



## TR News March-April 2014: Annual Meeting on the Move: Highlights and Hallmarks

### DETAILS

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# TR NEWS

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COVER: TRB Annual Meeting participant Jinqi Fang, Georgia Institute of Technology, refers to the latest edition of TRB’s *Critical Issues in Transportation* online. (Photo: Risdon Photography)

# 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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PHOTO: MINGO COUNTY REDEVELOPMENT AUTHORITY

Mining company equipment transports excavated material on the King Coal Highway roadbed during construction of West Virginia DOT's first public–private partnership project, which links to Interstate 77. Completed roadway cut-and-fill sections are visible in the background.





# Performance Management for Transportation Organizations

## *Developing and Applying Metrics That Drive Performance*

PETE K. RAHN

*The author is National Transportation Practice Leader, HNTB Corporation, Kansas City, Missouri. He is a former member of the TRB Executive Committee, past Director of the Missouri Department of Transportation (DOT), past Secretary of New Mexico DOT, and past president of the American Association of State Highway and Transportation Officials.*

Opinion polls regularly show high levels of public dissatisfaction with traffic congestion and roadway conditions. Yet the same polls also show that motorists are unwilling to pay higher taxes to address these problems. The public's responses may appear illogical—but not if they believe that the added revenues will not produce the desired results.

To overcome this cycle of public dissatisfaction and skepticism, government agencies must become more transparent and accountable; this in turn generates public trust. The website of the American Association of State Highway and Transportation Officials (AASHTO) has quoted Kevin Keith, former Director of the Missouri Department of Transportation (DOT): “Trust creates an environment for citizens of this country to invest more in transportation. It is a great equation.” Missouri DOT's success in

building public trust through performance management provides an instructive example.

### What Gets Measured

Much of what transportation agencies do is tangible and has an impact on the public almost daily, through the design, construction, and maintenance of roads or the management of traffic control systems across a region. Most agencies gather data related to their various activities, such as lane miles resurfaced, tons of road salt applied, and dollars spent in procuring specific materials and services.

Many organizations believe that measuring performance is synonymous with performance management. It is not. Performance measurement collects data as an indicator of an activity. Compiling and placing these indicators in an attractive binder is not performance management but paperwork.



PHOTO: MISSOURI DOT

Among the tangible results of the Missouri Department of Transportation's (DOT's) new, customer-oriented mission were roadways with easy-to-see stripes and reflectors.

*(Previous page:)* The work of transportation department employees, such as the Motorist Assist and Emergency Response patrol, often is highly visible. Performance measurement can assist in retaining a quality workforce.

Few state DOTs lack statistical data. Many, however, lack the ability to turn these data into metrics that can drive the agency toward a continuous search for better, faster, and less costly ways of doing business. According to the byword, "What gets measured, gets done." But in most cases, what gets measured only gets measured.

Developing measures that provide meaningful indications of performance—and that drive better performance—is the essence of performance management. Performance management requires more than measurement—it requires analysis and actions informed by the measures. Performance management entails measuring, analyzing, and then acting—and then repeating the steps, again and again.

### Defining the Mission

Before my tenure as CEO, Missouri DOT's stated mission was to "plan, design, construct, and maintain a safe transportation system for Missouri." But

did the customers really expect this? Would they describe their expectations in this way? The clear answer was no.

Missouri DOT needed to start the process of performance management by assessing the words that described the agency's mission, not by assessing the numbers. Understanding why the organization exists was necessary for determining the right metrics.

The question was asked across the department: Why do we exist as an organization? An understanding had to emerge from all levels of management, not by edict from the top executives. Every manager had to contribute to the answer, to understand the logic of the process and to take ownership of the results. Bringing everyone to the same starting line was a critical first step. The mission statement that evolved had more meaning for customers and more resonance with employees.

What Missouri DOT's customers wanted was to get to their destinations in the easiest and safest way possible, regardless of who owned the facility, and they wanted the transportation system to fulfill its role as a foundation for economic development. Missouri DOT's mission statement now is straightforward and intuitive: "To deliver a world-class transportation experience that delights our customers and supports a prosperous Missouri."

### Get-It-Done Attitude

This customer-oriented mission made it easier to identify the tangible results that would become the department's "get it done" agenda—that is, the array of deliverables the customers would see and experience when the organization was fulfilling its mission. For example, customers driving at night do not want the sensation of driving down a dark tube. A world-class transportation system therefore seeks the tangible result of highly visible nighttime roadways.

When tangible results are identified, metrics can be developed to indicate whether the results are being delivered and how well. In rare cases, a state DOT may find one metric that perfectly captures the delivery of a tangible result. In many more cases, however, not even two or three metrics will be adequate.

For example, Missouri DOT began with 110 metrics associated with 18 tangible results. The more complete and detailed the metrics, the better an organization can manage performance. Metrics for visible roadways in Missouri included measures for pavement markings, signing, striping, and reflectors.

### Three Phases

Various challenges can arise in identifying suitable performance metrics. An organization often goes



through three stages in choosing measures: the first stage is fear; the second, a search for safe measures; and finally, a clamor for more measures.

**Fear**

Many employees of large, bureaucratic organizations that undergo regular changes in leadership—a characteristic of state DOTs—are suspicious of management initiatives in general and of performance measures in particular. The employees wonder how the measures will be used internally by the department and externally by the media and the political establishment. A major worry is that management will use the data to fire employees or to take away resources. Another is that elected officials will harangue the department if the measures show that system conditions and performance are worsening.

A top executive mandating the implementation of performance measures must recognize and address these fears. But top-down mandates alone will not suffice—middle management support must accompany the initiative. Trusted leaders from throughout the department must make a commitment to performance management, explain its purpose to all employees, and champion the implementation. Broad staff support is a critical outcome of broad middle management involvement from the beginning of the initiative.

**Safe Measures**

Once employees have resigned themselves to the organization’s adoption of performance measures, they often proceed to identify measures that are “safe”—usually indicators of output. Output measures gauge activity levels and amounts, but not results. Examples include the percentage of maintenance budget expended, miles of striping installed, and number of checks issued for accounts payable.

Safe measures like these do not convey impacts, some of which could reflect negatively. Outcome-oriented versions of those measures would include the roadway roughness index, the percentage of striping in good condition, and the share of invoices paid within 30 days.

Overcoming the tendency to choose safe measures requires executive leadership. Top management should review all proposed measurements regularly for validity in indicating a deliverable valued by customers.

Nevertheless, management should not eschew output-based measures if outcome-based versions are not immediately available. Waiting for the perfect set of measures can become an excuse for inaction. Even if guided by imperfect measures at the outset, an agency that knows its mission and the tangible

Photo: Missouri DOT



results it seeks can work continually to improve the data available to measure performance.

**Clamor for More Measures**

As performance measures are incorporated into a performance management system, employees soon perceive that responsibilities not encompassed by a measure will be off the radar screen of the agency’s leadership. As a result, a clamor may arise throughout the department to add measures that capture more activities.

This is a good problem, because it demonstrates the general success of the performance management system in focusing attention and resources. A demand for more measures, however, will require management’s vigilance in guarding against diluted and superfluous indicators. As a performance management system matures, organizational units will develop their own measures to improve their own operations.

A meeting of the Information Systems staff at Missouri DOT. Successful performance measurement relies on effective, trusted department leaders.

Performance management leads to organization efficiency, as when a Missouri DOT analysis of road-striping paint revealed an alternative product that delivered the same results for less money.

Photo: Missouri DOT





PHOTO: MISSOURI DOT

Tracker meetings, or quarterly analyses of performance measures, brought together managers, analysts, and other frontline employees to assess the progress of various initiatives.

## Continual Improvement

Performance management cannot succeed in the long term by relying on a static set of measures created at the program's outset. Customers' expectations change, as should the corresponding performance measurements. Measurement is a dynamic process and warrants regular reassessment. An organization must continually ask if each metric is still providing value. Does a metric need to be altered or discarded? Is a better metric now available?

Even as new measures are added and some older ones dropped, a cardinal rule should be that no measure will be abandoned for disclosing a condition unfavorable to the organization. A competent organization should be able to explain why a measure is indicating undesirable results. Indeed, the results may reveal a need for additional resources. If the measures do not show warts and all, then measures that indicate desirable outcomes will lose credibility.

## Analyzing and Acting

The Missouri DOT initiative scheduled quarterly analyses that involved teams of managers, measurement compilers, and a changing mix of frontline employees. The quarterly reviews could involve as many as 125 employees. The dates of these so-called “tracker” meetings were set at the beginning of the year and never changed. Attendance was mandatory.

The reviews could last all day; once the meeting had started, everyone was expected to stay for the entirety. This approach generated an expectation of performance, as well as a greater understanding and appreciation by division management about the accountability expected from all divisions.

The reviews in the tracker meetings were direct and addressed the following questions: What did the metrics reveal about the organization? Was the metric on target? Was progress fast enough? Did previous actions change the direction of the metric? One permanent rule was strictly enforced: report what has been done, not what will be done.

If the results were positive, the review encouraged continued progress in the desired direction. If not, the results informed a need to reallocate resources—people, time, and money—to produce better results. In either case, the process discouraged complacency, because the cycle of measurement, analysis, and action would start all over again.

## Revealing What Is Important

Performance management improves agency operations in at least four ways:

- ◆ **It drives organizational efficiency.** Performance measurements indicate where the agency can make better use of its resources. For example, Missouri DOT tested the quality of its roadway striping paint and maintained a record of the performance statewide. Analysis of the results revealed that the performance of the less expensive paint was comparable with that of the more expensive paint. The agency switched to the less expensive paint, saving approximately \$2 million a year.

- ◆ **It guides resource allocations.** Performance management indicates when to allocate more resources to programs that customers value most, by diverting resources from programs customers value least. For example, after analyzing the performance of the road striping program, Missouri DOT was able to decrease the budget for striping and invest \$2 million in other activities.

- ◆ **It builds a common vocabulary.** Instituting performance management encourages employees to speak the same language, with a shared terminology. The description of the tangible results in the perfor-



mance management system creates a common vocabulary of deliverables desired by customers. In this way, communicating and achieving expectations are made easier. One way to test the adoption of the performance management system is to observe whether employees at all levels are using the same words to describe desired outcomes. Until everyone from the payroll clerk to the highway maintenance engineer speaks this common vocabulary, the program will not produce maximum results.

◆ **It emphasizes the customer.** Some argue that government entities do not have customers; taxpayers, however, provide the resources to accomplish a state DOT's goals and expect something in return for these payments. In other words, taxpayers are purchasing the department's services and therefore are customers. Performance management makes eminently clear to all in the agency that all of their work aims at satisfying the customer.

## Benchmarking

Once a performance management program produces results, a new question arises: Should the agency find comparative benchmarks or strive for continual improvement against its own performance? The answer is to do both.

External benchmarks show that a certain metric or outcome is possible because another agency is already achieving it. Finding external benchmarks can be challenging, however, because state DOTs traditionally do not post performance metrics publicly. Moreover, the metrics from other organizations sometimes may derive from different sources or types of data.

Nevertheless, comparative benchmarks can be found and are important in pushing the organization toward the highest levels of performance.<sup>1</sup> For example, Missouri DOT benchmarked its pavement conditions against those of Georgia DOT, which had the best in the country. Raising the bar for performance creates an environment of "positive discomfort" that can motivate everyone in the organization to find ways to do a job better, faster, and cheaper. This is the definition of continuous improvement.

## Performance Targets

Many organizational experts recommend setting specific performance targets for each metric, but this can undermine the purpose of the program. The first temptation is to choose performance targets that are readily achievable. Moreover, once a target is met, the temptation is to defer additional effort until the next

<sup>1</sup> In partnership with the Midwest Transportation Knowledge Network, AASHTO has produced an online pathfinder that synthesizes performance metrics for state DOTs: <http://members.mtkn.org/measures>.



PHOTO: DOUG KERR

performance period, when targets are reset.

In short, targets that are met decrease the pressure to improve. Only when performance is under pressure are innovative approaches found and embraced.

But how can an organization drive performance without clear targets? The answer is to do everything possible to improve performance every day—nothing less. The goal should be the never-ending search for better, faster, and cheaper ways to serve the customer.

## Spread the News

Distributing the results of performance management inside and outside the organization is essential. Citing measurable data on organizational performance can generate tremendous credibility. When people ask how well the agency is delivering its services, responding with actual performance data is powerful.

The governor, state legislators, the news media, bond raters, potential public-private proposers, contractors, consultants, and the public all want to know if the agency is delivering and cares about delivering on its commitments. Distributing the performance management results to these stakeholders sends a clear message that the agency has a strategic view and is aggressively pursuing it.

A willingness to share performance results shows that an agency is accountable, ethical, and a good steward of resources. Although demonstrated accountability may not guarantee a boost in the agency's resources, it is a critical step.

Performance management can prove its worth by producing a more efficient and effective organization that is competent in using allocated resources. That, in turn, can build the public trust and political support ultimately needed to increase these resources.

Missouri DOT used external as well as internal benchmarks, comparing its pavement conditions with those of Georgia, which had the best in the country.

**Editor's Note:** Feature articles slated for the July–August 2014 issue of *TR News* will offer additional perspectives, models, tools and techniques, case studies, and lessons learned on performance management at a variety of transportation agencies.



# Leveraging Social Media and Online Tools to Increase Research Report Distribution

*Tips and Lessons Learned from Mineta Transportation Institute*

DONNA R. MAURILLO



*The author is Director of Communications and Technology Transfer, Mineta Transportation Institute, College of Business, San Jose State University, San Jose, California.*

**H**ow many research reports did your organization publish in the past year? Did the reports contain usable information that would benefit a transportation provider, planner, policy maker, vehicle designer, or other critical group? Did the reports reach the intended users or sit on the website unused? If they reached the users, how large a percentage did they reach?

These are important questions. No matter how well done, research has no intrinsic value if it does not reach the people who could make practical use of it. In technology terms, it becomes “shelfware.”

But suppose the reports could reach a much greater audience, with thousands of copies read and applied not only in the local region, but also across the globe. Benefits would compound exponentially whenever media stories or professional journals quote data from the reports, or when the data are used for practical applications.

The Mineta Transportation Institute (MTI), a University Transportation Center (UTC) under the U.S.

Department of Transportation, has increased the downloads of its website documents approximately tenfold over the course of four years. Evidence indicates that the reports also have been leveraged for planning and legislation in the United States and abroad. The metrics corroborating the increased impact are continuing to rise.

## **MTI's Challenges**

### ***Upgrading the Website***

The first challenge for MTI was a website that was difficult to use, nonintuitive, and built on outdated code that was no longer functional. With a limited budget, the Institute purchased a template website for less than \$100 and adapted it. This provided a temporary fix but allowed MTI to post research reports and other information in a way that was easy to download and much more intuitive to find and use.<sup>1</sup>

<sup>1</sup> <http://transweb.sjsu.edu/>.

Improvements to the Mineta Transportation Institute's (MTI's) website and stronger social media outreach efforts have led to a tenfold increase in downloads of its website documents.

### Tracking Traffic

The Institute had tracked website traffic through WebTrends and kept this method of following monthly metrics in place.<sup>2</sup> The MTI communications team was most interested in metrics for visits, document downloads, and page hits, although the reports included much more data. Graphing the monthly metrics made trends readily apparent.

Discouragement set in, however, when the site's numbers suddenly dropped 15 percent. MTI is affiliated with San Jose State University, and the drop in website activity turned out to be typical during academic breaks. A comparison of year-over-year numbers revealed an uptick for comparable months.

### Distributing News Releases

MTI realized that document downloads also depend on high-quality, informative news releases with a wide geographic reach. The Institute had been sending releases on an irregular schedule, primarily by mail or fax to local print and broadcast media. The research documents, however, were valuable nationwide and required targeted audiences—not local music stations or general interest newspapers.

The Institute hired PR Newswire to distribute news releases throughout the United States, specifically to public interest markets.<sup>3</sup> The focus was on audiences interested in the reports. Each release included a direct link to the research report posted on the MTI website. Website traffic metrics rose.

### Connecting by Social Media

Soon after, MTI realized that social media were trending much faster than traditional media were and decided to investigate those outlets as a way to increase traffic and downloads. A blog was launched and aggressively promoted but did not attract an audience. After six months, a move was made to another venue.

An MTI Facebook page offered a built-in audience.<sup>4</sup> After establishing the page, MTI staff encouraged their Facebook friends to follow it. These contacts comprised the initial audience, which grew from there.

An MTI Twitter presence was the next logical step—links to the research reports could be distributed immediately to a growing list of followers.<sup>5</sup> Followers also could forward MTI posts to their own followers—which they did, increasing the potential audience by many thousands.

MTI maintains two pages on LinkedIn—one for

<sup>2</sup> <http://webtrends.com/>.

<sup>3</sup> <http://www.prnewswire.com/>.

<sup>4</sup> <https://www.facebook.com/MinetaTransportation>.

<sup>5</sup> <https://twitter.com/MinetaTrans>.

The screenshot shows the homepage of the Mineta Transportation Institute. At the top is a navigation menu with links for Home, About Us, Research, Education, Security, Finance, Events, and News Room. Below the menu is a header featuring the MTI logo on the left and a photograph of a transit station on the right. The tagline reads "Mineta Transportation Institute: Creating Transportation Policy for the People".

The main content area features a large article titled "2014 Garrett Morgan Sustainable Transportation Competition Underway". The article includes a sub-headline "Middle-school competition set for the last week of March" and a brief description of the competition. Below the article is a "Learn more about the competition" link.

On the left side, there is a "Recent reports" section listing several documents, including "Low-Stress Bicycling and Network Connectivity" and "Public Bikesharing in North America: Early Operator and User Understanding".

On the right side, there is a "Quick Links" section with several bullet points, such as "Obtain a Master of Science degree in Transportation Management" and "Download transportation research reports and transcripts".

MTI followers<sup>6</sup> and another for students and alumni of the graduate education program.<sup>7</sup> Joining other LinkedIn group pages that have similar audiences allows the posting of news on those sites, as well.

### Assessing the Metrics

User statistics decisively prove the Institute's success in social media marketing. For fiscal year 2006, the Institute recorded approximately 2,088,000 annual visits and 60,000 annual document downloads. By the end of calendar year 2013, annual visits had jumped to 3,644,640, and annual document downloads reached a record 1,121,892.

In some months, downloads exceeded 10,000 and occasionally 20,000 for individual research reports. This allowed MTI to determine which topics were of greatest interest and, therefore, the better choices for funding.

These initiatives increased the workload, but the results have demonstrated the value of concentrating on online promotions, especially with social media. Almost any research organization can do the same.

<sup>6</sup> [http://www.linkedin.com/groups?home=&gid=1859350&trk=anet\\_ug\\_hm](http://www.linkedin.com/groups?home=&gid=1859350&trk=anet_ug_hm).

<sup>7</sup> [http://www.linkedin.com/groups/MTI-MSTM-Alumni-Association-3777547?trk=myg\\_ugrp\\_ovr](http://www.linkedin.com/groups/MTI-MSTM-Alumni-Association-3777547?trk=myg_ugrp_ovr).

When MTI targeted press releases about its research to public interest markets nationwide, its website traffic increased.





PHOTO: RON WISER, FLICKR

University students glean most of their information from social media and mobile device applications, creating a new and rapidly changing market for research distribution.

### Changing Media

In the past, publicizing a research report meant distributing a news release to the press. For the most part, the recipients were limited to newspapers and magazines or journals, and the news releases went out in hard copy by fax or postal mail. Today, the media comprise every communications venue, including broadcast and digital media and no longer are referred to as the press, which implies only print outlets.

Digital media are growing rapidly, increasing in influence through their appeal to users who want

news in quick summaries with links to more information in digital forms that can be saved and searched and that are accessible through a variety of communication devices.

The variety of media available today may be daunting—not only websites, but also social media such as blogs, Twitter, Google Plus, LinkedIn, Pinterest, Short Message Service or SMS, Rich Site Summary or RSS—also called Really Simple Syndication—and much more. This variety, however, also offers many distinct advantages over traditional media.

### Digital Media Advantages

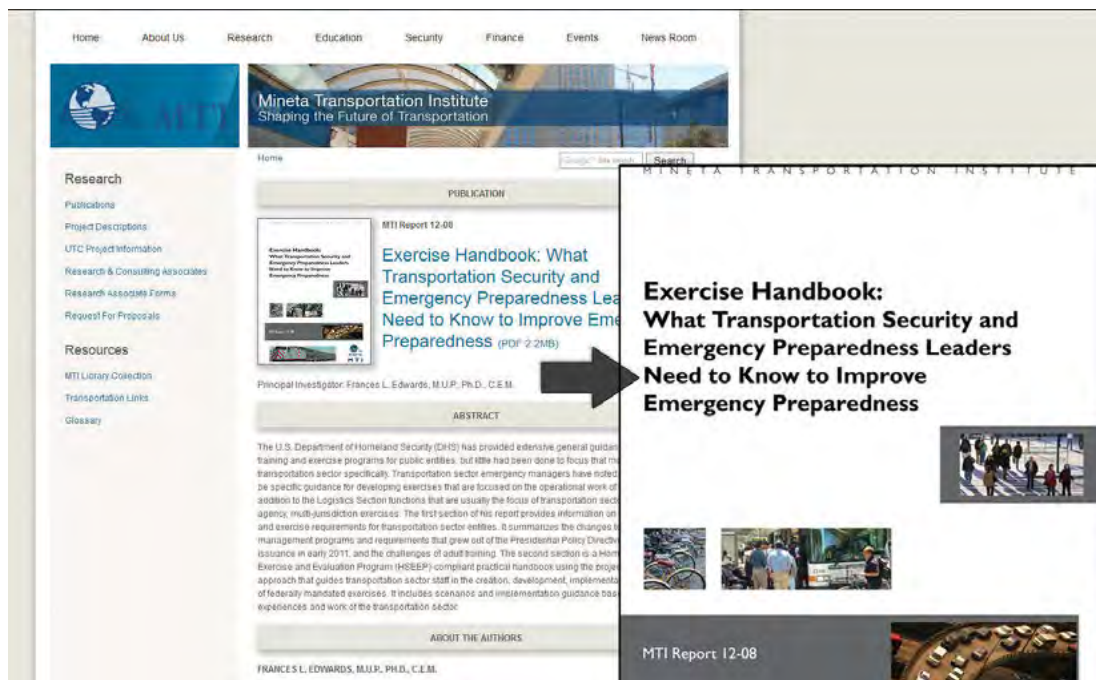
A primary advantage is that communicators no longer need to go through the reporters and editors who once functioned as gatekeepers, deciding which news to include in their publications. In fairness, these publications required large staffs to write, prepare, produce, and distribute each issue; covering these costs limited the number of stories that could be published.

In contrast, digital media reduce or eliminate many of these costs, allowing publication of an almost unlimited amount of content. In addition, digital media often are accessible directly, without gatekeepers. As a result, communicators can deliver stories directly to the desired audiences, avoiding filters and misinterpretations. An organization can refine the intended audiences to connect with the desired targets.



PHOTO: RASDOR PHOTOGRAPHY

The TRB Standing Committee Communications Coordinator Council assists committee representatives in developing communications priorities.



Research reports posted in PDF format on an organization website are most accessible to a wide range of site visitors.

Digital media are as simple or as complex as staff talents allow and can involve a few hours a week or a full-time assignment. At MTI, the communications position includes approximately two hours a day for managing digital outreach and requires the assistance of a part-time webmaster.

Digital media are immediate. There is no waiting for tomorrow's newspaper or next month's newsletter. Information can be posted as it becomes available.

Audiences also can respond instantly, so that metrics and reactions are immediately apparent. Digital media can be adjusted or changed at any time; traditional print media are permanent at publication.

The down side is that the sheer breadth of social media can be confusing and discouraging. Which outlet is right for your organization? How can you determine where the targeted users are? What if your choice is wrong? Most transportation organizations do not have a budget for professional market analysts, but this does not mean that communication policies must be formulated in the dark.

## Getting Started

First, an organization should assign at least one person as communicator. The communicator should have some knowledge of social media—of Facebook and Twitter at the minimum. The staffer should have sufficient time to keep the communications moving out, because lapses reduce traffic on social media pages. Posting messages all day, however, is not necessary; too much information can be annoying for recipients.

If the organization does not have a webmaster, it should hire one. Although a student can fill that role, a webmaster should have direct training in building and managing websites. Hiring a trained and experienced webmaster can make a difference and is preferable, for example, to hiring a student of software engineering.

The webmaster should post research reports on the organization's website, including previously issued reports not already posted. Ideally, the reports will be in portable document format (PDF) and optimized to reduce download time. Site visitors may not be willing to wait two minutes for a large document transfer and may not have the necessary storage space, especially on a handheld device. Optimizing eliminates the problems of size and speed without sacrificing document quality. The MTI website provides an example of posted research reports.<sup>8</sup>

Once posted, the reports are ready for promotion—do not send out news releases before the documents are posted to the site. Website visitors will arrive immediately—do not lead them to an empty page.

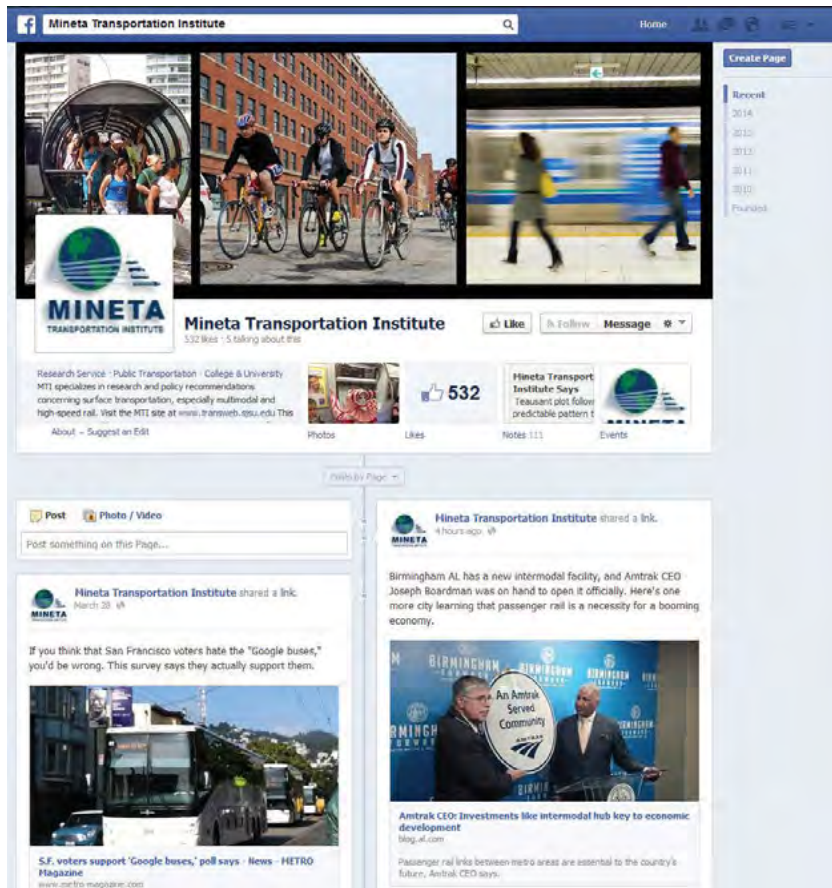
## Distributing News Releases

The news release is a key tool for generating traffic to the website. Your organization can subscribe to PR Newswire, BusinessWire,<sup>9</sup> or another news distribution service that will broadcast the release to the chosen markets. Most services charge a flat rate for

<sup>8</sup> <http://transweb.sjsu.edu/MTIportal/research/Publications.html>.

<sup>9</sup> <http://www.businesswire.com/portal/site/home/>.





MTI posts news releases on Facebook as well as general transportation news and related items of interest from other organizations.

the first 400 words and then for each additional block of 100 words. This provides good motivation to be concise.

Avoid paying what is known as the rack rate—the full retail price—for distributing news releases. Good negotiation can produce a favorable contract, including special deals, such as for guaranteeing a minimum number of releases during the year.

An organization that does not have a distribution service can build its own e-mail lists. The task is difficult, but not impossible. Although MTI uses a distribution service, it also maintains its own list of legislators, students, researchers, and others who would be interested in the new reports.

## Writing News Releases

Following are some tips for writing news releases:

- ◆ Write a headline of no more than 23 words. Search engines read only the first several words and move on—they do not read the entire release. The 23 words should include the keywords most likely to be entered in an online search. If the report is about factors contributing to increased safety at transit centers, for example, the keywords may include “transit,” “safety,” and “research,” among other rele-

vant terms. Anticipate which terms will connect with your report when someone does an online search, and place those terms in the news release headline, along with your organization’s name.

- ◆ Include your organization’s city and the release date. The first paragraph should summarize the most important information. If the rest of the story is cut, at least the critical elements will remain. Critical elements include the organization’s name, the report title, the author’s name, and a summary of the topic and results. Hyperlink the document’s title, allowing the reader to access the report directly. Live links give a release additional importance in the search results, but more than three links can reduce the search value.

- ◆ Follow with two to three paragraphs providing additional details and author quotes.

- ◆ Provide the organizational boilerplate statements at the end. This is the standard one-paragraph description of the organization, which should include a link to the website home page, along with links to the organization’s social media sites.

- ◆ Include the name and phone number of a contact who can answer media questions, even after office hours. Place this at the top or the bottom of the release.

## Leveraging Social Media

Discovering the appropriate social media often requires trial and error. Once a particular medium proves valuable, stick with it and continue to refine the content. Similarly, if another medium does not attract an audience within a few months, move on to the next outlet.

### Facebook

Facebook is an easy way to reach friends, supporters, and staff at other transportation organizations by asking them to “like” the page.<sup>10</sup> Professional courtesy requires returning the favor. The Facebook page setup should employ the business format instead of the group or individual formats. The business templates provide for a mission statement, address, website, product descriptions, and more. For an example, click the “About” link on MTI’s Facebook page.

MTI posts copies of its news releases via the Facebook “Notes” feature, as well as posting announcements, general transit news, and information from other industry-related sites, including other Facebook pages. Users consider a page more valuable if it includes a variety of information, not only news about the page owner. If possible, post at least once a day, and encourage comments.

<sup>10</sup> <https://www.facebook.com/>.

## Twitter

Twitter challenges the ability to be concise.<sup>11</sup> Messages cannot exceed 140 characters and can be compared to a “headline crawl” at the bottom of a TV screen. Twitter’s value is in disseminating a quick news bite, along with a link to more information. Readers can scan the list of incoming news and select the most interesting.

When signing up for Twitter, create a distinctive user name. MTI chose @MinetaTrans. The name always begins with the @ symbol and can be no longer than 15 characters. “Mineta” gives a unique identifier as the name of retired Secretary of Transportation Norman Mineta, who founded the Institute. Few other organizations will have “Mineta” in their user names. A unique name has an advantage for search engine results; anyone searching for “Mineta,” for example, will find a short list.

MTI Twitter posts include a direct link to the report on the Institute’s website. The typical message is written like a headline—for example, “New

<sup>11</sup> <https://twitter.com/>.



A unique Twitter user name, like @MinetaTrans, increases the chance that an organization’s feed will appear in search results.

MTI research shows how to reduce traffic accidents.” Then the link is inserted. When “send” is clicked, the message is distributed, or “tweeted,” to all MTI followers. A follower can repost or “retweet” the message to another set of followers, which can start a viral distribution of the MTI announcement.

Attracting followers who themselves have a large following is beneficial. Recently someone retweeted one of MTI’s messages to 101,000 followers. That tweet alone significantly extended the Institute’s audience reach.

Twitter messages can scroll away quickly, as new tweets arrive. Therefore repeating each message two or three times is a good practice.

Many news reporters and editors follow Twitter posts to pick up promising leads. Make friends with media contacts on Twitter, and send them good news stories. Media people also appreciate your distribution of their stories, if relevant to your organization’s Twitter followers.

## LinkedIn

LinkedIn has shown promise as a site to reach and develop business contacts.<sup>12</sup> The site can help locate other researchers, industry people, legislators, and others who may have an interest in your organization’s research projects. MTI maintains two group pages on LinkedIn and posts links to research reports, as well as other news items. LinkedIn is free.

## YouTube

MTI has leveraged YouTube<sup>13</sup> for posting videos of research presentations, workshops, panel discussions, and other events. Video is uploaded and stored on the YouTube server, and a link should be posted to your organization’s website, news releases, or other social media. Storing video on the YouTube server is advantageous, because the large files can consume space on your own organization’s server.

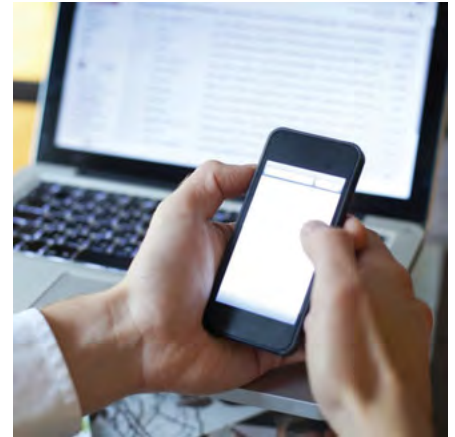
When posting a video, include a title, the names of the authors or participants, and a link to the research report, if applicable. This makes the posting visible to search engines and helps increase downloads for reports or other documents. YouTube is free.

## Useful Apps and Sites

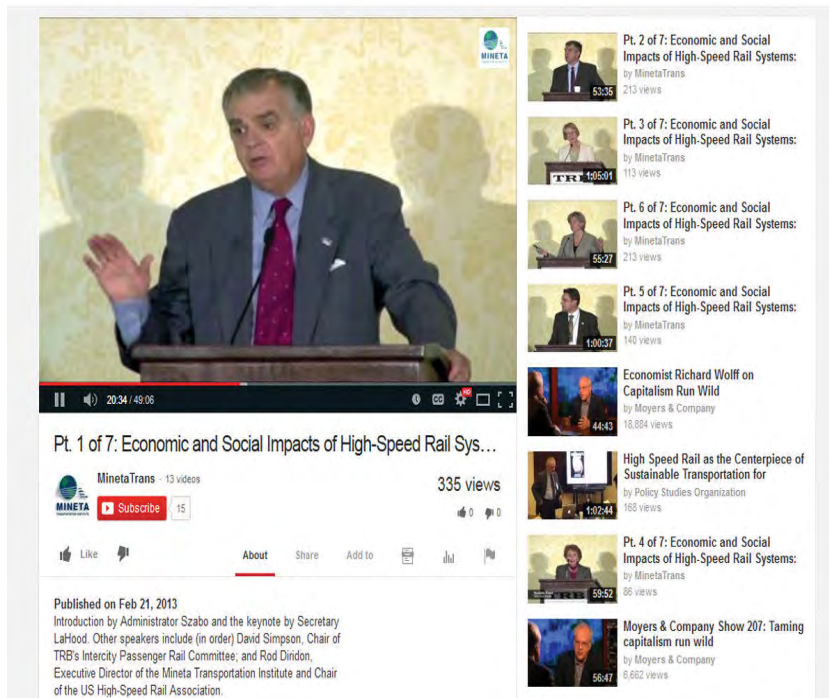
A small staff can face difficulties managing the many options of social media. Some companies have created innovative applications to simplify the task.

<sup>12</sup> <https://www.linkedin.com/>.

<sup>13</sup> <http://www.youtube.com/>.







MTI recorded an address by former U.S. Transportation Secretary Ray LaHood at the 2013 TRB Annual Meeting and posted it on its YouTube channel for wider distribution.

These apps can be found with a quick online search. Some sites offer instruction in social media. Descriptions of a few of the many available resources follow.

**Buffer**

Buffer is an application that facilitates posting to multiple social media sites.<sup>14</sup> Several items can be placed in the Buffer queue for posting at various times throughout the day. This distributes the information at regular intervals instead of releasing all of the items at the same time. Other supporting apps are available.<sup>15</sup> There is no charge.

<sup>14</sup> <https://bufferapp.com/guides>.

<sup>15</sup> <https://bufferapp.com/extras>.

**TweetDeck and HootSuite**

Twitter users benefit from TweetDeck<sup>16</sup> and HootSuite,<sup>17</sup> which filter the news, send notifications of relevant posts, schedule multiple tweets, organize incoming tweets, and allow users to add comments to the messages they retweet. The apps are free.

**TweetReach**

TweetReach reports how many times a tweet was followed or retweeted, along with a list of the top ten sources for tweets or retweets. The basic TweetReach is free, but the metrics apply only to the past week.<sup>18</sup> Detailed reports are available for a fee with TweetReach Pro.<sup>19</sup>

**Interactive Insights Group**

The Interactive Insights Group does not provide management tools for social media but aggregates instructions on how to use social media.<sup>20</sup> The site offers tutorials on topics from blogging and microblogging to social networking and video sharing. The information is written in plain English and is free of charge.

**Social Media Examiner**

Social Media Examiner is a resource for tips on how to make the most of social media. If a topic is confusing, the site will make it simple to understand.<sup>21</sup> Social Media Examiner publishes new articles daily and can deliver the articles via e-mail, all at no charge.

<sup>16</sup> <https://about.twitter.com/products/tweetdeck>.

<sup>17</sup> <https://hootsuite.com/>.

<sup>18</sup> <http://tweetreach.com/>.

<sup>19</sup> <http://tweetreach.com/plans>.

<sup>20</sup> <http://blog.interactiveinsightsgroup.com/#SocialNetworking>.

<sup>21</sup> <http://www.socialmediaexaminer.com/>.

**Communication Guidelines to Address Social Media Tools—and More**

TRB’s National Cooperative Highway Research program (NCHRP) is launching a project to develop communications guidelines for state departments of transportation (DOTs).<sup>a</sup> The guidelines will help state DOTs communicate about challenges, opportunities, and day-to-day operations more effectively and efficiently and will address the use of new tools, such as social media and electronic communications, that have radically enhanced direct communication with the customer base.

In addition to guidelines, the project is expected to produce such resources as templates, case studies, examples, graphics, and other tools to illustrate the strategies and practices that transportation agencies can use successfully.

For more information, contact Christopher Hedges, 202-334-1472; [chedges@nas.edu](mailto:chedges@nas.edu).

<sup>a</sup> NCHRP Project 20-99; <http://apps.trb.org/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=3667>.

# 2014 ANNUAL MEETING HIGHLIGHTS

## Celebrating Our Legacy, Anticipating Our Future



**1** At his Chairman’s Luncheon address on January 15, U.S. Secretary of Transportation Anthony Foxx drew an enthusiastic response to his emphasis on an integrated national transportation plan—and his quip that his audience comprised the “wonkiest transportation folks in the world.”

**2** A session for new Annual Meeting attendees offered advice on navigating and networking, developing a transportation career, and becoming involved in TRB activities and committees.

**W**ith a record-breaking attendance of 11,900, the Transportation Research Board’s 93rd Annual Meeting convened January 12–16, 2014, in Washington, D.C.—the final meeting at the Connecticut Avenue collection of hotels before relocation to the Walter E. Washington Convention Center in 2015. Transportation students, researchers, and professionals from private industry; academia; and federal, state, and local agencies attended more than 3,300 presentations and committee meetings, networking events, award presentations, and exhibits. Approximately 30 sessions addressed the theme “Celebrating Our Legacy, Anticipating Our Future,” with topics addressing big data, performance-based design,

sustainability, and more. The TRB Annual Meeting mobile application was downloaded more than 9,000 times, and participants were active on social media platforms such as Twitter and Facebook.

Professor Joseph L. Schofer, Northwestern University, gave the 2014 Thomas B. Deen Distinguished Lecture on “Moving the Goods: Performance Measures and the Value Proposition for Transportation Projects.” U.S. Secretary of Transportation Anthony Foxx delivered the Chairman’s Luncheon address, affirming the value of robust transportation research to a standing-room-only crowd.

Details and highlights appear on the following pages.



Annual Meeting photographs by Risdon Photography.



# TRB Annual Meeting 2014

## INTERSECTIONS

**1** Social and electronic media played an important role at the 2014 Annual Meeting, with attendees generating more than 4,000 tweets via #TRBAM.



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**2** (Left to right:) Somaye Fakharian Qom, Mojtaba Mohammadafzali, and Abel Crean, Florida International University, confer after a session on research by students in the Federal Highway Administration's (FHWA) Eisenhower Transportation Fellowship Program.



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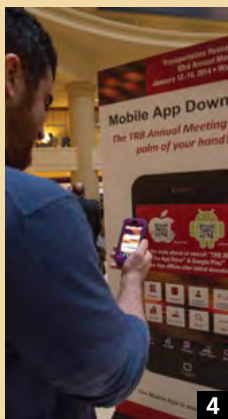
**3** The TRB Technical Activities Council oversees Annual Meeting planning.



3

**3** 2014–2015 TRB Technical Activities Council (front row, left to right:) Mark Norman, Harold (Skip) Paul, Peter Briglia, Mary Ellen Eagan, Hyun-A Park, and Paul Jovanis; (back row, left to right:) Thomas Wakeman, David Wilcock, Thomas Kazmierowski, Mark Kross, Stephen Popkin, Council Chair Daniel Turner, Alison Conway, James Thiel, and Peter Mandle.

**4** Nima Roohi Sefidmazgi, University of Wisconsin–Madison, downloads the Annual Meeting mobile application. The app featured an interactive program, schedule, floor plans, exhibitors, and more.



4

**5** Andrew Cooper (left), James Cox & Sons, demonstrates testing equipment to Louay Mohammad, Louisiana State University. Approximately 190 companies and agencies exhibited.



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**6** Tim Hoffman tests a driving simulator at the PTV Group exhibit.



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**7** At the Chairman's Luncheon, Beverly Scott (standing), recipient of the Sharon D. Banks Award for Humanitarian Leadership in Transportation, chats with students of TransTech STEM Academy, Francis L. Cardozo Senior High School, Washington, D.C.



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**8** (Left to right:) Deborah H. Butler, 2013 Executive Committee Chair; Sandra Rosenbloom, 2012 Executive Committee Chair; Lucy Phillips Priddy, 2013 Young Members Council Chair; Katherine F. Turnbull, 2013 Technical Activities Council Chair; Ann M. Brach, second Strategic Highway Research Program (SHRP 2) Director; and Susan Hanson, Subcommittee for NRC Oversight Chair, at the TRB Executive Committee meeting.



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## SESSIONS AND WORKSHOPS

**1** Attorney Jorgé Eduardo Ritter discusses the history and legacy of the Panama Canal in one of two spotlight sessions commemorating the canal's 100th anniversary.

**2** Cortney Robinson, Aerospace Industries Association, presents information on the integration of NextGen and unmanned aerial systems at a session on the future of aviation.



**3** Paul (Chip) Jaenichen, Maritime Administration, delivers the keynote presentation at One Hundred Years of the Panama Canal: Legacy and Future—Looking to the Future.

**4** Julia Koschinsky (left), Arizona State University, and Scott C. Brown, University of Miami, examine accessibility in low-income communities as it relates to multimodal access, employment, and health.



**6** Stephanie Brooks (left), Michael Baker Corporation, leads a group exercise in Reimagining the Public Meeting.

**7** Rina Cutler, City of Philadelphia, addresses changing trends in urban areas at Rethinking the Transportation Organization in the New Millennium.



**5** Marc Howlett, University of North Carolina at Chapel Hill, leads Marine Transportation 101: Exploring the World of Water Transportation.

**8** Emily Stock, Virginia Department of Rail and Public Transportation, presents the Virginia perspective at Status of Rail Planning: Coordinating, Collaborating, and Implementing.



**9** Ananth Prasad, Florida DOT, takes part in a panel discussion on Thriving, Not Just Surviving the Moving Ahead for Progress in the 21st Century Act Implementation Process.

**10** Josh Sawislak, Department of Housing and Urban Development, responds to audience questions after his keynote address at Carrying Forward the Lessons of Superstorm Sandy.



# TRB Annual Meeting 2014

## SESSIONS AND WORKSHOPS

(continued)

**1** Patricia Hu, Office of the Assistant Secretary of Transportation for Research and Technology, shares the federal perspective on the value of transportation infrastructure.



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**2** Lindsay Allen, North Carolina A&T State University, discusses her research on the transportation of hazardous materials with Keith Tanner, South Carolina State University.



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**3** Georgios Giannopoulos, Hellenic Institute of Transport, assesses the future of international research development, governance, and administration.



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**4** Nemmi Cole, Florida A&M University, presents information on the sustainable use of dredged materials in roadway construction.



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**5** Jorge Marquez Balderrama, New Mexico State University, describes a preliminary design aid for concrete bridge girders.



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**6** Katherine Fichter (center), Massachusetts DOT, guides discussion on engaging hard-to-reach populations at Big Ideas That Change Transportation as We Know It.



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**7** Ogi Redzic, Nokia, offers the private-sector perspective on automated driving and other transportation innovations.



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**8** Paul van Hagen, HDR Inc., recounts the mission to raise the roadway of the Bayonne Bridge.



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**9** Claudia Billotto, AECOM, moderates the 7th Annual Competition and Call for Communicating Concepts with John and Jane Q. Public. A Utah DOT project that used animation to alert and engage the public about road realignment received top honors.



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**10** David Genova, Denver Regional Transportation District, analyzes the components of an effective transit safety management system.



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## SESSIONS AND WORKSHOPS

(continued)

**1** Trenton Clark, Virginia Asphalt Association, addresses the Past, Present, and Future of Pavement Design.

**2** Jamario White, South Carolina State University, reviews national data and policies on distracted walking at Pedestrian Planning, Design, and Safety.

**3** Matt Miyasato, South Coast Air Quality Management District, examines low-emission technologies at Finding Cleaner Ways to Move Goods and People.

**4** Thomas Wakeman (left), Stevens Institute of Technology, participates in panel discussion at Sustainability: 20 Years in the Past and 20 Years in the Future.

**5** John Schroer (right), Tennessee DOT, presides over a roundtable discussion on funding and financing projects with Greg Whirley (left), Virginia DOT, and other state DOT leaders.

**6** Alessandro Damiani, European Commission, outlines New Horizons for International Research Collaboration: European Union's Horizon 2020 Program.

**7** Maryam Shekarrizfard, McGill University, shares insights on air quality, transportation, and land use impacts of a highway extension near Montreal, Canada, at Environmental Analysis in Transportation.

**8** Jeffrey Kneuppel, Southeastern Pennsylvania Transportation Authority, explores Resiliency in Public Transportation.

**9** Gregory Johnson, Michigan DOT, addresses performance management at a roundtable discussion with state DOT leaders.



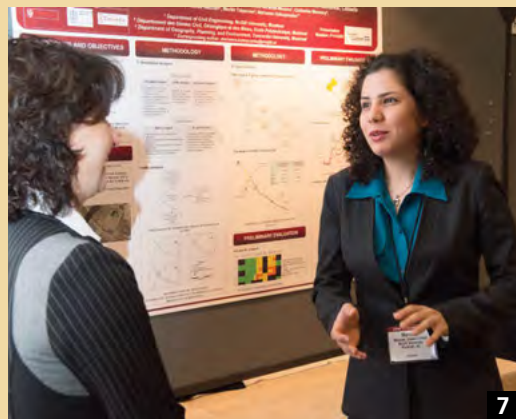
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**10** (Photo, right) Michael McKeever (left), Sacramento Area Council of Governments, joined Joel Ettinger (center), New York Metropolitan Transportation Council, and Jane Hayse (right), Atlanta Regional Commission, in a dialogue on Framing a Vision for the Future of Our Nation's Metropolitan Planning Organizations.



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# TRB Annual Meeting 2014

## SESSIONS AND WORKSHOPS

(continued)

**1** Kouros Mohammadian, University of Illinois, Chicago, guides discussion on Transportation Data: Our Legacy and Our Future.



**2** Anna Maria Rakoczy, Transportation Technology Center, Inc., addresses fatigue reliability indices in Special Topics for Steel Bridges.



**3** Hui Li, University of California (UC), Davis, describes an integrated local microclimate model in Cool Pavements: Thermal Properties, Field Experiments, and Modeling Techniques.



**4** Steven Gillen, Illinois Tollway Authority, recounts an I-90 project in Construction of Two-Lift Portland Cement Concrete Pavements.

**5** Sean Connaughton, Virginia Secretary of Transportation from 2010 to 2014, presents a challenge to marine researchers at a session on funding and research for inland waterways.



**6** Keaton Browder, Tennessee State University, shares results from a case study of parking problems near a downtown university campus at Parking Revolution from A(sset Management) to Z(oning).

**7** Anupam Srivastava, UC Irvine, examines Macroscopic Approaches to Traffic Flow.



**8** Peter Rogoff (*far right*), Federal Transit Administration (FTA), presides over a dialogue with former FTA officials in honor of the 50th anniversary of the Urban Mass Transportation Act.

**10** William Bachman, Westat Inc., analyzes challenges and opportunities in Tapping Private-Sector Capabilities to Meet National Transportation Data Needs.



**9** Iliya Yut, University of Connecticut, explores SHRP 2 Asphalt- and Pavement-Related Products.

**11** Keith Molenaar (*right*), University of Colorado at Boulder, discusses Alternative Project Delivery with moderator Matthew McDole (*left*), LS Gallegos.





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## COMMITTEES

**1** Diane Anderson, WRScompass, presents the membership report of the Waste Management and Resource Efficiency in Transportation Committee.

**2** Arash Mirzaei, North Central Texas Council of Governments, participates in a meeting of the Task Force on Understanding New Directions for the National Household Travel Survey.

**3** Shawn Turner, Texas A&M Transportation Institute (TTI), presides over his final meeting as chair of the Pedestrians Committee.

**4** The Safety Data, Analysis, and Evaluation Committee focuses on highway safety-related research.

**5** Joseph Bryan, Parsons Brinckerhoff, leads a dialogue on emerging research at a meeting of the Urban Freight Transportation Committee.

**6** Kelly Clifton (*center*), Portland State University, weighs in at a Travel Analysis Methods Section meeting.

**7** Cesar Quiroga, TTI, received recognition for his leadership of the Geographic Information Science and Applications Committee.

**8** Arlando Teller (*right*), Navajo Division of Transportation, shared insights on airport system management on the Navajo Nation at a meeting of the Aircraft–Airport Compatibility Committee, chaired by Geoffrey Baskir (*left*), CSSI, Inc.

**9** Shashi Nambisan (*right*), University of Tennessee, Knoxville, takes part in discussion at a Conduct of Research Committee meeting.



# TRB Annual Meeting 2014

## COMMITTEE LEADERSHIP AWARDS

**1** Committee chairs accept the Blue Ribbon Award, which recognizes exceptional standing committees, on behalf of their fellow members.

The Blue Ribbon Award for Communications was presented to the Travel Survey Methods Committee; for Community Building and Mentoring, to the Women's Issues in Transportation Committee; for Advancing Research, to the Operational Effects of Geometrics Committee and the Geometric Design Committee; and for Contributing to TRB and the Transportation Community, to the Conduct of Research Committee and the Urban Transportation Data and Information Systems Committee.

**2** As Technical Activities Council Chair, Turnbull guided the activities of nearly 200 standing committees.

**3** Stephane Hess (*center*), Institute of Transport Studies, University of Leeds, United Kingdom, receives the Outstanding Young Member Award, presented by Bomar (*right*) and Lucy Phillips Priddy, 2013 Young Members Council Chair (*left*).



**1** (Left to right:) 2013 Technical Activities Committee Chair Katherine Turnbull; Kay Fitzpatrick, Operational Effects of Geometrics Committee; Eric Donnell, Geometric Design Committee; Stacey Bricka, Urban Transportation Data and Information Systems; Guy Rousseau, Travel Survey Methods Committee; Elaine Murakami and Jason Bittner, Conduct of Research Committee; and Heather Rothenberg and Marsha Anderson Bomar, Women's Issues in Transportation Committee.

## Volunteer Leaders Recognized with Emeritus Status

In recognition of their dedication and valuable contributions to technical activities committees, the following individuals received emeritus membership in TRB at the 2014 Annual Meeting:

- ◆ Mary R. Brooks, International Trade and Transportation Committee;
- ◆ Anthony S. Caserta, Tunnels and Underground Structures Committee;
- ◆ Jon A. Epps, General Issues in Asphalt Technology Committee;
- ◆ William H. Hartt, Corrosion Committee;
- ◆ Newton C. Jackson, Flexible Pavement Design Committee;
- ◆ Anthony R. Kane, Strategic Management Committee;
- ◆ Philip H. Masters, Freeway Operations Committee;
- ◆ Gerald S. McDougall, Light Commercial and General Aviation Committee;
- ◆ Wilfrid A. Nixon, Winter Maintenance Committee;
- ◆ Andrzej S. Nowak, Field Testing and Nondestructive Evaluation of Transportation Structures Committee;



Emeritus Member Anthony Kane, American Association of State Highway and Transportation Officials (AASHTO), participates in a meeting of the Strategic Management Committee.

- ◆ Roger C. Olson, Pavement Rehabilitation Committee;
- ◆ Peter Schauer, Rural Public and Intercity Bus Transportation Committee;
- ◆ Alexander Skabardonis, Traffic Flow Theory and Characteristics Committee;
- ◆ Michael M. Sprinkel, Polymer Concretes, Adhesives, and Sealers Committee;
- ◆ Thomas Urbanik II, Traffic Signal Systems Committee; and
- ◆ Pam Ward, Rural Public and Intercity Bus Transportation Committee.





## BEST PAPER AWARDS

**1** The Pyke Johnson Award recognizes an outstanding paper on transportation systems planning and administration.

**2** Alexander Schmets (left) and Sayeda Nowrozon Nahar, Delft University of Technology, The Netherlands, accepted the K. B. Woods Award for outstanding paper in design and construction. (Not pictured: coauthors Mohamad Mohajeri, Athanasios Scarpas, and Martin van den Ven, Delft University of Technology, and Georg Schitter, Vienna University of Technology, Austria)

**1** Pyke Johnson Award recipients (left to right:) Ram Pendyala, Arizona State University; Rajesh Paleti and Chandra Bhat, University of Texas, Austin; and Konstadinos Goulias, UC Santa Barbara.

**3** The William W. Millar Award honors the best paper in the field of public transportation. (Left to right:) Millar, past president of the American Public Transportation Association and award namesake; Margaret Campbell, Ben Cummins, and Greg Spitz, Resource Systems Group, Inc.; and Tara O'Malley, Chicago Transit Authority.



**4** For their paper on "Treatment Effects and Design Guidance for High-to Low-Speed Transition Zones for Rural Highways," (left to right:) Robert Frazier, HDR Engineering, Inc.; Karin Bauer, MRIGlobal; Christopher Kinzel, HDR Engineering, Inc.; and Darren John Torbic, MRIGlobal, received the D. Grant Mickle Award. (Not pictured: coauthor David Gilmore, MRIGlobal)



**5** The Patricia F. Waller Award for outstanding paper on safety and system users was presented to Richard Blomberg, Dunlap & Associates, Inc.; Ronald Van Houten, Western Michigan University (WMU); and J. E. Louis Malenfant, Center for Education and Research in Safety, Canada. (Not pictured: coauthor Brad Huitema, WMU)



**7** (Photo, right) Turnbull (center) presented the Fred Burggraf Award for best paper in design and construction by young researchers to Erin Cooper (left) and Magdala Arioli (right), EMBARQ/World Resources Institute. (Not pictured: coauthors Aileen Carrigan and Umang Jain)



**6** Michael Loulakis, Capital Project Strategies, and Shannon Briglia, Briglia McLaughlin, PLLC, received the John C. Vance Award for *TCRP Legal Research Digest 40: Legal Issues Involving Surety for Public Transportation Contracts*. (Not pictured: coauthor Lauren McLaughlin, BrigliaMcLaughlin, PLLC)



# TRB Annual Meeting 2014

## MAJOR AWARDS

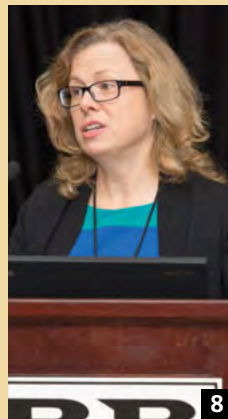
**1** TRB Executive Director Robert E. Skinner, Jr., presents Beverly A. Scott (left), General Manager, Massachusetts Bay Transportation Authority, and Administrator, Massachusetts Department of Transportation, Rail and Transit Division, with the 2014 Sharon D. Banks Award for Humanitarian Leadership in Transportation. Scott's leadership, results-driven management style, and progressive approach to transit labor relations were noted, along with her focus on diversity and the well-being of communities affected by transit initiatives.



**2** For wide-ranging accomplishments in pavement and civil engineering research, Ralph Haas (right), Norman W. McLeod Engineering Professor and Distinguished Professor Emeritus, University of Waterloo, Canada, received the Crum Award from 2013 Executive Committee Chair Deborah Butler.



**3** 2013 Executive Committee Vice Chair Kirk Steudle (right) presents Harold (Skip) Paul, Louisiana Department of Transportation and Development, with the W. N. Carey, Jr., Distinguished Service Award. Paul was recognized for his outstanding efforts in transportation research and more than 30 years of service to TRB.



**4** Frederick (Bud) Wright (left), AASHTO Director, presents the George S. Bartlett Award to Susan Martinovich, Director, North American Highway-Bridge, Transportation Business Group, CH2M Hill, for her many contributions to highway progress.

**5** Joseph Schofer (second from right), Northwestern University, delivered the 2014 Thomas B. Deen Distinguished Lecture. (Left to right:) 2013 Technical Activities Council Chair Katherine Turnbull, past TRB Executive Director Thomas B. Deen, Butler, Schofer, and Robert E. Skinner, Jr.

## EXECUTIVE COMMITTEE

**6-10** At a special Executive Committee policy session on Aviation Issues—Challenges and Opportunities, aviation experts presented research on the response of the industry to a turbulent decade. Speakers included

**6** Jeff Hamiel, Minneapolis-St. Paul Metropolitan Airports Commission;

**7** Thomas Berry, MITRE Corporation;



**8** Victoria Arroyo, Georgetown University, who served as rapporteur for the session;

**9** Michael Whitaker, Federal Aviation Administration; and

**10** Stephen Van Beek, Leigh-Fisher.

**11** Jay Shambaugh summarizes findings from *TRB Special Report 312: Transportation Investments in Response to Economic Downturns*.



# New Leaders Take Helm

**K**irk Steudle, Director, Michigan Department of Transportation (DOT), is the 2014 Chair of the TRB Executive Committee. Daniel F. Sperling, Professor of Civil Engineering and Environmental Science and Policy, University of California (UC), Davis, and Director, Institute of Transportation Studies, is the 2013 Vice Chair.

A member of the Executive Committee since 2004, Steudle joined Michigan DOT in 1987 and was appointed Director in 2006. He administers a budget of more than \$3 billion and oversees the construction, operation, and management of approximately 10,000 miles of state highways, 4,000 bridges, and many multimodal transportation programs. Steudle also is chair of the second Strategic Highway Research Program Oversight Committee. Past president of the American Association of State Highway and Transportation Officials (AASHTO) and current AASHTO Executive Committee member, Steudle serves on the Board of Directors of the Intelligent Transportation Society of America and the Engineering Society of Detroit and as Chair of the University of Michigan Transportation Research Institute Advisory Board. He graduated from Lawrence Technological University with a bachelor's degree in construction engineering and, in 2012, was inducted into the school's Engineering Hall of Fame. He is a registered Professional Engineer in Michigan.

Founding Director of the Institute of Transportation Studies at UC Davis, Sperling also is Acting Director of the UC Davis Energy Efficiency Center. He is an

expert on transportation technology assessment, energy and environmental aspects of transportation, and transportation policy and is coauthor of *Two Billion Cars*. Sperling is an emeritus member of the Alternative Transportation Fuels and Technologies Committee and serves on the Special Task Force on Climate Change and Energy and the Subcommittee on Planning and Policy Review. He is a lifetime National Associate of the National Academies and, in 2007, was appointed to the California Environmental Protection Agency Air Resources Board. Sperling received a bachelor's degree from Cornell University and a Ph.D. from UC Berkeley.

Newly appointed to the Executive Committee are A. Stewart Fotheringham, Director, Centre for GeoInformatics and Professor of Human Geography in the School of Geography and Geosciences, University of St. Andrews, United Kingdom; Abbas Mohaddes, President and Chief Executive Officer, Iteris, Inc.; and ex officio member George W. VanSteenburg, U.S. Air Force Civil Engineer Center. Reappointed to the Executive Committee are James M. Crites, Executive Vice President, Operations Division, Dallas-Fort Worth International Airport; Michael W. Hancock, Secretary, Kentucky Transportation Cabinet; Michael P. Lewis, Director, Rhode Island DOT; Joan McDonald, Commissioner, New York State DOT; and Kumares C. Sinha, Edgar B. and Hedwig M. Olson Distinguished Professor of Civil Engineering at Purdue University and Director, Joint Transportation Research Program of Purdue University and Indiana DOT.



Steudle



Kirk Steudle presents a plaque to Deborah Butler in honor of her service as 2013 Executive Committee chair.



1



2



3

## EXECUTIVE COMMITTEE (continued)

- 1** 2013 Chair Deborah Butler guides the Executive Committee through its meeting agenda.
- 2** TRB Executive Director Robert E. Skinner, Jr., updates the committee on critical research issues and on the status of TRB's strategic plan.
- 3** Kirk Steudle, 2013 Vice Chair, offers insights on major Executive Committee initiatives.



# TRB Annual Meeting 2014

## EXECUTIVE COMMITTEE

(continued)

The Executive Committee met January 15–16 to review the current state of transportation research and to establish new areas of focus.

**1–3** New members participating in meeting deliberations for the first time were (left to right) A. Stewart Fotheringham, University of St. Andrews School of Geography and Geosciences, United Kingdom; Abbas Mohaddes, Iteris, Inc.; and Craig Rutland, Air Force Civil Engineer Center.

**4–8** Also taking part in meeting discussions were (left to right) Lisha Smith, South Coast Air Quality Management District; Michael Lewis, Rhode Island DOT; Joan McDonald, New York State DOT; Lucy Phillips Priddy, U.S. Army Corps of Engineers; and Philip Washington, Denver Regional Council of Governments.

**9** Daniel Sperling (left), UC Davis, and James Crites (right), Dallas–Fort Worth International Airport, attend to a discussion of automated vehicles.

**10** Venkatesh (Venky) Narayanamurti represented the National Academy of Engineering.

**11–14** Presenting the federal transportation perspective were (left to right) Todd Lewis Ripley, Maritime Administration; Stacy Cummings, Federal Railroad Administration; Gregory Winfree, Office of the Assistant Secretary of Transportation for Research and Technology; and Gregory Nadeau, FHWA.







PHOTO: RISSON PHOTOGRAPHY

# The Transportation Research Board's Annual Meeting on the Move

*Reflecting on the History of an Extraordinary Event*

THOMAS B. DEEN AND ALAN E. PISARSKI

*The authors are members of the TRB History Committee. Deen, a transportation consultant in Stevensville, Maryland, and a member of the National Academy of Engineering, served as TRB's eighth Executive Director from 1980 until his retirement in 1994; TRB's Distinguished Lectureship was named for him in 2002, and he received the Frank Turner Medal for Lifetime Achievement in Transportation in 2006. Pisarski, a transportation consultant in Falls Church, Virginia, is author of the *Commuting in America* series and recipient of TRB's Distinguished Lectureship and the W. N. Carey, Jr., Distinguished Service Award.*

On a cold January day in New York City in 1922, the executive director of the Highway Research Board (HRB) rose to speak to a small group of policy and technical experts assembled from around the country. Professor W. K. Hatt had dressed in his best striped pants and cutaway coat for this important occasion. This began a series of annual meetings that gradually morphed into the premier event hosted by the Transportation Research Board (TRB) and attended by tens of thousands over the years.

Hatt had been appointed to his post the previous July. His predecessor Alfred D. Flynn had access to space in the Engineering Societies Building in New York City, where he had maintained the offices of the Board during his two-year stint as executive director. Hatt used this same space to stage the first Annual Meeting.

*(Top photo:)* For nearly 60 years, transportation professionals have networked and shared research at the Marriott Wardman Park Hotel during the TRB Annual Meeting. The Omni Shoreham and the Washington Hilton supplemented for most of that span.



W. K. Hatt, the second Executive Director of TRB (then the Highway Research Board), presided over its inaugural Annual Meeting in 1922.





PHOTO: UNIVERSITY OF WASHINGTON DIGITAL COLLECTION

Road construction in Washington State in the 1920s. Highway research, fledgling at the time, responded to the need for better technology and construction methods.

The meeting had to be held during cold weather to avoid conflicts with the construction season—many of the attendees were engineers engaged in building the nation’s road system. The 30 participants at the first meeting included 17 members of the Executive Committee. Five technical and two administrative committees had been appointed, papers were presented on ways to improve the design and construction of pavements, and discussions were held about HRB’s role in coordinating and advising federal and state agencies on highway research.

### Survey of Research

The participants agreed to undertake a survey of ongoing research projects. A few months later, results showed that 479 highway research projects were under way at 132 institutions, public and private. None of the projects could have been large, because the combined spending totaled only \$300,000 per year (approximately \$4 million in today’s dollars), or an average of \$625 per year per project (\$8,500 in today’s dollars).

Nonetheless, this level of research activity demonstrated that the agencies charged with building the new roads were seeking improvements in technology and methods. The survey also showed the need for a clearinghouse to help researchers avoid duplication, build on each other’s work, share results, and facilitate the transfer of promising outcomes from the laboratory to field practice.

HRB and its Annual Meeting were tools for ful-

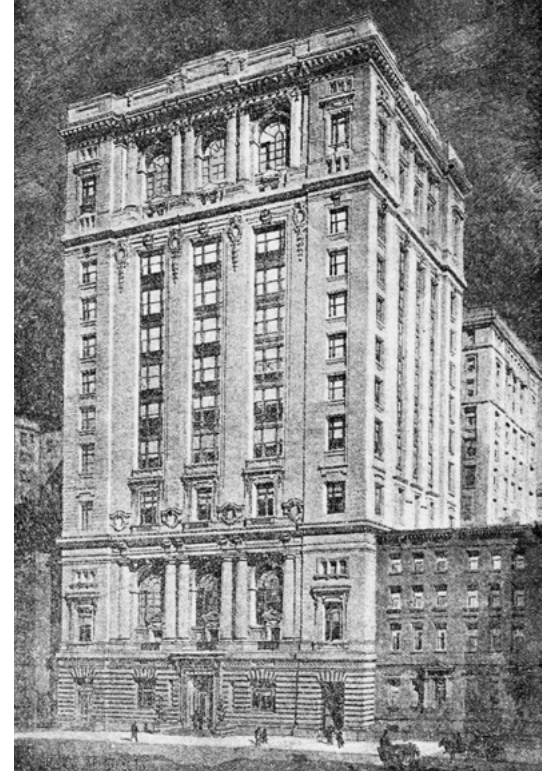


IMAGE: POPULAR SCIENCE MONTHLY, VOL. 68

The Engineering Sciences building, on West 39th Street in New York City, was the site of the first Annual Meeting.

filling this mission. Research successes and failures could be peer reviewed, published, presented, and discussed.



With an attendance of 1,700 in 1956, the HRB Annual Meeting moved to the Sheraton Park Hotel, Washington, D.C.; the hotel later was renamed the Marriott Wardman Park.

Although they had high hopes, those 30 attendees could not have known that they were setting in motion an annual event that would continue through the Great Depression, World War II, the Cold War, several smaller wars, and countless other national tragedies and triumphs, growing steadily, and that almost a century later would attract nearly 12,000 from dozens of countries to explore transportation technology in all modes.

## Momentum of Growth

Although expanding the Annual Meeting was not an explicit objective, growth began immediately. By the fifth meeting in December 1925, attendance had increased to 293, and the Executive Committee, concerned about overcrowding, considered limiting the meeting to 300 attendees, but after a brief discussion, the members dismissed the idea. This was the first of several attempts over the years by members of the Executive Committee to rein in the growth of the Board and of the Annual Meeting.

For example, Thomas D. Larson,\* who chaired the Executive Committee in 1981, believed that too many technical committees were sponsoring too many sessions at the Annual Meeting and sought policies to constrain growth. For a while, any request for a new committee required an accompanying recommendation for eliminating a committee or merging committees to limit the total.

When restraints were in effect at other times, program planners created a workaround—the so-called “boxed sessions,” which were not numbered. This permitted the actual sessions to increase even as the numbered sessions remained in check.

These periodic restraints, however, encountered an inexorable expansion of the issues facing transportation and a commensurate demand for more committees to address the issues. Initially, the main concern was the improvement of pavements, materials, drainage, right-of-way, bridges, and vehicle weight standards on highways. But other modes became part of the Board’s portfolio—including public transit, railroads, aviation, and marine transport. All of these faced an ever-increasing array of issues such as environmental impacts, finance, social justice, economic development, safety, and the reconciliation of private and public interests.

\* Thomas D. Larson (1929–2006) was Federal Highway Administrator, 1989–1993; Pennsylvania’s Secretary of Transportation, 1979–1987; and a longtime researcher, civil engineering professor, and administrator at Pennsylvania State University, now home of the Thomas D. Larson Pennsylvania Transportation Institute. He was the 2003 recipient of the Frank Turner Medal for Lifetime Achievement in Transportation.

## PERSONAL HISTORY 1956

### A Sense of Awe and Wonder

**M**y first Annual Meeting in 1956 was the biggest meeting I had yet attended. It produced a sense of awe and wonder at the variety of presentations. I was seeing and hearing in person many respected professional leaders addressing a cascade of issues related to the building of the just-authorized, gigantic Interstate Highway System. I was a student, bused to the meeting with my entire class at Yale University’s Bureau of Highway Traffic—the Annual Meeting was part of the curriculum. One of the enduring virtues of the Annual Meeting has been to introduce career-minded students to the array of opportunities within the fields of transportation.

—Thomas B. Deen



PHOTO COURTESY THOMAS B. DEEN

Thomas B. Deen directed the Nashville Metropolitan Area Transportation Study in 1958.

## Meeting Sites

Growth therefore was inevitable and from time to time has required moving the Annual Meeting and using multiple locations to accommodate the presentations, committee meetings, and displays that deliver the valued content.

From 1924 through 1955, the Annual Meeting was held at the brand new National Academy of Sciences (NAS) building, which opened in 1924 on Constitution Avenue, NW. Within a few years, however, the burgeoning sessions required the use of

## PERSONAL HISTORY 1964

### A Gold Mine of Research Materials

**M**y introduction to the Annual Meeting came in 1964 via the treasure trove of papers that returning attendees brought back from something called the HRB. I was a college student working on travel surveys for the Tri-State Commission, an enormous planning project for the New York City region. One Monday morning I arrived at work and found that the entire senior staff had disappeared—they had gone to Washington for HRB. When they returned later that week, they brought along a gold mine of research materials.

—Alan E. Pisarski



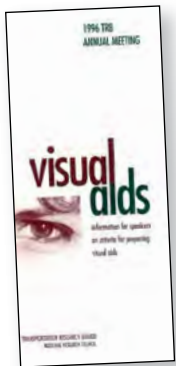
PHOTO COURTESY ALAN E. PISARSKI

Alan E. Pisarski (seated right) and his home interview survey staff at the New York Metro Area Tri-State Transportation Commission in 1964.





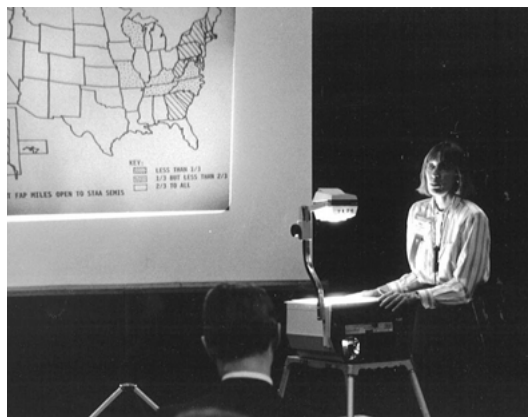
TRB staff members check slides at the 1988 Annual Meeting. Strict standards were set to improve the quality of visual aids and were outlined in brochures for meeting attendees.



other buildings in the vicinity, including the buildings owned by the Red Cross, the Bureau of Public Roads, and the Department of the Navy. The program for the 1955 meeting showed that accommodating the many sessions and the 1,520 registrants required space from the State Department, the Department of the Interior, the Red Cross, and the General Services Administration, in addition to the NAS headquarters.

Washington, D.C., has been the site for all of the Annual Meetings but the first in New York and then during World War II, when hotel space in the crowded capital was limited. The meeting moved to Baltimore, Maryland, in 1941; St. Louis, Missouri, in 1942; Chicago, Illinois, in 1943; and Oklahoma City, Oklahoma, in 1945. The 1944 meeting was planned for Cincinnati, Ohio, but was canceled at the request of the Office of Defense Transportation because of the war's demands on the national transportation system—the one gap in the succession of 94 transportation conclaves, ironically, was the result of a shortage of transportation.

In 1956, the meeting moved to the Sheraton Park Hotel, off Connecticut Avenue, NW, near Rock Creek Park; the venue offered plenty of sleeping rooms for out-of-town attendees and a large number of meeting rooms. Attendance reached 1,700.



The overhead projector supplanted slide projectors as an aid to presenting papers; today, presenters use PowerPoint and upload their visual media to a shared database.

## Setting Standards

The growing program, however, received criticism for the poor quality of the slides used by presenters. Attendees at the back of some of the larger rooms could not see the technical details projected. To remedy the problem, TRB developed strict standards that required presenters to submit slides for review beforehand. Although the quality of the slides improved, controversies arose, especially when an eager speaker who missed the deadline for slide submission and who had traveled a long distance to make a presentation discovered that the slides could not be used.

On one occasion, a speaker in a standing-room-only session in the Blue Room of the Shoreham received a waiver and began the presentation by explaining that the slides had not been reviewed and that some might be unreadable. The audience booed. The slide review policy remained in effect for more than a decade, with supporters outnumbering detractors, but eventually the process proved too time consuming and was discontinued.

## Disseminating Papers

From the 1970s into the 1990s, authors whose papers were approved for publication through the peer-review process were required to submit 100 copies for distribution at the Annual Meeting. A large room was reserved with long tables to display the hundreds of stacks of papers. “Early birds” who arrived when the doors opened would patrol the rows of tables and pick up copies of the papers of interest. Registrants could choose four free papers and could purchase additional papers for a modest fee. Papers with a wide audience disappeared quickly, to the disappointment of those who arrived later.

But technology eliminated need for the prepublication papers, the big room, and the long rows of tables. In the early 1990s, all papers were digitized and distributed on CD-ROMs, so that all registrants could receive all the papers. More recently, the papers have been made available on computer memory sticks or flash drives and online.

Changes in the media of communication employed by participants provide one way to trace the history of TRB Annual Meeting. Media have progressed from typewritten and photocopied research papers to 35-mm slides; to overhead projectors and folders thick with transparencies; to the mixed blessings of PowerPoint. Not long ago, a speakers’ dais lined with three or more laptops dangling wires connected to powerstrips became a common sight; add today’s thumb drives and file uploads to a shared database.

## Adding Hotels

Although the move to the Sheraton Park Hotel in 1956 brought the meeting once again under one roof, within a few years, continuing growth required additional space in the neighboring Shoreham across Calvert Street and later in the Hilton Hotel on Connecticut Avenue.

In many ways, the architectural design made the Sheraton Park, with its long, elegant lobby, the perfect tool for human interaction. In only one or two trips up and down that capacious hall, a participant could meet everyone he or she wanted to see and could enjoy a dozen serendipitous meetings. A stroll along the connecting corridor between the Marriott and its Wardman Tower at any recent meeting could capture a similar ambience.

In the past few years, the TRB Annual Meeting has required a half-dozen or more additional hotels for overnight accommodations, with an extensive shuttle bus system between the various venues. In 2014, the meeting attracted more than 11,000 attendees to 750 workshops and sessions, featuring more than 3,300 presentations and scores of poster sessions, 500 committee meetings, more than 150 other meetings, and nearly 200 exhibitors. The five-day program offered more than 1,600 events.

## A Heterogeneous Mix

The TRB Annual Meeting is unique, a professional gathering of people from the government, commercial, academic, and independent sectors involved in all aspects and all modes of transportation, address-



ing policy, administration, finance, engineering, the environment, and the social sciences. This heterogeneous mix provides unparalleled opportunities to network in an atmosphere where information is king.

In an ever-shrinking world, the Annual Meeting has become a place for international networking, as well. More than 1,800 experts from 70 foreign countries attended the 2014 event.

In addition, other national transportation organizations piggyback some of their committee or other meetings immediately before or after the TRB Annual Meeting, with so many of their members in town. Scores of these associated group meetings convene each year.

From the 1970s to the early 1990s, attendees could browse and pick up copies of peer-reviewed papers that had been presented at the Annual Meeting.



With the development of the Compendium of Papers—first on a CD, then on a flash drive, then online—meeting attendees have access to all the papers presented.



Photo: Robson Photography

A unique, signature headliner session at the 2012 TRB Annual Meeting brought together six former U.S. transportation secretaries to discuss past challenges and future research opportunities.





Annual Meeting attendees can use a mobile application and online program as well as the traditional printed program to navigate the event.

**Scope and Complexity**

Conducting a meeting of such scope and complexity requires the dedicated and timely services of a highly trained and motivated staff, along with the help of hundreds of volunteers who peer-review the papers, organize and preside over the sessions, and ensure that the thousands of tasks related to the meeting are completed on time and within the limits of available funds.

The printed program—in recent years, a hefty 300-plus-page, 8-1/2-by-11-inch book—is gradually being augmented through an interactive web version and an app for mobile devices. Participants can

follow events via social media, including LinkedIn, Twitter, and Facebook. The meeting’s unique and signature headliner sessions—for example, one featuring six former U.S. Transportation Secretaries addressing current issues—provide ample opportunities and content for coverage in all media.

Tracing the roots of present-day technical standing committees also offers insights into the growth of the TRB Annual Meeting. As mature subjects identify new concerns in an increasingly specialized world, those new concerns quickly gather adherents and raise calls for new committees. The Data and Information Systems Section, for example, traces back to what was called the O-D, or origin–destination, committee, which addressed and discussed just about everything a young planner needed to know; that eventually spun off the Data Committee; and now 17 entities have proliferated to form the section.

**Promoting Synergies**

The scattering of this activity over several hotels, however, has restricted the spontaneous contacts between modes and interests that often is the foundation for innovation. The multiple venues also have experienced overcrowded sessions, congested corridors, slowly moving shuttle buses between hotels, restrictions on exhibit space, limits to growth, and complaints from registrants. Moreover, the Marriott is converting many of the rooms in the Wardman Tower, scene of countless TRB events for more than six decades, into permanent residential apartments. Something had to give.

Construction of the new Marriott Marquis Hotel will be completed by May 2014. In combination with the adjacent Walter E. Washington Convention Center, the new hotel offers considerably expanded facilities that will enable the TRB Annual Meeting once again to convene under one roof. The connected venues offer ample space for the hundreds of meeting events, as well as virtually unlimited exhibit space.

This new location will promote the synergies of intermodal contacts, reduced crowding, and increased exhibits. Although more than half of attendees commute to the meeting from their homes in greater Washington, D.C., or arrange accommodations on their own, TRB has contracted with the Marriott Marquis and other hotels in the vicinity for an adequate supply of guest rooms.

The original purpose of the TRB Annual Meeting continues: to facilitate the exchange of information through a variety of planned events, as well as informal contacts. The move of the meeting to a new venue in January 2015 once again will maximize this potential.



As the Annual Meeting has grown, so has the physical size—and shape—of the Final Program. In 1972, the printed program was 54 pages, at 5.5 × 8.5 in.; in 1982, in a 4 × 9 vest pocket format, 126 pages, bulking to 222 pages in 1992; by 2002, in an 8.5 × 11 format, it was 216 pages, and reached 360 pages in 2014.

## NEW TRB SPECIAL REPORT

# Framing Surface Transportation Research for the Nation's Future

JILL WILSON

*The author is Senior Program Officer, Transportation Research Board, and served as study director for this project.*

Despite major progress in U.S. transportation systems and services since the 1950s and 1960s, improvements are needed to ensure competitiveness in the global marketplace and to enhance quality of life. Research plays a major role in addressing the challenges facing U.S. surface transportation.

The Transportation Research Board's (TRB's) Special Report 313, *Framing Surface Transportation Research for the Nation's Future*, explores opportunities for improving the productivity of U.S. expenditures on surface transportation research by building on lessons learned from transportation research in other countries and from research in nontransportation sectors in the United States. According to the committee that produced the report (see box, page 35), the timely development of a new national research framework that engages the public, private, academic, and nonprofit sectors and draws on the nation's research capacity in academia, industry, and elsewhere is needed.

## U.S. Research Enterprise

Research has informed many major improvements and policy innovations in surface transportation in the United States: safer and more fuel-efficient automobiles, more durable and economical pavement designs, real-time tracking of cargo shipments, and a resurgence of freight rail after the deregulation of the railroad industry, to cite a few examples. The U.S. surface transportation research enterprise is characterized by a diversity of participants, activities, and funding sources and is highly decentralized, with most research programs initiated from the bottom up. As a result, much of current research aims at specific problems identified by sponsors and is relatively short term, applied, and focused on individual modes such as highway or rail.

Leaders within the transportation community have questioned whether the U.S. approach to surface transportation research will yield the kinds of innovations in transportation services and policies needed to support national goals for economic devel-

The National Renewable Energy Laboratory debuts an energy-efficient parking garage, with charging stations for electric vehicles. Research in fuel efficiency for vehicles and infrastructure could benefit from a nationally coordinated framework, according to a TRB policy study.



PHOTO: DENNIS SCHROEDER, NREL





PHOTO: SOUSEF, FLICKR

A goods train carries a variety of containers through the Rocky Mountains in the western United States. Research has assisted the boom in rail freight since industry deregulation in 1980; a cohesive national framework could strengthen links to societal goals.

opment, safety, mobility, competitiveness, and sustainability in the 21st century.

The current research enterprise frequently lacks clear links to national goals. The tendency is to focus on solving narrowly defined problems at the expense of basic and advanced research that could form the basis for exploring broader crosscutting issues and for developing innovative solutions to long-term challenges. Moreover, because research activities remain largely uncoordinated and fragmented, the integrative systems-level research needed to support national goals receives insufficient attention.

The policies of competitors in Europe and Asia emphasize transportation research as a vital means of achieving economic, societal, and environmental goals. Many European and Asian nations have established effective frameworks for prioritizing, funding, assembling, and coordinating research activities.

## Scope of the Study

In 2008, U.S. transportation research experts undertook a scanning tour of European and Asian countries. The experience highlighted the potential of alternative frameworks for improving the effectiveness of transportation research in the United States.

Subsequently, the state departments of transportation (DOTs) asked TRB, through the National Cooperative Highway Research Program, to convene an expert committee for a follow-on assignment: to describe and evaluate potential frameworks and institutional models for surface transportation research in the United States, drawing on experience in the transportation sector internationally and in nontransportation sectors domestically.

To keep the task within the allocated resources, the committee focused on highways, rail, and public transportation and excluded pipelines, inland waterways, and coastal shipping, although these modes conventionally are included within surface transportation.

## Framework Advantages

Innovations in surface transportation are needed to support the economic growth of the United States, strengthen its global competitiveness, and enhance its inhabitants' quality of life. The United States, however, lacks a cohesive national framework to link surface transportation research activities to societal goals. Without a framework, U.S. surface transportation research tends to be organized by mode, funding source, federal government department, and other arbitrary groupings.



PHOTO: LAURA SANDY, PEDESTRIAN AND BICYCLE INFORMATION CENTER

Pedestrian traffic in London, United Kingdom. Development of sustainable urban mobility plans is one of the topics explored in the European Commission's transportation research frameworks.

A cohesive national framework would strengthen U.S. surface transportation research by establishing a holistic approach to problem solving and by building greater connectivity between researchers and research activities. To help create a framework, the committee considered the desirable attributes, devised a concept, and recommended the necessary steps to develop the concept.

## Recommended Steps

No “silver bullet” solution could rapidly transform the current fragmented and ad hoc national research framework for surface transportation into a more cohesive alternative. Instead, a series of steps over a period of years will be needed, both to engage a broad spectrum of interested groups and to implement strategies for making more effective use of the nation’s extensive research capabilities.

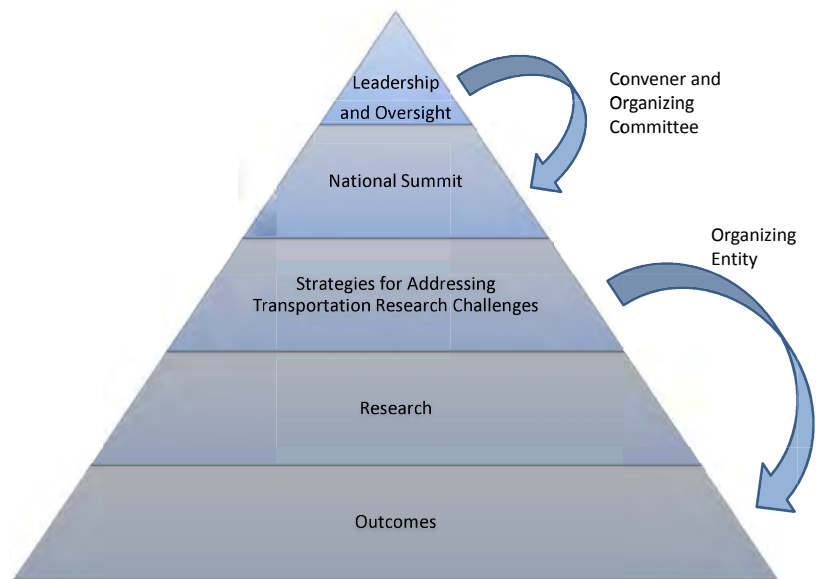
Taking the initial steps without delay is essential, because of the growing and changing demands on the nation’s transportation, the ever-increasing pressure on research budgets, the need to use research funds wisely, and the emphasis that many U.S. competitors have placed on transportation research. Figure 1 (at right) schematically illustrates the proposed steps to a new national research framework.

### Convening a Summit

The committee recommends launching an initiative to establish a new framework for U.S. surface transportation research without delay. A group of influential organizations led by the American Association of State Highway and Transportation Officials’ (AASHTO’s) Standing Committee on Research and composed of representatives from the public, private, academic, and nonprofit sectors should launch the initiative.

The leadership group would market the potential advantages of a cohesive research framework to a broad spectrum of public, private, academic, and nonprofit organizations; raise funding for a national surface transportation summit; and appoint a convener for the summit, which would use the framework concept to explore effective strategies for addressing major challenges in surface transportation research.

The summit would engage a broad range of interested parties, including representatives from entities outside the traditional transportation research community, such as the information technology and communications industries. The committee recommends that the summit convener issue a report to the leadership group on the outcomes of the summit. This report would address two important questions:



◆ Which group or organization should take the lead in furthering the framework initiative after the summit?

◆ How will the initiative be funded?

**FIGURE 1** Steps leading to a new national research framework.

### The Federal Role

The committee also recommends that the federal government take actions to support the transition to a new national research framework for surface transportation. These actions would help build a more productive federal research enterprise.

## Committee on National Research Frameworks: Application to Transportation

**Sue McNeil**, University of Delaware, Newark, *Chair*

**William L. Ball**, Merriweather Advisors, LLC, Grosse Pointe Farms, Michigan

**Irwin Feller**, Pennsylvania State University (emeritus), State College

**Robert E. Gallamore**, Gallamore Group, LLC, Rehoboth Beach, Delaware

**Genevieve Giuliano**, University of Southern California, Los Angeles

**David L. Huft**, South Dakota Department of Transportation, Pierre

**Dennis C. Judycki**, Federal Highway Administration (retired), Annandale, Virginia, and Red River, New Mexico

**Tschangho John Kim**, University of Illinois at Urbana–Champaign (emeritus), Fairfax, Virginia

**Laurie G. McGinnis**, University of Minnesota, Minneapolis

**Herbert H. Richardson**, Texas A&M Transportation Institute (emeritus), College Station

**Peter F. Sweatman**, University of Michigan, Ann Arbor

**Nigel H. M. Wilson**, Massachusetts Institute of Technology, Cambridge





Study committee member Genevieve Giuliano presents findings from Special Report 313 to the TRB Executive Committee, January 2014.

U.S. DOT has primary responsibility for the health of the nation's transportation system, but other federal departments, such as the Departments of Energy and Defense, also devote considerable resources to research related to surface transportation in support of their missions. To make better use of federal resources, the White House Office of Science and Technology Policy should create a task force to explore potential synergies and gains from greater coordination between the agencies.

To play a key role in the new national research framework, as appropriate to its mission, U.S. DOT will need to strengthen its research culture and capacity. In addition, the department should engage more fully with the research community; this would help it leverage the investments in technical and policy areas by other federal departments, as well as by the states, industry, and academia.

One option for the Secretary of Transportation to consider in furthering progress toward these objectives is to establish the position of chief scientist within the Office of the Secretary. This individual could serve as a science and technology adviser to the secretary and as U.S. DOT's champion for research.

Finally, federally funded research should more explicitly and intensively explore high-risk, high-payoff opportunities for quantum leaps in transportation performance. The committee recommends



TRB Special Report 313, *Framing Surface Transportation Research for the Nation's Future*, is available from the TRB online bookstore, [www.trb.org/bookstore](http://www.trb.org/bookstore); to view the book online, go to [www.trb.org/Publications/Blurbs/169932.aspx](http://www.trb.org/Publications/Blurbs/169932.aspx).

establishing a broad and robust program of basic and advanced research encompassing the many disciplines relevant to surface transportation.

### Supporting National Goals

Replacing the current fragmented assemblage of activities and funding with a more cohesive research framework is not without challenges. For example, no current organization or research group could effectively fill the multimodal leadership, stewardship, and funding roles for the framework.

By working together, however, surface transportation leaders and the research community have an opportunity to build a more productive research enterprise in support of national goals. The result will be a more cohesive and coordinated national research framework.



PHOTO: U.S. DEPARTMENT OF ENERGY

Participants in the 2013 Argonne Sustainability Teachers Workshop view research on energy efficiency at the U.S. Department of Energy's Argonne National Laboratory. The Department of Energy devotes considerable resources to research related to surface transportation.



IMAGES: UTAH DOT FOR NCHRP PROJECT 24-29

# Scour and Safe Bridges

## *Advancing the State of the Practice*

JEFFREY R. KEATON, PETER F. LAGASSE, AND LARRY A. ARNESON

Keaton is Principal Engineering Geologist, AMEC, Los Angeles, California. Lagasse is Senior Water Resources Engineer, Ayres Associates, Fort Collins, Colorado. Arneson recently retired as Senior Hydraulic Engineer, Federal Highway Administration, Lakewood, Colorado.

Scour is a process of erosion caused by the flow of water, air, or ice over susceptible earth materials. The effects of past glacial scour are visible in some locations, but glacial scour is not an important concern in day-to-day activities. Similarly, some soft geologic formations reveal features sculpted by flowing air, and sandstorms in parts of the southwestern United States and elsewhere can pit car windows and paint. Nevertheless, wind scour is not a concern, because most materials are not susceptible to erosion by the low forces of flowing air.

Flowing water, however, can have sufficient energy to cause substantial erosion and to move blocks of rock. Therefore, scour produced by rivers and streams flowing under highway bridges is of the greatest concern to society.

### Types of Water Scour

Flowing water causes three types of scour:

- ◆ **Degradation scour**, which occurs with the general lowering of stream channels;
- ◆ **Contraction scour**, which occurs when water moves faster through narrow reaches in stream channels, as at many bridge crossings; and
- ◆ **Local scour**, which occurs when water flows around obstructions in channels, generating complex flow patterns, increased flow velocities, and turbulence.

Sandy soil—particularly fine-grained sand—is most susceptible to scour, because flowing water can lift and transport the grains. Larger grain sizes, such as gravel and cobbles, require more energy to lift and transport, and smaller grain sizes, such as silt and

clay, can exhibit cohesion that can be less susceptible to erosion.

### Evaluating Scour

Hydraulic engineers evaluate scour at bridge sites by characterizing the flow of water in the channel upstream of the bridge, calculating the changes as the flow moves through the bridge opening, and estimating the flow properties in the channel downstream of the bridge. The evaluation estimates the scour prism—that is, the depth of scour under the bridge—and generally assumes that the channel is composed of sand.

The calculated depth of the scour hole in the sand adjacent to the bridge foundations determines whether the bridge is scour-stable or scour-critical. A multidisciplinary team of structural, hydraulic, and geotechnical engineers will confirm a scour-

(Above:) Composite photograph of the September 2003 flood flow in Montezuma Creek, San Juan County, Utah, which eroded the claystone and sandstone abutments of the SR-262 Bridge. Water flowed from left to right over a 6-foot-high (2-m-high) knick point to the left of the shadow of the bridge railing crossing the stream. The bridge has a 66-foot-long (20-m-long) span.



PHOTO: MARK ANDERSON, U.S. GEOLOGICAL SURVEY

In 2007, flash flooding near Hermosa, South Dakota, caused scouring of bridge abutments at Battle Creek.





PHOTO: U.S. ENVIRONMENTAL PROTECTION AGENCY

US-34 in Greeley, Colorado, was breached by South Platte River floodwaters in late 2013. Floods and other hydrology effects sometimes are related to climate change.

critical assessment—that is, that the scour hole is a threat to the stability of the bridge.

State department of transportation (DOT) personnel inspect bridges regularly. They review bridge plans and other engineering information before visiting a bridge site. The inspectors examine the channel upstream and downstream of the bridge to assess the general conditions and to identify any features of erosion or sediment deposition and any accumulations of tree branches or other debris.

The evaluation also notes construction or changes in development in the upstream drainage basin that can alter the hydrology from the conditions assumed in forecasting the stream flow. The effects of climate change increasingly are considered in terms of potential influence on hydrology and stream flow—for example, wildfire caused by drought in the drainage basin above a bridge can increase runoff and sediment yield in tributary channels to the stream that passes under the bridge.

Major floods can cause a bridge deck to become submerged, introducing an additional scour process that can erode the boundary at a pier site and increasing the net depth of the scour.



PHOTO: NCHRP Web-Only Document 175, EVALUATION OF BRIDGE SCOUR RESEARCH—PIER SCOUR PROCESSES AND PREDICTIONS

Certain characteristics of the stream channel and the bridge can influence scour response, including the locations of channel bends, the orientation of the bridge crossing, and the shape of the bridge piers. Inspectors examine the channel and the banks adjacent to and under the bridge for scour holes and other evidence of scour. Scour holes can form rapidly in sandy soil during flood flows, but these often are refilled with the same type of sandy soil when the flood flows dissipate; this makes detection of the scour features more challenging.

### Scour Countermeasures

Countermeasures to reduce and manage the impacts of stream instability and scour on bridges include hydraulic, structural, and biotechnical features:

- ◆ The hydraulic approach focuses on controlling the water that flows past a bridge;
- ◆ The structural approach focuses on strengthening the bridge or on armoring the stream channel or banks; and
- ◆ The biotechnical approach focuses on stabilizing stream banks through the erosion resistance of vegetation.

Monitoring scour development from flood to flood is a method of scour management used for bridges with certain characteristics. The Federal Highway Administration's (FHWA's) Hydraulic Engineering Circular (HEC) 23, *Bridge Scour and Stream Instability Countermeasures: Experience, Selection, and Design Guidance* describes this approach.<sup>1</sup> The FHWA website offers technical resources for evaluating and dealing with scour,<sup>2</sup> and the Transportation Research Board (TRB) website has several resources posted.<sup>3</sup>

### Oversight of Bridges

FHWA maintains the National Bridge Inspection Standards (NBIS) and oversees other regulatory policies and programs for the nation's bridges. Recent high-profile bridge failures, however, led the U.S. Congress to take a closer look at the safety, management, and oversight of bridges.

In a conference report, Congress recommended that FHWA “use a more risk-based, data-driven approach to its bridge oversight” to improve bridge safety.<sup>4</sup> Congress stated it would monitor FHWA's

<sup>1</sup> <https://www.fhwa.dot.gov/engineering/hydraulics/pubs/09111/>.

<sup>2</sup> [www.fhwa.dot.gov/engineering/](http://www.fhwa.dot.gov/engineering/).

<sup>3</sup> [www.trb.org/Main/Search2.aspx?q=scour](http://www.trb.org/Main/Search2.aspx?q=scour).

<sup>4</sup> House Report 111-366: Departments of Transportation and Housing and Urban Development and Related Agencies Appropriations Act, 2010.



Researchers with Wayne State University and Lawrence Technological University collect field-scale pier scour data for Michigan DOT. State DOT personnel and affiliated researchers inspect bridges regularly for scour.

progress in identifying new approaches to bridge oversight, in completing the initiatives, and in achieving results. Congress directed FHWA to apply funds to focus on and perform these activities.

FHWA undertook a combination of activities that contribute to four primary outcomes:

- ◆ More rigorous oversight of bridge safety,
- ◆ Full compliance with the NBIS by all states,
- ◆ Improved information for safety oversight and condition monitoring, and
- ◆ Personnel qualified and equipped for bridge inspection.

Because hydraulic issues remain a leading cause of bridge failures, FHWA included efforts in conjunction with each of these activities to collect, understand, and deploy recent and robust guidance and techniques for accepted hydraulic and waterway-related practice.

## Developing Resources

FHWA significantly revised HEC 18, *Evaluating Scour at Bridges*,<sup>5</sup> and HEC 20, *Stream Stability at Highway Structures*,<sup>6</sup> last updated in 2001, and released the revisions in 2012. At the same time, FHWA's National Highway Institute (NHI) revised the training course on Stream Stability and Scour at Highway Bridges (Course 135046) to reflect changes in the two hydraulic engineering circulars.

Over the past 10 years, research activities spon-

<sup>5</sup> [www.fhwa.dot.gov/engineering/hydraulics/pubs/hif12003.pdf](http://www.fhwa.dot.gov/engineering/hydraulics/pubs/hif12003.pdf).

<sup>6</sup> [www.fhwa.dot.gov/engineering/hydraulics/pubs/hif12004.pdf](http://www.fhwa.dot.gov/engineering/hydraulics/pubs/hif12004.pdf).

sored under TRB's National Cooperative Highway Research Program (NCHRP) have advanced the state of practice in bridge scour and stream stability analyses. These contributions to bridge scour technology also have been incorporated into the 2012 revisions to HEC 18 and 20.

## Scour-Caused Bridge Failures

On March 10, 1995, at about 9 p.m., the southbound and northbound bridges on Interstate 5 over Arroyo Pasajero in California collapsed during a large flood. Four vehicles plunged into the river, and seven people were killed. Built in 1967, each bridge was approximately 122 feet long and consisted of four concrete-slab spans supported by cast-in-place pile bents.

California DOT, in cooperation with FHWA and the U.S. Geological Survey, investigated the conditions that led up to the collapse. Findings indicated that the stream channel had degraded and, during the flood event, a combination of contraction scour and local pier scour undermined the stability of the structures. Stream channel changes in the vicinity of the bridges also had played a role in the failure.

This tragedy is only one example of bridge failures that have highlighted the national problem of scour. Stream instability, long-term stream aggradation or degradation, contraction scour, local scour, and lateral channel migration or erosion cause 60 percent of all U.S. highway bridge failures. In addition to the human toll, the failures cost millions of dollars in direct expenditures for replacement and restoration, as well as in substantial indirect costs from the disruption of transportation facilities.



Scour hole after the failure of the I-90 Bridge over Schoharie Creek, New York, April 5, 1987. The water flow was from right to left; cobbles and boulders on the creek bed provided an armoring layer that protected the underlying hard glacial till from erosion by flood flows at less than 20,000 cubic feet per second (566 cubic meters per second). Photo is from the forensic report prepared by Resource Consultants and Colorado State University in 1987 for the National Transportation Safety Board and the New York State Thruway Authority. (See also [www.fhwa.dot.gov/engineering/hydraulics/pubs/09111/page05.cfm#figure517](http://www.fhwa.dot.gov/engineering/hydraulics/pubs/09111/page05.cfm#figure517).)



Another example of national importance occurred in April 1987 during a near-record flood; the catastrophic failure of the Schoharie Creek Bridge on the New York State Thruway (Interstate 90) claimed 10 lives. The National Transportation Safety Board (NTSB) determined that the probable cause was severe scour in the glacial till beneath the spread footings of the 35-year-old bridge.

The scour hole that caused the failure of the Schoharie Creek bridge is shown in the photograph above. The cumulative effect of local pier scour, particularly in the previous 10 years, was considered the most significant hydraulic factor contributing to the failure, not the 1987 flood.

In response to the findings, FHWA issued a mandate to perform scour evaluations of all bridges over water. A summary released by FHWA nearly 10 years ago stated that the mandated evaluations by state DOTs had identified 26,471 of the 484,546 U.S. highway bridges over waterways as scour-critical.

### Establishing Guidance

After the Schoharie Creek Bridge failure, FHWA established a national scour-evaluation program as an integral part of the National Bridge Inspection Program and developed the first editions of HEC 18 and HEC 20. In the past 20 years, the two documents, enhanced with updates, have established FHWA's recommended guidance for analyzing bridge scour and stream stability problems.

NHI's training course (NHI 135046) debuted in 1990 and has been presented more than 200 times to

state DOTs and other bridge owners. The course has served as an important source of technology transfer on bridge scour and stream instability problems.

The 1989 revision and subsequent updates of the NBIS require procedures for underwater inspection. Each of the approximately 500,000 U.S. bridges over water must be inspected every two years—although longer intervals can be approved when justified. At least every five years, qualified divers must inspect the underwater structural members of bridges that state DOT personnel cannot evaluate visually for integrity and the effects of scour.

A technical advisory issued in 1991 covers procedures for evaluating bridge scour. Every bridge over a waterway, whether in service or in design, must be evaluated for scour to determine prudent protection measures. An interdisciplinary team conducts the evaluations, which include hydraulic studies and scour evaluation according to procedures in HEC 18 and HEC 20.

### Advancing the State of Practice

Since 2001, NCHRP and FHWA have sponsored research projects to improve the state of practice in bridge scour and stream stability technology and to provide bridge owners with definitive guidance about design. The 22 projects listed in Table 1 (page 41) represent advances in this technology; the listed projects were completed between 2001 and 2013; the list is not comprehensive.

The common objectives of NCHRP Projects 24-27(01), 24-27(02), and 24-27(03) were to

TABLE 1 NCHRP and FHWA Bridge Scour Projects

Project Number	Project Title*	Completed
<b>NCHRP</b>		
24-07(02)	Countermeasures to Protect Bridge Piers from Scour	2006
24-14	Scour at Contracted Bridge Sites	2004
24-15	Complex Pier Scour and Contraction Scour in Cohesive Soils	2002
24-15(02)	Abutment Scour in Cohesive Soils	2008
24-16	Methodology for Predicting Channel Migration	2003
24-18	Countermeasures to Protect Bridge Abutments from Scour	2003
24-20	Prediction of Scour at Bridge Abutments	2006
24-24	Criteria for Selecting Numeric Hydraulic Modeling Software	2007
24-25	Guidelines for Risk-Based Management of Bridges with Unknown Foundations	2006
24-26	Effects of Debris on Bridge-Pier Scour	2007
24-27(01)	Evaluation of Bridge Scour Research: Pier Scour Processes and Predictions	2011
24-27(02)	Evaluation of Bridge Scour Research: Abutment and Contraction Scour Processes and Predictions	2011
24-27(03)	Evaluation of Bridge Scour Research: Geomorphic Processes and Predictions	2011
24-29	Scour at Bridge Foundations on Rock	2011
24-32	Scour at Wide Piers and Long Skewed Piers	2011
24-33	Development of Design Methods for In-Stream Flow Control Structures	In progress
24-34	Risk-Based Approach for Bridge Scour Prediction	In progress
<b>FHWA</b>		
RD-02-078	Bottomless Culvert Scour Study, Phase I	2003
HRT-05-072	Assessing Stream Channel Stability at Bridges in Physiographic Regions	2006
HRT-07-026	Bottomless Culvert Scour Study, Phase II	2007
HRT-12-034	Submerged-Flow Bridge Scour Under Clear-Water Conditions	2012
HRT-12-022	Pier Scour in Clear-Water Conditions with Nonuniform Bed Materials	2012

\*For detailed information, go to [www.trb.org/CRP/NCHRP/NCHRPProjects.asp?AreaID=24](http://www.trb.org/CRP/NCHRP/NCHRPProjects.asp?AreaID=24) and [www.fhwa.dot.gov/bridge](http://www.fhwa.dot.gov/bridge).

◆ Evaluate critically the bridge-scour research completed since the early 1990s and

◆ Recommend the adoption of specific research results by AASHTO, which was developing new editions of two key highway hydraulic engineering guidance documents: *Policy for Design of Highway Drainage Facilities* and *Recommended Procedures for Design of Highway Drainage Facilities*.

The most recent revisions to FHWA's HEC 18 and HEC 20 have drawn on the results from the NCHRP Project 24-27 series.<sup>7</sup> In June 2008, NCHRP sponsored a joint workshop to evaluate present knowledge and future needs on abutment scour.<sup>8</sup> Panelists and principal investigators from NCHRP Projects

24-15, 24-20, and 24-27 attended this workshop, which produced recommendations for technical and editorial improvements, primarily to HEC 18, although several recommendations applied to HEC 20, as well.

In September 2010, FHWA and NHI initiated an update of Course 135046, Stream Stability and Scour at Highway Bridges. Extensive revisions were made to the supporting reference manuals for the course, which include HEC 18 and HEC 20, to incorporate the results of the NCHRP and FHWA projects listed in Table 1. The revisions to these manuals included other significant advances in scour technology available in the national and international literature.

FHWA has developed additional guidance and a standard template for bridge owners on preparing plans of action (POAs) for scour-critical bridges. Both HEC 18 and NHI Course 135046 reference and incorporate information from this new guidance. FHWA also has developed guidance on how to treat the scour susceptibility of bridges with unknown

<sup>7</sup> See NCHRP Research Results Digest 378, *Evaluation of Bridge Scour Research*, May 2012, [www.trb.org/Publications/Blurbs/167759.aspx](http://www.trb.org/Publications/Blurbs/167759.aspx).

<sup>8</sup> See NCHRP Research Results Digest 334, *Joint Workshop on Abutment Scour: Present Knowledge and Future Needs: June 2008*, [www.trb.org/Publications/Blurbs/160851.aspx](http://www.trb.org/Publications/Blurbs/160851.aspx).



Riprap installed by Washington State DOT to prevent scour along Tokul Creek. Research continues on bridge scour, scour countermeasures, and stream stability.



PHOTO: WASHINGTON STATE DOT

foundations. Again, this new guidance has been made part of HEC 18 and NHI Course 135046.

### Expanding Evaluations

The current revised and updated edition of HEC-18, *Evaluating Scour at Bridges*, includes the following:

- ◆ Expanded discussion of the policy and regulatory bases for the FHWA scour program, including risk-based approaches for evaluations, developing POAs for scour-critical bridges, and understanding design philosophies and technical approaches;
- ◆ Expanded discussion of countermeasure design philosophy for new and in-service bridges;
- ◆ New chapter on soils, rock, and geotechnical considerations related to scour;
- ◆ New sections on contraction scour in cohesive materials, on pier scour in cohesive materials, and on pier scour in erodible rock;
  - ◆ Updated section on abutment scour;
  - ◆ Alternative approaches to abutment design;
  - ◆ Alternative procedures for estimating pier scour;
- ◆ New guidance on pier scour with debris loading and on scour at wide and skewed piers;
- ◆ New approach to pier scour with coarse material;



Debris accumulation at a bridge pier diverts flow, enhances contraction, and causes turbulence that contributes to scour of channels and abutments.

- ◆ Revised guidance for vertical contraction, or pressure-flow, scour;
- ◆ Guidance for predicting scour at bottomless culverts; and
- ◆ Revised discussion of scour at tidal bridges, incorporating information covered in HEC 25, *Tidal Hydrology, Hydraulics, and Scour at Bridges*.<sup>9</sup>

### Stream Stability

The revised and updated edition of HEC 20, *Stream Stability at Highway Structures*, now includes the following:

- ◆ A new section on predicting meander migration with historical aerial photography;
- ◆ Simplified record sheets for stream reconnaissance, with an updated methodology for rapid assessment of channel stability;
- ◆ Expanded discussion of the natural channel design approach applied by several state DOTs and resource agencies;
  - ◆ A simplified but expanded discussion of sediment transport concepts and equations;
  - ◆ A new chapter on channel stability concepts for gravel-bed rivers;
  - ◆ A new section on channel stability concepts in nonalluvial channels—that is, cohesive beds and banks;
  - ◆ Guidance for preparing stream stability evaluations in support of POA development; and
  - ◆ New sections on techniques for analyzing stream stability, managing the impacts of roadways on stream ecosystems, and applying geomorphic concepts.

### Solving the Problem of Scour

Transportation professionals have made considerable advances in solving the problem of scour. Research continues on bridge scour, stream stability, and scour countermeasures.

Although state DOTs realize the importance of anticipating the effects of climate change, procedures are needed for selecting appropriate ranges of input parameters to reflect climate change. The impacts of climate change on debris production and on runoff characteristics also require systematic consideration.

Society's general endorsement of sustainability and the genuine need for sustainable infrastructure underscore the importance of scour-safe bridges. Potential advances in scour countermeasures through applied bioengineering and use of recycled materials make future opportunities for scour management particularly exciting, as well as challenging.

<sup>9</sup> [www.fhwa.dot.gov/engineering/hydraulics/hydrology/hec25.pdf](http://www.fhwa.dot.gov/engineering/hydraulics/hydrology/hec25.pdf).



# Evaluating Bridges with Unknown Foundations for Vulnerability to Scour

## *North Carolina Applies Risk-Based Guidelines*

MOHAMMED A. MULLA

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For approximately 10 percent of the estimated 600,000 bridges that span waterways in the United States, the “as built” information—that is, the details of the final structure—is not available or is missing. The National Bridge Inventory (NBI) of the Federal Highway Administration (FHWA) classifies these as bridges with unknown foundations.

### Problem

Scour is the removal of material such as sand and rock around a bridge foundation—the abutment and piers—by flowing water. Scour affects the stability of the foundations of bridges over water and contributes to an estimated 60 percent of all U.S. bridge failures. Bridge failures cause loss of property—sometimes loss of lives—and disrupt traffic. Determining the vulnerability of a bridge’s foundation to scour, therefore, is important.

Ideally, a bridge should have a construction plan and an as-built plan containing information on the

type, depth, geometry, and materials incorporated in the foundation. This information is necessary to determine a bridge’s vulnerability to scour. Bridges with unknown foundations, however, lack this information. Approximately 6,000 bridges in North Carolina have unknown foundations.

In 2001, FHWA encouraged each state and all bridge owners to develop a plan of action to evaluate bridges with unknown foundations for vulnerability to scour, to ensure the safety of the traveling public and to prevent traffic disruptions.

### Solution

In 2004, the North Carolina Department of Transportation (DOT) established a plan of action for bridges with unknown foundations. The Scour Committee, which consists of the Geotechnical Engineering, Hydraulic, Structure, and Bridge Management Units and the local FHWA bridge engineer, would oversee the evaluations of the bridges; \$1 million was allocated every two years for evaluations by

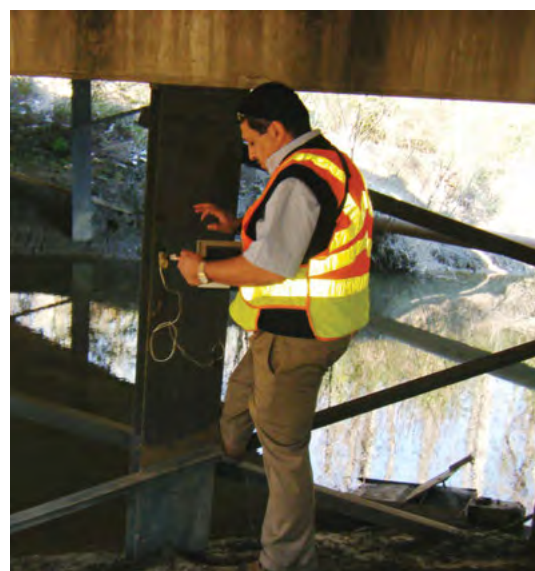


PHOTO: NORTH CAROLINA DOT

(a)

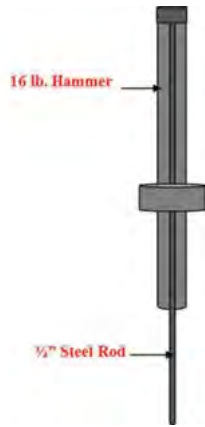


PHOTO: NORTH CAROLINA DOT

(b)

Pile integrity testing on (a) HP12x53 steel and (b) 12-in. timber.





**FIGURE 1** Schematic sketch of a half-inch sounding rod.

private firms in conjunction with the North Carolina DOT Geotechnical Engineering Unit.

The type of foundation and the lengths of the pile embedments would be determined through an in-house record search or through nondestructive testing (NDT). North Carolina DOT used NDT and half-inch steel rod soundings for field verification in evaluating bridges with unknown foundations for vulnerability to scour. The Scour Committee made the final evaluation of the 6,000 bridges.

**Pile Integrity Testing**

North Carolina DOT performed pile integrity testing (PIT) according to the ASTM D-5882 procedure, Low-Strain Integrity Testing of Piles (see photos, page 43). PIT length predictions for concrete, steel, and timber piles can only be considered approximations that must be verified, when possible, by other means, such as half-inch rod soundings.

The half-inch rod soundings procedure requires dropping a 16-lb weight from a vertical height of 24 inches to strike a rod 5 feet long and one-half inch in diameter (see photo below and Figure 1, above left). The rod is driven into the ground until penetration ceases, indicating the minimum tip elevation for the piles.

The verification method works well for PIT but is labor intensive and time consuming. From 2004 to

2011, North Carolina DOT evaluated 1,398 bridges at a total cost of \$2.7 million, but 4,602 bridges with unknown foundations still required evaluation. North Carolina DOT realized that completing the evaluation of all the bridges with unknown foundations would be difficult within the allotted time and the allocated budget.

**Risk-Based Method**

A quicker, less expensive, but reliable method was needed to accomplish the task, and North Carolina DOT found the answer in the *Risk-Based Management Guidelines for Scour at Bridges with Unknown Foundations* (1), produced under National Cooperative Highway Research Program (NCHRP) Project 24-25. The method involves quantifying the probability of failure. The project studied both the occurrence of hazardous events and a bridge’s susceptibility to these occurrences (2).

In 2009, FHWA issued a memorandum, “Additional Guidance for Assessment of Bridges over Waterways with Unknown Foundations,” recommending the process developed under NCHRP Project 24-25. In 2010, North Carolina DOT applied the technical guidance in the FHWA memorandum and tested the risk-based management guidelines, evaluating 100 bridges with an average daily traffic of 500 or fewer vehicles. The results were acceptable.



PHOTO: NORTH CAROLINA DOT

### Selection Criteria

The pilot effort yielded selection criteria for the bridges to be evaluated under the NCHRP procedure—the bridges should

- ◆ Be small, low impact, and low risk;
- ◆ Have a low average daily traffic of 500 or fewer vehicles;
- ◆ Be located on a secondary road; and
- ◆ Have a detour available if a failure occurs.

To evaluate these bridges, the Scour Committee used the bridge survey reports generated by the Bridge Management Unit, with reference to the North Carolina DOT bridge tier categories: statewide, regional, and subregional.

### Application

In 2010, the Geotechnical Engineering Unit selected 3,752 bridges from the 4,602 still to be evaluated, using the bridge inventory reports. The NCHRP risk-based management guidelines were used to evaluate the bridges with unknown foundations for vulnerability to scour.

Most of the data required for the NCHRP procedure were available in electronic format; as a result, the data for a few hundred bridges could be processed at the same time. Evaluation of these bridges was completed in approximately three months.

The remaining 850 bridges were in mountainous areas; most had timber piles encased in concrete over rock and had to be field-inspected by North Carolina DOT staff; these bridges therefore were removed from the list. The evaluation of all the bridges with unknown foundations was completed in 2012. The total cost of evaluating the 3,752 bridges under the NCHRP risk-based approach was \$21,000, or \$5.60 per bridge.

### Benefits

FHWA accepted the management plan that North Carolina DOT developed for evaluating the scour vulnerability of bridges with unknown foundations. The 3,752 bridges that the NBI shows as having unknown foundations now have plans of action for assessment.

The average cost to North Carolina DOT for evaluating a bridge with the conventional method was \$1,900. Evaluating the 3,752 bridges under the conventional method would have cost more than \$7 million total. As noted, the NCHRP risk-based approach to evaluate the 3,752 bridges cost North Carolina DOT \$21,000—achieving nearly \$7 million in savings or benefits.

## Steps in Risk Management of Scour Failure

In the first phase of NCHRP Project 24-25, Guidelines for Risk-Based Management of Bridges with Unknown Foundations, researchers surveyed a variety of specialists, including engineers, economists, and state transportation officials, and analyzed their expert opinions. The analysis indicated that risk-based methods provide the most inexpensive and flexible approach to selecting a management plan.

The study proposed the following steps:

- ◆ Set the priority for a bridge according to its intended function. High-priority bridges should receive an aggressive management plan.
- ◆ Set minimum performance levels for each bridge category.
- ◆ Compare the estimated risk of bridge failure with the cost of automated monitoring and the installation of countermeasures, to determine if these actions are needed.

Researchers applied this basic approach to the assessment of scour failure, using the scour vulnerability assumptions described in the FHWA Report, *HYRISK Methodology and Users Guide (2)*. The HYRISK estimate of scour vulnerability had a strong correlation with the known scour vulnerability of nearly 300,000 bridges with known foundations.

The maximum number of bridges that North Carolina DOT could evaluate with the conventional method was 200 in a year; processing the 3,752 bridges would have taken more than 12 years. In contrast, the risk-based approach completed the evaluations in three months, a considerable savings in project time. In addition, the scour vulnerability evaluations have ensured the safety of the traveling public, with no traffic disruptions.

For more information, contact Mohammed Mulla, Assistant State Geotechnical Engineer, North Carolina Department of Transportation, 1020 Birch Drive, Raleigh, NC 27610; [mmulla@ncdot.gov](mailto:mmulla@ncdot.gov).

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2. Pearson, D., S. Stein, and J. S. Jones. *HYRISK Methodology and Users Guide*. Report FHWA-RD-02-XXX. Federal Highway Administration, Washington, D.C., 2002.

EDITOR'S NOTE: Appreciation is expressed to G. P. Jayaprakash, 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 (202-334-2952; [gjayaprakash@nas.edu](mailto:gjayaprakash@nas.edu)).



## Peter B. Mandle

*LeighFisher Inc.*

**P**eter B. Mandle draws on more than 30 years of experience in traffic engineering and transportation planning in leading the ground transportation and parking practice of LeighFisher, a global management consulting firm. He directs roadway, parking, and rental-car planning studies for airports in Dallas–Fort Worth and Houston, Texas; Denver, Colorado; Portland, Oregon; and San Francisco and San Jose, California. Mandle also manages the ground transportation and access components for a strategic plan for the Massachusetts Port Authority, which operates Boston Logan International Airport.

Mandle has watched the growth of research in airport ground transportation and parking and has contributed significantly to its development. “At the start of my career, there were no accepted methodologies, no definitions of roadway or curbside

an off-airport parking facility. This landmark case was reviewed in the first issue of the Airport Cooperative Research Program (ACRP) Legal Research Digest, published in 2008.

Mandle has worked on many ACRP and Transit Cooperative Research Program projects as principal investigator, investigating such topics as airport parking strategies and technologies, airport curbside and roadway operations, and public transportation access to airports. He guided the development of an airport access guide prepared for the Federal Aviation Administration and Federal Highway Administration. He serves on the ACRP Project Panel on Elimination of Baggage Recheck for Arriving International Passengers.

The issues raised in airport research resonate elsewhere in transportation practice, Mandle affirms. “Airports function much like a city, generating more vehicle trips than some downtown areas and having many of the same roadway congestion and parking availability challenges,” he observes. “They are important contributors to the economic development of a community, and their ground transportation and parking components frequently serve as a visitor’s first and last impression.” Because airports also are required to be self-sustaining, revenues from transportation activities are essential—parking comprises 40 percent of an airport’s nonairline revenues, for example.

“A transportation professional interested in airport ground transportation and the research in this field should have an appreciation for basic traffic engineering principles, the business and financial aspects of airport operations, and the regulatory environment,” Mandle notes. Airport management must rely on staff members to address roadway, transit, and parking challenges, many of which are immediate, controversial, or involve new technology, he adds; expertise in traffic engineering is vital and not always represented among airport personnel.

Mandle has been active in TRB since 1978, when he presented his first paper on airport parking at the TRB Annual Meeting. In 1985 he joined the Airport Capacity Study Committee and the Airport Terminals and Ground Access Committee, which he chaired from 2004 to 2010. In 2010, Mandle became Aviation Group chair and joined the Technical Activities Council.

A registered professional engineer in Connecticut, New Jersey, and New York, Mandle also is a life member of the Institute of Transportation Engineers and of the American Society of Civil Engineers. He is an active participant in the International Parking Institute, the Airport Ground Transportation Association, and the American Association of Airport Executives. Mandle has authored more than 20 papers on airport roadways, curbsides, and parking.



**“Airports are important contributors to the economic development of a community, and their ground transportation and parking components frequently serve as a visitor’s first and last impression.”**

levels of service, and few guidelines or defined best practices existed,” he observes. “Through the efforts of TRB members, and with the support of other organizations, these gaps have been rectified.” Initiatives such as car sharing and ride brokering at airports are emerging as areas of study, he adds.

Mandle received a bachelor’s degree in civil engineering from Clarkson University and a master’s degree, also in civil engineering, from the University of Connecticut. In his career he has worked with more than 40 airports estimating future demands for roadway and curbside plans, analyzing roadway operations, developing and evaluating programs to reduce congestion and improve operations, and directing the planning and conceptual design of new access and circulation roadways. He also has developed estimates of parking demands and alternative parking revenues and has planned surface and multilevel parking facilities. His studies for airport operators have led to improved control and management of commercial ground transportation operations.

In 2004, Mandle provided expert witness testimony on behalf of the Norfolk Airport Authority (NAA) in Virginia, which was challenged by an off-airport parking lot operator. The court determined that NAA did not violate the Commerce Clause, the Equal Protection Clause, or the First Amendment by imposing a fee on

## John C. Milton

### *Washington State Department of Transportation*

A leading expert in roadway safety and enterprise risk management, John C. Milton is Director of Enterprise Risk and Safety Management at the Washington State Department of Transportation (DOT). He guides risk evaluation, management, and measurement for Washington State DOT initiatives and programs; works to reduce risk across the agency; and deals with tort claims, enterprise risk, and highway safety analysis and management. He also serves as Washington State DOT's Highway Safety Executive Committee Chair. By advocating for well-designed and robust research methods geared toward practical application, Milton has been instrumental in advancing the use of scientific methods in safety analysis.

A professional engineer in the state of Washington, Milton has a bachelor's degree in civil engineering and a master's degree in

agement and control, safety and infrastructure research, contracts, and permits. He became an assistant state design engineer in 1998, leading safety research activities and the development of the guide *Understanding Flexibility in Transportation Design—Washington*. This practical and context-sensitive design guide set the stage for integrated and multimodal considerations throughout the project development process for Washington State DOT.

As chief engineer and then project director of the SR-520 Bridge Replacement and High-Occupancy Vehicle Program, Milton took a lead role in the multibillion project to design and construct a new, structurally sound floating bridge and to add pedestrian, bicycle, transit, and roadway improvements to a 7-mi section of freeway between Seattle and Bellevue. He led the development of a large-scale environmental impact statement; set policies and procedures for the project team; directed communication and outreach efforts; and coordinated with federal, local, transit, and resource agencies.

"Where would we be if transportation innovation had not occurred?" Milton muses. "Research brings us to a point where roads and vehicles can provide information to each other to make the roadway system safer and more efficient."

Milton also has contributed his expertise in

academic settings. He has taught subjects from performance measurement to analytical methods in transportation to tort law, and has guest-lectured on such topics as geometric design, enterprise risk management in transportation, and safety analysis.

In 1999, Milton was part of a group of academics and practitioners brought together to discuss the potential development of a *Highway Safety Manual* (HSM). As Chair of Content for the *Highway Safety Manual* Joint Subcommittee, he played a key role in shaping the format and content of the HSM. The joint subcommittee became the Task Force on the Development of the *Highway Safety Manual* in 2003. In 2009, Milton became chair of the task force; he helped shepherd it into full committee status as the Highway Safety Performance Committee.

He has served on many National Cooperative Highway Research Program (NCHRP) panels since 2002, including several on the development of the *Highway Safety Manual*. He currently serves as chair of the Highway Safety Performance Committee and of the NCHRP Project Panel on Development of a Comprehensive Approach for Serious Traffic Crash Injury Measurement and Reporting Systems. Milton is a member of the Safety Section, the Statistical Methods Committee, and the second Strategic Highway Research Program Technical Coordinating Committee for Safety Research.



**"Research brings us to a point where roads and vehicles can provide information to each other to make the roadway system safer and more efficient."**

engineering management from Saint Martin's College in Lacey, Washington; he also received a master's degree and Ph.D. in civil engineering from the University of Washington in Seattle.

"I am fortunate that my background has allowed me to view transportation from both an academic and a practical point of view," Milton notes. "Research forms the cornerstone for growth and change in transportation practice."

In his 25-year engineering career at Washington State DOT, Milton has worked in many different engineering specialties and across multiple modes. He joined the agency in 1989 as a freeway operations engineer and then designed and operated signal systems throughout the Washington State DOT Northwest Region. As safety and operations engineer, he managed the Corridor Safety Improvement Program; developed policy for traffic, design, planning, and programming activities; and led the creation of the Washington State DOT Safety Management System. As system planning engineer, he also conducted long-range planning activities for the \$28 billion highway system plan; as standards, plans, and policy engineer he oversaw activities related to Washington State DOT's *Highway Design Manual*, development of standard plans, and design matrices.

In 1996, Milton began working in right-of-way accommodations and safety management, directing staff in access man-



# TRB Annual Meeting Takes Center Stage in 2015

MARK R. NORMAN

The author is Director, Technical Activities, TRB.

For the first time in almost 60 years, the TRB Annual Meeting will be moving to a new venue. The TRB 94th Annual Meeting will be held at the Walter E. Washington Convention Center in Washington, D.C., January 11–15, 2015. This article, the second in a series on the move, provides a brief overview of expected changes. The first article appeared in the January–February 2014 issue of *TR News* and presented the reasons behind the change of venue.

## What Will Be Different?

The location—of course! The Convention Center is located between 7th and 9th Streets and N Street and Mount Vernon Place, NW, in downtown Washington, D.C. This is approximately 2.5 miles southeast of the former TRB Annual Meeting site on Connecticut Avenue. It is across from the Carnegie Library at Mount Vernon Square; the library will become the new site of the International Spy Museum in 2017.

The Convention Center is Metro accessible, served by the Yellow and Green lines at the Mount Vernon Square–7th Street–Convention Center stop. One mile north of the National Mall, the Convention Center offers easy access to the Smithsonian Museums, the Washington Monument, the Lincoln Memorial, and the U.S. Capitol.

The new Marriott Marquis Washington, D.C., hotel is directly across the street from the Convention Center, and the buildings are connected by a short under-

ground walkway. The Marquis, scheduled to open in May 2014, will be the primary venue for TRB committee meetings.<sup>1</sup> Workshops, sessions, exhibits, posters, and most of the large events will take place in the Convention Center. The larger rooms in both facilities should reduce the level of crowding and congestion for all events, and the state-of-the-art exhibit hall will allow for more, larger, and different types of exhibits.

The majority of hotels that will be included in the TRB room block will have Metro access or will be within walking distance to the Convention Center. For this reason, the TRB shuttle bus will be discontinued.

TRB will provide free wireless Internet (wi-fi) access to all attendees in public areas, meeting rooms, and sessions at the Convention Center and in the Marquis, as well as in the exhibit hall. Because of the wi-fi access and the availability of all papers on the Annual Meeting Online website, the flash drive containing this same information will be discontinued.

The new venue and surrounding area offer more food and beverage options than the former meeting location. Both facilities meet modern standards for sustainability and for accessibility according to the Americans with Disabilities Act of 1990.

## What Will Be the Same

The Annual Meeting program will continue its high standards of quality and content. The structure of the program and meeting schedule will not change significantly—at least during the new venue's first year. The theme for the TRB 94th Annual Meeting is “Corridors to the Future: Transportation and Technology.”

Costs to attendees will not be affected by the move. Annual Meeting registration fees will remain essentially unchanged, adjusted only for annual inflation. Most hotel guest rooms will be available at the federal government per diem rate. Meeting registration and hotel reservations will open in early September; attendees are advised to book through the official TRB housing bureau. Meeting exhibitors and attendees should be wary of contacts from unofficial brokers who may claim to have lower rates and better hotels; these may be scams.<sup>2</sup>

Opportunities for formal and informal networking

<sup>1</sup> <http://tinyurl.com/MarquisDC>.

<sup>2</sup> <http://supportassociations.com>.

The exhibit hall at the Convention Center can accommodate more—and larger—exhibits than previous TRB Annual Meeting venues.



will be plentiful. With the entire meeting in one contiguous venue, opportunities for collaboration across transportation modes and disciplines will be enhanced; TRB will take maximum advantage of the layouts and technologies of the new facilities to foster collaboration. Wi-fi availability will enable real-time, virtual networking to supplement face-to-face opportunities.

The 2015 TRB Annual Meeting will continue many of the traditions that have evolved over the years and will open opportunities to establish new traditions.

## Assessing the Effects of Changes in Truck Size and Weight Limits

The Committee for Review of U.S. Department of Transportation (DOT) Truck Size and Weight Study released its first report, *Review of Desk Scans*, in April. The report reviews five desk scans—preliminary products of the truck size and weight limit study conducted by U.S. DOT at the request of the U.S. Congress. The desk scans survey past research and methods for estimating the effects of changes in truck size and weight limits for bridges, pavements, truck and rail shares of freight traffic, safety, and enforcement of truck regulations.

The committee recommends that the U.S. DOT final report include two syntheses to help assess the



**ROLE OF INLAND WATERWAYS**—Craig Philip (second from left), Ingram Barge Company, takes part in a panel discussion exploring the challenges encountered by shippers and operators using the inland waterways system. The Committee on Reinvesting in Inland Waterways: What Policymakers Need to Know met March 7 at the National Academies Building in Washington, D.C., to study the investment needs of the aging inland waterways system.

consequences of different truck size and weight limits on safety, efficiency, infrastructure, and the environment. The first synthesis would apply alternative methods of estimating the effect of changes in truck characteristics and would assess future research needs, data collection, and evaluation. The second synthesis would compile quantitative results of past prospective and retrospective estimates of effects.

(continued on page 50)

## International Transportation Research Converges in India

G. P. JAYAPRAKASH

The Transportation Research Group of India (TRGI) provides a forum for students, academics, and practitioners from India and from around the world to exchange information and to access new ideas and challenging transportation problems. More than 200 transportation planners, engineers, academics, and students from 10 countries attended TRGI's second conference, December 12–15, 2013, in Agra, India. The conference was supported by TRB and other associates, sponsors, and grant institutions.<sup>1</sup>

The conference featured eight tutorials, eight keynote lectures, five workshops, and 35 sessions in which authors presented 125 papers. Subject areas included asphalt and concrete materials, pavement, safety, traffic operations, pedestrian flow modeling, operations research methods, intelligent transport sys-

tems, bus transit, transport policy and operations, traveler behavior, and nonmotorized transport.

The final day of the conference was devoted to a discussion of the future for countries such as India that have embarked on the large-scale expansion of transportation infrastructure to move people and goods safely and efficiently.<sup>2</sup>

Research presented at the conference covered nearly all aspects of transportation. Published papers comprise Volume 104 in the series *Procedia: Social and Behavioral Sciences*.<sup>3</sup> The third conference is scheduled for 2015.

<sup>1</sup> [www.trgindia.org/trg\\_conference\\_2013](http://www.trgindia.org/trg_conference_2013).

<sup>2</sup> For more information on conference sessions, tutorials, workshops, and keynote lectures, see [www.trgindia.org/trg\\_conference\\_2013/Doc/Tutorial%20schedule.pdf](http://www.trgindia.org/trg_conference_2013/Doc/Tutorial%20schedule.pdf) and [www.trgindia.org/trg\\_conference\\_2013/Doc/Detailed%20view%20%282nd%20CTRG%20Schedule%29.pdf](http://www.trgindia.org/trg_conference_2013/Doc/Detailed%20view%20%282nd%20CTRG%20Schedule%29.pdf).

<sup>3</sup> Proceedings are available at [www.sciencedirect.com/science/journal/18770428/104](http://www.sciencedirect.com/science/journal/18770428/104). All papers are open access and can be downloaded free of cost.



S. Gangopadhyay, director of the Central Road Research Institute of New Delhi, India, delivered a keynote lecture on the development of the Indian Highway Capacity Manual. The session was moderated by G. P. Jayaprakash.

The author is Senior Program Officer and Soils, Geology, and Foundations Engineer, TRB.



# TRB HIGHLIGHTS

## Truck Size and Weight Study

(continued from page 49)

David Harkey (left), University of North Carolina Highway Safety Research Center, provides expert testimony at a meeting of the Committee for Review of the U.S. Department of Transportation (DOT) Truck Size and Weight Study, December 5, 2013, at the Keck Center.



The committee's second report, examining the study's effectiveness addressing the issues identified by Congress, will be released later this year.

For more information and for the full text of the report, go to [www.trb.org/Main/Blurbs/170503.aspx](http://www.trb.org/Main/Blurbs/170503.aspx).

## SECOND STRATEGIC HIGHWAY RESEARCH PROGRAM NEWS

### Improving Incident Response Through Training

Three injurious crashes occur every minute in the United States, potentially summoning a total of nearly 39,000 incident responders into harm's way each day. Congestion from these incidents can generate secondary crashes that increase traveler delay, frustration, and risk of injury. The longer responders remain at the scene, the greater the risk they—and the traveling public—face.

The National Traffic Incident Management Responder Training, developed under SHRP 2, can be implemented to train responders to work together as a team, from the moment the first emergency call is made, to the correct deployment of response vehicles and equipment, to the creation of a safe work area using traffic control devices, to final scene clearance.

Approximately 33,000 incident responders have already received this training.

The program brings together police, firefighters, medical personnel, and incident responders from towing and recovery and departments of transportation to engage in interactive, hands-on incident resolution exercises. The experience of learning to coordinate response activities and optimize operations in the classroom is vital for effective response in the field and for a unified national incident management practice. The training program is endorsed by the International Association of Chiefs of Police, the International Association of Fire Chiefs, and the National Volunteer Fire Council.

For more information email [TIMTraining@dot.gov](mailto:TIMTraining@dot.gov).

## COOPERATIVE RESEARCH PROGRAMS NEWS



**DEVELOPING RESEARCH**—Michael Trentacoste (right), Federal Highway Administration, offers the federal perspective at a meeting of the American Association of State Highway and Transportation Officials' (AASHTO's) Standing Committee on Research (SCOR), March 25-26 at the National Academies' Keck Center in Washington, D.C. SCOR solicits problems from AASHTO committees and member departments of transportation and from the federal government to guide the work of the National Cooperative Highway Research Program.

# NEWS BRIEFS



PHOTO: DAN BURDEN, PEDESTRIAN AND BICYCLE INFORMATION CENTER

Bicycle racks line a footpath in San Luis Obispo, California. According to the California Household Travel Survey, the numbers of pedestrian and bicycle trips have doubled since 2000.

## Active Transportation on the Rise in California

The percentage of California residents biking, walking, or using public transportation for daily activities has more than doubled since 2000, according to the most recent California Household Travel Survey (CHTS). Automobile trips still are the most common, with approximately 75 percent of all trips taken as either a passenger or driver in a car, van, or truck; this share has decreased from 86 percent in 2000. Walking trips increased from 8.4 percent of all trips in 2000 to 16.6 percent in 2010 to 2012, public transportation trips increased from 2.2 percent to 4.4 percent, and bicycle trips increased from 0.8 percent to 1.5 percent.

The average person took 3.6 trips per day, according to CHTS. The average trip duration was approximately 18 minutes, with the average work trip lasting 21.3 minutes and the average school trip 14.6 minutes. The average route distance was 6.8 miles.

The largest single regional household travel survey in the country, CHTS compiled data from more than 42,500 households via interviews, mail surveys,

wearable and in-vehicle GPS units, onboard diagnostic sensors, and other data collection methods.

For more information, visit [www.dot.ca.gov/hq/tsip/otfa/tab/chts\\_travelsurvey.html](http://www.dot.ca.gov/hq/tsip/otfa/tab/chts_travelsurvey.html).

## Targeted Simulator Training Leads to Safety

Simulator training for truck drivers may lead to greater safety on the roads, according to research from the American Transportation Research Institute (ATRI). The report investigated the effectiveness of customized simulators to train truck drivers and to reduce specific unsafe driving behaviors that had been identified in previous research.

ATRI collected driver safety and training data from motor carriers for drivers trained on general and on ATRI-customized simulators. The safety performance differences between drivers were analyzed at 6 and 12 months after the training was completed.

According to the report, results at 6 months showed that drivers who had taken the simulator training had fewer incidents, but that the safety effects did not remain after 12 months. This may be due to driver turnover; according to researchers, frequent simulator training can mitigate these effects.

For more information on this report, visit <http://atri-online.org/2014/02/12/atri-research-examines-safety-impacts-of-driver-simulator-training>.



13 LINK SIMULATION &amp; TRAINING

TranSimVS truck driving simulator.

## INTERNATIONAL

### Footpath Features Valued by Pedestrians

A series of studies by the Swedish Transport Administration measured pedestrians' assessments of their walking environment. According to researchers, the survey respondents did not express a strong preference for separated pedestrian and bicycle paths or secluded footpaths. Study results showed walkers' preference for a footpath in general, instead of sharing a road with motor vehicles; respondents also

rated visibility as desirable.

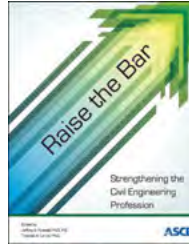
A study of a walk on a well-maintained, separated pedestrian and bicycle path with good visibility, far from a road, showed the lowest travel-time savings: 79 Swedish krona per hour (SEK/h). In another study, a walk to or from another travel mode along a road with a 50-km/h speed limit, showed the highest travel time savings—239 SEK/h.

To read the full report, visit [www.vti.se/en/publications/pdf/pedestrians-valuations-of-footpaths.pdf](http://www.vti.se/en/publications/pdf/pedestrians-valuations-of-footpaths.pdf).



**Raise the Bar: Strengthening the Civil Engineering Profession**

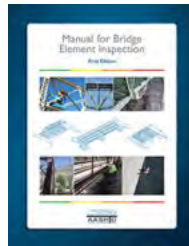
Edited by Thomas A. Lenox and Jeffrey S. Russell. American Society of Civil Engineers (ASCE), 2013; 272 pp.; ASCE members, \$45; nonmembers, \$60; 978-07-8441-317-3.



The papers in this volume survey the history and evaluate the effectiveness of ASCE's Raise the Bar initiative for adopting and implementing higher academic requirements for future professional engineers. Examined are broad areas of professionalism, the body of knowledge, curricula and experiential development, accreditation, and licensing.

**Manual for Bridge Element Inspection, 1st Edition**

American Association of State Highway and Transportation Officials (AASHTO), 2013; 252 pp.; AASHTO members, \$160; nonmembers, \$192; 1-56051-591-3.



This manual captures the condition of bridges in

a simple and effective way that can be standardized nationwide and adapted to both large and small agencies. It provides a reference for standardized element definitions, element quantity calculations, condition state definitions, element feasible actions, and inspection conventions.

**Driver Adaptation to Information and Assistance Systems**

Alan Stevens, Corinne Brusque, and Joseph Krems. Stylus Publishing, 2013; 382 pp.; \$120; 978-1-84919-639-0.



This volume offers readers a better understanding of drivers' adaptation processes after using information and assistance systems, perspectives to distinguish the effects of technology use on driver behavior, an appreciation of the impact of age on technology use and skill acquisition, and research on the effects of system performance and the level of automation on driver adaptation.

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

**TRB PUBLICATIONS**

**Traffic Enforcement Strategies for Work Zones**  
NCHRP Report 746

This report presents guidance for the safe and effective deployment of traffic enforcement strategies in work zones on high-speed highways, addressing the planning, design, and operation of traffic enforcement strategies, as well as administrative issues.

2013; 34 pp.; TRB affiliates, \$33; nonaffiliates, \$44. Subscriber categories: construction; maintenance and preservation; operations and traffic.

**Guidelines for the Use of Mobile LIDAR in Transportation Applications**  
NCHRP Report 748

Offered are guidelines for the application of mobile 3-D lidar technology to the operations of state departments of transportation (DOTs). Mobile lidar uses laser scanning equipment mounted on vehicles, global positioning systems, and inertial measurement units to capture large data sets of roadway areas.

2013; 195 pp.; TRB affiliates, \$54.75; nonaffiliates, \$73. Subscriber categories: highways; data and information; design; planning and forecasting.

**Methods for Evaluating Fly Ash for Use in Highway Concrete**  
NCHRP Report 749

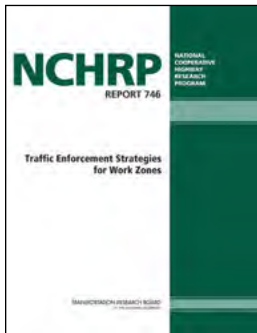
This volume suggests changes to coal fly ash specifications and test protocols in the AASHTO Standard Specifications for Transportation Materials and Methods of Sampling and Testing (AASHTO M 295).

2013; 80 pp.; TRB affiliates, \$41.25; nonaffiliates, \$55. Subscriber categories: materials; pavements.

**Strategic Issues Facing Transportation, Volume 1: Scenario Planning for Freight Transportation Infrastructure Investment**  
NCHRP Report 750

This report analyzes the driving forces behind high-impact economic and social changes as well as sourcing patterns that may affect the U.S. freight transportation system, and introduces scenario planning to improve the quality of long-range transportation infrastructure planning. A DVD accompanies the print version of the report.

2013; 155 pp.; TRB affiliates, \$55.50; nonaffiliates, \$74. Subscriber categories: freight transportation; planning and forecasting; terminals and facilities.



## TRB PUBLICATIONS (continued)

**Strategic Issues Facing Transportation,  
Volume 3: Expediting Future Technologies for  
Enhancing Transportation System Performance**  
NCHRP Report 750

The third volume in a series, this report presents a systematic methodology for the reconnaissance, evaluation, and adoption of technology. The process helps transportation agencies use new and emerging technologies to achieve long-term system performance objectives.

2013; 105 pp.; TRB affiliates, \$43.50; nonaffiliates, \$58. *Subscriber categories: freight transportation; planning and forecasting; terminals and facilities.*

**Practical Highway Design Solutions**

NCHRP Synthesis 443

Presented in this synthesis is information about the application of practical design approaches during roadway project development.

2013; 96 pp.; TRB affiliates, \$43.50; nonaffiliates, \$58. *Subscriber categories: administration and management; highways; design.*

**Pollutant Load Reductions for Total Maximum  
Daily Loads for Highways**

NCHRP Synthesis 444

This synthesis assembles information on the types of structural and nonstructural best management practices used by state DOTs, including performance and cost data, in meeting water quality goals for stormwater runoff.

2013; 62 pp.; TRB affiliates, \$36.75; nonaffiliates, \$49. *Subscriber categories: environment; highways.*

**Practices for Unbound Aggregate  
Pavement Layers**

NCHRP Synthesis 445

The report summarizes effective practices in material selection, design, and construction of unbound aggregate layers to improve pavement performance and longevity.

2013; 180 pp.; TRB affiliates, \$54.75; nonaffiliates, \$73. *Subscriber categories: geotechnology; highways; materials.*

**Operational and Business Continuity Planning  
for Prolonged Airport Disruptions**

ACRP Report 93

Provided in this report are a guidebook and a software tool for airport operators to assist, plan, and prepare for disruptive and catastrophic events that can cause a prolonged airport closure with adverse impacts on the airport and on the local, regional,

and national economy. A CD-ROM is included with the print version of the report.

2013; 139 pp.; TRB affiliates, \$55.50; nonaffiliates, \$74. *Subscriber categories: aviation; operations and traffic management; security and emergencies.*

**Integrating Web-Based Emergency Management  
Collaboration Tools into Airport Operations:  
A Primer**

ACRP Report 94

This report offers information on evaluating and implementing web-based collaboration tools to provide a common operating picture for day-to-day airport operations and full emergency response management.

2013; 46 pp.; TRB affiliates, \$34.50; nonaffiliates, \$46. *Subscriber categories: aviation; operations and traffic management; security and emergencies.*

**Apron Planning and Design Guidebook**

ACRP Report 96

Best practices for planning, designing, and marking apron areas for all sizes and types of U.S. airports are presented in this report. Topics include facility geometrics, aircraft maneuvering, apron-airfield access points, and more.

2013; 157 pp.; TRB affiliates, \$51; nonaffiliates, \$68. *Subscriber categories: aviation; design; terminals and facilities.*

**Environmental Assessment of Air and High-Speed  
Rail Corridors**

ACRP Synthesis 43

This synthesis explores research to improve assessments of the environmental outcomes from the air and high-speed rail modes.

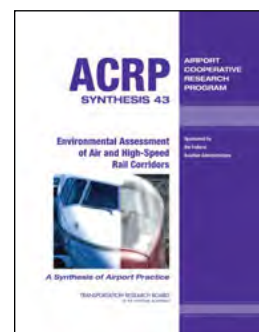
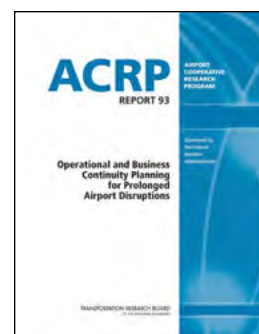
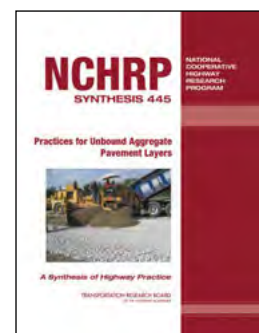
2013; 36 pp.; TRB affiliates, \$33; nonaffiliates, \$44. *Subscriber categories: aviation; energy; environment; passenger transportation; public transportation; railroads.*

**Environmental Management System  
Development Process**

ACRP Synthesis 44

Presented are background on the framework of an environmental management system (EMS), similarities and differences of the various approaches to an EMS, the EMS development process, and lessons learned.

2013; 49 pp.; TRB affiliates, \$34.50; nonaffiliates, \$46. *Subscriber categories: aviation; environment.*





## TRB PUBLICATIONS (continued)



**Model Mutual Aid Agreements for Airports**  
ACRP Synthesis 45

The research presented in this report will assist airport operators in creating and sustaining effective emergency management mutual-aid partnerships by documenting the specifics of current agreements.

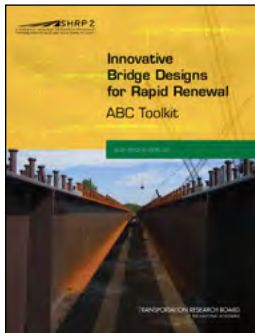
2013; 56 pp.; TRB affiliates, \$36.75; nonaffiliates, \$49. Subscriber categories: administration and management; aviation; society.



**Smart Growth and Urban Goods Movement**  
NCFRP Report 24

The interrelationships between goods movement and smart growth applications are identified, particularly the relationship between the transportation of goods in the urban environment and land use patterns.

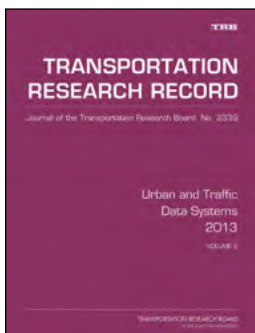
2013; 86 pp.; TRB affiliates, \$43.50; nonaffiliates, \$58. Subscriber categories: highways; freight transportation; planning and forecasting.



**Guidebook for Developing Subnational Commodity Flow Data**  
NCFRP Report 26

This report comprises descriptions of public and private commodity flow data; standard procedures for corridor databases from these sources; methodologies for conducting subnational commodity flow surveys and studies; and methods for using commodity flow data in practice.

2013; 155 pp.; TRB affiliates, \$51; nonaffiliates, \$68. Subscriber categories: data and information technology; freight transportation; planning and forecasting.



**Hazardous Materials Transportation Risk Assessment: State of the Practice**  
HMCRCR Report 12

This report documents the current practice for hazardous materials transportation risk assessment by government agencies and the private sector.

2013; 114 pp.; TRB affiliates, \$45.75; nonaffiliates, \$61. Subscriber categories: administration and management; freight transportation; security and emergencies.

**Innovative Bridge Designs for Rapid Renewal: ABC Toolkit**  
SHRP 2 Report S2-R04-RR-2

Included in this volume are design standards and design examples for complete prefabricated bridge systems, as well as proposed specification language for accelerated bridge construction systems.

2013; 307 pp.; TRB affiliates, \$63; nonaffiliates,

\$84. Subscriber categories: bridges and other structures; construction; design; highways.

**Precast Concrete Pavement Technology**  
SHRP 2 Report S2-R05-RR-1

This volume reviews available precast concrete pavement (PCP) systems; summarizes PCP applications; and offers guidelines for the design, fabrication, installation, and selection of PCP systems.

2013; 163 pp.; TRB affiliates, \$51; nonaffiliates, \$68. Subscriber categories: construction; highways; pavements.

**Nondestructive Testing to Identify Concrete Bridge Deck Deterioration**  
SHRP 2 Report S2-R06A-RR-1

Identified in this report are nondestructive testing technologies for detecting and characterizing common forms of deterioration in concrete bridge decks. Also documented is the validation of promising technologies, along with grades and ranks.

2013; 85 pp.; TRB affiliates, \$41.25; nonaffiliates, \$55. Subscriber categories: bridges and other structures; construction; maintenance and preservation; materials; highways.

**Urban and Traffic Data Systems 2013, Volume 2**  
Transportation Research Record 2339

The papers in this volume explore axle-based and length-based vehicle classification stations, tablet-based traffic counting applications, bicycle traffic patterns, the impacts of various trucks on pavement design and analysis, and more.

2013; 127 pp.; TRB affiliates, \$53.25; nonaffiliates, \$71. Subscriber categories: administration and management; operations and traffic management; pedestrians and bicyclists.

**Air Quality 2013, Volume 1**  
Transportation Research Record 2340

In-use construction equipment emissions, sidewalk-level particulate matter concentrations, and greenhouse gas emissions for last-mile deliveries are some of the topics addressed in this volume.

2013; 94 pp.; TRB affiliates, \$43.50; nonaffiliates, \$58. Subscriber categories: environment; energy; freight transportation.

**Air Quality 2013, Volume 2**  
Transportation Research Record 2341

Authors present comparisons of locomotive emissions during dynamometer versus rail yard engine load tests, an environmentally conscious highway

**TRB PUBLICATIONS** *(continued)*

design for vertical grades, a statistical study of variables associated with particulate matter exposure levels at bus shelters, and more.

2013; 90 pp.; TRB affiliates, \$47.25; nonaffiliates, \$63. Subscriber categories: environment; energy.

**Concrete Materials 2013**

Transportation Research Record 2342

Topics addressed in this volume include an evaluation of drilled shafts with self-consolidating concrete, internal curing of concrete bridge decks, and low-cost techniques for improving surface durability of pervious concrete.

2013; 128 pp.; TRB affiliates, \$53.25; nonaffiliates, \$71. Subscriber categories: materials; pavements; bridges and other structures.

**Travel Demand Forecasting 2013, Volume 1**

Transportation Research Record 2343

Tour-based models of public transportation use, out-of-home leisure activity choices, the value of business travel time savings, and reliable short-term traffic flow forecasting are among the subjects examined in this volume.

2013; 115 pp.; TRB affiliates, \$48.75; nonaffiliates, \$65. Subscriber category: planning and forecasting.

**Travel Demand Forecasting 2013, Volume 2**

Transportation Research Record 2344

The papers in this volume explore social adoption in design and analysis of stated-choice experiments related to choice of electric cars, the impact of distribution choice for representing input variation, static and dynamic land use, and modeling long-distance travel in Great Britain.

2013; 151 pp.; TRB affiliates, \$56.25; nonaffiliates, \$75. Subscriber category: planning and forecasting.

**Policy 2013: Finance, Economics, and Equity Considerations, Volume 1**

Transportation Research Record 2345

The federal role in state transportation finance, the vehicle miles traveled fee system in Nevada, mar-

ginal-cost vehicle mileage fees, and dynamic road pricing for revenue maximization are among the topics addressed in this volume.

2013; 125 pp.; TRB affiliates, \$48.75; nonaffiliates, \$65. Subscriber categories: policy; finance; economics.

**Policy 2013: Finance, Economics, and Equity Considerations, Volume 2**

Transportation Research Record 2346

Authors present research on congestion pricing and intertemporal preference rates, a comparison of public-private partnerships with conventional procurement, fuel tax evasion via the fuel tax refund process, and more.

2013; 71 pp.; TRB affiliates, \$44.25; nonaffiliates, \$59. Subscriber categories: finance; economics; policy.

**Construction 2013**

Transportation Research Record 2347

Explored in this volume are topics including fatigue in highway construction workers, thickness in portland cement concrete pavement, the influence of thermal segregation on asphalt pavement compaction, and the Lake Champlain bridge emergency replacement project.

2013; 114 pp.; TRB affiliates, \$48.75; nonaffiliates, \$65. Subscriber categories: construction; pavements; bridges and other structures.

**Operational Effects of Geometrics and Access Management 2013**

Transportation Research Record 2348

A deterministic model of the operational effects of continuous flow intersection geometrics, applying driveway design for all users, and an evaluation of the safety performance of relief lanes are presented.

2013; 83 pp.; TRB affiliates, \$45.75; nonaffiliates, \$61. Subscriber categories: operations and traffic management; design; safety and human factors.

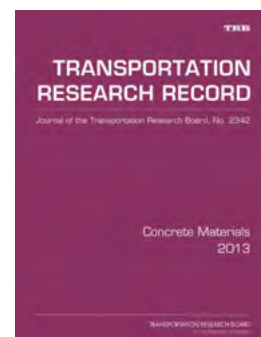
**Geology and Properties of Earth Materials 2013**

Transportation Research Record 2349

Examined in this volume are hexagonal wire mesh gabion panels, unbound aggregate base materials, recycled asphalt shingles, phase composition curves of frozen soils, effective technology transfer, and more.

2013; 144 pp.; TRB affiliates, \$53.25; nonaffiliates, \$71. Subscriber categories: geotechnology; materials; pavements.

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# CALENDAR

## TRB Meetings

### May

21–22 Development of Freight Fluidity Performance Measurements  
Washington, D.C.

26–28 GeoShanghai International Conference 2014\*  
Shanghai, China

### June

8–11 American Society of Civil Engineers 2nd Transportation and Development Institute Congress\*  
Orlando, Florida

8–12 31st International Bridge Conference\*  
Pittsburgh, Pennsylvania

9–12 National Equipment Fleet Management Conference\*  
Orlando, Florida

10–11 Innovation in Mobility Public Policy Summit Shared Use Mobility Summit\*  
Washington, D.C.

22–24 Integrated Corridor Transportation Management System Workshop and Joint Midyear Meeting  
Irvine, California

24–26 Innovative Technologies for a Resilient Marine Transportation System: 3rd Biennial Research and Development Conference  
Washington, D.C.

29–  
July 2 North American Travel Monitoring Exposition and Conference (NATMEC): Improving Traffic Data Collection, Analysis, and Use  
Chicago, Illinois

### July

7 Geosynthetics in Roadway Design  
Laramie, Wyoming

7–11 7th International Conference on Bridge Maintenance, Safety, and Management\*  
Shanghai, China

9–11 5th International Conference on Surface Transportation Financing: Innovation, Experimentation, and Exploration  
Irvine, California

10–11 9th Strategic Highway Research Program Safety Symposium  
Washington, D.C.

13–16 53rd Annual Workshop on Transportation Law  
San Francisco, California

15–17 Automated Vehicles Symposium  
San Francisco, California

15–18 9th International Conference on Short and Medium Span Bridges\*  
Calgary, Alberta, Canada

20–23 GeoHubei International Conference\*  
Hubei, China

20–23 Symposium on Alternative Intersection and Interchange Design  
Salt Lake City, Utah

21–23 14th National Conference on Transportation Planning for Small and Medium-Sized Communities: Tools of the Trade  
Burlington, Vermont

23–24 Workshop on the Value of Transportation Infrastructure  
Washington, D.C.

### August

3–8 Global Level Crossing Safety and Trespass Prevention Symposium\*  
Urbana–Champaign, Illinois

11–13 Istanbul Bridge Conference\*  
Istanbul, Turkey

11–13 Symposium Celebrating 50 Years of Traffic Flow Theory\*  
Portland, Oregon

20–22 Vision of Railroading in the 21st Century\*  
Altoona, Pennsylvania

25–27 15th Biennial Harbor Safety Committee and Area Maritime Security Committee Conference  
Philadelphia, Pennsylvania

25–28 4th International Symposium on Naturalistic Driving Research  
Blacksburg, Virginia

Additional information on TRB meetings, including calls for abstracts, meeting registration, and hotel reservations, is available at [www.TRB.org/calendar](http://www.TRB.org/calendar). To reach the TRB staff contacts, telephone 202-334-2934, fax 202-334-2003, or e-mail [TRBMeetings@nas.edu](mailto:TRBMeetings@nas.edu). Meetings listed without a TRB staff contact have direct links from the TRB calendar web page.

\*TRB is cosponsor of the meeting.

## INFORMATION FOR CONTRIBUTORS TO

# TR NEWS

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**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.

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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.

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- ◆ 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.

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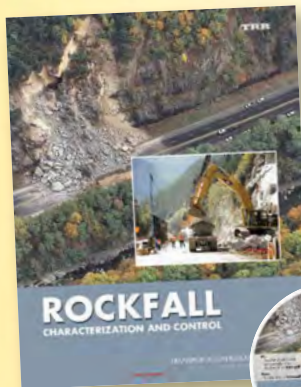
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