

February 27, 2018

Vincent Valdes
Associate Administrator for Research,
Demonstration, and Innovation
Federal Transit Administration
U.S. Department of Transportation
1200 New Jersey Avenue, SE
Washington, DC 20590

Dear Mr. Valdes,

The Transportation Research Board's (TRB's) Transit Research Analysis Committee (TRAC) met on November 16–17, 2017, to learn more about the Office of Research, Demonstration, and Innovation's (commonly abbreviated as TRI) research plans and activities pertaining to the following three Innovation Initiatives: (a) Transit Automation, (b) Next Generation Public Transportation Vehicles, and (c) Workforce Development in an Era of Emerging Technology. In your October 31, 2017 letter to me (attached), you asked TRAC to consider any important needs, issues, and opportunities in the public transportation arena that should inform TRI's work on these three topics and to offer ideas on other emerging research areas for FY 2018 projects. This letter summarizes the committee's understanding of the TRI work and makes recommendations on the research projects and topics underway.

As you know, TRAC consists of 12 members appointed by the National Academies of Sciences, Engineering, and Medicine for their wide-ranging expertise in public transportation (see attachment for membership). The interdisciplinary committee—drawn from industry, academia, and the private and public sectors—is charged with recommending actions that the Federal Transit Administration (FTA) can take to ensure that its research program is relevant, timely, and effective in meeting the diverse and changing needs of the public transportation community. TRAC's standing charge is contained in Box 1.

I thank you and your staff for seeking TRAC's advice on TRI's Innovation Initiatives. Your overview of the work and the detailed briefings by Mary Leary, Faith Hall, Michael Baltes, and Gwo-Wei Tornng provided committee members with enough information to provide the requested feedback and advice. Thanks also go to K. Jane Williams, FTA Acting Administrator, and Matthew Welbes, FTA Executive Director, for discussing the importance of research and demonstration in the transit industry. The meeting agenda and a list of participants are attached.

Box 1: TRAC Statement of Task

TRAC, an interdisciplinary committee of experts from industry, academia, and the private and public sectors, will examine and recommend actions FTA can take to ensure that its research and innovation program is relevant, timely, and effective in meeting the diverse and changing needs of the public transportation community. To do so, TRAC will review the program's

- Latest Section 5312 Research Report that highlights program activities and accomplishments;
- Strategic planning process, including approaches for setting research priorities and identifying research needs and opportunities;
- Procedures for obtaining and evaluating stakeholder input; and
- Means for evaluating research results, furthering their use, and understanding their value to the transit industry and broader public.

TRAC will identify candidate areas of emphasis for FTA-sponsored research that are consistent with the stated goals of the U.S. Department of Transportation and with the Fixing America's Surface Transportation (FAST) Act's emphasis on improving mobility and infrastructure durability, reducing congestion, promoting safety, and preserving the transportation system and environment.

Drawing on its interdisciplinary knowledge and experience, TRAC will assist FTA in identifying and examining emerging trends affecting the public transportation sector as well as transferable practices from outside the sector that can benefit public transportation. TRAC will make recommendations to FTA on research and innovation program strategies intended to strengthen the public transportation industry's adaptation to new circumstances and adoption of new practices.

TRAC will issue its findings and recommendations in biannual consensus letter reports but with the option, per request of FTA and subject to funding availability, to issue a longer consensus report that addresses elements of the task statement in more depth and over a longer time horizon.

This letter report begins with a summary description of the three Innovation Initiatives and continues with TRAC's recommendations to FTA on these three topics and other research areas.

SUMMARY OF INNOVATION INITIATIVES

The three Innovation Initiatives were described to us as follows.

Transit Automation Research

TRI's transit automation research is being conducted by the Strategic Transit Automation Research (STAR) program, which was launched in the summer of 2016. The program's goal is to encourage the application of automation technologies on buses and other on-road transit vehicles with a range of vehicle sizes, platforms, configurations, and passenger capacities.

STAR is reviewing federal, state, and local policies on automated vehicles to see which policies may slow or prevent the development, demonstration, deployment, and evaluation of automated transit buses and related technologies. In addition, the program is funding research on light-duty and commercial vehicle automation technologies that are currently on the market to determine which have the greatest potential for application on buses and other transit vehicles. The research includes demonstration projects for vehicles that have varying degrees of automation capability, including a project with Valley Metro in Phoenix to test an automated shuttle bus system through 2019.

TRI reports that its future plans for STAR include funding human factors research on user acceptance of automated vehicles, although this research is not currently funded in its five-year plan. TRI also expects to undertake an automated vehicle hazard safety analysis in coordination with the U.S. Department of Transportation (U.S. DOT) Joint Program Office, although this work is in a formative stage.

Next Generation Public Transportation Vehicle Technology Research

The stated purpose of the Next Generation Transit Vehicle Initiative (NGTVI)—the former Zero Emission Research Opportunity program—is to make the transition to new zero- and low-emissions technology smoother and less costly. To do so, NGTVI is facilitating public-private research coalitions to identify and address the challenges of deploying fleets of electric buses. NGTVI has made \$2.75 million available for nonprofit organizations to partner with public transit agencies on demonstration projects for small-scale deployments of electric fleets. These projects are intended to help transit agencies better understand and solve challenges associated with small-scale deployments, the results of which will be applied later to larger-scale deployments.

At the time TRI briefed the committee on NGTVI, partners were being selected for the demonstration projects. However, TRI had not yet determined whether the program would focus solely on electric drives or whether it would combine electric drive, vehicle automation, and communications-driven service deployments into one integrated testing model.

Workforce Development in an Era of Emerging Technology

TRI estimates that one million new workers will need to join the U.S. public transportation workforce by 2022 to fill vacancies caused by retirements and changes in job definitions as a result of new technologies, including jobs in information technology. TRI reported that, to attract, develop, and retain workers with the needed skill sets, FTA is encouraging transit agencies to provide workers with career paths, or “lattices,” that allow for lateral, vertical, and diagonal career advancement. FTA and TRI are also working with individual agencies to develop and strengthen apprenticeship programs and employee development training initiatives with local colleges.

TRI has undertaken three rounds of Innovative Workforce Grants over the past seven years, in 2011, 2012, and 2015. These grants, totaling more than \$20 million, have gone to 45 agencies for training of incumbent workers, youth outreach, curriculum development, and new technology training activities in new technologies. TRI also reported on FTA’s partnership with the National Transit Institute (NTI) on workforce development and training, to which FTA contributes \$5 million per year.

RECOMMENDATIONS

You asked for TRAC’s advice on important needs, issues, and opportunities in the public transportation domain that should inform TRI’s work on the Innovation Initiatives. The recommendations that follow are intended to be helpful in this regard, including an observation about an area of research—cybersecurity—that the committee believes deserves more explicit consideration in future TRI work.

Transportation Automation Research

With its national perspective, FTA is well positioned to understand the transit industry's diverse array of automation technology needs and opportunities, the degree of implementation, and technological developments that have the potential for application in the industry. A great deal of technology and automation R&D is being conducted outside the transit industry, with freight vehicle automation and fleet operations among the most analogous applications to bus and transit operations. TRI can, and should, ensure that its industry stakeholders are aware of this work and of its potential applicability for transit services. Through STAR, TRI should focus its near-term research on testing existing prototypes and determining how best to retrofit existing transit vehicles with new technologies. In doing so, TRI should work with other parts of FTA to ensure that (a) the definition of what constitutes "transit" is not outdated but reflective of changing developments in the transportation industry, (b) equitable access to transit service remains a top priority, and (c) interest in automation is driven by a desire to meet existing needs and not overly focused on future needs that may or may not materialize. For example, elements of current automated vehicle technology can address known exposure such as backing-up incidents. As part of STAR, TRI should consider undertaking a synthesis report on the automation integration plans of transit agencies across the country.

New technology-enabled transportation services, including Uber and Lyft, may affect the ability of transit agencies to serve their regions effectively by drawing "choice" customers from transit bus and rail services. TRI should examine various policy options in this context for preserving, expanding, and improving the quality of mobility options for all customers, especially those with low-incomes, the growing proportion of the population that is elderly, and other underserved groups. FTA and TRI should help the transit industry identify and implement policies that enlist these new transportation services for these purposes and consider the implications of such policies on overall transit agency ridership levels and revenues.

Next Generation Public Transportation Vehicle Technology Research

Because technologies available for transit vehicles are changing quickly, transit agencies face challenges keeping their long-lived fleets up to date. To help transit agencies meet this challenge, FTA should undertake research into different options for transit agencies to acquire and maintain vehicles. Leasing vehicles is one consideration, as is three-dimensional printing for parts and maintenance needs.

In addition, testing of vehicles that contain multiple new systems (such as electric drive, vehicle automation, and/or communications-driven service deployments) in a single vehicle can be challenging, particularly when the goal is to isolate the effect of one technology in a vehicle containing many other new technologies. For this reason, TRI should use its limited testing resources to engage in single-system testing as opposed to integrated testing and leave the latter to vehicle manufacturers.

In funding demonstration projects of new vehicle technologies, TRI should be explicit in its expectation for data gathering by including data requirements in its requests for proposals. Nevertheless, TRI should ensure that the data being gathered have a well-defined purpose. All data collected should be used and useful, to minimize the burdens on suppliers and transit agencies.

Workforce Development

Recruitment, training, and retention of employees remain significant challenges for the transit industry and will continue to present challenges for the foreseeable future. The industry needs to ensure that its current employees have the skills and training suited to today's operations and conditions while it develops a flexible workforce that can adapt quickly to the changing demands of new technologies (including those tested in the STAR program). TRI can play an important role in assisting transit agencies in meeting these challenges. TRI recognizes, through its emphasis on career lattices, that it is very likely that transit agencies will need to make major changes to their organizational cultures to create this flexibility and adaptability. Transit offers a spectrum of career opportunities

across its rank and file and its technical and management domains. The opportunities should be exploited by transit agencies as an enticement for new employees and a critical means of retaining existing ones.

Challenges in employee recruitment, training, and retention are not unique to the transit industry. The Federal Highway Administration's (FHWA's) Center for Transportation Workforce Development assists state transportation agencies and others with on-the-job training and apprenticeship programs.¹ Although FTA has more limited resources than FHWA, TRI should look for features of this program, as well as those supported by labor unions, that are proving helpful in encouraging students to pursue transportation careers and in ensuring that existing workers remain in the industry and succeed. There are many ways for workers to obtain the skills and training needed to accommodate changing technologies, and they do not always involve traditional classroom-based settings. TRI should review online methods of training, as well as other digital learning platforms, and encourage greater use of the most promising methods. In doing so, TRI should consider hosting workshops for transit agencies to share best practices for attracting and training workers in this environment of fast-changing technologies. Inasmuch as bus manufacturers and other transit industry suppliers benefit from such agency training programs (by making their products more useable), TRI should explore ways for agencies to partner with private companies to further such initiatives, including contributions to cover their financial cost.

Cybersecurity

Although TRI did not discuss it during meeting presentations, ensuring cybersecurity will be critical to capitalizing on a technology-rich future. The potential for hacking or digital malware exists not only in the operations of transit systems, but in their infrastructure and vehicle fleets. It would be impractical for TRI to include cybersecurity as a key component of all research topics, but it should be an identifiable element of research plans, and TRI should be prepared to answer questions about how cybersecurity will be addressed when the products of research are disseminated to industry. Additionally, as other agencies within the U.S. DOT focus on the issue, particularly within connected vehicle demonstrations, TRI should coordinate with them to ensure that transit needs are considered and to discuss the implications of cybersecurity implementation plans.

CONCLUDING COMMENTS

Once again, the members of TRAC and I appreciate your team's efforts to explain the many important research and workforce initiatives at TRI and to seek our ideas for strengthening these efforts. The opportunities for, and implications of, fast-changing technologies in the transit industry are central to your initiatives, and rightly so.

In keeping with your desire for timely and constructive advice, this report has been brief and focused. On behalf of TRAC's members, I thank you and your staff for providing a high-level set of program presentations and for so ably and patiently responding to our many questions as needed to offer this advice. I look forward to consulting with you about the timing and agenda of the next TRAC meeting, traditionally held in the spring.

Sincerely,



Anna M. Barry, Chair

Attachment

¹ https://www.fhwa.dot.gov/innovativeprograms/centers/workforce_dev/professionals.aspx.

Transit Research Analysis Committee
Meeting Agenda: November 16–17, 2017
The Keck Center (Room 208) of The National Academies
500 5th St NW; Washington, DC 20001

Thursday, November 16

- 9:00 Introduction: **Vincent Valdes**, Associate Administrator, FTA Office of Research, Demonstration, and Innovation
- 9:30 FTA presentations on innovation initiatives
- 9:30–10:15
Transit Automation Research: **Gwo-Wei Torng**, Director, Office of Mobility Innovation, FTA Office of Research, Demonstration, and Innovation
- 10:15–10:30
Break
- 10:30–11:15
Next Generation Public Transportation Vehicle Technology Research: **Mike Baltes**, Director, Office of Infrastructure and Asset Innovation, FTA Office of Research, Demonstration, and Innovation
- 11:15–12:00 pm
Workforce Development in an Era of Emerging Technology: **Mary Leary**, Acting Deputy Associate Administrator, FTA Office of Research, Demonstration, and Innovation
- 12:00 pm Open session adjourns

Friday, November 17

- 8:30 FTA discussion with committee members
K. Jane Williams, Acting Administrator, FTA; **Matt Welbes**, Acting Deputy Administrator and Executive Director, FTA; and **Vincent Valdes**
- 10:00 Open session adjourns

PARTICIPANT LIST

Committee

Anna M. Barry, Deputy Commissioner,
Connecticut Department of Transportation,
Chair

J. Barry Barker, Executive Director, Transit
Authority of River City

Ron Brooks, Manager of Accessible Transit
Services, Valley Metro*

Charles Carr, Director, Office of Intermodal
Planning, Mississippi Department of
Transportation

Adib Kanafani, Professor of the Graduate
School, University of California, Berkeley*

Nadine Lee, Deputy Chief Innovation Officer,
Office of Extraordinary Innovation, Los
Angeles County Metropolitan
Transportation Authority

Carol Abel Lewis, Professor and Director,
Center for Transportation Training and
Research, Texas Southern University

John Lewis, Chief Executive Officer, Charlotte
Area Transit System*

Angela Miller, Director, Cubic Transportation
Systems

Brad Miller, Chief Executive Officer, Pinellas
Suncoast Transit Authority*

Macy Neshati, Senior Vice President, BYD
Heavy Industries

Ed Watt, Director of Special Projects,
Amalgamated Transit Union

*Not in attendance.

Speakers and Discussants

Mike Baltes, Director, FTA Office of
Infrastructure and Asset Innovation

Faith Hall, TRAC Program Manager, Office of
Research Management, Innovation and
Outreach

Mary Leary, Acting Deputy Associate
Administrator, FTA Office of Research,
Demonstration, and Innovation

Gwo-Wei Torng, Director, FTA Office of
Mobility Innovation

Vincent Valdes, Associate Administrator, FTA
Office of Research, Demonstration, and
Innovation

Matthew Welbes, Executive Director, FTA

K. Jane Williams, Acting Administrator and
Deputy Administrator, FTA

TRB Staff

Michael Covington
Katherine Kortum
Tom Menzies



U.S. Department
Of Transportation
**Federal Transit
Administration**

Headquarters

1200 New Jersey Avenue S.E.
Washington DC 20590

31 October 2017

Ms. Anna M. Barry
Deputy Commissioner, Connecticut Department of Transportation
Chair, Transit Research Analysis Committee

Dear Ms. Barry and Members of the Transit Research Analysis Committee,

We look forward to the next Transit Research Analysis Committee (TRAC) meeting November 16 - 17, 2017 in Washington, DC. We would like to extend our sincere thanks to you, Ms. Barry for your continuing leadership as well as express our appreciation to each TRAC member for your dedication to this important interchange. Given the exceptionally fast pace of recent months, the TRAC forum proves its value in having us pause, share, and reflect on our activities to ensure relevant and meaningful research results for public transportation stakeholders and the riding public.

I found our April discussion to be very informative for the ongoing refinement of the performance framework and metrics my office is developing as part of FTA's Research Strategic Plan and process. As discussed, this work is a key element in support of higher-level Secretarial priorities for the Department. As you may know, a little over a week ago, [Secretary Chao's office established a public comment period for the U.S. Department of Transportation's \(DOT\) draft DOT Strategic Plan for FY 2018 – 2022](#), which closes Monday, November 13, 2017, several days before we meet in person. The draft DOT Strategic Plan reflects the Secretary's priorities for achieving DOT's mission through four strategic goals:

- *Safety*: Reduce Transportation-Related Fatalities and Serious Injuries Across the Transportation System.
- *Infrastructure*: Invest in Infrastructure to Ensure Mobility and Accessibility and to Stimulate Economic Growth, Productivity and Competitiveness for American Workers and Businesses.
- *Innovation*: Lead in the Development and Deployment of Innovative Practices and Technologies that Improve the Safety and Performance of the Nation's Transportation System.
- *Accountability*: Serve the Nation with Reduced Regulatory Burden and Greater Efficiency, Effectiveness and Accountability.

Given this activity's importance in guiding Departmental priorities and investments through FY 2022, I invite you to provide us with your thoughts and to share this information with your networks. The DOT website provides details on how to submit a complete response via email to: dotstrategicplanning@dot.gov.

Since we last met, FTA also welcomed Acting Administrator K. Jane Williams to the agency in August. Acting Administrator Williams' leadership and perspectives have elevated the critical role of innovation and research in the public transportation arena – especially in this transformative time. Thus, I would like to focus next month's TRAC meeting on three inter-related "Innovation Initiatives" at FTA: 1.) Transit Automation Research; 2.) Next Generation Public Transportation Vehicle Technology Research; and 3.) Workforce Development in an Era of Emerging Technology.

So, my charge this time is to ask for your thoughts and feedback on these topics, and any other emerging research areas the Committee feels we should consider. Specifically, we ask that the Committee focus its deliberations on the following questions:

1. What needs, issues, or opportunities does the Committee envision in the public transportation arena related to these topics?
2. Are there any other emerging public transportation innovation areas the Committee recommends that FTA consider exploring for upcoming FY 2018 projects?

TRAC is a key FTA partner. You all represent a unique source of external, expert, and broad industry stakeholder perspectives. We deeply value your feedback and welcome the opportunity to work with you to strengthen the Federal transit research program while "taking the pulse" on our direction to ensure we really are moving the needle for both the industry and riders. My team and I look forward to another productive round of discussions with the Committee on November 16th and 17th!

Sincerely,

A handwritten signature in black ink, appearing to read "Vincent Valdes", written over a horizontal line.

Vincent Valdes
Associate Administrator
Office of Research, Demonstration and Innovation

CC:
TRAC Members
Katherine Kortum, TRB