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INNOVATION IN SURFACE TRANSPORTATION

(115–52)

HEARING

BEFORE THE

SUBCOMMITTEE ON
HIGHWAYS AND TRANSIT

OF THE

COMMITTEE ON
TRANSPORTATION AND
INFRASTRUCTURE
HOUSE OF REPRESENTATIVES

ONE HUNDRED FIFTEENTH CONGRESS

SECOND SESSION

SEPTEMBER 5, 2018

Printed for the use of the
Committee on Transportation and Infrastructure

Available online at: https://www.govinfo.gov/committee/house-transportation?path=/browsecommittee/chamber/house/committee/transportation

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33–627 PDF WASHINGTON : 2018

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Committee on Transportation and Infrastructure
U.S. House of Representatives
Washington, DC 20515

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August 31, 2018

SUMMARY OF SUBJECT MATTER

TO:	Members, Subcommittee on Highways and Transit
FROM:	Staff, Subcommittee on Highways and Transit
RE:	Subcommittee Hearing on "Innovation in Surface Transportation"

PURPOSE

The Subcommittee on Highways and Transit will meet on Wednesday, September 5, 2018 at 10:00 a.m. in 2167 Rayburn House Office Building to receive testimony related to "Innovation in Surface Transportation". The purpose of this hearing is to receive updates from non-federal partners regarding the various kinds of innovations used in surface transportation. The Subcommittee will hear from DriveOhio, ITS America, a representative from the Community Transportation Association of America, and Contra Costa Transportation Authority.

BACKGROUND

FAST Act

On December 4, 2015, the President signed H.R. 22, the *Fixing America's Surface Transportation Act* (FAST Act, P.L. 114-94) into law. The FAST Act reauthorizes the federal surface transportation programs of the U.S. Department of Transportation through fiscal year 2020. The FAST Act improves the Nation's infrastructure, reforms federal surface transportation programs, refocuses those programs on addressing national priorities, and encourages innovation to make the surface transportation system safer and more efficient.

In order to encourage innovation and support the use of transportation technologies, the FAST Act includes specific policies across federal surface transportation programs. Examples of those policies include:

- Establishing the Advanced Transportation and Congestion Management Technologies Deployment (ATCMTD) Program, which is a competitive grant program to deploy large scale installation and operation of advanced transportation technologies. ATCMTD

requires the Secretary of Transportation to develop criteria that encourages return on investments, reduce traffic crashes, and collect real-time data, among others.
- Providing eligibility for the installation of vehicle-to-infrastructure communications equipment to reduce congestion and improve safety.
- Establishing a National Highway Freight Program, which includes eligibilities for intelligent transportation systems and other technologies; traffic signal optimization; and real-time traffic, truck parking, roadway condition, and multimodal transportation information systems to improve the flow of freight.
- Allowing for utilization of public transit research funding for the integration of mobility on demand projects that utilize tools such as smart phone applications.
- Establishing a pilot program for innovative projects that improve the coordination of transportation services and non-emergency transportation services for those who are transportation disadvantaged.

The Future of Surface Transportation

Over the next 30 years, the Nation's transportation infrastructure will need to keep pace with anticipated increases in population and demand for freight transportation. Forecasts predict that America's population will grow from 319 million in 2014 to approximately 400 million in 2051.[1] The movement of freight is expected to increase by 40 percent over the next 30 years.[2] U.S. trade volume is expected to double by the year 2021, and double again by the year 2030.[3] In terms of highway usage, vehicle miles traveled are projected to increase by nearly 20 percent by 2035.[4]

As the transportation needs of communities change, state and local entities are continuing to look at innovative ways at how to address those transportation demands. A number of emerging transportation technologies are currently being utilized or explored. These technologies have the potential to improve the safety and productivity of the surface transportation system. While not an exhaustive list, below are some of the technologies and developments that are relevant to this hearing.

Autonomous Vehicle (AV)

AVs are motor vehicles capable of operating without any direct human input or control over a vehicle's safety-critical functions, such as steering, acceleration, and braking. These vehicles generally work by using a combination of three systems:

- A global positioning system (GPS) or other mapping system that defines the starting and ending point of the drive;
- A sensor system composed of cameras, lasers, radar, or lidar (a technology that measures distance using laser light) that detects dynamic and variable roadway conditions; and

[1] U.S. Census Bureau, *Projections of the Size and Composition of the U.S. Population: 2014 to 2060*, 2015.
[2] U.S. Department of Transportation, Bureau of Transportation Statistics, *DOT Releases 30-Year Freight Projections*, 2016.
[3] Federal Highway Administration, *FHWA Forecasts of Vehicle Miles Traveled (VMT): Spring 2016*, 2016.
[4] *Id.*

- A computer system that can turn the information from the mapping system and sensor systems into a driving action, which is typically executed by the vehicle's internal electronic network.[5]

Connected Vehicle

Connected vehicle technologies enable cars, buses, trucks, trains, roads, infrastructure, bicyclists, and pedestrians to communicate through wireless technology.[6] Connected vehicle technologies, which allow vehicles to "talk" with each other (as well as other modes of transportation and surrounding infrastructure), can prevent crashes by detecting when another vehicle's speed and location present a dangerous situation. For instance, if two connected vehicles approaching an intersection appear to be on a collision course, the vehicle may alert its respective driver of the hazard, and could do so even before the driver would normally be able to assess the situation.

Intelligent Transportation Systems (ITS)

ITS integrate advanced transportation technologies into transportation infrastructure and vehicles. ITS can improve safety, mobility and efficiency of the transportation system. Some examples of ITS technologies currently used include electronic toll collection, traffic signal coordination, transit signal priority, and traveler information systems. [7]

Mobility on Demand (MOD)

MOD refers to the use of emerging mobility services that utilize a multi-modal network (i.e. bikeshare, carpooling, public transit, etc.) which is available to all travelers and users of the transportation system. An example of utilizing MOD is when a public transit agency partners with an on-demand transportation network company, such as Uber or Lyft, to provide first and last mile solutions.[8]

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[5] U.S. Department of Transportation, National Highway Traffic Safety Administration, Automated Vehicles Safety.
[6] U.S. Department of Transportation, Federal Highway Administration, Truck Platooning "Partially-Automated Truck Platooning Demo Frequently Asked Questions (and Answers)".
[7] U.S. Department of Transportation, Intelligent Transportation Systems Joint Program Office, "ITS Research Fact Sheets - Benefits of Intelligent Transportation Systems".
[8] U.S. Department of Transportation, Intelligent Transportation Systems Joint Program Office, "Mobility on Demand (MOD) Fact Sheet: *Transform the Way Society Moves*".

WITNESS LIST

Mr. James Barna
Executive Director
DriveOhio

Ms. Julia Castillo
Executive Director
Heart of Iowa Regional Transit Agency
On behalf of the Community Transportation Association of America

Mr. Shailen Bhatt
President and Chief Executive Officer
ITS America

Mr. Randell Iwasaki
Executive Director
Contra Costa Transportation Authority

INNOVATION IN SURFACE TRANSPORTATION

WEDNESDAY, SEPTEMBER 5, 2018

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON HIGHWAYS AND TRANSIT,
COMMITTEE ON TRANSPORTATION AND INFRASTRUCTURE,
Washington, DC.

The subcommittee met, pursuant to call, at 10:05 a.m., in room 2167, Rayburn House Office Building, Hon. Sam Graves (Chairman of the subcommittee) presiding.

Mr. GRAVES OF MISSOURI. The subcommittee will come to order.

Without objection, the Chair is authorized to declare a recess at any time.

Good morning. I want to welcome everybody to today's hearing. We are going to hear from our non-Federal partners on some of the innovations that they are using to improve our surface transportation system.

The FAST Act [Fixing America's Surface Transportation Act] was reauthorized on the Federal surface transportation programs through fiscal year 2020. And through these programs, our non-Federal partners are investing in research, transportation technologies, and other innovations to meet the current and future needs of our communities.

For example, some of our communities have invested in intelligent transportation systems, others have experimented with autonomous and connected vehicles, and some have been partnering with the private sector to improve the quality of life for the general public.

The population and the amount of freight moving through our Nation is projected to increase significantly over the coming decades, and being innovative and utilizing transportation technologies where it makes sense to do so is going to help our surface transportation system move people and goods safely and more efficiently.

Innovative solutions and transportation technologies are going to be applied differently across our Nation, and it is vital that we share the best practices and the best lessons that are learned. The leaders with us here today are going to showcase some of those innovations and technologies that are currently being used on our highways and our public transit systems. Congress has to continue to provide our non-Federal partners with the flexibility to implement innovative solutions and to deploy transportation technologies that are going to work best for them.

And with that, I look forward to your testimony, and I now turn to Ranking Member Norton for her opening statement.

Ms. NORTON. Thank you very much, Mr. Chairman. I really appreciate this hearing.

This is a fascinating time to be a member of this committee and this subcommittee. I remember when I first chose this committee and see now how it has changed and believe it has got to change even further, because our mission is no longer about cars and trucks and roads and bridges. I mean, of course, there was a time when we had surface transportation bills passed, and when they passed, the amount of money we put in to roads and bridges automatically went up. That is gone.

While we are fixing that, we must not take our eyes off of these fast-moving technological advances, which under our feet and right before our eyes are changing the way people move, the way they get from one destination to the other. We see in transportation technology innovations that can solve some of our worst problems. Every Member sees those problems just getting to the House through the streets of the District of Columbia.

We see that the new technology may not only help us solve these excruciating congestion problems, but can help us save lives and innovate for safety. For example, the cars that drive themselves, the electric cars make us nervous when we hear about a car without a driver, until we learn that those cars are far safer than the cars that we ourselves drive.

Now, there has been a safety mishap here and there, but compare that to the mishaps that occur every day on the streets of the United States. The whole notion of being able to have a choice as to the form of transportation, and we already see those choices coming before us. Will it be an Uber or a Lyft? Will it be a subway? Will I take my car? Not too long ago, most people didn't have but one choice when it came from getting from one place to another.

At the same time—and I must, I think, call attention to the two screens that we have to have before us, because while we are looking to the future, as I am grateful that this hearing does, we have immediate problems in the near term, and those problems really do have to do with old-fashioned 20th-century surface transportation problems that need to be addressed.

We have a funding crisis, and we have not yet found any way to increase funding for old-fashioned transportation needs. Witness how we got the FAST Act passed. We got it passed because we simply said that we declared a 6-year bill was a 5-year bill, and therefore, there was more money because it was over 5 years. We can't keep doing that. So we have got to work on both kinds of transportation, the new transportation that is coming at us, like it or not, and the old-fashioned transportation that we still haven't caught up on.

We are looking for the most cost-effective and efficient transportation solutions, and we are looking for commercially viable solutions because that is the way to make these new innovations available to the public.

I do want to indicate that while I am excited about these innovations for the way they will affect big cities like the ones I represent, these changes are critical for rural areas as well.

I want to commend Ms. Castillo for your testimony, which reminds us of the advancement of the investment necessary in rural

America and how they are consistent with the kinds of innovations that I have just indicated. We need to consider that suburban and rural areas benefit from the same options that I have been describing.

So I will be particularly mindful of and attentive to your testimony as we prepare for a new surface transportation bill, while thinking on the other side of the brain about how to bring transportation innovation into the 21st century.

Thank you again, Mr. Chairman.

Mr. GRAVES OF MISSOURI. Thank you very much.

It is a pleasure to have Congressman DeFazio, who is the ranking member of the full committee with us. I would ask for your statement.

Mr. DEFAZIO. Thanks, Mr. Chairman. Thanks very much for holding this hearing.

Obviously, we are looking at a very large number of traffic deaths this year. Congestion is worse than ever. And the question is, how much will new technologies be able to address these concerns, both the fatalities and the congestion? I think there is great promise, but there are a lot of unanswered questions as we move forward.

About a year ago, I went out to California. I called it my visit to the future. And I visited Autodesk; and I went to Uber to see their driver-assisted truck; Tesla; and Waymo. And it was pretty extraordinary, particularly—not to be plugging anybody here, Waymo in Mountain View at near rush hour with construction and all sorts of challenges, the driver never even got close to touching the wheel. It was an extraordinary experience.

And I can see where these technologies could both facilitate dealing with congestion. You know, you get frustrated sitting at traffic lights when the jerk in front of you is on the cell phone and didn't see the light change. The cars will take care of those problems in the future.

But then there are questions about what are the algorithms. MIT had an online quiz to see what the algorithm should look like, and they gave you a series of incidents. You are driving the car, a kid runs in front of you with a ball. Well, you are going to turn and crash into the wall.

Another one is you just saw some guy mug somebody. He is running across the street with the purse. You can turn and crash into the wall or you can run over the mugger. What are you going to choose? Well, I chose to run over the mugger. So, what are the algorithms going to be?

So it was an interesting test, and at the end, they showed what the history was. And then the question of where we are today, which is, it is all voluntary. It is all based in the innovation that is going forward, which I think with the new technology is appropriate, but at some point it has to be integrated into the national system.

And if it is going to be integrated into a uniform national system, at some point, the Government is going to have to be involved in setting some regulation dealing with the industry. We don't want to end up with things that are incompatible with one another, you know.

I was on the Committee on Homeland Security for many years, and we never—I don't even think they have still gotten to totally—I am trying to remember the word—interoperable communication systems. And so the same thing here with these technologies. So we have got to be sure that there aren't going to be conflicts between competitors and different technologies and things that will perhaps work in some areas of the country won't work in others.

I think it was Waymo said that they were having trouble with rain so they were trying to operate in Seattle, and they kind of were doing OK with rain, but they are still having trouble with snow and other things. So, obviously it is an evolving technology, very quickly evolving. But at some point, we are going to have to make sense of it and in an integrated 21st-century system for the country, and that is why we are here today, to learn more about how we might do that.

So thank you for holding the hearing.

Mr. GRAVES OF MISSOURI. All right. I want to, again, welcome our panel here. And today we have Mr. James Barna, who is the executive director of DriveOhio; we have Ms. Julia Castillo, who is the executive director of Heart of Iowa Regional Transit Agency, and she is here on behalf of the Community Transportation Association of America; Mr. Shailen Bhatt, president and CEO of ITS America; and Mr. Randell Iwasaki, who is the executive director of Contra Costa Transportation Authority.

And I would ask unanimous consent that our witnesses' full statements be included into the record. And without objection, that is so ordered.

And since your written testimony is being made a part of the record, the committee would request that you try to limit your summary to 5 minutes.

And with that, we will start with Mr. Barna.

TESTIMONY OF JIM BARNA, EXECUTIVE DIRECTOR, DRIVEOHIO, OHIO DEPARTMENT OF TRANSPORTATION; JULIA CASTILLO, EXECUTIVE DIRECTOR, HEART OF IOWA REGIONAL TRANSIT AGENCY (HIRTA), ON BEHALF OF THE COMMUNITY TRANSPORTATION ASSOCIATION OF AMERICA; SHAILEN P. BHATT, PRESIDENT AND CHIEF EXECUTIVE OFFICER, INTELLIGENT TRANSPORTATION SOCIETY OF AMERICA (ITS AMERICA); AND RANDELL IWASAKI, EXECUTIVE DIRECTOR, CONTRA COSTA TRANSPORTATION AUTHORITY

Mr. BARNA. Thank you, Chairman Graves.

Chairman Graves, Ranking Member Norton, and members of the subcommittee, my name is Jim Barna. I serve as the executive director of DriveOhio. I am pleased to appear here today on behalf of Governor John Kasich and Ohio Director of Transportation Jerry Wray to talk with you about the important ways we are preparing Ohio for the future of smart mobility.

With autonomous and connected vehicles dominating both the automotive and infrastructure agendas across the globe, DriveOhio was created by Governor Kasich as a one-stop shop for those looking to safely develop, test, and deploy advanced mobility solutions in Ohio. We are establishing Ohio's leadership in this realm by providing a single point of collaboration for the dozens of public and

private entities in our State that are involved in the design, development, testing, use, and regulation of autonomous and connected technologies.

As the State center for smart mobility, DriveOhio brings these agencies and organizations under one umbrella, serving as a single point of contact for all of Ohio's smart mobility initiatives and advancements. DriveOhio fosters cooperation, innovation, and collaboration, offers faster access to resources by breaking down Government barriers for people and organizations that want to be part of this industry.

Our work is guided by four fundamental pillars: transportation safety, which is first and foremost; reliability, mobility, and workforce. We have nearly a dozen smart mobility projects either under construction or soon to be announced, projects aimed at testing advanced transportation technologies in a variety of real-life smart mobility applications, including improved access to work, education, healthcare, and the essentials of a healthy productive life.

One of the biggest things we are learning is the importance of using public-private partnerships to achieve our goals. Our public-sector partners, including nine State agencies and municipalities from across the State, are participating in working groups along with the automotive industry, academia, and Ohio's world-class research and development institutions. Together, they are working to ensure Ohio stays on the cutting edge of smart mobility, technology, standardization, infrastructure, and implementation.

One example that is well underway is our 33 Smart Mobility Corridor, a 35-mile stretch of U.S.3 northwest of Columbus, which is being equipped with some of the highest concentrations of connected vehicle infrastructure in the country. Working with a collaborative team of local governments, along with the Transportation Research Center, Honda, Bosch, Michael Baker International, and others, we are equipping the four-lane divided highway with fiberoptic cable and wireless roadside sensors.

Midway along this corridor we are working with local officials in Honda on a project to install dedicated short-range communication units in every traffic signal in the city of Marysville. When fully operational, connected signals will communicate with as many as 1,500 public and private vehicles we will be equipping with onboard units. This will provide the largest concentration of connected vehicles and infrastructure in the country.

The Marysville and U.S. 33 Smart Mobility Corridor projects are each funded in part through a U.S. Department of Transportation grant.

In another public-private partnership, DriveOhio and the Ohio Department of Transportation are working with the city of Columbus, the Columbus Partnership, and The Ohio State University to soon deploy a low-speed, self-driving passenger shuttle service around the downtown area. This is part of a three-phase plan to help develop guidelines that will inform future developments or deployments of self-driving technology in Columbus and throughout the State of Ohio.

Ohio has a singular advantage in our work to advance these technologies: We are home to the Transportation Research Center, a 4,500-acre automotive proving ground, the largest and most ad-

vanced in North America. Now with a $45 million investment by the State of Ohio, JobsOhio, and The Ohio State University, the Transportation Research Center is building the SMARTCenter, the largest automated and connected vehicle testing facility in the world, strategically located at one end of the U.S. 33 Smart Mobility Corridor.

By supporting projects like those I have described and others sure to follow, DriveOhio is committed to advancing smart mobility solutions and innovation that will benefit transportation safety, efficiency, and economic impact, not only in Ohio, but throughout this entire great Nation.

Thank you for letting me share the Ohio story. I have provided additional details in my written testimony, and I will be happy to answer any questions the committee might have.

[Mr. Barna's prepared statement follows:]

Prepared Statement of Jim Barna, Executive Director of DriveOhio, Ohio Department of Transportation

Chairman Graves, Ranking Member Norton, and Members of the Subcommittee: My name is Jim Barna. I serve as the Executive Director of DriveOhio. I'm pleased to appear here today on behalf of Governor John Kasich and Ohio Director of Transportation Jerry Wray to talk with you about the important ways we are preparing Ohio for the future of smart mobility.

With autonomous and connected vehicles dominating both the automotive and infrastructure agendas of governments at every level, here and across the globe, DriveOhio was created by Governor Kasich as a one-stop shop for those looking to safely develop, test and deploy advanced mobility solutions in Ohio. We are establishing Ohio's leadership in this realm by providing a single point of contact and collaboration for the dozens of public and private entities in our State that are involved in the design, development, testing, use and regulation of autonomous and connected technologies—as well as as those responsible for the public policies and infrastructure needed by those technologies.

As the State's center for smart mobility, DriveOhio brings these agencies and organizations under one umbrella, serving as the single point of contact for all of Ohio's smart mobility initiatives and advancements. DriveOhio fosters cooperation, innovation and collaboration, offers faster access to resources by breaking down government barriers, and improves efficiencies for people and organizations that want to be part of this industry. Our work is guided by four fundamental pillars: Transportation Safety—which is first and foremost—Reliability, Mobility and Workforce. We have nearly a dozen smart mobility projects either under construction or soon to be announced—projects aimed at testing advanced transportation technologies in a variety real-life smart mobility applications including improved access to work, education, healthcare and the essentials of a healthy, productive life.

One of the biggest things we are learning is the importance of using public/private partnerships to achieve our goals. Our public-sector partners, including nine State agencies and municipalities from across the State, are participating in working groups along with the automotive industry, academia, and Ohio's world-class research and development institutions. Together, they are working to ensure Ohio stays on the cutting edge of smart mobility technology, standardization, infrastructure and implementation.

One example I can point to, which is well underway, is our 33 Smart Mobility Corridor, a 35-mile stretch of U.S. 33 northwest of Columbus, which is being equipped with some of the highest concentrations of connected vehicle infrastructure in the country. Working with a collaborative team of local governments along the corridor that is overseeing the project, along with the Transportation Research Center, Honda, Bosch, Michael Baker International and others, we are equipping the four-lane, divided highway with fiber-optic cable and wireless roadside sensors.

Midway along this corridor, we are working with local officials and Honda on a project to install dedicated short-range communication units in every traffic signal in the city of Marysville. When fully operational, these connected signals will communicate with as many as 1,500 public and private vehicles we will be equipping with onboard units. This project will provide the largest concentration of connected

vehicles and infrastructure in the country, with a saturation rate of daily traffic in the area reaching between 10 and 20 percent.

The 33 Smart Mobility Corridor and Marysville projects are funded in part through a U.S. Department of Transportation ATCMTD grant. This project was selected for the grant because it was the only demonstration project involving a rural-to-suburban-to-urban application of this technology. And it has been recognized as advancing more rapidly and more successfully than others that were awarded.

Ohio has a singular advantage in our work to advance these technologies, as we are home to the Transportation Research Center, a 4,500-acre automotive proving ground—the largest and most advanced in North America. It's strategically located at one end of the 33 Smart Mobility Corridor. Now, with a $45 million investment by the State of Ohio, JobsOhio, and The Ohio State University, the Transportation Research Center is building the SMARTCenter, the largest automated and connected vehicle testing facility in the world. Automakers and systems developers recognize the value in SMARTCenter's capabilities and are already buying "track time" reservations before construction is even completed.

Another project ramping up along the 33 Smart Mobility Corridor will gather vehicle data and monitor traffic from the air. We will soon be using unmanned aircraft that will interact with sensors and communication equipment along the corridor, feeding data into our Traffic Management Center in Columbus. The project will also use sensors and communication devices to ensure the unmanned aircraft will not interfere with one another or with manned aircraft, such as small planes and helicopters, which also use the lower altitude airspace.

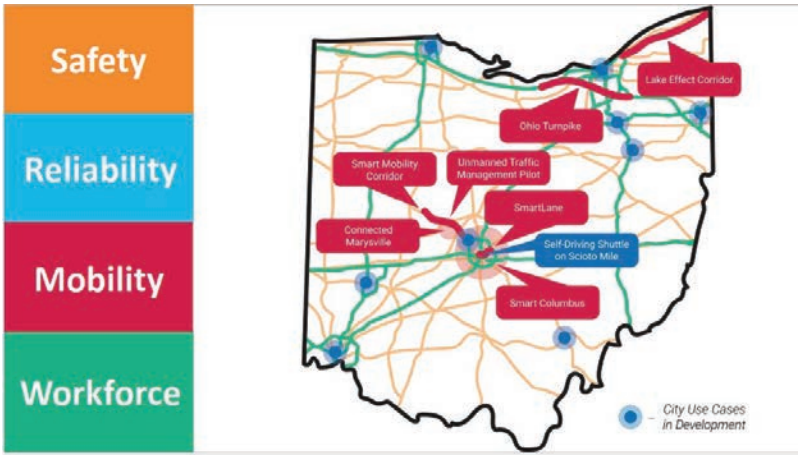
We are also identifying innovative financing opportunities to support this research.

In another public/private partnership, DriveOhio and the Ohio Department of Transportation are working with the city of Columbus, the Columbus Partnership and The Ohio State University to soon deploy a low-speed, self-driving passenger shuttle service around city's downtown area with free rides for passengers during the first year. This pilot is the first step in a three-phase plan for Smart Columbus that will help develop guidelines that will inform future deployments of self-driving technology in Columbus and throughout Ohio.

To truly maximize our investments in this area, we need the ability to connect local and regional projects under a cohesive Statewide framework. DriveOhio has begun work on a Smart Mobility plan to guide our future investments in connected and automated vehicle technology. The purpose of the project is to provide equipment and application specifications for smart mobility technologies that could be used by State and local governments. We are also looking at a master plan for Statewide data storage, management and security for connected and autonomous vehicles.

By supporting projects like those I've described and others sure to follow, DriveOhio is committed to advancing smart mobility solutions and innovation that will benefit transportation safety, efficiency and economic impact not only in Ohio, but throughout the entire nation.

Thank you for your time and for letting me share the Ohio's smart mobility story. I will be happy to answer any questions the committee might have.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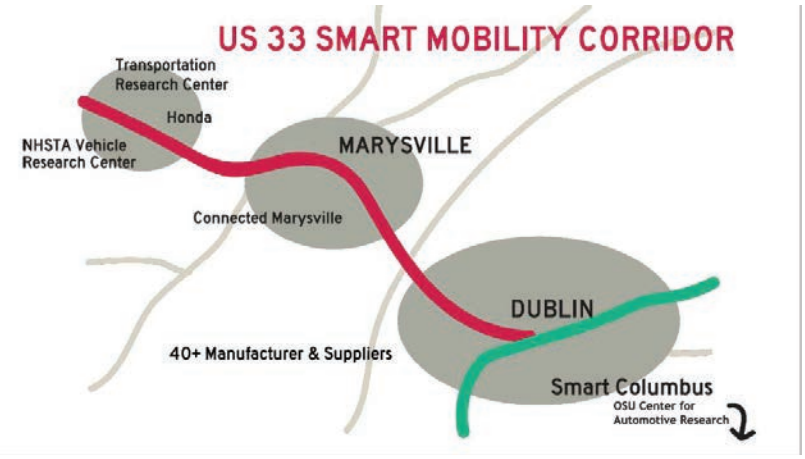
Smart Columbus
City Use Cases in Development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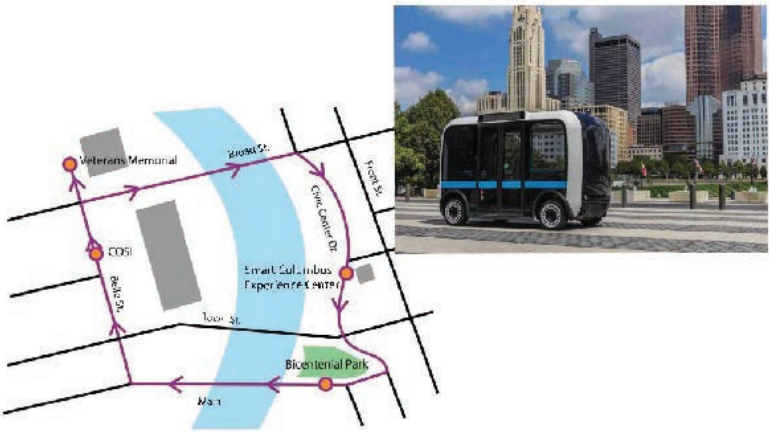
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Mr. GRAVES OF MISSOURI. Thank you.

Ms. Castillo.

Ms. CASTILLO. Mr. Chairman, Ranking Member Norton, and members of the subcommittee, my name is Julia Castillo, and I am the executive director of HIRTA, the Heart of Iowa Regional Transit Agency, better known as HIRTA, and I have been there for 8 years. It is with great appreciation and honor to be selected on behalf of the Community Transportation Association of America and its members to appear before you today regarding innovations in public transportation.

HIRTA's service area is a seven-county, 4,200-square-mile region, with a population of 321,000. We provide approximately 300,000 trips per year traveling over 1.3 million miles with a 95-percent on-time rate. All of this can be a challenging task, for Iowa has the second oldest fleet of public transportation vehicles in the United States. In our community, HIRTA is the safest way to go with our 87 drivers having traveled 218,000 miles since our last preventable incident.

Innovations in rural transit look different than in our urban transit, but the goals—more efficient service to more people—they are the same. Staffing resources of rural transit systems like mine are far more limited than in urban communities. For rural transit, the most obvious path to innovation is through vehicles.

We have a fleet of 84 fully accessible vehicles which range from 2-passenger to 18-passenger capacity. Rural transit systems like mine perform at our best when we are able to effectively group trips and right-size our fleet to customer demand. Our service can't be a one-size-fits-all. Different size vehicles allow us to be more responsive and flexible.

Thanks to Congress' leadership and increasing dedicated bus capital, the transit industry is making headway in reducing the national bus capital backlog. To build on that investment we must explore practical applications such as autonomous vehicles.

Some small urban transit providers, such as my fellow CTAA member StarTran in Lincoln, Nebraska, have been testing autonomous vehicles in limited applications to determine their effectiveness. Both small urban and rural transit providers will need technical assistance and peer examples to embrace and implement these new technologies while Federal legislation on autonomous vehicles needs careful consideration by Congress to ensure these vehicles are accessible, safe, convenient, and affordable for all Americans.

At the same time, there have been innovations in technology that rural transit providers across the country have been utilizing for more than a decade. Our Routematch centralized scheduling and dispatch software allows us to make realtime decisions about serving our customers across a wide geographic area.

HIRTA NOW was started because there was a need for same-day service where people don't have to reserve their trip 24 hours in advance. They can call anytime we are open and we pick them up and take them where they need to go. Rural and specialized transportation providers such as OATS in Missouri, which serves your district, Mr. Chairman, and Suburban Transit Network in Montgomery County, Pennsylvania, have also developed efficient, same-

day, and on-demand service, which is an important innovation in rural areas.

People don't live in advance. Sometimes things happen and people need a ride now, not tomorrow. And since most rural areas do not have Ubers, Lyfts, or even taxis, HIRTA decided we could provide the same type of service, so we have become the Uber in our area.

Our newest and most exciting project which launched last month is a smartphone app and online payment option known as Amble. This allows our riders to manage their own trips, including scheduling, canceling, and payment. Combined technologies like Amble are what smaller communities and public transit providers like mine are striving to implement. In Norwalk, Connecticut, the CTAA member Norwalk Transit District is set to launch an on-demand ride-sharing service known as Wheels to You that will utilize a similar scheduling and fare payment app.

Additionally, in 2017, we developed a 10-year strategic plan crafted with elected officials, private partners, customer groups, and more. And as a result, we are now working on deploying new innovations such as HIRTAworks, which is a van pool service for commuters, getting them into factories and large employers in our most rural areas; HIRTAJoblink, which is going to be a commuter shuttle getting employees to jobs in our rural areas, and we have been working with job service programs and employers as well as local officials to make this happen; deviated route service in the city of Newton. CTAA members have launched similar deviated routes recently in small towns like Georgetown, Kentucky, and Biddeford, Maine.

An important innovation for all forms of public transportation is better understanding of the outcomes that our services create: healthcare outcomes, employment, independence, and education. Using data we must demonstrate how our services benefit entire communities, even for those who never ride public transit. Failure to do this creates challenges.

For example, many of my peers are innovating with non-emergency medical transportation to diversify their funding sources and provide more efficient services to healthcare destinations. CTAA member in Flint, Michigan, the Flint MTA, has developed a fleet of sedans and minivans to serve non-emergency medical trips within 30 minutes through its Ride to Wellness program. Since its launch in September of 2016, it has grown from transporting 160 people a month to more than 1,000 per day.

In closing, our responsibility as rural transit systems is to stay in the know, keep up with industry standards, look for and secure additional funding, determine what technology makes sense to enhance the customer's experience and allow staff to operate more efficiently. We all know the community and public transportation industry is changing. The vehicles and technology we use may evolve; however, people will always need to get somewhere.

I look forward to answering any questions you think of, and thank you for the opportunity to testify before you on behalf of HIRTA and CTAA.

[Ms. Castillo's prepared statement follows:]

Prepared Statement of Julia Castillo, Executive Director, Heart of Iowa Regional Transit Agency (HIRTA), on behalf of the Community Transportation Association of America

Mr. Chairman, Ranking Member Holmes-Norton and Members of the Subcommittee:

My name is Julia Castillo and I have been the Executive Director of the Heart of Iowa Regional Transit Agency, better known as HIRTA, for 8 years. I also serve on the National Rural Transit Assistance Program Review Board and as Treasurer on the Iowa Public Transit Association Board.

As the Executive Director of a rural transit system, it is with great appreciation and honor to be selected, on behalf of the Community Transportation Association of America, to appear before you today regarding innovations in public transportation in rural communities.

The State of Iowa has 35 community and public transportation systems serving all 99 counties. We have 16 rural and 19 urban transit providers, which are the only entities eligible to receive public transit investment administered by the Iowa DOT Office of Public Transit (OPT). The Iowa DOT issued TransPlan 77 further defining the concept of regional transit systems as being multicounty regions based on the Governor's sub-State planning regions, which is an innovative approach to public transit dating back to 1977. HIRTA is the designated public transit system for region 11, responsible for serving the counties of Boone, Dallas, Jasper, Madison, Marion, Story and Warren. Our service area is unique in that we are the only regional transit system in Iowa serving a circle around the Des Moines metropolitan area. Our service area ranges from our smallest county spanning 554 square miles to our largest covering 730 square miles, and populations from 16,013 to 97,502 with a some counties slightly declining in population while others grow. Unlike urban areas, when rural population decreases, the need for mobility grows, due to increased isolation.

Our agency was established in 1981, and when I became the Executive Director in 2010, there was only two of us employed at HIRTA. Historically, we had contracted our transit services with local non-profit agencies, working with a contractor in each county we serve. Our Board is comprised of one county supervisor from each of the counties we serve, and our 2010 Board election brought major changes in leadership. In 2011, just 6 months into my position, five of seven board members were new to HIRTA. I recognized the great opportunity to begin initiating change. By October 2011, HIRTA began operating service directly in Jasper County, and hired drivers for the first time. In 2012, we were the first transit system in central Iowa to hire a Mobility Manager, and added direct service in Story county. Today, we only contract in two of our seven counties, and we have more than 90 employees. None of this growth would have been possible if not for a Board of Directors who made the decision to invest in the future of HIRTA, and allowed us to grow and implement innovative programs, technology, and approaches to making us the transportation option of choice in our region.

HIRTA has a fleet of 84 fully accessible vehicles, which includes 18-, 16-, and 12-passenger buses, as well as minivans and MV1's, which serve two-to-four people. Our newest additions are ProMasters, which can transport up to nine people. We provide approximately 300,000 trips per year, traveling over 1.3 million miles, which can be a challenging task as Iowa has the second oldest fleet of public transit vehicles in the United States.

The demographics we service are as varied as the places we go: 60 percent are people with disabilities (including those 60 and older); 13 percent are seniors and 27 percent is general public, which includes Head Start, preschool, K–12 school riders and anyone under age 60. We provide both long-distance and in-town services, which are broken out as 33 percent program services; 12 percent medical and hospital releases; 11 percent employment; 8 percent education; 4 percent congregate meal programs, adult daycare and shopping trips, and 27 percent for other reasons. HIRTA also stands on its safety record, with our 87 drivers having provided more than 41,000 trips, traveled 218,000 miles and worked 14,000 since our last preventable incident.

As with many rural transit systems, we have a limited number of staff, and most wear many hats, covering a variety of tasks and skills. It is a challenge to plan for the future, when we are just trying to get through the daily tasks of ensuring safe, on-time and reliable service. We focus on keeping customers happy, while working within the rules and regulations encompassing public transportation. It can be challenging to dedicate time and staff to thinking about the future, with a variety of

new programs, services, technology and innovations to consider. However, I believe it is imperative for rural transit systems to plan, educate and invest in our future, or we will fall even further behind our urban counterparts. People who live in more rural areas need the same types of services as those in urban areas and even though it may be more challenging and sometimes more expensive, we need to find ways in which to efficiently meet those needs so their independence, freedom, quality of life and ability to grow and prosper where they live is not compromised. This is where innovation and technology come together to play a vital role.

We also need to be aware of how our industry is changing based on economics, technology, education and other factors. Those in their 80's and 90's are using smart technology and social media more than ever before. Rural America must realize our demographics resemble a collage of people from all different walks of life, ages, ethnicities and abilities, and they require a variety of ways to receive information and services. Status quo is no longer good enough and those who don't continue to plan and advance, will see their services decline, which will have a negative impact, not only on those we serve, but the communities as a whole. Innovations in rural transit systems may look different, and may not even appear from first glance to be innovative. However, staff and funding is very different and much smaller than urban communities. Our innovative success may be smaller, and not as glamorous, but they should not go unnoticed, because to those we serve and those who work to in rural transit, they are significant.

As we began the process of looking at where we were in 2011, and were we needed to be, I pulled a small team together, and began to look at what we do well, what we could do better and what resources and products are available for us to improve. The State of Iowa wanted to partially fund Mobility Management positions in 2012, so we hopped on board, secured funding, and were on our way to growing and being innovative in how we interacted and secured partnerships with community agencies and businesses. We developed a Transportation Advisory Group (TAG) in each of our counties, and began discussing transit improvements and unmet needs. Through this process we created a partnership with Goodwill Career Connections, secured a State Transit Assistance (STA) grant from the Iowa Department of Transportation, Office of Public Transit, and began the Employment Initiative which allowed us to provide free rides to and from work for 30 days to anyone reentering the workforce in Jasper county. We then expanded the initiative into Warren county the following year. Our Mobility Coordinator created a travel training program and cultivated partnerships allowing us to provide free trips to farmers' markets and food pantries, as part of the Hunger Collation, helping to improve access to healthy food and reduce food deserts. Other collaborations emerged with the Veterans Administration, Legal Aid, ESL classes and IMPACT (which manages programs like Low Income Home Energy Assistance Program).

It is great to live in a multimodal society, which means having great transportation options. In rural areas, those options are generally fewer, and sometimes nonexistent. HIRTA Now was started because there was a need for same-day service, where people don't have to reserve their trip 24 hours in advance. They can call any time of the day and we will pick them up and take them where they need to go. It is more efficient and easier with advanced notice for transit providers, however, people don't live in advance. Sometimes things happen, and people need a ride now—not tomorrow—and since most rural areas do not have Uber or Lyft, or even taxis, HIRTA decided we could provide this type of service, and cater to more people because our small vehicles all have ramps, so we could also serve those who use mobility devices.

We also began to look at how we connected with people outside the vehicle, and those who didn't use our service. Our first step into social media was to develop a more user-friendly website. We kept it simple and yet informative, with pictures and up-to-date news about what is happening at HIRTA. We currently average over 2,000 unique visitors per week. Then we branched into the world of Facebook, where we focus on our customers and what is of interest to them. We have continued to grow this part of our social media, averaging 11,300 reaches per month. We actively use Twitter too, however, this form of social media is directed more toward agencies, government, businesses and individuals interested in rural transit as a whole. Daily service announcements are rare, but tweets about our value to the community, the economy, funding or benefits of transit are the main focus. On Twitter, we average over 11,000 impressions a month. Most recently we began using Instagram as a platform to showcase our outreach and marketing efforts. Some may say social media is not very innovative. However, it is not common for rural transit systems to have a website, Facebook, Twitter or Instagram account, and the rational is often "the majority of the people we serve, aren't on those platforms". That line of think-

ing is getting further and further from the reality of how people receive information today.

Our Operations team conveyed ways we could enhance service to our customers and streamline it for our staff. Over the past 5 years, we have invested in and secured additional funds to implement the following, innovative solutions:

- Notification Module, which automatically calls people at a specified time to remind them of their upcoming trip, reducing costly and inefficient no-shows;
- Maintenance Module, which allows HIRTA staff to proactively track and manage maintenance on all of our vehicles through real-time updates, and notifications when a vehicle experiences a problem while en-route;
- Audio and Video Surveillance cameras in all vehicles, not only ensuring greater safety and providing examples for improved driver training, but also reducing our insurance expenses by recording our drivers' actions during accidents;
- Centralized Scheduling and Dispatch, which offers improved efficiency along with continuity in our operating procedures and customer service;
- Tablets for drivers, replacing paper manifests, which are more efficient, economical and sustainable;
- Electronic pre/post-trips have replaced paper forms; and
- Dedicated one staff person to be responsible for safety and training. We have invested in a demand-response training program, and various other trainings, such and Drug and Alcohol awareness. All drivers are now required to go through these training programs, pass a written test and undertake behind-the-wheel training. If someone doesn't pass, they have to take the training again before they are allowed to drive.

Our newest and most expensive project, which launched last month, is a smartphone app and online payment option known as *Amble.* We are the only rural transit system in the U.S. that has implemented both of these options at the same time, and only one of three using the online payment feature. We are committed to bringing in technology for use across all of our customer demographics. Before launching, we did a trial run for 4 months using eight people, from all walks of life, ages, disabilities and genders. Each of them consistently used the app to better their transit experience. They managed their own trips, including scheduling, canceling and reviewing. It is very important we not limit people by any preconceived biases, so we offer options to ensure those we serve have choices for what best fits into their life. We are also focused on safety, and therefore it was important to have a secure way of paying without cash or tickets.

Do rural transit systems take time for strategic planning? HIRTA had not undertaken one in 36 years. It may not sound innovative, however, I am a firm believer if we don't know what our goals are, we will never know if we are reaching them. In 2017 we developed a 10-year working strategic plan, so we would work toward goals such as achieving outstanding customer experiences, ensuring our safety culture, maintaining organizational viability and improved connectivity. I even changed my monthly Executive Director report to the HIRTA board, which lists our ten goals and everything reported falls into one of those categories. It helps keep me on track and updates the board on the living and working plan.

We are now developing and anticipate implementing the following innovations this fiscal year:

- *HIRTAworks*, a vanpool service for commuters, getting them to the factories and large employers in our most rural areas.
- *HIRTAJoblink*, a commuter shuttle getting employees to jobs in our rural areas. We've been working with refugee service programs, and also have employers as well as city and county officials working together to make this happen. This is an economic need and stakeholders see the impact it will make in their communities.
- Our first deviated fixed-route in the city of Newton, which is highly supported by the City and the county's TAG. Deviated fixed-route service is a hybrid option that allows us to run a conventional fixed-route bus line, but deviate off the route for up to ¾ of a mile to provide door-to-door service for eligible passengers, avoiding the cost of creating a complimentary paratransit operation to serve people with disabilities along the route.

Providing rural transit is different than providing transit in urban areas. Both have challenges and barriers, some the same, but several are unique to operating in large geographic areas with much less population density. One challenge is having a facility conducive to housing the operations, and more importantly, the vehicles and maintenance. Many rural agencies, like HIRTA, operate out of various leased buildings or office spaces, with no indoor storage for vehicles. Some smaller agencies actually have drivers take the bus and park it at their private home for the night. Having vehicles sit out in the elements, whether it be excessive heat,

rain, hail, or extreme cold and snow, ages the vehicles' exteriors and interiors. The excessive wear shortens the life of the vehicle, as well as, increases failures and repair costs. Whatever capital resources we have available we devote to our vehicle fleet to maintain our service levels. A new, centralized facility hasn't been possible with our budgetary constraints. The end result is vehicles which do not look aesthetically pleasing and reduce the public perception and image of public transit. To a customer, rusty vehicles equate to old and unsafe. For the transit system, this means money, which could be used to maintain or enhance services, goes into maintenance. This is one undeniable contrast in public transit infrastructure between urban and rural communities.

Rural systems in Iowa have historically provided, not only Non-Emergency Medical Transportation (NEMT), but also trips supported by Medicaid waivers through Iowa's Medicaid program. Over the past 2 years, the State has hired Managed Care Organizations (MCOs) to handle both types of transportation. Late last year, with less than 30 days of notice, we were told the MCO's would no longer pay for Supported Community Living (SCL) transportation, and that SCL facilities would be responsible to pay for transit services. Many of them could not afford to pay, so in 6 months, HIRTA took a loss of $900,000. We were simply not given enough notice to prepare for how the change would affect our bottom-line. Fortunately, we had already been working on new types of services to implement, so what we have lost in Medicaid funding, we hope to be able to partially recoup by implementing new services. But, to be clear, if rural transit agencies can no longer access Medicaid-supported contract trips as allowable matching funds for Federal Section 5311 rural transportation programs, millions of dollars of Section 5311 funds could be left on the table due to lacking matching funds.

Iowa's rural systems have the second-oldest fleet of vehicles in the United States, so we—unfortunately—spend a large portion of our operating funds on maintenance. Vehicle repairs are necessary in order to meet the needs of our customers. It is not unusual for us to operate ten-plus year-old, light-duty buses with over 300,000 miles on them. The useful life of a light-duty bus, as defined by FTA is 4 years. We have discussed purchasing more fuel-efficient vehicles, or even autonomous vehicle, and what it would look like for our rural communities.

Even though we are intrigued and curious about how we could implement these types of vehicles, the immediate barriers are purchasing cost and maintenance of the vehicles. Paying a 20 percent local match on new vehicles requires planning, saving and/or applying for grants. For vehicles with increased price tags, it would take even longer to secure additional funding. Also we do not have a transit facility, which means we don't have a maintenance facility. We work with local private garages and mechanics. Additional barriers would include ensuring a local maintenance vendor has the expertise to work on these new types of vehicles. Rural transit providers like ours need technical assistance and peer examples to embrace and implement these new technologies, while Federal legislation on autonomous vehicles needs careful consideration by Congress to ensure these vehicles are accessible, safe, convenient and affordable for all Americans in communities large and small.

Another stark difference is with staffing, whether drivers or office staff. Rural systems—which typically transport a large number of people with mobility devices, and provide door-to-door services—are often unable to pay their drivers a living wage. The majority of drivers we employ are part-time retirees who are 65 or older. Rural areas have qualified people we could hire, who could grow with our agencies, if we could afford to pay them a living wage and offer full-time employment with benefits. The reality is, current levels of Federal and State funding for rural systems are not enough to allow us to hire full-time drivers, and in many cases, do not allow us to hire enough staff to handle all the duties of running a transit system. It is not unusual for administrative staff to also hop in a bus and pick people up as a driver, or schedule and dispatch will-call trips. It is highly unlikely this would happen in New York, Chicago or even in a smaller city, like Des Moines.

In closing, our responsibility as rural transit systems is to stay in the know, keep up with industry standards, look for and secure additional funding sources, determine what technology makes sense to enhance the customer experience and allow staff to operate most efficiently. We set goals, take chances and most importantly, through it all, develop partnerships, communicate, collect feedback and never give-up. We all know community and public transportation industry is changing. The vehicles and technology we use may evolve, however, people will always need to get somewhere. Rural transit systems need to rise to the occasion and be innovative and forward-thinking to best serve the people in our communities. However, there are costs, and we need sustainable public funding to help us innovate. We are not asking for a gold-star transit facility that would look great to tourist or business professionals. We are simply asking for a fair and equitable share of funding so that those

who choose to live more remotely can have access to services, vehicles and facilities that suit their way of living, as much as urban transit providers try to meet the needs of those in cities.

HIRTA will continue working to remain on the forefront and keep up with what is happening in the communities we serve. We will also follow what is happening in urban areas too, because people, no matter where they live, deserve to have the safest, most affordable and reliable public transit service available.

Mr. GRAVES OF MISSOURI. Thank you.

Mr. Bhatt.

Mr. BHATT. Thank you, Chairman Graves and Ranking Member Norton, for the opportunity to testify today.

Over the past 15 years, I have been appointed by three Governors and one President to be a leader in transportation across the country, and in that 15 years, we have seen amazing changes in technology, and I believe we are just on the leading edge of that. And it represents the best tool in our toolbox, I believe, to save lives and improve the quality of life for Americans as we move forward.

I have picked five from our members across the country. We are actually going to submit a report later this year based on this hearing, but we could literally have picked a project in all of your districts because that is how widespread across the country these deployments are.

So we will start with Colorado, where I was the director of the Colorado Department of Transportation. When I was there, people would say, why is traffic so bad in Colorado? And I would say it is because we have a transportation system that was designed in the 1950s, built in the 1960s for a population of the 1980s. Colorado has doubled that, and we are still existing on that same infrastructure.

So we created our RoadX program, and one of the projects that we had come out of there was what we called SMART 25. So this is a deployment that is going to go live next year. We actually stole this idea from Melbourne, Australia. And basically what it is, it is intelligent ramp metering.

And so you have ramp meters that know the storage capacity on the ramps. It knows the speed of the traffic on the highway. And when that speed starts to break down, it stops letting people onto the highway, so you never lose the maximum capacity of the highway. When they deployed this in Melbourne, they saw a 35- to 60-percent improvement in average speed and a reduction in congestion.

Australians follow traffic laws a little bit better than Americans, so we think that they might see a 20-percent improvement. But that is the equivalent of adding a lane on I–25 in that 18-mile stretch. And in 20 years, we think that that will save about 500,000 hours of passenger vehicle time and about 50,000 hours of freight, because this is an important corridor both for the Denver metro area and to move freight from Texas up to the Canadian border.

So moving from Colorado to Florida and staying with this theme of freight, so safety is a huge issue when it comes to freight. We always talk about making sure that we don't have drivers that are too tired. One of the challenges for truck drivers is when they leave in the morning, they are not sure where they are going to spend

the night because they don't know where they can park because truck parking is a huge challenge for us. It creates huge environmental issues.

So TPAS is the program that Florida has released. Iowa is doing this as well, lots of other States. But, basically, this uses microwave detection and the existing rest stops and weigh stations so that we can broadcast into the cab so that the truck drivers know at the beginning of their journey where they can spend the night so they are not wasting time or fuel trying to find a place to park. Also during inclement weather, whether it is snowstorms or hurricanes, it is important to help move people quickly, and we are glad that Florida is leading in this space.

Moving from Florida to Michigan, I actually drove on this corridor, the U.S.–23 Flex Route this weekend. My wife is from Michigan. And they are doing some amazing things with active traffic management, maximizing throughput using lanes as they go through, using CCTV and traffic counts so that they know when the traffic begins to break down.

And because of this system they have seen a 57-percent improvement in planning time. Planning time is the time where you think the trip should take this amount of time, so we have seen almost a 60-percent improvement in that travel time and a 32-percent improvement in peak hour travel through that corridor.

Moving from Michigan to San Francisco, across the bay from Mr. Iwasaki. Metropolitan Transportation Commission, one of our members, sent forward the Bay Bridge Forward initiative. This is a bridge that moves about 300,000 vehicles a day. All kinds of different modes are involved. So there is transit, there is ferries. Active transportation is important here. And it is—one important aspect here is letting people know where there is parking available through ITS as they move forward so they are not wasting time and energy. This is a very exciting project for this entire region.

And then our last project that we have is in Nevada with the Regional Transportation Commission of Southern Nevada. There are autonomous shuttles, you know, popping up all over the place. University of Michigan I know has one. This is exciting in Nevada where they are using automated transit, and this is deploying automated transit to help fix the first-mile/last-mile challenge. This is live. It provides a test bed for integrated autonomous vehicle deployment, and you are seeing this across the country from Las Vegas to Lincoln, Nebraska.

So in closing, I would say thank you for the opportunity to testify. We will provide the report when we are done, and happy to answer any questions that you may have. Thank you very much.

[An abbreviated version of Mr. Bhatt's 78-page prepared statement follows. It is available in its entirety at the ITS America website as indicated at the end of this statement:]

Prepared Statement of Shailen P. Bhatt, President and Chief Executive Officer, Intelligent Transportation Society of America (ITS America)

Chairman Graves, Ranking Member Holmes Norton, and Members of the Subcommittee, thank you for the opportunity to provide the Intelligent Transportation Society of America's (ITS America) perspective on "Innovation in Surface Transportation."

I am pleased to be joined on this panel by ITS America member Contra Costa Transportation Authority Executive Director Randell Iwasaki.

We applaud the Subcommittee on Highways and Transit for its interest in how intelligent transportation technologies are solving many of our nation's transportation safety, mobility, and infrastructure challenges. We also commend the Subcommittee for its leadership, which made deployment of intelligent transportation technologies an eligible activity in the Fixing America's Surface Transportation Act (FAST Act).

With FAST Act funding, commitments from State and local governments, innovative partnerships with the private sector and research institutions, we see firsthand how deployment of intelligent transportation technologies are saving lives; reducing crashes; extending the life of transportation infrastructure; improving capacity; reducing the rate and growth in congestion; moving more people in fewer vehicles; improving travel times; and reducing greenhouse gas emissions.

A BETTER FUTURE TRANSFORMED BY INTELLIGENT TRANSPORTATION TECHNOLOGIES: INTRODUCTION

My name is Shailen P. Bhatt, and I am the President and CEO of ITS America. Before joining ITS America in January, 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 under U.S. Department of Transportation Secretary Ray H. LaHood.

It is an honor to testify on behalf of ITS America and our members who have been researching, developing, testing or deploying intelligent transportation technologies. 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 institutions. Our Board Chair is Carlos Braceras, Executive Director of the Utah Department of Transportation, and our Vice-Chair is Gary Smyth, Executive Director Global Research and Development Laboratories at General Motors.[1] These members come to one table—ITS America—to shape the next generation of transportation and infrastructure driven by intelligent mobility.

ITS America is united around a shared vision of a better future transformed by intelligent mobility that is safer, greener, and smarter. Our mission is to advance the research and deployment of intelligent transportation technologies to save lives, improve mobility, promote sustainability, and increase efficiency and productivity. For nearly 30 years, ITS America has been educating policy and decisionmakers at every level of government and in the private sector on policy that supports intelligent transportation technologies. Our focus is policy that accelerates deployment of connected and automated vehicle technology and smart infrastructure; breathes new life into our transportation infrastructure by expanding investments in technologies that support smart and sustainable States and cities; and supports new models and modes of transportation including micro-transit, rideshare, carshare, bikeshare, and unmanned systems. That said, our first and foremost priority has been, and continues to be, safety.

A BETTER FUTURE TRANSFORMED BY INTELLIGENT TRANSPORTATION TECHNOLOGIES: NEXT GENERATION OF MOBILITY

Today's hearing takes place at an important time. Just as infrastructure was critical to the development of our economy in the 20th century, maintenance of existing

[1] The ITS America Board of Directors includes AAA, Arizona Department of Transportation, California Partners for Advanced Transportation Technology at University of California Berkeley, California Department of Transportation, Conduent, Cubic, Delaware Department of Transportation, Econolite, General Motors, GRIDSMART, HELP Inc., Iteris, Kapsch TrafficCom North America, Metropolitan Transportation Commission, Michael Baker International, National Renewable Energy Laboratory, New York City Department of Transportation, Pennsylvania Department of Transportation, Qualcomm, Serco, Southwest Research Institute, State Farm Insurance, Texas A&M Transportation Institute, Toyota, Utah Department of Transportation, and Virginia Tech Transportation Institute.

infrastructure and deployment of smart infrastructure will be critical for our global competitiveness in this century. Advances in robotics, artificial intelligence, and wireless communications have inspired a race to make the next generation of mobility a reality.

We are entering a technology revolution that will define the way people, goods, services, and information move in the 21st century. It is a whirlwind of innovation that will change entire industries as well as transform communities large and small as well as urban and rural. It is a new transportation era as dramatic as the period when the car supplanted the horse and buggy. This transformation can positively affect both the safety and operations of our transportation system.

A BETTER FUTURE TRANSFORMED BY INTELLIGENT TRANSPORTATION TECHNOLOGIES: SAFER. GREENER. SMARTER

According to the U.S. Department of Transportation's National Highway Traffic Safety Administration (NHTSA), 37,461 people died in U.S. road crashes in 2016. This is a 9-year high, and it is an increase of 5.6 percent from the 35,485 fatalities in 2015. The 5.6 percent increase, following the 2015 increase of 7.2 percent, is the largest back-to-back percentage increase in fatalities since the 1963–1965 reporting period. In addition, there were 6.29 million crashes in 2015, which resulted in 2.44 million injuries, which is up from 2.34 million in 2014. Another alarming statistic is that pedestrian fatalities rose by 9 percent in 2016. Deaths related to reckless behaviors including speeding, alcohol impairment, and not wearing seat belts also continued to increase. Every day on average in the United States, 100 people lose their lives on our roadways.

As fatalities continue to trend upwards, mobility and environmental challenges continue to worsen. According to the 2017 Global Traffic Scorecard by ITS America member INRIX, U.S. drivers spent an average of 41 hours a year in traffic during peak hours, which cost drivers nearly $305 billion, an average of $1,445 per driver. Three of the world's top five most congested cities are in the United States, with Los Angeles (first), New York (tied for second with Moscow) and San Francisco (fifth) costing upwards of $2.5 billion. According ITS America member Texas Transportation Institute (TTI), congestion produced 56 billion pounds of carbon dioxide pollution and contributed to 3.1 billion gallons of wasted fuel in 2015.

Once the envy of the world, our increasingly outmoded roads, bridges, transit, freight, and intercity passenger systems are struggling to move the nation's technology-driven economy. Our transportation infrastructure is the backbone of our nation's economy. It is also increasingly overcrowded, in poor condition, and more dangerous. The most recent American Society of Civil Engineers Report Card gave our infrastructure a D-plus. Highways were ranked a D and public transportation a D-minus. Bridges were only slightly better with a C-minus. The 2015 U.S. Department of Transportation Conditions and Performance Report highlighted that current freight demands are straining existing capacity. Forecasts for population growth, freight growth, trade volume, and vehicle miles traveled all point to a dramatic increase over the next several decades.

We need a safer, greener, smarter future where lives aren't lost on our roads, goods are transported to markets quickly, States and cities prioritize investments in technology to enable scare infrastructure funds to reach farther and with longer-lasting results, and people get back their most precious resource: time.

Today, we are on the cusp of that future transformed by intelligent transportation technologies. The modern world literally turns on the boundary of where the tire rubber meets the paved road. For over a century, this was the most important interface between the car and the infrastructure. For automakers, the objective was always to design vehicles that were "road friendly" to the greatest extent practical. However, with new information and wireless technologies, there is a new interface—a digital interface between the car and driver and the road infrastructure. This has presented an opportunity for infrastructure operators to improve safety, manage traffic, and introduce new models and modes of transportation in ways that were previously unknown. By applying intelligent transportation technologies to our existing infrastructure, we can maximize the efficiency of our system and make it more sustainable, accessible, and equitable.

Connected and automated technology is an example of innovative transportation technology that will transform mobility and our communities. Connected and automated technologies have the potential to expand access to transportation. Older Americans and people with disabilities are demographics that are impossible to ignore. According to the U.S. census, residents age 65 and over grew from 35.0 million in 2000, to 49.2 million in 2016, accounting for 12.4 percent and 15.2 percent of the total population, respectively; and nearly one in five people have a disability. They

also represent a significant demand for transportation services, with explosive growth in travel occurring should fully automated vehicles succeed in expanding mobility access. We hope to have a future in which people with disabilities have full freedom of transportation; older adults have greater independence; and people in underserved communities and transit deserts—who are often low-income, minority, and immigrant—will have better work opportunities, better education, and access to better healthcare.

Connected vehicle technology has arrived, and automated vehicle technology is coming, but this should come as no surprise because we have seen technology being added to cars, trucks, and buses since the 1950's. Cruise control, an early example of vehicle automation, was first introduced in the 1958 models of the Chrysler Imperial, New Yorker and Windsor. According to NHTSA, vehicle safety technologies have been researched, developed, tested, and deployed safely over nearly 70 years—including cruise control, anti-lock brakes, electronic stability control, blind spot detection, forward collision warning, lane departure warning, rearview video systems, automatic emergency braking, pedestrian automatic emergency braking, rear cross traffic alert, and lane centered assist.

New transportation technologies are game changers. We now have the technical capability to connect vehicles to other vehicles, to the infrastructure, and to pedestrians—collectively referred to as Vehicle-to-Everything (V2X) communications or Connected Vehicle—via the 5.9 GHz spectrum band. Advanced traffic management infrastructure, Vehicle-to-Infrastructure (V2I) communications, and Vehicle-to-Pedestrian (V2P) communications can reduce crashes, smooth traffic flow, reduce pollution, and most importantly, save lives.

NHTSA estimates that safety applications enabled by V2V and V2I could eliminate or mitigate the severity of up to 80 percent of non-impaired crashes, including crashes at intersections or while changing lanes. More than 30 States and 45 cities are deploying V2I communications that use the DSRC safety spectrum band to enhance safety, reduce crashes, and decrease fatalities. V2I deployments include expansions of the Safety Pilot Model Deployment in Ann Arbor (MI), large Pilot Deployments in New York City (NY), Tampa (FL), and Wyoming, and the Smart City Challenge in Columbus (OH).

Electric vehicle infrastructure will be key to the deployment of the next generation of mobility. An increasing number of vehicle manufacturers are committing to deploy electric vehicles. ITS America believes that electric vehicles represent one of the best ways to reduce carbon dioxide pollution and our nation's dependence on oil from volatile and unpredictable regions of the world.

One of my last acts as the head of CDOT was to work across State agencies to help implement Governor John Hickenlooper's Executive Order D 2017–015, "Supporting Colorado's Clean Energy Transition." The executive order directs State agencies to develop a plan to electrify Colorado's transportation corridor.

Despite the recent growth in Colorado's electric vehicle (EV) market, including that the first 8 months of 2017 saw EV sales jump 73 percent over the same period in 2016, we found significant barriers to adoption. These barriers included a lack of public charging stations, particularly EV fast-charging along major transportation corridors. Consumers were apprehensive about the availability of public charging—including local, community-based charging stations and fast-charging stations along Colorado's transportation corridors and the cost of building out of an EV fast-charging network that would likely require significant public funding due to the high cost of installation. These barriers are not unique to Colorado.

Now, as head of a national association, I hear similar concerns from our member States and cities as well as vehicle manufacturers. As companies increase their commitment to deploy electric vehicles, ITS America calls on Federal, State, and local governments and the private sector to build-out the charging infrastructure to support the next generation of mobility powered by electricity.

A BETTER FUTURE TRANSFORMED BY INTELLIGENT MOBILITY: FAST ACT REAUTHORIZATION

Before I provide a preview of ITS America's intelligent transportation technology best practices report, I would be remiss if I did not strongly urge Congress and the Administration to identify long-term and sustainable funding for the Highway Trust Fund to ensure the FAST Act is reauthorized before the law expires in 2020. Maintaining our infrastructure is vital. Funding for ongoing intelligent transportation research also is important. This kind of research requires funding. Changes are happening today that will fundamentally affect how people interact with transportation in the months and years ahead. ITS America is helping States, cities, the private

sector, and researchers work toward our vision of a better world transformed by intelligent transportation technologies—one that is safer, greener, and smarter.

A BETTER FUTURE TRANSFORMED BY INTELLIGENT TRANSPORTATION TECHNOLOGIES: BEST PRACTICES

I am pleased today to provide the Subcommittee on Highways and Transit with a preview of ITS America's "Intelligent Transportation Technologies Best Practice Report: A Better Future Transformed by Intelligent Mobility" that the association is preparing for the reauthorization of the FAST Act.

This report will provide best practices on current intelligent transportation technology deployment in the United States including: project sponsor; location; description of technology and why technology was selected; transportation safety, mobility or infrastructure challenge the project is addressing; project cost information, including Federal match, State and local match, and private funding; how the project contributes to the overall state of good repair of the system; how the project helps freight and goods movement; how the project improves the environment; how the project will support the deployment of connected and automated vehicle technologies and smart infrastructure; how the project supports larger smart communities objectives; the project's economic benefits; and level of support from Federal, State, and local elected officials.

The report will provide a detailed body of data on intelligent transportation technology deployment. We will use the data to inform Congress and the Administration on the need to prioritize intelligent transportation technologies in the reauthorization of the FAST Act. We will also use the best practices to inform the owners and operators of most of nation's transportation infrastructure—State, city, and county elected officials and policymakers.

The ITS America's "Intelligent Transportation Technologies Best Practice Report: A Better Future Transformed by Intelligent Mobility" project was announced on August 9, 2018. We have received best practices from 12 State departments of transportation, two metropolitan planning organizations, three research institutions, and one private sector company. Although it is early in the process, the best practices received to date provide excellent examples of how intelligent transportation technologies are helping to address transportation infrastructure challenges from metropolitan areas to rural communities across the country.

Best practices focus on deployment of congestion-reduction technologies available today such as current generation active traffic management, managed lanes, incident response management and smart signal operations. Current travel demand management strategies include systems that provide availability and pricing of capacity on roads, highways, parking, and curb space.

The current generation of intelligent transportation systems don't simply report congestion to infrastructure operators or road users, but also actively manage transportation assets (e.g., highway/intersection/bridge lanes, ramps, parking stalls, etc.) to leverage their maximum capacity, capabilities, and lifespan for all. The next generation systems will tightly integrate data from automated and connected vehicles, which further improve the productivity of our transportation infrastructure by orders of magnitude over current systems.

ITS America will be compiling intelligent transportation best practices through the end of 2018. We look forward to an opportunity to again appear before this Subcommittee with our complete report on intelligent transportation technologies best practices.

SUMMARY OF INTELLIGENT TRANSPORTATION TECHNOLOGY BEST PRACTICES

Arizona Department of Transportation Interstate 10 Dust Detection and Warning System

The Arizona Department of Transportation is in the process of creating a first-of-its-kind dust detection and warning zone on a busy rural stretch of Interstate 10 between Phoenix and Tucson that has frequently seen hazardous blowing dust. The dust storm early warning system uses both spot detection technology and remote sensing technology to measure both the visibility along the roadway and to detect the development of dust events at a distance from the highway to allow for advance warning time. The visibility alerting capability will be integrated with automated response using Variable Speed Limit (VSL), Dynamic Message Sign (DMS), and in-pavement detection (speed loops) to warn travelers of actual or potential dust events prior to encountering them within the corridor, and closed-circuit cameras will be installed that allow staff at ADOT's Traffic Operations Center in Phoenix to see the real-time conditions on the roadway. This entire system will be connected via fiber

optic cable, which results in faster information dissemination for motorists and for ADOT when blowing dust develops suddenly in this 10-mile stretch.

California Department of Transportation Interstate 80 Safety, Mobility, and Automated Real-time Traffic (SMART) Corridor

The Interstate 80 Safety, Mobility, and Automated Real-time Traffic (SMART) Corridor project combines traditional traffic operations management strategies and technologies, with new approaches, such as active traffic management and the use of overhead lane control signs to alert travelers and harmonize traffic speeds to conditions. These measures are being combined with adaptive ramp metering, the use of arterials, and information display boards to give travelers the information needed to make wise travel route and mode choices. The integrated corridor management approach relies on interconnecting Transportation Management Centers (TMCs) operated by local jurisdictions with Caltrans' regional TMC, video monitoring, and playbooks for planned events and incidents.

Colorado Department of Transportation SMART 25 Managed Motorways Pilot Demonstration

The managed motorways concept first developed and implemented by the Victoria State Department of Transportation (VicRoads) in Melbourne, Australia, is a complex coordinated ramp metering and freeway management system which adjusts to real-time traffic conditions to prevent the breakdown of corridor traffic-flow. The complexity of the system requires a robust deployment of traffic detection on ramps and the freeway mainline to fully understand and control for real-time congestion conditions.

Colorado Department of Transportation RoadX's Smart Pavement Project

RoadX Smart Pavement is a precast concrete panel embedded with digital technology and fiber optic connectivity that acts like a laptop tracking pad.

Colorado Department of Transportation RoadX's Smart Cone Pins Project

RoadX in partnership with iCone developed a low cost ($600/unit to buy) GPS pin that fits into a standard roadway cone. When that "smart cone pin" is activated, it sends its true location and status to a cloud environment that anyone one can ingest and display on a map.

Florida Department of Transportation Truck Parking Availability System (TPAS)

Truck parking shortages are a national safety concern. The current deployment of TPAS is 68 public sites located throughout Florida's State highway system along Interstate 10 (SR 8), Interstate 75 (SR 93), Interstate 95 (SR 9), and Interstate 4 (SR 400). TPAS uses a combination of in-pavement space occupancy detection for the location with mixed vehicle type usage (welcome centers and rest areas) and microwave vehicle detection for monitoring of ingress/egress at the weigh stations. The data are aggregated at the District Regional Transportation Management Center (RTMC) and disseminated to the commercial vehicle operators through dynamic roadside signs as well as through Florida's 511 system and third party data feeds.

Georgia Department of Transportation Statewide Traffic Signal Software Upgrades

By deploying an advanced and open traffic signal control platform, Georgia Department of Transportation (GDOT) seamlessly manages arterial operations with local agency partners across jurisdictional boundaries. With an additional suite of operational tools, as well as real-time monitoring using high-resolution data and automated traffic signal performance measures, GDOT leverages technology to extend engineering and maintenance resources across the entire State. Targeting issues proactively and responding to maintenance issues before they impact the traveling public improves the mobility of all users on the arterial network.

Maryland Department of Transportation: Coordinated Highways Action Response Team (CHART) Development

The CHART Advanced Traffic Management System (ATMS) is a set of software programs running on a combination of Windows 2008 Servers, connected to a Statewide network of Closed Circuit Television (CCTV) cameras, overhead and portable Dynamic Message Signs (DMSs), Highway Advisory Radios (HARs), Traffic Sensor Systems (TSSs) (microwave traffic flow detectors), remote weather stations, and On/Off devices (electronic relay devices such as for horns and fog beacons). It is used to identify and track traffic flow disruptions, send responders to correct the disruption and notify the public using the DMS and HAR devices, as well as sending noti-

fications to the media and feeding data to a live traffic web site (http://www.traffic.maryland.gov) and Maryland 511.

Maryland Department of Transportation: Freeway Traffic and Safety Patrol/Response (FTSP) Vehicle Acquisition

The FTSP vehicles include both heavy duty and light duty vehicles. To perform incident management and emergency response functions efficiently, these FTSP vehicles are equipped with state-of-the-art technologies such as Automated Vehicle Location (AVL), Permanently mounted Closed Circuit Television (CCTV) cameras, two-way radio communications and Capital Wireless Information Net (CapWIN) capabilities.

Michigan Department of Transportation: US–23 Flex Route

Completed in 2017, the US–23 Flex Route is nine miles in length from M–14 to M–36 north of Ann Arbor. The project included construction of road, bridge and interchange operational improvements and Active Traffic Management (ATM) strategies for the US–23 corridor to address daily recurring and non-recurring traffic, incident management and overall motorist safety. Using the Flex Route's lane control gantry system, MDOT can now dynamically manage recurrent and non-recurrent congestion through technology and operational ATM strategies including dynamic lane control and shoulder use, variable speed advisories and queue warning.

Metropolitan Transportation Commission of the San Francisco Bay Area: Bay Bridge Forward

Bay Bridge Forward is a suite of projects that moves more people in fewer vehicles to make the most efficient use of the bridge's capacity. It includes implementation of near-term, cost-effective operational improvements that offer travel time savings, reliability and increased capacity for carpooling and bus/ferry transit. These improvements will not only increase person throughput and improve access to jobs in San Francisco but also reduce congestion, incidents, and emissions in the bridge corridor.

Pennsylvania Department of Transportation: Interstate 76 Integrated Corridor Management

The project is located along the I–76 corridor in Montgomery and Philadelphia Counties. The mainline component of the program consists of junction control and flex lanes using a collection of ITS technologies such as dynamic lane assignment, variable speed limits and queue warning, also known as Active Traffic Management (ATM). Traffic signal equipment on arterial roadways will be upgraded and standardized, and control and maintenance responsibilities for these corridor signal systems will transfer from the municipalities to PennDOT. Both the mainline and arterial roadways will be outfitted with communications equipment that will allow for the bi-directional flow of information between roadway infrastructure, automobiles, transit vehicles, pedestrians, and bikers. These deployments will support the Commonwealth's commitment to furthering vehicle-to-infrastructure connected vehicle initiatives.

Regional Transportation Commission of Southern Nevada: Waycare

Located in southern Nevada, Waycare helps 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.

Regional Transportation Commission of Southern Nevada: INRIX

INRIX's state-of-the-art platform allows cities and road authorities to digitize their traffic rules and restrictions, such as speed limits, crosswalks, turn restrictions and bikes lanes, so they can communicate with highly automated vehicles (HAVs), allowing them to operate safely and effectively.

Regional Transportation Commission of Southern Nevada: Audi

Audi debuted the first-of-its-kind "Time to Green" feature that provides the driver with a countdown to when a red light will turn green. The Regional Transportation Commission of Southern Nevada's (RTC) advanced traffic management system provides specially equipped Audi vehicles real-time traffic signal information through countdown in the instrument panel. The "Time to Green" feature helps reduce stress and keep drivers more informed when approaching intersections. Thanks to data provided from the connected vehicle, traffic signal timing sequences can be adjusted

to keep traffic flowing and reduce idling time and congestion that leads to increased emissions and air pollution.

Regional Transportation Commission of Southern Nevada: AAA and Keolis

The Regional Transportation Commission of Southern Nevada (RTC), along with the city of Las Vegas, provides traffic signal data to a self-driving shuttle sponsored by AAA and Keolis that operates in mixed traffic along a half mile loop in downtown Las Vegas. The shuttle is the country's first autonomous bus to be fully integrated with "smart city" infrastructure. The shuttle is fully electric and does not produce emissions that lead to air pollution. Lessons learned from a fully autonomous deployment in a complex urban setting will inform other use cases and lead to environmental benefits.

Regional Transportation Commission of Southern Nevada: Nexar

Nexar is an app that uses smartphone dash cams and wireless technology to provide drivers real-time alerts to prevent vehicle, cyclist and pedestrian collisions. The app records video outside of a vehicle and measures vehicle dynamics related to speed, braking and turns. Warnings from adjacent vehicles are communicated to drivers via the app, such as the need to brake for a hazard. The Nexar network is well established in New York City and San Francisco, where it reported a 24 percent reduction in collisions since its inception.

Tennessee Department of Transportation: I–24 SMART Corridor

Tennessee Department of Transportation is implementing an Integrated Corridor Management (ICM) system that will seamlessly manage the corridor as a multimodal system through institutional collaboration and integration of infrastructure. This ICM system will implement ramp metering, multijurisdictional traffic signal coordination, electronic signs for traveler information, incentivized removal of disabled vehicles, transit service enhancements, incident management strategies.

Utah Department of Transportation: Multiple Intelligent Transportation Technology Projects

The signal interconnected projects improved signal coordination through signal controller time clock syncing. Variable message sign project improved communication of road conditions and safety messaging to traveling public. The fiber optic communications projects improved communications with ITS devices (CCTV, VMS, Traffic Signals, RWIS, etc.) and improved communications/emergency services to remote areas.

Washington State Department of Transportation: US 395/Hawthorne Road Channelization & Signal Modification

This project revised the lane configuration and upgraded the existing signal system at Hawthorne Road and US 395 in Spokane, Washington. US 395 (Division Street) is a major at-grade arterial route in/through Spokane and a major freight route. Channelization revisions created exclusive left turn lanes on Hawthorne going east and west, a combined through lane and right turn lane for eastbound traffic, and exclusive through lanes and right turn lanes for west bound traffic. These changes allowed the signal to run in a standard eight-phase operation under new signal controllers capable of expansion to automated vehicle technologies and increased operational efficiency of the intersection. The total reduction in vehicle delay is 22,637 minutes/day.

Washington State Department of Transportation: Centralized Signal System-Joint ATMA throughout Clark County

Clark County, Washington, is part of the Portland, Oregon metropolitan service area. As the second densest county in Washington, smart solutions are necessary to extend the service life of existing infrastructure to sustain the region's rapid growth. Clark County negotiated with their vendor to transform their local centralized traffic signal system into a regionally shared Advanced Traffic Management System (ATMS). This upgrade by Clark County enabled the remaining local jurisdictions to share traffic data, and remotely operate traffic signals, within each other's systems. As part of the agreement, WSDOT-owned-and-operated signals from the seven-county region of Southwest Washington may utilize the regional signal system. These automated processes will maximize utilization of existing infrastructure, reduce delays and emissions, and increase mobility.

Wyoming Department of Transportation: Mobile App Enhancements

WYDOT developed a mobile application for smartphones to share pre-trip and en route traveler information. This application had three major components:

- A map for pre-trip planning that provides information including road conditions, traffic incidents, weather sensor data, web camera images, road construction notifications, and truck parking locations.
- A hands free/eyes free feature that speaks road condition, traffic incident, and road construction information as drivers travel down the road, alerting them in advance to adverse conditions ahead.
- A "Where am I?" feature that correlates the user's GPS location to the nearest route and mile marker. This can be used in an emergency when a driver needs to be able to share his or her location. The location can easily be sent via text or email.

Wyoming Department of Transportation: Revised Commercial Vehicle Operator Portal

The Commercial Vehicle Operator Portal (CVOP) is a web-based system focused on providing a one-stop shop for current road conditions and road weather forecast information on the most commonly traveled commercial routes in the State. This information is shared with the trucking community and was designed based on feedback provided directly from fleet managers.

Econolite: Lakeview Avenue Overcrossing Orange County Transportation Authority

On June 6, 2017, the Lakeview Ave. overcrossing in Orange County, California, officially opened to drivers. The overcrossing now routes vehicular traffic over Burlington Northern Santa Fe (BNSF) railroad line uninterrupted. Nearly 70 individual trains use the BNSF tracks daily, regularly blocking the way of drivers traveling north or south along the busy corridor. As part of the project, several intersections along Lakeview Ave. were upgraded with new NEMA traffic control cabinets and 2070 controllers. This provides the traffic management technology that enables programming of signals to help optimize traffic flow through the corridor. In addition, emergency vehicles and first responders, including ambulances, fire, and police are now able to respond more quickly and cross the rail line without interruption, which is critical for life-saving calls.

Southwest Research Institute: ActiveITS

ActiveITS is a proven and stable system, capable of obtaining 99.99 percent+ uptime, and can run in clustered virtualized and cloud-hosted configurations. Key features of the ActiveITS system include automated event management response plans for dynamic message sign (DMS) postings, email notification, traveler information alerts, highway advisory radio (HAR) messages; archiving and reporting to enable performance-based oversight of event management operations; interconnected operations for information sharing and control between traffic management centers; and management of field devices, events, and other functions by an operator in a single integrated browser/map-based/application-based interface in a Windows environment.

Texas A&M Transportation Institute and Virginia Tech Transportation Institute: Implications of Truck Platoons for Roadside and Vehicle Safety Hardware

Researchers and students at the Texas A&M Transportation Institute (TTI) are examining how roadside safety devices, such as guard rail and median barriers, will react to an impact from a truck platoon. Researchers and students at the Virginia Tech Transportation Institute (VTTI) are examining how crashes such as these would affect the occupants of the vehicle. The research will inform policy on truck platoon operating rules and roadside safety device standards.

[Editor's note: Mr. Bhatt's 78-page prepared statement is available in its entirety at the ITS America website at http://www.itsa.org/s/ITSA-Shailen-Bhatt-Testimony-House-Highways-and-Transit-Subcommittee-Innovation-in-Surface-Transport-tyt4.pdf.]

Mr. GRAVES OF MISSOURI. Thank you very much.

Mr. Iwasaki.

Mr. IWASAKI. Thank you, Chairman Graves. Good to see you.

Ranking Member Norton, Chairman Shuster, Ranking Member DeFazio, it is good to see you again as well.

Thank you for inviting us here this morning. We appreciate it. My name is Randy Iwasaki, and I am the executive director of the Contra Costa Transportation Authority. I have been a director for

8 years. Prior to the 8 years at CCTA, I worked for Caltrans for 27 years. I started as an entry-level engineer. I left as the director under Governor Schwarzenegger.

I have been fortunate enough to participate on a number of national panels. Recently, I was the chairman of the National Freight Advisory Committee. And also, the Strategic Highway Research Program, I was the technical coordinating committee chair for renewal of our Nation's infrastructure. And so I have experience on the national level as well.

The Contra Costa Transportation Authority, we are a public agency. We administer a sales tax. We oversee the planning, the construction, the design of our transportation improvement projects and programs for the county. So we have a staff of 20, but that is not the secret sauce. I think we have a great relationship with our elected officials. We have an elected board that governs us, 11 members, and they support our big thinking and our innovations. I think that is pretty critical for us at the authority.

One of those is Congressman DeSaulnier. He has been a powerful and tireless transportation advocate for CCTA and the bay area. I want to especially thank him for his leadership in sponsoring an important bipartisan bill, H.R. 4421. Along with other leaders such as Congressman Rodney Davis, Congressman Lloyd Smucker, Ranking Member DeFazio, and others, this bipartisan piece of legislation will level a playing field for electric trucks.

Because we are responsible for planning, we keep an eye on the future. And so our planning documents look out in the future, and the reason why that is important is your capital improvement programs are based on your planning documents. So if you are not taking into account the next generation of technology, you may be planning your future incorrectly, and I think that is very, very important.

I am here today to talk about three projects that we are working on. The first is we founded the largest secure autonomous vehicle test bed in the United States, GoMentum Station. We have a large number of partners that are testing there: Honda, Lyft. We also have freight, so Uber ATG. And we also have the electric shared autonomous EasyMile shuttles.

It is also a magnet for startup companies, which is important. And that is why CCTA is leading a pilot demonstration project to test electric, low-speed, multipassenger autonomous vehicles manufactured by EasyMile that are not equipped with a steering wheel, brake pedal, or an accelerator.

Earlier this year, we deployed the first ever shared autonomous vehicle on public roads in California, so we got the first two licenses for our two vehicles on public streets in Contra Costa County, in the city of San Ramon.

We know that in our county, probably like many of yours, we can no longer build our way out of congestion, and so we have a seven-pronged approach called Innovate 680. I have a document here. There are seven approaches combined into four projects. So express lanes, we are going to complete the express lanes on Interstate 680. It is the eighth worse commute congested area in the bay area.

We are going to cool hot spots. We are going to fix the weaving problem that we have that causes congestion. We are going to run

buses on shoulders. When speeds drop below 35 miles an hour in the main line, we are going to allow those buses to go out on the shoulders. We are going to have adaptive ramp metering to hold the traffic as those buses pass the on-ramps to clear the way for the bus to keep those buses on schedule.

We are also going to do innovative operational strategies, and first- and last-mile connection with our technology. We are going to prepare the corridor for the future. You heard from Ohio that they are preparing their corridor with DSRC, dedicated short-range communication, and other technologies. We are going to make our park-and-ride lot smart. And then TDM strategies, transportation demand strategies.

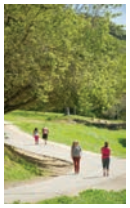
So the last example I have, and I have results of it, is we are using an app called Scoop. And so we incentivize, using $2 a ride, we are connecting a driver with a rider. And that is very important, because we don't need everybody to ride a bus, just a small percentage of the population will fix congestion. It is like the Birthday of Martin Luther King, Jr. Not everybody gets that holiday off, but yet the freeways in your communities probably operate pretty well. Why? A small percentage of the community is on vacation that day. And that is what we are looking for at the authority.

So thank you very much for the short time that I have had here to share some of the technology projects that we are working on. And I look forward to working with you on the next surface transportation bill. Thank you very much.

[Mr. Iwasaki's prepared statement follows:]

Prepared Statement of Randell Iwasaki, Executive Director, Contra Costa Transportation Authority

The Contra Costa Transportation Authority (CCTA) is a public agency formed by Contra Costa voters in 1988 to manage the county's transportation sales tax program and oversee countywide transportation planning efforts. With a hard-working staff of 20 people managing a multi-billion-dollar suite of projects and programs, CCTA is responsible for planning, funding and delivering critical transportation infrastructure projects and programs that connect our communities, foster a strong economy, increase sustainability, and safely and efficiently get people where they need to go. We utilize the tax-exempt municipal bond market to accelerate construction and delivery of our projects to the public. Because of this important tool, we've been able to deliver 25 years' worth of construction projects in 10 years. We believe the solutions we're testing to our county's transportation challenges can be replicated in most communities across the country.



THE FUTURE OF TRANSPORTATION IS BRIGHT

In addition to planning, funding, and delivering the transportation projects and programs the voters approved, we're also the county's congestion management agency and long range transportation planning agency. With this in mind, we are deeply involved in identifying and applying ground-breaking new developments in transportation and technology. Technology is redefining mobility and disrupting the transportation industry on a global scale, as it is doing in most industries. CCTA wants to make sure that the plans we make for the county's transportation infrastructure take these emerging technologies into account so we can best serve the needs of Contra Costa's 1.1 million citizens. Our over-arching goals are to ensure that our plans use taxpayer dollars wisely and that we are investing in the technology of the future—not yesterday's technology. We are addressing the challenges of proactively engaging with and preparing for future transportation technologies through GoMentum Station.

COLLABORATION AND INNOVATION

Founded by CCTA and its partners, GoMentum Station is a secure, automated and connected vehicle testing facility built on a public/private partnership model, offering the private sector a space to innovate and test while providing the public sector access to new technologies as they are developed. Because of our proximity to Silicon Valley, we are close to where major auto manufacturers are conducting research and development for connected and autonomous vehicles. Named one of ten federally designated automated vehicle proving grounds by the U.S. Department of Transportation (DOT), GoMentum Station is one of the largest secure proving grounds in the United States, featuring 20 miles of paved roadway, two 1,400-foot tunnels, curbs, gutters and sidewalks, railroad crossings, potholes and a mini-city. The unique features offered by GoMentum Station enable partners to safely push their technology to its limits while testing in a controlled environment.

GoMentum Station is also a magnet for startup companies. We receive a wide variety of promising ideas presented to us by companies looking for partners and a place to test. Partnering is a philosophy that we try to employ in all aspects of our work, and we're very proud of our national and international partnerships. GoMentum Station has developed cooperative agreements with the governments of Japan and the Netherlands, and is one of a handful of facilities which support multimodal testing. In addition to testing self-driving cars for companies like Lyft and Honda, GoMentum Station has also hosted testing of freight vehicles by Uber ATG and electric, shared autonomous EasyMile shuttles. We're exploring how these technologies can most efficiently contribute to our future transportation system by bringing in partners to test wireless charging and fleet management.

STRIVING FOR THE BEST SOLUTIONS—LOCALLY & GLOBALLY

Our work with GoMentum Station has enabled our agency's commissioners and staff to keep their finger on the pulse of innovative transportation research. Armed with this knowledge, we can then incorporate the best available information and resources on what is truly working to improve mobility and safety, and deploy it across the county, like inductively charged electric buses with our transit partner County Connection. We're also changing the way we plan for the future. We're using the latest technology to gather public input—from social media to telephone town halls and webinars—and to bring our information directly to the public, instead of making them come to us in traditional public meetings. Because of this, we received more public comments on the last update of our Countywide Transportation Plan than we had in the previous 25 years combined.

One concern we heard over and over again from residents was that we have a first-and last-mile problem in our county. Many of our residents would choose to use public transit—but when they arrive at the train station there is no parking available, so they drive to their destination. Other residents have told us the bus station is too far to walk to from their home, or the bus doesn't drop them off close to their workplace, school, or medical appointments. We're working hard to solve these problems by using innovative new technologies.

For example, CCTA is leading a pilot demonstration project to test an electric, low-speed, multi-passenger autonomous vehicle manufactured by EasyMile that are not equipped with a steering wheel, brake pedal, or accelerator. These vehicles can help connect residents to existing transit options, schools, and business centers with zero emission, and offer a smart solution to the first-and last-mile challenge. We have been coordinating with the National Highway Traffic Safety Administration (NHTSA) to ensure this pilot project is conducted as safely as possible.

And in March of this year, CCTA received permission from the Department of Motor Vehicles to deploy the first-ever shared autonomous vehicle on public roads in California. We believe these vehicles show great promise and are poised to become a cornerstone of publicly accessible shared vehicle technology for Mobility-on-Demand (MOD) programs worldwide.

CCTA is committed to identifying alternatives to transportation solutions that attempt to build our way out of congestion. Instead, we're evaluating and developing our long-range plans to apply current and future technologies to improve our regional transportation system. A great example is our comprehensive plan to innovate InterState 680, one of the most congested corridors in our county. We're looking at integrating traditional corridor management techniques such as carpool lanes and adaptive ramp meters with modern transit management. We're adding cutting-edge concepts like neighborhood mobility hubs to centralize bike share, car share, electric scooters, and provide a pick-up place for shared autonomous vehicles to connect with transit. We're also looking at using incentives to encourage mode shift away from single-occupant vehicles. We know that if we can persuade some of our residents and commuters—not all of them—to leave their single-occupant vehicles at home, we can make a big dent in congestion in our area.

Incorporating technology into our transportation systems holds a lot of promise—not just to eliminate those annoying moments where you're the only vehicle waiting for the red light to change at an otherwise empty intersection, but to improve the quality of life for your constituents as well. Think about the benefits of a system

that could give emergency vehicles priority, clearing the path for an ambulance by initi-ating signal timing changes ahead of the vehicle, which could potentially shave life-saving minutes off its trip.

If it sounds like we are working on a lot of interesting projects and ideas, it's because we are. I'd like to recognize the visionaries on the Contra Costa Transportation Authority Board who enable our staff to really think big and try out new ideas. There's not a lot of incentive for government to innovate, because innovation sometimes involves failure. And given our responsibility to taxpayers, it's not easy for elected officials to embrace the uncertainty of untested solutions. I am fortunate to work with a forward-thinking Board, staff and community.

This is an exciting time for public agencies, like CCTA, to participate in and contribute to the conversation about how this new technology can best be put to use. Whether it's an 81-year old grandmother who no longer drives but still wants to visit her granddaughter, or finding a workable solution for the first-and last-mile challenges of public transportation, by staying abreast of new and emerging technologies, public agencies like CCTA can lead the way in reimagining how we get where we need to go. I firmly believe these new technologies will have a transformative and positive effect on our transportation systems, our cities, and our lives. Thank you for giving me the opportunity to share highlights of the work we are doing to plan for the future of transportation in our region and beyond.

Mr. GRAVES OF MISSOURI. All right. With that, we will move to Members and questions, and we are going to start with Mr. Gibbs.

Mr. GIBBS. Thank you, Mr. Chairman. Thank you, witnesses, for being here.

To Mr. Barna, DriveOhio, welcome. I visited your facility. It is an excellent facility. I also want to thank you for participating in the press conference we had requesting that Secretary Chao officially designate the Transportation Research Center as a Federal autonomous vehicle proving ground.

As you know, the outgoing Obama administration made only 10 designations around the country, and TRC was not one of the 10, despite having tested autonomous vehicles for more than 40 years. And I think it should be a part of that to get those extra, extra resources.

In your opinion, why should the United States Department of Transportation include TRC as a federally designated autonomous vehicle proving ground?

Mr. BARNA. Chairman Graves, Representative Gibbs, thank you. My understanding is those designations were made under the Obama administration as a community of practice with the idea that they would share information as far as testing research around autonomous-connected vehicles.

I believe TRC, being the largest automotive proving ground in North America, would offer prominently as far as contributing information, as far as testing research to that community of practice.

As I mentioned before, the TRC is 4,500 acres in size. Within that 4,500 acres in size, 540 are being now—well, it is under construction now, is building an autonomous vehicle, connected vehicle testing facility. And let alone that, TRC is connected to a smart corridor, the U.S. 33 corridor I mentioned in my testimony, as well as it is the only facility where NHTSA [National Highway Traffic Safety Administration] test-crashes vehicles.

Mr. GIBBS. Yeah, I agree. And I think I also would note that that happened, I think, the day before President Trump's inauguration, so it might have been not thought out as well as it should have been.

Another question, Mr. Barna. Commercial communication providers, you know, are increasingly conducting cars and smart cities

technologies like we are doing in Columbus, Ohio, with cellular networks, deploying fiber to support 4G LTE networks and future 5G networks. What role do you see the providers, whether fiber or cellular, in supporting connected vehicles?

Mr. BARNA. Chairman Graves, Representative Gibbs, I believe they will play a role in the connected vehicle environment. When we look at connected vehicles, whether it is a vehicle communicating with another vehicle or a vehicle communicating with infrastructure or vice versa, where tomorrow we see the vehicles providing us a lot of information as far as infrastructure is concerned. Instead of us having instrumentation on the highways, your vehicle will give us a lot of information, whether the headlights come on, whether the windshield wipers come on, your antiskid technology comes on. All that information will be fed via either direct short-range communication or cellular to the folks monitoring the infrastructure, and as well the folks monitoring the infrastructure can push information instantaneously out to those vehicles via the 5G or the short-range communication, which would add the fiber back on.

Mr. GIBBS. OK. Mr. Iwasaki, as you know, your Contra Costa GoMentum Station was one of the 10 who received the U.S. Department AV proving ground designation by the Obama administration. Your program director sent a letter to Secretary Chao in support of the TRC being designated as an AV proving ground. Would you please share your views on the DOT AV proving ground designation program and if you still support the TRC being designated?

Mr. IWASAKI. Absolutely. So we are actually going to visit TRC in Ohio to try to form a partnership to make sure that we are sharing that data. So when you become one of the 10 designated test beds—well, when we did, we agreed to a couple of things: one, there was no money available; number two was we would create a safety officer, which we did, that is Jack Hall; and then three, we would share information.

So we are making a concerted effort to go out to TRC to see if they still want to partner with us. And we can do some testing that they can't. So our pavement is very old. The bridges are old. And it is very hard for a contractor to mimic old pavement that is reflective of maybe the conditions of the roads in all parts of the country——

Mr. GIBBS. California especially, but OK.

Mr. IWASAKI [continuing]. Versus brandnew pavement. And so I think there are some synergies that we can have with Ohio because it is a state-of-the-art test bed. We understand that. And I think that they would be a great partner for GoMentum Station.

Mr. GIBBS. Well, great. Thanks, all, for being here.

I yield back, Mr. Chairman.

Mr. GRAVES OF MISSOURI. Ms. Norton.

Ms. NORTON. Thank you, Mr. Chairman.

I must say, the testimony that all of you have given has told me much I did not know about how innovation is proceeding, notwithstanding anything that happens in the Congress. It just looks like it is happening and that States, localities are making it happen.

So I find it very exciting. I couldn't tell—and maybe I could begin with Mr. Bhatt—whether we are—since the 1,000 flowers look like they are blooming out there already, and I am trying to find what role Congress should play in facilitating this new mobility, transportation mobility around the country. For example, typically, the Federal Government has a role in safety, and so when we think about autonomous vehicles, we have to focus on that. We have to think about taxpayer dollars.

Essentially, are we in a period of experimentation where the Federal Government will be irrelevant when we do the next surface transportation bill, or should we be thinking about ways to incorporate the kind of innovations you are describing into our bill?

For example, just to take at the local level here in the Nation's Capital, the streets are very crowded. So everybody likes to get an Uber or a Lyft when they want to. But the streets are already crowded, and almost anybody can use his or her private car for Uber or Lyft.

At the same time, the investment by the Congress and the localities in transit has been so meager that our subway system was falling apart. So what the city is doing, because it has got to limit the number of cars out there, is it is putting some taxes on Uber and Lyft in order to help pay for the transportation system underground because it has got to keep both going, and yet it has got to get some of those cars off the streets.

So when I see what is happening in the Nation's Capital, I am wondering what should we be doing as we prepare for the next surface transportation bill? Is anything you are saying part and parcel of what should be in a bill, should be facilitated by a bill, should be encouraged by a bill? I am talking about the next surface transportation bill. Looks pretty clear that it won't look a lot like the last one, which was all about roads and bridges and trucks and cars.

So if the Federal Government has a role through its 5- or 6-year transportation bills, you could help us to learn what the innovations you have described could be incorporated into the next bill. Any of your ideas, beginning with you, Mr. Bhatt, and any of the rest of you, I would be most informed by your ideas. Or just—should we just let it happen out there and just leave it all alone?

Mr. BHATT. Thank you, Ranking Member Norton. I think that it is happening, and you can see across the country—and we have members who are States, who are cities, and are private-sector members, who are research institutions, and so it is happening. I do think there is a role for the Federal Government to play to ensure uniformity across the country.

I think that the FAST Act began a nice transition, opened up some opportunities for jurisdictions to use some Federal funding. I think that there are a couple of bills that are looking at the autonomous vehicles, one in the House, one in the Senate, that I think that it would be good to get a national framework around safety. Safety is our number one priority. It would be good to not have 50 different States and 400 cities all doing something a little different.

I do agree with you that the approach to moving people—you know, we used to talk about moving cars, and now I think it is about moving people and data and freight. And this is a little dif-

ferent in terms of how we approach the next bill, so it is one that needs to be multimodal. And I will stop there and see if anybody else has any other ideas they would like to add.

Ms. NORTON. Ms. Castillo.

Ms. CASTILLO. I think the Federal Government absolutely needs to be involved. My concern, if you are not, is that the rural systems will be left behind because everybody will focus then again on the urban systems.

And I understand congestion. I know that is something that absolutely needs to be handled and taken care of, but there are a lot of people in the rural areas. They need transportation just as much as those people do. Even though they are less congested, they still have places to go. And I think there is a place for autonomous vehicles in those areas and more technology.

It is easier for us to get things done sometimes in the rural areas. I just have to get approval by my board to say this is the way we want to go, and we figure out the funding and go on and just get it done. So there are some pluses for having innovation in rural areas. But I absolutely do think that the Federal Government needs to stay involved, if nothing else, to look out for the rural areas and to ensure that all autonomous vehicles are held to the same safety standards.

Thank you.

Ms. NORTON. Yes, Mr. Iwasaki.

Mr. IWASAKI. Ranking Member Norton, great question. I have a couple of points. One, sometimes meaningful regulations will get in the way of innovation. So you have to kind of steer clear of that, understand what that technology will do.

I think in the area of a low-speed shuttle, we see that is probably one of the few technologies that will help us get to the underserved parts of our community. The people that are disabled, old like me, and the folks that choose not to own a car or can't afford a car, you can get to that part of the community.

The problem is the regulations don't address those vehicles. It is too heavy. And so under the NHTSA guidelines, anything under 2,500 production in over 2 years, a speed of less than 35 miles an hour, but the weight is 3,000 pounds or less, it is really a golf cart under the Neighborhood Electric Vehicle program. These vehicles weigh 6,000 pounds, 7,000 pounds, so they are in a gray area. And so that is one of the things that we have to go to NHTSA for every one we bring into the country or we deploy. And that is probably not going to work into the future.

And the other thing, and this is really a bigger issue, but it is data. And there is some data that is proprietary that the partners don't want to share. But imagine the day when, instead of being reactive to safety issues, we are going to be proactive. So these vehicles, they can see 360 degrees around them. They are gathering information. They can see where there are near misses.

And so when I worked for Caltrans, what we did was you had accident concentration. You didn't get the near-miss data, and so you just were very reactive. We want to be proactive and understand where those near misses are, so sharing of the data is going to be critical in the future.

And lastly, I think, just off the top of my head, procurement. So when you try to procure technology, it takes a while to go through that process. In the meantime, they are on version 4 and you are trying to procure version 1, and that is going to be a problem, I think, in the future with the rapid pace of deployment of this technology.

Thank you.

Ms. NORTON. Thank you very much, Mr. Chairman.

Mr. GRAVES OF MISSOURI. Chairman Shuster.

Mr. SHUSTER. Thank you, Chairman Graves. I thank all of you for being here today.

Just following up on talking about autonomous transit vehicles and really the cost. There is just not enough money to go around. And I think in the FAST Act—I don't think, I know—we kept the formula the same, 80/20.

But what are the—talking about funding, what are the ways that transit systems can cut costs significantly? Can you address it, Mr. Bhatt?

Mr. BHATT. Yes, sir. Thank you, Chairman Graves and Representative Shuster, and thank you for your work in this space.

When I was the secretary of transportation in Delaware, we saw our transit budget for paratransit go from $15 million in 2003—I am roughing these numbers—$15 million to $50 million because of the demand of people wanting access to the service. And that was a challenge for us because each ride that we provided cost the State $50, and we charged $2 for that trip. So you could see how a return trip quickly became a challenge.

And so one of the things we started doing was looking to partner with private-sector partners where we would just offer them $20. Didn't really matter, as long as they met safety standards. I believe that the autonomous shuttles that are being deployed across the country represent a huge opportunity for us to cut those costs, provide better service.

As Ms. Castillo said, you have to place a call 24 hours before, sometimes 48 hours before, and then that ride sometimes doesn't show up. With an autonomous service, it is cheaper, it is more flexible, and it provides better service. So that would be one example.

Mr. SHUSTER. And improves safety?

Mr. BHATT. And improves safety, as long as it was done correctly.

Mr. SHUSTER. So autonomous vehicles, that is really the path forward if we are going to find out how to expand transit systems and not costs keep going through the roof.

Mr. BHATT. And, sir, and just to qualify, I was referring to the rural transit part of that. I do think that transit in urban areas needs to be part of the solution. I think that some of the first-mile/last-mile challenge is getting people to those trunk lines, the existing either rail or bus lines that are out there. I think that will help because that is a big challenge for us is how to get people from the house in their subdivision out to a main line. That is real a challenge.

Mr. SHUSTER. I was in Las Vegas, and I rode on the autonomous shuttle. It only holds about 9 right now, but I think they have a model that goes up to maybe 22 or 24. But they took us around

the city, and nobody was driving it. They had to go pretty slow because of the—they are going through the process, but it just seems to me that that is a big answer for us, especially if you are on a line, you are on a rail system where we know where the train is going, and it just seems to me that is the place we ought to be really focused to look to make those tremendous cost cuts and improve transit significantly.

And the other question I have is, I am traveling to Pittsburgh on Monday to meet with Argo AI, which is Ford's autonomous vehicle company, Uber, and Carnegie Mellon just to sort of get a brief on where they are, what they need.

And so what do you think are some of the things, from your perspective, that I am going to hear from autonomous vehicle developers? What does the Government need to do? What does the Government not need to do? Because I know the one thing I am sure of is we can't keep up with the technology. The minute we figure out it is OK, it is a whole new technology.

So what are some of the things you might tell me that the Government should do or shouldn't do to make sure we are going to be the leaders in the world on autonomous vehicles? Start with Mr. Barna.

Mr. BARNA. Chairman Graves, Representative Shuster, I do believe the Federal Government has a role as far as facilitating a conversation in this. You know, I am not a big fan of regulation, but I think because we are looking at 50 States—and there are a lot of great things happening out there, as my colleague, Mr. Bhatt, mentioned, as well as the other colleagues—I do believe at some point we are going to have to have a national conversation on setting standards, interoperability standards, so if we are driving in one State and we drive to the next State, it is all the same, in a way that that promotes the technology.

I believe this technology has an opportunity—will impact transportation like never before. So it is very important that we have the interoperability between the States, not regulation necessarily, but interoperability consistency and some standardization.

Ms. CASTILLO. So speaking from a rural perspective, the first-mile/last-mile is something that is also very important to us because a lot of people that live in the rural areas do work in the urban areas. And so we can partner with our urban transit providers as rural providers if we can cover some of that first-mile/last-mile stuff.

And I also just want to encourage people to keep in mind the different types of people that use transportation. You know, they are not all just young and wanting something new and improved. But we have a lot of people that have some cognitive disorders or health issues or they are older. I think the autonomous vehicles can serve them just as well if they understand them and if they are considered safe and accessible for all types of people.

Because when we do talk about accessible vehicles, that is not just for people that have some physical disability. Accessibility means a lot of different things to a lot of different people. So I would just keep those things in mind. But I know CTAA also really supports piloting some autonomous vehicles and the future of that, especially in some of the rural areas.

Thank you.

Mr. BHATT. Representative Shuster, I will be speaking at ITS Pennsylvania in Pittsburgh Monday morning, and I am sure that they would love for you to come by if you had a moment.

I think——

Mr. SHUSTER. Who is in Pittsburgh besides——

Mr. BHATT. ITS Pennsylvania is having their annual meeting. I just thought I would flag that for you.

I would say, when you are talking to those companies, I think this is the Federal role that is important here. I spoke in China earlier this year at the Beijing Auto Forum, and they were very clear that they wanted to dominate the automobile manufacturing and communications technology sectors over the coming decade.

And this is, I think, the most important message that from a Federal perspective is that we are going to create one market in the United States with standards across the entire country, as opposed to having 50 different States and a bunch of different cities. So I think the economic certainty would be a great one to promote.

Mr. SHUSTER. Mr. Iwasaki.

Mr. IWASAKI. I agree with Shailen that that is the key thing. You can't create a car for 50 States, so the Federal Government has to regulate it so it is interoperable throughout our country. And then they have to sell their product somewhere else.

Mr. SHUSTER. Right.

Mr. IWASAKI. Right. So that is the key piece that they would tell you.

Mr. SHUSTER. Thank you all very much. Appreciate it.

Mr. GRAVES OF MISSOURI. Ranking Member DeFazio.

Mr. DEFAZIO. Thanks, Mr. Chairman.

Mr. Bhatt, you mentioned the difference between Melbourne and Denver in terms of throughput because you alluded to Aussies being a little more law-abiding or something? Tell me about that quickly.

I mean, here is a question: I am trying to figure this out in my head. So you get people at the ramps. You are increasing the throughput on the freeway, but at some point previously there were more people, you know, trying to—there must be some backup on the ramps. And I saw your little graph and there is a little bit of backup, but at some point, the ramps are going to get unmanageable also, right? I mean, how is that being handled?

Mr. BHATT. Carefully, sir.

So thank you, Representative DeFazio, and Chairman Graves. As quickly as I can I will say, we use 2,000 vehicles per lane per hour is what an interstate lane will move. And when you start to get friction and you start to get that start/stop effect, you start to break down that number.

And so the reason I made the comment about the Aussies is that they have incredibly high levels of compliance because they enforce traffic penalties a lot more punitively there. Two, they have photo enforcement. And they will hold people for up to 4 minutes on that ramp. And I think that we might have different challenges if we tried to hold people for 4 minutes. That is why we have reduced our expectation.

And this is a pilot. It may not work. And if it doesn't, we have just added ramp meters that can coordinate with each other, but we think it is a valuable aspect. I know that California is looking at it. Arizona is also looking at intelligent ramp metering. So it is a new technology in the toolbox.

Mr. DEFAZIO. I mean, the start and stop on the freeway, I mean, you get the max—I mean, 2,000 is sort of optimized now, but if we had some future date, autonomous vehicles might be a higher number, because you would have——

Mr. BHATT. Yeah. So when I was speaking with some folks in Europe, they said that the introduction of autonomous vehicles in Paris actually degrades the system because they don't deal well with the traffic circles. But once you get to 20 percent penetration, now performance improves.

And so once we have vehicles talking to each other, autonomous vehicles out there, I have seen projections of using 4,000 vehicles per lane per hour. I talked to a leader from Contra Costa County who thought it might be 6,000. And so——

Mr. DEFAZIO. So they are going to be like 6 inches per bumper off?

Mr. BHATT. Right, at that point. But in some parts of the country, you are at peak road, because if you can double the capacity of the highway because you can move more vehicles through it, you are just making a better, more efficient use of an asset.

Mr. DEFAZIO. Sure. How about urban congestion smart lights? One of my nephews, who is an engineer, one of his friends has had a system used in Nevada, and now it is being tested somewhere in Virginia, on crowdsourcing traffic lights, so that you are not sitting at a traffic light, and you are sitting there and sitting there and there is like no one coming the other way, but you are sitting there because it is a red light. Has anyone deployed a system, that you are aware of, that works well for that, Mr. Iwasaki?

Mr. IWASAKI. Congressman DeFazio, there is a company in Marin County called RMS. They are looking at adaptive signals, because that was the second most common complaint that we got as we gathered information to update our countywide transportation plan, is people are tired of sitting at a stoplight when nobody else is around.

Technology today ought to be able to let you go. And so the idea is adaptive ramp metering based on main line flows of your freeway, hold the delay back. It is no different at a traffic signal. The problem is coordinating a queue of traffic through that during peak hour. It is off peak that drives people nuts.

Mr. DEFAZIO. OK.

Mr. IWASAKI. So there is a company working on that now.

Mr. DEFAZIO. OK. Good. I will have to follow up with them.

Ms. Castillo, I represent a very large district, so I have a lot of rural challenges, and I am impressed with your system. What is it costing you per ride?

Ms. CASTILLO. Currently, it costs an average of about $16 per ride, and we charge $2. So we are supplementing $14 of it.

Mr. DEFAZIO. Sure. OK. And what do you project if you could move to an autonomous system? How much would that change?

Ms. CASTILLO. So we have—even though we are in rural communities, we have some universities or some colleges—they are not universities. They are colleges that are in those. And they have a lot of foreign students that come, and foreign students are usually used to very good public transportation. And so it would be great to have—I mean, I could see like an autonomous vehicle allowing us to be able to serve them in a lot better way than what we are doing now.

And I think we are starting to look at in the—typically in the rural systems, a lot of services provide door-to-door service, much like a paratransit service. And so autonomous vehicles would allow us to do more shuttle-type services so that it would be less expensive, because it is very expensive. Like you said, when you are doing paratransit, those costs are much higher.

And so I do think that there are great opportunities in the rural communities to use autonomous vehicles to change the look of what transportation looks like but still get people where they need to go.

Mr. DEFAZIO. OK. Thank you. My time has expired.

Thank you, Mr. Chairman.

Mr. GRAVES OF MISSOURI. Mr. Duncan.

Mr. DUNCAN. Well, thank you, Mr. Chairman.

One thing I am interested in, and anybody can comment who wants to, but just yesterday, Fox Business had an article that said driverless trucks could eliminate nearly 300,000 industry jobs over the next quarter decade, including more than 80,000 of the highest paying positions, according to a new study.

And it says that, "as technology progresses, autonomous vehicles may replace about 51,000 less-than-truckload drivers," and so forth and so on, and it goes on: "an additional 211,000 truckload jobs will also be vulnerable to elimination."

What do you think about that, sir? Or what do you say about that? Have you considered that or—I am sure you have thought about this?

Mr. BHATT. Chairman Graves and Representative Duncan, thank you for the question.

Obviously, the job displacement of automation is, I think, something that—there is a Federal role there as well.

In Colorado, under RoadX, we have the world's first commercial autonomous vehicle delivery where a truck went 100 miles on the interstate with the driver not in the driver's seat. And I actually got to be on Road Dog Radio because this was a big issue for truckers.

My feeling is that you will see a great deal of displacement, probably in a 20-year horizon, not in the next few years.

And so, I think what is important is that we spend the next few years making sure that if there are 300,000 jobs potentially at stake, that we are intercepting people who may be looking at that career and educating them around that.

However, I would also say from a trucking perspective, I think that it is a little similar to an airplane where you have a lot of automation in planes, but you still have a pilot in there. And I could see a scenario where you have for long-haul trucking, a truck driving itself for the overnight and long-haul portions of it, but when

you get into an urban area, the driver taking back over just because of the complexity of that area.

Mr. DUNCAN. Well, it is something to consider. I mean, right now, people are saying that there is a shortage of truck drivers, and yet, if this automation moves as fast as some people predict, it may be sooner than 20 years. And you are talking about 300,000 truck driving jobs and another 200,000 related jobs. That is a lot of jobs. So that is something that we need to be considering or thinking about.

Also, there is another article here from just a few days, 4, 5 days ago, from the Washington Post that says, "surveys indicate that large portions of the public harbor deep reservations about the safety of self-driving technology," and now it is one of the biggest challenges facing companies developing driverless vehicles.

What are you all doing about that? Do you think that is a problem that is just going to take care of itself, or are you doing something about it?

Mr. Barna?

Mr. BARNA. Chairman Graves, Representative Duncan, yeah, the two questions we get all the time associated with the technology, one is, how safe it is; and two, is how ultimately will it disrupt the workforce.

To address the safety matters, you know, I look at Ohio. 2017 end, we had 302,282 total crashes, 1,179 of those were fatals.

As with a lot of colleagues around the country, those numbers are going up, especially the fatal numbers are going up. Over the last 4 years, we have been seeing a 2-percent per-year increase in our fatal traffic accidents. This technology offers a lot of promises as far as addressing those accidents.

You know, I would like to say this technology doesn't text down the roadway, it doesn't comb its hair, it is not eating a cheeseburger, and so forth.

So we see a lot of promises as far as the safety. And as we do a lot of outreach to the public, we stress those numbers. Ninety-four percent of all of our accidents are caused by human error, and that is where this technology would come in and, hopefully, reverse that trend.

As it relates to the workforce you mentioned, that is true, you know, we have a lot of logistics in the State of Ohio just by the way we are positioned. A lot of the logistics companies are projecting 200,000 to 300,000 shortage of truck drivers over the next 5 to 10 years.

I agree with my colleague, Mr. Bhatt, that it is not necessarily about the first-last mile that may be impacted as most of that middle segment, which is the long haul where they cannot get enough folks to drive trucks, if you look at what's happening in the industry today.

Be that as it may, as with any new technology, it ultimately disrupts the workforce in some form or fashion. And I think what we are doing at DriveOhio is we have a group workforce development. We are playing an active role, not only in job training programs, but also looking at curriculum in high schools; STEM programs, everything like that, looking at the future jobs.

I think if we get in front of this and be more proactive with it, that transition will be a lot more smoother than us just, you know, going from one type of job to the other.

So that is how we are addressing it in the State of Ohio.

Mr. DUNCAN. All right. Thank you very much.

Thank you, Mr. Chairman.

Mr. GRAVES OF MISSOURI. Albio.

Mr. SIRES. Thank you, Mr. Chairman. Thank you for being here today.

You know, I am from New Jersey, and I probably represent the most congested area in the country. The town that I live in is 1 square mile, has got 52,000 people in it.

The other town, Hoboken, New Jersey, has about 51,000, and it is 1 square mile. And then I have other cities that are just as congested.

So I will invite you to my district to test this technology out to see how this thing works when you have so many people out on the road.

We have every kind of transportation you can think of. From the ferry to the light rail, to the buses, to the illegal jitneys that stop in the middle of the roads, to Uber. So I would think that out in the middle of nowhere, testing this technology might not work as good as it would work in a district that is so congested.

So I was just wondering where have you tested that is so congested that you are so enthused about this technology in the future? I know that Columbus, Ohio, obviously is a big city, but I don't think they have, you know, 52,000 people, 1 square mile, and everybody wants to drive a car. I mean, you can't even park in my district.

So have you tested in some of these areas?

Go ahead, sir. You seem to be the most advanced, you know, you seem to be——

Mr. BARNA. Chairman Graves, Representative Sires—if I pronounced that right—we are looking at testing in the urban areas. Obviously, that is where we get most of the congestion. If we look at Columbus, Columbus is the fastest growing, million-plus metro city in the country. It is the fastest growing in the Midwest. So we are starting to experience those pains now that some of the larger cities are.

And what we are looking at is a combination of the connected technology, where the infrastructure plays a role in that.

My colleague, Mr. Bhatt, mentioned a smart lane or a hard shoulder run, is what sometimes it is referred to in Michigan. We are now employing that technology in the city of Columbus, where ultimately, we are looking at ways to push traffic through the same footprint.

We can't build our way out of congestion anymore by adding pavement. It is just not working. So what we are looking at is pushing a lot more through that corridor than we used to yesterday. And that is mostly that connected technology, using shoulders where we can dynamically open and close based upon the level of congestion, using the smart meter systems, getting information to you so you can avoid certain congested areas. So it is a combination of all of that we are doing.

The connected technology, as we model that in—and this was mentioned earlier, the more and more we saturate a corridor with these connected vehicles, a lot closer these vehicles can run, and a lot more accidents that can be eliminated that truly causes most of the congestion in an urban corridor.

So we are looking at them all. But, yes, to answer your question, they are either under construction right now or they are being scoped out as projects right now as far as using this technology to move a lot more traffic through the same footprint.

Mr. SIRES. Well, thank you.

Mr. Bhatt, I would love 4 minutes just to get around a ramp in any part of my district. Believe me, 4 minutes, I will take it any day.

Mr. BHATT. Sir, thank you, Representative. And New York City is actually one of the—I think the largest deployment of V2I [vehicle-to-infrastructure communication] in the country right now from a connected vehicle standpoint, getting that dissemination of information out along with Tampa, and, actually, Wyoming as well.

And I know that GM is testing their vehicles in San Francisco, again, another congested area. So there is a whole range of technologies. And we can follow up with your office afterwards around what some of them either may be in there or might be applicable for your region.

Mr. SIRES. Come. Come on to New Jersey.

Mr. BHATT. I would be happy to.

Mr. SIRES. I am inviting you. I will take you around. You are talking about cars close, without technology. All right. Thank you very much.

I am excited about, you know, the future with this, but I just have a lot of concerns about it, and that is why, you know, I ask these questions. I think it is going to take longer than that. In trying to get 50 States to be on the same page, that is even tougher.

So I thank you for being here.

Thank you.

Mr. IWASAKI. Representative, may I add something to your question?

Mr. GRAVES OF MISSOURI. Please, do.

Mr. IWASAKI. This is the reason why the test beds are so important, because can you repeat a test 1,000 times and not disrupt the countless number of vehicles that are in your district, and then when it is ready to be deployed, you can run it out onto public streets and make sure that that vehicle does exactly what it says in a very urbanized area with high congestion.

And the other piece is on getting the word out, 97 or 87 percent of the population is worried. They want a driver to take over, just in case. And we liken that to the elevator. The elevator many, many years ago had an operator to pull that brake, just in case the cable broke.

So in our case, one of our partners is AAA. So AAA has this over 100-year reputation of being laser-focused in on safety, because they want to be able to talk to their members, at least in northern California, 6 million members, to make sure they are aware of the progression of this technology so they aren't afraid when it is ready.

Mr. SIRES. Thank you.

Thank you, Chairman.

Mr. GRAVES OF MISSOURI. Ms. Esty?

Ms. ESTY. Thank you very much. And this is really important and helpful information you are sharing with us today.

I represent a very diverse district. I have got congested cities and I have got rural areas as well, and everything in between.

So I think one of the important things is to deal with some of these issues about equity. You know, my kids don't want to drive a car. They use ride-sharing apps, and they live in cities. But in my district, the people who need to up-skill and get to community college can't afford a car and they can't get there because we have cut the local bus service.

I have got veterans in the northwest corner of my district who are 30 miles from their doctor's appointments. So we have to be looking at systems, and I think talking about these systems, not as a Silicon Valley "fun to have," but as a "need to have," to allow Americans who are aging, like my mother, who can't be driving a car, and shouldn't be driving a car, to get where she needs to go, and not to be locked in, but also for our veterans to get to appointments.

And so part of that, I think, needs to be talking about it differently. When Model Ts came out, and I met a veteran recently, he told me he had saved up $25, earning 25 cents an hour to buy his first car, and it was a Model T.

We have people alive in this country who embraced that. And it displaced all of the buggy makers and all of the people who were shoeing horses. And America made that decision.

Clearly this is coming, but we need to figure out how to be responsible. And it is going to be a long transition.

So hearing from you and getting feedback as we go about how do we train the workforce, the workforce that is going to be displaced, how do we make sure the public has confidence that they can do this and not get run over. But this, we did face with cars when cars first came in and were sharing the road with horses. And I think we need to go back and look a little bit about that history and learn how did those transitions happen? What made them happen well? How did they deal with people who did get killed by getting run over by cars? How did America make that transition at that point?

But I really would like to drill down a little bit on this question about how we make these technologies accessible to the people who don't have means, for whom it is not a nice-to-have. It is the people who actually, they need this to conduct their daily lives. They need this to participate in American democracy. They need this to get to their job, they need this to get to work, they need this to get to their doctors.

And how long are we going to have to subsidize? Because that is part of it. People don't want to pay the subsidies, but otherwise, Americans are going to get left behind.

So I know, Ms. Castillo, I know you talked about, I mean, Norwalk, Connecticut, is doing this, not my district. And, Mr. Bhatt, how do we do this to make sure it is available to all Americans?

Mr. BHATT. I have answered a lot, so I will let Ms. Castillo have some time here.

I think mobility represents freedom. And for so many Americans, I think we view this as a "would I like to buy a new car that has this cool self-driving feature." And for parents with teenagers, they probably don't want their kids driving. And for parents with parents, they may have issues with parents aging out of driving.

And so, there are tens of millions of Americans for whom this is not a cool technology issue. It represents a transformative chance for us to go out and connect them with jobs and hospitals and their loved ones in a way that we haven't been able to.

So ITS America is incredibly passionate about making sure that our members are talking about that because, again, mobility is freedom.

Ms. CASTILLO. Thank you. That is a great question.

I think this is a great start to have conversations, especially bringing rural America into the discussions for technology. Oftentimes, we are left out of those discussions because people think that people that live in the most rural areas don't necessarily need, you know, because we are not facing congestion and all of that, but they still have a lot of issues and they still have a daily life to live, and they need to get there.

With autonomous vehicles, I think one of the things in rural America that we also need to talk about is the majority of the drivers that drive in our service areas are older, they have already retired. They left their career. This is a second, you know, career for them. And so they are in their seventies and their eighties. And that is changing as people change, that generation is changing.

And so all of that generation that doesn't want to just sit around, and they want to serve and they want to help, not that there aren't people that want to do that, but that is changing.

And so we are looking at driver shortages. We also have to look at how can we manage that. And I know that the people that—in the more rural areas, they do like to have somebody on there. Our drivers know these people by name. They do that. There is nothing to say that we couldn't still give that same type of service on an autonomous vehicle, but we have to look at something, because drivers are definitely going to be an issue. And I am talking probably within the next 5 years, not, you know, 20 years.

So I think we just need to continue to keep the discussions going. Rural America looks different to every rural area. You can talk to some people that say rural is, you know, like a 5,000 county, and they are driving huge distances and then some that are butted up against urban areas, but they are still rural because they still can't get into it the urban areas. So we just have to keep the discussions going.

Thank you.

Mr. BARNA. Chairman Graves, Representative Esty, that question is a great question, but more about the question, a great point is raised.

What we see in this technology is about giving folks historically that haven't had access now the opportunity to have access, and to do it in a sustainable manner.

If we look at public transit today, in Ohio, we have lost 16 percent of our public transit ridership since 2011. A lot of that is Uber, Lyft, but a lot of it is transit agencies pulling back routes.

And what that is, what we see with this technology, first-last mile options here, whether it is sending these shuttles we are all testing—and by the way, we are getting ready to test our first one in Columbus, Ohio, in 60 days. But we are looking at different use cases with these shuttles all around the country. And it offers an efficient way to start giving folks who haven't had access to healthcare, jobs, entertainment. Think about the aging population, what this technology can offer.

I was there when my father took the keys away from his father, and we may not have to do that tomorrow. And truly, access is very proportional to longevity. And that is, again, where we see this technology.

We also, you know, we have a workforce corridor project where there is a challenge now with companies getting able bodies to their jobs. And now we are seeing, we talk about public-private partnerships, we are seeing a more proactive role by the private sector in transportation, and that is the reason being. So we are studying between Cincinnati and Dayton. There are a lot of logistic companies between the two cities. And we are working with them, working with even private ride share companies about how we can best get people to jobs.

So the question was great. The point is great. But this technology offers probably more promise in giving folks access than we have seen, at least in my generation.

Mr. IWASAKI. Chairman Graves, Representative Esty, let me add a little bit to that.

So we have two pilot projects. Two vehicles are running on public streets in San Ramon currently. It is a private-public partnership in that a business park owner—it is a 600-acre business park—he has paid to lease these two vehicles for 2 years. So we are doing the testing in that fashion to try to figure out how does he get the 30,000 employees to their places of employment when the bus drops them all off at a location if they are in a modal center.

We are rolling out the third vehicle that we have access to. The city of Dublin in the county to the south of us, Alameda County, and that is a public-private partnership.

So the transit agencies, Livermore Amador Valley Transit Authority, and County Connection, our central bus provider in Contra Costa County, they are going to oversee that. So they don't get into the California Public Utilities Commission issue of running a jitney service and all those kinds of things because they have a license to do that.

And so, we are trying to make sure what is the right business model, because that is the piece that we can't figure out, is how do we fund this in the future and what is the best way? And so through research, we are trying to figure out what is the business model to do that.

Mr. GRAVES OF MISSOURI. Thank you very much.

I am reminding Members that we have 5 minutes each, not 10 minutes.

Garret.

Mr. GRAVES OF LOUISIANA. Thank you, Mr. Chairman.

Mr. Bhatt, I have a question for you.

Right now, when I watch transportation planning occur, oftentimes what happens is they will lay down the rubber hoses and they will count cars that drive over a certain road, determine a level of service, and decide if they need to add additional lanes, or what have you.

With the evolution of Google Maps and Waze—and actually, one of my co-workers let me know that she still prints out MapQuest directions, which I didn't know existed. Thanks, Nancy. But you have this just amazing amount of data that doesn't just tell you where people are driving, but it actually tells you where they are starting and ending.

And so in many cases, transportation planning could be revolutionized by taking that data and realizing that we don't need to add more lanes on the road that goes like this and goes like this and then comes back to here. The reality is, many of the people, majority of the people are simply trying to do this. They are using these roads because it is the only way to get there.

Are you aware of any efforts right now, anywhere in the country, where that type of integration is occurring to help to revolutionize transportation planning in a way where you can actually reduce miles traveled, save gas, save emissions, save time, anywhere in the United States, or even around the world?

Mr. BHATT. Yes, Representative Graves. There is a lot, and to manage the time well, I will be happy to follow up afterwards, as well. But, you know, we use——

Mr. GRAVES OF LOUISIANA. I think we have another 6½ minutes, but——

Mr. BHATT. We use sort of a late 20th-century transportation planning process now that drives us into a 25-year plan, and then we make 50- and 100-year estimates. And all I know is that that estimate is wrong because it doesn't take into account a lot of these technologies.

And so it does need to change. It needs to evolve rapidly. What we did in Colorado at the DOT is we got away from, like, making—because we don't know yet what the impact of autonomous vehicles will be. Will it reduce VMT? Will it reduce demand? And will it increase demand? And will it increase the trips?

And so what we have done, is we started trying to develop scenarios. So early adoption, less VMT, more VMT, and you create scenarios around it. But there are lots of great examples nationally and internationally where people are integrating technology now into transportation planning so that it is not just 20th-century planning.

Mr. GRAVES OF LOUISIANA. I think autonomous vehicles are going to increase VMT, because I am going to be so mesmerized by the technology, I am going to make it drive me in circles.

But second question, and sort of related. Are you aware of any—going back to the first one, Secretary Foxx and I, the previous Secretary Foxx and I, had a number of discussions about ways to try and push that type of approach. Because I really think it could revolutionize how we invest in transportation projects around the Nation.

But second, talking about Waze and Google and other apps that are available to help guide you in your traffic management, are you aware of any efforts whereby those types of technologies are communicating directly with ITS systems to where the ITS is communicating back and saying, traffic light is going to be green in 48 seconds, drive 27 miles an hour and you won't have to sit there and wait?

Mr. BHATT. Representative Graves, yes, there is a SPaT challenge that is currently underway trying to get all 50 States to get 20 signals coordinated so that you can communicate to the vehicle that a signal is going to be red. As Mr. Iwasaki talked about, moving through the corridor.

There are lots of third-party providers that collect the data. The data is what is key around making these decisions. And you can get that data through third-party providers that are linked in with some of our transportation management centers. There is a V2X [vehicle-to-everything communication] deployment in Colorado right now so that if somebody's airbag deploys, that information goes from vehicles to other vehicles, and vehicles into the TMC to help disseminate that.

So that is the next sort of great leap forward here, and that is, it is here now and getting more traction.

Mr. GRAVES OF LOUISIANA. Thank you. Look, I represent Baton Rouge, Louisiana, in addition to a number of other area in south Louisiana. And we have, I think, the last study I saw, I think the 14th worst traffic in the Nation. Who would have thought Baton Rouge, Louisiana? And we are not going to be able to pour pavement fast enough to address our problems.

And when you look at the surface roads that are available and the lack of efficiency there, it is going to have to be part of our solution. And technology, I think, can really help to buy us some time and help to alleviate some of the amazing traffic problems that we have.

I would love to work with you all on that. I know that in the FASTLANE bill, we did emerging technology or technology grant program and others, but I think we are missing some opportunities to help gain some efficiencies.

I yield back my 4 seconds.

Mr. GRAVES OF MISSOURI. Mr. Lipinski.

Mr. LIPINSKI. Thank you, Mr. Chairman. Thank you for holding this hearing. I thank our witnesses for being here today. And Mr. Iwasaki, I look forward to being back out in Contra Costa sometime soon and see what the latest is that you are doing, especially at the GoMentum test site there.

I would put Chicago's traffic up against anyone else's for being the worst in the country. Technology, we have great opportunities in technology to make real improvements.

I wanted to ask about the issue in terms of testing, because we want this technology to get on the road so we can get all the advantages, but we have to make sure that it is safe.

And as Mr. DeFazio had talked about earlier about VOD, you know, choices have to be made if there is a—who he is going to run over, had he had to make that choice. So these are questions that

have to be answered, but we need to know what the technology is going to do. We need to know if the technology is safe.

There are two things when you are talking about automated vehicles that you really need to test. You need to test whatever you are using for the sensors to sense what is around the vehicle, but you also need the software. And the software has to make the right decision or the decision that we decide is the right decision in difficult edge cases.

So have you looked at anything in terms of using a simulation to test the software?

Should we have a national standard where all the software needs to be tested in a particular simulation to determine if that software is safe for an autonomous vehicle?

I was wondering if any of you have done any work on that or any comments on that, starting with Mr. Iwasaki?

Mr. IWASAKI. Chairman Graves, Representative Lipinski, thanks for the question. I appreciate that.

We are actually not modeling any of the software currently out at GoMentum Station. We have a number of partners that are testing their artificial intelligence out at GoMentum Station. So at Toyota research and Baidu, Baidu is on its third generation of the Apollo platform, and Toyota research is making great strides connecting their sensors to that artificial intelligence.

But we had this conversation before about the standard testing protocol for the software, and we haven't started on that at GoMentum Station.

Mr. LIPINSKI. Anyone else have any—Mr. Barna?

Mr. BARNA. Chairman Graves, Representative Lipinski, we are developing, as I mentioned in my testimony, 540 acres of autonomous-vehicle, connected-vehicle infrastructure at the Transportation Research Center.

And what that is able to do, able for us to do, is to test in that closed laboratory setting, testing software, testing the limits of the software and what the vehicles can do before we put it within live traffic.

So we are currently under construction. And those facilities include a six-lane high-speed intersection, a highway loop, as well as residential streets with roundabouts, so we can take the software to the limits as far as what it is capable of doing. And then with TRC connected to the U.S. 33 Smart Mobility Corridor, we can test it there and then bring it out into live traffic. But basically, that is the idea of the ABCD testing.

Mr. LIPINSKI. Does anyone think that having that, the Federal Government should be developing or should have a set, you know, software that the, you know, autonomous vehicles software has to be tested through to see what it does in all cases that we can posit?

Mr. BARNA. Chairman Graves, Representative Lipinski, you know the National Highway Traffic Safety Administration sets the minimum standards as it relates to the automotive manufacturers. And that may ultimately be the vehicle where we set those standards as far as what the vehicle, the autonomous vehicle, should be capable of doing.

I agree at some point that that probably should be set at some point in motion. If we look at infrastructure, if we look at, for in-

stance, connected vehicles and certain standards, I believe that the Federal Government plays a role in setting those standards, setting the interoperability specifications so that we don't have a vehicle operating differently in all 50 States.

Mr. BHATT. Just real quickly, Mr. Lipinski. I think that U.S. DOT is providing some leadership in this. There are, under the Federal legislation that is being considered, there are safety reports that would have to be submitted by the manufacturers, also that Turner-Fairbank is working with software developers, and they are looking to build some open source programs.

So I think it is this blend of regulation and private-sector innovation that I think will get to the safety component that you are looking for.

Mr. LIPINSKI. Thank you. I yield back.

Mr. GRAVES OF MISSOURI. Mr. LaMalfa.

Mr. LAMALFA. Thank you. I appreciate the panel being here today. Sorry for my late arrival with other committees meeting at the same time.

I am going to come from maybe a little different angle on this.

It seems when we are innovating for our surface transportation and traffic needs, we are not even fully using our capabilities we have right now. I mean, I am all about traffic flow. And so when I travel in my home State of California, I see that we are not even taking advantage of ability to—when we are spending money, when we have projects that are open—we are not adding additional passing lanes or things like that.

We have this money here that is tied up in particular safety-type spending, and other dollars that are tied up in maybe adding expanding capacity, things like that.

And so they don't seem to be able to meld them together at the same time, so that when you have a project that is open and a piece of highway that is torn up, it is only you think about do one or another, not adding an additional passing lane; or things such as stoplights that are timed better to keep traffic moving instead of all bottling up, you know, truck traffic and such, so that it takes miles and miles for the traffic to finally become less like a caterpillar and flowing again.

So the frustration I have with traffic flow doesn't seem to be addressed as much by the bureaucracy.

We have a project, in my district, Highway 70 in northern California that desperately needs to be done. And we have had much, much carnage on there the last couple of years, and over many years, that has been—dollars are finally going to move forward on that, but, again, we are going to have to study it for 2 years, an existing highway, add two lanes.

I just wonder, can anybody on the panel comment on the inability to walk and chew gum at the same time on expanding these highway projects at the same time you are doing safety work, that you are not doing more flow work—not you, but in general, in the bureaucracy?

I see we have somebody from Contra Costa here. Would you like to touch upon that and see, just in general, on what—with our highways? Anybody on the panel here, how can we do better with

putting the dollars forward to have better traffic flow and not this frustration?

Because I know drivers out there just continue to be frustrated. They have torn up highways and not the additional flow that, I think, that would be very helpful for all our goals.

Mr. IWASAKI. Chairman Graves, Representative LaMalfa, I, too, am from California and I, too, share sometimes your frustration.

So we have a seven-pronged approach, I mentioned earlier, to try to fix congestion on a heavily congested corridor, Interstate 680.

It does allow for auxiliary lanes. Those are the widening between the interchanges, allow for weaving on and off the freeway. So it is lengthened, it adds a little capacity to the roadway. We are also going to finish our HOV lane and we are going to make them express lanes so that single occupant vehicles, if they choose, and they are late, and they want to pay a toll, they can get into that HOV lane, adding capacity to your mixed-flow lanes.

But when we go into a corridor, I was talking earlier about how we change the way we plan the future. And so what we are trying to do is not take today's technology, model against the next 30 years and determine we are going to have to widen every road in Contra Costa, because by the year 2040, our population is slated to grow by 29 percent.

When we go into the corridor, we want to do it once. The problem is, in many cases when you are working for DOT, you have a certain type of money that you are spending, and so you have a safety project, so you fix the safety project. But you need more capacity but that is not the right kind of money to add capacity.

Mr. LAMALFA. As I was mentioning, why can't we have a better process of having them move in parallel when you have the construction there, when you have the roads torn up, when you had everything going on, add that additional lane, or whatever needs to be done, that could be added.

And so what can we do in this Federal committee to be helping with that?

Mr. IWASAKI. I think we need better planning. I think we need to incentivize better plans that once you go in and tear up a corridor, do it once, because that is what the taxpayers expect. They don't want to see 2 years of construction to put an auxiliary lane on the outside, and then 4 years to put an HOV lane on the inside. And that is 6 years later, plus it took 20 years to plan the project.

I am not here to talk about regulation reform, because I was told not to, so I am not going to do that.

Mr. LAMALFA. But you feel it in your heart somewhere there, huh?

Mr. IWASAKI. I do have it in my heart.

Mr. LAMALFA. Close enough, I guess.

Mr. IWASAKI. We need to work together to make sure that the type of money is flexible enough, on the State level as well, so we can do those projects and coordinate those projects, keeping in mind that the taxpayers are the ones that are affected. Our constituents are affected on a daily basis when you widen the right side, then come back 2 years later and widen the left side of the road.

Mr. LAMALFA. And when you are talking about Highway 70, those people that are losing their lives in all the accidents on a State highway that is two lanes that needed to be connected a long time ago to a four-lane.

Thank you, Mr. Chairman. I appreciate it.

Mr. GRAVES OF MISSOURI. Ms. Brownley.

Ms. BROWNLEY. Thank you, Mr. Chairman, and thank you for calling this hearing together. I think it is very informative, and very, very interesting and very, very exciting as well. But I live in a city in California, Thousand Oaks, which is one of the most bicycle-friendly communities in California. And so I wanted to talk a little bit about, as we put more intelligence into our transportation systems, how is that interoperability working with pedestrians and bicycle traffic?

Mr. Barna?

Mr. BARNA. Chairman Graves, Representative Brownley, it is very promising as we see more and more pedestrians and bicycles interacting with vehicular traffic. We are also seeing an increase in fatal accidents between cars, pedestrians and bicycles. In our State, that number has gone up.

This technology is now, we are getting to the point where the technology will be able to sense, you know, whether in the blind spots or any type of objects, whether it is pedestrians, bicycles, and giving these drivers much more warning than they had before. So, you know, as far as the connected vehicle environment, or even just—it is a little more of the autonomous features that they are able to sense pedestrians, bicyclists all around.

Just now, as many cars that are coming off the assembly line today, you have the blind spot warnings where you see your lights in the rearview mirror come on if there is somebody there. That technology is advancing to the point where we can detect pedestrians and bicyclists as well.

If we look at in the downtown space, our signals are actually becoming the eyes and ears for us there. So you making a right turn sometimes might be blinded by parked cars. You may not see a pedestrian in that crosswalk.

What happens is now that signal identifies that pedestrian in that crosswalk and sends you a signal in your car that there is a pedestrian in that crosswalk.

We are actually doing that testing right now, as we speak, in the city of Marysville as we advance signal technology, but the signal is acting, now, kind of as a watchdog for the entire intersection as sending messages to the car, hey, you have got a pedestrian in that walk, or you have got a bicycle approaching such and such. Let alone it is communicating that information to you, but it is also making decisions on its own as far as how it changes the pedestrian crossings and as well as even the reds, greens, in all directions.

Ms. BROWNLEY. Mr. Bhatt, do you have a comment?

Mr. BHATT. Yes, just really briefly. I think it is a great question.

When you delve into the fatality increase across the country, where we are seeing the biggest increase is in vulnerable users of the system, bicyclists, pedestrians, motorcyclists. And I believe it is

because of this epidemic of distracted driving that we have out there.

One of our members in New York City has this great program called Vision Zero, and they have actually seen a reduction in pedestrian and bicyclist fatalities. And all of this technology that is out there, I think, will help us with this distracted driving issue, which is really driving a lot of these fatalities.

Ms. BROWNLEY. Thank you very much.

And Ms. Castillo, I wanted to ask you, my other responsibility in Congress is taking care of our Nation's veterans. And I was just wondering if you collected any data, and what you are doing out in the rural areas on veterans?

I know there is a medical center in Iowa. There are obviously community clinics throughout. And if you are collecting any of that data in terms of veteran use?

Ms. CASTILLO. Yes, we work with our veterans association, and they all have their own vehicle, which they take a lot of veterans to various clinics, but because their vehicles are not accessible vehicles, we have partnered with them, and we allow the veteran to—we take them to the veterans hospital in the Des Moines area or in the Marshalltown area, and then they just reimburse us for a cost, because they are not able to take those.

So we do have that data. I don't know what that is off the top of my head. But, yeah, we store all of that in our software.

Ms. BROWNLEY. Well, I would love to, if you would, share the data.

Ms. CASTILLO. I will absolutely do that.

Ms. BROWNLEY. Because I think what you are doing is possibly an important solution in terms of veterans getting to their healthcare throughout the country. So I actually would like to see the data.

Ms. CASTILLO. I will absolutely share that with you. It has been difficult, to be quite honest, in working with the VA [Department of Veterans Affairs], but we don't want to take the transportation away from them. We just want to be able to partner with them in doing that.

So I think there are some more opportunities we have. We just haven't been able to make those connections, but I will get you the data, absolutely.

Ms. BROWNLEY. Thank you very much. And I yield back, Mr. Chairman.

Mr. GRAVES OF MISSOURI. Mr. Smucker.

Mr. SMUCKER. Thank you, Mr. Chairman. I appreciate you holding a hearing on this topic.

It is fascinating for me to contemplate what our transportation system will look at just a few decades from now.

We know mobility will be increased and that will change the lives of so many people, increase their quality of life, but it is also really great to see the work that each of you are doing. I appreciate all of you being here, but also for the innovation that you are driving in your organizations.

Mr. Barna, you just, a few questions ago, mentioned two specific areas of public policy, really, from our perspective that you all are impacting in a big way. And that is, one, that folks do want to age

in place, at their homes. And transportation has always been one of the biggest barriers to that, so some of the things that you are doing will increase their quality of life and enable them to stay with their families longer.

And then the other is, today we have huge workforce needs and we are working to connect people who are not participating in the workforce today with jobs that are available, will help lift people out of poverty. And transportation has always been one of the biggest challenges there. So the kind of things that you are doing is helping in that area as well.

Ms. Castillo, you mentioned in your testimony just a little bit ago that one of your ongoing challenges is staffing and how you struggle to recruit and retrain employees. I am bouncing back and forth between two hearings. There is one just down the hall with the Committee on Education and the Workforce, and we are talking specifically about apprenticeship programs, and other policies that we could be advancing here at the Federal level.

What I hear from you is not unlike what we hear from companies all across my district and all across the country. Truck drivers are in short supply and, in fact, companies everywhere are having trouble filling positions as we see more retirees.

You said that a lot of your drivers are 65 years old and older, and you are going to have a severe shortage within 5 years. So what, in your opinion, could we be doing here at the Federal level to ensure that there is skilled workforce pipeline in place that can fill those positions? Maybe 20 years down the road we don't need as many drivers, but now we certainly do. What could we be doing?

Ms. CASTILLO. And I do think from a rural perspective, employees typically, in more rural settings, are not at a pay grade that a lot of the urban employers are, so people want to make more money, a livable wage, actually.

And the majority of the rural systems with drivers, they are all part-time. Very few of them have full-time positions with benefits. And so for us to recruit younger drivers who would like to stay in our agency and, you know, grow with us, which would be ideal, they can't live off of a part-time job during the day.

So for rural transportation systems, it really does come down to funding. We are all doing multiple jobs like our urban counterparts, which have departments of these people, and these people, and these people. We have a person that is four departments.

And a lot of that just comes down to funding. I mean, it is an issue with funding. So one of the things that we have been doing is really working toward commuter transportation and trying to get that so that employers are buying into that. We have been working with economic development so that what we are doing also has an impact in the community, and hopefully, some of that then, they buy into our system as well. And so that is kind of keeping some of the money flowing, kind of in a circle that we are helping our whole community.

Because when we talk about our communities, there are communities, we live in these small communities, our drivers know all of the people that we are serving. So that is really important to us to keep that going. But it is actually getting people to make a livable wage, and that is where the smaller transportation agencies

need to come up to that. Unfortunately, we just don't have the funding to do that right now.

Mr. SMUCKER. Thank you. Just one other quick question for Mr. Iwasaki.

You had mentioned in your written testimony the importance of gathering public input.

And you are employing some of the latest technologies to engage with stakeholders and you have seen a real increase.

Could you expand just a little bit about how that works?

Mr. IWASAKI. Chairman Graves, Representative Smucker, thank you for the question.

So we have changed the way we go out and normally gather public input.

Normally, you go to a library at 6 o'clock in the evening on a Thursday and you get 20 people or 40 people; 10 are your consultants, and the other 30 don't like you. And so you get very skewed input from the public.

So what we have done is we have used social media. We have revamped the website, KeepContraCostaMoving.net, and ask you for your input. We give you an allocation of Contra Costa coins, CoCo coins, 10. You make an investment. Everybody—and we know exactly where you are logging into the computer. So if you are in Alameda County, you don't count, but if you are in Contra Costa, you do.

We have changed the way we use Facebook. So Facebook now gathers information for us. And we would aggregate all that information. We changed the telephone town hall. Normally you propagate out your message, you are running for Governor or wherever, and you send out a robocall message to thousands of people.

What we do, we robocall 15,000 people in each of the 4 subregions of our county. And, say, on Friday night, the executive director and an elected board member, they are going to answer your questions about transportation live for an hour and a half.

And we ask polling questions: Do you like potholes? Press 1. Do you not like potholes? Press 2. It is not that basic, but you get the point.

When we aggregate all this input, four things came up. One, they don't like potholes. Number two is they don't like those gosh darn red lights at midnight when nobody else is around. Three, they want a better subway, BART system. Four, they want a first- and last-mile solution.

So when we aggregated all this information together, we got more comments this cycle of our countywide transportation than the previous 25 years combined.

And I think that we don't use enough social media to mine that. We tend to use the old methodologies that don't work, but yet we gather information that way, and we are seeing things from a skewed perspective. And we don't see things from an overall perspective. And I think technology is helping us gather better information, make better decisions on using our Federal, State, and local funding.

Mr. SMUCKER. And allows a lot more people to participate.

Mr. IWASAKI. Absolutely.

Mr. SMUCKER. Thank you.

Mr. IWASAKI. You are welcome.

Mr. GRAVES OF MISSOURI. Mrs. Lawrence.

Mrs. LAWRENCE. Thank you, Mr. Chairman. Mr. Bhatt, in your testimony, you mentioned a need for comprehensive electric vehicle, or EV infrastructure plan. I represent Detroit. I represent the Motor City. I have GM as the world headquarters. I have, in my district, one of the largest number of tier 1 R&D for auto parts, and everyone is testing electric vehicles.

I had an opportunity to ride in an autonomous vehicle. There were some interesting moments in it, but it was still autonomous.

I have heard repeatedly from the industry that while I heard Mr. Barna say he did not want regulations, but we must move forward to a national plan when we start talking about autonomous vehicles and our infrastructure plan for electric vehicles.

Please tell me how you and your colleagues can help us move faster in that discussion? Because it is, for me, a giant failure if we are going to be behind the eight ball, all the technology is ready, and every State is trying to implement their own plan, and then we are actually hindering the success of innovation if we don't have a national plan.

So would you please comment on that?

Mr. BHATT. Thank you, Representative Lawrence. My wife was actually a teacher at Renaissance High School in Metro——

Mrs. LAWRENCE. Oh, cool. Yeah.

Mr. BHATT. So from there, just spent the weekend there, and our vice chair, our chair next year is Gary Smyth from General Motors, head of global R&D.

Mrs. LAWRENCE. Yes.

Mr. BHATT. So Detroit gets it.

Mrs. LAWRENCE. Detroit gets it.

Mr. BHATT. Michigan is a hotbed. There are all kinds of activity around the country.

I think you have a great question. And we have to find that right balance of regulation that creates a level playing field and standards for everybody that doesn't then stifle the innovators that are working in Contra Costa County, or in Ohio, in order to move forward.

On the EV piece, I think it is generally accepted that the future of transportation is electric automated. It is not in the next couple years, but over the next coming decades, this has an implication for gas tax revenues and others. But I think that the innovators are out there, whether in California or Michigan, or around the country, we just need to provide a level playing ground and framework.

And U.S. DOT is taking strides, but I think the next authorization can take some important steps there.

Mrs. LAWRENCE. Have you all gotten together to say this is a plan that we think will work? Or are you resting on the shoulders of the brilliant minds of Congress to present a plan?

Mr. BHATT. So our association represents, you know, over 30 States, cities, private-sector companies, research institutions. And so we have a task force that will be, depending on reauthorization needs, we are already having those discussions now, because while we have great faith in Congress' ability to provide good legislation, we want to provide the best input possible.

Mrs. LAWRENCE. And I just want to be on the record, great innovation is not solely in the hands of Congress. It has to have all hands on deck. And I am always concerned at the speed and the progress. We get there eventually, but this technology is one that we really need all hands on deck so that we can be efficient and be timely so that we are all moving forward together. So your task force, I really welcome some input.

Now, this is a question for you, Mr. Barna. I am a person who really gets the crisis that we are having in our skilled trade and our workforce. As we innovate, as we move forward, our workforce is not moving at the same pace, so, you know, we need the educational community on board, but we also need you, the innovators, and those in corporate America to be a partner.

Can you talk about how, in the State of Ohio, are you looking at your workforce for autonomous vehicles and for connected vehicles? How are you building that workforce, and what type of opportunities are there going to be for American workers in your field?

Mr. BARNA. Chairman Graves, Representative Lawrence, that is another great point. And as I mentioned before, next to safety workforces, the number two question we get. We created a group within DriveOhio that specifically focuses on workforce development.

All these projects that we showed on the slide around the State of Ohio has to have a workforce development component to it. So as we do each of our projects, it is not just a bunch of engineers sitting in a room trying to develop connected technologies. We actually have academic partners, private-sector partners, and we are looking at a workforce component to each of the projects.

So we are involving community colleges. We may go to the high schools. A lot of our meetings to which we hold in DriveOhio, our last one was at a STEM program, so we have a group under the direction of Rich Granger, the State of Ohio, who actively gets involved with folks developing curriculum. And what we do is look at curriculum surrounding this type of technology.

So if we go and install some of the infrastructure for one of our projects, there are terms we use as onboard units where you put these receivers-transceivers in cars, or roadside units, receivers-transceivers on the highway. We are actually getting the students involved to be able to help install the technology. It is not that easy.

Mrs. LAWRENCE. I do want to say, because I know my time is running out. That is exactly—I really appreciate how you have looked at, not only the innovation, but the education of the workforce. And I want to really engage you and with your representative as we talk about workforce, so we can use best practices around the country.

I yield back my time and thank you so much. And I am excited about the flying car that will be coming soon.

Mr. BARNA. Thank you.

Mr. GRAVES OF MISSOURI. Seeing that there are no other further questions, I would like to thank each of our witnesses for your testimony today.

I appreciate it very much. And with that, I would ask unanimous consent that the record of today's hearing remain open until such

time as our witnesses have provided answers to any questions that may be submitted to them in writing, unanimous consent that the record remain open for 15 days for additional comments and information submitted by Members or witnesses to be included in the record of today's hearing.

Without objection, that is so ordered.

No other Members—obviously, there are none—have anything to add, then the hearing is adjourned.

Thank you.

[Whereupon, at 11:59 a.m., the subcommittee was adjourned.]

SUBMISSIONS FOR THE RECORD

RESPONSES OF JULIA CASTILLO TO QUESTIONS FOR THE RECORD FROM HON. SCOTT PERRY

QUESTION: Ms. Castillo, in your testimony, you highlight the need to find ways in which to efficiently meet the transportation needs of rural Americans despite the added challenges and costs associated with servicing rural communities, stating, "This is where innovation and technology come together to play a vital role." Do you believe this combination of innovation and technology can be utilized to reduce costs while at the same time expanding the access to transportation in rural America?

ANSWER: Thank you for your follow-up question in response to my testimony before the Subcommittee on Highways and Transit, and I appreciate your dual concerns in striving for improved efficiency and improving access to mobility options in rural America.

Innovation and technology offer tremendous opportunities for community and public transportation providers like our agency to address the priorities of our communities and customers. Like a manager at any business, I have to make informed decisions on tradeoffs between operational efficiency and expanded services. Even when armed with new technology and innovative strategies, there are seldom win-win scenarios where we can reduce our costs while delivering a better product at the same time. In an era of constrained investment, we can utilize innovative practices and emerging technology to provide more options using the same resources, or we can provide the same options when fewer resources are available.

Rural and specialized transportation providers like mine are often pitched the concept of coordination, which is really just a hope of program managers that we finely thread the needle of doing more with less. Mindful of our responsibility to be good stewards of public investment, our mission is to meet the mobility needs of our region by operating responsive, effective and efficient service. Innovation and technology are important tools we use to achieve these objectives.

Again, thank you for the question, Congressman. I—along with the staff at the Community Transportation Association of America, of which HIRTA is a member—are available as resources to you and your staff at any time.

RESPONSES OF SHAILEN P. BHATT TO QUESTIONS FOR THE RECORD FROM HON. MIKE GALLAGHER

QUESTION: The U.S. Department of Transportation has been encouraging the use of public-private partnership (P3s) as innovative financing models to support physical transportation infrastructure deployments. Last Congress, the Fixing America's Surface Transportation Act (P.L. 114–94, FAST Act) created the Build America Bureau (formerly the National Surface Transportation Infrastructure Finance Bureau) to help facilitate access to innovative funding opportunities, including P3s. What forms of P3s do you think can help support expanding ITS deployments? Are transportation infrastructure owner-operators equipped to work with commercial communications providers in P3s for ITS deployments?

ANSWER: One of the fundamental aspects of a public-private partnership (P3) is revenue, so ITS deployments with the most revenue (tolling) have generally had the most P3 support. Another example is fiber sharing—the Utah Department of Transportation leases sections of its fiber assets to the private sector, thereby enabling revenue for the state and access to communications equipment. Another approach is cost savings. Cities, for example, are deploying highly-efficient street lights, which result in cost-cutting and create P3 opportunities. Transportation infrastructure owner-operators are equipped to work with commercial communications providers in P3s for ITS deployments.

RESPONSES OF RANDELL IWASAKI TO QUESTIONS FOR THE RECORD FROM HON. SCOTT PERRY

QUESTION: Mr. Iwasaki, in your testimony, you state that Contra Costa Transportation Authority's "over-arching goals are to ensure that our plans use taxpayer dollars wisely and that we are investing in the technology of the future—not yesterday's technology." In light of the rapid pace of private sector innovation, it has become apparent that federal policies stand as a barrier to integrating these technologies of the future. Do you feel that focusing our federal policies on encouraging innovative and high-performing mobility pilot programs would allow for a more seamless integration of these technologies, providing increased efficiency and quality of our transportation systems?

ANSWER: Representative Perry, thank you for the question. My answer is yes—but the devil is in the details. Having federal policies that encourage innovative and high-performing pilot programs would help determine how new technologies can enhance and improve the transportation system. I am a big believer in research. The value in research is testing applicability and that is what pilot programs can do. One of the challenges are that federal funding is not always flexible enough to use to support these pilot programs. Another is that current federal procurement rules make it difficult for agencies to quickly procure current and new technology for testing. By the time an agency has completed all the appropriate paperwork and waited for the required approvals, the "innovative" technology they were hoping to test has been eclipsed by a new version, or new technology. It is very difficult to be nimble and responsive within the current federal funding framework. Lastly, the nature of a pilot program is that it's a trial period to put new technologies through the paces. Once that technology has been proven to work in multiple locations or tests, federal policies should consider how to revise policy and funding guidelines to accommodate future, more permanent procurements.

511CC Scoop Incentive Pilot Program

5,800 rider trips per month in **Contra Costa**

8,300 registered users in **Contra Costa**

TOP DESTINATIONS:

1. Santa Clara County
2. Pleasanton/Dublin
3. San Mateo County
4. San Ramon

Over the 11-month pilot, riders saved:

728,000 miles
ENOUGH TO TRAVEL TO THE MOON 3 TIMES

$410,000
COMPARED TO DRIVING ALONE*

175 cars off the road daily
SAVING ENOUGH SPACE TO FILL THE FIELD AT LEVI'S STADIUM

The pilot reduced carbon emissions by:

660,000 lbs of CO_2*

EQUAL TO:

BURNING **33,700** GALLONS OF GASOLINE*

POWERING **45** HOMES FOR A YEAR*

80% of users **drove alone** prior to the pilot

30% of users are driving **less often**

75% of users are carpooling **more often**

511 CONTRA COSTA

CONTRA COSTA transportation authority

BAY AREA AIR QUALITY MANAGEMENT DISTRICT

DELIVERING THE FIRST CONNECTED CORRIDOR

[illegible]

PROJECTS

[illegible]

INNOVATE 680 WILL IMPROVE QUALITY OF LIFE

TRAVEL TIME SAVED

LESS CONGESTION

ACCESSIBILITY

SAFER ROADS

BETTER AIR

BE A PART OF THE VISION FOR INNOVATE 680!

What will the future look like on I-680? Traffic will flow more smoothly and at more stable speeds. There will be fewer empty seats in cars and buses, and traveling will be safer and more efficient. When taken all together, implementing Innovate 680 will enhance the quality of life for all Contra Costa residents and travelers.

Learn more about CCTA's vision for the I-680 corridor at ccta.net.

CONTRA COSTA
transportation
authority

Innovate 680

Integrated Solutions. Redefined Mobility

CRITICAL CORRIDOR, RISING CONGESTION

Serving communities in central and southern Contra Costa County, Interstate 680 (I-680) is a backbone corridor for the Bay Area. It extends south to Silicon Valley and north to Fairfield, while providing access to scenic recreational areas, popular retail hubs, and thriving business centers. I-680 is critical to the region's prosperity as it provides for the movement of goods and services throughout the Bay Area and beyond. Thousands of homes and businesses rely heavily on this corridor for day-to-day travel.

8th worst commute in Bay Area

[illegible]

The continued economic vitality and quality of life for residents depends on the ability to get where they need to go efficiently and safely. In 2015, it took the average person almost 25 minutes longer to commute northbound on I-680 during peak drive time versus non-peak drive time. By the year 2020, that delay is expected to nearly quadruple, bringing the average delay to over an hour and a half. Such increases make travel along this corridor highly unpredictable and unreasonably time consuming. As the congestion management agency for the county, the Contra Costa Transportation Authority (CCTA) is focused on alleviating the congestion that plagues I-680.

NEXT GENERATION of Mobility

Alleviating congestion in Contra Costa County does not have a "one size fits all" solution. Simply adding lanes is not an option as the corridor lacks the physical space for expansion. Any congestion management plan for I-680 must use the existing infrastructure and careful planning.

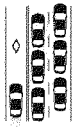
Innovation is key to optimizing the county's transportation system and managing congestion more efficiently. By using advanced technology, CCTA can simplify access to reliable mobility options by providing real-time, data-driven traffic updates so travelers can make informed decisions about cost, timing, mode and route.

The goal is to provide options and tools to improve mobility in the corridor and move towards shared modes.

SUMMER 2018

A HOLISTIC APPROACH TO IMPROVE CONGESTION

CCTA has formulated a suite of seven strategies that combine next generation traffic management techniques with new, time-proven transportation strategies designed to improve traffic flow, and fill empty seats in cars and buses. Taken together, these strategies provide a comprehensive approach to traffic management that was formulated based on our Countywide Transportation Plan, CCTA staff and stakeholder feedback received from the public about the CTP, travel data and other research, and analysis of the potential to benefit and disrupt travel in Contra Costa, technology provided transportation leading 1-680 via the "Connected Corridor".



STRATEGY 1

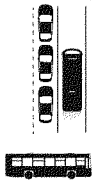
COMPLETE EXPRESS LANES

Extending the existing express lanes in both directions from Rudgear Road in Walnut Creek to the Benicia Bridge will provide 25 miles of fully-continuous express lanes in the southbound direction, and nearly continuous express lanes in the northbound direction. The goal is to provide reliable travel at a minimum speed of 45 mph in the express lanes for those choosing to travel by transit, carpool, vanpool, or motorcycle. Solo drivers can utilize express lanes as well, for a fee.

STRATEGY 2

COOL CORRIDOR "HOT SPOTS"

Vehicles changing lanes and merging on and off the interstate causes friction and can slow traffic. I-680 has several critical congestion "hot spots" between Livorna Road and Treat Boulevard. Modifying these locations with additional lanes and ramp improvements will provide safer merging for motorists and ease bottlenecks that create regular, daily delays.



STRATEGY 3

ENHANCE TRANSIT SERVICE WITH BUS-ON-SHOULDER OPERATIONS

Enabling buses to travel on dedicated shoulder lanes (or "transit only" lanes) to bypass congestion during heavy traffic will make transit a more viable travel mode, and help reduce congestion on freeway and express lanes, reduce weaving, and provide more reliable service between transit hubs and major employment centers. Minneapolis, Minnesota has successfully operated bus-on-shoulder lanes for more than 17 years and currently has more than 300 miles dedicated to this purpose. Bus-on-shoulder lanes are currently planned between Bollinger Canyon and Ygnacio Valley Road, operating only when the adjacent lane operates at 35 mph or less.

Within this strategy, CCTA will also fund additional city buses and school bus service, expand park and ride facilities, and develop smart mobility hubs to support multimodal needs. Smart mobility hubs will include increased parking, bike share and rideshare options, as well as shuttle service between mobility hubs and transit stations.

STRATEGY 4

INNOVATIVE OPERATIONAL STRATEGIES

Innovative operational strategies include next generation Integrated Corridor Management (ICM) and Adaptive Ramp Metering (ARM)—which are basically hardware and communication technologies, also known as Intelligent Transportation Systems (ITS). Operational data gathered from ICM and ARM will be used to refine the transportation system through a county-wide connected data center where real-time traffic information will allow for adjustments to traffic signals, metering lights and speed control signage, to smooth traffic and increase efficiency of the freeway. These systems can also learn from historical congestion data, anticipate how traffic will flow and predict necessary adjustments. Additionally, the data can be transmitted to the mobile application so travelers can access it and make informed decisions about when to travel and how to do it—transit, ridesharing, express lanes or ride-sourcing.

STRATEGY 5

PROVIDE FIRST MILE/LAST MILE CONNECTIONS WITH SHARED AUTONOMOUS VEHICLES

Express bus service and other mass transit options have the capacity to move the highest numbers of passengers efficiently through a crowded corridor so riders can get to destinations like school, work, medical appointments and business centers. However, often the most challenging part of a transit trip is that first mile to or from a residence or destination. Bridging this first mile/last mile gap with shared autonomous vehicles, shuttles, bike paths and pedestrian trails will make mass transit a more convenient option for travelers that do not live close to a transit stop, or just need extra assistance getting to or from transit.

STRATEGY 6

PREPARE THE CORRIDOR FOR THE FUTURE

Connected and autonomous vehicles (CAVs) are just now starting to enter our roadways, but at the rate of technological advances in this exciting arena, CAVs will dot our landscape in great numbers very soon. It is imperative that we install new and upgraded vehicle-to-infrastructure and vehicle-to-vehicle communication capabilities, such as dedicated short range communications (DSRC), to accommodate this invaluable technology. Installing advanced communication platforms allows vehicles like buses and CAVs, to connect to ramp meters and provide data that can be used to smooth travel and reduce congestion.

STRATEGY 7

TRANSPORTATION DEMAND MANAGEMENT (TDM)

TDM programs are designed to reduce single-occupancy vehicle travel by supporting, scheduling and incentivizing travel using other modes of transportation. Creation of a mobile application that can provide information about transportation options will help travelers make informed decisions about mode choice, travel time and cost-per-trip. The mobile application will support mobility options for ride-sourcing, such as Uber or Lyft, carpooling, bike-sharing and transit.

Additions to the Record

STATEMENT OF CATHERINE CHASE, PRESIDENT
ADVOCATES FOR HIGHWAY AND AUTO SAFETY

ON

"INNOVATION IN SURFACE TRANSPORTATION"

SUBMITTED TO THE

U. S. HOUSE OF REPRESENTATIVES
COMMITTEE ON TRANSPORATION AND INFRASTRUCTURE
SUBCOMMITTEE ON HIGHWAYS AND TRANSIT

SEPTEMBER 5, 2018

Introduction

Advocates for Highway and Auto Safety (Advocates) is a unique coalition of public health, safety, and consumer organizations, insurers and insurance agents that promotes highway and auto safety through the adoption of federal and state laws, policies and regulations. Advocates works to prevent crashes, deaths and injuries through the advancement of safer vehicles, safer drivers and passengers, and safer roads and infrastructure.

Motor Vehicle Deaths Remain Unacceptably High

According to the federal government, each year motor vehicle crashes kill tens of thousands of people and injure millions more at a cost to society of over $800 billion.[1] According to the latest statistics from the National Highway Traffic Safety Administration (NHTSA), 37,461 people were killed on our nation's roads in 2016. This is an increase of over five percent from 2015,[2] and it follows a seven percent increase from 2014 to 2015.[3] Preliminary data from 2017 and the early months of 2018 unfortunately do not indicate meaningful declines in crash fatalities.[4]

Advocates Consistently Supports Innovation and Promotes Proven Technology to Save Lives and Prevent Injuries

Advocates has always enthusiastically championed innovative vehicle safety technology and for good reason; it is one of the most effective strategies for preventing deaths and injuries. NHTSA has estimated that since 1960, over 600,000 lives have been saved by motor vehicle safety technologies.[5] In 1991, Advocates led the coalition that supported bipartisan legislation that included airbag technology in the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991.[6] As a result, by 1997, every new car sold in the United States was equipped with a front seat airbag and the lives saved have been significant. Over the last decade airbags saved approximately 2,500 lives annually,[7] and have saved an estimated 47,625 lives since 1987, according to NHTSA.[8]

Advocates continued to build on this success by supporting additional lifesaving technologies as standard equipment in all vehicles in other legislation and regulatory proposals. These efforts include: tire pressure monitoring systems;[9] rear outboard 3-point seat belts;[10] electronic stability control;[11] rear seat belt reminder systems;[12] rearview cameras;[13] brake transmission interlocks;[14] seat belts on motorcoaches;[15] and, electronic logging devices for commercial motor vehicles (CMVs).[16] These safety advances have prevented countless crashes and saved hundreds of thousands of lives, and many have been accomplished because of bipartisan leadership of members of Congress.

Available and Inventive Safety Advancements Should be Deployed Now to Reduce Crashes

Crash Avoidance Systems and Advanced Driver Assistance Systems

Available crash avoidance systems, such as automatic emergency braking (AEB), are foundational to the development of autonomous vehicles (AVs) and should be made standard equipment on all new vehicles.[17] This system uses on-board sensors such as radar, cameras or lasers to detect an imminent crash, warns the driver and applies the brakes or increases the braking effort if the driver does not take sufficient action. Research performed by the Insurance Institute for Highway Safety (IIHS) has revealed that AEB decreases front-to-rear crashes that cause injuries by 56%.[18] Similarly, rear automatic braking can reduce backing crashes by 62%.[19] More advanced systems that would also be able to prevent or mitigate pedestrian and bicyclist collisions should also be considered. The already impressive safety benefits of AEB will be increased by implementing a federal performance standard and requiring that all new vehicles be equipped with this technology.

Additionally, advanced driver assistance systems (ADAS) such as lane departure warning (LDW) and blind spot detection (BSD) should also be fully implemented. IIHS research shows that LDW reduces single-vehicle, sideswipe and head-on crashes by more than 10% and injury crashes of the same types by more than 20%.[20] BSD reduced lane-change crashes with injuries by nearly a quarter and lane-change crashes by 14%.[21] On the road to fully autonomous vehicles, ADAS systems are the building blocks and should be included as standard equipment in all new vehicles.

Connected Vehicle Technology

Connected vehicle technologies allow a vehicle to send and receive communications with other vehicles (vehicle-to-vehicle (V2V)) and the infrastructure (vehicle-to-infrastructure (V2I)). These messages can relay information ranging from the relative location and direction of motion of other vehicles to warning messages that traffic lights are about to change or weather conditions are soon to be encountered. These systems will likely help fill in gaps in the performance of AVs. For instance, V2V communication can provide safety applications for ADAS such as Left Turn Assist (LTA) and Forward Collision Warning (FCW). LTA warns drivers to the presence of oncoming, opposite-direction traffic when attempting a left turn. FCW warns drivers of stopped, slowing or slower vehicles ahead. In a 2017 Notice of Proposed Rulemaking to require V2V technology, NHTSA noted that "[b]ecause of V2V's ability to provide vehicles with information beyond a vehicle's range of perception, V2V is the only source of information that supports applications like Intersection Movement Assist (IMA) and Left Turn Assist (LTA). These applications have the unique ability to address intersection crashes, which are among the most deadly crashes that drivers currently face in the U.S."[22] Advocates filed comments in support of requiring V2V because of the technology's ability to

help prevent serious crashes.[23] However, despite the identified safety benefits of V2V technology, this rule is languishing at the U.S. Department of Transportation (DOT).

Additional Safety Technologies

It is generally predicted that highly autonomous vehicles, Society of Automotive Engineers (SAE) Level 4 and 5, will not be available for the next 10-20 years.[24] We should not accept or be complacent about the fact that absent a change in current circumstances, more than 500,000 people will be killed and more than 36 million more will be injured in crashes over the next 15 years. The following are some available and emerging technologies that hold promise for curbing preventable deaths and injuries.

- ***Headlights:*** Approximately half of traffic fatalities occur in the dark or at dawn or dusk, and the proportion of pedestrians killed in low light conditions is even greater.[25] According to IIHS, there are few vehicles equipped with adequate headlights. Properly aimed, adaptive and high-beam assist headlights all may be effective at improving nighttime visibility.[26] Adequate illumination provides drivers extra time to see road conditions, including pedestrians, bicyclists and wheelchair users, and to react to avoid a crash or lessen its severity. This is especially critical as more than 70% of pedestrians are killed at a non-intersection.[27]
- ***Rear Seat Belt Reminders:*** The majority of passengers in the rear seats of vehicles are children and teens, and studies have shown that seat belt usage by teens is among one of the lowest segments of society.[28] Congress required NHTSA to issue a final rule requiring rear seat belt reminders in all new motor vehicles by October 2015 as part of the Moving Ahead for Progress in the 21st Century (MAP-21) Act.[29] NHTSA has failed to initiate the rulemaking. As transportation network companies become even more

prevalent and AVs are deployed, passengers may more frequently ride in rear seats and it is crucial that they be properly restrained.[30]

- ***Smart Roads and Intersections:*** A number of localities and states have been utilizing systems to make roads and intersections "smarter" with the goal of reducing congestion and improving safety. For example, in Colorado, it has been reported that the state is testing "smart roads" that are equipped with sensors that can monitor wear and tear, inform drivers to traffic and alert first responders when a crash occurs.[31] As 40% of crashes happen at intersections,[32] advances such as adaptive traffic signals that can improve flow of traffic and interactions with other road users like bicyclists and pedestrians may offer significant potential benefits.[33] Moreover, according to IIHS more than 800 people died in crashes involving red light running in 2016, an increase of 17% since 2012.[34] IIHS research has demonstrated that red light cameras prevent crashes. A 2001 IIHS study found that the average annual rate of fatal red light running crashes decreased by 35% in large cities that implemented a camera enforcement program.[35] Conversely, in states that ended automated enforcement, IIHS found that the fatal red-light-running crash rate was 30% higher than had the cameras remained active.[36] The performance of such systems will likely be further improved with the deployment of V2V, V2I and V2X (vehicle-to-everything).

<u>The Emerging Technology of Autonomous Vehicles Requires Sensible Safeguards</u>

Advocates believes that AVs have the potential to make significant and lasting reductions in the number of deaths and injuries that occur each year on our Nation's roads. However, deploying AVs before they can be safely operated on public roads and without commonsense government

oversight and industry accountability is not only reckless and ill-advised, but it will also substantially reduce public confidence in this new technology, which is currently weak.

Experts and Industry Agree that the Widespread Deployment of Autonomous Vehicles is Decades Away

Legislation including the House-passed SELF DRIVE Act (H.R. 3388) and the pending Senate AV START Act (S. 1885) is being rushed through Congress to facilitate the large-scale sale of experimental AV technology.[37] The speed at which this legislation is being advanced is not aligned with the reality that AVs are a long way from being ready for prime time.

In fact, a number of auto industry executives have publicly stated that fully autonomous vehicles are still likely decades away. For example, Ford Motor Co. CEO Bill Ford, Jr. commented, "There's been a lot of over-promising and I think a lot of misinformation that's been out there. It's really important that we get it right, rather than get it quickly."[38] Toyota Research Institute CEO Gill Pratt stated, "It's a mistake to say that the finish line is coming up very soon. Things are changing rapidly, but this will be a long journey."[39] And, Nissan's Senior Vice President of Connected Vehicles and Mobility Services Ogi Redzic remarked, "Say a 2021 target is the example. What they may be saying is in a little, geofenced area with certain speed and conditions. If you ask generic statements, like 'when will all cars be driverless?', well of course we are talking about the very distant future."[40] The primacy of the technology was also underscored by a recent report by IIHS.[41] The report stated, a "production autonomous vehicle that can go anywhere, anytime isn't available at your local car dealer and won't be for quite some time. We aren't there yet."[42]

The Public is Deeply Skeptical about the Safety of Autonomous Vehicles

Numerous public opinion polls show strong public skepticism and reticence about AVs.[43] Those doubts are warranted based on the recent crashes as well as the past conduct of some automakers. Over the last few years, certain automakers have hidden from the American public and regulators safety defects which have led to numerous unacceptable and unnecessary deaths and injuries and the recall of tens of millions of vehicles.[44] Consumer acceptance of AV technology is integral to its success and to fully realizing the lifesaving potential of AVs. Right now, families know that when they go into auto showrooms to buy a new car, the federal government has protections in place to ensure their safety. Similar oversight and regulation are needed for AVs to both assure and safeguard consumers, especially when considering the recent auto industry history of defects and cover-ups.[45]

To provide some examples of the numerous recent surveys:

- A recent Allianz Global Assistance survey found that 57% of Americans are not very or not at all interested in utilizing self-driving or autonomous vehicles - up from 47% in 2017. When asked why they had a lack of interest, 71% of respondents cited safety concerns - up from 65% in 2017.[46]
- In July of 2018, Advocates commissioned an independent public opinion poll[47] that showed intense apprehension regarding the widespread deployment of AVs with 69% expressing concern about safety; this figure was up from 64% when a similar question was asked in January 2018.[48]
- In a May 2018 poll commissioned by the American Automobile Association (AAA), 73% of American drivers said they would be too afraid to ride in a fully self-driving vehicle, up from 63% in late 2017.[49]

- A Reuters/Ipsos poll found that 67% of Americans were uncomfortable with the idea of riding in self-driving cars.[50]
- A May 2018 Public Policy Polling/Consumer Watchdog poll revealed that 80% of respondents agreed that federal and state governments should regulate driverless vehicles for the safety of riders, pedestrians and other drivers.[51]

Clearly, the public needs assurances that they will be safe in and around AVs, yet the legislation falls short of establishing safeguards to achieve confidence.

The Safe Operation of Autonomous Vehicle Systems Has Yet to be Proved

The artificial urgency to deploy immature AVs is disconnected from public opinion as well as the reality that serious and fatal crashes have revealed significant flaws in this still developing technology. On May 7, 2016, in Williston, Florida, a Tesla Model S on "Autopilot" struck and passed beneath a semitrailer killing the driver.[52] On January 22, 2018, in Culver City, California, another Tesla Model S operating on "Autopilot" collided with a parked fire truck that was responding to the scene of a separate crash.[53] Remarkably, neither the Tesla driver nor any first responders were injured.[54] On March 18, 2018, in Tempe, Arizona, an Uber test vehicle operating on self-driving mode struck and killed a pedestrian walking a bicycle.[55] Then, just a few days later on March 23, 2018, in Mountain View, California, a Tesla Model X operating on "Autopilot" collided with a safety barrier resulting in the death of the driver.[56] According to the National Transportation Safety Board (NTSB) preliminary report on the crash, the vehicle was being operated under "Autopilot", had moved out of the lane of travel on its own and accelerated to 70 miles-per-hour (MPH) before colliding with the barrier.[57] The collision and subsequent intense fire closed the freeway for at least five hours.[58] On May 29, 2018, a Tesla Model S

operating on "Autopilot" struck a parked police vehicle in Laguna Beach, California.[59] Late last month on August 25, 2018, in San Jose, California, a Tesla Model S collided with a fire truck that was stopped in the far right lane with its emergency lights activated. The NTSB has investigated or is investigating all of these crashes except the last two.[60] Several of these crashes demonstrate that you do not have to purchase or even chose to ride in an AV to be put at risk.

In addition to the tragic crashes that have already happened involving autonomous systems, data accumulated from the limited miles traveled also paints an alarming picture. In 2016, the latest year for which final data is available, on average a person was killed in a traffic collision every 84.7 million miles traveled on U.S. roads.[61] Before the fatal crash in Arizona, Uber had reportedly logged two million autonomous miles as of the end of 2017 and was predicted to accrue another one million miles over the next 100 days.[62] Based on a simple evaluation of this data, the autonomous Uber had one fatality in three million miles; that is a fatality rate 28 times that of human drivers. This analysis highlights just how little proof there is that these systems are safe. While it must be stated that the Uber crash is a single data point and may not be necessarily indicative of future performance statistically, if we are going to ignore this data point, then AV manufacturers must likewise stop touting the millions of miles their AVs have driven as evidence of their safety, as they are currently doing in voluntary safety self-assessments filed with NHTSA.[63] Moreover, these numbers pale in comparison to the more than three *trillion* miles traveled by human drivers on U.S. roads each year.[64] The fact is that the industry has yet to prove the safety of these systems and has yet to even agree upon a metric or method for comparing the safety of these systems, yet they are pushing to allow these vehicles into showrooms and onto the roads.

Similar misdirection about safety performance data has been used in response to recent crashes involving AVs. After the 2016 fatal Tesla crash in Florida, the NHTSA Office of Defects and Investigation (ODI) issued a report which included an analysis of data supplied by Tesla that showed "that the Tesla vehicles crash rate dropped by almost 40 percent after Autosteer [a feature of the Autopilot system] installation."[65] However, included in the ODI report was a key footnote that the crash rates reported were "for all miles travelled before and after Autopilot installation and are not limited to *actual Autopilot use*" (emphasis added).[66] Despite this clear statement by NHTSA, Tesla has mischaracterized the ODI analysis in response to subsequent fatal crashes involving vehicles operating under the "Autopilot" system.[67] NHTSA has since clarified again that the effectiveness of the "Autopilot" system was not evaluated in its prior investigation, refuting the claims by Tesla.[68] Moreover, Tesla was removed as a party to the NTSB investigation of the second fatal crash involving one of its vehicles shortly after a March blog post once again made this same claim.[69]

These types of details matter when it comes to AVs, particularly when evaluating claims that are made to support their introduction. Some members of the industry assert that waiting for AV technology to be perfect would be "the enemy of the good."[70] In some cases, they point to a report of the same title by the Rand Corporation (RAND) to bolster this argument.[71] In fact, the RAND report concluded that allowing the deployment of AVs, which have a safety performance that is just 10 percent better than that of the average human driver, would save more lives than waiting for a perfectly safe AV.[72] However, the underpinning of this statement, which is being widely missed in the use of this report, is that these vehicles are in fact demonstrably better, even in some minute amount, than human drivers -- this is a fact which has yet to be proved. Again, the industry and regulators have not even agreed upon the proper metrics for evaluating the

safety performance of an AV, let alone requirements for operation which would assure that these vehicles are ten percent, one percent, or even a tenth of a percent better than the average human driver.

Minimum Performance Standards Have Both Immediate and Long Term Benefits for Nascent Safety Technologies

Advocates has always supported the introduction of safety technologies once its benefits have been identified and verified. Often additional advantages arise out of the widespread implementation of the base technology. For example, Advocates evaluated an abundance of research and data demonstrating that installing a rearview camera in passenger vehicles would help to prevent backover crashes and resultant deaths and injuries, often to young children and disabled persons.[73] Advocates, together with others in the safety community especially KidsAndCars.org and the remarkable families of backover victims, then fought for a decade in total to obtain a rearview camera requirement for all new vehicles, which took effect on May 1, 2018. The IIHS conducted research, published in their November 17, 2016 *Status Report*, demonstrating additional benefits of rearview cameras such as reducing property damage crashes during backing and assistance with backing maneuvers such as parking.[74] The report noted that drivers 70 and older gained the biggest benefit from the technology as their backing crash rate fell by 40 percent.[75] Furthermore, if a video sensor stream was required, including additional driver assistance technologies such automatic rear braking, parking guidance and automated parking assistance, even more advantages could be realized.

Similarly, Advocates supported equipping vehicles with anti-lock braking systems (ABS), which helps a driver to maintain control of the vehicle when braking on slippery surfaces. ABS has also resulted in wide ranging benefits. In fact, ABS is the base technology for electronic stability

control (ESC) which helps to prevent rollover and loss of control crashes and is attributed to having saved more than 7,000 lives since 2011.[76] The applications which are in ABS and ESC are also an underlying technology for AVs. A significant component of both of these safety successes is a federal standard that ensures these technologies have a specific level of performance so that consumers can have confidence in the technology as well as familiarity with a new feature of their vehicle. Federal standards also pave the way to build public acceptance and use of these technologies which magnifies the safety benefits. Effective government oversight and performance standards are vital to the success of new safety technologies placed into motor vehicles.

Moreover, examples of the success of effective standards and oversight of automated systems fly over our heads every single day. According to the U.S. Bureau of Transportation Statistics, 741 million passengers traveled on domestic flights in 2017.[77] The tragic April 2018 death of a Southwest Airlines passenger was the first U.S. commercial airline fatality since 2009.[78] Over that same span of time (2010-2017), nearly 5.4 billion passengers travelled safely through our skies. The Federal Aviation Administration (FAA) estimates that airline pilots use automated systems 90 percent of the time while flying.[79] Meanwhile, on our roads from 2010 to 2017, crashes claimed the lives of approximately 275,000 road users.[80] The federal government, particularly the U.S. DOT, has experience in developing standards and implementing effective oversight of autonomous systems in transportation. While adaptation for governing AVs on roads will be required, this is not an entirely new concept. The U.S. DOT would do well to coordinate with other departments and its own agencies, and make the best use of its past research, current regulations, and the latest technologies to set standards ensuring the safe introduction of AVs and their interoperability in all fifty states.

Proper Government Oversight is Needed for the Safe Deployment of Autonomous Vehicles

Over fifty years ago, Congress passed the National Traffic and Motor Vehicle Safety Act of 1966 because of concerns about the death and injury toll on our highways.[81] The law required the federal government to establish minimum vehicle safety performance standards to protect the public against "unreasonable risk of accidents occurring as a result of the design, construction or performance of motor vehicles."[82] While motor vehicles have changed dramatically since that time and will continue to do so in the future, the underlying premise of this crucial law and NHTSA's safety mission have not.

Unfortunately, NHTSA has chosen to issue only "voluntary guidelines" for the development of AVs.[83] Voluntary guidelines are not enforceable because they are not legally binding, and, therefore, are inadequate to ensure safety and protect the public. Manufacturers may unilaterally choose to deviate from the guidelines or ignore them entirely at any time and for any reason including internal corporate priorities such as cost or marketing considerations.

Congressional Legislation on AVs Fails to Ensure Public Safety

Compounding NHTSA's inaction are the flawed House-passed SELF DRIVE Act and Senate-pending AV START Act – legislation which falls well short of the oversight and accountability necessary to ensure public safety. The legislation unnecessarily takes aim at the current federal regulatory scheme which has provided protection to those traveling on America's roads for decades.

Furthermore, for Congress to fully consider the public safety implications associated with the mass deployment of AVs, a final bill should not be enacted until the ongoing multiple investigations by the NTSB of the serious and fatal crashes involving vehicles equipped with

autonomous systems are completed. Our Nation's foremost investigatory body has highly regarded expertise and will issue recommendations that should help guide Congress as it sets our Nation's first AV policy which will likely set the stage for years.

We urge Congress to adopt the following reasonable improvements to the AV legislation, which will ensure public safety and industry accountability, while still allowing for the development and deployment of AVs:

- ***Reduce the Size and Scope of Exemptions:*** Both the House and Senate bills will allow potentially millions of vehicles to be deployed into the public domain that are exempt from existing critical Federal Motor Vehicle Safety Standards (FMVSS). Providing broad statutory exemptions from the FMVSS for AVs is both unnecessary and unwise. There is already a statutory process in place for manufacturers to seek an exemption from the FMVSS. Moreover, Section 24404 of the Fixing America's Surface Transportation (FAST) Act[84] permits auto manufacturers to test or evaluate an unlimited number of vehicles exempt from one or more of the FMVSS.[85] Additionally, the exemption provision in current law, 49 USC Section 30113(a), provides that manufacturers may receive an exemption from compliance with the FMVSS for the sale of 2,500 vehicles to be sold in the United States in any 12-month period. No evidence has been presented to show that the development and deployment of AVs requires wholesale exemptions for an untold number of AVs from federal safety standards that are essential to protecting public safety.
- ***Prohibit Crashworthiness and Occupant Protection Exemptions:*** Exemptions from crashworthiness or occupant protection standards which protect the vehicle's passengers must be prohibited. Such exemptions can diminish the level of occupant protection that

has been established through years of research under the existing regulations.[86] Prohibiting such exemptions will in no way inhibit the development of AV technology but will ensure that passengers of AVs are properly protected in a crash. The House bill only temporarily limits these types of exemptions and the Senate bill does not at all prohibit them.

- ***Maintain Current Law Restricting Manufacturers Ability to Turn Vehicle Systems Off:*** Federal law prohibits manufacturers from rendering safety systems, such as the steering wheel and brake pedals, inoperable. A provision in the Senate bill that would allow automakers to turn off safety systems while the AV is being driven by the computer could unnecessarily dilute safety at the discretion of the manufacturer and sets a precedent of Congress allowing manufacturers to unilaterally circumvent many of the existing safety standards.
- ***Require Sufficient Documentation in NHTSA Submission:*** Both bills require manufacturers of AVs and AV technology to file a submission with NHTSA that details the development of the technology and its expected performance in real world conditions. While Advocates supports the mandatory submission of such information, in the absence of a legislative directive that sufficient documentation and data be included, manufacturers are permitted to continue submitting slick marketing brochures such as those already released by four manufacturers.[87] Moreover, these submissions must be made available to the public as well as provide detailed information so that consumers, researchers and NHTSA are able to accurately evaluate the safety of the technology.
- ***Provide for Adequate Consumer Information:*** At a minimum, every manufacturer should be required to provide consumers with information about the capabilities, limitations and exemptions from safety standards for all vehicles sold in the U.S. at the

time of sale. This information should be made available to consumers from day one, even before NHTSA issues a rule. NHTSA should also be required to establish a public website with basic safety information about AVs for consumers and for use in safety research. This online database would be similar to the safercar.gov website that NHTSA maintains to inform the public about safety recalls applicable to their vehicle. This would enable consumers to enter their VIN to obtain relevant information about their AV such as the level of automation, any exemptions granted by NHTSA from the FMVSS, and the operational design domain which includes limitations and capabilities of each autonomous driving system with which a vehicle is equipped. Such a database will be an important tool for consumers who purchase AVs, whether first-hand or as a pre-owned vehicle, and will also allow NHTSA and other research groups to perform independent evaluation of the comparative safety performance of AV systems.

- ***Compel AVs to Capture Necessary Crash Data:*** The NTSB in their investigation of the fatal Tesla crash in Florida noted that event data recorders (EDRs) are not required nor would current standards mandate the capturing of data needed to evaluate the performance of AVs. It is currently not required that this critical safety data generated by AVs will be recorded, shared or even provided to NHTSA and the NTSB for crash investigations. The legislation should require all crashes involving AVs be reported immediately to NHTSA by manufacturers.
- ***Direct Final Rules for Minimum Performance Standards:***
    - ***Cybersecurity:*** A failure to adequately secure AV systems and to protect against cyber-attacks could endanger AV passengers, non-AV motorists, pedestrians, bicyclists and other vulnerable roadway users. It could also clog roads, stop the movement of goods and hinder the responses of emergency vehicles. The real

possibility of a malevolent computer hack impacting hundreds or thousands of AVs, perhaps whole model runs, makes strong cybersecurity protections a crucial element of AV design. Yet, the House and Senate legislation merely requires manufacturers to have a cybersecurity plan in place with no minimum standards of protection or effectiveness. Instead, NHTSA should be required to establish a minimum performance standard to ensure cybersecurity protections are required for AVs of all levels. Considering the recent record of high-profile cyber-attacks,[88] allowing manufacturers merely to have a cybersecurity plan is grossly inadequate to ensure that AVs are protected against potentially catastrophic cyber-attacks and breaches.[89]

- ***Driver Distraction:*** In AVs that require a human to take control from the AV system (Levels 2 and 3), the automated driving system must keep the driver engaged in the driving task. Research demonstrates that even for a driver who is alert and performing the dynamic driving task, there is a delay in reaction time between observing a safety problem and taking appropriate action.[90] For a driver who is disengaged from the driving task during autonomous operation of a vehicle, that delay will be longer because the driver must first be alerted to re-engage, understand the situation, and then take control of the vehicle before taking appropriate action. The failure of the automated driving system to keep the driver engaged in the driving task during the trip was identified as a problem by the NTSB Florida Tesla crash investigation. The NTSB found that the Tesla "Autopilot" facilitated the driver's inattention and overreliance on the system, which ultimately contributed to his death.[91] The "Autopilot" was active for 37 minutes of the 41 minute trip and the system detected hands on the steering wheel

only 7 times for a total of 25 seconds.[92] The NTSB also found that these problems are widespread across manufacturers with similar systems.[93] The House and Senate legislation fails to address this serious safety problem, yet technology to discern distraction and provide alerts is already available. NHTSA should be directed to establish a minimum performance standard to ensure driver engagement throughout the trip.

- ***Electronics Systems:*** Motor vehicles and motor vehicle equipment are powered and run by highly complex electronic systems and will become even more so with the future deployment of autonomous driving systems. Interference from non-safety systems can affect the electronics that power safety systems if they share the same wiring and circuits. For example, in one reported instance a vehicle model lost power to its dashboard lights when an MP3 player was plugged in and used.[94] Similar to FAA requirements to protect the electronics and their functions in aircraft under any foreseeable operating condition,[95] NHTSA should require minimum performance standards for the electronics in all motor vehicles, particularly AVs. However, the House and Senate bills fail to direct NHTSA to develop and issue performance standards for the electronics systems of modern motor vehicles.
- ***AV "Vision Test":*** In order for an AV to properly interact with its surrounding environment, it must not only detect other vehicles and roadway infrastructure but also other participants using our Nation's transportation systems including pedestrians, bicyclists, wheelchair users, construction workers in work zones, first responders providing assistance after crashes, and law enforcement officers directing traffic. A failure to properly detect and react to any of these could have

tragic results. AVs and automated driving systems must be subject to objective testing to ensure that they properly detect other road users, as well as pavement markings and infrastructure, can correctly identify the type of object that has been detected, and can then also respond properly and safely. Therefore, the legislation should direct the Secretary of Transportation to conduct a rulemaking proceeding to require automated driving systems, including SAE Level 2 automated driving systems, to meet a minimum performance standard for detecting and reacting to the AV's driving environment.

- ***Safety and Accessibility for Underserved Communities, Especially People with Disabilities:*** According to the most recent U.S. Census, there are 56.7 million people with disabilities in the United States.[96] In a given year, about 3.6 million Americans miss at least one medical trip for lack of transportation. They are disproportionately female, older and of limited means.[97] Therefore, the long-term promise of AVs to improve access to mobility is significant. However, there is no requirement in either bill that AVs will be safe and accessible to all members of the disability community who have varying needs. In addition, there are a number of lawsuits pending against ridesharing companies in major metropolitan areas such as New York City, San Francisco and Washington D.C. for their failure to provide sufficient accessibility for wheelchair users.[98]
- ***Include Level 2 AVs:*** For all intents and purposes, the legislation fails to regulate SAE Level 2 AVs, which require a human driver to monitor their performance and be available to take over the driving task when necessary, like the Tesla vehicles which have been involved in several crashes. During a September 12, 2017, hearing on the 2016 crash conducted by the NTSB, deadly failures of Tesla's Level 2 "Autopilot" system

were readily identified.[99] The NTSB found that similar problems also exist in other Level 2 AVs across many manufacturers.[100] In the near term, Level 2 AVs will likely comprise a majority of the passenger vehicle AV fleet. Proper safeguards to curb Tesla-like failures must be put in place. Level 2 AVs should be subject to all safety critical provisions in the bills.

- ***Do Not Preempt State Action in the Absence of Federal Regulations:*** It is the statutory mission of NHTSA to regulate the design and performance of motor vehicles to ensure public safety which, in modern day terms, includes AVs and automated driving system technology. However, in the absence of comprehensive federal standards and regulations to govern the AV rules of the road, the states have every legal right, indeed a duty to their citizens, to fill the regulatory vacuum with state developed proposals and solutions for ensuring public safety. Both bills prohibit this state action.

U.S. DOT Requires Sufficient Funding and Authority to Properly Regulate Vehicle Safety

As emerging technologies are developed and deployed, the U.S. DOT is already facing and will continue to confront unique challenges which warrant additional tools and funding to protect against potentially catastrophic defects and failures. NHTSA should be granted imminent hazard authority to expedite the grounding of vehicles that the agency has identified as having a potentially dangerous, widespread problem or when it detects a cybersecurity threat that could lead to inordinate crashes, deaths and injuries. Additionally, because of the potential serious nature of software defects that could imperil safety in thousands of vehicles, the ability to levy enhanced penalties is essential. The unacceptable level of current motor vehicle crashes, fatalities and injuries combined with the demands being placed on NHTSA with regard to AV technology necessitates an increase in agency funding.

Today, 95 percent of transportation-related fatalities and 99 percent of transportation injuries involve motor vehicles on our streets and highways.[101] Yet, NHTSA receives only one percent of the overall DOT budget.[102] NHTSA will be required to take on new significant responsibilities under the driverless car legislation. In order to efficiently execute all of these tasks, an office dedicated to AV safety should be established within NHTSA. The protection of public safety should not be compromised and progress should not be slowed because the agency does not have adequate technical expertise, organization, resources and funding to oversee the development and deployment of AVs.

Many Significant Obstacles and Uncertainties Remain Regarding the Safe Deployment of Autonomous Vehicles

AVs will be operating on public roads, therefore ensuring that our Nation's infrastructure can accommodate the safe and successful deployment of AVs is essential. "Stand-alone" AVs (those that will not communicate with other vehicles or infrastructure) will be limited by the capability of the on-board sensors and therefore, will largely suffer from the same types of sensing limitations that afflict human drivers such as not being able to see around a corner or past a vehicle.

Claims made by the AV industry that the introduction of these vehicles will reduce congestion, improve environmental quality, and advance transportation efficiency may amount to nothing more than fanciful theories.[103] Instead, AVs may bring about so-called "hyper-commuters" who work from their vehicles on long commutes thereby making living further from offices and/or city centers more palatable. Likewise, the possibility of empty AVs adding substantial miles on the roads as they re-position autonomously after dropping off riders could undermine many of

the benefits claimed.[104] In fact, a recent study has demonstrated ridesharing services have increased congestion in some of America's largest cities.[105] And, New York City has placed a temporary cap on the new licenses for ride-hailing vehicles while the city conducts a study of the implications of these services. Moreover, AVs share many of the same characteristics, and will likely be used as, ridesharing services at least during their introduction.[106]

With the advent of AVs, more emphasis must be placed on consistency of road design, and consideration must be given to the effects variations can have on autonomous technology. While a human driver can see a unique situation and interpret those circumstances fairly well, an AV may not be able to do the same. Research has already shown that minor distortion of a sign can result in havoc for AVs, causing stop signs to be interpreted as speed limit signs, a confusion which can have serious and even potentially fatal results.[107] Additionally, roadway deterioration and delayed repair, which are common occurrences on existing infrastructure, will have a negative impact on AV operation.

Autonomous and Connected Trucks

The emergence of experimental autonomous commercial motor vehicles (ACMVs) and their interactions with conventional motor vehicles demand an enhanced level of federal and state oversight to ensure public safety. It is imperative that CMVs be regulated. For the foreseeable future, regardless of their level of automation, ACMVs must have an operator with a valid commercial driver's license in the vehicle at all times. In addition, important safety regulations administered by the Federal Motor Carrier Safety Administration (FMCSA) such as those that apply to driver hours-of-service, licensing requirements, entry level training and medical qualifications must not be weakened.

Advocates is also concerned with a number of issues presented by truck platooning. In order to achieve any efficiency benefits, the trucks in a platoon must operate much closer together than is current practice. This presents very real safety concerns. Issues such as vehicle maintenance may hamper the ability to execute these types of operations outside of controlled experiments. In real-world scenarios, realities of brake and tire maintenance as well as vehicle loading can all affect handling capability. Currently, one in five heavy vehicles inspected at the roadside are placed out of service for vehicle issues, a large number of which are related to brakes or tires.[108] Moreover, until the first vehicle in a platoon is operated by a verifiably safe automated driving system, the safety of the platoon relies on the lead human driver. There are also questions concerning the interaction of platoons with other road users, including the ability of other vehicles to pass a platoon safely or navigate between them to reach an exit or to enter a road safely.

Rural Considerations

There are many unique transportation characteristics present in rural America that will affect the performance of, and access to, emerging technologies. Necessary infrastructure such as broadband connectivity and up-to-date mapping may be limited. Maintenance of roadway markings, signs and pavement may vary. Unpaved roads in rural areas could increase sensor fouling which could degrade or prevent safe operation. More consideration must be given to this complex issue before AVs can be deployed on a large scale.

Conclusion

Every day on average 100 people are killed and 6,500 more are injured in motor vehicle crashes in the U.S. Advocates has consistently promoted proven technology to reduce this unacceptable death and injury toll. Available crash avoidance systems, such as automatic emergency braking (AEB), that have already been shown to have substantial public safety benefits should be required as standard equipment in all new vehicles. In addition, emerging technologies that hold promise for curbing preventable deaths and injuries should be fostered and advanced. Some of these innovative developments are the building blocks for autonomous technology which hold the potential to make significant and lasting reductions to this public health epidemic. However, AVs should not be prematurely deployed and sold before they can be safely operated on public roads and without commonsense government oversight in place. Serious and fatal crashes involving AVs which have already occurred reveal significant flaws in this still developing technology. In sum, the path to the safe and effective introduction of AVs requires government oversight, transparency and a comprehensive regulatory framework in all aspects from vehicle standards to infrastructure design.

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Innovation in Surface Transportation

Statement of the American Road & Transportation Builders Association

Submitted to the United States House of Representatives Committee on Transportation and Infrastructure Subcommittee on Highways and Transportation

September 5, 2018

Chairman Graves, Representative Holmes-Norton, and members of the subcommittee, the American Road & Transportation Builders Association (ARTBA) greatly appreciates you convening today's hearing on the topic of innovation in surface transportation.

The topic of innovation in the transportation arena in recent years has largely focused on the deployment of technology in operational areas. These discussions have ranged from autonomous and connected vehicles, to real-time traveler information, to intelligent transportation systems, and congestion management strategies. Unfortunately, the role of innovation specific to the infrastructure that supports these operational activities is often overlooked. Even more disturbing is the fact that existing federal regulatory policy actively inhibits the type of innovation that is the focus of today's hearing.

Federal Highway Administration (FHWA) regulatory barriers have long precluded the use of patented and proprietary products and processes from being an eligible activity for federal highway funds. This policy is not only substantively flawed, as this testimony will demonstrate, but it is also out of step with the practices of other federal agencies that actively embrace the type of technological and procedural expertise that warrant intellectual property protections.

ARTBA strongly supports the further deployment of new technology and processes to ensure the operation of the nation's surface transportation system is as safe and efficient as possible. It is inconceivable, however, that these same objectives do not apply to the infrastructure networks without which operational advances would be meaningless.

Deploying innovation, technology and process improvements to deliver transportation projects in a safer, less costly, and faster manner has been a major U.S. Department of Transportation (U.S. DOT) priority for more than 20 years. The Bush Administration initiated its Highways for LIFE Program in 2004 to "Creat[e] a culture within the highway community that invites innovation and rapidly adopts new practices…to get things done better, faster, safer and cheaper." The Obama Administration launched Every Day Counts (EDC) in 2010 "to identify and rapidly deploy proven but underutilized innovations to shorten the project delivery process, enhance roadway safety, reduce congestion and improve environmental sustainability."

In contrast to these well intentioned and meaningful efforts, a century plus-old regulation (23 CFR 635.411 or the "proprietary products rule") prohibiting the expenditure of federal highway funds on proprietary products remains a fixture of FHWA policy. Since many new technologies — particularly those that mark a significant advance in quality, performance, or durability — incorporate intellectual property protected by patents or proprietary processes, 23 CFR 635.411 inevitably impedes the development and deployment of those same innovations that various congressional and U.S. DOT/FHWA initiatives are intended to foster.

The Benefits of Patented Products

Patents or proprietary products can bring about innovation, opportunity and competition. As noted in a recent joint report from the Economic and Statistics Administration and the U.S. Patent and Trademark Office: "Innovation protected by IP rights is key to creating new jobs and growing exports. Innovation has a positive pervasive effect on the entire economy, and its benefits flow both upstream and downstream to every sector of the U.S. economy." Furthermore, the report notes the following significant points about the impact that Intellectual Property (IP) has on the overall economy:

- By focusing on relevant data and various statistical measures, this report identified 75 industries (from among 313 total) as IP-intensive. These IP-intensive industries directly accounted for 27.1 million American jobs, or 18.8 percent of all employment in the economy, in 2010.

- IP-intensive industries accounted for about $5.06 trillion in value added, or 34.8 percent of U.S. gross domestic product (GDP), in 2010.

It is also important to point out that when a state outright disallows a patented or proprietary product, they may be preventing a transformative solution to a serious problem from taking place in a timely manner. For example, every great paradigm shift in the bridge world originated from a patented idea or IP, generally marketed as a proprietary product. 23 CFR 635.411, and its current implementation, prohibits innovation and agencies may be forced to settle for products that perform marginally at best which is absolutely contrary to public expectations, the safety and efficiency needs of the U.S. surface transportation network and the goals of the U.S. IP system.

The Fallacy of Competition

23 CFR 635.411 is predicated on preserving competition, but ensuring a level playing field should not be dominated by a pursuit of the lowest common denominator or glorification of the status quo. Inhibiting the opportunity for innovation on federal-aid highway and bridge construction projects ultimately serves to squelch competition and favors protection. Further, it is contradictory to the very intent of the patent system as defined in Article 1, Section 8, of the United States Constitution, which states:

> *"The Congress shall have Power...To promote the Progress of Science and useful Arts, by securing for limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries."*

The goal of any true commercial competition should be to identify and reward a product, process or service that is the best. If a patented or proprietary product is not better than its competition or its cost outweighs its benefits, it will not be rewarded in the marketplace. However, this determination should be made through competition—not regulation.

The goal of federal highway policy should be to deliver the safest, most efficient, and fiscally responsible highway and bridge network possible. Achieving that goal must include a thoughtful assessment of technological and other advances to ensure infrastructure development strategies are in fact delivering the best possible outcome as opposed to the widest achievable outcome. The practical effect of the existing proprietary and patented products rule, however, impedes that process and can potentially deny the travelling public a better service.

It should also be pointed out that repealing 23 CFR 635.411 does not mandate that any specific product or process be used on a transportation construction project. Rather, it removes a prohibition preventing states from considering all of their possible options and gives states the flexibility to determine which products are the best fit for their own unique transportation needs. The ability to consider all products and processes, regardless of whether or not they are patented or proprietary, is essential to competition as it is the only way to ensure the best possible product is chosen. Alternatively, prohibiting a specific product beforehand renders any true competitive analysis incomplete.

23 CFR 635.411 is an Impediment to Innovation

There must be a middle ground between preventing unfair or illegal contracting practices and allowing new technologies, practices and products to be utilized in federal-aid highway and bridge construction. Right now, however, the current regulation errs heavily on preserving a one-sided definition of competition. Ideally 23 CFR 635.411 should be repealed and states should be given the flexibility to decide whether or not to use proprietary products on federal-aid eligible projects. Alternatively, FHWA should consult with other federal agencies (Department of Defense (DOD) and the National Aeronautics and Space Administration (NASA)) to determine how they strike a balance between ensuring competition while taking full advantage of innovations.

For example, a 2014 U.S. Government Accountability Office report found in FY 2013 the DOD awarded contracts for about $308 billion for products and service, of which 43 percent was awarded without competition through a process known as "class justifications" that detail in writing the exception to full and open competition. According to the report, "About 90 percent (59 of 65) of the class justifications in our sample cited only one responsible source as the exception to competition, generally because the contractor's ownership of proprietary technical data or expertise prevented the ability to compete for the contract."

This example demonstrates two key revelations regarding FHWA's proprietary products rule. First, the DOD clearly recognizes the value derived from utilizing advanced technological and operational expertise. Second, other federal agencies have learned how to protect the public interest on their quest to deliver the highest quality product possible. Both of these realities demonstrate the antiquated nature of the FHWA regulation.

Inconsistent Application among the States

One of the biggest hurdles with the implementation of 23 CFR 635.411 is that states can have different processes in terms of utilizing the exceptions under the rule. For example, some states may require a moderate level of documentation for an exemption from the rule while others may require much more. Furthermore, the FHWA has encouraged the use of proprietary products through EDC, such as Ultra-High Performance Concrete, but some FHWA regional offices still insist an exemption or "Public Interest Finding" (meaning use of the product has been found to be in the public interest) is necessary to deploy this product. These inconsistencies and the perceived resistance at both the state and federal level to utilizing proprietary and patented products reinforce the existing rule is not workable.

States may petition an FHWA Division Administrator for an approval that it is in the public interest to allow the contracting agency to require the use of a specific material or product even though other equally acceptable materials or products are available. Unfortunately, many states are reluctant to initiate such a process due to concerns about personnel time and increased cost. Unwillingness to seek out improvements to the status quo can deny the public needed improvements in roadway safety and more durable transportation infrastructure facilities.

ARTBA's Petition to Repeal 23 CFR 635.411

ARTBA submitted a March 27 petition to FWHA formally requesting the repeal of 23 CFR 635.411. The ARTBA petition has been attached to this statement for the subcommittee's reference.

ARTBA's filing points out that since many new technologies incorporate intellectual property, "the rule has inevitably impeded the development and deployment of products from the market that could save lives, minimize congestion or otherwise improve the quality of our nation's highways." It cites examples including the use of composite materials and disc bearings for bridges, moveable traffic barriers, higher visibility signage and breakaway sign posts.

The association's petition argues the rule was not directed by the governing statute, the 1916 Federal-Aid Road Act, nor was it ever subject to the Administrative Procedures Act's rigorous

public notice and comment requirements. It further notes there does not appear to be any factual record or official federal proceedings to support an objective rationale for the rule.

ARTBA also reiterated other federal agencies, including the U.S. Department of Defense, the Coast Guard and the NASA, have set up procurement systems that allow for the appropriate use of sole source contracts for patented or proprietary products to accomplish their missions.

While FHWA's response to our petition has not yet been addressed, we appreciate the ongoing dialogue the agency has engaged in with stakeholders on this important topic.

Conclusion

The goal of federal transportation policy should be to promote innovation and enable ideas and products aimed at building a better transportation network as efficiently as possible—not to protect the status quo. While U.S. DOT is to be commended for moving in the right direction in a number of areas, the proprietary products rule is an antiquated regulation that has no place in today's marketplace of ideas and needs to be corrected as soon as possible.

ARTBA would like to thank the committee for the opportunity to be heard on the issue of innovation in surface transportation. As part of the committee's further efforts on this issue, we urge you to closely examine 23 CFR635.11 and pursue legislative efforts to repeal this regulation as you move towards a federal direction that promotes, rather than stifles, the use of innovative products and techniques in the transportation infrastructure market.

BEFORE THE U.S. DEPARTMENT OF TRANSPORTATION AND
THE FEDERAL HIGHWAY ADMINISTRATION

PETITION FOR RULEMAKING TO REPEAL THE
PROPRIETARY AND PATENTED PRODUCTS RULE
23 CFR 635.411

SUBMITTED BY
AMERICAN ROAD & TRANSPORTATION BUILDERS
ASSOCIATION

ON

March 27, 2018

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I. Introduction and Summary

On behalf of its more than 7,500 members, the American Road and Transportation Builders Association ("ARTBA")[1] submits this petition to the Federal Highway Administration ("FHWA") for a rulemaking to repeal the proprietary and patented products rule (23 CFR 635.411, the "Rule"). The Rule—a relic of the early 1900s—prohibits state contracting agencies from using federal funds to acquire patented or proprietary materials, products, or services, except under certain limited circumstances. In doing so, the Rule discourages industry and state contracting agencies from developing and deploying products that could save lives, minimize congestion, and otherwise improve the quality of our nation's highways.

As Secretary Chao explained at her Senate confirmation hearing, "Our country's transportation infrastructure is the underpinning of our world-class economy," but this benefit is increasingly "jeopardized by infrastructure in need of repair, the specter of rising highway fatalities, growing congestion, and by a failure to keep pace with emerging technologies."[2] Of particular concern, road fatalities have increased at an alarming rate after decades of decline. According to estimates from the National Safety Council ("NSC"), there were 40,100 motor-vehicle deaths in 2017, a 1% decrease from its 2016 estimates, but a 6% increase from 2015.[3]

Similarly, the National Highway Traffic Safety Administration ("NHTSA") found that 37,461 people died in motor vehicle crashes in 2016, an increase of 5.6% over the prior year, and

[1] ARTBA's membership includes private and public sector members that are involved in the planning, designing, construction, and maintenance of the nation's roadways, waterways, bridges, ports, airports, rail, and transit systems. Our industry generates more than $380 billion annually in U.S. economic activity and sustains more than 3.3 million American jobs.

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[3] NSC Motor Vehicle Fatality Estimates, Prepared by the Statistics Department National Safety Council, (December 2017) available at http://www.nsc.org/NewsDocuments/2018/December_2017.pdf.

an increase of 14.4% since 2014.[4] The U.S. Department of Transportation ("DOT") estimates that motor vehicle crashes alone cost our country $242 billion a year (the NSC estimates $413.8 billion in costs for 2017).[5] And while there are new products on the market that could help address these harms, state contracting agencies are discouraged from acquiring and deploying them on our nation's highways, *all because of a regulation first implemented in 1916 by the Secretary of Agriculture.*

The Rule is a prime example of a misguided regulation that impedes safety, quality, competitiveness, and innovation in the transportation industry, but has nevertheless survived for decades under prior Administrations. The Trump Administration has made clear that this type of regulation is no longer viable: "[e]very regulation should have to pass a simple test: Does it make life better or safer for American workers or consumers? If the answer is no, we will be getting rid of it and getting rid of it quickly."[6] The Rule fails this basic test—it effectively deters state contracting agencies from acquiring the safest and most advanced products and services, while simultaneously discouraging industry from developing new, innovative products and technologies.

For these reasons, and as explained in greater detail below, ARTBA respectfully requests that the FHWA follow the Administration's directive and open a rulemaking to repeal the Rule (a process that will also assist the FHWA in carrying out the President's Executive Order 13771, which directs agencies to eliminate two rules for every new rule promulgated).

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[4] Insurance Institute for Highway Safety, Yearly Snapshot, available at http://www.iihs.org/iihs/topics/t/general-statistics/fatalityfacts/overview-of-fatality-facts. According to the NSC, its figures are not comparable to NHTSA figures. NSC counts both traffic and non-traffic deaths that occur within a year of the accident, while NHTSA counts only traffic deaths that occur within 30 days.

[5] *Id. See also* NSC Motor Vehicle Fatality Estimates, Prepared by the Statistics Department National Safety Council, (December 2017) available at http://www.nsc.org/NewsDocuments/2018/December_2017.pdf.

[6] Remarks by President Trump at Signing of Executive Order on Regulatory Reform, Oval Office, (Feb. 24, 2017).

II. Why the Petition is Needed — Our Nation's Highways Face Significant Challenges that Require Innovative Solutions

The U.S. faces serious challenges on our nation's highways, including rising fatalities, increasing congestion, and an infrastructure in need of repair and improvement. Recognizing these challenges, the Trump Administration and Secretary Chao have committed the DOT to improving safety by eliminating "unnecessary, duplicative or seldom used regulations from the regulatory agenda, so we can ensure that resources are spent on actually improving safety, rather than paperwork exercises."[7] Unfortunately, the Rule, as explained in greater detail in Section III, stands in the way of solving these critical challenges.

A. Safety on Highways Continues to Present Significant Challenges

During the first decade of the 21st century, over 400,000 people died on America's roadways, while 25 million suffered life-altering injuries.[8] Such incidents have had a profound impact, not only on those injured, but also on their families and communities.[9] Even more concerning, after years of declining rates, the number of motor vehicle fatalities has increased at an alarming rate the past few years.

According to preliminary estimates from the NSC, there were 40,100 motor-vehicle deaths in 2017, marking "the second consecutive year the annual fatality total has been around 40,000 after having not reached this level since 2007."[10] Similarly, NHTSA data for 2016 shows a total of 37,461 people died in motor vehicle crashes, a 5.6% increase in deaths compared with 2015,

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[7] Remarks by U.S. Secretary of Transportation Elaine L. Chao at Western Governors Association Winter Meeting, Phoenix Arizona, (Dec. 2, 2017).

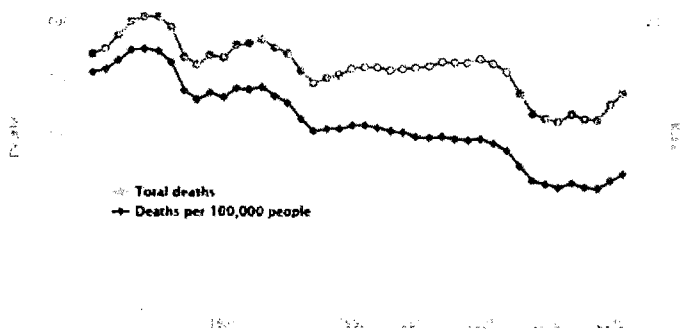
[8] DOT Roadway Safety Plan, available at https://www.transportation.gov/policy/transportation-policy/dot-roadway-safety-plan.

[9] *Id.*

[10] NSC Motor Vehicle Fatality Estimates, Prepared by the Statistics Department National Safety Council, (December 2017) available at http://www.nsc.org/NewsDocuments/2018/December_2017.pdf.

and the highest number of traffic deaths since 2007.[11] NHTSA has reported that the rate of motor vehicle fatalities per 100,000 people is at its highest level since 2009.[12]

Fig. 2 NHTSA Data on Motor Vehicle Crash Deaths and Deaths Per 100,000 People[13]



According to NHTSA, the number of vehicle miles traveled on U.S. roads in 2016 increased by 2.2%, and resulted in a fatality rate of 1.18 deaths per 100 million VMT—a 2.6% increase from the previous year.[14] Fatalities increased from 2015 to 2016 in almost all segments of the population—passenger vehicle occupants, occupants of large trucks, pedestrians, pedal cyclists, motorcyclists, alcohol-impaired driving, male/female, and daytime/nighttime.[15]

[11] National Center for Statistics and Analysis, 2016 Fatal Motor Vehicle Crashes: Overview, Report No. DOT HS 812 456, (Oct. 2017).

[12] DOT National Highway Traffic Safety Administration, *Quick Facts 2016*, Report No. DOT HS 812 451, (Oct. 2017); *See also* NHTSA Fatality Analysis Reporting System, Data Tables Summary.

[13] Insurance Institute for Highway Safety, Highway Loss Data Institute, *General Statistics 2016*, Citing FARS, (Dec. 2017) available at http://www.iihs.org/iihs/topics/t/general-statistics/fatalityfacts/overview-of-fatality-facts.

[14] National Center for Statistics and Analysis, *2016 Fatal Motor Vehicle Crashes: Overview*, Report No. DOT HS 812 456, (Oct. 2017).

[15] *Id.*

B. Our Highway Infrastructure is in Need of Repair and Expansion

The Trump Administration has warned repeatedly that "American infrastructure has fallen behind due to years of inaction and a broken permitting system."[16] According to the White House, "[o]ne out of every five miles of U.S. highway pavement is in poor condition," "[o]ne third of America's bridges are 50 years or older," and Americans spend on average 42 hours per driver a year stuck in traffic. To address these challenges, the President continues to push for the "safe, fast, reliable, and modern infrastructure our economy needs and our people deserve."[17]

Specifically, the Trump Administration has called for more "efficient and effective federal infrastructure decisions" to address the "poor" condition of our current infrastructure.[18] In his State of the Union Address, President Trump called out the regulatory burdens limiting our ability to address infrastructure challenges: "We built the Empire State Building in just 1 year — is it not a disgrace that it can now take 10 years just to get a permit approved for a simple road?"[19] Similarly, in a speech on August 15, 2017, the President explained that the approval process for building a routine highway requires "builders [to] get up to 16 different approvals involving nine different federal agencies governed by 29 different statues."[20] The President has further warned that these

[16] President Donald J. Trump Will Rebuild American Infrastructure and Forge a Path Towards Greater Prosperity, Facts Sheet, (Jan. 30, 2018).

[17] President Donald J. Trump's State of the Union Address, (Jan. 30, 2018).

[18] Presidential Executive Order on Establishing Discipline and Accountability in the Environmental Review and Permitting Process for Infrastructure, (August 15, 2017) available at https://www.whitehouse.gov/presidential-actions/presidential-executive-order-establishing-discipline-accountability-environmental-review-permitting-process-infrastructure.

[19] President Donald J. Trump's State of the Union Address, (Jan. 30, 2018).

[20] Remarks by President Trump on Infrastructure, (Aug. 15, 2017). Similarly, the FHWA has recognized the need for "modernizing bridges and roads through better materials, new construction techniques, and consistent quality control . . . ." Federal Highway Administration Research and Technology Agenda, Meeting the Challenge: Infrastructure, (visited Feb. 8, 2018) available at https://www.fhwa.dot.gov/research/fhwaresearch/agenda/researchareas.cfm?urlanchor=infrastructure#.

challenges "not only . . . cost our economy billions of dollars but . . . also den[y] our citizens the safe and modern infrastructure they deserve."[21]

More recently, in February, the President released the outline of his proposed Infrastructure Plan to "rebuild [the nation's] failing infrastructure and develop innovative projects."[22] The Plan calls for the "[e]liminat[ion] of regulatory barriers" to provide "needed flexibility for projects to be developed and managed effectively and efficiently."[23] This desire for regulatory reform is a pillar of the President's Infrastructure Plan, which notes that excessive federal regulation can "impede creativity, add costs, and slow down the process"[24] of delivering projects.

III. The Proprietary and Patented Rule is a Roadblock to Achieving the Administration and Department's Safety and Infrastructure Goals

Despite the alarming increase in fatalities on our roads, and the clear need to augment highway infrastructure, the FHWA is burdened with a 102 year-old rule that discourages industry and state contracting agencies from deploying the most innovative and efficient products and services.

Specifically, 23 CFR 635.411 prohibits state contracting agencies from using federal funds for patented or proprietary materials, specifications, or processes unless (1) the item is purchased or obtained through competitive bidding with equally suitable unpatented items; (2) the contracting agency certifies either that the proprietary or patented item is essential for synchronization with the existing highway facilities or that no equally suitable alternative exists; or (3) the item is used for research or for a special type of construction on relatively short sections of road for

[21] Remarks by President Trump on Infrastructure, (August 15, 2017).

[22] Building a Stronger America: President Donald J. Trump's American Infrastructure Initiative, Press Release, (Feb. 12, 2018).

[23] *Id.*

[24] Building a Stronger America, Department of Transportation - Briefing Room, (Feb. 12, 2018) available at https://www.transportation.gov/briefing-room/building-stronger-america.

experimental purposes. Since many new technologies—particularly those that mark a significant advance in quality, performance, or durability—incorporate intellectual property, the Rule inevitably impedes the development and deployment of products from the market that could save lives, minimize congestion, and otherwise improve the quality of our nation's highways.

As explained in this section, there are ample legal and policy reasons why repealing the Rule would benefit the public and help achieve the government's stated goals of improving safety and our nation's highway infrastructure. In this regard, President Trump has directed that regulations that do not make life better or safer for American workers or consumers should be gotten rid of and gotten rid of quickly.[25] And President Trump and the DOT have both stated a goal to empower local jurisdictions, such as by "enhancing State and local participation in safety planning processes."[26] Repealing the Rule will help accomplish these objectives.

A. The History of the Rule Demonstrates its Lack of a Valid Basis

The Rule was first adopted by the Secretary of Agriculture in 1916 in response to the Federal Aid Road Act of 1916 (the "Act").[27] While the Act has been superseded by many other funding statutes, the Rule has remained in place, even though it rested on questionable legal footing from the beginning and was subject to heated (and, as it turned out, accurate) criticism that it would stifle competition and inhibit the development of the best products and services.

Following passage of the Act in 1916, the Department of Agriculture, then in charge of the nation's highways, began drafting regulations to govern implementation of the federal aid program. On February 6, 1917, representatives of the Department of Agriculture addressed the

[25] Remarks by President Trump at Signing of Executive Order on Regulatory Reform, Oval Office, (Feb. 24, 2017).

[26] *Id.*

[27] Creation of a Landmark: The Federal Aid Road Act of 1916 by Richard F. Weingroff and various news reports from 1916.

American Road Builders' Association ("ARBA")[28] to explain the new rules and regulations.[29] One of these rules, "Section 4," effectively barred state contracting agencies from using federal funds to acquire proprietary or patented products:[30]

> "No part of the money apportioned under the act shall be used directly or indirectly to pay or to reimburse a state, county or local subdivision for the payment of any premium or royalty on any patented or proprietary material, specification, process, or type of construction, unless purchased or obtained on open, actual competitive bidding at the same or a less cost than unpatented articles or methods equally suitable for the same purpose."

During the drafting phase of the regulations, the Department of Agriculture shared an early copy of the proposed rules with the American Association of State Highway Officials ("AASHO"),[31] which unanimously voted to advise the Department to remove the proposed Section 4 rule.[32] AASHO, however, was informed by the Department "that it would have to stay in spite of that body's previous unanimous vote advising its omission."[33]

When the Rule was presented to ARBA in its final form, the state officials and private industry representatives present at the meeting immediately questioned the legal basis and wisdom of the Rule. According to the Department of Agriculture, the Rule was designed to require open competition in procurements using federal funds.[34] The Act, however, did not reference proprietary or patented products or otherwise direct the Department of Agriculture to restrict their use in procurements. One of the state officials present at the ARBA presentation read a paper from an

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[28] The "ARBA" became the American Road & Transportation Builders Association in 1977.

[29] *Id.* at 85.

[30] Section 6 of the 1916 Act provided that "construction work and labor in each State shall be done in accordance with its laws, and under the direct supervision of the State Highway Department, subject to the inspection and approval of the Secretary of Agriculture and in accordance with the rules and regulations made pursuant to this act."

[31] The predecessor organization of the American Association of State Highway and Transportation Officials.

[32] Creation of a Landmark: The Federal Aid Road Act of 1916 by Richard F. Weingroff at 87.

[33] *Id.*

[34] *Id.* at 86-88.

AASHO committee member who helped draft the underlying Act and wanted to file a "solemn protest" against the Rule.[35]

According to the paper, the Rule presented a host of legal and practical problems:

- ***The Rule overstepped the Secretary of Agriculture's authority*** – "The legality of the regulation has been questioned. It is asked whence the Secretary of Agriculture derives the power he proposes to exercise. This question can be well left to those better qualified to discuss it. That it can be raised at all is unfortunate. It is always regrettable for a leader to so perform his duties as to raise doubts in the minds of those under him as to the legality of his actions. Nothing is more subversive of discipline and co-operation."[36]

- ***The Rule was a misguided attempt to mandate competition*** – "[Mandating] competition is impossible in the case of meritorious patents under any strict interpretation of the language used. As published, the section represents the mind of the Government Officials modified by a somewhat obscure and, in execution, impracticable, proviso suggested by some of the State Officials to relieve the obvious objections to the section."[37]

- ***The practical impact of the Rule would be to bar the use of proprietary and patented products*** – "[For states,] there will be but one safe course to follow, and that is to cut out the use of anything patented. This is unfair, unprogressive, un-American, but it will be the only safe thing to do if one wants to keep cost within the appropriation, and failure to do so is generally noticed in criminal legislation."[38]

Following this protest, J. M. Head, attorney for Warren Brothers Company, a prominent contractor that held patents for bituminous concrete pavements, provided a lengthy discussion of the legislative background and reasons why the regulation involved "unjust discrimination."[39] In its defense against these various criticisms, the Department demonstrated a clear bias against private industry and the patent system, with Director Page of the Office of Public Roads and Rural Engineering explaining that "the government and the state highway departments can conduct their

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[35] *Id.* at 87.

[36] Remarks of Colonel Stevens, Better Roads and Streets, Vol. VII No. 3, (March 1917); *See also* Creation of a Landmark: The Federal Aid Road Act of 1916 by Richard F. Weingroff.

[37] *Id.*

[38] *Id.*

[39] Creation of a Landmark: The Federal Aid Road Act of 1916 by Richard F. Weingroff, at 88.

cooperative work without the advice of any patented material company. This is all I have to say."[40] Indeed, Director Page had a documented bias against patented and proprietary products, including having participated in a 1905 Office of Public Roads'[41] annual report criticizing the use of proprietary and patented materials.[42] This bias was reflected in Director Page's irritated defense of the Rule: "I think it is nothing more than fair that open competition should be required in this. When a patented material is selected, competition is closed . . . . I think it is absolutely the only stand the government can take, and as far as I am concerned I shall never recommend to the Secretary of Agriculture . . . that the regulation be rescinded."[43]

B. The Rule Continues to Suffer from Numerous Legal Deficiencies

All of the problems identified in 1916 and 1917 continue to plague the Rule — only now, the impact of these problems is greater due to the challenges facing our country's highways.

First, the Rule does not bear a reasonable relationship to the governing statute. The initial statutory authority for the Rule (the Act) did not direct the federal government to bar the use of proprietary or patented products. Those who drafted the Rule within the Department of Agriculture appear to have gone out of their way to target proprietary and patented materials. Today, according to the FHWA, the current version of the Rule is apparently based on a 1958 statute (23 USC 112)

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[40] *Id.* at 89. This comment was in response to concerns raised by J. M. Head, attorney for Warren Brothers Company, a prominent Boston-based contractor that held patents for bituminous concrete pavements known as Bitulithic.

[41] The Office of Public Roads (OPR) was changed into the Office of Public Roads and Rural Engineering in 1915.

[42] U.S. Department of Agriculture, Report of the Director of the Office of Public Roads for 1905 by Logan Waller, at 785 (Sept. 29, 1905). The report stated that "[m]any worthless road preparations have been and are at present being manufactured and sold to the public through ignorance on the part of both producer and consumer . . . . These materials are sold under trade names, and as a rule carry no valid guarantee of quality." Later, in same report Director Page expressed, "[t]here are on the market a number of patented and secret water-proofing materials, but none of these, we believe, has given satisfactory results under the varied conditions of service." *Id.* at 790.

[43] Good Roads Vol. XIII, Use of Patented Pavements on Federal Aid Roads, 123 (February 17, 1917).

that is focused on "letting of contracts."[44] Again, nothing in this statute directs the federal government to limit the ability of state contracting agencies to use federal funds to acquire proprietary and patented products for use on our nation's highways.

Second, the Rule's legal deficiencies are compounded by the fact that the Rule has, to our knowledge, never been subject to public input through a notice and comment process.[45] The overriding goal of the Administrative Procedure Act ("APA") and its notice and comment mandate is to establish procedural fairness in agency rulemaking.[46] Courts have routinely echoed this sentiment, acknowledging that the "essential purpose of according notice and comment opportunities is to reintroduce public participation and fairness to affected parties"[47] and "assure[] that the agency will have before it the facts and information relevant to a particular administrative problem, as well as suggestions for alternative solutions."[48]

Thus, notice and comment procedures serve as an important safeguard against arbitrary government action by providing the public and interested parties a chance to present evidence and their views on such proposed action, which, in turn, helps the government make a more informed decision. While we recognize the Rule was first promulgated prior to the enactment of APA's notice and comment mandate, the underlying rationale and need for these procedures to ensure

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[44] *See* FHWA Construction Program Guide, Patented and Proprietary Products, available at https://www.fhwa.dot.gov/construction/cqit/propriet.cfm.

[45] Section 553 of the Administrative Procedure Act, enacted in 1946, generally requires that, to become effective, a legislative rule must go through notice and comment rulemaking, a lengthy process in which the public is given an opportunity to comment on a proposed version of the rule and the agency responds to the comments. The public-comment process sometimes significantly influences the content of legislative rules.

[46] *See* U.S. Dep't of Justice, Attorney General's Manual on the Administrative Procedure Act, 9 (1947).

[47] *Dia Nav. Co. v. Pomeroy*, 34 F.3d 1255, 1265 (3d Cir. 1994) (citing *Batterton v. Marshall*, 648 F.2d 694, 703 (D.C.Cir.1980)). *See also Morton v. Ruiz*, 415 U.S. 199, 232, 94 S.Ct. 1055, 1073, 39 L.Ed.2d 270 (1974) ("The Administrative Procedure Act was adopted to provide, *inter alia*, that administrative policies affecting individual rights and obligations be promulgated pursuant to certain stated procedures so as to avoid the inherently arbitrary nature of unpublished *ad hoc* determinations.").

[48] *Am. Hosp. Ass'n v. Bowen*, 834 F.2d 1037, 1044 (D.C. Cir. 1987) (citing *Guardian Federal Savings & Loan Insurance Corp.*, 589 F.2d 658, 662 (D.C.Cir.1978).

fairness and rationality in rulemaking remains, especially given that the Rule was adopted under highly questionable and contentious circumstances. Granting this Petition will help protect the common-sense values of government transparency and accountability while promoting sound public policy.

Third, there does not appear to be any factual record to support the Rule, and we are unaware of any rulemaking proceeding in which the basis for the Rule has been adequately articulated. In this regard, the Rule is a relic of antiquated early 20th century views of antitrust, intellectual property, and procurement. The Department of Agriculture officials who promulgated the initial version of the Rule in 1916 demonstrated a clear bias against "materials . . . sold under trade names . . . ." Today, antitrust and intellectual property are viewed as complementary, with both playing an important role in fostering competition.

As explained by the Federal Trade Commission, patent and antitrust law "both are aimed at encouraging innovation, industry, and competition."[49] New innovations and technologies are often subject to protection under our nation's intellectual property laws, a framework designed to encourage innovation by granting innovators a limited monopoly in the intellectual property they develop so that they can recoup the cost of their research in designing the novel products and materials. Beyond the patent space, trade secrets protect proprietary formulas, procedures, and methods that are kept reasonably confidential from illegal disclosure. While the Department of Agriculture was openly hostile toward intellectual property in 1916, today's Department of Transportation recognizes the many benefits of protecting and respecting intellectual property to use technology to improve safety and better our nation's roads.[50]

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[49] FTC, To Promote Innovation: The Proper Balance of Competition and Patent Law and Policy, (2003). Patent law plays an important role in the property rights regime essential to a well-functioning and competitive economy.

[50] In a speech at the Western Governors Association Winter Meeting, Secretary Chao listed "[p]reparing for the future by encouraging innovation" as one of her top priorities. Remarks by U.S. Secretary of Transportation Elaine L. Chao

Finally, consideration has never been given to all of the important problems presented by the Rule, such as the effects or costs of the policy choice, or the factual circumstances bearing on that choice. Even back in 1917, it was recognized that the Rule would discourage use of the best materials on roads, and thus represented "an actual loss to the highway system on account of the exclusion of this patented [materials] from the competition."[51] This is, unfortunately, what has happened.

C. There are Compelling Policy Justifications for Repealing the Rule

The Trump Administration has unequivocally stated that it is the "policy of the United States to alleviate unnecessary regulatory burdens placed on the American people."[52] Similarly, Secretary Chao has stated that encouraging innovation "is especially important because transportation is on the verge of one of the most transformational eras in history. The U.S. Department of Transportation has an important role to play in building and shaping this future."[53]

Repealing the Rule would help achieve the President's and Secretary's shared policy goal of encouraging the deployment of new technologies that promise to improve safety, minimize congestion, and augment our nation's highways. Moreover, the recent history of the Rule

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at Western Governors Association Winter Meeting, Phoenix Arizona, (Dec. 2, 2017). Similarly, the FHWA's website states the agency's priority to "champion[] innovations by supporting new and better ideas to get highways planned, designed, built, and maintained. The Center for Accelerating Innovation (CAI) is FHWA's focal point for advancing new technologies and practices through the Every Day Counts (EDC) program, the Accelerated Innovation Deployment (AID) Demonstration program, and the State Transportation Innovation Council (STIC) Incentive program."

[51] Municipal Engineering, Vol. 52 page 124, Engineering Publishing Company, (1917).

[52] EO 13777. Executive Order 13771 directs agencies to repeal two existing regulations for every new regulation. Executive Order 13777 directs agencies, including the DOT, to establish a regulatory reform task force to research all regulations that are unnecessary, burdensome, and harmful to the economy, and therefore harmful to the creation of jobs and business.

[53] Remarks by U.S. Secretary of Transportation Elaine L. Chao at Western Governors Association Winter Meeting, Phoenix Arizona, (Dec. 2, 2017).

demonstrates that this is a bi-partisan issue—past Administrations have attempted to resolve the unnecessary limitations imposed by the rule, but have fallen short of a true fix.

1. Repealing the Rule will Spur Investment in and Deployment of New Technologies.

When the Rule was first adopted in 1916, the Department of Agriculture's goal was to encourage open competition in the procurement market. While open competition is an important goal, the Rule was drafted and implemented in a narrow way that has, unfortunately, inhibited competition. Rather than promoting competition, the Rule discourages industry from developing new products in the first instance by limiting the market for them—state contracting agencies are unable to use federal funds to obtain proprietary products. This was predicted at the time of the Rule's adoption by AASHO, which cautioned that mandating open competition would simply bar the use of the best products and services.

Today, there are many examples of new and innovative technologies that could help address the many challenges facing our nation's highways, but which have not been as widely adopted as they could be, because the Rule discourages state contracting agencies from acquiring them. Just a few examples include:

- **Mobile Barriers LLC's MBT-1** – Colorado-based Mobile Barriers has created a patented mobile, self-contained, semi-trailer that protects workers while reducing public disruption and lane closures. Movable barriers like the MBT-1 provide a physical and visual wall between traffic and maintenance and construction personnel. Studies have shown that movable barriers save lives and have a cost benefit of $1.911 million per year over traditional non-movable barriers. The MBT-1 has been tested and accepted for use on the National Highway System (TL-3 use). The MBT-1 has received multiple awards for improving worker safety and efficiency. Although state contracting agencies have expressed significant interest in this product, they have been constrained in acquiring them because of the Rule.

- **RJ Watson Inc.'s Disc Bearings** – RJ Watson spent years developing patented "disc bearings" for bridges. While these disc bearings are now recognized as superior to alternatives in the market, RJ Watson had difficulty selling these products to state

contracting agencies until the patents on the disc bearings expired. If the Rule did not exist, these superior products could have been installed on bridges much sooner and efficiently.

- **HCB, Inc.'s Composite Beams** – HCB has developed the Hillman Composite Beam (HCB®) for use in bridges. The HCB provided a cost-competitive, resilient bridge system benefitting from the extended service life inherent in composite materials. The lightweight design provides added benefits for shipping and erection while using standard construction equipment and methods. While this technology has been deployed for numerous bridges, it has not been as widely adopted as possible given the proprietary product limits placed on state contracting agencies.

- **Transpo Industries' Break-Safe** – In the 1970's and 80's the primary system used for ground mounted breakaway sign structures was the "Texas Slip Base". The system was available to all state agencies as a non-proprietary design and was adopted by the majority of states. While the system performed well in some cases, it became evident that the system had significant limitations. To address these issues, Transpo Industries obtained a patent in the 1980s on Break-Safe, a unique sign post breakaway system that the company developed. After receiving the FHWA Acceptance Letter in 1989 to receive federal funding, Transpo began marketing the new patented system but experienced great resistance from state contracting agencies because of the product's proprietary status. Today, after more than 25 years of continued effort to market the system it is finally accepted in 38 states and used by 12 states as their state standard.

- **Lindsay Transportation Solutions** – Lindsay markets a unique moveable barrier product that can be used for both permanent and temporary applications. It allows NCHRP 350 and MASH approved concrete and steel barriers to be quickly and efficiently moved under traffic conditions, to expand and contract work areas in construction work zones, and add/drop lanes for directional traffic in permanent applications. Because the product is patented and unique, many states simply do not specify this product, thus limiting wide-spread deployment of the very useful device.

Not surprisingly, in 2011, the DOT's Retrospective Review and Analysis of Existing Rules for implementing Executive Order 13563[54] acknowledged the broad industry concern that the Rule imposes unnecessary restrictions on the ability of states to utilize proprietary methods, materials, and equipment on Federal-aid projects.[55] In response to these concerns, the FHWA agreed "that a

[54] DOT Plan for Implementation of Executive Order 13563, Retrospective Review and Analysis of Existing Rules, Slide 65-66 (Aug. 2011) available at https://www.slideshare.net/whitehouse/departmentof-transportationregulatory reformplanaugust2011.

[55] FWHA recognized industry concern that "State DOT's hands are tied when trying to use these products" and that a "new proprietary product that is developed and placed on the market cannot easily be used in highway construction until a 'comparable' product is produced. The inability of government agencies to specify a particular product which

further reexamination of its existing regulations and/or guidance in this area might accelerate project delivery and provide states needed flexibility." Similarly, in a 2016 review of the Rule, the DOT again acknowledged the private sector's concerns that: 1) State DOTs processes ensure competition in the traditional low bid system; 2) this system maintains the status quo and generally does not foster innovation; and 3) there is no intentional focus on pursuing innovation through the use of this regulation.[56]

Unfortunately, efforts by the FHWA to moderate the impact of the Rule have not worked. While the Rule provides for limited exceptions to the general prohibition, a number of logistical and practical challenges are embedded in the Rule which continue to (and will likely always) inhibit the development and deployment of innovations that could enhance the safety and efficiency of the U.S. surface transportation network. The past Administration attempted to provide additional flexibility by clarifying that contracting agencies may approach the FHWA and request a "Public Interest Finding" to allow use of a specific material or product for a project even when other suitable products are available.[57] But even though states may petition a FHWA Division Administrator for approval to use a specific material or product, many states are reluctant to initiate such a process due to concerns about personnel time and increased cost. The burdens associated with acquiring such products can deny the public-needed improvements in roadway safety and more durable transportation infrastructure facilities.

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currently has no 'equal' limits innovation by essentially 'lowering the bar' for all products in order to artificially produce competition within the market." *Id.*

[56] Executive Summary from the PnPP National Program Review (Oct. 2016).

[57] Questions and Answers Regarding Title 23 CFR 635.41, (April 11, 2013) available at https://www.fhwa.dot.gov/programadmin/contracts/011106qa.cfm#_Hlk307505978.

Similarly, in 2006, the DOT implemented the Highways for Life ("HfL") pilot program to allow greater flexibility for states to incorporate all forms of innovation.[58] The stated purpose of the Pilot Program was to accelerate the rate of adoption of innovations and technologies, thereby improving safety and highway quality while reducing congestion caused by construction.[59] This pilot program, however, did not address the underlying problems with the Rule.

In sum, the DOT under the two prior Administrations understood the need to address the Rule, but failed to resolve the chilling effect imposed by the Rule or otherwise promote innovative proprietary products when such products would provide added benefits to states. The current Administration, however, has made it a priority for federal agencies to seek out and repeal rules that are unnecessary or do not work to the benefit of the American people.[60]

2. Repealing the Rule will Provide States Greater Flexibility to Address Key Challenges on our Nation's Highways.

The Rule is a regulatory burden that prevents states from employing innovative technologies and thereby slows down sorely needed infrastructure development. Repealing the Rule will further the President's call for improving our nation's infrastructure by providing states increased flexibility to develop and manage projects effectively and efficiently.[61] The Administration clearly prioritizes innovation as a key driver for partnering with states for infrastructure development. As the Administration points out, numerous regulatory barriers

[58] Federal Highway Administration, Notice of Implementation of the Highways for LIFE Pilot Program, 71 Fed. Reg. 30221, (May 25, 2006). The Highways for LIFE Pilot Program was outlined in Section 1502 of the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA–LU).

[59] The federal register notice called out the "Super-Slab System" as an example of a proprietary product that could be used under the HfL program and encouraged states to adopt "performance-based specifications" to justify the use of these products. The FHWA stated that "[p]roprietary products frequently offer benefits in safety, quality and speed of construction[,]" and that the "FHWA is open to their use and will work with States to allow the flexibility to incorporate all forms of innovation into the HfL Program." Id. at 30223.

[60] Remarks by President Trump at Signing of Executive Order on Regulatory Reform, Oval Office, (Feb. 24, 2017).

[61] President Trump's Legislative Initiative to Rebuild Infrastructure in America, Highlights Document, (Feb 12, 2018).

"needlessly get in the way of infrastructure projects."[62] Similarly, the DOT has noted the need to provide states and localities with more flexibility so they can develop data-driven roadway safety plans.[63] Repealing the Rule will accomplish these goals and provide state contracting agencies with the flexibility they need to procure the best and most efficient products.

3. The Rule is Out of Step with Other Federal Agency Approaches to Procurement.

The Rule's restrictions on the use of proprietary and patented products conflicts with general federal competitive bidding rules that allow for single-source procurement under certain conditions—including when the item is available only from a single source.[64] The federal government's general respect for flexibility in procurement is especially relevant when federal funds are awarded to states. The Rule, however, deviates from these principles by targeting patented and proprietary products and discouraging states from using them.

The Office of Management and Budget ("OMB") has adopted *Uniform Administrative Requirements, Cost Principles, and Audit Requirements for Federal Awards* ("Uniform Guidance") as a "government-wide framework for grants management."[65] The Uniform Guidance sets "standard requirements for financial management of Federal awards across the entire federal government.[66] The FHWA, however, under the authority of 2 CFR 200.101(b)(3), has deviated

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[62] Building a Stronger America: President Donald J. Trump's American Infrastructure Initiative, Press Release, (Feb. 12, 2018).

[63] DOT, Roadway Safety Plan at 5, available at https://www.transportation.gov/policy/transportation-policy/dot-roadway-safety-plan.

[64] 2 CFR 200.320(f).

[65] Office of Management and Budget, Uniform Administrative Requirements, Cost Principles, and Audit Requirements for Federal Award, 78 Fed. Reg. 78589, (Dec. 26, 2013).

[66] *Id.*

from these carefully constructed rules in a few instances, particularly with regard to procurement by states.[67]

Section 200.317 of the Uniform Guidance exempts states from sections 200.319 and 200.320, which specify the procurement methods that recipients must incorporate into their procurement procedures. When procuring property and services under a federal award, a state (including state agencies and instrumentalities of the state) is directed to use the same policies and procedures that it uses for procurements from its non-federal funds.[68] Other non-federal entities, by contrast, are subject to the competition and procurement method requirements set forth in section 200.319 and 200.320.[69]

The Rule, however, limits states from following their own policies when it comes to the procurement of proprietary and patented products. This forces states to amend their policies and practices to conform to the Rule or lose federal funding despite no determination or finding that the state's procedures are deficient in anyway. As was cautioned when the Rule was adopted, "there are some meritorious patents and their use can be had on reasonable terms by honest and competent road officials. The practical denial of the right to bargain for such use would seem justifiable only on the assumption that state officials are either dishonest or incompetent."[70]

Even if this was not the case, the competition rules set forth in 2 CFR 200.319 are more flexible than the FHWA's Rule. The FHWA may claim that its Rule operates in virtually the same manner, with similar goals and conditions, but this claim ignores the reality of the situation. By specifically focusing on patented and proprietary products, as opposed to a more principled

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[67] *See* FHWA Memorandum, 2 CFR 200 Implementation Guidance, (Dec. 4, 2014).

[68] 2 CFR 200.317.

[69] *Id.*

[70] Remarks of Colonel Stevens, Better Roads and Streets, Vol. VII No. 3, (March 1917).

approach, the FHWA expresses (whether intentional or not) a bias against these products. States and other non-federal entities are therefore reluctant to use FHWA funds for patented or proprietary products even when such products would fit safely within an exception to the Rule.

This has been the case since the Rule was first adopted. Colonel Stevens, one of the AASHO committee members who helped draft the Federal Aid Road Act of 1916, strongly objected to the Rule, explaining that "[t]he language used has no exact meaning" and "there will be but one safe course to follow and that is to cut out the use of anything patented. . . . it will be the only safe thing to do if one wants to keep cost within the appropriation, and failure to do this is generally noticed in criminal legislation."[71]

Moreover, the exemption provided by the Rule requires a state to either "certify that no equally suitable alternative exists" or make and submit a public interest finding to the Division Administrator who ultimately must approve the choice as being in the public interest.[72] This administrative burden further strains any potential use of a patented or proprietary product, even when such a product would otherwise be the most economical and beneficial procurement.

The competition rules under the Uniform Guidance are far more flexible, allowing procurement by noncompetitive proposals when the item sought "is available only from a single source."[73] Furthermore, this single-source procurement option is available at any dollar amount. And purchases under $3,000 ("micro-purchases") may be awarded without soliciting competitive quotations, regardless of the item's availability from other sources.[74] Even purchases as much as $150,000 (the Simplified Acquisition Threshold) only require "relatively simple and informal"

[71] *Id. See also* Creation of a Landmark: The Federal Aid Road Act of 1916 by Richard F. Weingroff.

[72] 23 CFR 635.411.

[73] 2 CFR 200.320(f).

[74] 2 CFR 200.320(a).

procedures for obtaining price or rate quotations.[75] Competitive bidding procedures are only required for purchases over $150,000, and even then, the exemptions for single-source procurement still apply.[76]

Furthermore, the Department of Defense ("DOD") and other federal agencies have set up systems that allow for the appropriate use of sole source contracts. The DOD, Coast Guard, and National Aeronautics and Space Administration, for example, make sole source purchases under 10 USC 2304(c). For example, 2304(c) allows an applicable agency to use non-competitive bidding when "the property or services needed by the agency are available from only one responsible source or only from a limited number of responsible sources and no other type of property or services will satisfy the needs of the agency[.]"[77] Section 2304(c) lists six additional circumstances where non-competitive, single-source procurement is permitted, for a total of seven permitted circumstances.[78]

The DOD's non-competitive spending is not insignificant, demonstrating a need for these procedures. While a recent GAO Report found that for FY 2016, 68% of the DOD's commercial spending was competitive, the same report found that between $41.2 and $63.2 billion was spent by the DOD each year on contracts citing an exception to competitive bidding procedures.[79] Moreover, 60-70% of the non-competitive contracts awarded in that timeframe cited "only one responsible source" as the reason for using non-competitive procedures.[80] Other executive

[75] 2 CFR 200.320(b).

[76] 2 CFR 200.320(d).

[77] 10 USC 2304(c)(1).

[78] 10 USC 2304(c).

[79] GAO-17-645, Recent Legislation and DOD Actions Related to Commercial Item Acquisitions, (Jul. 17, 2017).

[80] *Id.*

agencies are subject to 41 USC 3304, which provides very similar avenues for sole source procurement under similar conditions.[81]

Finally, it is worth noting that there are numerous federal programs—including within the FHWA—that *actively encourage* industry to develop proprietary and patented products. These programs further demonstrate that the Rule is out of step with the federal government's support for the development and procurement of the best products on the market. The FHWA's Every Day Counts ("EDC") program, for example, seeks to identify and rapidly deploy proven, yet underutilized innovations to enhance roadway safety, reduce traffic congestion, and shorten the project delivery process.[82] Through the EDC model, the FHWA works with state and local transportation agencies and private industry to identify a collection of innovations to promote and adopt over a two-year deployment cycle.[83] To date, the EDC program has advanced over 43 different innovations, many of which have significantly improved transportation system project delivery and helped further a culture of innovation within the transportation community.[84] Unfortunately, the legacy of the Rule is so pervasive that the FHWA has provided that "[r]espondents should not submit unique, proprietary, or patented products" for consideration in the EDC program, even though the program is meant to promote innovation.[85]

Another relevant example of how the Rule works to undermine efforts to innovate is how the FHWA implemented Section 1525 of Moving Ahead for Progress in the 21st Century Act

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[81] *See* Federal Acquisition Regulation (FAR), Subpart 6.3 – Other Than Full and Open Competition.

[82] Every Day Counts: An Innovation Partnership with States, Fact Sheet, available at https://www.fhwa.dot.gov/innovation/everydaycounts/everydaycounts_overview.pdf.

[83] *Id.*

[84] FHWA Center for Accelerating Innovation, About Every Day Counts (EDC), (visited Feb. 23, 2018) available at https://www.fhwa.dot.gov/innovation/everydaycounts/about-edc.cfm; *See also* Every Day Counts: An Innovation Partnership with States, Fact Sheet.

[85] FHWA, Every Day Counts Initiative; Request for Information, 79 FR 1422, (Jan. 8, 2014).

("MAP-21").[86] Section 1525 required the DOT to modify a portion of the Rule "to ensure that States shall have the autonomy to determine culvert and storm sewer material types to be included in the construction of a project on a Federal-aid highway."[87] The final rule adopted, however, explained that although the states had autonomy over material types for culverts and storm sewers, ". . . section 1525 does not relieve the States of compliance with other applicable Federal requirements, such as... the restriction against the use of proprietary products in 23 C.F.R. 635.411."[88] In other words, even though Congress expressly included Section 1525 in MAP-21 to encourage states to use innovative products, the DOT still felt that the application of the Rule could not be avoided.

There are many other examples of government programs that encourage industry to develop new and innovative products. These programs, like EDC, demonstrate the inconsistency of the Rule—it makes no sense for the federal government to encourage the development of innovative products only to make it nearly impossible for states to acquire them.

- The DoD's Rapid Innovation Fund provides a collaborative vehicle for small businesses to provide the department with innovative technologies that can be rapidly inserted into acquisition programs that meet specific defense needs.[89]

- The DoD's Defense Innovation Marketplace is a communications resource to provide industry with improved insight into the Research and Engineering investment priorities of the Department of Defense.[90]

- The Defense Innovation Unit-Experimental, an effort within the DoD's Defense Innovation Initiative, accelerates commercial innovation for national defense. It is able to

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[86] Public Law 112-141 (2012).

[87] *Id.*

[88] Federal Highway Administration, Construction and Maintenance—Culvert Pipe Selection, 78 Fed. Reg. 5715, 5715-5715 (Jan. 28, 2013).

[89] Defense Innovation Marketplace, Rapid Innovation Fund, (visited Feb. 26, 2018) available at http://www.defenseinnovationmarketplace.mil/rif.html.

[90] Defense Innovation Marketplace, Connecting Industry and DoD, (visited Feb. 26, 2018) available at http://www.defenseinnovationmarketplace.mil/.

accomplish innovation in a "fraction of the amount of time" that it traditionally takes by facilitating pilot projects between companies and DoD entities without being bound by the Federal Acquisition Regulations (FAR); after a successful pilot, "any DoD entity has sole source justification to procure the piloted solution."[91]

- The National Institute of Standards and Technology's Small Business Innovation Research program solicits R&D proposals from small businesses that respond to specific technical needs described in the subtopics of the annual Solicitation.[92]

- The Regional Innovation Strategies Program, led by the Economic Development Administration's Office of Innovation and Entrepreneurship, awards grants to provide proof-of-concept and commercialization assistance to innovators and entrepreneurs and operational support for organizations that provide essential early-stage risk capital to innovators and entrepreneurs.[93]

If other federal agencies have set up systems that allow for efficient procurement of proprietary and patented technologies, there can be no basis for the FHWA to bar states from using federal funds to do the same. Moreover, Secretary Chao has recognized that many states are leading the way in testing new transportation technologies and innovations, and thus the FHWA policy should be to support states in these efforts.[94]

IV. Conclusion

The U.S. faces serious challenges on our nation's highways, including rising fatalities, increasing congestion, and an infrastructure in need of repair and improvement. The Rule is an example of a regulation that stands in the way of solving these challenges—it creates disincentives to the development of safe and innovative products and inhibits competition in the market. For these reasons, the DOT and the FHWA should grant this Petition so that the public can, for the

[91] The Defense Innovation Initiative (DII), (visited Feb. 23, 2018) available at http://www.defenseinnovationmarketplace.mil/DII_Defense_Innovation_Initiative.html.

[92] NIST Technology Partnership Office, Small Business Innovation Research Program (SBIR), (visited Feb. 26, 2018) available at https://www.nist.gov/tpo/small-business-innovation-research-program.

[93] Economic Development Administration, Office of Innovation and Entrepreneurship (OIE), Regional Innovation Strategies (RIS) Program, (visited Feb. 26, 2018) available at https://www.eda.gov/oie/ris/.

[94] Remarks by U.S. Secretary of Transportation Elaine L. Chao at Western Governors Association Winter Meeting, Phoenix Arizona, (Dec. 2, 2017).

first time, participate in the rulemaking process and engage in a dialogue with the Department on the Rule's various legal and policy implications. The public interest would be served because repealing the Rule will spur investment in and deployment of new technologies that promise to help improve safety, minimize congestion, and augment our nation's highways.

ARTBA appreciates the DOT's and the FHWA's consideration of our petition to repeal. Please feel free to contact us if you have any questions.

* * * * *

Respectfully,

/s/

Nick Goldstein
Vice President of Regulatory & Legal Issues
American Road & Transportation Builders Association
250 E Street, S.W.
Suite 900
Washington, D.C. 20024
202.683.1005

Of Counsel
James H. Burnley IV, Esq.
Andrew E. Bigart, Esq.
Christopher L. Boone, Esq.

Venable LLP
575 7th Street, NW
Washington, DC 20004
202.344.4000

September 4, 2018

Chairman Sam Graves
U.S. House Committee on
Transportation and Infrastructure
Subcommittee on Highways and Transit
2165 Rayburn House Office Building
Washington, DC 20515

Ranking Member Eleanor Holmes Norton
U.S. House Committee on
Transportation and Infrastructure
Subcommittee on Highways and Transit
2164 Rayburn House Office Building
Washington, DC 20515

RE: Hearing on Innovation in Surface Transportation

Dear Chairman Graves and Ranking Member Holmes-Norton:

The Center for Auto Safety ("the Center") wants to express our appreciation for the Subcommittee holding this important hearing today. Despite the ceaseless hype and hyperbole by some industries and investors interested in short term profits, the era of driverless vehicles is in its infancy. Accordingly, this is exactly the moment to conduct a holistic review of the future of these technologies and examine how to measure their impact on America's existing infrastructure as well as the best way to ensure our nation's infrastructure will be prepared to accommodate autonomous technologies for passenger and commercial traffic in the future.

For our transportation eco-system to succeed it will require these issues be considered in concert with – and not separate from – the legal, regulatory, and safety issues that surround these early developmental days for driverless cars and trucks. Such a potentially revolutionary change requires careful planning at the local and national level and is unlikely to be best served by a rush-to-market philosophy.

As the Subcommittee is aware, the FAST Act authorized manufacturers to begin testing an unlimited number of autonomous vehicles (AV) and AV technology in the United States. This provision (Section 24404 of the FAST Act (Pub. L. No. 114-94) has been utilized by a variety of manufacturers, to test the technology across the country. In fact, using this provision, Waymo has passed the 8 million mile mark for testing and Lyft and Aptiv just completed their 5,000th self-driving paid trip in Las Vegas. This early stage testing has demonstrated how far the technology has come – and yet the related crashes, deaths, and injuries, demonstrate how far there is to go.

The Center, founded in 1970, is an independent, non-profit consumer advocacy organization dedicated to improving vehicle safety, quality, and fuel economy not only for our members, but all drivers, passengers, and pedestrians in rural and urban areas alike. On behalf of those 310 million Americans who use our nation's highways daily, we urge the Subcommittee to recognize that it may be decades until deployment of truly autonomous passenger vehicles is realized at levels beyond small geofenced areas. Therefore, while driverless cars may represent an exciting future, and generate headlines, in the here and now Americans are buying more than twice as many *used* cars and trucks every year instead of the technically advanced new vehicles. The annual traffic crash toll of 37,000 deaths, and more than 2 million serious injuries, will not be waved away by a magic wand called "autonomy" any time soon, because conventional vehicles will dominate our roadways for decades to come. Our highway plans should bear this in mind.

V2X

Vehicle-to-Vehicle, (V2V) Vehicle to Infrastructure, (V2I) Vehicle to Pedestrians, (V2P) and Vehicle to Network, (V2N) technology is often referred to collectively as "V2X." This connectivity has the potential to significantly improve traffic safety by giving drivers an early warning of yet-unseen crash hazards posed by other vehicles. V2X could enable drivers to obtain advance warning of potential road dangers and could improve pedestrian and cyclist safety as well. Such communication has the potential to make everyone's lives more efficient and convenient. For example, V2I and V2N could allow for an offramp's traffic camera to inform a vehicle's GPS of backed-up traffic and offer a reroute that gets the vehicle's occupant to her destination more quickly and with the use of less fuel or electricity. Put simply, V2X has great potential for safety advancements if it is an integrated feature of driverless vehicle and infrastructure development – and not an after the fact add-on.

Yet, it is exactly this integration that presents significant challenges in developing and implementing effective and reliable V2X communications systems, and in taking them from the closed testing environment to the open road. These include technological challenges, serious security concerns such as vulnerability to hacking or system failure,[1] message congestion and gaps in GPS coverage; and potential privacy issues.[2] In other words, for V2X to be a successful feature – and not simply a luxury infotainment system – it will require the intervention of regulating bodies, be they Congress or the Department of Transportation.

For maximum road safety utility all new vehicles will need have V2V and V2I as a standard feature, because the value of the connectivity is in its ubiquity. Yet, that same safety priority must be built into the approval of the deployment of V2V and V2I, perhaps including the ability to move the technology into a "fail safe mode" in order to override inevitable software failures and vulnerabilities.

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[1] Jason Levine, Advantages of connected cars come with cybersecurity risks, Axios.com, August 16, 2018
[2] Yet another reason using Dedicated Short- Range Communication is a good idea. https://consumerfed.org/press_release/consumer-auto-safety-groups-call-non-commerical-use-auto-safety-spectrum-strong-privacy-security-protections/

Also, V2X must have a common language, not only from manufacturer to manufacturer, but from state to state, and even city to city. Finally, safety messaging and traffic information must be separate from and primary to infotainment. This is important not only from a cybersecurity standpoint, but from a primacy of purpose view as well. Dedicated Short- Range Communication (DSRC) [3] can accomplish this last item right away. After a complete review it may well be that DSRC can be improved upon when it comes to delivering on the potential for connected vehicles and roads in terms of both safety and economic utility. Yet, instead of having that debate on the way to a safety rule, the process to require V2V communications has been ground to a halt with no movement in sight. It is exactly this kind of conflicting motive that can only be overcome by a nationwide plan that builds safety into the infrastructure from the start.

Cybersecurity

As discussed above, the measured and planned development of V2X technologies are likely to play a key role in the success of driverless vehicles achieving their maximum utility from both a safety and commercial standpoint. V2X technologies have the potential to dramatically improve highway safety and traffic situational awareness for both conventional and driverless vehicles.

Unfortunately, these technologies also provide multiple opportunities for bad actors to interfere with individual vehicle operation, and potentially interfere with operation of the entire transportation system. The presence of safety-critical software in conventional automobiles (SAE autonomy levels 0-2) and the complete dependence of driverless vehicles (SAE autonomy levels 3-5) on extensive safety-critical software demand the establishment and enforcement of software safety standards for all elements of the technology. The reliance on safety critical software is what led the Department of Defense[4] and the Federal Aviation Administration (FAA)[5] to recognize the absolute need for cybersecurity in these types of applications and to respond by promulgating enabling requirements and regulations. These guidelines have been successful in protecting the security of military assets and the public safety of commercial aircraft operations.

While fully driverless vehicles may be years away from widescale deployment, or public acceptance, the time to plan for such occurrences is prior to their arrival. This is

[3] https://www.regulations.gov/document?D=NHTSA-2016-0126-0009

[4] DOD 5000.02, January 7, 2015, section 3h, Information Technology;

> "(1) All IT that receives, processes, stores, displays, or transmits DoD information will be acquired, configured, operated, maintained, and disposed of consistent with applicable DoD cybersecurity policies, standards, and architectures.
>
> "(2) Risks associated with global sourcing and distribution, weaknesses or flaws inherent in the IT, and vulnerabilities introduced through faulty design, configuration, or use will be managed, mitigated, and monitored as appropriate.
>
> "(3) Cybersecurity requirements must be identified and included throughout the lifecycle of systems including acquisition, design, development, developmental testing, operational testing, integration, implementation, operation, upgrade, or replacement of all DoD IT supporting DoD tasks and missions."

[5] FAA Advisory Circular AC No. 20-115C, Subject: Airborne Software Assurance, specifies acceptability of RTCA DO-178C, "Software Considerations in Airborne Systems and Equipment Certification," dated December 13, 2011.

especially the case when it comes to the difficult and time-consuming task of creating usable process and performance standards for the cybersecurity of the hundreds of millions of driverless vehicles that may one day be operating across the country. Unfortunately, neither of the major bills currently under consideration in Congress regarding driverless vehicle technology require cybersecurity standards – either for the vehicles or infrastructure. What makes this lack of standards particularly puzzling is that analogous standards exist, such as RTCA DO-178C,[6] which are required to be met by the FAA prior to aircraft certification and commercial use.

As has been demonstrated in the of context a moving vehicle, the threats of cyber intrusion for autonomous cars and trucks are real.[7] Moreover, at a moment when massive cyber-breaches of major corporations or government entities seem to be announced on a weekly basis, to undertake the mass deployment of hackable multi-ton vehicles that can travel 100 mph without mandatory, demonstrable, security protocols is not only foolhardy – it presents a potential national security concern. The time is now to determine whether it is better to use an existing standard and adapt it to the ground transportation needs for V2X, or whether a new protocol must be developed.

Finally, from a fiduciary perspective, addressing these issues and implementing solutions on the front end is likely to be far less expensive than attempting to close the barn door after the proverbial horses have already escaped. All of us who believe in the importance of auto safety must work together to encourage the development of safety-critical software requirements or regulations in response to these emerging threats in order to mitigate, and ideally eliminate, automotive vehicle and related infrastructure cyber vulnerabilities.

Crash Data

As recent on-road crashes involving semi-autonomous (level 2) vehicles have demonstrated, the interaction between infrastructure and next generation vehicle technology can have tragic consequences.[8] In fact, the Tesla operating on "Autopilot" in the fatal Mountain View, California crash was reported to have veered into a guardrail – in a spot it had done so previously.[9] In two other instances, Tesla has had vehicles using the "Autopilot," mode crash in essentially the same highway location approximately one year apart.[10] Last week, a driver in San Jose, California crashed into the back of a parked firetruck at highway speed claiming he though "AutoPilot" was engaged – the investigation is ongoing.[11]

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[6] https://www.faa.gov/aircraft/air_cert/design_approvals/air_software/
[7] https://www.wired.com/2015/07/hackers-remotely-kill-jeep-highway/
[8] Drew Harwell, Experts Worry Tesla is using consumers as guinea pigs, Washington Post, June 11, 2018
[9] http://abc7news.com/automotive/i-team-exclusive-victim-who-died-in-tesla-crash-had-complained-about-autopilot/3275600/
[10] https://www.upi.com/Self-driving-Tesla-car-crashes-in-same-California-location-as-2017-accident/1131527692147/
[11] Meagan Flynn, I think I had AutoPilot on - Tesla driver arrested after crashing into parked firertuck, Washington Post, August 27, 2018

One of the key issues raised in any crash involving cars with autonomous or semi-autonomous technology, including the one involving an Uber that killed a pedestrian in Tempe, Arizona, is how to understand what happened.[12] Two of these incidents resulted in deaths, two involved injuries. Ideally, each crash helps prevent the next one, but after each of these incidents there were conflicting media reports, and in some instances, conflicting police reports. How can national policy makers and the public be sure they are getting the facts? How can local authorities understand whether the infrastructure is to blame or the vehicle is at fault?

Today, when the National Transportation Safety Board (NTSB) undertakes a crash investigation of semi-autonomous vehicles, the agency must work with manufacturers to access any data available to assist in an accurate evaluation of the crash. Unlike aviation, railroad, and ship accidents, when it comes to driverless vehicles, investigators are dependent upon the manufacturer to interpret the data and provide an accurate account of all relevant data available to the vehicle's recording systems.

Yet, there are no uniform parameters for driverless vehicle data recorders to allow crash investigators to compare information across manufacturers to help understand whether different autonomous systems might react the same or differently to the same stretch of road. Making things even more difficult in the context of several of these incidents, the manufacturers publicly disclosed information about the crash, prior to any official announcements, thwarting long-established policies of cooperation that are critical to conducting independent crash investigations.

Current event data recorder (EDR) requirements focus exclusively on the milliseconds prior to a crash with enough impact to cause airbags to deploy (among other factors). To properly evaluate driverless technology, investigators must be able to see far more time and data than on conventional vehicles. They must have access to pre-crash and post-crash data to be able to accurately evaluate the performance of the driverless vehicle. Otherwise, it will be next to impossible to answer such questions as whether a sensor malfunctioned or was simply not good enough; whether there was a data processing, communications, or software problem; whether a safety driver or the machine was in control; or whether the fault lies with a conventional driver. Current EDR rules mean the public and policy makers will have to rely on the *least* objective party involved to provide the information: the manufacturer. As the Committee with jurisdiction over public roads, highways, and bridges, it is vital for your oversight purposes to be sure that enough objective, unbiased information will be available to crash analysts to reduce or eliminate unnecessary deaths, injuries, and property damage.

Conclusion

While it is our current position that driverless cars should remain on test tracks and in controlled environments until they have demonstrated sufficient levels of safety to be allowed into our neighborhoods, testing is ongoing. The FAST Act has achieved its

[12] Uber – Tempe, AZ, March 18, 2018, resulting in a death; Tesla – Mountain View, CA, March 23, 2018, resulting in a death; Waymo – Chandler, AZ, May 4, 2018, resulting in an injury to the test driver; Tesla – South Jordan, UT, May 11, 2018, resulting in an injury to the driver.

goal of allowing the auto and technology industry to experiment in real world conditions with new and sometime frightening artificial intelligence. Fortunately, casualties have been limited, so far. Yet, autonomous vehicle technology is far from ready to be deployed and sold to consumers in its current state. More oversight is required, tests are needed to demonstrate safety, and tasks human take for granted – such as turning left – still need to be mastered.[13]

At some point in the coming decades, driverless vehicles are likely to be deployed on public highways. These vehicles must work together with our existing and future infrastructure to maximize safety for everyone on the highway. Undertaking that process simultaneously is the best chance for all of us to reach that future as safely as possible.

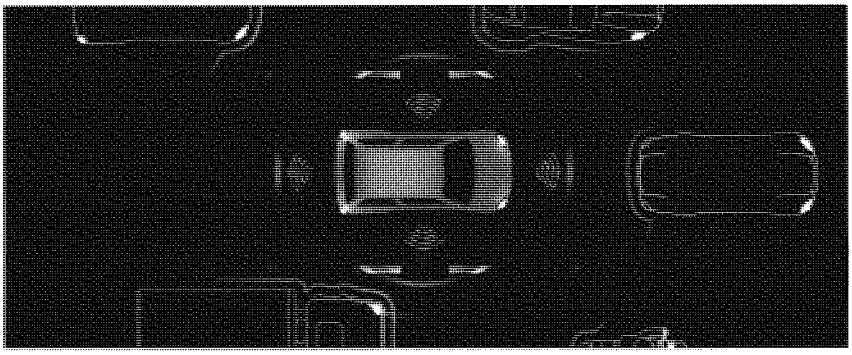
On behalf of the Center for Auto Safety and our members, thank you for holding this hearing and your attention to this important matter.

Sincerely,

Jason Levine
Executive Director

[13] Amir Efrati, Waymo's big ambitious slowed by tech trouble, at www.theinformation.com, August 28, 2018

NAMIC ISSUE ANALYSIS



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VALIDATING SAFETY: THE NEXT PHASE IN DEVELOPING AUTOMATED DRIVING SYSTEMS

Tom Karol
General Counsel – Federal
National Association Of Mutual Insurance Companies

TOM KAROL

Tom Karol serves as General Counsel – Federal in NAMIC's Washington, D.C., office. Tom represents NAMIC on issues impacting property/casualty insurance companies and has primary management of NAMIC's response to federal legislation and regulation. Tom has extensive legal, regulatory, and operations experience with major financial services companies, law firms, regulatory agencies, and Congress, having served as legal counsel in federal agencies and with the U.S. Senate Committee on Governmental Affairs.

Acknowledged as a leader in the insurance industry on autonomous vehicles, Tom is on the Board of Directors of both the Highway Loss Data Institute and Advocates for Highway Safety and Auto Safety, and is an Observer on the Uniform Law Commission Committee on Highly Automated Vehicles. Tom has worked directly with National Highway Transportation Safety Administration officials and has provided testimony to Congressional committees on automated driving systems. Tom leads NAMIC's Autonomous Vehicles Council and has been a featured speaker at insurance, actuary and legal conferences. He served on NHTSA panels relating to state jurisdiction and pre-market approval, has worked with the Insurance Institute for Highway Safety supporting the Virginia Tech Transportation Institute as part of the National Cooperative Highway Research Program, and is a stakeholder in the NHTSA Federal Motor Vehicle Safety Standards Considerations for Automated Driving Systems peer review.

For more information about NAMIC Issue Analyses, please visit namic.org/issues/our-positions or contact:

TOM KAROL
tkarol@namic.org
Direct 202.580.6741

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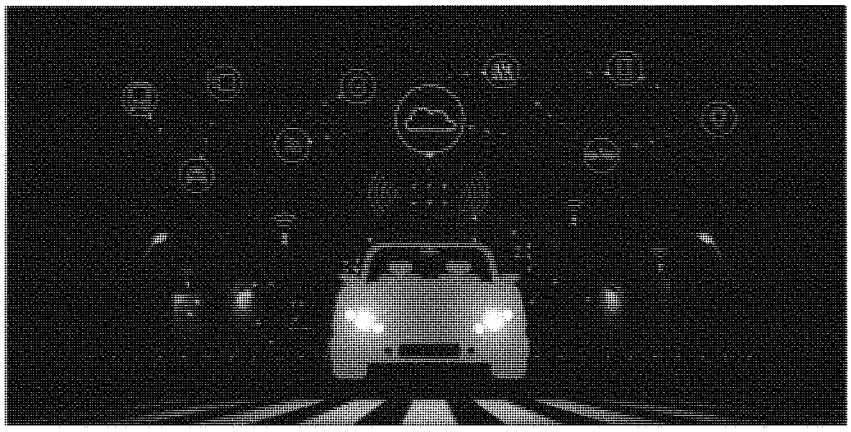
INTRODUCTION

The development of Automated Driving Systems (ADS) may be the most consequential transportation issue of our time. New technology and novel service strategies promise faster and better mobility that will be less expensive, and more environmentally friendly. Spring boarding from existing and widely accepted "assisted driving" systems such as cruise control, ADS developers promise a wider array of functions from greater driver assistance to vehicles that will perform every driving operation with no human intervention.

The single most important reason to support the development of highly automated driving systems is the potential for ADS to enhance safety and save lives. While the idea of working, napping, or watching a movie while the car drives itself may be enticing to many, enhanced safety must always be the primary focus of ADS development. ADS that are proven safer than existing drivers will have innumerable benefits to society.

The development and deployment of proven, safe ADS will require significant technological advances, revisions to the regulatory paradigm, and the active participation of far more than just the auto manufacturers and technology companies. The potential of technology to move the needle on crash statistics is extraordinary; however, there will still be crashes, especially in an environment where autonomous vehicles continue to share the road with human drivers. It is important to note that ADS, in and of themselves, do not fundamentally change the legal theories of liability associated with motor vehicle crashes. Insurance will still play a crucial role for manufacturers, suppliers, owners, operators, and passengers.

The critical issues related to passenger safety, liability, and compensation after a crash require that insurance companies are included in the development, deployment, regulation, and use of ADS. Consumers will continue to look to property/casualty insurers to provide them with the protections they have come to expect as this new frontier of automotive products and services evolves.



VALIDATING SAFETY: THE NEXT PHASE IN DEVELOPING AUTOMATED DRIVING SYSTEMS

EYES ON THE PRIZE: IN A SHIFTING REGULATORY PARADIGM FOCUS MUST REMAIN ON POTENTIAL TO ENHANCE SAFETY AND SAVE LIVES

Safety must be the primary goal for ADS development, but defining and proving what "improved safety" means for ADS are not simple. Currently, federal auto safety regulations focus more on the structure and design of vehicles and less on the driving operations that are subject to human control. With ADS, the vehicle will assume driving operations formerly performed by the human driver. Thus, the safety responsibilities of the vehicle will expand and will continue to expand until the vehicle assumes all driving operations without any human control.

On the one hand, most car crashes involve driver error[1] and ADS promises computer systems that will not replicate the conditions that lead to those errors – i.e. sleeping, intoxication, distraction, speeding. According to the National Highway Traffic Safety Administration (NHTSA) "Fully automated vehicles that can see more and act faster than human drivers could greatly reduce errors, the resulting crashes, and their toll." On the other hand, the elimination of certain human errors does not tell us anything about the introduction of computer, sensor, or software error.

Safe ADS will require a substantial amount of specialized software, sensors, controllers, and actuators to collectively perform without error the large universe of operations that human drivers already perform, or at least as well as those human drivers. The bar for performance has been set high: human drivers average 3.4 million vehicle hours (390 years of non-stop driving) between fatal crashes and 61,400 vehicle hours (7 years of non-stop driving) between injury crashes.

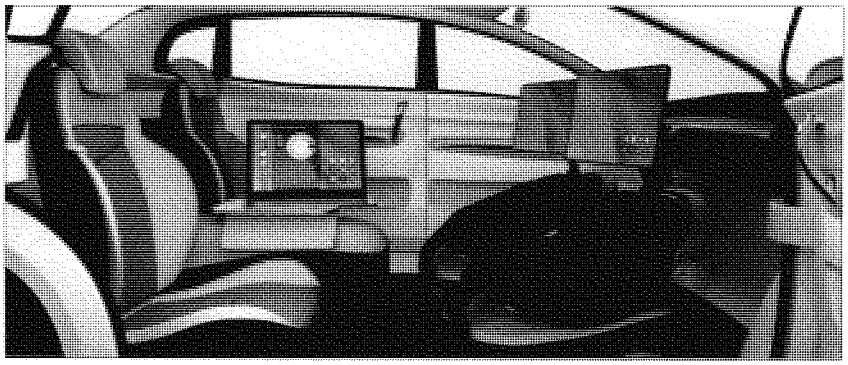
POST-"DRIVER" SAFETY REGULATION

There is a growing recognition that some change to the regulatory environment may be needed to foster the development of ADS. As Secretary of the U.S. Department of Transportation (DOT) Elaine Chao has stated, "What we are trying to do is to reduce the number of regulations that are hampering the growth of technology in this area. We do not know best what is happening [with self-driving vehicles]. So, we want to partner with the sector. We want to ensure that we are not doing things that hamper [progress]."

Under the existing regulatory structure, defining and validating the overall safety of the vehicles have been the focus of NHTSA, a division of the DOT, which has the mission to "Save lives, prevent injuries, reduce vehicle-related crashes." Congress empowers NHTSA to write and enforce Federal Motor Vehicle Safety Standards (FMVSS). Under current law, auto manufacturers bear the responsibility to self-certify that all the vehicles they manufacture comply with all applicable FMVSS. If the self-certified vehicle is not compliant with the FMVSS, manufacturers are subject to NHTSA's defects, recall, and enforcement authority. NHTSA does not certify vehicle safety or require pre-market verification but, instead, relies on the manufacturers' self-certification.

[1] A 2015 NHTSA survey that concluded "driver" error was a critical reason for 94 percent of crashes is often misquoted as concluding that "human" error is the reason. ADS may not fall asleep or be drunk like humans, but ADS can be as susceptible, if not more susceptible, to driving recognition errors, decision errors, performance errors, and non-performance errors. The absence of some errors does not establish the absence of all errors.

The development of ADS will require a new way to look at the fundamental nature of driving, and that development should not be hindered by requiring outdated safety requirements that do not apply to new technologies. At the extreme end of the spectrum, the development of ADS with no driver controls will mean that vehicle features that are now required for human operation may not be necessary or practical. Sound policy should include a review of which requirements would no longer be relevant for a fully autonomous vehicle. The FMVSS are the U.S. federal regulations specifying nationwide design, construction, performance, and durability requirements for auto-safety-related components, systems, and design features. FMVSS focus mostly on crash avoidance, crashworthiness, and crash survivability. Existing FMVSS specify that controls and displays must be located where they are visible to or within the reach of a person sitting in the driver's seat. If the occupants have limited or no control of an ADS, there may not be a "driver's seat" or the relevant controls or displays of driving operations may vary with the driving operations that the human retains. In various iterations of ADS, auto parts subject to FMVSS such as rearview mirrors may be superfluous for driving operations. Similarly, controls for turn signals, lights, or wipers may not be required and may not be subject to safety standards.



With respect to ADS, in 2016, NHTSA issued a 116-page Federal Automated Vehicles Policy, which was updated in 2017 with a 36-page automated driving systems policy document. The NHTSA ADS policy detailed in these documents outlines ADS Vehicle Performance Guidance and requests that manufacturers provide Voluntary Safety Assessment Letters to NHTSA on ADS development and deployment. However, entities are not required to submit an assessment letter, nor is there any mechanism to compel entities to do so. NHTSA does not require that entities provide disclosures nor are they required to delay testing or deployment. Assessments are also not subject to federal approval.

Under the existing system, with the DOT establishing national safety standards for automobiles, the states are generally prohibited from requiring additional safety features. States have retained the responsibilities of: licensing human drivers and registering motor vehicles in their jurisdictions; enacting and enforcing traffic laws and regulations; conducting safety inspections; and regulating motor vehicle insurance. State law also governs liability issues surrounding auto accidents. For vehicles in which increasing numbers of autonomous driving functions have replaced the human driver, it makes sense for the existing NHTSA and state roles and responsibilities to be closely reexamined. However, the current federal/state dichotomy is likely to lead to the most efficient development and deployment of ADS on the nation's roadways.

VALIDATING SAFETY: THE NEXT PHASE IN DEVELOPING AUTOMATED DRIVING SYSTEMS

The focus must remain on ensuring that critical safety aspects are examined and validated and that any safety assurance gaps that may be created by the introduction of ADS onto the roads are identified and addressed. This is far more complicated than it may seem. While many human-driver-focused FMVSS do not make sense for ADS, perhaps ADS-specific safety tests should accompany broad exemptions. Pre-market approval has many downsides, but some level of independent ADS safety review could supplement self-certification. Existing self-certification should be supplemented by governmentally defined and publicly disclosed standards and then supplemented by third-party validation of design and testing.

In many ways, ADS is a game changer for a vast number of issues and challenges that are still being developed and explored.

THE TECHNOLOGICAL CHALLENGES: WE'RE NOT THERE ... YET

Replacing a human driver with an amalgamation of integrated software, sensors, actuators, controllers, and other hardware is no simple task. Human errors may contribute to most accidents, but human drivers have proven to be capable of performing millions of miles of complex and demanding driving operations without crashes. Robotic, automated systems have achieved incredible progress, but in many ways they still lag basic human operations. In the high-level Defense Advanced Research Projects Agency Robotics Challenge, which has been focusing on humanoid robotics executing complex task underway since 2012, there was great celebration in 2018 when the robot finally was able to ... open a door.

ADS mishaps, crashes, and tragedies have and will happen, and they will continue to make headlines. These highly publicized ADS problems, many resulting from the complexity of driving tasks, diminish the confidence of the public that ADS will be safe. The ADS-related fatalities in Florida, Arizona, and California have seriously challenged many people's beliefs in the current progress of ADS technology. The National Transportation Safety Board review of those fatalities shine a bright light on potential safety concerns for ADS.

Unfortunately, the list of ADS problems does not end with the recent tragedies. In January 2018 alone:

- General Motors was sued in federal court in the Northern District of California by a motorcyclist alleging that a Chevy Bolt utilizing ADS injured the cyclist by negligent self-driving.
- In Pittsburgh, an automated test vehicle with Argo AI, a startup backed by Ford, was reportedly involved in an accident that sent two people to the hospital.
- Waymo announced that it would acquire thousands of Fiat Chrysler Pacifica minivans for its driverless ride-hailing service to the public, but Fiat Chrysler Automobiles issued a recall of more than 162,000 Chrysler Pacifica minivans due to a potential software glitch that may cause the vehicle to stall.
- A Tesla Model S slammed into the back of a stopped fire truck on the 405 freeway in Los Angeles County. Reportedly, Tesla acknowledged that the driver assistance system ignored the stationary vehicle and instead accelerated to the cruise speed the driver punched in. The driver was required to intervene and apply the brakes.

Other recent events include:

- A driverless shuttle bus operating in Las Vegas did not move and was struck by a truck that was backing into a driveway.
- Uber grounded its fleet of self-driving cars in Pittsburgh as the company investigated a crash involving one of its vehicles. Uber grounded its fleet nationwide in March after a self-driving Uber vehicle was involved in a fatal crash in Tempe, Arizona.
- GM tried to show off its automated GM Cruise to reporters in San Francisco, but the vehicle was reported to have issues with traffic cones and double-parked vehicles.

These and other incidents have led to the public remaining unconvinced and skeptical of ADS technology. One respected 2017 survey concluded that 40 percent of respondents anticipate ADS will reduce the number of people killed or injured in traffic accidents. But the remaining 60 percent are evenly split between those who think traffic fatalities will increase with ADS and those who expect fatalities will neither increase nor decrease.

By a 2:1 margin, Californians say driverless cars should not be allowed on the streets "where I live," a recent survey found. When asked "Who should be ultimately responsible for deciding where driverless cars are allowed and where they are not allowed" only 4 percent of respondents said the car manufacturer. Roughly half the respondents thought that state and local authorities were best suited to make such decisions. Fifty-eight percent said they did not believe the cars should be allowed on their neighborhood streets, while 57 percent said they would feel "unsafe" or "very unsafe" riding in such a vehicle.

The public belief in improving ADS safety is critical to any long-term development and acceptance of ADS. Government approval and technical development will mean little if people do not accept ADS as directly reducing the number of people killed or injured in traffic accidents.

That requisite public/market acceptance of safety improvement through ADS is far from certain:

- The 2018 AAA Vehicle Technology Survey reveals that 63 percent of U.S. drivers report feeling afraid to ride in a fully self-driving vehicle. It also found that 46 percent of U.S. drivers report that they would feel less safe sharing the road with a self-driving vehicle.
- A 2018 CARAVAN Public Opinion Poll found that 64 percent of respondents expressed concern about sharing the road with driverless cars and 80 percent support minimum performance requirements for computers that operate driverless cars. More than eight in 10 respondents support uniform DOT rules to ensure that the human driver is alert to safely take control from the computer and 73 percent support DOT developing safety standards for new features related to the operation of driverless cars.
- A 2017 MIT white paper on consumer interest in automation found that while the percentage of respondents favoring automation that helps the driver perform increased by 50 percent from 2016 to 2017, the percentage of people who were comfortable with features relieving the driver of control for extended periods or the entire drive dropped. Roughly half of all respondents said they would never buy a car that completely drives itself.
- A 2018 study by Morning Consult concluded almost half of Americans don't believe that ADS will ever fully replace human drivers. The same study found that while 58 percent of Americans do not trust ADS, their opinions could change as the technology evolves.

- Pew Research in 2017 reported that 54 percent of Americans expressed worry compared to only 40 percent who expressed enthusiasm about the development of driverless vehicles. More than half reported they would not want to ride in a driverless vehicle if given the opportunity.

- Seventy-five percent of persons surveyed by AIG in 2017 said they think there is a threat that hackers would take control of automated vehicles.

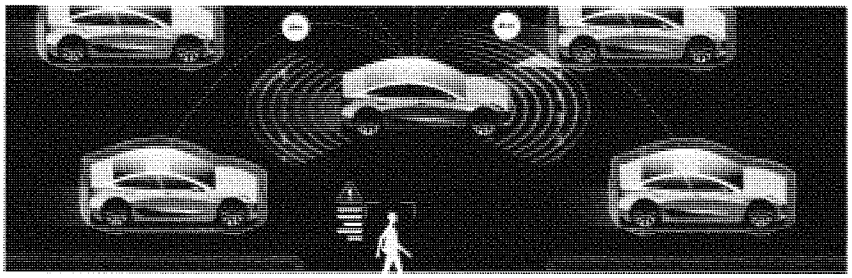
These events and statistics strongly favor an appropriately robust, tailored regulatory environment, without which more accidents will likely occur. Without a strong regulatory environment, there is an increasing risk that the public trust both in ADS and the government institutions that approve and regulate them may erode.

CHAMPIONS OF SAFETY: PROPERTY/CASUALTY INSURANCE COMPANIES LEADING ADVOCATES FOR AUTO PASSENGER SAFETY

Insurers have long championed auto and highway safety issues and have helped raise public awareness through the creation of auto safety research organizations such as the Insurance Institute for Highway Safety. The IIHS is an independent, nonprofit scientific and educational organization dedicated to reducing the losses – deaths, injuries, and property damage – from motor vehicle crashes. Insurers have allied with safety groups such as the Advocates for Highway and Auto Safety to work together to make America's roads safer.

The business of insurance demands that it applies hard data and institutes actuarial science to assess and mitigate risk. It was more than 30 years ago that coalitions of insurance companies together with consumer groups first favored state requirements for seat belts and air bags and opposed the auto makers reluctance to provide such safety features. Insurers have a long and proven history of working hand-in-glove with regulators and auto manufacturers to facilitate developments that save lives and prevent injuries and damage.

The revolutionary replacement of the human driver with ADS will require auto insurers to understand each vehicle's design and operation. Ultimately, drivers may not be comfortable with no control whatsoever, which means that the insurer of that human driver must understand the planned automated driving operations as well as any possible human operation of the vehicle under any circumstances.



The insurance industry understands that new and different data will be needed for insurers to write ADS-related insurance policies. The extensive history and level of human driving data that insurers have developed must now be supplemented by increasingly complex data on the automated driving systems that assist or replace the human drivers. Insurers have a proven track record of assessing driving risks and communicating to auto owners the methods to mitigate that risk.

The types of objective and verifiable data that will be required to provide insurance for ADS – data on frequency, severity, repairs – are the same types of data that can authoritatively validate safety levels of ADS to the public and regulators.

Auto insurance rates and coverage are established by insurance companies using vast amounts of historical data and established actuarial science, analyzing years of relevant data on frequency and severity of incidents. The rates determined by insurance companies are then frequently subject to a review by the state insurance regulators to ensure that they are fair and supported by data.

WHEN MORE IS BETTER: VALID AND UNDERSTANDABLE DATA ON ADS IS CRITICAL TO SAFETY

The development and deployment of ADS – particularly the proposed ADS with no controls for a human driver – is a game changer. It will entail a fundamental change in transportation, mobility, infrastructure, and myriad other areas. The adoption of ADS on a wide scale will impact millions of people and will require adaptation by governments, industries, and the culture in general.

The precondition to this development is an accepted belief that ADS improve safety, which will itself require sufficient data and information upon which to validate that belief. To date, information about ADS development in general and safety specifically has been limited.

NHTSA's Federal Automated Vehicles Policy encourages entities to disclose Voluntary Safety Self-Assessments demonstrating their varied approaches to achieving safety in the testing and deployment of ADS. NHTSA suggestions for the voluntary ADS disclosure advocates brevity and confidentiality. For instance, the 2017 update to the Federal Automated Vehicles Policy asks only for "concise information" and specifically not "an exhaustive recount of every action the entity took to address a particular safety element." In addition to NHTSA's one-page Voluntary Safety Self-Assessment Template related to crashworthiness, only two companies, Waymo and GM, have published ADS "safety reports."

At the state level, the California Department of Motor Vehicles requires all companies testing ADS to obtain a permit, file crash reports within 10 days of an incident, and complete annual "disengagement reports" explaining when autonomous technology has failed. Forty-nine companies have permits to test in California, and as of January 29, 2018, the DMV has received 55 Autonomous Vehicle Accident Reports.

ADS development is still in the early stages and myriad business, design, technical, and other issues are still only being discussed. In the competition to bring ADS to market, there should be a requisite level of confidentiality; premature disclosure of technical issues can have disastrous financial and developmental effects and potentially stifle innovation. Basic ADS design decisions such as whether to utilize vehicle-to-vehicle communication systems or to include an "emergency stop control" remain subject to internal corporate debate, technical questions, and related business considerations. Insurance companies

understand confidential information and have a long history of working with auto companies to obtain and use available data. Similarly, insurance companies have deep experience in data security and the wide scope of data privacy requirements.

Basic ADS design decisions such as whether to utilize vehicle-to-vehicle communication systems or to include an "emergency stop control" remain subject to internal corporate debate, technical questions, and related business considerations. Insurance companies understand confidential information and have a long history of working with auto companies to obtain and use available data.

At the same time, there is a significant level of concern that this system of voluntary self-certification by manufacturers of the safety of ADS may not be adequate to enable the development and public acceptance of safe ADS. Having defined and transparent government standards will result in more and better data and information on ADS that will help its development, the understanding and acceptance by the public of ADS, and the development of related businesses like insurance that will be critical to ADS use. Countries outside the U.S. have developed ideas to address data access, and ADS companies in those countries may be getting an acceptance advantage over U.S. companies. German companies and legislators are developing readouts of data in self-driving cars that will be simple and as standardized as possible. And in Japan, the government plans to make onboard data recorders compulsory for ADS vehicles.

The market acceptance critical to ADS development will be greatly facilitated by publicly available data that clearly states what the ADS is supposed to do and not do. This could be further enhanced with real-time data that provides the public with a clearer understanding regarding the performance capabilities, or limitations, of ADS. With access to such data, consumers, regulators, DMVs, and other entities could readily understand what aspects of the steering, acceleration, and braking of a specific ADS model are or can be partially or fully automated.

For ADS where a human has some level of control of driving operations, the ADS features, abilities, and limitations could be – absent aftermarket alterations – set and built for that make and model on the factory floor. Every Company X, Model Y built in month Z in Kentucky will have the same ADS features. It is extremely doubtful that auto manufacturers will build each car to custom orders; the assembly line will produce the same car with the same ADS features in the same way. Providing data on the exact ADS features, abilities, and limitations for those cars may be the same and would not involve any private data. This would allow owners and DMVs to understand, dealers to service, and insurers to write coverage based on the same ADS features, abilities, and limitations.

It would be in the best interests of proponents of safe ADS to coordinate and consider new and improved alternatives to communicate on ADS technology and performance. Somewhere between the extreme poles of "just trust us" and reams of federal regulations requiring submission of millions of certified data points is a system of information and communication that is usable and comprehendible for the public, governments, and other industries. Validation of safe ADS development and a resulting public acceptance can be greatly enhanced by a measurable gauge of ADS safety/risks through recognized analysis of most relevant data.

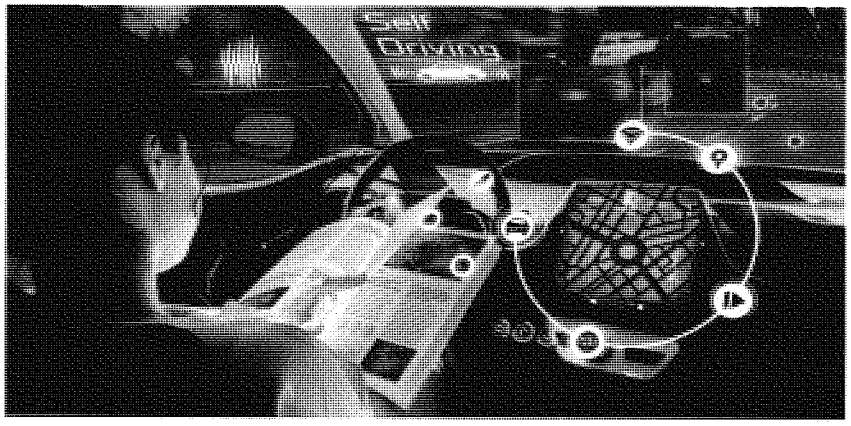
CONCLUSION

The potential safety benefits of ADS are tremendous, and the insurance industry is committed to supporting the development and deployment of real safety benefits at the earliest time. These benefits are dependent, however, on many and daunting technological, logistical, and regulatory revisions that remain to be designed and successfully implemented.

As noted in this paper, the existing environment of auto safety regulation evolved with a human-driver focus and has not fully considered the many nuances of increased assisted and automated driving systems. As these systems develop and evolve, the risk of regulatory safety gaps increases and the need for a comprehensive reassessment of driving operation safety grows exponentially, starting with the paramount focus on the safety of vehicle occupants, occupants of other vehicles, and the public.

Recent ADS tragedies have clearly illustrated that greater validation of safety features will be necessary to promote the development and deployment of this new world of safe ADS. Like middle school math homework, it may be beneficial to show how we got to the answer; to illustrate the exact steps taken to achieve specific metrics of safety for ADS. Broad assurances of overall safety must be bolstered by facts and data on ADS design and operation. Third-party validation of safety testing will help to develop the requisite public, insurer, and governmental trust to support further ADS deployment.

A prerequisite of that trust, particularly for insurers, is the access to more and better data on the proposed and adopted design and operation of ADS. Through their highly regulated development of rates and coverage, insurers apply many of the objective and independent validations sought for ADS operational safety. Just as with the established and active advocacy of seat belts and air bags, auto insurance companies can work with auto manufacturers and safety advocates to develop and implement commercial standards that can save lives.



Comments of the U.S. Vehicle Data Access Coalition To the Subcommittee on Highways and Transit Of the House Committee on Transportation and Infrastructure Hearing on "Innovation in Surface Transportation"

September 5, 2018

Good morning, Chairman Graves, Ranking Member Norton, and Members of the Highways and Transit Subcommittee. The U.S. Vehicle Data Access Coalition ("Coalition") is pleased to present this statement to the Subcommittee with respect to your hearing on "Innovation in Surface Transportation." The Coalition respectfully asks that this statement be made a part of the official record of this hearing.

The Coalition is a voluntary group of diverse stakeholders – consumer protection and privacy advocates, vehicle fleet owners (both light- and heavy-duty), vehicle equipment suppliers, distributors and repair facilities, telematics and fleet management companies, insurers and others – united by our common belief that vehicle owners must control access to, and the use of, the personal information and vehicle data generated and stored by the motor vehicles they own.

As we collectively move towards the deployment of more connected and automated driving system-equipped vehicles – both light- and heavy-duty – in the coming years, the importance of data access and control by vehicle owners, and other parties,

will only increase. The Coalition commends the Subcommittee for calling this hearing and urges its members to focus your collective attention on the issue of data access as you consider broader policy issues of innovations in surface transportation.

There are three key issues with respect to data access involving connected and automated driving system-equipped motor vehicles that the Coalition urges the Subcommittee to address: (1) communication and interoperability; (2) safety; and, (3) cybersecurity.

First, with respect to communication and interoperability, all vehicles are undergoing revolutionary changes with respect to how they communicate with other vehicles on the road, with the transportation environment surrounding them, and with vehicle owners and their representatives, drivers and passengers, both inside the vehicle and at remote locations. The Coalition's focus is on access to, and control of, the data being generated by, and transmitted from, connected and automated driving system-equipped motor vehicles. However, without interoperability, that access and control will not be meaningful; seamless communication between vehicles, infrastructure and the overall transportation environment (including governmental oversight and regulation) are essential. Given the very nature of motor vehicles, the communication and interoperability of vehicle data, as well as the access to and control of that data, are a core consideration for federal legislators and regulators.

The Coalition strongly supports guaranteeing that the rights of motor vehicle owners are not eroded through the introduction of new technologies. Owners of motor vehicles, as well as parties to whom the owners give informed and advance permission, must control access to the data generated and stored by connected and

automated driving system-equipped motor vehicles. This data can relate to the location of the vehicle, the operation of the vehicle, the weather at the vehicle's current location or along its planned route, and numerous other interactions between the vehicle, its driver and/or passengers, and individuals at remote locations (dispatchers, logistics and safety experts, first responders, and customers). All of these individuals need real-time and accurate communication with all vehicles operating in a connected and/or autonomous mode.

Second, with respect to safety, the Coalition anticipates that data on the freight, cargos and packages being transported by commercial motor vehicles – particularly medium- and heavy-duty trucks -- will be communicated increasingly through data and the airwaves, rather than through placarding and manifests. As a result, first responders and law enforcement will be able – and must be able -- to access real-time, accurate and detailed information about a vehicle's cargo electronically. Such real-time data exchange could save lives and limit property damage in the event of an incident or an accident as well as actually preventing incidents and accidents – underscoring the importance of real-time data access by vehicle owners and other authorized parties. Again, maintaining data access and control by vehicle owners – who have the accurate information on the freight being transported – and their authorized third parties – is vital to assuring real-time responses to incidents to avoid safety risks.

Third, cybersecurity has become a focus of connected and automated driving system-equipped motor vehicles, including the potential for hackers to disrupt communications between vehicles or take over control of a vehicle. Some stakeholders have gone so far as to assert that the sole method of addressing cybersecurity concerns in connected and automated driving system-equipped motor

vehicles is to shut down or limit access to the data generated by a motor vehicle for anyone other than the manufacturer of the vehicle.

The Coalition strongly disagrees with this position and asserts that basic cybersecurity tenants support that proprietary and closed data systems are actually the most vulnerable to catastrophic failures. Accordingly, the Coalition urges legislators and regulators to resist the adoption of such an approach to connected and automated driving system-equipped motor vehicle cybersecurity and data access. The Coalition urges that legislators and regulators promote a policy framework that insures that vehicle data access is: (1) open, secure, and neutral; (2) protected against hacking through recognized principles of data security by design; and, (3) accessible without charge to the vehicle owner and, should the vehicle owner provide informed advance consent, to authorized third parties.

Congress has signaled its interest in the connected and autonomous vehicle data access and control issue through its unanimous adoption of a bi-partisan autonomous vehicle data access amendment to the Senate autonomous vehicle bill. This data access amendment, sponsored by Senators Inhofe (R-OK) and Baldwin (D-WI), would create a data access advisory committee comprised of a wide spectrum of stakeholders, including the Department of Transportation and the National Highway Traffic Safety Administration. The Inhofe/Baldwin Amendment was adopted by the Senate Commerce Committee unanimously in October 2017 and its inclusion of all legitimate stakeholders with an interest in connected and autonomous vehicle data access should form the foundation for all future discussions of data access and control of vehicle and personal data by vehicle owners – whether by the Subcommittee, by the full Committee, by other congressional committees, or by federal vehicle, consumer protection and privacy regulators.

Thank you for the opportunity to provide these comments from the U.S. Vehicle Data Access Coalition. The Coalition looks forward to working with the members of this Subcommittee and all stakeholders to address the issues of connected and automated driving system-equipped motor vehicle data access, vehicle owner data control rights, and cybersecurity in the near future.

If the members of the Coalition can be of assistance to this Subcommittee, please do not hesitate to contact Greg Scott at 202-297-5123 or at gscott@merevir.com.

MEMBERS OF THE U.S. VEHICLE DATA ACCESS COALITION

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American Bus Association
American Car Rental Association
Auto Care Association
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