

EXAMINING TECHNOLOGICAL INNOVATIONS IN TRANSPORTATION

HEARING BEFORE THE SUBCOMMITTEE ON TRANSPORTATION AND SAFETY OF THE COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION UNITED STATES SENATE ONE HUNDRED SIXTEENTH CONGRESS

FIRST SESSION

JUNE 25, 2019

Printed for the use of the Committee on Commerce, Science, and Transportation



Available online: <http://www.govinfo.gov>

U.S. GOVERNMENT PUBLISHING OFFICE

WASHINGTON : 2023

52-726 PDF

SENATE COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION

ONE HUNDRED SIXTEENTH CONGRESS

FIRST SESSION

ROGER WICKER, Mississippi, *Chairman*

JOHN THUNE, South Dakota	MARIA CANTWELL, Washington, <i>Ranking</i>
ROY BLUNT, Missouri	AMY KLOBUCHAR, Minnesota
TED CRUZ, Texas	RICHARD BLUMENTHAL, Connecticut
DEB FISCHER, Nebraska	BRIAN SCHATZ, Hawaii
JERRY MORAN, Kansas	EDWARD MARKEY, Massachusetts
DAN SULLIVAN, Alaska	TOM UDALL, New Mexico
CORY GARDNER, Colorado	GARY PETERS, Michigan
MARSHA BLACKBURN, Tennessee	TAMMY BALDWIN, Wisconsin
SHELLEY MOORE CAPITO, West Virginia	TAMMY DUCKWORTH, Illinois
MIKE LEE, Utah	JON TESTER, Montana
RON JOHNSON, Wisconsin	KYRSTEN SINEMA, Arizona
TODD YOUNG, Indiana	JACKY ROSEN, Nevada
RICK SCOTT, Florida	

JOHN KEAST, *Staff Director*

CRYSTAL TULLY, *Deputy Staff Director*

STEVEN WALL, *General Counsel*

KIM LIPSKY, *Democratic Staff Director*

CHRIS DAY, *Democratic Deputy Staff Director*

RENAE BLACK, *Senior Counsel*

SUBCOMMITTEE ON TRANSPORTATION AND SAFETY

DEB FISCHER, Nebraska, <i>Chairman</i>	TAMMY DUCKWORTH, Illinois, <i>Ranking</i>
JOHN THUNE, South Dakota	AMY KLOBUCHAR, Minnesota
ROY BLUNT, Missouri	RICHARD BLUMENTHAL, Connecticut
JERRY MORAN, Kansas	EDWARD MARKEY, Massachusetts
CORY GARDNER, Colorado	TOM UDALL, New Mexico
SHELLEY MOORE CAPITO, West Virginia	GARY PETERS, Michigan
TODD YOUNG, Indiana	TAMMY BALDWIN, Wisconsin
RICK SCOTT, Florida	

CONTENTS

Hearing held on June 25, 2019	Page 1
Statement of Senator Fischer	1
Statement of Senator Duckworth	2
Statement of Senator Peters	47
Statement of Senator Blumenthal	49
Statement of Senator Thune	53

WITNESSES

Steve Ingracia, PE, Deputy Director, Technology and Strategic Planning, Nebraska Department of Transportation	3
Prepared statement	5
Shailen P. Bhatt, President and Chief Executive Officer, Intelligent Transportation Society of America	6
Prepared statement	8
Patrick Duffy, President, Blockchain in Transportation Alliance	30
Prepared statement	32
Ann Schlenker, Director, Center for Transportation Research, Argonne National Laboratory	34
Prepared statement	36
Brent Hutto, Chief Relationship Officer, Truckstop.Com	39
Prepared statement	40

APPENDIX

Response to written questions submitted to Steve Ingracia by:	
Hon. Maria Cantwell	63
Hon. Amy Klobuchar	63
Response to written questions submitted to Shailen P. Bhatt by:	
Hon. Maria Cantwell	64
Hon. Amy Klobuchar	64
Response to written questions submitted by Hon. Maria Cantwell to:	
Patrick Duffy	65
Ann Schlenker	65

EXAMINING TECHNOLOGICAL INNOVATIONS IN TRANSPORTATION

TUESDAY, JUNE 25, 2019

U.S. SENATE,
SUBCOMMITTEE ON TRANSPORTATION AND SAFETY,
COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION,
Washington, DC.

The Subcommittee met, pursuant to notice, at 2:34 p.m. in room SD-562, Dirksen Senate Office Building, Hon. Deb Fischer, Chairman of the Subcommittee, presiding.

Present: Senators Fischer [presiding], Duckworth, Peters, Blumenthal, and Thune.

OPENING STATEMENT OF HON. DEB FISCHER, U.S. SENATOR FROM NEBRASKA

Senator FISCHER. The hearing will come to order.

Good afternoon. I am pleased to convene the Senate Subcommittee on Transportation and Safety for a hearing today titled “Examining Technological Innovations in Transportation.”

Everyone here today knows that technology is increasingly changing how we work, stay in contact with friends and family, and go about our daily lives. The transportation sector is no exception.

Technology is already changing how we move people and goods across this country and there is potential for new technology to improve safety, efficiency, and mobility across our surface transportation system.

But with great potential comes challenges. The process of adopting new technologies, especially across a complex system like the United States transportation network, can come in fits and starts.

Today, the subcommittee has an opportunity to learn about the potential new technologies that can be offered and the challenges and changes that could come from their adoption.

As members of this Subcommittee and Congress more broadly are debating and considering legislation to reauthorize the FAST Act, it is important to understand innovations within the transportation system already happening on the ground.

This is by no means the first time the Congress has debated new technologies in transportation. The FAST Act added intelligence transportation systems technology as eligible activities under several Federal aid funding programs.

It also established new programs, such as the Advanced Transportation and Congestion Management Technologies Development

Program, which provides grants to states to deploy large-scale transportation technologies.

I was pleased to see the Nebraska Department of Transportation working with the Wyoming and Utah Departments of Transportation received a \$2.8 million Advanced Transportation and Congestion Management Technologies Grant this April.

Nebraska Innovative Project will incorporate sensors along I-80 to support Nebraska's DOT understanding and ability to respond to traffic and weather conditions.

Additionally, recognizing that traffic and weather don't correspond to state boundaries, this project will support and enable the sharing of road condition information between Nebraska, Wyoming, and Utah.

I look forward to hearing more about this and similar projects.

Just as Federal, state, and local governments could improve infrastructure, traffic flow, and safety by adopting new technologies, the private sector also is looking to technology for improvements.

Innovations, like digital freight matching and visibility, could improve the management of available resources, resulting in more efficient uses of our current infrastructure.

Blockchain also has the capacity to heighten efficiencies and optimize costs for transportation and logistics. Blockchain-powered smart contracts offer the potential to better enforce conditions and validate data through the entire supply chain, improving vehicle fleet and freight traffic, capacity monitoring, platooning, on-time delivery, payment management, and regulatory compliance.

However, the benefits of new technologies are not a foregone conclusion. Technology that is adopted today may look very different 10 years from now.

Today's hearing gives us a chance to understand what technologies are available today, their potential for tomorrow, and the obstacles that need to be overcome along the way.

It also provides us an opportunity to consider what role Congress should have in technology development and deployment as we consider reauthorization of the FAST Act.

We have several witnesses before the Committee today that can speak directly about the current and future deployment of transportation technologies. I'm grateful to all the witnesses for their willingness to travel to participate in the hearing.

I am particularly pleased to have Steve Ingracia from the Nebraska Department of Transportation here to talk about the exciting work happening in my home state.

I look forward to testimony from all our witnesses.

I would now like to invite my colleague, Ranking Member Duckworth, to offer any opening remarks.

**STATEMENT OF HON. TAMMY DUCKWORTH,
U.S. SENATOR FROM ILLINOIS**

Senator DUCKWORTH. Chairman Fischer, thank you for holding today's hearing to Examine Technological Innovations in Transportation.

I would also like to thank our witnesses for participating.

Given today's hearing topic, it is worth mentioning that our national laboratories are the crown jewels of the Nation's research and innovation ecosystem.

I'd like to specifically thank Ann Schlenker, Director of the Center for Transportation Research at Argonne National Laboratory in Illinois, for being with us today. Welcome.

Not so long ago, road maps like this were an essential tool for anyone driving beyond their hometown. Most of the millennials and Gen Zs in my office have no idea what this is.

[Laughter.]

Senator DUCKWORTH. Yes. Today, GPS-capable devices on our phones and cars provide turn-by-turn directions to nearly any destination in the world, saving commuters and businesses valuable time and resources.

GPS has become ubiquitous in the transportation sector. Every plane and ship uses it to navigate. Thousands of businesses and millions of products rely on it and each of us has a GPS-capable phone in our pocket. Not many, though, know that GPS was developed by our military during the cold war. In fact, it's still operated by the United States Air Force in partnership with the U.S. Department of Transportation and other Federal agencies.

Like our national labs, GPS is a shining example of the Federal Government's long history of supporting research and development efforts that promote innovation and are a catalyst for economic prosperity.

Last year, Senator Ernst and I started the Senate GPS Caucus to shine a light on how this critical technology continues to change our world and, in addition to technologies like GPS, advances in data collection, computing, communication, and mobile technologies are dramatically affecting the ways we travel and deliver goods and services.

These emerging technologies have the ability to make our transportation systems safer, more reliable, and more efficient.

I look forward to learning more from our witnesses about the opportunities and challenges associated with the emerging technologies in the transportation sector.

I yield back. Thank you.

Senator FISCHER. Thank you, Senator Duckworth.

Next, I would ask the witnesses to give their opening statements, try to keep those limited to 5 minutes, please, and we will begin with Mr. Steven Ingracia, who is the Deputy Director for Technology and Strategic Planning with the Nebraska Department of Transportation, fairly new in the position but not new to the issues.

So, welcome, Steve.

**STATEMENT OF STEVE INGRACIA, PE, DEPUTY DIRECTOR,
TECHNOLOGY AND STRATEGIC PLANNING, NEBRASKA
DEPARTMENT OF TRANSPORTATION**

Mr. INGRACIA. Thank you, Chairman Fischer, Ranking Member Duckworth, and members of the Subcommittee. Thank you for the opportunity to testify today.

My name is Steve Ingracia, and I am Deputy Director of Technology and Strategic Planning for the Nebraska Department of Transportation.

Our agency's 2,100 employees serve the state of Nebraska by operating and maintaining nearly 10,000 miles of roadway and 3,500 bridges.

In Nebraska, we have carved out an approach to transportation policy that is practical, forward leaning, and rooted in fiscal responsibility. Through the leadership of Governor Pete Ricketts and then State Senator Fischer, Nebraska passed the Transportation Innovation Act and the Build Nebraska Act, which gave NDOT the resources to care for and improve transportation in Nebraska.

Technological innovation is happening at NDOT as well as at other DOTs around the country and I'm pleased that the Committee has asked us how Congress can support the states as we know that shifts in technology will certainly alter the transportation industry in significant ways over the next 20 years.

We're always looking for ways to incorporate technology into what we build. The Advanced Transportation and Congestion Management Technologies Deployment Federal Grant just awarded to NDOT, in partnership with the Wyoming and Utah DOTs, will advance technologies that improve mobility and safety across the multistate I-80 corridor. This project will build upon Wyoming's Connect Vehicle Pilot Program to increase the flow of information to freight haulers and will ultimately improve safety along I-80.

We are also incorporating technology into the operational side of our business. Systems, like the Maintenance Decision Support System and Automatic Vehicle Location, have been installed on all 633 of our snowplows, and they allow us to make database choices on our application rates and to better track quantities of materials used.

We have taken this one step further by installing cameras on the front of our trucks to provide real-time snapshots of road conditions to the public through the web, which was immediately popular with the traveling public.

NDOT's implementation of MDSS, along with our public-facing cloud tracker site, was recently recognized by AASHTO with regional top monitors as a best use of technology and innovation.

NDOT is also active in discussions regarding policy. Nebraska lawmakers passed a law in 2018 that opened Nebraska's roadways to autonomous vehicles and as a result, the need for national AV standards have been at the forefront of our minds.

I'd encourage continued conversations on best practices for standardization and design, maintenance, and operations of the roadway. The way a highway appears to an AV is very important and clear and concise nationwide standards would go a long way to support the development of AVs in the U.S.

I believe that the path to national standards begins with groups of states agreeing amongst themselves to standards on key corridors. This multistate approach to standardization offers a way forward to test and validate what works and to gain an understanding of what needs to be developed in terms of national standards or regulation.

Through a recent INFRA grant proposal, we are part of such a multistate coalition. Nebraska's part of a 12-state consortium that submitted an INFRA proposal for the Safe Acceleration of Automated Freight Infrastructure Readiness Project in March of 2019.

Through this proposal, covering over 3,400 miles of interstate highway, including I-80, coast to coast, these states would develop and agree to comply with standards for striping, work zone design, and data exchange to support highway automation readiness.

This would effectively create a corridor for autonomous and connected freight movement across the Continental U.S. while also demonstrating the ability of states to collaborate and develop, design, operational, and data exchange standards that can ultimately become the de facto national standard.

Chairman Fischer, Ranking Member Duckworth, and members of the Subcommittee, I joined NDOT to help our state move forward with technology. In the transportation field, I believe we're at an inflection point with multiple technologies advancing quickly and simultaneously.

It is only through partnership between the Federal Government and the states that we will be able to keep pace with these changes and I thank you for your willingness to consider the needs of the states.

I appreciate the invitation to join you today and I look forward to your questions.

[The prepared statement of Mr. Ingracia follows:]

PREPARED STATEMENT OF STEVE INGRACIA, PE, DEPUTY DIRECTOR, TECHNOLOGY
AND STRATEGIC PLANNING, NEBRASKA DEPARTMENT OF TRANSPORTATION

Chairman Fischer, Ranking Member Duckworth and members of the Subcommittee, thank you for the opportunity to testify today.

My name is Steve Ingracia and I am the Deputy Director of Technology and Strategic Planning at the Nebraska Department of Transportation (NDOT). Our agency's 2,100 employees serve the state of Nebraska by operating and maintaining nearly 10,000 miles of roads and 3,500 bridges.

In Nebraska, we've carved out an approach to transportation policy that is practical, forward-leaning, and rooted in fiscal responsibility. Through the leadership of Governor Pete Ricketts and then State Senator Fischer, Nebraska passed the Transportation Innovation Act and the Build Nebraska Act which gave NDOT the resources to care for and improve transportation in Nebraska.

Technological innovation is happening at NDOT and nationwide across all DOTs, and I am pleased the Committee has asked us how Congress can support states, as shifts in technology will certainly alter the transportation industry in significant ways over the next 20 years.

We are continually looking for ways to incorporate technology into what we build. The Advanced Transportation and Congestion Management Technologies Deployment (ATCMTD) Federal grant just awarded to NDOT, in partnership with the Wyoming and Utah DOTs, will advance technologies that improve mobility and safety across the multi-state I80 corridor. This project will build upon Wyoming's successful connected vehicle pilot program to increase the flow of information to freight haulers and will ultimately improve safety along I-80.

We are also incorporating technology into the operational side of our business—systems like the Maintenance Decision Support System (MDSS) and Automatic Vehicle Location (AVL) have been installed on all 633 of our snowplows to allow us to make data-based choices on application rates and to better track quantities of materials used. We have taken this one step further by installing cameras in the front of our trucks to provide realtime snapshots of road conditions to the public through the web, which was immediately popular with the traveling public. NDOT's implementation of MDSS, along with our public facing Plow Tracker site, was recently recognized by AASHTO with regional top honors as a Best Use of Technology and Innovation.

NDOT is also active in discussions regarding policy. Nebraska lawmakers passed a law in 2018 that opened Nebraska's roadways to Autonomous Vehicles (AV), and as a result the need for national AV standards has been at the forefront of our minds. I'd encourage continued conversations on best practices for standardization in design, maintenance, and operations of the roadway. The way a highway appears to an AV is very important, and a clear and concise nationwide standard would go a long way to support the development of AVs in the US.

I believe that the path to a national standard begins with groups of states agreeing amongst themselves to standards on key corridors. This multi-state approach to standardization offers a way forward to test and validate what works, and to gain an understanding of what needs to be developed in terms of national standards or regulation.

Through a recent INFRA grant proposal, we are part of such a multi-state coalition. Nebraska is part of a 12-state consortium that submitted an INFRA proposal for the Safe Acceleration of Automated Freight Infrastructure Readiness project in March of 2019. Through this proposal, covering over 3,400 miles of interstate highway including I-80 coast-to-coast, these states would develop, and agree to comply with, standards for striping, work zone design, and data exchange to support highway automation readiness.

This would effectively create a corridor for autonomous and connected freight movement across the continental US, while also demonstrating the ability of states to collaborate and develop design, operational, and data exchange standards that could ultimately become the de facto national standards.

Chairman Fischer, Ranking Member Duckworth, and members of the Subcommittee, I joined NDOT to help our state move forward with technology. In the transportation field, I believe we are at an inflection point, with multiple technologies advancing quickly and simultaneously. It is only through partnership between the Federal government and the states that we will be able to keep pace with these changes, and I thank you for your willingness to consider the technology needs of states. I appreciate the invitation to join you today, and I look forward to your questions.

Senator FISCHER. Thank you, Steve.

Next, we have Mr. Shailen Bhatt, who is the CEO of the Intelligent Transportation Society of America.

Welcome, sir.

**STATEMENT OF SHAILEN P. BHATT, PRESIDENT
AND CHIEF EXECUTIVE OFFICER, INTELLIGENT
TRANSPORTATION SOCIETY OF AMERICA**

Mr. BHATT. Thank you. Good afternoon, Chairman Fischer, Ranking Member Duckworth, and members of the Committee.

My name is Shailen Bhatt, and I am the President and CEO of the Intelligent Transportation Society of America.

Our members include automakers and technology companies, public sector agencies, such as state and city departments of transportation, transit agencies, and metropolitan planning organizations, along with research institutions.

It's an honor to be here today. Throughout my career, I've been appointed by three Governors and one president to be a leader in transportation. I've always said that departments of transportation exist to save lives and make people's lives better, which is why I feel so strongly that the next transportation reauthorization must reflect the incredible benefits technology can deliver to improve the safety and efficiency of our system.

When I began as the Executive Director of the Colorado Department of Transportation in 2014, 484 people lost their lives on our roadways. When I left in 2017, there were 715 fatalities and the vast majority of that increase were among the most vulnerable users of the system, bicyclists, pedestrians, motorcyclists.

Just last week, NHTSA estimated that while the overall number of roadway deaths was generally unchanged in 2018, we saw a 10 percent increase in cyclist fatalities from the prior year.

So clearly, there is an epidemic of fatalities on our roadways and we believe that technology is the best tool in our toolbox to reduce this epidemic.

Now the first tool I want to talk about are connected vehicle technologies, known as V2X or Vehicle to Everything. These are technologies that allow vehicles to communicate with other vehicles, with the infrastructure, and, most importantly, with users of the system, including pedestrian, cyclists, and motorcyclists.

Last year, there were two million crashes on U.S. roadways. About 30 percent of those were due to impaired driving. NHTSA estimates that V2X can address 80 percent of unimpaired crashes, which means that more than 1.2 million crashes could have been eliminated or mitigated through connected vehicle communications.

V2X technologies are deployed in dozens of cities in the majority of states and require use of the 5.9 gigahertz safety spectrums to communicate, this band that has been designated for transportation safety-critical communications.

Preserving this spectrum for these life-saving technologies is the top priority for ITS America and our members.

Investment in technology in the next reauthorization can also help speed the movement of freight, whether it's at the ports where many of these goods come into the United States, or in the vast multimodal network that moves them across the country.

As an example, Wyoming DOT is using connected vehicle technology to provide truck drivers with a wide range of information, from parking options so they can make the most efficient choice about where to safely stop for the night to imminent collision warning because inclement weather has closed the interstate, and they can share with neighboring states, like Nebraska and Colorado.

Cities, like Las Vegas, are using big data and predictive analytics to improve response times to crashes on I-15. The Regional Transportation Commission of Southern Nevada uses big data and predictive analytics to determine where crashes are likely to occur and prepositions emergency equipment.

This has led to a 12-minute reduction in response time and a 17 percent reduction in secondary crashes on I-15. Getting someone to a doctor within an hour of a crash significantly increases survival chances. It's known as the golden hour. So a 12-minute reduction is massive.

V2X is a critical component of operating our system more safely, but I would be remiss if I didn't mention that cybersecurity safeguards must also be part of the next reauthorization bill.

As our transportation systems become more connected, we must ensure states and cities have the necessary tools to fight against threats from bad actors.

Finally, we hear a lot these days about the transformation of transportation. Nowhere is that more evident than with the Mobility on Demand Initiatives cropping up across the country.

Last year, I spoke at the ITS Heartland Meeting in Lincoln, Nebraska, and one of the things I talked about there was deployment

of autonomous shuttles in Lincoln to provide micro-transit first and last mile solutions.

From Lincoln to Los Angeles, the public and private sectors, along with researchers, are working together using technology to develop solutions that allow people to move seamlessly from place to place, whether that means finding a way to use one form of payment for multiple modes or ensuring that people with disabilities and older adults have complete access to the system.

The next reauthorization holds the key to unlocking the 21st Century of transportation in this country for mobility and infrastructure improvements to eliminating the epidemic of roadway fatalities that claims a hundred lives on our roads every day.

Thank you again for the opportunity to be here. I look forward to any questions.

[The prepared statement of Mr. Bhatt follows:]

PREPARED STATEMENT OF SHAILEN P. BHATT, PRESIDENT AND CHIEF EXECUTIVE OFFICER, INTELLIGENT TRANSPORTATION SOCIETY OF AMERICA

Introduction

Chairman Fischer, Ranking Member Duckworth, and Members of the Committee, thank you for the opportunity to provide the Intelligent Transportation Society of America's (ITS America) perspective on "Examining Technological Innovations in Transportation."

I am pleased to be joined on this panel with Nebraska Department of Transportation Deputy Director of Technology and Strategic Planning Steve Ingracia.

My name is Shailen P. Bhatt, and I am the President and CEO of ITS America. Before joining ITS America in January 2018, I served as Executive Director for the Colorado Department of Transportation (CDOT). In that role, I oversaw the launch of the RoadX program, which is focused on deploying innovative technology solutions—including connected vehicles—and teaming with the private sector to shape the future of transportation. While at CDOT, I also served as the national Chair of the Vehicle-to-Infrastructure Deployment Coalition and the Chair of the National Operations Center of Excellence. Before CDOT, I served as Cabinet Secretary with the Delaware Department of Transportation and Deputy Executive Director of the Kentucky Transportation Cabinet. I also had the pleasure of serving as Associate Administrator at the Federal Highway Administration.

ITS America's vision is "A better future transformed by intelligent mobility—one that is safer, greener, and smarter." Our mission is to advance the research and deployment of intelligent transportation technologies and solutions to save lives, improve mobility, promote sustainability, and increase efficiency and productivity.

Our focus is policy that accelerates seamless mobility technology, connected and automated vehicle technologies, and smart infrastructure; policy that breathes new life into our transportation infrastructure by expanding investments in technologies that support smart communities; and policy that encourages new models and modes of transportation, including micro-transit, rideshare, carshare, bikeshare, micro-mobility, and unmanned systems. Investments in these new modes should also address issues of transportation equity so everyone gains access to mobility and opportunity. That said, our first and foremost priority has been, and continues to be, safety.

Founded as an official advisory board on road technology to the U.S. Department of Transportation, ITS America represents state and city departments of transportation, metropolitan planning organizations, automotive manufacturers, technology companies, engineering firms, automotive suppliers, insurance companies, and research and academic universities.¹ Our Board Chair is Malcolm Dougherty, Senior

¹ The ITS America Board is represented by the following companies: AAA, AECOM, Arizona Department of Transportation, California Department of Transportation, California PATH University of California Berkeley, Conduent, Central Ohio Transit Authority, Crown Castle, Cubic, Delaware Department of Transportation, District of Columbia Department of Transportation, Econolite, Ford Motor Company, General Motors, Gridsmart, HELP, Inc., HNTB, Iteris, Kapsch Trafficom North America, MCity, Michael Baker International, Michigan Department of Transportation San Francisco Bay Area Metropolitan Transportation Commission, National Renewable Energy Lab, New York City Department of Transportation, Panasonic North America, Pennsylvania Department of Transportation, Qualcomm, Southwest Research Institute, State

Vice President and Practice Lead, Transportation, Michael Baker International and former Director, California Department of Transportation; our Vice-Chair is Jennifer Cohan, Secretary, Delaware Department of Transportation.

Over the years since the Fixing America's Surface Transportation (FAST) Act was signed into law, automated and connected vehicle technologies have advanced, the collection and use of big data has become an increasingly valuable tool for decision makers, electrification of vehicles of every type from human scale to large-scale continues, and Mobility on Demand services are transforming how we get around. These technologies allow additional freedom of movement for those who have limited mobility access, such as people with disabilities, older adults, and those living in transit deserts. Technology advancements will also help begin to reduce the epidemic of fatalities on our roadways.

For these reasons, ITS America supports a FAST Act reauthorization that recognizes the added value of integrating technology into transportation infrastructure and services and provides funding for the rapid deployment of intelligent transportation technologies quickly and uniformly to transportation agencies and providers across the entire country.

Moving People, Data, and Freight

Given the title and focus of this hearing is "Examining Technological Innovations in Transportation," and with Congress increasingly focused on the reauthorization of the FAST Act, my written testimony encompasses ITS America's FAST Act Reauthorization Platform: *Moving People, Data, and Freight: Safer. Greener. Smarter*, which ITS America released earlier today. *Moving People, Data, and Freight* bridges new and existing infrastructure technologies and new modes of mobility that we see across the country with the utmost importance of investments to bring our infrastructure to a state of good repair and integrate research, development, and deployment of technology to maximize efficiencies and safety and secure the United States' global leadership in the development and deployment of advanced transportation technologies.

Increase Investment in Research and Deployment of Intelligent Transportation Technologies

Intelligent transportation technologies advance transportation safety and mobility, reduce congestion, improve air quality, and enhance American productivity by integrating advanced technologies into transportation infrastructure, operations, and vehicles. Only with investment certainty will the Nation finally see and benefit from the research and the large-scale transformational deployments of intelligent transportation technologies that will define the way people, goods, services, and information move in the 21st century—and most importantly, finally help begin to reduce the epidemic of fatalities on our roadways.

Moving People, Data, and Freight investment policy supports the solvency of the Highway Trust Fund; the transition to a long-term and sustainable revenue source for transportation; and a national Vehicle Miles Traveled (VMT) pilot. In connection with a national VMT pilot, the platform recommends including large freight shippers as participants and examines whether fleet telematics can be used as a method of data collection.

The platform supports increased funding for research, development, and demonstration of intelligent transportation systems technology; maintaining Federal programs that allow state, metropolitan areas, and city congestion pricing strategies; and increased funding for Intelligent Transportation Systems programs to streamline the movement of goods beginning at ports and through the multimodal supply chain including freight intelligent transportation systems and digital infrastructure systems.

ITS America strongly supports the Advanced Transportation and Congestion Management Technologies Deployment (ATCMTD) program. The platform supports increasing funding and Federal share to 80 percent. It recommends increasing the Federal share to 100 percent for safety critical connected vehicle technologies including Vehicle-to-Vehicle (V2V), Vehicle-to-Infrastructure (V2I), and Vehicle-to-Pedestrian (V2P) under ATCMTD. The association also supports policy that makes V2P technologies an eligible activity under ATCMTD and recommends that the FAST Act reauthorization authorize and dedicate separate funding for ATCMTD. Under the FAST Act, the ATCMTD program has been funded through a set-aside from the Highway Research and Development, Technology and Innovation Deployment, and Intelligent Transportation System Research programs and has resulted in a reduc-

tion of transportation research and development that has historically propelled United States leadership in areas such as connected and automated vehicle development as well as the emerging area of artificial intelligence in mobility management.

Safeguard Critical Transportation Infrastructure from Cybersecurity Threats

As vehicles and infrastructure become more connected, our Nation's transportation system faces increasing cybersecurity risks. Given the ability to cause loss of life and inflict significant economic damage in a highly visible manner, cybersecurity attacks directed at those producing or operating technologies travelling over or connected to U.S. roadways will intensify. ITS America supports policy that would provide states and localities funding and technical assistance under federal-aid highway programs, Federal public transportation programs, and ATCMTD to safeguard critical transportation systems that are more reliant than ever on connectivity to communicate and exchange data from cybersecurity threats.

Prioritize the 5.9 GHz Spectrum for Vehicle-to-Everything (V2X) Public Safety Transportation Communications and Grow Investments in Vehicle-to-Infrastructure (V2I) and Vehicle-to-Pedestrian (V2P) Technologies

The U.S. Department of Transportation is working with industry, safety, and public sector stakeholders to develop and evaluate cooperative technologies, equipment, and applications known as Connected Vehicle (CV) technologies that operate in the 5.9 GHz band, inclusive of V2V, V2I, and V2P—collectively referred to as Vehicle-to-Everything (V2X). This includes all V2X technologies—Dedicated Short Range Communications (DSRC) as well as Cellular vehicle-to-everything (C-V2X)—because the band can be configured to enable real-time crash-avoidance alerts and warnings—offering a significant opportunity to achieve a transformation in transportation safety.

Cable companies and their supporters are seeking additional spectrum for enhanced WiFi experiences and are aggressively pressuring the Federal Communications Commission (FCC) to force public safety transportation communications operating in the 5.9 GHz band to share that spectrum with unlicensed consumer broadband devices.

Speed matters when safety information is involved. Sharing the band could compromise the speed and put lives at risk. What if a driver knew, in fractions of a second, that an airbag deployed in a car in front of them? Alternatively, that the car in front, around the next curve, was sliding on black ice? Or a person is walking just around the next corner? Thanks to V2X, that driver would react—and avoid a crash. Deploying V2X that allow cars, trucks, bicycles, motorcycles, streetlights and other infrastructure to talk to each other will ensure more people travel safely. Safety is the top priority of the Nation's transportation system.

Moving People, Data, and Freight supports policy that makes clear the 5.9 GHz band is prioritized for existing, new, and developing vehicle-to-everything (V2X) technologies that send hazard alerts to infrastructure, motorists, pedestrians, and other transportation system users and hold the promise to enhance automated driving systems. The platform supports a policy that ensures all three phases of testing for the 5.9 GHz band are complete before the FCC rules on whether the spectrum can be shared between V2X operations and unlicensed devices like WiFi.

V2I communications, which involves the exchange of safety and operational data between vehicles and elements of the transportation infrastructure, offer a wide range of safety benefits. V2I provides vehicles and drivers information about infrastructure operations—weather and pavement conditions, how signals are directing traffic, and even the location of potential hazards at intersections and other critical road safety hotspots. V2I applications include red light violation warnings, reduced speed zone warnings, curve speed warnings, and spot weather impact warnings. V2I soon will support other applications that will disseminate the condition of the infrastructure, such as bridge integrity, and may even collect vehicle data that describes pavement condition. According to the National Highway Traffic Safety Administration (NHTSA), V2I technology helps drivers safely negotiate intersections and could help prevent 41 to 55 percent of intersection crashes. Another connected vehicle safety application that helps drivers with left turns at intersections could help prevent 36 to 62 percent of left-turn crashes. In addition to the lives saved, just these two applications alone could prevent up to 592,000 crashes and 270,000 injuries each year.

Fatalities in crashes involving at least one large truck increased by an estimated three percent in 2018, according to NHTSA's preliminary statistics. As part of the USDOT's Connected Vehicle Pilot Program, Wyoming is demonstrating what rural states can do to benefit travelers. Wyoming is deploying CV technology along the 402 miles of I-80 where winter wind speeds and gusts result in trucks blowing over

and often lead to road closures. The Wyoming Department of Transportation (WYDOT) CV pilot focuses on commercial vehicle operators by developing applications to support advisories including roadside alerts, parking notifications and dynamic travel guidance. WYDOT is equipping 400 vehicles, a combination of fleet vehicles and commercial trucks with on-board units (OBUs). Of the 400 vehicles, at least 150 would be heavy trucks that are expected to be regular users of I-80. In addition, of the 400 equipped-vehicles, 100 WYDOT fleet vehicles, snowplows, and highway patrol vehicles will be equipped with OBUs and mobile weather sensors.

The Regional Transportation Commission of Southern Nevada recently became the first in the world to put roadway information into a digital format. As connected vehicles drive over the actual roadway, they can pick up differences between the “digital” road and the actual road. This could eliminate the need for agencies to manually examine roadways for striping or automatically report potholes instead of waiting for enough drivers to incur tire damage before fixing them. These vehicles will also give an up-to-the-minute snapshot of the system—how it is performing, are there any incidents, and live weather conditions.

Moving People, Data, and Freight recommends increasing the Federal match to 100 percent for installation of V2I safety technologies. We also recommend expanding eligibility to include data collection and analysis software (including data acquisition through private sector partnership), maintenance and operations, fiber, integration, the costs associated with systems, and equipment required for V2I communications technology.

Pedestrian deaths increased by an estimated 4 percent and “pedalcyclist” deaths increased by an estimated 10 percent in 2018, according to NHTSA’s preliminary statistics. V2X will enable deployment of safety solutions to protect these vulnerable users of the system. By allowing vehicles to communicate with users through sensors or vehicle-to-device communication, we can significantly reduce the number of people killed on our roadways. V2P encompasses a broad set of road users—people walking, children being pushed in strollers, people using wheelchairs or other mobility devices, passengers embarking and disembarking buses and trains, and people riding bicycles and scooters. ITS America recommends expanding eligibility under the Advanced Transportation and Congestion Management Technologies Deployment (ATCMTD) program to include V2P technologies.

Expand Investments in Advanced Mobility Improvements

ITS America supports expanding eligibility under highway programs to include advanced mobility safety improvements including data infrastructure and analysis, smart mobility improvements such as smart truck parking, smart work zones, smart pavements, predictive analytics platform, and build out of electric vehicle charging stations, hydrogen fueling infrastructure, natural gas fueling infrastructure, and other alternative fuels.

Due to the lack of truck parking availability information and safe and convenient truck parking spaces, tired commercial vehicle operators may continue to drive while searching for a place to park and rest, resulting in fatigue-associated crashes. Florida, Texas, Arizona, and California are among a growing number of states planning and deploying smart truck parking technologies for real-time truck parking availability. Smart truck parking technology uses a combination of in-pavement space occupancy detection for the location with mixed vehicle type usage and microwave vehicle detection for monitoring of ingress/egress at the weigh stations.

Another example of an advanced mobility improvement is data analytics. The Regional Transportation Commission of Southern Nevada (RTC) is using predictive analytics to improve safety and efficiency on freeways, including key freight corridors and major arterials by compiling and analyzing data to report in real-time the location of accidents and predict where dangerous driving conditions or congestion may occur. This technology enables faster validation and response to roadway incidents as well as a more efficient use of resources to proactively deploy traffic patrols and abatement efforts with the goal of preventing incidents.

Plan for Transformative Transportation Technologies

States, providers of public transportation, and Metropolitan Planning Organizations (MPOs) are expanding beyond traditional long-range scenario planning, which holds fixed certain transportation and land use assumptions, to consider big questions facing the transportation system, including whether connected and automated vehicles will increase the vehicle capacity of existing highway lanes; how automation and active transportation connections might help solve the first mile/last mile transit challenge; what roadway investments could incentivize the shift to connected and automated vehicles; how to make sure the entire transportation system is working together; and how to expedite technology safety benefits. Increased funding and

flexibility will help planners analyze project performance across a range of different futures, including ensuring all modes of transportation work in concert and will lead to more informed project prioritization that maximizes the benefits of connected and automated technologies.

The Metropolitan Transportation Commission (MTC), MPO for the San Francisco Bay Area, launched Horizon, a new effort to plan for, and help shape, a range of possible connected and automated vehicle futures. By expanding beyond traditional long-range scenario planning, which holds fixed certain transportation and land use assumptions, Horizon will help inform big questions facing the transportation industry, such as:

- Will connected and automated vehicles substantially increase the vehicle capacity of existing highway lanes? If so, does it make sense to add additional physical capacity today?
- How might automation help solve the first mile/last-mile transit challenge, reducing barriers to transit ridership? What type of investments are needed to get us there?
- What roadway investments could incentivize the shift to connected and automated vehicles and expedite short-term safety benefits?

Ultimately, this effort could help planners analyze project performance across a range of different futures and lead to more informed project prioritization. Though the benefits may be significant, this planning effort requires substantial time and resources. Additional Federal planning funds and flexibility to experiment with innovative initiatives like Horizon could support transportation planners in efforts to maximize the benefits of connected automated technologies.

Moving People, Data, and Freight supports additional planning funds to help regions and states better address complexities around transformative transportation technologies and climate change in the context of an integrated multimodal transportation system. ITS America also supports additional planning funds and flexibility to the planning process to prepare for a range of possible connected and automated vehicle future scenarios.

Deploy Broadband to Support Intelligent Transportation Technologies

Telecommunication technologies, such as broadband, are essential to the transport of people, data, and freight. Assisting states and localities with recovering costs associated with conduit installation, maintenance of conduit, and conduit inventory is critical to increasing broadband installation, especially in rural areas and economically disadvantaged urban areas. Combining broadband conduit installation with highway and road construction will result in decreased frequency of construction on highways and roads, reduce broadband installation costs, increase access to and reliability of broadband networks, increase public and economic benefits, and decrease the time needed to deploy fiber.

Moving People, Data, and Freight supports a new authorization that supports smart highways and streets with broadband fiber optic cable to make roads safer by establishing new Federal funding to assist states and localities to coordinate statewide telecommunication and broadband plans and state and local transportation and land use plans, including strategies to minimize repeated excavations that involve the installation of broadband infrastructure in a right-of-way, among other activities that promote broadband conduit installation.

Increase Buildout of Alternative Fuel Vehicle Infrastructure to Support a Future of Zero Emission Vehicles

Alternative Fuel Vehicles are shaping the future of mobility, and the United States is poised to lead a global transition to zero emission vehicles (ZEV). Nevertheless, U.S. government analysis suggests that additional ZEV infrastructure investments will be required to satisfy the future of transportation. ZEV sales continue to increase year-over-year; however, these new mobility options will need 21st century infrastructure to continue to spur consumer adoption and address consumers' "range anxiety". U.S. government analysis suggests that current and projected deployments represent only a fraction of the estimated demand.

Moving People, Data, and Freight supports a new grant program to support state and local governments' efforts with infrastructure providers to invest in electric vehicle charging and hydrogen fueling infrastructure along designated alternative fuel corridors. ITS America also supports increasing Federal funding under the Surface Transportation Block (STBG) Grant program and Congestion Mitigation and Air Quality (CMAQ) program to rapidly build out electric vehicle charging stations, hydrogen refueling stations, natural gas infrastructure, and technologies such as inductive charging to speed the deployment. The platform also supports the zero-emis-

sion plug-in electric vehicle tax credit, an additional allocation of zero-emission plug-in electric vehicle tax credits reserved for medium-duty commercial delivery vans, and the reinstatement of a zero-emission consumer tax credit for the purchase of fuel cell vehicles.

Build Transformative and Adaptive Infrastructure for Deployment of Intelligent Transportation Technologies to Mitigate Climate Change

States, metropolitan regions, and cities will require substantial investment to adapt infrastructure to be resilient in a changing climate and responsive to a new mobility paradigm. Federally supported, near-term infrastructure improvements will provide the dual benefit of immediately mitigating carbon-emitting congestion while preparing our Nation for intelligent mobility and smart infrastructure.

ITS America recommends establishing a new flexible program to make transportation networks more resilient in the face of a changing climate and more responsive to the technology-fueled transformation in how people and goods move. The program should be highly flexible, modeneutral and include formula and discretionary components. Eligible projects should include capital and operational investments that improve both near-term and long-term system safety and performance. Examples include programs to support deployment of automated vehicles; V2X communications technologies; priced managed lanes; transportation demand management programs; strategic micro-transit investments; advanced parking freight delivery and incident management systems; alternative fuel charging infrastructure and other advanced technologies to support a clean transportation system; and climate mitigation/resiliency improvements. *Moving People, Data, and Freight* supports policy to make eligible funding for renewable energy projects in the Interstate rights-of-way for transportation use by states and localities for transportation related purposes.

Establish a Mobility on Demand (MOD) Program for the New World of Mobility

In the 21st century, mobility is less about moving vehicles and more about moving people, data and freight. Long-existing silos among cities, states, counties, road and transit agencies are disappearing; and private mobility service providers barely existed a decade ago. More choices exist now, but for people to fully realize the benefits of this new world of mobility, it must be easier to choose which option best meets their needs. This also means services that are accessible for every traveler and in all communities and neighborhoods.

In cities, Mobility on Demand (MOD) offers convenient, affordable, and, in the case of bikeshare, rideshare or micromobility services, more sustainable alternatives to driving within congested environments. For suburban areas, MOD offers first mile/last mile accessibility to transit, as well as more dynamic on-demand services to get around town. While often seen as an urban/metro transportation solution, MOD deployed in rural areas also provides first mile/last mile (though more like first/last 50 miles) connections to transit, intercity bus and rail transport, and essential air service airports. Rideshare and ride sourcing is providing support for seniors to access social and health services. Micromobility services offer options to travel in town. MOD includes bikeshare and scooter share deployments on college campuses. New and improved MOD transit and paratransit services also can benefit rural communities.

The framework for aggregating and managing supply and demand depends on connected data rather than on a particular technology. MOD is powered by technology and mobility services that currently and will include:

- Data systems and data analytics platforms, specifically open data platforms, open source technologies, and data sharing agreements that allow public and controlled access to mobility data to plan real-time operations and longer-term planning;
- Asset management systems (parking, curb, freight delivery), specifically to provide opportunity for mapping assets to develop more comprehensive use management strategies and value pricing systems (*e.g.*, assessing a fee for curb-side passenger drop off, or use of designated delivery or drop-off zone or conversely a fee for not using provided zones);
- Security/safety systems: this can be physical technologies—like locking systems for bikeshares where bikes must be secured at the end of a trip—or cybersecurity systems. With the potential introduction of automated/autonomous vehicles into MOD services, like rideshare, it will be increasingly important to have systems that monitor performance and track/mitigate any security breaches. It also may be increasingly important to have systems that confirm

that the rider is the intended person, and also potentially (in the case of AVs, per say) monitor that riders are safe throughout their trip.

- Geospatial Technology: defined as the collective data and associated technology that has a geographic or locational component; Technology used to acquire, manipulate, and store geographic information. Geographic Information Systems (GIS) is one form of geospatial technology. GPS, remote sensing, and geofencing are other examples of geospatial technology.—Geofencing, for example, is being used in scootershare and bikeshare programs to monitor use and designate certain areas as no-go or no-park zones.
- Connected vehicle platforms and data, specifically to provide opportunity for real-time operations such as deployment of emergency service providers, rerouting of traffic during major events, and fleet management (public or private);
- Integrated trip planning technology platforms that power travel across a variety of modes, including public transportation, transportation network companies, car and bike sharing services, micro-transit providers, and even private vehicle mobility planning;
- Integrated booking and payment systems that power seamless travel across a variety of modes to include both public and private mobility services;
- Integrated payment systems for transportation adjacencies or value-pricing asset usage (*e.g.*, tolling, congestion pricing, dynamic parking, curb-side pricing, motor vehicle administrative transactions, electric charging stations);
- Integrated payment systems that include other specialized and demand-response transportation (*e.g.*, human service transportation, faith-based transportation, nonemergency medical transportation, paratransit, volunteer-based transportation, closed or open loop shuttle services, employee and campus transportation); and
- Integrated payment systems that could include multiple non-transit/non-mobility services (*e.g.*, retail, incentivization, loyalty programs); social programs (*e.g.*, travelers with disabilities, student discounts, transit benefits, social security, senior citizens, veteran benefits, human service programs); and access and authorization (*e.g.*, student cards, government IDs, campus/academic cards, library access, community and facility access, municipal programs, age-based programs).

In the future, Augmented Reality (AR) enhanced by 5G connectivity could make MOD and the delivery of real-time data even more useful. For instance, AR can be used to create interactive maps to help people navigate transit systems. By using the camera in a traveler's mobile device and superimposing digital information on what the camera is capturing, AR can make it easier for the user to make more informed decisions based on up-to-date information. Holding a mobile device on top of a transit map, for example, would allow users to see real-time movement of trains and buses near their location.

Access to transportation means access to jobs, education, and healthcare, which is a major challenge for people with disabilities. New technologies have in the past and will continue to expand access to transportation. According to the U.S. Census, nearly one in five people in the United States have a disability. They also represent significant pent-up demand for transportation services. As a result, it is anticipated that there will be a notable increase in travel should fully automated vehicles succeed in expanding mobility access. The Policy Institute of AARP (formerly the American Association of Retired Persons) estimates that one-third of U.S. residents do not drive. Recent research by Carnegie Mellon University suggests that if non-drivers, such as older adults and people with disabilities, were to gain access to automated vehicles, VMT could increase up to 14 percent. To put this in perspective, VMT growth usually hovers around one percent annually. Nearly everyone experiences disability at one time or another, often the result of injury, sickness, or aging. Furthermore, access to transportation may also help older adults remain in their homes to age in place, and independence in mobility not only often improves the lives of those who achieve it but also reduces associated burdens and stress on caregiving family members.

MOD may also promise expansion of accessible transportation. Transit agencies are contracting with shared ride and ride hailing companies to provide paratransit services. As a result, ridehailing services become less like taxi services and more like paratransit. Under these contracts, ride-hailing services must provide accessible vehicles and driver assistance.

ITS America has worked with the auto industry, tech companies, groups representing people with disabilities, and the Departments of Transportation, Labor

and Health and Human Services to devise roadmap for accessibility in new automated and connected vehicle systems.

Moving People, Data, and Freight supports establishing a MOD program that encourages flexibility within Federal transportation programs to meet changing mobility needs, including partnerships with companies offering shared-use trips (car, bicycle, new mobility modes), data management, and other technology companies for first mile/last mile services and improved freight delivery, the integration of mobility services and technologies, and new fare and integrated payment technologies. ITS America supports a MOD program that establishes a data sharing framework that provides standardization for the transfer of data among transportation operators and providers to foster the efficient use of capacity, enhance management of new modes of mobility, and promote the creation of innovative planning tools.

Strengthen the University Transportation Centers Program

Moving People, Data, and Freight supports reforms in the University Transportation Centers program that directs grants to universities with research and technical expertise; encourages leading edge as well as near-term practical applied research (reduce the time period from research concept to completion); encourages broader inclusion of ITS-related curriculum, degrees, and professional development programs for current and future workforce; and increases opportunities for private sector funding contributions.

Conclusion

Just as transportation infrastructure was critical to the development of our economy in the 20th century, maintenance of existing infrastructure and deployment of intelligent mobility and smart infrastructure will be critical for our global competitiveness in this century. Advances in robotics, artificial intelligence, and wireless communications will define the way people, goods, services, and information move in the 21st century.

New forms of mobility are being deployed even as others are being developed. When cars were invented a century ago, Departments of Roads were created to build infrastructure for this new form of transportation. Those agencies are now Departments of Transportation, having grown to include many modes of transportation. Now those same agencies are evolving again to provide seamless multimodal mobility and to build smart infrastructure that will support the technology-driven 21st-century economy, which is all about moving, people, data, and freight.

Changes are happening today that will fundamentally affect how people interact with transportation in the months and years ahead. ITS America is helping cities, states, the private sector, and researchers as we work toward our vision of a better future transformed by intelligent mobility—one that is safer, greener, and smarter.

Our members come to one table—ITS America—to shape the next generation of transportation and infrastructure driven by intelligent transportation technologies.

Thank you again for the opportunity to testify today, and I am happy to answer any questions you may have.

ITS America acknowledges the contributions of ITS America Smart Infrastructure Task Force FAST Act Reauthorization co-chairs John Barton, National DOT Market Sector and Senior Vice President, HNTB, and Tina Quigley, Chief Executive Officer, Regional Transportation Commission of Southern Nevada, and more than 40 members of the task force representing the strength of ITS America: states, cities, metropolitan planning organizations, automakers, technology companies, research universities, and engineering, construction, and technical services firms. ITS America acknowledges the assistance of Boyagian Consulting.



FIXING AMERICA'S SURFACE TRANSPORTATION (FAST) ACT REAUTHORIZATION

PLATFORM AND RECOMMENDATIONS

Moving People, Data, and Freight: Safer, Greener, Smarter.

ITS America's vision is "A better future transformed by intelligent mobility – one that is safer, greener, and smarter." Our mission is to advance the research and deployment of intelligent transportation technologies and solutions to save lives, improve mobility, promote sustainability, and increase efficiency and productivity.

Our focus is policy that accelerates seamless mobility technology, connected and automated vehicle technologies, and smart infrastructure; policy that breathes new life into our transportation infrastructure by expanding investments in technologies that support smart communities; and policy that encourages new models and modes of transportation, including micro-transit, rideshare, carshare, bikeshare, micro-mobility, and unmanned systems. Investments in these new modes should also address issues of transportation equity so everyone gains access to mobility and opportunity. That said, our first and foremost priority has been, and continues to be, safety.

Founded as an official advisory board on road technology to the U.S. Department of Transportation, ITS America represents state and city departments of transportation, metropolitan planning organizations, automotive manufacturers, technology companies, engineering firms, automotive suppliers, insurance companies, and research and academic universities.^[1] Our Board Chair is Malcolm Dougherty, Senior Vice President and Practice Lead, Transportation, Michael Baker International and former Director, California Department of Transportation; our Vice-Chair is Jennifer Cohan, Secretary, Delaware Department of Transportation.

^[1] The ITS America Board is represented by the following companies: AAA, AECOM, Arizona Department of Transportation, California Department of Transportation, California PATH University of California Berkeley, Conduent, Central Ohio Transit Authority, Crown Castle, Cubic, Delaware Department of Transportation, District of Columbia Department of Transportation, Econolite, Ford Motor Company, General Motors, Gridsmart, HELP, Inc., HNTB, Iteris, Kapsch TrafficCom North America, MCity, Michael Baker International, Michigan Department of Transportation San Francisco Bay Area Metropolitan Transportation Commission, National Renewable Energy Lab, New York City Department of Transportation, Panasonic North America, Pennsylvania Department of Transportation, Qualcomm, Southwest Research Institute, State Farm Insurance, Toyota, Texas Transportation Institute, Utah Department of Transportation, Washington State Department of Transportation.



Over the years since the Fixing America's Surface Transportation (FAST) Act was signed into law, automated and connected vehicle technologies have advanced, the collection and use of big data has become an increasingly valuable tool for decision makers, electrification of vehicles of every type from human scale to large-scale continues, and Mobility on Demand services are transforming how we get around. These technologies allow additional freedom of movement for those who have limited mobility access, such as people with disabilities, older adults, and those living in transit deserts. Technology advancements will also help begin to reduce the epidemic of fatalities on our roadways.

For these reasons, ITS America supports a FAST Act reauthorization that recognizes the added value of integrating technology into transportation infrastructure and services and provides funding for the rapid deployment of intelligent transportation technologies quickly and uniformly to transportation agencies and providers across the entire country.

Just as transportation infrastructure was critical to the development of our economy in the 20th century, maintenance of existing infrastructure and deployment of intelligent mobility and smart infrastructure will be critical for our global competitiveness in this century. Advances in robotics, artificial intelligence, and wireless communications will define the way people, goods, services, and information move in the 21st century.

New forms of mobility are being deployed even as others are being developed. When cars were invented a century ago, Departments of Roads were created to build infrastructure for this new form of transportation. Those agencies are now Departments of Transportation, having grown to include many modes of transportation. Now those same agencies are evolving again to provide seamless multimodal mobility and to build smart infrastructure that will support the technology-driven 21st-century economy, which is all about moving, people, data, and freight.

Our members come to one table—ITS America—to shape the next generation of transportation and infrastructure driven by intelligent transportation technologies.

Shailen P. Bhatt
President and CEO
The Intelligent Transportation Society of America



TABLE OF CONTENTS

INTRODUCTION	1
1. Increase Investments in Research and Deployment of Intelligent Transportation Technologies	5
1.1. Ensure the solvency of the Highway Trust Fund	
1.2. Transition to a long-term and sustainable revenue source for transportation	
1.3. Support additional funding for intelligent transportation technologies	
1.4. Support a national Vehicle Miles Traveled (VMT) pilot program	
1.5. Support and expand the existing state pilot program	
1.6. Support a national study to apply fuel excise taxes to grid acquired electricity used in transportation	
1.7. Include large freight shippers as participants in a national VMT pilot	
1.8. Maintain federal programs that allow state, metropolitan area, and city congestion pricing strategies; fund the Value Pricing Pilot Program to provide congestion pricing grants to state, metropolitan areas, and local governments	
1.9. Support policy that increases multimodal funding to improve supply chain efficiencies at ports and throughout the multimodal network	
1.10. Support funding for Maritime Administration's Port Infrastructure Development Program	
1.11. Increase funding and federal share to 80% for the Advanced Transportation and Congestion Management Technologies Deployment (ATCMTD) program	
1.12. Support policy that makes vehicle-to-pedestrian (V2P) technologies an eligible activity under ATCMTD	
1.13. Adopt the Federal Transit Administration (FTA) Mobility-on-Demand Sandbox demonstration grant program rules regarding private sector partners for the ATCMTD Program	
2. Safeguard Critical Transportation Infrastructure from Cybersecurity Threats	7
3. Prioritize the 5.9 GHz Spectrum for Vehicle-to-Everything (V2X) Public Safety Transportation Communications and Grow Investments in Vehicle-to-Infrastructure (V2I) and V2P Technologies	8
3.1. Support policy that makes clear the 5.9GHz band is prioritized for existing, new, and developing V2X technologies	
3.2. Support a policy that ensures all three phases of testing for the 5.9 GHz band are complete	
3.3. Increases the federal match to 100% for installation of vehicle-to-infrastructure (V2I) safety technologies	
3.4. Expand eligibility, under the ATCMTD program, to include V2P technologies	
4. Expand Investments in Advanced Mobility Improvements	9
4.1. Expand eligibility under highway programs to include advanced mobility improvements	
5. Plan for Transformative Transportation Technologies	10
5.1. Support policy that provides additional planning funds to address complexities around transformative transportation technologies and climate change	
5.2. Support policy that provides additional planning funds and flexibility to the planning process to prepare for connected and automated vehicles	
6. Deploy Broadband to Support Intelligent Transportation Technologies	10
7. Increase Buildout of Alternative Fuel Vehicle Infrastructure to Support a Future of Zero Emission Vehicles	11
7.1. Establish a grant program to invest in electric vehicle charging and hydrogen fueling infrastructure	



- 7.2. Support policy that increases federal funding to rapidly build out alternative vehicle fueling infrastructure
- 7.3. Support policy that maintains the zero-emission plug-in electric vehicle tax credit
- 7.4. Provide an additional allocation of zero-emission plug-in electric vehicle tax credits for medium-duty commercial delivery vans
- 7.5. Support policy that reinstates a zero-emission consumer tax credit for fuel cell vehicles
- 8. Build Transformative and Adaptive Infrastructure for Deployment of Intelligent Transportation Technologies to Mitigate Climate Change **12**
 - 8.1. Support a new program to make transportation networks more resilient with climate change responsive to the technology-fueled transformation in how people and goods move
 - 8.2. Support policy to make eligible funding for renewable energy projects in the interstate rights-of-way for transportation use
- 9. Establish A Mobility-on-Demand Program for the New World of Mobility **13**
 - 9.1. Support flexibility with federal highway and transit funding to meet changing mobility needs
 - 9.2. Support increased federal funding to public transit
 - 9.3. Support a data sharing framework
 - 9.4. Make permanent and increase funding for FTA MOD Sandbox
- 10. Strengthen the University Transportation Centers Program **14**



SAFER. GREENER. SMARTER.

1. POLICY: INCREASE INVESTMENT IN RESEARCH AND DEPLOYMENT OF INTELLIGENT TRANSPORTATION TECHNOLOGIES.

Intelligent transportation technologies advance transportation safety and mobility, reduce congestion, improve air quality, and enhance American productivity by integrating advanced technologies into transportation infrastructure, operations, and vehicles. Only with investment certainty will the nation finally see and benefit from the research and the large-scale transformational deployments of intelligent transportation technologies that will define the way people, goods, services, and information move in the 21st century - and most importantly, finally help begin to reduce the epidemic of fatalities on our roadways.

ITS America Recommendation

- Ensure the solvency of the Highway Trust Fund; transition to a long-term and sustainable revenue source for transportation; and support additional funding for intelligent transportation technologies.
- Increase funding authorizations from the Highway Trust Fund for research, development, and demonstration of intelligent transportation systems technology to secure the United States' global leadership in the development and deployment of advanced transportation technologies. Ensuring United States technological leadership in transportation will have broad and substantial safety and economic benefits.
- Support a national Vehicle Miles Traveled (VMT) pilot program and support and expand the existing state pilot program to test the viability of a VMT user fee collection system. The programs should, at a minimum, consider equity among users, determine the efficiency in collection of fees and address any diversion of revenue, and resolve driver privacy issues.
- In conjunction with a national VMT pilot program, support a national study to apply fuel excise taxes to grid acquired electricity used in transportation. In connection with a national VMT pilot, include large freight shippers as participants and examine if fleet telematics can be used as a method of data collection.
- Maintain federal programs that allow state, metropolitan areas, and city congestion pricing strategies to reduce congestion and to raise revenues to support transportation improvements and improve trip time reliability; fund the Value Pricing Pilot Program to provide grants to state, metropolitan areas, and local governments to demonstrate to what extent congestion may be reduced and person-throughput can be increased through application of congestion pricing strategies, and the magnitude of the impact of such strategies on driver behavior, traffic volumes, transit ridership, air quality and availability of funds for transportation programs.
- Support increased funding for Intelligent Transportation Systems (ITS) programs to streamline the movement of goods beginning at ports and through the multimodal supply chain.



- Support policy that increases funding to improve supply chain efficiencies at ports and throughout the multimodal network the serve ports by increasing multimodal funding under current FAST Act formula programs and removing the multimodal caps from the Infrastructure for Rebuilding America (INFRA) grants. Support funding for Maritime Administration's (MARAD) Port Infrastructure Development Program that includes freight intelligent transportation systems and digital infrastructure systems as an eligible project.

1.1 ADVANCED TRANSPORTATION AND CONGESTION MANAGEMENT TECHNOLOGIES DEPLOYMENT (ATCMTD) PROGRAM

The Advanced Transportation and Congestion Management Technologies Deployment (ATCMTD) program funds cutting-edge technologies that are ready to be deployed to enhance traffic capacity for commuters and businesses. The FAST Act established ATCMTD to make competitive grants for the development of model deployment sites for large-scale installation and operation of advanced transportation technologies.

ITS America Recommendation

- Amend 23 U. S. C. §503 (c) to authorize and dedicate separate funding for the Advanced Transportation and Congestion Management Technologies Deployment (ATCMTD) program. Under the FAST Act, the ATCMTD program has been funded through a set-aside from the Highway Research and Development, Technology and Innovation Deployment, and Intelligent Transportation System Research programs and has resulted in a reduction of transportation research and development that has historically propelled United States leadership in areas such as connected and automated vehicle development as well as the emerging area of artificial intelligence in mobility management.
- Increase funding and federal share to 80% for the ATCMTD program to account for the overwhelming demand for advanced transportation and congestion management technologies. In 2017, the Federal Highway Administration (FHWA) received 68 applications from 52 states and localities requesting more than \$362 million. In 2016, FHWA received 81 proposals requesting more than \$509 million. (See increased funding for base grant program in 104(b) amendments).
- Increase the federal share to 100% for safety critical connected vehicle technologies including Vehicle-to-Vehicle (V2V), Vehicle-to-Infrastructure (V2I), and Vehicle-to-Pedestrian (V2P). Support policy that makes V2P technologies an eligible activity under ATCMTD at 100% federal share.
- Make safety databases required of Automated Driving System (ADS) Demonstration Grants eligible for ATCMTD funding.
- Adopt the FTA Mobility on Demand (MOD) Sandbox demonstration grant program rules regarding private sector partners. Under the MOD program, the FTA may determine that any named project partner in the proposal is a key partner and make any award conditional upon the participation of that key partner. A key partner that is essential to the project, as approved by FTA, is eligible for a noncompetitive award by the applicant to provide the goods or services described in the application. A key partner's participation on a selected project may not later be substituted



without FTA's knowledge and approval. Eligible project partners under the MOD Sandbox program may include a private for-profit and not-for-profit organization, including shared use mobility providers and technology system suppliers.

- Support policy for Cooperative Automation Research Mobility Applications (CARMA).

2. **POLICY: SAFEGUARD CRITICAL TRANSPORTATION INFRASTRUCTURE FROM CYBERSECURITY THREATS**

As vehicles and infrastructure become more connected, our nation's transportation system faces increasing cybersecurity risks. Given the ability to cause loss of life and inflict significant economic damage in a highly visible manner, cybersecurity attacks directed at those producing or operating technologies travelling over or connected to U.S. roadways will intensify.

ITS America Recommendation

- Support policy that would provide states and localities funding and technical assistance to safeguard critical transportation systems that are more reliant than ever on connectivity to communicate and exchange data from cybersecurity threats.
- Amend 23 U. S.C. § Sections 119, 133, 167, and 148 of 23USC to authorize that funds made available may be used to implement measures to protect highways, roads, bridges, and tunnels against cybersecurity threats to transportation infrastructure by allowing system access only as authorized and preventing malicious activity.
- Amend 49 U. S. C. Chapter 53 of Subtitle III of 49USC to protect public transportation systems from cybersecurity threats – Amend § 5302 definitions to include measures to protect against cybersecurity threats under the definition of Capital Project to allow system access only as authorized and prevent malicious activity.
- Amend 23 U. S. C. § 503(c)(4)(E) to include measures to protect against cybersecurity threats as an eligible use of grants.
- Provide funding for risk assessments and planning services; developing best practices supporting cyber protection of legacy infrastructure, software and hardware solutions; implementing active and predictive threat monitoring services; deploying continuous monitoring and attack mitigation cyber security technologies and devices to harden traffic management systems and operations centers, creating Security Operations Centers (SOCs); and providing cybersecurity training to cybersecurity staff and other staff.
- Eligible activities include operating Intelligent Transportation System networks (ITS Networks) that enable infrastructure owner-operators to actively manage and protect transportation system such as secure traffic signal and sensor networks; secure wireless, wired, and fiber-optic networks; toll lane devices and systems; secure devices and systems to provide reliable and authoritative traveler information (VMS, websites, handheld device applications, in-vehicle information systems, etc.); active traffic management systems (lane use signals, variable speed limits); camera networks; weather-incident management systems; rock fall, flood, and avalanche detection systems; seismic detection systems; connected vehicle systems (Vehicle-to-Everything;



infrastructure, other vehicles, people, cyclists, etc.); and Security Credential Management System (SCMS) that ensures connected vehicle technologies operate in a safe, secure, and privacy-protective manner.

3. POLICY: PRIORITIZE THE 5.9 GHZ SPECTRUM FOR VEHICLE-TO-EVERYTHING (V2X) PUBLIC SAFETY TRANSPORTATION COMMUNICATIONS AND GROW INVESTMENTS IN VEHICLE-TO-INFRASTRUCTURE (V2I) AND VEHICLE-TO-PEDESTRIAN (V2P) TECHNOLOGIES

The U.S. Department of Transportation is working with industry and public sector stakeholders to develop and evaluate cooperative technologies, equipment, and applications known as Connected Vehicle (CV) technologies that operate in the 5.9 GHz band, inclusive of Vehicle-to-Vehicle (V2V), Vehicle-to-Infrastructure (V2I), and Vehicle-to-Pedestrian (V2P) – collectively referred to as V2X; this includes all V2X technologies – Dedicated Short Range Communications (DSRC) as well as Cellular vehicle-to-everything (C-V2X) – because it can be configured to enable real-time crash-avoidance alerts and warnings—offering a significant opportunity to achieve a transformation in transportation safety.

Cable companies and their supporters are seeking additional spectrum for enhanced WiFi experience and are aggressively pressuring the FCC to force public safety transportation communications operating in the 5.9 GHz band to share that spectrum with unlicensed consumer broadband devices.

Speed matters when safety information is involved. Sharing the band could compromise the speed and put lives at risk. What if a driver knew, in fractions of a second, that an airbag deployed in a car in front of them? Alternatively, that the car in front, around the next curve, was sliding on black ice? Or a person is walking just around the next corner? Thanks to V2X, that driver would react – and avoid a crash. Deploying V2X that allow cars, trucks, bicycles, motorcycles, streetlights and other infrastructure to talk to each other will ensure more people travel safely. Safety is the top priority of the nation's transportation system.

ITS America Recommendation

- Support policy that makes clear the 5.9 GHz band is prioritized for existing, new, and developing vehicle-to-everything (V2X) technologies that send hazard alerts to infrastructure, motorists, pedestrians, and other transportation system users and hold the promise to enhance automated driving systems.
- Support a policy that ensures all three phases of testing for the 5.9 GHz band are complete before the Federal Communications Commission (FCC) rules on whether the spectrum can be shared between V2X operations and unlicensed devices like WiFi. Any unlicensed use in the band should be done without harmful interference to the incumbent technology or other intelligent transportation systems technologies.
- Request a report from the U.S. Department of Transportation on the outcomes of the FCC studies.

3.1. VEHICLE-TO-INFRASTRUCTURE (V2I)

V2I communications, which involves the exchange of safety and operational data between vehicles and elements of the transportation infrastructure, offers a wide range of safety benefits. V2I provides vehicles



and drivers information about infrastructure operations -- weather and pavement condition, how signals are directing traffic, and even the location of potential hazards at intersections and other critical road safety hotspots. V2I applications include red light violation warnings, reduced speed zone warnings, curve speed warnings, and spot weather impact warnings. V2I soon will support other applications that will disseminate the condition of the infrastructure, such as bridge integrity, and may even collect vehicle data that describes pavement condition.

According to NHTSA, V2I technology helps drivers safely negotiate intersections and could help prevent 41 to 55 percent of intersection crashes. Another connected vehicle safety application that helps drivers with left turns at intersections could help prevent 36 to 62 percent of left-turn crashes, according to NHTSA. In addition to the lives saved, just these two applications alone could prevent up to 592,000 crashes and 270,000 injuries each year.

ITS America Recommendation

- Increase the federal match to 100% for installation of V2I safety technologies. Expand eligibility to include data collection and analysis software (including data acquisition through private sector partnership), maintenance and operations, fiber, integration, the costs associated with systems, and equipment required for V2I communications technology. Amend 23 USC § 120(c) to make all V2I safety projects eligible to receive up to 100% federal share. Amend 23 USC § 503(c)(4) to allow any project to receive up to 100% federal share of project costs.

3.2. VEHICLE-TO-PEDESTRIAN (V2P)

V2X will enable us to deploy safety solutions to protect vulnerable users of the system, which will be transformational. V2P encompasses a broad set of road users - people walking, children being pushed in strollers, people using wheelchairs or other mobility devices, passengers embarking and disembarking buses and trains, and people riding bicycles and scooters. Pedestrian detection systems can be implemented in vehicles, in the infrastructure, or with pedestrians themselves to provide warnings to drivers, pedestrians, or both. By allowing vehicles to communicate with these users through sensors or vehicle-to-device communication, we can significantly reduce the number of pedestrians killed on our roadways.

ITS America Recommendation

- Expand eligibility, under the Advanced Transportation and Congestion Management Technologies Deployment (ATCMTD) program, to include V2P technologies. Allow up to 100 % federal share for these safety projects. Amend 23 U. S. C. § 503(c)(4)(E) to include advanced vulnerable road user safety information systems. Amend 23 U. S. C. § 503(c)(4)(J) to allow up to 100% federal share of the cost of a project.

4. POLICY: EXPAND INVESTMENTS IN ADVANCED MOBILITY IMPROVEMENTS

Expand eligibility under highway programs to include advanced mobility safety improvements including data infrastructure and analysis, smart mobility improvements such as smart truck parking, smart work zones, smart pavements, predictive analytics platform, and build out of electric vehicle charging stations, hydrogen fueling infrastructure, natural gas fueling infrastructure, and other alternative fuels.



ITS America Recommendation

- Amend 23 U. S. C. Federal-Aid Highways to include as an eligible project or program the deployment of advanced transportation safety improvements, including data infrastructure and analysis, smart mobility improvements such as smart truck parking, smart work zones, and smart pavements.
- Amend 23 U. S. C. §133(b), §119(d), § 167 – to make eligible a project or program to establish electric vehicle charging stations or natural gas or hydrogen vehicle refueling stations for the use of battery powered or natural gas or hydrogen fueled trucks or other motor vehicles at any location in the state (giving priority to corridors designated under section 151) except that such stations may not be established or supported where commercial establishments serving motor vehicle users are prohibited by section 111 of title 23, USC.

5. POLICY: PLAN FOR TRANSFORMATIVE TRANSPORTATION TECHNOLOGIES

States, providers of public transportation and Metropolitan Planning Organizations (MPOs) are expanding beyond traditional long-range scenario planning, which holds fixed certain transportation and land use assumptions, to consider big questions facing the transportation system, including whether connected and automated vehicles will increase the vehicle capacity of existing highway lanes; how automation and active transportation connections might help solve the first mile/last mile transit challenge; what roadway investments could incentivize the shift to connected and automated vehicles; how to make sure the entire transportation system is working together; and how to expedite technology safety benefits.

Increased funding and flexibility will help planners analyze project performance across a range of different futures, including ensuring all modes of transportation work in concert and will lead to more informed project prioritization that maximizes the benefits of connected and automated technologies. Increased planning funding will also support states and MPOs in fulfilling current performance-based planning mandates, which were added in the 2012 transportation authorization without a commensurate increase in planning resources

ITS America Recommendation

- Support policy that provides additional planning funds to help regions and states better address complexities around transformative transportation technologies and climate change in the context of an integrated multimodal transportation system.
- Support policy that provides additional planning funds and flexibility to the planning process to prepare for a range of possible connected and automated vehicle futures scenarios.
- Amend section 23 U.S. C. § 104(b)(6) and 49 U. S. C. § 5338 to increase the amount of funding for Metropolitan Planning.

6. POLICY: DEPLOY BROADBAND TO SUPPORT INTELLIGENT TRANSPORTATION TECHNOLOGIES

Telecommunication technologies, such as broadband, are essential to the transport of people, data, and freight. Assisting states and localities with recovering costs associated with conduit installation,



maintenance of conduit, and conduit inventory is critical to increasing broadband installation, especially in rural areas and economically disadvantaged urban areas. Combining broadband conduit installation with highway and road construction will result in decreased frequency of construction on highways and roads, reduce broadband installation costs, increase access to and reliability of broadband networks, increase public and economic benefits, and decrease the time needed to deploy fiber.

Nothing in this policy proposal establishes a mandate or requirement that a state or locality install broadband infrastructure in a highway right-of-way.

ITS America Recommendation

- Amend 23USC to add a new authorization that supports smart highways and streets with broadband fiber optic cable to make roads safer by establishing new federal funding to assist states and localities to:
 - Identify a broadband utility coordinator to facilitate the broadband infrastructure right-of-way efforts within the state;
 - Register broadband infrastructure entities that seek to be included in those facilitation efforts;
 - Establish a process to electronically notify such entities of the state transportation improvement program on an annual basis;
 - Coordinate statewide telecommunication and broadband plans and state and local transportation and land use plans, including strategies to minimize repeated excavations that involve the installation of broadband infrastructure in a right-of-way; and
 - That any existing broadband infrastructure entities are not disadvantaged.

SAFER. GREENER. SMARTER.

7. POLICY: INCREASE BUILDOUT OF ALTERNATIVE FUEL VEHICLE INFRASTRUCTURE TO SUPPORT A FUTURE OF ZERO EMISSION VEHICLES

Alternative Fuel Vehicles are shaping the future of mobility, and the United States is poised to lead a global transition to zero emission vehicles (ZEV). Nevertheless, U.S. government analysis suggests that additional ZEV infrastructure investments will be required to satisfy the future of transportation. ZEV sales continue to increase year-over-year; however, these new mobility options will need 21st century infrastructure to continue to spur consumer adoption and address consumers' "range anxiety". U.S. government analysis suggests that current and projected deployments represent only a fraction of the estimated demand. According to a 2017 U.S. Department of Energy report, the U.S. will require 600,000 Level 2 plugs and 25,000 DC fast charger plugs by 2030 to fuel the electric market alone. Additionally, a 2017 study commissioned by the U.S. Department of Energy found that a network of 1,500 to 3,300 hydrogen stations would be needed to serve a market of millions of fuel cell vehicles by 2035.

ITS America Recommendation

- Establish a grant program to support state and local governments' efforts with infrastructure providers to invest in electric vehicle charging and hydrogen fueling infrastructure along designated alternative fuel corridors.
- Support policy that increases federal funding under the Surface Transportation Block (STBG) Grant program and Congestion Mitigation and Air Quality (CMAQ) program to rapidly build out



electric vehicle charging stations, hydrogen refueling stations, natural gas infrastructure, and technologies such as inductive charging to speed the deployment.

- Support policy that maintains the zero-emission plug-in electric vehicle tax credit. Provide an additional allocation of zero-emission plug-in electric vehicle tax credits reserved for medium-duty commercial delivery vans.
- Support policy that reinstates a zero-emission consumer tax credit for the purchase of fuel cell vehicles.

8. POLICY: BUILD TRANSFORMATIVE AND ADAPTIVE INFRASTRUCTURE FOR DEPLOYMENT OF INTELLIGENT TRANSPORTATION TECHNOLOGIES TO MITIGATE CLIMATE CHANGE

States, metropolitan regions, and cities will require substantial investment to adapt infrastructure to be resilient in a changing climate and responsive to a new mobility paradigm. Federally supported, near-term infrastructure improvements will provide the dual benefit of immediately mitigating carbon-emitting congestion while preparing our nation for intelligent mobility and smart infrastructure. For example, a high-speed communications infrastructure backbone would support near-term congestion-reduction and air quality improvement strategies like smart traffic signal operations while laying the foundation for future vehicle-to-vehicle and vehicle-to-infrastructure communications.

ITS America Recommendation

- Establish a new flexible program to make transportation networks more resilient in the face of a changing climate and more responsive to the technology-fueled transformation in how people and goods move.
- The program should be highly flexible, mode-neutral and include formula and discretionary components. Eligible projects should include capital and operational investments that improve both near-term and long-term system safety and performance. Examples include programs to support deployment of automated vehicles; V2X communications technologies; priced managed lanes; transportation demand management programs; strategic micro-transit investments; advanced parking freight delivery and incident management systems; alternative fuel charging infrastructure and other advanced technologies to support a clean transportation system; and climate mitigation/resiliency improvements.
- In lieu of a new program, the next bill should provide-resources for 21st century transportation investments through existing FAST Act programs by expanding project eligibility within these programs.
- Support policy to make eligible funding for renewable energy projects in the Interstate rights-of-way for transportation use by states and localities for transportation related facilities (conversion and/or removal of existing lighting systems to high efficiency technologies, alternative fueling infrastructure, maintenance buildings, rest areas, etc.) on-site (including through net metering) or off-site through off setting electricity bills at other sites.



SAFER. GREENER. SMARTER.

9. POLICY: ESTABLISH A MOBILITY ON DEMAND (MOD) PROGRAM FOR THE NEW WORLD OF MOBILITY

In the 21st century, mobility is less about moving vehicles and more about moving people, data and freight. Long-existing silos among cities, states, counties, road and transit agencies are disappearing; and private mobility service providers barely existed a decade ago. More choices exist now, but for people to fully realize the benefits of this new world of mobility, it must be easier to choose which option best meets their needs. This also means services that are accessible for every traveler and in all communities and neighborhoods. In cities, Mobility on Demand (MOD) offers convenient, affordable, and, in the case of bikeshare, rideshare or micromobility services, more sustainable alternatives to driving within congested environments. For suburban areas, MOD offers first mile/last mile accessibility to transit, as well as more dynamic on-demand services to get around town. While often seen as an urban/metro transportation solution, MOD deployed in rural areas also provides first mile/last mile (though more like first/last 50 miles) connections to transit, intercity bus and rail transport, and essential air service airports. Rideshare and ride sourcing is providing support for seniors to access social and health services. Micromobility services offer options to travel in town. MOD includes bikeshare and scooter share deployments on college campuses. New and improved MOD transit and paratransit services also can benefit rural communities.

ITS America Recommendation

- Support a MOD program with funding that encourages flexibility with federal (FHWA/FTA) funding to meet changing mobility needs including partnerships with companies offering shared-use trips (car, bicycle, new mobility modes), data management, and other technology companies for first mile/last mile services and improved freight delivery, the integration of mobility services and technologies, and new fare and integrated payment technologies.
- Support increased federal funding to public transit as it will be a key component in any successful implementation of MOD. Support policy that makes clear the MOD should leverage public transportation investment.
- Support a data sharing framework that provides standardization for the transfer of data among transportation operators and providers to foster the efficient use of capacity, enhance management of new modes of mobility, and promote the creation of innovative planning tools.
- Make permanent and increase funding for the FTA MOD Sandbox demonstration grant program, which experienced overwhelming demand for innovative approaches to integrating emerging mobility solutions within a public transportation framework. Increase funding in 49USC Chapter 5, Section 5338 for the Public Transportation Innovation authority under Section 5312(b).
- Support policy that makes clear that accessibility and equity are a foundational pillar of Mobility on Demand (MOD).



- 7.2. Support policy that increases federal funding to rapidly build out alternative vehicle fueling infrastructure
- 7.3. Support policy that maintains the zero-emission plug-in electric vehicle tax credit
- 7.4. Provide an additional allocation of zero-emission plug-in electric vehicle tax credits for medium-duty commercial delivery vans
- 7.5. Support policy that reinstates a zero-emission consumer tax credit for fuel cell vehicles
- 8. Build Transformative and Adaptive Infrastructure for Deployment of Intelligent Transportation Technologies to Mitigate Climate Change **12**
 - 8.1. Support a new program to make transportation networks more resilient with climate change responsive to the technology-fueled transformation in how people and goods move
 - 8.2. Support policy to make eligible funding for renewable energy projects in the interstate rights-of-way for transportation use
- 9. Establish A Mobility-on-Demand Program for the New World of Mobility **13**
 - 9.1. Support flexibility with federal highway and transit funding to meet changing mobility needs
 - 9.2. Support increased federal funding to public transit
 - 9.3. Support a data sharing framework
 - 9.4. Make permanent and increase funding for FTA MOD Sandbox
- 10. Strengthen the University Transportation Centers Program **14**

Senator FISCHER. Thank you very much.
 Our next panelist is Mr. Patrick Duffy, who is President of Blockchain in Transport Alliance.
 Welcome.

**STATEMENT OF PATRICK DUFFY, PRESIDENT,
 BLOCKCHAIN IN TRANSPORTATION ALLIANCE**

Mr. DUFFY. Thank you. Chairwoman Fischer, Ranking Member Duckworth, and members of the Subcommittee, thank you for holding this timely hearing.

I'm grateful for the opportunity to submit my testimony to the Committee's hearing on Examining Technological Innovations in Transportation and for allowing for me to appear here on Capitol Hill.

I look forward to the opportunity to share my thoughts regarding the massive opportunities associated to the digitization of analog and legacy processes across the supply chain of the transportation sectors, including blockchain's impactful role.

Numerous emerging technologies are transforming the surface transportation realities for operators and users of over-the-road trucking and rail industries in the United States, moving from the antiquated analog systems through the exploration of technologies, including artificial intelligence, blockchain and machine learning, to cite a few.

This process of digitizing the data associated with supply chains that leverage the services of transport providers on the Nation's roads, highways, interstates, railroads, at sea and air routes, holds the promise of greatly improving commercial efficiencies but may also help produce more resilient data systems and impact the safety and security of our conduits of commerce.

One of the biggest drivers of digitization in the freight industry today is the rapid deployment of blockchain technology to solve some of transportation's biggest headaches. Blockchain is the tip of the spear in the fight to digitize some of the antiquated systems and practices used in the transportation, logistics, and supply chain sectors.

Among the major catalysts for digitization are the value-deriving benefits that can be realized by increasing trust between counterparties.

One of the technologies that can enhance trust between counterparties is distributed ledger technology, often referred to as blockchain and sometimes as the blockchain. So what is blockchain? Is it a currency, a code, a server?

In reality, blockchain is simply a type of database functioning as a ledger in which transactions are stored as blocks of data that are recorded in a protected manner. The introduction of new data or the modification of existing data can only be done with the agreement of those individuals or organizations on that ledger. That agreement is needed before previously recorded data can be changed, overwritten, or deleted.

While cryptocurrency, like Bitcoin, Ethereum, and a wide spectrum of all coins leverage blockchain technology to record transactions, it's important to recognize that blockchains are not cryptocurrencies. Blockchain is, however, an ideal technology for

security because it is an immutable distributed ledger. This ledger records every transaction or change. Transactions cannot be obscured, hidden, or erased after the fact.

So how will this technology be useful in the context of over-the-road transportation in the United States? Take the customs process. It's slow with components often reliant on the transfer of paper documents and the use of fax machines, a situation ripe for human-induced error.

By leveraging technologies like blockchain and through the digitization of analog processes required to leverage blockchain in a meaningful way, it may be possible to mitigate data-driven situations before they become problems.

For instance, consider the romaine lettuce scare in the United States that we experienced in 2018. Dangerous E.coli bacteria was introduced into the Nation's food supply. Moving through the supply chain that contaminated lettuce was used in fast food and white tablecloth restaurants and homes across the United States, whether in a salad or as a topping for a cheeseburger or a taco, the lettuce was eaten by unsuspecting consumers. This situation resulted in deaths, many consumers were sickened and financial hardships occurred.

Even though that contaminated romaine lettuce was a small percentage of the total romaine lettuce in the market, all romaine lettuce was pulled from grocery store shelves and restaurant coolers.

The dangerous bacteria infiltrated the agricultural supply chain and because of legacy and analog processes, the contaminated legacy provenance was not easily identified by regulators. They faced an arduous task to identify the contaminated produce.

Because that data could not be quickly determined, regulators were left with no other choice but to remove the product from U.S. commerce.

If the lettuce had been registered on a blockchain, track and trace would have been relatively easy. Many of those sickened might not have been and time and costs of the investigation would have been less. That's the power of blockchain.

Digital breadcrumbs indicating the who, what, when, and where and why of a supply chain enhanced through the use of technologies, including blockchain, may provide an opportunity to catch challenges before they become a crisis.

It's my honor and privilege to be here today representing the Blockchain in Transportation Alliance, most commonly referred to as BITA. Our mission is to help educate stakeholders advocate for the adoption of innovative technologies and through collaboration among member companies and organizations and their talented staff members to establish standards around the data components that comprise the world's supply chain and transportation technologies.

These companies come together generating standards that will drive innovation in the digitization space for decades to come. BITA has moved faster than anyone expected to release its first standards in February and has three more in the pipeline that we expect to unveil later this summer.

In normal time, many of these companies working to develop these standards work in fierce commercial competition, but they come together in agreement in our rooms.

Using blockchain in the near future, we'll have answers to questions, such as was a vaccine kept at a correct temperature? When were aircraft parts damaged in transit? Where were these salmon caught, and what was their path to consumer? These are problems that the industries struggle to solve with every day and consumers are asking for answers.

With blockchain digitization, they have an immutable ledger that can hold up in court. In short, we'll be able to state with certainty that a certain thing has happened at a certain time and place.

Thank you.

[The prepared statement of Mr. Duffy follows:]

PREPARED STATEMENT OF PATRICK DUFFY, PRESIDENT,
BLOCKCHAIN IN TRANSPORT ALLIANCE

Chairman Fischer, Ranking Member Duckworth, and members of this Subcommittee, thank you for holding this timely hearing.

I'm grateful for the opportunity to submit written testimony for the Committee's hearing on "Examining Technological Innovations in Transportation," and for allowing me to appear today on Capitol Hill.

I look forward to the opportunity to share my thoughts regarding the massive opportunities associated to the digitization of analog and legacy processes across the supply chain and transportation sectors, including blockchain's impactful role.

Numerous emerging technologies are transforming the surface transportation realities for operators and users of over-the-road trucking and rail industries in the United States—moving from antiquated analog systems through the exploration of technologies, including artificial intelligence, blockchain and machine learning, to cite a few.

This process of digitizing the data associated with supply chains that leverage the services of transport providers on the Nation's roads, highways, interstates, railways and sea and air routes holds the promise of greatly improving commercial efficiencies, but may also help produce more resilient data systems that impact the safety and security of our conduits of commerce.

One of the biggest drivers of digitization in the freight industry today is the rapid deployment of blockchain technology to solve some of transportation's biggest headaches. Blockchain is the tip of the spear in the fight to digitize some of the most antiquated systems and practices used in the transportation/logistics/supply chain sectors.

Among the major catalysts for digitization are the value-driving benefits that can be realized by increasing trust between counterparties.

One of the technologies that can enhance trust between counterparties is distributed ledger technology, often referred to as "blockchain" and sometimes as "the Blockchain."

So what is blockchain? Is it a currency? A code? A server? In reality, blockchain is simply a type of database, functioning as a ledger in which transactions are stored as blocks of data that are recorded in a protected manner. The introduction of new data, or the modification of existing data can only be done with the agreement of those individuals or organizations on that ledger. That agreement is needed before previously recorded data can be changed, overwritten or deleted.

While cryptocurrencies like Bitcoin, Ethereum, and a wide spectrum of alt-coins leverage blockchain technology to record transactions, it is important to recognize that blockchains are not cryptocurrencies.

Blockchain is, however, an ideal technology for security because it is an immutable distributed ledger. This ledger records every transaction or change. Transactions cannot be obscured, hidden, or erased after the fact.

So how will this technology be useful within the context of over-the-road transportation in the United States?

Take the customs process. It's slow, with components often reliant on the transference of paper documents and the use of fax machines—a situation ripe for human-induced error. By leveraging technologies like blockchain, and through the

digitization of analog processes required to leverage blockchain in a meaningful way, it may be possible to mitigate data-driven situations before they become problems.

For instance, consider the romaine lettuce scare the United States experienced in 2018. Dangerous *e. coli* bacteria was introduced into the Nation's food supply. Moving through the supply chain, that contaminated lettuce was used in fast-food and white tablecloth restaurants and in homes across the United States. Whether used in a salad, or as a topping on cheeseburgers or tacos, the lettuce was eaten by unsuspecting consumers.

This situation resulted in deaths, many consumers were sickened and financial hardships occurred. Even though the contaminated romaine lettuce was a small percentage of total romaine lettuce in the market, all romaine lettuce was pulled from grocery store shelves and restaurant coolers.

The dangerous bacteria infiltrated the agricultural supply chain, and because of legacy and analog processes, the contaminated lettuce's provenance was not easily identified by regulators. They faced an arduous task to identify the contaminated produce. Because that data could not be quickly determined, regulators were left with no other choice but to remove the product from U.S. commerce.

If the lettuce had been registered on a blockchain, track and trace would have been relatively easy. Many of those sickened might not have been. The time and cost of the investigation would have been less. That is the power of blockchain.

Digital 'breadcrumbs' indicating the who, what, when, where and why of a supply chain, enhanced through the use of technologies including blockchain may provide an opportunity to catch challenges before they become a crisis.

The real-life example used involved romaine lettuce, but it could be baby formula—as recently occurred in China—or the agricultural inputs associated with antibiotics.

Looking back we should consider ourselves lucky; a breakdown in an arcane process led to deaths and illnesses, but it could have been much, much worse—and the next outbreak of contaminated foods or faulty products may lead to serious harm for millions of U.S. citizens.

It's my honor and privilege to be here today representing the Blockchain in Transport Alliance, most commonly referred to as BiTA.

Our mission is to help educate stakeholders, advocate for the adoption of innovative technologies, and through collaboration among member companies and organizations, and their talented staff members, to establish standards around the data components that comprise the world's supply chain and transportation technologies.

Since its inception in 2017, BiTA has moved expeditiously to identify use cases where the standardization of data would be beneficial for parties involved in supply chain and transportation. And it's important to realize that this work is not being done in silos or by a group of interested "techies." BiTA is comprised of hundreds of member companies representing more than \$1 trillion in revenue annually. The membership base spans the spectrum from technology companies like Google, IBM, Microsoft and Salesforce, to some of the world's most important conveyors of goods like BNSF, Delta, FedEx, J.B. Hunt and UPS, and all types of companies and organizations that either leverage their services or provide ancillary products and/or services.

These companies together are generating standards that will drive innovation in the digitization space for decades to come. BiTA has moved, faster than anyone expected, to release its first standard this February, and has three more in the pipeline that we expect will be unveiled later this summer.

In normal times, many of these companies working on developing standards are fierce commercial competitors. But we've seen them put aside their differences and work together to improve the way we transport everything from bullets to baby formula. Blockchain technology will improve safety in the supply chain, increase transparency, unlock value across the commercial ecosystem, empower small businesses and give regulators the tools they need to make the best decisions.

The essential goal of BiTA is to help guide and promote the creation of open source blockchain systems in the transportation industry. Blockchain in transport may function as a digital referee capable of providing high-fidelity data to enable users to make better-informed decisions.

The technology is quickly moving from the experimental—being looked at in universities and research organizations—to being implemented within the technology stacks, and business processes, of the world's largest companies and organizations.

So why talk about standards? Because all too often new technologies are delayed because of the development of multiple proprietary systems that are not designed to work with each other. Take Windows versus Mac, or Blu-Ray versus HD-DVD, or Betamax versus VHS. And how many different shapes and sizes of cables have we used over the years to charge our mobile phones or plug in our computers?

The purpose of the Blockchain in Transport Alliance is to bring all freight industry stakeholders together to create a global language around the data components that comprise the supply chain and transportation technologies that power the global economy.

Using blockchain, in the near future we will have answers to questions such as: Was a vaccine kept at the correct temperature? When were the aircraft parts damaged in transit? Where were these salmon caught and what was their path to the consumer?

These are problems that the industry struggles to solve every day, and consumers are asking for answers. With blockchain digitization, they have an immutable ledger that can hold up in court.

In short, we will be able to state with certainty that a certain thing happened at a certain time and a certain place.

Thank you.

Senator FISCHER. Thank you, sir.

Next, we have Ann Schlenker, who is the Director of the Center for Transportation Research at Argonne National Laboratory.

Welcome.

**STATEMENT OF ANN SCHLENKER, DIRECTOR,
CENTER FOR TRANSPORTATION RESEARCH,
ARGONNE NATIONAL LABORATORY**

Ms. SCHLENKER. Thank you. Chairwoman Fischer, Ranking Member Duckworth, and members of the Subcommittee, thank you for the opportunity to appear before you today.

It is my honor to talk to you about how the U.S. Department of Energy, National Laboratories, bring prosperity and security to all Americans by making transportation more affordable, efficient, accessible, and safe.

I am Ann Schlenker, Director of the Center for Transportation Research at Argonne DOE's multidisciplinary National Laboratory near Chicago.

I am privileged to lead a team of scientists and engineers working on a research portfolio that ranges from components to vehicles to transportation as a holistic system. My passion for transportation runs deep and long.

I serve as co-chair of the Systems and Modeling for Accelerated Research and Transportation, or SMART, Mobility Consortia. The consortium is an initiative of the Vehicle Technologies Office within DOE's Office of Energy Efficiency and Renewable Energy.

The consortia, which includes Argonne, Idaho, Lawrence Berkeley, National Renewable Energy, and Oak Ridge National Labs, studies transportation across many rapidly changing facets, including connected and automated vehicles, urban science, advanced fueling infrastructure, decision science, and multimodal transportation.

The program is creating new knowledge, insights, tools, and technology solutions that increase mobility and energy productivity for individuals and businesses. Our scalable smart mobility projects target opportunities to greatly increase the efficient and affordable movement of people and goods.

That phrase "movement of people and goods" is significant. Mobility is the foundation of how humanity interacts. It is fundamental to our quality of life. Transportation gives us access to opportunities for good food, good jobs, quality education, superior health care, and leisure moments with nature.

Now more than ever before, we have the potential to not only move more but move smarter; that is, more affordably and cleaner and with ever more increasing choices.

The DOE National Laboratories use integrated scalable models, tools, and field experiments to study the effects of advanced vehicle and infrastructure changes, new business models, transportation modes, and other factors for the transportation systems.

The result is expanded understanding from the vehicle to the city level. We can tailor our assessments for regional outcomes, such as vehicle miles traveled, vehicle hours traveled, passenger miles traveled, energy used, cost effectiveness, greenhouse gas emitted, productivity gains, and more.

The aging U.S. population, urbanization, shared transportation usage, and expectation of on-demand goods and services and real-time information availability drive traveler activities and decisions.

Transportation researchers seek automation, electrification, and other mobility solutions to address these new realities while remaining cognizant that as a nation, we are not fully connected and advancements need to fit broadly.

The range of solutions is broad and poised to impact efficiency and safety in dense urban areas as well as in rural locations. Automated vehicles equipped with sensors for situational awareness and connectivity help us glean information from other cars on the roadway for rural benefits of improved efficiency and reduced collisions.

In an urban setting, we can use vehicle-to-vehicle and vehicle-to-infrastructure connectivity to improve safety and increase traffic flow with smart traffic signals and smart parking apps.

Shared services and automation will provide today's underserved population with increased access and affordability.

Our ability to understand the complex interactions between all these systems, technologies, business models, and emerging travel modes is paramount to achieving secure and robust smart mobility.

Applying the DOE National Laboratories' computational horsepower, artificial intelligence, and data analytics is in a scenario-based framework for analyzing the potential mobility future. We come away knowing how to guide implementation of new solutions that maximize benefits while minimizing the downside.

Research recently conducted by Argonne in the Chicago region demonstrates the kind of insights DOE laboratories can provide stakeholders to help them prepare for these new futures.

Research showed that, for example, private ownership of highly automated vehicles, the vehicle miles traveled could increase by greater than 40 percent, in turn causing network speeds to decrease about 15 percent as a surrogate of congestion.

Conversely, in a transportation network with high-sharing behaviors, that is, greater reliance on mass transit and ride-sharing services, vehicle miles traveled could be reduced by 13 percent and energy usage reduced by over 25 percent, while still netting that exact same mobility to serve our population.

This type of analysis is possible to capture the upside and manage any downside in mobility futures.

Collaborations across government agencies are another example of key partnering. DOE and the Department of Transportation

partner on many automated, connected, and efficient shared mobility projects. DOE complements DOT research, development, demonstration, and deployment portfolio by offering tools and capabilities in modeling and simulation, managing and analyzing data, and quantifying technology benefits.

DOE also has partnered on the DOT Smart City Challenge. DOE's National Laboratories are a powerhouse of science, technology, and engineering. They are principal agents of execution on missions of national importance, including the effort to provide greater mobility in the vehicle and travelers within the transportation system.

Work at the National Labs continues to make mobility more affordable, efficient, safe, and convenient.

Thank you for your time. I welcome any comments you might have.

[The prepared statement of Ms. Schlenker follows:]

PREPARED STATEMENT OF ANN SCHLENKER, DIRECTOR, CENTER FOR
TRANSPORTATION RESEARCH, ARGONNE NATIONAL LABORATORY

Chairwoman Fischer, Ranking Member Duckworth, and members of the subcommittee, thank you for the opportunity to appear before you. It is my honor to talk to you about how the U.S. Department of Energy (DOE) national laboratories bring prosperity and security to all Americans by making transportation more affordable, efficient, accessible, and safe.

I am Ann Schlenker, director of the Center for Transportation Research at DOE's Argonne National Laboratory, one of America's first and largest multipurpose science and engineering laboratories, located in Lemont, Illinois, near Chicago. Prior to joining Argonne in 2009, I worked for Chrysler, LLC, for more than 30 years, most recently as Director of Advanced Vehicle Engineering and Alliances. During my career in industry I held a variety of executive engineering positions in research, regulatory development, and front-line product development. My passion for transportation runs deep and long.

As director of the Argonne center, I am privileged to lead a team of scientists and engineers working on a research portfolio that ranges from components to vehicles to transportation as a holistic system. We are improving engine fuel efficiency, evaluating vehicles in virtual and experimental contexts, studying low carbon fuel potentials, improving and validating vehicle electrification interoperability and security with the Smart Grid, and studying complex transportation systems.

I serve as co-chair of the Systems and Modeling for Accelerated Research in Transportation, or SMART, Mobility Consortium. The consortium is an initiative of the Vehicle Technologies Office within DOE's Office of Energy Efficiency & Renewable Energy. The consortium, which includes Argonne, Idaho, Lawrence Berkeley, National Renewable Energy, and Oak Ridge national labs, studies transportation across many rapidly changing facets, including connected and automated vehicles, urban science, advanced fueling infrastructure, decision science, and multi-modal transportation.

The SMART Mobility Consortium is part of DOE's Energy Efficient Mobility Systems (EEMS) Program, which envisions an affordable, efficient, safe, and accessible transportation future. The program is conducting cutting-edge research at the vehicle, traveler, and system levels, creating new knowledge, insights, tools, and technology solutions that increase mobility and energy productivity for individuals and businesses. Our scalable smart mobility projects target opportunities to greatly increase the efficient and affordable movement of people and goods.

Mobility Underpins Quality of Life

That phrase, "movement of people and goods," is significant. Mobility is a foundation of how humanity interacts. It is fundamental to our quality of life. Transportation gives us access to opportunity in the form of healthy food, good jobs, quality education, superior health care, and leisure moments with nature. Now, more than ever before, we have the potential to not only move more, but move smarter—that is, more affordably and cleanly and with ever increasing choice. It is natural that the DOE national laboratories, with our mission to accelerate the science and technology that drive U.S. prosperity and security, have a critical role in realizing the

potential of smart mobility. The laboratories possess tools, teams, and expertise that exist nowhere else and deliver impact through use-inspired solutions that address the complex, long-term challenges we face.

To understand the transformational power of smart mobility solutions, we need only look at previous transportation revolutions. I began my career working on emissions in the days of brown clouds and hazy skies as the Clean Air Act was being implemented. My fellow auto and oil industry researchers and I developed solutions that achieved a 99 percent improvement in vehicle emissions for tangible air quality gains while at the same time doubling fuel economy. Research and development drove a similar transformation in automobile safety, starting with the passive solutions of seat belts and air bags and evolving to active safety innovations including anti-lock braking systems, electronic stability controls, and safety sensors and cameras. These active systems are standard today and are paving the path to further vehicle automation.

The knowledge and technology we are creating now have the power to create the next transportation revolution, one of smart mobility. We use integrated, scalable models, tools, and field experiments to study the effects of advanced vehicle and infrastructure technologies, new business models, transportation modes and other factors on transportation systems—the result is expanded understanding from the vehicle to the city level. We can tailor our assessments of complex transportation mobility systems to desired regional outcomes such as vehicle miles traveled, vehicle hours traveled, passenger miles traveled, energy used, costs affected, greenhouse gases emitted, productivity generated, and more.

Transportation is Changing; New Solutions Can Meet Emerging Demands Across All Areas

Despite all the ways in which we can connect virtually, we are traveling more today, on a variety of modes, than ever before. Trips on what is called micro-mobility—scooters, bikes, e-bikes—doubled in 2018 to 84 million trips in a single year. Transportation network companies such as Uber, Lyft, and Via weren't operating 10 years ago; today in the U.S. they account for an annual 4.2 billion trips and counting.

The number of annual vehicle miles traveled continues to increase, with incremental increases in travel times due to congestion now totaling some 42 hours per year—that's an average of \$1,300 in financial terms—per traveler. Transportation costs are now second only to housing expenses. The aging U.S. population, urbanization, and a shift toward shared transportation usage also drive the need for creative thinking and solutions to meet new mobility demands.

All these transportation trends are borne of changes in traveler choice and consumer behavior. We now expect on-demand services and goods, as well as real-time information to guide our way of life and activities—witness the navigation and routing apps that allow us to choose the greenest, cheapest, or fastest option, or even delay or cancel a trip in light of real-time traffic information. Transportation researchers like me seek automation, electrification, and other mobility solutions to address these new realities while remaining cognizant that as a nation we are not fully connected and advancements need to fit broadly.

The range of solutions that inform traveler choices and optimize our movement and the movement of our goods is broad and poised to impact efficiency and safety in dense urban areas as well as in rural locations. Automated vehicles equipped with sensors for situational awareness and connectivity help us glean information from other cars and the roadway for rural area benefits of improved efficiency and reduced collisions. In an urban setting, we can use vehicle-to-vehicle and vehicle-to-infrastructure connectivity to improve safety and increase traffic flow with smart signal intersections. Smart parking apps enable us to improve our energy use by reducing the amount of time we drive around, instead directing us to open spots with reliable information. Shared services and automation will provide today's underserved population with access and affordability.

It is important to note that this connectivity requires the high-speed 5.9 gigahertz spectrum that has been reserved for vehicle-related safety applications. Without this spectrum, the promise of future mobility technology could be significantly reduced.

Solutions that make ride hail companies more complementary to mass transit and other solutions that enable seamless intermodal (for example, between air and ground or bike and bus) transportation increase our efficient movement, while multimodal freight solutions do the same for our goods. Our ability to understand the complex interactions between all these systems, technologies, business models, and emerging travel modes is paramount to achieving secure and robust smart mobility.

National Laboratories Perfectly Positioned to Lead

DOE national labs leverage distinguishing capabilities in science, unique user facilities, and external collaboration networks to execute pioneering research into solutions that will satisfy consumer mobility needs in a technology-rich and on-demand service-oriented economy. We are applying our established expertise in advanced computer science, visualization, data, decision science and analysis, and systems engineering and integration—as well as our capabilities in artificial intelligence, big data, computation, and predictive analytics—to the tough mobility challenges the public and private sectors face.

Applying the DOE national labs computational horsepower—some of the world's fastest supercomputers are located at Argonne and other labs—to our transportation system modeling and simulation underpins our smart mobility work. This capability gives us a scenario-based framework for analyzing potential mobility futures, allowing us to easily and quickly adjust various parameters. The result is greater insight into impacts with broad knowledge transfer and applicability. We come away knowing how to guide implementation of new solutions that maximize benefits while minimizing harms.

Research conducted by Argonne in the Chicago region demonstrates the kind of insights DOE laboratories can provide stakeholders to help them prepare for various mobility futures. Research showed that with private ownership of highly automated vehicles, vehicle miles traveled could increase by greater than 40 percent, in turn causing network speeds to decrease about 15 percent; such a scenario represents substantial congestion. Conversely, in a transportation network with high sharing behaviors—that is, greater reliance on mass transit and ride sharing services—vehicle miles traveled could be reduced by 13 percent and energy usage reduced by more than 25 percent while giving travelers the same level of mobility. This type of analysis is possible with strong private-public partnership relationships, data sharing, and strategic planning, to capture the upside and manage any downside of mobility futures.

The commitment of the national laboratories to rapidly bring technologies and knowledge into real-world application also takes the form of collaborations across government agencies. For example, DOE and the Department of Transportation partner on many automated, connected, and efficient, shared mobility projects, including coordination with the Federal Transit Administration to understand the energy implications of using mobility services to enhance transit. The Federal Highway Administration and DOE also are conducting leveraged work on connected/automated vehicle systems, such as truck platooning and eco-driving approaches. DOE complements DOT's research, development, demonstration, and deployment portfolio by offering tools and capabilities for modeling and simulation, managing and analyzing data, and quantifying technology benefits. DOE also has partnered with DOT on the Smart City Challenge, which underscored the fact that cities, regardless of size, identify the same set of critical issues for their communities; air quality, safety, accessibility, congestion, curb management, parking, payment systems and multimodal transportation issues.

Use-inspired, collaborative, comprehensive, and innovative—these terms generate enthusiasm, passion and full engagement among the many transportation DOE researchers who are addressing a spectrum of needs for future mobility. This mobility revolution also requires workforce development, and Argonne is spearheading the EcoCAR Mobility Challenge program for DOE, with a 30 year history of advanced vehicle technology competitions, representing 20,000 university graduates for a highly skilled domestic workforce.

DOE's national laboratories and their facilities are America's powerhouses of science, technology, and engineering. They are principal agents of execution on missions of national importance, including the effort to provide greater mobility to the vehicles and travelers within the transportation system. The work of the labs continues, applying expertise and coordinating the myriad of private and public stakeholders to make mobility more affordable, efficient, safe, and convenient, and bring prosperity and security to all Americans.

Thank you for your time. I welcome any questions you may have.

Senator FISCHER. Thank you, ma'am.

Our next panelist is Brent Hutto. He's the Chief Relationship Officer for Truckstop.com.

Welcome, sir.

**STATEMENT OF BRENT HUTTO,
CHIEF RELATIONSHIP OFFICER, TRUCKSTOP.COM**

Mr. HUTTO. Thank you, Chairwoman Fischer, Ranking Member Duckworth, and Members of the Subcommittee.

We appreciate the opportunity to testify at today's hearing. I'd also like to thank the FMCSA and Administrator Martinez for his great work he's done in the past couple years in really connecting with our industry and our partner, the American Trucking Association, and their CEO, Chris Spear.

My name is Brent Hutto, and I'm the Chief Relationship Officer at Truckstop.com. My responsibilities include working with hundreds of transportation technology partners and that gives me a unique insight into the entire freight marketplace.

We were founded as a company in 1995 as the very first online load board. Today, we are the largest web-based digital freight-matching marketplace in North America and the companies that use us represent more than a million trucks on the road and the brokers retain capacity for 500,000 unit loads every day.

My purpose in testifying today is to provide insight into the emerging technology trends within the transportation industry and to provide a basic framework for understanding how digitization could ultimately challenge or evolve existing business models and impact our freight market and surface transportation infrastructures.

I'd like to start by defining the marketplace a little bit for you guys. It's a very, very large market. Fifty percent of all the freight in the world is in North America and 70 percent of that freight is moved by a truck every single day.

It is an expanding marketplace. With rising population and urbanization and the consumer demand for expedited delivery, it continues to expand. It is very fragmented when it comes to how it communicates. Freight is moved today via an inefficient system where shippers, brokers, and carriers transact using outdated technology and at times none at all.

For example, the byproduct of this is that 40 percent of the carriers that own trucks have empty trailers as they go up and down the highways. So there's only a 60 percent utilization of all the trucks in America at any given time.

How can this improve? Recognizing an opportunity to eliminate inefficiencies and capitalizing on one of the Nation's most lucrative marketplaces, new and existing companies have dramatically increased their investment in and adoption of new digital technologies. These technologies are simplifying and automating information between carriers and brokers.

The process allows carriers to use digital technology, typically today it's a mobile app, to book freight at the click of a button. This automated process eliminates current manual costly tasks, like onboarding paperwork and payments. It digitizes the paperwork. It increases truck productivity and reduces waste, like deadhead miles and detention.

And why is this beneficial? Well, automation reduces truck driver fatigue, which makes the truck driver more safe on the road. Transparency and visibility of the data and information increases

consumer satisfaction. Improved carrier profitability leads to more efficiency which leads to better safety on our highways.

In order to realize these benefits, a couple things need to happen. We must have an affordable connected universal system where all players can participate. It is imperative that all software service providers within this universal system remain neutral and transparent, enabling all the players to succeed.

This transparency will ultimately enable greater trust and safety throughout the freight industry.

In conclusion, digital technology will drastically improve the transportation and freight industry efficiency and safety on the road. However, without supporting surface transportation infrastructure, any gains achieved through digital improvement will be minimized by congestion, parking availability, hours of service corrections, fuel costs, and wear and tear on the trucks due to poorly maintained roadways and bridges.

We, Truckstop.com, are committed to improving the noisy, chaotic, multisystem freight industry by automating connections so carriers and brokers, regardless of their size, can move freight more efficiently.

In closing, our industry is ready, the freight industry is ready to transition to digital technology, but it will take time and we look forward to working with the subcommittee on bringing that to our industry. We appreciate being here.

We thank you for the opportunity and we're happy to respond to any questions.

[The prepared statement of Mr. Hutto follows:]

PREPARED STATEMENT OF BRENT HUTTO, CHIEF RELATIONSHIP OFFICER,
TRUCKSTOP.COM

Introduction

Chairwoman Fischer, Ranking Member Duckworth and Members of the Subcommittee, thank you for the opportunity to testify at today's hearing. As the Nation's first digital load board and online freight marketplace, Truckstop.com has been serving carriers (owner-operators and small fleets), freight brokers (third-party logistics providers or 3PLs), and shippers for nearly 25 years (see appendix). As a result, we have unique insight into the state of transportation and logistics within our Nation.

Introduction of Brent Hutto

I joined Truckstop.com six years ago, I serve as the Chief Relationship Officer for Truckstop.com which includes ensuring the health of all of Truckstop.com's external relationships with the hundreds of transportation technology companies that we have integrated with. In my 22 years in the transportation and logistics industry, I have developed extensive experience covering the market including positions of leadership in sales, marketing, media, and communication. I have specific experience with carriers, brokers, shippers, industry suppliers, technology leaders, media companies, and financial firms. Presently, I serve on the Boards, Committees, and have membership with Transportation Intermediaries Association (TIA), National Strategic Shippers Transportation Council (NASSTRAC), Specialized Carriers & Rigging Association (SC&RA), Women In Trucking (WIT), American Trucking Association (ATA), Truckload Carriers Association, National Private Truck Council (NPTC), Intermodal Association of North America (IANA), and National Industrial Transportation League (NITL).

Introduction of Truckstop.com

Truckstop.com was founded in 1995 as the first online load board. Prior to Truckstop.com, carriers (truck drivers and trucking companies) and freight brokers (third-party logistics providers or 3PLs) transacted freight via a system of physical bulletin boards, TV monitors, and fax machines at truck stops throughout the country.

Today, Truckstop.com is one of the largest digital freight matching marketplaces in North America, with more than 500,000 unique load posted per day. In addition to load board services, Truckstop.com provides a neutral marketplace with real-time visibility into freight capacity, availability, market rates, and truck location. Truckstop.com offers freight management services ranging from carrier onboarding to insurance and payments.

State of the transportation and freight industry

My purpose in testifying today is to provide insight into the emerging technology trends within the transportation industry and provide a basic framework for understanding how digitization (the introduction of new digital technologies) could ultimately challenge or evolve existing business models and the impact on current freight and surface transportation infrastructures.

Understanding the transportation and freight industry requires a quick examination of the milestones that have led to our current state. In 1980, The Motor Carrier Act, partially deregulated the trucking industry, resulting in a dramatic increase in the number of trucking carriers in operation (less than 20,000 in 1980 to around 1.2 million today)¹ and paving the way for 3PLs. The highly fragmented market created by deregulation made it possible for 3PLs to offer value-added logistics services, increasing competition and productivity within the trucking industry and benefiting the American consumer by reducing costs.²

Two decades later, the introduction of the internet, “dot-coms,” and e-commerce changed the traditional shipping model once again. The rush to free delivery and the increased purchasing of unpredictable sets of items from online retailers, required the transportation industry to adapt to a new set of shipping practices. This change in consumer behavior and the desire for expedited delivery, helps explain increases in the American Trucking Associations’ trucking tonnage index, which has steadily risen since 2001 except for the recession in 2009.³ According to the CSCMP’s Annual State of Logistics Report, e-commerce continues to create multiple challenges for parcel carriers. These include:

- **Delivery density.** *With more residential deliveries—often single-package stops—routes are longer and less effective.*
- **Variability.** *Shipments in the Thanksgiving-to-Christmas window are about twice non-holiday levels. Volumes also fluctuate across weekdays as a flood of weekend orders are picked up Mondays and delivered Tuesdays and Wednesdays.*
- **Volume profiles.** *As e-commerce expands to larger and irregularly shaped items (mattresses, patio furniture) that won’t fit on standard sorting equipment, special handling is required.*
- **Click-to-door requirements.** *Same-day, two-hour, rush, critical, urgent—customers have a seemingly insatiable demand for getting their packages as fast as possible.*⁴

Today, more than 70 percent of all freight is moved via road in North America. Of this, the for-hire market accounts for 60 percent, with nearly 34 percent of that market in turn accounted for by spot brokerage (shippers broadcasting loads to freight brokers in order to find capacity at a competitive rate).⁵

However, under the current system, empty miles (trucks traveling without freight) and lengthy idle times (sitting in traffic, wait times for loading/unloading) have led to decreased safety and low margins for the trucking industry. This results in fuel waste, non-productive emissions, lost driver hours, inflated operational costs, and unnecessary road congestion.

As it turns out, of all the miles that truck drivers travel across the country, 40 percent of those trucks are empty. Let’s think about that—40 percent of the carbon impact from trucks today is because of empty mileage.

- *For every 1 percent improvement in truck routes and utilization, we can save:*

¹Legacy Supply Chain Services. The Evolution of 3PL and How it Can Solve Your Business’ Supply Chain Challenges; <https://legacyscs.com/evolution-of-3pl-supply-chain-challenges/>

²Moore, Thomas Gale (2002). *Trucking Deregulation*; <http://www.econlib.org/library/Enc1/TruckingDeregulation.html>

³Yardeni, Dr. Edward (2019). *US Economic Indicators: ATA Truck Tonnage Index*; <https://www.yardeni.com/pub/atatruck.pdf>

⁴CSCMP (2019). *Annual State of Logistics Report: Cresting the Hill*; <https://legacyscs.com/evolution-of-3pl-supplychain-challenges/>

⁵Paul, Silpa (2019). *Expect Fast Adoption of Digital Freight Brokerage Solutions*; <https://www.trucks.com/2019/03/26/expect-fast-adoption-digital-freight-brokerage-solutions/>

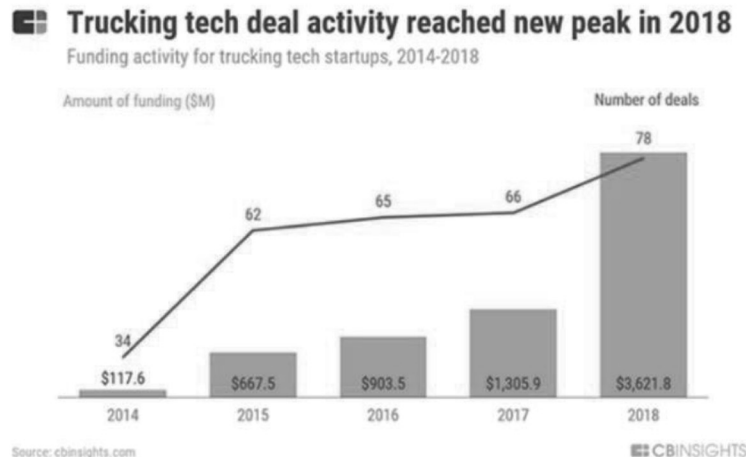
- Nearly 400 million gallons of fuel from being consumed.
- 100 million productivity hours from being wasted.
- 3 billion miles from being driven each year.⁶

To put all of this in perspective, spending in the U.S. logistics and transportation industry totaled \$1.64 trillion in 2018 (8 percent of U.S. GDP).⁷

Enter the digital transformation era. Recognizing an opportunity to eliminate inefficiencies and capitalize on one of the Nation's most lucrative markets, new and existing companies have dramatically increased their investment in, and adoption of, new digital technologies, including digital freight brokerage apps.

It is important to note that while multiple industry segments (including finance, healthcare, and retail) have been early adopters of digital technologies, the transportation and logistics industry has traditionally been slower to adopt new technology. A survey of 200 executives working for terminal operators, carriers, logistic providers, shippers, and other supply chain companies found that only 31 percent of respondents believed their industry was as good or better than other industries at adopting new technologies.⁸

To further emphasize the increased interest in technology adoption, we look at global funding for digital brokerage solutions which passed \$1 billion in 2017 and exceeded \$3.6 billion in 2018; a 260 percent year-over-year increase.⁹



Graphic: CB Insights

With the U.S. population expected to grow by 38 million between 2015 and 2030, consumer demand will increase the amount of pressure on the transportation and logistics industry to deliver goods in a timely and efficient manner. Digital technology adoption will play a huge role in transforming the industry as we know it today.

Digital freight matching and automation

Digital freight matching allows carriers to use digital technology (typically a mobile app) to “tap and go.” That means the carrier pushes a button to accept a load at an offered rate and they are on the road. No more time spent manually researching available loads, negotiating on the phone, etc.

⁶<https://convoy.com/about-us/>

⁷CSCMP (2019). Annual State of Logistics Report: Cresting the Hill; <https://legacyscs.com/evolution-of-3pl-supplychain-challenges/>

⁸Morley, Hugh R. (2017). Industry Skeptical of Pace of Logistics Tech Adoption; <https://www.joc.com/international-logistics/logistics-providers/industry-skeptical-pace-logistics-techadoption-20170620.html>

⁹Zwahlen, Cyndia (2019). Freight Tech VC on Track to Top 2018's Record \$3.6 Billion; <https://www.trucks.com/2019/04/29/freight-tech-vc-top-record-3-6-billion/>

The carrier starts by setting up a profile with their list of preferences in their preferred digital freight matching app. For example, they select their preferred lanes (the routes they routinely travel or service), their truck's capabilities (flatbed, refrigerated, etc.), any additional certifications (hazmat, over-sized, etc.), and load information. An offer would come through as an alert on their phone. The driver can then choose to accept the load if the price, location, haul, and timing are right for them.

Behind what the driver sees, there is a shipper or broker posting the freight they need moved. For freight to be moved at the push of a button, extensive details about the load must be included. Without knowing information like weight, rate, distance, appointment times, and pick-up and delivery locations, a carrier cannot confidently commit to moving the load.

Ideal digital freight matching experiences should have the ability to predictively and proactively push load matches out to its users. It should prioritize a user's preferred business partners. It should have wide geographic coverage and automatically track loads, so shippers and brokers know exactly where their freight is, estimated time of arrival, and when it is delivered.

Benefits of digital freight matching

Digital freight matching is evolving the transportation and logistics landscape by bringing attention to current inefficiencies and outdated practices. Digital freight matching addresses issues associated with empty miles, maximizing truck utilization (capacity), and wasted time, but it also has the potential to reshape some of the more painful parts of the freight negotiation process for both carriers AND brokers. For example:

- It can shorten the amount of time spent between getting a load posted and having it filled by a carrier.
- It can reduce or remove time spent making phone calls trying to find or book a load.
- It can automate processes for finding qualified partners, rates, and loads so users have greater confidence and insight into the entire freight process from initiation to final delivery and payment.
- It can replace outdated systems like fax machines and paper documents for carrier onboarding.
- It can automate proof-of-delivery and document management to increase the trust between parties and decrease the time needed for verifications before payments are made.
- It can increase overall efficiency by eliminating redundant manual tasks and allowing employees to focus their time and energy on more value-added work.
- It can decrease idle time and improve overall asset utilization.
- It can increase available data points and records allowing for better reporting and analytics.

Ideally, digital freight matching will do more than simplify the negotiation process. In fact, it should:

- Provide digital messaging and paperwork like bills of lading, invoices, contracts, etc.
- Connect partners seamlessly.
- Provide insights for business growth and profit.
- Have a quick-pay solution.
- Provide predictive matching so drivers stay loaded.
- Auto-match capacity (find trucks faster) for brokers.
- Integrate into a transportation management system (TMS) or on any mobile device.

As it stands, there isn't a complete technology solution that can do everything it should when it comes to digital freight matching. However, as noted previously, increased attention on current inefficiencies are rapidly driving innovation, which will have a dramatic effect on the current transportation and logistics system we know today.

Effects on the transportation industry

E-commerce will continue to increase the number of short-haul and final-mile trips (movement of goods from a transportation hub or warehouse to the final delivery destination), which will increase the volume of traffic in densely populated

urban areas. So, while digital technology has the potential to help the transportation and logistics industry address many of the inefficiencies outlined above, the ultimate success of digital adoption and successful delivery of goods will be closely tied to a reliable and sustainable surface transportation infrastructure that can handle increased capacity while simultaneously ensuring driver and public safety.

The FMCSA Electronic Logging Device (ELD) Mandate has introduced a wealth of new data to the marketplace. This data opens the door to getting better data on transit times and carrier locations and more. As additional technology is applied and more end points are added, data flowing from computers to computers (sensors, mobile devices, logging devices, etc.) will reduce, and in some cases eliminate, the use of telephones to match loads with truck capacity reducing the time it takes to move and deliver freight. It will allow for better prediction of when trucks will arrive despite weather, traffic, and other unpredictable events creating more transparency and visibility for more efficient load matching and pricing.

For shippers and brokers, automation will drastically reduce the number of repetitive processes that have to occur regularly including things like carrier onboarding. For carriers, automation means better loads at more attractive rates—using digital technology to coordinate, track, and manage documents with full transparency—ultimately making them more efficient.

Conclusion

According to a September 2018 report by Goldman Sachs Transportation, 3PLs and freight brokerages handle 23 percent of all loads moved in the U.S., a share that has grown 5x since 2000. As technologies continue to evolve, the digitization of the highly fragmented freight brokerage marketplace has the potential to drastically improve the transportation and freight industry. Technology can provide a promise of increased efficiency, however, without supporting surface transportation infrastructure, any gains achieved through digital improvement will be eliminated by problems of congestion, parking availability, hours of service corrections, fuel costs, and wear and tear on trucks due to poorly maintained roadways.

Ultimately, digitization has the potential to improve the entire freight matching process, and that translates to increased safety on the road. The safety benefits of digital freight matching include:

- Automation replaces the hours spent making manual phone calls thus reducing truck driver fatigue.
- Increased efficiency reduces truck driver workload allowing the driver to concentrate on the road and become more profitable while driving fewer miles.
- More profit means less need to bend the rules thus increasing safety.
- Real-time tracking and monitoring of freight movement, increases consumer satisfaction and allows for on-the-fly updates to avoid traffic congestion due to accidents, weather delays, and more.

Truckstop.com is working to smooth the noisy, chaotic, multi-system interface between freight and capacity by automating connections so carriers and brokers (regardless of size or resources) can move freight more efficiently. We believe it's imperative that Truckstop.com and other software service providers remain neutral and not classified as licensed freight brokers to help ensure a neutral and transparent marketplace enabling all players to succeed—to find, rate, manage, optimize, track, insure, and pay for freight.

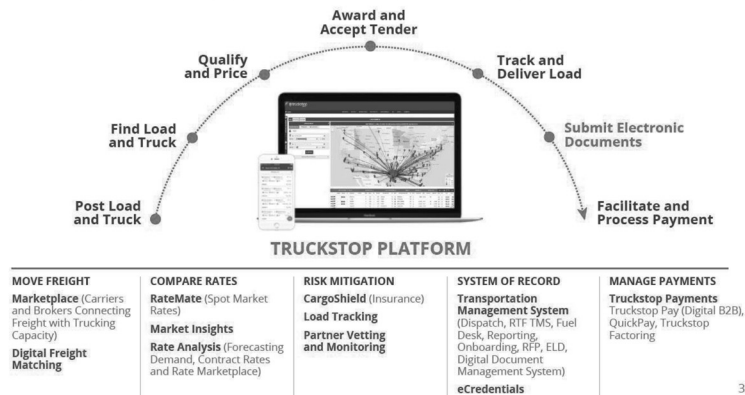
We are deeply committed to efforts to continuously improve the success of transportation and logistics operations including relationships between carriers, brokers, and shippers. We believe that adopting digital technology will ultimately improve our Nation's trucking infrastructure leading to improved safety on the roads and happier consumers. We look forward to working with you and National and State officials to help advance the understanding and adoption of digital technologies within the transportation industry.

Thank you, again, for the opportunity to be here today. I am happy to respond to any questions.

Appendix



Complete Freight Matching Marketplace



Senator FISCHER. Thank you, sir.

Welcome again to all the panelists. We will begin with our first round of questions and I will start.

Mr. Ingracia, so nice to see you here. Welcome. You mentioned the Advanced Transportation and Congestion Management Technologies Deployment Grant that Nebraska won along with Wyoming and Utah Departments of Transportation.

Can you elaborate on the goals of this project and the types of technologies that the Department of Roads will deploy along I-80?

Mr. INGRACIA. Yes, thank you, Chairman.

Wyoming has obvious winter weather issues and as we do in Nebraska. They have a lot of blow-overs in the winter and their initial idea was let's build a system that communicates blow-over risk, wind speed, weather conditions directly into the cab of the truck.

Our idea with the ATCMTD Grant that we applied for and were awarded was let's take that technology that Wyoming was success-

ful in deploying and let's get it on a larger section of I-80 and then let's try to find ways to amplify that technology by doing things like predictive road closures. Let's not predict a 60 percent chance of snow. Let's predict a 60 percent chance of road closure on this segment. Let's get that into the cab of more trucks. Let's inform them because it's a major safety issue.

Senator FISCHER. How can regular drivers benefit from this? When I was in Nebraska during March with the blizzards and then the flooding and such, I went to the website and I saw just a lot happening across the state on the map.

How many people visit the website and what other means do you have to get information out to not just truckers but travelers on the road, as well?

Mr. INGRACIA. So the primary method that we use is our 5-1-1 app as well as the associated website. Anyone can go there. They can view road closures and, you know, as you're aware, with the flooding, with the blizzard that occurred in March, we had a third of our roadways, our state roadways closed for the better part of several days. Certainly it's an issue. We had a lot of them hit.

Normally we'll have 2.8 million hits a year on our 5-1-1 site. We had that amount in a matter of 6 days during this event. So people were really driving to the website. They can call 5-1-1 on their phone. We also have a two-way push of data into Waze which goes to Google and so if people are using Google Maps, if there are detours, that information goes there, as well. So it's distributed widely.

Senator FISCHER. Thank you.

Mr. Hutto, given the broad information load boards that Truckstop.com have on their freight transportation network, what insights can you provide on challenges and bottlenecks in the surface transportation system and how do you incorporate that information into the services that you provide because I know there's deep concern about the future with the projected increase in the number of trucks that are going to be needed to continue commerce here in the United States, but there's also concern on bottlenecks at known specific points around the country, but how do you get that information out?

Mr. HUTTO. How do we get it out or what's the solution?

Senator FISCHER. Well, tell me first what services you provide. Then if you have a solution, we'd all be excited to hear it.

Mr. HUTTO. We provide data and information to all the players that are moving spot market freight, which is 20 percent of the freight on the U.S. highways every day.

We are a data resource for every single player and the solution I think that I would suggest to you, to the Committee would be for systems to be connected. One of the challenges you have is you have an unwariness of the marketplace and what's going on in metropolitan areas because systems are not connected.

You have certain systems at certain parts of the truck driving universe in North America that has the availability to, and then the other parts don't have access to it or don't use it, because they're not connected to what they use every day. So I would say that connecting systems together would be the most important—connecting transportation freight systems together would be the

most impactful way to reduce congestion in metro areas as freight moves through those areas at different times of the day.

Senator FISCHER. To tie this in with FMCSA recently asked for comments on driver detention times during the loading and the unloading at shipping facilities.

Did Truckstop.com have any insights on that driver detention time?

Mr. HUTTO. We did not comment on any detention but detention is something we intend to solve.

Senator FISCHER. OK. Thank you.

Senator Duckworth.

Senator DUCKWORTH. Thank you, Madam Chair.

With your consent, I'd like to hold on my questions and to allow our colleague from Michigan, the great state of Michigan, to ask his questions.

Senator FISCHER. Thank you.

Senator Peters, please.

**STATEMENT OF HON. GARY PETERS,
U.S. SENATOR FROM MICHIGAN**

Senator PETERS. Thank you.

Senator FISCHER. My former Ranking Member.

Senator PETERS. I know, exactly.

Senator FISCHER. We tossed you over for a new addition.

Senator PETERS. You did very well. You did very well.

Senator FISCHER. Glad you're still here.

Senator PETERS. Good to be here. Thank you, Madam Chair. Ranking Member Duckworth, thank you for yielding. To all of the folks who are testifying, very interesting testimony.

We truly are living in very exciting times and the types of technological change we're going to see in the years ahead are truly transformational and I'm thinking of one of those technologies, which many of you mentioned, which is self-driving cars, something I've been very involved in and believe that the changes we'll see in the auto industry and to our society are probably every bit as big as when the first car came off of the assembly line and think how that changed our world dramatically and created the American middle class and really truly created mobility for the first time in human history in a significant way. So my questions relate to how we go forward with this.

Mr. Bhatt, I certainly appreciated ITS's past support for the AV START Act that I'm working on with Senator Thune who's a part of this Committee, as well, but right now I'm in the process of working with our House colleagues. We are trying to work through some of the aspects of the legislation that we developed here in the Senate and coordinate that with what came out of the House. I certainly am grateful for your work with us on that.

My question to you is let's take a step back from any specific bill right now. If you could just talk about why we need legislation versus just maintaining the current status quo under NHTSA's existing authority, and what we need to be doing, and why we need to be doing it? If you could just kind of outline that for the Committee, please?

Mr. BHATT. Thank you, Senator Peters, and thank you for your work along with Senator Thune and all the other leaders who have been trying to wrangle this very complicated issue.

I think that from an ITS America perspective, we have a diverse range of membership. We have automakers, we have cities, we have technology companies, we have states, and I think the area that we all sort of find common agreement on is this idea that, you know, when you drive from New York City to Los Angeles and go across the country, the interstate you drive on is the same all the way across the country. That's a safety benefit, and it's an operational benefit. So as we deploy new technologies, such as driverless vehicles, we want to make sure that there's a national standard, just like we have for highways or transit or aviation, around what is a driverless vehicle, and what the components of are. You know, that you have one regulatory agency overseeing what that is as opposed to 50 states and countless jurisdictions sort of putting their take on it.

So standardization at the Federal level around what the vehicle is but still allowing for locals to enforce things like speed limits and their licensing. I think those are sort of the higher-level frameworks that we're looking at because our competition globally is racing ahead in this sphere and we want to make sure we stay with them.

Senator PETERS. Which is why we need to have national legislation and move beyond the current exemptions that may exist under current NHTSA rules. This is about seizing the technology, the innovation, but allowing companies also to scale up quickly so that we can deploy this, is that accurate?

Mr. BHATT. Yes, I think that the exemptions were a good start when the numbers were still fairly small and as the technology matures and the market matures, we want to make sure that the legislation is there to keep pace as the market becomes more robust.

Senator PETERS. The other point, and you made this in your testimony, to remind us how dangerous our highways are, that well over a hundred people will die today as we speak, and that the promise of this technology is that we can dramatically reduce those deaths as well as dramatically reduce the injuries, some of those debilitating injuries, so those can be reduced.

So I would sense that getting this law passed quickly is very important. It literally means saving lives. Every extra day it takes to move this industry forward another hundred people may die that many of them could have been saved, is that accurate?

Mr. BHATT. I would say that there's a broad swath of technologies that are deployable available today and I'm really grateful that this hearing has been convened to inform the next authorization because every day that we delay another hundred people die on our roadways and NHTSA estimates that connected vehicle technologies could mitigate 80 percent of unimpaired crashes. That's 1.2 million crashes that could be mitigated every year, tens of thousands of lives. So, yes, the sooner we can speed the deployment of technology we think it'll be a positive outcome.

Senator PETERS. Two weeks ago, Chairman Pai from the FCC suggested once again that transportation stakeholders were not taking advantage of the 5.9 gigahertz band and that the FCC

should go forward in perhaps sharing it or giving it to other entities.

In your written testimony, you acknowledge that there are divergent views held by transportation stakeholders and the cable industry. What are the real risks to public safety if the FCC were to move forward with their idea of sharing 5.9 bands without the benefit of all the studies that are going on?

Mr. BHATT. Yes, I would just quickly say I have a lot of respect for Chairman Pai and I think he has a diverse set of stakeholders that he needs to listen to.

I would simply say that all of the connected vehicle technologies require the 5.9-gigahertz spectrum, whether it's DSRC, CV2X. You need that spectrum. We're open to sharing, as long as the testing is completed with unlicensed devices, and we encourage the rapid completion of that, but we want to be clear that whether it's Nebraska, Florida, Utah, New York City, there is deployment today and people who say that it's not being used it's just not an accurate statement.

Senator PETERS. Thank you.

Senator FISCHER. Thank you, Senator Peters.

Senator Duckworth.

Senator DUCKWORTH. Again, I'd like to hold my remarks and yield to Senator Blumenthal so he can get his questions in if that's all right.

Senator FISCHER. Senator Duckworth is the nicest person we know, and you two owe her big time.

Senator Blumenthal.

Senator DUCKWORTH. Thank you.

**STATEMENT OF HON. RICHARD BLUMENTHAL,
U.S. SENATOR FROM CONNECTICUT**

Senator BLUMENTHAL. Thank you, Madam Chairwoman, and thank you, Senator Duckworth, and I agree totally. She is one of the nicest persons I know and since my wife would regret if I said the nicest person I know and we're on the record, but thank you, Senator.

You were just talking about, Mr. Bhatt, life-saving technologies that are available right now. We'll be debating the legislation that might further driverless cars, but automated emergency braking technology is available right now and it could literally stop 80 percent of the rear-end collisions that we have in this country.

So my question is couldn't this technology be made available in 2019 or 2020 models, and shouldn't the automakers of America provide this kind of technology as a standard feature on all cars?

Mr. BHATT. Thank you, Senator.

I think that, yes, automatic emergency braking not only prevents rear-end collisions but also in this increasingly distracted world in which we live, in which drivers are distracted, pedestrians are distracted, and other and new forms of mobility options, like scooters, come out there, a technology like automatic emergency braking can prevent rear-end collisions and also greater tragedies.

In fact, at the ITS America annual meeting, Ford demonstrated how their connected vehicle platform using CV2X was able to de-

tect a scooter and how the vehicle stopped because it recognized that the scooter was coming into its field of view.

So in terms of technologies, like automatic emergency braking or lanekeeping, it is critically important and it's being deployed on more and more models, just as many safety features are, and we'd love to see it deployed on more models.

Senator BLUMENTHAL. Anybody on the panel disagree?

[No disagreement.]

Senator BLUMENTHAL. Great. No one is disagreeing, let the record show.

I know this is primarily an automotive panel, I think, but in terms of rail safety and technology, I've been a strong advocate of positive train control. The deadline for implementing it has been set back a couple of times. The trains of America are under a 2020 deadline.

Anybody here see any reason that trains should be excused from meeting that deadline? It is a form of technology that also can save lives on trains. I gather no one does see any reason that it should be delayed further.

[No disagreement.]

Senator BLUMENTHAL. We all understand the reasons why it can help save lives because it will stop trains when they're going to hit another train or when they're going too fast and that's very important, long overdue.

I am introducing the Used Car Safety Recall Repair Act with Senator Markey. As you may know, there are a lot of innovations in transportation, a lot of advances in technology, but the safety of our roads will continue to be in jeopardy as long as we resell cars that are under recall.

Incredibly, most Americans have no idea that there is no provision in Federal law that requires that consumers be told those cars are under recall or why and so there are about 70 million vehicles on the road today with open recalls. That's double the number last year and one in four of all cars and many are sold by used car dealers unrepai red with safety defects.

Let me ask all of you what other ideas—I assume that you would support this legislation. If anyone on the panel disagrees, I hope you'll tell me why?

[No disagreement.]

Senator BLUMENTHAL. No takers. Let me ask the panel what other ideas you have about how we can reduce the number of vehicles on the road with open recalls? Anybody have other ideas?

[No response.]

Senator BLUMENTHAL. These are safety defects, as you all know, being driven today on the roads. They endanger not only the drivers and the passengers in those cars but others who are on the road with them. They have bad brakes or a Takata airbag that explodes. They can endanger other vehicles.

Ms. SCHLENKER. I would just say that a tracking of the subsequent owners from the first purchase into the second, third, fourth as they move into the used vehicle, the tracking system today, I think, is inadequate to be able to reach out to those subsequent owners for address and e-mails, et cetera, to be able to connect them to understand about the recalls that are open.

Senator BLUMENTHAL. Thank you. Mr. Bhatt.

Mr. BHATT. Senator, I would say on the positive train control, when I was in the Secretary of Transportation in Delaware, sat on the Northeast Corridor Commission and saw a lot of need for PTC and pledge your efforts on that, and on the used vehicle fleet, there are about 300 million vehicles in the fleet and so some form of a big data application. It shouldn't be that hard to—using VIN numbers and being able to track and maybe it's potentially a Bitcoin application. I think there are opportunities to make it safer.

Senator BLUMENTHAL. Thank you. Great panel. Thank you, Madam Chairman, and thank you again, Senator Duckworth.

Senator FISCHER. Thank you, Senator.

Senator DUCKWORTH. OK. My turn. Thank you, Madam Chair.

Senator FISCHER. I thought you were going to yield to me.

[Laughter.]

Senator DUCKWORTH. Ms. Schlenker, in your testimony, you talked about smart mobility as the next transportation revolution that we can expect. You also mentioned the mobility challenges facing the public and private sector today.

What are the major challenges facing the advent of smart mobility technologies and what, if anything, can Congress do to address those barriers?

Ms. SCHLENKER. So as we talk about smart mobility, it's about data availability, the Internet of things and all the modes of information that are available to us.

As we reach out for the Department of Energy National Laboratories, frequently the metropolitan planning organizations, the MPOs, the city DOTs, the states, they're aware of all these changes in technologies and new micro-mobility modes coming out, the way people interact with transportation, transit viability and how important it really is, and so they're, I don't want to say paralyzed, but they're seeking new information what the future could really be and where they should invest and how they should better prepare.

One example is in Chicago, they're going to try curbside management. As you start to think about the demand for the curb, whether it be taxi or TNC transportation network company drop-offs, whether it be bike lanes, whether it be scooters that are there, a bus lane, maybe it's the beer delivery truck that's at the curb or the FedEx truck. So how you manage that whole curb as an example and really it's trialing different solutions—whether they be price signals, time of day signals, other incentives potentially, you know, some other downside risks that you're trying to mitigate, and having that best practice and sharing globally and certainly across all the different regions here in the U.S. to be able to share those learnings.

Senator DUCKWORTH. Thank you. I also see tremendous value in, as you're talking, about big data to make more informed planning decisions, just like you're mentioning, and maximizing the return of infrastructure investment.

Can you talk a bit about the collaborations you're engaged with to improve this decisionmaking process, like the Utopia Mission, the Urban Technology Optimization and Planning in America Mission?

Ms. SCHLENKER. Absolutely. So big data, as we look at many of the cities and regions, some of them are now adopting chief information officers beyond sustainability officers or mobility officers, trying to manage all that data that comes in, whether it be from red light cameras, whether it be from signal phase and timing, whether it be all these new detectors that are out there, so trying to move toward predictive analytics and not just collision avoidance but also health effects and other things that we want to take a look at from that big data. So open source, data standardization, providing it back to academia, to industry, understanding you're protecting privacy at the same time.

I think this is one of the ways that we really will improve the future for all of us.

Senator DUCKWORTH. Thank you. Mr. Ingracia, according to the National Law Enforcement Officers Memorial Fund, 122 law enforcement officers have been killed in traffic-related deaths along U.S. roadways over the past 10 years.

In the first three months of this year alone in Illinois, two officers in Illinois were tragically killed after being struck by vehicles that failed to move over as they were conducting routine traffic stops, and I appreciate everyone's interest in addressing long-term transportation issues like autonomous vehicle deployment, on-demand services, but how are state DOTs using new technologies today to address critical safety concerns like roadside accidents?

Mr. INGRACIA. I would have to apologize. It's not something I've really been briefed on and we can certainly respond to the Committee in writing on that.

Senator DUCKWORTH. OK. Great. Thank you.

Mr. Hutto, what innovative tools and practices are available to truck drivers to make our roadways safer?

Mr. HUTTO. Well, thank you for the question, Ranking Member Duckworth.

The products that are available to increase safety on the highways are through the connected systems and what I mean by that is that we have recently worked on products with the FMCSA and Wisconsin DOT and we've been working on this since 2017 on an e-credentialing product where all the permits that our truckers are required to have and to display during inspection have been authorized to be able to show to the highway officer through a digital product, through a phone or a digital display, and our initial test on that for the last two years on it with the truck fleet of 157 trucks, we were able to determine that we could reduce the stopped time by 20 minutes the highway officer would be exposed to being on the highway and that is a massive increase in efficiency when it comes to their safety on the road with not being exposed while making these inspections.

It's also a cost reduction for the fleets, but, most importantly, it's a safety issue.

Senator DUCKWORTH. What's the average length of time of those stops, if you're dropping it by 20 minutes? Is that like 50 percent per drop or?

Mr. HUTTO. That's a good question. I don't know the percentage drop.

Senator DUCKWORTH. Thank you. I yield back, Madam Chair.

Senator FISCHER. Thank you, Senator Duckworth.
Senator Thune.

**STATEMENT OF HON. JOHN THUNE,
U.S. SENATOR FROM SOUTH DAKOTA**

Senator THUNE. Thank you, Madam Chair, and I appreciate this hearing and all of you being here today and the opportunity to talk about technology and transportation and how they are integrated, especially as we think about the reauthorization of the FAST Act, which expires at the end of next year and which we all need to be focused on, but I'm hopeful that this highway bill can incorporate and integrate a lot of these new technologies into enhancing our supply chain.

I just had a couple of quick questions. Mr. Duffy, you mentioned in your testimony the potential for blockchain to greatly enhance supply chain visibility, enabling efficient and cost-effective freight transportation and more targeted responses when supply chain issues arise.

We often hear about the pitfalls of cryptocurrencies, like Bitcoin and Ethereum, which leverage open decentralized blockchain platforms. Could you describe how a permissioned blockchain platform proposed for use in the transportation sector would be differentiated from such platforms?

Mr. DUFFY. Yes, thank you for the question, Senator Thune.

It's important to differentiate blockchain from cryptocurrency. While cryptocurrency is leveraged, blockchain technology to keep records of the transactions that occur leveraging those cryptocurrencies, blockchain technology can leverage U.S. dollars or regular currencies or not be associated with financial transactions at all.

As Mr. Hutto was just talking about with the e-credentialing technology, it's another great use of blockchain, ensuring that the accuracy around driver credentials, whether that's health records or insurance or driving records, that that data is high-fidelity data, and hasn't been corrupted or modified through time, and so supply chain in transportation industries are notoriously low margin and so much of that margin capture is associated to creating trust between counterparties.

By leveraging blockchain technology, we can increase the trust available between counterparties and allow for collaborative commerce to emerge and so I think there's value unlocked to be had by leveraging that technology, an economic benefit but also energy efficiencies, as Ms. Schlenker had referred to, and even safety efficiencies when we start talking about records of safety.

Senator THUNE. For companies who already have advanced supply chain management systems, could you speak more to the feasibility of incorporating these existing technologies into a blockchain smart contract-based system?

Mr. DUFFY. Yes, sir. So the Blockchain in Transportation Alliance represents hundreds of companies spanning the globe, representing almost a trillion dollars in annual revenue, and we're quickly moving from the experimental into the real world. So we're seeing enterprises move from proof of concepts into implementing this technology in real world practices.

So whether that is tracking containers as they move across the globe into U.S. commerce, that's a great use case but also around creating visibility between supply chain partners. So on a containerized good movement from East Africa into the United States, there may be up to 40 different counterparties associated with that move and hundreds or possibly even a thousand pages of documentation.

It's a situation ripe for human error. So leveraging advanced technology, including blockchain, is a way to minimize that, those human-induced errors, and create better trust between counterparties.

Senator THUNE. You briefly discussed a set of blockchain standards being developed by your member companies, including one released this February.

How do you think the development of these standards will help companies integrate blockchain into the supply chain management systems?

Mr. DUFFY. I think we're really reaching kind of a critical mass moment in terms of the needs for the adoption of standards and Mr. Bhatt and Mr. Ingracia mentioned the need for national standards around highway safety technologies.

Our technology and our standards associated to the technologies around them for which they'll be applicable, it's global, global in nature, and so it's really important to understand that our member companies when developing these standards represent every transportation mode, air, road, rail, ocean, and they're all coming together in a collaborative way to agree upon these standards and I think that's really going to move the ball forward from the experimental into an ecosystem level adoption over the next 36 months to 5 years.

Senator THUNE. Mr. Hutto, you mention in your testimony many of the enormous improvements that can be made through the use of technology in the supply chain.

Given the strain on our current infrastructure from a growing economy, new technologies that optimize the efficiency and capacity of the supply chain are needed now more than ever.

So could you just speak to some of the challenges facing the adoption of the new technologies in the transportation sector?

Mr. HUTTO. Yes, sir, thank you for the question, Senator.

Some of the challenges with adoption of it are availability to them. A lot of systems that are being created today are privatized and are only available for those that have massive resources.

When you look at the transportation industry, it is proliferated by small players and we as a technology, we started in 1995, were built for the small player in the marketplace, the small carrier, the small fleet, the small brokerage company, and really its the access to that system and for that system to have universal availability of data to an entire marketplace.

So the biggest challenge is being able to get at the data and as the market begins to move into a digital process, which is where you've got predictive and proactive information being pushed to them, it's got to be available for all players. That's the biggest problem. It should not just benefit those that readily have the resources to do it because they are a large company.

Senator THUNE. So what would you say Congress can do to encourage the adoption or deployment of some of these innovative technologies? What role do we play in all of it?

Mr. HUTTO. The role that you play would be to help to make our roadways and highway systems the most efficient possible because that allows more players to come in the marketplace which enables more trucks to move freight.

Senator THUNE. I get that, but I'm just wondering, you know, how we enable that to happen because, like you said, a lot of this is happening in the private sector, in the private economy, and is only adopted by those who have the resources to do that.

So as we think about the reauthorization of the highway bill, do you have any suggestions about that, things that we could be doing on our side?

Mr. HUTTO. Well, the one thing that jumps in my mind is to—and I know I may go back to this a couple times, but the Number 1 thing that puts a small trucking company out of business is a major mechanical failure and when you think about the wear and tear on the road that goes into a vehicle, a truck, and you consider that's the Number 1 thing that puts them out of business, a smooth surface to roll on and a dependable surface to roll on is probably the most important because it's the Number 1 thing that puts them out of business.

Senator THUNE. OK. An old technology and a new technology.

Thank you. Thank you, Madam Chair.

Senator FISCHER. Thank you, Senator.

Mr. Hutto, would you say that driver shortage is also a concern that you have and that the Federal Government could help if we had an age—looking at lowering ages for drivers to be able to drive interstate, not just intrastate?

Mr. HUTTO. Thank you for your question, Chair Fischer. I apologize. I think earlier I did refer to you improperly, so I apologize about that, ma'am.

Senator FISCHER. I don't know. I'd have to go back and look.

Mr. HUTTO. I do appreciate you getting my name correct. Thank you very much.

That is a hot topic that has been around for a long time and certainly it's one that could alleviate part of the problem. I know that it's a principle that the American Trucking Association is looking at as far as what's the feasibility of that.

Our marketplace certainly needs more drivers to operate the trucks but also needs technology systems connected where the capacity utilization of the truck is at its greatest amount. When you have 60 percent utilization of something, you've got to have a big solution on that end.

Senator FISCHER. OK. Thank you.

Mr. HUTTO. Yes, ma'am.

Senator FISCHER. Mr. Duffy, you noted in your testimony that blockchain is the tip of the spear in digitizing some of the most antiquated systems used in the transportation sector.

In what ways do blockchain-powered distributed ledgers offer new solutions for a supply chain in ways that other technology, like RFIT is limited?

Mr. DUFFY. Can you repeat the last part of that?

Senator FISCHER. The question?

Mr. DUFFY. Just the last part, the RFID?

Senator FISCHER. The R-F-I-D, RFID.

Mr. DUFFY. Oh, R-F. So blockchain technology isn't necessarily special. You know, it's a specialized type of database. Every database is in a blockchain but it is allowing for collaborative commerce to emerge where companies are otherwise operating in silos.

Those data silos create massive inefficiencies. So whether you're talking about detention and demurrage time around ports or around trying to create higher fidelity data points inside systems, like the automated customs environment that CDP leverages, creating standards around the data components that operate in the technological systems levered by the supply chain in transportation intermediaries across the globe will increase the efficiencies, which will also allow for all sorts of opportunities to emerge.

Senator FISCHER. Thank you.

Mr. Bhatt, you recommended several times in your testimony that ITS technologies should be considered eligible projects for Federal support.

What are some of the key programs or grants within the Department of Transportation that limit eligibility or do not provide support for ITS projects, such as smart traffic signals or data collection and analysis software?

Mr. BHATT. Thank you, Chairman Fischer.

I actually think there's a great deal of flexibility that was introduced in the FAST Act to allow for states and cities to deploy these technologies. I think what we're looking for is probably—I think the biggest challenge that faces the next reauthorization is the amount of funding that is available. States and cities have to make tough choices about preserving the system, expanding capacity, and making important investments in technology.

So I think there's a lot of flexibility that exists. It's just making sure that there are enough resources within the program so that we don't have to make tough choices between those two priorities.

Senator FISCHER. Mr. Ingracia, do you agree with that? Does the State of Nebraska have enough flexibility when you're looking at Federal funding and grant programs to support your efforts so that we can start deploying more of these technological advances that we're seeing?

Mr. INGRACIA. I generally feel like we do. The ATCMTD Grant Pilot Programs in general, that is the way for us as a state to take an appropriate level of risk and try something new and that's really as a technology guy, that's what I get more excited about, is the opportunity to participate in a pilot program.

To the extent that we learn something and we're able to disseminate that knowledge to other states, to the extent that we can even partner with other states on the project, like we are with ATCMTD, it's a very powerful thing.

Senator FISCHER. Do you have any other examples you can share with us where Nebraska is doing that or where you've maybe learned something from another state that's participated in a pilot program? I'm putting you on the spot here.

Mr. INGRACIA. Yes, that's a very good question. You know, I think data analytics might be the best example of that. We have

a project right now that's another one of these things where it's new technology.

We're bringing consultants in to help us understand what our data can tell us about the roadway and we've done all kinds of projects with regard to pavement condition and what influences pavement condition and when you have years and years and years of data, you're able to distil that down into some very counterintuitive sometimes results, even to our business processes, and what gets us better bids, what reduces bid prices, over years and years of data, and you're able to distil that down and get good results.

Senator FISCHER. Great. Thank you.

Senator DUCKWORTH.

Senator DUCKWORTH. Thank you, Madam Chair.

Mr. Bhatt, I agree with you that many of the transportation decisionmakers cling to outdated functions and policies that sometimes dampen or undermine implementation of new technologies and far too often transportation decisions are made behind closed doors, leaving the average taxpayer to question whether or not their hard-earned dollars are being spent wisely.

Generally, I agree with your testimony about providing transportation planners the flexibility to experiment with innovative initiatives, like the Horizon effort in San Francisco, but we must be careful not to waste taxpayer dollars.

Are there specific Federal planning policies that you think are rigid that are in existence right now?

Mr. BHATT. Thank you, Ranking Member Duckworth.

I think the entire planning process, which was pretty innovative at the time, came out of ISTEA and some of those like mid-1990s transportation authorizations, are still being used today. I think some of the projects that we're building in Colorado and Delaware, but we're using 1980s-based planning method and not looking at new technology and how it's going to change.

So there are examples around the country where MPOs and other planning organizations are starting to bring in the advent of new technology and what the impact is, just thinking about things like autonomous vehicles and connected vehicles and what that does to driver demand, new mobility options, so we don't necessarily just have to go out and widen roadways. We can perhaps move more people, data, and freight with existing roadways.

So I think there's a lot that we can do using things like big data and other things to improve that planning process.

Senator DUCKWORTH. Are there policies that are preventing us from doing that? I mean, why are we not—is it just because this is how we've always done it since the 1990s or are there actual policies in place, whether Federal or otherwise, that are keeping us from being able to do that?

Mr. BHATT. I'd be happy to check with some of our MPO partners to see if that is the case. I think it is an element of, you know, you have to have certain levels of public engagement and are there better ways to do public engagement in this new digital age?

I think we sort of go out and do a 25-year plan and say let's take our traffic counts from today and extrapolate those out, but the technology is advancing at such a rapid pace that maybe that's not

the best way to do it. Maybe we want to look at scenarios of different rates of deployment of technology.

So I think we want to tweak it. I think it's still delivering a good product, but I think it needs to be freshened up for the 21st Century.

Senator DUCKWORTH. Is there a cost component that's acting as a barrier to sort of adopting some of these new technologies, big data, or that? I mean, once you get it, then it's helpful in the planning process, but there's a cost barrier to starting to use it, whether it's acquisition costs?

Mr. BHATT. I actually think that your question is probably even two steps down the road from where we are. We talk about big data, but it's a question of what is the actionable information that I need? Is it origin and destination data for travelers in a metropolitan region? Is it traffic counts? You know, are there different measures of mobility? Scooters are a fairly new invention and they are transforming a lot of urban landscapes. They're not in any transportation plan that I've seen that was done before 2 years ago because they didn't exist.

And so I think that we want to look at where our planning dollars are being spent and what the outcomes are that we're looking at, but again we'd be happy to check with some of our planning partners and come back and say here's some things that we could definitely try to look at in the next authorization.

Senator DUCKWORTH. OK. Thank you. I yield back.

Senator FISCHER. In case we have any subcommittee members or committee members who are watching and would like to come down and ask questions, Senator Duckworth and I will ask a couple more questions to keep the hearing open so they can make it here.

Ms. Schlenker, in your testimony, you mentioned that rural areas can also benefit from technological solutions that inform traveler choice and optimize movement.

In your opinion, what are some of the key challenges rural areas face in adopting and deploying these technologies and how might they benefit from them?

Ms. SCHLENKER. Thank you.

In rural areas in particular, just the density of the population sometimes brings forward a lag in the technology that's available into that particular community. You can witness that now in dense urban areas where you see the scooters erupting. You see the ride health services coming there just because of the market pull.

So in the rural areas, you have to understand that one of the big issues, I believe, is the connectivity and having a connection both to the infrastructure and vehicle to vehicle is key.

I think that information is going to help on traffic accidents and I think it will also help on some of the efficiency or the movement that we have through the particular areas.

When you think of a rural neighborhood or a rural corridor, rural streets, and sometimes they're dark, they don't have the street light benefit, et cetera, and we have collisions with wildlife and blind corners with headlights not glaring in particular from passengers and travelers and so the opportunity with that connecti-

ty, I think, is one of the big assets that we'll have with rural densities.

Senator FISCHER. Thank you.

Mr. Ingracia, what are some of the challenges that we see in Nebraska in rural areas when they're looking at adopting and implementing new transportation technologies?

As you know, I come from a county of less than one person per square mile and we have 6,000 square miles. So tell me my challenges?

Mr. INGRACIA. Thank you, Chairman Fischer.

That's a question that I really appreciate. I also grew up in a very rural area in Southern Missouri and moved to Nebraska after college.

I would say, you know, connected vehicle, autonomous vehicle, electric vehicle, all these conversations have been a very urban level conversation. They have not been centered on rural areas and yet I think that rural areas stand to benefit as much, maybe even more, from these kind of technologies.

If you think about, even in your own experience, you know, driving to the grocery store, what if your car goes and get groceries and brings them back for you and that saves you three or four hours out of your day. That's a life-changing thing.

We support as a state, as NDOT, we support rural mobility options where folks need to get to the doctor. They're in rural areas. It's a long trip. They have a long wait to get picked up and a long wait to go back home. The idea that an autonomous vehicle could take them there on their own time table would be a life-changing thing.

So we have recently sponsored research at the University of Nebraska to go out and have them survey folks in rural areas, talk to people who have experienced autonomous farm equipment, and what have their experiences been like. I don't think anyone's asking them those questions. Are they learning when does this work, when does it not work, what are the weather effects? You know, are there things that we can learn when we talk even about urban autonomous vehicles? Are there things we can learn from the rural community and then also to ask them how is this going to change your life? You know, how would this change your commute? How would this change your day?

I think these technologies will transform rural areas just as much as urban.

Senator FISCHER. Thank you.

Senator Duckworth.

Senator DUCKWORTH. Thank you.

Mr. Duffy, your written testimony talks about how the digitization of outdated analog systems is an important step to being able to take advantage of current technologies, like blockchain, for the transportation sector.

What analog systems need to be prioritized for digitization in order to support blockchain and other technology deployments in the transportation sector? Are there priorities of analog systems that you think, you know, we should be looking at?

Mr. DUFFY. I don't have a specific list or an ordering of the technologies, but in the case of the lettuce situation that I mentioned

previously, you know, that's associated to a pen and paper-based process.

You know, there are instances of pen and paper, fax machines, old technology being leveraged where modern technology could definitely be available. So whether that's actual bill of lading input through a smart phone at the farm site, that might be an easy way to mitigate risk there.

Senator DUCKWORTH. Do you know of any important datasets, for example, that are maintained by the Department of Transportation or other Federal agencies that should be digitized?

One of the things we talked about already is perhaps sharing of the VIN numbers for the sale of used cars and along those lines.

Are there other datasets that you can think of or maybe someone else on the panel can think of that should be priority for digitization so that we can take advantage of blockchain technology?

Mr. DUFFY. Again, I don't have a specific list. I'd defer to any one of the panelists.

Mr. BHATT. Ranking Member Duckworth, again this concept of the data, there's performance data that we collect on the system, so it's how many vehicles per day is moving in a certain area, what is the on-time performance of transit. There are all kinds of performance indicators, condition performance, so what are the potholes on our roads, what are the conditions of bridges.

So again our challenge right now, we are awash in the sea of data. It is figuring out what is that actionable intelligence that we can get and then how do we translate that for states and cities to operate their system more effectively.

But happy to come back with some very specific datasets that we either have or we should have in order to work that into the next authorization.

Senator DUCKWORTH. So that's exactly what I'm wondering, is we have so much data, how do we winnow it down? Is there a process that we should be following? Is that something we should be developing? How do we winnow it down and say, OK, these are the top 10 that we need to digitize now and this is going to make the biggest difference for the trucking industry for highway safety? You know what I'm asking?

Mr. DUFFY. A hundred percent and so just on the mobility piece, we're having a robust discussion. We have our Mobility on Demand Alliance that is a mix of public sector agencies and private sector transportation providers who are trying to figure out what data is it that the private sector companies have, what data is it that public sector agencies have.

There is some reticence around sharing some of the data right now because some of it could be linked to competitive issues, but we're working through some of that stuff. On the crash system, we have FARS data that is pretty accurate, the fatalities.

Bridge condition is another one that we have great datasets around. So there's a lot of good data out there. I think it's just a couple of steps and this is something I think that the public sector agencies can be working on in time for the next authorization to say this is where you get the biggest bang for the buck and where we deploy our resources.

Senator DUCKWORTH. Mr. Hutto, do you have like a wish list of data that, boy, if this stuff was digitized, this would make it so much easier, more profitable? It would, you know, reduce the costs for my industry? Do you have that?

Mr. HUTTO. Thank you. That's a great question, Ranking Member Duckworth.

In the trucking industry, because of fragmentation and, most of all, the information is privatized in some of our product companies, it would be the availability of that data to be plugged into a universal platform where the participants and all the trucking companies and the trucks that are moving could do their routing and planning based on how freight is moving nationwide.

What I mean by that is that it would create great efficiency because you'd have visibility into where freight's moving. So you could reduce congestion because you'd know that this number of trucks is going into that city at that time and so you could plan and route that better.

What you have is a disparate system that they're not connected together. So you have a tremendous amount of trucks trying to go into a certain area that creates more congestion, but if you had systems that were connected together, then you could efficiently route and plan that better which would create better safety on the roads because you'd have less miles because of the planning that would happen.

So as far as a wish list, it would be that all of the pieces of data that are required for freight to move from beginning to end would exist on a platform that would have visibility through the entire industry.

Senator DUCKWORTH. Thank you. Yield back.

Senator FISCHER. Thank you, Senator Duckworth.

Once again, I would like to thank the panel for being here today. We appreciate all the information that you've given us.

The hearing record will remain open for two weeks and during this time, any Senators are asked to submit their questions for the record. Upon receipt, the witnesses are requested to submit their written answers to the Committee as soon as possible.

With that, thank you once again.

The hearing is adjourned.

[Whereupon, at 4 p.m., the hearing was adjourned.]

A P P E N D I X

RESPONSE TO WRITTEN QUESTION SUBMITTED BY HON. MARIA CANTWELL TO STEVE INGRACIA

Traffic Congestion. Washington State faces growing traffic congestion problems. The 2018 Traffic Scorecard by INRIX, which ranks cities based on analysis of congestion and mobility, ranked Seattle as the sixth most congested city in the country. Drivers in Seattle each lost 138 hours to congestion in 2018, costing over \$1,900 per driver. These are real losses in time and productivity.

Question. What technologies or innovations are being used by NDOT and other state DOTs to improve congestion and mobility?

Answer. Ongoing advancements in technology, and the transportation industry's ability to innovatively apply them to positively impact quality of life through increased mobility, are supplying state DOT's with a magnitude of resources to support enhanced safety and improved driver experience in congested areas.

Technology advancements that improve mobility and provide current and relevant information to drivers on roadway situations help manage driver expectation and improve overall satisfaction levels. For Departments of Transportation, maintaining a free-flowing roadway is not always the optimal goal—in some areas and at some times of day this is unattainable—but providing predictable mobility should always be a primary goal.

In Nebraska, we seek to provide predictable mobility by using a mix of operations techniques and technology. We monitor congested locations during rush hour using fiber-connected cameras, and we co-locate our operations center staff with state patrol to allow quick face-to-face collaboration.

The DOT also gathers weather data at 62 sites around Nebraska, including pavement temperature and subsurface temperature, in order to work with the National Weather Service and our private sector partners to predict weather conditions on the roadway. Our full-time meteorologist uses the Pathfinder platform to communicate with our State Operations Center, first responders, and our eight districts to translate weather information into road condition predictions to assist with road maintenance and provide information to the public on traveling conditions.

Like many DOT's we're always seeking to improve our partnerships with other governmental bodies and collaborate with the private sector to better communicate roadway situations to the public. Technological advancements in data gathering tools provides DOT's with better information on the mobility needs of the public.

RESPONSE TO WRITTEN QUESTION SUBMITTED BY HON. AMY KLOBUCHAR TO STEVE INGRACIA

Question. The DOT estimates that up to 80 percent of vehicle crashes involving unimpaired drivers could be prevented by vehicle-to-vehicle technology, which allows vehicles to communicate wirelessly with other vehicles and helps alert drivers to dangerous traffic situations. How can technology like this help to improve roadway safety, particularly in rural areas?

Answer. As a rural state, freight management is an important topic both in terms of efficiency that can be gained through autonomous technology and connectivity concerns that could impact roadway safety. In October of 2018, I attended a meeting in Portland, Oregon with Daimler Trucking, where they demonstrated their commercially-available vehicle-to-vehicle (V2V) solution for freight haulers using Dedicated Short Range Communications (DSRC) technology. In this demonstration, two fully-loaded (80,000 lb.) DSRC-equipped trucks were platooning—travelling roughly 50 feet apart at highway speed. When the lead truck encountered an obstacle in the roadway, it wirelessly notified the follow truck to slow down in advance of applying its own brakes. In this manner, when the lead truck stopped, the follow truck had already stopped and was 75 feet from the lead truck. This was a compelling demonstration, and seeing this technology in action on the roadway only acts to rein-

force the importance of encouraging its adoption in both heavy trucks and passenger vehicles.

The Advanced Transportation and Congestion Management Technologies Deployment (ATCMTD) Federal grant just awarded to the Nebraska DOT, in partnership with the Wyoming and Utah Departments of Transportation, will advance technologies that improve mobility and safety across the multi-state I-80 corridor. This project will build upon Wyoming's successful V2I connected vehicle pilot program to increase the flow of information to freight haulers and will ultimately improve safety along I-80. We are looking forward to working with the private sector and other DOT's along the I-80 freight corridor to improve safety and efficiency through connected vehicle technologies.

RESPONSE TO WRITTEN QUESTIONS SUBMITTED BY HON. MARIA CANTWELL TO
SHAIEN P. BHATT

5.9 GHz Spectrum. Mr. Bhatt, 20 years ago the FCC dedicated 75 MHz of the 5.9 GHz spectrum for the purposes of developing intelligent transportation systems. Emerging vehicle-to-everything technologies that communicate over the 5.9 band have the potential to make our transportation network safer and save countless lives. Recently, the FCC has expressed interest in taking a “fresh look” at the 5.9 band currently dedicated to transportation safety.

Question 1. If the 5.9 band were opened up to share with broadband streaming services, how might that affect transportation safety?

Answer. Since the Federal Communications Commission (FCC) commenced its ET Docket 13-49 in 2013, Intelligent Transportation Society of America (“ITS America”) has supported sharing of the 5.9 GHz band between ITS and unlicensed devices provided that such sharing does not cause harmful interference to life-saving ITS services.

ITS America supported the consensus on a three-phase testing methodology to be overseen by the FCC's Office of Engineering and Technology (OET) arrived at with the U.S. Senate Committee on Commerce, Science and Transportation's support (See September 9, 2015 letter). OET accepted public comments on its Phase 1 Test Report in late 2018.

ITS America continues its support of the consensus plan for testing and the completion of testing by OET to determine whether sharing of the 5.9 GHz band is viable. Initiation by the FCC of an ancillary and collateral rulemaking bypassing the completion of testing is not in the best interests of the public as it will further complicate an already uncertain regulatory environment into which many public and private parties are investing their scarce resources to develop and deploy lifesaving services, unduly tax those resources and delay the introduction of those services. We urge instead that OET be provided all support necessary to promptly complete its testing of band sharing.

ITS America agrees with National Highway Traffic Safety Administration's (NHTSA) assessment, that the three-phase testing must be completed to continue to ensure that this lifesaving technology is deployed and that the driving public can have confidence in the results. “The three phases of the test plan are interdependent and ongoing, and the testing will show whether unlicensed devices can safely operate in the 5.9 GHz band.” (U.S. Department of Transportation's National Highway Traffic Safety Administration issues statement on safety value of 5.9 GHz spectrum, October 24, 2018)

Question 2. Is it important that we maintain the entire 5.9 band for the deployment of transportation safety technologies?

Answer. ITS America supports prioritizing the entire 5.9 GHz band for existing, new, and developing V2X technologies. The entire 5.9 GHz Band should be protected and that no decision should be made regarding band re-allocation until after the entire three-phase test plan is completed. The Commission must allow the completion of the three-phased test plan established by the Office of Engineering and Technology (“OET”) to determine whether entry by UNII devices into the 5.9 GHz Band would cause harmful interference to incumbent licensees.

RESPONSE TO WRITTEN QUESTION SUBMITTED BY HON. AMY KLOBUCHAR TO
SHAIEN P. BHATT

As vehicles increasingly rely on the internet, we must have a cybersecurity workforce with the expertise to secure our transportation infrastructure. I introduced a bill with Senator Thune to bolster our cyber workforce by establishing a public-pri-

vate exchange program to recruit cybersecurity experts in the private sector and academia to do tours of duty in the Federal government.

Question. Can you speak to the need for cybersecurity professionals in efforts to secure vehicles that rely on Internet connections from cyberattacks?

Answer. ITS America does not have a specific policy on the need for cybersecurity professionals in efforts to secure vehicles that rely on Internet connections from cyberattacks.

RESPONSE TO WRITTEN QUESTIONS SUBMITTED BY HON. MARIA CANTWELL TO
PATRICK DUFFY

Blockchain in Transportation. Mr. Duffy, your written testimony talks about the digitization of outdated analog systems and how the deployment of blockchain technologies can enhance trust amongst stakeholders, produce resilient data sets, and can lead to efficiencies in the transportation sector.

Question 1. Can you describe what information transportation stakeholders are sharing on blockchain platforms and how the technology leads to increased trust amongst stakeholders?

Answer. Transportation stakeholders are sharing a myriad of information on blockchain platforms. The types of data being put on chain include, but are certainly not limited to: bill of lading; booking requests and confirmations; party information; shipment information; sea and air waybills; pro-forma invoices and commercial invoices; packing lists; shipping instructions; export declarations; arrival notices; import declarations; health certificates; driver information; phytosanitary certificates; fumigation certificates; inspection and customs certificates; certificates of origin; dangerous goods declarations; and many other data types. Blockchain and distributed ledger technologies when combined with existing and new technologies can guarantee immutability and traceability of data (supply chain, transportation, trade, and associated documentation), in a manner that provides participants to have permissioned access (only know what they need to know), in a manner that provides for immediate access to information eliminating waiting times and time for counterparty actions. These allow for massive efficiencies around workflow automation, and the minimization of costly, repetitive, and often error-prone manual input.

Question 2. The efficient movement of freight is critical to our economy. How does blockchain lead to efficiencies in the supply chain that help goods get to their destination as quickly as possible?

Answer. Blockchain technology leads to efficiencies in the supply chain helping goods get to their destination as quickly as possible by creating trust-enhancing, shared, immutable ledgers of data that record transactions and tracks assets—whether these are tangible or intangible. By working in a tamper-proof environment, blockchain platforms for supply chain, transportation, and trade create verifiability of data, with provenance and auditability. When utilized within a supply chain and transportation ecosystem of stakeholders, and combined with data standards, the technology allows for interoperability between stakeholders technology stacks leading to the reduction in time for processes by sharing high-fidelity data. The benefits are being seen across ports and terminal operators, ocean carriers, shippers and beneficial cargo owners, freight forwarders and 3PLs, financial service providers, and regulatory and governmental authorities.

RESPONSE TO WRITTEN QUESTIONS SUBMITTED BY HON. MARIA CANTWELL TO
ANN SCHLENKER

Smart Cities Challenge. In December 2015, the U.S. Department of Transportation (DOT) launched the Smart City Challenge, which asked mid-sized cities to develop technology that would help move people and goods more quickly and improve congestion.

Question 1. Can you discuss the Department of Energy's partnership with DOT on the Smart City Challenge and the types of innovation cities are deploying?

Answer. The Department of Energy (DOE) engaged with DOT as the program was developed; participated in the many educational sessions leading up to the Columbus, Ohio, award; showcased DOE research and technology capabilities; and collaborated across the challenges seeking solutions. Following the award, DOE embedded a researcher in Columbus, to serve as a liaison between the DOE national laboratories' mobility expertise and the vast array of partners on the Columbus Smart City proposal. The intent was to showcase the research program within the DOE's Vehicle Technology Office SMART Mobility Consortia and connect and transfer ex-

pertise to the cities' mobility priorities. The Columbus solution set includes connected and automated shuttle pilots, micro-mobility platforms, and first-/last-mile solutions with broader reach to residents. Simultaneously, DOE national lab researchers engaged with many midsize cities that were nominees to the program. Several of these relationships and collaborations continue, and joint work is underway across the Nation.

DOE SMART Mobility program researchers are engaged in active studies on many fronts, to understand the benefits, mitigate downsides, and share lessons across the ecosystem to improve future deployments. Examples of innovations that cities are deploying include (this is a non-exhaustive list):

- Smart traffic signal controls that incorporate signal, phase, and timing, and even pilot demonstrations—to permit vehicle-to-infrastructure (V2I) communication and control for improved traffic flow;
- Camera and LIDAR sensors installed at intersections—for improved situational awareness for V2I, traffic accident reduction, and preparation for automated and connected vehicles (CAVs);
- Micro-transit pilots and deployments for e-bikes, bike-sharing, and scooters—to improve access and equity for mobility;
- Dedicated Short Range Communications service installed in contained original equipment manufacturer (OEM) and government vehicle fleets and production vehicles—to continue down the path of vehicle-to-vehicle (V2V) and V2I connectivity, using data analytics to glean keen insights;
- First-and last-mile solutions to supplement transit—small shuttles and transit network company services are adjunct to improve operational efficiency;
- Geo-fenced demonstration of CAV shuttles—to generate services and lessons learned, generally in a mobility district or dense urban area;
- Real-time mobility information for system users across providers—to provide informed movement decisions;
- Seamless payment transactions across providers—to encourage multi-modal travel;
- Curb reservation systems—for street management of freight, goods delivery, pedestrians, bikes, para-transit, transportation network company drop-off, and transit;
- Goods delivery optimization strategies—for spoke and hub logistics, and time of day/night delivery;
- Managed and dedicated traffic lanes, and real-time messaging—to improve congestion and reduce accidents;
- Electric vehicle infrastructure deployments—for a pathway of a low-carbon transportation future;
- Electrification of transit buses—for an environmentally sound solution that yields cost parity for total cost of ownership;
- Installation of Internet of Things sensors—to collect data ranging from environmental parameters, to vehicle and people counts, to consumer preference information; and
- Pilots with improved access to services (*e.g.*, healthcare, food, education, cultural opportunities, greenspace)—to expand mobility to underserved populations and vulnerable road users, for improved quality of life.

Fuel Economy. Your research helped to develop solutions that improved air quality and doubled fuel economy as the Clean Air Act was being implemented. As you know, fuel economy standards finalized in 2012 require the U.S. fleet to achieve 54.5 miles per gallon for new cars by 2026. Last year, the administration proposed revisiting the 2012 rulemaking to freeze the 2020 standards through 2026.

Question 2. Why is it important that the U.S. stay on track to meet the fleet average of 54.5 miles per gallon for passenger cars by 2026?

Answer. This topic is very complex, and many factors must be considered to yield a balanced societal solution. As you state, tremendous progress has been obtained in air quality and fuel economy from the automotive fleet. Year after year, there is significant improvement in fuel efficient offerings in the marketplace, coincident with lower emissions and the latest safety technologies.

The DOE continues to focus its research portfolio on energy efficiency at the component, vehicle, and system levels. Tremendous breakthroughs have been achieved in battery technology, whereby plug-in electric vehicles are indeed gaining a market foothold. Lightweight materials, improved combustion regimes, gasoline direct-injec-

tion engines, turbocharging, cylinder deactivation, idle start/stop control strategies, and the pathway from hybrids to plug-in hybrids and full battery-electric vehicles are examples of technology that continues to make fundamental and important progress for improved fuel efficiency with a lower environment impact.

As you know, my employer is the management and operations contractor that operates Argonne National Laboratory for the DOE. As such, we assist DOE by providing technical support in furthering its research objectives as regards fuel efficiency, but it is not our role to determine or debate the appropriate governmental policy in that area. Appropriately, public hearings, rulemaking proceedings, and open dockets permit policymakers to consider the many voices on this complex topic.

Question 3. What are some of the consequences of scaling back fuel economy standards?

Answer. Argonne National Laboratory has a vast transportation research program that addresses topics that include combustion engines and fuels, electrification, propulsion system optimization, and the creation of sophisticated product-development tools that permit virtual engineering, which allows developers to speed technology and products to the market. We participate in the full pipeline from innovation and discovery to deployment of technology and knowledge for light duty and medium/heavy-duty vehicles. The national laboratories work with nearly all vehicle manufacturers and key suppliers, to deliver joint research that benefits all parties. This pairing provides direct knowledge of customer challenges, a matching of research expertise, and collaborating teams to develop advances in fuel efficiency and emission reductions.

As you know, my employer is the management and operations contractor that operates Argonne National Laboratory for the DOE. As such, we assist DOE by providing technical support in furthering its research objectives as regards fuel efficiency, but it is not our role to determine or debate the appropriate governmental policy in that area. Appropriately, public hearings, rulemaking proceedings, and open dockets permit policymakers to consider the many voices on this complex topic.