VERMONT
AGENCY OF TRANSPORTATION

VTRANS RESEARCH MANUAL

Finalized September 2020

VTrans Research Section
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CERTIFICATION

I, Michele Boomhower, Director of the Policy, Planning and Intermodal Development Division of the Vermont Agency of Transportation, do hereby certify that the Vermont Agency of Transportation is in compliance with all requirements of 23 CFR Part 420, Subpart B and its implementing regulations with respect to research, development, and technology transfer programs, and contemplate no changes in statutes, regulations, or administrative procedures which would affect such compliance.

E-SIGNED by Michele Boomhower
on 2020-10-08 18:11:35 GMT

Michele Boomhower

October 08, 2020

Date

RESEARCH PROCEDURES MANUAL

Contents

Acronyms

AASHTO	American Association of State Highway and Transportation Officials
CFR	Code of Federal Regulations
FAST Act	Fixing America's Surface Transportation Act
FHWA	Federal Highway Administration
IDEA	Ideas Deserving Exploratory Analysis program
ITS	Intelligent Transportation Systems
NCHRP	National Cooperative Highway Research Program
VTrans	Vermont Agency of Transportation
PI	Principal Investigator
RAC	Research Advisory Committee
RD&T	Research, Development and Technology Transfer (FHWA term)
SHRP	Strategic Highway Research Program
SPR	State Planning and Research
TAC	Technical Advisory Committee
TCRP	Transit Cooperative Research Program
TPF	Transportation Pooled Fund Program
TRB	Transportation Research Board
USDOT	United States Department of Transportation
UTC	University Transportation Center

1 INTRODUCTION

This Procedures Manual summarizes the background, organization, and funding of the Research Program, and provides a detailed description of the full cycle of the research process including: 1) program development and review, 2) project oversight and reporting, and 3) implementation and technology transfer. The purpose of this manual is to provide insight into VTrans' Research Program and guide employees through VTrans' research process.

Research can provide the most effective solution to many of the problems facing today's transportation officials. Often, these problems are of local or regional interest and can best be addressed by or through individual transportation agencies. This Manual outlines the Vermont Agency of Transportation's (VTrans) Research, Development, and Technology Transfer procedures for administration of the research projects.

Federal-Aid policies administered through the Federal Highway Administration (FHWA) provide funding to research programs at state highway agencies. These provisions are reaffirmed in the highway appropriations bills.

Title 23 Section 505 of the United States Code (23 U.S.C.) requires that a minimum of two percent (2%) of each states' federal-aid apportionment of core programs be set aside for the purposes of planning and research. Not less than 25% of the funds set aside by 23 U.S.C. 505 each fiscal year shall be expended by the state for research, development, and technology (RD&T) transfer activities. Regulations for the administrative requirements that apply to RD&T are outlined in 23 CFR Part 420 Subpart A.

Based on the recognition that research delivers value and the federal mandate for transportation research, VTrans created the Research Section within the Agency's Policy, Planning, and Intermodal Development Division. The Research Section is part of the Policy, Planning and Research Bureau.

1.1 RESEARCH MISSION

The mission of the Research Section is to facilitate improvement in the state transportation system, focusing on the following areas of transportation:

- Safety
- Access and mobility
- Durability and service life
- Environmental impact
- Cost savings and cost avoidance

The Research Section serves within the context of the VTrans mission: "Provide for the safe and efficient movement of people and goods" and helps Vermont partner with the FHWA and implement a national mission: "To improve mobility on our Nation's highways through national leadership, innovation, and program delivery."

2 ORGANIZATION

The Research Section is comprised of the Research Manager and Research Engineer.

2.1 RESEARCH PROGRAM

2.1.1 Responsibilities

The primary responsibilities of the Research Section are to coordinate, administer, and supervise research activities within the agency; to conduct research projects; to assure the use of proper research methods; to prevent duplication of effort; to cooperate and communicate with other agencies doing transportation research; to assist other transportation providers by sharing and disseminating new technology and research findings; to serve as an information source; and to promote the implementation of research findings. Specific responsibilities of the Section include the following:

- Solicit transportation users for research needs.
- Review all research problem statements and obtain the information necessary to formulate a research program.
- Participate on committees.
- Facilitate selection of principal investigators for each project and the personnel for project oversight.
- Conduct literature searches and reviews.
- Conduct research projects.
- Assist in the preparation of reports covering the results of research, and work with key personnel to identify opportunities for implementation of research results.
- Promote the implementation of the research findings through distribution of research results to appropriate persons for their consideration and use.
- Manage participation in Transportation Pooled Funds.
- Provide expertise for VTrans in specialty areas such as research design, research data management and analysis and research consultant selection.
- Participate in state-sponsored seminars and training meetings to help implement new research findings.
- Provide a liaison with FHWA, universities, consultants, and other agencies conducting and supporting research for VTrans.
- Provide continuous liaison and monitoring of progress and expenditures for all research projects.
- Provide liaison with the Transportation Research Board and the Cooperative Research Programs (NCHRP, TCRP).
- Prepare annual budgets for federally supported research activities.

A principal implementing document for the Research program is the Annual Work program, “State Planning and Research: Part II - Research.” This document describes how the VTrans Research Section uses FHWA funds provided under Title 23, Code of Federal Regulations, Part 420. This and other sources of funds are described more completely in Section 3.

3 RESEARCH FUNDING PROGRAMS AND RESOURCES

3.1 FUNDING

Several funding programs are available to the Research Section. The largest source is the State Planning and Research (SPR) program. Other programs are also used and are described in more detail in the following sections.

3.1.1 SPR Funds

The VTrans SPR-B Research program supports research, development, and technology transfer (RD&T) activities relating to highway, public transportation, and intermodal transportation systems. Requirements for the SPR-B program are described in 23 CFR 420.

These funds require 20% local participation or match unless they are used for annual VTrans commitments to NCHRP, TRB, FHWA Pooled Funds and AASHTO Technical Service Programs. Each of these annual commitments have 100% SPR-B waiver letters and can be funded through 100% SPR-B funds. The 20% match for the other activities in the Vermont SPR-B Work Program come from general state funds.

3.1.2 FHWA Transportation Pooled Fund Program (TPF)

The TPF program is not a separate source of funds, but a program through which funds from multiple states can be leveraged to solve common problems in transportation. A pooled fund project is initiated when a lead agency circulates a proposal and invites other states to contribute funds. The lead agency may be FHWA or any state DOT.

Once the lead agency has gathered enough commitments to make the project financially viable, FHWA reviews the proposal for compliance with requirements and approves the project to go forward, and may waive the 20% match requirement, if asked to do so. Each participating state designates a financial and a technical contact for the project. The technical contact serves on a Technical Advisory Committee (TAC) which finalizes a work plan, review proposals, and reviews reports and other work products. The TAC is the vehicle through which each participating state has a role in oversight of the project. The Research Manager working in concert with the FHWA Division Office is generally the state financial contact for the Pooled Fund.

The key advantage offered by a pooled fund project is the streamlining of financial administration. FHWA plays a role in every pooled fund project analogous to that of a bank account or an escrow fund. Also, while every state has its own financial standards, in Vermont, obligating Federal funds to a TPF project led by another agency has no budget impact, because Vermont neither receives nor spends those Federal funds.

Pooled Fund solicitations are posted at any time. Decisions to participate in a Pooled Fund are made by the Research Manager after consultation with technical staff, Bureau Directors, and the Vermont Division Office.

FHWA maintains a website dedicated to the selection and administration of pooled funds. VTrans will follow the published federal procedures for initiating a pooled fund, recording a commitment of funds, and transferring funds to a TPF lead agency.

3.1.3 Other Funding Sources

3.1.3.1 Cooperative Research Programs

There are three Cooperative Research Programs managed by the Transportation Research Board (TRB), these include:

- National Cooperative Highway Research Program (NCHRP)
- Transit Cooperative Research Program (TCRP)
- Airport Cooperative Research Program (ACRP)

With the exception of NCHRP, which is funded voluntarily by state Agencies of transportation based on a percentage of their SPR funding, these programs are funded directly by the USDOT. Each program accepts problem statements and selects projects annually. Projects are carried out by contractors with the oversight of TRB Cooperative Research program's staff and a panel made up of interested and knowledgeable stakeholders.

NCHRP is by far the largest of these programs. Also of note, there are several sub- programs within NCHRP. Of particular interest are the NCHRP Syntheses and NCHRP IDEA Programs, both funded with a set-aside from NCHRP. The Synthesis program selects and carries out small projects which gather data from the 50 states on current practices in a defined area, to produce a "synthesis of current and best practices." The NCHRP IDEA (Innovations Deserving Exploratory Analysis) develops transportation related inventions and other intellectual property for the benefit of the transportation industry as a whole.

3.1.3.2 University Transportation Centers Program

University Transportation Centers (UTCs) receive annual funding from the USDOT Office of the Secretary of Transportation-Research (OST-R). The VTrans Research program seeks opportunities to jointly fund projects with University Transportation Centers.

The goals of University Transportation Centers are not perfectly aligned with state DOT programs. Each UTC has a stated theme which concentrates their research efforts in a specified area within transportation, whereas DOT research programs tend to be eclectic, at least in the long run. Second, UTC research is expected to emphasize basic and advanced research, whereas DOT research programs tend to have a much more applied emphasis. Consequently, working with a UTC can be a challenge, and not every project is suitable for UTC/DOT collaboration. The main UTC we work with is the TIDC (Transportation Infrastructure Durability Center), centered at the University of Maine, of which University of Vermont is a member.

3.1.3.3 Experimental Features Program

The FHWA Experimental Features program affords state DOTs the opportunity to test and evaluate new technology on Federal Aid highway projects. The Experimental feature is incorporated into a federal-aid construction project. If the Experimental Feature fails then the same federal-aid construction funds can be used for the necessary corrective action.

An Experimental Features project can be initiated through the FHWA Vermont Division Office. One requirement is that the feature be installed on a federally funded highway project. The "research" usually takes the form of a monitoring project which entails careful documentation of the construction/installation process in a Construction Report, followed by ongoing monitoring of performance in the field, concluding with an evaluation report. Funding for the monitoring and evaluation of the experimental feature comes from the Experimental Features Task in the SPR-B Work Program.

3.1.3.4 Miscellaneous Funding Sources

In any Federal Transportation Authorization bill there are programs, funding grants and cooperative agreements that may be of interest to VTrans Research. VTrans Research will evaluate these funding opportunities based on the goals of the research program as compared to the intended purpose of the grant program. Any application for grant funds will consider agency resources and the need for state

legislative action to accept and spend additional funds. VTrans continues to be active in applying for Federal Awards through programs such as the second Strategic Highway Research Program (SHRP2) and the Accelerated Innovation Deployment (AID) demonstration program.

4 RESEARCH PROGRAM DEVELOPMENT AND REVIEW

Federal regulations, specifically 23 CFR 420.205 (c), states that "states are encouraged to develop, establish and implement an RD&T program…that anticipates and addresses transportation concerns before they become critical problems." The VTrans Research program has developed an approach to accomplish this objective.

The VTrans Research program conducts both internal and external research. Internal research is done in house, to address project related research tasks and monitoring. External research provides an opportunity for additional activities. External research projects are selected annually by VTrans Bureau Directors.

4.1 INTERNAL RESEARCH

Internal Research is related to various ongoing efforts. The majority of internal research is conducted on Experimental Features. The FHWA Experimental Feature program allows VTrans to trial new technology and methods, while minimizing the risk of failure. The balance of our internal research activities are legacy research efforts that align with the priorities of various committees and working groups in which research is involved. These efforts include the Pavement Life Study, Pavement Markings and Recycled Materials.

Newly proposed internal research projects are conducted at the discretion of the Research Manager in consultation with the Policy, Planning and Research Bureau Director and FHWA. Acceptance of internal research depends on availability of research work program funds. Such projects require a scope including timeline, expected tasks, and deliverables and clear expectations of who will be working on the project (research staff or additional technical staff).

4.1.1 Experimental Features

Experimental Feature projects are developed as requested by subject matter experts (SME) or groups. The research staff collaborates with the SME to draft a workplan documenting the purposed work, location, experimental testing, cost, and study duration. Experimental Feature projects are generally related to a specific construction project and use project funds for implementation. Experimental Feature projects typically have a Construction Report, Interim/Field Report(s), and Final Report, and often require routine annual evaluations, over a study duration of 3-5 years. A combination of research staff and AOT non-research technical staff conduct the site visits and compile the reports. The reports are made available on the Research web site.

4.2 EXTERNAL RESEARCH

The VTrans research section manages and conducts an external research program, currently consisting of funded academic research. Outlined below is the process for annual external research project selection. Project Management and Oversight is described in Section 5 of the Research Manual.

4.2.1 Participating Researchers

VTrans Research periodically solicits and approves qualified researchers to partner with VTrans, to be able to propose and conduct research on its behalf. Application to the qualified research pool is currently available to Vermont Institutes of Higher Education. In Fall 2018, potential Vermont Institutes of Higher Education were asked to submit a Statement of Qualification to VTrans Research. Instructions for submitting this statement are found here. The current (Spring 2019) qualified research pool includes University of Vermont (UVM), Vermont Technical College (VTC), St. Michael's College, and Norwich University. These universities can work with VTrans through a cooperative agreement leading to project task agreements. A sample generic cooperative agreement is found here.

4.2.2 Soliciting Ideas

In the fall of each year the Research program issues an open call for research ideas. We have used this link on the VTrans Research web site: https://vtrans.vermont.gov/planning/research/research-ideas . Participation is open to anyone. For the most part, problem ideas are generated by VTrans employees, university researchers, other state and local transportation agencies, other research organizations, or consultants, emphasizing a "bottom up" approach.

Various techniques are used to reach as many potential research customers as possible. These techniques include, but are not limited to:

- Promotion of research activities in the "Research and Innovation" e-newsletter produced by the VTrans Research Section. Most issues of the newsletter include a link to the Research Idea Suggestion form.
- Email announcements to Agency personnel.
- Formal and informal discussions with Agency personnel and external contacts.

4.2.3 Agency Champion Identification

Research staff review the submitted Research Ideas, perform a short literature search, and work to pair the ideas with a potential VTrans Champion. This step removes ideas that have no support from within the Agency. At this stage, the Champion's Supervisor is asked if they support their staff's involvement with the specific idea. When a Champion is identified, they are asked to draft a Research Problem Statement. In December 2018 we distributed a Problem Statement Template to our staff Champions.

4.2.4 Statement of Interest

Research Problem Statements are distributed to the Qualified Research institutions. Researchers are asked to submit two page Statements of Interest, highlighting their experience and ability to collaborate with the VTrans Champions on this project.

4.2.5 Proposals

The Champions select one research team (one submission) from the submitted Statements of Interest that they would like to work with to develop a full 10-page proposal. The researchers draft the proposals, working in conjunction with the champions to meet their objectives and the scope they prefer. The proposals follow a standard format (Proposal Template and Instructions).

4.2.6 Project Selection

Projects are selected by a panel of the Agency's Bureau Directors. The Bureau Directors are a level below Agency Division Directors on the Executive Team: Chief Engineer and Policy, Planning and Intermodal Development Director. In Spring 2019, the Highway Bureaus include: Construction and Materials, Maintenance, Support Services, Operations and Safety, Project Delivery, Municipal Assistance, and Asset Management. Policy, Planning and Intermodal Development includes the Policy, Planning and Research Bureau and the Rail and Aviation Bureau. We also invited the heads of the Finance and Administration Division Performance, Training, and Civil Rights sections in Spring 2020. The proposals and a one-page summary developed by the research section are distributed to the selection group prior to the annual selection meeting. Each Champion makes a short (<4 minute) presentation, answers questions, and advocates for their project. The panel votes for the projects they prefer, resulting in a rank of the projects. Projects are selected by rank as the total budget allows.

4.3 FHWA OVERSIGHT

4.3.1 Conditions for Grant Approval

Regulations in 23 CFR Parts 420-State Planning and Research Program Administration, Subpart B-Research, Development and Technology Transfer Program Management, set requirements for administration of the SPR-B program. FHWA provided State DOTs with updated guidance about the regulations in 23 CFR Part 420, on October 16, 2018 (Link to document).

23 CFR Part 420 Subpart A identifies the administrative requirements that apply to use of FHWA planning and research funds both for planning and for research, as well as for development and technology transfer (RD&T) activities. Subpart B describes the policies and procedures that relate to the approval and authorization of RD&T work programs. Section 420.209 in Subpart B contains the conditions that VTrans must comply with in order to receive grant approval from the FHWA.

Research section work is completed in partnership with the FHWA. This includes regular coordination with the FHWA Vermont Division office. Regular programmatic coordination includes the development of an annual SPR-B research work program (described here and in Section 4.4.2) an annual narrative of progress (Section 4.4.2), and the hosting of a multi-state peer exchange (Section 4.4.1) once every five years. The Research Section sends a request to the Vermont Division Office for a FHWA representative on project technical advisory committees (Section 5.3.1).

4.3.1.1 Annual Research Work Program Purpose

There are many documents assembled by the Research Section that help define and justify the expenditure of resources. The Annual *Research Work Program* includes a narrative of the accomplishments and expected activities of all the research activities undertaken in the previous and upcoming Federal Fiscal years. It also includes a financial budget for the next Federal Fiscal Year's research activities. These activities use State Planning and Research Part B funds and constitute the SPR-B program. The Annual Research Work Program is first drafted in July and August each year by the Research Section and then is presented to the FHWA Division Office by VTrans in September for approval in expectation of the new federal fiscal year starting on October 1.

4.3.1.2 FHWA requirements

The RD&T Work Program requirements needed to meet the FHWA regulations defined in Section 23 CFR 420.207 are as follows:

"(a) The State DOT's RD&T work program must, as a minimum, consist of a description of RD&T activities to be accomplished during the program period, estimated costs for each eligible activity, and a description of any cooperative activities including the State DOT's participation in any transportation pooled fund studies and the NCHRP. The State DOT's work program should include a list of the major items with a cost estimate for each item. The work program should also include any study funded under a previous work program until a final report has been completed for the study. [Traditionally the Vermont work program includes programs for one additional federal fiscal year after the project/program has ended.]

(b) The State DOT's RD&T work program must include financial summaries showing the funding levels and share (Federal, State, and other sources) for RD&T activities for the program year. State DOTs are encouraged to include any activity funded 100% with State or other funds for information purposes.

(c) Approval and authorization procedures in § 420.115 are applicable to the State DOT's RD&T work program."

4.3.1.3 Equipment Purchase Requirements

Projects requiring the purchase of equipment valued over $5000 will have a list of anticipated equipment to be purchased in the Work Program description of the project.

4.4 PROGRAM EFFECTIVENESS

The performance of a research program is measured by its implementation of results and its timely solutions to agency problems. Performance measures can be used to assess project and program efficiencies (projects finishing on time and on budget) or outcomes like the length of time until project implementation and the number of projects implemented.

4.4.1 Peer Exchange

4.4.1.1 Purpose

The performance of a research program is measured by its implementation of results and its timely solutions to agency problems. One technique designed to improve the quality of the program is a peer exchange of the management process. A team with knowledge of state research programs can bring its expertise to provide recommendations to enhance the Research Section's performance. 23 CFR 420.209 requires that a peer exchange be completed on a periodic basis. FHWA interprets that to mean that a peer exchange shall be completed approximately every five years.

4.4.1.2 Procedure

4.1.2.1.1 Team Members

The team can include representatives of FHWA, universities, TRB, the private sector, other agencies, and transportation research program managers from other states. The VTrans Research Section budgets travel and expenses from SPR-B funds for the peer exchange team. Organizations furnishing the peer exchange team members are responsible for their salaries.

4.1.2.1.2 Peer Exchange Agenda and Process.

The peer exchange team spends at least two days with VTrans staff and Research Program stakeholders. Recent Peer Exchanges across the country have chosen to focus on a short list of issues. The focus of a peer exchange is at the discretion of the host program. A peer exchange consists of a fact finding phase and a summation and reporting phase.

Fact finding may begin with written information provided to members of the peer exchange panel prior to the peer exchange for their review. This information typically includes a copy of the host program's procedures manual, examples of forms and reports, more general information about the agency, and possibly reports from previous peer exchanges.

Fact finding continues with a series of interviews with groups of Research Program stakeholders and other interested parties. These interviews are conducted by the peer exchange panel and may be scripted using a series of discussion questions designed to elicit information relevant to the focus of the exchange.

Summation and reporting begin with a work session involving members of the peer exchange team. The work session has three objectives. The first objective is to attempt to synthesize and summarize the insights and action items that have been gleaned from the fact finding phase. The second objective is to incorporate those findings into a written peer exchange report. The third objective is to prepare a presentation to be delivered at the peer exchange close-out meeting.

Summation and reporting conclude with the close-out meeting. Key representatives from the Agency's upper management and Research Section staff are invited. The peer exchange team presents the findings and recommendations of the panel. The written peer exchange report is generally completed after the Exchange. The written report is shared on the AASHTO Research and Innovation website. Winter AASHTO Research Activity Committee (RAC) meetings held at the Transportation Research Board Annual Meeting usually includes summaries of Peer Exchanges held the previous calendar year.

4.4.2 Development and Operation of Annual SPR-B Research Work Program including Narrative of Accomplishments and Expected Activities

Vermont Agency of Transportation (VTrans) develops an annual Research Work Program that includes a budget for each desired Task and a narrative that includes accomplishments of the past year and expected activities during the next federal fiscal year. In the narrative, each task is covered on a separate page and each task narrative includes the task objective, the accomplishments of the previous federal fiscal year, and expected activities during the next federal fiscal year. Each task budget includes an estimate of VTrans Payroll/Expenses, Consultant Contracts, Equipment Purchases and Travel/Training. This breakdown is repeated at the bottom of the narrative document. Each month VTrans provides FHWA with a Work Program expenditure spreadsheet broken down by specific task.

Most tasks are carried in the Budget and Narrative from year to year. A Closed and New Project Listing at the beginning of the narrative includes a listing of Projects/Tasks Deleted from the new federal fiscal year Work Program, projects included in the Work Program but that are Closed, and New Work Program Activities. Tasks/Projects are generally included in the following year Work Program the year after closure (with no budget or expected activities).

The Work Program Tasks/Projects are categorized three ways: the VTrans Research and Development Program, Committed Contributions, and FHWA Pooled Fund Studies. The Research and Development Program tasks are funded with 80% federal (SPR-B) funds and 20% State funds (using Administrative funds from the VTrans Policy, Planning and Intermodal Development (PPAID) Division). The Committed and FHWA Pooled Funds are funded with 100% federal (SPR-B) funds. Committed tasks/projects include the Transportation Research Board and several AASHTO Technical Service Programs. FHWA Pooled Funds require a 100% waiver letter for SPR-B funds to utilize 100% SPR-B funds.

The Work Program budget is developed concurrently with the annual Work Program narrative utilizing the expenditures of the previous federal fiscal year. The budget is formed by balancing Task priorities with Task needs. A small portion of each year's budget is assigned to a Projects Pending VTrans and FHWA Approval (Reserve) fund to allow participation in small projects or new FHWA Pooled Funds during the federal fiscal year (with FHWA Division Office approval). As the year progresses, funds are reallocated between Work Program tasks as necessary, appropriate, and approved by the FHWA Division.

5 PROJECT OVERSIGHT AND REPORTING FOR EXTERNAL RESEARCH

5.1 RESEARCH PROJECT TASK AGREEMENT

Each external research project is governed by a project proposal, task agreement and the use of deliverables. Deliverables-based invoices are expected. For each quarter (Jan-Mar, Apr-Jun, Jul-Sep, Oct-Dec), the researchers indicate what deliverables will be submitted to document their progress.

5.2 RESEARCH STAFF OVERSIGHT

Once a project is selected, the research project's Administrative Lead (either the Research Manager or Research Engineer) is responsible for working with the VTrans Technical Champion to organize a Technical Advisory Committee (TAC), refine the project's schedule and quarterly deliverables, execute a task agreement, monitor and oversee the conduct of the project, and review deliverables for acceptability. The Administrative Lead also assists in implementing research findings.

5.2.1 Project Execution

The Administrative Lead provides ongoing monitoring of the principal investigator and research team's progress and timeliness in carrying out the project. The Administrative Lead convenes the Technical Advisory Committee at regular intervals to review progress and project deliverables and provide guidance on the direction of the project. Site visits from Administrative Lead can also be performed for continued project engagement. The Administrative Lead records and reviews invoices for accuracy and checks reasonable billing for work completed.

5.3 TECHNICAL ADVISORY COMMITTEE (TAC) OVERSIGHT

5.3.1 Purpose

A Technical Advisory Committee (TAC) is formed at the outset of each new external research project. Technical Advisory Committees provide technical input and guidance to research projects. To the extent that project scope and objectives have budget implications, the TAC may only make recommendations. Final authority for the conduct of any research project resides with the Research Manager. However, in all but relatively rare instances, the views and recommendations of the TAC are to be respected. The roles defined below are also summarized in Technical Advisory Committee (TAC) Guidance. The TAC has the following roles and responsibilities:

- *Objectives and Deliverables*

The committee develops, reviews, and establishes or revises recommended project objectives and deliverables.

- *Project Progress*

Quarterly reports are distributed by the Research Section to keep each TAC member informed about research progress, problems, finances, and work planned for the next quarter. The committee reviews the progress of the project and may recommend changes of direction or termination.

- *Deliverables*

The committee reviews the project deliverables (reports, etc.) and may recommend revisions. It is critical that the TAC review all project deliverables, including interim reports, the final report, and results summaries (such as a Research Note), so that the VTrans personnel most likely to be affected by the research findings are aware of them and have an opportunity to comment on them prior to completion and dissemination.

- *Implementation*

TAC members are expected to sponsor implementation of the research findings. This may be facilitated by the Research Administrative Lead and an implementation plan and/or and implementation memo.

- *Membership*

A TAC typically has four to seven members. There may be fewer members for small projects. The TAC has the following composition. Generally, the Research Section does not cover salary or expenses for committee members.

- *Project Administrative Lead*

The Administrative Lead is an assigned staff from the Research Section. He/she works with principal investigator(s) (PI) to develop the task agreement and provides technical and administrative assistance to the committee. The Administrative Lead also monitors funding, supports the TAC, and monitors project progress.

- *Principal Investigator (PI)*

The principal investigator is the one person responsible for proper conduct and completion of the research project and is generally from an external organization. In the event of co- principal investigators, one will be designated as the key contact for administration purposes.

- *Project Champion*

The Project Champion is an individual within VTrans with a technical and business interest in the project and sufficient authority to help overcome impediments to the project and to influence implementation. Project Champions draft the Problem Statement distributed to potential researchers and present the proposal to the selection committee. It is critical that individuals selected are aware of the duties and responsibilities of a Project Champion and that they accept those responsibilities.

- *Vermont FHWA Division Representative*

Each TAC may include a representative from the FHWA Vermont Division Office. By including a Division representative among the membership, TAC decisions have implicit Division concurrence. In case a FHWA representative declines, the research Section will keep a record of project communications for documentation purposes.

- *Other Technical Experts*

The TAC should include a number of other technical experts not meeting the definition of one of the members listed above. These can include people from inside and outside the agency.

5.3.2 TAC Meeting Operation

- *Chairperson*

Typically, the Project Champion chairs the committee but there is a lot of guidance from the Administrative Lead. The Administrative Lead is responsible for scheduling meetings and distributing agendas and minutes for each meeting. The Administrative Lead may also orient the committee to the project by providing key information, including:

  - A review of project objectives
  - A discussion of the milestones and general progress of the project

- A discussion of project problems and their solution
- A review of the implementation process and any impediments to it

- *Meetings*

The committee meets on an as-needed basis, usually at least twice per year, often quarterly. Meetings are often related to project deliverables—progress is presented by the researchers to the TAC who comment on and guide the research in expectation of implementable deliverables. Much of the review process can be carried out by e-mail.

- *Agenda*

Agenda items are provided by the principal investigator and/or committee members and sent to the chairperson.

- *Confidential Material*

Research draft reports are considered confidential documents. Approval should be sought from the Administrative Lead for distribution of the draft reports outside of the TAC. TAC members are expected to respect the confidential nature of draft research reports and draft project materials.

5.4 QUARTERLY REPORTS

A quarterly report is intended to be a clear, concise, and complete summary of current project status, detailing progress, problems, and work planned. In addition to documenting progress being made on individual research projects, quarterly reports also satisfy the FHWA requirement for performance and expenditure reporting contained in 23 CFR 420.117. All projects using SPR funds shall produce a quarterly report. This is the current Quarterly Report Template.

Quarterly reports are due by the 15th of the month following the end of each quarter. This report and accompanying deliverables are distributed to the TAC.

5.5 PROJECT REPORTS

5.5.1 Purpose

Project reports are prepared to document the research work and recommend further research. In regard to research that is federally funded, a provision of the Federal-aid Project Agreement requires both the preparation of suitable reports to document the results of activities performed with FHWA State Planning and Research funds and suggests at the discretion of each Division Office FHWA approval prior to the publishing of such reports. Since a representative of the FHWA Vermont Division serves as a member of each research project TAC and participates in the review of reports prior to publication, the requirement for prior approval is waived by the Division Office.

5.5.2 Types of Reports

5.5.2.1 Construction Report

Construction reports are completed for projects where an item is built or a product is installed. The construction report includes a brief description of what was built and why there was a necessity to build it. The report includes a project description showing the general area of the construction on a state map and the construction plans. The materials used are listed along with the placement. Any unforeseen problems are documented. The conclusion includes any recommendations for further monitoring of the project.

5.5.2.2 Interim Deliverables

External projects include several interim deliverables (generally associated with each quarter). The

interim deliverables are generally distributed to the members of the TAC and potentially other interested individuals.

5.5.2.3 **Final Report**

The TAC is made aware of the findings generally with a draft final report and a presentation of the draft final report before the final report is published. The research community and operational units affected by the work should also be informed. The final report is the most complete record of the research and is carefully assembled to include the following information:

- Title page
- Technical documentation page with abstract
- Acknowledgements/Disclaimer
- Table of contents
- Introduction
- Literature review
- Methodology
- Conclusions and recommendations
- Summary of Findings
- References
- Appendices (as needed)

Researchers should use the Cover, Disclaimers, and Technical Documentation Page Template found under Research Guidance Documents on the VTrans Research web page. The final report receives the widest possible distribution. It is forwarded to the TAC, affected operations units, potentially affected customers outside VTrans, other state research units, TRID and other national research collections and archives.

5.5.2.4 **Termination without Report**

In rare instances when a project is clearly not progressing in a direction that would yield information useful to include in a final report, a letter of termination without report may be appropriate. This is a brief but concise letter that includes a project description with reference to any data collected and analyses performed, conclusions (reason for termination) and recommendations (lessons learned). This satisfies the FHWA requirement of a suitable report to document results of activities performed with State Planning and Research Funds. The draft letter should be sent to the TAC for review prior to forwarding to the FHWA Division Office.

6 IMPLEMENTATION AND TECHNOLOGY TRANSFER

6.1 IMPLEMENTATION

Implementation is the critical link between research results and practical application. Planning implementation starts as early as the problem statements, which are assessed for implementation potential. Implementation is considered at the beginning, middle and end of every project. We ask for an implementation plan in the proposal and initial TAC meetings. Regular TAC meetings with stakeholders from multiple sections within the Agency of Transportation, other state agencies, local governments, FHWA and others help foster implementation as the potential implementers are apprised of the research and help guide the project into results that will be useful and implementable.

As projects near completion or are close to producing results, the Research Section and TAC evaluates them for applicability to VTrans practice. Implementation activities, methods, and actions required by the numerous technologies with which VTrans deals are broad and flexible.

Implementation is primarily the responsibility of the TAC and the research users. Monitoring and follow-up of implementation progress is performed periodically by the Research Section.

6.2 TECHNOLOGY TRANSFER

The Research Section performs technology transfer activities for VTrans and transfers the technology developed through the efforts of the Research program. The Research Section puts significant effort into sharing information about our projects and results. We want internal staff and external stakeholders to know as much about current and completed research as possible. A few methods used by the Research Section to transfer technology are as follows:

- VTrans Research and Innovation Symposium. Held in September, posters of research projects and Agency innovations are presented by researchers and Champions. All current researchers must share a Poster and Fact Sheet of their project(s). A website includes posters, Fact Sheets, reports as available, and other materials. Websites for the 2017-2020 Symposiums are found here: 2020, 2019, 2018, 2017.
- Website – an active website is maintained with links to published reports and research updates, staff, and information on submitting research ideas. The published research reports and updates can be found here.
- Report and publication distribution – research reports and other materials generated by RD&T activities are distributed according to FHWA requirements.
- Promotion and sponsorship of seminars, conferences, exhibitions and other opportunities for disseminating research, either in-house or outside of VTrans.
- Journal articles and conference papers originating from research activities are prepared and submitted by university and other investigators.