



U.S. Department
of Transportation
**Federal Highway
Administration**

Tennessee Division

December 17, 2020

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In Reply Refer To:
HPD-TN

Mr. Matt Meservy
Director, Long Range Planning Division
Tennessee Department of Transportation
James K. Polk Building, Suite 900
Nashville, TN 37243

Subject: Tennessee's RD&T Program Management – Process Review

Dear Mr. Meservy:

The Federal Highway Administration (FHWA) Tennessee Division has completed a process review of the Tennessee Department of Transportation's (TDOT's) Research, Development, and Technology Transfer (RD&T) Program Management procedures. This review was conducted in accordance with Title 23 Code of Federal Regulations (CFR) Section 420.209(d), which requires the FHWA to periodically review the State DOT's research program management process for compliance with Federal regulations.

Through this review, the FHWA identified 6 recommended process improvement actions for TDOT's consideration in carrying out the RD&T program. The highest-priority recommendation is provided below:

Recommendation: TDOT is recommended to continue efforts to update the Research Office Standard Operating Procedures, ensuring continued compliance and increasing effectiveness and value of the documented procedures. This update should be informed by the results of this review, TDOT's upcoming Research Peer Exchange, internal and external stakeholder outreach, and research on other best practices in research program administration.

Additionally, TDOT is strongly recommended to suspend any research calls-for-projects until the Standard Operating Procedures have been updated, in order to ensure that new research projects are identified and administered in accordance with TDOT's program priorities moving forward.

Once the updated documentation is finalized, TDOT must submit the documentation for review and approval by the FHWA Tennessee Division in accordance with 23 CFR 420.209(b).

Further recommendations and review observations are provided in the enclosed Process Review Report.

The FHWA Tennessee Division is highly appreciative of the partnership with TDOT Long Range Planning Division leadership and staff throughout this review. We are fully prepared to assist TDOT however possible in addressing these recommendations and undertaking other actions to grow the RD&T program.

If there are any questions on this review, please contact Sean Santalla, Transportation Planning Specialist, at (615) 781-5767 or sean.santalla@dot.gov.

Sincerely,

Theresa Claxton
Program Development Team Leader

Enclosure

cc: Ms. Pamela M. Kordenbrock, Division Administrator, FHWA TN Division
Ms. Sabrina David, Deputy Division Administrator, FHWA TN Division
Mr. Sean Santalla, Transportation Planning Specialist, FHWA TN Division
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Mr. Kwabena Aboagye, Assistant Director of Long Range Planning, TDOT
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Ms. Melanie Murphy, Long Range Planning Research Office Supervisor, TDOT



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Process Review

Tennessee's Research, Development and Technology Transfer (RD&T) Program Management

December 2020

FINAL REPORT



Table of Contents

Executive Summary	2
Background.....	3
Purpose	5
Scope and Methodology	6
Team Members & Review Participants.....	12
Observations and Findings.....	13
Summary of Findings	46
Conclusion	48



Executive Summary

In September 2020, the Federal Highway Administration (FHWA) Tennessee Division completed a process review of the Tennessee Department of Transportation (TDOT's) Research, Development, and Technology Transfer (RD&T) program. This review was performed in accordance with Title 23 of the Code of Federal Regulations (CFR) Section 420.209(d), which requires the FHWA to periodically review the State DOT's management process to determine if the State follows the requirements of 23 CFR 420.

This review was conducted in association with TDOT's Long Range Planning Division, Research Office, which manages TDOT's RD&T program. The Research Office provided valuable information necessary to this review, including program and project management documentation and observations on the current management processes.

This review report provides a series of findings identified by the FHWA. These findings are provided throughout this report, with the highest priority finding provided below:

Recommendation: TDOT is recommended to continue efforts to update the Research Office Standard Operating Procedures, ensuring continued compliance and increasing effectiveness and value of the documented procedures. This update should be informed by the results of this review, TDOT's upcoming Research Peer Exchange, internal and external stakeholder outreach, and research on other best practices in research program administration.

Additionally, TDOT is strongly recommended to suspend any research calls-for-projects until the Standard Operating Procedures have been updated, in order to ensure that new research projects are identified and administered in accordance with TDOT's program priorities moving forward.

Once the updated documentation is finalized, TDOT must submit the documentation for review and approval by the FHWA Tennessee Division in accordance with 23 CFR 420.209(b).



Background

Title 23 of the United States Code (U.S.C.) Section 505 establishes the State Planning & Research (SPR) program through a required two percent annual set-aside of a State's apportionment of core Federal-aid programs. Title 23 U.S.C. Section 505(b) and Title 23 of the Code of Federal Regulations (CFR) Section 420.107 requires State Departments of Transportation (DOTs) to expend no less than 25 percent of this annual set-aside for purposes of "research, development, and technology transfer" (RD&T) activities relating to highway, public transportation, and intermodal transportation systems.

23 U.S.C. Section 505 provides two eligible uses for RD&T funding:

- Research, development, and technology transfer activities necessary in connection with the planning, design, construction, management, and maintenance of highway, public transportation, and intermodal transportation systems; and
- Study, research, and training on the engineering standards and construction materials for highway, public transportation, and intermodal transportation systems, including the evaluation and accreditation of inspection and testing and the regulation and taxation of their use.

Requirements for RD&T activities, programs, and studies undertaken by State DOTs and their subrecipients with FHWA planning and research funds are established in 23 CFR 420, Subpart B - Research, Development and Technology Transfer Program Management.

23 CFR 420.209(a) provides the following requirements for a State DOT's management of the RD&T program:

"As a condition for approval of FHWA planning and research funds for RD&T activities, a State DOT must develop, establish, and implement a management process that identifies and results in implementation of RD&T activities expected to address high priority transportation issues. The management process must include:

- (1) An interactive process for identification and prioritization of RD&T activities for inclusion in an RD&T work program;*
- (2) Use of all FHWA planning and research funds set aside for RD&T activities, either internally or for participation in transportation pooled fund studies or other cooperative RD&T programs, to the maximum extent possible;*



- (3) *Procedures for tracking program activities, schedules, accomplishments, and fiscal commitments;*
- (4) *Support and use of the TRIS database for program development, reporting of active RD&T activities, and input of the final report information;*
- (5) *Procedures to determine the effectiveness of the State DOT's management process in implementing the RD&T program, to determine the utilization of the State DOT's RD&T outputs, and to facilitate peer exchanges of its RD&T Program on a periodic basis;*
- (6) *Procedures for documenting RD&T activities through the preparation of final reports. As a minimum, the documentation must include the data collected, analyses performed, conclusions, and recommendations. The State DOT must actively implement appropriate research findings and should document benefits; and*
- (7) *Participation in peer exchanges of its RD&T management process and of other State DOTs' programs on a periodic basis. To assist peer exchange teams in conducting an effective exchange, the State DOT must provide to them the information and documentation required to be collected and maintained under this subpart. Travel and other costs associated with the State DOT's peer exchange may be identified as a line item in the State DOT's work program and will be eligible for 100 percent Federal funding. The peer exchange team must prepare a written report of the exchange."*

23 CFR 420.209(b) requires that documentation describing the State DOT's RD&T management process must be developed by the State DOT and approved by the FHWA Division, while 23 CFR 420.209(d) states that the FHWA Division Administrator shall periodically review the State DOT's RD&T management process to determine compliance with applicable regulations.



Purpose

The 2020 Tennessee Department of Transportation (TDOT) Research, Development and Technology Transfer (RD&T) Program Management Process Review was conducted in accordance with applicable Federal regulations found in 23 CFR 420, Subpart B. As previously stated, these regulations require the State DOT to develop documentation describing the RD&T management process and mandate approval authority of these documented procedures to the FHWA Division office. Additionally, Federal regulations require the FHWA Division Administrator to periodically review the State DOT's management process to determine compliance with Federal regulations.

The objectives of this process review included:

- Capture and reflect a “snapshot” of TDOT's existing RD&T program management procedures and documentation, for use by FHWA and TDOT in identifying future development of the program;
- Determine compliance of TDOT's RD&T program management procedures with Federal regulations;
- Inform FHWA Tennessee Division approval of TDOT's documented RD&T program management procedures; and
- Identify areas of opportunity to strengthen TDOT's RD&T program management procedures and projects, to provide further value to TDOT, FHWA, and other national, state, regional, and local partners.

This review provided an opportunity for the FHWA Tennessee Division and TDOT to reflect on the successes, challenges, and experiences in managing Tennessee's RD&T program, considering both the current state of the program as well as future needs and enhancements to grow the program. Based on this reflection, TDOT and FHWA discussed potential activities and strategic direction to improve the program. These activities are captured throughout this report, which is intended to support TDOT and FHWA in identifying potential technical assistance and training needs.



Scope and Methodology

Review Scope

The scope of the 2020 TDOT RD&T Program Management Process Review encompassed the entirety of TDOT's process for administering the Federally funded RD&T program, including the procedures for selecting and implementing RD&T activities. Requirements for this management process are described in 23 CFR 420.209(a) and are provided in the [Background](#) discussion above.

To clarify the scope of this review and the presentation of observations and findings through this report, the review was broken into the following distinct categories:

- **Identification & Prioritization of Research Activities:** procedures for identifying research needs, soliciting research activities to support those needs, and prioritizing research activities to be undertaken with RD&T funding.
- **Managing & Programming Research Funding:** procedures for managing RD&T funding, programming research activities in the SPR Work Program, ensuring funding is available to support programmed research activities, and receiving Federal authorization of RD&T-funded activities.
- **Tracking Research Activities:** procedures for managing research projects; tracking program activities and schedules; ensuring accomplishments are being made in a timely fashion; and responding to any deviations in project scope, schedule, or funding.
- **Documenting Research Activities:** procedures for ensuring research activities are adequately documented in a report or other documentation which summarizes data collected, analyses performed, conclusions, and recommendations; and ensuring that said documentation supports implementation of research findings and benefits.
- **Effectiveness of Research Program:** procedures for monitoring the effectiveness of the RD&T program management and the implementation of research findings.
- **Other Programmatic Functions:** procedures related to other functions and requirements of the RD&T program, including but not limited to participation in the American Association of State Highway and Transportation Officials (AASHTO) Special Committee on Research and Innovation (R&I) and its Research Advisory Committee



(RAC), research peer exchanges, using the Transport Research International Documentation (TRID) Database, and others.

Observations and findings of TDOT's RD&T program associated with each of these categories are described in [Observations and Findings](#) below.

Review Methodology

The 2020 TDOT RD&T Program Management Process Review was performed as a four-step process conducted between March and July 2020. These steps included:

- **Organize & Establish Review Scope**

The first phase of this process review was to organize the review schedule, establish the scope, and collect information necessary to conduct the review.

This step was conducted by the FHWA team in cooperation with the staff of the TDOT Long Range Planning Division, primarily the Research Office. FHWA and TDOT held a kickoff meeting to discuss review scope and schedule, and to formally initiate the review, on April 2nd, 2020.

Following this kickoff meeting, TDOT provided a significant amount of RD&T program and project management documentation for purposes of the desk review. This documentation was provided on April 17th, 2020, which marked the end of this step and the start of the desk review.

- **Perform Desk Review**

In the desk review, the Federal Review Team examined the RD&T program management procedures and associated documentation to begin the process of identifying observations and findings. The desk review is critical in informing the subjects to be discussed through the partner interviews.

In conducting this review, the Federal Review Team examined several documents associated with TDOT's RD&T management procedures. This documentation can best be described as either *program management* documentation or *project management* documentation:

- *Program management* documentation includes manuals, operating procedures, and other guidance used by TDOT in the administration of the RD&T program.



This documentation guides TDOT staff in identifying research needs, soliciting research activities, prioritizing and selecting research activities for programming, and tracking effectiveness of the RD&T program. Program management documentation reviewed for this effort included:

- Research Office Standard Operating Procedures (*DRAFT*) (*Note: On December 10th, 2020, TDOT provided FHWA a revised draft of the Research Office Standard Operating Procedures. These revised procedures were approved by the FHWA Tennessee Division on December 15th, 2020. Review observations and findings in this report are based on the previous draft document provided as part of the Desk Review document request.*)
 - Research Office Performance Measures (*DRAFT*)
 - Research Idea Template
 - Research Needs Statement Template
 - Research Proposal Evaluation Scoring Sheet
 - 2017, 2018, and 2019 Call for Proposals Timelines
 - “Roles & Responsibilities of TDOT Research Office Staff”
- *Project management* documentation is primarily those materials designed to be used by TDOT staff and university researchers in carrying out a research project on behalf of TDOT. Examples of project management documentation includes templates, published expectations, and the like. Project management documentation reviewed for this effort included:
- Grant Budget Template
 - Research Proposal Template
 - Progress Report Template
 - Travel Authorization Template
 - Amendment Request Form
 - Final Report Instructions
 - Final Report Template
 - Technical Report Documentation Page Template
 - Disclaimer Template
 - “Roles and Responsibilities of TDOT Lead Staff”
 - “Top 15 Tips PIs Should Know”
 - Final Report Evaluation Sheet (*DRAFT*)

In addition, the Review Team reviewed the following miscellaneous documentation which is descriptive of the TDOT Research Office:



- TDOT Research Office Fact Sheet
- TDOT Research Office Program and Process – *presentation from Nov. 2018*
- TDOT Research Office Newsletter – *September 2018*

Finally, the Review Team also reviewed documentation from a selection of ten recent RD&T-funded research activities (five active projects and five recently closed projects). These projects were selected at random from a population of active RD&T-funded projects and RD&T-funded projects which were closed in the last three years. Although this approach does not produce a statistically valid sample set for the purposes of determining compliance, it was valuable in examining the actual application of TDOT’s RD&T management procedures.

Selected projects for further review included:

Table 1. Active Project Samples for Review

Federal Project No.	State Project No.	Project Title
040B355	RES2016-35	Evaluating Freight Intermodal Connectors (FICS) in TN
032B388	RES2020-17	Community Engagement in Rural Communities
042B388	RES2020-07	Mitigating Stripping in Asphalt Mixtures
034B388	RES2020-25	Development of a New Attenuation Model for West TN
004B388	RES2019-12	Utilization of Accelerated Pavement Tester (APT) for New Materials and Pavement Structure Research

Table 2. Closed Project Samples for Review

Federal Project No.	State Project No.	Project Title
041B229	RES2011-10	Development of a TDOT Class S-LH (Lower Heat) Concrete Mixture
013B268	RES2013-25	Review Stream Channel Restoration and Relocation Projects in Tennessee
029B268	RES2013-22	Impacts Resulting from a Failure of the Navigation Lock at Chickamauga Dam
028B355	RES2016-26	Hernando De Soto Bridge Structural Research
022B268	RES2013-23	Pedestrian Oriented Transit: A New Criteria for Pedestrian Network Building

Documentation reviewed for these projects included, as available:

- Research Needs Statements
- Research proposals, including grant budgets and schedules



- Evaluation/scoring documentation
- SPR Work Program pages
- Progress reports
- Draft & final reports
- Other documentation

The Desk Review portion of this review was conducted from mid-April to the end of the review.

- **Partner Interviews:**

A critical component to a process review of this type is to hold interviews with relevant staff involved in the program. Doing so is essential for the Federal Review Team to fully understand the State DOT's management process and provide context to the desk review.

Following the desk review, the Federal Review Team identified several questions and subjects needing clarification, to inform these interviews. Interviews were held over two sessions with TDOT Long Range Planning – Research Office staff on June 2nd.

- **Document Results:**

The final step in this review was to document the results in this report, in a format to be used by FHWA, TDOT, and other partners in understanding the state of the program and inform implementation of any findings. This report was reviewed by TDOT Research Office staff prior to final publication.

Review Observations and Finding Categories

As stated, the final step of this review was to capture the results in this report. Within each subject area reviewed, the Federal Review Team has noted **observations** and **findings** to reflect the state of the project and inform implementation of program-improvement actions.

Review **observations** reflect the factual basis upon which findings are developed. Items observed and described include, but are not limited to, Federal and State laws, rules, and regulations; Federal and State manuals, guidance documents, and operating procedures; past and current State practices and considerations in carrying out the program; items discussed and learned through partner interviews; and reviews of the “state of the practice” and best practices from across the country.



Review **findings** are the predominant “items of note” based on the observations identified through the review. Findings are categorized as **recommendations** and **corrective actions**:

- **Corrective Actions** denote items that do not meet the requirements of the applicable Federal rules and regulations. FHWA expects TDOT to address corrective actions in accordance with prescribed timelines to achieve specific outcomes.
- **Recommendations** concern the state of practice or technical improvements that would enhance existing processes and procedures. FHWA requests TDOT to give due consideration to the implementation of recommended actions.

The Federal Review Team identified 6 recommendations related to TDOT’s RD&T program and project management procedures. These findings are detailed in the [Summary of Findings](#) section of this report.



Team Members & Review Participants

The 2020 TDOT RD&T Program Management Process Review was led by a Federal Team made up of staff from the FHWA Tennessee Division. The team included the following members:

- Sean Santalla, Transportation Planning Specialist
- Elizabeth Watkins, Transportation Planning Specialist
- Theresa Claxton, Program Development Team Leader

In addition, staff of the TDOT Long Range Planning Division were instrumental in carrying out this review. This team included the following members:

- Kwabena (KB) Aboagye, Assistant Director for Comprehensive Planning
- David Lee, Assistant Director for Data Management
- Lia Prince, Planning Manager, Program & Administration Group
- Melanie Murphy, Planning Supervisor, Research Office
- Allison Gwinup, Research Planning Specialist - Advanced



Observations and Findings

Program Management & Project Development Process

Observations

Program Management Roles and Responsibilities

The Tennessee DOT's research, development and technology (RD&T) program is administered primarily by the TDOT Long Range Planning Division's Research Office. As currently established, the Research Office is made up of four staff positions: an Office Supervisor, a Senior Research Analyst, a Planning Specialist, and a Senior Research Planner. The Research Office is housed in the Comprehensive Planning unit within the Long Range Planning Division.

The Research Office is responsible for general RD&T program administration, including the solicitation and awarding of research needs and proposals, tracking and monitoring of progress on research projects, overseeing implementation of research findings, and other programmatic functions. In addition, this office is largely responsible for TDOT's participation in nationwide research activities, including participation in pooled fund studies and national research organizations and working groups, such as the American Association of State Highway and Transportation Officials (AASHTO) Research Advisory Committee (RAC) and the Transportation Research Board (TRB). The Research Office website is found at: <https://www.tn.gov/tdot/long-range-planning-home/longrange-research.html>.

In administering the program, the Research Office is supported by several other offices and Divisions across TDOT. The Long Range Planning Administration Office is responsible for development and maintenance of the SPR Work Program, in which all research activities must be documented; for coordinating the authorization of Federal funding for programmed research activities; and for assisting with invoice review and progress reporting. The Program Development and Administration Division is responsible for requesting Federal authorization of research projects and funding from the FHWA Tennessee Division. Finally, the program depends on the participation and input of a variety of other Divisions across the agency, such as Construction, Structures, Maintenance, Traffic Operations, and Multimodal, among others, which are needed to provide research needs, oversee research projects, and incorporate research findings into their everyday delivery of Tennessee's surface transportation network.



Principles of Delivering a Research Program

The AASHTO RAC and TRB maintains an online community titled the Research Program and Project Management (RPPM) for Transportation website, available at:
<https://rppm.transportation.org/Pages/default.aspx>.

The RPPM characterizes the research development cycle as follows in Figure 1:



**Figure 1. Research Development Cycle (Source:
<https://rppm.transportation.org/Pages/default.aspx>)**

The steps within this cycle include:

- **Setting the Research Agenda:** this is the stage where research and research managers identify and share agency and research priorities and focus areas and identify processes to prioritize and select research activities. Strategic planning, performance measures and targets, partner and stakeholder outreach, organizational incorporation, guidance document development, and consideration of national, state, and regional/local research needs are common activities in this stage of the cycle.
- **Carrying Out Research:** at this stage, the State undertakes research activities, actively managing these activities to ensure that needs are being addressed and projects are progressing. The State should be considering templates, tools, samples, and best practices in conducting research activities.



- **Delivering Results:** at this stage, research activities are being finalized and reported. At this point, considerations are being made on reporting research findings, communicating these findings, informing implementation, and considering intellectual property.
- **Communicating Value:** communicating the value of research is critical to a successful research program. In doing so, the State DOT is evaluating the program as a whole and individual research projects; making considerations such as, how well does the program support the research agenda? What level of implementation of research findings is being carried out? Is the program meeting, exceeding, or falling short of performance targets?

Assessing and communicating the value of the research program and activities is a necessary component of the “feedback loop” built into the Research Development Cycle. Following the principles of a performance-based planning process, the evaluation of the research program in meeting strategic objectives and performance measures defined earlier in the process (“Setting the Research Agenda”) should inform the evolution of those strategic goals, objectives, performance measures and targets.

- **Collaborating in Research Activities:** at each stage in the cycle, collaboration with public and private partners and stakeholders at the national, state, and local level is critical. Doing so provides a beneficial foundation throughout each stage of the cycle, improving the quality and value of research activities and uncovering opportunities for partnership.

These overarching steps define the development of a high-value research program and require careful consideration by the program administrator (in this case, TDOT) at each stage along the way, from the program administration (i.e. setting the research agenda, identifying needs, communicating value of research, etc.) and specific research project development (how research projects are prioritized, funded, and carried out). The research program administration and project development process used in Tennessee is discussed below.

TDOT Research Program Administration and Project Development Process

Tennessee’s process for setting research needs, identifying and prioritizing research activities, and research project development follows a standard process, beginning with the identification of a research need and advancing through to development of a final report and closure of the research activity.

This project development process is demonstrated below in Figure 2.

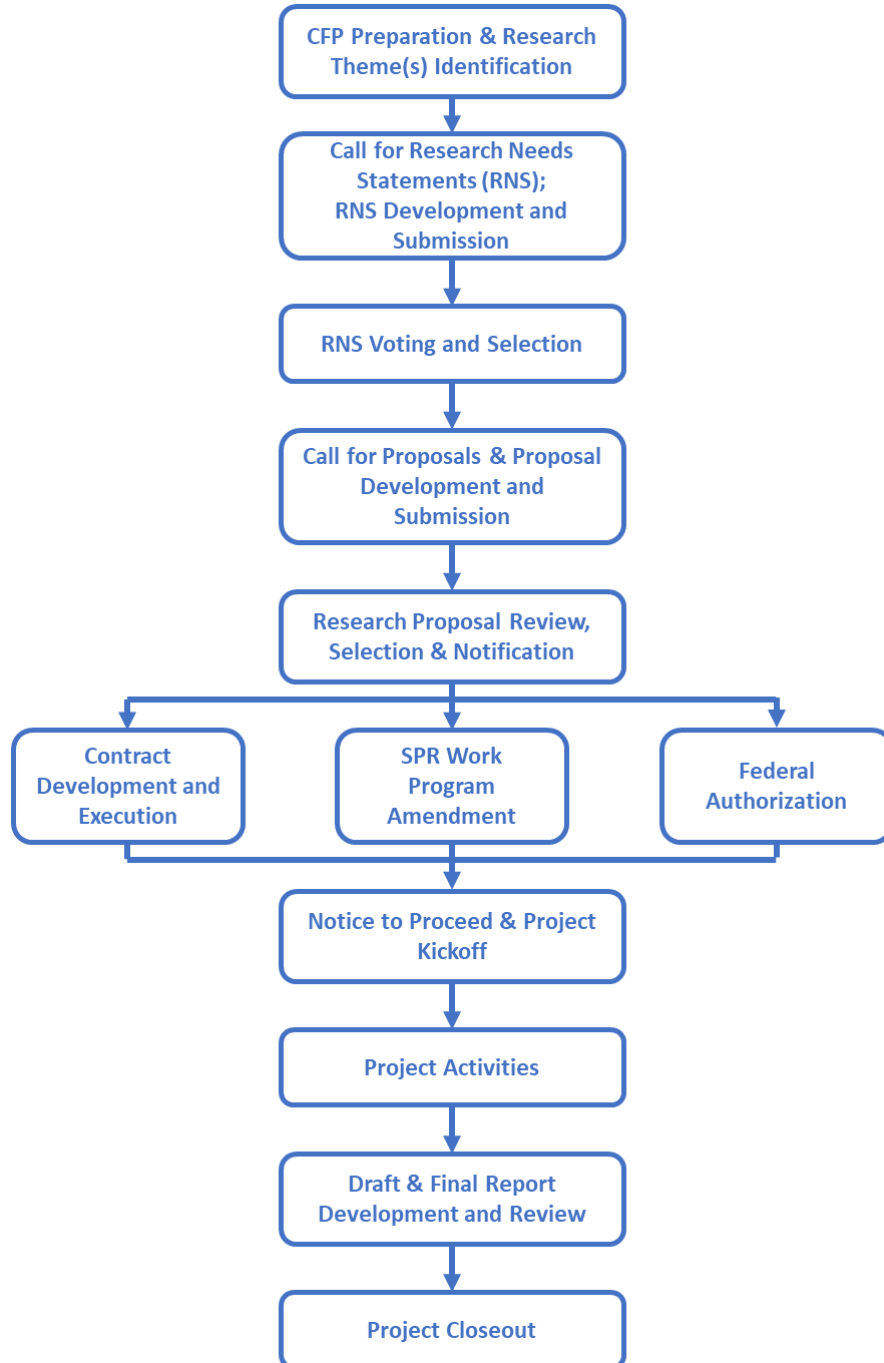


Figure 2. TDOT Research Program Administration and Project Development Process (Source: adapted from information in draft *TDOT Research Office Standard Operating Procedures*)



TDOT Research Office Standard Operating Procedures

Title 23 CFR 420.209(b) requires State DOTs to develop “documentation that describes the State DOT's management process and the procedures for selecting and implementing RD&T activities” and submit this documentation to the FHWA Division Office for approval.

TDOT RD&T process and procedures are documented in the *Research Office Standard Operating Procedures* (Figure 3). For the majority of this review period, these documented procedures were in a draft form and had not been approved by the FHWA Tennessee Division. These documented procedures were finalized by TDOT and approved by the FHWA Tennessee Division in December 2020. Review observations are based on the draft *Research Office Standard Operating Procedures* provided early in the review period as part of the Desk Review document request.

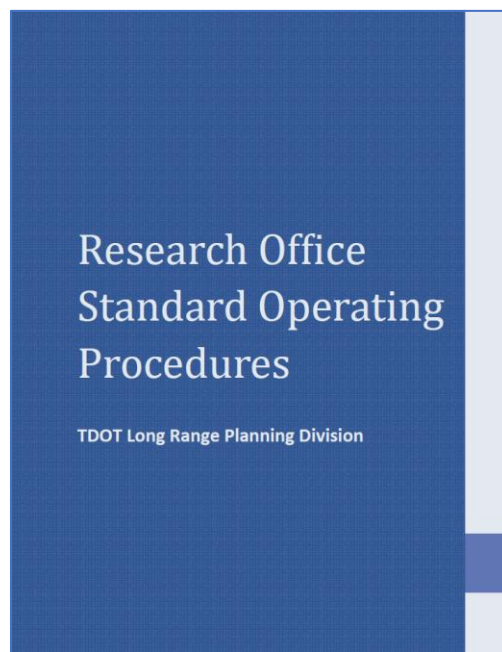


Figure 3. Draft Research Office Standard Operating Procedures (Source: TDOT)

The draft *Standard Operating Procedures* provide guidance to the Research Office, TDOT research project sponsors, and University researchers in carrying out the RD&T program, including the call-for-proposals process, selecting and awarding research activities, managing research projects, carrying out and documenting research activities, and roles and responsibilities.



A review of the draft *Standard Operating Procedures* finds that the document largely complies with the requirements of 23 CFR 490.209, with the following exceptions:

- The draft document does not provide for TDOT’s support and use of the TRIS database for program development, reporting of active RD&T activities, and input of the final report information (23 CFR 490.209(a)(4));
- The draft document does not include procedures to determine the effectiveness of the State DOT's management process in implementing the RD&T program, to determine the utilization of the State DOT's RD&T outputs, and to facilitate peer exchanges of its RD&T Program on a periodic basis (23 CFR 490.209(a)(5)); and
- The draft document does not describe TDOT’s process and procedures for participation in peer exchanges of its RD&T management process and of other State DOT’s programs on a periodic basis (23 CFR 490.209(a)(7)).

As noted previously, TDOT provided FHWA a revised draft of the *Standard Operating Procedures* late in the review period. This revised draft addressed these compliance concerns and provided a limited amount of additional information on TDOT’s research program management processes.

Based on discussion with the TDOT Research Office and review of sample research projects, the draft *Standard Operating Procedures* adequately capture the process that has traditionally been used by TDOT in administering the RD&T program. However, Research Office staff have undertaken a process to review and update the document to come into compliance with Federal regulations and identify opportunities to strengthen the RD&T management process.

As noted in the following recommendation, TDOT is strongly recommended to continue to carry out this update process and to suspend any research calls-for-projects until these documented procedures have been updated. Doing so will ensure that any newly-identified research activities align with the updated program priorities currently being developed.

A consideration that should be made when revising these documented procedures is the intended use and audience for these procedures; as written currently, the document provides guidance to both Research Office staff carrying out the RD&T program, TDOT project sponsors overseeing specific research activities, and University staff carrying out research. In the opinion of the Federal Review Team, trying to address these different needs and perspectives in this one documented fashion can be distracting. TDOT is recommended to consider separate documented procedures for RD&T program administration and RD&T project development.



Much of the remainder of this review focuses on the process as described in the draft *Standard Operating Procedures* with additional perspective from review of other program management documents and discussions with Long Range Planning Division Research Office staff.

Findings

Recommendation: TDOT is recommended to continue efforts to update the Research Office Standard Operating Procedures, ensuring continued compliance and increasing effectiveness and value of the documented procedures. This update should be informed by the results of this review, TDOT’s upcoming Research Peer Exchange, internal and external stakeholder outreach, and research on other best practices in research program administration.

Additionally, TDOT is strongly recommended to suspend any research calls-for-projects until the Standard Operating Procedures have been updated, in order to ensure that new research projects are identified and administered in accordance with TDOT’s program priorities moving forward.

Once the updated documentation is finalized, TDOT must submit the documentation for review and approval by the FHWA Tennessee Division in accordance with 23 CFR 420.209(b).

Identification & Prioritization of Research Activities

Observations

General Identification & Prioritization Principles

Federal regulations require State DOTs to develop, establish, and implement a management process which includes “An interactive process for identification and prioritization of RD&T activities for inclusion in an RD&T work program” (23 CFR 420.209(a)(1)).

TDOT’s RD&T identification and prioritization process is described below.



Research Needs Identification

The first step in the research project identification and selection process is the solicitation of research needs. As described in the draft *Standard Operating Procedures*, this process begins with preliminary meetings of Long Range Planning Division leadership and Research Office staff to define research themes, review the funding availability, and establish the timing of the call-for-projects. Concurrently, the Research Office will update any templates, guidance documents, and other resources to be used throughout the call-for-proposals.

Once research themes are defined, the Research Office convenes “Research Focus Groups” of various TDOT Division Directors and staff to communicate the research themes and initiate a request for research needs statements. At this point, University researchers are also engaged in the process and can similarly provide research needs.

Research needs statements are required to be developed using a template provided by the Long Range Planning Division Research Office. This template is demonstrated in Figure 4 below.



TDOT
Department of
Transportation

Research Office
Long Range Planning Division
505 Deaderick Street, Suite 900
Nashville, TN 37243
TDOT_Research@tn.gov

Research Needs Statement

Please complete all sections in blue

Title:	Click here to enter text.
Key Words:	Click here to enter text.
Research Problem Statement:	Identify and describe the problem or need that the research will address.
Research Objective:	Explain how the research will address the identified research problem.
Related Research/Continuation of Past or Current Project:	Describe how the proposed research will add to and build upon existing research, RES#, and/or research project title.
Expected Deliverables:	Describe the expected final products.
Estimate of Problem Funding & Research Period:	Provide an estimate of the required funding and how long it will take.
Urgency and Potential Benefits:	Describe why the research need is urgent and list the likely benefits to TDOT.
Implementation Planning:	Describe the potential policy implementation of the research results.
Person(s) Developing the Problem Statement:	Provide name, title and email address.
Submission Date:	Click here to enter a date.
Problem Number	To be assigned by Research Office.

1
Last Revised 9/15/17

Figure 4. TDOT Research Needs Statement Template (Source: TDOT)

As described in the template, these statements are required to include the following information:



- Title
- Key Words
- Research Problem Statement
- Research Objective
- Related Research/Continuation of Past or Current Project
- Expected Deliverables
- Estimate of Problem Funding & Research Period
- Urgency and Potential Benefits
- Implementation Planning
- Person(s) Developing the Problem Statement
- Submission Date
- Problem Number

In the observation of the Federal Review Team, much of this required information exceeds that which would normally be expected or available this early in the process. FHWA's October 2018 memo, [INFORMATION: Planning and Research Program Administration Guidance \(Revised\)](#), provides that "first stage research problem statements" need only include a title, a problem statement, a description of the potential implementation and benefit, and the name of the submitter. Such information is likely adequate for consideration of whether an idea is worth further exploring. Inclusion of additional information such as deliverables and estimated funding need, which are often more clearly defined in a specific project proposal, could lead to a situation where a specific University researcher is directly informing and influencing development of a specific research need, providing an undue advantage to that researcher in the call-for-proposals.

One beneficial field that needs statements are required to include is "implementation planning"; i.e. how can the research need be implemented by TDOT? Early and effective implementation planning is a proven best practice in fostering research activities which directly support a State DOT's mission and processes. However, in reviewing sample project needs statements and through discussions with TDOT staff, it appears that there are limited expectations on the content of this field and the use of this field in needs statement evaluation is unclear.

Research Needs Prioritization

Research needs statements are submitted by TDOT staff and University researchers to the Research Office. Following the closure of the research needs statement solicitation, needs statements are reviewed in the following process:



- Long Range Planning Division leadership review the needs statements for how well they support identified research themes; those that do not support research themes are removed from consideration.
- Research needs statements that support the research themes are then reviewed and voted on by TDOT Division Directors.
- Using the results of this voting and any comments, the Long Range Planning Division convenes a “Research Oversight Committee” to do a final review, prioritization, and selection of the proposed needs statements.
- Selected research needs statements are then proposed to TDOT leadership, including the Commissioner and Executive team, for final decision.

Once research needs statements have gone through this process and have been selected for advancement by TDOT senior leadership, the Research Office is able to advance to a call-for-proposals of research activities to support these needs. This process is further discussed below in *Research Proposal Solicitation*.

At this point, all committees previously formed, including the Research Focus Groups and the Research Oversight Committee, are disbanded and the call-for-proposals is overseen by the Research Office and those staff whose research needs statements are being responded to.

In the opinion of the Federal Review Team and supported by discussion with TDOT Long Range Planning Division staff, the research needs identification process presents a significant opportunity for enhancement of TDOT’s research program (see [Findings](#)).

Focusing efforts in this area could prove highly beneficial in many “downstream” components of the research program. Strengthening the research needs identification process could increase transparency in the research proposal process, by clearly identifying and supporting TDOT’s needs versus those desires from external partners. Additionally, this could bring additional accountability and ownership to researchers and project sponsors responsible for overseeing and carrying out research activities; should improve the quality of research findings; would promote the implementation of innovations throughout the State’s planning and project development process; and could foster a “culture of innovation”.

FHWA guidance strongly recommends the use of a standing committee(s), made up of membership from various State DOT program offices and the FHWA Division Office, to oversee the process of identifying, prioritizing, and selecting RD&T activities (see [Findings](#)).



In addition to a standing committee(s), there are several actions and approaches which can be considered by TDOT in optimizing the research needs identification process, including:

- Fostering idea generation from external partners, such as Metropolitan Planning Organizations (MPOs), Regional Planning Organizations (RPOs), the Tennessee Transportation Assistance Program (TTAP), associations such as the Tennessee Road-Builders Association, Federal Land Management Agencies (FLMAs), and others in the research needs process;
- Better define the role of University researchers in the need identification process, to ensure that research needs and ideas which come from researchers are supportive of TDOT objectives and are implementable by TDOT;
- Engage with TDOT's State Transportation Innovation Council (STIC), a body tasked with evaluating innovative practices and overseeing efforts to institutionalize innovations, especially those coming from FHWA's Every Day Counts (EDC) program.

[NCHRP Synthesis 280: Seven Keys to Building a Robust Research Program](#) provides several considerations that a State DOT can make in building their research program to provide the greatest value to the DOT and the research community as a whole.

In promoting these opportunities, it must be acknowledged that, as of this writing, TDOT's Research Office staff consists of two persons responsible for administering the research program, with an additional two vacancies in the Research Office. While the team continues to grow, it should be made clear that FHWA does not expect TDOT to accomplish the "laundry-list" of recommended program improvements listed above and throughout this report. FHWA stands prepared to assist TDOT in prioritizing, documenting, and implementing any process improvements which will put TDOT in the best position to succeed given State priorities and resources.

Research Proposal Solicitation

After final research needs statements have been selected using the above-described process, the Research Office proceeds with a call for research proposals. Needs statements are advertised through email to existing University researchers and through placement on TDOT's website. All research proposals must support a specific research needs statement and must be provided using a template provided by TDOT (Figure 5).



The image shows a three-column layout for a research proposal template. The left column is the title page, the middle column contains the main content sections, and the right column contains summary and qualification sections.

Left Column (Title Page):

- PROJECT: ALL CAPS
- RESEARCH PROPOSAL
- Submitted to Tennessee Department of Transportation
- Principal Investigator: Enter Name
- TDOT Department of Transportation logo
- Enter Name
- Enter a Date

Middle Column (Content):

- TDOT Department of Transportation logo
- Long Range 505 Debar
- PROBLEM STATEMENT: Click here to enter text.
- OBJECTIVES OF THE RESEARCH: Click here to enter text.
- RELATED LITERATURE AND STUDIES: Click here and provide information on any relevant research literature and findings of the
- SCOPE OF WORK: Click here to enter text.
- RESEARCH METHODOLOGY: List Task and explain Research Methodology.

Right Column (Summary/Qualification):

- Research Office: Long Range Planning Division, 505 Debarick Street, Suite 900, Nashville, TN 37243, TDOT.Research@tn.gov
- EXPECTED BENEFITS AND IMPLEMENTATION: List expected benefits and implementation.
- RESEARCH DELIVERABLES: Click here to provide the following deliverables upon the completion of this review project. The proposed time line of milestones is presented in Table 1.
- Table 1: Proposed Timing of Milestones

Milestones	Date	Budget (Cumulative)
Task 1	Completion of Task	Enter Date
Task 2	Completion of Task	Enter Date
Task 3	Completion of Task	Enter Date
Task 4	Completion of Task	Enter Date
Task 5	Completion of Task	Enter Date
Task 6	Completion of Task	Enter Date
Task 7	Completion of Task	Enter Date

- QUALIFICATION OF RESEARCH TEAM/FACILITY AND EQUIPMENT: Enter PI Name and Title.
- BUDGET AND TIME SCHEDULE: Please complete the additional pdf entitled Grant Budget template. The proposed period for this research project will be Please provide the period length after receiving the fully executed contract. The time period will include the final review and approval of the final report. Insert Project Schedule.

Figure 5. TDOT Research Proposal Template (Source: TDOT)

Per the template, the following fields are required to be provided in a research proposal:

- Problem Statement
- Objectives of the Research
- Related Literature and Studies
- Scope of Work
- Research Methodology
- Expected Benefits and Implementation
- Research Deliverables
- Proposed Timing of Milestones
- Qualification of Research Team/Facility and Equipment
- Budget and Time Schedule
- Grant Budget (using State contract template)

The content of the research proposal template aligns well with FHWA guidance.

Per TDOT policy, TDOT's RD&T program is limited to public and private universities located in Tennessee. In the observation of the Federal Review Team, the field of researchers conducting research activities for TDOT is a relatively small community, with several researchers leading multiple research projects, and the same researchers being awarded projects continuously. In



fact, one researcher is specifically identified in TDOT's draft Research Office Standard Operating Procedures by name.

While such an approach is compliant with Federal regulations and supportive of TDOT's local partners, it can also be considered limiting towards the types of research that are able to be conducted. Universities across the country may be able to bring a different expertise or different testing facilities, equipment, and technology that are not available in Tennessee, and which TDOT is not able to take advantage of under current practices. Through discussion on this topic with TDOT staff, it is clear that this idea is under consideration; however, staff also expressed a desire to improve their outreach to universities in Tennessee initially, in order to grow the program locally.


Another concern which may be worsened by this policy is the limited ability of the Research Office in enforcing timeliness and quality of delivery of research projects. As discussed below in [Tracking & Managing Research Activities](#), timely invoicing, project delivery, and quality of research activities has been an issue in the RD&T program; opening the research program to additional partners could provide an incentive for TDOT's usual research partners to improve in this part of project delivery.

Research Project Prioritization, Awarding & Contracting

Once the call-for-proposals has closed and all proposals have been received, TDOT subject-matter experts and potential project sponsors are provided relevant proposals which address their research need and are asked to score these proposals. Scoring is done using a standard template developed by the Research Office, displayed in Figure 6.



Research Office
Long Range Planning Division
505 Deaderick Street, Suite 900
Nashville, TN 37243
TDOT.Research@tn.gov



Research Proposal Evaluation Form

Please complete all sections in blue

Needs Statement #:			
Proposal Title:			
Principal Investigator(s):			
Research Agency:			
Evaluation Factors	Guidelines	Max	Score
Problem Statement	1. Does the proposal demonstrate a clear description of the problem and address the stated needs? (10) 2. Does the proposal identify the questions that will be answered by the proposed research? (10)	20	
Goals and Objectives of the Research	1. Are the goals and objectives of the research clearly defined? (10) 2. Does proposal identify the goals associated with each of the research questions? (10)	20	
Literature Review	1. Does the proposal describe the findings of relevant literature? (5)	5	
Scope of Work	1. How well does the scope of work meet the needs of TDOT? (10) 2. Is the scope of work to be performed sufficient to meet the research objectives? (10)	20	
Research Methodology	1. Is the research methodology appropriate for the research proposed? (10) 2. Is the research methodology defined and clearly described, and does it demonstrate systematic or theoretical analysis of methods applied to the research? (10)	20	
Expected Benefits and Implementation	1. Does the proposal provide expected benefits from the research to make a significant impact on TDOT? (15) 2. Does the proposal provide a potential application on how TDOT may apply the results of the research? (10) 3. Is the potential implementation realistic and appropriate for the scope of work? (5)	30	
Research Deliverables	1. Does the proposal list all expected products and outcomes? (10) 2. Are the descriptions of each task fully described and appropriate for the proposed research? (10)	20	
Qualification of Research Team/Facility and Equipment	1. Does the proposal demonstrate that the research team has the capacity to conduct this research? (10) 2. Are the identified personnel and man-hours for each specific task appropriate and realistic? (5) 3. Does the proposal demonstrate that the researcher has access to facilities and equipment required to complete this research? (5)	20	
Budget and Time Schedule	1. Is the proposed budget reasonable and corrected for the scope of work as defined in the proposal? (10) 2. Is the schedule reasonable for the research being conducted? (5)	15	
Total Score		170	
Reviewer recommendation for this proposal:			
Reviewer:	Division:	Date:	

Submit completed review final scores electronically to: TDOT.Research@tn.gov

1 Last Revised 1/18/18

Figure 6. Research Proposal Evaluation Form (Source: TDOT)

Using results of this scoring, Research Office staff prepares a list of recommended research projects for approval by TDOT executive leadership.

At this point, the Research Office also shares the proposed research activities with the FHWA for Federal eligibility review. This is the earliest point in the research project development process where FHWA is involved, and the role of FHWA at this point is limited to review of proposed projects for funding eligibility.

While this is a compliant approach, it does leave TDOT vulnerable to potential advancement of an ineligible activity and limits the ability for FHWA to provide early feedback on how best research needs and proposals align with Federal priorities and activities. As previously discussed, including FHWA in the research needs identification process is considered a best practice across the country; FHWA staff work hand-in-hand with their associated TDOT program offices in strengthening their program and project development, and can provide perspective on potential research needs which may not be anticipated by the program offices. FHWA staff



are also routinely made aware of best practices and innovations occurring across the country which may be worth further exploration and consideration by TDOT. In order to best take advantage of this, TDOT is strongly encouraged to include FHWA earlier in the research needs identification process.

In fact, 23 CFR 420.205(h) encourages State DOTs “to make effective use of the FHWA Division, Resource Center, and Headquarters office expertise in developing and carrying out their RD&T activities. Participation of the FHWA on advisory panels and in program exchange meetings is encouraged.”

Once proposals are selected for award, the Research Office works with the Long Range Planning Division Administration Office to initiate the contracting, programming, and authorization of the activity before work proceeds. This process is further described below in [Managing & Programming Research Funding](#).

Findings

Recommendation: TDOT is strongly recommended to develop and implement a standing committee, or several committees, tasked with overseeing the research needs identification process. Committee membership should include, at a minimum, TDOT subject matter experts and FHWA Tennessee Division staff, with other perspectives from state, regional and local transportation and research partners being considered as well.

Recommendation: TDOT is recommended to consider other enhancements to the research needs identification process based on best practices identified throughout this review and from the national research community.

Managing & Programming Research Funding

Observations

General Fund Management Principles

Federal regulations require State DOTs to develop, establish, and implement a management process which includes the “use of all FHWA planning and research funds set aside for RD&T activities, either internally or for participation in transportation pooled fund studies or other cooperative RD&T programs, to the maximum extent possible” (23 CFR 420.209(a)(2)).



TDOT's RD&T funds management principles, roles, and responsibilities are described below.

Status of RD&T Funding

The following table details the RD&T funding apportioned to TDOT through the life of the most recent Federal surface transportation authorization act, the FAST Act (FFY 2016-2020):

Fiscal Year	RD&T Funding Apportionment
2016	\$2,579,300
2017	\$4,297,270
2018	\$4,397,381
2019	\$4,511,697
2020	\$3,102,102

As of July 31, 2020, TDOT has a balance of **\$1,684,879** in unobligated RD&T funding, available for research activities. There is no RD&T funding subject to lapse over the next three Federal fiscal years.

Managing RD&T Funding

The primary responsibility for managing TDOT's RD&T funding lies with the TDOT Long Range Planning Division's Administration Office. The Administration Office is responsible for management of both SPR Part A and Part B (RD&T) funding. In carrying out this responsibility, the Administration Office works with program offices across TDOT which make use of SPR funding to identify planning and research priorities, program planning and research activities in the SPR Work Program, authorize Federal funding for these activities, and track and report expenditures and progress of SPR-funded activities. The Office of Administration also acts as a resource to program offices in awarding of funding, contracting, and invoice review. In this capacity, the Office of Administration works closely with a number of additional Divisions across TDOT, including the Program Development & Scheduling Division and the Finance Division.

In managing RD&T funding, the Research Office works closely with the Administration Office to ensure research activities are programmed in the approved SPR Work Program, funding has been authorized, and invoices and expenditures meet all Federal and State grant administration requirements.

Through discussion with the Research Office, it is somewhat apparent that the Research Office could undertake a more active role in management of their RD&T funding, through more



frequent understanding of how much funding has been obligated, how much funding is unobligated, project statuses, and the like.

The Long Range Planning Division has already recognized this opportunity area, and is working to acquire and implement a grants management software which will assist in many of these functions. Staff are reviewing to consider if this software will provide additional clarity to the Research Office in understanding the status of RD&T funding and activities (see [Findings](#)).

Programming & Authorizing Research Activities

As with the general management of RD&T funding, the programming and authorizing of RD&T funding and activities is done jointly through the Research Office and the Administration Office in the Long Range Planning Division.

The Administration Office is responsible for the development and management of the SPR Work Program. The SPR Work Program is a Federally required program of planning and research projects over a 2-year period to be carried out using FHWA planning funding. Federal regulations permit the programming of planning and research activities in separate work programs or in one joint work program; TDOT elects to use a single, joint work program of both planning and research activities.

Once the Research Office has identified a research project to be awarded and has initiated the contracting of the project, the Research Office notifies the Administration Office with a request to include the project in the SPR Work Program and authorize the funding.

From this point, the Administration Office works with the FHWA Tennessee Division to process an amendment to the SPR Work Program and works with the TDOT Program Development & Scheduling Division to obtain Federal authorization of the funding/activity. An example representation of a research project in the SPR Work Program is displayed in Figure 7, while the associated project agreement (reflecting Federal authorization) between FHWA and TDOT is displayed in Figure 8.

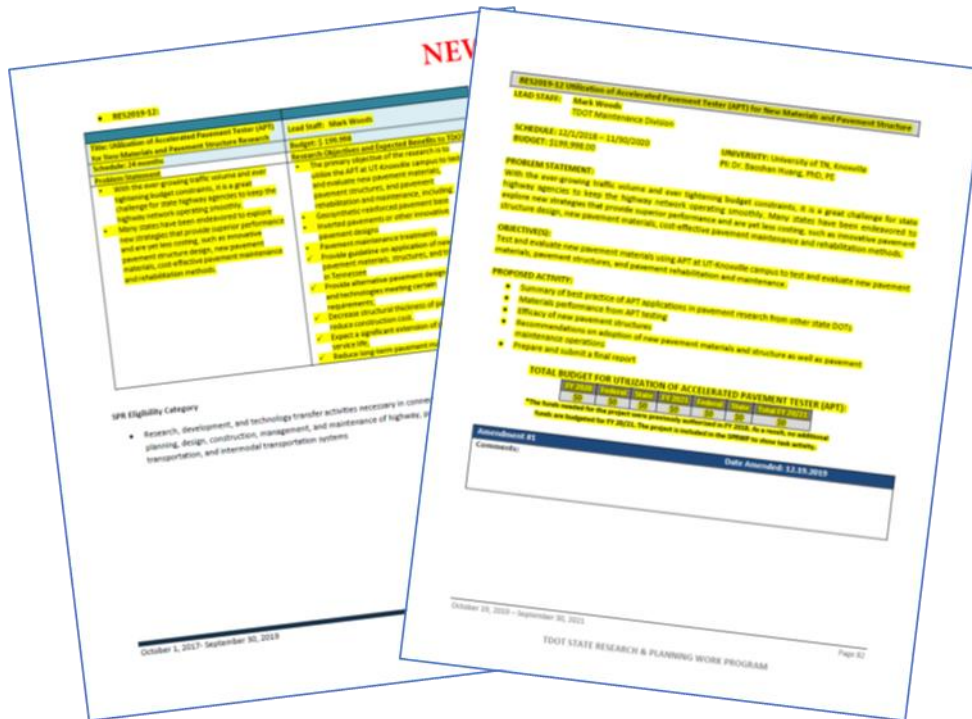


Figure 7. RD&T Activity SPR Work Program Pages (Left: Original Programming, FY 2018-2019 SPRWP; Right: Carryforward Programming, FY 2020-2021 SPRWP) (Source: TDOT)

Run Date: 08/26/2020
Run Time: 12:36:50

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
FEDERAL-AID PROJECT AGREEMENT

Report: FMISD05A
Page 1 of 1

RECIPIENT: 47-Tennessee
FEDERAL PROJECT NO.: 006818

RECIPIENT PROJ. NOS: 12687 01.1819R2.F7-005

1. The State through its department of transportation, or other recipient, has completed, or hereby agrees to complete, with the applicable terms and conditions set forth in 23 CFR 215.11 U.S. Code, Highway. (b) The recipient must procure items, and the policies and procedures promulgated by the Federal Highway Administration, and (c) All other applicable federal laws and regulations. 2. The State, or other recipient, certifies that as a condition to payment of the Federal funds obligated, it agrees and will comply with the provisions of 23 CFR 215.11. These provisions incorporate by reference all other federal laws and regulations pertaining to the project or the activity for which the funds are obligated. Safety for the purposes of this agreement, such as applicable provisions include, but are not limited to, the requirements of Appendix A to 23 CFR Part 115. These provisions reporting activities that require a compensation adjustment, and 2 CFR 200, including the three funds for which such support will be obligated to a subrecipient, 2 CFR 201.11. Failure to do so may constitute a breach of the project or the activity for which the funds are obligated. The law stated above applies to the period of time of work. For each subrecipient with an indirect costs obligation, the indirect costs obligation, as set in effect by direct charges below, shall be the obligation of the State or other direct recipient. 4. Such obligations of Federal funds shall remain only if project costs incurred by the State, or other recipient. Indirect Federal Highway Administration's obligations to proceed with the project.

PROJECT TITLE: Utilization of Accelerated Payment Tester (APT) for New Materials and Pavement Structure Research RESEARCH FY 2018-2019 (PART 2)-SPR
PROJECT DESCRIPTION: Utilization of Accelerated Payment Tester (APT) for New Materials and Pavement Structure Research RESEARCH FY 2018-2019 (PART 2)-SPR
DUNS#: 57257712
PROJECT END DATE: 09/30/2021

CLASSIFICATION OF PHASE OF WORK		EFFECTIVE DATE OF AUTHORIZATION				
TO BE SET UNDER AGREEMENT		09/19/2018				
HIGHWAY PLANNING & RESEARCH						
PRELIMINARY ENGINEERING						
SCHEMATIC DESIGN						
CONSTRUCTION						
OTHER						
PROGRAM CODE	FAIN	URBAN WITH	TOTAL COST	FEDERAL SHARE	FEDERAL FUNDS UNDER AGREEMENT	ADVANCED CONST. FUNDS
Z166	47068318E2560		\$109,898.00	80.00%	\$116,898.00	\$0.00
TOTAL			\$109,898.00		\$116,898.00	\$0.00
ESTIMATED TOTAL COST:			\$109,898.00			
TOTAL AUTHORIZED FOR PROJECT:			\$116,898.00			

TRANSPORTATION, TENNESSEE DEPARTMENT OF

AVAILABLE FUNDS CERTIFIED BY: Lee Collins DATE: 09/14/2018
APPROVED AND REQUESTED BY: Lawrence R. Porter DATE: 09/14/2018
AGREEMENT REQUESTED BY: Lawrence R. Porter DATE: 09/14/2018

FEDERAL HIGHWAY ADMINISTRATION

PROJECT INFORMATION REVIEWED BY: Kim Robinson DATE: 09/18/2018
APPROVAL RECOMMENDED BY: Sam Swanda DATE: 09/18/2018
APPROVED AND AUTHORIZED BY: Tim Vickars DATE: 09/19/2018

RECIPIENT REMARKS: The Authorization of this project is from September 30, 2018 Through September 30, 2020. RES2019-12. This agreement is subject to the following event terms: <http://rdetcat.access.gpo.gov/2019/pdf/2019-12-10-00.pdf> and <http://rdetcat.access.gpo.gov/2019/pdf/2019-12-10-00.pdf>.

DIVISION REMARKS: Costs will be eligible for FHWA participation provided that they were not incurred prior to FHWA authorization, per 23 CFR 201.113(a)(2) - 5AG.

Figure 8. FHWA/TDOT Project Agreement for RD&T Activity (Source: FHWA Fiscal Management Information System)



Both activities (programming and authorization) are required to be complete before a project can proceed and be eligible for Federal reimbursement. Once complete, the Administration Office issues a Notice to Proceed to the grantee and work may begin.

In all cases of the sample projects reviewed, programming and authorization appeared to occur in an appropriate fashion.

Findings

Recommendation: TDOT is recommended to ensure that the program management software currently in procurement provides full program and project management capabilities, including but not limited to, program revenues, obligations, and expenditures; project tracking and deadlines; user roles and review workflows; and contract file management and document storage capabilities.

Tracking & Managing Research Activities

Observations

General Tracking Principles

Federal regulations require State DOTs to develop, establish, and implement a management process which includes “procedures for tracking program activities, schedules, accomplishments, and fiscal commitments” (23 CFR 420.209(a)(3)).

TDOT currently tracks the status of active research activities through a basic database software. This process can prove difficult in identifying progress made on projects, current status, future status, etc. However, the Long Range Planning Division is in the process of procuring a project management software which should enable easier tracking of research activities.

Current Status of Research Activities

As of this review, there were 64 active TDOT-sponsored research projects in the FY 2020-2021 SPR Work Program and 18 pooled fund studies which TDOT is participating in, for a total of 82 current research activities. The combined total project cost of the 64 active TDOT-sponsored research projects is just over \$11 million.



These projects are broken down into several subject areas, reflected in Figures 9 and 10 below.

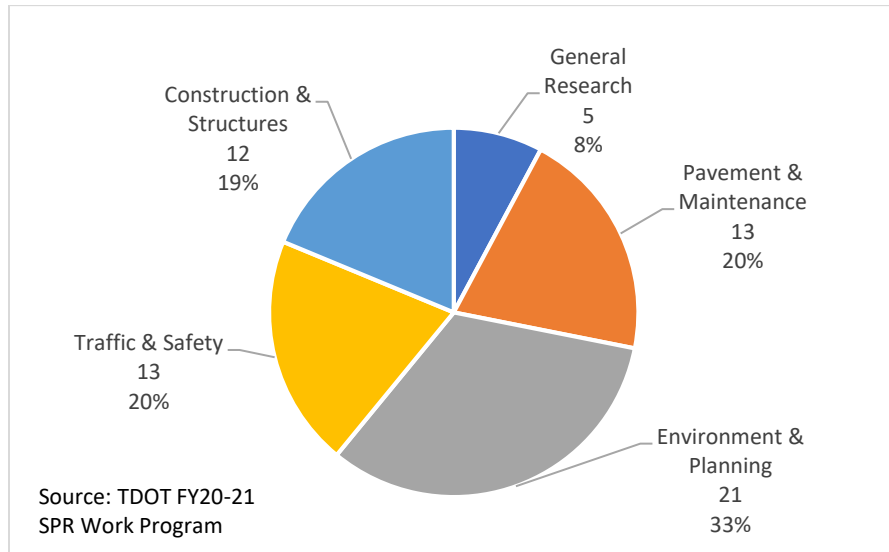


Figure 9. TDOT-Sponsored Active Research Projects by Subject Area

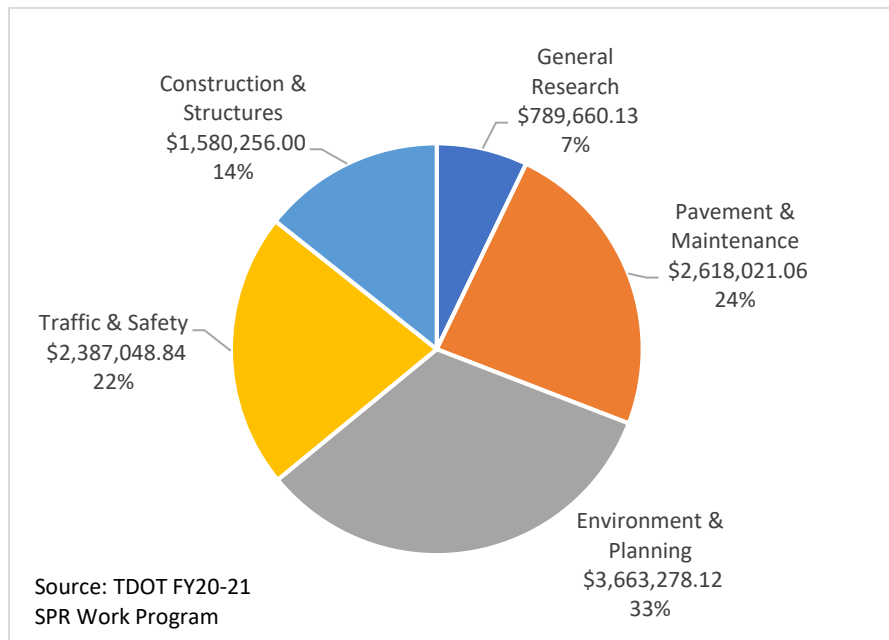


Figure 10. Total Project Cost of TDOT-Sponsored Active Research Projects by Subject Area



Roles & Responsibilities in Tracking Research Activities

As previously discussed, in any research activity, there are three main staffers responsible for carrying out the project and/or overseeing it:

- Research Office staff;
- TDOT lead staff(s), also referred to as the “project sponsor”; and
- The researcher(s) (generally located at a University), also referred to as a “principal investigator”; in cases where there are multiple researchers, the lead is the “principal investigator” while secondary researchers are referred to as “co-principal investigators”.

Responsibility for managing progress on a research activity is carried out jointly by these staffs, each with a unique role and expectations. In an effort to clarify these roles and responsibilities, the Research Office maintains three primary documented expectations (see [Program Management & Project Development Process Findings](#)):

- “Roles and Responsibilities of TDOT Research Office Staff”
- “Roles and Responsibilities of TDOT Lead Staff”
- “TDOT Top 15 Tips PIs Should Know”

These documents are displayed in Figure 11.



Figure 11. TDOT Documented Expectations for Research Office Staff, Research Lead Staff, and Research Principal Investigators (Source: TDOT)

The project-specific roles and responsibilities, as described in these documents, can be summarized as follows:

- **Research Office staff** are primarily responsible for higher-level RD&T program administration. In overseeing projects, Research office staff are expected to provide a knowledge of the research process and the expectations when carrying out a project. Example project-specific activities of this nature include assisting in proposal review; tracking and reporting research project progress; assisting with coordination activities, including kickoff and close-out meetings; ensuring research projects follow the basic research process and use all appropriate templates; review invoices and maintain a project file; and feed research findings into the national research landscape through national research affiliations.
- **TDOT project sponsors** are critical to ensuring the successful initiation and delivery of TDOT-sponsored research projects. Given their expertise and familiarity with the research topic, project sponsors are responsible for ensuring that projects address research questions that support TDOT’s programs and missions; identify and resolve research problems; review progress reports and invoices; and ensure that final research reports are complete, accurate, and are valuable to inform TDOT implementation.



Continuous coordination and communication with the Research Office team is expected when carrying out these activities.

- **Principal Investigators (PIs)** are those staff actually carrying out the research on behalf of TDOT. At the time of this review, lead researchers are limited to those affiliated with universities within Tennessee; however, lead universities may subcontract with universities outside Tennessee and private organizations to support projects. PIs are responsible for carrying out a research activity which meets the scope of the proposal and is performed in a timely fashion; communicating any requests for information or research problems to TDOT project sponsors and the Research Office; coordinating any necessary meetings to support the research activity; preparing invoices and progress reports; and writing draft and final research reports which meet TDOT expectations.

As demonstrated, coordination between these three parties is necessary to the success of a research project.

In discussion with the Research Office staff, it became somewhat apparent to the Federal Review Team that these roles and responsibilities are not always clearly understood or carried out. Concerns discussed include, limited or unclear expectations of project administration; ineffective communication between Research Office staff, project sponsors, and PIs; and a lack of clarity in how to deliver a high-quality research project. Many of these concerns result in additional responsibility on the Research Office and limit the value of completed research projects.

While the cause(s) of these issues is not immediately clear, it can be assumed that turnover among Research Office staff and project sponsors is at least partially a reason; it can also be assumed that, at times, project sponsors are not fully “vested” in the research process, and see management of a research project as a collateral duty with limited value, distracting from their primary duties and responsibilities; finally, it may also be the case that University PIs do not fully understand the expectations of timely delivery of research activities.

There are a number of potential strategies that Research Office staff could undertake to improve the effectiveness of project sponsors in overseeing RD&T activities (see [Findings](#)). Example strategies include, but are not limited to:

- Enhance the existing “Roles and Responsibilities of TDOT Lead Staff” document: the version of this document reviewed by the Federal Review Team could be further enhanced through additional clarity of the expectations of TDOT lead staff throughout the lifecycle of a research project, from inception to implementation;



- Develop a training session which clearly describes these expectations and provides examples, and require staff to undergo this training before sponsoring a project;
- Encourage TDOT Divisions with sponsored research projects to hold regular, recurring meetings to discuss their various projects, including project statuses, progress, findings, implementation; and more, and include Research Office staff in these conversations;
- Increase the visibility of a research project by requiring research projects be overseen by both a “project sponsor” which must be a Division Director or other member of TDOT leadership, and a “technical expert”, which is a lesser staff person assigned to support delivery of a research project;
- Increase accountability by limiting participation in the RD&T program by research project sponsors and University PIs which have a history of not delivering research projects in a timely and high-quality fashion;
- Incentivize effective project sponsorship through employee recognition efforts, such as performance appraisals and awards systems.

In addition to these strategies and more not listed, the previous strategies discussed regarding research need identification will likely prove beneficial in research project management through enhanced ownership of a research project by a project sponsor.

Progress Reporting and Invoicing

In addition to the three documents described above, the Research Office also maintains templates for invoices and progress reporting. PIs are expected to submit invoices and progress reports on a quarterly basis. All invoices must be reviewed by the project sponsor, a Research Office staff member, and TDOT Long Range Planning Division leadership before reimbursement can be made.

Through review of select project documentation, there were few instances where the template was not used; this was not marked as an area of concern by the Federal Review Team.

While it appears that templates are being used, the Federal Review Team has observed certain recent instances in which research projects are not being invoiced in a timely fashion, leading to potential inactivity and risking Federal participation in the activities.

Through discussion with Research Office staff, two primary concerns in this area were raised.



First, as previously discussed, there have been instances where a project sponsor is not adequately reviewing progress reports and invoices, or even requesting quarterly review from the PIs, resulting in potential project delays and additional burden on the Research Office. This may be able to be resolved through some of the previously listed strategies.

Secondly, as also previously mentioned, TDOT Research Office staff have a difficult time in effectively tracking the status of research activities using current tools and resources. As discussed, TDOT is in the process of acquiring a project management software which will provide the Research Office additional capability to track when invoices are due and ensure they are received and processed in a timely fashion.

Findings

Recommendation: The TDOT Research Office is recommended to clarify the expectations of TDOT project sponsors, enhance communication of these expectations through training and other communication strategies, and consider other best practices identified through this review and from the national research community towards ensuring that research projects are being effectively managed and guided by subject matter experts.

Documenting Research Activities

Observations

General Documentation Principles

As described in the AASHTO/TRB Research Development Cycle above, effectively communicating the value of a research program and research activities is a critical component of a high-value research program. The primary means of communicating the value of research is through performance measurement: How effectively is the program meeting stated goals and objectives? How is implementation of research findings being facilitated, promoted, and monitored?

One way to set a foundation for success in communicating the value of research is through effective documentation of research activities. When research findings are compiled and documented in an accessible, user-friendly format, implementation of the findings becomes straightforward; project sponsors can more easily take a research report and consider how well



the findings complement their program area processes and procedures and respond accordingly.

Federal regulations require State DOTs to develop, establish, and implement “procedures for documenting RD&T activities through the preparation of final reports. As a minimum, the documentation must include the data collected, analyses performed, conclusions, and recommendations. The State DOT must actively implement appropriate research findings and should document benefits” (23 CFR 420.209(a)(6)).

Roles and Responsibilities in Documenting Research Activities

TDOT’s draft *Research Office Standard Operating Procedures* describes the expectations associated with development and review of draft and final documents of research activities and findings.

Development of a draft research report begins with the use of the Research Office’s *Final Report Template*, last revised in June 2018. The template requires final research reports to include the following components:

- Cover Page
- Disclaimer Language
- USDOT Technical Report Documentation Page
- Acknowledgements (optional)
- Executive Summary
- List of Acronyms
- Table of Contents
- List of Tables
- List of Figures
- Introduction
- Objectives/Scope of Work
- Literature Review
- Methodology/Data Analysis
- Findings/Deliverables
- Benefits to TDOT
- Implementation
- Conclusion/Recommendations
- References
- Appendices



Draft reports are reviewed by both the Research Office staff and the TDOT project sponsor. The project sponsor is expected to review the report from the perspective of a project lead and subject matter expert, verifying the soundness of the methodology, the validity of the findings, the relevance to implementation at TDOT, and other technical aspects of the project. The Research Office staff review the report to ensure that a sound research process was carried out and that the report meets editorial expectations. Upon completion of both reviews, feedback is provided to the principal investigator and the final report is produced based on this feedback.

The TDOT Research Office recently developed a *Research Project Final Report Evaluation Form*, to guide project sponsors and Research Office staff in carrying out their evaluation of the draft and final report. As of this review, the form is still in draft form, so the Federal Review Team was unable to assess the effectiveness of the form in improving the quality of the draft and final reports; however, such a template should prove beneficial. The draft form is demonstrated in Figure 12.

The figure displays two overlapping copies of the 'Research Project Final Report Evaluation Form'. The top-left copy shows the front page, which includes the TDOT logo, contact information for the Research Office (Long Range Planning Division, 505 Deaderick Street, Suite 900, Nashville, TN 37243), and the form title. Below the title is a section for 'Research Project Title' and 'Principal Investigator(s)'. The main body of the form is a checklist with 26 numbered criteria, each with a 'Y/N' column and a 'Comments' column. The criteria cover various aspects of the report, from title clarity to bibliography. The bottom-right copy shows the back page, which features a table for 'Assessment Grade' with columns for 'Assessment Grade', 'Reviewer recommendation for the final report', and 'Reviewer recommendation for the executive summary'. Below this is a section for 'Additional Comments' and a 'Date' field.

Figure 12. TDOT Research Project Final Report Evaluation Form (Source: TDOT)

Upon completion of the final report and acceptance by TDOT, the report is shared with the FHWA Tennessee Division, and the project is considered closed out.



Given that the template was most recently updated in June 2018, the project sample documentation reviewed largely did not reflect the template. It appears that one of the newer elements in the final report expectations is the discussion on implementation; this should prove beneficial for use by TDOT in ensuring that research findings are implementable and in performing measurement.

Based on discussion with Research Office staff, there is a general feeling that both University principal investigators and TDOT project sponsors may not be effectively reviewing draft research reports before submitting to the Research Office for consideration. This is reflected through sometimes poor-quality work being received by the Research Office, requiring the Research Office staff to perform a longer-than-expected review of the report.

This observation, shared by the Research Office, follows a similar trend discussed earlier in this report, in which there is a need for more active management of research projects by project sponsors and principal investigators. While the Research Office can take steps to try to improve the quality of the research reports, such as developing and sharing examples, doing training, and increasing accountability of project sponsors and principal investigators, some of the previously discussed recommendations could benefit this concern as well.

Findings

None.

Effectiveness of Research Program

Observations

General Effectiveness Principles

Federal regulations require State DOTs to develop, establish, and implement “procedures to determine the effectiveness of the State DOT’s management process in implementing the RD&T program, to determine the utilization of the State DOT’s RD&T outputs, and to facilitate peer exchanges of its RD&T program on a periodic basis” (23 CFR 420.209(a)(5)).

TDOT’s draft Research Office Standard Operating Procedures do not provide any such procedures being used by TDOT. The Research Office does have a draft set of performance measures and targets, which were provided for this review; however, it is unclear how these



measures are used. Based on discussion with TDOT staff, these do not appear to be currently in use by TDOT in managing the RD&T program. As such, these were not highly considered in this review.

Performance Measurement – Implementation of Research Findings

Implementation of research findings is a core consideration in measuring the effectiveness of a research program. As stated, Federal regulations require State DOTs to “determine the utilization of the State DOT’s RD&T outputs”, and this is a primary mechanism for communicating the value of a research program. What benefit is being realized from the cost of carrying out research?

Tracking and measuring implementation of research findings was shared by TDOT as an area of concern and opportunity as part of this review. At present, Research Office staff are not tracking implementation of research findings, and the Research Office believes that most program offices sponsoring research activities are also not tracking implementation.

TDOT plans to conduct an RD&T program peer exchange in Spring 2021; a primary focus area for this peer exchange is implementation of research findings.

In carrying out this peer exchange and considering processes and procedures for determining the effectiveness of the RD&T program and activities, FHWA would advise TDOT consider several factors, including but not limited to:

- As discussed under [Identification & Prioritization of Research Activities](#), TDOT’s research needs statement template requests potential project sponsors to provide a narrative on “implementation planning”. Based on review of the sample project documentation provided by TDOT, the specificity of information provided in this narrative is highly variable; one sample needs statement specifically called for incorporation of research findings into TDOT specifications, while another simply provided “N/A”. Given this variability, TDOT should consider opportunities to strengthen implementation planning, to support the identification of implementable, valuable research activities.

It should also be noted that the current templates being used by TDOT for needs statements and proposals have only been implemented over the last approximately 3 years; research projects awarded prior to this template appear to have very little documented consideration of implementation planning.

- As discussed under [Identification & Prioritization of Research Activities](#), fostering a “culture of innovation”, will naturally bring benefits to implementation through



enhanced awareness of research activities and results and consideration throughout TDOT's operations.

- Implementation of research findings will vary by project and program area; defining implementation through traditional performance measures and metrics can be a difficult task. In some cases, implementation may be, and likely is, occurring without the knowledge of the Research Office.

In defining performance measures and objectives for implementation, TDOT is encouraged to make use of the broader nationwide research community through FHWA, AASHTO, TRB, NCHRP, and others in seeking ideas for valuable and varied performance objectives to capture how research findings are being implemented.

- Effective and continuous communication of the value of research will improve the perceived worthiness of research throughout TDOT and with its partners across Tennessee. TDOT should consider a varied, tailored, accessible communication strategy that highlights the benefits of the research program and fosters enthusiasm regarding the program.

Communicating the Value of Research

As part of this review, the Federal Review Team reviewed an issue of the *Research Roundup*, a newsletter of the TDOT Research Office, from September 2018 (Figure 13). While such a newsletter can be an effective strategy in communicating the value of research, this practice has not continued; the September 2018 newsletter was the only one produced.

It is worth noting that none of the staff present in the Research Office at the time of the newsletter's publication continue to work in the Research Office as of this review.

One resource TDOT could look to for guidance on this is [NCHRP Report 610: Communicating the Value of Research](#), which provides a framework for communicating the value of research and various ideas for approaches.

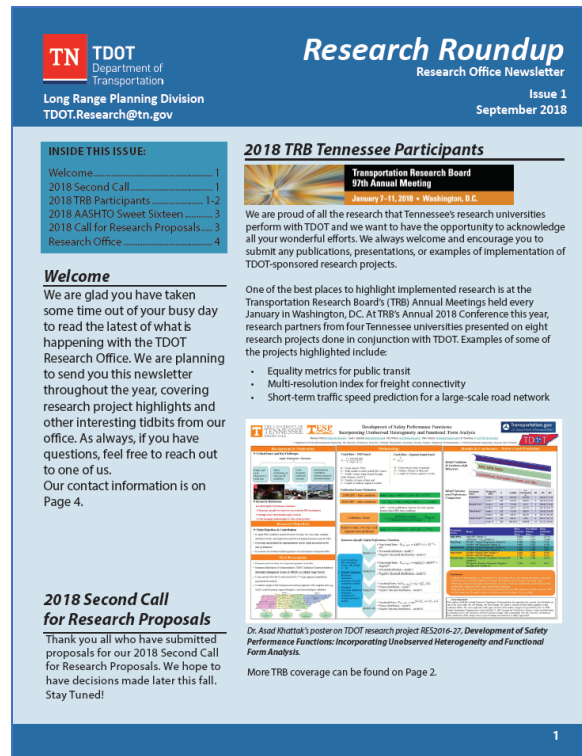


Figure 13. *Research Roundup* Newsletter, Sept. 2018 (Source: TDOT)

Findings

Recommendation: TDOT is recommended to ensure the delivery of the Spring 2021 research peer exchange in a fashion which provides maximum value to TDOT in its management of the research program. Given the current peer exchange focus on implementation of research findings, TDOT should be sure that the scheduled peer exchange provides valuable information on early and effective implementation planning, roles and responsibilities in implementation and implementation monitoring, performance measurement, communicating the value of research, and other topics which support determinations of the effectiveness of the RD&T program.



Other Programmatic Functions

Observations

Hosting and Participating in Peer Exchanges

Federal regulations require State DOTs to develop, establish, and implement an RD&T management process which includes “Participation in peer exchanges of its RD&T management process and of other State DOTs' programs on a periodic basis” (23 CFR 420.209(a)(7)). These regulations go on to require State DOTs to make their documented management process available, as necessary, to facilitate peer exchanges (23 CFR 420.209(b)).

There were no records available for this review to provide evidence of Tennessee having previously hosted a peer exchange to support TDOT’s RD&T management process (AASHTO maintains a directory of peer exchange reports dating back to 1997). This is not to say that TDOT has not participated in peer exchanges hosted by other States; it appears that TDOT last participated in a peer exchange in 2018, hosted by South Carolina DOT. Near the conclusion of this review, TDOT staff indicated that records were found regarding two previous peer exchanges in which TDOT was involved; this was not reviewed by the Federal Review Team.

As previously discussed, TDOT is prepared to host a peer exchange scheduled for Spring 2021. FHWA is prepared to assist TDOT in finalizing the agenda for the upcoming peer exchange and will be an active participant.

Following the peer exchange, FHWA encourages TDOT to update their documented procedures to clarify expectations in implementation planning, implementation monitoring and tracking, and communication of the value of the research program. Components of this process, including early implementation planning practices and expectations, should be incorporated into the procedures prior to the next call-for-projects (see [Identification & Prioritization of Research Activities Findings](#)).

Supporting and Using the TRIS Database

Federal regulations require State DOTs to develop, establish, and implement an RD&T management process which includes “Support and use of the TRIS database for program development, reporting of active RD&T activities, and input of the final report information” (23 CFR 420.209(a)(4)).



Although TDOT's documented procedures do not address this requirement, the five completed projects sampled for review were all uploaded to the TRIS database, and the Federal Review Team has limited concern in this area.

Participation in AASHTO RAC/R&I

In the observation of the Federal Review Team, TDOT is an active and continuing participant in the national transportation research community. TDOT has three staff members on the AASHTO Research Advisory Committee (RAC): Kwabena Aboagye (Long Range Planning Division Assistant Director) acts as a voting member, while two additional staff are non-voting. Dr. David Lee (Long Range Planning Division Assistant Director) was also recently appointed a voting member of the AASHTO Special Committee on Research & Innovation. TDOT is also an active member of the Region 2 RAC, made up of the southern states, and has offered to host national and regional RAC activities.

This active engagement strengthens TDOT's ability to be aware of and participate in innovative and beneficial practices in advancing the state of the research program.

Findings

None.



Summary of Findings

Program Management & Project Development

Recommendation: TDOT is recommended to continue efforts to update the Research Office Standard Operating Procedures, ensuring continued compliance and increasing effectiveness and value of the documented procedures. This update should be informed by the results of this review, TDOT's upcoming Research Peer Exchange, internal and external stakeholder outreach, and research on other best practices in research program administration.

Additionally, TDOT is strongly recommended to suspend any research calls-for-projects until the Standard Operating Procedures have been updated, in order to ensure that new research projects are identified and administered in accordance with TDOT's program priorities moving forward.

Once the updated documentation is finalized, TDOT must submit the documentation for review and approval by the FHWA Tennessee Division in accordance with 23 CFR 420.209(b).

Identification & Prioritization of Research Activities

Recommendation: TDOT is strongly recommended to develop and implement a standing committee, or several committees, tasked with overseeing the research needs identification process. Committee membership should include, at a minimum, TDOT subject matter experts and FHWA Tennessee Division staff, with other perspectives from state, regional and local transportation and research partners being considered as well.

Recommendation: TDOT is recommended to consider other enhancements to the research needs identification process based on best practices identified throughout this review and from the national research community.

Managing & Programming Research Funding

Recommendation: TDOT is recommended to ensure that the program management software currently in procurement provides full program and project management capabilities, including but not limited to, program revenues, obligations, and expenditures; project tracking and deadlines; user roles and review workflows; and contract file management and document storage capabilities.



Tracking & Managing Research Activities

Recommendation: The TDOT Research Office is recommended to clarify the expectations of TDOT project sponsors, enhance communication of these expectations through training and other communication strategies, and consider other best practices identified through this review and from the national research community towards ensuring that research projects are being effectively managed and guided by subject matter experts.

Effectiveness of Research Program

Recommendation: TDOT is recommended to ensure the delivery of the Spring 2021 research peer exchange in a fashion which provides maximum value to TDOT in its management of the research program. Given the current peer exchange focus on implementation of research findings, TDOT should be sure that the scheduled peer exchange provides valuable information on early and effective implementation planning, roles and responsibilities in implementation and implementation monitoring, performance measurement, communicating the value of research, and other topics which support determinations of the effectiveness of the RD&T program.



Conclusion

As noted throughout this review report, TDOT's RD&T program management procedures and staff have experienced a high level of variability in recent years, and documented procedures have been developed but are not providing maximum value to TDOT and program partners.

Through this review, the Federal Review Team identified 6 recommended process improvement actions for TDOT's consideration. The highest-priority recommendation is noted below:

Recommendation: TDOT is recommended to continue efforts to update the Research Office Standard Operating Procedures, ensuring continued compliance and increasing effectiveness and value of the documented procedures. This update should be informed by the results of this review, TDOT's upcoming Research Peer Exchange, internal and external stakeholder outreach, and research on other best practices in research program administration.

Additionally, TDOT is strongly recommended to suspend any research calls-for-projects until the Standard Operating Procedures have been updated, in order to ensure that new research projects are identified and administered in accordance with TDOT's program priorities moving forward.

Once the updated documentation is finalized, TDOT must submit the documentation for review and approval by the FHWA Tennessee Division in accordance with 23 CFR 420.209(b).

In Federal Fiscal Year 2021, the FHWA Tennessee Division will prioritize working with TDOT to address this corrective action and continue to grow the program.



U.S. Department
of Transportation
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