Acknowledgements

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The project was managed by Mr. Sid Mohan, NCHRP Senior Program Officer.

Disclaimer

The opinions and conclusions expressed or implied are those of the research agency that performed the research and are not necessarily those of the Transportation Research Board or its sponsoring agencies. This report has not been reviewed or accepted by the Transportation Research Board Executive Committee or the Governing Board of the National Research Council.
Summary

Fostering implementation of transportation research is a top priority among state departments of transportation (DOTs). Staff from multiple state DOTs and their research partners commonly discuss aspects of research implementation during their State Planning and Research (SP&R) peer exchange meetings. Likewise, many of the resources that state DOTs submit to the Research Program and Project Management (RPPM) database—including reports, forms, plans, and other materials—address aspects of research implementation.

Over the last decade, the 31 peer exchange reports and 66 RPPM resources focused on research implementation represent a wealth of knowledge.

NCHRP implementation funds were used to synthesize these peer exchange reports and RPPM resources to identify best practices, challenges, and opportunities related to implementation of transportation research. The synthesis reports on the peer exchanges and RPPM resources helped to identify top strategies that support implementation of transportation research, and they include citations for users in need of more details or contact information.

The strategies further informed a follow-up survey of state DOT research directors, who offered perspectives on the value and relative difficulty of each strategy. The top findings from the peer exchange synthesis report, the RPPM synthesis report, and the survey were compiled into a six-page Best Practices Guide.

The guide highlights strategies across seven areas related to transportation research:

- Program management
- Roles and staffing
- Project management and process
- Funding and contracting
- Tracking
- Technology transfer and marketing
- Demonstrations, pilots, and other implementation activities
In addition to discussing each strategy, the guide calls out:

- Low-cost, high-impact tactics, or easy-to-borrow approaches that are appropriate for state DOT research programs with very limited budgets and staff time.
- Transferable tools—tactics for enacting successful strategies that can be adopted readily by any state DOT research program.
- Advanced recommendations that have proved successful for mature or advanced programs; these likely require more resources or greater effort, but they can help take state DOT research programs to the next level.
- Top strategies that surfaced as the most widely adopted among state DOTs.

For users interested in more details, the guide includes pointers to the source materials. All research stakeholders—DOT executives, managers, and practitioners; municipal and county agencies; and investigators—will find practical approaches and valuable considerations to help support implementation before, during, and after completion of any research project.

A final product of this effort was a template to help a peer exchange host or facilitator capture and report the top findings of the peer exchange. This tool will help others quickly and easily identify the most important outcomes of these events.

**Synthesis of Peer Exchange Reports**

Per federal regulations, each state DOT must host a peer exchange at least once every five years. Peer exchanges bring together state DOTs and others involved in state DOT research to share best practices and innovations through an open exchange of ideas, knowledge, and brainstorming. During a two- to four-day meeting, staff and management from the host state and a group of invited peers from other states, federal agencies, and research partners exchange information on a few focused topics that are particularly relevant to the host state’s research program.

In conducting these research peer exchanges, state DOTs commonly select research implementation as a discussion topic. They seek to learn about best practices from among their peer agencies to help ensure that research results are implemented. Among the 93 reports housed in American Association of State Highway and Transportation Officials (AASHTO) Research Advisory Committee’s (RAC’s) peer exchange report database (https://research.transportation.org/peer-exchange-reports/) dating back to 1997, fully 60 address the topic of “Implementation/Deployment of Results/Technology Transfer” in whole or in part.

The investigators conducted a detailed review of all 31 peer exchange reports from 2010 to 2019 that feature implementation as a topic area. This synthesis of peer exchange reports is reproduced as Appendix A. It summarizes strategies to facilitate, promote, or enhance implementation, followed by specific approaches drawn from the reports, including citations. Particularly noteworthy findings are highlighted in the Best Practices Guide on page 4.
Synthesis of RPPM Database

The Research Program and Project Management database (https://rppm.transportation.org/) is an online repository to which state and national organizations—typically state DOTs, AASHTO, and the Transportation Research Board (TRB)—may submit resources related to all phases of transportation research. Registration is required to submit resources, but they are freely accessible to the public. The site is hosted by AASHTO.

Implementation is one of many topics covered by RPPM. The four main implementation areas in the database are:

- Setting the Research Agenda
- Carrying Out Research
- Delivering Results/Communicating Value
- Collaborating in Research Activities

The investigators reviewed, synthesized, and summarized 66 resources in the RPPM database labeled as relating to implementation dating from 1996 to 2018. The different types of resources included agreements/contracts, forms, guidelines/standards, lists, minutes/notes, plans, process, reports, surveys, and templates.

The synthesis of RPPM resources is reproduced as Appendix B. Like the peer exchange synthesis report, it similarly summarizes strategies to facilitate, promote, or enhance implementation, illustrated with examples and citations. Particularly noteworthy findings are highlighted in the Best Practices Guide on page 4.

Survey

The project panel and investigators together identified 28 top strategies from the two synthesis studies. These strategies formed the basis of a survey (Appendix C) that was distributed to all state DOT research directors via the AASHTO RAC email list. For each strategy, respondents were asked to describe their agency’s experience by selecting one or more appropriate statements:

- We already do this
- We do NOT do this
- This is challenging to do
- We are interested in trying this
- We are working toward this
- We tried this without success

Representatives of 30 states responded. The summary tabulation of responses is Appendix D to this report, and a detailed table of all responses is Appendix E. The survey also allowed participants to provide free-response comments, compiled in Appendix F. Particularly noteworthy survey findings are highlighted in the Best Practices Guide on page 4.
State DOT Research Implementation Strategies: Best Practices Guide

Overview

As noted, best practices for implementing state DOT research are drawn from three core data collection and synthesis tasks conducted for this project:

- The synthesis of State Planning and Research peer exchanges (Appendix A) focused on those where the host state DOT addressed implementation as a theme for discussion.
- The synthesis of the AASHTO Research Program and Project Management (RPPM) database (Appendix B) focused on documentation, processes, and reports tagged by submitter DOTs as related to implementation.
- The survey of research directors (Appendices C, D, E, and F) focused on state DOT experiences and perspectives related to research implementation practices, plans, and barriers.

Drawing from these sources, this guide serves not only to compile best practices but to present opportunities and next steps for agencies looking to put these findings to work. When additional details or expanded examples are available in the synthesis reports or survey responses, they are cited and linked in this guide. Users interested in more details are encouraged to refer back to these reports, which in turn include citations back to the source peer exchange reports and RPPM entries.

Strategies, Barriers, and Opportunities

Strategies are organized around seven functional areas that evolved from the synthesis reports and served as the basis for the survey:

- Program Management
- Roles and Staffing
- Project Management and Process
- Funding and Contracting
- Tracking
- Technology Transfer and Marketing
- Demonstrations, Pilots, and Other Implementation Activities

Discussion of each functional area closes with highlighted best practices for implementation (encompassing stand-alone implementation activities as well as implementation tasks included within a research project). These are grouped into three categories with increasing expectation of cost and level of effort:

1. **Low-Cost, High-Impact Tactics**—These are tactics to support research implementation that will be helpful for state DOT research programs that have particularly small or limited budgets and staff time.
2. **Transferable Tools**—These are tactics for enacting successful strategies that can be adopted readily by any state DOT research program.
3. **Advanced Recommendations**—These are tactics that have been proven successful for mature or advanced programs. While typically more involved than Transferable Tools—often requiring the development of new processes rather than easy-to-borrow ideas—they will be helpful for those state DOT research programs looking to advance research implementation to the next level.

In addition, this guide calls out **Priority Strategies**, approaches that surfaced as the most important and most widely deployed by state DOTs.
Best Practices by Area

PROGRAM MANAGEMENT strategies involve ways a research program is organized to support implementation, and ways it interacts with others within or beyond the agency to support implementation.

- **Seek buy-in from agency leaders.**
  While this is a popular strategy among agencies, it was noted that it can be difficult to secure the attention and support of leadership for individual research projects or the program as a whole. It is important to seek leadership buy-in early in the process—before a project is put under the direction of a technical panel.

- **Use successful implementation efforts to demonstrate the value of the research program (including benefit-cost and return-on-investment calculations) and build staff and management support.**
  Over 80% of survey respondents already use this strategy or are working toward it. It was also described as the most challenging in the Program Management area. One agency stated: “Everyone is interested in quantifying the benefits of research, but ... quantification is hard.” Aligning research with innovation (peer exchange synthesis, p. A-11) can build the case for research implementation.

- **Develop a comprehensive set of strategies to advance implementation within the transportation agency.**
  A question raised by agencies was, both philosophically and practically, whose job is implementation? The research program can encourage, promote and facilitate implementation by developing the products necessary for implementation (such as training, manuals, and specifications). Ultimately, however, implementation falls in the hands of technical areas of the DOT, industry, or others.

- **Formalize and document the implementation process (roles, steps, options).**
  It was noted that even when the implementation process is well defined, sometimes “by the time it comes around to implementation, the project has lost its momentum.” These formalized processes (peer exchange synthesis, p. A-12) are the same strategies detailed within the other six areas below in this guide (Roles and Staffing, Project Management and Process, etc.).

- **Identify barriers to implementation and opportunities to address them.**
  It is important to begin the discussion of possible barriers early in project development and continue examining them throughout a project’s life cycle. It was noted in the peer exchange synthesis (p. A-13) that not every project will or should be implemented. Moreover, documenting and understanding failed implementation is also valuable.

<table>
<thead>
<tr>
<th>Low-Cost, High-Impact Tactics</th>
<th>With limited resources, try to borrow successful practices of other states.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Priority Strategy</td>
<td>Seeking buy-in from agency leaders was the most used strategy in this area (55% of survey respondents).</td>
</tr>
</tbody>
</table>

ROLES AND STAFFING strategies involve the ways a research program establishes and defines the roles and responsibilities of research staff, others at the DOT, and the consultants/investigators involved in implementation work.

- **Involve other business and technical areas within the agency that may be affected by implementation activities, such as information technology.**
  Many agencies are engaging internal stakeholders early and keeping them plugged in throughout the research process. Staff responsible for implementation (peer exchange synthesis, p. A-19) should be involved as early as possible and provide “the driving force behind the research.”
• **Include external stakeholders, such as by gathering industry feedback on new specifications and products, and secure early buy-in.**

Early and ongoing participation of external stakeholders (other state agencies, federal agencies, and industry) is encouraged to identify roadblocks that could impede implementation, gain support for the project, and identify other needs while the project is underway and after it concludes.

• **Involve senior management and decision-makers in implementation.**

One agency described leadership buy-in as “a must.” Another described engaging decision-makers by requiring that highly placed agency staff members agree to support implementation of project results in their business areas. **TRB guidance** (RPPM synthesis, p. B-12) notes that strong support from senior management can foster innovation and eliminate potential barriers to new products and processes.

• **Define the roles and responsibilities of research staff, project panels, project champions, and functional area staff who will be implementing the research.**

Consider selecting project champions who are highly regarded and have a degree of authority. Encourage cross-functional engagement by appointing panel members from a wide range of program areas. Note that champions do more than serve on project panels; they are the driving force who must take the lead on future implementation.

• **Keep the project panel together after the project has ended to track and facilitate implementation activities.**

Prepare for post-project implementation by ensuring that project panels include staff who will be responsible for implementing project results, and use a form to help panel chairs and research project managers track implementation after a project concludes. Keep research staff engaged with the project panel to facilitate continued progress.

• **Designate a research staff member as a dedicated implementation coordinator or implementation manager.**

This Roles and Staffing strategy is the least likely to be applied among survey respondents. Limited staffing levels and resources are prompting some respondents to find other ways to advance implementation. **Georgia DOT's technical/implementation managers** (RPPM synthesis, p. B-10) are selected from the membership of the Research Technical Advisory Groups overseeing research projects to track and report on implementation during a project and after it concludes.

### Low-Cost, High-Impact Tactics

<table>
<thead>
<tr>
<th><strong>Low-Cost, High-Impact Tactics</strong></th>
<th>Task the project manager overseeing the research project with tracking implementation of research results. These individuals tend to have knowledge and insight gained over the project’s life cycle that can facilitate implementation.</th>
</tr>
</thead>
</table>

### Advanced Recommendations

<table>
<thead>
<tr>
<th><strong>Advanced Recommendations</strong></th>
<th>Establish a committee of subject matter experts from inside and outside the agency, including internal stakeholders impacted by the research, that oversees and ensures implementation of a research project’s findings.</th>
</tr>
</thead>
</table>

### Priority Strategy

<table>
<thead>
<tr>
<th><strong>Priority Strategy</strong></th>
<th>Involving other business areas is the strategy in this area that is the most likely to be applied by respondents. More than two-thirds are already doing it and another 23% are working toward it.</th>
</tr>
</thead>
</table>

**PROJECT MANAGEMENT AND PROCESS** strategies involve steps established at all phases of research to support implementation.

• **Address implementation throughout all phases of the research process (scoping, kickoff, and through completion); set clear goals for putting research into practice.**

Several agencies **integrate implementation across the research process** (peer exchange synthesis, p. A-20). One agency notes: “It’s understood from the beginning and by the technical committee and researchers.” Implementation goal-setting is another commonly used strategy in the area of project management.
• Implement relevant research results from other agencies, including research discussed at the TRB Annual Meeting and other conferences.

While implementing research found at national conferences like the TRB Annual Meeting can be challenging, setting up channels to report noteworthy findings is not difficult and can be an important first step. States’ reporting documents are available (peer exchange synthesis, p. A-27).

• Detail implementation in the program’s research manual and process documents.

There are many examples of state DOT program manuals with details on implementation—defining it, stating its importance, and explaining how it can be fostered (RPPM synthesis, p. B-14; peer exchange synthesis, p. A-21).

• Develop and revise an implementation plan for each research project; consider using an implementation planning worksheet or template as a guide.

Some agencies have sophisticated planning documents that are updated through the life of the research project (survey free responses by North Carolina, p. F-2, and Montana, p. F-3). These keep stakeholders focused on implementation through the life of the project, even as outcomes develop over time.

• Prioritize projects for implementation.

It can be “challenging to prioritize implementable projects because it is not always clear how beneficial they will be.” Virginia uses a prioritization form with a scoring rubric (RPPM synthesis, p. B-16).

• Develop “tactical tools” to accelerate implementation (policies, contracts and agreements, reference guides, and evaluation procedures).

Some agencies referred to the implementation plan (see above) as their “tactical tool.” According to the survey, employment of tactical tools is the least commonly used strategy in this area.

<table>
<thead>
<tr>
<th>Transferable Tools</th>
<th>Many states’ research manuals and related materials do a comprehensive job of documenting implementation processes; these can be drawn upon as examples. Multiple agencies have staff who attend the TRB Annual Meeting report back (in one case, to DOT executives) on technology with promising potential for implementation.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advanced Recommendations</td>
<td>Montana DOT has a comprehensive implementation planning and documentation form updated through the life cycle of a project that helps inform and update a strategic approach to implementing project results. North Carolina DOT likewise has an implementation plan for the kickoff, intermediate, and closeout meetings.</td>
</tr>
<tr>
<td>Priority Strategy</td>
<td>Integration of implementation across the research process is already underway by a large majority of survey respondents (65%), and 26% are working toward this.</td>
</tr>
</tbody>
</table>

FUNDING AND CONTRACTING strategies involve formal channels for providing funds for implementation and establishing contract language to facilitate implementation.

• Allocate dedicated funding for implementation activities (funded as discrete projects or included as tasks in the original research project contract).

Examples of state implementation budgets vary significantly, from $100,000 to $10 million (peer exchange synthesis, p. A-29). Funds should be accompanied by leadership/institutional support and clear goals.

Write necessary implementation products into research contracts when possible. As further discussed in the RPPM synthesis (p. B-18) and the survey free responses (p. F-6), interpretations vary on rules governing what may be covered through federal State Planning and Research, Part II funds; therefore, it is important to carefully define and scope implementation components of a research project.

State DOT Research Implementation Strategies: Synthesis of State Peer Exchanges and RPPM 7
- **Seek alternative funding sources for implementation activities.**
  Suggested channels include state DOT technical areas, NCHRP, federal State Transportation Innovation Council funding, and national pooled funds.

<table>
<thead>
<tr>
<th>Low-Cost, High-Impact Tactics</th>
<th>Dedicating funding to implementation may be unrealistic. Aim instead to “integrate implementation into everything.” Write implementation products into research contracts when possible.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transferable Tools</td>
<td>Successful alternative funding sources include state DOT technical areas (for example, construction) to implement findings; the NCHRP implementation support program (Project 20-44); federal State Transportation Innovation Council funding; and the Transportation Pooled Fund program.</td>
</tr>
</tbody>
</table>

**TRACKING** strategies involve established methods to track what research is being implemented and how successful those implementation efforts have been.

- **Report periodically on implementation progress (staff communications, dashboards, conferences).**
  This is the most commonly used tracking strategy. The responsibility for final reporting of implementation data can be shared among the DOT research office, the functional area/champion, and the researcher. **Several examples** are detailed in the RPPM synthesis (p. B-19).

- **Report periodically on implementation progress at the program level.**
  As detailed in the **survey free responses** (p. F-6) and the **RPPM synthesis** (p. B-21), one agency conducts a large-scale evaluation every five years on the extent and impact of the implementation of recommendations that resulted from agency research studies; this involves interviews, surveys, documentation, and refinement of ways to measure impact. Another is reviewing every research project completed over the past five years in order to document the implementation—or nonimplementation—of each, to classify the types of implementation, and to assign a value to each implementation where applicable.

- **Track implementation for all completed research projects using a database or other tool.**
  Limited staff time was called out as an obstacle to enacting this strategy. One survey respondent stated that it can be difficult to acquire the necessary feedback from customers due to competing objectives and changes in positions and roles over time. Caution was offered not to try to capture too much information. This strategy was called out as challenging by 26% of survey respondents.

- **Conduct surveys or interviews of project stakeholders to assess implementation status.**
  Stakeholder surveys revealed **staff movement and limited interest in completed projects** are barriers to implementation of research results (survey free responses, p. F-7).

<table>
<thead>
<tr>
<th>Low-Cost, High-Impact Tactics</th>
<th>Contract with a university partner to conduct tracking activities as part of its program support.</th>
</tr>
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<tbody>
<tr>
<td>Transferable Tools</td>
<td>Successful tracking strategies include scheduling exit surveys near completion of a research project to learn about implementation potential and timing; discussion and calculation of benefit-cost potential of implementation; and creation of a research program and project management system.</td>
</tr>
<tr>
<td>Priority Strategy</td>
<td>Implementation tracking is of high interest to research programs. All four of the strategies above are now used by a significant number of survey respondents (as high as 61%), and many other respondents are either working toward each of these strategies or are interested in trying them.</td>
</tr>
</tbody>
</table>
TECHNOLOGY TRANSFER AND MARKETING strategies address how transfer of technology intersects implementation, and how marketing successful research promotes implementation.

- **Present research results directly to relevant DOT staff and local agencies; use webinars, videos, research briefs/summaries, conference presentations, conference posters, newsletters, email notifications, and/or annual reports.**

  While agencies are using a range of communication products and outreach efforts to disseminate research findings (peer exchange synthesis, p. A-33), some “would like and need to do more” and are interested in taking greater control over the process. This was the most widely used strategy in the entire survey.

- **Communicate research results and showcase implementation successes to communicate the value of implementation.**

  Moving from an ad hoc approach to an organized and strategic effort is recommended, and annual poster sessions and showcases to highlight research program results are seen as effective ways to communicate the value of implementation.

<table>
<thead>
<tr>
<th>Low-Cost, High-Impact Tactics</th>
<th>Require researchers to prepare a webinar, conference poster, and/or two-page brief as a final deliverable.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transferable Tools</td>
<td>Assign research program staff to contribute to a periodic agency e-newsletter, or develop email notifications that highlight opportunities for implementation.</td>
</tr>
<tr>
<td>Advanced Recommendations</td>
<td>Learn more in the peer exchange synthesis (pp. A-34 and A-35) about New Jersey DOT's annual research showcase to recognize innovative research projects, and Utah DOT's annual research conference that couples researchers’ presentations with participant workshops.</td>
</tr>
<tr>
<td>Priority Strategy</td>
<td>Presentation of research results was the most frequently used strategy among every strategy in the survey, with three-quarters of respondents already engaging in this effort and 16% working toward it.</td>
</tr>
</tbody>
</table>

DEMONSTRATIONS, PILOTS, AND OTHER IMPLEMENTATION ACTIVITIES highlight the ways a research program can enhance an agency’s knowledge base with an incremental approach to implementation and by learning from other agencies.

- **If appropriate, begin deployment with a demonstration project or pilot project.**

  Agencies noted that application of this strategy is project-dependent, and the research office may not have control over the pilot effort. Where possible, engage with external partners, and consider launching a pilot when buy-in is lacking for an immediate broader implementation. Avoid the typical barriers (RPPM synthesis, p. B-23) described in a 2014 NCHRP report that can limit the success of a demonstration project.

- **Learn from other agencies’ successful and unsuccessful implementation efforts.**

  Case studies in the peer exchange synthesis (p. A-40) describe the factors contributing to successful DOT implementation efforts. Applying other agency successes can be challenging if the implementing agency has not provided sufficient guidance to allow for transfer of its experience. Limited resources and the lack of broader agency interest may also preclude implementation of other agencies’ research.
### Low-Cost, High-Impact Tactics

Include a demonstration or pilot in the research project contract. Use the pilot’s success to encourage broader implementation.

### Transferable Tools

Seek partnerships with academic and industry stakeholders to develop demonstration projects after projects conclude. Request supplemental information (internal documents, recommendations) from contacts at state DOTs successfully implementing research results in their agencies.

### Priority Strategy

Use of demonstration projects or pilot projects was among the most used strategies in the survey. Many examples are detailed in the survey free responses (pp. F-8 to F-9).

## Peer Exchange Summary Form

Peer exchange reports are often lengthy and dense with useful information, and it takes users time to identify and extract the most important findings and the actionable recommendations. This, in part, necessitated the synthesis effort described in this report.

It also drove the development of a companion product to this study: a Microsoft Word template to help state DOTs capture and summarize the highlighted findings of future SP&R peer exchange meetings. This two-page Peer Exchange Summary Form includes a page of instructions and a form for capturing:

- The peer exchange needs, purpose, and goals (suggested limit of 150 words).
- The top findings and takeaways (a bulleted list, suggested no more than 10 items of a few sentences each).

The completed form functions as a bulleted abstract of the associated peer exchange report. It will give readers a quick understanding of what was learned and allow them to decide if they wish to explore the more detailed report findings. It may also be useful as a stand-alone summary document to help an agency communicate the top-level outcomes of the peer exchange.

The form is reproduced in this report as Appendix G.

The form may also be accessed in its native Word format for use by peer exchange hosts on the NCHRP Project 20-44(21) web page.

## Appendices

- **Appendix A.** Peer Exchange Synthesis
- **Appendix B.** RPPM Synthesis
- **Appendix C.** Survey Tool
- **Appendix D.** Survey Results – Summary of Multiple-Choice Responses
- **Appendix E.** Survey Results – Detail of Multiple-Choice Responses
- **Appendix F.** Survey Results – Free Responses
- **Appendix G.** Peer Exchange Summary Form
Appendix A.

Implementation Approaches, Practices, and Challenges: Synthesis of Findings from State DOT Peer Exchanges

Prepared for
National Cooperative Highway Research Program

Prepared by
CTC & Associates LLC

NCHRP 20-44(21) Task 1 Deliverable
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Overview and Synthesis

Per federal regulations, each state department of transportation (DOT) must host a peer exchange at least once every five years. Peer exchanges bring together state DOTs and others involved in state DOT research to share best practices and innovations through an open exchange of ideas, knowledge, and brainstorming. During a two- to four-day meeting, staff and management from the host state and a group of invited peers from other states, federal agencies, and research partners exchange information on a few focused topics that are particularly relevant to the host state’s research program.

In conducting these research peer exchanges, state DOTs commonly select research implementation as a discussion topic. They seek to learn about best practices from among their peer agencies to help ensure that research results are implemented. Among the 93 reports housed in American Association of State Highway and Transportation Officials (AASHTO) Research Advisory Committee’s (RAC’s) peer exchange report database (https://research.transportation.org/peer-exchange-reports/) dating back to 1997, fully 60 address the topic of “Implementation/Deployment of Results/Technology Transfer” in whole or in part.

These peer exchange reports are lengthy and dense with information, and it takes users significant effort to identify and extract the most important findings and the actionable recommendations.

This project seeks to extract value from these underutilized resources through a detailed synthesis of studies on implementation-focused peer exchange reports (Task 1, this report) and a synthesis of implementation resources submitted to the Research Program and Project Management (RPPM) database (Task 2, conducted in parallel).

These will be complemented with follow-up work to further identify implementation best practices (Task 3) and with the development of guidance to effectively communicate future peer exchange findings (Task 4), all compiled in a final report (Task 5).

RESEARCH PEER EXCHANGE REPORTS

CTC & Associates conducted a detailed review of all peer exchange reports from the last 10 years (2010 to 2019) that feature implementation as a topic area. The topic area designation is made by the host state DOT at the time it submits the peer exchange report to AASHTO RAC’s peer exchange report database. As of the time of this report writing, 31 reports meet this criterion. In most cases, reports have more than one topic area; implementation is a central focus to some reports and a secondary focus for others.

The eight categories in the report database (https://research.transportation.org/peer-exchange-reports-topics/) are:

1. Research Project and Program Management
2. Alignment of the Research Function with Departmental Missions and Goals
3. Research Staffing Needs, Capacity Building, and Skill Sets
4. Research Collaboration and Partnerships
5. Optimizing the Value and Quality of Research
6. Implementation/Deployment of Results/Technology Transfer
7. Information and Knowledge Management
8. Research Performance Measures and Communicating the Value of Research Projects and Programs

Implementation is part of Category 6, “Implementation/Deployment of Results/Technology Transfer.”

In analyzing the peer exchange reports, we sought to identify practices, opportunities, and challenges related to research implementation identified by peer exchange host states and visiting out-of-state participants. In this report, those practices are grouped by category, including citations to their source. This synthesis also includes observations about trends and unique practices.

Citation Format

For ease of readability, the peer exchange reports are cited in this synthesis according to the peer exchange’s host state and the year the peer exchange was conducted. In the Detailed Findings chapter of this report, citations are presented in the following format:

\[
\text{[(presenting agency, as appropriate); (host state) (year), (page)]}
\]

Example: [AASHTO presentation; Montana 2017, page 4]

The citations used for the 31 reports are listed in chronological order in the List of Peer Exchange Reports at the end of this document.

**ORGANIZATION OF FINDINGS**

The findings are organized into seven top-level functional areas. These are the same areas used to organize the synthesis of findings from the Research Program and Project Management (RPPM) database (Task 2 of this project). A brief description of what each area covers is also provided.

1. Program Management — Ways a research program is organized to support implementation, and ways it interacts with other agency departments or organizations beyond the DOT to support implementation.
2. Roles and Staffing — Who is responsible for implementation work; this might include research staff, others at the DOTs, and consultants/investigators.
3. Project Management and Process — Steps established at all phases of research to support implementation.
4. Funding and Contracting — Formal channels for providing funds for implementation; established contract language to facilitate implementation.
5. Tracking — Established methods to track what research is being implemented and how successful those implementation efforts have been.
6. Technology Transfer/Marketing — How transfer of technology intersects implementation; how marketing successful research promotes implementation.
7. Demonstrations, Pilots, Other Implementation Activities — Noteworthy implementation examples in practice.
In each area, we present one or more strategies to facilitate, promote, or enhance implementation, followed by specific approaches drawn from the reports, including citations.

Beyond these seven areas, this synthesis includes an eighth section:

8. Other Noteworthy Approaches — Additional approaches that were noteworthy in terms of their sophistication level but were mentioned only occasionally across the 31 peer exchange reports.

**CONSIDERATIONS**

The following considerations should be taken into account with respect to the findings in this report:

- Some of the peer exchange reports are years old and may no longer represent current practice.
- Text from peer exchange reports has been edited for clarity in some cases. Readers should consult the cited reports directly for more details.
- The reference to the peer exchange host state in each citation (“Montana 2017” in the example above) does not necessarily imply that the state endorses the cited approach or strategy.

**SYNTHESIS OF FINDINGS**

**Observations and Trends**

A research program’s ability to produce implementable results is a critical measure of its effectiveness. Generally, though, results are implemented not by research staff, but by an agency’s functional areas: bridges, pavements, safety, operations. The 31 peer exchange reports we reviewed examine a research program’s role in bridging the gap between results and implementation.

In these reports, which spanned a decade, we observed a trend toward greater involvement by research programs in facilitating implementation in functional areas. At more than one peer exchange, attendees noted that the historical approach to implementation—described as taking completed research and passing implementation responsibility to the functional areas—was ineffective and was no longer an accepted practice. In the last decade, research programs have increasingly formalized their processes for planning for implementation during project selection; requiring project tasks and deliverables that support implementation; coordinating implementation efforts with functional areas; and tracking implementation activities after a project is completed.

Despite the challenges inherent in this effort, research programs have made great strides in implementing process changes in the last decade. Not uncommonly, strategies, processes, or tools that states described as their own were the same practices or tools that they had noted as takeaways at an earlier peer exchange. As a whole, the nation’s research programs are more sophisticated—sometimes considerably so—in their approach to implementation than they were a decade ago.

Below is a high-level summary of implementation-related strategies and approaches that were discussed at peer exchanges in the last decade. The strategies are grouped according to the seven categories listed above, with a focus on approaches that had some consensus of support among attendees. They are followed by a final category, Other Noteworthy Approaches—emerging practices of interest that were mentioned only occasionally across the 31 peer exchange reports.
Findings reinforced by a significant number of citations and states are tagged here as **KEY FINDINGS**. These are candidate topics to be addressed in more detail in follow-up tasks for NCHRP Project 20-44(21).

Full detailed citations referencing specific resources, agencies, and citation links are presented in the next chapter, “Detailed Findings.”

**Program Management**

- **KEY FINDING:** Institutionalize the central role that implementation plays in research. Have a program-level research philosophy that “begins with the end in mind” as projects are selected for funding and project tasks are outlined.

- **KEY FINDING:** Get buy-in from agency leaders.

- **KEY FINDING:** Formalize and document the implementation process (roles, steps, options).

- Use successful implementation efforts to demonstrate the value of the research program and build staff and management support.
  - Some agencies take this further, using implemented results in benefit-cost analyses and return-on-investment calculations or linking implementation to operational performance measures. Others caution that this approach can create issues and may not capture all benefits.

- Identify barriers to implementation and opportunities to address them. Common challenges include resistance to change, lack of dedicated implementation resources and funds, and difficulty in accurately anticipating implementation needs and costs before research has begun.

**Roles and Staffing**

- Define the roles and responsibilities of research staff in implementation.
  - In the last decade, designating a research staff member as a dedicated implementation coordinator or implementation manager has become a common approach. However, institutionalizing a focus on implementation may be more important than using any one specific staffing structure.

- **KEY FINDING:** Define the roles and responsibilities of project panels, project champions, and functional area staff who will be implementing the research. Throughout the research effort, engage the practitioners who will ultimately implement the research.

- Keep the project panel together after the project has ended to track and facilitate implementation activities.

- Involve other groups within the agency who may be affected by implementation activities, such as information technology (IT). As appropriate, include external stakeholders as well, such as by gathering industry feedback on new specifications and products. Early involvement promotes buy-in and future implementation.
Project Management and Process

- **KEY FINDING:** Consider implementation throughout the research process, beginning with project selection. Evaluate proposed projects for implementation potential.

- **KEY FINDING:** Develop an implementation plan for each research project. Develop the plan early and revise it as the project progresses. Consider using an implementation planning worksheet or template as a guide.

- Require high-quality deliverables that facilitate implementation. In addition to the final report, consider requiring companion deliverables that promote implementation, such as manuals or training materials.

- As the project concludes, outline implementation recommendations in the final report or in a separate implementation report.

- Begin implementation activities in a timely manner. The appropriate time frame will vary depending on the project; be open to implementing known results even before the project concludes.

- Implement relevant research results from other agencies, including research discussed at the Transportation Research Board (TRB) Annual Meeting and other conferences. Establishing reporting tools from conference attendees and internal technology transfer channels can facilitate such implementation.

Funding and Contracting

- Allocate dedicated funding for implementation projects. Depending on the scope, implementation activities may be funded as discrete projects or included as tasks in the original research project contract.

- Consider alternative funding sources for implementation activities.

Tracking

- **KEY FINDING:** Track implementation for all completed research projects. Use a database or other tool to document implementation activities.

- Conduct surveys or interviews of project stakeholders to assess implementation status.

- Report periodically on implementation progress. Share results with agency staff through regular communications, dashboards, conferences, or other methods.

Technology Transfer/Marketing

- **KEY FINDING:** Communicate research results and showcase implementation successes.

- Present research results directly to relevant DOT staff and local agencies.

- Consider a variety of approaches to make staff aware of research results. Options include webinars, videos, research briefs and summaries, conference presentations and posters,
newsletters, email notifications, and annual reports. Tailor your message and format to each targeted audience.

**Demonstrations, Pilots, Other Implementation Activities**

- Define and document a framework of deployment steps or options.
- As appropriate, translate findings from the final report into a user-friendly format. Develop specifications, manuals, or training materials; consider holding technology transfer meetings with DOT staff.
- Learn from other agencies’ successful and unsuccessful implementation efforts.
- If appropriate, begin deployment with a demonstration project or pilot project.

**Other Noteworthy Approaches**

In addition to the strategies outlined above, we identified a few other approaches that were noteworthy in terms of their sophistication level but were mentioned only occasionally across the 31 peer exchange reports. These included:

- **Accelerated/concurrent implementation**, or “[taking] advantage of early implementation opportunities and accomplish[ing] them concurrently with the research phases of other implementation activities” [Indiana 2013, page 1]. This was identified as a primary focus of Indiana DOT’s 2013 peer exchange; early implementation was also mentioned as a positive approach at Georgia DOT’s 2015 peer exchange [Georgia 2015, page 6].

- **Considering implementation/deployment steps through the lens of change management.** This approach was mentioned at Caltrans’ 2011 peer exchange [California 2011, page 15].

- **Highlighting the connection between innovation and research implementation.** Aligning research and innovation was discussed at a few peer exchanges, including Wisconsin’s 2018 peer exchange [Wisconsin 2018, pages 1-2].
Detailed Findings

1. PROGRAM MANAGEMENT

1.1. Program-Level Philosophy

**Strategy:** *Define what implementation means to your agency.*

Approaches:

- Agencies’ *definitions of research implementation* include:
  - Widespread adoption or systematic use. [Montana 2017, page 109]
  - Deployment, demonstrations, and pilot projects. [Montana 2017, page 109]
  - Specification changes. [Utah DOT; Georgia 2015, page 4]
  - Verification of existing practice. [Montana 2017, pages 3 and 109]

- For Maine DOT, *successful implementation* is defined:
  - **Generally:** As implementation adopted by the agency (e.g., bridge project postings; calibration of Highway Safety Manual for rural intersections).
  - **Programmatically:** As the implementation of one to two projects within a one-year period.
    - Using this definition, roughly half of core Maine DOT research projects are implemented. [Georgia 2015, page 3]

- Over time, an implemented process becomes a normal way of doing business, typically after deployment in multiple locations. [Virginia DOT comment; Georgia 2015, page 3]

**Notes:**

- Keep in mind that knowing not to use or do something has value. [AASHTO presentation; Ohio's Research Initiative for Locals (ORIL) 2017, page 7] Validating and confirming current practice likewise has value [Montana 2017, page 13]

**Strategy:** *Have a program-level research philosophy that prioritizes implementation.*

Approaches:

- **Institutionalize research** into daily business. [Wisconsin 2018, pages 1-2]

- Focus the research program on **tangibly implementable products.** [Georgia DOT approach; Georgia 2015, page 6]

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1 Some agencies equate implementation with technology transfer; others do not. This report treats these as distinct concepts.
• **Make incremental changes** that can be sustained. [Wisconsin 2018, pages 1-2]

• Implementation can be a **need-driven process** or institutionalized at a program level. (“Need-driven” means an implementation project is proposed by a practitioner who is solving a problem, using results from completed research.) [Montana 2017, pages 5 and 113]
  
  o A need for one district might not be a universal need—an innovation or pilot in one region may find resistance elsewhere in the state. **Research staff can help expand implementation by playing the role of salesperson**, marketing one area’s successes with a deployment to other areas.
  
  o Implementation may start as needs-based and then evolve into an institutionalized practice. Also, having an institutionalized process can be helpful, even if it isn’t used every time, because it gives a path forward.
  
  o Utah’s exercise of asking people in the DOT functional areas to list their primary concerns is an interesting approach to understanding needs across an agency and knowing what kinds of research results to watch for. [Montana 2017, pages 13 and 115]

**Notes:**

➢ In Montana’s experience, implementation is more successful when it is needs-driven and less successful when it is driven by a programmatic desire to “push out” the results of single completed research projects. [Montana 2017, page 113]

➢ In Ohio, research that comes from districts leads naturally to implementation; central office-led projects are less frequently applied. [Montana 2017, page 15]

• **Align research and innovation.** Opportunities for implementing research may be missed if the research program does not have strong connections with innovation experts. [Wisconsin 2018, pages 1-2]
  
  o Enhance connections between research staff and innovation experts.
  
  o Promote a **people-driven culture of innovation**.
  
  o In 2016, Illinois DOT launched a gainsharing pilot program to identify opportunities to improve operational efficiency and enhance the quality of services it delivers. The gainsharing program financially rewards employees who bring forward tangible cost-saving ideas the department can implement. (See page 30 of IDOT’s 2016 Annual Report.) The IDOT Bureau of Research would like to investigate methods in which the research program can be incorporated into the process. [Illinois 2017, page 18]

• Many research solutions require new ways to do business. Consider research implementation/deployment as a change management process. There may be tools available from the change management process that are applicable. [California 2011, page 15]

• **Treat research as risk management.** [Wisconsin 2018, pages 4 and 9]
  
  o Target efforts toward improving areas of greatest risk.
  
  o Research risks losing value the longer it takes to communicate it to implementers; reducing that time reduces risk.
Risk-averse agencies may be more receptive to research if branded as risk mitigation.

Notes:
➢ To lead your implementation effort, you must be in tune with the culture of your organization. [California 2011, page 15]

1.2. Strategies That Support Any Philosophy

Strategy: Get buy-in from agency leadership.

Approaches:
• Before a project begins, get commitment to implementation from high-level leadership (as appropriate). [Montana 2017, page 112]

• Involve research staff in providing updates to agency staff as a project progresses, especially when the research is expected to lead to a change that will affect the entire agency. [TRB approach, Montana 2017, page 112]

• Market implementation successes to upper managers through targeted outreach. (See Section 6, Technology Transfer/Marketing, for examples of this approach.)

• Put implementation on division heads’ performance evaluations. [Mississippi 2015, page 11]

Notes:
➢ For leadership engagement in particular, program implementation support may be more important than specific project support. There may be politics and multiple agencies involved. Good communication with leaders and the entire agency is vital. [Montana 2017, pages 4 and 112]

➢ For a mass deployment, staff needs to hear from leadership that the change is important, that the research was implemented, and that this is the way the agency is going to do things. [Ohio DOT comment, Montana 2017, page 112]

Strategy: Formalize the implementation process.

Approaches:
• Clearly define implementation roles early in project proposal development. [Georgia 2015, page 8]
  o (See Section 2, Roles and Staffing, for related strategies.)


  Step 2: Implementation action plan developed as project nears completion.
  o Project manager (PM), research manager (RM), and implementation coordinator (IC) concur that research results are ready for implementation.
Recommend implementation level.

- Could be implemented at division, Transportation Service Center (TSC), region, or office level.
- Trial project/test sections.
- Regionwide or statewide use.

Establish a work plan with tasks and deliverables (reports, guides, specifications, training materials, etc.).

Develop budget and funding sources.

Determine if principal investigator (PI) involvement is needed.

With approval signatures from PM, RM, and IC, the IC obtains approval from the following:

- Bureau, division, office, TSC, and/or region depending on the jurisdiction of implementation.
- Engineer of research, who will forward to deputy director.
- The Research Executive Committee provides final implementation approval.

With final approval, implementation of results in the field or a pilot study can begin.

- Define and document a framework of deployment steps or options. *(See Section 7, Demonstrations, Pilots, Other Implementation Activities, for examples of this approach.)*

**Strategy:** Recognize that not every project will be implemented.

**Approaches:**

- Communicate to stakeholders that not every project will be implemented. Causes can include:
  
  - Changes in circumstances or priorities.
  
  - Due to the nature of the research, there are no results to implement. [Montana 2017, page 4]

- Aggregate reasons for not implementing the results of certain research projects, including lessons learned. [Mississippi 2015, pages 9 and 14]

**Notes:**

- If a customer doesn’t “bite,” it's OK for a research office to let go of a possible implementation. [Montana 2017, page 5]

- Studying examples where implementation was not successful can be valuable if it provides insights into barriers and how to overcome them. [Montana 2017, page 6]

- The successful implementation of one project every five years may be enough to justify the cost of the entire ORIL program. [AASHTO presentation; ORIL 2017, page 7]

1.3. **Implementation and the Value of Research**

**Notes:**
As noted below, peer exchange attendees differed in their assessments of whether implementation should be linked to performance measures or used to quantify the value of research.

**Strategy:** Use successful research implementations to demonstrate the value of the research program.

- (See Section 6, Technology Transfer/Marketing, for examples.)

**Strategy:** Use implemented results to calculate and quantify the benefits of research.

**Approaches:**

- Use a **benefit-cost analysis** to evaluate the success of the implementation process. [South Carolina 2018, page 14]

- Assess the value of the implemented research at the end of the research project by conducting a **performance analysis** on the organizational change/improvement. [Oregon 2014, page 5]

- The calculation of benefits needs to be based on known data, such as bid prices, miles of roadways, expected life, and miles of repairs from a recent year. The validity of the calculations may be questioned if the metrics used are not clear and reliable. [MnROAD 2014, page ii]

- Agency methods to calculate benefits are not standardized and probably cannot be. They do have to be based on realistic values and accepted data and pass a common reality check. [MnROAD 2014, page ii]

- Separate out projects that will not have implementation plans and label them as such from the beginning. These are projects where the product will be knowledge, or information to be gained, policy research, or research where the product will be training. Exclude these projects from benefit-cost ratio calculations. [Kansas 2013, pages 4-5]

**Notes:**

- Use **department technical experts to perform analyses** and document their assumptions. [Montana 2017, page 124]

- A politician’s cycle for return on investment is not realistic. For example, it took the automobile industry 15 years to fully implement airbags. [AASHTO presentation; ORIL 2017, page 7]

- “There is not much value in attempting to determine a return-on-investment for individual research projects. In general, the criteria for quantifying value are ambiguous and argumentative. There is, however, immense value in evaluating the overall program. It is suggested that a program-level evaluation occur every five years to show what the program has done, highlight success and show a programmatic savings/contribution.” [AASHTO presentation; ORIL 2017, page 7]

- **Not all benefits of research can be calculated in terms of cost savings.** Projects results may be useful for reinforcing the effectiveness of current practices, avoiding harmful practices or approaches, or establishing new products or approaches that are extremely beneficial but cannot be easily assigned dollar values. Research can help agencies better...
understand the tools and techniques they have available to extend pavement life (both in terms of what works and what does not). [MnROAD 2014, page ii]

**Strategy:** Use research implementation as an operational performance measure.

Approaches:

- In Missouri, performance measures have been used for 12 years in a centralized way and **project implementation was one of the statewide performance measures** at one time. Several years ago, the number of statewide performance measures were reduced and this measure was removed. Each division and district have their own performance measures, but research project implementation is not one of them. [Mississippi 2015, page 11]

- **Performance measures** discussed at peer exchanges include:
  - Percent of projects where recommendations are implemented or adopted within two years of the final research report. [New Mexico DOT performance measure; New Mexico 2013, page 35]
  - Percent of projects deemed successful by the department. [New Mexico 2013, page 35]
  - Percent of projects with implementation plan complete. [New Mexico 2013, page 35]
  - Number of products (specifications, policies, training, etc.) produced and shared. [Illinois DOT performance measure; Iowa 2013, page 11]

**Notes:**

- The research group should not be indebted to performance measures regarding implementation, since research does not have the authority to implement research results in functional areas. [New Mexico 2013, page 36]

### 1.4. Program-Level Challenges and Opportunities

Challenges and barriers to implementation:

- The **status quo**. [Virginia DOT presentation; Georgia 2015, page 3]

- **Resistance to change.** Agency management or staff in charge of implementing research findings may not buy into research or changes to current practices. [Wisconsin 2018, page 6]
  - Opportunity: Seek buy-in from staff and management. [Wisconsin 2018, page 7]
    - Target “late adopters” to innovation with strategies to encourage earlier adoption (see the buy-in bell curve in Appendix E of Wisconsin 2018, page 172).

- **Not enough staff** to properly oversee the conduct of research or track implementation and outcomes. [Wisconsin 2018, page 7]
  - If implementation and outcomes are not tracked, return on investment cannot be calculated.

- A project could be too **politically sensitive or expensive** to implement. [Illinois DOT presentation; Georgia 2015, page 4]
• **Difficulty in accurately anticipating implementation costs** at the beginning of a research project. [Michigan 2010, page 8]
  
  o Opportunities: [Michigan 2010, pages 9-10]
    
    ▪ Plan for implementation funding by using a dedicated source for follow-up activities, building it into the research work plan, or by leaving some flexibility in the overall program budget.
    
    ▪ Require a benefit-cost analysis from every PI when the research is completed, even if it’s a best guess at what benefit the implementation will yield.
    
    ▪ Consider pooled fund studies with other states to implement research results of common interest.

• **Defining expected implementation products or plans before the research results are known.** [Michigan 2010, page 7]
  
  o Opportunity: Consider adding implementation products or related activities to a project after it is already under way and the need becomes apparent. [Michigan 2010, page 9]

• **Determining who has the authority and responsibility for implementation.** [Michigan 2010, page 8]

• **Lacking dedicated resources for managing implementation activities** and seeing them through, within the research program or among technical experts within the agency. [Michigan 2010, page 8]
  
  o Opportunities: [Michigan 2010, page 9]
    
    ▪ The research program needs to make implementation simple for its department stakeholders. Provide whatever support in time and money is possible to make sure it happens. Hire out the work if you don’t have the staff in house.
    
    ▪ Don’t fund research projects unless they have strong project champions. A project won’t be successful, and the results are hard to implement if the customer isn’t willing to be involved.
    
    ▪ Make sure everyone who will be needed for implementation is involved in the research project panel. Use that panel to oversee both the research and the implementation activities.
    
    ▪ Have senior managers share the risk of pursuing research in order to drive innovation in the department. If senior managers assume that risk with you, they’ll support you when the project is a big win or when it doesn’t meet expectations.
2. ROLES AND STAFFING

2.1. Research Staff

*Strategy: Assign implementation responsibilities to research staff.*

Approaches:

- **Designate a research staff position focused on implementation.**
  - Titles will differ across agencies (implementation coordinator, manager, engineer, specialist, etc.). [Montana 2017, page 6]
  - Responsibilities include promoting, facilitating, and tracking research implementation. [Kentucky 2011, page 4]
  - Engaging people across the agency is a key part of the job. Duties may include a combination of program-level tasks and project-specific implementation efforts. [Montana 2017, page 112]

*Notes:*
- Having an implementation coordinator who is well connected within an agency is a key job requirement; an in-house hire makes sense. [Montana 2017, page 6]
- **Involves project managers and other research staff in implementation.**
  - In Arkansas, the research team has a formal implementation committee. [Arkansas 2012, page 4]
  - Research project managers can help implement research results. [Utah 2016, page 28]
  - Convey that ownership of the project belongs to the technical staff (end users), not the research group. Express that the panel needs to review all project deliverables and ensure that they are meeting their needs. [Montana DOT approach; Montana 2017, page 111]

2.2. Project Panels and Champions

*Strategy: Clearly define and document the roles and responsibilities of each member of the project team.*

Approaches:

- **Develop written guidance** on responsibilities of sponsors, project managers, and technical advisory committee members for project oversight and implementation. [ID-NV-SD-WY 2015, page 19]
  - Include guidance on what panel members should be looking for in their reviews. [NCHRP; Ohio 2015, page 14]
  - Build in a close-out checklist for the technical panel. [New Mexico 2013, page 37]
**Strategy:** Give the project champion a central role in implementation.

Approaches:

- **Engage champions (subject matter experts) early in the project** for successful implementation later. [Georgia DOT; Georgia 2015, page 6]

**Notes from peer exchange discussion:**
- Implementation manager should have in-depth knowledge of Maine DOT mechanics, know direct points of contact, and establish relationships with key project team members.
- One of the biggest implementation hurdles is not having a strong champion.

- **Find ways to increase the motivation and effectiveness** of implementation champions. Consider incentives or recognition. [NCHRP; Ohio 2015, page 14]

- At Maine DOT, research projects are initiated by establishing an **internal champion (implementation manager)** while maintaining focus on the final presentation to stakeholders. [Georgia 2015, page 3]

- In Montana, research projects have a **champion** (can be anyone in the department) and a **sponsor responsible for implementation (division and/or division administrator or higher)**. [Mississippi 2015, page 12]

**Notes on selecting a champion:**
- Identify champions through constant dialogue and showing field staff that the research program can be of value; many innovations come from district offices. [Montana 2017, page 4]
- For a specific project, the research project manager may be better positioned than the implementation coordinator to identify a champion. [Montana 2017, page 4]
- The staff member who wrote the project idea should be involved in the beginning and throughout. They know the project and are invested in it. [Ohio comment; Montana 2017, pages 4 and 110]

- Utah DOT relies on **project champions as implementers**. [Montana 2017, pages 4 and 111]

**Strategy:** Assign implementation responsibilities to the project panel.

Approaches:

- South Carolina DOT has a **Steering and Implementation Committee** for each project with clearly defined roles and expectations. Multiple stakeholders are included in each committee. [South Carolina 2018, pages 4-5]

**Notes:**
- Having “implementation” in the steering committee’s name emphasizes implementation for the duration of the project and “makes a clear statement of the
importance of implementation and the responsibility of the committee.” [South Carolina 2018, pages 5 and 16]

- For research projects that have a high potential for cross-cutting implementation, consider utilizing technical advisory committees made up of experts that will be impacted by the implementation. [Oregon 2014, page 8]

- Have an implementation team so that if the champion leaves, the project will still move forward. [TRB comment; Montana 2017, page 111]

- Keep the technical advisory committee together after the project has ended to track implementation. [Mississippi 2015, page 17]

**Strategy:** Include subject matter experts and staff from regions or districts on project panels.

Approaches:

- Within the technical advisory committee, choose staff who are invested so that if the champion leaves, there are others to whom the project is important. [Utah DOT; Montana 2017, page 110]

- Manage technical leadership changes during project if project focus shifts. [Georgia DOT; Georgia 2015, page 6]

- Engage young engineers as members of project technical panels or ad hoc to research. [Georgia DOT; Georgia 2015, page 6]

**Strategy:** Engage the practitioners who will ultimately implement the research.

Approaches:

- Staff responsible for implementation should be involved as early as possible in a research project. [Montana 2017, page 4]

- The project champion should be closely tied to project initiation and implementation. A key part of the process is to go to the field and work with the people there to develop specific ways to put research recommendations into practice. The process combines research methodology with the embedded commitment of resources to implement research-based solutions. Research neutrality is critical. [VA-WV 2014, page 18]

2.3. Other Stakeholders

**Strategy:** Involve other groups within the agency who may be affected by implementation activities.

Approaches:

- Engage information technology in the research preparation and implementation process, especially if an IT component is a part of the research. [Oregon 2014, page 8]

- Facilitate coordination between researchers and implementers and asset management teams. [Wisconsin 2018, page 7]
• Georgia DOT has set a goal to foster connections between research and its New Products Evaluation group. [Georgia 2015, page 8]

Strategy: As appropriate, include external stakeholders in the implementation process.

Approaches:

• Consider including outside parties as part of a project review committee or implementation review committee, since this can foster important stakeholder buy-in. [Montana 2017, page 4]


• Incorporate industry review and feedback on new specifications and products to ensure they are viable. [MnROAD 2014, page iii]

3. PROJECT MANAGEMENT AND PROCESS

3.1. Project Selection

Strategy: Address implementation during project selection.

Approaches:

• Evaluate proposed projects for implementation potential.

  o Florida DOT’s Call for Research Proposals process includes ranking of “implementability” and potential benefits. [Illinois 2017, page 43]

  o Illinois DOT focuses on implementation when considering research needs and outputs, evaluating problem statements, and scoping new projects. [Utah 2016, page 8]

    ▪ In Illinois, implementation discussions start early. Illinois DOT’s Technical Advisory Groups (TAGs) identify research needs that can be implemented to assist the agency. When reviewing research proposals, TAGs discuss the ability or likelihood of research implementation. If a project does not have a high likelihood of implementation, it is typically not selected for funding consideration. [Georgia 2015, page 4]

  o At Mississippi DOT, technical experts are required to rate proposals, and implementation potential is one of the criteria. [Mississippi 2015, page 4]

    ▪ In Mississippi, project champions must state if a project has implementation potential and specify what benefits he/she expects from a study before MDOT will fund the study. [Mississippi 2015, page 6]

  o At Utah DOT, research projects are prioritized based on importance and likelihood of implementation. [Georgia 2015, page 4]

• Encourage incremental changes that do not require lengthy, costly projects. [Wisconsin 2018, page 7]
Innovations can be expedited when the value is apparent and implementation is easy/low-cost.

Notes from peer exchange discussions:

- Considering implementation from the beginning is key to a high rate of implementation. [Montana comment; Mississippi 2015, page 13]
- Challenge: Front-end screening helps to some degree but cannot anticipate all problems. Sometimes useful results do not happen. [Mississippi 2015, page 6]

**Fund implementation activities as separate projects.**

- Evaluate and fund implementation projects in an annual process. [Utah 2016, page 28]
- *(See Section 4, Funding and Contracting, for more detail on this approach.)*

Notes:

- Funding implementation as a separate project provides a clear line of demarcation and avoids the appearance of scope creep. [Montana 2017, page 111]

**Strategy:** Address implementation in the research contract.

Approaches:

- **Include implementation as a task or deliverable** within traditional research projects.
  - Require researchers to provide implementation support as one of the research contract tasks. SHRP2 was noted as a model of this. [Montana 2017, page 6]
  - At Montana DOT, implementation products are included in the contract. [Mississippi 2015, page 13]
    - As a research project ends, if the needed implementation activities are more extensive than expected, the implementation becomes a separate project. [Montana 2017, page 111]
- **Encourage or mandate deliverables that ease implementation.** [Wisconsin 2018, page 7]
  - A research project’s primary deliverable could be a specification, product, and/or report; it doesn’t necessarily have to be a formal report. [Missouri 2011, page 4]
  - In New Jersey, implementation is addressed from the beginning, starting with the RFP deliverables to an implementation product in the final report package. [Montana 2017, page 110]

### 3.2. Implementation Plans

**Strategy:** Develop an implementation plan for each research project.

Approaches:

- Require an implementation plan at the **problem statement stage**.
o At Alabama DOT, implementation plans are included within research proposals. This emphasizes the importance of implementation from the beginning of a project. [AL-AR-KY 2019, page 13]

o In Georgia, project development procedures require that an implementation plan be included in each research proposal. [Georgia 2015, page 5]

o Make sure selected projects have implementation plans with time frames developed and incorporated into work plans and schedules. [MnROAD 2014, page iii]

- Develop an implementation plan as the project progresses.
  
o In Illinois, the implementation plan is acknowledged within the initial phase of each research project. [Georgia 2015, page 4]

o In Kentucky, a preliminary implementation assessment is prepared at the beginning of the project, concurrently with the project’s work plan. The PI and Study Advisory Committee chair work together to determine:

  - How each project will be implemented.
  - The anticipated impacts of that implementation.
  - The potential challenges to implementation.

  During the project, the assessment is developed into a more extensive implementation plan, due before the final report is published. [AL-AR-KY 2019; page 14]

  **Participants’ notes on Kentucky’s approach:**
  
  ➢ Having a preliminary implementation assessment due at the beginning of the project emphasizes the importance of implementation from the projects’ starts. [AL-AR-KY 2019; page 14]

  ➢ The assessment breaks down different types of implementation to more accurately define the degree to which each project can be implemented. [AL-AR-KY 2019; page 15]

- Complete an implementation plan as the project ends.
  
  o Have a post-project implementation meeting with the technical advisory committee and researcher. Then, require the researcher to submit a report and formal implementation plan. [Mississippi 2015, page 11]

  o In Mississippi, an implementation plan is now required for each project from the researcher (modeled after NCHRP). [Mississippi 2015, page 17]

  o South Carolina DOT requires the project steering committee chair to complete an Implementation Statement at the end of the project detailing the implementation plan. [South Carolina 2018, page 5]

  o In South Dakota, researchers have the latitude to provide any implementation recommendation that they consider appropriate. [Mississippi 2015, page 16]

  o In South Dakota, projects are evaluated to determine if a formal implementation plan is required. [Mississippi 2015, page 16]

- Distribute the implementation plan to the project sponsors. [New Mexico 2013, page 37]
• Use an implementation planning form for every research or implementation project.
  
  o Illinois DOT uses an Implementation Planning Worksheet (IPW), a living document that is updated regularly. The worksheet includes expected benefits. [Utah 2016, page 8; also mentioned in Montana 2017, page 5]
    - The IPW is the initial document where implementation performance measures are defined. [Georgia 2015, page 4]
    - The IPW is reviewed to ensure that all stakeholders involved are held accountable for their role within the implementation process. [Georgia 2015, page 4]

  Notes on Illinois’ worksheet:
  
  ➢ The worksheet can be useful but possibly a burden or too formal in its existing form for some agencies. [Montana 2017, page 5]
  ➢ Multiple participants were excited about this tool.

• In South Dakota, an implementation plan template is in place for projects that require a formal implementation plan. [Mississippi 2015, page 16]
  
  ▪ The template includes version history, implementation plan approval, a research summary, an implementation plan, an evaluation, and key terms. [Mississippi 2015, page 16]

3.3. Ensuring Quality in Deliverables

_strategy: Require high-quality research products that facilitate implementation._

Approaches:

• Include as part of the RFP how the researcher will ensure quality. [Mississippi 2015, page 11]

• Have task reports submitted throughout the project, so issues can be detected sooner. [Mississippi 2015, page 11]

• Tie deliverables (report chapters) to payment. [Arizona DOT; Ohio 2015, page 8]

• Require a midproject presentation. [Maryland SHA; Mississippi 2015, page 9]

_strategy: Require final reports that are highly usable and accessible in terms of clarity, readability, length, and distillation of key results._

Approaches:

• Aim to produce “field-ready” reports that support implementation. [CTC & Associates; Ohio 2015, page 12]

• Limit the length of research reports. [Utah DOT; Ohio 2015, page 10]
  
  o Consider what should go in the report and what should appear in the appendices. [Ohio 2015, page 15]
• **Develop report writing requirements** and guidance for researchers. This guidance should address:
  
  o Intended audience and purpose of the report.
  o Desired sections of the report (including an executive summary and expected use of appendices).
  o Style guidance (see style manuals used by TRB and other state DOTs for examples).
  o Writing guidance (to emphasize the importance of readability/flow, clarity, and concise writing).
  o Formatting guidance/template (to reinforce the DOT brand and ensure consistency).  
  [Ohio 2015, page 21]

• Require universities to hire **technical editors** for research reports. [Georgia DOT; Georgia 2015, page 8]

• Identify and require **companion deliverables** (in addition to the final report) that encourage implementation. Consider a range of communication products aimed at senior managers, middle managers, and practitioners—all of whom have a role in putting results into practice.  
  [Ohio 2015, page 22]

### 3.4. Implementation Reports, Final Reports

**Strategy:** *Outline implementation recommendations or plans in the final report or in a separate implementation report.*

**Approaches:**

• **Address implementation as a section within the final report.**
  
  o Final reports from projects are expected to include a business plan or section addressing technology transfer and implementation of the findings, but not a completed plan for implementation. [Iowa Highway Research Board strategy; ORIL 2017, page 4]
  
  o At Maryland State Highway Administration (SHA), researchers are asked to provide implementation recommendations. Maryland SHA evaluates the implementation potential and decides if the project should be implemented. [Mississippi 2015, page 8]

**Notes:**

➤ When determining the structure of research reports, be cautious of trying to accomplish too many items with one report. Traditionally, research reports detail everything that was done during the study. This is good for other researchers who are interested in doing additional work on the subject matter. However, the needs of the sponsoring agencies and practitioners are different. Sponsoring agencies had an issue that they wanted evaluated while practitioners want directions for solving the problem. While it is good to have this technical documentation, many state DOTs are moving toward managing programs as opposed to performing engineering duties. Awareness of this
trend should be considered when determining how to document research. [AASHTO presentation; ORIL 2017, page 7]

- Require a separate implementation report as a final project deliverable.
  
  - In Virginia, once each project has been completed, a full implementation report is published to move toward standard agency practice. [Georgia 2015, page 2]
  
  - In Montana, the researchers and panel meet to discuss the researcher’s implementation recommendations and determine the agency’s response. This all gets put into an implementation report from the consultant. Research staff put this information into the agency’s implementation report template. All implementation reports have to be approved by the high-level sponsor, who is ultimately responsible for implementation. [Montana 2017, page 118]

3.5. Implementation Time Frame

**Strategy:** Once research results are known, begin implementation activities in a timely manner.

**Approaches:**

- After the research is completed, Illinois DOT “closes the deal” by acting while the information is fresh and on people’s minds. This includes supporting project champions, finding money and resources, and helping with technology transfer, marketing, communications, and training. Implementation funding is typically state funds. Then six to 12 months after implementation has begun, they interview the practitioners, stakeholders, and champions to assess benefits of the research and ongoing implementation. [Utah 2016, page 8]

- Be open to implementing known results even during the project. [Georgia DOT, Georgia 2015, page 6]
  
  - As appropriate, consider accelerated/concurrent implementation, which takes advantage of early implementation opportunities and accomplishes them concurrently with the research phases or other implementation activities. Its primary goal is to accelerate application of research results to practice. [Indiana 2013, page 6]

- Select a time frame that can be tied to a performance measure regarding whether projects have been implemented. Survey stakeholders to see what implementation activities have occurred during this time. Three to five years was suggested, but this will vary across agencies. [Montana 2017, page 114]

**Notes:**

- The appropriate time frame for implementation can vary significantly depending on the type of research and type of implementation. [Montana 2017, page 5]

- Not all research is implemented immediately; it takes time to make a cultural shift. [Iowa 2011, page 20]

- Research has a shelf life; any time lost communicating it with the right people costs the agency time/money. [Wisconsin 2018, page 8]
3.6. Role of Principal Investigator in Implementation

**Strategy:** Consider where a project’s PI best fits into the implementation process.

Approaches:

- **Have the researcher develop implementation recommendations** for each project. [Missouri DOT approach; Mississippi 2015, page 11]

  *Notes from peer exchange discussions:*
  - Recommendations on how to implement results are more appropriate coming from the agency rather than the researcher; they might come from research staff, a technical advisory panel, or a champion in a functional area. Researchers may make recommendations, but it’s the agency that owns the results and needs to derive benefit. It is likewise the agency’s role, rather than the researcher’s, to develop the implementation plan. [Montana 2017, page 3]

- **Explore ways to utilize PIs with implementation after the completion of the project** where appropriate. [South Carolina 2018, page 5]
  - PIs working with Alabama DOT research will sometimes stay involved in the implementation of projects once projects are complete, as they are often able to develop future work related to the project. [AL-AR-KY 2019, page 13]

  *Notes:*
  - It may be helpful not to have the original researcher lead implementation. The focus of implementation can be significantly different than the original research. [Montana 2017, page 3]
  - Challenge: Those performing and overseeing the research are not adequately incentivized to see it through to implementation. [Wisconsin 2018, page 4]

3.7. Implementing Other Agencies’ Research

**Strategy:** Implement relevant research results from other agencies.

Approaches:

- **Implement research results from NCHRP Research Reports, Synthesis Reports, and other publications.**
  - Use dedicated implementation funding through NCHRP Project 20-44 to help implement NCHRP research results. [Montana 2017, page 5]
    - NCHRP Project 20-44, “Accelerating the Application of NCHRP Research Results,” is a funding source managed by TRB for implementation. It primarily funds brochures, workshops, travel for attendees, etc. [Georgia 2015, page 5]
  - Consider adopting successful implementation strategies shared in the NCHRP “Paths to Practice” case studies. [Montana 2017, page 20]
Illinois DOT tracks TRB publications and webinars in a spreadsheet and automatically sends them to appropriate staff. [Georgia 2015, page 4]

Include discussions of NCHRP research at spring and summer research meetings. [Georgia 2015, page 7]

Mississippi DOT is working to quantify implementation of NCHRP projects. [Mississippi 2015, page 17]

- Implement research discussed at the TRB Annual Meeting and other conferences.
  - Utah DOT tracks what employees have learned and implemented from the TRB Annual Meeting. After the meeting, the Utah DOT attendees meet every other month as a group to discuss what they learned and what they are doing with it. The process is changing as they want to mentor younger employees about national membership. [Montana 2017, page 11]
    - In Utah, TRB annual meeting attendees have to implement two ideas after the meeting. [Georgia 2015, page 4]
  - Minnesota DOT requires each traveler to the TRB Annual Meeting or other national conferences to submit a trip report to highlight what they learned and what they plan to do with the knowledge. [Utah 2016, page 11]

Notes:

- Both active and passive activities (distributing research reports from other states, TRB E-Newsletter, etc.) are important. [Montana 2017, page 100]

- Reviewing other agencies’ research results is a large undertaking, but the benefit-cost ratio is high. [Georgia 2015, page 8]

- When trying to foster implementation of research from other states or elsewhere, it can be challenging to get the right information into the right hands at a DOT due to information overload; emails often go unread, and results could be marketed to other agencies better. [Montana 2017, page 5]
  - An implementation coordinator can play a role in getting research results (or two-page briefs, webinars, etc.) to the right people.
  - Typically, other states’ research is just a starting point to start the conversation and get people thinking about how it would be adapted for their own state.
  - Implementing other research efforts administered outside of your state may warrant further review to see what works for your state when considering weather conditions, funding for larger DOT divisions, and the like. [Montana 2017, page 19]
3.8. Pooled Fund Participation

**Strategy:** Find implementation opportunities from pooled fund participation.

Approaches:
- Consider **pooled fund studies** with other states to implement research results of common interest. [Michigan 2010, page 10]
- Mississippi DOT is looking into **pooled funds back to 2005** to see which ones the agency has implemented. [Mississippi 2015, page 17]
- Montana DOT is evaluating how **pooled fund contributions** are benefiting the agency. [Mississippi 2015, page 14]

4. FUNDING AND CONTRACTING

**Strategy:** Fund implementation activities as discrete projects, separate from the original research contract.

Approach:
- The Iowa Highway Research Board utilizes an **agreement** with the Institute for Transportation (InTrans) at Iowa State University to **assist in implementation and technology transfer efforts.** [ORIL 2017, page 4]

Notes:
- Previous projects are a good reference for **determining resources needed** for implementation, but with an understanding that every project is different. This determination is difficult for many agencies. [Montana 2017, page 5]
- Implementation is commonly funded separately from a research project, especially if the implementation can’t be defined up front. Also, committing funds before knowing whether implementation is feasible and desirable may tie up funds unnecessarily. Some agencies always fund implementation as a separate project. [Montana 2017, page 4]

**Strategy:** Fund implementation activities as tasks within the original research project.

Approaches:
- In Montana, **implementation products are included in the research project budget.** This means the research team must have people on the team who can develop any products that are expected to result from the research. [Montana 2017, page 108]
- In Ohio, implementation is included in a research project budget **to the extent that the deliverables can be identified and defined up front.** For district projects, at six months into a project the district staff look at what’s being developed to see if it would be feasible. If not, they end the project. If the research is implementable, then there is a Phase Two of the project. [Montana 2017, page 108]
• In Texas, implementation is not included as part of the research project budget, since they don’t yet know if the results of the project will be valuable. **If it were included, it would tie up funds.** [Montana 2017, page 108]

**Notes:**

➤ Some states feel that including implementation support (such as training) in the original research project contract **makes implementation success more likely.** [Montana 2017, page 119]

**Strategy:** Allocate dedicated funding for implementation projects.

**Approaches:**

• In Maryland, funds are set aside in the work program for the implementation of research products. [Mississippi 2015, page 8]

• The Minnesota Local Road Research Board allocates funding for implementation in its budget. These funds are overseen by the Research Implementation Committee (RIC). From these funds, the RIC contracts with a consultant to provide assistance in implementation of research findings. This contract is for three to four years and **typically initiates five to eight implementations each year.** [ORIL 2017, page 5]

• Minnesota DOT directs $1 million to implementation each year. [Utah 2016, page 4]

• In 2013, Texas DOT had an annual research budget of $21.5 million and an annual implementation budget of $3.5 million. [New Mexico 2013, page 21]

• Virginia DOT has a $13 million annual budget for research projects (mostly state funds) plus a $10 million annual budget solely for implementation (all state funds). [Georgia 2015, page 2]
  
  o In Virginia, 50 or more funded implementation projects are currently underway. Once each project has been completed, a full implementation report is published to move toward standard agency practice. [Georgia 2015, page 2]

**Strategy:** Investigate whether funding for implementation is available from functional areas.

**Approaches:**

• In Texas, if the research office cannot fund a project proposed by a functional area, area staff sometimes **conduct their own targeted research activity and implement the results independently.** [Montana 2017, pages 4 and 109]

• At the 2017 Montana peer exchange, attendees discussed whether a research implementation pay item could be jointly funded by the research office and a functional area. [Montana 2017, page 109]

**Notes:**

➤ **Getting funding from a DOT functional area** to pay for implementation of relevant research is not common, though in-kind support (like traffic control) is common. [Montana 2017, pages 4 and 109]
**Strategy:** Consider alternative funding sources for implementation activities.

Approaches:

- Consider an experimental features program as a mechanism to facilitate implementation of new materials, technologies, and processes. [Missouri 2011, page 3]
- Consider pooled fund studies with other states to implement research results of common interest. [Michigan 2010, page 10]

5. TRACKING

**Strategy:** Track implementation activities for all completed research projects.

Approaches:

- Keep the technical advisory committee together after the project has ended to track implementation. [Mississippi 2015, page 17]
  
  - (See Section 2, Roles and Staffing, for more examples of how staff can be involved in tracking.)

- Seek and communicate feedback from research stakeholders regarding research project successes (i.e., measure how their needs have been met). [VT-NH-ME 2010, page 7]
  
  - Follow-up on the success of the implementation is crucial: Did it work the way we thought it would? [Michigan 2010, page 12]
  - Consider a formal customer satisfaction survey (in addition to each project exit survey). [Mississippi 2015, page 14]

- Consider tracking what can’t be implemented and lessons learned (in addition to what can be implemented). [Mississippi 2015, page 14]

- For projects with barriers to implementation, check later to see if barriers got removed. [Mississippi 2015, page 17]

- The Kentucky Transportation Cabinet has funded an effort at the Kentucky Transportation Center begun in 2017 to review every research project completed over the past five years in order to document the implementation or nonimplementation of each, to classify the types of implementation, and to assign a value to each implementation where applicable. The effort will also help Kentucky identify processes to start tracking this information on an ongoing rather than periodic basis. [AL-AR-KY 2019, page 14]

Notes:

- Successful implementation tracking requires buy-in from participants on its value, because such tracking does require effort. Before requiring staff to begin tracking, build the business case and present it to show the long-term value. Sell it as “this is a good thing.” Selling it is critical. [Montana 2017, pages 5 and 117]
➢ Be careful of asking staff to capture too much information. This can lead to poor-quality information, which can be worse than having none. [Montana 2017, page 117]

➢ It can be hard to identify (and therefore track) research deployment beyond initial deployment. [Montana 2017, page 5]

**Strategy:** Use tools to document and track implementation.

**Approaches:**

- **Use a dedicated database or tool** for tracking implementation. Examples include:
  - Florida DOT tracks implementation in a SharePoint database. [Illinois 2017; screen shots of database on pages 46-47]
  - In Illinois, project details are placed in an implementation planning database that tracks project progress. [Georgia 2015, page 4]
- Incorporate implementation tracking into the research project database. [Utah 2016, page 28] Examples include:
  - Minnesota’s ARTS system, an Oracle-based system that was developed in-house, which includes a tab for tracking implementation activities. [Montana 2017, pages 116-117]
  - Ohio’s ARMS system was developed in-house using .NET technology. [Montana 2017, page 116]
- Develop a post-project checklist. [Mississippi 2015, page 17]

**Notes:**

- Issues with tracking systems include dependence on contractors, learning curve to use systems, need to create and update documentation, interface with DOTs’ other systems, IT support, and development and maintenance costs. [Montana 2017, page 5]

**Strategy:** Select a time frame for tracking implementation efforts.

**Approaches:**

- Explore tracking early implementation. [South Carolina 2018, page 14]
- Wyoming DOT tracks implementation at nine months and three years following project completion. [ID-NV-SD-WY 2015, page 17]
- In Arkansas, the research team tracks projects for three years after completion of the project. [Arkansas 2012, page 4]
- (See the next strategy below for more examples of states’ time frames.)

**Strategy:** Conduct surveys or interviews of project stakeholders to assess implementation status.

**Approaches:**
• In **panel exit surveys**, ask members to describe activities they are undertaking to implement the results of their project. [NCHRP; Ohio 2015, page 14]

• Conduct **retrospective surveys** to track implementation. Possible time frames: annually, every five years. [Montana 2017, page 5]

• About six to 12 months after research is done and implementation has begun, Illinois DOT **interviews stakeholders and champions** on implementation progress. [Utah 2016, page 8]

• Utah DOT conducts **evaluations** every three years to track implementation. [Georgia 2015, page 4]

• **Revisit the implementation report with the project subcommittee** (6 months after project ends) to ensure implementation is on track. [Arkansas 2012, page 4]

• Conduct a **pre- and post-condition survey of the research topic** if implemented (potentially a six- to 12-month follow-up). [South Carolina 2014, page 12]

• Consider **alternative methods** to gather feedback from users regarding implementation on projects. [Arkansas 2012, page 4]

• Some states do **surveys of the implementation of “old” research projects**. [Montana 2017, page 15]

**Notes:**

➢ It can be difficult to conduct periodic (such as five-year) retrospective surveys to track implementation. **Annual or ongoing efforts** are more work but ultimately may be more effective. [Montana 2017, page 5]

5.1. **Reporting on Implementation**

**Strategy:** **Report periodically on implementation progress.**

**Approaches:**

• It is important to share the tracking results beyond research to the rest of the agency. This can be done through **regular communications, dashboards, conferences, or other methods.** [Montana 2017, page 6]

  o Make implementation tracking worthwhile by **communicating successes at various meetings and conferences** for the department. [Montana 2017, page 20]

  o The responsibility for **final reporting of implementation data** can be shared between the DOT research office, the functional area/champion, and the researcher; this varies from state to state, and can depend on whether this is written into the contract. [Montana 2017, pages 6 and 117]

  o The tracking process should include **periodic implementation status reports**. [Kentucky 2011, page 5]
• Texas DOT’s tools for managing implementation projects include an interactive online Research Project Map. [Utah 2016, page 13]

Notes:
➤ Multiple participants were excited about this tool.

6. TECHNOLOGY TRANSFER/MARKETING

6.1. Communication Strategies and Talking Points

**Strategy:** Communicate research results and showcase implementation successes.

Approaches:

• Utilizing professional web and communications staff to share and promote research findings is one of the most effective ways to assist with implementation. [MnROAD 2014, page i]

• Communication is critical for the acceptance/implementation of projects and the survival of programs. Making efforts to not only share the findings from research, but to communicate the importance of those findings is key. Be aware that not everyone will like the results. [AASHTO presentation; ORIL 2017, page 7]

Notes:
➤ Several DOTs pointed out that technology transfer and implementation go hand-in-hand to be effective. Effective technology transfer is often derived from quality content created during implementation. It is important to understand how implementation feeds into technology transfer, and how marketing and promoting the research program can enhance this effort. [Illinois 2017, page 19] Conversely, technology transfer leads into implementation as well. [Montana 2017, page 3]

➤ Minnesota DOT suggests that research departments be timely with publicizing research. For example, if something happens in the news, the department can send out information about relevant research underway or projects that have already been implemented. [Illinois 2017, page 20]

• “What have we implemented today?” will become a communication effort that places implementation in the vision of Utah DOT’s research program. [Georgia 2015, page 8]

  o Question can only be answered if research has actually been implemented or applied.
  o Question also provides the best justification for research.
  o The agency plans to incorporate this message into research project selection and management processes to maintain proper perspective on ultimate goal of research.
  o Afterward, implemented research will be summarized and communicated throughout Utah DOT to transfer technology and market the agency’s research services.
6.2. Staff Outreach

**Strategy:** Present research results directly to relevant DOT staff and local agencies.

**Approaches:**

- Maryland DOT invites the PI to present within the division, so the research effort can be heard by all the impacted staff. [South Carolina 2018, page 15]

- Consider conducting presentations on implementation to upper management as appropriate. [South Carolina 2014, page 10]

- In Utah, project managers coordinate post-project implementation presentations. Interested parties may observe project results and ask questions. Upon completion of the presentation, professional development hour (PDH) credits are given to participants as applicable. [Georgia 2015, page 2]

- At Georgia DOT, a post-project presentation is directed to end users. [Georgia 2015, page 6]
  - Expand post-project presentations to other offices interested in project findings. [Georgia 2015, page 8]

- A concise, fast-paced presentation series to showcase different aspects of the research program, sometimes referred to as “Pecha Kucha” or “Fast and Furious,” was discussed among peer exchange participants. Each presenter has seven minutes for the actual presentation, and seven minutes for questions. Each session has two presentations. This presentation style is used to encourage researchers to focus on clear messaging, storytelling, and presentation skills in an informal setting. Presenters gain practice giving presentations, participate in idea sharing, increase the use of technology, network, foster collaboration between researchers, and improve communication for broad audiences. There is a three-step process for this presentation style: [Illinois 2017, page 19]
  - **Preparation.** A steering committee works with presenters to prepare and offer presentation tips such as providing additional background information on the topic, explaining why the topic matters, and telling a story.
  - **The event.** This presentation style is casual and fun, but all aspects have been prepared and rehearsed ahead of time. Agencies can determine how often the series should occur, but typically once a month during the lunch hour. Conference calls, video, and WebEx are used for remote attendees.
  - **Follow up.** The steering committee is typically highly responsive to attendee and presenter feedback via regular surveys.

**Strategy:** Hold a research showcase or conference.

**Approaches:**

- In 2016, New Jersey DOT implemented an annual research showcase to recognize innovative research projects. Staff can submit their own ideas or nominate others. Projects are evaluated
and selected for awards. In the future, the agency plans to tie this in with the State Transportation Innovation Council incentive program. [Illinois 2017, page 19]

- Utah DOT hosts an annual research conference in which participating universities, consultants, and DOT professionals present their projects in specific subject areas and in-depth discussions are held in workshops. [Georgia 2015, page 2]

- Organize either a stand-alone research poster session or a poster session in conjunction with the agency’s research peer exchange. [Georgia 2015, page 7]
  - Revisit education/workforce development benefits of research without undue emphasis on them, keeping the main focus on implementable research for the DOT. [Georgia 2015, page 7]

- Include transportation industry/local governments as part of research outreach efforts. [Georgia 2015, page 8]

**Notes:**
- Take every opportunity to tout and aggressively market the program. Get the research products out there so people know what you are doing. Sharing information through emails is good, but it is important to physically get in front of people and get their attention. After some time has passed, follow up to see who is using the products and capture their experiences and any benefits. [AASHTO presentation; ORIL 2017, page 8]
- The best people to “sell” the [ORIL] program are the locals (counties). Peer-to-peer conversations will generate more interest and potential buy-in. Utilize testimonials from locals who have used a research product. Those individuals become advocates for the program. Start with [ORIL’s] board members and expand from there. [AASHTO presentation; ORIL 2017, page 8]

6.3. **Webinars**

**Strategy:** Use webinars to provide detail on implementation-ready research.

**Approach:**
- Illinois DOT recently carried out a Safety Project Outreach webinar series to showcase implementation projects. The series included three presentations: Pavement Markings, Right Turn Skew, and Flashing Yellow Arrows. Over 450 attendees from 60 Illinois cities and local jurisdictions, as well as registrants from Arkansas, Missouri, and Iowa, have participated. A total of 452 PDH certificates were issued. [Illinois 2017, page 4]

6.4. **Videos**

**Strategy:** Use short videos to promote research results.

**Approaches:**
- Use YouTube video clips to highlight research projects and implementation efforts. [Minnesota DOT strategy; Utah 2016, page 10]
• Work with DOT communications personnel to develop short videos promoting research findings on YouTube and other online venues. [South Carolina 2018, page 5]

• Minnesota Local Road Research Board hosts its own YouTube channel. This has become a main method for outreach. [ORIL 2017, page 5]

6.5. Research Briefs and Summaries

**Strategy:** Prepare brief summaries of completed research.

**Approaches:**

• **Prepare a one-page project summary for agency leadership.**
  
  o Develop a one-page market summary for management to encourage implementation. [South Carolina 2018, page 14]
  
  o Create handouts on project/program implementation for the agency executive committee. [Georgia 2015, page 7]

**Notes:**

➤ One-page summaries may be a good promotional tool for senior/executive leadership to highlight the program. However, for practitioners, be careful that they realize additional information is available elsewhere. Potential misuse of the results could occur if one-pagers are relied on for all pertinent information. [AASHTO presentation; ORIL 2017, page 7]

• **Prepare two- to four-page research briefs for a wider audience.**
  
  o Michigan DOT is putting together success stories on pooled funds that describe how they’ve been beneficial to the state and what has been implemented. [MnROAD 2014, page 13]
  
  o Minnesota DOT both contracts out and develops two-page technical summaries in-house to effectively communicate to a general audience. [MnROAD 2014, page 13]
  
  o Have researchers prepare three- to four-page summary text that DOT staff then puts into a template. [Mississippi 2015, page 12]

**Notes:**

➤ There is a tendency to go toward shorter summaries (two-page briefs rather than eight-page executive summaries) to best communicate results for implementation. It can be useful for an investigator to draft these documents, but ultimately these summaries must reflect the needs of the agency: “How does this research help us?” Videos can be effective as well. These communication tools can be built into the research contract, but this is only done by some DOTs. [Montana 2017, page 6]

➤ Online formats are often preferred. Two-page summaries should be adapted for easy viewing online or on smartphones. [MnROAD 2014, page 13]
6.6. Posters

**Strategy:** Use conference posters to showcase completed research.

**Approaches:**

- Require inclusion of posters and brochures as project deliverables. [Kansas DOT; South Carolina 2018, page 15]
- Develop additional technology transfer processes (project deliverables) such as posters for use as marketing materials within headquarters and region offices and at committee meetings, and with human resources for workforce development. [South Carolina 2018, page 21]

6.7. Conference Presentations

**Strategy:** Present research findings at state, regional, or national conferences.

**Approaches:**

- Florida DOT promoted research efforts within the agency by making presentations at scheduled district and state meetings. These large meetings provided large, diverse audiences from around the state that were able to learn how the research program benefits the DOT and the state of Florida. [Illinois 2017, page 19]
- Minnesota Local Road Research Board hosts booths at various state conferences organized by American Public Works Association, Local Technical Assistance Program (LTAP) and others. Preloaded flash drives containing research findings are handed out at these events. Numerous presentations are also given at these local conferences and before TRB subcommittees. Efforts are made to keep conference presentations interactive by utilizing trivia games and other audience participation activities. [Minnesota Local Road Research Board; ORIL 2017, page 5]

6.8. Newsletters (Internal, External)

**Strategy:** Prepare articles about completed research for inclusion in internal or external newsletters.

**Approaches:**

- Minnesota Local Road Research Board publishes a newsletter in February and August providing updates on the program and individual projects. In addition, articles are submitted for other publications such as DOT and LTAP newsletters, and national publications. [ORIL 2017, page 5]
- Consider submitting selected projects for publication in The Connector, South Carolina DOT’s quarterly newsletter. [South Carolina 2018, page 29]
- Utah DOT publishes a quarterly newsletter to highlight salient research at the agency. [Georgia 2015, page 4]

6.9. Email Notifications

**Strategy:** Use listservs and email notifications to notify stakeholders of completed research.

**Approach:**
• Minnesota Local Road Research Board distributes email notifications through a listserv to let people know projects are completed and reports are available. [ORIL 2017, page 5]

6.10. Annual Reports

Strategy: Showcase successful implementations in the research program’s annual report.

Approaches:

• Include an implementation summary in the annual report. [Montana 2017, page 14]

• In the annual report, include a look back at projects completed five years earlier to see how effective the implementation was. [Oregon 2014, page 5]

• To share information about its projects, the Minnesota Local Road Research Board uses fact sheets and an annual “At-A-Glance” report that summarizes all reports for a given year. [ORIL 2017, page 5]

7. DEMONSTRATIONS, PILOTS, OTHER IMPLEMENTATION ACTIVITIES

Strategy: Define and document a framework of deployment steps or options.

Approaches:

• In a 2012 presentation, TRB staff described SHRP2 activities to convert research results into usable products. Activities included development of:
  
  o Guidebooks
  o Training programs
  o Model specifications and/or standards
  o Web tools
  o Webinars and workshops
  o Pilot tests of products (new technologies, IT and processes) [SHRP2 presentation; Utah 2012, page 64]

• SHRP2 product-level implementation plans addressed the following: [Utah 2012, page 67]
  
  o Implementation goals and objectives
  o Target audiences
  o Barriers to implementation
  o Implementation strategies and tactics
  o Change management issues
  o Roles and responsibilities for FHWA, AASHTO, and others
  o Governance structure (e.g., advisory committee)
  o Hosting of web tools; IT requirements
Strategy: Translate findings from the final report into a user-friendly format.

Approaches:

- **Challenge:** Consistently implementing the changes in the field and developing needed standards and guidelines. Staff resources are needed to support this transition, and research results may need to be refined for simplicity in field/operational applications. [Michigan 2010, page 12]
  - Opportunities: [Michigan 2010, page 12]
    - Hold tech transfer meetings with DOT staff to pare down the findings for them.
    - Identify a DOT implementation coordinator for each project who will work through all details to get a final product ready for use.

- **Develop training.**
  - Mississippi DOT now requires a two-page technical brief for every final report. Depending on the project, a presentation, webinar, or training may be required. [Mississippi 2015, page 5]

- **Provide training through webinars.** (See Section 6.3, Webinars, for an example.)

- **Related case studies:**
  - Minnesota DOT dedicated funding for an implementation project for field testing the calibration of salt spreaders (to measure how sand and salt are dispensed on the roadway). Implementation dollars were used to purchase calibration scales from the Iowa Research Program. The original research was done through the Clear Roads Pooled Fund Program and it was then customized for MnDOT. The department then deployed the technology for local agencies by developing a training course for MnDOT maintenance staff, creating a controller calibration guide, and implementing training through the LTAP. [California 2011, page 8]
  - Ohio recently deployed pre- and post construction strategies for preventing the “bump at the end of the bridge.” The research was successfully deployed because the DOT’s pavements, materials, construction, geotechnical, structures, and production divisions were involved in the process from the outset. Throughout the process, there was interdisciplinary communication and strong project management. The project resulted in a paradigm shift from “smoothness” to the connection of the pavement and the bridge and an increased emphasis on safety. To deploy the technology, the department developed a comprehensive specification, and training for bridge and pavement contractors. [California 2011, page 6]
Utah recently started using a Self Propelled Modular Transport (SPMT) system to reconstruct bridges. This system utilizes a computer-operated, multi-axle platform that pivots 360 degrees to lift, carry, and set large and heavy loads at walking speed. The use of this system drastically reduces road closures associated with bridge replacements and saves millions of dollars. **The state DOT was very successful in communicating the benefits of the system to put it in agency use and to inform the public. However, the state did experience an internal problem with staff support** that will represent a lesson learned for the department going forward. [California 2011, page 7]

**Strategy:** Begin deployment with a demonstration project or pilot project.

**Approaches:**

- Iowa Highway Research Board began to emphasize efforts on implementation of research findings within the last four years. Recent efforts have been focused on demonstration projects, which have been shown to be effective. [ORIL 2017, page 3]

- **Related case studies:**

  - Washington State DOT used a solar, fiber optic lighting system to replicate natural lighting under some of its overwater structures in an attempt to alleviate damage to fish habitats caused by overwater structures. Although the research was well-done, it was **aborted during the pilot phase** because researchers realized that the equipment used wasn’t designed for outdoor applications or for seawater. The time invested in the project was worthwhile and instructive because the risks were low (the research was relatively inexpensive), collaboration high, and if it had succeeded, it would have been easily implemented and very beneficial. [California 2011, page 6]

  - In the SHRP2 program, the four Technical Coordination Committees identified actions to move the research products nearing completion to the next step of readiness for implementation. The Oversight Committee then selected and approved a slate of activities to refine and strengthen research results and move them forward to practice. Activities were selected to **identify knowledge gaps and other barriers to implementation, conduct pilot tests, construct demonstration projects**, and undertake additional similar efforts to advance research results to produce the tools and products that are most useful to transportation practitioners. [California 2011, page 6]

**Strategy:** Learn from other agencies’ successful and unsuccessful implementation efforts.

**Related case studies:**

- Connecticut has developed several low-cost technologies that improve roadway safety and performance. The department implemented the Longitudinal Notched Wedge Joint, which improved the performance of hot mix asphalt longitudinal joints. **The research successfully transferred into practice because its use had a proven safety benefit** (it kept longitudinal joints together), it was **fast to implement**, and it had **limited risks**. This project indicates that implementation doesn’t need to be difficult or expensive. [California 2011, page 8]

- Two examples of implementation efforts at Illinois DOT: Implementation of the Construction Scheduling Expert System project, produced with the intent of transferring historical and
institutional knowledge, was less successful. One year after training and a user manual were provided to the districts, no one was using the system and there was no IT support from the PI. A more successful implementation example was the Flashing Yellow Arrows for Protected/Permissive Left Turn Control project. Research demonstrated that left-hand turn related crashes were reduced significantly, and changes were made to the design manual. Implementation was successful for this project due to effective technology transfer through a series of webinars, supported with implementation funding, as well as dedicated project champions and excellent communication. [Utah 2016, pages 8-9]

- Louisiana deployed high-strength concrete in bridge construction, which potentially permits either reduction of girders or longer girders with a reduction in foundation elements. In addition, the high-strength concrete is denser, providing corrosion resistance of reinforcing steel and therefore enhancing lifespan. The technology uses one less girder/span in each direction, which in a recent application on the Twin Span Bridge resulted in a return on investment of $17.1 million. Other benefits include lower foundation costs and a longer lifespan. This technology is now specified for all bridges in a marine environment. The research for this technology was initiated at a TRB committee meeting that resulted in four research projects that cost $1.3 million over a sustained 10-year period. This project indicates that it is worthwhile for agencies to stick with long-term research that supports a vision. [California 2011, page 8]

- One Oklahoma DOT implementation success is the Road Runner 3 Traffic Counting and Classification System. Success in this implementation is aided by an active project panel and is proven by the accuracy of the data, saved man-hours by the organization, and fewer hours spent correcting errors. An example of an implementation failure at the agency is an anti-icing system on bridges. The design and materials were poor, there was no maintenance, and there was a lack of communication and coordination with the structures division. [Utah 2016, page 11]

- A peer exchange attendee described his experiences implementing research results as part of FHWA’s Every Day Counts innovation deployment initiative. This project was a success because it was an initiative from FHWA Administrator Victor Mendez—the directive came straight from the top of the organization, so funding and high-level support were secured. The initiative also included proven new technologies, and the agency partnered with AASHTO to hold innovation summits across the country, which educated transportation staff on the benefits of the technologies and how to use them. [California 2011, page 7]
# 8. LIST OF PEER EXCHANGE REPORTS

Reports may be accessed at [https://research.transportation.org/peer-exchange-reports](https://research.transportation.org/peer-exchange-reports).

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Appendix B.

Implementation Resources and Practices:
Synthesis of Findings from the Research Program and
Project Management (RPPM) Database

Prepared for

National Cooperative Highway Research Program

Prepared by

CTC & Associates LLC

NCHRP 20-44(21) Task 2 Deliverable
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Overview and Synthesis

NCHRP Project 20-44(21) is an effort to identify practices, opportunities and challenges related to implementation of research conducted by state departments of transportation (DOTs).

The first two tasks, conducted in parallel, are a synthesis of findings from peer exchanges (Task 1) and from materials in the Research Program and Project Management (RPPM) database (Task 2, this report).

RESEARCH PROGRAM AND PROJECT MANAGEMENT DATABASE

RPPM (https://rppm.transportation.org/) is an online repository to which state and national organizations—typically state DOTs, American Association of State Highway and Transportation Officials (AASHTO), and Transportation Research Board (TRB)—may submit resources related to all phases of transportation research. Registration is required to submit resources, but they are freely accessible to the public. The site is hosted by AASHTO.

Implementation is one of many topics covered by RPPM. The four main areas in the database are:

- Setting the Research Agenda
- Carrying Out Research
- Delivering Results/Communicating Value
- Collaborating in Research Activities

Under this hierarchy, implementation falls under “Delivering Results/Communicating Value,” together with these topics:

- Communication
- Implementation
- Intellectual Property
- Program Evaluation
- Project Evaluation
- Value of Research

IMPLEMENTATION RESOURCES

At the time of the writing of this report, there are 66 resources in RPPM labeled as relating to implementation dating from 1996 to 2018. Submitters include national groups (TRB, AASHTO Research Advisory Committee (RAC), AASHTO RAC Program Management and Quality (PM&Q) Task Force), and state DOTs (19 different states have submitted).

Each implementation resource is tagged according to a type by the submitter. The count of each type is noted.

- Agreement/Contract — 1
- Form — 11
- Guideline/Standard — 4
- List — 2
- Minutes/Notes — 5
- Plan — 8
- Presentation — 2
- Process — 5
- Report — 17
- Survey — 8
- Template — 2
- Other — 1
These may be accessed directly on https://rppm.transportation.org/communicatingvalue/Implementation/Forms/AllItems.aspx.

Citation Format

For the purpose of citation in this synthesis, these resources are numbered 1 to 66 in the List of RPPM Resources at the end of this report. In the Detailed Findings chapter of this report, citations are presented in the following format:

[(resource number). (type), (submitting organization) (year), (pages, as appropriate)]


ORGANIZATION OF FINDINGS

The findings are organized into seven top-level functional areas. These are the same areas used to organize the synthesis of research peer exchanges (Task 1 of this project). A brief description of what each area covers is also provided.

1. Program Management — Ways a research program is organized to support implementation, and ways it interacts with other agency departments or organizations beyond the DOT to support implementation.

2. Roles and Staffing — Who is responsible for implementation work; this might include research staff, others at the DOTs, and consultants/investigators.

3. Project Management and Process — Steps established at all phases of research to support implementation.

4. Funding and Contracting — Formal channels for providing funds for implementation; established contract language to facilitate implementation.

5. Tracking — Established methods to track what research is being implemented and how successful those implementation efforts have been.

6. Technology Transfer/Marketing — How transfer of technology intersects implementation; how marketing successful research promotes implementation.

7. Demonstrations, Pilots, Other Implementation Activities — Noteworthy implementation examples in practice.

In each area, we present one or more strategies to facilitate, promote or enhance implementation, followed by specific approaches drawn from the RPPM resources, including citations.

Beyond these seven areas, this synthesis includes an eighth section:

8. Challenges and Opportunities — Perceived barriers to implementation of research results and how they may be overcome.
CONSIDERATIONS

The following considerations should be taken into account with respect to the findings in this report:

- Several of the resources are years old and may no longer represent current practice.
- It is seldom known how much any given resource is used in practice. The existence of an instrument, form or tool does not necessarily mean that it is widely or successfully used.
- Each resource could only be labeled as a single type (report, survey, form, etc.), and sometimes the label selected does not best represent what the resource actually is.

With these caveats noted, a wealth of findings on implementation strategies were compiled, as synthesized in this chapter and presented in full in the next chapter.

SYNTHESIS OF FINDINGS

A high-level synthesis of implementation strategies collected in the RPPM resources are presented here by topic. Findings reinforced by a significant number of citations and states are tagged here as KEY FINDINGS. These are candidate topics to be addressed in more detail in follow-up tasks for NCHRP Project 20-44(21).

Full detailed citations referencing specific resources, agencies and citation links are presented in the next chapter, “Detailed Findings.”

Program Management

- Consider a comprehensive set of strategies to advance an implementation program. Strategic considerations might include articulating a vision, defining in advance what success will look like, establishing a culture that rewards innovation, and setting an environment conducive for testing and deployment of new ideas.
- Select the right problems for research. Prioritized, targeted research that addresses a genuine user is more likely to lead to successful implementation.
- Collaborate and pool resources to strengthen implementation efforts. Interagency and interjurisdictional collaboration can be an effective way to share cost and risk and address needs of common concern for local, regional and state stakeholders.

Roles and Staffing

- Assign implementation as a staff responsibility. A 2014 survey of state DOTs showed that most responding states had staff dedicated to implementing research or tracking implementation. However, the percent of time that person dedicated to implementation varied greatly, from “very little” and just 5 percent up to 100 percent for a few agencies.
- Encourage the active engagement of technical staff. This may not only increase the likelihood of successful implementation, but would also distribute the workload.
• Expand participation in the review and oversight of research projects with respect to anticipated implementation. The research requestor, potential implementers and representatives of affected external groups can play an integral role on technical advisory committees. One state convenes a 10-person panel to review projects for implementation.

• **KEY FINDING:** Assign a champion with a vested interest in implementation to lead the research project. This approach appeared in materials and guidance from several states and a TRB report. Specific recommendations include assigning management-level champions with technical and communication expertise and charging the champion with promoting the expected benefits of implementation to users and policymakers.

• Prepare staff to conduct implementation-related activities. A range of general and hands-on training may be appropriate depending on the experience level of the staff.

• Recognize the significant role senior management and decision makers can play. Buy-in by senior management and decision makers is critical. Strong support can foster innovation and eliminate potential barriers to new products and processes.

**Project Management and Process**

• Set clear goals for putting research into practice. Goals related to benefits should be established and communicated clearly to all parties involved in implementation.

• **KEY FINDING:** Address implementation in the research needs statement and during project development. Several states incorporate implementation into the project development phase. As provided on different agencies’ templates, forms and planning documents, this may involve providing a budget for innovation, naming likely implementers, and establishing other implementation needs.

• **KEY FINDING:** Detail implementation in the program’s research manual and process documents.

• **KEY FINDING:** Develop an implementation plan. This is a common strategy to support implementation, with many states having a form, template or questionnaire for developing an implementation plan. Typical plan elements include research goals, anticipated benefits, participants (names of individuals and agency departments), costs, tasks, timelines, and measures of a successful implementation.

• Address implementation at project kickoff. A kickoff meeting form can help guide discussion.

• Evaluate and prioritize projects for implementation. One state holds semiannual meetings to review recently completed research projects to recommend implementation for selected projects. Another uses a spreadsheet-based scoring system to evaluate projects that could be implemented.

• **KEY FINDING:** Integrate implementation across the research process. Multiple states stress that implementation is a process, not an event, and must be considered from the beginning and throughout each phase of a research project. This is supported by an NCHRP report.

• Evaluate implementation feasibility at the end of the research process. One state surveys technical panel members at the conclusion of each research project to establish potential for implementation. Another convenes a meeting with every project monitor after a research
• Develop “tactical tools” to accelerate implementation. These tools might include model policies, contracts and agreements, boundary-spanning activity guidance, reference guides, and evaluation procedures.

• Consider the societal and legal issues associated with implementing technology. Questions to consider address privacy, security, intellectual property, and other legal issues.

Funding and Contracting

• Commit or set aside funds for implementation. Agencies can institutionalize innovation by committing funds in the annual budget for research implementation, dedicate a trained and expert staff to implementation efforts, and formalize interactions between researchers and users.

• Detail eligibility for federal funding. Spelling out eligibility requirements for implementation projects to receive federal funding facilitates access to these funds.

• Address implementation in the contract language. Standard contract verbiage can call out a benefit analysis task and an implementation task.

Tracking

• **KEY FINDING:** Use tools to document and track implementation. Many states have implementation tracking tools. These include databases, Excel spreadsheets, forms, progress reports, closeout reports, and evaluation forms. A 2012 survey indicated that half the responding states use a tracking system, while a 2014 survey indicated that fewer than that did, with many states having systems in development.

• Report periodically on implementation progress at the program level. An annual report on implementation progress can help an agency’s research advisory committee understand short-term implementation successes and challenges. A more comprehensive approach might include looking back on implementation over a full decade.

Technology Transfer/Marketing

• **KEY FINDING:** Support implementation by communicating the value of implementation. Targeted communication efforts can help inform those empowered to act on the new information. Internal communication planning tools can help draw out information about the importance and potential value of a research project. A TRB report suggests a range of practices to identify, inform and engage stakeholders.

• Educate the participants in implementation. Decision makers and stakeholders may need to be educated about a new innovation.

• Include implementation recommendations in final reports.

• Increase awareness of implementation using a well-designed department newsletter. This is an effective method to raise awareness of completed research in an agency.
Demonstrations, Pilots, Other Implementation Activities

- Conduct a pilot or demonstration project. Key factors in developing a successful demonstration project include establishing objectives; confirming decision maker endorsement; obtaining the necessary resources; communication and logistics; marketing; and evaluation steps. Demonstrations that involve hands-on learning are particularly effective.

Challenges and Opportunities

- Challenges are drawn from surveys and meeting notes that appear in the RPPM database. Selected challenges that are stressed in these resources or that appear in multiple citations follow:
  - Lack of staffing/staff time for implementation.
  - Lack of resources for implementation.
  - Responsibility for implementation lies outside the research organization.
  - Lack of leadership and managerial/executive buy-in.
  - Lack of implementation processes.
  - Lack of an implementable product.
  - Lack of real benefit in some instances from implementing research.
  - Inability to track implementation over time.
  - Insufficient or ineffective dissemination.

- Opportunities to improve implementation include the following recommendations:
  - Clarify and formalize roles and responsibilities.
  - Involve stakeholders from the start.
  - Engage users with the research team; engage researchers with deployment.
  - Embed implementation in the research process.
  - Enhance and formalize implementation mechanisms.
  - Educate all stakeholders on the processes and tools needed to help implement transportation research.
  - Boost communication processes and products.
  - Expand implementation resources.
  - Link research funding with implementation funding.
Detailed Findings

1. PROGRAM MANAGEMENT

*Strategy:* Consider a comprehensive set of strategies to advance an implementation program.

Approaches:

- A 2015 conference proceeding that summarized the Second EU-U.S. Transportation Research Symposium held April 2014 in Paris, France, provides a wealth of information about best practices for the implementation of research outcomes. Supplementing the symposium papers are summary findings and recommendations from breakout sessions. Selected excerpts of these findings and recommendations are reproduced below. [43. Report, Transportation Research Board 2015, pages 52-53]

  o Five key points to encourage successful implementation:
    - Understand the definition of research. Advanced research involves higher risk and is not necessarily tied to a product. Applied research, in contrast, is tied to a known problem or product.
    - Connect advanced research with the end in mind. Even though advanced research does not have to be tied to a product, it must be tied to a purpose. The purpose sets the context for the research.
    - Use consortia to connect research needs to the end user.
    - Maintain awareness of the full funding requirements from advanced research through to product development. Know the cost estimate from the start.
    - Develop procurement practices that encourage innovation (for example, provide incentives for innovation).

  o Driving elements that lead to deployment of innovative solutions:
    - Define and articulate the vision.
    - Set aside a percentage of all funds for advanced research that is separate from applied research funding so the two are not in competition.
    - Reward innovation by giving a bonus to all partners who move the research forward.
    - Define success—advanced research has different criteria for success. If researchers do not fail on occasion, they are not reaching high enough.
    - Conduct field operation tests under real-world conditions. Create the environment to test and deploy ideas in the field.

  o A synthesis of suggestions for “improving the efficacy of transportation research to produce successful implementations at scale” begins on page 58. This section includes detailed recommendations under each of the following high-level suggestions:
    - Structure the research.
    - Involve stakeholders.
    - Disseminate research outcomes.
    - Mitigate systemic impediments.
- Manage the double-edged swords (accelerators and impediments).
- Track research and implementation over the long term.

**Strategy:** Select the right problems for research.

**Approaches:**

- **Targeted research** that addresses a genuine user need or goal leads to better implementation. [56. Report, Transportation Research Board 1996, page 16]
- Select problems for research that match users’ needs. Engage users in the selection process to express objectives of the agency and help prioritize research efforts. [55. Report, Transportation Research Board 1998, page 3]

**Strategy:** Collaborate and pool resources to strengthen implementation efforts.

**Approaches:**

- Explore the opportunities for interagency and interjurisdictional collaboration on evaluations, field tests, and demonstration projects to share costs and risks. [56. Report, Transportation Research Board 1996, page 16]
- Collaborating with other agencies or the private sector and sharing resources can distribute the cost and time needed to implement innovations, reduce the cost and time to implement, and enhance confidence in the outcome. [55. Report, Transportation Research Board 1998, page 4]
- Encourage researchers to team with implementers (users) in design, construction, maintenance, or other divisions to fine-tune a new product or process. [55. Report, Transportation Research Board 1998, page 4]
- The Minnesota Local Road Research Board is a partnership among counties, cities, and the state DOT (including research and state aid for local transportation), and the University of Minnesota. Research partnerships include implementation efforts, overseen by a Research Implementation Committee. Projects are typically in the areas of road design, construction, maintenance, and environmental compatibility. [34. Presentation, Minnesota 2014]

## 2. ROLES AND STAFFING

**Strategy:** Assign implementation as a staff responsibility.

**Approaches:**

- Each research technical advisory group (RTAG) at Georgia DOT has an assigned technical/implementation manager. This manager reports to the RTAGs on the implementation status of the research as it is being conducted, as well as six months and one year after its completion. Additional responsibilities are detailed in an appendix to Georgia DOT’s research and development manual. [13. Guideline/Standard, Georgia 2013, pages 13, 51-53]
- A survey of state DOTs conducted by Iowa DOT sought to identify which agencies had staff dedicated to research implementation. Highlighted findings among the 18 states responding follow. [60. Survey, Iowa 2014]
o Most had staff dedicated to implementation or otherwise help track it. A few were planning on having one soon.

o The percent of time that person dedicated to implementation varied greatly, from “very little” and just 5 percent up to 100 percent for a few agencies.

o Formal training or mentoring in this area, when offered, was typically the National Highway Institute’s course titled “Leap Not Creep: Accelerating Innovation Implementation.”

**Strategy:** Encourage the active engagement of technical staff.

**Approach:**

- The active involvement of technical staff throughout the research process—from needs identification through implementation—could improve awareness, strengthen project definition, increase the likelihood of successful implementation, and distribute the workload. [54. Report, Alaska 2006, page 5]

**Strategy:** Expand participation in the review and oversight of research projects with respect to anticipated implementation.

**Approaches:**

- Including the research requestor, potential implementers and representatives of affected external groups on technical advisory committees can be very productive and enhance implementation. [54. Report, Alaska 2006, page 5]

- Illinois DOT convenes a 10-person panel to review projects for implementation. [23. Minutes/Notes, Iowa 2014, page 2]

**Strategy:** Assign a champion with a vested interest in implementation to lead the research project.

**Approaches:**

- Illinois DOT’s 2012 survey found that most participants reported that the best research results are produced by management-level champions with technical and communication expertise. [52. Report, Illinois 2012, page iv]

- Michigan DOT’s Engineering Operations Committee recommends an Implementation Manager (IM) for each project selected for implementation. The IM is responsible for finalizing a draft implementation plan that outlines project cost, scope, and schedule, and updates the plan throughout the implementation process. [19. Minutes/Notes, AASHTO Research Advisory Committee 2015, page 8]

- The research projects most likely to have a successful implementation are those with a designated champion. Success appears to depend less on the type of project. [22. Minutes/Notes, Iowa 2014, page 5].

- Find and develop a champion to present and promote the expected benefits of implementation to users and policymakers to overcome inaction, change attitudes, and build widespread
support for the implementation of new processes or products. **Recruit champions** from different sectors of the industry. [55. Report, Transportation Research Board 1998, page 5]

- **Implementation champions**—individuals or groups—are **needed to implement NCHRP research results.** [46. Report, Transportation Research Board 2014, page 2]

- An **effective champion** is a basic element of the guided technology transfer activities used to **accelerate adoption of new technology.** Agencies should accurately define the champion’s role, address shortcomings associated with the champion, ensure the champion has the resources needed, and help the champion develop an “understudy” to limit the impact of turnover or loss of a champion before implementation is complete. [47. Report, Transportation Research Board 2014, pages 30-35]

**Strategy:** Prepare staff to conduct implementation-related activities.

**Approaches:**

- A variety of levels and types of training can be useful, from gaining general knowledge regarding implementation practices to hands-on project-oriented implementation pilots that show the potential for and begin organizational change. [45. Report, Transportation Research Board 2014, page 53]

- Retain **experienced talent** to perform implementation by bringing in new staff with this expertise or building capacity within the organization. [45. Report, Transportation Research Board 2014, page 52]

**Strategy:** Recognize the significant role senior management and decision makers can play.

**Approaches:**

- Ensure senior management and decision makers understand the importance of implementation and engage in effective dialog with these stakeholders. Facilitate information sharing across jurisdictional boundaries. [56. Report, Transportation Research Board 1996, pages 16-17]

- **Strong support from senior management** can foster innovation and eliminate potential barriers to new products and processes. Management is also responsible for ensuring sufficient funding and the availability of “an expert or skilled staff” to implement research. [55. Report, Transportation Research Board 1998, page 2]

### 3. PROJECT MANAGEMENT AND PROCESS

**Strategy:** Set clear goals for putting research into practice.

**Approach:**

- **Establish clear goals** (achieve cost, time, or labor savings; meet new regulatory requirements; or replace outdated practices) and communicate them to all parties involved in implementation. Allow for flexibility and incorporate all stakeholders in the goal-making process. [55. Report, Transportation Research Board 1998, page 3]
**Strategy:** Address implementation in the research needs statement and during project development.

Approaches:

- The likelihood of successful implementation increases when a project is **designed and budgeted to develop products** (such as specifications, drawings, standards, and methods) that are fully ready to use in normal practice. [54. Report, Alaska 2006, page 6]

- Georgia DOT names the likely technical/implementation manager for a project in the research needs statement. The selected individual provides further guidance during the research project development and principal investigator (PI) selection. [13. Guideline/Standard, Georgia 2013, page 51]

- Kansas DOT’s PIs include a draft implementation plan in the project proposal. [37. Process, Kansas 2013]

- Michigan DOT’s work plan specifies whether there will be an implementable product. [19. Minutes/Notes, AASHTO Research Advisory Committee 2015, page 8]

- Missouri DOT conducts a pre-research discussion of objectives, deliverables, and the research need. Considerations include the impacts and value to society. A **communication planning sheet** is used to capture key elements needed for implementation, including timing; communicating the project outcome and its value; and the information needed to track progress. [23. Minutes/Notes, Iowa 2014, page 2]

- Washington State DOT’s problem statement form includes a section on implementation. It asks: “What specific deliverables will help WSDOT implement the results of this project (such as, new standards will be published in a specific agency manual, a new policy will be developed or one modified)”? and “Which WSDOT Office or Division will be responsible to implement the results of the project?” [10. Form, Washington State 2010]

**Strategy:** Detail implementation in the program’s research manual and process documents.

Approaches:

- Several DOTs include a section or chapter in their research and development manuals dedicated to implementation.
  
  - Georgia DOT’s manual spells out participant responsibilities for implementation and outlines post-project implementation actions and activities. [13. Guideline/Standard, Georgia 2013, pages 26-29]

  - California Department of Transportation’s (Caltrans’) manual provides definitions, roles, and approaches to foster implementation of research results. [38. Process, California 2011]

  - Ohio DOT’s manual outlines how implementation is addressed at each stage of the research project: during project development, in the research proposal, during the conduct of the project, and as formally planned as a post-project implementation effort. [14. Guideline/Standard, Ohio 2013]
Chapter 9 in Indiana DOT’s research manual is titled “Implementing Research” and describes the roles of all research participants in implementation and the implementation processes throughout the research life cycle. Sections of this manual follow. [39. Process, Indiana 2007]

- Funding implementation activities
- Implementation projects utilizing research funds
- Annual summaries of implementation projects
- Benefit-cost analysis

The project management checklist from Utah DOT calls out the completion of an implementation plan/worksheet as part of midproject planning and review among the technical advisory committee and PI. The completed plan is later handed off to the Utah DOT champion during the closeout phase. [17. List, Utah 2014]

**Strategy:** Develop an implementation plan.

**Approaches:**

- Caltrans provides a project deployment plan template, along with an outline of the items to appear in the plan. As noted in the Caltrans research manual, this plan helps “…the Project Manager and the Project Panel to identify the expected outcome and to develop a clear deployment strategy at the outset of the research process.”

  The implementation plan is one of the major components of the deployment plan, along with the establishment of a business case, a marketing plan, and a commercialization plan.

  The implementation plan is further divided into an implementation strategy and an action plan with a scope of work, schedule, budget, training considerations, and maintenance/operations considerations. Caltrans also provides a sample deployment plan. [25. Plan, California 2013] [26. Plan, California 2012] [27. Plan, California 2012]

- Georgia DOT’s research manual indicates that it is the PI’s role to deliver an implementation plan. [13. Guideline/Standard, Georgia 2013, page 28]

- Illinois DOT’s Implementation Planning Worksheet is discussed at the first project meeting and includes an assessment of the research project’s implementation potential, what needs to be accomplished to facilitate implementation, specific implementation activities, and an assessment of the benefits that will accrue when the project’s results are implemented.

  Efforts were made to make the form as user-friendly and streamlined as possible:

  - Clear, detailed directions are provided, and submitters are provided contacts who can answer questions about completing the form.
  - The electronic version of the form contains drop-down menus to facilitate data entry.
  - Checklists and number lists visually organize information while providing ample room for additional comments or details that cannot be gleaned from lists. [52. Report, Illinois 2012] [5. Form, Illinois 2014]
• Indiana DOT’s **project implementation plan form** directs the agency “business owner” to identify the agency’s key performance indicator that will most be impacted; to name the primary and secondary implementers; and to list each implementer’s tasks with start and end date and required help/resources needed for each task. [21. Minutes/Notes, Indiana 2014] The research project administrator and technical contact collaborate on completion of the form. [21. Minutes/Notes, Indiana 2014] [23. Minutes/Notes, Iowa 2014, page 1]

• Kansas DOT’s **Research Project Implementation Plan** is completed in conjunction with publication of each project’s final report. The plan includes a description of implementation potential, implementation strategies, and a subjective rating and cost estimate of benefits if the project were implemented; a **Research Project Implementation Progress Report** is also included. [28. Plan, Kansas 2013] [37. Process, Kansas 2013]

• Louisiana Transportation Research Center’s **Research Assessment and Implementation Report** (RAIR) is completed for an initial review during the Project Review Committee’s (PRC’s) kickoff meeting. The RAIR, which is reviewed and updated at each subsequent PRC meeting, consists of a series of topics and questions designed to provide guidance and insight to the PRC and research team for development of a successful implementation strategy. [11. Form, Louisiana 2009] [53. Report, Louisiana 2010]

• Minnesota DOT’s **implementation plan and project proposal template** collects entry of data that will feed into the state’s innovation roadmap: research project goals, expected benefits of implementation (including support of the agency’s strategic goals), ties to previous research, and anticipated methods to put the results into practice. The implementation work plan also included on this form requires the listing of projects tasks, with scope, schedule, and budget information for each task. [29. Plan, Minnesota, 2013]

Minnesota DOT’s **online Implementation Plan questionnaire**, which is completed at the end of each research project, leads research staff through questions on how to move forward with research results. Responses are intended to provide sufficient information to determine if an implementation project should be funded and set the stage for the next steps of procurement and implementation. [22. Minutes/Notes, Iowa 2014, pages 7, 9] [61. Survey, Minnesota, 2013]

• Ohio DOT’s **implementation plan form** is used to document research outcomes; implementation recommendations from the researcher and the agency technical staff; implementation actions and schedule; and anticipated benefits, risks, and impacts. Ohio DOT provides an example plan in the area of stormwater management. [30. Plan, Ohio 2013] [31. Plan, Ohio 2012]

• Texas DOT uses an **implementation project recommendation form** outlining the project objectives and anticipated benefits, costs, and tasks. Different sections of the form are to be completed by the researcher and by agency staff. [7. Form, Texas 2013]

The agency also uses an **implementation scheduling Gantt chart template**. Each implementation activity must be associated with one or more deliverables on the chart, and an estimated cost must be associated with each activity. [65. Template, Texas 2013]

• Utah DOT’s **implementation plan form** includes fields to collect a definition of successful implementation for the project, a listing of major tasks for implementation, the products
needed, where in the agency implementation will take place, expected obstacles, and necessary staff. [32. Plan, Utah 2012]

- Washington State DOT’s implementation report is a brief description provided by the agency’s technical monitor documenting how the results of this research will be used—or has been used—by the DOT. Provided details include major discovery from the research, the use of information, and value added to the agency. [12. Form, Washington State 2003]

The agency also has an implementation plan checklist to collect information in the five areas below. [18. Form, Washington State 2007]

- What type of results were achieved?
- Items/actions needed to implement results
- When should deployment begin?
- What factors are influencing the urgency of deployment?
- What are the anticipated benefits?

**Strategy:** Address implementation at project kickoff.

**Approach:**

- A completed kickoff meeting form guides discussion at Florida DOT’s research project kickoff meeting. Questions include initial thoughts on research quantification and implementation, benefits to the state, and visibility beyond the state. The form also notes administrative details. [4. Form, Florida 2014]

- Implementation is discussed at Georgia DOT’s research kickoff meeting. The technical/implementation manager addresses the support needed for implementation at the meeting. [13. Guideline/Standard, Georgia 2013, page 52]

**Strategy:** Evaluate and prioritize projects for implementation.

**Approaches:**

- Twice each year, Michigan DOT’s four Research Advisory Committees meet to review recently completed research projects to recommend implementation for selected projects. [19. Minutes/Notes, AASHTO Research Advisory Committee 2015, page 8]

- Virginia DOT’s Implementation Project Prioritization Process uses a spreadsheet-based scoring system to evaluate projects that could be implemented. After prioritizing, the implementation project is planned separately from the original research project. Participants and project review teams are likely to be different for the initial research and follow-up implementation efforts. [22. Minutes/Notes, Iowa 2014, page 3]

**Strategy:** Integrate implementation across the research process.

**Approaches:**

- Illinois DOT requires its PIs to address implementation potential and implementation strategies in the work plan and consider both issues throughout the project, revising them as needed upon completion of the research. [22. Minutes/Notes, Iowa 2014, page 8]
• Montana DOT details how implementation is a process, not an event, and “must be considered from the beginning and throughout each research project.” [35. Process, Montana 2018]

Implementation is considered at the following stages of the research project:

- At the first technical panel meeting, through scope of work development and in the Implementation Planning and Documentation form.
- In the project proposal, with directions to describe how research results can be applied.
- At the project kickoff meeting and as updates are made to the Implementation Planning and Documentation form.
- As research results are available, implementation can occur at any time in the research process. Early implementation is enhanced with the requirement of project task reports.

Instructions and appendixes are included in this resource. Beyond its own research, the agency makes a deliberate and focused effort to identify the implementation of innovations from its staff and the innovations and research results from other state and national organizations and programs.

• Ohio DOT’s discussion questions guides the research office in framing the discussions on implementation among its technical liaisons and researchers. Questions are grouped across the research life cycle: retrospective questions about past research and considerations during project startup meetings, project review sessions, and project closeout. [15. Guideline/Standard, Ohio 2013]

• A 2014 NCHRP report recommends communicating project goals and interim results to stakeholders in an understandable way, gaining and leveraging the support of AASHTO and Federal Highway Administration for upcoming changes, and addressing stakeholder concerns before the project is complete. [46. Report, Transportation Research Board 2014, page 2]

**Strategy:** Evaluate implementation feasibility at the end of the research process.

Approaches:

- Montana DOT surveys the technical panel members of research projects at the conclusion of each research project to evaluate potential implementation, and to provide feedback on consultant and research project manager performance. [64. Survey, Montana 2010]

- A Kansas DOT implementation facilitator convenes a brief meeting with every project monitor after a research report is published and assists with completion of the Research Project Implementation Plan. The implementation facilitator:
  - Provides staff with statistics that can be used in a cost/benefit analysis. For example, on safety-related items, the cost of saving one life, the cost of reducing one injury accident, etc. Any benefit analysis over $1 million is subject to a peer review.
  - Offers ideas on how to determine triennial benefits.
  - Assists with developing an outline of an Implementation Plan that the project monitor completes after the meeting and returns to the research office within one week. [22. Minutes/Notes, Iowa 2014, pages 6-7] [23. Minutes/Notes, Iowa 2014, page 1]
The sections of Ohio DOT’s research implementation summary report are background, research objectives, research deliverables, researcher’s recommendations, liaison recommendations, and implementation evaluation/return on investment. Ohio DOT provided a completed example of this report. [49. Report, Ohio 2013]

**Strategy:** Develop “tactical tools” to accelerate implementation.

**Approach:**

- Accelerating implementation in other domains often requires development of tactical tools. In the transportation realm, these tools might include model policies, contracts and agreements, boundary-spanning activity guidance, reference guides, and evaluation procedures. The availability of these tools could move innovations into practice more quickly and with greater confidence. [45. Report, Transportation Research Board 2014, page 53]

**Strategy:** Consider the societal and legal issues associated with implementing technology.

**Approach:**

- New technologies, particularly information-sharing technologies, tend to push the boundaries of legal interpretation with regard to individual privacy and corporate security issues. Consider the following questions: 1) Are the privacy, security, intellectual property, and legal issues understood?; 2) Have the intellectual property rights to the innovation been identified?; and 3) Has the innovation been protected? [47. Report, Transportation Research Board 2014, page 21]

### 4. FUNDING AND CONTRACTING

**Strategy:** Commit or set aside funds for implementation.

**Approaches:**

- Agencies should institutionalize innovation by committing funds in the annual budget for research implementation, dedicate a trained and expert staff to implementation efforts, and formalize interactions between researchers and users. [55. Report, Transportation Research Board 1998, page 5]

- State implementation budgets vary significantly, from $100,000 to $10 million (these are from among just a few examples highlighted in 2014). [22. Minutes/Notes, Iowa 2014] [23. Minutes/Notes, Iowa 2014]

**Strategy:** Detail eligibility for federal funding.

**Approach:**

- Minnesota DOT spells out eligibility requirements for implementation projects to receive federal funding through the State Planning & Research Part II research program with matching state funds (80/20 federal-state split). Projects must address a transportation project or need, be linked to federal, state, or local research, be applicable to the DOT’s practices, and have an internal champion. Equipment and construction considerations are also addressed. [16. Guideline/Standard, Minnesota 2012]
**Strategy:** Address implementation in the contract language.

Approach:

- **Standard verbiage** included in all Illinois DOT research project work plans details a benefit analysis task and an implementation task. [1. Agreement/Contract, Illinois 2014] [22. Minutes/Notes, Iowa 2014, page 8]

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5. TRACKING

**Strategy:** Use tools to document and track implementation.

Approaches:

- Establishing an **integrated research project database** can reduce the administrative burden of tracking progress, reporting status, and updating the national Research in Progress system. Some states use the same database to automatically generate research project web pages. [54. Report, Alaska 2006, page 6]

- Florida DOT uses a Microsoft Excel-based **form to document research project implementation**. Text box fields allow collection of narrative information (project findings, results of implementation, expected impacts) and record impacts by quantity and cost in predefined areas (safety condition, infrastructure condition, congestion reduction, and eight other areas). [3. Form, Florida 2014]

- Illinois DOT’s 2012 survey of state DOTs found that **half of all respondents reported using a formal implementation tracking system**, while most other respondents reported time limitations and staff size as the key factors preventing implementation tracking. [52. Report, Illinois 2012, page iv]

- Illinois DOT’s **spreadsheet-based Implementation Planning Database** provides research staff and upper management with macro- and micro-level perspectives into the entire research program. Details from the Implementation Activities portion of the Implementation Planning Worksheet are entered into the database. A calculated percentage of completed implementation tasks from the Implementation Planning Worksheet allows the research division to track implementation activities on a project-by-project basis. [52. Report, Illinois 2012, pages 37, 58]

- Illinois DOT’s **Implementation Status workflow** illustrates the points at which the agency tracks implementation. Accompanying the workflow is a list of **definitions related to research implementation**. These definitions were informed by a RAC survey that identified the categories state DOTs use to describe implementation status. [36. Process, Illinois 2014] [24. Other, Illinois 2014] [58/59. Survey, Illinois 2014]

- A **research implementation and project closure report form** is completed for each Iowa DOT research project by the technical committee with input from the PI. The form documents implementation recommendations, activities, costs, and benefits. The form has fields for expected costs and measurable benefits when implementation is recommended; it also has a field for explanation when implementation is not recommended. [6. Form, Iowa 2014]
• Iowa’s 2014 survey of state DOTs found that fewer than half had formal implementation forms and tracking processes in place. However, a majority of the 18 respondents had these materials under development. [60. Survey, Iowa 2014]

• Montana DOT’s implementation planning and documentation form is a “living document” used through the life of each research project. The fields are to be completed as information becomes available. The interactive PDF form is broken into the three sections below. [2. Form, Montana 2018]
  
  o Project information. Form fields include project vitals, likely applications, anticipated final products/tools, and anticipated barriers to implementation.
  
  o General implementation information. Form fields include whether research objectives were fulfilled, whether results are implementable, what type of implementation is recommended, and implementation benefits/impacts.
  
  o Implementation activities (include necessary technology/knowledge transfer, marketing, and training activities). Form fields include activity description, required resources, barriers, a schedule, and status.

• Ohio DOT’s research implementation progress report form uses a simple table for agency staff to summarize the actions that have been taken toward implementing the results of a research project. Table fields detailing anticipated actions and participants are prefilled with information from the project implementation plan. [66. Template, Ohio 2011]

• Wyoming DOT employs a two-part project performance evaluation form. The first portion of this form is completed after the completion of each research project. It provides information on the project, implementation, and technology transfer. The second portion of this form is to be completed two years after the completion of each project. It provides information on the project, implementation, and benefits. [62. Survey, Wyoming 2013]

• Notes from the January 2015 Research Implementation Facilitators’ meeting highlighted methods to track implementation. A summary of attendee comments is reproduced below. [19. Minutes/Notes, AASHTO Research Advisory Committee 2015, pages 6-7]
  
  o Caltrans does not use a database but does use implementation plans and selects a limited number of projects to examine delivery of results (lives saved, for example).
  
  o Louisiana uses a computer management system. An implementation plan is created and tracked, and performance measures are recorded.
  
  o Minnesota has added a new implementation module to its tracking database and is budgeting $1 million each year for implementation. All new projects beginning with fiscal year 2016 will identify implementation and estimated benefits.
  
  o Mississippi and Wisconsin use an Access database. Wisconsin’s database did not include a field for implementation at the time of the meeting; implementation for the previous six years was tracked using an Excel spreadsheet. Kansas also tracks implementation using an Excel spreadsheet.
**Strategy:** Report periodically on implementation progress at the program level.

Approaches:

- Georgia DOT’s research office submits an annual research implementation report to the agency’s research advisory committee summarizing how the state has implemented research findings during the preceding year. [13. Guideline/Standard, Georgia 2013, page 28] [41. Report, Georgia 2017] [42. Report, Georgia 2015] [44. Report, Georgia 2014] [48. Report, Georgia 2013]
  - In these reports, Georgia DOT distinguishes between three kinds of implementation: developmental (a new or modified material, technology, policy, or process), response (developed to meet a stakeholder concern), and feasibility (guidance on whether to use a new or modified material, technology, policy, or process).

- Arizona DOT conducted a 10-year study of research projects conducted by the agency to determine the extent to which their recommendations were implemented, as well as the impact of the implemented research. [33. Presentation, Arizona 2014]
  - The methodology included the creation of an “inventory of research” and a stakeholder interview tool.
  - For 78 percent of the completed studies, one or more recommendations had been implemented.
  - Arizona DOT research has supported federal compliance and accountability; tribal outreach; environment stewardship; intelligent transportation system (ITS) accountability; safety; organizational development; consumer access to transit; funding efforts; risk management; core competencies; culture change initiatives; building partnerships; institutional credibility; agency recognition; decision-making and data-driven assessment; design/procedural improvements; advancing state of knowledge; improved efficiencies; and cost savings.
  - The study identified factors that contributed to nonimplementation and underutilization of research findings.

6. TECHNOLOGY TRANSFER/MARKETING

**Strategy:** Support implementation by communicating the value of implementation.

Approaches:

- Missouri DOT’s communication planning sheets draw out information about the importance and potential value of a research project through preliminary questions as well as post-research follow-up questions. There are two versions of the sheet: one for the PI, and one for the agency’s technical liaison. [8. Form, Missouri 2012] [9. Form, Missouri 2012]
  - The PI’s form asks why the research is a good value for Missouri citizens and the agency; what the deliverables and objectives are; and what the benefits are and how they are quantified.
The technical liaison’s form asks why the research is important to the agency; whether it has the potential to be controversial; which divisions/districts will be impacted; and what key events or timing should be considered in communicating this research.

- **Targeted communication efforts** can help inform those empowered to act on the new information. Dissemination activities should focus on getting the right information to the right people at the right time. [46. Report, Transportation Research Board 2014, page 3]

- A 2014 NCHRP synthesis includes this **advice for sharing information about innovations**: To establish the foundation for successful reception of an innovation, groups must be able to present the radical so it can be **understood in familiar terms** and to cushion disruptive innovations with assurances that the disruption will be manageable (Kanter, 2006). [45. Report, Transportation Research Board 2014, page 53]

- **Identify, inform and engage stakeholders**. Suggested practices include creating mechanisms for knowledge sharing (newsletters, library, and network teams); designating an innovation champion to lead technology transfer activities; offering “brown bag” or “just-in-time” training to highlight innovations; establishing social media links within the organization focused on knowledge sharing; mentoring/coaching new technology transfer champions; and actively engaging the user community in the entire innovation process from research and development to deployment. [47. Report, Transportation Research Board 2014, page 49]

**Strategy: Educate the participants in implementation.**

**Approach:**

- **Assess the need for education** when engaging in technology transfer activities to advance a technological innovation. [47. Report, Transportation Research Board 2014, page 73]

  - Do decision makers and/or stakeholders require education about a new innovation?
  - Does intellectual property rights counsel need to be educated about a new innovation?
  - Can education enhance a demonstration/showcase effort?
  - Will education and/or technical assistance be part of the deployment of an innovation?

**Strategy: Include implementation recommendations in final reports.**

**Approach:**

- Kansas DOT’s PIs **include implementation recommendations in their final reports.** [37. Process, Kansas 2013]

**Strategy: Increase awareness of implementation using a well-designed department newsletter.**

**Approach:**

- Alaska’s Research and Technology Transfer **newsletter** could be used to more effectively **raise awareness of completed research** in the department by increasing hard copy and electronic circulation, specifically highlighting active and completed research projects, including a concise digest of contents, providing links to project web pages, and annually listing completed projects. [54. Report, Alaska 2006, page 6]
7. DEMONSTRATIONS, PILOTS AND OTHER IMPLEMENTATION ACTIVITIES

*Strategy:* *Conduct a pilot or demonstration project.*

**Approach:**

- Users indicate that *pilot projects conducted in real settings* are “essential to the success of many innovative ideas.” [55. Report, Transportation Research Board 1998, page 4]

- Implementation champions build confidence in the research products through webinars, *pilot projects, workshops,* and *other information and demonstration initiatives.* [46. Report, Transportation Research Board 2014, page 2]

- A *demonstration project* is considered a successful strategy for *facilitating technology transfer of technological innovations,* especially demonstrations that have hands-on learning. Technology may allow a demonstration to be conducted remotely (Skype, iPhone, or smartphone) and recorded. [47. Report, Transportation Research Board 2014, page 57]

- A 2014 NCHRP report described key factors in *developing a successful demonstration project,* including establishing objectives; confirming decision maker endorsement; obtaining the necessary resources; communication and logistics; marketing; and evaluation. **Barriers** associated with *demonstration projects* are reproduced below. [47. Report, Transportation Research Board 2014, pages 61-64]
  - No champion to lead the demonstration effort.
  - Decision makers not engaged or supportive.
  - Poor or insufficient marketing to end users.
  - Innovation not adequately tested.
  - Benefits of innovation not readily apparent or communicated.
  - High cost of demonstration efforts (also a resource barrier).
  - Insufficient personnel resources to organize logistics.
  - Insufficient technical resources to answer questions.
  - Poor or insufficient demonstration opportunities.

Some of these barriers are similar to challenges that may be encountered when conducting a pilot project.

8. CHALLENGES AND OPPORTUNITIES

Beyond strategies, the RPPM entries highlighted challenges to implementation and opportunities for overcoming these challenges. Noteworthy items are presented here.

- Iowa’s 2014 survey of state DOTs inquired about agencies’ **greatest challenges** related to implementation. Highlighted findings are reproduced below. [60. Survey, Iowa 2014]
  - Lack of organizational leadership.
• Developing a process for filtering all research coming from various sources and identifying the ones that will be of benefit to the organization.

• Changes to established procedures based on research findings.

• Setting a formal process that all projects use.

• Staffing to facilitate and track implementation.

• Getting buy-in from management.

• Commitments from the implementers.

• Getting the project monitor to complete the paperwork.

• Implementation of research recommendations is not a high priority for technical advisory committee members.

• Determining practitioner needs for innovation.

• Funding, technical details, and time needed to implement findings.

• Quantifying benefits numerically/economically.

• Following implementation over time.

• In the years that it takes for research to be selected and conducted, policy, political, and personnel changes often leave solid research dangling and unimplemented.

• The misconception that every research project is supposed to save the agency time or money.

• Formalizing a process that results in actual benefits to the department and the public.

• Organizational disconnect between research and the implementing business units.

• Defining implementation.

• Illinois DOT’s 2012 survey of state DOTs identified motivation and time as key factors in effective research results championing. These factors were also identified as key barriers to the implementation of research results at interviewees’ transportation departments. [52. Report, Illinois 2012, page iv]

• Notes from the January 2015 Research Implementation Facilitators’ meeting identified challenges associated with implementation plan development. Selected participant feedback is reproduced below. [19. Minutes/Notes, AASHTO Research Advisory Committee 2015, page 6]

  o Staffing issues and challenges, including finding additional resources to conduct and track implementation.

  o Identifying who is responsible for implementation when the people who control it fall outside the research office.
• Identifying what constitutes implementation, and how much has to be done for an activity to qualify as implementation.

• Allowing for flexibility in implementation—things may change when research meets the field. Consider integrating these discussions at various points in the research process—early in the project process, during the project, or just before publication of the final report.

• The Implementation Subgroup of AASHTO RAC’s Program Management and Quality Task Force conducted a 2016 survey that examined the concerns or challenges related to implementation and gathered recommendations for what the subgroup should produce. A summary of survey results was posted to RPPM in 2018. Selected excerpts from this summary of findings are reproduced below. [57. Survey, PM&Q Implementation Subgroup 2016] [40. Report, RAC-PM&Q Implementation Subgroup 2018]

Overriding concerns or challenges related to implementation:

• Making sure research results are communicated to the right people.
  - Getting an audience with the right people and delivering a persuasive argument.
  - Consider intradepartment communication, coordination, and knowledge transfer.

• Assigning responsibility for implementation and ensuring it gets done.
  - Limited staffing; implementation requires time, effort, and focus.
  - The responsibility for implementation lies outside the research organization.

• Commitment required from the implementers for their time and effort.

• Planning for implementation.
  - Development of an implementation plan for each individual project (adjusted as necessary throughout the life of the project).

• Bridging the gap between research and implementation.
  - Lack of resources for implementation.
  - Adequately describing the implementation effort to make the case for adequate resources.

• Need to accelerate the process and get research results implemented more quickly.

What the subgroup should produce:

• Develop and share best practices.

• Guidance for determining benefits and costs for safety-related projects.

• Coordination regarding implementation of national research efforts.

• Implementation-related training.

• A 2014 report evaluating implementation of NCHRP products identified barriers to successful implementation and offered recommendations to improve implementation of NCHRP
Barriers to successful implementation:

- Insufficient implementation leadership.
- Lack of buy-in and readiness.
- Insufficient or ineffective dissemination.
- Lack of an implementable product.

Recommendations to improve implementation:

- Clarify and formalize roles and responsibilities.
- Embed implementation in the research process.
- Enhance and formalize implementation mechanisms.
- Boost communication processes and products.
- Expand implementation resources.

- A 2014 NCHRP synthesis that examined ways to accelerate implementation of transportation research results identified topic areas requiring more investigation. Highlighted findings are reproduced below. [45. Report, Transportation Research Board 2014, page 53]

  - There is no definitive resource for the practice of transportation implementation.
  - There is not a critical mass of implementation success stories available to the broad transportation community.
  - Investigating risk associated with the implementation of transportation research results is a topic that could produce valuable findings for the transportation community.
  - A question that has yet to be given a definitive answer for the transportation research community: How is research implementation success measured?

- A 2015 conference proceeding that summarized the Second EU-U.S. Transportation Research Symposium held April 2014 in Paris, France, identified impediments to applying or deploying research and practices to overcome them. Highlighted findings are reproduced below. [43. Report, Transportation Research Board 2015, pages 53-54]

  - Impediments to application of research:
    - Lack of incentives to apply the research. The solution is either to provide academic recognition or to provide funding for implementation as an incentive for researchers.
    - Lack of understanding that research is a tool. Help implementers–users to understand that research is a tool that can help them solve their problems.
    - Lack of cooperation between industry and academia.
    - Standards and regulations can both impede and enable implementation.
    - Although communication is vital, it is difficult and requires a skill set different from that of researchers. In addition, communication must be ongoing.
There is a need for a research-to-innovation culture, and this need boils down to leadership and people. People need to see the importance of research.

Practices to overcome impediments to the application of research outcomes:

- Spread risk by teaming with partners.
- State DOTs pool funds to conduct research, most typically for applied research. Advanced research may also be needed.
- Foster a culture of innovation among DOTs and agencies. Deployers tend to be risk-averse.
- Articulate a return on investment for the dollars invested in research; consider rebranding research so people understand it.
- Target funding for advanced research and recognize that, regardless of whether research is technology-pull or technology-push, technology is still needed.

Factors that inhibit deployment:

- Procurement rules need to move away from the low-bid model.
- Agencies should be protected from potential liability when implementing innovation, which means that procurement rules should be based on functional performance and not on technical specifications.

Selected feedback from three groups of symposium participants addressing the impediments to the application of research outcomes is reproduced below. [43. Report, Transportation Research Board 2015, pages 13-16]

From funders:

- Involving stakeholders from the start is essential in the process of identifying priorities and drawing up the research agenda.
- Users should be engaged in and with the research teams, and researchers should be engaged in deployment, which is not a linear process.
- The obstacles to creating an innovation-friendly policy environment include the lack of enabling legislation, standards, and general political uncertainty.
- Researchers need to redefine the research in terms of having a solution to a problem rather than having a good research outcome.
- Link research funding with implementation funding so that the funding does not stop at the doorstep of deployment.
- There is a need for procurement to be based on performance rather than on compliance with technical standards.

From researchers:

- Monitor research outcomes for a sufficient length of time at the end of the project.
- Fund implementation.
- Change intellectual property (IP) rights so that IP does not go to the funding agency but could go to manufacturers that would implement the research.
- Educate all stakeholders (e.g., designers, contractors, and decision makers) on the processes and tools needed to help implement transportation research.

From **implementers–users**:

- Reward taking the risk of implementation or spread the risk around.
- Procurement rules sometimes impede innovation because they focus on the lowest initial cost rather than on the overall life cycle cost.
- Transportation infrastructure is not considered to be an innovative, cutting-edge area. There is a need to drive innovators to be interested in transportation.
- A predominant theme from the implementers’ discussion was stakeholder involvement in deployment, because implementation is about end users. Involving stakeholders can shorten the time to acceptance.
## 9. LIST OF RPPM RESOURCES

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The research effort NCHRP Project 20-44(21): Synthesis of State Peer Exchanges and RPPM is seeking to identify practices, opportunities, and challenges related to implementation of research conducted by state departments of transportation (DOTs).

The first two tasks were a synthesis of findings from State Planning & Research peer exchanges and from materials in the Research Program and Project Management (RPPM) database.

From these syntheses, a list of state DOT research implementation strategies was developed in seven areas:

1. Program Management
2. Roles and Staffing
3. Project Management and Process
4. Funding and Contracting
5. Tracking
6. Technology Transfer and Marketing
7. Demonstrations, Pilots, and Other Implementation Activities

Drafts of these synthesis reports may be found on the NCHRP project page.

This survey aims to determine the extent to which state DOTs are employing these research implementation strategies and further establish best practices, opportunities, and barriers.

We would appreciate your response by Friday, April 3.

If you have any questions about this survey, please contact principal investigators Brian Hirt, brian.hirt@ctcandassociates.com, 402-770-9067, or Chris Kline, chris.kline@ctcandassociates.com, 920-771-0128.

For more information about this research effort of NCHRP Project 20-44(21), please contact TRB Senior Program Officer Sid Mohan, smohan@nas.edu, 202-334-1249.

* 1. Please provide your contact information.

Name

Job Title

Agency

Email Address

Phone Number
2. Program Management

The following research implementation strategies are related to program management: the ways a research program is organized to support implementation, and ways it interacts with other agency departments or organizations beyond the agency to support implementation.

For each strategy, please indicate which statements apply to your agency's program and processes. Select all options that apply.

<table>
<thead>
<tr>
<th>Strategy</th>
<th>We already do this</th>
<th>We do NOT do this</th>
<th>This is challenging to do</th>
<th>We are interested in trying this</th>
<th>We are working toward this</th>
<th>We tried this without success</th>
</tr>
</thead>
<tbody>
<tr>
<td>Develop a comprehensive set of strategies to advance implementation within the transportation agency.</td>
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<tr>
<td>Formalize and document the implementation process (roles, steps, options).</td>
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<tr>
<td>Seek buy-in from agency leaders.</td>
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<tr>
<td>Use successful implementation efforts to demonstrate the value of the research program (including benefit-cost and return-on-investment calculations) and build staff and management support.</td>
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<tr>
<td>Identify barriers to implementation and opportunities to address them.</td>
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</table>

3. Please provide additional comments or clarifying remarks about the selections you made related to the strategies above.
4. Roles and Staffing

The following research implementation strategies are related to roles and staffing: who is responsible for implementation work. This might include research staff, others at the DOTs, and consultants/investigators.

For each strategy, please indicate which statements apply to your agency’s program and processes. Select all options that apply.

<table>
<thead>
<tr>
<th>Strategy</th>
<th>We already do this</th>
<th>We do NOT do this</th>
<th>This is challenging to do</th>
<th>We are interested in trying this</th>
<th>We are working toward this</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Designate a research staff member as a dedicated implementation coordinator or implementation manager.</td>
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<td>Define the roles and responsibilities of research staff, project panels, project champions, and functional area staff who will be implementing the research.</td>
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<td>Keep the project panel together after the project has ended to track and facilitate implementation activities.</td>
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<td>Involve senior management and decision-makers in implementation.</td>
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<tr>
<td>Involve other business and technical areas within the agency that may be affected by implementation activities, such as information technology.</td>
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<tr>
<td>Include external stakeholders, such as by gathering industry feedback on new specifications and products, and secure early buy-in.</td>
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</tbody>
</table>

5. Please provide additional comments or clarifying remarks about the selections you made related to the strategies above.
6. Project Management and Process

The following research implementation strategies are related to project management and process: steps established at all phases of research to support implementation.

For each strategy, please indicate which statements apply to your agency’s program and processes. **Select all options that apply.**

<table>
<thead>
<tr>
<th>Set clear goals for putting research into practice.</th>
<th>We already do this</th>
<th>We do NOT do this</th>
<th>This is challenging to do</th>
<th>We are interested in trying this</th>
<th>We are working toward this</th>
<th>We tried this without success</th>
</tr>
</thead>
<tbody>
<tr>
<td>Detail implementation in the program’s research manual and process documents.</td>
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<tr>
<td>Address implementation throughout all phases of the research process (scoping, kickoff, and through completion).</td>
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<td>Develop and revise an implementation plan for each research project; consider using an implementation planning worksheet or template as a guide.</td>
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<tr>
<td>Prioritize projects for implementation.</td>
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<tr>
<td>Develop “tactical tools” to accelerate implementation (policies, contracts and agreements, reference guides, and evaluation procedures).</td>
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<tr>
<td>Implement relevant research results from other agencies, including research discussed at the TRB Annual Meeting and other conferences.</td>
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</tbody>
</table>

7. Please provide **additional comments or clarifying remarks** about the selections you made related to the strategies above.
8. **Funding and Contracting**

The following research implementation strategies are related to funding and contracting: formal channels for providing funds for implementation, and established contract language to facilitate implementation.

For each strategy, please indicate which statements apply to your agency’s program and processes. **Select all options that apply.**

<table>
<thead>
<tr>
<th>We already do this</th>
<th>We do NOT do this</th>
<th>This is challenging to do</th>
<th>We are interested in trying this</th>
<th>We are working toward this</th>
<th>We tried this without success</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allocate dedicated funding for implementation projects (funded as discrete projects or included as tasks in the original research project contract).</td>
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<tr>
<td>Seek alternative funding sources for implementation activities.</td>
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</tbody>
</table>

9. Please provide **additional comments or clarifying remarks** about the selections you made related to the strategies above.

```markdown

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10. **Tracking**

The following research implementation strategies are related to tracking: established methods to track what research is being implemented and how successful those implementation efforts have been.

For each strategy, please indicate which statements apply to your agency’s program and processes. *Select all options that apply.*

<table>
<thead>
<tr>
<th>Strategy</th>
<th>We already do this</th>
<th>We do NOT do this</th>
<th>This is challenging to do</th>
<th>We are interested in trying this</th>
<th>We are working toward this</th>
<th>We tried this without success</th>
</tr>
</thead>
<tbody>
<tr>
<td>Track implementation for all completed research projects using a database or other tool.</td>
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<tr>
<td>Conduct surveys or interviews of project stakeholders to assess implementation status.</td>
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<tr>
<td>Report periodically on implementation project progress (staff communications, dashboards, conferences).</td>
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<tr>
<td>Report periodically on implementation progress at the program level.</td>
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</table>

11. Please provide **additional comments or clarifying remarks** about the selections you made related to the strategies above.

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12. Technology Transfer and Marketing

The following research implementation strategies are related to technology transfer and marketing: how transfer of technology intersects implementation, and how marketing successful research promotes implementation.

For each strategy, please indicate which statements apply to your agency’s program and processes. Select all options that apply.

<table>
<thead>
<tr>
<th>Statement</th>
<th>We already do this</th>
<th>We do NOT do this</th>
<th>This is challenging to do</th>
<th>We are interested in trying this</th>
<th>We are working toward this</th>
<th>We tried this without success</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communicate research results and showcase implementation successes to communicate the value of implementation.</td>
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<tr>
<td>Present research results directly to relevant DOT staff and local agencies; use webinars, videos, research briefs/summaries, conference presentations, conference posters, newsletters, email notifications, and/or annual reports.</td>
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</table>

13. Please provide additional comments or clarifying remarks about the selections you made related to the strategies above.
14. Demonstrations, Pilots, and Other Implementation Activities

The following research implementation strategies are related to demonstrations, pilots, and related activities. For each strategy, please indicate which statements apply to your agency’s program and processes. Select all options that apply.

<table>
<thead>
<tr>
<th>If appropriate, begin deployment with a demonstration project or pilot project.</th>
<th>We already do this</th>
<th>We do NOT do this</th>
<th>This is challenging to do</th>
<th>We are interested in trying this</th>
<th>We are working toward this</th>
<th>We tried this without success</th>
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<table>
<thead>
<tr>
<th>Learn from other agencies’ successful and unsuccessful implementation efforts.</th>
<th>We already do this</th>
<th>We do NOT do this</th>
<th>This is challenging to do</th>
<th>We are interested in trying this</th>
<th>We are working toward this</th>
<th>We tried this without success</th>
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</thead>
</table>

15. Please provide additional comments or clarifying remarks about the selections you made related to the strategies above.
* 16. To further inform the results of this project and aid in the development of a best practices guide, the principal investigators may conduct short follow-up interviews with selected survey participants. Would you be willing to participate in a brief telephone interview?

- Yes
- No

Please click the “Done” box below to submit your answers when you are finished with this survey. Thank you for your time and assistance with this important effort.
## Appendix D. Survey Results – Summary of Multiple-Choice Responses

### Survey Response Options

- A. We already do this
- B. We do NOT do this
- C. This is challenging to do
- D. We are interested in trying this
- E. We are working toward this
- F. We tried this without success

### Survey Responses

#### Area 1. Roles and Staffing

<table>
<thead>
<tr>
<th>Number of Responses</th>
<th>0</th>
<th>5</th>
<th>10</th>
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<th>30</th>
<th>35</th>
<th>40</th>
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</thead>
<tbody>
<tr>
<td>1.1. Develop a comprehensive set of strategies to advance implementation within the transportation agency.</td>
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<td>1.2. Formalize and document the implementation process (roles, steps, options).</td>
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<td>1.3. Seek buy-in from agency leaders.</td>
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<tr>
<td>1.4. Use successful implementation efforts to demonstrate the value of the research program (including benefit-cost and return-on-investment calculations) and build staff and management support.</td>
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<tr>
<td>1.5. Identify barriers to implementation and opportunities to address them.</td>
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#### Area 2. Roles and Staffing

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<tr>
<th>Number of Responses</th>
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<th>30</th>
<th>35</th>
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<tbody>
<tr>
<td>2.1. Designate a research staff member as a dedicated implementation coordinator or implementation manager.</td>
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<tr>
<td>2.2. Define the roles and responsibilities of research staff, project panels, project champions, and functional area staff who will be implementing the research.</td>
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<tr>
<td>2.3. Keep the project panel together after the project has ended to track and facilitate implementation activities.</td>
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<td>2.4. Involve senior management and decision-makers in implementation.</td>
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<td>2.5. Involve other business and technical areas within the agency that may be affected by implementation activities, such as information technology.</td>
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<td>2.6. Include external stakeholders, such as by gathering industry feedback on new specifications and products, and secure early buy-in.</td>
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#### Area 3. Project Management and Process

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<tr>
<th>Number of Responses</th>
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<th>30</th>
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</thead>
<tbody>
<tr>
<td>3.1. Set clear goals for putting research into practice.</td>
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<td>3.2. Detail implementation in the program’s research manual and process documents.</td>
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<td>3.3. Address implementation throughout all phases of the research process (scoping, kickoff, and through completion).</td>
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<tr>
<td>3.4. Develop and revise an implementation plan for each research project; consider using an implementation planning worksheet or template as a guide.</td>
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<td>3.5. Prioritize projects for implementation.</td>
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<tr>
<td>3.6. Develop “tactical tools” to accelerate implementation (policies, contracts and agreements, reference guides, and evaluation procedures).</td>
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<td>3.7. Implement relevant research results from other agencies, including research discussed at the TRB Annual Meeting and other conferences.</td>
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### Appendix D. Survey Results – Summary of Multiple-Choice Responses

#### Survey Response Options

- A. We already do this
- B. We do NOT do this
- C. This is challenging to do
- D. We are interested in trying this
- E. We are working toward this
- F. We tried this without success

#### Survey Responses

<table>
<thead>
<tr>
<th>Area 4. Funding and Contracting</th>
<th>Number of Responses:</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.1. Allocate dedicated funding for implementation projects (funded as discrete projects or included as tasks in the original research project contract).</td>
<td>![Bar Chart]</td>
</tr>
<tr>
<td>4.2. Seek alternative funding sources for implementation activities.</td>
<td>![Bar Chart]</td>
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<table>
<thead>
<tr>
<th>Area 5. Tracking</th>
<th>Number of Responses:</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.1. Track implementation for all completed research projects using a database or other tool.</td>
<td>![Bar Chart]</td>
</tr>
<tr>
<td>5.2. Conduct surveys or interviews of project stakeholders to assess implementation status.</td>
<td>![Bar Chart]</td>
</tr>
<tr>
<td>5.3. Report periodically on implementation project progress (staff communications, dashboards, conferences).</td>
<td>![Bar Chart]</td>
</tr>
<tr>
<td>5.4. Report periodically on implementation progress at the program level.</td>
<td>![Bar Chart]</td>
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<table>
<thead>
<tr>
<th>Area 6. Technology Transfer and Marketing</th>
<th>Number of Responses:</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.1. Communicate research results and showcase implementation successes to communicate the value of implementation.</td>
<td>![Bar Chart]</td>
</tr>
<tr>
<td>6.2. Present research results directly to relevant DOT staff and local agencies; use webinars, videos, research briefs/summaries, conference presentations, conference posters, newsletters, etc.</td>
<td>![Bar Chart]</td>
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<thead>
<tr>
<th>Area 7. Demonstrations, Pilots, and Other Implementation Activities</th>
<th>Number of Responses:</th>
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<tbody>
<tr>
<td>7.1. If appropriate, begin deployment with a demonstration project or pilot project.</td>
<td>![Bar Chart]</td>
</tr>
<tr>
<td>7.2. Learn from other agencies’ successful and unsuccessful implementation efforts.</td>
<td>![Bar Chart]</td>
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</tbody>
</table>
Appendix E. Survey Results – Detail of Multiple-Choice Responses

Area 1. Program Management

Strategies
1.1. Develop a comprehensive set of strategies to advance implementation within the transportation agency
1.2. Formalize and document the implementation process (roles, steps, options).
1.3. Seek buy-in from agency leaders.
1.4. Use successful implementation efforts to demonstrate the value of the research program (including benefit-cost and return-on-investment calculations) and build staff and management support.
1.5. Identify barriers to implementation and opportunities to address them.

Responses
A. We already do this
B. We do NOT do this
C. This is challenging to do
D. We are interested in trying this
E. We are working toward this
F. We tried this without success

<table>
<thead>
<tr>
<th>Respondent</th>
<th>State</th>
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<th>1.3</th>
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## Area 2. Roles and Staffing

### Strategies

2.1. Designate a research staff member as a dedicated implementation coordinator or implementation manager.

2.2. Define the roles and responsibilities of research staff, project panels, project champions, and functional area staff who will be implementing the research.

2.3. Keep the project panel together after the project has ended to track and facilitate implementation activities.

2.4. Involve senior management and decision-makers in implementation.

2.5. Involve other business and technical areas within the agency that may be affected by implementation activities, such as information technology.

2.6. Include external stakeholders, such as by gathering industry feedback on new specifications and products, and secure early buy-in.

### Responses

A. We already do this

B. We do NOT do this

C. This is challenging to do

D. We are interested in trying this

E. We are working toward this

F. We tried this without success

### Area 2. Roles and Staffing

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### Area 3. Project Management and Process

#### Strategies

3.1. Set clear goals for putting research into practice.
3.2. Detail implementation in the program's research manual and process documents.
3.3. Address implementation throughout all phases of the research process (scoping, kickoff, and through completion).
3.4. Develop and revise an implementation plan for each research project; consider using an implementation planning worksheet or template as a guide.
3.5. Prioritize projects for implementation.
3.6. Develop "tactical tools" to accelerate implementation (policies, contracts and agreements, reference guides, and evaluation procedures).
3.7. Implement relevant research results from other agencies, including research discussed at the TRB Annual Meeting and other conferences.

#### Responses

A. We already do this
B. We do NOT do this
C. This is challenging to do
D. We are interested in trying this
E. We are working toward this
F. We tried this without success

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**Area 4. Funding and Contracting**

**Strategies**

4.1. Allocate dedicated funding for implementation projects (funded as discrete projects or included as tasks in the original research project contract).

4.2. Seek alternative funding sources for implementation activities.

**Responses**

A. We already do this  
B. We do NOT do this  
C. This is challenging to do  
D. We are interested in trying this  
E. We are working toward this  
F. We tried this without success

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## Area 5. Tracking

### Strategies
1. Track implementation for all completed research projects using a database or other tool.
2. Conduct surveys or interviews of project stakeholders to assess implementation status.
3. Report periodically on implementation project progress (staff communications, dashboards, conferences).
4. Report periodically on implementation progress at the program level.

### Responses
- A. We already do this
- B. We do NOT do this
- C. This is challenging to do
- D. We are interested in trying this
- E. We are working toward this
- F. We tried this without success

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Area 6. Technology Transfer and Marketing

**Strategies**
6.1. Communicate research results and showcase implementation successes to communicate the value of implementation.
6.2. Present research results directly to relevant DOT staff and local agencies; use webinars, videos, research briefs/summaries, conference presentations, conference posters, newsletters, email notifications, and/or annual reports.

**Responses**
A. We already do this  
B. We do NOT do this  
C. This is challenging to do  
D. We are interested in trying this  
E. We are working toward this  
F. We tried this without success

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## Area 7. Demonstrations, Pilots and Other Implementation Activities

**Strategies**
1. If appropriate, begin deployment with a demonstration project or pilot project.
2. Learn from other agencies’ successful and unsuccessful implementation efforts.

**Responses**
A. We already do this
B. We do NOT do this
C. This is challenging to do
D. We are interested in trying this
E. We are working toward this
F. We tried this without success

### Area 7. Demonstrations, Pilots, Implementation

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<td>Anna Bosin</td>
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Appendix F. Survey Results – Free Responses

Program Management

- Implementation is addressed in each research needs statement submitted for scoring. Cost/benefit is subjective and difficult to include on each project. We are moving towards workshop type report-out for highly successful research projects in order to facilitate better implementation after the project is complete. (Alaska)

- Our agency advised us to focus on delivering, for most studies, implementable research recommendations, but not to develop implementation plans, require formal agreements, or otherwise take responsibility for implementation. The agency identifies implementation as the realm of the research customer. We do, however, document the extent and impact of implementation within the agency and identify factors that contribute to implementation or the lack of; we are also in the process of developing a means of "measuring" impact. We clearly promote implementation of our research and offer opportunities for customers to pilot implementation of completed research through studies that we would fund. We also led a successful effort to apply for NCHRP implementation support funding to help DOTs from Arizona and four other states learn how to implement the recommendations of NCHRP 905, Measuring the Effectiveness of Public Involvement. (Arizona)

- We are starting to talk more about implementation, but we are also a really small program, so haven't had a lot of research projects completed to help shape our efforts. (District of Columbia)

- It was done in one package, since research ideas to the implementation plan after the research is done. (Indiana)

- Seeking buy-in from agency leaders is challenging because it's difficult to get their time/attention on individual research projects. Demonstrating value has been challenging because we need to rely on technical offices to provide much of the data on benefit/cost and ROI and it is difficult to get them to do that. (Maryland)

- Whether research results and recommendations can be implemented or not depends on a lot of factors and each project is different. Some may not deliver a final product that is readily implementable, some may intend to produce additional information, and the circumstances for implementation may have changed (staff change, political environment, and new standards/regulations...). (Massachusetts)

- This is a challenge due to turnover and shifting priorities. (Mississippi)

- Seeking buy-in from agency leaders and identifying barriers to implementation need to be done early in the process. We have buy-in from agency leaders even before a potential project is moved forward to a technical panel, before the first discussion of scope. We discuss barriers to implementation at the very first technical panel meeting and continue the discussion throughout the project. (Montana)

- We have designed our project selection process to include implementation potential as a criteria and have asked our Principal Investigators to develop an implementation plan using our form. We have not developed a system to track implementation after the research project is completed. (Nevada)

- Our SPR2 Research Program Manual documents implementation roles, steps, and options. Sometimes, the challenge is that by the time it comes around to implementation, the project has lost its momentum. (New Hampshire)
• The state of NJ does an Annual Implementation Research Report through the technology transfer program which reviews the effect and implementation steps taken. The annual report provides examples of the return on investment or economic benefit to the state and builds on the success. The annual report documents the strategies that have been used for technology transfer of research findings to the state's transportation community, including its practitioners. Also, the Implementation Report is a means to screen for additional opportunities to advance implementation of valued research. (New Jersey)

• The NCDOT Research & Development Program implements a multi-prong strategy to implement research products and to document the benefits of said research products. We capture the potential implementation of research products through our Implementation Plans. This information is captured at the Kick-off Meeting, Intermediate meeting (6 - 9 months prior to completion of the research project) and at the close-out meeting. We also have a Technology Transfer (T^2) Request form which is designed to assist with the implementation of research products through workshops, training, or further development of the research product. The T^2 program utilizes separate funding specifically designated to assist with the implementation of research products. We conduct an annual research follow-up survey to capture the use of research products as well as to try to verify the use and quantifiable metrics of these projects. This is our first year implementing (quantifying the benefits of research) this portion of the program. We also conduct an annual Research & Innovation Summit designed to have transportation subject matter experts from the public (NCDOT/FHWA) and private sector as well academia, to discuss innovative research products, projects and implementation. The conversations and presentations range from (but are not limited to) innovative subject matters, the logistics of applied research as well as addressing the barriers of research implementation. This contributes to our technology transfer and implementation efforts. (North Carolina)

• At NDDOT implementation of research falls back to the Divisions/District that would have a vested interest in the implementation. We do not have a formalized process to facilitate implementation. (North Dakota)

• Our Office staff is currently too small to be able to add these as parts of our Research program, though they should be important to all DOT research programs. (Tennessee)

• The gist is that VT is a small state. So we definitely are trying to copy what other states do if feasible. And we definitely have support that we want projects that will be implemented and the goal is to use the research. So formalizing anything seems to be not worth our resources. And I’m not concerned about barriers. And I’m interested, everyone is interested in quantifying the benefits of research, but MN and others have shown us that quantification is hard. So we have support and we can keep pointing to successes—that’s probably sufficient. (Vermont)

Roles and Staffing

• IT and data governance is always consulted prior to a research needs statement (RNS) being approved for anything that MIGHT require software or data management during the project and/or after the project is completed. Outside stakeholders (local agencies, fed agencies, etc.) are consulted also during RNS drafting and data collection time frame to ensure they are supportive of the project before we begin. They are included in project updates as well. (Alaska)

• I selected “already do this” to reflect our requirement that key stakeholders, including decision-makers, support and participate in the research process from the development of an initial need through the conclusion of a study. (Arizona)

• We have not had consistent project panels, but when we do, we make sure they cross program areas. We are going to try to do this better on the set of projects starting this year (we haven’t had new projects since 2017/8, so kind of starting fresh). Given staffing levels, we are unlikely to designate a staff person to monitor
implementation, but we have written this responsibility into our new university support contract and will have the university partner help to put together an annual implementation report. (District of Columbia)

- The Joint Transportation Research Program includes all the stakeholders, such as central office and District staff, the industry and the FHWA. (Indiana)

- We include external stakeholders to the extent possible, but it’s not always easy as they do not always see the value. It has been very helpful when they participate, though. Our Research Division only has two full-time staff and both serve as project managers. Having an implementation position is ideal, but we have not been able to get additional staff resources for the Research Division in the past 15 years. (Maryland)

- To have successful implementation, the project champion should be someone with high credentials in a functional area (someone with well-respected expertise and some position authority too); leadership buy-in is a must too. (Massachusetts)

- We do not have the staff nor the work load to assign one person to implementation. Also, we feel it is better to keep the same research project manager who ran the project from the beginning to follow implementation. This person has the knowledge and insight to do so. Likewise, implementers are on the technical panel from the beginning and are leading the charge as the champion and chair of the technical panel. They have to be leading the charge in order to expect implementation of the research results. We have an implementation planning and documentation form that the research manager completes with input from the project panel. Those involved in implementation activities report implementation progress and when an implementation activity is complete so that the research project manager can keep the form up to date. This form is sent to the panel with periodic updates. Our Stage 2: Research Topic Statement form requires a sponsor. Only the highest 16 people in the Department can sponsor a research topic. When sponsors sign on to a research topic, they are agreeing to ensure implementation, as appropriate. This happens before a research topic is even discussed to decide if it should be moved forward to a technical panel. All those, both inside and outside the Department, are involved on the technical panel. This makes sure the research meets everyone’s needs and creates buy-in from the get-go. There may be times when some of these stakeholders are not included on the panel because their input is a part of the research project. (Montana)

- Senior management is not typically involved after the topic is funded and our Technical Advisory Group (TAG) is capable of guiding the project. Our research project TAGs include external stakeholders (i.e., other state agencies, private, federal) if appropriate. This allows us to identify roadblocks to implement results early in the research process. (New Hampshire)

- NJ DOT has an Implementation Officer, but all research staff members are responsible for their project implementation. Research staff, project panel champions and functional area staff are part of the implementation plan and success. The Implementation Officer communicates with project champions after the project has been completed to verify if topics or results were addressed. Senior management are involved at the beginning of the project for support and approval. Also, funding is approved by the decision-makers. (New Jersey)

- NCDOT utilizes a StIC (Steering & Implementation Committee) for each research project to assist in guiding the research. The StIC consist of members who are subject matter experts from either within NCDOT, FHWA or the private sector. These members will either be interested and/or impacted by the research. The StIC is led by the Committee Chair who is typically the Project Champion. When there is follow-up for completed research projects, the Committee Chair is normally contacted, but rarely do we contact the whole committee. (North Carolina)
Keep the project panel together after the project has ended to track and facilitate implementation activities. (We sometimes do this.) Involve senior management and decision-makers in implementation. (We sometimes do this.) (Pennsylvania)

These are all interesting ideas, but we are definitely behind in being able to accomplish this at this moment in time. (Tennessee)

We’re a small state and we don’t have the resources for a full-time implementation person. So it’s all hands on deck. The panels get this, middle-level directors get this, executive staff gets it. We do have external participation on our technical panels. This has been very positive. (Vermont)

**Project Management and Process**

See previous comments for clarification, particularly on implementation plans. (Arizona)

We had set aside some funds for implementation in 2015 (additional obligation), but due to staffing and other program activities, couldn't put enough focus on that. Those funds were used for a couple projects that were more like local versions of national research, but that wasn't really what we originally intended the funds for. We were hoping to identify relevant NCHRP and other research to directly implement. (District of Columbia)

All staff that goes to TRB Annual Meeting has to report to the executive staff on promising technology that has potential for implementation in the state. (Indiana)

This depends on the project, but we do require implementation to be considered at all phases. (Mississippi)

Individual implementation activities are listed on our implementation planning and documentation form. Each activity is tracked. The first two sections of the implementation planning and documentation form are completed when a project is contracted. The last three sections of the implementation planning and documentation form are completed when the research is complete. This form is used to track implementation until every activity is implemented or it is clear that there will be no additional implementation. Implementation is considered from the Stage 2: Research Topic Statement before a potential project is moved forward to a technical panel. When a project is moved forward to a technical panel, implementation, including barriers and products to facilitate implementation ("tactic tools") are discussed at the very first panel meeting. The next step is to develop a scope of work; this SOW includes implementation. A proposal, which becomes a part of the contract, is developed from the scope of work and requires an implementation section. Also, the products identified as necessary to facilitate implementation are included in all of these documents. Progress reporting includes implementation. Implementation recommendations are made in the final report and products to facilitate implementation are project deliverables. If as the research is in progress or is completed and we identify additional products to facilitate implementation, we either amend the contract to include these deliverables or we execute another contract for these deliverables. We do not prioritize projects for implementation. All of our projects go through the implementation process. We also produce an implementation report. This report results from a discussion between the researchers and the technical panel. Every implementation recommendation is discussed and there is an MDT response. The MDT response may be that an activity may be fully, partially, or not implemented at all. Reasons are documented as well. The researcher writes the text of the implementation report, but research staff put it in our template for publishing. This report is a final deliverable of each research contract. The sponsor signs off on this report before it is published. Another final deliverable that includes information on implementation is our project summary report; this report contains a one or two paragraph summary of MDT's implementation intention. It is very difficult to track when staff implement the research results of others, unless it results from an additional MDT research project. We ask when we give
the results of literature searches and when we share the research results of others. Unfortunately, we don't get much response. I'd love to hear if others are successful at this. (Montana)

- Our current work program is the first time we established implementation guidelines and requested an Implementation Plan as part of the final report. (New Hampshire)

- Do not have detailed implementation research manual currently, but using research project management process for implementation projects. Though we are using the project management process, it has been streamlined and broken down into 5 stages. (New Jersey)

- As noted before we have an Implementation Plan for the Kick-off, Intermediate and Close-out Meeting. We also have mechanisms to assist with the implementation of research within NCDOT as well as externally (i.e., NCHRP, TRB). (North Carolina)

- Prioritize projects for implementation: Yes or No. Implement relevant research results from other agencies, including research discussed at the TRB Annual Meeting and other conferences.: Have not attended research conference yet. (Pennsylvania)

- We could probably do better in using TRB's resources to inform our processes and procedures. Additionally, it is challenging to prioritize implementable projects because it is not always clear how beneficial they will be. (It's the nature of research.) (Tennessee)

- I was a fan of implementation plans in my previous position. Now I think that implementation is more integrated into our process—it's understood from the beginning and by the technical committee and researchers. Projects are selected because they'll be implemented/there's a need. (Vermont)

- We document "improvement ideas" that agency TRB attendees must submit which may include implementing other agencies' research results. (Wisconsin)

**Funding and Contracting**

- My understanding is that FHWA cannot participate in implementation funding. We do include "report out" type activities in each project at the end when the final report is completed to help get the results widely shared. This can be a webinar, in-person workshop, presentations at conferences, etc. We are currently working on a specific video training module for one project that was set up separately because the results were excellent from the parent project, and it needed dedicated funding to do video editing and transcript writing. (Alaska)

- We don't explicitly set aside funds for implementation projects because our funding is adequate without having to do so. See previous comment on our leadership in securing funds from the NCHRP Implementation Support program. (Arizona)

- As mentioned in the prior section, we set aside funds in 2015, but didn't have clear enough objectives for them and didn't have the institutional supports necessary to really make that happen. It turned out to be too much when we were trying to get several regular research projects underway, and run a grant-funded project, and had staffing turnover. (District of Columbia)

- Alternative funding means also funding from the construction projects that incorporate implementation of research projects. (Indiana)

- The bureau that monitors the project is responsible for implementation funding if needed. (Kansas)

- We don't have dedicated funding for implementation only; but a research project with an implementation component is highly valued. (Massachusetts)
• This is also very project-dependent. (Mississippi)

• We try to include deliverables that will facilitate implementation in our research contract. If need be, we can have a separate implementation contract. We actively advertise NCHRP 20p-44 to staff and consider other opportunities as well (e.g., STIC, EDC, SHRP 2, etc.) We have to be careful here with our definitions because "implementation" is not an SPR-B eligible activity. What we include in our contracts are things to facilitate implementation or full deployment. (Montana)

• We use STIC funds to implement innovative (EDC) initiatives. (New Hampshire)

• SPR funding is allowed for implementation, as long as it is a part of the overall research project and includes documentation and analysis of results or findings. Alternate fund sources can come from various Resource Centers within NJDOT. Research Centers use their funds for Research Studies. (New Jersey)

• Using funds for tech transfer should be a priority. We currently have no mechanism to have contingent funding for that part of a project but would like to implement it. We currently allow projects to suggest tech transfer and workshops as part of their projects, though I would think having it be contingent on the projects success would make more sense. (Tennessee)

• We have limited resources—implementation is integrated into everything. (Vermont)

• The technical areas seek funding for implementation activities. (Wisconsin)

Tracking

• Research project managers attempt to identify and document the implementation of research recommendations for, ideally and to the extent possible, 18 months after the conclusion of a study. It can be difficult to acquire the necessary feedback from customers, however. As we all know, challenges results from discontinuity in who the customers and their objectives are -- positions, roles, and individuals change over time. We also periodically (approximately every five years) conduct a large-scale evaluation of the extent and impact of the implementation of recommendations that resulted from ADOT research studies. This involves interviews, surveys, documentation, and refinement of ways to measure impact. (Arizona)

• As mentioned earlier, we are hoping to get our university partner to do this as part of their program support. (District of Columbia)

• Every implementable project where the benefits can be calculated has to be included. (Indiana)

• Benefit cost is discussed twice per year with the Research Advisory Council (Kansas)

• implementation of project results generally reported to my internal research advisory committee. (Maine)

• We track implementation through our Implementation Planning and Documentation form. When we have a research program and project management system, we will be able to track all implementation in one system. Each implementation activity has a deadline. When the deadline nears or is reached, the research project manager requests an update from the individual responsible for each activity and updates the Implementation Planning and Documentation form. We also have an exit survey that is conducted when research is complete. There are a few questions that ask about implementation potential, timing, etc. We report on implementation at both the program and project level to our high level Research Review Committee meetings and in our annual reports. I would love to implement an implementation/performance measures dashboard and plan to do so within the next year. (Montana)

• We do not have staff time available to track implementation or request information from the TAG champion and members. (New Hampshire)
• Surveys are conducted on completed research projects to determine projects that were implemented and any recommendations for future implementation research yearly. Most of these reports can be in design and construction or multimodal system components. We do not have a formal tracking system to track implemented projects. We are currently planning to develop a spreadsheet database to track implemented projects. (New Jersey)

• With our limited staff it can be difficult to track and follow projects through implementation. (North Dakota)

• The first two options here are ones that we have mentioned with other divisions as feedback on projects is sorely lacking. The latter two are less important because we need to do better with other things first before moving into the marketing side. (Tennessee)

• VT has not done surveys but NETC (regional Pooled Fund project) has and it has been very painful. Six years later, there’s a lot of movement in Agencies and few technical committee members exist and there’s limited interested in completed projects. It's shown us that we need to get better and better at selecting projects with enthusiastic technical committees/Champions. We can try to share implementation in our Quarterly newsletter. (Vermont)

• Information on how individual research projects are being implemented is shared within the agency and at contractor-engineer conferences in the state. We are also starting to utilize social media to highlight successful research projects. (Wisconsin)

**Technology Transfer and Marketing**

• We have yearly poster sessions in the administration office (Government Center) showing the finished projects and ongoing promising projects. (Indiana)

• Always room for improved marketing. This is done here on an ad hoc basis; being more organized and strategic about it could be very productive. For example, holding an annual research showcase. (Maine)

• Some of the required deliverables that help us share research results and implementation include: project webinars, posters and implementation reports. We take every opportunity we have to discuss research. Some examples are MDT and other conferences, our quarterly to biannual research e-newsletter, meeting with new managers and our MDT internal bimonthly e-newsletter. We also have a display case outside the auditorium where we share project posters, which are a required deliverable. We also produce research briefs (project summary reports) for every project and share results in email notifications via listservs. Finally, we also highlight implementation in our annual reports. It's important to tailor products to each different audience. (Montana)

• Research results and showcase implementation successes are communicated as value of implementation. The research results are communicated directly to DOT staff as final reports and also posted on the research website. (New Jersey)

• We have an Annual Research & Innovation Summit. (North Carolina)

• While we do communicate results and do some presentations on research, we would like and need to do more. (South Carolina)

• We do these in some respects currently, but not with any kind of gusto. It is up to the lead staff for our projects how they want to see it be used. We do not prioritize these things and have little control over it currently, but we would like to see it get better. (Tennessee)

• Quarterly e-newsletter; annual symposium of posters of research and innovations. (Vermont)
Demonstrations, Pilots and Other Implementation Activities

- It's practically a full-time job to track what other agencies and the national groups are doing for research—there is so much going on out there (good problem to have!). I think we are more successful in learning from others during pooled fund projects. (Alaska)

- For years, we have trumpeted the opportunity for agency stakeholders to pilot implementation of completed research—our agency's, NCHRP's, etc. We inform them that we (research group) will fund and manage it. We have not yet had one "taker" on this offer, but we continue to communicate the opportunity and look for new ways to inspire interest. (Arizona)

- We are working on a program to vet pilots, testing and demonstration projects where external partners approach us with ideas. The first round of review has been completed and the champions are working on the projects. These efforts do not come out of a research project necessarily, but the research program is supporting and hopefully tracking in an effort to help the agency be more effective in its efforts to be innovative. (District of Columbia)

- Projects from other agencies means from FHWA, NCHRP and other National Transportation Centers. (Indiana)

- We have been successful with demonstration projects working with UMaine and partners on new FRP composite bridge technology. (Maine)

- For 14b: I would consider literature/state-of-practice review, which is a part of every research project, informs the funding agency and research team of others' experience. (Massachusetts)

- This is again very project-dependent. (Mississippi)

- We are always listening and learning more on this topic. (New Hampshire)

- Innovative ideas can be deployed as a pilot program. Successful projects can be tried in our state. Unsuccessful implementation efforts become lesson learned. (New Jersey)

- We have had success with pilot projects, especially if it has already been proven feedable in another agency or similar application. It is easier to get people to commit to one project to "test the waters" rather than trying to try to get buy-in directly for implementation of a full-blown change. (North Dakota)

- If appropriate, begin deployment with a demonstration project or pilot project. (The Bureau of Planning and Research doesn't lead these activities.) (Pennsylvania)

- For "If appropriate, begin...", we try to conduct demonstration and field trials prior to implementation, and then use further demonstrations for educational understanding. For "Learn from other agencies...", we have found that most documentation coming from other DOTs is lacking in explaining what was done and how, so it is difficult to learn from their experience. We really want to, but seldom do the DOTs provide the sufficient manuals, videos, class material or do's/don'ts to learn from their experience. (Texas)

- Limited resources for demos and pilots. If any, these are part of research projects. (Vermont)
Appendix G. Peer Exchange Summary Form

Peer Exchange At-A-Glance Form – Purpose and Instructions

Purpose

The form on the following page is intended to help capture the highlighted findings of an SP&R peer exchange.

- The completed text should be inserted at the start of the peer exchange report.
- It functions as a bulleted abstract of the peer exchange report. It will give readers a quick understanding of what was learned and allow them to decide if they wish to explore the more detailed report findings.
- It may also be useful as a standalone summary document to help an agency communicate the top-level outcomes of the peer exchange.
- When completed, it should be no longer than one page (or two at most).

This form was developed as part of NCHRP Project 20-44(21), Synthesis of State Peer Exchanges and RPPM.

Instructions

- Delete this instructions page.
- Replace [text in brackets] on the next page with your own text.
- Please list only the host and guest agencies. There is no need to list individuals’ names (these and other details will appear in the full report).
- For the Peer Exchange Need/Purpose/Goals, briefly state what the host agency hoped to learn from this peer exchange. Aim for 50 to 150 words.
- For the Top Findings and Takeaways:
  - Keep list items brief: short statements, a sentence or a few sentences at most.
  - Provide page references to the detailed report if doing so is helpful. Page numbers may be less useful if this text is used in a standalone document.
  - To make it easier to create this list, consider identifying and collecting the highlights and key takeaways of the detailed peer exchange report during the usual meeting wrap-up session with the participants. This way it will not add to the facilitation or reporting workload for the meeting.
  - Limit this list to the top 10 key findings, takeaways and/or items of interest from the peer exchange report to give a high-level overview of the findings to the reader.
Host Agency: [Agency]

Guest Agencies: [Agency 1], [Agency 2], [etc.]

For additional details, please read the complete report documenting this peer exchange, available on the AASHTO Research Advisory Committee website.

Note in Word file: Include this paragraph if this page is being used as a standalone informational piece. Delete this paragraph if the text on this page is being pasted into the front of a peer exchange report.

Peer Exchange Need/Purpose/Goals

[Text]

Top Findings and Takeaways

- [Takeaway] (see p. [page number])
- [Takeaway] (see p. [page number])
- [Takeaway] (see p. [page number])
- [Etc.]