

# TR NEWS

## Alcohol-Impaired Driving Interventions and Research

Plus:

U.S. DOT's Disadvantaged Business Enterprise Program

Diversity and Inclusion at TRB

Weather and Barrier Effects on Highway Noise



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TRANSPORTATION RESEARCH BOARD

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# TR NEWS

NUMBER 318

NOVEMBER–DECEMBER 2018

## 3 NASEM STUDY

### Eliminating Alcohol-Impaired Driving Fatalities

*Amy Geller and Yamrot Negussie*

To combat the deadliest, costliest danger on U.S. roads—alcohol-impaired driving—a study committee of the Health and Medicine Division of the National Academies of Sciences, Engineering, and Medicine identified evidence-based interventions to reduce fatalities caused by alcohol-impaired driving in the United States. The study also examined alcohol-impaired driving interventions—both potential and in use—and their promise and effectiveness.

## 11 U.S. DOT's Disadvantaged Business Enterprise Program: Key Components and Issues

*Colette Holt and Joanne Lubart*

The United States Department of Transportation's (DOT's) Disadvantaged Business Enterprise (DBE) program has endured for nearly 40 years. The national program helps to correct a historic imbalance in opportunities for minority- and women-owned small businesses in DOT-assisted contracting and applies to recipients of U.S. DOT transportation funds. This article explores the DBE program's background and goals as well as related legal and programmatic complexities.

## 18 Advancing Core Values: TRB's Inclusion and Diversity Initiative

*Karen Febey*

The Transportation Research Board's (TRB's) support of inclusion and diversity has focused on increasing diversity in the selection of committees and project panels. To broaden and fortify this effort, Executive Director Neil Pedersen has sought to integrate diversity and inclusion into TRB's organizational culture. This article outlines TRB's work formalizing and building on best practices, developing a task force, and identifying other actions by staff and volunteers to ensure that TRB represents as many perspectives and opinions as possible.

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### Designing Safety Regulations for High-Hazard Industries

*Thomas R. Menzies, Jr.*

Presented in TRB Special Report 324, *Designing Safety Regulations for High-Hazard Industries*, is a framework for the design of safety regulations for industries engaged in hazardous activities. Different regulatory designs offer different advantages depending on how they are applied; to make smart decisions, regulators must have a clear conceptual framework for design options and under which circumstances a given design would be most effective.

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### Research Offers Insights on Highway Noise

*Ann M. Hartell, Ken Kaliski, Darlene Reiter, Bill Bowlby, Roger Wayson, and Judy Rochat*

Traffic noise from highways can affect human health and quality of life negatively; since 1970 federal legislation has required state DOTs to anticipate and mitigate noise effects of proposed new highways and expansion projects. State DOTs continue to hear complaints about traffic noise, however. Two recent National Cooperative Highway Research Program research reports offer new insights for noise specialists, project designers, and policy makers.



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**COVER:** A vehicle that had been crashed by an intoxicated driver is towed from a pond. A study from the National Academies of Sciences, Engineering, and Medicine explored research on interventions to reduce alcohol-impaired driving crashes. (Photo: Mark Taylor, Flickr)

# 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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## 29 Preparing for Shared Mobility and Automated Vehicles: Symposium and TRB Forum Chart a Course for Research

*Katherine A. Kortum*

To facilitate needed evidence-based research on automated vehicles, shared mobility services, and other transformational transportation technologies—and on how and when the technologies can meet long-term goals—TRB launched the Forum on Preparing for Automated Vehicles and Shared Mobility in early 2018. This article reviews the Forum's activities to date and reports on the 2018 Automated Vehicle Symposium in San Francisco in July.

## 34 Bilateral Automation Research: 6th EU–U.S. Transportation Research Symposium

*Katherine A. Kortum*

Since 2013, TRB, the U.S. DOT Office of the Secretary of Transportation—Research, and the European Commission have joined forces for bilateral transportation research: sharing experiences, identifying potential next steps and research needs, and uncovering opportunities for joint efforts. In June, European and U.S. researchers convened in Brussels, Belgium, to examine the impacts of connected and automated vehicles on the workforce, economy, community land use, and transportation equity.

## 37 RESEARCH PAYS OFF Streamlining Survey in Reno's Spaghetti Bowl

*Emily Pettis, Sebastian Renfield, and Alexis Thomas*

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### COMING NEXT ISSUE

PHOTO: CHRIS STATION, OHIO DOT



Completed bat gate at an abandoned railway tunnel in Harrison County, Ohio.

The 2018 state partnership visits of state transportation agencies by TRB senior program officers, the topic of a feature article in the January–February 2019 issue of TR News, showcase emerging trends, applied research, research needs, and innovative solutions to challenges across all transportation modes and

functions. Other articles explore obesity solutions through investments in the built environment, the Ohio Department of Transportation's work protecting historic railroad tunnels as artificial bat hibernacula, and a transportation test bed corridor in Atlanta, Georgia.

Among the alcohol-impaired driving interventions examined in a recent report from the National Academies of Sciences, Engineering, and Medicine are designated driving programs, which incentivize patrons to designate a driver who will not drink alcohol.



PHOTO: TECH SGT. CHRIS STAGNER, U.S. AIR FORCE

## NASEM STUDY

# Eliminating Alcohol-Impaired Driving Fatalities

AMY GELLER AND YAMROT NEGUSSIE

*Geller is Senior Program Officer and Negussie is Associate Program Officer, Board on Population Health and Public Health Practice, Health and Medicine Division, National Academies of Sciences, Engineering, and Medicine, Washington, D.C.*

**A**lcohol-impaired driving is the deadliest and costliest danger on the nation's roads, with approximately one-third of all traffic deaths in the United States caused by drinking and driving. One person dies in an alcohol-impaired driving crash every 49 minutes—that is 29 people each day. In 2016, 10,497 deaths were caused by alcohol-impaired driving—the largest single cause of traffic fatalities (see Figure 1, page 4). In comparison, distracted driving accounted for 3,450 fatalities in 2016. Almost 40% of alcohol-impaired driving fatalities are victims other than the drinking driver. The economic cost is staggering: \$121.5 billion in 2010, including medical costs, earnings and productivity losses, legal costs, and vehicle damage (see box, page 4).

Although the causes of this problem are complex, the resulting deaths are preventable. A report released by the National Academies of Sciences, Engineering, and Medicine early this year identifies many

evidence-based and promising policies, programs, and systems changes to accelerate national progress in reducing deaths from alcohol-impaired driving.

### Getting to Zero

As a public health and safety problem, alcohol-impaired driving transcends the transportation, law enforcement, and clinical care systems. Despite its persistent nature, however, the problem is not intractable. Many evidence-based and promising strategies to address alcohol-impaired driving are available; however, a coordinated, multilevel approach across multiple sectors is required to accelerate change.

To address alcohol-impaired driving fatalities, the National Highway Traffic Safety Administration (NHTSA) commissioned the Health and Medicine Division of the National Academies to identify evidence-based and promising interventions to reduce fatalities caused by alcohol-impaired driving in the

## Key Facts About Alcohol-Impaired Driving

- ◆ Each day 29 people in the United States die in an alcohol-impaired driving crash; this is equal to one death every 49 minutes.
- ◆ Since 1982, an average of one-third of all traffic fatalities were alcohol-impaired driving fatalities; more than 10,400 people were killed in 2016.
- ◆ Nearly 40% of alcohol-impaired driving fatalities are victims other than the drinking driver.
- ◆ In 2016, 214 children 14 years of age or younger were killed in alcohol-impaired driving crashes.
- ◆ Rural areas are disproportionately affected by alcohol-impaired driving crashes and fatalities.
- ◆ In 2010, the total economic cost of alcohol-impaired driving crashes was \$121.5 billion—including medical costs, earnings losses, productivity losses, legal costs, and vehicle damage.



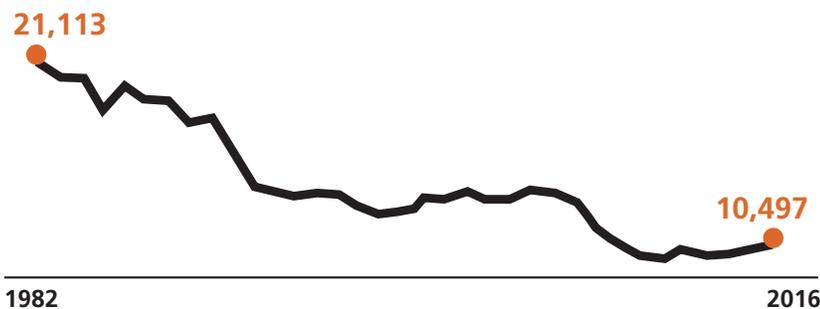
Standard drink sizes for alcohol include (left to right) 12 fluid oz regular beer, 8–9 fluid oz malt liquor, 5 fluid oz table wine, and 1.5 fluid oz distilled spirits.

United States. Focusing on strategies to provide maximum benefit at the population level, the study committee (see box, page 10) released its final report, *Getting to Zero Alcohol-Impaired Driving Fatalities: A Comprehensive Approach to a Persistent Problem*, in January 2018.<sup>1</sup>

For the most part, this article will focus on the report's chapter on driving while impaired (DWI) interventions; that is, interventions that reduce the likelihood that an individual will drive once already

<sup>1</sup> To view the report and other materials, see [www.nationalacademies.org/stopDWIdeaths](http://www.nationalacademies.org/stopDWIdeaths).

**FIGURE 1** Alcohol-impaired driving fatalities in the United States, 1982–2016.



impaired by alcohol. Other chapters in the report cover such topics as the current alcohol environment, interventions to reduce drinking to impairment, postcrash and arrest interventions, data surveillance needs and opportunities, and efforts to initiate and sustain action to reduce alcohol-impaired driving fatalities. The report's appendixes include four commissioned papers that offer additional context and perspective on alcohol-impaired driving and fill gaps in related literature.

## Overview of Approach and Methods

Traditional preventive countermeasures for motor vehicle crashes are categorized as follows, with each category representing opportunities for interventions: before the crash, during the crash itself, and after the crash.

The study committee primarily covered interventions directly related to the prevention of alcohol-impaired driving injuries and fatalities. These include precrash interventions—alcohol policies that affect price, the availability of alcohol, and alcohol consumption—as well as interventions that affect whether or not an impaired person will drive, such as alternative transportation and ridesharing options. The committee embraced Vision Zero, a philosophy in which no alcohol-impaired driving deaths are acceptable and in which each alcohol-impaired driving crash represents a failure of the system, from excessive alcohol service to poor road design to lack of effective policies and enforcement.

The literature on the effectiveness and applicability of interventions provides important information for assessing which interventions are most effective and cost-effective, as well as which are suitable for either a general or more specific population. Comparisons of interventions often are incomplete because studies vary in appropriateness of design and setting and outcomes measured as well as in consideration of unintended consequences and interactions with other interventions. With this in mind, the study committee examined the available literature.

## Eliminating Alcohol-Impaired Driving Crash Fatalities

### BAC Laws

In the United States, drivers 21 years of age and older are prohibited from driving with a blood-alcohol concentration (BAC) that exceeds 0.08%—the limit prescribed in state per se laws for alcohol-impaired drivers (I).<sup>2</sup> Based on the number of grams of alcohol (ethanol) per 100 mL of blood, BAC commonly

<sup>2</sup> A per se law means that the act in question is illegal in and of itself.

is used for medical or legal purposes to quantify an individual's level of alcohol impairment.

For drivers under age 21, BAC limits generally are lower, ranging from zero to 0.02% depending on the state. Laws limiting the BAC of drivers are a key intervention to reduce alcohol-impaired driving and resulting crashes, injuries, and fatalities. In December 2018, Utah will be the first state to lower its BAC per se law to 0.05%.

According to high-quality laboratory and real-world crash studies, alcohol impairment begins at BAC levels well below 0.08% (see Table 1, page 6). For example, experimental motor vehicle and motorcycle simulator studies consistently have shown impairment at a BAC level of 0.05%. Despite state laws currently mandating a limit of 0.08% BAC in the United States, evidence shows that a substantial proportion of alcohol-related crashes and fatalities occur when drivers have BAC levels below 0.08%.

Studies around the world consistently show that drivers with BAC levels between 0.05% and 0.079% are more at risk of being involved in a fatal crash than drivers with a BAC of zero. In 2015, approximately 1,800 alcohol-related driving fatalities involved a driver with a BAC of less than 0.08%. As of 2015, 34 countries comprising 2.1 billion people have laws limiting a driver's BAC to 0.05% or less. Many high-income countries—including Australia, France, Germany, and Italy—have adopted such BAC limits, considered a best practice by the World Health Organization. Based on the available studies, these countries have implemented and enforced this policy without placing undue burdens on the court system.

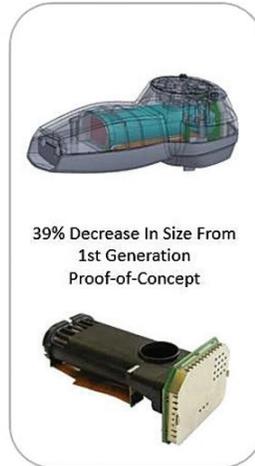
The majority of international evidence suggests that lowering the BAC limit for drivers to 0.05% reduces alcohol-related crashes and driving fatalities—an effect greatest among highest-risk groups. Based on recent literature reviews and estimates by the committee and others, national adoption of 0.05% BAC per se laws could save more than 1,500 lives annually (2). The committee recommended that state governments enact such per se laws, noting that this change would be most effective if implemented along with high-visibility enforcement activities, such as frequent, widely publicized sobriety checkpoints.

**Enforcement and Arrest**

One intervention with a strong, consistent evidence base is the use of sobriety checkpoints. This high-visibility enforcement strategy involves checking drivers for signs of impairment, often through breath testing. Law enforcement officers can conduct breath testing at sobriety checkpoints either selectively or randomly. In selective breath testing, which is used in



Proof-of-Principle



39% Decrease In Size From 1st Generation Proof-of-Concept

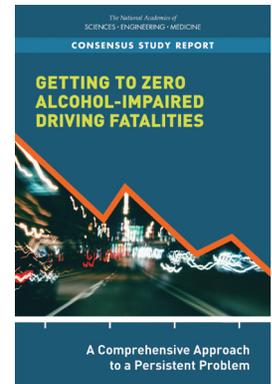


85% Decrease In Size From 1st Generation Integrated into DADSS Research Vehicle

the United States, officers stop vehicles and conduct a breath test on the driver only when they observe and suspect impairment; in random breath testing—used in many European countries and Australia but illegal in the United States—officers test all drivers they stop (3).

The Community Preventive Services Task Force (CPSTF) found strong evidence for the effectiveness of publicized sobriety checkpoint programs, based a systematic review of studies published between 2000 and 2012 (3). Reduced fatalities were attributed to publicized sobriety checkpoint programs implemented in cities, counties, states, and nationwide, as well as in areas that are rural or urban or both—indicating the effectiveness of these programs across a wide range of settings.

(Left to right:) First, second, and third generations of DADSS devices.



The consensus study report *Getting to Zero Alcohol-Impaired Driving Fatalities* is available at <https://www.nap.edu/catalog/24951/getting-to-zero-alcohol-impaired-driving-fatalities-a-comprehensive-approach>.



Pre-crash interventions—like local laws that limit days or hours of sales—are critical to reducing alcohol-related crashes.

PHOTO: OMINAE, WIKIMEDIA

When publicized and conducted frequently, sobriety checkpoints are highly visible strategies that can decrease alcohol-related crashes by up to 20%.

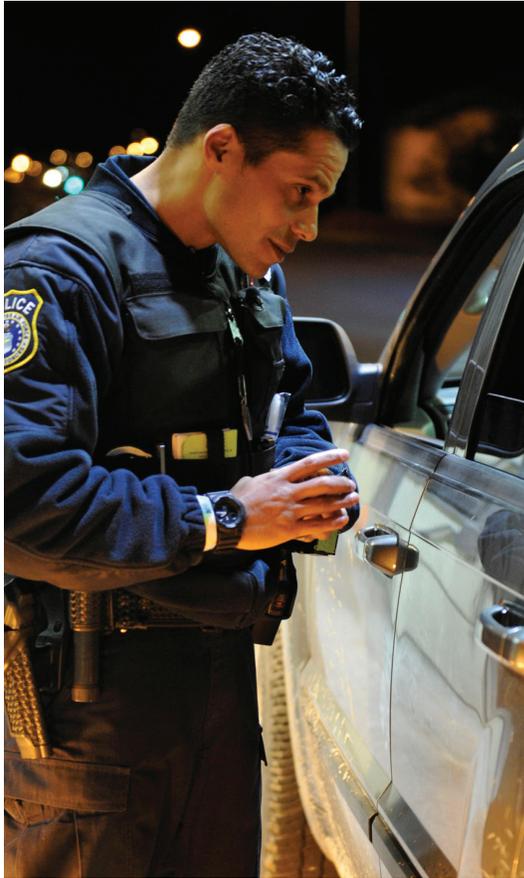


PHOTO: AMMANI 1ST CLASS TAMMIE RAMBOUSE, U.S. AIR FORCE

Other reviews by CPSTF found that sobriety checkpoints with selective breath testing decreased alcohol-related crashes by 20% and checkpoints with random breath testing reduced these crashes by 18% (4). NHTSA's *Countermeasures That Work: A Highway Safety Countermeasure Guide for State Highway Safety Offices* rates the effectiveness of sobriety checkpoints as high and notes that implementation time can be short if law enforcement officers are trained appropriately (5).

Checkpoints sometimes have unintended negative consequences, however. Evidence suggests that these consequences include racial profiling and

targeting of undocumented immigrants. To minimize the likelihood of racial profiling, Bergen et al. encourage systematic selection and standardization methodologies to select vehicles and drivers for breath testing, so that driver selection is not left to the discretion of law enforcement officers (3).

Despite the potential unintended consequences of sobriety checkpoints, the study committee recommended that, based on its review of a strong body of evidence, states and localities conduct frequent sobriety checkpoints in conjunction with widespread publicity to promote awareness of these enforcement initiatives.

## Technology and Vehicle Factors

### Ignition Interlock Devices

The study committee also focused on current and emerging technological interventions that have reduced, or shown promise of reducing, alcohol-impaired driving and alcohol-related crashes. One such technological intervention is the use of ignition interlock devices; that is, breath-alcohol analyzers connected to a vehicle's ignition. These devices require a breath sample to start the engine and inhibit driving if the sample contains more than a preset alcohol concentration—usually 0.02%. Ignition interlock use has increased, with more than 318,000 devices in use in 2014, but the devices remain underused relative to the number of eligible alcohol-impaired driving offenders. Research suggests the current ratio of installed interlocks per DWI arrests is one to five.

Most states have all-offender ignition interlock laws—laws requiring all convicted impaired-driving offenders to install an interlock device—but these vary in the length of time for which offenders must keep the device installed. For example, some states require an interlock device only for repeat offenders or those with a high BAC. Ohio and Oklahoma require offenders to obtain a marked license indicating they can only drive a vehicle with an interlock.



PHOTO: VCU, FLUCK

Ignition interlock devices require an alcohol breath analysis to start a car's engine, preventing a user from driving with a BAC concentration over a preset limit.

**TABLE 1 Alcohol's Effects on Driving Ability**

| BAC   | Typical Effects on Driving   |
|-------|--|
| 0.02% | <ul style="list-style-type: none"> <li>• Decline in visual function</li> <li>• Decline in ability to perform two tasks at the same time (divided attention)</li> </ul>   |
| 0.05% | <ul style="list-style-type: none"> <li>• Reduced coordination</li> <li>• Reduced ability to track moving objects</li> <li>• Difficulty steering</li> <li>• Reduced response to emergency driving situations</li> </ul> |

NOTE: BAC = blood-alcohol concentration.

Other states have no requirements for interlocks; these states may instead offer such incentives as a limited driving permit or jail time avoidance if an offender installs an ignition interlock.

Ignition interlock fees generally are affordable and are borne by the offender. Offenders usually pay \$100 to \$250 to install the device, and then approximately \$65 to \$90 per month. Ignition interlocks can be made more affordable for low-income offenders via indigent funds, helping to address low installation rates. Research also suggests that all-offender interlock devices are cost-effective, especially for first-time offenders.

Substantial scientific evidence from the United States and other countries such as Canada and Sweden indicates that ignition interlock devices are effective in reducing alcohol-impaired driving, as well as in reducing recidivism and crashes. The positive effects of ignition interlock devices generally dissipate after their removal; therefore, an interlock program may benefit from being paired with alcohol use disorder treatment.

Based on the evidence, the study committee recommended that all states enact all-offender ignition interlock laws to reduce alcohol-impaired driving fatalities. The committee also recommended that these laws require an ignition interlock for all offenders with a BAC above the limit set by state law and that, to increase effectiveness, states should consider increased monitoring periods based on the offender's BAC or past recidivism.

### **Safety Restraints**

Another vehicle-based intervention is safety restraints, since alcohol-impaired drivers are less likely to use seat belts than nonimpaired drivers. Several different factors can affect seat belt use: primary versus secondary seat belt laws, time of day, urban versus rural driving, and the strength of a car's seat belt reminder system.

Primary seat belt laws are those that allow law enforcement officials to stop vehicles if drivers or passengers are not wearing seat belts, and secondary seat belt laws are those that only allow law enforcement officials to ticket drivers for noncompliance with seat belt laws if the vehicles are first pulled over for another offense (6). A 4-year study conducted by Lange and Voas found that after California changed its state seat belt laws from secondary to primary, the rate of compliance increased from 53.4% to 92.1% among drivers with BAC levels of 0.10% or less (7). In addition, enhanced belt reminder systems have been found to increase the rate of seat belt use by about 3% (8–9). The study committee concluded that, given the low rates of seat belt use and high



Laws that penalize not wearing a seat belt could reduce crash injuries and fatalities for alcohol-impaired drivers, who are less likely to buckle up.

rates of crashes in rural areas, universal adoption of primary seat belt laws for all occupants combined with enhanced enforcement could reduce alcohol-related crash injuries and fatalities.

### **Passive Technologies**

Passive technologies that can detect levels of alcohol in the driver's body also show promise. The study committee examined the Driver Alcohol Detection System for Safety (DADSS), a public–private partnership between NHTSA and the Automotive Coalition for Traffic Safety that is developing non-invasive, vehicle-integrated technology to prevent a vehicle from moving when the driver's BAC exceeds the legal limit—for example, a touch-based DADSS device that uses spectrometry to measure alcohol concentration in the driver's skin tissue (10–11). The technology would be integrated into the push button of new vehicles to measure a driver's BAC when they use their fingertip to start the vehicle (10). A breath-based DADSS device, using spectrometry to measure alcohol concentration in a driver's exhaled breath, also is being explored (11–12).

The study committee recommended that, when DADSS is accurate and available for public use, auto insurers should offer policy discounts to stimulate its adoption. Once the cost of the device is on par with other automobile safety features and the technology is demonstrated to be accurate and effective, NHTSA should make DADSS mandatory in all new vehicles, the committee further advised.

### **Autonomous Vehicles**

The committee also explored the potential of autonomous vehicles. Although research and development in autonomous vehicles shows potential, the committee noted, the solutions offered by these vehicles for addressing alcohol-impaired driving fatalities are not yet feasible. It is important to continue efforts to reduce alcohol-impaired driving using technological resources, the study committee noted. There may come a time when vehicle occupants no longer have to be mindful of their alcohol consumption when it comes to driving, but that time is far off.

### **Physical Environment and Transportation**

#### **Designated Driver Programs**

The designated driver concept originated in Scandinavia and was popularized in the United States in the late 1980s and early 1990s (7). The two most common approaches to promoting designated driver use are population-based campaigns and programs that incentivize patrons at drinking establishments to act as designated drivers. Incentives can include non-alcoholic beverages and free or discounted admission to a venue (13).

Although the costs of designated driver programs are low and their implementation time is short, few

studies have evaluated the effects of the programs on traffic injuries. This is partly because of variations in the definition of the term and the selection of a designated driver. According to CPSTF, because of the small magnitude of observed changes and the limitations of measured outcomes, studies on designated driver programs did not provide sufficient evidence to determine whether these programs were effective. The study committee also found that the available evidence is insufficient to determine whether designated driver programs are effective in reducing alcohol-impaired driving crashes.

#### **Alternative Forms of Transportation**

**Ridesharing** Another intervention is for alcohol-impaired drivers to seek alternative means of transportation via smartphone-enabled transportation network ridesharing (e.g., Uber and Lyft). Emerging empirical evidence examines the association between the uptake of network ridesharing and alcohol-impaired driving crashes, alcohol-related driving fatalities, and potential unintended consequences.

Current literature is limited to evaluations of data available after the publicly reported start date of Uber's launch in any given local market (of transportation network companies to date, Uber has the largest market share). As of September 2017, six

According to the study committee, national adoption of 0.05% BAC per se laws could save approximately 1,500 lives each year.



Photo: Mark Taylor, Flickr



Student use of Phoenix's light rail system has been linked to significantly lower odds of impaired driving in one study.

independent analyses have been published, three in peer-reviewed literature and three in online economics working papers. Although the methodologies and findings are somewhat heterogeneous, the main findings generally demonstrate either that ride-sharing has a net positive benefit in addressing alcohol-impaired driving or that it makes no difference.

Some evidence shows that the effect of smartphone-enabled transportation network ridesharing on reducing alcohol-involved crashes may be strongest in areas with poor public transportation usage.

**Safe Ride Programs and Public Transportation** Other forms of alternative transportation include safe ride programs and public transportation. Safe ride programs can be conducted with vehicles such as taxis, private cars, limousines, and trolleys, and they usually supplement public transportation options. *Countermeasures That Work* concluded that the effectiveness of safe ride programs has not yet been determined and that different study methods produce different results (5).

It is difficult to obtain appropriate data and assess causality, so evidence is sparse regarding public transportation and impaired driving. A few studies focusing on specific urban areas attempted to correlate ridership with impaired driving, however: a study of light rail in Phoenix, Arizona, found that frequent light rail use by college students was associated with

significantly decreased odds of impaired driving (14).

Additionally, a 2011 study evaluated changes in Washington, D.C., Metro schedules from 1999 to 2003 that resulted in the system staying open until 3 a.m. on Fridays and Saturdays (15). When Metro operated until 3 a.m., ridership increased 7% per hour and DWIs declined by 7% per hour of additional service. Alcohol-related arrests increased 8% in areas close to a Metro station.

Although the limited research into alternative transportation options is mixed, the study committee

When the Washington Metropolitan Area Transit Authority expanded weekend hours until 3 a.m., ridership increased and DWI citations decreased by equal amounts.



## Committee on Accelerating Progress to Reduce Alcohol-Impaired Driving Fatalities

**Steven M. Teutsch**, Fielding School of Public Health, University of California, Los Angeles; Fellow, Public Health Institute; Leonard D. Schaeffer Center for Health Policy and Economics, University of Southern California, *Chair*

**Julie A. Baldwin**, Center for Health Equity Research, Northern Arizona University

**Linda C. Degutis**, Defense Health Horizons, Henry M. Jackson Foundation; Rollins School of Public Health, Emory University

**Mucio Kit Delgado**, Perelman School of Medicine, University of Pennsylvania

**David H. Jernigan**, Bloomberg School of Public Health, Johns Hopkins University

**Katherine Keyes**, Mailman School of Public Health, Columbia University

**Ricardo Martinez**, Adeptus Health; School of Medicine, Emory University

**Timothy S. Naimi**, School of Medicine, School of Public Health, Boston University; Section of General Internal Medicine, Boston Medical Center

**Jeff Niederdeppe**, Department of Communication, Cornell University

**Charles P. O'Brien**, Center for Studies of Addiction, University of Pennsylvania

**Jody L. Sindelar**, School of Public Health, Yale University

**Joanne E. Thomka**, National Association of Attorneys General

**Douglas Wiebe**, Department of Biostatistics, Epidemiology, and Informatics, University of Pennsylvania

observed that the area that shows great promise. For that reason, the committee recommended that municipalities support policies and programs that increase the availability, convenience, affordability, and safety of transportation alternatives for drinkers who might otherwise drive. This includes permitting transportation network company ridesharing; enhancing public transportation options, especially during nighttime and weekend hours; and boosting or incentivizing transportation alternatives in rural areas.

### Conclusion

Taken together, the recommendations outlined in this article and the additional recommendations in the report have the potential to reinvigorate commitment and accelerate progress to eliminate deaths from alcohol-impaired driving. It is critical to revive

public concern as well as policymaker attention and resolve into decisive action to address this tragic and preventable problem.

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To learn more and to access report-related materials, visit <http://nationalacademies.org/endDWIdeaths>.

The Disadvantaged Business Enterprise (DBE) program reduces barriers for minority- and women-owned businesses.



PHOTO: ASTRID WESTVANG, FIDICR

# U.S. DOT's Disadvantaged Business Enterprise Program

## Key Components and Issues

COLETTE HOLT AND JOANNE LUBART

*Holt is Principal, Colette Holt & Associates, and General Counsel, American Contract Compliance Association, Oakland, California, and Lubart is a legal consultant on disadvantaged and diverse business programs, Palmyra, Pennsylvania, and Chair, TRB's Standing Committee on Disadvantaged Business Enterprises.*

The United States Department of Transportation's (DOT's) Disadvantaged Business Enterprise (DBE) program has been the subject of considerable debate for more than three decades—but despite its challenges and detractors, the program endures. The DBE program is national in scope, enacted in response to the well-documented history of race and sex discrimination and how it limits opportunities for minority- and women-owned small businesses in DOT-assisted contracting (1). Recipients of U.S. DOT transportation funds through the Federal Highway Administration (FHWA), Federal Aviation Administration (FAA), and the Federal Transit Administration (FTA) all must comply with the program.

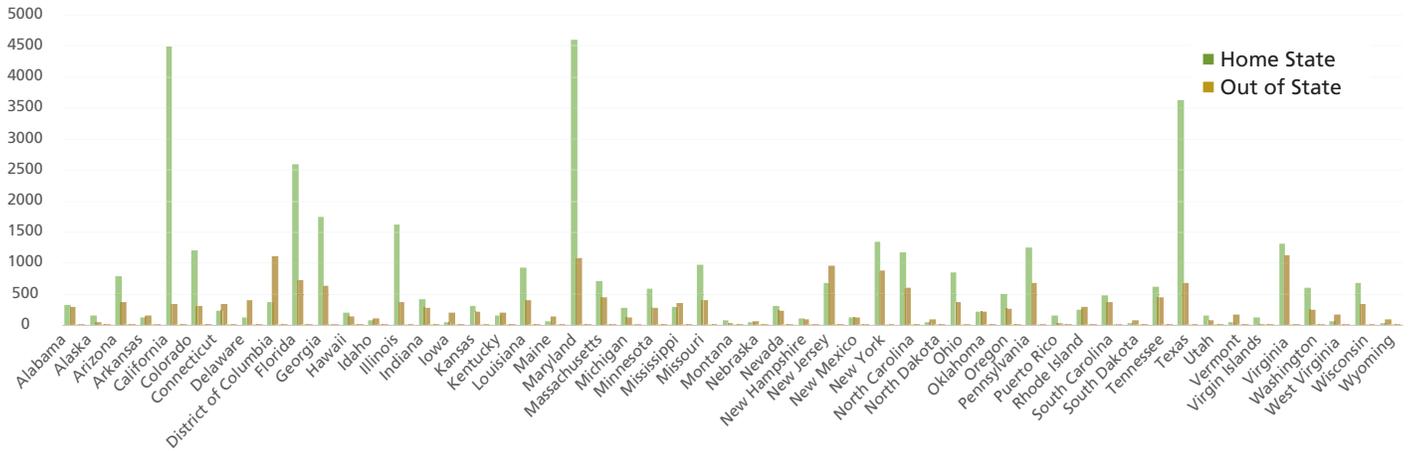
Although many state and local programs have been struck down as a result of legal challenges, the federal DBE program has been upheld by every court and continues to facilitate economic opportunity for

DBEs. This article shares the purpose, history, and structure of the program and explores some legal and programmatic impediments to its success.



PHOTO: CECIL SPOUGHTON, WHITE HOUSE PRESS OFFICE

President Lyndon Johnson signed the Civil Rights Act in July 1964. Title VI of this legislation paved the way for the DBE program.



**FIGURE 1** Local and out-of-state distribution of DBE certifications. (Source: U.S. DOT, 2017.)

### DBE Program’s Purpose, History, and Elements

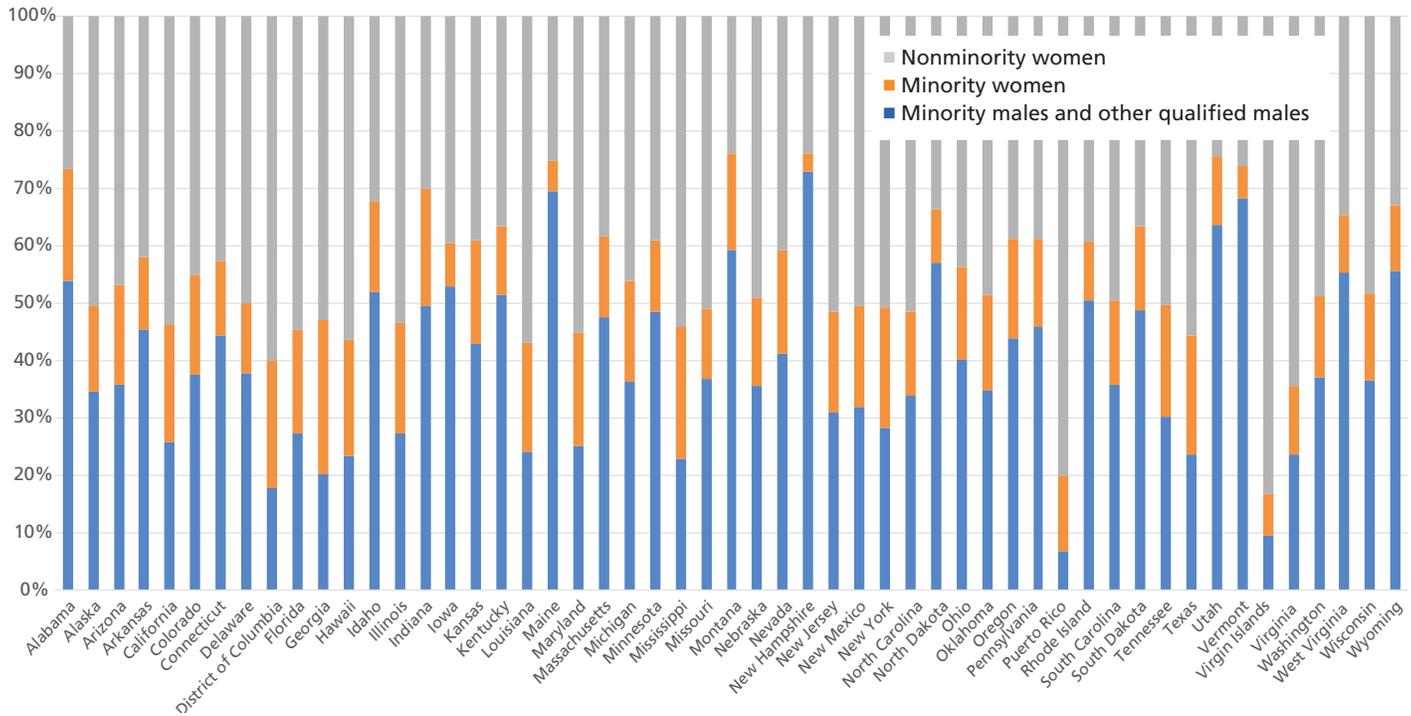
In a nondiscriminatory market, firms would have equal opportunities to compete regardless of the race, ethnicity, or gender of their owners. Among the barriers to market participation by DBEs, however, are unequal access to capital, bonding, education, and training; exclusion of minority and female entrepreneurs from business networks; harassment; and beliefs that minority- and women-owned firms are not competent. The U.S. DOT DBE program responds to this market failure by seeking to ensure that federally funded highway, transit, and airport contracts and associated subcontracts are available to all firms on a nondiscriminatory basis.

Since its inception, the program has reduced barriers and the effects of discrimination for thousands of minority- and women-owned firms (see Figures 1–2, this page). Decades of studies demonstrate that the program is necessary to ensure full and fair market competition for U.S. DOT–assisted contracts.<sup>1</sup> DBEs around the country report that the program is critical to their growth—and even their continued existence.

In 1983, Congress enacted the first DBE statutory provision and it has been reauthorized repeatedly—

<sup>1</sup> See, for example, the recent disparity study for the Washington State Department of Transportation, [www.wsdot.wa.gov/sites/default/files/2017/09/11/OEO-DisparityStudy-2017.pdf](http://www.wsdot.wa.gov/sites/default/files/2017/09/11/OEO-DisparityStudy-2017.pdf), as well as the decision in *Associated General Contractors, San Diego Chapter v. Caltrans*, [www.justice.gov/sites/default/files/crt/legacy/2012/02/13/agccalbrief.pdf](http://www.justice.gov/sites/default/files/crt/legacy/2012/02/13/agccalbrief.pdf).

**FIGURE 2** Distribution of DBE certifications by ethnicity and gender. (Source: U.S. DOT, 2017.)





At a DBE conference, the Virginia Department of Transportation (DOT) works with local businesses to “match” diverse organizations with Virginia DOT needs.

most recently in the Moving Ahead for Progress in the 21st Century Act (2). The program regulations also were updated extensively in 1999 in response to the U.S. Supreme Court’s decision in *Adarand v. Peña* (3) and congressional findings.

Supreme Court decisions mandate that any race-conscious program be based on a compelling governmental need and narrowly tailored to achieve program objectives; repeated congressional findings of discrimination in the market for federal-aid transportation contracts over many years have met these requirements. The U.S. DOT DBE program rules were designed specifically to meet the Supreme Court’s requirement of narrow tailoring (4–5). As a result, federal courts uniformly have upheld the program’s constitutionality against repeated, highly charged challenges.

Eligible persons may apply to state and local recipient programs for DBE certification. Congress found that certain racial and ethnic minorities as well as women are presumed to be socially and economically disadvantaged because of discrimination in the transportation industry, although others can apply on a case-by-case basis. The business owner also must have a limited “personal net worth” and the firm must meet the Small Business Administration’s size standards.<sup>2</sup>

Recipients establish triennial DBE overall participation goals, based on local market conditions,

<sup>2</sup> The current limit is \$1.32 million, exclusive of the owner’s equity in his or her primary residence and equity in the firm seeking certification; retirement accounts are discounted to their present value.

for their federally assisted contracts. These goals and methodologies must be submitted for approval to the appropriate administration—FHWA, FAA, or FTA. Recipients then set goals on specific contracts that bidders must make good-faith efforts to meet. Following the award of the contract, specific rules for counting DBE utilization apply: recipients must monitor work sites and compare DBE quotes to commitments, and commitments to attainment, to ensure work committed to each DBE at contract award or subsequently was actually performed by those DBEs.

## Challenges

Although the U.S. DOT DBE program has endured, several issues currently are relevant to the implementation and success of the program. What follows is a closer examination of these issues.

### *Uniformity of Practice*

Because the DBE program is national in scope, it encourages uniformity of practice; however, certain factors work against this objective. First, recipients have substantial discretion in structuring their programs. Despite the availability of U.S. DOT sample templates and guidance, as well as training available through a variety of channels, programs often differ markedly from one another, creating a source of frustration for firms seeking to work in multiple jurisdictions.

Next, distrust between recipients concerning DBE certification and inconsistent program requirements creates difficulties for DBE and non-DBE

Contractors conduct maintenance work on the Tacoma Point Defiance Bypass. Washington State DOT is one of the states in the Ninth Circuit; DBE recipients in these states must independently establish that discrimination exists in their market area.



PHOTO: WASHINGTON STATE DOT

firms. Variations in oversight practices increase the likelihood that ineligible firms will be certified as DBEs and then be wrongly counted toward DBE participation goals.

Litigation by opponents of the DBE program also has affected uniformity. In *Western States Paving v. Washington State Department of Transportation*, the Ninth Circuit Court of Appeals—like all other federal courts—upheld the DBE program’s constitutionality (6). The court created two conditions for recipients within the Ninth Circuit that are not found in the regulations or imposed by courts in other areas of the country, however.<sup>3</sup> Although the court found that Congress met the compelling interest test through national findings, Ninth Circuit recipients must independently establish that discrimination exists in their market area. In practice, this means that overall goals must be based on a disparity study, which is a comprehensive statistical and anecdotal research compendium of findings on whether the effects of discrimination disproportionately limit opportunities for minority- and woman-owned firms.

Also, even when discrimination affects the market, the recipient must tailor contract goal credit narrowly, to only the specific, presumptively disadvantaged groups found to suffer barriers. This means

that if a disparity study finds that white women and Hispanic Americans are not underutilized but that black Americans and Native Americans are, then race-conscious goals are supportable for black Americans and Native Americans but not for white women and Hispanic Americans.

The *Western States* decision has resulted in most Ninth Circuit recipients no longer setting DBE contract goals. Disparity studies require the compilation and in-depth analysis of large amounts of data; as a result, the studies are expensive and often take at least a year to conduct. Many smaller agencies therefore have chosen to rely only on race-neutral measures such as outreach and encouragement to prime contractors to meet their annual DBE goals. For larger agencies, such as state DOTs, some studies have failed to find sufficient evidence of discrimination and have recommended eliminating certain groups for credit toward DBE contract goals. Both approaches have diminished opportunities for DBEs.

### **Resource Allocation and Oversight**

In addition to uniformity, resources are essential to the effective administration of the U.S. DOT DBE program. Section 26.25 requires that recipients designate a DBE Liaison Officer (DBELO) who has direct, independent access to the agency head. The DBELO must implement all aspects of the DBE program. Additionally, the recipient must have “adequate” staff—a term that is left undefined—to administer the program.

In reality, many recipients are understaffed and

<sup>3</sup> The following jurisdictions are in the Ninth Circuit: Alaska, Arizona, California, Hawaii, Idaho, Montana, Nevada, Oregon, Washington State, Guam, and the Northern Mariana Islands.



The staff at New York’s Metropolitan Transit Authority available to assure DBE compliance is limited—only 20 of 500 active contracts were reviewed in 2013.

underfunded.<sup>4</sup> Although state DOTs generally have larger staffs to fulfill the requisite goal setting, contract compliance, counting, good-faith efforts, certification, record keeping, and reporting requirements, smaller recipients—including many airports and transit authorities—often employ only one or two individuals to discharge program responsibilities along with their other duties. Moreover, because the program only affects federal-aid contracts and because many recipients administer state and local civil rights and contracting programs as well, they often draw upon the same resources for functions

<sup>4</sup> A 2013 study undertaken by the U.S. DOT Office of the Inspector General found that 10 of 15 states randomly sampled did not have enough staff to perform these duties adequately.

beyond the scope of the federal DBE program.

In many cases, resource allocation seems to be weighted heavily toward the certification process and the initial certification time constraints in 49 C.F.R. Part 26 (5).<sup>5</sup> When this occurs, recipients may not have sufficient resources to devote to compliance monitoring and project oversight, increasing the likelihood of charges of arbitrary administration and DBE fraud.<sup>6</sup>

An effective way to strengthen postaward monitoring is to train and deploy contracting officers, inspectors, project management and oversight consultants, and other non-civil rights office personnel to assist with DBE compliance. Only when DBE program matters are integrated fully into the procurement and project management processes—and monitored with the same intensity as are costs and technical performance—will the program achieve its full potential. Leaving compliance solely to overstretched core civil rights staff does little to advance the program and sends the signal that compliance is not important.<sup>7</sup>

A 2013 report issued by the U.S. DOT Office of

<sup>5</sup> Initial DBE certification decisions must be made within 90 days of the date the certification application is deemed complete.

<sup>6</sup> OIG’s 2013 audit noted that weaknesses in Unified Certification Program certifications and project oversight were evident in its DBE fraud investigations.

<sup>7</sup> The preamble to the 1999 rule repeatedly refers to the administrative burden imposed on U.S. DOT recipients by the revamped DBE program. The attendant Paperwork Reduction Act memorializes U.S. DOT’s estimate of approximately 1.47 million annual burden-hours to recipients and contractors.



Contract crews pour concrete on a Rogue Valley Expressway overpass. Oregon is one of many states in which the DBE liaison does not directly oversee DBE compliance staff.

Regular dealer concerns—that is, concerns related to whether a DBE acts as a traditional dealer or middleman in the contract process—are among the challenges faced by the DBE program.

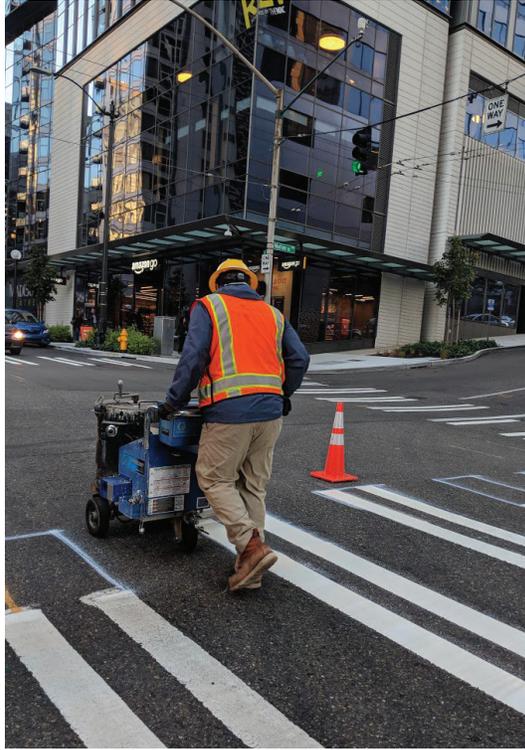


PHOTO: SOUTH DAKOTA DOT

the Inspector General (OIG) found that resource allocation is a widespread concern that can affect program integrity (7). One significant finding was that, although FHWA, FAA, and FTA are responsible for overseeing DBE recipients' programs, these administrations' oversight responsibilities are carried out inconsistently, allowing weak certification and contract oversight practices to go uncorrected. This may result partly from resource limitations at the federal level, as FTA and FAA regional civil rights officials must oversee a large number of recip-

Correct accounting of DBE participation, and counting of materials, is vital to the program's success.

ient programs, in addition to their other civil rights responsibilities.

In another important finding, the OIG report revealed that the states it visited did not adequately verify that firms applying for DBE certification met program eligibility requirements or that they continued to meet these requirements to maintain certification. OIG noted that many recipient agencies are woefully understaffed, contributing to weaknesses in certification and compliance monitoring.

Inadequate resources pose a challenge to administration of the U.S. DOT DBE program nationwide. The program fulfills a proven need to ensure a discrimination-free federal transportation marketplace, but program administration would benefit from more efforts by U.S. DOT recipients to add knowledgeable staff to their DBE programs.

## Counting and Crediting

One of the keys to continued success of the DBE program is proper counting and crediting of DBE participation. Counting participation is done on a contract-by-contract basis and is separate from certification. Under 49 C.F.R. Part 26, contractors may count toward their goals only the value of work actually performed by DBEs.

### Counting Challenges

Counting correctly can be a daunting task. One of the most vexing issues involves counting materials supplied by DBEs. "Furnish and install" contracts, in which a DBE will both obtain and install materials, often comprise a substantial portion of the contract price.

To get credit for materials purchased, the DBE must complete all of the following tasks: 1) negotiate the price; 2) determine quality and quantities; 3) order the material; and 4) install and pay for the material (8). Some recipients have denied DBE credit because a DBE failed to do one or more of these four tasks—even if non-DBE subcontractors may not typically do all four. In the DBE universe, activities that may be legitimate business practices in many contexts do not qualify for participation credit, and this can have the unintended consequence of limiting DBE opportunities and distorting the market for their services.

### Supplier and Regular Dealer Concerns

Recently, contractors and recipients have queried whether a DBE regular dealer must have a product or material physically in stock or whether the dealer might drop ship specialty items. In response to this inquiry, the U.S. DOT Office of General Counsel issued official institutional guidance in 2011 that

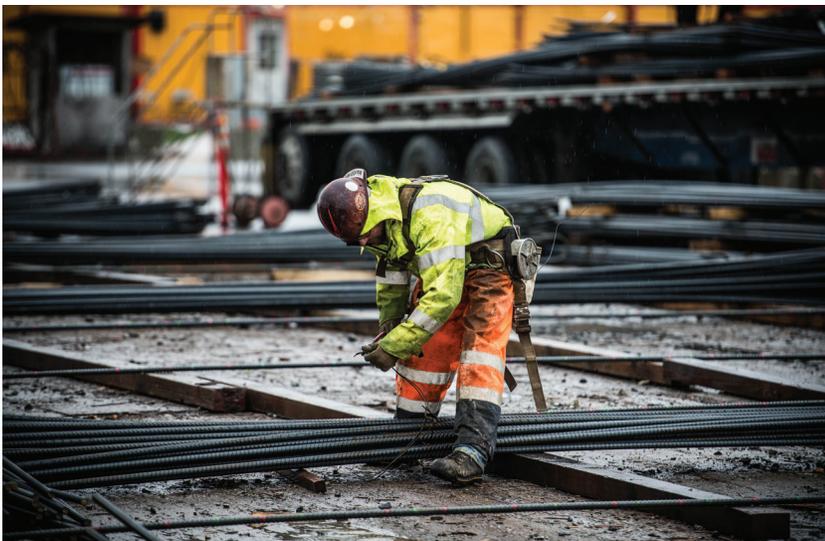


PHOTO: WASHINGTON STATE DOT

extenuating circumstances must exist—other than being out of stock—for the contractor to receive credit for the value of materials ordered by the DBE supplier. U.S. DOT does not recognize drop shipping as an activity that merits DBE credit.

The preamble to U.S. DOT's Part 26 amendments in 2014 invited comments about whether to change the regular dealer concept in light of modern business models, about the appropriate measure for the value added by a DBE that does not act as a traditional regular dealer or middleman in a transaction, and whether the policy considerations behind the regular dealer credit limitation of 60% influence a higher rate of use of DBEs as contractors (which receive 100% credit).

In response, U.S. DOT received more than 50 public comments. Many voiced the need for additional clarification of, or changes to, the terms used to describe regular dealers or middlemen. Others addressed the changing business environment, arguing that the best method of delivering supplies ordered from a non-DBE manufacturer is drop shipping rather than delivery by a regular dealer using its own trucks. These commentators opined that the requirement for an inventory or storefront is an outmoded concept that fails to reflect today's standard industry practices, with wholesalers and e-commerce businesses that do not require an inventory or a store open to the public.

Some respondents called for eliminating regular dealers and brokers from the rule. Others argued that any proposal to eliminate counting regular dealer participation toward contract goals would reduce the pool of ready, willing, and able DBEs. Some noted that U.S. DOT should keep the regular dealer concept but should consider increasing the counting percentage because of the value added by the services. Others suggested a complete overhaul of the regular provisions to recognize decades of change in the construction industry.

In response to these comments, U.S. DOT indicated that more analysis was needed. One question that must be answered is whether value is added by a DBE participant who simply arranges an electronic transaction to provide materials and supplies. If the answer is yes, what is the appropriate percentage for goal credit? Prime contractors often are understandably tempted to secure as much DBE credit as possible from supplies funneled through DBE vendors, so a major expansion of DBE credit for such transactions could reduce the amount of work available to other DBEs working as trade subcontractors markedly.

Under current rules and guidance, the regular dealer concept remains an issue, and recipients and



PHOTO: ARIZONA DOT

contractors alike must do their best to work within the confines of the current language. Moving forward, continuing discussion could result in change.

## Conclusion

Despite its complexity and its challenges, the DBE program is a viable tool to remediate the effects of past and current discrimination in federal transportation contracting. Like most programs, it stands to benefit from continual analysis and improvement.

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The DBE program has proved effective in mitigating the effects of discrimination in transportation contracting.



# Advancing Core Values

## *TRB's Inclusion and Diversity Initiative*

KAREN FEBEY

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Although TRB has a long history of working toward inclusion, new efforts focus on increasing diversity in organizational culture.

**I**ncreasing diversity and ensuring inclusion are essential to the Transportation Research Board's (TRB's) continued success. Because of this, TRB has a long history promoting inclusion and diversity among its staff, 8,000-plus volunteers, research portfolio, contractors, and Annual Meeting activities. For many years, staff from the Board's Cooperative Research Programs (CRP), Consensus and Advisory Studies Division, Technical Activities Division, and the TRB Division Committee and from the volunteer Technical Activities Council have focused on increasing diversity, especially in the selection of members for CRP project panels, consensus and advisory studies committees, and standing committees. In addition, CRP staff have given particular consideration to disadvantaged business enterprises when evaluating requests for proposal from contractors for research teams.



Oregon Department of Transportation employees participate in a state diversity conference. Diversity in transportation organizations helps ensure that research accurately addresses the needs of the community.



A National Cooperative Highway Research Program panel meeting. TRB's selection of committee members strives to incorporate a wide range of backgrounds and viewpoints.

But TRB Executive Director Neil Pedersen thought the Board could do better and wished to ensure that inclusion and diversity became part of the organizational culture by formalizing and building on the practices that staff and volunteers were already doing. Pedersen also wanted to identify other actions that staff and volunteers could take to ensure that TRB has the broadest possible array of perspectives and opinions on its committees and panels, contractors, staff, and programs and activities. He hoped to promote a focus on inclusion and diversity, believing that an inclusive environment is necessary for diversity to be successful.

### Inclusion and Diversity Task Force

These efforts are in line with what organizations large and small around the world are discovering: that a culture of inclusion and diversity is highly correlated with better decision-making, higher employee engagement, and improved innovation. For instance, research has found strong correlations between the extent to which for-profit companies prioritize innovation and diversity and the extent to which the companies grow and achieve financial gains (1).

TRB's Inclusion and Diversity Initiative began with a task force, chaired by



PHOTO: RISSON PHOTOGRAPHY

Nathaniel Ford chaired the task force for TRB's Inclusion and Diversity Initiative.

Nathaniel Ford, CEO of the Jacksonville Transportation Authority. The group first met at the 2017 TRB Annual Meeting, to fulfill the following mission:

To facilitate making diverse and inclusive involvement a core value for TRB staff, volunteers, contract awardees, projects, and the transportation communities TRB serves. A diverse and inclusive culture will enhance the mission of TRB because it will increase innovation and creativity.

#### Defining Inclusion

The task force started by articulating a definition of inclusion and diversity. Inclusion refers to an environment in which all individuals and groups are valued, respected, and supported as they contribute to the mission and success of a community. In an inclusive environment, all team members are heard and feel safe to propose new ideas; furthermore, credit for success is shared, actionable feedback is given, and feedback is implemented (2).

#### Defining Diversity

Diversity is defined as the variety of experiences, cultures, or physical attributes that influence the interactions within a community—including but not limited to race, ethnicity, language, sexual orientation, age, culture, socioeconomic status, gender, religion, perspective, disability, and experience. Task force members were fully aware that they would not be able to measure certain aspects of diversity included in this definition, but wanted to convey a

A 2018 NCHRP Synthesis of Practice panel meeting. Research shows that a person considers an idea more deeply if it is shared by someone who looks different from them.



view of diversity that was much broader than a limited number of physical traits.

This definition of diversity is consistent with two-dimensional, or 2-D, diversity, which encompasses both inherent and acquired characteristics. Inherent characteristics are those that people are born with—race, ethnicity, and sexual orientation. Acquired characteristics are traits gained from experience or environments—language, culture, and education (2). When combined in a work environment or other working group, both aspects of diversity allow the group to reap its positive benefits. This is best understood through the concept of informational diversity, which posits that when groups come together, individual members who come from different backgrounds bring unique information, opinions, and perspectives to the task at hand.

Research has found that when people hear opposing viewpoints from someone who looks different from them, it provokes more consideration

than the same viewpoint from someone who looks like them (3).

## Strategies and Action Items

After its first meeting, the task force broke into four workgroups to develop strategies and action items. These workgroups met over a span of 8–10 months to develop and refine their strategies and proposed actions. The groups then developed the Inclusion and Diversity Strategic Plan, approved by the TRB Executive Committee at its January 2018 meeting. The seven strategies are as follows:

- ◆ **Strategy 1.** Identify practices for committee and panel chairs and TRB staff that highlight strategies and resources used to recruit, welcome, and actively involve a more diverse committee and panel membership.

- ◆ **Strategy 2.** Engage with other transportation-related organizations to increase their members' awareness of and participation in TRB.

- ◆ **Strategy 3.** Find new ways for attendees of the TRB Annual Meeting and specialty conferences to network and to feel included and welcome.

- ◆ **Strategy 4.** Identify resources for staff and for the contracting office to minimize barriers to greater diversity among TRB contractors.

- ◆ **Strategy 5.** Identify and minimize barriers to achieving greater TRB staff inclusion and diversity.

- ◆ **Strategy 6.** Ensure that inclusion and diversity—and issues of equity, civil rights, and workforce development—are addressed through technical activities and other projects.

- ◆ **Strategy 7.** Improve existing data, information, and communication mechanisms to support all strategies.

TRB Executive Director Neil Pedersen welcomes Minority Fellows to the 2018 Annual Meeting.



PHOTO: RISSON PHOTOGRAPHY



TRB hopes to create a culture of inclusion and diversity through the active implementation of its strategic plan.

TRB’s Inclusion and Diversity Strategic Plan is designed to apply to anyone involved with TRB—as a volunteer on a committee or panel, staff member, counterpart organization, Annual Meeting attendee, CRP research project contractor, or a user of the Board’s publications. The plan also is designed to reflect TRB’s collaborative relationships, through memoranda of understanding with such organizations as the Women’s Transportation Seminar and the Conference of Minority Transportation Officials.

With the strategic plan in place, a Special Committee on Inclusion and Diversity was formed to oversee implementation, along with TRB staff (see box, at right). The Special Committee’s work is complemented by a parallel effort within the National Academies of Sciences, Engineering, and Medicine to diversify boards, committees, reviewer slates, panels, and its own policy and practices.

The Academies’ efforts, like TRB’s, are based on the “policy objective of broadening the participation of qualified candidates from across different groups that might otherwise be underrepresented... [because]... greater diversity contributes to more robust committee deliberations by ensuring that important issues are not overlooked or underemphasized” (4). TRB employees are involved with these overarching efforts and seek opportunities for coordination. Action items in the strategic plan reflect these concerns and any concerns and initiatives of the future.

As the Special Committee moves forward, it seeks to ensure that the strategic plan is a living document and that inclusion and diversity become part of TRB culture. The committee will continue to monitor in-progress and planned action items and to

consider feasible metrics and actions. TRB staff will look to Special Committee members for advice on organizational changes needed for successful implementation, given their broad experience in inclusion- and diversity-related initiatives.

For more information, see [www.trb.org/abouttrb/strategicplan1.aspx](http://www.trb.org/abouttrb/strategicplan1.aspx).

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3. Phillips, K. W. How Diversity Makes Us Smarter. *Scientific American*, Oct. 2014.
4. *Improving the National Research Council’s Study and Administrative Processes: An Independent Review*. National Academy of Public Administration, 2017.

**Special Committee on Inclusion and Diversity**

- Carol Lewis**, Texas Southern University, *Chair*
- Tanisha Hall**, Tennessee Department of Transportation
- Susan Hanson**, Clark University
- Chris Hendrickson**, Carnegie Mellon University
- Rosemarie Merrigan**, Minnesota Department of Transportation
- Hyun-A Park**, Spy Pond Partners, LLC
- Andrew Braham**, University of Arkansas (associate member)

# Designing Safety Regulations for High-Hazard Industries

THOMAS R. MENZIES, JR.

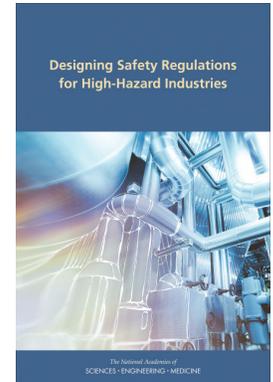
*The author is Director, Consensus and Advisory Studies Division, Transportation Research Board, National Academies of Sciences, Engineering, and Medicine, Washington, D.C., and served as study director for this project.*

Governments have long regulated the safety of industries engaged in hazardous activities. The goal of safety regulation is to ensure that industries can continue to provide their vital goods and services without imposing undue risk of harm to workers, the public, and the environment. How can regulatory officials best design their regulations to achieve this goal? Various regulatory designs offer different advantages and disadvantages, depending on the circumstances under which they are applied.

To make smart decisions, regulators need a clear conceptual framework for design options and about the conditions under which different designs will work best. Such a framework can be found in Special Report 324, *Designing Safety Regulations for High-Hazard Industries*, issued by the Transportation Research Board (TRB) of the National Academies of Sciences, Engineering, and Medicine.

The U.S. Pipeline and Hazardous Materials Safety Administration (PHMSA) asked TRB to examine key factors for government safety regulators as they choose among regulatory designs. PHMSA was particularly interested in regulations to prevent low-frequency, high-consequence events. These types of safety regulations often are scrutinized after an incident occurs, but the effectiveness of the regulations is inherently difficult to assess as their main purpose is to reduce catastrophic failures that are rare to begin with.

Although safety regulations cannot prevent all harmful incidents, regulators must have confidence that the regulatory designs they choose are well-suited to their particular circumstances. Regulators also must be able to provide a reasoned basis for their choices to policymakers and members of the public.



TRB Special Report 324, *Designing Safety Regulations for High-Hazard Industries*, is available from National Academies Press at [www.nap.edu/catalog/24907/designing-safety-regulations-for-high-hazard-industries](http://www.nap.edu/catalog/24907/designing-safety-regulations-for-high-hazard-industries); to view information about the book, visit [www.trb.org/Main/Blurbs/176637.aspx](http://www.trb.org/Main/Blurbs/176637.aspx).



PHOTO: BLEIFINGER SE, FLICKR

## Regulatory Design

Regulators can design their regulations in several ways. One way is to focus on the point at which the regulation intervenes in a causal chain leading to the ultimate catastrophic risk. For example, regulations can target at the micro level by imposing requirements on firms to address specific risk contribution factors and can regulate at the macro level by focusing requirements less on individual risk factors and more on mitigating overall risk.

In addition to having a micro- or macro-level emphasis, regulations also can be designed to specify either the means used or the ends achieved by firms. This suggests four basic regulatory design types: micro-means, micro-ends, macro-means, and macro-ends. The study committee's work was motivated by growing interest in macro-means regulations; that is, regulations that require firms to establish management systems to identify, prioritize, and mitigate their safety risks.

Often contrasted with prescriptive, or micro-means, regulations—and sometimes mislabeled as performance-based—management regulations have a macro-means design. These regulations require firms to use a management system to address overall risk—that is, at a macro level. Under this regulatory design, firms are required to develop internal plans and manage organizational- and system-level processes that focus managers' attention on catastrophic risk.

Notably, these management regulations do not require firms to achieve specified performance outcomes, such as a demonstrable reduction in the risk of major incidents. Such outcomes are difficult to demonstrate when regulations are intended to prevent catastrophic failures, given their complexity and rare occurrence.

The study committee reviewed academic research and case studies of the regulatory regimes in four countries governing two high-hazard industries. Special Report 324 concludes that macro-means regulations can serve a valuable purpose by addressing risks that are complex and context-specific, as is characteristic of low-frequency, high-consequence events. How well these regulations serve this purpose, however, will depend on many factors, including details of how the regulation is structured; the regulator's capability to support and motivate compliance; and the capacity of regulated firms to plan, assess, and act in ways that fulfill the purpose of the regulation.

Any decision to use macro-means regulation must consider the regulator's own ability to enforce and motivate compliance via such methods as auditing and field inspections and should take into account



PHOTO: BUREAU OF SAFETY AND ENVIRONMENTAL ENFORCEMENT, FLICKR

the capacity of regulated entities to meet their obligations. If these preconditions are missing or cannot be created, regulators should be concerned that this management style of regulation will be less effective than desired.

For many years, regulatory professionals have placed too much emphasis on ambiguous, often misleading labels such as “performance-based” and “prescriptive” and have gravitated toward simplistic lists of generic advantages and disadvantages of regulatory design types. Only by clarifying design concepts and explaining how specific circumstances can affect the advantages and disadvantages of each design can regulators of high-hazard industries make better regulatory choices.

Safety regulators from the Bureau of Safety and Environmental Enforcement inspect an offshore oil rig.

## Committee for a Study of Performance-Based Safety Regulation

**Detlof von Winterfeldt**, University of Southern California, *Chair*

**Kenneth E. (Ken) Arnold (NAE)**, K Arnold Consulting, Inc.

**Cary Coglianese**, University of Pennsylvania

**Louis Anthony (Tony) Cox, Jr. (NAE)**, Cox Associates, LLC

**Lois N. Epstein**, Wilderness Society

**Robin L. Dillon-Merrill**, Georgetown University, Washington, D.C.

**Orville D. Harris**, O.B. Harris, LLC

**L. Robin Keller**, University of California, Irvine

**Allison M. Macfarlane**, Nuclear Regulatory Commission

**Rachel McCann**, Health and Safety Executive, United Kingdom

**Arthur D. Meyer**, Enbridge Pipeline

**Donald P. Moynihan**, University of Wisconsin–Madison

**Susan S. Silbey**, Massachusetts Institute of Technology

**James A. Watson IV**, U.S. Coast Guard, American Bureau of Shipping

# Research Offers Insights on Highway Noise

ANN M. HARTELL, KEN KALISKI, DARLENE REITER, BILL BOWLBY, ROGER WAYSON, AND JUDY ROCHAT

Hartell is Senior Program Officer, Cooperative Research Programs, Transportation Research Board, National Academies of Sciences, Engineering, and Medicine, Washington, D.C.; Kaliski is Senior Director, RSG, White River Junction, Vermont; Reiter is President and Bowlby is Principal Engineer, Bowlby & Associates, Nashville, Tennessee; Wayson is Research Engineer, AECOM, Cottonwood Shores, Texas; and Rochat is Principal Associate, Cross Spectrum Acoustics, Rancho Palos Verdes, California.

When state departments of transportation (DOTs) propose projects to build new roadways or to expand existing facilities, nearby residents and communities often raise concern about traffic noise. Traffic noise can negatively affect human health and quality of life—interfering with concentration and speech perception, affecting sleep, increasing stress levels, and reducing the quality of outdoor spaces such as yards and patios. These effects have led to long-standing regulations, policies, and guidelines on traffic noise.

Since the Federal-Aid Highway Act of 1970, state DOTs have been required to assess the anticipated noise effects of proposed new highways and projects that add lanes or substantially alter the alignment of an existing highway. If an analysis demonstrates that a project will exceed established noise thresholds, state DOTs must incorporate feasible, reasonable noise abatement into the project. As required by the Federal Highway Administration (FHWA), all state DOTs have developed or updated their policies and guidance related to traffic noise (1). These policies and guidelines describe the agencies' approaches to addressing noise effects, including when a noise wall is an appropriate mitigation strategy. In total, state



PHOTO: GILIE RHODES, FUJIK

Weather conditions like wind, cloud cover, humidity, and temperature gradients can affect traffic noise—even in communities far from roads.

DOTs have constructed more than 3,000 miles of noise barriers.

Despite these efforts, however, state DOTs continue to receive complaints from communities about traffic noise—in some cases even after a barrier has been constructed. Sometimes complaints of increased traffic noise come from communities on the opposite side of the road from where a noise



PHOTO: VIRGINIA DOT

Sound walls are erected near a Virginia neighborhood. Recent Cooperative Research Program research reports analyze various impacts on traffic noise and the effectiveness of noise barriers.

barrier has been constructed. In other cases, communities located far from the roadway have reported increased traffic noise under certain weather conditions.

Are such complaints warranted? Do they point to gaps in common noise assessment methods that may not fully account for factors that affect traffic noise? Are there ways to improve noise assessment methods to better predict potential noise impacts and abatement effectiveness?

Two recently published National Cooperative Highway Research Program (NCHRP) research reports provide new insights for noise specialists, project designers, and policy and decision makers. The reports are accompanied by technical tools to help agencies more effectively consider site-specific characteristics affecting the propagation of traffic noise. Additional materials present the research results in a format for public outreach and for communicating with decision makers.

### Weather Effects on the Propagation of Traffic Noise

*NCHRP Research Report 882: How Weather Affects the Noise You Hear from Highways* explores how wind and temperature gradients can alter the way traffic noise propagates from a roadway. The research team—led by RSG, with support from Bowlby & Associates, TNO, Wyle, Northeast Wind, and the U.S. DOT Volpe National Transportation Systems Center—collected extensive sound and meteorological data from two field locations adjacent to Interstate 17 outside Phoenix, Arizona, one with a noise barrier and one without.

Each location was instrumented with an array of microphones located strategically to capture how sound levels vary with distance from the roadway under different meteorological conditions. These data were combined with traffic data, including vehicle volume, mix, and speed, provided by Arizona DOT. Local data on cloud cover, humidity,



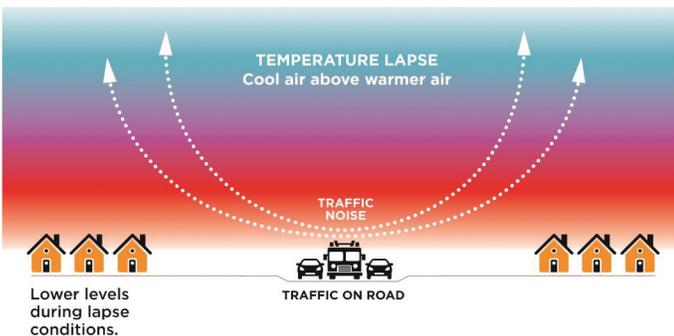
Microphones in the field for NCHRP Project 25-52, Meteorological Effects on Roadway Noise, whose results are documented in NCHRP Research Report 882.

temperature, and wind were compiled from the nearby airport, on-location meteorological towers, and upper-air wind and temperature profilers. In total, data for more than 35,000 5-minute periods were collected from the microphones.

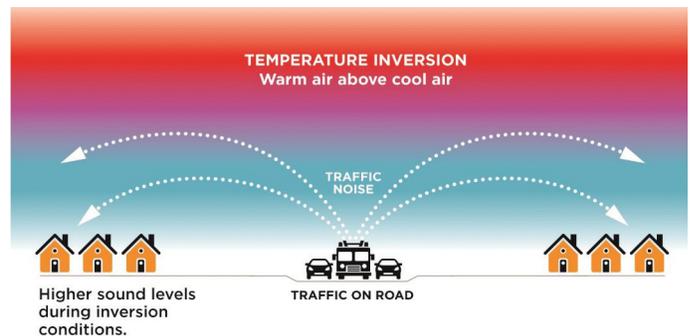
#### Temperature Inversion Effects

These measurements revealed that, on most nights, the two sites experienced inversions, or conditions in which the air temperature near the ground is lower than the temperature higher up. This allowed the research team to compare how traffic noise in these inversion conditions propagates compared with normal, or “lapse,” conditions—those in which the air close to the ground is warmer than the air higher up.

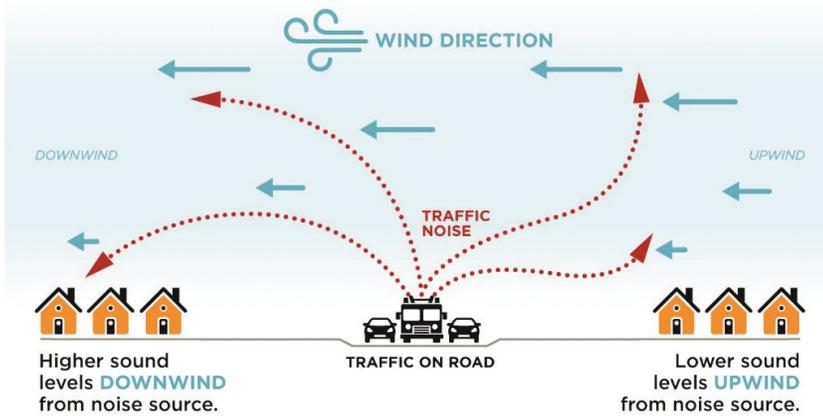
**FIGURE 1** Traffic noise propagation affected by (a) temperature lapse conditions and (b) temperature inversion conditions.



(a)



(b)



**FIGURE 2** Wind effects on highway traffic noise.

In normal lapse conditions, sound was refracted upward, reducing traffic noise levels relative to neutral conditions for communities next to the highway; in inversion conditions, sound was refracted downward and this tended to increase traffic noise levels within a specific distance from the road (see Figure 1, page 25). Inversion conditions also affected the effectiveness of the noise barrier, as sound was refracted downwards after passing above the barrier.

### Wind Effects

Researchers also investigated the effects of wind (see Figure 2, above). The data revealed that sound levels increased when the wind blew toward the microphones from the direction of the highway and when wind speeds increased with distance from the ground, which is a common occurrence. In these conditions, sound is refracted toward the ground in the downwind direction by the higher, faster wind speeds. The opposite effect occurred in the upwind direction, where sound was refracted upwards, forming a shadow zone of reduced sound levels.

Although afternoon rush hours traditionally produce the highest levels of traffic noise, temperature inversion can cause worse noise at lighter traffic hours.

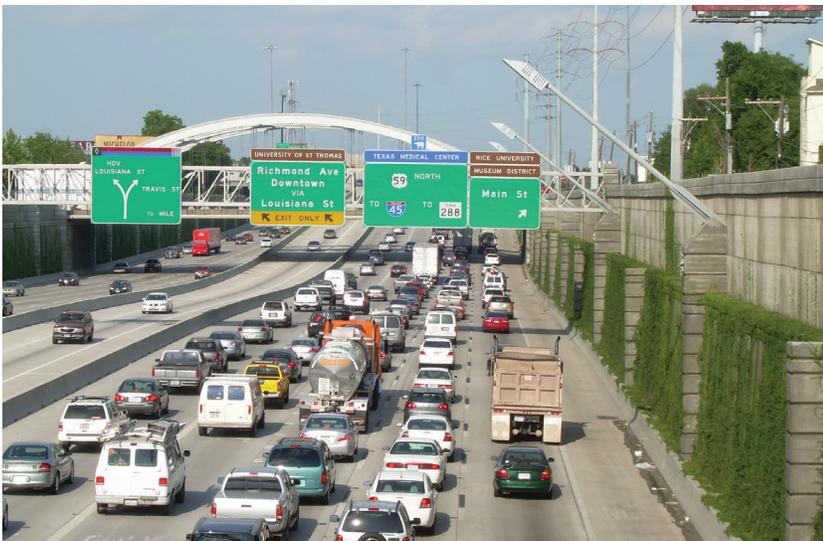


PHOTO: JAMES FREMONT, FLICKR

### Noise Abatement and Weather

For transportation agencies in the United States, FHWA requires its Traffic Noise Model to be utilized when predicting traffic noise impacts. The model does not incorporate the bending, or refraction, of sound rays caused by temperature and wind gradients and therefore may over- or underpredict noise effects under different weather conditions, leading to important implications for state DOTs that must identify impacts and evaluate the feasibility and reasonableness of noise barriers.

Results of the research in NCHRP Research Report 882 indicate that traffic noise levels and impacts generally would decrease under upwind and lapse conditions—possibly resulting in a finding that abatement measures are not feasible or reasonable. Conversely, noise levels and impacts generally would increase under downwind and inversion conditions, although the results indicate that barriers may still be feasible and reasonable under these conditions.

The consideration of meteorological effects also could affect the determination of the worst traffic noise hour; that is, the hour used by state DOTs in evaluations of noise abatement. For example, the afternoon peak hour at a certain location may have the highest traffic noise levels as modeled under acoustically neutral conditions—but when the potential for temperature inversions or wind conditions is considered, traffic noise levels may be highest during other times, even if traffic volumes are lower.

### Outreach and Analysis Tools

NCHRP Research Report 882 is accompanied by a spreadsheet-based tool that helps noise analysts at state DOTs better understand the impact of these meteorological effects for specific locations. The Sound Speed Profiler Tool uses output from a U.S. Environmental Protection Agency preprocessor of National Weather Service meteorological data to calculate how often sites would be subject to favorable or unfavorable weather conditions.

To help transportation agencies communicate research results, researchers also developed outreach materials in two formats: 1) a customizable pamphlet suitable for print distribution or online publication with colorful, clear graphics that succinctly present the main concepts from the study; and 2) an interactive presentation offering greater detail about the research and results. The interactive presentation “Why Is It So Loud Today?” includes audio files that allow users to compare traffic noise under different meteorological conditions and can be used online, at public outreach events, or for state DOT staff training.

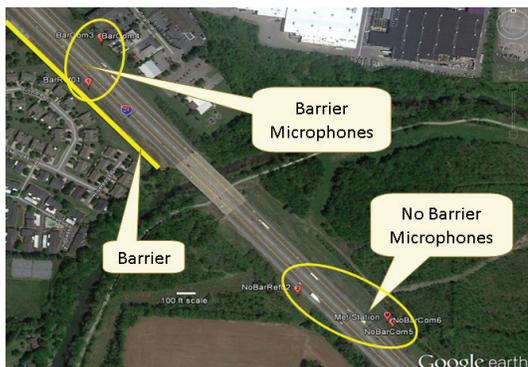
The research, results, and related resources presented in NCHRP Research Report 882 will better equip state DOT noise specialists and colleagues to assess the anticipated noise effects of projects and to communicate with stakeholders about the effects of weather and the potential benefits—and limitations—of any noise abatement.

## Sound Barrier Noise Reflection

It is not unusual for state DOTs to receive complaints from communities located across the roadway from noise barrier walls. These residents claim that, although their neighbors behind the barrier have received a noise-reduction benefit, they experience increased levels of traffic noise.

*NCHRP Research Report 886: Field Evaluation of Reflected Noise from a Single Noise Barrier* investigates how noise barriers on one side of a highway reflect sound and can increase perceived effects on the opposite side of the roadway where there is no noise barrier. Jointly funded by the American Association of State Highway and Transportation Officials and FHWA, the research was conducted by a team led by RSG, with key researchers from Bowlby & Associates, ATS Consulting, Environmental Acoustics—Gannett Fleming, and Sanchez Industrial Design.

The study compares sound reflected from two types of noise barriers: sound-reflective barriers and sound-absorptive barriers. Sound-absorptive barriers are barriers with a special facing on the roadway side, such as boards of mineralized wood shavings or rubber crumb, or perforations backed by fiberglass or rock mineral wool batting. These barriers generally are found to reduce reflected noise across the road by 1–2 dB, although they can increase project and maintenance costs. Sound-absorptive barriers have been deployed widely—from 2011 to 2013, 30% of sound barriers constructed by state DOTs were sound-absorptive barriers.

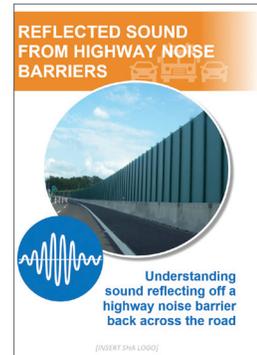


**FIGURE 3** Typical layout at data collection site as seen in NCHRP Research Report 886.

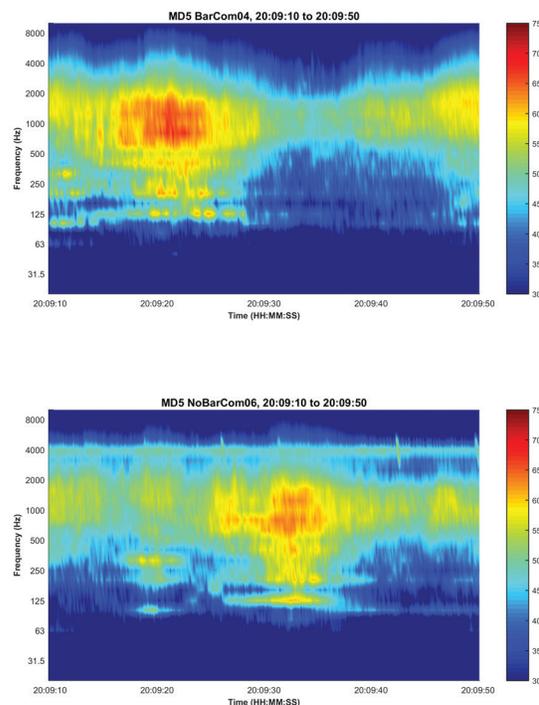
## Reflected Noise

NCHRP Research Report 886 explores not only the level of sound reflected from noise barriers, but also the characteristics of reflected traffic noise. Data for the study were collected from eight field sites: five locations with sound-reflecting barriers in Tennessee, Illinois, California, and Maryland; and three locations with sound-absorptive barriers in Ohio. Each site was instrumented to collect sound data at multiple locations, both across from the barrier and down the road at a location with no barriers (Figure 3, below, left). Meteorological data, traffic speeds, and video for traffic counts also were collected.

For its analysis, the research team studied differences between the barrier and no-barrier sites in different meteorological conditions. The sound data were visualized using spectrograms and difference spectrograms (Figure 4, below). Spectrograms are plots that use color shading to display the amplitude and frequency content of sound over a specified period of time. Difference spectrograms compare



A customizable pamphlet for use by state transportation agencies accompanies NCHRP Research Report 886.



**FIGURE 4** Spectrograms of the same vehicle passing (a) opposite the barrier and (b) at the “no barrier” site.

Sound barriers go up along a Mercer Island highway in Washington State. Research shows sound barriers can create their own unique noise for nearby residents.



PHOTO: SOUNDTRANSPORT, FLICKR

sound between two sites—one with a barrier and one without—to isolate the differences that likely are attributable to the presence of the barrier.

For sound-reflective barriers, the analysis revealed a general pattern of slightly increased sound levels from sites with a reflective noise barrier compared with no-barrier sites along the same roadway. Sound levels at the barrier site also tended to rise as the distance from the roadway increased, measured out to 400 feet.

Of particular interest was a finding that sound reflections off the barrier caused the sound heard on the opposite side of the highway to be sustained for a longer time than at the no-barrier site. Sustained sound from vehicle pass-by events reduces the time that the sound level can drop off between events—resulting in an effective increase in the background traffic noise level. Although the results at locations with sound-absorptive barriers revealed somewhat similar increases in overall sound levels across the roadway as for the sound-reflecting barriers, these barriers did not appear to produce the lengthening effect of sound from individual vehicles passing by.

### **Comb Filtering**

Further exploring these results, the research team discovered the presence of an audio effect called “comb filtering” at the sound-reflecting barrier sites. In comb filtering, the reflected sound and direct sound combine; to the human ear, this combination has a slightly raspy, buzzy quality that was not observed at the sites without a barrier.

Overall, the results provide insights into why residents on one side of a road may perceive increases in traffic noise after the construction of a noise barrier on the opposite side of the road. The research reveals that, although traffic noise opposite the barrier can be slightly louder, it is the difference in character and the sustained sound that may be responsible for that negative perception. Sound-absorptive barriers reduce the reflection of sound waves and thus can reduce bothersome effects for people living across the roadway from a noise barrier.

### **Outreach and Analysis Tools**

A spreadsheet-based screening tool is included to help analysts estimate noise increases from sound reflected from a barrier. These estimates can be used to determine whether and where a more detailed study of reflected noise may be warranted and whether strategies to reduce reflected noise should be considered.

NCHRP Research Report 886 is accompanied by a customizable bifold pamphlet that uses clear graphics and straightforward language to explain the basic concepts of noise barriers, their function, and how they can reflect traffic noise across a roadway.

### **Reference**

1. Federal Highway Administration, U.S. Department of Transportation. *Procedures for Abatement of Highway Traffic Noise and Construction Noise*. Final rule. 23 CFR, Part 772, 1997.



PHOTO: JAGUAR MENA, FLICKR

# Preparing for Shared Mobility and Automated Vehicles

*Symposium and TRB Forum Chart a Course for Research*

KATHERINE KORTUM

*The author is Senior Program Officer, Consensus and Advisory Studies Division, Transportation Research Board, National Academies of Sciences, Engineering, and Medicine, Washington, D.C.*

As automated vehicles (AVs) move from concept to deployment, transportation and technology experts must define priorities and needs.

Automated vehicles (AVs), shared mobility services, and other transformational transportation technologies can dramatically increase safety, reduce congestion, improve access, enhance sustainability, and spur economic development. Success meeting these goals is not assured, however—and deploying these technologies may have unintended consequences.

To facilitate the evidence-based research needed on new transportation technologies and on how and when the technologies can most efficiently meet long-term goals, the Transportation Research Board (TRB) of the National Academies of Sciences, Engineering, and Medicine launched the Forum on Preparing for Automated Vehicles and Shared Mobility in early 2018. The Forum's most recent meeting took place at the 2018 Automated Vehicle Symposium

(AVS), cosponsored by TRB and the Association for Unmanned Vehicle Systems International, in July in San Francisco, California.

## Forum on Preparing for Automated Vehicles and Shared Mobility

### Research Priorities

Members of the Forum met in person at AVS to define their top 10 research priorities and sponsored a breakout session to review this list and solicit feedback from attendees. Audience members also voted on their own set of priorities.

Greg Winfree and Peter Sweatman, two of the Forum's three co-chairs, described the group's activities. Sweatman led a discussion of the top 10 research priorities:



Members of the Forum on Preparing for Automated Vehicles and Shared Mobility met in San Francisco, California, in July at the 2018 Automated Vehicle Symposium.

1. Models for data sharing,
2. Potential safety scenarios for the transition to highly automated vehicles,
3. State and local policies to ensure safety before deployment,
4. Ways to facilitate infrastructure for AVs and shared mobility,
5. Opportunities to mitigate the negative social impacts of AV deployment and shared mobility,
6. Ways to address social inclusion and equity concerns,
7. Impacts of higher-level automated vehicles and shared mobility on traveler behavior and freight movement,
8. Impacts of shared mobility on transit and vice versa,
9. Implications for transportation planning and planning models, and
10. Impacts of AVs and shared mobility on land use and vice versa.

Each of these topic areas includes several related questions. In the coming months, Forum members will refine these research needs and seek to work with organizations that already are considering some of these questions.

**Panel Discussion**

In a panel discussion during the Forum-sponsored AVS breakout session, Reema Griffith of the Washington State Transportation Commission agreed generally with the priorities but felt that sustainable finance questions were missing from the list. She added that the public should be included along with experts and research. Representing both the Virginia Department of Transportation (DOT) and the Virginia Transportation Research Council, Catherine McGhee emphasized the need to accommodate both urban and rural settings and urged researchers to influence the development of shared mobility and AVs rather than merely accommodating it.

Chandra Bhat, University of Texas at Austin, commented that it was gratifying to see so many sectors working together and suggested that future action focus on the use of time and quality-of-life considerations. King Gee, American Association of State Highway and Transportation Officials (AASHTO), described the states as 50 “living laboratories” for AVs and called for a third Strategic Highway Research Program to address these issues.

When TRB Executive Director Neil Pedersen opened the discussion, audience members brought up a variety of topics, including differing viewpoints on the ability of highly automated vehicles to operate seamlessly in mixed traffic. Some participants believed that insurance companies, pricing, and market forces could drive the adoption of AVs; others believed that consumers would drive the adoption



Breakout sessions and panel discussions allowed Forum members to choose and refine AV research priorities for the coming year.



TRB Executive Director Neil Pedersen gave opening remarks at an AVS panel discussion, generating lively and varied input from attendees.

of AV technologies, noting that alternative-fuel vehicles still make up less than 4% of new-vehicle sales despite high-level promotions and incentives.

A great deal of discussion focused on education, with general audience consensus that the list of top research priorities should have included educating policy makers and the public. Direct exposure to AVs, as well as the chance to ride in AVs or in shared vehicles, may help address many people’s fear of change, participants noted.

Booz Allen Hamilton, the contractor for a parallel National Cooperative Highway Research Program project, conducted an audience poll on priorities and how these priorities compare with those outlined by the Forum. Priority options were grouped into categories: safety, systems, social and environmental, data, and cross-cutting issues. Safety and data-sharing models were a top priority of both the

attendees of the panel discussion and of Forum members, but research questions about travel behavior, societal impacts, and education had a stronger showing among discussion participants. Forum members placed an overall higher emphasis on applied research.

Discussion participants suggested that the members of the forum should consider how to transition from AV research to education to deployment, and called for additional international collaboration on both research and standards.

## Strategic Questions

In addition to specific research priorities, the Forum posed four overarching, strategic questions for researchers and practitioners:

- ◆ What can be done to build awareness across a broader spectrum of people of the potentially transformational societal impacts of AVs?
- ◆ What options are available to generate and fund a significant strategic research effort or program informing policy decisions?
- ◆ How can existing research programs be leveraged most effectively?
- ◆ What new approaches to conventional research processes should be considered?

These questions will be a focus of the Forum’s future activities and informed the list of highest-priority research needs. Forum members will continue to refine the list of priority research questions and will prepare research problem statements. Future work products may include white papers, working groups, and structures for information sharing.<sup>1</sup>

<sup>1</sup> For more information, visit [www.trb.org/AVSMforum](http://www.trb.org/AVSMforum).



PHOTO: AUTOMOTIVE RHYTHMS, FLICKR

Forum members debated how best to drive the adoption of AVs, noting that alternative-fuel vehicle ownership has not exploded, despite promotion and incentives.



U.S. Secretary of Transportation Elaine Chao delivered the keynote address to approximately 1,700 attendees of the 2018 AVS.

## 2018 Automated Vehicle Symposium

The Forum held its summer 2018 meeting in conjunction with the AVS because of the strong synergies between the Forum's goals and those of AVS attendees. Held July 9–12, the 2018 AVS provided an opportunity for communication, collaboration, and information sharing on a wide range of topics: public policy, safety and security, ethics, equity concerns, and technology innovations and applications. The symposium featured a keynote address from U.S. Secretary of Transportation Elaine Chao, presentations on current projects and programs, 35 breakout sessions, 75 poster sessions, and ancillary meetings, and attracted approximately 1,700 participants from the United States and abroad. The growth in attendance from 2013 to 2018 reflects the increased interest in connected and automated vehicles (CAVs)—approximately 250 people attended the first symposium in 2013.

### State of Research

In general, presenters noted that most of the near-term challenges are not necessarily technical ones, but are associated more with user interactions and systems impacts. Human interaction with AVs is a key area of testing and research. Options for training drivers on AV capabilities are being studied, with much of the current research on driver monitoring focusing on nausea and other physiological responses to riding in an AV.

Human behavior research also is under way on how humans outside of the vehicle are able to understand what a vehicle is doing next. Planning and travel behavior models also will need to accommodate AV technologies; metropolitan planning organizations and travel planners work to understand the impacts of automated vehicles on how people make their mobility decisions compared with options from traditional modes of transportation.

Research challenges facing AVs are not just technical—human reaction and training also need to be studied.



### Anticipated Issues

Sensors and detection tools are critical in AV deployment, panelists observed. In terms of how the technologies detect the surrounding driving environment, consistency and logical application of the technologies may be more important than compliance concerns. Navigation in adverse weather requires independent, complementary sensors, which can include conventional video, radar, lidar, thermal imaging, or ultrasonic sensors. States that have implemented real-time kinematic systems throughout the state dramatically improve the accuracy of global navigation satellite system localization systems.

Freight operations may be one of the first industries in which significant automation takes hold. Platooning within a company or fleet—considered to fall within Levels 1 and 2 of the SAE International levels of driving automation—is being tested in field trials in both the European Union and United States; these trials demonstrate business models in revenue-producing operations.<sup>2</sup> Low-speed Level 4 automation, for trailer switching and drayage, also is being tested.

Longer-term testing plans include multifleet and multibrand platooning opportunities, as well as level 4 highway operations, which represent the strongest business case for automated technology applications.

Safety and security issues related to AVs are a concern for many members of the public, speakers noted. To address these concerns, AVs will need misbehavior detection systems for safety and security purposes, perhaps following the National Institute of Standards and Technology cybersecurity framework as an example. Crash and incident data must also be standardized: currently, different roadway designs, traffic laws, traffic protocols, traffic density, and more make crash reporting quite variable. Two of the priority-use cases for data exchange include work zone safety and cybersecurity protections.

Symposium participants expressed hope that AVs can usher in a less energy-intensive transportation system. Shared, automated, and electric fleets, however, will not alone help the United States meet any worldwide greenhouse gas targets. Energy-related policy questions include those related to electrification, including for trucks; right-sizing of vehicles and fleets; credit-based congestion pricing; carbon taxes; and renewable energy sources. Emission and health implications of CAV electrification across different types of power grids also must be addressed.

<sup>2</sup> The SAE International Levels of Driving Automation are as follows: Level 0—no automation; Level 1—driver assistance; Level 2—partial automation; Level 3—conditional automation; Level 4—high automation; Level 5—full automation.



Poster sessions at AVS offered further opportunity for attendees to share research.

Equity and workforce concerns are of great importance, according to panelists—not only to the public, but to industry experts. Aftermarket automation options help make vehicles more accessible for travelers with physical impairments, sensory disabilities, and cognitive disabilities. If transit is more highly automated, onboard attendants may be a necessary replacement for the passenger attention that a driver can provide. Overall, the economic benefits of AVs are estimated to exceed the cost of job losses,

though the degree to which this estimation is true depends on a wide variety of factors. According to some analyses, AVs could result in a 0.13% increase in unemployment at its peak, which would occur in the late 2040s.<sup>3</sup>

<sup>3</sup> See “America’s Workforce and the Self-Driving Future,” [https://aworkforce.secureenergy.org/wp-content/uploads/2018/06/Americas-Workforce-and-the-Self-Driving-Future\\_Realizing-Productivity-Gains-and-Spurring-Economic-Growth.pdf](https://aworkforce.secureenergy.org/wp-content/uploads/2018/06/Americas-Workforce-and-the-Self-Driving-Future_Realizing-Productivity-Gains-and-Spurring-Economic-Growth.pdf).

The 2019 Automated Vehicle Symposium will be held Monday, July 15, through Thursday, July 18, at the Orlando World Center Marriott in Florida.

## Federal Agencies and TRB Activity Updates

**B**rian Cronin, Federal Highway Administration (FHWA), offered an overview of the U.S. Department of Transportation’s (DOT’s) work on AV research at the Forum’s in-person meeting. He described the Automated Driving Systems 2.0 policy, which clarifies voluntary safety self-assessment processes. In late 2018, the Automated Driving Systems 3.0 update was released, broadening the policy’s considerations to reflect multimodal operations. Additionally, FHWA’s Accessible Transportation Technologies Research Initiatives program will enable a complete automated trip and has several applications in development.

According to Cronin, U.S. DOT has convened a working group of several early deployers of low-speed automated shuttles to document their emerging findings. FHWA also is engaged in cooperative AV testing with Virginia DOT and Transurban, studying speed harmonization, vehicle platooning, and cooperative merging on a managed facility where access is limited to cooperative AVs.

The Federal Railroad Administration is working on rail-grade crossing issues and the Federal Transit Administration has developed a Strategic Transit Automation Research Plan, with seven demonstrations planned through 2022. The Fed-

eral Motor Carrier Safety Administration is developing baseline safety performance measures to evaluate commercial motor vehicles operated autonomously.

The U.S. Maritime Administration is considering automated low-speed truck operations at ports and warehouses. At the National Highway Traffic Safety Administration, federal motor vehicle safety standards research projects are identifying potential barriers for self-certification and compliance verification of innovative new vehicle designs precipitated by automated driving systems. Pipeline and Hazardous Materials Safety Administration officials are trying to determine when it is safe to use AVs to assist with moving hazardous materials.

Ram Kandarpa, Booz Allen Hamilton, summarized the firm’s work as contractors on TRB’s National Cooperative Highway Research Program Project 20-102, which is updating the AASHTO CAV research roadmap. The project’s first task is reviewing the current research plan, written 4 years ago, and which of the plan’s 19 problem statements are complete or under way and determining which are still valid. The second task is to develop a new research catalog of 62 potential projects and one-page problem summaries for each. The final task is to develop white papers on selected topics.



# Bilateral Automation Research

## 6th EU–U.S. Transportation Research Symposium

KATHERINE KORTUM

*The author is Senior Program Officer, Consensus and Advisory Studies Division, Transportation Research Board, National Academies of Sciences, Engineering, and Medicine, Washington, D.C.*

A fully automated Mercedes concept car. The 6th EU–U.S. Transportation Research Symposium concentrated on the impacts of connected and automated vehicles.

Since 2013, the Transportation Research Board (TRB) and the Office of the Secretary of Transportation—Research of the U.S. Department of Transportation have collaborated with the European Commission to conduct annual research symposia, covering critical research topics for both the United States and Europe—urban freight logistics, research implementation, automated vehicles, and climate change mitigation and adaptation.

The 6th EU–U.S. Transportation Research Symposium, held June 27–28, 2018, in Brussels, Belgium, built on the concept of bilateral transportation research by bringing together European and U.S. researchers to discuss and compare the impacts of connected and automated vehicles (CAVs) on the workforce, economy, community land use, and transportation equity. These in-depth discussions among researchers facilitated communication,

fostered immediate collaboration, and identified potential next steps to enable systematic long-term collaboration in pinpointing research needs, sharing information on ongoing and completed projects, and developing opportunities for joint efforts.

The invite-only symposium began with the review of a white paper developed to provide background on the topic by Johanna Zmud, Texas A&M Transportation Institute, and Nick Reed, Bosch. Zmud and Reed described the levels of automation and the differences between American and European advancements to date. On both sides of the Atlantic, the Society of Automotive Engineers' (SAE's) descriptions of automation levels have become standard shorthand for how advanced an automated vehicle is. These levels are summarized in Table 1 (page 35).

In the United States, CAV-related regulations currently are bifurcated between the National Highway



An automated shuttle in Estonia. The European Commission is working on legal frameworks and regulation for implementing Level 4 public transportation.

**TABLE 1 SAE Levels of Automation**

|         |   |
|---------|---|
| Level 0 | No automation. Entirely human-controlled.   |
| Level 1 | Driver assistance: vehicle assists with either steering or acceleration and deceleration—e.g., adaptive cruise control or automatic emergency braking. Human driver remains engaged at all times. |
| Level 2 | Partial automation: vehicle can execute steering and acceleration and deceleration—e.g., parking assist. Human driver remains engaged at all times.   |
| Level 3 | Conditional automation: vehicle can execute driving tasks in limited modes and highly mapped environments. Human driver must be able to respond to intervention request.                          |
| Level 4 | High automation: vehicle can execute driving tasks in all modes, stopping the vehicle if systems fail. Human driver can take over if desired.   |
| Level 5 | Full automation: vehicle executes all driving tasks. No steering wheels or pedals so humans cannot drive.   |

Traffic Safety Administration, which regulates the vehicles, and states, which regulate the drivers. In the European Union (EU), the European Commission is working to harmonize legal frameworks, research, and industrial innovation across all member states. Policy and regulation are linked to use cases—including passenger cars and trucks at Levels 3 and 4 on motorways and in cities—and Level 4 public transportation vehicles in low-speed situations. Both cases are expected to be operating on European roads by 2020. The EU also is providing support for 5G mobile and Internet and has gained industry commitment to offering connectivity on new vehicles.

Two keynote speakers, one from the United States and one from the EU, shared perspectives on the effects of future transportation systems. Karel Martens of Technion—Israel Institute of Technology and Radboud University Nijmegen focused on transportation justice issues, urging participants to think about people, not just technology, and to keep justice as a goal of a transport system rather than simply an impact. Michael Abelson, Vice President of Global Strategy at General Motors, described the company’s stated goal of reaching zero congestion, zero emissions, and zero fatalities. Abelson described automated vehicles as a natural extension of what automobile manufacturers have done for years: designing, developing, testing, and selling highly complex machines that operate for and in society.

Breakout groups discussed current and emerging technologies that affect drivers and society.



PHOTO: NOZILUA, WIKIMEDIA

Participants then gathered in four breakout groups, each focused on a single topic:

1. Freight automation's impact on people;
2. Places where people live, work, and play;
3. Impact of automation on travel behavior; and
4. Actions for stakeholders.

In each group, a pair of planning committee members—one American and one European—wrote read-ahead briefing papers and led the breakout session. Each of the four breakout groups then focused on four cross-cutting topic areas:

1. Equity,
2. Data access and privacy,
3. Economy and workforce, and
4. Safety and security.

Each of these breakout groups developed research problem statements and research questions that addressed the four topic areas. More information about these statements and questions will be available in the conference proceedings that will be published on TRB's website and in hard copy.

The next challenge for attendees of the symposium—as well as for all involved in CAV research—is ensuring that the research be used by government agencies. TRB will work with its Cooperative Research Programs and its members—including state and other public agencies, government officials, and industry—to address the issues developed at the conference and to develop practical research. The results of the 2018 EU–U.S. Symposium also

will be the focus of a workshop at the TRB 98th Annual Meeting in January 2019.

Transportation research demands that practitioners, researchers, and policy makers think outside the box in new and creative ways, seeking fresh perspectives and continuously tapping new innovations for the cost-effective, environmentally friendly movement of people and goods. Collaboration across borders is perhaps more imperative in transportation research than in other disciplines, considering globalized economies, commerce, and societal trends and values. If successful, international collaboration in transportation research can create a fertile ground for innovations, understanding, and common solutions to common problems.

### Committee for the 6th EU–U.S. Transportation Research Symposium

**Barbara Lenz**, German Aerospace Center and Humboldt University of Berlin, *Cochair*

**Susan Shaheen**, University of California, Berkeley, *Cochair*

**Matthew Daus**, City University of New York  
**Satu Inamaa**, VTT Technical Research Center of Finland

**Alex Karner**, The University of Texas at Austin  
**Alexandra Millonig**, AIT Austrian Institute of Technology

**Timothy Papandreou**, City Innovate  
**Marcin Stępnik**, Complutense University of Madrid



# Streamlining Survey in Reno's Spaghetti Bowl

EMILY PETTIS, SEBASTIAN RENFIELD, AND ALEXIS THOMAS

*Pettis is Senior Historian, Mead and Hunt, Inc., Middleton, Wisconsin, and Chair, Historic and Archeological Preservation in Transportation Committee; Renfield is Cultural Resources Specialist, Mead and Hunt, Inc., Minneapolis, Minnesota; and Thomas is Architectural Historian, Nevada Department of Transportation, Carson City.*

In the decades after World War II, residential subdivisions sprang up across the United States as developers responded to the nationwide housing shortage and population boom. Many of these subdivisions contained hundreds of modest homes, constructed using similar or even identical building forms to maximize efficiency and economy. Just as the original builders applied a streamlined model to design and construct these subdivisions, architectural historians can use a similar approach to document and evaluate them when transportation agencies need to consider project-related impacts to these subdivisions.

## Problem

Known locally as the Spaghetti Bowl, the US-395/I-80/I-580 interchange in Reno, Nevada, occupies a substantial footprint. Under Section 106 of the National Historic Preservation Act, agencies must determine whether any historically significant buildings, sites, or other resources may be affected by projects receiving federal funds.

In advance of a proposed Spaghetti Bowl improvement project, the Nevada Department of Transportation (DOT) needed to identify and evaluate several

post-World War II, or postwar, residential subdivisions in the area of potential effects (APE) and retained a contractor to prepare an assessment of these resources for Section 106 review. Overall, the APE contained more than 1,400 properties, including more than 650 single-family residences in several postwar subdivisions. A traditional approach would have required individual documentation and evaluation of each property for the National Register of Historic Places—a disproportionately high level of effort given the relative uniformity of architectural styles and historic contexts in the subdivisions.

## Solution

*National Cooperative Highway Research Program (NCHRP) Research Report 723: A Model for Identifying and Evaluating the Historic Significance of Post-World War II Housing*, provides a historical context and methodology to streamline the process of surveying and evaluating these postwar subdivisions. Published in 2012, the report includes a general context that establishes significant national trends and influences, offering an existing framework within which the project team could situate Reno-area regional and local trends.

Hiko Avenue streetscape. These houses are mirrored examples of a single form with slightly varied decorative details.



Photo: Mead & Hunt, Inc.

Three examples of the same form showing the variation of decorative detail.

Crucially, the methodology in NCHRP Research Report 723 also provides a framework that allows an entire subdivision to be treated as a single entity or district. Rather than surveying each home within a subdivision, historians can identify recurring styles and forms and develop a typology of homes in the

subdivision. The resulting survey report documents the distribution of the styles and forms with representative examples of each types and subtypes.

Using the national context as a starting point, the research team found that postwar residential development in Reno and the adjacent Sparks area mirrored national trends; between 1945 and 1960, local employment soared, incomes increased, and the number of housing units constructed nearly doubled. Residential construction skyrocketed in the mid-1950s and 1960s as developers built thousands of homes in planned subdivisions at the fringes of the city. Located at the northeastern edge of the Reno city limits, much of the Spaghetti Bowl APE lay in one of these formerly agricultural areas that, between 1955 and 1965, transformed into dense residential neighborhoods.

## Application

Project historians applied the guidance in NCHRP Research Report 723 in the documentation and evaluation of several postwar residential developments, including the Silverada subdivision. Located at the northwest quadrant of the US-395/I-80/I-580 interchange, the 50-acre Silverada subdivision is the largest cohesive residential development within the APE, containing 244 single-family homes constructed between 1960 and 1965. Its properties generally conform to one of seven general types, although the builder employed a range of modest decorative details and roof forms to create more variety.

A two-person survey team completed two windshield surveys of the subdivision, driving each street once to record general impressions and preparing simple sketches of each of the distinct house types to use as a guide (see Figure 1, page 39). On a second drive-through of the subdivision, surveyors recorded the type of each property, noting major alterations, and took representative photographs of the most intact examples of each type. This level of documentation was sufficient to establish the defining characteristics of the subdivision as a whole and served as the basis for inventory forms, maps, and National Register determinations of eligibility.

## Benefits

This tailor-made process for postwar residential subdivisions can help to ensure that significant examples are documented and understood, allowing members of the public to take greater pride in their communities. The application of the guidance provided by NCHRP Research Report 723 also resulted in substantial savings of time and effort for Nevada DOT. The project team was able to complete context research, field survey, and evaluation—and to



PHOTOS: MEAD & HUNT, INC.



compile project deliverables—in less than 20% of the time typically required to survey a comparable number of individual resources for similar projects. Nevada DOT estimates that the review of these deliverables took less than 50% of the time it would have taken to review individual and district evaluations for postwar residential subdivisions in a large urban transportation project.

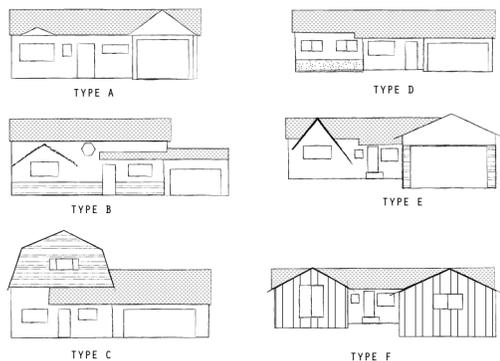
Other benefits of the streamlined approach included the following:

- ◆ Preparation of a historic context typically requires consideration of national, state, and local or regional trends to establish whether a historic resource is significant for purposes of National Register eligibility. By eliminating the need to research national trends and by allowing project historians to focus on local and regional trends, the national context provided by NCHRP Research Report 723 reduced the level of effort by half.

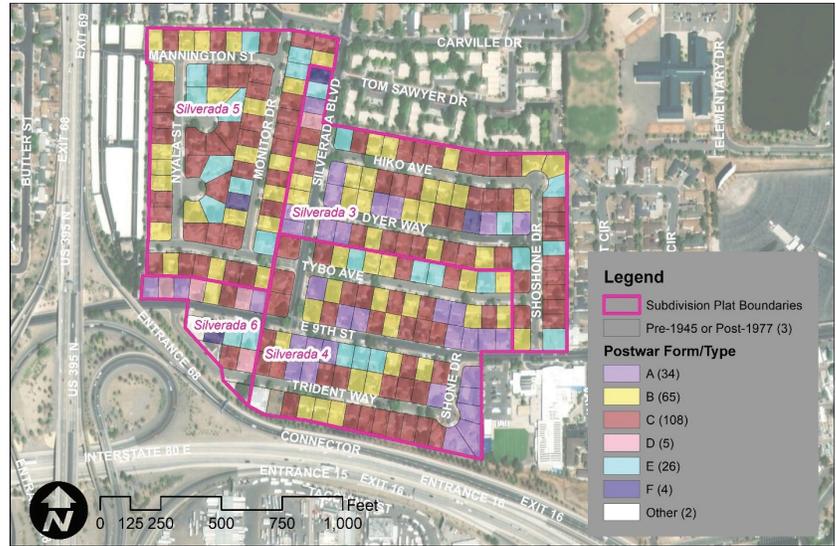
- ◆ Individual field survey of 244 properties can require up to a week of field work. Using the streamlined approach, the survey team was able to complete field work in less than one day.

- ◆ Preparation of individual inventory forms exponentially increases the level of effort required to produce report deliverables. Using the guidance in NCHRP Research Report 723, the project team documented the Silverada subdivision as a district on a single inventory form for submission to the Nevada State Historic Preservation Office (SHPO). Documentation included representative photographs of each architectural type or form, a table of addresses, and the preparation of maps showing the construction date and typological distribution (see Figure 2, above right).

- ◆ Preparation of a single district inventory form greatly reduces the amount of agency review time. Nevada DOT and SHPO staff were able to review a single form rather than hundreds of individual property forms. Nevada DOT noted that this approach



**FIGURE 1** Survey team sketches of typology in the Silverada subdivision.



**FIGURE 2** Map of the Silverada subdivision, showing platted additions and properties color-coded by form and type.

offered “added benefit for the agency and SHPO review of the single inventory form in comparison to the number of individual forms and definitely decreased the amount of review.” After its review, SHPO described the project as “an excellent example of the balance necessary to ensure that critical infrastructure occurs, while taking historic properties into consideration.”

The project is ongoing and has progressed through the Section 106 review process with the determinations of eligibility and concurrence on eligibility from Nevada SHPO. Nevada DOT now is addressing effects and mitigation per 36 C.F.R. Part 800 (I).

### Contact

For more information, contact Cliff Creger, Chief Cultural Resources Program Manager, Nevada Department of Transportation, 775-888-7666, [ccreger@dot.nv.gov](mailto:ccreger@dot.nv.gov), or Chad Moffett, Cultural Resources Market Leader, Mead & Hunt, Inc., 916-993-4655, [chad.moffett@meadhunt.com](mailto:chad.moffett@meadhunt.com).

EDITOR’S NOTE: Appreciation is expressed to Sid Mohan, Transportation Research Board, for his efforts in developing this article.

### Reference

1. Protection of Historic Properties, 36 C.F.R. 800 (2000).

Suggestions for Research Pays Off topics are welcome. Contact Stephen Maher, Transportation Research Board, Keck 486, 500 Fifth Street, NW, Washington, DC 20001; 202-334-2955; [smaher@nas.edu](mailto:smaher@nas.edu).

# CALENDAR

## TRB Meetings

### November

- 12–15 15th International Conference on Mobility and Transport for Elderly and Disabled Persons  
*Taipei, Taiwan*
- 24–28 GeoMEast International Conference: Sustainable Civil Infrastructures—Structural Integrity\*  
*Cairo, Egypt*
- 27–28 6th Florida Automated Vehicles Summit\*  
*Tampa, Florida*

### December

- 2–5 6th International Symposium on Nanotechnology in Construction\*  
*Hong Kong*

### January 2019



- 13–17 TRB 98th Annual Meeting  
*Washington, D.C.*
- 13–17 2019 Planning for Shifting Trade Workshop\*  
*Tampa, Florida*

### March

- 10–15 Inaugural African Conference for Linear Infrastructure and Ecology\*  
*Kruger National Park, South Africa*
- 24–27 8th International Conference on Case Histories in Geotechnical Engineering\*  
*Philadelphia, Pennsylvania*

- 31–  
April 2 Lifesavers\*  
*Louisville, Kentucky*

### April

- 7–9 14th National Light Rail and Streetcar Conference  
*Jersey City, New Jersey*

- 9–10 Innovations in Freight Data Workshop  
*Irvine, California*
- 15–17 International Conference on Demand Responsive and Innovative Transportation Services  
*Baltimore, Maryland*
- 23–25 2nd International Intelligent Construction Technologies Group Conference\*  
*Beijing, China*

### June

- 2–5 17th National Transportation Planning Applications Conference  
*Portland, Oregon*
- 12–14 7th International Conference on Bituminous Mixtures and Pavements\*  
*Thessaloniki, Greece*

- 25–27 17th Biennial National Harbor Safety Committee Conference  
*Houston, Texas*

### July

- 15–18 Automated Vehicles Symposium 2019  
*Orlando, Florida*
- 20–25 58th Annual Workshop of Transportation Law  
*Cleveland, Ohio*
- 22–24 Bridge Engineering Institute Conference 2019\*  
*Honolulu, Hawaii*

### August

- 4–7 9th International Conference on Structural Health Monitoring of Intelligent Infrastructure\*  
*St. Louis, Missouri*

### September

- 10–13 6th International Conference on Women's Issues in Transportation  
*Irvine, California*
- 12–18 12th International Conference on Low-Volume Roads  
*Kalispell, Montana*
- 15–19 Conference on Performance and Data in Transportation Decision Making  
*Atlanta, Georgia*
- 29–  
Oct. 2 3rd International Conference on Information Technology in Geo-Engineering\*  
*Guimaraes, Portugal*

## Upcoming Webinars

### November

- 15 Traffic Control Devices and Measures for Deterring Wrong-Way Movements
- 19 Moisture Infiltration and Pavement Surface Treatments
- 26 Balanced-Performance-Engineered Asphalt Mixture Design, Part 2
- 28 Changes in Demographics and Markets for Public Transportation
- 29 Design Considerations for Airport Emergency Operations Centers

### December

- 11 Airport Response During Communicable Disease Outbreaks
- 12 Understanding Airport Air Quality Management and Public Health

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), or e-mail [TRBMeetings@nas.edu](mailto:TRBMeetings@nas.edu).

\*TRB is cosponsor of the meeting.

## Veronica M. Murphy

*New Jersey DOT*

Since 2003, Veronica M. Murphy has worked in project development and project management at the New Jersey Department of Transportation (DOT), where every aspect of transportation projects offers opportunities to interact with the public and work with engineers to ensure that communities' needs and values are met.

"As a certified planner, I bring a different perspective to the project team," Murphy comments. "I help assess how a project may affect adjacent communities and road users and I work with the engineers to find solutions to mitigate the problem." She also oversees the development of the study area's community profile and determines an appropriate outreach program for each project.

Murphy received a bachelor's degree in environmental studies from St. John's University in Queens, New York, and is an alumna of Columbia University's urban planning graduate



**"At TRB, I found a community of like-minded professionals and realized that as a transportation planner I could still advocate for vulnerable and traditionally underserved populations."**

program. She joined New Jersey DOT in 2003 as a transportation planner and community impact assessment specialist and became senior planner in 2009 and principal planner in 2012. In 2017 Murphy joined the Capital Program Support team, assisting with the implementation of a new project management and reporting system and developing process improvement strategies for project management.

Although every project had its own challenges and issues, a few projects stand out to Murphy because of the opportunity to interact with stakeholders and members of the public. In one project, Murphy's team was tasked with facilitating the safe passage of pedestrians across Route 22, a busy highway in Union County, New Jersey.

"Low-income workers had traveled long distances by bus to jobs in the suburbs and found themselves on the wrong side of the highway with no way of crossing the highway safely," Murphy recalls. Her team worked with the county and municipal governments, the transit agency, major employers, and the employees to assess the problem and find a solution. The collaboration led to the creation of a shuttle service from the bus stop to the various employment centers in the corridor—and the workers were happy to be included in the decision-making process.

Murphy also participated in developing a feasibility assessment for a project on I-280 and Route 21 in Newark. In this case, challenges included environmental justice issues and historic structures in the community adjacent to the project site.

"The challenge on this project was not necessarily getting the community to participate, but instead ensuring that all parties were heard in order to eventually reach consensus," Murphy observes. Each stakeholder group was identified and consulted and their issues and concerns were documented—and because of their involvement, New Jersey DOT was able to advance the project.

Part of the Pulaski Skyway rehabilitation project in northeastern New Jersey involved a lane closure on a major thoroughfare. As the project manager for the project's public outreach, Murphy used traditional strategies and innovative techniques

to develop a comprehensive outreach plan—utilizing social media and YouTube to help disseminate information and working with various partner agencies to share information on their platforms, conducting more than 100 outreach meetings. "The public was happy that they were provided with the information they needed in a timely manner and that the project team was responsive to their queries and concerns," Murphy notes.

Murphy first became involved with the Transportation Research Board (TRB) in 2004 on the advice of her director, who recently had started an initiative to implement community impact assessment in New Jersey DOT's project development process. She joined the practitioner's group of the Community Impact Assessment Joint Subcommittee. "I found the group to be very resourceful and the network of practitioners a lifeline that has lasted during my career," Murphy comments.

In 2005, Murphy served as a project manager planning the Northeast Community Impact Assessment Workshop, a collaboration between New Jersey DOT, the Federal Highway Administration, and TRB. After the workshop, TRB staffer Martine Micozzi recommended Murphy as a member of the Social and Economic Factors of Transportation Committee. She attended her first TRB Annual Meeting the following year.

"While studying urban planning at Columbia University, I was drawn to the issues that affect vulnerable populations, including affordable housing, access to healthy food, clean air, and more," Murphy observes. "At TRB, I found a community of like-minded professionals and realized that as a transportation planner I could still advocate for vulnerable and traditionally underserved populations."

Murphy serves on the Public Involvement and Environmental Justice committees and was appointed chair of the Joint Subcommittee on Community Impact Assessment in 2017.

## IN MEMORIAM



Gambaccini

### Louis J. Gambaccini, 1931–2018

Louis J. Gambaccini, former general manager of the Southeast Pennsylvania Transportation Authority (SEPTA), founder of NJ Transit, and the recipient of the Transportation Research Board's (TRB's) 1996 W. N. Carey, Jr., Distinguished Service Award, died August 19, 2018. He was 87.

Gambaccini's 50-year transportation career included 32 years at the Port Authority of New York and New Jersey, serving as vice president and general

manager of Port Authority Trans Hudson (PATH) rail system and as assistant executive director. In 1978, he was appointed New Jersey Commissioner of Transportation, founding NJ Transit in 1979 and serving as the system's first chairman of the board. Gambaccini later joined SEPTA as its longest-tenured general manager before joining the faculty at the National Transit Institute at Rutgers University and establishing the Voorhees Transportation Policy Institute.

Gambaccini chaired TRB's Executive Committee and the American Public Transportation Association (APTA). In 1999, he was inducted into APTA's Hall of Fame. He was known especially for a tireless work ethic, high level of integrity, and early advocacy for women in transportation. According to Jerry Premo, NJ Transit's first executive director, Gambaccini was a "lion in the world of public service." He is survived by six children and 10 grandchildren.

## COOPERATIVE RESEARCH PROGRAMS NEWS

### Geophysics in Cemeteries and Burial Grounds

According to Section 106 of the National Historic Preservation Act, state departments of transportation are required to document the presence of human gravesites located in areas where a transportation project is planned. Historic cemeteries and tribal or informal burial grounds can pose a challenge, as records may be incomplete and landscapes may have changed over time. Even in formal cemeteries with well-delineated boundaries, unmarked graves can be common.

Noninvasive, geophysical methods are available for identifying human remains. These methods can reduce the risk of an unexpected discovery of human remains during construction,

which can lead to delays, unanticipated mitigation costs, and negative publicity.

As part of National Cooperative Highway Research Program (NCHRP) Project 25-25, contractors New South Associates and WSP USA recently published the report *Practical Guide for Developing Effective Scopes of Work for the Geophysical Investigation of Cemeteries*. The report provides the information needed for state DOT staff to request consultant services that will meet project needs and result in an investigation report that informs the project development process.

Chapters cover how to conduct background and archival research for an investigation; how cultural variables—such as religious affiliation, ethnic affiliation, and age—affect the orientation of burials; and how environmental conditions influence the effectiveness of geophysical technologies. Also included is information on the limitations of geophysical technologies. The report's guidance was developed from an extensive literature review and practitioner survey.

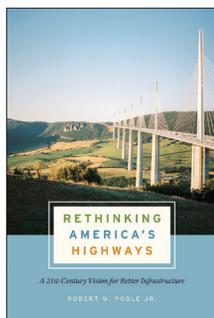
The report, along with a customizable electronic library of resources, is available at <http://apps.trb.org/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=3973>.

For more information, contact Ann Hartell, TRB, 202-334-2369, [ahartell@nas.edu](mailto:ahartell@nas.edu).



PHOTO: NEW SOUTH ASSOCIATES

Ground-penetrating radar survey at a cemetery.



### **Rethinking America's Highways**

Robert W. Poole. University of Chicago Press, 2018; 352 pp.; \$30; 978-0-226-55757-1.

Chronic traffic congestion, structurally deficient highways and bridges, tax debates and diversions, and low-productivity projects plague American highway systems. Poole offers a new model that provides users with highway services users will be willing to pay for, advocating for highway projects that are motivated by economic rather than political factors.

The title in this section is not a TRB publication. To order, contact the publisher listed.

## TRB PUBLICATIONS

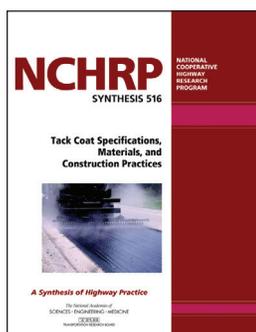


### **Design Guide for Low-Speed Multimodal Roadways**

NCHRP Research Report 880

This report offers guidance on the design of low-to intermediate-speed, mixed-use roads, balancing operation efficiency, comfort, safety, and convenience.

2018; 280 pp.; TRB affiliates, \$75; nonaffiliates, \$100. Subscriber categories: pedestrians and bicyclists, design.



### **Tack Coat Specifications, Materials, and Construction Practices**

NCHRP Research Report 881

Analyzed in this report are the factors associated with wrong-way movement on unsignalized divided highways and freeways, with a focus on design, signage, and roadway markings. Recommended revisions to the *Manual for Uniform Traffic Control Devices* are offered.

2018; 106 pp.; TRB affiliates, \$55.50; nonaffiliates, \$74. Subscriber categories: design, highways, operations and traffic management.

### **How Weather Affects the Noise You Hear from Highways**

NCHRP Research Report 882

This report documents the meteorological effects on roadway noise propagation under different atmospheric conditions and offers guidance on when atmospheric conditions should or should not be considered in noise analysis.

2018; 326 pp.; TRB affiliates, \$81; nonaffiliates, \$108. Subscriber categories: design, environment.

### **Fracture-Critical System Analysis for Steel Bridges**

NCHRP Research Report 883

Specifications based on comprehensive 3-D finite element analyses and case studies are proposed in this volume for the analysis and identification of fracture-critical and system-redundant members, including simple- and continuous-span I-girder and tub-girder, through-girder, truss, and tied-arch steel bridges.

2018; 60 pp.; TRB affiliates, \$45; nonaffiliates, \$60. Subscriber category: bridges and other structures.

### **Guidance for Managing Geotechnical Risks in Design-Build Projects**

NCHRP Research Report 884

This report offers five strategies for aligning the perception of geotechnical risks between a transportation agency and its designer-builder. The volume also provides 25 geotechnical risk-management tools to reduce levels of geotechnical uncertainty for better cost and schedule outcome.

2018; 80 pp.; TRB affiliates, \$50.25; nonaffiliates, \$67. Subscriber categories: administration and management, construction.

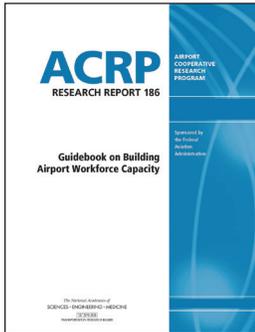
### **Tack Coat Specifications, Materials, and Construction Practices**

NCHRP Synthesis 516

This synthesis provides state agencies guidance for evaluating their tack coat specifications, the materials they use, and practices for placing the tack coats.

2018; 128 pp.; TRB affiliates, \$58.50; nonaffiliates, \$78. Subscriber categories: construction, materials, pavements.

## TRB PUBLICATIONS (continued)

**Staffing for Alternative Contracting Methods**

NCHRP Synthesis 518

State department of transportation (DOT) practices in staffing and organizational structure for alternative contracting methods are documented in this synthesis: design–build, construction manager–general contractor, public–private partnerships, and other innovative contracting techniques.

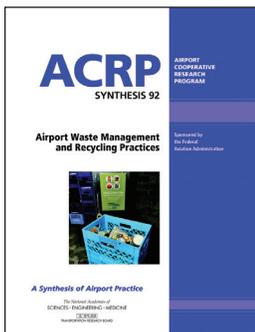
2018; 124 pp.; TRB affiliates, \$55.50; nonaffiliates, \$74. Subscriber categories: highways, administration and management, construction.

**Integration of Roadway Safety Data from State and Local Sources**

NCHRP Synthesis 523

This synthesis documents the ways in which transportation agencies and local agencies collaborate to integrate, facilitate access to, and maintain data from external sources for information systems.

2018; 90 pp.; TRB affiliates, \$52.50; nonaffiliates, \$70. Subscriber category: planning and forecasting.

**How Transportation Agencies Assess the Value of Added Capacity Highway Projects Versus Other Modal Projects and Strategies**

NCHRP Synthesis 529

Summarized in this synthesis are state DOT and metropolitan planning organization methods and policies of evaluating and comparing types of transportation strategies and quantifying their benefits, costs and economic impacts.

2018; 70 pp.; TRB affiliates, \$48; nonaffiliates, \$64. Subscriber categories: administration and management, economics, highways.

**Guidebook on Building Airport Work Capacity**

ACRP Research Report 186

This report builds on preliminary analysis of airport job requirements and identification of mission-critical airport occupations to identify optimal workforce planning and development strategies in preparation for emerging industry changes.

2018; 232 pp.; TRB affiliates, \$69.75; nonaffiliates, \$93. Subscriber categories: aviation, administration and management, education and training.

**Transportation Emergency Response Application (TERA) Support Materials for Airport EOC Exercises**

ACRP Research Report 187

Provided in this report are tools for airport staff tasked with planning, coordinating, and facilitating

functional emergency operations center exercises. Also included is guidance for using TERA software.

2018; 120 pp.; TRB affiliates, \$55.50; nonaffiliates, \$74. Subscriber categories: aviation, security and emergencies.

**Microgrids and Their Applications for Airports and Public Transit**

ACRP Synthesis 91–TCRP Synthesis 137

This synthesis describes microgrids that airports and public transit agencies can implement to increase resilience of their critical infrastructure, including the benefits, costs, revenue streams, and ownerships structures relevant to the airports and agencies.

2018; 68 pp.; TRB affiliates, \$48; nonaffiliates, \$64. Subscriber categories: aviation, public transportation, energy.

**Airport Waste Management and Recycling Practices**

ACRP Synthesis 92

Using literature reviews, surveys from 35 organizations, and interviews with airport waste management experts, this synthesis presents waste management and recycling practices that reduce costs as well as impacts to airports and surrounding communities.

2018; 52 pp.; TRB affiliates, \$42; nonaffiliates, \$56. Subscriber category: aviation.

**Sustainability's Role in Enhancing Airport Capacity**

ACRP Synthesis 93

This synthesis compiles information and examples that demonstrate the value of building sustainability concepts into capacity-enhancing projects. Included are additional resources and tools that provide guidance on how to select, apply, and communicate sustainability measures.

2018; 76 pp.; TRB affiliates, \$50.25; nonaffiliates, \$67. Subscriber categories: aviation, environment.

**Tools for a Sustainable Transit Agency**

TCRP Research Report 197

This report describes the development of practical tools for improving sustainability at transit agencies. Included are a sustainability route map and S+ROI calculator.

2018; 79 pp.; TRB affiliates, \$50.25; nonaffiliates, \$67. Subscriber categories: public transportation, environment.

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