projects

- There is one USDOT ADS grant project administered by the division with non-SPR funds (0-7099)

4.2 List of Implementation Projects

Functional Area	Project No.	Project Title	Status
Program Support	5-7097-24	Texas Local Technical Assistance Program (TxLTAP)	New
Strategy and Innovation	5-9905-24	Innovation Consortium (TTTF, TxSTIC, EDC)	New
Strategy and Innovation	5-9908-24	Innovative Transportation Projects at TxDOT	New
Construction, Maintenance & Materials	5-9055-01	Workforce Development Lifecycle for Road and Bridge Agencies	Continuing
Safety and Operations	5-7049-01	Implementation of Improving and Communicating Speed Management Practices	Continuing
Safety and Operations	5-7083-01	Implementation of Safety Prediction Methods Developed for Texas Highways	Continuing
Strategy and Innovation	0-9908-22	Planning Innovation and Technology Deployments at TxDOT	Continuing
Strategy and Innovation	5-7081-01	Implementation of Understanding the Impact of Autonomous Vehicles on Long-distance Travel Mode and Destination Choice in Texas	Continuing

4.3 List of Research Projects

Functional Area	Project No.	Project Title	Status
Construction, Maintenance & Materials	0-6674-04	Automated IDEAL Cracking and Rutting Tests	New
Construction, Maintenance & Materials	0-7173	Develop Guidelines for Evaluation of Embankment Conditions in Bridge Approach Slabs and Pavement Structures	New
Construction, Maintenance & Materials	0-7175	Develop Best Practices for Flexible Pavement Repairs	New
Construction, Maintenance & Materials	0-7177	Identifying Pavement Improvement Projects for Enhanced Safety	New
Construction, Maintenance & Materials	0-7178	Use Network Level Texture to Enhance Pavement Management	New
Construction, Maintenance & Materials	0-7185	Develop Enhanced Cold Recycling Methods and Specifications	New
Construction, Maintenance & Materials	0-7186	Develop Next Generation of Hamburg Rutting Test for Asphalt Mixes	New
Construction, Maintenance & Materials	0-7188	Synthesis: Pavement Widening Best Practices	New
Construction, Maintenance & Materials	0-7191	Develop Systematic and Quantitative Approach to Assess the Probability of Extreme Weather and Resilience Risks for TxDOT Highways and Bridges	New
Construction, Maintenance & Materials	0-7195	Quantify Bridge and Pavement Consumption Due to Permitted Overweight/Oversized (OW/OS) Vehicles	New
Construction, Maintenance & Materials	0-7197	Evaluate Effects of Recycled Asphalt Pavement (RAP) on Performance-Graded (PG) Binder Polymer Concentration	New
Planning and Environmental	0-7174	Develop an Interactive Statewide Production Rate Estimation Tool for Reliable Contract Time Determination	New

Functional Area	Project No.	Project Title	Status
Planning and Environmental	0-7176	Automated Ideal Cracking and Rutting Tests	New
Planning and Environmental	0-7182	Determine Effectiveness of Construction Management Plans	New
Planning and Environmental	0-7184	Develop an Interactive Unit Price Estimation and Visualization Tool	New
Planning and Environmental	0-7187	Exploring and Developing Innovative Methods for Estimating VMT on Local Roads in Texas	New
Planning and Environmental	0-7189	Safety Assessment of Shared Use Paths at Roadway Crossings using Exposure-Based Models	New
Planning and Environmental	0-7194	Evaluating the Risks that Erosion Control Products Pose to Protected Species and Other Wildlife	New
Planning and Environmental	0-7196	Data-Driven Prioritization of Roadway Segments for Treatment during Severe Weather Events	New
Safety and Operations	0-7171	Barrier Striping for the Reduction of Accidents	New
Safety and Operations	0-7180	Select High Risk Pedestrian Midblock Crossings and Perform Safety Evaluations for Select High Risk Pedestrian Midblock Crossings and Perform Safety Evaluations for Developing Pedestrian Crossings Countermeasures	New
Safety and Operations	0-7183	Develop Crash Modification Factors for Super 2 Highways	New
Safety and Operations	0-7190	Roadside Safety Device Analysis, Testing, and Evaluation Program	New
Safety and Operations	0-7198	Traffic Control Device Analysis, Testing, and Evaluation Program	New
Strategy and Innovation	0-7181	Development of Digital Twins for Texas Bridges	New

Functional Area	Project No.	Project Title	Status
Strategy and Innovation	0-7199	Identification of Needs and Strategies for First Responder Interactions with Automated Vehicles (Avs)	New
Strategy and Innovation	0-7200	Utilizing Telematics to Understand Driving Behavior During Missed Exits and Wrong Turns	New
Structures and Hydraulics	0-7172	Developing a Performance-Based Concrete Overlay Mix Design for Improved Resistance to Early-Age Cracking and Increased Durability	New
Structures and Hydraulics	0-7179	Evaluate Safety End Treatments for Roadside Drainage Structures	New
Structures and Hydraulics	0-7192	Develop Performance of Baseplate Connections in COSS and Traffic Signal Structures	New
Structures and Hydraulics	0-7193	Develop Assessment and Mitigation Guidance for Ancillary Highway Structures with Existing Cracks	New
Structures and Hydraulics	0-7201	Hydrologic Approaches to Playa Lakes, Areas of Significant Karst Geology, and Arid Regions	New
Structures and Hydraulics	0-7202	Synthesis: The State of Knowledge and State of Practice for Non-Contact Radar Stream Gauges in Texas, the United States, and Internationally	New
Construction, Maintenance & Materials	0-7002	Evaluation of Geogrids for Asphalt Pavement Construction	Continuing
Construction, Maintenance & Materials	0-7006	Design, Construction, and Performance Monitoring of Stabilization of Expansive Soils and Cement	Continuing
Construction, Maintenance & Materials	0-7027	Accelerating Mix Designs for Base Materials	Continuing
Construction, Maintenance & Materials	0-7028-01	Integrated SiteManager and Pavement Analyst Database on an Online Platform	Continuing
Construction, Maintenance & Materials	0-7031-01	Develop Efficient Prediction Model of Highway Friction on an Annual Basis on Texas Network	Continuing

Functional Area	Project No.	Project Title	Status
Construction, Maintenance & Materials	0-7072	Improve Data Quality for Automated Pavement Distress Data Collection	Continuing
Construction, Maintenance & Materials	0-7073	Improving Testing Requirements in Item 300 Of TxDOT Standard Specifications	Continuing
Construction, Maintenance & Materials	0-7076	Develop Laboratory Mix Design of Full Depth Reclamation (FDR) Projects Using Foamed Asphalt Binder and Emulsified Asphalt	Continuing
Construction, Maintenance & Materials	0-7102	Develop Models for Field Performance of Friction and Skid Number	Continuing
Construction, Maintenance & Materials	0-7103	Investigating Prime versus Curing: Where, When and Why	Continuing
Construction, Maintenance & Materials	0-7104	Establish Performance-Based Acceptable Lab-Molded Density Range for Mix Design and QC/QA	Continuing
Construction, Maintenance & Materials	0-7105	Measuring Seal Coat Rate Field Adjustments	Continuing
Construction, Maintenance & Materials	0-7106	Quantify Maximum Accumulated Seal Coat Layers for Stability	Continuing
Construction, Maintenance & Materials	0-7107	Determine Feasibility and Methodologies of Using Structural Data From Traffic Speed Deflection Devices in Network-Level Treatment Decision Making	Continuing
Construction, Maintenance & Materials	0-7108	Evaluate the Importance of Fine Aggregates in Achieving Adequate Skid Resistance in TxDOT Hot Mix Asphalt Mixtures	Continuing
Construction, Maintenance & Materials	0-7111	Determine Impact of Field Sands on Workability and Engineering Properties of Superpave Mixtures in Texas	Continuing
Construction, Maintenance & Materials	0-7139	Determination of Pavement Surface Type	Continuing
Construction, Maintenance & Materials	0-7141	Evaluation of Nano-Materials in Concrete for Improved Durability	Continuing

Functional Area	Project No.	Project Title	Status
Construction, Maintenance & Materials	0-7142	Develop Safety Scoring Tool for the Wet Surface Crash Reduction Program	Continuing
Construction, Maintenance & Materials	0-7143	Develop Methodologies for Reducing Costs in Full Depth Reclamation (FDR) Construction	Continuing
Construction, Maintenance & Materials	0-7145	Develop Rapid New Tests for Detecting Poor Quality Binders and RAP Materials	Continuing
Construction, Maintenance & Materials	0-7147	Project Level Performance Database for Rigid Pavements in Texas, Phase III	Continuing
Construction, Maintenance & Materials	0-7148	Develop Design Details for CRCP Whitetopping at Intersections	Continuing
Construction, Maintenance & Materials	0-7150	Artificial Intelligence for Pavement Condition Assessment from 2D/3D Surface Images	Continuing
Construction, Maintenance & Materials	0-7151	Develop Recommendations for Evaluating Surface Types and Aggregate Properties to Minimize Wet Weather Crashes	Continuing
Construction, Maintenance & Materials	0-7153	Develop Design of Hot-Mix Cold-Laid (HMCL) Mixtures with the Superpave Gyratory Compactor	Continuing
Construction, Maintenance & Materials	0-7168	Use of X-Ray Fluorescence (XRF) to Determine Tire Rubber Content in Asphalt Binders	Continuing
Planning and Environmental	0-6701-02	Planning and Environmental Linkages Toolkit	Continuing
Planning and Environmental	0-7022-01	Monarch Conservation Strategies for Texas Roadways	Continuing
Planning and Environmental	0-7023-01	Ecological Impacts of Sediment Derived from Bridge Construction	Continuing
Planning and Environmental	0-7132	Quantify the Real Impact of Transportation Activity on Regional Ozone and Near-Road PM Concentrations	Continuing

Functional Area	Project No.	Project Title	Status
Planning and Environmental	0-7133	Develop Guidebook for Managing System Costs: Operational and Capital Cost Management at Rural and Small Urban Public Transit Systems	Continuing
Planning and Environmental	0-7138	Driver Distraction in an Era of Rapid Technological Change, Digital Advertising Billboards	Continuing
Planning and Environmental	0-7149	Determine Feasibility and Methodologies of Incorporating Third-Party Traffic Data into Transportation	Continuing
Planning and Environmental	0-7152	Estimating Latent Bicyclist and Pedestrian Demand for Shared Use Path Design	Continuing
Planning and Environmental	0-7162	Quantifying Benefits of Roadside Vegetation	Continuing
Planning and Environmental	0-7165	Logistics Sprawl Impacts on E-commerce Travel Patterns	Continuing
Program Support	0-6974	Digital Publication and Outreach Services in Support of Research	Continuing
Program Support	0-9902-23	University of Texas Library Services	Continuing
Safety and Operations	0-7004	Improve System Emergency Response Performance in the Houston District Using Connected Vehicle Technology	Continuing
Safety and Operations	0-7045	Analyze the Use of Green Pavement Markings – Intersection Safety for Non-Motorized Users	Continuing
Safety and Operations	0-7086	Roadside Safety Device Analysis, Testing, and Evaluation Program	Continuing
Safety and Operations	0-7087	Develop Standards for Temporary Concrete Median Barrier in Flood-Prone Areas	Continuing
Safety and Operations	0-7099	AVA: Automated Vehicles for All	Continuing

Functional Area	Project No.	Project Title	Status
Safety and Operations	0-7122	Evaluate Alternative Methods to Examine Visibility of Pavement Markings	Continuing
Safety and Operations	0-7137	Assessment of Austin, El Paso, and San Antonio HERO Incident Management Programs	Continuing
Safety and Operations	0-7140	Develop Improved Queue Warning System Combining Multiple Data Sources	Continuing
Safety and Operations	0-7144	Develop a Real-time Decision Support Tool for Urban Roadway Safety Improvement	Continuing
Safety and Operations	0-7156	Using Vehicle Probe Data to Evaluate Speed Limits on Texas Highways	Continuing
Safety and Operations	0-7157	Develop Guidelines for Integration of UAS LiDAR and Photogrammetry to Enhance Land Surveying Capabilities	Continuing
Safety and Operations	9-1531	Development and Evaluation of Roadside Safety Systems for Motorcyclists	Continuing
Strategy and Innovation	0-7159	Develop Guidelines for the Use of Unmanned Aerial Systems (UASs) and Smartphones for Construction and Utility Inspections	Continuing
Strategy and Innovation	0-7160	Improving Traffic Signal System Planning, Design and Management with Big-data-enhanced Automated Traffic Signal Performance Metrics (ATSPM) System	Continuing
Strategy and Innovation	0-7164	Expanding Connected Vehicle Data Framework (CVDF) Data Sources to Increase Applications and Use on Texas Roadways	Continuing
Strategy and Innovation	0-7166	Leveraging Probe-Based Data to Enhance Long-Term Planning Models	Continuing
Strategy and Innovation	0-7169	Post-NEVI Electric Vehicle Infrastructure Research (Freight, Fleet, and Multi-family Housing	Continuing
Structures and Hydraulics	0-6958	Developing Performance Specification for High Performance Concrete	Continuing

Functional Area	Project No.	Project Title	Status
Structures and Hydraulics	0-7040	Evaluation of Corrosion Prevention and Mitigation Approaches Used On Texas Bridges	Continuing
Structures and Hydraulics	0-7041	Develop NextGen Texas Bridge Decks	Continuing
Structures and Hydraulics	0-7042	Use of Larger Diameter Shear Studs for Composite Steel Bridges	Continuing
Structures and Hydraulics	0-7090	Evaluate the Deployment of High Strength Reinforcing Steel in Texas	Continuing
Structures and Hydraulics	0-7093	Develop Refined Design Methods for Lean-On Bracing	Continuing
Structures and Hydraulics	0-7112	Development of a Continuous for Live Load Prefabricated Steel Accelerated Bridge Construction (ABC) Unit for Texas Bridges	Continuing
Structures and Hydraulics	0-7113	Determine Service and Ultimate Behavior for Bent to Column Joints in TxDOT Substructures	Continuing
Structures and Hydraulics	0-7114	Re-Examine Minimum Reinforcement Requirements for Shear Design	Continuing
Structures and Hydraulics	0-7115	Investigate Live Load Distribution and Stability of Prestressed Concrete Girders During Construction	Continuing
Structures and Hydraulics	0-7116	Develop Deck and Overhang Design Guidelines for Sound Walls and Other Heavy Loads	Continuing
Structures and Hydraulics	0-7117	Investigate the Strength of Struts Crossing Cold Joints	Continuing
Structures and Hydraulics	0-7154	Utilization of 300 ksi Strands for TxDOT Prestressed Girders	Continuing
Structures and Hydraulics	0-7155	Develop/Refine Design Provisions for Headed and Hooked Reinforcement	Continuing

Functional Area	Project No.	Project Title	Status
Structures and Hydraulics	0-7158	Calibration of Bridge Performance Models Using Element Data	Continuing
Structures and Hydraulics	0-7161	Settlement Criteria and Design Approach for Embankments and Retaining Walls Built on Compressible Soils	Continuing
Structures and Hydraulics	0-7167	Evaluate Performance of Sealers and Coatings Applied to TxDOT Bridge Substructures	Continuing
Structures and Hydraulics	0-7170	Evaluate Bridge Deck Condition and Replacement Methods	Continuing
Structures and Hydraulics	9-1532	TPF-5(508) Concrete Bridge Engineering Institute (CBEI)	Continuing

4.4 Totals Awarded by Functional Area

Table 8. Totals Awarded to New (N) and Continuing (C) Projects by Functional Area

Financials	Type	FY24 Budget	80% Federal	20% Estimated TDCs*
Construction, Maintenance & Materials	N	$2,875,366.25	$2,300,293.00	$575,073.25
Construction, Maintenance & Materials	C	$4,702,561.88	$3,762,049.50	$940,512.38
Planning and Environmental	N	$1,318,166.69	$1,054,533.35	$263,633.34
Planning and Environmental	C	$1,219,152.00	$975,321.60	$243,830.40
Program Support	N	$1,664,169.38	$1,331,335.50	$332,833.88
Program Support	C	$775,579.21	$620,463.37	$155,115.84
Safety and Operations	N	$1,972,712.18	$1,578,169.74	$394,542.44
Safety and Operations	C	$3,324,857.09	$2,659,885.67	$664,971.42
Strategy and Innovation	N	$1,941,395.13	$1,553,116.10	$388,279.03
Strategy and Innovation	C	$1,463,599.69	$1,170,879.75	$292,719.94
Structures and Hydraulics	N	$1,173,287.54	$938,630.03	$234,657.51
Structures and Hydraulics	C	$4,782,660.30	$3,826,128.24	$956,532.06

*Non-Federal Match provided by Transportation Development Credits (TDCs)

5. New Projects by Functional Area

5.1 Construction, Maintenance and Materials

Project Number: 0-6674-04 University: TTI

Project Title: Automated IDEAL Cracking and Rutting Tests

Project Start Date: TBD Termination Date: 08/31/2026

Project Status: Pending Total Project Budget: $692,780.00

Project Manager: Martin Dassi Researcher: Fujie Zhou

Project Objectives: The objective of this project is to complete the design and construction of the automated test system and to deliver an automated IDEAL cracking and rutting test system working unit to the Receiving Agency's MTD lab. The automated test system, includes (1) specimen rapid cooling unit, (2) auto-air void measurement unit, (3) specimen conditioning unit for both room and high temperature, (4) automation arm unit, and (5) automated IDEAL cracking test (IDEAL-CT), IDEAL rutting test (IDEAL-RT), and indirect tensile (IDT) strength test unit, and (6) waste disposal unit. This automated test system shall shorten test time and improve lab safety, test efficiency and accuracy. The Performing Agency shall work closely with the Receiving Agency to build one automated lab test system. The Performing Agency shall conduct comprehensive parallel comparison with the standard (manual) test system to ensure that the automated test results align with the current standard tests. The Performing Agency shall develop a user manual for the automated test system. Additionally, the Performing Agency shall provide training and demonstrations to Receiving Agency lab technicians after delivering the automated test system.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
Contract Total	$294,828.00	$235,862.40	$58,965.60

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7173 University: TECH

Project Title: Develop Guidelines for Evaluation of Embankment Conditions in Bridge Approach Slabs and Pavement Structures

Project Start Date: TBD Termination Date: 08/31/2026

Project Status: Pending Total Project Budget: $735,865.23

Project Manager: Darrin Jensen Researcher: Hoyoung Seo

Project Objectives: Distresses of bridge approach slabs (BAS) and nearby pavement structures on roadway embankments are often caused by poor conditions in the embankments. The goal of this project is to develop guidelines for (1) evaluations of roadway embankment conditions and (2) maintenance strategies. The Performing Agency shall (a) conduct literature review and survey to synthesize information about the current state of the practice for embankment evaluations and repairs, (b) locate field test sections for new evaluations and monitoring of past repair performance, (c) conduct field investigations of the test sections and develop evaluation guidelines for embankment conditions, (d) identify causes of distresses and classify them, (e) develop maintenance strategies for the classified distress types and mechanisms, and conduct pilot field applications, and (f) develop training materials for the Receiving Agency.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
Contract Total	$217,193.78	$173,755.02	$43,438.76

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7175 University: PVAMU/TTI

Project Title: Develop Best Practices for Flexible Pavement Repairs

Project Start Date: TBD Termination Date: 02/28/2026

Project Status: Pending Total Project Budget: $394,319.00

Project Manager: Martin Dassi Researcher: Tito Nyamuhokya

Project Objectives: This research study aims to perform a study focusing on best practices for performing pavement preparatory work in advance of preventive maintenance (PM) surfacing contracts. The study shall respond to answer, "What are the best practices for repairing a roadway before a new surface is placed?" Seal coats or thin overlays are typical PM surfacing projects. The preparatory work performed by in-house maintenance forces or maintenance contracts may include crack sealing, fog seal, repairs, milling, and level-up. The preparatory work should be completed well before the PM contract. This study will identify the main flexible pavement repair types and investigate best practices for performing both in-house and contracted repairs. A procedure will be developed to determine the limits and type of flexible pavement repair. An evaluation process of the repair, including its performance and effects on the PM surfacing, will be developed.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
PVAMU	$11,202.50	$8,962.00	$2,240.50
TTI	$157,747.00	$126,197.60	$31,549.40

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7177 University: TTI/UH

Project Title: Identifying Pavement Improvement Projects for Enhanced Safety

Project Start Date: TBD Termination Date: 02/28/2026

Project Status: Pending Total Project Budget: $478,160.00

Project Manager: Jade Adediwura Researcher: Nasir Gharaibeh

Project Objectives: The Performing Agencies shall develop a method and tool for analyzing safety-related pavement data to identify candidate pavement safety projects, such as cross-slope improvement projects and flushing treatment projects. The Performing Agencies shall assemble a dataset containing comprehensive data on the pavement, site condition, and crashes for a representative sample of on-system roadways. The Performing Agencies shall conduct a comprehensive analysis of the integrated dataset to identify critical combinations and thresholds of pavement conditions that may pose a safety hazard and use these factors to assess pavement susceptibility to crashes. The Performing Agencies shall quantify the pavement crash susceptibility based on measurable pavement characteristics such as cross-slope, geometrics, distresses (e.g., rutting, flushing), skid resistance, and roughness. Finally, the Performing Agencies shall develop a data analysis and visualization tool for assessing pavement crash susceptibility and recommending solutions to reduce crash risks. The Receiving Agency's districts will be able to use this tool to identify potential site-specific crash contributing factors and proactively select appropriate pavement safety improvement projects.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
TTI	$141,647.50	$113,318.00	$28,329.50
UH	$49,850.00	$39,880.00	$9,970.00

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7178 University: CTR/TXST

Project Title: Use Network Level Texture to Enhance Pavement Management

Project Start Date: TBD Termination Date: 08/31/2025

Project Status: Pending Total Project Budget: $399,814.26

Project Manager: Darrin Jensen Researcher: Jorge A. Prozzi

Project Objectives: The Performing Agencies shall evaluate the use of texture data currently available in the Receiving Agency Pavement Analyst software as collected by the Receiving Agency's third-party vendor (the vendor), and shall assess the accuracy of data (mean profile depth (MPD) and raw profile used to calculate MPD) and provide guidance on applications and uses of the data.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
CTR	$142,653.13	$114,122.50	$28,530.63
TXST	$46,831.25	$37,465.00	$9,366.25

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7185 University: TTI

Project Title: Develop Enhanced Cold Recycling Methods and Specifications

Project Start Date: TBD Termination Date: 08/31/2026

Project Status: Pending Total Project Budget: $1,731,875.00

Project Manager: Joanne Steele Researcher: Stephen Sebesta

Project Objectives: Texas continues to use cold recycling for pavement rehabilitation and performs a significant amount of full depth reclamation (FDR). While cement remains the most widely used treatment, use of asphalt emulsion and foamed asphalt continues to grow. This project shall identify and evaluate topics to strategically enhance cold recycling practices in Texas. This project shall perform a comprehensive performance analysis of recent as-built projects to identify strengths and opportunities for process enhancement. For cement, this project shall evaluate how cement type may influence mixture properties, analyze the Texas Flexible Pavement System (FPS) structural design assumptions based on current mix design and construction practices, and summarize methods to improve early trafficking. For emulsified and foamed asphalt, this project shall develop cold-in-place recycling (CIR) applications for Texas and identify, evaluate, and recommend enhanced pavement design procedures for cold recycling with asphalt binders. This project shall use all results to develop enhanced cold recycling project selection procedures, recommend updates to the Receiving Agency's specifications, and develop and perform training.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
Contract Total	$619,619.00	$495,695.20	$123,923.80

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7186 University: CTR/TTI

Project Title: Develop Next Generation of Hamburg Rutting Test for Asphalt Mixes

Project Start Date: TBD Termination Date: 08/31/2026

Project Status: Pending Total Project Budget: $634,305.00

Project Manager: Tom Schwerdt Researcher: Fujie Zhou

Project Objectives: The Hamburg Wheel Track (HWT) rutting test generally serves well as the standard rutting test for asphalt mixes in Texas; however, in the last several years, some premium mixes (i.e. stone matrix asphalt), designed with PG76-22 and low HWT rut depth, have experienced premature rutting failures under slow moving (or stop/ go) traffic in several Receiving Agency Districts. Such failures burden the Receiving Agency with extra cost. Furthermore, it was reported that the HWT test cannot accurately quantify the better rutting performance of some tougher mixes with highly modified asphalt (HiMA). Thus, the Performing Agency shall develop the next generation of HWT test to accurately screen out asphalt mixes that are prone to rutting failures. The Performing Agencies shall review the literature, survey Districts, and other state departments of transportation (DOTs) to identify the proper rutting test(s) and asphalt mixes for addressing the rutting failure caused by the slow-moving traffic. The Performing Agencies shall further develop the next generation of HWT test and associated acceptance criteria through finite element analysis, laboratory testing, field accelerated pavement testing and survey of in-service pavement intersections, round robin test, and recommendation of specification changes.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
CTR	$10,000.00	$8,000.00	$2,000.00
TTI	$174,326.00	$139,460.80	$34,865.20

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7188 University: TTI

Project Title: Synthesis: Pavement Widening Best Practices

Project Start Date: TBD Termination Date: 08/31/2024

Project Status: Pending Total Project Budget: $64,931.75

Project Manager: Jade Adediwura Researcher: Bryan Wilson

Project Objectives: The Receiving Agency has observed premature pavement failures on several widening projects, including shoulder widenings, conversion of two-lane roadways to Super 2 sections, and other safety enhancements. Repairing these early failures is time-consuming, expensive, disrupts traffic, and poses safety hazards. Key contributing factors include poor-quality materials, poor joint construction, inadequate drainage, differential settlement, etc. These issues could have been avoided through proper pre-evaluation, design, and construction practices; but detailed guidance which methods to employ, which can be project specific, is not readily available to district personnel. Therefore, there is a need to document and implement better widening practices. The Performing Agency shall synthesize the best practices for pavement widening by conducting the following research objectives:

- Reviewing the literature for effective widening practices.
- Reviewing current widening practices employed by the Receiving Agency, including:
  - o Pre-design pavement evaluation,
  - o Pavement layer and cross-section design,
  - o Materials,
  - o Project plans, specifications, and estimates, and
  - o Construction practices.
- Evaluating previous widening projects both in good and poor condition. Identify issues and practices that can lead to premature failure, and practices that should be adopted more widely.
- Developing comprehensive guidelines and modifications to specifications.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
Contract Total	$64,931.75	$51,945.40	$12,986.35

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7191 University: CTR/TTI/TXST/UTSA

Project Title: Develop Systematic and Quantitative Approach to Assess the Probability of Extreme Weather and Resilience Risks for TxDOT Highways and Bridges

Project Start Date: TBD Termination Date: 08/31/2025

Project Status: Pending Total Project Budget: $796,521.00

Project Manager: TBD Researcher: Andrew Birt

Project Objectives: Climate stressors pose a significant threat to transportation infrastructure. Recognizing this, Federal Highway Administration (FHWA) requires State Departments of Transportation (DOTs) to consider extreme weather and resilience in life cycle planning and risk management analyses within a State's Transportation Asset Management Plan (TAMP). The 2022 Texas TAMP identified risk categories that could impact the Receiving Agency's infrastructure (specifically, highways and bridges). Extreme weather and resilience were discussed extensively, but the 2022 TAMP lacked a systematic and quantitative approach to assess climate-related risks to infrastructure and in life cycle planning analysis. The objective of this research is to develop a robust quantitative risk framework that can be implemented in subsequent Texas TAMPs. To successfully accomplish this objective, the Performing Agencies shall: manage the project scope, budget, and timeline (1), conduct an extensive review of the literature (2), identify climate stressors to the Receiving Agency's pavements and bridges (3), assess the probability of such climate stressors and extreme weather events (4), quantify the impact on bridges (5) and pavements (6), develop an asset risk and resilience assessment framework (7), develop and quantify adaptation strategies (8), conduct scenario analysis (9), and identify proxy indicators that can be tracked to monitor high-priority risks (10).

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
CTR	$156,720.80	$125,376.64	$31,344.16
TTI	$159,778.00	$127,822.40	$31,955.60
TXST	$35,014.04	$28,011.23	$7,002.81
UTSA	$41,444.00	$33,155.20	$8,288.80

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7195 University: CTR/TTI/UTSA

Project Title: Quantify Bridge and Pavement Consumption Due to Permitted Overweight/Oversized (OW/OS) Vehicles

Project Start Date: TBD Termination Date: 02/28/2026

Project Status: Pending Total Project Budget: $828,584.25

Project Manager: Joanne Steele Researcher: Jorge Prozzi

Project Objectives: In 2012, the Rider 36 study indicated that damage caused to bridges and pavements by overweight (OW) vehicles surpassed the revenue collected by permit fees by approximately $200 million annually. This finding was corroborated by a recent 2022 study mandated by House Bill 2223, which quantified this gap at $168 million. Besides the revenue shortage to cover bridge and pavement maintenance and rehabilitation costs due to the damage cause by OW vehicles, the 2022 study also identified additional shortcomings that need to be urgently addressed. These shortcomings include: 1) lack of a methodology for periodically adjusting permit fees to account for changes in traffic patterns and configurations and higher inflation rates; 2) lack of accurate data and process for calculating annual vehicles-miles-travelled (VMT) by each permit type; 3) uncertainty in the identification of routes and number of trips for monthly, quarterly, or annual permits; 4) absence of a method and process to assess the damage caused by OW vehicles to the off-system bridges and highways. The Performing Agencies shall develop, recommend, and provide the Receiving Agency a well-established and documented step-by-step method to periodically update the permit fee structure.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
CTR	$164,411.50	$131,529.20	$32,882.30
TTI	$30,000.00	$24,000.00	$6,000.00
UTSA	$120,006.00	$96,004.80	$24,001.20

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7197 University: CTR/TTI

Project Title: Evaluate Effects of Recycled Asphalt Pavement (RAP) on Performance-Graded (PG) Binder Polymer Concentration

Project Start Date: TBD Termination Date: 02/28/2026

Project Status: Pending Total Project Budget: $593,006.28

Project Manager: Tom Schwerdt Researcher: Amit Bhasin

Project Objectives: Polymer additives are used to design high PG virgin binders that meet the PG requirements to protect the mix against rutting and cracking under the climate and traffic conditions of an HMA project. When RAP is added to the mixture, the effective binder may not meet the desired grade. This project shall quantify the extent to which polymer dilution is a problem that should be addressed in the Receiving Agency's HMA specifications and if so, develop specification language to address it. This project involves evaluating binder blends and mixtures with RAP. Both lab blended and commercial PG binders shall be evaluated for continuous grade, elasticity, polymer content, and other rheological parameters. Then these binders shall be mixed with recovered RAP binders at several percentages and retested to determine the same properties. Standard mixtures(s) shall also be used with several of these binders and various RAP percentages to measure mixture performance-related properties (cracking and rutting). The Performing Agency shall use the results from binder and mixture results on the impact of "virgin binder – RAP binder dilution" and work with the Receiving Agency to develop specification language for inclusion in the Receiving Agency's HMA specifications, as needed

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
CTR	$127,712.50	$102,170.00	$25,542.50
TTI	$109,449.50	$87,559.60	$21,889.90

*Non-Federal Match provided by Transportation Development Credits (TDCs)

5.2 Planning and Environmental

Project Number: 0-7174 University: TTI

Project Title: Develop an Interactive Statewide Production Rate Estimation Tool for Reliable Contract Time Determination

Project Start Date: TBD Termination Date: 02/28/2026

Project Status: Pending Total Project Budget: $374,458.25

Project Manager: Darrin Jensen Researcher: David Jeong

Project Objectives: Understanding and estimating realistic production rates of major work items in a highway project are critical to determining a reasonable project contract time, evaluating the contractor's baseline schedule, monitoring progress schedules, and ultimately completing the project on time. The Performing Agency shall leverage the Receiving Agency's historical project data to obtain the as-built information of production rates of various work items, and shall develop a) an expanded version of the Receiving Agency's construction production rates table, b) an interactive tool that can generate color-coded heat maps to visualize feasible ranges of production rates of major work items across Texas, and c) implementation guidance and recommendations. An advanced and interactive production rate estimation tool could significantly help the Receiving Agency achieve the goal of completing highway projects on time. The Performing Agency's decision-aid tool could significantly improve the Receiving Agency's practice in determining more accurate production rates, resulting in more accurate contract time determination, the contractor's baseline schedule evaluation, and progress schedule monitoring. The Performing Agency shall aid in providing higher certainty and reliability of data-driven and practical production rates to expand the Receiving Agency's current construction production rates table.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
Contract Total	$150,220.50	$120,176.40	$30,044.10

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7176 University: TTI

Project Title: Automated Ideal Cracking and Rutting Tests

Project Start Date: TBD Termination Date: 08/31/2024

Project Status: Pending Total Project Budget: $250,971.50

Project Manager: Joanne Steele Researcher: Cesar Quiroga

Project Objectives: Of the various situations in which a utility relocation is eligible for reimbursement at the Receiving Agency, one of the most complex situations is when parts of the existing utility facility involve a property interest. For utility facilities that involve a private property interest, the Receiving Agency uses an eligibility ratio, which is defined as the percentage of utility facilities that are reimbursable in relation to the total amount of utility facilities being relocated. In practice, eligibility calculations can be convoluted or complex, particularly in situations where the utility facility spans multiple property interest locations. The Performing Agency shall develop and test an improved methodology to determine reimbursement eligibility and calculate utility reimbursement amounts. The Performing Agency shall document a significant sample of utility relocations and their associated reimbursement costs to develop a reliable baseline of practices throughout the state, evaluate practices in other states, develop and test an updated methodology for utility reimbursement eligibility criteria and calculations, prepare a guidebook with examples on how to determine utility reimbursement criteria and calculate reimbursement amounts, and prepare and test training materials.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
Contract Total	$250,971.50	$200,777.20	$50,194.30

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7182 University: CTR

Project Title: Determine Effectiveness of Construction Management Plans

Project Start Date: TBD Termination Date: 08/31/2025

Project Status: Pending Total Project Budget: $299,302.47

Project Manager: Martin Dassi Researcher: Carlos Caldas

Project Objectives: A Construction Management Plan (CMP) is a document that describes the project execution plan and sequence of construction activities that can be performed in the project considering pending clearances related to unclear utility conflicts, right-of-way (ROW) acquisition, ROW encroachments, ROW relocation, and/or outstanding railroad agreements. the Receiving Agency CMPs are required for projects where the estimates for certification and permit clearance extend beyond three months after letting. One of the main goals of CMPs is to mitigate the risk of construction delays. Since the implementation of CMPs a few years ago, the Receiving Agency has not conducted a thorough review of their effectiveness to date. Therefore, the main objectives of this research project are to conduct a review of the Receiving Agency CMPs, verify the potential impact of the Receiving Agency CMPs on change orders and claims, compile lessons learned, and develop recommendations to make the Receiving Agency CMPs more effective. A guidebook and training materials shall be developed to facilitate implementation by districts, divisions, consultants, and contractors.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
Contract Total	$149,108.21	$119,286.57	$29,821.64

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7184 University: UTA

Project Title: Develop an Interactive Unit Price Estimation and Visualization Tool

Project Start Date: TBD Termination Date: 08/31/2025

Project Status: Pending Total Project Budget: $199,997.00

Project Manager: Joanne Steele Researcher: Mohsen Shahandashti

Project Objectives: The unit prices could be significantly different for various Receiving Agency's districts considering several factors (e.g., soil conditions, weather conditions, urban vs. rural conditions, regional construction market conditions) impacting construction costs in these districts. The objectives of this project are to (1) conduct an overview analysis of factors affecting unit prices, (2) identify factors affecting unit prices in Texas, (3) create a unit price estimation database, (4) create a geospatial statistical unit price estimation model considering the factors affecting unit prices, the interactions between factors, and the factors' spatial variability, (5) develop the GIS-based visualization tool with color-coded map, and automatic data updating function, and (6) implement, demonstrate, and validate the interactive unit price estimation and GIS-based visualization tool on five ongoing Receiving Agency's projects (located in 5 different districts in North, South, East, West, and Center of Texas) to cover for different project-specific factors (e.g., urban vs. rural conditions, geotechnical site conditions, weather conditions) and external factors (e.g., regional construction market conditions). The deliverables shall provide the Receiving Agency with implementation details of the interactive unit price estimation and visualization tool, enabling their workforce to quickly and accurately estimate unit prices based on the estimation and visualization tool.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
Contract Total	$100,391.50	$80,313.20	$20,078.30

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7187 University: TTI/TXST

Project Title: Exploring and Developing Innovative Methods for Estimating VMT on Local Roads in Texas

Project Start Date: TBD Termination Date: 08/31/2025

Project Status: Pending Total Project Budget: $399,269.95

Project Manager: Tom Schwerdt Researcher: Sushant Sharma

Project Objectives: State agencies must report vehicle miles traveled (VMT) estimates for local roads compiled in the statewide summaries dataset of the Highway Performance Monitoring System (HPMS) database. While the VMTs for higher functional class roads are the product of annual average daily traffic (AADT) with the corresponding roadway segment length (L); the states produce the VMT estimates for local roads as an aggregate measure using a variety of methods. Currently, the local road network accounts for more than two-thirds (67%) of the total roadway mileage in Texas and is the largest in the United States. Conducting short-term counts (STCs) (e.g., for a few hours up to a few weeks) on an extensive local road network to develop VMT is financially challenging; hence, the Receiving Agency uses statistical methods to obtain aggregated VMT. Although the current methods are statistically verified, they are yet to be revised and validated. The Performing Agencies shall investigate and develop data-driven methods for VMT estimation that can be implemented in Texas and provide significant savings to the Receiving Agency. The developed methods shall also reduce any bias in the estimation of VMTs on local roads that can lead to the overestimation or underestimation of travel demand.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
TTI	$157,605.50	$126,084.40	$31,521.10
TXST	$25,018.20	$20,014.56	$5,003.64

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7189 University: TTI/TXST

Project Title: Safety Assessment of Shared Use Paths at Roadway Crossings using Exposure-Based Models

Project Start Date: TBD Termination Date: 08/31/2025

Project Status: Pending Total Project Budget: $399,999.35

Project Manager: Joanne Steele Researcher: Bahar Dadashova

Project Objectives: Shared or multiuse paths invite a wide range of users, including pedestrians, bicyclists, and other wheeled users, with a range of transportation purposes such as commuting, exercise, and recreation. Although shared use path (SUP) users are physically separated from traffic, they remain vulnerable at roadway crossings. In the absence of roadway cross-section designs for accommodating pedestrians and bicyclists, SUP crossings can present users with complex tasks including gap selection, scanning for turning vehicles, and interacting with other path users. Ensuring safe crossings for all users at these locations is essential. Pedestrian and bicycle treatments have been developed and their safety effectiveness has been assessed in several studies and practices. Although technically these designs can be applied to SUPs, it is not clear how to integrate treatments for different types of path users, road classifications, land-use contexts, and crossing geometries. With the increasing implementation practices of SUPs across Texas, there is a need to assess the potential safety concerns involving pedestrians, bicyclists, micromobility users, and people with disabilities at these locations and develop guidance for treatment selection, including for paths next to railroads. The Performing Agencies shall explore the pedestrian and bicyclist crashes at the vicinity of SUPs and develop design and planning guidance for implementation purposes.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
TTI	$145,215.50	$116,172.40	$29,043.10
TXST	$31,040.30	$24,832.24	$6,208.06

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7194 University: TARL

Project Title: Evaluating the Risks that Erosion Control Products Pose to Protected Species and Other Wildlife

Project Start Date: TBD Termination Date: 08/31/2025

Project Status: Pending Total Project Budget: $310,622.00

Project Manager: TBD Researcher: Heather Mathewson

Project Objectives: Although many erosion control products (ECPs) are marketed as wildlife friendly, few assessments of the risk of such products to wildlife exist. Current knowledge focuses primarily on reptiles, specifically snakes, thus, the effects on other species such as terrestrial arthropods, mammals, or birds remains unknown. This research would provide evaluations on wildlife friendly ECPs from the Approved Product List (APL) based on their risk of wildlife entanglement. Our objectives are to (1) determine entanglement potential for different sizes and categories of animals in different products on APL, (2) evaluate the temporal window in which an erosion control blanket poses a risk to wildlife entanglement from pre-vegetative growth through post-vegetative growth, (3) determine which types of materials pose greater and lesser risk to protected species and other wildlife, (4) determine if weaving type or mesh size impacts entanglement, and (5) identify which products contain non-biodegradable materials. We shall address these objectives through the integration of wildlife camera trapping, surveys of construction workers for observational data, and controlled field experiments. We shall cross-reference species of concern within TxDOT districts with our study results, to produce a region-specific list of rankings of ECPs and risk to wildlife specific to each district's ecological region.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
Contract Total	$129,820.00	$103,856.00	$25,964.00

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7196 University: UTA

Project Title: Data-Driven Prioritization of Roadway Segments for Treatment during Severe Weather Events

Project Start Date: TBD Termination Date: 08/31/2025

Project Status: Pending Total Project Budget: $365,727.10

Project Manager: Darrin Jensen Researcher: Jinzhu Yu

Project Objectives: Effective maintenance is critical to ensure mobility, equity, and safety when roadways are experiencing severe weather events. Conventional approaches for prioritizing road segments for treatment (i) are empirical, (ii) are mostly based on static data about weather, traffic, road users, and road conditions, and (iii) do not account for important mobility, equity, and safety concerns. Therefore, conventional approaches (i) can lead to suboptimal road treatment effectiveness during extreme events, (ii) fail to prioritize the mobility of vulnerable populations and first responders, and (iii) may not guarantee a desired level of safety during extreme weather. To fill these gaps, the Performing Agency shall develop a risk-informed data-driven optimization (RIDDO) framework (Fig. 1) to enhance the effectiveness of the prioritization of road segments for treatment in response to weather extremes, accompanied by case studies that transportation authorities can use to improve their future road treatment prioritization. The Performing Agency shall leverage previous efforts on the Snowplow Operations Management System and Population Vulnerability Map to develop a software tool for the prioritization of roads for treatment during extreme weather events. This project will support the big data initiative by TxDOT to explore emerging data to improve traffic mobility, equity, and safety.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
Contract Total	$178,775.48	$143,020.38	$35,755.10

*Non-Federal Match provided by Transportation Development Credits (TDCs)

5.3 Safety and Operations

Project Number: 0-7171 University: TTI/TXST

Project Title: Barrier Striping for the Reduction of Accidents

Project Start Date: TBD Termination Date: 11/30/2024

Project Status: Pending Total Project Budget: $241,942.50

Project Manager: Chris Glancy Researcher: Boniphace Kutela

Project Objectives: The Traffic Safety Division (TRF) of the Receiving Agency drafted a special specification (SS) for the vertical application of a retroreflective solid stripe on concrete barriers, approximately six (6) inches below the barrier's top. During the phase of new product approval, this SS describes an application similar to three (3) locations already installed on Texas roadways in previous years. Barrier striping increases motorist awareness of the roadway's edge and the barrier itself, particularly in low-visibility conditions (i.e., heavy rain and snow). These existing implementation sites have not been formally evaluated. Furthermore, the short-term effectiveness of the treatments has not been investigated; therefore, there is a need for long-term and short-term safety effectiveness evaluation of these treatments. The Performing Agencies shall collect before-and-after collision data from Crash Record Information System (CRIS) and near-collision data from connected vehicle data vendor (e.g., Wejo) to evaluate the effectiveness of vertical application of a retroreflective solid stripe on concrete barriers. Furthermore, the Performing Agencies shall install these treatments at six (6) high crash locations with different barrier types including, but not limited to concrete barriers and metal beam guard fences to evaluate their short-term effectiveness using non-traditional safety evaluation approaches. The Performing Agencies shall utilize the findings to update the drafted SS for the future use across the state and beyond.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
TTI	$167,703.25	$134,162.60	$33,540.65
TXST	$62,673.75	$50,139.00	$12,534.75

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7180 University: UTSA

Project Title: Select High Risk Pedestrian Midblock Crossings and Perform Safety Evaluations for Select High Risk Pedestrian Midblock Crossings and Perform Safety Evaluations for Developing Pedestrian Crossings Countermeasures

Project Start Date: TBD Termination Date: 02/28/2025

Project Status: Pending Total Project Budget: $393,865.00

Project Manager: TBD Researcher: Hatim Sharif

Project Objectives: In 2018, there were 6,227 pedestrian fatalities in the United States. Of those, 4,612 (74%) occurred outside of intersections, including midblock locations. This means that nearly 3 out of every 4 pedestrian deaths in the U.S. occur at midblock locations. Midblock pedestrian crashes are often more severe than crashes that occur at intersections. This is because drivers are not expecting pedestrians to cross at midblock locations, and they may not be paying as close attention. San Antonio, Houston, and Dallas have historically had the highest number of pedestrian crashes annually; consequently, there is a need to identify the high-risk locations within these cities and their optimal countermeasures. Several pedestrian midblock treatments can be implemented to improve pedestrian safety; however, there is a need to better understand the safety effects of some of the more promising treatments on pedestrian crashes in Texas. There is a need to develop crash modification factors (CMFs) specific to Texas for appropriate types of treatments at midblock crossings to guide the development of countermeasures. The goal of this research is to develop a system for Texas Department of Transportation districts to help identify high-risk pedestrian midblock crossings and select the most effective treatments for them. The project tasks include an information search on midblock pedestrian crossing safety, the collection and analysis of safety and operational data, the identification of high-risk locations for occurrence of midblock crossings and appropriate treatments, the development of crash modification factors for midblock crossings, including benefit-cost ratios.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
Contract Total	$198,141.25	$158,513.00	$39,628.25

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7183 University: TTI/TXST

Project Title: Develop Crash Modification Factors for Super 2 Highways

Project Start Date: TBD Termination Date: 11/30/2024

Project Status: Pending Total Project Budget: $236,029.68

Project Manager: Joanne Steele Researcher: Marcus Brewer

Project Objectives: Super 2 highways have been used across Texas for over 20 years, providing operational and safety benefits to rural two-lane highways at lower cost than widening to four-lane, and more are planned as the demand increases on the state highway system. Previous Super 2 research has provided insights on safety improvements, but the Receiving Agency would benefit from an updated crash modification factor (CMF) based on a rigorous review and analysis of recent crash data from the state's many Super 2 highways. This CMF would provide additional support for installing Super 2 corridors throughout the state and complement existing guidance. The Performing Agencies shall use their existing database of Super 2 highways and site characteristics, combined with additional data on traffic volumes, crashes, and other relevant factors, to develop a comprehensive Super 2 dataset for analysis and identification of relationships between crashes and other characteristics. Using the results of this analysis, the Performing Agencies shall define one (1) or more CMFs or crash modification functions (CMFunctions) that the Receiving Agency and other practitioners can use to make decisions on installing future Super 2 corridors. The Performing Agencies shall disseminate these CMFs to the Federal Highway Administration's (FHWA's) CMF Clearinghouse for inclusion in their database.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
TTI	$145,845.00	$116,676.00	$29,169.00
TXST	$64,954.43	$51,963.54	$12,990.89

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7190 University: TTI

Project Title: Roadside Safety Device Analysis, Testing, and Evaluation Program

Project Start Date: TBD Termination Date: 11/30/2026

Project Status: Pending Total Project Budget: $2,542,402.75

Project Manager: Darrin Jensen Researcher: Roger Bligh

Project Objectives: The Road to Zero has targeted a goal of zero deaths and serious injuries on Texas roadways. Recent trends in Texas indicate a continued increase in highway fatalities each of the past three years. In 2021, roadway departure crashes were responsible for 40 percent of all crash-related fatalities in Texas, which is the largest single category by crash type. In October 2021, Federal Highway Administration (FHWA) designated Texas as one of 16 Roadway Departure Focus States based on being over-represented on three (3) different roadway departure crash fatality metrics. Roadside safety devices are a key element of an effective roadway departure safety strategy. These safety devices shield motorists from roadside hazards such as non-traversable terrain and fixed objects, thereby reducing injuries and fatalities associated with roadway departure crashes.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
Contract Total	$805,753.50	$644,602.80	$161,150.70

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7198 University: TTI

Project Title: Traffic Control Device Analysis, Testing, and Evaluation Program

Project Start Date: TBD Termination Date: 11/30/2026

Project Status: Pending Total Project Budget: $1,637,159.25

Project Manager: Tom Schwerdt Researcher: Melissa Finley

Project Objectives: Traffic control devices (TCDs) are the primary means of communicating highway information to road users and play a key role in highway automation. The design, application, and maintenance of TCDs is under constant transformation as new technologies, methodologies, and policies are introduced. In addition, vehicle technologies and the roadway infrastructure industry are rapidly evolving, spurred by technology advancements, customer demand, changes in the vehicle fleet, and changes in national and state policies. The Performing Agency shall provide the Receiving Agency a mechanism to quickly and effectively conduct high priority evaluations of issues related to TCDs. The TCD issues to be evaluated in this project could represent new devices or technologies, new applications of an existing device or technology, TCD material performance, changes in the Receiving Agency's practices regarding a TCD, or other TCD related needs. Examples of various evaluations include human factors, machine vision performance, safety and operational effects, visibility assessments, and cost effectiveness analyses. The activities conducted through this project shall support the development of TCD related policy, specifications, guidelines, handbooks, and training.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
Contract Total	$527,641.00	$422,112.80	$105,528.20

*Non-Federal Match provided by Transportation Development Credits (TDCs)

5.4 Structures and Hydraulics

Project Number: 0-7172 University: TXST

Project Title: Developing a Performance-Based Concrete Overlay Mix Design for Improved Resistance to Early-Age Cracking and Increased Durability

Project Start Date: TBD Termination Date: 08/31/2026

Project Status: Pending Total Project Budget: $700,370.51

Project Manager: Darrin Jensen Researcher: Anthony Torres

Project Objectives: Concrete bridge decks are exposed to a wide range of environmental and mechanical distress that can lead to severe deterioration. Typical bridge deck deterioration starts with shrinkage cracks, and additional cracks may occur due to traffic loads and effects such as temperature and moisture fluctuations. Cracking can lead to water and chloride ingress, causing corrosion of the reinforcement and further damage to the structure. In Texas, several concrete overlay mix design options are available, however, they are prescriptive-based. Although convenient, prescriptive-based designs have led to inconsistencies between mixtures and batches during placement, especially when mobile mixers are used. Additionally, as individual materials in prescriptive concrete overlay mix designs evolve and newer or alternative materials become available; e.g., Type IL cements and alternative supplementary cementitious materials (SCMs), unexpected and unanticipated behavior can occur. Furthermore, as bridge decks age there will be a need to preserve service life and ensure long-term performance of concrete overlay mix designs through performance-based specifications. This project aims at developing a robust performance-based, non-UHPC, mix design specification for concrete overlays to achieve low cracking and superior long-term durability. Developing such a specification that is adaptable to shifts in material technology will ensure long-term success in practice.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
Contract Total	$242,464.38	$193,971.50	$48,492.88

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7179 University: TTI

Project Title: Evaluate Safety End Treatments for Roadside Drainage Structures

Project Start Date: TBD Termination Date: 08/31/2026

Project Status: Pending Total Project Budget: $863,759.75

Project Manager: Martin Dassi Researcher: Sofokli Caskalli

Project Objectives: Drainage is a critical element of roadside design and often calls for the use of cross-drainage and parallel-drainage culverts. If untreated, the ends of the drainage structures can become roadside hazards that can result in serious injury when an errant vehicle leaves the roadway. The most cost-effective strategy is often to make the culvert end traversable using grates comprised of pipe runners across the culvert end. The Performing Agency shall investigate the safety performance of traversable cross-drainage and parallel-drainage culvert end treatments installed on roadside slopes. The Performing Agency shall address the various design variations of safety end treatments supported by current standards to investigate the safety performance. The Performing Agency shall develop design guidance to recommend slopes and size, length, and spacing of the pipe runners for both cross-drainage and parallel-drainage culverts that comply with the American Association of State Highway and Transportation Officials (AASHTO) Manual for Assessing Safety Hardware (MASH). The Performing Agency shall use full-scale crash testing to aid with validating the design guidance.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
Contract Total	$204,590.00	$163,672.00	$40,918.00

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7192 University: TTI/UTEP

Project Title: Develop Performance of Baseplate Connections in COSS and Traffic Signal Structures

Project Start Date: TBD Termination Date: 08/31/2026

Project Status: Pending Total Project Budget: $988,604.75

Project Manager: Darrin Jensen Researcher: Stefan Hurlebaus

Project Objectives: The Receiving Agency cantilever overhead sign structures (COSS) and traffic signal pole structures have a socketed fillet welded connection between the column and the baseplate. While economical, this connection has a low fatigue-resistance threshold. Some current and past Receiving Agency designs and contractor submitted alternates involving multi-sided bent plate columns were not designed using fatigue provisions. Fatigue provisions did not exist in the design specification of the time. The Receiving Agency is currently updating various ancillary structure standards for Load and Resistance Factor Design - Luminaires and Traffic Signals (LRFD-LTS) specifications, which does include fatigue provisions. Research is needed to ascertain the best connection type and design, while balancing economy and performance for new structures. The Performing Agencies shall identify the fatigue life of existing structures, including critical cases and means of repair and retrofit, in this research. The results of this research will lead to improved ancillary structure details with mitigated fatigue risk, as well as a method of identifying existing inventory with fatigue risks. The objectives of this research are to (1) outline fabrication practices and economic considerations that may affect proposed connection type and design, (2) develop an inventory database of COSS and traffic signal pole structures that are representative, (3) utilize structural modeling to identify from within the inventory critical cases that should be advanced to a testing program, (4) develop and execute a targeted testing program that isolates critical design parameters for the fatigue performance of both the critical cases found in the inventory and recommended connection types and designs, (5) provide recommendations for connection types and designs based on fatigue provisions, and (6) provide recommendations for identifying fatigue-critical of existing inventory

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
TTI	$219,180.25	$175,344.20	$43,836.05
UTEP	$45,501.25	$36,401.00	$9,100.25

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7193 University: CTR/TTI

Project Title: Develop Assessment and Mitigation Guidance for Ancillary Highway Structures with Existing Cracks

Project Start Date: TBD Termination Date: 08/31/2026

Project Status: Pending Total Project Budget: $1,493,580.09

Project Manager: Darrin Jensen Researcher: Todd Helwig

Project Objectives: Ancillary structures (AS) exist in a wide variety of applications critical to safety and daily needs of the travelling public (e.g. HMIP, COSS, and traffic signals). The long-term corrosion performance of these structures is of utmost importance to prevent deterioration and extend the structural design life and safety. While hot-dipped galvanizing provides excellent long-term behavior for corrosion control of these critical structures, over the past 20 years this process has been found to create extensive cracking of welds on base plate connections that is detrimental to the fatigue lives of these poles. Although improved details are used in new designs, thousands of HMIP, COSS, and signal poles exist in Texas with varying levels of cracking in the welds between the baseplates and pole shafts. The research outlined in this proposal identifies and provides critical assessment parameters and guidance for the Receiving Agency to determine if cracks should be monitored, repaired, or the structural component replaced. The proposed research includes a representative assessment of weld cracking in the AS inventory, the development of monitoring hardware and techniques, the development and assessment of repair techniques, and the development of certification methods/standards for inspection personnel.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
CTR	$230,194.46	$184,155.57	$46,038.89
TTI	$112,259.00	$89,807.20	$22,451.80

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7201 University: UTA

Project Title: Hydrologic Approaches to Playa Lakes, Areas of Significant Karst Geology, and Arid Regions

Project Start Date: TBD Termination Date: 08/31/2024

Project Status: Pending Total Project Budget: $54,322.00

Project Manager: TBD Researcher: Habib Ahmari

Project Objectives: Hydrology of karst terrains, playas, and arid zones is complex, and designing transportation infrastructure in these regions is challenging and requires a deep understanding of the unique hydrologic processes in these areas. In absence of consistent, scientifically-based standards for hydrologic design of transportation infrastructures in these regions, designers consider the specific conditions in each region and adopt design measures and management strategies based on their judgment. The Performing Agency shall develop a summary of the state of knowledge, the state of practice, and approaches and models for flood forecasting and design of drainage structures in these regions. By adopting the outcomes of this project, the Receiving Agency can better understand the hydrological behavior of these regions and make informed decisions toward developing hydrological design guidance and standards of practice for these areas.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
Contract Total	$54,322.00	$43,457.60	$10,864.40

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7202 University: TTI/USGS

Project Title: Synthesis: The State of Knowledge and State of Practice for Non-Contact Radar Stream Gauges in Texas, the United States, and Internationally

Project Start Date: TBD Termination Date: 08/31/2024

Project Status: Pending Total Project Budget: $64,776.20

Project Manager: Joanne Steele Researcher: Kuang-An Chang

Project Objectives: The United States Geological Survey (USGS) and other entities have begun to use non-contact radar for stream gauging to collect near-real-time stream velocity, discharge, and stage. Use of these devices is limited compared to traditional stream gauge methods that are typically used by the USGS and local government agencies in Texas. At the state level, TxDOT is leading the way, through partnership with the USGS, to deploy these stream gauges and is constantly learning how they can best be deployed. Because the gauges measure stream velocity and water level, they are easier and more useful to install in tidal areas than traditional gauges. In some streams, there is a peak in velocity wave in advance of a peak in water surface elevation, potentially acting as an advance warning of flood levels. Installation of these gauges is far simpler than traditional gauges in areas where channel vegetation, slope, or size, may affect equipment that must be installed down in the channel. While these gages appear to be less expensive to operate and maintain than traditional USGS gauging approaches, it would be beneficial to learn from experiences in other US states, agencies, and other countries who have used these devices for longer periods of time rather than solely learning by doing.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
TTI	$49,999.25	$39,999.40	$9,999.85
USGS	$14,776.95	$11,821.56	$2,955.39

*Non-Federal Match provided by Transportation Development Credits (TDCs)

5.5 Strategy and Innovation

Project Number: 0-7181 University: UH

Project Title: Development of Digital Twins for Texas Bridges

Project Start Date: TBD Termination Date: 08/31/2026

Project Status: Pending Total Project Budget: $505,286.00

Project Manager: Chris Glancy Researcher: Vedhus Hoskere

Project Objectives: Bridges are a critical component of transportation infrastructure, providing safe and efficient travel for millions of people every day. However, bridge maintenance can be complex and expensive, and it is challenging to detect problems early before they become more significant and costly to repair. Digital twins offer a solution to this challenge, providing a comprehensive and efficient means of obtaining, integrating, processing, and storing high-fidelity information about the current geometry and condition of a bridge. Developing digital twins of Texas bridges is a significant undertaking, as it requires collecting and integrating data from multiple sources, including sensors and unmanned aerial systems (UASs). Moreover, the resulting data must be complete and usable without overtaxing existing computer systems at TxDOT, which presents challenges related to data compression and redundancy. To address these challenges, this research proposes an outcome-based framework for the development of digital twins of TxDOT bridges. This framework will be extensively validated across real-world conditions through data collection and digital twin construction efforts from 30 (or as many as requested and agreed to) TxDOT bridges. The resulting guidelines and procedures will provide a means for comprehensively and efficiently collecting, integrating, processing, and storing geo-referenced, multi-sensor, and high-fidelity information about the current geometry and condition of a bridge. To enable early identification of bridge maintenance needs, the researchers will investigate and assess feasibility and requirements for aligning multi-temporal models and detecting and quantifying changes over time both with manual observation and automatically. The prototype routines for alignment and change detection developed will be integrated into the digital twinning framework for direct use by TxDOT. Additionally, the performing agency will prepare and test training materials to teach project managers, maintenance supervisors, and other personnel on field collection and planning of 3D data, digital twin development, and data processing and modeling. These training materials will include operational recommendations and guidance on data collection plans, reviews and approval, and safety. The proposed research will provide a clear path for the digital transformation and integration of TxDOT bridge inspections, design, and maintenance activities, enabling more scientific decision-making and bridge management practices with broad impacts to TxDOT operations.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
Contract Total	$184,489.00	$147,591.20	$36,897.80

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7199 University: TEEX/TTI

Project Title: Identification of Needs and Strategies for First Responder Interactions with Automated Vehicles (Avs)

Project Start Date: TBD Termination Date: 02/28/2025

Project Status: Pending Total Project Budget: $310,814.12

Project Manager: Joanne Steele Researcher: Brad Trefz

Project Objectives: The number of vehicles with automated functions continues to increase on Texas roadways. Several companies are testing or will soon deploy demonstrations of Level 4 automated vehicles or connected automated vehicles (CAV/AVs) within the state, with no notification requirements. Additionally, several automated commercial motor vehicle (ACMV) projects are testing Level 4 automation. While safety goals are aimed at minimizing the number of adverse incidents that occur, it is inevitable that a crash or other adverse operations will happen involving one (1) of these automated vehicles. The Receiving Agency's Highway Emergency Response Operator (HERO) program and other first responders are part of the front line that must be prepared to encounter a CAV/AV or ACMV during a routine interaction or adverse event/accident. This project will identify needs and strategies for first responders to understand how these vehicles operate, how to safely approach and disable these vehicles as needed during routine and adverse incident interactions and how to interact with AVs during an accident or emergency.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
TEEX	$19,402.38	$15,521.90	$3,880.48
TTI	$231,424.25	$185,139.40	$46,284.85

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7200 University: TTI/UTA

Project Title: Utilizing Telematics to Understand Driving Behavior During Missed Exits and Wrong Turns

Project Start Date: TBD Termination Date: 08/31/2025

Project Status: Pending Total Project Budget: $306,215.21

Project Manager: Jade Adediwura Researcher: Jason Wu

Project Objectives: Texas is currently experiencing its largest population growth in decades. More and more lands are being urbanized and complex design methods are often adopted. As a result, drivers are likely confused at certain locations such as ramps, roadway exits and intersections. The overarching goal of this project is to identify unsafe and inefficient locations of Texas state highways, where driving behaviors often reveal excessive abnormities (e.g., hard brakes, control stops and/or missing of road entrances/exits). Problematic locations are due to misleading roadway designs or signage configurations in many cases. In the past, the Receiving Agency could not identify such locations until either a driver called to complain or crashes occurred frequently. The emerging telematics data from connected vehicles (CVs) will enable such possibility to identify and fix problematic locations proactively. Applying the state-of-the-art big data analytics and Artificial Intelligence (AI) techniques on the emerging vehicle telematics data (delivered by Wejo and INRIX), the Performing Agencies shall demonstrate how to identify problematic locations within the selected area. The Performing Agencies shall also integrate multiple advanced computing techniques (e.g., high-performance computing, cloud-computing etc.) to cost-effectively streamline the process of traffic big data fusion, cleaning, and reduction for the Receiving Agency' future practices.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
TTI	$95,591.50	$76,473.20	$19,118.30
UTA	$29,231.00	$23,384.80	$5,846.20

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 5-9905-24 University: CTR

Project Title: Innovation Consortium (TTTF, TxSTIC, EDC)

Project Start Date: TBD Termination Date: 08/31/2025

Project Status: Pending Total Project Budget: $2,000,000.00

Project Manager: Lauren Freriks Researcher: Kristie Chin

Project Objectives: The Texas Department of Transportation (TxDOT) needs support to manage the Innovation Consortiums – projects or programs that facilitate collaboration, dissemination, and development of innovative transportation technologies and practices. The Innovation Consortiums include three previous standalone programs: Texas Technology Task Force (TTTF), the Texas State Transportation Innovation Council (TxSTIC), and the Everyday Counts (EDC) program. Closer coordination of these programs will further help to accomplish each programs individual goals. The TTTF, authorized by Texas's 83rd Legislature General Appropriations Bill, S.B. No. 1, Item 44, VII-31, was established in 2013 to enhance its vision for the future of Texas's transportation systems. The TTTF began with a core knowledge group of transportation experts and has grown into a successful program that is responsible for managing the Emerging Technology Portfolio, publishing white papers on critical topics, delivering strategic plans such as the Technology Utilization Plan, developing communication strategies, and conducting TTTF meetings with in-depth technical analysis. The TxSTIC was the 51st STIC established on the 22nd of March 2016, by the STIC State of Texas Charter and renewed the 20th of November 2019. The TxSTIC was established to foster a collaborative culture for the rapid implementation of ready to deploy and beneficial innovations and technologies among stakeholders to efficiently deliver a safe and effective transportation system to the State of Texas. Everyday Counts (EDC) is a Federal Highway Administration (FHWA) initiative to advance a culture of innovation in the transportation community. FHWA works with State transportation departments, local governments, tribes, private industry, and other stakeholders to identify a new collection of innovations to champion every two years that merit accelerated deployment. The TTTF, TxSTIC and EDC program, together serve as a catalyst for rapid deployment of nationally and state identified new technologies, strategies, and methods that have already been demonstrated to be successful in real world applications and would lead to improved performance and effectiveness of the transportation system within the State of Texas.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
Contract Total	$631,257.00	$505,005.60	$126,251.40

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 5-9908-24 University: TTI

Project Title: Innovative Transportation Projects at TxDOT

Project Start Date: 01/01/2024 Termination Date: 12/31/2023

Project Status: Pending Total Project Budget: $3,000,000.00

Project Manager: Katelyn Kasberg Researcher: Bob Brydia

Project Objectives: From time to time, TxDOT districts produce ITS and other technology innovations that improve roadway and/or worker safety, roadway efficiency and/or produce cost savings. By failing to recognize and scale these innovations across the state, TxDOT does not receive the full benefit of 25 diverse centers of excellence. This contract utilizes TTI, which is an organization that excels at innovation in and of itself, to investigate innovative district practices and to develop plans at a district and statewide level to share and scale innovation across the state. By harvesting the knowledge already contained within TxDOT, new avenues will open to improve roadway safety, efficiency and produce cost savings. Due to the breadth of TxDOT, these innovations may have very large impacts on the millions of Texans across the state and their visitors. Additionally, by cataloging and bringing together these innovations, divisions and districts can work together to make sure that solutions are developed in such a way that unified systems and interoperability occur throughout the state. This project also complements a wider effort to catalog, share and grow innovation at TxDOT. The end result for Planning for Innovation and Technology Deployments at TxDOT is a programmatic set of documents that compile and recommend innovative ITS and advanced technology roadway projects and system improvements that TxDOT districts can execute, customized to each district. To arrive at this, the consultant team will interact with districts and industry professionals as unique stakeholders across the state and the nation to compile insights of innovative projects that may include data analysis, operational improvements or deployment of advanced technologies along the roadway, among others. The consultant team will develop high level scope and cost estimates for each offered transportation project. The consultant may also be directed to develop a strategy blueprint (goal, purpose, scope, timeline, responsibilities) for how innovation and technology deployment can be progressed as an integral part of the Receiving Agency's functions and to develop evaluation plans and/or templates for Department innovation and technology deployment projects.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
Contract Total	$750,000.00	$600,000.00	$150,000.00

*Non-Federal Match provided by Transportation Development Credits (TDCs)

5.6 Program Support

Project Number: 5-7097-24 University: UTA

Project Title: Texas Local Technical Assistance Program (TxLTAP)

Project Start Date: TBD Termination Date: 09/30/2025

Project Status: Pending Total Project Budget: $3,377,917.13

Project Manager: TBD Researcher: Debra Dahn

Project Objectives: The Local Technical Assistance Program (LTAP) is a nationwide effort financed by the Federal Highway Administration and individual state departments of transportation. Its purpose is to translate into understandable terms the best available technology for roadways, bridges, bicycle and pedestrian facilities, and public transportation for city and county roadway and transportation personnel. The TxLTAP, operated by the Performing Agency, is sponsored by the Receiving Agency and the Federal Highway Administration. TxLTAP is focused on preserving and enhancing the local road system by delivering quality training and technical assistance to local city and county road agencies in Texas. The training provided through this program will increase the performance of the transportation workers in Texas by ensuring they conduct their duties in a safe, efficient, environmentally sound, and cost-effective manner. This program will also allow city and county agencies to maximize benefits from their often limited fiscal and staffing resources. Through training geared to local government circumstances, customized technical assistance, advice provided at events, and a library of resources, TxLTAP provides relevant and impactful information focused on road and bridge/culvert maintenance, the use of traffic control devices, and other techniques to promote traffic safety.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
Contract Total	$1,664,169.38	$1,331,335.50	$332,833.88

*Non-Federal Match provided by Transportation Development Credits (TDCs)

6. Continuing Projects by Functional Area

6.1 Construction, Maintenance and Materials

Project Number: 0-7002 University: CTR

Project Title: Evaluation of Geogrids for Asphalt Pavement Construction

Project Start Date: 05/14/2019 Termination Date: 08/31/2024

Project Status: Active Total Project Budget: $1,194,503.05

Project Manager: Jade Adediwura Researcher: Jorge Zornberg

Project Objectives: Geogrids have been used in several Receiving Agency Districts to reinforce Hot-Mix Asphalt (HMA) with the objective of minimizing reflective cracking. Recent field evaluations have revealed that polymeric geogrids within HMA resulted in an additional promising benefit; increasing structural capacity and consequently reducing the required thickness of hot-mix overlays. Despite strong field evidence, important questions remain concerning proper geogrid selection criteria for this new application, what properties to specify, and how to quantify the increased structural capacity. The Performing Agency shall: (1) evaluate different types of polymeric and glass geogrids; (2) instrument field test sections along SH21 to validate constructability and assess long-term field performance; and (3) translate the research findings into practical specifications.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
Contract Total	$217,976.47	$174,381.18	$43,595.29

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7006 University: TTI

Project Title: Design, Construction, and Performance Monitoring of Stabilization of Expansive Soils and Cement

Project Start Date: 04/24/2019 Termination Date: 08/31/2024

Project Status: Active Total Project Budget: $1,730,912.76

Project Manager: Jade Adediwura Researcher: Dar Hao Chen

Project Objectives: The Receiving Agency is actively looking for alternatives to stabilize expansive soils and cement treated bases with polypropylene fiber. Polypropylene fiber, hereafter is referred to as fiber. Many areas in Texas have problems stabilizing expansive soils with traditional stabilizers (i.e. lime, cement, fly ash, or in combination) because of the high levels of sulfates in the soil. Many major pavement failures have occurred due to lime/cement induced sulfate heaves. In addition, reflection cracks from cement treated bases have been reported in numerous projects. There are huge potential benefits of applying polypropylene fiber to stabilize expansive soils and cement treated bases to (1) increase strength, (2) reduce shrinkage potential, (3) reduce chemical stabilizer content, and (4) increase flexibility/ductility. There is a critical need to incorporate fiber in the Receiving Agency's "Modification and Stabilization of Soils and Base for Use in Pavement Structures" guidelines. Therefore, this study will develop appropriate laboratory test methods to evaluate mix designs for (1) fiber reinforced cement treated base, (2) fiber reinforced clay, and (3) fiber reinforced sandy soil. In addition, this study will provide assistances to Receiving Agency Districts to develop optimum fiber application rates and establish specifications and construction QC/QA plans for uniform mixing. The Performing Agency shall conduct laboratory tests to determine optimum fiber application rates for cement treated base and 6 different subgrade soils: (1) PI < 15, (2) 15 ≤ PI < 35, (3) PI ≥ 35, (4) sulfate concentration > 3000 ppm but ≤ 8000 ppm, (5) sulfate concentration > 8000 ppm, and (6) organics content exceeds 1%. Over the last few years, the Receiving Agency has successfully constructed several Full Depth Recycling (FDR) sections with foamed asphalt using innovative reclaiming equipment. One key issue that the Performing Agency shall address in this study is an evaluation of the mix technologies that ensure fibers are mixed uniformly in the field. The Performing Agency shall use the Wirtgen Reclaimer as the initial device for mixing fibers into the material being stabilized. The Performing Agency shall progress to other common construction equipment and processes to achieve the optimum mixing results. This study shall investigate innovative Nondestructive Testing (NDT) tools to (1) assist site characterization, (2) select candidate test sections, (3) identify sampling locations, (4) provide input on mix design process, (5) provide Input during QC/QA process, and (6) monitor field performance of the test section. The Performing Agency shall document the optimal construction techniques and identify time and cost savings.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
Contract Total	$397,898.75	$318,319.00	$79,579.75

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7027 University: TTI

Project Title: Accelerating Mix Designs for Base Materials

Project Start Date: 07/10/2019 Termination Date: 10/31/2023

Project Status: Active Total Project Budget: $689,885.00

Project Manager: Martin Dassi Researcher: Stephen Sebesta

Project Objectives: Stabilization of roadway or stockpile materials allows for enhancing strength and stiffness properties of pavement base layers to meet structural requirements in a cost-effective and sustainable manner. Historically, stabilization mixture design criteria relied on compressive strength results and, depending on the treatment and test method, could take nearly a month to complete. Additionally, the different treatments currently require different preparation, curing, and acceptance criteria. This project will develop a harmonized accelerated design procedure for base materials with the objective of producing an acceptable design recommendation within seven (7) days. This project will include stabilizer types such as cement, lime, lime-fly-ash, asphalt emulsion, and foamed asphalt, and will focus on rapid test turnaround time, lab curing techniques to rapidly simulate cured field conditions, inclusion of moisture susceptibility in the mix design, and performance-related design criteria. This project will develop recommended harmonized test procedures, suggested specification modifications as applicable, and perform training workshops.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
Contract Total	$11,485.25	$9,188.20	$2,297.05

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7028-01 University: CTR

Project Title: Integrated SiteManager and Pavement Analyst Database on an Online Platform

Project Start Date: 09/01/2022 Termination Date: 04/30/2024

Project Status: Active Total Project Budget: $139,964.98

Project Manager: Tom Schwerdt Researcher: Amit Bhasin

Project Objectives: The Receiving Agency maintains several databases to record materials, construction, and performance information for roadway projects: materials and test records in the SiteManager database; construction related information in TxDOT Connect or Design and Constructions Information System; and performance measures in the Pavement Analyst database. Data from these databases has been compiled in a recent project to identify relationships between the materials and construction records and observed long-term performance of hot mix asphalt pavements. The objective of this project is to implement this work through a visualization and analysis tool via a commercially available software and that can be accessed in near real time by the Receiving Agency on an ongoing basis. The Performing Agency shall utilize Tableau Prep Builder to integrate data from all data sources and develop the visualization and identification interface on Tableau Packaged Workbook. In addition to the aforementioned databases, maintenance history from Compass and GIS information from the Receiving Agency Open Portal to locate and map all projects shall be incorporated. A text and visual guide on how to use the Tableau interface shall be developed, and an online workshop shall be held to demonstrate the functionality of the interface to the Receiving Agency's Divisions and Districts. Such a tool shall allow the Receiving Agency to investigate all construction and maintenance projects performed on a pavement section and understand the effect of materials, design and construction processes on the long-term pavement performance.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
Contract Total	$43,942.73	$35,154.18	$8,788.55

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7031-01 University: CTR

Project Title: Develop Efficient Prediction Model of Highway Friction on an Annual Basis on Texas Network

Project Start Date: 09/01/2022 Termination Date: 08/31/2024

Project Status: Active Total Project Budget: $357,134.51

Project Manager: TBD Researcher: Jorge Prozzi

Project Objectives: The number of wet-weather crashes is a significant problem in Texas, consequently, the provision of pavement surfaces with adequate skid resistance or friction is of utmost importance for promoting public safety and saving lives. Measuring skid numbers for the entire Texas roadway network on an annual basis is challenging and inefficient because of the regular stops necessary to refill the water tanks. Fortunately, recent laser technology allows the measurement of texture at high resolution and speed in an efficient manner. Today, a contractor collects only macrotexture for Receiving Agency and delivers mean profile depth (MPD), which is a very poor predictor of skid. Consequently, the Receiving Agency personnel have to go out and collect skid data at a high cost to calculate skid numbers. Currently the Receiving Agency collects skid resistance on about 33% of their network on an annual basis (approximately 50% of the Interstate system and 25% of the non-Interstate system). The objective of this project is to: (i) continue the work that started under Receiving Agency's Project 0-7031, (ii) enhance the system that was developed as part of that project and (iii) update the models developed by collecting texture and skid on, at least 3,000 additional pavement sections distributed in at least six different Districts. This information shall be used to calibrate and validate equations to predict friction and skid numbers with a high degree of accuracy. This research would result in an enhanced system to collect texture data at highway speed for the entire Texas on-system network on an annual basis. The system is intended to be compact and capable of retrofitting to any surveying vehicle with minimal time and effort. This shall provide not only savings but additional safety to operations.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
Contract Total	$175,578.66	$140,462.93	$35,115.73

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7072 University: TXST

Project Title: Improve Data Quality for Automated Pavement Distress Data Collection

Project Start Date: 09/08/2020 Termination Date: 08/31/2024

Project Status: Active Total Project Budget: $449,720.00

Project Manager: Jade Adediwura Researcher: Feng Wang

Project Objectives: Accuracy and precision issues associated with the reliability of the existing automated and semi-automated pavement condition data collection methods have existed since inception with the Receiving Agency. This research shall develop data quality assurance guidelines for the Receiving Agency to improve the quality of automated pavement condition data. The three components in the research are the development of an audit sampling method, a set of consistency check criteria for pre-analysis of new data, and data quality criteria in acceptance of new data. A pilot study for a selected Receiving Agency District shall be completed with the developed guidelines to evaluate the effectiveness of the proposed data quality assurance procedures for data quality improvement.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
Contract Total	$112,742.48	$90,193.98	$22,548.50

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7073 University: CTR/TTI

Project Title: Improving Testing Requirements in Item 300 Of TxDOT Standard Specifications

Project Start Date: 09/01/2020 Termination Date: 08/31/2025

Project Status: Active Total Project Budget: $580,030.00

Project Manager: Tom Schwerdt Researcher: Amit Bhasin

Project Objectives: The Receiving Agency's standard specification Item 300, Asphalts, Oils, and Emulsions, includes more than 48 different test procedures or conditioning procedures for asphalt concrete (AC) graded binders (12), cutbacks (8), emulsified binders (17), and performance-graded (PG) binders (11) used in different pavement construction and maintenance applications. This does not include testing requirements for recycling agents, crack sealants, or asphalt rubber binder. The Receiving Agency regularly performs many of these tests for quality management or quality assurance purposes. This test schedule presents a challenge for the binder lab in terms of maintaining test procedures, acquiring and maintaining test equipment, calibrating equipment, and training personnel. Some specification tests are legacy tests that once were the state-of-the-art and thought to be related to asphalt binder performance. Many of these legacy tests are not used in more recently developed specifications, as other tests are now available and may be more indicative of performance. This project seeks to review the Receiving Agency's Item 300 binder specifications and tests for relevance; determine whether they assess safety, performance, or constructability; and take into account accuracy, efficiency, and environmental considerations. The project shall also make recommendations for changes.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
CTR	$134,889.57	$107,911.66	$26,977.91
TTI	$125,000.00	$100,000.00	$25,000.00

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7076 University: TTI

Project Title: Develop Laboratory Mix Design of Full Depth Reclamation (FDR) Projects Using Foamed Asphalt Binder and Emulsified Asphalt

Project Start Date: 09/01/2020 Termination Date: 08/31/2024

Project Status: Active Total Project Budget: $885,286.25

Project Manager: Joanne Steele Researcher: Tom Scullion

Project Objectives: Full depth reclamation (FDR) is a cost-effective recycling strategy that reuses both asphalt bound and unbound granular materials. FDR was implemented in Texas in the early 1990s in the Bryan and Lubbock Districts. In the past five years, the Receiving Agency has implemented FDR using either foamed asphalt or emulsions. The current specification allows for 4-inch diameter by 2-inch height specimens or 6-inch diameter by 3.75-inch height specimens to be tested, with identical acceptance criteria for both sample sizes. This practice has raised concern regarding the effect of sample size on the indirect tensile (IDT) strength because larger specimens have shown lower IDT strength compared to 4-inch diameter specimens regardless of material source, binder type, binder content, or conditioning procedure. The Performing Agency shall evaluate the strength differences between the two specimen sizes and provide acceptance criteria revisions, as appropriate. In addition, the effect of testing temperature is critical with regard to IDT strength of FDR specimens. Therefore, the Performing Agency shall evaluate the specimens at various testing temperatures and recommend a target temperature to substitute the more general test conditions currently specified. The Performing Agency shall validate the revised criteria by evaluating the performance of selected field projects.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
Contract Total	$234,116.00	$187,292.80	$46,823.20

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7102 University: CTR

Project Title: Develop Models for Field Performance of Friction and Skid Number

Project Start Date: 09/01/2021 Termination Date: 02/28/2024

Project Status: Active Total Project Budget: $471,872.25

Project Manager: Jade Adediwura Researcher: Jorge Prozzi

Project Objectives: The Receiving Agency's Maintenance Division has recently implemented a comprehensive and more powerful pavement management system known as Pavement Analyst (PA). The new system is capable of prioritizing maintenance and rehabilitation (M&R) activities for different time horizons based on a series of decision trees that account for current distress levels, scores, traffic, location, environment, etc. The decision trees incorporate new variables, such as skid and texture which are correlated to the number of wet weather crashes. Controlling these variables shall significantly improve the safety of the Texas highway network. There are no current models for the prediction of skid or texture that can be used on Pavement Analyst. The existing models are based on laboratory characterization and the exponential decay rate is estimated from laboratory performance. The objective of this research project is to develop a performance model to predict pavement skid number as a function of time, for use in the Receiving Agency's pavement management system, i.e. Pavement Analyst. The Performing Agency shall develop models that account for field prediction of skid and texture, to be incorporated into Pavement Analyst and to aid in the selection of optimal M&R activities. These models shall also account for treatment type: PM, LRhb, MRhb, and HRhb.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
Contract Total	$122,654.93	$98,123.94	$24,530.99

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7103 University: TTI

Project Title: Investigating Prime versus Curing: Where, When and Why

Project Start Date: 09/01/2021 Termination Date: 11/30/2024

Project Status: Active Total Project Budget: $525,000.25

Project Manager: Martin Dassi Researcher: Darlene Goehl

Project Objectives: The objective of this research project is to determine where, when, and why a prime or cure is needed for a pavement layer. Materials such as prime coats, curing materials, seal coats, and tack coat are typically considered non-structural, but integral to the pavement structure. Some materials can be used for multiple purposes: prime, bond or help cure; however, the rates and timing of use may change depending on why the material is being used. Guidance is needed to help designers, inspectors and construction personnel understand the materials and where, when, and why to use them. The Performing Agency shall develop guidelines for prime and curing through a series of laboratory and field testing and develop tests and procedures to determine the best materials for a prime, cure or a combination. These guidelines shall aid decision makers in determining whether a prime, cure or bonding material is needed, and where, when and why to design and use the appropriate materials.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
Contract Total	$156,036.75	$124,829.40	$31,207.35

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7104 University: TTI/UTEP

Project Title: Establish Performance-Based Acceptable Lab-Molded Density Range for Mix Design and QC/QA

Project Start Date: 09/01/2021 Termination Date: 04/30/2025

Project Status: Active Total Project Budget: $829,999.25

Project Manager: Martin Dassi Researcher: Fujie Zhou

Project Objectives: Lab-molded density of asphalt mixes is a critical factor for laboratory mix design, plant production, and field performance. Current mix design and production quality control and quality assurance (QC/QA) are developed around a fixed lab-molded density of 96 percent. Adherence to a fixed lab-molded density is not only one of the main factors leading to drier, more crack susceptible mixes where low asphalt binder content is often caused by balancing high lab-molded density values at plant production, but it also impacts the implementation of the Balanced Mix Design approach. Furthermore, various field test sections designed with densities ranging from 96.5 to 98 percent were previously constructed in different areas of Texas, and they performed well in the field with no observed rutting problems. Thus, the objective of this project is to establish an acceptable range of lab-molded densities for laboratory mix design and production QC/QA testing. To achieve the objective, the Performing Agencies shall review the literature, conduct extensive laboratory performance tests, construct test sections and monitor their performance, and finally recommend an acceptable range of lab-molded density based on all the information and data collected.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
TTI	$141,890.00	$113,512.00	$28,378.00
UTEP	$133,000.00	$106,400.00	$26,600.00

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7105 University: TTI

Project Title: Measuring Seal Coat Rate Field Adjustments

Project Start Date: 09/01/2021 Termination Date: 11/30/2024

Project Status: Active Total Project Budget: $450,000.00

Project Manager: Tom Schwerdt Researcher: Darlene Goehl

Project Objectives: The objective of this research project is to develop measurable and repeatable adjustment criteria for seal coat application rates based on pavement condition, traffic and material properties for the design method developed in research project 0-6989 Update Seal Coat Application Rate Design Method (TxDM6989). Current practice requires experienced personnel to understand the adjustments needed for application rates, including changing the adjustments as conditions on the pavement change. The adjustments in the TxDM6989 combine multiple pavement conditions into one description. By measuring the conditions, a combined adjustment based upon measured parameters will remove subjectivity from the procedure. This will lead to more consistently constructed projects that meet the objectives of designing the rates so that the resulting seal will not have too much binder so that it flushes or bleeds in the summer; but there is enough binder to prevent rock loss over the winter. This research project will produce measurable methods for adjustments to the rate design procedures that will help engineers and inspectors make better decisions resulting in successful projects.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
Contract Total	$115,431.75	$92,345.40	$23,086.35

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7106 University: TTI

Project Title: Quantify Maximum Accumulated Seal Coat Layers for Stability

Project Start Date: 09/01/2021 Termination Date: 11/30/2024

Project Status: Active Total Project Budget: $449,211.00

Project Manager: Jade Adediwura Researcher: Darlene Goehl

Project Objectives: The Receiving Agency invests over $250 million annually on seal coats, it is therefore critical to apply the right treatment to the right road at the right time. Projects are typically selected based on the time since the last seal coat (an average of 7 years) with little to no testing performed to ensure that the section is a good candidate for seal coat and how many seal coats to apply. The objective of this research is to determine the maximum number of seal coats that can be applied to a pavement surface before the accumulated layers of seal coats become unstable. The Performing Agencies shall evaluate the stability of existing accumulated seal coat substrate layers through a series of laboratory and field testing and develop tests and procedures to determine when an additional seal coat may not perform well. The Performing Agencies shall develop guidelines to select candidate seal coat projects with multiple seal coat layers ensuring that a new seal coat is used on a good candidate pavement will lower risk to the Receiving Agency, improve life cycle costs and lead to better performing sections of pavement.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
Contract Total	$124,757.75	$99,806.20	$24,951.55

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7107 University: TTI

Project Title: Determine Feasibility and Methodologies of Using Structural Data From Traffic Speed Deflection Devices in Network-Level Treatment Decision Making

Project Start Date: 09/01/2021 Termination Date: 08/31/2024

Project Status: Active Total Project Budget: $449,941.00

Project Manager: Martin Dassi Researcher: Tom Scullion

Project Objectives: Traffic Speed Deflection Devices (TSDD) non-destructively measure structural condition while traveling at traffic speeds. Advancements in TSDD's have enabled these evaluations to be made with the benefit of reducing safety hazards associated with traditional stop and go Falling Weight Deflectometer (FWD) devices. The Receiving Agency is an active participant in the Transportation Pooled Fund TPF-5(385) "Pavement Structural Evaluation with Traffic Speed Deflection Devices". As a participant, the Receiving Agency has collected more than 1000 miles of TSDD data in several Receiving Agency Districts and is expected to continue to collect TSDD data for the next three (3) years. Recent interest from Receiving Agency Districts on using continuous structural data in network level treatment decisions has necessitated the need to verify TSDD measurements and provide guidelines and analysis methodologies to implement structural condition data for both network and project level pavement management applications. Incorporating a structural condition index into network level decisions has been a goal of the Receiving Agency's for over 30 years with the objective of providing Receiving Agency Districts a comprehensive integrated assessment of both visual and structural condition. Use of this tool shall provide Receiving Agency Districts with what level of pavement rehabilitation treatment is required as they develop their 4-year plans

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
Contract Total	$152,041.00	$121,632.80	$30,408.20

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7108 University: UTEP

Project Title: Evaluate the Importance of Fine Aggregates in Achieving Adequate Skid Resistance in TxDOT Hot Mix Asphalt Mixtures

Project Start Date: 09/01/2021 Termination Date: 08/31/2024

Project Status: Active Total Project Budget: $477,000.00

Project Manager: Tom Schwerdt Researcher: Imad Abdallah

Project Objectives: The lack of skid resistance has been an important issue for Receiving Agency pavement as many of them cannot hold adequate skid resistance in the long run, and even some newly constructed roads are observed to have poor skid resistance. Skid resistance is a function of the quality of the aggregate as well as the micro-and macro-texture of the surface. Those textures can be modified by using the appropriate type and amount of fine aggregates and fines in asphalt concrete. The main focus of the research is understanding the effects of fine aggregates and fines on the skid resistance of asphalt concrete since their impacts on the skid resistance and performance. The Performing Agency shall evaluate the current practices and research studies commissioned by Receiving Agency (in particular) and other states (in general) on the use of fine aggregates and fines in asphalt concrete to improve skid resistance. The major objective of this project shall be critical to evaluate the influence of fine aggregates and high-quality fines on the skid resistance of asphalt concrete.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
Contract Total	$164,000.00	$131,200.00	$32,800.00

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7111 University: TTI/UTEP

Project Title: Determine Impact of Field Sands on Workability and Engineering Properties of Superpave Mixtures in Texas

Project Start Date: 09/01/2021 Termination Date: 08/31/2024

Project Status: Active Total Project Budget: $500,001.50

Project Manager: Tom Schwerdt Researcher: Imad Abdallah

Project Objectives: Field sands have been used in hot mix asphalt (HMA) pavements to reduce binder requirement since they are readily available and are less expensive than crushed materials. Considering their adverse effects on the performance, field sands are limited to 10% to 15% of the aggregates. The most common feature of field sand that can have a significant detrimental effect on the Asphalt Concrete (AC) performance is the presence of harmful clay particles. Understanding the impact of these clay particles on AC performance is the subject of this research. The upper limit of specific field sand, given the amount of active clay present in it, the process to determine the clay content, and how they affect the performance of AC mixes shall be evaluated. Since field sands are more round compared to the crushed aggregates, mixes containing more field sands can be compacted to a given density at lower binder contents. Given the less particle to particle interlocking of such mixes, however, they are more suspect to excessive rutting. Thus, this research shall investigate the effect of clay minerals as well as the sand properties independently on the performance of AC mixes (with a focus on Superpave mixtures) and evaluate their combined/interactive effects, as the natural sands are a combination of both. To that end, the Performing Agency shall provide interaction plots and/or charts that can be used to select the maximum allowable percentage of a given field sand.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
TTI	$35,000.50	$28,000.40	$7,000.10
UTEP	$140,000.00	$112,000.00	$28,000.00

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7139 University: CTR

Project Title: Determination of Pavement Surface Type

Project Start Date: 09/01/2022 Termination Date: 08/31/2024

Project Status: Active Total Project Budget: $414,534.69

Project Manager: TBD Researcher: Jorge Prozzi

Project Objectives: An accurate knowledge of the pavement surface type is fundamental to efficient pavement management. Knowledge of the surface type is important for tracking the performance of different surfaces and predicting skid numbers and noise. While surface type is already a data element in Pavement Analyst, it lacks the necessary accuracy. Previous Receiving Agency projects have attempted to populate this field by combining different data sources, but the results have not been implemented because of lack of accuracy. Laser, video, and 3D technologies have made it possible to scan large networks and obtain full coverage on an annual basis. Artificial intelligence and these technologies can be used to predict surface type with an accuracy higher than 90%. This research project shall utilize the latest technologies to develop equipment and a methodology for determining surface type. To accomplish this goal, the Performing Agency shall conduct a literature review to identify potential technologies, evaluate them and determine the technology with the highest potential, develop a set of technical specifications for the system, set a target for the degree of accuracy, develop an experimental design, use the system developed to determine surface type, evaluate its performance, and assemble and deliver a final system.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
Contract Total	$225,590.26	$180,472.21	$45,118.05

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7141 University: CTR

Project Title: Evaluation of Nano-Materials in Concrete for Improved Durability

Project Start Date: 09/01/2022 Termination Date: 05/31/2026

Project Status: Active Total Project Budget: $611,267.44

Project Manager: Jade Adediwura Researcher: Raissa Ferron

Project Objectives: The application of nanotechnology in the construction industry has led to significant advancements in enhancing the mechanical properties of concrete through changing concrete's structure at the nanolevel. However, advancements in understanding how to leverage nanomaterials to combat durability issues has lagged behind the progress made on the mechanical property side. Concrete is susceptible to various physical and chemical degradation mechanisms that can reduce its service life. Historically, Class F fly ash has been used to address many of these degradation issues. However, with changes in fly ash quality and availability, identifying other materials that the Receiving Agency can use to protect concrete against durability issues are needed. Over the last 20 years, much progress has been made in using nanomaterials in concrete mixtures, for example, nanoparticles have even been used in high-volume fly ash cementitious systems to offset the negative effects of fly ash on rate of hydration and early-age strength gain. This project shall investigate the use of nanomaterials on the properties of concrete mixtures, with special emphasis placed on durability properties and self-healing capabilities. Various nanomaterials shall be used, alone and in combination with supplementary cementing materials (SCMs). The most promising mixtures shall be selected for field trails to validate laboratory findings.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
Contract Total	$167,586.54	$134,069.23	$33,517.31

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7142 University: TTI

Project Title: Develop Safety Scoring Tool for the Wet Surface Crash Reduction Program

Project Start Date: 09/01/2022 Termination Date: 08/31/2024

Project Status: Active Total Project Budget: $200,001.75

Project Manager: Jade Adediwura Researcher: Darlene Goehl

Project Objectives: The Performing Agency shall develop a risk assessment procedure related to the reduction of wet weather crashes that incorporates pavement surface type and aggregate selection and will be integrated into the Safety Scoring Tool (SST). The developed scoring tool will bridge the gap between the approaches in the two current tools, the SST and Receiving Agency Form 2088. The Performing Agency shall leverage the inputs and framework of the SST and the communalities with Receiving Agency Form 2088 to improve the SST and the wet surface crash reduction program (WSCRP). Integration of the SST and Receiving Agency Form 2088 will provide the benefits of streamlining the data inputs already required for the SST to avoid duplication of efforts and will effectively improve the quality of the assessment of pavement friction safety.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
Contract Total	$75,110.75	$60,088.60	$15,022.15

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7143 University: TTI

Project Title: Develop Methodologies for Reducing Costs in Full Depth Reclamation (FDR) Construction

Project Start Date: 09/01/2022 Termination Date: 11/30/2025

Project Status: Active Total Project Budget: $679,483.50

Project Manager: Joanne Steele Researcher: Stephen Sebesta

Project Objectives: Full depth reclamation (FDR) using emulsified asphalt or foamed asphalt continues to grow in usage throughout Texas. To date, almost all mixtures use a cement additive in the mix design. The cement additive reportedly contributes to early strength gain which can be particularly important for projects that require daily opening to heavy traffic. However, not all construction projects require daily opening to traffic, and some materials may provide adequate performance without the cement additive. Additionally, with potential cement supply shortages, design and construction of FDR layers using only the asphalt treatments could save materials cost, reduce schedule risk, and increase daily productivity since one less step would be required in the treatment process. The Performing Agency shall analyze the performance of asphalt-based FDR materials with and without the cement additive and evaluate the strength and stiffness properties of those mixes in the early, intermediate, and final curing stages. The Performing Agency shall leverage those results to determine the operational benefits and acceptability of placing traffic on the section for traffic control and construction staging, evaluate how the long-term performance of the layer may be impacted for pavement design, and make recommendations for mix design and construction specification updates.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
Contract Total	$228,483.75	$182,787.00	$45,696.75

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7145 University: CTR/TTI

Project Title: Develop Rapid New Tests for Detecting Poor Quality Binders and RAP Materials

Project Start Date: 09/01/2022 Termination Date: 10/31/2024

Project Status: Active Total Project Budget: $635,610.78

Project Manager: Joanne Steele Researcher: Fujie Zhou

Project Objectives: Asphalt binders are one of the most expensive and critical materials used in the construction of the roadways in Texas, costing taxpayers hundreds of millions of dollars annually. It has been widely recognized that asphalt binders with the same performance grade (PG) can perform very differently due to changes in crude source, refining processes used, modification technique, and other factors. Several districts recently reported early cracking issues with some mixes which had historically performed well, while other districts had mix design and quality assurance (QA) problems when the binder source was switched and/or a different recycled asphalt pavement (RAP) stockpile was used. Thus, the objective of this project is to develop rapid new tests for detecting poor quality binders and RAP materials. To achieve this objective, the Performing Agencies shall review the literature to identify candidate tests that can be used for screening binders and RAP materials. The Performing Agencies shall further refine the most promising tests using laboratory mixture performance tests as a benchmark. The Performing Agencies shall also provide a standard test method and specification limit for each of the final test methods.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
CTR	$137,034.57	$109,627.66	$27,406.91
TTI	$178,822.00	$143,057.60	$35,764.40

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7147 University: TECH

Project Title: Project Level Performance Database for Rigid Pavements in Texas, Phase III

Project Start Date: 09/01/2022 Termination Date: 08/31/2025

Project Status: Active Total Project Budget: $749,999.55

Project Manager: Martin Dassi Researcher: Moon Won

Project Objectives: The primary tasks in this project will consist of: • Collecting field performance information on rigid pavements. • Gathering field performance information on experimental and special sections in Texas. • Evaluating the effectiveness of special or innovative techniques tried in Texas. • Developing a platform for storing all the information collected in this study in a central server with various features imbedded so that the information could be easily accessible in a systematic way.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
Contract Total	$249,858.09	$199,886.47	$49,971.62

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7148 University: TECH/TTI

Project Title: Develop Design Details for CRCP Whitetopping at Intersections

Project Start Date: 09/01/2022 Termination Date: 08/31/2025

Project Status: Active Total Project Budget: $599,563.25

Project Manager: Darrin Jensen Researcher: Moon Won

Project Objectives: The Performing Agencies shall establish a method to evaluate the existing pavement structural condition and design continuously reinforced concrete pavement (CRCP) overlays, both thin and thick. The design methods will include non-destructive (NDT) pavement evaluation techniques and tools, deflection based CRCP slab thickness design procedures, and CRCP reinforcing design details. The Performing Agencies shall identify state-of-the-art practices that can be implemented as well as areas that need additional research. The findings from this research will result in procedures that will be used to design CRCP overlays, both thin and thick.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
TECH	$101,058.25	$80,846.60	$20,211.65
TTI	$104,106.50	$83,285.20	$20,821.30

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7150 University: TXST

Project Title: Artificial Intelligence for Pavement Condition Assessment from 2D/3D Surface Images

Project Start Date: 09/01/2022 Termination Date: 08/31/2025

Project Status: Active Total Project Budget: $451,875.00

Project Manager: Jade Adediwura Researcher: Feng Wang

Project Objectives: While manual quality assurance is inefficient and expensive, the proprietary data storing and processing methods have prevented the Receiving Agency from developing automated methods for data validation. Recently, with the national initialization of standard format for two-dimensional/three-dimensional (2D/3D) pavement surface images and the development of Artificial Intelligence (AI)/Machine Learning (ML) in Computer Vision, the Receiving Agency sees the opportunity of developing new methods for automated pavement condition assessment, with more independence from vendors and their equipment. The main objective of this research is to develop ML-based application software to assess pavement conditions using the standard format 2D/3D pavement surface images. The three main components of this research include the development of a standard format 2D/3D pavement surface image library, a set of ML models for pavement distress measurement, and application software for pavement condition evaluation. The proposed project will assist the Receiving Agency to enhance the quality of the automated pavement condition data, which would eventually help the State of Texas improve its pavement performance.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
Contract Total	$150,625.00	$120,500.00	$30,125.00

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7151 University: TTI/UT-TYLER

Project Title: Develop Recommendations for Evaluating Surface Types and Aggregate Properties to Minimize Wet Weather Crashes

Project Start Date: 11/10/2022 Termination Date: 02/28/2026

Project Status: Active Total Project Budget: $599,992.25

Project Manager: TBD Researcher: Darlene Goehl

Project Objectives: The current design methodology for asphalt and seal coat surfaces is limited when considering safety aspects like friction and surface texture, also known as skid resistance. The only requirement for asphalt or seal coats placed on high demand areas is that they use surface aggregate classification (SAC) A coarse aggregates. This approach has several shortcomings: • Does not consider the friction and texture of the final surface. • Does not consider the change in skid resistance versus trafficking. • SAC system is defined by the acid insolubility test, not a direct measurement of aggregate properties that mechanically generate skid resistance. • SAC categories are very broad with no distinction of the best and worst performing aggregates in each class. Consequently, some recent resurfacing projects have resulted in unacceptable skid resistance shortly after construction, even when SAC A aggregates were used. As such, there is a serious need to improve the current design process for asphalt and seal coat to ensure that the surfaces will have acceptable long-term skid resistance. The Performing Agencies shall develop a laboratory-based system to select the pavement surface type and coarse aggregate types that will provide adequate skid resistance over the life of the pavement surface.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
TTI	$192,237.00	$153,789.60	$38,447.40
UT-TYLER	$7,322.50	$5,858.00	$1,464.50

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7153 University: TTI

Project Title: Develop Design of Hot-Mix Cold-Laid (HMCL) Mixtures with the Superpave Gyratory Compactor

Project Start Date: 09/01/2022 Termination Date: 11/30/2023

Project Status: Active Total Project Budget: $210,004.25

Project Manager: Tom Schwerdt Researcher: Fujie Zhou

Project Objectives: Different from patching materials, hot-mix cold-laid (HMCL) asphalt mixes are often used as a blade-on/level up material in Texas. Currently, the HMCL asphalt mixes are designed with a Texas Gyratory Compactor (TGC) and checked with the Hveem stability test. The Materials and Tests Division (MTD) of the Receiving Agency is undertaking an initiative to design all asphalt mixes with the Superpave Gyratory Compactor (SGC) and officially phase out the TGC in the upcoming Standard Specifications Book update in 2024. As a result, there is an urgent need to study HMCL mix design with the SGC and replace the Hveem stability test with a new performance related test. The objective of this project is to establish a new HMCL mix design method with the SGC and new performance tests ensuring high quality and long-lasting HMCL mixes which will save millions of dollars of taxpayer money annually. To achieve this objective, the Performing Agency shall review the literature and conduct extensive laboratory TGC, SGC, and performance tests; then develop the SGC-based HMCL mix design method including performance tests and associated criteria; and finally recommend specifications changes.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
Contract Total	$45,440.75	$36,352.60	$9,088.15

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7168 University: CTR

Project Title: Use of X-Ray Fluorescence (XRF) to Determine Tire Rubber Content in Asphalt Binders

Project Start Date: 10/05/2022 Termination Date: 12/31/2023

Project Status: Active Total Project Budget: $217,664.91

Project Manager: Darrin Jensen Researcher: Amit Bhasin

Project Objectives: Tire rubber is required in certain asphalt binders; e.g., AC-205TR, used for chip seal construction. These binders are specified and used in several districts across the state. Current Receiving Agency Standard Specification Item 300, Asphalts, Oils, and Emulsions, includes using test procedure Tex-533-C, Determining Polymer Additive Percentages in Polymer Modified Asphalt Cements. This test procedure is only performed in the Receiving Agency Materials and Tests Division (MTD). This test can be implemented in the field with a portable XRF device and test procedure Tex-533-C can be used in conjunction with a calibration chart to test and obtain a quantitative estimate of tire rubber at the district level. The Performing Agency shall make this device available to district personnel and to train them to use the device on a routine basis. The Performing Agency shall revise test procedure Tex-533-C, if needed, to account for procedures to use in the field since the device is portable.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
Contract Total	$31,950.83	$25,560.66	$6,390.17

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 5-9055-01 University: UTA

Project Title: Workforce Development Lifecycle for Road and Bridge Agencies

Project Start Date: 07/21/2023 Termination Date: 08/31/2024

Project Status: Active Total Project Budget: $125,000.00

Project Manager: TBD Researcher: Ray Belk

Project Objectives: The Workforce Development Lifecycle for Road and Bridge Agencies project proposes a multi-faceted approach to educate Texas Local Public Agencies (LPAs) about FHWA's Every Day Counts, Round 6 and Round 7 Strategic Workforce Development innovation, implementation methods, and valuable resources as well as encourage the adoption and implementation of recommended best practices at the local level. LPAs across the state are faced with the critical challenge of attracting and retaining Road and Bridge (R&B) personnel to maintain Texas local roadways. The proposed project builds on the successful FY21 Texas Local Technical Assistance Program (TxLTAP) Strategic Workforce Development, Texas State Transportation Innovation Council (TxSTIC) Incentive Program, project entitled Texas Transportation Workforce Development for Cities and Counties that reached 25 Texas counties who had not previously utilized TxLTAP's services. The project achieved an 87% statewide adoption rate of deliverables, products, and services.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
Contract Total	$68,892.50	$55,114.00	$13,778.50

*Non-Federal Match provided by Transportation Development Credits (TDCs)

6.2 Planning and Environmental

Project Number: 0-6701-02 University: TTI

Project Title: Planning and Environmental Linkages Toolkit

Project Start Date: 03/03/2023 Termination Date: 08/31/2024

Project Status: Active Total Project Budget: $388,735.50

Project Manager: TBD Researcher: Jolanda Prozzi

Project Objectives: The Receiving Agency funded research project 0-6701 in FY 2012 to investigate potential methods of linking transportation planning in Texas with the environmental clearance process required of the National Environmental Policy Act (NEPA). The study approach and findings were documented in a guidance document entitled Texas Department of Transportation (TxDOT) Resource for Linking Planning with Project Planning in Support of NEPA (0-6701-P1). The research that produced 0-6701-P1 was developed a decade ago prior to the Receiving Agency's participation in the NEPA Assignment program under 23 U.S.C. 327 and the Memorandum of Understanding with FHWA. In early FY2022, the Performing Agency renewed this effort in 0-6701-01 by conducting structured interviews with the Receiving Agency's planning and environmental subject matter experts, five of the state's Metropolitan Planning Organizations (MPOs), and five state Departments of Transportation (DOTs) that pioneered Planning and Environmental Linkages (PEL) to determine the need for updated/new PEL guidance. The structured interviews conducted in 0-6701-01 revealed the need for updated/additional PEL guidance. In 0-6701-02 the Performing Agency shall develop a user-friendly PEL Toolkit that the Receiving Agency's Divisions and District staff, as well as transportation partners can reference when using PELs in the state of Texas.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
Contract Total	$226,443.00	$181,154.40	$45,288.60

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7022-01 University: TAR/TTI

Project Title: Monarch Conservation Strategies for Texas Roadways

Project Start Date: 02/17/2023 Termination Date: 08/31/2025

Project Status: Active Total Project Budget: $580,659.50

Project Manager: Joanne Steele Researcher: Darlene Goehl

Project Objectives: The US Fish and Wildlife Service (USFWS) supported federal listing of the monarch butterfly (Danaus plexippus) in December 2020, but listing is currently delayed due to other higher priority listing actions. Texas roadways play a critical role in the successful spring and fall migrations of the eastern monarch butterfly population. Receiving Agency project 0-7022, "Evaluating Fall Monarch Butterfly Roadkill Hotspot Incidence and Potential Roadkill Mitigation" has revealed perennial hotspots for fall monarch butterfly roadkill in Texas. Yearly roadkill can comprise up to 2.5% of the Mexican overwintering population. Spring and fall roadside milkweed and monarch-preferred nectar plant hotspots have also been identified which provide critical resources to monarchs in terms of both milkweed larval food and flower nectar for adults.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
TAR	$57,440.00	$45,952.00	$11,488.00
TTI	$116,893.25	$93,514.60	$23,378.65

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7023-01 University: UTA

Project Title: Ecological Impacts of Sediment Derived from Bridge Construction

Project Start Date: 11/10/2022 Termination Date: 08/31/2025

Project Status: Active Total Project Budget: $392,000.00

Project Manager: Jade Adediwura Researcher: Habib Ahmari

Project Objectives: The release of sediment due to bridge construction may change the sediment regime and geomorphology of receiving streams causing short- and long-term effects on aquatic habitat. A GIS-based Predictive Sediment Toolbar is already developed and coupled with the Hydraulic Engineering Center's River Analysis System (HEC-RAS) 2D to determine the potential depositional area and suspended sediment concentration at bridge construction sites. The toolbar was submitted to the Receiving Agency in Phase I. The performance of the toolbar was assessed using field data and observations at a bridge construction site. The toolbar showed a promising performance; however, to reduce modeling uncertainties and develop an understanding of the uncertainties, and increase the accuracy of the approaches and model capabilities, the Performing Agency shall perform following tasks: i. develop a guideline for selecting stream flow events to be used in HEC-RAS 1D model and for determining the extent of modeling downstream of the bridge; ii. develop a new 1D sediment transport model coupled with HEC-RAS 1D and add to the current GIS toolbar; iii. investigate alternative methods for defining eroded sediment characteristics from a typical bridge replacement site and incorporate into the model; iv. examine the performance of the new tool using field data collected from a number of bridge sites with a wide range of flow and sediment characteristics. In this Phase II of the project, the Performing Agency shall conduct this research at a Technology Readiness Level (TRL) of 7.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
Contract Total	$136,125.00	$108,900.00	$27,225.00

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7132 University: TTI/UTEP

Project Title: Quantify the Real Impact of Transportation Activity on Regional Ozone and Near-Road PM Concentrations

Project Start Date: 09/07/2021 Termination Date: 07/31/2024

Project Status: Active Total Project Budget: $537,321.00

Project Manager: TBD Researcher: Reza Farzaneh

Project Objectives: The Receiving Agency and its partner agencies are required to comply with the requirements of the transportation conformity requirement. Transportation conformity is an emissions control-centric process built on the assumption that that reducing emissions from transportation activities would lead to better air quality. However, the air quality observations collected since the onset of the COVID-19 pandemic shows ambient ozone and particulate matter of less than 2.5 micrometer in aerodynamic diameter (PM2.5), concentrations have a mixed response to the significant changes in traffic activities and emissions. This trend has raised questions regarding the extent of the transportation's impacts on air quality. This study will bridge the gap in the understanding of the actual extent of transportation activities' impacts on regional and near-road air quality. The Performing Agency shall study three major activities for selected case study areas: • Analysis of before- and during-pandemic traffic activity and air quality monitoring data. • Evaluate the performance of air dispersion modeling in capturing the changes of near-road PM2.5 concentrations in near-road environment resulting from traffic activity variations. • Evaluate the performance of photochemical modeling in capturing the changes of regional ozone in response to changes of traffic activities. The study will also result in a characterization of COVID-19 restrictions' impacts on traffic activities and air quality.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
TTI	$92,433.00	$73,946.40	$18,486.60
UTEP	$25,016.25	$20,013.00	$5,003.25

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7133 University: TTI

Project Title: Develop Guidebook for Managing System Costs: Operational and Capital Cost Management at Rural and Small Urban Public Transit Systems

Project Start Date: 09/01/2021 Termination Date: 03/31/2024

Project Status: Active Total Project Budget: $213,562.50

Project Manager: Joanne Steele Researcher: Michael Walk

Project Objectives: Rural and small urban transit systems across the United States face fiscal challenges caused by the growing gap between the cost of providing transit service and available federal, state, and local funding. In Texas, the fiscal challenges facing rural and small urban transit systems are compounded by not only an increasing population but also revenue and ridership impacts related to COVID-19. Rural and small urban transit systems also often face high levels of staff turnover and a lack of knowledge management procedures to sustain cost management practices over time. The Performing Agencies shall equip the Receiving Agency's transit systems to understand, predict, and manage operational/capital costs and provide a reliable go-to-resource for cost management best practices.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
Contract Total	$32,967.00	$26,373.60	$6,593.40

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7138 University: CTR/TTI

Project Title: Driver Distraction in an Era of Rapid Technological Change, Digital Advertising Billboards

Project Start Date: 09/01/2022 Termination Date: 08/31/2024

Project Status: Active Total Project Budget: $404,050.89

Project Manager: Joanne Steele Researcher: Adam Pike

Project Objectives: Outdoor advertising signs impact millions of travelers around the world every day. These signs are designed to attract driver attention thus taking it away from the driving task. Driver inattention and distraction are two of the most critical factors for road safety. Receiving Agency regulation of outdoor advertising signs must deal with changing technologies, including digital billboards, which allow for modifications to sign illumination, motion, and content. Regulations are not keeping pace with changing sign trends and must be updated to address potential impacts on road user safety. This research project focuses on the degree of driver distraction caused by typical and digital advertising sign contents. The project includes a comprehensive state-of-the-practice review, crash investigation, and an on road human factors evaluation. The illumination levels and content (including motion) during daytime and nighttime travel for dry and wet-weather conditions are considered. This research project shall provide the Receiving Agency with tools and resources to help manage outdoor digital advertising billboards by establishing practical criteria for sign illumination and content. These resources shall allow the Receiving Agency to manage the advertising signs such that road user safety is accounted for while maintaining the ability of sign owners to develop effective means of communicating with the public.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
CTR	$35,811.13	$28,648.90	$7,162.23
TTI	$177,798.25	$142,238.60	$35,559.65

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7149 University: CTR

Project Title: Determine Feasibility and Methodologies of Incorporating Third-Party Traffic Data into Transportation

Project Start Date: 09/01/2022 Termination Date: 02/29/2024

Project Status: Active Total Project Budget: $266,457.00

Project Manager: Darrin Jensen Researcher: Chandra Bhat

Project Objectives: With the increasing availability of third-party traffic and transportation data, there is a growing interest among government agencies to incorporate these into planning and operations. These data can also provide valuable input to many other applications, such as improving traffic safety by identifying hotspots for traffic accidents, reducing intersection congestion by enabling smart traffic control, and streamlining the visualization of traffic maps. In this project, the Performing Agency shall synthesize various sources of third-party data and the Receiving Agency's current workflows in transportation planning, traffic management, and visualization capabilities that can benefit from their incorporation. Based on the evaluation of data source characteristics, historic usage, strengths and limitations, and possible context in the Receiving Agency's workflows, the Performing Agency shall develop pathways for data integration including effective public-private partnerships. In addition to a research report, this project shall provide a data integration decision support system that recommends the most appropriate implementation strategy given input parameters and query type (data-, application-, or policy-driven). Using the information gathered, the Performing Agency shall also design procedures for implementing proven technology (as determined through this research) that integrate third-party data sources within a range of Receiving Agency work environments.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
Contract Total	$56,508.43	$45,206.74	$11,301.69

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7152 University: TTI

Project Title: Estimating Latent Bicyclist and Pedestrian Demand for Shared Use Path Design

Project Start Date: 09/01/2022 Termination Date: 02/29/2024

Project Status: Active Total Project Budget: $250,173.25

Project Manager: Tom Schwerdt Researcher: Ipek Nese Sener

Project Objectives: The Receiving Agency's Roadway Design Manual was updated in July 2020 and incorporates considerations for and accommodations of bicyclists and pedestrians, including preferred design order toward Shared Use Paths (SUPs) compared to bicycle lanes and shared lanes. However, the Guidance does not include specific procedures to estimate the anticipated volumes of non-motorized path users. The Receiving Agency's Bicycle Accommodation Design Guidance makes it clear that anticipated user volumes should be considered when designing facilities. Performing Agency shall develop a simple sketch planning-level demand estimation tool that provides anticipated user volumes for SUPs. The project shall also incorporate the results into the future editions of The Receiving Agency's design guidance/manuals. Given the uncertainty in resources, Performing Agency shall not use an overly complicated method or a method that requires complex data or data architecture. The project shall benefit from existing data sources, including The Receiving Agency's Texas Bicycle and Pedestrian Count Exchange and other count data resources in the State as well as other secondary and spatial data sources. Performing Agency shall develop an easy-to-use tool responding to the needs and requirements of the intended audience while incorporating advancements to improve the accuracy of the demand estimation.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
Contract Total	$62,656.25	$50,125.00	$12,531.25

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7162 University: UTA

Project Title: Quantifying Benefits of Roadside Vegetation

Project Start Date: 10/12/2022 Termination Date: 08/31/2024

Project Status: Active Total Project Budget: $242,284.76

Project Manager: Darrin Jensen Researcher: Kyeong Rok Ryu

Project Objectives: The Performing Agency shall develop a roadside vegetation evaluation toolkit for the sustainability, use, community, cost-effectiveness, and safety (RVET-SUCCES). The Performing Agency shall coordinate with the Receiving Agency districts to analyze a total of 6 pilot studies in 1 urban and 1 rural sites in 3 different ecoregions. The Performing Agency shall particularly perform and combine real-world measurements of air quality, thermal environment, visibility, and safety in the pilot studies using sensors and drone in the analysis. For the evaluation of pre- and post-impacts of roadside vegetation, the Performing Agency shall employ five evaluation modules: environmental sustainability, visibility and safety, operations and maintenance, aesthetics, and life cycle costs. The project shall provide the roadside vegetation evaluation toolkit consisting of 1) web-based and spreadsheet-based worksheets and 2) a user guidebook describing the best practices for the evaluation and comparison, the evaluation procedures, a summary of the pilot studies as a sample and/or best practices, and fact sheets, to promote knowledge and skills for sustainable and cost-effective roadside vegetation.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
Contract Total	$113,692.63	$90,954.10	$22,738.53

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7165 University: CTR

Project Title: Logistics Sprawl Impacts on E-commerce Travel Patterns

Project Start Date: 09/01/2022 Termination Date: 02/29/2024

Project Status: Active Total Project Budget: $293,389.26

Project Manager: Darrin Jensen Researcher: Chandra Bhat

Project Objectives: E-commerce services and facilities have the benefits of bringing new employment opportunities to communities and meeting consumer needs, but they also attract heavy traffic, which results in congestion and negative environmental and economic repercussions. In this context, the current project offers a new lens for studying future e-commerce facility siting, considering (1) current and projected consumer demands that will drive facility siting from the perspective of e-commerce companies. It also considers (2) the industry and workplace standards and the tax and zoning policies of governing bodies (including the Receiving Agency's own land-use regulation and standards) that can affect, and be proactively employed to influence, facility siting from the perspective of the Receiving Agency. This project shall provide a predictive mechanism that is not simply reactive to e-commerce companies' facility siting preferences but that can be proactively leveraged by the Receiving Agency, who can use land-use regulations and standards to influence the siting of e-commerce facilities in ways that bring home the positives of e-commerce to Texans while tempering negative repercussions for the transportation network.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
Contract Total	$85,367.81	$68,294.25	$17,073.56

*Non-Federal Match provided by Transportation Development Credits (TDCs)

6.3 Safety and Operations

Project Number: 0-7004 University: TTI

Project Title: Improve System Emergency Response Performance in the Houston District Using Connected Vehicle Technology

Project Start Date: 07/18/2019 Termination Date: 12/31/2023

Project Status: Active Total Project Budget: $480,124.25

Project Manager: Darrin Jensen Researcher: Hongmin Zhou

Project Objectives: Emergency response services play a vital role in saving lives and minimizing property damage when major events or incidents happen. The Dedicated Short Range Communication (DSRC) and Bluetooth Low Energy (BLE) technologies have the potential to improve the efficiency and roadway safety related to emergency management services. The primary objective of this project is to develop and test DSRC- and BLE-based prototype systems for enhancing emergency preemption and notification. Another objective is to provide the Receiving Agency with guidelines for implementing DSRC and BLE technologies for supporting emergency response services. To this end, the Performing Agency shall: (1) Identify methodologies for improving emergency vehicle signal preemption in a connected environment; (2) Develop and test prototype DSRC-based and BLE-based systems to broadcast Signal Phase and Time (SPaT) messages, Emergency Vehicle Alerts (EVAs), and other notifications to emergency vehicles and other roadway users in the vicinity; (3) Enhance signal preemption performance; (4) Assist the Receiving Agency in implementing the prototype systems at selected Houston field sites; and (5) Identify anticipated cost and benefit of the connected emergency response system. The key products of the project include DSRC and BLE prototype systems that operate with the Receiving Agency's infrastructure and guidelines for implementing the system.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
Contract Total	$12,067.75	$9,654.20	$2,413.55

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7045 University: UTA

Project Title: Analyze the Use of Green Pavement Markings – Intersection Safety for Non-Motorized Users

Project Start Date: 05/26/2020 Termination Date: 08/31/2024

Project Status: Active Total Project Budget: $596,259.00

Project Manager: Darrin Jensen Researcher: Katie Kam

Project Objectives: More communities are using green to delineate at intersections where cyclists should wait at a traffic signal, start a left turn, or cross the roadway. In 2011, the Federal Highway Administration issued a memo giving interim approval (IA-14) for the optional use of green colored pavement for bike lanes as a traffic control device for inclusion in the Manual on Uniform Traffic Control Devices (MUTCD). The FHWA indicated that they found the green to be successful for bicycle applications because cyclists felt safer and drivers felt more aware that cyclists may be present. In addition, the National Association of City Transportation Officials (NACTO) included green pavement in their Bikeway Design Guide. The Receiving Agency has requested research into the safety and behavioral implications of using green colored pavement and their performance to help inform an agency opinion on their use in Texas communities and possible inclusion in the Texas MUTCD.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
Contract Total	$124,808.63	$99,846.90	$24,961.73

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7086 University: TTI

Project Title: Roadside Safety Device Analysis, Testing, and Evaluation Program

Project Start Date: 09/01/2020 Termination Date: 10/31/2023

Project Status: Active Total Project Budget: $2,307,324.75

Project Manager: Darrin Jensen Researcher: Roger Bligh

Project Objectives: Roadway departure crashes are the most common type of crash in Texas. These crashes represent over 45 percent of all fatal crashes and 34 percent of all serious injury crashes. Texas data shows that there were 9,560 fatal and 30,766 serious injury roadway departure crashes from 2010-2016. Roadside safety devices shield motorists from roadside hazards such as non-traversable terrain and fixed objects, thereby reducing injuries and fatalities associated with roadway departure crashes. To improve the safety of the motoring public, there is a need to develop new or improved safety devices that accommodate a variety of site conditions, placement locations, and a changing vehicle fleet. The Performing Agency shall provide the Receiving Agency with a mechanism to quickly and effectively address high priority issues related to roadside safety devices. The Performing Agency shall provide results in new and improved safety features that minimize the consequences of vehicles leaving the road and reduce injuries and fatalities associated with roadway departure crashes. The Performing Agency shall develop roadside safety devices to meet the 2016 edition of the American Association of State Highway and Transportation Officials (AASHTO) Manual for Assessing Safety Hardware (MASH) roadside safety criteria, to address the continuing trend of larger vehicles in the statewide vehicle fleet.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
Contract Total	$40,786.00	$32,628.80	$8,157.20

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7087 University: CTR/TTI

Project Title: Develop Standards for Temporary Concrete Median Barrier in Flood-Prone Areas

Project Start Date: 09/01/2020 Termination Date: 10/31/2023

Project Status: Active Total Project Budget: $638,887.25

Project Manager: Darrin Jensen Researcher: Chiara Silvestri Dobrovolny

Project Objectives: Portable concrete median barriers are used in work zones to prevent serious cross-median crashes and vehicle penetration in work zones. These barriers are used on highways to provide positive containment of vehicles and to reduce maintenance and repair needs. When implemented in flood-prone areas, portable concrete median barriers can act as a dam for flood waters until the damming of water causes the barrier to displace and break, as recently occurred in the Houston and Beaumont Districts during severe storms. These situations required significant repair before the highways could be reopened and the level of safety for motorists restored. Any required barrier maintenance or repair increases risk to maintenance personnel and can result in significant congestion if a lane closure is required. There is a need to develop and evaluate an appropriate portable concrete median barrier in compliance with the 2016 edition of the American Association of State Highway and Transportation (AASHTO) Manual for Assessing Safety Hardware (MASH) Test Level (TL-3) for implementation in flood-prone areas. To meet this objective, the Performing Agencies shall design such a barrier to accommodate passage of flood water, to decrease risk to motorists, and to reduce level of damage to the highway.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
CTR	$1,950.25	$1,560.20	$390.05
TTI	$16,212.50	$12,970.00	$3,242.50

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7099 University: TEES

Project Title: AVA: Automated Vehicles for All

Project Start Date: 01/26/2021 Termination Date: 08/31/2025

Project Status: Active Total Project Budget: $7,063,787.00

Project Manager: Tom Schwerdt Researcher: Reza Langari

Project Objectives: USDOT awarded federal funds to Texas A&M Engineering Experiment Station (TEES) to take the lead on and subcontract with George Washington University, University of California at Davis, University of Illinois at Urbana-Champaign to study and test the safe integration of automated driving systems on rural Texas roadways for the purpose of the Automated Driving System Demonstration Grants program. TxDOT through RTI will help foster these efforts in partnership with FHWA and govern reimbursement of this project, in a separate Grant Subrecipient Agreement with TEES. All necessary Grant documents that outline the details of this agreement have been completed and attached.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
Contract Total	$1,503,743.00	$1,202,994.40	$300,748.60

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7122 University: TTI/UTSA

Project Title: Evaluate Alternative Methods to Examine Visibility of Pavement Markings

Project Start Date: 09/01/2021 Termination Date: 08/31/2024

Project Status: Active Total Project Budget: $467,604.25

Project Manager: Jade Adediwura Researcher: Adam Pike

Project Objectives: Pavement markings are the primary means for an agency to provide longitudinal guidance to drivers. Effective pavement markings can improve safety, improve driver comfort, and increase functionality/reliability of automated driving systems and Advanced Driver Assistance Systems (ADAS). To be effective, markings must be visible during all driving conditions, day and night. Markings are typically characterized by their retroreflectivity which is a surrogate measure for how visible the marking is at night. Retroreflectivity does not consider other factors that will impact the actual visibility of the markings such as the color or retroreflectivity of the pavement that the marking is applied to, the color or width of the marking, or the viewing conditions (i.e., observation vehicle, observer characteristics, weather conditions). Retroreflectivity is also a metric for nighttime visibility that may not relate to the marking visibility during the day. The objective of this project is to improve current pavement marking installation and maintenance practices, such that effective markings are continuously maintained. The Performing Agencies shall develop a tool to effectively assess the visibility of pavement markings and to make suggestions/recommendations for maintenance of markings. The Performing Agencies shall evaluate marking visibility for both human and automated drivers across a range of conditions. These evaluations shall be used to make recommendations to improve new marking installation specifications and techniques, improve marking maintenance practices, and evaluate other technologies that should be considered to improve pavement marking delineation.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
TTI	$112,272.25	$89,817.80	$22,454.45
UTSA	$24,726.25	$19,781.00	$4,945.25

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7137 University: CTR

Project Title: Assessment of Austin, El Paso, and San Antonio HERO Incident Management Programs

Project Start Date: 09/01/2022 Termination Date: 08/31/2024

Project Status: Active Total Project Budget: $393,182.94

Project Manager: TBD Researcher: Zhe Han

Project Objectives: The Receiving Agency aimed at improving safety and keeping traffic flowing, the Highway Emergency Response Operator (HERO) program was established to clear minor crashes from roadways and assist motorists in need. Following the public's positive response, more districts have instituted HERO programs in recent years. Although HERO has proven popular, the program has not been formally assessed. The objective of this project is to conduct a systematic assessment of HERO in Austin, El Paso, and San Antonio. The Performing Agency shall perform comprehensive analyses in terms of operational efficiency, staffing and equipment levels, incident response and clearance time improvements, impacts on travel delay, and benefit to cost ratio through a series of on-site interviews, data analysis, and Dynamic Traffic Assignment micro-simulations. The Performing Agency shall compare clearance times on Safety Service Patrol (SSP) routes vs. non-SSP routes, and contract service vs. non-contract service. Recommendations and guidance shall be provided to the Receiving Agency's districts and Traffic Safety Division to improve HERO effectiveness and efficiency. This project shall give the Receiving Agency a thorough understanding of HERO as well as future improvement recommendations.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
Contract Total	$196,942.96	$157,554.37	$39,388.59

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7140 University: TTI

Project Title: Develop Improved Queue Warning System Combining Multiple Data Sources

Project Start Date: 09/06/2022 Termination Date: 08/31/2024

Project Status: Active Total Project Budget: $379,728.75

Project Manager: TBD Researcher: Geza Pesti

Project Objectives: Existing queue warning (QW) systems predominantly use infrastructure-based sensors to detect the formation of queues and use dynamic message signs (DMS) to warn drivers. These QW systems, may be inadequate where the required number or density of sensors are not available. Research has shown that crowd sourced probe and connected vehicle (CV) trajectory data used in combination with sensor data can significantly improve the accuracy and latency of queue detection. Furthermore, because of gaps between fixed location of DMSs a subset of drivers can encounter a queue without seeing any warning. Sharing queue information through third-party providers and providing vehicle-specific queue warning in CVs can ensure provision of queue warning to a broader audience in a timely manner. The Performing Agency shall: 1. Develop detailed design of an enhanced queue detection and warning system that combine point-, probe-, and vehicle trajectory data. 2. Test and fine-tune the queue detection algorithm design using computer simulation. 3. Conduct a proof of concept, prototype deployment and field evaluation of the new QW system design on a freeway segment where vehicle queues frequently form. 4. Document the systems engineering and algorithm for the QW system as a potential enhancement to the Lonestar™ advanced traffic management system software application.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
Contract Total	$187,585.50	$150,068.40	$37,517.10

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7144 University: TTI/TXST

Project Title: Develop a Real-time Decision Support Tool for Urban Roadway Safety Improvement

Project Start Date: 01/09/2023 Termination Date: 12/31/2024

Project Status: Active Total Project Budget: $465,010.00

Project Manager: TBD Researcher: Subasish Das

Project Objectives: Due to the complex nature of urban roadways, conventional crash prediction models are limited as these models omit operating speed, short-duration volume, and weather data. To mitigate this research gap, the following three national databases can be utilized: (1) National Performance Management Research Data Set (NPMRDS) with passenger and freight speed data, (2) Travel Monitoring Analysis System (TMAS) data with both temporary traffic counting and continuous traffic counting programs, and (3) real-time weather data from the National Oceanic and Atmospheric Administration (NOAA). The fatality rate on Texas roadways for 2020 was 1.50 deaths per hundred million vehicle miles traveled, which is an 18.94% increase from 1.26 in 2019. From 2011 to 2020, the fatalities on rural roadways increased by 19%, and this increase on urban roadways is disproportionately high (31%). Research and a supporting decision support tool are necessary to improve urban safety. The Performing Agencies shall leverage ongoing staff leadership and engagement in several national and state Department of Transportation (DOT) speed-safety projects. The Performing Agencies shall provide updated safety performance functions (SPFs) for urban roadways and a real-time decision support tool on risk scoring with the applicability of new data input and model updating pipeline.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
TTI	$71,882.75	$57,506.20	$14,376.55
TXST	$222,507.50	$178,006.00	$44,501.50

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7156 University: TTI

Project Title: Using Vehicle Probe Data to Evaluate Speed Limits on Texas Highways

Project Start Date: 09/01/2022 Termination Date: 08/31/2024

Project Status: Active Total Project Budget: $399,981.75

Project Manager: Darrin Jensen Researcher: Kay Fitzpatrick

Project Objectives: The Receiving Agency's current practice is to conduct numerous speed studies throughout the year to determine if the speed limits should be changed due to new traffic patterns, development, crash history, and other factors. These studies are driven by stakeholder requests or as part of routine annual reviews. The number of studies performed at any given time is limited by staff and consultant resources, resulting in a process that can take several months to complete. Can the increasing availability of vehicle probe data, along with other big datasets, be used to reduce the level of effort and time needed to collect speed data? If so, what data can be readily obtained from big data sources and what procedure would be needed to refine the use of probe speed information and produce speed limit recommendations that are consistent with the sound engineering practices currently used by Receiving Agency staff? This project will explore if there are more efficient methods for conducting Texas speed limit studies that would allow Receiving Agency districts to be more pro-active and responsive with their speed zone program. Such a program would also provide a much safer method of collecting speed data, especially on high-speed and controlled access highways.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
Contract Total	$204,575.75	$163,660.60	$40,915.15

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7157 University: TAMUCC/TTI

Project Title: Develop Guidelines for Integration of UAS LiDAR and Photogrammetry to Enhance Land Surveying Capabilities

Project Start Date: 09/01/2022 Termination Date: 08/31/2024

Project Status: Active Total Project Budget: $499,992.00

Project Manager: Chris Glancy Researcher: Michael Starek

Project Objectives: Unmanned aircraft systems (UASs) equipped with digital cameras, light detection and ranging (LiDAR) sensors, or both enable the collection of high spatial resolution three-dimensional (3D) quantitative geospatial data. This data may be used to support a variety of surveying and mapping activities, potentially with lower costs and greater safety than traditional survey methods. When using a camera, the technique is called Structure-from-Motion photogrammetry or UAS-SfM. In practice, there are important differences between UAS-SfM and UAS-LiDAR including measurement fidelity, operational considerations, post-processing workflows, and cost-effectiveness. With a lack of clear guidance on when UAS-SfM versus UAS-LiDAR is the best fit for a specific task, there is a need to evaluate the real-world performance capabilities and limitations of both technologies.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
TAMUCC	$133,426.00	$106,740.80	$26,685.20
TTI	$112,284.25	$89,827.40	$22,456.85

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 5-7049-01 University: TTI

Project Title: Implementation of Improving and Communicating Speed Management Practices

Project Start Date: 03/24/2023 Termination Date: 08/31/2024

Project Status: Active Total Project Budget: $95,608.00

Project Manager: TBD Researcher: Kay Fitzpatrick

Project Objectives: This project shall increase the Receiving Agency's understanding of the fundamental relationships between posted and operating speed along with providing content to support external and internal Receiving Agency dialog about speed limits and their development for all roadway environments. This project shall include three (3) workshops along with developing Spanish versions of previously delivered materials (to include pamphlets and a short video) on speed limit setting practices oriented to the general public to meet the diverse needs of Texans.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
Contract Total	$34,785.00	$27,828.00	$6,957.00

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 5-7083-01 University: TTI

Project Title: Implementation of Safety Prediction Methods Developed for Texas Highways

Project Start Date: 02/28/2023 Termination Date: 02/29/2024

Project Status: Active Total Project Budget: $67,365.00

Project Manager: Jade Adediwura Researcher: Srinivas Geedipally

Project Objectives: The Receiving Agency Research Projects 0-7083 Develop Highway Safety Manual (HSM) Safety Performance Functions (SPFs) and Calibration Factors for Texas and 0-7067 Enhancing Freeway Safety Prediction Models developed safety prediction methods for all Texas highways. These methods are used to predict safety performance and help with the complex trade-offs between safety, operations, community impacts, and costs that are often necessary when planning and designing highway projects. These resources shall form a powerful tool for selecting Highway Safety Improvement Program projects and will support and defend safety decisions made by the Design Division and districts. The Performing Agency incorporated these methods into spreadsheet tools to implement the new models and facilitate analysis of all rural and urban roadway segments and intersections. The Performing Agency shall develop and present webinars and workshops for Receiving Agency personnel who are responsible for traffic safety analysis. The webinars and workshops will familiarize personnel with the safety prediction methods and the analysis tools.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
Contract Total	$30,242.50	$24,194.00	$6,048.50

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 9-1531 University: TTI

Project Title: Development and Evaluation of Roadside Safety Systems for Motorcyclists

Project Start Date: 09/01/2021 Termination Date: 08/31/2024

Project Status: Active Total Project Budget: $780,000.00

Project Manager: Chris Glancy Researcher: Chiara Silvestri Dobrovolny

Project Objectives: This pooled fund study shall provide a cooperative approach to conducting research addressing roadside safety issues specifically related to improving motorcyclist safety. The study shall provide participating states an opportunity to collaborate on best practices, new regulatory issues, risk management strategies, and other research pertaining to roadside safety improvements for motorcyclists. The research activities shall include the identification, development, and evaluation of strategies and devices for mitigating the frequency and severity of roadway departure motorcyclist crashes.

Financials	FY24 Total Budget	100% Federal
Contract Total	$294,058.25	

6.4 Structures and Hydraulics

Project Number: 0-6958 University: TTI

Project Title: Developing Performance Specification for High Performance Concrete

Project Start Date: 09/01/2017 Termination Date: 04/30/2024

Project Status: Active Total Project Budget: $1,142,586.00

Project Manager: Tom Schwerdt Researcher: Anol Mukhopadhyay

Project Objectives: In the past, achieving high strength was considered by the Receiving Agency as the main design criteria to formulate high performance concrete. The Receiving Agency considers mix design options 1-4 in item 421 as high performance concrete (HPC) and these options were developed for ASR mitigation and not for other durability aspects. Very little work has been done to determine if these options are adequate to provide long-term durability often needed when HPC is specified. The main objective of this study is to develop performance specification for high performance concrete in order to ensure high performance in terms of durability. The Performing Agency will conduct a combination of both field investigation and laboratory study in order to achieve this objective. The Performing Agency shall use both conventional and innovative new lab testing methods to determine the key performance characteristics (i.e., prescribing acceptable limits of permeability, shrinkage, surface resistivity, and chloride ingress - basis for developing performance specification) followed by developing specific prescriptive requirements in order to formulate wide varieties of prescriptive mixes that can meet the durability requirements matching with different exposure conditions. A combined approach of relating mix design parameters, lab based durability test results, mechanical properties, structural dimensions, climatic conditions, and / exposure conditions through suitable service life prediction model and predicting will be used to ensure long term durability (at least 75 years) for the HPCs in typical aggressive environments. This will lead to develop performance- and prescriptive-based concrete specifications for HPC. This could potentially encourage contractors to effectively use these fine-tuned prescriptive HPC mixtures without the need of conducing additional long duration testing and ensure making long lasting durable concrete and save taxpayers' dollars.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
Contract Total	$133,333.00	$106,666.40	$26,666.60

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7040 University: TTI

Project Title: Evaluation of Corrosion Prevention and Mitigation Approaches Used On Texas Bridges

Project Start Date: 12/01/2019 Termination Date: 11/30/2023

Project Status: Active Total Project Budget: $856,909.50

Project Manager: Tom Schwerdt Researcher: Stefan Hurlebaus

Project Objectives: Corrosion of steel has been causing millions of dollars of loss in infrastructure to the state of Texas. The use of corrosion-resistant reinforcement in concrete structures and painting of steel elements have been the most common mitigation strategies. In addition, the use of weathering steel, metalizing on steel and concrete elements, and cathodic protection (sacrificial anode) have also been applied on the Receiving Agency bridges. The performances of different approaches vary with different bridges in different geographic areas; i.e., cold, arid, and humid districts. It is imperative for the Receiving Agency to have a decision tool to conduct effective corrosion prevention for new construction and corrosion mitigation for effective maintenance. The project objectives are to (1) conduct a synthesis of worldwide field investigations of the performance of corrosion mitigation, (2) perform field evaluations statewide to investigate the effectiveness of corrosion mitigation instrumented in the past, and to (3) perform lab tests, as necessary, to verify findings and to obtain a better understanding of corrosion mitigation approaches.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
Contract Total	$15,000.25	$12,000.20	$3,000.05

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7041 University: CTR

Project Title: Develop NextGen Texas Bridge Decks

Project Start Date: 12/09/2019 Termination Date: 05/31/2024

Project Status: Active Total Project Budget: $1,195,069.27

Project Manager: Martin Dassi Researcher: Oguzhan Bayrak

Project Objectives: The Performing Agency shall conduct a comprehensive experimental and analytical investigation to develop appropriate design criteria for using partial-depth precast panels that can span the full width of bridge superstructure. The Performing Agency shall develop and validate a precast deck panel system with wire trusses that will integrate with precast panel practices in Texas. The Performing Agency shall study the behavior of full-scale bridge superstructure models under design loads, typical overloads, and at ultimate conditions. The Performing Agency shall develop and test standard details for partial-depth deck panels in the laboratory for use in the Receiving Agency's standards for bridges constructed in Texas. The Performing Agency shall provide design guidelines that reflect the knowledge developed during the course of the project's experimental and analytical investigations.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
Contract Total	$68,536.48	$54,829.18	$13,707.30

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7042 University: CTR

Project Title: Use of Larger Diameter Shear Studs for Composite Steel Bridges

Project Start Date: 12/17/2019 Termination Date: 10/31/2023

Project Status: Active Total Project Budget: $1,267,152.60

Project Manager: Jade Adediwura Researcher: Michael Engelhardt

Project Objectives: Efficient steel bridge girder design makes use of composite action between the concrete bridge deck and the steel girders. Shear studs welded to the girder top flange provide the critical link between the deck and girders. Satisfying AASHTO fatigue requirements normally leads to a very large number of shear studs, which makes placing partial-depth precast panels extremely difficult and results in a safety hazard for workers during erection or early construction stages. Using larger-diameter shear studs shall significantly reduce the number of studs required on composite steel girders. This project focuses on the feasibility of using shear stud diameters greater than 7/8 inch for composite steel bridge construction, and the development of design guidelines for evaluating the static and fatigue strength of larger diameter shear studs. The Performing Agency shall perform: - laboratory testing using push-out or similar specimens to obtain data to evaluate both the static strength and fatigue strength of larger diameter shear studs. - large-scale composite beam tests and associated computational studies to provide an evaluation of the performance of composite steel bridge girders with larger diameter shear studs.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
Contract Total	$5,250.00	$4,200.00	$1,050.00

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7090 University: CTR

Project Title: Evaluate the Deployment of High Strength Reinforcing Steel in Texas

Project Start Date: 09/01/2020 Termination Date: 08/31/2024

Project Status: Active Total Project Budget: $1,175,887.21

Project Manager: Martin Dassi Researcher: Oguzhan Bayrak

Project Objectives: The Performing Agency shall: • Demystify the use of high strength reinforcing steel in Texas bridge design in Phase 1. This shall be accomplished through examination of Texas bridge components and systems. Phase 1 shall address where and when it makes sense to use high strength reinforcing, what benefits can be realized, who else is using high strength reinforcing and how they are using it. • Supplement Phase 1 through a series of analytical and experimental test programs covering a wide range of structural bridge components in Phase 2. This shall include realistically scaled structural testing in combination with numerical modeling to address data gaps related to serviceability performance and ultimate strength behavior.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
Contract Total	$175,988.91	$140,791.13	$35,197.78

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7093 University: CTR/TTI

Project Title: Develop Refined Design Methods for Lean-On Bracing

Project Start Date: 09/01/2020 Termination Date: 01/31/2024

Project Status: Active Total Project Budget: $980,000.00

Project Manager: Martin Dassi Researcher: Todd Helwig

Project Objectives: The Performing Agencies shall instrument and conduct field monitoring of bridges with lean-on bracing identified in Task 3. The monitoring shall include bridges under construction and also completed bridges subjected to controlled loading using trucks to better understand the behavior described in Tasks 2, 4 and 7. The Performing Agencies shall carry out parametric Finite Element Analyses (FEA) along with the field monitoring and develop improved guidelines to facilitate widespread use of lean-on bracing applications in Texas bridges.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
CTR	$39,062.00	$31,249.60	$7,812.40
TTI	$33,367.00	$26,693.60	$6,673.40

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7112 University: TTI/UTEP

Project Title: Development of a Continuous for Live Load Prefabricated Steel Accelerated Bridge Construction (ABC) Unit for Texas Bridges

Project Start Date: 09/01/2021 Termination Date: 08/31/2024

Project Status: Active Total Project Budget: $689,994.50

Project Manager: Martin Dassi Researcher: Stefan Hurlebaus

Project Objectives: The overall goal is to develop a system where prefabricated steel ABC unit perform continuous for live load. The system must be: easily constructible, fast to assemble, durable long-term, safe, and cost-effective. The Performing Agencies shall conduct a literature review to first synthesize what has been done by state departments of transportation and other agencies. The Performing Agencies shall also evaluate the behavior of related Receiving Agency bridges through visual inspection and monitoring. The Performing Agencies shall perform a system development program utilizing this information in conjunction with expert feedback from an Industry Review Panel (IRP) workshop (including the Receiving Agency Panel). The three (3) best system designs shall be selected for full-scale laboratory testing followed by an analytical parametric study. The Performing Agencies shall compile and present the results at an IRP meeting with the Receiving Agency, where the final system shall be selected. The Performing Agencies shall develop full Microstation details and specifications along with a user-friendly design guide. The guide shall identify the following: • Span length capabilities for girder sizes/depths/spacings. • General details for establishing live load continuity. • Closure pour details at interior bents and how to achieve acceptable deck stresses. • Structural steel splice details and acceptable tolerances. • Bearing layout to meet the Receiving Agency substructure details.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
TTI	$191,254.50	$153,003.60	$38,250.90
UTEP	$49,977.50	$39,982.00	$9,995.50

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7113 University: CTR

Project Title: Determine Service and Ultimate Behavior for Bent to Column Joints in TxDOT Substructures

Project Start Date: 09/01/2021 Termination Date: 08/31/2025

Project Status: Active Total Project Budget: $1,275,132.89

Project Manager: TBD Researcher: Oguzhan Bayrak

Project Objectives: The Bridge Design Manual requires consideration of various extreme events such as lateral stream loads and debris accumulation during flooding, severe scouring, and loss of supports due to collision for multi-column bent cap design. Typically, column-to-cap connections are designed as simple supports. As a result, current/past details have no confinement in bent cap joints, and the longitudinal column reinforcement is not always fully developed into the cap. Detailing joints for developing plastic capacity, as well as to permit sufficient load redistribution, is a common strategy in design for extreme loading scenarios (e.g., seismic design). To accommodate this increased moment demand, the standard column-to-cap connection requires improved detailing techniques. The Performing Agency shall utilize analytical/computational methods and an experimental program to investigate the performance of bent cap connections with traditional and improved details. The Performing Agency shall provide practical, easily implementable design recommendations for column-bent connections through these activities: • Reviewing literature to identify state-of-the-art detailing techniques and design parameters • Performing analytical or computational analysis to determine moment demand induced by extreme events • Developing improved detailing methods and retrofitting methods • Conducting large-scale structural experiments to investigate the performance of various details • Providing design guidelines for designers to account for the extreme events.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
Contract Total	$359,434.81	$287,547.85	$71,886.96

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7114 University: TTI

Project Title: Re-Examine Minimum Reinforcement Requirements for Shear Design

Project Start Date: 09/01/2021 Termination Date: 08/31/2024

Project Status: Active Total Project Budget: $930,904.25

Project Manager: Jade Adediwura Researcher: Petros Sideris

Project Objectives: Minimum shear reinforcement requirements in the Association of State Highway Transportation Officials (AASHTO) Load and Resistance Factor Design (LRFD) Bridge Design Specifications are based on tests conducted on reinforced concrete panels and beams. The extension of these requirements to prestressed concrete beams introduced significant conservatism in the current LRFD provisions for shear design. More accurate provisions are necessary to better predict the shear strength of prestressed beams. The objective of this project is to investigate the validity of the minimum shear reinforcement requirements and develop new/revised guideline specifications. The Performing Agency shall: • Perform a literature review and outreach in order to synthesize a unique database of load tests for prestressed concrete beams, which the Performing Agency shall analyze using data driven methods to identify major design parameters and missing information that will inform an experimental program. • Perform twenty (20) full scale tests on ten (10) commonly used prestressed girders combining a range of identified design parameters to comprehensively re-examine the minimum reinforcement requirements of AASHTO LRFD Bridge Design Specifications accounting for reserve strength and ductility and as well as performance under service conditions. The Performing Agency shall complement the experimental program by analytical modelling to expand its impact. • Develop design guidelines for the minimum reinforcement requirements based on the synthesized comprehensive dataset complemented by the full-scale tests and analytical modeling. The Performing Agency shall also pursue integration of these guidelines in the AASHTO LRFD Bridge Design Specifications.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
Contract Total	$269,051.00	$215,240.80	$53,810.20

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7115 University: CTR

Project Title: Investigate Live Load Distribution and Stability of Prestressed Concrete Girders During Construction

Project Start Date: 09/01/2021 Termination Date: 01/15/2025

Project Status: Active Total Project Budget: $998,766.67

Project Manager: Martin Dassi Researcher: Todd Helwig

Project Objectives: The Performing Agency shall focus on the stability of long-span prestressed concrete I- and U-girders during erection and construction. The Performing Agency shall consider the distribution of live load in the completed bridge as well the role of diaphragms in stability and live load distribution and develop methods of analysis of the girder behavior. The Performing Agency shall focus on the stability of long-span prestressed concrete I- and U-girders during erection and construction. The Performing Agency shall consider the distribution of live load in the completed bridge as well the role of diaphragms in stability and live load distribution and develop methods of analysis of the girder behavior.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
Contract Total	$301,063.14	$240,850.51	$60,212.63

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7116 University: CTR

Project Title: Develop Deck and Overhang Design Guidelines for Sound Walls and Other Heavy Loads

Project Start Date: 09/01/2021 Termination Date: 08/31/2024

Project Status: Active Total Project Budget: $599,347.64

Project Manager: TBD Researcher: Eric Williamson

Project Objectives: Economic considerations typically encourage limiting the total number of girders across the width of most bridges. The width of bridge overhangs is normally proportioned so that the same girder sections can be used for both the interior and fascia girders. While many state transportation agencies have guidelines on sizing and detailing bridge overhangs, the current provisions are generally based on rules-of-thumb developed through experience. The Performing Agency shall develop guidelines for analyzing and designing bridge decks and overhangs to accommodate increased loads due to heavy rails or sound walls. Detailed computational models shall be developed and validated against available test data. A parametric study shall represent the range of design variables encountered for representative Texas bridges. The Performing Agency shall allow engineers to select the deck thickness, reinforcement detailing, and overhang geometry for a specific project given the bridge railing type, girder spacing, and total number of girders to which the load is distributed. The research shall consider commonly used girder systems and focus on identifying cross-sectional profiles that lead to improved performance for cases with heavier loads compared to standard overhangs.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
Contract Total	$207,766.34	$166,213.07	$41,553.27

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7117 University: CTR

Project Title: Investigate the Strength of Struts Crossing Cold Joints

Project Start Date: 09/01/2021 Termination Date: 06/30/2025

Project Status: Active Total Project Budget: $1,366,368.89

Project Manager: Jade Adediwura Researcher: Oguzhan Bayrak

Project Objectives: Cold joints commonly occur in concrete structures, whether they are a part of new construction (e.g., staged construction, roadway expansion projects, spliced girder bridges) or retrofit efforts (e.g., interface between the new structural elements and the older concrete components). In many cases, the cold joints occur within “disturbed regions” of a structure. The preferred design method in the AASHTO LRFD Bridge Design Specifications for disturbed regions is the strut-and-tie design method. While the commentary states that the capacity of cold joints should be checked in addition to traditional strut-and-tie design checks, there is no specific guidance provided for how to include shear-interface resistance in the context of the strut-and-tie design provisions. Thus, there is a need to develop specific design recommendations for use in the AASHTO LRFD Bridge Design Specifications, as well as the TxDOT Bridge Design Manual. The Performing Agency shall investigate the strength of struts crossing cold joints through a comprehensive analytical and experimental test program informed by a literature review and examination of common cold joint cases encountered by bridge designers. The design recommendations developed shall provide the guidance for implementing the necessary design checks at cold joints encountered in Texas bridge design practice.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
Contract Total	$411,484.81	$329,187.85	$82,296.96

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7154 University: UTSA

Project Title: Utilization of 300 ksi Strands for TxDOT Prestressed Girders

Project Start Date: 09/19/2022 Termination Date: 08/31/2025

Project Status: Active Total Project Budget: $849,245.00

Project Manager: Tom Schwerdt Researcher: Wassim M. Ghannoum

Project Objectives: Advances in material and fabrication processes have allowed the prestressing-strand industry to increase the strength of strands from 270 ksi to 300 ksi. Several state DOTs around the nation are already considering incorporating higher strength strands into their designs. The impetus is to obtain longer bridge span lengths for a given section depth. The main goal of this research project is to update the designs of standard Texas DOT prestress girders to incorporate 300 ksi 0.6 inch diameter strands. The main concern for upgrading to 300 ksi strands revolves around the increased spalling and bursting stresses associated with higher prestressing forces. Such increases in stresses can cause increased cracking in girders at prestress transfer. The Performing Agency will conduct tests on full-scale prestressed girders for all standard TX girder section sizes. These tests will allow the research team to hone in on optimal detailing for girders using 300 ksi strands. As a result, new designs for all TX girder sections shall be produced for 300 ksi strands. Updates to design specifications shall also be proposed to reflect research findings. The expected benefits are more economical bridges that can span longer distances for a given section depth.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
Contract Total	$308,900.00	$247,120.00	$61,780.00

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7155 University: TTI/UTSA

Project Title: Develop/Refine Design Provisions for Headed and Hooked Reinforcement

Project Start Date: 09/01/2022 Termination Date: 02/28/2026

Project Status: Active Total Project Budget: $999,401.25

Project Manager: Tom Schwerdt Researcher: Kinsey Skillen

Project Objectives: The usefulness of reinforced concrete is dependent on sufficient anchorage between concrete and reinforcing steel. Sufficient anchorage occurs when reinforcing steel is embedded into the concrete a distance referred to as the development length. When this length of embedment is achieved the reinforcing steel is expected to reach or exceed stresses beyond yield. Geometric constraints within structural members may prevent straight lengths of reinforcement from developing their yield strength, such as straight bars being terminated within a beam-column joint. In these cases, the addition of a hook or headed bar attachment provides a more efficient anchorage mechanism compared to straight bars. Both hooked and headed bars have shorter development lengths than straight bars. However, the current American Association of State Highway and Transportation Officials (AASHTO) Load and Resistance Factor Design Bridge Design Specifications (LRFD) Bridge Design Specification (9th edition) has not developed standard details for headed reinforcement in bridge structures. In addition, current AASHTO LRFD design provisions for hooked bars are adapted from the American Concrete Institute (ACI) 318-14 Building Code Requirements for Structural Concrete. Considerable revisions to the current ACI 318-19 specification for the design of hooked reinforcement, which require increased lengths (50 to 70 percent longer) relative to previous code cycles, necessitates the Receiving Agency to revisit its current design practice for hooked reinforcement. This research seeks to provide the Receiving Agency with clear and concise design guidance for engineers to use both hooked and headed bar attachments in Receiving Agency bridge structures. The Performing Agencies shall accomplish this through large-scale experimental testing of specimens with hooked and headed bars representative of Receiving Agency bridge structures and current design practice.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
TTI	$250,590.50	$200,472.40	$50,118.10
UTSA	$114,723.75	$91,779.00	$22,944.75

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7158 University: UTSA

Project Title: Calibration of Bridge Performance Models Using Element Data

Project Start Date: 09/02/2022 Termination Date: 08/31/2024

Project Status: Active Total Project Budget: $393,835.00

Project Manager: Tom Schwerdt Researcher: Jose Weissmann

Project Objectives: The Performing Agency shall develop element deterioration models covering all bridge elements, including culverts, known as National Bridge Elements (NBEs) and Bridge Management Elements (BMEs), which shall forecast the probabilities that each statistically validated family of bridge elements and culverts will deteriorate to lower condition states within certain time frames. The Performing Agency shall also develop, test and validate Element Health Indices (EHIs), and aggregate them into a Texas Bridge Health Index (TxBHI) representing the entire bridge or culvert, ensuring that it prioritizes at-risk structures while balancing overall maintenance needs. These products shall have a Technology Readiness Level (TRL) of 8 or higher and be easily implementable into AASHTOWare BrM software and/or other desired Receiving Agency software. The project shall also use the deterioration forecasts in conjunction with the historical inspection database to identify and recommend structural details that warrant further improvements on design and construction specifications at TRL 2 or 3. All products shall be based on statistical analyses of a historical database with combined NBE, CoRe, NBI, climatic and environmental data.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
Contract Total	$195,630.00	$156,504.00	$39,126.00

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7161 University: TARL/UTSA

Project Title: Settlement Criteria and Design Approach for Embankments and Retaining Walls Built on Compressible Soils

Project Start Date: 09/12/2022 Termination Date: 08/31/2024

Project Status: Active Total Project Budget: $218,455.00

Project Manager: Chris Glancy Researcher: Jie Huang

Project Objectives: Soil improvement is essential for construction of embankments and retaining walls over highly compressible soils. However, due to diversity of soil improvement technologies, selection of suitable technology is an important and demanding task. Especially, if more than one soil improvement methods need to be used jointly to meet settlement, cost, and time requirements. To facilitate the selection process, this project shall: (1) collect and compile performance data of constructed embankments and retaining walls to establish settlement criteria based on their functionality and relative locations to a bridge, (2) analyze most commonly-used soil improvement methods in Texas to generate cost vs. construction time charts that can be used for preliminary screening, (3) develop a calculator that can calculate cost and time based on the determined settlement criteria for various soil improvement methods as well as their combinations so cost and benefit can be assessed, and (4) identify optimal combination of preloading with other methods under different Texas soil conditions. The focus of this project shall be preloading with/without wick drain, pile/columns supported embankment and lightweight fills. This project shall provide not only charts and tables that are ready to use in design but also design tools to analyze complicated situations.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
TARL	$31,685.00	$25,348.00	$6,337.00
UTSA	$87,722.50	$70,178.00	$17,544.50

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7167 University: TTI

Project Title: Evaluate Performance of Sealers and Coatings Applied to TxDOT Bridge Substructures

Project Start Date: 09/01/2022 Termination Date: 08/31/2024

Project Status: Active Total Project Budget: $499,972.00

Project Manager: Tom Schwerdt Researcher: Anol Mukhopadhyay

Project Objectives: The Performing Agency shall perform a comprehensive evaluation of concrete sealers and coatings applied to bridge substructure in the state of Texas. The Performing Agency shall investigate the need for and extent of surface preparation on both new and existing concrete surfaces including those with previously applied coatings. A focus is placed on material testing to evaluate the performance of coatings applied with various surface preparation methods and exposed to environmental conditions. The potential benefits are the development of recommendations for the level of surface preparation required for various sealer or coating systems and for the optimal coating type for the Receiving Agency's substructures with or without previously applied coatings.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
Contract Total	$249,988.50	$199,990.80	$49,997.70

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7170 University: TTI

Project Title: Evaluate Bridge Deck Condition and Replacement Methods

Project Start Date: 01/01/2023 Termination Date: 01/31/2026

Project Status: Active Total Project Budget: $734,786.00

Project Manager: TBD Researcher: Anna Birely

Project Objectives: Bridge decks usually have a minimum service life of 50 years but many bridge decks in Texas far exceed that value and are showing concerning signs of deck soffit cracking. Deck replacement is performed to take advantage of the good existing condition of the super- and sub-structures; however, since replacement is expensive (up to 40% of the cost of a new bridge), especially over concrete girders, it is critical to have sound decision and appropriate design and construction methods for this work to protect public safety and use bridge preservation funds wisely. While life-cycle cost analysis can be beneficial when assessing the overall deck condition relative to the condition of the rest of the deck, it does not address the risk of a punch through failure. The outcomes of this project will aid the Receiving Agency's Bridge Division and districts to have accurate assessments of cast-in-place (CIP) bridge deck conditions to make sound decisions about emergency repairs, regular repairs, deck overlay, and deck replacement to preserve bridge assets while minimizing the risk of punch through.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
Contract Total	$273,424.00	$218,739.20	$54,684.80

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 9-1532 University: CTR

Project Title: TPF-5(508) Concrete Bridge Engineering Institute (CBEI)

Project Start Date: 06/21/2023 Termination Date: 05/31/2027

Project Status: Active Total Project Budget: $2,917,900.00

Project Manager: Joanne Steele Researcher: Oguzhan Bayrak

Project Objectives: The objective of TPF-5(508) Concrete Bridge Engineering Institute (CBEI) Transportation Pooled Fund (TPF) is to create a national resource for innovative workforce development programs and implementation of new technologies in the field of concrete bridges, establishing a consortium of member states. CBEI shall be the center of concrete bridge related research, education, and training at the Performing Agency, the University of Texas at Austin in the Cockrell School of Engineering. The Performing Agency shall work with bridge stakeholders (primarily state and federal transportation agencies) and seek input from industry groups representing the concrete bridge community to develop pioneering, practical, and effective programs that will have national impact with the goal of addressing issues encountered in concrete bridges and implementing plans to work toward ensuring resiliency expectations for concrete bridges. The Performing Agency's specific objectives are to develop and implement the following services with coordinated input from members of the pooled fund:

- Three training programs which will include both classroom and hands-on training
  - Concrete Bridge Deck Construction Inspection Program
  - Concrete Materials for Bridges Program
  - Post-tensioning (PT) Laboratory
- The Concrete Solutions Center
- The Bridge Component Collection
- The Technology Development Program

The Performing Agency shall also implement the components of the Concrete Solutions Center comprised of workshops, seminars, and project technical support. The Performing Agency shall develop and administer the Technology Development Program for the evaluation and implementation of new and emerging technologies in the field of concrete bridges.

Financials	FY24 Total Budget	100% Federal
Contract Total	$1,009,426.31	

6.5 Strategy and Innovation

Project Number: 0-7159 University: TAMUCC/TTI

Project Title: Develop Guidelines for the Use of Unmanned Aerial Systems (UASs) and Smartphones for Construction and Utility Inspections

Project Start Date: 09/01/2022 Termination Date: 08/31/2024

Project Status: Active Total Project Budget: $482,278.00

Project Manager: Joanne Steele Researcher: Cesar Quiroga

Project Objectives: Unmanned aircraft systems (UASs) equipped with miniaturized cameras enable the collection of high resolution, three-dimensional (3D) geospatial data at lower costs than traditional techniques. New technologies also make it possible to gather pictures and video using smartphones, which can be fed to Structure from Motion (SfM) software to develop highly accurate 3D products. Operating UASs requires trained pilots and observers, but smartphones do not. There is a need to test whether construction contractor crews in the field can gather data using either of these technologies and upload the imagery and video to a server to enable inspectors to conduct inspections remotely. The Performing Agencies shall conduct a literature review of UAS-SfM and smartphone technologies; prepare a list of use cases and case studies to test relevant technologies; conduct field tests to document advantages, disadvantages, complementary capabilities, and potential implementation scenarios and costs; prepare recommended settings, procedures, use cases, and operational workflows to ensure repeatable data collection and processing; and prepare guidelines for quality assurance and control of inspections conducted with UAS- and smartphone-based SfM photogrammetry, as well as identify project suitability for the adoption of these technologies to support construction and utility inspection activities at the Receiving Agency.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
TAMUCC	$50,150.00	$40,120.00	$10,030.00
TTI	$178,119.50	$142,495.60	$35,623.90

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7160 University: UTA

Project Title: Improving Traffic Signal System Planning, Design and Management with Big-data-enhanced Automated Traffic Signal Performance Metrics (ATSPM) System

Project Start Date: 11/14/2022 Termination Date: 08/31/2024

Project Status: Active Total Project Budget: $292,010.25

Project Manager: Martin Dassi Researcher: Pengfei (Taylor) Li

Project Objectives: This project provides a guideline accompanied with the necessary software tools for the Receiving Agency and local agencies to better use the Automated Traffic Signal Performance Metrics System (ATSPM) in arterial traffic management. The ATSPM system came to traffic signal operations years ago and it can help agencies better understand arterial traffic signal performance. Many agencies are considering adopting the ATSPM systems because the ATSPM system(s) focuses on monitoring the traffic signal performance in the field. However, most traffic signal planning and design activities at present still rely on the traditional methods, such as Synchro, Highway Capacity Manual, etc. If agencies adopt different criteria between the planning/design stage and implementation stage, confusion will form and grow with the increase of ATSPM adoptions. To fill this gap, the Performing Agency plans to take a systematic approach to introduce the ATSPM concepts into all stages of traffic signal management. The Performing Agency shall develop a series of software tools to establish a new “ATSPM-In-The-Loop” traffic signal simulation framework, accompanied by case studies that public agents or consultants can use to evaluate their future traffic signal timing plans in simulation before deployment. The outcomes of this project will nationally be the first of its kind.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
Contract Total	$158,157.75	$126,526.20	$31,631.55

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7164 University: CTR

Project Title: Expanding Connected Vehicle Data Framework (CVDF) Data Sources to Increase Applications and Use on Texas Roadways

Project Start Date: 09/01/2022 Termination Date: 08/31/2024

Project Status: Active Total Project Budget: $350,000.00

Project Manager: Martin Dassi Researcher: Kristie Chin

Project Objectives: Connected vehicle (CV) technology is enabling transportation systems to become safer and smarter. Texas is assembling a robust CV ecosystem, with several CV deployments underway. At the heart is the Connected Vehicle Data Framework (CVDF), a data exchange that enables the Receiving Agency to publish key information, such as work zone locations and travel times, as well as ingest data from other public agencies and third parties regarding traffic characteristics, road weather conditions, and safety events. Constraints in data access and format standardization, however, limit the CVDF from realizing its full potential. This project shall leverage the existing CVDF that currently supports the Texas Connected Freight Corridors project to expand its efficacy through applications, data partners, and corridors. By expanding the CVDF, the Receiving Agency will unlock new benefits—improved real-time traveler information; increased CV adoption in passenger and freight markets; and more strategic infrastructure investments. This project shall deliver a CVDF Expansion Toolkit that includes:

- New applications that improve safety and mobility (e.g., truck parking availability, road weather warning, border wait times);
- Recommended data partners from local and regional agencies as well as third-party data providers to improve traffic operations; and
- Corridor investment strategies that identify Texas roadways for CV operations and describe infrastructure readiness tactics.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
Contract Total	$175,119.23	$140,095.38	$35,023.85

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7166 University: TTI/UTSA

Project Title: Leveraging Probe-Based Data to Enhance Long-Term Planning Models

Project Start Date: 09/06/2022 Termination Date: 08/31/2024

Project Status: Active Total Project Budget: $346,904.25

Project Manager: Joanne Steele Researcher: Jason Wu

Project Objectives: Long-range transportation planning (LRTP) and travel demand models (TDMs) play an important role in the planning process, which assists transportation agencies with prioritizing future transportation investments. Improved LRTP and TDMs can bring direct benefits to transportation planning in the state. Effective transportation planning and investment decision making depends on timely, comprehensive, and accurate data. However, traditional data collection methods only provide a "snapshot" of the travel information, which limits the performance of conventional LRTP and TDMs. In this regard, while these sources are still used, transportation planners at the state, metropolitan, and local levels are beginning to incorporate third-party traffic data into their planning processes. Planners also start to look at the opportunities afforded through third-party data and provide guidance on how to take advantage of that data to expand and improve planning practices. This project aims to utilize probe-based data to improve the LRTP process and TDMs used by the Receiving Agency, MPOs and other planning agencies in the state. The Performing Agencies shall study how probe-based and location-based data may be leveraged to facilitate the validation and calibration of existing planning models, enhance existing modeling tools, and incorporate advanced modeling techniques.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
TTI	$74,822.75	$59,858.20	$14,964.55
UTSA	$82,511.25	$66,009.00	$16,502.25

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-7169 University: TTI

Project Title: Post-NEVI Electric Vehicle Infrastructure Research (Freight, Fleet, and Multi-family Housing

Project Start Date: 09/12/2022 Termination Date: 08/31/2024

Project Status: Active Total Project Budget: $399,347.00

Project Manager: Joanne Steele Researcher: Edgar Kraus

Project Objectives: With the growing adoption of electric vehicles (EVs) in the United States and by Texans, Texas has a need for adequate and comprehensive coverage of EV charging infrastructure. While currently comprising less than one percent of all registered vehicles in Texas, projections forecast that EVs could comprise up to 55 percent of all vehicles by the year 2040. This significant industry shift will require considerable and proactive efforts to support this transition, focusing on infrastructure readiness; customer experience; interregional connectivity, equity, and economic impacts; and other consequences related to the closure or repurposing of gas stations. Texas needs to identify optimal places where infrastructure will be needed in advance of federal and local funding that will be available to build out EV charging infrastructure. Since implementation of EV charging infrastructure will occur in phases over multiple years, a long-term strategic plan is necessary to guide the development of EV infrastructure, ensure that the Receiving Agency meets the needs of EV stakeholders, and maximize financial opportunities available to the state. The long-term strategic plan will guide infrastructure investment across the state, with a goal of a stable and consistent EV charging network. The project will also help guide future charging infrastructure funding opportunities and provide guidance to effectively and equitably distribute available funding. The Performing Agency shall review the existing EV charging infrastructure state of practice to understand needs and challenges in EV infrastructure, including deployment models, grid connectivity and upgrades, and evolving technologies such as in-road charging, swappable batteries, and future-proofing existing technology; assess tools available to guide statewide EV planning analysis, such as EVI-Pro and other platforms; develop an analysis of projected EV charging demand based on adoption trends and projections; develop a policy analysis of the local, state, and federal statutory landscape to identify barriers and opportunities in comparison to peer states; analyze funding opportunities and develop frameworks for funding models, including private-public partnerships, that will consider the state of practice, federal funding opportunities, and alternative funding sources; and develop strategies to improve the EV charging infrastructure system in Texas over the course of 5 to 10 years, including an evaluation of variables that affect the placement of new EV charging locations and the necessity and viability of battery storage and off-grid capabilities. These efforts will result in an assessment of EV planning analysis tools, a policy analysis framework, and long-term statewide EV infrastructure strategies.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
Contract Total	$200,772.25	$160,617.80	$40,154.45

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-9908-22 University: TTI

Project Title: Planning Innovation and Technology Deployments at TxDOT

Project Start Date: 03/10/2022 Termination Date: 12/31/2023

Project Status: Active Total Project Budget: $3,152,815.00

Project Manager: Kevin Pete Researcher: Bob Brydia

Project Objectives: From time to time, TxDOT districts produce ITS and other technology innovations that improve roadway and/or worker safety, roadway efficiency and/or produce cost savings. By failing to recognize and scale these innovations across the state, TxDOT does not receive the full benefit of 25 diverse centers of excellence. This contract utilizes TTI, which is an organization that excels at innovation in and of itself, to investigate innovative district practices and to develop plans at a district and statewide level to share and scale innovation across the state. By harvesting the knowledge already contained within TxDOT, new avenues will open to improve roadway safety, efficiency and produce cost savings. Due to the breadth of TxDOT, these innovations may have very large impacts on the millions of Texans across the state and their visitors. Additionally, by cataloging and bringing together these innovations, divisions and districts can work together to make sure that solutions are developed in such a way that unified systems and interoperability occur throughout the state. This project also complements a wider effort to catalog, share and grow innovation at TxDOT. The end result for Planning for Innovation and Technology Deployments at TxDOT is a programmatic set of documents that compile and recommend innovative ITS and advanced technology roadway projects and system improvements that TxDOT districts can execute, customized to each district. To arrive at this, the consultant team will interact with districts and industry professionals as unique stakeholders across the state and the nation to compile insights of innovative projects that may include data analysis, operational improvements or deployment of advanced technologies along the roadway, among others. The consultant team will develop high level scope and cost estimates for each offered transportation project. The consultant may also be directed to develop a strategy blueprint (goal, purpose, scope, timeline, responsibilities) for how innovation and technology deployment can be progressed as an integral part of the Receiving Agency's functions and to develop evaluation plans and/or templates for Department innovation and technology deployment projects.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
Contract Total	$481,339.00	$385,071.20	$96,267.80

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 5-7081-01 University: CTR

Project Title: Implementation of Understanding the Impact of Autonomous Vehicles on Long-distance Travel Mode and Destination Choice in Texas

Project Start Date: 11/04/2022 Termination Date: 10/23/2023

Project Status: Active Total Project Budget: $159,917.34

Project Manager: Martin Dassi Researcher: Kara Kockelman

Project Objectives: The 0-7081 research project produces a model that forecasts long-distance demand by autonomous passenger and freight vehicles. It combines rigorous insight gained from literature, survey results, and a variety of data sets to predict a future 20+ years from now, where autonomous vehicles are readily available for all ground-based travel. Key findings thus far include 15+% added VMT to the Texas and US networks, 10+% longer passenger-trip distances (within the state), and notable mode-share losses for freight rail and passenger air travel. While this project delivers complex long-distance travel-demand model specifications for passengers and freight, including all parameter estimates, the models are not yet ready for in-house applications by the Receiving Agency personnel. The research team proposes an implementation project to put all passenger and freight-based travel demand equations and parameters (and various input files, like network distances and travel times, export demand volumes by industry, weight per container by industry) into a user-friendly TransCAD-based package for the Receiving Agency employees to use in coming years. The team also proposes hosting several training sessions for the Receiving Agency staff and stakeholders (like MPO staff and their consultants, across the state and nation). In this way, the Receiving Agency and its partners can run hundreds of diverse simulations over the coming years, thereby implementing this research work fully, while adding new forecasts and value for infrastructure maintenance and expansion, traffic management, and trade and travel support across the state and nation.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
Contract Total	$62,607.96	$50,086.37	$12,521.59

*Non-Federal Match provided by Transportation Development Credits (TDCs)

6.6 Program Support

Project Number: 0-6974 University: TTI

Project Title: Digital Publication and Outreach Services in Support of Research

Project Start Date: 07/11/2018 Termination Date: 08/31/2025

Project Status: Active Total Project Budget: $1,913,647.00

Project Manager: Phillip Hempel Researcher: Kelly West

Project Objectives: The Performing Agency shall produce Video Summary Report's (VSRs) for the Receiving Agency which summarize transportation research and implementation projects. Additionally, the Performing Agency shall also produce outreach materials for the Receiving Agency that will be transportation research related material and may include additional related subjects of interest.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
Contract Total	$336,998.50	$269,598.80	$67,399.70

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Project Number: 0-9902-23 University: CTR

Project Title: University of Texas Library Services

Project Start Date: 08/31/2022 Termination Date: 08/31/2025

Project Status: Active Total Project Budget: $1,313,756.18

Project Manager: Tom Schwerdt Researcher: Michael Nugent

Project Objectives: The Performing Agency shall provide publishing services, library information services, and collection management to support the federally-funded State Planning and Research Part II (SPR II) Work Program managed by the Receiving Agency's Research and Technology Implementation Division (RTI). The Performing Agency shall provide the facilities, technical oversight, and trained professional, technical, and clerical staff needed to respond to the Receiving Agency's research information needs and to update, preserve, and facilitate public access to the collection of published resources contained in the Receiving Agency's transportation research library (TxDOT Research Library). The U.S. Department of Transportation (USDOT) Public Access Plan ensures public access to unclassified publications and digital data sets arising from the USDOT's research and development funding, which includes the SPR Part II Work Program (Research Program). The Performing Agency shall support transparency and long-term stewardship of Research Program results by providing online public access to Research Program information, performing services that ensure the Receiving Agency follows USDOT Public Access Plan guidelines, and serving as the Receiving Agency's official repository for all Research Program deliverables.

Financials	FY24 Total Budget	80% Federal	20% Estimated TDCs*
Contract Total	$438,580.71	$350,864.57	$87,716.14

*Non-Federal Match provided by Transportation Development Credits (TDCs)

7.0 Pooled Fund Projects

Pooled-fund projects are for planning, research, development, or technology transfer project activities administered by FHWA and are supported by two or more participants. These projects address an issue of significant or widespread interest related to highway, public, or intermodal transportation. The research is intended to address a new area or provide information that will complement or advance previous investigations of the subject matter.

As 23 CFR 420.205 describes, "To promote effective use of available resources, the State DOTs are encouraged to cooperate with other State DOTs, the FHWA, and other appropriate agencies to achieve RD&T objectives established at the national level and to develop a technology transfer program to promote and use those results. This includes contributing to cooperative RD&T programs such as the NCHRP, the TRB, and transportation pooled fund studies as a means of addressing national and regional issues and as a means of leveraging funds."

Pooled-fund projects are a very effective means of leveraging precious research funds.
Table 8. shows the pooled-fund projects that Texas participates in.
The following are project descriptions of the pooled-fund projects where Texas is contributing funds:

Table 9. FY 2024 Pooled-Fund Projects.

Project	Title	Study No.	Lead Agency	Start-End Date	FY24 Commitment
8-8458	Connecting the DOTs: Implementing ShakeCast Across Multiple State Departments of Transportation for Rapid Post-Earthquake Response	TPF-5(357)	California Department of Transportation	2017-2024	$15,000.00
8-8470	Improve pavement surface distress and transverse profile data collection and analysis, Phase II	TPF-5(399)	FHWA	2019-2024	$20,000.00
8-8471	National Partnership to Determine the Life Extending Benefit Curves of Pavement Preservation Techniques (MnROAD/NCAT Joint Study – Phase II)	TPF-5(375)	Minnesota Department of Transportation	2018-2023	$50,000.00

Project	Title	Study No.	Lead Agency	Start-End Date	FY24 Commitment
8-8482	Smart Work Zone Deployment Initiative (FY20-FY24)	TPF-5(438)	Iowa Department of Transportation	2020-2024	$25,000.00
8-8484	EconWorks - Improved Economic Insight	TPF-5(456)	Arkansas Department of Transportation	2020-2024	$4,000.00
8-8486	Technology Transfer Concrete Consortium (FY20-FY24)	TPF-5(437)	Iowa Department of Transportation	2020-2024	$20,000.00
8-8487	No Boundaries Transportation Maintenance Innovations	TPF-5(441)	Colorado Department of Transportation	2020-2025	$10,000.00
8-8490	Traffic Safety Culture - Phase 2	TPF-5(444)	Montana Department of Transportation	2020-2024	$50,000.00
8-8491	National Accessibility Evaluation Phase II Access Across America	TPF-5(455)	Minnesota Department of Transportation	2021-2025	$40,000.00
8-8492	Automated Vehicle Pooled Fund Study	TPF-5(453)	Ohio Department of Transportation	2021-2025	$50,000.00
8-8499	Road Usage Charge (RUC) America	TPF-5(451)	Oregon Department of Transportation	2020-2025	$25,000.00
8-8502	Hydrologic and Hydraulic Software Enhancements (SMS, WMS, Hydraulic Toolbox, and HY-8)	TPF-5(464)	FHWA	2020-2024	$10,000.00
8-8504	Traffic Control Device (TCD) Consortium (3)	TPF-5(447)	FHWA	2020 - 2025	$25,000.00
8-8506	Pavement Surface Properties Consortium: Phase III - Managing the Pavement Properties for Improved Safety	TPF-5(463)	Virginia Department of Transportation	2021-2025	$20,000.00
8-8508	Soil and Erosion Testing Services for Bridge Scour Evaluations	TPF-5(461)	FHWA	2021-2025	$15,000.00

Project	Title	Study No.	Lead Agency	Start-End Date	FY24 Commitment
8-8510	Demonstration to Advance New Pavement Technologies Pooled Fund	TPF-5(478)	FHWA	2021-2025	$10,000.00
8-8513	Building Information Modeling (BIM) for Infrastructure	TPF-5(480)	Iowa Department of Transportation	2021-2025	$30,000.00
8-8514	In-Service Performance Evaluation (ISPE) of Roadway Safety Features	TPF-5(481)	Arizona Department of Transportation	2022-2024	$30,000.00
8-8515	Development and Evaluation of Roadside Safety Systems for Motorcyclists (TxDOT-Led)	TPF-5(482)	Texas Department of Transportation	2022-2024	$40,000.00
8-8516	Clear Roads Winter Highway Operations Phase III Pooled Fund	TPF-5(479)	Minnesota Department of Transportation	2022-2026	$25,000.00
8-8517	Center for the Aging Infrastructure: Steel Bridge Research, Inspection, Training and Education Engineering Center - SBRITE (Continuation)	TPF-5(486)	Indiana Department of Transportation	2022-2024	$75,000.00
8-8518	LTPP Forensic Investigations - Stage 2	TPF-5(500)	Washington State Department of Transportation	2021-2025	$20,000.00
8-8519	ENTERPRISE- PHASE III (Phase II Continuation)	TPF-5(490)	Michigan Department of Transportation	2022-2026	$30,000.00
8-8520	Safety Service Patrol Standardization and Management Practices	TPF-5(489)	FHWA	2021-2025	$25,000.00
8-8522	Transportation Management Centers Pooled Fund Study Phase II	TPF-5(487)	FHWA	2022-2027	$50,000.00
8-8523	Roadside Safety Pooled Fund - Phase 3	TPF-5(501)	Washington Department of Transportation	2023-2027	$65,000.00

Project	Title	Study No.	Lead Agency	Start-End Date	FY24 Commitment
8-8524	2023 through 2025 Biennial Asset Management Conference and Training on Implementation Strategies	TPF-5(492)	Iowa Department of Transportation	2022 - 2024	$12,000.00
8-8526	Continuous Bituminous Pavement Stripping Assessment Through Non-destructive Testing	TPF-5(504)	Minnesota Department of Transportation	2023-2027	$25,000.00
8-8527	Emerging Data Streams for Pavement (Asset) Health Monitoring and Management	TPF-5(513)	Virginia Department of Transportation	2023-2028	$30,000.00
8-8529	Standardizing Rigid Inclusions for Transportation Projects – Phase I	TPF-5(503)	Kansas Department of Transportation	2023-2025	$30,000.00
8-8530	Highway Safety Manual 2nd Edition (HSM2) Implementation	TPF-5(516)	FHWA	2023-2028	$16,000.00
8-8531	Concrete Bridge Engineering Institute (CBEI)	TPF-5(508)	Texas Department of Transportation	2023-2026	$250,000.00
8-8532	National Partnership to Improve the Quality of Preventive Maintenance Treatment Construction & Data Collection Practices (PG Phase III)	Click or tap here to enter text.	Minnesota Department of Transportation	2023 - 2027	$50,000.00
8-8533	National Hydraulic Engineering Conference	TPF-5(507)	FHWA	2022 - 2027	$1,000.00
8-8534	Building Information Modeling (BIM) for Bridges and Structures - Phase II	Click or tap here to enter text.	Iowa Department of Transportation	2023 - 2027	$20,000.00
8-8535	New Performance Approach to Evaluate ASR in Concrete	TPF-5(521)	FHWA	2023 - 2027	$5,000.00

Project	Title	Study No.	Lead Agency	Start-End Date	FY24 Commitment
8-8536	Consortium for Asphalt Pavement Research and Implementation (CAPRI)	TPF-5(465)	Alabama Department of Transportation	2021 - 2025	$10,000.00
8-8537	Expansion: Enhanced Traffic Signal Performance Measures	TPF-5(519)	Indiana Department of Transportation	2023 - 2025	$40,000.00
8-8538	Resilience Approaches for Pavements and Geotechnical Assets	TPF-5(512)	Virginia Department of Transportation	2023 - 2027	$20,000.00
8-8540	Work Zone Analytics	TPF-5(514)	Indiana Department of Transportation	2023 - 2025	$30,000.00
8-8541	Evaluation of Low-Cost Safety Improvements (ELCSI-PFS)	TPF-5(515)	FHWA	2023 - 2027	$10,000.00
8-8542	Implementation of Structural Data from Traffic Speed Deflection Devices	TPF-5(518)	Virginia Department of Transportation	2024 - 2028	$149,000.00
8-8543	Human-Centered Steel Bridge Inspection Enabled by Augmented Reality and Artificial Intelligence	Click or tap here to enter text.	Kansas Department of Transportation	2024 - 2026	$40,000.00
8-8544	Improving Traffic Detection Through New Innovative i-LST Technology Demonstration Pilot	TPF-5(520)	FHWA	2023 - 2024	$15,000.00

7.1 Pooled Funds Where Texas is Not the Lead State

Project Number: 8-8458

Study Number: TPF-5(357)

Title: Connecting the DOTs: Implementing ShakeCast Across Multiple State Departments of Transportation for Rapid Post-Earthquake Response

Lead Agency: California Department of Transportation

Status: Cleared by FHWA

Project Objectives: This collaborative effort will bring participating DOTs into full ShakeCast operation for post-earthquake assessment of state and local bridge inventories. The project will provide a mechanism to actively engage representatives from state DOTs with the common interests in implementing and expanding the application of ShakeCast technologies to improve emergency response capabilities.

Financials:	Commitment Years	FY24 Commitment
TxDOT	2017-2024	$15,000.00

Project Number: 8-8470

Study Number: TPF-5(399)

Title: Improve pavement surface distress and transverse profile data collection and analysis, Phase II

Lead Agency: FHWA

Status: Cleared by FHWA

Project Objectives: Improve the Quality of Pavement Surface Distress and Transverse Profile Data Collection and Analysis by assembling SHAs, the FHWA, and industry representatives to: • Identify data collection integrity and quality • Assist in solution deployment issues • Identify data analysis needs • Suggest approaches to addressing identified issues and needs Based on this information, the SHAs and the FHWA will: • Initiate and monitor projects intended to address identified issues and needs • Disseminate results

Financials:	Commitment Years	FY24 Commitment
TxDOT	2019-2024	$20,000.00

Project Number: 8-8471

Study Number: TPF-5(375)

Title: National Partnership to Determine the Life Extending Benefit Curves of Pavement Preservation Techniques (MnROAD/NCAT Joint Study – Phase II)

Lead Agency: Minnesota Department of Transportation

Status: Cleared by FHWA

Project Objectives: MnROAD and NCAT are seeking organizations to join the partnership for the second phase of research efforts. Main objectives include: 1. Determining the life cycle cost of various pavement preservation alternatives in a highly controlled experiment that will provide state Departments of Transportation (DOTs) with the financial foundation to begin to build a decision tree for their own maintenance program 2. Develop quality assurance QA field testing protocols to correlate construction practices with long term performance of pavement preservation techniques. 3. Technology transfer - Answering practical questions posed by research sponsors through formal (i.e., reports & technical papers) & informal (e.g., one-on-one responses to sponsor inquiries) technology transfer on how these life extending benefits can be best utilized in each state.

Financials:	Commitment Years	FY24 Commitment
TxDOT	2018-2023	$50,000.00

Project Number: 8-8482

Study Number: TPF-5(438)

Title: Smart Work Zone Deployment Initiative (FY20-FY24)

Lead Agency: Iowa Department of Transportation

Status: Contract signed

Project Objectives: This program represents an on-going effort among cooperating states' DOTs, the FHWA, universities, and industry to evaluate new products and conduct related research focused on the enhancement of safety and mobility in highway work zones. Over 100 studies and evaluations have been completed since the inception of the SWZDI and final reports are posted in the Smart Work Zone Deployment Initiative web site at https://swzdi.intrans.iastate.edu/.

Financials:	Commitment Years	FY24 Commitment
TxDOT	2020-2024	$25,000.00

Project Number: 8-8484

Study Number: TPF-5(456)

Title: EconWorks - Improved Economic Insight

Lead Agency: Arkansas Department of Transportation

Status: Cleared by FHWA

Project Objectives: The focus of this pooled fund project will be to support transportation planners with a better understanding of the economic impact of transportation projects by continuing the overall operation, maintenance and improvement to the EconWorks website, and completing and adding additional case studies to provide more robust economic analysis.

Financials:	Commitment Years	FY24 Commitment
TxDOT	2020-2024	$4,000.00

Project Number: 8-8486

Study Number: TPF-5(437)

Title: Technology Transfer Concrete Consortium (FY20-FY24)

Lead Agency: Iowa Department of Transportation

Status: Contract signed

Project Objectives: The goal of the TTCC is to: • Identify needed research priorities by region • Provide a forum for technology exchange between participants • Develop and fund technology transfer materials • Provide on-going communication of research needs faced by state agencies to the FHWA, industry, and CP Tech Center • Provide technical leadership for concrete related national initiatives to advance state-of-the-art construction and material practices It is anticipated that this consortium would become the national forum for state involvement in the technical exchange needed for collaboration and new initiatives and provide tactical strategies and solutions to issues identified by the member states.

Financials:	Commitment Years	FY24 Commitment
TxDOT	2020-2024	$20,000.00

Project Number: 8-8487

Study Number: TPF-5(441)

Title: No Boundaries Transportation Maintenance Innovations

Lead Agency: Colorado Department of Transportation

Status: Cleared by FHWA

Project Objectives: Through this pooled fund project, the Colorado Department of Transportation (CDOT) will work with other State Departments of Transportation (DOTs) to facilitate the transfer of knowledge of promising non-snow and ice maintenance innovations and technologies. This project provides a forum for State DOTs to share their maintenance innovations with each other, support technology transfer activities and develop marketing and deployment plans for selected innovations through bi-annual 2-3 day peer exchange meetings at various locations selected by participating members. Resources will be provided for the transfer of knowledge and experience of various innovations that includes travel, training and other technology transfer activities. It is anticipated that this consortium will become the national forum for state involvement in the technical exchange needed for collaboration and new initiatives, and be a forum for advancing the application and benefit of research technologies. In addition, the project will create a searchable database or warehouse where innovations and research done relating to highway maintenance can be found and showcased. State participation in this process will be through the pooled fund. FHWA, industry and others will be invited to participate in the project discussions and activities. Workshops will continue to be provided for the states participating in the pooled fund project. This project will help DOTs to save time and money by not investing in the same research that has already been performed by other state DOTs. Rather than having each DOT identify and conduct research separately, DOTs can work collectively through this pooled fund project. The Colorado DOT will serve as the lead state for the execution of the pooled fund project described in this proposal. The Colorado DOT will handle all administrative duties associated with the project.

Financials:	Commitment Years	FY24 Commitment
TxDOT	2020-2025	$10,000.00

Project Number: 8-8490

Study Number: TPF-5(444)

Title: Traffic Safety Culture - Phase 2

Lead Agency: Montana Department of Transportation

Status: Contract signed

Project Objectives: Only through the growth of a positive safety culture can significant and sustainable reductions in crash fatalities and serious injuries be achieved. Towards that end, this pooled fund program will: (1) conduct research to identify solutions to specific culture-based traffic safety problems, taking advantage of the implementation opportunities to improve traffic safety; (2) develop resources to enhance understanding and application of traffic safety culture strategies; and (3) provide technology transfer of best practices in traffic safety culture strategies.

Financials:	Commitment Years	FY24 Commitment
TxDOT	2020-2024	$50,000.00

Project Number: 8-8491

Study Number: TPF-5(455)

Title: National Accessibility Evaluation Phase II Access Across America

Lead Agency: Minnesota Department of Transportation

Status: Contract signed

Project Objectives: This project has two main objectives. First, it will create a new, national Census block-level accessibility dataset that can be used by partners in local transportation system evaluation, performance management, planning, and research efforts. Second, it will produce and publish a series of annual reports describing accessibility to jobs by auto, transit, and biking in metropolitan areas across America. Accessibility Dataset This project will create a national Census-block level dataset describing accessibility to jobs from locations across the county, updated annually. Accessibility calculations will rely on detailed travel time calculations for both driving and transit, which will be implemented using commercially-available GPS-based speed measurements, published transit schedules, and detailed bike and pedestrian networks. Each Access Across America partner will have direct digital access to the accessibility datasets covering the jurisdictions of all partners. Annual Report The annual Access Across America series of annual reports will provide summaries of the detailed accessibility datasets for the 50 largest metropolitan areas across America. These will be released to national and local media outlets and supported by publicity and communications efforts. Partners will be recognized in the report for their sponsorship and support. Optional Goals The accessibility evaluation tools and expertise developed in this project can also support optional goals for interested agencies: 1. Include destinations from local data sources - Local destination datasets from your organization can be included in the annual accessibility calculations. Cost: $5,000 2. Accessibility Data Workshop - Researchers can lead an on-site or remote workshop to provide transportation agency staff hands-on experience with accessibility data and training on accessibility concepts. Cost: $5,000. 3. Scenario Evaluation - Using annual accessibility data as a baseline, researchers can develop an accessibility evaluation of highway, transit, bike, or pedestrian scenarios based on planning data from your organization. Cost varies with scenario complexity and objectives.

Financials:	Commitment Years	FY24 Commitment
TxDOT	2021-2025	$40,000.00

Project Number: 8-8492

Study Number: TPF-5(453)

Title: Automated Vehicle Pooled Fund Study

Lead Agency: Ohio Department of Transportation

Status: Cleared by FHWA

Project Objectives: Through this pooled fund, the Ohio Department of Transportation (ODOT) will work with federal and state departments of transportation to establish multiple projects to research vehicle-roadway interaction including data failures and mitigation methods, identify and define standards, and encourage interoperability across state borders.

Financials:	Commitment Years	FY24 Commitment
TxDOT	2021-2025	$50,000.00

Project Number: 8-8499

Study Number: TPF-5(451)

Title: Road Usage Charge (RUC) America

Lead Agency: Oregon Department of Transportation

Status: Cleared by FHWA

Project Objectives: Explore the technical and operational feasibility of a multi-jurisdictional road usage charge system. • Investigate public and key decision maker criteria for acceptance and share experience and lessons learned to foster positive outcomes. • Develop standards and protocols for how road use charges could best be collected and remitted among the various jurisdictions. • Develop preliminary operational concepts for how a multi-jurisdictional road usage charge system could be administered. • Develop a model for regional cooperation and interoperability that can be used in the Western region and potentially across North America. • Engage the automotive manufacturing and technology sector to encourage the ability for mileage reporting to occur in conjunction with other products and services the sector provides in the marketplace. • Share knowledge to maximize the preparedness for and efficiency of policy and program development for road usage charging among the members.

Financials:	Commitment Years	FY24 Commitment
TxDOT	2020-2025	$25,000.00

Project Number: 8-8502

Study Number: TPF-5(464)

Title: Hydrologic and Hydraulic Software Enhancements (SMS, WMS, Hydraulic Toolbox, and HY-8)

Lead Agency: FHWA

Status: Cleared by FHWA

Project Objectives: This Transportation Pooled Fund (TPF) project will: 1. Enhance the capabilities of the four FHWA sponsored software programs and ensure they remain consistent with the latest FHWA technical reference documents. 2. Update the software user manual documentation. 3. Make new software versions publicly available. 4. Develop and deploy technology transfer materials and workshops to test and demonstrate new software content and features. 5. Inform users of the availability of new software versions and features through website postings, email notifications, newsletter articles, conference presentations, and other avenues.

Financials:	Commitment Years	FY24 Commitment
TxDOT	2020-2024	$10,000.00

Project Number: 8-8504

Study Number: TPF-5(447)

Title: Traffic Control Device (TCD) Consortium (3)

Lead Agency: FHWA

Status: Cleared by FHWA

Project Objectives: To assemble a consortium composed of State Departments of Transportation; additional interested entities or organizations; County, regional, and/or local transportation agencies; and FHWA program offices to meet national and state needs in support of the MUTCD. Activities of the consortium include:

a) Identify human factors, safety, and operational issues related to TCDs;
b) Select new and existing TCDs for evaluation;
c) Initiate and monitor research projects;
d) Disseminate results; and
e) Facilitate collaboration and information sharing among members.

Financials:	Commitment Years	FY24 Commitment
TxDOT	2020 - 2025	$25,000.00

Project Number: 8-8506

Study Number: TPF-5(463)

Title: Pavement Surface Properties Consortium: Phase III - Managing the Pavement Properties for Improved Safety

Lead Agency: Virginia Department of Transportation

Status: Cleared by FHWA

Project Objectives: The mission of the Surface Properties Consortium has been to conduct applied research focused on enhancing the level of service provided by the roadway transportation system by optimizing pavement surface characteristics. Phase I [TPF-5(141)] included regular verification and validation of the participants' equipment, opportunities for technology transfer, and the accumulation of a significant body of knowledge on the measurement of pavement surface properties. Phase II [TPF-5(345)] continued to support the members' effort to produce high-quality surface properties measurements, but focused mainly on emerging friction and macrotexture measurement technologies and the integration of these measurements into the next generation of pavement asset management systems. Practical and tangible results were well documented and disseminated. The focus of Phase III will be on continuing to support the implementation of asset management approaches and tools that help improve the safety of our road networks by reducing the number of crashes and related fatalities. It will represent a concerted effort to bring pavement design and evaluation experts together with maintenance and safety professionals to maximize the contribution of the pavement community Towards Zero Deaths on US highways. It will also seek participation of industry through the pooled-fund or an industrial affiliate program.

Financials:	Commitment Years	FY24 Commitment
TxDOT	2021-2025	$20,000.00

Project Number: 8-8508

Study Number: TPF-5(461)

Title: Soil and Erosion Testing Services for Bridge Scour Evaluations

Lead Agency: FHWA

Status: Cleared by FHWA

Project Objectives: The objective of these pooled funds is to provide and/or support soil and erosion testing services for bridge projects over water crossings managed or coordinated by State DOTs, to provide technical assistance to design, fabricate, and install erosion testing devices to support and seek to broaden the use of erosion testing devices among State Department of Transportations, and to compile and analyze the collected soil and erosion testing data in a broader research effort to more accurately estimate reliable scour design depths given the soil conditions and hydraulic load during a given storm event.

Financials:	Commitment Years	FY24 Commitment
TxDOT	2021-2025	$15,000.00

Project Number: 8-8510

Study Number: TPF-5(478)

Title: Demonstration to Advance New Pavement Technologies Pooled Fund

Lead Agency: FHWA

Status: Cleared by FHWA

Project Objectives: This pooled fund seeks to support and showcase the implementation of innovative pavement technologies, products, and processes by State DOTs by leveraging of Federal investments with State DOT partnerships.

Financials:	Commitment Years	FY24 Commitment
TxDOT	2021-2025	$10,000.00

Project Number: 8-8513

Study Number: TPF-5(480)

Title: Building Information Modeling (BIM) for Infrastructure

Lead Agency: Iowa Department of Transportation

Status: Contract Signed

Project Objectives: The pooled fund serves as the mechanism for stakeholders to work collaboratively to advance BIM for Infrastructure. This will involve building off the foundational work that was charted out in the BIM National Strategic Work Plan, with emphasis on increasing coordination and awareness of BIM technologies and activities. This pooled fund will coordinate with efforts of TPF-5(372) focusing on BIM for Bridges and Structures.

Financials:	Commitment Years	FY24 Commitment
TxDOT	2021-2025	$30,000.00

Project Number: 8-8514

Study Number: TPF-5(481)

Title: In-Service Performance Evaluation (ISPE) of Roadway Safety Features

Lead Agency: Arizona Department of Transportation

Status: Cleared by FHWA

Project Objectives: The primary objective of this pooled fund study is to evaluate the performance of roadside safety hardware in the field through inter-state collaboration by using standardized data collection and data analysis with a uniform interpretation of results. The second objective is to provide a forum for states to share ISPE data, experiences, practices, information, and resources.

Financials:	Commitment Years	FY24 Commitment
TxDOT	2022-2024	$30,000.00

Project Number: 8-8516

Study Number: TPF-5(479)

Title: Clear Roads Winter Highway Operations Phase III Pooled Fund

Lead Agency: Minnesota Department of Transportation

Status: Cleared by FHWA

Project Objectives: Objectives of the new phase of the Clear Roads pooled fund project will include: • Conduct structured field testing and evaluation across a range of winter conditions and different highway maintenance organizational structures to assess the practical effectiveness, ease of use, optimum application rates, barriers to use, durability, safety, environmental impact, and cost-effectiveness of innovative materials, equipment, and methods for improved winter highway maintenance. • Conduct research that explores the use of innovative materials, equipment, and processes that will promote environmentally sustainable winter maintenance operations. • Conduct cost-benefit analyses to ensure that new technologies, materials, or methods contribute to operational efficiency. • Investigate state agency uses of performance measures for winter operations and develop management tools that support effective analysis and reporting of the measures. • Establish industry standards and develop performance measures for evaluating and utilizing new materials and technologies. • Support technology transfer by developing and disseminating practical field guides and training curriculum and reference materials to promote the results of research projects. • Support the exchange of information and ideas among state agencies via peer exchanges, ad hoc internal surveys, and collaborative research efforts that provide opportunities for winter maintenance specialists to share experiences related to winter maintenance. • Conduct national surveys to compile and document agency practices on the latest operational issues (for example salt shortages, level of service requirements, or other "hot button" issues). • Conduct quick turnaround, low-cost synthesis projects to investigate the latest research and practices on pressing winter maintenance topics. • Coordinate with the Aurora Pooled Fund (http://www.aurora-program.org/) to enhance the impact, and avoid duplication, of winter road weather research. • Promote public education and outreach related to winter maintenance and winter driving safety.

Financials:	Commitment Years	FY24 Commitment
TxDOT	2022-2026	$25,000.00

Project Number: 8-8517

Study Number: TPF-5(486)

Title: Center for the Aging Infrastructure: Steel Bridge Research, Inspection, Training and Education Engineering Center - SBRITE (Continuation)

Lead Agency: Indiana Department of Transportation

Status: Cleared by FHWA

Project Objectives: Objectives and Impact: The objective of the proposal is to request a continuation of SPR-5(281) the Steel Bridge Research, Inspection, Training, and Education Engineering Center (S-BRITE Engineering Center) focused on existing steel highway bridges. This National Center when initially proposed in 2013, has become a national Center leading education, training, research, and engineering benefitting the existing aging steel bridge and structure inventory. Over the life of the project, ten (10) states, the US Army Corps, and FHWA have provided support through TPF-5(281) and continue to do so. Current funding is very strong and partner states continue to be added. Although the Center has been focused on highway bridges, it will also support stakeholders of steel railroad bridges as well as steel ancillary structures, such as lighting towers and sign supports. As a result, in-kind support from the railway industry has been strong as well. The Center has contributed to improved asset management decisions for DOTs, FHWA, and other partners relative to existing steel bridge inventory. However, since the existing TPF-5(281) needs to sunset per FHWA guidelines, the Research Team, and the current active partners are requesting a continuation of this pooled fund study, albeit under a different TPF number. The original project objectives and deliverables remain unchanged. Nevertheless, a summary of the Center is presented below.

Financials:	Commitment Years	FY24 Commitment
TxDOT	2022-2024	$75,000.00

Project Number: 8-8518

Study Number: TPF-5(500)

Title: LTPP Forensic Investigations - Stage 2

Lead Agency: Washington State Department of Transportation

Status: Cleared by FHWA

Project Objectives: The objective of the proposed pooled fund study is to create a mechanism to allow for rapidly completing forensic evaluations of LTPP sections before going out of service. Test sections that are no longer active, but which have remained unchanged (i.e., no maintenance or rehabilitation has been applied), may also be considered for forensic evaluation. Possible reasons for carrying out the forensic evaluations include: • Determining reasons for poor pavement performance/premature failures • Understanding exceptional pavement performance and/or longevity • Validating pavement performance prediction (predicted vs actual) • Collecting data to support development and/or calibration of pavement performance prediction models • Closing-out/conducting final investigations of experimental test sections Ultimately, however, the primary reason for carrying out the evaluations will be to determine if the data contained in the LTPP database adequately explains the performance of the test sections and why they performed as they did.

Financials:	Commitment Years	FY24 Commitment
TxDOT	2021-2025	$20,000.00

Project Number: 8-8519

Study Number: TPF-5(490)

Title: ENTERPRISE- PHASE III (Phase II Continuation)

Lead Agency: Michigan Department of Transportation

Status: Cleared by FHWA

Project Objectives: This proposed TPF study is a continuation of TPF-5(359) to enhance innovation in highway operations and intelligent transportation systems through research and technology transfer, as well as to continue assessing transformational technologies and their impact on the transportation industry.

Financials:	Commitment Years	FY24 Commitment
TxDOT	2022-2026	$30,000.00

Project Number: 8-8520

Study Number: TPF-5(489)

Title: Safety Service Patrol Standardization and Management Practices

Lead Agency: FHWA

Status: Cleared by FHWA

Project Objectives: The primary objective of this PFS study will be to gain technical information related to SSP program management, standards associated with SSP response protocol and the implementation of traffic control, and references and guidance related to staffing, training, and resource allocations within SSP programs. The goals include: 1. Assemble best practices and lessons learned from existing programs 2. Develop guidance documents based on lessons learned from existing programs 3. Reference or create tools that will help agencies make informed program decisions such as route selection, staffing levels, and resource allocation

Financials:	Commitment Years	FY24 Commitment
TxDOT	2021-2025	$25,000.00

Project Number: 8-8522

Study Number: TPF-5(487)

Title: Transportation Management Centers Pooled Fund Study Phase II

Lead Agency: FHWA

Status: Cleared by FHWA

Project Objectives: The objectives of the Traffic Management Centers (TMC) Pooled Fund Study (PFS) is to assemble regional, state, and local transportation management agencies and FHWA to: (1) identify key issues and challenges agencies are facing with their traffic management systems (TMSs) or centers (TMCs); (2) suggest approaches to addressing identified issues; (3) initiate and monitor projects intended to address identified issues; (4) develop technical resources and disseminate results; (5) provide leadership and coordinate with others on TMC interests; and (6) promote and facilitate sharing information on TMC issues nationally. The TMC Pooled PFS involves a group of public agencies and organizations who voluntarily pool funds each year to address the key challenges and issues they are facing in support of improving performance, capabilities, and how they manage and operate their TMSs. TMC PFS members collaborate by using funds they contribute for the pursuit of projects they agree to pursue and develop technical resources and advance activities to address the key challenges and issues they are collectively facing. This project is being created to establish a new number (Phase II of TPF- 5(319)) and allow for 5 additional years (April 17, 2022 to April 16, 2027) beyond the existing study (TPF-5(319)). Agencies can join and add their commitments to the TMC PFS at any time during each year the TMC PFS, which is approved through April 16, 2027.

Financials:	Commitment Years	FY24 Commitment
TxDOT	2022-2027	$50,000.00

Project Number: 8-8523

Study Number: TPF-5(501)

Title: Roadside Safety Pooled Fund - Phase 3

Lead Agency: Washington Department of Transportation

Status: Cleared by FHWA

Project Objectives: The objective of this Pooled Fund is to assist transportation agencies in achieving their Roadway Departure (RwD) related all state Strategic Highway Safety Plans (SHSPs) goals through development, evaluation and deployment of life-saving roadside safety devices and countermeasures in accordance with AASHTO and Federal Highway Administration (FHWA) adopted standards such as the Manual for Assessing Safety Hardware (MASH). It will also support continuation of MASH implementation in roadside hardware categories that have lagged in achieving MASH compliance (special barrier applications, sign supports, work zone traffic control devices, luminaire poles, etc.) due to various design and performance challenges and other related factors. These activities will directly support and impact state efforts to achieve Target Zero by helping reduce the frequency and severity of roadway departure crashes. Given their common interest in SHSP implementation, all states would benefit from participation in this Pooled Fund program. However, the FHWA Roadway Departure Focus States may particularly benefit from the roadside safety research, collaboration, and information sharing that will constitute the framework of the program.

Financials:	Commitment Years	FY24 Commitment
TxDOT	2023-2027	$65,000.00

Project Number: 8-8524

Study Number: TPF-5(492)

Title: 2023 through 2025 Biennial Asset Management Conference and Training on Implementation Strategies

Lead Agency: Iowa Department of Transportation

Status: Contract signed

Project Objectives: 1. Provide communication and information sharing among member states. Discuss research needs and provide research ideas to be developed through TRB (and other research opportunities). 2. Provide a technology and knowledge exchange forum to enhance the practical knowledge of member states concerning asset management implementation. 3. Enhance the working knowledge of the asset management community.

Financials:	Commitment Years	FY24 Commitment
TxDOT	2022 - 2024	$12,000.00

Project Number: 8-8526

Study Number: TPF-5(504)

Title: Continuous Bituminous Pavement Stripping Assessment Through Non-destructive Testing

Lead Agency: Minnesota Department of Transportation

Status: Cleared by FHWA

Project Objectives: The primary objective of the proposed pooled-fund project is to establish a research consortium focused on addressing the R06D and IAP recommendations. As per the IAP and R06D findings and recommendations, particular emphasis will be placed on using 3D-GPR along with Traffic Speed Deflectometer (TSD) and/or Falling Weight Deflectometer (FWD) to detect the location, distribution, and severity of stripping in full-depth and composite bituminous pavements.

Recognizing that 3D-GPR and TSD may not be readily available to all participating states, the study will allocate a portion of the pool fund to hire consulting firms for 3D-GPR and TSD surveys on the projects considered in this study. This will provide a good opportunity for states to familiarize themselves with 3D-GPR applications. Furthermore, the proposed pool fund study will include 1D-GPR testing on limited projects to compare with the 3D-GPR data. The proposed investigation also recognizes that 3D-GPR alone cannot identify stripping all the time and at all subsurface moisture conditions. Hence, the proposed study will also investigate using IE/SASW, MIRA, Thermal Imaging for localized spot verifications. It is essential to clarify that the intent of this study is not to evaluate these tools but to support and validate the final deliverables of the study. The set goals are to be accomplished by:

1.Developing a methodology for rapid and automatic stripping detection based on 3D-GPR (or 1D-GPR) data and validating the output using other NDE technologies such as Falling Weight Deflectometer (FWD), Traffic Speed Deflectometer (TSD), Impact Echo (IE), and Thermal Imaging. The development will be based on experience and needs from participants so that the developed methodology can effectively and efficiently support their pavement evaluation program. 2.Verifying and validating the developed methodology on actual projects selected by the participating agencies. The more states, the stronger the methodology 3.Providing participating agencies guidelines on data collection and analysis protocols 4.Drafting AASHTO specification 5.Facilitating and supporting communication between experts of NDE technologies, state engineers and vendors to advance the use of GPR for inspecting pavement subsurface issues 6.Providing training and technical assistance that includes providing support for specification development and strategies for agency full implementation 7.Conducting technology promotion for the technologies. The tools (i.e., equipment, testing procedures, data processing algorithms, specifications) advanced through this project will assist state transportation agencies in rapidly and confidently detecting at early stages the location, extent, depth, and severity of stripping in their roads. The tools will also help eliminate or reduce the number of corings required to evaluate road sections suspected of stripping. Specific tasks within

this multi-year program will be developed in cooperation with the consortium participants and in such a manner to address the needs of each participant state.

Financials:	Commitment Years	FY24 Commitment
TxDOT	2023-2027	$25,000.00

Project Number: 8-8527

Study Number: TPF-5(513)

Title: Emerging Data Streams for Pavement (Asset) Health Monitoring and Management

Lead Agency: Virginia Department of Transportation

Status: Cleared by FHWA

Project Objectives: The main objective of the pooled-fund program of research is to identify, test and evaluate emerging big data stream that may enhance the process we use to evaluate the performance and manage our pavement assets. The technologies considered will include at a minimum, vehicle response data collected by connected and automated vehicles, smart infrastructure sensors (e.g., internet of things), mobile devices and e-construction and BIM technologies (e.g., digital twins).

Financials:	Commitment Years	FY24 Commitment
TxDOT	2023-2028	$30,000.00

Project Number: 8-8529

Study Number: TPF-5(503)

Title: Standardizing Rigid Inclusions for Transportation Projects – Phase I

Lead Agency: Kansas Department of Transportation

Status: Cleared by FHWA

Project Objectives: The main objectives of the Phase I study are to assess the state of the practice of rigid inclusions used for embankment and structure support, analyze existing data and design methods available in the literature or agencies, identify knowledge gaps and missing data and procedures, and develop a plan for full-scale field tests to be carried out in the Phase II study.

Financials:	Commitment Years	FY24 Commitment
TxDOT	2023-2025	$30,000.00

Project Number: 8-8530

Study Number: TPF-5(516)

Title: Highway Safety Manual 2nd Edition (HSM2) Implementation

Lead Agency: FHWA

Status: Cleared by FHWA

Project Objectives: Accelerate implementation of HSM2 and related analytical tools to assess current and future safety performance of existing roadways and alternative designs, and help practitioners make more informed decisions, better target investments, and reduce fatalities and serious injuries on the nations roadways. This includes activities before and after publication of HSM2 (anticipated 2025).

Financials:	Commitment Years	FY24 Commitment
TxDOT	2023-2028	$16,000.00

Project Number: 8-8532

Study Number:

Title: National Partnership to Improve the Quality of Preventive Maintenance Treatment Construction & Data Collection Practices (PG Phase III)

Lead Agency: Minnesota Department of Transportation

Status: (Solicitation 1581)

Project Objectives: This pooled-fund study is being developed to assist SHAs and LPAs in reviewing and developing pavement PM treatments which can advance their pavement preservation programs. This study is also supplementing ongoing data analysis of existing pavement test sections in Minnesota (NRRA-MnROAD) and Alabama (NCAT) and support continued implementation activities established. Combining these efforts will establish a national construction and data collection effort of pavement PM treatments applied to roadways at the direction of the study's Technical Advisory Committee (TAC). Participation in the study is being encouraged by SHAs, LPAs, FHWA, Federal Lands Highway Division, academia and industry representatives. Collaboration with experts from these groups will help set criteria for identifying PM construction practices and data collection requirements, discuss optimal timing for placing of PM treatments and establishing the minimum number of pavement sections required for each type of PM treatment used for statistical analysis. Non-financial participants can provide technical knowledge and input; however, financial contributors will make final decision on treatments to be constructed.

Using the outcome from the above collaborative activities, the study partners will initiate and monitor State, local, and Federal PM treatments and projects to develop preventive maintenance solutions (i.e. decision trees, toolboxes, etc.). Implementation of practical research results from other PM cooperative projects (i.e. NCAT, MnROAD, NCPP) will be used to access the impact of preventive maintenance treatments on extending service life of pavements. Lessons learned will be documented and shared along with information to assist in the updating of the national pavement preservation research roadmap.

Financials:	Commitment Years	FY24 Commitment
TxDOT	2023 - 2027	$50,000.00

Project Number: 8-8533

Study Number: TPF-5(507)

Title: National Hydraulic Engineering Conference

Lead Agency: FHWA

Status: Cleared by FHWA

Project Objectives: The next National Hydraulic Engineering Conference is proposed for Summer 2024, with subsequent conferences tentatively planned for 2026 and 2028.

The objectives of this study are:

Provide opportunities for communication and information sharing among state hydraulic engineers, federal agencies, and national technical organizations (AASHTO TCHH and TRB AFB60) through the National Hydraulic Engineering Conference.
Provide a technology and knowledge exchange forum to enhance the practical knowledge of member states concerning transportation hydraulic engineering, including advanced modeling technologies, FHWA initiatives, and best practices.

Financials:	Commitment Years	FY24 Commitment
TxDOT	2022 - 2027	$1,000.00

Project Number: 8-8534

Study Number:

Title: Building Information Modeling (BIM) for Bridges and Structures - Phase II

Lead Agency: Iowa Department of Transportation

Status: (Solicitation 1587)

Project Objectives: This pooled fund project will provide the primary mechanism for AASHTO COBS T-19 to expand and refine the outcomes of TPF-5(372) and developing additional guide specifications for open BIM national data standards to support model-based exchanges of workhorse bridges.

Financials:	Commitment Years	FY24 Commitment
TxDOT	2023 - 2027	$20,000.00

Project Number: 8-8535

Study Number: TPF-5(521)

Title: New Performance Approach to Evaluate ASR in Concrete

Lead Agency: FHWA

Status: Cleared by FHWA

Project Objectives: To evaluate a wide selection of concrete mix designs to validate the use of the new AASHTO TP-144-21 (T-FAST) and alkali threshold test (ATT) methods in conjunction with mix design data, cement mill reports and SCM properties to determine the likelihood of ASR gel formation in concrete.

Financials:	Commitment Years	FY24 Commitment
TxDOT	2023 - 2027	$5,000.00

Project Number: 8-8536

Study Number: TPF-5(465)

Title: Consortium for Asphalt Pavement Research and Implementation (CAPRI)

Lead Agency: Alabama Department of Transportation

Status: Cleared by FHWA

Project Objectives: The goals of CAPRI are to: • Provide technical guidance on current and evolving specifications for asphalt materials. • Develop asphalt pavement research needs. • Conduct small-scale studies to address knowledge gaps or explore new topics. • Foster the implementation of practical research findings to help improve the performance, sustainability, value, and safety of asphalt pavements. As a consortium of all asphalt pavement stakeholders, CAPRI will be a key resource to the AASHTO Committee on Materials and Pavements, state DOTs, FHWA, and industry.

Financials:	Commitment Years	FY24 Commitment
TxDOT	2021 - 2025	$10,000.00

Project Number: 8-8537

Study Number: TPF-5(519)

Title: Expansion: Enhanced Traffic Signal Performance Measures

Lead Agency: Indiana Department of Transportation

Status: Cleared by FHWA

Project Objectives: During the April 2022 TPF-5(377) Pooled Fund Study Panel Meeting in Columbus, OH, participating states expressed interest in developing a new study led by a neutral state/academic partner in the following areas:

1. Broadening performance measures to additional modes that are impacted by traffic signal systems, particularly transit and pedestrians.

2. Identifying use cases for enhanced probe data beyond the current trajectory and hard braking/hard acceleration data.

3. Integrated Analysis of High-res Controller Data and Trajectory Probe Data

These initiatives would complement and expand the past work the multi-state team has done in the area of enhanced traffic signal performance measures using connected vehicle data.

Financials:	Commitment Years	FY24 Commitment
TxDOT	2023 - 2025	$40,000.00

Project Number: 8-8538

Study Number: TPF-5(512)

Title: Resilience Approaches for Pavements and Geotechnical Assets

Lead Agency: Virginia Department of Transportation

Status: Cleared by FHWA

Project Objectives: This pooled fund study seeks to support and showcase the research, development, and implementation of resilience approaches in the areas of pavement and geotechnical design, maintenance, preservation, and rehabilitations by various state DOTs. This would also provide platform for the agencies to share ideas and plans related to resiliency that would eventually help agencies to implement their resilience plans without duplicate and wasteful efforts.

Financials:	Commitment Years	FY24 Commitment
TxDOT	2023 - 2027	$20,000.00

Project Number: 8-8540

Study Number: TPF-5(514)

Title: Work Zone Analytics

Lead Agency: Indiana Department of Transportation

Status: Cleared by FHWA

Project Objectives: For the past 3 years, Purdue University and the Indiana Department of transportation have been monitoring congestion and hard braking data across all 2600 miles of Indiana Interstates using connected vehicle data. Figure 1 illustrates one such report for I-465 that shows the impact of the 2021 construction activities on congestion.

These reports have evolved over the past 3 years in Indiana and there is a need to develop a multi-state consensus on the most effective reports. This will provide a framework to formalize the reporting models, data reduction processes and decision-making process so these techniques can be scaled to other states so they can pro-actively identify emerging safety concerns in their work zones, conduct effective after action reviews of past work zones, and ultimately identify best practices for future work zones that minimize congestion, hard braking and ultimately crashes.

Financials:	Commitment Years	FY24 Commitment
TxDOT	2023 - 2025	$30,000.00

Project Number: 8-8541

Study Number: TPF-5(515)

Title: Evaluation of Low-Cost Safety Improvements (ELCSI-PFS)

Lead Agency: FHWA

Status: Cleared by FHWA

Project Objectives: The goal of this research is to develop reliable estimates of the effectiveness of the safety improvements identified as strategies, including but not limited to, those in the National Cooperative Highway Research Program (NCHRP) Report 500 Guidebooks. These estimates will be determined by conducting scientifically rigorous before-and-after evaluations at sites in the United States where these strategies are being implemented. This work will support efforts towards Vision Zero and the Safe Systems Approach.

Financials:	Commitment Years	FY24 Commitment
TxDOT	2023 - 2027	$10,000.00

Project Number: 8-8542

Study Number: TPF-5(518)

Title: Implementation of Structural Data from Traffic Speed Deflection Devices

Lead Agency: Virginia Department of Transportation

Status: Cleared by FHWA

Project Objectives: The objectives of this follow-on pooled fund study include continuation of an existing research consortium that focuses on providing participating agencies guidance on how to specify and implement TSDD data within their respective pavement management systems and processes. Specific tasks within this multi-year program will be developed in cooperation with the partner agencies.

Financials:	Commitment Years	FY24 Commitment
TxDOT	2024 - 2028	$149,000.00

Project Number: 8-8543

Study Number:

Title: Human-Centered Steel Bridge Inspection Enabled by Augmented Reality and Artificial Intelligence

Lead Agency: Kansas Department of Transportation

Status: (Solicitation 1597)

Project Objectives: The main objective of this proposed research is to provide state DOTs practical tools for supporting human-centered steel bridge inspection with real-time defect (e.g., fatigue cracks and corrosion) detection, documentation, tracking, and decision making. The proposed research will not only bridge the gaps identified in the IDEA project, but also expand the existing capability by developing AI algorithms for crack and corrosion detection. In addition to AR headsets, the project will also develop AR-based inspection capability using tablet devices. The tablet device can be used to perform AR-based inspection directly in a similar way to the AR headset. It can also leverage Unmanned Aerial Vehicles (UAV) for remote image and video acquisition during inspections, enabling bridge inspections from a distance in a human-centered manner, as illustrated in Figure 2.

Financials:	Commitment Years	FY24 Commitment
TxDOT	2024 - 2026	$40,000.00

Project Number: 8-8544

Study Number: TPF-5(520)

Title: Improving Traffic Detection Through New Innovative i-LST Technology Demonstration Pilot

Lead Agency: FHWA

Status: Cleared by FHWA

Project Objectives: Demonstrate the loop signature technology (inductive Loop Signature Technology: i-LST) over various corridors across the US to demonstrate application of new effective and comprehensive data collection methods.

Financials:	Commitment Years	FY24 Commitment
TxDOT	2023 - 2024	$15,000.00

7.2 Pooled Funds Where Texas is the Lead State

Project Number: 8-8515 RTI Project No: 9-1531

Study Number: TPF-5(482)

Title: Development and Evaluation of Roadside Safety Systems for Motorcyclists (TxDOT-Led)

Lead Agency: Texas Department of Transportation

Status: Contract Signed

Project Objectives: The objective of this pooled fund study is to provide a cooperative approach to conducting research to address roadside safety issues specifically related to improving motorcyclist safety. Furthermore, the study is intended to provide participating states collaborative opportunities to stay abreast of best practices, new regulatory issues, risk management strategies, and other research pertaining to roadside safety improvements for motorcyclists. Research activities will include identification, development, and evaluation of strategies and devices for mitigating the frequency and severity of roadway departure motorcyclist crashes.

Financials:	Commitment Years	FY24 Commitment
TxDOT	2022-2024	$40,000.00

Project Number: 8-8531 RTI Project No: 9-1532

Study Number: TPF-5(508)

Title: Concrete Bridge Engineering Institute (CBEI)

Lead Agency: Texas Department of Transportation

Status: Contract Signed

Project Objectives: The overall objective of this pooled fund is to implement specific programs within CBEI that address national workforce training needs through research, development, and technology transfer activities. The specific objectives are to develop and implement the following programs with coordinated input of members of the pooled fund: Three initial specific training programs, a Concrete Solutions Center, and a Bridge Component Collection. The scope of each is further defined below. The technology transfer through training programs will draw on the latest technologies and provide an innovative approach by utilizing a hands-on intensive curriculum. The training programs will draw from the best, and most current, state of the art methods. CBEI will serve to continually gather emerging or underutilized technologies such as those above, and provide research, development, and technology transfer activities in partnership with the originators of the technology. This will result in training curricula and technology transfer documents for the concrete bridge workforce. Non-destructive Evaluation (NDE) techniques will be an overarching component included in each of the programs.

Financials:	Commitment Years	FY24 Commitment
TxDOT	2023-2026	$250,000.00

8. Non-Project Activities

8.1 Research Management and Administration

RTI performs the following non-SPR activities.

Project Number: 0-0050

Project Title: Research Management and Administration

Project Objectives: RTI provides administrative oversight for support functions including budgeting, purchasing, contract administration, legislative analysis, mapping, and the SPR Part II Work Program.

Planned Activities: Develop, implement, and monitor the division's biennium budget.

1. Develop, implement, and monitor the SPR Part II Work Program, ensuring that all requirements of 2 CFR 200, 23 CFR 420 and other applicable federal and state statutes and regulations are followed.
    a. Prepare and submit the proposed 2022 SPR Part II Work Program to FHWA.
    b. Prepare and submit the 2021 Annual Performance and Expenditures Report (APER) to FHWA.
    c. Hold quarterly status meetings with FHWA to report on the 2022 SPR Part II Work Program.
    d. Prepare and submit amendments to the 2022 SPR Part II Work Program as needed.
2. Administer and ensure that all the division's agreements/contracts are approved, procured, monitored, and closed out in accordance with the provisions of 2 CFR 200.318-327. In addition, this function ensures that program monitoring and reporting requirements of FHWA planning and research funds are in compliance with 23 CFR 420.117.

Project Number: 0-9710

Project Title: Research Committee Support - FY2023

Project Objectives: RTI provides support to research committee members participating in research prioritization and subject matter experts' participating in the research program as advisors and technical leads.

Financials:	FY24 Budget	80% Federal	20% Estimated TDCs*
Contract Total	$20,000.00	$16,000.00	$4,000.00

*Non-Federal Match provided by Transportation Development Credits (TDCs)

Table 10. FY 2024 RTI Division Financials

Financials		Budget
Division Travel		$25,000.00
Program Committee Support		$35,000.00
Salary		$2,314,561.00
RFA*		$45,000.00
RTI Division Program Management		$2,419,561.00

* Coordinate with the District(s) for TxDOT's assistance to provide Traffic Control or other support as needed for projects in the Program.

8.2 FHWA & USDOT Grant Support (Non-SPR Funded)

RTI provides management and FHWA support of the following pass-through grant.

Project Number: 0-7099 University: TEES

Project Title: AVA: Automated Vehicles for All

Project Start Date: 1/26/2021 Termination Date: 8/31/2025

Project Status: Active Total Project Budget: $7,063,787.00

RTI Project Manager: Tom Schwerdt Researcher: Reza Langari

Project Objectives: USDOT awarded federal funds to Texas A&M Engineering Experiment Station (TEES) to take the lead on and subcontract with George Washington University, University of California at Davis, University of Illinois at Urbana-Champaign to study and test the safe integration of automated driving systems on rural Texas roadways for the purpose of the Automated Driving System Demonstration Grants program. TxDOT through RTI will help foster these efforts in partnership with FHWA and govern reimbursement of this project, in a separate Grant Subrecipient Agreement with TEES. All necessary Grant documents that outline the details of this agreement have been completed and attached.

Financials:	FY24 Total Budget
Contract Total	$1,503,743.00

*100% Federally Funded Grant Project

9. Summary Statement

The Texas State Planning and Research (SPR) Part II activities identified within the work program demonstrates the states commitment to addressing transportation challenges within the state and those common across the nation. The innovative ideas for meeting those challenges have been thoroughly vetted by the research committees within TxDOT to ensure only the best ideas are submitted with success in mind.

Our continued partnership and collaboration with FHWA Texas Division, university researchers, Metropolitan Planning Organizations, and other state DOTs, positions Texas to remain at the forefront for advancing new and innovative technologies and solutions. Many of the solutions will meet both near term and future surface transportation challenges and aid with meeting the aim of the Infrastructure Investment and Jobs Act.

TxDOT Research and Technology Implementation (RTI) Division will continue to manage and foster good stewardship of the federal State Planning and Research (SPR) Part II, Subpart B - Research, Development and Technology Transfer Program, for the state of Texas. RTI will submit amendments to this work program by way of Round Templates throughout the fiscal year to address new project start dates, project modifications, and any cancelled projects as needed.