Purpose of “How To” White Papers for the AASHTO Committees
A white paper developed for AASHTO committees to provide guidance on research-related activities.

BACKGROUND: The Research Advisory Committee (RAC) Work Group on AASHTO Committee Outreach determined that due to the 2017 reorganization of the AASHTO committee structure, the transportation community would benefit from a series of “How To” documents that can provide guidance on carrying out specific research tasks. These documents will provide a high-level view of the various processes that may be leveraged to advance any research funded program. This series of white papers will help your committee successfully navigate the research process.

1. Who Developed the “How To” Documents and What Are They
Members from the Research Advisory Committee (RAC) community developed the documents to articulate and provide instructions on topics that could be of interest to AASHTO committees. The “How To” documents give step-by-step instructions and provide useful information that can be leveraged to advance a research program.

2. Current “How To” Documents
The figure below depicts the topics covered in the “How To” series. View these documents.

3. Resources Available
There are extensive resources in every state DOT as well as throughout the research community that may provide guidance when needed.

- AASHTO Staff
- NCHRP Staff
- RAC State Representative and other Research Staff
- Other “How To” Documents
Committee Approach to Research

1. Create a Research Subgroup
   Each committee should create a “Research” subgroup, designate a research point of contact, or assign activities related to research to an existing group, such as the Steering Committee. The goal of this group is to be the champion for research. This group would take on much of the responsibilities identified in this document. The benefits of having this group are the creation of better research topics, more committee engagement in research, improved implementation, etc.

2. Connection to TRB
   It’s important for AASHTO committees to a) be aware of and b) partner with their corresponding Transportation Research Board (TRB) committees. While these two committees may have overlapping membership, they do have separate goals; however there are areas of overlap, with research. TRB committees should be viewed as vital research cooperators in helping AASHTO committees identify research needs, develop and draft potential research problem statements, facilitate technology transfer, etc. View AASHTO–TRB Committee Connections.

3. Develop a Strategic Research Plan
   In developing a research strategic plan, you will identify the ongoing and completed research. From this, you can identify the research gaps and the research that needs to follow.

4. Collection of Research Ideas
   It is important to create a central point for research ideas identified through the research strategic planning process. This central point allows all committee members the ability to pursue research opportunities. It your committee starts a running collection of ideas, it is critical to periodically update your collection as various research progresses.

5. Review/Vet Ideas
   In order to ensure transparency and prioritize the aforementioned collection of ideas, there should be a review process to determine which ideas move to the next step. The Strategic Plan can play a role in this process.

6. Write Problem Statement (or leverage TRB Committees)
   The next step is to turn the idea into a problem statement. The proposer of each idea generally takes on this task, however, committees are encouraged to engage your corresponding TRB committees for assistance; see AASHTO–TRB committee connections. Also, please consult the “How To” guide on writing problem statements to assist with drafting of problem statements.

7. Selection of Problem Statements
   Once there are a number of problem statements, there should be a process to review, rank, and determine which problem statements are submitted to the various research programs. Your research strategic plan can inform this process. This process does not need to be formal, but it should be rigorous enough to help explain which problem statements were submitted and why.

8. Know and Understand the Various Research Programs
   There are a number of research programs where problem statements and ideas can be submitted. Each program may have a different goal.

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9. Research Tracking/Monitoring

This item applies to problem statements which are selected for funding. The aim of this task is to keep the committee informed of the research which they initiated.

- Committee members should be nominated to serve on the project panel. This panel members are tasked with:
  - At the beginning of the project, your panel representative can help to ensure the project is scoped to give your committee what it needs.
  - In the scoping process, your committee should identify the products that will be needed for implementation. As appropriate, include these products in the scope.
  - As the project progresses, your panel representative can ensure that the project remains on scope.
  - Given this, at the end of the project, there should be no surprises, your committee should get exactly what it needs out of the research; this facilitates implementation of the research results.
  - The panel representative should share research progress with your committee.

- Committee members should assign a project monitor (which may be a project panel member). This role is tasked with keeping the connection between the committee and the research project. This generally entails some type of quarterly report or update to the committee on the research project.

10. Project Completion/Sharing the Research Results

At the completion of a project, the sharing of the results is paramount in the implementation process. It is vital that the results get in the hands of those who can actively implement the research results. If additional products are needed for implementation, create them or initiate a follow-on project to develop these implementation products.

11. Research Implementation

Implementation of research results, as appropriate, is critical. Otherwise, why do we bother? Implementation ultimately has to occur at the agency-level. However, if a committee is interested in championing the implementation of NCHRP funded research, there is an NCHRP Project (20-44) which provides funding for activities that assist in the adoption of research findings.

12. Research Value

When possible, there should be an effort to determine the value of the research. This activity helps identify the benefits of research, which helps ensure continued funding for research. For more detailed information on how to capture the value of research, please read the “How To” guide.

13. Committee Engagement: Get Involved

Committee members are encouraged to participate in the research process. The main avenues of participation are: participate on the research subgroup, participate in writing a research strategic plan, write a problem statement, serve as panel member to monitor a project, and help to share research results and determine the value of research. All these require a different level of engagement and as well as a different time commitment.

The complete set of “How To” documents include the following:
- Committee Approach to Research
- Writing a Strategic Plan
- Writing a Problem Statement
- Funding Resources
- Experimental Features
- Sharing Results
- Implementing Results
- Determining the Value of Research
- Monitoring Results
“How To” Create a Transportation Research Strategic Plan
A white paper developed for AASHTO committees to provide guidance on research-related activities.

Developing a plan for strategically accomplishing research activities within an AASHTO Committee can be a daunting, but necessary activity. The intent of this document is to highlight steps necessary to develop a committee-focused research strategic plan.

1. Why Complete a Committee Level Plan for Research?
- Develops a clear road map for research activities and provides an opportunity to organize and identify needs over a period of time rather than just addressing short-term issues
- Provides context for individual projects
- Allows for progress tracking towards goals
- Identifies priorities and how research can accomplish them
- Aligns resources
- Helps take advantage of emerging opportunities
- Presents a clear succession between leaders and committee member changes

2. Considerations for Planning
- Consider using small groups to develop a draft mission/vision/expectations
  Strategic planning cannot be effectively completed in a large committee setting. Awareness, buy-in, and ownership are strengthened by using a small group process, and vetting the results with the larger committee.
- Maintain a Record of Existing Research
  Identifying what has already been achieved is the crucial first step, as it helps to identify the current state of research. There are several tools available for monitoring research endeavors. Also, reaching out to relevant University Transportation Center (UTC) programs can assist this step. Committees should consider having a liaison to TRB Committees (see AASHTO–TRB Committee Connection) and NCHRP Panels that are completing research. TRID is the main database to identify ongoing and completed transportation research.
- Identify Related Research Needs
  It is also critical to identify the related research needs of others, as it helps to identify the direction future research may follow and helps to identify collaborators, champions, and sponsors of research.
  The following resources are available for coordinating activities:
  - TRB Research Needs Statements (RNS) database
  - U.S. DOT Research Hub
  - Research Program and Project Management (RPPM) Unfunded and Partially Funded Research Needs
- Poll Committee Members for Key Issues
  Completing a survey of members helps identify key topics and can specify timeframes. It can also complement the results of the previous step. The survey can be completed over email using basic spreadsheets or using an online provider (Qualtrics or Survey Monkey).
- Develop a Research Plan or Roadmap
  From the previous four steps, identify the research gaps within the committee’s mission/vision/expectations. These gaps can then be turned into research problem statements.

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• **Document**
  Capturing the information on vision/mission/expectations, and research gaps and needs allows the committee to keep a running record of the information and material, and ensures this information is not lost when committee members change.

• **Ensure research goals are time-bound**
  Determine a time frame for moving research needs forward into research projects.

• **Enlist consultant support as needed**
  Third party support for managing the process and developing the surveys, templates, and compiled results are valuable opportunities for augmenting volunteer time.

• **Regularly report on progress made toward goals**
  The committee should revisit progress made toward specific research activities regularly.

• **Update plans as needed**
  Revisiting the research plan is critical to its long-term success.

The complete set of “How To” documents include the following:

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• Monitoring Results
“How To” Write an Effective Research Statement

A white paper developed for AASHTO committees to provide guidance on research-related activities.

There are seven main elements in writing a strong research problem statement: Title, Problem Description, Literature Search, Objective, Funding and Duration, Urgency, Benefits, and Implementation. This document is a brief outline of these elements with tips and suggestions. For more problem statement development information see the Funding Sources for Transportation Research: Competitive Programs: Appendix A. This guidance document is based on the problem statement template used by the National Cooperative Highway Research Program (NCHRP), but is transferable to any research funding program.

1. Title

The title briefly and immediately conveys to the reader what the proposed study is about. It SHOULD NOT capture every element, nuance, and expected task of the research problem. To help decision makers understand what the research is about, the title should be clear and concise. Here are some additional tips:

- Branding is important—good titles establish a connection with your research statement.
- Negative first impressions linger—a poor title affects how the research statement is perceived.
- Confusing titles—lead to confusion about what the research is really about.
- Good titles are good sound bites—people will remember them.

Hint: Look at every word in your title and ask: Does it help? Is it necessary?

2. Research Problem Statement (aka: Description of Problem)

The description convinces the reviewer that the problem or opportunity matters to a majority of the state DOTs—that research is needed and should be funded. It should set the context and explains why this issue or problem is important, and who it is important to. Here are some suggestions:

- Link the problem to an issue faced by a majority of state DOTs.
- Indicate the affected area within transportation, e.g., the technical disciplines or functions.
- Identify connections with priorities and efforts of AASHTO committees and FHWA offices.

Hint: Keep thinking “Why should my CEO care about this problem?”

3. Literature Search

This step helps to avoid duplicative efforts on the same or similar research topics, and identifies how the proposed research differs from existing or ongoing research. This section should contain an overview of past work related to the problem statement. This information can be pulled from an up-to-date research strategic plan. There are resources available to help you provide a solid summary of current research:

- TRID—A TRB database on existing research both completed and in-progress
- RIP—A TRB database on research currently in progress
- Literature Searches and Literature Reviews—A website for guidance on how to conduct a literature search

Hint: Google is a fine tool, but use the tools above to get the most accurate information. Also, ask your AASHTO Research Advisory Committee (RAC) member or library services professional for help with this.

4. Objective

In this element, the desired outcome of the research is defined, and specific products and deliverables are identified. The objective should be short, concise, and specific. Here are a few additional guidelines:

- Individual tasks may or may not be included, but they can be very helpful in illustrating what the problem statement author has in mind for how the research might be conducted. (The NCHRP project panel will decide what tasks to include).
- Limits on the scope (depth and breadth) of the research effort should be included that are
consistent with the amount of funding requested to ensure the products can be produced.

- Implementation activities should be considered here.

**Hint:** Go back and read the advice above on titling your research statement. A very reasonable objective statement is “…to develop (insert your title).”

### 5. Estimate of Problem Funding and Research Duration

In this element, two items are identified: the anticipated cost to complete the objectives (which may include dissemination and implementation activities) as well as an estimated time frame to accomplish the objectives. Below are a few suggestions for this section:

- Costs should include any testing, computer modeling, and other items related to the research.
- The average cost of a full-time research professional is $200,000 per year.
- The research period should include four months for review and finalization of the interim and final reports.
- It is critical to estimate the cost as closely as possible. An overestimate may cause the research statement to be rejected. An underestimate may result in an underfunded project, resulting in either incomplete work or a request for a funding amendment.

**Hint:** Reviewers have a good sense of the time and cost, so please submit a reasonable cost and timeframe. If this section is a struggle, ask your RAC member for assistance.

### 6. Urgency and Potential Benefits

These are crucial factors to be considered in the selection process. This element conveys the importance of the problem as well as the possible benefits from the completed research. Below are tips to strengthen this section:

- Be specific and provide as much detail as you can on the potential benefits of the project.
- Identify the consequences of NOT doing this work.
- Indicate how the expected results may affect things like worker productivity, agency budgets, and/or customers’ quality of life, etc.

**Hint:** Be positive but honest. Use real numbers if you can measure or estimate them.

### 7. Implementation Planning

This section targets how research products can quickly be put into practice. Below are some items this element should identify:

- The target audience for the research findings and products.
- Key decision-makers who can approve, influence, or champion implementation of the research products.
- AASHTO committees and other individuals/organizations with likely responsibility for adoption of the results.
- Potential “early adopters”—state DOTs that would be willing to pilot the research products in their agency.
- Any barriers to implementation—Identify institutional or political barriers to implementation of the anticipated research products and potential mitigation actions.
- Any products that can be widely applicable for facilitating implementation should be included in the research statement.

**Hint:** How to deploy the research should be thought through at the inception of a research idea and should be considered through the research process.

The complete set of “How To” documents include the following:

- Committee Approach to Research
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- Writing a Problem Statement
- Funding Resources
- Experimental Features
- Sharing Results
- Implementing Results
- Determining the Value of Research
- Monitoring Results
Funding Resources

1. Identify Related Research Needs
Committee strategic planning efforts help determine if there are others with the same or a similar research idea. This helps identify funding program champions and sponsors. This also can avoid duplication of efforts and facilitates communication, coordination, and collaboration. Search the following databases and websites:
- TRB Research Needs Statements (RNS) database
- U.S. DOT Research Hub
- Research Program and Project Management (RPPM) Unfunded and Partially Funded Research Needs

2. Identify Transportation Research Funding Programs
While not exhaustive, the best source of transportation research funding programs is the Funding Sources for Transportation Research: Competitive Programs. See Chapter 3 for a table of funding programs. The table designates the programs by topical area, annual funding, and project type to help identify which program(s) fits your research need.

3. Know the Programs/Understanding the Requirements of the Program
- What is the project schedule?
- Who can submit research problem statements?
- Are there research focus areas or high-priority topical areas?
- Are champions required? If so, who can be a champion?
- Who prioritizes the research problem statements?
- Who makes the funding decisions?
- What is the process for funding research problem statements?

4. Select the Program(s) That Best Meet Your Research Needs
After reviewing the available funding programs and understanding their requirements, select the program(s) that fulfill your needs. Please reach out to the sponsoring entity, if you have questions about the program(s).

5. Set Up a Schedule
Develop a schedule from research idea gathering through problem statement submittal that matches the funding program(s) schedule.

6. Develop Your Research Problem Statements with the Funding Program in Mind
Write your research problem statements to meet the requirements of the funding program(s). See the “How To” Write an Effective Research Statement.

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7. Get your Research Problem Statement Out There

This completes the cycle that began with #1 above.

- If you have a connection to a TRB committee, get your research problem statement entered to the TRB RNS database. Universities search this database to identify student projects.
- If you do not have a connection with a TRB committee, identify a committee related to your AASHTO committee and make a connection, see AASHTO–TRB Connections.
- If there is no related TRB committee and your research need is not funded, add it to RPPM.

8. Do Not Get Discouraged

If your research needs are not funded initially, do not get discouraged, it is an iterative process. Learn from previous submittals to improve your chances the next time.

- Obtain review comments.
- Never forget your target audience.
- Network—ask for advice and seek support from others.

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1. What Is an Experimental Feature?

An experimental feature is any material, process, method, innovative highway technology or alternative standard technology that needs to be evaluated, because it has not been tested sufficiently under actual service conditions to merit acceptance, or has been accepted and needs to be compared with alternative acceptable features to determine relative merit and cost effectiveness. Experimental features do not have to be new to the world; they can be new to your state and the conditions (e.g., weather, traffic, and available materials) of your state. The Experimental Features Program can be used in conjunction with a state’s product testing and acceptance process.

Note: Not all states have an experimental features program. Check with your state DOT research manager to determine if this option is available to you.

In addition to your state DOT research manager, NCHRP Report 727, Effective Experimental Design and Data Analysis in Transportation Research provides useful information. The following principles describe the experimental features process:

- **Experimental Project Designation.** Any Federal-aid project incorporating experimental features should be designated an experimental project and treated accordingly.
- **Work plan.** A work plan is required for each experimental feature.
- **Approvals**
  - For projects on the Interstate system that incorporate experimental features or on any NHS route that incorporates proprietary products, the work plans must be approved by the Division Administrator prior to or with approval of Plans, Specifications, and Estimates (PS&E). Work plans for experimental projects utilizing State Planning and Research (SPR) funds need approval by the Division Administrator in accordance with normal approval procedures for SPR funded studies. (For NHS projects with State approval authority and oversight, work plan approval is delegated to the State.)
  - Experimental features included in ongoing projects by change order also need approval by the Division Administrator.
- **Control Sections.** Control sections or other alternatives should be provided for performance comparisons in all experimental projects unless the nature of the experiment is such that a control section or alternative would serve no purpose.
- **Cost Data.** Cost data should be compiled for all experimental and control features.
- **Multiple Project Justification.** Two or three construction projects should be adequate to conclusively evaluate a single feature. The justification for more than five construction projects should be carefully analyzed prior to initiation.

2. How Do I Proceed with Experimental Features?

- Inform your experimental features coordinator/office as soon as you identify a feature you would like to test. Early notification may allow for a literature search and a query to state DOTs,

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allowing you to gain from the knowledge of others. It also allows a discussion on appropriate controls to include in your deployment.

- Your experimental features coordinator/office may then perform the following tasks:
  - Draft a work plan for FHWA approval. This document contains the following information on the specific experimental feature to be deployed:
    i. Location and extent of project
    ii. Project type
    iii. Research staff involved
    iv. Technical area contact(s)
    v. Objectives
    vi. Experimental design
    vii. Estimated quantities and costs
    viii. Evaluation method(s)
    ix. Evaluation schedule
  - Send the work plan to the technical contact(s) for review
  - Send the work plan to FHWA for approval. Once formally approved by FHWA, this affords some additional benefits as follows:
    i. Proprietary products can be specified without a public interest finding
    ii. Total construction costs attributable to experimental features may be financed with the appropriate class of Federal-aid funding
    iii. If an experimental feature should prematurely fail, total costs attributable to the removal, repair, and/or reconstruction on an experimental feature may be financed with the appropriate class of Federal-aid funding
  - Attend any preconstruction meetings
  - Attend construction and write a construction report to document any events that might affect the performance of the experimental feature and/or the control sections
  - Evaluate the experimental feature as detailed in the project work plan to document performance. This is documented in evaluation and final reports
  - Report back to the technical contact, AASHTO committee members, and others regarding the performance and cost-effectiveness

3. How Long Does This Process Last?

The time to complete each experimental feature is highly variable, ranging from months to test new flexible delineators used in construction projects, to years when testing the performance of a new asphalt or concrete. The timing depends on how long it may take to see different performance between the test and control sections.

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“How To” Share Transportation Research Results

A white paper developed for AASHTO committees to provide guidance on research-related activities.

All things begin and end as stories. Transfer of knowledge generated through research activities is reliant on sharing such stories. It is equally important to share failures as well as successes. Lessons emerge from each. There are numerous ways to move research results into practice and to promote technology transfer. Some approaches are more logical with certain types of research. For example, introducing a new travel demand modeling computer program can best be accomplished through workshops and training programs, while the deployment of a new variable message sign technology may involve commercialization, licensing, and pilot tests. The bottom line, however, is that dissemination and sharing of research results and facilitation of implementation do not occur spontaneously or without cost.

1. Knowledge Transfer Requires Discipline

Technology transfer is defined broadly to encompass sharing ideas, knowledge, practices, processes, technologies, and techniques from research within the sponsoring agency and with other agencies and groups. It can be tangible (hardware and software) or intangible (knowledge and practices) and involves at least two parties—a source and a recipient. The ability to apply lessons learned from a research endeavor requires planning and vigilance. NCHRP 768: Guide to Accelerating New Technology Adoption Through Directed Technology Transfer provides key lessons on how a committee can contribute to better sharing of results.

2. What Approaches Exist to Share Research Knowledge?

There are dozens of ways to share the results of research and encourage wider use of research results. Among the many approaches your committee could consider are:

- Workshops and specialty conferences, including joint meetings with TRB committees of similar interests.
- Meeting presentations, papers, and newsletter articles. A regular agenda item to share research efforts as part of the committee’s business meeting will help expand the dissemination of priority activities.
- Web seminars. Several committees engage in regular webinars to discuss emerging practices.
- Guidebooks. Incorporating the findings of research sponsored through the committee in guidance documentation is a key opportunity for promotion of research results.
- New or updated practices, procedures, and policies.

AASHTO staff and subject matter experts in the RAC and NCHRP programs can help provide guidance for these knowledge transfer practices.

3. How Can This Sharing Be Most Successful?

Keys to successful technology transfer include following the guidance in this series of whitepapers, but also through planning ahead. By identifying appropriate technology transfer methods as part of a research project, success is more likely. Other key practices include partnerships with the researchers, appropriate public and private sector groups, marketing and communication groups, and using pilots and demonstrations to showcase new technologies and methods.

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4. What Resources Are Available to Our Committee?

**AASHTO RAC**—Your state’s research manager is a great place to start. They are knowledgeable on existing research activities and can facilitate connections with other states.

**NCHRP Report 768 – Guide to Accelerating New Technology Adoption through Directed Technology Transfer**: This document presents a framework and guidance on how to use technology transfer to accelerate innovation within a state department of transportation or other such agency.

**NCHRP Synthesis 355 – Transportation Technology Transfer: Success, Challenges, and Needs**: This document explores the use of technology transfer practices in the highway transportation community. The report documents successful practices, discusses challenges encountered, and identifies the needs of those responsible for sponsoring, facilitating, and conducting technology transfer activities and processes.

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“How To” Implement Results
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Implementation can be the most challenging step of the research lifecycle, however it is the most critical step of a successful research project and respective program. Implementation refers to incorporating warranted results into your department’s operations such as adopting a material specification, updating field or laboratory procedures, or a change in a department policy.

1. Do You Have a Plan?
Agencies need to start planning for implementation at project initiation. It requires careful planning and needs to be considered when defining the deliverable(s) of a research project. An implementation plan should include input from potential users within an agency and technical advisors who can ultimately adopt the results and products. More importantly, a key decision-maker or champion needs to be identified to help eliminate barriers and facilitate the use of research results by the agency. The high-level steps for planning implementation are covered in “Writing a Problem Statement” but agencies should develop a more in-depth implementation plan once the research is underway. The plan should include, at a minimum, the following elements:

- Identify the “Audience” or the “Market” for this research;
- Anticipated “Products” expected from this research;
- List of feasible “Action Items” and associated person/group responsible; and
- Timeline for implementation.

2. Who Will Be Involved?
The nature of applied research is that the end results are intended to assist agencies in employing promising methods, policies, or practices that can be integrated into an agency’s standard processes. Typically, implementation results in changes to standard policies or practices that can be difficult to integrate without the buy-in and support of key decision-makers. Given the inherent differences in how policies or methods may be adopted by various entities within an agency, it is important that the end users of the research are identified up front and involved in the research project. Having one or more end user serve on the technical advisory committee (TAC) from research idea to implementation will ensure that the results will ultimately be useful for practitioners.

3. Are the Proper Resources Allocated?
Effective implementation requires setting aside the resources (e.g., financial, staffing, etc.) needed to implement research into practice. Agencies need to ensure that resources are set aside to ensure successful integration of results. Implementation of research may require additional expertise whether it is an outside consultant or internal expertise to train staff to modify or update practices and policies. Researchers also play a major role in this stage and can serve as a training resource. This should be identified from the beginning to ensure the researcher budgets time and effort for the implementation training.

Implementation can be facilitated by the development of products, such as specifications and training. These products can be developed through the original research project or a separate implementation research project. Additional funding may be available through NCHRP 20-44 which provides funding for implementing NCHRP project research results through an application process.

4. How Do You Evaluate Implementation and Impact?
One difficulty in implementing research, is that research findings are unknown at the onset of a project and implementation of findings may be undefined. In addition, specific barriers unique to each project may arise throughout. To address these potential issues, again, it is important to identify and engage key stakeholders and a TAC early. More-
However, they will be critical in evaluating the progress of the project and implementation potential along with providing focus of the intended impact that the project is aiming to achieve.

5. What Resources Are Available?

**AASHTO Innovation Initiative**—Formerly the AASHTO Technology Implementation Group, the AASHTO Innovation Initiative (A.I.I.) advances innovation from the grassroots up: by agencies, for agencies, and peer-to-peer. The program actively seeks out proven advancements in transportation technology, investing time and money to accelerate their adoption by agencies nationwide.

**NCHRP Synthesis 461**—Accelerating Implementation of Transportation Research Results. This must-have desktop reference contains valuable approaches and strategies for implementing research results and contains a number of useful case studies that can help agencies can directly apply to their situation.

**NCHRP Implementation Support Program**—Created in 2014, and building upon efforts incorporated in dozens of NCHRP projects over the years, the Implementation Support Program provides funding for the adoption of NCHRP research products. NCHRP 20-44 empaneled several experts to help select and monitor the Implementation Support Program.

**Research Program and Project Management** (RPPM)—Implementation Section includes research results related to the topic as well as example plans, guidelines, surveys, and other useful tools.

**Technology Readiness Guidebook**—This FHWA guidebook provides the information to agencies interested in using a Technology Readiness Level (TRL) Assessment to help determine the maturity of technologies. This can help with identifying and determining next steps in the research process.

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“How To” Calculate the Value of Research
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Given limited research funding in transportation and increasing questions about the benefits of research, it is absolutely critical to demonstrate the value of research that is conducted. In doing this, we help to ensure future research funding. This value should be expressed in both qualitative and quantitative terms, as appropriate. This is not an easy task. Documentation of the value of research needs to begin in the early stages of the research cycle. It needs to be planned for so that any data needs are addressed early and opportunities are not missed.

1. Background
The Value of Research (VoR) can be calculated in many ways and can be determined for any research project. Value can turn the subjective into the objective, which can often turn uncertainty into support. It also builds stakeholder support for projects and to further research if new phases or possibilities arise. Determining value assists practitioners in investigating benefits that might not have seemed obvious at project inception and thereby identify new advocates. Below is just one example of how the VoR can be calculated for a research project.

While you will not likely determine the value of research projects, your expertise will be needed by your research manager who may lead the effort to determine the value of research. You may provide assumptions, estimates of money and time savings, and other data that is key in determining the value of research.

2. VOR Benefits
The Project Lead will select and “define” the qualitative (Qual) and Economic (Eco) benefit areas based on its association to the project during the proposal period. A few examples of benefit areas are listed below:

<table>
<thead>
<tr>
<th>Benefit Area</th>
<th>Type</th>
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<tbody>
<tr>
<td>Customer Satisfaction</td>
<td>Qual</td>
</tr>
<tr>
<td>Environmental Sustainability</td>
<td>Qual</td>
</tr>
<tr>
<td>Reduced Construction, Operations, and Maintenance Cost</td>
<td>Eco</td>
</tr>
<tr>
<td>Increased Service Life</td>
<td>Eco</td>
</tr>
<tr>
<td>Engineering Design Improvement</td>
<td>Both</td>
</tr>
<tr>
<td>Safety</td>
<td>Both</td>
</tr>
</tbody>
</table>

3. Value of Research Calculations
For the economic selections, variables should be defined (i.e., man-hours, crash and/or severity reduction, life-cycle costs) and details given on how they were determined. The expected value and expected value duration should be included for each. The Net Present Value of all benefit areas is then determined using a Federal discount rate. An aggregate of all economic areas should be generated. Assumptions should be taken into consideration and documented to ensure there is an understanding of what was considered. View a detailed example of benefits calculation.

[ Continues on next page ]
4. Reporting the VOR

In reporting the VoR, a narrative should be written on each of the selected qualitative areas explaining the benefits associated with the research. Economic benefit area calculations should be reported and variables, inputs, and assumptions discussed to validate the estimates of the VoR. Include references and source material as needed. Researchers should highlight and discuss findings of the research that affects VoR benefit areas and how.

5. Available Resources

- **Performance Measurement Tool Box and Reporting System for Research Programs and Projects.** This document was developed to provide State transportation agencies a standardized methodology to follow when measuring the benefits of their research programs. The product was developed by taking research performance measures and some tools to develop the Research Performance Measurement (RPM) System. It takes into consideration the following five categories: outcome measurements, output measurements, resource allocation measurements, efficiency measurements, and stakeholder measurements.

- AASHTO RAC State Representative
- AASHTO Staff
- NCHRP Staff
- Research Staff in your DOT

The complete set of “How To” documents include the following:
- Committee Approach to Research
- Writing a Strategic Plan
- Writing a Problem Statement
- Funding Resources
- Experimental Features
- Sharing Results
- Implementing Results
- Determining the Value of Research
- Monitoring Results
“How To” Monitor Research and Results
A white paper developed for AASHTO committees to provide guidance on research-related activities.

As a part of developing and maintaining a committee research strategic plan, understanding research gaps, and identifying research needs, AASHTO committees need to stay up-to-date on active and recently published research. While TRB is the largest source of information, there are other sources to keep you informed. As each of the following resources has a unique focus, try using as many as possible, as appropriate, when developing a strategic plan or developing research project scope to ensure all relevant information is considered, preventing unnecessary duplication and optimizing future research.

1. TRB Online Resources: Two excellent resources can keep you informed:

- **TRB Transportation Research E-Newsletter:** The Transportation Research E-Newsletter is a free weekly electronic service highlighting recent research publications. You can update your interests at any time to deliver only the most relevant information.

- **TRB Library Snap Searches.** Snap Searches are designed for the busy researcher or professional who would like to quickly get up to speed on complex research topics. They provide a succinct summary of activities in TRB on a given topic including: upcoming events such as conferences and webinars, names of committees working on relevant issues, and a list of recent reports.

**Literature Searches:** For more detailed information on a specific topic, a literature search may be needed. The process of completing a literature search may be best executed by a professional librarian, but this resource provides directions the professionals follow: Literature Searches and Literature Reviews for Transportation Research Projects, including defining the topic, choosing resources to search, choosing search terms and strategy, and organizing the results. For more assistance, contact your agency’s librarian or TRB staff. These are the key resources to search:

2. Ongoing Research

- **RIP:** TRB’s Research in Progress (RIP) Database contains current and recently completed research projects from the state departments of transportation, the U.S. Department of Transportation, University Transportation Centers, TRB, and international organizations. RSS feeds can be set up to push information out to you on specific searches when new information is added. Ask your librarian or IT staff about setting up RSS feeds with your mail system. Every night, RIP is copied into another database called TRID, so you can search both by searching TRID (see below).

- **Websites:** Individual websites may also be searched, including those of state DOTs, universities, and other organizations. State DOT research and development websites can be accessed via the Research Advisory Committee (RAC) to the AASHTO Special Committee on Research and Innovation website.

3. Completed Research

- **TRID** [Transportation Research International Documentation]: TRID contains records in the field of transportation research covering all modes and disciplines, making it the largest resource covering published transportation research. TRID contains links to full text documents and ordering information. RSS feeds can be set up to push information out to you on specific searches when new information is added. Ask your librarian or IT staff about setting up RSS feeds with your mail system.

- **NTL:** The National Transportation Library (NTL) provides an integrated search tool called ROSA P (Repository and Open Science Access Portal) to search TRID Online, NTL catalog, NTL Digital Repository, and other websites either individually or collectively. The NTL offers other resources for transportation information on the home page.

- **Internet Search Engines:** Google and many others cover all subjects, are free, retrieve many results, but provide no quality control. Using a search engine like Google Scholar can increase

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the quality of results as it specifically searches scholarly literature and academic resources.

- **Subscribed Databases:** Your state university or employer may subscribe to several databases that could be of assistance. They provide a level of quality control to their content and cover information in a specific area. Ask a librarian for help. The largest database of library collections in the world is [WorldCat](https://www.worldcat.org).

- **AASHTO RAC Survey Results:** The AASTHO RAC maintains an online database of surveys detailing the state of the practice within a full range of transportation business areas.

**You Can Always Ask a Librarian:** Start with your agency's librarian. If your agency does not have one, consider contacting the [TRB Library](https://www.trb.org) or a university library.

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