

**Dr. Robert Edelstein
Senior Vice President, ITS Practice Lead
AECOM**

**On the use of new technologies to enhance infrastructure and transportation
across the country**

**Before the Senate Commerce, Science and Transportation Subcommittee on
Surface Transportation and Merchant Marine Infrastructure, Safety and
Security**

June 28, 2016

Introduction

Chairman Fischer, Ranking Member Booker, and members of the Subcommittee, on behalf of AECOM, I thank you for this opportunity to testify on the advancement of new technologies to enhance infrastructure and transportation across the country. Whether we are discussing the so-called “Internet of Things” (IoT) in transportation and infrastructure, or more broadly, the application of technology, and the utilization and analysis of data to evaluate, manage and improve system performance, there is much being accomplished in this area.

My name is Robert Edelstein, and I am a Senior Vice President and Intelligent Transportation Systems (ITS) Practice Leader for AECOM.

When I joined AECOM in 1978, my focus was largely on the planning, design and construction of transportation facilities including roadways, transit systems, airports, seaports, and multimodal transportation centers. This focus has transitioned to making these infrastructure projects more efficient in terms of operational integration. This is now facilitated through the advent IoT and big data applications.

About AECOM

AECOM is a premier, fully integrated professional and technical services firm positioned to design, build, finance, operate and maintain infrastructure assets around the world for public and private sector clients. We have nearly 92,000 employees - including architects, engineers, designers, planners, scientists and management and construction services professionals - serving clients in over 150 countries around the world. AECOM is ranked – for the seventh consecutive year -- as the #1 engineering design firm by revenue in Engineering News-Record magazine’s annual industry rankings, and has been recognized by Fortune magazine as a World’s Most Admired Company. The firm is a leader in all of the key markets that it serves, including transportation, facilities, environmental, energy, oil and gas, water, high-rise buildings and government. AECOM provides a blend of global reach, local knowledge, innovation and technical excellence in delivering customized and creative solutions that meet the needs of clients’ projects. A Fortune 500 firm, AECOM companies, including URS Corporation, Tishman Construction and Hunt Construction Group, have annual revenue of approximately \$18 billion.

Evolution of Transportation Management Centers (TMCs)

Over the years, transportation management centers (TMCs) have transformed from being single-dimensional (e.g., focusing on signals, freeways, transit systems) to becoming more multi-jurisdictional and multi-modal. The “TMC of the Future” is anticipated to evolve in applying predictive models and automated decision support systems to stay ahead of congestion rather than reacting to it.

AECOM is a global leader in TMCs in all aspects of master planning, design, software development, systems integration, construction, and operations. Our forte is in the area of operations where we have worked in over 40 TMCs, thereby giving us an end-user’s perspective of ITS and how to take it to the next level.

In Florida and California, we developed dynamic pricing software to operate their managed lanes networks. In Virginia, we designed, operated and maintained their reversible roadways systems. In New Jersey, we developed the next generation of Advanced Traffic Management System software to support predictive analytics and decision support systems. In Michigan, we are operating four TMCs where Connected Vehicle test beds are operating. In Missouri, we are operating the Gateway TMC in St. Louis which we anticipate will accommodate “Road to Tomorrow” innovations in the future.

Performance measures are reported on a monthly and annual basis for many of these TMCs. For example, the most recent annual report for the Florida DOT TMC in Miami shows a benefit-cost ratio of 53, meaning that for every dollar invested in the program, \$53 is being returned in terms of travel time savings and safety benefits. This considers the fact that for every minute that a lane is blocked it translates to 4 minutes of delay and the probability of a secondary accident occurring increasing by 2.8%. Therefore, if you can clear the blocked lane 15 minutes faster, then you can avoid a one-hour delay and reduce the probability of a secondary accident occurring by over 40%.

Technology Partnerships and Smart Cities

The pace of change in this area creates a critical need for extensive technology partnerships. Innovation is occurring through these numerous and varied partnerships, and Federal, state, and local policy should do everything possible to encourage and facilitate continuation of dynamic partnering opportunities. Project sponsors need to pursue platforms that are flexible and will allow them to grow and develop over time as the community sets its priorities and develops its blueprint to guide future decision-making.

Strong and adaptive technology partnerships allow communities to build upon lessons-learned from previous efforts across the country. We recommend integrating the transportation technology strategy with the long-range regional transportation plan to connect the dots between existing conditions, forecast future conditions, and transformative technologies. Further, being creative and catalyzing new partnerships with the private sector is what enables adaptive solutions to be developed to new and changing challenges.

AECOM collaborates with many of the technology giants including Xerox with whom we developed the Los Angeles dynamic pricing system, and with IBM where we are developing

software systems for the New Jersey Turnpike and collaborating on developing smart cities in India.

We were recently selected for the RoadX program in Colorado, and we are assisting the Missouri DOT on the “Road to Tomorrow” program in developing technology partnerships and innovations. In response to these emerging trends, the Colorado DOT is forming a technology-driven innovation venture called “RoadX”. This initiative is aiming to make traveling in Colorado crash-free and delay-free, and will improve the efficiency of the state’s transportation system within the next 10 years. The collaborative project focuses on building partnerships and entrepreneurial relationships that will deliver innovative solutions to reduce the cost of transporting goods, turn a rural state highway into a zero-death road, and improve congestion on Colorado’s critical corridors. The program will employ a multi-pronged deployment, operations, innovation and technology approach with several efforts to be completed in the next five years. The Missouri DOT “Road to Tomorrow” program is looking at a broad suite of innovations including solar roadways, “Internet of Things” applications for smart traffic control, safety and road assistance, as well as smart pavement applications and truck platooning. Aggressive approaches to innovation such as these efforts require strong technology partnerships.

Internet of Things (IoT)

As no one owns the Internet, nor the controls and routes used to transmit data, the same could be said about the IoT. While there are 75 million servers running the global Internet, there are 1.2 billion cars driving global transportation (of which 20% are in the US). Personal vehicle ownership is grossly inefficient: cars are estimated to be parked 95 percent of the time and our transportation systems are under-utilized during non-peak periods.

There is a reason the leading global Internet companies are looking at connected and automated vehicles as they understand the issues are similar to the decentralization of car ownership that created the Internet decades ago.

IoT approaches will allow people and cargo to be transported more efficiently across multimodal transportation networks at designated pickup and drop off times. This will enable the balancing of transportation supply and demand in real time by optimizing routes, modes, and schedules while eliminating human errors, thereby reducing accidents.

Working IoT strategies into our short and long-range transportation plans is a challenge. AECOM is currently supporting the New Zealand Transportation Authority in preparing them for connected and automated vehicles by assessing various scenarios of technology adoption rates and identifying the appropriate technology infrastructure improvements that will support it.

Innovations

In recent years, several innovations have surfaced to embed technology into our transportation systems to enable them to operate safer and more efficiently. Many DOTs have embraced a Transportation Systems Management & Operations approach which focuses on developing a higher level of operational integration across transportation modes while being aligned with performance measures used to improve operations. Other strategies include smart motorways, smart parking, data management, dynamic pricing, integrated corridor management, and electric vehicle charging systems. In addition to ITS, our “New Ventures” Practice seeks innovations in

all aspects of our business such as the Hyperloop program which will eventually transport pods of people and cargo at speeds in excess of 700 mph. Meanwhile, smart cities, connected and automated vehicles have been receiving the most attention.

Examples of innovative projects where a great deal of the excitement is focused include:

- **Lake Tahoe Smart Parking:** This is a demonstration of how this technology improves the user's experience in mobility. Estimates indicate that 30% of urban congestion is created by people circling city streets looking for parking.
- **LA Metro Mobility Hubs:** The mobility hub model brings multiple technology-enabled transportation choices together in a single place to create a more streamlined experience for commuters, visitors or residents going about their daily business in the Los Angeles region. This project, funded by the Jobs Access Reverse Commute program, is also a way to make the benefits of a smarter transportation system accessible to those without access to the internet at home.
- **Connected Vehicle Data Applications for TMCs:** Transportation agencies understand the importance of connected and automated vehicles and the impending emergence of this technology on the roads. AECOM is helping agencies figure out how to integrate this more holistically into the transportation ecosystem.

Each new innovation brings with it unique benefits, such as better management of infrastructure, and more responsive government services. Innovations can stretch limited resources to address greatest demand, bringing operational efficiencies that save taxpayers money, including:

- **On-demand services:** Improve garbage collection efficiency sending garbage trucks to collect trash based on sensors that indicate the need for service.
- **Waste reduction:** An estimated 2.1 trillion gallons of clean, treated water is lost every year to leaks in water infrastructure. For example, during 2013, Houston lost 15 percent of its water – 15 billion gallons – to leaking pipes. Even aggressive efforts to fix leaks will not keep up with the rate of new leak formation. We need to better manage the flow of water by embedding sensors in water pipes throughout the distribution network which will save energy and water.
- **Optimized systems:** We can better manage storm water to minimize runoff and maximize capacity. Kansas City, Missouri is using sensors at critical points across the city for advance notification of potential flooding issues. Jacksonville, Florida is using a combination of cameras, sensors and analytics tools to quantify the passage of cars, pedestrians and bikes to measure the high rate of fatalities and injuries, inform planning staff of the need for new bike/pedestrian infrastructure as well as tracking and evaluating resulting behavior change, thereby increasing safety for pedestrians, cyclists and drivers.
- **Use of data to preempt and predict problems before they occur:** Infrastructure sensors can provide an ongoing assessment of the lifespan of major bridges, and even detect structural problems. For example, on the Brooklyn Bridge, sensors monitor cracks and temperature fluctuation.
- **Expanding the capacity of government to reach more people:** Digital kiosks in Kansas City and New York City, for example, are making it possible for citizens to

access city services without needing to have access to smartphones or the Internet at home. This is essential in helping local government bridge the digital divide.

- **Better communication to stakeholders:** This includes real-time tracking of transportation (where is my bus) and other services such as snow plows (when will my street be plowed). When Pennsylvania was hit with a major snow storm last year that crippled traffic on the interstates, the DOT used its partnership with Google Waze to provide information to drivers stuck in traffic/snow when the highways were shut down

TMC of the Future

I would like to leave you with my vision for the “TMC of the Future”. While the “TMC of the Present” continues to focus on our core functions related to traffic operations and safety (i.e., incident, traffic, special event, and work zone management); and the “TMC of the Future” will accommodate next generation ITS strategies (e.g., active traffic management, managed lanes, integrated corridor management, connected vehicles, predictive modelling, decision support systems); the Internet of Things has the potential for integrating transportation operations with other city services (e.g., smart parking, public safety, smart buildings, security, air quality, emergency management, water & waste water management, and smart energy grid systems).

While this integration may be virtual or a physical collocation of operations staff, and there are pros and cons to each approach, the integration has the potential to open new ways to apply the IoT and big data to utilize our transportation resources to its highest and best use while enabling the user to customize their trips based on their specific needs and desires. I suggest that consideration be made to incorporating the “TMC of the Future” concept into Smart Cities.

Enabling Policies

Innovation is occurring at an incredibly rapid pace across this country. To address these changes, and continue to foster innovation, Congress may wish to consider the following:

Revisiting policies at the federal and state levels to attract technology partnerships. For example, public-private partnerships may be considered where the auto manufacturers/original equipment manufacturers (OEMs) build new capacity (e.g., an additional traffic lane) to accommodate autonomous vehicles. As the penetration of autonomous vehicles grows over time, more vehicles would likely use this dedicated lane. Funding for all infrastructure remains a challenge. Through the current available and developing technologies, it would be possible to enable the assessment of user fees which would generate revenue to offset the costs of construction, operations and maintenance. This also opens the possibility for revenue sharing arrangements that could expedite the phase in of autonomous vehicles while generating revenue for both parties.

Relieving regulatory constraints that may hinder implementation of new technologies. Much of our public policy is built around the technologies of the past and can make it difficult to introduce new alternatives. This is particularly relevant when you think about how cities function - if an inspector has access to real-time data in the field, he or she may be empowered to make different decisions than if he were to simply respond to the issue at hand.

Providing expanded funding for “Smart City” grants to allow more cities to participate across the nation. As 78 cities applied for the USDOT Smart City Challenge grant, and only one (Columbus) was selected, the interest in these technology developments is significant, and demand for resources is high. Dedicated resources for Smart Cities would provide an expanded national showcase of how IoT and big data can be applied in a diverse range of applications. Federal funding for the implementation of new technology applications can remove the risk for project sponsors and provides technology partners (large and small) the opportunity for a return on investment to cover their R&D costs.

Provide federal funding for programs similar to RoadX (Colorado) and Road to Tomorrow (Missouri). These programs are seeking technology partnerships to innovate new technologies and apply them to our transportation systems. While RoadX is funded by the Colorado DOT, the Road to Tomorrow is primarily reliant on revenue generated from new sources and innovative partnering strategies. New grant programs (such as the nationally significant freight and highway (FASTLANE) grant program included in the FAST Act can be helpful, as can funding provided through the TIGER Grant Program. At the end of the day, sustainable revenue streams are critical for major innovations to be implemented in meaningful ways.

Areas for Future Focus/Opportunities:

Standardization is critical: This will further help the scalability of these solutions: data management (ownership, sharing, privacy, security and future monetization strategies).

Open architecture and interoperability of systems: It is important to maintain flexibility to adapt systems over time as technology evolves so quickly. Communities need to be sure that they are building a platform that can adapt as the technology changes.

Workforce Development: Managing digital infrastructure requires new skill sets and there is a foundational need to focus on digital literacy at all levels within government (from the field technician to supervisors and management). We need to build local capacity for data analysis which requires the ability to contract with and hire talent equipped for the new world of big data.

Closing

On behalf of AECOM, I would like to thank you for receiving my testimony and look forward to addressing your questions.