NCHRP PROJECT 20-44(09)
QUANTITATIVE AND QUALITATIVE METHODS FOR CAPTURING THE IMPACTS AND VALUE OF NCHRP RESEARCH

GUIDELINES FOR AN EFFECTIVE NCHRP RESEARCH IMPACT ASSESSMENT

Prepared for
National Cooperative Highway Research Program
Transportation Research Board
of
The National Academies of Sciences, Engineering, and Medicine

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1. Introduction

The goal of National Cooperative Highway Research Program (NCHRP) Project 20-44(9) is to deliver guidance for gathering information on the impacts of the portfolio of NCHRP research studies in a systematic way, with consideration of the challenges in doing so. Systematically collected evidence that its research results are being used and are associated with positive impacts for the implementing agencies and their constituencies can provide benefits to NCHRP, such as increased commitment to implementation of NCHRP research results in the future and continued State department of transportation (SDOT) investment in NCHRP, as well as ongoing technical support from the Federal Highway Administration (FHWA). This evidence can also provide positive reinforcement to NCHRP study managers, who may not be aware of the impacts and value of the studies they administer.

This document presents a framework and associated guidelines for NCHRP research impact assessment. This document is a companion document to the NCHRP Report from project 20-44(9), which documents the findings from research activities to develop the framework and guidelines.

Fundamental Concepts

The guidance relies on an understanding of several fundamental concepts.

Research Impact

Research impact is defined in this study as real change in the real world. In terms of transportation, it means outcomes, such as safer roads, less congestion, reduced costs, better decision making, improved business processes, or more efficient operations. The exact impacts from any given research study depend on:

- The problem or specific topic addressed.
- Research products selected to fill a gap in knowledge, method, or tool.
- The pieces of the research results that were implemented.
- Resources available to implement research results.

Research Impact Assessment

Research impact assessment (RIA) is the scientific process of measuring the benefits of applying research results. As a multidisciplinary practice, RIA is in its formative stage but is not new. In many countries around the world, research organizations are starting to use RIA as a practical tool for making decisions in scientific strategy, demonstrating accountability to research funders, and allocating research resources (Adam et al., 2018). However, there is no one methodological solution for doing so. Entities conducting RIA have used a multitude of methods from social science and other disciplines to examine the research process with a view to maximizing understanding of societal, economic, and other benefits.

Research Value

In contrast to research impact, which implies a results chain between research activities and impacts, "value can be thought of as a cumulative benefit, where results are achieved across a system or network" (Australian Academy of Humanities, 2015). Where impact is fixed at points in time, value is dynamic. Measuring research impact is based on study objectives, whereas measuring research value is based on program goals.

Why Assess Impact and Value?

Increasingly, research funders and managers in all fields, including transportation, are interested in assessing the impacts that can be generated by implementation of research results. If positive, these impacts can produce longer-term value for implementing agencies and their broader environments. Documenting this information can confirm the value of research and is critical to engendering continued financial and political support for research.

While SDOTs, other transportation agencies, and private-sector organizations certainly derive value from implementation of NCHRP research results, evidence of derived value is not systematically captured and documented. This limits the ability of NCHRP to communicate powerful and rich stories of impacts and value that constitute a positive return on investment (ROI) for NCHRP funding.

How Are Research Implementation, Impact, and Value Linked?

Positive impacts of NCHRP research may happen in two ways:

- Benefits within an implementing organization (i.e., internal impacts).
- Benefits beyond the implementing organization (i.e., external impacts).

Together, these two manifestations of impact provide value from the program. But positive impacts on transportation cannot occur unless research results are implemented.

What Are Important Considerations in Measuring NCHRP Impact and Value?

Measuring impact and value is not straightforward and comes with a unique set of challenges. Many methodological challenges in RIA are well known to experts (Morgan Jones and Grant, 2013; Guthrie et al., 2013) (see Table 1).

Table 1. Common Methodological Considerations in RIA.

Consideration	Description
Unit of assessment	What is the appropriate unit of assessment given that NCHRP is a historical portfolio of research studies?
Attribution	How do we attribute impacts to particular research projects if research is not done in isolation?
Time lags	When is the right time to assess when the time lag from research completion to implementation and the development of impacts take a long time and can vary by study?
Bias	How can we avoid bias in the selection of studies and implementations for assessment?
Marginal differences	How can we quantify impacts or distinguish high and low impacts when there is no shared understanding or assessment standards yet?
Transaction costs	How can we ensure the benefits of RIA outweigh the costs?

The challenges faced during the design and implementation of RIA by practitioners responsible for managing a portfolio of research are not well addressed in the current literature. For NCHRP RIA, these operational challenges may include finding implementations, attribution, time lag, gathering evidence, bias, and maintaining momentum.

Finding Implementations

NCHRP projects are intended to produce results that will be applied in practice—that is, implemented. Some implementations are readily known to NCHRP, but many go undetected for various reasons. Some research subject areas will lead obviously and directly to implementing agencies, but others may not. So, knowing about the implementation and making it a focus for impact assessment are essential. Identifying implementations of NCHRP research results is not a simple task, not because they are rare but because there is currently no systematic tracking and reporting process to record implementations. This guidance recommends the development and maintenance of a database of implementations that would provide a measure of the value of NCHRP.

Attribution

It is seldom straightforward to attribute an impact, and subsequent value, to a single piece of research. Research implementation is not done in isolation. Agencies may be implementing the outputs of a variety of research projects at the same time. Impacts are also influenced by factors external to an agency. In addition, it is quite possible that the implemented research was built upon other sources of information. Given the attribution challenges, there are limits to the inferences about causality that can be drawn from quantitative data in the form of single metrics. Qualitative, textual information, such as interviews and case studies, may be more useful in ferreting out causality because it brings the richness of varying perspectives from multiple informants.

Time Lag

The time lag from research completion to implementation and the development of impact and value varies enormously. Impacts stemming from a change in bridge design specifications can take place in a short period, whereas the safety impacts from those changes in design standards may take decades to be observed.

Gathering Evidence

Consideration of *evaluability*—whether or not a particular research project implementation was originally designed or structured to enable observation and assessment of impact(s)—must inform the judgment in the choice of implementations selected for such assessments. Gathering evidence of the links among research implementation, impact, and value is often problematic because this evidence has not, in many cases, been systematically collected or may no longer be readily available. Looking forward, NCHRP will be able to reduce this challenge by encouraging implementing agencies to identify, capture, and store the evidence for use in impact assessments.

Bias

Impact assessment comes with the risk of bias. The most obvious is in the selection of implementations for assessment. It will be easy to choose those that seem to be the most successful or are known to have the greatest impact. A similar bias is to select those projects that seem easiest to evaluate with easily quantifiable impacts. Ensuring that sample implementations selected for impact assessment span NCHRP study topic areas will help manage this bias.

Maintaining Momentum

The benefits of systematic assessment of NCHRP are clear: growing and sustaining program support; and guiding improvements in the management, conduct, and dissemination of research. There will also be costs, in terms of personnel effort and money. An important challenge will be to remain focused on the value to be produced by impact assessment, in terms

To derive maximum return, NCHRP needs to devote sufficient resources to maintain a systematic impact assessment effort and to integrate the outcomes into decision making.

of ensuring and enhancing the stream of NCHRP products going forward. This means devoting sufficient resources to deploy and maintain a systematic assessment effort so that it delivers the expected benefits. This also means making some recommended changes to the NCHRP research process to facilitate RIA. It will be important to integrate the outcomes of the RIAs into NCHRP management and decision making and, to the extent possible, into American Association of State Highway and Transportation Officials (AASHTO) priority setting.

Researchers believe that standards and recommendations to guide research program managers and other practitioners on how to effectively design and conduct RIA would prove useful both for practical applications and for establishing a common language to facilitate mutual learning in the global community of practice. This document proposes initial guidelines by systematizing expert and practitioner knowledge.

What Is the Recommended RIA Approach?

Given these considerations, a five-step measurement approach is recommended to effectively capture information on impacts, which can then be integrated to describe value. Brief explanations of the five steps are as follows:

1. **Select studies.** Every two years, a sample of implementations is selected for impact assessment.

2. **Find implementations of selected studies.** Implementations are identified through several different strategies. An evaluability assessment is conducted on implementations to determine whether it is feasible and worthwhile to pursue an impact assessment.

3. **Identify relevant impacts.** Each study in the sample cohort has a defined set of expected internal and external impacts that are derived from the research objectives and should be described in an impact roadmap. Core measures are provided in this report.

4. **Collect and analyze information on impacts.** The basic methodology for collection and analysis of information on impacts follows a hybrid approach that incorporates elements from quantitative (mostly economic) and qualitative techniques. The approach minimizes primary data collection and relies on information that can be gathered from implementing agencies.

5. **Communicate value.** The multidimensional character of the contributions of NCHRP research means that absolute (or quantifiable) valuations are difficult, particularly given the lack of precision of the measurement of value. The findings regarding internal and external benefits will naturally lend themselves to the compilation of narrative stories about NCHRP program benefits. Such stories can effectively communicate the experiences of people involved in implementations and what resulted from them, providing insight and understanding that cannot be quantified, and giving context to implementation activities and impacts.

This recommended approach was derived from research activities for this study that included a review of the literature on RIA in transportation and non-transportation contexts, interviews with key stakeholders to understand their perspectives on NCHRP impact and value, and proof-of-concept tests of possible measurement approaches. By following the guidance in this document, NCHRP will be able to both broaden the vision of what constitutes value and narrow the focus to impacts of specific implementations in ways that enhance NCHRP's biennial reporting of impact and value. Documenting examples of implementations and the impacts within and beyond implementing agencies will enable NCHRP to communicate a more comprehensive and complete story about the value of its research program.

Intended Audiences

NCHRP is a complex research program with many elements. Developing a strategy to assess NCHRP's impact and value is a challenging endeavor. This guidance document distills information from varied sources, both within and outside transportation, to present a straightforward approach for capturing research product impact and value. This document also highlights the challenges and limitations in applying the approach to NCHRP and other research programs.

This guidance is geared toward NCHRP program managers and staff, with the understanding that applying the process will require time, personnel, and funding resources, but the benefits of measuring impact and value are many, including making fact-based decisions on program priorities, having detailed information to buttress research funding from SDOTs, optimizing program activities, and knowing whether the program is fulfilling its mission.

NCHRP sponsors (i.e., SDOTs, AASHTO, and FHWA) should also find this guidance useful, in that these organizations may need to develop a process for measuring the effectiveness of their own research programs. The five-step process outlined in this guidance, and its underlying concepts, can be applied to other research programs. While SDOT research programs differ fundamentally from NCHRP, this guidance can be generalized to serve as a fundamental resource for impact assessment at the State level. As in any technology transfer activity, the framework and guidelines outlined in this document do not need to be applied exactly as described here. The guidelines were specifically developed to be flexible so they can be modified to suit many different contexts.

Members of the National Academies of Sciences, Engineering, and Medicine (NAS) may have an interest in the guidance since the role of NAS is to provide independent, objective advice to inform policy with evidence. The RIA process and its underlying concepts can be applied to research programs outside transportation.

Fundamental Distinction between NCHRP and SDOT Research Programs

NCHRP is an open, national research program. Interest in adoption of research results varies across States based on needs, capabilities, and expected ROI from implementation. Research results could lead to many, few, or no implementations. In the absence of a mandatory process for reporting research uptake, NCHRP managers cannot expect to be aware of all implementations arising from a particular study. Often, they become aware of an implementation anecdotally or opportunistically. In the absence of a comprehensive assessment of all implementations and all their benefits, it is not possible to produce a summative evaluation measure, such as a benefit-cost ratio, for a project or the program.

SDOT research programs operate in a closed system. An SDOT invests in research to solve its specific problems, and research results flow directly to internal implementations. The full set of benefits can be known and captured, enabling traditional ROI calculations that weigh the benefits of a research investment against its cost using cost-benefit analysis, which transforms all benefits (positive impacts) and costs (resources consumed and negative impacts) into monetary terms and produces a single ratio of benefits to costs.

2. NCHRP Research Impact Assessment Framework

The recommended NCHRP RIA framework follows the theoretical and practical guidance found in the broader impact assessment literature, and at the same, the framework has been particularized to fulfill the specific needs of NCHRP.

Pathway to Value

The RIA framework builds upon the conceptual foundation of an impact pathway (Douthwaite et al., 2003) (see Figure 1). A research program like NCHRP is built upon a portfolio of individual research studies. In the recommended RIA framework, the leadership of a research study (i.e., the panel and research team) develops an impact pathway, which is an explicit theory or model of how the project sees itself achieving impact. The project team then uses the impact pathway to guide project management and to target likely implementers of the research results. The impact pathway may evolve, based on learning during project execution. The second stage is an *ex-post* impact assessment sometime after the project has finished, in which the project's impacts (benefits) are assessed. The evaluator seeks to establish plausible links between the project outputs and impacts for implementing entities and the broader context in which they operate. These benefits become evidence of the value of the research study and, by association, of the program's research portfolio.
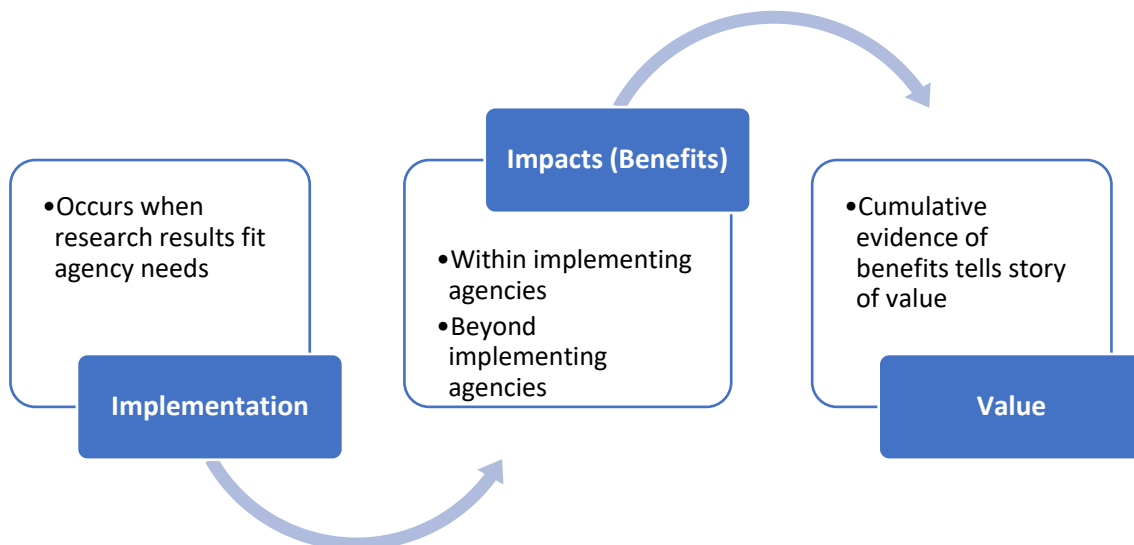
Figure 1. Pathway to Value.

Three key concepts comprising the impact pathway are described as follows:

- **Implementation.** Implementation is the act of putting something into practice and is a fundamental goal of NCHRP. Implementation depends on the fit of the research results to the needs of agencies, and documenting the locations of implementations provides important information on the perceived quality and utility of different NCHRP studies. Implementation is necessary for obtaining impacts.

- **Impacts.** Impact is defined as the expected "provable change [benefit] of research in the 'real world'" (Bayley, 2018). For NCHRP, impacts can happen in two ways: benefits within an implementing organization (i.e., internal benefits) and benefits beyond the implementing organization (i.e., external benefits). Internal impacts are typically changes that occur within the transportation agencies that implement research results. Examples are modifications of strategies, methods, designs, materials, organizational structures or systems, processes, procedures, or policies. External impacts are benefits in the transportation eco-systems from implementing research findings, such as changes in safety, system performance, air quality, cost savings, and equity. An example of an internal-external benefit pair is implementation of a new guardrail design that changes the design practices of the agency (internal) and results in safety benefits, such as lives saved (external).
- **Value.** Value is defined as worth, usefulness, excellence, or importance. Value is estimated from the perspective of the research user and results from the occurrence and capture of positive impacts of implementing NCHRP study findings across a portfolio of research studies.

The simplicity of thinking about this as a linear process is useful when applying a systematic approach for capturing impact and value, but it is more complex. It is an extended, iterative process due to time lags in implementation of research results and to adaptation of research results to agency applications and in broader contexts. The complexity creates challenges for attributing impacts to specific NCHRP research implementations. This is why impact roadmaps are useful tools for determining the pathway to value for research studies.

Impact Roadmaps

Impact roadmaps (or logic models) are an important piece of the RIA framework. An impact roadmap visually depicts the link between a research study's objectives and the expected impacts of research implementation. These are used commonly in RIAs in other disciplines (see references for the Centers for Disease Control and Prevention, Department of Health and Human Services, Innovation Network, and U.S. Department of Agriculture in Appendix A).

Impact roadmaps, a tool that prospectively depicts the link between research objectives and impacts, should be a required element at the start of NCHRP research studies.

Developing an impact roadmap at the start of a research study helps the NCHRP research manager, panel, and contracted research team think about the customers of the research and the necessary conditions for implementation. In the creation of an impact roadmap, the following issues should be considered:

- What are specific research objectives?
- Which agencies are likely to implement the research results?
- What final deliverable formats will be most useful to likely implementers?
- If the results are implemented, what benefits are expected within implementing entities?

- If the results are implemented, what benefits are expected in the transportation system or in a broader context?

The answers to these questions, in turn, may bring about new perspectives among NCHRP, the panel, and the research team that will shape research execution and the development of final deliverables to facilitate implementation. Figure 2 presents the basic elements of an impact roadmap.
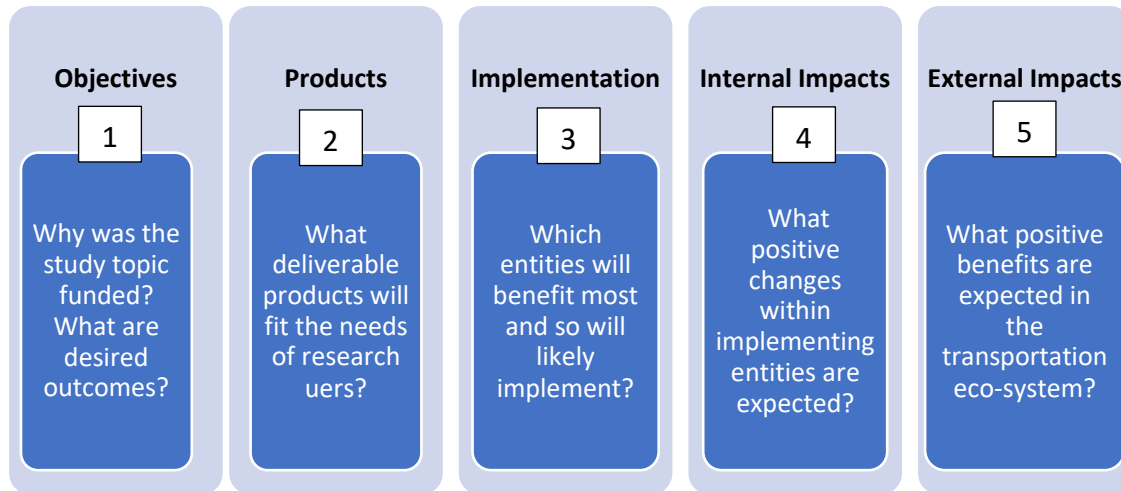
Objectives	Products	Implementation	Internal Impacts	External Impacts
1	2	3	4	5
Why was the study topic funded? What are desired outcomes?	What deliverable products will fit the needs of research uers?	Which entities will benefit most and so will likely implement?	What positive changes within implementing entities are expected?	What positive benefits are expected in the transportation eco-system?

Figure 2. Basic Elements of an Impact Roadmap.

Element 1 is the research objectives. Most NCHRP requests for proposals (RFPs) specify research objectives. Well-defined objectives establish the overall direction and focus for the research and define what the research will achieve in terms of impacts. Impacts should identify the expected results of implementation of the research findings. Elements 2 and 3 focus on deliverables and audiences. Deliverables need to be designed to meet the information needs and format preferences of likely implementing entities. Audiences for NCHRP products are the likely implementing agencies. Attention should be paid to identifying potential implementing agencies throughout research execution. Elements 4 and 5 focus on the research study's expected impacts. The RFP should provide direction in terms of desired benefits of implementing the research results, both internal to implementing agencies and external to them.

Figure 3 illustrates an impact roadmap applied to a specific (hypothetical) research product, the design of a quick-install replacement culvert to restore road operations after washouts. The objective of the research is to guide product definition, which in turn suggests implementation opportunities. From this, the implementation steps are outlined, and expected impacts on agencies' activities are identified. Agency activities and impacts lead, in this case, to specific expectations about impacts on the transportation system, its users, and the affected community. These hypotheses about potential internal and external impacts guide the search for actual impacts in the evaluation process.

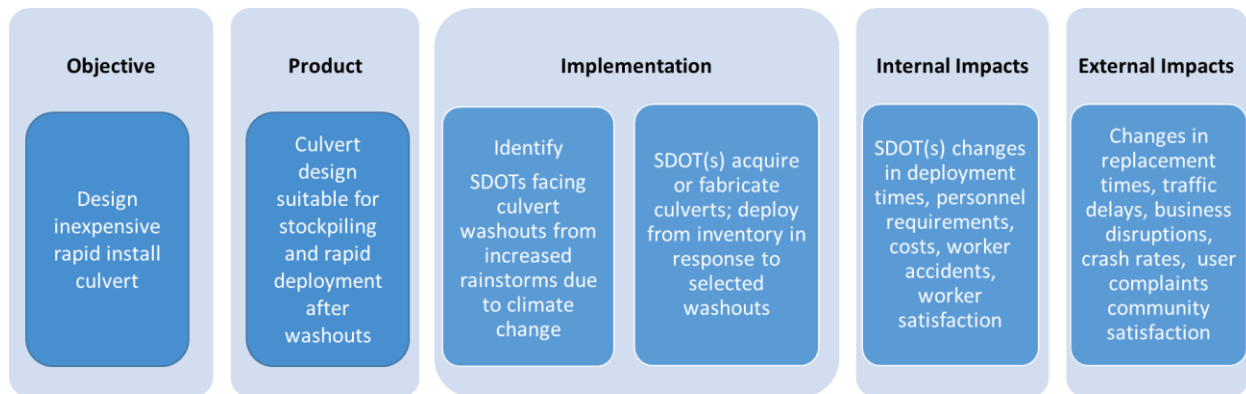| Objective	Product	Implementation		Internal Impacts	External Impacts
Design inexpensive rapid install culvert	Culvert design suitable for stockpiling and rapid deployment after washouts	Identify SDOTs facing culvert washouts from increased rainstorms due to climate change	SDOT(s) acquire or fabricate culverts; deploy from inventory in response to selected washouts	SDOT(s) changes in deployment times, personnel requirements, costs, worker accidents, worker satisfaction	Changes in replacement times, traffic delays, business disruptions, crash rates, user complaints community satisfaction

Figure 3. Example of a Research Impact Roadmap.

3. Guidelines for Effective NCHRP Impact Assessment

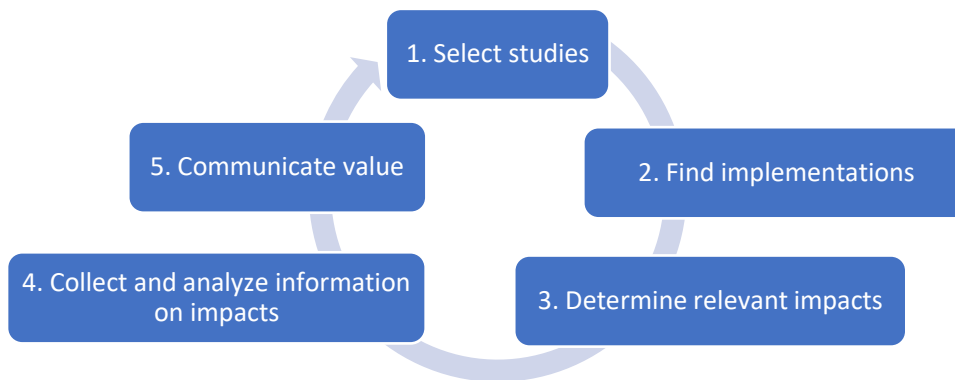This section presents the recommended five-step RIA process (see Figure 4).

Figure 4. Recommended RIA Process.

Step 1: Select Studies

Overview

NCHRP cannot expect to assess the impact and value of all of its studies. It will be necessary to sample from the stream of NCHRP studies. Due to resource constraints (i.e., time, money, and people), NCHRP should select studies for assessment either strategically or opportunistically:

1. **Strategic selection** is based on the expected significance of a study, one that has a high probability of producing both broad and substantial effects on implementing agencies and transportation systems. These should be chosen carefully, with the realistic understanding that not every study will have significant strategic significance. Care must be taken to avoid bias by *only* selecting studies that seem to be especially successful.

2. **Opportunistic selection** is made for studies for which the implementers are obvious or known in advance, providing an easy trail to follow. It will be advantageous, initially, to follow easy paths to build experience and sharpen RIA processes and tools.

Sampling Strategy

Sampling of completed NCHRP studies should be done at a consistent interval (e.g., every year or every two years). A sporadic impact assessment process, occurring at irregular intervals, will not accumulate enough consistent evidence of value to be useful to NCHRP.

The most representative way to sample is by NCHRP study topics, assuring that projects from each cluster are selected over a period of several evaluation cycles. *NCHRP Impact Report 2019* grouped its reporting on NCHRP study topics into eight topic clusters. For consistency of reporting, NCHRP should use these same clusters when selecting studies for RIA. The topics are:

1. **Administration**: economics, law, finance, and agency administration.

3. **Design**: pavements, bridges, general design, roadside development, and vehicle barrier systems.

4. **Maintenance**: snow and ice control, equipment, and maintenance of way and structures.

5. **Materials and construction**: general materials, bituminous materials, specifications, procedures and practices, and concrete materials.

6. **Soils and geology:** testing and evaluation of soils, and foundations and scour.

7. **Traffic:** operations and control, illumination and visibility, traffic planning, and safety.

8. **Transportation planning:** planning methods and processes, and human and natural environment.

9. **Special projects:** all other subject matter not readily identified in the other areas.

Selected projects should have research results available (widely disseminated) for at least three years to permit implementations to occur and important impacts to develop. If the impacts are expected to be primarily external to the agency, a longer waiting period will be necessary.

A particular risk is focusing the evaluation on projects that produce easily measured impacts. NCHRP projects, which are themselves selected based on consensus priorities of SDOTs, cover a wide range of problems and products, ranging from hard, quantitative specifications to soft, qualitative policy guidance. The program evaluation should cover all these project types.

Sampling Interval

Sampling of completed NCHRP studies should be done at a consistent interval (e.g., every year, every two years, or every five years) based on NCHRP resources. Likewise, the number of studies selected for impact assessment will necessarily be based on available resources. The important point is to maintain a systematic, ongoing assessment effort so that it tracks the stream of benefits for NCHRP. A sporadic impact assessment process, occurring at irregular intervals, will not accumulate enough consistent evidence of value to be useful to NCHRP.

A pragmatic sampling strategy might be to evaluate five to eight projects every two years (i.e., a sample cohort) and one or two implementations of each project in the sample cohort.

A practical process might be designed and budgeted to evaluate five to eight projects every two years (referred to as a *sample cohort* in this document).

Step 2. Find Implementations

Overview

Finding implementations is vital to the RIA process. Some implementations are readily known to NCHRP, but many go undetected for various reasons. Some research studies will lead obviously and directly to implementing agencies, but others may not. Therefore, it is important to seek out and document implementations in an ongoing, proactive manner.

The NCHRP RIA should include all study clusters, with different levels of implementation. Partial implementations should not be systematically excluded because they are likely to be most common. Deciding whether enough of the research product has been implemented will be a matter of judgment, but to make a project a candidate for assessment, there should be evidence that core ideas and principles have been adopted and that new or modified practices have been in place long enough to mature. During data collection for the impact assessment, it will be important to determine just what was implemented because it is normal for this to deviate from research recommendations.

Also, aborted implementations should not be systematically excluded because it can be important to report on failed research implementation and the reasons why something did not work. During data collection, why the implementation was aborted and the lessons learned from the attempt should be documented.

Strategies for Finding Implementations

Proactive Outreach to SDOTs by NCHRP

The regular visits to SDOTs by Transportation Research Board (TRB) senior program officers (SPOs) are an active method for teasing out applications of NCHRP research. SPOs could ask a general question about implementations or could target specific research outputs that were particularly well matched with key issues within a State.

Gathering Information Directly from Panel Members, NCHRP Research Managers, and Research Teams

Key sources of information about implementation are oversight panels. Oversight panel members are chosen because of expertise and interest in the topic, and it is not uncommon for them to be, or to know, likely first adopters of research results.

NCHRP research managers have the most direct knowledge of and contact with projects, and their hands-on engagement will be a source of information on likely implementers. In some cases, this knowledge may stem from questions coming to them from the potential implementers once results are disseminated.

Members of research teams may know of implementations of their completed research study results. Would-be implementers sometimes contact research team members for more information, and this information can be passed along to the Research Implementation Support Program. The personal investment of research team members in the project may be motivation enough for them to pass the information along. This motivation might be amplified by explicitly considering a team's implementation record when evaluating proposals for future contract awards.

Self-Reporting

Another way to discover implementations of NCHRP results is to give implementers an easy way to report their use of a research product to TRB. This could be done simply by putting a "report-back implementation" web address or QR code in printed documents. For digital documents, embedded hyperlinks could give a user an easy way to get to a webpage that will invite reporting of a product application. Similar report-back hyperlinks could be routinely

printed/published in publications such as *TR News* and *The AASHTO Journal*. The request can be simple: "Is your organization using the tools presented in NCHRP (project number)? If so, (click here/go to this website) to tell us about it.

Some commercial services provide a platform for researchers to report uses and implementations of their research results. Interfolio's Researchfish (https://researchfish.com/) is one. Some research funding agencies contract with Researchfish to collect researcher reports in multiple categories—including papers in journals and trade publications, news reports, social media, policy studies, and policy actions, among others—to build a 360-degree picture of the effects of a product, finding, or entire research portfolio.

Targeted Surveys Conducted by NCHRP

When a target group of potential implementers can be easily located, such as members of a topic-specific AASHTO committee, TRB committee, or webinar participants, the response rates to requests for survey participation tend to be higher, and the information collected can be accurate and reliable.

Integration into the NCHRP Research Process

A strategy that would not only serve to identify potential implementers but also serve to improve the usefulness of a study's final deliverables is to gather information on likely implementers throughout the NCHRP research execution process. To do this, implementation should be integrated into the entire NCHRP process by identifying likely implementing agencies by type and, where possible, by name during:

- Development of research needs statements (RNSs).
- Priority-setting discussions within AASHTO committees.
- Writing of RFPs.
- Preparation of the amplified work plans by research contractors.
- Production of interim and final deliverable products.

Implementation Database

Once implementations are determined, a record of implementations should be systematically maintained. A new tool for doing so would be an implementation database. The database can be maintained by NCHRP's Research Implementation Support Program. The program provides funding assistance to facilitate implementation of completed and in-development NCHRP research results and products. The database of implementations would serve as an indicator of the value of completed NCHRP research. While it would not be a record of *all* implementations, it would be a documented measure of successes. The database should contain at least the following four data elements:

Documentation of implementations in a database will provide evidence of the NCHRP research value.

- NCHRP project title.
- Topic cluster
- Year of dissemination of research products.
- Implementing agencies.

Evaluability Assessment

Every implementation is not equally suitable for assessment. Evaluability considers the extent to which an impact assessment for a particular implementation can be done in a reliable, credible, and cost-effective fashion. An evaluability assessment saves time and effort by screening out implementations that are likely to be overly difficult to assess because they generate impacts that cannot be accurately or reasonably measured.

The evaluability screening process should assess whether impacts are likely to be detected. The process should be a rapid, qualitative review conducted with information available within NCHRP, along with a discussion with a knowledgeable representative of the implementing agency. In terms of level of effort, it should take no more than a few hours.

To conduct an evaluability assessment, it is necessary to obtain basic information about the implementation by asking one or more key screening questions, listed in Table 2. Most importantly, it is necessary to contact the implementing agencies to identify a key contact person who can help answer the screening questions. Answering the questions is not about a simple *yes* or *no* but more likely involves addressing *to what extent*.

Table 2. Evaluability Assessment Screening Questions.

Screener Question	Answer	Recommended Action
1. Is there an agency representative who is knowledgeable about the implementation and willing to support the impact assessment?	If NO, then…	Drop from sample
2. Are there factors outside of the implementation setting that could prevent the implementation from generating internal or external benefits?	If YES, then…	Consider what these factors are and the extent to which they negatively impact the assessment; if extremely problematic, drop from sample
3. Has the implementation reached a sufficient level of maturity to generate expected internal benefits?	If NO, then…	Consider when timing could be right; if too long, drop from sample or set aside for future consideration
4. Has sufficient time passed so that data on external impacts for an implementation can be obtained? Do these data exist?	If NO, then…	Consider assessing internal impacts only
5. Are there other operational difficulties that would make impact assessment for this implementation particularly difficult and/or costly?	If YES, then…	Drop from sample

While it is important to assess the availability of, access to, and quality of existing information about the implementation, this should not be the sole basis for inclusion in the RIA process. The maturity of the implementation should be considered. The concept of maturity means that enough time must pass since implementation (not the research product dissemination) began so that substantial change *could* have occurred; whether it did or not is the subject of study. At early stages, not much change can be expected. Therefore, one to three years should be allowed after implementation for internal impacts to develop and before in-depth study should begin, depending again on project type and context. For example, recommended changes in design specifications or inspection methods may develop more rapidly than adjustments in

organizational structure or operating policies. External impacts will take longer than internal ones to develop.

Step 3. Determine Relevant Impacts

Overview

Each study in the sample cohort has a defined set of expected impacts that are derived from the research objectives and should be described in an impact roadmap. Where multiple implementations of an NCHRP project are identified, each should be considered its own unit of assessment and results combined after the assessments are completed. Relevant impact should be consistent across implementations for a given study. Not all implementations of a study's research results will have both internal and external impacts. Partial or aborted implementations, for example, may not have external impacts.

Quantitative and Qualitative Measures

Impacts can be measured with quantitative or qualitative metrics. Simply put, the terms *qualitative* and *quantitative* refer to the type of data generated in the research process (Garbarino and Holland, 2009). Quantitative research produces data in the form of numbers, while qualitative research tends to produce data that are stated in prose or textual forms (see the resources in Appendix A for more information.)

Economic analyses tend to use quantitative measures. The two most common forms of economic analysis are benefit-cost analysis (BCA) and cost-effectiveness analysis. The key similarity between BCA and cost-effectiveness analysis is in the collection of data on costs. BCA seeks to determine whether benefits provided were greater than the program (or implementation) costs and requires all benefits to be expressed in monetary terms. Cost-effectiveness analysis is like CBA; while costs are still expressed in monetary terms, benefits are expressed in non-monetary terms, using a common impact metric, such as patents filed or jobs created. As a result, cost-effectiveness analysis requires comparisons among families of programs or implementations to determine which option is the most cost effective (Rogers et al., 2015). Not all quantitative measures are economic. Sample surveys produce quantitative data that can be statistically analyzed with the main aim of measuring, aggregating, or modeling attitudes or opinions regarding impacts. Computations of accident or fatality rates are other examples of relevant quantitative measures.

Qualitative measures, in contrast, generally describe and explore issues in depth. Qualitative research includes techniques such as participant observation and interviews that are often group based. Using open-ended questions, these methods are designed to capture judgments and perceptions and allow complex analyses of often non-quantifiable cause-and-effect processes (Garbarino and Holland, 2009).

Quantitative metrics are important for describing and characterizing the impacts of research implementation, such as changes in construction costs, pavement roughness, trained personnel recruited, or timely snow removal crew performance. Where metrics are available as evidence of impacts of research implementations, they should be presented along with baseline data describing the before-implementation situation so that change attributable to the

implementation can be captured. Any additional information on the context of the implementation data will be valuable for understanding the degree to which the impact has taken place and can be attributed to the research implementation.

For some NCHRP projects, quantitative metrics alone may not convey the full set of impacts. For such projects, qualitative impacts can contribute to understanding the value of research implementation. For this reason, qualitative impacts must be included in the characterization of impacts. For some research projects, these may be the most important outcomes.

Internal Impacts

Internal impacts are the benefits of implementing research results within an agency. A wide range of possible impacts internal to agencies can result from NCHRP research, so it is necessary to determine which of them are relevant for the studies selected. Table 3 presents a core set of possible agency benefits (i.e., the most common ones); however, these do not capture the universe of potential agency benefits. Due to the diversity of NCHRP research topics, the universe is impossible to enumerate here. Also, for any implementation evaluated, multiple measurable internal impacts are possible.

Table 3. Examples of Potential Expected Internal Impacts of Implementations.

Internal Impact	Type of Measure	Potential Metric
Knowledge increase	Qualitative	Perceived benefit of new knowledge gained
Engineering/administration savings (planning/design costs and paperwork)	Quantitative/ qualitative	Perceived or quantified cost/time savings due to process or practice improvement; perceived quality or accuracy improvement
New design technical standard	Quantitative	Extension in life cycle or decreased life-cycle costs
Construction savings	Quantitative	Δ $ agency savings (labor, equipment, and time)
Agency operation/maintenance savings	Quantitative	Δ $ agency savings (per worker or per week/month or per assignment, task, or project)
Better decision support	Qualitative	Perceived improvement in efficiency; effectiveness of data and analytical tools for supporting agency decisions
Worker safety	Quantitative	Δ rate of agency worker injury (per worker or per week/month); number of workers affected
Worker productivity	Quantitative	Δ agency performance per worker; number of workers affected
Workforce development	Qualitative	Extent to which agency staff perceive improvements attributable to training/education
Workforce diversity	Quantitative	Δ ratio of participation by minority or disadvantaged population groups; number affected

External Impacts

External impacts are benefits that accrue to the transportation eco-system stemming from an agency implementation of NCHRP research results. While the internal impact assessment tells what kind of change has occurred in an agency, an external impact assessment paints a picture of what might be the ultimate and perhaps most important effects of a research implementation on a broader scale—changes to the characteristics and performance of the transportation system and the effects on its users and community. Measuring external impacts,

along with internal ones, enables NCHRP to communicate a comprehensive and complete story about the value of research implementations of NCHRP studies.

Table 4 presents the most common types of external impacts and associated measures. This list is not comprehensive, and applications of this guidance will need to look broadly for external impacts. The impact roadmap will be helpful here. Multiple impacts are possible for a single NCHRP study, with a wide range of possible ways in which they can occur and be measured. To make the information collection and analysis reasonable in terms of cost and time, these processes need to focus on the impacts considered to be most likely and most important.

Table 4. Potential Expected External Impacts of Implementations.

External Impact	Type of Measure	How Measured
System performance	Quantitative	Δ (change) in transport level of service, reliability, speed, delay, number served, and connectivity
System cost	Quantitative	Δ $ user savings (per capita, trip, vehicle-mile, or passenger-mile)
System revenue	Quantitative	Δ $ generated (per capita, trip, vehicle-mile, or passenger-mile)
System safety	Quantitative	Δ rate of collision, injury, or death (per vehicle-mile or passenger-mile)
System productivity	Quantitative	Δ $ outcome/$ invested (cost-effectiveness)
Environment	Quantitative	Δ emissions rate (for air or water), noise, or regional quality index
Quality of life	Quantitative/ qualitative	Δ index or rating for traveler comfort or broader quality of life; assessment by community leaders and stakeholders
Equity	Qualitative/ quantitative	Δ availability and quality of service for under-served groups (relative to well-served groups)
User satisfaction	Quantitative	Δ satisfaction rate from surveys

When attributing external impacts to NCHRP research, there should be a documented and specific connection between intervention and outcome. For example, when the NCHRP report is an evaluation of cable median barriers, an SDOT implements them while referring to the NCHRP report, and median crossover deaths go down, the attribution is clear.

But attributing external impacts to specific NCHRP research implementations is not always this clear. The impact roadmap is an important tool for establishing a plausible causal pathway but may not be sufficient. Impacts occur through a complex variety of processes, individuals, and organizations that may reference, use, adopt, or build upon the NCHRP research. In addition, it is quite possible that the original NCHRP research was itself built upon other sources of information and lessons learned from the experiences of other processes, individuals, and organizations. There will be cases in which external impacts occur as an indirect consequence of NCHRP projects, and those indirect effects will tend to be missed when applying the roadmap (logic model) to identify the directly relevant impacts. For example, an NCHRP study on the use of license plate readers for transportation data collection purposes may have data collection cost savings as a desired external impact. This impact may be directly measured. But the research could also lead indirectly to an improvement in safety, depending on when and how the license plate reader technology is applied, for example, by avoiding putting field personnel at risk or disrupting traffic flows. Such safety impacts may be missed because of the indirect connection to the NCHRP study itself. For these reasons, it is seldom straightforward to

attribute an impact to a single piece of research or to even isolate the contribution made by that research.

Step 4: Collect and Analyze Information on Impacts

Overview

The basic methodology for collection and analysis of information on impacts follows a hybrid approach that incorporates elements from quantitative (mostly economic or performance-related) and qualitative techniques. The general process is:

1. Select an implementation for a given study.

2. Formulate a checklist of information to be gathered based on the expected internal and external impacts and metrics from Table 3 and Table 4, respectively, in step 3 and guided by the logic model (impact roadmap).

3. Find an inside collaborator who knows the implementation in detail (see "Evaluability Assessment" in step 2), and recruit four or five other knowledgeable agency staff to talk with—the implementation leader, support staff, relevant technical expert, or manager.

4. In a group interview setting, obtain perceptions on expected impacts, as well as any surprising, internal, or external impacts, both positive and negative.

5. Gather documentation for impacts that have been quantified by agency staff. If important quantitative metrics are missing, ask agency staff to attempt to quantify the benefits (e.g., assign a monetary value or performance evaluation rating) through subjective assessment (see the methodology for doing this in "Subjective Assessments" in this step).

6. Review gathered information and data; identify unanswered questions, conflicts, and uncertainties about impacts; and talk with individuals to clarify.

7. Formulate a draft impact report as narrative supported by quantitative metrics, using the template supplied in Appendix B.

8. Cycle the draft back to interviewees for reviews, correction, and ratification.

It is important to ensure that enough time has passed from the actual implementation of research results for agency impacts and, more importantly, broader transportation eco-system benefits to occur. The timing may differ based on the external impact category of interest. There is no set rule for identifying when the time is right; it is a matter of judgment for the evaluator and the implementing agency.

Sources of Information

The target of the data collection task is three types of information:

- Impact data from agency operations and administrative records.
- Agency performance measures.
- The views of those engaged in and experiencing the implementation.

With multiple sources of data, the evaluator can draw a more complete picture of what occurred and why. The search for information about the implementation should be guided by expected relevant impacts (as discussed in step 3). The goal is to build an understanding of the outcomes of the implementation, based as much as possible on the perspectives of those involved in the implementation. Then, narratives, including and informed by available objective data, are used to describe the impacts of the research implementation; embedding this information in a narrative will create a comprehensive story about the benefits of the research for an implementing agency's context.

Qualitative Interviews

Key sources of information are group interviews (not surveys) with the people who were involved in the specific sampled implementation. Group interviews are an efficient method for gathering multiple perspectives, and interactions among group members can amplify the information derived from the discussion. The project champion within the agency often has the most knowledge about the implementation's successes and failures. The project champion may also bring a biased perspective, so she/he alone should not be the sole interview target. Interviewing four or five other persons for each implementation is recommended. Site visits for interviews are desirable, but most interviews can take place via telephone, video conference, or webinar. Interviews should be planned in advance, structured to address both impacts expected from the project roadmap as well as other important outcomes and uncertainties. Other sources of information are observations and document reviews. The goal is to collect and present information from multiple sources in sufficient detail so that a critical audience will understand the research implementation story and find it credible.

Document Reviews

Documents are likely to be the primary source of quantitative data on impacts. Relevant documents are agency maintenance, construction, operations, or personnel records, depending on the expected impacts.

Quantitative Performance Measures

Many of the required impact measures can be found among the data collected and analyzed for SDOT performance management programs.[1] Using or adapting this information will reduce the need for costly, incremental data collection and analysis. It is important, as much as possible, to draw the measures of impact from the performance measures that are available from the implementing agency or its partner agencies. Any new data collection activity to populate the measures must be carefully considered and discussed with the specific implementing agencies to make the best use of the effort of the evaluation team and agency personnel.

Subjective Assessments

Even if quantitative sources of data on impact are available, subjective assessments should also be used to assess impact. *Subjective* refers to information that is based on personal opinions. It

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[1] See SDOT performance measures in an interactive map at
https://www.fhwa.dot.gov/tpm/tellingperformancestory/tpmstory_map.cfm.

is contrasted with *objective*, which refers to information that is based on factual evidence (e.g., the performance measures in the preceding paragraph).

Agency staff should be asked to assign a numeric rating to indicate the potential significance of the research results in terms of the applicable impact factors. Nominal scales are typically used in which numbers or letters serve as tags or labels to identify or classify an object (e.g., 1, 2, 3… or A, B, C…). These numbers or letters should be anchored or explained with verbal descriptions to promote consistency, such as with the five-point grade scale (A–F) used in most public schools. Figure 5 is an example of a subjective scoring tool. Specific questions are drawn from the research products being evaluated and their associated objectives—the expected impacts of the research.

Example Agency Value Assessment NCHRP Synthesis 564: Practices for Selecting Pedestrian and Bicycle Projects					
	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
Helped select project selection approach	___	___	___	___	___
Application worked smoothly	___	___	___	___	___
Confidence in selected project was high	___	___	___	___	___
Engaging other stakeholders was valuable	___	___	___	___	___
Selected method brought agency value	___	___	___	___	___

Figure 5. Nominal Scale from NCHRP Synthesis 564.

Scoring or rating is best done using odd-number scales so there is a natural midpoint, and the ends should be labeled to represent the least and most desirable impact values. There are different approaches to the group scoring, where judgments are averaged over several (e.g., three to five) raters:

- **Collaborative scoring.** Scores are determined by a knowledgeable group (participants or observers) in an interactive setting, such as a meeting or focus group. This builds agreement and develops shared explanatory details.
- **Independent scoring.** Scores of separate raters are aggregated. This promotes independence of views and prevents bias that might be created by a dominant rater, such as a unit manager or advocate for the research product. Scores should be supported by brief text explanations from the raters. This helps a rater think through the choice of score and provides supporting evidence.

The Kansas Department of Transportation uses subjective assessment in its prospective RIA process. Research staff assign a numeric rating to indicate the potential significance of the research results in terms of the applicable impact factors. The applicable benefit categories are rated from 1 to 10, with 10 representing the most significant positive benefit. The ratings are:

- NA: the factor does not apply to this project.

- 0: absolutely no benefit.
- 1: an intuitive feeling that the project has some slight benefit.
- 5: no clear evidence but a strong subjective feeling that the project has a significant positive benefit.
- …
- 10: clear evidence or a strong feeling that the project has an excellent or outstanding, positive benefit.[2]

Characterizing and Reporting the Impacts

Qualitative impacts can be described in specific, credible, and consistent terms. Quantitative impacts can be documented with numbers (see the resources in Appendix A). Appendix B provides a suggested research impact report template.

An important source of bias in characterizing research impacts is ignoring or downplaying qualitative research outcomes. Among these risks are that:

- The full value of the research implementation will not be captured; evaluators will measure the measurable rather than the value of the research.
- Projects that produce high value for agency leadership and the community may be ignored or de-emphasized. Over time, this may bias the direction of the overall program away from projects that might deliver such qualitative value.

Step 5. Communicate Project and Program Value

Overview

Value in this context is the cumulative benefit, where results are achieved across a program of research. Value is based on achievement of program goals. NCHRP goals are to "help state DOTs effectively plan, design, construct, operate, and maintain their surface transportation network while keeping workers and the traveling public safe, providing or improving mobility, and contributing to the economic vitality of communities and the nation" (NCHRP, 2020).

At the project level, value is further refined based on the objectives of specific research projects. The multidimensional character of the contributions of NCHRP research in meeting these goals means that absolute (or quantifiable) valuations are difficult, particularly because of the breadth of objectives and impacts expected from projects, individually and collectively. Precision in valuation is particularly problematic with assessments of quality, which are essential for research, but may vary among research stakeholders. This introduces the need to use expert judgment in making comprehensive research value assessments, which is the approach taken in this study—including structured questions, group assessment to collect multiple perspectives, and aggregation techniques to manage bias.

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[2] This approach has been adapted from the Kansas Department of Transportation.

Approach

The approach for communicating value is based on the concept of a pathway to value discussed in Chapter 2. This concept is predicated on a results chain that connects the activity from dissemination of research results, through implementation, to impacts and then value, with attention focused on including all important sources of value. Information on which to assess value comes from the findings about internal and external impacts. These findings will naturally lend themselves to the compilation of narrative stories about NCHRP program benefits, stories that encompass both quantitative impacts and subjective assessments by experts. Such stories can effectively communicate the experiences of experts involved in implementations and their results, providing insight and understanding that cannot be quantified, and giving context to implementation activities and impacts.

Reporting of stories is an important component of communicating research value. When presented with a story, both sides of the brain work to process the words, interpret the story, and store its meaning in memory, making the brain behave as if the events in the story have been experienced firsthand (Keene et al., 2016). The research impact template provided in Appendix B will guide preparation of the stories of NCHRP program value.

The product is a narrative discussion that tells the story of the impacts of the research, wrapped around those quantitative measures of impacts that are available. The narrative is a description of *what happened* because of the research implementation and the *value* of what happened, either explicitly measured or in the form of an integration of subjective perspectives.

The research impact reports and associated narratives should be archived in categories of research topics. This way, NCHRP can accumulate evidence of research value for clusters or streams of research. When the accumulated evidence has reached a critical mass, such as three to five assessments of individual projects, particularly where a shared pattern of impacts and values is found, a special report on research value can be produced for a particular cluster or stream of research.

4. Key Recommendations for Evaluating NCHRP Research

Importance of Documenting the Value of Research

The primary recommendation of this study is that NCHRP will benefit from routine, systematic evaluation of its impacts on transportation agencies and the transportation system. Such an evaluation will confirm and document the value of the program and its projects, and will provide useful information for guiding the management of the program itself.

Based on research and experience in many fields, and the experience of NCHRP itself, researchers concluded that while such evaluations are not particularly easy and not without cost, they are feasible and worthwhile, especially if there is a long-term commitment to evaluation, because research impacts do not occur quickly. For many of the projects in the NCHRP portfolio, benefits accrue over long periods of time and from the synergistic effects of multiple, related research projects.

Evaluation of research should focus on uptake of products and the impacts and values created. This is a different focus than performance of the research itself—for example, whether a project has been completed and whether it is on schedule and within budget. These are relevant for operational management of a research program while projects are in progress, but the ultimate value of research will be determined by how the research results bring benefits to agencies, the transportation system, and society. These are the most important questions and also the most challenging to answer.

Implementation Is the Path to Research Value

The first and most important step in evaluating the impacts of research is identification of implementations—value is produced when results are implemented. Identifying implementation is not simple and tends to be done serendipitously. It will be important to use multiple channels for identifying implementations—outreach, tracking, and networking—and in the long run, creating a culture among transportation agencies and other entities of reporting to NCHRP managers routinely when they implement NCHRP research. Implementation of research results is an indicator of the perceived or expected value of the research; implementation by multiple agencies is itself a strong confirmation of the value of the research.

Assuring Feasibility of the Evaluation

Evaluability assessment is an essential tool to determine if it is feasible and cost-effective to evaluate an implementation. Evaluability assessment is a screening process that addresses whether agency access and cooperation can be secured, whether the implementation is mature enough to have produced significant impacts, and whether major obstacles would make evaluation difficult or impossible. Evaluability assessment assures that resources for evaluation will be effectively used.

Searching for Impacts

An active search is required to find measures and indicators of research impact and value. This is not a random process. The objectives and task statements of the research project itself should guide the development of an impact roadmap, a logic model that defines the path and processes through which impacts occur. Impacts themselves can be both internal and external to implementing agencies: research can help agencies perform better and, in some cases, can help the transportation system itself perform better. Ignoring either of these impact categories will prevent important value from research from being counted.

Mapping the Impact Process

Research roadmaps (logic models) are qualitative, graphical models or sketches that define and explain the process by which impacts are produced and value is created. As such, they serve as practical guides in the search for those impacts. These roadmaps should be initiated during or even prior to the research process, and will usually evolve during the course of the research as the vision of products and implementation sharpens. Such logic models not only facilitate evaluation by telling us where and how to look for research impact values, but they can also help mold the research by identifying barriers to successful implementation, thus amplifying the value of the products.

Impacts in Numbers and Words

The values produced by NCHRP research come in both qualitative and quantitative dimensions. Excluding qualitative research impacts—focusing solely on easy-to-measure quantitative impacts (e.g., saving lives or costs)—risks excluding important policy and management benefits coming from some research, particularly answers to questions coming from agency leadership and its community constituencies. Systematic description and scoring of qualitative research impacts will bring them into the evaluation process.

Benefits and Costs of Research

BCA is useful as a framework for evaluating NCHRP research, but strict monetary evaluation will rarely be possible because it is unlikely that NCHRP will be able to monetize all of the benefits. Still, conceptually comparing benefits and costs offers a good paradigm for evaluating research projects.

Importantly, a summative evaluation of NCHRP using a BCA framework is not feasible because it would require identifying all of the implementations of the program and capturing their benefits. The nature of NCHRP and its constitutive projects is that impacts will be dispersed, will develop (and continue to develop) over an extended period of time, and most importantly will

not all be identified and included in the evaluation. One can know all of the costs of conducting and disseminating the research but not all of the benefits.[3]

Seeking Research Value by Strategic Sampling

Still, it will be possible to develop an understanding of program value by strategic sampling of evaluation targets. For example, by sampling clusters of closely related projects, it will be possible to show the totality of research impacts in a specific area, such as asphalt pavement durability or pedestrian crossing safety research. Alternatively, by sampling projects from across the domain of NCHRP, an image of the value of the overall program can be assembled.

What Is Missing

When conducting an evaluation of a research project or program, it is important to be aware of what might be left out because of obstacles to identification, measurement, or monetization of impacts. Where such exclusions are known and important, some effort should bring them into the narrative description of a project.

Tuning NCHRP to Support Evaluation

Finally, there are lessons in this research for the development and conduct of NCHRP research that will facilitate future evaluation of the program and its projects, thus amplifying its value. In developing research projects (RNSs, RFPs, proposals, and project reports), the outcomes, impacts, and potential user organizations should be explicitly identified to maintain a focus on implementation and production of value. A systematic process for tracking research implementation is needed. Evaluation should become routine and regular, rather than sporadic.

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[3] This is importantly different from evaluating an SDOT transportation research program, where all of the costs and benefits are internal to the agency and its constituencies. This facilitates a comparison of all of the costs and all of the benefits of SDOT research. Under these circumstances, almost all of the strategies presented here are applicable to SDOT research programs.

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Appendix A: Resource List

This appendix includes a listing of publications and guides on topics introduced in this guidance document.

Case Studies

Colorado State University. "Case Studies."
https://writing.colostate.edu/guides/guide.cfm?guideid=60.

Impact Roadmaps (Logic Models)

Administration for Children and Families. *Basic Logic Model Template.*
https://www.acf.hhs.gov/sites/default/files/documents/logic_model_with_definitions_and_blank_template_0.docx.

Centers for Disease Control and Prevention. 2018. "Logic Models: CDC Approach to Evaluation."
https://www.cdc.gov/eval/logicmodels/index.htm.

Innovation Network. *Logic Model Workbook.*
https://www.innonet.org/media/logic_model_workbook_0.pdf\.

Kellogg Foundation. *Logic Model Development Guide.*
https://www.wkkf.org/resource-directory/resources/2004/01/logic-model-development-guide

U.S. Department of Agriculture. 2015. "Logic Model Planning Process."
https://nifa.usda.gov/resource/logic-model-planning-process.

Evaluability Assessment

Centers for Disease Control and Prevention. 2016. "Evaluability Assessments."
https://www.cdc.gov/eval/tools/evaluability_assessments/index.html.

Methods Lab. *Evaluability Assessment for Impact Evaluation*.
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Vaessen, J. 2017, June 13. "Evaluability and Why It Is Important for Evaluators and Non-evaluators." World Bank Group. https://ieg.worldbankgroup.org/blog/evaluability.

Economic Analysis Methods

Rogers, P., A. Hawkins, B. Macdonald, A. Macfarlan, and C. Milne. 2015, November. *Choosing Appropriate Designs and Methods for Impact Evaluation.* Australian Government, Office of the Chief Economist.
https://www.industry.gov.au/sites/default/files/May%202018/document/pdf/choosing_appropriate_designs_and_methods_for_impact_evaluation_2015.pdf?acsf_files_redirect.

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Qualitative Analysis Methods

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Sage Publications*. Qualitative Research: Defining and Designing*. https://www.sagepub.com/sites/default/files/upm-binaries/48453_ch_1.pdf.

Meyrick, J. 2006. "What Is Good Qualitative Research?" *Journal of Health Psychology,* Vol. 11, No. 5, pp. 799–808. https://journals.sagepub.com/doi/pdf/10.1177/1359105306066643.

Transportation Performance Measures

Federal Highway Administration. 2021. "Transportation Performance Management." https://www.fhwa.dot.gov/tpm/.

Appendix B: Impact Report Template

Project Information NCHRP Project Number and Title: Project Objectives (from RFP): Dissemination Date:
The Implementation Implementing Agency: Implementation Start Date: Motivation for the Agency to Implement the Research (e.g., the Problem(s) to Be Addressed): Description of What Research Results Were Actually Implemented:
Summary of Internal and External Impacts Narrative description of the internal impacts on the agency and the benefits they brought. Describe who, what was affected and how, magnitude and scope of changes, and key factors driving or limiting changes. If external impacts were addressed, provide narrative description of them, including who, what was affected and how, magnitude and scope of changes, and factors driving or limiting changes.
Supporting Evidence Briefly outline the evidence that supports the findings on internal and external impacts: quantitative measures illustrating changes, descriptive reports, and results of interviews with key participants, including quotes of key personnel interviewed (cite title or function, not names). Present relevant contextual information about the implementation, such as factors that affected the impacts (state of the agency and depth of the problem), positively or negatively. Provide evidence that supports attributing internal and external changes to the research results, such as describing the processes linking research results to internal and external change, following the research roadmap, providing event timelines, and including citations from reports and quotes from key players.

Subjective Assessment

    A. Substantial Benefits (e.g., Significantly Revised Operations, Policies, Processes, etc.).

    B. Major Benefits (e.g., Improved Operations, Policies, Processes, etc.).

    C. Minor Improvements (e.g., Savings, Productivity, Knowledge, etc.).

    D. Unclear or Contradictory Impacts.

    E. Expected Impacts Not Realized.

Provide a supporting rationale for the grade, in terms of the value of the research to the agency and its constituencies, in comparison to implementation costs and effort. End the report with a single-sentence description of that value.