TR NEWS

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COVER: The standing ovation for outgoing TRB Executive Director Robert E. Skinner, Jr., who received the Frank Turner Medal for Lifetime Achievement in Transportation, was one of many—actual and metaphorical—standing ovations for TRB's Annual Meeting in its new, spacious, and accommodating venue.

TR NEWS

features articles on innovative and timely research and development activities in all modes of transportation. Brief news items of interest to the transportation community are also included, along with profiles of transportation professionals, meeting announcements, summaries of new publications, and news of Transportation Research Board activities.

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Javy Awan, Editor and Publications Director
Lea Camarda, Associate Editor
Jennifer J. Weeks, Photo Researcher
Juanita Green, Production Manager
Michelle Wandres, Graphic Designer

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Editorial Correspondence: By mail to the Publications Office, Transportation Research Board, 500 Fifth Street, NW, Washington, DC 20001, by telephone 202-334-2972, by fax 202-334-3495, or by e-mail jawan@nas.edu.

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ALSO IN THIS ISSUE:

COMING NEXT ISSUE

Articles in the next *TR News* explore the effects of the changing world energy market on the transportation industry, with deliveries of coal declining, natural gas use on the increase, and oil shipments from North American locations rising to challenge overseas sources. Authors examine the changing energy market by energy source, the transportation of North American crude oil, the effects on the U.S. Gulf ports and on barges and inland waterways, natural gas pipelines in New England, the effects of increased truck traffic on Pennsylvania roads, the shipment of crude oil by rail—including the crash in Lac Megantic, Canada—and more.

PHOTO: AMANDA GRAHAM, FLICKR

A tanker carries liquefied natural gas. New technology, energy sources, and routes are changing the transportation of fuels.

Evolving to Meet Customers' Needs in the 21st Century

Implementing the Transportation Research Board's Strategic Plan

NEIL J. PEDERSEN

The author became TRB's 10th Executive Director in February. A longtime volunteer leader in TRB, notably as Chair of the TRB Executive Committee and of the Technical Activities Council, Pedersen joined the TRB staff in 2012 as Deputy Director of the second Strategic Highway Research Program. He is the former Administrator of the Maryland State Highway Administration.

A change in an organization's executive leadership offers an occasion to reflect on its strategic challenges and opportunities, as well as on its future direction. TRB is a large and complex organization; it is an integral part of the National Academies and the National Research Council[1] (NRC); it depends on a number of sponsoring organizations; it engages more than 7,000 volunteers on committees, panels, and task forces; it provides products and services to hundreds of thousands of customers throughout the world; and it has a talented staff of professionals who support its diverse portfolio of activities, studies, and services.

TRB is highly regarded for providing a neutral forum for information exchange among researchers and practitioners on policy and on technical innovation in transportation, for managing research programs, and for producing policy studies based on objective data and research. TRB's challenge is to maintain and build on what it does well, recognizing at the same time that issues, trends, and expectations are constantly evolving and that TRB must evolve to maximize its value to its sponsors, participants, and customers.

TRB faces five strategic challenges, all presenting pivotal opportunities. These challenges and opportunities are my intended focus as Executive Director.

[1] Effective July 1, 2015, the National Academies, including the National Research Council, will be known externally under a new institutional name, "The National Academies of Sciences, Engineering, and Medicine."

Dan Turner, Technical Activities Council Chair, contributes to the discussion of TRB's Strategic Plan at a 2014 meeting of the Subcommittee for Planning and Policy Review.

PHOTO: RISDON PHOTOGRAPHY

As technology advances, TRB must adapt its methods of presenting and publicizing research and major events such as the Annual Meeting.

TRB's role as a neutral forum allows for robust information exchange. Steve Morse, Western Carolina University College of Business, presents a data analysis of visitation trends at the Conference on Transportation and Federal Lands: Enhancing Access, Mobility, Sustainability, and Connections in September 2014.

1. Continue to increase the value that sponsors, participants, and customers derive from TRB.

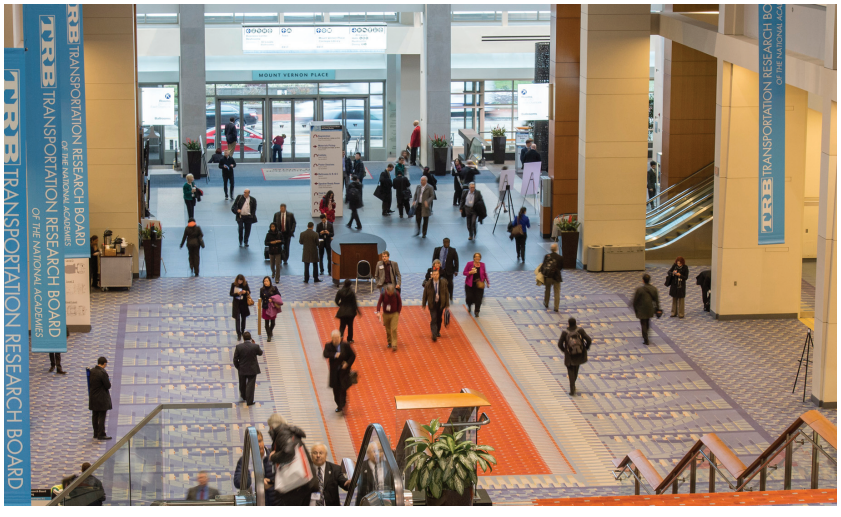
TRB's success and growth derive from the value that it provides to its sponsors; to the volunteers who participate on its committees, panels, and task forces; and to the customers who use its products and services. The needs, requirements, and expectations of each of these constituencies, however, are evolving, and TRB must be prepared to evolve to provide ever-increasing value to each of these groups.

Because of the diversity among and within its constituencies, TRB must evolve in a multifaceted way, to address the needs, requirements, and expectations of its stakeholders. Stakeholders' needs vary by their discipline, the type of organization for which they work, their career stage, their ability to travel, their use of technology, and their status as researchers or practitioners.

TRB must recognize these differing needs, and it must offer different value propositions to the variety of stakeholders who participate in TRB activities or who take advantage of TRB products and services. Because so many stakeholders already value what TRB offers, the principal challenge is to build on and evolve incrementally from what TRB does so well today to what will maximize the value of its products and services in the future.

Therefore a priority is to understand the needs and requirements of each stakeholder group. TRB's recently completed strategic planning included an environmental scan and outreach to TRB participants; the findings provide a starting point, but TRB will continue to reach out to stakeholders to gauge what our constituencies need and want—to keep our finger on the pulse. Immediate opportunities to increase value to TRB stakeholders include the following:

◆ Identifying ways to speed the delivery of TRB's research results and products to customers. A top-to-bottom review of TRB's publication process will identify ways to deliver results to customers faster. A review will explore ways that papers and reports, including the results of conferences, workshops, Cooperative Research Programs projects, and policy studies can be made available more quickly.



The new venue of the TRB Annual Meeting in 2015 has allowed the event to grow in influence and to expand its audience.

PHOTO: RIDDON PHOTOGRAPHY

◆ Identifying how TRB can take further advantage of technology to provide services and to reach stakeholders—for example, by expanding the use of webinars, virtual meetings, and social media. TRB will focus on using technology to improve outreach to young professionals and underrepresented groups.

◆ Determining how TRB can take full advantage of the new venue for its Annual Meeting.

◆ Making it easier for customers to find information from and about TRB products.

◆ Finding ways to move TRB research results more effectively into implementation.

◆ Regularly evaluating and communicating the benefits of TRB research results.

◆ Identifying ways to provide value to those sectors of the transportation profession that are not participating in TRB activities.

◆ Leveraging TRB's position in the National Academies by conducting more joint policy studies; undertaking more jointly staffed and funded initiatives, such as workshops and conferences; and drawing on expertise from other NRC divisions for research and policy studies.

2. Increase the focus given to strategic, emerging, and long-term issues.

TRB derives strength from its committee structure and from the commitment of its volunteers who are technical experts in a variety of specialized fields. TRB not only offers a forum in which these technical experts can discuss current issues, but it also conducts applied research projects on many technical topics through the Cooperative Research Programs.

The study on Reinvesting in Inland Waterways: What Policy Makers Need to Know, a TRB study partially funded by the U.S. Army Corps of Engineers, investigated the costs, benefits, and investment requirements for the federally funded Inland Waterway System.

Many of the issues that are addressed come "from the bottom up," are technical, and are usually current or short term. TRB primarily addresses strategic issues through the periodic *Critical Issues in Transportation* series of documents, usually prepared in conjunction with a new strategic plan; through policy studies; through sessions at its Annual Meeting; and through the specially funded second Strategic Highway Research Program (SHRP 2).

Although the TRB Technical Activities Council has encouraged sessions on crosscutting issues, most sessions focus on current issues in a particular technical area. TRB therefore needs to address more strategic, emerging, crosscutting, and long-term issues in its conferences, papers, sessions, policy studies, and Cooperative Research Programs projects.

TRB will engage the members of its Executive Committee and other transportation leaders to iden-

PHOTO: NEW YORK STATE DEPARTMENT OF TRANSPORTATION

The second Strategic Highway Research Program provided a forum for large-scale studies, research implementation activities, and such key technical innovations as accelerated bridge construction.

The oversight committee reviews the status of Transit Cooperative Research Program projects in a meeting at the National Academy of Sciences building.

tify and define additional strategic issues to be addressed. The goal is to identify "hot topics"—future-focused, crosscutting issues—that engage all parts of TRB.

The first hot topic is connected and automated vehicles, a focus area across all of TRB for the past year. More guidance to technical standing committees and to the Cooperative Research Programs on these kinds of strategic, long-term, and crosscutting issues will broaden the scopes and time frames for their activities.

TRB also will identify opportunities for joint strategic efforts with other NRC divisions. Potential areas to explore include global climate change and adaptation, resilience, energy, sustainability, national security, cybersecurity, safety-related behavioral issues, and big data.

3. Work to ensure stable, long-term revenue streams for TRB.

For most of its history, TRB has relied principally on funding from state departments of transportation (DOTs), U.S. DOT, and Congressional authorization for specific research programs. Both TRB's core technical activities and the National Cooperative Highway Research Program have depended heavily on voluntary contributions of State Planning and Research program funds from all state DOTs.

The largest portion of U.S. DOT financial support has come from the Federal Highway Administration (FHWA). After the passage of the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users in 2005, FHWA was forced to reduce its funding for TRB core programs for several years because of reductions in its budget for research.

To offset this reduction, TRB sought to increase revenues from its Annual Meeting—for example, by initiating paid exhibits and by soliciting patrons for the annual meeting and advertisers for the printed program. At the same time, TRB launched a subscription and pay-per-view service for the online version of its journal, the *Transportation Research Record*.

Recently, funding for the Transit Cooperative Research Program dropped from $10 million to $3 million per year, and funding has ended for the Cooperative Research Programs in freight, rail, and hazardous materials. TRB's role in the $218 million SHRP 2 ended in March, except for its stewardship of Phase 1 of the Naturalistic Driving Study databases.

As Executive Director, I plan to engage in a dialogue with members of Congress and their key staff, with state DOT chief executive officers, and with other funding decision makers about the value of research in transportation—specifically, about the

A meeting of TRB state representatives. TRB's funding traditionally has come from the federal government and state departments of transportation; maintaining a dialogue with state and federal decision makers about the value of research is imperative.

PHOTO: RISDON PHOTOGRAPHY

Paid exhibits at the Annual Meeting have become a robust source of revenue for TRB.

value that TRB brings to the transportation community—to ensure that they all understand the return on their investments in TRB.

In addition, I plan to work with TRB volunteer leaders and with the leaders of NRC to explore opportunities for raising additional revenues, recognizing the need to evaluate carefully the pros and cons, as well as the revenue-raising potential, of each proposal. The objectivity and neutrality of TRB cannot be compromised—that is a given. Options to explore include the following:

- New sponsors—for example, foundations and universities;
- Pooled funding for TRB-sponsored conferences and workshops;
- Cafeteria-style packaging of products and services;
- Alternative pricing for electronic products or online participation, distinguished from products and services delivered in print or in person;
- Advertising in TRB's e-newsletter and other publications;
- A range of sponsorship types or levels; and
- Opportunities for the funding of policy studies.

4. Develop and implement a strategic marketing and communications plan.

TRB has several means of communicating with its stakeholders—for example, the weekly *TRB E-Newsletter*, the bimonthly magazine *TR News*, the TRB website and its manifold web pages, and—increasingly—social media. Nevertheless, TRB faces challenges in reaching certain key constituency groups—including all parts and all levels of key organizations—and underrepresented groups, such as women and minorities.

Helping potential customers understand the full range of products and services that TRB offers has proved a particular challenge. The development and implementation of a comprehensive, strategic communications and marketing plan therefore should focus on increasing the value that sponsors, participants, and customers derive from TRB, as well to ensure stable, long-term revenue streams.

The planning for this is under way. TRB will determine who its key stakeholders and customers should be five to 10 years into the future, will develop goals for targeted communications and marketing, and will specify strategies and actions to support these goals. Among the priorities for communications and marketing will be ensuring good two-way communications with stakeholders—listening to their needs, as well as informing them about TRB; penetrating all levels and parts of key constituency organizations; getting customers to understand the full range of TRB products and services; developing specific strategies for different constituencies; focusing on young stakeholders and underrepresented groups; and communicating the value of TRB and research to key policy makers, such as state DOT executives and Congressional members and staff.

A strategic plan, however, is only as good as the degree to which it is implemented. Among the issues to be addressed in implementation will be the role

The Transportation Asset Management conference in 2014 was funded partly by a pooled-fund initiative.

PHOTO: RISDON PHOTOGRAPHY

Vincent Hassell, Texas Southern University, shares his research on a hazmat incident tool for bridge locations at the 2015 TRB Annual Meeting. Hassell participated in the TRB Minority Fellows Program, which began in 2009 and serves as an entry point for career guidance, professional mentoring, and networking.

that TRB staff and volunteers should play in carrying out the plan—particularly in communicating the value of TRB, its products and services, and the results of its policy studies and research projects.

5. Develop a diverse set of future leaders of TRB, both among volunteers and staff.

TRB's reputation and successes reflect the strong leadership of its volunteers and staff. Some of the most respected people in transportation history have served in leadership roles at TRB. TRB currently has a strong group of volunteer leaders, including chairs of standing committees and project panels, leaders of sections and groups, and members of the Executive Committee.

Many volunteer leaders, however, are of the Baby Boom generation and may soon retire. TRB must groom the next generation of leaders. The staff leadership team likewise is strong, but several members of the team are eligible to retire in the next few years.

PHOTO: RISDON PHOTOGRAPHY

Neil Pedersen, then Executive Director–designate, reports to the TRB Executive Committee on upcoming initiatives guided by the strategic plan.

TRB has emphasized increasing the participation of underrepresented groups, including women and minorities, and it has made considerable progress in the past 10 to 15 years in terms of committee membership and leadership, but this needs to remain a focus. The demographics at the leadership level among volunteers and staff provide both a challenge and an opportunity.

TRB is focusing on succession planning programs for volunteer and staff leadership positions. Several excellent tools assist new standing committee chairs, and with these tools as a starting point, methods can be developed for identifying and grooming potential successors—for example, by assigning them responsibility for certain leadership tasks.

Particular emphasis will be placed on diversifying the pool of candidates for leadership positions. Guidance is needed to assist staff and committee chairs in recruiting a more diverse committee membership. Succession planning for TRB senior staff positions also will be a priority.

Strategic Evolution

The five strategic challenges and opportunities and the outlined responses are consistent with the goals, objectives, and strategies stated in the recently adopted TRB strategic plan. Many contributors invested considerable time and thought in the development of the strategic plan, which has the support of the TRB Executive Committee.

The strategic plan must guide TRB's volunteers and staff alike. The plan will serve as the basis for developing performance objectives for each of the top staff positions in TRB, including the Executive Director, and each senior manager will be accountable for implementation of the plan.

This is an ambitious agenda. TRB staff is working with volunteer leaders to establish priorities among these initiatives and to identify what can be accomplished and when, within the available resources.

As Executive Director, I am committed to reaching out continually to key stakeholders to discuss challenges and opportunities for TRB and to maintain a dialogue on how TRB can best provide value to key stakeholder groups. Adjustments will be made in response to the input from stakeholders to ensure that TRB's value continues to increase. I welcome your input as you see opportunities for TRB to improve its services to you.

TRB has many opportunities to evolve in ways that maximize its value to its sponsors, its volunteers, its customers, and the general public. I will work with each of you to ensure that TRB provides you with that value and meets your needs.

Corridors to the Future

Transportation and Technology

For the first time in nearly 60 years, attendees of the Transportation Research Board Annual Meeting gathered at a new venue: the Walter E. Washington Convention Center and Marriott Marquis hotel in Washington, D.C. More than 12,200 transportation research practitioners from academia, private industry, government agencies, and more joined their colleagues, January 11–15, 2015.

The new venue served as the stage for more than 5,000 presentations, as well as committee meetings, networking events, award ceremonies, and exhibits. Research topics including vehicle automation, shared-use mobility, and alternative transportation fuels were explored in 25 sessions related to the meeting's theme, "Corridors to the Future: Transportation and Technology."

Daniel Sperling, Professor of Civil Engineering and Environmental Science and Policy, University of California, Davis, delivered the 2015 Thomas B. Deen Distinguished Lecture on "The Emerging Transformation of Mobility, Vehicles, and Fuels." Sperling also is the 2015 Chair of the TRB Executive Committee. Robert E. Skinner, Jr., who retired in February after more than two decades as TRB Executive Director, delivered the Chairman's Luncheon address, after receiving the Frank Turner Medal for Lifetime Achievement in Transportation.

Details and highlights appear on the following pages.

Annual Meeting photographs by Risdon Photography.

1 U.S. Secretary of Transportation Anthony Foxx outlined a 30-year framework for national transportation priorities and policies in a conversation with Washington Post transportation reporter Ashley Halsey III.

2 Skinner's address at the Chairman's Luncheon, as well as his 21 years of service as TRB Executive Director, drew a standing ovation. In its first year at a new venue, the 2015 Annual Meeting was similarly well-received and enthusiastically applauded.

3 Abe Lincoln, one of the Washington Nationals' Racing Presidents—whose historical counterpart signed the National Academy of Sciences charter in 1863—led attendees to the Exhibits Hall after the Welcome and Attendee Orientation Session.

INTERSECTIONS

1 Karen White, Office of the Assistant Secretary for Research and Technology, U.S. DOT (*left*), discusses topics of interest in freight transportation with Dinar Karatas, Middle East Technical University.

2 Alejandro Miramontes (*center*) and Victor Manuel Garcia (*right*), undergraduates at the University of Texas at El Paso, were among the 15 Minority Student Fellows attending the Annual Meeting. Their paper, "Understanding Sources of Variability of Overlay Test Procedure," was selected for publication in the *Transportation Research Record: Journal of the Transportation Research Board*.

3 The 2015 Technical Activities Council, which oversees the TRB Annual Meeting programs.

4 (*Left to right:*) Don Hunt, Colorado Department of Transportation (DOT); Phillip J. Caruso, Institute of Transportation Engineers; Frederick G. (Bud) Wright, American Association of State Highway and Transportation Officials (AASHTO); Thomas E. Kern, ITS America; Dennis Motiani; and Jeffrey A. Lindley, Federal Highway Administration (FHWA), unveil the National Operations Center of Excellence.

5 A new venue facilitated the largest Exhibit Hall in TRB Annual Meeting history.

6 Jamie Holter describes the Greenroads rating system to a meeting attendee in the Exhibit Hall.

7 Trung Duong, FHWA, examines the robot-assisted, remote-controlled RABIT bridge deck assessment tool in the Exhibit Hall.

8 Dianne Skinner, the "Hostess of TRB," receives accolades for her more than 20 years of contributions to the Annual Meeting.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3 TRB Technical Activities Council (*front row, left to right:*) Harold (Skip) Paul, Eric Shen, Council Chair Daniel Turner, Paul Jovanis, and Hyun-A Park; (*back row, left to right:*) Mark Norman, D. Stephen Lane, Barbara Ivanov, Ram Pendyala, Peter Briglia, Stephen Popkin, Mary Ellen Eagan, David Wilcock, Georgios Giannopoulos, Alison Conway, and Robert Shea.

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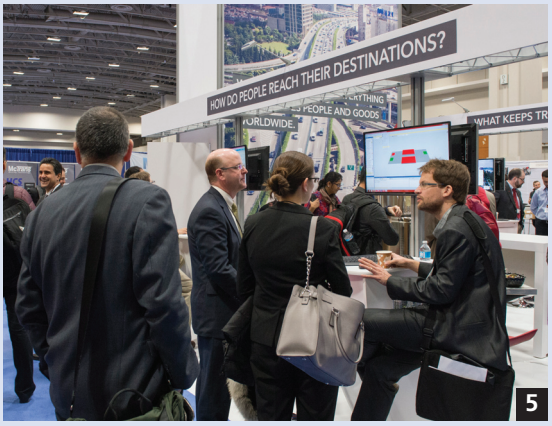

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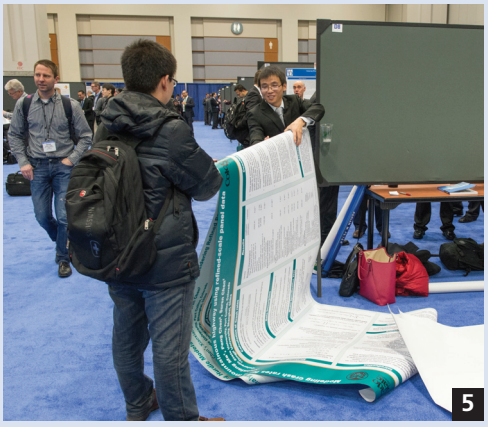

11 Nimiforos Stamatiadis, University of Kentucky, leads a session on performance metrics.

12 (*Clockwise from upper left:*) Planning and Environment Group Chair Mark Kross with winners of the Eighth Annual Competition and Call for Communicating Concepts with John and Jane Q. Public: Robert Lee; Rick Crawford; Claudia Bilotto; and Annie Nam, Southern California Association of Governments.

SESSIONS AND WORKSHOPS

1 Steve Phillips, Conference of European Directors of Roads, presents perspectives on Harnessing Potential Payoff of Research Implementation Across Borders.

2 Fawn Thompson, FHWA, showcases the research of the Dwight David Eisenhower Transportation Fellowship Program.

3 Roberta Weisbrod, Worldwide Ferry Safety Association, discusses ferry and passenger boat safety.

4 Krista Nordback, Portland State University, participates in a session on bicycle and pedestrian data programs.

5 Attendees set up posters for their presentations.

6 Joseph Coughlin, Massachusetts Institute of Technology (MIT), delivers an address on vehicle automation at the Human Factors Luncheon.

7 Yi Lin Pei, Cambridge Systematics, examines the Freight Advanced Traveler Information System.

8 Ghada Gad, Bowling Green State University, guides a session on risk management in construction.

9 Edward Strocko, FHWA, discusses innovations from the second Strategic Highway Research Program.

10 Trent Victor, Volvo, examines sustainable mobility and self-driving cars at a Human Factors Workshop.

SESSIONS AND WORKSHOPS
(continued)

1 Greg Nadeau, FHWA, explores innovation at the agency on a panel with other transportation policy leaders.

2 Atinuke Diver, Volpe National Transportation Systems Center, presides over a session on transportation law, marijuana, and changes in enforcement laws.

3 Daniel Alzamora, FHWA, discusses geosynthetic reinforced soil–integrated bridge system technology on low-volume roads.

4 Sandra Tosca, Pennsylvania DOT, presents information on the agency's snow route planning process using geographic information systems.

5 The economic impact of the elderly ceasing to drive was the subject of research by David Joseph, Morgan State University.

6 Albert Ferlo, Perkins Cole LLP, shares effective strategies to comply with National Environmental Policy Act transportation-related legislation.

7 Nicholas Johnson, Virginia Tech, participates in a session on roadway departure risk.

8 Panelists examine transportation technology trends and revenue capture.

9 Tyson Rupnow, Louisiana Department of Transportation and Development, speaks about roller-compacted concrete testing.


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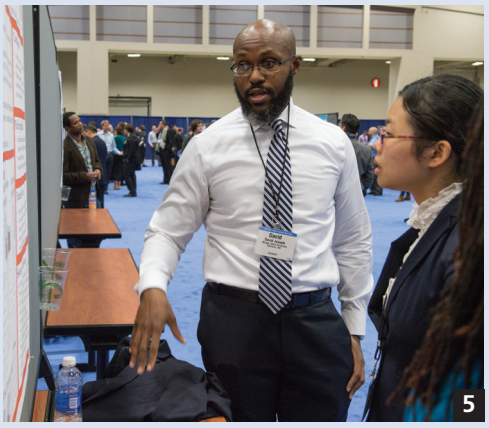
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10 (*Left to right:*) Airport Cooperative Research Program (ACRP) graduate award recipients Jeffrey Eloff, Evan Humphries, Jaime Hernandez, Tara Conkling, Paulos Lakew, Sophine Clachar, Maria Vercia, and Leslie McCarthy, with ACRP Senior Program Officer Larry Goldstein.

1 (*Above left, left to right:*) Barbara Ivanov, Washington State DOT; Mike Patterson, Oklahoma DOT; and John Cox, Wyoming DOT.

2 (*Above right, left to right:*) Therese McMillan, Federal Transit Administration; Michael Huerta, Federal Aviation Administration; and Victor Mendez, Deputy Secretary, U.S. DOT.

5 (*Left to right:*) G. P. Jayaprakash, TRB; Anand Puppala, University of Texas, Arlington; Marshall Thompson, University of Illinois, Urbana–Champaign; Billy Connor, University of Alaska, Fairbanks; and Nancy Whiting, Purdue University.

SESSIONS AND WORKSHOPS

(continued)

1 State Department of Transportation CEO Roundtable, Moving the Goods: Accommodating Major Changes in Freight Flows.

2 U.S. DOT: Rulemaking for Safety.

3 Charles Zelle, Minnesota DOT, and TRB Executive Committee member Joan McDonald, New York State DOT, share insights on funding transportation investments in an uncertain federal fiscal environment.

4 Elizabeth Ogard, Prime Focus, LLC, participates in a question-and-answer session with state DOT CEOs.

5 Dialogue with Leaders in Design and Construction of Transportation Facilities.

6 Mark Carr, Channel Design Group, Inc., moderates a session on changing energy sources and multimodal freight systems.

7 John Carlson, Sundt Construction, discusses the perspectives of the main stakeholders in a construction manager–general contractor project contract.

8 Debbie Shinstine, University of Wyoming, and Vichika Iragavarapu, Texas A&M Transportation Institute, participate in informal discussions after a panel on Native American tribal transportation issues.

SESSIONS AND WORKSHOPS
(continued)

1 Ezra Hauer delivers insights from his latest book, *The Art of Regression Modeling in Road Safety*, to a standing-room-only audience.

2 Xin Xu, MIT, shares research on use phase and pavement–vehicle interaction in pavement life cycles.

3 Taylor Czaplewski, South Dakota State University, presents information on field testing for highway bridges.

4 Gina Capra, Veterans Health Administration Office of Rural Health, participates in a dialogue on veterans' transportation needs.

5 Panelists discuss bicycle and pedestrian data collection.

6 Matthew Beck, University of Sydney, Australia, explores methodological advances in travel behavior research.

7 China's world trade perspective is presented by Yushi Cheng, Shanghai Maritime University.

8 Mary Karlsson, Metro Transit, addresses public perceptions of managed lane implementation on I-35E in Minnesota.

9 Transportation resilience was the subject of a presentation by Ali Mostafavi, Florida International University.

10 (*Left to right:*) Panelists Michael Manore, Danny Kahler, Deke Smith, and Steven Hagan gather at a workshop on digital project delivery.

11 Stephanie Blanco, Parsons Transportation Group Inc., explores environmental compliance in California design–build highway projects.

COMMITTEES

1 Susan Sillick, Montana DOT, conducts a meeting of Committee Research Coordinators.

2 Jonathan Regehr, University of Manitoba (*right*), shares an idea with the Standing Committee on Highway Traffic Monitoring.

3 Paola Bandini, New Mexico State University, guides the Standing Committee on Modeling for the Design, Construction, and Management of Geosystems.

4 Debra Brisk, Hennepin County, Minnesota (*left*), receives a certificate of appreciation for chairing the Standing Committee on Construction Management from Section Chair Stuart Anderson.

5 Matt Hardy, AASHTO, discusses an upcoming conference with members of the Standing Committee on Transportation Asset Management.

6 Rail Group Chair Stephen Popkin (*left*) and Ann Mills (*right*), Chair of the Standing Committee on Railroad Operational Safety, outline committee business.

7 Vicki Miller, FHWA (*center*), contributes to the Standing Committee on Statewide Transportation Data and Information Systems.

8 Concrete Materials Section Chair Mohammad Khan delivers a report to the Standing Committee on Durability of Concrete.

9 The Standing Committee on Transportation Safety Management proceeds through its meeting agenda.

10 Chip Millard, FHWA (*right*), and Genevieve Giuliano, University of Southern California, participate in a breakout discussion group of the Standing Committee on Urban Freight Transportation.

COMMITTEE AWARDS

1 (*Left to right:*) Technical Activities Council Chair Daniel Turner with the chairs of the Blue Ribbon committees for 2014: Beverly Kuhn, Active Traffic Management Joint Subcommittee, honorable mention; Eugene Russell, Standing Committee on Roundabouts, for contributing to TRB and the transportation community; Kathryn Zimmerman, Standing Committee on Transportation Asset Management, for advancing research; and Robert Bertini, Standing Committee on Traffic Flow Theory and Characteristics, for community building and mentoring.

2 Outstanding Young Member Jonathan Regehr, University of Manitoba (*center*), with Marsha Anderson Bomar, Stantec Consulting, Inc. (*left*), sponsor of the award, and Young Members Council Chair Alison Conway (*right*).

3 The K. B. Woods Award for outstanding paper in design in construction went to (*left to right:*) Walaa Mogawer, University of Massachusetts, Dartmouth; Jo Sias Daniel, University of New Hampshire; and Thomas Bennert, Rutgers University.

4 The D. Grant Mickle Award recognizes research in operations and maintenance.

4 Mickle Award winners Kay Fitzpatrick (*left*) and Marcus Brewer (*right*), Texas A&M Transportation Institute. Not pictured: Raul Avelar, Texas A&M Transportation Institute.

TRB Selects 11 as Emeritus Members of Standing Committees

The following individuals received emeritus membership in TRB technical activities standing committees at the 2015 Annual Meeting, recognizing their significant, long-term contributions, outstanding service, and invaluable participation.

- **Michael H. Belzer**, Standing Committee on Trucking Industry Research;
- **Paul H. Bingham**, Freight Group;
- **Franz Gimmler**, Standing Committee on Emerging and Innovative Public Transport and Technologies;
- **Elaine R. Murakami**, Standing Committee on Travel Survey Methods;
- **Robert Stephen Newbery**, Standing Committee on Historic and Archeological Preservation in Transportation;
- **C. Paul Scott**, Standing Committee on Utilities;
- **Steven Silkunas**, Standing Committee on Intermodal Transfer Facilities;
- **John C. Tone**, Standing Committee on Intercity Passenger Rail;
- **Rod J. Troutbeck**, Standing Committee on Roadside Safety Design;
- **Jeffrey Western**, Standing Committee on Critical Transportation Infrastructure Protection; and
- **John D. Wilkins**, Standing Committee on Light Rail Transit.

5 Several emeritus members of standing committees gather with 2015 TRB Executive Committee Chair Daniel Sperling (*right*) at the Chairman's Luncheon.

1 Wootan Award winners (*left to right:*) Adjo Amekudzi-Kennedy, Janille Smith-Colin, Jamie Montague Fischer, and Margaret-Avis Akofio-Sowah, Georgia Institute of Technology.

3 Waller Award winners (*left to right:*) Dongxi Zheng, Madhav Chitturi, David Noyce, and Andrea Bill, University of Wisconsin, Madison.

4 William Millar, former president of the American Public Transportation Association (*right*), joins Millar Award recipients (*left to right:*) David King, Amer Shalaby, and Siva Srikukenthiran, University of Toronto, Canada.

PAPER AWARDS
(continued)

1 The Charley V. Wootan Award is presented for the outstanding paper on policy and organization.

2 Otto Anker Nielsen (*left*) and Thomas Kjær Rasmussen, Technical University of Denmark, receive the Pyke Johnson Award for planning and environment research.

3 A paper on secondary crash identification on a large-scale highway system received the Patricia F. Waller Award.

4 The William W. Millar Award recognizes the outstanding paper on public transportation.

5 Turner (*left*) presents the John C. Vance Award for a publication of distinction in transportation law to Larry W. Thomas (*right*).

6 The Fred Burggraf Award for papers by young researchers on planning and environment recognized (*left to right:*) Shoupeng Tang and Tarun Rambha, University of Texas (UT), Austin; Avinash Unnikrishnan, West Virginia University; and Stephen Boyles, UT Austin. Not pictured: Reese Hatridge, UT Austin.

7 Matt Kroneberger, Metropolitan Washington Council of Governments, receives the Burggraf Award for outstanding paper on the subject of safety and systems users. Not pictured: Nicolae Duduta, EMBARQ World Resources Institute, and Qianqian Zhang, MIT.

MAJOR AWARDS

1 Former TRB Executive Director Thomas B. Deen (*right*) with Deen Distinguished Lecturer Dan Sperling, University of California, Davis.

2 Katherine Turnbull, TTI, receives the W. N. Carey, Jr., Distinguished Service Award.

3 2014 TRB Executive Committee Chair Kirk Steudle (*left*) presents Forrest M. Council, University of North Carolina Highway Safety Research Center (*right*), with the Roy W. Crum Distinguished Service Award.

4 Steudle reviews the year's highlights at the Chairman's Luncheon.

5 Robert E. Skinner, Jr., then–TRB Executive Director, receives the Frank Turner Medal for Lifetime Achievement in Transportation, from Bud Wright, AASHTO Executive Director; the medal is awarded biennially.

6-9 Big data was the topic for guest speakers at the Executive Committee Policy Session.

10 Neil Pedersen, then–TRB Executive Director designate, reports to the Executive Committee on SHRP 2 implementation.

11 James Crites, Dallas–Fort Worth International Airport, is 2015 Vice Chair of the TRB Executive Committee.

12 Victoria Arroyo, Georgetown University, was appointed to a new term on the Executive Committee.

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Policy session speakers included (*left to right:*)

6 Carson Farmer, Center for Advanced Research of Spatial Information and the City University of New York;

7 Irving Wladawsky-Berger, MIT, Imperial College Business School, and New York University;

8 Jack Dangermond, ESRI; and

9 Executive Committee rapporteur Stewart Fotheringham, Arizona State University.


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New Leaders Guide Executive Committee

Daniel Sperling, Professor of Civil Engineering and Environmental Science and Policy, University of California (UC), Davis, is 2015 Chair of the TRB Executive Committee. He succeeds Kirk Steudle, Director, Michigan Department of Transportation. James Crites, Executive Vice President, Operations Division, Dallas–Fort Worth International Airport, is the 2015 Vice Chair.

Sperling

An authority on transportation technology assessment, energy and the environmental aspects of transportation, and transportation policy, Sperling is the founding director of the Institute of Transportation Studies at UC Davis. His policy expertise and research on efficient transportation systems have received many accolades, including the 2013 Blue Planet Prize and an appointment to the California Air Resources Board. He has served on many TRB standing committees and more than one dozen National Research Council (NRC) committees. Sperling also is a National Associate of NRC.

A graduate of Cornell University, Sperling received a Ph.D. in transportation engineering from UC Berkeley. He has written more than 200 technical papers and 12 books, including *Two Billion Cars* and *Driving Climate Change: Cutting Carbon from Transportation*.

Crites oversees many divisions at Dallas–Fort Worth International Airport, from asset management to public safety to environmental affairs. After working in key management positions at American Airlines, he joined the airport in 1995 as director of planning and marketing research. His leadership in facilities development planning and business opportunities assessment was fundamental to DFW's Airport Development Plan. Crites received a bachelor's degree in business administration from the University of Illinois and a master's in operations research from the Naval Postgraduate School in Monterey, California.

Geraldine Knatz, University of Southern California, is a new member of the Executive Committee; she is a past Chair of the Marine Board. Reappointed members include Victoria Arroyo, Georgetown University; Sandra Rosenbloom, University of Texas, Austin; Chris Hendrickson, Carnegie Mellon University; and Henry (Gerry) Schwartz, consultant.

2014 and 2015 Executive Committee Chairs Kirk Steudle (*right*) and Dan Sperling (*left*).

EXECUTIVE COMMITTEE
(continued)

Also appointed to new terms on the Executive Committee were (*left to right:*)

1 Chris Hendrickson, Carnegie Mellon University;

2 Geraldine Knatz, University of Southern California;

3 Past Executive Committee Chair Sandra Rosenbloom, UT Austin; and

4 Henry (Gerry) Schwartz.


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EXECUTIVE COMMITTEE
(continued)

1 Skinner reports to his final Executive Committee meeting as TRB Executive Director.

2 Sperling discusses the TRB strategic plan.

Also participating in Executive Committee deliberations were

3 Michael Hancock, Kentucky Transportation Cabinet;

4 Alison Conway, City College of New York;

5 John Gray, Association of American Railroads;

6 Donald Osterberg, Schneider National, Inc.;

7 William Bronrott, Federal Motor Carrier Safety Administration;

8 Gary Thomas, Dallas Area Rapid Transit;

9 Gregory Winfree, Assistant Secretary for Research and Technology, U.S. DOT;

10 Scott Bennett, Arkansas State Highway and Transportation Department;

11 Michael Rodriguez, Maritime Administration;

12 Phillip Washington, then with Denver Regional Transportation District;

13 Barry Wallerstein, South Coast Air Quality Management District; and

14 Jeff Holt, Bank of Montreal.


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CHAIRMAN'S LUNCHEON ADDRESS 2015

Research and Innovation in Transportation

ROBERT E. SKINNER, JR.



PHOTOS: RSDON PHOTOGRAPHY

The author served as TRB Executive Director for 21 years, overseeing dramatic growth in the size and scope of the Board's activities; he retired at the end of January 2015. His 32 years at TRB also included directorship of the policy studies unit. At the TRB 94th Annual Meeting, Skinner received the Frank Turner Medal for Lifetime Achievement in Transportation. The accompanying article is excerpted from his address at the Chairman's Luncheon, January 14, 2015.

It is a special honor, as I close out my career at the Transportation Research Board (TRB), to talk with you in this forum about an appropriate topic, given the organization's name and this meeting. Nevertheless, the topic is seldom dealt with directly in a TRB luncheon address—namely, research and innovation in transportation.

Usually the speakers deal with the issue of the day in transportation, sometimes with the history or the specific challenges facing a particular mode or agency. But from time to time, we should talk here about research and the pursuit of innovation in our field. This has been topic number one for me for many years.

Research and Innovation Process

After working at TRB for so long, it would be nearly impossible for me not to have some views about research and innovation. I am especially grateful for the Federal Highway Administration's (FHWA's) support of a continuing committee that has provided advice about the agency's research and technology programs for more than 20 years. Former FHWA Administrator Thomas D. Larson and my predecessor Thomas B. Deen share the credit for establishing this committee.

The members of the Research and Technology Coordinating Committee—through many rotations now—have helped me to shape and organize my thoughts about transportation research and to relate my thinking more broadly to theories of innovation. The main themes, in retrospect, seem like common sense—but an enlightened common sense that only becomes clear after grappling with the issues for a while.

By and large, the managers of research and technology programs have no formal training in research management but learn on the job. Therefore these insights need to be passed on to avoid wasteful periods of getting up to speed.

Let me offer three illustrations of this common sense.

Research Is the Beginning

First, research is part of the innovation process, but for many, research, research and development (R&D), and research, development, and technology are code words for promoting innovation. The results of research only achieve value through use, by making something better, less costly, or the like. In its various dimensions—basic, advanced, short-, or long-term—research is part of the innovation process, and in some contexts—transportation is often one—research is the beginning, and maybe the easier and less costly step, of getting a new product, material, or process into common use.

Other steps—development, testing, piloting, revising standards and specifications, training, and

Photo Courtesy of Florida DOT

Self-propelled modular transporters move a bridge span into place within minutes. The results of research achieve value through use, by saving costs, time, and resources.

evangelism—are important in the innovation process. Research by itself seldom leads to innovation; but innovation does not necessarily involve research, at least not formal research.

One Size Does Not Fit All

Second, the innovation process is not linear. Talking about the innovation process as though it is linear may be convenient sometimes, to present a well-defined set of steps that begin with an idea and then progress from basic research to application. In reality, the process is messy, with interdependencies, iterations, and necessary variations in emphasis, because each innovation faces different technical challenges and operates in different contexts for implementation.

An important implication is that the process for delivering innovation to state and local transportation agencies differs markedly from the one that information technology firms use in developing consumer products or from the process suited to the needs of the Department of Defense. When it comes to innovation, one size definitely does not fit all.

With the operation of the nation's highways falling not just to the federal government but also to state and local agencies, highway research must involve collaboration.

Photo: Doug Kerr, Flickr

The Scope Is Diverse

The third illustration concerns the scope of transportation research. Transportation is about moving goods and people and providing choices. Transportation involves engineered stuff, and much of the research is rooted in physical sciences and engineering.

But planning and operating transportation systems require knowledge of human behavior; therefore we need researchers trained in the behavioral and social sciences. In addition, transportation's connection with the natural environment introduces the need for researchers with backgrounds in the natural sciences—and so on.

In short, transportation research is inherently multidisciplinary and incredibly diverse. The pressure to expand the scope of transportation research is virtually inexorable as we gain understanding of the connections to economic, social, and environmental goals and as we seek to exploit new scientific discoveries and technologies from other fields.

For TRB, a continuing challenge is to involve this expanding list of stakeholders, researchers, and practitioners in interactions with transportation practitioners and with the researchers already engaged with TRB. We owe a debt to the founders of TRB—who were mostly engineers—for choosing to organize the Board around an unbounded set of technologies and problems instead of disciplines. This founding principle has allowed an almost seamless evolution into the multidisciplinary organization of today.

Nontechnical Challenges

Some of the other challenges in transportation research are not technical but involve explaining and organizing transportation research.

Complexity of the Endeavor

The first challenge is complexity. The complexity of transportation research per dollar must be among the highest of any field—that is, the complexity is high in relation to the scale of the program. Transportation is a large, highly decentralized public–private enterprise, and therefore research activities are far less centralized than those of defense research, for example.

Tens of thousands of U.S. counties, towns, and cities—as well as the states—own and operate highways. As a result, the nation's highway research effort is decentralized, and the state departments of transportation (DOTs), individually and collectively, play an important role, along with FHWA, private industry, universities, and other research organizations.

Some duplication and some less-than-optimal coordination are the prices for having a decentralized program that has the buy-in from system operators—those who implement the research products. Understanding and accepting this takes some time. We need not apologize for the complexity, but we must be ready to explain it.

Demonstrating the Value

Another challenge concerns demonstrating the value of research. Transportation researchers and program managers share this challenge with most everyone engaged in research. We all understand the difficulty of measuring the benefits, of linking changes in practice to specific research efforts, and of dealing with the time scales involved. Nevertheless, we must

monitor and measure the effects of research investments systematically.

Beyond that, we should not lose sight of the big picture, which I would liken to a glass that is more than half full yet defies easy quantification. Despite the many barriers to innovation and modest research investments—sometimes with strings and earmarks attached, particularly in the public sector—remarkable gains have been made in practice.

To a casual observer, a new section of an Interstate highway may look the same as one constructed in 1960—but it is not. Almost everything about the planning, design, construction, operation, and maintenance of highways today has changed for the better. Paving materials, roadside safety, real-time traveler information, operations, construction equipment—almost any nameable aspect—all have improved, often because of innovations devised through research.

The same is true for public transportation systems, aviation and airport systems, and private railroads—they deliver better, more efficient services than they did 30 years ago because of the accumulation of innovations, small and large. Sometimes the changes have happened in obvious ways, such as those in vehicle technology, but often the changes are not obvious, such as those from innovations in planning, operations, and finance. Nonetheless, the changes have continued while the systems have dealt with new challenges, such as security and changing travel patterns.

Securing Funds

Demonstrating the value of past research, of course, relates to the challenge of securing funds for transportation research. That the federal government should support basic research, defense-related research, and health-related research is widely accepted, and the government has provided support in significant ways since World War II.

Less well known is the critical role that the federal government plays in funding research related to publicly provided infrastructure. This is the primary source of funds for transportation. For many years, I have observed closely how Congress has dealt with transportation research in an environment of perpetually scarce resources and competing priorities, and I view federal support as fragile.

Every surface transportation authorizing bill after the Intermodal Surface Transportation Efficiency Act of 1991 has contained some unexpected and unpleasant morning-after surprises for research. Research loses out when funds are needed to make the donor–donee balance work out or when a new construction program is needed. At the negotiation table, research is probably no one's priority.

1970 Map Photo: davecito, Flickr

Map of Cowlitz County, Washington State, highways in 1970, inlaid with a current online version. New technology and other innovations in recent decades have improved highway design, operations, maintenance, planning, and information.

The only thing we can do about this is to demonstrate the value of research and to rely on those who can take on the advocacy role. Federal support for transportation research has been and continues to be absolutely crucial, but nonetheless I would be more comfortable if state and local transportation agencies—including regional transit agencies and toll road and airport authorities—provided greater support for research with their own funds and depended less on the federal government.

Programming Research Funding

But suppose that money was not a problem. What if we had a generously funded program with no strings attached and a clean slate? How should those funds be invested among all of the possible topic areas and among the stages in the innovation process? No easy answer and certainly no optimal strategy arise. Simply having across-the-board increases for each topic area and each stage in the innovation process would be a cop-out.

In a recent editorial in *TR News* (*1*), I argued that we should be guided by four considerations in programming research funding:

Stakeholders in the Cooperative Research Program choose a slate of projects at the yearly meeting of the American Association of State Highway and Transportation Officials Standing Committee on Research.

PHOTO: RISDON PHOTOGRAPHY

Richard Capka, FHWA; John C. Horsley, AASHTO; and Ralph J. Cicerone, National Academy of Sciences, signed a Memorandum of Understanding for the second Strategic Highway Research Program in 2006. TRB benefits from its institutional base and works closely with federal, state, and other partners to stimulate and manage applied research.

1. Alignment with agency goals, plans, and needs.
2. Context, which includes such things as the type and scale of the organization, available funding, research capabilities, presence or absence of complementary research programs, and connections with other organizations.
3. Balance across topic areas and steps in the innovation process. No single agency can excel or have the capacity to do it all, but balance is desirable. Therefore funding must be considered based on the subject agency's research program and on the R&D activities under way elsewhere.
4. Stakeholder involvement and engagement. How decisions are made is important, and involving stakeholders—users and other affected groups—in a meaningful way not only provides input for selecting priorities but also helps build the relationships needed for implementation.

TRB's Unique Role

TRB plays a unique role in transportation research and is a unique organization. Transportation professionals often observe that the Board could never be created from scratch today—this is probably true; and professionals from other fields often wish that such an organization had been created in theirs.

PHOTO: RISDON PHOTOGRAPHY

Relationship-building among transportation professionals—from industry to academia—lies at the heart of TRB's core activities.

Empowerment and Community

A large part of TRB's success comes about through empowerment and community building. TRB provides a forum, a place for professionals to meet, organize, build on each other's endeavors, and to help shape the direction of their particular technical areas.

A good amount of informal coordination takes place among researchers, and informal coordination often is the best kind. Informal coordination is a grass-roots process; in my experience, top-down tinkering with TRB's technical standing committee structure must be done with caution—why mess up a good thing?

TRB's cooperative research programs also are about empowerment—giving the owners and operators of state and local transportation facilities their own national research programs to work on common problems from their own perspective. My firsthand observation is that the engagement level among a committee of stakeholders is much greater when they are making actual programming decisions than when they are merely advising an agency about priorities.

Sponsor Support

As noted, the TRB founders were remarkably farsighted in how they organized the Board, but credit also must go to the Board's founding sponsor, the Bureau of Public Roads—today's FHWA; to the state DOTs that have been the principal sponsors with FHWA since the late 1940s; and to the sponsors from other modes and related organizations that joined in after the Board officially became multimodal in 1976—they believed the Board truly could become a transportation organization.

Justifying research is difficult, but think about the skepticism that can accompany the decision to fund, year after year, a research organization that does no research itself. TRB is indebted to the literally thousands of agency heads and research program managers who have supported the Board throughout its 95-year history.

Volunteer Participants

The Board could not exist without sponsors nor without the individual researchers and practitioners who join committees and panels and participate in activities. Drawn from public agencies, the private sector, and academia, tens of thousands of individuals have supported TRB in this way over the years; nearly 8,000 are currently active.

Today's volunteer participants are far more diverse than their predecessors in almost every way—in demographics, disciplines, and perspectives—and TRB and transportation are better for it. It is a great bargain: TRB provides forums for participants to promote their ideas and to help build their careers, and they provide the energy and collective action that helps advance good ideas into practice.

Institutional Home

Finally, another important ingredient to TRB's success—for which the founders again get credit—was the housing of the Board within the National Research Council (NRC) of the National Academy of Sciences (NAS). This was a wise decision. The Academies, which now include the National Academy of Engineering and the Institute of Medicine, have provided an institutional home characterized by

- Meticulous attention to quality,
- A well-deserved reputation for independence and credibility,
- Access to units with complementary technical expertise, and
- A special relationship with the federal government, starting with a congressional charter and including periodic endorsements through Executive Orders.

In the early 1980s, NAS prodded TRB to start undertaking policy work like that of the other NRC units. This work initially attracted me to the TRB staff, but more importantly, policy studies have proved a boon for TRB and a valuable service to the nation.

A growing number of policy issues in transportation involve questions of science and technology, and a dwindling number of organizations are making independent assessments of these issues. Therefore I expect that TRB's policy study assignments will take on added importance, as willing sponsors emerge for this important work.

Continuing Evolution

TRB will continue its unique role in transportation for years to come. The fundamentals will stay the same, but TRB will continue to evolve. The diversity of participants is increasing, along with the accompanying benefits, but TRB has not finished growing the tent—either in terms of the participants or of the issues they tackle.

Freight, environmental issues, and multimodal planning have been at the forefront in the past 20 years, but new issues will emerge, and new approaches for enduring challenges will be developed. TRB's impact has widened with the adoption of webinars, teleconferences, online publications, and web-based search tools. Continued evolution in these areas will be crucial.

Nevertheless, the goal is not growing TRB but helping researchers and their colleagues deliver better services to transportation system users and to other stakeholders. I am truly thankful for the opportunity I have had to assist in this process during my time at the Transportation Research Board.

TRB's Division of Studies and Special Programs fulfills high-profile policy studies and congressionally mandated research, such as the Review of U.S. DOT Truck Size and Weight Study, at the request of Congress, federal agencies, and other sponsors.

PHOTO: RISDON PHOTOGRAPHY

Skinner responds to a standing ovation after receiving the Frank Turner Medal for Lifetime Achievement in Transportation for his more than 30 years of service to TRB.

Reference

1. Skinner, R. E., Jr. A Note About Programming Research Funding. *TR News*, No. 292, May–June 2014, pp. 31–35.

PHOTO: JACK E. BOUCHER/ LIBRARY OF CONGRESS PRINTS AND PHOTOGRAPHS DIVISION

Framing National Agendas for Transportation Research

Trends and Lessons from TRB's Critical Issues Statements, 1976–2013

ALAN E. PISARSKI

The author is a transportation consultant in Falls Church, Virginia; author of the Commuting in America *series; and recipient of TRB's Distinguished Lectureship Award and the W. N. Carey, Jr., Distinguished Service Award.*

In *Critical Issues in Transportation 2013*, the Executive Committee of the Transportation Research Board (TRB) identified five central transportation policy challenges. The document has a long lineage as the 12th in a series of critical issues statements issued periodically, starting in 1976.

A 2003 *TR News* article on the history of the critical issues raised the questions of which issues have been resolved, which have disappeared from collective awareness, and which have remained perennials, reappearing perhaps with syntactic changes, as terms come in and out of vogue (*1*). Tracing the persistence, appearance, disappearance, and variations in critical issues reveals the evolution of transportation policy.

What Is an Issue?

Washington, D.C., lives on issues: to public officials, issues are contentious problems to resolve with legislation and with the creation or management of programs; to associations or public interest groups, an issue is an item on a list of priorities that promote or threaten the organization's goals; to a cabinet-level secretary or agency administrator, an issue is an item on the agenda of the White House, a senator, or the governor. In 1979, the federally appointed National Transportation Policy Study Commission defined an issue as a conflict with identifiable disputants (*2*).

The TRB definition of an issue appeared in the critical issues list of 1984:

Those unresolved aspects of transportation, national in scope, on which there is a wide variety of viewpoints, for which the impacts of possible actions are unknown, and for which decisions will be made at the policy level.

Most statements, in contrast, treat issues as "problems to be solved" or "focus areas for action." Some lists define ends to be achieved collectively. An issues list therefore may be seen as an agenda for action.

Early Statements

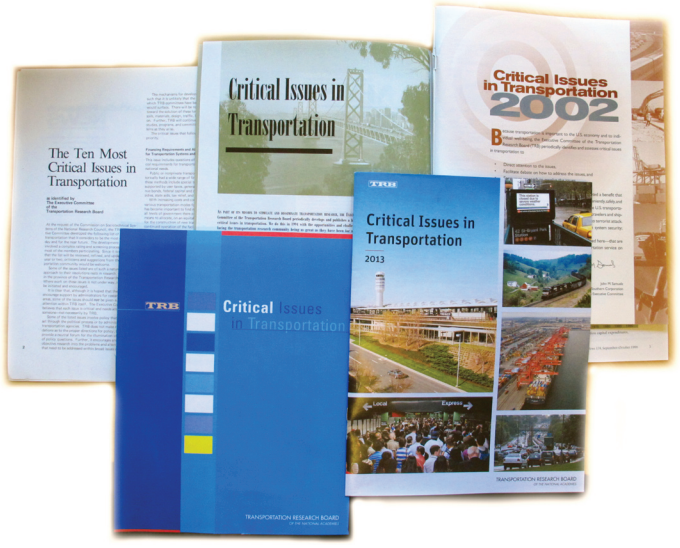
The first TRB list of critical issues arrived in a terse, three-page "top 10" statement in *TR News* in December 1976 (see sidebar, page 34). Variations followed in 1978 and 1981, also employing a top-10 approach.

Nevertheless, the 1978 and 1981 updates each added several new items, by dropping some or restating others. Until 1981, the order of the issues held no significance; that year, the Executive Committee determined that the rank was key. The 1981 list was produced by distributing the 1978 list to the TRB group councils and the standing committee chairs for suggestions and for a vote on the order of the issues for review by the Executive Committee.

The new issues in this cycle introduced new perspectives on older issues or perhaps a new way of phrasing a previous topic. Finance, for instance, became the "equitable allocation of resources." The issue "viability of U.S. railroads," introduced in 1978, grew out of "effects of transportation regulations" in the 1976 edition. The 1978 issue, "improving use of existing systems," generalized a limited 1976 topic and raised the topics of operations and demand management for the first time.

The new issue in 1978 involved addressing national goals, an issue that resurfaces whenever funding is threatened, although rethinking goals is appropriate at any time. At one point, the reliability of the federal government in developing and funding legislation for surface programs was in question after delayed legislative reauthorizations and conflicts over appropriate roles for transit. In 1981, "viability of public transit" joined the topic of "railroad viability," addressing the financial survival of these systems.

Energy, environment, safety, and land use have been hardy perennials on the list, with occasional absences. Often the descriptions of these and of other issues did not change from edition to edition. In 1976, the discussion of "system maintenance and management" opened with the sentence, "The U.S. transportation system is now essentially in place,"



TRB issued its first critical issues in transportation statement (*far left*) in a 1976 issue of *TR News*. The 12th statement was issued in 2013.

(*Photo, facing page:*) An aerial view of railroad tunnels in Bergen Hill, New Jersey, circa 1978. Railroad viability was added as a critical transportation issue that year.

First identified as a critical issue in transportation in 1987, congestion was a top issue in the past three statements.

and the 1978 and 1981 texts repeated the phrasing. The 1984 list dropped the statement but added the topic of congestion for the first time.

The issues identified in the 1970s—finance, economic development, national goals, environment, and safety—continue to have currency. Their persistence, however, does not imply a lack of progress.

Middle Period, 1984–1990

With the 1984 list, the Executive Committee increased the number of critical issues from 10 to 18. After 1984, the list reverted to a top-10 for three cycles, then dropped to five in 1997, and jumped to 14 in 2002. The varying pattern recurs with nine issues in 2007 and 2009 and five in 2013.

In 1984, 10 of the 18 were new or nearly new issues—that is, variants on past issues. But the document introduced several truly new and timely topics: improved productivity, international com-

PHOTO: SOUNDERBRUCE, FLICKR

Photo: Robert Couse-Baker, Flickr

Muir Woods in Marin County, California, offers free electric car charging stations. The environment is a perennial topic in TRB's critical issues statements.

petitiveness, procedural complexity, impacts of high technology, private-sector involvement in the decision process, truck freight, and congestion. Two other new issues appeared as one-time events: the decommissioning of infrastructure—road abandonments had occurred in some farm states—and the loss of transportation equipment manufacturing.

The discussion of finance cited gasohol and other exemptions as reducing the potential investment revenues in the trust fund—a harbinger of current concerns. An interesting addition, the "changing character of urban transportation services," may have extended and broadened the transit survival topic of 1981 in the context of economic malaise. The discussion notes that "the strain of paying for existing services is approaching the breaking point in many localities" and addresses a set of related topics, many persisting today.

The single addition to the issues list in 1987 was "the changing roles of governments," an extension of the issue of national goals and intergovernmental relations. The focus at the time was on shifting responsibilities from Washington to states and local governments or to the private sector. The effects of deregulation were an important consideration, especially the declining number of carriers—a problem echoed in the 2002 edition and still current.

The 1990 list added one new issue, "human resources," which has remained and will continue with the aging of the transportation workforce. The first approach, however, cited concerns that guide the issue and framed the questions to lead toward a resolution.

Civil engineering students tour a project site. A newer addition to the critical issues statements, human resources will continue to be a topic of significance as larger numbers of the transportation workforce reach retirement.

Photo: Iowa State University

Modern Period, 1994–2013

The modern period of the critical issues series began with the 1994 treatment, which added several new issues and applied the terms "sustainable," "intermodal"—reflecting the new surface transportation legislation—and "quality." The technical and graphical treatment of the issues was a welcome addition.

Identifying Security

The 1997 report was the first to have a limited set of issues—five. Two were composites of previously identified concerns—"mobility and accessibility" and "safety and security." The report's enduring significance was the identification of the concern about security from terrorist acts—a prescience that was inadequately heeded. The document raised the following, still pertinent questions:

◆ How vulnerable is the U.S. surface transportation system to threats of terrorism and sabotage, and what should be done to address these concerns?

◆ Given that the U.S. passenger systems were designed to be accessible, easy to use, and capable of processing masses of users efficiently, what kinds of changes to increase security will users accept and be willing to pay for?

New, Added, or Dropped

The first delineation of issues in the new century, the 2002 edition, added two new elements: equity across socioeconomic groups and the aging population—the first critical issue to focus on demographics, despite such influences on the nation in the preceding 50 years as the Baby Boom, the Sun Belt migration, suburbanization, and immigration.

The 2006 report and its 2009 update reverted to a top-10 format—if energy and environment were identified separately, the total would have been 10. Significant wording changes include the addition of climate change to energy and environment and the shift of emergencies to emergency preparedness, response, and mitigation.

Congestion remained at the top in each. Climate change, energy, and environment rose to second place, and emergencies—even with the added components—shifted down the list to sixth place. Infrastructure made the greatest shift upward, from sixth to third, as infrastructure renewal gained recognition.

Several issues were subsumed or lost from the 14 in 2002. Among those lost were "transportation system technology and management," "institutional and legal reform," "industry consolidation," "aging population," and "impact of telecommunications." Although these terms are not mentioned in the 2006 and 2009 editions, the questions remain relevant. Table 1 (page 30) summarizes the issues of the most recent period.

A List Apart

The set of five 2013 critical issues stands apart from others in this century and may have its closest correlate in the five-issue 1997 report that introduced safety and security. Neither security nor terrorism is separately identified in the 2013 list, but both are addressed in the topic of system performance, and the energy issue grouping makes a brief, positive reference to the energy security benefits from increases in domestic energy production.

The 2013 document drops equity, emergency-related activities, and institutions, and it addresses congestion and infrastructure under "system performance," which relates to legislative requirements in the Moving Ahead for Progress in the 21st Century Act. "Human and intellectual capital" can relate to the new issue, "innovation lags and R&D investment." The report notes that the order of the issues is not significant.

PHOTO: LI TSIN SOON, FLICKR

The issue of security in the transportation system, introduced in 1997, raised questions about terrorism threats still pertinent today.

The 2013 approach gives more extensive treatment to each of the issues. Some discussions, such as that on funding, treat individual modal or sectoral elements in detail. Equity reemerges as a topic under funding.

The five issues of 2013 can serve as umbrella categories for future issue elements. The 2013 statement, however, did not follow the trend of melding the topics of emergency preparedness and of disaster response into broader safety concerns.

PHOTO: DWAYNE BENT, FLICKR

Aging infrastructure, exemplified by the Manhattan Bridge in New York, is a concern of increasing importance.

TABLE 1 Most Recent Critical Issues Correlated by Topic

2006	2009 Update	2013
[1] Congestion	[1] Congestion	[1] System Performance
[2] Emergencies	[6] Emergency Preparedness, Response, and Mitigation	
[3] Energy and Environment	[2] Energy, Environment, and Climate Change	[3] Energy, Climate, and Environment
[4] Equity	[5] Equity	
[5] Finance	[4] Finance	[4] Funding Public Infrastructure
[6] Human and Intellectual Capital	[9] Human and Intellectual Capital	[5] Innovation Lags—R&D Investment
[7] Infrastructure	[3] Infrastructure	
[8] Institutions	[8] Institutions	
[9] Safety	[7] Safety	[2] Safety

NOTE: The number in brackets indicates the order in which the issue appeared on the list.

Enduring Threads

Synthesizing almost 40 years of issues development is not easy—the same words take on different meanings, and nuances acquire new connotations. Nevertheless, seeing the broader picture has value (see Table 2, page 31). What criteria could determine the effectiveness of the work on critical issues?

The 2003 *TR News* article identified several overarching themes that can help to comprehend the trends in issues (*1*). The original set has been expanded somewhat, as follows.

Transportation and…

One set of issues always relates to transportation's interaction with the world—the potentially deleterious or the occasionally positive effects. Much of contemporary transportation policy and planning analysis responds to these concerns. The key point is that the issues involve the interaction between transportation and something valued.

Issues with negative implications include transportation and energy, transportation and environment, transportation and safety, transportation and social equity, and transportation and security. Issues with neutral or positive implications include transportation and economic development, transportation and international trade, transportation and productivity, and transportation and land use.

Getting More out of the System

Another set of actions involves improvements in such tasks as maintaining system assets and operations, addressing system throughput, streamlining processes, responding to future needs, assuring adequate human resources, establishing a sound research base, and analyzing investments.

Coordination

Transportation involves all levels of government and many components of the private sector. A set of perennial issues derives from the interactions between levels of government and the private sector, sometimes taking new forms, such as government roles, improving intergovernmental arrangements, regulation and deregulation, planning and policy interactions, and public–private cooperation.

Saving Some

A set of issues relates to the needs of a threatened or declining component of the transportation sector. These have included road disinvestments, saving transit, the viability of railroads, and equipment manufacturing. In recent editions, this area has received less focus—perhaps indicating the maturity of the

PHOTO: STEVE ZUMWALT/FEMA

A Federal Emergency Management Agency emergency operations center handles disaster management after flooding in Waynesville, Missouri. In the 2013 critical issues statement, disaster response was addressed under the heading of "system performance."

TABLE 2 Trends in the Critical Issues

Critical Issue Introduced		1976	1979	1981	1984	1987	1991	1994	1997	2002	2006	2009	2013[a]
No. of Issues Identified	Topic Theme	10	10	10	18	10	9	10	5	14	9	9	5
Financing requirements and alternatives for transportation systems and services	*Finance*	1		1		4	3	10		8	5	4	4
Need for measurable, attainable goals at the national level	*Goals*		1	3									
Improved management of public capital investments in transportation	*Capital decisions*				1	1					7	3	1
Sustainable transportation	*Sustainability*							1	2				
Mobility and accessibility	*Mobility*								1				
Performance	*Performance*												1
Energy efficiency	*Energy efficiency*	2	10	8	15		6			6	3	2	2
Improved transportation productivity	*Productivity*				2	2	1						
Institutional and legal reform	*Institutional reform*							2		4	8	8	
Intergovernmental responsibility for transportation systems	*Intergovernmental*	3	2	4			7						
Finance and equitable allocation of resources	*Resource allocation*		3		5								
Safety and security	*Security*								3	1	2	6	
Transportation system maintenance, technology, and management	*System management*	4	7	5	12		4	4		7			
Transportation performance criteria and design standards	*System performance*	5	5	6									
Changing roles of federal, state, and local governments	*Roles*					5			5				
Effects of transportation regulations	*Regulations*	6	4		10	8							
Improvement of existing nonurban transportation facilities	*System operations*	7	6	2									
Improved use of existing system	*Operations*		6	2									
Procedural complexity	*Streamlining*				6								
Intermodal issues	*Intermodal*							6					
Interrelationship between transportation and economic development	*Economic development*			7	3	7							
Challenge of high technology and the Information Age	*High technology*				7			3	4				
Transportation, land use, and city form	*Land use*	8											
Viability of U.S. railroads	*Railroads*		8	9									
Transportation and the U.S. competitive position worldwide	*International competition*				8	6		7					
Quality	*Quality*							8					
Transportation and the environment	*Environment*	9			16	10	5			5	3	2	2
Decommissioning of existing infrastructure	*Disinvestment*				9								
Energy, land use, and transportation	*Energy, land use, and transportation*		9										
Human resources	*Human resources*						9	9		9	6	9	5
Transportation safety	*Safety*	10			4	3	8	5		2	9	7	3
Survival of public transit	*Transit*			10	11								
Industry consolidation	*Consolidation*									10			
Aging population	*Population*									11			
Equity	*Equity*									12	4	5	
Loss of transportation equipment manufacturing industry	*Manufacturing*				13								
Impacts of telecommunications	*Telecommunications*[b]									13			
Congestion	*Congestion*				14	9	2			3	1	1	1
Barriers to innovation	*Innovation*[c]									14			5
Involving the private sector in the planning process	*Private plans*				17								
Highway goods transportation	*Highway freight*				18								

NOTE: Numbers in the cells represent the order in which the issue appeared in the published list.
[a] Because the 2013 report issues meld multiple antecedents, multiple references are made. [b] Link to high technology. [c] Link to institutional.

Photo: Viiban Pavic, Flickr

The role of all transportation modes in various aspects of social or economic development is an often-addressed critical issue.

system—although the saving of the U.S. automobile industry in the past decade comes under this concern. New communications-based, shared systems and their impacts on extant services is a prospective example—saving taxi companies or carpools may soon become issues.

Respice, Adspice, Prospice

A few statements of issues anticipate challenges—security, for example, or the aging population. Most of the issues, however, have focused on problems of the here and now, already manifested—something is not working and needs to be fixed. Amtrak would be the quintessential example of this kind of issue.

Nevertheless, little focus is placed on methods, and issues of data for planning have been mentioned rarely. One component has focused on where we are and where are we going, addressing national goals, performance measurement, design standards, and sustainability.

Several critical issues statements have focused on anticipated challenges, such as the transportation needs of an aging population.

Photo: AAA Foundation for Traffic Safety

Where's the Money?

Having sufficient financial resources is, and probably always will be, the main issue in transportation—where will the money come from to deal with the problems and the intertwined relationships between levels of government. The uncertainties in the federal process during the past few decades have generated continuing concern about such issues as finance, sharing costs, equity in funding, new sources of revenue, inflation adjustment, and public–private interactions.

Antecedents of the 2013 Issues

Of the five critical issues of 2013, two—safety and "energy, climate, and the environment"—have recognizable antecedents in the traditional "transportation and" category. Safety, sometimes melded as "safety–security," was the 10th of 10 issues in the first edition of critical issues in 1976 and has appeared in every edition except for 1979 and 1981. In 2002, security and safety appeared as the top two issues.

The grouping of energy, climate, and the environment debuted in 2013 but has a long trail of antecedents. Climate makes its first appearance in 2013, but except for the 1987, 1994, and 1997 editions, energy has appeared in every critical issues treatment, including a one-time appearance as "energy, land use, and transportation" in 1979. Environment similarly has persisted, missing only in 1994 and 1997. The related issue of sustainable transportation replaced energy and environment in the 1994 and 1997 editions.

Funding frequently appears as finance and is the hardiest of perennials, skipped only in 1997. The number one issue in the first edition of 1976 and again in 1981, funding was presented in the interim year of 1979 as a joint issue with "equitable allocation of resources" and again in 1984.

"Innovation lags—R&D investment" has a complex history as an issue, linked with the concepts of

human and intellectual capital or human resources. In those forms, this issue has appeared in all of the recent editions, as well as in 1991 and 1994.

System performance melds many disparate elements of the critical issues lists and may be considered present from the beginning—in the broadest interpretation, perhaps 20 of the critical issues over the years can be linked to system performance.

Final Scorecard

Can any issues from the almost four-decade history be singled out as solved or resolved? Times change, and frontline topics are replaced. Semantics sometimes puts old ideas into current terms and sometimes provides valuable insights into shifts in perspective. Many issues have made progress, and the apparent persistence of an issue can indicate further developments, adjusted goals, and new values redefining old problems. Environment, safety, and finance remain issues despite progress in each area.

The TRB definition of an issue carries the connotation that research can resolve parts of the problem—appropriate to the Board's mission of providing leadership in research. Better knowledge of the potential impacts of possible actions can enlighten the "unresolved aspects of transportation…for which the impacts of possible actions are unknown."

The definition presents a positive view of the issues, in contrast to the notion of irreconcilable conflict. The TRB definition also implies guidance for action—the first step in addressing issues in a meaningful way involves data collection and analyses of the scale, scope, and implications of alternative policy responses.

Photo: Oregon Department of Transportation

Severe storms in Oregon caused damage to sections of US-101. The effects of climate change on transportation first appeared in the 2013 critical issues statement.

The measure of progress, then, would be to what extent TRB has added to the storehouse of knowledge and analytical tools concerning "the impacts of possible actions." By that measure, TRB and the transportation community have made substantial progress; nevertheless, much work remains, particularly to expand the assessment of the analyses, the modeling, and the data needs to respond effectively to any critical issue.

Shaping the Next Set

This review yields several ideas for consideration in shaping the next set of critical issues:

◆ Words written long ago are subject to personal interpretations; reviewing the history of the issues from different vantage points therefore would be valuable.

Photo: Scott L, Flickr

A sobriety checkpoint in California. Driver safety and other enduring topics of concern can benefit from new approaches.

The 12 Editions of Critical Issues

Critical Issues in Transportation 2013
http://www.trb.org/main/blurbs/169945.aspx
TR News, No. 288, September–October 2013 (insert)

Critical Issues in Transportation: 2009 Update
http://onlinepubs.trb.org/Onlinepubs/general/CriticalIssues09.pdf

Critical Issues in Transportation
http://onlinepubs.trb.org/onlinepubs/general/CriticalIssues06.pdf
TR News, No. 242, January–February 2006 (insert)

Critical Issues in Transportation 2002
http://onlinepubs.trb.org/onlinepubs/trnews/2002_critical_issues_article.pdf
TR News, No. 217, November–December 2001 (insert)

Critical Issues in Transportation
TR News, No. 193, pp. 9–19, November–December 1997

Critical Issues in Transportation
TR News, No. 174, pp. 2–10, September–October 1994

Critical Issues in Transportation for the 1990s
TR News, No. 157, pp. 2–9, November–December 1991

TRB Identifies 10 Critical Issues in Transportation
TR News, No. 132, pp. 2–14, September–October 1987

Critical Issues in Transportation
TR News, No. 114, pp. 2–14, September–October 1984

Ten Most Critical Issues in Transportation: 1981 Update
TR News, No. 95, pp. 2–5, July–August 1981

The Ten Most Critical Issues in Transportation: A 1978 Update
TR News, No. 79, pp. 2–5, November–December 1978

The Ten Most Critical Issues in Transportation
TR News, No. 67, pp. 2–4, November–December 1976

◆ The authors of future reports in the critical issues series might consider placing their statements in the context of previous editions.

◆ A synthesis study or an effort at the TRB Technical Activities group level could research the role, effects, and influence of past critical issues treatments by TRB and by others and consider how to expand the influence.

◆ The TRB Executive Committee could reinstitute the process of inviting the Technical Activities standing committees, sections, and groups to assess the critical issues and their roles in response. For example, in the past, the Data Section addressed the data needs generated by the new set of issues; this contribution proved particularly important in the area of system performance. The 40th anniversary of the TRB critical issues series in 2016 may present a good opportunity to reintroduce a bottom-up approach to delineating issues, starting at the standing technical committee level.

The work of many people over many years in identifying the critical issues in transportation has proved a useful and engaging exercise. In many cases, the issues have heightened the recognition of threats to the transportation system and have served to consolidate and focus responses from all levels and sectors of transportation.

References

1. Pisarski, A. E. Prescriptions for Research: Reviewing the History of TRB's Critical Issues in Transportation. *TR News*, No. 226, May–June 2003, pp. 30–35.
2. National Transportation Policy Study Commission. *Final Report*. Washington, D.C., 1979.

The Subcommittee on Planning and Policy Review of the TRB Executive Committee, shown at a 2013 meeting, develops and coordinates the statements on critical issues in transportation.

With adaptive capabilities and transport efficiency developed over many decades, the American circus has served as a model for the truck and rail freight industries.

PHOTO: DAVE HERHOLZ, FLICKR

Logistical Challenges of the American Circus

Solving Transportation Problems with Ingenuity, Daring, and Timing

SCOTT BABCOCK

With its ferocious felines, hazardous high-wire daredevils, and cavorting clowns, the American circus is an institution that provokes fascination in people of all ages. Behind the scenes, however, the inner workings of moving the circus from city to city open up another area of high performance. The circus has evolved in every aspect throughout its more than 200-year history, but the adaptations of travel methods to the momentous changes in the circus industry offer insights into applied research and adaptive logistics.

Circus Origins

Today's American circus traces its roots to London, where in the late 1760s, Philip Astley opened a horseback riding school and performed riding tricks for the public in a circular arena. Astley soon added acrobats, rope walkers, and jugglers. He also reintroduced the clown, a stock character from the Elizabethan theater, to perform in comedic interludes. This model for a circus was exported to other countries and arrived in the United States around 1800.

In Europe, circus shows had taken place in large buildings, but the early 19th century United States presented a different market. Several large cities

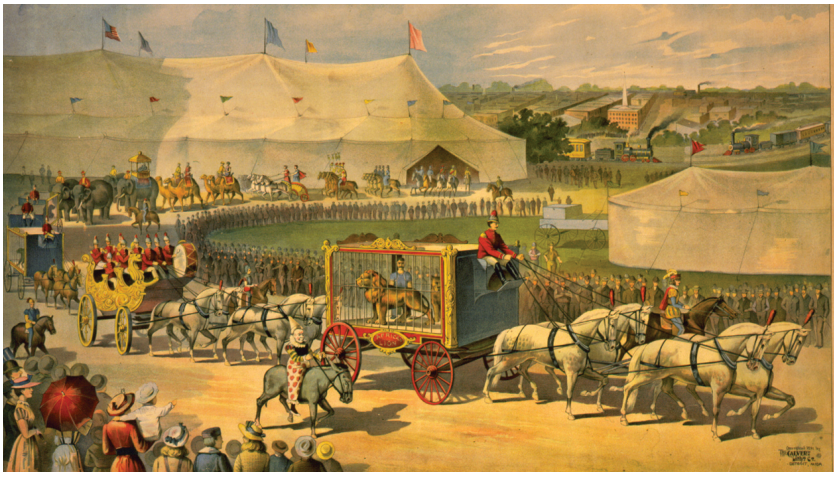


PHOTO: LIBRARY OF CONGRESS PRINTS AND PHOTOGRAPHS DIVISION

A poster from the late 19th century shows a circus parading through an American town. In the 1800s, the English model of circuses hosted in large buildings was adapted to American geography as a traveling show.

The author is Senior Program Officer, Rail and Freight, TRB Technical Activities Division.

Photo: Edward J. Kelty, Tibbals Digital Collection of the John and Mable Ringling Museum of Art

The "spectacle," a show-opening procession of all the circus acts, under the Big Top tent circa 1931.

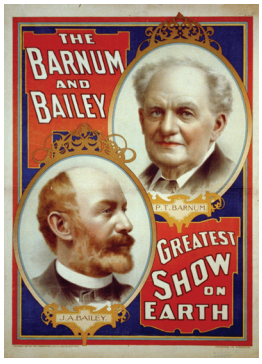


Photo: Library of Congress Prints and Photographs Division

P. T. Barnum (*right*) and J. A. Bailey (*left*), founders of America's most recognized circus, the "Greatest Show on Earth."

flourished along the East Coast, but the population was moving westward and was becoming more dispersed than that of Europe.

To reach more customers, circus owners decided to send their shows on the road. Traveling by horse-drawn wagons, the typical circus moved between small towns that could support only one or two shows. The horse-drawn vehicles limited the travel distance to 10 to 20 miles between sites, restricting the choices for circus itineraries.

In 1871, Phineas Taylor (P. T.) Barnum joined with William Cameron Coup to present P. T. Barnum's Museum, Menagerie & Circus in New York City. Soon after, Coup invented a system for the circus to travel from city to city by railroad. This opened up greater distances on an overnight "jump," increasing the flexibility of the tour schedule.

In 1881, James Anthony Bailey of the Cooper & Bailey Circus joined with P. T. Barnum to form the Barnum & Bailey Circus. After Barnum's death in 1891, Bailey ran the circus until his own death in 1906. The following year, the Ringling Brothers of Baraboo, Wisconsin, acquired the Barnum & Bailey Circus, creating the Ringling Brothers and Barnum & Bailey Circus and retaining the Barnum & Bailey trademark slogan, "The Greatest Show on Earth." This new entity, which has lasted to this day, ushered in the golden age of the American circus.

Ringling on the Move

In the early 1900s, many traveling shows criss-crossed the country, but Ringling Brothers was the largest and most famous. The traveling troupe consisted of 400 workers, 300 performers, 200 baggage or working horses, 100 ring or performing horses, exotic animals, supporting equipment and material, and the all-important tents—including the Big Top—that housed and supported the show.

Preparations and First Section

Plans for the route and logistical arrangements would be developed up to one year in advance, and supply contracts were negotiated months ahead of the circus visit. Advance men would visit each town on the route to post advertisements and to check on supplies. The "24-hour man" would arrive one day ahead of the circus to verify that the unloading area, the wagon route, and the circus lot were ready. In addition, he would make sure that all supply contractors were prepared to deliver everything as needed.

At dawn on show day, around 5:00 a.m., the first section of the circus train arrived with the stake driver, the baggage horses, the pole wagons, the stable and menagerie tents, and the cookhouse tent. The 16 flatcars were stationed on a track adjacent to a road crossing to unload the wagons.

"Runs," or portable ramps, would be set up on the end of the first car, and bridge plates were installed between the cars. Horses on the ground would pull

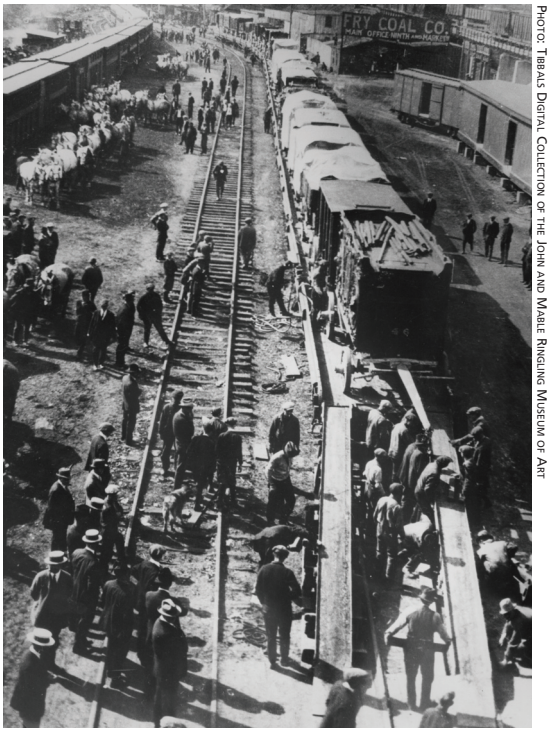


Photo: Tibbals Digital Collection of the John and Mable Ringling Museum of Art

A view of the train yard and portable ramp setup.

each wagon by rope from car to car until it reached the run and was led down to ground level. A team of horses would be hitched to each wagon to pull it to the circus lot. This method, known as "circus loading," would be adapted and applied in the early days of intermodal freight transportation for moving highway trailers on and off railroad flatcars.

First off the train, the stake driver and the stake and pole wagons would travel to the circus lot. Crews drove the five-foot anchoring stakes into the ground, raised poles to support the tents, and tied the poles to the stakes.

Next Sections

The first tent erected on the lot was the cookhouse tent, to serve breakfast to all of the circus workers—their first opportunity to eat since the evening meal in the previous city. The second section of the circus train arrived one hour later, with more baggage horses, more workers, and additional wagons with the side show and dressing room tents, as well as the main tent or Big Top.

The third section of the circus train would arrive around 7:00 a.m., delivering additional baggage horses, the ticket wagons, and the wagons containing the rings, the seating risers, the seats, the show props, and the wardrobe.

The fourth and last section of the circus train would arrive at around 8:00 a.m. This section contained the large animals—including elephants, camels, ponies, and ring horses—as well as the performers and the circus executives.

Breakfast was served during the morning setup, and the midday meal would be served to all circus workers and performers between noon and 1:30 p.m. The matinee performance ran from 2:00 to 4:30 p.m., and the evening meal was served from 5:00 until 6:30 p.m. After that, the tent dropping and packing up would begin.

Packing Up

Crews struck the cookhouse tent first and loaded it back on the first section of the train. After the start of the evening performance at 7:00 p.m., the sideshow, stable, and menagerie tents were struck and loaded. The first section of the circus train would leave town before the conclusion of the evening performance.

As soon as their use in the show was over, the tents and equipment would be dropped, packed, and loaded, so that by the time the evening show ended—around 9:30 p.m.—a major portion of the circus already had left town. Crews completed the loading of the remainder of the circus by midnight, and the various sections of the circus train traveled through the night to the next town, where the cycle would start again.

Photo: Allen Lester, Tibbals Digital Collection of the John and Mable Ringling Museum of Art

Circus workers prepare the ramps, or runs, for unloading the wagons from train cars for a 1952 Ringling Bros. show.

Logistics Principles

A 2010 paper by Mabert and Showalter outlined circus logistics principles and provided examples of the applications (*1*):

◆ **Minimize inventory through an order lot size of one.** The more than 700 people and 400 animals traveling with the circus consumed an enormous amount of supplies every day. Buying these items in large quantities periodically would necessitate carrying inventory, as well as additional handling, wagons, and railcars.

The circus developed a system for ordering in advance and procuring locally all of the consumables needed for a single day. Vendors made deliveries to the lot daily, saving the labor and expense of carrying supplies to the next town. Morning deliveries in each town consisted of the food for the noon and evening meals and for the following day's breakfast. The circus practiced just-in-time inventory for food and other materials.

Photo: Charles W. Cushman Collection, Indiana University, Bloomington

Workers started dismantling tents, from the cookhouse to the stables, during the evening show, so that by the time the final show of each engagement was over, most of the circus had already left for the next location.

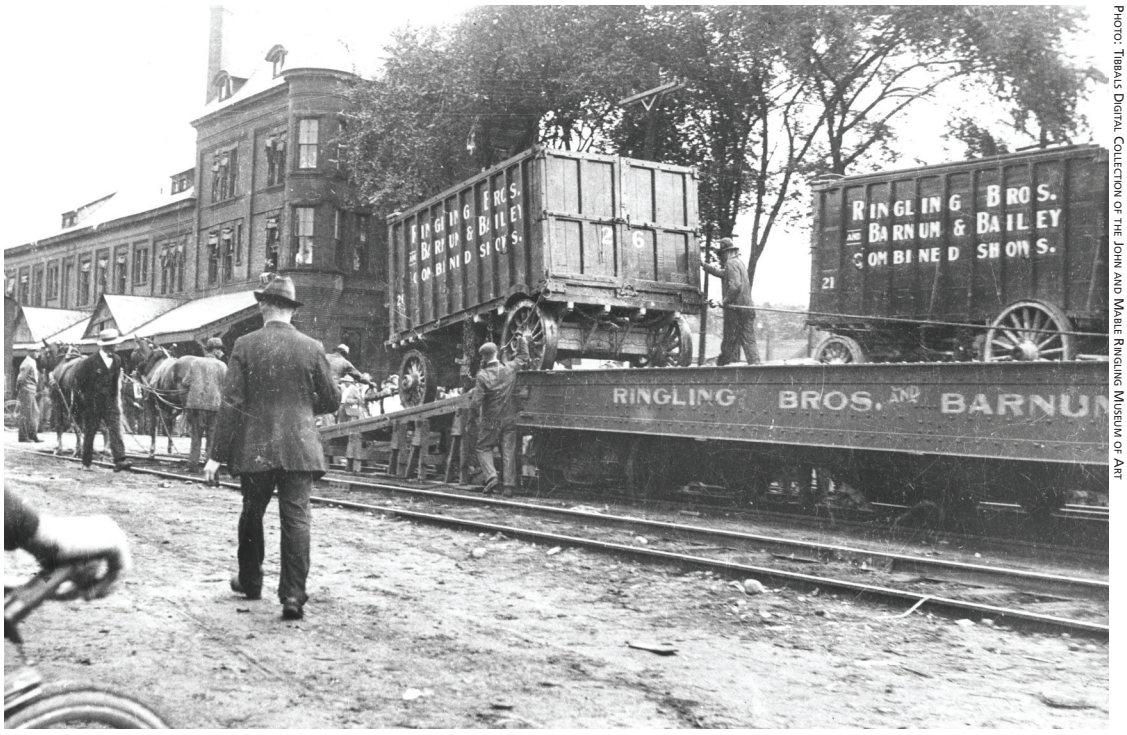


Photo: Tibbals Digital Collection of the John and Mable Ringling Museum of Art

Circus logistics adapted to changing transportation technology—from the horse-drawn containers shown in this undated photo to automobiles.

◆ **Track the procurement and require point-of-use delivery.** If the preliminary checkup found that a vendor was unable to supply materials as promised, the advance man would negotiate a new contract with another vendor. The circus would only accept deliveries after the tents were set up, so that supplies went directly to the point of use. Some vendors—for example, the suppliers of hay and straw—would have multiple drop points, to reduce handling by circus workers.

◆ **Position operational equipment to maximize flows and minimize waste.** The circus would arrange its tents to fit the lot in each city, but always to accommodate the flows of people and equipment. Just past the ticket windows, patrons would find the midway and the sideshow tent. These led to the menagerie tent, and behind that or adjacent to it stood the Big Top.

Patrons entered the front of the Big Top, and performers and supplies arrived at the back. The support tents—such as stable tents, performers' tents, and dining tents—would be located toward the back of the circus lot.

The most important logistical flow—moving the equipment on and off the train—was carefully orchestrated. Each night, each section of the train was loaded in the exact order it would be unloaded the next day.

◆ **Design equipment to minimize setup and task times.** The circus owned all of the cars in the circus train and designed each to a specific purpose. The circus carried the runs for moving the wagons on and off the train, negating the need to find ramps at each destination. The horse cars were designed with built-in feeding equipment, and the design of the passenger cars maximized living space.

◆ **Reduce or eliminate bottlenecks by splitting lots.** The entire circus train could encompass as many as 100 cars. To minimize delays, the train was split into sections that ran separately on staggered schedules to eliminate bottlenecks. Equipment and materials would be moved to the train and loaded when use at the circus lot was complete.

Photo: Charles W. Cushman Collection, Indiana University, Bloomington

Equipment for offloading and setup, each piece dedicated to one or more specific tasks, streamlined the process.

Developing New Models

The principles that Mabert and Showalter identify reflect the so-called golden age of the American circus, from the late 19th century through the 1920s. Motion pictures, radio, and eventually television presented competitive challenges to the traditional circus model.

Big Top Down

Ringling family infighting for control of the circus, coupled with labor issues, a decline in the quality of railroad service, and diminishing ticket sales threatened the survival of the circus, and on July 16, 1956, Ringling Brothers played the final tent show in Pittsburgh, Pennsylvania. The circus struck the Big Top for the last time and headed to its winter home in Florida. The president of Ringling Brothers and Barnum & Bailey noted, "The tented circus as it now exists is…a thing of the past" (2).

John Ringling North and his brother Henry, nephews of the original Ringling Brothers, undertook a redesign of the circus to fit the modern entertainment model. The model abandoned the Big Top in favor of modern, heated and air-conditioned indoor sports arenas.

This changed the logistics of the circus dramatically, also eliminating the dressing top, the sideshow, and the menagerie. Gone too were the baggage horses, whose use had declined over the years with the introduction of tracked and wheeled tractors.

Because the venues provided seating, the risers and chairs no longer accompanied every move. The number of circus employees was reduced by nearly one half. The circus train also was abandoned for a time but soon was reinstated on a reduced scale.

Rocking the Circus

Instrumental in these changes and in the development of the new model for the circus were two brothers, Irvin and Israel Feld, who applied their expertise at booking rock-and-roll shows in big city, indoor venues. In 1957, when Ringling Brothers went back on the road, the circus hired the Felds, who placed and promoted the revised shows in large venues, applying modern marketing techniques.

PHOTO: TIBBALS DIGITAL COLLECTION OF THE JOHN AND MABLE RINGLING MUSEUM OF ART

The six-pole Big Top tent in this undated photo dominates the circus lot, which also includes seven other tents and many smaller structures in a layout that maximized the flow of people and equipment. This setup often was put up and torn down in less than 24 hours.

The result was a rebirth of the circus as a thriving entertainment business. The Feld brothers eventually bought the circus from the Ringling family, and their ownership continues under Feld Entertainment in Vienna, Virginia.

Three-Unit Circus

The Ringling Brothers Circus of today consists of three circuses or units. The Red Unit and Blue Unit are self-contained shows redesigned in alternate years. Each unit embarks on a two-year tour every other year, following approximately the same route. Each unit tours from late January until mid-November, visiting 30 to 42 cities each year.

After the Ringling Brothers train arrives at a city, local towing companies move the trailers to the arena and circus tractors position the trailers for unloading and storage.

Common Sayings with Circus Origins

SCOTT BABCOCK

Many common sayings have their origins in the American circus. Some examples follow:

Hold your horses. Most circus troupes held a parade to move the large animals from the train yard to the circus lot after arrival and to advertise the show. Before automobiles, the streets were crowded with everyday citizens riding horses. The sight, sounds, and smells of the exotic circus animals often spooked domesticated horses, and the warning would go out to "hold your horses," to prevent frightened horses from bolting away.

Jump on the bandwagon. Circus parades featured a brightly colored wagon carrying the circus band to the Big Top. Politicians would rent seats on the bandwagon to be seen by the crowds, and supporters often would "jump on the bandwagon" with them.

Grandstanding. Circus grandstands were near the center of the Big Top and offered the best views. The most well-off and influential citizens purchased these seats. Politicians would tour the sections before and during circus performances, greeting and visiting patrons—or "grandstanding."

Toss his hat into the ring. Originally, "tossing the hat into the ring" was a way of issuing a challenge for a boxing match, but in 1916, President Woodrow Wilson threw his hat into the center ring at a Ringling Brothers performance, to indicate his intent to run for reelection. After that, the expression became political.

Dog-and-pony show. This term originally referred to a small traveling circus that could not afford large, exotic animals and horses and therefore had to settle for "dogs and ponies." The term has come to mean a highly touted, overly staged presentation or production.

Get this show on the road. This was the order that the circus boss would shout at the end of the last performance in a town; the expression now applies to getting any activity started.

Jumbo. P. T. Barnum purchased Jumbo, then believed to be the largest elephant in the world, from the London Zoo. Jumbo became a major attraction throughout North America from 1882 until 1885, when he was struck and killed by a locomotive in Ontario, Canada. The term jumbo eventually described anything outsized or the largest of the large.

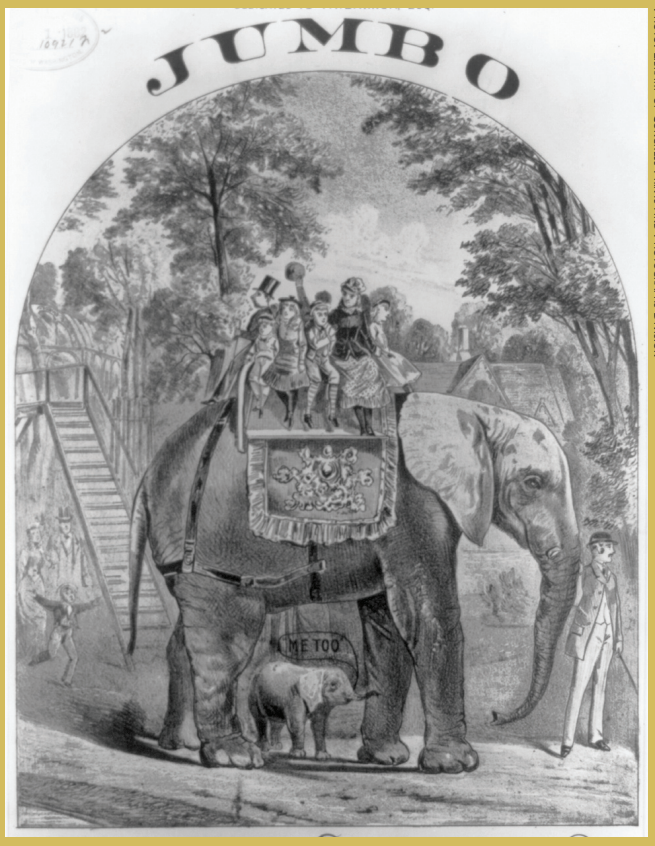


PHOTO: LIBRARY OF CONGRESS PRINTS AND PHOTOGRAPHS DIVISION

Jumbo, "the largest and noblest animal that ever lived," lent his name to anything of extra-large size.

PHOTO: GEORGE GRANTHAM BAIN COLLECTION, LIBRARY OF CONGRESS PRINTS AND PHOTOGRAPHS DIVISION

"Hold your horses!"—a horse-drawn lion cage of the Society Circus, Long Branch, New Jersey, in the early 20th century, prepares to enter town.

PHOTO: FORT CARSON

Ringling Brothers elephants start their walk from the circus train, parked near the B Street gate at Fort Carson, Colorado, to the World Arena in southeast Colorado Springs. Earlier this year, the circus announced that it will retire its elephant herd by 2018.

The Gold Unit, the third circus, travels exclusively by truck and plays smaller cities and venues. All of the units spend the winter at the Ringling headquarters in Venice, Florida.

The circus trains of today's Red and Blue Units are modern traveling cities that usually change location weekly. Typically the circus train leaves a city on Monday and travels into Tuesday if necessary. The circus is unloaded at arrival, and all of the equipment is moved to the venue and set up. Local towing companies are contracted to move the trailers to the arena, where circus tractors position the trailers for unloading and for storage nearby.

The elephants and some horses usually walk to the arena, sometimes quietly in the middle of the night—depending on the arrival time—and sometimes during the day or early evening in a parade with fanfare. Other animals arrive from the train yard by truck. The show opens on Wednesday or Thursday, with two or three shows daily until closing on Sunday.

After Sunday's last show, the process reverses, and the big animals walk back to the train yard while the circus wagons are loaded and pulled to the train. The circus train is reloaded and reassembled during the night—with adjustments for the train's direction and for the facilities in the next city—and generally departs early Monday morning for the next destination, to begin the cycle again.

Train Makeup

The circus train itself is a combination passenger and freight train unique in American railroading. The makeup of the train changes slightly from year to year and unit to unit, but generally consists of four animal cars, two power-generator cars, 33 passenger cars of various configurations, and 21 flatcars that carry containers, wagons, and vehicles.

The average train comprises 60 cars, extends approximately 1 mile, and weighs between 4,200 and 4,900 tons fully loaded. The circus owns all of the cars, but the host railroads own and operate the locomotives that pull the trains.

Routing requirements pose a logistical challenge for the circus train. The circus has always played in Madison Square Garden in New York City and in

PHOTO: JOE SHLABOTNIK, FLICKR

The circus train has adapted to the logistical challenges of certain locations, such as Madison Square Garden in New York.

From containerization to splitting lots, many of the logistical practices in use today were pioneered by the circus.

Photo: Don Barrett, Flickr

recent years has moved on to venues in Brooklyn and on Long Island. Travel to these venues requires passage through the tunnels under the Hudson and the East Rivers, as well as into Amtrak's New York Penn Station. The circus train is the only non-Amtrak, noncommuter, freight-hauling train that negotiates this trackage, which requires special designs and configurations to fit the restrictive clearances of these routes.

Height restrictions prevent conventional trailer-on-flatcar intermodal equipment, as well as modern multilevel automobile carriers. The circus therefore has developed specialized equipment to comply. The circus wagons are designed and built as "containers on wheels," unlike standard highway trailers or containers on conventional intermodal chassis.

These custom-built containers ride on numerous small-diameter wheels, not on standard highway tires. The design provides the circus wagons with a low profile that fits the New York tunnels, as well as other restricted clearances on potential routes throughout North America.

Custom-designed elements of circus train equipment—such as the small-diameter wheels of the circus wagons—ensure a low profile so that the vehicles can travel in height-restricted areas.

Photo: Scott Babcock

Circus Train Living

The circus train is more than a means of conveyance from city to city. The train is home to all of the performers and workers while the circus is on the road. The passenger cars therefore are not conventional coaches but sleeping cars with custom interior configurations.

The circus hierarchy determines the train accommodations—circus workers live in small rooms no larger than an office cubicle, but a star may occupy quarters that take up half a car or more. The passenger cars are stored in a rail yard as close as possible to the arena in each city, and a shuttle bus conveys all circus personnel between the train and the arena.

Many circus workers and performers who live on the train travel with their families. For the children on board, the circus provides a teacher who runs a school on the train. Many circus workers and performers prepare meals in their rooms on board, and the restaurant or "pie car" serves meals and snacks 24 hours a day for those who do not cook.

Logistically the Greatest

The trains of the Ringling Brothers Circus are unique not only in the railroad industry but also in the logistical arena. No other transportation and logistical entity combines shipper investment, freight movement, passenger transport, and living accommodations in the way that the circus trains do. The Ringling Brothers and Barnum & Bailey Circus has been billed as the Greatest Show on Earth for more than 100 years, but the circus also can claim the title of the Greatest Logistical Show on Earth.

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The Federal Aviation Administration's Approach for Determining Future Air Traffic Controller Staffing Needs

JILL WILSON AND MARK HUTCHINS

Wilson is Senior Program Officer, and Hutchins is Program Officer, Transportation Research Board. Wilson served as study director for this project; she retired in March after 20 years with the National Research Council, including 15 at TRB.

Air traffic controllers are the frontline operators of the U.S. airspace system, the largest and most complex air navigation system in the world. Controllers' primary function is to separate aircraft safely from one another and from the terrain and to issue safety alerts. At busy facilities, they also support the efficient handling of traffic to increase throughput and reduce delays.

The Right Number

The Federal Aviation Administration (FAA) employs approximately 14,900 air traffic controllers at a cost of $2.8 billion per annum—18 percent of the agency's total budget. Establishing safe and cost-effective levels of controller staffing, however, is not an exact science.

No methods have been established for calculating the number of controllers needed to provide safe air traffic services; information from historical trends provides the only guidance. Data from the National Transportation Safety Board show that controller staffing levels in the United States are safe, at least in the aggregate, but how close these staffing levels are to the limit required to maintain the current safety level is not known.

Staffing to meet demand adds further complications. Controllers generally require two to three years of on-the-job training to qualify fully for all positions at an air traffic control facility, and even fully qualified controllers require at least one year to recertify after transferring to a new facility. Although traffic may suddenly drop in response to external factors—such as the global recession of 2008 or the terrorist attacks of September 11, 2001, in the United States—the controller workforce cannot immediately be right-sized.

The size of the controller workforce that will be available within the next year is also uncertain,

PHOTO: JIM HOWARD, FLICKR

Austin–Bergstrom International Airport in Texas. Air traffic controllers ensure that flights are cleared safely and efficiently.

PHOTO: DALLAS–FORT WORTH INTERNATIONAL AIRPORT

A plane awaits clearance from the control tower. Retirements among the air traffic control workforce have posed a staffing challenge to the Federal Aviation Administration.

because trainees may fail to qualify and controllers may retire or be promoted to supervisory positions. In recent years, FAA has faced special challenges in preparing for impending retirements. The Professional Air Traffic Controllers Organization strike and subsequent firings in 1981 necessitated the hiring of a large cohort of new trainees; as a result, a large proportion of the controller workforce has reached retirement age in the span of a few years. Staffing levels therefore often have appeared high because trainees had to be brought in to counter the impending retirements.

Request for a Study

In response to long-standing debates about appropriate levels of controller staffing, Section 608 of the FAA Modernization and Reform Act of 2012 tasked the National Academy of Sciences to study the FAA's methods for estimating the number of air traffic controllers needed for the safe and cost-effective operation of the nation's airspace system. The Transportation Research Board (TRB) and the Board on Human–Systems Integration of the National Research Council convened a 12-member committee of experts (see box, page 45) to address this task. The committee's findings are published in TRB Special Report 314, *The Federal Aviation Administration's Approach for Determining Future Air Traffic Controller Staffing Needs*.

Safety in Staffing

Air traffic control is vital to the safety of aviation operations. Nevertheless, the relationship between controller staffing levels and aviation safety is not well understood.

FAA gathers data on safety from various sources but lacks systematic and proactive mechanisms for analyzing these data in relation to staffing levels. As a result, the agency does not have the data needed for anticipating the safety effects of changes in current controller staffing levels or of changes in air traffic operations as the nation's airspace system is updated.

To overcome this problem, the committee recommended that FAA explore the relationships between controller staffing and safety by analyzing

PHOTO: FAA NEWS

Air traffic controllers at the Chicago En Route Center in Aurora, Illinois. Better models are needed to estimate staffing at en route centers.

the relevant data, including accident and incident data and voluntary reports from controllers. In addition, the controller workforce should be involved in staffing decisions, particularly as knowledge emerges about related safety issues.

Workforce Size

FAA uses a three-step process to determine the number of controllers needed to manage traffic at each facility:

1. Estimates are generated from mathematical models, including forecasts of air traffic demand.
2. The initial estimates are combined with input from facility managers to calculate staffing ranges.
3. The agency develops a hiring plan and transfer process, producing net changes to the total workforce and to the distribution of the workforce across FAA's 315 air traffic control facilities.

FAA's models for determining air traffic controller staffing needs are suitable for developing the initial estimates of the number of controllers required at terminal areas and airport towers. Nevertheless, the models to estimate staffing numbers for the centers that control air traffic between airports can be improved.

The steps that FAA takes to create and execute a controller staffing plan from the initial estimates are not consistently documented, and various organizations within FAA can modify the steps without coordination. Informed, data-driven decision making about staffing needs and hiring require not only justification but consistent documentation and application of the methods for determining the size of the controller workforce.

The committee therefore recommended that FAA take steps to ensure that the planning and execution of its process for determining air traffic controller staffing are clear, consistent, and transparent to a range of stakeholders, including the controller workforce and the U.S. Congress, which needs the information to set budgets for controller staffing.

Addressing Fatigue Risk

Work schedules determine how many controllers report to a facility at a given time, when they take breaks, and how long they have to recuperate between shifts. The schedules affect the cost-effectiveness of the use of controller staff, particularly at larger facilities, which can benefit from economies of scale.

In addition, scheduling can affect safety. Extensive evidence shows that fatigue is a risk factor in any air traffic control facility that operates 24 hours a day, seven days a week. Incidents of FAA controllers falling asleep on the job are rare but are widely publicized, highlighting the issue.

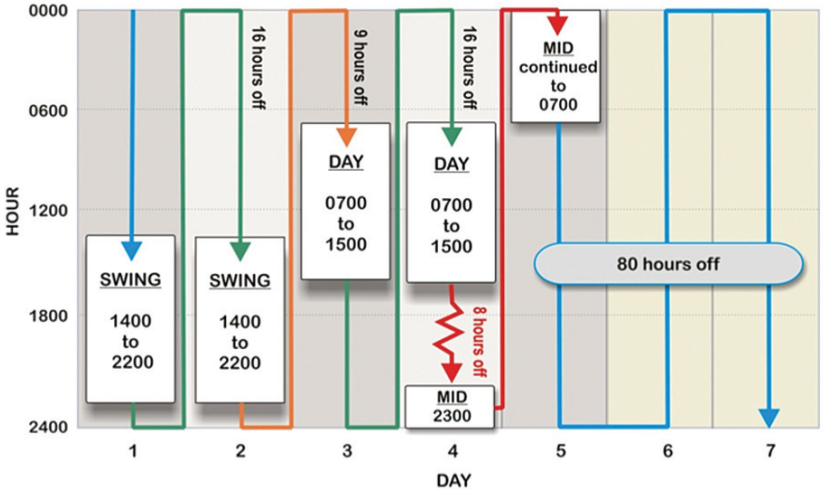

FIGURE 1 Example of a counterclockwise rotating 2-2-1 schedule.

Of particular concern is the so-called "2-2-1" schedule (see Figure 1, above) in which controllers work five eight-hour shifts over four consecutive days, with the last assignment a midnight shift. Controllers favor this schedule, which allows 80 hours off afterward but likely reduces cognitive performance severely during the midnight shift, because of fatigue. The committee recommended that FAA should collaborate with the National Air Traffic Controllers Association to develop and implement an improved scheduling tool as a matter of priority, to create efficient controller work schedules incorporating strategies to mitigate fatigue.

FAA has begun establishing a fatigue risk man-

Committee for a Study of Federal Aviation Administration Air Traffic Controller Staffing

Amy R. Pritchett, Georgia Institute of Technology, Atlanta, *Chair*
Mathias Basner, University of Pennsylvania, Philadelphia
Peter J. Basso, American Association of State Highway and Transportation Officials (retired), Rockville, Maryland
Lawrence M. Cole, Aloft Aviation Consulting, Fredericksburg, Virginia
Mary L. Cummings, Duke University, Durham, North Carolina
Francis T. Durso, Georgia Institute of Technology, Atlanta
John J. Fearnsides, MJF Strategies, LLC, Washington, D.C.
Andrew LeBovidge, National Air Traffic Controllers Association, Spring, Texas
Amedeo R. Odoni, Massachusetts Institute of Technology, Cambridge
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Clinton V. Oster, Jr., Indiana University (emeritus), Troy, Montana
Roger Wall, FedEx Corporation (retired), Kent, Washington

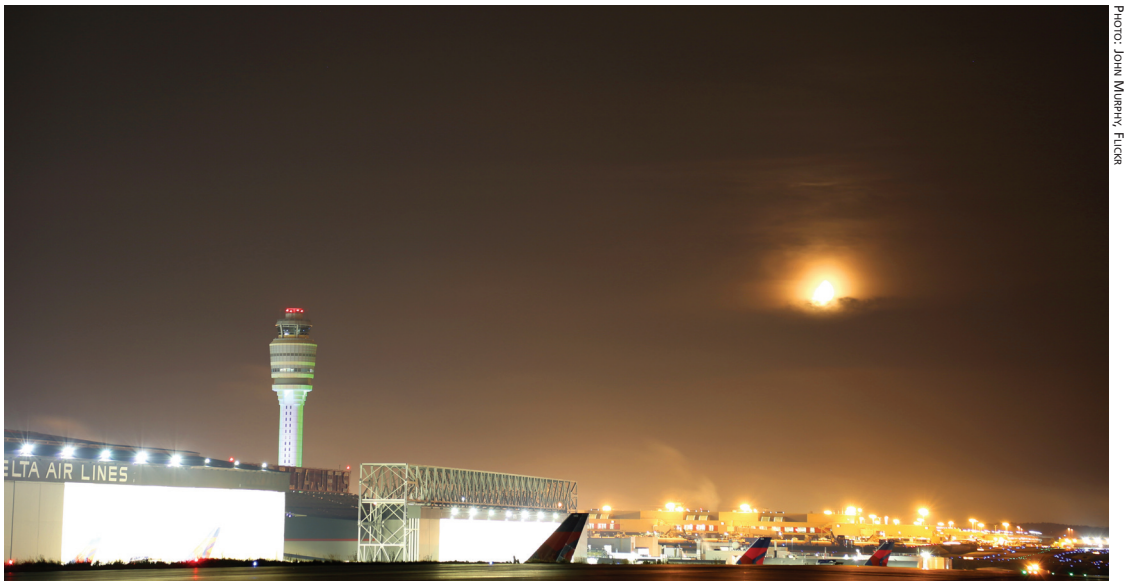


PHOTO: JOHN MURPHY, FLICKR

Hartsfield-Jackson Airport in Atlanta, Georgia. The annual controller workforce plan provides the number of air traffic controllers as well as target staffing ranges for each airport.

agement program that involves controllers, management, and experts in fatigue. Recent budget cuts, however, have eliminated the ability to monitor fatigue concerns proactively and to investigate whether the recent initiatives to reduce fatigue risks are providing the intended benefits.

Budgets and Cost-Effectiveness

Every year since 2004, FAA has submitted to Congress an updated version of the agency's controller workforce plan. The annual update describes the agency's staffing strategy for the next 10 years and identifies trends in air traffic and in controller staffing levels. In part, Congressional concerns about the cost-effectiveness of FAA's controller staffing stem from the observation that air traffic has declined significantly since its peak in 2000 and is not expected to return to that level in the near term, yet controller staffing levels are similar to those in 2000.

The systemwide data presented in the controller workforce plan are misleading. The data do not indicate that all air traffic control facilities are overstaffed or that controller productivity has dropped dramatically at all facilities since 2000. Several important facilities appear to be chronically understaffed, including the New York Terminal Radar Approach Control, or TRACON, which handles traffic for three major airports: John F. Kennedy, Newark Liberty, and LaGuardia.

Generalizations about controller productivity can mask significant variations at individual facilities. In particular, the volume and nature of traffic vary among facility types; although almost all operations have been reduced since 2000, the decline in air traffic control operations has been pronounced at smaller towers. Staffing levels at smaller facilities, however, may depend on minimum requirements that are not determined by traffic levels but by the hours that the facility is required to provide service.

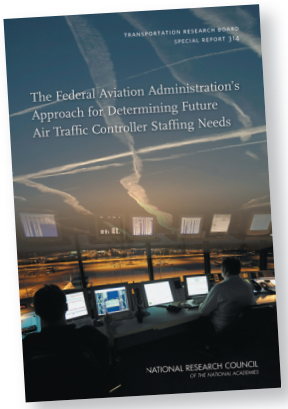
The annual controller workforce plan also provides target staffing ranges for all of FAA's 315 air traffic control facilities, as well as the actual numbers of controllers at each facility as of the end of the past fiscal year (FY).

Enabling Consistent Decisions

The lack of consistent documentation of staff planning processes prevented the committee from determining the effect of corrections to staffing imbalances across facilities over time in ensuring cost-effective staffing. The committee did note, however, that transfers of controllers between facilities appear to be poorly coordinated and do not achieve their potential in redistributing the workforce to meet facility targets.

The committee examined the costs of current and future air traffic control budgets and the estimated revenue streams available. The committee also considered hypothetical options for managing cost pressures related to the air traffic control workforce.

A lack of metrics on safety and performance and of information about staffing methods limited the committee's ability to assess the cost-effectiveness of FAA's staffing process, as requested by Congress. Consequently, the committee's recommendations—presented in full in Special Report 314—aim to enable decisions about controller staffing that are consistent; that are driven by proper science and data analysis; and that will address the interrelated goals of ensuring safety, meeting the operational needs of the aviation community, and demonstrating cost-effectiveness.



TRB Special Report 314, *The Federal Aviation Administration's Approach for Determining Future Air Traffic Controller Staffing Needs*, is available from the TRB online bookstore, https://www.mytrb.org/Store/Product.aspx?ID=7383; to view the book online, go to www.trb.org/Main/Blurbs/170870.aspx.

Developing Decision Support Tools for Florida's Traffic Management Centers

MOHAMMED HADI, YAN XIAO, MELISSA ACKERT, MARK PLASS, AND ELIZABETH BIRRIEL

Hadi is Associate Professor and Xiao is Research Assistant Professor, Florida International University, Miami. Ackert is Transportation System Management and Operations Program Manager, Plass is District Traffic Operations Engineer, and Birriel is Deputy State Traffic Operations Engineer and Intelligent Transportation Systems Program Manager, Florida Department of Transportation, Tallahassee.

Research by the Florida Department of Transportation (DOT) has produced a data analytics tool that combines archived intelligent transportation systems (ITS) data collected at the state's regional transportation management centers (TMCs) with data from other sources to inform transportation planning and operation decisions. With traffic analysis, simulation modeling, data fusion and mining, and optimization, the accumulated data can support performance measurement, planning, operations, and management.

Problem

Florida DOT has implemented SunGuide, an advanced traffic management software system that collects information on the traffic conditions of limited-access roadways in urban areas. SunGuide allows Florida's TMCs to monitor and control roadside equipment and incident management vehicles. Each TMC collects and archives a wealth of local data on traffic and event conditions. Tools and methods are needed, however, to exploit the vast amounts of data collected by SunGuide.

Solution

Florida DOT staff have worked with researchers at Florida International University on several projects to develop software tools to help transportation practitioners analyze ITS data more effectively. These developments have been incorporated into an integrated web-based tool called ITS Data Capture and Performance Management, or ITSDCAP. Tool functions include the following:

◆ Fusion of SunGuide and other data, including point detector and vehicle identification reader data, incident databases, and private-sector data, along with Florida DOT's work zone database, Crash Analysis Reporting System data, planning data, 511 calls, website hits, weather data, ramp metering data, and dynamic toll pricing data for managed lanes;

◆ Provision of data for developing and calibrating traffic models;

◆ Decision support for traffic management center operations, including the prediction of incident impacts, calculation of the probability of breakdowns, and assistance in construction management, with several modules to be added;

◆ Estimates of measures for mobility, reliability, safety, and environmental performance; and

◆ Support for benefit–cost assessments of advanced strategies.

TABLE 1 Incident Duration, Maximum Queue Length, and Secondary Incident Probability for One-Lane Blockage Incidents

Direction	Time Period	Incident Duration (minutes)	Data-Based Analysis		Queuing Analysis	
			Maximum Queue Length (miles)	Secondary Incident Probability (%)	Maximum Queue Length (miles)	Secondary Incident Probability (%)
Eastbound	a.m.	16.92	1.7	7.02	1.29	6.55
		7.52	1.15	4.4	0.11	3.68
	Midday	37.7	2.45~4.5	4.59–13.61	0.64~3.29	3.37–11.1
Westbound	a.m.	12.62	2.25	4.29	0.56	3.22
	Midday	2.03	1.7	1.7	0.13	1.3
		30.23	0~2.7	2.36~7.95	0.06~0.55	1.94~5.92
	p.m.	7.58	1.7	2.42	0.47	1.96

PHOTO: DOUG KERR, FLICKR

Interstate 4 in Florida. SunGuide, a data analytics tool developed by the Florida Department of Transportation, has improved transportation operations and planning.

Application

Researchers demonstrated the new software tools for a segment of the Interstate 4 corridor in Orlando, Florida. Some of the uses of the tools were to

◆ Visualize the recurrent, day-to-day locations of

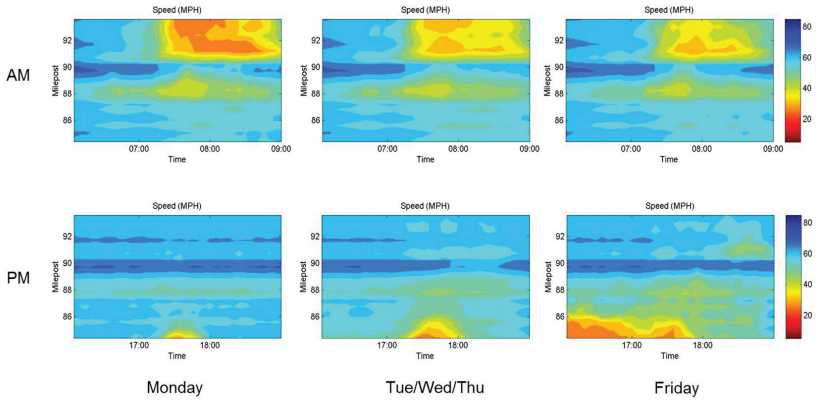


FIGURE 1 Average speed under normal traffic conditions, I-4 Westbound.

bottlenecks and the effects on mobility, as shown in Figure 1 (above)—the color indicates the speed of the traffic; and

◆ Estimate the effects of incidents on queue lengths and on secondary crashes (Table 1, page 47) —that is, crashes that probably would not have occurred without the first crash.

Researchers have converted the tools produced in these projects to web-based applications (Figure 2, below). The tools also constituted a platform for a pilot project under the second Strategic Highway Research Program[1] and for other Florida DOT research projects. Florida DOT District 4, in Broward County, is using the tool, and District 6, in Miami–Dade County, will soon follow. Other agencies also have expressed interest in deployment.

[1] SHRP 2 Project L38C, Pilot Testing of SHRP 2 Reliability Analytical Products: Miami–Dade Pilot Site. http://apps.trb.org/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=3457.

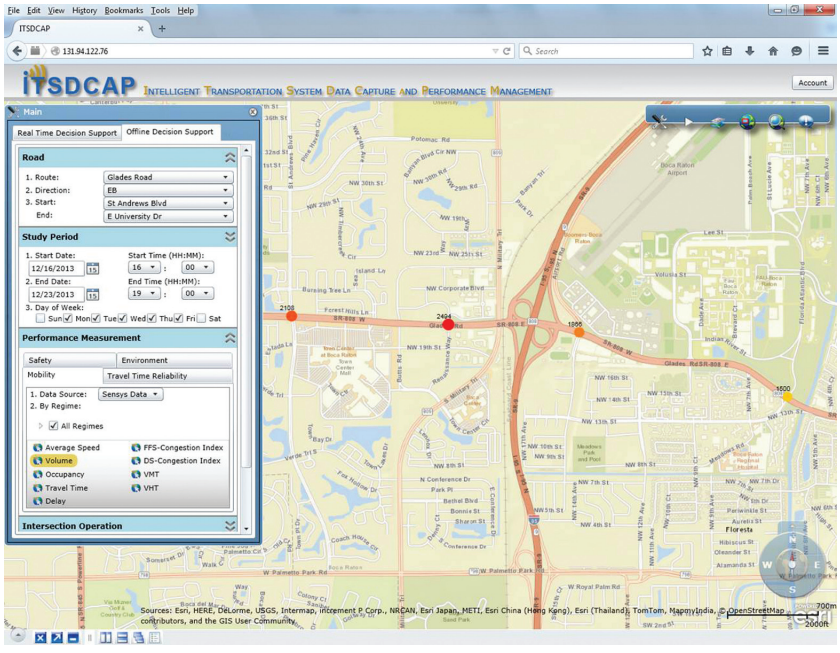


FIGURE 2 ITS Data Capture and Performance management interface.

Benefits

The tools developed in these research projects can support decision making by transportation planning and operations agencies. For example,

◆ Monitoring the performance of the system;

◆ Determining the safety, operational, and environmental effects from bottleneck improvements;

◆ Determining the effectiveness of advanced strategies and providing decision support; and

◆ Analyzing active traffic and demand management strategies.

These improved capabilities potentially will help Florida DOT and local agencies make the best decisions with limited resources to improve safety and operations on the system.

For more information, contact Mohammed Hadi, Associate Professor, Lehman Center for Transportation Research (LCTR), 10555 West Flagler Street, EC 3605, Miami, FL 33174; hadim@fiu.edu; or Yan Xiao, Research Assistant Professor, LCTR, 10555 West Flagler Street, EC 3730, Miami, FL 33174; yxiao001@fiu.edu; or Elizabeth Birriel, Deputy State Traffic Operations Engineer, ITS Program Manager, Florida DOT, Elizabeth.Birriel@dot.state.fl.us.

Resources

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EDITOR'S NOTE: Appreciation is expressed to B. Ray Derr, Transportation Research Board, for his efforts in developing this article.

Suggestions for Research Pays Off topics are welcome. Contact G. P. Jayaprakash, Transportation Research Board, Keck 488, 500 Fifth Street, NW, Washington, DC 20001 (202-334-2956; gjayaprakash@nas.edu).

CALENDAR

TRB Meetings

May

17–19 9th National Aviation System Planning Symposium
Charleston, South Carolina

17–21 15th TRB National Transportation Planning Applications Conference
Atlantic City, New Jersey

18–22 9th International Conference on Managing Pavement Assets*
Alexandria, Virginia

24–26 5th International Symposium on Nanotechnology in Construction*
Chicago, Illinois

26–29 2nd International Conference on Public–Private Partnerships*
Austin, Texas

June

1–2 5th International Conference on Transportation Systems Performance Measurement and Data
Denver, Colorado

7–10 American Society of Civil Engineers 2015 Airfield and Highway Pavements Conference
Miami, Florida

10–12 6th International Conference on Bituminous Mixtures and Pavements*
Thessaloniki, Greece

22–24 5th International Symposium on Highway Geometric Design*
Vancouver, British Columbia, Canada

24–26 Summer Meeting and Conference of Freight Systems and Marine Committees
Washington, D.C.

TBD Workshop on 2015 *Highway Capacity Manual* Update
Little Rock, Arkansas

TBD North American Transportation Statistics Interchange 2015 (*invitation only*)
Washington, D.C.

July

6–9 Southern African Transportation Conference *
Pretoria, South Africa

12–15 11th International Conference on Low-Volume Roads
Pittsburgh, Pennsylvania

18–22 54th Annual Workshop on Transportation Law
Chicago, Illinois

19–23 14th AASHTO-TRB Conference on Transportation Infrastructure Maintenance and Operations*
Des Moines, Iowa

20–24 Automated Vehicles Symposium 2015*
Ann Arbor, Michigan

28–31 TRANSED 2015: 14th International Conference on Mobility and Transport for Elderly and Disabled People*
Lisbon, Portugal

August

2–5 International Symposium on Systematic Approaches to Environmental Sustainability in Transportation
Fairbanks, Alaska

9–12 44th Annual International Congress and Exposition on Noise Control Engineering*
San Francisco, California

9–13 9th International Conference on Road and Airfield Pavement Technology
Dailan, China

24–25 8th New York City Bridge Conference*
New York, New York

September

1–3 Transit Geographic Information Systems Conference*
Washington, D.C.

7–9 3rd Conference on Smart Monitoring, Assessment, and Rehabilitation of Civil Structures*
Antalya, Turkey

14 Geotechnical Risk Assessment and Performance Management
Sturbridge, Massachusetts

15–17 International Symposium on Nondestructive Testing in Civil Engineering*
Berlin, Germany

16–18 International Conference on Transportation System Resilience to Climate Change and Extreme Weather Events
Washington, D.C.

20–23 Environmental Analysis in Transportation Summer Workshop
San Diego, California

20–24 International Conference on Ecology and Transportation
Raleigh, North Carolina

Additional information on TRB meetings, including calls for abstracts, meeting registration, and hotel reservations, is available at www.TRB.org/calendar. To reach the TRB staff contacts, telephone 202-334-2934, fax 202-334-2003, or e-mail TRBMeetings@nas.edu.

*TRB is cosponsor of the meeting.

Thomas R. Hickey

Virginia Railway Express

Thomas R. Hickey's motivation to implement and guide large-scale public transportation projects has taken him throughout the United States and abroad. "There typically are few major public transportation projects in any given region that span a career lifetime, so it often is necessary for planners and engineers to 'follow the crops,'" he observes. Having served eight transit agencies and consulted in more than 30 states, Canada, Asia, and the Middle East, Hickey comments that his career has followed "wherever there are crops that need tending."

Hickey graduated with a degree in urban geography and postgraduate studies in transportation engineering from Villanova University. He worked as a planner and manager for the Southeastern Pennsylvania Transportation Authority in Philadelphia, and in 1989, joined the Bi-State Development Agency in St. Louis, Missouri, which was building its first light rail line. For the new line, MetroLink, Hickey developed operations and maintenance programs and initiated a strategic planning process, bringing a multimodal focus to the traditionally bus-oriented transit agency and making room for light rail transit (LRT). In the early 1990s, Hickey served as State Railroad Administrator in Delaware, expanding freight and passenger rail services in the state. He created a new State Office of Rail Operations, as well as the first statewide commuter bus network. He also consolidated several transportation administrations into a single, multimodal agency.

"The light rail revolution that started in the United States in the late 1970s can be traced directly to the activities of the TRB Standing Committee on Rail Transit Systems."

In 2001, Hickey joined the Port Authority Transit Corporation, a subsidiary of the Delaware River Port Authority, as general manager. He enacted several organizational and budgetary reforms, advanced a backlog of capital improvement projects, and fostered a renewed corporate culture focused on safety and customer service. He also launched initiatives to expand rail services; modernize stations, rolling stock, and revenue collection systems; and repurpose park-and-ride lots near rail stations into hubs for smart growth development.

Hickey then became associate vice president of the Metropolitan Transit Authority of Harris County in Houston, Texas. He led special projects that required rapid and decisive response—notably a public–private partnership for the delivery of four light rail lines, maintaining a proactive fiscal discipline that avoided budget gaps, service cuts, layoffs, and fare increases.

Over the years, Hickey also has worked with leading engineering firms on national and international projects. He was instrumental in the design and construction of new LRT and commuter rail systems in New Jersey; in Phoenix, Arizona; in Atlanta, Georgia; and in Tel Aviv, Israel. He also managed the operations and maintenance planning for a new bullet train in Taiwan and for the development of a regional rail network in the United Arab Emirates. Hickey planned and designed new rail services in New Mexico, Florida, suburban Philadelphia, western Pennsylvania, New York, and Utah and managed the transition between contractors for a major commuter rail service in suburban Maryland.

Hickey now is chief development officer for Virginia Railway Express (VRE), a commuter rail service operator in Northern Virginia and Washington, D.C. From his home in Philadelphia, Hickey oversees planning, engineering, and construction of VRE's track, signals, stations, rolling stock, and ancillary facilities.

"We live in a wondrous time in terms of communications, so travel doesn't place the same burdens on families as it did for our forefathers, as long as we are committed to work at it," Hickey muses. "Like so much in life and work, what you can accomplish requires focusing on what you consider your priorities."

After joining the Standing Committee on Intermodal Transfer Facilities early in his career, Hickey realized the value of research review and sharing at TRB. He served on the committee for 15 years; as chair, he focused on creating a consistent, measurable set of design standards for rail stations—eventually developing a section of the *Transit Capacity and Quality of Service Manual*—and on forming subcommittees to examine new and emerging technologies.

"The light rail revolution that started in the United States in the late 1970s can be traced directly to the activities of the TRB Standing Committee on Rail Transit Systems," Hickey comments. He joined that committee in 1992 and notes that its sponsorship of national LRT conferences generated crucial research for the discipline. He also served as a longtime member of the Standing Committee on Commuter Rail Transportation and the Standing Committee on Transit Capacity and Quality of Service; since 2000, he has administered nine Rail Passenger Caucuses throughout the United States and Canada.

"The rail passenger caucuses include presentations from metropolitan planning organizations, transit agencies, and railroads about their plans and operations, followed by opportunities to 'kick the tires' by riding trains and visiting rail facilities to see theory put into practice," he explains.

Jack Stickel

Alaska Department of Transportation and Public Facilities

For the first 20 years of his career, Jack Stickel served in the U.S. Air Force as an operational and research meteorologist. He led a variety of forecast units supporting U.S. Army operations, extended-range forecasting, and aircraft and satellite upper-air observation validation. Stickel also modeled atmospheric and electro-optical data for the Air Force Geophysical Laboratory, using the Weibull distribution mathematical curve—which he recalls encountering again in his transportation career years later, for modeling weigh-in-motion vehicle loads and truck volumes.

"Expanding your horizons can yield surprising results," Stickel muses. "Staying abreast of ongoing research can help identify best practices and techniques from transportation and other disciplines that can be applied to your work."

"Research should be everyone's business, no matter what their role in an agency."

In 1990, Stickel changed fields and joined the Alaska Department of Transportation and Public Facilities (DOT&PF). His background in meteorology proved useful as he advocated for the Federal Highway Administration (FHWA) Road Weather Management program and the Road Weather Information System (RWIS)—decision-support tools for winter weather maintenance, internal operations, avalanche forecasting, emergency response, and air quality monitoring.

At Alaska DOT&PF, Stickel advanced the use of intelligent transportation systems (ITS) engineering principles and the ITS V-diagram life-cycle development in department projects. He managed the primary transportation database, oversaw its replacement, and helped to develop the Alaska iWays Architecture, as well as protocols for ITS systems engineering principles.

Currently the Enterprise Geographic Information System (GIS) Manager in the Alaska DOT&PF Information Systems and Services Division, Stickel oversees the department's transition to an agencywide spatial infrastructure. He recently transferred from the Transportation Information Group in the Alaska DOT&PF Program Development Division, where he provided oversight for data programs and transportation data systems. Stickel played key roles in developing information delivery options, management strategies, and governance programs.

"Research should be everyone's business, no matter what their role in an agency," Stickel comments. "Adopting the new methods and technologies from completed research can improve productivity, introduce new capabilities, and make your work more rewarding."

Stickel also spent many years developing transportation data solutions for the Statewide Transportation Improvement Program, the Highway Safety Improvement Program, the Highway Performance Monitoring System, and the Maintenance Management System. He piloted effective data governance and data management practices for highway safety, traffic monitoring, road weather management, traveler information, and transportation asset management programs. Stickel worked closely with staff of the second Strategic Highway Research Program (SHRP 2) to help Alaska DOT&PF implement highway safety, renewal, reliability, and capacity research. Stickel also facilitated a multistate peer exchange through the Volpe National Transportation Systems Center and the FHWA Office of Safety on integrating computer-aided design (CAD) drawings into GIS.

"The lessons from the peer exchange have been molded into the engineering automation team's GIS–CAD working group initiatives to improve work flow efficiencies and integration for the GIS and CAD platforms," he notes.

In 2002, Stickel joined the TRB Standing Committee on Statewide Transportation Data and Information Systems. He served as chair of the committee from 2008 to 2014. "Working with committee members, we raised awareness of data issues and promoted focused research needs," he recalls. "Connecting with the agencies and users who have shared interests in quality data programs and research efforts also was relevant."

In addition, Stickel has served on the Standing Committees on Transportation Asset Management and on Statewide Multimodal Transportation Planning. He was a member of the Special Task Force on Climate Change and Energy and serves on National Cooperative Highway Research Program (NCHRP) project panels for Integrating Extreme Weather and Adaptation into Transportation Asset Management Plans and for the Transportation Data Program Self-Assessment Guide. He also served on the NCHRP project panel for Setting Effective Performance Targets for Transportation Programs, Plans, and Policy.

"Following the progress from the initial research needs statements developed in TRB standing committees through American Association of State and Highway Transportation Officials and NCHRP funding, and then seeing NCHRP and SHRP 2 results implemented make it all worthwhile," Stickel comments.

In 2013, Stickel received the Intelligent Transportation Society of Alaska's Outstanding Achievement Award for RWIS and for advancing Alaska's ITS program. He also received the 2013 L. I. Hewes Award for highway development from the Western Association of State Highway and Transportation Officials.

Norman

Brach

TRB Makes Executive Staff Appointments

Mark Norman, formerly Director of the Technical Activities Division, has been appointed Director of Program Development and Strategic Initiatives at the Transportation Research Board. In his new position, Norman will guide the implementation of the initiatives outlined in TRB's strategic plan and will examine sources of stable, long-term funding for TRB.

Ann Brach is the new Director of the Technical Activities Division. Most recently Director of the second Strategic Highway Research Program (SHRP 2), Brach helped establish the program and played key management roles until its conclusion in March 2015. Brach has a master's degree and a PhD in civil engineering from the Massachusetts Institute of Technology as well as a master's degree in philosophy from The Catholic University of America.

To help support the safety data initiatives begun in SHRP 2 and continued by TRB, Steve Andrle and David Plazak have joined the Technical Activities Division. As

Andrle

Plazak

Program Director for Safety Data and Public Transportation, Andrle will manage the large, complex SHRP 2 Naturalistic Driving Study safety database as well as the activities of TRB's standing committees in public transportation. Plazak is the new Associate Director for Safety Data and will assist Andrle in maintaining and accessing the database.

FIFTY YEARS OF SERVICE— Phyllis D. Barber-Gray (formerly Barber), Publishing Services Manager, receives congratulations from Neil J. Pedersen, TRB Executive Director, for her 50 years of service to the Transportation Research Board. Barber-Gray joined TRB—then the Highway Research Board—in 1965 as a typesetter. In her distinguished career in TRB's Publications Office, Barber-Gray has overseen the typesetting and production departments and has coordinated the publication of hundreds of TRB titles. She currently manages the production of figures and tables for the *Transportation Research Record: Journal of the Transportation Research Board* and conducts peerless quality control for the journal and many other TRB publications, including *TR News*.

COOPERATIVE RESEARCH PROGRAMS NEWS

Guide for Performance Measures in Snow and Ice Control Operations

Highway agencies and contractors increasingly must monitor the performance of snow and ice control operations. A variety of performance measures, both in the United States and abroad, show varying degrees of success—but no measures are widely accepted that apply to different roadway classifications, storm characteristics, or traffic conditions.

Ways to collect and quantify relevant information and to establish level-of-service targets are crucial to the implementation of performance measures. A guide that addresses these methods for applying performance measures to snow and ice control operations is needed to help highway agencies and contractors monitor the level of performance and make appropriate adjustments for effective resources management.

ICF Incorporated, LLC, has been awarded a $299,956, 24-month contract (National Cooperative Highway Research Program Project 14-34, FY 2015) to develop a guide for applying performance measures to snow and ice control operations.

For further information, contact Amir N. Hanna, TRB, at 202-334-1432 or ahanna@nas.edu.

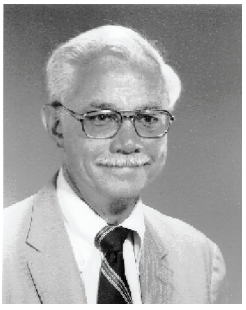
IN MEMORIAM

William L. Garrison, 1924–2015

William L. Garrison, 1973 Chair of the Transportation Research Board Executive Committee, died on February 1, 2015 in Lafayette, California. Garrison, 90, was professor emeritus, University of California (UC), Berkeley.

Former director of UC Berkeley's Institute of Transportation Studies, Garrison joined the school in 1973 and retired in 1991. He was the first Edward R. Weidlein Professor of Environmental Engineering at the University of Pittsburgh and was Director of the Center for Urban Studies at Northwestern University. He received a PhD in Geography from Northwestern in 1950 and bachelor's and master's degrees from Peabody College.

Garrison became Executive Committee Chair, after serving on National Cooperative Highway Research Program panels and on standing committees related to communications and to passenger and freight characteristics. In 2007, he delivered the Anderson Distinguished lecture in Applied Geography at the Association of American Geographers in Washington, D.C.



Garrison

NEWS BRIEFS

No Hazardous Variations Found in Guardrails

A joint task force of the Federal Highway Administration (FHWA) and the American Association of State Highway and Transportation Officials (AASHTO) examined allegations that multiple sizes of a component of ET-Plus—a commonly used highway guardrail system manufactured by Trinity Highway Systems—were used on highways and that some sizes posed a safety hazard in crashes.

FHWA engineers conducted measurements of the exit gap and channel height of more than 1,000 Trinity ET-Plus devices in five states—Arizona, California, Illinois, South Carolina, and Texas—and found no evidence suggesting that multiple versions of the devices were in use. Measurements across all devices were similar.

Researchers at the Southwest Research Institute conducted crash tests using ET-Plus guardrail end terminals at heights of 27.75 and 31 in.; the terminals matched those used on the nation's highways. Crash test results showed that the devices met safety criteria outlined in National Cooperative Highway Research Program Report 350, *Recommended Procedures for the Safety Performance Evaluation of Highway Features*.

A second task force is reviewing crash reports to determine if vulnerabilities in the ET-Plus devices may pose safety hazards.

For more information, visit www.fhwa.dot.gov/guard railsafety.

Technology to Assist Visually Impaired Travelers

Three projects in FHWA's Exploratory Advanced Research Program are exploring the use of GPS technology and intelligent transportation system (ITS) infrastructure to assist travelers who are visually impaired.

Researchers from City College, City University of New York, are developing situational awareness and assistive technologies for navigation and path planning—from reading signs to generating verbal object descriptions—as well as advance warning of obstacles or events, using GPS, geographic information systems, and ITS infrastructure. The project's first phase will undergo trials indoors; the second phase will move outdoors.

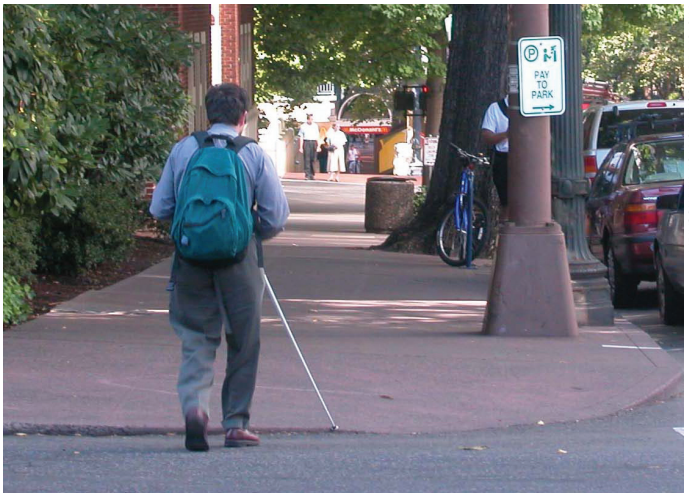


PHOTO: AAA FOUNDATION FOR TRAFFIC SAFETY

Research on new technologies may lead to navigation tools for visually impaired travelers.

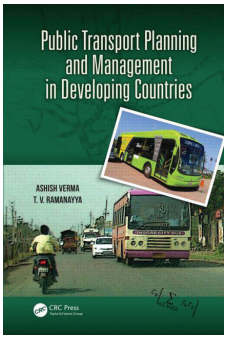
A navigation aid developed by TRX Systems, Inc., will track a user's location, even in areas where GPS is not available. Sensors in a smartphone can detect and save a user's route, providing spatial awareness that allows return to the route later. The technology can work to navigate cities and public transit.

Another project also tackles gaps in GPS navigation by providing visually impaired travelers with navigation information indoors and outdoors. Auburn University researchers are developing a system that combines broadband wireless technology, computer vision, and inertial sensing technology for accurate wayfinding assistance. Inertial measurement units and stereo visual odometry provide accurate positioning for users in locations without GPS.

For more information, visit www.fhwa.dot.gov/ research/tfhrc/projects/projectsdb.

The titles in this section are not TRB publications. To order, contact the publisher listed.

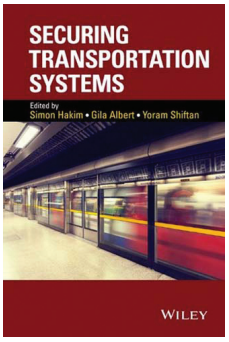
Public Transport Planning and Management in Developing Countries



Ashish Verma and T. V. Ramanayya. CRC Press, 2014; 278 pp.; $99.95; 978-14-6658-158-6.

This text surveys principles of public transportation planning and management relevant to India and other developing countries, addresses transportation system inefficiencies, and explores and analyzes the relationship between mobility and accessibility.

Securing Transportation Systems



Simon Hakim, Gila Albert, and Yoram Shiftan. Wiley, 2015; 400 pp.; $99.95; 978-11-1897-793-4.

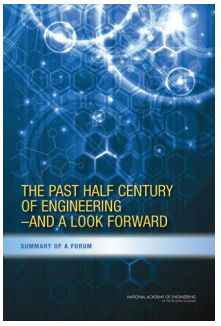
Addressed in this volume are threats to transportation systems from sources ranging from chemical warfare to cyberattacks to natural disasters. Authors explore technologically and managerially based security measures, as well as guidelines for policy and public decision making.

Permeable Pavements

Edited by Bethany Eisenberg, Kelly Collins Lindow, and David R. Smith. American Society of Civil Engineers (ASCE), 2015; 262 pp.; $90, ASCE members; $120, nonmembers; 978-07-8441-378-4.

A comprehensive resource for the design, construction, and maintenance of permeable pavement systems, this book reviews design considerations, emerging technologies, maintenance considerations, hydrologic design approaches, key components in specification writing, and more.

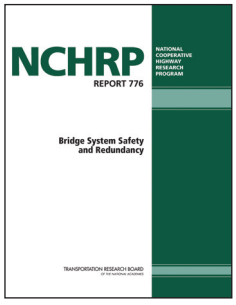
The Past Half-Century of Engineering and a Look Forward: Summary of a Forum



Edited by Steve Olson. National Academy of Engineering, 2015; 48 pp.; $39; 978-03-0936-901-5.

Engineering achievements of the past and future are examined in this volume, which comprises presentations from the 2014 annual meeting of the National Academy of Engineering and a commemoration of its 50th anniversary.

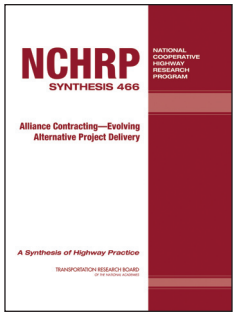
TRB PUBLICATIONS



Bridge System Safety and Redundancy
NCHRP Report 776

This report offers revisions to the design philosophy section of the American Association of State Highway and Transportation Officials (AASHTO) Load and Resistance Factor Design (LRFD) Bridge Design Specifications.

2014; 126 pp.; TRB affiliates, $48; nonaffiliates, $64. Subscriber category: bridges and other structures.



A Guide to Regional Transportation Planning for Disasters, Emergencies, and Significant Events
NCHRP Report 777

Planning principles, case studies, tips, and tools help explain the implementation of transportation planning for multijurisdictional disasters, emergencies, and other major events. Also included are the contractor's final research report and a PowerPoint presentation.

2014; 160 pp.; TRB affiliates, $51; nonaffiliates, $68. Subscriber categories: public transportation; planning and forecasting; security and emergencies.

Alliance Contracting: Evolving Alternative Project Delivery
NCHRP Synthesis 466

A survey of current practices in alliance contracting around the world, this volume also describes procurement procedures on typical transportation projects.

2015; 72 pp.; TRB affiliates, $41.25; nonaffiliates, $55. Subscriber categories: administration and management; construction; highways.

Visualization of Technical Data for Hazard Mitigation and Disaster Response
NCHRP Synthesis 467

This synthesis evaluates tools and techniques for mitigating geotechnical hazards and responding to geotechnical disasters such as landslides, rockfalls, settlement, sinkholes, and other events.

2015; 80 pp.; TRB affiliates, $41.25; nonaffiliates, $55. Subscriber categories: geotechnology; highways; security and emergencies.

TRB PUBLICATIONS *(continued)*

A Guidebook for Airport–Airline Consortiums
ACRP Report 111

This report provides information on consortiums and guidance for airport operators and airline representatives responsible for agreements related to facilities, equipment, systems, and services.

2014; 123 pp.; TRB affiliates, $45.75; nonaffiliates, $61. Subscriber categories: aviation, terminals and facilities.

Airport Terminal Incident Response Planning
ACRP Report 112

This report summarizes the development and use of a tool for creating and maintaining integrated incident response plans that address hazards in and around airport terminals. The print edition includes a terminal incident response plan tool on CD-ROM.

2014; 89 pp.; TRB affiliates, $34.50; nonaffiliates, $46. Subscriber categories: aviation, security and emergencies, terminals and facilities.

Backcountry Airstrip Preservation
ACRP Synthesis 55

This synthesis catalogues the uses, benefits, and threats to backcountry airstrips and identifies practices and strategies to manage the threats.

2014; 76 pp.; TRB affiliates, $41.25; nonaffiliates, $55. Subscriber categories: administration and management; aviation.

Use of Mobility Devices on Paratransit Vehicles and Buses
TCRP Report 171

Current and emerging issues that limit the use of mobility devices in paratransit vehicles and buses are presented, along with guidance on the implementation of solutions for accessible design and accommodation.

2014; 75 pp.; TRB affiliates, $15; nonaffiliates: $20. Subject area: public transportation.

Improving Transit Integration Among Multiple Providers, Volume I: Transit Integration Manual; and Volume II: Research Report
TCRP Report 173

This two-volume report demonstrates the benefits of transit integration, illustrates the range of integration activities, and describes procedures for carrying out integration efforts, including tips for success.

2015; Vol. I, 86 pp.; Vol. II, 64 pp.; TRB affiliates, $15 per volume; nonaffiliates, $20 per volume. Subject areas: administration; public transportation.

Open Data: Challenges and Opportunities for Transit Agencies
TCRP Synthesis 115

This synthesis documents the current state of the practice in the use, policies, and impact of open data for improving transit planning, service quality, and treatment of customer information.

2015; 115 pp.; $25. Subject areas: planning and forecasting, public transportation.

Validation of Urban Freeway Models
SHRP 2 Report S2-L33-RW-1

This volume documents and presents the results of a project to investigate, validate, and enhance travel time reliability models developed in the second Strategic Highway Research Program Project L03 .

2015; 378 pp. Subject areas: highways; operations and traffic management; planning and forecasting. Available at www.trb.org/Publications/Blurbs/171443.aspx.

Technologies to Support the Storage, Retrieval, and Use of 3-D Utility Location Data
SHRP 2 Report S2-R01A-RW-1

Included in this volume are strategies, processes, and systems for acquiring, storing, using, and maintaining 3-D utility location data from previous projects.

2015; 296 pp. Subject areas: construction; data and information technology; highways. Available at www.trb.org/Publications/Blurbs/171927.aspx.

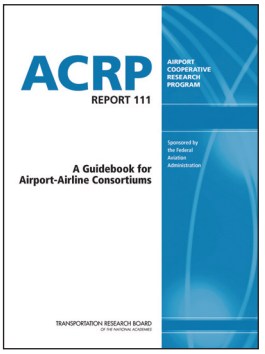
Naturalistic Driving Study: Technical Coordination and Quality Control
SHRP 2 Report S2-S06-RW-1

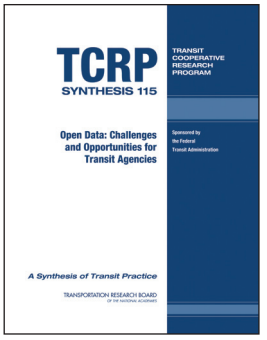
This volume documents the coordination and oversight of participant- and vehicle-based operations for an in-vehicle driving behavior field study collected from naturalistic driving data and from associated participant, vehicle, and crash-related data.

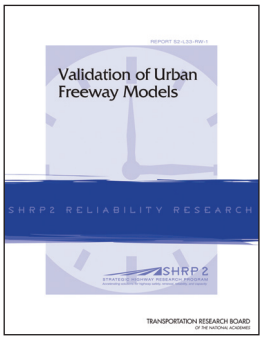
2015; 370 pp. Subject areas: data and information technology; highways; operations and traffic management; safety and human factors; vehicles and equipment. Available at www.trb.org/Publications/Blurbs/170935.aspx.

Construction 2014
Transportation Research Record 2408

Performance bonds; alternative technical concepts; indefinite delivery–indefinite quantity contracting; geotechnical requirements in the design–build selection process; visualization technology; and air content stability in the slipform paving process are among the topics covered.







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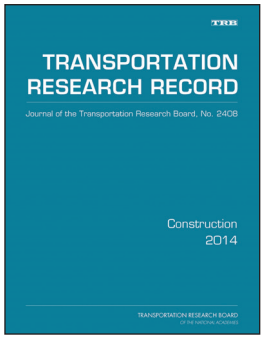

2014; 113 pp.; TRB affiliates, $48.75; nonaffiliates, $65. Subscriber categories: construction; pavements; bridges and other structures.

Marine Transportation, Terminal Operations, and International Trade 2014
Transportation Research Record 2409

Among the topics presented in this volume are manned and automated horizontal handling equipment, liner ship fleet deployment with uncertain demand, and land-based port-of-entry infrastructure planning.

2014; 73 pp.; TRB affiliates, $44.25; nonaffiliates, $59. Subscriber categories: marine transportation; terminals and facilities; freight transportation.

Freight Systems 2014, Volumes 1 and 2
Transportation Research Record 2410 and 2411

Volume 1 examines planning, modeling, and logistics in freight systems; Volume 2 addresses urban freight, hazardous materials, and trucking.

2014. Vol. 1, 159 pp.; TRB affiliates, $56.25; nonaffiliates, $75. Vol. 2, 126 pp.; TRB affiliates, $53.25; nonaffiliates, $71. Subscriber category: freight transportation.

Travel Behavior 2014, Volumes 1 and 2
Transportation Research Record 2412 and 2413

These two volumes comprise papers on topics including the route choice behavior of car drivers; context-sensitive, dynamic activity travel behavior; travel to common destinations; and choice, frequency, and engagement for telecommuting behavior analysis and modeling.

2014. Vol. 1, 108 pp.; TRB affiliates, $48.75; nonaffiliates, $65. Vol. 2, 109 pp.; TRB affiliates, $48.75; nonaffiliates, $65. Subscriber category: planning and forecasting.

Research and Education 2014
Transportation Research Record 2414

Authors present research on a library e-book lending platform for U.S. Department of Transportation employees with personal reading devices, a pilot initiative in Iowa for intern development and management, and more.

2014; 68 pp.; TRB affiliates, $44.25; nonaffiliates, $59. Subscriber categories: education and training; research; data and information technology.

Transit 2014, Volumes 1, 2, 3, 4, and 5
Transportation Research Record 2415, 2416, 2417, 2418, and 2419

Papers in these five volumes examine such topics as route-level passengers' perceived transit service reliability; an automated, data-driven performance regime for operations management, planning, and control; fleet sizing for flexible carsharing systems; pedicabs in U.S. cities; development of a rail service sensitivity meter; optimal connected urban bus networks of priority lanes; the performance of Australian light rail and a comparison with U.S. trends; and rail transit networks with ring lines.

2014. Vol. 1, 151 pp.; TRB affiliates, $56.25; nonaffiliates, $75. Vol. 2, 99 pp.; TRB affiliates, $47.25; nonaffiliates, $63. Vol. 3, 138 pp.; TRB affiliates, $53.25; nonaffiliates, $71. Vol. 4, 129 pp.; TRB affiliates, $53.25; nonaffiliates, $71. Vol. 5, 127 pp.; TRB affiliates, $53.25; nonaffiliates, $71. Subscriber categories: Vols. 1–5, public transportation; Vol. 1, policy; Vols. 2, 3, and 5, transportation, general; Vols. 3 and 4, planning and forecasting; Vol. 5, rail.

Performance Measurement and Strategic Management
Transportation Research Record 2420

Multimodal street performance calculations, performance measures for infrastructure investment decision makers, and organizational integration for Valley Metro in the greater Phoenix metropolitan area are among the topics explored in this volume.

2014; 61 pp.; TRB affiliates, $44.25; nonaffiliates, $59. Subscriber categories: administration and management; policy.

Traffic Flow Theory and Characteristics 2014, Volumes 1 and 2
Transportation Research Record 2421 and 2422

Addressed in this volume are subjects including group dynamics in pedestrian crowds, the modeling and analysis of merging behavior at expressway on-ramp bottlenecks, and vehicle time headways and speeds on rural roads.

2014. Vol. 1, 160 pp.; TRB affiliates, $56.25; nonaffiliates, $75. Vol. 2, 149 pp.; TRB affiliates, $56.25; nonaffiliates, $75. Subscriber categories: operations and traffic management; planning and forecasting.

The TRR Journal Online website provides electronic access to the full text of approximately 14,800 peer-reviewed papers that have been published as part of the Transportation Research Record: Journal of the Transportation Research Board *(TRR Journal) series since 1996. The site includes the latest in search technologies and is updated as new TRR Journal papers become available. To explore the TRR Online service, visit www.TRB. org/TRROnline.*

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INFORMATION FOR CONTRIBUTORS TO

TR NEWS

TR News welcomes the submission of manuscripts for possible publication in the categories listed below. All manuscripts submitted are subject to review by the Editorial Board and other reviewers to determine suitability for *TR News*; authors will be advised of acceptance of articles with or without revision. All manuscripts accepted for publication are subject to editing for conciseness and appropriate language and style. Authors receive a copy of the edited manuscript for review. Original artwork is returned only on request.

FEATURES are timely articles of interest to transportation professionals, including administrators, planners, researchers, and practitioners in government, academia, and industry. Articles are encouraged on innovations and state-of-the-art practices pertaining to transportation research and development in all modes (highways and bridges, public transit, aviation, rail, marine, and others, such as pipelines, bicycles, pedestrians, etc.) and in all subject areas (planning and administration, design, materials and construction, facility maintenance, traffic control, safety, security, logistics, geology, law, environmental concerns, energy, etc.). Manuscripts should be no longer than 3,000 words (12 double-spaced, typed pages). Authors also should provide charts or tables and high-quality photographic images with corresponding captions (see Submission Requirements). Prospective authors are encouraged to submit a summary or outline of a proposed article for preliminary review.

RESEARCH PAYS OFF highlights research projects, studies, demonstrations, and improved methods or processes that provide innovative, cost-effective solutions to important transportation-related problems in all modes, whether they pertain to improved transport of people and goods or provision of better facilities and equipment that permits such transport. Articles should describe cases in which the application of project findings has resulted in benefits to transportation agencies or to the public, or in which substantial benefits are expected. Articles (approximately 750 to 1,000 words) should delineate the problem, research, and benefits, and be accompanied by one or two illustrations that may improve a reader's understanding of the article.

NEWS BRIEFS are short (100- to 750-word) items of interest and usually are not attributed to an author. They may be either text or photographs or a combination of both. Line drawings, charts, or tables may be used where appropriate. Articles may be related to construction, administration, planning, design, operations, maintenance, research, legal matters, or applications of special interest. Articles involving brand names or names of manufacturers may be determined to be inappropriate; however, no endorsement by TRB is implied when such information appears. Foreign news articles should describe projects or methods that have universal instead of local application.

POINT OF VIEW is an occasional series of authored opinions on current transportation issues. Articles (1,000 to 2,000 words) may be submitted with appropriate, high-quality illustrations, and are subject to review and editing.

BOOKSHELF announces publications in the transportation field. Abstracts (100 to 200 words) should include title, author, publisher, address at which publication may be obtained, number of pages, price, and ISBN. Publishers are invited to submit copies of new publications for announcement.

LETTERS provide readers with the opportunity to comment on the information and views expressed in published articles, TRB activities, or transportation matters in general. All letters must be signed and contain constructive comments. Letters may be edited for style and space considerations.

SUBMISSION REQUIREMENTS: Manuscripts submitted for possible publication in *TR News* and any correspondence on editorial matters should be sent to the Director, Publications Office, Transportation Research Board, 500 Fifth Street, NW, Washington, DC 20001, telephone 202-334-2972, or e-mail jawan@nas.edu.

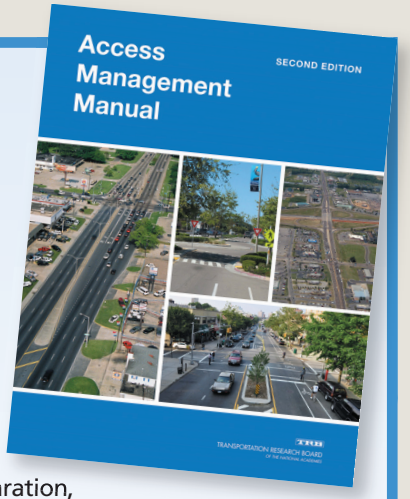
- All manuscripts should be supplied in 12-point type, double-spaced, in Microsoft Word, on a CD or as an e-mail attachment.
- Submit original artwork if possible. Glossy, high-quality black-and-white photographs, color photographs, and slides are acceptable. Digital continuous-tone images must be submitted as TIFF or JPEG files and must be at least 3 in. by 5 in. with a resolution of 300 dpi. A caption should be supplied for each graphic element.
- Use the units of measurement from the research described and provide conversions in parentheses, as appropriate. The International System of Units (SI), the updated version of the metric system, is preferred. In the text, the SI units should be followed, when appropriate, by the U.S. customary equivalent units in parentheses. In figures and tables, the base unit conversions should be provided in a footnote.

NOTE: Authors are responsible for the authenticity of their articles and for obtaining written permissions from publishers or persons who own the copyright to any previously published or copyrighted material used in the articles.

Access Management Manual— New, Updated, and Expanded!

TRB's *Access Management Manual*, second edition, provides a comprehensive, coordinated approach to transportation and community design to enhance mobility, mode choice, and environmental quality. The interdisciplinary guidance addresses access management as a critical part of network and land use planning and pertains to government decision makers at all levels, as well as to pedestrians, bicyclists, and operators of motorized vehicles. The revised and expanded new edition includes the following key updates:

- Network and circulation planning and modal considerations;
- Frameworks and strategies for applications in a variety of contexts;
- Performance measures and monitoring;
- Corridor management planning, alternative funding, and cooperative agreements;
- Network planning, regional policies and programs, interchange areas, auxiliary lane warrants, rights-of-way, and access controls;
- Program development, staffing, training, internal coordination, and roles for transportation agencies; and
- Methods to improve coordination and cooperation between state agencies, local jurisdictions, and private developers—plus sample cooperative agreements.



Most chapters coordinate with sections of a companion volume in preparation, the *Access Management Application Guidelines* (AMAG), which offers additional technical information, design criteria, and practical guidance, along with case examples. The AMAG is scheduled for publication in fall 2015 and will be sold separately.

Order your copy of *Access Management Manual*, second edition, today for $120 (TRB affiliates $90) from the TRB Online Bookstore: https://www.mytrb.org/Store/Product.aspx?ID=7507.

For more information, send an e-mail to TRBSales@nas.edu or visit www.trb.org/main/blurbs/171852.aspx.

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