A brave **new world**

A panel of experts offer a look at where various segments of our industry stand—and what's happening next

Accelerating the future of ITS

Regina **Hopper**

Rodney **Slater**

ITS America kicked off the 2016 Consumer Electronics Show Broadband conference with the question: "Intelligent Transportation: Are We There Yet?"

Actually, intelligent transportation systems, or ITS, are not new. But, with blazing attention on connected and automated vehicles—there were more than 500 automotive industry exhibits and demonstrations at the show—ITS is now sitting in an intense consumer, media, policy and business spotlight.

There is no doubt 2016 will be a defining year for intelligent transportation systems.

In his State of the Union address, President Obama declared it is time to "put tens of thousands of Americans to work building a 21st century transportation system." Within days, Transportation Secretary Anthony Foxx unveiled the administration's proposal to spend $4 billion over 10 years to fund automated and connected vehicle pilot projects, and a landmark pact was reached between the federal government and 16 automakers to guide closer collaboration on critical cybersecurity and safety matters at the dawn of this new age of intelligence.

All of this progress builds on Congress' December passage of a long-term highway bill for the nation. The "FAST Act" includes a first-ever Innovation Title to fund important research and accelerate the adoption of intelligent transportation systems, effectively mainstreaming ITS by making intelligent transportation projects eligible for funding across all core highway programs.

Taken as a whole—and fully and effectively implemented—these actions could dramatically accelerate the ability of consumers and our nation's economy to move from point A to point Z more safely, efficiently and in a more sustainable way than ever before.

There are few investments in our nation's and our people's future that could yield a higher rate of return. To get a sense of the magnitude of such a move, a preliminary estimate by the U.S. DOT shows just two safety applications—Left Turn Assist and Intersection Movement Assist—could alone prevent nearly 600,000 crashes and save more than 1,000 lives each year.

Sound policy holds real potential to accelerate this progress in 2016, in several key ways.

As of this writing, the Obama administration is working with the automotive and ITS community to create an updated Autonomous Vehicle Policy that will advance new safety innovation and also is working to accelerate the adoption of vehicle-to-vehicle (V2V) communications in all new passenger vehicles.

The ITS community is working with the Federal Highway Administration and other stakeholders to prepare vehicle-to-infrastructure (V2I) deployment guidance for state and local agencies to ensure infrastructure, from parking meters to intersections, gets the same IQ upgrades as our vehicles.

The National Highway Traffic Safety Administration (NHTSA) will be following through on its decision to modernize its New Car Assessment Program for an ITS world, including, for the first time, information on collision-avoidance technologies versus crash worthiness alone.

This spring, the U.S. DOT will select the winner of its Smart City Challenge to create a fully integrated, first-of-its-kind city that uses data and technology to revolutionize the movement of people and goods.

Government agencies are working with auto and Wi-Fi engineers to determine whether spectrum sharing is possible in the 5.9 GHz band without causing interference that would put safety and other ITS communications at risk.

Our collective challenge is to ensure we move ahead with constructive policies that are just as intelligent and nimble as the technology transforming the ITS sector—policies that protect the public interest, while accelerating the arrival of new transportation innovations that continually make people's lives better. The stakes are high, and we all have every incentive to get it right.

The promise of ITS has never been more clear or more exciting.

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Considering the future of autonomous vehicles

Rob **Deans**

The questions that seem to dominate discussions about autonomous vehicles these days revolve around when the fully driverless car will arrive, how the transition will occur and what form this new way of getting from here to there will take.

Already, vehicle navigation systems or smartphone apps can guide you around traffic congestion, accidents and the like, optimize a trip based on cost, distance and speed, and include first responder and weather alerts as well. It won't be long before your on-board digital assistant will plan the best route to get you to appointments on time, and make any necessary notifications en route.

Vehicles are rapidly becoming "connected" to the driver and communicating important information. Already, there are systems installed on major highways and interstates that make possible automated or dynamic pricing facilities to better manage traffic flows and reduce congestion. Now imagine if that information could be communicated directly to your connected vehicle and, based on user preferences, optimize your trip?

Soon, the combination of sensors, high-speed connectivity, big data analytics and advanced computing technology, such as is presently being tested in northern Virginia—the Virginia Automated Corridors initiative, an autonomous vehicle highway testing program being overseen by Transurban, Virginia Tech, Nokia HERE maps and other partners—will be in place which can communicate with enabled vehicles to guide them safely and reliably on major thoroughfares.

Vehicles are expected to be capable of operating in a driverless mode within two to five years, according to many technology and automotive leaders (including Google and Tesla, Ford, Volvo and Cadillac, to name just a few). Elon Musk has said he expects to have a fully autonomous Tesla ready for the road by 2018, and Google has, of course, been testing its autonomous vehicles for several years. The reality is most, if not all, of the technology to make an autonomous vehicle is already available.

Regulatory approvals are expected to take longer, and will vary by jurisdiction. However, that could change if Congress opts to fund President Obama's fiscal 2017 budget proposal for nearly $4 billion over 10 years for automated vehicle projects in designated highway corridors. To support this plan, the NHTSA just released updated policy guidance on automated vehicles and will be pushing to accelerate safety technologies as well.

Most futurists and technology experts agree that the arrival of the autonomous vehicle will be a game changer, ushering in business model and social changes along with new ways of getting around, and helping cities transform into 21st century centers that are no longer defined by vehicles.

Predictions with which I concur include: Traffic accidents will become rare as computers exceed human capabilities to react to sudden changes on the road; electric vehicles will be more widely adopted; car services such as Uber and Lyft are likely to operate autonomous fleets; there will be fewer single-owner and more shared vehicles; and parking will migrate to areas outside of crowded city centers.

In the next 10 to 20 years, as more technology is embedded in roadways to communicate with autonomous vehicles, traffic can be better managed to accommodate pedestrians, bicyclists and other forms of mass transit. Road maintenance costs will decline. The grind of a daily car commute to and from work, and time wasted looking for parking in crowded urban areas will become things of the past.

The more interesting question is how do we start preparing now for the future benefits that autonomous vehicles can deliver? How do we encourage the new thinking needed to plan and fund the infrastructure for smart highways and cities?

Clearly, the old funding model based on gasoline taxes and government funding is not up to the task even today, and certainly isn't sufficient to invest in new transportation infrastructure. Innovative approaches will be needed. The model of the public-private partnership (P3) is emerging as a leader in helping to drive technology for smarter transportation solutions and more livable cities. The P3 approach leverages private-sector research and private-sector capital with the ability to shoulder the largest share of the financial risks of demand and adoption. Government supplies the policy and regulatory framework and public engagement to guide management of new transportation systems to deliver safety, efficiency and the most benefits to society.

Deans is vice president of technology for Transurban North America.

Kurtis
McBride

How secure is secure?

The panic on the driver's face as hackers killed the engine on his Jeep in the middle of a busy highway was palpable. Even when he knew it was part of a stunt, you could see the terror in his eyes as cars whizzed by and he sat helpless in a lane of traffic. "Guys, I'm stuck on the highway. Guys, I need the accelerator to work again," he pleaded. "Seriously, it's f***ing dangerous. I need to move."

That high-profile hack, profiled in *Wired* magazine in July 2015, drew breathless media attention at a time when the prospect of autonomous vehicles is at a fever pitch. It seems like every week, there is news about a different car manufacturer or tech company getting into the self-driving car business. While stunts like the Jeep hack understandably attract attention to the issue of security and connected cars, we also need to think about the security of municipal infrastructure. I'm not talking about just physical infrastructure such as roads and bridges—though they need security too. No, I'm talking about the technology infrastructure—the sensors, servers, routers, traffic signals and more—that form the backbone for smart cities.

While hacking one car puts the driver and passengers at risk, infrastructure breaches can cause peril to thousands of lives all at once. Imagine what would happen if hackers took over a city's transportation grid and turned all of the traffic signals red.

It's not far-fetched. Last year, security researchers discovered that magnetic sensors embedded in roadways in 40 U.S. cities including San Francisco, New York and Los Angeles lacked basic protections such as data encryption or authentication. That exposed the entire system to someone who might want to replace traffic data with false information and trick traffic signals into adjusting their timing. The potential for gridlock and even deadly accidents is very real. Also last year, researchers from the University of Michigan hacked into nearly 100 wireless traffic lights with permission from the local road agency.

Cities often use default authentication settings in traffic cabinets, which means the radio signals they use to communicate are not encrypted. If the servers and software running signal controllers aren't updated with the most recent security patches, they could be taken over. The three major weaknesses exploited by the Michigan team were unencrypted wireless connections, the use of default usernames and passwords that could be found online, and a debugging port that is easy to attack. Many older traffic controllers and technology still running city infrastructure were never designed with Internet connectivity in mind. They can usually be brought online in a safe and secure way, but it takes a well-designed security plan—not simply plugging them into a modem.

Modern cities run on computers just like every modern organization. Technology enables some incredible opportunities. Unfortunately, it also makes us inherently vulnerable to cyber attack. It may not be imminent, but you never know what could inspire someone to mount an offensive. Part of what puts cities at greater risk is the patchwork of technology that connects them. City IT systems are not known for their strong security or architecture. They're working with a mix of legacy systems and modern software running on a mishmash of network infrastructure. So many weak links make cities a hacker's dream target.

But what can we do about it? Auto companies face lawsuits over the security of their cars, but when it comes to transportation infrastructure security, confusion reigns. Is it the responsibility of the city, county, state or transportation authority? How does liability change as infrastructure crosses government boundaries? Is it the responsibility of the company that builds the project? The engineers who designed it? The technology provider who installs the network?

These are questions and vulnerabilities that no previous generation could have even imagined, but as more cities turn to technology to improve efficiencies and service to their residents, they need a coordinated approach to make sure safeguards are in place. In the case of the in-road sensors found to be vulnerable last year, the cities buying them specifically rejected encryption and other security protocols because they didn't think anyone would want to attack sensors.

If there's anything we've learned in the last few years, it's that if there is a vulnerability, someone will exploit it at some point even if it seems innocuous. The problem is that it's not as simple as pointing a finger at a single government agency or private vendor. We all have a responsibility to help each other find the holes in these systems and plug them. We can't afford not to. Complacency will be our downfall.

In 2006, two municipal traffic engineers on strike in Los Angeles disabled four signal controllers. The district attorney called the act sabotage "not to be tolerated no matter what the dispute or cause." Nearly 10 years later, vulnerabilities are as prevalent as ever. Security is serious business. We shouldn't hide from technology out of fear, but making it safe and secure needs to be a top priority.

McBride is the CEO and co-founder of Miovision.

Michael
Townes

Transit rising, rising, rising

National transit ridership rose last year to the highest it's been in over half a century—and it doesn't appear to have peaked. According to a report by the American Public Transportation Association (APTA), Americans took 10.8 billion trips on public transportation in 2014, and 2015 ridership rates are on track to equal or even surpass this number. Increased ridership is not limited to large metro areas; it also is prevalent in small- and medium-sized communities.

The numbers say it all. Americans want more travel options and will use public transportation if efficient, convenient options exist. With the range of transit systems available—buses, subways, light rail, heavy rail and streetcars—it is becoming increasingly easier for people to choose the transportation mode that works best for them. Choice matters. It's what defines the future of the transportation industry and what industry leaders must consider when planning new projects and systems.

The U.S. has seen an upsurge in transit ridership alongside urban design and economic developments. For example, as 49,000 jobs were added between January and June 2015 in Seattle, Sound Transit, the greater Seattle area's bus, commuter rail and light-rail service, saw record ridership with a 6.7% increase from the previous year. In addition, Washington State Ferries ridership rose 4.5%.

The future looks bright. Groundbreaking transit projects have gained momentum nationwide and more exciting projects are underway. In the San Francisco Bay Area, the Santa Clara Valley Transportation Authority's BART Silicon Valley Extension will bring 16 additional miles of heavy-rail public transit, representing a more than 15% service increase. The Gateway Program in New York will double the number of passenger trains running under the Hudson River to link Manhattan with New Jersey. And high-speed rail projects in California, Texas and Florida indicate a promising future for rail developments nationwide.

Still, as the population booms and more people look to transit, our current transportation infrastructure is deteriorating. Critical road, bridge and railway maintenance and safety measures have often been far too long deferred. Yet research shows Americans are more apt to use public transit when we invest in repairs and improvements to these systems. It is thus essential to maintain the value of our enormous investment in these existing sinews of the national transportation infrastructure. Equally important is a streamlined environmental and regulatory process to advance critical infrastructure projects. Why? Because projects such as rail transit and bus rapid transit connect communities and spur development and livability.

Despite the many transit advances that have been made in recent years, the industry suffers from inadequate funding. In December, we took a step forward with passage of the Fixing America's Surface Transportation (FAST) Act, a fully funded $305 billion measure to invest in highways and transit projects over the next five years. This represents the first time since 2005 that Congress passed a transportation funding bill that covers more than two years. While this major legislative achievement deserves our appreciation for providing stability and modest growth for five years, we must start thinking about a more robust bill that can build on this growth.

While the FAST Act's resources are a starting point, a consistent, long-term funding fix is needed to provide the increased investment necessary for the development of a truly interconnected system. Despite the FAST Act's being "fully funded," the federal gas tax, the primary source of transportation infrastructure funding, has remained unchanged since 1993. Yet the price of everything else has soared, sapping the purchasing power of this now-paltry 18.4-cents-per-gallon tax that today has only about 60% of the buying power it commanded when it was last raised over 22 years ago. With the government now spending more on transportation than the gas tax produces in revenue, this funding model is clearly outdated and inadequate.

Today, public transit ridership nationwide attracts more than 158 million people, or two-thirds of Americans age 18 and older. People recognize the value of public transportation, but they demand and deserve more from our transportation network. Its ability to keep pace with growing demand requires public and private investment in the infrastructure that will support it.

Finally, it is important to note that by investing in transportation systems, we are making a commitment to growing our economy, creating jobs, reducing our carbon footprint, expanding mobility, spurring urban development, and improving the nation's overall quality of life. Simply put: It's worth it.

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State DOTs ease congestion with ATDM tactics and make ready to harness emerging tech

Ananth **Prasad**

Jim **Barbaresso**

For state department of transportation leaders facing worsening urban traffic congestion, few proverbs have resonated more in recent years than, "Necessity is the mother of invention." Hemmed in by fiscal constraints, including uncertain federal funding, many leaders have focused on adopting creative tactics for more proactively managing traffic to get more efficiency out of their existing infrastructure.

Inspired by the holistic Active Transportation and Demand Management (ATDM) approach, DOTs across the country—such as those in Georgia, Virginia, Florida and Michigan—have successfully experimented with a range of concepts. One of the most popular concepts has been lane management, which consists of opening and closing lanes, reversing a lane's traffic during certain hours, displaying variable speed limits that reduce speed turbulence, and selectively opening hard shoulders to traffic based on congestion levels. Highway ramp management also is becoming more popular, effectively metering the number of vehicles entering the highway to avoid congestion and collisions due to on-ramp turbulence or off-ramp spillback.

To more effectively manage demand on certain roads and bridges, and to gain revenue, more metropolitan areas are expanding their toll networks. In areas where it makes sense, existing high-occupancy vehicle lanes with excess capacity are being transformed into high-occupancy toll lanes. Such conversions preserve the financial and environmental incentives for carpooling and ridesharing, while reducing congestion on the general-purpose lanes—and generating revenue—from toll-paying vehicles.

Such creative tactics have already made a significant impact by improving day-to-day transportation issues in many cities. They represent the beginning of an era of far more advanced and innovative traffic and demand-management approaches. This transformation began with relentless technological improvements, which will be further accelerated by the FAST Act, recently passed by the U.S. Congress. The measure provides $100 million each year for ITS research, and another $60 million for competitive grants to encourage the development of advanced transportation and congestion management technologies. On Jan. 14, 2016, Secretary of Transportation Anthony Foxx, speaking at the North American International Auto Show in Detroit, proposed a 10-year, $4 billion investment to accelerate the development and adoption of connected and automated vehicle technology. Equally important was the administration's commitment to quickly develop a policy and partnership framework for the deployment of these transformative technologies.

This type of forward-looking investment could not have come at a better time for DOTs eager to glean even more value from their existing infrastructure. This is because technology is giving us revolutionary tools that, when integrated into our operational approach, can reduce congestion and accidents, while greatly improving user experience.

As one example, every year automakers roll out new features that are setting the stage for autonomous vehicle operation. Already, some vehicles are rolling off the assembly line with the ability to autopilot in limited circumstances, such as when traveling under 40 mph in stop-and-go traffic. While it will perhaps take 10 to 20 years for these autonomous features to become prevalent, DOTs can already set the stage for adapting restricted travel lanes to accommodate future "platooning," in which vehicles communicate among themselves and the roadway to travel in tight packs. This would allow two to three times as many vehicles to travel per lane per mile, greatly impacting congestion.

DOTs also will be able to harness data from vehicles to improve traffic flow on secondary roads. Many cities are already using adaptive traffic signals to reduce backups, but real-time data from cars will infuse predictive models to allow for highly advanced light timing based on the realities of the day.

The key to success going forward will be to break down silos between agencies and jurisdictions to make mobility a shared goal and integrated corridor management a core principle. After all, an individual traveler cares mainly about getting from Point A to Point B, with convenience and cost determining whether car, train, bus, bike or foot (or a combination of these) makes the most sense. The more effectively we can adopt this same mobility-centric, rather than mode-centric, approach to transportation planning and execution, the greater our ability to make every mile of infrastructure work harder to deliver the safe, efficient journeys our citizens deserve.

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