NCHRP

NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

2016 Annual Report

TRB TRANSPORTATION RESEARCH BOARD
The National Academies of
SCIENCES · ENGINEERING · MEDICINE

NCHRP

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Research sponsored by the American Association of State Highway and Transportation Officials
in cooperation with the Federal Highway Administration

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2016

NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

Systematic, well-designed research is the most effective way to solve many problems facing highway administrators and engineers. Often, highway problems are of local interest and can best be studied by highway departments individually or in cooperation with their state universities and others. However, the accelerating growth of highway transportation results in increasingly complex problems of wide interest to highway authorities. These problems are best studied through a coordinated program of cooperative research.

Recognizing this need, the leadership of the American Association of State Highway and Transportation Officials (AASHTO) in 1962 initiated an objective national highway research program using modern scientific techniques—the National Cooperative Highway Research Program (NCHRP). NCHRP is supported on a continuing basis by funds from participating member states of AASHTO and receives the full cooperation and support of the Federal Highway Administration, United States Department of Transportation.

The Transportation Research Board (TRB) of the National Academies of Sciences, Engineering, and Medicine was requested by AASHTO to administer the research program because of TRB's recognized objectivity and understanding of modern research practices. TRB is uniquely suited for this purpose for many reasons: TRB maintains an extensive committee structure from which authorities on any highway transportation subject may be drawn; TRB possesses avenues of communications and cooperation with federal, state, and local governmental agencies, universities, and industry; TRB's relationship to the National Academies is an insurance of objectivity; and TRB maintains a full-time staff of specialists in highway transportation matters to bring the findings of research directly to those in a position to use them.

The program is developed on the basis of research needs identified by chief administrators and other staff of the highway and transportation departments and by committees of AASHTO. Topics of the highest merit are selected by the AASHTO Standing Committee on Research (SCOR), and each year SCOR's recommendations are proposed to the AASHTO Board of Directors and the National Academies. Research projects to address these topics are defined by NCHRP, and qualified research agencies are selected from submitted proposals. Administration and surveillance of research contracts are the responsibilities of the National Academies and TRB.

The needs for highway research are many, and NCHRP can make significant contributions to solving highway transportation problems of mutual concern to many responsible groups. The program, however, is intended to complement, rather than to substitute for or duplicate, other highway research programs.

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PHOTOGRAPH CREDITS

Cover: Roads and bridges through our national parks. Clockwise from left: (1) Scenic Byway 12, Bryce Canyon National Park, Utah (courtesy of Janet Reffert); (2) New River Gorge Bridge, New River Gorge National River, West Virginia (courtesy of Ryan Stanton, CC BY-ND 2.0); (3) U.S. Highway 191, Yellowstone National Park (courtesy of U.S. National Park Service); and (4) U.S. Highway 89, Yellowstone National Park (courtesy of U.S. National Park Service).

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REPORT DESIGN AND CONTENT

CTC & Associates LLC in collaboration with TRB.

The National Academies of
SCIENCES • ENGINEERING • MEDICINE

The **National Academy of Sciences** was established in 1863 by an Act of Congress, signed by President Lincoln, as a private, non-governmental institution to advise the nation on issues related to science and technology. Members are elected by their peers for outstanding contributions to research. Dr. Marcia McNutt is president.

The **National Academy of Engineering** was established in 1964 under the charter of the National Academy of Sciences to bring the practices of engineering to advising the nation. Members are elected by their peers for extraordinary contributions to engineering. Dr. C. D. Mote, Jr., is president.

The **National Academy of Medicine** (formerly the Institute of Medicine) was established in 1970 under the charter of the National Academy of Sciences to advise the nation on medical and health issues. Members are elected by their peers for distinguished contributions to medicine and health. Dr. Victor J. Dzau is president.

The three Academies work together as the **National Academies of Sciences, Engineering, and Medicine** to provide independent, objective analysis and advice to the nation and conduct other activities to solve complex problems and inform public policy decisions. The National Academies also encourage education and research, recognize outstanding contributions to knowledge, and increase public understanding in matters of science, engineering, and medicine.

Learn more about the National Academies of Sciences, Engineering, and Medicine at **www.national-academies.org**.

The **Transportation Research Board** is one of seven major programs of the National Academies of Sciences, Engineering, and Medicine. The mission of the Transportation Research Board is to increase the benefits that transportation contributes to society by providing leadership in transportation innovation and progress through research and information exchange, conducted within a setting that is objective, interdisciplinary, and multimodal. The Board's varied activities annually engage about 7,000 engineers, scientists, and other transportation researchers and practitioners from the public and private sectors and academia, all of whom contribute their expertise in the public interest. The program is supported by state transportation departments, federal agencies including the component administrations of the U.S. Department of Transportation, and other organizations and individuals interested in the development of transportation.

Learn more about the Transportation Research Board at **www.TRB.org**.

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PREFACE

By Christopher Hedges
Manager
National Cooperative Highway Research Program

This year's cover celebrates the 100th anniversary of the National Park Service. President Woodrow Wilson signed a bill that created the Park Service on August 25, 1916. Its first director was Stephen Mather, a businessman and conservationist who led a campaign to create an agency to oversee America's national parks. According to popular accounts, Mather wrote a letter to the Department of the Interior in 1914 protesting the deteriorating conditions in several national parks. The Secretary of the Interior allegedly responded "Dear Steve, If you don't like the way the parks are being run, come on down to Washington and run them yourself."

The formation of the National Cooperative Highway Research Program (NCHRP) in 1962 was not unlike that of the Park Service, in that a small group of visionaries recognized a need and decided to do something about it. Construction of the Interstate highway system was under way and traditional highway problems were about to become a lot more complex. At the same time, responsibility for highways in the United States was more decentralized than for any other public service, and no single agency had the mandate or the resources to meet the growing demands. Moreover, individual state highway research efforts had become highly duplicative, with limited sharing of results and few opportunities for conducting cooperative research. In 1959, American Association of State Highway Officials (AASHO) Executive Director E. H. "Ted" Holmes published a paper noting that 32 states were researching the same topic. This led to a conversation between Holmes and Alfred E. Johnson of the Bureau of Public Roads and the concept of NCHRP was born. Discussions between the Bureau of Public Roads, AASHO, and the Highway Research Board [today the Federal Highway Administration, the American Association of State Highway and Transportation Officials (AASHTO), and the Transportation Research Board] led to a three-way agreement between these three organizations that created NCHRP and the states agreed to fund it with voluntary contributions.

Over the years, NCHRP conducted a great deal of research on the unique needs of low-volume roads and highways that were directly relevant and applicable to our national parks. NCHRP investigated pavement design and construction for rural areas, ways to improve safety, and how to predict travel demand and economic impacts in areas in and around our

national parks. Studies have looked at speed reduction techniques for rural high-to-low speed transitions and provision of emergency medical services response to motor vehicle crashes in rural areas.

In 1966, the National Park Service was given the responsibility to maintain a National Register of Historic Places under the National Historic Preservation Act. State and federal transportation departments were required to evaluate National Register eligibility as a critical component of compliance with Section 106 of the National Historic Preservation Act and Section 4(f) of the Department of Transportation Act. It became evident that there were inconsistencies in how the requirements were interpreted and implemented by different agencies, and NCHRP research led to more effective application of the Section 106 and 4(f) requirements.

This year, NCHRP continues to address a number of key national needs at a strategic level. The program is developing "research roadmaps" in the areas of resiliency, freight movement, transformational technologies, and transportation and public health. These roadmaps will identify the most pressing needs facing the departments of transportation (DOTs) in these critical areas and will develop research problem statements that will feed into NCHRP and other research programs.

NCHRP is also moving forward with a greater emphasis on the implementation of its research results. A full-time implementation coordinator position has been filled to work with project panels, state DOTs, and AASHTO committees to identify and fund activities to facilitate and expedite the deployment of needed NCHRP research results.

This balance of strategic research and getting practical results put into immediate practice will keep NCHRP vital and fulfill its mission to give the state DOTs the best possible return on investment for its research dollar.

NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

ANNUAL REPORT

December 31

2016

INTRODUCTION

The National Cooperative Highway Research Program (NCHRP) is a unique contract research effort designed to respond to the practical needs of state departments of transportation (DOTs). The Transportation Research Board (TRB) administers the program, for which the state DOTs fund, select, and oversee the research. NCHRP is an applied research program, and every possible effort is made to help administrators and practitioners put the findings to early use in the form of policies, procedures, specifications, and standards.

During 2016 NCHRP completed 129 research projects, published 53 research products, and approved 53 new and continuation projects. This *Annual Report* provides, in Table 1, a concise list of research published in 2016 and, in Table 2, a list of all active projects, projects completed in 2015, and projects that were approved in 2016 but not yet under contract. The *Annual Report* also presents detailed information about the operation of NCHRP through the Standing Committee on Research (SCOR) of the American Association of State Highway and Transportation Officials (AASHTO).

The *NCHRP Annual Report* supersedes the *Summary of Progress*, which was published in hard copy for the last time in 2014. The *Summary of Progress* documented all NCHRP projects since the inception of the program in 1962. While it provided a useful reference, this information is now readily available on the TRB and NCHRP websites. Therefore, the new annual report series focuses on activities conducted in the current year. See the following search tips for information on how best to locate NCHRP research and publications online.

Finding information on the TRB/NCHRP websites

There are many points of entry to the TRB and NCHRP websites, depending on the kind of information you're looking for. For a general search of all TRB activities on a given topic, enter keywords related to that topic in the search box at the top of the TRB website at www.trb.org.

To find specific projects, use the "Find a Project" option in the left-hand navigation bar at www.trb.org/NCHRP. You can restrict your search to NCHRP research by selecting NCHRP in the "Program" dropdown menu, or select "All" to include projects from our transit, aviation, freight, hazardous materials, rail, and strategic highway research programs. Enter keywords from the title, a project number, or the staff officer's name in the appropriate box. The "Research Area" dropdown menu lets you view all projects in any of 27 subject areas. If you select "All Projects" in the left-hand menu bar, you will see NCHRP projects categorized by subject area dating back to 1988 when our systems were first digitized. A summary of NCHRP projects from 1962 through 1988 is available online as *NCHRP Web Document 7* and can be accessed through a link on the NCHRP home page or by going to http://tinyurl.com/NCHRPWebDoc7.

If you are interested in publications in a specific series, such as NCHRP Reports or Syntheses of Practice, direct links are provided on the right-hand side of the NCHRP home page. The home page also includes links to our quick-response series of projects supporting AASHTO committees.

To search all TRB publications, you can visit the TRB Online Bookstore at www.mytrb.org/store.

Finally, the most comprehensive source of information on transportation research globally is the TRID database, available at trid.trb.org.

NCHRP

Transportation research that *works*

Objective national highway research since 1962
Managed by the Transportation Research Board
Funded cooperatively by AASHTO member departments • Project topics determined by state DOTs • Competitive selection of investigators
Oversight by technical specialists • Wide dissemination of findings • Focus on practical results that impact practice

THE STATES' HIGHWAY RESEARCH PROGRAM

The critical role of state DOTs

The state DOTs created NCHRP in 1962 to find answers to common problems in highway planning, design, construction, operation, and maintenance. The state DOTs, through AASHTO, are the sole sponsors of NCHRP. The program is operated in cooperation with the Federal Highway Administration (FHWA) and is administered through the Transportation Research Board of the National Academies of Sciences, Engineering, and Medicine.

Fifty-four years after the program's creation, state DOTs continue to be the driving force behind NCHRP research. The members of AASHTO—the DOTs of the 50 states and the District of Columbia—come together every year to fund, select, and oversee NCHRP research projects aimed at addressing the states' most critical research needs.

> "NCHRP supports our vision of creating transportation solutions through innovation and exceptional service. With applied research and implementation, we strive to deliver on the high expectations of our customers."
>
> *Mark Gottlieb,*
> *Secretary, Wisconsin DOT, and*
> *Member, AASHTO Standing Committee on Research*

States provide the funding for NCHRP

Each year, state DOTs voluntarily commit to NCHRP research 5.5 percent of the State Planning and Research (SPR) portion of their Federal-Aid-Highway funds. FHWA requests and pools these state contributions and, under a cooperative agreement, makes them available for research contracts and for administration of the program through TRB.

Available funds for NCHRP have remained strong during the past 20 years, rising along with increases in the Federal-Aid-Highway funds provided by Congress and the corresponding growth of SPR funds. The Intermodal Surface Transportation Efficiency Act (ISTEA) resulted in a funding level of approximately $17 million for NCHRP for fiscal years 1992 through 1997. This was increased by more than 50 percent on average in fiscal years 1998 through 2003 by the Transportation Equity Act for the 21st Century (TEA-21), which Congress extended, resulting in $35.4 million for FY 2004.

The last two federal highway acts—the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) and the Moving Ahead for Progress in the 21st Century Act (MAP-21)—resulted in an average of $42 million being programmed for fiscal years 2013 through 2017. See Exhibit 1. A slight annual increase is expected as a result of the Fixing America's Surface Transportation (FAST) Act, signed into law on December 4, 2015.

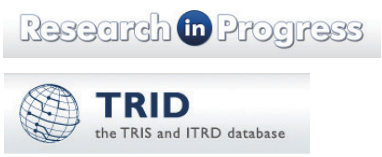
Exhibit 1. ***Budget Allocations for NCHRP, FY 2013 to FY 2017***

Allocations	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017
New projects and continuation projects	$26,465,000	$29,916,000	$28,630,000	$30,840,000	$31,525,000
Administration, technical direction, panels, and publications	$11,121,473	$11,300,600	$12,064,000	$11,332,000	$11,746,000
Total	**$37,586,473**	**$41,216,600**	**$40,694,000**	**$42,172,000**	**$43,271,000**

States select NCHRP research projects

A thorough process of consultation and review gives states a strong voice in selecting NCHRP research projects. The process is led by AASHTO SCOR, which provides oversight to NCHRP. SCOR is composed of 16 state DOT members (four from each of the four AASHTO regions) plus ex officio members from FHWA and other federal agencies. In addition, the SCOR chair must be the CEO of one of the state DOTs, and the vice-chair is the chair of the AASHTO Research Advisory Committee (RAC), composed of research directors from all AASHTO member departments.

In July of every year, SCOR invites the submission of research problem statements from three authorized sources: (1) AASHTO member transportation departments, (2) the chairs of AASHTO's committees and subcommittees, and (3) FHWA.



Searching TRB databases helps submitters of problem statements avoid duplicating research.

Individuals from the three sources have until October 15 to submit their ideas, describing why the research they are proposing represents an immediate need and is of interest to the majority of states. The problem must be one that can be handled effectively under a cooperative program and have a high probability of success. Submitters are asked to search the relevant literature in TRID—a database that combines the records of TRB's Transportation Research Information Services (TRIS) and the Organization for Economic Cooperation and Development (OECD) Joint Transport Research Centre's International Transport Research Documentation—and the Research in Progress (RiP) database to determine if similar efforts are already under way or if satisfactory answers are already available.

NCHRP and FHWA staff and other technical experts review all problem statements for technical merit and request clarification from submitters when appropriate. At the same time, NCHRP panels and staff also prepare recommendations for continuation of projects begun in earlier years.

In December, NCHRP prepares a report of proposed continuation projects and new problem candidates. This report is sent to members of SCOR and RAC as a ballot for rating each of the candidates according to need, value, and appropriateness. The ballot results are used to establish a preliminary ranking to help structure the discussion of candidates by SCOR at its March meeting.

In March, based on expected funding for the next fiscal year, SCOR allocates funds for new and continuation projects. Once the program is developed, SCOR sends a report to the AASHTO Board of Directors (CEOs of each of the member departments) requesting final approval. A favorable vote of at least two-thirds of the member departments is required. In addition, each year's program must be approved by FHWA and accepted by the National Academies.

> "[The NCHRP Synthesis Program] helps us address problems in all areas of transportation. That includes design, contracting, operations, maintenance—everything that we do as a DOT."
>
> *Brian Blanchard, Assistant Secretary, Engineering and Operations, Florida DOT*

In each of the last several years, approximately 120 problem statements and 20 requests for continuation have been balloted. SCOR typically funds a number of requests for continuation projects each year. These include quick-response research for AASHTO committees; research carried

out under NCHRP subprograms, such as the Synthesis series, the IDEA program, and the Domestic Scan Program; and projects from previous years that request additional funds to build on their success with additional research. In recent years, SCOR has funded approximately 40 new projects each year.

A cumulative total of 1,778 research contracts have resulted from all NCHRP yearly programs through 2016. The FY 2017 program will add another 37 new contracts and 16 continuations. See Exhibit 2.

Exhibit 2. ***Number of Research Projects Selected by SCOR, FY 2013 to FY 2017***

Projects	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017
Continuation projects	17	15	12	16	16
New projects	41	50	46	45	37
Total projects	58	65	58	61	53
Total project funds	**$26,465,000**	**$29,916,000**	**$28,630,000**	**$30,840,000**	**$32,275,000**

Funding for the FY 2017 program is expected in early 2017, permitting execution of contracts and initiation of research. SCOR will formulate the FY 2018 program in March 2017 based on proposals solicited in July 2016, the beginning of another cycle of NCHRP research.

States help guide NCHRP research projects

Each research project is assigned to a panel of subject experts who are very knowledgeable in the project area and who are looked to for technical guidance and counsel throughout the research and reporting phases. A broad search is made for these individuals, and TRB usually receives about four to five times as many nominees as can be used in the available panel positions.

Panel members do not act as consultants or advisors to project investigators; they may not submit proposals for research. All members serve without compensation, and their total yearly contribution to the program adds up to thousands of staff-days. The panel members are drawn from all walks of professional life, with heavy dependence on practitioners from AASHTO member departments. See Exhibit 3.

Exhibit 3. ***Affiliations of Panel Members on Active Projects***
(Current number of active projects = 332)

	Panel Members*	
Affiliation	**Number**	**Percentage**
State agencies	1,188	55
Federal agencies	60	3
Local, transit agencies, MPOs	100	5
Educational institutions	243	11
Industry, consultants, associations	556	26
All	**2,147**	**100**

** Does not include liaison representatives.*

Panel members assume a number of key responsibilities for helping ensure the quality of NCHRP research. The project panel analyzes the initial problem that was submitted, develops a final project scope and objectives, and then prepares a formal research project statement by which proposals are solicited from qualified research agencies. The panels review the research proposals, recommend contract awards, and provide counsel to the NCHRP staff members responsible for management of the research contracts. Finally, the panels review final reports for acceptability and for accomplishment of the approved research plan.

A model for cooperative research

The model developed for NCHRP not only has functioned effectively for more than 50 years but also has served as the foundation for five other successful applied research programs managed by TRB. TRB now has national cooperative research programs in the fields of highways, transit, airports, hazardous materials, freight, and rail transportation. Beyond the walls of TRB, much of the research community looks to NCHRP as a model of what works. Many of the research programs in state departments of transportation use procedures modeled on NCHRP. From other units of the National Academies to industry associations in a variety of fields, experts approach NCHRP for advice on how best to manage cooperative research.

NCHRP is the model for TRB's suite of cooperative research programs that address high-priority research in transit, freight, rail, airports, and hazardous materials.

Stakeholders drive success

What makes this model so effective? Why has NCHRP been supported by voluntary contributions for 50 years? One of the key success factors is stakeholder involvement. Those who will ultimately benefit from the research are involved from beginning to end, starting with the identification of research ideas that might address their day-to-day problems. Once these ideas are identified, stakeholders review them and select and prioritize projects that will provide the greatest benefit. When projects are selected, stakeholders help to craft requests for proposals, and then provide technical guidance throughout the project to ensure that the research will provide practical, beneficial, and implementable results. When an NCHRP research project is completed, every step has been taken along the way to make sure the research product will address a real need in the real world.

An objective eye

Another key element in the NCHRP model is objectivity. Operating within the structure and guidelines of the nonprofit National Academies, NCHRP does not own roads, make laws, or set policy. It provides a neutral forum for objective research without bias or prejudgment. NCHRP does not bend to changing political whims or a need to generate profit. NCHRP panels bring diverse stakeholder groups together with a common interest for a common objective.

The program is not intended to be "all things to all people." NCHRP research is effective because each project is directly targeted at a current problem. When a project is completed, there is an audience waiting to implement the results.

Investing wisely in research

Further, by working on shared, national problems and issues, the NCHRP model is designed to seek solutions effectively and efficiently. Every dollar spent on NCHRP research is a dollar saved by each of the state and local agencies that would need to seek independent solutions to its problems in the absence of a coordinated, national program. The reduction of duplication allows all stakeholders to leverage their funds for a common goal and provides them a body of knowledge far in excess of what they could achieve on their own.

The NCHRP model is designed to spend its stakeholders' dollars wisely and to save them time, money, and lives. Transportation research helps in a variety of ways—for example, minimizing the time wasted by the travelling public due to roadway congestion, keeping down vehicle costs and commuting times, improving the efficiency and cost effectiveness of government programs, reducing vehicle crashes, and lessening the tragic loss of life and its impacts on families and communities. NCHRP fosters innovation in design, construction, and materials that results in better-performing, longer-lasting products and savings for road users.

Competitive investigator selection

Finally, one of the most significant success factors is the competitive process used to select NCHRP contractors. Each project panel develops a request for proposals that is posted publicly and can be responded to by any private firm or academic institution. Contractors are selected based on the qualifications of their team members and the merit of their research approach.

> "[NCHRP's process is like] the seal of approval.... [It means] the research behind the product is there and it's solid."
>
> *Greg Johnson,*
> *Administrator, Maryland State Highway Administration*

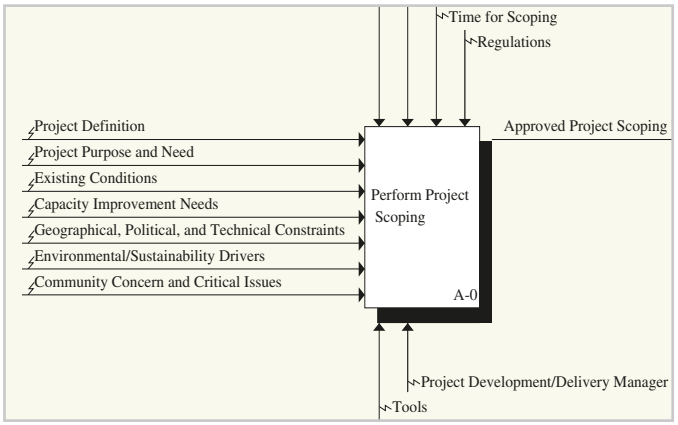
NCHRP RESEARCH AREAS

Topics across the spectrum of highway concerns

The subject matter of NCHRP projects extends across the full spectrum of concerns within the highway industry and demonstrates AASHTO's interest in acquiring answers to the many acute problems facing DOT administrators and engineers. Problems submitted as candidates for funding each year are given a unique identification number based on the NCHRP Classification System. See Exhibit 4.

This identification number, corresponding to the specific problem area addressed, is part of the number that identifies a research project throughout its life cycle, until the project is given an NCHRP publication number when the final deliverable is published. For example, NCHRP Project 08-88 identifies a project in Area 8 (Forecasting). NCHRP Project 09-49B identifies a project in Area 9 (Bituminous Materials). Once research was completed, final reports for these projects were published, respectively, as *NCHRP Report 821: Effective Project Scoping Practices to Improve On-Time and On-Budget Delivery of Highway Projects* and *NCHRP Report 817: Validation of Guidelines for Evaluating the Moisture Susceptibility of WMA Technologies*.

Table 2 of the *Annual Report* uses this project numbering system to present information about active, completed, and pending NCHRP projects in 2016. The projects are grouped sequentially from Area 1: Design—Pavements through Area 25: Transportation Planning—Impact Analysis.



Project scoping guidance developed in NCHRP Project 08-88 helps agencies make more informed decisions and enhance accountability through improved cost estimates and scheduling. The research results are published in *NCHRP Report 821: Effective Project Scoping Practices to Improve On-Time and On-Budget Delivery of Highway Projects*.

NCHRP Project 09-49B developed guidelines for identifying and limiting moisture susceptibility in warm mix asphalt pavements, as documented in *NCHRP Report 817: Validation of Guidelines for Evaluating the Moisture Susceptibility of WMA Technologies*.

NCHRP Classification System

Exhibit 4. ***Problem Areas***

1	Pavements
2	Economics
3	Operations and Control
4	General Materials
5	Illumination and Visibility
6	Snow and Ice Control
7	Traffic Planning
8	Forecasting
9	Bituminous Materials
10	Specifications, Procedures, and Practices
11	Law
12	Bridges
13	Equipment
14	Maintenance of Way and Structures
15	General Design
16	Roadside Development
17	Safety
18	Concrete Materials
19	Finance
20	Special Projects
21	Testing and Instrumentation
22	Vehicle Barrier Systems
23	Properties
24	Mechanics and Foundations
25	Impact Analysis (Social, Environmental, Economic, Energy)

"[NCHRP Project 15-30 on median intersection design for high-speed divided highways] is one of the most successful NCHRP projects I've been involved with.... I'm proud to be a part of something that has saved lives."

Tom Welch,
Highway Safety Engineer (retired),
Iowa DOT

SELECTING THE BEST INVESTIGATORS

A rigorous, competitive process

NCHRP does not award grants for research. Rather, the program invites competing proposals from prospective investigators who can demonstrate capability and experience in the problem area to be researched. Eligible organizations can be from either the public or private sector and include universities, nonprofit institutions, consulting and commercial firms, and individual consultants. Throughout its history, NCHRP has awarded research contracts to agencies headquartered in 47 states, the District of Columbia, Canada, and England. Agencies selected to conduct NCHRP research fall, principally, into two categories—industry/consultant and university/research institute—as shown in Exhibit 5.

Exhibit 5. ***Agency Distribution Across Contracts***

	FY 2012		FY 2013		FY 2014		FY 2015		FY 1963 - FY 2015	
Contractor Type	**No.***	**%**	**No.***	**%**	**No.***	**%**	**No.***	**%**	**No.***	**%**
Industry/consultant	31	58	36	63	25	56	28	57	978	55
University/research institute	22	42	21	37	20	44	21	43	763	43
Other	0	0	0	0	0	0	0	0	23	2
Total	**53**	**100**	**57**	**100**	**45**	**100**	**49**	**100**	**1,764**	**100**

** Contract totals do not include the individual topics and tasks for Projects 08-36, 20-07, 20-65, and 25-25 (quick-response research for AASHTO committees); 20-05; 20-06; 20-30; 20-36; 20-44; and 20-68.*

Requests for proposals are issued on TRB's website, announced through the weekly TRB E-Newsletter, and distributed to a self-subscription listserv. Proposals must comply with the format outlined in the publication *Information and Instructions for Preparing Proposals for the Transportation Research Board's Cooperative Research Programs.*

The proposed budget total is not a primary factor in selecting an investigator because the funds available for research are announced in the project statement. Specific budget items in the proposal are reviewed to determine staff allocations and distribution of resources. When the proposed cost exceeds the funds stated to be available, the proposal is rejected on receipt.

The project panels select investigating agencies based on careful evaluation of all proposals and a review of available information on proposers' past performance on other research projects sponsored by NCHRP or others. The successful proposals are retained by panel members for use in monitoring the research. Proposals, panel deliberations, and meeting notes are considered to be privileged information and are not released outside of TRB.

"[*NCHRP Synthesis 372* on construction delivery] was instrumental in spurring along state-sponsored studies, pilot projects, and implementation."

John Hannon,
Associate Professor, University of Southern Mississippi

To support AASHTO's interests, needs, and capital investments, a contract is not signed with the selected agency until the NCHRP staff and project panel are satisfied that the proposed scope of work provides the best probability for a successful outcome. Furthermore, soon after contract execution, the investigating agency is required to submit a Working Plan (an amplified version of the research plan), against which project progress is monitored by the staff and project panel.

NCHRP will provide a debriefing, if requested, to unsuccessful proposers to indicate the technical areas in which their proposals were judged to have weaknesses or deficiencies that were factors in not being selected.

Selection of an agency is made by the responsible project panel considering the following factors*:

(1) the proposer's demonstrated understanding of the problem;

(2) the merit of the proposed research approach and methodology;

(3) experience, qualifications, and objectivity of the research team in the same or closely related problem area;

(4) the plan for ensuring application of results;

(5) the proposer's plan for participation by Disadvantaged Business Enterprises—small firms owned and controlled by minorities or women; and

(6) the adequacy of the facilities and equipment.

*From *Information and Instructions for Preparing Proposals for the Transportation Research Board's Cooperative Research Programs*

"[*NCHRP Report 761* on bridge scour prediction] gives engineers confidence about which ... equations they can hang their hats on."

Steve Ng,
Engineer,
California Department of Transportation

The central role of NCHRP professionals

TRB is headquartered at the Keck Center of the National Academies, 500 Fifth St. NW, Washington, D.C.

Once research starts, administrative and technical oversight of progress is performed by NCHRP staff. In-depth oversight by project managers with wide-ranging expertise is an important factor contributing to project success.

In addition to reviewing monthly progress schedules and quarterly progress reports, the project managers maintain frequent contact with the research agencies throughout the contract periods. They review the project's status to learn whether the research is being pursued in line with the approved research plan, and they provide guidance to the investigator in all technical and administrative matters. They also serve as liaisons to the project panels to keep them abreast of progress and to acquire panel guidance and counsel in technical matters, particularly regarding the needs of the DOT practitioner.

The principal investigator has flexibility in managing the project budget up to the point of not materially departing from the approved research plan or exceeding the contract's maximum allowable cost. Any major changes to account for promising new research leads or unproductive lines of study must be approved in advance by the staff and project panel and are authorized through a contract amendment. Agency invoices are checked by the staff for deviations from the approved budget. Based on all oversight activities, the staff members update project status on the NCHRP website. Finally, the staff and panels evaluate the completed research to determine the degree of technical compliance with the contract so that recommendations for contract close-out can be made.

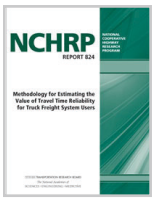
Members of the panel for NCHRP Project 17-81, "Incorporating Road Safety Planning in the *Highway Safety Manual*." Clockwise from person closest in the foreground: Gordon Lovegrove, Deo Chimba, Timothy Barnett, Young-Jun Kweon, and Esther Strawder.

NCHRP project managers require research agencies to present results in a form that is directly usable by practitioners in AASHTO member departments.

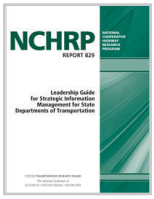
RESEARCH PRODUCTS

Disseminating research and documenting success

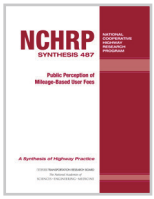
Dissemination of research findings to practitioners is a primary objective of the entire NCHRP research process. Publication of the final report or other deliverables is a key means of dissemination. NCHRP research findings are published in a number of series, which are listed in Table 1 of this *Annual Report*. Quantities for these series published over the past five years are shown in Exhibit 6. Some NCHRP publications produced this year are:



- *NCHRP Report 824: Methodology for Estimating the Value of Travel Time Reliability for Truck Freight System Users* presents a means to estimate the value of travel time reliability for truck freight system users. This provides guidance in the evaluation of proposed highway infrastructure and operations investments. (Project 08-99)



- *NCHRP Report 829: Leadership Guide for Strategic Information Management for State Departments of Transportation* is a guidebook for DOT executives and managers on effectively developing and maintaining an agency's capability to provide mission-critical information when and where it is needed. (Project 20-96)



- *NCHRP Synthesis of Highway Practice 487: Public Perception of Mileage-Based User Fees* explores proposals to replace the current motor fuel tax with a road usage charge assessed on vehicle-miles traveled (often called a mileage-based user fee). The report identifies and assesses various measures of public opinion on the concept. (Project 20-05/Topic 46-01)

- *NCHRP Legal Research Digest 69: A Look at the Legal Environment for Driverless Vehicles* explores legal policy issues that may be associated with driverless vehicles. It addresses civil and criminal liability, implications for privacy and security, possible impacts on automobile insurance, and other topics. (Project 20-06/Topic 21-01)

Exhibit 6. ***Number of NCHRP Publications, 2012 to 2016***

Publication Series	2012	2013	2014	2015	2016 (est.)
NCHRP Reports	31	25	39	20	19
NCHRP Syntheses of Highway Practice	14	14	14	17	17
NCHRP Research Results Digests	13	9	5	7	3
NCHRP Legal Research Digests	2	4	2	5	4
Web-Only Documents	10	8	9	8	8
CD-ROMs	3	4	9	5	2
Total	**73**	**64**	**78**	**62**	**53**

Publications are distributed widely by NCHRP and through TRB's distribution process, with print runs for reports ranging from 1,000 to 3,000 copies. Print copies are mailed to AASHTO, the CEOs of state DOTs, and the following individuals and organizations:

- TRB members who have chosen to receive publications in the particular subject area of the report
- About 100 libraries
- TRB representatives in the state DOTs
- Numerous educational institutions
- Liaison representatives from industry and transportation organizations in other countries
- Appropriate TRB panels and committees

NCHRP subprograms

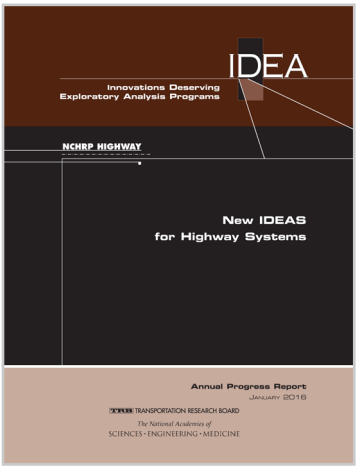
Several "subprograms" are carried out within NCHRP. Results may be published in hard copy, delivered in the form of internal reports and presentations, published on the TRB website, or made available upon request.

Synthesis of Information Related to Highway Problems (Project 20-05)

Administrators, practicing engineers, and researchers continually face highway problems on which much information already exists, either in documented form or in terms of undocumented experience and practice. Unfortunately, this information is often fragmented and scattered, and therefore overlooked. The NCHRP Synthesis series aims to remedy this lack of awareness of existing solutions by assembling and organizing relevant information, practices, and research for particular highway problems.

Legal Problems Arising out of Highway Programs (Project 20-06)

State DOTs have an interest in evaluating the operating practices, administrative procedures, and legal issues associated with planning, design, and construction of transportation projects. Individual state legal experiences need to be compared and made available for possible wider application. This research identifies and evaluates legal options for DOTs, which facilitate the handling of both immediate and long-range needs.



Initiated in the early 1990s, the NCHRP-IDEA program complements applied research by nurturing novel technologies, methods, and processes for highways.

Research for AASHTO and State DOT Leadership (Project 20-24)

NCHRP conducts focused research that addresses and responds to the evolving challenges facing state DOT decisionmakers. Reports from this project deliver timely information on topics including asset management, innovative financing and contracting, performance measures, and e-business, as well as emerging topics such as connected automated vehicles.

NCHRP IDEA Program (Project 20-30)

The Innovations Deserving Exploratory Analysis (IDEA) program funds research into promising but unproven innovations for highway design and construction, materials, operations, maintenance, and other areas of highway systems. A progress report that describes current and completed projects is published annually. A high percentage of products funded by the IDEA program have been successfully implemented.

International Highway Research and Technology (Project 20-36)

The International Highway Research and Technology program provides a coordinated approach to international information sharing and technology exchange. The program's overall objective is to improve highway safety, development, maintenance, and operations through dissemination of innovative technology and successful policies and practices from around the globe.

Domestic Scan Program (Project 20-68)

The NCHRP Domestic Scan Program is broad, considering any innovative practices of high-performing transportation agencies that could be beneficially adopted by other interested agencies. The purpose of each scan and of the program as a whole is to facilitate information sharing and technology exchange among the states and other transportation agencies and to identify actionable items of common interest.

Research Support for AASHTO committees

- **Standing Committee on Highways (Project 20-07)**
  Through this project, the Standing Committee on Highways obtains guidance on an accelerated schedule through a continuing research program geared to the needs of the committee in the development of guides, standards, policies, and other AASHTO activities.
- **Standing Committee on Planning (Project 08-36)**
  The objective of this project is to provide a flexible, ongoing program of quick-response research for the Standing Committee on Planning to improve analytical methods, decision support tools, procedures, and techniques employed by practitioners to support statewide and metropolitan transportation planning, programming, and development.
- **Standing Committee on the Environment (Project 25-25)**
  This project provides flexible, ongoing, quick-response research to the Standing Committee on the Environment. The research is focused on environmental analysis, streamlining, stewardship, and planning to respond effectively to program delivery and project development issues.
- **Standing Committee on Public Transportation (Project 20-65)**
  This project comprises quick-response research tasks to assist in the fulfillment of Standing Committee on Public Transportation responsibilities. Research is carried out on transit planning, operations, transit delivery, and related matters as state involvement in public transportation continues to grow.

The final report

As an applied research program, NCHRP expects final research reports to be presented in language understandable to both administrators and practitioners and in a format that permits easy assimilation and application. The detailed research techniques and analyses in which a researcher would be interested are generally presented in appendices. NCHRP specifies the style and organization of all reports to guide the researchers in their writing so that AASHTO member departments may obtain the greatest benefit.

NCHRP staff write a foreword to each published report that (1) identifies the fields of specialty of those likely to be most interested in the results and (2) suggests how the results fit into present knowledge and practice. All published reports are offered for sale through TRB's Business Office. Since 2001, published reports also have been made available electronically on TRB's website. For ready availability to interested parties, unpublished reports are available in hard copy or electronically.

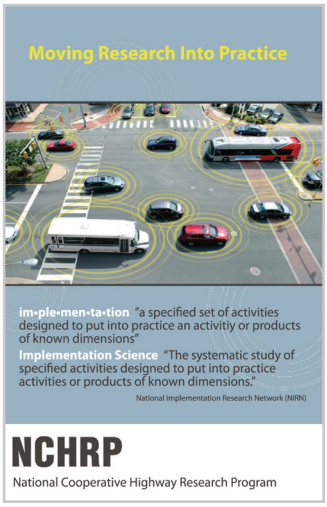
Promoting useful results before publication

NCHRP undertakes a number of activities before formal publication of the final reports to increase the probability that results will be applied:

- Initial research proposals are required to state how the anticipated results can be used to improve practice.
- Panel members—who not only are experts in the particular problem area, but also have a good understanding of practitioner needs—define the research problem and its objectives. Experts from state DOTs play a major role in this task.
- Investigators are selected both for the clarity of their research objectives and the likelihood that the research will be usable and readily implementable.
- Staff and panel members establish agreement with the investigator on what is expected from the project and the researchers in order to meet the needs of the practitioner.
- Project oversight aims to keep the research in line with the approved research plan and ensure that all project developments through final reporting center on practitioner needs.

Implementing research results

Over the years, NCHRP staff and various AASHTO committees have worked together to structure research findings into the best possible form for immediate use by the practitioner. Such joint efforts have facilitated implementation of the findings. AASHTO has provided NCHRP with frequent opportunities for staff and project researchers to go before the association's various committees to present their findings and recommendations directly to the user community. This year NCHRP created a full-time implementation coordinator position that was filled by Waseem Dekelbab. Waseem will work closely with project panels, AASHTO Committees, and state DOTs to identify and fund activities to move high-value research into practice more effectively and efficiently.



NCHRP uses an active implementation approach to foster the full and effective use of NCHRP research products.

Documenting success

For the past several years, NCHRP has addressed the challenge of documenting or showcasing successful research products. Several approaches are being used, and NCHRP will continue to explore new and better ways to meet this challenge.

Every four years, NCHRP surveys panel members from completed projects to identify known applications of research results. Feedback from these surveys enables NCHRP to confirm high usage and application of research results, to improve the implementation of future research results, and to identify successful applications of research.

These successful applications of NCHRP research are showcased in a series of case studies, "Impacts on Practice," based on interviews with DOT practitioners. More than 35 of these case studies are posted on the TRB website.

In addition, the interviews with DOT practitioners have identified the various ways that states implement NCHRP research results. NCHRP documents some of these implementation efforts and methods in the "Paths to Practice" series.

Two examples each of "Impacts on Practice" and "Paths to Practice" case studies are included in the following pages.

- Knowledge and Information—Critical DOT Assets
- Peers Share Know-How to Speed Innovation
- Research Makes the Case for Roundabouts
- Partner Involvement Speeds New Specifications

NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM
IMPACTS ON PRACTICE

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NCHRP Reports 754 and 813

Knowledge and information—critical DOT assets

State transportation agencies are increasingly focused on knowledge management (KM), an umbrella term for a variety of techniques to preserve and enhance employee knowledge and use it as a productive asset. At the same time, DOTs are enhancing their capabilities for information management, a strategy that supports KM and improves information capture, storage, search, and retrieval. States are making the most of the extensive guidance that NCHRP provides in both areas.

Capturing knowledge from a rapidly changing workforce

As DOTs lose employees to retirement, downsizing, and reorganization, the agencies face a critical challenge: how to retain those employees' knowledge and share it within the organization. To address this need, NCHRP Project 20-98 set out to develop a guide to help DOTs implement effective agency-wide KM practices.

"DOTs are increasingly concerned about the knowledge that is walking out the door with the retirement of long-tenure employees," says Maureen Hammer, NCHRP 20-98 panel member and former knowledge management director at Virginia DOT. "DOTs also contract out more and more work. It's critical that they document the knowledge of workers and contractors so that they don't lose it."

> "DOTs are increasingly concerned about the knowledge that is walking out the door with the retirement of long-tenure employees."

KM can involve everything from succession management, leadership development programs, and mentoring programs to communities of practice, after-action reviews, and information management in support of KM. Despite the fact that KM practices and tools have been developed and adopted by a range of private- and public-sector organizations, they have not been systematically used by most DOTs.

"Knowledge management often goes on in DOTs in isolated pockets, such as succession planning or the use of a lessons-learned database," says Frances Harrison, principal investigator for NCHRP 20-98 and chief technical officer of Spy Pond Partners, Inc.

KM strategies ensure that the vital knowledge held by veteran employees is passed along and retained by DOTs.

"However, DOTs typically don't have an agency-wide function or point person who can help implement these strategies broadly."

The document resulting from the project, *NCHRP Report 813: A Guide to Agency-Wide Knowledge Management for State Departments of Transportation* (www.trb.org/Main/Blurbs/173082.aspx), lays out principles and practices DOTs can use to capture, organize, and share critical knowledge in pursuit of their strategic mission.

"More and more, transportation agencies are making forays into knowledge management," says Hammer. "It helps to be able to point them to a very thorough document that explains the basics and says at a high level what knowledge management is."

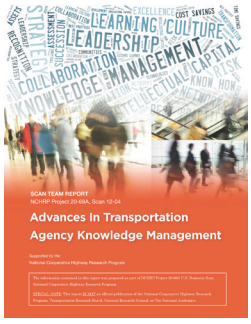
Published in 2015, the guide is already having a major impact on the transportation industry, and has been presented at numerous conferences and meetings.

> "Transportation agencies are becoming increasingly interested in knowledge management."

"Transportation agencies are becoming increasingly interested in knowledge management," says Leni Oman, knowledge strategist at Washington State DOT. "Some agencies are creating knowledge management initiatives and using NCHRP research results as a resource for developing their programs." According to Oman, such programs are helping Washington State DOT and other agencies identify risks for knowledge loss and develop strategies to protect critical institutional knowledge in the rapidly changing DOT environment.

The guide is designed to be a starting point for agencies interested in implementing KM, and will be helpful particularly to senior and mid-level management staff responsible for an agency's strategic direction, as well as others seeking to put KM into practice.

"The guide is a great resource for our agency," says John Halikowski, director of Arizona DOT. "Knowledge management is helping us run as efficiently as possible without wasting resources. Our mentoring program for new employees helps get them up to speed during the onboarding process, so that they can add value to our organization as quickly as possible. We also have a



A survey of public- and private-sector KM practices conducted through NCHRP's U.S. Domestic Scan Program (domesticscan.org) contributed to *NCHRP Report 813*.

(continued)

> "Where knowledge management ... starts with what's in people's heads, information management is about what's being stored in some other medium."

lessons-learned process after major projects, and are looking at how our data is captured and how easy our information is to retrieve."

Information management: a key part of the KM toolkit

A related research project, NCHRP Project 20-90, focused on providing DOTs with guidance on information management. Information management encompasses data and documentation of all kinds, from reports and manuals to maps and photographs, any of which can be in print or electronic form. It includes information housed within libraries and functional units at DOTs, in organized bibliographic databases such as TRID (trid.trb.org), and on transportation websites.

While information management and knowledge management are not the same thing, information management can play a supporting role for KM. "Where knowledge management is about know-how and starts with what's in people's heads, information management is about what's being stored in some other medium," says Oman, an NCHRP 20-90 panel member. "Information management is an essential tool in the knowledge management toolkit. You can't do effective knowledge management without it."

Information management is especially important as DOTs move away from central filing systems and replace them with electronic records and modernized information practices. It is also critical for responding to public requests and providing transportation professionals with the information they need to make good decisions.

Even with vast stores of data online, transportation information still spans many physical and electronic platforms.

"The cost of public disclosure requests often goes up when finding information is more difficult," says Oman. "Moreover, we need authoritative sources of information for decision makers."

The research findings, published as *NCHRP Report 754: Improving Management of Transportation Information* (www.trb.org/Main/Blurbs/169522.aspx), provide effective strategies that DOTs can use to improve information capture, preservation, and retrieval. "What we were trying to do with the project was understand the landscape of information management best practices," says Anita Vandervalk, investigator for the project and principal with Cambridge Systematics, Inc. "To pursue cost efficiencies, DOTs need to understand the interconnectivity involved in managing records, data, library resources, and the Web."

The NCHRP guidebook gives DOTs a go-to framework to refer to as they develop data planning guides. It provides a baseline that illustrates opportunities for improving information practices at DOTs. It also gives the industry a good way to talk about what information management entails.

> "To pursue cost efficiencies, DOTs need to understand the interconnectivity involved in managing records, data, library resources, and the Web."

"This report is building awareness of the need for information management," says Oman. "We in the transportation sector are beginning to talk more commonly about information management needs."

New tools for new challenges

The need for knowledge and information management by DOTs is especially acute given changing social and economic pressures.

"Society and the economy are constantly changing, and changes in the economy in particular are putting pressure on departments of transportation to be more efficient in managing our systems," says Halikowski. "This requires us to be able to use knowledge and information management to extract as much value from our efforts as we possibly can."

Harrison agrees: "New demands and changing roles make it more important to have access to the right knowledge and information." *NCHRP Reports 754* and *813* give practitioners the tools they need to face these challenges.

> "New demands and changing roles make it more important to have access to the right knowledge and information."

"These guides give DOT officials and other transportation professionals a point of departure for developing knowledge and information management programs for their organizations," says Oman. "Doing so will be critical to their having access to what they need to make decisions that ensure the performance of the nation's transportation infrastructure."

Related NCHRP Research

NCHRP is developing further guidance for DOTs on capturing knowledge and managing information. See trb.org for more details.

NCHRP Project 20-104, "Capturing and Learning Essential Consultant-Developed Knowledge within Departments of Transportation," is developing guidance for DOTs on how to capture and maintain essential, mission-critical knowledge from the work of external consultants and contractors.

NCHRP Project 20-96, "Leadership Guide for Strategic Information Management for State Departments of Transportation," is creating a guidebook for state DOT executives and managers on how to allocate resources effectively to develop and maintain the agency's capability to provide vital information when and where it is needed.

NCHRP Project 20-97, "Improving Findability and Relevance of Transportation Information," is working to improve DOT information findability by defining a management framework, documenting successful practices for organizing and classifying information, and developing enterprise search procedures that a DOT can use to make transportation information available to users.

ACKNOWLEDGMENT OF SPONSORSHIP This work was sponsored by the American Association of State Highway and Transportation Officials, in cooperation with the Federal Highway Administration, and was conducted in the National Cooperative Highway Research Program (NCHRP), which is administered by the Transportation Research Board of the National Academies of Sciences, Engineering, and Medicine. **DISCLAIMER** The opinions and conclusions expressed or implied in this report are those of the researchers who performed the research and are not necessarily those of the Transportation Research Board, the Academies, or the program sponsors.

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U.S. Domestic Scan Program

Peers share know-how to speed innovation

Strides forward in transportation technology and practice come from all corners of the nation. However, it is seldom a simple proposition to take an innovation from one agency and make it work at another. The U.S. Domestic Scan Program was founded on the proven effectiveness of face-to-face contact among peers as a means of spreading innovative technologies and practices in transportation.

Built for knowledge transfer

On a scan conducted as part of the U.S. Domestic Scan Program, a core group of scan participants—typically eight to 12 from different state DOTs and federal agencies—meets with several hosts who have been identified as early adopters or technical experts in the scan focus area. Scans may involve travel across the country when it is important to see technology firsthand, or scans can be conducted as workshops where the team and hosts convene at a single site.

> "The scan program was designed to take advantage of person-to-person contact to accelerate the transfer of good new ideas from one agency to the next."

The U.S. Domestic Scan Program began in 2006 with a pair of pilot scans that addressed asset management and right-of-way issues. In the years since, AASHTO has sponsored three to five scans per year in virtually every DOT business area. (See the complete list of scan topics through fiscal year 2014 at left and full details at domesticscan.org.)

Andrew Lemer is the TRB senior program officer who has overseen the scan program since its inception, and he explained the program's successful formula. "The scan program was designed to take advantage of person-to-person contact to accelerate the transfer of good new ideas from one agency to the next," Lemer says.

Advancing state practice

Finding ways to trace the impact of the scans has been an ongoing interest for Lemer and the NCHRP panel overseeing the program. In an NCHRP survey of scan team members from nine completed scans, nearly 50 percent of survey respondents reported follow-up implementation of scan findings that was proposed, in progress, or completed at their home agencies.

> "Being able to point to other states' practices helped augment the final-rule process in our state."

In-depth discussion of other states' practices helped New Hampshire DOT get the best value out of its work zone data.

> "It was helpful to see what states were and weren't doing and where the greatest needs are."

Specific examples abound on the wide range of scans' impacts on state practice.

Denise Markow, transportation systems management and operations administrator for New Hampshire DOT, served on a scan that investigated work zone best practices. "Based in part on what we saw of highly developed and organized systems on the scan tour, New Hampshire created our own traffic control committee to ensure that all projects are reviewed on a systematic and regular basis," Markow says. "Being able to point to other states' practices helped augment the final-rule process in our state."

Markow adds, "The scan helped address the question of how to get the best value out of work zone data. That has been a question that many states have struggled with, and it was helpful to see what states were and weren't doing and where the greatest needs are."

(continued)

Scan Topics Cover the Range of DOT Operations

Administration and Planning
- Developing a Cross-Trained Workforce
- Knowledge Management
- Rail and Intermodal Access and Parking
- Risk-Based Forecasts of Land Volatility
- Pollution Elimination and Water Quality
- Transportation Improvement Programs

Design and Construction
- Accelerated Construction
- Work Zone Assessment
- Quality Control/Assurance of Design Plans
- Roadway Tunnels
- Extreme Events and ABC
- Civil Integrated Management
- Reinforced Polymer Composites

Delivery and Asset Management
- Asset Management
- Right-of-Way Acquisition/Utilities Relocation
- Project Delivery
- Bridge Management
- Superload Permits
- Integrated Corridor Management
- Intermodal Corridor Management

Traffic and Safety
- Multiagency Traffic Signal Management
- Maximizing Traffic Flow
- Lane Departure Avoidance
- Motorcycle Safety
- Traffic Incident Management
- "Toward Zero Deaths"
- Organization-Wide Safety Culture

Maintenance and Preservation
- Winter Maintenance
- Performance Measuring of Maintenance and Preservation
- Maintenance Outsourcing and Privatization
- Maintenance and Preservation Funding

John Halikowski, director of Arizona DOT, served as chair of a scan on transportation agency knowledge management. Halikowski similarly took lessons learned from that scan to focus efforts at his agency.

"We were already doing a lot of things that fell under the umbrella of knowledge management," Halikowski says. "However, participating in the scan gave me new perspective on how to address knowledge management at an enterprise level."

The relationships built among peers during the scans continue to provide benefits long after the scans conclude. Greg Duncan, formerly Tennessee DOT's assistant chief engineer of operations, chaired a scan on privatization of maintenance functions. "Information provided by Missouri DOT prompted interest at my agency in job order contracting," Duncan says. "As we entered into our first contract of this type for guardrail repair, Missouri provided ongoing help in specifications development and determining how to bid and administer the contract."

> "Participating in the scan gave me new perspective on how to address knowledge management at an enterprise level."

Many scan participants share Duncan's perspective on the value of building peer relationships. In surveys of scan team members spanning several years, the aspect of the program consistently rated as most valuable is the identification of individuals at the host states or on the scan team to call on as future resources.

Traveling scans not only allow for information sharing among peers, but they give participants the opportunity to see innovative solutions at work in the field.

Making an impact nationally

Even as scan outcomes help individual states put innovations to work, scans commonly make an impact at the national level as well. This includes input to policy, guidance, and research that can ultimately reach all practitioners.

Alexander Bardow, state bridge engineer for Massachusetts DOT, served on a scan that examined accelerated bridge construction (ABC) connections in bridges that are subject to multihazard and extreme events. Bardow outlined a number of ways that the scan impacted national practice. "The scan contributed to the establishment of a national center on ABC," says Bardow.

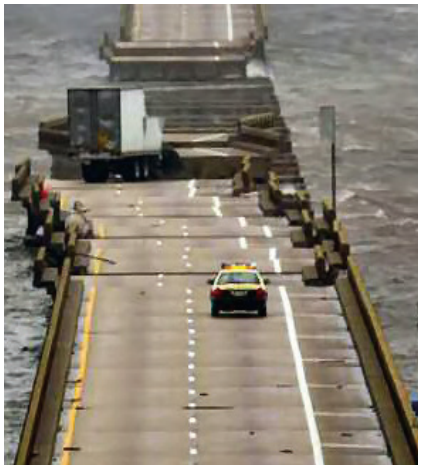
"In addition, the scan helped drive national efforts to develop AASHTO code provisions for applying ABC in high seismic areas," he says. "It also supported priority NCHRP research in this area."

Jesus Rohena, former senior bridge engineer at FHWA, explains that his participation in a tunnels scan that he co-chaired helped FHWA see firsthand how tunnel owners are inspecting, maintaining, and operating their facilities. "We took these findings into consideration as we updated FHWA's *Tunnel Operations, Maintenance, Inspection and Evaluation Manual*," Rohena says.

Eddie Curtis, traffic management specialist with FHWA, served on a scan that addressed regional, multiagency traffic signal management. "The scan led to incorporation of case studies on regional traffic signal programs in a National Highway Institute training course on performance measures," Curtis says.

Lasting success

"The scan process is very application oriented," says Michigan DOT Passenger Transportation Administrator Sharon Edgar, who co-chaired a scan on transit oriented development (TOD) with a focus on access and parking. "Even as you're learning new information during the scan, you're always thinking about how you're going to use it. You immediately start asking: What are the next steps? Who is involved? It's an exciting dynamic. In our case, the scan led to a peer exchange on stakeholder roles in TOD, which was a different focus from the original scan."



A scan on bridge hazards and accelerated construction contributed to national research and code development.

> "Even as you're learning new information during the scan, you're always thinking about how you're going to use it."

The unique nature of the program can also present challenges when it comes to measuring its impact. "It's not always easy to gauge the ultimate outcome of scans," TRB's Andrew Lemer says. "We can't always know for certain that the program itself is responsible for a topic gaining traction nationally."

However, Lemer points to the strong annual support of the program by AASHTO's Standing Committee on Research (SCOR) as a sure sign that it is delivering value. "Moreover," Lemer says, "we get more recommendations for scans every year than we could ever fund. There's a real desire among DOTs to have their questions answered through the U.S. Domestic Scan Program."

Halikowski chairs SCOR and is a vocal supporter of the program at the individual level as well. "I have actively supported the scan program among my peers and encouraged them to participate in the program," Halikowski says. "Serving on a scan team can expand your horizons and change the way you think about doing business in ways you wouldn't ever expect."

ACKNOWLEDGMENT OF SPONSORSHIP This work was sponsored by the American Association of State Highway and Transportation Officials, in cooperation with the Federal Highway Administration, and was conducted in the National Cooperative Highway Research Program (NCHRP), which is administered by the Transportation Research Board of the National Academies of Sciences, Engineering, and Medicine. **DISCLAIMER** The opinions and conclusions expressed or implied in this report are those of the researchers who performed the research and are not necessarily those of the Transportation Research Board, the Academies, or the program sponsors.

NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM
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NCHRP Reports 572 and 672

Research Makes the Case for Roundabouts

Roundabouts clearly provide safety and mobility benefits, yet some transportation agencies in the United States have been slow to adopt them. NCHRP research established foundational knowledge on roundabout safety, operation, and design that has driven a surge in their use nationwide.

Roundabouts, which help increase safety and reduce congestion, are becoming more common in the United States through the implementation of NCHRP Project 03-65.

Roundabouts in the United States: A Need for Data

In the 1950s, traffic circles fell out of favor in the United States because they allowed for high-speed merging and weaving of vehicles. A remedy for this unsafe and inefficient design was developed overseas: The United Kingdom developed the modern roundabout design that slows entering vehicles and requires them to yield to circulating traffic.

> "Virtually everything that came out of *NCHRP Report 572* worked its way into the roundabout guide."

This design is generally more efficient than traditional intersections, typically reducing congestion by keeping traffic flowing. It is safer as well, minimizing traffic conflict points and reducing the right-angle crashes that lead to more severe injuries and fatalities.

Because of these benefits, modern roundabouts are now widely used internationally. However, the United States has been slower to accept roundabouts because of questions about safety and operational capacity.

To help address such questions, NCHRP Project 03-65 was conducted, which resulted in *NCHRP Report 572: Roundabouts in the United States* (trb.org/news/blurb_detail.asp?id=7086). Researchers inspected several representative roundabout installations to gather data and compiled a comprehensive inventory of roundabouts in the United States.

The resulting report includes methods for estimating the safety and operational capacity of roundabouts as well as updated design criteria. Technical guidance is spelled out in detail in the companion appendices, *NCHRP Web-Only Document 94* (trb.org/news/blurb_detail.asp?id=7274).

Paths to Practice

Incorporation into widely used tools

The results of NCHRP 03-65 have been incorporated into a number of widely used tools, including *NCHRP Report 672: Roundabouts: An Informational Guide—Second Edition* (trb.org/Publications/Blurbs/164470.aspx). This report is an update to an FHWA guide originally published in 2000, one based primarily on European and Australian guidelines.

"Virtually everything that came out of *NCHRP Report 572* worked its way into the roundabout guide, *NCHRP Report 672*," says Lee Rodegerdts, the principal investigator who authored both *NCHRP Reports 572* and *672*. "This is a go-to source nationally for information on roundabouts and is also being used outside of the United States."

> "With the help of FHWA, TRB, and other agencies, we were able to get our results into key documents used nationally and internationally."

The roundabout capacity model and operational information developed in *NCHRP Report 572* was also implemented into TRB's 2010 *Highway Capacity Manual* (HCM). "The HCM is widely used by transportation agencies across the United States and can be drawn upon to aid roundabout implementation nationwide," says Rodegerdts, who is also a former HCM committee member and part of the team that updated the 2010 edition. "It's a cornerstone document with a huge audience."

(continued)

Implementation Strategies *AT A GLANCE*

- **The Basis for National Guidance:** Results were incorporated into a number of widely used manuals and specifications such as *NCHRP Report 672*, TRB's *Highway Capacity Manual*, and AASHTO's "Green Book."
- **Facts Drive Acceptance:** Beyond demonstrating benefits, the research helped identify and dispel misconceptions that act as barriers to implementation.
- **Identifying Additional Needs:** Follow-up projects will improve crash prediction and capacity models, and will address accessibility for the visually impaired. The results will further accelerate implementation.

> "This research is key for states that have challenges with implementation."

Results were also incorporated into AASHTO's *A Policy on Geometric Design of Highways and Streets*, or "Green Book," as well as several state DOT roundabout guides, noted Mark Doctor, FHWA liaison to NHCRP 03-65. "The breadth of its influence is a testament to the wealth of useful information this project produced," Doctor says.

Rodegerdts adds, "With the help of FHWA, TRB, and other agencies, we were able to get our results into key documents used nationally and internationally. That was a critical part of implementation."

Demonstrating safety, increasing acceptance

Part of the importance of *NCHRP Report 572* is how it continues to drive acceptance of roundabouts by clearly demonstrating their safety benefits. "This is the first large-scale national study to collect field data and make recommendations," Rodegerdts says. "Our safety data are powerful and definitive."

Doctor agrees. "Without a doubt, roundabouts are safer than traditional intersections," he says.

Some of the reluctance to adopt roundabouts in the United States is predicated on public misconception. One common misconception is that a roundabout and a rotary are the same. Rotaries are higher speed facilities and can require changing lanes to exit, making them difficult for drivers to navigate during peak use. Other misconceptions about roundabouts are that they are always more expensive to build than signaled intersections and that they are difficult to learn to navigate. Tools to dispel such myths and provide facts to the public are important for acceptance.

"This research is key for states that have challenges with implementation," Doctor says, "whether in design, or planning, or convincing the public and elected officials that roundabouts are indeed the safer and more cost-effective choice."

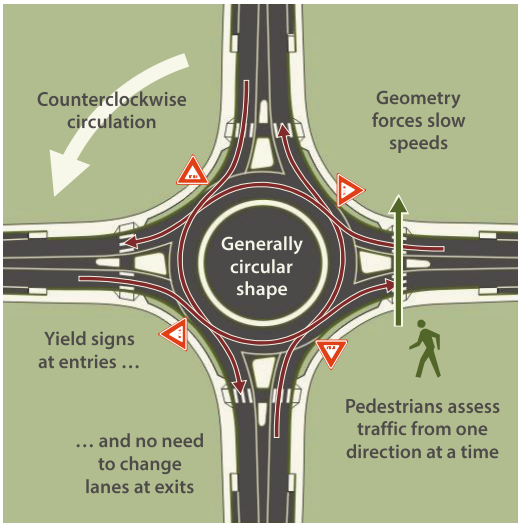
Continued research to accelerate implementation

NCHRP Report 572 has also been the impetus for continued research focused on encouraging implementation. "We're now 10 years removed from the data collected in 2003 for NCHRP Project 03-65," Rodegerdts says. "There were about 300 roundabouts in the United States back then, while now there are closer to 3,000."

> "There were about 300 roundabouts in the United States [in 2003], while now there are closer to 3,000."

With increasing use of roundabouts, there is also more data—data that can be used to develop more robust capacity and safety models. To that end, NCHRP Project 17-70 is underway to develop roundabout crash prediction models for AASHTO's *Highway Safety Manual*. NCHRP Project 03-78B is addressing the accessibility of roundabouts to visually impaired pedestrians.

In addition, an FHWA-funded project (kittelson.com/projects/fhwa-topr-34-accelerating-roundabout-implementation-in-the-united-states) is focused directly on accelerating roundabout implementation in the United States by updating capacity and crash models with new data. This is an important project for the evolution of roundabout practice because some practitioners are concerned that current models based on *NCHRP Report 572* data do not reflect the operations of roundabouts at full capacity.



Modern roundabouts are designed for safety and ease of use.

"All of these projects are important descendants of NCHRP Project 03-65 that will help with implementation nationwide," Rodegerdts says.

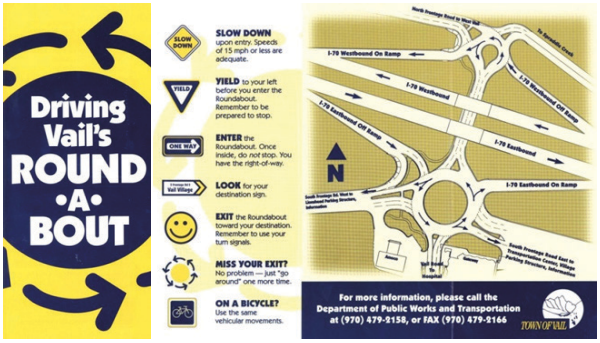
Implementation Success

With *NCHRP Report 572*'s broad and definitive influence, NCHRP 03-65 is a model for successful implementation. "The project has significantly improved roundabout design in the United States and made engineers more comfortable with selecting roundabouts as an alternative to other intersection controls," says project panel member Richard Long, a professor at Western Michigan University with expertise in pedestrian safety. "It also brought to the forefront concerns about access for pedestrians, especially the visually impaired."

> "There was a lot of hunger for practical information. This led to a widely used report that put implementation at the forefront."

Doctor noted that one key to the project's success was a focus on implementation from the beginning. "This was a practitioner-oriented project with very useful results that were bound to change practice," Doctor says.

Long agrees. "There was a lot of hunger for practical information," he says. "This led to a widely used report that put implementation at the forefront."



Road authorities encourage acceptance of roundabouts by providing guidance to road users who are unfamiliar with them.

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NCHRP Report 796

Partner involvement speeds new specifications

A main goal for many NCHRP projects is incorporating research findings into national AASHTO standard specifications. NCHRP recently piloted a new approach to facilitate the approval of new AASHTO specs and their subsequent adoption and use by state DOTs.

LRFD for Signs and Supports

After establishing load and resistance factor design (LRFD) specs for major bridge structures, state DOTs looked to similarly update design guidance for highway signs and supports. This motivated NCHRP Project 10-80 to develop new AASHTO specs.

However, Waseem Dekelbab, NCHRP senior program officer, noted that typically several years are required for the completion and publication of NCHRP research and the subsequent development and approval of AASHTO specs.

"We saw ways to involve more parties earlier in the process," Dekelbab says, "which could possibly lead to faster and smoother approval." These methods were tried out for NCHRP 10-80 with great success.

Paths to Practice

A fast track to AASHTO

For this project, NCHRP began sharing the investigators' early results—first progress reports and later draft specs—with the AASHTO Highway Subcommittee on Bridges and Structures (SCOBS).

> "Early input from AASHTO and industry helped guide the specification language."

Norm McDonald, state bridge engineer for Iowa DOT and former chair of SCOBS Technical Committee 12 (Structural Supports for Signs, Luminaires, and Traffic Signals), explained that the committee received updates on a semiannual basis. "I was also invited to participate on the NCHRP 10-80 panel meetings and provide an AASHTO perspective," McDonald says.

Later discussions also included FHWA and industry representatives to provide feedback on draft specs. "Early input from AASHTO and industry helped guide the specification language, ensuring that it was not only technically correct but sensible from an implementation standpoint," McDonald says.

McDonald and Dekelbab agreed that the review and balloting of the specs went smoother than usual thanks to so much stakeholder input up front. In fact, the AASHTO specs were approved before the publication of the final research findings, *NCHRP Report 796: Development and Calibration of AASHTO LRFD Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals* (www.trb.org/Publications/Blurbs/171725.aspx).

Ample learning opportunities

The shift from existing design tools to LRFD for signs and supports is significant. This project also dedicated resources to extensive outreach and training to answer practitioner questions and help states transition to the updated design methodology.

"During the specifications vetting process, several participants voiced a need for training and implementation guidance," Dekelbab says. "NCHRP was able to respond quickly and provided funding and facilitation support to meet this need."

Carl Macchietto, with lighting and traffic pole manufacturer Valmont, served on the NCHRP 10-80 panel and participated as an industry representative in AASHTO spec development discussions. His company also hosted one among several training sessions.

"There were workshops on both coasts and in the Midwest, and then an abbreviated workshop at the TRB Annual Meeting," Macchietto says. "Some of those were held before the new specs came out. Those sessions, plus a number of webinars and a video series based on the live workshops, helped address a wide range of technical questions."

Implementation Success

Xiaohua "Hannah" Cheng, principal engineer of bridge design for New Jersey DOT, served on the project panel, and her agency hosted one of the workshops. Cheng reported that New Jersey DOT and others are already using the new specs.

Design differences between traditional (left) and LRFD-based support designs are immediately apparent.

"It takes time to digest all this new information," Cheng says. "Our involvement with this project put us ahead of the game."

The trend toward early AASHTO involvement is catching on. Dekelbab reported that a similar process is moving forward with other NCHRP projects now underway.

Implementation Strategies *AT A GLANCE*

- **Stakeholder Involvement:** The right people discussing results early ensured faster and smoother approval of specifications.
- **Widespread Training:** Multiple training formats helped practitioners understand how to implement the new specs.

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Table 1. 2016 Publications of the National Cooperative Highway Research Program

Research Reports

No.	Proj. No.	Title, Pages
817	09-49B	Validation of Guidelines for Evaluating the Moisture Susceptibility of WMA Technologies, 44 p.
818	09-48	Comparing the Volumetric and Mechanical Properties of Laboratory and Field Specimens of Asphalt Concrete, 90 p.
819	18-16	Self-Consolidating Concrete for Cast-in-Place Bridge Components, 112 p.
820	14-31	Framework for a Pavement-Maintenance Database System (& CD 179 Vol. 1; & CD 179 Vol. 2), 132 p.
821	08-88	Effective Project Scoping Practices to Improve On-Time and On-Budget Delivery of Highway Projects, 188 p.
822	24-39	Evaluation and Assessment of Environmentally Sensitive Stream Bank Protection Measures (& CD 183), 264 p.
823	24-35	Guidelines for Certification and Management of Flexible Rockfall Protection Systems, 32 p.
824	08-99	Methodology for Estimating the Value of Travel Time Reliability for Truck Freight System Users, 104 p.
825	07-22	Planning and Preliminary Engineering Applications Guide to the Highway Capacity Manual, 272 p.
826	15-51	Estimating Highway Preconstruction Services Costs, Vol. 1: Guidebook, 120 p.
826	15-51	Estimating Highway Preconstruction Services Costs, Vol. 2: Research Report, 96 p.
827	25-43	Navigating Multi-Agency NEPA Processes to Advance Multimodal Transportation Projects, 138 p.
828	05-20	Guidelines for Nighttime Visibility of Overhead Signs, 80 p.
829	20-96	Leadership Guide for Strategic Information Management for State Departments of Transportation, 110 p.
830	08-97	Multi-State, Multimodal, Oversize/Oversight Transportation, 176 p.
831	10-96	Civil Integrated Management (CIM) for Departments of Transportation, Vol. 1: Guidebook, 72 p.
831	10-96	Civil Integrated Management (CIM) for Departments of Transportation, Vol. 2: Research Report, 100 p.
832	20-65/Task 60	State DOTs Connecting Users and Rides for Specialized Transportation, Vol. 1: Research Report, 118 p.
832	20-65/Task 60	State DOTs Connecting Users and Rides for Specialized Transportation, Vol. 2: Toolkit for State DOTs and Others, 48 p.
833	14-29	Assessing, Coding, and Marking of Highway Structures in Emergency Situations, Vol. 1: Research Overview (& WOD 223), 108 p.
833	14-29	Assessing, Coding, and Marking of Highway Structures in Emergency Situations, Vol. 2: Assessment Process Manual (& WOD 223), 138 p.
833	14-29	Assessing, Coding, and Marking of Highway Structures in Emergency Situations, Vol. 3: Coding and Marking Guidelines (& WOD 223), 162 p.
834	03-78B	Crossing Solutions at Roundabouts and Channelized Turn Lanes for Pedestrians with Vision Disabilities: A Guidebook (& WOD 222), 128 p.
835	15-49	Guidelines for Implementing Managed Lanes (& WOD 224), 164 p.

Syntheses of Highway Practice (Project 20-05)

No.	Topic. No.	Title, Pages
483	46-17	Training and Certification of Highway Maintenance Workers, 138 p.
484	46-04	Influence of Geotechnical Investigation and Subsurface Conditions on Claims, Change Orders, and Overruns, 52 p.
485	46-12	Converting Paved Roads to Unpaved, 88 p.
486	46-07	State Practices for Local Road Safety, 136 p.
487	46-01	Public Perception of Mileage-Based User Fees, 148 p.
488	46-02	Roundabout Practices, 92 p.
489	46-09	Extending Bridge Service Life Through Field Welded Repair and Retrofits, 76 p.
490	46-13	Practice of Rumble Strips and Rumble Stripes, 60 p.
491	46-06	Use of Mobile Information Technology Devices in the Field for Design, Construction, and Asset Management, 112 p.
492	46-03	Performance Specifications for Asphalt Mixtures, 100 p.
493	46-14	Practices for High-Tension Cable Barriers, 64 p.
494	46-15	Life-Cycle Cost Analysis for Management of Highway Assets, 44 p.

Syntheses of Highway Practice (Project 20-05)

No.	Topic. No.	Title, Pages
495	46-05	Use of Reclaimed Asphalt Pavement and Recycled Asphalt Shingles in Asphalt Mixtures, 132 p.
496	46-16	Minimizing Roadway Embankment Damage from Flooding, 120 p.
497	46-11	Post-Extreme Event Damage Assessment and Response for Highway Bridges, 92 p.
498	46-10	Application of Pedestrian Crossing Treatments for Streets and Highways, 144 p.
499	47-02	Alternate Design/Alternate Bid Process for Pavement-Type Selection (In Production)
500	47-01	Control of Concrete Cracking in Bridges, 104 p.

Research Results Digests

No.	Proj. No.	Title, Pages
398	20-05	Continuing Project to Synthesize Information on Highway Practices, 24 p.
399	09-57	Field Validation of Laboratory Tests to Assess Cracking Resistance of Asphalt Mixtures: An Experimental Design, 28 p.
400	08-36/Task 123	Sample Size Implications of Multi-Day GPS-Enabled Household Travel Surveys, 38 p.

Legal Results Digests

No.	Proj. No.	Title, Pages
69	21-01	A Look at the Legal Environment for Driverless Vehicles, 84 p.
70	21-03	Takings and Mitigation, 36 p.
71	21-04	Liability of Transportation Entity for the Unintentional Release of Secure Data or the Intentional Release of Monitoring Data on Movements or Activities of the Public, 60 p.
72	22-04	Summary of Federal Law Restricting Use of Highway Safety Data in Tort Litigation, 66 p.

Web-Only Documents

No.	Proj. No.	Title, Pages
215	20-59(30)	Incident Command System (ICS) Training for Field-Level Transportation Supervisors and Staff, 220 p.
218	25-44	Field Evaluation of Reflected Noise from Single Noise Barrier—Phase 1, 428 p.
219	20-07/ Task 361	Hamburg Wheel-Track Test Equipment Requirements and Improvements to AASHTO T 324, 87 p.
220	03-110	Estimating the Life-Cycle Cost of Intersection Designs, 117 p.
221	20-59(48)	Protection of Transportation Infrastructure from Cyber Attacks: A Primer, 183 p.
222	03-78B	Guidelines for the Application of Crossing Solutions at Roundabouts and Channelized Turn Lanes for Pedestrians with Vision Difficulties: Final Project Report (& Rep. 834), 349 p.
223	14-29	Guidelines for Development of Smart Apps for Assessing, Coding, and Marking Highway Structures in Emergency Situations (& Rep. 833 Vol. 1; & Rep. 833 Vol. 2; & Rep. 833 Vol. 3), 47 p.
224	15-49	Research Supporting the Development of Guidelines for Implementing Managed Lanes (& Rep. 835), 345 p.

CD-ROMs

No.	Proj. No.	Title
179	14-31	Pavement-Maintenance Database (PMDb), Vol. 1: Framework (& Rep. 820)
179	14-31	Pavement-Maintenance Database (PMDb), Vol. 2: Sample Data (& Rep. 820)
183	24-39	NCHRP Report 822 Compendium of Field Data, Documentation, and Photographs (& Rep. 822)

Notes:

Publications in parentheses with an ampersand (&) are companion publications.

See Table 2 for project titles. Progress reports are superseded annually. See inside back cover of this document for ordering information.

TABLE 2
STATUS (AS OF 12/31/2016) OF PROJECTS ACTIVE OR PENDING DURING 2016

Project No.	Title	Research Agency	Contract Amount	Starting Date	Completion Date	Project Status*
AREA ONE: DESIGN--PAVEMENTS						
01-50	Quantifying the Influence of Geosynthetics on Pavement Performance	Texas A&M Research Foundation	600,000	9/1/2011	2/15/2017	Research in progress
01-51	A Model for Incorporating Slab/Underlying Layer Interaction into the MEPDG Concrete Pavement Analysis Procedures	University of Minnesota	449,998	8/24/2012	12/31/2016	Completed---Publication decision pending
01-52	A Mechanistic-Empirical Model for Top-Down Cracking of Asphalt Pavement Layers	Texas A&M Transportation Institute	500,000	3/4/2013	10/31/2017	Research in progress
01-53	Proposed Enhancements to Pavement ME Design: Improved Consideration of the Influence of Subgrade and Unbound Layers on Pavement Performance	Texas A&M Transportation Institute	400,000	10/1/2014	3/31/2017	Research in progress
01-54	Guidelines for Limiting Damage to Flexible and Composite Pavements Due to the Presence of Water	Applied Pavement Technology	349,881	8/1/2014	3/3/2017	Research in progress; final report pending
01-55	Performance-Based Mix Design of Porous Friction Courses	Auburn University	300,000	7/31/2014	11/30/2016	Research in progress; final report under review
01-57	Standard Definitions for Comparable Pavement Cracking Data	Iowa State University	300,000	1/4/2016	10/31/2016	Terminated---No report
01-58	Quantifying the Effects of Implements of Husbandry on Pavements	-----	400,000			In development
AREA THREE: TRAFFIC--OPERATIONS AND CONTROL						
03-62	Guidelines for Accessible Pedestrian Signals (APS)	University of North Carolina - Chapel Hill	1,070,000	10/4/2001	9/30/2017	Research in progress; interim materials summarized in NCHRP Research Results Digest 278; contractor's final report pending. Workshops completed.
03-78C	Training and Technology Transfer for Accessability Guidelines for Roundabouts and Channelized Turn Lanes	-----	250,000			In development
03-99	Development and Application of Access Management Guidelines	Oregon State University	400,000	5/26/2009	7/31/2016	Completed---Publication pending
03-105	Design Guidance for Interchange Loop Ramps	MRIGlobal	675,000	7/30/2012	3/29/2016	Completed---To be published as an NCHRP report
03-108	Guidance on Quantifying Benefits of TIM Strategies	Noblis Inc.	499,985	7/10/2013	3/31/2017	Research in progress; contractor final report pending
03-111	Effectiveness of Work Zone Transportation Management Plan Strategies	KLS Engineering LLC	749,961	6/24/2014	7/24/2018	Research in progress
03-112	Operational and Safety Considerations in Making Lane Width Decisions on Urban and Suburban Arterials	MRIGlobal	750,000	8/4/2014	8/4/2017	Research in progress; draft final report pending

TABLE 2 (continued)

Project No.	Title	Research Agency	Contract Amount	Starting Date	Completion Date	Project Status*
03-113	Guidance for Traffic Signals at Diverging Diamond Interchanges and Adjacent Intersections	North Carolina State University	999,941	6/13/2014	6/12/2018	Research in progress
03-114	Planning and Evaluating Active Traffic Management Strategies	Texas A&M Transportation Institute	700,000	1/16/2014	2/15/2017	Research in progress
03-115	Production of a Major Update to the 2010 Highway Capacity Manual	Kittelson & Associates	1,379,737	9/20/2013	3/19/2016	Completed---HCM 6th Edition published
03-117	Traffic Control Devices and Measures for Deterring Wrong-Way Movements	Texas A&M Transportation Institute	298,697	5/11/2015	9/11/2017	Research in progress
03-118	Decision-Making Guide for Traffic Signal Phasing	Vanasse Hangen Brustlin, Inc.	600,000	8/13/2015	8/12/2017	Research in progress
03-119	Application of MASH Test Criteria to Breakaway Sign and Luminaire Supports and Crashworthy Work Zone Traffic Control Devices	George Mason University	599,134	9/28/2015	3/28/2018	Research in progress
03-120	Assessing Interactions Between Access Management Treatments and Multimodal Users	Kittelson & Associates	800,000	8/11/2015	2/11/2018	Research in progress; interim report pending
03-121	Incorporating Freight, Transit and Incident Response Stakeholders into Integrated Corridor Management (ICM): Processes and Strategies for Implementation	Cambridge Systematics	399,558	7/5/2016	7/5/2018	Research in progress
03-122	Performance-Based Management of Traffic Signals	Kittelson & Associates	600,000	4/14/2016	4/13/2018	Research in progress
03-123	Proposed Practices for the Application of Dynamic Lane Use Control	Texas A&M Transportation Institute	350,000	7/1/2016	6/30/2018	Research in progress
03-124	Principles and Guidance for Presenting Drivers with Dynamic Information on Active Traffic Management	Battelle Memorial Institute	749,939	11/1/2016	5/1/2019	Research in progress
03-125	Evaluation of Change and Clearance Intervals Prior to the Flashing Yellow Arrow Permissive Left-Turn Indication	University of Wisconsin - Madison	300,000	9/21/2016	9/20/2018	Research in progress
03-126	Operational Standards for Highway Infrastructure	-----	500,000			In development
03-127	Cybersecurity of Traffic Signals and Related ITS Equipment	-----	500,000			In development
AREA FOUR: MATERIALS AND CONSTRUCTION--GENERAL MATERIALS						
04-39	Field Performance of Corrugated Pipe Manufactured with Recycled Polyethylene Content	TRI/Environmental, Inc.	600,000	7/11/2013	2/28/2017	Research in progress; draft final report in review
04-40	Reliability-Based Geotechnical Resistance Factors for Axially-Loaded Micropiles	-----	250,000			In development

TABLE 2 (continued)

Project No.	Title	Research Agency	Contract Amount	Starting Date	Completion Date	Project Status*
AREA FIVE: TRAFFIC--ILLUMINATION AND VISIBILITY						
05-20	Guidelines for Nighttime Visibility of Overhead Guide Signs	Texas A&M Research Foundation	720,000	4/1/2011	2/29/2016	Completed---Published as NCHRP Report 828
05-21	Safety and Performance Criteria for Retroreflective Pavement Markers	Texas A&M Transportation Institute	675,000	9/1/2015	12/1/2017	Research in progress
05-22	Establishment of a National Specification for Use of LED Roadway Lighting	-----	400,000			In development
AREA SEVEN: TRAFFIC--TRAFFIC PLANNING						
07-19(02)	Methods and Technologies for Collecting Pedestrian and Bicycle Volume Data [Follow-On]	Kittelson & Associates	49,982	4/13/2015	1/31/2017	Research in progress; contractor's final report under review
07-21	Asset Management Guidance for Traffic Control Devices, Barriers, and Lighting	Vanasse Hangen Brustlin, Inc.	550,000	4/10/2013	12/9/2017	Research in progress
07-22	Planning and Preliminary Engineering Applications Guide to the Highway Capacity Manual	Kittelson & Associates	566,000	6/4/2013	10/30/2017	Completed---Published as NCHRP Report 825; implementation activities continuing
07-23	Access Management in the Vicinity of Interchanges	Texas A&M Transportation Institute	900,000	6/20/2013	4/30/2018	Research in progress; interim report pending; continuation request approved
07-24	Estimating the Value of Truck Travel-Time Reliability	-----	300,000			In development
07-25	Guide for Pedestrian and Bicycle Safety at Alternative Intersections and Interchanges (AII)	-----	400,000			In development
AREA EIGHT: TRANSPORTATION PLANNING--FORECASTING						
08-36	Research for the AASHTO Standing Committee on Planning	-----	600,000 **	5/4/1999		Ongoing---Refer to project writeup on NCHRP website
08-36/Task 116	Development of Transportation Asset Management Plan Templates	RAND Corporation	234,718	6/12/2013	11/30/2016	Research in progress; continuation request under review
08-36/Task 117	Sketch Planning Tools for Regional Sustainability	Cambridge Systematics	85,000	10/4/2013	3/31/2016	Completed---Final report sent to AASHTO
08-36/Task 120	Snapshots of Planning Practices	Cambridge Systematics	190,000	4/22/2013	11/1/2017	Research in progress
08-36/Task 123	Survey Sample Size and Weighting	RAND Corporation	100,000	5/13/2015	11/15/2016	Completed---Publication decision pending
08-36/Task 125	Transportation Asset Management Knowledge Portal	RAND Corporation	125,000	12/13/2013	1/31/2017	Monitoring continuing; project continuation under review
08-36/Task 126	Development of a Risk Register Spreadsheet Tool	Parsons Brinckerhoff	115,000	5/5/2015	12/31/2016	Completed---Publication decision pending

TABLE 2 (continued)

Project No.	Title	Research Agency	Contract Amount	Starting Date	Completion Date	Project Status*
08-36/Task 127	Employment Data for Planning: Do You Know What You're Getting, Who's Your Supplier, and How Good are the Goods?	Cambridge Systematics	99,975	6/18/2015	12/31/2016	Research in progress
08-36/Task 128	What You Get is What You See: Modern Visualization and Analysis Tools for Strengthening Transportation Agencies' Reporting and Analysis Requirements	Cambridge Systematics	100,000	6/18/2015	12/31/2016	Completed---Publication decision pending
08-36/Task 129	Scoping Study to Establish Standards and Guidance for Data for Transportation Planning and Traffic Operations Purposes	Cambridge Systematics	80,000	6/18/2015	11/15/2016	Completed---Publication decision pending
08-36/Task 130	Inventory and Assessment of Methods for Making Collected Transportation Data Anonymous	RAND Corporation	74,353	6/2/2015	12/31/2016	Completed---Publication decision pending
08-36/Task 131	Transportation Data Integration to Develop Planning Performance Measures	Cambridge Systematics	100,000	9/25/2015	12/31/2016	Research in progress
08-36/Task 132	Understanding Changes in Youth Mobility	RAND Corporation	124,976	7/21/2015	12/31/2016	Research in progress
08-36/Task 133	Second Continuation of Task 120, Snapshots of Planning Practices	-----	15,000			Added to Task 120
08-36/Task 134	Transportation Asset Management Research Roadmap	RAND Corporation	99,791	9/25/2015	12/15/2016	Completed---Publication decision pending
08-36/Task 135	Addressing Margins of Error in Small Areas of Data Delivered through the American Fact Finder or the Census Transportation Planning Products Program	RAND Corporation	74,997	9/25/2015	11/30/2016	Research in progress
08-36/Task 136	License Plate Reader Technology: Privacy Risk Analysis and Case Studies	Cambridge Systematics	125,000	9/11/2015	12/31/2016	Completed---Publication decision pending
08-36/Task 137	Assessing the Utility and Costs of Statewide Travel Demand Models	RAND Corporation	124,697	6/21/2016	6/20/2017	Research in progress
08-36/Task 138	Support and Update of the Strategic Plan for SCOP/Subcommittees on TAM	Parsons Brinckerhoff	80,000	7/20/2016	5/19/2017	Contract pending
08-36/Task 139	Planning Research Digest	RAND Corporation	124,401	6/21/2016	6/20/2017	Research in progress
08-36/Task 140	Assessing Actual Transportation Impacts of the 2005 BRAC Decisions	Parsons Brinckerhoff	124,996	7/20/2016	7/19/2017	Research in progress
08-36/Task 141	Evaluation of Walk and Bicycle Demand Modeling Practice	-----	100,000			In development
08-36/Task 142	Advancing Sustainability through Multi-Agency Collaborations	-----	100,000			In development
08-36/Task 143	Evolving Transportation Planning Research Needs for the 21st Century	-----	125,000			In development
08-36/Task 144	Transportation Asset Management and Effective Organizational Models	-----	125,000			In development

TABLE 2 (continued)

Project No.	Title	Research Agency	Contract Amount	Starting Date	Completion Date	Project Status*
08-91	Cross-Asset Resource Allocation and the Impact on System Performance	CH2M Hill	489,835	3/28/2013	9/28/2016	Completed---Published as NCHRP Report 806
08-93	Managing Risk Across the Enterprise: A Guidebook for State Departments of Transportation	Gordon Proctor & Associates, Inc.	500,000	4/18/2014	3/15/2016	Completed---Report sent to AASHTO for publishing
08-94	Guidelines for Selecting Travel Forecasting Methods and Techniques	Resource Systems Group, Inc.	499,911	5/16/2014	12/31/2016	Research in progress
08-95	Cell Phone Location Data for Travel Behavior Analysis	Cambridge Systematics	250,000	5/30/2014	12/31/2016	Research in progress
08-96	Integrating Goods and Services Movement by Commercial Vehicles in Smart Growth Environments	Cambridge Systematics	300,000	4/9/2014	1/31/2017	Research in progress; contractor's final report under review
08-97	Finding and Using Data to Identify and Evaluate Corridors for Transporting Multi-state, Multi-modal Oversize/Overweight Freight	CPCS Transcom Inc.	500,000	5/9/2014	5/8/2016	Completed---Published as NCHRP Report 830
08-98	Guide for Identifying, Classifying, Evaluating, and Mitigating Freight Truck Bottlenecks	Cambridge Systematics	350,000	2/24/2014	10/31/2016	Research in progress; draft guidebook under review
08-100	Environmental Justice Analyses When Considering Toll Implementation or Rate Changes	Louis Berger Group	499,915	7/29/2014	11/30/2016	Completed
08-101	Enhanced Truck Data Collection and Analysis for Emissions Modeling	Cambridge Systematics	500,000	6/22/2015	6/22/2017	Research in progress
08-102	Bicyclist Facility Preferences and Effects on Increasing Bicycle Trips	Georgia Tech Research Corporation	350,000	6/24/2015	6/24/2017	Research in progress; interim report pending
08-103	Implementing NCHRP Report 806: Guide to Cross-Asset Resource Allocation and the Impact on Transportation System Performance	Spy Pond Partners	398,300	6/1/2016	6/1/2018	Research in progress
08-104	A Guidebook for Post-Award Contract Administration for Highway Projects Delivered Using Alternative Contracting Methods	University of Colorado - Boulder	500,000	9/16/2016	9/15/2018	Research in progress; interim report pending
08-105	Measuring the Effectiveness of Public Involvement in Transportation Planning and Project Delivery	PRR Inc.	350,000	6/6/2016	2/6/2018	Research in progress
08-106	Metropolitan Freight Transportation: Implementing Effective Strategies	Texas A&M Transportation Institute	375,000	5/25/2016	5/25/2018	Research in progress
08-107	A Guidebook for Emergency Contracting Procedures for Administration of a Regional Emergency	-----	249,997			Contract pending
08-108	Developing National Performance Management Data Strategies to Address Data Gaps, Standards, and Quality	-----	250,000			In development
08-109	Updating the AASHTO Transportation Asset Management Guide—A Focus on Implementation	-----	800,000			In development

TABLE 2 (continued)

Project No.	Title	Research Agency	Contract Amount	Starting Date	Completion Date	Project Status*
08-110	Traffic Forecasting Accuracy Assessment Research	-----	350,000			In development
08-111	Effective Decision Making Methods for Freight-Efficient Land Use	-----	500,000			In development
08-112	Guidebook for Implementing Alternative Technical Concepts into All Types of Highway Project Delivery Methods	-----	500,000			In development
AREA NINE: MATERIALS AND CONSTRUCTION--BITUMINOUS MATERIALS						
09-40A	Field Evaluation of the Louisiana Interlayer Shear Strength Tester	Louisiana Transportation Research Council	186,407	6/1/2013	7/31/2017	Research in progress; final report pending
09-49A	Performance of WMA Technologies; Stage II--Long-Term Field Performance	Washington State University	1,010,925	4/29/2011	1/31/2017	Research in progress; revised final report pending
09-50	Performance-Related Specifications for Asphaltic Binders Used in Preservation Surface Treatments	North Carolina State University	500,000	8/1/2011	6/30/2016	Completed---To be published as NCHRP Report 837
09-51	Material Properties of Cold In-Place Recycled and Full Depth Reclamation Asphalt Concrete for Pavement Design	University of Maryland	499,234	6/4/2012	3/31/2017	Research in progress; final report pending
09-52A	Short-Term Laboratory Conditioning of Asphalt Mixtures: Field Verification	Texas A&M Transportation Institute	162,000	10/18/2016	10/18/2018	Research in progress
09-54	Long-Term Aging of Asphalt Mixtures for Performance Testing and Prediction	North Carolina State University	800,000	5/21/2013	7/31/2017	Research in progress; Phase II underway
09-55	Recycled Asphalt Shingles in Asphalt Mixtures with Warm Mix Asphalt Technologies	Auburn University	600,000	6/10/2013	6/30/2017	Research in progress; Phase II underway
09-56	Identifying Influences on and Minimizing the Variability of Ignition Furnace Correction Factors	Auburn University	500,000	4/15/2014	12/31/2016	Research in progress; draft final report under review
09-57	Experimental Design for Field Validation of Laboratory Tests to Assess Cracking Resistance of Asphalt Mixtures	Texas A&M Transportation Institute	250,000	9/1/2014	4/30/2016	Completed---Summarized in NCHRP Research Results Digest 399
09-58	The Effects of Recycling Agents on Asphalt Mixtures with High RAS and RAP Binder Ratios	Texas A&M Transportation Institute	1,500,000	5/2/2014	10/2/2017	Research in progress; Phase II underway - interim reports available
09-59	Relating Asphalt Binder Fatigue Properties to Asphalt Mixture Fatigue Performance	Advanced Asphalt Technologies, LLC	1,000,000	4/20/2015	10/20/2017	Research in progress; Phase II underway
09-60	Addressing Impacts of Changes in Asphalt Binder Formulation and Manufacture on Pavement Performance through Changes in Asphalt Binder Specifications	Western Research Institute	1,000,000	7/6/2016	1/6/2019	Research in progress; interim report pending
09-61	Short- and Long-Term Binder Aging Methods to Accurately Reflect Aging in Asphalt Mixtures	-----	750,000			In development

TABLE 2 (continued)

Project No.	Title	Research Agency	Contract Amount	Starting Date	Completion Date	Project Status*
09-62	Quality Assurance and Specifications for In-Place Recycled Pavements Constructed Using Asphalt-Based Recycling Agents	-----	1,000,000			In development
AREA TEN: MATERIALS AND CONSTRUCTION--SPECIFICATIONS, PROCEDURES, AND PRACTICES						
10-82A	Performance-Related Specifications for Pavement Preservation Treatments	Michigan State University	349,997	2/3/2014	12/31/2016	Completed---Publication decision pending
10-86A	Software for Bidding Alternative Drainage Pipe Systems	Golder Associates Inc.	325,188	1/5/2015	12/31/2016	Research in progress; workshop pending
10-91	Guidebook for Selecting and Implementing Sustainable Highway Construction Practices	Parsons Brinckerhoff	157,155	4/22/2013	5/1/2016	Cancelled
10-91A	Sustainable Highway Construction Practices	University of Washington	300,000	10/10/2016	10/10/2018	Research in progress
10-92	Optimizing the Risk and Cost of Materials QA Programs	Hill International Inc.	399,970	9/16/2013	8/31/2016	Completed---To be published as NCHRP Report 838; pre-publication draft available
10-93	Measuring, Characterizing, and Reporting Pavement Roughness of Low-Speed and Urban Roads	University of Michigan	450,000	10/1/2013	4/28/2017	Research in progress
10-94	Mitigation of Weldment Cracking of Highway Steel Structures due to the Galvanizing Process	University of Kansas	499,975	7/1/2014	1/31/2018	Research in progress
10-95A	Toughness Requirements for Heat-Affected Zones of Welded Structural Steels for Highway Bridges	University of Kansas	425,000	9/19/2016	12/18/2018	Research in progress
10-96	Guide for Civil Integrated Management (CIM) in Departments of Transportation	University of Texas - Austin	249,988	5/20/2014	4/19/2016	Completed---Published as NCHRP Report 831
10-97	Detection and Remediation of Soluble Salt Contamination Prior to Coating Steel Highway Structures	Elzly Technology Corporation	500,000	9/15/2015	7/15/2018	Research in progress; Phase II underway
10-98	Protocols for Network-Level Macrotexture Measurement	Virginia Polytechnic Institute	500,000	9/6/2016	9/5/2019	Research in progress
10-99	Guidebook for Implementing Constructability Across the Entire Project Development Process: NEPA to Final Design	-----	500,000			In development
10-100	Procedures and Guidelines for Validating Contractor Test Data	-----	300,000			In development
AREA TWELVE: DESIGN--BRIDGES						
12-87A	Fracture-Critical System Analysis for Steel Bridges	Purdue University	260,000	9/18/2014	3/17/2017	Research in progress
12-89	Recommended AASHTO LRFD Tunnel Design and Construction Specifications	PB Americas, Inc.	714,877	6/21/2011	7/31/2016	Research completed; contractor's final deliverable pending; specifications to be published by AASHTO

TABLE 2 (continued)

Project No.	Title	Research Agency	Contract Amount	Starting Date	Completion Date	Project Status*
12-90	Guidelines for Shielding Bridge Piers	Roadsafe LLC	450,000	11/20/2012	9/30/2017	Research in progress
12-91	Strand Debonding for Pretensioned Girders	University of Cincinnati	650,000	9/13/2012	12/31/2016	Research in progress
12-92	Proposed LRFD Bridge Design Specifications for Light Rail Transit Loads	University of Colorado - Denver	349,754	7/26/2013	2/28/2017	Research in progress
12-93	Contribution of Steel Casing to Single Shaft Foundation Structural Resistance	State University of New York - Buffalo	469,818	6/13/2013	2/28/2017	Research in progress
12-94	LRFD Minimum Flexural Reinforcement Requirements	Iowa State University	550,000	9/30/2013	12/31/2017	Research in progress
12-95	Connection Details of Adjacent Precast Concrete Box Beam Bridges	Iowa State University	130,151	8/5/2013	5/3/2016	Terminated---Work to be completed under project 12-95A
12-96	Simplified Full-Depth Precast Concrete Deck Panel Systems	George Washington University	400,000	7/1/2013	12/31/2016	Research in progress
12-97	Guide Specification for the Design of Concrete Bridge Beams Prestressed with CFRP Systems	University of Houston	500,000	8/1/2013	7/31/2017	Research in progress
12-98	Recommended Guidelines for Prefabricated Bridge Elements and Systems Tolerances and Dynamic Effects of Bridge Moves	CME Associates Inc.	299,875	5/20/2014	6/30/2017	Research in progress
12-100	Guidelines for Maintaining Small Movement Bridge Expansion Joints	University of Delaware	150,000	7/16/2014	9/30/2016	Completed---Publication decision pending
12-101	Seismic Design of Bridge Columns with Improved Energy Dissipating Mechanisms	Infrastructure Innovation LLC	250,000	7/7/2014	2/28/2017	Research in progress
12-102	Recommended AASHTO Guide Specification for ABC Design and Construction	CME Associates Inc.	369,842	5/20/2014	6/30/2017	Research in progress
12-103A	Bridge Superstructure Tolerance to Total and Differential Foundation Movements	Rutgers, The State University of New Jersey	162,141	6/22/2016	6/21/2017	Research in progress
12-104	Guidelines to Improve the Quality of Element-Level Bridge Inspection Data	University of Missouri	347,961	8/11/2015	11/10/2017	Research in progress
12-105	Proposed AASHTO Seismic Specifications for ABC Column Connections	University of Nevada - Reno	450,000	9/1/2015	12/31/2018	Research in progress
12-106	Proposed Guidelines for Performance-Based Seismic Bridge Design	Modjeski & Masters	299,920	9/23/2016	3/22/2019	Contract pending
12-107	Proposed AASHTO Guidelines for Use of Stainless Steel in Bridge Girders	-----	400,000			In development
12-108	Development of Guidelines for Uniform Service Life Design for Bridges	Modjeski & Masters	279,846	9/1/2016	2/28/2019	Research in progress
12-109	Use of 0.7-in. Diameter Strands in Precast Pretensioned Girders	-----	600,000			Contract pending

TABLE 2 (continued)

Project No.	Title	Research Agency	Contract Amount	Starting Date	Completion Date	Project Status*
12-110	Proposed New AASHTO Load Rating Provisions for Implements of Husbandry	E&T Consulting Engineers	650,000	10/21/2016	10/20/2019	Research in progress
12-111	Evaluating the Effectiveness of Vibration-Mitigation Devices for Structural Supports of Signs, Luminaires, and Traffic Signals	-----	400,000			Contract pending
12-112	Update of the AASHTO LRFD Movable Highway Bridge Design Specifications	-----	500,000			In development
12-113	Proposed Modification to AASHTO Cross-Frame Analysis and Design	-----	750,000			In development
	AREA THIRTEEN: MAINTENANCE--EQUIPMENT					
13-04	Guide for Optimal Replacement Cycles of Highway Operations Equipment	Dye Management Group	398,059	5/1/2015	4/30/2017	Research in progress
13-05	Guide for Utilization Measurement and Management of Fleet Equipment	Washington State University	399,998	6/1/2015	5/31/2017	Research in progress
13-06	Development of an Automated Tool to Assist in the Formulation and Maintenance of Long Range Equipment Replacement Plans	-----	400,000			In development
	AREA FOURTEEN: MAINTENANCE--MAINTENANCE OF WAY AND STRUCTURES					
14-20A	Consequences of Delayed Maintenance of Highway Assets	University of Texas - El Paso	450,000	12/9/2013	12/31/2016	Completed---Publication decision pending
14-26	Culvert and Storm Drain Inspection Manual	Simpson Gumpertz & Heger, Inc.	250,000	8/24/2012	5/31/2016	Completed
14-28	Condition Assessment of Bridge Post-Tensioning and Stay Cable Systems Using NDE Methods	Texas A&M Transportation Institute	650,000	11/29/2012	9/30/2016	Completed---Publication decision pending
14-29	Assessing, Coding, and Marking of Highway Structures in Emergency Situations	Oregon State University	399,655	11/1/2013	4/15/2016	Completed---Published as NCHRP Report 833
14-30	Spot Painting to Extend Highway Bridge Coating Life	University of Kentucky	350,000	9/3/2013	7/31/2017	Research in progress; draft final report pending
14-32	Proposed Revisions to the AASHTO Movable Bridge Inspection, Evaluation, and Maintenance Manual	Parsons Brinckerhoff	230,000	7/31/2013	1/31/2016	Completed---To be published by AASHTO
14-33	Pavement Performance Measures that Consider the Contributions of Preservation Treatments	AMEC Foster Wheeler Environ & Infrastructure Inc.	399,993	6/2/2014	12/31/2016	Completed---Publication decision pending
14-34	Guide for Performance Measures in Snow and Ice Control Operations	ICF Incorporated	299,956	4/20/2015	4/19/2017	Research in progress
14-35	Acceptance Criteria of Complete Joint Penetration Steel Bridge Welds Evaluated Using Enhanced Ultrasonic Methods	Purdue University	538,965	4/24/2015	4/23/2018	Research in progress

TABLE 2 (continued)

Project No.	Title	Research Agency	Contract Amount	Starting Date	Completion Date	Project Status*
14-36	Proposed AASHTO Guide for Bridge Preservation Actions	University of Colorado - Boulder	299,821	11/13/2015	2/12/2018	Research in progress
14-37	Guide Specifications for the Construction of Chip Seals and Microsurfacing	Shuler Consultants LLC	150,000	8/15/2016	2/15/2018	Research in progress
14-38	Guide for Timing of Asphalt-Surfaced Pavements Preservation	AMEC Foster Wheeler Environ & Infrastructure Inc.	299,694	8/1/2016	8/1/2018	Research in progress
14-39	Using Vegetated Compost Blankets to Achieve Highway Runoff Volume and Pollutant Reduction	-----	500,000			In development
14-40	Transforming Roadside Management Technology and Practices for the Benefit of Safety, Ecology, and Economy	-----	300,000			In development
	AREA FIFTEEN: DESIGN--GENERAL DESIGN					
15-44	Guidelines for the Use of Mobile LIDAR in Transportation Applications	Oregon State University	400,584	9/14/2011	9/30/2016	Completed---Published as NCHRP Report 748; implementation activities completed
15-47	Developing an Improved Highway Geometric Design Process	CH2M Hill	533,564	3/15/2013	6/14/2016	Completed---To be published as an NCHRP report
15-48	Developing a Methodology for Designing Low and Intermediate Speed Roadways that Serve All Users	Gresham, Smith and Partners	499,900	7/22/2013	5/31/2017	Research in progress; draft final report pending
15-49	Geometric Design Guidelines for Managed Lanes	Texas A&M Transportation Institute	750,000	9/1/2013	9/30/2016	Completed---Published as NCHRP Report 835
15-50	Guidelines for Integrating Safety and Cost-Effectiveness into Resurfacing, Restoration, and Rehabilitation Projects	MRIGlobal	680,000	7/3/2013	1/9/2017	Research in progress
15-51	Preconstruction Services Cost Estimating Guide	Iowa State University	424,995	3/27/2013	3/26/2016	Completed---Published as NCHRP Report 826
15-52	Developing a Context-Sensitive Functional Classification System for More Flexibility in Geometric Design	University of Kentucky	250,000	1/15/2015	3/14/2017	Completed---To be published as an NCHRP report; implementation activities continue
15-53	Roadside Design for Conflicts in Proximity to Bridge Ends and Intersecting Roadways	KLS Engineering LLC	499,767	8/25/2014	8/25/2017	Research in progress; Phase 2 underway; continuation request pending
15-54	Proposed Modifications to AASHTO Culvert Load Rating Specifications	Michael Baker, Jr., Inc.	499,773	7/7/2015	7/6/2018	Research in progress
15-55	Guidance to Predict and Mitigate Dynamic Hydroplaning on Roadways	Virginia Polytechnic Institute	499,992	6/17/2015	12/16/2017	Research in progress
15-56	Guidelines for Selecting Ramp Design Speeds	MRIGlobal	400,000	11/10/2015	11/9/2017	Research in progress; contractor draft final report pending

TABLE 2 (continued)

Project No.	Title	Research Agency	Contract Amount	Starting Date	Completion Date	Project Status*
15-57	Highway Capacity Manual Methodologies for Corridors Involving Freeways and Surface Streets	University of Florida	799,999	8/18/2016	2/17/2019	Research in progress
15-59	Horizontal Sightline Offset Design Criteria, Exceptions, and Mitigation Strategies	MRIGlobal	400,000	8/10/2015	8/10/2017	Research in progress
15-60	Proposed Update of the AASHTO Guide for the Development of Bicycle Facilities	Toole Design Group	400,000	6/1/2015	9/1/2017	Research in progress
15-61	Applying Climate Change Information to Hydrologic and Hydraulic Design of Transportation Infrastructure	Kilgore Consulting and Management	750,000	9/20/2016	9/19/2018	Research in progress; interim report pending
15-62	Design and Access Management Guidelines for Truck Routes	MRIGlobal	500,000	7/5/2016	10/5/2018	Research in progress
15-63	Guidance to Improve Pedestrian and Bicycle Safety at Intersections	University of North Carolina - Chapel Hill	500,000	7/19/2016	10/19/2018	Research in progress
15-64	Guidelines for the Design of Unsignalized Median Openings in Close Proximity to Signalized Intersections	Texas A&M Transportation Institute	325,000	8/22/2016	8/22/2018	Contract pending
15-65	Develop Comprehensive Objective Criteria to Reduce Serious and Fatal Lane Departure Crashes and Prepare a Major Update to the Roadside Design Guide	-----	300,000			In development
15-66	Arterial Weaving on Conventional and Alternative Intersections	-----	750,000			In development
	AREA SIXTEEN: DESIGN--ROADSIDE DEVELOPMENT					
16-05	Guidelines for Cost-Effective Safety Treatments of Roadside Ditches	Texas A&M Research Foundation	400,000	5/14/2010	9/30/2017	Research in progress; Phase 2 underway
	AREA SEVENTEEN: TRAFFIC--SAFETY					
17-11(02)	Development of Clear Recovery Area Guidelines	Texas A&M University	270,000	9/7/2008	4/30/2017	Research in progress; contractor's draft final report pending
17-43	Long-Term Roadside Crash Data Collection Program	Virginia Polytechnic Institute	1,000,000	4/27/2010	12/31/2017	Research in progress; contractor's draft final report pending
17-46	Comprehensive Analysis Framework for Safety Investment Decisions	Cambridge Systematics	912,884	4/14/2010	4/30/2017	Research in progress; contractor's final report under review
17-50	Lead States Initiative for Implementing the Highway Safety	CH2M Hill	299,000	1/11/2011	12/31/2017	Research in progress; two additional peer exchanges and webinars in process; contractor's draft user guide and final report pending
17-54	Consideration of Roadside Features in the Highway Safety Manual	Roadsafe LLC	1,310,000	4/4/2011	12/31/2017	Research in progress; Phases 2 and 3 underway

TABLE 2 (continued)

Project No.	Title	Research Agency	Contract Amount	Starting Date	Completion Date	Project Status*
17-55	Guidelines for Slope Traversability	Texas A&M Research Foundation	500,000	5/2/2012	3/31/2017	Research in progress; contractor's draft final reports pending
17-56	Development of Crash Modification Factors for Uncontrolled Pedestrian Crossing Treatments	University of North Carolina - Chapel Hill	500,000	11/1/2012	9/1/2016	Completed---To be published as NCHRP Report 841
17-57	Development of a Comprehensive Approach for Serious Traffic Crash Injury Measurement and Reporting Systems	University of Michigan	449,986	5/22/2012	6/30/2017	Research in progress; final report under review/draft implementation
17-58	Safety Prediction Models for Six-Lane and One-Way Urban and Suburban Arterials	Texas A&M Transportation Institute	599,910	1/14/2013	4/30/2017	Beta testing completed; contractor's final report under review
17-59	Safety Impacts of Intersection Sight Distance	Vanasse Hangen Brustlin, Inc.	450,000	5/14/2012	12/31/2016	Research in progress; final report pending
17-60	Cost-Benefit Metrics for Behavioral Highway Safety Countermeasures	HDR Engineering, Inc.	499,841	4/16/2012	7/31/2017	Research in progress; contractor's draft report pending
17-61	Work Zone Crash Characteristics and Countermeasure Guidance	Texas A&M Research Foundation	600,000	9/19/2012	1/31/2017	Research in progress; draft final report pending
17-62	Improved Prediction Models for Crash Types and Crash Severities	University of Connecticut	800,000	7/2/2013	12/31/2017	Research in progress; Phases 2 and 3 underway
17-63	Guidance for the Development and Application of Crash Modification Factors	University of North Carolina - Chapel Hill	600,000	8/1/2013	2/28/2017	Research in progress; contractor's draft final report pending
17-64	Guidance for the Implementation of the Toward Zero Deaths National Strategy on Highway Safety	University of Minnesota	496,810	3/4/2016	2/4/2019	Research in progress
17-65	Improved Analysis of Two-Lane Highway Capacity and Operational Performance	University of Florida	499,213	9/22/2014	9/30/2017	Research in progress; draft final report pending; continuation request pending
17-66	Guidance for Selection of Appropriate Countermeasures for Opposite Direction Crashes	Texas A&M Transportation Institute	350,000	8/27/2014	7/31/2017	Research in progress; phase 2 underway
17-67	Identification of Factors Contributing to the Decline of Traffic Fatalities in the United States	University of Michigan	299,738	9/22/2014	2/28/2017	Research in progress; phase 2 underway; contractor's draft final reports pending
17-68	Intersection Crash Prediction Methods for the Highway Safety Manual	MRIGlobal	600,000	9/1/2014	9/1/2017	Research in progress; phase 2 underway
17-69	A Strategic Approach to Transforming Traffic Safety Culture to Reduce Deaths and Injuries	Montana State University	299,989	7/1/2014	12/31/2016	Research in progress
17-70	Development of Roundabout Crash Prediction Models and Methods	Kittelson & Associates	600,000	7/14/2014	7/1/2017	Research in progress
17-71	Proposed AASHTO Highway Safety Manual, Second Edition	Kittelson & Associates	800,000	10/12/2015	4/12/2019	Research in progress
17-72	Update of Crash Modification Factors for the Highway Safety Manual	University of North Carolina - Chapel Hill	400,000	8/31/2015	12/31/2017	Research in progress; phase 2 underway

TABLE 2 (continued)

Project No.	Title	Research Agency	Contract Amount	Starting Date	Completion Date	Project Status*
17-73	Conducting Systemic Pedestrian Safety Analyses	University of North Carolina - Chapel Hill	300,000	7/28/2015	7/28/2017	Research in progress
17-74	Developing Crash Modification Factors for Corridor Access Management	Vanasse Hangen Brustlin, Inc.	450,000	10/24/2016	4/24/2019	Research in progress
17-75	Leveraging Big Data to Improve Traffic Incident Management	Applied Engineering Management Corporation	275,000	8/15/2016	11/15/2017	Research in progress
17-76	Guidance for the Setting of Speed Limits	Texas A&M Transportation Institute	500,000	10/7/2016	4/7/2019	Research in progress
17-77	Quantitative Approaches to Systemic Safety Analysis	MRIGlobal	300,000	8/5/2016	8/4/2018	Research in progress
17-78	Understanding and Communicating Reliability of Crash Prediction Models	University of North Carolina - Chapel Hill	300,000	9/20/2016	3/19/2019	Research in progress
17-79	Safety Effects of Raising Speed Limits to 75 mph and Higher	Texas A&M Transportation Institute	500,000	9/19/2016	9/18/2019	Research in progress
17-80	Expansion of Human Factors Guidelines for Road Systems, Second Edition	-----	499,914			Contract pending
17-81	Incorporating Road Safety Planning in the Highway Safety Manual	-----	400,000			In development
17-82	A Practical Approach to Fixed Objects Within the Clear Zone	-----	500,000			In development
17-83	Implementation and Training Materials for the Highway Safety Manual, Second Edition	-----	500,000			In development
17-84	Pedestrian and Bicycle Safety Performance Functions for the Highway Safety Manual	-----	500,000			In development
	AREA EIGHTEEN: MATERIALS AND CONSTRUCTION--CONCRETE MATERIALS					
18-17	Entrained Air Void System for Durable Highway Concrete	Iowa State University	599,986	11/2/2015	11/2/2018	Research in progress
18-18	Design and Construction of Wide-Flange Precast Concrete Deck Girders with Ultra-High Performance Concrete Connections for Prefabricated Bridge Elements and Systems/Accelerated Bridge Construction	-----	500,000			In development
	AREA NINETEEN: ADMINISTRATION--FINANCE					
19-10	AASHTO Partnering Handbook, Second Edition	Iowa State University	400,000	4/9/2015	4/8/2017	Research in progress
19-11	Applying Risk Analysis, Value Engineering, and other Innovative Solutions for Project Delivery	Value Management Strategies Inc.	193,798	7/14/2015	1/31/2017	Research in progress
19-12	Development of Financial Plans and Performance Measures for Transportation Asset Management	Spy Pond Partners	350,000	5/11/2016	5/10/2018	Research in progress

TABLE 2 (continued)

Project No.	Title	Research Agency	Contract Amount	Starting Date	Completion Date	Project Status*
19-13	Value Capture Toolkit for State Transportation Agencies	Texas A&M Transportation Institute	350,000	6/2/2016	8/1/2017	Research in progress
19-14	Right-Sizing Transportation Investments--Methods for Planning and Programming	-----	500,000			In development
	AREA TWENTY: SPECIAL PROJECTS					
20-05	Synthesis of Information Related to Highway Problems	TRB Studies and Special Programs Division	1,750,000 **	12/15/1967		Research ongoing; refer to NCHRP Research Results Digest 398 for topic reports published as NCHRP Syntheses
20-06	Legal Problems Arising Out of Highway Programs	TRB Technical Activities Division	350,000 **	11/1/1968		Research ongoing; published as Selected Studies in Transportation Law (CRP-CD-20, volumes 1-4 and 8) and various NCHRP Legal Research Digests
20-07	Research for AASHTO Standing Committee on Highways	Various	1,200,000 **	12/2/1968		Research ongoing---Refer to project writeup at http://www.trb.org/nchrp
20-24(89)C	Transportation Asset Management, Inclusive Wealth, and Ecosystem Services	-----	389,250			In development
20-24(95)	Ensuring Essential Capability for the Future Transportation Agency	Spy Pond Partners	200,000	10/7/2016	4/7/2018	Research in progress (Phase I)
20-24(102)	Executive Strategies to Deliver Practical Design	Leidos Inc.	199,997	7/14/2015	9/13/2016	Completed---Contractor's final report sent to AASHTO and available on project web page
20-24(103)	Peer Exchange on Transportation Investment for Economic Development: Making the Case	TRB Technical Activities Division	100,000			Completed---Summary of proceedings published as Transportation Research Circular E-C202
20-24(104)	State DOT Implementation of MAP21 Performance Measure Rules	Cambridge Systematics	149,917	7/18/2016	9/17/2017	Research in progress
20-24(105)	Launching U.S. Transportation Enterprise Risk Management Programs	Spy Pond Partners	200,000	5/27/2015	7/26/2016	Completed---Contractor's final report sent to AASHTO and available on project web page
20-24(107)	Update to Transportation Governance: A 50-State Review of State Legislatures and Departments of Transportation	J.R. Rall Consulting LLC	100,000	2/17/2016	5/17/2017	Research in progress
20-24(108)	CEO Peer Exchange (2016)	Parsons Brinckerhoff	209,770	3/11/2016	11/11/2016	Completed---Contractor's final report sent to AASHTO and available on project web page
20-24(110)	Development of Resources to Support State DOT Communications on Safety	-----	130,000			In development

TABLE 2 (continued)

Project No.	Title	Research Agency	Contract Amount		Starting Date	Completion Date	Project Status*
20-24(111)	State DOT CEO Leadership Forum on "Connected & Autonomous Vehicles and Transportation Infrastructure Readiness" in conjunction with 2017 ITSWC, Montreal, Canada	-----	175,000				In development
20-24(112)	Connected Road Classification System (CRCS) Concept Development	-----	180,000				See NCHRP Project 03-126
20-24(113)	CEO Peer Exchange 2017	-----	300,000				In development
20-30	NCHRP-IDEA Program	TRB Studies and Special Programs Division	1,250,000	**	7/8/1992		Research ongoing; see project writeup on NCHRP website
20-44	Accelerating the Application of NCHRP Research Results	Various	31,870	**	8/1/1995	9/30/2018	Support for implementation and dissemination activities
20-44(01)	Workshop on Increasing WMA Implementation by Leveraging the State-Of-The-Knowledge	-----	150,000				In development
20-44Q	Communication Services for NCHRP	CTC & Associates LLC	603,323		5/7/2015	12/31/2017	In progress
20-59(14)C(02)	Strategic Plan Implementation Support Services for SCOTSEM	Geographic Paradigm Computing Inc.	100,000		8/11/2015	2/10/2017	Research in progress; contractor's final report pending
20-59(50)	Mainstreaming Transportation Hazards and Security Risk Management: CAPTA Update and Implementation	Countermeasures Assessment & Security Experts, LLC	175,000		8/5/2014	9/30/2016	Completed---Publication decision pending
20-59(51)A	Security 101: A Physical & Cyber Security Primer for Transportation Agencies	Countermeasures Assessment & Security Experts, LLC	100,000		2/10/2016	7/9/2017	Research in progress; interim report pending
20-59(51)B	A Guide to Emergency Management at State Transportation Agencies, Second Edition	Countermeasures Assessment & Security Experts, LLC	100,000		2/3/2016	7/2/2017	Research in progress; interim report pending
20-59(51)C	A Toolkit and Guide for Implementing Security, Emergency Management, and Infrastructure Protection at State Transportation Agencies	Geographic Paradigm Computing Inc.	100,000		9/30/2016	1/31/2018	Research in progress; interim report pending
20-59(52)	Communications Worker Credentialing Requirements	Virginia Polytechnic Institute	75,000		9/16/2015	3/15/2017	Research in progress; revised final report pending
20-59(53)	FloodCast: A Framework for Enhanced Flood Event Decision Making for Transportation Resilience	Dewberry Consultants LLC	498,162		9/2/2014	3/1/2018	Research in progress; contractor's draft final report pending; continuation request approved
20-59(54)	Transportation System Resilience: Research Roadmap and White Papers	Geographic Paradigm Computing Inc.	200,000		9/30/2016	2/28/2019	Research in progress; interim report pending
20-59(55)	Transportation System Resilience: CEO Primer & Engagement	-----	300,000				Contract pending
20-63B	Performance Measurement Tool Box and Reporting System for Research Programs and Projects	ICF Incorporated	367,655		7/20/2010	7/19/2016	Completed
20-65	Research for the AASHTO Standing Committee on Public Transportation	-----	450,000				Research in progress---Refer to project writeup on NCHRP website

TABLE 2 (continued)

Project No.	Title	Research Agency	Contract Amount	Starting Date	Completion Date	Project Status*
20-65/Task 56	Best Practices in Rural Regional Mobility	Cambridge Systematics	100,000	2/3/2015	12/31/2016	Research in progress
20-65/Task 57	Assessment of State DOT Transit Vehicle Procurement Models	AECOM Consulting Transportation Group	100,000	12/8/2014	8/2/2016	Completed
20-65/Task 60	The National Mobility Management Initiative: State DOTs Connecting Users and Rides for Specialized Transportation	ICF Incorporated	75,000	11/17/2014	3/30/2016	Completed---Summarized in NCHRP Research Results Digest 832, Volumes 1 and 2
20-65/Task 61	Determine the Degree To Which JARC And New Freedom Activities are Being Continued or Initiated Under Map-21	Parsons Brinckerhoff	49,981	10/20/2015	12/31/2016	Research in progress
20-65/Task 62	The National Perspective –An Assessment of Section 5310 Program Administration Under MAP-21	Parsons Brinckerhoff	49,991	10/13/2015	12/31/2016	Research in progress
20-65/Task 63	DOT Oversight of Facility Projects	AECOM Consulting Transportation Group	100,000	2/18/2016	1/17/2017	Research in progress
20-65/Task 64	Health and Human Services (particularly Medicaid) Revenue as Match	Kittelson & Associates	74,963	9/16/2015	9/15/2016	Completed
20-65/Task 65	Best Practices for State DOTs to Meet Rural Bus Fleet Replacement and Expansion Needs	ICF Incorporated	100,000	9/16/2015	8/16/2016	Completed
20-65/Task 66	States and Local Use of Administrative Resources Provided by the Federal Transit Administration	ICF Incorporated	50,000	9/9/2015	9/8/2016	Completed
20-65/Task 67	Multi-Modal Project Planning	Cambridge Systematics	100,000	9/20/2016	9/19/2017	Research in progress
20-65/Task 68	Successful Mobility Management Practices for Improving Transportation Services in Small Urban and Rural Areas	Cambridge Systematics	75,000	9/20/2016	9/19/2017	Research in progress
20-65/Task 69	Consolidation of Rural Transit Systems	ICF Incorporated	74,990	9/29/2016	9/29/2017	Research in progress
20-65/Task 70	Cross Modal Investment	Parsons Brinckerhoff	74,944	10/18/2016	10/17/2017	Research in progress
20-65/Task 71	Transit Network Balance; Efficiency and Equity	ICF Incorporated	49,987	9/29/2016	9/28/2017	Research in progress
20-65/Task 72	Small System Alternative Fuel Strategies	ICF Incorporated	74,959	9/29/2016	9/28/2017	Research in progress
20-68A(02)	U.S. Domestic Scan Program	Arora and Associates, P.C.	2,710,592	12/28/2012	12/26/2017	Research in progress
20-82A	Next Generation of the Transportation Pooled Fund (TPF) Website	Science Applications International Corporation	99,784	10/23/2012	10/22/2016	Completed
20-83(03)A	Long-Range Strategic Issues Affecting Preservation, Maintenance, and Renewal of Highway Infrastructure	Parsons Brinckerhoff	499,999	5/18/2015	5/18/2017	Research in progress
20-83B	Communicating the Results of NCHRP Strategic Transportation Issues Research	Burns & McDonnell Engineering Company Inc.	384,200	7/11/2013	12/16/2016	Research in progress; draft final report pending

TABLE 2 (continued)

Project No.	Title	Research Agency	Contract Amount	Starting Date	Completion Date	Project Status*
20-83C(01)	Technical Assistance for NCHRP Report 750, Vol. 2, "Climate Change, Extreme Weather and the Highway System: Impacts and Adaptation Approaches"	MMeyer Consulting LLC	50,000	3/17/2015	8/1/2016	Completed
20-95A	Compendium of Successful Practices, Strategies, and Resources in the FHWA Disadvantaged Business Enterprise (DBE) Program	-----	175,000			In development
20-96	Leadership Guide for Strategic Information Management for State Departments of Transportation	Spy Pond Partners	250,000	4/16/2014	3/15/2016	Completed---Published as NCHRP Report 829
20-97	Improving Findability and Relevance of Transportation Information	Spy Pond Partners	500,000	4/18/2014	4/17/2017	Research in progress
20-99	Communication Guidelines for State Departments of Transportation	Parsons Brinckerhoff	300,000	6/30/2014	2/1/2017	Research in progress
20-100	Return on Investment in Transportation Asset Management Systems and Practices	Spy Pond Partners	400,000	1/28/2015	3/31/2017	Research in progress
20-101	Guidelines to Incorporate the Costs and Benefits of Adaptation Measures in Preparation for Extreme Weather Events and Climate Change	Dewberry Consultants LLC	299,210	9/1/2015	4/30/2017	Research in progress; contractor draft final report pending
20-102(01)	Policy and Planning Actions to Internalize Societal Impacts of CV and AV Systems into Market Decisions	Texas A&M Transportation Institute	400,000	11/3/2015	2/2/2017	Research in progress
20-102(02)	Impacts of Transit System Regulations and Policies on CV/AV Technology Introduction	Kimley-Horn & Associates	149,982	1/4/2016	3/4/2017	Research in progress
20-102(03)	Critical Next Steps for AV/CV Applications in Freight Operations	Booz-Allen & Hamilton	149,851	10/15/2015	3/14/2017	Research in progress
20-102(04)	Evaluation Guidance for Automated Vehicle Pilot and Demonstration Projects	-----	75,000			In development
20-102(05)	Strategic Communications Plan for NCHRP 20-102	-----	100,000			In development
20-102(06)	Road Markings for Machine Vision	Texas A&M Transportation Institute	200,000	7/13/2016	7/12/2017	Research in progress
20-102(07)	Implications of Automation for Motor Vehicle Codes	Virginia Polytechnic Institute	350,000	11/14/2016	2/13/2018	Research in progress
20-102(08)	Dedicating Lanes for Priority or Exclusive Use by CVs and AVs	Booz-Allen & Hamilton	349,929	8/2/2016	2/1/2018	Research in progress
20-102(09)	Providing Support to the Introduction of CV/AV Impacts into Regional Transportation Planning and Modeling Tools	Texas A&M Transportation Institute	300,000	9/1/2016	12/31/2017	Research in progress
20-102(11)	Summary of Existing Studies on the Effects of CV/AV on Travel Demand	-----	100,000			In development

TABLE 2 (continued)

Project No.	Title	Research Agency	Contract Amount	Starting Date	Completion Date	Project Status*
20-102(12)	Business Models to Facilitate Deployment of CV Infrastructure to Support AV Operations	-----	400,000			In development
20-102(13)	Planning Data Needs and Collection Techniques for CV/AV Applications	-----	250,000			In development
20-102(14)	Data Management Strategies for CV/AV Applications for Operations	-----	250,000			In development
20-103	Guidance for Development and Management of Sustainable Information Portals	Applied Engineering Management Corporation	249,903	4/17/2015	4/16/2017	Research in progress
20-104	Capturing and Learning Essential Consultant-Developed Knowledge within Departments of Transportation	Spy Pond Partners	249,992	4/15/2015	1/14/2017	Research in progress
20-105	Development of Course Outlines for Ahead of the Curve Training Program: Mastering the Management of Transportation Research	Cambridge Systematics	55,000	2/23/2015	3/31/2016	Completed
20-105A	Development of Course Outlines for Ahead of the Curve Training Program: Mastering the Management of Transportation Research	Applied Research Associates	75,000	6/1/2016	6/1/2017	Research in progress
20-106	Framing Surface Transportation Research for the Nation's Future	-----	675,000			Under review; research to be conducted by TRB's Studies and Special Programs Division
20-107	Effective Construction Project Staffing Strategies for Transportation Agencies	University of Kentucky Research Foundation	499,613	6/28/2016	6/28/2018	Research in progress
20-108	Effective Practices for Creating and Maintaining an Innovation-Delivery Culture within Departments of Transportation	Burns & McDonnell Engineering Company Inc.	249,954	7/11/2016	11/10/2017	Research in progress
20-109	Enhancement of the Transportation Research Thesaurus	Information International Associates Inc.	174,793	7/28/2016	7/27/2017	Research in progress
20-110	A Guide to Ensure Access to the Publications and Data of Federally Funded Transportation-Related Research	University of Michigan	249,960	8/5/2016	2/4/2018	Research in progress; interim report pending
20-111	Support for AASHTO RAC Task Forces in Response to the SCOR Strategic Plan	-----	300,015			See below
20-111A	RAC/SCOR Website	-----	15,000			In development
20-111B	Research Program and Project Management Web Application	-----	10,000			In development
20-111C	Research Funding Guide	CTC & Associates LLC	15,000	10/2/2016	3/1/2017	In progress
20-111D	Research Performance Management Website	iEngineering Corporation	15,000	6/8/2016	6/30/2019	In progress
20-111E	Transportation Pooled Fund Website	iEngineering Corporation	75,000	10/17/2016	12/31/2019	In progress

TABLE 2 (continued)

Project No.	Title	Research Agency	Contract Amount	Starting Date	Completion Date	Project Status*
20-111F	Documenting Research Management Information that Needs to be Shared Amongst AASHTO Member Agencies and Stakeholders	-----	25,000			In development
20-111G	Documenting Deliverables from and Best Practices for Federally-Required, State DOT Research Peer Exchanges	-----	50,000			In development
20-111H	Developing Recommendations for Optimal Skill Sets of State DOT Research Staff and Managers	-----	50,000			In development
20-111J	Developing High Value Research Brochures and Compilation	-----	50,000			In development
20-112	Research Roadmap--Public Health and Transportation	-----	250,000			In development
20-113	Research Roadmap--Transformational Technologies (other than CV/AV)	-----	150,000			In development
20-113A	Support for TRB Symposium on Transformational Technologies Affecting Transportation	CAVita LLC	130,000	9/15/2016	4/14/2017	Research in progress
20-114	Multimodal Freight Transportation Research Roadmap	-----	250,000			In development
20-115	Deploying Transportation Security Practices in State DOTs	-----	750,000			In development
20-116	Emergency Management in State Transportation Agencies	-----	750,000			In development
20-117	Deploying Transportation Resilience Practices in State DOTs	-----	1,000,000			In development
20-118	Effective Performance Management for Transportation Agencies	-----	500,000			In development
20-119	Evaluating the Suitability of Roadway Corridors for Use by Monarch Butterflies	-----	350,000			In development
20-120	Next Generation Transportation Pooled Fund Website	-----	150,000			In development
AREA TWENTY-ONE: SOILS AND GEOLOGY--TESTING AND INSTRUMENTATION						
21-10	Manual on Subsurface Investigations--Update	GeoSyntec Consultants of North Carolina PC	299,912	6/17/2014	2/28/2017	Research in progress; draft final report pending
21-11	Improved Test Methods and Practices for Characterizing Steel Corrosion Potential of Earthen Materials	McMahon & Mann Consulting Engineers PC	400,000	7/5/2016	1/5/2019	Research in progress; Phase I underway
AREA TWENTY-TWO: DESIGN--VEHICLE BARRIER SYSTEMS						
22-14(04)	Testing of Cable Median Barrier in a Narrow Ditch	Texas A&M Research Foundation	100,000	3/17/2011	6/30/2017	Research in progress; contractor's draft final report pending

TABLE 2 (continued)

Project No.	Title	Research Agency	Contract Amount	Starting Date	Completion Date	Project Status*
22-20(02)	Design Guidelines for TL-3 through TL-5 Roadside Barrier Systems Placed on Mechanically Stabilized Earth (MSE) Retaining Walls	Texas A&M Research Foundation	610,000	5/14/2010	5/31/2017	Research in progress; contractor's draft final report under review
22-22(02)	Effectiveness of Traffic Barriers on Non-Level Terrain	Texas A&M Research Foundation	420,742	6/12/2012	5/11/2017	Research in progress
22-26	Identification of Factors Related to Serious Injury and Fatal Motorcycle Crashes into Traffic Barriers	Virginia Polytechnic Institute	500,000	5/1/2009	12/31/2017	Research in progress; added additional driving season for added crash records; draft final report pending
22-29A	Evaluating the Performance of Longitudinal Barriers on Curved, Superelevated Roadway Sections	George Mason University	250,000	7/28/2014	12/31/2016	Research in progress; final report pending
22-31	Recommended Guidelines for the Selection and Placement of Test Levels 2 through 5 Median Barriers	Roadsafe LLC	300,000	9/28/2015	9/28/2018	Research in progress; interim report approved; Phase 2 underway
22-32	Development of Methods to Evaluate Side Impacts with Roadside Safety Features	-----	500,000			In development
22-33	Development of a Collaborative Approach for Multi-State In-Service Evaluations of Roadside Safety Hardware	-----	650,000			In development
	AREA TWENTY-FOUR: SOILS AND GEOLOGY--MECHANICS AND FOUNDATIONS					
24-36	Scour at the Base of Retaining Walls and Other Longitudinal Structures	University of Minnesota	500,000	11/15/2012	11/30/2016	Research in progress; contractor's draft final report under review
24-37	Combining Individual Scour Components to Determine Total Scour	Georgia Tech Research Corporation	600,000	10/1/2012	12/31/2016	Research in progress; contractor's draft final report pending
24-40	Design Hydrology for Stream Restoration and Channel Stability at Stream Crossings	Colorado State University	350,000	7/22/2013	6/30/2016	Completed---Publication decision pending
24-41	Defining the Boundary Conditions for Composite Behavior of Geosynthetic Reinforced Soil (GRS) Structures	University of Texas - Austin	500,000	9/1/2014	11/30/2017	Research in progress; contractor's draft final report pending
24-42	Underwater Installation of Filter Systems for Scour and other Erosion Control Countermeasures	Ayres Associates	300,000	6/30/2014	6/30/2017	Research in progress; contractor's draft final report pending
24-43	Relationship between Erodibility and Properties of Soils	Texas A&M Transportation Institute	300,000	8/11/2015	8/11/2018	Research in progress; contractor's draft final report pending
24-44	Guidelines for Managing Geotechnical Risks in Design-Build Projects	Iowa State University	350,000	6/1/2015	12/1/2017	Research in progress; interim report pending
24-45	Evaluating Mechanical Properties of Earth Material During Intelligent Compaction	University of Texas - El Paso	500,000	7/27/2015	7/27/2018	Research in progress; contractor's draft final report pending

TABLE 2 (continued)

Project No.	Title	Research Agency	Contract Amount	Starting Date	Completion Date	Project Status*
24-46	Development of an Implementation Manual for Geotechnical Asset Management for Transportation Agencies	Shannon & Wilson, Inc.	499,682	7/27/2016	7/27/2018	Research in progress; interim report pending
24-47	Revised Clear-Water and Live-Bed Contraction Scour Analysis	Ayres Associates	500,000	10/6/2016	4/6/2019	Research in progress; interim report pending
AREA TWENTY-FIVE: TRANSPORTATION PLANNING--IMPACT ANALYSIS						
25-25	Research for the AASHTO Standing Committee on the Environment	-----	600,000			Research in progress---Refer to project writeup on NCHRP website and individual tasks
25-25/Task 96	Quick Reference Guide for Traffic Modelers for Generating Traffic and Activity Data for Project-Level Air Quality Analyses	Parsons Brinckerhoff	75,000	11/4/2015	7/31/2017	Research in progress
25-25/Task 97	Historic Roads: A Synthesis of Identification and Evaluation Practices	Parsons Brinckerhoff	74,834	2/16/2016	2/16/2017	Research in progress
25-25/Task 98	Practical Guide for Developing Effective Scopes of Work for the Geophysical Investigation of Cemeteries	Parsons Brinckerhoff	74,961	2/16/2016	8/16/2017	Research in progress
25-25/Task 99	Lessons Learned from State DOT NEPA Assumption	Louis Berger Group	105,000	7/21/2015	11/16/2016	Completed---Report sent to AASHTO
25-25/Task 100	Compilation of Existing Data on Northern Long-Eared and Other Cave-Dwelling Bat Habitat and the Roadside Environment	-----	125,000			Cancelled
25-25/Task 101	Stormwater Monitoring Program Goals, Objectives, and Protocols for State Departments of Transportation	Parsons Brinckerhoff	124,948	4/15/2016	4/15/2017	Research in progress
25-25/Task 102	Artificial Bat Roost Mitigation Designs and Standardized Monitoring Criteria	-----	125,000			In development
25-25/Task 103	Research and Report on the Administration of Categorical Exclusions by State Departments of Transportation (DOTs) under NEPA	-----	60,000			In development
25-25/Task 104	A Pilot Program for Streamlining Carbon Monoxide Project-Level Air Quality Analyses with Programmatic Agreements	-----	125,000			In development
25-25/Task 105	A Guidebook for Communications between Transportation and Public Health Communities	-----	100,000			In development
25-25/Task 106	National Synthesis of Highway Noise Effects on Historic Properties and Effective Mitigation Practices	-----	100,000			In development
25-25/Task 107	Synthesis of Best Practices for the Development and Implementation of Section 106 Delegation Programmatic Agreements	-----	100,000			In development

TABLE 2 (continued)

Project No.	Title	Research Agency	Contract Amount	Starting Date	Completion Date	Project Status*
25-25/Task 108	How to Maximize NEPA Streamlining Benefits: An Assessment of National Streamlining Efforts	-----	115,000			In development
25-37	A Watershed Approach to Mitigating Stormwater Impacts	Low Impact Development Center, Inc.	598,539	7/1/2012	7/1/2016	Completed---To be published as NCHRP Report 840
25-43	Navigating Multi-Agency NEPA Processes to Advance Multimodal Transportation Projects	Parsons Brinckerhoff	249,988	6/3/2013	2/1/2016	Completed---Published as NCHRP Report 827
25-44	Field Evaluation of Reflected Noise from a Single Noise Barrier	Resource Systems Group, Inc.	549,969	9/4/2013	2/1/2018	Research in progress; Phase I published as NCHRP Web-Only Document 218
25-45	Mapping Truck Noise Source Heights for Highway Noise and Barrier Analysis	Illingworth & Rodkin, Inc.	499,969	6/4/2013	12/31/2016	Completed---Publication decision pending
25-46	Deploying Clean Truck Freight Strategies	ICF Incorporated	500,000	6/10/2014	1/31/2017	Research in progress
25-48	Combined Interface for Project Level Air Quality Analysis	Resource Systems Group, Inc.	499,706	4/24/2014	12/31/2016	Research in progress; draft final report pending; additional $80,000 from Federal Highway Administration
25-49	Development of a Highway Construction Noise Prediction Model	Gannett Fleming, Inc.	349,579	11/2/2015	2/2/2018	Research in progress; interim report pending
25-50	Prioritization Procedure for Proposed Road-Rail Grade Separation Projects along Specific Rail Corridors	Olsson Associates Inc.	349,763	9/28/2015	9/28/2018	Research in progress
25-51	Limitations of the Infiltration Approach to Stormwater Management in the Highway Environment	GeoSyntec Consultants	499,772	8/10/2015	2/10/2018	Research in progress
25-52	Meteorological Effects on Roadway Noise	Resource Systems Group, Inc.	299,912	6/8/2015	6/8/2017	Research in progress
25-53	Approaches for Determining and Complying with TMDL Requirements Related to Roadway Stormwater Runoff	-----	200,000			In development
25-54	Field Testing of BMPs Using Granulated Ferric Oxide Media to Remove Dissolved Metals in Roadway Stormwater Runoff	Barr Engineering	400,000	9/16/2016	9/15/2018	Research in progress

* Information on all projects initiated under the NCHRP from its inception in 1962 through 1988 is included in NCHRP Web Document 7: Special Edition of Summary of Progress through 1988 located at http://tinyurl.com/NCHRPWebDoc7. Detailed status reports on projects initiated after 1988 for which there is any type of contractual activity can be found on the NCHRP website at www.trb.org/nchrp.

** Continuing activity. Amount shown is for latest fiscal year in which funding was provided.

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A summary of NCHRP projects from 1962 through 1988 is available online as *NCHRP Web Document 7*. This document can be accessed through the link on the NCHRP home page (www.trb.org/NCHRP) or by going to http://tinyurl.com/NCHRPWebDoc7.

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