Smart City Challenge: San José on the Move

SAN JOSÉ'S VISION FOR A SMART CITY

The City of San José is a city on the move. From its early days as the *Valley of Hearts Delight* to its current status as the *Capital of Silicon Valley*, San José is leading the way in developing new opportunities to meet its safety, mobility and sustainability needs. As a city with a growing population with increasing transportation needs San José must look to new ways to move its residents in a safe manner through the use of innovation and technology.

San José must provide a safe and reliable transportation network to a population that is expected to grow by nearly 50 percent by the year 2040, but that is experiencing transportation challenges today. With a smaller population than most urban areas, San José is still one of the most congested. According to an August 2015, Wall Street Journal article, residents of San José experienced 67 lost hours annually per commuter due to congestion at an annual cost of $1,422. The total cost of the congestion cost the area $2.2 billion annually in both fuel costs and lost productivity. Even with the smaller amount of population, San José's travel index of 1.38 is tied for third highest in the country and higher than the average index of 1.32 for urban areas with over three million people (Wall Street Journal). The City's geography as well as the current expanding economy in Silicon Valley has added to the number of vehicles on the City's roadway system. The increase in vehicles on the roads increases the need to look at innovative smart solutions to address the increased need for safety and mobility choices for San José's residents.

As the Capital of Silicon Valley, San José is uniquely positioned to leverage the knowledge and creativity of its citizens, corporate partners, and premier academic institutions to reimagine the role of technology and connectivity. "Smart City" is a ubiquitous term and means different things to different stakeholders, yet the first step in identifying how best to utilize this grant if San José were to win is to define the values and vision of a SMART San José.

A **SMART** San José is:

S – Safe

Any traffic fatality in San José is unacceptable. Consequently, San José has adopted and implemented Vision Zero San José, a comprehensive **citywide** plan to eliminate all traffic fatalities as soon as possible. Technology and innovation will be a cornerstone to achieving Vision Zero, closely coupled with progressive engineering, education and enforcement strategies.

Vision Zero San José

M- Multi-Modal

The City of San José has 2,432 miles of local streets, 243 miles of bike lanes, 16 miles of bike routes and 55 miles of trails, and residents have access to an extensive transit system that includes the Santa Clara Valley Transportation Authority's (VTA) bus and light rail network. Current and future construction of the Bay Area Rapid Transit (BART) system will provide residents with additional options to travel throughout the San José-San Francisco Bay Area. A SMART San José will help enhance an already strong, connected and multi-modal transportation network through technology innovation solutions, such as advanced intersection communication and demand-based traffic management, privately and publicly developed applications, on demand transit services (VTA FLEX) and other emerging technologies.

VTA FLEX

A- Activated

San Jose has a diverse community surrounded by technology and business partners with a thriving downtown area. This community is rich in ethnic diversity and vibrant with sports, cultural activities, fine dining and cultural/residential amenities. There are many large shopping complexes with Santana Row being a centerpiece of urban village activity. As the Capital of Silicon Valley San José sits in the center of worldwide innovation with new emerging companies that are on the forefront of urban automation technologies. Within the City there is an area that has been set aside for innovation - the North San José Transportation Innovation Zone (TIZ). This initiative is a collaboration with Prospect Silicon Valley and other regional partners to provide a real life test lab for world class smart city innovation. A SMART San José will utilize innovation and technology to activate its diverse community.

Transportation Innovation Zone

R- Responsive

Our transportation infrastructure is already well on its way to being highly responsive allowing us to predict and respond to dynamic transportation needs. We have created a world class connected signal system and Traffic Management Center (TMC), which allows real time traffic management control. Our advanced systems and high tech TMC facility will be the foundation of future innovation that will further enhance our responsiveness. Intersections equipped with advanced sensors and controllers will respond to traffic patterns and ensure the efficient flow of traffic. We will add connectivity and intelligence to our existing infrastructure, and by using real-time responsive data, the city will be able to provide a more efficient transportation system, such as on demand service to VTA riders.

Transportation Incident Management Center

T- Transparent

As the City and its partners adopt advanced sensing and reporting technologies and pursue open data initiatives, government will be more accessible to those it serves than ever before. As data quality improves and real-time data-sets become more accessible, citizens can understand why traffic planning and deployment decisions are made and provide public-policy input. A SMART San José will develop and utilize improved dashboards and data analytics tools and provide open-source trend visualizations to increase public and private engagement. Open data will enable our public and private partnerships to thrive and will help build out services for our residents at a speed that has never been accomplished before.

San José Open Data Platform

These values support the key tenets of what a "Smart City" should comprise; sensing, communicating and applying. We have very innovative and committed Government leaders from the mayor, Sam Liccardo, to our new Director of Transportation, Jim Ortbal, and a strong innovative partner in the VTA delivering world class public transportation.

Sam Liccardo's book "Safer City, Smarter Government"

Approach

Through transportation innovation, the City envisions addressing safety, mobility and sustainability through the **citywide** deployment of:

- Connectivity through DSRC Technology – CV/AV
- Advanced Traffic Management
- Smart Sensor Technologies
- Data Analytics & Operational Dashboards
- Electric Vehicle Solutions

In our Smart City Challenge project:

- We will build out a connected City utilizing **Dedicated Short Range Communications** (DSRC) technology as a base communications platform to enable vehicle to vehicle and vehicle to infrastructure connectivity.

- We will utilize **advanced traffic management** systems to roll-out adaptive and preemptive capability across the City, and provide a unique Transit Bus to bus stop customer experience. This will drive us towards achieving Vision Zero and further improving mobility for our City.

- We will implement **smart sensor technologies** across the City to enhance the focus on safety and mobility such as advanced traffic counts and collision avoidance for our transit buses.

- We will use **data analytic solutions** combined with advanced traffic counts, and transit bus movement to integrate with other infrastructure and software platforms to enhance SMART. An implementation of an **operational dashboard** will be undertaken where the smart technology can display through to a single point of reference for control and visibility.

- We will further advance our **electric vehicle solutions** by developing a plan for wireless charging, converting diesel hybrid buses to Battery powered vehicles and utilizing current assets (smart streetlights, and light rail power distribution grid) to grow our already impressive electric vehicle charging fleet.

As referenced above, San José is a **Smart City** that can develop and demonstrate technologies that can be used by other cities to address many of the overlapping challenges that all cities face. In order to demonstrate technologies that can be replicated by others, San José has determined that four areas of the City would provide opportunities to concentrate the initial phased rollout and reflect many of the characteristics of other cities.

While our vison is absolutely **citywide,** we have identified four areas where we would focus our initial implementation. These areas will enable us to concentrate on our safety, mobility and sustainability where they are most needed and most conducive for evaluation, scalability and application in other cities.

1. Transportation Innovation Zone (TIZ) – located in North San José this technology industry rich area will provide a real-world testing ground for innovators looking at DSRC and CV/AV technologies. San José is a pioneer in Urban Technology Demonstration a step ahead of many cities with this innovative work-live technology hub.

2. Priority Safety Streets – the City of San José is one of the major cities that have adopted Vision Zero. Fifty percent of all fatal crashes on San José's roadways occur on the City's 14 identified Priority Safety Streets, which represent only three percent of the overall street system. One fatality is too many and San José has committed to focus on technology and education to lower the number of crashes with a goal of eliminating roadway fatalities.

3. Priority Development /Urban Village Areas – planning is underway in West San José that is expected to culminate in Urban Village Plans for three areas: Santana Row/Valley Fair Mall (high-level/high-traffic retail), Winchester Boulevard, and Stevens Creek Boulevard (both Winchester Boulevard and Stevens Creek feed I-880 and carry heavy traffic loads). Collectively, these three Urban Villages are known as the Tri-Villages. The Urban Village concept is a major strategy of San José's General Plan *Envision San José 2040* to transform strategically identified growth areas into higher-density, mixed-use, more urban districts that promote transit use, walkability, and bike-ability. The Urban Village concept is the growth strategy for future development in San José and Urban Village planning processes engage area community members, including property owners, community group representatives, developers, and other stakeholders.

4. Downtown area of San José - A strong downtown is a hotbed of innovation, creativity and sustainability; downtown San José is no exception. Thousands of residents work for large companies such as Adobe, Price Waterhouse Coopers and Oracle which converge with San José State University and City Hall, and are serviced by extensive mobility options including bike sharing, light rail, bus routes and planned BRT and BART extensions. With significant infrastructure and investment in place, downtown presents incredible opportunities to advance the deployment of Smart City technology.

Through its engaged populace, proximity to vast reserves of human capital in the private, public and academic sectors and commitment to innovation as demonstrated in the North San José Traffic Innovation Zone, San José is prepared to accept and utilize grant funds to the fullest. As the "Capital of Silicon Valley", San José is well positioned to work collaboratively with stakeholders across all sectors, implement new technologies, and set the standard for Smart City deployment nationwide.

Program Management Approach

The City of San José is looking to create a Smart City advisory board comprised of elected officials, city management and staff, public/private partnerships, community and other organizations. This will ensure an established policy steering entity is driven to offer advice on policy, management and tactical/operational components. The program will ultimately be rolled out by a strong team comprised of experienced engineers, innovators and Smart City private/public partners.

DEMOGRAPHICS AND CHARACTERISTICS

According to the 2010 Census-designated place (CDP) population - the City of San José had a population of 945,942 and an urban density (2010) of 56.8 percent within the San José UZA. San José has many characteristic that the U.S. Department of Transportation is looking for in a Smart City. The City is the significant regional population center within the San José UZA and within the County of Santa Clara. As the home to many of Silicon Valley's innovators, San José possesses an engaged populace that is using cutting edge technology every day. These residents are continuously looking for new ways to use technology to benefit their daily lives.

The City of San José was founded on November 29, 1777 (as Pueblo de San José) and was the California's first civilian settlement - San José the City was incorporated on March 27, 1850. For more than 150 years San José was a small farming community, and the area in the mid-20th century contained some of the last undeveloped land near San Francisco Bay. The City then began to experience rapid population growth, much of it coming from veterans returning home after World War II. San José continued its aggressive expansion during the 1950s and 1960s and today, San José encompasses 180.2 square miles and is located in a valley that is bounded by hillsides, baylands, and wetlands. The rapid growth of the high-technology and electronics industries further accelerated the transition from an agricultural center to an urbanized metropolitan area. Today, only 0.4 percent of the City's jobs are related to farm industries - the other 99.6 percent of jobs are divided between goods producing (20.2 percent) and service providing (79.4 percent).

According to the 2010 Census, the median age of the City's residents was 35 years with 24 percent of the population under the age of 18. This demographic supports the efforts of the Smart City Challenge to address transportation issues through the use of technology and innovation. Residents within these age groupings are already using technology and are using technology actively to provide opportunities in their daily lives to make choices on where they are going, how they will get there and how their choices are impacting the environment. In addition to the usage of technology by the City's younger demographic residents over 35 are also highly engaged in innovative work through their employment and also rely on technology. This engagement and acceptance of the benefits of technology encompasses the goals of a Smart City.

The City of San José is a diverse community that is proud of the cultural and ethnic diversity of its population and workforce and the rich cultural identity of its many neighborhoods. Within the City of San José there are more than 50 different languages spoken by its residents. People travel from all over the world to live and work in San José. The richness of this cultural background feeds the innovative spirit of the City and brings together people willing to experience new things and embrace new ideas.

The Residents of San José identify their race and ethnicity in the following way:

Race	Percentage
Hispanic	33.2
Asian	32.8
White	27.6
African American	2.8
Other	3.6

Source: US Census Bureau, American Community Survey: 2012

San José has an educated populace with 66 percent of its residents having at least some college experience and 39 percent of its residents identifying that they have a Bachelor's, Graduate or Professional degree.

Education Level / Degree	Percentage
Graduate or Professional	15
Bachelor's	24
Associate	8
Some College / No Degree	19
High School Diploma (or Equiv.)	17
Less than High School Diploma	18

Source: US Census Bureau, American Community Survey: 2012

The region’s concentration of highly skilled workers is one of its main competitive advantages as a technology and manufacturing cluster. High tech manufacturing provides local residents with well-paying job opportunities for a range of occupations and educational levels, while businesses of all sizes benefit from a large and diverse talent pool.

SAN JOSÉ'S ALIGNMENT WITH SMART CITY GOALS

Existing Transportation System

The City is a close partner with a public transportation provider in the Santa Clara Valley Transportation Authority (VTA). The VTA is headquartered in the City's transportation innovation zone (TIZ) and is an independent special district responsible for bus and light rail operations, congestion management, specific highway improvement projects and countywide transportation planning. As such, VTA is both an accessible transit provider and multi-modal transportation planning organization involved with transit, highways, roadways, bikeways, and pedestrian facilities. VTA is also engaged in the development and construction of Bus Rapid Transit (BRT) and a new dynamic demonstration service (FLEX) that is an on-demand

connection service between regular transit stops. The Bay Area Rapid Transit (BART) is also under construction within San José. As a City within the nine-county Bay Area, San José also has access to a broader network of public transit that spans not only the nine-county region, but agencies that provide service to Santa Cruz and Monterey Counties.

Environment that is conductive to demonstrating strategies

The City of San José encompasses many characteristics that makes it a perfect candidate to become a Smart City. The rapid change in the City's economy base from agricultural to high-technology shows the nimbleness of its residents to respond quickly to changing economies and industries. The Silicon Valley is home to an incredible number of High Tech employers. The top 5 major high tech employers in San José are:

1. Cisco Systems
2. eBay
3. IBM
4. Hitachi
5. Adobe Systems

There are also currently 18 firms locally developing technology around the use of DSRC technologies including Google, Toyota and BMW. These companies would benefit from the designation of San José as a Smart City. The environment in and around San José is conducive to demonstrating the strategies proposed within this submittal. The fast-paced innovative environment of Silicon Valley creates opportunities to move technology forward and to work with major high-tech companies to develop and implement shared goals. The City has the advantage to be able to work with these "local" firms through partnerships that are already established. We have a track record in using our existing demonstration policy to partner with companies looking to implement and test new technology.

Continuity of committed leadership

The City of San José has a history of progressive leadership and policy support for technology demonstration. In 2008, San José was the first city to create a "Technology Demonstration Partnership Policy" to enable companies to access City facilities and assets for pre-commercial technology demonstration. The City's Mayor, who has just completed his first year in office, has made innovation a primary focus of his term. As such, the Cities administration is following suit and have created a Civic Innovation Cabinet made up of top officials from throughout the city, including the Director of Transportation. City leadership also founded a nonprofit partner, ProspectSV in 2013, to support emerging technology innovators, emphasizing advanced transportation, buildings, and renewable energy solutions. The Mission of ProspectSV is to provide critical infrastructure and affordable space for clean tech companies seeking technology demonstration and prototype opportunities – providing commercial trials for innovators to test technology solutions and helping attract private capital investment.

Commitment to making open data

Our City has recently implemented an open data policy, platform and city manager lead team. As such, we have much of the hardware and infrastructure in place to take advantage of Smart City Challenge funding. While other cities may need to use the majority of the funds to build up its technology spine San José will be able to leverage the funding to layer additional technology on its already expansive system. The City's early commitment to technology allows it to jump start its program and meet the tight deadlines to implement and evaluate it programs and projects.

Further characteristics that makes San Jose a great candidate

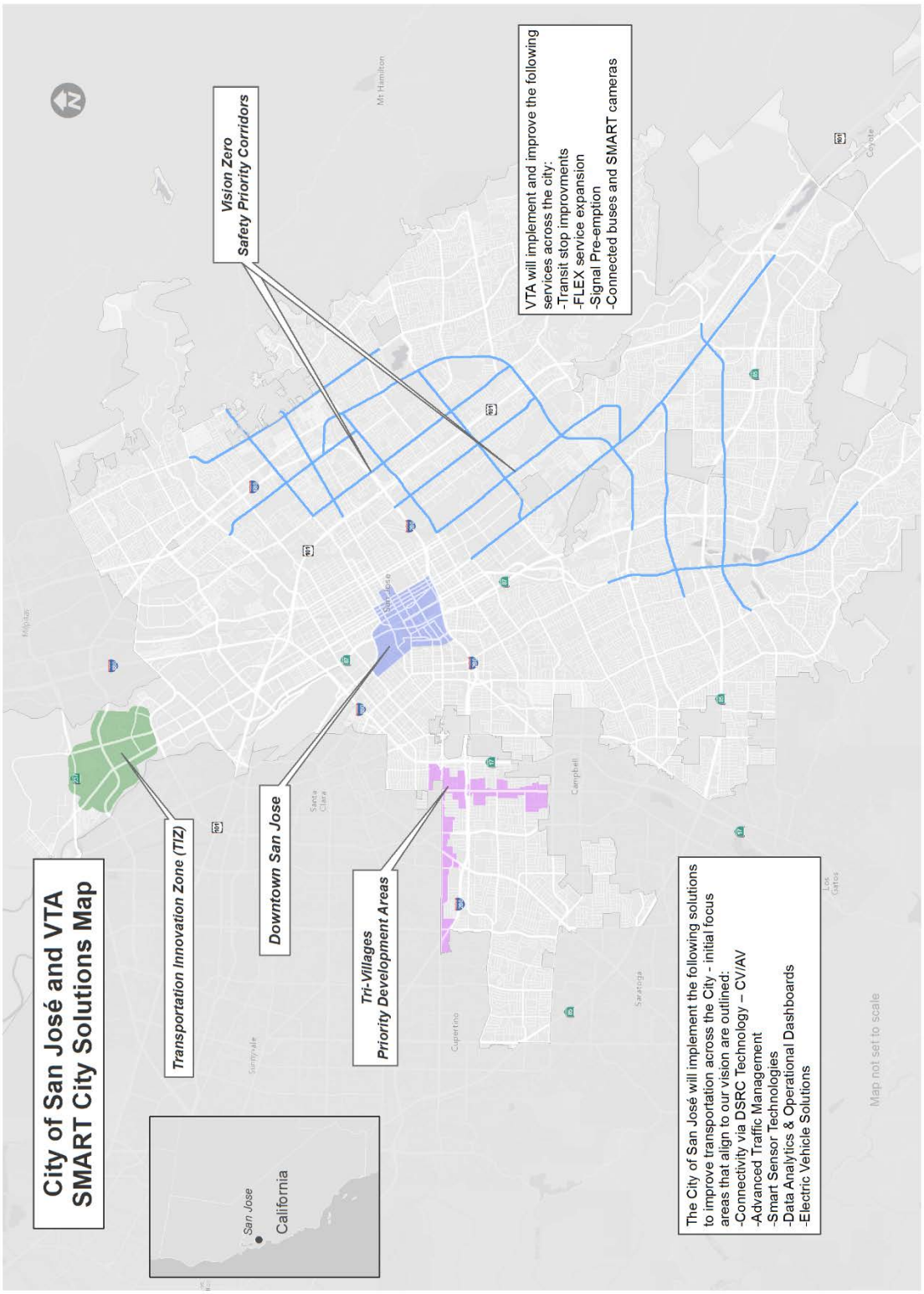
As stated previously, San José has been a leader in developing demonstration and pilot programs through the creation of a Technology Demonstration Partnership Policy in 2008. This policy has allowed San José to demonstrate the first public solar-powered electric vehicle charging station and 15 other clean tech projects.

The challenge that the U.S. Department of Transportation has put forward is one that looks to mid-sized cities to develop innovative ways to address transportation challenges and demonstrate proven methods to address these issues and to create a "playbook" that other cities can utilize to put the demonstrated technologies in place. San José in its approach is looking at ways to demonstrate innovation that will provide safety to its residents, create opportunities for mobility and will address climate change. These goals of the program are ones that San José shares with other cities that have similar characteristics including a downtown core, business/innovation center and surrounding neighborhoods. The goal is to develop the playbook with technology chapters that can be used by other cities looking for specific types of smart technology, whether it is urban automation and connected vehicles, intelligent, sensor-based infrastructure, data analytics, and other areas of technology and Smart City elements; San José has the urban population, density and characteristics necessary to foster success.

Summary of Benefits for the City of San José

- Highly Innovative Public Transportation System - including bus, light rail and heavy rail
- Ability to demonstrate proposed strategies; utilizing our transportation innovation zone and partner in Prospect Silicon Valley
- Extremely committed leadership - in our innovative Mayor and Transportation leads
- A clear commitment to making open, machine-readable data accessible - through our open data platform, data management team and partners.
- Rich and diverse community with a saturation of smart phone devices

ANNOTATED PRELIMINARY SITE MAP



VISION ELEMENTS

Vision Element #1: Urban Automation

The Smart City Challenge grant will spur further innovation in urban automation technologies here in San Jose. We will be able to expand transit solutions by allowing application and infrastructure developers to have access to our newly deployed smart technology platforms and data. Self-driving technologies will be able to speak to our environment and allow partners and vendors to provide autonomous mobility as a service options.

A critical component of advanced urban automation is transit agency and municipality nexus. Collaboration between VTA and the City of San Jose Smart City network will result in solutions that vastly improve mobility for residents by increasing flexibility and connection opportunities. VTA is excited to partner with San Jose, brings the following ideas for cooperation into the conversation:

- VTA Flex service (on-demand bus service currently in pilot in North San José)
- A collaboration with AI and Autonomous vehicle manufactures, initially operating in the Transportation Innovation Zone (TIZ), supported by the City's advanced infrastructure, high speed broad band communication with operation out of VTA's Cerone bus yard.
- Right sizing city buses and using real time analytics to determine ridership throughout the day and hour to send proper size bus - full bus, van size or passenger vehicle
- Allowing integration of sensors at bus stops to alert and enable real time pick up
- Public transit on demand – autonomous vehicles to pick up passengers
- Inter-city and inter-state autonomous buses – allowing a standard based platform for cross state vehicle sensor integration
- Real Time Traffic Information and route analysis to communicate with constituents and effectively load balance services

VTA Flex Service

Vision Element #2: Connected Vehicles

We will be implementing a Dedicated Short Range Communication network across our city and already have in place advanced traffic management infrastructure, such as fiber optic cable, ready to enable the rollout. This communication network will serve as a base platform to enable many connected vehicle and application based components such as:

- DSRC communications across the Transportation Innovation Zone (TIZ) area in North San José to serve as a real life vehicle to vehicle (V2V) and vehicle to infrastructure (V2I) testbed
- Partner with self drive provider for use of these technologies in VTA FLEX on demand services
- Current transit bus cell network, closed caption TV camera integration and connection back to the City's Advanced Traffic Management control center
- Transit bus connection to a SMART stop to share stop requests, bike rack status, wheelchair status etc.
- Enabling smart/cell phone with DSRC: o ~2B cell phone shipped worldwide – fast penetration. Open platform for app developers – safety, social, consumer, commercial applications
- Enabling DSRC components for vehicle manufacturers – V2V automation, accident avoidance, braking and information system integration
- Default applications are around safety-related alert applications such as the USDOT Q-WARN project, fuel efficiencies. Adjacent applications are toll paying, reserved parking, consumer/commercial (instant wireless coupons)

DSRC Enabled Intersection

Vision Element #3: Intelligent, Sensor-Based Infrastructure

Smart City intelligent sensor based technology will be implemented and installed at selected City locations to address our major priorities in safety and enhancing mobility. We will be looking at various solutions and trying to focus on those that allow us to enhance advanced traffic, pedestrian and bike counts using open data platforms to enhance real-time decision making and city planning. We will connect our signal control systems across the City to these data collectors to create a smart environment in which our signals can be predictive and adaptive. Some enhanced opportunities are:

- Implementation of advanced traffic sensors
- Road and traffic condition reporting – enable traffic light signals to work efficiently
- Collect analytics and pattern for predictive, proactive actions and safety analysis
- Basis for bicyclist and pedestrian friendly road alteration planning
- Connect transit buses using prediction software as the core to do traffic light management
- Connect transit bus cctv to control center to validate traffic
- Change transportation priority levels by individual bus using real time bus load
- Advanced emergency vehicle handling and management
- Base connectivity infrastructure opportunities
- Wireless network with gateway type devices located throughout the district
- Low power wireless connector technologies to deploy COTS and prototype sensors from a wide variety of vendors.

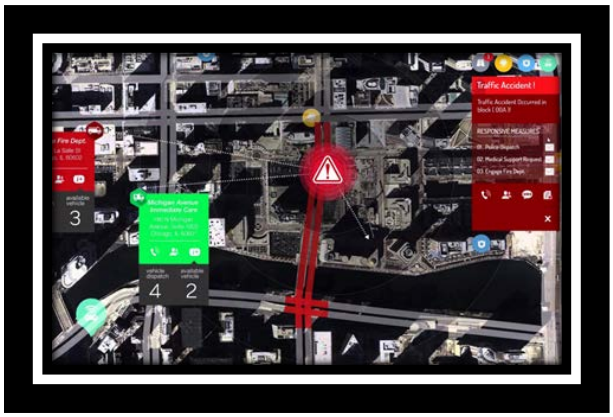
Smart Sensor Concept

Vision Element #4: Urban Analytics

Integrated systems will provide real-time and streaming analytical insights to the City. We envisage building a single pane of glass view of various Smart City components through an advanced operational dashboard. This will be supplemented by allowing our data to be open and

pulled into other systems to enhance the solutions for our partners and community. Further analytic opportunities are:

- Open source data/dashboards fed by and enhanced by increased quality and quantity of real time data
- Enable big data analytics leading to operational and maintenance enhancements
- Data mining to enable adjustment in traffic instrument and road structure
- Offer citizens optimal traffic schedules based on data
- Provide open data access to citizens to leverage fresh ideas from the public
- Allow data to be consumed by anyone to create solutions to problems
- Using data to drive predictive algorithm in future city planning
- Set up measureable metrics and performance goals in traffic enhancement



Interactive Dashboard

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

The implementation of the Smart City project will allow us to enhance and grow our multi-modal transportation environment by incorporating the big data components into solutions and allowing applications to be built upon this platform. One challenge that many cities face that could be resolved is the opportunity of getting insight into ridership habits of the community in order to provide transportation options that allow people to shift from cars to sustainable public transportation options. Detailed mobility service ideas include:

- Open data platform will give app developers and partners access to create innovative solutions to problems that government may not solve on its own
- Integration into an interactive bus stop, next bus arrival, trip plan, bus status (bike rack status, wheelchair status, re-route stop request
- Wayfinding (ADA) and next stop notification (using beacons/sensors on bus stations).
- Enhancing and building out VTA FLEX, or increasing sensor capabilities to further support such options

- Ability to make available a variety of mobility on demand choices
- Allows flexibility in boarding locations - within a specific rider zone, user can be picked up and dropped off door to door or incorporate other alternatives that include a mixture of transportation types
- Fully integrated real time apps for smart phones to indicate location of vehicles, estimated time of arrival and duration of ride
- Ability to give a full multimodal view of the City's transportation options

Vision Element #6: Urban Delivery and Logistics

Our program will help improve the movement of goods throughout the City by improving traffic flow and reducing congestion. Congestion is a major issue in the area and any reduction would see an economic boost. Applications can be built upon our open data and transportation communications network which will allow supply chain and logistics companies to improve their business workflow and delivery times. Industry is under constant disruption and our private/public partnerships can help leverage our Smart City solutions to provide readiness for next generation solutions,

- Provide open data to private industry
- Private app development opportunities through open data
- Provide routing/construction information to improve roadway efficiency
- Using sensors where possible to provide guidance on infrastructure failures and potentially drive preventative maintenance
- Smart sensor data could be used to investigate commercial vehicle movement and make adjustments as needed to improve flow
- Leverage coordination and control from the transportation infrastructure to more efficiently control Signal and Timing and traffic around distribution centers

Next Generation Solution?

Vision Element #7: Strategic Business Models and Partnering Opportunities

San Jose is located in the heart of Silicon Valley and is in an extremely good position to work with and leverage the most innovative minds, partners and vendors in this area. Many companies look to work with us to help foster their innovative ideas and solutions. We are able to partner with Prospect Silicon Valley to work through concept & partnership development, technology discovery and assessment, project development, technical advisory and knowledge transfer.

Other great partnership opportunities are detailed below:

- University Partners (metrolab) - City of San Jose, Berkeley, Mineta Transportation Institute (MTI) and other relationships
- Leverage Private Public Partnerships (P3s)
- Work closely with code 4 San Jose to help involve the community and foster innovation
- Silicon Valley partnerships
- VTA - including Mobile Eye (bus and City fleet) and Santa Clara County
- Airports/parks and stadiums
- Leading car manufacturers located within close range of San José to co-ordinate and test automation technologies
- Building project including traffic impact assessment projects that can allow us to use smart city technologies in useful ways
- Enhanced Wi-Fi utilizing city infrastructure (discuss smart poles that are funded by private companies)

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

Electric vehicle usage within San José is on the rise and there are now more electric vehicles in the City than ever before. It has been reported that the county with the highest amount of electric vehicle ownership is Santa Clara County. Recognizing this trend, the City made an early commitment to electric vehicle infrastructure and has installed electric vehicle stations across the City. These stations are located in parking garages and on-street locations. We are looking to extend this network by using Smart City solutions to integrate with current smart streetlight locations. Furthermore, we are looking towards technology advances in wireless charging to see how that would integrate into our road network.

- Look at using current infrastructure assets to further roll out electric vehicle charging stations.
- Review Smart streetlights for use for charging stations
- Transit on demand, community electrical vehicles, green vehicles in TIZ and downtown
- Utilize in city street environments, the streets can be used as wireless charging parking spaces
- Investigate wireless charging opportunities and look toward automatic wireless charging of autonomous vehicles

Wireless Electric Vehicle Charging Stations

Vision Element #9: Connected, Involved Citizens

The City of San José is committed to freely sharing as much information as possible. We recognize that information is a valuable resource and a strategic asset to the public. Making information accessible, discoverable, and usable by the public can help fuel entrepreneurship, innovation, scientific discovery, and a more efficient government. Using visualizations as a data story is important to connect our citizens to the data so we will be looking at creating useful data dashboards and information sources for our community.

- Open data and open analytics/visualizations
- Build real-time data information into smart kiosks at bus stops
- Allowing access for developers to create and integrate smart phone applications. Some examples include:
    - access to traffic, schedule and congestion information
    - social media applications using parking/traffic data

- Real time information, some requested information points are outlined
    - air quality data
    - traffic and speed data
    - parking data
    - transit bus fleet locations

Vision Element #10: Architecture and Standards

Our current infrastructure architecture is based on open standards and our strategic vision is to ensure implementations are interoperable across other environments. The City is broad with many partners operating within it and logistically, San José is in close proximity to many other cities so this standards based approach is even more important as we extend and expand our transportation infrastructure. We will ensure these standards continue by:

- Use of ITS Nation Architecture and supporting standards
- Utilize the SET-IT tool for deployments
- For mobility applications, use of TMDD at center, then NTCIP to interface and SAE J2735 and J2945/x at the field element level
- Project architecture conformable to enterprise, physical and communications architecture defined in CVRIA
- Leverage vendors knowledge and participation of over-the-air standards and technologies in all relevant sectors – transportation, automotive, telecommunications – to bring high performing interface solutions pertinent to into the project and the CVRIA architecture

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

The City currently owns an extensive fiber network which allows for the ability to rapidly deploy communication equipment. There is a citywide monitoring system in place to ensure equipment and connectivity is maintained without interruption and the City is working on a request for proposal (RFP) for a smart alerting system that will be incorporated into this program. The City would be able to utilize this asset to:

- Leverage the existing Fiber-City network
- Use existing and opportunistic WI-FI access points
- Ensure current Smart City infrastructure is leveraged such as the smart LED streetlights
- Implement DSRC secured authentication for trusted devices

- Leverage cloud based services for elastic scalability and cost efficiency
- Provide open data without providing access to secure process control networks or PII data

Vision Element #12: Smart Land Use

The City is committed to Smart Land Use with the development of its Envision 2040 General Plan. San Jose recognizes that in order to provide the needed transportation services for its growing population there needs to be new innovative ways to address these issues. San Jose is focusing on the development of Urban Villages that will benefit from innovative approaches to transportation including modal options, advanced traffic management and open data. Some ideas include:

- Use of smart software to identify dead traffic zones, which will allow planners to rejuvenate and re-invent neighborhoods
- Connect different aspects (businesses) i.e. in a city stadium or airports
- Implement eco-friendly last mile solutions, such as: bike-share, electric bikes, scooters, narrow vehicles or segways
- Bicycle safe lanes with buffers and other improvements to encourage more bike use
- Re-using existing transportation for multi-purpose such as:
    - Electrifying wireless charging parking space
    - Installing sensors for ridership analytics and pick up
    - Enabling access to city data for all citizens
    - More shared vehicles: fewer garages, more living space

RISKS AND MITIGATIONS

Risk	Mitigation
Innovative solutions have an inherent technical risk	Utilize the transportation innovation zone and our partners at Prospect Silicon Valley to beta test solutions.
Shortage of City staffing resources	Build upon our strong civic innovation values and rely upon our strong partnerships with the private sector, non-profits and public agencies.
Ongoing maintenance and operational costs	Investigate solution as a service model.
Regulatory restriction for autonomous vehicles and advanced mobility solutions	Seek exemptions for demonstration projects and work with regulators and industry leaders to advocate for more flexible regulations

Autonomous vehicle rollout and uptake is slow and varied	Consider limiting the initial rollout of DSRC to a smaller scope

PARTNERS - STAKEHOLDER - DEMONSTRATION PROCESS

Public Agency Partners	
California Department of Transportation (Caltrans)	www.dot.ca.gov
VTA	www.vta.org
University of California Berkeley	www.berkeley.edu
San José State University	www.sjsu.edu
MetroLab	http://metrolab.heinz.cum.edu
USDOT	www.transportation.gov
Mineta Transportation Institute	http://transweb.sjsu.edu
Prospect Silicon Valley	http://prospectsy.org
Silicon Valley Partners/Vendors	www.siliconvalley.com
Code for San José	http://codeforsanJosé.com

A Demonstration Partnership program was created by San José in June 2008 to create a framework for partnering with companies to test innovative solutions. This program helps pre-commercial technologies and emerging business models demonstrate their viability in a real-life environment. This program makes available access to City buildings, assets and staff expertise to assist in proofing concepts. At the same time it allows the City to explore emerging opportunities to continue improving City operations. The goal of the program is that through these partnerships, new markets and jobs will be created, local innovators and companies encouraged to invest in R&E, all while advancing the City's Green Vision and Economic Development Strategy.

There will be the opportunities for private partnerships throughout the Smart City Challenge implementation. Many of the partners below have provided the City of San José thought leadership and guidance around smart cities and technology advancement.

First and Last Mile

- Swiftmile http://www.swiftmile.com/
- RideCell http://ridecell.com/
- Scoop Technology http://www.scopetechnology.com/

Electric and Automatous Transit Vehicles

- Proterra http://www.proterra.com/
- Thomson Power http://www.thomsonpower.com/
- NREL National Renewable Energy Laboratory http://www.nrel.gov/

- Mercedes-Benz Silicon Valley R&D Center in Sunnyvale http://www.benzinsider.com/2013/11/new-mercedes-benz-rd-center-opens-in-sunnyvale-california/

Customer Information Systems and Security

- N3n www.n3n.io
- Connected Signals www.connectedsignals.com
- CHK America http://chkamerica.com/
- Allied Telesis http://www.alliedtelesis.com/
- Mobileye and ROSCO http://www.mobileye.com/

Connected and Autonomous Vehicles

- Cisco Systems www.cisco.com
- Savari http://www.savarinetworks.com/
- RSM www.rsm.ie
- Qualcomm www.qualcomm.com
- Inrix http://inrix.com/
- Arada Systems http://www.aradasystems.com/
- AnyCOMM http://www.anycomm.com/
- Microsoft www.microsoft.com
- Philips www.usa.philips.com

SYSTEM FEATURES - EXISTING TRANSPORTATION INFRASTRUCTURE

Arterial miles – There are 314 centerline miles of arterials within the City of San José.

Freeway miles – There are 63.8 centerline miles of Federal interstates and State highways in San José.

Transit services

Santa Clara Valley Transportation Authority (VTA)

Santa Clara Valley Transportation Authority (VTA) is an independent special district that provides sustainable, accessible, community-focused transportation options that are innovative, environmentally responsible, and promote the vitality of our region. VTA provides bus, light rail, and paratransit services, as well as participates as a funding partner in regional rail service including Caltrain, Capital Corridor, and the Altamont Corridor Express. As the county's congestion management agency, VTA is responsible for countywide transportation planning, including congestion management, design and construction of specific highway, pedestrian, and bicycle improvement projects, as well as promotion of transit oriented development. VTA provides these services throughout the county. VTA continually builds partnerships to deliver transportation solutions that meet the evolving mobility needs of Santa Clara County.

Bay Area Rapid Transit (BART)

Bay Area Rapid Transit (BART) is a rapid transit system serving the San Francisco Bay Area. The heavy-rail public transit and subway system connects San Francisco with cities in the East Bay and suburbs in northern San Mateo County. BART's rapid transit system operates five routes on 104 miles (167 km) of line, with 44 stations in four counties. With an average of 422,490 weekday passengers, 211,288 Saturday passengers, and 158,855 Sunday passengers in September 2014, [7] BART is the fifth-busiest heavy rail rapid transit system in the United States.

BART is operated by the San Francisco Bay Area Rapid Transit District, a special-purpose transit district that was formed in 1957 to cover San Francisco, Alameda County, and Contra Costa County. The acronym is almost universally pronounced like the name "Bart" rather than spelled out.

Caltrain

Caltrain provides inter- and intra-county commuter rail service along the San Francisco Peninsula, including San Francisco, San Mateo, and Santa Clara counties. The current weekday Caltrain operating schedule is comprised of a mix of 92 express (Baby Bullet), limited, and local trains. Caltrain operates 36 trains on Saturday and 32 on Sunday, with service primarily composed of local trains, with two Baby Bullet trains in each direction per day.

Altamont Corridor Express (ACE)

The Altamont Corridor Express (ACE) provides service from the city of Stockton to Santa Clara County. It runs a distance of approximately 85 miles from Stockton through Alameda County into San José in Santa Clara County.

Capital Corridor Inter-City Rail

The Capitol Corridor is an intercity passenger train system that provides a convenient alternative to traveling along the congested I-80, I-680 and I-880 freeways by operating fast, reliable and affordable intercity rail service to 16 stations in 8 Northern California counties: Placer, Sacramento, Yolo, Solano, Contra Costa, Alameda, San Francisco, and Santa Clara, a 170-mile rail corridor. An extensive, dedicated motor coach network provides bus connections to serve the second-largest urban service area in the Western United States.

Shared-Use Mobility Services

Shared-use mobility comprises transportation services that are shared among users, including traditional public transit; taxis and limos; bike sharing; car sharing (round-trip, one-way, and personal vehicle sharing); ridesharing (car-pooling, van-pooling); ride-sourcing; scooter sharing; shuttle services; neighborhood jitneys; and commercial delivery vehicles providing flexible goods movement. San José has responded to the call for shared-use mobility by significantly expanding its bike network, fostering the development of bike- and car-sharing services, collaborating with the Santa Clara Valley Transportation Authority (VTA) on transit improvements, adopting a Vision Zero (no traffic fatalities or serious injuries) policy and plan, and preparing to roll out a community-based social marketing (CBSM) program to encourage residents and employees to use "green" commute options rather than drive alone. But, smart technology, applied effectively, could help make even greater gains. San José is working with a number of public agencies, non-profits, and private organizations to expand the mobility options available to those who live and work in this area.

City Bike Fleet – City bicycle program that provides bicycle to use to go to meetings and for other city trips.

Bay Area Regional Bike Share Program – 24/7 shared bicycles available throughout the region at key transportation locations and ride generators.

Eco Pass - The Eco Pass provides free access to eligible City employees to VTA's bus and light rail services.

TDM Pilot Program- Developing community-based social marketing to encourage residents and employees to use green transportation options.

Carpooling - Carpool Buddy program allows fellow CSJ employees to connect and set up carpools at their own convenience. 511.org also supports City employees and resident carpool options.

Car sharing - San José adopted a car share parking pilot program in 2012 to support the growth and long-term success of car sharing in the City. The pilot has enabled Zipcar to expand its operation in San José from an initial 12 cars to 35.

Information and Communication Technology (ICT)

A strong Information and Communication Technology infrastructure is required to create and deploy a strong Intelligent Transportation System. Many of the traditional forms of data collection are currently in use in U.S. cities. These include sensors, induction loops, and cameras among others. This data is then processed analyzed and processed in traffic control centers. The City of San José currently utilizes information that it receives and processes it through its Traffic Incident Management Center (TIMC).

It is envisioned that this information, among others currently under consideration, will be shared to academia and industry partners to promote and support mobility, urban automation, and various elements of the sharing economy. A current example of an ICT application already taking place in San José is the City's Cooperative agreement with BMW to study and explore how vehicle drivers can time the green light of an approaching signalized intersection.

Intelligent Transportation Systems (ITS)

Eight years ago, San José embarked on an ambitious, $20 million grant effort to modernize its legacy, serial based traffic signal infrastructure into a state-of-the art, IP based transportation system. The foundation of this implementation is a robust field communications network made up of a mixture of hardware technologies, transport mediums, and network architectures. Over 70 miles of fiber optic cabling are installed in three physically separated rings, providing the highest level of redundancy to traffic signal communication and the various transportation applications and services. Six hubs strategically located along the fiber rings serve as aggregation points for more than 650 DSL based Ethernet switches that leverage the City's existing inventory of 150 miles of SIC cabling. Additionally, over 400 high-speed, wireless broadband Ethernet radios are installed in point-to-point and point-to-multipoint configurations to address the last mile connection requirement for hard to reach signalized intersections. The design of a fiber optic trunk system with aggregated hub locations and establishment of fiber optic hub to hub redundancy provides a highly robust fault tolerant network with high bandwidth throughput.

The City's current mix of standard ITS hardware and networking protocols has facilitated the use of industry standard network management system which ITS staff routinely uses to monitor the network's health. This exercise has resulted in improved response times in addressing communication faults, improved signal operations by enabling staff to be more responsive to real-time traffic conditions, and allowed for timely repair and restoration of optimal intersection operations. In addition to utilizing industry standard networking equipment in its traffic communication network, San José has adopted industry standard traffic signal equipment, such as 2070ATC controllers at more than its 930 signalized intersections, NEMA TS1/TS2 and Caltrans 332 cabinets, and NTCIP protocols for central based communications between field controllers and the ATMS. To improve traffic surveillance, the City has deployed CCTV cameras at over 240 locations over its existing IP-based communications network, allowing staff to effectively monitor live traffic conditions and adjust signal timing if required to accommodate demand. With the primary aim of improving traffic flow and reducing vehicle emissions, San José is an ardent supporter of transit signal priority and adaptive signal control. Transit signal

priority is deployed at 77 light rail signalized intersections and over 50 intersections along two of the VTA's most heavily utilized express bus lines. In 2011, San José successfully implemented adaptive traffic signal control at 35 signalized intersections, spread throughout six heavily congested corridors.

Building on the experience and knowledge gained from this and other infrastructure improvement projects, San José saw unique opportunities to be an early adopter of Smart City technologies, such as smart LED streetlights, parking guidance and dynamic message signs, and smart parking meters. One third of the 62,000 streetlights have been converted to LED to date, with plans to complete the total conversion by 2020. To ensure positive travel experience to downtown events, a network of eight dynamic message signs and 13 of parking guidance signs are utilized to provide timely and useful information of available parking, traffic conditions, detours, etc.

At the heart of this operation is a second generation, state-of-the-art, traffic management center recently opened in March 2015. Located at City Hall, it was designed to better integrate operations of city traffic, roadway safety and maintenance services, and to better coordinate regional transportation services, including county-wide transit operations. This federally funded facility enables engineering staff to actively monitor traffic flow conditions, optimize traffic signal operations, minimize travel delays resulting from event and incident traffic, as well as identify and facilitate timely repair of traffic signal system malfunctions. Currently, roadway system performance capabilities are being implemented to allow staff to easily identify unusual conditions and events that may have potential to cause travel delays and system malfunctions.

The City's infrastructure includes:

- 932 traffic signals
- 453 surveillance cameras (Fixed, PTZ, Embedded) at 241 intersections
- 447 video image detection system (VIDS) cameras @ 150 intersections
- 8 Changeable message signs (CMS)
- 61 flashing beacons / RRFB's (41 solar)
- 66 Speed radar signs (20 solar) 88 related Wireless Radios
- 167 International protocol (IP) video encoders
- 650 Ethernet over copper network switches
- 6 Hub Ethernet fiber switches
- 50 Ethernet wireless radios Downtown Wi-Fi
- 402 wireless Ethernet radios for signal communications
- 21 EMTRAC bus priority units (San Carlos-Stevens Creek)
- 6 communication poles/equipment
- 41,982 Traffic signals light emitting diodes (LED)
- 5,785 countdown LED peds
- 86 miles of fiber
- 146 miles of interconnect cable
- 215 Streetlight Segment Controllers (total by end of FY 14-15)

DATA

San José's current data landscape is robust, but we also recognize that growth and innovation—particularly in the areas of transportation and civic technology—will allow the City to collect even larger quantities of real-time information. With this in mind, the City has begun laying the groundwork to make use of this information through a variety of interrelated Smart City and civic innovation initiatives related to data collection, sharing, and analytics.

In 2015, at the request of the City Manager, the City conducted a comprehensive, citywide inventory of all existing datasets as part of our on-going Open Data Initiative. With over 600 datasets identified to date, this effort has resulted in a vastly improved understanding of our information assets, which we have already begun using to improve service delivery and streamline the flow of information across agencies and to the public. Transportation in particular will benefit tremendously from this effort. In DOT alone, over 50 datasets have been identified, many of which will be made publicly available on the City of San José's Open Data Portal, allowing residents, visitors, and employees unfettered access to the same information management uses for internal decision making. City managers and frontline staff will soon be operating with maximum access to citywide information resources regardless of which agency "owns" and maintains a given dataset. In the first quarter of 2016, San José will codify its Open Data Policy, either through administrative action or City Council vote, which will solidify its commitment to the core principles of open data and information sharing. This will ensure opportunities for innovation are executed efficiently and appropriately and community feedback is integrated thoroughly into the City's vision of a highly efficient, safe and reliable, multi-modal transportation network.

As the "Capital of Silicon Valley," San José has a litany of opportunities to collaborate with our community of technology-based businesses, non-profits and "civic hacktivists", along with our regional transportation partners and neighboring jurisdictions, to advance Smart City technologies in support of our broader transportation goals. As part of our Vision Zero traffic safety initiative, the City has already begun leveraging the expertise of its internal Data Analytics Team and the non-profit organization DataKind, a data-science firm supporting Vision Zero efforts in cities across the United States, to enhance public safety through mitigating traffic fatalities and severe injuries for pedestrians, motorists, and cyclists. On the transportation innovation front, San José is engaging with a local research institution as part of the nationwide MetroLab Network to identify opportunities for the implementation of Smart City projects related to sensor technologies and big data analytics. These are the first of many cross-cutting partnerships the City plans to cultivate, catalyzing our Smart City and innovation vision.

Given its early commitment to developing cross-cutting partnerships, the City is well positioned to execute timely data sharing agreements to support our Smart City endeavors. The San José Open Data Policy explicitly states that data owned and maintained by the City is open by default, barring security or privacy concerns. Where privacy concerns and security risks are a factor, our

current collaborative partnerships will inform the processes by which we share sensitive data. Implementation of this policy in early 2016 will help facilitate a seamless flow of information to our partners. Indeed, the City has already begun sharing information and has seen significant improvements in this area. DataKind has been given complete access to the DOT collision database, which tracks all data coming out of the San José Police Department's traffic collision reports, for example. In support of our MetroLab Network partnership, the City plans to share data collected from sensors placed throughout the City. Data collected from our new LED "smart" streetlights, which record energy use, is also likely to be shared as part of our ongoing, citywide Smart City vision.

Standards, Architectures, and Certification Processes for ITS and Connected Vehicle Based Technologies

The City will leverage our partnership with our vendors to participate in and understand the standards and certifications needed from around the world – with particular focus of IEEE 802.11, IEEE 1609 WG, SAE DSRC TC – to ensure that our National Architecture- and CVRIA-compliant and documented architectures are or can be compliant to existing and proposed standards. For proposed standards, we will ensure that in partnership with our vendors we use knowledge and participation in standards bodies to advocate for and develop standards as appropriate.

We will ask our vendors to assist in translating their understanding of the capabilities and gaps of incipient Connected Vehicle certifications to focus and mature certifications of Smart City applications.

We will seek partnership and guidance with vendors that have leadership positions in some of the standards development and certification. This would position us well to collaborate with the vendor in all aspects of the familiar standards and certification ecosystem to the benefit of our proposed project approach and to the benefit of our Connected Vehicle and Smart Cities deployments.

We will ask our chosen vendors to use the SET-IT tool and also contribute to the editorial content of emerging standards. Additionally, a "Standards and Architecture" publication will be created to enable understanding and replication of the Smart Cities applications as well as current and anticipated standards to enable deployment and interoperability.

GOALS AND OBJECTIVES

Service delivery goals and metrics will be tracked using the strategic goals set out in the Transportation Service Delivery Framework. Some examples include:

Goal	Metric
Improve transportation safety	Percent of residents rating traffic conditions as safe while driving, biking and walking Number of injury crashes by 1000 population Number of pedestrian and bicycle related injury crashes per 1000 population
Expand use of alternate commute options	Percent of residents rating access to public transit as "easy" Percent of trips by alternate modes of transportation
Improve traffic flow on major streets	Percent of residents rating commute traffic flow on city streets as "acceptable" or better Percent of city intersections the council adopted level of service
Provide neighborhood - friendly traffic operations	Percent of residents rating traffic impacts in their neighborhood as "acceptable" or better

Furthermore - discussions with technology partners will set highly measurable goals to ensure the implementation is carry out on time, measured and analyzed. Results will be used to adjust and improve the operations. Comparison will be calculated to provide the most meaningful collation.

PROJECT CAPACITY AND COMMITMENT

San José's Office of Economic Development is committed to providing an integrated, solutions based approach to business assistance that creates a foundation for entrepreneurs and companies to develop new ideas and foster economic opportunities for generations to come.

We are committed to driving a vital and competitive economy that increases prosperity and quality of life for our residents and businesses. Our mission is to catalyze job creation, private investment, revenue generation, and talent attraction and development.

As the largest city in the Bay Area, a growing population of young professionals, expert technologists and experienced managers call San José home. You will have the advantage of attracting a globally diverse workforce by locating in San José.

City Capacity for Implementation: San José has been in the fore front of technology implementation. Situated in the heart of Silicon Valley, San José has been partnering with technology leaders to transform the City into a Smart City, serving our large diverse population and improving the quality of life for the under privileged.

Our commitment to innovation has led to having a great technical base to implement Smart City solutions. Our Transportation Innovation Zone coupled with Prospect Silicon Valley gives us an opportunity to partner with interested vendors to lab test Smart City technology and then deploy rapidly in a real world scenario.

We not only have the technological knowhow and innovative culture to take on the smart transportation implementation, but the passion to be the leader in autonomous vehicles and road electrification. We have already implemented many advanced and innovative solutions within the City and are passionate about moving forward with more implementations.

OPPORTUNITIES

The City will work closely with its partners to leverage any Federal dollars received from the Federal Government for the Smart City Challenge. As the Capital of Silicon Valley, San José has a unique opportunity to take advantage of both public and private leveraging opportunities. There is a long history supporting innovation and incubation, going back over more than 15 years. For example, San José helped create and fund four different incubators that were highly successful and each remained operation for between 10-15 years.

Working in partnership with PROSPECT SV, the City would be able to leverage Federal funding by having access to the benefits that PROSPECT SV generates, such as:

- Provide a public commercial facility that will facilitate prototype development, testing and demonstration of emerging solar, clean transportation, energy efficiency, smart grid, storage and other clean technologies in Silicon Valley.
- Increase commercialization of grant-funded applied research in clean technologies through partnerships with universities, government agencies and research labs in order to help meet City, State and National environmental priorities.

According to conversations with Governor Jerry Brown's office, the Governor is supportive of all California cities that submit an application to USDOT's Smart City Challenge and that for every $1 invested by the Federal Government, the State will more than double the Federal investment with State funding.

The City will also work with the many educational institutions locally and those local private companies already advancing work in these fields.