PROVIDENCE, RI:
Planning for the Smart Transit and Infrastructure System of the Future

Mayor Jorge O. Elorza

Submitted by the City of Providence, RI

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1. Providence's Smart City Vision - The City of Providence is at a rare moment; a moment when political leadership, thought leadership, technology and smart urban infrastructure are aligned. The new Mayor and Governor are together committed to reform with big ideas in a Capital City that has started a second renaissance. With the removal of one linear mile of I-195 from downtown Providence opening up 19 acres of developable land and eight acres of parkland on 21 parcels, encompassing the new LINK District, the City has a once in a generation opportunity to build out a series of Smart Transportation Corridors centered around this newly created District. This is a unique opportunity in the United States to build out a new state-of-the-art downtown urban transportation corridor from scratch.

With 29% of its population in poverty, Providence is a city both in need and in transition. Laying the foundation for a new approach to city-making is critical as the City works to address and find opportunities within major transportation, pollution, community connectivity, and workforce development challenges. The new leadership recognizes that economic development needs new methodologies and new technology, and the key role that transportation can play in combatting the effects and spread of urban poverty. Technology adaption combined with a systems analytics, data-driven methodology for planning new transportation infrastructure can provide next-generation tools to tackle poverty in Rhode Island's urban core. With a once in a generation opportunity to harness large tracks of downtown white space and make a leap forward technologically, Providence can begin enhancing community connectivity and safety; driving equitable, innovative economic development in target districts/corridors; and ensuring Providence exceeds residents' expectations of a responsive, efficient government.

Mayor Jorge Elorza has been in office for just over a year and has articulated and begun to execute a bold vision for change that, at its heart, is about disrupting norms and delivering more value to the people of Providence. This vision combined with the build out of the LINK District makes a historic moment for Providence as a medium sized capital city to build a new state-of-art transportation network. Providence has started down a path of a '100 year digital leap' with the plan to install up to 16,000 LED street lights that are Internet of Things sensor enabled; streamlining and digitizing outdated City operations; three-university participation in MetroLab; increasing WiFi availability; supporting smarter vehicle, bike and walking strategies; and laying the foundation for Providence's LINK District to be a Center of Excellence in the global knowledge economy. The City and State recognizes the impact strategic technology investments have on citizens' day-to-day lives and are deepening connections to the New Economy to promote economic resiliency and locally grown innovation.

As a medium sized city, Providence does not have a subway or light rail public transit system. Because of the densely concentrated nature of the state, public transit in Providence is part of a statewide system run by the quasi-public RI Public Transit Authority (RIPTA). Many commuters into Providence are heavily reliant on 'one person one car' which has caused pollution, congestion and pedestrian safety issues City-wide. As Providence's LINK District starts to build out with a focus on innovation and design, the City leadership realizes that it is imperative that a higher efficacy, technology enabled public transit system grows with the commercial construction in the district. This will help bring about reduced congestion, reduced pollution, increased pedestrian safety, better community health, and a more favorable attractive economic environment for Providence.

Additionally, commuters traveling to Providence via Amtrak and MBTA Commuter Rail need to have efficient connections to inter-city public transit from the rail station. Expansion of the use of our intelligent transportation systems (ITS) is a must as the City and RIPTA begin to

plan for Providence's new economic growth and riders expect real time information about their transportation options, to access the LINK and other important business districts within the City. The Rhode Island Department of Transportation (RIDOT) currently runs the State's Transportation Management Center (TMC). With the formal adoption of a Complete Streets policy, the City has already begun this work through initiatives such as Citywalk (a project that will improve connections between eight Providence neighborhoods and two of the City's largest parks--India Point Park and Roger Williams Park), advancing development of two new intermodal transit hubs, planning for a transit emphasis corridor in Downtown to connect the two hubs to the LINK/I-195 Redevelopment District, and the recent introduction of the State's first rapid bus line.

The City of Providence, RIDOT, and RIPTA are currently working together to develop two new intermodal transit hubs, one to be integrated into the Providence Amtrak/MBTA station and one adjacent to the Hospital District. The two hubs will be tied together by a 1.4-mile transit emphasis corridor that will provide frequent service and enhanced passenger amenities that tie the LINK District directly to the Hospital District, the rest of Downtown, and to regional Amtrak and MBTA commuter rail services at Providence Station. RIPTA riders from key destinations across the metropolitan area will benefit from direct connectivity to the six key stations that are part of the Downtown transit emphasis corridor: the new Providence Intermodal Station, Kennedy Plaza, Downcity, the LINK District, Jewelry District/South Street Landing, and the southern transit hub/Hospital District. The six station locations will feature high-tech amenities and will be integrated with the City's bike share network. The City plans to use its $13M FY14 TIGER grant from USDOT to implement the transit emphasis corridor plan. The development of the two new transit hubs and a transit emphasis corridor with dedicated right-of-way, transit signal improvements, a branded fleet of buses, and attractive station stops along the corridor, will help RIPTA and the City decrease congestion at Kennedy Plaza (the city's signature downtown plaza and park space) and will better integrate the State's bus system with regional rail service, bike-share, and future modes of transportation.

A recently passed statewide bond referendum will allow us to develop a new state-of-the-art intermodal facility in the capital city; this facility would improve travel throughout the state and region, providing for more seamless connections between travel services such as rail and bus. It would also allow for improved service along the state's rail corridor and increased growth in alternate modes of transportation. The Providence Station is currently ranked one of the top three stations in the MBTA network and 15 out of 500 in the Amtrak network. The station's current 1980s design cannot adequately meet today's demand – let alone tomorrow's. In short, the leaders and people of Rhode Island have demonstrated a commitment to invest in their public infrastructure and the timing of this DOT Smart City is opportune.

A partnership with the MIT Media Lab's City Science Initiative involving the chief scientists from MIT's Changing Places lab as well as their Human Dynamics lab offers partnerships with internationally recognized experts in Urban Automation, Connected Vehicles, city-planning and urban-health related Big Data Analytics. The MIT team are at the forefront of transportation transitions in the United States and ready to pilot technology with an eye to impact. Providence's Brown University as a leader in computer science and data analytics brings cybersecurity expertise, along with MIT data platform expert collective ID3, while MetroLab-committed Rhode Island School of Design (RISD) brings a world-renowned expertise in industrial and UI/UX design, and the University of Rhode Island (URI) brings powerful GIS

capabilities and a Transportation Center, all enhancing next-generation transportation opportunities and data capabilities for Providence.

While several cities have made incremental investments in smart city solutions, Providence is at a uniquely strategic moment to be able to embrace technology, leverage partnerships, enhance existing resources, and use this DOT grant to model and heighten the impact that city-wide smart transportation and technology investments have on a community, environment and economic outcomes. We will advance Providence's Smart Cities plan, and corresponding investments to address the following three priorities: enhancing community connectivity and safety; driving equitable, innovative economic development in target districts/corridors; and ensuring Providence exceeds residents' expectations in being a responsive, efficient government.

Enhancing Community Connectivity and Safety - Utilizing the abundance of fiber investments throughout the City coupled with nodes on each of the City's 16,000 LED streetlights, the Smart City initiative will accelerate the City's commitment to building a strong urban automation network (UAN) and ITS applications synced to RIPTA and City vehicle fleets to advance Smart Cities technology within a series of 'Smart Transportation Corridors' that will include the LINK District and two new transit hubs - the Providence Intermodal Center and the Hospital District hub. The City will work with the state, RIPTA, and strategic partners to deploy sensor and surveillance technology to increase the safety of public vehicles operating within those districts, provide real time

Figure 1 Future build out of the LINK redevelopment parcels made available through the I-195 relocation project and build out of associated development throughout the Downtown and Hospital District

information to users about available transportation options throughout that area, and to deploy one autonomous bus line along with a fleet of electric buses connecting the 1.4-mile transit emphasis corridor between the two new transit hubs. Additionally, the City will work with our current technology vendors and new technology partners to experiment with transportation incentives, such as dynamic parking pricing, bike share use incentives, etc. to test the impact of these incentives on traffic patterns and foot traffic in specific zones. Residents will be able to use tools such as PVD311 (the city's new services app) and our newly developed "Safety Concerns" map to report transportation related issues and track the City's response. PVD311 will also be the access point for a wide variety of real time public transport and traffic data, as well as other sensor data (air quality, real-time weather, etc).   Lastly, the City will connect sensors on each streetlight to our secure public safety network to improve response times to emergency situations. The desired outcome of these investments is to improve community connectivity,

increase physical activity, reduce traffic accidents, increase our community sense of safety and security, and promote further investment within the Smart Transportation Corridors and beyond.

Driving equitable, innovative economic development - The Smart City initiative will help accelerate the redevelopment of the LINK District and incubate and test new technologies to support the growth of the sharing economy and better connect residents and commuters with jobs throughout the City. The relocation of I-195 has opened up 19 developable acres of land in the heart of the City (the LINK District) and allowed for the reconnection of the historic street grid, contributing to improved multi-modal connectivity throughout the city. The I-195 relocation has also resulted in a soon to be constructed waterfront park and a pedestrian bridge that will begin construction in 2016 to connect the park to the

New pedestrian bridge soon to be built upon the footings of the old I-195 river crossing

Fox Point neighborhood over the Providence River. The City has worked closely with RIDOT and the I-195 Commission to help shape the waterfront park and other open public spaces which will showcase the Providence waterfront and promote non-vehicular circulation.

The creation of the I-195 Redevelopment Commission by the City and State established the redevelopment of the former highway land as a key economic development priority. State legislation passed in 2011 designates the LINK District/I-195 parcels for "commercial, institutional and residential development and beneficial reuse, including without limitation to support or encourage workforce development, education and training, and the growth of 'knowledge based' jobs and industries such as research and development, life sciences, media technologies, entrepreneurship and business management, design, hospitality, software design and application, and a variety of other uses consistent with a knowledge based economy." Investments in smart technology are integral to the district's success and its ability to fulfill its development goals. In partnership with RIDOT and other Smart Cities partners the City proposes to develop a new overlay district that encompasses the Smart Transportation Corridors to ensure the policy supports exist to allow for the testing of automated vehicle technology and to better integrate transportation planning for that area with data generated from the Smart Cities technology investments. This systems based approach will also support evidence-based analysis of the smart transportation investments and their impact on goals and outcomes as outlined in Question 10, including using sensor pollution monitoring data to make the case for clean vehicle investments that reduce NOx, SOx, particulates and carbon -- all significant pollutants within the Providence metro area.

Ensuring a responsive, efficient government - Core to Providence's Smart Cities plan is connecting the City's operation-based vehicle fleet to realize transportation and operational efficiencies within City Departments and amongst major quasi-public and private agencies that deliver core services to residents and businesses. One of the City's taglines is "A City that Works" and we propose to effectuate that vision by connecting City service vehicles to a dynamic work order system that tracks location and resources, and also connects our infrastructure inventory and citizen requests to in-the-field teams to optimize response time and equipment utilization. Efficiently and seamlessly connecting community needs to City operational procedures will help the City realize its goal to achieve an overall operational efficiency improvement of at least 30% across applications. The City will convene regional entities such as the Narragansett Bay Commission, RIPTA, and the Providence Water Authority (a multi-jurisdiction quasi-public entity that is largely controlled by Providence and integrated into city government) to develop use and network agreements to maximize the impact of this investment. The City has a track record of successfully facilitating regional entity collaboration to manage infrastructure and resident services.

Rhode Island's new public sector leadership believes new paradigms are needed and that a '100 year' leap with technology can improve transit planning, increase the yield of deployed transportation assets and in short, improve the lives of its residents and commuters across numerous social metrics. The DOT Smart City Challenge funding will allow the City to accelerate and attract new investments to make the City of Providence a national model for smart transportation systems.

2. Population Characteristics - Providence is a compact, densely populated city with unique and varied neighborhoods, beautiful historic architecture and authentic arts and cultural vibrancy. Since its founding in 1636, the City of Providence has been the economic, industrial, and cultural center of Rhode Island. The city's densely populated, compact size makes it an ideal candidate to implement innovative technologies in integral parts of our city. Our population characteristics gives us the flexibility to deploy "smart" technologies through our downtown and city center and is a key differentiator with regards to USDOT's Smart City Challenge.

Providence is the capital city of Rhode Island and, according to 2014 American Community Survey data, has a population of 179,154 and an urban population density of 9,736 people per square mile. The City's population comprises approximately 15% of the Providence, RI-MA Urbanized Area, which includes 1.19 million people. However, to most residents, Providence belongs to a more local metro area comprised of North Providence, East Providence, Pawtucket, Central Falls, Cranston, Warwick and West Warwick. Many residents of these border cities commute into Providence for work or school each day. The population of this combined area, serviced by most of the same transportation resources as Providence, is 541,185, according to 2010 Census data. This puts the greater Providence area squarely in the middle of the mid-sized city range. Providence's population accounts for 33% of this more localized metro area's total population.

Providence's unique size, density, and assets give it numerous advantages over other mid-sized US cities. Its success as a thriving service and tourism center has increased its desirability as a place to visit and live. As home to seven higher educational institutions and over 35,000 students (in addition to the City's base population), Providence is a center for the millennial generation, young entrepreneurs, and institutional and research facilities. The health

care institutions in the city include the state's only Level I trauma center, a major children's hospital, a leading birth hospital and leading psychiatric hospital, the VA Medical Center two more community hospitals and a network of community health centers. A new project is being planned in the LINK district that will provide a shared facility for the nursing schools of the University of Rhode Island (now located 25 miles away) and Rhode Island College (located on the other side of the city), bringing the two school's nursing students into close proximity with the city's major hospitals.

Further establishing Providence as a national center of excellence in innovation will drive entrepreneurship, company formation, and job creation. Since 1989 over $500M of equity capital has been invested in Rhode Island life science start-up companies. In addition, the current amount of federal and foundation research funding among the partner institutions approximates $300M with private and other sources providing another $30M in support. In the past, Providence institutions have produced a Nobel laureate, eight Guggenheim fellows, twelve MacArthur award winners, eight award recipients of the Academy of Arts and Sciences and a Pulitzer Prize. Beyond that, the LINK District in Downtown is the epicenter of the federally-funded research that is currently underway. As a result, there is already a strong base of assets to build upon. We are seeking to scale that activity up by an order of magnitude through this proposal. This area is becoming a major employment center with varied job opportunities across the income spectrum for Providence and Rhode Island.

Despite these numerous assets, Providence is one of the poorest cities in the Northeast. Approximately 29% of the city's 179,154 residents have incomes below the federal poverty level with a median household income of $37,632 compared to $56,361 statewide. Over 23% of the city's households earn less than $15,000/year; 23% of households receive SNAP benefits, including a majority of the city's children. Unemployment and underemployment are a significant economic development challenge that contribute to community and household instability. The Providence Schools have a 21 percent student mobility rate.

With poverty also comes public health challenges. Providence County ranks in the worst 6% of of all U.S. Counties for health problems caused by diesel pollution. The City's racial and ethnic population includes significantly higher proportions of people known to be at increased risk for chronic diseases and associated risk factors: 16% Black, 38% Hispanic and 6% Asian. A majority of the city's under-18 population is Hispanic. Recent neighborhood health assessments conducted in the low income neighborhoods of Olneyville, South Side and the West End found hypertension, obesity and diabetes to be priority intervention focus areas. In Southside Providence, 34% of adults have high blood pressure and 11% have diabetes.

In addition to chronic disease risk factors, various environmental factors exacerbate health issues. Providence has 59% impermeable groundcover and neighborhoods range from less than 6% tree canopy to more than 40%, with lower income neighborhoods generally having less tree coverage, and most of the city towards the lower end of this range. One in ten Rhode Island children has asthma, and Providence rates of emergency department visits and hospitalizations as a result of asthma (18.3 per 1,000 children per year from 2009-13) are nearly twice that of the state (9.5 per 1,000).

3. Other City Characteristics
Public Transportation in Providence - Providence has a strong history of people-focused development that has helped to create thriving neighborhoods with a strong sense of place. *Providence Tomorrow*, the City's comprehensive plan, calls for a livable city "with healthy,

vibrant, walkable neighborhoods connected to an active downtown, with many transit options." Providence's compact form makes alternative forms of transportation viable options for commuting and getting around the city. Together with RIPTA and RIDOT, the City is making great progress toward creating a strong, multimodal transportation system. There are many exciting recent and upcoming investments that have been undertaken to improve bus and rail service, enhance bike mobility and improve the pedestrian environment in the city, including a new Rapid Bus line that uses transit signal prioritization (TSP) technology; further planning underway around TSP expansion; a bike-share program which has been fully planned and is now securing sponsorships; a $2M investment in the State's main bus hub at Kennedy Plaza; and upgrades to Providence Station, which serves as the fifteenth busiest Amtrak station in the country, the third busiest commuter rail station in the Massachusetts Bay Transportation Authority's Commuter Rail system, and the busiest on the system outside of downtown Boston. Amtrak's Acela Express and Northeast Regional service both serve Providence Station.

RIPTA, Rhode Island's quasi-public, independent statewide provider of transit services for the past 50 years, stands on the shoulders of the bus, trolley, streetcar, rail, and horse-and-carriage transportation providers that have served Providence's core since the city's earliest days. RIPTA operates 2,924 daily trips on 55 statewide fixed bus routes serving over 17.7 million rides per year. Providence has more RIPTA bus service than any other city or town in the state and is a hub for bus service to all major regional cities. Providence's Kennedy Plaza, Rhode Island's rail hub, was once the site of the Old Union Train Station, with tracks entering from the West along Washington Street. Constantly changing over the past two centuries, the Plaza is due to enter yet another transformation in the coming years. For the first time, the change to Downtown's transportation hub will be not a small step or even a giant step, but a leapfrogging over today's "state of the art" technology into a new paradigm of urban automation.

Over the past 20 plus years, Providence has reinvented itself. Mistakes made in the 1970s, such as the capping of the Moshassuck River and the construction of I-195 through downtown have been reversed, and these and other efforts have made Providence one of the best small cities in America. As this transformation has taken place, RIPTA has worked hard to keep pace, and the success of these efforts can be seen in ridership that continues to increase.

However, Providence's growth is now outstripping RIPTA's ability to support this growth with its traditional focus around a single transit terminal at Kennedy Plaza. Providence Station is the busiest outer station in the MBTA commuter rail system and the 14th busiest in the Amtrak system, but connections between Kennedy Plaza and Providence Station (a distance of 0.4 miles on foot) are limited. The relocation of I-195 has created immense opportunities for growth in the LINK District and adjacent Jewelry District, but RIPTA service there is also limited.

RIPTA has worked hard–and largely succeeded–at providing big city service to Providence, and its residents and workers heavily use existing services to the extent that many services and Kennedy Plaza are crowded and sometimes overcrowded. For RIPTA to effectively serve continuing growth and revitalization, it will need to provide more and better service, connect an expanding downtown and attract a new generation of riders.

When cities outgrow a single transit hub, the most common approach is to identify additional transit centers and to integrate bus operations in a manner that expands service coverage and improves overall transit service. Buses can be routed to pass through and serve more than one transit center, providing passengers with more convenient access to new locations and better distributing volumes of bus traffic. The ongoing transformation of Downtown is

spreading activity further from the historic city center, and beyond walking distance from Kennedy Plaza. The number of passengers boarding trains at Providence Station has doubled since 2003 and the relocation of Interstate I-195 has opened new land (the LINK District) for development in the southern area of Downtown. Introducing new transit centers and terminals helps meet desired community development goals, including the revitalization of the greater Kennedy Plaza area, providing better connections to Providence Station to support continued growth of commuter and intercity rail ridership in Rhode Island, and meeting City goals for desired development in the Capital Center (surrounding to Providence Station and state offices) and LINK special development districts.

With statewide voter referendum-approved bond funding, Providence is poised to make an historic move away from Kennedy Plaza as the sole transit hub and embrace a multi-hub plan. As design of this new network goes forward, the necessary sensors, electrical and alternative-energy infrastructure, and right-of-way improvements for a connected, automated future will be detailed. A next-generation transit emphasis corridor, connecting the multi-hub system would also embrace the opportunities provided by urban automation, a smart grid, and a connected citizenry and serve as the link between two new hubs, with tech-enabled smart stations along the way.

In particular, two key points will be reviewed for "leapfrog" technology enhancements: the Eastside Tunnel and the Providence Station Intermodal Center/Transit Hub. The tunnel, Rhode Island's sole fixed-guideway bus infrastructure and the gateway to Downtown for thousands of East Side residents each day, can be upgraded with guidance technology (magnetic or optical) to reduce accidents in the narrow guideway. Through automation, RIPTA can considerably improve speed and safety of trips to and from Downtown through the Eastside Tunnel.

In redeveloping Providence Station into a major intermodal center, Providence can gain not only a state-of-the-art transportation facility, but also a first-of-its-kind Downtown Automation Center. Home to the IT, logistics core, and physical infrastructure needed to manage the transit network of the future, the Providence Station Intermodal Center can be the point from which Providence's transportation quantum leap springs.

Environment That is Conducive to Demonstration of Proposed Strategies -Providence's tight-knit fabric and creative community make it an ideal City to advance a Smart Cities plan. For the past three years, the City has led an award-winning tactical urbanism initiative, Pop Up Providence, that introduces interactive art installations and public space improvements throughout the City's 25 neighborhoods. Through the Pop Up program, the City has enlivened public spaces, supported and engaged local artists and the diverse communities of Providence, and demonstrated and catalyzed lasting change.

The Partnership for Future Greater Providence is a public-private partnership that was recently formed to promote a systems approach to economic development and is in the process of seeking 501c3 status. This partnership reflects a longstanding practice in city government to bring key external stakeholders to the table to advance shared economic development objectives and seeks to deepen this collaboration in the area of economic development. Additionally, the City is working to advance a demonstration partnership policy to better support and streamline the logistical processes involved in partnering with the City on innovation and community connectivity initiatives.

City government in Providence is focused on intra-governmental collaboration and coordination, and there is strong existing collaborative work that brings together the departments

of Planning and Development, Economic Development, Emergency Management and Public Works, which includes the Traffic Engineering Division. The Department of Innovation is focused on spurring further collaborations and the Office of Sustainability and Healthy Communities Office, both of which coordinate closely with the Executive Office of Mayor Jorge Elorza, have worked across city departments to support active transportation and complete streets. All of these city departments have strong and close working relationships with RIPTA and RIDOT.

Lastly, the Raimondo administration has introduced a number of new economic development tools through the reinvigorated CommerceRI agency and through the Executive Office of Commerce. Stefan Pryor, appointed by the Governor, is the first Commerce Secretary under the state's new unified structure, in which he oversees and coordinates the efforts of CommerceRI along with the Department of Business Regulation, the Office of Community and Housing Development, the Quonset Development Corporation, Rhode Island Housing, the Department of Labor and Training, and the I-195 Redevelopment District Commission.

Committed Leadership - Long Range Vision - The Smart City Challenge is particularly well-timed for Providence. Mayor Jorge Elorza and Rhode Island Governor Gina Raimondo have just completed one year of their first four year terms, with both aiming to serve in their current roles through 2022. The Mayor and Governor are committed to spurring innovation in government and the private sector and ensuring a more evidence-driven, transparent and accessible government for local citizens and businesses.

The City plans to address many of the root causes of its community challenges by advancing new service delivery models, streamlining current delivery models, building public-private partnerships, and utilizing technology in new ways. To re-invent the City's approach to governance, the Mayor created the aforementioned Department of Innovation and has championed direct service-level and executive-level innovations during his first year in office. Examples include a complete overhaul of the City's 311 system, championing and accelerating the implementation of the LED light conversion project, development of several open data tools, and engagement with the National Research Network to advance new budgeting strategies. The Mayor is passionate about implementing better models of government service delivery, and is committed to partnering with local and national leaders to ensure Providence is a "City that Works" for everyone.

Mayor Elorza has also appointed a new Director of Sustainability, and has committed Providence to do its part to respond and adapt to Climate Change. The City is working on its resiliency plans, and recently announced divestiture of its pension portfolio from the coal industry. Last summer, the Mayor appointed a new Economic Development Director who has a background in renewable energy and electric vehicle venture capital.

Governor Raimondo recently appointed a Chief Innovation Officer at the state level to facilitate piloting and scaling innovations throughout the state. She is laser-focused on economic development and job creation, and recognizes the state's transportation system as a key component of that. Within the past few weeks, the Governor announced jointly with the House Speaker and Senate President a RhodeWorks proposal as one of her top legislative priorities for the year. RhodeWorks would establish a new revenue stream and plan to repair the state's roads and bridges funded through a toll on trucks.The Governor has engaged the support of organized labor and the business community to move this program forward.

A Commitment to Integrating with the Sharing Economy - Providence is committed to supporting the most forward thinking solutions to address civic challenges, and companies

supporting peer-to-peer based sharing of goods and services are a critical component of the City's proposed Smart Cities plan. The Mayor himself is an enthusiastic supporter of ride and bike sharing services and worked with Uber to ensure residents had rides to his Inaugural "One Providence" Ball, an event which also featured a bike valet. The City has an agreement with Zipcar so employees can get to meetings without driving a car to work.

This enthusiasm extends into City neighborhoods as well, where collaborative consumption through peer to peer platforms and programs is familiar. For example, several of the City's neighborhood associations have agreements with Zipcar and Uber, actively promote convenience services such as DogVacay, support and encourage the creation of co-working spaces, and organize their own sharing networks, such as purchasing and financing buy-to-own solar panel programs. The City sees a huge opportunity to build on this enthusiasm using the data collected and the partnerships developed through the Smart Cities plan to incubate and host entrepreneurs who are committed to growing other peer-to-peer platforms to making transit more accessible, convenient, and fun.

Data Transparency & Innovation - The City of Providence is already leveraging its data to increase transparency, improve public interactions with the government and foster ideas that will drive innovation. The OpenPVD website hosts several open data platforms that the public can use to become more familiar with the inner workings of the city and access open data sets. One of those platforms, an Open Checkbook module allows the public to explore city spending interactively. The data fueling this platform is also available to view and download in tabular format. Application Program Interfaces (APIs) built into the hosting tool allow for easy, automated access to any of the city's open data. The City is committed to ensuring data on these platforms is relevant and automatically updated at meaningful intervals.
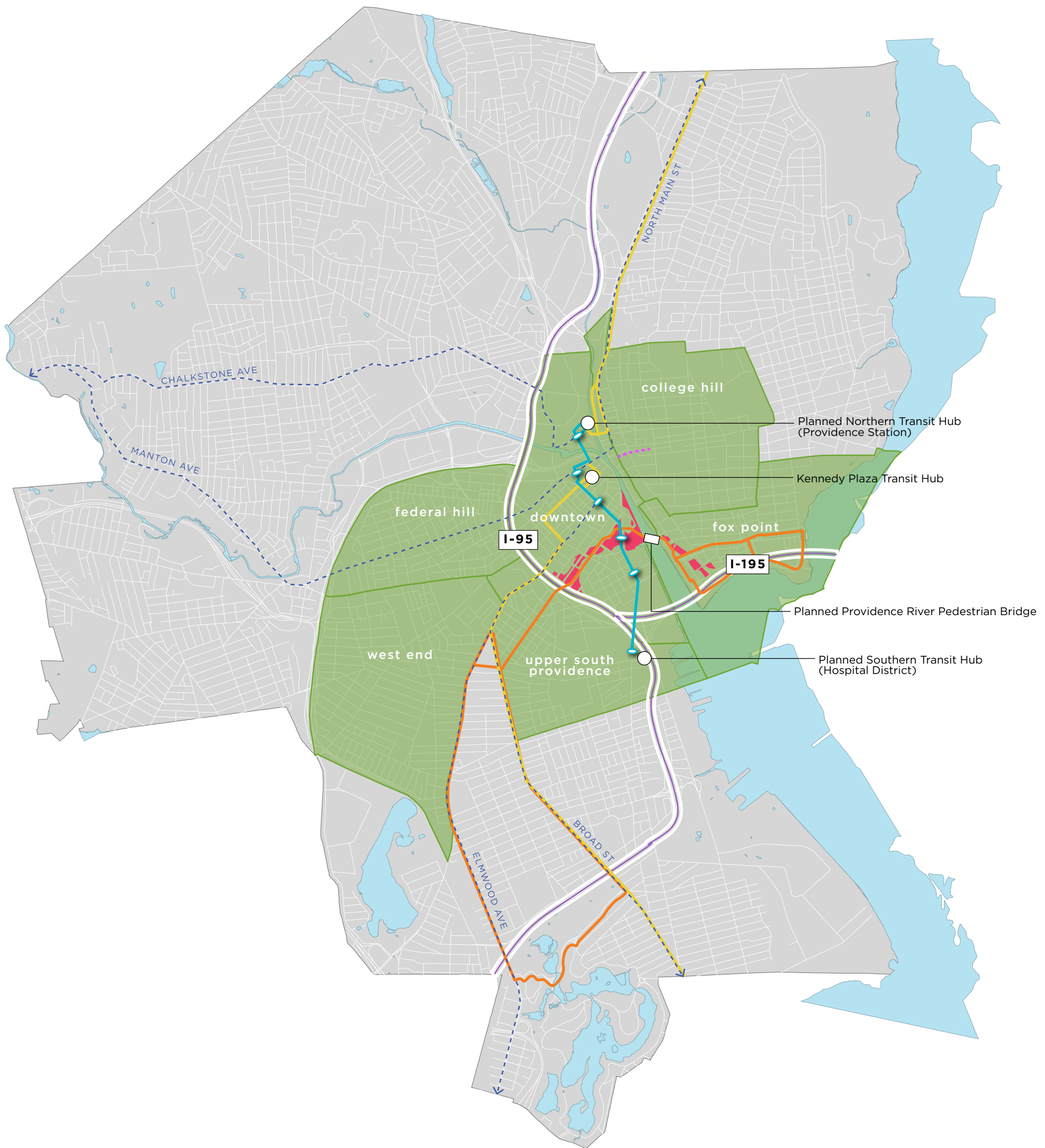
The Providence City Council has spearheaded the initiative to make the content of public meetings easily accessible. Through the open meetings portal the public has the ability to view the planned content of upcoming meetings as well as minutes and audio/video from past meetings. The Board of Licenses has followed suit in an effort the city hopes will promote transparency and encourage business owners. These efforts go above and beyond the standard set by legislation governing open meetings, a practice that the city hopes to continue through other aspects of the open data program.

Community engagement is an integral part of the city's open data efforts. Embracing partnerships with local universities through MetroLab, a recently-launched network of more than 20 city-university partnerships focused on Smart Cities; CodeIsland, Rhode Island's Code for America Chapter; and the Department of Innovation's monthly "Code Night with the Mayor"; the City is eager to engage residents, entrepreneurs, and students in open data projects and ventures. The city will soon be releasing an Open Data policy to ensure clear expectations are outlined for data formatting, data security, and open data use with assistance from the Sunlight Foundation.

4. Site Map - See page 13

SMART CITY CHALLENGE

CITY OF PROVIDENCE, RHODE ISLAND

NORTH MAIN ST

CHALKSTONE AVE

MANTON AVE

college hill

Planned Northern Transit Hub
(Providence Station)

Kennedy Plaza Transit Hub

federal hill

downtown

I-95

fox point

I-195

Planned Providence River Pedestrian Bridge

west end

upper south
providence

Planned Southern Transit Hub
(Hospital District)

BROAD ST

ELMWOOD AVE

SMART TRANSPORTATION CORRIDOR ELEMENTS

- = THE LINK I-195 Redevelopment Parcels
- = Proposed enhanced bus service route
- = Proposed enhanced transit stop
- = Providence Bike-Share System
- = Planned City Walk Trail
- = R-Line rapid bus line
- = Major transit corridor
- = East Side Bus Tunnel

5. Alignment to the Smart City 12 Vision Elements

5.1 Urban Automation - Providence is actively looking to utilize the benefits of automated transportation to enhance safety, mobility, accessibility, and better the environment for its citizenry. As outlined in the overview of Public Transit within the City of Providence, the City in partnership with RIPTA is in a position to "leapfrog" over and past traditional transportation infrastructure investments to support a more inclusive, technologically advanced, and responsive system. The initial targeted focus for that system will be the Smart Transportation Corridors, which will require both a planning overlay district and technology investments, such as a robust Urban Automation Network (UAN) to ensure the successful testing and deployment of autonomous vehicle technology along the 1.4 mile transit emphasis corridor. Additionally, the City will ensure that corridor is 'autonomous ready' through partnering Providence's Planning department with MIT's Changing Places lab to create appropriately designed lane markers, alternate transit lanes, necessary expedited policy changes, and vehicle guidance systems.

The City is committed to engaging the public in the planning process for Autonomous Vehicle (AV) implementation, and will be using the CityScope tool designed by MIT to facilitate engagement and planning of the Smart Transportation Corridors. The City will further partner with MIT on a pilot for Mobility on Demand (MoD) electric vehicles developed by the MIT Media Lab, and will seek partnerships to deploy new urban delivery service models, such as delivery by autonomous vehicles, utilizing the UAN and sensor-based platform investments. MoD personal electric vehicles have app-enabled E-Hailing capabilities, supporting autonomous delivery systems and are bike-lane legal. They contain Persuasive Technology in the form of electronic pedal assist to create more willing bike riders. Bike paths in Providence cut through downtown to Providence's highest urban poverty density neighborhoods, and MoD's allow for efficient delivery to these spaces. This is a possible next-generation solution to food deserts and safer, more efficient, more environmentally friendly delivery. In off-peak hours, this fleet of autonomous personal electric vehicles will transform Providence.

Beyond automated vehicles, the aforementioned UAN is capable of detecting critical events and monitoring physical magnitudes relevant in the urban context, and will serve as the foundation for many other components of the City's Smart Cities plan. Networked sensors to the UAN will provide information that will advise travel decisions such as a suggested bike route or walk home based on traffic, weather, and geo-location of the citizen. This will be enabled by Providence's high density, high proximity, and high diversity bike, rideshare and footpath mobility systems. Smart travel advisories will go as far as telling a citizen when to exit a building, while reducing exposure to harsh weather conditions. These same advisories can be used during night travel when commuters seek to reduce exposure time at transit hubs. Foot traffic, bicycle, and vehicle routing information will not only reduce congestion, it will also provide green routing, so that commuters can choose more efficient travel options. Pedestrians can elect to walk cleaner "green routes", where they can be routed to avoid high emission intersection pollution. Additional information such as special needs preferences can be added based on individual citizen needs. Other applications include the use of predictive analytics to adjust service, identify stress points in networks, allow for dynamic carpooling/ridesharing, track the availability of bikes at each bikeshare station, and improve travel planning.

5.2 Connected Vehicles - Providence is uniquely situated to be able to utilize a network of connected vehicles allowing opportunities to provide more responsive and efficient solutions to its population in real-time and long term. As outlined in Element 5.1, the City will work to develop robust UAN and ITS applications to support and allow for connected and autonomous

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vehicles in the Smart Transportation Corridors. The City's investment in over 16,000 LED streetlight sensor nodes will simplify and accelerate the piloting of autonomous vehicles within the Corridors and will help support future expansion to other parts of the City. The City will also ensure that it provides strategic real-time open data that technology and transportation startups can utilize to test new automated vehicle and sharing economy business models.

The magnitude of the impact of the transition from fixed infrastructure to on-demand mobility services is enormous, and is evolving alongside rapid advancements in vehicle automation. Providence will partner with MIT to pilot autonomous vehicles within the Corridors. Through this pilot the City will aim to create an open platform to design, test and enable a diverse, flexible mobility system that can function as proof of concept for best of breed mobility solutions. As Mobility as a Service grows, and vehicles are integrated into data-sharing systems, the City will also work with Brown and RISD expertise to build Driver-Rider Credential API's to expand use of MaaS in Providence and, using V2V and V2I communications and connectivity, to provide safer, more efficient mobility solutions to citizens and commuters. This technology will complement the autonomous personal electric vehicles referenced in Section 5.1. These vehicles have the ability to share real-time data, allowing for flexibility in mobility services and building a data framework for the use of big data in planning City transportation infrastructure.

Providence will utilize Mobileye's Shield technology to share data between buses and ensure the safety of pedestrians, bikes, and other vehicles in the Smart Transportation District, and data collected from the Shield technology will be utilized to inform adjustments to and future expansion of transportation systems piloted within the District. Importantly, the Mobileye collision solution includes a full telematics system which tracks the vehicle and reports all warnings to a fleet management system, providing fleet managers with valuable information about daily driving occurrences. This will allow us to identify dangerous 'hotspots' of both collisions and near-collisions, and prioritize these hotspots as spaces for mobility interventions, integrating this data with autonomous personal electronic vehicle data to make the CityScope planning tool as robust as possible.

5.3 Intelligent, Sensor Based Infrastructure - Smart Cities use a collective intelligent infrastructure, including an ITS and UAN, that allows sensors to collect and report real-time data to inform everyday transportation-related operations, performance and trends of a city. This data allows city operators to survey the operation of facilities, systems and services, making more intelligent and efficient interfaces for public services with Providence's citizens. Intelligent infrastructure includes sensors that collect transportation and environmental data. To effectuate the City's goals of enhancing community connectivity and safety, and ensuring an efficient, responsive government, the City and RIPTA will utilize intelligent, sensor based infrastructure to support improved outcomes in the following areas:

Efficient Operations, Proactive Infrastructure Maintenance - The City could outfit its operations fleet with mobile sensors connected to multi-sensor nodes in the City's LED streetlights to capture valuable infrastructure inventory, workflow, traffic, and environmental data. This data will provide unprecedented actionable insight and will enable an array of applications and services for citizens and businesses. It will also support more efficient maintenance, inspection and refurbishment protocols for city infrastructure, allowing the City to better sustain its infrastructure investments through proactive preventative maintenance. While the City has not yet secured a vendor for the replacement of its current GPS sensors, we will explore emerging smart infrastructure technologies such as low power sensors based on

microelectromechanical systems (MEMS) and ensure the hardware and corresponding platforms seamlessly integrate with other ITS and UAN investments.

Environment/Air Monitoring - Providence has made a commitment to tracking and reducing greenhouse gas emissions. Air quality monitoring can also support early detection of environmental and public safety hazards such as methane leaks from natural gas infrastructure. The roll-out of sensor enable LED lighting in Smart Transportation Corridors opens up a frontier for much more accurate data collection that can include for example neighborhood NoX levels.

Public Safety - The City will test smart network enabled surveillance technology embedded in a multi-sensor node on the LED street lights, with appropriate privacy controls, within the Smart Transportation Corridors to reduce public safety response time. Using a framework of algorithms designed to detect potential public safety hazards, the city will utilize this data to predict what areas will need more public safety coverage. Once again, a new frontier of data collection is coming with applications that can range from understanding pedestrian traffic patterns to better deploy City services to LEDs lighting natural disaster evacuation routes.

The majority of new vehicles are now equipped with Advanced Driver Assistance Systems (ADAS) to provide alerts to drivers regarding dangerous scenarios or near collisions. The City and RIPTA will utilize ADAS systems in public transportation and operations fleets to mitigate dangerous collisions. The City will also utilize the data collected from the ADAS system in its transportation planning process to ensure assets such as new bike lanes, expanded sidewalks, and traffic calming infrastructure are optimally located.

Parking - As the City works to reduce congestion downtown, increase and connect urban green spaces, promote the use of public transit, and make city streets more accessible to bikers and pedestrians, our on-street and garage parking system will play an important role in enabling change to occur. Employing advanced parking technology to allow drivers to find parking, dynamically adjust rates, and 'nudge' drivers to park in areas to reduce congestion is something the City is already experimenting with in partnership with our parking technology vendor, Xerox, and will expand upon with additional partners to complement other transportation and building investments within Smart Transportation Corridors.

Smart City Lighting Solutions - The aforementioned parking, traffic, public safety, and environmental sensors will be combined into one multi-sensor node, leveraging the lighting infrastructure to create a powerful Light Sensory Network (LSN).

5.4 Urban Analytics - Urban analytics create value from the data that is collected from connected vehicles, connected citizens, and sensors throughout a city. With the ubiquity of the smart-phone, it is now feasible to track vehicles and people continuously and inexpensively. This capability has launched the rise of the enormously successful and transformative "ride hailing services" that are rewriting the rules of public transportation. As the sources of passenger, traffic and driver data become more available and fine grained, cities have a unique opportunity to rethink and redesign their public transportation options - and their role in overseeing and shaping public and private services. Through data analysis, it is practical to identify new kinds of ride services for specific groups: low income workers, single mothers, K-12 students, handicapped, elderly, and provide incentives to individuals and ride services to better serve different constituencies. Data analysis - and indeed - new kinds of ridesharing services have shown that it is possible to radically reduce the time and cost of transportation and open up the resources of schools, hospitals, social services and cities in general to individuals and groups that have been "ghettoized" by the cost and lack of availability of traditional transportation services. There is

now the opportunity to combine different mobility modalities to better manage congestion and pollution to provide a predictable and safe mobility experience for all urban residents and visitors.

The major automobile manufacturers have recognized the inevitable transition from car ownership to mobility access. Moreover, they have also recognized the inevitability of a combination of autonomous vehicle services for package shipping, personal services and pooled transportation services. A key component to making this happen is for cities to have access to relevant mobility data without compromising privacy and security - and at the same time providing the necessary oversight and leadership to make sure that the needs of their diverse residents are being met. Through a collaboration with Brown, RISD, URI, MIT Media Lab's City Science, and the non profit privacy and data-focused off-shoot of MIT, ID3, Providence is in a unique position to draw on research and expertise to deploy and test a big data analytics platform to better understand the challenges and opportunities posed by new mobility services.

While data collection is necessary for measurement, and big data is surely useful, it is even more important to ask the right questions (i.e., ones that are both answerable and actionable); then collect the appropriate data, clean it, analyze it to obtain answers and show how the data answers the questions; and finally to communicate questions, process and answers to decision makers and the public and get stakeholders to take action. To do this well requires collaboration among system designers, policy makers, analysts, and quantitative experts. In addition, asking the right question can be done 'once' by hand (i.e. for a pilot or experiment) but for building a system, the data collection/analysis/decision capability described above must be built into the system from the start, as part of its information technology infrastructure, processes, and accountability components, and must be updated as people learn what works and what doesn't, and as new data collection capabilities are developed. This is why CityScope and other data-rich, stakeholder engagement focused planning tools are key in the outset of exploring new mobility services.

An initial data project for Providence to take directed data analytics action will be to apply MIT's CityScope tool for Corridor planning. This research will measure the attributes of innovation districts across the US in terms of their land-use configurations and population characteristics and behaviors. These measurements will be used to develop a methodological approach for producing quantitative planning guidelines to support nimble decision-making processes and the economic health of Providence.

We want to virtualize Providence. The CityScope urban analytics platform offers a virtualized city model that lets city planners test the robustness of a transportation system and how it will affect vehicle and pedestrian flows. Providence is interested in using this data to privilege walkability and increase overall transportation efficiency. CityScope offers the capability to create algorithms and simulations to probabilistically predict where people will walk to be sure that commercial and residential districts are connected most efficiently. This is non-intuitive, machine learning based prediction. Once Providence has created a virtual city simulation, there is capability to add any layer of data density--pedestrian flows, vehicle flows, energy distribution. CityScope allows the Providence government to start with telecomm data, understand fine-grained mobility patterns, build on that data with visualization tools, simulate all mobility interventions with the goal of understanding impact, and make our Corridor a next generation mobility hub with shared use systems and integrated autonomy. Understanding the social and spatial settings that encourage positive social outcomes like innovation and

walkability to accrue will equip policymakers and developers with the metrics to promote and sustain healthy cities.

5.5 User Focused Mobility Services and Choices - In Providence, the percentage of commuters who walk to work each day is above the national average, yet the percentage using mass transit is lower than the city's density would suggest. RIPTA and the City of Providence have been working steadily to increase high occupancy vehicle transportation through a variety of efforts. RIPTA has a mission to integrate and coordinate all public transportation services in Rhode Island and provide public information on all travel options, including bus, paratransit, rail, car- and vanpool, and bicycle. By coordinating the development of intermodal facilities, helping connect bus riders to rail facilities and pedestrian centers, and piloting accessible transportation options for people in need, RIPTA supports enhanced mobility for all – students, workers, seniors, and individuals with disabilities.

Now, RIPTA is preparing to develop its recent technology investments into a true advanced traveler information system providing real-time transit information to riders together with traffic, parking, and shared-use transportation updates, allowing for seamless first/last-mile connections and a more effective delivery of the traveler-focused mobility services Providence residents desire. RIPTA's fleet now has an integrated ITS in place, with vehicle locators and electronic fareboxes on all buses and Automatic Passenger Counters soon to be deployed throughout the bus fleet. Planned farebox upgrades will allow real-time wireless data-sharing, while migration to smart fare media will allow passengers to access multiple transit and alternative transportation systems seamlessly with a simple mobile phone app.

Commuter Resource RI, the state's RIPTA-coordinated Transportation Demand Management (TDM) organization, serves as an information clearinghouse on mobility options for Rhode Islanders, providing a one-stop source for shared/demand response transportation services as well as transit user incentives including EcoPass, UPass, and parking cash-out opportunities. RIPTA is preparing to launch a Passenger Experience Enhancement Program (PEEP), that will raise the level of bus stop and hub amenities and "technology-enable" each of Providence's 770 bus stops. RIPTA aims to use data from its UPASS and EcoPass programs, and the Providence Public School Department (which uses RIPTA buses rather than busing for city high school students) to improve the efficiency of bus routes and explore congestion pricing. The authority is also interested in developing a higher quality demand responsive "Flex like" service for on demand transportation for seniors and persons with disabilities. based on positive experience with existing Flex service within its system.

Providence is also excited to explore the integration of MIT's Mobility on Demand (MoD) systems into Providence's user focused mobility services. For ease of use, autonomy-ready MoD fleets are installed with strategically distributed electrical charging stations throughout a city. MoD systems solve the "first and last mile" problem of public transit, providing mobility between transit station and home/workplace. Users can swipe a membership card at the MoD station and drive a vehicle to any other station (one-way rental), or E-hail an electric vehicle via mobile app. MoD systems incorporate intelligent fleet management through sensor networks, pattern recognition, and dynamic pricing, and the benefits of Smart Grid technologies include intelligent electrical charging (including rapid charging), vehicle-to-grid (V2G), and surplus energy storage for renewable power generation and peak sharing for the local utility. As emphasized in section 5.4, data analysis and new kinds of ride-sharing services have shown that it is possible to radically reduce the time and cost of transportation and open up the resources of schools, hospitals, social services and cities in general to individuals and groups that

have been isolated by the cost and lack of availability of traditional transportation services. Offering user-focused mobility services, coupled with incentivizing green, healthy choices, is a powerful move in the direction of democratizing transportation.

5.6 Urban Delivery and Logistics - With increasing transportation costs, higher sustainability standards, and a lack of stability in regional and local transportation infrastructure, generating and providing enhanced data to support urban delivery and logistics is critical. Such data will allow for alternate services to augment traditional delivery channels, which is key to customer satisfaction and the bottom line for many companies operating within Providence. The City's LED and 16,000 sensor investments will track traffic patterns in key, often congested hubs within the City. This data will be available through the City's Open Data system and can be used to augment delivery patterns and fleets to meet delivery deadlines. Within the Corridor, the City will seek partnerships to deploy new urban delivery service models, such as delivery by autonomous vehicles, utilizing the UAN and sensor-based platform investments.

MIT's MoD electric vehicles accommodate autonomous delivery systems whenever they are passenger-less. These passenger vehicles are currently bike-lane legal and transform into delivery-capable vehicles. They can be hailed to a distribution center by cell phone app and sent on delivery routes autonomously or piloted by passengers with electronically assisted pedaling. Bike paths in Providence cut directly through downtown to Providence's highest urban poverty density neighborhoods and Changing Places MoD's allow for efficient delivery to these spaces. Further, the City is currently in conversation with RISD Industrial Design experts on creating a studio for electric drivetrain solutions for green food trucks, focusing on increasing healthy food access throughout Providence. Coupled with autonomous delivery, this is a powerful next-generation solution to food deserts and environmentally friendly efficient delivery.

5.7 Strategic Business Models and Partnering Opportunities - The success and sustainability of the buildout and implementation of the Smart Transportation Corridors will require partnerships in addition to MIT, Brown University, and URI. The City is open to partnerships to technology driven multi-national corporations, relevant non-profits, and other government and quasi-government entities. The City will also seek best practices with other Universities through the National MetroLab Network. Currently the City has Metrolab agreements with Brown University, RISD, the URI, and College Unbound. The City will also be working with MIT to deploy tools such as CityScope to enhance and support community engagement in the planning and implementation process. To streamline the City's ability to partner with technology and transportation companies, the City is working to pass an Innovation Partnership Policy. The City has committed to working with such corporates as Cisco, Xerox, Mobileye, and Vulcan to advance its broad Smart Cities vision. The City will also partner with the Providence Plan, a local data analysis and visualization nonprofit to support community engagement efforts and to develop impact assessment tools for the Smart Transportation Corridors.

5.8 Smart Grid, Roadway Electrification and Electric Vehicles - A Providence based venture capital backed energy technology start-up, Utilidata, is conducting a Volt/Var Optimization pilot that leverages real-time information from the grid to enable National Grid to adjust voltage and reduce wasted energy. As the centralized grid continues the march to a more distributed, dynamic demand/load profile - from PV to PHEVs, digitizing the grid is inevitable. The State has a "System Reliability Procurement" pilot which is evaluating how energy efficiency, demand response, and PV distributed generation can help cost-effectively better manage capital assets which translates to lower rates and lower emissions. Providence's rollout

of smart LED street lights opens up an option of the LED lights also being the transfer data node for future smart electricity, water and natural gas meters. The EV chargers in the city also have the capability to be connected to a smart grid infrastructure. Providence does not have a roadway electrification system at this time. By the time that a driverless bus program is near completion we believe we will be able to fund roadway electrification through a Statewide Transportation Bond.

Electric Vehicles - Rhode Island was the first New England state to participate in Project Get Ready, a national initiative to jump-start investment in electric vehicles and electric vehicle supply equipment (EVSE). The City is home to over fifty charging stations. On January 29, 2016 the State launched the "Driving Rhode Island to Vehicle Electrification (DRIVE)" rebate program which has a sliding scale tied to a PHEV battery energy rating of up to $2,500. Additionally, the State has created a Master Price Agreement which will provide turnkey services for EVSE purchasing and installation . The State will soon be making available $600,000 of Regional Greenhouse Gas Initiative (RGGI) funds for the purchase and installation of EVSE. Providence plans to take advantage of this funding to help pay for the cost of the EVSE equipment and installation, and to offset the cost of new electric vehicles in the City's fleet.

RIPTA is taking steps toward a green fleet and has investigated both hybrid diesel-electric and fully electric bus technologies. Roughly one-quarter of RIPTA's current fleet is made up of hybrid electric buses and trolleys. Moving toward a zero-emissions fleet is one way that RIPTA seeks to help implement the 2014 Resilient Rhode Island Act, which set targets for the reduction of greenhouse gas emissions by 25% below 1990 levels by 2025, 50% below 1990 levels by 2035, and 85% below 1990 levels by 2050. EV/PHEV or Fuel Cell buses significantly reduce street level urban emissions, lower noise pollution and in general promote a much better rider and urban pedestrian experience.

With planning for the transition to a multi-hub transit network in Downtown Providence now getting underway, it is the perfect time to identify technologies, strategies and infrastructure needed for an autonomous Downtown Circulator service – charging stations, docking systems, magnetic vehicle guidance systems, and other system investments key to launching the nation's first automated/electronic downtown transit circulator.

RIPTA's experience with hybrid-electric buses has validated the wisdom that an environmentally-friendly fleet enhances the desirability of transit, particularly in the economic, academic, and artistic core of Providence. Even short of fully electric buses, the latest hybrid-electric technology allows for operation in a geolocator-triggered "battery power only" mode, providing reduced emissions in those areas where health and air quality needs are greatest. The grant will help fund the evolutionary planning of EV or fuel cell buses in the new Downtown transit hubs being developed pursuant to a 2014 public transit referendum.

5.9 Connected, Involved Citizens - Providence is actively looking to involve and inform citizens at the individual level by deploying innovative solutions to encourage engagement. The city has a rich tradition of citizen engagement which continues today with increasing interest from residents in how our city continues to grow and develop, and broadened City efforts to expand the community engagement process to include all voices. Providence is a racially and culturally diverse city, and for projects to be truly representative of the people of Providence, the City continually works to ensure that participation in crafting and updating plans is as diverse as the community itself. One notable recent effort to engage residents, organizations and businesses in collaborative efforts to share information, solve problems and plan for the future of

Providence and its neighborhoods was the *Providence Tomorrow* planning process, which included hundreds of community meetings and charrettes and resulted in the creation of a new comprehensive plan in 2012 and individual plans for each of Providence's 25 neighborhoods. More recently, the Department of Planning and Development launched a Neighborhood Planning Liaison Program to ensure that the City is engaged in the neighborhoods and can serve as an effective partner in neighborhood development. The City regularly uses both traditional engagement tools such as public meetings and stakeholder engagement, as well as more modern engagement tools such as online surveys and social media.

Both the City of Providence and RIPTA are committed to advancing the proposed elements of the Smart Transportation Corridors through close collaboration with and inclusion of those who live within the City and those who utilize our transportation network. In 2015, RIPTA began providing real-time arrival data to its passengers at Downtown's Kennedy Plaza thanks to the new Automatic Vehicle Locators (AVLs) embedded in each RIPTA bus. Also in 2015, users of RIPTA's Flex and paratransit services began making reservations and making "where's my ride?" inquiries through a real-time-enabled reservations application. In addition to passenger tracking through Smart Card and Automatic Passenger Counter (APC) technologies, these and planned communications and technology investments will revolutionize RIPTA's capacity to perform efficient route scheduling and provide an enhanced rider experience.

RIPTA's electronic fareboxes record each transaction at the farebox and are used for ridership analysis at a route-level basis. APCs count boardings and alightings and record the latitude and longitude at which these events occur; this data is used for ridership analysis at a bus stop-level basis. The AVLs installed on each fixed route vehicle provide schedule adherence and running time information essential to fine-tuning scheduling; this system is creating greater confidence among passengers, due to accurate bus arrival and departure times. RIPTA looks to use these current technologies as a springboard to vastly improved passenger communications and rider-informed decision-making. Adopting crowdsourcing applications such as Swyft and Moovit would empower riders to assist in refining the reliability of arrival-time estimates by reporting service issues such as delays, driver concerns, and crowding. Another potential model is a Singapore-based service called Beeline, which invites customers to propose transit routes via web or mobile app website.

In 2015, RIPTA won praise from FTA for proposing a "Snow-Free Bus Stop" application that would (1) engage residents in cataloguing and reporting snow-blocked bus stops, shelters, and sidewalks, (2) empower them to participate in solving the problem by adopting stops and routes, recruiting teams to provide labor, and accessing prizes for successful efforts, and (3) call delinquent businesses and property owners to task for failing to fulfill their civic responsibility. The city will work with RIPTA to develop this app in the near future.

Users of RIPTA's Commuter Resource RI program, which promotes alternatives to single occupancy vehicle use through the NuRide application, could be invited to join a social network to develop solutions to identified gaps in Providence's alternative transportation network.

Through RIPTA's proposed Passenger Experience Enhancement Program (PEEP), RIPTA will benefit from connected riders, buses, and bus stop infrastructure to provide and receive valuable information about service quality, timeliness, and the like. Such information-sharing, further integrated into a grid incorporating smart meters and other civic infrastructure, can provide a measurable boost to public safety, local economic development, and resident satisfaction.

As mentioned in other Vision Element narratives, the City and RIPTA will build upon strong community engagement and connectivity platforms to support the planning and implementation of projects within the Corridor. The City will utilize tools such as CityScope, PublicStuff, PVD311, and new online community engagement forums such as Loomio to engage citizens in helping shape this exciting infrastructure and transportation vision.

5.10 Architecture and Standards- RIPTA's ITS system conforms to the National ITS Architecture standards and complies with The Connected Vehicle Reference Implementation (CVRIA). As stated in previous elements, the ITS system and UAN will integrate with other internal and public data systems to support the goals outlined in the Vision narrative. The City and RIPTA will utilize existing ITS standards, architectures, and certification processes for ITS and connected vehicle based technologies whenever viable, and will document cases where such use is not viable.

5.11 Low-Cost, Efficient, Secure and Resilient Information and Communications Technology - The City and State are making strategic investments in information and communications technology (ICT) to advance their transportation and smart government initiatives. Making the city and nearby communities smarter is a very relevant goal for Providence, but also an extremely complex process that involves several stakeholders and poses a number of challenges in different fields. Collectively, ICT is essential and ubiquitous to all challenges and smart city related sectors. The City, RIPTA and the State's ICT investment strategy emphasizes unification and integration of hardware, software, storage, analysis, and open data systems. Cybersecurity and individual privacy, with a sensitivity for how Personally identifiable information (PII) is safeguarded, will be addressed in the Corridor's security plan while balancing open data and data transparency goals. This integrated approach will be effectuated by the State's Office of Digital Excellence, the Providence Emergency Management Agency (PEMA), the City's Department of Innovation, and RIPTA's technology team in partnership with DOT and partners outlined in Question 6. The notion of "growing" cities based on implementing correct urban planning is being replaced with the idea of making a city "smart". The Internet of Things is changing the traditional urban planning model and compelling planners to not only consider the physical planning of a city but also to consider the use of Information Technology to make the economy, environment, mobility and governance of a city more efficient and effective. Fostering the development of a rich environment of broadband networks that support digital applications, ensuring that these networks are available throughout the city and to all citizens is essential.

5.12 Smart Land Use - In January 2015, Providence adopted a new citywide zoning ordinance which places priority on compact, walkable development, transit-oriented growth, mixed-use development, and the preservation of our unique historic character and culture. Through the new zoning ordinance, Providence has reduced (and in some cases eliminated) parking requirements, created new bicycle parking requirements, established two new transit-oriented development overlay districts, expanded historic district protections, and improved design regulations for commercial corridors and mixed-use industrial areas throughout the City to encourage the creation of pedestrian-friendly environments. The City recognizes that its rich historic and cultural resources are a unique asset, and need to be preserved and enhanced.

Prior to the adoption of the new citywide zoning ordinance, Providence updated zoning for the LINK/I-195 Redevelopment parcels in 2012 as part of planning for the district and a comprehensive overhaul of all zoning in Downtown. Redevelopment parcels in the LINK gain value from their proximity to the highly walkable, attractive and valuable existing development

patterns of Downcity, the Jewelry District, College Hill and adjacent neighborhoods, and the zoning and development guidelines ensure this value will extend to new development and its environs.The D-1 Downtown District Zone covers all of downtown Providence, including the LINK parcels on the west side of the Providence River. While historic buildings and public spaces provide strong definition to much of Downtown, parcels in the LINK offer prime opportunities to accommodate appropriate expansion of the downtown area in ways that continue Downtown's walkability and urban qualities through the economic and design contributions of new construction. The LINK and its larger downtown setting thrive on a diverse mix of land uses that support Providence's creative community and keep public places alive by day, evening and weekend.

The City has also worked closely with RIPTA to plan for and implement recommendations from a FY2010 Community Challenge Planning Grant that was awarded by HUD's Office of Sustainable Housing and Communities to conduct the Transportation Corridors to Livable Communities study. The project focused on enhancing transit, land use, and art and cultural opportunities along the highest ridership bus routes in the city— Broad Street, Chalkstone Avenue, Elmwood Avenue, Manton Avenue, and North Main Street (see site map). By working together with RIPTA, the City identified ways to enhance transit service, improve bus stops, add pedestrian amenities, encourage the development of mixed-income housing, and create opportunities for good jobs and the arts on each of the five project corridors. To complement RIPTA's transit investments in the corridors, the City worked to ensure that the five project corridors support transit-oriented development through the new citywide zoning ordinance. The development scenarios that were ultimately produced for key hubs along each of the five project corridors and the creation of strategies to integrate arts and culture with future development at those locations will ensure the creation of lively urban places that encourage activity and enable residents to enjoy a lifestyle that is less reliant on automobiles for personal travel needs. Enhancing livability through investments in community hubs at key nodes also, in turn, ensures the success of the transit investment in those areas. Through the Transportation Corridors to Livable Communities project, the City also worked to integrate arts and cultural opportunities into neighborhood-based community hubs, build community and foster neighborhood vitality through increased access and diversified cultural participation, and increase access to art, culture, and creativity at the street-level in order to catalyze social and physical change in the neighborhoods located along the key corridors.

In 2011, the City passed a Complete Streets resolution which places priority on providing safe and convenient access for pedestrians, bicyclists, transit riders, and motorists of all ages and abilities. The City and the Bicycle and Pedestrian Advisory Commission continue to work together to ensure equitable access to Complete Streets and expand the footprint and reach of safe and attractive bicycle and pedestrian infrastructure.

6. Key Technical, Policy and Institutional Risks- Integrating digitally connected systems into city infrastructure makes the city more susceptible to data breaches and, due to the highly technical nature of some of these systems,vulnerable to human error. Data collected and shared by the city also raises privacy and ethical questions. Integrating digitally connected systems into city infrastructure makes the city more susceptible to data breaches and, due to the highly technical nature of some of these systems, vulnerable to human error. Data collected and shared by the city also raises privacy and ethical questions.

To address these concerns, the Providence Emergency Management Agency (PEMA) in partnership with city and state stakeholders identified in Question 7, will lead the creation of a security and response strategy for the Corridors. PEMA will engage with outside experts such as Securing Smart Cities, a nonprofit focused on cybersecurity and risks inherent in Smart Cities, the National Institute of Standards and Technology's Global City Teams Challenge participants, MIT data-driven-design expert collective ID3, and the Department of Homeland Security's Office of Cyber and Infrastructure Analysis. A significant focus of this strategy will be on workforce education and training.

The City considers this process, and the perceived risks of Smart Cities technology, to be a high risk for advancing this Corridor. The City will depend greatly on partnerships and networks of experts to overcome and adequately address this risk. Providence will work closely with Brown University. Brown has long been recognized as having one of the top computer science research and teaching programs in the world. Among Brown's computer science faculty are internationally-renowned experts in fields comprising cybersecurity including experts in secure cloud storage systems, cryptography, user authentication systems, web security, network systems security, operating systems security and cybersecurity policy. Brown University faculty expertise covers the full spectrum cyber security issues from technological matters to policy and implementation concerns and Brown faculty have testified before the United States Congress on cybersecurity threats and responses. At the State level, Governor Raimondo has appointed a cyber czar tasked with assuring that the State is building a cyber security infrastructure leveraging off of existing RI competencies such as Brown and the US Navy to make RI a leader in the rapidly changing space of cyber security.

Policy and Workforce challenges also pose a risk to advancing projects in the Corridors. Enabling certain technology partnerships, such as working with MIT on testing autonomous vehicles, will require an overlay policy that will need to be approved by the City and a state commission. This risk is considered low due to the alignment of this proposal with the vision of leadership at the City and State level, however robust education and community engagement elements will need to be planned and deployed to build support for the overlay policy. Another potential risk associated with the deployment vision is pushback from labor over potential driver jobs lost. Providence is well-equipped to handle this scenario. Rhode Island is a small state where the state and the city are accustomed to working closely with one another. RIPTA has several other routes in and around the confined area proposed for the autonomous bus, to which they can easily reassign any bus drivers whose routes become driverless. Further, the state, Providence, and RIPTA will together embark on a robust public relations campaign to explain to the public the many benefits of the driverless bus.

On policy / institutional risk, the State and the Capital city leadership are aligned. This builds off of the streamlined zoning and approval process for the I-195 Corridor. The City has convened an interdepartmental and intergovernmental team to advance its Smart City work. Participants include representatives of the City's Department of Planning and Development, the Economic Development Director, the Providence Emergency Management Agency, the traffic engineering division in the Department of Public Works, the Department of Innovation, Economic Development, the Office of Sustainability, and the Mayor's Policy Office. At the state level, partners include the RI Public Transit Authority (RIPTA), a quasi-state agency; the Office of Governor Gina Raimondo; the RI Department of Transportation (RIDOT); the RI Statewide Planning Office; and the state Chief Innovation Officer. We believe this risk is effectively

mitigated.

7. Team Partners, Key Stakeholders and Governance Processes - The City will pursue further partnerships with Cisco, Xerox, Mobileye, and Vulcan to support projects outlined in this proposal. The City has an existing contract with Xerox for several public works and IT systems within the City of Providence, and will be leveraging their partnership with Cisco to pilot new parking technology. Cisco's suite of Smart Cities products, specifically their smart streetlights technologies, will also be explored in the next phase of this project. Mobileye's Shield technology will be utilized to ensure the safety of pedestrians, bikes, and other vehicles in the Smart Transportation Corridors, and data collected from the Shield technology will be utilized to inform adjustments to and future expansion of transportation systems piloted within the Corridors. The City looks forward to working with Vulcan on ensuring our plan has the desired sustainability and emissions reduction impact(s), and to gaining their support in developing best practice tools to support replicability in other cities.

The City will leverage its Metrolab agreements with Brown University, RISD, the University of Rhode Island, and College Unbound to support relevant research, testing, and technology development to advance the City's Smart Cities plan. Together, these institutions bring competencies in engineering, computer science, design, community engagement, and system analysis that are already being leveraged to support Smart Transportation solutions. The City has specific commitments to work with URI's Transportation Center, which conduct multidisciplinary education, research, technology transfer and outreach for surface transportation systems and advanced transportation infrastructure.

The City has a partnership with MIT, a global Center of Excellence (CoE) in urban analytics, connected vehicles, and data-driven city planning. The City will work with MIT to deploy tools such as CityScope to enhance and support community engagement in the planning and implementation process. A digital map overlaid by a lego model of the new construction and resultant changes in commuting patterns in the Corridors will allow for interactive community charrettes and give participants a tangible sense of the benefits, and potential tradeoffs, certain transportation and planning projects will have on how the City moves. The modeling done through CityScope will help planners better understand and address neighborhood connectivity limitations, such as lower income neighborhood resident's access to employment centers such as Providence's hospital district.

As mentioned in other elements and questions, the City will soon be advancing a demonstration partnership policy to better support and streamline the logistical processes involved in partnering with the City on initiatives advancing the City's innovation and community connectivity goals. We will build on existing city, state and RIPTA governance structures as well as our past practices in collaboration.

8. Existing Transportation Infrastructure - RIPTA operates fixed-route and Flex services throughout Rhode Island and also administers the RIde Program, Rhode Island's statewide paratransit program and other transportation programs. RIPTA's fixed route service program operates 7 days a week in 34 cities and towns on 56 bus routes and carries more than 18 million passengers each year with a fleet of more than 200 vehicles. This service brings about 1.5 million students and faculty members to local colleges and universities, provides over 4.3 million discounted passenger trips each year to individuals with disabilities and those over the age of 60, and serves 37 Park and Ride lots throughout Rhode Island. RIPTA's Flex services include 8 Flex

service zones serving 11 Rhode Island communities with a fleet of 19 smaller transit vehicles, providing fully accessible, reservation-based services helping to meet the mobility needs in less developed parts of the state.

Providence has more RIPTA bus service than any other city or town in the state, and is a hub for bus service to all major regional cities. By removing transportation barriers and improving access to regional transportation, jobs and cultural venues, our city has the opportunity to further build community and foster neighborhood vitality. With 82 miles of arterial roadways and 33 miles of freeway, Providence also serves as an important nexus for commuters traveling by car within the metropolitan region and those traveling along the East Coast between New York City and Boston. Providence Station in the northern end of Downtown, serves as the third busiest commuter rail station in the MBTA system after the two downtown Boston stations, and the 15th busiest station (out of 500) in Amtrak's system. Providence has approximately 500,000 MBTA riders annually, and 700,000 Amtrak riders annually, totaling 1.2 million.

RIPTA serves the City of Providence with 29 routes and 770 bus stops. Downtown Providence is home to RIPTA's primary statewide operational center, Kennedy Plaza, through which the majority of RIPTA's fixed-route bus service passes, with approximately 50,000 passenger boardings every day. RIPTA also offers paratransit service throughout most of Providence, providing point-to-point transportation service for qualified individuals with disabilities who are unable to use the fixed route system. RIPTA is currently in the planning phase for a new operational hub in downtown Providence located near Providence Station. This new hub will serve in conjunction with Kennedy Plaza and will strengthen RIPTA's role as Rhode Island's regional transit provider.

RIPTA is in the final stages of deploying a CAD/AVL system that allows the authority to track its buses in real time. This system allows RIPTA to more accurately track and monitor vehicle location, which assists in creating more accurate schedules. The system also creates greater confidence with passengers, due to accurate bus arrival and departure times. Additionally, RIPTA has recently completed its first Transit Signal Prioritization (TSP) project in coordination with the State's first rapid bus line, the R-Line, including 48 intersections along Broad and North Main streets in Providence and 13 intersections along Main Street in Pawtucket. TSP allows buses to communicate directly with traffic signals to give buses a slight priority over general traffic. Currently, this system is optically-based, but recent technological advances have started allowing for GPS-based systems. The City of Providence has enthusiastically adopted the use of TSP to speed the flow of transit and enhance operational performance. Since implementation of the TSP along the R-Line, RIPTA has seen increased ridership as service becomes faster and more reliable. We are committed to employing the same technology along other corridors, to make public transit more competitive with other modes and to enhance the efficiency of operations.

Providence is served by Zipcar, Uber, Lyft, and coordinated vanpooling and carpooling services. Through RIPTA's transportation demand management (TDM) program, Commuter Resource RI, commuters are encouraged to plan and log alternative transportation trips in exchange for rewards. Through NuRide, commuters seeking car- and vanpool opportunities are matched with others travelling in the same direction toward common destinations. Providence has also selected a bike share program provider and will be launching this service in the near future.

9. Current and Future Data - RIPTA currently collects and analyzes substantial data. Automatic Passenger Counters (APCs) are installed on 35 of RIPTA's fixed route vehicles. This equipment counts boardings and alightings and records the location (latitude and longitude) at which these events occur. This data is used for ridership analysis at a bus stop-level basis. Electronic Fareboxes are installed on all fixed route vehicles. This equipment records each transaction at the farebox and is used for ridership analysis at a route-level basis. An Automatic Vehicle Locator (AVL) System is installed on each fixed route vehicle. This system provides Schedule Adherence and Running Time information. RIPTA is looking to build on this data collection capacity and continue improving its use of this data and its ability to share it with riders to improve their experience.

The City collects and manages several infrastructure and transportation related datasets. The Department of Public Works (DPW) reviews the condition of city roads every few years and uses that data to maintain a pavement management system. The city conducts traffic pattern analyses in priority transportation and economic development areas and utilizes traffic count data from RIDOT to support particular projects or address concerns about traffic in a particular area. DPW collects data on the condition of the city's sidewalks and within the past year the Department of Public Property has done a complete survey on the condition of sidewalks in the city. Recent efforts on street light conversion included a field survey of the city's streetlights. RIDOT performs inspections of city owned bridges and provides that information to the city. The City also collects complaint and request data through its online 311 system regarding numerous transportation and public works projects, and allows residents to track responses and view other user activity within their surrounding geographic area.

City-level data is also collected and available through The Providence Plan, a nonprofit created through a joint effort of the City of Providence and the State of Rhode Island to promote better collaboration between government, the private sector, and academic institutions. Their work focuses on generating neighborhood-level data and information about Rhode Island's capital city in four key areas: economic development, early education, job readiness, and health care. They crunch census and municipal data, work to develop indicators of community well-being, and sit down with local stakeholders to find ways in which this information could support their work.

10. Technology Approach - The City is currently drafting an Open Data policy to normalize its approach to adopting new technologies for city services and handling data produced therein. Part of the process of establishing the standards and processes for this data has been working with partners like The Sunlight Foundation, who are well versed in successful Open Data policies. Practically this affects a number of infrastructure and transportation initiatives already underway. For example, the installation of smart LED street lights will potentially allow the City to gather data on vehicle and foot traffic, parking availability, noise pollution and other urban health relevant metrics. It is imperative to the City's data programs that it is prepared to handle this and any other new data that the implementation of new technologies produce and most importantly, to protect PII data while also sharing relevant information with entities that will be able to put it to use. Potential partnerships with Cisco, Xerox, MIT and Brown have already begun to inform the City of the promising feeds the smart LED lamps could provide as well as the challenges behind collecting the data. The Open Data policy will also ensure that the processes and standards put in place are evaluated periodically so that they are in line with the technologies the City implements and the needs of those who rely on them.

As a precursor to the plans laid out in section 5.3 the city is currently leveraging its GIS platforms to build solutions to infrastructure and transportation concerns. During snow storms the Department of Public Works is able to monitor and more efficiently allocate its resources through use of custom built GIS tools. The Open Data portal also provides information on transportation and public safety for the general population. When the City undertook a large repaving project from 2013 to 2015, a schedule and interactive map of the streets to be paved was posted to the portal. There are also data sets on crime statistics that are updated nightly, maps of community gardens within city limits, and an inventory of trees that was put together by volunteers. Soon the City will also be launching a dashboard that it will use to communicate the status of certain projects and goals. Among those will be periodic reviews of the accomplishments of the City's Office of Sustainability which has specific goals in categories like energy, transportation, and land use.

Future Data: The installment of 16,000 sensor enabled LED street lights is a significant step towards digitizing the City. As discussed, the new functionality options are nonlinear and analogous to the analog phone being replaced by the digital smartphone of today. The volume, accuracy and time dimension of data will drive much better planning. And working with MIT Media Lab, a systems approach combined with CityScope's mapping methodology can now enable big data analytics to determine cross-silo social determinants such as public transit access in the inner city with possible correlations to employment, education, food nutrition deserts. Brown University is working on a regional National Science Foundation proposal that will leverage a "Smart-city Cloud-based Open Platform and Ecosystem (SCOPE) to allow stakeholders to harness, learn and innovate from urban big data by monetizing unused assets, enhancing quality/equity of services, and developing new ones", especially in regard to transportation and energy. In short, new digital data driving analytics is expected to be a powerful tool for the City's new leadership to tackle some of Providence's most difficult and entrenched social problems.

11. Goals and Evaluation Measures -Below are initial proposed goals and associated, relevant performance measures for the Corridor. However, the City hopes to further refine and define these goals and measures through community and stakeholder engagement strategies outlined in previous questions.

Table 1: Goals and Evaluation Measures

Goal	Evaluation Measures
Goal 1: Smart Transportation investments serve as a catalyst for new citizen engagement approaches and for greater accessibility to and use of multiple transportation options.	- Average vehicle occupancy (AVO) - Transportation mode share and per day counts (mode shifts) - Total travel time by mode - Availability of travel mode by time of day - Cost per low-income household served by transit (trial measure); % of household income spent on transportation - Length and % of road network, including public transport stops, within the Corridor for which dynamic traffic, safety and traveller information

	is made available to the public.
Goal 2: Providence and partners support equitable economic growth and attract new employers in the Corridors by enhancing smart public transit and transportation infrastructure and tools.	• % change in peak period journey time, % change in peak period traffic flow, and % change in journey time variability along routes where the UAN and connected ITS applications have been implemented. • Economic impact, such as the decreases in vacancies, changes in revenue, increased investment development, and the number of new jobs created in proximity of multimodal streets and near transit. • % of the city that is within a 5 minute walk of a shared transit mode • Number and % of new vehicles including the following intelligent vehicle features: 1) Safety readiness 2) Automated operation 3) Cooperative systems
Goal 3: Smart Transportation investments support the City and State's emissions reduction goals and encourage development of alternate transit options.	• VMT per capita • % change in annual CO2 (Tons), other GHG and particulate matter (PM) emissions on routes and from vehicles operating within the Corridor • # of public charging stations per capita and per job • # of electric vehicles registered in Providence and number • Mode shifts (as outlined in Goal #1)
Goal 4: The safety for users of all transportation modes is increased through the use of technology and improved coexistence of different modes.	• Length and % of road network within Corridor covered by incident detection and incident management systems • % change in number of reported accidents along routes where the UAN and connected ITS applications have been implemented • % change in response time of emergency responders within Corridor
Goal 5: Smart Transportation investments help the City and partner organization realize operational efficiencies, enhanced safety, and increased citizen satisfaction.	• Number and % of signal controlled road intersections using adaptive traffic control or prioritisation • % change in response time by City and RIPTA to citizen complaints and suggestions related to transportation within the Corridor • % change in road and infrastructure maintenance costs within the Corridor • % change in overall operational efficiency of the City and its partners in identifying, responding to,

	and completing necessary maintenance and/or emergency work along routes where the UAN and connected ITS applications have been implemented

The City in partnership with RIPTA will engage a third party evaluator to validate site system performance with respect to the above targeted measures, to collect or infer contextual data that allows for the isolation and mitigation of confounding factors, and to provide supplementary evaluation with respect to a broader set of safety, environmental, mobility and public agency efficiency measures of interest to USDOT. The City will ensure the third party evaluator has access to the site and to site staff to conduct evaluation-related experiments, interviews, and surveys. During the planning stage, the evaluator will assist with determining how the city and RIPTA can collect needed data that they do not currently collect, including how to incorporate data collection into planned technology solutions.

12. Applicant Capacity - The City of Providence manages a sizeable annual budget of $696 million (FY2016) and has the capacity and ability to sponsor, build and take ownership of a project of this magnitude. The City brings significant managerial experience and capacity to this project. As the capital city of a small state, Providence works closely with state governing entities on a daily basis, as demonstrated by the cooperative funding and management partnership formed to develop the City's FY14 TIGER grant project. The City of Providence aims to strengthen the partnerships already established to guide this project by drawing on the strengths and expertise of state partners and formalizing agreements to develop a viable and practical structure for project delivery and operation.

       The Department of Planning and Development is responsible for the expenditure and management of numerous federal funds. Officials from the Department also serve as members of the State Planning Council, the State Transportation Advisory Committee and the I-195 Redevelopment Commission. The Department employs 50 people to implement the City's programs related to economic development, housing, community development, workforce development and training, and transportation. The Department manages and implements a great number of grant programs including: over $24.6 million in federal grants awarded to the City and its economic development arm, the Providence Business Loan Fund Corporation, from HUD, DOT, and other federal agencies, as well as managing economic development business loan programs; the Providence Housing Trust, which includes a home loan portfolio of over $4.2 million and lead hazard reduction grants of over $5 million; the City's CDBG, HOME, HOPWA and ESG grants; the City's First Source program to connect employers and Providence residents seeking work and a $2.5 million green jobs training program; an $11 million transportation bond program; and a $1 million 2011 HUD Community Planning Challenge Grant.

       To ensure compliance with federal regulations and sound fiscal management of grant funds, over 25% of the Department's staff is devoted to regulatory and fiscal compliance activities. Compliance and fiscal officers monitor program activities, sub-recipients and budgets to ensure that all grant funded activities comply with the appropriate federal guidance, the OMB circular and specific grant requirements.

       The new Director of Economic Development for the City, Mark Huang has over 15 years of private sector experience in technologies relevant to the Smart Cities plan. At General Electric he led multidisciplinary teams mapping and investing in the emerging li-ion battery sector,

advances which are now enabling the 'electrification-of-transport' today. As a venture capitalist he first invested in LED lighting in 2010 and has worked in this emerging industry as LED lighting started to transform from analog to digital. Additionally, the Mayor recently created a Department of Innovation tasked with streamlining the delivery of city services, promoting public entrepreneurship, and supporting citizen engagement.

RIPTA is a quasi-public agency of the state of Rhode Island, governed by an eight-member board. It operates a variety of transportation services, including fixed route bus services, zone-based community transportation, and brokered demand response paratransit service for multiple state human service transportation programs as well as an ADA complementary paratransit service. Its service area covers the entire state of Rhode Island. Some level of service is provided in 38 of Rhode Island's 39 cities and towns. RIPTA was created by state law "to own and operate a mass motor bus passenger system" and is the designated recipient of six Federal Transit Administration (FTA) programs: the Section 5307 urban area formula grant, the Section 5309 bus discretionary grant, the Section 5311 non-urban area formula grant, the Section 5310 capital assistance program for elderly and disabled persons, the Section 5316 Job Access and Reverse Commute, and the Section 5317 New Freedom Program. In addition to supporting the work of statewide planning programs, RIPTA staff is responsible for planning transit services for fixed route, demand response, neighborhood circulator services, paratransit, and special transit services.

As a partner, RIPTA is fully committed to maintaining its infrastructure in a State of Good Repair, as demonstrated by the construction of a new $41M operations center in 2010 with indoor bus storage to replace an outdated and undersized facility; the recent replacement of significant portions of the bus fleet, including 50 new buses in 2013 alone; efforts to upgrade the East Side Tunnel through an $820,000 State of Good Repair grant; the deployment and active use of a full-featured Asset Management System to monitor the condition of physical assets; and the inclusion of facility and capital asset repairs in the state's Long Range Transportation Plan, Transportation Improvement Program, and in RIPTA's Capital Improvement Plan.

13. Resource Leveraging - The DOT Smart City Grant will be layered on top of existing RIDOT, RIPTA and City of Providence resources that are already being deployed in Providence's transportation infrastructure. Planning efforts, such as the renovation of Providence Station, continue to use 'traditional' methodologies with existing budgets for new assets.

The new leadership at the State, City and Universities (URI, Brown, MIT and RISD) are committed to expanding the knowledge and innovation economies in the LINK/I-195 Redevelopment District. The award of this transformative Smart City grant will be the focal point to attract technology companies from around the world. The leadership of Rhode Island has a diverse corporate network and a track record of being able to raise funds. The leadership would look forward to seeking multinationals to co-share development of the nation's first autonomous public transit route and other Smart Transportation Corridor elements to advance the vision articulated in this application.

In 2014, Rhode Island voters approved a $35 million transit bond to help advance the Providence Station Multimodal Transit Center, a planned state-of-the-art transportation center/bus hub serving rail and bus passengers adjacent to the existing Amtrak and MBTA station in downtown Providence. This facility will serve as the northern terminus for the Smart Transportation Corridor that is being funded separately through a $13M FY14 TIGER grant. This project will improve the quality of transit service to help attract new riders, increase the

capacity of our mass transit system, and support the transformation of Kennedy Plaza into a world-class civic space. The project has broad support from more than fifty private, public, and non-profit partners.

In addition to the TIGER project, we are looking to coordinate our Smart City work with other existing and future federally funded initiatives. For example, the Woonasquatucket River Watershed Council is working to make improvements to the Woonasquatucket Greenway with funds from the FHA's Recreational Trails Program, and has committed approximately $1 million in these funds to support improvements on the trail close to downtown Providence - which will support improved pedestrian and bicycle connectivity in and around the corridors.