U.S. Department of Transportation

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FY 2025

Small Business Innovation Research (SBIR) Program
PHASE I PROGRAM SOLICITATION

NAICS CODE: 541715

Issue Date: February 5, 2025

Closing Date: March 7, 2025, 3:00 p.m. ET

Small Business Innovation Research (SBIR) Program
U.S. Department of Transportation (U.S. DOT)
Office of the Assistant Secretary for Research and Technology
John A. Volpe National Transportation Systems Center (Volpe Center)
220 Binney Street
Cambridge, MA 02142-1093

INFORMATION ABOUT IMPORTANT DATES

Date	Description
February 5, 2025	Solicitation Open Date with amended topics (see below)
	Pre-solicitation Questions & Answers (Q&A) available on the U.S. DOT SBIR website (see Section I.D)
February 9, 2025, 5:00 p.m. ET	Registration Deadline for Pre-Offer Webinar (see below)
February 10, 2025, 2:00 p.m. ET	Pre-Offer Webinar (see below)
February 27, 2025, 3:00 p.m. ET	Administrative and Contract Pricing Worksheet (Appendix C) Questions Due (see Section I.D)
March 7, 2025, 3:00 p.m. ET	Solicitation Closing Date (See Section V)
On or about May 5-9, 2025	Pitch Day (see Section III.D)

A. Solicitation Open with Amendments to Topics as Follows:

The proposed topic list shared during the pre-solicitation has been amended for the U.S. DOT FY25 Phase I Solicitation as follows:

- Topic 25-FH3, Concrete Shrinkage Measurement Device, has been updated with clarifications on desired testing parameters and requirements for field use.
- Topic 25-FR4, Human Factors Fatigue Assessment System (HFFAS), has been updated with clarifications in the Topic Objectives.
- Topic 25-FT1, Exploring AI-based Predictive Maintenance for Public Transit Fleets (Buses), has been updated with clarifications adding “buses” to the title and in the body of the topic to better define fleets and provide an initial data source for potential offerors.
- Topic 25-NH1, Automated Police Crash Report Data Collection and Management Software, has one update made to Phase I Outcomes.

B. Pre-Offer Webinar

The Pre-Offer Webinar will be held on Monday, February 10, 2025, at 2:00 p.m. ET. The Government encourages all small businesses and persons that are interested in or considering submitting an offer to attend the pre-offer webinar. Small businesses may attend this webinar only virtually via a webinar conference. Come learn about the U.S. DOT's SBIR program, this year's topics, and Pitch Day. Administrative questions about the solicitation will be collected during the webinar, but no technical questions regarding the research topics will be accepted.

To register, visit:
https://usdot.zoomgov.com/webinar/register/WN_r2q1TPukT2m61vTrJKESgA#/registration.

The deadline to register for the webinar is Sunday, February 9, 2025, at 5:00 p.m. ET.

After the webinar, a recording will be posted to the U.S. DOT SBIR Program website (https://www.volpe.dot.gov/work-with-us/small-business-innovation-research).

C. Closing Date

Offers must be received through the U.S. DOT's automated proposal website no later than **Friday, March 7, 2025, at 3:00 p.m. ET.** The U.S. DOT's automated proposal website is located at https://usg.valideval.com/teams/usdot_2025/signup.

D. Pitch Day

The most favorably rated offers for the respective research topics (per Section III.D) may, at the discretion of the Government, have an opportunity to make a virtual oral presentation to the Government promoting its offer. Pitch Day is scheduled on or around May 5-9, 2025. For more information, see Section III.D.

Contents

I. PROGRAM DESCRIPTION

A. Introduction

The United States Department of Transportation (U.S. DOT) welcomes small businesses to participate in the U.S. DOT's Small Business Innovation Research (SBIR) program. The purpose of this solicitation is to invite small businesses, with their valuable resources and creative capabilities, to submit innovative research ideas and solutions in response to the topics identified by the U.S. DOT as described in Section VIII. Under the SBIR Program, the U.S. DOT does not accept unsolicited proposals.

The goals and objectives of the SBIR Program are to:

- Stimulate technological innovation;
- Meet Federal research or research and development (R/R&D) needs;
- Foster and encourage participation in innovation by socially and economically disadvantaged and women-owned businesses; and
- Increase private sector commercialization of innovations derived from Federal R/R&D, thereby increasing competition, productivity and economic growth.

The SBIR Program encourages small businesses to engage in R/R&D that has the potential for commercialization and meets Federal R/R&D objectives. The Small Business Innovation Development Act of 1982 [Public Law (P.L.) 97-219 codified at 15 U.S.C. 638] established the SBIR Program. More information is available at https://www.sbir.gov/.

B. Three-Phase Program

The U.S. DOT SBIR Program is a three-phase program.

THIS SOLICITATION IS FOR PHASE I OFFERS ONLY.

Phase I. Phase I is the conduct of feasibility-related experimental or theoretical R/R&D efforts on research topics described herein. For the U.S. DOT SBIR Program, Phase I offers can be funded up to $200,000, unless otherwise noted in Section VIII. The period of performance of the resulting contract shall be six months. The basis for award is the scientific and technical merit of the offer, its commercial potential, and its relevance to U.S. DOT requirements and current research priorities. The U.S. DOT intends to award Firm-Fixed-Price (FFP) purchase orders utilizing Federal Acquisition Regulation (FAR) Part 13 Simplified Acquisition Procedures. A purchase order is an offer by the Government to buy supplies or services, including research and development, upon specified terms and conditions (in this instance, this solicitation and the contractor's offer). The U.S. DOT will require written acceptance of the purchase order by the Small Business Concern (SBC) at the time of award via the SBC signing the purchase order, thus

creating a binding contract between the SBC and the Government. Award of a bilaterally signed purchase order is subject to the availability of funding.

All U.S. DOT SBIR Phase I awardees who have successfully completed Phase I are eligible to submit a Phase II proposal for evaluation and possible selection for award.

Phase II. The objective of Phase II is to continue the R/R&D effort from the completed Phase I. Award of a contract for a Phase II effort is based on the results of Phase I, the scientific and technical merit of the Phase II proposal, and the commercial potential of the proposed Phase II project. Commercial potential includes the capability to transition the technology to private sector applications, Government applications, or Government contractor applications. For the U.S. DOT SBIR Program, contracts for Phase II proposals can be funded up to $1,500,000 (except where a lower ceiling is specifically identified) and can have a period of performance of up to 24 months from the date of contract award. The Government is not obligated to fund any specific Phase II proposal.

The U.S. DOT typically awards Firm-Fixed-Price (FFP), FFP-Level-of-Effort (FFPLOE), or Cost-Plus-Fixed-Fee (CPFF) negotiated contracts for Phase II efforts utilizing FAR Part 15 Contracting by Negotiation procedures. Approximately 30 days prior to the end of Phase I efforts, the U.S. DOT SBIR Program will provide Phase I contract awardees details on the due date, content, submission requirements, and evaluation criteria for Phase II proposals. A summary of Phase II proposal submission requirements can be found on the U.S. DOT's SBIR website at https://www.volpe.dot.gov/work-with-us/small-business-innovation-research/submit-proposal.

If invited by the Government, a Phase II awardee may receive one additional, sequential Phase II award, identified by U.S. DOT as a Phase IIB, to continue the work of an initial Phase II award.

Phase III. SBIR Phase III refers to work that derives from, extends, or logically concludes effort(s) performed under a U.S. DOT or another Agency's Phase I and/or Phase II funding agreement. Phase III is funded by sources other than the set-aside funds dedicated to the SBIR Program. Phase III work is typically oriented toward commercialization of SBIR research or technology and may be for products, production, services, R/R&D, or a combination thereof. The following activities are some of the types of SBIR Phase III work:

- Commercial application of SBIR-funded R/R&D financed by non-Federal sources of capital.
- SBIR-derived products or services intended for use by the Federal Government, funded by non-SBIR sources of funding.
- Continuation of SBIR work, funded by non-SBIR sources of Federal funding including R/R&D.

C. Eligibility

Size Rule

Regulations governing size and eligibility requirements for the SBIR program are found at 13 CFR Part 121.701-121.705. See SBA's Guide to SBIR/STTR (Small Business Technology Transfer) Program Eligibility at http://sbir.gov/sites/default/files/elig_size_compliance_guide.pdf for further details. 13 CFR Part 121.702 includes a provision that allows agency discretion relating to the participation by firms that are majority-owned by multiple venture capital operating companies, private equity firms or hedge funds. **The U.S. DOT elects at this time not to use the authority that would allow companies that are majority-owned by multiple venture capital operating companies (VCOCs), hedge funds or private equity firms to participate in the SBIR Program. Offers submitted by these parties will not be considered for award.** This does NOT include allowable VCOCs per 13 CFR 121.702(a)(1)(i) that are majority-owned by a single VCOC, hedge fund, or private equity firm that is itself a small business concern.

Each SBC submitting an offer must qualify as an SBC at the time of award of Phase I and Phase II contracts (see Section I. E. for the definition of an SBC). An SBC, together with its affiliates, must not have more than 500 employees. In addition, the following requirements must be met:

- The primary employment of the principal investigator must always be with the small business firm at the time of the contract award and during the conduct of the proposed research. "Primary employment" means that more than one-half of the principal investigator's employment time is spent working for the small business. This precludes full-time employment with another organization.
- For Phase I, a minimum of two-thirds of the research or analytical effort, measured in total contract dollars using simple math, must be performed by the awardee (i.e., 66.7% of total contract cost must be for other than subcontractor/consultant costs).
- For Phase II, a minimum of one-half of the research or analytical effort, measured in total contract dollars using simple math, must be performed by the awardee (i.e., 50% of total contract cost must be for other than subcontractor/consultant costs).
- For both Phase I and Phase II, the R/R&D work must be performed in the United States. "United States" means the 50 states, the territories and possessions of the Federal Government, the Commonwealth of Puerto Rico, the Republic of the Marshall Islands, the Federated States of Micronesia, the Republic of Palau, and the District of Columbia.

Performance Benchmark Requirements for Phase I Eligibility

Section 6(a)(7) of the SBIR Policy Directive requires each Federal agency participating in SBIR to set a Phase II transition rate benchmark per Section 5165 of the SBIR/STTR Reauthorization

Act of 2011. General information on the Performance Benchmark requirements is available at https://www.sbir.gov/performance-benchmarks.

Before submitting an offer to this solicitation, all potential offerors should verify their Transition Rate eligibility for Phase I awards on SBA's SBIR website. On June 1st of each year, SBA identifies companies that fail to meet the transition benchmarks. Phase I applicants that meet the Phase I to Phase II transition rate are eligible to submit an offer for a new Phase I award.

Phase I to Phase II Transition Rate: The U.S. DOT's Phase I to Phase II Transition Rate uses a five-year period and counts an offeror's total number of Phase I awards over the past five fiscal years, excluding the most recently completed fiscal year; and the total number of Phase II awards over the last five fiscal years, excluding the most recently completed fiscal year. The U.S. DOT SBIR Phase I to II Transition Benchmark is: at least 0.25.

Effective July 25, 2013, for all U.S. DOT SBIR Program Phase I offerors that have received 21 or more Phase I awards during the past five fiscal years, the ratio of Phase II awards received to Phase I awards received must be at least 0.25.

Commercialization Benchmark:

The Commercialization Benchmark requirement applies only to SBIR and STTR Phase I applicants that have received 16 or more Phase II awards during the past 10 fiscal years, excluding the two most recently completed fiscal years. These companies must have achieved at least the minimum required levels of commercialization activity, resulting from their past Phase II work, to be eligible to submit a proposal for a new Phase I (or Direct-to-Phase II) award. The current Commercialization Benchmark requirement, agreed upon and established by all 11 SBIR agencies, was published for public comment in the Federal Register (FR) at 78 FR 48537 in August 2013 with a reopening of the comment period at 78 FR 59410 in September 2013. It requires the awardee applicant to average at least $100,000.00 in sales and/or investments per Phase II award received during the period or have received a number of patents resulting from the SBIR work equal to or greater than 15% of the number of Phase II awards received during the period.

As of April 2021, the Small Business Administration (SBA) is enforcing the Commercialization Benchmark and is compiling a list of companies that will be deemed ineligible to submit a proposal for a new Phase I (or Direct-to-Phase II) award due to failure to meet the Commercialization Benchmark requirement.

SBIR and STTR awardees are required to update and maintain their organization's SBIR.gov Company Commercialization Report, accessible when logged in to the Company Registry profile as an authorized user under the "My Dashboard" section. Commercialization information is required upon completion of the last deliverable under the funding agreement. SBIR and STTR

awardees are requested to voluntarily update the information in the database annually thereafter for a minimum period of 5 years.

Foreign Disclosure Notice

The SBIR and STTR Extension Act of 2022 (P.L. 117-183), Section 4(c), requires each SBC submitting a proposal or application for a federally funded award to disclose information in the proposal or application regarding ties to the People's Republic of China and other foreign countries. As such, all offerors submitting in response to this solicitation are required to complete a disclosure form at the U.S. DOT's online page at: https://forms.office.com/g/BmmrYKqhpz on or before the solicitation closing date. Foreign involvement or investment does not independently disqualify your offer but failing to disclose such affiliations or relationships may result in denial of an award. Details on the requirements of the Extension Act and disclosures can be found at https://www.congress.gov/bill/117th-congress/senate-bill/4900/text. The Disclosure Form was also published by the SBA in the Federal Register on April 4, 2023, and more information can be found at https://www.sbir.gov/foreign_disclosures.

D. Contact Information

If you have any administrative questions not listed on our Frequently Asked Questions (FAQs) web page (https://www.volpe.dot.gov/work-with-us/small-business-innovation-research/faqs), or questions regarding this Solicitation's Appendix C: Contract Pricing Worksheet, please submit such questions via email to:

U.S. DOT SBIR Program
dotsbir@dot.gov

All administrative and Appendix C questions must be submitted **no later than 3:00 p.m. ET on Thursday, February 27, 2025**. Questions received after 3:00 p.m. ET on February 27, 2025, may not be answered. The Government reserves the right to address a late question, if the Government determines an answer is in its best interests.

PLEASE NOTE:

- Technical questions pertaining to the research topics will not be answered during the solicitation period, as technical questions were only permitted during the pre-solicitation period. To review the technical questions and answers, visit https://usdot.uservoice.com/forums/964763-u-s-dot-fy-2025-phase-i-pre-solicitation-q-a.
- Inquiries regarding offer status will not be answered.

For general SBIR Program inquiries not pertaining to this solicitation, please contact:

U.S. DOT's SBIR Hotline
(617) 494 2051
dotsbir@dot.gov

To support full and open competition and comply with the Procurement Integrity Act, 41 USC Sections 2101-2107 requirements, during the Phase I submittal and evaluation period, offeror or potential offeror contact with U.S. DOT relative to this Solicitation is restricted to the officials identified in this Solicitation. During the open period of this Solicitation (from solicitation issuance until release of award recommendation list), contact with U.S. DOT officials (excluding certain offices and positions such as the DOT Office of the Inspector General and the U.S. DOT/Office of the Secretary) from or at any U.S. DOT agency, other than those U.S. DOT officials identified in this Solicitation, may result in rejection of the offer attributable to such unauthorized contact.

E. Definitions

Funding Agreement

Any contract, grant, or cooperative agreement entered into between any Federal Agency and any SBC for the performance of experimental, developmental, or research work, including products or services, funded in whole or in part by the Federal Government.

NOTE: The U.S. DOT does not award grants or cooperative agreements under the SBIR Program.

Historically Underutilized Business Zone (HUBZone)

A SBC that meets the requirements described in 13 CFR § 126.200 (https://www.ecfr.gov/current/title-13/chapter-I/part-126/subpart-B/section-126.200), is certified by the SBA, and designated by SBA as a HUBZone SBC in the Dynamic Small Business Search (https://www.ecfr.gov/current/title-13/chapter-I/part-126/subpart-A/section-126.103). SBA's designation also appears in SAM.

Research or Research and Development (R/R&D)

Any activity that is:

- A systematic study directed toward greater knowledge or understanding of the subject studied;
- A systematic study directed specifically toward applying knowledge and innovation to meet a recognized but unmet need; or
- A systematic application of knowledge and innovation toward the production of useful materials, devices, and systems or methods, including design, development, and improvement of prototypes and new processes to meet specific requirements.

SBIR Data

All data developed or generated in the performance of an SBIR award, including Technical Data

and Computer Software developed or generated in the performance of an SBIR award. The term does not include information incidental to contract administration, such as financial, administrative, cost or pricing or management information.

SBIR Data Rights

The Government's license rights in properly marked SBIR Data during the SBIR protection period as follows: SBIR Technical Data Rights in SBIR Data that are Technical Data or any other type of Data other than Computer Software and SBIR Computer Software Rights in SBIR Data that is Computer Software. Upon expiration of the protection period for SBIR Data, the Government has a royalty-free license to use, and to authorize others to use on its behalf, these Data for Government purposes, and is relieved of all disclosure prohibitions and assumes no liability for unauthorized use of these Data by third parties. The Government receives unlimited rights in all Form, Fit, and Function Data, Operations, Maintenance, Installation, or Training Purposes (OMIT) Data, and unmarked SBIR Data.

Small Business Concern (SBC)

A concern that meets the SBIR program eligibility requirements set forth in 13 CFR § 121.702, "What size and eligibility standards are applicable to the SBIR and STTR programs?", which can be found here: https://www.ecfr.gov/current/title-13/chapter-I/part-121/subpart-A/subject-group-ECFRb7921b3fcf04228/section-121.702.

Socially and Economically Disadvantaged SBC (SDB)

For Eligibility, and Certification relating to Federal SDB Programs, See 13 CFR § 124, Subpart B at https://www.ecfr.gov/current/title-13/chapter-I/part-124?toc=1.

Subcontract

Any agreement, other than one involving an employer-employee relationship, entered into by an awardee of a funding agreement calling for supplies or services for the performance of the original funding agreement.

Veteran-Owned SBC

An SBC:

1. Not less than 51% of which is owned and controlled by one or more veterans (as defined at 38 USC 101[2]) or, in the case of any publicly owned business, not less than 51% of the stock of which is owned by one or more veterans; and,

2. The management and daily business operations of which are controlled by one or more veterans.

Women-Owned SBC (WOSB)

An SBC that is at least 51% owned by one or more women, or in the case of any publicly owned business, at least 51% of the stock is owned by women, and women control the management and

daily business operations.

F. Report SBIR Fraud, Waste, and Abuse

The U.S. DOT Office of Inspector General Hotline (Phone: 800-424-9071, Email: hotline@oig.dot.gov) accepts concerns and other tips from all sources about allegations of fraud, waste, abuse, and/or mismanagement in U.S. DOT programs. If an allegation of fraud, waste, abuse, and/or mismanagement pertains to the SBIR Program, then the reporting individual should indicate that the alleged fraud, waste, abuse, and/or mismanagement pertains to an SBIR solicitation or contract. Additionally, the U.S. DOT SBIR Program website contains information and links to report potential fraud, waste, abuse, and/or mismanagement: https://www.volpe.dot.gov/work-with-us/small-business-innovation-research/report-fraud-waste-and-abuse.

G. Other Information

Executive Order (EO) 13329, Encouraging Innovation in Manufacturing, February 26, 2004

"Encouraging Innovation in Manufacturing" requires SBIR agencies, to the extent permitted by law and in a manner consistent with the mission of that department or agency, to give high priority within the SBIR Programs to manufacturing-related R&D. "Manufacturing-related" is defined as "relating to manufacturing processes, equipment and systems; or manufacturing workforce skills and protection."

The U.S. DOT SBIR Program solicits manufacturing-related projects through the call for topics distributed to each of the Department's SBIR participating agencies. Additionally, the SBA requires each agency with an SBIR program to develop a written policy on the implementation of EO 13329 as well as publish an annual report.

Energy Independence and Security Act of 2007, December 19, 2007

The Energy Independence and Security Act of 2007 (P.L. 110-140) amends the Small Business Act (15 U.S.C. Section 636(a)) to instruct the SBA Administrator to ensure that certain Federal Departments and agencies give priority to SBCs that participate in or conduct energy efficiency or renewable energy system research and development projects. U.S. DOT SBIR projects that focus on conducting R/R&D in energy efficiency and/or renewable energy are reported annually to SBA.

II. OFFER PREPARATION INSTRUCTIONS AND REQUIREMENTS

A. Overview

This is a solicitation for Phase I R/R&D offers on advanced, innovative concepts from SBCs having strong capabilities in applied science or engineering. Phase I R/R&D offers shall demonstrate a sound approach to the investigation of an important transportation related scientific or engineering problem categorized under one of the research topics listed in Section VIII.

An offer may respond to any of the research topics listed in Section VIII herein but must be limited to one topic. No one offer may be accepted under more than one topic. An SBC may, however, submit separate offers on different topics, or different offers on the same topic under this solicitation. Where similar research is discussed under more than one topic, the SBC shall choose that topic which appears to be most relevant to the SBC's technical concept.

The proposed research must have relevance to the improvement of some aspect of the national transportation system or to the enhancement of the ability of an Operating Administration of the U.S. DOT to perform its mission. Offers shall be confined principally to scientific or engineering research, which may be carried out through construction and evaluation. Offers must be for R/R&D, particularly on advanced or innovative concepts.

Each offer shall be self-contained and checked carefully by the offeror to ensure compliance with all preparation instructions (see Appendix D, Offer Submission Checklist).

All offers must be submitted using U.S. DOT's SBIR online submittal page:
https://usg.valideval.com/teams/usdot_2025/signup

B. Solicitation Requirements

The following requirements must be met by the solicitation closing date for the offer to be evaluated for award:

1. **SBA Company Registry Confirmation** – Each SBC applying to the SBIR program is required to complete its registration in SBA's Company Registry (https://app.www.sbir.gov/company-registration/overview) **prior to** submitting its Offer. At a minimum, registration requires a Unique Entity ID (UEI) and employer identification (EIN) numbers. Completed registrations will receive a unique SBC Control ID and PDF file, which should be submitted as the first page in the Technical Section of the Offer. Registrations should be updated at a minimum of every 6 months and the PDF

file attached to the offer should have this current version to demonstrate adherence to the updated registration requirement.

2. **Submission of Offer** – Offers must be submitted using the U.S. DOT SBIR Program's online submission process (https://usg.valideval.com/teams/usdot_2025/signup) during open solicitation periods only. Offers must be complete, accurate and submitted as four separate files.

    a. **Technical Section** – The technical section must be submitted in PDF format in accordance with the following requirements:

        i. The technical section shall not exceed 15 pages. Any information over the 15-page limit may not be considered and could adversely affect the offer evaluation. A Table of Contents, the SBA Company Registry Confirmation, SAM Registry Confirmation, and Prior Phase II Awards do not count toward the 15-page limit.

        ii. Font size shall be no smaller than 10-point.

        iii. Offers shall be on standard letter size pages (8.5" by 11").

        iv. All pages should be numbered consecutively.

    b. **Appendices A and B** – Appendix A: Signature Page and Appendix B: Project Summary must be submitted as a PDF file, which does not count toward the 15-page limit for the technical section.

    c. **Appendix C: Contract Pricing Worksheet** – The Contract Pricing Worksheet should be submitted as an Excel file. This section does not count toward the 15-page limit for the technical section. SBCs **must** use the template provided by the U.S. DOT SBIR Program to be considered responsive.

    d. **Contract Pricing Worksheet Supporting Documentation** – Supporting documentation for Appendix C: Contract Pricing Worksheet must be submitted as a PDF file, and include the required supporting information described on page 15 of this Solicitation and in Appendix C. This section does not count toward the 15-page limit for the technical section. There is no limit on the number of pages for the Contract Pricing Worksheet Supporting Documentation.

3. **Offer File Names** – Offer file names for each of the four separate files must include the following:

    a. The first three characters must be the topic number that the offer is associated with (e.g., FH2).

b. The remaining characters must include an abbreviation of the company's name and a distinct character to designate each file (e.g., 1, 2, 3, and 4).

4. **Offer Submission Deadline** – Offers must be received no later than **3:00 p.m. ET on Friday, March 7, 2025,** through U.S. DOT's automated proposal website at https://usg.valideval.com/teams/usdot_2025/signup. Offers received after this time will be automatically rejected; no exceptions will be permitted. Please be aware that the submittal process requires answering several questions: be sure to allow ample time to complete the multi-step submittal process. Offers shall not be considered received by the Government until this multi-step process is complete. Offerors are encouraged to submit their offers as early as possible.

5. **Duplicate Offers** – Offers shall only be submitted through the U.S. DOT's automated proposal website. No duplicate offers shall be sent by any other means. An offer may respond to any of the research topics listed in Section VIII herein but must be limited to one topic. No one offer may be accepted under more than one topic. An SBC may, however, submit separate offers on different topics, or multiple separate offers on the same topic under this solicitation. **Note: To submit more than one offer in the proposal website, please add the topic number at the end of the company name in the 'Team Name' field (e.g., Small Business, Inc. – FH1). This will create a new profile for each offer. If submitting two or more offers under the same topic, please add "a", "b", etc. respectively after the topic number to each Team Name. (e.g., Small Business, Inc. – FH2a).**

6. **Specific Instructions for the Four Separate Offer Files**

Technical Section (PDF)

Includes SBA Registry Confirmation, Technical Section, and Prior Phase II Awards.

SBA Company Registry Confirmation (does not count toward the 15-page limit) *First Page of PDF*	All SBIR applicants are required to be registered in SBA's company registry database. The confirmation page from registering in the database should be included as the first page of the Technical Section. See https://app.www.sbir.gov/company-registration/overview to register or print your registration confirmation. This registration page does not count toward the 15-page limit.

SAM Registration Confirmation (does not count toward the 15-page limit) *Second Page of PDF*	All SBIR applicants must be registered in SAM (see paragraph II.D) at time of offer submission. A page(s) from SAM validating the active registration should be included as the second page of the Technical Section. This registration page does not count toward the 15-page limit.
Technical Section (not to exceed 15 pages)	Submitted offers are encouraged to have a Table of Contents (which does not count toward the page limit). Offers must include the following headings in bold (in cases where a section does not apply, please state "Not Applicable"): 1. **Identification and Significance of the Problem or Opportunity.** State the specific technical problem or innovative research opportunity addressed and its potential benefit to the national transportation system. 2. **Phase I Technical Objectives.** State the specific objectives of the Phase I R/R&D effort; including the technical question(s) the research seeks to answer to determine the feasibility of the proposed approach. 3. **Phase I Work Plan.** Describe the Phase I R/R&D plan. The plan shall indicate what will be done, where it will be done, when it will be done, and how the R/R&D will be managed or directed and carried out. Phase I R/R&D shall address the objectives and the question(s) cited above in No. 2. Discuss in detail the methods planned to achieve each objective or task, including the level of effort associated with each task. 4. **Related Research or R&D.** Describe significant R/R&D that is directly related to the offer including any R/R&D conducted by the project manager/principal investigator or by the proposing firm. Describe how related research affects the proposed effort, and any planned coordination with outside sources. The SBC must persuade reviewers of its awareness of recent, key R/R&D conducted by others in the specific topic area. 5. **Key Personnel and Bibliography of Directly Related Work.** Identify key personnel involved in Phase I including related education, experience, and bibliographic information. Where vitae are extensive, summaries that focus on the most relevant experience or publications are desired and may be necessary to meet page limitation. 6. **Relationship with Future Research and Development.** State the

anticipated results of the proposed approach if the project is successful (Phase I and Phase II). Discuss the significance of the Phase I effort in providing a foundation for a Phase II R/R&D effort.

7. **Facilities.** Provide a detailed description of the availability and location of instrumentation and physical facilities proposed for Phase I.
8. **Subcontractors/Consultants.** Involvement of consultants in the planning and research stages of the project is permitted. Describe any intended consultant involvement in detail. For Phase I, a maximum of one-third of the research or analytical effort, measured in total contract dollars using simple math, may be performed by subcontractors/consultants.
9. **Potential Post Applications.** Briefly describe whether and how the proposed project appears to have (1) potential commercial application; and (2) potential use by the Federal Government.
10. **Similar Offers and/or Awards.** While it is allowed, with notification, to submit identical offers or offers containing a significant amount of essentially equivalent work for consideration under numerous federal program solicitations, **it is unlawful to enter into funding agreements requiring essentially equivalent effort**. If there is any question concerning this, it must be disclosed to the soliciting agency or agencies before award. If an SBC elects to submit similar or identical offers containing equivalent work under other Federal program solicitations, a statement must be included in each offer indicating:
    - The name and address of the agencies to which offers were submitted or from which awards were received;
    - Date of offer submission or date of award;
    - Title, number, and date of SBIR Program solicitations under which offers were submitted or awards received;
    - The applicable research topics for each SBIR offer submitted or award received;
    - Titles of research projects;
    - Name and Title of Principal Investigator or Program Manager for each offer submitted or award received.
11. **Human Factors**. Research that involves human subjects may be subject to additional regulations found in 49 C.F.R. Part 11 (Part 11) as well as other applicable federal and state laws and regulations. Research will be considered to involve human subjects under Part 11 if the research obtains (1) data through intervention or interaction

	with an individual(s), and/or (2) identifiable private information. Unless exempt under 49 CFR §11.104, human subject research must adhere to the regulations of Part 11, which includes review and approval of the research by a federally approved Institutional Review Board (IRB). Due to the short timeframe associated with Phase I of the SBIR process, the DOT does not recommend the submission of Phase I offers that require the use of Human Subjects Testing. For more information, visit the FAQ at https://www.volpe.dot.gov/work-with-us/small-business-innovation-research/faqs.
Prior SBIR Phase II Awards (does not count toward the 15-page limit)	If the SBC has received more than a total of 15 Phase II awards in the prior five fiscal years, submit the name of the awarding agency, date of award, funding agreement number, dollar amount, topic or subtopic title, follow-on agreement dollar amount, source and date of commitment, and current commercialization status for each Phase II. Provide the name and title of the project manager or principal investigator for each award received.

Appendices A and B (PDF)

Signature Page (Appendix A – page 1 of PDF)	Complete the signature page in Appendix A. The "topic title" block is to list the topic name as shown in this solicitation. The "offer title" block should be the name given to the offeror's proposed solution and should differ from the topic title block. Sign and date in blocks where indicated; the date used should be the date the offer is submitted to the Government.
Project Summary (Appendix B - page 2 of PDF)	Complete the Project Summary Sheet in Appendix B. The Project Summary of successful offers may be published by U.S. DOT and, therefore, must not contain classified or proprietary information. The Project Summary must include at a minimum: 2. A technical abstract with a brief statement of the problem or opportunity, project objectives, and description of the effort. a. The technical abstract shall be prepared in accordance with the instructions on the Appendix B Project Summary sheet, e.g., word limit using space on form, no proprietary/classified information. **7.** Anticipated results and potential applications of the proposed research.

Appendix C: Contract Pricing Worksheet (Excel)

The required Appendix C template is available on our website in Microsoft Excel format.	A Phase I Contract Pricing Worksheet must be submitted using the template provided. SBCs must use the template provided by DOT. Some cost breakdown items of Appendix C may not apply to the proposed project. If such is the case, there is no need to provide information for every item. When completing your cost offer, please consider the following: • It is important to provide enough information to allow the U.S. DOT to understand how the SBC plans to use the requested funds if an award is made. • Phase I contract awards may include profit. Note: FFP purchase orders are the type used for Phase I SBIR awards. • Travel is allowable, however, unusual, for Phase I projects. • The SBC must note its EIN and UEI numbers in Appendix C, in the Contract Pricing Worksheet Coversheet. The UEI is assigned through SAM.gov (See II (D) below). • If you have any trouble accessing the Appendix C spreadsheet, please contact the U.S. DOT SBIR Program via email at dotsbir@dot.gov no later than February 27, 2025. • Offers that exceed the Phase I Estimated Award Amount listed in Section VIII **will not be considered for award**.

Contract Pricing Worksheet Supporting Documentation (PDF)

See the first two tabs of Appendix C for instructions and further examples of supporting documentation.	Supporting documentation for the costs and pricing proposed in Appendix C must be submitted as a separate file in PDF format. Supporting documentation is required for **all** costs proposed (e.g., material quotes, subcontractor proposals, indirect rate calculations, etc.).

7. Specific Instructions for Pitch Deck

PITCH DECK (FOR INVITED OFFERORS ONLY)
Not part of the initial offer submission.

Pitch Deck (not to exceed 15 slides)	Upon invitation only and separate from the initial submission, offerors invited to Pitch Day must submit a pitch deck in MS PowerPoint or PDF via email to the U.S. DOT SBIR Program (dotsbir@dot.gov) no later

	than 3 business days prior to the event. There is no set format for the slide content. Pitch deck slides are not to be submitted with the initial offer and will not be considered.

C. Other Information

1. **Offer Handling.** Offers will be available to Government employees in the U.S. Government team of engineers and/or scientists responsible for evaluating the offer, the U.S. DOT SBIR Program, and/or Volpe Center staff pertinent to the SBIR program.

   In the conduct of offer package processing, DOT may need to provide access to the offer package to DOT contractor personnel responsible for DOT's automated proposal website, Valid Eval. Access to such data requires the contractors to fully protect the information from unauthorized use or disclosure, in accordance with 41 U.S.C. §2101-2107.

2. **Fraudulent Information**. Submitting plagiarized information and/or false information pertaining to the company, the principal investigator and/or work to be performed may result in:

   a. An offer being deemed non-responsive;

   b. A recommendation for Phase I award being rescinded;

   c. Termination of an award; and/or

   d. Possible referral to the Suspension and Debarment authority for review and action.

3. **Technical and Business Assistance (TABA).** The SBIR Program Policy Directive permits an agency to provide TABA to an SBIR awardee. For the U.S. DOT, this amount shall be up to and not exceed $6,500 for Phase I awards. This amount is in addition to the award amount for Phase I awards.

   The purpose of TABA, as defined by the SBA Policy Directive, is to assist SBIR awardees in: (1) making better technical decisions on SBIR projects; (2) solving technical problems that arise during SBIR projects; (3) minimizing technical risks associated with SBIR projects; and (4) commercializing the SBIR products or processes.

   A U.S. DOT SBIR awardee can receive support through TABA in one of two ways:

   a. The U.S. DOT SBIR Program intends to have a Blanket Purchase Agreement (BPA) with a vendor that will be capable of providing Phase I and Phase II TABA

services to its SBIR awardees. It is anticipated the BPA will be in place prior to Phase I awards made from this solicitation. Once an offer is recommended for award, the prospective awardee will receive notification from the U.S. DOT SBIR Program identifying the services available and guidance on how to obtain these services at no cost to the small business.

These services for Phase I will include a kick-off meeting with the TABA vendor and an individualized Commercialization Readiness Assessment report to support the development of the Phase II proposal's commercialization strategy,

OR

b. Awardees can receive assistance in an amount not to exceed $6,500 not using the BPA of the U.S. DOT SBIR Program. To do so, an awardee must, through its own efforts, obtain a vendor to provide TABA services.

   If recommended for award, the SBIR Program will contact the awardee and require them to provide an outline of the specific services its proposed vendor will provide and the detailed qualifications and experience of the proposed vendor, as well as pricing information. This information should not be included in the initial offer, the pitch deck (if selected for pitch day), or the Appendix C contract pricing worksheet.

4. **National Institute of Standards and Technology (NIST)/Hollings Manufacturing Extension Partnership (MEP).** An SBC may wish to contact its local NIST Hollings MEP for manufacturing and other business-related support services. The MEP works with small and mid-sized companies to help them create and retain jobs, increase profits, and save time and money. The nationwide network provides a variety of services, from business development assistance to innovation strategies to process improvements and the identification of commercialization opportunities. MEP is a nationwide network of locally managed extension centers with over 1,400 technical experts, located in every state. To contact an MEP center, call 1-800-MEP-4-MFG (1-800-637-4634) or visit MEP's website at http://www.nist.gov/mep.

D. System for Award Management (SAM)

Any business that seeks to work with the Federal Government under a FAR-based contract is mandated to register with SAM when submitting an offer and at time of a contract award. Any SBC submitting an offer to this solicitation MUST have an active SAM registration at the time the offer is submitted. Obtaining a new SAM registration or updating a lapsed registration may take 10 or more business days so it is imperative potential offerors start this process significantly before the solicitation's closing date (March 7, 2025). Additional information on SAM and the

registration process is provided on the SAM website at: https://sam.gov/content/home. A UEI number is also provided through SAM.

III. METHOD OF SELECTION AND EVALUATION CRITERIA

A. Basis of Award

All Phase I offers will be evaluated and judged on a competitive basis. Initially, all offers will be screened to determine responsiveness to the solicitation. All non-responsive offers will be rejected by the Government and will not be further evaluated.

Each offer will be judged on its own merit. A Phase I contract award will be made to the responsive and responsible SBC(s) whose offer provides the best value to the Government, based on the technical and scientific merit of the offer. **The U.S. DOT is under no obligation to fund any offer or any specific number of offers on a given topic. For any given topic, the U.S. DOT reserves the right to award more or less than the anticipated quantity of awards stated in Section IV, and to make no awards under a given topic.**

B. Phase I Evaluation Criteria

Offerors will be evaluated based on the criteria outlined below. Selections will be based on best value to the Government considering the following criteria, which are listed in descending order of importance. Details of what are considered within each criterion are included below.

Technical Merit & Feasibility	Demonstration of understanding of the problem and solution alignment with the topic description; innovative approach; scientific feasibility
Experience, Qualifications, and Facilities	Description of technical personnel; equipment and facilities; and partnerships/subcontracts (when applicable)
Effectiveness of Proposed Work Plan	Clarity of technical plan and timeline
Commercial Potential	Market understanding and awareness of regulatory, compliance, or legal issues
Offer Quality	Quality of narrative and supporting evidence

C. Offer Responsiveness Review

Each offer will be examined to determine if it is complete and contains all solicitation requirements. **An offer that does not meet the requirements of the solicitation as described in Section II.B may be excluded from further consideration.**

D. Evaluation and Selection of Awardees

Responsive offers will be evaluated in a two-step process to reduce the time from submission to

selection and award.

1. Each responsive offer will be evaluated against the evaluation criteria described in Section III.B. After evaluations are complete, the most favorably rated offers within each topic may be invited by the Government to move on to the next evaluation step, Pitch Day, and have an opportunity to be considered for an award. The Government reserves the right to not extend a Pitch Day invitation to Offerors recommended for award after this first step in the evaluation process and instead proceed directly to award. At the time the Government identifies the offerors that will participate in Pitch Day, all offerors will be notified of their evaluation status. Offerors invited to Pitch Day will receive instructions on how to prepare a short (15-slide maximum) Pitch Deck to present at the event.

2. The most favorably rated offers from step 1 may be invited to attend a virtual Pitch Day event on or around May 5-9, 2025. On Pitch Day, offerors will have no more than 15 minutes (timed) to present their Pitch Decks to the team of Government evaluators, with an additional 15 minutes (timed) to respond to Government Q&A on the presented pitch.

    a. It is recommended that no more than three individuals attend Pitch Day, and no more than five shall be permitted. Further logistical information will be made available closer to the event.

    b. Pitches will be evaluated against the evaluation criteria described in Section III.B independently of the initial offer. Once Pitch Day evaluations are complete, all Pitch Day offerors will be notified of the offers that the Government is recommending for award. At this time, the U.S. DOT SBIR Program will post a listing of all Phase I offers recommended for award on the U.S. DOT SBIR Program webpage: http://www.volpe.dot.gov/sbir.

E. Time to Award Requirements

The SBIR Program Policy Directive requires all SBIR agencies to make Phase I awards within 180 days after the close of the solicitation.

The U.S. DOT SBIR Program intends to make recommendations for SBIR Phase I awards no later than 90 days after the closing date of this solicitation. If circumstances are such that notification to each applicant cannot be met within 90 days after the solicitation closing date, the U.S. DOT SBIR Program shall notify each applicant as soon as practicable.

F. Debriefing Requests

Each offeror will have an opportunity to access a written debriefing regarding the evaluation of its offer. Debriefings will be available electronically via the offer submission website. Debriefing

information will consist of a summary of ratings across all evaluation criteria and may include comments received by the Government evaluators. The identity of the evaluators will not be disclosed. Debriefings will be available as follows:

Offerors who do not advance on to Pitch Day, inclusive of those recommended for award after the first step in the evaluation process, may access its written debriefing within ten (10) calendar days from the notification from the Government. If there is no response from the SBC within the ten (10) calendar days, the debriefing shall close without further notice. Offerors who do advance on to Pitch Day may access feedback regarding its offer within ten (10) calendar days from the notification from the Government and will also receive information regarding Pitch Day.

Within ten (10) calendar days after Pitch Day, Offerors who have participated in Pitch Day will be notified of its award recommendation status. Once notified, Offerors will have ten (10) calendar days to access the debriefing. If there is no response from the SBC within the ten (10) calendar days, the debriefing shall close without further notice.

IV. CONSIDERATIONS

A. Funding Awards

The Government anticipates awarding a total of eleven Phase I awards among all the topics identified in this solicitation, but reserves the right to make fewer, more, or no awards if it is in the best interest of the Government. The actual number of contract awards is subject to the availability of funding and the responses from small business firms to the solicited research topics described in Section VIII.

1. **Dollar Value of Awards**. The U.S. DOT SBIR Program has set the maximum thresholds for Phase I and Phase II awards for this solicitation at $200,000 and $1,500,000, respectively.

    a. **Phase I Awards**. Phase I is the conduct of feasibility-related experimental or theoretical research or R/R&D efforts on research topics described herein. For the U.S. DOT SBIR Program, Phase I offers can be funded up to $200,000, unless otherwise noted in Section VIII. The period of performance of the resulting contract shall be six months. The basis for award is the scientific and technical merit of the offer, its commercial potential, and its relevance to U.S. DOT requirements and current research priorities. The U.S. DOT intends to award Firm-Fixed-Price (FFP) purchase orders utilizing FAR Part 13 Simplified Acquisition Procedures. A purchase order is an offer by the Government to buy supplies or services, including research and development, upon specified terms and conditions (in this instance, this solicitation and the contractor's offer). The U.S. DOT will require written acceptance of the purchase order by the SBC at the time of award via the SBC signing the purchase order thus creating a binding contract between the SBC and the Government. Award of a bilaterally signed purchase order is subject to the availability of funding.

    All U.S. DOT SBIR Phase I awardees who have successfully completed Phase I are eligible to submit a Phase II proposal for evaluation and possible selection for award.

    b. **Phase II Awards**. The objective of Phase II is to continue the R/R&D effort from the completed Phase I. Award of a contract for a Phase II effort is based on the results of Phase I, the scientific and technical merit of the Phase II proposal, and the commercial potential of the proposed Phase II project. Commercial potential includes the capability to transition the technology to private sector applications, Government applications, or Government contractor applications. For the U.S. DOT SBIR Program, contracts for Phase II proposals can be funded up to $1,500,000 (except where a lower ceiling is specifically identified) and can have a

period of performance of up to 24 months from the date of contract award. The Government is not obligated to fund any specific Phase II proposal.

The U.S. DOT typically awards Firm-Fixed-Price (FFP), FFP-Level-of-Effort (FFPLOE), or Cost-Plus-Fixed-Fee (CPFF) negotiated contracts for Phase II efforts utilizing FAR Part 15 Contracting by Negotiation procedures. Approximately 30 days prior to the end of Phase I efforts, the U.S. DOT SBIR Program will provide Phase I contract awardees details on the due date, content, submission requirements, and evaluation criteria for Phase II proposals. A summary of Phase II proposal submission requirements can be found on the U.S. DOT's SBIR website at: https://www.volpe.dot.gov/work-with-us/small-business-innovation-research/submit-proposal.

If invited by the Government, a Phase II awardee may receive one additional, sequential Phase II award, known as Phase IIB awards, to continue the work of an initial Phase II award.

2. **Phase II Contract Type and Accounting System Audits.** The Contracting Officer will consider whether a FFP, FFPLOE, CPFF, or other contract type is appropriate for each Phase II award. Phase II awardees MUST have an accounting system that is adequate for determining costs applicable to the contract or order to receive a cost type contract.

B. Reports

Under Phase I SBIR efforts, three (3) reports will be required, consisting of two (2) interim narrative reports, and a comprehensive final report. These reports are due at two-month intervals starting at the end of month two. An acceptable report is one that is comprehensive and describes all efforts and progression made on the R&D from the start of the funding agreement through the report submitted time.

C. Payment Schedule

The SBC may invoice for three partial payments for Phase I awards based on the SBC's delivery of, and the Government's acceptance of, each report. The SBC must ensure invoices are submitted in accordance with instructions in the award document, in conjunction with or after the submission by the SBC of an acceptable report(s) as described in above Paragraph B. Invoices submitted before submission of a due report will be rejected until the Phase I awardee submits an acceptable report.

Contracts for Phase II, and/or IIB will allow for incremental payments to the successful SBC as work progresses dependent on the negotiated contract type, invoice/payment contract requirements, and/or payment schedule incorporated into the contract.

D. Innovations, Inventions, and Patents

1. **Proprietary Information.** Information contained in unsuccessful offers will remain the property of the SBC. The Government will, however, retain copies of all offers. Public release of information in any offer submitted will be subject to existing statutory and regulatory requirements.

   The U.S. DOT prefers that SBC offers avoid the inclusion of proprietary data. If the inclusion of proprietary data is considered essential for meaningful evaluation of an offer it must adhere to the terms explained in this paragraph IV.D.

   If proprietary information is provided by a SBC in an offer that constitutes a trade secret, or commercial or financial information, it will be treated in confidence, to the extent permitted by law, provided the offer is clearly marked by the SBC as follows:

   The following legend must appear on the title page of the offer:

   > "This offer contains information that shall not be disclosed outside the Federal Government and shall not be duplicated, used, or disclosed in whole or in part for any purpose other than evaluation of this offer, unless authorized by law. The Government shall have the right to duplicate, use, or disclose the data to the extent provided in the resulting contract if award is made as a result of the submission of this offer. The information subject to these restrictions are contained on all pages of the offer except for pages [*insert page numbers or other identification of pages that contain no restricted information*.]
   >
   > (End of Legend)"; and,

   The following legend must appear on each page of the offer that contains information the SBC wishes to protect:

   > "Use or disclosure of information contained on this sheet is subject to the restriction on the title page of this offer."

2. **Protection Period for Rights in Data Developed under SBIR Funding Agreements.** Rights in technical data, including software developed under any award resulting from this solicitation, shall remain with the SBC except that the Government shall have the limited right to use such data for Government purposes and shall not release such data outside the Government without permission of the SBC for not less than a period of twenty years from the award date of the Phase I project from which the data was generated. However, effective at the conclusion of the protection period, the Government shall retain a royalty free license for Federal Government use of any technical data delivered under an SBIR contract whether patented or not.

3. **Copyrights**. With prior written permission of the Contracting Officer, the SBC may copyright and publish (subject to and consistent with appropriate national security considerations, if any) material developed with U.S. DOT support. The U.S. DOT receives a royalty free license for the Federal Government and requires that each publication contain an appropriate acknowledgement and disclaimer statement.

4. **Patents/Invention Reporting**. SBCs may retain the principal worldwide patent rights to any invention developed with Government support. The Government receives a royalty free license for Federal Government use, reserves the right to require the patent holder to license others in certain circumstances, and requires that anyone exclusively licensed to sell the invention in the United States must manufacture it domestically. To the extent authorized by 35 U.S.C. 205, the Government will not make public any information disclosing a Government-supported invention for a two-year period to allow the SBC a reasonable time to pursue a patent.

5. **Invention Reporting Process**. Awardees shall report SBIR inventions to the U.S. DOT through the iEdison Invention Reporting System (http://www.iedison.gov/). Use of the iEdison System satisfies all invention reporting requirements mandated by any award.

E. Cost Sharing

The U.S. DOT permits cost sharing for its Phase II efforts under the topic areas identified in this solicitation; however, cost sharing is not required nor is it a factor in evaluation. Cost Sharing is not applicable to Phase I offers or awards.

F. Profit

A profit is allowed on awards to SBCs under the U.S. DOT SBIR Program consistent with the Federal Acquisition Regulations.

G. Joint Ventures or Limited Partnerships

Joint venture (JV) and limited partnerships are permitted to submit offer(s) to this solicitation provided the entity created qualifies as an SBC in accordance with the Small Business Act, 15 U.S.C. 632, and the definition of SBC included in this solicitation (Paragraph I.E). JVs must be properly registered in SAM as a JV prior to submitting an offer and/or receiving an award. As this can be a time-consuming process, if offering as a JV is anticipated, working with SAM immediately to get the registration done is highly recommended.

H. Research and Analytical Work

1. For Phase I, a minimum of two-thirds of the research or analytical effort, measured in total contract dollars using simple math, must be performed by the awardee (i.e., 66.7%

of total contract cost must be for other than subcontractor/consultant costs).

2. For Phase II, a minimum of one-half of the research or analytical effort, measured in total contract dollars using simple math, must be performed by the awardee (i.e., 50% of total contract cost must be for other than subcontractor/consultant costs).

I. Awardee Commitments

Upon award of a U.S. DOT SBIR contract, the SBC will be required to make certain legal commitments through acceptance of FAR and Transportation Acquisition Regulation (TAR) clauses, and other Government requirements. The FAR and TAR may be found using the following links:

- FAR: https://www.acquisition.gov/browse/index/far
- TAR: https://www.acquisition.gov/tar

The Summary Statements that follow are illustrative of the types of clauses to which the SBC would be committed. This list does not represent a complete list of clauses to be included in Phase I awards and does not provide the specific wording of such clauses. A complete copy of the terms and conditions will be provided upon issuance of the contract for signature prior to award.

J. Summary Statements

1. **Standards of Work.** Work performed under all SBIR efforts must conform to high professional standards.
2. **Inspection.** Work performed under all SBIR efforts is subject to Government inspection and evaluation.
3. **Cause/Default.** The Government may terminate the funding agreement if the Contractor fails to adhere to its terms.
4. **Termination for Convenience.** The Government may terminate the funding agreement if the Government deems termination to be in the Government's best interest. In such case, the Contractor may submit its costs for work performed and for reasonable termination costs.
5. **Disputes.** Any dispute concerning the funding agreement which cannot be resolved by agreement shall be decided by the Contracting Officer with right of appeal in accordance with the Contracts Disputes Act of 1978, 41 U.S.C. 71.
6. **Certain Telecommunications and Video Surveillance Services or Equipment.** Work performed under all SBIR efforts will require certification by an Awardee as to its use of and/or delivery of covered telecommunications equipment/services and compliance with

any restrictions/prohibitions based on that certification. The offeror shall review a list of excluded parties in SAM for entities excluded from receiving federal awards for "covered telecommunication equipment or services" as specifically prohibited by Section 889 of the John S. McCain National Defense Authorization Act for Fiscal Year 2019 (Pub. L. 115-232).

7. **Equal Opportunity.** The Contractor shall not discriminate against any employee or applicant for employment because of race, color, religion, sex, sexual orientation, gender identity, or national origin.
8. **Equal Opportunity for Veterans.** The Contractor shall not discriminate against any qualified employee or applicant for employment because he or she is a disabled veteran, recently separated veteran, active-duty wartime or campaign badge veteran, or Armed Forces service medal veteran.
9. **Equal Opportunity for Workers with Disabilities.** The Contractor shall not discriminate against any qualified employee or applicant for employment because he or she is physically or mentally disabled.
10. **Officials Not to Benefit.** No Government official must benefit personally from the SBIR funding agreement.
11. **Gratuities.** The Government may terminate the funding agreement if any gratuity is or was offered to any representative of the Government to secure the award.
12. **Patent/Copyright Infringement.** The Contractor shall report each notice or claim of patent or copyright infringement based on the performance of the funding agreement to the SBIR Program Contracting Officer.
13. **Procurement Integrity.** Submission of an offer under this solicitation subjects the Offeror to the "Restrictions on Obtaining and Disclosing Certain Information" (41 U.S.C. §2101-2107, commonly known as the Procurement Integrity Act). This statute, as implemented by FAR (48 C.F.R. §3.104), prohibits the following conduct during an agency procurement: prohibits federal employees and certain Government contractors involved in federal procurements from **disclosing** contractor bid or proposal information or source selection information (§2102); prohibits any individual from obtaining contractor bid or proposal information or source selection information prior to award (§2102); requires agency officials to **report employment contacts** regarding non-Federal employment (§2103); and bans for a definitive period certain personnel from accepting compensation from the vendor and the vendor from compensating such certain personnel during this definitive period (§2104). Violations of the statute may result in criminal and/or civil penalties, and administrative actions (e.g., suspension and debarment, cancellation of the procurement, and/or rescission of the contract).
14. **Section 508 Access Board Standards**. All information and communication technology

(ICT) deliverables rendered under this contract must comply with the Revised Section 508 Standards of the Rehabilitation Act and the Access Board Standards, available for viewing at https://section508.gov/. For purposes of Revised Section 508 compliance, the definition of ICT includes information technology and other equipment, systems, technologies, or processes, for which the principal function is the creation, manipulation, storage, display, receipt, or transmission of electronic data and information, as well as any associated content. ICT acquired by a contractor incidental to this contract shall not be required to conform to the Revised 508 Standards. Unless otherwise indicated, the contractor represents by signature on a contract or order that all deliverables will comply with the Access Board Standards.

15. **Government Property**. Materials, equipment, special tooling, and special test equipment either furnished by the Government or, in a cost type contract, acquired or fabricated by the contractor, is subject to FAR clause 52.245-1 Government Property and may also be subject to special clauses specific to certain items of property.
16. **American Made Equipment and Products**. When purchasing equipment or products under an SBIR funding agreement, purchase only American-made items whenever possible.
17. **Prohibition on ByteDance Limited (TikTok).** The Contractor shall not have/use TikTok on any information technology owned or managed by the Government, or on any information technology used or provided by the Contractor under the contract.

K. Additional Information

1. This solicitation reflects current planning. Although not expected, there may be inconsistencies between the information contained in the FY 2025 solicitation and the terms and conditions of any resulting SBIR contract. The terms and conditions of the contract once executed are controlling.
2. The SBC shall complete an Online Representations and Certifications Application at https://sam.gov/content/home. The SBC should be certified in the designated North American Industry Classification System (NAICS) code (541715) of this solicitation. The size standard of NAICS code 541715 for the SBIR program is 500 employees.
3. The Government may request the SBC to submit additional management, personnel, and financial information for the Government to consider and determine the responsibility of the SBC.
4. The Government is not responsible for any monies expended by the SBC before award of any contract.
5. This solicitation is not an offer by the Government and does not obligate the Government to make any specific number of awards. Also, awards under this program are contingent

upon the availability of funds.

6. The U.S. DOT SBIR Program is not a substitute for existing unsolicited offer mechanisms. Unsolicited offers shall not be accepted under the U.S. DOT SBIR Program for either Phase I or Phase II efforts. For information pertaining to submission requirements for unsolicited offers, please refer to the U.S. DOT's Guidelines for Unsolicited Proposal Submission at https://www.volpe.dot.gov/work-with-us/guidelines-unsolicited-proposal-submission.

V. SUBMISSION OF OFFERS

Offers must be received no later than **3:00 PM ET on Friday, March 7, 2025,** through the U.S. DOT's automated proposal website at https://usg.valideval.com/teams/usdot_2025/signup.

Offers received after that time will be automatically rejected; no exceptions will be permitted. Please be aware that the submittal process requires answering several questions: be sure to allow ample time to complete the multi-step submittal process. Offers will not be considered received by the Government until this multi-step process is complete. Offerors are encouraged to submit their offers as early as possible.

VI. SCIENTIFIC AND TECHNICAL INFORMATION SOURCES

The following publications and websites are referenced in the research topics found in Section VIII.

A. Federal Highway Administration (FHWA)

25-FH1: Open Standards-based 3D-Model Viewer for Highway Construction

- FHWA Advanced Digital Construction Management Systems: https://www.fhwa.dot.gov/construction/adcms/.
- FHWA Annual Modal Research Plan (AMRP): https://www.transportation.gov/sites/dot.gov/files/2024-08/AMRP%20FY2024-2025%20FHWA.pdf.
- Advancing BIM for Infrastructure: National Strategic Roadmap, June 2021 - FHWA-HRT-21-064, https://www.fhwa.dot.gov/publications/research/infrastructure/pavements/21064/21064.pdf.
- BuildingSMART International technical information: https://technical.buildingsmart.org/standards/ifc/.
- List of States who have received grants through the ADCMS Program: https://www.fhwa.dot.gov/construction/adcms/grants.cfm.

25-FH2: Modular Construction of Protected Intersection and Turbo Roundabout

- Insurance Institute for Highway Safety (IIHS): Fatality Facts 2022: Pedestrians. https://www.iihs.org/topics/fatality-statistics/detail/pedestrians.
- Insurance Institute for Highway Safety (IIHS): Fatality Facts 2022: Bicyclists. https://www.iihs.org/topics/fatality-statistics/detail/bicyclists.
- Governors Highway Safety Association (GHSA): Pedestrian Traffic Deaths Fall for First Time Since Pandemic. https://www.ghsa.org/resources/news-releases/pedestrians24.
- League of American Bicyclists®. n.d. “National: Rates of Biking and Walking” (web page). https://data.bikeleague.org/data/national-rates-of-biking-and-walking.
- Ministry of Transport, Public Works and Water Management. 2007. Cycling in the Netherlands. The Hague, Netherlands: Ministry of Transport, Public Works and Water Management. https://bicycleinfrastructuremanuals.com/wp-content/uploads/2019/02/Cycling_in_the_Netherlands_Netherlands.pdf.

- Buehler, Ralph and John Pucher, "Walking and Cycling in Western Europe and the United States." TR News, Number 280, May-June 2012. https://onlinepubs.trb.org/onlinepubs/trnews/trnews280westerneurope.pdf.
- Types of intersections that the developed product may be used for:
  - https://highways.dot.gov/sites/fhwa.dot.gov/files/FHWA-HRT-23-052.pdf.
  - https://safety.fhwa.dot.gov/intersection/roundabouts/fhwasa19027.pdf.

25-FH3: Concrete Shrinkage Measurement Device

- AASHTO. 2022. Standard Practice for Developing Performance Engineered Concrete Pavement Mixtures. AASHTO R 101-22. Washington, DC: American Association of State Highway and Transportation Officials.
- De la Varga, I., R.P. Spragg, J.F. Munoz, M.A. Helsel, and B.A. Graybeal. 2018. "Cracking, bond, and durability performance of internally cured cementitious grouts for prefabricated bridge element connections." Sustainability, Vol. 10, Issue 3881, DOI: 10.3390/su10113881.
- AASHTO. 2017. Standard Method of Test for Evaluating Stress Development and Cracking Potential due to Restrained Volume Change Using a Dual Ring Test. AASHTO T 363. Washington, DC: American Association of State Highway and Transportation Officials.

B. Federal Motor Carrier Safety Administration (FMCSA)

25-FM1: Lidar-Based Tire Inspection

- No references.

25-FM2: Weight Equalization Smart Automatic Tire Inflation System for Commercial Motor Vehicles

- No references.

C. Federal Railroad Administration (FRA)

25-FR1: Non-Destructive Longitudinal Rail Stress Measurement Device

- Freight Rail Overview: https://railroads.dot.gov/rail-network-development/freight-rail-

overview.

25-FR2: Development of Next Gen End of Train Device Technology

- Freight Rail Overview: https://railroads.dot.gov/rail-network-development/freight-rail-overview.

25-FR3: Railroad Ground Hazard Mitigation Technology

- No references.

25-FR4: Human Factors Fatigue Assessment System (HFFAS)

- No references.

D. Federal Transit Administration (FTA)

25-FT1: Exploring AI-based Predictive Maintenance for Public Transit Fleets (Buses)

- Cavalieri S, Salafia MG. A Model for Predictive Maintenance Based on Asset Administration Shell. Sensors (Basel). 2020 Oct 23; https://pmc.ncbi.nlm.nih.gov/articles/PMC7660343/.
- Artificial Intelligence in Mass Public Transport Report: https://cms.uitp.org/wp/wp-content/uploads/2020/08/UITP-AP-CTE-AI-in-PT-Executive-Summary-Dec-2018_0.pdf.
- The Impact of AI and Cloud on Fleet Management and Financial Planning: A Comparative Analysis: https://www.researchgate.net/publication/382622809_The_Impact_of_AI_and_Cloud_on_Fleet_Management_and_Financial_Planning_A_Comparative_Analysis/link/66a56b464433ad480e80bee6/download?_tp=eyJjb250ZXh0Ijp7ImZpcnN0UGFnZSI6InB1YmxpY2F0aW9uIiwicGFnZSI6InB1YmxpY2F0aW9uIn19.
- The Study of Trends in AI Applications for Vehicle Maintenance Through Keyword Co-occurrence Network Analysis: https://papers.phmsociety.org/index.php/ijphm/article/view/3583.

E. National Highway Traffic Safety Administration (NHTSA)

25-NH1: Automated Police Crash Report Data Collection and Management Software

- Model Performance Measures for State Traffic Records Systems: https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/811441.
- NHTSA FY 2024-2025 Annual Modal Research Plan: https://www.transportation.gov/research-and-technology/national-highway-traffic-safety-administration-2024-annual-modal-research.
- Model Minimum Uniform Crash Criteria: https://www.nhtsa.gov/traffic-records/model-minimum-uniform-crash-criteria.
- NHTSA's Fatality Injury Reporting System Tool (FIRST): https://cdan.dot.gov/query.
- Law Enforcement Employees data: https://cde.ucr.cjis.gov/LATEST/webapp/#/pages/le/pe.

VII. SUBMISSION FORMS AND CERTIFICATION (APPENDICES)

A. Offer Signature Page (Appendix A)

PDF version of Appendix A (page 1 of PDF) is available on U.S. DOT's SBIR website. A sample is provided in this solicitation document.

B. Project Summary (Appendix B)

PDF Version of Appendix B (page 2 of PDF) is available on U.S. DOT's SBIR website. A sample is provided in this solicitation document.

C. Contract Pricing Worksheet (Appendix C)

MS Excel Version of Appendix C is available on U.S. DOT's SBIR website.

D. Offer Submission Checklist (Appendix D)

(Do not include with offer – for offeror's use only)

A. Offer Signature Page (Appendix A)

U.S. DEPARTMENT OF TRANSPORTATION
SMALL BUSINESS INNOVATION RESEARCH PROGRAM
SOLICITATION NO. 6913G625QSBIR1, FY 2025
SIGNATURE PAGE

Offer Information		
Topic No. (see Solicitation):	Solicitation No.: 6913G625QSBIR1	
Topic Title:		
Offer Title:		
Company Information		
Company:		
UEI #:		
Address:		
City:	State:	Zip:

Offeror Certification
By signing belowand submitting this offer in response to Solicitation No. 6913G625QSBIR1, Topic Number_, I(We) am(are) representing on my(our) own behalf, and on behalf of the SBIR applicant, that the information provided in this certification, the application, and all other information submitted in connection with this application, is true and correct as of the date of submission. I acknowledge that any intentional or negligent misrepresentation of the information contained in this certification may result in criminal, civil or administrative sanctions, including but not limited to: (1) fines, restitution and/or imprisonment under 18 U.S.C. § 1001; (2) treble damages and civil penalties under the False Claims Act (31 U.S.C. § 3729 *et seq.*); (3) double damages and civil penalties under the Program Fraud Civil Remedies Act (31 U.S.C. § 3801 *et seq.*); (4) civil recovery of award funds, (5) suspension and/or debarment from all Federal procurement and non-procurement transactions (FAR Subpart 9.4 or 2 C.F.R. part 180); and (6) other administrative penalties including termination of SBIR awards.

Principal Investigator Name:	Corporate/Business Official Name:
Title:	Title:
Address:	Address:
Telephone Number:	Telephone Number:
Email:	Email:
Signature:	Signature:
Date:	Date:

B. Project Summary (Appendix B)

U.S. DEPARTMENT OF TRANSPORTATION
SMALL BUSINESS INNOVATION RESEARCH PROGRAM
SOLICITATION NO. 6913G625QSBIR1, FY 2025
PROJECT SUMMARY

Project Summary
Abstract (Limited to two hundred words in this space only. The Project Summary of successful offers may be published by the U.S. DOT and, therefore, shall not contain classified or proprietary information.).
Anticipated Results/Potential Commercial Applications of Results.
Keywords

C. Contract Pricing Worksheet (Appendix C)

U.S. DEPARTMENT OF TRANSPORTATION
SMALL BUSINESS INNOVATION RESEARCH PROGRAM
SOLICITATION NO. 6913G625QSBIR1, FY 2025
CONTRACT PRICING WORKSHEET

Appendix C can be found on our website here in Microsoft Excel format. Please fill out the spreadsheets as directed in the instructions.

Additional information about the contract pricing worksheet and its requirements can be found in the Appendix C instructions in the first two tabs of the workbook and on our FAQ page (https://www.volpe.dot.gov/work-with-us/small-business-innovation-research/faqs).

If you have any questions regarding Appendix C not listed on our FAQ page, please submit such questions via email to:

U.S. DOT SBIR Program
dotsbir@dot.gov

All administrative and Appendix C questions must be submitted no later than 3:00 p.m. ET on Thursday, February 27, 2025. Questions received after 3:00 p.m. ET on February 27, 2025, may not be answered. The Government reserves the right to address a late question if the Government determines an answer is in its best interest.

D. Offer Submission Checklist (Appendix D)

U.S. DEPARTMENT OF TRANSPORTATION
SMALL BUSINESS INNOVATION RESEARCH PROGRAM
SOLICITATION NO. 6913G625QSBIR1, FY 2025
OFFER SUBMISSION CHECKLIST

This is a CHECKLIST OF REQUIREMENTS for your offer. Please review the checklist carefully to assure that your offer meets the U.S. DOT SBIR requirements. Failure to meet these requirements may result in your offer being returned without consideration. (See Section II.B of this Solicitation). **Do not include this checklist with your offer.**

____ 1. The offer reflects that for Phase I, a minimum of two-thirds of the research or analytical effort, measured in total contract dollars using simple math, must be performed by the awardee (i.e., 66.7% of total contract cost must be for other than subcontractor/consultant costs).

____ 2. A Foreign Disclosure form has been completed for the U.S. DOT at https://forms.office.com/g/BmmrYKqhpz.

____ 3. The offer is submitted according to the requirements described in Section II.

____ 4. The offer is limited to only ONE of the research topics in Section VIII.

____ 5. The budget may be up to $200,000 *unless otherwise indicated in Section VIII of the solicitation* and duration does not exceed six months.

____ 6. The technical abstract contains no proprietary information, does not exceed 200 words, and is limited to the space provided on the Project Summary sheet (Appendix B).

____ 7. The offer contains no type smaller than ten-point font size.

____ 8. All Appendices (A, B, and C) have been completed.

____ 9. The Technical Section includes all items identified in Section II.B of the Solicitation and does not exceed 15 pages per II.B requirements.

____ 10. Additional information on prior Phase II awards, if required, in accordance with Section II.B, is included.

____ 11. The Contract Pricing Worksheet (Appendix C) has been completed, and the Contract Pricing Worksheet Supporting Documentation file provides the necessary supporting information.

____ 12. Business has been registered in both SAM and the SBA Company Registry as described in Section II.D and II.B, respectively, of this solicitation.

____ 13. The offer must be submitted online and received by the U.S. DOT automated proposal website by **3:00 p.m. ET, March 7, 2025. Offers received via email or any other means will not be accepted. Do not send duplicate offers via email or by any other means.**

VIII. RESEARCH TOPICS

The FY 2025 SBIR Solicitation Phase I research topics for identified U.S. DOT Operating Administrations are listed on the following pages. These topics indicate the specific areas for which SBIR Phase I offers are to be considered for acceptance by the U.S. DOT. The topics are not listed in any order of priority. Each offer submitted must respond to one (and only one) topic and/or focus area as described in this section. An offer may, however, indicate and describe its relevance to other topics. Offerors are encouraged to review Section VI of this solicitation for scientific and technical information sources that may be referenced in the respective topic descriptions.

U.S. DOT Operating Administration	Topic Number & Title	Estimated Award Amount Phase I*	Estimated Award Amount Phase II**
Federal Highway Administration (FHWA)	25-FH1: Open Standards-based 3D-Model Viewer for Highway Construction	$200,000	$1,250,000
	25-FH2: Modular Construction of Protected Intersection and Turbo Roundabout	$200,000	$1,500,000
	25-FH3: Concrete Shrinkage Measurement Device	$200,000	$1,500,000
Federal Motor Carrier Safety Administration (FMCSA)	25-FM1: Lidar-Based Tire Inspection	$200,000	$1,500,000
	25-FM2: Weight Equalization Smart Automatic Tire Inflation System for Commercial Motor Vehicles	$200,000	$1,500,000
Federal Railroad Administration (FRA)	25-FR1: Non-Destructive Longitudinal Rail Stress Measurement Device	$200,000	$750,000
	25-FR2: Development of Next Gen End of Train Device Technology	$200,000	$500,000
	25-FR3: Railroad Ground Hazard Mitigation Technology	$200,000	$350,000
	25-FR4: Human Factors Fatigue Assessment System (HFFAS)	$200,000	$350,000
Federal Transit Administration (FTA)	25-FT1: Exploring AI-based Predictive Maintenance for Public Transit Fleets (Buses)	$200,000	$1,000,000
National Highway Traffic Safety Administration (NHTSA)	25-NH1: Automated Police Crash Report Data Collection and Management Software	$200,000	$500,000

* Offers that exceed the Phase I Estimated Award Amount will not be considered for award.

**The Phase II funding level noted is an estimate only, is subject to the availability of funds, and/or the technical requirements to accelerate the development of a commercial product and/or innovation. Any changes to the Phase II estimated funding level listed above will be communicated to the small business when instructions on the Phase II process are sent approximately 1 month prior to the end of the Phase I project.

Research topics are organized into five sections:

A. Federal Highway Administration (FHWA)

B. Federal Motor Carrier Safety Administration (FMCSA)

C. Federal Railroad Administration (FRA)

D. Federal Transit Administration (FTA)

E. National Highway Traffic Safety Administration (NHTSA)

A. Federal Highway Administration (FHWA)

About Us: FHWA's Research, Technology, and Education (RT&E) Program strives to generate new solutions, build more effective partnerships, and provide better information and tools for decision making, which will enable the nation to enhance and make the best investments in the U.S. transportation system.

FHWA's RT&E program supports research and development (R&D) to improve safety; the mobility of people and goods; stimulate growth, productiveness, and competitiveness; reduce congestion; improve durability and extend the life of transportation infrastructure, accelerate project delivery, and the transition to a transportation system that provides an equitable approach that serves all road users, including those in social and demographic communities that are underserved in access to mobility options and disproportionately represented in preventable and fatal injury.

The program accelerates the adoption of proven innovative practices and technologies as standard practices to significantly improve: safety, system efficiency, infrastructure health, reliability and performance, and a balanced approach to provide livable/sustainable communities across the Nation.

25-FH1: Open Standards-based 3D-Model Viewer for Highway Construction

The FHWA Building Information Management (BIM) program supports the intelligent 3D model-based approach that gives engineering and construction professionals the insight and tools to more efficiently plan, design, and build highways and bridges. The FHWA Advanced Digital Construction Management Systems (ADCMS) strategic program objectives and grant funding supports digital technologies and processes for management of construction and engineering activities. Through these programs, including activities outlined in the *Advancing BIM for Infrastructure National Strategic Roadmap*[1], owner agencies have identified a gap and need to fully leverage and deploy 3D design models into construction and inspection.

One challenge that faces the adoption of ADCMS and digital delivery is the lack of a simple 3D model viewer that can be used by construction staff in the field on consumer grade portable electronics and doesn't require advanced understanding of modeling, design, and associated authoring tools and software. Such model viewer capabilities in the field would assist owners and contractors with digital project delivery and usage of 3D design models and information

[1] Advancing BIM for Infrastructure: National Strategic Roadmap, June 2021 - FHWA-HRT-21-064, https://www.fhwa.dot.gov/publications/research/infrastructure/pavements/21064/21064.pdf

during construction, inspection, and acceptance activities. The model viewer would help to ensure the design requirements, standards, specifications, and intent are met.

This research topic supports FHWA's Annual Modal Research Plan (AMRP) by accelerating the implementation and delivery of new innovations and technologies that support the goals of ADCMS. The primary goal of the ADCMS activity is to transform State DOTs and local planning agencies (LPAs) adoption of ADCMS technologies by promoting, implementing, deploying, demonstrating, showcasing, supporting, and documenting the application of ADCMS practices, performance, and benefits. ADCMS systems are generally defined as commercially proven digital technologies and processes for managing construction and engineering activities. ADCMS also includes developing and supporting systems to enhance and share data across an asset's lifecycle and between organizational silos, maximizing interoperability across the agency.

Accelerated implementation and deployment of ADCMS is a priority for the U.S. DOT and FHWA and will ensure that highway construction is using best practices and leveraging advanced digital techniques to accelerate project delivery and increase the safety and efficiency of highway construction. The implementation will support digital transformation in the highway construction and engineering sectors and the advancement and implementation of BIM for Infrastructure, which is an open standards–based collaborative work method for structuring, managing, and using data about transportation assets and networks throughout their lifecycles. It liberates data from siloed systems, which is a repository of data that's controlled by one department or business unit and isolated from the rest of an organization and makes it easier for automated processes to generate asset information and distribute it to anyone within a State DOT when they need it.

Topic Objectives

To that end, the solution being sought aims to facilitate the use of 3D design models during construction by field staff without requiring modeling expertise or advanced skills to view and understand the design models and information to support construction operations and digital project delivery.

The solution shall be devised to provide functionalities to view and utilize 3D design models during construction without requiring the end user to be a modeling expert and not requiring expertise with 3D design authoring tools. The solution shall be capable of viewing model files that are compliant with Industry Foundation Classes (IFC) format and data requirements and be agnostic to any specific authoring tool or 3D model format.[2].

[2] Refer to buildingSMART International technical information at https://technical.buildingsmart.org/standards/ifc/

The solution will assist agencies in equipping their field staff with a simple method to access and view 3D design models, properties, and information during construction and inspection activities and ensure the as-constructed asset meets design requirements, materials properties, location, and dimensional requirements for acceptance and payment.

The solution can be either a stand-alone solution or a web-based solution. Stand-alone solutions must function on Microsoft, Android, and Apple iOS operating systems compatible with tablets and smart phones. Web-based solutions must work seamlessly in Safari, Edge, and Chrome browsers. The solution shall be designed with stakeholder needs in mind and undergo beta-testing through a FHWA approved group of personnel with a wide range of understanding of the subjects addressed by the solution and across different areas of responsibility.

The opportunity for commercialization in the United States is high. There are many State agencies that started the transition to digital delivery, utilizing 3D models as the legal document (MALD), and need capabilities for their construction and inspection staff to have access to the design model and information during construction, development of digital as-builts and hand off to asset management and maintenance.[3] Using the model viewer, design and construction teams can connect remotely to visualize design data, features, location, orientation, and specification requirements throughout construction. Intricate design features and details can be viewed geospatially, in three dimensions, from multiple perspectives, and used during construction to build and inspect the project. This solution would provide a simple way to implement and advance digital project delivery, utilize 3D design models during construction, and ensure the capabilities and use by field staff during construction. Highway construction contractors would also significantly benefit from the solution with an easy to use and affordable solution that is compatible with various design authoring software in order to bid on MALD and other digital projects. Companies involved in private infrastructure projects can use the solution to optimize digital workflows and ensure compliance with owner specifications. Consulting firms can use the solution to provide specialized design and compliance services to various clients. Designers and authoring software companies can use the solution to improve their products and demonstrate the IFC compliance to potential buyers and owners. Academic institutions can use the solution for educating and training the next generation of engineers and construction project managers. In the future, an effective solution could make its way into other markets such as airfield/airport markets, ports or trucking distribution markets, railway, and other commercial construction markets, or international markets where digital project delivery is deemed critical to project success, facility operations, and economic viability. Specific stakeholders that could be involved in the evaluation and testing phase include the FHWA, one or more State Highway Agencies (SHA) using design models for construction and inspection in the field, academic institutions, and contractors that are interested in implementing the technology and solution.

[3] To view a list of States who have received grants through the ADCMS Program visit the "Grant Applications" section of https://www.fhwa.dot.gov/construction/adcms/grants.cfm.

Expected Phase I Outcomes

The Phase I project is expected to result in a proof-of-concept report that:

- Describes the development of the proposed solution and its architecture;
- Provides preliminary design and layout, and proposed requirements; and
- Discusses how to achieve the most effective implementation within agencies and contractor operations.

This involves creating detailed documentation and diagrams that describe how each capability and workflow will be implemented and function. Flowcharts and diagrams must show the overall structure and organization of function with more specific diagrams showing the interactions between different components and modules. It should also involve creating mockups and visualizations of the solution to help stakeholders and other members of the development team visualize and understand the design. Demonstrating a successful proof-of-concept would include an initial build or prototype of the solution to demonstrate initial functionality.

A market analysis is also expected within Phase I to gather information about available systems and software that state highway agencies and contractors across the United States use for digital delivery and use of 3D models by construction staff.

Expected Phase II Outcomes

Phase II will include the development and demonstration of a market-ready solution for user testing and commercialization. Phase II shall perform further refinement of the Phase I concept and design to develop the final solution(s); and conduct analytical and experimental verification and testing. At the end of Phase II, the awardee will have developed a user-friendly solution that was tested in an operational environment with SHAs and contractors.

25-FH2: Modular Construction of Protected Intersection and Turbo Roundabout

In 2022, 7,522 pedestrians[4] and 1,084 bicyclists[5] were killed in traffic crashes, representing increases of 77 percent and 75 percent to the pedestrian and bicyclist fatalities in 2010, while all other traffic fatalities increased by 22%.[6] About two out of three pedestrian fatalities happened at locations with no sidewalk; about three out of four bicycle fatalities occurred in urban areas with poor bicycle infrastructure and lack of protected lane/space for cyclists. Meanwhile, the need to rely on walking and biking to school and work and other short-distance trips has been on a steady rise in major cities across the country. There is an urgent need to improve the safety for pedestrians and cyclists on the roadway network. Vision Zero is now embraced and officially adopted by most states and large cities; a key element of the Vision Zero policy is to drastically reduce pedestrian and cyclist fatalities by installing safe pedestrian and cyclist facilities along the roadway network.

Protected intersection is an innovative intersection design that uses corner islands and raised curbs to provide separate travel paths for motor vehicles, pedestrians, and cyclists. This design considers all modes of traffic but puts more emphasis on protecting and accommodating pedestrians and cyclists. FHWA has conducted a limited field evaluation which found that a protected intersection instills a higher sense of security to vulnerable road users and encourages people to use micromobility, such as walking, biking, and rolling, rather than cars for short-distance trips. According to the latest daily trip surveys, in the United States, 11 percent was done by walking, and 1 percent was done by biking[7]; in the Netherlands, 35 percent was done by walking and 26 percent was done by biking[8]; in Europe, 25 to 30 percent of daily trips was done by walking and biking[9]. Successful examples from other countries indicate that network level implementation of protected intersection design can induce a change in traffic modes, which could replace 10 percent (5,6) or more short-distance single occupant vehicle trips with micromobility trips, leading to reduced congestion and pollution, reduced need for parking spaces, and a more livable and enjoyable environment.

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[4] Insurance Institute for Highway Safety (IIHS): Fatality Facts 2022: Pedestrians. https://www.iihs.org/topics/fatality-statistics/detail/pedestrians

[5] Insurance Institute for Highway Safety (IIHS): Fatality Facts 2022: Bicyclists. https://www.iihs.org/topics/fatality-statistics/detail/bicyclists.

[6] Governors Highway Safety Association (GHSA): Pedestrian Traffic Deaths Fall for First Time Since Pandemic. https://www.ghsa.org/resources/news-releases/pedestrians24.

[7] League of American Bicyclists®. n.d. "National: Rates of Biking and Walking" (web page). https://data.bikeleague.org/data/national-rates-of-biking-and-walking.

[8] Ministry of Transport, Public Works and Water Management. 2007. Cycling in the Netherlands. The Hague, Netherlands: Ministry of Transport, Public Works and Water Management. https://bicycleinfrastructuremanuals.com/wp-content/uploads/2019/02/Cycling_in_the_Netherlands_Netherlands.pdf.

[9] Buehler, Ralph and John Pucher, "Walking and Cycling in Western Europe and the United States." TR News, Number 280, May-June 2012. https://onlinepubs.trb.org/onlinepubs/trnews/trnews280westerneurope.pdf.

One approach to a protected intersection is a turbo roundabout. A turbo roundabout is an innovative intersection design that uses raised lane dividers to separate vehicle lanes within the roundabout, eliminating weaving and angle conflicts near multi-lane exits. This design drastically reduces traffic crashes inside multi-lane roundabouts while providing better protection to pedestrians and cyclists.

Topic Objectives

Traditional methods of constructing protected intersections typically involve cutting and removing existing pavements, which can be expensive. This SBIR project seeks to develop a modular construction approach for converting existing intersections into protected intersections using methods that do not require cutting and removing existing pavement. To ensure long service life, the modular construction material shall be able to be assembled and expand horizontally to form the shapes of typically corner islands and longitudinal curbs; the assembled units shall form one integrated structure with well-conceived ductile design to absorb and distribute vehicle impact loads, while functioning as lane dividers or vulnerable road user refuge areas.

The traditional method of constructing turbo roundabout lane dividers uses the key-in approach, which also involves cutting and removing existing pavements. Lane dividers are slender elements that are prone to fail under repeated lateral vehicle impact loads. So far, there is no reliable product that can be installed directly on top of pavement and survive more than five years of repeated vehicle impacts.

This SBIR research topic seeks the development of a product that is modular, strong, durable, and capable of withstanding repeated heavy vehicle loads. The ultimate objective of this topic is to achieve a final product which can be used for constructing raised islands to convert an existing intersection into a protected intersection or raised lane dividers to convert a multi-lane roundabout into a turbo roundabout.

This SBIR topic aligns with the following FHWA AMRP Goals:

- Improving Highway Safety for All Users;
- Improving Infrastructure Integrity, Sustainability, and Practices;
- Promoting Equity, and Enhancing Environmental Decision-making;
- Reducing Congestion, Improving Operations
- Accelerating the Implementation and Delivery of New Innovations and Technologies
- Accelerating the Discovery of Transformational Solutions; and Crosscutting.

Proposed solutions must be a product which:

- Can be installed on existing pavement surface.

- Can be produced in different colors and surface textures to resemble conventional construction material such as concrete, brick, and stone.
- When assembled, will form an integrated structure and uses a ductile design mechanism to absorb and distribute vehicle impact loads.

Proposed solutions shall include material intended for use under high traffic environment, where the vehicle impact load may be any combination of compression, bending, and shearing, and where application sites may be located in extreme hot, cold, or wet environment. The installed product shall have service life of at least five years under the above conditions.

Potential customers include state DOTs, County and City Public Works Departments, and any other agency responsible for constructing and maintaining the roadway system. The links below show the types of intersections that the developed product may be used for:

- https://highways.dot.gov/sites/fhwa.dot.gov/files/FHWA-HRT-23-052.pdf
- https://safety.fhwa.dot.gov/intersection/roundabouts/fhwasa19027.pdf

Expected Phase I Outcomes

The Phase I effort will lead to a proof-of-concept report that includes:

- The development of at least three sample products, each of which will have color and surface texture resembling concrete, brick, and stone. The sample products should have compressive strength of 4,000 psi or above, and a minimum flexural strength of 500 psi, which is the typical strength for roadway concrete.
- Design details of how the modular material will be assembled or connected with each other to form an integrated structure; how the ductile design principle is implemented to absorb and distribute vehicle impact loads; and how the integrated structure is installed onto the pavement surface.
- Design features that enable slender structures such as lane dividers that are up to one foot in width to survive long term under vehicle impact load.

Expected Phase II Outcomes

Phase II outcome will include the construction of three intersections as demonstration projects: 1) two protected intersections with six lanes on a major road and 2) one turbo roundabout. The final report shall document the modular design, installation details, and lessons learned during the field implementation process.

25-FH3: Concrete Shrinkage Measurement Device

An increasing number of novel cementitious materials are emerging in the market and leading to renewed need for tests that can measure total shrinkage. Volume stability is a critical aspect of concrete pavement performance to reduce unwanted slab warping and cracking from shrinkage.

AASHTO R 101[10] identifies various shrinkage tests that can be performed targeting different types of shrinkage that cementitious materials may experience. Plastic, drying, chemical, autogenous, and carbonation shrinkage are all different types of shrinkage that can affect volume stability of cementitious materials. However, these different types of shrinkage are typically tested separately, with a different test method for each type of shrinkage.

Existing test methods do not sufficiently determine the total shrinkage from the time of initial stress development. Shrinkage test setups most commonly use length comparators to test shrinkage beginning 24 hours after casting samples and immediately after demolding. However, much of the chemical and autogenous shrinkage occurs during that first 24-hour period. The lack of volume stability measurements during the first 24 hours of concrete curing would also fail to capture expansion that may have occurred during the first 24 hours[11]. AASHTO R 101 identifies the AASHTO T 363 test[12] which can be performed to measure shrinkage and expansion of cementitious materials and allows for estimation of cracking potential. However, the test is not commonly conducted (there are only three devices for performing AASHTO T 363 in the United States) because the development of the device and test setup is labor intensive and is not available commercially.

This research topic and potential solution(s) will contribute to the Department's strategic objective of designing for the future by investing in purpose-driven research. Additionally, this work supports the FHWA strategic objective of enhancing the performance of the nation's transportation system through research and accelerated development and deployment of innovative technologies by enhancing the ability of the concrete industry to accurately measure total shrinkage and expansion in concrete infrastructure mixtures.

Topic Objectives

Overall, this SBIR topic seeks to develop a device to measure total shrinkage and expansion of cementitious materials immediately upon initial stress development. Furthermore, the solution

[10] AASHTO. 2022. Standard Practice for Developing Performance Engineered Concrete Pavement Mixtures. AASHTO R 101-22. Washington, DC: American Association of State Highway and Transportation Officials.
[11] De la Varga, I., R.P. Spragg, J.F. Munoz, M.A. Helsel, and B.A. Graybeal. 2018. "Cracking, bond, and durability performance of internally cured cementitious grouts for prefabricated bridge element connections." Sustainability, Vol. 10, Issue 3881, DOI: 10.3390/su10113881.
[12] AASHTO. 2017. Standard Method of Test for Evaluating Stress Development and Cracking Potential due to Restrained Volume Change Using a Dual Ring Test. AASHTO T 363. Washington, DC: American Association of State Highway and Transportation Officials.

will reduce the amount of testing needed to measure the volume change expected for novel and traditional cementitious materials. The solution may include test equipment for 1) performing AASHTO T 363, 2) measuring volume change from drying, chemical, and autogenous means concurrently, or 3) another type of test equipment suited for this purpose.

The solution to this challenge is creating test equipment that State Highway Agencies, industry professionals, and researchers can use to measure total shrinkage and expansion of mortar or concrete beginning immediately upon initial stress development.

Proposed solutions should:

- Identify the types of shrinkage (e.g., drying, chemical, carbonation, plastic, autogenous) that the proposed device can measure.
- Develop a device that should be useable in laboratory or field settings. If the device is intended to be used in the field, then it should be portable. The device should also be applicable for mortar or concretes, and should consider the effects of sample size, sample shape, edge effects, and temperature.
- Identify the amount of restraint associated with the test setup (i.e., the amount of friction from contact surfaces, whether the materials will allow for unrestrained movement, etc.).

Specific stakeholders that might participate in the evaluation and testing phase include the FHWA Office of Infrastructure R&D, one or more state highway agencies, building and transportation materials consultants, and academic institutions that are interested in implementing this technology to facilitate the comprehensive evaluation of novel materials emerging on the market. The combined chemical, autogenous, and drying shrinkage and potential early-age expansion are important avenues to exploring novel concrete materials solutions.

Commercialization potential might include potential buyers in the construction materials industry, State DOTs, and research laboratories across the cement and concrete industries. Commercialization should also include long-term support and necessary updates to the technology to meet standards changes and to facilitate the device's use with other emerging materials. For example, there might be different needs for measuring alkali-activated materials compared to traditional hydraulic materials.

Expected Phase I Outcomes

The Phase I project is expected to result in a proof-of-concept report that (1) describes the conceptual design and requirements of the proposed device for cementitious materials volume stability, (2) provides a detailed scientific basis for the operation of the device, and (3) shares a comprehensive description of the proposed prototype(s).

The report should:

- Include an estimated timeline for the prototype(s) production, evaluation, and accuracy verification;
- Discuss critical opportunities and obstacles to implementation;
- Provide schematics and/or shop drawings of the equipment and/or device;
- Identify if any current test methods would allow use of the proposed device;
- Identify how setting time will be accounted for when determining stress development;
- Evaluate the mechanism for measuring shrinkage and expansion;
- Provide example outputs that the device will generate, such as an excel spreadsheet providing volume change and time measurements, a graph displaying volume over time, or a net shrinkage measurement at one or more ages;
- Identify any necessary additional post-processing of the measurements or inputs;
- Illustrate a practical and tentative plan for conducting verification and demonstration in Phase II.

Expected Phase II Outcomes

Phase II will include the development and demonstration of a market-ready prototype device for user testing and possible commercialization with the ability to demonstrate the technology in a laboratory. Phase II shall perform further refinement of the concept, design, and fabrication of the prototype(s) and conduct analytical and experimental verification. To increase the likelihood of effective implementation, the experimental verification will include experimentation with:

- A wide range of concrete mixture types (e.g., paving, structural bridge deck, pre-cast).
- A wide range of cementitious materials (e.g., non-shrinkage grouts, ultra-high-performance concrete, PLC, natural pozzolan).

In Phase II, FHWA will also evaluate a delivered final prototype device(s).

B. Federal Motor Carrier Safety Administration (FMCSA)

About us: The mission of FMCSA's Office of Analysis, Research, and Technology is to reduce the number and severity of commercial motor vehicle (CMV) crashes and enhance the efficiency of CMV operation by: 1) providing data, producing statistics, and conducting systematic studies directed toward fuller scientific discovery, knowledge, or understanding, and 2) identifying, testing, and supporting technology transfer activities and deployment of CMV safety technologies.

25-FM1: Lidar-Based Tire Inspection

Tire inspections for commercial motor vehicles can be challenging for drivers and maintenance shops without the training and skills to perform an accurate inspection. Drivers typically kick tires or use a small bat to determine if the tires on the vehicle are below recommended pressure or flat. In addition, tires may be mismatched or damaged from a previous trip, making them apt to have a tire-related failure. Drivers and maintainers do not have access to tools that can provide a hands-off and accurate status of the vehicle's tires in the immediate state and over time.

While more and more devices are being equipped with Light Detecting and Ranging (LiDAR), there are few applications for it beyond photography. LiDAR represents a powerful tool for characterizing the environment and objects, including the application for tire inspection.

Topic Objectives

The overall solution to the challenges of tire inspections includes using an existing LiDAR device to evaluate tires on a commercial motor vehicle while maintaining a wear and damage record of the tires on the vehicle. The record must be able to associate a specific tire with the vehicle as well as the tire's position on the vehicle. When the vehicle is a combination unit, the solution must be able to recognize the trailer and the truck both as two different vehicles and as a matched set while in transit.

The solution should be able to detect abnormalities in the tire that indicate abnormal wear. Additionally, tires develop wear patterns or fingerprints over time that indicate the unique wear and damage they have experienced.

The user of the LiDAR enabled device should be able to analyze, document, and associate the scan to a power unit and a trailer prior to starting the inspection. The user should be able to perform a tire inspection of the vehicle by scanning each tire with the LiDAR enabled device. The user should be able to scan a large area of each tire (approximately 24 - 36 inches), depending on the visibility and body type of the vehicle, and obtain an analysis of each tire. The analysis should be able to tell the user if there is a problem with a tire that would prevent operation of the vehicle, such as a flat tire, and if there is a developing problem in the tire, such

as misalignment, tire size issues, etc. The system must also be able to associate a tire with its position on the vehicle. When tires are rotated, the system shall be able to update quickly.

All data for the vehicle shall be stored on the device and transferable by cellular to a web-based server for analysis. The web-based server shall associate every tire scan to its respective tire, vehicle, and tire position. The web-based server shall be able to analyze tire wear and wear patterns that indicate issues with the tire or vehicle.

The scanner must be a handheld device with built-in LiDAR. The advantage of using an existing LiDAR device is that more people can quickly adopt the technology with an application and a service subscription. The market for this device is large and could include both military and civilian privately owned vehicles. FMCSA is most interested in Motor Carriers with Commercial Motor Vehicles.

Expected Phase I Outcomes

The proof-of-concept report should include:

- A description of a successful demonstration of using LiDAR to evaluate tires with several typical issues.
- A framework for the intended web service to be developed in Phase II. The proposed solution can also be the "bones" of a web service.
- A report and presentation of lessons learned.

Expected Phase II Outcomes

A successful Phase II outcome is a substantially working system with vehicle and tire location association. The Phase II final report and presentation should include some tire analysis, a well-defined procedure for the tire inspection process, lessons learned, and future research opportunities.

25-FM2: Weight Equalization Smart Automatic Tire Inflation System for Commercial Motor Vehicles

Commercial Motor Vehicles (CMVs), contrary to common knowledge, do not equally share the weight of loads across all tires on the vehicle. In adjacent research, we find that when tires in a dual pair are equally inflated to the same air pressure, the load is not borne equally between the two tires. In addition, the adjacent research shows that collections of 8 tires on the drive axles of the power unit and the trailer axles on the trailer carry the weight quite differently. The result of an imbalance in the load on the tires reduces stopping power, decreases maneuverability, and increases the risk to the driver for crashes.

Since tires, even adjacent tires, respond differently to weather and road conditions, it makes sense that a single tire inflation figure for all tires on the vehicle is not improving the drivability of the vehicle. Often equal inflation pressures decrease the drivability. Given this, developing a new technology that can sense the load on each tire and adapt the inflation of the tires automatically will create a significantly safer road environment for all drivers. In addition, today drivers cannot change the tire pressures manually to mimic or prepare for changing conditions. For instance, a truck leaves Minnesota in January at -40F and drives to Miami, FL where the temperature is +80F. The change in temperature alone will dramatically increase the tire pressure as the truck moves south. Conversely, as the truck moves north, the pressures will decrease. Drivers cannot accurately stay ahead of this change while they drive. Also, drivers today perform per-trip inspections and rely on hammers and small bats to assess tire pressures, which is also inadequate.

Topic Objectives

A Weight Equalization Smart Automatic Tire Inflation System (WESATIS) for CMVs will automatically adapt for conditions while the truck is in motion creating a dynamic and accurate weight distribution on all tires in a group. These groups of tires on the trailer and drive axles of the truck will be more fuel efficient, wear the tires more evenly, provide significantly better stopping power, and improve maneuverability when the driver needs to make evasive movements to avoid accidents. This system would be expected to dramatically reduce CMV crashes, injuries and fatalities**.**

The system would have several components:

- A tire sensor that can wirelessly broadcast tire weight or strain information to an on-vehicle receiver.
- The receiver will notify the processor of the weight bearing on each tire.
- The processor will command the tire inflation system to inflate or deflate tires – within the safety parameters of the tire – to load balance the vehicle for optimal performance.
- The automatic tire inflation system will increase or decrease inflation on each tire.

- The microprocessor will continuously monitor the tire inflation and tire weight and make adjustments as conditions change.

At the core of the system would be sensors that measure weight. It is expected that the weight of the vehicle would be equally shared amongst all the tires on the drive axles and trailer axles. The accuracy of such a system might be +/- 50 lbs. of total vehicle weight (base vehicle weight +cargo weight) on that set of axles. For instance, a truck may be carrying 32,000 lbs. on the drive axles and 36,000 lbs. on the trailer axles. The system would ensure that the weight bearing of the drive axles is approximately 4000 lbs. each. On the trailer, the value would be 4500 lbs. All tires would bear the load equally. The system shall also have notifications to the driver if it is unable to inflate a tire (e.g. a nail in a tire that is letting air escape).

The system must operate with little driver interaction. Drivers should be notified that the vehicle is operational and carrying the load as expected. There must also be a warning system in case the truck's system is unable to keep a tire adequately pressurized.

The market here is quite large and could include military vehicles in addition to civilian privately owned vehicles. FMCSA is most interested in Motor Carriers with Commercial Motor Vehicles.

Expected Phase I Outcomes

The proof-of-concept report should include:

- A design of a prototype with some basic demonstrability of how the issues noted here would be addressed.
- System design and expected equipment and cost.

Market analysis to determine the market and associated cost parameters.

Expected Phase II Outcomes

Phase II should have a demonstrable system that can be shown on a CMV. The system shall be able to inflate and deflate based on a wireless tire-mounted sensor.

C. Federal Railroad Administration (FRA)

About Us: FRA's research, development, and technology (RD&T) mission is to ensure the safe, efficient, and reliable movement of people and goods by rail through basic and applied research, and development of innovations and solutions. Safety is U.S. DOT's primary strategic goal and thus, the principal driver of FRA's RD&T program. FRA's RD&T program also contributes to other U.S. DOT strategic goals because safety-focused projects typically yield solutions toward state of good repair, economic competitiveness, and environmental sustainability goals. The RD&T program also has an important role to play in workforce development.

FRA's RD&T program is founded on an understanding of safety risks in the industry. Hazard identification and risk analysis allows us to identify opportunities to reduce the likelihood of accidents and incidents, and to limit the consequences of hazardous events, should they occur. Key strategies include stakeholder engagement and partnerships with other researchers such as the Association of American Railroads, prioritization of projects, and conducting research through cost-effective procurement.

25-FR1: Non-Destructive Longitudinal Rail Stress Measurement Device

The U.S. railroad network spans over 140,000 miles consisting of seven Class I railroads, 22 regional, and 584 local/short line railroads.[13] A variety of different rails, ties, fasteners, rail anchors, and other components make up the network. Continuous welded rail (CWR), which has a longitudinal stress-free temperature or rail neutral temperature (RNT), makes up much of the network. When the rail heats up in the summer, significant compressive stresses can build up and cause a sudden track buckle to relieve the stress. These buckles derail trains with disastrous consequences and are one of the costliest forms of track-caused accidents.

To date, there is no robust way to measure or monitor the rail longitudinal stress or RNT without disturbing the railroad track. A device that can be readily used by field personnel to measure the longitudinal stress or RNT could identify locations that might buckle soon, and thus have the potential to prevent track buckle derailments. Such a device would serve the interests of the public and rail operators through enhanced rail safety and operational efficiency, which supports the U.S. DOT's strategic objectives for safety, state of good repair, and transformation.

Topic Objectives

This SBIR topic seeks to develop and demonstrate new technologies that can reliably measure RNT non-destructively and preferably without a zero-reference. Such a technology must be proven in the laboratory before field test to ensure accuracy and repeatability with numerous

[13] https://railroads.dot.gov/rail-network-development/freight-rail-overview

variables. The only device that effectively estimates internal rail stress without damaging the system is the VERSE(R) system. This system has drawbacks in that it is labor intensive since it requires users to unfasten clips, and it only works when the rail is in tension. This topic seeks a more efficient method and technology that can work with rail in tension and compression states.

The proposed technology should be able to obtain a reliable RNT measurement within 1 hour of track time and within 5 degrees of the actual RNT for various rails and track constructions. The other requirements are purposefully flexible as this is a new technology, and the main goal is repeatability and accuracy.

Expected Phase I Outcomes

The Phase I outcome includes a proof-of-concept report which describes:

- The proposed technology.
- Preliminary results of the demonstration of the technology in lab.
- Plans for future field testing.

Expected Phase II Outcomes

The Phase II outcome would be further validation of the prototype and the production of a pre-production prototype suitable for extensive field testing and demonstration with the potential for manufacturing at scale. Phase II should also include field tests on rail in varied track construction configurations (e.g., Wood vs. Concrete Tie, Cut Spike vs. Elastic fastener, etc.).

25-FR2: Development of Next Gen End of Train Device Technology

The U.S. railroad network spans over 140,000 miles consisting of seven Class I railroads, 22 regional, and 584 local/short line railroads.[14] This large and diverse system crosses various terrains, from remote rural areas and mountainous regions to densely populated urban centers. Communication between the front and rear of the train can be particularly difficult in mountainous areas where terrain blocks signals or in urban environments where interference is common.

End of Train (EOT) devices are crucial because they continuously monitor brake pressure and ensure communication between the end and head of the train. These devices communicate with the Head of Train (HOT) device, which can be more than a mile away, and help to maintain safe operations, especially during emergencies. As trains grow longer, with some now exceeding two miles, this communication becomes even more challenging, particularly on curving tracks or in difficult terrain.

EOT devices, developed in the 1980s and updated to two-way communication in the mid-1990s, have seen little technological advancement since. They monitor brake pressure at the rear of the train and trigger emergency braking when necessary. However, these devices have limitations, especially as train lengths increase and communication reliability becomes more critical.

FRA envisions a new generation of EOT devices that will address these limitations by enhancing communication frequency and signal reliability. These new devices could maintain more consistent and frequent communication by leveraging advances in battery life, alternative energy sources like air-driven generators, and modern digital communication systems. Additionally, they can improve safety by incorporating an emergency signal that transmits continuously until braking is confirmed.

Beyond communication, these new EOTs could offer benefits such as data management and cybersecurity features, providing real-time or downloadable data insights and ensuring system security.

Accidents such as the Granite Canyon incident in Wyoming underscore the importance of developing next-generation EOT devices. In that accident, communication between the EOT and the HOT device failed, preventing the activation of the emergency brake at the rear of the train. This communication failure allowed the train to accelerate uncontrollably, resulting in a fatal collision. Investigations revealed that the emergency brake signal from the EOT only transmitted for two minutes before stopping, further exacerbating the accident.

[14] https://railroads.dot.gov/rail-network-development/freight-rail-overview

The National Transportation Safety Board (NTSB) made two key recommendations in response to the incident: (1) increasing the frequency of communication checks between EOT and HOT devices, and (2) ensuring that emergency brake signals continue to transmit until they are received and addressed. While the FRA has not yet updated regulations to reflect these recommendations, developing new EOT technology that addresses these challenges is critical. Implementing these improvements could prevent similar accidents in the future by ensuring more reliable and continuous communication, enhancing both safety and operational efficiency across the rail network. By enhancing both rail safety and operational efficiency, these advancements serve the interests of both the public and rail operators, helping to maintain the reliability of the U.S. railroad network.

Topic Objectives

This topic seeks the development and demonstration of new technologies that enhance the efficiency and reliability of EOT devices. The topic's goals include increased frequency of communication between the EOT and HOT devices to ensure near-continuous monitoring, even over long distances or in challenging terrains. Additional objectives involve leveraging advancements in battery life and alternative energy sources to extend communication capabilities and developing more effective emergency signal systems that transmit continuously until they receive confirmation from the EOT. These innovations will provide greater safety, data management, and operational efficiency benefits for both rail operators and the public.

The performance requirements for this next generation of EOT devices are such that they must function reliably for all railroads, across all terrains, and without customization for specific routes. These devices must maintain consistent performance whether operating in mountainous, urban, or rural environments to ensure seamless communication over long distances regardless of track conditions or train length.

Expected Phase I Outcomes

The Phase I outcome includes a proof-of-concept report which provides:

- A detailed physical description of the proposed device(s) including renderings, drawings, or photographs.
- Descriptions of the device's communications framework and how they will interface with existing EOT/HOT technology.
- A description of how the device will be powered.
- A description of how the device will be protected against the environmental hazards of the rail environment.
- A description of how the device complies with current Federal regulations, while also improving the technology over current standards.
- An analysis of the proposed device's improvements over existing technology.
- An analysis of the feasibility of production, adoption, and maintenance.

The Phase I effort will produce a prototype, or "beta" version, of a "Next Gen EOT" system. The prototype may work with either existing HOT devices or a new "Next Gen" complementary HOT device. The awardee will collaborate with at least one railroad operator to test or demonstrate the system and collect feedback on the system's performance to prepare plans for Phase II enhancements.

Expected Phase II Outcomes

Phase II objectives include enhancing the Phase I prototype system based on the initial trials to improve the feature set and autonomy of the technology. The contractor will increase the number and type of demonstrations to broaden the application of the tool. FRA expects that a Phase II effort will require the awardee to have an established working relationship with a railroad to demonstrate the feasibility of a prototype.

25-FR3: Railroad Ground Hazard Mitigation Technology

Existing monitoring technologies to assess ground hazards along railroad rights of way such as slope failures, washouts, floods, rockfalls, and landslides tend to be designed for the specific territory and hazard making them site specific. While this supports safety risk management for known hazards, there is a gap in technology to identify and manage emerging hazards. As a result, there is a need for more efficient and effective hazard identification and warning system that serves the interests of the public and rail operators through enhanced rail safety and operational efficiency.

The challenge of this research topic is to develop technology to support an advanced ground hazard alert and notification system using railroad condition assessment data that provides improved technology to identify the hazard, location, and provides initial data to mitigate the operational risk. This research, and intended outcomes, support U.S. Department of Transportation safety, state of good repair, and future transformation strategic objectives.

Topic Objectives

This SBIR topic seeks the development and demonstration of new technologies to improve the efficiency and effectiveness of railroad ground hazard detection, monitoring, and warning systems.

The solution needs to:

- Enable industry assessment of ground hazard risks to locate specific areas of concern;
- Provide remote monitoring of these locations using satellite, weather, or other data generally available to the public;
- Develop effective automated warning algorithm to alert stakeholders of changes in conditions that pose a safety risk; and
- Support or advance implementation of a real-time Railroad Ground Hazard Detection, Monitoring and Warning System in cooperation with an operating railroad.

The commercialization potential has applications within the railroad community, including industry, suppliers, regulatory agencies, academia, and international counterparts.

Expected Phase I Outcomes

Desired Phase I proof-of-concept report and deliverables for this technology development should:

1. Demonstrate an adequate resolution to quantify a ground hazard in engineering terms using data from one or more data sources or sensors.
2. Support or advance implementation of a real-time Railroad Ground Hazard Detection, Monitoring, and Warning System in cooperation with an operating railroad.

3. Enable industry assessment of ground hazard risks to locate specific areas of concern; remote monitoring of these locations using satellite, weather, or other data generally available to the public; and development of effective automated warning algorithm to alert stakeholders of changes in conditions that pose a safety risk.

Expected Phase II Outcomes

Phase II outcomes should align with the level of effort and funding provided for Phase II. Phase II outcomes typically include further demonstration or validation of design/concept and/or prototype development.

Deliverables may include prototype iterations, software capabilities, or test results. Deliverables are typically documented in reports and not physically delivered to the Government.

The expected Phase II outcome is a demonstration of a working prototype that includes the following:

1. An alert system and one or more approaches that compiles and makes accessible the necessary algorithm for consumers.
2. Technology results.
3. A marketing plan.

25-FR4: Human Factors Fatigue Assessment System (HFFAS)

There is a growing need for research that measures levels of fatigue in locomotive engineers as documented in the Bipartisan Infrastructure Law, Transportation Review Board AR070 Committee Research Needs Statements, and FRA Office of Safety. Measuring fatigue of engineers during operation – either in real life or in a simulator – can play an important part in research and development (R&D) and testing and evaluation (T&E). This topic seeks novel approaches to measure fatigue using observational techniques instead of relying on self-reporting methodologies. Other modes have had success using similar systems (NHTSA, FHA, FAA, etc.) to measure types of fatigue.

Topic Objectives

FRA is seeking a system developed specifically to measure fatigue for locomotive engineers during operation on a simulator and actual engine using camera systems and multiple behavioral indicators of fatigue for near-real time assessment of fatigue for testing. This Human Factors Fatigue Assessment System (HFFAS) will be a software and hardware system suite that uses a camera system to measure multiple potential factors (e.g., facial expression analysis, body language assessment, movement statistics such as sway and speed deviations, etc.) to provide human factors analyses to determine the level of fatigue a locomotive engineer is experiencing. The objective of this topic is to develop a system that can measure behavioral indicators and antecedents of fatigue, analyze data, and provide a fatigue level measurement in near-real time. FRA may support system testing and demonstration at DOT's Transportation Technology Center (TTC) in Pueblo, Colorado for Phase II development activities.

The HFFAS shall use multiple behavioral indicators of fatigue to assess an overall fatigue level which users can validate against existing standardized measures of fatigue. Field equipment such as cameras, eye trackers, body trackers, etc. must be able to easily measure behavioral indicators in the HFFAS. The total combined weight of the entire system, including associated computer for analysis and near-real time data analysis and reporting, should not exceed 50lbs. The system does not need to be portable but shall be able to be relocated with 1-2 people. It does not need to be battery powered but shall at a minimum be powered via US standard electric cable with a ground. The system may include other non-invasive and non-contact devices as needed to attain accuracy and efficiency of fatigue measurement. Data shall be savable and exportable in a .csv file format. System shall be able to provide reasonable fatigue measurement while human subjects are wearing PPE. Fatigue measurements shall be validated against the NASA-TLX and should be validated against other fatigue measures.

Expected Phase I Outcomes

Phase I will include a proof-of-concept report describing:

- The solution and components to the system,
- Behavioral and/or psychophysiological measures,

- The method used to combine data into a fatigue score framework,
- Alternative analysis of existing systems,
- User and/or system requirements, and
- The initial prototype design.

Expected Phase II Outcomes

Phase II will include a final report indicating the:

- Results of the field testing and piloting,
- Validation of the system and measures,
- Demonstration of a fully developed system, and
- Identification of gaps in the initial design and recommendations to enhance and/or expand the system.

D. Federal Transit Administration (FTA)

About Us: The Federal Transit Administration's (FTA) mission is to improve public transportation in America's communities. In support of this mission, FTA's research vision is to advance public transportation by accelerating innovation that improves mobility, enhances transit operations, and ensures safety for all. The goal of FTA's SBIR program is to help small businesses grow by funding product development research in strategic areas such as safety, infrastructure, mobility, and other topics important to transit. The program helps invest in promising early-stage innovations that may otherwise be too high of a risk for private investors.

25-FT1: Exploring AI-based Predictive Maintenance for Public Transit Fleets (Buses)

"Predictive maintenance is an approach that tries to prevent catastrophic failure of scheduling maintenance operations and detects the type of failures on the basis of the current condition of the machine. It is also referred to in the literature as condition-based maintenance since it uses actual operating conditions of the equipment to predict the future state of the machine, using a model defined on the basis of historical data where sensors are applied in machinery to continuously monitor signals, or other appropriate indicators, to assess the health of the equipment."[15] Transit agencies can benefit from an intelligent predictive model that analyzes their transportation rolling stocks, determines the current conditions, predicts when they need to be replaced or rehabilitated, and determines the funding needed to replace in a future year to maintain the state of good repair.

Since many transit agencies do not have adequate analytical tools for predicting the service life of their fleets, exploring the use of AI predictive model would be a valuable resource for identifying their state of good repair needs and prioritizing their capital needs for fleet replacement and rehabilitation. This research topic will explore the potential of AI applications for predictive maintenance by harnessing the power of data-driven insights to optimize maintenance schedules, reduce downtime, and improve overall fleet performance improvements and safety.

Regarding the availability of data for this topic, potential offerors can explore FTA's National Transit Database (NTD) as a starting point. NTD was set up to be the repository of data about the financial, operating and asset conditions of American transit systems. Transit agencies report data on a number of key metrics including Vehicle Revenue Miles (VRM), Vehicle Revenue Hours (VRH), Passenger Miles Traveled (PMT), Unlinked Passenger Trips (UPT), and Operating Expenses (OE). However, this information might not be sufficient for the potential offerors to

[15] Cavalieri S, Salafia MG. A Model for Predictive Maintenance Based on Asset Administration Shell. Sensors (Basel). 2020 Oct 23; https://pmc.ncbi.nlm.nih.gov/articles/PMC7660343/.

conduct their research on this topic. For any data need for this topic, potential offerors need to coordinate and work with any transit agency/ies of their choice.

Topic Objectives

One of the main objectives of the research in Phase I is to conduct a feasibility-study of the potential solutions of AI use for predictive maintenance opportunities in public transportation systems, mainly for transit fleets (buses). It also includes a thorough review of relevant information, such as studies, reports, industry publications, and market trends to help establish the foundational knowledge to identify potential risks, challenges, and key success factors for the use of AI approaches in predictive maintenance applications.

As AI technology advances, there are growing benefits and increasingly sophisticated predictive maintenance solutions. This technology has the potential for:

- Real-time Monitoring: enable real-time monitoring of transit fleet conditions to allow immediate intervention when maintenance issues arise.
- Enhanced Diagnostics: analyze data with even greater precision, pinpointing the root cause of potential problems and enabling more targeted repairs.
- Diagnosing Vehicles: as vehicles become even more intelligent, they will be capable of self-diagnosing problems and communicating maintenance needs directly to fleet managers.
- Integration with Other Technologies: seamlessly integrate AI with other technologies such as autonomous vehicles to further optimize logistics and transportation operations.

The integration of AI innovations in preventive maintenance offers numerous benefits for fleet management, including:

- Reduced Downtime: by predicting potential failures and proactively scheduling maintenance, the AI can reduce vehicle downtime to ensure fleet vehicles are always in optimal operation condition.
- Cost Savings: AI-driven preventive maintenance helps to identify and address issues before they escalate, reducing the need for expensive repairs.
- Improved Operational Efficiency: real-time monitoring and automated maintenance schedules enhance operational efficiency by ensuring prompt and accurate performance of maintenance tasks.
- Enhanced Safety: by ensuring that vehicles remain in optimal condition, AI innovations in preventive maintenance contribute to improved safety for drivers and passengers.

The future of preventive maintenance could be shaped by several emerging trends in AI technology with:

- The integration of AI with the Internet of Things (IoT) devices will further enhance predictive maintenance capabilities. IoT sensors can provide a wealth of data on vehicle performance, which AI algorithms can analyze to predict and prevent failures.
- The development of more advanced machine learning algorithms will enable even more accurate predictions of vehicle failures. These algorithms will be able to analyze vast amounts of data and identify patterns that may not be apparent to human analysts.
- Cloud-based AI solutions will allow fleet managers to easily access and analyze data from anywhere. This will facilitate better decision-making and ensure efficient maintenance activities.

For small businesses, incorporating AI can provide competitive advantages such as the ability to streamline operations, predict market trends, and respond to customer demands with greater agility. The technology can empower these businesses to reduce their operational costs by proactively managing their inventory, enhancing supply chain transparency, and optimizing delivery routes.

The following references provide additional information to help support this topic.

- https://cms.uitp.org/wp/wp-content/uploads/2020/08/UITP-AP-CTE-AI-in-PT-Executive-Summary-Dec-2018_0.pdf
- https://www.researchgate.net/publication/382622809_The_Impact_of_AI_and_Cloud_on_Fleet_Management_and_Financial_Planning_A_Comparative_Analysis/link/66a56b464433ad480e80bee6/download?_tp=eyJjb250ZXh0Ijp7ImZpcnN0UGFnZSI6InB1YmxpY2F0aW9uIiwicGFnZSI6InB1YmxpY2F0aW9uIn19
- https://papers.phmsociety.org/index.php/ijphm/article/view/3583
- https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7660343/

Expected Phase I Outcomes

The Phase I proof-of-concept report should define the concept solution with specifications for designing, building, and testing in Phase II.

Expected Phase II Outcomes

Phase II should build on the Phase I concept to develop a working prototype, in the form of a software or tool, that has undergone demonstration and testing at a transit agency. The Phase II awardee must work with at least one transit agency to test and demonstrate how the product will work.

E. National Highway Traffic Safety Administration (NHTSA)

About us: The National Highway Traffic Safety Administration's (NHSTA) mission is to save lives, prevent injuries and reduce economic costs due to road traffic crashes, through education, research, safety standards and enforcement activity. NHTSA's research offices are the Office of Vehicle Safety Research and the Office of Behavioral Safety Research. The Office of Vehicle Safety Research's mission is to strategize, plan, and implement research programs to continually further the agency's goals in reduction of crashes, fatalities, and injuries. Our research is prioritized based on potential for crash/fatality/injury reductions and is aligned with Congressional Mandates, along with DOT and NHTSA goals. The Office of Behavioral Safety Research studies behaviors and attitudes in highway safety, focusing on drivers, passengers, pedestrians, and motorcyclists, and uses that to develop and refine countermeasures to deter unsafe behaviors and promote safe alternatives.

25-NH1: Automated Police Crash Report Data Collection and Management Software

In support of five DOT innovative principles and the National Highway Traffic Safety Administration's (NHTSA's) Annual Modal Research Plan, this project aims to develop software with automation features and capabilities that integrates into current crash report software of law enforcement agencies (LEAs).

Law enforcement officers are tasked with completing crash reports and submitting crash information to entities overseeing their agency's jurisdiction, such as the state-level Department of Transportation or Department of Motor Vehicles. To help NHTSA gather more robust data, crash reports should be accurate, complete, uniform, timely, accessible to users of data, and in a format that supports data integration with other data and systems, in accordance with NHTSA's Model Performance Measures for State Traffic Record Systems. However, officer exposure to traffic while capturing crash information increases their risk of being involved in a secondary crash. Additionally, forms that officers submit may have issues such as incomplete, missing, or inaccurate data. Data and data quality may not be uniform and may vary widely within and between agencies, creating difficulties in comparisons and missed opportunities for identifying contributing factors. Further, completing the forms may take a significant portion of the officer's time, which may lead to poor quality data as the officer may rush or not have enough time to complete their task. NHTSA is mindful of officer roadway exposure to secondary crashes and inaccuracies in data collection and looks for ways to reduce risk while improving data quality. Discrepancies between reported crash characteristics and actual crash characteristics lead to biases not only in NHTSA's crash fatality and injury data, but also the state's records. As such, findings and results are affected, and the implications supported by the statistics may be invalid. Data-driven programs, policies, and procedures that are implemented as a result are not precise.

For this project, NHTSA will collaborate with small business researchers to explore the use of automation to reduce police officer exposure to secondary crashes and assist in populating police crash reports of LEAs. As such, the automation must fully integrate into various crash report software used by LEAs. This partnership will also assist NHTSA in enabling LEAs to increase accuracy, timeliness, completeness, and uniformity of crash reports through the reduction of missing data and coding errors. This will improve accessibility and integration, thereby improving the quality of the data NHTSA uses for its Fatality Analysis Reporting System (FARS).

The proposed SBIR project also aligns with NHTSA's FY2023 and FY2024 AMRP program areas for the Office of Behavioral Safety Research (OBSR): Highway Safety Research. A key component of highway safety research is the monitoring and measurement of safe and unsafe driving behaviors to track progress and identify emerging safety problems, all of which are captured as elements in crash reports.

Topic Objectives

This SBIR topic seeks the development of software with automation features and capabilities that integrates into various LEAs police crash report software to more efficiently capture and manage crash information and populate the fields on the crash report, limiting exposure of law enforcement to traffic. Information that the automation software collects must align with the Model Minimum Uniform Crash Criteria (MMUCC). MMUCC represents a minimum, standardized set of data variables to describe motor vehicle traffic crashes. This can help to identify traffic safety problems and design countermeasures to improve traffic safety nationally and in each state. Overall, the software must collect data at the crash, vehicle, and person level using a combination of input methods. It must also add officer identification. The software must allow for differences in data collection formats as states and territories vary in how they gather and submit data elements. All Personally Identifiable Information (PII) and Public Health Information (PHI) safeguards must follow the same protocols which LEAs currently use.

The software with automation features and capabilities must employ a variety of collection methods, including:

- Geolocating to determine the location, date, and time;
- Integrating Federal Highway Administration's (FHWA's) Model Inventory of Roadway Elements (MIRE) data to determine roadway characteristics and traffic inventory elements;
- Capturing an image of the scene and drawing inferences from photo contents and positioning of such contents;
- Pulling current location-based weather and lighting conditions; and optical character recognition for scanning capabilities.

Additionally, the software must collect, transcribe, and integrate officer narrative. One example is the ability to perform speech-to-text transcription. The automation software should also be able to create and add a crash diagram to the record. Type ahead, or predictive text, and keywords for text fields must be an incorporated feature. The software must collect and integrate FARS data elements at the crash, vehicle, and person level found on NHTSA's Fatality Injury Reporting System Tool (FIRST). For example:

- Crash Level Data Elements: Time-based data (e.g., date, day of week, weekend, minute), Atmospheric conditions (e.g., snow, cloudy, severe crosswinds), Crash type (e.g., single vehicle), First harmful event (e.g., collision with fixed object)
- Vehicle Level Data Elements: Vehicle type (i.e., make, model, body class), Vehicle identification (VIN, license plate number, registration State and County), Owner and address, Motor carrier or responsible entity (i.e., type and identification)
- Person Level Data Elements: Identity, Ejection, Injury type and severity, Person type (e.g., driver, pedestrian), Related factors – Person level (e.g., overcorrecting, improper lane usage), Demographics (e.g., age)

The proposed project will accept any software and hardware platforms. The performer should, to the extent feasible, describe the potential for, and any challenges with, integration with market-prevalent software and hardware platforms available to consumers.

Commercialization potential is expansive as all police agencies in the United States may adopt the automation software to streamline management operations and data collection. The Federal Bureau of Investigation reports that in 2023, there were 19,156 law enforcement agencies.[16]

The awardee should demonstrate a knowledge of recent publications in automation, especially integrating data of different formats and sources into one record. Knowledge of automation systems that can generate new content, such as text and images, is necessary for project success.

Expected Phase I Outcomes

The Phase I outcomes should include:

1. Collection of data sufficient to address the specifications from the topic description and table above.
2. Prototype design and specification for the Automated Police Crash Report Data Collection and Management Software to address the project's requirements.
3. Proof of Concept paper including a testing plan to determine, at a minimum, the software's sensitivity, validity, and reliability with a sufficient sample size for meaningful

[16] https://cde.ucr.cjis.gov/LATEST/webapp/#/pages/le/pe

analyses. The paper should also discuss the feasibility for LEAs use, and any potential legal issues.

Expected Phase II Outcomes

Phase II outcomes should include a functioning prototype of the Automated Police Crash Report Data Collection and Management Software. The prototype must demonstrate the ability to integrate officer information and crash-level, vehicle-level, and person-level data consistent with MMUCC standards into police crash reports software of LEAs to fully populate the fields and be amendable as agencies require.

Phase IIb outcomes should include: Law enforcement must be able to determine the following based on a demonstration of prototype.