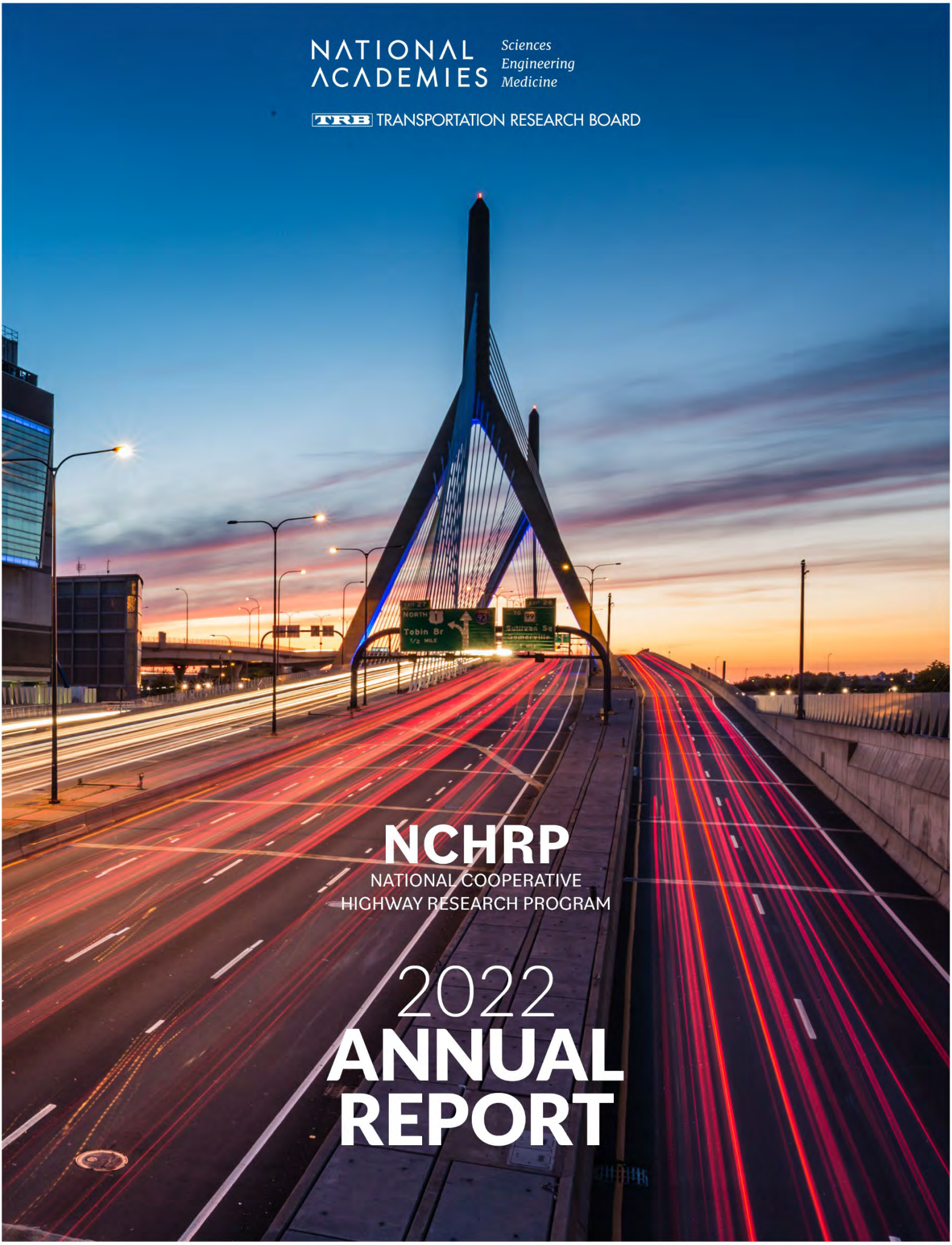
NATIONAL ACADEMIES *Sciences Engineering Medicine*

TRB TRANSPORTATION RESEARCH BOARD



NCHRP

NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

2022 ANNUAL REPORT

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**Membership as of November 2022.

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TRB TRANSPORTATION RESEARCH BOARD

NCHRP
NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

2022 ANNUAL REPORT

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

About the National Academies of Sciences, Engineering, and Medicine

The **National Academy of Sciences** was established in 1863 by an Act of Congress, signed by President Lincoln, as a private, nongovernmental 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. John L. Anderson 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.nationalacademies.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 provide leadership in transportation improvements and innovation through trusted, timely, impartial, and evidence-based information exchange, research, and advice regarding all modes of transportation. The Board's varied activities annually engage about 8,000 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.**

Transportation Research Board
500 Fifth Street, NW
Washington D.C. 20001
202.334.3224

Contents

Cover Photo: Leonard P. Zakim Bunker Hill Memorial Bridge in Boston, Massachusetts, photographed by **Robbie Shade** (**CC BY 2.0**). Modified from the original.

About the National Cooperative Highway Research Program (NCHRP)

Systematic, well-designed, and implementable research is the most effective way to solve many problems facing state departments of transportation (DOTs) administrators and engineers. Often, highway problems are of local or regional interest and can best be studied by state DOTs 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 (FHWA), 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 assurance 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, by committees of AASHTO, and by the FHWA. Topics of the highest merit are selected by the AASHTO Special Committee on Research and Innovation (R&I), and each year, R&I'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.

Message from the CRP Deputy Director and NCHRP Manager

Waseem Dekelbab

I am pleased to introduce the NCHRP 2022 Annual Report as the new NCHRP Manager, succeeding Ms. Lori Sundstrom who retired on August 12 after nearly 16 years of service to NCHRP, including 5 years as the NCHRP Manager. I had the great pleasure of working for Ms. Sundstrom as the NCHRP Associate Program Manager, and I am honored and humbled to have been given the opportunity to lead the program. Ms. Sundstrom leaves behind a stronger NCHRP that is more responsive to sponsor needs, is supported by new project management tools and a robust research management process, and has attracted some talented new project managers. NCHRP's continued success, however, very much depends on others: the leadership of NCHRP's sponsors—the state departments of transportation (DOTs), through the American Association of State Highway and Transportation Officials (AASHTO)—and the Federal Highway Administration; thousands of volunteer panel members; and the hundreds of staff from our contractor teams.

Now in its 60th year, this national collaboration continues to produce solutions for some of the important problems faced by state DOTs and other transportation agencies. This Annual Report highlights some of those accomplishments, and a full list of pending, active, and recently completed research is found in Table 2. I want to highlight two critical projects that show how our research is at the forefront of helping states prepare for the future of transportation.

At its April meeting, R&I allocated $4 million to support the nation in preparing for weather- and climate-related disasters. Phase 1 of this effort will be conducted under NCHRP Project 23-32. It will include the development of a transportation asset risk and resilience manual and performance metrics and thresholds for resilience and risk tolerance, and will provide guidance on reducing risk and improving resilience. The budget includes $500,000 from the U.S. Department of Transportation's Office of the Assistant Secretary for Research and Technology to broaden the scope to include multimodal elements.

While most of NCHRP's portfolio addresses specific technical challenges faced by the many and varied disciplines that constitute the transportation practitioner community, NCHRP also conducts research that serves state DOT executive leadership and supports them in the work they do to lead their agencies and meet the needs of their communities, their states, and the nation. During its Annual Meeting in October, the AASHTO Board of Directors approved the AASHTO Policy Resolution PR-1-22, "Development of a National Vision for the Future of Transportation and Individual and Collective Actions for State Departments of Transportation to Make Progress toward the Vision." In this policy resolution, our sponsors adopted the transportation vision framework developed under NCHRP Project 20-24(138).

The variety of topics that NCHRP takes on mirrors the diversity of challenges and opportunities that transportation practitioners and leaders encounter every day. Our staff are similarly diverse in their knowledge and experience. Personally, I find this diversity part of what makes working in NCHRP so professionally satisfying, in addition to knowing that the work we do is appreciated, and, more important, that it is used. I know this is also true for our volunteer panel members. Service to the nation is at the heart of NCHRP, and it is the mission of the National Academies of Sciences, Engineering, and Medicine. I look forward to serving the transportation community in the years to come.

This Year at NCHRP

New and Continuing Projects

During 2022, NCHRP completed 118 research projects, published 98 research products, and approved 160 new and continuing projects, including 73 new and continuing projects selected by the R&I for FY 2023, as shown in Exhibit 1. A cumulative total of 2,137 research contracts have resulted from all NCHRP yearly programs through 2022.

Funding for the FY 2023 program is expected in early 2023, permitting execution of contracts and initiation of research. R&I will formulate the FY 2024 program in April 2023 based on research problems that were submitted by November 1, 2022, the beginning of another cycle of NCHRP research. An overview of the NCHRP research cycle can be found on **pages 24 - 29** of this report.

Exhibit 1. Number of Research Projects Selected by R&I, FY 2019 through FY 2023

Projects	2019	2020	2021	2022	2023
Continuing projects	11	11	11	12	12
New projects	47	56	47	49	61
Total projects	58	67	58	61	73
Total project funds	**$34,429,000**	**$33,330,000**	**$31,304,200**	**$31,893,000**	**$40,524,000**

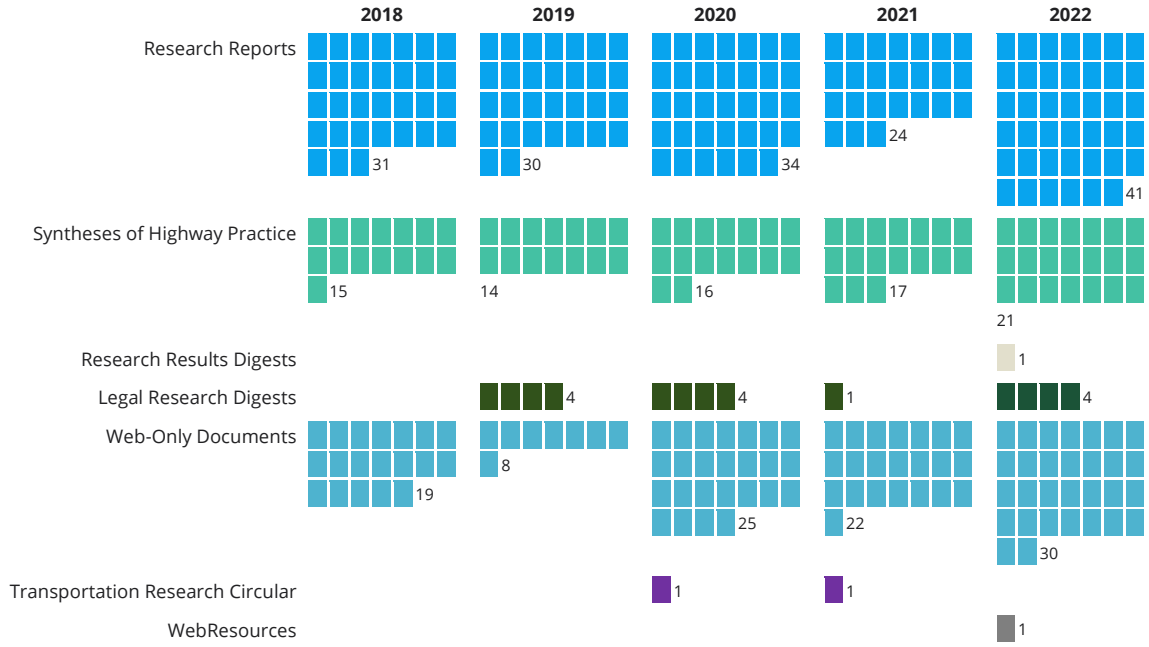
Research Products

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 several numbered series, which are listed in Table 1 of this Annual Report. In 2022, NCHRP produced 98 research products, and quantities for these series published over the past 5 years are shown in Exhibit 2.

Publications are distributed by TRB online and in print, with print runs for reports ranging from 400 to 700 copies. Print copies are mailed to the chief operating officers (CEOs) of state DOTs, AASHTO staff, panel members, the research contractor, and the following individuals and organizations:

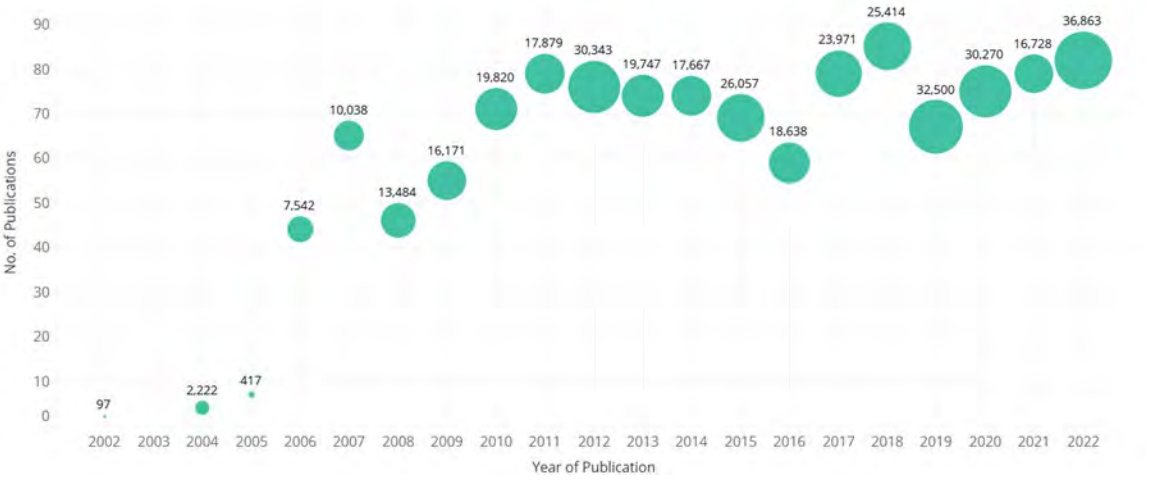
- TRB members who have chosen to receive publications in the particular subject area of the report
- About 100 libraries
- TRB representatives in the state DOTs
- Numerous educational institutions
- Liaison representatives from industry and transportation organizations in other countries
- Relevant TRB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

Exhibit 2. NCHRP Research Products Produced, CY 2018 through CY 2022



NCHRP research products have value beyond their immediate publication dates. In 2022, NCHRP research products were accessed over 400,000 times. The downloads and OpenBook data indicate that NCHRP research products published from 2002 through 2022 were accessed in 2022 (see Exhibit 3).

Exhibit 3. NCHRP research products accessed in 2022, by their year of publication.



Panel Members

NCHRP continues to engage panel members drawn from all walks of professional life, with heavy dependence on practitioners from NCHRP's program sponsors—the state departments of transportation. Exhibit 4 provides a breakdown of the affiliation of new NCHRP panel members since FY 2019.

Exhibit 4. Affiliations of New Panel Members, FY 2019 through FY 2023

Affiliation	2019	2020	2021	2022	2023
State agencies	294	264	313	326	407
Federal agencies	9	17	11	10	4

Affiliation	2019	2020	2021	2022	2023
Local agencies, transit agencies, MPOs	26	20	19	13	24
Educational institutions	67	56	74	67	62
Industry, consultants, associations	116	117	130	101	82
Other	20	11	9	5	5
All	**532**	**485**	**556**	**522**	**584***

* As of November 30, 2022.

Webinars

NCHRP research results are frequently the subject of TRB webinars. Webinar participants have diverse professional expertise and interests and come from varied affiliations. Over 4,000 participants from all 50 states and the District of Columbia attended 14 NCHRP research product webinars in 2022 (see Exhibit 5).

Exhibit 5. Location of attendees of NCHRP research product webinars held in 2022.

Update on NCHRP Continuing Projects

Several continuing projects are carried out within NCHRP. Results may be published in hard copy, delivered in the form of internal reports and presentations to AASHTO committees and councils, available on the TRB website, or made available on request.

NCHRP Project 20-05, "Synthesis of Information Related to Highway Problems"

Often, administrators, practicing engineers, and researchers have problems that can be addressed through existing research findings and practices. Unfortunately, this information is often fragmented, scattered, and sometimes 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 highway problems. The program is in its 54th year and publishes approximately 16 reports annually.

Notable NCHRP Syntheses published in 2022

NCHRP Synthesis 587: Use of Smart Work Zone Technologies for Improving Work Zone Safety, by Henry Brown and Praveen Edara, University of Missouri, documents state department of transportation (DOT) practices regarding the use of smart work zone technologies to improve safety for motorists, construction and maintenance workers, and other users of the transportation system. The synthesis covers various types of smart work zone technologies, integration of these technologies with crowdsourcing systems, performance measures to evaluate their effectiveness, and challenges to implementation.

NCHRP Synthesis 593: 3D Digital Models as Highway Construction Contract Documents, by Hala Nassereddine, Makram Bou Hatoum, Gabriel Dadi, Timothy Taylor, and Ryan Griffith, University of Kentucky, documents state DOT practices for delivering 3D digital models to highway contractors and the use of these models as contract documents. The synthesis focuses on the use of 3D digital models as contract documents at four levels: policies, technical, process, and people.

For more information:
http://www.trb.org/SynthesisPrograms/SynthesesNCHRP.aspx

NCHRP Project 20-06, "Legal Problems Arising out of Highway Programs"

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. Begun in 1968, this research project identifies and evaluates courses of action for state DOTs and facilitates the handling of both immediate and long-range needs. The final products of this research are Legal Research Digests (LRDs), available at **http://www.trb.org/Publications/PubsNCHRPLegalResearchDigests.aspx**.

NCHRP Legal Research Digests published in 2022

Transportation agencies across the country may face legal challenges from property owners when design or permit changes cause safety concerns or obstruct access to private driveways in the public right-of-way. *NCHRP Legal Research Digest 85: Public Liabilities Relating to Driveway Permits* evaluates the circumstances under which transportation agencies are held liable by property owners for the regulatory function of permitted and unpermitted driveways.

Managing risks is central to ensuring the success of highway construction projects. This has become even more evident as projects that are drastically increased in size and complexity have become more common. Known generally to the transportation industry as "mega projects," the number of such highway projects is on the rise. *NCHRP Legal Research Digest 86: Managing Enhanced Risk in the Mega Project World* addresses the change in risk profiles of larger transportation projects in terms of size, project delivery methods, and legislation. It examines how standard contract provisions must be modified to allocate risks in accordance with the enhanced scope of the project.

NCHRP Legal Research Digest 87: Encampments of Unhoused Individuals in Transportation Rights-of-Way: Laws and State DOT Practices presents the laws, statutes, cases, procedures, policies, and other resources governing or addressing:

(1) a transportation agency's prevention or removal of encampments inhabited by people who are unsheltered from transportation rights-of-way; and (2) the authorized use of transportation rights-of-way for homeless shelters and social services to assist transportation agencies in addressing safety, health, and public welfare issues and the ability of transportation agencies to control their rights-of-way. Also, this digest includes a comprehensive overview of the types of legal claims against transportation agencies that involve the prevention or removal of encampments from transportation rights-of-way and the use of transportation rights-of-way for authorized shelters.

The LRD will be helpful to transportation lawyers, engineers, planners, state and federal civil rights transportation officers, private civil rights attorneys, civil rights groups, administrators, and researchers of civil rights in transportation.

For more information:
https://apps.trb.org/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=508

NCHRP Project 20-24, "Research for AASHTO and State DOT Leadership"

This project is designed to conduct research focused on issues facing state transportation agency leadership. Reports from this project deliver timely information on such topics as enterprise knowledge management; workforce development; enterprise-level decision-making frameworks; measurement and management of transportation system performance and asset condition; economic and social benefits of transportation system performance; transportation system resilience; and the significance of new technologies and societal trends that are shaping transportation.

Funded by NCHRP Project 20-24 and released in 2022 by AASHTO, *Transportation Governance and Finance, A 50-State Review of State Legislatures and Departments of Transportation, 3rd Edition,* provides a state-by-state review of how state DOTs are structured, how transportation is funded and financed, and the governmental relationships between DOTs and state legislatures. The report also includes a section on how the COVID-19 pandemic affected transportation funding and finance. The forthcoming *NCHRP Research Report 1014: Developing a Highway Framework to Conduct an All-Hazards Risk and Resilience Analysis* presents a roadmap for developing an all-hazards risk and resilience assessment of transportation system assets.

NCHRP Project 20-24 also supports events that bring together state DOT leadership to share information and experiences. NCHRP Project 20-24(139), "Into the 2020s: A Peer Exchange Series for State DOT CEOs," supported three peer exchanges, including one specifically designed for CEOs recently appointed to their positions. The series will continue into 2023. NCHRP Project 20-24(138), "Collective and Individual Actions for State Departments of Transportation Envisioning and Realizing the Next Era of America's Transportation Infrastructure," convened state DOT leadership and a range of stakeholders at a workshop to develop a community-focused vision for transportation. The project will continue with plans to support work to advance adoption and implementation of the vision.

For more information:
https://apps.trb.org/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=560

NCHRP Project 20-30, "IDEA Program"

The Innovations Deserving Exploratory Analysis (IDEA) Program, begun in 1992, 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. Of the 212 projects completed to date, products of 42 projects (20%) have been successfully implemented. Another 45-plus completed or active projects have resulted, or are expected to result, in products with a high implementation potential in the near term, if provided resources for their further development and evaluation. Also, at least 11 AASHTO and ASTM standard test methods or procedures have resulted from NCHRP IDEA research, and several more are expected in the near future.

For more information: **http://www.trb.org/IDEAProgram/IDEAHighway.aspx**

NCHRP Project 20-44, "Implementation Support Program"

The NCHRP Implementation Support Program has funding to implement NCHRP research results by state DOTs and other eligible transportation agencies. NCHRP procures and manages consultant services to undertake the implementation projects as required by the applicant, and draws on panels of experts to oversee the projects. State DOTs, AASHTO committees and councils, and NCHRP project panels can apply for funding for a range of implementation products and activities, including pilot/demonstration projects, workshops, peer exchanges, training, and briefing materials. Completed NCHRP research results and products, as well as products still in development, are eligible, and there is no maximum amount for funding requests.

In FY 2022, the NCHRP Project 20-44 oversight panel approved seven implementation projects, totaling $1,530,000.

For more information:
https://www.trb.org/NCHRP/NCHRPImplementationSupportProgram.aspx

NCHRP Project 20-68, "U.S. Domestic Scan Program"

The objective of the U.S. Domestic Scan Program is to accelerate the rate of advances in practice by facilitating information sharing and technology exchange among the states and other transportation agencies and to identify actionable items of common interest. Summaries of the multi-year program and access to its principal products are available on the TRB website at **https://www.trb.org/NCHRP/USDomesticScanProgram.aspx**.

Each year, two to three new scan topics are programmed and initiated. Scan durations, from topic selection to completion of the scan team's report, are typically 2 to 3 years. The following scans were initiated in 2022:

- Scan 22-01, "Recent Leading Innovations in the Design, Construction, and Materials Used for Concrete Bridge Decks," seeks to identify lessons learned from bridge deck projects that use innovative materials and strategies. These lessons will help states determine approaches to designing new bridge decks, providing better durability and service life of those decks.

- Scan 22-02: “Experiences in the Use of Digital Construction Management (DCM) in the Highway Industry,” seeks to identify the successful construction management processes used by states deploying innovative DCM practices and to document how the DCM was adopted, its governing architecture, value added by its use, and how others may accelerate adoption of this proven innovation.
- Scan 22-03, “Leading Practices in Equitable Decision-Making to Support Societal Goals within Transportation Agencies,” explores the methods that transportation organizations took to implement innovative strategies throughout their organization to improve safety and equity in transportation decision-making, the specific organizational factors that lead to successful organizational mission implementation aimed at advancing societal goals, the methods that the organization successfully used with stakeholders to implement new strategies, and the information on what socioeconomic and sociodemographic metrics are being used by agencies in transportation funding decisions and project prioritization.

For more information:
https://www.trb.org/NCHRP/USDomesticScanProgram.aspx

NCHRP Project 20-123, “Support for AASHTO Committees and Councils”

This continuing project provides ongoing support for AASHTO councils and committees for research-related needs. Tasks must result in or contribute to the development of high-quality research problem statements that can be submitted to or pursued by state transportation research programs, the FHWA pooled fund program, NCHRP, or other interested entities. Tasks may include but are not limited to developing research roadmaps or prioritized lists of specific research needs; updating council or committee strategic plans that include a research component; conducting research scoping studies for narrow research topics; developing activities to update specifications and manuals maintained by a committee or council, using previously conducted research, and convening experts to arrive at a consensus; and convening peer exchanges.

The oversight panel has approved $900,000 in CY 2022. Since the project’s inception in 2019, funding requests totaling $3,400,000 have been approved.

For more information: **http://www.trb.org/NCHRP/NCHRP20-123.aspx**

RESEARCH SHOWCASE

Wind Drag Coefficients for Highway Signs and Support Structures

Research under NCHRP Project 15-67 was completed and will be published as *NCHRP Research Report 1012: Wind Drag Coefficients for Highway Signs and Support Structures*.

Research Agency:
University of Iowa

Principal Investigator:
George Constantinescu

NCHRP Project 15-67, "Wind Drag Coefficients for Highway Signs and Support Structures," was initiated to provide more accurate estimates of wind loads acting on isolated signs and signs supported on monotube and truss structures. It also involved estimating wind loads acting on monotube structures and the chords, secondary members, and gusset plates of truss structures supporting highway signs.

Safe and economical design of highway sign support structures requires accurate estimation of wind loads acting on highway signs and their support structures. NCHRP Project 15-67 proposed new general methodologies based mainly on three-dimensional numerical simulations to estimate wind loads acting on isolated rectangular signs, those with add-on signs, and side-by-side signs as well as wind loads acting on structures supporting highway signs. The methodologies are applicable to multiple highway signs placed on overhead bridge-type and cantilever-type truss structures as well as on overhead bridge-type and cantilever-type monotube structures, and they account for the interactions and shielding effects between the signs and the support structures.

The general approach is to calculate the drag coefficient for an element (e.g., chords, secondary members of trusses, highway signs), assuming it is isolated (i.e., free of interactions with other structural elements), and then use modification factors to account for different effects due to the presence of other highway signs and members of the support structure in the vicinity of that element. The research team also developed a comprehensive set of design examples illustrating how to apply the proposed methodologies and recommendations to estimate wind drag coefficients for highway signs and their support structures.

Based on the findings of the investigation, the research team prepared draft language for consideration by AASHTO to incorporate the research results in the next update of the *AASHTO Load and Resistance Factor Design (LRFD) Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals* (LRFDLTS-1). The LRFDLTS-1 specifications account for a subset of the relevant geometrical and flow parameters that affect the drag coefficient for commonly used highway traffic signs. The investigation showed that, in some cases, the wind loads calculated using the new methodologies were much larger than those calculated based on the procedures given in the present LRFDLTS-1 specifications. This finding was supported by wind tunnel experiments conducted as part of the present investigation.

The proposed language to the AASHTO LRFDLTS-1 specifications, if considered, will increase the design safety of highway sign support structures by using wind loads that are based on the best current understanding of the phenomena. As a result, service life of the highway sign support structures used throughout the United States will increase.

RESEARCH SHOWCASE

Update of Design of Bonded FRP Systems for Repair and Strengthening of Concrete Bridge Elements

Research under NCHRP Project 20-07/Task 428 was completed and provided to Technical Committee T-6 of the AASHTO Committee on Bridges and Structures (COBS), who voted to consider the proposed language to the guide specification. The updated edition of the guide specification will be published by AASHTO.

Research Agency:
University of Kentucky Research Foundation

Principal Investigator:
Issam Harik

The first edition of the *AASHTO Guide Specifications for Design of Bonded FRP Systems for Repair and Strengthening of Concrete Bridge Elements* represented the initial step toward streamlining the design of externally bonded fiber reinforced polymer (FRP) for bridge retrofits. NCHRP Project 20-07/Task 428, "Update of Design of Bonded FRP Systems for Repair and Strengthening of Concrete Bridge Elements," was carried out to identify the current state of the art in externally bonded FRP strengthening of concrete structures.

The research team from the University of Kentucky carried out a detailed review of published literature, domestic and international design guides for externally bonded FRP, and relevant material, construction, and maintenance guide specifications. The updates include the streamlining of the FRP flexural retrofit design process to conform to the latest *AASHTO Load and Resistance Factor Design (LRFD) Bridge Design Specifications* as well as developing FRP-concrete interface strain relationship dependent on FRP and concrete material properties.

The analysis and design process is considerably simplified by introducing a new uniform compressive concrete stress-strain relationship that is applicable at strain levels less than 0.003 in./in. Environmental reduction factors for both the FRP material and the FRP-concrete bond are introduced to account for deterioration in material and bond properties based on the type of FRP material and degree of environmental exposure. The updates also include draft language to address the following areas that were not explicitly addressed in the 2012 AASHTO guide:

- Strengthening of flanged sections in flexure
- Strengthening prestressed concrete elements
- Design using near surface mounted (NSM) FRP
- Design of end anchors for FRP used in both flexure and shear
- Detailing of laps and splices

For practitioners to acquire an overall knowledge of the use of externally bonded FRP systems, the proposed updates also included additional guidance on installation and inspection of FRP retrofit systems as well as additional material specifications. Detailed examples that highlight the proposed language for consideration by AASHTO to incorporate the research results into the next update of the 2012 AASHTO guide specifications are also included as an attachment to the report. These included examples on flexural strengthening of rectangular sections, flanged sections, and prestressed sections as well as using different FRP systems such as fabric, precured laminates, and NSM FRP. The updates to the guide were adopted by the AASHTO Committee on Bridges and Structures at its 2022 annual meeting.

RESEARCH SHOWCASE

Research on AASHTO M 180-18 and Associated Highway Guardrail Specifications

NCHRP Project 22-40 received continuation funding from AASHTO to add high tension cable barriers to the scope of work. The original scope of work has been published as *NCHRP Research Report 1020: Investigation of Material Requirements for Highway Guardrail Systems*.

Research Agency:
RoadSafe, LLC

Principal Investigator:
Chuck Plaxico

AASHTO M 180 is the predominant specification that states use to specify material properties for corrugated sheet steel for guardrail and associated fasteners. AASHTO M 180-18 is the most recent version of this standard; however, earlier editions of this document have served the roadside safety industry and the traveling public for nearly 60 years, going back to the 1961 publication of the *AASHTO Materials Specifications*. Recent updates in industry standard practice and materials development have created a need to revise AASHTO M 180-18 as well as to expand its scope to include additional guardrail components. The increased focus on roadside safety has made it important for transportation agencies to be able to assure the public that they are specifying and using correct materials in the construction of roadside safety barriers.

The objectives of NCHRP Project 22-40, "Research on AASHTO M 180-18 and Associated Highway Guardrail Specifications," were to perform a comprehensive review of AASHTO M 180-18 and its associated/referenced AASHTO and ASTM standards and to prepare draft language for consideration by AASHTO to incorporate the research results in the next update of the AASHTO M 180-18. The literature review in the final report includes an extensive review of all the AASHTO M 180 updates and revisions since its first publication, including a detailed review of the current version. The mill reports for steel guardrail materials used in full-scale crash testing were also reviewed to determine general statistics regarding the range of material properties (i.e., yield strength, tensile strength, and percent elongation) for the various guardrail components used in the test articles. The specific components reviewed in this study included w-beam, thrie beam, terminal connectors, guardrail posts, transition posts, and bolts.

Guardrail damage resulting from MASH Test 3-10 in Test No. 420020-5.

Source: Bligh et al. Texas A&M Transportation Institute, Texas Department of Transportation, and Federal Highway Administration. MASH Test 3-10 on 31-Inch W-Beam Guardrail with Standard Offset Blocks. 2011.

Multiple sources were used to identify deficiencies in M 180-18, including the literature review, feedback and discussions with the NCHRP Project 22-40 panel, responses to the survey of practice that was submitted to state highway agencies, and interviews with industry and crash test facility personnel. The scope for the research was subsequently expanded to include all corrugated sheet steel components used in non-proprietary guardrail, including guardrail beams, transition beams, end sections, buffer sections, terminal connectors, and backup plates. The updated scope also incorporates review of additional fastener hardware, steel guardrail posts, anchorage wire rope, and swage fittings. Although guardrail systems include many different components manufactured from different materials, the proposed language was ultimately limited to the steel components.

The result of this work is a more thorough and consistent draft language within M 180 that will improve consistency for manufacturers, transportation agencies, and guardrail suppliers. Appendix A is the complete proposed draft language to AASHTO. The research findings are provided on the NCHRP Project 22-40 webpage: **https://apps.trb.org/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=4586**.

SYNTHESIS SHOWCASE

Use of Recycling Agents in Asphalt Concrete Mixtures

NCHRP Project 20-05/Topic 52-17 has been published as *NCHRP Synthesis 586: Use of Recycling Agents in Asphalt Concrete Mixtures.*

Research Agency:
University of New Hampshire

Principal Investigator:
Jo Sias

An increase in awareness and popularity of sustainability concepts in pavement engineering has encouraged the use of recycled asphalt materials (RAM), including reclaimed asphalt pavement (RAP) and reclaimed asphalt shingles (RAS) in the highway construction industry. Although the use of RAM in new asphalt mixtures can reduce the amount of virgin and nonrenewable materials and increase the rutting resistance of pavements, it may also compromise cracking resistance. To mitigate this issue, asphalt mixtures containing RAM may require the use of a recycling agent (RA). NCHRP Project 20-05/Topic 52-17, "Use of Recycling Agents in Asphalt Concrete Mixtures," was initiated to serve as a reference for transportation agencies and other entities regarding existing practices for the use of RAs in asphalt mixtures containing RAM. The information for this synthesis was gathered through a comprehensive literature review, a survey of state departments of transportation (DOTs) and Canadian Provincial Transportation Agencies (CPTAs), and subsequent interviews of personnel from five selected states. The following key observations were made:

- The use of RAM is widespread. All responding agencies allow the use of RAP in asphalt mixtures, but most do not allow the use of RAs in asphalt mixtures at present. For those that do currently use RAs, they are primarily used for demonstration or research purposes. No changes have been made to QA processes for state DOTs that currently use RAs in asphalt mixtures.
- Results of the literature review show that the addition of an RA can improve cracking performance but may increase the rutting and moisture susceptibility of asphalt mixtures containing RAM. Some agencies have also observed premature distress of bleeding, raveling, and increased moisture damage for RA-treated asphalt mixtures.
- Three primary factors impact the performance and effectiveness of RAs: the type of RA, appropriate selection of the RA dosage, and the dispersion and diffusion of the RA into RAM.
- The most prevalent tool for RA dosage determination is the use of blending charts to meet desired properties or specifications (e.g., viscosity/penetration level or specific performance grade).
- RA types can be classified based on either the viscosity-based ASTM D 4552 specification or source (chemical) composition. Neither system is used consistently, and many agencies are unsure of the classification of RA products used in their mixtures.

The project also revealed that the major challenges for agencies to start or continue using RAs include the following:

- Lack of agency experience in evaluating asphalt mixtures containing RAs.
- Lack of tests and criteria to approve RAs.
- Lack of tests and criteria to determine dosage rate and performance.

Overall, the usage of RAs is still relatively new for a majority of agencies and most have limited experience with the use of RAs in asphalt mixtures. More studies and research to help agencies evaluate and select the appropriate RAs and determine the appropriate dosage are strongly encouraged.

RESEARCH SHOWCASE

Identification of AASHTO Context Classifications

Research under NCHRP Project 15-72 has been published as *NCHRP Research Report 1022: Context Classification Application: A Guide*.

Research Agency:
University of Kentucky

Principal Investigator:
Nikiforos Stamatiadis

By expanding the number of contexts and encouraging highway designers to recognize the needs of all roadway users, *NCHRP Research Report 855: An Expanded Functional Classification System for Highways and Streets* and the 7th Edition of *A Policy of Geometric Design for Highways and Streets* [Green Book (GB7)] established a framework transportation agencies can follow to develop contextual multimodal solutions. However, agencies implementing the GB7 context classification system have lacked well-defined methodologies and measures for determining roadway context and its influence on design and operations.

NCHRP Project 15-72, "Identification of AASHTO Context Classification," sought to develop practical guidance that state, regional, and local transportation agencies can use to identify the appropriate context for an area or transportation project. The Application Manual developed as part of the project establishes stratified measures practitioners can use to determine context categories at the state, regional/metropolitan planning organization (MPO), and local corridor levels.

The framework was developed in two phases. Phase I activities included reviewing and synthesizing literature on expanded context classification systems, surveying transportation agencies to understand data requirements for implementation, documenting challenges associated with implementing expanded context classification systems, and developing a proposed set of contexts.

Phase II efforts refined proposed contexts; established transportation expectations, which specify how users expect to move within a context; evaluated potential measures for applying context classification; and developed the Application Manual to help agencies establish context classification systems. Two evaluations related to data were undertaken: a review of data availability for each measure in every state and an assessment of which step in the project development process that data may be available. Contexts are defined using intersection density (derived from roadway centerline mapping files) and building densities (derived from the nationwide Microsoft Bing Building Footprint dataset).

NCHRP Research Report 1022: Context Classification Application: A Guide walks users through the process of developing a context classification system. The report provides a high-level review of the relationship between context and design, includes a comprehensive list of measures used for classification, reviews data sources needed to derive proposed measures, discusses issues related to implementing the proposed context classification system and their implications for current practices, precisely describes each context, provides representative images of each context, and presents case studies demonstrating the application of context classification. Agencies can use case studies to guide implementation.

Practitioners will use information on context and transportation expectations from the outset of project development to create holistic, balanced, and context-adapted roadway designs that ensure all user needs are met at the local and network levels. Understanding context clarifies the multiple roles a roadway plays or is intended to play in the community and lets practitioners identify and analyze the impacts and trade-offs necessary to balance user needs and safety and address other community issues.

RESEARCH SHOWCASE

Evaluation of Bridge Rail Systems to Confirm AASHTO MASH Compliance

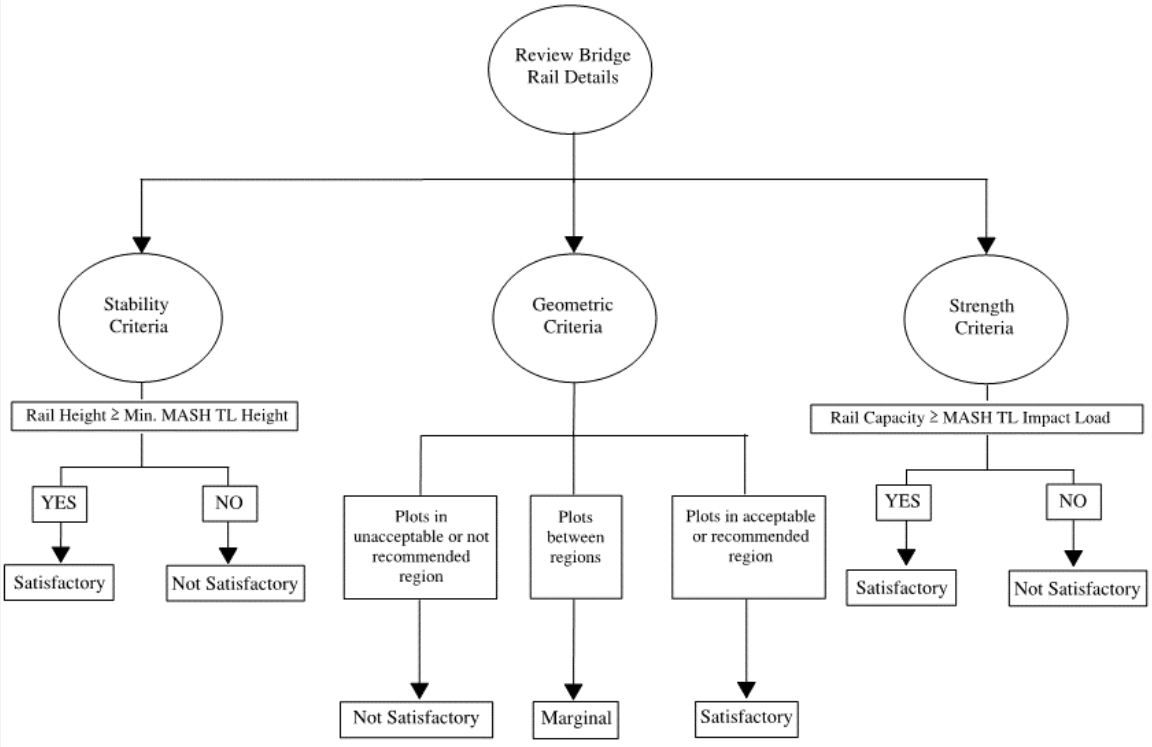
Research under NCHRP Project 22-35 was completed and will be published as *NCHRP Research Report 1024: Evaluation of Bridge Rail Systems to Confirm AASHTO MASH Compliance*.

Research Agency:
Texas A&M Transportation Institute

Principal Investigator:
William Williams

Existing bridge rails previously crash tested and evaluated according to *NCHRP Report 230: Recommended Procedures for the Safety Performance Evaluation of Highway Appurtenances* and *NCHRP Report 350: Recommended Procedures for the Safety Performance Evaluation of Highway Features* are now required to be *Manual for Assessing Safety Hardware* (MASH) compliant to be installed on the National Highway System. Studies have been conducted to evaluate these existing bridge rail systems according to MASH evaluation criteria. These studies have consisted of full-scale crash testing, structural strength analysis, existing geometric consideration, and computer simulations. One need identified for further investigation and evaluation is the effect of bridge rail geometrics on MASH compliance. Many bridge rails have openings that could allow vehicle parts to snag on the bridge rail post or other bridge rail parts. This snagging phenomenon has been shown to cause high occupant risk metrics in previous *NCHRP Report 230* and *NCHRP Report 350* testing. It is unknown whether similar occupant risk concerns would be observed if these systems were impacted according to MASH test conditions.

AASHTO LRFD Bridge Design Specifications provide guidance on bridge rail geometric design. However, this guidance was based on *NCHRP Report 230* and *NCHRP Report 350* crash testing and thus needed to be updated per MASH test conditions. The purpose of NCHRP Project 22-35, "Evaluation of Bridge Rail Systems to Confirm AASHTO MASH Compliance," was to establish new geometric curves for the AASHTO Specifications based on the MASH Specifications.



Rail-specific evaluation assessment designation process.
Source: NCHRP Research Report 1024.

To address this need, finite element models of the 1100C and the 2270P test vehicles were used to evaluate various bridge rail systems according to MASH Test Level 3 (TL-3) evaluation criteria. It was anticipated that significant interaction would occur between the vehicle wheels and the bridge rail systems. As such,

detailed high-fidelity tire models were incorporated into the existing vehicle models to improve the accuracy and response of the models.

A total of 98 bridge rail systems were evaluated according to MASH Test 3-10 and Test 3-11 evaluation criteria. These bridge rail systems were separated into four categories: concrete post and beam, metal post and beam deck-mounted, metal post and beam curb-mounted, and metal post and beam parapet-mounted. The geometrics of each bridge rail system were varied to evaluate systems with a wide range of post setback distances, vertical clear openings, and rail contact width-to-height ratios. All the bridge rail systems were found to be acceptable for MASH Test 3-11 evaluation criteria. Several systems had occupant risk metrics exceeding the MASH limit for Test 3-10. Severe snagging of the small car vehicle wheel on the bridge rail post was observed for many of these systems.

As part of this research, two full-scale crash tests were performed: one on a deck-mounted metal beam and post bridge rail system, and one on a curb-mounted metal beam and post bridge rail system to better understand vehicle interaction with bridge rail features. Information obtained from the full-scale crash testing was also used to further validate the finite element models used in this research.

Based on LS-DYNA simulations performed on numerous bridge rail types and geometries for this project, modified curves were proposed and evaluated for consideration by AASHTO to incorporate the research results into the next update of the *AASHTO LRFD Bridge Design Specifications,* Section 13 post setback and snag potential figures. These curves establish a “recommended” region that includes MASH-compliant bridge rail systems and a “not recommended” region that includes bridge rail systems not expected to be MASH-compliant. The modified curves developed from this research were evaluated with computer simulations and were found to be adequate.

From this research, the new snag potential figure allows larger vertical clear openings up to 15 inches for most post setback distances. The new post setback figure allows for smaller total vertical width of rail and concrete elements. The adoption of the new geometric curves will assist bridge designers in the design of new bridge rail systems with respect to the MASH 2016 requirements.

RESEARCH SHOWCASE

State and Local Impacts of Automated Freight Transportation Systems

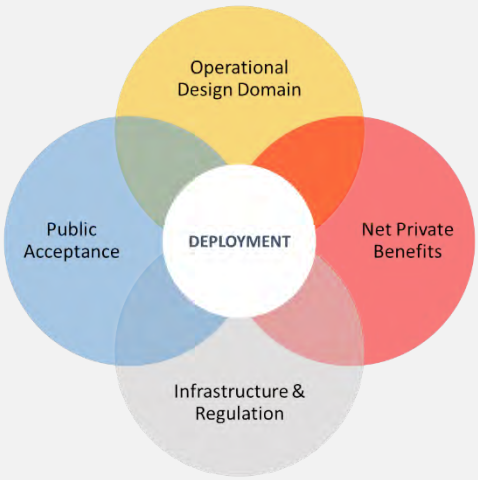
Research under NCHRP Project 20-102(22) was completed and will be published as *NCHRP Research Report 1028: State and Local Impacts of Automated Freight Transportation Systems*.

Research Agency:
Tioga Group

Principal Investigator:
Daniel Smith

Autonomous freight vehicles—self-driving trucks, sidewalk robots, and delivery drones—have captured the imagination of the public, the transportation industry, and transportation planners. NCHRP Project 20-102(22), "State and Local Impacts of Automated Freight Transportation Systems," explored what is known about freight autonomous vehicles (FAVs), how they might be used in U.S. supply chains, what the public sector must do to facilitate their use, and how public agencies might reach regulatory and policy decisions.

FAVs will be commercially deployed in significant numbers where four main factors overlap: Operation Design Domain (ODD), net private benefits, public acceptance, and applicable infrastructure and regulation. For the near term, automated trucks will likely be used primarily on freeways. Sidewalk robots and related vehicles, if commercially viable, would be used for small, short-range urban deliveries. If delivery drones are allowed by the FAA and prove commercially viable, they would most likely be used for very small suburban and rural deliveries.



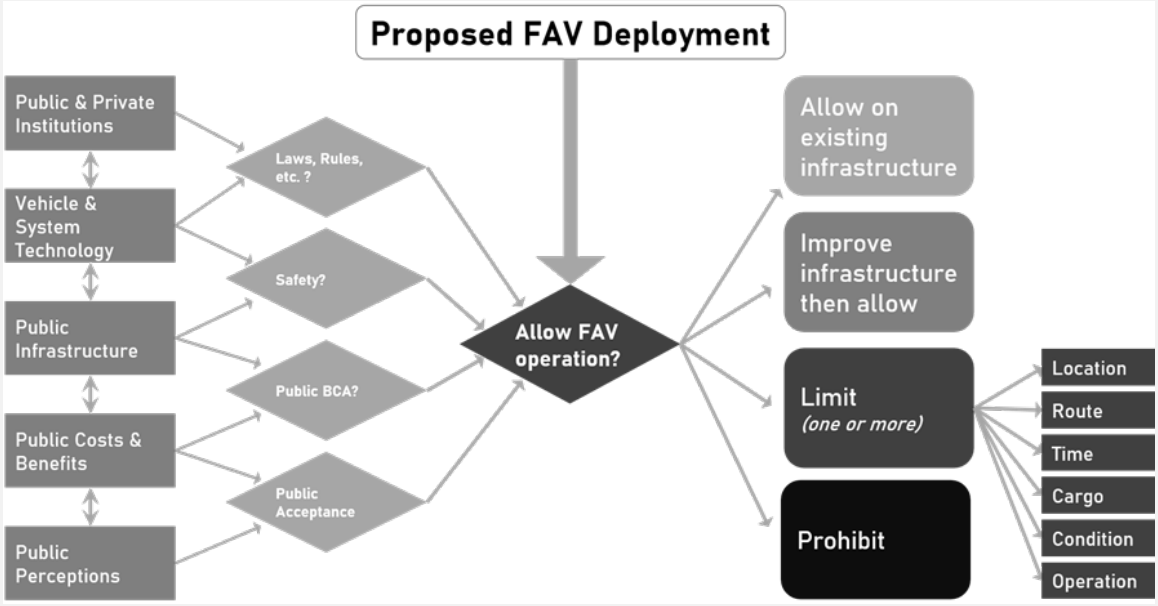
The four main factors for deployment of FAVs.
Source: NCHRP Research Report 1028.

Highway safety improvements are the main reason for public support of autonomous vehicle deployment. Removing the human element is expected to significantly reduce accidents and fatalities. There is a distinction to be made, however, between the benefits of active safety systems and automated driver assistance systems (ASS/ADAS) and the incremental benefits of automated driving systems (ADS), once ASS/ADAS benefits have already been achieved. The research team did not find estimates of either the benefits of ASS/ADAS features or the incremental safety benefits of driverless operation.

Efficiency improvements depend on assumptions regarding labor savings, 24/7 operations, and more economical over-the-road operation. Widespread driverless truck operations, however, have not yet been achieved and may not be achievable. Sidewalk robots or delivery drones may be more efficient than individual human deliveries, but are less efficient than multi-stop, route-based delivery (e.g., USPS, UPS, FedEx). There is as yet no firm basis for estimating net environmental, employment, or congestion impacts of FAV deployment, because, in each case, the balance of positive and negative impacts is far from clear.

The research team found that highway infrastructure requirements of self-driving trucks may not differ much from those of self-driving cars, minimizing incremental investment for FAVs. Sidewalk robots and delivery drones do not have significant public infrastructure needs. The research also found that FAV developers were not relying on public sector physical or communications infrastructure investments, but instead adapting to what exists. This approach reduces public IT infrastructure needs but also limits the use of vehicle-to-vehicle (V2V) or vehicle-to-everything (V2X) communications to reduce congestion or improve safety.

Physical infrastructure requirements may be less than some have anticipated, yet institutional and operation barriers may be greater. Unoccupied vehicles raise complex issues of responding to law enforcement, accommodating incidents and work zones, meeting inspection requirements, and fulfilling other non-driving functions of human operators. The industry's narrow focus on technology to date leaves these and other issues unaddressed.



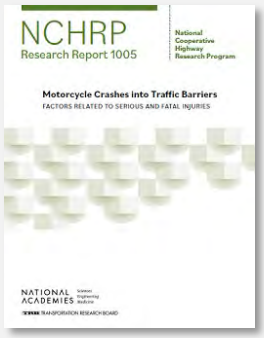
Conceptual decision framework for proposed FAV deployment.
Source: NCHRP Research Report 1028.

The report also provides conceptual decision frameworks for use by public planners and policymakers. The overall framework contains the key factors facing public agencies. These factors include readiness of public and private institutions, technology readiness, and infrastructure readiness, and they lead to a determination of legality, safety, and public acceptance before allowing FAV deployment.

Public agencies can choose to allow FAV deployment on existing infrastructure, to wait for infrastructure improvements, to limit deployment on some basis, or to prohibit deployment. Despite wide coverage of automated vehicle technology and many high-visibility trials, FAVs remain in their infancy, and the study yielded more questions than answers. There is thus an evident need for more experience with the vehicles and research into their long-term use and impacts.

RESEARCH SHOWCASE

Factors Related to Serious Injury and Fatal Motorcycle Crashes with Traffic Barriers



Research under NCHRP Project 22-26 was completed and has been published as *NCHRP Research Report 1005: Motorcycle Crashes into Traffic Barriers: Factors Related to Serious and Fatal Injuries*.

Research Agency:
Virginia Polytechnic Institute and State University

Principal Investigator:
H. Clay Gabler

Despite more fatalities in barrier impacts among motorcyclists than occupants of any other vehicle type, there is currently no guidance available to U.S. transportation agencies, policymakers, or engineers for reducing the risk of injury in motorcycle-barrier crashes. The objective of NCHRP Project 22-26, "Factors Related to Serious Injury and Fatal Motorcycle Crashes with Traffic Barriers," was to identify the factors that contribute to serious and fatal injury in motorcycle collisions with roadside barriers including guardrails, concrete barriers, and cable barriers. Some of the findings include the following:

- In the United States, from 1999 to 2008, there were 39,468 fatally injured motorcycle riders and passengers with 1,803 of them fatally injured in motorcycle-guardrail crashes according to an analysis of the Fatality Analysis Reporting System.
- National Automotive Sampling System General Estimates System Data from 2004 to 2008 showed that motorcycle collisions with a guardrail, concrete barrier, or tree were 7.2, 4.1, and 15 times more likely, respectively, to be fatal than collisions with the ground.
- Analysis of barrier crashes in North Carolina, Texas, and New Jersey showed that W-beam guardrails had significantly higher odds of serious injury than concrete barriers (1.4 times). Cable barriers were not found to pose an increased risk but the number of these crashes within the dataset was small.
- New Jersey police accident reports from 2007 to 2011 showed the majority of riders (68.0%) in single-vehicle barrier crashes collided with the barrier while upright and 20.0% of riders slid into the barrier.
- The Crash Outcome Data Evaluation System (CODES) was used to determine the type, relative frequency, and severity of injuries in motorcycle crashes in Maryland from 2006 to 2008. Motorcyclists involved in barrier crashes were about 2 times more likely to suffer a serious injury to the thorax (most commonly lung contusion) compared with other crashes (most commonly hemothorax or pneumothorax).
- Data from Washington and Ohio indicated that motorcycle impacts with barriers were found to be overrepresented on horizontal curves and on sections with grades in excess of 3%. Whether or not the roadway was divided was the characteristic having the largest influence on rider injury.
- In-depth data collection of motorcycle-barrier crashes showed the primary injury mechanisms to be rider entanglement with posts, laceration from the top of posts, and laceration from the top of the W-beam rail. No evidence of laceration injuries from the wire rope in cable barrier systems was found; injuries resulted from contact with the posts.

The research outcomes of NCHRP Project 22-26 can be used to help establish priorities for U.S. transportation agencies and roadside safety engineers seeking to remediate the injury and fatality risk of motorcyclist-barrier collisions. This study is one of the first in the United States to investigate the factors leading to serious injury in motorcycle collisions with a roadside barrier. Recommendations include evaluation of the field performance of U.S. pilot tests of the *Motorcycle Protection System* (MPS), the development of a *Manual for Assessing Safety Hardware* (MASH) standard motorcyclist crash test, and considerations for the *Roadside Design Guide*.

RESEARCH SHOWCASE

Algorithms to Convert Basic Safety Messages into Traffic Measures

Research under NCHRP Project 03-137 was completed and has been published as *NCHRP Research Report 997: Algorithms to Convert Basic Safety Messages into Traffic Measures*.

Research Agency:
Noblis, Inc.

Principal Investigator:
Meenakshy Vasudevan

Basic safety messages (BSMs) are used by connected vehicles (CVs) to communicate safety and mobility information with nearby vehicles, personal communications devices, and transportation infrastructure equipment. Initially intended to support safety applications, BSMs provide data such as a vehicle's speed, position, size, and brake system status. These attributes cannot be measured using traditional surveillance technology. There is an opportunity to leverage BSM data for the management of traffic on arterials and freeways; in work zones; and for the management of system-wide surface transportation systems. Use of BSM data can allow state and local DOTs to increase the area their systems monitor and reduce reliance on infrastructure sensors.

NCHRP Project 03-137, "Algorithms to Convert Basic Safety Messages into Traffic Measures," was initiated to develop algorithms for estimation of key traffic measures, with the goal of positioning state and local agencies to take early advantage of BSM data, reduce costs, improve accuracy, and add new measures to their systems management capabilities. The objective of the project was to develop and validate algorithms that use BSM data to estimate seven traffic measures selected by the NCHRP Project 03-137 panel. These measures were route-specific travel time, space mean speed, queue length, mean time to detect and verify incidents, hard braking, deceleration rate to avoid collision (DRAC), and time-to-collision with disturbance (TTCD).

The project was led by Noblis, Inc., and was carried out in two phases. In Phase I, a literature review was conducted to identify algorithms that convert BSMs into traffic measures to avoid duplication of efforts as well as identify gaps. The research team also held discussions with experts from academia to get their insights and inputs on traffic measures that could benefit from BSM data. In Phase II, the research team defined the requirements, and developed algorithmic statements and code for the seven measures. The algorithms were developed, tested, and validated using simulation and field data for various market penetrations of CV technology and for various use cases.

Nearest neighbor search algorithms were developed for travel time and space mean speed estimations. The applications resulted in similar accuracy as previous work by the project team but are now set up to operate in real time. Machine learning models were developed for queue length and mean time to detect and verify incidents. The ability to accurately estimate these measures in under a minute can allow agencies to take rapid action, thus minimizing impact on traffic flow and throughput.

Novel algorithms were developed for hard braking, DRAC, and TTCD. The hard braking algorithm can be applied for real-time operation while the DRAC algorithm is feasible for near real-time applications. DRAC and TTCD algorithms can overcome the lack of off-the-shelf software, and can be used for safety performance evaluation, hotspot identification, and safety countermeasure development. The source code and corresponding documentation for the seven measures are posted on GitHub. Guidance and tips for customizing the algorithms for specific conditions are provided to allow other researchers to adapt the algorithms as needed.

RESEARCH SHOWCASE

Long-Term Roadside Crash Data Collection Program

Research under NCHRP Project 17-43 was completed and will be published as *NCHRP Research Report 1033: Long-Term Roadside Crash Data Collection Program* and *NCHRP Web-Only Document 341: Roadside Database Coding Manual*.

Research Agency:
Virginia Polytechnic Institute and State University

Principal Investigator:
H. Clay Gabler

NCHRP Project 17-43, "Long-Term Roadside Crash Data Collection Program," was a retrospective data collection study with roadside crash data extracted from existing crash datasets. The NCHRP Project 17-43 database was built on the methods used in the NCHRP Project 17-22, "Identification of Vehicular Impact Conditions Associated with Serious Ran-Off-Road Crashes," database and extracted roadside crash elements from the National Automotive Sampling System/Crashworthiness Data System (NASS/CDS). In total, 88 data elements were collected to describe the road, roadside, trajectory, and roadside object characteristics. Each of these elements was extracted from an existing NASS/CDS variable, scene photograph, or scene diagram. In total, 1,581 run-off-road crashes were extracted from NASS/CDS and an additional 277 crashes were extracted from the Crash Investigation Sampling System (CISS). The NCHRP 17-43 database includes case identifiers to join the dataset with NASS/CDS and CISS. This allows analyses to include the detailed variables present in the source dataset such as occupant injury severity.

The NCHRP Project 17-43 database is useful for evaluating the *Manual for Assessing Safety Hardware* (MASH) and the *Roadside Design Guide* (RDG). The 85th percentile or practical worst-case impact conditions in the NCHRP Project 17-43 database were compared with the MASH barrier impact conditions. The impact speeds in both the NCHRP Project 17-43 database and the NCHRP Project 17-22 database are below the MASH TL-3 impact speed. For left-side departures, the impact angle in both datasets is larger than the MASH TL-3 impact angle. The impact angle in the NCHRP Project 17-43 database for right-side departures is lower than the MASH TL-3 impact angle.

The NCHRP Project 17-43 database was used to develop an encroachment corridor method for determining barrier length of need (LON). These corridors incorporated the obstacle location, departure side, driver maneuver, and barrier location in the recommended runout length. The benefit of this corridor-based approach to barrier placement is that each agency can balance the runout length and the protected proportion of encroachments depending on individual priorities. A similar methodology can be considered for justifying the recommended barrier LON in the RDG and could be used to compare potential barrier installation configurations.

The NCHRP Project 17-43 and Project 17-22 databases were compared for run-off-road crash characteristics. The NCHRP Project 17-43 database included more recent vehicles than the NCHRP Project 17-22 database. The vehicles had substantial advances in vehicle safety, such as frontal airbags, side airbags, rollover curtain airbags, anti-lock brake systems, and electronic stability control systems. The NCHRP Project 17-22 focused data collection on roads with a speed limit over 56 km/h (35 mph), but the NCHRP Project 17-43 database sampled roadway departure crashes at all speed limits. Many of the elements useful for understanding run-off-road crashes are not recorded in the NCHRP Project 17-43 database. Examples are slope, shoulder width, tree diameter, and geometric dimensions of roadside barrier. It is recommended that a prospective data collection procedure be implemented to facilitate direct measurement of these elements. In addition, data collection should be continued to reflect changes in the vehicle fleet.

RESEARCH SHOWCASE

Accessibility Measurement in Practice: Guidance for Transportation Agencies

Research under NCHRP Project 08-121 was completed and has been published as *NCHRP Research Report 1000: Accessibility Measures in Practice: A Guide for Transportation Agencies*.

Research Agency:
University of Texas at Austin

Principal Investigator:
Alex Karner

Transportation infrastructure and land use combine to produce accessibility or the ability to reach valued destinations. In contrast to traditional performance measures, like level of service, that focus on congestion and mobility, accessibility captures the fundamental purpose of a transportation system—to enable meaningful, dignified, and fulfilling lives by linking people to the opportunities they value. Even under congested conditions, accessibility can be high, especially in settings where public transit, walking, and cycling are prioritized, land uses are dense and diverse, and urban design features are favorable. An accessibility perspective shifts the focus from facilitating automobile movement to connecting people and opportunities.

The objective of NCHRP Project 08-121, "Accessibility Measures in Practice: Guidance for Transportation Agencies," was to provide transportation agency staff with a practical guide that can be used to create and apply accessibility measures in support of long-range planning, programming, corridor analysis, multimodal planning, civil rights and environmental justice analysis, public engagement, and many other agency needs. In many cases, the novelty of accessibility approaches, issues with data and analysis methods, and differences from traditional performance measures have hindered implementation. To remedy this situation, the guide provides step-by-step illustrations and many real-world examples that can be used to understand and apply accessibility measures and concepts. Agencies of all sizes and across geographic and modal contexts—ranging from very rural to very urban—will be able to apply the guide in their cities, counties, regions, and states. The guide assumes no prior experience with accessibility measures or concepts.

To ensure that the guide addresses real-world planning and engineering needs, it is grounded in dozens of interviews with transportation agency staff, a review of planning documents at all 50 state departments of transportation and two dozen metropolitan planning organizations, and scholarly research. The guide was also refined through piloting activities undertaken with transportation agencies around the country. This groundwork indicated that while there are many barriers to implementing accessibility measures in practice, they are surmountable. For example, data and staffing challenges are a commonly cited barrier, but applying simple accessibility measures and using accessibility concepts in the absence of detailed quantitative data can still be incredibly valuable. The guide offers support and recommendations for agencies wishing to apply basic concepts as well as more sophisticated measures.

In addition to providing easy-to-use guidance, the guide includes recommendations for enhancing accessibility applications. For example, existing accessibility measures are rarely tailored to individual travel experiences, limiting their relevance for population groups that face specific needs and barriers, including people with disabilities, recent immigrants, women, queer people, and people of color. These measures also do a poor job of measuring virtual access to online shopping and delivery services. The guide provides suggestions for addressing these limitations, giving users the information they need to apply accessibility concepts and measures in ways that will most effectively support transportation decision-making and ultimately enhance the connection between people and opportunities across jurisdictions.

RESEARCH SHOWCASE

State Transportation Agency Multifaceted Decision-Making for Future System Performance

Research under NCHRP Project 20-126(02) was completed and will be published as *NCHRP Research Report 1042: State Transportation Agency Multifaceted Decision-Making for Future System Performance: Practitioner's Playbook* and *NCHRP Web-Only Document 345: State Transportation Agency Multifaceted Decision-Making for Future System Performance: Conduct of Research Report*.

Research Agency:
Metro Analytics

Principal Investigator:
Tony Furst

Transportation agencies must grapple with a broad array of trends and issues that influence and act on the systems they manage and operate. These trends and issues act as pressures influencing system performance and the agencies' ability to meet system objectives. A major challenge is any single issue—such as climate change, e-commerce, or changing demographics—can influence multiple system-level objectives, including reliability, resiliency, and equity, simultaneously. The objective of NCHRP Project 20-126(02), "State Transportation Agency Multifaceted Decision-Making for Future System Performance," was to develop an analytic framework that helps transportation agencies integrate these trends and issues into their system management decision-making.

Metro Analytics developed an analytic framework that connects the trends and issues from the research effort and two TRB reports, *TRB Special Report 329: Renewing the National Commitment to the Interstate Highway System: A Foundation for the Future* and *Critical Issues in Transportation 2019*, to system performance objectives at a national level. The framework presents the level of influence and the relationships that the trends and issues have on system objectives. This framework helps to structure thinking, heighten awareness of the relationships, and improve the ability to organize and absorb the complexity of these relationships to inform multifaceted decision-making. The research developed an interactive visualization tool enabling users to choose the relationships they wish to explore.

The relationships between the objectives, trends, and issues at the national level were developed using the Delphi Method. As the relationships at the state or local level may be different, the visualization tool provides agencies the ability to adjust the relationships to fit state or local dynamics. These adjustments can be done using the same methodology used in the research. Providing the ability to adjust the interconnected trends, issues, and objectives to the state or local level helps agency decision-makers integrate them more effectively into planning and managerial processes (e.g., scenario planning, enterprise risk management). The suggested approach was validated through a workshop that involved the NCHRP Project 20-126(02) panel and stakeholders at the state and local levels.

A major work product of the research is a practitioner's playbook that provides examples of how and where the analytic framework brings value to decision-making. The playbook includes a play on how the relationships can be adjusted to state or local dynamics. Additionally, the research includes pilot studies that showcase how emerging data and analytics can be accessed and utilized to support improved descriptive analytics and advance the evolution toward prescriptive analytics to improve system performance.

RESEARCH SHOWCASE

Incorporating Resilience Concepts and Strategies in Transportation Planning

Research under NCHRP Project 08-129 was completed, and a publication decision is pending.

Research Agency:
AEM Corporation

Principal Investigator:
Kelley Pecheaux

Given the increasing frequency of disasters, both natural and human-caused, it is critical for transportation agencies to design for and modify existing systems to be resilient and adaptive. Investing in strategic resilience planning and implementation is the first step toward mitigating the risk associated with these events. State and regional transportation agencies have made considerable progress in incorporating resilience concepts into transportation planning processes and policies; however, there is a need for new methodologies, tools, data, metrics, frameworks, and funding to support these efforts. NCHRP Project 08-129, "Incorporating Resilience Concepts and Strategies in Transportation Planning," created a guide to address these needs.

The project was led by AEM Corporation, Jacobs, and AJOC Consulting Engineers. The team conducted a series of research activities that included a review of over 200 relevant publications; workshops with state and regional transportation agencies and other public and private stakeholders; and 11 "quick scan" studies and 4 "deep-dive" studies. The guide consists of three primary components to assist agencies in incorporating resilience concepts and strategies into transportation planning:

- Key building blocks. Six key building blocks or strategies are presented, along with 27 recommended actions for transportation agencies to incorporate resilience concepts and initiatives into transportation planning. These strategies and actions were validated by state DOT representatives, including planners, engineers, asset managers, operations and maintenance staff, and safety professionals.
- Capability maturity framework (CMF). A CMF is provided to help agencies establish their current level of maturity as well as to provide information on how to advance their capabilities.
- Roadmap. A multimodal roadmap lays out six milestones to assist agencies in taking positive steps toward incorporating resilience into transportation planning. The roadmap applies to agencies at different points—whether just beginning to develop a resiliency program or already incorporating resilience at some level—in conjunction with the key building blocks, which can help agencies move in the right direction.

The findings of the research also offered the following key lessons to drive the successful integration of resilience concepts into transportation planning:

- Develop or adopt a standard definition and understanding of resilience.
- Establish and use state and federal regulations and policies.
- Garner leadership support for a dedicated resilience staff or working group.
- Collaborate with internal and external partners.
- Dedicate funds to train staff, collect data, and improve models and tools.
- Develop resilience metrics and conduct routine, quantitative risk and resilience assessments.

The guide will benefit transportation agencies by the following:

- Assisting them with meeting Infrastructure Investment and Jobs Act (IIJA) requirements.
- Accelerating the resilience learning curve for agency staff.
- Familiarizing agency staff with resilience practices from peer agencies.
- Transforming organizational resilience practices from reactive to proactive.

Why NCHRP Works

An effective model for our stakeholders

A Model for Cooperative Research

The cooperative research model developed for NCHRP has functioned effectively since 1962 and served as the foundation for other successful applied cooperative research programs managed by TRB. TRB manages or has managed national cooperative research programs in the fields of highways, transit, airports, hazardous materials, freight, rail transportation, and behavioral traffic safety. Many of the research programs in state DOTs 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.

Stakeholders Drive Success

What makes this model so effective? One of the key success factors is stakeholder involvement. Those who 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 results will be practical, beneficial, and implementable.

An Objective Eye

Another key element in the NCHRP model is objectivity. NCHRP does not own roads, make laws, or set policy. Instead, it provides a neutral forum for objective research without bias or prejudgment. NCHRP conducts evidence-based research that adheres to the highest standards of integrity. NCHRP panels bring diverse stakeholder groups together with a common interest for a common objective.

Investing Wisely in Research

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 shared by a majority of state DOTs.

NCHRP works on shared national problems and issues, and is designed to seek solutions effectively and sufficiently. A comprehensive research program coordinated and funded by all the states allows every state to leverage its budget and receive far more value for the research dollars it spends. By joining forces to solve common problems, state DOTs are able to produce solutions to important problems that might otherwise be beyond the ability of any single state.

The NCHRP process is designed to maximize efficiency while producing the highest quality research results. These results will help state DOTs to effectively plan, design, construct, operate, and maintain their surface transportation network while

keeping workers and the traveling public safe, providing or improving mobility, and contributing to the economic vitality of communities and the nation.

State DOTs' National Highway Research Program

Competitive Investigator Selection

The competitive process used by NCHRP to select research contractors is another aspect of the program that contributes to its success. Each project panel develops a request for proposals that is typically publicly advertised. Successful proposers are selected based on the qualifications of their team members and their research approach.

Critical Role of State DOTs

The members of AASHTO—the 50 state DOTs and the District of Columbia—come together every year to fund, select, and oversee NCHRP research projects aimed at providing research-based solutions that address the state DOTs' most critical challenges. The state DOTs are the sole sponsors of NCHRP and continue to be the driving force behind NCHRP research. The program is administered by TRB under a cooperative agreement with FHWA and in partnership with AASHTO.

States Provide the Funding for NCHRP

Each year, state DOTs voluntarily commit to NCHRP research 5.5% 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 with the National Academies of Sciences, Engineering, and Medicine makes them available for research contracts and for administration of the program by TRB.

Available funds for NCHRP have remained strong during the past 22 years, rising along with increases in the Federal-Aid-Highway funds provided by Congress and the 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% 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 available annually for fiscal years 2014 through 2018. A slight increase was experienced as a result of the Fixing America's Surface Transportation (FAST) Act, signed into law on December 4, 2015.

State DOTs Select NCHRP Research Projects

A thorough process of consultation and review by subject matter experts from the state DOTs, AASHTO, FHWA, and TRB ensures that each proposed research project is vetted prior to being considered for funding. The process is led by AASHTO R&I, which serves as NCHRP's governing body. R&I membership includes 16 state DOT members (two research managers and two senior managers from each of the four AASHTO regions), plus ex officio members from FHWA and other federal agencies. In addition, the R&I 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), a subcommittee of R&I, and composed of research directors from every state DOT.

In July of every year, R&I invites the submission of research problem statements from three authorized sources: (1) state DOTs, (2) the chairs of AASHTO's committees and councils, and (3) FHWA. Problem statements are due November 1 each year and should explain why the research represents an immediate need and is of interest to the majority of states. The proposed research should have a high probability of success and should not duplicate other research. Submitters are asked to search the relevant literature in the Transport Research International Documentation (TRID) database and the Research in Progress (RiP) database to determine if similar efforts are already underway or if satisfactory answers are already available.

From November through February, NCHRP receives comments on the problem statements from AASHTO, FHWA, and NCHRP staff. In February, NCHRP sends these comments and the problem statements to AASHTO R&I and RAC for review. Those committees rate each of the candidates according to need, value, and appropriateness. The results help establish a preliminary ranking to structure the discussion of candidates by R&I at its April meeting.

At its April meeting, R&I allocates funds (based on expected funding for the next fiscal year) for new and continuing projects. Once the program is developed, AASHTO sends a report to the AASHTO Board of Directors (CEOs of the state DOTs) requesting final approval. Each project must receive a yes vote from at least two-thirds of the members of the Board of Directors. In addition, each year's program must be approved by FHWA and accepted by the National Academies.

An average of 120 problem statements and 15 requests for project continuations are received each year. Continuing projects include research carried out under NCHRP subprograms, such as the Synthesis of Practice series, the IDEA program, and the U.S. Domestic Scan Program, and projects from previous years that request additional funds. In recent years, R&I has funded approximately 100 new projects each year.

State DOTs Help Guide NCHRP Research Projects

Each research project is assigned to a volunteer panel of subject matter experts who will provide technical guidance and counsel throughout the research and reporting phases. 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-hours. The panel members are drawn from many disciplines, with heavy dependence on practitioners from state DOTs. A broad search is made for these individuals, and TRB usually receives about four to five times as many nominees as are needed.

Panel members assume a number of key responsibilities for helping ensure the quality of NCHRP research. Project panels analyze the initial problem statement, develop the final project scope and objectives, and prepare a formal request for proposals from qualified research agencies. The panels review the research proposals, recommend contract awards, and provide counsel to the NCHRP staff responsible for management of the research contracts. Finally, the panels review

final reports for acceptability and for accomplishment of the approved research plan.

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 relevant capability and experience in the problem area. Eligible organizations include private-sector organizations, academic institutions, and nonprofit entities. Throughout its history, NCHRP has awarded research contracts to entities headquartered in a majority of the 50 states, as well as the District of Columbia, Canada, and England. Contractors selected to conduct NCHRP research principally fall into two categories—private sector and university/research institute.

Requests for proposals are posted on TRB's website, announced through TRB Weekly, an 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, available on the NCHRP webpage.

The proposed budget total is established in advance and is not a factor in selecting an investigator. Because the funds available for research are announced in the project statement, proposers instead provide a research plan that is achievable with the available funds.

The project panels select investigating agencies after evaluation of all proposals and discussion of proposers' past performance on other research projects conducted by NCHRP or others. The successful proposals are retained by panel members for use in monitoring the research.

NCHRP will provide a debriefing, if requested, to unsuccessful proposers to discuss the 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:

- The proposer's demonstrated understanding of the problem;
- The merit of the proposed research approach and methodology;
- Experience, qualifications, and objectivity of the research team in the same or closely related problem area;
- The plan for ensuring application of results;
- The proposer's Diversity and Inclusion Plan; and
- The adequacy of the facilities and equipment.

From *Information and Instructions for Preparing Proposals* for the Transportation Research Board's Cooperative Research Programs, available online at the NCHRP Information for Proposers webpage.

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 state DOTs and demonstrates AASHTO's interest in acquiring answers to the many acute problems facing state DOT administrators and engineers. Problem statements submitted as candidates for funding each year are given a unique identification number based on the NCHRP Classification System for problem areas.

This identification number 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 03-117 identifies the 117th project in Area 3 (Operations and Control). NCHRP Project 17-73 identifies the 73rd project in Area 17 (Safety). Once research was completed, final reports for these projects were published, respectively, as *NCHRP Research Report 881: Traffic Control Devices and Measures for Deterring Wrong-Way Movements*, and *NCHRP Research Report 893: Systemic Pedestrian Safety Analysis*.

Table 2 of the Annual Report uses this project numbering system to present information about active, completed, and pending NCHRP projects in 2021. The projects are grouped sequentially from Area 1: Pavements through Area 25: Human & Natural Environment.

1. Pavements
2. Economics
3. Operations and Control
4. General Materials
5. Illumination and Visibility
6. Snow and Ice Control
7. Traffic Planning
8. Planning Methods & Processes
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 Evaluation of Soils
22. Vehicle Barrier Systems
23. Agency Administration
24. Foundations and Scour
25. Human & Natural Environment

Central Role of NCHRP Staff

Once research starts, administrative and technical oversight of progress is performed by NCHRP staff.

In addition to reviewing monthly progress schedules and quarterly progress reports, the project managers maintain frequent contact with the research contractors. They monitor the conduct of the research to ensure it is consistent with the approved research plan, and they consult with project panels for technical

feedback on the contractor's work. Project managers provide guidance to the research contractor's principal investigator in all technical and administrative matters.

The principal investigator is responsible for managing the project budget consistent with the approved work plan, and in no case can the costs exceed the available budget. Any changes to the approved research plan must be approved in advance by NCHRP and are authorized through a contract amendment. Contractor invoices are checked by the staff. Finally, the panel and NCHRP project manager evaluate the final research results to determine their acceptability and suitability for publication, respectively.

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NCHRP Research in 2022

Table 1. Publications of the National Cooperative Highway Research Program, 2022

Reports

No.	Proj. No.	Title and Pages
969	03-133	Traffic Signal Control Strategies for Pedestrians and Bicyclists, 182 p.
972	15-65	Development of Safety Performance-Based Guidelines for the Roadside Design Guide, 184 p.
977	07-23	Access Management in the Vicinity of Interchanges, Volume 1: Practitioner's Guide, 84 p.
977	07-23	Access Management in the Vicinity of Interchanges, Volume 2: Research Overview, 310 p.
979	08-114A	Systematic Approach for Determining Construction Contract Time: A Guidebook (& WOD 298), 180 p.
981	03-108	Guidelines for Quantifying Benefits of Traffic Incident Management Strategies (& WOD 301), 88 p.
982	09-59	Relationships Between the Fatigue Properties of Asphalt Binders and the Fatigue Performance of Asphalt Mixtures, 178 p.
985	08-113	Integrating Effective Transportation Performance, Risk, and Asset Management Practices, 74 p.
986	20-44(02)	Implementation of the AASHTO Guide for Enterprise Risk Management, 412 p.
987	09-57A	Ruggedness of Laboratory Tests for Asphalt Mixture Cracking Resistance, 114 p.
988	20-122	Rural Transportation Issues: Research Roadmap, 414 p.
989	04-40	Reliability-Based Geotechnical Resistance Factors for Axially Loaded Micropiles, 118 p.
990	19-15	Guidebook for Effective Policies and Practices for Managing Surface Transportation Debt, 108 p.
991	17-63	Guidelines for the Development and Application of Crash Modification Factors, 404 p.
992	17-87	Guide to Pedestrian Analysis (& WOD 312), 124 p.
993	02-27	Managing Performance to Enhance Decision-Making: Making Targets Matter (& WOD 317), 86 p.
995	17-66	Guidelines for Treatments to Mitigate Opposite Direction Crashes, 44 p.
996	22-31	Selection and Placement Guidelines for Test Level 2 Through Test Level 5 Median Barriers, 178 p.
997	03-137	Algorithms to Convert Basic Safety Messages into Traffic Measures, 170 p.
998	08-111	Planning Freight-Efficient Land Uses: Methodology, Strategies, and Tools, 324 p.
999	18-18	Design and Construction of Deck Bulb Tee Girder Bridges with UHPC Connections, 128 p.
1000	08-121	Accessibility Measures in Practice: Guidance for Transportation Agencies (& WOD 330), 148 p.
1001	17-91	Framework for Assessing Potential Safety Impacts of Automated Driving Systems (joint with BTSCRP Rep. 2), 148 p.
1002	08-122	Metropolitan Planning Organizations: Strategies for Future Success, 156 p.
1003	20-07/Task 416	Guide to Alternative Technologies for Preventing and Mitigating Vehicle Intrusions into Highway Work Zones (& WOD 322), 36 p.
1004	19-16	Federal Funding Uncertainty in State, Local, and Regional Departments of Transportation: Impacts, Responses, and Adaptations, 174 p.
1005	22-26	Motorcycle Crashes into Traffic Barriers: Factors Related to Serious and Fatal Injuries (& WOD 327), 136 p.
1006	17-79	Guide to Understanding Effects of Raising Speed Limits (& WOD 328), 36 p.
1007	01-61	Evaluation of Bonded Concrete Overlays on Asphalt Pavements (& WOD 329), 146 p.
1008	02-25	Attracting, Retaining, and Developing the 2030 Transportation Workforce: Design, Construction, and Maintenance, 286 p.
1009	20-102(11)	Shared Automated Vehicle Toolkit: Policies and Planning Considerations for Implementation (& WOD 331), 106 p.
1010	22-33	In-Service Performance Evaluation: Guidelines for the Assembly and Analysis of Data (& WOD 332), 92 p.
1011	25-60	Watershed Approach to Mitigating Hydrologic Impacts of Transportation Projects: Guide (& WOD 333), 88 p.
1013	15-53	Roadside Barrier Designs near Bridge Rail Ends with Restricted Rights-of-Way: A Guide (& WOD 334), 108 p.
1015	05-21	Performance Criteria for Retroreflective Pavement Markers, 244 p.
1016	17-82	Design Guidelines for Mitigating Collisions with Trees and Utility Poles (& WOD 336), 82 p.
1018	22-34	Zone of Intrusion Envelopes under MASH Impact Conditions for Rigid Barrier Attachments, 166 p.
1019	01-58	Quantifying the Effects of Implements of Husbandry on Pavements (& WOD 338), 100 p.
1020	22-40	Investigation of Material Requirements for Highway Guardrail Systems, 144 p.
1021	03-123	Application of Dynamic Lane-Use Control: Proposed Practices, 240 p.
1022	15-72	Context Classification Application: A Guide, 84 p.

No.	Proj. No.	Title and Pages
1023	19-17	Federal Funding Flexibility: Use of Federal Aid Highway Fund Transfers by State DOTs, 120 p.

Syntheses of Highway Practice (Project 20-05)

No.	Topic No.	Title and Pages
571	51-13	Load Rating of Bridges and Culverts with Missing or Incomplete As-Built Information, 118 p.
578	52-04	Use of Unmanned Aerial Systems for Highway Construction, 58 p.
579	52-10	Subsurface Drainage Practices in Pavement Design, Construction, and Maintenance, 138 p.
580	52-03	Practices for Ensuring the Smoothness of Concrete Bridge Decks, 84 p.
581	52-12	Rehabilitation of Culverts and Buried Storm Drain Pipes, 80 p.
582	52-01	Highway Infrastructure Inspection Practices for the Digital Age, 176 p.
583	52-05	Implementation of Subsurface Utility Engineering for Highway Design and Construction, 156 p.
584	52-16	Visualization of Highway Performance Measures, 136 p.
585	52-02	Bridge Element Data Collection and Use, 114 p.
586	52-17	Use of Recycling Agents in Asphalt Concrete Mixtures, 126 p.
587	52-11	Use of Smart Work Zone Technologies for Improving Work Zone Safety, 318 p.
588	52-18	Design Practices for Rock Slopes and Rockfall Management, 184 p.
589	52-07	Automated Data Collection and Quality Management for Pavement Condition Reporting, 118 p.
590	52-06	Agency Use of Quality Control Plans for Administering Quality Assurance Specifications, 164 p.
591	52-09	Use of Safety Management Systems in Managing Highway Maintenance Worker Safety, 238 p.
592	52-08	Practices for Balancing Safety Investments in a Comprehensive Safety Program, 202 p.
593	52-14	3D Digital Models as Highway Construction Contract Documents, 86 p.
594	52-19	Technological Capabilities of Departments of Transportation for Digital Project Management and Delivery, 214 p.
595	51-07	Practices for Assessing and Mitigating the Moisture Susceptibility of Asphalt Pavements, 96 p.
596	52-15	Measuring Investments in Active Transportation When Accomplished as Part of Other Projects, 80 p.
597	52-13	Micromobility Policies, Permits, and Practices, 134 p.

Research Results Digests

No.	Proj. No.	Title and Pages
403	20-65/Task 79	Program Management Insights for the Section 5310 Program, Including Subrecipient Consolidation and Urban 5310, 48 p.

Legal Research Digests (Project 20-06)

No.	Topic No.	Title and Pages
85	25-01	Public Liabilities Relating to Driveway Permits, 128 p.
86	25-03	Managing Enhanced Risk in the Mega Project Era, 96 p.
87	25-04	Encampments of Unhoused Individuals in Transportation Rights-of-Way: Laws and State DOT Practices, 60 p.
88	25-05	Consequential Damages Provisions in Construction Contracts: Legal Issues, 32 p.

Web-Only Documents

No.	Proj. No.	Title and Pages
298	08-114A	Developing a Systematic Approach for Determining Construction Contract Time (& Rep. 979), 140 p.
301	03-108	Development of Guidelines on Quantifying Benefits of Traffic Incident Management Strategies (& Rep. 981), 168 p.
308	25-56	Methods for State DOTs to Reduce Greenhouse Gas Emissions from the Transportation Sector (& WR 1), 82 p.
312	17-87	Enhancing Pedestrian Volume Estimation and Developing HCM Pedestrian Methodologies for Safe and Sustainable Communities (& Rep. 992), 304 p.
315	12-109	Details of the Study on the Use of 0.7-in Diameter Strands in Precast Pretensioned Girders (& Rep. 994), 160 p.
316	17-80	Human Factors Guidelines for Road Systems: 2021 Update, Volume 1: Updated and New Chapters, 191 p.
316	17-80	Human Factors Guidelines for Road Systems: 2021 Update, Volume 2: Conduct of Research Report, 21 p.
317	02-27	Developing a Guide for Managing Performance to Enhance Decision Making (& Rep. 993), 82 p.
318	17-58	Safety Prediction Models for Six-Lane and One-Way Urban and Suburban Arterials, 439 p.
319	22-27	Roadside Safety Analysis Program (RSAP) Update, 30 p.
320	15-77	Aligning Geometric Design with Roadway Context, 235 p.
321	20-59	Command-Level Decision Making for Transportation Emergency Managers (joint with TCRP WOD 75 and ACRP WOD 52), 259 p.
322	20-07/Task 416	Alternative Technologies for Mitigating the Risk of Injuries and Deaths in Work Zones: Conduct of Research (& Rep. 1003), 182 p.

No.	Proj. No.	Title and Pages
323	17-50	Highway Safety Manual User Guide, 143 p.
324	17-64	Guide to Implementation of the Toward Zero Deaths National Strategy on Highway Safety, 69 p.
325	17-54	Consideration of Roadside Features in the Highway Safety Manual, 136 p.
326	22-20(02)	Design Guidelines for Test Level 3 through Test Level 5 Roadside Barrier Systems Placed on Mechanically Stabilized Earth Retaining Walls, 372 p.
327	22-26	Serious and Fatal Motorcycle Crashes into Traffic Barriers: Injury Information (& Rep. 1005), 102 p.
328	17-79	Safety Effects of Raising Speed Limits to 75 mph and Higher (& Rep. 1006), 203 p.
329	01-61	Bonded Concrete Overlays on Asphalt Pavements: Resources for Evaluation (& Rep. 1007), 300 p.
330	08-121	Accessibility Measures in Practice (& Rep. 1000), 135 p.
331	20-102(11)	Mobility on Demand and Automated Driving Systems: A Framework for Public-Sector Assessment (& Rep. 1009), 150 p.
332	22-33	Multi-State In-Service Performance Evaluations of Roadside Safety Hardware (& Rep. 1010), 62 p.
333	25-60	Watershed Approach to Mitigating Hydrologic Impacts of Transportation Projects: Conduct of Research Report (& Rep. 1011), 307 p.
334	15-53	Roadside Barrier Designs near Bridge Rail Ends with Restricted Rights-of-Way: A National Survey and Testing Results (& Rep. 1013), 286 p.
335	23-06	Guide to Computation and Use of System-Level Valuation of Transportation Assets, 210 p.
336	17-82	Proposed Guidelines for Fixed Objects in the Roadside Design Guide (& Rep. 1016), 135 p.
338	01-58	Quantifying the Effects of Implements of Husbandry on Pavements: Appendices (& Rep. 1019), 86 p.
340	20-102(26)	Dynamic Curbside Management: Keeping Pace with New and Emerging Mobility and Technology in the Public Right-of-Way, 136 p.
346	20-126(01)	Programmatic Issues of Future System Performance, 259 p.
349	08-142	Virtual Public Involvement: Lessons from the COVID-19 Pandemic, 80 p.

WebResources

No.	Proj. No.	Title and Pages
1	25-56	Reducing Greenhouse Gas Emissions: A Guide for State DOTs (& WOD 308)

Notes:
Publications in parentheses with an ampersand (&) are companion publications.
See Table 2 for project titles. See inside back cover of this document for ordering information.

Table 2. Status (as of 12/31/2022) of Projects Active or Pending During 2022

Project No. and Title	Fiscal Year	Research Agency	Contract Amount	Starting Date	Completion Date	Status	Status Comments
AREA ONE: DESIGN—PAVEMENTS							
NCHRP 01-54A, "Guidelines for Limiting Damage to Flexible and Composite Pavements Due to the Presence of Water"	2014	Applied Pavement Technology	$203,699	6/4/19	12/31/21	Completed	Publication decision pending
NCHRP 01-57B, "Validating Proposed Definitions for Comparable Pavement Cracking Data"	2022		$500,000			Contract pending	
NCHRP 01-58, "Quantifying the Effects of Implements of Husbandry on Pavements"	2017	University of Pittsburgh	$399,997	9/1/2017	5/31/2022	Completed	Published as NCHRP Research Report 1019 and NCHRP Web-Only Document 338
NCHRP 01-59, "Proposed Enhancements to Pavement ME Design: Improved Consideration of the Influence of Subgrade Soils Susceptible to Shrink/Swell and/or Frost Heave on Pavement Performance"	2018	Arizona State University	$500,000	8/15/18	1/31/23	Research in progress	
NCHRP 01-60, "Measuring the Characteristics of Pavement Surface Images and Developing Standard Practices for Calibration, Certification, and Verification of Imaging Systems"	2018	Georgia Tech Research Corporation	$593,633	9/10/18	1/31/23	Research in progress	
NCHRP 01-61, "Evaluation of Bonded Concrete Overlays on Asphalt Pavements"	2018	Nichols Consulting Engineers	$570,000	2/26/18	10/1/21	Completed	Published as NCHRP Research Report 1007 and NCHRP Web-Only Document 329
NCHRP 01-62, "Impact of Flooding and Inundation on the Resiliency of Pavements"	2023		650,000			In development	
AREA TWO: ADMINISTRATION—ECONOMICS							
NCHRP 02-25, "Workforce 2030—Attracting, Retaining, and Developing the Transportation Workforce: Design, Construction, and Maintenance"	2019	ICF Incorporated	$700,000	5/16/19	11/30/21	Completed	Published as NCHRP Research Report 1008
NCHRP 02-26, "Implementation of Life-Cycle Planning Analysis in a Transportation Asset Management Framework"	2019	WSP USA Inc.	$499,998	4/5/19	9/30/22	Completed	Publication decision pending
NCHRP 02-27, "Making Targets Matter: Managing Performance to Enhance Decision-Making"	2019	High Street Consulting Group	$649,647	2/11/19	2/28/23	Research in progress	Phase I published as NCHRP Research Report 993 and NCHRP Web-Only Document 317; Phase II—Implementation in progress
AREA THREE: TRAFFIC—OPERATIONS AND CONTROL							
NCHRP 03-78C, "Training and Technology Transfer for Accessibility Guidelines for Roundabouts and Channelized Turn Lanes"	2016	Kittelson & Associates	$250,000	1/4/17	9/30/20	Completed	Publication decision pending
NCHRP 03-114(01), "Planning and Evaluating Active Traffic Management Strategies"	2019	Texas A&M Transportation Institute	$334,796	2/25/21	12/22/23	Research in progress	
NCHRP 03-119, "Application of MASH Test Criteria to Breakaway Sign and Luminaire Supports and Crashworthy Work Zone Traffic Control Devices"	2015	George Mason University	$879,134	9/28/15	1/31/23	Research in progress	Includes continuation funding of $280,000
NCHRP 03-123, "Proposed Practices for the Application of Dynamic Lane Use Control"	2016	Texas A&M Transportation Institute	$430,000	7/1/16	4/30/20	Completed	Published as NCHRP Research Report 1021

Project No. and Title	Fiscal Year	Research Agency	Contract Amount	Starting Date	Completion Date	Status	Status Comments
NCHRP 03-125, "Evaluation of Change and Clearance Intervals Prior to the Flashing Yellow Arrow Permissive Left-Turn Indication"	2016	University of Wisconsin–Madison	$300,000	9/21/16	1/31/23	Research in progress	
NCHRP 03-126, "Transportation Operations Manual"	2022	WSP USA Inc.	$749,964	8/2/19	2/6/23	Research in progress	Combined with NCHRP Project 20-123(15); managed by NCHRP Project 03-126
NCHRP 03-127(01), "Cybersecurity of Traffic Management Systems"	2017		$750,000			Canceled	Funding to be reprogrammed
bTechniques for Transportation Agency Decision Making"	2018	Applied Engineering Management Corporation	$395,940	6/20/18	1/27/23	Research in progress	
NCHRP 03-129, "Essential Communications: A Guide to Land Mobile Radio (LMR)"	2018	Commdex Consulting LLC	$536,433	8/1/18	12/31/21	Completed	Publication decision pending
NCHRP 03-130, "Guide for Roundabouts"	2018	Kittelson & Associates, Inc.	$750,000	6/1/18	9/30/22	Completed	To be published as NCHRP Research Report 1043 and NCHRP Web-Only Document 347
NCHRP 03-132, "Guidance for Safe and Effective Temporary Traffic Control for Mobile Operations on Two-Lane Two-Way Roadways"	2018	Texas A&M Transportation Institute	$300,000	5/14/18	11/30/22	Completed	Publication decision pending
NCHRP 03-134, "Determination of Encroachment Conditions in Work Zones"	2019	Texas A&M Transportation Institute	$428,073	6/20/19	11/30/22	Completed	Publication decision pending
NCHRP 03-135, "Wrong-Way Driving Prevention Solutions and Guidance"	2019	Auburn University	$600,000	7/22/19	12/23/22	Completed	Publication decision pending
NCHRP 03-136, "Evaluating the Performance of Right-Turn-On-Red Operation at Signalized Intersections (with single and dual right-turn lanes)"	2019	Iowa State University	$300,000	8/13/19	9/30/22	Completed	Publication decision pending
NCHRP 03-137, "Algorithms to Convert Basic Safety Messages into Traffic Measures"	2019	Noblis, Inc.	$400,000	8/1/19	11/30/21	Completed	Published as NCHRP Research Report 997
NCHRP 03-138, "Application of Big Data Approaches for Traffic Incident Management (TIM)"	2020	Applied Engineering Management Corporation	$489,998	7/28/20	3/28/23	Research in progress	
NCHRP 03-139, "Next Generation of the USLIMITS2 Speed Limit Setting Expert System"	2020	University of North Carolina–Chapel Hill	$450,000	8/1/20	2/1/23	Research in progress	
NCHRP 03-140, "Applications of RFID and Wireless Technologies for Highway Construction"	2020	University of Kentucky Research Foundation	$370,000	8/5/20	2/6/23	Research in progress	
NCHRP 03-141, "Guidance on Midblock Pedestrian Signals (MPS)"	2020	Texas A&M Transportation Institute	$125,000	6/16/21	8/16/22	Completed	To be published as NCHRP Research Report 1030
NCHRP 03-142, "Evaluating the Impacts of Real-Time Warnings and Variable Speed Limits on Safety and Travel Reliability during Weather Events"	2022		$400,000			Contract pending	
NCHRP 03-143, "Warrants for a Pedestrian Traffic Control Signal and for Other Pedestrian Traffic Control Devices"	2022		$600,000			In development	
NCHRP 03-144, , "Leveraging Existing Traffic Signal Assets to Obtain Quality Traffic Counts and Enhance Transportation Monitoring Programs"	2022	Texas A&M Transportation Institute	$450,000	9/29/22	3/28/25	Research in progress	
NCHRP 03-145, "National Traffic Sensor System Evaluation Program"	2023		$600,000			In development	
NCHRP 03-146, "Transportation Operations Manual Best Practices Guide"	2023		$350,000			In development	

Project No. and Title	Fiscal Year	Research Agency	Contract Amount	Starting Date	Completion Date	Status	Status Comments
NCHRP 03-147, "LED Applications on Traffic Control Devices"	2023		$500,000			In development	
NCHRP 03-148, "Capabilities, Requirements, Planning, and Preparing to Virtually Operate Traffic Management Systems (TMS)"	2023		$600,000			In development	
NCHRP 03-149, "Signal Timing Manual: Development of the Third Edition"	2023		$750,000			In development	
AREA FOUR: MATERIALS AND CONSTRUCTION—GENERAL MATERIALS							
AREA FIVE: TRAFFIC—ILLUMINATION AND VISIBILITY							
NCHRP 05-22A, "Gaps and Emerging Technologies in the Application of Solid-State Roadway Lighting"	2019	Virginia Polytechnic Institute & State University	$300,000	9/3/20	4/30/23	Research in progress	
NCHRP 05-24, "Guidelines for Vehicle and Equipment Color, Marking, and Lighting"	2018	Texas A&M Transportation Institute	$600,000	6/1/18	12/31/22	Completed	Publication decision pending
NCHRP 05-25, "Safety Performance of LED and Variable Lighting Systems"	2021		$650,000			In development	
NCHRP 05-26, "Development of an Updated Warranting System for Roadway Lighting"	2023		$350,000			In development	
NCHRP 05-27, "Practitioners' Guide for Lighting at Innovative Intersections/Interchanges, including Roundabouts"	2023		$500,000			In development	
AREA SIX: MAINTENANCE—SNOW AND ICE CONTROL							
NCHRP 06-19, "Guidebook for Mechanical Methods for Snow and Ice Control Operations"	2021	Wilfrid A. Nixon & Associates, LLC	$264,269	6/2/21	3/1/23	Research in progress	
AREA SEVEN: TRAFFIC—TRAFFIC PLANNING							
NCHRP 07-26, "Update of Highway Capacity Manual: Merge, Diverge, and Weaving Methodologies"	2019	Kittelson & Associates	$400,000	6/10/19	12/31/22	Completed	Phase I: to be published as NCHRP Research Report 1038 and NCHRP Web-Only Document 343; Phase II: research in progress
NCHRP 07-27, "An Update of the Green Book Design Vehicles"	2019	MRIGlobal	$400,000	5/8/19	9/30/22	Completed	Publication decision pending
NCHRP 07-28(01), "Assessing the Safety Impacts of Right-Turn Lanes on Rural and Suburban Highways"	2019	MRIGlobal	$250,000	5/6/19	7/31/22	Completed	Publication decision pending
NCHRP 07-28(02), "Assessing the Multi-Modal Safety Performance of Turn Lanes"	2019		$400,000			In development	
NCHRP 07-29, "Development of the 8th Edition of AASHTO's A Policy on the Geometric Design of Highways and Streets (Green Book)"	2020	Texas A&M Transportation Institute	$1,000,000	5/10/21	5/10/24	Research in progress	
NCHRP 07-30, "Methods for Assigning Short-Duration Traffic Volume Counts to Adjustment Factor Groups for Estimating AADT"	2021	Texas A&M Transportation Institute	$500,000	6/1/21	11/30/23	Research in progress	
NCHRP 07-31, "State DOT and Tribal Use of Active Transportation Data: Practices, Sources, Needs, and Gaps"	2021		$800,000			In development	
NCHRP 07-32, "Future-Proofing Automatic Traffic Signal Performance Measurement	2022		$500,000			Contract pending	

Project No. and Title	Fiscal Year	Research Agency	Contract Amount	Starting Date	Completion Date	Status	Status Comments
Systems for Scalability, Transferability, and CAV Integration"							
NCHRP 07-33, "Evaluate the Benefits of Increasing Clear Zone at Higher Speed/Traffic Volume/Crash Locations"	2023		$450,000			In development	
NCHRP 07-34, "Artificial Intelligence for Transportation Systems Management and Operations Applications"	2023		$450,000			In development	
AREA EIGHT: TRANSPORTATION PLANNING—PLANNING METHODS AND PROCESSES							
NCHRP 08-107, "A Guidebook for Emergency Contracting Procedures for Administration of a Regional Emergency"	2016	AECOM Consulting Transportation Group	$249,997	12/15/16	11/30/20	Completed	Publication decision pending
NCHRP 08-115, "Guidebook for Data and Information Systems for TAM"	2018	Spy Pond Partners	$700,000	8/1/18	12/31/22	Completed	Final deliverables posted on NCHRP project webpage
NCHRP 08-118, "Risk Assessment Techniques for Transportation Asset Management"	2019	Starisis Corporation	$600,000	6/24/19	6/30/22	Completed	Publication decision pending
NCHRP 08-119, "Data Integration, Sharing, and Management for Transportation Planning and Traffic Operations"	2018	Applied Engineering Management Corporation	$1,349,990	9/16/19	3/23/23	Research in progress	
NCHRP 08-121, "Accessibility Measures in Practice: Guidance for Transportation Agencies"	2019	University of Texas–Austin	$499,025	5/31/19	9/29/21	Completed	Published as NCHRP Research Report 1000 and NCHRP Web-Only Document 330
NCHRP 08-123, "Census Transportation Data Field Guide for Transportation Applications"	2019	Cambridge Systematics	$499,859	6/1/19	2/6/23	Research in progress	
NCHRP 08-124, "Quantifying the Impacts of Corridor Management"	2018	Metro Analytics PLLC	$449,427	6/17/19	1/31/22	Completed	Publication decision pending
NCHRP 08-127, "Emerging Issues: Impact of New Disruptive Technologies on the Performance of DOTs"	2020	Cambridge Systematics	$249,731	9/1/20	8/31/22	Completed	Publication decision pending
NCHRP 08-128, "Snapshots of Planning Practices"	2020		$200,000			Contract pending	
NCHRP 08-129, "Incorporating Resilience Concepts and Strategies in Transportation Planning"	2020	Applied Engineering Management Corporation	$299,979	9/10/20	6/30/22	Completed	Publication decision pending
NCHRP 08-130, "Best Practices in Coordination of Public Transit and Ride Sharing"	2020	Texas A&M Transportation Institute	$250,000	9/1/22	9/1/24	Research in progress	
NCHRP 08-131, "Access to Jobs, Economic Opportunities, and Education in Rural Areas"	2020	EBP US Inc.	$249,951	9/1/20	5/31/22	Completed	Publication decision pending
NCHRP 08-132, "Accessing America's Great Outdoors: Understanding Recreational Travel Patterns, Demand, and Future Investment Needs for Transportation Systems"	2020	Resource Systems Group, Inc.	$449,978	8/5/20	3/30/23	Research in progress	
NCHRP 08-133, "Implementing the National Intercity Bus Atlas"	2020	Resource Systems Group, Inc.	$599,994	2/5/21	2/5/23	Research in progress	
NCHRP 08-134, "Integrating Freight Movement into 21st Century Communities' Land Use, Design, and Transportation Systems"	2020	Cambridge Systematics	$489,998	12/7/20	3/7/23	Research in progress	
NCHRP 08-135, "Reliability and Quality of Service Evaluation Methods for Rural Highways"	2020	University of Florida	$399,960	12/8/20	6/8/23	Research in progress	
NCHRP 08-136, "Guidebook on Using Performance-Based Management Approaches for Maintenance"	2021		$500,000			Contract pending	

Project No. and Title	Fiscal Year	Research Agency	Contract Amount	Starting Date	Completion Date	Status	Status Comments
NCHRP 08-137, "Updates to the Digital Edition of the AASHTO Transportation Asset Management Guide"	2021	Spy Pond Partners	$450,000	8/22/22	6/22/24	Research in progress	
NCHRP 08-138, "Connecting Transportation Asset Management (TAM) and Transportation System and Management Operations (TSMO)"	2021		$500,000			In development	
NCHRP 08-139A, "Guide for Preventing and Mitigating the Risk of Bridge and Tunnel Strikes by Motor Vehicles"	2021	University of Wisconsin–Milwaukee	$500,000	10/1/21	4/1/24	Research in progress	Includes $400,000 from FHWA
NCHRP 08-140, "Guide for Truck Parking Information Management Systems"	2021	Cambridge Systematics	$499,911	8/17/22	6/16/24	Research in progress	
NCHRP 08-141, "A Guidebook for Local Truck Parking Regulations"	2021		$450,000			Contract pending	
NCHRP 08-142, "Virtual Public Involvement: A Manual for Effective, Equitable, and Efficient Practices for Transportation Agencies"	2021	Rutgers, The State University of New Jersey	$650,000	9/21/21	3/20/24	Research in progress	Phase I published as NCHRP Web-Only Document 349
NCHRP 08-143, "Impact of Spatial Segmentation on Travel Time Reliability Performance Measures"	2021		$150,000			In development	
NCHRP 08-144, "Best Practices in Determining Rural Transit Fleet Size—How to Provide Service for Changing Demographics of Rural Ridership (Right-sizing of Rural Transit Fleets)"	2021		$250,000			In development	
NCHRP 08-145, "Utilizing Cooperative Automated Transportation (CAT) Data to Enhance Freeway Operational Strategies"	2020	Noblis, Inc.	$500,000	7/14/21	2/9/24	Research in progress	
NCHRP 08-146, "Integrating Resiliency into Transportation System Operations"	2021		$350,000			Contract pending	
NCHRP 08-147, "Improving Public Transportation in Rural Areas and Tribal Communities"	2021	KFH Group Inc.	$599,919	8/27/21	2/27/24	Research in progress	
NCHRP 08-148, "Utility Abandonment, Out of Service Plant, and Decommissioning without Removal on Public Right of Way"	2021		$300,000			Contract pending	
NCHRP 08-149, "Estimating Benefits of Closing Gaps in Active Transportation Networks"	2021	Alta Planning and Design, Inc.	$450,000	9/19/22	7/18/24	Research in progress	
NCHRP 08-150, "Valuation of Transportation Equity in Active Transportation and Safety Investments"	2022		$650,000			In development	
NCHRP 08-151, "Risk Management at State DOTs: Building Momentum and Sustaining the Practice"	2022	Jacobs Engineering Group, Inc.	$350,000	6/21/22	6/21/24	Research in progress	
NCHRP 08-152, "Strategies for Advancing Equity in Transportation Planning by Increasing Diversity, Equity, and Inclusiveness in the Transportation Planning Profession"	2022		$350,000			Contract pending	
NCHRP 08-153, "Guidance on Improving Truck Traffic Estimates in 'Design Traffic' Forecasts"	2022		$425,000			In development	
NCHRP 08-154, "Guidance for Agencies to Incorporate Uncertainty into Long-Range Transportation Planning"	2022	EBP US Inc.	$600,000	8/31/22	8/30/25	Research in progress	
NCHRP 08-155, "Handbook for Addressing Racial Disparities in the Project Delivery Process"	2022		$400,000			Contract pending	

Project No. and Title	Fiscal Year	Research Agency	Contract Amount	Starting Date	Completion Date	Status	Status Comments
NCHRP 08-157, "Best Practices for Data Fusion of Probe and Point Detector Data"	2022	Michael L. Pack, LLC	$200,000	9/7/22	3/7/24	Research in progress	
NCHRP 08-158, "Communicating the Value, Interactions, and Impacts of Freight to Stakeholders"	2022		$350,000			Contract pending	
NCHRP 08-159, "Understand How Accessibility to Employment, Health Care, Education, and Other Vital Needs Varies for Different Population Groups in Different Settings, and Methods for Effectively Assessing Mobility and Accessibility Options"	2022		$500,000			In development	
NCHRP 08-160, "Understand the Role of Transportation Infrastructure Investment in Gentrification and Displacement and Identify Effective Policies and Strategies to Address These Effects"	2022		$400,000			In development	
NCHRP 08-161, "Identify Emerging Approaches for Public Engagement to Meaningfully Involve Minorities, Low-Income, and Other Vulnerable Populations"	2022		$500,000			In development	
NCHRP 08-162, "Guidance for Implementing Equitable Transportation Decision-Making"	2022	Thrivance Group, LLC	$750,000	8/24/22	12/24/24	Research in progress	
NCHRP 08-163, "Defining Appropriate Design and Accommodation Thresholds for Active Transportation in a Context-Driven Approach"	2023		$550,000			In development	
NCHRP 08-164, "Institutional Integration of Active Transportation"	2023		$600,000			In development	
NCHRP 08-165, "Integrating Active Transportation Data into Transportation Decision-Making"	2023		$550,000			In development	
NCHRP 08-166, "Racial and Economic Disparities in Pedestrian and Bicyclist Safety"	2023		$750,000			In development	
NCHRP 08-167, "A Guide for Creating Effective Visualizations"	2023		$375,000			In development	
NCHRP 08-168, "Analysis and Assessment of the National Performance Management Data"	2023		$550,000			In development	
NCHRP 08-169, "EDI (Equity, Diversity, and Inclusion) and Other Indicators to Improve TAM Impact and Outcomes"	2023		$500,000			In development	
NCHRP 08-170, "Ex Post Project Evaluation: Frameworks, Guidance, and Tools to Support Post-Implementation Evaluation of Transportation Projects"	2023		$600,000			In development	
NCHRP 08-171, "Institutionalizing Safe Systems and Safety Culture in the Transportation Planning Process"	2023		$400,000			In development	
NCHRP 08-172, "Benefit Analysis of Private Health Sector Investments in Public/Human Transportation"	2023		$400,000			In development	
NCHRP 08-173, "Impacts of E-Commerce on Travel and Land Use Patterns"	2023		$400,000			In development	
AREA NINE: MATERIALS AND CONSTRUCTION—BITUMINOUS MATERIALS							
NCHRP 09-56A, "Identifying Influences on and Minimizing the Variability of Ignition Furnace Correction Factors"	2016	Auburn University	$250,000	5/12/17	2/28/22	Completed	Publication decision pending

Project No. and Title	Fiscal Year	Research Agency	Contract Amount	Starting Date	Completion Date	Status	Status Comments
NCHRP 09-57A, "Ruggedness of Laboratory Tests to Assess Cracking Resistance of Asphalt Mixture"	2018	Texas A&M Transportation Institute	$750,000	6/15/18	10/31/22	Completed	Phases I and II published as NCHRP Research Report 987; publication decision pending on report of Phase III
NCHRP 09-60, "Addressing Impacts of Changes in Asphalt Binder Formulation and Manufacture on Pavement Performance through Changes in Asphalt Binder Specifications"	2016	Western Research Institute	$1,650,000	7/6/16	3/31/24	Research in progress	Includes continuation funds of $500,000
NCHRP 09-62, "Rapid Tests and Specifications for Construction of Asphalt-Treated Cold Recycled Pavements"	2017	Virginia Department of Transportation	$999,751	6/1/17	8/31/22	Completed	Phases I, II and III report published as NCHRP Research Report 960; Phase IV publication decision pending
NCHRP 09-63, "A Calibrated and Validated National Performance-Related Specification for Emulsified Asphalt Binder"	2019	Asphalt Institute	$1,000,000	5/1/19	5/1/23	Research in progress	Includes continuation funds of $500,000
NCHRP 09-64, "Developing Laboratory Methods and Specifications to Test Tack Coat Materials"	2020	University of Nevada–Reno	$500,000	4/15/20	1/31/23	Research in progress	
NCHRP 09-65, "Capturing Durability of High Recycled Binder Ratio (RBR) Asphalt Mixture"	2021	Texas A&M Transportation Institute	$750,000	3/26/21	3/26/24	Research in progress	
NCHRP 09-66, "Performance Properties of Laboratory Produced Recycled Plastic Modified (RPM) Asphalt Binders and Mixtures"	2021	Auburn University	$500,000	4/30/21	10/30/23	Research in progress	
NCHRP 09-68, “Recycled Asphalt Materials: Binder Availability and Its Impact on Mix Performance”	2022	Auburn University	$500,000	8/18/22	3/17/25	Research in progress	
NCHRP 09-69, "Verifying Quantities of Materials Used in Asphalt Mixtures at Production Facilities"	2022	University of Nevada–Reno	$350,000	6/28/22	10/28/24	Research in progress	
AREA TEN: MATERIALS AND CONSTRUCTION—SPECIFICATIONS, PROCEDURES, AND PRACTICES							
NCHRP 10-95A, "Toughness Requirements for Heat-Affected Zones of Welded Structural Steels for Highway Bridges"	2014	University of Kansas	$425,000	9/19/16	1/30/23	Research in progress	
NCHRP 10-99, "Guidebook for Implementing Constructability Across the Entire Project Development Process: NEPA to Final Design"	2017	University of Florida	$450,000	5/24/18	2/25/22	Completed	Publication decision pending
NCHRP 10-102, "A Guidebook for Risk-Based Construction Inspection"	2019	HKA Global Inc.	$415,719	6/18/19	7/17/22	Completed	To be published as NCHRP Research Report 1039 and NCHRP Web-Only Document 344
NCHRP 10-103, "Improving Guidance of AASHTO R 80/ASTM C 1778 for Alkali-Silica Reactivity (ASR) Potential and Mitigation"	2019	University of Texas–Austin	$648,500	6/15/19	6/14/23	Research in progress	
NCHRP 10-104, "Recommendations for Revision of AASHTO M 295 Standard Specification to Include Marginal and Unconventional Source Coal Fly Ashes"	2019	South Dakota School of Mines and Technology	$600,000	8/1/19	4/30/23	Research in progress	
NCHRP 10-105, "Verification of Traffic Speed Deflection Devices' (TSDD) Measurements"	2020	Wood Environment & Infrastructure Solutions, Inc.	$399,989	8/3/20	2/2/23	Research in progress	
NCHRP 10-106, "Update of AASHTO Standard Practice for Certification of Inertial Profiling Systems (R 56)"	2020	Wood Environment & Infrastructure Solutions, Inc.	$249,984	8/3/20	12/16/22	Completed	Publication decision pending
NCHRP 10-107, "Guide for Implementing Performance Specifications"	2020	Applied Research Associates	$600,000	3/5/20	10/31/22	Canceled	

Project No. and Title	Fiscal Year	Research Agency	Contract Amount	Starting Date	Completion Date	Status	Status Comments
NCHRP 10-108, "Manual for Incorporating Nondestructive Testing (NDT) in Quality Assurance of Highway Pavement Construction"	2020	Applied Research Associates	$250,000	10/1/20	12/31/22	Completed	Publication decision pending
NCHRP 10-109, "Modern Solutions to Safe and Efficient Work Zone Travel"	2021	Virginia Polytechnic Institute & State University	$600,000	5/4/21	5/4/24	Research in progress	
NCHRP 10-110, "3D Modeling Guide for Construction Inspection"	2021	Greenman-Pedersen, Inc.	$299,748	6/24/21	6/24/23	Research in progress	
NCHRP 10-111, "Evaluation and Selection of 3D Model Viewers for Construction Inspection"	2022		$400,000			Contract pending	
NCHRP 10-112, "Guidelines for Digital Technologies and Systems for Remote Construction Inspection for Highway Infrastructure Projects"	2022		$500,000			Contract pending	
NCHRP 10-113, "Quality Management for 3D Model-Based Project Development and Delivery"	2022	HDR Engineering, Inc.	$450,000	8/18/22	2/18/25	Research in progress	
NCHRP 10-114, "Developing Performance and Safety Specifications for Rejuvenating Seals"	2022	Auburn University	$300,000	8/4/22	8/4/25	Research in progress	
NCHRP 10-115, "Guidebook on Progressive Design-Build for Transportation Projects: Project Planning through Project Implementation"	2023		$300,000			In development	
NCHRP 10-116, "Variability in Pavement Materials and Construction"	2023		$500,000			In development	
NCHRP 10-117, "GFRP Barrier Testing Evaluation and Repair Strategies"	2023		$850,000			In development	
NCHRP 10-118, "Guidance for Efficient Timelines and Incentives/Disincentives for Accelerated Bridge Construction Projects"	2023		$275,000			In development	
NCHRP 10-119, "Guidance for Implementing Utility Investigations in Alignment with Project Delivery"	2023		$400,000			In development	
NCHRP 10-120, "Guidance for Including Right-Of-Way and Utilities in Value Engineering Studies"	2023		$400,000			In development	
NCHRP 10-121, "Performance-based Specification for the Application of Ground Modification Methods for Bridges, Retaining Structures, and Associated Geotechnical Features"	2023		$450,000			In development	
NCHRP 10-122, "Update of the AASHTO Practical Guide to Cost Estimating (PGCE)"	2023		$250,000			In development	
NCHRP 10-123, "Quality Assurance and Sustainability"	2023		$350,000			In development	
NCHRP 10-124, "Development of Field Test to Determine Actual Percent Embedment of Chip Seal Aggregate"	2023		$400,000			In development	
NCHRP 10-125, "Update to the AASHTO LRFD Bridge Construction Specifications"	2023		$700,000			In development	
AREA ELEVEN: ADMINISTRATION—LAW							
NCHRP 11-08, "Improving Rights-of-Way Acquisition and Compensation Practices for Utility Relocations"	2019	Texas A&M Transportation Institute	$400,000	4/1/19	9/30/22	Completed	Publication decision pending

Project No. and Title	Fiscal Year	Research Agency	Contract Amount	Starting Date	Completion Date	Status	Status Comments
AREA TWELVE: DESIGN—BRIDGES							
NCHRP 12-95A, "Proposed AASHTO Guidelines for Adjacent Precast Concrete Box Beam Bridge Systems"	2013	University of Cincinnati	$399,516	7/17/18	7/15/22	Completed	To be published as NCHRP Research Report 1026
NCHRP 12-102A, "AASHTO Guide Specification for ABC Design and Construction—Implementation Workshops"	2014	CME Associates Inc.	$261,106	12/10/19	6/8/22	Completed	Publication decision pending
NCHRP 12-111, "Evaluating the Effectiveness of Vibration-Mitigation Devices for Structural Supports of Signs, Luminaires, and Traffic Signals"	2016	University of Connecticut	$400,000	4/3/17	8/19/22	Completed	Publication decision pending
NCHRP 12-113, "Proposed Modification to AASHTO Cross-Frame Analysis and Design"	2017	University of Texas–Austin	$749,950	6/1/17	6/30/22	Completed	Phase I published as NCHRP Research Report 962; Phase II publication decision pending
NCHRP 12-114, "Guidance on Seismic Site Response Analysis with Pore Water Pressure Generation"	2018	GeoLogic Associates Inc.	$639,989	11/8/18	1/31/23	Research in progress	
NCHRP 12-115, "Guidelines for Risk-Based Inspection and Strength Evaluation of Suspension Bridge Main Cable Systems"	2018	Modjeski & Masters	$365,899	8/14/18	10/31/22	Completed	Publication decision pending
NCHRP 12-116A, "Design Specifications for the Static and Seismic Design of Piles for Downdrag"	2019	University of Arkansas	$419,999	10/15/20	7/14/23	Research in progress	
NCHRP 12-117, "Guidelines for Corrosion Protection of Steel Bridges Using Duplex Coating Systems"	2019	Elzly Technology Corporation	$397,854	5/16/19	10/30/22	Completed	Publication decision pending
NCHRP 12-118, "Design and Construction Specifications for Bonded and Unbonded Post-Tensioned Concrete Bridge Elements"	2019	Purdue University	$800,000	9/1/19	12/29/23	Research in progress	
NCHRP 12-119, "Bridge Deck Overhangs with MASH-Compliant Railings"	2020	University of Nebraska–Lincoln	$440,000	8/17/20	2/17/23	Research in progress	
NCHRP 12-120, "Stainless Steel Strands for Prestressed Concrete Bridge Elements"	2020	University of Houston	$600,000	9/1/20	4/30/23	Research in progress	
NCHRP 12-121, "Guidelines for the Design of Prestressed Concrete Bridge Girders Using FRP Auxiliary Reinforcement"	2021	University of Houston	$540,000	4/19/21	4/19/24	Research in progress	
NCHRP 12-122, "Proposed AASHTO Guidelines for Applications of Unmanned Aerial Systems Technologies for Element-Level Bridge Inspection"	2021	Michael Baker International	$340,000	5/11/21	11/11/23	Research in progress	
NCHRP 12-123, "Proposed AASHTO Guideline for Load Rating of Segmental Bridges"	2021	Auburn University	$300,000	4/30/21	10/30/23	Research in progress	
NCHRP 12-124, "Design of Stud Shear Connectors in Composite Steel Bridges"	2022	University of Arkansas	$800,000	8/4/22	8/3/26	Research in progress	
NCHRP 12-125, "Earthquake-Induced Bridge Displacements"	2023		$400,000			In development	
AREA THIRTEEN: MAINTENANCE—EQUIPMENT							
NCHRP 13-06A, "Guide for the Formulation of Long-Range Plans and Budgets for Replacement of Highway Operations Equipment"	2017	North Carolina State University	$324,998	5/18/20	5/31/22	Completed	To be published as NCHRP Research Report 1017
NCHRP 13-08, "Guideline for Decision-Making for Repair vs. Replacement of Highway Maintenance Equipment"	2019	The Cadmus Group LLC	$350,000	1/28/21	7/27/22	Completed	Publication decision pending
NCHRP 13-09, "Guide to Maximize Vehicle and Equipment Surplus Values"	2021	The Kercher Group, Inc.	$299,991	8/16/21	6/15/23	Research in progress	

Project No. and Title	Fiscal Year	Research Agency	Contract Amount	Starting Date	Completion Date	Status	Status Comments
AREA FOURTEEN: MAINTENANCE—MAINTENANCE OF WAY AND STRUCTURES							
NCHRP 14-36(01), "Implementation of AASHTO Guides for Bridge Preservation Actions"	2011		$300,000			In development	
NCHRP 14-39, "Using Vegetated Compost Blankets to Achieve Highway Runoff Volume and Pollutant Reduction"	2017	University of Maryland	$499,999	4/27/17	1/26/22	Completed	To be published as NCHRP Research Report 1040
NCHRP 14-40, "Transforming Roadside Management and Technology Practices for the Benefit of Safety, Ecology, and Economy"	2017	Texas A&M Transportation Institute	$300,000	9/5/17	11/15/20	Completed	Final deliverables posted on NCHRP project webpage
NCHRP 14-41, "Permanent Vegetation Control Treatments for Roadsides"	2018	Texas A&M Transportation Institute	$200,000	5/23/18	8/31/20	Completed	Publication decision pending
NCHRP 14-42, "Determining the Impact of Connected and Automated Vehicle Technology on State DOT Maintenance Programs"	2019	Iowa State University	$300,000	6/6/19	12/31/23	Research in progress	
NCHRP 14-43, "Construction Guide Specifications for Cold Central Plant Recycling and Cold In-Place Recycling"	2020	Auburn University	$250,000	5/26/20	8/31/22	Completed	Publication decision pending
NCHRP 14-45, "Guidelines for Response Planning, Assessment, and Rapid Restoration of Service of Bridges in Extreme Events"	2020	Oregon State University	$400,000	8/6/20	2/28/23	Research in progress	
NCHRP 14-46, "Guidelines for the Maintenance and Construction of Rumble Strips"	2021	Texas A&M Transportation Institute	$449,441	6/1/21	11/30/23	Research in progress	
NCHRP 14-47, "Tools and Technology for Roadside Landscape Asset Management"	2022		$350,000			Contract pending	
NCHRP 14-48, "Construction Guide Specifications for Pavement Treatments - Sand Seals and Ultra-thin Bonded Surface Treatments"	2022	University of Arkansas	$175,000	10/10/22	4/9/24	Research in progress	
AREA FIFTEEN: DESIGN—GENERAL DESIGN							
NCHRP 15-53, "Roadside Design for Conflicts in Proximity to Bridge Ends and Intersecting Roadways"	2014	KLS Engineering LLC	$744,767	8/25/14	11/23/21	Completed	Published as NCHRP Research Report 1013 and NCHRP Web-Only Document 334
NCHRP 15-55, "Guidance to Predict and Mitigate Dynamic Hydroplaning on Roadways"	2015	Virginia Polytechnic Institute & State University	$499,992	6/17/15	3/31/21	Completed	Publication decision pending
NCHRP 15-56, "Guidelines for Selecting Ramp Design Speeds"	2015	MRIGlobal	$400,000	11/10/15	6/9/21	Completed	Published as NCHRP Web-Only Document 333
NCHRP 15-61A, "Updates to the Design Practices Guide for Applying Climate Change Information to Hydrologic and Coastal Design of Transportation Infrastructure"	2020		$400,000			In development	
NCHRP 15-66, "Operational Performance and Safety Effects of Arterial Weaving Sections"	2017	University of Florida	$749,922	11/16/20	5/16/23	Research in progress	
NCHRP 15-67, "Wind Drag Coefficients for Highway Signs and Support Structures"	2018	University of Iowa	$358,197	11/7/18	1/31/22	Completed	To be published as NCHRP Research Report 1012
NCHRP 15-68(01), "Effective Low-Noise Rumble Strips"	2018	Illingworth & Rodkin, Inc.	$330,359	8/19/21	1/31/23	Research in progress	
NCHRP 15-69, "Utility Conflict Impacts During Highway Construction"	2020	Texas A&M Transportation Institute	$600,000	6/19/20	8/18/23	Research in progress	

Project No. and Title	Fiscal Year	Research Agency	Contract Amount	Starting Date	Completion Date	Status	Status Comments
NCHRP 15-70, "Valuation and Compensation for Accommodating Utility and Communications Installations in Public Rights of Way"	2020	Iowa State University	$330,748	8/17/20	8/17/22	Completed	Publication decision pending
NCHRP 15-71, "Contingency Factors to Account for Risk in Early Construction Cost Estimates for Transportation Infrastructure Projects"	2020	Texas A&M Transportation Institute	$250,000	7/8/20	6/30/22	Completed	To be published as NCHRP Research Report 1025
NCHRP 15-72, "Identification of AASHTO Context Classifications"	2020	University of Kentucky Research Foundation	$300,000	7/29/20	3/28/22	Completed	Published as NCHRP Research Report 1022
NCHRP 15-73, "Design Options to Reduce Turning Motor Vehicle—Bicycle Conflicts at Intersections"	2020	Toole Design Group	$600,000	10/2/20	10/2/23	Research in progress	
NCHRP 15-74, "Safety Evaluation of On-Street Bicycle Facility Design Features"	2020	Texas A&M Transportation Institute	$600,000	9/1/20	8/31/23	Research in progress	
NCHRP 15-75, "Update of the Policy on Geometric Design of Highways and Streets Guidance on Acceleration/Deceleration and Stopping Sight Distance Criteria"	2020	Michigan State University	$500,000	9/1/20	2/28/23	Research in progress	
NCHRP 15-76, "Designing for Target Speed"	2020	Texas A&M Transportation Institute	$750,000	7/16/20	1/16/23	Research in progress	
NCHRP 15-78, "Guidebook for Urban and Suburban Roadway Cross-Sectional Reallocation"	2020	Kittelson & Associates	$600,000	3/25/20	9/30/22	Completed	To be published as NCHRP Research Report 1036 and NCHRP Web-Only Document 342
NCHRP 15-79, "Development of Guidance for Non-Standard Roadside Hardware Installations"	2021		$400,000			Contract pending	
NCHRP 15-80, "Design Guide and Standards for Infrastructure Resilience"	2021	ICF Incorporated, LLC	$734,960	6/17/21	8/17/24	Research in progress	
NCHRP 15-81, "Guideline for Depicting Existing and Proposed Utility Facilities in Design Plans"	2022		$550,000			Contract pending	
NCHRP 15-82, "Effects of Operating Speed and Posted Speed Limit in Conjunction with Roadway Geometric Design on Safety Performance for High-Speed Rural Highways and Freeways"	2023		$950,000			In development	
AREA SIXTEEN: DESIGN—ROADSIDE DEVELOPMENT							
AREA SEVENTEEN: TRAFFIC—SAFETY							
NCHRP 17-11(03), "Development of Clear Recovery Area Guidelines"	2020	Texas A&M Transportation Institute	$132,571	8/4/21	4/4/23	Research in progress	
NCHRP 17-43, "Long-Term Roadside Crash Data Collection Program"	2008	Virginia Polytechnic Institute & State University	$1,000,000	4/27/10	9/30/21	Completed	To be published as NCHRP Research Report 1033 and NCHRP Web-Only Document 341
NCHRP 17-71A, "Proposed Highway Safety Manual, Second Edition"	2015	Texas A&M Transportation Institute	$709,705	1/21/21	1/21/24	Research in progress	
NCHRP 17-72, "Update of Crash Modification Factors for the *Highway Safety Manual*"	2014	University of North Carolina–Chapel Hill	$845,000	8/31/15	7/5/22	Completed	To be published as NCHRP Research Report 1029
NCHRP 17-79, "Safety Effects of Raising Speed Limits to 75 mph and Higher"	2016	Texas A&M Transportation Institute	$500,000	9/19/16	2/28/22	Completed	Published as NCHRP Research Report 1006 and NCHRP Web-Only

Project No. and Title	Fiscal Year	Research Agency	Contract Amount	Starting Date	Completion Date	Status	Status Comments
							Document 328
NCHRP 17-81, "Proposed Macro-Level Safety Planning Analysis Chapter for the *Highway Safety Manual*"	2017	Vanasse Hangen Brustlin, Inc.	$400,000	10/26/17	1/31/22	Completed	To be published as NCHRP Research Report 1044 and NCHRP Web-Only Document 348
NCHRP 17-82, "Proposed Guidance for Fixed Objects in the *Roadside Design Guide*"	2017	MRIGlobal	$500,000	12/12/17	3/31/22	Completed	Published as NCHRP Research Report 1016 and NCHRP Web-Only Document 336
NCHRP 17-83, "Briefings and Training Materials for Implementation of the *Highway Safety Manual*, Second Edition"	2016	University of North Carolina–Chapel Hill	$500,000	12/12/17	9/15/23	Research in progress	
NCHRP 17-84, "Pedestrian and Bicycle Safety Performance Functions for the *Highway Safety Manual*"	2017	MRIGlobal	$820,000	3/27/17	8/26/22	Completed	Publication decision pending
NCHRP 17-85, "Development and Application of Crash Severity Models for the *Highway Safety Manual*"	2018	University of Connecticut	$600,000	1/10/19	6/30/22	Completed	Publication decision pending
NCHRP 17-86, "Estimating Effectiveness of Safety Treatments in the Absence of Crash Data"	2018	Vanasse Hangen Brustlin, Inc.	$599,567	10/22/18	12/31/22	Completed	Publication decision pending
NCHRP 17-88, "Roadside Encroachment Database Development and Analysis"	2018	Virginia Polytechnic Institute & State University	$675,000	6/19/18	6/30/23	Research in progress	
NCHRP 17-89A, "HOV/HOT Freeway Crash Prediction Method for the *Highway Safety Manual*"	2018	Vanasse Hangen Brustlin, Inc.	$299,998	7/10/18	12/31/21	Completed	Publication decision pending
NCHRP 17-89B, "Safety Performance of Part-Time Shoulder Use on Freeways"	2018		$125,000			In development	Includes continuation funding of $125,000
NCHRP 17-90, "Evaluation of Roadside Crash Injury Metrics in MASH"	2019	Virginia Polytechnic Institute & State University	$400,000	7/8/19	12/31/22	Completed	Publication decision pending
NCHRP 17-92, "Developing Safety Performance Functions for Rural Two-Lane Highways that Incorporate Speed Measures"	2019	Texas A&M Transportation Institute	$500,000	4/24/19	3/31/23	Research in progress	
NCHRP 17-93, "Updating Safety Performance Functions for Data-Driven Safety Analysis"	2019	University of North Carolina–Chapel Hill	$500,000	7/1/19	12/31/23	Research in progress	
NCHRP 17-95, "Crash Modification Factors (CMFs) for Intelligent Transportation System (ITS) Applications"	2020	University of North Carolina–Chapel Hill	$400,000	6/1/20	9/6/23	Research in progress	
NCHRP 17-96, "Traffic Safety Culture Research Roadmap"	2021	University of North Carolina–Chapel Hill	$374,589	8/31/21	8/31/23	Research in progress	
NCHRP 17-97, "Strategies to Improve Pedestrian Safety at Night"	2021	Toole Design Group, LLC	$500,000	10/1/21	9/30/24	Research in progress	
NCHRP 17-98, "Guide for Intersection Control Evaluation"	2021	Kittelson & Associates, Inc.	$400,000	5/17/21	5/16/23	Research in progress	
NCHRP 17-99, "Safety Effectiveness Assessment of Advanced Highway-Rail Grade Crossing Improvements"	2021	Oklahoma State University	$399,968	8/31/22	2/28/25	Research in progress	
NCHRP 17-100, "Leveraging Artificial Intelligence and Big Data to Enhance Safety Analysis"	2021	University of Washington	$650,000	2/3/22	8/2/24	Research in progress	
NCHRP 17-101, "Applying the Safe System Approach to Transportation Planning, Design, and Operations in the United States"	2021	University of North Carolina–Chapel Hill	$450,000	8/25/22	8/25/24	Research in progress	
NCHRP 17-102, "Safety Performance for Active Transportation Modes Using Exposure Models"	2022		$700,000			Contract pending	
NCHRP 17-103, "Developing Multidisciplinary Safety Strategies from Understanding	2022		$500,000			In development	

Project No. and Title	Fiscal Year	Research Agency	Contract Amount	Starting Date	Completion Date	Status	Status Comments
Roadway Fatality Trends during the New Millennium"							
NCHRP 17-104, "Enhancement of Roadside Design Features Safety Performance Models for the *Highway Safety Manual*"	2022	University of North Carolina–Chapel Hill	$500,000	9/6/22	3/5/25	Research in progress	
NCHRP 17-106, "Motorist Behavior and Safety Impacts on Bicyclists from Centerline and Shoulder Rumble Strips on High-Speed Two-Lane Highways"	2022		$400,000			Contract pending	
NCHRP 17-107, "Work Zone Intrusion Frequency and Characteristics"	2022		$600,000			In development	
NCHRP 17-108, "Developing Crash Modification Factors for Alternative Intersections"	2022	University of North Carolina–Chapel Hill	$600,000	8/25/22	8/25/25	Research in progress	
NCHRP 17-109, "Crash Modification Factors for Automated Traffic Signal Performance Measures"	2022		$400,000			Contract pending	
NCHRP 17-110, "Template for Gathering and Disseminating Telemetric Data for Safety and Operational Uses by State DOTs (Phase 1: State of the Practice Survey and Synthesis)"	2022		$200,000			In development	
NCHRP 17-111, "Speed Management Strategies to Improve Pedestrian and Bicyclist Safety on Arterials and Higher-Speed Roadways"	2023		$550,000			In development	
NCHRP 17-112, "Enhancing Crash Modification Factors and Safety Performance Functions for Pedestrian and Bicyclist Countermeasures"	2023		$600,000			In development	
NCHRP 17-113, "Incorporating Safe System Approach into the NCHRP 500 Series"	2023		$700,000			In development	
NCHRP 17-114, "Integrated Strategies for Managing High Travel Speeds"	2023		$500,000			In development	
NCHRP 17-115, "Guide for Marked Crosswalk Design, Spacing, Placement, and Safety"	2023		$500,000			In development	
NCHRP 17-116, "Practical Approaches to Quantifying Safe System Concepts"	2023		$450,000			In development	
NCHRP 17-117, "Safety Performance Functions for Horizontal Curves"	2023		$350,000			In development	
NCHRP 17-118, "Understanding the Impacts of Operational Changes on Safety Performance"	2023		$450,000			In development	
NCHRP 17-119, "Conflict-Based Crash Prediction Method for Intersections"	2023		$550,000			In development	
NCHRP 17-120, "A Method to Link Crash, Emergency Medical Service, and Trauma Registry Data"	2023		$400,000			In development	
NCHRP 17-121, "Using Advanced Technologies to Reduce Commercial Motor Vehicle Crashes in Work Zones"	2023		$500,000			In development	
NCHRP 17-122, "Evaluation of Trespassing Detection and Warning Systems in the Vicinity of Highway-Rail Grade Crossings"	2023		$450,000			In development	
AREA EIGHTEEN: MATERIALS AND CONSTRUCTION—CONCRETE MATERIALS							
NCHRP 18-19, "Rating Concrete Water Permeability Based on Resistivity Measurements"	2019	University of Florida	$600,000	8/12/19	3/13/23	Research in progress	

Project No. and Title	Fiscal Year	Research Agency	Contract Amount	Starting Date	Completion Date	Status	Status Comments
NCHRP 18-20, "Structural Design Methodology for Cured in Place Pipe (CIPP) Liners in Gravity Stormwater Conveyance Conduits"	2020	Golder Associates Inc.	$370,000	8/21/20	1/22/24	Research in progress	
AREA NINETEEN: ADMINISTRATION—FINANCE							
NCHRP 19-15, "Guidebook for Effective Policies and Practices for Managing Surface Transportation Debt"	2018	WSP USA Inc.	$300,000	6/25/18	4/15/21	Completed	Published as NCHRP Research Report 990
NCHRP 19-16, "Federal Funding Uncertainty in State, Local, and Regional Departments of Transportation: Impacts, Responses, and Adaptation"	2019	WSP USA Inc.	$400,000	5/22/19	3/1/22	Completed	Published as NCHRP Research Report 1004
NCHRP 19-17, "Federal Funding Flexibility: Use of Federal Aid Highway Fund Transfers by State DOTs"	2020	AECOM Technical Services, Inc.	$400,000	5/20/20	6/30/22	Completed	Published as NCHRP Research Report 1023
NCHRP 19-18, "Transitioning Fuel Tax Assessments to a Road Usage Charge"	2021	Milestone Solutions (CDM Smith)	$599,932	5/25/21	5/25/23	Research in progress	
NCHRP 19-19, "Sustaining Zero-Fare Public Transit in a Post COVID-19 World: A Guide for State DOTs"	2022	Texas A&M Transportation Institute	$300,000	9/19/22	6/18/24	Research in progress	
NCHRP 19-20, "Interdependence of Federal, State, and Local Transportation Funding and Ownership"	2022		$450,000			Contract pending	
NCHRP 19-21, "Revenue Generation Models for Electric Vehicles: In-Road and Roadside Charging"	2022		$500,000			Contract pending	
NCHRP 19-22, "Future Equity Impacts of Existing Fuel Taxes"	2023		$450,000			In development	
NCHRP 19-23, "New Mobility and the User Fee Concept"	2023		$450,000			In development	
AREA TWENTY: SPECIAL PROJECTS							
NCHRP 20-05/Topic 51-07, "Practices for Assessing and Mitigating the Moisture Susceptibility of Asphalt Pavements"	2019	Purdue University	$45,000	1/14/20	12/31/22	Completed	Published as NCHRP Synthesis 595
NCHRP 20-05/Topic 52-01, "Highway Infrastructure Inspection Practices for the Digital Age"	2021	Tran and Associates, LLC (ePro)	$45,000	11/1/20	4/30/22	Completed	Published as NCHRP Synthesis 582
NCHRP 20-05/Topic 52-02, "Bridge Element Data and Use"	2021	Basak Bektas	$45,000	10/1/20	3/31/22	Completed	Published as NCHRP Synthesis 585
NCHRP 20-05/Topic 52-03, "Practices for Ensuring Bridge Surface Smoothness"	2021	SME	$45,000	12/14/20	6/14/22	Completed	Published as NCHRP Synthesis 580
NCHRP 20-05/Topic 52-04, "Use of Unmanned Aircraft Systems for Highway Construction"	2021	Oregon State University	$45,000	12/23/20	6/23/22	Completed	Published as NCHRP Synthesis 578
NCHRP 20-05/Topic 52-06, "Agency Use of Quality Control Plans for Administering Quality Assurance Specifications"	2021	Tran and Associates LLC (ePro)	$45,000	11/1/20	4/30/22	Completed	Published as NCHRP Synthesis 590
NCHRP 20-05/Topic 52-07, "Use of Pavement Data Collection Technology for Pavement Data Quality Management and MAP-21 Reporting"	2021	Nichols Consulting Engineers	$45,000	12/15/20	6/15/22	Completed	Published as NCHRP Synthesis 589
NCHRP 20-05/Topic 52-08, "Practices for Balancing Safety Investments in a Comprehensive Safety Program"	2021	Vanasse Hangen Brustlin, Inc.	$45,000	12/4/20	6/4/22	Completed	Published as NCHRP Synthesis 592
NCHRP 20-05/Topic 52-09, "Use of Safety Management Systems in Managing Highway Maintenance Worker Safety"	2021	Blue Hardhat Consulting LLC (ePro)	$45,000	11/1/20	4/30/22	Completed	Published as NCHRP Synthesis 591

Project No. and Title	Fiscal Year	Research Agency	Contract Amount	Starting Date	Completion Date	Status	Status Comments
NCHRP 20-05/Topic 52-10, "Subsurface Drainage Practices in Pavement Design, Construction, and Maintenance"	2021	Kathleen T. Hall (ePro)	$45,000	12/15/20	6/15/22	Completed	Published as NCHRP Synthesis 579
NCHRP 20-05/Topic 52-13, "Micromobility Policies, Permits, and Practices"	2021	University of South Florida	$45,000	2/23/21	8/23/22	Completed	Published as NCHRP Synthesis 597
NCHRP 20-05/Topic 52-15, "Measuring Investments in Active Transportation When Accomplished as Part of Other Transportation Projects"	2021	Toole Design Group LLC	$45,000	1/11/21	7/11/22	Completed	Published as NCHRP Synthesis 596
NCHRP 20-05/Topic 52-19, "Technological Capabilities of DOTs for Digital Project Management and Delivery"	2021	University of Kentucky Research Foundation	$45,000	12/16/20	5/31/22	Completed	Published as NCHRP Synthesis 594
NCHRP 20-05/Topic 53-01, "Practices to Promote Equity in Transportation Funding"	2022	University of Texas at Arlington	$45,000	2/9/22	8/9/23	Research in progress	
NCHRP 20-05/Topic 53-02, "Practices to Motivate Safe Behaviors with Highway Construction and Maintenance Crews"	2022	Blue Hardhat Consulting LLC	$45,000	2/23/22	8/23/23	Research in progress	
NCHRP 20-05/Topic 53-03, "Practices Leveraging Social Media Data for Emergency Preparedness and Response"	2022	Board of Regents of the University of Nebraska for University of Nebraska−Lincoln	$45,000	3/9/22	9/9/23	Research in progress	
NCHRP 20-05/Topic 53-04, "Practices for the Collection, Use, and Management of Utility As-Built Information"	2022	University of Kentucky Research Foundation	$45,000	11/1/21	5/2/23	Completed	Publication decision pending
NCHRP 20-05/Topic 53-05, "Practices for Bioretention Stormwater Control Measures"	2022	University Enterprises, Inc.	$45,000	3/2/22	9/1/23	Completed	Publication decision pending
NCHRP 20-05/Topic 53-06: Local Calibration of LRFD Geotechnical Resistance Factors	2022	Dan Brown and Associates, P.C.	$45,000	11/10/21	5/10/23	Completed	Publication decision pending
NCHRP 20-05/Topic 53-07, "Curing Practices for Concrete Pavement"	2022	Global Sustainable Solutions, LLC	$45,000	12/13/21	6/13/23	Completed	Publication decision pending
NCHRP 20-05/Topic 53-08, "Strategies and Programs for Electric Vehicle Charging"	2022	Blue Cyclone, LLC	$45,000	1/13/22	7/13/23	Research in progress	
NCHRP 20-05/Topic 53-09, "Use of Unmanned Aerial Systems for Highway Stormwater Inspections"	2022	Maple Consulting, LLC	$45,000	2/14/22	8/14/23	Research in progress	
NCHRP 20-05/Topic 53-10, "Practices for Contrast Pavement Markings"	2022	Omar Smadi dba Omar Smadi Consulting	$45,000	2/17/22	7/31/23	Research in progress	
NCHRP 20-05/Topic 53-11, "Resilient Design with Distributed Rainfall-Runoff Modeling"	2022	Auburn University	$45,000	1/4/22	7/4/23	Completed	Publication decision pending
NCHRP 20-05/Topic 53-12, "Practices for Adding Bicycle and Pedestrian Access on Existing Vehicle Bridges"	2022	Texas A&M Transportation Institute	$45,000	12/22/21	6/22/23	Research in progress	
NCHRP 20-05/Topic 53-13, "Practices for Steel Bridge Fabrication and Erection Tolerances"	2022	Medlock LLC	$45,000	11/1/21	4/30/23	Completed	Publication decision pending
NCHRP 20-05/Topic 53-14, "Use of Probe Data for Freight Planning and Operations"	2022	CPCS Transcom Inc.	$45,000	1/20/22	7/20/23	Research in progress	
NCHRP 20-05/Topic 53-16, "Critical Findings for Tunnel Functional Systems"	2022	Gannett Fleming Inc.	$45,000	12/6/21	6/6/23	Completed	Publication decision pending
NCHRP 20-05/Topic 53-17, "Integrating Freight and Active Transportation into Policies, Programs, Plans, and Project Development"	2022	University of Texas at Arlington	$45,000	1/19/22	7/19/23	Research in progress	
NCHRP 20-05/Topic 53-18, "Moisture Measurement for Foundations and Slopes"	2022	Arizona State University	$45,000	2/22/22	8/22/23	Research in progress	
NCHRP 20-05/Topic 53-19, "State DOT Product Evaluation Processes"	2022	Black Dog Consultants, LLC	$45,000	9/15/22	3/15/24	Research in progress	

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NCHRP 20-05/Topic 54-01, "Practices to Identify PFAS Impacts on Highway Construction Projects and Maintenance Operations"	2023	Iowa State University	$55,000	10/10/22	4/10/24	Research in progress	
NCHRP 20-05/Topic 54-02, "Outsourcing Post-Construction Stormwater Best Management Practice Inspection and Maintenance Activities"	2023	Maple Consulting, LLC	$55,000	10/13/22	4/12/24	Research in progress	
NCHRP 20-05/Topic 54-03, "DOT Practices on Road Safety Audits"	2023		$55,000			Contract pending	
NCHRP 20-05/Topic 54-04, "Mobile Devices as a Tool for Digitalized Project Documentation and Inspection"	2023		$55,000			In development	
NCHRP 20-05/Topic 54-05, "Practices for Statewide and MPO Coordination"	2023		$55,000			Contract pending	
NCHRP 20-05/Topic 54-06, "Ancillary Asset Data Stewardship and Data Models"	2023		$55,000			In development	
NCHRP 20-05/Topic 54-07, "Visualization for Public Involvement"	2023		$55,000			In development	
NCHRP 20-05/Topic 54-08, "Practices for Integrating Performance-Based Plans with Long-Range Transportation Plans and Statewide Transportation Investment Programs"	2023		$55,000			Contract pending	
NCHRP 20-05/Topic 54-09, "Hydraulic Engineering Practices for Construction and Temporary Facilities in Streams and Rivers"	2023		$55,000			In development	
NCHRP 20-05/Topic 54-10, "State Customization of *Highway Safety Manual* Methods"	2023		$55,000			In development	
NCHRP 20-05/Topic 54-11, "Quality Processes for Bridge Analysis Models"	2023		$55,000			Contract pending	
NCHRP 20-05/Topic 54-12, "Programmatic Implementation of Alternative Delivery Methods by State Transportation Agencies"	2023		$55,000			In development	
NCHRP 20-05/Topic 54-13, "Truck Escape Ramp Design and Operation"	2023		$55,000			Contract pending	
NCHRP 20-05/Topic 54-14, "Artificial Intelligence Applications for Automated Pavement Condition Evaluation"	2023		$55,000			In development	
NCHRP 20-05/Topic 54-15, "Prevention and Mitigation of Surficial Slope Failures on Highway Embankment Slopes"	2023		$55,000			In development	
NCHRP 20-05/Topic 54-16, "Post-Construction Evaluation Practices for Highway Projects Delivered Using Alternative Contract Methods"	2023		$55,000			Contract pending	
NCHRP 20-05/Topic 54-17, "State DOT Innovation Programs and Practices"	2023		$55,000			In development	
NCHRP 20-05/Topic 54-18, "Wintertime Pavement Maintenance Strategies"	2023		$55,000			Contract pending	
NCHRP 20-05/Topic 54-19, "Practice for Controlling Tunnel Leaks"	2023		$55,000			Contract pending	
NCHRP 20-05/Topic 54-20, "Advancing Gender Equity in the DOT Workforce"	2023		$55,000			Contract pending	
NCHRP 20-05/Topic 54-21, "Practices in the Transportation Planning Process to Address Climate Change and GHG Emission Quantification and Reduction"	2023		$55,000			Contract pending	

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NCHRP 20-05/Topic 54-22, "Practices in the Transportation Planning Process to Address Climate Change and GHG Emission Quantification and Reduction"	2023		$55,000			In development	
NCHRP 20-06/Topic 25-03, "Managing Enhanced Risk in the Mega Project Era"	2018	Cal Poly Pomona Foundation, Inc.	$150,000	5/13/20	9/30/21	Completed	Published as NCHRP Legal Research Digest 86
NCHRP 20-06/Topic 25-04, "Laws Governing Homeless Encampments in Transportation Rights-of-Way"	2018	Texas A&M Transportation Institute	$75,000	11/19/20	3/1/22	Completed	Published as NCHRP Legal Research Digest 87
NCHRP 20-06/Topic 25-05, "The Legal Issues Associated with Consequential Damages Provisions in Construction Contracts"	2018	Kaplan Kirsch Rockwell, LLP	$74,625	2/6/20	1/31/22	Completed	Published as NCHRP Legal Research Digest 88
NCHRP 20-06/Topic 25-06, "Legal Aspects and Strategies of Best-Value Procurement for Highway Construction (Update)"	2018	Colorado State University	$100,000	1/14/21	7/8/22	Completed	Publication decision pending
NCHRP 20-06/Topic 25-07, "Review of Statutory and Case Law on Planning and Environmental Linkages"	2018	Beveridge & Diamond PC	$50,000	4/20/20	8/25/22	Completed	To be published as Legal Research Digest 89
NCHRP 20-06/Topic 26-01, "Effects of Indian Treaties on Development and Operation of Transportation Facilities"	2021	Kaplan Kirsch Rockwell, LLP	$100,000	6/27/22	8/26/23	Research in progress	
NCHRP 20-06/Topic 26-02, "Analysis of Arbitration and Holdings in Construction Disputes"	2021	Capital Project Strategies	$100,000	9/1/22	8/31/23	Research in progress	
NCHRP 20-06/Topic 26-03, "Multistate Coordination and Harmonization for AV Legislation"	2021	The University of Texas at Austin	$100,000	7/25/22	7/25/23	Research in progress	
NCHRP 20-06/Topic 26-04, "Pandemics and Contractual Issues"	2021	Conner Gwyn Schenck, PLLC	$100,000	7/7/22	7/6/23	Research in progress	
NCHRP 20-07/Task 358, "Reducing Risks to Worker Safety in Work Zones Due to Distracted Drivers"	2014	Texas A&M Transportation Institute	$100,000	3/1/21	9/1/22	Completed	To be published as NCHRP Research Report 1037
NCHRP 20-07/Task 383, "Review and Update of the AASHTO Roadside Design Guide"	2016	Leidos Inc.	$220,000	6/27/16	8/1/23	Research in progress	
NCHRP 20-07/Task 428, "Update of Design of Bonded FRP Systems for Repair and Strengthening of Concrete Bridge Elements"	2018	University of Kentucky Research Foundation	$130,000	9/3/19	7/30/21	Completed	Publication decision pending
NCHRP 20-24(127), "Performance Management Implementation Concerns, Issues and Challenges"	2019	Spy Pond Partners	$224,977	6/10/19	12/31/22	Completed	Publication decision pending
NCHRP 20-24(128), "State-of-the-Art Review of Cooperative Automated Transportation (CAT) Systems"	2019	WSP USA Inc.	$699,998	7/16/19	9/31/2022	Completed	Final deliverables posted on NCHRP project webpage
NCHRP 20-24(131), "Mapping the Common Interests of AASHTO Committees"	2020	Spy Pond Partners	$250,000	10/23/20	11/22/22	Completed	Publication decision pending
NCHRP 20-24(133), "Update to Transportation Governance: A 50-State Review of State Legislatures and Departments of Transportation"	2020	J.R. Rall Consulting LLC	$200,000	8/30/21	2/28/23	Research in progress	Final deliverables to be published by AASHTO
NCHRP 20-24(137), "Assessing and Communicating the Economic and Quality of Life Benefits of Transportation Infrastructure Investments: Message Testing"	2020	WSP USA, Inc.	$150,000	11/8/21	11/7/22	Completed	Final deliverable transmitted to AASHTO
NCHRP 20-24(138), "Collective and Individual Actions for State Departments of Transportation Envisioning and Realizing the Next Era of America's Transportation Infrastructure"	2021	Cambridge Systematics, Inc.	$400,000	10/12/21	12/30/22	Completed	Publication decision pending
NCHRP 20-24(139), "Into the 2020s: A Peer Exchange Series for State DOT CEOs"	2022	High Street Consulting Group LLC	$900,000	3/1/22	2/29/24	Research in progress	

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NCHRP 20-24(141), "The Art of Decision-Making"	2022		$300,000			Contract pending	
NCHRP 20-24(143), "Template for Gathering and Disseminating Telemetric Data for Safety and Operational Uses by State DOTs: Phase 1: State of the Practice Survey and Synthesis"	2022		$200,000			Canceled	See NCHRP Project 17-110 for follow-on activity
NCHRP 20-30/IDEA 196, "Smart Installation and Monitoring System for Large Anchor Bolts of Support Structure of Highway Signs, Luminaires, and Traffic Signals"	2016	Iowa State University	$140,000	1/23/17	12/31/22	Completed	Final deliverables posted on NCHRP project webpage
NCHRP 20-30/IDEA 215, "Achieving Resilient Multi-Span Bridges by Using Buckling-Restrained Braces"	2018	University at Buffalo	$99,997	4/1/19	12/31/22	Completed	Final deliverables posted on NCHRP project webpage
NCHRP 20-30/IDEA 217, "Real-Time Proactive Intersection Safety Monitoring and Visualization System Based on Radar Sensor Data"	2018	University of Louisville	$137,000	7/1/19	7/31/22	Completed	Final deliverables posted on NCHRP project webpage
NCHRP 20-30/IDEA 219, "A Novel Durable, Healable, and Conveniently Removable Pavement Marking Material Suitable for Permanent and Temporary Marking Uses"	2018	North Dakota State University	$129,999	10/25/19	8/31/22	Completed	Final deliverables posted on NCHRP project webpage
NCHRP 20-30/IDEA 221, "Development of In-Situ Cyclic Borehole Shear Soil Test Device"	2019	Iowa State University	$130,000	1/1/20	9/30/22	Completed	Final deliverables posted on NCHRP project webpage
NCHRP 20-30/IDEA 222, "Mixed Reality Infrastructure Inspections"	2019	University of Central Florida Board of Trustees	$135,000	4/1/20	12/31/22	Completed	Final deliverables posted on NCHRP project webpage
NCHRP 20-30/IDEA 223, "Fatigue Crack Inspection Using Computer Vision and Augmented Reality"	2019	University of Kansas Center for Research	$135,000	1/1/21	12/31/22	Completed	Final deliverables posted on NCHRP project webpage
NCHRP 20-30/IDEA 224, "Development of an Automated and Rapid Conditioning and Testing Device for Cracking and Rutting"	2019	Texas A&M Transportation Institute	$135,000	1/1/21	6/30/23	Research in progress	
NCHRP 20-30/IDEA 225, "An Automated System for Large-Scale Intersection Marking Data Collection and Condition Assessment"	2019	Old Dominion University Research Foundation	$135,000	1/1/21	12/31/22	Completed	Final deliverables posted on NCHRP project webpage
NCHRP 20-30/IDEA 226, "A Smart IoT Proximity System for Highway Work Zone Safety"	2020	Georgia Institute of Technology	$100,000	1/19/21	1/18/24	Research in progress	
NCHRP 20-30/IDEA 227, "Adjustable Cross-frames for the Erection of Steel Girder Bridges"	2020	University of Notre Dame	$135,000	7/1/21	6/30/24	Research in progress	
NCHRP 20-30/IDEA 229, "Lab Dielectric Measurement System for Asphalt Mixture Bulk Specific Gravity Determination"	2020	University of New Hampshire	$135,422	1/1/21	12/31/22	Completed	Final deliverables posted on NCHRP project webpage
NCHRP 20-30/IDEA 230, "Automated Data and Feature Extraction from Bridge Plans"	2020	Iowa State University	$134,638	7/1/21	6/30/23	Research in progress	
NCHRP 20-30/IDEA 231, "AI Analyzer for Revealing Insights of Traffic Crashes"	2020	University of Nevada–Las Vegas	$82,899	7/1/21	6/30/23	Research in progress	
NCHRP 20-30/IDEA 232, "Measuring Concrete Permeability with CHIP"	2020	Oklahoma State University	$100,000	7/1/21	6/30/23	Research in progress	
NCHRP 20-30/IDEA 233, "Development of an Innovative Bio-Mediated Self-Healing Concrete Technology"	2020	Case Western Reserve University	$135,000	10/1/21	9/30/23	Research in progress	
NCHRP 20-30/IDEA 234, "Field Test and Evaluation of a Solar Snow Fence"	2021	Longboard Power, LLC	$99,430	10/1/21	5/31/23	Research in progress	
NCHRP 20-30/IDEA 235, "High Bond Steel Fibers for Ultra High Performance Concrete (UHPC)"	2021	HiPer Fiber, LLC	$99,971	10/1/21	9/30/22	Completed	Final deliverables posted on NCHRP project webpage

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NCHRP 20-30/IDEA 236, "A Practical Method to Determine Reclaimed Asphalt Pavement Binder Availability"	2021	North Carolina State University	$134,995	10/1/21	3/31/23	Research in progress	
NCHRP 20-30/IDEA 237, "Machine Learning-Based Tool to Predict the Retroreflectivity of Pavement Markings in the U.S."	2021	Louisiana State University A&M College	$100,000	1/1/22	12/31/23	Research in progress	
NCHRP 20-30/IDEA 238, "Low-Cost Sensing System for the Detection and Classification of Super Single Wheel Types and Distribution at the Network Level"	2021	Michigan State University	$135,000	7/1/22	6/30/24	Research in progress	
NCHRP 20-30/IDEA 239, "A Real-Time Ice Warning System Empowered by Dielectric Ice Sensors for Bridges"	2021	University of Texas at Arlington	$135,000	7/1/22	6/30/24	Research in progress	
NCHRP 20-30/IDEA 240, "Stainless Steel Coated Rebar for Chloride-Resistant Concrete Highways and Bridges"	2021	Allium Engineering, Inc.	$138,750	4/1/22	6/30/23	Research in progress	
NCHRP 20-30/IDEA 241, "Producing DynaSignal: A Novel Aerodynamic Solution for Traffic Signal Lights to Mitigate Large Vibrations and Fatigue-Related Issues in Structural Supports of Traffic Signals"	2021	Iowa State University	$100,000	10/1/22	9/30/24	Research in progress	
NCHRP 20-30/IDEA 242, "Development of an AI-Powered Dynamic Modulus Test with a Low-Cost Loading Frame"	2021		$135,000			Contract pending	
NCHRP 20-30/IDEA 243, "Establishing NDE Protocols for Use in Early Age Bridge Deck Preservation Strategies"	2021		$137,850			Contract pending	
NCHRP 20-30/IDEA 244, "Development of a Compaction Quality Control Standard for the Small Diameter Pressure meter"			$100,000			Contract pending	
NCHRP 20-44(19), "Implementation of Proposed AASHTO Standards for Asphalt Binders and Mixtures"	2019	Asphalt Institute	$119,866	5/1/20	11/1/22	Completed	Publication decision pending
NCHRP 20-44(23), "Pilot Test of Climate Change Design Practices Guide for Hydrology and Hydraulics"	2020	Dewberry Engineers Inc.	$247,547	9/30/20	8/31/22	Completed	Final deliverables posted on NCHRP project webpage
NCHRP 20-44(24), "Pilot Test of Proposed Standard Practice for Recycling Agents in Asphalt Mixtures Incorporating RAP and RAS"	2020	Texas A&M Transportation Institute	$150,000	12/19/19	12/15/22	Completed	Publication decision pending
NCHRP 20-44(26), "Implementing Guide Specifications for the Construction of Chip Seals, Micro Surfacing, and Fog Seals"	2020	Michigan State University	$200,000	9/24/20	9/25/23	Research in progress	
NCHRP 20-44(27), "Facilitating Balanced Mix Design Implementation"	2021	Auburn University	$195,000	9/9/20	9/9/22	Completed	Final deliverables posted on NCHRP project webpage
NCHRP 20-44(28), "Development of a Technology Transfer Plan for State Departments of Transportation Research Programs"	2020	CTC & Associates LLC	$159,960	11/30/20	11/29/22	Completed	Final deliverables posted on NCHRP project webpage
NCHRP 20-44(31), "Implementation of NCHRP Research Report 923 & the Electronic Workforce Optimization Workbook (e-WOW) for Transportation Projects"	2021		$200,000			Contract pending	
NCHRP 20-44(32), "Guidelines for Selecting Travel Forecasting Methods and Techniques—Implementation"	2020	Resource Systems Group, Inc.	$375,878	9/21/20	5/31/23	Research in progress	
NCHRP 20-44(33), "Evaluating the Suitability of Roadway Corridors for Use by Monarch Butterflies (NCHRP Project 20-119)"	2020	Monarch Joint Venture	$162,800	2/10/21	8/10/23	Research in progress	

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NCHRP 20-44(34), "Successful Practices for State Transportation Research Office's Complying with 2 CFR 200 (NCHRP Project 20-111J)"	2020	Applied Research Associates Inc.	$190,000	4/26/21	10/26/22	Completed	Publication decision pending
NCHRP 20-44(35), "Implementation for NCHRP Research Report 948—Guide for Pedestrian and Bicycle Safety at Alternative Intersections and Interchanges"	2020	Kittelson and Associates	$250,000	6/1/22	12/1/23	Research in progress	
NCHRP 20-44(36), "Workshops on Long-Range Strategic Issues Affecting Preservation, Maintenance, and Renewal of Highway Infrastructure"	2020	WSP USA Inc.	$279,999	4/6/22	12/5/23	Research in progress	
NCHRP 20-44(37), "Workshops on Performance Measures in Snow and Ice Control Operations"	2020	ICF Incorporated, LLC	$225,000	3/23/22	9/23/24	Research in progress	
NCHRP 20-44(39), "Consultant Support for Implementation of Guidebook for Managing Data from Emerging Technologies"	2020	Applied Engineering Management Corporation	$365,700	4/21/21	12/20/22	Completed	Final deliverables posted on NCHRP project webpage
NCHRP 20-44(40), "Ensuring Essential Capability for the Future Transportation Agency"	2020		$300,000			Contract pending	
NCHRP 20-44(41), "Deploying Transportation Resilience Practices in State DOTs: Implementation"	2021		$180,000			In development	
NCHRP 20-44(42), "Agency Implementation of the Design-Build and Contract Manager/General Contractor Guidebooks for Post-Award Contract Administration"	2021	Arizona State University	$250,000	2/1/22	2/1/24	Research in progress	
NCHRP 20-44(43), "Implementation of NCHRP Domestic Scan Report 16-02: Leading Landscape Design Practices for Cost-Effective Roadside Water Management"	2021		$150,000			In development	
NCHRP 20-44(44), "Implementation of the Research Results of NCHRP Project 15-61, 'Applying Climate Change Information to Hydrologic and Hydraulic Design of Transportation Infrastructure'"	2021		$130,000			In development	
NCHRP 20-44(45), "Supporting State DOT Adoption of Knowledge Management Practices"	2021		$200,000			In development	
NCHRP 20-44(46), "Implementing the Asset Valuation Guide Developed through NCHRP Project 23-06, 'A Guide to Computation and Use of System Level Valuation of Transportation Assets'"	2021		$300,000			In development	
NCHRP 20-44(47), "UAS Flight Proficiency Certification Pilot Program for State DOTs"	2021		$200,000			In development	
NCHRP Project 20-44(48), "Peer Exchange on Data Management and Governance Practices"	2022		$150,000			In development	
NCHRP Project 20-44(49), "Research Implementation Barriers and Guidance for Overcoming Barriers"	2022		$325,000			In development	
NCHRP Project 20-44(50), "Implementation of Asphalt Pavement Raveling Detection Algorithm"	2022		$225,000			In development	
NCHRP 20-50(20), "LTPP Data Analysis: Develop Practical Tools and Procedures to Improve WIM Data Quality"	2018	Applied Research Associates	$469,998	10/1/18	12/30/22	Completed	Publication decision pending
NCHRP 20-50(21), "Enhancements of Climatic Inputs and Related Models for	2018	Applied Research Associates	$350,000	8/24/18	11/30/23	Research in progress	

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Pavement ME Using LTPP Climate Tool (MERRA-2)"							
NCHRP 20-50(22)A, "LTPP Data Analysis: Guidelines to Improve Use of FWD and Longitudinal Profile Measurements"	2019	Nichols Consulting Engineers, Chtd	$350,000	11/16/21	2/15/24	Research in progress	
NCHRP 20-59(30)A, "Train-the-Trainer Regional Workshops for Incident Command System (ICS) Training for Field Level Transportation Supervisors and Staff"	2017	San Jose State University	$450,000	7/11/17	9/30/24	Research in progress	
NCHRP 20-59(53)A, "A Guide to Flood Forecasting for Transportation Resilience"	2014	Dewberry Engineers Inc.	$650,000	6/27/19	3/31/24	Research in progress	
NCHRP 20-65/Task 78, "Impact of Decline in Volunteerism on Rural Transit Systems"	2018	AECOM Technical Services, Inc.	$99,943	8/24/19	10/7/22	Completed	Publication decision pending
NCHRP 20-65/Task 79, "Program Management Insights for the 5310 Program (Including Sub-Grantee Consolidation and Urban 5310)"	2018	ICF Incorporated	$124,955	7/12/19	12/30/21	Completed	Published as NCHRP Research Results Digest 403
NCHRP 20-65/Task 80, "Capacity Building Options for DOT Transit Staff"	2018	ICF Incorporated	$100,000	7/23/19	3/30/23	Research in progress	
NCHRP 20-65/Task 81, "Best Practices in Rural Service Assessment"	2018	AECOM Technical Services, Inc.	$75,000	7/10/19	8/5/22	Completed	Final deliverables posted on NCHRP project webpage
NCHRP 20-65/Task 82, "Issues Associated with Providing Customized, Client-Based Transportation Services"	2018	AECOM Technical Services, Inc.	$149,998	11/7/19	8/5/22	Completed	Final deliverables posted on NCHRP project webpage
NCHRP 20-68D, "U.S. Domestic Scan Program"	2020	Arora and Associates, P.C.	$1,800,000	4/3/19	4/7/23	Research in progress	
NCHRP 20-102(11), "Mobility-on-Demand and Automated Driving Systems: A Framework for Public-Sector Assessment"	2017	Booz-Allen & Hamilton	$300,000	5/17/18	9/30/20	Completed	Published as NCHRP Research Report 1009 and NCHRP Web-Only Document 331
NCHRP 20-102(16), "Impacts of Connected, Automated Vehicle Technologies on Traffic Incident Management Response"	2021	Gannett Fleming	$249,584	2/7/22	11/13/23	Research in progress	
NCHRP 20-102(17): Deployment Guidance for CV Applications in the Open Source Application Development Portal	2018		$450,000			Canceled	Funding to be reprogrammed
NCHRP 20-102(19)B, "Updated Research Roadmap for NCHRP 20-102, Impacts of Connected Vehicles and Automated Vehicles on State and Local Transportation Agencies"	2019	Kimley-Horn & Associates	$125,000	1/21/20	12/15/22	Completed	Publication decision pending
NCHRP 20-102(20), "Workforce Capability Strategies for State and Local Agencies"			$300,000			In development	
NCHRP 20-102(21), “Infrastructure Modifications to improve the Operational Domain of Automated Vehicles”						Canceled	Combined with NCHRP Project 20-102(24)
NCHRP 20-102(22), "State and Local Impacts of Automated Freight Transportation Systems"	2019	The Tioga Group	$339,990	9/16/19	4/30/22	Completed	To be published as NCHRP Research Report 1028
NCHRP 20-102(24), "Infrastructure Enablers for Connected and Automated Vehicles and Shared Mobility—Near-Term and Mid-Term"	2019		$800,000			Contract pending	Combined with NCHRP Project 20-102(21); managed by NCHRP Project 20-102(24)
NCHRP 20-102(25), "Readiness and Effectiveness of Freeway-Based Corridor V2X Applications for Improving Congestion and Safety"	2020		$500,000			In development	
NCHRP 20-102(26), "Dynamic Curbside Management: Keeping Pace with New and Emerging Mobility and Technology in the Public Right of Way"	2020	Fehr & Peers	$249,923	2/16/21	5/15/22	Completed	Published as NCHRP Web-Only Document 340

Project No. and Title	Fiscal Year	Research Agency	Contract Amount	Starting Date	Completion Date	Status	Status Comments
NCHRP 20-102(27), "Realistic Timing Estimates for Automated Vehicle Implementation"	2020	WSP USA Inc.	$149,874	6/29/21	9/29/22	Completed	Publication decision pending
NCHRP 20-102(28), "Preparing Transportation Agencies for Connected and Automated Vehicles in Work Zones"	2020	Virginia Polytechnic Institute & State University	$250,000	10/21/20	11/21/22	Completed	Publication decision pending
NCHRP 20-102(29), "Incorporating New Mobility Options into Travel Demand Forecasting and Modeling"	2020	University of Central Florida Board of Trustees	$125,000	8/22/22	12/22/23	Research in progress	
NCHRP 20-102(33), "Safety of Vulnerable Road Users in a C/AV Future"	2020		$150,000			In development	
NCHRP 20-102(34), "Toolbox for Navigating the Land-Use Impacts of the Automated Vehicle Ecosystem"	2020		$450,000			Contract pending	
NCHRP 20-121, "State DOT Contributions to the Study, Investigation, and Interdiction of Human Trafficking"	2018	Project Performance Corporation	$299,883	5/31/18	3/30/20	Completed	Publication decision pending
NCHRP 20-121A, "Countering Human Trafficking: A Toolkit for State DOTs"	2018		$450,000			In development	
NCHRP 20-123(01), "Transportation Asset Management Strategic Planning and Research Roadmap Development"	2019	Spy Pond Partners	$220,000	9/12/19	3/31/22	Completed	Final deliverables posted on NCHRP project webpage
NCHRP 20-123(06), "Merging and Updating AASHTO Policy on the Accommodation of Utilities within Freeway Right-of-Way and AASHTO Guide for Accommodating Utilities within Highway Right-of-Way"	2020	Texas A&M Transportation Institute	$75,000	5/5/21	11/5/22	Completed	Publication decision pending
NCHRP 20-123(09), "Feasibility Study for a Platform to Capture Innovations from State Departments of Transportation"	2020	Public Knowledge, LLC	$99,865	1/4/2021	10/29/21	Completed	Final deliverables posted on NCHRP project webpage
NCHRP 20-123(10), "AASHTO Committee on Bridges and Structures Strategic Plan, Operating Guidelines, and Research Roadmap Development"	2020	Clough, Harbor & Associates LLP	$119,940	6/7/21	10/7/22	Completed	Publication decision pending
NCHRP 20-123(12), "System Mobility and Emerging Technologies (SMET): Strategic Planning Session and Research Roadmap Development"	2021	Stantec Consulting Services, Inc.	$225,000	6/16/22	11/16/23	Research in progress	
NCHRP 20-123(13), "Strategic Plan and Research Roadmap for the AASHTO Committee on Planning"	2021	Spy Pond Partners	$250,000	8/4/22	3/3/24	Research in progress	
NCHRP 20-123(14), "Scoping Study for the Development of a Platform for AASHTO Committee Surveys"	2021	Spy Pond Partners	$200,000	3/24/22	9/23/23	Research in progress	
NCHRP 20-123(16), "Roadmap for AASHTO Bridge Railing MASH Updates to Support Future Vehicle Fleet Transformation"	2021		$150,000			In development	
NCHRP 20-123(17), "*Highway Safety Manual* Development and Roadmap"	2022		$150,000			In development	
NCHRP 20-123(18), "Development of a New Transportation System Operations Strategic Plan"	2022		$225,000			Contract pending	
NCHRP 20-123(19), "Transportation Equity Related Research—A Roadmap"	2022		$250,000			In development	
NCHRP 20-124, "Deploying Transportation Security Practices in State DOTs"	2019	Critical Ops, LLC	$797,636	1/22/20	7/21/24	Research in progress	Includes continuation funding of $99,000
NCHRP 20-125, "Strategies for Incorporating Resilience into Transportation Networks"	2019	Metro Analytics, LLC	$599,679	12/30/19	10/26/22	Completed	Publication decision pending
NCHRP 20-126(01), "Programmatic Strategies for State Transportation Agencies	2020	WSP USA Inc.	$350,000	10/1/20	8/1/22	Completed	Published as NCHRP Web-Only Document 346

Project No. and Title	Fiscal Year	Research Agency	Contract Amount	Starting Date	Completion Date	Status	Status Comments
Dealing with Issues of Future System Performance"							
NCHRP 20-126(02), "State Transportation Agency Multifaceted Decision-Making for Future System Performance"	2020	Metro Analytics	$348,929	1/27/21	8/1/22	Completed	To be published as NCHRP Research Report 1042
NCHRP 20-126(03), "Advancing Practices of In Situ Nondestructive Evaluation of Highway System Asset Foundational Condition and Capability"	2020	Applied Research Associates, Inc.	$150,000	5/4/21	8/3/22	Completed	To be published as NCHRP Research Report 1041
NCHRP 20-127, "Business Case and Communications Strategies for State DOT Resilience Efforts"	2020	Cambridge Systematics Inc.	$349,704	12/15/20	12/15/22	Completed	Publication decision pending
NCHRP 20-128, "Emergency Response: Organizational and Operational Models Used by State DOTs"	2020	WSP USA Inc.	$400,000	2/1/21	2/1/23	Research in progress	
NCHRP 20-129, "Guide for Addressing Encampments on State Transportation Rights-of-Way"	2022		$350,000			Contract pending	
AREA TWENTY-ONE: TESTING AND EVALUATION OF SOILS							
AREA TWENTY-TWO: VEHICLE BARRIER SYSTEMS							
NCHRP 22-26, "Factors Related to Serious Injury and Fatal Motorcycle Crashes with Traffic Barriers"	2009	Virginia Polytechnic Institute & State University	$500,000	5/1/09	11/30/20	Completed	Published as NCHRP Research Report 1005 and NCHRP Web-Only Document 327
NCHRP 22-29B, "Evaluating the Performance of Longitudinal Barriers on Curved, Superelevated Off-Ramps"	2018	George Mason University	$325,000	1/29/19	12/31/22	Completed	Publication decision pending; includes continuation funds of $75,000
NCHRP 22-32A, "Development of Methods to Evaluate Side Impacts"	2017		$534,031			In development	
NCHRP 22-33, "Multi-State In-Service Performance Evaluations of Roadside Safety Hardware"	2017	Roadsafe LLC	$650,000	1/2/18	12/31/21	Completed	Published as NCHRP Research Report 1010 and NCHRP Web-Only Document 332
NCHRP 22-34, "Determination of Zone of Intrusion Envelopes under MASH Impact Conditions for Barrier Attachments"		University of Nebraska–Lincoln	$400,000	6/20/18	12/31/21	Completed	Published as NCHRP Research Report 1018
NCHRP 22-35, "Evaluation of Bridge Rail Systems to Confirm AASHTO MASH Compliance"	2018	Texas A&M Transportation Institute	$500,000	6/1/18	6/1/22	Completed	To be published as NCHRP Research Report 1024
NCHRP 22-37, "Development of a MASH Barrier to Shield Pedestrians, Bicyclists, and Other Vulnerable Users from Motor Vehicles"	2019	Texas A&M Transportation Institute	$644,819	5/3/19	7/31/23	Research in progress	
NCHRP 22-38, "Development of MASH TL-3 Deflection Reduction Guidance for 31-inch Guardrail"	2019	Texas A&M Transportation Institute	$499,429	7/8/19	3/15/23	Research in progress	
NCHRP 22-39, "Guardrail Performance at Various Offsets from Curb for MASH TL-3 Applications"	2019	University of Nebraska–Lincoln	$600,000	6/3/19	6/2/23	Research in progress	
NCHRP 22-40, "Research on AASHTO M 180-18 and Associated Highway Guardrail Specifications"	2019	Roadsafe LLC	$550,000	7/1/19	7/8/24	Research in progress	Published as NCHRP Research Report 1020; Includes continuation funding of $250,000
NCHRP 22-41, "Proposed Modification to AASHTO LRFD Bridge Design Specifications, Section 13—Railing"	2019	Modjeski & Masters	$229,996	6/6/19	6/30/23	Research in progress	

Project No. and Title	Fiscal Year	Research Agency	Contract Amount	Starting Date	Completion Date	Status	Status Comments
NCHRP 22-42, "Impact Performance Assessment of Barrier Performance at High Speeds"	2020		$600,000			Contract pending	
NCHRP 22-43, "Developing Testing Protocol for a Family of Devices—Signs, Breakaway Poles, and Work Zone Devices"	2020	University of Nebraska–Lincoln	$500,000	8/13/20	5/13/23	Research in progress	
NCHRP 22-44, "A Transportation Agency Data Collection Practice for Use with In-Service Performance Evaluations (ISPEs)"	2020	Roadsafe LLC	$400,000	8/3/20	2/2/23	Research in progress	
NCHRP 22-45, "Informing the Selection of Countermeasures by Evaluating, Analyzing, and Diagnosing Contributing Factors That Lead to Crashes"	2020	Exponent	$689,900	10/5/20	10/4/23	Research in progress	
NCHRP 22-46, "Human Factors Guidelines for Road Systems, Proposed 4th Edition"	2020	Exponent	$549,963	6/1/21	5/31/24	Research in progress	
NCHRP 22-47, "Incorporating Driver Behavior Considerations in Safety Performance Estimates of Infrastructure Improvements"	2020	University of North Carolina–Chapel Hill	$600,000	9/1/20	3/1/23	Canceled	See NCHRP Project 22-47A for follow-on activity
NCHRP 22-47A, "Incorporating Driver Behavior and Characteristics into Safety Prediction Methods"	2020		$465,000			In development	
NCHRP 22-48, "Development of Crash Prediction Models for Short-Term Durations"	2020	University of Central Florida Board of Trustees	$650,000	7/15/20	1/16/23	Research in progress	
NCHRP 22-49, "The Effect of Vehicle Mix on Crash Frequency and Crash Severity"	2020	University of Central Florida Board of Trustees	$400,000	9/3/20	3/3/23	Research in progress	
NCHRP 22-50, "Crashworthiness of Roadside Hardware on Curbed Roadways"	2021		$400,000			Contract pending	
NCHRP 22-51, "Evaluation of MASH 2016 Soil Specifications and Procedures"	2021		$250,000			Contract pending	
NCHRP 22-52, "Development of a Crashworthy Tangent End Treatment for Low-Speed Curbed Roadways"	2022		$750,000			Contract pending	
NCHRP 22-53, "Delineation of Linear Roadside Hardware Systems and Roadside Obstacles"	2022	Texas A&M Transportation Institute	$400,000	8/23/22	2/22/25	Research in progress	
NCHRP 22-54, "MASH Hardware Evaluation with New Proposed Test Vehicles"	2022		$1,000,000			In development	
NCHRP 22-55, "Implementation of MASH Surrogate Test Vehicles for Sign Supports, Breakaway Poles, and Work Zone Traffic Control Devices"	2022	University of Nebraska–Lincoln	$750,000	8/19/22	10/19/26	Research in progress	
NCHRP 22-56, "Development of Non-proprietary Prefabricated Solutions for Concrete Barrier Systems for Accelerated Bridge Construction"	2022		$900,000			Contract pending	
NCHRP 22-57, "Development of MASH Full-Scale Test Matrices for Additional Roadside Safety Devices"	2023		$500,000			In development	
NCHRP 22-58, "National Guidance for Defining Acceptable Roadside Hardware Field Performance through In-Service Performance Evaluations (ISPEs)"	2023		$400,000			In development	
AREA TWENTY-THREE: AGENCY ADMINISTRATION							
NCHRP 23-02, "Guidelines on Collaboration and Information Security for State DOTs"	2020	Southwest Research Institute	$350,000	7/9/20	7/8/22	Completed	To be published as NCHRP Research Report 1034

Project No. and Title	Fiscal Year	Research Agency	Contract Amount	Starting Date	Completion Date	Status	Status Comments
NCHRP 23-03, "Guidelines for State Transportation Agency Chief Executive Officers on Cybersecurity Issues and Protection Strategies"	2020	Southwest Research Institute	$350,000	6/1/20	7/12/22	Completed	Publication decision pending
NCHRP 23-04, "Statewide Insurance Pooling for Public Transit"	2020	AECOM Technical Services, Inc.	$300,000	8/31/21	8/30/23	Research in progress	
NCHRP 23-05, "Guidance for Training and Certification of Construction Inspectors for Transportation Infrastructure"	2020	Colorado State University	$450,000	7/22/20	7/21/22	Completed	To be published as NCHRP Research Report 1027 and NCHRP Web-Only Document 337
NCHRP 23-07, "Effective Methods for Setting Transportation Performance Targets"	2020	ICF Incorporated, LLC	$500,000	6/12/20	12/30/22	Completed	Available as a Pre-Publication NCHRP Research Report 1035; Full publication pending
NCHRP 23-08, "Guidelines for Incorporating Maintenance Costs into a Transportation Asset Management Plan"	2020	Applied Pavement Technology	$349,976	8/20/20	2/19/22	Completed	Publication decision pending
NCHRP 23-09, "Scoping Study to Develop the Basis for a Highway Standard to Conduct an All-Hazards Risk and Resilience Analysis"	2019	Applied Engineering Management Corporation	$249,998	10/20/20	4/20/22	Completed	To be published as NCHRP Research Report 1014
NCHRP 23-11, "Transportation Emergency Management/Security Summit and Exchange"	2020		$250,000			In development	
NCHRP 23-12, "Artificial Intelligence Opportunities for State and Local DOTs—A Research Roadmap"	2020	Virginia Polytechnic Institute & State University	$200,000	11/2/21	5/1/23	Research in progress	
NCHRP 23-13(01), "Telecommuting, Remote Work, and Hybrid Schedules: Managing the Shift to a Flexible Work Future"	2021	ICF Incorporated. LLC	$150,000	5/5/22	6/4/23	Research in progress	
NCHRP 23-13(03), "Guidance for State DOTs on Truck Rest and Service Areas for Critical Supply Chain Delivery"	2021		$180,000			In development	
NCHRP 23-13(04), "Scoping Supply Chain Challenges and Solutions amid COVID-19"	2021		$150,000			Contract pending	
NCHRP 23-13(05), "Regulatory Relief of Commercial Vehicle Weight Requirements for Emergency Transportation of Critical Commodities"	2021	Texas A&M Transportation Institute	$180,000	9/9/22	1/9/24	Research in progress	
NCHRP 23-13(06), "Assessing the Equity and Workforce Mobility Implications of the Expansion of E-Commerce and Direct-to-Consumer Delivery Services"	2021		$250,000			Contract pending	
NCHRP 23-14, "Research Roadmap for Knowledge Management"	2021	Spy Pond Partners	$300,000	8/9/22	8/9/24	Research in progress	
NCHRP 23-15, "Guidance on Risks Related to Emerging and Disruptive Transportation Technologies"	2020	The RAND Corporation	$500,000	10/1/21	11/22/24	Research in progress	
NCHRP 23-16, "Implementing and Leveraging Machine Learning at Departments of Transportation"	2021	Old Dominion University Research Foundation	$348,585	3/24/22	3/23/24	Research in progress	
NCHRP 23-17, "Assessing and Measuring the Business Value of Knowledge Management"	2021		$350,000			Contract pending	
NCHRP 23-19, "Practices for Transportation Agency Procurement and Management of Advanced Technologies"	2020		$225,000			Contract pending	
NCHRP 23-20, "Guidebook for Implementation of UAS Operational Capabilities"	2020		$279,918			Contract pending	
NCHRP 23-21, "Enabling Knowledge Management through Leadership Strategy and Culture"	2020		$400,000			Canceled	Combined with NCHRP Project 23-17. Managed by NCHRP Project 23-17.

Project No. and Title	Fiscal Year	Research Agency	Contract Amount	Starting Date	Completion Date	Status	Status Comments
NCHRP 23-22, "Alternative Project Delivery Methods: Assessing and Allocating Risk to Increase Competition"	2022		$500,000			Contract pending	
NCHRP 23-23, "Data Governance Design and Implementation—Links Between Governance Approaches and Performance Effects in DOTs"	2022		$350,000			In development	
NCHRP 23-24, "Methods to Allow Agencies to Incorporate Quantitative Risk Assessment at Project and Network Level"	2022		$500,000			Contract pending	
NCHRP 23-25, "Architecture for an Information System for Reporting and Sharing Truck Regulatory Requirements Data"	2022		$400,000			Contract pending	
NCHRP 23-26, "Measuring Impacts and Performance of State DOT Resilience Efforts"	2022		$300,000			Contract pending	
NCHRP 23-27, "Strategies to Strengthen Data Driven Decision-Making"	2022		$300,000			Contract pending	
NCHRP 23-28, "Planning for 4.9 GHz Spectrum Changes—What Transportation Agencies Need to Know"	2022		$250,000			Contract pending	
NCHRP 23-29, "Enterprise Data Warehouse Implementation Guide"	2023		$350,000			In development	
NCHRP 23-30, "Knowledge Strategies to Support the Research Lifecycle and Application of Research Results"	2023		$400,000			In development	
NCHRP 23-31, "Learned from Two Decades of Knowledge Management"	2023		$250,000			In development	
NCHRP 23-32, "Development of the AASHTO Highway Asset Risk and Resilience Manual: Phase 1"	2023		$4,000,000			In development	Includes $500,000 from U.S. DOT Office of the Assistant Secretary for Research and Technology
NCHRP 23-33, "Guidance in Planning for Managed Retreat as an Extreme Weather and Climate Adaptation Strategy"	2023		$500,000			In development	
AREA TWENTY-FOUR: FOUNDATIONS AND SCOUR							
NCHRP 24-48, "Develop a Formula for Determining Scour Depth around Structures in Gravel-bed Rivers"	2018	University of Idaho	$600,000	1/11/19	5/31/22	Completed	Publication decision pending
NCHRP 24-49, "Guidance on the Selection and Use of Flow Resistance Values in Two-Dimensional (2D) Hydraulic Models"	2020	Pennsylvania State University	$495,254	8/21/20	2/21/23	Research in progress	
NCHRP 24-50, "Rewrite of the AASHTO Drainage Manual"	2021	Ayres Associates	$600,000	8/9/21	8/9/24	Research in progress	
NCHRP 24-51, "Effects of Construction Installation Methods on the Design and Performance of Drilled Shaft Foundations"	2021		$600,000			Contract pending	
AREA TWENTY-FIVE: HUMAN AND NATURAL ENVIRONMENT							
NCHRP 25-47, "How to Measure and Communicate the Value of Access Management"	2014	University of South Florida	$600,000	5/17/18	3/31/21	Completed	Publication decision pending
NCHRP 25-55, "Assessment of Regulatory Air Pollution Dispersion Models to Quantify the Impacts of Transportation Sector Emissions"	2018	ICF	$700,000	6/4/18	9/30/22	Completed	Publication decision pending
NCHRP 25-59, "Pollinator Habitat Conservation along Roadways"	2019	ICF	$489,978	8/1/19	1/18/23	Research in progress	

Project No. and Title	Fiscal Year	Research Agency	Contract Amount	Starting Date	Completion Date	Status	Status Comments
NCHRP 25-60, "Watershed Approach to Mitigating Hydrologic Impacts of Transportation Projects"	2019	Kilgore Consulting and Management	$500,000	6/15/19	1/30/22	Completed	Published as NCHRP Research Report 1011 and NCHRP Web-Only Document 333
NCHRP 25-61, "Development of On-Bridge Treatment Practices"	2020	GeoSyntec Consultants	$495,724	9/14/20	9/14/23	Research in progress	
NCHRP 25-62, "Improving the Efficiency and Consistency of Section 106 Compliance for State DOTs: Strategies for Project-Level Programmatic Agreements and Postwar Commercial Properties"	2020	Mead & Hunt, Inc.	$499,896	4/15/20	4/14/23	Research in progress	Phase I report published as NCHRP Web-Only Document 289; Phase II research in progress
NCHRP 25-63, "Handbook on Deterring and Excluding Bats from Transportation Structures"	2021	Environmental Solutions & Innovations, Inc.	$499,965	11/15/21	1/14/25	Research in progress	
NCHRP 25-64, "Considering Greenhouse Gas Emissions and Climate Change in Environmental Reviews: Resources for State DOTs"	2021	Cambridge Systematics, Inc.	$375,000	7/27/21	10/26/23	Research in progress	
NCHRP 25-65, "Preparing Successful No-Effect and No-Adverse-Effect Section 106 Determinations: A Handbook for Transportation Cultural Resource Practitioners"	2022	WSP USA Inc.	$149,980	9/14/22	1/14/24	Research in progress	
NCHRP 25-66, "Update the National REMEL Database Used in FHWA Traffic Noise Model"	2023		$1,000,000			In development	
NCHRP 25-67, "Cultural Resources Mitigation: What Works and What Doesn't?"	2023		$500,000			In development	
NCHRP 25-68, "Successful Practices in Tracking and Implementing Environmental Commitments"	2023		$350,000			In development	

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Items Available on Request

Some research agencies' final reports, manuals, videotapes, etc. that are identified in the project summaries are available upon written request to:

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Summary of Progress Through 1988—Special Edition

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