



# Beyond Traffic: The Smart City Challenge Phase 2 Application

5.24.16

City of Kansas City, MO





Office of the Mayor

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Dear Secretary Foxx,

I want to thank you once again for your recent visit to Kansas City. I have said it before, and I'll say it again, whenever we have the opportunity to host you, we know big things are happening here.

Kansas City is on the move and we are incredibly enthusiastic about the Smart City Challenge. Our grant application reflects our bold vision to establish the foundations for a 22<sup>nd</sup> Century City. We believe that transportation systems can be the catalyst to enhance the quality of life for our citizens, improve the livability of our neighborhoods, strengthen our economy, increase public safety and invest in modern infrastructure that will stand the test of time.

Much like our predecessors in Kansas City built a City Hall that continues to inspire, we are striving to create infrastructure and systems that connect our city physically and digitally. The Smart City Challenge will enable Kansas City to continue to work with multiple partners and transform a \$40 million grant into a plethora of opportunities for our citizens to live in the smartest city in the country.

As we head into the next phase of the Smart City Challenge, our work continues while our outlook remains optimistic. I hope you and our DoT partners would agree this is not the end of a signature project, but rather the beginning of something truly transformative for the people of Kansas City. We hope to serve as a model to other U.S. cities as we roll out a project that focuses on safety, reliability and efficiency. We look forward to the future and as always, we thank you for bringing us along for the ride.

Sincerely,

Sylvester “Sly” James  
Mayor of Kansas City, Missouri



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# 1 Technical Approach

## 1.1 Executive Summary

There is a distinct, interesting sound coming from Kansas City, Missouri these days. It is the blended harmony of progress, opportunity, innovation, and determination - reminiscent of the jam sessions that take place in the historic 18th and Vine Jazz District. That sound is Kansas City pulling its chair up to the table of world-class cities.

Our City's transformation has been significant and expeditious. Concurrent with efforts to revitalize downtown, Kansas City was selected to become the first ever city for Google Fiber. This laid the foundation for neighborhoods of every kind to become connected. Next came the streetcar, providing the City with a new form of transportation, one that has already resulted in \$1.7 billion of adjacent development. Finally, the City successfully implemented a Smart + Connected City along the streetcar corridor, enabling digital advancement, including public Wi-Fi, smart lighting, information kiosks, and data analysis tools to make government more efficient. We are ready to take our transformation to a new level through the USDOT Smart City grant because we are not even close to being done.

The City's unique smart city vision can already be seen along the downtown streetcar line. We will use our experience as the first smart city in North America to develop and deploy next generation transportation technologies to address safety, mobility, and climate change issues. Furthermore, we will consider the Prospect Corridor as ground zero in our effort to close the opportunity gap that is far too present in neighborhoods east of Troost Avenue. We will base our success on our ability to transform the Prospect Corridor, currently riddled with high crime, vacant and abandoned buildings, and pervasive hopelessness, into an area as vibrant as our downtown, with cutting edge public transportation, economic development opportunities, and immense pride.

This grant will accelerate our momentum by expanding our reach of mobility and connectivity, particularly into neighborhoods of need. This framework will not include technology "for technology's sake," but will instead utilize technology as a vehicle to transform neighborhoods and lives. Additional public Wi-Fi will enable our students to better complete homework, while also granting access to citizens seeking employment. Mobility hubs on the east side of town will provide several forms of transportation options, including bike share, car share, bus rapid transit lines, as well as educational opportunities for people to learn how to take advantage of these new options. Simultaneously building new transportation infrastructure, and working together with our citizens on how to embrace their new connectivity, is key in ensuring mobility for all. ShotSpotter technology will aid our police force in quickly and immediately responding to exigent circumstances in our neighborhoods. Smart streetlights will save energy and public funds all while helping residents feel safe. Neighborhood by neighborhood, Kansas City will get smarter, and the opportunity gap will close, by virtue of this grant.

Kansas City is the ideal location for the USDOT to showcase the impact of effective collaboration between technology and transportation systems. The City's affordable cost of doing business, combined with a growing urban population and existing initiatives that are reinventing our downtown, provide the most return on investment for this grant competition. Our existing smart city initiatives and regional partnerships enable our city to demonstrate ideas, scalability, and efficiency because we already have a significant head start on our competition. Our central and bi-state location also enables the City to easily share lessons learned.

The holistic vision of the Kansas City Smart City is captured in three mutually supporting pillars. These pillars encapsulate the "how" as well as justify "why" specific smart technologies will be used in Kansas City to achieve the goals set forth by the USDOT and city leadership. The pillars incorporate the USDOT's 12 vision elements, addressing the various needs of next generation technology. Ultimately, the three pillars are based on "what if" statements rather than "we cannot because..." We have learned through our existing smart city efforts that rather than just "thinking outside the box" we can move the needle much further if we eliminate the box all together, roll up our sleeves, and turn on our collective imagination.

**Pillar 1- Prospect Corridor: Developing Ladders of Opportunity for Eastern Kansas City.** This first pillar focuses on transforming the eastern third of the city along the Prospect Avenue Corridor. The eastern third of Kansas City is in need of revitalization to help improve the economic and social environment for underserved segments of the population and to address public safety concerns inhibiting growth and opportunity. Average incomes are below regional averages and unemployment and crime rates are high. The population in this area is highly dependent on public transit and cellular phone-based digital connectivity. Implementation of connected



vehicle technologies for mass transit, access to wireless and other digital technologies, and deployment of smart lighting and other safety oriented technologies will improve access to economic opportunities and jobs, reduce the geographic isolation of the community, and stimulate growth of new businesses along a critical corridor for the city.

Kansas City and local organizations are already working hard to serve the economic and social development needs of low-income, urban core residents. One effort, funded through the FTA Prospect MAX BRT Small Starts Grant, the Prospect Metro Area Express (MAX) bus rapid transit line, aims to increase mobility throughout the corridor through faster bus routes and additional technology (e.g., interactive kiosks, real-time transit information, station Wi-Fi, and more). Our Prospect Corridor Pillar will build upon existing efforts, like the MAX line, to maximize the effectiveness of smart city technologies. We will increase Wi-Fi availability as well as add additional interactive kiosks throughout the corridor to better connect citizens with the rest of the city and the world, thus reducing digital isolation. We will work closely with community organizations along the Prospect Corridor offering digital access and training programs to help bridge the digital divide, including additional educational and training programs centered on the new technologies. The digital expansion and improvement of the transportation system through the smart city efforts will also provide added incentives for local and national businesses to establish operations along the corridor, thus revitalizing the area and increasing the ladders of opportunity available to residents.

Mobility hubs, offering several modes of transportation at a single location, will be placed at two bus stations along Prospect Corridor to improve city connectivity through transportation accessibility, and increase convenience during the “last mile, first mile” of a trip. Sensors will collect real-time transit and traffic data that will be combined with additional city data to develop comprehensive real-time travel information, which will be accessible at smart kiosks and smart phone applications. Additionally, an integrated payment system will allow users to pay for multiple modes of transportation through one system, making transfers between transportation types more convenient.

Improving safety along the corridor is a crucial goal for this pillar. The Prospect Corridor is home to AlphaPointe, the third largest single employer of the visually impaired in the US as well as a comprehensive rehabilitation and education agency for people with vision loss. Voice responsive wayfinding technology and automatic audio at all bus stations will be added to the corridor to help visually impaired individuals move freely and safely along the Prospect Corridor. Furthermore, connected vehicle technology will be deployed on transit vehicles and along the Prospect Corridor, which will further improve safety for all citizens, including the visually impaired.

**Pillar 2- Automated Vehicles, Connected Vehicles, and Electric Vehicles: Advancing Safety, Mobility, Accessibility, and Clean Transportation.** The second pillar focuses on deploying automated vehicle (AV), connected vehicle (CV), and electric vehicle (EV) technologies to advance safety, mobility, and clean transportation solutions within KCMO. AV and CV deployments will be focused around the airport, downtown, and the Prospect Corridor. A fully autonomous shuttle system will be deployed along 11<sup>th</sup>, 12<sup>th</sup>, and 18<sup>th</sup> streets. This AV shuttle system will connect the current streetcar and Smart + Connected City initiative with other city investments in the 18<sup>th</sup> and Vine Jazz District and the West Side community. The 20-mile corridor from KCI Airport to the downtown area will serve as a highway test corridor for connected and semi-autonomous vehicles in addition to connecting passenger terminals at KCI to the downtown area, and provide state of the art transportation to visitors and residents.

Kansas City will benefit from 13 CVRIA applications deployed throughout key areas to improve safety and mobility, targeting critical areas identified through a five-year collision data set from KCPD and MoDOT. DSRC on-board units will be deployed on 500 private and fleet vehicles as well as over 500 initial RSUs that will be placed throughout the city, enabling V2X messaging. A pedestrian safety and mobility pilot will solicit 50,000 people to enable Personal Information Devices (PIDs) or Radio Frequency Identification (RFID) stickers to test applications designed for pedestrian safety and increased mobility.

Leveraging Kansas City’s extensive existing EV charging infrastructure (the largest in the country), the City will begin transitioning fleet vehicles, buses, and logistics yard terminal truck fleets at intermodal parks from gas-powered to electric vehicles. New electric charging infrastructure will be installed at locations throughout the city as well as at the intermodal park to complement the transitioned EVs. Furthermore, smart grid technologies such as vehicle-to-grid power transfer and automatic billing to vehicle owners will be incorporated in charging stations.

**Pillar 3- Connected and Empowered Communities: Connecting Citizens Spatially and Virtually.** The third pillar focuses on connecting neighborhoods and groups of citizens both spatially and virtually. It will build upon existing city efforts, create a conducive innovation environment, as well as create infrastructure and digital connectivity that will holistically link the city together. The Smart + Connected City initiative is a current city effort





that builds on the new 2.2 mile streetcar starter line. Select smart streetlights with video sensors are placed along the streetcar line to detect blockages and potential accidents. Twenty-five interactive kiosks are being installed along the streetcar line and provide public Wi-Fi, information about nearby activities, city services, and travel information.

We will build upon this momentum to add additional connectivity for citizens both in terms of physical access to economically vibrant areas and opportunities, and in terms of access to helpful digital technology and services. KCMO will expand public Wi-Fi through testing of the FCC's 3.5 Ghz Innovation Band in the FCC Dynamic Spectrum Sharing initiative. Additional digital information kiosks will be placed throughout KCMO. Smart lighting will be installed in several parts of the city, which will better connect the east and west sides of the city and increase safety along those corridors. The additional sensors and increased Wi-Fi will provide more refined data to the City's open data platform which will enhance application development.

The existing Smart + Connected City initiative is being driven by a partnership with Cisco, Sprint, and others to enhance internet availability, energy savings, new revenue streams, and improve connectivity with citizens, including efforts to bridge the "digital divide." The initiative will attract technology startups from across the globe to test their concepts as KCMO becomes an open data "Living Lab." The changes are happening first along the 2.2-mile downtown streetcar line and will change the way the city works – from more efficient management of infrastructure like traffic signals, streetlights, and storm water systems to new ways to engage with residents and visitors.

## 1.2 Introduction

Not since the advent of the Internet has a technology revolution garnered as much attention as the Smart City movement currently underway. The combination of need, technological readiness, economic and workforce drivers, and collaborations between public and private agencies across multiple industries is leading us to a precipice of massive urban change. The USDOT is leading the charge in soliciting city proposals for the Smart City Challenge, for which Kansas City, Missouri (KCMO) is ideally positioned. We present herein a comprehensive, multi-faceted proposal and vision that will catapult our city into a leading position among cities, private industry, non-profits, and government agencies as a leader for deployment of significantly beneficial systems and solutions.

Smart city concepts that are in their infancy of development and deployment combine connectivity, large scale data management and analyses, communications, and new approaches to solving old problems such as congestion, safety, and economic vitality to bring new solutions to communities. Kansas City has already embraced this vision in our current deployments, such as the Smart + Connected City and the KC Street Car, and will build on our current work to apply the USDOT Challenge Grant monies to tip us into the next stage of this evolution. Our vision provides **increased safety benefits for transportation users, improved access to resources, communications, and transportation to all members of the community, regardless of where they live, and reduces environmental impacts of a large and multimodal transportation system.**

### As the USDOT Smart City, Kansas City will:

- Radically improve the economic opportunities for large segments of the population by providing them with convenient and affordable transportation options, bridging the digital divide, and attracting new investment and resources
- Provide a leading-edge center for development and testing of automated and other next-generation technologies that will shift the citizen experience on multiple dimensions
- Engage a variety of stakeholder groups by engaging them early and often and including multiple organizations and private entities in the planning and deployment of our technologies
- Reduce carbon emissions and address climate change through electrification and smart grid systems
- Provide incentives for private companies to partner with the City and non-profits to improve infrastructure, facilitate more freight movement, and improve education and training opportunities
- Serve as a central hub for other cities to develop, learn, and collaborate on new technology deployments

Several factors have converged to uniquely position Kansas City to lead America into the smart city movement. Kansas City is currently the only American city to serve as an Institute of Electrical and Electronic Engineers



(IEEE) Core Smart City<sup>1</sup>, one of only five Core Smart Cities in the world. Kansas City has already begun to deploy smart city technology, currently implementing the Smart + Connected City initiative that is enabling great digital advancement through pervasive free wireless and other technologies. Kansas City was also the first city (and region) to receive Google Fiber, which has laid over 8,000 miles of fiber-to-the-home throughout the region, enabling high-speed internet service of up to 1,000 megabits per second. Kansas City is already one of the best places to own an electric vehicle as a result of the charging infrastructure provided by the KCPL Clean Charge Network (over 1,100 electric vehicle charging stations, which is more than any other U.S. city). These existing initiatives, and others such as the new Prospect Ave Metro Area Express (MAX) bus rapid transit line providing increased mobility to underserved communities, will be leveraged to amplify the development impact of Smart City Challenge funding.

The City serves as the major regional economic engine, supporting both the states of Kansas and Missouri. The Kansas City area represents 38% of the gross domestic product of the state of Missouri's eight metropolitan areas, and the city's metropolitan area generates Kansas' largest GDP. KCMO is also unique as a major freight hub for rail, trucking, air, and inland water traffic served by four intermodal logistics parks. The grant will help to improve information sharing and technology deployment to reduce bottlenecks, which will improve freight throughput and lessen impact on the environment.

KCMO serves as an incubator for new smart technologies and solutions that can be exported to other cities and communities. Kansas City recognizes the responsibility of becoming a leader in the smart city movement. Our smart city concepts will be developed and implemented to become the foundation of a replicable platform for future smart cities in America. Kansas City has many unique qualities, including its multi-state location, large freight movement, affordable cost of living, and others that position the city as leader in the smart city movement. The City was one of the first to develop, publically debate, and pass a series of data privacy policies in its City Council. Nonetheless, the city still faces issues that are common amongst many other cities in America, such as the need to bridge the digital divide among underserved populations, and an increasing urban concentration. The commonalties that relate KCMO with other American cities, combined with unique factors and comprehensive smart city concept, will show other cities that smart city deployment is possible anywhere across the country.

Kansas City's vision and plan for catapulting into the next generation of smart technologies include focus and elements that address all major USDOT goal areas (**safety, mobility, ladders of opportunity, and climate change**) as described below. The table below describes the goal areas and our vision.

*Table 1-1: Kansas City Smart City Focus Areas Aligned to Goal Areas*

USDOT Goal Area	Kansas City Smart City Challenge Grant Focus
Safety	<ul style="list-style-type: none"><li>• Vehicle-to-Everything (V2X) communications through Dedicated Short Range Communications (DSRC), cellular, and other mediums for fleet and private vehicles using On-Board Units (OBU) and key intersections using Roadside Units (RSU)</li><li>• Volunteers using Personal Information Devices (PIDs) and/or Radio Frequency Identification (RFID) tags will test applications designed for pedestrian safety</li><li>• Increased mobility for the visually impaired through CV applications and sensor technologies that assist with identification of the appropriate bus and route information, transit stop navigation and audible signage, and safe pedestrian crossings</li><li>• ShotSpotter gunshot detection using sensors to enable an intelligent analysis through the triangulation of sounds to deliver accurate and real-time location of gun crime</li><li>• Smart lighting and sensor technology placed throughout city, and additional security cameras at bus rapid transit Metro Area Express (MAX) bus stations connected to the Kansas City Police Department (KCPD) Genetec video management system</li><li>• Increased public safety capacity will spur additional activity on the part of</li></ul>

<sup>1</sup> The IEEE Core Smart Cities consist of Casablanca; Morocco; Guadalajara, Mexico; Kansas City, Missouri, USA; Trento Italy; and Wuxi, China. IEEE selected these cities based on their ability to build on existing plans to develop a smart city, funding to carry out those plans, willingness to share their knowledge and experience, and formation of multidisciplinary working groups.





USDOT Goal Area	Kansas City Smart City Challenge Grant Focus
Mobility	<p>neighborhood associations to improve citizen-first security for homes, schools, and businesses</p> <ul style="list-style-type: none"> <li>• Connect with and improve our current transit options, with more bike, bike sharing, and a way-finding app to create a one-stop shop for all the City's transit options</li> <li>• Automated electric shuttles along corridors offering on demand transportation</li> <li>• Enabling sensors and infrastructure will support an optimal urban testing ground for automated vehicles, which will eventually expand to facilitate full automation throughout the city</li> <li>• Micro-bus, on-demand services will be expanded and electrified to enhance both the responsiveness of transportation capabilities and environmental sustainability of transportation systems</li> <li>• Transit applications using real-time city data enhance the transportation experience</li> <li>• Micro-carpooling applications help fill "last mile, first mile" by connecting rides with citizens</li> <li>• Wayfinding applications seamlessly bring together all transportation options so that citizens can find the quickest mode of travel while considering factors like cost, environment, etc.</li> <li>• Mobility hubs integrated into stations along the Prospect MAX line and provide the following additional modes of transport: bike share programs, taxi/transportation on demand unloading zones, car share, paratransit, bus route transfer opportunities and electric vehicle charging facilities</li> <li>• Road diets and additional bike sharing programs added to promote safe bike travel and connect areas of the city</li> <li>• Greater access to reliable, scheduled transportation options will transform existing bus stops into launch pads for citizen opportunities from education to employment to social interaction</li> </ul>
Climate Change	<ul style="list-style-type: none"> <li>• 12 new electric buses added to the KCATA Fleet to support the addition of the Prospect MAX bus rapid transit line</li> <li>• KCMO will partner with real estate developers to encourage the adoption of intelligent and shared transportation systems, requiring fewer parking spaces for those without a car</li> <li>• At the airport, electric vehicles favored with close parking proximity and free charging stations</li> <li>• New electric charging infrastructure installed at the KCATA motorpool and along the Prospect MAX corridor. Additional charging infrastructure to be installed at the locations of new fleet vehicles and the intermodal logistics facilities at Edgerton, KS</li> <li>• Smart Grid enhancements – Vehicle-to-Grid energy transmission and automatic billing to a customer's account when charging at public charging stations</li> <li>• Cleaner, greener neighborhoods will draw citizens into parks and open spaces where they can enjoy healthy outdoor activity and increase interactions across social boundaries</li> </ul>
Ladders of Opportunity	<ul style="list-style-type: none"> <li>• Connect communities, bridge the digital divide, and spark more economic development in multiple areas</li> <li>• Focus on the Prospect Corridor will connect people with other parts of the city where there may be more job opportunities, bring technology to KC's east side, and improve the position of the community with investments and improvements in transit and economic development</li> <li>• Bring the technology implemented along the KC Streetcar Corridor to the Prospect Corridor. Expansion of Wi-Fi, especially in underserved areas will increase citizens' connectivity, which will create more access to important information, education, and job opportunities</li> <li>• Increase of digital access will be supported through education and training programs that will accompany the digital expansion and improvement of the transportation systems</li> <li>• 100 kiosks added throughout the city and use city data to provide real-time information on transit and traffic, jobs, educational offerings, city events, and more</li> </ul>







## Future, Longer Term Efforts

While we have dedicated much of the proposal to describing our planned vision of the Smart City Challenge Grant, all of our efforts will lead to both near- and long-term impacts, leading to additional future investments and technology deployments throughout the city. KCMO plans to continue development of a smart city through future efforts that will build on and complement the solutions we deploy with the initial Smart City Challenge grant. Longer-term efforts will continue the momentum begun with the grant to carry on improving the lives of citizens and enable further economic development, transportation options, innovation, and education. Some of our envisioned future efforts, slated for deployment over the next 5 to 10 years, are described below.

### Innovation Center

KCMO will develop an innovation center along the 18<sup>th</sup> Street Corridor that will spur an innovation corridor along 18<sup>th</sup> St. to further connect the eastern side of the city and continue revitalization of the 18<sup>th</sup> and Vine Jazz District. The innovation center will serve many functions, including to:

- Help close the digital divide
- Promote entrepreneurial ideas
- Advance transportation and other smart city technology testing across the entire city
- Serve as an area for universities, established companies, and entrepreneurs to collaborate on initiatives to advance digital communities technologies, mobility solutions, autonomous vehicles, and other innovations
- Serve as a digital lab for development and testing of new urban analytics solutions and rapid prototyping of new sensor-based solutions. KCMO is partnering with Argonne National Laboratory on their Waggle Sensor Platform and Array of Things sensors that are currently being deployed in Chicago, and will use the Innovation Center to facilitate and explore this work.

### Additional AV Deployment

After focusing on testing and deployment in the 11<sup>th</sup>/12<sup>th</sup> St corridor and the 18<sup>th</sup> St corridor, KCMO will explore additional opportunities to test and deploy AVs that cover first mile and last mile (e.g., from bus stop to residence or workplace) to move people more efficiently to and from mobility hubs and large intermodal freight facilities. When truck-following distance regulation updates are finalized, the region can also become a test bed for truck platooning since KCMO is located at the crossroads of four of the nation's major interstate highways (I-35, I-70, I-29 and I-49).

### Additional V2X Communications Equipment Deployment

KCMO will build upon successful CV communications equipment and application deployment by deploying additional equipment through the downtown and heavily trafficked corridors to facilitate AV shuttles and V2X applications.

## 1.3 Detailed Technical Approach

### 1.3.1 Holistic, Integrated Smart City Approach

KCMO will meet the Smart City Challenge through three interrelated work streams, which we refer to as “pillars.”

- **Pillar 1** – Prospect Corridor: Developing Ladders of Opportunity for Eastern Kansas City
- **Pillar 2** – Automated Vehicles, Connected Vehicles, and Electric Vehicles: Advancing Safety, Mobility, Accessibility, and Clean Transportation
- **Pillar 3** – Connected and Empowered Communities: Connecting Citizens Spatially and Virtually

Figure 1-1 illustrates our three pillars and provides a mapping of the 12 USDOT Vision Elements to the pillars. Our pillars are built on a foundation of cross-cutting elements – public policy, data management, and security. In turn, our pillars support USDOT's goals relating to safety, mobility, ladders of opportunity, and climate change.

Our three pillar approach will result in improved quality of life in east side neighborhoods, decreased congestion in key transportation corridors, increased safety across the transportation system, increased mobility for all sectors of the city's population, reduced negative environmental impacts, integrated city-wide infrastructure and systems, and will support the evaluation of the region's development and economic vitality into its next phase. While each pillar in our concept is described individually in the following sections of our proposal, the outcomes of all three will be

integrated to provide region-wide improvement of transportation systems in a Smart City environment. These efforts will complement those already underway in the Kansas City Smart + Connected City initiative.

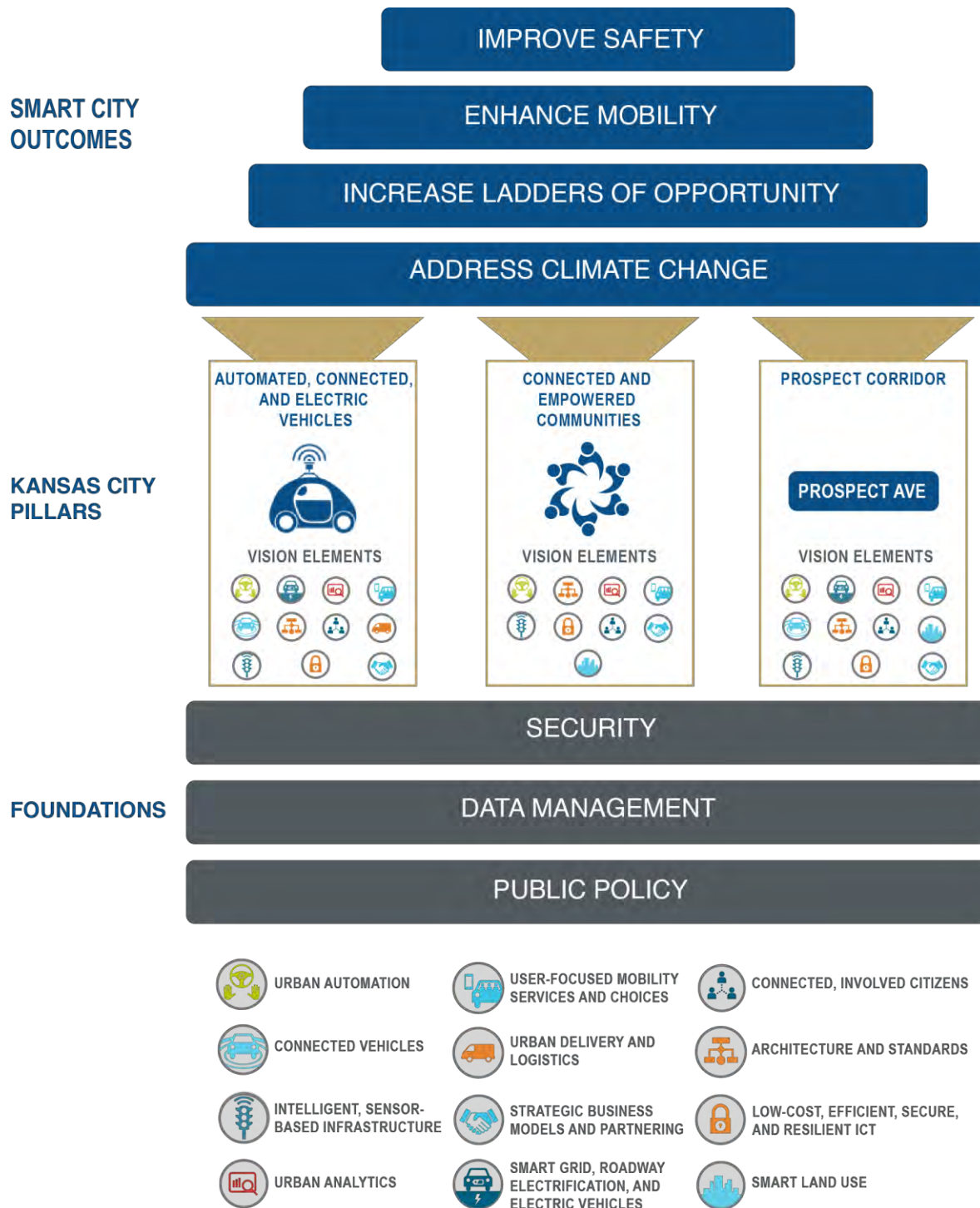


Figure 1-1: Kansas City Smart City Challenge Approach

Sections 1.3.1.1 – 1.3.1.3 include descriptions and technology solutions for each pillar, followed by descriptions of the vision elements and how they are integrated and represented in the three pillars.



### 1.3.1.1 Pillar 1 – Prospect Corridor: Developing Ladders of Opportunity for the East Side of Kansas City

Over the past six decades, neighborhoods on the east side of Kansas City have not seen the levels of private investment as have other areas of the city. Despite many different strategies and tactics from local government, high crime and deteriorating physical conditions, coupled with vacant residential and commercial space, as well as depreciated property values have taken a heavy toll in these neighborhoods. Nonetheless, this area boasts many assets including historic homes, strong community ties, and proximity to jobs in the Central Business Corridor, positioning many jobs and opportunities within a few miles of the east side. The Prospect Corridor has several block groups where a majority of households does not own a vehicle and whose residents are dependent on public transit.

The 3-mile section of the Prospect Corridor from 50<sup>th</sup> Street to 75<sup>th</sup> Street parallels Bruce R. Watkins Drive (71 Highway) separated by one block. The right-of-way of 71 Highway is roughly 400 feet wide creating a physical barrier for residents of neighborhoods east of the Prospect Corridor wishing to access transit service and businesses along the route. The width of the intersection and speed of traffic make this a dangerous pedestrian crossing. Prospect Corridor is a critical commercial arterial and is an important destination for east side goods and services. Three KCATA bus routes operate east of 71 Highway, but service areas are limited and the hourly service on two of the routes encourages residents to walk rather than wait for a bus for the relatively short trip. The result is that pedestrians must cross 71 Highway, too often at locations not intended for pedestrians--a dangerous act and a barrier to opportunities, goods, and services.

**Prospect MAX will serve Alphapointe, which employs and rehabilitates visually impaired adults**

The divide between this underserved area and the rest of Kansas City is both physical and digital. Increasing digital inclusion in Kansas City and increasing access to needed transit resources are principal goals of our Prospect Corridor pillar for the Smart City deployments. A report authored by Blue Hills Community Services (BHCS), a Prospect Corridor economic development organization, finds that, “transportation is the backbone to economic development.” Kansas City will apply a portion of the grant to support BHCS’s efforts to improve the commercial corridor and make it easier for public transit dependent residents to reach crucial goods, services, and jobs.

#### 1.3.1.1.1 Concept and Description

A central tenet of smart city technologies and strategies is finding ways of using new technologies and increased connectivity to improve the economic standing of all citizens, especially those from economically distressed communities. A significant portion of the grant will be invested in the Prospect Corridor, focusing on improving conditions for both individuals and households, as well as for businesses and commercial enterprises.

- Expanded transit options will provide greater access to jobs and economically vibrant areas of the city
- Electric and connected buses will reduce carbon emissions and provide additional connectivity



Figure 1-2: Prospect MAX Route Map



- Applications, including smart lighting and gunshot detection technology will improve community safety
- Mobility improvements for the visually impaired, a vast community within KCMO, will improve access to the rest of the city and more opportunities for this community
- Businesses potentially investing and locating in this corridor, given the improvements in safety, lighting, infrastructure, and accessibility, will be more attracted to the corridor

Kansas City and local organizations are already working hard to serve the economic and social development needs of low-income, urban core residents. For instance, the Bluford Public library, located on Prospect Avenue, has developed the ONENORTH Technology Center, which boasts 36 desktop computers as well as 11 tablets. The center offers free educational classes in computer basics, career development and finance (high school equivalency, personal finance, etc.), and literacy and language, which will be used for additional training and education on new technologies and services deployed with the Smart City Grant. Furthermore, the City has included Prospect Corridor in the Urban Neighborhood Initiative (UNI)<sup>2</sup>. UNI works with neighborhood organizations as well as residents around the Prospect Corridor focusing on bringing better health, improved education, more jobs, and increased investment to the corridor. The combination of this foundation and commitment of the city and the east side neighborhoods, with the investment in advanced technology will have a transformative impact on both the east side and the rest of the city as we destroy the digital divide, advance commercial investment, and provide safe and accessible transportation to the greater community.

**The KCATA Prospect MAX** bus rapid transit line, slated to begin operations in early 2019, will cover the distance between downtown KCMO and 75th Street and the Prospect Corridor with stations located every four to six blocks at approximately 26 intersections along the corridor. The route shown in Figure 1-2 also connects the 18<sup>th</sup> and Vine Jazz District and the south by the Marlborough Neighborhood and **AlphaPointe**, a comprehensive rehabilitation and education agency for people with vision loss. AlphaPointe provides outreach, services, employment, and education and is the third largest single employer of visually impaired individuals in the United States.

KCATA's MAX lines currently have a fleet-wide GPS-based transit management system (automatic vehicle location/computer aided dispatch (AVL/CAD) system) including electronic real time bus arrival signs at stations, onboard stop announcements, web-based real-time bus arrival information, and Transit Signal Priority (TSP). Funding from the FTA Prospect MAX BRT Small Starts Grant is being used to develop technologies for the Prospect MAX line to enhance passenger information, traveler mobility, personal safety and security, as well as encourage economic development and transform Prospect Avenue into a smart corridor. The Small Starts Grant will also help fund the implementation Ticket Vending Machines (TVMs) that will be placed at major transit stations to allow passengers to buy fare media prior to boarding the vehicle, which will help reduce congestion when boarding a bus as well as increase accessibility. We will leverage these current investments with the addition of new technologies, including:

- Interactive Smart Kiosks at select stations that provide greater flexibility in displaying transit and wayfinding information. The kiosks will have a large LCD touch screen to display information such as real time information, connecting services, general transit service and fare information, station-area wayfinding, and information on nearby destinations and attractions. Kiosks will also be equipped with a direct 911-call button, microphone, and speaker to communicate with law enforcement personnel.
- Furthermore, the Smart City Challenge Grant will fund additional Wi-Fi that will be deployed on the entire 260 KCATA bus fleet, including MAX vehicles. It will also include Wi-Fi at each of the 50 stations and transit centers with the same SSID as the mobile bus Wi-Fi to allow users to seamlessly transition between both.

**AlphaPointe**, a comprehensive rehabilitation and education agency for people with vision loss, is located on Prospect Ave and is the third largest single employer of visually impaired individuals in the United States. **Voice responsive wayfinding** technology using Wi-Fi, beacon technology, and mobile phones will help visually impaired individuals move freely and safely along the Prospect Corridor. The beacons placed at bus stations, cross walks, intersections, and other key mobility points will send information to the user's mobile phone to help guide their travel. The beacons will also send real-time notifications, like bus arrivals, or impending accidents to the user. All

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<sup>2</sup> The Urban Neighborhood Initiative (UNI) is part of the Big 5 initiatives led by the KC Chamber of Commerce. The objectives are to bring better health, improved education, more jobs, increased investment, and a better quality of life to all in the region.



KCATA vehicles will be equipped with **automatic audio** for all stops and will provide real-time travel information as stations can be requested as an audio message.

Increased **Wi-Fi availability** and connectivity through **interactive kiosks**, combined with additional transportation options will serve the goal to better connect citizens with the rest of the city and the world, thus reducing the isolation of this area. These efforts will concurrently increase safety along the corridor and draw businesses back to corridor. **Digital access and supporting education and training programs** that will accompany the digital expansion and improvement of the transportation system will improve the skills and overall awareness and education of this community, providing more skilled workers for new businesses and the rest of the city. The Digital Media Lab will be a focal point of Bluford Library that hosts youth entrepreneurial mentoring and hosts the kickoff of ‘Startup Village East’ in the Linwood shopping center at 31<sup>st</sup> Street and the Prospect Corridor. Prospect MAX will provide improved transit access to the Full Employment Council and Connecting For Good<sup>3</sup>, two integral organizations to the community focused on employment support and bridging the digital divide. Furthermore, a mobile learning lab for kids, sponsored by the Kansas City Public Library, will help to bridge the digital divide in east-side neighborhoods.

**Mobility hubs** will be placed at two bus stations along Prospect Corridor and will offer modes of transportation, like bike and car share access. Citizens will be able to easily transfer transportation modes and continue the “last mile, first mile” of their trips. Furthermore, an **integrated payment system** will give the ability to transfer between different modes of transportation with ease. Real-time transit and traffic data will be collected from **sensors** along the corridor and will be combined with other types of city data to develop comprehensive **real-time traffic and transit information**. This information will be available at **smart kiosks and smart applications**, allowing citizens to make well-informed travel decisions when traveling along the Prospect Corridor.

These smart city efforts will allow KCMO to achieve a safer, more mobile, and better connected Prospect Corridor. Furthermore, the Prospect Corridor concept will become scalable beyond the first three years of deployment. KCMO will evaluate the success of these efforts in the Prospect Corridor and work to export successful strategies and technologies to other underserved areas of the city such as the Troost Corridor and southern area of the city.

#### *1.3.1.1.2 Technology Solutions*

##### *Kiosks*

Additional interactive kiosks will be added to ensure that at least one kiosk is installed at every station. The design of the kiosks will follow the similar concept of the currently implemented systems in the existing Smart City initiative on Main St. and will be connected through Wi-Fi and fiber optics.

The kiosks will use customized data from the city, Visit KC, and the city’s kiosk vendor, Smart City Media, to provide information on City and Municipal services, attractions in the vicinity, and KCATA transit services. Additionally information will be sent to kiosks to notify citizens if danger is nearby. In addition to notifying citizens on gunshot detections, weather alerts, amber/silver alerts, or other public safety notices, the kiosks will also act as a security alert system, where citizens will be able to dial 911.

##### *Sensors*

KCATA buses will be equipped with collision detection technology utilizing vehicle to pedestrian (V2P) communication from Mobileye. KCATA is already piloting the technology on two city buses. Sensors will detect pedestrians and cyclists. The in-vehicle warning application alerts the bus operator when pedestrians are within the intended path of the bus. Video sensors will detect pedestrians crossing 71 Highway and trigger electronic warning signs to alert motorists.

##### *Smart Lighting*

KCMO will expand the current deployment of smart lighting and video sensor technology in the downtown area to this corridor as well as additional security cameras at MAX bus stations that will be connected to the KCPD Genetec

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<sup>3</sup> Connecting for Good is a nonprofit organization focused on digital inclusion that has been bridging the digital divide since 2011 using wireless Internet, community computer centers, low cost refurbished PCs and free digital life skills classes.



video management system. Motion sensors will control lighting intensity based on the time of day and the surrounding activity. The sensors can also provide location analytics for pedestrian counts and frequency notifying law enforcement if large concentrations of pedestrians are congregating in one area. Energy efficient lighting will save the city in operating and maintenance costs and lighting matched to activity will improve the safety in the corridor. Beacon technology will be used on each individual streetlight along the Prospect Corridor. This will enable a multitude of other solutions and insights that will increase safety. For example, smart lighting where a gunshot was detected will increase its brightness to better record the video as well as make it easier for the police to locate. Studies have shown that improved street lighting has been effective in significantly reducing nighttime violent crimes, by as much as 40%, when compared to control areas.

### Wi-Fi

The Smart City initiative will provide for the digital inclusion of free Wi-Fi of up to 16 square miles of east side neighborhoods and approximately 80,000 underserved residents along the entire corridor. Wi-Fi coverage will be approximately a half mile on either side of Prospect Corridor. Benefits to residents and businesses alike will be felt throughout this historically low income and underserved area. Internet availability provides education, access to services, and opportunities for career advancement. Many residents along the Prospect Corridor who do not have access to a home computer, do have access to a smart phone. KCATA's last survey indicated that between 80-95% of riders have smart phones.

KCATA and the City will collaborate with external partners to provide free access to Wi-Fi for residents and transit users in the Prospect Corridor as part of the Prospect MAX and Smart City initiative. KCATA is in the process of deploying mobile Wi-Fi on the entire 260-bus fleet, including MAX vehicles. Prospect MAX also includes adding cellular Wi-Fi to each of the route's 50 stations and transit centers. With the City adding a complete fiber network along the entire Prospect Corridor from downtown to 75th and Prospect, the Prospect MAX Wi-Fi quality and speed will be greatly enhanced. Each of the MAX stations and transit centers and streetlights will host small cell Wi-Fi access points with the same ESSID as the current suite of Smart and Connected Cities infrastructure, the streetcar and mobile bus Wi-Fi to allow transit users to seamlessly transition between all connected mass transportation modes in the city. The free Wi-Fi along the Prospect MAX route will be very beneficial to transit riders in the immediate area of the stations but alone would have limited penetration into the adjacent neighborhoods .

### ShotSpotter

ShotSpotter enables local authorities to respond to gunshots in an urban environment faster and more precisely than standard 911 calls. Of the over 280 weapons-related arrests in the United States initiated by ShotSpotter in the last two years, over 160 were made in Kansas City. The system is based on a wide area acoustic sensor network which is triangulates incidences of gunfire within the coverage area to within 10 meters of the location of gun crime. Statistically only 10-20% of outdoor gunfire is reported to 911 call centers. Areas covered by Shotspotter bring that reporting percent to virtually 100%. ShotSpotter technology is currently used by the KCPD for the following purposes:

- Shotspotter data and intelligence is used in KCPD's Law Enforcement Resource Center (LERC), the Real-Time Crime Center, along with gunfire data supporting intelligence led policing and comprehensive crime analysis.
- Shotspotter activation information and associated mapping information is used to inform responding patrol officers of safe areas of entry into active scenes, and potential avenues of escape of suspects to enhance the likelihood of apprehension.
- Shotspotter data is used to support planning and strategic targeted deployments of personnel
- KCPD has formed collaborative partnerships with ATF and grant funded officers using Shotspotter data and evidence found at scenes to aid in violent crimes investigations.

Since ShotSpotter was deployed in Kansas City in 2014, over 240 arrests have been made based on ShotSpotter deployment of police patrols; 182 of those arrests took place in Kansas City based on current KCPD procedures. Additional sensors and beacons added throughout the Prospect Corridor will enhance the capability of these systems. Furthermore, real-time data from gunshot detection will integrate into the city data platform offering advanced real-time analytics and solutions. For instance, gunshot detection technologies will be connected directly to active patrol cars close to a suspected location, while notifying HQ through use of a modification to existing communications protocols that will be funded by the grant.





## CV Applications

Select MAX buses will be equipped with DSRC On-Board Units (OBU) to help facilitate transit CV applications that will improve safety, mobility, and environmental impacts for the Prospect MAX bus line. Roadside units (RSU) will also be added along the corridor to enable vehicle to infrastructure (V2I) applications. KCMO and KCATA will develop a systems engineering lifecycle to reduce the risk of schedule and cost overruns as well as increase the likelihood that CV implementation will meet users' needs. Each of these applications are extremely relevant to Kansas City, the Prospect Corridor even more so, however the deployment of each application will be prioritized by their level of maturity. Refer to Section 1.3.5 for a full list and description of selected CVRIA CV applications.

Building off applications currently being developed in the CV pilots will give KCMO better guidance, which will help ease the conceptual development and implementation process. Furthermore, this will lay a foundation for CV deployment knowledge, which will give KCMO a stronger understanding when implementing CV applications that are not yet fully developed.

## Integrated Payment System

Kansas City will implement an integrated payment system that will offer easy fare payment, one-stop billing, that can be used for multiple modes of transport. By first leveraging any publicly available Application Programmer Interfaces (API) or developing new, it is our intent to encompass many multi-modal services such as public transit, ridesharing applications, parking payment, electric charging payments, as well as car and bike sharing. The payment system will integrate with existing smart card services to enable reloads or allow for mobile payment and fare collection through a native application. Furthermore, KCMO will be able to add financial aid to specific accounts as well as offer companies, high schools, and universities the ability to integrate employee and student subsidized accounts.

In addition to modernizing the user experience across various modes of transit, an integrated payment system will provide robust data about riders, their transportation choices (per mode or across all modes) which can be used to improve scheduling, route planning, and customer service.

## Mobility Hubs

KCMO and KCATA are developing three mobility hub locations along the Prospect Corridor: 31<sup>st</sup> Street and Prospect Avenue, 75<sup>th</sup> Street and Prospect Avenue, as well between 11<sup>th</sup> Street and 12<sup>th</sup> Street on Holmes Street. The location of each hub will be integrated into a station along the Prospect MAX line and may provide the following additional modes of transport:

- Demand based transportation such as Bridj
- Bikeshare stations
- Carshare parking spots
- Bike storage
- Directional signage and wayfinding incorporated into electronic kiosks
- Electric vehicle charging stations
- Integrated fare payment system
- Paratransit

KCMO will designate reserved parking spaces for several carshare companies. Bikeshare companies, like B-cycle, will also incorporate bike share stations into the mobility hubs. KCMO will work with demand-based transportation, like Bridj, to add virtual stations to the mobility hubs. Bridj already has a strong presence in KCMO since March 2016 and will be expanding services and routes in May 2016. The mobility hubs will provide connectivity and integration between modes of transportation at a single location. This will extend the service area and enhance mobility by providing convenient transfers, and facilitating first and last mile connections.

## Visually Impaired Assistance

Technology services geared toward maximizing accessibility for our disabled community will allow all users to move more freely and safely through the community and along the Prospect Corridor. A visually impaired assistance system will utilize beacons placed throughout the corridor and located on kiosks, stations, and vehicles. Users can access directions and virtual tours through the on-line website, smart kiosks, or smart phone application developed



by the system. This wayfinding application will include interactive voice response (IVR) to assist users. When users are nearby a smart kiosk, the interactive kiosks will identify themselves to pedestrians using the beacon technology. The wayfinding system also includes “Tactile Maps” to facilitate clear and confident user navigation. Tactile maps will be available to the public at major transit centers and major bus stops along the Prospect Corridor and throughout the metro area.

Also with the implementation of Remote Audible Signage (RAS), real-time bus arrival information will be available in audio at select stations when requested by a passenger. Remote actuation will also be available for sight impaired persons using infrared or wireless communications. All KCATA passenger buses are equipped with automatic on-board stop announcements.

### Solar and Green Technologies

Solar energy employed for MAX station lighting and elements that require electrical power will help reduce electrical usage. Solar panels will be located on the rooftops of select shelters to help reduce grid power requirements.

### Mobile Learning Lab

Education is a critical component of building ladders of opportunity. KCATA will partner with Connecting For Good and the Kansas City Public Library system to bring a 'Mobile Learning Lab' to the Prospect Corridor. The program will broaden the reach of technology to children on Kansas City's east side and be modeled after a similar successful program in Blue Springs, Missouri. KCATA will retrofit a retired passenger vehicle to include computers, desks, whiteboards, and other general classroom equipment. The mobile lab will utilize the Wi-Fi along the corridor and will enhance learning opportunities outside the classroom by pairing computers and instructors to children who need them. The lab will be used for a variety of learning opportunities including typing games, test preparation, coding, and other general computer learning. Particularly, this lab can fill a need during the summer months or other times when children are out of school to keep them engaged with learning.

#### 1.3.1.2 Pillar 2 – Automated Vehicles, Connected Vehicles, and Electric Vehicles: Advancing Safety, Mobility, Accessibility, and Clean Transportation

The second pillar of our Smart City concept focuses on deploying automated vehicle (AV), connected vehicle (CV), and electric vehicle (EV) technologies to advance safety, mobility, and clean transportation solutions within KCMO. AV and CV deployments focus on three areas of the city: **the Airport, Downtown, and the Prospect Corridor** to create “connected spines.” EV fleet transitions focus on segments of the **KCATA MAX bus fleet, intermodal facility terminal trucks, and city fleet**. The goals of this pillar of the Smart City Challenge are to **improve road safety, increase efficiency along highway and arterial networks, increase mobility, and reduce vehicle greenhouse gas (GHG) emissions**. This pillar connects to both of the other pillars through deploying CV and EV technologies within the Prospect Corridor and capturing new data from AV, CV, and EV to assist in the deployment of new data analytics and supporting mobility applications to connect citizens spatially and virtually. KCMO will evaluate the success of AV testing zones, CV implementation, and EV fleet transitions to determine where and how to expand deployment to other areas of the city and segments of the city vehicle fleet. The following near term goal will be to deploy V2X infrastructure over the remaining roughly 110 sq blocks of downtown bounded by Broadway on the west to Grand on the east and Union Station on the South to River Market on the North.

Deployment of CV, AV, EV will address several needs across the city, including but not limited to:

- Improve safety along key problem areas such as the Prospect Corridor, which will improve the lives of all citizens and provide stability for the residents of the east side of the city, thereby improving not only their safety but also their ability to pursue education and training opportunities for increased economic growth
- Increase mobility by providing more transportation options and accessibility for all KCMO citizens, and especially addressing the need for increased access to jobs and other areas of the city for those currently isolated by physical and digital limitations
- Address climate change and reduce carbon emissions by providing incentives and technologies that make electric car ownership more affordable and convenient



#### 1.3.1.2.1 Concept and Description

KCMO will deploy AVs in three key areas within the city in a phased approach (refer to Section 1.6 for a more detailed description of the approach). The focused corridors, in priority order, include

- Fully automated shuttles along:
  - 18<sup>th</sup> Street Corridor (from Broadway Blvd to Prospect Ave),
  - 11<sup>th</sup>/12<sup>th</sup> Street (from the East Village Transit Center to the West Bottoms), and
- Partially automated transit along:
  - I-29 North/South Bound from the Airport to Downtown.

We will connect 18<sup>th</sup> Street east to the Prospect Corridor by deploying an **autonomous shuttle** from Broadway Boulevard to Prospect Avenue with stops at Vine and Troost. The 18<sup>th</sup> and Vine Jazz District is a historic district that preserves Kansas City's jazz heritage. The district is located just east of downtown and has become an important focal point for African American culture in the community.

Connected by the **11<sup>th</sup>/12<sup>th</sup> Street shuttle**, the west side is a historically Hispanic community just west of downtown and the Crossroads District that includes restaurants and commercial areas with a Hispanic theme. This **shuttle will connect the current streetcar and smart city initiative** with city investments within the 18<sup>th</sup> and Vine Jazz District and the West Side community. The shuttles will also connect the Smart City deployments on the east side of the city with the Major League Baseball youth academy.

The 11<sup>th</sup>/12<sup>th</sup> St shuttle will connect the KCATA proposed **East Village Transit Center** at 12<sup>th</sup> and Charlotte to the West Bottoms, an up and coming commercial and residential district just west of downtown below the bluffs. This shuttle will better connect residents occupying the 1,000 new apartment units with the rest of the city and citizens attending events such as First Fridays (art and antique events) in the West Bottoms, which would limit the need for new parking lots and structures. The implementation of enabling **sensors and infrastructure** will also support an optimal urban testing ground, which will eventually expand to facilitate full automation throughout the city.

The City, the Missouri Department of Transportation (MoDOT), and KCATA will develop a connected and **semi-autonomous vehicle corridor from KCI Airport to the Downtown area**. This 20-mile corridor will serve as a test corridor for highway speed connected and semi-autonomous vehicles. The route will serve the passenger terminals at KCI and connect to key points in the downtown area, such as the River Market Streetcar station, the convention center, and Crown Center. The primary market will be air travelers, but the service will also be available for employees of the airport area. This deployment will enhance the suitability of the KCI airport to a growing metropolitan center and will allow for testing of new AV technologies to serve as lessons for further deployment in the future.

KCMO will leverage the work on the current CV pilots in NYC, Tampa, and Wyoming in developing **CV deployment strategies**. The City will deploy a total of **700 OBUs**: 200 fleet vehicles and an additional 500 units in a lottery for public use. KCMO CV efforts will focus on outfitting **fleet and private vehicles** with DSRC OBUs to facilitate **V2X communications** with RSUs at intersections along Prospect Ave, 11th St, 12th St, 18th St, 71 Highway at-grade intersections, Alhambra facilities, and at I-35 arterial connectors between the Logistics Park KC intermodal facility in Edgerton, KS and KCMO. Fleet vehicles include buses and paratransit vehicles, KC Police Department vehicles, and intermodal facility day cabs.

The City will also solicit pedestrian volunteers to pilot **pedestrian based safety and mobility applications**, focusing on accessibility for the disabled and visually impaired community within KCMO and specifically along the Prospect Corridor. The scale of V2X communications area coverage, functionality, and applications will gradually grow as applications are deemed successful. V2V applications will be less of a priority at the start of the project as these applications typically need a larger population of equipped vehicles to provide a safety benefit. However, after the National Highway Traffic Safety Administration (NHTSA) issues the expected Federal Motor Vehicle Safety Standard mandating all light vehicles be equipped with DSRC radios to facilitate V2X communication, the number of light CVs within the KCMO area will inevitably grow. At the airport, we will upgrade to **smart and connected parking solutions** where people can reserve parking spots before traveling to the airport.





With Kansas City Power & Light's (KCPL) extensive existing **EV charging infrastructure**, KCMO will work with KCATA and the Logistics Park KC intermodal facility to begin transitioning bus and yard terminal truck fleets. The City will also work to begin transitioning its own city fleet of light vehicles and continue to transition these vehicles as they reach the end of their serviceable life. The city will partner with KCPL to expand **smart grid technologies** such as vehicle to grid power transfer and automatic billing to vehicle owners when using public charging stations.

To improve **freight operations**, KCMO is partnering with KDOT and Logistics Park KC enhance mobility and safety along the I-35 corridor from KCMO to the Logistics Park KC intermodal facilities in Edgerton, KS. I-35 connects directly with the Logistics Park KC and provides connections to other regional freight networks and facilities in the Kansas City metropolitan area in Kansas and Missouri. I-35 in Kansas City is the busiest corridor in both Missouri and Kansas, and the Kansas City metropolitan area. Efforts will focus on **improving the flow of day trucks** between the two nodes by deploying CV technology to implement Freight Signal Priority applications. The challenge will also help to implement additional **ramp metering, upgrade weigh station efficiency, and enhance KC Scout<sup>4</sup>** by pushing traffic, weather, and construction advance warning information to trucks leaving Logistics Park KC with the ultimate goal of providing that information within the truck itself.

In addition, KCMO will partner with MoDOT and their "**Road to Tomorrow**" initiative along the I-70 highway as well as KDOT to connect Logistics Park KC. The "Road to Tomorrow" effort allows innovators to propose unique technologies to enable CV, AV, and EV vehicles and help generate revenue to maintain right-of-ways. Kansas City also plans to expand the planned one-mile "Road to Tomorrow" pilot into connective tissue that links thousands of commuters throughout the region and validates a realistic scenario that can be replicated by other cities.

#### *1.3.1.2.2 Technology Solutions*

Automated Vehicles (further information in Sections 1.4.1 and 1.6):

KCMO will focus AV deployment around downtown electric AV shuttle systems along 11<sup>th</sup>, 12<sup>th</sup>, and 18<sup>th</sup> St. These fully automated (NHTSA Level 4) shuttles will be capable of driving up to 35 mph while operating in mixed driving environments (i.e., with pedestrians and other vehicles), and will not require an on-board operator. In the longer term, the City will work with MoDOT and KCATA to facilitate the deployment of a larger electric bus route between the airport and downtown with varying levels of automation based on the environment (e.g., downtown, interstate highway, airport terminal). These buses will be gradually transitioned to full autonomy as the concepts are proven and deemed safe to operate at highway speed. Other OEMs will be invited to test their AVs on the highways. After extensive testing of autonomous shuttles and buses, KCMO will extend the autonomous shuttle deployment to handle "first mile, last mile" transition from mobility hubs, crossing 71 Highway, and other areas in need of such services. AV deployment will be supported by enabling technology and data sources such as weather sensors embedded in the road and/or in RSUs deployed at select intersections along the 18th St and 11/12th St corridors, as well as high definition mapping. Weather sensors will assist AV shuttles in identifying when the vehicle is approaching operational boundaries. KCMO already has access to high quality video and sensor data from Stantec for every city street. The City will purchase remaining necessary databases from Stantec to help enable AVs within the 18th St, 12th St, and airport corridors. Gaps in data will be filled through conducting further high quality mapping activities through firms such as HERE. AV corridors will also become priority areas for high quality lane markings and road signs to ensure AV sensors, video, etc., have the necessary data to operate.

**Wi-Fi** – Wi-Fi deployed along the 18<sup>th</sup> St and 11/12<sup>th</sup> St corridors as well as the Prospect MAX Corridor will assist in AV (and CV) communications and data use/capture. This will include signal phase and timing data, real-time map updates, condition updates (e.g., weather, traffic, etc.), and route selection to enable priority signal functionality.

**Supporting AV Shuttle-hailing Application** – Hailing ability will be accessed via API so that multiple app developers can integrate into their applications and kiosks along the applicable roadside corridors.

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<sup>4</sup> KC Scout is a bi-state transportation management system that uses cameras, sensors, and traveler information tools (i.e., electronic message boards, highway advisory radios, website, and phone applications).



### Connected Vehicles:

KCMO will build from the existing plans completed for the NYC, Tampa, and Wyoming CV pilots, where appropriate, to make use of current concepts and approaches for security and privacy, safety management, human use, etc. KCMO has analyzed vehicle crash data since 2011 to determine V2X focus areas and appropriate V2X applications. The City will outfit approximately 100 Logistics Park KC day trucks, 75 KCPD vehicles, 25 KCATA buses, and 500 private vehicles with OBUs through a lottery. The City will also request 50,000 volunteers to deploy Personal Information Devices (PIDs) or Radio Frequency Identification (RFID) stickers to test CV applications designed for pedestrian safety and increased mobility for the visually impaired. Additional Wi-Fi deployed along the Prospect Corridor will help support V2X communications as well. Sensors deployed to assist with AV operations will be deployed with the V2X infrastructure and also feed select CV applications along with the integrated KCMO data platform. Mobileye will deploy their connected bus technology in 300 city buses.

**Roadside Sensors** – KCMO will deploy Cisco's Connected Roadways to cover downtown KCMO and the 11<sup>th</sup>/12<sup>th</sup> St and 18<sup>th</sup> St AV testing corridors with high density DSRC and other Intelligent Traffic Control Sensors building on the current Smart City Deployment along the streetcar. We anticipate approximately 500 NXP “Beige Box” RSU sensors at scale deployment including sensors for transit stops, mobility hubs, I-29, I-35, and other collision “hotspots” throughout the city.

**V2X communications equipment** – KCMO will utilize OBUs, RSUs, and PIDs with DSRC capabilities to facilitate V2X communications.

**CV applications** – V2X applications will provide safety, mobility, and environmental benefits across the city and along the freight truck-heavy I-35 corridor. The City selected sites and applications to improve safety within areas with high rates of collisions and pedestrian incidents. RSUs will also help facilitate AVs within specific corridors by providing signal phase and timing information. Details on the selected applications and corridors/sites are found in Section 1.3.5 Vision Element #2: Connected Vehicles. The City will also work with KDOT to add new ramp metering on 11 on-ramps along I-35 from the 95<sup>th</sup> St interchange south to the Logistics Park KC to further improve operations, safety, and emissions.

**Truck weigh station enhancements** – 90 percent of the trucks leaving the intermodal site are headed north on I-35 toward KCMO. As a pilot project, a truck license plate reader and weigh in motion will provide early information and send it to the I-35 weigh station 10 miles downstream of the intermodal site. Low cost investments will include weigh in motion in concrete and a license plate reader to get basic truck identification information.

### Electric Vehicles:

Electric vehicle deployments will focus on fleet transitions within the KCATA MAX fleet and KCPD. KCATA will acquire 12 new electric buses instead of CNG buses to support the addition of the Prospect MAX line. KCATA will rotate these buses through the three MAX lines as necessary based on operations and charging cycles. KCMO will begin transitioning KCPD parking enforcement and non-cruiser fleet vehicles starting with vehicles currently scheduled for replacement over the next three years. Grant funds will augment the current budgets and enable the City to allocate currently forecasted funds to replace internal combustion engine vehicles with electric vehicles. The City will also work with the BNSF and Logistics Park KC to begin transitioning six heavy-duty terminal trucks from diesel to electric, further reducing GHG emissions by focusing on vehicles with high hours and/or mileage usage. Downtown, the focus will be on shared electric mobility. KCMO will partner with real estate developers to encourage the adoption of intelligent and shared transportation systems, thus requiring less parking spaces for residents who do not have to own a car. At the airport, electric vehicles will be favored with close parking proximity and free charging stations.

**Charging infrastructure** – New electric charging infrastructure will be installed at the KCATA motorpool and along the Prospect MAX corridor to facilitate charging along the route. Additional charging infrastructure will also be installed at the locations of new city fleet vehicles and the intermodal logistics facilities at Edgerton, KS.

**Smart Grid enhancements** – KCPL will work to add capabilities such as Vehicle-to-Grid (V2G) energy transmission and automatic billing to a customer’s account when charging at public charging stations.



### 1.3.1.3 Pillar 3 – Connected and Empowered Communities: Connecting Citizens Spatially and Virtually

#### 1.3.1.3.1 Concept and Description

The third pillar of the concept will cater to connecting Kansas City citizens both spatially and virtually. The Connected and Empowered Communities pillar will build upon existing city efforts, create a conducive innovation environment, and create infrastructure and digital connectivity that will holistically link the city together. This concept will increase the connectivity and information sharing by advancing the steps already made for new transportation options and technologies with the 2.2 mile streetcar starter line, which began operations in early May 2016. We will build upon this momentum to add additional connectivity for citizens both in terms of physical access to economically vibrant areas and opportunities, and in terms of access to helpful digital technology and services. While the Prospect Corridor pillar focuses on these aspects specifically for the corridor, this third pillar focuses on connecting other neighborhoods and groups of citizens. Our current efforts to expand public Wi-Fi, put in place digital information kiosks, increase speedy and safe movement throughout the city and across 71 Highway, and deploy related applications will be increased and expanded to include more connectivity and integration to multiple city systems.

The current Smart + Connected City effort includes select smart streetlights with video sensors to **detect blockages** on the street car line and **improve safety**, as well as twenty-five kiosks that provide citizens the **opportunity to learn** about nearby activities, **interact** with the city through messaging formats, or obtain **knowledge about city services** if they have no smart phone. The expansion of these efforts will occur through the deployment of **additional digital information kiosks, Wi-Fi transmitters, and smart lighting**. While many of these efforts focus on the Prospect Corridor to increase safety and ladders of opportunity, KCMO will deploy new **kiosks and smart lighting** along the 11<sup>th</sup>/12<sup>th</sup> St and 18<sup>th</sup> St corridors to facilitate **AV shuttle operations** and **physically connect** smart city initiatives on Main St and Prospect Ave.

KCMO will tailor content on new kiosks to meet the needs and desires of the citizens and frequent visitors within the selected locations. The City and kiosk operators can simply adjust and restructure kiosk content as the information needs of local personnel change and evolve. KCMO will integrate the **findings from the data** received through the sensors and videos, as well as kiosks, with the other information from data across the city's improved transportation systems.

#### 1.3.1.3.2 Technology Solutions

##### Wi-Fi Expansion within the Innovation Band

KCMO already has an established partnership with Google to prove the viability of utilizing the FCC's 3.5 Ghz Innovation Band in the FCC Dynamic Spectrum Sharing initiative. Dynamic Spectrum Sharing is significant as part of the KCMO Smart City Challenge application due to the inclusion of mobile technologies that will inherently demand increased wireless spectrum. Spectrum sharing is seen as key to opening up a number of bands occupied by incumbent government users and others, including the 3.5 GHz band, for commercial broadband services in the United States. The band is seen as ideal for small cells, but FCC staff also has said it is possible that new, as-yet-unforeseen uses for the band will emerge; hence, it is referred to as the "innovation band." The testing of this band will provide new Wi-Fi access to multiple neighborhoods throughout KCMO, including Waldo, Brookside 18<sup>th</sup> and Vine Jazz District, Crossroads, Downtown, Country Club Plaza, Westport, and Barry Road/Zona Rosa.

##### Kiosks

While kiosks are already discussed in the Prospect Corridor pillar, kiosks will also be placed throughout other areas of KCMO to facilitate increased access to information, provide employment information, provide additional Wi-Fi coverage, and enable hailing of AV shuttles. KCMO will also place kiosks in other corridors throughout the City: 11<sup>th</sup> St, 12<sup>th</sup> St, 18<sup>th</sup> St, Troost Ave, the West Bottoms, and KC International Airport. One hundred new kiosks will be installed as part of this proposal, all of which will be the same model currently installed in the Smart and Connected Cities initiative. These kiosks are in lieu of the 100 kiosks provided by Google to continue the uniformity of our current initiative, and will save a significant amount of increased costs.





## Smart Lighting

As with the kiosks, smart lighting will also be installed along the 11<sup>th</sup>, 12<sup>th</sup>, and 18<sup>th</sup> St corridors to assist in physically connecting the existing Smart City initiative on Main St with the new smart corridor along Prospect Ave. This will create another true link between the east and west sides of the city and increase safety along the corridor, while also continuing to attract residents and businesses.

## Enabling Development of Mobility Applications

As Kansas City solidifies its place in the “Big Data” movement, we will continue to make data open and available to the public and entrepreneurs to develop innovative applications that benefit the local government and citizens. The city will develop additional capabilities beyond the Smart City grant based on data collected by sensors. Possibilities range from dynamic tasking of public transportation assets based on population movement, to focused application of public safety resources based on sensor data, to decreasing congestion due to interconnected traffic lights, and increasing availability of non-vehicle traffic. Example application concepts include:

### Crowdsourcing

A crowdsourcing application will allow Kansas City to produce and capture significant amounts of data in a cost effective manner, thus refining and enhancing the integrated city data platform. The application will be accessed through a smartphone, interactive kiosks, or computer. Citizens will be able to report potholes, unpaved roads, accidents, and more. The information will be sent to a TMC where maintenance teams will be able to respond.

### Multimodal Wayfinding

Kansas City currently lacks a central “one-stop shop” point of information for transportation options. We have a foundation; Z-Trip currently integrates all private modes in our City. We will engage in building an application that will seamlessly bring together all of the options Kansas City has to offer so that an end user may find a path from A to B that may be 1) the quickest; 2) the most cost-efficient; or even 3) the most environmentally friendly option. The City will release an RFP to seamlessly integrate real time information from public (Streetcar, KCATA, Bike Share, Bridj) and private (Uber, Lyft, or other competitors in that space) transportation services and infrastructure (Electric Vehicle charging stations). These services will go beyond GPS location, and include real time details about ridership, availability and traffic. Through our efforts with U.S. Ignite, a White House initiative through the National Science Foundation, we have a Digital Town Square (DTS) that provides unique city-wide low-latency gigabit infrastructure for applications that produce large amounts of time sensitive information. The DTS assures that local communication stays local, providing the best possible experience for transportation planners and users.

### Micro-Carpooling

The micro-carpooling application allows users to either list a ride request or a ride offer. Ride offers and ride requests will be categorized depending on the “group” each one selects. This could be a business park, shopping center or other employment center. Under each group are listed the transit lines that serve the area and riders select the stop where they exit the bus. General Transit Feed Specification (GTFS) information provides bus arrival times to facilitate trip planning. Ride requests or ride offers can be added up to a week ahead of time, and then can either wait for an invitation, or actively search the listed ride requests and offers to find one that matches their time frame. Users will be able to see the profile of their potential carpool partner and accept or decline a ride request/offer. Once a match is confirmed, riders and drivers will be able to watch the approach of their partner on screen. Upon entering the car, the two phones complete a “digital handshake” to automatically record the ride. If one of the parties does not have a smartphone, they can enter a digital code to confirm the ride. Additionally, this application will be available at the kiosks and a smart phone substitute.

There is no payment platform or electronic wallet, however Kansas City will consider measures in collaboration with partner firms and community organizations to ensure a reliable supply of drivers, and they should be appropriate to the demographics of the group. Company measures could include a prime parking spot or time off work provided by employers, cash payments or a gas card provided by a transit agency or Transportation Management Association (TMA), or a driver lottery or other prize drawings. A customized dashboard will allow transit agencies, TMAs or other administrators to manage groups, view activity such as number of ride requests/offers, number of invitations and completed rides, and which bus stops are the most popular. The dashboard will also allow for the management of incentives and push notifications, especially for adverse weather conditions, ozone alert days or disruptions in transit service.



The micro-carpooling application will make better use of the existing and abundant vehicle resource to help connect citizens who are in need of “last mile” transportation. 85% of commuters drive alone, with one or more empty seats. According to the Mid-America Regional Council’s (MARC) 2015 Air Quality survey, 46% of respondents said they were willing or very willing to carpool during ozone season, and the Lawrence OnBoard<sup>5</sup> research indicates that one in eighteen drivers is willing to pick up a rider – even a random stranger – for a short local trip, as long as it is convenient for them. The short distance from bus stop to workplace is an easy ask for a driver, but can make an enormous difference in travel time and comfort for the bus rider who otherwise must walk.

### Road Diets and Bike Lanes

KCMO will implement a new road diet network to create new bike lanes and connect various bike lanes and trails throughout the city. The proposed road diet network will re-purpose existing underutilized public infrastructure and will expand transportation choices to over 200,000 residents. This project will also connect the employment centers such as Downtown, the University of Kansas Medical Center, Crown Center, the Plaza, and the University of Missouri-Kansas City to the Prospect Corridor and residential neighborhoods. Another vision of this system is providing transportation choices to higher education. This network improves access to the Kansas City University of Medicine and Biosciences, University of Kansas Medical Center, University of Missouri-Kansas City, Rockhurst University, and Kansas City Art Institute. These proposed improvements have been selected based on citizen feedback through the City’s area plan updates, the Bike KC! Masterplan, and efforts from Two Centric’s crowd source initiative at the website for “Where should the bike lanes go” (<http://whereshouldthebikelanesgo.com/>).

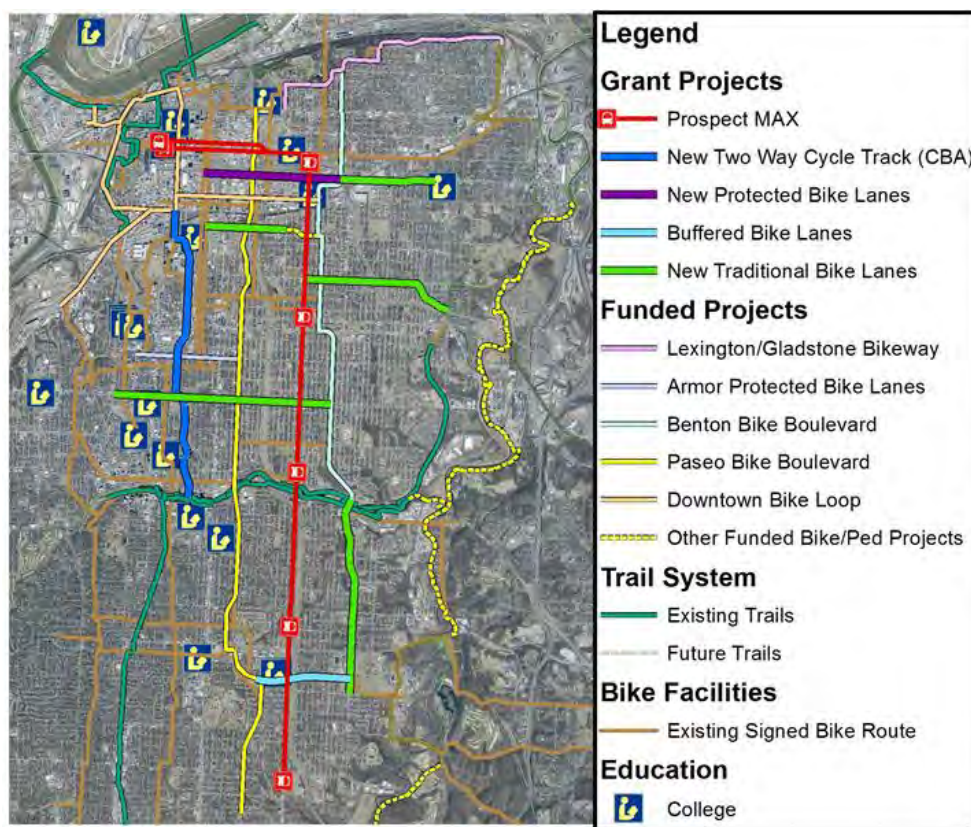


Figure 1-3: Road Diet and Bike Lane Projects

<sup>5</sup> Lawrence OnBoard is an organized hitch hiking ride sharing strategy. People who need a ride sign up, receive a background check, and are given a photo-ID. The ID allows them to catch a ride with a registered driver, who displays a windshield logo.





KCMO is already in the process of re-purposing many streets with road diets, focusing on the Downtown Bike Loop project is a 13 mile system circling the Central Business District with spurs along Grand Avenue, 18th Street, and Southwest Boulevard. Current efforts include:

- Installing protected bike lanes along the east-west Armor Boulevard
- Converting north-south corridors such as Paseo and Benton Boulevard into bicycle boulevards
- Installing a two-way cycle track connecting the City's historic Old Northeast to Downtown

We plan to connect all of these facilities and the Prospect Corridor to enhance transportation choices by completely re-purposing multiple east-west corridors and creating a new system called the Central Bike Artery (CBA). To provide east-west connections to the CBA and Prospect Corridor, the City will implement protected bike lanes on Truman Road from Downtown to Benton Boulevard and transition to traditional bike lanes between Benton and Van Brunt Boulevards. The protected bike lane segment is parallel to I-70 and will transform the corridor from a 1940's trafficway to a livable street and promote redevelopment and re-use of the existing commercial buildings. This will also serve the Major League Baseball Youth Academy being built as part of the Negro Leagues Baseball Museum in the historic 18<sup>th</sup> and Vine Jazz District. KCMO will install traditional bike lanes on 22<sup>nd</sup> Street between Holmes Street and Benton Boulevard, along 27<sup>th</sup> Street from Prospect Avenue to Raytown Road, along Raytown Road to Van Brunt Boulevard, and along 39<sup>th</sup> Street from the Southwest Trafficway to Benton Boulevard.

The CBA will create a north-south two-way cycle track system along Grand and Gillham Avenues and Rockhill Road, connecting the Downtown Bike Loop system to the existing Brush Creek Trail. Traffic volumes in the Gillham corridor during the AM and PM peak hours range between 700-900 vehicles. Road diets tend to become problematic from a traffic flow perspective when peak hour volumes approach 750 vehicles at signalized intersections. In order to successfully implement a two-way cycle track, this project will include traffic signal interconnect so that the signalized intersections can be controlled via the City's Traffic Operation Center. This will allow the signals to be programmed and synchronized with coordinated green time for inbound/outbound peak traffic flow and the cycle track to move continuously through the corridor during the rush hour. Interconnecting and centralizing control of the signals will reduce intersection queuing that would be created by a road diet on this corridor with its usage. It also allows the installation of the two-way cycle track without requiring additional cost and impacts of street widening.

To supplement the CBA, buffered bike lanes will be installed on Meyer Boulevard from the Paseo to Swope Parkway and Swope Parkway will also be re-purposed to include traditional bike lanes. This north-south corridor will provide transportation choices for a substantial number of residents to the Brush Creek Trail and provide an extension of the planned bicycle facilities on Benton Boulevard.

#### Enhance Mobility Crossings over 71 Highway

Envisioned as a limited access depressed/elevated freeway but constructed as a high-speed, high-capacity urban expressway, 71 Highway helped to increase vehicle mobility along a north – south corridor of the city and reduce congestion on surface streets. However, the highway severed and cutoff the eastern side of the city and hindered east-west travel within KCMO. Residents without access to vehicles are required to cross this corridor to access the Prospect corridor. KCMO will work to develop new pedestrian walkways to help improve mobility, safety, and physical connections to pedestrians that must cross 71 Highway. While this may not be fully in-scope of the Smart City Challenge group, the program management team will work closely with an existing partnership of MARC, MoDOT, and KCATA in a planning effort to integrate potential funds from other grants to enhance safety and better link communities currently separated by the highway. Initial concepts are to develop new separated pedestrian facilities, potentially at 51st St and 75th St. In addition, to reduce demand for pedestrians crossing 71 Highway, there will be connecting services at 55th Street, 59th Street, and Gregory Boulevard. Service will be provided by connected shuttles or TNCs.

#### 1.3.1.4 Pillar Connections

Each pillar represents a different focus area or work stream for the KCMO Smart City Challenge vision. However, no pillar is a silo. The three pillars are interconnected to support a holistic, integrated smart city designed to improve transportation services and unlock the potential of KCMO citizens, especially the economically distressed populations on the east side.





The Prospect Corridor incorporates concepts from both the AV, CV, and EV pillar and the Connected and Empowered Citizens pillar. AV shuttles running along the 18th St corridor will help to link the existing Smart City initiative centered on Main St. to Prospect Ave., while also providing additional mobility, technology, and development within the 18th and Vine Jazz District. OBUs on KCATA buses, and RSUs added along the Prospect Corridor will increase safety and mobility through CV applications such as Vehicle Turning Right in Front of Transit Vehicle (VTRFTV) and Pedestrian in Signalized Crosswalk. KCATA will procure new electric buses for the Prospect MAX route. KCMO will add kiosks to all Prospect MAX stations as well as at the three mobility hubs. The kiosks will use city data to provide real-time information on transit and traffic, news, jobs, educational offerings, city events, and more. Wi-Fi coverage will expand along the Prospect Corridor to increase citizens' internet connectivity, which will create more access to services, as well as educational and job opportunities. Road diets added to multiple corridors will connect the east and west by providing safer travel for bicyclists as well as promote bikesharing.

AV, CV, and EV deployments are embedded throughout the entire integrated concept and within the Prospect Corridor and Connected and Empowered Citizens pillars. Data sources integrated within the new data ingestion engine and real-time analytics platform will serve to enable AVs and CV applications. Data generated by AVs, CVs, and EVs will be fed back into the platform to gain efficiencies in traffic management throughout the city, identify necessary future CV applications and implementation sites, and develop personal mobility applications. New RFID V2X technologies will help increase safety for those biking along the new bike lanes created from road diets. Select KCATA buses, including the new buses acquired for Prospect MAX, will be equipped with CV OBUs and Mobileye technology to improve safety, enhance mobility, and reduce environmental impacts of idle buses.

The Connected and Empowered Citizens pillar helps to connect people spatially and virtually throughout the city. This pillar is weaved throughout the Prospect Corridor and AV/CV/EV pillars. Data from sensors along the Prospect Corridor and from new AV, CV, and EV will help to feed open data sets that the City and entrepreneurs can use to develop new mobility applications. New kiosks and smart lighting along 18th St and 11/12th St will help to physically connect smart city initiatives on Main St and Prospect Ave while also supporting AV shuttle operations along the route. This investment should also help spur development and resident population growth within the corridor, further connecting the east to the west. New road diets, bike lanes, and pedestrian crossings will also help connect east to west with new safer, low cost, and zero-emission transportation options.

### 1.3.2 Deployment Phasing and Milestones

To manage such a large-scale effort upon selection as the Smart City Challenge winner, KCMO will develop more detailed plans to deploy and implement the solutions, applications, and technology detailed within each pillar of the holistic, integrated Smart City approach. Our Smart City approach will consist of three primary phases similar to the current USDOT Connected Vehicle Pilot phases: Conceptual Development, Design/Deploy/Test, and Maintain/Operate. There will be a fourth phase not supported by Smart City Challenge funding, Post-Demonstration Operations. These phases are not mutually exclusive and will overlap in some pillars and vision elements based on previously executed or currently in-process development efforts, such as the current planning efforts for the Prospect MAX BRT line and supporting infrastructure. Figure 1-4, below, identifies deployment phases and the deliverables schedule.

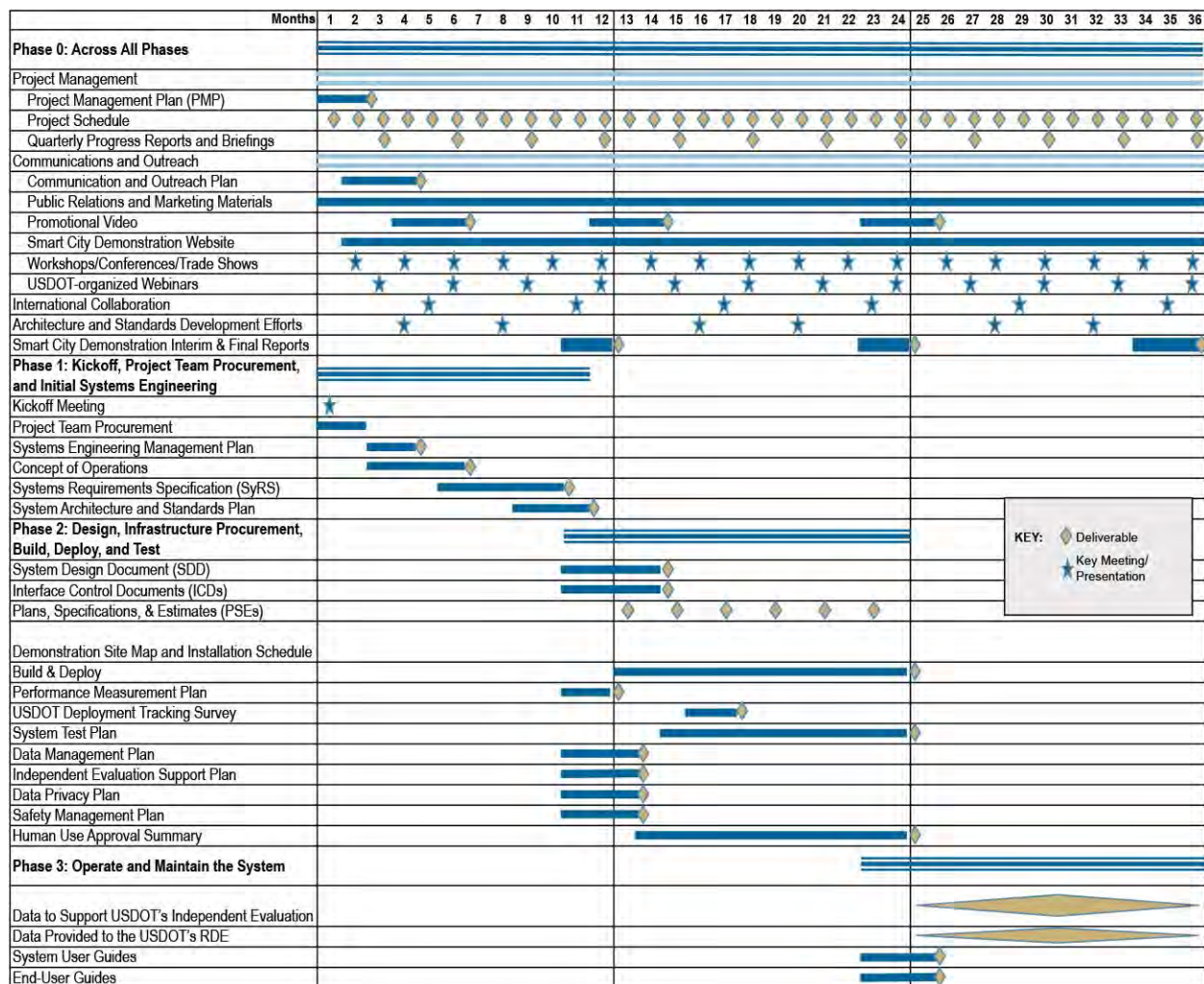



Figure 1-4: High-level Schedule

## All Phases

Certain tasks will be performed throughout the duration of the Smart City project. A key task will include program, project, and task management. With the multi-faceted nature of our concept, there will be many people managing different aspects of the project with a coordinated core. Communication and outreach will be an ongoing task. The Smart City project will generate local, national, and international interest and we are prepared to meet the challenge of representing Kansas City and USDOT. Representation will take on roles such as speaking engagements in-person and on webinars; demonstrations; videos; and public media events and sites. In all phases of the Smart City project, we will keep USDOT and our stakeholders updated on progress both formally and informally. Deliverables cutting across all phases include:

- **Project Management Plan (PMP)** – The PMP will encapsulate the entire project and how we intend to manage the project including scope, scheduling, communications, cost, quality, configuration, and risk. The PMP will follow the processes outlined within the Project Management Body of Knowledge (PMBOK). As in all projects over a significant timeframe, situations change. We will update the PMP as needed in the event there are changes in key elements of the project.
- **Project Schedule** – The project schedule will be created to demonstrate the project activities to provide a Work Breakdown Structure (WBS) including activity names; activity timing; responsible task manager; dependencies between tasks; and associated deliverables, procurements, or milestones. The Project Schedule will be updated monthly.



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- **Quarterly Progress Reports and Briefings** – Progress reports will be created on a quarterly basis that to document deliverables and their status; accomplishments by task; anticipated next quarterly activities; and narratives that cover schedule, technical, and partnership risks and cost (past and future). A quarterly briefing will be held in-person monthly with USDOT, alternating locations between Kansas City and USDOT headquarters in Washington, DC.
  - **Communications and Outreach** – The communications and outreach activities will be extensive, reaching across the world to share our project progress, lessons learned, and successes. This suite of activities has already begun by discussing Kansas City's bid in open forums. Upon selection as the winning city, the campaign will continue to highlight both the vision for the Kansas City proposal and the steps required to implement it. Multiple contacts with community leaders will shape the implementation through a variety of media. Most of the activities/materials associated with communications and outreach are described below:
    - Communication and Outreach Plan – At a minimum, the plan will outline the topics to share; the target audiences; the communication methods; and the timing of events. The plan will also address strategies for local and national media; websites; social media; trade shows; demonstrations and site visits; local outreach; and crisis communications.
    - Public relations and marketing materials – These materials will include items such as: brochures; press releases and conferences; trade journals and news articles; slide decks; talking points; fact sheets; and photos.
    - Promotional Video – A promotional video will be created to stimulate interest in the Smart City Demonstration. As this video will be used by Kansas City and USDOT, we will coordinate the message with USDOT to maximum use at different events and interest locally, nationally, and internationally. As the project progresses, we will update the video two times and each video shall be between six and twelve minutes.
    - Smart City Demonstration Website – The current KCMO Smart City website will be updated and regularly maintained to demonstrate the vision, goals, activities, and progress of the Smart City Challenge. Additionally, the primary goal will be to generate interest and demonstrate how Kansas City is benefiting from the Smart City project with a takeaway of how other cities could benefit as well.
    - Workshops/Conferences/Trade Shows – The City will participate in-person at workshops, conferences, and/or trade shows as decided and coordinated with USDOT. This participation may include making presentations, being on a panel, working in a booth, etc. We anticipate that there will be six trips per year with one potentially being international. The team will set aside funds for the travel budget and plan travel for team members.
    - USDOT-organized Webinars – The City will participate in webinars organized by USDOT to share the status, lessons learned, community involvement, and other information regarding the City's Smart City project. We anticipate four webinars per year.
  - **International Collaboration** – The City would be honored to collaborate and share lessons learned with USDOT's international partners. As directed by USDOT, the City will prepare for, participate in, and document results from one collaboration meeting each year. Current engagements planned for 2017 include the IEEE International Smart Cities Summit, scheduled for Summer 2017 and the Accelerating Smart Communities Conference in Summer 2017 and 2018.
  - **Architecture and Standards Development Efforts** – As new technology and applications develop, standards must either be created or modified to meet these developments. The City will represent the Smart City project at six architecture and standards meetings with two potentially being outside the US. Following each meeting, the City will document the meeting outcomes, potential impacts to the Smart City Demonstration, and inputs or needs identified by the program. Additionally, the City will participate on related conference calls as needed. The City will continue to serve on the IEEE Smart Cities Standards committee and comply with the ISO 37120 as managed by the World Council on City Data.
  - **Smart City Demonstration Interim & Final Reports** – At the end of each project year, the City will create an interim report that documents the progress to date, lessons learned, issues, opportunities, and other relevant information. At the end of the project, the City will create a 508-compliant final report that will be made available to the public. The final report will capture original objectives and goals, accomplishments, benefits, deployment and operational costs, lessons learned, recommendations, improvements, and strategy effectiveness.





## Phase 1: Kickoff, Project Team Procurement, and Initial Systems Engineering

As we begin the project, there are a couple of key activities to be performed almost immediately upon award including kicking off the project with a kickoff meeting with USDOT and procuring the consultants needed to execute the project. Once these activities have been completed, we will dive into identifying the City's needs, creating the Concept of Operations (ConOps), establishing the requirements for each of the systems/infrastructure identified, and then creating the system architecture and standards plan. Because these foundational systems engineering documents are so important to the rest of the project, we will have a walk-through meeting after the creation of each of the documents. All of the Systems Engineering activities will be documented in a System Engineering Management Plan (SEMP). The deliverables for Phase 1 are identified below:

- **Kickoff Meeting** – The kickoff meeting will afford the USDOT and Kansas City the opportunity to share the Smart City Demonstration project with each other. It will be a time to set boundaries, expectations, and opportunities for the project. The City looks forward to participating and presenting at the kickoff meeting.
- **Project Team Procurement** – The City will create multiple Requests for Proposals (RFP) to engage consulting firms and technology providers to assist with project management; systems engineering; plans, specifications, and estimates; and other related tasks.
- **Systems Engineering Management Plan** – The SEMP will document the systems engineering approach for the City's Smart City Demonstration project. Each element of the systems engineering processes and documents will be discussed and how to enforce change management within the process. In the SEMP, we will identify specific documents that will require walk-through meetings. As part of our Plan, we will identify the specific standards that must be used as a guideline.
- **Concept of Operations (ConOps), in compliance with IEEE 1362-1998** – The ConOps will be created to document the many elements of the project; how the City or area will be enhanced; the holistic and integrated approach; and the changes that will occur due to the deployment. The ConOps will not be created in a vacuum; the City will engage our stakeholders so that the needs are captured as a foundation for the Smart City Demonstration. The ConOps will be created at a high enough level that it is understood by technical and non-technical individuals. It will also document the plans to interface with USDOT partners.
- **Systems Requirements Specification (SyRS), in compliance with IEEE 1233-1998** – The SyRS will be created to document the needs identified for the Smart City Demonstration as requirements – what the system will do. The document will capture functional, interface, data, performance, and security requirements at a detailed enough level to identify and associate subsystems. During the requirements development, we will engage the evaluation team to ensure that the data and storage requirements are sufficient for their needs. During the interface requirements, we will identify Interface Control Documents (ICDs) that should be created during the design phase.
- **System Architecture and Standards Plan** – The System Architecture and Standards Plan will be created to document the enterprise, functional, physical, and communications architecture of the Smart City Demonstration plus the standards to be used. The City will utilize existing tools such as the Turbo Architecture Tool for the National Architecture and the SET-IT tool for the Connected Vehicle Reference Implementation Architecture (CVRIA) to assist in the creation of the Plan. As part of the process, the City will provide the information necessary to update the Regional Architecture maintained by MARC.
- **Demonstration Site Map and Installation Schedule** – Although a Demonstration Site Map may be created early in the project, the map and an installation schedule will be created (or updated) during this phase with the specific location of deployment activities. The installation schedule will periodically be updated in the event of delays.
- **Performance Measurement Plan** – The City will define a rigorous set of performance measures with their associated quantitative performance targets that are achievable during the performance period. The City will also look at forward performance measures that may be achieved beyond the period. The Plan will validate that the correct data is being collected to confirm the performance measures are in fact measurable.
- **Data Management Plan** – The City will create a data management plan that will describe how data will be collected, managed, integrated, and disseminated before, during, and after the Smart City Demonstration.
- **Data Privacy Plan** – There are many requirements for sharing of data by the USDOT and by agencies. In this Plan, we will document how we will collect, store, strip, suppress, and disseminate information internally and externally. The plan will consider all aspects of Personally Identifiable Information (PII) and Sensitive





Personally Identifiable Information (SPII). The City will work with USDOT to make sure that all aspects are covered in the Plan.

- **Safety Management Plan** – The City shall create a Safety Management Plan that will document the safety risks based on the demonstration and how these risks should be mitigated based on existing City policies, processes, and procedures.
- **Human Use Approval Summary** – As part of the Smart City Demonstration, the City may use individuals as active participants. The City shall make sure that all human participants have executed the proper approvals from and accredited Institutional Review Board (IRB). The City will document the required information in the approval summary for the USDOT.

## Phase 2: Design, Infrastructure Procurement, Build, Deploy, and Test

After all of the foundational information is collected and documented, it is time to create the very technical documents that will be used moving forward such as the System Design Document with associated ICDs; and the test plans and scripts. During this phase is when the plans, specifications, and estimates (PSEs) are created for procurement of equipment. After the PSEs are created, the City will use their internal process for procurement. Phase 2 will also include building any software systems and/or applications that will be used. As items are deployed, testing will occur based on the system test plan and scripts plus the independent evaluator will become much more involved. Deliverables during Phase 2 are described below:

- **System Design Document (SDD)**, in compliance with IEEE 1016-1998; **Interface Control Documents (ICDs)**; **Plans, Specifications, & Estimates (PSEs)** – The City will create the System Design Document to document how the systems will be created or procured based on the SyRS. The SDD will be detailed enough for developers to create the systems and/or applications down to the system components, interfaces, and subsystems. During the creation of the SDD, ICDs shall be created to documents the interaction and protocols for interoperability between disparate systems. The ICDs may exist as separate documents or be included in the SDD. PSEs will also be created during the SDD to determine hardware and software components that will be procured for off-the-shelf components. The PSEs may exists as separate documents referenced to the SDD.
- **USDOT Deployment Tracking Survey** – The City will participate in the tracking surveys of ITS deployments as requested by USDOT.
- **Testing Documentation** – In this project, testing will take be undertaken at many different times based on the deployment schedule of the field units and integration systems. Additionally, the team will work with an independent evaluator to for the Smart City Demonstration project. Although this may be challenging and involve many different entities from the City and its stakeholders, USDOT, and the independent evaluators, we believe that we can coordinate schedules to accomplish it well. The documentation regarding testing is as follows:
  - **System Test Plan** – The System Test Plan will document the coordination required for all the testing and will identify the components to be tested based on the requirements. As addendums to the test plan or as separate documents, the City will create the scripts required to conduct testing: test descriptions, test cases, test procedures, test data, and expected test results. The scripts will be tailored to the specific system or infrastructure being testing.
  - **Independent Evaluation** – The City shall support the USDOT and independent evaluators by performing the following:
    - **Independent Evaluation Support Plan** – The City will create a plan to work with the independent evaluators to achieve the highest success by proactively making available the information, resources, and infrastructure required.

## Phase 3: Operate and Maintain the System

As the final phase of the Smart City Demonstration, the City will operate and maintain the system. This phase will be the crowning glory for the City and USDOT as our goals and plans are realized. Although there may be tweaks along the way to bring the system to its intended service level, this is the time that end users will be able to take advantage of the implemented enhancements. Along with the deployment, we envision that there may be some documentation required such as:



- **System User Guides** – These guides provide City employees with instructions on the operation and maintenance of the system(s).
- **End-User Guides** – These guides provide the citizens of Kansas City with instructions of how to use the newly deployed systems
- **Data to Support USDOT’s Independent Evaluation** – As mentioned in Phase 1, the City will engage the independent evaluators early in the requirements phase to assure that the evaluators have the data they need.
- **Data Provided to the USDOT’s Research Data Exchange (RDE)** – The City will share data with the RDE as requested and desired in the format required. The data shared will be well-documented for use by others.

### Post-Demonstration Operations Phase

KCMO will work with technology providers and vendors to continue operations beyond the Smart City Challenge. Much of the current technology including the Wi-Fi and kiosks generate income for the city. At the conclusion of the grant, approximately 50% of the investment value will be generating, allowing the positive aspects of this deployment to expand to other parts of the city. Within 10 years, the system is anticipated to be fully self-sustainable through public private partnerships and data-driven procedural efficiencies. From an academic perspective, the establishment of an innovation center with Cisco, the Kansas City Economic Development Council, and other entities will ensure that research will continue the evolution of products and technologies that prove viable. The next great evolution in smart city technology may emerge from the innovation center based largely on the scale of accessibility, usability, and regulation-friendly environment in which scientists and student researchers can work in Kansas City.

### 1.3.3 Integrated Pillars and Vision Elements

The three pillars of Kansas City’s Smart City concept address the twelve vision elements outlined by the USDOT in this solicitation. The table below illustrates how each element is represented in our three pillars, with additional summaries of each element below. Our Phase 1 application documents each vision element in detail, while here we focus on the process of implementation and how the various elements tie together in a holistic Smart City vision.

*Table 1-2: Pillars Aligned to Smart City Vision Elements*

PILLAR	Urban Automation	Connected Vehicles	Intelligent, Sensor-based Infrastructure	Urban Analytics	User-Focused Mobility Services and Choices	Urban Delivery and Logistics	Strategic Business Models and Partnering Opportunities	Smart Grid, Roadway Electrification, and Electric Vehicles	Connected, Involved Citizens	Architecture and Standards	Low-cost, Efficient, Secure, and Resilient ICT	Smart Land Use
1) Prospect	♦	♦	♦	♦	♦		♦	♦	♦	♦	♦	♦
2) AV/CV/EV	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	
3) Connected Communities	♦		♦	♦	♦		♦		♦	♦	♦	♦



### 1.3.4 Vision Element #1: Urban Automation

Pillar 2 contains the Urban Automation components of the KCMO Smart City concept. The primary focus is on connecting the eastern and western areas of the city and upcoming areas such as the West Bottoms and the 18<sup>th</sup> and Vine Jazz District with the current smart corridor on Main St and the new smart corridor along Prospect Ave.

While we recognize that AV technology will eventually take full advantage of smart city infrastructure and data to improve performance to create a faster, safer, and more environmentally friendly transportation system, our focus for the Smart City Challenge is on establishing automated and semi-autonomous shuttles in certain areas of the city. These areas include 18<sup>th</sup> St between Broadway Blvd and Prospect Ave, 11th and 12<sup>th</sup> St between the East Village Transit Center at 12th and Charlotte and the West Bottoms, and Kansas City International Airport to downtown. The





MO House Bill (HB) 924 currently allows testing of driverless motor vehicles until August 28, 2018. As part of the Smart City Challenge, we will reintroduce a bill in the 2017 legislative session to extend testing.

While the shuttles pose no regulatory or technical issues, the autonomous bus to the airport will need to start with different levels of automation throughout the journey due to the numerous environments. The City and KCATA are already actively working with MoDOT to determine how to dedicate a lane or expand shoulders to allow for eventual increased levels of automation throughout the entire journey. As testing is evaluated as safe and secure, the City and KCATA will work to expand AV shuttle and bus deployments throughout areas of the city that depend on public transport and can benefit from first mile/last mile trips to and from transit stations.



### 1.3.5 Vision Element #2: Connected Vehicles

Pillar 2 of our concept includes identifying, using, and analyzing CV data from Smart City Challenge CV participants, public vehicles, and freight vehicles from partners to combine with existing KC Scout (Kansas City's bi-state traffic management system, a joint venture of the Kansas and Missouri departments of transportation), KCATA, and Operation Green Light. These combined data sets will facilitate smart travel throughout the city. Kansas City will benefit from 13 CVRIA applications, nine vehicle to infrastructure (V2I) and four vehicle to vehicle (V2V), deployed throughout our target areas to improve safety and mobility based on the five year collision data set from KCPD and MoDOT. These areas focus on at-grade intersections of 71 Highway (55th St, 59th St, and Gregory Blvd), Prospect Ave, 11th St, 12th St, and 18th St. While most of these sites and applications were selected to improve safety, 11th St, 12th St, and 18th St corridors need connectivity to support AVs by providing back up signal phase and timing information. Table 1-3 describes the applications that KCMO will deploy.

KCATA has already begun a pilot study with Mobileye technology deployed on two buses. KCATA will evaluate the effectiveness of the pilot study and plans to deploy this technology across the bus fleet during the Smart City Challenge. Table 1-3 below includes descriptions of CV applications for our deployments. It is likely that others will be added as new applications are developed.

*Table 1-3: Smart City Challenge CV Applications, per CVRIA*

Impact	CVRIA Applications
	<b>V2I Intelligent Traffic Signal System (ISIG)</b> application adjusts signal timing for an intersection or group of intersections to improve traffic flow, including vehicle platooning through intersections. When connected with real-time city data, including information about special events such as concerts at the Kauffman Center or athletic games at the Sprint Center, signal timing could be tailored to manage traffic flows.
	<b>V2I Freight Signal Priority (FSP)</b> application provides traffic signal priority for freight and commercial vehicles traveling in a signalized network. The goal of the freight signal priority application is to reduce stops, delays, to increase travel time reliability for freight traffic, and to enhance safety at intersections.
	<b>V2I Transit Signal Priority</b> application will incorporate CV technologies to Kansas City's Transit systems. Buses will be able to request priority at intersections to increase schedule reliability and reduce time spent stopped at red lights, reducing emissions.
	<b>V2I Emergency Vehicle Preemption (EVP)</b> application provides a very high level of priority for emergency first responder vehicles to facilitate safe and efficient movement through intersections.
	<b>V2I Pedestrian Mobility</b> application will provide information to pedestrians and vehicles at crosswalks and intersections. Mobile devices will inform pedestrians when to cross as well as warn people and vehicles of possible infringement while crossing. This application will also give those with disabilities priority and additional crossing time.
	<b>V2I Queue Warning (Q-Warn)</b> application enables vehicles within the queue event to automatically broadcast their queued status information (e.g., rapid deceleration, disabled status, lane location) to nearby upstream vehicles and to infrastructure-based central entities (e.g., TMC). The infrastructure will broadcast queue warnings to vehicles in order to minimize or prevent rear-end or other secondary collisions.





- V2I **Curve Speed Warning (CSW)** application allows vehicles to receive information approaching a curve along with the recommended speed for the curve. The vehicle can perform additional warning actions if the speed through the curve exceeds the recommended speed.
- V2I **Red Light Violation Warning (RLVW)** application enables a vehicle approaching an instrumented signalized intersection to receive information regarding the signal timing and the geometry of the intersection. The application in the vehicle uses its speed and acceleration profile, along with the signal timing and geometry information to determine if it appears the vehicle will enter the intersection in violation of a traffic signal.
- V2V **Emergency Electronic Brake Light (EEBL)** application enables vehicles to broadcast emergency brake events to surrounding vehicles and provide a warning to the driver.
- V2V **Forward Collision Warning (FCW)** application warns drivers if there is an impending rear-end collision ahead in traffic in the same lane as the travel.
- V2V **Intersection Movement Assist (IMA)** application warns drivers when it is not safe to enter an intersection due to high collision probability with other vehicles.
- V2V **Vehicle Turning Right in Front of Transit Vehicle (VTRFTV)** application determines the movement of vehicles near a transit vehicle at a transit stop and provides an indication to the operator that a nearby vehicle is pulling in front to make a right turn.



### 1.3.6 Vision Element #3: Intelligent, Sensor-Based Infrastructure

Designing and deploying a robust sensor network will ensure that KCMO is equipped to capture real-time insights into the performance of the city as well as the effects of smart city projects. The existing Cisco Digital Platform (CDP) has the ability to aggregate data from multiple sensor networks, such as parking and lighting, and make that information available in standardized formats and APIs. All three pillars in our concept will include deployment of intelligent, sensor-based infrastructure that will facilitate the ability to identify and react in real-time to factors that affect transportation and public services. Kansas City is already managing traffic in the area through KC Scout to manage operations and disseminate information. These data are reviewed monthly at a City Council KC Stat meeting, and all the supporting information are posted for public awareness on the City's existing Open Data site. As the amount of data increases with sensors and new algorithms, the data will be added to the site.

KCMO is a partner with MARC in Operation Green Light (OGL), a multi-jurisdictional system that coordinates more than 700 traffic signals throughout the region, including the Prospect MAX corridor. OGL currently provides pre-timed synchronization of traffic signals for peak commuter periods and special events. KCMO will work to integrate new CV data into OGL, which will reduce congestion, leading to fewer CO2 emissions and roadway delays for the traveling public. We will also incorporate this information to proposed CV technologies, which will allow for CV applications that recommend speeds, helping drivers time green lights potentially allowing them pass through entire corridors without stopping. Kansas City will add weather sensors to RSUs deployed along AV shuttle routes to facilitate AV operations.

Kansas City is forming a partnership with Argonne National Labs and Cisco to extend the Array of Things urban sensing project to the Kansas City area. Argonne is committed to providing the city with one of the first "nodes" that will become available in the summer of 2016. Additionally, Cisco and Argonne are working together to deliver a new model of the Argonne sensors that will deliver Power over Ethernet (PoE), and thus use Kansas City's Cisco infrastructure to reduce the cost of cutting-edge sensor deployment. KCMO will leverage the learning from Argonne's Chicago project to design and deploy a sensor network throughout the metro area that will measure the effects of the smart city efforts in real-time. By partnering with both Cisco and Argonne, all environmental sensor data collected can be simultaneously published to the City Data Platform for processing as well as directly to Argonne's data repository at the University of Chicago for purposes of academic research.

The Argonne Sensors include the ability to measure:



Environmental	Natural and Manmade Behavior
<ul style="list-style-type: none"> <li>• Temperature</li> <li>• Relative humidity</li> <li>• Atmospheric pressure</li> <li>• Temperature of sidewalk/street</li> </ul>	<ul style="list-style-type: none"> <li>• Acceleration/vibration</li> <li>• Magnetic fields</li> <li>• Visible light</li> <li>• Infrared light</li> <li>• UV light</li> <li>• Sound pressure</li> </ul>
Air Pollutants	City Activity
<ul style="list-style-type: none"> <li>• Density of particulate matter</li> <li>• Ethanol</li> <li>• Nitrogen dioxide</li> <li>• Ozone</li> <li>• Hydrogen sulphide</li> <li>• Total oxidizing gases</li> <li>• Carbon monoxide</li> <li>• Sulfur dioxide</li> </ul>	<ul style="list-style-type: none"> <li>• Anonymized wireless device sightings: Average roadway speed, travel times</li> <li>• Video sensor: Pedestrian, bike and car traffic; Abandoned packages or objects; Clogged basins/on- street standing water</li> </ul>

By working directly with Argonne National Labs, Kansas City can learn from their existing research and ensure that these sensors are strategically placed throughout the city and transit corridors to ensure optimal data collection.

KCMO will also deploy widespread use of sensors with video technology at multi modal transportation access points, starting with the Prospect MAX corridor. Bus stop sensors will be able to identify an increased number of people waiting at a stop. Sensors on bike share stands currently identify how many bikes are available in a specific location and all bikes are equipped with GPS units to identify popular bike routes. KCMO will work to integrate this data into the comprehensive data platform to support mobility applications and determine locations for new bike routes and bike share stations.



### 1.3.7 Vision Element #4: Urban Analytics

Urban Informatics and Analytics uses data to better understand how cities work. This understanding can remedy a wide range of issues affecting the everyday lives of citizens and the long-term health and efficiency of cities — from morning commutes to emergency preparedness to air quality. Kansas City aims to be a leader and innovator in the emerging field of Urban Informatics and Analytics.

Kansas City is partnering with Argonne National Labs, Cisco and an ecosystem of partners to make the urban core a more ‘Quantified Community’ – a fully instrumented urban environment that will measure and analyze key physical and environmental attributes. The Quantified Community will create a unique experimental environment that provides a testing ground for new informatics technologies and analytics capabilities, which will allow for unprecedented studies in transportation engineering, urban systems operation, planning, and the social sciences.

As an example, Sidewalk Labs has committed to develop their Flow Transit Analytics Application by leveraging their proprietary *trips and destinations* from Google Maps and Waze data combined with new data that will be generated as part of the Smart City Project. Kansas City will promote an open data architecture and data accessibility to promote the development of such applications.

Kansas City and partners are still developing the final list of attributes that will be measured but examples include:


- Measuring, modeling, and predicting pedestrian and multi-modal transportation flows through traffic and transit points, and open spaces
- Gauging air quality across the open spaces, key transit corridors, and surrounding areas
- Measuring health and activity levels of residents and workers using a custom-designed, opt-in mobile app

Data from connected vehicles will create an entirely new category of use cases for Urban Analytics. Kansas City and our partners will explore many use cases for the Basic Safety Messages and other data collected. These include:

- **Accident Investigations and Safety Improvements** – Provide historic and pre-accident snapshots of weather and traffic, car sensor, and phone usage information for the purpose of incident prevention.





- 
- **Taxi, Rental Equipment, & EMS positioning** – Identifying activity hotspots and high probability areas by date/time/location analysis of cellular and car activity to correctly pre-position and maximize services.

The Kansas City Office of Performance Management already uses urban analytics to analyze data for the city and update performance metric dashboards such as KCStat (the City’s public-facing performance management program). Additionally, Kansas City will work with partners such as KC Scout, KCATA, KCPL, and B-cycle (bike share) to layer archived data on vehicle and traffic patterns with other external data factors like road weather, energy usage, and accident reports to develop probabilistic analytics that will prevent future travel incidents. Maintenance and construction crews will be able to use this information to work at ideal times, which will reduce mobility and safety concerns.

Kansas City’s Smart City Data Platform allows for the rapid development, iteration and deployment of predictive algorithms from various partners. This will encourage the rapid development of new insights and applications in the marketplace, such as potential real-time pricing analytics to enable more cost and time-efficient travel choices for the public. The data platform will host a marketplace of algorithms and insights that KCMO can share with other cities around the world. These advanced analytics can start bridges among transportation, utilities, health, and other smart city components. Chapter 2.0 Data Management Approach discusses the analytics approach in more detail.



### 1.3.8 Vision Element #5: User-Focused Mobility Services and Choices

All three pillars in our smart city concept will incorporate user-focused mobility services and choices. Kansas City has the greatest number of highway miles per resident in the country, most likely due to ease of access and culture of use, creating a dependency on automobiles. This vision element will help Kansas City shift its dependency from individual vehicles to transit usage and other modes of transportation.

Along the Prospect Corridor, there will be three mobility hubs that will be a focal point for several mobility services. The mobility hubs will better accommodate travelers transferring to other transportation services providing for convenient transfers. The hubs will provide real-time transportation and traffic information that will be accessible via smartphone or kiosk, which will make citizens well informed when deciding the best way to travel. A shuttle-hailing application integrated into kiosks along 18th Street East, which will create and on-demand autonomous shuttle connecting citizens from Broadway Blvd to Prospect Ave. A similar service will be made available on 11<sup>th</sup> and 12<sup>th</sup> St from downtown to the West Bottoms. New, safer bike lanes developed out of road diets will enable yet more travel choices for citizens that desire to bike along specific east-west and north-south corridors.

Integrated payment systems accessible either through a smart card or through a mobile phone application will allow citizens to pay for different modes of transportations from one source. This allows citizens to easily transfer between different types of transportation. Furthermore, smart phone applications for multimodal wayfinding and micro-carpooling will create added mobility services.



### 1.3.9 Vision Element #6: Urban Delivery and Logistics

The Kansas City region is one of the nation's leading freight hubs, with infrastructure that supports goods movement by truck, rail, air, and water for domestic and international trade. MARC engages the freight industry through a standing Goods Movement Committee and is in partnership with Kansas City SmartPort, an organization focused on promoting regional freight and logistics. Major intermodal centers to transfer freight containers between trucks and rail are being developed at the 1300-acre Center-Point-KCS Intermodal Center in Kansas City, the 450-acre Northland Park, and the 1000-acre Logistics Park KC in its suburb of Edgerton, Kansas. The 800-acre KCI Intermodal Business Centre will handle transfer between trucks and aircraft. Amazon announced in 2016 that they would be building a new distribution facility at Logistics Park KC with 1,000 employees. Logistics Park KC has also projected a total employee count of 20,000 at full build out. This creates a tremendous employment opportunity

for the entire metropolitan area. The KCMO concept will focus on partnering with the Edgerton, KS facilities to further the state-of-the-art facility as well as encourage cross-state collaboration in improving freight operations.



Figure 1-5: BNSF and Logistics Park KC Location

The BNSF Intermodal / Logistics Park KC is a combined BNSF intermodal & logistics park located in Edgerton, KS on the southwest side of the Kansas City metropolitan area along I-35. The intermodal site opened in 2014 as the most technologically advanced intermodal facility in the country. As the most advanced intermodal site in the country, this gives the KC Smart City application the tremendous opportunity to continue to be on the bleeding edge of innovation and provides a perfect test bed for advanced freight technologies, particularly in fulfilling BNSF's goals for full electrification at the site.

The major freight effort will focus on improving safety and mobility directly outside of the site, primarily along the I-35 corridor to KCMO. KDOT led a study to develop a recommended improvement plan for I-35 addressing both freight and commuter traffic. The plan, called I-35 Moving Forward, was completed in 2014, and focused on improvements to I-35 from the BNSF Intermodal and Logistics Park, KC to downtown Kansas City, Missouri. Both KDOT and MoDOT have already implemented some of the

recommended improvements in the corridor since the plan was completed. Additional improvements through this challenge will include ramp metering and Freight Signal Priority CV applications deployed along key freight interchanges and weigh station enhancements to improve

throughput and reduce traffic times. The City also aims to enhance KC Scout to provide traffic, weather, and construction advance warning data to trucks leaving Logistics Park KC to enable informed trip decision making.

Within Logistics Park KC, the concept will focus on furthering electrification of the site through transitioning heavy-duty terminal trucks from diesel to electric, installing fast charging stations, and integrating with the KCPL grid for V2G enhancements. The facility is expected to grow exponentially over the next five years because both Wal Mart and Amazon have leased warehouses in the area and will begin extensive intermodal operations there by 2018. By establishing an electric

#### KCMO Freight Characteristics

- In 2014, the system handled an estimated 264 million tons of freight with an estimated total value of \$357 billion
- Largest rail freight traffic hub in the United States - carries over 300 daily arrivals and departures
- Third largest trucking hub in the country – intersection of four of major interstate highways (I-35, I-70, I-29, and I-49)
- Airport moves more air cargo each year than any air center in a six-state region
- Located on the largest navigable inland waterway



fleet standard prior to this growth, the site will continue to lead the nation in effectiveness and corporate responsibility.

By implementing these solutions and technologies, the Smart City Challenge will export successful projects to other intermodal sites and freight corridors to show how to improve safety, mobility, and emissions in heavy freight areas.



### 1.3.10 Vision Element #7: Strategic Business Models and Partnering Opportunities

Kansas City's vision for deploying new Smart City technologies across our three pillars is reliant on effective relationships and partnerships. We have already assembled a multi-dimensional team and are actively in discussions with other partners. Smart City integrated efforts are best implemented with a combination of private, non-profit, academic, government, and other agency cooperation. Kansas City plans to develop a Smart City Challenge Management subcommittee to the existing Kansas City Smart City Advisory Board, which will review progress of ongoing work monthly. The Kansas City Public Works Department will maintain administrative oversight of the challenge while KCATA, KCPL, and Public Works directorates would manage operational oversight of supporting projects. Section 3.2 describes our current and potential partners.

KCMO will call on the expertise of our partners in developing new effective models to ensure cross-organization collaboration to leverage the best ideas and expertise across any relevant organizations. Examples of these kinds of models include P3s, subcontractor agreements, and strategic alliances. Many of our team members are already involved in these arrangements, as is the City with private companies and other government agencies. Within the region, we are well versed at collaborating across government agencies, based on our dual-state location and our established civic, community, and government organizations standing working groups and projects. MARC is the regional planning organization and area council of governments, which will be active in all Smart City Challenge efforts. The Kansas City area is currently home to Kansas City Digital Drive, a bi-state non-profit organization committed to employing digital technology to impact citizen experiences in both digitally rich and digitally poor neighborhoods. ConnectHome, a collaborative team featuring technology experts from both Kansas and Missouri, is providing computers and training for underserved populations. Kansas and Missouri also collaborate effectively in traffic control through KC Scout, which manages traffic flow across both sides of the state line and executes Operation Greenlight.



### 1.3.11 Vision Element #8: Smart Grid, Roadway Electrification, and Electric Vehicles

As outlined in Pillar 2, KCMO will work with the KCPD, KCATA, and the BNSF Intermodal Facility operators to begin transitioning the non-cruiser police vehicles, KCATA buses, and logistics terminal trucks to EVs, along with installing additional charging infrastructure as necessary. In fact, this work will be a continuation of an existing green fleet transition by KCMO. In 2014, KCMO was ranked first in the country for its green government fleet in the North American Green Fleet Awards Forum for a city fleet that includes 271 vehicles that operate on compressed natural gas, 46 electric vehicles, 12 hybrids, six liquefied petroleum gas vehicles, and six industrial tricycles. Electric charging stations will also be incorporated into the design of the mobility hubs along the Prospect Corridor.

KCMO is now one of the best places to own an electric vehicle as a result of the charging infrastructure provided by the KCPL Clean Charge Network. The network consists of more than 1,000 electric vehicle charging stations, more than any other U.S. city, and is free to use for the first two years. KCPL is also demonstrating an end-to-end SmartGrid—built around a major SmartSubstation—that includes advanced generation, distribution, and customer technologies. Co-located renewable energy sources, such as solar and other parallel generation, will feed into the energy grid.

KCMO will work with KCPL to incorporate electric vehicle smart grid technologies into their current Smart Grid capabilities. These technologies will enable the grid to interact with electric vehicles in the home to charge at the most optimal time (usually early morning) while still assuring a fully charge. KCPL will also work to further Vehicle-to-Grid (V2G) capabilities, enabling vehicles to communicate with the grid to sell demand response services by returning power to the grid or reducing the charging rate. For vehicles using public charging stations, these technologies will enable the vehicle to identify itself to the charging station where the electricity cost can be automatically billed to the user—similar to using an EZPass on a toll road.





### 1.3.12 Vision Element #9: Connected, Involved Citizens

KCMO will deploy an additional interactive 100 kiosks around KCMO to increase digital connectivity and provide access to city services, current events, transportation services, local business information, public digital art, local history, and entertainment. Additionally, the 3.5 GHz Innovation Band will add significant Wi-Fi coverage throughout the city. This will provide additional connectivity and access to transportation services, educational programs, city events, and employment opportunities.

Kansas City will continue to focus on connecting the new type of citizen – the “digital citizen.” The digital citizen is a person or business who expects fast and efficient delivery of government services that leverage the power of social media, mobile, analytics, and cloud-based technologies. For instance, the proposed micro-carpooling application will connect citizens who need rides with those who can provide rides. Connected citizens will contribute data through methods like crowdsourcing to give smart cities more accurate and holistic information. Crowdsourced information will increase from expansion of public Wi-Fi coverage and will be gathered from social media, kiosks, 311, and smartphone applications. Kansas City’s thriving startup community will be an asset when developing and deploying connectivity mediums. The Kansas City Living Lab, a joint proposal by Cisco and Think Big Partners, is already actively working to accelerate technologies and applications focusing on citizen engagement. Furthermore, Kansas City’s Open Data portal gives the general public access to Kansas City data. This will allow entrepreneurs and start-up companies to use city data to develop mobile applications. Involvement from the Innovation Partnership Program (an initiative for entrepreneurs to apply to develop, test, and demonstrate innovative solutions with KCMO data and infrastructure) will offer collaborative efforts, which will enhance application development.



### 1.3.13 Vision Element #10: Architecture and Standards

For all aspects of our concept and deployment, it is crucial to have a well-defined set of standards to ensure interoperability, consistency in deployment plans and operations, and adherence to the latest security, performance, and communication requirements. All aspects of the deployment will utilize existing standards for deployment and integration of new technologies. During concept and requirements development, applicable standards will be chosen and documented. There are several existing standards and architectures across multiple industries that are being used as the foundation for development of new technologies, including but not limited to:

- IEEE standards for communications protocols (e.g., IEEE 1609 Suite)
- NIST and FIPS standards for security and control (e.g., FIPS 140-2, FIPS 199, FIPS 200)
- SAE standards for vehicle architectures and technologies (e.g., SAE J2945)
- Connected Vehicle Reference Implementation Architecture (CVRIA)
- National ITS Architecture
- Kansas City Regional ITS Architecture

All of these existing, and in some cases in-development, standards and architectures will be the starting point for the Kansas City team to develop technical specifications across all new technologies, including how we manage and secure data; build out new infrastructure or infrastructure components; deploy additional applications and device-based technology; and other back end system changes or integrations.

Kansas City will ensure that we complete development of interoperability and interface architectures as we develop and deploy technologies that will be communicating with multiple systems. We will utilize a systematic approach to review all existing standards, develop requirements based on operational and use case needs, and develop new standards or architectures with the USDOT only where ones do not exist.



### 1.3.14 Vision Element #11: Low-Cost, Efficient, Secure and Resilient Information and Communications Technology (ICT)

At the core of any smart city and its systems that enable connectivity, information exchange, analytics, and new citizen services must be a strong, secure, efficient, and affordable information and communications technology (ICT) system. The notion of “smart” is predicated on the ability of data and information to easily be transmitted from a number of sources (e.g., sensors, personal devices, vehicles, infrastructure) then combined at a location (anywhere from the back-end centralized location to an actual device) with advanced analytics to glean insights from those data and information sources. Kansas City has already set much of the foundation for this system and will include all needed elements within our comprehensive data management plan.



Kansas City has an open data platform, a cloud-based solutions for Government, which serves as one of the foundational elements. As more information becomes available, KCMO will build upon this system to develop detailed plans for ensuring that the ICT systems are all secure; include redundancy and contingency plans; are adaptable and scalable; and include multiple approaches for visualization, reporting, analytics, and data storage and management. Advanced ICT systems include multiple ways to transmit and store data, as well as provide insights and targeted information to the right decision makers at the most convenient location (be that desktops, integrated traffic management centers, personal devices, or vehicles and infrastructure elements).

The security for connected vehicles is underway with the Security Credentials Management System (SCMS) prototype being built for the CV pilots. We will take these lessons and expertise to apply and improve upon them for the CV applications deployed in KCMO. The scale of the project will be larger than that seen to date, since it will involve additional systems and data transmissions, all of which will be secured using the same tested approach of threat assessment, and control selection based on industry standards, such as NIST or Common Criteria approaches.



### 1.3.15 Vision Element #12: Smart Land Use

Smart land use is incorporated in the Prospect Corridor pillar as well as the Connected and Empowered Communities pillar. On Prospect Ave, mobility hubs, based off a comprehensive tool kit developed by MARC for the regional transit expansion initiative, will take advantage of optimizing available land to create central locations where multiple modes of transportation will be offered. Not only does this optimize land use, but it also creates an initiative to reduce car ownership, which will reduce infrastructure like parking spaces that could be allocated for other use. Transit-oriented development should continue to attract millennials, who tend to prefer urban living.

Kansas City has utilized smart land use practices to analyze corridors and subsections that would be best to implement road diets, thus creating safer biking and walking opportunities. KCMO will implement road diets to develop new bike lanes to create an integrated bike network, both connecting the east to the west and north to the south. Road diets will also help in calming traffic along corridors with high numbers of bikers and walkers. Additionally, car share programs will be given designated parking spots to increase their presence and further reduce car dependency. Kansas City will also make efforts to make better use of downtown parking facilities by collaborating with infrastructure and application developers to work toward multi-level, automated parking structures, or those with parking availability information displayed through signs and/or smartphone applications.

## 1.4 Proposed Applications and Technology Solutions

For each of our pillars we have identified the needed applications and technology solutions. Quantities and locations of the proposed applications and technology solutions are further enumerated here.

### 1.4.1 Automated Vehicles

KCMO plans to develop autonomous vehicle testing districts and lanes along I-29 from the airport to downtown, and along 11<sup>th</sup>, 12<sup>th</sup>, and 18<sup>th</sup> Streets. While not a part of this Smart City effort, KCMO will eventually work to implement AV technology to assist with first mile, last mile transportation to mobility hubs and transit stations.

#### Airport to Downtown (I-29)

KCATA and the City will implement a bus route with **one electric, semi-autonomous bus** from downtown to the airport. Initially, the bus will have an operator due to the multiple environments between the destinations. KCMO and KCATA will collaborate closely with MoDOT to determine infrastructure changes, planning, and construction.

#### 11<sup>th</sup> and 12<sup>th</sup> Street (East Village Transit Center to West Bottoms)

KCATA and the City will deploy **two electric, autonomous transit vehicle shuttles** to connect the West Bottoms and the East Village Transit Center to the Streetcar route to expand the Streetcar's market area.

#### 18<sup>th</sup> St (Broadway Blvd to Prospect Ave)

KCATA and the City will deploy **two electric, autonomous transit vehicle shuttles** to connect communities along 18<sup>th</sup> St, such as Crossroads and 18<sup>th</sup> and Vine Jazz District, to the Streetcar and Prospect Ave.



### 1.4.2 Connected Vehicles and Infrastructure

KCMO will deploy CVs and V2I infrastructure across the city to facilitate safer and more efficient transportation by focusing on fleet vehicles among KCATA bus lines, the police department, and Logistics Park KC, as well as private light vehicles. The tables that follow include more detail about these applications and infrastructure.

*Table 1-4: Connected Vehicles and Pedestrians – On-Board Units (OBUs) and Personal RFID Tags*

Organization	Number of Connected Vehicles and Personnel
Metropolitan Area Transit Fleet	<b>25 total vehicles</b> with OBUs. <b>300 fixed route vehicles</b> will also be equipped with Mobileye technology
KC Police Department	<b>75 total vehicles</b> with OBUs: parking control and non-cruiser vehicle
Logistics Park KC	<b>100 local drayage trucks (day trucks)</b> targeting those that travel between Logistics Park KC and KCMO along I-35
Private Light Vehicles	<b>500 private light vehicles</b> targeting those that live and/or work within areas with deployed RSUs along Prospect Ave
Pedestrian and Bicyclist RFID Tags/Stickers	<b>50,000 pedestrians and bicyclists</b> , targeting those that live and/or work within areas with deployed RSUs along Prospect Ave

*Table 1-5: Connected Infrastructure – Roadside Units (RSUs)*

Location	Number of RSUs
Prospect Ave	106
71 Highway	26
11 <sup>th</sup> and 12 <sup>th</sup> St	42
18 <sup>th</sup> St	45
I-29 and connectors	50
I-35 and connectors	50

### 1.4.3 Sensor Infrastructure

**Smart LED Lighting Systems:** KCMO will extend smart lighting to the Prospect Corridor to improve Wi-Fi accessibility and safety. KCMO will also deploy systems along the 11th, 12th, and 18th Street AV/CV corridors to complement the required enabling infrastructure. This technology will also provide several data streams to the Urban Analytics platform with the potential to include:

1. Pedestrian sensors with group detection to aid in dispatching law enforcement;
2. Parking and traffic congestion sensors;
3. Air quality sensors to identify environmental zones in need of attention and action;
4. Temperature sensors to map the effective temperature of the urban core; and
5. Sound sensors to increase lighting levels where loud noises indicate a possible emergency.

*Table 1-6: Smart Lighting Locations and Scope*

Locations	Scope
Prospect Corridor	<b>Replace existing 318 streetlights and add 15-20 new lights along 6 miles of Prospect Ave</b> –includes new poles/arms and LED fixtures, all wiring, circuitry, and electrical equipment
11 <sup>th</sup> Street	<b>Install 26 new light poles and modify 16 existing poles along 0.8 miles from Holmes to Broadway</b> – includes 42 new LED fixtures along with 3 new controllers and 4,000 linear feet of electrical circuits
12 <sup>th</sup> Street	<b>Install 52 new light poles and modify 32 existing poles along 1.6 miles from Holmes to Genesee</b> – includes 84 new LED fixtures along with 7 new controllers and 8,400 linear feet of electrical circuits
18 <sup>th</sup> Street	<b>Install 56 new light poles and modify 35 existing poles along 1.75 miles from Broadway to Brooklyn</b> – includes 120 new LED fixtures along with 9 new controllers and 9,240 linear feet of electrical circuits





Gunshot Detection Technologies: KCMO will deploy additional gunshot detection technologies along the Prospect Corridor and will provide coverage of **6 square miles**. For reasons of security, KCMO does not detail the actual number or locations of the new systems.

Traffic Sensors/Cameras: **53 CCTV security cameras** will be added to the Prospect Corridor. KCMO will also install video sensors in the median of 71 Highway to detect pedestrians.

Navigation assistance for the visually impaired: **40 beacon sensors** will be added to bus stations, **260 buses** will be retrofitted with sensors, and **50 sensors** will be added to downtown bus stops. Beacons will identify themselves to pedestrians and support wayfinding assistance. This is in addition to **tactile maps** at **6 transit centers**, **40 bus stops** (Prospect Corridor), and **10 bus stops** (downtown).

#### 1.4.4 EVs and Charging Infrastructure

KCMO is already one of the best places to own an EV because of the Clean Charge Network, the largest EV charging operation in the United States. KCMO will focus efforts on fleet transition of convention vehicles to EVs. Inevitably, additional charging infrastructure will be required in select locations to support larger EV numbers, especially in locations where new fleets are housed. New charging stations will also be designed into the plan for the smart mobility hubs along the Prospect Corridor.

*Table 1-7: EV Fleet Transition*

Organization	Number and Type of Electric Vehicles
KCATA	<b>12 new electric buses</b> for the Prospect MAX line instead of the originally planned CNG buses <b>4 autonomous, electric shuttles</b> along 11 <sup>th</sup> , 12 <sup>th</sup> , and 18 <sup>th</sup> Streets.
KCPD	<b>12 new electric light vehicles</b> (non-cruiser and parking enforcement)
Logistics Park KC / BNSF	<b>6 Class 8 terminal trucks</b> from diesel to electric (with 160 kWh battery packs)

*Table 1-8: Additional Charging Infrastructure*

Organization	Number and Type of Chargers
KCATA	<ul style="list-style-type: none"> <li>To support charging of the 12 new electric buses, there will be 2 fast charge “on-street” charging stations: 1 at 75<sup>th</sup> and Prospect and 1 at 11<sup>th</sup> and Charlotte. There will also be 1 extended battery charger at KCATA’s bus facility at 1200 E 18<sup>th</sup> St</li> <li>Mobility hubs will also include charging stations for the general public.</li> </ul>
KCPD	<b>4 charging stations</b> to support the new KCPD electric vehicles.
Logistics Park KC / BNSF	<b>3 fast charging stations</b> to support charging the six electric terminal trucks.

#### 1.4.5 Citizen Engagement Kiosks and Wi-Fi

As part of the current KCMO Smart City effort, the City is already in the process of deploying 25 interactive digital kiosks along the new streetcar line and nearby downtown locations for accessing city services, current events, transportation services, local business information, public digital art, local history, and entertainment. For the Smart City Challenge, KCMO will place an additional 100 CityPost kiosks in the following locations. Each kiosk will also have a security alert system integrated into the design.

*Table 1-9: Citizen Engagement Kiosks*

Location	Quantity	Configuration
Prospect MAX Stations (outside of downtown)	40	46" single screens retrofit into new MAX shelters
Troost MAX	15	46" double sided screens retrofit into existing MAX signs

Main Street MAX	15	46" double sided screens retrofit into existing MAX signs
KC Transit Centers (75th & prospect, East Village)	3	46" double screens retrofit into new shelters
Northland	5	46" single screens same as Sprint Center Design
Airport	4	46" double screens same as Sprint Center Design
Airport	2	46" single screens same as Sprint Center Design
Other - TBD	16	46" double screens same as Sprint Center Design

Wi-Fi transmitters: The Smart City initiative will provide digital inclusion of free Wi-Fi of up to **8 square miles** of east side neighborhoods and approximately 40,000 underserved residents along the entire corridor. Wi-Fi coverage will be approximately ½ mile on either side of the Prospect Corridor. Benefits to residents and businesses alike will be felt throughout this historically low income and underserved area.

Additionally, testing of the Innovation Band will provide new Wi-Fi access to multiple neighborhoods throughout the city, including Waldo, Brookside, 18th and Vine Jazz District, Crossroads, Downtown, Country Club Plaza, Westport, and Barry Road/Zona Rosa.

Mobile Learning Lab: KCATA will renovate **one retired KCATA bus** into a mobile learning lab. This lab will utilize the Wi-Fi along Prospect Avenue and will primarily operate during times when students are out of school (breaks and evening hours) along the Prospect Corridor.

#### 1.4.6 Mobility Hubs

The following tables show the numbers of each service and technology for each of the mobility hubs.

*Table 1-10: Mobility Hub between 11<sup>th</sup> and 12<sup>th</sup> Streets on Holmes Street*

Service	Deployed Amount
Demand based transportation (Bridj)	Space for 2 Bridj vehicles
Demand based transportation (Uber)	Space for 2 Uber vehicles
Paratransit service	Space for 2 paratransit vehicles
Car Share	4 car share stations
Bike share	15 bike share docking stations
Personal bike storage	8 bike lockers with supplemental bike parking racks
Bicycle and pedestrian improvements	Bike lane on Charlotte Street and sharrows on 11 <sup>th</sup> Street connecting to mobility hub
Smart kiosks	1 kiosk built into transit shelter
Electric vehicle charging stations	4 EV charging stations

*Table 1-11: Mobility Hub at 31<sup>st</sup> Street and Prospect Avenue*

Service	Deployed Amount
Demand based transportation (Bridj)	Space for 1 Bridj vehicle
Demand based transportation (Uber)	Space for 1 Uber vehicle
Paratransit	Space for 2 paratransit vehicles
Car Share	2 car share stations
Bike Share	10 bike share docking stations
Smart kiosks	1 kiosk screen built into transit shelter
Electric vehicle charging stations	1 EV charging stations

Table 1-12: Mobility Hub at 75<sup>th</sup> Street and Prospect Avenue

Service	Deployed Amount
Demand based transportation (Bridj)	Space for 1 Bridj vehicle
Demand based transportation (Uber)	Space for 1 Uber vehicle
Paratransit	Space for 2 paratransit vehicles
Car Share	2 car share stations
Car Share	2 car share stations
Bike Share	10 bike share docking stations
Smart kiosks	1 kiosk screen built into transit shelter
Electric vehicle charging stations	1 EV charging stations

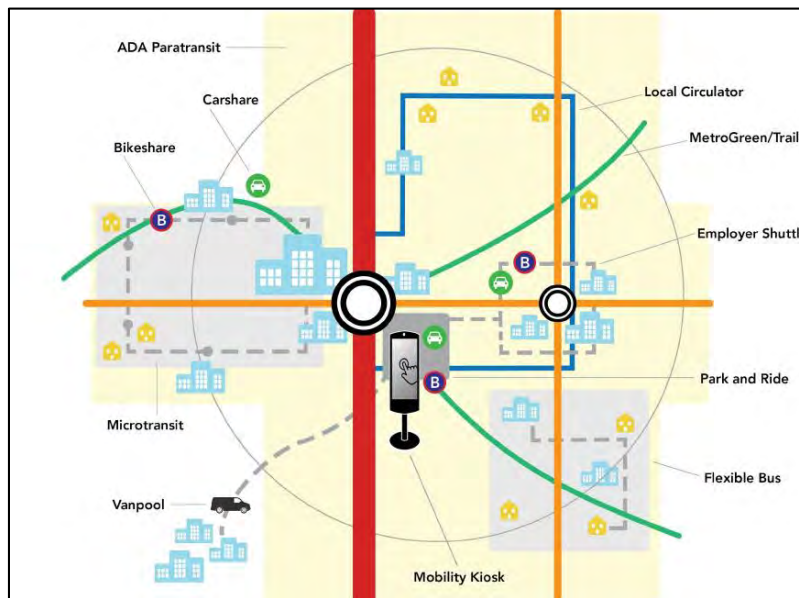


Figure 1-6: Standard Mobility Hub Features

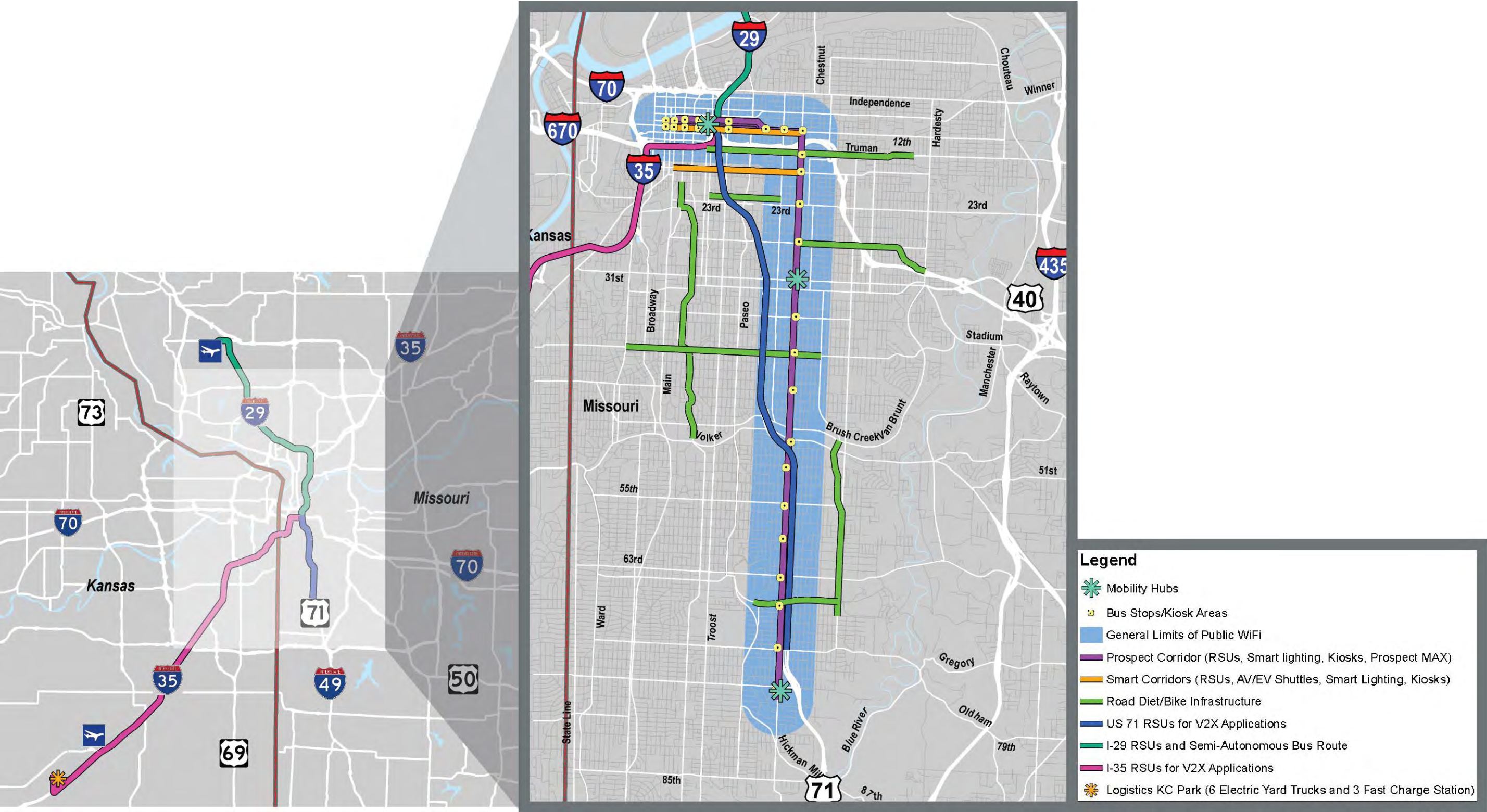
#### 1.4.7 Road Diets and Bike Lanes

Table 1-13: New Bike Lane Types and Locations

New Bike Lane Types	Locations
Two-way Cycle Track	Grand and Gillham Avenues and Rockhill Road
Protected Bike Lanes	Truman Road, from Downtown to Benton Boulevard
Buffered Bike Lanes	Meyer Boulevard, from the Paseo to Swope Parkway
Traditional Bike Lanes	<ul style="list-style-type: none"> <li>22nd Street between Holmes Street and Benton Boulevard</li> <li>27th Street from Prospect Avenue to Raytown Road</li> <li>39th Street from the Southwest Trafficway to Benton Boulevard</li> <li>Truman Road from Benton to Van Brunt Boulevard</li> <li>Along Raytown Road to Van Brunt Boulevard</li> </ul>



1.5 Annotated Site Map





## 1.6 Automated Vehicle Testing and Demonstration Approach

### 1.6.1 AV Testing and Demonstration Scope

Within the 3-year Smart Cities Challenge timeframe, KCMO will deploy and demonstrate an autonomous shuttle system downtown and partially automated transit vehicles between the airport and downtown. These systems will improve economic opportunity, mobility, and safety in Kansas City by connecting distinct zones and existing transportation options, and taking full advantage of the improvements in safety and mobility that are highlighted as benefits to AV technologies. Upon conclusion of the project, the City will continue to operate these systems, and expand service as appropriate.



Figure 1-7: AV Shuttle Deployment Zones

As seen in Figure 1-7, the service will enhance transportation in the downtown area and connectivity to KCATA. One AV shuttle route will operate along 12<sup>th</sup> Street from Quality Hill on the west to the East Village Transit Center. The route will use the Transit Emphasis Corridor (TEC) Business Access Transit (BAT) lanes in the CBD along the 11<sup>th</sup>/12<sup>th</sup> Street couplet. As the West Bottoms develops the route will be extended west to tie this area in. The second route will operate along 18<sup>th</sup> Street from Broadway Blvd on the west through the Crossroads district and 18<sup>th</sup> & Vine to Prospect Avenue to tie into MAX. This route will connect with all three MAX routes and tie in the minority neighborhoods along Southwest Boulevard and east of Troost Avenue with the Crossroads and the Streetcar line. The system will include:

- 4 electric fully-automated vans (NHTSA [National Highway Traffic Safety Administration] Level 4 automation), which will allow the shuttles to operate efficiently at relatively high levels of service – 10 minute headways at most times of day;
- Software application (including smartphone app) to enable on-demand ride hailing;
- High definition 3D automation grade maps;
- Operations Center with staff, hardware, and communications systems to monitor operations, handle customer support, and provide remote control of vehicles in unusual circumstances;
- Vehicle charging stations.

The City, MoDOT, and KCATA will develop a connected and partially autonomous corridor from KCI Airport to the Downtown area. This 20-mile corridor will serve as a test corridor for highway speed connected and autonomous vehicles. The route will serve the passenger terminals at KCI and connect to key points in the downtown area, such as the River Market Streetcar station, the convention center and Crown Center. The primary market will be air travelers, but the service will also be available for employees of the airport area. This system will include:

- Electric transit vehicles with automated electronic braking (AEB), adaptive cruise control, and lane centering (NHTSA Level 2 automation);

- CV Technology using Cellular V2X/I and V2I RSU Units; the roadway infrastructure will need to be determined during an initial feasibility study. Existing KC Scout communications network assets along the corridor will be leveraged in deploying the RSUs.
- The system may be expanded to include a dedicated lane for testing highly automated AVs or shoulder running; MoDOT will leverage their Road to Tomorrow initiative to solicit proposals from private firms to use the I-29 right-of-way to expand technology along this important corridor.

### 1.6.2 Deployment Approach

The AV shuttle roll-out includes 3 phases: preparation, testing, and demonstration, as shown in Table 1-14. The first year will focus on defining the service and developing data and communication systems. The second year will include equipping vehicles and implementing the Operations Center and software application. During this timeframe, vehicles will be tested with data, communication, and Operations Center systems. Towards the end of the second year, vehicles will begin testing on road without public passengers. Finally, in year three, the vehicles will be ready for public use.

*Table 1-14: AV Shuttle Deployment*

Tasks	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12
<b>Preparation</b>												
Define detailed site and system operations												
Map operations area												
Deploy communication systems												
Equip vehicles												
Ready Ops Center facility												
Train Ops Center personnel and develop apps												
<b>Testing</b>												
Test (non-public)												
<b>Demonstration</b>												
Full operations with public use												

### 1.6.3 Regulatory Environment

The proposed automated vehicle deployments are not categorically prohibited by local, state, federal, or international law. As explained by Bryant Walker Smith<sup>6</sup>, a flexible interpretation of the term “driver” to include the self-driving software and/or an operator that is not present inside the vehicle is sufficient for compliance with the existing legal frameworks. At the international level, the Geneva Convention does not impact the legality of automated vehicles, and the Vienna Convention was recently updated to allow automated vehicles as long as they can be switched into manual mode. At the federal level, the USDOT NHTSA has adopted the policy of defining the self-driving software as the “driver,” which should render the proposed systems legal. The proposed automated vehicles have all the same indicators, mirrors, and driving controls as conventional passenger vehicles. Where complications arise from an unoccupied vehicle, KCMO will work with team members to seek FMVSS exemption, as suggested by NHTSA in a January 2016 policy statement. State and local statutes similarly require a flexible interpretation of references to the driver. The City will work with the USDOT to secure any additional permissions needed in deploying AVs and related technologies.

<sup>6</sup> Bryant Walker Smith, Automated Vehicles Are Probably Legal in the United States, 1 Tex. A&M L. Rev. 411 (2014)



### 1.6.4 Potential Challenges to Deployment

The proposed deployments may face challenges associated with public perception and regulatory uncertainty. KCMO will actively manage public perception to address any fears and promote the benefits. KCMO will develop and implement a public relations campaign to manage this challenge. Among the tools likely to be used include public meetings, safety demonstrations, social media highlights and public tests that include community leaders. Some citizens will have the opportunity to win a sensor for their vehicle and will serve as public leaders for the safe integration of this technology into daily life. The regulatory uncertainty arises from a dynamic federal, state, and local legal environment. To reduce the risks associated with problematic legal developments, KCMO will work with the contract team and the USDOT to share information about the deployment in order to provide decision makers at all levels with accurate and timely information to inform regulation and encourage harmonization.

## 1.7 Ability and Commitment to Electric Vehicles, De-carbonizing Electricity Grid, and Transitioning Major Fleets to Lower-emitting Non-fossil Fuel Alternatives

Underpinning the entire Kansas City Smart City effort is the electrification and decarbonization of the power grid and transportation modes. KCPL has made the largest impact in decarbonizing the grid and promoting electric vehicles. The City is already an active partner with KCPL in these efforts and will become an even closer partner in implementing further electric fleet transition, infrastructure deployment, and public outreach campaigns.

KCMO also adopted a Climate Protection Plan in July 2008. As a direct result of the plan, the City has reduced GHG emissions from municipal operations by 25% and reduced emissions citywide by 4% between 2000 and 2013. The City is currently working on a 2015 update to municipal operations GHG emissions and intends to do annual updates in the future. The City will conduct citywide GHG emission updates once every three years.

### 1.7.1 Electricity Supply De-carbonization

Over the past decade, KCPL has been a regional leader and made multiple environmental investments to provide affordable and reliable energy while improving regional air quality. KCPL's efforts are not only focused on CO<sub>2</sub> reduction, but also on additional emissions reductions critical to improved air quality. Figure 1-7 shows a brief summary of these efforts since 2005.

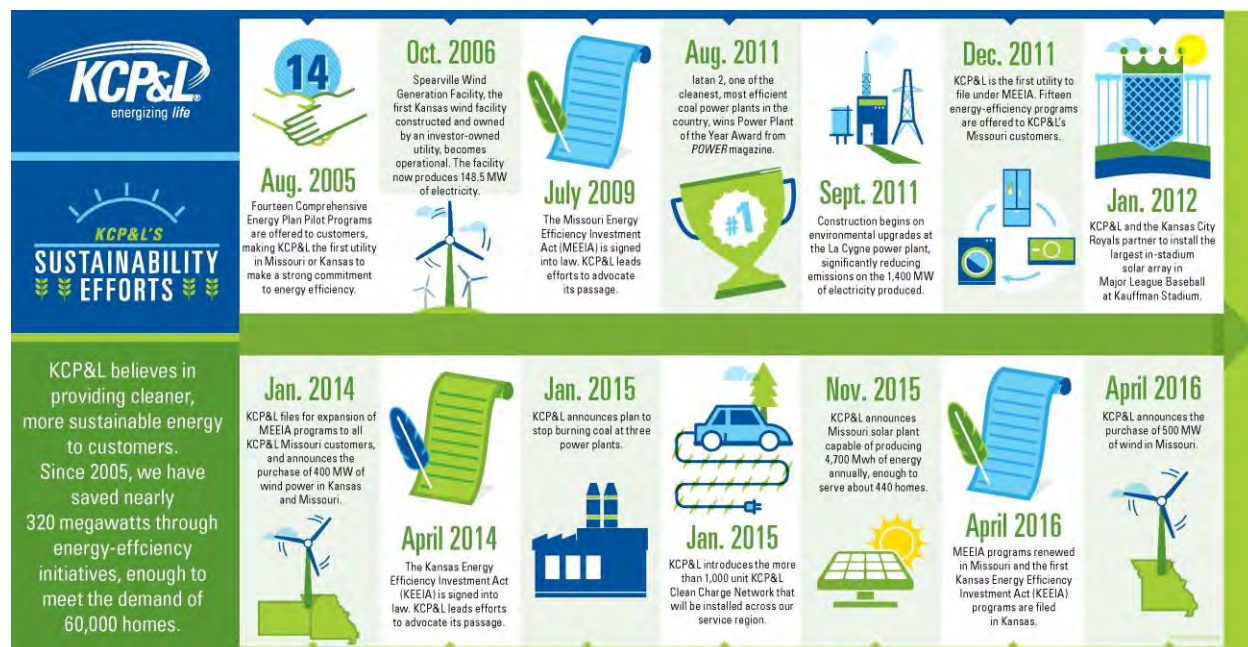


Figure 1-8: KCPL Sustainability Efforts

### 1.7.1.1 Smart Grid

In 2010, KCPL successfully demonstrated the ability to apply advanced energy controls in residential, municipal, and industrial applications to reduce energy use, and make the process fundamentally more efficient. This Smart Grid demonstration focused on a subset of the area served by KCPL's Midtown Substation, which improved service to approximately 14,000 commercial and residential customers across five square miles in Kansas City, MO. The Smart Grid Demonstration introduced new technologies, applications, protocols, communications, and business models that increased energy efficiency, reduced energy delivery costs, and ultimately reduced GHG emissions. KCPL has demonstrated a 10-year track record of reducing SO<sub>2</sub> and NO<sub>x</sub> emissions, displaying that the efforts of the smart grid demonstration and now the Smart City Challenge are capable of long term achievements.

### 1.7.1.2 Energy Efficiency and Demand Response

Since the launch of demand side management programs in 2005, KCPL energy efficiency and demand response initiatives have resulted in 621,600 MWh savings and 342 kW peak demand reduction. KCPL has embarked on a second branch of DSM programs under the Missouri Energy Efficiency Investment Act (MEEIA) legislation, which includes 382,700 MWh savings and 172 kW peak demand reduction.

### 1.7.1.3 Distributed Generation

KCPL has also been instrumental in proactively crafting state policy for distributed renewable generation. In 2007, KCPL helped write and pass the Missouri Easy Connection Act. In 2008, the company supported solar rebate incentives and renewable mandates when supporting Proposition C (the only investor-owned utility to do so). KCPL also supports net metering policies that are fair to all customers and do not result in customers without renewable generation subsidizing disproportionate renewable incentives. In 2013 & 2014, KCPL supported the retention of net metering in Kansas through helping to write and pass legislation to reform and streamline net metering. As a result, KCPL has paid out nearly \$100 Million in solar rebates to customers in Missouri.

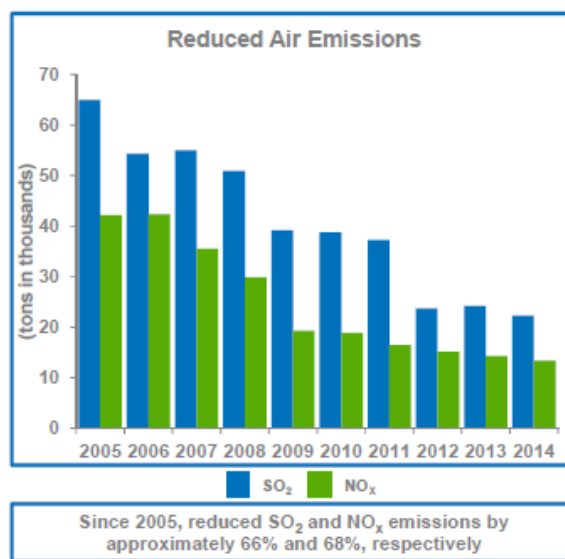


Figure 1-9: KCPL Emissions Reduction

### 1.7.2 Fleet Electrification

Kansas City is proposing extensive fleet electrification as part of its proposal including electrification of both city fleets and commercial vehicles. The transition of smaller, multiple fleets during the grant period will ensure broad acceptance of electrification and have a greater net effect on reduction of greenhouse gasses through a greater distribution of the effort across industries.

Kansas City will replace 12 non-cruiser KCPD vehicles with electric vehicles, augmenting the current budget with Vulcan funds to make up the difference between the replacement cost of an internal combustion engine-powered vehicle with an EV. KCMO will also work to replace 6 terminal yard trucks with electric trucks at Logistics Park KC and purchase 12 electric buses for the Prospect MAX line. The 8 AV shuttles along 11<sup>th</sup>, 12<sup>th</sup>, and 18<sup>th</sup> Streets will also be electric vehicles.

KCPL will also participate in fleet electrification. The current fleet transition plan will replace retired conventional vehicles with plug-in electric hybrids. KCPL's current electric fleet consists of 34 vehicles with 29 in the Kansas City metro area. 33 of the 34 cars are either electric, plug in electric hybrids or electric hybrids. In addition, KCPL has one electric bucket truck and four plug-in hybrid bucket trucks. The planning period for further fleet electrification will commence in May 2016.

Kansas City will work directly with Nohm EV and their extensive current client base of EV users (e.g., FedEx, UPS, Frito-Lay, USPS) to incentivize the purchase of electric vehicles. Nohm and Kansas City will develop a "business offering" to motivate these businesses and local businesses to purchase and use EVs in the city. The



offering may include such things as working with KCPL to purchase and place infrastructure and charging stations, providing charging capabilities at certain local businesses, and working with the City Council to create favorable local ordinances that benefit electric truck usage.

### 1.7.3 Charging Infrastructure

Charging infrastructure is an area in which Kansas City is already a global leader. The Smart City Challenge grant will further increase the usage and demand for the charging infrastructure within the City. Within the City proper, KCPL has installed 160 stations and has established an existing partnership with the City to install over 50 stations across more than 20 locations on City owned property. Data shows at in one year from the start of the Clean Charge Network initiative, charging sessions increased from 513 to 3,337, kWh usage from charging stations increased from 4,029 to 20,335, and the number of unique EV drivers increased from 88 to 548. KCPL will further partner with the City of Kansas City to ensure public charging is available within the target areas of interest. In addition, KCPL will be enabled to go beyond the Clean Charge Network public charging program and expand these benefits by partnering and contributing to the efforts described in this application.

### 1.7.4 Consumer and OEM Engagement

Getting the word out about electric vehicle adoption and charging options has been a continuous effort from KCPL through their Clean Charge Network. Current key outreach and education efforts focus on engaged EV drivers serving as affinity group ambassadors to support continued influence in the market. KCPL plans to host quarterly events that will allow open communication and network amongst drivers and industry organizations to continue the evolution of vehicle electrification in the region. The outreach will educate prospective EV users that “range anxiety” is virtually nonexistent in Kansas City because of the world leading network of electric charging stations. The City and KCPL will communicate this regional EV transformation through several tactics to engage the population and evoke customers into choosing GHG friendly vehicle options. Live events like the Smart City Challenge launch to tailgating at the World Series Champion Kansas City Royals home games are examples of outreach events. Additional media outreach includes broadcast, print, and online media to build awareness, in addition to social media communications and user generated content.

In the fall of 2016, KCPL will open a facility – *KCPL Connect, Your Energy Solutions Center* – to provide customers with an on-site center for self-serve payment kiosks and face-to-face consultations as well as education and demonstration areas for customers to learn about energy savings programs and products, renewable energy, and electric transportation. Located at 17th and Paseo, the center will be an important part of the community fabric and integrate easily with local events. A significant portion of the center’s educational focus will be dedicated to smart transportation and specifically current options for electric vehicles. Education will also include new innovations in the Smart Cities project including connected and autonomous transportation. Components of the center will include an electric vehicle with a home charging unit, an educational kiosk with changing videos in which to promote electrification, and three external charging units outside the facility.

## 1.8 Measureable Goals and Objectives

Kansas City’s technology initiatives are a catalyst for connecting communities and fostering economic development. KCMO’s currently tracked key metrics, in terms of progress, are geared toward building the capacity to plan and track existing smart city process and engagement (Table 1-15).

*Table 1-15: Current KCMO Smart City Performance Measures*

Dimension	Working Area	Indicator	Description
Environment	Smart Buildings	Sustainability-certified Buildings	Number of LEED or BREAM sustainability certified buildings in the city
	Resources Management	Total Energy Consumption	Annual Total Electrical Energy Consumption per capita (in mWh)
		Carbon Footprint	Annual CO2 emissions per capita (in tonnes)
		Waste Generation	Annual total waste volume generated by the city per capita (in kg)



Dimension	Working Area	Indicator	Description
Mobility	Sustainable Urban Planning	Green Space per Capita	Urban green open areas per capita (in m <sup>2</sup> )
	Efficient Transport	Clean Energy Transport	Percentage of Clean-energy Transport use (electric train, subway/metro, tram, cable railway, electric taxis, bicycling)
	Multi-modal Access	Public Transport Use	% of Public transit trips/ Total trips
Government	Open Government	Open Data	Open Data Use
Society	Integration	Internet-connected Households	Percentage of Internet-connected households
	Education	University Graduates	Number of University Graduates per 1000 inhabitants
Quality of Life	Safety	Crime	Number of crimes per 100,000 inhabitants
	Health	Life Expectancy	Life Expectancy at birth

Building on these current capacity metrics, we have begun the identification of key measures that will ensure we stay on track and deliver the benefits promised in our vision. Table 1-16, Table 1-17, Table 1-18, and Table 1-19 capture the proposed Smart City Challenge goal categories, as well as the objectives, and potential metrics, aligned to goals, to measure success based on USDOT's specified goals for the challenge. When developing a comprehensive Performance Management Plan, KCMO will ensure that measures and metrics support the independent evaluator's ability to conduct evaluation-related experiments, interviews, and surveys.

For the three pillars of our Smart City vision, the team will leverage KCMO's current goals and metrics, as well as develop more detailed metrics that will measure the effectiveness of our efforts along a broad spectrum of outcomes. These outcomes will include traditional transportation measures, such as throughput, numbers of incidents, and overall performance of the system, combined with new measures and outcomes that address the intended goals of the Smart City Challenge, including but not limited to:

- Use of new technologies (kiosks, transit applications, connected vehicle applications, etc.)
- Satisfaction with new technologies
- Usage of expanded transit options
- Economic development that can in some way be tied to new deployments
- Changes in air quality and congestion
- Efficiency of the freight system
- Safety along the Prospect Corridor
- Number of start-ups participating in the new initiatives
- Number of traffic collisions
- Accessibility for the visually impaired

These additional measures will each be tied to an objective of our Smart City vision, grouped in categories that correlate to each of the USDOT goal areas for the Smart City Challenge. Below we outline the measures and where they exist, based on our vision for deployments.

**Improve Safety** – By using advanced technologies, including connected vehicle technologies, to reduce the number of collisions, fatalities, and injuries for both vehicle occupants and non-vehicle occupants.

*Table 1-16: Performance Measures for Safety Improvement*

Intent	Measure	Objective/ Subjective	Related Pillars
Reduce vehicle and non-vehicle	Crash rate by type and severity: analyze safety changes by collection of crash rates (for transit, vehicle, pedestrian, and bicyclist) by type and severity through assessing changes in crashes before and after smart city deployment (CV technology, road diet, pedestrian crossing, smart lighting,	Objective	1, 2, 3

collisions	etc.) deployment, using crash data from the police department.		
	Percent of red light violations: analyze safety changes by collecting red light violation data from CV applications and intersections equipped with detection cameras before and after CV deployment.	Objective	1,3
Reduce crime	Crime rate reduction: compare current crime rate as measured by both KCPD and KCMO Public Safety during pre-and post- smart LED lighting/kiosk deployment at bus stations/smart lighting areas	Objective	1, 3
	KCPD crime statistics and resident survey	Subjective	1, 3
	Resident safety confidence level: change in residents opinion of neighborhood safety conducted through survey	Objective	1
	Responsiveness to gun-related crimes: measure the change in response time to respond to a gun-related crime before and after ShotSpotter and other smart city technologies are implemented	Objective	1
	Decreased crime rate at station areas and adjacent neighborhoods. KCPD crime statistics and resident survey to assess the perception of security.	Objective	1

**Enhance Mobility** – By providing real-time traveler information and emerging mobility services to improve personal mobility for all citizens including people with lower incomes, people with disabilities, and older adults.

*Table 1-17: Performance Measures for Mobility Enhancement*

Intent	Measure	Objective/ Subjective	Related Pillars
Reduce congestion	Travel time and travel time reliability: analyze segment travel times of buses and municipal vehicles	Objective	1, 2, 3
	Percent arrival on green light: analysis of Transit Signal Priority effectiveness in buses along equipped corridors	Objective	1, 2
Increase mobility options	Assessment of mode shift from single-occupant vehicles (SOV) to public transit, rideshare (carpool, vanpool) walking, biking, etc., through ACS Journey to Work Data. Reduction in emissions through a decrease in vehicle miles travelled (VMT)	Objective	1, 2, 3
	Improvement in the pedestrian environment measured through Walkability Assessment	Objective	1, 3
	Number of bike share users: analyze usage of bike share before and after deployment of new bike share stations and bike lanes using bike share data and/or sensors.	Objective	3
	Number of trips on bike lanes: analyze bicyclist usage of routes before and after implementing new road diets and bike lanes using bike share data and/or sensors.	Objective	3
	Number of mobility application users and satisfaction: analyze access and usage of open transportation data along with the use of new mobility applications. Survey user satisfaction of new mobility applications.	Subjective	3
Provide additional access to public transit	Number of mobility hub users and usage: analyze usage of transportation modes and the number of citizens using the mobility hubs	Objective	1
	Number of linked transit trips at mobility hubs using the multiple transportation modes and technologies (e.g., bike share, car share and demand, app based service options, etc.)	Objective	1
	Visually impaired mobility satisfaction level: remote audible signage (RAS) and visually impaired wayfinding technology will be assessed on safety and mobility through user survey.	Subjective	1
	Ridership increase for Prospect MAX based on service improvements	Objective	1
	Number of AV shuttle riders	Objective	2

**Enhance Ladders of Opportunity** – By providing access to advanced technology and its benefits for underserved areas and residents, increasing connectivity to employment, education and other services, and contributing to revitalization by incentivize reinvestment in underserved communities

Table 1-18: Performance Measures for Ladders of Opportunity Enhancement

Intent	Measure	Objective/ Subjective	Related Pillars
Improve Wi-Fi access and citizen connectivity	Percentage of city population covered by Wi-Fi: analyze Wi-Fi coverage in terms of area (sq mi) and population before and after deployment of new WiFi transmitters and innovation band testing	Objective	1, 3
	Number of city blocks covered by Wi-Fi	Objective	1, 3
	Change in the number of Prospect Corridor residents with access Wi-Fi	Objective	1, 3
	Percentage up-time of Wi-Fi	Objective	1, 3
	Number of times Wi-Fi accessed	Objective	1, 3
	Number of times kiosks accessed	Objective	1, 3
Improve economic development	Number of new building permits	Objective	1, 2, 3
	Number of business license issued	Objective	1, 2, 3
	Resident population growth: analyze increase in resident population within areas of technology deployment before and after deployment	Objective	1, 2, 3
	Reduction of commercial and office vacancy	Objective	1, 2, 3
	Investment: analyze increase in outside investment within areas of technology deployment before and after deployment	Objective	1, 2, 3
	Reduction in unemployment rate and underemployment rate measured through the Bureau of Labor Statistics	Objective	1, 2, 3
	Targeted surveys of businesses in the Corridor to determine changes in business levels	Subjective	1
	Analyze increase in jobs within areas of technology deployment before and after smart city deployment	Objective	1
	Assessment of the use of development incentives including the recently proposed “Shared Success Fund,” which focuses development in distressed ZIP Codes and is funded by successful economic development projects throughout the city	Objective	1
	Improved access between east side housing and major employment centers measured through the U.S. Census Bureau American Community Survey (ACS) Journey to Work Data and Prospect MAX On-Board Survey Data.	Objective	1

**Address Climate Change** – By implementing advanced technologies and policies that support a more sustainable and cost-effective relationship between transportation and the environment through more efficient fuel use and emissions reductions.

Table 1-19: Performance Measures for Addressing Climate Change

Intent	Measure	Objective/ Subjective	Related Pillars
Reduce GHG emissions and fossil fuel usage	Air quality sensors (ppm for specific gases)	Objective	1, 2, 3
	Analyze changes in vehicle idle time using CV technologies	Objective	1, 2
	Number of fleet and private EVs	Objective	1, 2
	Analyze changes in GHG emissions based on new electric vehicle fleet deployments and CV application implementation.	Objective	1, 2
	Analyze fleet vehicle travel changes for CV application impacts and apply customized emission rates obtained through the Environmental Protection Agency Motor Vehicle Emission Simulator (MOVES) modeling system.	Objective	1,2
Reduce electricity usage	Number of street light replacements with LED lights	Objective	1, 3
	Reduced electricity usage through smart city lighting and solar power at Prospect MAX stations measured through average kwh	Objective	1





The Mid-America Regional Council (MARC), along with KCATA and the region's transit providers, is currently in the process of updating the region's long-range transit plan, Smart Moves. The new plan, RideKC Regional Transit Plan, will not only focus on transit, but will also address jobs accessibility, land use, economic vitality, multi-modal connectivity, and funding. A detailed implementation strategy will be the centerpiece of this plan; and, utilizing performance measures and targets, will help ensure progress can be tracked and be held accountable by the public and community stakeholders. The goals and measures for the Smart City initiative will be a high profile integral component of the regional effort. This will include a public-facing data-sharing dashboard interface that is user friendly and will also support official transit performance measures and targets to be developed through the RideKC Regional Transit Plan process

## 1.9 Standards, Architectures, and Certification Approach

The National ITS Architecture is a mature architecture that provides a common framework for the ITS community to plan, define, and integrate ITS solutions. The Connected Vehicle Reference Implementation (CVRIA) was developed to extend the National Architecture to include detailed information to support development of fully interoperable regional connected vehicle architectures. The CVRIA and the associated Systems Engineering Tool for Intelligent Transportation (SET-IT) software tool will be fully integrated into the National ITS Architecture and software toolset to support development of interoperable architectures including complete ITS infrastructure and connected vehicle capabilities along with interface information needed for standards selection. The CVRIA is based on a set of applications defined by various connected vehicle programs. The source for all the application descriptions ranges from ConOps, Requirements Specifications, or existing Standards and Architectures.

Kansas City will rely on CVRIA and its own regional ITS Architecture to identify relevant applications and technologies to: reduce congestion, keep travelers safe, protect the environment, respond to climate change, connect underserved communities, and support economic vitality. CVRIA will allow Kansas City to identify the type of application and hardware and software required to implement the application.

The Kansas City Regional ITS Architecture will help the deployment of interoperable systems without impeding innovation as technology advances, vendors change, and new approaches evolve. The regional architecture is built upon standard documents from organizations such as AASHTO, ITE, NEMA, APTA, ASTM, IEEE, and SAE. An example of a regional standard that will be used to help Smarty City development in Kansas City is the ASTM E2468-05: Standard Practice for Metadata to Support Archived Data Management Systems. This standard includes, but is not limited to, data management standards for RIDESHARE, KDOT Traffic Data Warehouse, KDOT KanRoad Reporting System, KCMO Parking Management, KCATA Operations Center, and Kansas City Scout Operations Center.


Prior to deploying V2X communications equipment to implement CVRIA applications, the equipment must be certified to operate in vehicles and on the road. Kansas City will leverage the certification procedures developed by the CV Pilot teams, in coordination with the Certification Operating Council supported by USDOT, in developing the certification strategy for V2X communications equipment deployment. Kansas City will also work with OEMs and equipment manufacturers to test and evaluate AV equipment to support safe and secure operations in an urban environment. Our potential partners have been active in CV standards development, as well as certification testing procedures development.

In using existing standards and architectures to develop detailed ConOps and systems engineering plans, the Kansas City team will also coordinate with standards organizations, such as IEEE and SAE, to participate in standards development working sessions and provide feedback to improve standards and architectures throughout the challenge based on lessons learned. The team will maintain a central databased for lessons learned with a category specifically for recommendations to improve and sustain specific standards and architectures that support smart city, CV, and AV technology deployment.

## 1.10 Systems Engineering Approach

Every project should follow a disciplined systems engineering process from the beginning of planning through the time when the systems or technologies become operational. U.S. DOT's definition states: "Systems engineering is an approach to designing projects that employs an iterative process in the design, testing, and evaluation of the implementation. A systems engineering approach requires the project team to consider all phases of a system's lifecycle from the moment of the system's conception to its installation. This means taking into consideration the





stages of planning, design, procurement, deployment, operations, maintenance, expansion, and retirement of the system or subsystems. This approach also requires a project team to:

- Identify alternatives at each step of building the system
- Evaluate each alternative based on costs, political and technical considerations, and customer needs
- Consider what risks exist throughout the process and plan for their management

Our standard systems engineering approach for the development of any ITS application is consistent with U.S. DOT's definition of systems engineering, and dictates that the development and integration of systems follow a systematic and well-detailed approach. Throughout the process, key analyses and tradeoffs are conducted, including cost/benefit, performance needs, technology assessments, implementation risks, and an assessment of operations and maintenance requirements.

The first step of the process is to provide a well-documented concept of operations (CONOPS). This provides a point of departure from which the requirements of the system can be discussed in a meaningful and consistent manner with the stakeholders, and ensures that the project will follow the needed steps of development, design, and deployment. A process to identify all of the user requirements follows completion of the CONOPS. This step involves discussions with all agencies, organizations, and individuals that have an input into the functionality of the system. These users are encouraged to describe the ultimate functionality of the system without regard to cost or schedule considerations. The purpose in doing so is to provide a definition of the "ultimate" system capability. The third step involves the identification of the system requirements necessary to support the large majority of the user needs.

The next step of the process is to analyze the user and system requirements developed during the earlier steps and develop a system architecture. This step will also identify those elements of any existing systems, including software, computers, and communications, that will require modification or replacement. The list of requirements is prioritized and then balanced against the available budget. Those requirements that can be reasonably implemented within the system, given the cost and schedule constraints, are identified. These requirements then become the technical baseline for the project.

With the full set of implementation requirements identified, the project enters a detailed design stage. During this step, the specific elements of the software and communications system designs are developed. This stage of the work often involves the development of procurement documents that can be used by the agency to select system vendor(s). With detailed design complete, the project enters the system implementation phase. During this stage, each of the elements of the design is implemented, integrated, and tested by the vendor and other members of the project team.

Once the system is integrated and tested, it is ready for operational use and maintenance. In addition to the basic operational use of the system, system parameters will be adjusted and refined to ensure the most efficient operation. System elements will need to be monitored and maintained to retain reliability.

## **1.11 Safety Management Approach**

Safety is paramount during all projects and KCMO will place safety considerations at the forefront of all Smart City Challenge initiatives and technology deployments. The special challenges of this deployment effort adds uncommon and complex public safety issues, especially for AVs. Recognizing this, the team will work diligently to mitigate the associated risks. KCMO will develop a Safety Management Plan in conjunction with the ConOps. Key partners will provide input to the plan, bringing extensive experience with safety considerations on roadway, transit, CV, and AV projects. KCMO will also utilize public Safety Management Plans and lessons learned from similar projects, such as the current USDOT CV Pilots, to help guide development of a holistic Smart City Challenge Safety Management Plan.

The safety management plan develops a set of safety scenarios for the solutions and technologies prior to implementation within the KCMO Smart City Challenge. Safety scenarios include an evaluation of potential impacts and the mitigating benefits of fail-safe or other appropriate actions for the applications provided in the program. The development team will produce a set of safety needs from the scenario-based analysis. The Safety Management Plan will identify levels of safety risk associated with the solution and technology deployment by adopting or adapting standard safety practices for production, such as ISO 26262 and Automotive Safety Integrity Level (ASIL) hazard



analysis and risk assessment. In addition, KCMO will but also adhere to equipment installation safety standards as prescribed by OSHA, MoDOT, KDOT, KCATA, and intermodal facility stakeholders.

The test conductor will perform an Automotive Safety Integrity Level (ASIL) style of analysis or develop appropriate measures using system engineering and project management principles. These will include, but not limited to, bench and field testing in isolated environments and pre-technology deployment dry runs. The combined safety testing and risk management efforts will lead to safe deployment within KCMO and the surrounding area.

Currently known safety solutions and issues to analyze consist of, but are not limited to, use of fail-safe design, fault-tolerant design, redundancy design, problems that could arise from latency delays in data transmission and processing in real-time field tests, and other issues. Given the extremely dynamic environment of vehicle, bicyclist, and pedestrian traffic within KCMO, particularly the diversity and complexity of electronics that will influence driver behavior and operate AVs, the City will exhaust every effort to anticipate the safety needs of the challenge participants and the non-participant travelers.

## 1.12 Communications and Outreach Approach

KCMO will develop a Communications and Outreach Plan that will articulate the **media strategy** for local and national press, media coordination with the USDOT, **web and social media presence, trade show strategy and budgets, local outreach strategy, initiatives to increase community awareness, and a crisis communications plan**. The plan will propose how to interact with other USDOT efforts, such as the CV Pilots, and how we will accommodate site visits and demonstrations. The plan will detail the public relations and marketing activities that will occur through the creation of **talking points, briefing materials, and articles for the news media, news releases, fact sheets, media kits, videos, and trade show events**. We propose regularly scheduled meetings to keep outreach efforts well-coordinated internal to the project team, partners/stakeholders, and with USDOT.

The Communications and Outreach Plan will also include a stakeholder outreach plan during the first phase of the Smart City Challenge grant. We will develop a comprehensive list of stakeholder groups to connect with, and search for opportunities to conduct listening and feedback sessions to understand the needs of the variety of interested communities and ensure that they are attended to during our planning and deployment processes. Consistent and regular communications throughout the project will ensure that we maintain strong relationships and take advantage of all potential partnership opportunities.

### The Communications and Outreach Plan

Successful programs engage in local outreach efforts early. The best way to overcome misperceptions and build factual understanding is working with a broad base of local stakeholders. This creates a well-informed group of **policy makers, citizens, and media** on the local level that become **champions**, helping spread the smart city story throughout the region. Critical to developing strong and valuable partners with a diverse set of **public agencies, private industry, academia, various trade associations, and non-profit organizations** is gathering feedback on insights, needs, and concerns with any Smart City plans.

The project website and on-going social media will be the primary methods to demonstrate the project to the rest of the country and the world. The team's web, graphic design, photography, and HD video production capabilities will provide the resources required to update content while focusing on the benefits of smart city technologies, including AVs, CVs, and EVs. The website will include the latest news coverage and a section offering expert sound-bites, photos, and infographics for the media to use when covering the story. Social media is constantly evolving, and each agency involved in this effort has its own social media policies. We will provide social content that is appropriate for all partners, recognizing and respecting the policies of each agency.

The team will propose a full calendar of trade show conferences and events to attend. Members of our team already regularly attend ITS America Annual Meetings, World Congresses, and many other engineering, smart city, automotive, transit, freight, and safety events. Kansas City actually hosts an annual smart city conference known as the Gigabit City Summit. In 2015, 50 communities and 250 delegates attended the conference to network, learn, and share insights on developing smart cities. Our media relations efforts will support the personnel presenting,





demonstrating and exhibiting. A news release and electronic media kit will be developed. Video and photos will be taken of the exhibit, and the expert spokespeople to be used on the project website, in social media and in other outreach efforts.

We may also engage the media in helping us recruit drivers for the CV piece of the effort. The project website will be developed to make it easy for the local community to learn about the project and to qualify to participate in it. We will establish clear guidelines for participants and target the most relevant groups for participation. The most effective outreach for the Smart City Challenge will be site visits and demonstrations. KCMO will showcase our demonstrations to a wide variety of stakeholder groups.

To provide consistent messaging, a brand and tagline will be developed for the pilot program that will be used for all outreach and marketing materials. A unique brand will provide a strong identity for the pilot and at the same time will clearly position it as a joint effort of the USDOT and local agencies.

KCMO will detail a protocol to identify and swiftly respond to a crisis. While not all circumstances can be anticipated, our plan will cover issues that could arise from a crash or injuries involving a challenge vehicle or participant, local protesters that may seek to undermine the advancement of technology, or natural disasters that can have an adverse effect on a program resulting in damage to equipment and a setback to the timeline or perception.

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## 2 Data Management Approach

### 2.1 Data Management Plan

A smart city is a collection of cyber-physical systems that form a broad ecosystem, and data are the lifeblood that run through it. This data is typically stored in disconnected systems, where it is rapidly diversifying in type and exponentially increasing in volume. To manage data effectively, it is important to understand the scope of the smart city system to identify all points where data flows in and out, procedures for how to handle different types of data, and where those data are stored for long-term use.

Each layer of the Data Management Reference Architecture (DMRA) needs to be understood to measure what is required to support the effort ranging from infrastructure, city management, federal oversight, commercial partnerships, and public use. The ultimate intent is to collect the data generated by the city itself, and through proper care and management publish the data back to promote innovation and progress towards the Smart City Challenge goals.

It is important to note that the DMRA consists of systems, infrastructure, and applications and governance policies that are part of efforts underway through key initiatives supported by the City. Systems such as Cisco and CDP are representative examples. The DMRA schematic represents an evolution of the work underway and how new efforts will weave into that fabric securely and effectively. Figure 2-1 outlines the Kansas City DMRA that maps out the different layers of data collection, communication, storage, analysis, and provisioning



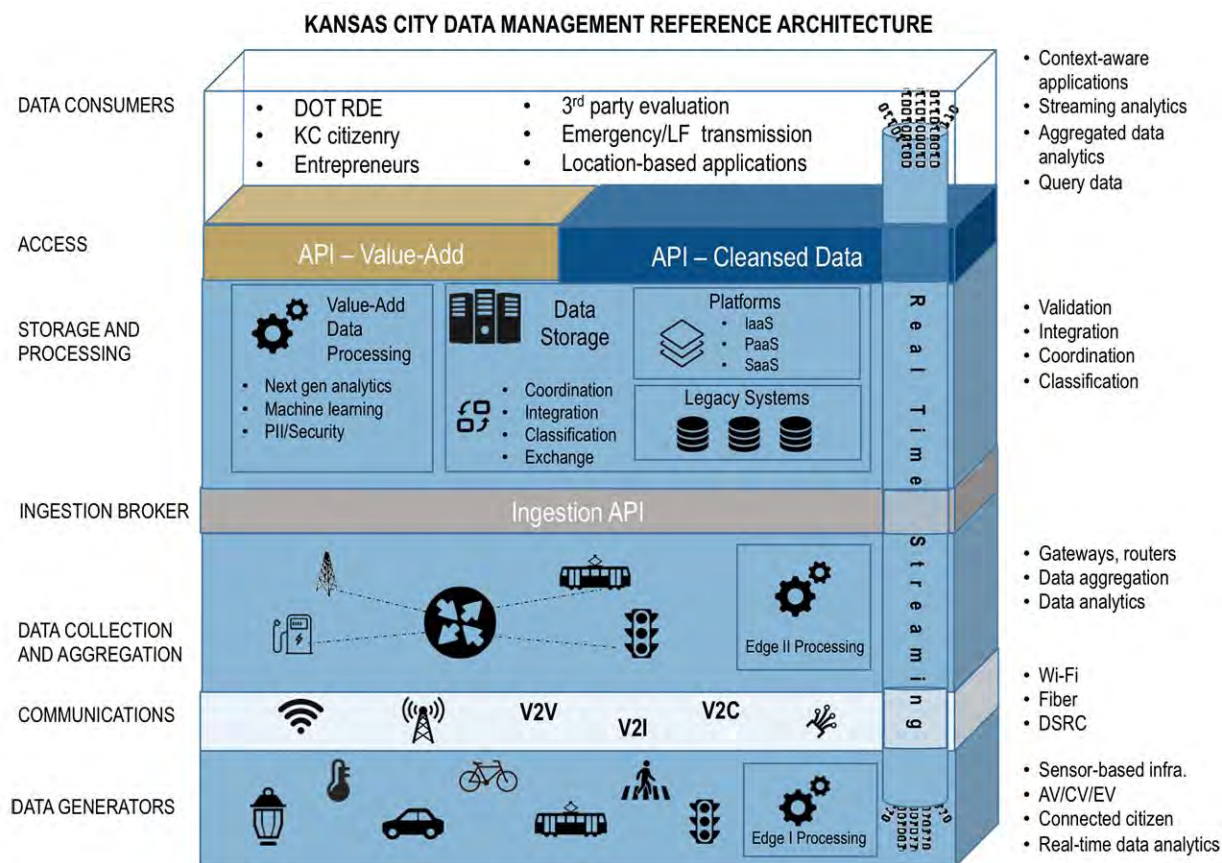


Figure 2-1: Kansas City Data Management Reference Architecture

A foundational data management approach will ensure flexibility to collect and safely transmit data, secure sensitive and potentially private data, conduct analyses at the local site and more centrally, and seamlessly use archived data in future analyses. The following sections do not prescribe but rather assess data management considerations across important data elements: ownership, formatting, quality, governance/security, retention, and availability. The effort of building a Smart City requires a broad set of guiding principles that adapt and evolve over time in adherence to federal government standards around data management. This data will form the foundation of efforts to improve city conditions and initiatives as innovators, developers, and businesses draw insights and develop applications that move Kansas City further towards its goals of providing mobility, accessibility, safety, and quality of life improvements. It will also serve as a catalyst to the sharing economy as services such as Bridj, Uber, and Lyft force cities and service providers to think differently about the way cities function.

### 2.1.1 Types of data produced

#### Data Generation

As represented in the Data Generation layer of the DMRA, Kansas City's network of sensors will generate a range of data at different rates as prescribed by governing standards. The following table lists out a representative sample.

Table 2-1: Representative Sample of Data Sources and Descriptions

Data Source	Description
Connected and Autonomous Vehicles	CV data conforming to SAE standards and are collected by Roadside Units to the digital ecosystem for applications. In addition, these vehicles can also act as probe-vehicles reporting traffic status at a higher resolution. VSD standard format used
Parking Meters	Occupancy status, payment status



<b>Pavement Sensors</b>	Bridge conditions, pothole detection
<b>Roadway Detection Sensors</b>	Loop-, video- and radar- detectors are existing legacy sensors that report roadway travel speeds and uses NEMA standards
<b>Environmental sensors monitoring weather, air-quality and precipitation</b>	Warn citizens of higher ozone levels and such, and identify potential zones for traffic control.
<b>Energy grid sensors</b>	Real-time energy consumption data from charging electric vehicles as well as available electric charging stations
<b>Car/bike share data</b>	Usage statistics, location tracking
<b>Transit vehicle data such as schedule, occupancy</b>	Real-time transit applications, multi-modal wayfinding; GTFS format
<b>Telecommunications Platforms</b>	Sensity and Cisco telecommunications
<b>Spaces</b>	Place-making spaces, innovation corridors
<b>Environmental</b>	Argonne National Labs Sensors

The network of sensors will generate data that is either (a) processed and analyzed onboard the infrastructure from which it is generated, (b) communicated to other pieces of infrastructure for sensor-to-sensor based communication, or (c) sent to a data aggregator that will bundle the information and route it to a data storage provider via a data ingestion API. Data generated at this level based on physical interactions with citizens and infrastructure is referred to as “the edge.”

As edge-based technology continues to improve, the ability to run real-time analysis on edge devices increases. Planning efforts will account for edge-based infrastructure enhancements, systems design and analytics processing to promote a continual evolution of smarter “things.”

### Data Collection and Aggregation

Before data is sent to data storage and processing centers, it will need to be bundled, packaged, and sent over secure communication lines. That processing will happen at gateways located throughout the city that serve as these data collection and aggregation engines. Gateways are relatively small and can be integrated into other pieces of infrastructure such as light posts, kiosks, or other large-scale equipment.

### Sensor-to-Sensor Communication Example

Connected vehicle data will use Dedicated Short Range Communications (DSRC) to enable Vehicle-to-Infrastructure (V2I) communication with the roadside units (RSUs). Sensors will use on-board intelligence to run analysis at the edge and provide realtime feedback to drivers while also leveraging fiber-optic or wireless communication protocols to push data up to data storage centers for processing and analysis.

### Data Storage and Processing


Data generated at the edge will be sent to data storage repositories for processing and analysis via ingestion APIs. The APIs provide a seamless, accessible, and extensible means to process incoming data, providing a standard for devices and infrastructure to push data into the system while also allowing new platforms and tools to come online behind the API. The storage layer itself is meant to represent a vast array of data sources from on-premise Kansas City data storage facilities and existing cloud-based infrastructure. It also represents where new cloud-based systems supported by Amazon, Cisco, or others should be considered. Value-added data analysis will also be performed at this layer. All of this information will then be stripped of any Personally Identifiable Information (PII) or other sensitive information prior to being surfaced to data consumers through APIs.

### Data Consumption

Any individuals, City managers, federal oversight organizations, or other third parties will access data through an API, which provide a level of abstraction and a way for data consumers to reliably access data and build applications. This will provide the means for entrepreneurs to innovate, City managers to glean insights, and USDOT and/or third-party evaluators to access an open data ecosystem.

Types of data available to consumers will fall in to one of three categories:



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1. **Real-time Data:** Data applications use real-time data to perform streaming analytics and support decision making. For example, kiosks at bus stops provide traveler information to citizens or emergency management centers provide real-time traffic information to emergency vehicles.
  2. **Aggregate Data:** Agencies such as Traffic Management Centers and transit agencies will use aggregate data for usage statistics and to detect anomalies and develop/match performance targets.
  3. **Queryable Data:** Non-real-time applications would have access to data that is queryable from the storage layer to understand traffic patterns for a typical Monday, or even the possible bus routes between point A to point B.

### 2.1.2 Policies for Re-Use, Re-Distribution, and Derivative Products

Kansas City will make all data public whenever possible and in accordance with Kansas City data privacy principals. The DMRA approach provides a shared public/private broker for data providers to store information about the city and its resources in a consistent, open, and accessible way.

A critical component to expanding the amount of data available for city services is the ability to store public and private data about cities in a consistent, secure way. The data platform provides infrastructure to facilitate this kind of storage and access without concerns of loss of control. All software products resulting from this project will be re-usable and redistributable as part of Kansas City's open data initiative. Appropriate licensure policies and procedures will be analyzed as part of this effort.

Kansas City has already demonstrated the capacity to implement these policies and protect data. With the opening of the streetcar, the City had to define a policy before initiating the public sensors along the streetcar corridor. With regard to the Wi-Fi, Sprint, and Pinsite Media owned the specific IP address level data, the City receives anonymized, aggregated data that reflect the health of the community based on publicly available datasets. In collaboration with the UMKC Law School, the City was prepared long before the first individual accessed the public internet system to protect that person's privacy as well as learn how to better respond to that person's needs.

### 2.1.3 Policies for access and sharing data

#### Data Access

Kansas City will employ a data classification policy and system compliant with ISO27001 standards. Data is classified based on its level of sensitivity and potential impact should that data be disclosed, altered, or destroyed without authorization. This will apply to both data that is collected directly by the City as well as data that are shared with the City from third parties, such as private sector companies sharing their proprietary data with the City for research and operational purposes.

The data platform has the potential to handle PII from a variety of city and private data sources. The City will establish a framework that categorizes identified people and objects related to stored data, and map them to public and private spaces. This framework will be used to guide the collection and management of data as either default open, available for limited access, or default closed.

#### Data Security

Ensuring security of the system and any data that is produced, communicated, and stored, is an essential need for trustworthy and accessible smart city solutions. Kansas City will review and update its current data privacy principals and guidelines to ensure that access to PII, Protected Health Information (PHI), and any other identifying information will be protected at appropriate levels. The City will employ industry best practices by developing a Security Plan that will review all data and its transmission according to NIST standards based on the need for Confidentiality, Integrity, and Availability. The Data Privacy and Security Plan will include required controls and the use of the appropriate encryption or other security-based solutions. We will draw from existing data security requirements and systems developed for similar systems, such as the CV Pilots, and NIST access control documents.

#### Data Privacy

The potential for PII, PHI, sensitive business information, and state and federal information needs to be addressed at all levels of data management from creation to ingestion and further processing related to securing the data and running analysis. There are especially strict rules around transmitting PHI, though the interpretation of "transmission" can take different forms. We will incorporate the most current interpretations of how PII/PHI can be



used and stored, always abiding by corporate privacy controls and local regulations that may have different requirements depending on site location.

### Data Format and Extensibility

Data comes in many formats and sizes, and part of the purpose of the DMRA is to help promote proper monitoring and controls. By creating normalized, yet adaptable, data schemas across our virtualized data network, KCMO can accommodate for the rapidly changing needs of the city and our infrastructure. Entirely new data types without a standard schema can also be added to the data platform, for instance if cities provide novel transportation systems or use third-party services to handle uncommon city resources.

### Infrastructure Security

Kansas City's end-to-end smart city deployment requires a multitude of infrastructure components and devices. These infrastructure components can be classified into the following categories: street devices, network access (wired and wireless), core and distribution network data center layer, and cloud components.

Security will be included in each component piece of infrastructure and also examined from an end-to-end perspective. At the street devices layer, Kansas City will consider device security aspects like device authentication, identification, data encryption from sensors, and tamper resistant, evident, and detection hardware implementation. We will leverage the existing security systems developed for connected transportation infrastructure, such as that being piloted in the CV Pilots, and extend the same consideration and threat assessment to new infrastructure components that may not yet have been accounted for. A complete threat assessment and specification of the needed controls based on industry best practices will include security of infrastructure components, as well as data.

### Data Provenance

Some use cases may require special steps to ensure data provenance. Data tags can identify where and when data was generated. In cases where additional information is needed, such as how data has been used, and which customer it came from, methods such as audit trails, examining lineage to estimate data transformations, and conducting other analyses will ensure data provenance identification.

KCMO's Smart City architecture provides for secure end-to-end routing from source to destination, with discrete user authorization and detailed, real-time visual chain of custody and metadata (data provenance). The ability to equally support security and encryption on small scale, Java Virtual Machine (JVM) capable data sources from the edge of the Internet of Things, to large-scale enterprise clusters in support of the Internet of Anything ensures high trust of analytical outcomes and its underlying data.

#### 2.1.4 Plans for archival and preservation of access

Given that the nature of a Smart City is a system of systems, it is critical to establish a core set of guidelines and principles that will govern archival and preservation. The list of repositories, metatags and classification systems, and dissemination practices will evolve over time.

All data entering the system will be tagged with metadata to ensure discoverability. Tags will allow consumers to locate data in a timely manner. Vendor and partner equipment used at the edge will be vetted to ensure adherence to relevant industry standards. Metadata will adhere to the US Federal Government "Common Core" metadata provision.

Archives will allow for creation and maintenance of persistent identifiers throughout the lifecycle of the data. For a scalable, secure, and federated data storage solution, KCMO will use Amazon Web Services for infrastructure hosting and data storage. The City will make real-time data available to applications as well as push out a copy for archival purposes. All data marked as public will be automatically classified and published to Kansas City's existing Open Data Portal. The archives can be:

1. **Quick-Access Queryable Archives:** This holds all the data that would be queried frequently by non-realtime applications. For example, a TMC that needs to know the average level of service for the last day or week would query data from this archive for computation.
2. **Infrequent Access Storage:** Owing to the massive size of data, the "stale" data that would not be used frequently will be pushed into a long-term infrequent access storage.



## 2.2 Current Data Collection

Kansas City currently collects a broad range of data relating to city service operations and assets. Many key data sets are provided in a machine-readable format through the City's open data portal, Open Data KC. The City's Data Governance Committee is currently undertaking a department-by-department data inventory to identify and prioritize other high value datasets for public release.

Kansas City has already started creating a master asset database that integrates across departments and regional agencies. The City is moving beyond basic asset management and into mapping entities and how they relate to each other. This entity mapping resides in a master metadata (file) that mitigates the need to have all data stored in one database. This data will be made public through the open data portal to allow for crowdsourced enhancement. The current database will be augmented with the offer from Sidewalk Labs' use of Google Streetview to create an inventory of all parking spaces and policies. By better managing assets, we can extend the life of vehicles and critical infrastructure.

Open Data KC also helps to feed the City's public-facing performance management program, KCStat. KCStat focuses on monitoring the City's progress toward its Five-Year Citywide Business Plan through monthly meetings as well as the KCStat Dashboard, which provides an "at-a-glance" view of the Business Plan's goals, objectives, and metrics. Underlying KCStat and the City's strategic goals, DepartmentStat is a collaborative effort between the City Manager's Office and key service departments to utilize data-driven management to meet departments' goals. Not only does this effort focus on building capacity for data analysis, but these operational goals also are foundational for the City's pursuit of its strategic goals.

Kansas City has been recognized as a national leader among cities who are using data to improve the lives of residents and to foster innovative ideas and initiatives. Two recent accolades have recognized Kansas City's strategic use of City data:

- The Ash Center for Democratic Governance and Innovation at the John F. Kennedy School of Government, Harvard University, recognized Kansas City's use of citizen survey data as part of the 2015 Bright Ideas program.
- Results for America, a national organization committed to municipal governance driven by data and results, has added **Mayor Sly James to its Moneyball for Government All-Star Team**.

Kansas City has partnered with What Works Cities, a national initiative to help 100 mid-sized cities enhance use of data and evidence to engage residents, make government more effective, and improve residents' lives. This partnership has led to greatly expanding the existing open data efforts in alignment with best practices. The City also recently passed a revised Open Data policy that created the position of Chief Data Officer, extends open data to component units, and required more accountability from departments on opening up data. This new policy helped form a Data Governance Committee to build internal data capacity, stewardship, and utilization. After reviewing against privacy policies, new data and information generated during the Smart City Challenge will be shared with the appropriate partners such as KCATA and KC Scout, as well as published to Open Data KC and KCStat.

KCMO's Department of Public Works is an early adopter in asset data collection technologies. For example, they already deploy telematics devices and sensors on snowplows and work trucks to enable better fleet management, as well as citizen transparency into road maintenance and conditions.

Additionally, Kansas City has contracted with Stantec to create a video inventory of the City's street level assets. Stantec drove a van around every single city street to capture video and sensor data. The sensor data provides insight into road condition (smoothness, cracking, etc.). The City is then able to purchase the data from Stantec by asset class. Currently, Kansas City has purchased the street quality data. This information was prioritized because street quality is constantly one of the top areas for improvement as shown by our quarterly citizen survey. Kansas City has the option to purchase data on: bridges, curbs, sidewalks, guardrails, retaining walls, signs, streetlights, traffic signals, ADA ramps, bike lanes, parking meters, pavement marking, catch basin & inlets, fire hydrants, trees, water valves, manholes and ATA Bus Stops. We believe this data will be an asset when prioritizing investments for deploying Connected and Autonomous Vehicles.





## 2.3 Data Integration

Kansas City proposes to collect multiple new data sets during the Smart City Challenge including, but not limited to, vehicle situation, social media, transit user volumes, and population movement data. This data will be used to optimize transportation services as well as to feed the data analytics platforms discussed in the Urban Analytics vision element. A data bus will be developed to receive data feeds from new intelligent infrastructure, sensors, CV, AV, and potential partners (e.g., ride-hailing companies). As with all other systems, the data bus will be developed with privacy and security as primary objectives, while providing machine-readable, real-time application program interfaces. Kansas City will manage this new data with team partners and share as appropriate with Open Data KC based on open data policies to fuel entrepreneurship and innovation. When integrated, partners and transportation providers and managers such as KCATA and KC Scout will use the existing and new data. The newly integrated data will be used to address further city challenges and improve the quality of life for all citizens by making city service delivery more customized, targeted and seamless.

Kansas City will work with other entities to integrate data to provide synergies for urban analytics and innovative applications. The integration of data currently takes place through algorithms developed by City of Kansas City Office of Performance Management or developed by a contractor supporting that office. In the Smart City Challenge, the Office of Performance Management will work with partners to create a data hub that will integrate data from multiple organizations into a single platform. This new system will provide data in a machine-readable format, a portal for developers to build applications and tools, and data logs for interested parties to conduct research.

Integrating data with KCATA and KC Scout could realize huge benefits in optimizing transportation services and investment in transportation services and necessary infrastructure. Other benefits of integrating data from existing and proposed new sources include, but are not limited to:

- Gunshot detection data will be integrated with data on patrol car usage to improve public safety and asset use
- Population density data may lead to changes in education, training and aid agency planning activities
- Population density data may also encourage business development on Prospect MAX corridor, especially with increased public safety that is data supported

KCMO will develop additional analyses to understand where the need for new technologies exist, as well as targeted plans and processes that will integrate new technologies and data management techniques in order to further improve efficiencies in operations and safety. These efforts will have a downstream impact on the economic well-being of the region, reduce pollution associated with the transportation industry and large numbers of freight movers, and improve worker safety for all the firms involved in these operations. Close collaboration between automobile manufacturers, analytics firms based in Kansas City, and universities will pave the way for future implementation in similarly sized and larger cities.


### Sidewalk Labs

Sidewalk Labs will be an important part of the broader deployment. In an effort to ensure the best use of resources, KCMO will offer guidance to Sidewalk Labs on the platform that they want to build and how to best deploy their solution in such a way that it is not duplicate to the existing Cisco platform in Kansas City, but rather augments and compliments KCMO's existing data infrastructure.

## 2.4 Data Policies

Kansas City adapted Resolution 150288 on April 30, 2015. The resolution expresses the Council's support of data privacy principles and directs the City Manager to implement data privacy best practices and report on implementation efforts. The City's Smart City Advisory Board receives quarterly updates on data collected and how it is used. The City Office of Performance Management and Office of Innovation also report semi-annually to the Council at the Open Data Review, or KC Stat. Among the principles that the city holds are:

- Kansas City is committed to only using data in a manner that is consistent with the context in which it was collected.
- Kansas City believes people have a right to control what personal data is collected from them and how it is used.

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- Kansas City believes that people have the right to understand and have access to information about their data privacy and security.
  - Kansas City believes that people have the right to ensure secure and responsible use of their data.
  - Kansas City believes that people have the right to access and correct their data where reasonable considering the sensitivity of the data and possibility of harm to the person if the data is inaccurate.
  - Kansas City believes that people should have an effective and responsive mechanism for exercising privacy complaints.

## 2.5 Data Partnerships

Data that can produce valuable insights often resides outside of the city, such as with other government agencies, non-profits and private sector service providers. Often, data is spread throughout the greater metro area and belongs to other jurisdictions such as the State's Department of Transportation and other cities in the metro area. Developing a trusted data sharing environment and platform will ensure that all stakeholders have access to the information they need as well as drive better analytical outcomes.

Kansas City is a metro region rich in data. Regional organizations such as KC Scout, MARC, MoDOT, KDOT, KCATA and are already collecting vast amounts of data that will be harnessed for this project:

- KC Scout has 670 Vehicle Detection Sensors (VDS) and 350 CCT cameras monitoring the major arteries throughout the bi-state metro region. KC Scout uses this data to power their Traffic Operations Center and has archived VDS data back to 2007. Additionally, KC Scout had made a real-time XML feed for their VDS data available to KCMO. All archived data can be accessed for historical benchmarking purposes, while the real-time data can be integrated into CDP for analytic use cases.
- Through MARC's Operation Greenlight Project, we will have access to signal control data on over 200 traffic signals.
- KCATA is in the process of deploying a pilot project with Mobileye. All data captured through Mobileye will be integrated into CDP for aggregation and analysis.
- KCPL has real-time and historical data on 1000+ Electric Vehicle charging stations.

KCMO is already in the process of creating data sharing agreements with KC Scout, MoDOT, KDOT, KCATA, KCK, KCPL, and other entities such as ride-hailing companies to improve urban analytics and services. By establishing partnerships and sharing data with other transportation providers and related organizations, Kansas City will be able to more effectively identify problem areas (e.g., congested corridors, unsafe intersections) within the urban transportation system. This new data could be used to further identify areas to deploy V2I technologies, improve Operation Green Light traffic signal management, and implement smart land use initiatives such as road diets. In establishing partnerships, Kansas City will analyze the data to be shared to determine the necessary controls to protect the privacy interests of citizens and public security.

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## 3 Management Approach

### 3.1 Program Management and Team Organization

Kansas City's Smart City Challenge proposal presents a comprehensive system that takes advantage of ongoing smart city development efforts, expands programs throughout the region to optimize transportation services, and advocates for continued development in the Kansas City metro area and beyond. Management of this system requires detailed planning at the strategic level to:

- Identify objectives and final performance measurement plans
- Generate CONOPS, requirements, detailed budgets, and safety and security plans
- Develop construction and implementation timelines
- Assess progress throughout the planning, construction and operations processes
- Implement changes to ongoing efforts when required
- Communicate with organizational leaders, partners, commercial firms, non-profits, and citizens
- Formalize internal City and partner process for handling support for service-related issues

Given the complexity of the system, the program management must also delegate authority for needed activities, employment of evolving technologies over the 3-year course of the grant and beyond, the various members of supporting teams, and individual project plan execution to the firms and non-profits doing the work on Kansas City's streets and in our neighborhoods. To achieve these requirements, the following program management structure is proposed:

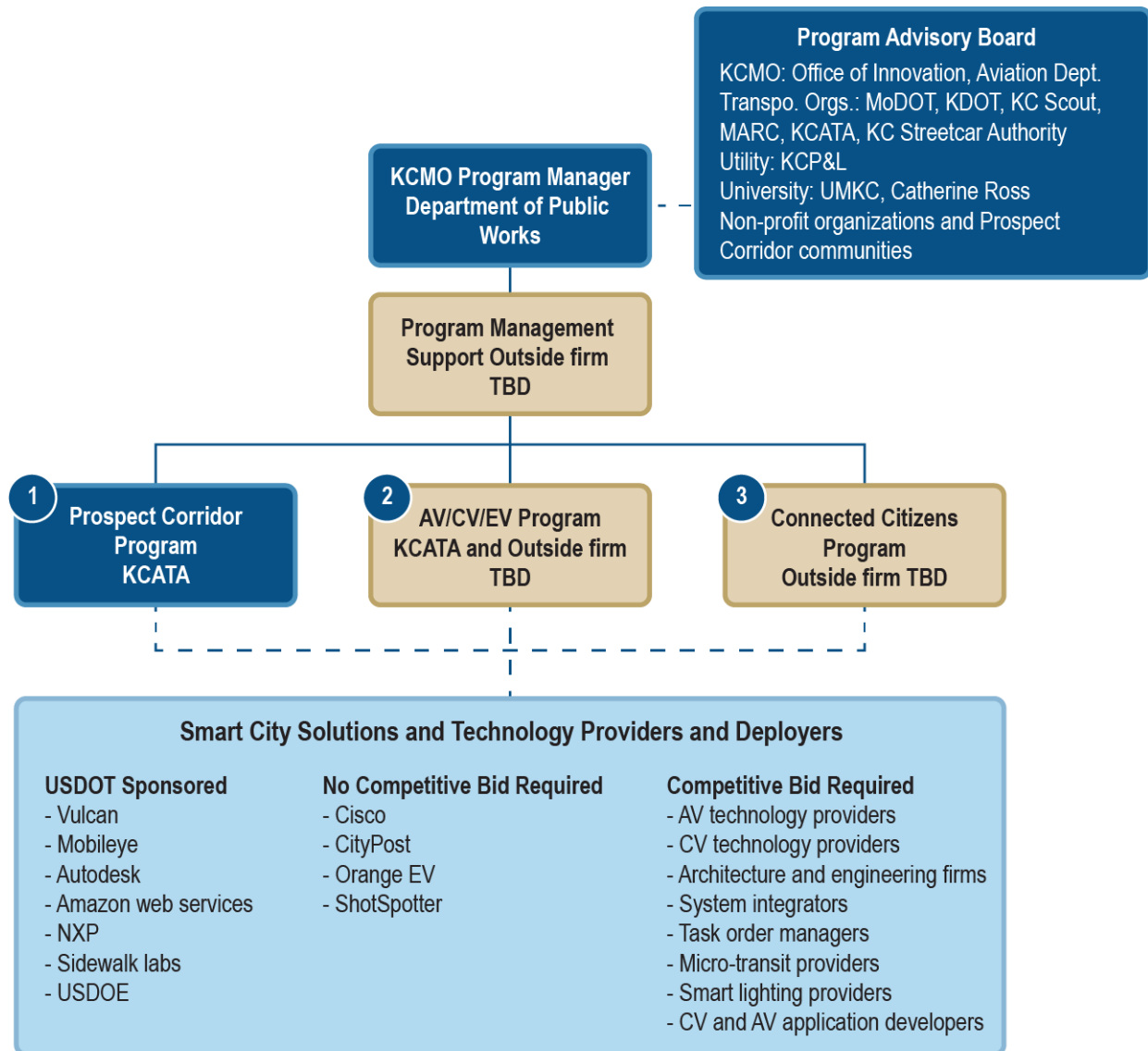


Figure 3-1: KCMO Smart City Challenge Organizational Chart

The City will appoint a single Program Manager who will serve as the City's representative for all contracts supporting the Smart City Challenge initiatives. This new position in the Public Works Department will be responsible for coordinating with and directing the activities of KCATA and other City departments as well as partner private sector firms such as the AV and CV Program Management firm(s), KCPL, and private vehicle operators. Overall management will be strengthened by the formation of an Advisory Board comprised of line managers from KCATA, involved City departments, MoDOT, KDOT, KC Scout, KCPL, UMKC professors, and representatives from local non-profit organizations. The Program Manager will also coordinate with the Communication and Outreach team, which will be led by the City's Director of Communications and will include representatives from the Mayor's Office, Office of Innovation, Mid America Regional Council, Kansas City Power and Light, KCATA, Clean Cities KC, and supporting contractors and non-profits as they are integrated into the





program. The City may hire subject matter experts to embed in the planning teams to ensure that projects are developed and that the construction of the projects is synchronized with the organizations that will ultimately operate them. The Program Manager will develop detailed schedules and assess progress toward operational timelines for their projects.

Kansas City will synchronize grant projects through the Public Works Department and the Office of Innovation and manage the grant funds through the City Manager's office. The Public Works Program Manager will serve as the primary point of contact for planning, sequencing, installing and monitoring contracts associated with the grant. In this capacity, the Program Manager will coordinate with applicable city departments and regional stakeholder organizations. The Program Manager will host weekly updates with project teams as required to ensure synchronization with the grant concept and compliance with applicable contracts and codes.

The Program Manager will provide formal updates at monthly Smart City Advisory Board meetings, and the program managers for the three major efforts will be asked to contribute to this meeting as required. The City Council will also receive formal updates through the existing KC Stat program every six months concurrently with the Public Works update (each monthly KC Stat session focuses on a different city department). The City will update the existing publicly accessible KCMO Smart City web site detailing the Smart City Challenge programs, and it will include an updated dashboard detailing progress toward meeting the scheduled opening date of operations, copies of formal progress reports, news about ongoing initiatives, links to more information about technologies used and feedback mechanisms for citizens. The lead Program Managers will be responsible for key communication with the USDOT. They will conduct the kickoff meeting at the USDOT within two weeks after the award. They will also be responsible for preparing and submitting the quarterly project status reports and briefings as well as Smart City Demonstration Interim Reports and the Smart City Demonstration Final Report. Additionally, the lead Program Managers will be in charge of the preparation and team attendance for the one international and one domestic yearly smart city related international collaboration meeting.

### 3.2 Existing and Future Public and Private Partnerships

KCMO is already working with smart city technology partners for its current Smart + Connected City initiative and the new streetcar along Main St. The City has also been engaging potential partners since the release of the Smart City Challenge Phase 1 NOFO to better understand various smart city technologies and solutions that are currently available, along with the new solutions currently under development. The City has worked to vet potential partners based on their expertise, experience, and what they can provide to the overall challenge. Table 3-1 lists and describes the necessary partners and partner types required to implement KCMO Smart City Challenge concepts.

Because of local procurement regulations, the City cannot exclusively partner with all the necessary companies, vendors, and firms required to implement the Smart City Challenge vision and concept without going through a competitive procurement process. However, in certain situations, the City can enter into exclusive partnerships if the vendor is the sole source for the product or service, or if it would create additional costs to switch from a vendor with an existing contract for similar products or services. KCMO plans to utilize the services of the USDOT sponsored partners to the fullest extent possible, as these partners are already committed to the higher level challenge through the USDOT and are providing in-kind products and services. The City and KCATA have already started working with some of these partners, as is the case with Mobileye. For products or services with many potential providers, the necessary partner types and high-level roles are described with example companies, vendors, and firms.

*Table 3-1: KCMO Smart City Challenge Solution and Technology Providers*

Provider	Description and Role
USDOT Sponsored	
<b>Vulcan</b>	Submitted a separate proposal to Vulcan for the additional \$10 million in funding to support GHG emission reduction efforts, such as city fleet and transit electrification.
<b>Mobileye</b>	Already initiated a Mobileye pilot with two buses and plans to outfit 300 buses with Mobileye technology.
<b>Autodesk</b>	Utilizing Autodesk software and services to develop select renderings of the technology deployments for the Prospect Corridor, AV shuttle system, and new bike lanes developed from road diets.



Provider	Description and Role
<b>Amazon Web Services</b>	Plan to utilize AWS to store data collected from the multitude of sensors deployed during the Smart City Challenge.
<b>NXP</b>	Plan to utilize NXP support to deploy OBUs, RSUs, and RFID tags to support CV applications to improve safety, enhance mobility, and reduce emissions.
<b>Alphabet's Sidewalk Labs</b>	Will provide services and promote the use of travel data to bridge the digital divide and increase transportation services and efficiency.
<b>USDOE</b>	Plan to host the resident DOE scientist to support energy initiatives, including fleet electrification, smart grid developments, and identify focus areas for future energy efforts. Coordinate with other DOE efforts that are related to smart city developments, including its Smart City Air Challenge.
<b>No Competitive Bid Necessary</b>	
<b>Cisco</b>	Hardware provider for public WiFi. For WiFi to continue to work seamlessly and provide quicker turnaround on installation, KCMO needs the same equipment. Cisco also holds an existing contract with KCMO. Additionally, the CDP for Smart Cities will be leveraged to accommodate the expansion of KCMO's sensor and data network.
<b>CityPost</b>	Provides kiosks for the current smart city initiative. Will continue to provide kiosks along the Prospect Corridor and other areas in town.
<b>Orange EV</b>	Only company that produces electric Class 8 yard transport trucks in the world. Local company.
<b>ShotSpotter</b>	Gunshot detection technology provider. Existing contract with the City.
<b>Catherine Ross, Ph.D.</b>	Directs Georgia Institute of Technology's Center for Quality Growth and Regional Development (CQGRD) and is internationally recognized expert on transportation systems planning, urban planning, and quality growth.
<b>Competitive Bid Process</b>	
<b>AV and CV Program Development and Management</b>	A few firms provide this expertise. This would likely be a multi-firm effort to provide overall program management, systems engineering, and implementation services for the deployment of AV, CV, sensors, Wi-Fi, coordinate with automobile manufacturers and transportation providers as well as provide data management services. Examples include, but are not limited to, Booz Allen Hamilton, HNTB, ICF, and Transcore.
<b>AV Technology Providers</b>	Multiple companies enable, provide, and implement AV technology. Provider(s) will work with the firm(s) providing program management to deploy AV shuttles along 11 <sup>th</sup> /12 <sup>th</sup> St and 18 <sup>th</sup> St. Examples include, but are not limited to, Bridj, Nissan, and Meridian/Local Motors.
<b>CV Technology Providers</b>	Multiple companies provide and implement CV technology. Provider(s) will work with the firm(s) providing program management to deploy OBUs, RSUs, RFID tags, and CV applications within KCMO. In addition to NXP and their partners examples include, but are not limited to, Siemens, Nokia, Arada, and Savari.
<b>Architecture and Engineering Firms</b>	Multiple firms provide architecture and engineering services, which will be necessary to build bus stations, bike lanes, and potentially assist in CV technology deployment. KCATA would procure these services through a RFP with funding from City of KCMO. Firm examples include, but are not limited to, HNTB, Black & Veatch, and HDR.
<b>Marketing Firms</b>	Multiple firms provide marketing and communications support, which will be necessary for communications and outreach regarding the Smart City Challenge demonstration. Examples include, but are not limited to, VML, SHS, and Phillips West.
<b>Integrated Payment Application Provider</b>	Multiple firms provide integrated payment solutions, which will be needed to develop the integrated payment system for all public transit. Firms include, but are not limited to, Paylt, Cubic Transportation Systems, etc.
<b>Mobility Technology for the Visually Impaired</b>	Multiple firms provide integrated technology solutions to provide seamless, wayfinding solutions for visually impaired travelers. Each system (ClickandGo, RouteID, etc.) varies in some way from the others, however, it is still anticipated an RFP process will be utilized to secure this contract.
<b>Micro-transit Provider</b>	Multiple firms provide on-demand micro-transit, which will be used to expand transportation services from mobility hubs and potentially as partners for the AV shuttle system. Examples include, but are not limited to, Bridj, Leap Transit, Chariot, etc.
<b>Smart Lighting Vendor</b>	Multiple vendors provide smart lighting solutions, which will be deployed along Prospect, 11 <sup>th</sup> , 12 <sup>th</sup> , and 18 <sup>th</sup> Streets. Vendors include, but are not limited to, Sensity Systems and General Electric.

KCMO is also working closely with organizations that will help drive and promote the Smart City Challenge program. These organizations are a mix of public and private organizations that will help shape requirements and assist in the deployment of Smart City Challenge efforts and are considered key local stakeholders during our development, communications, and deployment processes.

*Table 3-2: KCMO Smart City Challenge Stakeholders*

Stakeholder	Description and Role
<b>Blue Hills Community Services (BHCS)</b>	Not-for-profit community development corporation, is a catalyst for neighborhood development, educational programs, and community services. BHCS will assist with implementation of the Prospect Corridor pillar.
<b>Connecting for Good</b>	Not-for-profit whose primary mission is digital inclusion to bridge the digital divide with wireless networks, technology centers, low cost refurbished PCs, and free digital life skills classes. Connecting for Good will assist with implementation of the Prospect Corridor pillar.
<b>KCATA</b>	Transportation authority that currently manages all transit services and leads the Prospect MAX efforts and subsequent operations.
<b>KCPL</b>	Local utility provider that is critical to furthering EVs within the city by continuing to provide public charging stations, smart grid initiatives, and public outreach.
<b>KC Digital Drive</b>	KC Digital Drive will help Kansas City by connecting everyone to affordable broadband Internet, and make emerging technology equitable and accessible; giving more opportunity and resources to create new technology ventures/applications that will grow the economy.
<b>KC International Airport (KCI)</b>	KCI is a public airport 15 miles northwest of downtown Kansas City, in Platte County, Missouri. In 2014, 10.2 million passengers used the airport. The integration of KCI into the Smart City will increase efficiency for airline companies as well as travelers.
<b>KC Police Department</b>	The police department will be an integral partner in implementing CVs and EVs within the second pillar.
<b>KC Streetcar Authority</b>	The Kansas City Streetcar Authority oversees operations and maintenance of the City's 2-mile modern streetcar project. The new streetcar line opened May 6th, 2016, and runs between River Market and Union Station. The KC Streetcar has served as the backbone to current Smart City deployments downtown and will serve as an on-going laboratory for new technologies and applications.
<b>KC Scout</b>	KC Scout is the area's traffic management system. It uses cameras for highway monitoring, sensors to gauge traffic flows, and activates electronic message boards and an advisory radio system to send traffic notices to drivers, which lessens traffic jams, increases safety, and improves emergency response.
<b>KC Startup Village (KCSV)</b>	KCSV is an entrepreneur-led community helping to grow and support entrepreneurs and the Kansas City startup ecosystem. KCSV will promote new technology companies.
<b>Kansas Department of Transportation (KDOT)</b>	KDOT is a partner in smart city efforts in Kansas, specifically the freight improvements along the I-35 corridor and integration of KC Scout data.
<b>Logistics Park KC</b>	1,500-acre inland, intermodal port capable of handling 17 million square feet (SF) of buildings in Edgerton, KS. Logistics Park KC will be a critical partner in the implementation of freight solutions and deploying CVs and EVs.
<b>Mid-America Regional Council (MARC)</b>	MARC is the regional planning organization for Greater Kansas City, including transportation and mass transit.
<b>Missouri Department of Transportation (MoDOT)</b>	MoDOT is a partner in smart city efforts in Missouri, specifically in the development of an AV shuttle to the airport along I-29 and integration of KC Scout data. MoDOT is also working to implement the Road to Tomorrow, a transportation laboratory for testing and constructing highway technology, along I-70 which promotes technology developments such as truck platooning, data communication, and renewable energy.
<b>University of Missouri-Kansas (UMKC)</b>	UMKC's Computer Science and Electrical Engineering department is a leader in courses pertaining to Smart Cities such as Internet of Things and Cloud Computing. UMKC researchers are making Smart City relevant innovations like Wi-Fi honk and Wi-Fi Amber. Also, the UMKC School of Law has organized two Smart City related conferences and related initiatives.



### Engagement approach for start-ups, small businesses, local technologists

KCMO smart city concept will incorporate multiple entities ranging from startup companies to local businesses. For instance, Kansas City's thriving startup community will be a huge asset for developing connectivity mediums, like mobile phone applications. Local and small business will be able to benefit by using or adding important data (e.g., promoting business through ads on kiosks, or using City data to track the travel patterns of potential customers). As discussed in the communication plan, the Kansas City team will develop and implement an engagement approach during the first phase of the Smart City Challenge grant. We will develop a comprehensive list of business types that will have different uses for the smart city technologies. As engagements progress and business interactions increase, the approach will be reevaluated through surveys and feedback sessions to understand the needs of businesses and to ensure the approach is effective and can continue to accommodate all types of businesses. Consistent and regular communications throughout the project will ensure that we maintain strong relationships, which will create a more connected community.

### 3.3 Opportunities to Leverage Federal and Non-Federal Resources

Kansas City understands that federally funded programs can only be effective if they are used as a foundation for other programs and investments, both public and private. We will leverage multiple federally funded programs and other locally funded initiatives to amplify the impact of the Smart City Challenge grant across the city. The Prospect Corridor is a focus of many public and private initiatives to address the mobility and quality of life issues in this part of the community. There are several important initiatives already in place that represent a foundation to advance mobility and quality of life goals through the Smart City Challenge. A few of these investments are summarized in the table below.

*Table 3-3: Opportunities to Leverage Federal and Non-Federal Resources*

Project or Program	Status	Description	Program Funding
<b>TIGER Grant – Green Impact Zone Infrastructure Improvements</b>	Complete	Urban core infrastructure improvements and place-based investment demonstrated how targeting resources in a concentrated area that had seen decades of disinvestment and neglect could lead to significant, sustainable improvements. This grant has generated more than a dozen subsequent investment programs leveraging more than \$175 million of public and private investment.	\$50 Million from TIGER 1
<b>Kansas City Ride KC Streetcar</b>	Complete	2 mile modern streetcar system supported by an underlying smart city technology network consisting of smart street lights, digital kiosks, public Wi-Fi and other sensor networks and data platforms. The streetcar is the catalyst for an investment of over \$1.7 billion of public and private funding for technology and development along the streetcar corridor downtown.	\$102 Million total including: \$20 Million Tiger grant; \$16 Million STP; \$1.2 Million CMAQ
<b>Prospect MAX BRT</b>	In process	\$54 million investment in improved transit service and infrastructure with a focus on stimulating economic development and improving the quality of life through investment in technology. Prospect MAX is proposed as the platform for additional technology investments including connected electric vehicles, smart kiosks and corridor-wide public Wi-Fi.	\$54 million total including: \$30 Million Small Starts (pending); \$3.5 Million STP (approved); \$4.5 Million STP (Requested)
<b>Prospect Avenue Ladders of Opportunities</b>	In process	\$1.5 million in transit improvements to revitalize the corridor, improve access to and from the corridor on connecting routes, construct new bus pads and bus pull offs, new curbs and sidewalks, passenger benches and shelters, and comply with ADA standards.	\$1.2 Million Ladders of Opportunity Grant (Approved)

Project or Program	Status	Description	Program Funding
<b>Morning Star Senior and Youth Center</b>	In process	\$5 Million investment in faith-based community facilities at 27 <sup>th</sup> and Prospect Avenue.	Private funding
<b>RideKC Transit Plan (Jobs Access)</b>	In process	Transit study with the goal to improve access to jobs in the metropolitan area via transit which includes improving access to decentralized employment sites for residents of the urban core. The study is evaluating alternative transit service delivery such as demand and app based services.	\$1.2 million TIGER funding
<b>Major League Baseball's Urban Youth Academy at Parade Park</b>	In process	Adjacent to the 18 <sup>th</sup> and Vine Jazz District, the project consists of three baseball fields, one softball field, a walking trail, relocated basketball courts, relocated and renovated tennis courts and a relocated playground near the community center.	\$14 Million – mix of public and private funding
<b>Choice Neighborhoods Initiative Implementation Grant</b>	In process	Focuses on a 450 acre targeted development area that includes redeveloping an isolated public housing project into a multi-phased mixed-income community that will house 360 units. The plan will increase public safety, spur economic growth through commercial investment, and improve the health and well-being by rejuvenating key corridors, parks, and vacant properties.	\$30 Million from US Department of Housing and Urban Development
<b>Linwood Shopping Center Tax Increment Financing</b>	In process	Tax increment financing has been approved for the Linwood Shopping Center at 31 <sup>st</sup> Street and Prospect Avenue. The current plan for the area centers around the supermarket as the anchor tenant.	\$15 Million renovation to be reimbursed by TIF revenues
<b>18<sup>th</sup> and Vine Jazz District Renovation</b>	Pending	Improvements to make the District a more attractive destination for visitors and tourists, and will allow the District to share in the development of the city's central area. Connectivity with the Crossroads District along 18 <sup>th</sup> Street is an important component of the plan.	\$27.6 Million city funding and \$12 Million private funding.
<b>FTA Technical Support to Assist Communities with Transit-Oriented Development</b>	Pending	Kansas City was selected as one of nine cities by FTA to benefit from technical assistance relating to transit-oriented development (TOD) in order to encourage economic development around local transit service.	Valued approximately at \$1 Million
<b>Expanded Bike Share Stations</b>	Pending	The project will add multiple bike stations along the Prospect Corridor and region-wide to continue expansion of bike share system.	\$4 Million federal Bike share funding
<b>South Prospect Connectivity</b>	Pending	Study to determine how to enhance multi-modal connectivity and access across 71 Highway (parallel to Prospect Avenue) from E 55th St. to Gregory Blvd.	Planning for Sustainable Places (PSP) grant

To encourage even more investment the Urban Neighborhood Initiative (UNI), one of the Big 5 initiatives identified by the Greater Kansas City Chamber of Commerce, is focused on improving the opportunities for residents in an east side area between Troost Avenue and 71 Highway. This broad-based program to encourage investment in the urban core is further evidence of the community's support for these initiatives. Development within the Prospect Corridor is taking place today. Over 100 permitted planned developments and improvements have taken place in the past five years. These include roughly 30 improvements and repairs to single family dwelling units, and upgrades to numerous commercial buildings, churches, civic, and educational buildings. While the scale of such development is unlike a dense downtown district, these improvements are notable for the Prospect Corridor.



## 3.4 Quality, Timeliness, and Cost Control

### 3.4.1 Quality

The Program Manager will be responsible for implementation of a team-wide Quality Assurance and Control Plan, supported by a dedicated QA/QC team. This person will work with the QA/QC team to develop the plan, including milestone schedule dates for quality reviews and document control procedures and forms, such as comment resolution. Within each phase of the Smart City Challenge, the program team will strategically apply the quality review process wherein all deliverables are team reviewed and approved by the Program Manager and appropriate Project Leads prior to submittal of each deliverable. The detailed project schedule will include lead time to address USDOT's comments on the initial submission of each document, to create a final deliverable.

### 3.4.2 Timeliness

Immediately following award, the Program Manager and Project Leads will develop a detailed project schedule based on careful analysis of project activity time requirements. Our Project Managers will conduct a weekly meeting with the entire project team to review its status, schedule, and any potential risks and issues that might impact the schedule and/or budget. We will conduct more frequent schedule reviews in situations where schedule problems exist or for short-term deliverables. Key members of our team will also participate in regularly scheduled and ad-hoc meetings with the USDOT to discuss project status and issues, both active and resolved, and to preview and explain upcoming project activities.

### 3.4.3 Cost

Our Program Manager and Project Managers will monitor cost throughout the life of each phase and deliverable, and will routinely report on and communicate costs during monthly meetings and quarterly progress report meetings. The program team takes a proactive approach to identify hours charged and dollars spent supporting projects to ensure we stay within budget. To support this contract, the team will use a government-approved, web-based financial reporting system to provide detailed information on every aspect of assignment such as cost, reportable labor hours, ODCs, and travel for the current reporting period, year-to-date, and contract-to-date. We will use this information to compare actual to planned costs, analyze monthly expenditures and remaining cost to completion, and update the budget as needed. As a part of EVM reporting, our managers will track and report the cost and schedule variances and identify mitigation plans when needed. The team will submit monthly task order progress and reports concurrently to the COTR and GTM.

## 3.5 Risk Management Approach

Our risk management approach follows industry best practices for mitigating factors that are likely to jeopardize the ability to achieve project or task objectives within budget and schedule constraints. We will take the following steps to manage risk:

- **Risk Identification** – Identifying sources of risk during early stages of the project and, as the project progresses, identifying specific risks to the project
- **Risk Assessment** – Identifying the root cause of the risk, quantifying the likelihood and consequences of the potential risk outcome(s), and determining the area of impact of the risk
- **Risk Mitigation** – Assigning ownership of the risk and developing mitigation strategies
- **Risk Tracking and Reporting** – Tracking the risk to ensure that the mitigation approach is effective, capturing and documenting mitigation strategies in the project budget and schedule, and reporting risk status to the stakeholders.

To manage risks, we will establish a risk log to track project risks and develop risk assessment criteria to ensure consistent risk assessment practices. We will review these risks with the USDOT management on a monthly basis and offer technically sound and achievable mitigation approaches.

While there are risks to accomplishing Kansas City's bold vision for the Smart City Challenge, the City will take active steps to mitigate all known risks and continually assess tasks and schedules to document and track new risks. Kansas City's currently known risks and mitigation approaches are listed in the tables below.



Table 3-4:Key Technical Risks and Mitigation

Technical Risk	Mitigation Approach
Private industry capacity to complete testing prior to deployment of vehicles or smart city components	The Kansas City team will develop test plans in coordination with private firms
Increased connectivity and system interoperability will increase the impact of cybersecurity attacks	The team will follow industry approaches and standards (e.g., NIST Risk Management Framework) to developing security controls for new smart city components
The city will require new, advanced data processing and storing capabilities to manage enormous amounts of real-time data	The team will incorporate data management and advanced data analytics practices within technology deployment processes to identify processing and storage requirements

Table 3-5: Key Policy/Institutional Risks and Mitigation

Policy Risk	Mitigation Approach
State or national regulations must change concurrently with fielding of new technologies	The team will utilize the City's Office of Innovation, the UMKC Law School, and City Council Legislative Committee to monitor, prioritize, and propose Smart City legislation at local, State, and Federal levels. The City will partner with Greater Kansas City Chamber of Commerce and KCnext, the technology council for Greater Kansas City in support of Smart City legislative initiatives
Kansas City data privacy and general security policies must change concurrently with fielding of new technologies	The team will incorporate the identification of privacy and security challenges and mitigation practices within technology deployment processes
Government and private partner organizations may need to modify data sharing policies to facilitate smart city challenge efforts	The team will review current data policies and coordinate to make the necessary modifications without revealing proprietary or PII-related information
Kansas City may need to update funding mechanisms to account for new operations and maintenance funding requirements	The team will determine new O&M requirements based on deployed roadway and communications infrastructure and work with the necessary organizations to propose modified or new funding mechanisms
Transportation planners will need to adjust planning processes to incorporate CV/AV technologies	The team will work with MoDOT, KDOT, and MARC to adjust planning processes to incorporate smart city initiatives and general CV/AV considerations in long range plans
Public transportation employee uncertainty on potentially being monitored or losing jobs as a result of CV/AV technology	The team will ensure AV testbeds are in addition to (not replacing) existing services and work with KCATA to implement processes and procedures to ensure compliance in using new technology such as Mobileye
City Hall does not have the resources for in-house, full time program management	The team will utilize partners to manage the program and projects

## 4 Staffing Approach

The City of Kansas City must conduct a competitive procurement process for much of the services and technology that is necessary to implement and deploy the Smart City vision and pillars described in this proposal. Where possible, KCMO has identified the key personnel that will actually work on the project. In this case, these key personnel are limited to specific staff working within the City of Kansas City or the key partners that do not need to respond to Requests for Proposals issued by the City. Currently, the City only identifies select personnel within the City of Kansas City and KCATA as specifically key personnel. Remaining key personnel to lead the overall

### 4.3 Contingency Plan

The Kansas City team has chosen our most experienced and qualified personnel to serve as key personnel under this contract and proposes to retain the same Program Manager and Pillar Leads throughout the life of the grant. Our team has demonstrated the ability to provide the necessary resources to fulfill the Smart City Challenge objectives through the management of the Smart + Connected City and KC Streetcar implementation and deployment. We plan to augment our core team members with contractors (through a competitive bid process) to provide additional project management and oversight for the AV/CV/EV and Connected and Empowered Citizens pillars.

However, should the need for a change occur due to unforeseen or uncontrollable events, we will follow a prescribed contingency approach for staff replacement. Department of Public Works will be the primary management organization, but multiple other City offices such as the Office of Innovation will be instrumental in managing and guiding the program. Therefore, we have strong replacement candidates for any of the key positions should the need arise and can overlap responsibilities as necessary for temporary coverage situations. If replacement of the Program Manager or Pillar Leads should arise, we will immediately notify USDOT program managers, offer the resumes of several candidates to the CO and COR for review, and work together to minimize impact to the program. We will discuss all replacement candidates with the government contracting officials, and others, as appropriate, to make the final replacement determination. Upon the government approval, we will submit the appropriate documentation and execute the change through a contract modification request. We will keep the CO and COR informed immediately as we are aware of a need to change key staff and work diligently to ensure a smooth transition.

#### 4.3.1 Recruitment and Hiring Plan

Our experience shows that attracting and qualifying skills in advance of need are critical to a program as important as this and, as such, we propose establishing a virtual bench. This bench would be a database of qualified and screened resumes from within the program team. This will enable the Kansas City team to rapidly respond to unanticipated personnel requirements and vacancies. Refreshed on a continuous basis by the point of contact for each team member and our program leads, the virtual bench will provide resources available on short notice. The primary benefit of our approach is that the important personnel positions are never “one person deep.” Our proactive and comprehensive process for attracting and identifying requisite skill sets and experience will ensure that any position can be filled rapidly with a staff member who meets or exceeds the requirements of the job.

## 5 Capacity and Capability

Kansas City and its essential partners have experience that directly relates to some capacity of Smart Cities. Listed below in Table 5-1 are the distinct capabilities from previous performances that will give Kansas City an advantage when developing and deploying their Smart City. The letters of support also display the capacity and capability of our partners and potential partners.

*Table 5-1: Kansas City Capacity and Capability*

Kansas City Characteristic	Detail
<b>Executive Commitment</b>	
<b>Mayor Sly James</b>	Mayor Sly James created a Smart City Advisory Board consisting of 11 board members (including members from City Council, KC Streetcar Authority, KCPD, the water services department, public works department). The organization focuses on overseeing a successful implementation of the Smart + Connected City framework by recommending policies for the management and implementation of smart city technology, future smart city integration and establishing metrics for evaluating the success of the program.
<b>Infrastructure Readiness</b>	
<b>Transportation Infrastructure</b>	<ul style="list-style-type: none"><li>• Kansas City Area Transportation Authority (KCATA): MAX lines</li><li>• Main St. MAX links River Market, Downtown, Union Station, Crown Center, and Plaza</li><li>• Troost MAX links Downtown, Crossroads, Hospital Hill and UMKC Campus, Discovery Center, Stowers Institute, Rockhurst University, Research Medical Brookside Campus,</li></ul>



Kansas City Characteristic	Detail
	<p>Swope Health Services South, Bannister Federal Complex, and Cerner Complex</p> <ul style="list-style-type: none"> <li>• Features GPS tracking, transit signal priority and dedicated bus lanes</li> <li>• Kansas City's metro sits over two states where four major interstate highways intersect</li> <li>• Two-mile modern streetcar line, opened in May 2016, runs between River Market &amp; Union Station</li> </ul>
<b>Smart + Connected City Initiative</b>	<p>The Smart + Connected City initiative is driven by a partnership with Cisco, Sprint, and others to enhance internet availability, energy savings, new revenue streams, and improve connectivity with citizens, including efforts to bridge the "digital divide." 25 interactive digital kiosks are being deployed along the new streetcar line and nearby downtown to provide city services, current events, transportation services, local business information, public digital art, local history, and entertainment. Sensity smart streetlights with video sensors are being deployed along the streetcar line to improve safety and detect blockages.</p>
<b>Clean Charge Network</b>	<p>The Clean Charge Network consists of over 1,000 electric vehicle-charging stations making it the largest electric vehicle charging operation in the United States. The stations are capable of supporting more than 10,000 electric vehicles and offer free charging on every station to all drivers for the first two years. The fast charging stations charge vehicles from empty to 80% in about 30 minutes, and the standard stations provide most electric vehicles with a 25-mile charge per hour.</p>
<b>Operation Green Light</b>	<p>KCMO is a partner with MARC in Operation Green Light (OGL), a multi-jurisdictional system that coordinates over 700 traffic signals throughout the region, including Prospect Corridor. OGL provides pre-timed synchronization of traffic signals for peak commuter periods and special events. A majority of the OGL traffic signals can also support adaptive signal-control systems that provide real-time optimization of traffic signals, adjusting signal timing based on traffic prevailing conditions, demand, and system capacity.</p>
<b>KC Scout</b>	<p>KC Scout employs sensors over 8,000 highway miles in the Kansas City region and provides updates to commuters via digital signage and SMS texts. The system uses cameras, sensors, and electronic message boards to detect and solve problems and incidents on roadways. KC Scout's website features information for citizens including real-time camera views and traffic flows, activated message boards, and information on freeway work zones.</p>
<b>Smart Grid</b>	<p>KCPL is demonstrating an end-to-end SmartGrid —built around a major SmartSubstation— that includes advanced generation, distribution, and customer technologies. Co-located renewable energy sources, such as solar and other parallel generation, will feed into the energy grid. The demonstration area consists of two square miles with 14,000 commercial and residential customers. Part of the demonstration area contains the Green Impact Zone, 150 inner city blocks that suffers from high levels of unemployment, poverty, and crime. The SmartGrid program will provide area businesses and residents with enhanced reliability and efficiency through real-time information about electricity supply and demand.</p>
<b>Google Fiber</b>	<p>Kansas City, the first city to receive Google Fiber, has laid over 8,000 miles of fiber-to-the-home throughout the region. As Part of the U.S. Department of Housing and Urban Development's ConnectHome initiative, Google Fiber is bringing free gigabit speed internet to all low-income residences in Kansas City.</p>
<b>Workforce Capacity, Data Management, and Performance Management Capabilities</b>	
<b>Additional Workforce</b>	<ul style="list-style-type: none"> <li>• In 2013, Kansas City hired its first Chief Innovation Officer to help drive innovative strategies to improve how city government serves citizens through creative problem solving and citizen engagement.</li> <li>• Kansas City employs full-time social media manager to engage with residents online. In addition to utilizing traditional social media platforms Kansas City is also engaging citizens through Nixle, a text notification system, and Nextdoor, a neighborhood social media network, at no cost to citizens.</li> <li>• KC Streetcar Authority (KCSA) is dedicated to deploying, operating and maintain the new streetcar. KCSA is initiating application-based data exchanges in the downtown area to serve as a pilot for technology concept expansion and streetcar management.</li> <li>• Kansas City hired an Open Data Coordinator as a result of the passing on the open data ordinance and the creation of the open data portal.</li> </ul>
<b>Implementation Plans</b>	<ul style="list-style-type: none"> <li>• The Digital Roadmap is Kansas City's plan for a digital future. It includes plans to develop a City-wide digital inclusion policy aimed at bridging Kansas City's digital divide; develop City-wide digital strategies to increase public access to free Wi-Fi, and to</li> </ul>





Kansas City Characteristic	Detail
	<p>manage public infrastructure; and improve approaches to technology procurement with a focus on digital literacy, professional skills, communications, operations and service delivery.</p> <ul style="list-style-type: none"> <li>• Robust Five Year Business Plan presents goals to guide the budget process and ensure clear priorities. Priorities include customer service, finance and governance, infrastructure and transportation, neighborhoods and healthy communities, planning, zoning, economic development, and public safety.</li> </ul>
<b>KC Open Data Portal and KCStat</b>	<p>KCStat is a data-driven, public-facing initiative focused on improving the efficiency and effectiveness of city services. It is used to monitor and track progress toward the City's strategic priorities and Business Plan goals. KCStat uses metrics to monitor the following goal areas: neighborhoods and healthy communities; governance; public infrastructure; economic development; public safety; customer service and communication. The KCStat dashboard, organized around the six goals, allows residents to monitor online the City's progress toward its goals and plans. The dashboard uses the City's open data portal proving users with granular data users. KC Open Data Portal also offers public access to data on Kansas City. Data includes, budget information, statistics, sanitation and building data, city maps, 311 information, airport, audit data, and weather warning system data.</p>
<b>IEEE Core Smart Cities</b>	<p>Kansas City's Smart City Initiative is one of five IEEE Core Smart Cities. They have been working with the local IEEE chapter to develop expert knowledge, share experience with other core and affiliated cities, and support local innovation and entrepreneurs, working closely with city governance bodies, local industries, local universities, involving students and professors, and available relevant non-governmental organizations. Kansas City will be hosting the 2017 International IEEE Smart Cities Conference.</p>
<b>KC Digital Drive</b>	<p>Kansas City Digital Drive is a bi-state non-profit organization committed to best employing digital technology to positively impact citizen experiences for all. To date, this process has driven positive civic outcomes such as generating \$1.25 million in direct financial support for programming and technology projects in digital inclusion, health care, education, events, and community investment. KC Digital Drive has also attracted 250 delegates from 49 U.S. cities to the 2015 Gigabit City Summit (a smart-city conference for cities seeking to leverage broadband Internet for community benefit), as well as organized 5 hackathons attracting 300 participants and leading to the creation of 3 startup companies.</p>
<b>The Living Lab</b>	<p>The Living Lab is a joint proposal between Cisco and Think Big Partners for Kansas City to play a vital role in the innovation and commercialization of Internet of Things (IOT) technologies. The Living Lab will create an opportunity for entrepreneurs to build high growth companies, partner with large companies needing assistance and allow KCMO the ability to reap the financial and social benefits while improving the quality of life and reducing long term costs.</p>

Kansas City acknowledges the importance of ensuring that the Smart City Challenge is sustainable. We have built funding methods into our concept that will generate revenue allowing the Smart City to extend beyond the demonstration phase. Much of the smart technology, including the Wi-Fi and kiosks, generate income for the City. Expected savings in electricity costs as well as other data-driven procedural efficiencies will reduce operation cost, which can be used to reinvest into the Smart City. Furthermore, we will leverage our public private partnership experiences, like the Smart + Connected City initiative, to create new partnerships as well as build upon existing ones, which will provide additional funding sources.

Our recent projects have included the implementation of new technologies and systems that require additional commitment to fully implement and self-sustain. For instance, the Smart City Advisory Board was created as a result of the Smart + Connected City initiative to develop policies to will help operate and maintain the new technology along the streetcar corridor. The role of Chief Innovation Officer (CIO), recently added to Kansas City, ensures a forward-thinking and strategic approach to technology in support of all municipal business units. The CIO has helped optimize the operation and output of crosscutting city projects, like KCStat and KC Digital Drive. In addition, the Kansas City Streetcar Authority was established to ensure that the new streetcar system was effectively developed, deployed, and maintained. We will apply similar methods from our previous experiences to ensure that operations and maintenance will go beyond the Smart City Demonstration phase.