U.S. DOT's Small Business Innovation Research (SBIR) Program

SBIR Fiscal Year 2025 Phase I Awards

Project Title	Company Name
25-FH1: FIELDViewR: Field-Focused Inspection, Engineering, and Logistics Digital Viewer for Roadways	Kitware, Inc.
25-FH1: OpenBrIM OmniDataView: Field-Optimized 3D IFC Viewer for Digital Highway & Bridge Construction	Red Equation Corp. DBA:OpenBrIM Platform
25-FH1: Lightweight IFC Visualization for Infrastructure Construction: A Mobile-Optimized IFC Viewer for Improved Efficiency and Accuracy	TGIAS LLC
25-FH2: 3D-Printed vs Injection Molded Vortex Modular Roundabout Components for a New Turbo Configuration	ZKxKZ LLC
25-FM1: Portable LiDAR Tire Diagnostics System: Improving Safety and Reducing Downtime	Diamond Age Technology LLC
25-FM2: Autonomous Dynamic Load Adjusted Central Tire Inflation System (ADLACTIS)	RIX Industries
25-FR1: Mobile, Non-Contact System for RNT and Rail Stress Measurements	Insight Rail LLC
25-FR1: Non-Contact Ultrasonic System for Measuring Rail Neutral Temperature	X-wave Innovations, Inc.
25-FR2: Next Generation End of Train (EOT) Development and Testing for Railroad Safety	Redstone Technologies LLC
25-FR3: Geohazard Susceptibility and Risk Forecasting Tool for Railroads	Emprise Concepts LLC
25-FR3: Ground Hazard Observation Survey and Tracking System (GHOSTS)	International Electronic Machines Corp
25-FR4: Fatigue Assessment for Transportation Engineer Determination	Mosaic ATM, Inc.
25-FT1: PRISM - Predictive Reasoning Intelligent System for Maintenance	AvaWatz Company
25-FT1: FleetLynq: AI-driven Decision Support Solution for Transit Fleet	Flexlynqs LLC
25-FT1: TRAIDMA (Transit Reliability and AI Driven Maintenance Architecture)	FTL Labs Corporation
25-NH1: VALAR: An AI-driven Approach to Transforming Crash Reporting for Law Enforcement Agencies	New Math Data PubSec, LLC

Kitware, Inc. (Clifton Park, NY)

FIELDViewR: Field-Focused Inspection, Engineering, and Logistics Digital Viewer for Roadways

PI Name: Aashish Chaudhary **PI Email:** aashish.chaudhary@kitware.com

Abstract: Large-scale infrastructure projects rely on open standards such as Industry Foundation Classes (IFC) to streamline collaboration between architects, engineers, contractors, and owners. However, efficiently visualizing, managing, and monitoring complex IFC-based models in real-time remains challenging, especially when incorporating field data such as LiDAR scans and ground-based photos. Kitware, Inc. proposes FIELDViewR, a web-based BIM/IFC viewer that supports streaming data, geospatial alignment, and on-site progress tracking with reality-enhanced insights. Phase I prototype development will focus on core capabilities for interactive visualization of IFC models over the web, employing level-of-detail strategies for smooth streaming regardless of dataset size. The project will integrate basic geospatial alignment and camera calibration, enabling seamless overlays between digital infrastructure models and real-world coordinates. This foundation will support preliminary reality capture features that let field personnel compare site captures against design models for progress tracking. The platform will establish a foundation for digital-physical comparison in Phase II, enabling efficient real-time comparison of physical structures with digital counterparts. Ultimately, FIELDViewR promises to reduce rework, accelerate decision-making, and improve site safety by unifying BIM data, geospatial context, and real-world observations in one easy-to-use environment.

Company Website: https://www.kitware.com/

Red Equation Corp. DBA:OpenBrIM Platform (Commack, NY)

OpenBrIM OmniDataView: Field-Optimized 3D IFC Viewer for Digital Highway & Bridge Construction

PI Name: Cagan Yakar **PI Email:** cyakar@openbrim.org

Abstract: The lack of a simple, field-ready 3D model viewer limits the adoption of Advanced Digital Construction Management Systems (ADCMS). Existing solutions are complex, proprietary, and impractical for construction teams, making it difficult to access and verify 3D model data efficiently. OpenBrIM proposes OmniDataView, a lightweight, web-based viewer that will be developed to support IFC 4.3 and AASHTO IDM, ensuring interoperability, compliance, and real-time access for field teams.

By eliminating unnecessary complexity, OmniDataView will enable inspectors, contractors, and engineers to efficiently extract critical information without requiring advanced modeling expertise. This field-optimized solution will enhance digital project delivery, compliance verification, and construction workflows, supporting State DOTs and infrastructure projects.

Company Website: https://openbrim.org

TGIAS, LLC (Beckley, WV)

Lightweight IFC Visualization for Infrastructure Construction: A Mobile-Optimized IFC Viewer for Improved Efficiency and Accuracy

PI Name: Julie Fennell **PI Email:** julie.fennell@tgias.com

Abstract: Our proposed development of a lightweight, user-friendly IFC model viewer for highway and bridge construction sites will facilitate the transition to digital tools. Current challenges include the lack of an intuitive, open-standards-based 3D model viewer that can be adopted quickly across various construction sites without reliance on complex, proprietary software. This project proposes the development of a lightweight, user-friendly IFC model viewer specifically designed for mobile devices used in construction settings. By addressing the inefficiencies and high costs associated with current practices, where miscommunication and inaccessible project data lead to significant rework and financial losses, the proposed solution aims to enhance the efficiency and accuracy of construction project execution significantly. Our Phase 1 technical objectives focus on assessing the viability of developing such a viewer, evaluating the compatibility with commercial-grade mobile devices, and identifying the necessary algorithms, rendering techniques, and user interface requirements. Our uniquely qualified team, combining expertise in mechanical engineering, UI/UX design, sociological research, and software engineering, is exceptionally positioned to tackle these challenges. This proposed solution supports the DOT's digital acceleration goals and addresses the urgent need for industry-wide adoption of more efficient, interoperable technologies, streamlining workflows, and reducing costs.

Company Website: www.tgias.com

ZKxKZ, LLC (Lexington, MA)

3D-Printed vs Injection Molded Vortex Modular Roundabout Components for a New Turbo Configuration

PI Name: Adam Lanik **PI Email:** adaml@zkxkz.com

Abstract: ZKxKZ will develop and demonstrate two competing approaches for a modular plastic turbo-roundabout system. First, our baseline solution will be our current Vortex Roundabout commercial product. Vortex provides a LEGO®-like modular kit for customized for each intersection by CNC-machining units from large injection-molded recycled plastic boards. Modules anchor onto existing roadway using a patented energy-absorbing anchor and plug. Commercial Vortex installations have received multiple State and National innovation awards from the road construction industry. Second, we will compare a new approach, replacing Vortex's molded/CNCed modules with large- 3D-printed modules. 3D-printing offers many potential advantages over molding, including faster time between drawings and module production, elimination of costly tooling and CNC-machining, and infinite shape flexibility.

Phase I will physically produce and test molded verses 3D-printed full-scale modules in the lab and installed on road surfaces. Cost and installation time will be compared. We will also start searching for a prototype turbo-roundabout installation site for our Phase II demonstration unit.

The current Vortex system reduces roundabout cost and installation time by >50% compared to conventional concrete construction. Our goal will be to remove significant additional cost and time from the already impressive modular Vortex performance via 3D printing.

Company Website: www.vortex-roundabouts.com

Diamond Age Technology, LLC (Houston, TX)

Portable LiDAR Tire Diagnostics System: Improving Safety and Reducing Downtime

PI Name: John Blackwell **PI Email:** john@diamondagetechnology.com

Abstract: Tire failures are a leading cause of commercial motor vehicle (CMV) breakdowns and accidents, yet current inspection methods are manual, time-consuming, and prone to human error. This project proposes a handheld LiDAR-based tire inspection system to provide fast, accurate, and data-driven tire condition assessments for drivers, fleet operators, and safety inspectors.

Leveraging low-cost, commercially available LiDAR-enabled devices, our system will allow drivers to capture high-resolution 3D scans of a tire's tread and sidewall. Advanced algorithms will automatically detect low tread depth, uneven wear patterns, structural damage, and mismatched dual tires, providing clear, actionable insights. Scan results will be linked to individual tire IDs and vehicle records, enabling spatio-temporal tracking of wear over time. A cloud-based framework will be established for future fleet-wide data management and compliance reporting.

This innovation aligns with the DoT's strategic safety goals by reducing tire-related failures, improving regulatory compliance, and enhancing CMV operational efficiency. Phase I will develop and validate a proof-of-concept handheld scanner, setting the foundation for a scalable, industry-ready solution in Phase II and beyond.

Company Website: https://www.diamondagetechnology.com

RIX Industries (Benicia, CA)

Autonomous Dynamic Load Adjusted Central Tire Inflation System (ADLACTIS)

PI Name: Matthew Ellington **PI Email:** mellington@rixindustries.com

Abstract: Research has uncovered that the tires of the Commercial Motor Vehicles (CMVs) do not carry the weight of the loads equally even if the tires are inflated equally, resulting in an imbalance of the load on the tires, which reduces stopping power, decreases maneuverability and drivability, and increases driver crash risk. Without tire pressure adjustment to load and use, driver safety, tire life, and fuel efficiency is compromised.

To address the challenges of individual tire inflation based on load, RIX Industries proposes this Phase I program to design a Weight Equalization Smart Automatic Tire Inflation System (WESATIS) that will automatically adapt for conditions while the truck is in motion creating a dynamic and accurate weight distribution on all tires in a group.

The proposed project will examine how to change the pressure across the CMV tires on both the power unit and trailer. At the completion of Phase I, RIX will have designed a prototype WESATIS with basic demonstrability, established an expected equipment cost, and conducted preliminary market analysis and associated economic factors. In Phase II, RIX would work to develop a full scale WESATIS system, install onto a CMV, and conduct initial testing of the WESATIS.

Company Website: www.rixindustries.com

Insight Rail, LLC (Columbia, SC)

Mobile, Non-Contact System for RNT and Rail Stress Measurements

PI Name: Brennan Gedney **PI Email:** bgedney@insight-rail.com

Abstract: Continuous Welded Rail track, despite the significant advantages, is prone to buckling and rail breaks due to the inability to expand and contract freely to temperature changes, compromising, thus, the integrity and safety of the track. To date, there is no robust way to measure or monitor the rail longitudinal stress or the stress-free temperature (RNT) without disturbing the railroad track. Our proposed innovation is a mobile, non-contact, reference-free system that is free of the shortcomings of existing and competing techniques. The technology uses 3D imaging technology for rail shape measurements along with a patented technology that correlates the shape changes and deformations of the rail during temperature changes to the RNT and the longitudinal rail stress. A system like ours is the only technology that determines the RNT and stress of the rail in a single acquisition without disturbing the track structure or disrupting operations. It does not require a known zero-reference, and it operates regardless of the state of stress (tension/compression) in the rail. It is the only technology that has the potential to acquire measurements of both rails simultaneously in less than 10 minutes per location by a two-member trained crew without disturbing the track.

Company Website: https://insight-rail.com/

X-wave Innovations, Inc. (Gaithersburg, MD)

Non-Contact Ultrasonic System for Measuring Rail Neutral Temperature

PI Name: Dheeraj Velicheti **PI Email:** dvelicheti@x-waveinnovations.com

Abstract: Track buckling caused by excessive compressive stress in Continuous Welded Rail (CWR) is a leading cause of derailments, making Rail Neutral Temperature (RNT) a crucial parameter for rail safety. Current RNT measurement methods are slow, labor-intensive, and require direct contact with the rail, limiting their practicality. To address these challenges, X-wave Innovations Inc. (XII) proposes a Non-Contact Ultrasonic System for Measuring RNT using Electromagnetic Acoustic Transducers (EMATs) and induction heating. The system generates multiple ultrasonic wave modes in the rail and actively heats a short section to induce temperature variations. By analyzing changes in time-of-flight (TOF), amplitude, and nonlinear coefficient of ultrasonic waves, the system accurately determines RNT. A self-calibrating approach enhances precision by utilizing wave modes insensitive to longitudinal stress as references for calibrating stress-sensitive mode responses. This novel approach enables fast, repeatable, and non-contact RNT measurements without requiring track modifications or passive temperature monitoring. Additionally, machine learning algorithms will improve signal processing, enhancing measurement reliability under diverse field conditions. By providing rail operators with a proactive, high-precision tool for RNT assessment, this technology supports the U.S. DOT's rail safety and infrastructure objectives, reducing derailment risks and improving maintenance efficiency.

Company Website: www.x-waveinnovations.com

Redstone Technologies, LLC (North Brunswick, NJ)

Next Generation End of Train (EOT) Development and Testing for Railroad Safety

PI Name: Paul Stangas **PI Email:** paul.stangas@redstonetech.us

Abstract: End-of-Train (EOT) devices are crucial as they continuously monitor brake pressure and ensure communication between the head and end of the train. Originally developed in the 1980s, EOT devices were upgraded to support two-way communication in the mid-1990s. However, there has been limited technological advancement since then. The primary objective of this research is to develop a next-generation EOT system that enhances the reliability, safety, and resilience of train operations (especially for long trains) through advanced communication, braking, and power management solutions. By integrating multi-channel communication redundancy, fail-safe emergency braking enhancements, and a modular power system design, this project aims to mitigate risks associated with EOT-related communication failures and mechanical malfunctions. The proposed system will address key challenges such as reducing communication blackouts, ensuring prompt and reliable emergency braking activation, and implementing a scalable, regulatory-compliant system design architecture. These innovations will enhance safety, improve data management, and increase operational efficiency for both rail operators and the public. The project team will collaborate with our railroad partner to demonstrate and test the prototype in real-world field conditions.

Company Website: www.redstonetech.us

Emprise Concepts, LLC (Evergreen, CO)

Geohazard Susceptibility and Risk Forecasting Tool for Railroads

PI Name: Noah Kimmes **PI Email:** noahk@empriseconcepts.com

Abstract: The objective of this Phase I effort is to establish the feasibility of a real-time geohazard risk forecasting tool that integrates historical, real-time, and forecasted data to enhance railroad geohazard detection, monitoring, and alert systems. The research will focus on developing and validating semi-automated geohazard susceptibility assessments and real-time geohazard risk forecasting, ensuring that the proposed solution aligns with industry needs and can be effectively deployed by an operating railroad. The Phase I research seeks to answer the following technical questions to assess feasibility: 1) Can a semi-automated geohazard susceptibility assessment tool be developed to locate specific areas of concern and enable baseline assessment of geohazard risk; 2) Does publicly available remote sensing (e.g., EO satellite) data have sufficient spatial and temporal resolution to allow its use in real-time, remote monitoring of geohazards; 3) Is forecasted weather data reliable enough to be used as a real-time predictor of changes in geohazard risk; and 4) Can the geohazard risk forecasting tool successfully predict the increase in risk prior to the failure of known historic geohazards, and if so, how far advance can the prediction be made.

Company Website: https://www.empriseconcepts.com/

International Electronic Machines Corporation (Troy, NY)

Ground Hazard Observation Survey and Tracking System (GHOSTS)

PI Name: Marc Pearlman **PI Email:** mpearlman@iem.net

Abstract: There is a major missing piece to the existing approaches to ground hazard prediction: detailed, up to date ground-level information on the condition of the wayside terrain which could be analyzed over time to detect even small shifts or changes.

To address this, International Electronic Machines Corp (IEM) will develop the Ground Hazard Observation Survey and Tracking System (GHOSTS), a multimodal, high-accuracy surveying and monitoring system that can be placed on any train to produce detailed, multispectral imagery, out to considerable distances. GHOSTS will build upon IEM's decades of experience in multispectral, multimodal sensor system design, smart image analysis, data fusion, and big data analysis for trending and event prediction to allow early detection of washout erosion, hillside slumping, and more, by combining detailed local imagery and physical geometry with other data sources including weather, geomorphology, accurate topological data, seismic monitoring, satellite imagery, and more.

GHOSTS will also leverage IEM's extensive connections (built throughout our over 35 years of service to the rail industry) to and working relationships with Amtrak, CSX, CP, and other major railroads for key information on the design, capabilities, and requirements for GHOSTS to be a useful and functional addition to railroad safety and maintenance systems.

Company Website: http://www.iem.net

Mosaic ATM, Inc. (Leesburg, VA)

Fatigue Assessment for Transportation Engineer Determination

PI Name: Josh Noble **PI Email:** jnoble@mosaicatm.com

Abstract: Fatigue among locomotive engineers poses a persistent safety risk within the transportation sector, exacerbated by long shifts, monotonous environments, and high cognitive demands. To address the limitations of current fatigue management practices - largely reliant on subjective self-reports and periodic evaluations - Mosaic ATM proposes the development of a Human Factors Fatigue Assessment System.

At its core is the Fatigue Assessment for Transportation Engineer Determination (FATED) tool, a multi-feature, machine learning-driven system designed to detect real-time behavioral indicators of fatigue using non-invasive video data. By analyzing factors such as eye closure, gaze deviation, head posture, facial micro-expressions, and body movement, FATED generates a continuous, objective fatigue score. The system architecture features a lightweight, multi-tiered model optimized for edge computing hardware, ensuring real-time operation within locomotive environments. Phase I will focus on establishing the technical feasibility of this approach through algorithm development, validation against open-source datasets, and testing in automotive contexts as a precursor to rail applications.

The project builds on prior work in driver attention monitoring and leverages human factors expertise to create a scalable, transferable framework for improving transportation safety. HFFAS aims to reduce fatigue-related incidents and enhance situational awareness across the rail industry and beyond.

Company Website: https://mosaicatm.com/

AvaWatz Company (Lewisville, TX)

PRISM - Predictive Reasoning Intelligent System for Maintenance

PI Name: Rajini Anachi **PI Email:** rajini@avawatz.com

Abstract: PRISM (Predictive Reasoning Intelligent System for Maintenance) addresses a critical challenge facing transit agencies: maintaining bus fleets efficiently while preventing service disruptions. Using innovative artificial intelligence approaches, PRISM combines Knowledge Graphs and Graph Neural Networks to predict maintenance needs before failures occur. By working with Dallas Area Rapid Transit, this Phase I SBIR project will demonstrate the feasibility of representing complex bus systems and their maintenance relationships in a Knowledge Graph (KG) structure that captures both component interactions and temporal degradation patterns. The project will develop and validate GNN architectures using the KG and specifically designed for transit maintenance prediction, with emphasis on learning from statistically rare failure data while providing transparent, explainable recommendations. PRISM will help transit agencies transition from reactive to proactive maintenance approaches, improving safety, reducing costs, extending vehicle lifespans, and enhancing service reliability. The resulting system will provide maintenance staff with clear, actionable insights about developing problems and recommended interventions, creating a partnership between human expertise and artificial intelligence that optimizes maintenance planning and resource allocation.

Company Website: www.avawatz.com

Flexlynqs, LLC (Fremont, CA)

FleetLynq: AI-driven Decision Support Solution for Transit Fleet

PI Name: Santosh Mishra **PI Email:** santosh.mishra@flexlynqs.com

Abstract: Transit agencies connect millions of Americans daily to their critical needs. However, services are unreliable because the fleet at over one-third of agencies is old, has a 10-15% spare ratio, and experiences recurring major mechanical failures. Skilled technician shortages and unreliable tools worsen this situation. Transit agencies have deployed vehicle health monitoring (VHM) solutions over the past 2 decades for real-time monitoring and prognosis of component failures. However, these solutions suffer from false positives and have not met agency expectations. Recent deployments of predictive maintenance solutions are promising but models require significant human feedback for training, are black boxes, and are component specific. Further, both these approaches heavily depend on OEM data, which is either noisy, inconsistent, or insufficient. FleeyLynq is an AI-first solution that will deliver 1) an Edge AI unit to filter and process OEM and IoT data to train Cloud models; 2) Cloud AI models to train on long-term sensor data and maintenance/inspection records; 3) Self-learning knowledge base as a distilled LLM to augment edge/cloud processing and enable applications such as predictive maintenance and remaining useful life (RUL) estimation. FleetLynq will enable efficient, safe, and reliable transit services and deliver an approach scalable to other industries.

Company Website: https://www.flexlynqs.com

FTL Labs Corporation (Amherst, MA)

TRAIDMA (Transit Reliability and AI Driven Maintenance Architecture)

PI Name: Justin Italiano **PI Email:** justin@ftllabscorp.com

Abstract: FTL's "Transit Reliability and AI-Driven Maintenance Architecture (TRAIDMA)" leverages FTL's experience in fleet maintenance, graph databases, and machine learning to provide a decision support system enabling transit agencies to engage in predictive maintenance to ensure fleet-wide state-of-good-repair. By leveraging AI-driven models and condition-based monitoring, agencies can predict equipment failures, optimize maintenance schedules, and estimate future capital needs for fleet replacement and rehabilitation. TRAIDMA uses AI model insights to generate a real-time fleet manager dashboard that aggregates the predictive outputs into an at-a-glance view of fleet health providing context-driven recommendations that are easy for maintenance staff to interpret, and cost-aware predictions that provide insight into the financial impact of maintenance actions. FTL will be working with the UMass Transportation Center and the Pioneer Valley Transit Authority (PVTA) to acquire and pre-process a comprehensive maintenance and vehicle telemetry dataset. Two complementary machine learning models leveraging XGBoost and LSTM architectures will be developed and evaluated to generate introspectable predictive maintenance insights. The effort will culminate in a refined system design, validating predictive performance across the entire fleet, and preparing for Phase II expansion, which will integrate broader data sources and additional failure modes for enhanced reliability and scalability.

Company Website: https://www.ftllabscorp.com/

New Math Data PubSec, LLC (Houston, TX)

VALAR: An AI-driven Approach to Transforming Crash Reporting for Law Enforcement Agencies

PI Name: Bernard Hatch **PI Email:** thatch@newmathdata.com

Abstract: Accurate and efficient crash reporting is a cornerstone of transportation safety, yet current methods suffer from inconsistencies, time-consuming manual data entry, and officer safety concerns at crash scenes. This research presents the Vehicle Accident Lens for Automated Reporting (VALAR), an AI-powered system designed to modernize police crash reporting by leveraging multimodal large language models, computer vision, and agentic AI. VALAR enhances crash data collection by enabling officers to capture reports through conversational interfaces, voice dictation, and automated image processing rather than traditional form-based input. The system integrates with third-party data sources, including geolocation, weather, and traffic conditions, to enrich reports in real time. AI-driven automation improves data accuracy while reducing the administrative burden on officers, allowing them to focus on public safety. VALAR adheres to national crash data standards, including MMUCC and MIRE, ensuring interoperability with existing state and federal reporting systems. This Phase I research establishes VALAR's feasibility through user-centered design, prototype development, and pilot testing with law enforcement agencies. The project's findings will inform scalable, production-level implementation in Phase II, ultimately contributing to improved traffic safety, streamlined law enforcement workflows, and enhanced data-driven decision-making in transportation management.

Company Website: https://www.newmathdata.com