



**TDOT**  
Department of  
Transportation

# Research Manual

August 2021

Research Program

Long Range Planning Division

Tennessee Department of Transportation

# Table of Contents

- 1 Introduction ..... 1
  - 1.1 Manual Purpose ..... 1
  - 1.2 Legal Authority ..... 1
  - 1.3 Research Work Program ..... 2
- 2 Research Program Overview ..... 3
  - 2.1 Purpose ..... 3
  - 2.2 Research Activities ..... 3
  - 2.3 Research Strategic Direction ..... 4
    - 2.3.1 FY2021-2025 Strategic Research Priorities..... 4
    - 2.3.2. Program Goals..... 4
  - 2.4 Research Staff..... 5
  - 2.5 Research Funding ..... 5
  - 2.6 Partners & Stakeholders ..... 5
- 3 Roles and Responsibilities ..... 7
  - 3.1 Research Office Staff ..... 7
  - 3.2 Research Oversight Task Force (ROTF) ..... 7
  - 3.3 Executive Leadership..... 8
  - 3.4 TDOT Lead Staff ..... 8
  - 3.5 Technical Advisory Committees (TACs)..... 9
  - 3.6 Principal Investigator..... 10
  - 3.7 Federal Highway Administration ..... 11
- 4 Project Development ..... 12
  - 4.1 TDOT Research Project Partners ..... 12
  - 4.2 Call for Projects ..... 12
    - 4.2.1 Call for Research Needs Statements..... 13
    - 4.2.2 Call for Proposals..... 15
  - 4.3 Quick Response Program ..... 18
    - 4.3.1 Project Identification and Approval..... 18
- 5 Project Management ..... 20

5.1 Contracting.....	20
5.1.1 Contract Amendments.....	20
5.2 Project Meetings .....	21
5.2.1 Project Kickoff Meeting.....	21
5.2.2 Quarterly Progress Meetings .....	22
5.2 Invoicing .....	22
5.2.1 Final Invoice .....	23
5.3 Reporting.....	23
5.3.1 Progress Reports.....	23
5.3.2 Final Reports.....	24
5.4 Capital Equipment Purchases .....	24
5.4.1 Inventory.....	25
5.5 Intellectual Property .....	25
5.5.1 Special Instructions for Software.....	26
5.6 Project Closure .....	26
6 Evaluation.....	27
6.1 Internal Feedback .....	27
6.2 External Feedback.....	27
6.3 Performance Metrics.....	28
7 Implementation.....	29
7.1 Preliminary Assessment.....	29
7.2 Implementation Plan.....	30
7.3 Status Report.....	30
8 Technology Transfer .....	32
8.1 Methods for Technology Transfer .....	32
8.2 TDOT Technology Transfer Activities .....	33
8.3 Tennessee Technical Assistance Program.....	33
9 National Research Activities .....	34
9.1 American Association of State Highway Transportation Officials (AASHTO).....	34
9.1.1 Research Advisory Committee.....	34
9.1.2 Technical Service Programs.....	34

9.2 Transportation Research Board.....	35
9.2.1 Cooperative Research Programs.....	35
9.3 Transportation Pooled Fund Studies .....	35
9.4 Every Day Counts .....	36
9.5 State Transportation Innovation Council .....	36
Glossary of Terms .....	37

# 1 Introduction

## 1.1 Manual Purpose

The purpose of the Tennessee Department of Transportation's (TDOT) Research Manual is to provide an overview of the Research Program's processes and procedures for conducting and implementing transportation research. This manual is specifically aimed to provide research agencies and Principal Investigators (PIs) clear expectations and requirements when conducting research for the State of Tennessee. This manual will be reviewed and updated annually as TDOT's Research Program is expanded and new procedures are developed.

This manual provides guidance on the following:

- Roles and responsibilities of those involved in the research process.
- The research needs identification process and the proposal solicitation and selection processes.
- Project management procedures, including contracting, invoicing, and reporting.
- The evaluation process to be completed once the research project has concluded.
- The implementation of research findings.

## 1.2 Legal Authority

Federal and state codes provide specific authority for the conduct of transportation research by the Tennessee DOT.

### State

The authority for TDOT to perform research is set forth in Tennessee Code, Title 4, Chapter 3, Part 23, which states in part: "The commissioner has the power and duty to: ... (9) Undertake programs of transportation related to investigation, research and operation of safe, adequate and efficient transportation modes."

### Federal

The authority for a state research organization to use federal funds is found in Title 23 United States Code (USC) Section 505 and Title 23 of the Code of Federal Regulations (CFR) 420.

The authority for a state to administer the State Planning and Research (SPR) funds in the program is found in 23 CFR 420, Subpart B.

## 1.3 Research Work Program

The Research Office, along with Long Range Planning's Administration Office, work to prepare the Research Work Program on a biennial basis, documenting all research activities funded by SPR Part B funds. The work program provides the basis for approval by the Federal Highway Administration (FHWA) to fund the various research activities the Department engages in. Once approved, TDOT may proceed with projects as documented in the work program. Modifications can be made to the work program throughout the 2-year period; however, significant changes to the program require FHWA approval.

FHWA's requirements for "Research, Development and Technology Transfer (RD&T) Program Management" are established in 23 CFR 420. Requirements for the Research Work Program are set forth in 23 CFR Section 420.207 as follows:

- a) "The State's RD&T work program must, as a minimum, consist of a description of RD&T activities to be accomplished during the program period, estimated costs for each eligible activity, and a description of any cooperative activities including the State DOT's participation in any transportation pooled fund studies and the NCHRP. The State DOT's work program should include a list of the major items with a cost estimate for each item. The work program should also include any study funded under a previous work program until a final report has been completed for the study.
- b) "The State DOT's RD&T work program must include financial summaries showing the funding levels and share (Federal, State, and other sources) for RD&T activities for the program year. State DOTs are encouraged to include any activity funded 100 percent with State or other funds for information purposes.
- c) "Approval and authorization procedures in Sec. 420.115 are applicable to the State DOT's RD&T work program."

## 2 Research Program Overview

### 2.1 Purpose

The Research Office coordinates the Department's Research Program. The Research Program strives to be responsive to the agency's research priorities and strategic direction as well as emerging transportation topics and critical research ideas.

The program's goal is to provide solutions, information, and tools to TDOT's decision-makers and subject matter experts to meet the needs of the Department, residents, and visitors of Tennessee. Additionally, the program focuses on funding applied research to produce practical findings that can be integrated into TDOT's business practices.

#### **Mission**

*To enhance Tennessee's transportation system through high-quality research that leads to the adoption of efficient technologies, innovation, and best practices.*

### 2.2 Research Activities

The Research Office plans, monitors, reviews, and coordinates the selection, completion, and implementation of transportation research projects supported by the Department. The Research Office also acts as the lead for transportation research efforts for the State and supports national transportation research programs and organizations.

The Research Office's current primary activities include:

- Sponsored research through the Call for Projects. The Call for Projects occurs in two stages: 1) the solicitation of research ideas through a Call for Research Needs Statements, and 2) the subsequent request for proposals based on chosen research needs through a Call for Proposals. As part of the Call for Projects, the Research Office will:
  - Identify transportation research needs for the Department.
  - Solicit, evaluate, and recommend research projects for funding.
  - Work with TDOT Lead Staff and researchers to monitor progress and the fulfillment of project scopes.
  - Ensure all TDOT sponsored research is compliant with federal regulation, including working with FHWA to receive approval for research activities included in the Research Work Program.
  - Assist and document implementation efforts of research findings when appropriate.

- Disseminate research findings and reports to the appropriate units.
- Manage TDOT's participation in Transportation Pooled Fund (TPF) studies.
- Coordinate research-related activities with national programs, such as the National Cooperative Highway Research Program (NCHRP), Airport Cooperative Research Program (ACRP), Behavioral Traffic Safety Cooperative Research Program (BTSCR), and Transit Cooperative Research Program (TCRP).
- Act as the TDOT liaison to national transportation associations, such as the Transportation Research Board (TRB) and the American Association of State Highway Transportation Officials' (AASHTO) Research Advisory Committee (RAC).

## 2.3 Research Strategic Direction

The Research Program is guided by the Research Strategic Plan, developed in 2021 to provide a roadmap for programmatic and research activities. The plan established four strategic research priorities and five program goals.

### 2.3.1 FY2021-2025 Strategic Research Priorities

Based on the research needs discussed in the outreach meetings with directors and the prioritization of TDOT's Guiding Principles identified by the 25-Year Long Range Transportation Plan, the strategic research priorities for the Research Program were established.

1. *Security, Preservation, and Enhancement of the Existing System*
2. *Emerging and Enabling Transportation Technologies Implementation*
3. *Organizational Transformation*
4. *Multimodal Mobility Solutions Benefiting Safety and the Tennessee Economy*

### 2.3.2. Program Goals

To best improve the Research Program and incorporate the findings uncovered through the development of the Research Strategic Plan, five goals have been identified to guide the program over the next five years. The FY2021-2025 Research Program goals are:

1. *Enhance and streamline the research cycle processes and procedures.*
2. *Develop and strengthen relationships with stakeholders.*
3. *Increase the visibility and accessibility of the Research Program.*
4. *Increase the effectiveness of the Research Program.*
5. *Drive innovation and technology transfer efforts.*

## 2.4 Research Staff

The Research Office staff administers and manages research activities funded through Title 23 of CFR Section 420, Subpart B (SPR Part B) funds, ensuring the capture of research findings, deliverables, and technology transfer on behalf of TDOT. The staff provides the means to TDOT employees and universities to collaborate effectively and produce research, data, and products that enhance the innovative capabilities of the Department.

Currently, the Research Office is made up of the:

- 1) Research Office Supervisor
- 2) Advanced Research Specialist
- 3) Research Planning Specialist

The Research Program is also heavily supported by a Program Monitor specializing in contracting and invoicing, housed in Long Range Planning’s Administration Office. Additionally, the program relies on subject matter experts throughout the agency to provide project oversight and support throughout the research life cycle.

## 2.5 Research Funding

The majority of the Research Program’s budget comes from SPR Part B funds, with the State providing a 20 percent match for eligible projects, anticipating a total annual budget of approximately \$5.5 million. The annual budget is used to fund TDOT sponsored research projects, participation in TPF studies, the Local and Tennessee Technical Assistance Program (LTAP & TTAP), and contributions to national research programs (e.g., NCHRP).

## 2.6 Partners & Stakeholders

The Research Program has numerous stakeholders that have both an interest in and benefit from the research activities TDOT conducts and engages in.

*Table 1 Research Program Stakeholders*

<b>Stakeholder Type</b>	<b>Stakeholder Group</b>	<b>Members</b>
<b>Partner</b>	Internal Partners	TDOT Lead Staff, Research Oversight Task Force, executive leadership
	External Partners	FHWA-TN Division, Tennessee Universities, Consultants
<b>Primary Stakeholder</b>	TDOT	All TDOT divisions and staff
	Other State Agencies	All Tennessee state agencies

<b>Secondary Stakeholder</b>	Federal Agencies	USDOT and FHWA
	Planning Organizations	TN Metropolitan Planning Organizations, TN Rural Planning Organizations
	National Research Organizations	TRB, NCHRP, AASHTO, American Transportation Research Institute (ATRI), American Society of Civil Engineers (ASCE)
	Tennessee Stakeholders	Tennessee residents and visitors
<b>Other Stakeholder</b>	Businesses, Local Communities	Transportation industry, associations and trade groups, service providers (public and private), municipalities, authorities, and other traditional and non-traditional interests in transportation

## 3 Roles and Responsibilities

TDOT employees, research partners, and our federal partners each play a vital role in the success of the research process. Roles and responsibilities of those involved in the research process are described below.

### 3.1 Research Office Staff

Research Office staff are responsible for the day-to-day operations of the Research Program. Research staff team up with TDOT subject matter experts and research institutions to conduct transportation related research for the State of Tennessee.

The role of the Research Office staff includes but is not limited to:

- Developing the Research Work Program for approval by FHWA.
- Developing and implementing policies and procedures governing the Research Program.
- Coordinating and monitoring all research activities for TDOT.
- Soliciting research needs statements from internal and external stakeholders for the Call for Projects.
- Coordinating the Call for Projects, including the review of proposals by subject matter experts both internal and external to the Department.
- Ensuring compliance with both federal and state regulations and policies.
- Issuing contracts and monitoring the progress of research projects, budgets, and deliverables.
- Coordinating evaluations of all completed research projects.
- Assisting the Department in implementing research findings, as appropriate, to help achieve TDOT's mission.
- Disseminating research information to internal and external stakeholders.
- Coordinating TDOT's national research presence in AASHTO, TRB, NCHRP, ACRP, BTSCR, TCRP, and TPF studies.

### 3.2 Research Oversight Task Force (ROTF)

Beginning Fiscal Year (FY) 2022, the ROTF will advise the Research Program on research priorities for the Department and make recommendations for the Call for Projects. The Task Force is

comprised of key technical staff from various divisions across TDOT and meets on a quarterly basis.

The responsibilities of the ROTF include:

- Assisting in the coordination of transportation research activities and the development of TDOT's Research Program.
- Determining research themes (when applicable) for the Call for Projects.
- Leading the research need identification process for the Call for Projects and make recommendations to TDOT's executive leadership.
- Supporting the research proposal review and evaluation process and making recommendations to TDOT's executive leadership.
- Identifying Lead Staff to manage research projects and lead implementation activities.
- Approving implementation plans for research findings and recommendations.
- Assisting in identifying Technical Advisory Committee (TAC) members for research projects.
- Reviewing and approving Transportation Pooled Fund requests.
- Supporting, promoting, and assisting in the documentation of the "Culture of Innovation" within the Department, including the utilization of new technology wherever possible.

### 3.3 Executive Leadership

TDOT's executive leadership, consisting of the Department's Commissioner and Bureau Chiefs, are responsible for setting the overall direction of the Research Program to ensure it helps achieve TDOT's mission and meet its responsibilities to develop and maintain Tennessee's transportation system.

Executive leadership supports the activities of the Research Program by:

- Advising the Research Program of TDOT's strategic needs and priorities.
- Reviewing and approving project recommendations for the Call for Projects as put forth by the ROTF.
- Executing signature authority for contracts.

### 3.4 TDOT Lead Staff

Lead Staff are crucial partners with the program and researchers to ensure that research projects are effectively and efficiently managed and implemented.

The Research Program relies upon TDOT Lead Staff to perform the following tasks as part of their project responsibilities:

- Recommending Technical Advisory Committee (TAC) members for a research project.
- Developing research needs statements further into the Research Request for Proposal (RRFP).
- Confirming research projects address questions that are important and relevant to TDOT's ongoing programs and mission.
- Reviewing research project proposals and scopes of work to ensure they are clear and have well-defined objectives.
- Scheduling and leading kickoff meetings for a project.
- Reviewing and approving quarterly, interim, and final reports to provide guidance to researchers on the technical aspects of the research during the life of a contract.
- Identifying and resolving project complications as they occur during the life of a project.
- Communicating with Research Office staff on a regular basis, especially regarding project complications or challenges.
- Tracking the financial aspects of a project to ensure that the project is achieving progress commensurate with project expenditures.
- Reviewing, correcting, and approving invoices and eligible expenses.
- Evaluating all research deliverables for technical soundness, ensuring the research objectives were properly fulfilled.
- Assisting in reviewing and approving final reports.
- Developing and leading implementation plans for research projects and implementing research results, as applicable.

## 3.5 Technical Advisory Committees (TACs)

For projects initiated FY 2022 and beyond, each research project has a TAC made up of subject matter experts with topical expertise related to a specific research project. TAC members can be internal to the Department or can be an external public partner. The size of a TAC may vary, but a TAC should, at minimum, include two subject matter experts to provide direction to the research team and evaluate technical aspects throughout a research project. An established TAC can provide technical expertise to more than one project, as long as the members are able to devote sufficient time.

TAC members, other than the Lead Staff person, have responsibility for the following:

- Assisting in the development of the RRFP for the project they will advise.

- Reviewing proposals received in response to the RRF. TAC members can recuse themselves should there be any conflict of interest in whose proposals they review.
- Participating in quarterly meetings and monitoring project progress.
- Providing technical advice and direction to the research team, such as coordinating field selection and testing, procuring data sources, and directing communications.
- Reviewing and evaluating all research deliverables for technical soundness, ensuring the research objectives were properly fulfilled.
- Reviewing and making recommendations to Lead Staff on requests to modify contracts, specifically modifying the scope of work and project schedule.
- Assessing the researcher's findings and recommendations.
- Assisting with the development of implementation plans for research projects and supporting implementation efforts, as applicable.
- Other marketing or presenting that will bring greater notoriety to noteworthy research.

## 3.6 Principal Investigator

The Principal Investigator (PI) is the researcher selected for the research project. The PI conducts and manages the research tasks as defined in the proposal. A research project may also include Co-Principal Investigators (Co-PIs), graduate students, subconsultants, and other research team members.

The role of the PI and other research team members includes:

- Leading the research team and providing other project researchers with clear direction.
- Maintaining research team focus on project tasks, objectives, and deliverables.
- Providing quarterly invoices and progress reports on a timely basis.
- Managing the budget, scope, and project schedule.
- Identifying, communicating, and resolving research problems as they occur during the life of the project.
- Initiating contract amendments to accommodate the need for changes to the project budget, scope, or schedule.
- Maintaining regular contact with TDOT Lead Staff, TAC members, and the Research Office.
- Preparing and submitting all project deliverables, as well as responding to comments and feedback and making revisions as appropriate.

- Ensuring compliance with the executed contract and all Research Office policies and procedures.
- Being the expert lead in the subject researched for the awarded project.

## 3.7 Federal Highway Administration

As TDOT's Research Program is funded in part by federal funds, FHWA provides oversight for regulatory compliance.

FHWA has responsibility for the following:

- Reviewing and approving the Research Work Program.
- Authorizing federal research funds as requested by TDOT.
- Serving on the ROTF and TACs as appropriate.
- Providing approval of TDOT's procedures for selecting and implementing research activities, research final reports, and tracking program activities.
- Evaluating the Research Program from time-to-time for federal compliance.

## 4 Project Development

TDOT’s Research Program strives to provide both state and local decision makers with the information and tools they require to address critical transportation concerns in Tennessee. The program ensures Tennessee’s transportation system meets the current and future needs of our residents, communities, and the traveling public.

The majority of TDOT led research is completed through the biennial Call for Projects. The Call for Projects involves the collection of research ideas from TDOT staff and external partners and a request for proposals from Tennessee university researchers. In addition to the Call for Projects, research can be conducted through the Quick Response Program.

### 4.1 TDOT Research Project Partners

TDOT contracts for research with in-state, public and private universities. Universities have extensive facilities and faculty that meet the expertise required to complete transportation research. Research conducted for TDOT also provides students with valuable experience by working on real-world problems.

In-state universities may subcontract with out-of-state universities and other public and private institutions to conduct research. All subcontracts must receive prior written approval by TDOT. Currently, project application leads must be from in-state universities.

### 4.2 Call for Projects

The Call for Projects occurs in two stages: 1) the solicitation of research ideas through a Call for Research Needs Statements, and 2) the subsequent request for proposals based on chosen research needs through a Call for Proposals. The typical schedule for the Call for Projects is depicted in Table 2.

Table 2 Biennial Call for Projects Schedule

<b>Call for Projects Schedule (by Calendar Year)</b>	
<b>September</b> (odd year)	Research ideas solicited for the upcoming fiscal year (4 weeks)
<b>October</b> (odd year)	Deadline for research idea submission
<b>November</b> (odd year)	Research ideas approved by executive leadership
<b>December</b> (odd year)	Call for Proposals is posted (6 weeks)

<b>January</b> (even year)	Call for Proposals closes
<b>February</b> (even year)	Proposals/researchers approved by executive leadership
<b>March</b> (even year)	Awards announced
<b>Summer</b> (even year)	Projects under contract

Note: Schedule deviations may occur as deemed necessary by the Research Office or TDOT executive leadership.

### 4.2.1 Call for Research Needs Statements

Research ideas to be considered for funding can be submitted to TDOT by anyone, but the Research Office specifically solicits research ideas from internal staff, Tennessee university researchers, and Tennessee Metropolitan Planning Organizations (MPOs). These ideas are the basis for the Call for Proposals.

Ideas submitted should support both the mission of the agency and the Research Office. All ideas must also align with at least one of the 4 strategic research priorities established by the FY 2021-2025 Research Strategic Plan.

1. Security, Preservation, and Enhancement of the Existing System
2. Emerging and Enabling Transportation Technologies Implementation
3. Organizational Transformation
4. Multimodal Mobility Solutions Benefiting Safety and the Tennessee Economy

Prior to soliciting research needs statements (RNSs), the ROTF is convened to review the strategic research priorities and, if applicable, one or multiple themes for the Call for Research Needs Statements are developed to address Department-wide goals and efforts.

#### **Process Overview**



Figure 1 Call for Research Needs Statements Process Overview

#### 4.2.1.1 Research Needs Solicitation

The Call for Research Needs Statements is posted on TDOT's web page and announced via email to TDOT staff, Tennessee university researchers, and MPOs. For the FY 2022 call, the Research Office will be launching the use of the WebGrants system to accept research ideas; detailed instructions on how to submit a research needs statement can be found on the Research Office website. The solicitation for research ideas is open for 4 weeks to allow ample time to submit ideas. There is no restriction on how many ideas can be submitted by TDOT staff, but submitters outside of TDOT are limited to two RNSs per cycle.

An RNS asks the submitter to provide the following:

- **Research Problem Description** – A brief description of the transportation research problem to be investigated.
- **Previous Research** – Notes if this research idea is related to or a continuation of a TDOT research project. If so, the submitter must note the project.
- **Urgency and Anticipated Benefits** – Description of why the research need is urgent and a list of the likely benefits to TDOT.
- **Potential Implementation** – Description of the potential policy implementation of the research results. The area of implementation should be as specific as possible.

Additionally, submitters are asked to identify TDOT Divisions that could be affected, the most relevant strategic research priority, and any keywords associated to the research idea.

#### 4.2.1.2 Research Needs Selection

Once the submission window closes, Research Office staff review the ideas for any duplication, either within the particular call, or to see if the research need has been studied by either the Department or other state DOTs previously.

The RNSs are then reviewed and ranked by the Division Director(s) associated with the research idea, as identified by the submitter. Reviewers are asked to consider the following as they evaluate the RNS:

- Does this research solve an important problem?
- Does the research align with the needs of the Division/DOT?
- Could this research significantly improve or potentially replace TDOT's current practices?
- Would this research be innovative?
- Does the research have a clear path to implementation? Could it be altered slightly to achieve a clearer path?

The top ranked statements are presented to the ROTF, who then determine the statements to be developed further for the Call for Proposals. For the selected RNSs, ROTF members will also

recommend Lead Staff and TAC members, who will then be tasked with developing the formal Research Request for Proposal.

#### 4.2.1.3 Research Requests for Proposals

The assigned Lead Staff and TAC members are given two weeks to complete the Research Request for Proposal (RRFP). The RRFP template can be found on the Research Office website. The RRFP further develops the research need, including:

- **Problem Statement** – Provides a clear and concise description of the issue that is to be researched and explains the problem to be addressed.
- **Research Objectives** – Describe what the research should achieve. Should be as precise as possible as the research objectives drive the research methodology, including data collection, analysis, and ultimately the recommendations.
- **Minimum Research Deliverables** – List a minimum of all specific deliverables the researcher is expected to provide to TDOT during or at the conclusion of the research project.
- **Benefits and Implementation** – Explain how TDOT anticipates the research findings to benefit the Department, the state of Tennessee, its partners and/or the traveling public. Describe how the findings are expected to be implemented by TDOT and/or its partners.
- **Research Team Requirements** – Describe the specific expertise needed by the research team to conduct the research. Identify any key disciplines that should be represented on the team, as well as any known specific involvement needed from consultants, industry representatives, material suppliers, or other organizations.
- **TDOT Assistance** – List the support TDOT can provide to the research team throughout the duration of the project.
- **Estimated Cost and Project Duration** – Provide the estimated cost of the completing the research and the estimated timeframe.

The RRFPs are then provided to TDOT's executive leadership for approval. Once approved, the proposal requests are used for the Call for Proposals.

### 4.2.2 Call for Proposals

The RRFPs developed by Lead Staff and TAC members form the basis for the Call for Proposals. TDOT generally partners with Tennessee university researchers or federal agencies, who are asked to draft research project proposals to best address TDOT's research needs.

### Process Overview



Figure 2 Call for Proposals Process Overview

#### 4.2.2.1 Proposal Solicitation

The Call for Proposals is announced via TDOT's website and by email to allow Tennessee researchers to respond to the RRFPs developed by Lead Staff and TAC members.

For the FY 2022 Call for Proposals, the Research Office will be launching the use of the WebGrants system to accept and review research proposals. Detailed instructions on how to submit a research proposal via WebGrants can be found on the Research Office website. The call is open for 6 weeks to allow researchers adequate time to develop proposals. Researchers are limited to submitting 4 proposals for a given call and can only submit one proposal per RRF.

Components of the proposal are as follows:

- **Problem Description** – Details on the extent of this problem in Tennessee, including an explanation of the fundamental parts of the issue. This outlines the applicant's understanding of the issue for the State.
- **Objectives of the Research** – A description of what the research seeks to accomplish. These are the technical objectives upon which the project team is to focus attention and upon which research efforts are to converge. The objectives should clearly and concisely identify the expected products of the research effort.
- **Related Literature** – A brief narrative about current research and where gaps in research exist.
- **Scope of Work** – Description of the activities that are expected to be completed throughout the life of the project. The tasks must be assigned specific deadlines.
- **Methodology** – Explanation of the methods that will be incorporated in order to better understand the problem and potentially improve it. At a minimum, this section should describe how data will be collected, how data will be analyzed, what tools/materials will be used to accomplish the research, and the rationale for choosing those methods.

- **Additional Benefits/Potential for TDOT's Implementation** – Explanation of the benefits and opportunities for implementation TDOT will get through this applied research. This section should also answer the question: How will the benefits be realized through implementation?
- **Quality of Facility and Equipment** – A description of what the entity offers that will make this project easier for TDOT to pursue and what existing resources can be employed to assist the researcher in this project.
- **Research Team** – Information on all members of the research team should be provided, including their role, their estimated time commitment, project responsibilities, and each staff member's qualifications. The minimum expectations of graduate assistants should also be provided.
- **Additional Documentation** – Researchers are required to provide their Curriculum Vitae.
- **Budget** – A breakdown of the requested budget to complete the research. Researchers are also required to provide a narrative and justification for the requested budget.

#### 4.2.2.2 Proposal Selection

Subject matter experts internal and external to TDOT will be asked to review the research proposals to determine the best proposal for each research need. Reviewers score all assigned proposals and provide comment; these scores and comments are used to determine which proposals are selected and awarded. Refer to the *Research Proposal Evaluation Form*, found on the Research Office website, to understand what reviewers are asked to consider when evaluating the research proposals. Should two or more of the top proposals be scored closely, the Research Office staff will convene the subject matter experts to discuss the proposals and select a final recommendation to the ROTF.

The ROTF reviews the highest scoring proposals and the corresponding research PIs to make final recommendations to TDOT's executive leadership, who then provides final approval before the awards are made.

The selected researcher will receive an award letter from the Research Office. Submitters of proposals that were not selected will also be notified in writing.

If modifications to the proposal are requested, the Research Office will provide the request for revisions and a deadline for providing a revised proposal. Multiple modifications may be requested. If the researcher is unable to revise the proposal accordingly, the researcher and research agency will be notified in writing that the proposal has been rejected. TDOT may then select and negotiate with another submitter, if multiple proposals were received, or issue a special Request for Proposals to solicit new proposals.

Once the requested modifications have been made, all necessary documents are provided to Long Range Planning's Administration Office to start the contracting process, discussed in section 5.1.

## 4.3 Quick Response Program

While the majority of TDOT’s research needs are addressed through the competitive Call for Projects, the Quick Response Program allows the Research Office to address high-priority or emergent research needs in a timely manner as they arise. Quick Response projects are expected to be completed within one year and cost \$100,000 or less.

The Quick Response Program utilizes a non-competitive process to ensure the research need is addressed promptly, but it is the Research Office’s policy to make non-competitive awards only when necessary and under one or more of the following circumstances:

- The research need is critical to TDOT and the proposed research timeline does not align with the biennial Call for Projects.
- The Principal Investigator/research agency is the only entity known to possess the capability to perform the work.
- The Principal Investigator/research agency has proprietary information that best addresses the research need(s).
- The Principal Investigator/research agency has done substantial work or research on the topic previously, particularly with the Department, making them best suited to further advance the research and practice for the State of Tennessee.

### Process Overview

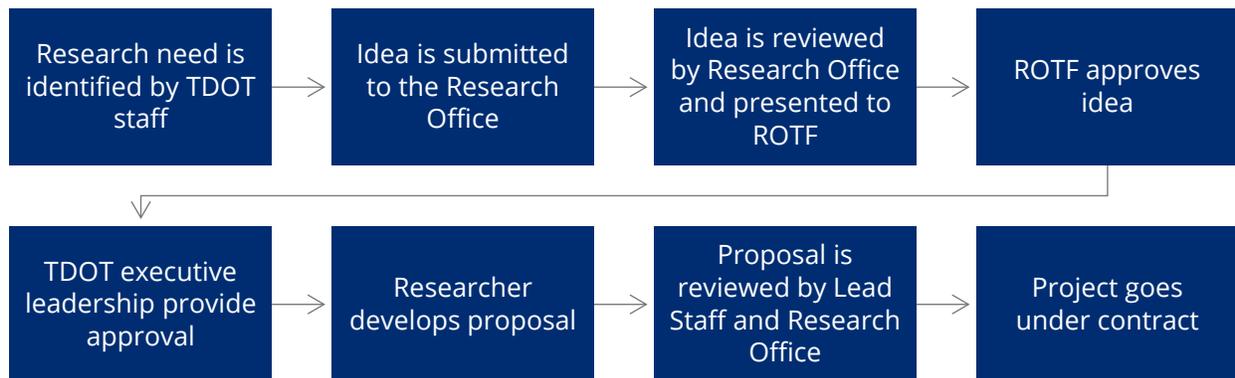


Figure 3 Quick Response Program Process Overview

### 4.3.1 Project Identification and Approval

TDOT staff discover a high-priority or emergent research need within their division or area of expertise and submit the research idea to the Research Office to be considered for funding. The template to develop the research need to be considered for funding through the Quick Response

Program can be found on the Research Office website. At this stage, the submitter is asked to identify the appropriate researcher best suited to find the solution for the research need.

Research staff review the proposal request to ensure the research need has not been addressed by projects funded by TDOT or other state DOTs and national programs previously. The proposal request is presented to the ROTF, who are asked to review the request to confirm the research is of critical need to the Department and recommend it for approval by TDOT executive leadership.

Once approved, the requested researcher is asked to develop a proposal for Lead Staff and Research Office staff to review and approve. The proposal must address all the same components as outlined in section 4.1.2.1. If any modifications are necessary, the Research Office will engage in the same negotiation process as discussed in section 4.1.2.2. The final proposal is passed to Long Range Planning's Administration Office to begin the contracting process (See section 5.1).

## 5 Project Management

The project period consists of three portions: project initiation, project execution, and project closeout. Project initiation consists of the contracting phase, culminating in the notice to proceed being issued (section 5.1). The project execution phase begins with the project kick-off meeting, continues with (at minimum) quarterly meetings to discuss project progress and obstacles, invoices, progress reports, final reports, and the submission of other contractually obligated deliverables (sections 5.2-5.3). The project is terminated in the project closure period, wherein deliverables have been accepted, a final presentation has been completed, and the Research Office pays the final invoice and closes the project with TDOT and FHWA. At that time, any capital purchases or copyrighted materials that come under TDOT's ownership should be turned over (sections 5.4-5.5).

### 5.1 Contracting

Once a proposal has been finalized, the Research Office, in coordination with Long Range Planning's Administration Office, will prepare and forward a contract to be approved by the appropriate TDOT signatories and the research agency. The Research Office has a Delegated Grant Authority (DGA), allowing the contract process to be streamlined and the approval process to be expedited. Because of the DGA, research project contracts all follow a standardized template, requiring the contract terms to be consistent no matter the project or research agency.

Once the contract has been approved by all required signatories and the funds have been authorized by FHWA, the Administration Office will issue the notice to proceed to the research agency along with the fully executed contract. No work can begin prior to the notice to proceed being issued; any work completed prior to the date indicated on the notice to proceed will not be reimbursed by the Department.

#### 5.1.1 Contract Amendments

Contract amendments are managed on a project-by-project basis. A contract can be amended up until 90 days prior to the contract end date. Contract amendments can encompass the following:

- Revising the scope of work
- Extending the contract terms
- Updating the PI(s)
- Significantly modifying the contract budget (greater than 20 percent per line item)

All contract amendments must be first discussed with and agreed to by Lead Staff before they are submitted to the Research Office. Contract amendments will only be processed if a valid justification is provided.

For FY 2022 projects, the Research Office will be launching the use of the WebGrants system to accept and process contract amendments. For projects initiated prior to FY 2022, the *Amendment Request Form*, found on the Research Office website, should be utilized.

## 5.2 Project Meetings

### 5.2.1 Project Kickoff Meeting

Each research project sponsored by TDOT's Research Office must hold a kick-off meeting at the onset of the project. The purpose of the meeting is to bring all involved parties together to establish a shared understanding of the research objectives, deliverables, project milestones, and workflow. To ensure a successful research project that will adequately address the need identified by the Department, the kick-off meeting serves as an avenue to establish a plan for communication and coordination for the duration of the project.

The kick-off meeting should be initiated by the TDOT Lead Staff person managing the project. Attendees should include: the project research team, TDOT Lead Staff, TAC members, and a Research Office representative. All templates and forms for the kick-off meeting can be found on the Research Office website.

The kick-off meeting agenda should be drafted by Lead Staff in consultation with the PI. The kick-off meeting must at minimum include:

- Introductions of the project research team, the Lead Staff person, TAC members, and Research Office representatives.
- An overview of the project, including the research need, project scope, research objectives and goals, expected methodology, as well as the planned tasks and deliverables. This should be led by the Lead Staff and PI.
- Discussion of the project team roles and responsibilities, including the roles of the project research team, Lead Staff and TAC members, and the TDOT Research Office. This should be discussed by the Research Office representative participating in the meeting.
- Discussion regarding the project schedule, including documenting the dates of quarterly progress meetings and documenting the expected completion dates of deliverables and tasks. This will be led by both the Lead Staff person and the PI.
- Implementation planning, including the *Research Implementation Preliminary Assessment* as discussed in section 7.1. This is the responsibility of the Lead Staff and TAC members.
- Lastly, project next steps and action items for the project team must be discussed, which is led by the Lead Staff person and the PI.

## 5.2.2 Quarterly Progress Meetings

During the kick-off meeting, a schedule for quarterly progress meetings is established. The project research team, Lead Staff, and TAC members shall adhere to the schedule established, ensuring they meet, at minimum, on a quarterly basis.

PIs are to prepare an agenda and, if necessary, a presentation for these progress meetings. These meetings should be used to discuss the status of the research project, progress since the last update, any challenges that may have arisen, and the need for a contract amendment modification if necessary (see section 5.1.1).

## 5.2 Invoicing

The Research Program will only reimburse for actual costs incurred throughout the project period. Any costs incurred before the date indicated on the notice to proceed or after the contract completion date are not eligible for reimbursement. For FY 2022 projects, the Research Office will be launching the use of the WebGrants system to accept and process all invoices.

Invoices are reviewed by Lead Staff and the Research Office Supervisor. Lead Staff ensures all project deliverables have been met for the period of the invoice and the effort/progress made throughout the reporting period aligns with the amount invoiced. The Research Office Supervisor will review the invoice line items to assure eligibility and compare with the corresponding quarterly report. If the invoice exceeds the project's progress as detailed in the progress report, the invoice will not be processed, and the research agency will be notified and asked to revise the invoice appropriately.

Should an invoice exceed approved funds or otherwise be incomplete, the invoice will be returned to the research agency for revision. To reallocate project funds within the approved budget categories or to request additional funds, see detailed information regarding contract amendments in section 5.1.1.

In order for an invoice to be processed, the following requirements must be met:

1. Invoices should be submitted for reimbursement quarterly, with all necessary supporting documentation. Required documentation includes a labor schedule, itemized reports for fringe benefits, mileage logs, copies of receipts for travel expenses, and copies of bills and proof of payment for project expenses.
2. All Personal Private Information (PPI) should be removed from all reimbursement backup documents. Examples of PPI are social security number, personal tax information, bank account/routing numbers, electronic funds transfer/automated clearing house forms and credit card information, etc. The PPI should be blacked out in all locations of backup documents.
3. An invoice will not be paid unless the corresponding quarterly progress report is also submitted and the work performed as detailed in the progress report is deemed

satisfactory by TDOT. The reporting period on the progress report must align with the invoice.

4. An invoice should only include reimbursement requests for actual, reasonable, and necessary expenditures required in the delivery of service under the contract and the expenses will be subject to the contract budget.
5. An invoice cannot include any reimbursement request for future expenditures.
6. Quarterly expenses must reflect the work that was accomplished during the reporting quarter.
7. Supporting documentation, such as travel reimbursement forms, must reflect the exact amount requested for reimbursement. If exclusion of unrelated expenses or items is not possible, applicable items must be clearly identified. For example, if your agency groups all travel information together and is unable to extract the travel information for specific employees, any pages that do not contain information for reimbursable employees must be removed and applicable pages must be highlighted, circled, asterisked, or check marked, etc. accordingly.
8. For out-of-state travel reimbursements, a previously Research Office-approved travel authorization form must be included with the supporting documentation.
9. Required supporting documentation for expenses should be in chronological order according to when the expense was incurred.

## 5.2.1 Final Invoice

Once a research project is complete, a final invoice that includes all applicable charges must be submitted for review and processing within 90 days of the contract completion date. The invoice must be marked as "final," which signifies the completion of all contractual and financial obligations associated with the project.

The final invoice will only be processed by the Research Office if all deliverables, necessary copyrightable material, including the final report, have been sent to and accepted by TDOT. The Research Office will withhold payment of the final invoice until all contractual obligations have been fulfilled as required. Once a final invoice has been processed, the project will be closed and no further requests for payments will be considered.

## 5.3 Reporting

### 5.3.1 Progress Reports

Progress reports should provide a succinct summary of the work performed over the reporting period. These reports detail the progress made on tasks, list of deliverables and significant results provided to TDOT throughout the quarter, and proposed activities for the next quarter.

Deliverables and copyrighted items should be provided to TDOT as they are completed and can be submitted with progress reports. Additionally, progress on potential implementation and any challenges or research barriers should also be noted.

Progress reports provide a record of expenditures and are used to validate and process invoices. For FY 2022 projects, the Research Office will be launching the use of the WebGrants system to accept and review all progress reports.

### 5.3.2 Final Reports

All research projects require the submission of a final report, which, at minimum, must document “the data collected, analyses performed, conclusions, and recommendations,” as per 23 CFR §420.209. The final report marks the conclusion of the research and once accepted, will trigger the project closeout process.

Extensive instructions regarding the requirements for final reports and the submission process are outlined in the *Procedures and Guidelines for Research Final Reports* found here: <https://www.tn.gov/content/dam/tn/tdot/long-range-planning/research/templates/Procedures%20and%20Guidelines%20for%20Research%20Final%20Reports.pdf>. PIs should follow these guidelines as closely as possible. The Research Office will require revisions for deviations from these guidelines. All requested revisions will be provided in writing to ensure transparency.

## 5.4 Capital Equipment Purchases

The use of non-expendable capital equipment is often necessary to fulfill the objectives of a research project. Capital equipment refers to tangible property (including information technology systems/software) with a life of one year or more and a per-unit cost of \$5,000 or more.

Capital equipment is considered eligible under the following conditions:

- The equipment is necessary to complete the research.
- The equipment is not normally used in regular operations of the research agency.
- The cost of the equipment is considered reasonable/at market value.

Anticipated capital equipment purchases must be identified in the project proposal, which is reviewed and approved by the Research Office and FHWA. Capital equipment not identified in the proposal must be approved by Lead Staff, the Research Office Supervisor, and FHWA prior to the actual purchase of the equipment.

Multiple quotes (at minimum 3) must be obtained for capital equipment purchases. Once purchased, all equipment information must be included in the corresponding invoice once reimbursement is requested, including the model number by manufacturer, serial number, and date purchased.

All capital equipment (equipment valued at \$5,000 or more) will become the property of TDOT once the research project is concluded, unless otherwise agreed upon by the Department. Equipment valued at \$4,999 or less may be retained, sold, or otherwise disposed of by the research agency with no further obligation.

## 5.4.1 Inventory

To comply with 2 CFR 200, it is necessary that all capital equipment items purchased with federal funds are inventoried in accordance with State of Tennessee procedures.

The contracted research agency is responsible for the accountability, maintenance, management, and inventory of all capital equipment purchased with the funds provided under a research contract. The research agency must inventory equipment annually and submit an inventory control report that includes, at minimum, the following:

- Description of equipment
- Manufacturer's serial number or VIN number
- Inventory equipment tag number
- Acquisition date, cost, and check number
- Fund source, State Grant number or other fund source identification
- Percentage of state funds applied to purchase
- Location used
- Condition of the property or disposition date if the grantee no longer has possession
- Depreciation method (if applicable)
- Monthly depreciation amount

The research agency must tag equipment with an identification number which is cross referenced to the equipment on the inventory control report. TDOT must be notified in writing if any equipment is lost, describing the reasons for the loss. Should equipment be destroyed, lost, or stolen, the research agency is responsible to TDOT for the pro rata amount of the residual value at the time of loss.

At the conclusion of a contract, the Research Section will initiate the equipment disposition process for all inventoried items.

## 5.5 Intellectual Property

TDOT and the grantee are also subject to the provisions of 37 CFR Part 401 governing patents and inventions. If a research project results in patent applications, TDOT and the federal government retain a royalty-free, nonexclusive, and nontransferable license. The PI/research

agency must notify TDOT of any patent applications resulting from work performed under a TDOT sponsored research project.

TDOT retains the ownership, right, title, and interest, including ownership of copyright, in all deliverables described in or developed as a result of a research contract. These items must be turned over to TDOT during the project period. Examples of copyrightable material include documents, computer source code, computer software, methodologies, models, templates, processes, testing assessment tools and scenarios that are created, designed, developed derived, documented, installed, or delivered under the research contract.

### 5.5.1 Special Instructions for Software

Software developed or purchased for use by TDOT must comply with the software guidelines developed by its Information Technology (IT) Division. The responsible TDOT Lead Staff person should review proposed software development and submit the necessary information for approval, if needed. Lead Staff will be provided with a contact person in the IT Division for required coordination.

## 5.6 Project Closure

Upon all final deliverables and presentations being accepted, the Research Office will notify the Long Range Planning Division's Administration Office to pay the final invoice for the project. At the same time, the Research Office will submit the final report to the necessary library collections as required by FHWA.

The Research Office will also create a two-page summary document for public distribution that highlights the findings and importance of the research project. They are written for the general public and policy makers. Fact sheets are used to market the research results to a broad audience. They highlight the issue(s) addressed, briefly describe the research conducted and provide an overview of the results and recommendations. Both the two-page summary and the accepted final report will be provided to the PI and posted on the Research Office's website.

Once the final invoice is paid and the deliverables are appropriately filed, the Research Office will notify the Administration Office to close the project with TDOT through the Program Development and Administration Division. The Program Development and Administration Division will complete the internal closure process and notify FHWA to officially close the project. At this time, no further corrections to invoices can be made and no further reimbursements can be issued.

## 6 Evaluation

As the management of a research project is a key indicator of success, the Research Office has established an evaluation process to gather feedback from project stakeholders, taking effect in September 2021. By gathering feedback, the Research Office can appropriately respond to stakeholders, ultimately improving the research process and the performance of all parties.

### 6.1 Internal Feedback

Once a research project has concluded and all final deliverables have been provided to the Department, the Research Office will send an evaluation survey to Lead Staff and TAC members (when applicable). Lead Staff and TAC members will be asked to evaluate the following:

- The quality of the research deliverables
- The communication skills of the PI
- The responsiveness of the PI
- The technical expertise of the PI
- The likelihood the respondent would work with the PI again
- The clarity of the research process
- The clarity of the expectations for Lead Staff and TAC members
- The communication and customer service skills of the Research Office

The evaluation of the PI will serve as a mechanism to provide feedback and create opportunities for the PI to respond accordingly and improve performance in the future. The evaluation(s) will be considered in the proposal and PI selection process in future Calls for Projects.

### 6.2 External Feedback

An evaluation survey will also be sent to the PI to assist in evaluating the value and support received throughout the lifecycle of the project by the Lead Staff person, TAC members (when applicable), and the Research Office.

The feedback received from PIs will be considered when selecting Lead Staff and TAC members for future research projects. This will also assist in balancing internal feedback and its effect on future proposals from PIs.

This evaluation will address:

- The communication skills of the TDOT representatives

- The responsiveness of TDOT
- The expertise of the Lead Staff and other TAC members
- The likelihood the respondent would like to work with TDOT members again
- The clarity of the project processes and procedures
- The customer service skills of the Research Office
- Additional feedback as it relates to improving the research process overall for PIs, Universities, and other entities conducting research for the state DOT

All feedback received regarding the performance of the Research Office will be reviewed and recommendations will be considered to improve the research process.

## 6.3 Performance Metrics

The purpose of performance metrics is to improve program effectiveness over time by evaluating the effectiveness of projects and their management. The Research Office tracks many output metrics from the program and from individual projects to assist in relating the benefits of the program to the DOT and the agency's stakeholders. The Fixing America's Surface Transportation (FAST) Act placed greater emphasis on recording metrics at the DOT level, and many divisions and offices have followed suit at TDOT.

Current output metrics include items reported on to FHWA and items reported to the Research Office through progress reporting by PIs. Reports to FHWA provide data on number of projects in a fiscal year, the number of projects on time, the funding for each project, the number of TPF projects, and the number of projects completed. Progress reports provide data to the Research Office on the percent of work accomplished, the percent of time elapsed, and the percent of funds expended by project.

The Research Office is currently testing the reporting capabilities of the WebGrants system. Through the web application, program and project-related data will be aggregated to produce more in-depth reporting on the benefits of the Research Program through more quantifiable means. In the coming years, this section will be updated as the application's reporting becomes automated. Examples of data expected include average duration of projects, percent of projects completed on time, number of amendments and the most common kinds, implementation status, and other evaluative metrics.

## 7 Implementation

TDOT's Research Program aims to fund practical research projects to find solutions for the complex issues facing the agency, developing effective pathways from research to practical application. A key component of a successful research project is the implementation of applicable findings. Implementation of findings may include better decision-making by key stakeholders, informing or changing current practices and procedures within the agency, or a tangible product to be adopted by the Department.

The implementation process takes place throughout the research project life cycle and can continue after the research contract is complete. This implementation process will take effect for new projects beginning in FY 2022, all forms can be found on the Research Office website.

### 7.1 Preliminary Assessment

Lead Staff and TAC members are responsible for completing the *Research Implementation Preliminary Assessment*. The preliminary assessment ensures implementation is considered at the onset of the research project and TDOT is properly preparing to implement the findings once the project is concluded. The assessment should be completed prior to the project kickoff meeting and discussed with the project team at the meeting.

Throughout the duration of the research project, particularly at quarterly update meetings, the assessment shall be reviewed for accuracy and revised as appropriate.

The preliminary assessment requires the following to be considered:

- What are the expected final deliverables?
- What are the anticipated implementation activities?
- What are the anticipated benefits for TDOT?
- How will the benefits/success be measured?
- Are there any anticipated barriers to implementation?
- To implement the research findings, will collaboration with other TDOT Divisions, state agencies, local transportation agencies, and/or other organizations be necessary?

The preliminary assessment is subjective. Further investigation may require significant changes to the implementation plan throughout the life of the project and entire research lifecycle.

## 7.2 Implementation Plan

Once the research findings are provided to TDOT, Lead Staff and TAC members shall complete the *Research Implementation Plan* at an appropriate progress meeting. While this may commonly not happen until the research has concluded, there are some cases where the findings may be evident earlier. Through completion of the implementation plan, Lead Staff, TAC members, and the Research Office will have a definitive understanding of how the research findings will be implemented within the Department or through partnerships with other agencies and organizations. If the research project does not result in implementable findings, the justification must be noted in the implementation plan, but no further action is required by Lead Staff or TAC members.

If a research project results in implementable findings, the implementation plan must be reviewed and approved by the ROTF. Lead Staff is responsible for leading the implementation effort of the research findings. The Research Office's role is to provide support in the progress toward implementation and should be an active participant in its realization.

The implementation plan requires responses to the following:

- What are the final research deliverables?
- Did the research result in findings that can be implemented at TDOT?
- How will the findings be implemented?
- When will implementation occur?
- What is the estimated cost of implementation?
- What are the benefits to TDOT?
- How will the benefits/success be measured? When will they be quantifiable?
- Is additional assistance needed to implement the findings? Who should this assistance be provided by?

## 7.3 Status Report

To allow the Research Office to best track the implementation of research findings, Lead Staff will be asked to complete the *Research Implementation Status Report*. Based on the implementation timeline provided, the Research Office will reach out to Lead Staff once implementation is expected to be complete.

The status report asks the following:

- What is the status of implementation?
- Were any challenges encountered throughout the implementation process?

- What was the cost of implementation?
- What are the realized benefits to TDOT?
- Is additional assistance needed?

The status report serves as the final implementation assessment, allowing the Research Office to measure the efficacy of the research project and program as a whole. When possible, the benefits to TDOT and the agency's stakeholders will be quantified to capture the return on investment of the Research Program.

## 8 Technology Transfer

In 23 CFR 420.203, technology transfer is defined as:

“those activities that lead to the adoption of a new technique or product by users and involves dissemination, demonstration, training, and other activities that lead to eventual innovation.”

TDOT aims to make research accessible and as widely distributable and available to potential users as current funding allows. In determining qualifying technology transfer activities, it is important to use methods that will bring about adoption of products and practices; consideration for the efficacy of an activity is key. The Research Office considers requests for technology transfer assistance on a case-by-case basis and will coordinate with other funding resources as appropriate.

### 8.1 Methods for Technology Transfer

Several different activities can be used in the transfer of technology. Technology transfer may include workshops, special publications, teleconferences, digital media, or other activities. Some examples of technology transfer include:

- **Workshops:** A workshop may be conducted to create an interactive environment to share and discuss the research and results.
- **Report Distribution:** Reports are distributed to national libraries and repositories as required by FHWA. All final reports are made available on the Research Office’s website.
- **News Releases:** Newspaper articles may be written to inform the public about successful research projects. The Research Office publishes a newsletter internally to highlight recently completed research projects.
- **Visual Media:** Webinars, websites, videos, and other digital media may be used to present research of widespread interest.
- **Conferences:** PIs and TDOT staff may attend conferences in Tennessee and other states to discuss research findings, including the annual TRB meeting in Washington, D.C.
- **Project Deliverables:** Often, research deliverables assist technology transfer efforts and aid in the implementation of the research results. Examples include training for direct users, train-the-trainer programs, technical review sessions, and research results presentations.
- **Technical Training:** Research Office staff and staff across the Department participate in training opportunities that enhance their technical capabilities. Examples include the National Highway Institute (NHI), the annual TRB meeting, local and regional seminars, and workshops and training offered by FHWA.

## 8.2 TDOT Technology Transfer Activities

The Research Program participates in and provides funding to national programs, like NCHRP, to contribute to nationwide technology transfer efforts. TDOT also encourages participation in TRB and AASHTO committees.

Individual projects may lead to trainings, workshops, webinar or conference presentations, and derivative published research. Activities like these are noted in progress reports and support the marketability of the program in addition to the knowledge benefits provided to other experts and the public alike.

## 8.3 Tennessee Technical Assistance Program

The Tennessee Technical Assistance Program (TTAP) is part of the nationwide Local Technical Assistance Program (LTAP) financed jointly by TDOT, FHWA, and the University of Tennessee. Technology transfer is one of the main drivers of TTAP, as the program aims to equip city and county officials charged with maintaining Tennessee's local roads and bridges with the tools to adopt and implement innovative transportation technologies and practices. Through dozens of training workshops, TTAP trains and informs thousands of state, city, and county personnel every year to improve the state of practice for Tennessee transportation professionals.

## 9 National Research Activities

### 9.1 American Association of State Highway Transportation Officials (AASHTO)

AASHTO is a nonprofit, nonpartisan association representing state highway and transportation departments, as well as the District of Columbia and Puerto Rico. TDOT's Commissioner serves on the AASHTO Board of Directors. In addition to highways, the association represents air, rail, water, active transportation, and public transportation.

The association's goal is to foster the development, operation, and maintenance of an integrated national transportation system. To achieve this goal, AASHTO works with volunteer state DOT personnel through the association's committee structure to produce and develop policy, standards, and technical activities. TDOT staff across the Department serve on AASHTO committees that best align with the agency's mission and strategic direction.

#### 9.1.1 Research Advisory Committee

The Research Advisory Committee (RAC) reports to the AASHTO Special Committee on Research and Innovation (R&I). It supports the activities of R&I by working with other research programs throughout the nation, sharing best practices, methods, and other resources to improve research capabilities nationwide.

Each AASHTO Member Department is represented on RAC. TDOT's Long Range Planning Director (voting member) and the Research Office Supervisor (non-voting member) both serve on the committee. RAC is split into four regions; Tennessee is part of Region 2.

#### 9.1.2 Technical Service Programs

AASHTO's Technical Service Programs (TSPs) allow participating state DOTs access to the latest technologies and techniques to plan, design, build, maintain, and operate the highest quality transportation system.

TSPs are created by vote of the AASHTO Board of Directors to fulfill specific needs and to pool resources to build a strong national program. State DOTs can leverage these programs to avoid spending additional the money, time, and resources to create their own program at the state level. Funding for TSPs is provided largely through voluntary contributions from participating state DOTs. A number of TSPs are eligible for funding through SPR Part B funds.

## 9.2 Transportation Research Board

The Transportation Research Board (TRB) is part of the National Academies of Sciences, Engineering, and Medicine (NAEM) and serves as an independent advisor on national transportation issues to public agencies. The TRB's mission is to provide leadership in transportation innovation and progress through research and information exchange, conducted within a setting that is objective, interdisciplinary, and multimodal. TRB currently has over 200 standing committees on various transportation topics. Leading experts help drive transportation innovation and progress through its efforts.

TDOT is a sponsoring agency of TRB; in addition to providing financial support, the Department supports the mission of TRB by serving on committees and task forces.

### 9.2.1 Cooperative Research Programs

TRB's Cooperative Research Programs Division organizes nationwide panels of experts to provide guidance on technical aspects of current national research priorities. Currently, TRB has four cooperative research programs:

- The Airport Cooperative Research Program (ACRP) solves common problems, learns about new technologies, and assesses innovations in service and operations for airports.
- The Behavioral Traffic Safety Cooperative Research Program (BTSCR) develops practical solutions to save lives, prevent injuries, and reduce costs of road traffic crashes associated with unsafe behaviors.
- The National Cooperative Highway Research Program (NCHRP) established to conduct research on serious problems related to highway planning, design, construction, operation, and maintenance nationwide.
- The Transit Cooperative Research Program (TCRP), which serves to develop innovative near-term solutions to meet demands placed on the public transportation industry.

TDOT may recommend problem statements for study and nominate employees for project oversight panels. The Department most notably assists with and contributes to NCHRP as a sponsoring agency.

## 9.3 Transportation Pooled Fund Studies

The Transportation Pooled Fund (TPF) program is a collaborative program, headed by the USDOT, where FHWA or a state DOT can partner with public or private entities to conduct research relevant with widespread interest across multiple states. To qualify as a pooled fund study, at minimum, two state transportation agencies or a transportation agency and FHWA must find the subject important enough to commit funds to the study.

Pooled fund studies must be initiated by either a state DOT or FHWA. Local and regional transportation agencies, private industry, foundations, and colleges and universities may partner with the sponsoring agencies to conduct pooled fund projects.

TDOT staff interested in joining a current TPF study or wanting to develop a study must contact the Research Office to determine eligibility and funding availability.

## 9.4 Every Day Counts

Every Day Counts (EDC) was launched by FHWA to assist with the speedy delivery of highway projects, enhance roadway safety, reduce traffic congestion, and integrate automation. FHWA works with state and local governments, tribes, and industry stakeholders to identify a new collection of innovations every two years that merit accelerated deployment. EDC is a state-based model, aiming to get all stakeholders together to collaboratively select the innovations the state is interested in pursuing, considering market readiness, impacts, benefits, and the ease of adoption.

TDOT has taken part in the EDC program since its inception in 2011, successfully pursuing innovations using the EDC model and framework.

## 9.5 State Transportation Innovation Council

TDOT's State Transportation Innovation Council (STIC) brings together public and private transportation stakeholders to foster a culture of innovation within the agency and the State. The STIC evaluates innovations and strategically spearheads their deployment in Tennessee.

The FHWA STIC Incentive program provides resources to help STICs establish an innovative culture and help implement it as standard practice within the Department. The STIC Incentive program offers up to \$100,000 of federal funding per state per fiscal year to support such efforts, which is administered by the FHWA Center for Accelerating Innovation through the Technology and Innovation Deployment Program (TIDP). This funding may be used to conduct internal assessments; develop guidance, standards and specifications; organize peer exchanges; offset the cost of implementation; or other activities that meet the innovation goals of both TDOT and TIDP.

## Glossary of Terms

**Applied Research** – Applied research is designed to answer a specific question or solve a specific problem. It is original work undertaken to acquire new knowledge for practical application.

**Deliverable** – A good or service provided during or upon completion of a research project. Deliverables are also called work products and can include documents, computer source code, computer software, methodologies, models, templates, processes, testing assessment tools and scenarios, created, designed, developed, derived, documented, installed, or delivered. Progress reports and a final report are required deliverables of all research projects under 23 USC Section 420.

**Call for Projects** – The competitive process TDOT utilizes to fund research projects. The Call for Projects occurs in two stages: 1) the solicitation of research ideas through a Call for Research Needs Statements, and 2) the subsequent request for proposals based on chosen research needs through a Call for Proposals.

**Call for Proposals** – Solicitation of proposals from prospective researchers to conduct research services on behalf of the Department.

**Call for Research Needs Statements** – Solicitation of candidate research ideas from stakeholders to be considered for the Call for Proposals.

**Capital Equipment** – Tangible property (including information technology systems/software) with a life of one year or more and a per-unit cost of \$5,000 or more.

**Code of Federal Regulations (CFR)** - The CFR is the codification of the general and permanent rules published in the Federal Register by the departments and agencies of the Federal Government. It is divided into 50 titles that represent broad areas subject to Federal regulation. The 50 subject matter titles contain one or more individual volumes, which are updated once each calendar year on a staggered basis. Each title is divided into chapters which usually bear the name of the issuing agency. Each chapter is further subdivided into parts that cover specific regulatory areas.

**Contract** – An agreement between the signatories (TDOT and the research agency) defining the rights and obligations of the signatories. The purpose of the agreement is to secure the performance of professional services to conduct research on behalf of the Department.

**Co-Principal Investigator (Co-PI)** - The Co-PI shares responsibility and oversight of a research project with the Principal Investigator.

**Copyright** – A legal protection for the owner of intellectual property. The 1976 Copyright Act gives the owner of copyright the exclusive right to reproduce the copyrighted work, to prepare derivative works, to distribute copies or phonorecords of the copyrighted work, to perform the copyrighted work publicly, or to display the copyrighted work publicly.

**Delegated Grant Authority (DGA)** – Authorizes a State Agency to execute grant contracts for a particular program within specified limits, guidelines, and conditions.

**Federal Highway Administration (FHWA)** - The FHWA is an agency within the U.S. Department of Transportation that supports State and local governments in the design, construction and maintenance of the Nation’s highway system (Federal Aid Highway Program) and various federally and tribal owned lands (Federal Lands Highway Program). Through financial and technical assistance to State and local governments, FHWA is responsible for ensuring that America’s roads and highways continue to be among the safest and most technologically sound in the world.

**Final Report** – Per 23 CFR §420.209, a document created that, at minimum, conveys “the data collected, analyses performed, conclusions, and recommendations” from a research project funded with SPR Part B funds.

**Implementation** – The incorporation of research findings into departmental decision making, policies, procedures, specifications, standard drawings, processes, or business practices. Implementation transitions research from theory to practice.

**Kick-Off Meeting** – The initial project meeting that brings everyone together who will be involved in the research project, including the Principal Investigator and/or their research team, Lead Staff, Technical Advisory Committee members, and Research Office staff. The objective of the meeting is to establish a shared understanding of the research objectives, deliverables, project milestones, and workflow.

**Lead Staff** – The individual assigned as the TDOT project manager. The Lead Staff person is a subject matter expert on the research topic, understanding how the problem and potential solutions may impact the agency. Lead Staff is responsible for providing direction on technical aspects of the research to the Principal Investigator throughout the duration of the project.

**Local Technical Assistance Program (LTAP)** – A national network of technology transfer centers dedicated to assisting local governments in managing and maintaining a safe, cost-effective, and environmentally sound transportation system through training, technical assistance, and other customer services to municipal elected officials and their staff.

**Notice to Proceed** – The notice to proceed is a letter from TDOT to the Principal Investigator and research agency to inform them of the date that work on the project can start. The date noted in the notice to proceed will be the official start of the contract.

**Patent** – The exclusive intellectual property right to an invention of a technical product or process.

**Personal Private Information (PPI)** – Sensitive information associated with a specific person, which can be used to identify or locate that individual.

**Principal Investigator (PI)** - The PI is the lead researcher for the research project, responsible for managing the day-to-day activities of the project and fulfilling the scope of work as outlined in the proposal.

**Proposal** – The document submitted to TDOT by a research agency that establishes the research need, defines the research objectives, provides a detailed description of the scope of work required to achieve the objectives, describes the project deliverables, and includes a schedule of the research tasks and budget. Once approved, proposals are attached to the project contract.

**Quick Response Program** – Mechanism the Research Office utilizes to address high-priority or emergent research needs through a non-competitive process. Quick Response projects are expected to be completed within one year and cost \$100,000 or less.

**Research Needs Statement (RNS)** – The document submitted to TDOT's Research Office that establishes the rationale for a research project by clearly identifying the gap or problem within the Department and/or transportation industry.

**Research Oversight Task Force (ROTF)** – The standing committee that supports the activities of the Research Program, specifically advising the program on research objectives and priorities and makes recommendations for the Call for Projects. The ROTF is comprised of key technical staff and Division Directors across the Department, as well as a FHWA representative. The ROTF meets on at least a quarterly basis.

**Research Work Program** – The federally required document that outlines proposed transportation research, development and technology transfer activities that reflect the goals and policies of TDOT's 25 Year Transportation Policy Plan. Every two years, TDOT prepares the Research Work Program to document the accomplishments of the previous two years and outline proposed activities for the upcoming two years. This document is approved by FHWA.

**State Planning and Research (SPR) Funds** – The two percent set aside of funds apportioned or allocated to a state DOT for activities authorized under 23 U.S.C. 505.

**Technical Advisory Committee (TAC)** – A committee of subject matter experts assembled to support a research project. The TAC should help provide direction for the research project to ensure the research objectives are appropriately met, and support implementation efforts as appropriate. TAC members can be TDOT staff but may also include representatives from other Tennessee state agencies, local transportation agencies, and/or any other appropriate organization.

**Technology Transfer** – Activities that lead to the adoption of a new technique or product by users and involves dissemination, demonstration, training, and other activities that lead to eventual innovation.

**Tennessee Technical Assistance Program (TTAP)** – TTAP is part of the nationwide Local Technical Assistance Program (LTAP) financed jointly by TDOT, FHWA, and the University of Tennessee. The program aims to equip city and county officials charged with maintaining Tennessee's local roads and bridges with the tools to adopt and implement innovative transportation technologies and practices.

**United States Code (USC)** – A consolidation and codification by subject matter of the general and permanent laws of the United States. The code does not include regulations issued by

executive branch agencies, decisions of the federal courts, treaties, or laws enacted by state or local governments.