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CONTRIBUTORS

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MAKING PROGRESS FOR TRB's STAKEHOLDERS | INITIATIVES AND IMPACTS

A MAJOR PROGRAM DIVISION of the National Academies of Sciences, Engineering, and Medicine, the Transportation Research Board (TRB) is recognized as one of the world's leading transportation research organizations. TRB is perhaps best known for its Annual Meeting held each January in Washington, D.C.; the 2016 meeting—TRB's 95th—attracted a record 12,500 attendees. TRB also is known for its other convening activities, such as workshops,



Through meetings, publications, policy studies, and more, the Transportation Research Board serves its mission to convene, research, and advise. (Photo: Risdon Photography)

conferences, symposia, webinars, and committee meetings.

In addition, TRB supports the conduct of research through its Cooperative Research Programs; the publication of research through the *Transportation Research Record: Journal of the Transportation Research Board* and other publications; presentation of research results through its convening activities; and the cataloguing of research through the Transportation Research Information Documentation—or TRID—database, which contains more than 1.1 million entries of published transportation research. TRB also produces highly respected and influential policy studies, which provide advice to the nation on important and complex policy issues.

ORGANIZATION

The National Academies of Sciences, Engineering, and Medicine honor the foremost scientists, engineers, and medical professionals in the nation; members of the National Academies are called on to provide evidence-based policy advice on issues related to science, engineering, and medicine. Known for its standards of objectivity, the expertise it is able to assemble, and the rigorous review process for its reports and recommendations, TRB's parent institution provides advice to Congress, the Administration, and other policy makers for the development of legislation, regulations, and implementation plans.

As one of seven program divisions, TRB benefits tremendously from the Academies' expertise and credibility. TRB's collaborations with other parts of the Academies continue to increase.



Neil Pedersen, TRB Executive Director (left), and James Crites, 2016 Executive Committee Chair (right). (Photo: Risdon Photography)



The 2016 Technical Activities Council guides the work of TRB's more than 200 standing committees. (Photo: Risdon Photography)

TRB relies on the knowledge and service of volunteers who are experts in all subjects related to transportation. More than 7,000 volunteers participate on TRB committees and research panels. The TRB Executive Committee, with 26 appointed members and 20 ex officio members, provides strategic direction and oversight for the Board's activities. Executive Committee members come from organizations representing government, academia, and private-sector companies and all modes of transportation.

TRB's more than 200 standing committees cover all modes and related subject areas. The Technical Activities Council provides oversight for these committees; the Council consists of the chairs of the 11 topical groups of committees. Each committee comprises approximately 30 to 35 members, with additional volunteers on its friends list. The committees organize Annual Meeting and conference sessions, review approximately 6,000 papers submitted for presentation at the annual meeting and for publication in the journal, develop research problem statements for consideration by the Cooperative Research Programs and other research organizations, and serve as communities of practice for experts in their respective subject areas. TRB's Technical Activities Division staff supports the work of the standing committees.

TRB's policy studies assemble the foremost experts in the topics to be addressed. Policy study

committees are constituted to balance expertise and perspectives, to ensure objectivity, and to avoid conflicts of interest. The hard work, dedication, commitment, and expertise of its volunteers have enabled TRB to produce key policy studies. TRB's Studies and Special Programs Division provides staff support.

Almost 2,000 volunteers serve on panels for TRB's Cooperative Research Programs. Each program manages contracted research to develop products useful to practitioners who manage and operate transportation systems. Each program has an oversight committee that selects projects, and each project has a panel of experts who provide direction, oversight, and review of the contracted research. TRB's Cooperative Research Programs Division supplies staff support for these activities.

TRB's Executive Office provides strategic direction and oversight of staff, as well as a variety of administrative, publication, communications, and information technology functions.

TRB's 2016 budget was \$88 million. With the number of volunteers involved in TRB, the logistics required to support convening activities, the amount of contracted research undertaken, the number of sponsors providing financial support, and the number of special studies, the management of TRB's finances is a complex task. TRB's Administration and Finance Division handles these assignments.

A summary of key accomplishments by each of these organizational units in 2016 starts on page 12; detailed reports begin on page 16.



Senior program officer Ed Harrigan (right) leads a panel discussion for a National Cooperative Highway Research Program project on guidelines for solid-state roadway lighting.



The South Carolina Army National Guard helps local law enforcement work a traffic control point in Myrtle Beach during a statewide response to Hurricane Matthew in early October. Increasing numbers of severe weather events cause new challenges for transportation networks. (Photo: Jorge Intriago, U.S. Air National Guard)

STRATEGIC INITIATIVES

In June 2014, the TRB Executive Committee adopted a five-year strategic plan to guide TRB volunteers and staff on several initiatives. To ensure a focus on the most important current and future issues, the Executive Committee identified three strategic areas for TRB programs and activities in the next few years. These emerging topics affect all modes and sectors of transportation. The oversight committees of each TRB division are charged with identifying ways to advance the state of knowledge and the state of practice in the three strategic areas.

Transformational Technologies

Advances in technology have the potential to change fundamentally the way that transportation services are provided and to improve safety, mobility, and sustainability significantly. TRB continues to convene experts and to manage research in the areas of connected and automated vehicles, which have the potential to reduce significantly the number of crashes caused by human error and to improve system efficiency.

Technology-enabled mobility services are altering the way that people travel, particularly in metropolitan areas; with automated vehicles, these services may change the automobile ownership model in the United States and worldwide. Unmanned aerial systems can change freight delivery. These services and the capture, processing,

and availability of data from sensors throughout the transportation system can change the use of real-time information to inform travel decisions and to manage the system efficiently.

Smart transportation, as part of the concept of smart cities, can significantly improve the quality of transportation services and the quality of life. TRB is at the forefront of sharing state-of-the-practice information and managing research on issues associated with these transformational technologies.

Resilience

The transportation system increasingly faces disruptions from natural or man-made disasters. Severe weather events have become more frequent and have closed down or adversely affected the operation of the transportation system. Terrorists have targeted physical and cyber elements of the system and have severely disrupted the mobility of passengers and freight.

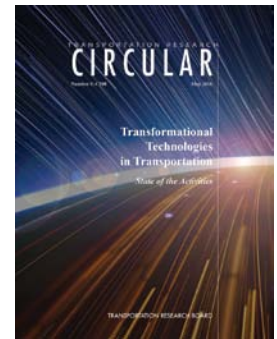
Planning for natural and man-made disruptions, identifying ways to manage during the disruptions, and recovering from the disruptions as quickly as possible have become priorities for transportation system owners and operators. TRB is convening meetings and conducting research activities related to resilience. An Executive Committee task force has identified a strategic plan for addressing these issues in a coordinated manner.

Public Health and Transportation

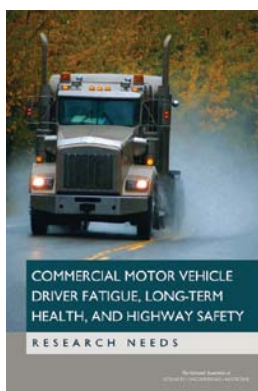
Public health is an important societal goal that transportation can and should help support. Some of the many ways that transportation can



Leslie Meehan, Tennessee Department of Health, briefs the TRB Executive Committee at a session on advancing public health through transportation. (Photo: Risdon Photography)



In response to the TRB strategic plan, the Executive Committee Task Force on Transformational Technologies in Transportation developed E-Circular 208, *Transformational Technologies in Transportation: State of the Activities*. For more information, visit www.trb.org/Publications/Blurbs/174370.aspx.



TRB collaborated with the Division of Behavioral and Social Sciences and Education, the Committee on National Statistics, and the Board on Human-Systems Integration on a study examining *Commercial Motor Vehicle Driver Fatigue, Long-Term Health, and Highway Safety: Research Needs*.

contribute to improving public health include reducing fatalities and injuries from traffic crashes, improving access to health care facilities, reducing the health-related impacts of transportation from air and noise pollution, reducing the role of transportation in the spread of communicable diseases, addressing the mobility needs of the elderly and disabled, and improving health by encouraging active transportation—such as walking and bicycling.

At the Forefront

Executive Committee task forces have developed plans for placing TRB at the forefront in addressing these strategic issues. TRB standing committees are identifying ways to address each issue from their perspectives. The Cooperative Research Programs are developing research roadmaps for each of these areas. Policy studies continue to examine the issues affecting these areas.

TRB is leading the way in other strategic topics as well. The Executive Committee has identified goods movement as an area of interest. A variety of TRB activities taking a strategic approach related to freight are under way; as a result, freight stakeholders are more engaged in TRB activities and programs and are more aware of TRB's work in this area.

REVIEW OF LEGACY PROGRAMS

Each of TRB's oversight committees regularly reviews TRB's legacy programs to identify opportunities to address feedback received from sponsors and stakeholders and to identify improvements in processes and in the timeliness and quality of the products and services delivered. TRB's strategic plan identified several areas for focus.

Transportation Research Record

A group of experts from peer journals reviewed the TRB editorial and production processes for articles after acceptance to the *Transportation Research Record* by TRB's standing committees. Applying recommendations from this peer review, TRB has developed an implementation plan to enable earlier online availability of journal articles. In addition, the earlier assignment of digital object identifiers for articles should help increase the citation impact factor for TRB's journal. A special task force is examining the entire peer

review process—from the initial calls for papers through submission, review, and acceptance—to identify efficiencies and to ensure that only high-quality articles are accepted for publication.

Cooperative Research Programs

At the request of sponsors and stakeholders, the Cooperative Research Programs have set a priority to reduce the time from the initial submission of problem statements to the availability of research results and reports. The programs' oversight committees and staff have undertaken process reviews and have identified opportunities to perform steps in parallel instead of in linear sequence, particularly during project selection and contracting. Also identified were ways to undertake more high-priority research through open-ended task order contracts, reducing the time required for procurement.

Several Cooperative Research Programs projects are making reports available online after acceptance by peer review, before the final editing; this makes research results and products available three to six months before the publication of the final edited report.

The Cooperative Research Programs are developing research road maps for select priority areas. This will ensure a more strategic approach to identify priority research and to address important areas that may not surface through the more traditional problem statements.

A major focus is the implementation of research results. This includes the pilot testing of usable products and increased dissemination activities to promote stakeholder awareness and understanding of the research products' benefits.

STRENGTHENING FINANCES

TRB improved its financial outlook significantly in 2016. To draw down the reserves for core programs from levels that were higher than targeted, TRB had operated under a budget deficit for the past several years, but this was not sustainable. At the same time, TRB had faced uncertainty about its long-term revenues without long-term authorization legislation for surface transportation.

The five-year Fixing America's Surface Transportation (FAST) Act, passed in December 2015, offers greater certainty about revenues from federal sources and enables long-term financial planning. The largest share of revenues for TRB's Technical Activities and Cooperative Re-



Christopher Poe, Texas A&M Transportation Institute, addresses the 2016 Automated Vehicles Symposium, cosponsored by TRB and the Association for Unmanned Vehicle Systems International. (Photo: Texas A&M Transportation Institute)

search Programs comes from state departments of transportation (DOTs) through contributions from each state’s Statewide Planning and Research funds. With modest increases in these funds projected through FY 2021, the state DOT contributions to TRB will increase proportionally, helping TRB to remain on a sounder financial footing through the end of the FAST Act.

At the same time, however, significant earmarking of Federal Highway Administration (FHWA) research, development, and technology funds has reduced FHWA’s contribution to TRB’s Technical Activities. This will be offset in part through contributions from new sponsors: the Department of Energy, the Environmental Protection Agency, and the California Air Resources

Board. TRB also relies on annual meeting registration fees, exhibits, and patrons as a source of revenue, and these continue to increase each year.

TRB is looking for opportunities to diversify and increase its revenue sources. The TRB Executive Committee’s New Revenues Task Force is exploring opportunities to attract new support from the public and private sectors. TRB launched a planned giving program in 2016 that enables individuals to support TRB activities through bequests or other contributions.

TRB’s 2016 financial statement is shown on pages 8–9.

DIVERSIFYING PARTICIPATION

The more than 7,000 volunteer participants on TRB committees and panels represent a diverse array of transportation community sectors and disciplines. It is critical that TRB reflect changes as the transportation community evolves and diversifies. TRB therefore has focused on expanding participation from underrepresented sectors, particularly among new technology firms; diversifying participation by gender, race, and young professionals; pursuing a more strategic approach to international activities; and partnering with other transportation professional organizations.

Technology innovations are disrupting the way that transportation services are provided, and TRB has recognized that transportation is attracting the involvement of many new actors from the technology sector. TRB proactively has



Victor Mendez, Deputy Secretary of Transportation, welcomes Minority Fellows and their faculty advisers to the 2016 Annual Meeting. (Photo: Risdon Photography)



TRB's new communications materials include a brochure describing its mission.

sought to involve participants from technology firms in activities, as well as to identify research needs. For example, attendance at TRB's automated vehicles conference has grown to more than 1,200, and many of the participants had no previous involvement in TRB activities. A TRB symposium in fall 2016 identified research needs across the range of transformational technologies. TRB is partnering with other organizations interested in transformational technologies in transportation.

During 2016, TRB developed and adopted a management plan for diversity and inclusion, identifying strategies to engage a diverse, inclusive pool of stakeholders representative of the community that TRB serves. TRB is continuing its focus on increasing the gender, racial, and age diversity of its committees and panels. Staff have partnered with leaders at organizations that serve female, minority, and young transportation professionals, to engage their members in TRB activities. In 2016, the TRB Minority Fellows Program nearly doubled the number of students who received financial assistance to attend the TRB Annual Meeting from historically minority-serving colleges and universities.

An Executive Committee task force reviewed TRB's international activities and recommended an approach to increase international participation related to strategic initiatives. For example, a joint symposium with the European Union

and U.S. DOT addressed the subject of climate change adaptation, part of TRB's strategic focus on resilience. Similarly, a new memorandum of understanding will improve the sharing of information and resources between the World Road Association and TRB.

TRB is actively working to partner with other transportation organizations to identify areas of common interest and potential joint activities. These partnerships can increase the participation by members of these organizations in TRB.

MEASURING THE IMPACTS

The TRB strategic plan called for more systematic approaches to identify and track the impacts of TRB activities. In 2016, the National Cooperative Highway Research Program (NCHRP) established the staff position of Implementation Coordinator, and the Airport Cooperative Research Program (ACRP) has hired a contractor to track the impacts of research products. NCHRP, ACRP, and the Transit Cooperative Research Program have conducted periodic surveys to collect information on the use of their research. Committees receiving a regular allocation of Cooperative Research Programs funds now must report annually on the benefits from previously funded projects.

Working with the National Academies, TRB is employing new tools and databases for tracking the impacts of products. Information about who is using the products, about how the products are being used, and the comments about the products

are more readily available than ever before. In the past year, TRB started tracking references to TRB products in federal and state legislation, regulations, and standards, and in testimony delivered before Congress.

The information is providing a better understanding of TRB's regional, national, and global influence and demonstrates the value of the products to stakeholders. The feedback will help TRB to enhance the value and quality of its services and products continuously.

COMMUNICATING ABOUT PROGRAMS AND ACTIVITIES

Current and potential stakeholders are not always well acquainted with the extent of TRB's diverse portfolio of products and services. TRB therefore adopted a communications and marketing

plan to guide efforts to increase awareness and knowledge of TRB products and services within the transportation professional community.

The first step was the development and distribution of a new brochure, a video, and a PowerPoint presentation. TRB staff and volunteers have used these communications materials at outreach events, including conferences and the annual meetings of partner organizations. TRB collected feedback from readers about its e-newsletter, and work began on redesigning the TRB.org homepage.

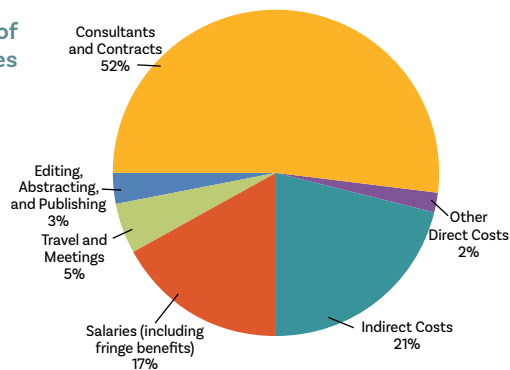
TRB's popular webinar series has continued to grow and has proved an effective means of increasing stakeholder awareness of TRB reports and current issues in transportation. TRB has started webcasting selected conferences, enabling those who cannot attend in person to participate remotely.

STATEMENT OF ACTIVITIES

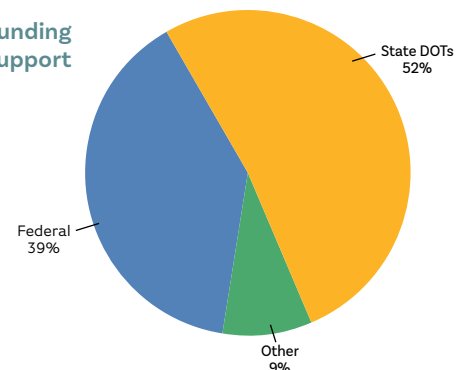
FUNDING SUPPORT BY PROGRAM AND EXPENDITURES, CALENDAR YEARS 2015 AND 2016

	2015 (Actual)	2016 (Projected)*
Core Technical Activities		
State Highway and Transportation Departments (State DOTs)	\$6,973,000	\$7,140,000
Federal Government		
Federal Highway Administration (FHWA)	1,900,000	1,675,000
Office of the Assistant Secretary of Transportation for Research and Technology (OST-R)	300,000	300,000
Federal Transit Administration (FTA)	250,000	250,000
National Highway Traffic Safety Administration	208,000	212,000
Bureau of Indian Affairs, Department of the Interior	80,000	85,000
Federal Motor Carrier Safety Administration (FMCSA)	75,000	75,000
Department of Energy (DOE)	0	65,000
Federal Aviation Administration (FAA)	65,000	65,000
Federal Railroad Administration (FRA)	65,000	65,000
U.S. Air Force Civil Engineer Center	65,000	65,000
U.S. Army Corps of Engineers	75,000	75,000
Subtotal, Federal Government	\$3,083,000	\$2,932,000
Other		
American Public Transportation Association	65,000	65,000
Association of American Railroads	65,000	65,000
South Coast Air Quality Management District, California Fees and Sales	5,730,000	5,943,000
Subtotal, Other	\$5,925,000	\$6,138,000
Total, Core Technical Activities	\$15,981,000	\$16,210,000
Marine Board Core Program		
U.S. Coast Guard	75,000	75,000
U.S. Army Corps of Engineers	75,000	75,000
National Oceanic and Atmospheric Administration	40,000	40,000
Bureau of Safety and Environmental Enforcement	30,000	30,000
Maritime Administration	19,000	19,000
U.S. Navy	12,000	12,000
Total, Marine Board Core Program	\$251,000	\$251,000
Cooperative Research Programs (CRP)		
National Cooperative Highway Research Program (State DOTs)	34,479,000	34,066,000
Airport Cooperative Research Program (FAA)	15,865,000	13,320,000
Transit Cooperative Research Program (FTA)	4,179,000	4,409,000
National Cooperative Freight Research Program (OST-R)	1,558,000	391,000
National Cooperative Rail Research Program (FRA)	1,529,000	438,000
Hazardous Materials Cooperative Research Program (Pipeline and Hazardous Materials Safety Administration)	258,000	86,000
Total, Cooperative Research Programs	\$57,868,000	\$52,710,000

Distribution of TRB Expenditures



TRB Funding Support



	2015 (Actual)	2016 (Projected)*
Strategic Highway Research Program 2 (SHRP 2)	\$4,413,000	\$0
SHRP 2 Safety Data Phase 1	\$3,358,000	\$5,407,000
Continuing Programs		
Innovations Deserving Exploratory Analysis (IDEA)		
NCHRP IDEA (State DOTs)	1,391,000	1,315,000
Transit IDEA (FTA)	517,000	366,000
Safety IDEA (FRA)	273,000	241,000
Subtotal, IDEA Programs	\$2,181,000	\$1,922,000
Synthesis Programs		
NCHRP Synthesis (State DOTs)	1,868,000	2,051,000
ACRP Synthesis (FAA)	1,276,000	1,033,000
TCRP Synthesis (FTA)	570,000	729,000
Subtotal, Synthesis Programs	\$3,714,000	\$3,813,000
Legal Programs		
NCHRP Legal (State DOTs)	453,000	293,000
TCRP Legal (FTA)	106,000	188,000
ACRP Legal (FAA)	6,000	4,000
Subtotal, Legal Programs	\$565,000	\$485,000
Total, Continuing Programs	\$6,460,000	\$6,220,000
Policy Studies	\$3,577,000	\$4,033,000
Conferences and Workshops	\$2,165,000	\$2,314,000
TRB TOTAL	\$94,073,000	\$87,386,000
Sources of Funds		
Federal	41,007,000	33,977,000
State DOTs	45,164,000	45,106,000
Other	7,902,000	8,303,000
	\$94,073,000	\$87,386,000
Expenditures by Major Cost Category		
Salaries (including fringe benefits)	14,289,000	14,926,000
Travel and Meetings	5,057,000	4,787,000
Editing, Abstracting, Publishing	2,854,000	2,299,000
Consultants and Contracts	51,857,000	45,546,000
Other Direct Costs	2,200,000	1,913,000
Indirect Costs	18,845,000	18,263,000
Total Expenditures	\$95,102,000	\$87,734,000

TRB Reserve Fund

Fund balance, end of previous fiscal year	\$17,763,000	\$16,734,000
Plus (minus) current fiscal year income over (under) expenditures	(1,029,000)	(666,000)
Balance, current fiscal year	\$16,734,000	\$16,068,000

In 1965, the TRB Executive Committee approved a reserve fund to provide for orderly adjustments in the event of a temporary shortfall in anticipated revenues for TRB Technical activities. This fund, built up over the years from surplus income in excess of expenditures from nonfederal sources for any one fiscal year, is reserved for expenditures in excess of income for any later fiscal year under a fixed budget approved triennially by the TRB Executive Committee.

*Calendar Year 2016 comprises actual data through October and estimates for the rest of the year.

TRANSPORTATION RESEARCH BOARD 2016 EXECUTIVE COMMITTEE*

Chair: James M. Crites, Executive Vice President of Operations, Dallas-Fort Worth International Airport, Texas

Vice Chair: Paul Trombino III, Director, Iowa Department of Transportation, Ames (through November 2016)

Vice Chair: Malcolm Dougherty, Director, California Department of Transportation, Sacramento (as of December 2016)

Executive Director: Neil J. Pedersen, Transportation Research Board



Crites



Trombino



Dougherty



Pedersen

Victoria A. Arroyo, Executive Director, Georgetown Climate Center; Assistant Dean, Centers and Institutes; and Professor and Director, Environmental Law Program, Georgetown University Law Center, Washington, D.C.

Scott E. Bennett, Director, Arkansas State Highway and Transportation Department, Little Rock

Jennifer Cohan, Secretary, Delaware Department of Transportation, Dover

A. Stewart Fotheringham, Professor, School of Geographical Sciences and Urban Planning, Arizona State University, Tempe

John S. Halikowski, Director, Arizona Department of Transportation, Phoenix

Susan Hanson, Distinguished University Professor Emerita, Graduate School of Geography, Clark University, Worcester, Massachusetts

Steve Heminger, Executive Director, Metropolitan Transportation Commission, Oakland, California

Chris T. Hendrickson, Hamerschlag Professor of Engineering, Carnegie Mellon University, Pittsburgh, Pennsylvania

Jeffrey D. Holt, Managing Director, Power, Energy, and Infrastructure Group, BMO Capital Markets Corporation, New York

S. Jack Hu, Vice President for Research and J. Reid and Polly Anderson Professor of Manufacturing, University of Michigan, Ann Arbor

Roger B. Huff, President, HGLC, LLC, Farmington Hills, Michigan

Geraldine Knatz, Professor, Sol Price School of Public Policy, Viterbi School of Engineering, University of Southern California, Los Angeles

Ysela Llort, Consultant, Miami, Florida

Melinda McGrath, Executive Director, Mississippi Department of Transportation, Jackson

James P. Redeker, Commissioner, Connecticut Department of Transportation, Newington

Mark L. Rosenberg, Executive Director, The Task Force for Global Health, Inc., Decatur, Georgia

Kumares C. Sinha, Olson Distinguished Professor of Civil Engineering, Purdue University, West Lafayette, Indiana

Daniel Sperling, Professor of Civil Engineering and Environmental Science and Policy; Director, Institute of Transportation Studies, University of California, Davis (Past Chair, 2015)

Kirk T. Steudle, Director, Michigan Department of Transportation, Lansing (Past Chair, 2014)

Gary C. Thomas, President and Executive Director, Dallas Area Rapid Transit, Dallas, Texas

Pat Thomas, Senior Vice President of State Government Affairs, United Parcel Service, Washington, D.C.

Katherine F. Turnbull, Executive Associate Director and Research Scientist, Texas A&M Transportation Institute, College Station



Arroyo



Bennett



Cohan



Fotheringham



Halikowski



Hanson



Heminger



Hendrickson



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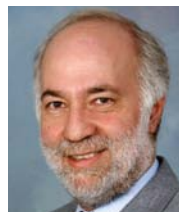
Redeker



Rosenberg



Sinha



Sperling



Steudle



G. Thomas



P. Thomas



Turnbull



Wise



Ayala



Brooks



Darling



Dominguez



Feinberg



Flowers



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Sarkar



Semonite



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Dean Wise, Vice President of Network Strategy, Burlington Northern Santa Fe Railway, Fort Worth, Texas

Alberto Ayala, Deputy Executive Officer, California Air Resources Board, Sacramento (ex officio)

Mary R. Brooks, Professor Emerita, Dalhousie University, Halifax, Nova Scotia, Canada, and Chair, TRB Marine Board (ex officio)

T. F. Scott Darling III, Acting Administrator and Chief Counsel, Federal Motor Carrier Safety Administration, U.S. Department of Transportation (ex officio)

Marie Therese Dominguez, Administrator, Pipeline and Hazardous Materials Safety Administration, U.S. Department of Transportation (ex officio)

Sarah Feinberg, Administrator, Federal Railroad Administration, U.S. Department of Transportation (ex officio)

Carolyn Flowers, Acting Administrator, Federal Transit Administration, U.S. Department of Transportation (ex officio)

LeRoy Gishi, Chief, Division of Transportation, Bureau of Indian Affairs, U.S. Department of the Interior, Washington, D.C. (ex officio)

John T. Gray II, Senior Vice President, Policy and Economics, Association of American Railroads, Washington, D.C. (ex officio)

Michael P. Huerta, Administrator, Federal Aviation Administration, U.S. Department of Transportation (ex officio)

Paul N. Jaenichen, Sr., Administrator, Maritime Administration, U.S. Department of Transportation (ex officio)

Bevan B. Kirley, Research Associate, University of North Carolina Highway Safety Research Center, Chapel Hill, and Chair, TRB Young Members Council (ex officio)

Gregory G. Nadeau, Administrator, Federal Highway Administration, U.S. Department of Transportation (ex officio)

Wayne Nastri, Acting Executive Officer, South Coast Air Quality Management District, Diamond Bar, California (ex officio)

Mark R. Rosekind, Administrator, National Highway Traffic Safety Administration, U.S. Department of Transportation (ex officio)

Craig A. Rutland, U.S. Air Force Pavement Engineer, U.S. Air Force Civil Engineer Center, Tyndall Air Force Base, Florida (ex officio)

Reuben Sarkar, Deputy Assistant Secretary for Transportation, U.S. Department of Energy (ex officio)

Todd T. Semonite (Lieutenant General, U.S. Army), Chief of Engineers and Commanding General, U.S. Army Corps of Engineers, Washington, D.C. (ex officio)

Karl Simon, Director, Transportation and Climate Division, U.S. Environmental Protection Agency (ex officio)

Richard A. White, Acting President and CEO, American Public Transportation Association, Washington, D.C. (ex officio)

Gregory D. Winfree, Assistant Secretary for Research and Technology, Office of the Secretary, U.S. Department of Transportation (ex officio)

Frederick G. (Bud) Wright, Executive Director, American Association of State Highway and Transportation Officials, Washington, D.C. (ex officio)

Paul F. Zukunft (Admiral, U.S. Coast Guard), Commandant, U.S. Coast Guard, U.S. Department of Homeland Security (ex officio)

* Membership as of December 2016.



DIVISIONAL HIGHLIGHTS

TO MANAGE ITS RESEARCH, convening, and advisory activities TRB relies on five administrative units: Technical Activities, Studies and Special Programs, Cooperative Research Programs, the Executive Office, and Administration and Finance. Highlights of accomplishments for each division in 2016 appear below; for more details about the activities of each division, see pages 16–48.

TECHNICAL ACTIVITIES

The Technical Activities division supports standing committees and task forces, organizes the TRB Annual Meeting and other conferences and workshops, and conducts field visits to transportation agencies, organizations, and research institutions. TRB’s 95th Annual Meeting, held for the second time at the Walter E. Washing-

ton Convention Center and Marriott Marquis Hotel in January, set another attendance record of 12,500. More than 2,160 attendees came from outside the United States—also a new record—and 30 percent were young professionals age 35 or younger. A highlight was the Chairman’s Luncheon speech by then-director of the Google Self-Driving Car Program, Chris Urmson, who described Google’s work, including a study comparing crash rates for the self-driving car and human-driven cars; some of the data came from the SHRP 2 Naturalistic Driving Study administered by TRB.

In 2016, the division organized several workshops and conferences to advance information and communication on TRB’s strategic topics of transformational technologies, transportation system resilience, and transportation and public health. The division’s more than 200 standing technical committees and task forces, which are organized into groups and sections, sponsored the development of 865 sessions and workshops at the 2016 Annual Meeting; sponsored or co-sponsored more than 45 specialty conferences throughout the year; and produced more than 50 webinars on a variety of important topics. Standing technical committees sponsored more than 15 reports, which include interim research findings and research problem statements, on topics such as senior mobility, the future locomotive, shared-mobility, asphalt mixture design, and freight fluidity performance measures.

With the sunsetting of TRB’s second Strategic Highway Research Program (SHRP 2) in 2015, the Technical Activities division became home to the SHRP 2 Safety Data Program, which oversees the Naturalistic Driving Study data for use by re-



Becky McDaniel, chair of the Asphalt Materials Section, discusses TRB research and volunteer activities with new Annual Meeting attendees. (Photo: Risdon Photography)



A record 12,500 attendees convened on Washington, D.C., in January 2016 for TRB's 95th Annual Meeting. (Photo: Risdon Photography)

searchers around the world. In 2016, the Safety Data Program kicked off an effort to foster a user community for the sharing of tools and lessons learned and launched a strategic business planning process to find a sustainable operational model for the database beyond 2019.

STUDIES AND SPECIAL PROGRAMS

The Studies and Special Programs division convenes specially appointed expert committees to conduct policy studies and program reviews, prepares synthesis reports on behalf of the Cooperative Research Programs, and manages the Innovations Deserving Exploratory Analysis (IDEA) programs.

Major studies released in 2016 examined the demand for and supply of interregional transportation in the United States; provided advice on the use of remote real-time monitoring to improve the safety and reduce the environmental risks of offshore oil and gas operations; developed recommendations to strengthen and sustain the safety culture of the offshore oil and gas industry; and assessed whether the U.S. Coast Guard's regulatory process impedes the ability of U.S. flag-registered vessels to compete effectively in international commerce. The division started several other studies, including one on the Future Interstates, requested by Congress and funded by the U.S. Federal Highway Administration. The

study will advise Congress and the nation on the future role of the Interstate Highway System and on the options for funding the system.

Issues addressed in 2016 by the division's synthesis unit included emergency communications planning for airports, helicopter noise information for airports and communities, public perception of mileage-based user fees, life-cycle cost analysis for the management of highway assets, and onboard camera applications for buses. In total, more than 30,000 copies of highway, transit, and airport synthesis reports were downloaded in 2016.

At the 2016 TRB Annual Meeting, the highway, transit, and safety IDEA programs conducted



The Studies and Special Programs division is conducting a congressionally requested, federally funded study on the future of the U.S. Interstate Highway System.



The Technical Activities division houses and manages data from the large-scale Naturalistic Driving Study, conducted with Virginia Tech Transportation Institute and other research partners, in its Safety Data Program. (Photo: Virginia Tech Transportation Institute)



A Transit Cooperative Research Program synthesis report on onboard camera applications for buses examines the bus camera security systems installed on more than 1,700 of New York City's buses. (Photo: Metropolitan Transportation Authority, New York)

poster sessions highlighting 22 of the most promising current projects. Each session received a stream of interested visitors, who interacted directly with the inventors.

COOPERATIVE RESEARCH PROGRAMS

The Cooperative Research Programs manage the National Cooperative Highway Research Program (NCHRP), the Transit Cooperative Research Program (TCRP), the Airport Cooperative Research Program (ACRP), the National Cooperative Freight Research Program, the Hazardous Materials Cooperative Research Program, and the National Cooperative Rail Research Program. During 2016, these programs produced more than 100 publications and products on a range of topics valuable to practitioners.

In 2016, more than 2,100 volunteers provided their time to help oversee more than 200 NCHRP projects in various stages of completion. With the rapid development and deployment of connected and automated vehicle technologies, the impacts of connected vehicles and automated vehicles on state and local transportation agencies became a focus. The American Association of State Highway and Transportation Officials' Standing Committee on Research, which selects NCHRP projects, requested the development of research roadmaps for the three critical strategic topics of freight transportation, transportation and public health, and transformational technologies.

TCRP products included transit-supportive roadway strategies; bus operator workstation design; the linking of transit agencies and land



Integration between unmanned aerial systems and airports was a topic of research addressed by the Airport Cooperative Research Program. (Photo: Gilles Ollivier, Flickr)

use decision making; ways to measure the economic impacts of transit projects; and opportunities and challenges for public transportation in relation to technology-enabled mobility services.

ACRP examined the ongoing transformation of the aviation system by the next generation of technologies in the five-volume ACRP Report 150, *NextGen for Airports*. ACRP also released five products addressing sustainable airport operations, another hot topic within the airport community. The program budgeted \$1 million for research on the integration of unmanned aerial systems into airports.

With the conclusion of funding authorization, the National Cooperative Freight Research Program and the National Cooperative Rail Research Program completed their final projects. Funding received in 2016 for the Hazardous Materials Cooperative Research Program will allow for a yet-to-be-determined number of projects in 2017.

EXECUTIVE OFFICE

The TRB Executive Office provides policy and operational guidance on TRB programs, as well as on issues related to human resources, diversity, information technology, communications, library services, publication production, and strategic planning.

In 2016, the Executive Office oversaw the implementation of TRB's strategic plan on diversity, as well as the strategic plan on marketing and communication—efforts to enhance the value of TRB to its volunteers and constituencies, improve TRB products, and increase public awareness of TRB. In the area of information technology, the Executive Office oversaw changes to the MyTRB online portal and participated in a National Academies effort to develop a more uniform web presence for the organization's var-

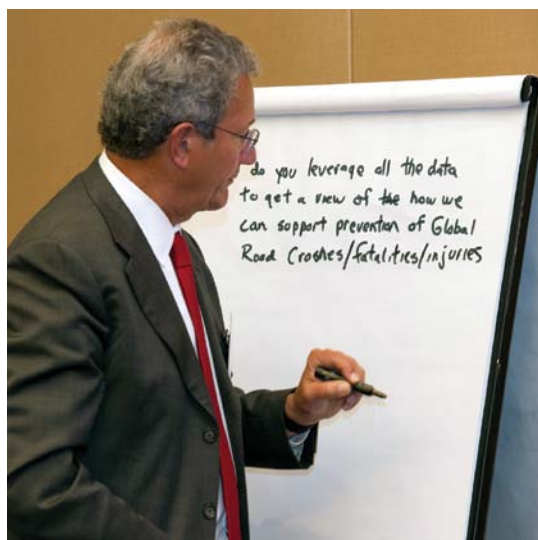


The American Association of State Highway and Transportation Officials Standing Committee on Research charts the course of the National Cooperative Highway Research Program.

ious units. More than 25,000 unique volunteers have accessed the MyTRB portal since its opening in April 2014, to provide contact information, participate in the Annual Meeting paper submission and review, become a friend of a TRB standing committee, and more.

Implementation of a plan to speed the release of the *Transportation Research Record: Journal of the Transportation Research Board* is under way. The goal of the transitional effort, to be completed with the 2018 journal series, is to have all papers available in electronic format five to eight months faster than the current process allows.

The Executive Office oversees actions to address TRB's strategic plan adopted in June 2014. The task forces on resiliency and on transportation and public health completed the development and approval of action plans. Implementation of the transformational technologies action plan began in 2016 with the Automated Vehicles Symposium in July and the Partners in Research Symposium on transformational technologies in transportation in October. Other activities conducted in response to the strategic plan in 2016 included a review of TRB's programs for sponsors and affiliates, measures by the Cooperative Research Programs to speed the release of research results, and the implementation of a partnership



Mark L. Rosenberg, Task Force for Global Health, Inc., leads a group discussion on transportation and public health, a topic explored in depth by a TRB task force, research projects, conferences, and Annual Meeting sessions. (Photo: Risdon Photography)



Annual Meeting attendees browse a display of TRB publications. (Photo: Risdon Photography)

between TRB and the National Academies Press to collect data for identifying and tracking the impact of TRB products.

ADMINISTRATION AND FINANCE

The Administration and Finance Division provides financial, information technology, and other administrative support, including financial oversight of the contracts and grants for the work of TRB, administration of publications sales and distribution, and maintenance of benefits and services for sponsor and affiliate organizations. A statement of income and expenditures for calendar year 2016 appears on pages 8–9.

In 2016, the Administration and Finance Division began a strategic review to enhance the value of TRB's programs for sponsors and affiliates and to expand the programs' appeal. Sponsors are the major source of financial support for TRB's core programs. Federal, state, and local government agencies and professional societies and organizations that represent industry groups are eligible to participate as TRB sponsors. Private-sector organizations and individuals can support TRB as affiliates. Fees and services are negotiated to fit the needs of each sponsor and affiliate and to ensure fundamental support for the Board's programs and activities of interest to the entire transportation community.



TECHNICAL ACTIVITIES

THE TECHNICAL ACTIVITIES Division provides opportunities for transportation professionals to exchange information on research needs and transportation-related issues. The division's staff works with thousands of volunteers who are members of the more than 200 TRB standing committees participating in various activities supporting TRB sponsors and the transportation community.

The Technical Activities Council oversees the organization and workings of the TRB standing committees. Daniel S. Turner, Emeritus Professor of Civil Engineering at the University of Alabama, chairs the council. TRB representatives in each state department of transportation (DOT) and in sponsoring organizations, universities,

and transit agencies serve as liaisons to the transportation community.

The TRB Annual Meeting was held for the second time at the Walter E. Washington Convention Center and Marriott Marquis Hotel. Setting another attendance record at 12,500, the 95th Annual Meeting also logged record numbers of presentations and exhibitors.

The Technical Activities Division continues to focus on three strategic topics identified by the TRB Executive Committee: transformational technologies, system resilience, and transportation and public health. The pursuit of better understanding of these topics contributes to other initiatives in the TRB strategic plan, such as strengthening sponsor relationships and identifying and developing relationships with new stakeholders. Activities supporting the strategic topics are described throughout this report; highlights follow.

TRANSFORMATIONAL TECHNOLOGIES

Transformational technologies fundamentally change travel and the transport of goods. Examples include connected and automated vehicle systems, shared transportation services, and big data. Notable events related to this topic included the following:

- The Intelligent Transportation Systems and the Vehicle-Highway Automation Committees cosponsored the 5th Symposium on Automated Vehicles in San Francisco, California, in July, drawing more than 1,000 participants.
- A two-part workshop at the TRB Annual Meeting explored Multimodal Mobility and the



Of the more than 800 sessions and workshops at the 2016 TRB Annual Meeting, approximately 35 addressed the meeting's theme of Research Convergence for a Multimodal Future. (Photo: Risdon Photography)

Sharing Economy: Shaping the Future Market Through Policy and Research.

■ The TRB Partners in Research Symposium: Transformational Technologies in Transportation convened in Detroit, Michigan, at the end of October.

TRANSPORTATION SYSTEM RESILIENCE

Resilience is the ability of transportation systems to withstand and recover from extreme events caused by natural forces or human activities. In addition to the work by TRB’s Resilience Section, TRB activities involving transportation resilience included the following:

■ The European Union–U.S. Transportation Research Symposium on Resilience and Adaptation convened international experts to consider innovations and research in response to climate change.



Andrea Seabrook, National Public Radio (*right*), moderates discussion with Federal Emergency Management Agency Administrator Craig Fugate (*left*) and Michael Berkowitz, Rockefeller Foundation (*center*) at the State of Resilience leadership forum, hosted by the National Academies of Sciences, Engineering, and Medicine in June. (Photo: National Academies of Sciences, Engineering, and Medicine)

■ Committee members participated in the Resilient America Roundtable of the National Academies of Sciences, Engineering, and Medicine, which sponsored the State of Resilience Leadership Forum and Community Workshop in Washington, D.C., in June.

TRANSPORTATION AND PUBLIC HEALTH

The relationship between transportation and public health goes beyond safety. Environmental concerns, disease transmission, fitness and obesity, and access to care are public health sub-



Daniel S. Turner
Council Chair
Technical Activities



Hyun-A C. Park
Chair
Policy and Organization Group



Ram M. Pendyala
Chair
Planning and Environment Group



D. Stephen Lane
Chair
Design and Construction Group



Peter M. Briglia, Jr.
Chair
Operations and Preservation Group



Robert Shea
Chair
Legal Resources Group



David Harkey
Chair
Safety and Systems Users Group



Dennis Hinebaugh
Chair
Public Transportation Group



Stephen M. Popkin
Chair
Rail Group



Anne Goodchild
Chair
Freight Systems Group



Mary Ellen Eagan
Chair
Aviation Group



Eric Shen
Chair
Marine Group



Harold R. (Skip) Paul
State DOT Representative



Bevan Kirley
Young Members Council Representative



Ann M. Brach
Director
TRB Technical Activities Division



Michael Browne, University of Gothenburg (right), leads a panel discussion on accommodating freight in urban planning as part of Freight Day at the Annual Meeting. (Photo: Risdon Photography)

jects closely related to transportation. Transportation and public health activities included the following:

- Exploring Data and Metrics of Value at the Intersection of Health Care and Transport, a conference sponsored by the Federal Transit Administration, in cooperation with the National Academies of Sciences, Engineering, and Medicine’s Division on Health and Medicine, brought together health care and transportation professionals to address the issues of return on investment and measures of value.
- An Annual Meeting session examined ways of integrating freight needs into planning for healthy and active communities.

POLICY AND ORGANIZATION

Policy and Administration

The committees on policy and management supported conferences and webinars to advance asset management, resilience, and approaches to smart cities initiatives and prioritized investment scenarios supporting economic development. Policy committees concentrated on resilience, the community health implications of transportation, sea level rise and deep decarbonization, trends in social and economic factors in automated and connected vehicle networks, reactive changes in transportation finance, and the urban transportation demands of younger generations. The committees held an Annual Meeting session on valuing transportation infrastructure for public policy making.

International

TRB continued its international outreach efforts in 2016 and welcomed a record 2,160 international attendees to the Annual Meeting.

- The International Cooperation Committee’s working group on international collaboration in transportation drafted two sections of a comprehensive report addressing China and Japan. The material was presented and discussed at the committee’s midyear meeting in Shanghai in July.
- TRB and the World Road Association (PIARC) renewed a cooperative relationship for engagement and information exchange between committees of the two organizations.
- TRB cosponsored the European Transport Conference in Barcelona, Spain, in October.
- The Technical Activities Division sent a contingent to the inaugural Transportation Research Congress in Beijing in June. Modeled on the TRB Annual Meeting, the congress brought together more than 1,000 participants to discuss transportation in China. Division staff discussed meeting planning, attended the conference, and toured research facilities.

Data and Information

Activities on data and information focused on the challenges of data collection and management:

- The North American Travel Monitoring Exposition and Conference attracted more than 250 attendees to view the latest in traffic data collec-



Transportation system resilience in response to severe weather events is an urgent research issue, illustrated most recently by flooded roads in the Southeast United States after Hurricane Matthew in October. (Photo: Ryan Johnson, North Charleston)



An Annual Meeting session on big data and freight transportation drew a standing-room-only crowd. (Photo: Risdon Photography)

tion equipment and to learn about recent legislation and policy.

- Sessions at the Annual Meeting addressed Big Data Analytics and Applications: Role of Artificial Intelligence and Machine Learning; How Information Technology Is Changing Transportation Planning, Engineering, and Operations; and Big Data and Freight Transportation: Private-Sector Applications and Agency Implications.

Research and Education

The Research and Education Section committees addressed improvements in transportation research methods, coordination of critical research, and dissemination of results. The Ahead of the Curve training program, Mastering the Management of Transportation Research and Innovation, continued progress with the development and piloting of a core course, “Making Research Relevant,” with support from the National Cooperative Highway Research Program (NCHRP).

Committee-sponsored events at the Annual Meeting addressed pressing issues in research and research management—for example,

- Public Access, Open Access, and Open Data: New Requirements for Federally Funded Research;
- Innovation Management: Building a Foundation for Effective Technology Transfer Through Integration with the Research Process;
- Addressing the Changing Landscape of Transportation Workforce: Demographics, Technologies, Career Pathways, and Workforce Needs; and
- Can We Keep Up? Accelerating Research Processes to Keep Pace with Disruptive Technologies.

System Resilience

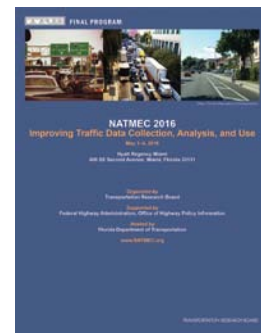
The Transportation System Resilience Section engaged in a variety of activities that reflect the broad interest in resilience and the need for coordination among stakeholders:

- TRB cosponsored the Second International Symposium on Disaster Prevention and Mitigation of Highway Infrastructure in Xi’an, China, in June.
- The TRB Standing Committee on Critical Transportation Infrastructure Protection and the American Association of State Highway and Transportation Officials (AASHTO) Standing Committee on Transportation Security and Emergency Management conducted a conference exploring state DOT resilience, emergency management functions, and research needs.
- The Subcommittee on Cybersecurity is working with the TRB Executive Committee Task Force on Transformative Technologies to examine cybersecurity risks and practices in transportation and to determine the technical requirements and needs for knowledge transfer and research.

PLANNING AND ENVIRONMENT

Transportation System Planning

Trends in travel behavior, advances in communications, and transformative transportation technologies have fueled a focus on disruption and



The North American Travel Monitoring Exposition and Conference in Miami, Florida, in May facilitated information sharing on the collection, management, and use of monitored traffic data.



State and local officials survey road damage from Hurricane Matthew in the city of Fayetteville, North Carolina. Emergency response to weather events by state transportation agencies was examined at a conference cohosted by the TRB Standing Committee on Critical Transportation Infrastructure Protection. (Photo: North Carolina Department of Transportation)

uncertainty in the planning arena. The trends affect the technical, travel forecasting–oriented committees and those focused on policy. Annual Meeting sessions and specialty conferences included technical topics such as scenario planning and innovations in travel demand forecasting, as well as policy-focused subjects such as the transportation trends among young people, megaregions, and planning for multimodal transportation.

TRB and AASHTO cosponsored a conference in Portland, Oregon, in August on the Use of Scenario Planning in Transportation Planning. The conference examined efforts to consider and integrate changing technology, demographics, and natural phenomena into planning processes and investment decision making. A key resource for the conference was the NCHRP Report 750 series, *Informing Transportation's Future*.

Environment, Energy, and Climate Change

Six committees sponsored conferences in 2016 for in-depth discussions on topics ranging from preservation of historic structures, alternative strategies and control techniques for reducing noise and vibration levels, and advances in environmental site assessment technologies and methodologies. Social and economic committees are evaluating and updating the *Community Impact Assessment Guide* in partnership with U.S. DOT. Revisions to the guide are incorporating results from a survey conducted by TRB.

Focused on transportation equity and health issues, many committees are conducting webinars and attending meetings on smart cities, the new Transportation Health Tool developed jointly by U.S. DOT and the Centers for Disease Control and Prevention, policies supporting local and regional demand management and mobility, multiuse land development, and social sustainability.

DESIGN AND CONSTRUCTION

Design

Design standing committees examined research needs, priorities, and findings via webinars, mid-year meetings, and conferences.

- The Roadside Safety Design Committee held a workshop with the AASHTO Technical Committee on Roadside Safety to explore ways to reduce the severity of roadway departure crashes and to evaluate crash testing guidelines that can enhance hardware performance by accommodating a wider range of real-world crash scenarios.
- The Accelerated Pavement Testing (APT) Committee cosponsored an international conference to address APT from an international perspective considering engineering, environmental, and economic sustainability.
- Committees in the Structures Section cosponsored three domestic and two international conferences focusing on bridge and tunnel infrastructure.



The Arizona Department of Transportation (DOT) constructed a new bridge on SR-89 in Hell Canyon. Several conferences hosted by Structures Section committees in 2016 explored bridge and tunnel infrastructure. (Photo: Arizona DOT)



Crews place new concrete pavement on westbound I-90 in Washington State. Concrete and Asphalt Materials Sections activities examined durable concrete, long-life concrete, concrete quality sensors, and more. (Photo: Washington State DOT)

Construction and Materials

Construction and Materials committees addressed a variety of research activities on critical and emerging topics.

- Performance requirements and specifications are placing greater demands on materials for recycling and longevity. Committees in the Concrete and Asphalt Materials Sections explored solutions and test methods to mitigate asphalt cracking and to improve the design and curing of durable concrete. Also examined were applications of novel, implementation-ready sensors to monitor concrete quality during placement, as well as construction techniques and materials for long-life concrete pavements and roundabout facilities.

- Construction Section activities focused on integrating information and cyberphysical systems to increase the productivity, safety, and automation of construction and on alternative contracting and project delivery to enhance multimodal construction and incorporate disadvantaged business enterprises.

Geotechnical Engineering

Common themes in the activities of the geological and geotechnical engineering committees included the following:

- Sustainable practices with recycled materials and by-products;
- Numerical modeling to reduce costs and improve solutions to complex problems;

- Advances in technology, such as remote sensing with interferometric synthetic aperture radar, for the networkwide monitoring of roads, bridges, slopes, and sinkholes;
- Three-dimensional geological and geotechnical digital data to improve communications between engineers, geologists, and users or owners;
- Advances in full-depth reclamation to rehabilitate deteriorated pavements, improve rapid construction, increase the use of in-place materials, and decrease costs; and
- Improved communication and sharing of knowledge through the Data Interchange for Geotechnical and Geoenvironmental Specialists, developed by a coalition of government agencies, universities, and industry partners to transfer transportation-related geotechnical data.

OPERATIONS AND PRESERVATION

Operations

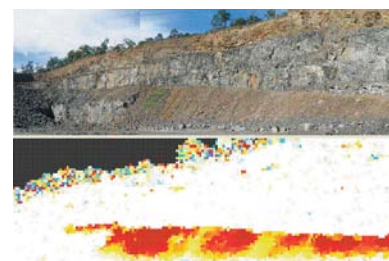
Few transportation issues are emerging more quickly or have more potential to spur revolutionary change than connected-automated vehicles. The impacts are extensive and include transportation operations, safety, and pavement and bridge design. To close the gap between the academic research community and the automated driving industry, the Intelligent Transportation Systems and the Vehicle-Highway Automation Committees cosponsored the 5th Symposium on Automated Vehicles in San Francisco in July, in cooperation with the Association for Unmanned Vehicle Systems International.

In addition, the Operations Section committees held midyear meetings or conferences:

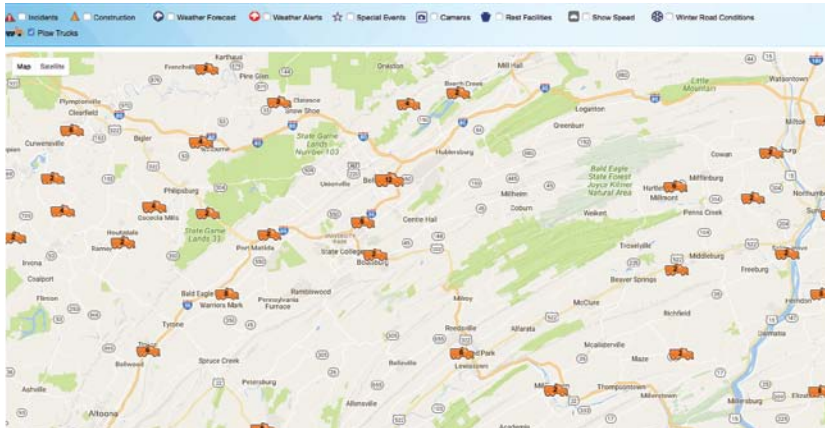
- The 15th International Conference on Managed Lanes in Miami, Florida;
- The 2016 International Symposium on Enhancing Highway Performance in Berlin, Germany, cosponsored by the Highway Capacity and the Freeway Operations Committees; and
- The Symposium on Innovations in Traffic Flow Theory and Characteristics in the Era of Autonomous Vehicles, Big Data, and the Internet of Things in Sydney, Australia, cosponsored by the Traffic Flow Theory Committee.

Maintenance and Preservation

The committees on Winter Maintenance and on Surface Transportation Weather held an International Conference on Winter Maintenance



A deformation plot (lower image) uses terrestrial interferometric synthetic aperture radar to show slope instability. (Photo: John Catsoulis, Ground-Probe Pty Ltd)



Automated vehicle location systems installed on snowplows allow Pennsylvania travelers and DOT operations offices to track the progress of the plows in real time.

in Fort Collins, Colorado, in April, to exchange information on research and technology to improve snow removal and ice control operations with weather information. Videos of the technical presentations were posted online, along with presentation materials, before the two-day, in-person workshop.

During the 2016 TRB Annual Meeting, the Maintenance and Preservation committees sponsored a variety of workshops and sessions on such topics as

- Applications of connected and automated vehicles to system maintenance and operations;
- Connected vehicles and the use of sensor data in winter maintenance equipment;
- Thin overlays for pavement preservation;
- A new paradigm for the maintenance and operations workforce;
- Pavement marking and signing design, maintenance, and evaluation; and
- Surface processes affecting snow accumulation on roads.

SAFETY AND SYSTEMS USERS

The Safety and Systems Users committees undertook the following activities:

- The Roundabouts Committee held another successful series of webinars, each attracting an average of almost 1,000 participants.
- The Committee on Safe Mobility of Older Persons published a circular, *Taxonomy and Terms for Stakeholders in Senior Mobility*.¹

¹ <http://onlinepubs.trb.org/Onlinepubs/circulars/ec211.pdf>.

- Committee and Subcommittee midyear meetings focused on such topics as building the highway safety workforce, the potential for information technology to improve alternative mobility options for older people, individual variability in teenage driving performance and risk, police reluctance to engage in traffic enforcement, and child passenger safety.

- The Highway Safety Performance Committee midyear meeting reviewed the state of the practice and research related to development of the second edition of the *Highway Safety Manual*.

LEGAL RESOURCES

The Legal Resources Group sponsored the 55th Annual Workshop on Transportation Law in July in Washington, D.C., attracting more than 150 lawyers, engineers, and transportation planners from federal, state, and local highway and transit organizations to exchange information on legal problems and solutions. Session topics included

- Updates on the federal regulation of automated driving and unmanned aerial systems (UAS),
- Legal issues related to mobility on demand, and
- Liability for design defects and for delays in property acquisition in design-build projects.

AVIATION

Aviation Group committees worked closely with the Airport Cooperative Research Program in developing, sponsoring, and reviewing research



Bob Shea, Pennsylvania DOT (left), and Jim McDaniel, TRB (right), guide a meeting of the Legal Resources Group. (Photo: Risdon Photography)



In 2016 the Marine Board and Marine Group activities focused on infrastructure needs from the larger ships crossing the newly expanded Panama Canal. (Photo: U.S. Embassy Panama)

problem statements. Several committees, including Aviation System Planning, Intergovernmental Relations in Aviation, Airfield and Airspace Capacity and Delay, and Light Commercial and General Aviation, held summer meetings in Washington, D.C. The Environmental Impacts of Aviation Committee met in Seattle, Washington, to discuss completed, ongoing, and needed research.

The committees also organized an issue of *TR News* on key topics in aviation research as the industry begins another century of commercial operations. Topics included workforce management, safety challenges, routine UAS operations in the National Airspace System, and more.²

MARINE

The Marine Group committees and the Marine Board addressed major themes at the 2016 Annual Meeting, including the impact of larger ships on infrastructure, using data to identify waterways risk, and alternative financing options for waterways infrastructure. Other activities included the following:

- The Marine Transportation Systems Research and Development Conference, designed to inform federal agencies about research priorities;

² www.trb.org/Publications/Blurbs/175073.aspx.

- The 16th Biennial National Harbor Safety Committee Conference, which gathered regional harbor safety committees to share best practices and to strengthen partnerships between the U.S. Coast Guard and waterways stakeholders;
- The Marine Board’s Spring Meeting in Woods Hole, Massachusetts, which focused on navigation technology and autonomous vessels and marine vehicles; and
- The Marine Board’s Fall Meeting in Washington, D.C., which addressed emergency preparedness, response, recovery, resilience, and risk analysis in maritime transportation.

RAIL

The Rail Group committees supported the following activities:

- An Annual Meeting session on rail line electrification, a technology in use for almost 100 years but now regaining favor as railroads seek to improve freight capacity and passenger rail speeds;
- The Joint Rail Conference on Railroad Engineering Technology, held in Columbia, South Carolina, with the theme, “Railroads: Progress Toward a Safe, Sustainable Future”;
- The Joint Meeting of the Rail Group and the Freight Rail Transportation Committee at the University of Illinois at Urbana–Champaign, including a tour of one of the most advanced university rail research laboratories in the United States; and
- An Annual Meeting workshop that discussed the shipment of crude oil by rail, the shale oil and



Admiral Thad W. Allen, U.S. Coast Guard (retired), delivered the keynote address at the Marine Board’s fall meeting in Washington, D.C.



The Rail Group and Freight Rail Transportation Committee toured the 3,500-square foot Research and Innovation Laboratory, part of the Rail Transportation and Engineering Center at the University of Illinois at Urbana-Champaign. (Photo: UIUC RailTEC)



Urban freight and other topics were addressed by Freight Systems committees in 2016. (Photo: AAA Foundation for Traffic Safety)

gas revolution, and research on the risks of transporting crude oil by rail and on the characteristics and classification of crude oil.

FREIGHT SYSTEMS

The Freight Systems committees focused on the needs to improve integration, planning processes, and freight mobility. Topics explored included urban freight, emissions and air quality, big data and modeling, and safety and planning related to the transport of energy. Additional activities included the following:

- Organizing four sessions at the 2016 Annual Meeting on optimizing supply chains to accommodate larger cargo vessels, big data and freight, emerging freight trends not captured by data, and accommodating freight early in the urban planning process; and
- Creating the Subcommittee on the Transport of Energy Products as a forum for systems thinking about the multimodal network from sources to processing facilities, storage, and retail outlets. The subcommittee will coordinate activities in this area for all of the Freight Group committees and with other TRB committees.

PUBLIC TRANSPORTATION

The Public Transportation committees worked to stimulate research and communication to advance operations, planning, safety, and security. In addition to the workshop on Exploring Data and Metrics of Value at the Intersection of Health Care and Transportation, activities included the following:

- The International Conference on Demand-Responsive Transportation, a forum for operators, health administrators, transportation network companies, service brokers, and suppliers, included a transportation and health care track that built on the metrics workshop.
- The 22nd National Conference for Rural, Public, and Intercity Bus Transportation attracted more than 400 professionals and featured Public Broadcasting System news anchor Jim Lehrer, who grew up in the intercity motor coach business.

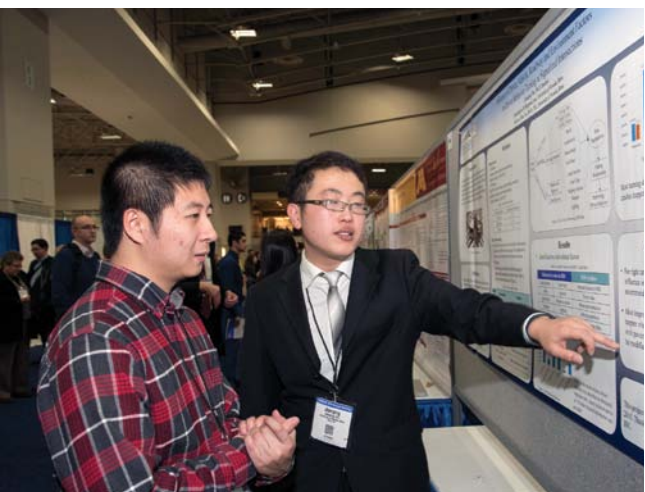
SAFETY DATA PROGRAM

The Technical Activities Division also houses the continuing Safety Data unit of the second Strategic Highway Research Program (SHRP 2). The SHRP 2 Naturalistic Driving Study collected data on real-world driving from more than 3,000 drivers. The Safety Data Program oversees the use of the data by researchers around the world. Almost 150 data use licenses are active, with several studies completed and many more on the way. Highlights include the following:

- The fostering of a user community through events such as an Annual Meeting session cover-



BoltBus passengers wait to board. A national conference on bus transportation and other workshops addressing health and public transportation were among the activities of Public Transportation committees. (Photo: David Hall)



Jiangqing Wu presents research using SHRP 2 Naturalistic Driving Study safety data at the Annual Meeting. (Photo: Risdon Photography)

ing 11 research projects and a webinar series for users to exchange tools and lessons learned;

- An independent risk assessment that explored the development of public-use data sets to make data more accessible without relaxing privacy standards;
- A draft certification process for secure data enclaves, to be tested at FHWA's Turner-Fairbank Highway Research Center; and
- A new expert task group to conduct strategic business planning, assisted by a consultant, on a sustainable operational model for the database beyond 2019.

Staff News

G. P. (Jay) Jayaprakash retired after serving for more than 28 years as Senior Program Officer, Soils, Geology, and Foundations. Jayaprakash was instrumental in the publication of two TRB textbooks, *Landslides: Investigation and Mitigation* and *Rockfall: Characterization and Control*; a champion of research on low-volume roads; and longtime chair of the staff task force that recruited and developed

articles in the *TR News* Research Pays Off series, promoting the value of research investments.

Frederick D. Hejl retired after 26 years of service to TRB, most recently as Associate Division Director and Senior Program Officer, Materials and Construction. Hejl organized the First International Conference in North America on Nanotechnology in Cement and Concrete in 2010. A key member of the *TR News* editorial board since 1993, he pioneered the theme issue approach and developed more than 10 theme issues, such as Highway Design and Construction: A 2020 Vision; he was named chair of the editorial board in 2009.

Bernardo B. Kleiner, Transportation Safety, and **Stephen F. Maher**, Design, were appointed Associate Division Directors.

Joining the staff as Senior Program Officers were **William B. Anderson**, Management, Policy, and International Relations; **Nelson H. Gibson**, Materials and Construction; **Jennifer L. Weeks**, Planning; and **Nancy M. Whiting**, Soils, Geology, and Foundations.



Frederick D. Hejl and G. P. Jayaprakash.

MAJOR AWARDS PRESENTED IN 2016

Lance A. Neumann, Chairman, Cambridge Systematics, received the 2016 Roy W. Crum Award for outstanding transportation research leadership. In his 25 years leading Cambridge Systematics, Neumann has helped to build an organization that has conducted innovative planning and policy research and implementation in subject areas from travel demand forecasting to transportation operations. His research on performance management, asset management, multimodal planning, and data-driven investment programming and project selection is nationally recognized and implemented at the federal and state levels.

For more than 35 years, Neumann has been active in TRB as a chair or member of more than 24 groups, sections, committees, panels, and task forces. He has chaired or cochaired seven committees and is an emeritus member of the Standing Committee on Performance Management and of the Standing Committee on Transportation Programming and Investment Decision Making. Neumann received Ph.D. and master's degrees from the Massachusetts Institute of Technology and a bachelor's degree from Brown University.



The 2016 W. N. Carey, Jr., Distinguished Service Award was presented to **Kirk T. Steudle** in recognition of his outstanding service to TRB and transportation research. Michigan Department of Transportation Director and past chair of the TRB Executive Committee, Steudle also has served as chair or vice chair of six other TRB committees, panels, and task forces, including the Oversight Committee for the second Strategic Highway Research Program (SHRP 2), the Committee on SHRP 2 Implementation, and the Transformative Technologies Task Force.

As Executive Committee Chair, Steudle helped oversee the



development and adoption of a new strategic plan, enhanced coordination of TRB's efforts promoting research into connected and automated vehicles, oversaw the move of the TRB Annual Meeting to a new location, and participated in the selection of Neil J. Pedersen as new TRB Executive Director.

A National Associate of the National Academies of Sciences, Engineering, and Medicine, Steudle received a bachelor's degree from Lawrence Technological University.

The 2016 recipient of the Sharon D. Banks Award was **Carol Abel Lewis**, Professor, Department of Transportation Studies, and



Director, Center for Transportation Training and Research, Texas Southern University. The award recognizes innovative and successful leadership in people-oriented initiatives in transportation.

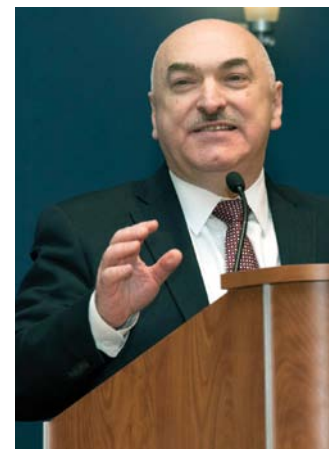
Lewis was recognized for her unique blend of transportation accomplishments, for her successes in mentoring and nurturing young people, and for her support of responsible growth and the protection of neighborhoods. Her signature people-oriented approach began in the 1980s, when she proactively engaged community groups and individuals in Houston METRO's planning processes.

Lewis has been active in many professional organizations, such as the Council of Minority Transportation Officials, the Women's Transportation Seminar, the Institute of Transportation Engineers, and TRB. Her community service includes appointments to advisory boards and commissions by three Houston mayors. During her tenure on the Houston Planning Commission, Lewis worked with a diverse group of civic leaders to promote responsible growth and protect neighborhoods.

Hani S. Mahmassani, William A. Patterson Distinguished Chair in Transportation at Northwestern University, delivered the 2016

Thomas B. Deen Distinguished Lecture, "Micromodels and Megadata: Taming Complexity for Deep Insight and Robust Decisions," to a capacity crowd.

Mahmassani also is Director, Northwestern University Transportation Center; Professor of Civil and Environmental Engineering, McCormick School of Engineering and Applied Science; and Professor of Managerial Economics and Decision Sciences, Kellogg School of Management. In his 35 years of academic and professional research, Mahmassani's interests have included multimodal transportation systems analysis, dynamic network modeling and optimization, transit network planning and design, telecommunication-transportation interactions, and real-time operation of logistics and distribution systems.



An active TRB volunteer since 1984, Mahmassani has chaired the Standing Committee on Transportation Network Modeling and the Standing Committee on Traffic Flow Theory and Characteristics. He is an emeritus member of three TRB standing committees.

Mahmassani received a Ph.D. from the Massachusetts Institute of Technology, an master's degree from Purdue University, and a bachelor's degree from the University of Houston.



STUDIES AND SPECIAL PROGRAMS

THE STUDIES AND Special Programs Division conducts policy studies at the request of the U.S. Congress, executive branch agencies, states, and other sponsors; produces syntheses of current practices in highway, transit, and airport operations; and manages Innovations Deserving Exploratory Analysis (IDEA) programs in highways, transit, and rail safety.

POLICY STUDIES

With the guidance of committees drawn from the nation's leading experts, the Policy Studies unit produces reports examining complex and controversial transportation issues. Studies address a variety of safety, economic, environmental, and research policy issues affecting all modes of transportation. In addition, studies conducted through TRB's Marine Board address offshore engineering and regulatory issues not directly related to transportation.

TRB's parent organization, the National Academies of Sciences, Engineering, and Medicine, appoints the study committees to achieve a balance of expertise and perspectives. The U.S. Congress and the executive branch have adopted many recommendations from TRB policy reports, attesting to the substantive value of the findings.

The TRB Executive Committee's Subcommittee on Planning and Policy Review provides oversight for TRB's policy work, under the leadership of former Executive Committee Chair Daniel Sperling, University of California at Davis. Since 1998, all completed policy study reports are posted on the TRB website.¹

¹ www.trb.org/Publications/PubsPolicyStudiesSpecialReports.aspx.



The Subcommittee on Planning and Policy Review, shown at its spring meeting, oversees TRB policy studies.

Completed Reports

Several major studies were completed and released during 2016, spanning a range of topics.

■ *Interregional Travel: A New Perspective for Policy Making*

Special Report 320 examines the demand for, and supply of, interregional transportation in the United States.² Major additions to transportation infrastructure, including high-speed rail, are under consideration in some of the country's most heavily traveled 100- to 500-mile corridors. The report reviews the availability and use of the automobile, airplane, and train—as well as the rejuvenated intercity bus—for interregional travel.

The study contrasts interregional corridors and transportation options in the United States with those in Japan and Europe, which are characterized by substantial investments in passen-

² www.trb.org/Publications/Blurbs/173764.aspx.



Daniel Sperling
Chair
Subcommittee on
Planning and Policy
Review



Stephen R. Godwin
Director
Studies and Special
Programs



The *Vermont* on Amtrak's Northeast Corridor. Special Report 320 contrasts interregional rail corridors in the United States with those in Europe and Japan.

ger rail. Public investments in new, long-lived transportation infrastructure can be risky because of uncertainty about future demand and the development of new technologies and competing transportation services.

Decision makers in interregional corridors face the added challenge of coordinating investments across multiple jurisdictions. The report recommends actions to reduce this uncertainty and to create stronger institutional means for developing interregional corridors.

■ *Application of Remote Real-Time Monitoring to Offshore Oil and Gas Operations*

Special Report 322 provides advice to the Bureau of Safety and Environmental Enforcement (BSEE) of the U.S. Department of the Interior on the use of remote real-time monitoring (RRTM) to improve the safety and reduce the environmental risks of offshore oil and gas operations.³ The report also evaluates the role that RRTM could play in condition-based maintenance and how BSEE could leverage RRTM into its safety enforcement program.

The report recommends ways to incorporate RRTM into BSEE's regulatory scheme. The recommendations also suggest that BSEE monitor the development of RRTM technologies in relation to risk-based goals governing offshore oil and gas processes. BSEE funded the study.

³ www.trb.org/Publications/Blurbs/174214.aspx.

■ *Strengthening the Safety Culture of the Offshore Oil and Gas Industry*

Special Report 321 recommends ways for industry and regulators to strengthen and sustain the safety culture of the offshore oil and gas industry.⁴ The committee that prepared the report addresses conceptual challenges in defining safety culture, empirical support for the definition offered by BSEE, methods for assessing company safety culture, barriers to improving safety culture in the offshore industry, and strategies for overcoming the barriers.

The committee's report also identifies topics requiring further research. A settlement agreement between the Justice Department and an independent offshore drilling company funded the project.

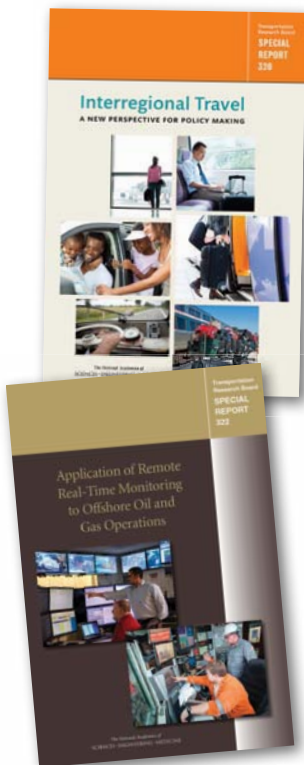
■ *Impact of U.S. Coast Guard Regulations on U.S. Flag Registry*

Congress requested the TRB Marine Board to assess whether the U.S. Coast Guard (USCG) regulatory process impedes the ability of U.S. flag-registered vessels to compete effectively in international commerce.⁵ The study committee finds that the costs related to USCG regulatory compliance, although increased, are relatively small compared with the operational costs associated with U.S. flag registry.

The committee therefore concludes that USCG regulatory compliance is not a major impediment to the competitiveness of vessels registered under

⁴ www.trb.org/Publications/Blurbs/174395.aspx.

⁵ www.trb.org/main/blurbs/173981.aspx.



General cargo ship *Ocean Giant* is registered under the U.S. flag. The regulatory process for the U.S. flag registry was the subject of a congressionally requested study. (Photo: Bernard Spragg)



The Future Interstates policy study team (left to right): Amelia Mathis, Katherine Kortum, Monica Starnes, Velvet Fitzpatrick, Maina Tran, and Anusha Jayasinghe.

the U.S. flag. Nevertheless, the committee notes that improvements in the regulatory process could reduce costs without increasing safety risk. The report identifies and recommends actions that USCG can take in the short term to bring about additional improvements, as well as other actions that would require enabling legislation. USCG funded the project.

Ongoing Studies

- *Future Interstates*, initiated at the request of Congress and funded by the Federal Highway Administration (FHWA), will provide advice on the future role of—and the options for funding—the Interstate Highway System.
- *Transportation of Petroleum, Natural Gas, and Ethanol*, initiated by the TRB Executive Committee, is examining policy and technical options to facilitate the most efficient and lowest-risk means of transporting liquid and gaseous domestic energy products.
- *Performance-Based Safety Regulation*, funded by the Pipelines and Hazardous Materials Administration, is addressing the pros and cons of relying on a performance-based approach to safety that encourages the pipeline industry to exceed the minimum requirements of prescriptive regulations.
- *Review of U.S. DOT Testing of Electronically Controlled Pneumatic (ECP) Brakes*, requested by Congress, is reviewing U.S. DOT testing and analysis of ECP brakes for unit trains operated by freight railroads, for hauling crude oil, ethanol, and other flammable products.

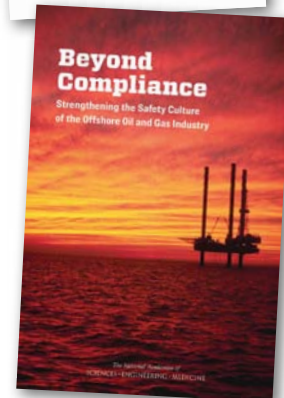
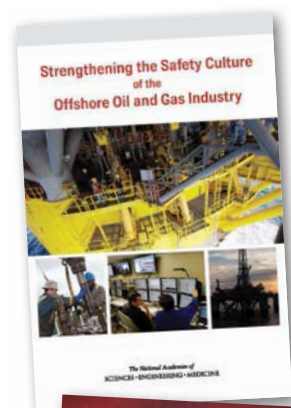
- *In-Service Performance of W-Beam Guardrail End Treatments*, funded by the states through the National Cooperative Highway Research Program (NCHRP), is developing advice for evaluating the in-service performance of guardrails and other roadside safety hardware.
- *Evidentiary Protection of Transit Safety Information*, a project requested by Congress, is examining whether information about public transportation safety should be protected from litigation in the same way that highway safety information is.
- *Polar Icebreakers Cost Assessment* is examining, at the request of Congress, the costs of procuring and operating heavy-duty icebreakers.

Other committees provide ongoing peer review of the research and technology programs of the Federal Motor Carrier Safety Administration (FMCSA), FHWA, and the Federal Transit Administration (FTA), as well as for major FHWA research activities, such as the Long-Term Pavement Performance Program and Long-Term Bridge Performance Program. The committees that review these programs and major projects issue letter reports, available on TRB's website.⁶

Assistance in National Academies Studies

In addition, the Policy Studies staff assisted the National Academies' Board on Energy and En-

⁶ www.trb.org/Publications/PubsPolicyStudiesLetterReports.aspx.



The highly technical Special Report 321, *Strengthening the Safety Culture of the Offshore Oil and Gas Industry*, was accompanied by *Beyond Compliance: Strengthening the Safety Culture of the Offshore Oil and Gas Industry*, a summary publication for a broader audience.



The Committee for a Study of Domestic Transportation Petroleum, Natural Gas, and Ethanol met in February.



Stephen R. Godwin details the status of current Studies and Special Programs division projects to the Executive Committee. (Photo: Risdon Photography)

environmental Systems on projects evaluating fuel conservation technologies for light-duty vehicles and for medium- and heavy-duty trucks, both for the National Highway Traffic Safety Administration; and a study of options for funding electric vehicle recharging stations, for the Department of Energy.

TRB also is assisting the Committee on National Statistics in a study requested by Congress and funded by FMCSA to review FMCSA's Compliance, Safety, and Accountability program.

SYNTHESIS PROGRAMS

Under the sponsorship of the Cooperative Research Programs administered by TRB—specifically the Airport Cooperative Research Program (ACRP), NCHRP, and the Transit Cooperative Research Program (TCRP)—the Synthesis Programs unit prepares reports on current practice and knowledge on a range of key airport, highway, and transit topics. Practitioners and researchers make extensive use of the reports.

An airport panel, a highway panel, and a transit panel select the study topics each year. In 2016, 10 new airport, 15 new highway, and seven new transit studies started up. A consultant experienced in the topic area researches and writes each synthesis report, with guidance from an expert panel.

A list of reports published in the past 12 months appears on pages 55–56. Approximately



Airport Cooperative Research Program syntheses addressed such topics as combining mixed-use flight operations at airports. (Photo: S. Quilty, SMQ Airport Services)

1,000 copies of each ACRP and NCHRP report are published in hard copy, with 600 to 700 distributed to state DOTs, airport operators, and TRB topic-area subscribers. Starting in 2014, TCRP has published reports on the TRB website only; ACRP and NCHRP reports are also available on the website.⁷ TRB maintains an inventory of hard-copy synthesis reports for sale.⁸

IDEA PROGRAMS

IDEA programs fund early-stage investigations of potential breakthroughs in transportation technology. Through small projects, researchers investigate the feasibility of innovative concepts that could advance transportation practice. IDEA programs sponsor high-risk research that is independent of the immediate mission concerns of public agencies and of the short-term financial imperatives of the private sector.

Three IDEA programs were operating in 2016:

- NCHRP IDEA, collectively funded by the state DOTs, for highway-related research;
- Transit IDEA, funded by FTA through TCRP, for research on innovations applicable to transit practice; and
- Rail Safety IDEA, sponsored by the Federal Railroad Administration, for projects to improve the safety of railroad operations.

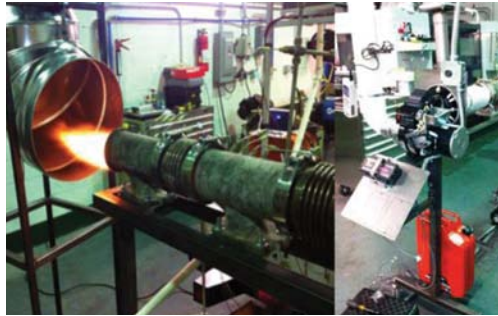
⁷ NCHRP Synthesis, www.trb.org/Publications/PubsNCHRPSynthesisReports.aspx; TCRP Synthesis, www.trb.org/Publications/PubsTCRPSynthesisReports.aspx; ACRP Synthesis, www.trb.org/Publications/PubsACRPSynthesisReports.aspx.
⁸ <https://www.mytrb.org/store>.



An NCHRP IDEA project examined the use of available vehicle detection devices for automated counts of turning movements in shared lanes. (Photo: Kelvin R. Santiago)

Recently Completed IDEA Projects

Highway Project 173: Graphene Nanoplatelet (GNP) Reinforced Asphalt Mixtures: A Novel Multifunctional Pavement Material
 Highway Project 177: Automated Turning Movement Counts for Shared Lanes
 Highway Project 180: Drained Timber Pile Ground Improvement for Liquefaction Mitigation
 Transit IDEA Project 81: Advanced Locomotive Exhaust Gas Simulator to Fine-Tune Energy Recovery and Conversion Systems
 Rail Safety IDEA Project 24: Railroad Bridge Dynamics and Ratings



Transit IDEA Project 81 expanded an earlier project (above) to develop advanced locomotive exhaust gas simulators. (Photo: Claudio Filippone, ThermoDynamics Rail)

Each IDEA program follows a similar administrative model, adapted for sponsorship arrangements and target audiences. Each program operates through a committee or panel of volunteer transportation experts who solicit, review, and select proposals that merit research contracts. Funds awarded for any one project range between \$50,000 and \$150,000. Frequently, however, the funds are augmented through cost-share arrangements, nearly doubling the amount of research that can be supported through the IDEA programs.

At the 2016 TRB Annual Meeting, the transit, highway, and safety programs conducted poster sessions highlighting 22 of the most promising current projects. Each session attracted a constant stream of interested visitors, who interacted directly with the inventors.

The box at right lists recently completed IDEA projects. Each of the IDEA programs publishes an annual report that includes summaries of completed and current projects. The summaries also are posted on the IDEA page of the TRB website, along with the IDEA program announcement, which contains forms and guidelines for submitting proposals.⁹ Contractor final reports for completed IDEA projects are posted on the TRB website.¹⁰

⁹ www.trb.org/ideaprogram/ideaprogram.aspx.

¹⁰ www.trb.org/Publications/PubsIDEAPublications.aspx.

Staff News

Senior Program Officer **Donna Vlasak** retired after 23 years of service, largely with the transit synthesis program. She managed 122 projects for TCRP Synthesis of Transit Practice, producing the first report in the series, and contributed to many other projects and reports for ACRP and FMCSA.

Monica A. Starnes, Senior Program Officer, transferred to the Policy Studies group from the Technical Activities Division.

Mariela Garcia-Colberg joined the Synthesis Studies staff as a Senior Program Officer.

Anusha Jayasinghe and **Katherine Ingebretsen** joined the Policy Studies group as Senior Program Assistants.



COOPERATIVE RESEARCH PROGRAMS

TRB ADMINISTERS six cooperative research programs:

- The National Cooperative Highway Research Program (NCHRP), sponsored by the American Association of State Highway and Transportation Officials (AASHTO) in cooperation with the Federal Highway Administration (FHWA);
- The Transit Cooperative Research Program (TCRP), sponsored by the Federal Transit Administration (FTA);
- The Airport Cooperative Research Program (ACRP), sponsored by the Federal Aviation Administration (FAA);
- The National Cooperative Freight Research Program (NCFRP), sponsored by the Office of the Assistant Secretary for Research and Technology (OST-R);
- The Hazardous Materials Cooperative Research Program (HMCRP), sponsored by the Pipeline and Hazardous Materials Safety Administration (PHMSA); and
- The National Cooperative Rail Research Program (NCRRP), sponsored by the Federal Railroad Administration (FRA).

During 2016, these programs produced 117 publications on a range of topics valuable to practitioners.

NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

A forum for coordinated and collaborative research, NCHRP addresses issues integral to the functions of state departments of transportation (DOTs) and to the work of transportation profes-



Cooperative Research Programs Director Chris Hedges leads a spring meeting of the AASHTO Standing Committee on Research (SCOR), which selected projects for the National Cooperative Highway Research Program (NCHRP) in fiscal year 2017.

sionals at all levels of government and private practice. Since 1962, NCHRP has helped the transportation community find practical solutions to pressing problems and develop and apply innovations to improve current practices. The AASHTO Standing Committee on Research (SCOR) serves as the governing board for NCHRP.

Support for NCHRP comes from voluntary contributions from the state DOTs. NCHRP's close association with AASHTO and its position within the National Academies of Sciences, Engineering, and Medicine have enabled the program to carry out research with sound, practical, and nationally important results. Stakeholder involvement throughout the NCHRP process guarantees that the program addresses high-pri-



John S. Halikowski
Chair
AASHTO Standing
Committee on
Research
(January–October)



Sherry E. Little
Chair
TCRP Oversight and
Project Selection
Committee
(January–June)



Paul Jablonski
Chair
TCRP Oversight and
Project Selection
Committee (June–)



Cheryl A. Burke
Chair
HMCRP Technical
Oversight Panel



Kitty Freidheim
Chair
ACRP Oversight
Committee



Christopher J. Hedges
Director
Cooperative
Research Programs

ority research needs and develops products that are ready for implementation by transportation practitioners.

NCHRP manages projects in research areas that range from highway and bridge planning, materials, design, construction, and operations, to economics and finance, policy, land use, environmental issues, and workforce development. The results of these research projects have appeared in 1,378 publications in the NCHRP Report and NCHRP Synthesis of Highway Practice series, in addition to 400 Research Results Digests and 71 Legal Research Digests, as well as 304 other documents published electronically.

AASHTO selected 16 continuing projects and 37 new projects in 2016. Each NCHRP project follows an approved research plan under the guidance of a panel of technical specialists and experienced practitioners. The panel defines the scope of work, selects the contractor through a competitive proposal process, and monitors the research from beginning to end. The panel's participation ensures the credibility of the research findings, facilitating adoption by AASHTO, state DOTs, and other organizations.

NCHRP panels convened for more than 153 project meetings in 2016; more than 2,130 volunteers offered their time, energy, and expertise as panel members, attending meetings and reviewing materials, primarily for the challenges and the satisfaction of making contributions to the field. Most NCHRP research projects have recommended specifications and have produced manuals and guidelines that have had a direct impact on practice, and the program often partners with AASHTO to ensure that the state DOTs learn about and deploy the products. Examples of NCHRP successes can be found in the *Impacts on Practice* series.¹

¹ www.trb.org/nchrp/nchrpimpactspractice.aspx.

Highlights of 2016

Connected and Automated Vehicles

With the rapid development and deployment of connected and automated vehicle technologies, state DOTs need research on the effects of these technologies and on preparing for their widespread use. NCHRP Project 20-102 seeks to (a) identify critical issues that state and local transportation agencies and AASHTO will face with connected and automated vehicles, (b) conduct research to address those issues, and (c) engage in technology transfer and information exchange.

Project tasks under way include policy and planning related to the societal impacts and market decisions; regulations and policies on uses in transit operations; challenges for truck freight operations; strategic communications planning; road markings for machine vision; implications for motor vehicle codes; dedicated and priority-use lanes; incorporating the impacts into regional transportation planning and modeling tools;



A self-driving, low-speed shuttle developed by Local Motors. The effects of automated vehicles, and preparations for their widespread use, were examined in NCHRP Project 20-102. (Photo: Matthew Lesh, Local Motors)



With freight volume projected to increase nearly 50 percent by 2045, freight is the topic of a forthcoming research roadmap. (Photo: Don Wilson, Port of Seattle)

cybersecurity implications; effects on travel demand; business models for the deployment of infrastructure; data needs and collection; and data management strategies for operations.

Research Roadmaps

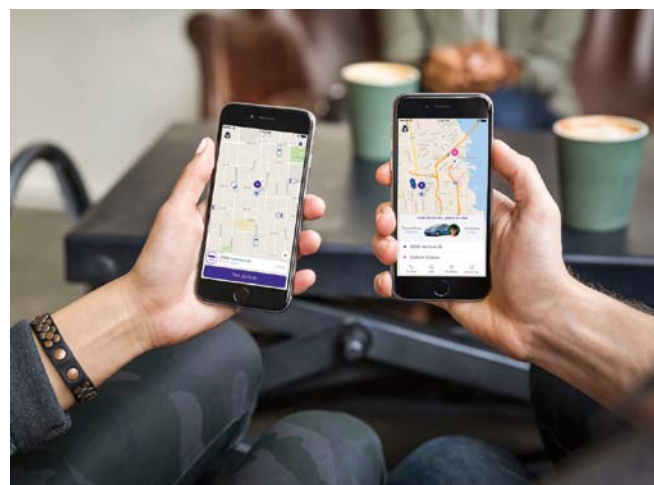
SCOR elected to develop research roadmaps in three critical strategic areas in 2016: freight transportation, transportation and public health, and transformational technologies. The roadmaps will review trends, identify pressing needs, suggest priorities, and develop a program of research to enable state DOTs to understand, anticipate, and prepare for the impacts on the transportation system.

■ **Freight.** As outlined in *Beyond Traffic*, the U.S. DOT’s 30-year plan, the nation’s ability to compete in global markets—and to meet the needs and expectations of consumers and industry—depends on a robust, multimodal freight transportation system. The U.S. freight system is under strain; roads, railways, and some airports are increasingly congested. Many ports and inland waterways require dredging, and facilities are aging. Nevertheless, freight volume is projected to increase 45 percent by 2045. Transportation agencies need to understand the current and anticipated trends in the freight transportation network to develop strategic goals and objectives.

■ **Transportation and Public Health.** Society relies on efficient and effective transportation to move people and goods, create personal mobility, and improve quality of life. Transportation systems, however, can have an impact on pub-



The effects of active transportation and other aspects of public health and transportation are the subject of another research roadmap. (Photo: Margaret Gibbs, pedbikeimages.org)



A third research roadmap examines on-demand shared ride services and other transformative technologies. (Photo: Lyft)

lic health through air quality, safety, noise, and incentives or disincentives for physical activity. Transportation agencies need to understand the complex relationships between transportation and public health to develop strategic goals and objectives.

■ **Transformational Technologies.** Transformational or disruptive technologies can be expected to displace the status quo and change forever the way people live and work. Examples in transportation include connected and automated vehicles; bicycle sharing in urban centers; carsharing, such as Car2Go and Zipcar; on-demand shared ride services, such as Uber and Lyft; hybrid and other alternative-fueled vehicles; and drones, e-retailing, and 3-D printing. Each of these is the subject of extensive research, but collectively these technologies will change the nature and role of the future DOT. Transformational technologies will affect the planning, building, operation, and maintenance of transportation systems. Transportation agencies need to understand the impacts of transformational technologies to develop strategic goals and objectives.

Implementation Planning

NCHRP has emphasized the development of practical products for immediate implementation by practitioners. In recent years, SCOR has prioritized activities that can expedite the implementation process—such as developing products in different formats for different target audiences, engaging stakeholders through workshops and peer exchanges, conducting demonstrations

of research products at sponsoring agencies, and strengthening dissemination efforts.

In December 2015, SCOR approved an implementation plan, funded at \$2 million annually, and authorized NCHRP to hire a full-time implementation coordinator. NCHRP will adopt a more proactive approach to implementation and will work with project panels to develop appropriate implementation plans for each project. Concerted efforts will ensure that the transportation community is fully aware of the availability and value of NCHRP research products.

Research Results

Following is a sample of the NCHRP reports published in 2016 that have particular importance to AASHTO. All reports are available on the TRB website.² General information on all projects is available in the NCHRP Summary of Progress, December 31, 2016,³ and on the web.

Project Delivery

- NCHRP Report 821, *Effective Project Scoping Practices to Improve On-Time and On-Budget Delivery of Highway Projects*; and
- NCHRP Report 827, *Navigating Multi-Agency NEPA Processes to Advance Multimodal Transportation Projects*.

Resilience

NCHRP Synthesis 496, *Minimizing Roadway Embankment Damage from Flooding*.

² www.trb.org/Publications/PubsTRBPublicationsbySeries.aspx.

³ <http://onlinepubs.trb.org/onlinepubs/nchrp/nchrpannual2016.pdf>.



A case study in NCHRP Report 827, *Navigating Multi-Agency NEPA Processes to Advance Multimodal Transportation Projects*, examines the Orange Line light rail extension to Dallas-Fort Worth International Airport in Texas. (Photo: Dallas Area Rapid Transit)



NCHRP Report 830, *Multistate, Multimodal, Oversize-Overweight Transportation*, compiles and reviews permitting requirements for oversized freight.

Design

- NCHRP Report 825, *Planning and Preliminary Engineering Applications Guide to the Highway Capacity Manual*; and
- NCHRP Synthesis 488, *Roundabout Practices*.

Administration

NCHRP Report 829, *Leadership Guide for Strategic Information Management for State Departments of Transportation*.

Environment

- NCHRP Report 822, *Evaluation and Assessment of Environmentally Sensitive Stream Bank Protection Measures*; and
- Legal Research Digest 64, *Legal Aspects of Environmental Permitting in the Emergency Response Environment*.

Traffic Management

NCHRP Report 828, *Guidelines for Nighttime Visibility of Overhead Signs*.

Freight

NCHRP Report 830, *Multistate, Multimodal, Oversize-Overweight Transportation*.

Pavements and Materials

- NCHRP Report 817, *Validation of Guidelines for Evaluating the Moisture Susceptibility of WMA Technologies*; and
- NCHRP Synthesis 495, *Use of Reclaimed Asphalt Pavement and Recycled Asphalt Shingles in Asphalt Mixtures*.

Connected and Automated Vehicles

Legal Research Digest 69, *A Look at the Legal Environment for Driverless Vehicles*.



Peggy Wilson, American Public Transportation Association, provides a status update on the Transit Cooperative Research Program (TCRP) at a TCRP Oversight and Project Selection Committee meeting.

Safety and Security

Legal Research Digest 71, *Liability of Transportation Entity for the Unintentional Release of Secure Data or the Intentional Release of Monitoring Data on Movements or Activities of the Public.*

TRANSIT COOPERATIVE RESEARCH PROGRAM

Initially authorized by the Intermodal Surface Transportation Efficiency Act and initiated under TRB management in July 1992, TCRP is supported by annual grants from the Federal Transit Administration (FTA). The TCRP Oversight and Project Selection (TOPS) Committee selects research for the program; the committee also serves as a subcommittee of the board of directors of the Transit Development Corporation (TDC), a nonprofit educational and research affiliate of APTA. A three-way memorandum of agreement by FTA, TDC, and TRB outlines the program’s operating procedures. In its 24 years, TCRP has undertaken more than 700 research studies. Details on the program’s development since 1992 can be found in the *2016 TCRP Annual Report of Progress*.⁴

The current surface transportation authorizing legislation—the Fixing America’s Surface Transportation (FAST) Act—passed in December 2015 and reauthorized TCRP for 5 years, from

⁴ <http://onlinepubs.trb.org/onlinepubs/tcrp/TCRPAnnual2016.pdf>.

Fiscal Year (FY) 2016 through FY 2020 at \$5 million per year. The FAST Act moved TCRP from 49 U.S.C. Chapter 53, Section 5313, a stand-alone section, into Section 5312, Public Transportation Innovation, and changed the funding source from the General Fund to the Mass Transit Account of the Highway Trust Fund, ensuring funding stability for the length of the act.

TCRP produced 17 publications in 2016, bringing the total to more than 637 since the program’s inception. The following TCRP publications of particular interest were completed during the year.

Operations, Maintenance, and Safety

TCRP Report 183, *A Guidebook on Transit-Supportive Roadway Strategies*, and Web-Only Document 66, *Improving Transportation Network Efficiency Through Implementation of Transit-Supportive Roadway Strategies*, are resources for improving bus speed and reliability on surface streets while addressing the needs of other roadway users, including motorists, bicyclists, and pedestrians. The report identifies consistent and uniform strategies to reduce delay and improve reliability for transit operations on roadways; develops decision-making guidance for operational planning



Bus lane strategies are presented in TCRP Report 183, *A Guidebook on Transit-Supportive Roadway Strategies*.

and functional design, including information on warrants and costs; and identifies institutional structures and intergovernmental agreements that can facilitate implementation.

TCRP Report 184, *Maintenance Technician Staffing Levels for Modern Public Transit Fleets*, identifies tools and practices to determine optimum staffing levels for maintenance technicians and analyzes variables that influence staffing needs. The report presents the MS Excel-based Maintenance Staffing Calculator, a tool for managers to estimate the optimal number of bus maintenance staff to meet needs.

Vehicles and Equipment

TCRP Report 185, *Bus Operator Workstation Design for Improving Occupational Health and Safety*, provides practical guidance, documents, and tools for the procurement process and bus design. The report presents strategies to develop, train, and support a bus procurement team of operators and representatives from operations, maintenance, and safety and offers training recommendations that include an ergonomics module. The report can assist transit agencies and bus manufacturers in integrating technologies into procurement practices and in improving bus operator workstation design.

Policy and Planning

TCRP Report 182, *Linking Transit Agencies and Land Use Decision Making: Guidebook for Transit Agencies*, addresses the connections between transit, land use planning, and decision making about development. The guidebook provides tools for transit agencies to self-assess their readiness to participate in the land use decision-making process and to improve their interactions with key stakeholders, including local governments and developers.

TCRP Report 186, *Economic Impact Case Study Tool for Transit*, examines the types of transit projects that are most applicable for case studies, ways to measure and report the economic impacts of transit projects, and the differences between transit case studies and highway case studies. The report explores the design and development of the case study database and web tool and offers seven prototype case studies.

TCRP Report 188, *Shared Mobility and the Transformation of Public Transit*, examines opportunities and challenges for public transportation from technology-enabled mobility services and



Michael Salamone, Airport Cooperative Research Program (ACRP) Manager, briefs the ACRP Oversight Committee.

suggests ways that transit can learn from, build on, and interface with new mobility options. The report analyzes transit and ridesourcing capacity, demand, and comparative travel times; assesses practices and regulations related to paratransit; and compiles business models and public-private partnerships that build on new technologies from the emerging shared-mobility sector.

AIRPORT COOPERATIVE RESEARCH PROGRAM

Because airport practitioners need access to tools and knowledge that help them understand opportunities and threats on the horizon, ACRP convenes subject matter experts to develop research, tools, and guidance to serve airports.

Established in 2006, sponsored by FAA, and managed by TRB, ACRP is an applied research program that develops near-term practical solutions to problems faced by airport operators. ACRP research publications are available online at no additional cost to the industry, and in diverse formats, such as reports, guidebooks, legal digests, syntheses of research, and more. To date, ACRP has committed \$113 million to fund 485 research projects spanning the full spectrum of disciplines in airport operations, including airport design, construction, sustainability, law, maintenance, operations, safety, policy, planning, human resources, and administration.

Each research project addresses a specific industry need identified by public- and private-sector stakeholders—including airport practitioners, academicians, consultants, advocates, and



Members of the ACRP panel on Emergency Communication Models for Persons with Disabilities and Non-English Speakers define the scope and goals of the project.

students—and is scoped and guided by a panel of select subject-matter experts. The research findings fill gaps in knowledge and practice, address persistent problems, identify best practices, and offer practical tools to help practitioners overcome common and emerging challenges.

Engaging the Industry

The world is more interconnected than ever before—domestic economic events are felt around the globe, and environmental and technological shifts highlight global interdependence. Amid these changes, the future is bright for the airport industry—especially for airport practitioners equipped with expert knowledge about the evolutions under way.

ACRP helps the industry respond to intertwined global challenges and opportunities by cultivating its own interconnections. Through more than 400 publications, events attracting a wide attendance, and initiatives to engage stakeholders, ACRP plays a key role in helping airports exchange knowledge and best practices, collaborate to address shared challenges, network with other professionals across distance and generations, and identify and address emerging challenges with timely information and tools.

The ACRP Ambassadors program, for example, expanded with an emeritus program, which honors and maintains contact with former ambas-

sadors, who can offer insight into the industry. The new ACRP Champions program for up-and-coming practitioners completed its first year and exceeded its initial goal of 100; ACRP is connecting champions with experienced ambassadors through the new ACRP Mentorship program.

In addition, new product summary cards are helping ACRP quickly disseminate and explain the latest research results at conferences and other events. An effort to expedite the submital and review process for problem statements promises to deliver research results and solutions to practitioners sooner. ACRP has taken measures to enhance its website, which serves as a hub of timely, no-cost tools and guidance, by tagging resources with metadata to help practitioners quickly find the resources they need.

NextGen

ACRP continues to examine the ongoing transformation of the aviation system with the next generation of technologies, known as NextGen. These technologies offer benefits in efficiency, the environment, safety, reliability, planning, and design for airports. In 2016, ACRP's NextGen initiative produced ACRP Report 150, *NextGen for Airports*, comprising five volumes:

Volume 1, *Understanding the Airport's Role in Performance-Based Navigation: Resource Guide*;

Volume 2, *Engaging Airport Stakeholders: Guidebook*;

Volume 3, *Resource Guide*;

Volume 4, *Leveraging NextGen Spatial Data to Benefit Airports: Guidebook*; and

Volume 5, *Airport Planning and Development*.



Installation of solar panels at an airport facility, from ACRP Report 151, *Developing a Business Case for Renewable Energy at Airports*.

Sustainability at Airports

Today's global economy depends on airports offering reliable and continued service despite financial and environmental pressures. Airports around the world are taking proactive steps to ensure sustainable operations on multiple fronts—from reducing reliance on fossil fuels by using renewable energy to managing water more efficiently. New titles addressing sustainability topics include the following:

- ACRP Report 158, *Deriving Benefits from Alternative Aircraft-Taxi Systems*;
- ACRP Report 154, *Water Efficiency Management Strategies for Airports*;
- ACRP Report 151, *Developing a Business Case for Renewable Energy at Airports*;
- ACRP CD-ROM 78, *Airport Terminal Building Energy Use Intensity Benchmarking Tool*;
- ACRP Synthesis 69, *Airport Sustainability Practices: Drivers and Outcomes for Small Commercial and General Aviation Airports*; and
- ACRP Web-Only Document 26, *Methodology to Improve AEDT Quantification of Aircraft Taxi-Idle Emissions*.

Technology and Trends

ACRP Report 65, *Guidebook for IROPS Stakeholder Communication and Coordination*, responds to passenger demand for improved communication and planning to meet passenger needs during irregular operations (IROPS). The report provides tools and best practices to help airports improve not only communication with passengers but also cooperation with airlines and government agencies during IROPS. As environmental disruptions become more frequent, and as passengers expect more from airlines and airports on social media and other communications channels, the focus on IROPS communication is likely to continue.

A \$1 million research initiative is exploring the integration of unmanned aerial systems (UAS) into airports. ACRP Project 03-42, *Integrating UAS into Airports*, will build on preceding research—including ACRP Report 144, *UAS and Airports: A Primer*, and ACRP Project 11-01, *Topic 08-03: Evolving Law on Airport Implications by UAS Operations*, in progress—to provide additional guidance and information.

Through engagement with stakeholders and a well-established research process, ACRP consistently provides the airport community with

relevant, valuable guidance and tools to help practitioners successfully manage their daily operations, avoid potential threats, and leverage new opportunities for growth and innovation.

NATIONAL COOPERATIVE FREIGHT RESEARCH PROGRAM

Authorized in 2005 under the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU), NCFRP is sponsored by OST-R and managed by TRB. An oversight committee comprising a representative cross section of freight stakeholders provides program guidance. Annual funding averaged \$3.4 million during SAFETEA-LU, but the Moving Ahead for Progress in the 21st Century Act (MAP-21) repealed NCFRP.

Although the program will be closing down, all research activity funded through FY 2012 will be completed as planned.

HAZARDOUS MATERIALS COOPERATIVE RESEARCH PROGRAM

SAFETEA-LU authorized a pilot cooperative research program on hazardous materials transportation. HMCRRP was initiated in September 2006 under the sponsorship of PHMSA to complement other U.S. DOT research efforts as a stakeholder-driven, problem-solving program, funding research on real-world, day-to-day operational issues with near- to midterm time frames. Annual funding averaged \$1.1 million, but MAP-21 did not provide funding beyond FY 2012.



In 2016, the National Cooperative Freight Research Program released the report, *Enhancing Sleep Efficiency on Vessels in the Tug-Towboat-Barge Industry*.



Four-quadrant gate installation on an intercity passenger rail line, an example of grade crossing design in National Cooperative Rail Research Program Report 6, *Guidebook for Intercity Passenger Rail Service and Development*.

NATIONAL COOPERATIVE RAIL RESEARCH PROGRAM

Authorized by the Passenger Rail Investment and Improvement Act, NCRRP started up under TRB management in 2012 with the sponsorship of FRA. The program has carried out applied research on intercity rail, intermodal efficiency, capacity, interconnectivity, high-speed rail corridors, and passenger and freight transportation. One year of funding was provided at \$5.0 million. NCRRP released all remaining publications before the end of 2016; the program has not been reauthorized.

Staff News

Christopher W. Jenks, TRB Director of Cooperative Research Programs since 2007, retired in July, after 22 years at TRB. Jenks joined TRB as a Senior Program Officer with TCRP and was appointed TCRP Manager in 1999; he managed many TCRP projects that developed products in widespread use throughout the transit industry. His commitment to the highest quality research products is much admired. “His steady, guiding hand at the helm of CRP and his input as a trusted member of the TRB



Christopher W. Jenks

senior leadership team will be missed,” stated TRB Executive Director Neil Pedersen.

Christopher J. Hedges, who joined TRB as a Senior Program Officer in 1999 and became Manager of NCHRP in 2014, was promoted to Director of Cooperative Research Programs in October.

Roy Mesler was promoted to Systems Analyst.

Waseem Dekelbab was appointed Implementation Coordinator for NCHRP.

Maina Tran joined the staff as a Web Developer; **Kathy Mion** came aboard as a Senior Editorial Assistant (part-time); and **Hana Vagnerova** and **Gary Jenkins** were hired as Senior Program Assistants.



EXECUTIVE OFFICE

THE TRB EXECUTIVE OFFICE provides policy and operational guidance for programs and activities; oversees committee and panel appointments and report review; supplies staff support to the Executive Committee and its Subcommittee for National Research Council (NRC) Oversight throughout the report review process; provides support and direction for human resources issues, staffing needs, information technology services, and the TRB Minority Student Fellows Program; develops and directs the Board's communications and outreach efforts; operates a bibliographic database of transportation research and provides library reference services; and maintains liaison with the executive offices of the National Academies of Sciences, Engineering, and Medicine, the Board's parent institution. The Executive Office also manages the editing, production, design, and publication of many TRB reports, including its journal series, magazine, policy studies, and other titles.



TRB Executive Director Neil Pedersen, with Immediate Past Chair Daniel Sperling (*right*), updates the Executive Committee on TRB's progress on its strategic plan. (Photo: Risdon Photography)



The Executive Committee Task Force on Public Health brings together a broad cross section of stakeholders, from transportation to medicine. (Photo: Risdon Photography)

OVERSIGHT ACTIVITIES

The Executive Office supports the work of the TRB Executive Committee, which provides policy direction to TRB programs and activities in accord with the policies of the National Academies. The Executive Office oversees the implementation of the TRB strategic plan, as approved by the TRB Executive Committee, to pursue the following goals:

1. Develop and implement processes to identify and address emerging and critical transportation issues in a strategic and proactive manner.
2. Involve a broader cross section of stakeholders and constituencies in TRB programs and activities.
3. Conduct strategic reviews of the portfolio of TRB legacy programs and products and introduce activities to meet critical marketplace needs.
4. Apply systematic approaches for identifying and tracking the impacts of TRB's research programs.



Iftin Thompson, Iowa State University, and Corey Harper, Carnegie Mellon University, at the Young Professionals Reception at the TRB 2016 Annual Meeting. (Photo: Risdon Photography)

5. Strengthen the long-term financial stability of TRB by augmenting traditional federal and federally derived sources of funding.
6. Develop and implement coordinated approaches to communicate information on TRB activities and products that address emerging and critical issues.
7. Provide TRB staff with the knowledge, resources, and tools necessary to meet and exceed the expectations of TRB stakeholders and customers.

APPOINTMENTS AND REPORT REVIEW

Oversight of committee and panel appointments and of report review is the responsibility of the Executive Committee’s Subcommittee for NRC Oversight (SNO), which ensures that TRB meets institutional standards and that its activities are appropriate for the National Academies of Sciences, Engineering, and Medicine. As part of this oversight, the subcommittee monitors the Board’s progress in expanding the participation of minorities and women on TRB committees and panels. Susan Hanson chairs the subcommittee and represents TRB as an ex officio member on the NRC Governing Board.

The Executive Office processes the Board’s large volume of committee and panel appointments and maintains committee membership records. It also manages the institutional report review process according to established guidelines. This review process, designed to ensure the independent, rigorous review of reports, is a hallmark of the National Academies of Sciences, Engineering, and Medicine.

MINORITY STUDENT FELLOWS PROGRAM

With support from the U.S. Federal Highway Administration, the TRB Minority Student Fellows Program seeks to increase the participa-



Susan Hanson
Chair, Subcommittee
for NRC Oversight



Neil J. Pedersen
Executive Director



Russell W. Houston
Associate Executive
Director



Mark R. Norman
Director, Development
and Strategic
Initiatives



Subcommittee for NRC Oversight (SNO) members for 2016 (left to right): James M. Crites, Executive Committee Chair; Scott Bennett, Arkansas State Highway and Transportation Department; Susan Hanson, SNO Chair; Neil Pedersen, TRB Executive Director; Daniel Sperling, University of California, Davis; Paul Trombino III, Executive Committee Vice Chair; and John Halikowski, Arizona Department of Transportation. (Photo: Risdon Photography)

tion by Hispanic, African American, and Native American students in the Annual Meeting, TRB committees and activities, and transportation research.¹ The program provides expenses for students from 14 eligible institutions to attend the Annual Meeting and present research. Since the program began in 2010, 83 graduate and undergraduate students have participated, with a record number of 26 attending the 2016 Annual Meeting, and 21 selected for 2017.

PUBLICATIONS

TRB disseminates transportation research results and technical information through an array of publications assessing the state of the practice in specific areas, addressing major national transportation policy issues, and identifying research needs. TRB publishes the majority of its titles electronically, some exclusively in electronic format.

TRB books and reports span the range of transportation functions, disciplines, and modes. The TRB Publications Office produces titles in the following series:

- *Transportation Research Record: Journal of the Transportation Research Board* gathers technical papers that have been accepted for publication

¹ www.trb.org/abouttrb/minoritystudent.aspx.

through a rigorous peer review process refereed by TRB technical committees. In 2016, the Board published 64 volumes containing 834 papers grouped by subject. TRR Online, a subscription and pay-per-view service, includes all journal papers published since 1996, providing access to approximately 16,000 papers in the TRR series.² The service allows all visitors to identify papers of interest and to review the abstracts. Access to the full papers is available to TRR Online subscribers and to employees of TRB sponsors; papers also may be purchased individually. In 2016, approximately 170 papers accepted for publication without revision were edited, typeset, and posted to TRR Online between January 4 and March 31; the papers represented the first installments of 46 volumes. In addition, TRB assigned the digital object identifiers, or DOIs—which locate a paper more reliably than a web address or a search by title or author—soon after submittal, allowing authors to cite papers in advance of publication. In June, TRB announced plans to publish the journal exclusively online, starting in 2017. More changes are planned for 2017 to accelerate the release of journal papers and to increase the citations rating, as well as to upgrade the journal in accordance with industry standards.

- The bimonthly magazine *TR News* features timely articles on innovative and state-of-the-art research and practice in all modes of transportation. The Research Pays Off series, news items of interest to the transportation community, profiles

² www.trb.org/Finance/TRRJournalOnline1.aspx.



of transportation professionals, book summaries, and highlights of TRB activities also are included. In 2016, *TR News* published theme issues on the renaissance in bus transportation, new issues in aviation research, and transportation knowledge management. Selected features are posted on the TRB website, and the full issue is made accessible on the web on a four-month delay.³

- *Special Reports* contain the results of TRB policy studies on issues of national importance in transportation. These studies—many conducted at the request of federal agencies or of the U.S. Congress—focus on a variety of complex, often controversial, topics. Special reports published in 2016 included the print and final online versions of *Modernizing Freight Rail Regulation*; *Between Public and Private Mobility: Examining the Rise of Technology-Enabled Transportation Services*; *Inter-regional Travel: A New Perspective for Policy Making*; *Strengthening the Safety Culture of the Offshore Oil and Gas Industry*, along with a summary version, *Beyond Compliance*; and *Application of Real-Time Monitoring to Offshore Oil and Gas Operations*. All

³ www.trb.org/Publications/PubsTRNewsMagazine.aspx.



Marcella Carnes, Florida A&M University, shares her research on carbon fiber bonded to concrete for rehabilitation. Carnes was one of 26 Minority Student Fellows presenting research at the 2016 Annual Meeting. (Photo: Risdon Photography)



Theme issues of the bimonthly magazine *TR News* allow for in-depth exploration of research on a single topic; (above) Technical Activities Council member Hyun-A Park scans the theme issue on Transportation and Public Health, distributed at an Executive Committee policy session. (Photo: Risdon Photography)

current and selected out-of-print special reports are posted on the Board’s website.⁴

- *Conference Proceedings* assemble formal papers, presentations, and summaries of discussions from TRB conferences and workshops. A summary report on the fourth European Union–U.S. symposium, on transportation resilience in response to climate change, appeared in the Conference Proceedings series.⁵ Titles released in the Conference Proceedings on the Web series included *Automated and Connected Vehicles*, summarizing a University Transportation Centers conference, and *Transportation Systems Performance Measurement and Data*, highlighting presentations at an international conference.⁶

- *Transportation Research E-Circulars* collect research problem statements, reports, and technical information from the work of TRB Technical Activities committees. Titles this year covered such topics as sustainability, resilience to climate change and extreme weather events, transformational technologies, the future locomotive, light rail transit, access management in other nations, roadside safety design, freight fluidity performance measures, and asphalt mixture design. Circulars are available exclusively in electronic format on the TRB website.⁷

⁴ www.trb.org/Publications/PubsPolicyStudiesSpecialReports.aspx.

⁵ www.trb.org/Publications/PubsConferencesandWorkshopsConferenceProceedings.aspx.

⁶ www.trb.org/Publications/PubsConferencesandWorkshopsWeb.aspx.

⁷ www.trb.org/Publications/PubsTransportationResearchCirculars.aspx.

- *Miscellaneous Reports* include special publications. The sixth, completely revised and updated edition of the *Highway Capacity Manual*, subtitled *A Guide for Multimodal Mobility Analysis*,⁸ and the *Access Management Application Guidelines*⁹ were released in the last quarter of 2016.

In addition, the Cooperative Research Programs produced an array of titles in several publications series. For a list of all TRB publications, see pages 54–56.

COMMUNICATIONS

TRB has undertaken a variety of initiatives to improve the communication and public awareness of transportation issues and to enhance the dissemination of research findings worldwide.

Communications milestones for 2016 included the following:

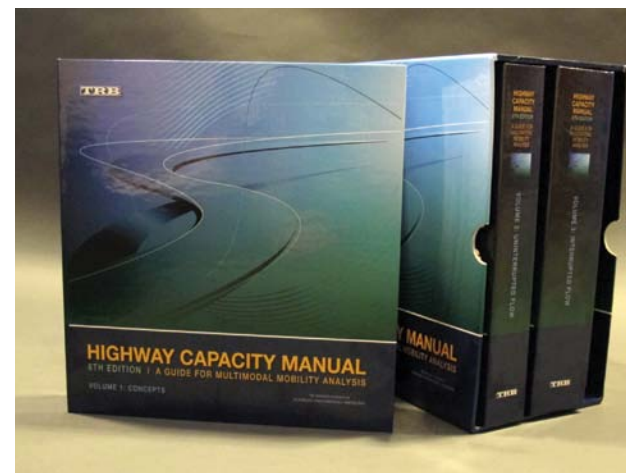
- Adoption of a strategic marketing and communications plan, featuring development of a new brochure, PowerPoint template, handouts, and introductory videos;
- Adoption of a social media strategic plan, which has stimulated engagement and growth on Twitter, with 16,300 followers; Facebook, with 6,000 likes; and LinkedIn, with 2,981 followers;¹⁰
- Reaching 64,000 subscribers to the NASEM TRB E-Newsletter;¹¹

⁸ www.trb.org/publications/hcm6e.aspx.

⁹ www.trb.org/Main/Blurbs/175418.aspx.

¹⁰ www.trb.org/ElectronicSessions/Twitter.aspx.

¹¹ www.trb.org/Publications/PubsTRBENewsletter.aspx.



The sixth edition of the *Highway Capacity Manual* was released in November 2016.



Communication of TRB's strategic initiatives included handouts and brochures as well as a social media plan.

- Attracting an average of 400,000 visits per month to TRB's website, www.TRB.org, with visitors almost evenly split between first-timers and returnees;
- Production of some 98 webinars attended by a total of more than 33,000 people;¹² and
- Creation of 14 TRB Straight to Recordings—on-demand webinars—that averaged more than 370 views.¹³

INFORMATION TECHNOLOGY AND RESEARCH SERVICES

The responsibilities of the Information Technology (IT) and Research Services group include customer support for internal and external users of TRB's software systems; software enhancement and development; server and website monitoring and security; general IT support activities, such as training, documentation, and troubleshooting; producing and managing the Transportation Research Information Services (TRIS) databases; and managing the TRB Library.

Information Technology

TRB relies on several software systems to meet program requirements: to maintain committee records, build and maintain TRB's extensive website, build and make available the TRIS bibliographic databases, support the Annual Meeting paper submittal and peer review process, and help manage and monitor the progress of Cooperative Research Programs projects and products.

In 2015, TRB introduced a new system to manage the Annual Meeting paper submission, paper peer review, and program development

processes. This new system was integrated with MyTRB, a portal that provides technical standing committee leaders with a suite of online tools to manage committees. MyTRB also allows committee members and other volunteers to maintain their own profiles and contact information. During 2016, the IT group continued to develop the Annual Meeting system in response to user feedback.

Transportation Research Information Services

TRIS continues to develop and maintain the TRIS databases:

- **TRID** is a comprehensive bibliographic database containing more than 1.1 million records of citations and abstracts of transportation research in all modes and disciplines.¹⁴ The records comprise published or ongoing research in English, German, French, or Spanish; more than 197,000 records link to full-text publications. All the TRIS databases are available free of charge on TRB's website.
- The **Publications Index** includes 68,000 citations and abstracts for all TRB, Highway Research Board (HRB), Strategic Highway Research Program (SHRP), and Marine Board publications

¹⁴ <http://trid.trb.org>.



End User Support Specialist Alan Rezaei helps acquaint an Annual Meeting attendee with MyTRB. (Photo: Risdon Photography)

¹² www.trb.org/ElectronicSessions/ConferenceRecordings.aspx.

¹³ www.trb.org/electronicSessions/str.aspx.

since 1923.¹⁵ Records contain links to available full-text documents and to ordering information.

■ The **Research Needs Statements** database is a dynamic collection of highest-priority topics developed by TRB technical standing committees.¹⁶ The database serves as a tool for reviewing research needs, setting research priorities, and identifying gaps in current research. More than 1,200 statements are posted.

■ **Research in Progress (RiP)** is a database of more than 14,000 records of active or recently completed research projects.¹⁷ The current awareness service notifies users about new and updated project records in specified subject areas. TRID offers users an option for searching the RiP database or the RiP and TRID databases simultaneously.

■ The **Practice-Ready Papers** database of some 3,000 records helps practitioners easily find TRB Annual Meeting and journal papers identified by peer reviewers as presenting research results immediately applicable to problems or issues.¹⁸ The database links to the full text of papers since 2006 and to abstracts from 1998 to 2005.

TRB Library

The TRB Library provides research and reference services to TRB sponsors, committee members, and staff. The library subscribes to more than 400 serial titles and contains the complete collection of TRB, HRB, SHRP, and Marine Board publications. The library participates in the Eastern Transportation Knowledge Network and in the National Transportation Knowledge Network.

¹⁵ <http://pubsindex.trb.org>.

¹⁶ <http://rns.trb.org>.

¹⁷ <http://rip.trb.org>.

¹⁸ www.trb.org/Publications/PubsPracticeReadyPapersBackground.aspx.



Phyllis D. Barber-Gray

Staff News

Phyllis D. Barber-Gray, Publishing Services Manager, retired in July after 53 years of invaluable contributions to the production and quality of TRB publications.

Jennifer J. Weeks was promoted to Publishing Projects Manager, and **Lea M. Camarda** was promoted to Editor.

Joining the Publications Office were **Linda Dziobek**, as Senior Editor–Journal Project Manager, and **James A. Parker**, as Senior Editorial Assistant.

The IT and Information Resources department added **Gareth Driver** as Help Desk–Business Systems Associate.



ADMINISTRATION AND FINANCE

THE TRB ADMINISTRATION and Finance Division provides financial management services and administrative support for the work of TRB staff; financial oversight of the contracts and grants related to TRB activities; expenditure controls; administration of publications sales and distribution; maintenance of the benefits and services for sponsor and affiliate organizations; and liaison to the administrative and financial offices of the National Academies of Sciences, Engineering, and Medicine.

FINANCIAL MANAGEMENT

The division manages the contracts and grants that support TRB's work, prepares budgets for continuing operations and individual projects, and controls expenditures. TRB's total expendi-



Bud Wright, American Association of State Highway and Transportation Officials (*left*), chats with Tony Furst (*center*) and Michael Trentacoste (*right*) of the Federal Highway Administration at a meeting of the TRB Executive Committee. AASHTO and FHWA are TRB sponsors. (Photo: Risdon Photography)

tures are estimated at \$88 million for the calendar year 2016. A statement of income and expenditures appears on pages 8–9.

AFFILIATE AND SPONSOR SERVICES

TRB's core programs have five main levels of support: student affiliates, individual affiliates, organizational affiliates, sustaining affiliates, and sponsors. All affiliates and sponsors contribute to the support of TRB activities through annual fees based on the level of services selected.

Individual and student affiliates' benefits include reduced registration fees for the TRB Annual Meeting; a complimentary subscription to *TR News*, TRB's magazine, which features articles on innovative and state-of-the-art research and practice in all modes of transportation; discounts on most TRB books and reports; and use of the TRB library.

Organizational affiliates include government agencies, academic organizations, private organizations, and consultants committed to the advancement of knowledge about the nature and performance of transportation systems and system components. In addition to the range of benefits for individual affiliates, organizational affiliates receive most publications at no cost, including complimentary access to TRR Online, the web posting of papers from the *Transportation Research Record: Journal of the Transportation Research Board*; and complimentary registrations—as well as marketing and exhibit opportunities—at the TRB Annual Meeting. Organizational affiliate contributions range from \$4,850 to \$11,875, depending on the level of benefits selected.

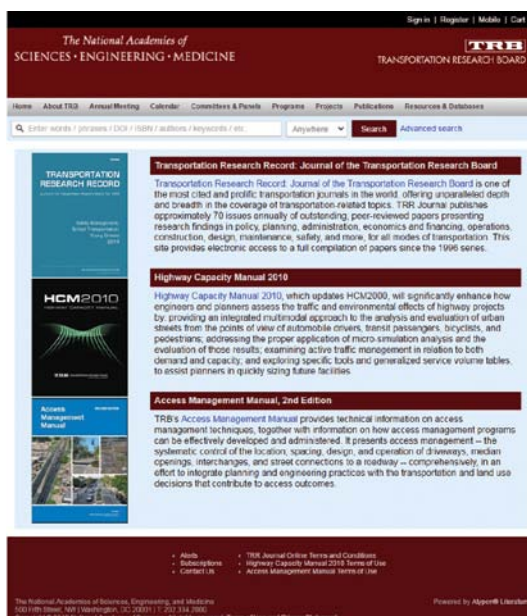


Gary J. Walker
Director
Finance and Business
Operations



The TRB exhibit at the 2016 Annual Meeting displayed information about a range of benefits in every category for sponsors and affiliates. (Photo: Risdon Photography)

In addition to the many benefits offered to an organizational affiliate, sustaining affiliates are entitled to complimentary registration to any TRB webinar. In 2016, TRB conducted approximately 100 webinars on a variety of topics, with a total of more than 33,000 registrants. The webinars offered more than 100 professional development hours for professional engineers, and certified planners had the opportunity to earn more than 50 hours of certification maintenance credits from the webinars approved by



Visitors to TRR Online can find all papers published in the *Transportation Research Record: Journal of the Transportation Research Board* since 1996 in electronic format.

the American Institute of Certified Planners. The minimum annual contribution to become a sustaining affiliate is \$19,000.

Sponsors are the major source of financial support for TRB's core programs. Federal, state, and local government agencies and professional societies and organizations that represent industry groups are eligible to participate as TRB sponsors. Fees and services are negotiated to fit each sponsor's needs and to assure fundamental support for the Board's programs and activities of interest to the entire transportation community. Each sponsor places a representative on the TRB Executive Committee. The current minimum annual contribution for a TRB sponsor is \$65,000. (See pages 49–50 for a list of TRB sponsors and sustaining affiliates.)

PUBLICATION SALES AND DISTRIBUTION

TRB disseminates the results of transportation research and technology worldwide through the timely distribution of its publications. In addition to printed editions, TRB publishes almost all publications—some exclusively—in electronic format. The *Transportation Research Record: Journal of the Transportation Research Board* is ceasing its print editions after the 2016 series and will be available only in electronic format starting in 2017.

Sponsors, sustaining and organizational affiliates, and subscribers have the option to receive all publications released by TRB or to receive only those publications in a particular transportation mode or select area of interest. A complete listing of TRB publications issued from January 1 through December 31, 2016, appears on pages 54–56.

Staff News

James W. (Jim) Henson, Jr., retired as Financial Officer in 2016 after more than 20 years of exemplary service to TRB and the National Academies' Office of the Chief Financial Officer.



INSTITUTIONAL AFFILIATES

SPONSORS

State Transportation Departments

(Listed with TRB Representatives)

Alabama Department of Transportation

Juanita Owens

Alaska Department of Transportation and Public Facilities

Carolyn Morehouse

Arizona Department of Transportation

Anne Ellis

Arkansas State Highway and Transportation Department

Elisha C. Wright-Kehner

California Department of Transportation

Jim Appleton

Colorado Department of Transportation

Amanullah Mommand

Connecticut Department of Transportation

Michael Connors

Delaware Department of Transportation

Drew Boyce

District Department of Transportation

Stephanie Dock

Florida Department of Transportation

James D. Dockstader

Georgia Department of Transportation

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Hawaii Department of Transportation

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Idaho Transportation Department

Ned E. Parrish

Illinois Department of Transportation

Megan Swanson

Indiana Department of Transportation

Barry K. Partridge

Iowa Department of Transportation

Peggi S. Knight

Kansas Department of Transportation

Richard Kreider

Kentucky Transportation Cabinet

Jason Siwula

Louisiana Department of Transportation and Development

Samuel Cooper

Maine Department of Transportation

Dale Peabody

Maryland State Highway Administration

Allison R. Hardt

Richard Y. Woo

Massachusetts Department of Transportation

Stephen Woelfel

Michigan Department of Transportation

Steven C. Bower

Minnesota Department of Transportation

Linda Taylor

Hafiz Munir

Mississippi Department of Transportation

James C. Watkins

Missouri Department of Transportation

William Stone

Montana Department of Transportation

Susan C. Sillick

Nebraska Department of Roads

Mick S. Syslo

Nevada Department of Transportation

Ken Chambers

New Hampshire Department of Transportation

Ann Scholz

New Jersey Department of Transportation

Camille Crichton-Sumners

New Mexico Department of Transportation

Randall Soderquist

New York State Department of Transportation

Debra A. Nelson

North Carolina Department of Transportation

Neil Mastin

North Dakota Department of Transportation

Ron Horner

Ohio Department of Transportation

Cynthia L. Jones

Oklahoma Department of Transportation

Ron Curb

Oregon Department of Transportation

Michael Edward Bufalino

Pennsylvania Department of Transportation

Michael R. Bonini

Rhode Island Department of Transportation

Colin A. Franco

South Carolina Department of Transportation

Terry Swygert

South Dakota Department of Transportation

David L. Huft

Tennessee Department of Transportation

Tanisha Hall

Texas Department of Transportation

Dana Glover

Utah Department of Transportation

Cameron T. Kergaye

Vermont Agency of Transportation

Joseph Segale

Virginia Department of Transportation

Jose P. Gomez

Washington State Department of Transportation

Leni Oman

West Virginia Department of Transportation

Donald L. Williams

Wisconsin Department of Transportation

Lori Richter

Wyoming Department of Transportation

Timothy McDowell

FEDERAL GOVERNMENT

U.S. Department of Transportation

Federal Aviation Administration

Federal Highway Administration

Federal Motor Carrier Safety Administration

Federal Railroad Administration

Federal Transit Administration

National Highway Traffic Safety Administration

Office of the Assistant Secretary of Transportation for
Research and Technology

Air Force Civil Engineer Center

Bureau of Indian Affairs

U.S. Army Corps of Engineers

U.S. Coast Guard

U.S. Department of Energy

U.S. Department of the Interior

OTHER ORGANIZATIONS

American Association of State Highway and Transportation
Officials

American Public Transportation Association

Association of American Railroads

South Coast Air Quality Management District

MARINE BOARD SPONSORS

Bureau of Offshore Energy Management

Maritime Administration

National Oceanic and Atmospheric Administration

Office of the Supervisor of Salvage and Diving, U.S. Navy

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TRB CONFERENCES AND WORKSHOPS

(JANUARY 1, 2016–DECEMBER 31, 2016)

JANUARY

- 9** TransportationCamp DC 2016
- 10–14** TRB 95th Annual Meeting
- 21–22** Shifting International Trade Routes Workshop

APRIL

- 3–5** Lifesavers National Conference on Highway Safety Priorities
- 12–15** 2016 Joint Rail Conference*
- 13–16** World Steel Bridge Symposium*
- 14–15** Ferry Safety and Technology Conference
- 22–28** World Tunnel Congress
- 25–27** International Conference on Winter Maintenance and Surface Transportation Weather
- 28** Women Transportation Leaders of the Northeast Panel Discussion

MAY

- 1–4** 6th Conference on Innovations in Travel Modeling
- 1–4** North American Travel Monitoring Exposition and Conference (NATMEC): Improving Traffic Data Collection, Analysis, and Use
- 4–6** 15th International Conference on Managed Lanes
- 17–19** Road Safety on Five Continents*

JUNE

- 2–3** Ferry Safety and Technology Conference
- 6–7** Exploring Data and Metrics of Value at the Intersection of Health Care and Transportation
- 12–14** 2nd International Symposium on Disaster Prevention and Mitigation of Highway Infrastructure
- 14–16** International Symposia on Enhancing Highway Performance: 7th International Symposium on Highway Capacity and Quality of Service and 3rd International Symposium on Freeway and Tollway Operations*

21–23 From Sail to Satellite: Delivering Solutions for Tomorrow's Marine Transportation Systems

26–29 American Society of Civil Engineers International Conference on Transportation and Development*

26–30 8th International Conference on Bridge Maintenance, Safety and Management*

27–30 National Equipment Fleet Management Conference*

JULY

- 6–7** 3rd International Conference on Access Management*
- 6–13** Chan Wui and Yunyin Rising Star Workshop for Early Career Professionals
- 10–12** 11th National Conference on Transportation Asset Management
- 11** Geological Modeling: Methods and Methodologies
- 16–18** International Conference on Transportation Infrastructure and Materials
- 17–20** 55th Annual Workshop on Transportation Law
- 17–20** Transportation-Related Environmental Analysis, Ecology and Historic and Archeological Preservation Summer Conference
- 19–21** Automated Vehicles Symposium 2016*
- 24–27** Transportation-Related Noise and Vibration Committee Summer Conference
- 25–27** GeoChina 2016 International Conference*
- 26–29** Resource Conservation and Recovery Summer Conference

AUGUST

- 4–5** Transportation Planning and Air Quality Conference
- 8–10** Istanbul Bridge Conference*
- 9–11** 2016 Summerail Conference*
- 14–17** Use of Scenario Planning in Transportation Planning
- 16** 2016 Innovations in Transportation Conference: Are You Ready for the Future?*

SEPTEMBER

- 4–7** 3rd International Conference on Transportation Geotechnics*
- 12–14** 15th National Tools of the Trade
- 13–15** 21st-Century Waterways: The Changing Tide of Harbor Safety—16th Biennial Harbor Safety Committee Conference
- 19–21** 5th International Conference on Accelerated Pavement Testing*
- 25–29** 8th World Congress on Joints, Bearings, and Seismic Systems for Concrete Structures*
- 26–28** International Conference on Demand-Responsive Transportation

OCTOBER

- 2–5** 22nd National Conference on Rural Public and Intercity Bus Transportation
- 5–7** European Transport Conference*
- 31–Nov. 1** Partners in Research Symposium

DECEMBER

- 1–2** 10th University Transportation Centers Spotlight Conference: Bicycles and Pedestrians
- 5** Symposium and Webcast on Data-Driven City Planning and Policy

*TRB was cosponsor of the meeting.

TRB WEBINARS, WEBCASTS, AND STRAIGHT-TO-RECORDING SESSIONS (JANUARY 1, 2016–DECEMBER 31, 2016)

JANUARY

- 26 Using the Updated TRID Interface
- 28 Promising Practices for Construction, Repair and Rehabilitation of Continuously Reinforced Concrete Pavement

FEBRUARY

- 1 Straight to Recording: Breaking Down Barriers—Funding and Finance Issues and Innovations in Public Transportation
- 3 Transportation Security Awareness and All-Hazards Emergency Training
- 4 Understanding Transportation Safety Risks on Tribal Lands: Learning from a Collaborative Research Project with American Indian Communities in Minnesota
- 10 Improving the Earthquake Performance of Bridges Using Seismic Isolation
- 11 Implementing Energy-Efficient Technologies for Cost Savings at Airports
- 18 Improved Test Methods for Specific Gravity and Absorption of Coarse and Fine Aggregate
- 22 Tools for Optimizing Performance of Airport Operations and Maintenance
- 25 Environmental Protection Agency's Revised Ozone Standard
- 29 A Sampling of Winter Maintenance Best Practices in Europe

MARCH

- 1 –Current Practices in Conducting Field Inspections for Maintenance Quality Assurance
 - Straight to Recording: U.S. Department of Transportation (DOT) Public Access Plan: Overview and Data Management Primer
- 7 Cities Beyond Driving
- 8 Comprehensive Analysis of Thermal Cracking in Asphalt Pavements
- 9 Lessons Learned from 10+ Years of Using Full-Depth Reclamation for Road Rehabilitation
- 15 Air Service Strategies for Small, Medium, and Non-Hub Airports in Today's Competitive Environment
- 17 Identifying and Developing New Sources of Airport Revenue
- 24 Scalability of Roundabouts

- 29 Performance Management: An Optimized Investment Portfolio
- 30 Straight to Recording: Understanding Pedestrian Behaviors and Traffic Controls at Signalized Crosswalks for Safety Improvement
- 31 New Technologies for Renewable Energy in the Public Right of Way

APRIL

- 1 Straight to Recording: Supplemental Guidance on the Application of Federal Highway Administration's (FHWA's) Traffic Noise Model
- 6 Effective Emergency Management Preparedness for Airports of all Sizes
- 7 Properties and Short-Term Laboratory Conditioning of Foamed Asphalt for Warm-Mix Asphalt Applications
- 11 Using Asset Valuation as a Basis for Bridge Maintenance and Replacement Decisions
- 13 Resistivity Measurements in Concrete
- 19 Estimating the Life-Cycle Cost of Intersection Designs
- 20 Wrong Way Driving: What We Know, What We Are Doing, and Where Are We Going
- 25 Guidance for General Aviation Facility Planning
- 27 Transparent Best Value Selection Procedures
- 28 Technology Readiness Level Assessments for Research Program Managers and Customers

MAY

- 3 Roundabout Construction Plans and Specifications: Development and Application of Practices
- 4 Health Impact Assessments: Their Role in Transportation Planning
- 5 National Transit Institute (NTI) Webinar: TCRP Report 181—Labor-Management Partnerships for Public Transportation*
- 9 Straight to Recording: Innovations in Public Transportation Planning and Modeling Utilizing General Transit Feed Specification

- 10 Indefinite Delivery-Indefinite Quantity Contracting Practices
- 12 Economic and Financial Dimensions to a Climate Resilient Transportation Infrastructure
- 16 Using Pavement Management System Data to Meet Agency Needs
- 17 Straight to Recording: Air Quality Fundamentals
- 24 Legal Aspects of Airport Programs
- 25 Minimizing the Risk of Early Age Cracking in Concrete
- 26 Data to Support Transportation Agency Business Needs: A Self-Assessment Guide
- 27 Straight to Recording: Automated Transit Future Impacts on the Built Environment

JUNE

- 2 Impact of Mega Events on Urban Growth Through Sustainable Transportation Solutions
- 7 –NTI Webinar: TCRP Report 169—Developing Best-Practice Guidelines for Improving Bus Operator Health and Retention*
 - Straight to Recording: Improving the Quality of ACRP Research
 - Quality Management Plans for Network-Level Pavement Data Collection
- 9 Considerations for Transporting Passengers to, and Through, Airport Facilities
- 15 Application of Human Factors Guideline for Road Systems
- 20 Thin Asphalt Concrete Overlays
- 21 Straight to Recording: Applying Game Theory to Promote Strategic Decision Making in Marine Transportation Scenarios
- 23 Introduction to Structural Design of Buried Bridges (Nonseismic)
- 27 Consideration of Preservation in Pavement Design and Analysis Procedures
- 30 Converting Paved Roads to Unpaved

JULY

- 6 Value of Transportation Infrastructure: Pathways to Measure Transportation's Contribution to the Economy

- 7 Considerations for Airport Capacity Projects
- 12 Using Technology for Practical Purposes in Work Zones
- 13 Unmanned Aircraft Systems at Airports
- 14 Management Guide to Intellectual Property for State Departments of Transportation
- 18 Inverted Pavements
- 20 Visualization of Geotechnical Data for Hazard Mitigation and Disaster Response: A Practical Update
- 21 Use of Geothermal Energy in Snow Melting and Deicing of Transportation Infrastructures

AUGUST

- 4 Controlling Corrosion of Infrastructure Systems
- 10 Volume Reduction of Highway Runoff in Urban Areas
- 11 Guidance on Developing Crash Modification Factors
- 16 Learning About and Using the Research in Progress Database
- 17 Development and Implementation of the Reflective Cracking Model in the Mechanistic-Empirical Pavement Design Guide
- 18 The Evolving Surface Transportation Operations and Maintenance Workforce: Challenges and Opportunities
- 22 Moisture and Compaction Measurement During Unbound Aggregate Layer Construction
- 29 Concepts in Soil-Foundation-Bridge Structure Interaction
- 30 Developing In-Stream Flow Control Structure Guidance Combining Field, Laboratory, and Numerical Experiments
- 31 Measurement and Evaluation of Pavement Splash and Spray

SEPTEMBER

- 1 Straight to Recording: Planning and Design of Nontraditional Airports
- 6 Design and Preservation of Low Volume Roads
- 7 Guide to 21st-Century Planning at State Departments of Transportation
- 8 An Understanding of the Economic Impact of Airports and Their Operations
- 12 Improved Specimen Preparation for Soil-Cement Design and Construction Monitoring

- 13 Design Guidance for Intersection Auxiliary Lanes
- 15 Models Used in Air Quality Analysis
- 19 States' Practices on Roundabout Selection, Design, and Performance Analysis
- 20 Highlights from the 11th National Conference on Transportation Asset Management
- 26 The Marriage of Roundabouts and Access Management
- 27 Vulnerable Road Users Safety: What Cities Can Do To Make Things Better
- 28 Validation of Guidelines for Evaluating the Moisture Susceptibility of Warm-Mix Asphalt Technologies
- 29 Shared Mobility and the Transformation of Public Transit
- 30 Straight to Recording: Towards Cyber Physical Systems in Construction

OCTOBER

- 5 Current State of Department of Transportation Mobile Information Technology Use in the Field
- 6 Development and Validation of Performance-Based Hot-Poured Crack Sealant Specifications
- 11 Federal Emergency Management Agency Public Assistance and FHWA Emergency Relief Funds Reimbursements
- 12 Selection of Alternative Quality Management Systems for Highway Construction
- 13 Integrating Climate Change Resilience into Transportation Asset Management
- 17 ActiveTrans Priority Tool: A Model Methodology for Prioritizing Pedestrian and Bicycle Improvements on Existing Roads
- 19 Sign and Pavement Marking Retroreflectivity: A State DOT Perspective on Measurement Basics, Safety Benefits, and Advancements
- 20 Renewable Energy Use and Sustainability Practices at Airports
- 24 Performance of Geosynthetic Reinforced Soil Integrated Bridge Systems
- 25 Determination of In-Place Elastic Layer Modulus: Backcalculation Methodology and Procedures
- 27 Improving Rear Seat Passenger Safety: Challenges and Strategies
- 28 Webinar on the Value of Transportation: Asset Valuation
- 31 Using Electrical Resistivity for Geotechnical Applications

NOVEMBER

- 2 Improving and Enhancing the Airport Customer Experience
- 3 Environmental Performance Measures for State Departments of Transportation
- 7 Using Interferometric Synthetic Aperture Radar for Networkwide Transportation Infrastructure Monitoring
- 9 -Energy Development and U.S. Infrastructure
 - Highway Capacity Manual Webinar Series
- 15 Construction, Quality Control, and Performance of Unbound Granular Layers
- 16 -Practical Techniques for Successfully Communicating Technical Topics
 - How to Survive and Thrive at the TRB Annual Meeting
- 17 Collecting Data for Airport Emissions Modeling
- 29 Safety on Low-Volume Roads
- 30 Roller-Compacted Concrete: Recent Research and Development

DECEMBER

- 5 Symposium and Webcast on Data-Driven City Planning and Policy
- 6 Bridge Preservation in Corrosive Environments Using Cathodic Protection
- 7 A New Transportation Safety Planning Framework
- 13 What Do Americans Think of Mileage Fees?
- 14 Effective Stakeholder Relationships at Airports

*TRB was cosponsor of the webinar.

TRB PUBLICATIONS

(JANUARY 1, 2016–DECEMBER 31, 2016)

Transportation Research Records

- 2539 Public Transportation, Volume 1: Urban and Rural Bus Services
- 2540 Public Transportation, Volume 2: Passenger Rail and Terminals
- 2541 Public Transportation, Volume 3: Management, Performance, and Quality of Service
- 2542 Public Transportation, Volume 4: Paratransit, Accessibility, Mobility, and the Sharing Economy
- 2543 Public Transportation, Volume 5: Planning and Parking
- 2544 Public Transportation, Volume 6: Marketing, Fare Policy, and Transformative Data Trends
- 2545 Railroads, Volume 1
- 2546 Railroads, Volume 2
- 2547 Freight Systems, Volume 1
- 2548 Freight Systems, Volume 2
- 2549 Marine Transportation and International Trade
- 2550 Maintenance and Preservation
- 2551 Maintenance Services, Transportation Weather, and Winter Maintenance
- 2552 Research and Education
- 2553 Highway Capacity and Quality of Service
- 2554 Freeway Operations; Regional Systems Management and Operations; Managed Lanes
- 2555 Visibility and Work Zone Traffic Control
- 2556 Operational Effects of Geometrics and Access Management
- 2557 Traffic Signal Systems, Volume 1
- 2558 Traffic Signal Systems, Volume 2
- 2559 Intelligent Transportation Systems and Connected and Automated Vehicles
- 2560 Traffic Flow Theory and Characteristics, Volume 1
- 2561 Traffic Flow Theory and Characteristics, Volume 2
- 2562 Traffic Control Devices
- 2563 Travel Demand Forecasting, Volume 1
- 2564 Travel Demand Forecasting, Volume 2
- 2565 Travel Behavior, Volume 1
- 2566 Travel Behavior, Volume 2
- 2567 Network Modeling
- 2568 Planning
- 2569 Aviation
- 2570 Air Quality
- 2571 Environment
- 2572 Energy, Alternative Fuels, and Climate Change
- 2573 Construction
- 2574 Asphalt Materials and Mixtures, Volume 1
- 2575 Asphalt Materials and Mixtures, Volume 2
- 2576 Asphalt Materials and Mixtures, Volume 3
- 2577 Concrete Materials
- 2578 Geological, Geoenvironmental, and Geotechnical Engineering, Volume 1
- 2579 Geological, Geoenvironmental, and Geotechnical Engineering, Volume 2
- 2580 Geological, Geoenvironmental, and Geotechnical Engineering, Volume 3
- 2581 Developing Countries
- 2582 Safety Management, School Transportation, and Safety Workforce Development
- 2583 Statistical Methods and Highway Safety Performance 2016
- 2584 Operator Education and Regulation; Safe Mobility for Older Persons; Traffic Law Enforcement; Occupant Protection; Alcohol and Other Drugs
- 2585 Truck and Bus Safety; Roundabouts
- 2586 Pedestrians
- 2587 Bicycles and Motorcycles

- 2588 Highway Design
- 2589 Pavement Management, Volume 1
- 2590 Pavement Management, Volume 2
- 2591 Pavement Management, Volume 3
- 2592 Structures
- 2593 Traffic Monitoring: Automobiles, Trucks, Bicycles, and Pedestrians
- 2594 Data and Methods to Understand Travel
- 2595 Information Technology, Geospatial Information, and Advanced Computing
- 2596 Managing Performance and Assets; Freight Data and Visualization
- 2597 Revenue, Finance, Pricing, and Economics
- 2598 Socioeconomics, Sustainability, Health, and Human Factors
- 2599 Systems Resilience and Climate Change
- 2600 Public-Sector Aviation: Graduate Research Award Papers, 2016
- 2601 Safety Data, Analysis, and Evaluation
- 2602 Human Performance, User Information, and Simulation

Special Reports¹

- 320 Interregional Travel: A New Perspective for Policy Making
- 321 Strengthening the Safety Culture of the Offshore Oil and Gas Industry
- Beyond Compliance: Strengthening the Safety Culture of the Offshore Oil and Gas Industry [derivative report]
- 322 Application of Remote Real-Time Monitoring to Offshore Oil and Gas Operations

Conference Proceedings¹

- 53 Transportation Resilience: Adaptation to Climate Change and Extreme Weather Events

Conference Proceedings on the Web (online)

- 18 Transportation Systems Performance Measurement and Data: Summary of the 5th International Conference
- 19 Automated and Connected Vehicles: Summary of the 9th University Transportation Centers Spotlight Conference
- 20 Transportation Asset Management: Summary of the 11th National Conference

Letter Reports (online)

- Long-Term Bridge Performance Committee Letter Report 6, February 23
- Impact of the U.S. Coast Guard Regulations on U.S. Flag Registry, February 25
- Long-Term Pavement Performance Committee Letter Report 37, February 26
- Long-Term Pavement Performance Committee Letter Report 38, May 16
- Long-Term Bridge Performance Committee Letter Report 7, July 5
- Research and Technology Coordinating Committee Letter Report, September 6
- Committee on the Review of Department of Transportation Testing of Electronically Controlled Pneumatic (ECP) Brakes Letter Report, October 26
- Transit Research Analysis Committee Letter Report, November 11

Transportation Research E-Circulars (online)

- 204 Surface Transportation System Resilience to Climate Change and Extreme Weather Events
- 205 Commodity Flow Survey Workshop
- 206 Trends and Issues in Marine Transportation and the Environment
- 207 Advancing Freight Fluidity Performance Measures: Summary of a Workshop
- 208 Transformational Technologies in Transportation: State of the Activities
- 209 Integrating Asphalt Mixture Design, Structural Design, and Construction Quality Control

- 210 Multimobility and Sharing Economy: Shaping the Future Market Through Policy and Research
- 211 Taxonomy and Terms for Stakeholders in Senior Mobility
- 212 The Future Locomotive: How to Manage What You Have Today with a View to the Future
- 213 13th National Light Rail and Streetcar Conference: Transforming Urban Areas
- 214 International Practice in Highway Access Management: A Primer
- 215 Roadside Safety Design and Devices: International Workshop
- 216 International Experience and Perspective of Pavement Texture Measurements and Evaluation
- 217 Exploring New Directions for the National Household Travel Survey: Phase Two Report of Activities
- 218 Advancing Freeway Operations Through Strategic Research

TR News

Nos. 301-306

Online Newsletters

TRB Transportation Research E-Newsletter

Miscellaneous Publications

Access Management Application Guidelines
 Highway Capacity Manual, 6th Edition: A Guide for Multimodal Mobility Analysis

Airport Cooperation Research Program (ACRP) Reports²

- 150 NextGen for Airports
 - Volume 1: Understanding the Airport’s Role in Performance-Based Navigation: Resource Guide
 - Volume 2: Engaging Airport Stakeholders—Guidebook
 - Volume 3: Resources for Airports
 - Volume 4: Leveraging NextGen Spatial Data for Airports: Guidebook
- 151 Developing a Business Case for Renewable Energy at Airports (with CD-177)
- 152 Evaluating Methods for Determining Interior Noise Levels Used in Airport Sound Insulation Programs
- 153 Guidebook for Irregular Operations (IROPS) Stakeholder Communication and Coordination (with CD-180)
- 154 Water Efficiency Management Strategies for Airports
- 156 Guidebook for Managing Compliance with Federal Regulations: An Integrated Approach
- 157 Improving the Airport Customer Experience
- 158 Deriving Benefits from Alternative Aircraft-Taxi Systems
- 159 Pavement Maintenance Guidelines for General Aviation Airport Management
- 160 Addressing Significant Weather Impacts on Airports: Quick Start Guide and Toolkit
- 161 Guidelines for Improving Airport Services for International Customers
- 162 Guidebook for Assessing Airport Lead Impacts
- 163 Guidebook for Preparing and Using Airport Design Day Flight Schedules
- 164 Exhaust Emissions from In-Use General Aviation Aircraft
- 165 Tracking Alternative Jet Fuel

ACRP Syntheses of Airport Practice²

- 69 Airport Sustainability Practices: Drivers and Outcomes for Small Commercial and General Aviation Airports
- 70 Building Information Modeling for Airports
- 71 Airport Safety Risk Management Panel Activities and Outcomes
- 72 Tabletop and Full-Scale Emergency Exercises for General Aviation, Non-Hub, and Small Hub Airports
- 73 Emergency Communications Planning for Airports
- 74 Combining Mixed-Use Flight Operations Safely at Airports
- 75 Airport Advisories at Non-Towered Airports
- 76 Helicopter Noise Information for Airports and Communities
- 77 Airport Sustainability Practices
- 78 Continuity of Operations Planning for Small Airports

ACRP Research Results Digests²

- 23 Synthesis of Information Related to Airport Practices: 2016
- 24 Recommended Community Noise Model Enhancements to Improve Prediction of Helicopter Activity Impacts

ACRP Legal Research Digests²

- 27 The Fourth Amendment and Airports
- 28 Operational and Legal Issues with Fuel Farms
- 29 Impact of Firearms Laws on Airports
- 30 Contract Risk Management for Airport Agreements

ACRP Web-Only Documents (online)

- 26 Methodology to Improve AEDT Quantification of Aircraft Taxi-Idle Emissions
- 27 Methodologies to Develop the Airport Terminal Building Energy Use Intensity (ATB-EUI) Benchmarking Tool
- 29 Compendium of State and Federal Laws Affecting the Possession of Firearms at Airports

Hazardous Materials Cooperative Research Program (HMCRP) Web-Only Document (online)

- 3 Evaluation of Small Quantities of Class 3 and Class 9 Hazardous Materials in Transportation

National Cooperative Freight Research Program (NCFRP) Reports²

- 36 Enhancing Sleep Efficiency on Vessels in the Tug-Towboat-Barge Industry

National Cooperative Highway Research Program (NCHRP) Reports³

- 817 Validation of Guidelines for Evaluating the Moisture Susceptibility of WMA Technologies
- 818 Comparing the Volumetric and Mechanical Properties of Laboratory and Field Specimens of Asphalt Concrete
- 819 Self-Consolidating Concrete for Cast-in-Place Bridge Components
- 820 Framework for a Pavement-Maintenance Database System (with CD 179)
- 821 Effective Project Scoping Practices to Improve On-Time and On-Budget Delivery of Highway Projects
- 822 Evaluation and Assessment of Environmentally Sensitive Stream Bank Protection Measures (with CD-183)
- 823 Guidelines for Certification and Management of Flexible Rockfall Protection Systems
- 824 Methodology for Estimating the Value of Travel Time Reliability for Truck Freight System Users
- 825 Planning and Preliminary Engineering Applications Guide to the Highway Capacity Manual
- 826 Estimating Highway Preconstruction Services Costs
 - Volume 1: Guidebook
 - Volume 2: Research Report
- 827 Navigating Multi-Agency National Environmental Policy Act (NEPA) Processes to Advance Multimodal Transportation Projects
- 828 Guidelines for Nighttime Visibility of Overhead Signs
- 829 Leadership Guide for Strategic Information Management for State Departments of Transportation
- 830 Multi-State, Multimodal, Oversize-Overweight Transportation
- 831 Civil Integrated Management for Departments of Transportation
 - Volume 1: Guidebook
 - Volume 2: Research Report
- 832 State DOTs Connecting Users and Rides for Specialized Transportation
 - Volume 1: Research Report
 - Volume 2: Toolkit for State DOTs and Others
- 833 Assessing, Coding, and Marking of Highway Structures in Emergency Situations
 - Volume 1: Research Overview
 - Volume 2: Assessment Process Manual
 - Volume 3: Coding and Marking Guidelines
- 834 Crossing Solutions at Roundabouts and Channelized Turn Lanes for Pedestrians with Vision Disabilities
- 835 Guidelines for Implementing Managed Lanes

NCHRP Syntheses of Highway Practice³

- 483 Training and Certification of Highway Maintenance Workers
- 484 Influence of Geotechnical Investigation and Subsurface Conditions on Claims, Change Orders, and Overruns
- 485 Converting Paved Roads to Unpaved
- 486 State Practices for Local Road Safety
- 487 Public Perception of Mileage-Based User Fees
- 488 Roundabout Practices
- 489 Extending Bridge Service Life Through Field Welded Repairs and Retrofits
- 490 Practice of Rumble Strips and Rumble Stripes
- 491 Uses of Mobile Information Technology Devices in the Field for Design, Construction, and Asset Management
- 492 Performance Specifications for Asphalt Mixtures
- 493 Practices for High-Tension Cable Barriers
- 494 Life-Cycle Cost Analysis for Management of Highway Assets
- 495 Use of Reclaimed Asphalt Pavement and Recycled Asphalt Shingles in Asphalt Mixtures
- 496 Minimizing Roadway Embankment Damage from Flooding
- 497 Post-Extreme Event Damage Assessment and Response for Highway Bridges
- 498 Application of Pedestrian Crossing Treatments for Streets and Highways
- 500 Control of Concrete Cracking in Bridges

NCHRP Research Results Digests³

- 398 Continuing Project to Synthesize Information on Highway Practices
- 399 Field Validation of Laboratory Tests to Assess Cracking Resistance of Asphalt Mixtures: An Experimental Design
- 400 Sample Size Implications of Multi-Day GPS-Enabled Household Travel Surveys

NCHRP Legal Research Digests³

- 69 A Look at the Legal Environment for Driverless Vehicles
- 70 Takings and Mitigation
- 71 Liability of Transportation Entity for the Unintentional Release of Secure Data or the Intentional Release of Monitoring Data on Movements or Activities of the Public
- 72 Summary of Federal Law Restricting Use of Highway Safety Data in Tort Litigation

NCHRP Web-Only Documents (online)

- 215 Incident Command System (ICS) Training for Field-Level Transportation Supervisors and Staff
- 218 Field Evaluation of Reflected Noise from Single Noise Barrier—Phase 1
- 219 Hamburg Wheel-Track Test Equipment Requirements and Improvements to AASHTO T 324
- 220 Estimating the Life-Cycle Cost of Intersection Designs
- 221 Protection of Transportation Infrastructure from Cyber Attacks: A Primer
- 223 Guidelines for Development of Smart Apps for Assessing, Coding, and Marking Highway Structures in Emergency Situations
- 224 Research Supporting the Development of Guidelines for Implementing Managed Lanes

National Cooperative Rail Research Program (NCRRP) Reports

- 4 Intercity Passenger Rail in the Context of Dynamic Travel Markets
- 5 Developing Multi-State Institutions to Implement Intercity Passenger Rail Programs
- 6 Guidebook for Intercity Passenger Rail Service and Development

NCRRP Legal Research Digest²

- 3 Issues That Emerge when Public Entities Acquire a Real Property Interest in Rail Lines

NCRRP Web-Only Documents (online)

- 2 Bibliography and Technical Appendices to Intercity Passenger Rail in the Context of Dynamic Travel
- 3 Documentation of Case Studies for NCRRP Project 07-02

Transit Cooperative Research Program (TCRP) Reports (online)

- 182 Linking Transit Agencies and Land Use Decision Making: Guidebook for Transit Agencies
- 183 A Guidebook on Transit-Supportive Roadway Strategies
- 184 Maintenance Technician Staffing Levels for Modern Public Transit Fleets
- 185 Bus Operator Workstation Design for Improving Occupational Health and Safety
- 186 Economic Impact Case Study Tool for Transit
- 187 Livable Transit Corridors: Methods, Metrics, and Strategies
- 188 Shared Mobility and the Transformation of Public Transit

TCRP Syntheses of Transit Practice (online)

- 119 Use of Taxis in Public Transportation for People with Disabilities and Older Adults
- 120 Use of Automotive Service Excellence Tests Within Transit
- 121 Transit Agency Practices in Interacting with People Who Are Homeless
- 122 Transit Supportive Parking Policies and Programs
- 123 Onboard Camera Applications for Buses

TCRP Research Results Digests (online)

- 111 Synthesis of Information Related to Transit Practices: 2015
- 112 Contracting Commuter Rail Services

TCRP Web-Only Documents (online)

- 66 Improving Transportation Network Efficiency Through Implementation of Transit-Supportive Roadway Strategies
- 67 Protection of Transportation Infrastructure from Cyber Attacks: A Primer
- 68 Developing an ITS Technology Web Portal for Transit System Leaders

Cooperative Research Programs CD-ROMs

- 177 Supplemental Information for ACRP Report 151
- 178 Airport Terminal Building Energy Use Intensity (ATB-EUI) Benchmarking Tool
- 179 Pavement Maintenance Database
 - Volume 1: Framework
 - Volume 2: Sample Data
- 180 IROPS Tools for Planning, Communication, and Coordination
- 181 End Use Water Audit Tool
- 182 Regulation Compliance Management Tool
- 183 NCHRP Report 822 Compendium of Field Data, Documentation, and Photographs

¹ Available in print and online.

² Entire series available in print and online.

³ Publications released since 2001 available in print and online.

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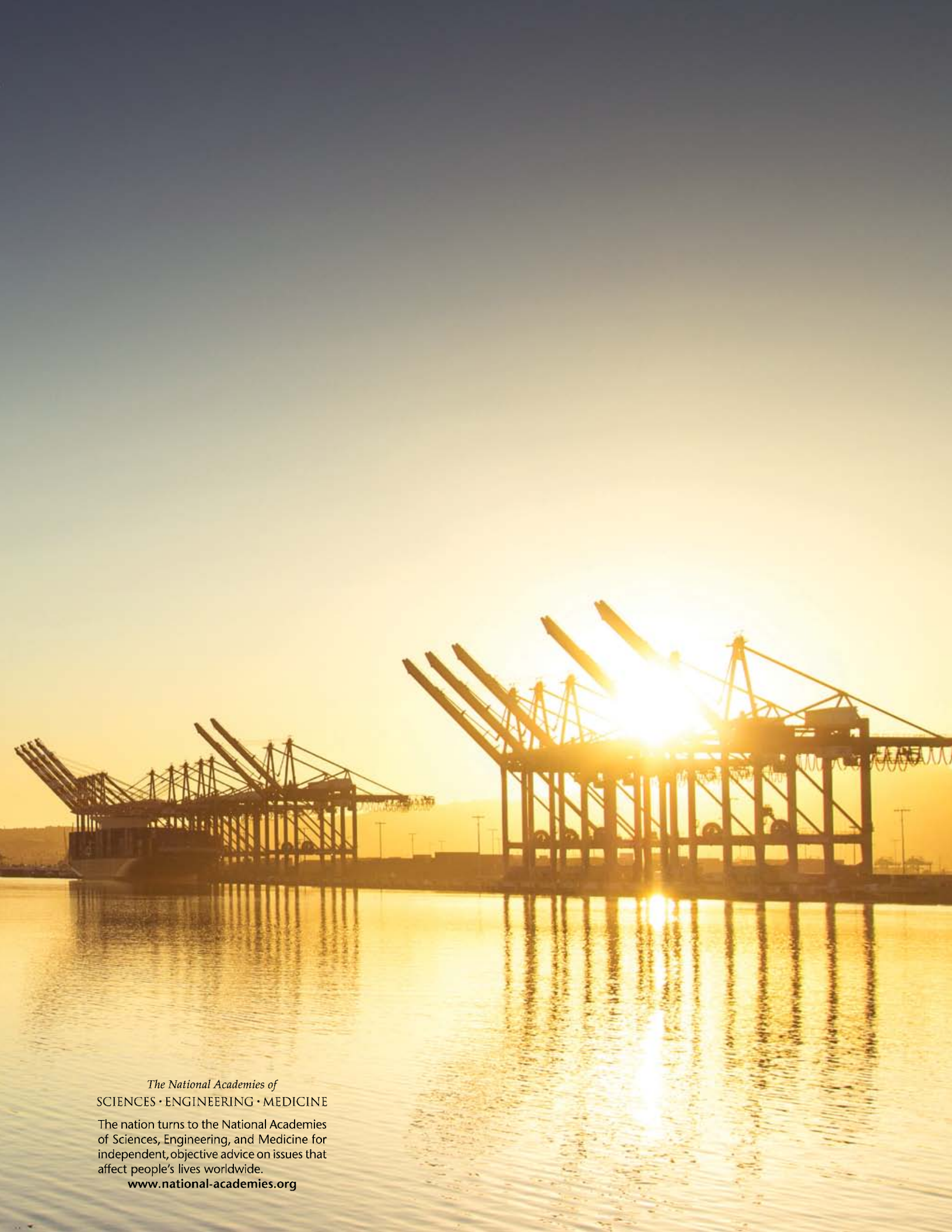
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