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Symposium Summary

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16. Abstract
Smart City Transportation holds the promise for addressing some of our most persistent transportation challenges. While smart transportation has the potential to provide many mobility and economic benefits to system users and communities, there are several policy gaps in issues of access, modal interactions, business model considerations and government roles and responsibilities. As part of the Policy Symposium Series, the FHWA Office of Policy Studies brought together national and global experts to discuss the challenges and opportunities with smart transportation systems. Discussants represented leadership from local, state and federal governments, academia, policy organizations, private companies, and the European Commission. This one-day event addressed policy solutions to transportation challenges, and how smart technology will change the transportation landscape.

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Introduction

Smart City Transportation holds the promise for addressing some of our most persistent transportation challenges. Smart Cities employ integrated smart transportation systems that use data, applications and technology to help people and goods move more quickly, cheaply, and efficiently. The goal of Smart Transportation is to improve system performance in areas such as mobility, safety, and reliability by using advanced technology to improve the efficiency of services and to better meet residents' needs.

Building on these topics, the Federal Highway Administration (FHWA) brought leading experts together to explore the role of policy in facilitating equitable access to Smart Transportation for the FHWA National Transportation Policy Symposium, "Access to Smart City Transportation" held in Washington, DC on January 12th, 2017. The Symposium brought together thought leaders and practitioners from across the country to explore the policy gaps and options in creating smart transportation systems that enhance economic opportunity, mobility, and safety for all users.   Panelists included business and government leadership, academia, international transportation professionals, and local organizations leading smart transportation implementation. Together, these panelists along with USDOT leaders moved the discussion forward by critically thinking about the issues and developing ideas for the future. This whitepaper summarizes the panelists' ideas, policy questions, and alternatives moving forward.

> The Symposium addressed the role of government in ensuring the full potential of smart transportation for enhancing mobility and economic opportunity for people, businesses and communities across the United States.

Smart transportation employs a holistic, integrated approach to improving surface transportation performance and integrating this approach with other smart city domains such as public safety, public services, and energy. As a rapid technological advancement with large private sector involvement, important policy questions regarding ownership, operation, and management arise. While smart transportation has the potential to provide many mobility and economic benefits to system users and communities, there are several policy gaps in issues of access, modal

interactions, business model considerations and government roles and responsibilities. Of particular interest are the issues of access and the role of government in ensuring the full potential of smart transportation for enhancing mobility and economic opportunity for people, businesses and communities across the United States.

Access to Smart City Transportation

Access to smart city transportation allows people, businesses and communities to take advantage of the mobility and economic benefits of technology in moving people and goods across the transportation system. Where smart transportation investments are made, such as urban, suburban and rural, determine which communities and businesses have smart transportation options available to them.

Providing safe and efficient transportation options for all users is a priority for the USDOT. In a smart transportation context, availability and ability to access transportation is important. For example, between 2000 and 2011, the number of low income residents in the suburbs of the nation's largest metropolitan areas grew by 66 percent – more than twice the growth rate in cities.[1] Typically, commute times are longer and transportation options are limited in the suburbs compared to major cities. Smart City Transportation could benefit these travelers but only if designed with their access in mind.

How smart transportation systems are designed and operated, such as payment systems, information access, and modal connectivity, determines who can access smart transportation service. For example, people and businesses without access to smart transportation information may have an unfair disadvantage in their ability to participate in a smart transportation system. Other issues such as user interactions, small business participation, and non-user options have significant equity elements as well.

Challenges of implementing Smart City Transportation from an access perspective are:

> How smart transportation systems are designed and operated, such as payment systems, information access, and modal connectivity, determines who can access smart transportation service.

- *Addressing the "digital divide";* the existing disparities in the availability of internet and wireless communication infrastructure that serve as a foundation for Smart Cities.

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[1] Elizabeth Kneebone and Natalie Holmes, New Census Data Show Few Metro Areas Made Progress Against Poverty in 2013, Brookings Institution Report, September 19, 2014.

- *Developing intermodal technologies*, algorithms, and associated integrated data which support efficient and comfortable active, transit, and rail modes as well as vehicle options for travel and movement of freight.
- *Securing smart transportation network resources*, including required data and data capacity throughout the U.S.; this may be particularly challenging where population is sparse, local resources strained, or where neighborhoods are already underserved.
- *Ensuring adequate provision of mobility services* for at risk populations such as the elderly, people with disabilities, and people in low income neighborhoods.
- *Safeguarding the availability of smart transportation access technologies* including affordable smart devices, services, and data plans for individuals and businesses. Especially for the unbanked, ensure the availability of flexible payment options.

These topics are not new. What is new is the convergence of telecommunications and transportation, and both the opportunities and challenges this convergence presents. It may become easier for elderly residents to move about and shared mobility services may be less expensive than car ownership for many. Both cars and trucks may be routed more efficiently and safely. However, the technology needs to be usable by those with a complete range of cognitive and physical abilities, income levels and geographic locations. From autonomous transportation to shared mobility services, the ownership, operations, and management of the system will affect the cost, availability and quality of the service. The underlying algorithms and standard that serve as the basis for new smart transportation opportunities also create the potential for differentiated access and service levels.

In addressing these key challenges, several policy themes emerged from the panelist discussion:

- **Define the problem first.** To address policy gaps and questions of ownership, operations, and management, adopt a big picture frame for talking about what problem will be solved with Smart Technology. The frame in the U.S. is taking shape around economic growth and social mobility.
- **There are benefits and challenges to the levels of government regulation.** The role of the Federal government in regulating development of smart city transportation can be small or large. There is a Federal role in setting standards and protocols to assure interoperability. A "light touch" regulatory role allows innovation while there is a need for policy and regulation to assure safety as well as equity.
- **Smart Transportation will impact our current business model.** The public ownership model of transportation is being rethought. We may need to leverage public-private ownership models to build this new digital infrastructure. However, the private sector wants to make the highest return on its investments. Government must carefully negotiate agreements to make sure equity is addressed and potentially use resources to fill the gap.

Procurement reform may be needed for governments and businesses to work together more productively.

- **System users vary in their fiscal, cognitive, and physical capabilities.** We must be realistic about the range of technical and financial abilities of users and how limited abilities can be accommodated (for example, lack of smart phone ownership).
- **You cannot plan for unintended consequences**; there will be some risk in innovation. However, you can reduce public fears by addressing their concerns. Listening to the voice of the local community is the key to getting this right.
- **Data ownership is a major challenge.** There are a small set of large companies aggregating and monetizing traveler information data. There is a potential for creating a data monopoly. We want to enable small businesses to enter this market, and allow for open data and data sharing for managing and operating the system for the public good.

These six major themes emerged in the panelist discussion of policy gaps and options in issues of user access, modal interactions, business model considerations and government roles and responsibilities. Important decisions in the ownership, operation, and management of a smart system will further define many of these broad policy considerations. The following sections summarize panelist remarks and discussions and provide FHWA with an improved understanding of the policy needs as smart technology becomes a larger part of transportation in the United States.

Opening Remarks

Officials from the USDOT, the Department of Energy, and the Office of Management and Budget opened the symposium. It was stressed that the FHWA is not only looking at the latest technology, but also how to connect Americans to their communities, by providing safe and reliable transportation to schools, jobs, and healthcare, all while not harming those in transportation's path. Smart city transportation is a new paradigm, and participants were asked to provide policy solutions, warnings, and critiques.

FHWA Office of Policy staff outlined USDOT's increased focus on the interplay of transportation, equity, and economic growth, the advent of smart technology and energy, and the broad definition of a Smart City. Participants were asked to explore transportation access and equity in underserved communities both urban and rural; how FHWA can integrate equity in to their day-to-day thinking; and how FHWA can adjust its policy framework to ensure alignment with the rapid pace of technological change.

Smart Technology and Energy

U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy representative explained DOE's objective in the transportation and smart technology context – to unleash economic value, while ensuring affordable access for all, eliminating accidents, all while dramatically reducing energy consumption and the carbon footprint. An overview of DOE's programs was provided, including the Systems and Modeling for Accelerated Research in Transportation (SMART) Mobility Consortium, which is a five-laboratory consortium that provides cities an integrated framework and tool for decision making related to energy consumption, urban planning and design, connected and autonomous vehicles, multimodal transportation, fueling systems and infrastructure, and consumer behavior. There is interest in the role smart cities can play in reducing transportation related energy consumption and emissions.

What is a Smart City?

Mark Dowd, expert discussant, presented an overview of the Smart City Challenge. It was noted that city officials have thousands of day-to-day items that cross their desks, and it can be hard to focus on future innovations. It was expressed that the most challenging aspect of implementing Smart City Transportation is getting cities to marshal the tremendous resources available to them through Federal laboratories, research dollars, expertise, and working with high technology businesses and entrepreneurship to solve problems. Cities should work together to build a common approach that can be applied across the country. The purpose of the Smart City Challenge was to empower cities, with some seed funding from the Federal government, to bring the tremendous resources at their disposal to attack major problems facing urbanized areas, and to scale those solutions to other areas.

The Challenge generated an overwhelming response: 78 applicant cities shared the challenges they face and ideas on how to address them. The USDOT recently issued "The Smart City Challenge: Lessons for Building Cities of the Future" to share lessons about the transportation challenges cites are facing and innovative solutions proposed.[2] In October 2016 an additional $65 million in grants to support community-driven advanced technology transportation projects – including support for four of the Smart City Challenge finalists to implement ideas developed as part of their applications.

Ken Leonard, Director, USDOT ITS Joint Program Office, served as moderator for the morning session focusing on lessons learned from the evolution of the internet, the mobile industry, and citizen participation in the deployment of transportation technologies.

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[2] https://www.transportation.gov/policy-initiatives/smartcity/smart-city-challenge-lessons-building-cities-future

The Internet Evolution

Smart City transportation builds on the internet and other telecommunications elements. This session explored the ways in which development of the internet may or may not provide a touchpoint for envisioning policy considerations for accessible smart transportation.

Internet and telecommunication services are market-provided, with investments focused geographically where demand is highest. Deployment of the internet has been slow to reach certain populations, particularly people with disabilities, those living in rural areas, and lower income populations. As part of the 2015 Broadband Progress Report, the Federal Communications Commission (FCC) indicated that 17 percent of U.S. households do not have access to broadband, with 53 percent of rural Americans lacking access to broadband (versus only 8 percent of urban Americans lacking access). Where it is available, adoption rates of broadband are comparable between urban and rural populations, according to the report. Further the study reported, 63 percent of individuals residing on tribal lands do not have access to broadband. [3]

In the U.S., internet service is provided through a number of telecommunication companies such as Comcast or Verizon, called internet service providers (ISPs). These companies may also provide media content. After substantial policy debate over whether ISPs could block, throttle, or charge extra for "fast lane" access for different content, a 2015 ruling of the FCC requires "net neutrality" by reclassifying broadband as a common carrier, requiring ISPs to treat all content on the internet in the same way.[4]

Access to resources on the internet can be challenging to those with disabilities; currently only federal agencies and those institutions receiving federal funding are required to be Section 508 compliant. This means that most of the internet, operated by private entities, is under no requirement to comply to standards enabling equal use by those with disabilities.[5]

Daniel Hoffman, Chief Information Officer of Montgomery County, Maryland, provided opening thoughts for a discussion on lessons from internet development for the development of an accessible smart city transportation system. Mr. Hoffman does not consider smart transportation as a parallel development so much as the next layer of the internet; in effect, the internet of things (IoT) is "absorbing" transportation. As a result, smart transportation will impact every department in a city; it is not just a CIO issue. Looking back, the Defense Agency created the Advanced Research Projects Agency Network and developed the original standards and protocols, and start-up companies grew it organically from there -- with a digital divide from

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[3] FCC: 2015 Broadband Progress Report https://www.fcc.gov/reports-research/reports/broadband-progress-reports/2015-broadband-progress-report

[4] FCC: Open Internet https://www.fcc.gov/general/open-internet

[5] GSA Government-wide Section 508 Accessibility Program https://www.section508.gov/

day one. Looking forward, the government must continue to prioritize standards and protocols to ensure interoperability and safety. Development, however, will be less organic, with legacy companies, including automobile manufacturers, involved in shaping development of smart transportation. Mr. Hoffman noted that how this development occurs will come down to what will make people comfortable, describing some of the backlash experienced by consumers to smart meters. Given that there is not a good way to know how smart transportation will unfold, it will be critical to address consumer fears through policies early on.

The panel discussion touched on an array of policy questions concerning how cities can position themselves to stay up to date with ever changing smart technologies. The infusion of the internet and smart technologies into almost every aspect of a community introduces new roles and responsibilities for local governments, for which traditional staffing skills, procurement strategies, and organizational structures are often not well suited. The key issues identified in this session carried as threads throughout the later sessions:

- Unlike the development of the internet, the development of smart transportation necessarily involves the interaction of people in public spaces managed by local governments, necessitating the need to rethink street design; the ways people and goods move throughout a community; how emergency response and public safety is provided for; and public perceptions of these changes.
- Consideration of what was lost as the internet expanded, such as community retail, might help identify elements that, without advance consideration, could be lost with smart transportation, such as the potential to lose public transportation options if middle class ridership moves to personal automated vehicles (AVs) or mobility services.
- Consideration of the extent to which smart transportation is a consumer good, which can be well provided in a private market or a public good, which requires a government role was discussed.
- Prevailing procurement laws and practices and models can be slow compared to the rapid speed of information technology (IT) advances and limiting in terms of the ways in which local governments can develop IT capabilities. Updating procurement regulations to accommodate new business models (e.g. "hand in glove" partnerships) was identified as particularly important, although participants also cautioned that changes needed to be conducive to ensuring the public good.
- Re-evaluation of existing regulatory frameworks at all levels of government to develop effective strategies for dealing with the rapid change of technology. Regulatory changes might remove existing impediments; create a common framework for predictable investment; address public safety, privacy, or other concerns; or promote efficient implementation and operation across transportation networks.
- With the use of new smart technologies, vast amounts of data become available and are necessary to the efficient operation of the transportation network. Discussion addressed

who owns this data; whether ownership by a limited number of large entities might restrict consumer choice; and how the data might be used, as well as whether government should set regulations to make the data available/unavailable or even use existing government vehicles and operations to collect the data necessary to manage smart transportation systems.

- With the advent of connected and automated vehicles, cities will have to grapple with their role in the broader transportation system, and potentially decreased demand on mainstream means of transportation (for example, bus or paratransit). Discussion addressed whether cities should be incubators for this technology, by adopting automated vehicles as a replacement for bus lines or adopting micro transit mobility on-demand.
- Taking into account the failure rate of current internet technologies and services, panel members asked what failure rate would be acceptable for smart transportation technologies and how cities might better prepare for the unintended consequences of integrating internet and transportation services.

User Interactions and Technology

A key element of the Smart City vision is its focus on user-focused mobility services and choices. Smart cities support mobility using traveler-oriented strategies that deliver innovative solutions to improve the mobility of all travelers, across all transportation modes. The new eco-system of automated vehicles, connected vehicles, next generation traffic signals, and smart infrastructure must be developed through a comprehensive framework to service all modes of transportation and to recognize and include all travelers, regardless of their disability, economic status, or technological ability.

John Hoffman, CEO and Director of GSMA, Ltd., described how the mobile device industry faced many challenges during the initial stages of worldwide cellular technology deployment. The key to the mobile industry's success has been a light touch regulatory approach by government, he stated. As the industry evolved, standards and technology protocols were set, eventually leading to today's industry that allows for global interoperability and connectivity. There are now over 7.5 billion worldwide mobile connections, and last year, AT&T connected more vehicles than mobile phones. Mr. Hoffman elaborated on the application of mobile technology in the context of smart technologies. Once Subscriber Identification Module (SIM) cards can be embedded in devices, true interoperability across networks and regions can be achieved. As smart technologies, connected and autonomous vehicles continue their technological evolution, security and privacy

> Documenting and describing the benefits of Smart City Transportation is critical and will play an important role in investment decisions. The value of communities working together and sharing the best practices cannot be understated and will be critical to successful deployment.

must continue to be ensured. Mr. Hoffman encouraged cities, counties and states to utilize market-available devices, open APIs, public private partnerships (PPP), and light touch regulation for smart technologies and their deployment. Mr. Hoffman referenced GSMA's partnership with the city of Barcelona, Spain and the "Smart City Barcelona" program. The City is utilizing a public private partnership with an array of device manufacturers and mobile phone providers to apply smart technologies to city services, education, health, security, and services to the elderly.

During the group discussion, panelists raised the following policy questions:

- Mobile phone coverage and service is not ubiquitous in the U.S. Mobile phone service varies in cities and rural areas for reasons varying from government regulation to commercial viability.
- Over a quarter of mobile phone users are not using smart phones due to cost and technical capacity. How do you roll out a smart phone based platform if there is a large group of users that cannot access it? What is the role of government in this respect; does the government need to implement programs to educate users or incentivize smart phone use?
- Government is inundated with vendors who wish to sell products and or services. There is a lack of trust between government and vendors.
- PPPs are successful if they have clearly defined goals and take advantage of private sector capabilities and efficiencies. Government should look to industry as co-creators of services for mobility.
- Mobile technology's success has been its ability to provide solutions that are not limited by silos. Yet many government transportation agencies are organized by mode. Should transportation agencies be reorganized as they integrate services?
- Data ownership from mobile technology, such as navigation applications and transportation network companies present unique challenges to government. How can government ensure access to this data for research and transportation operations and planning purposes? Who owns this data? Should data be readily available? How can government ensure data access without stymieing private sector participation? What type of platform or portal should be adopted to ensure small businesses and transportation agencies have access to and the ability to provide data?

User Participation in Smart Transportation

Smart city transportation, including shared use mobility services, has been advocated to solve some of the most persistent transportation challenges facing low income and geographically and

socially isolated populations. For example, first mile last mile (FMLM) access to public transportation disproportionately affects low income neighborhoods, which have a high number of carless households, unreliable access to employment and health services, lack of access to digital information, and high portion of cash-based households. However, to access these services, users would first need to have a smart phone linked to a payment system. In addition, the privately owned transportation provider would have to offer regular service in the neighborhood, possibly with a disability accessible vehicle. These problems are further complicated in rural and suburban areas where access to public transportation options is limited. As we consider introducing more privately owned resources to supplement public transportation, opening dialogues with the impacted communities about their needs and desired solutions is of critical importance.

Randell Iwasaki, Chief Executive, Contra Costa Transportation Authority (CCTA), provided an overview of and best practices from Contra Costa County's community outreach and relations. Over 23 percent of CCTA's budget is allocated for transportation improvement projects. The county has successfully passed sales tax initiatives to fund the access to the Bay Area Rapid Transit (BART)¸ and expansion of bike and pedestrian infrastructure. Mr. Iwasaki relates these successes to inclusive and community based budgetary and transportation planning processes. CCTA performs extensive stakeholder outreach via open houses, town halls (both in-person and via telephone) web, mail, and email campaigns. Additionally, CCTA updates its transportation plan every four to five years utilizing similar outreach mechanisms. CCTA conducts focus groups and continues community outreach and relations throughout a transportation project's lifecycle, providing updates on project progress, efficiency gains, and infrastructure built. CCTA is addressing inclusivity by using sales tax revenue to provide free BART passes to children who receive free and reduced lunch. CCTA is piloting the deployment of automated shuttles in the City of Richmond to address FMLM transportation challenges.

During the group discussion, panelists raised the following policy questions:

- How can government accelerate and share lessons learned? Government needs to align messaging and public relations to the successes of transportation projects.
- The internet has provided a new means of community outreach. Are we utilizing that technology to make the community engagement process more nimble? What are the best practices for community outreach? How can government integrate inclusivity throughout the transportation planning process? How can government best show the successes and demonstrate the benefits of pilot projects?
- When cities or counties pilot new technology they take on inherent risks. How can government incentivize cities and counties to take on more risk to provide innovative solutions to transportation challenges?

- How can we encourage people to move away from private automobile ownership once automated vehicles are deployed? How can we assure that all communities have access to automated vehicles once they become part of the mainstream? Is government willing to accept the potential that automated vehicles will only be available for the rich?
- Transportation tends to be the number one need for communities, the elderly, and care givers. As the population of the U.S. continues to age, autonomous vehicles must take this subset of the population into account. Additionally, autonomous vehicles must be readily available and deployable in urban and rural areas.
- Access to reliable and efficient transportation continues to be of concern. Inefficient and unreliable transportation has a higher impact on those who have lower incomes. This will require new solutions from both a user and government point of view and require a dynamic and multimodal approach to regional transportation.
- In some cities, the transportation network has not been updated since the 1950s and needs to be overhauled. Some bus and metro lines should be reevaluated, taking into account changes in housing, population, public trends. This also provides cities with the opportunity to evaluate and deploy new technologies (signal prioritization, ITS, Global Positioning System tracking) and build new infrastructure (bus rapid transit and bus lanes). Cities should evaluate where their transportation hubs are and use bike share as a solution for FMLM problems.
- Government continues to look at Smart Cities and transportation as if they were in isolation. Smart technologies aren't necessarily a panacea to all transportation problems. Decision makers should first clearly define the "what" and set clear objectives for a solution; this approach needs to become hardwired into the transportation planning process.

Heather Rose, Team Lead, Transportation Futures, FHWA, served as moderator for the afternoon session, focusing on business models, state and local experiences, and the path forward for smart city transportation systems.

Business Model Considerations

As noted in the USDOT's *Beyond Traffic* report, state and local governments will need to turn to new and innovative transportation and infrastructure business models to fund the maintenance and expansion of transportation projects. Though the majority of transportation projects utilize the publically owned and operated model, recent fiscal constraints have given rise to alternative options including: PPPs, treating transportation as a utility, or even complete privatization of transportation systems. Under these options, government plays a regulatory role in assuring continued equal access to and use of transportation systems.

John Boesel, President and CEO, of CALSTART, challenged smart transportation implementers to focus on the goals and objectives that they want to achieve with smart technologies, rather than the technology itself. Once the objectives are clear, then the business case can be made for investing in resources to achieve them. He remarked that the transportation industry is still primarily concerned with the hardware components that make up the vehicle and infrastructure. The industry is being disrupted by information and communication technology. He noted that automated vehicle technology could add to congestion as more people spend down time in their cars, resulting in more vehicle miles traveled (VMT). He encouraged the Federal government to think about the price signals being sent and suggested congestion fees may be needed.

The group explored a range of options from public ownership under the current model to totally privately owned, as well as the PPP option, discussing the strengths and weakness of each. During the group discussion, participants made the following points:

- The current business model is already being rethought. The roles of the public and private sectors are changing. Private investment will go where there is the greatest return on investment, which is currently in the major population centers. What is the government role in assuring equity in access to improved transportation systems?

> What is the role of state and local governments in a smart transportation model? What challenges do they face in implementation?

- If the transportation system is privatized, the Federal government must put policies in place to avoid making it a two-tiered system. These policies could be through regulation, tax credits or other incentives, subsidies to disadvantaged populations, or other innovative partnerships. Businesses have shown that they are willing to invest transportation resources in disadvantaged or less profitable areas if subsidies or other incentives are offered. Goal alignment is important for success.
- The advent of Smart Transportation offers an opportunity to discuss how we fund and maintain the transportation system. The Federal government should consider moving beyond the gasoline tax as a method of funding highway repairs and expansion and move toward mileage-based highway pricing to bring more equity into the system. However, there needs to be more precise in allocating costs if we are move to mileage based user fees.
- The role of public transportation needs to be rethought and right sized for the new environment of connected vehicles, automated vehicles, electric vehicles, and shared mobility services.
- Private ownership of the data collected from smart city transportation systems may limit innovation and small business expansion. Some regulation may be needed to allow for open data and data sharing which could lead to increased economic productivity.

Panelists made additional comments regarding these specific topics:

- Government at Federal, state, and local levels should partner to provide integrated services more efficiently. For example, these partnerships could offer payment systems for the unbanked, or provide affordable housing near transportation hubs and job centers.
- The business model for the electric charging infrastructure must be addressed.
- In freight, automated vehicles have the potential to cause unemployment if drivers are not retrained to take advantage of these technologies.
- Better methods to measure the benefits of these new technologies and communicate those benefits to attract investment and alternative sources of funding are needed.

State and Local Experiences with Smart Technology

Smart technology, despite its great promise, requires broad use to render the greatest benefits. The governments wishing to implement smart transportation will need to find new and innovative ways to reduce market entry costs for businesses (both large and small), while also ensuring that the technology is accessible to a broad user base, regardless of locality (urban vs rural) and socio economic status.

Some of the challenges to Smart City transportation implementation stem from competing demands regarding:

> Ensuring geographic coverage will be challenging. In areas with lower population density there is less opportunity for private profits and limited local government capacity.

- Resource constraints including sustainability of the Highway Trust Fund
- Ensuring that equity is included in private sector partnership opportunities
- Pre-existing attitudes and community concerns toward a project
- Navigating federal regulations, especially the procurement process

Representatives from government agencies that are implementing Smart City technologies shared their experiences as follows.

- Rob Phocus, Energy & Sustainability Manager, in Charlotte, NC – Smart Cities is not just technology, it is about people. In Charlotte, we are focused on improving the quality of life for all people, including underserved populations and the unbanked. We are bringing better mobility options to an underserved neighborhood where the median income is $22,000 per year and most of the workforce travels to another side of the city for jobs. We are providing a neighborhood circulator that will link to a light rail line that is opening in 2018. We are finding through our outreach that we need to better understand the audience and overcome their distrust of new technologies that involve

cameras and data collection. It is important to identify and reach out to leaders in the community.

- Jordan Davis, Director for Smart City Strategy and Collaboration, Columbus Partnership – The Columbus partnership is civic business organization focused on advancing economic competitiveness of the Columbus region that is working on behalf of the Smart Columbus Challenge. Winning the Smart City Challenge has been transformative for Columbus; the City and region are deeply appreciative of the funding and support from the USDOT. Ms. Davis described her organization's approach to Smart City Technology implementation as follows:

  o Provide an upgradable foundation including an integrated data exchange, connected vehicle deployments, and grid modernization. We aim for "no regrets investments" that are smart long term investments, and that can be upgraded as we go along.
  o Leverage our resources as living laboratories – We are developing use cases and real world tests for solving the FMLM problem with autonomous vehicles, developing a payment app for the unbanked, and leveraging our test track with R&D collaborations with academia and the private sector.
  o Make the culture shift – We do not consider ourselves early adopters, but as the test market for these technologies. We are committed to make a big leap in electric vehicle ownership with a 1.8 percent ownership rate by 2019. We also need to figure out how to talk to the private sector about how technology advances can be applied to the problems we face while maintaining the integrity of the procurement process.

- Kevin Biesty, Deputy Director for Policy, Arizona DOT, indicated that his agency is currently in the education phase. Arizona DOT is carefully making investments primarily in Transportation Systems Management and Operations (TISMO) and ITS based on the state of innovation. Mr. Biesty made the following observations about transportation innovation and financing:

  o We have system failures on the roads right now. We may need to accept that there will be some system failures from innovative technologies as we move toward our goals.
  o PPPs are defined differently by different people. However, every private investor wants a return on investment. No mode of transportation is free; the question is who pays for it.

- Scott Kubly, Director, Seattle DOT – In Seattle, we view smart city transportation through the lens of how is it going to help us deal with growth. Seattle is expected to add 70,000 units of housing and 115,000 jobs in the next 20 years. We are concerned about

our most vulnerable users – pedestrians and bicyclists. We emphasize the customer experience in our planning. We are developing an app for people who are visually impaired and are planning on moving our payment system to a mobile platform. We also need to think about how we price transportation systems. He offered the following suggestions for the future:

- o The Federal government and transportation agencies should begin to consider pricing models, including congestion pricing, for 2030 so they can be phased in over time.
- o The Federal government should work with cities to apply the right regulatory level to new technologies such as ride sharing through Transportation Network Companies (TNCs).
- o Procurement changes may be needed as some small businesses aren't able to sustain themselves through the current government procurement process.
- o Apply a risk assessment approach to thinking about new innovations. We need to protect the current public transit system; don't assume TNCs are sustainable as they currently operate.
- o From an equity perspective, consider providing the technology and training on how to use it to disadvantaged users. If smart phones are the barrier, then we should get them for people so they can access mobility options.

- Pete Rahn, Transportation Secretary, Maryland DOT, noted that his state is already experiencing a loss of revenue in gas taxes, due to better fuel economy of vehicles. Maryland DOT is seeing an increase in VMT, but decreased revenue from the gas tax. This is going to cause continuing problems for DOTs as the main funding mechanism. Mr. Rahn suggested changing the gas tax so that it is dual indexed based on the consumer price index (CPI) and average national fleet economy.

  Mr. Rahn described an innovative procurement that Maryland DOT is conducting to allow bidders to compete for $100 million to provide the best non-tolling methods to move vehicles through the I-270 corridor. If the solution is successful, his agency intends to replicate it. Mr. Rahn stated, "We are starting from the position that we don't know the answer and are opening ourselves up to proposed solutions." He noted that current regulations regarding procurements date from the 1950s and are in need of reform.

- Henriette Van Eijl, Policy Coordinator, Innovative and Sustainable Mobility (Smart Cities), the European Commission. – The European Commission is the funding and regulatory agency for the 28 member states of the European Union. Ms. Van Eijl described some of the characteristics of European cities:

- Most cities are small, and there is different modal usage. For example, In Amsterdam, 40 percent of the population uses bicycles, 30-40 percent uses public transportation, and 30-40 percent of the population uses private cars. In many cities TNCs are not allowed to operate.
- There are concerns about crumbling infrastructure. Many tunnels are collapsing, and there is underinvestment in assets.
- European governments are resource constrained and are looking to ITS for inexpensive solutions to these challenges. They are also looking at solutions that integrate modes and at user fee pricing systems.

Ms. Eijl related that initially smart city transportation was met with skepticism by the urban planning community who favor small pilot projects. The integrated solution providers prefer bigger projects with higher revenue, so there was a misalignment in goals. Her organization set up neutral meeting places for planners and suppliers to discuss possible projects. It also created two city networks for public sector procurers only to discuss their concerns. As a result, the European Commission has funded nine big lighthouse programs – involving many cities and private companies. She noted that many of these projects move ahead more quickly in the second or third largest city in the nation, rather than in the capital.

Identifying the Critical Path to Smart Cities

Robert Puentes, President & CEO, ENO Center for Transportation, summarized the major themes of the symposium as follows:

- This is not just a discussion about transportation technology, but has larger implications for the country going forward. How does smart technology impact the economy and land use? The places that are successful will lay out what intractable problems they want to tackle, then use smart technology as an economic driver for the city, while taking care not to create pockets of innovation that don't accrue to everyone.
- It is important to lay out a bigger frame for talking about what problem will be solved with smart Technology. For example, Europe's Smart Cities frame was all about carbon reduction. In Asian cities, we see a call for efficient use of space to address urban congestion. In the U.S., the frame could be around economic growth and social mobility. If we in transportation can figure out what we want to accomplish and frame it inside that larger message, we can couple it with the enormous demand for action to improve transportation to gain more support for deployment.
- Purposeful integration of transportation with other city services should be an important goal of the smart city movement. The places that integrate technology better across city services are making changes in governance as well. The new CIOs and CTOs are often people from

the private sector who have come onboard to implement smart city visions and have made progress in getting past the silo aspects of government.

- Procurement reform is needed. It is currently very difficult to innovate under the current rules, which often preclude smaller businesses from participating. There is a Federal role in improving the procurement process. The FHWA could also assist in bringing cities, counties or states together so they can learn from each other. This aspect will be critical to scaling up and replicating best practices from the pilot deployments.

Ken Leonard, Director, USDOT ITS Joint Program Office, noted that on January 12, 2017, the National Coordination Office for Networking and Information Technology Research and Development (NITRD) published in the Federal Register a request for public comments regarding its draft Smart Cities and Communities Federal Strategic Plan: Exploring Innovation Together. The draft Strategic Plan which outlines a coordinated federal research approach to smart cities is posted at: *https://www.nitrd.gov/drafts/SCC_StrategicPlan_Draft.pdf*.

The panelists made the following comments in response to the above remarks.

- Panelists expressed concerns about funding for smart city technologies. As the federal aid share shrinks, and there is resistance to increasing the gas tax, cites, counties and states have to make strategic investment decisions, while the revenue picture is uncertain.
- A panelist suggesting adding a user fee to the purchase or use of automated vehicles, as means of funding automated and connected vehicle infrastructure and smart technologies without stifling innovation.
- Several panelists advocated for more local control and influence, particularly in revenue collection. It was noted that it is much easier to raise revenue when it is targeted to specific improvement.
- A panelist noted that for mega-regions, there is a need for inter-jurisdictional cooperation so that we don't end up with integration issues, such as multiple transponders for different tolling authorities.
- Another panelist noted that we can't build our way out of congestion. His agency is funding ITS and TISMO solutions as economical ways of solving congestion problems.
- A panelist recommended that the Federal government focus on access to connectivity, including rural areas in smart technology deployment, and the issue of data ownership.
- A panelist posed the question of how do we want our future smart citizens to live and behave. A minority view is that there is value in the analog world -- from day dreaming or people watching or face to face conversation. Do we want to live in a city where we have to carry our cell phones at all times?

Wrap Up – Priority Policy Questions and Role of FHWA

Butch Waidelich, FHWA Executive Director, closed the session with a discussion of key lessons and highlights. While the pace of innovation has accelerated, the transportation industry can still be very conservative. The introduction of the automobile was a disruptive technology; smart technology may be equally disruptive. Mr. Waidelich expressed concern that many cities, counties and states do not see smart transportation systems on the horizon.

Looking at the transition to smart transportation systems, the way forward is to leverage existing assets and work with the private sector, while insisting on open interoperable systems, he noted. At the same time, we must understand that there are places that don't have access to connectivity or the means to pay for it. Government may need to play a role to fill this gap. Significant issues also remain regarding data sharing and ownership and in the area of procurement reform. Finally, the value of communities working together and sharing the best practices cannot be understated and will be critical to successful deployment.

FHWA Office of Policy staff highlighted the following key lessons from the symposium.

- Business Models ranging from current public ownership to complete private ownership were discussed. An example of innovative funding is the possibility of electric buses storing energy from the streets and selling it on the market.
- Governments and the private sector must share the risks and rewards when working in partnerships. For innovations with low safety implications, the private sector should take the lead. For innovations with high safety implications, the government will need to take a larger role, while considering access to mobility options and who pays.
- The benefits of successful projects must be documented to increase buy-in.
- From Charlotte, we learned that state and local governments need to listen carefully to the perspectives of the community.
- From Columbus, we learned about the need for smart system investments to be upgradeable.
- From Arizona, we learned that it is important to spend time to become educated as well as educate the public about smart technologies to understand their costs and potential benefits.
- We learned about Seattle's focus on using transportation technologies to deal with growth. We also learned that small pilots can be used to demonstrate larger concepts.
- From Maryland, we learned about an innovative procurement approach and the value of a DOT acknowledging that it doesn't know the answer.
- From the European Commission, we learned about the value of starting with projects in smaller cities, and getting government and business to connect.

Mary Zimmerman, Director, FHWA Office of Transportation Policy Studies, noted that her office will incorporate the policy issues raised in this symposium into its strategic plan and policy research program plan. A follow-on symposium could be organized for a future date. Final comments from panel members at closing are included in Table 1.

Table 1: Panel Closing Thoughts
Most important Federal Role is in developing interoperable standards and protocols.
Federal government should engage more robustly with municipalities.
Focus on improving contracting/procurement for transportation systems.
Impressed that FHWA was discussing policy issues with all the different levels of government – national, provincial and municipal. Sweden has many pilots in automated driving and electrified highway that we are willing to share.
Importance of the role of the city as the central service provider for transportation for a region. Challenge grants work.
The global nature of connectivity and smart transportation.
We need to partner with Europe, China, and Japan to realize some of the benefits of smart transportation, especially in underserved areas. Automated vehicles could lead to higher VMT, so price signals are important.
Value the local voice.
A Smart City should integrate the modes without barriers or consequences for users.
There is a Federal role in interoperability and security; light touch regulation works.
Embrace public-private partnerships as an opportunity for funding smart city transportation.
The next step is for FHWA to think about the role of the Federal government in smart transportation systems. The Federal government should be involved in developing standards and assuring interoperability, as well as seed grant funding. It should also facilitate the ability for cities to collaborate within a region. Customers want seamless everything; they don't care what jurisdiction is providing the service.
FHWA should provide benefit justification, and provide the educational element.

The session closed with thanks to the panelists and FHWA staff for participating and encouragement to continue this important conversation. The Smart City Challenge was intended to get the best ideas on the table, but also to assure that everyone is included as we implement smart transportation systems.

Appendix
Panelist Roster
Access to Smart City Transportation Symposia
Thursday January 12, 2017

Anna Wildt-Persson	Swedish Transport Administration
Tom Jensen	United Postal Service (UPS)
Deb Socia	Next Century Cities
Dr. Lei Zhang	UMD National Transportation Center
Raj Rajkumar	GM-Carnegie Mellon
Richard Trey Baker	Parson Brinkerhoff
Peter Sweatman	CAVita
Thomas Bamonte	North Central Texas Council of Governments (NCTCOG)
Susan Shaheen	University of California
Dr. Catherine Ross	Georgia Tech
Andrew Smyth	Data Science Institute, Columbia University
Christopher Cherry	Center for Transportation Research, University of Tennessee
Katherine Freund	ITNAmerica
Genevieve Giuliano	Research and Technology at University of Southern California
Adie Tomar	Brookings Institution
Pete Rahn	Maryland Department of Transportation
Scott Kubly	Seattle Department of Transportation
Reuben Sarkar	US Department of Energy
Mark Dowd	Office of Management and Budget
Daniel Hoffman	Montgomery County, MD
John Hoffman	GSMA
Randell Iwasaki	Contra Costa Transportation
John Boesel	CalStart
Rob Phocus	City of Charlotte, NC
Kevin Biesty	Arizona Department of Transportation
Pete Rahn	Maryland Department of Transportation
Scott Kubly	Seattle Department of Transportation
Jordan Davis	Smart Cities, Columbus Partnership
Rob Puentes	ENO Foundation

Attendance Roster
Access to Smart City Transportation Symposia
Thursday January 12, 2017

David Kim	US DOT, FHWA Office of Policy
W. Butch Waidelich	US DOT, FHWA Office of Policy
Ken Leonard	US DOT, ITS-JPO
David Howard	US DOT, FHWA Office of Policy
Mary Zimmerman	US DOT, FHWA Office of Policy
Heather Rose	US DOT, FHWA Office of Policy
Max Azizi	US DOT, FHWA Office of Policy
Melanie Becker	US DOT, FHWA Office of Policy
Emiliano Lopez	US DOT, Office of Civil Rights
Nicole McWhorter	US DOT, Office of Civil Rights
Scott Johnson	US DOT, FHWA Office of Safety
Caitlyn Hughes-Rayman	US DOT, FHWA Office of Freight
Sophie Shulman	US DOT, Office of the Secretary of Transportation
Mike Griffith	US DOT, FHWA Office of Infrastructure
Steve Kern	US DOT, FHWA Office of Policy
Ben Hawkinson	US DOT, FHWA Office of Policy
Brian Cronin	US DOT, FHWA
Andrew Wisnia	US DOT, FHWA Office of the Administrator
Marcia Pincus	US DOT, Office of the Secretary
Egan Smith	US DOT, ITS-JPO
Neil Gaffney	US DOT, FHWA Office of Policy
Shana Baker	US DOT, FHWA Office of Policy
Shari Schaftlein	US DOT, FHWA Office of Policy
Cheryl Walker	US DOT, FHWA Office of Policy
Dr. Maria Lindholm	Northern LEAD Research Centre, Chalmers University
Robert Missen	Mobility and Transport (MOVE)
Dr. Henriette van Eijl	European Smart Cities R&D Investment Programs
Patrice Davenport	Transportation Research Board
Adrienne Blackwell	Transportation Research Board
Mark Norman	Transportation Research Board
Courtney Counts	Democratic National Convention Host Committee
Sheryl Gross-Glaser	Community Transportation Association of America