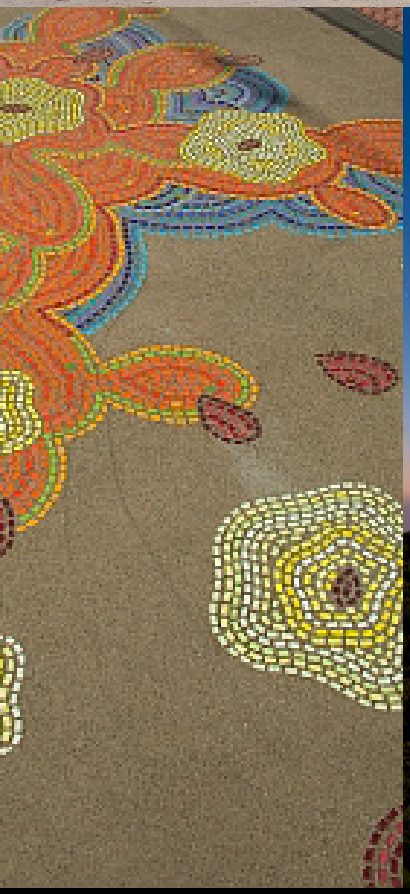

Tucson Smart City Demonstration Proposal

Part 1: Vision Narrative

February 4, 2016

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1 Smart City Vision

A. Existing Challenges and Proposed Solutions

CHALLENGE	PERFORMANCE MEASURES	SOLUTIONS
MOBILITY Tucson is **14th** in the nation for the **worst congestion** **vehicle miles traveled** 75% on arterials **nationally** 9th highest percentage COMMUTERS **Freight volumes** 10% on major roads causes disproportional damage to streets	Improved level of service without construction of new roadway Increase roadway capacity for cyclists while reducing potential for auto-cyclist conflicts Focus intra-regional freight traffic onto select corridors Improved enforcement of intra-regional overweight trucks Increase in transit utilization Reduced private and single occupancy vehicle use Develop regional Complete Streets Plan Improve transit on-time performance	**TUCSON'S SMART CITY VISION INCLUDES SOLUTIONS FROM EACH OF THE 12 USDOT VISION ELEMENTS**
SAFETY **FHWA SAFETY FOCUS CITY** **250** are **struck** while crossing the road —about **20** are **killed** per year **1/2** of all **WASHES** in the region lie in the study area **ANNUALLY** (on average) **360** = CRASHES FATALITIES = **3**	Year-over-year decrease in number of pedestrian and bicycle crashes and fatalities—the goal is to move toward zero Decrease flash flood-related acccidents and deaths around washes Increase public awareness of alternate transportation alternatives such as Uber, Lyft, etc. Development of security related policies and laws	**Solutions** fall into four primary categories of projects: 1 Connected/autonomous vehicle deployment 2 City-wide infrastructure inhancement 3 Move Tucson Smartly citizen engagement campaign 4 Transportation data management portal
ENVIRONMENTAL Low number of DC-fast charging stations Maintain **ATTAINMENT** Air Quality status	Performance measures established for siting and locating EV infrastructure Private funding or financing options are analyzed to expand EV infrastructure Decrease delays on freight-heavy arterials Examine policy and/or financial incentives to encourage alternate freight routes through city Reduce emissions on demonstration corridor Establish inventory of public and privately owned charging stations with real-time inventory and availability	

B. Program Management, Implementation, Operation, and Approach

i. Program Management Team

The City of Tucson Department of Transportation will be the lead on this project. Our organizational structure will include a Program Administrator, Project Manager, Technical Manager and technical support provided by consultants.

Similar to the Tucson Modern Streetcar project, this project will have a The Project Management Team (PMT) made up of representatives from various departments including Procurement, Finance, IT, Sun Tran, and Sun Link. The PMT will also include representatives from The University of Arizona, the Pima Association of Governments, and the Arizona Department of Transportation. Public outreach and communications will be included in this working group as well.

The PMT will develop a scope, schedule and budget that will identify the different tasks necessary to complete the project. The Procurement department will assist with setting up contracts, Intergovernmental Agreements (IGA)s and Memorandum of Understanding (MOU)s necessary to move the project forward. Long lead items will be identified and take priority. A Primavera schedule will be developed in detail. Private partnerships will be identified and MOU's or contracts will be developed.

ii. Implementation

PMT will meet on a weekly basis to assess the schedule and modify if necessary. Information will be developed to share with the public. Every opportunity to promote this unique project will be taken. Milestones will be developed that help us create an outline of public information and marketing opportunities.

The City of Tucson will be the liaison to the USDOT. We anticipate that something similar to the Project Management Oversight Consultant (PMOC) practice will be instituted to allow for federal oversight. We will develop monthly program reports that include updates on the schedule and budget and anticipate periodic meetings to provide briefings on the progress.

Another focus of the PMT will be the policy side of the Smart City Challenge project. The PMT will coordinate with the city, county, Pima Association of Governments and state to identify policies that need to be created to support the smart changes in infrastructure and open data.

iii. Operation

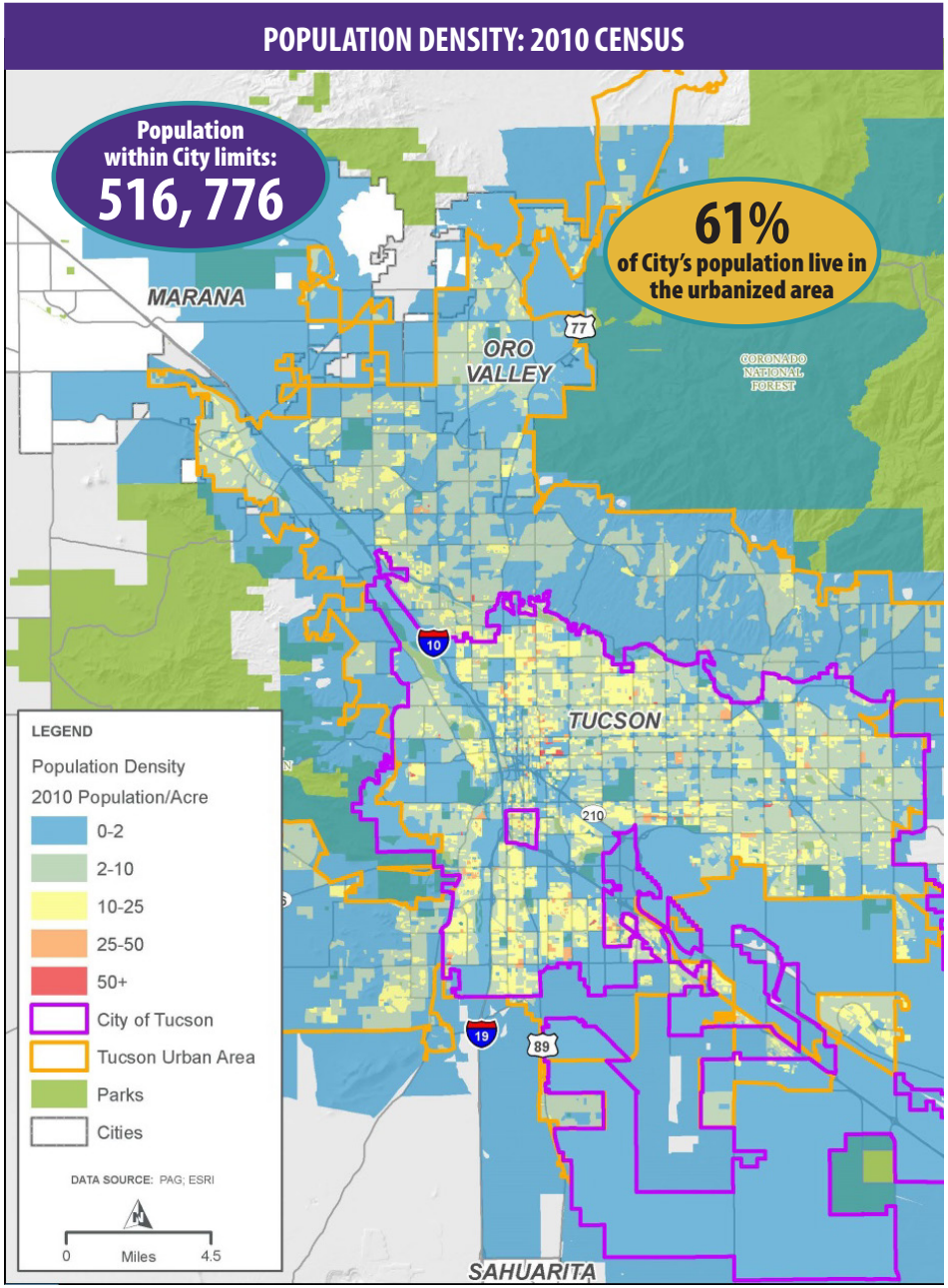
The first three years will focus on installation and implementation of the tasks identified in the application. The fourth year will be the actual demonstration year. The fourth year will include monitoring of congestion reduction, mobility and safety for vehicles, bicyclists, and pedestrians. The PMT will plan a Smart City Conference at the conclusion of the Demonstration period to provide information and lessons learned to other communities.

C. Tucson Smart City Challenge Organizatonal Charth

2 Tucson is an Ideal Smart City Candidate: *Population Characteristics*

Tucson is perfectly aligned with the USDOTs population characteristics of a Smart City. According to the 2010 Census:

- 2010 population within City Limits: 516,776
- 61% of the City's population are in the urbanized area
- 75% of traffic is carried on the arterial and collector roadways
- Due to a number of natural and man-made limitations, population is focused in the core
- By policy, future growth will be incentivized to locate in the urban core

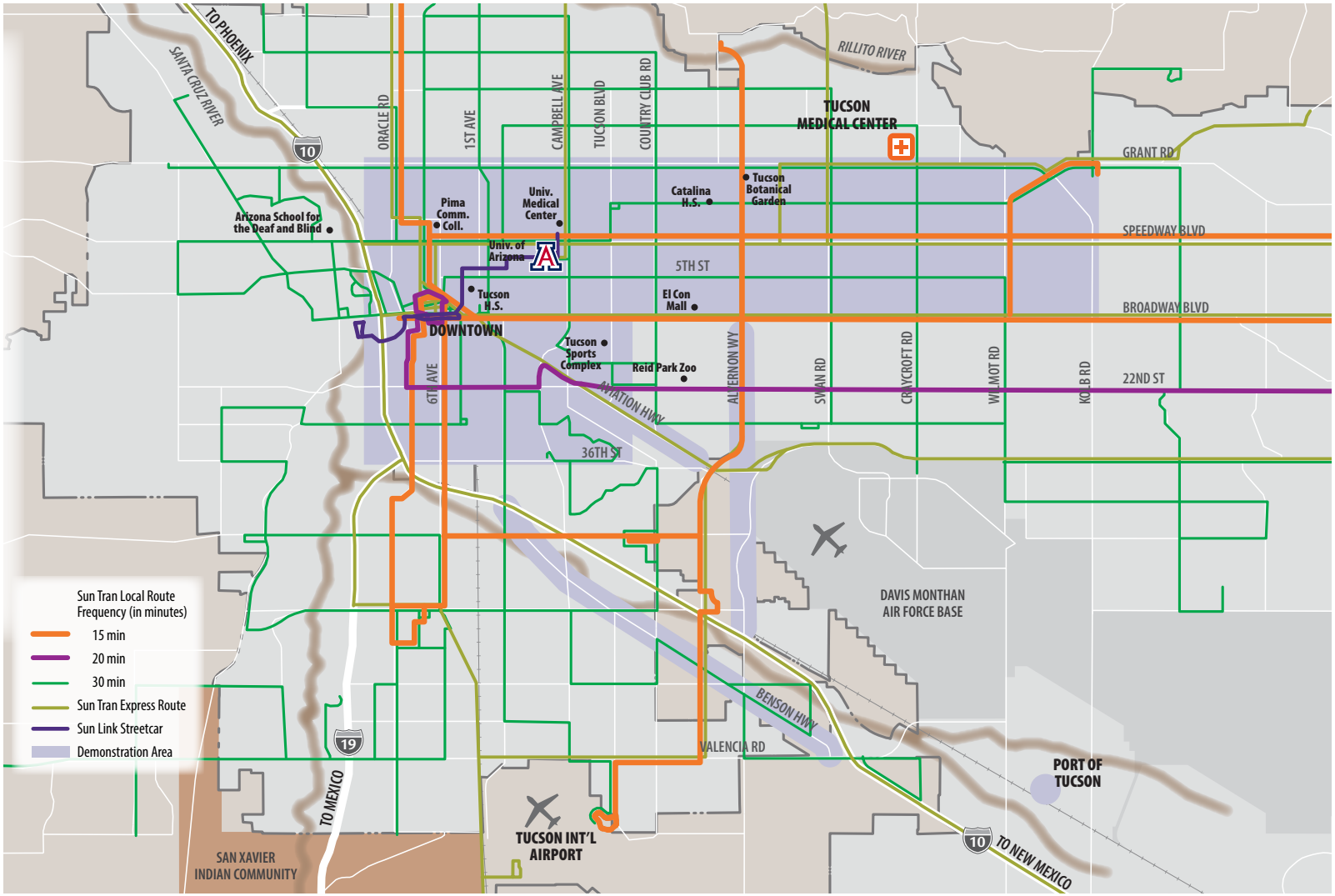


3 Tucson is an Ideal Smart City Candidate: *Additional Characteristics*

A. Robust Public Transportation System with Frequent Service

In addition to the public transportation system, the City of Tucson has extensive IT and Smart City infrastructure elements already in place. For a more detailed view of these assets, please refer to Section 8 of the proposal.

> *"The Smart City Challenge is a perfect opportunity to pair community momentum and forward-thinking transportation with smart technology for the safety of people on foot, bike, transit, and private automobikes. It has the potential to bring together and build upon so many of our efforts, as well as many others, including the Mayor's Challenge for Safer People, Safer Streets, our aspirations to be a Platinum Bicycle-Friendly Community, and our dedication to expanding transit lines throughout Tucson."*
>
> **– Emily Yetman**
> Executive Director,
> Living Streets
> Alliance



B. Tucson has a Conducive Demonstration Environment

- City will provide corridor(s) for demonstration
- Inductive charging pads will be provided for a demonstration corridor
- Gold rated bicycle friendly community
- Existing sensor-based transportation infrastructure
- Modern streetcar – sources electricity from clean energy
- TIGER I recipient – navigated new procurement and processes
- Go Tucson app—pay for parking and transit
- Procurement – Achievement of excellence in procurement—only city in ADP history to receive a perfect score
- Smart city enabled street light capability citywide
- Digital Cities award winner
- Innovative Tucson: Living Streets Alliance, Startup Tucson, UNESCO gastronomy designation and thriving local brew pub scene
- Transit – 4th most employment accessible transit system in country, Brookings Report; streetcar awards
- Bike share program – ***coming in 2017!***
- HAWKs, flashing yellow left turn arrow, deployed bike boulevard and separated and protected lanes

Cool City Hot Climate!

- Established Clean Cities program and Coalition
- Robust EV recharging and alt fuel infrastructure

- Connected /autonomous research and testing
- Traffic signal and control device technologies inventors
- CyVerse (formerly iPlant) - open data cyber infrastructure that serves as the basis for urban analytics and aggregator of big data

- In the presence of U of A President Ann Weaver Hart, Governor Doug Ducey signed Executive Order 2015-09 on August 25, 2015 that allows for the testing and operation of autonomous vehicles
- Has identified facilities that may be conducive to autonomous vehicle testing

Private Sector

- Defense field – world leader in autonomous systems
- Pioneering telemedicine

C. Tucson has Committed and Steadfast Leadership

Commitment to creating a smart future for Tucson has been made by leaders in the state, county, city and also by industry giants.

> ***"We recognize that we can also be a model for other states."***
>
> **–John Halikowski**
> **Director, Arizona Department of Transportation**

D. Tucson's Smart City will be Deeply Integrated with the Sharing Economy

At the heart of the sharing economy is the promise of building community while providing greater access to consumer goods and services at a lower cost. Within the context of a sharing city, the latter benefits can be conceptualized as creation of urban commons – physical and virtual spaces where everyday citizens consume collaboratively in an effort to live more sustainably. The physical commons could include traditional retail businesses, food cooperatives, farmers markets, local artisan guilds, and other retail providers centrally located to maximize their economic prosperity and minimize retail-related transportation impacts. The corresponding virtual commons could include sharing economy platforms, which connect citizens to maximize use of material goods and minimize landfill and environmental impacts associated with excess consumption. Using a mobile loyalty application that leverages geofencing and iBeacon technologies within the commons and along the City's transportation network, citizens could book and pay for public/shared transportation to and from the commons, check-in at the commons via social media, explore and purchase goods and services in advance or on demand, and even volunteer assistance within the commons. In our local context, this could help bilingual citizens and international UA students to assist cross-border and international visitors who are exploring the commons.

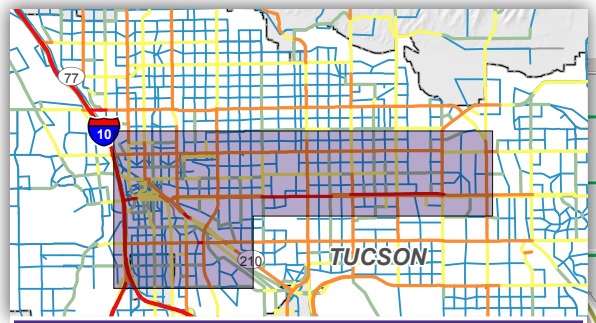
E. Smart City Data will be Accessible, Discoverable, and Usable

In 2012, the Tucson City Council passed the Open Government and Open Data Resolution to make all government data open and accessible to the public. The City will build upon this resolution by encouraging organizations such as ***Open Tucson*** and ***Code Tucson*** to find new ways to use City data.

Additionally, big data from the mobile loyalty application, potentially managed by The University of Arizona CyVerse and virtualized by U of A INSITE for public access, could provide data to refine and improve consumer offerings and public services, document citizen engagement on the transportation network and in the commons, and provide a wealth of other insights that could spur additional innovation and entrepreneurial ventures within the City.

4 Preliminary Site Map

A. Selection of Demonstration Area

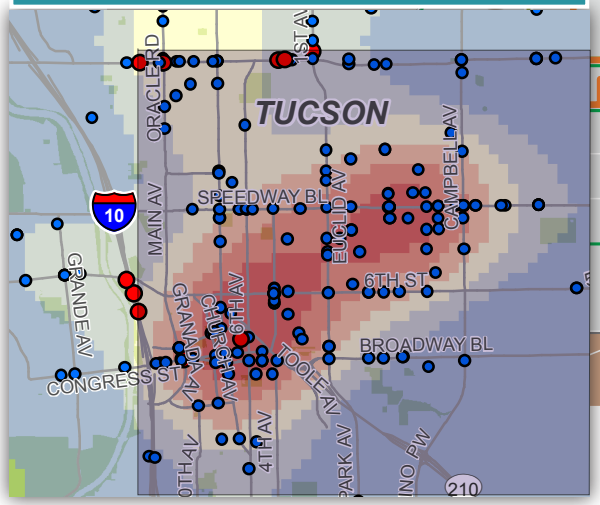


Forecasted freight volumes volumes increase significantly in the proposed demonstration area (*Source*: Arizona Freight Model)

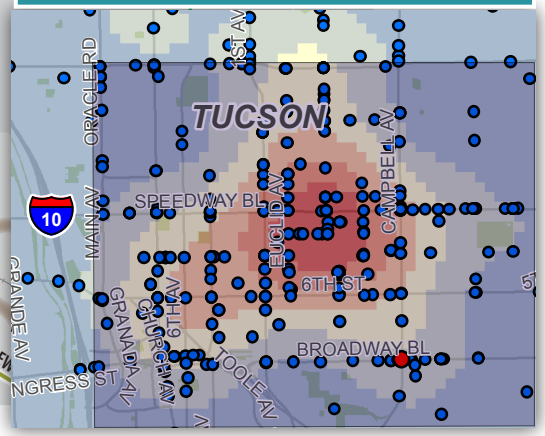
30% of electric vehicle charging stations are located in the proposed demonstration area (*Source*: PAG)

36% of all home-based peak-period trips are traveling to the proposed demonstration area (*Source*: PAG)

44% of pedestrian crashes and 36% of pedestrian fatalities occur in the proposed demonstration area (*Source*: PAG)



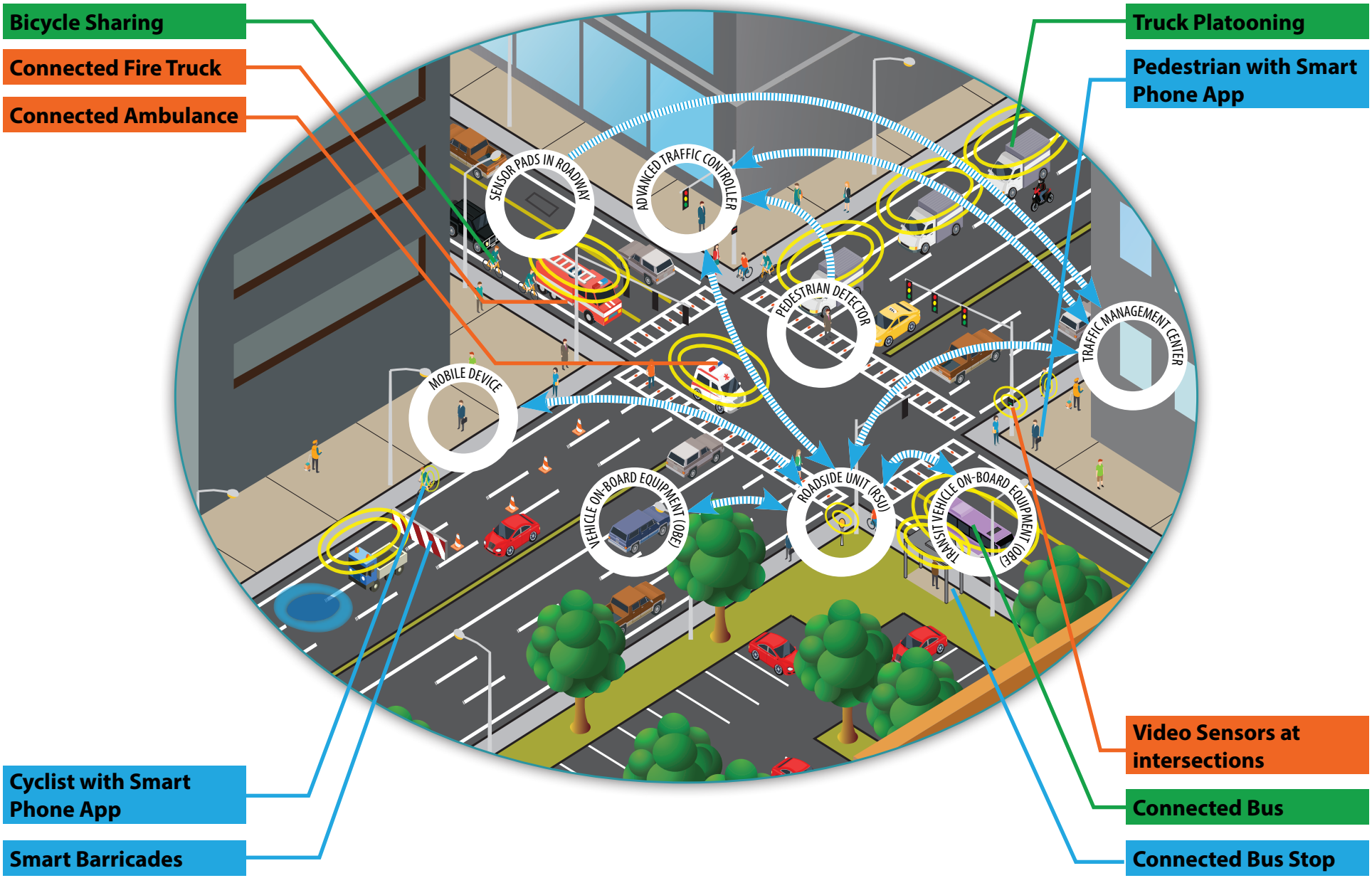
52% of bicycle crashes and 44% of bicycle fatalities occur in the proposed demonstration area (*Source*: PAG)



Population will increase 69% within demonstration area by 2050 (*Source*: PAG)

B. Proposed Technology Solutions

"Typical Intersection in Study Area"



5 The Tucson Smart City Vision

Tucson envisions its smart future to reflect a connected, agile, happy community that is able to travel to work, school, retail, and activity centers safely and efficiently using multiple methods of travel. In four years, Tucsonans, and visitors to Tucson, will experience easier ways of getting around town. They will be exposed to smart vehicles that are connected through apps that collect real-time data from sensors located on traffic lights, smart LED street lights, and work zone traffic control devices along the roadway, and from our community members through their vehicles and smart devices. These smart vehicles will be able to sense other roadway users and communicate between vehicles and smart devices to provide real-time information on optimal commuter/transit routes, construction zones, crash locations, and help identify congested corridors. This information will flow to a data center located on the University of Arizona campus, which will be supported by the City of Tucson Smart City Challenge partners including the City, the Pima Association of Governments, the University of Arizona, the Arizona Department of Transportation, and Pima County. Furthermore, Tucson's Traffic Operations Center will be expanded to create a more robust, citywide Traffic Management Center.

This open, comprehensive data will allow our private partners to use it to engage with our citizens to find the most safe and convenient way to move through the City. The average citizen will be encouraged to bicycle or walk, or to get to a bus or streetcar stop. Our elderly citizens, those who have difficulty driving, and our underserved, low income populations will hve convenient access to multiple methods of travel allowning for better movement throughout the community. More efficient ridesharing opportunities can be determined based on individual movements over a period of time. Our smart city will allow our visitors to easily find and pay for a parking space, pay for a transit pass, and find amenities including restaurants and retail located within walking distance of their destinations. It will be easy to find transportation options at any time of the day or night.

Tucsonans will be on the ground floor of innovative testing of connected and autonomous vehicles; identified corridors around Tucson will allow exploration of these innovative technologies. Citizens will see City of Tucson vehicle fleets including buses, waste management, first responders, and general maintenance using after-market devices to collect real-time data which provides up-to-date information on moving efficiently around the City. In addition, over 15% of vehicles in the region will be equipped with these data collection devices that pave the way for a truly connected society.

And it will be even easier to go "Green." Electric vehicle charging stations will be located within easy driving distance. BikeShare stations will be strategically placed to encourage bicycling for the "last mile." Tucsonans will be able to have all of this information at their fingertips in "easy to use" applications.

Finally, the City of Tucson will set the stage for developing practices that will be replicable across the United States. The practices, policies, and laws will help define what it means to be a smart city. To that end, Tucson will host an annual Smart City Conference that allows other cities to shape their futures from its lessons learned. The future is now and Tucson is ready.

A. Mobility

MOBILITY

CHALLENGE	
Tucson is **14th** in the nation for the **worst congestion**	▲ Optimization of the signal network to allow for better traffic management ▲ Apps that promote alternate routes and travel at non-peak times ▲ Propose "Move Tucson Smartly" campaign that promotes ride sharing ▲ Optimize on-time performance, particularly for high ridership transit routes
VISION ELEMENTS APPLIED	
vehicle miles traveled **75%** on arterials	▲ Parking sensors allow for real-time visibility of parking inventory, availability, and pricing ▲ Commercial vehicles are given signal prioritization on key corridors ▲ Promote alternate modes of transportation to reduce single-car occupancy rates ▲ Development of apps that identify congested corridors and suggest alternate routing ▲ Connected vehicles allow for locating and better positioning of vehicles to minimize idling at lights
VISION ELEMENTS APPLIED	
nationally **9th highest percentage** COMMUTERS	▲ Bike share app that identifies bike locations, availability, and pricing ▲ Incentive based app that identifies alternate bike routes to vehicle travel, carbon savings realized through biking, and tracks miles traveled
VISION ELEMENTS APPLIED	
Freight volumes 10% on major roads causes disproportional damage to streets	▲ Provide traffic signal prioritization for freight vehicles in key corridors ▲ Identify optimal routes for local and interstate freight vehicles ▲ Truck fleets equipped after market device to assist in connecting with other trucks to speed travel time
VISION ELEMENTS APPLIED	

B. Safety and C. Environmental

	CHALLENGE	
SAFETY	250 are struck while crossing the road —about 20 are killed per year	▲ Data collection on near misses through Mobileye technologies will allow for identification and tracking of potential conflict areas and notify pedestrians through a cell phone based app ▲ Sight and hearing impaired citizens will have access to an app that recognizes location and advises through text and voice of impending conflict areas ▲ Connected vehicles will recognize pedestrians and bicyclists, and advises drivers to be aware of routes ▲ Connected vehicles allow for locating and better positioning of vehicles to minimize idling at lights
	VISION ELEMENTS APPLIED	
	1/2 of all WASHES in the region lie in the study area	▲ Sensors will be placed in the washes around Tucson to track flash flooding activity in the region and provide real-time data to Tucsonans ▲ Provide apps for smart devices and vehicles for instant, location-based notifications
	VISION ELEMENTS APPLIED	
	ANNUALLY (on average) 360 = CRASHES FATALITIES = 3	▲ Develop app that notifies users of roadway conditions to include truck locations, construction zones, and highly congested areas ▲ Information provided to connected vehicles that recognize bike and pedestrians in real time and also provide relative locations
	VISION ELEMENTS APPLIED	
ENVIRONMENTAL	Maintain ATTAINMENT Air Quality status	▲ Install DC fast charging stations in strategically located destinations that minimize concerns of access to charging stations ▲ Develop an app that identifies DC fast charging locations and availability
	VISION ELEMENTS APPLIED	
	Low number of DC-fast charging stations	▲ Create measured reduction in greenhouse gas emissions by providing signal priority for first responders, transit, and commercial truck fleets ▲ Place sensors on traffic controllers, smart LED street light infrastructure, and construction barricades allowing for real-time updates to vehicles, bikes, and pedestrians in highly congested areas ▲ Metropia will target public outreach to use its app to provide users with alternate routes and encouragment to plan trips at off-peak hours through use of incentives at local businesses
	VISION ELEMENTS APPLIED	

TUCSON'S VISION ELEMENTS

1 Urban Automation
- Data for MAP message
- Executive Order 2015-09 authorizing autonomous vehicle testing, signed by Governor Ducey Aug, 2015

2 Connected Vehicles
- MMITSS Dynamic Mobility Application
- DSRC technology using 7-pin LED fixtures at every intersection in the City of Tucson - **over 390 intersections**
- Roadside alert (RSA)
- Vehicle to infrastructure (V2I), vehicle to pedestrian (V2P) technology
- Data for MAP messages and SPAT
- Traveler information messages (TIM)
- **15,000 vehicles equipped with aftermarket connected vehicle technology**

3 Intelligent, Sensor-Based Infrastructure
- Video/optical sensors
- Mobile sensors: LIDAR, low-cost after-market in-vehicle sensors, transit vehicles (GTFS), Metropia app, cardiac 12-lead transmissions, fire truck sensors monitor gamma radiation, ER Link (telemedicine), Connected Vehicles
- Fixed sensors – traffic counts, Bluetooth, smart trash compactors, smart water meters, construction zones, parking meters/infrastructure, Internet of things

4 Urban Analytics
- CyVerse (formerly iPlant) - open data cybersecurity platform
- INSITE Center Data Analytics, Machine Learning, and Social Media Data Mining
- Metropia

5 User Focused Mobility Services and Choices
- Metropia
- GoTucson mobile app
- On demand integrated special mobility services
- Car sharing programs

6 Urban Delivery and Analytics
- Use of transit and private vehicles for package delivery
- Freight vehicles will receive priority to move through network faster
- Unmanned aerial vehicle (drones) for delivery

7 Strategic Business Models and Partnering
- Current partners: U of A, PAG, ADOT
- Additional potential partners: Startup Tucson, U of A Tech Park

8 Smart Grid, Roadway Electrification, Electric Vehicles
- Tucson Clean Cities program
- 40% of Tucson's electricity is from CNG
- Instituted driver training on EVs
- Work with visually impaired community to enable EV detection (ASDB/SAAVI)
- Testing ground for most EV on the market
- EV trucks/fleet
- More than 100 EV charging stations – including 3 DC fast charging stations
- EV owners to receive CV device
- DOE/NARC/PAG "Greening" fleets
- Inductive charging station(s) for electric bus deployment

9 Connected, Involved Citizens
- Tucson has a very vibrant, active, involved citizenry
- NextDoor, CityConnect – community links to Tucson Police Department
- Committed to sharing Smart City results nationally
- Robust outreach program to educate community of different elements
- Social media analytics to monitor traveler satisfaction

10 Architecture and Standards
- Early adopter and implementer of national ITS architecture
- Connected Vehicle Reference Implementation Architecture (CVRIA)
- SAE DSRC, IEEE, NTCIP
- Industry standard, OpenDrive and NDS

11 Low-cost, Secure, Efficient and Resilient Information and Communications Technology (ICT)
- Regional Transportation Data Network
- EnergyCap Management system

12 Smart Land Use
- Envision Tomorrow Plus
- Building the Commons
- Roadway Design Linked to Land Use, Urban Design, Economic Vitality

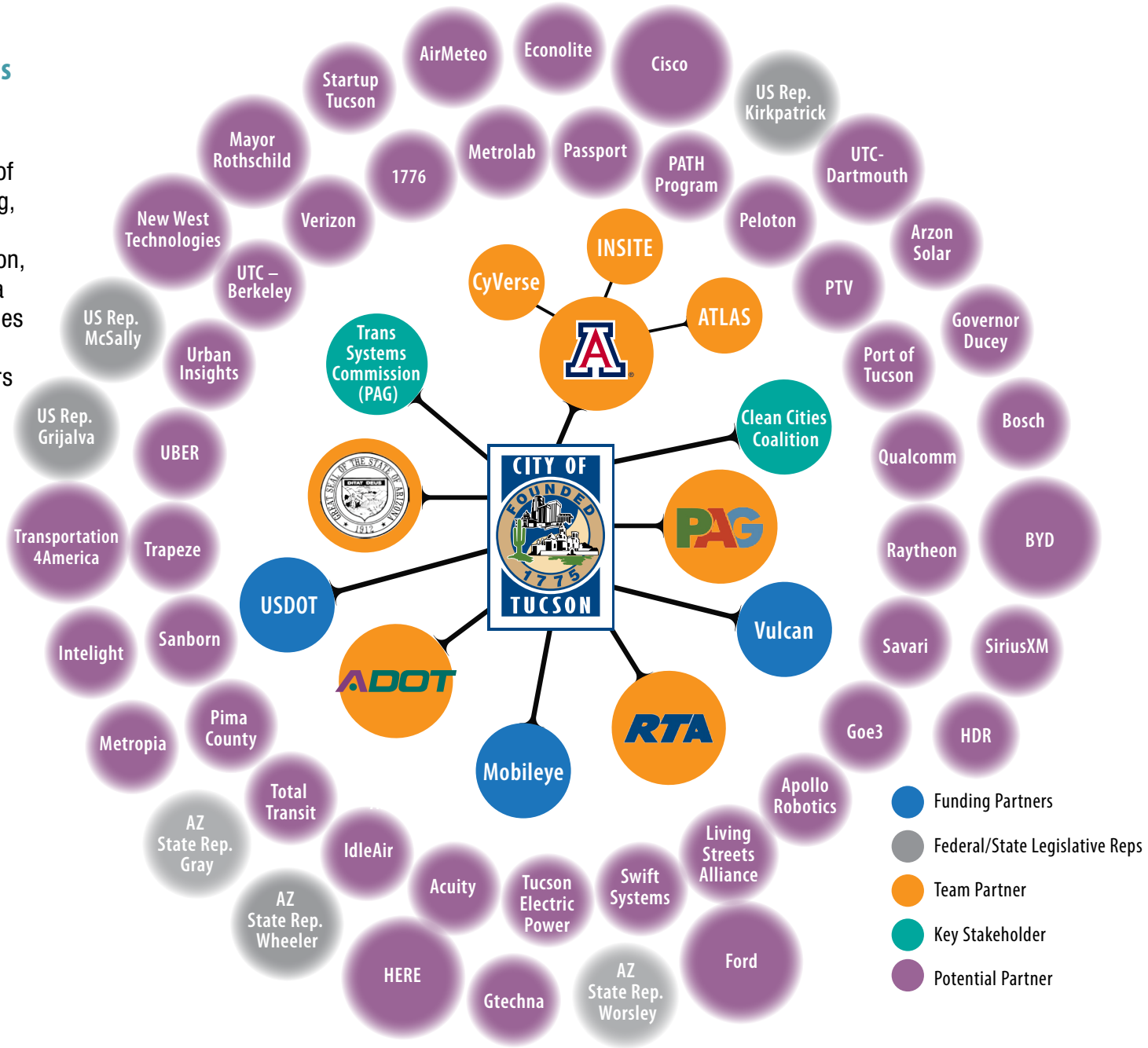
6 Potential Risks and Mitigation Measures

Description of Risk	Level of Risk	Mitigation
Technical Risks		
Ability to procure Buy America compliant components	Medium	When component specifications are written, Buy America will be a requirement; suppliers will have to provide certification
New suppliers may need longer to ramp up production	Medium	Critical path items will be identified, matched to suppliers, and an analysis of estimated production schedules will occur
Garnering sufficient public support to install after-market sensors in vehicle—to test connected vehicle infrastructure. National standards and architectures are emerging and, through the course of the demonstration period, may experience significant change	Medium	The number of additional vehicles needed outside of City and University fleet is low. Citizens with electric vehicles will be asked first—there is substantial existing relationships with this group, and they receive additional travel time benefits with the sensors Engage in open standards development process to influence development based on social gathering factors
Individual Privacy and Security Issues	Medium-High	Develop policies and procedures to protect private individual informaiton
Policy Risk		
Ability to introduce new or increased streams of revenue on existing infrastructure or products to assist with additional infrastructure needs	High	Comprehensive review of state and regional funding sources for transportation projects. Identify opportunities to alter or add funding sources. Additionally, determine how to best use existing funding to leverage private funding and financing
Addressing changes in use of infrastructure • Example: There is the potential to reduce number of lanes due to increased utilization. The risk is establishing how excess right-of-way is used	Medium-High	Will be addressed through a rigorous planning process; not unlike the process that was undertaken for Plan Tucson—the General and Sustainability Plan for Tucson
Legal issues with cyberspace protection	Medium	Establish reforms, standards, architecture, SSL encryption
Development and adoption of policy on use of unmanned aerial vehicles (UAVs)	Medium	Critical consideration of citizens' privacy and public safety
Institutional Risk		
Shifting risk from public to private sector; consideration of P3 elements	Medium	Conduct RFI and industry outreach to understand scope of available services; what are standard versus out-of-scope items Develop a thorough understanding of existing costs, funding sources
"Early adopters" vs. "late bloomers"	Medium	Education initiative through Move Tucson Smartly

7 Tucson Smart City Team

A. Partners and Key Stakeholders

Our team consists of a rich network of partners that include, at its core, a strong partnership with the University of Arizona (U of A). The U of A has existing, internationally recognized expertise in connected vehicles, big data aggregation, and analysis. We are proud to include a letter of support from each of the entities shown to the right. Please refer to the attached file that includes the **56** letters of support.



> *"...Tucson has further demonstrated that Uber has a welcoming support-ive partner...Tucson has proven to be a great fit for Uber's many innovative mobility products...."*
>
> —**Steve Thompson**
> Uber General Manager
> (currently operating autonomous vehicles in Tucson, Arizona)

B. Governance Processes

The City of Tucson will enter into a number of agreements with partners, stakeholders, potential private sector businesses and non-profit organizations. Following is an overview of the preliminary governance structures that will guide the development of Tucson's Smart City Demonstration Project. Once the Demonstration period has been completed, the agreements will be revisited to consider the lessons learned and to make any necessary adjustments to staffing, funding, or leadership.

Tucson Smart City Partner	Governance Structure	Vision Element	Demonstration Project Role
University of Arizona (U of A) – multiple entities, described below:	—	See below	Technical development, deployment, and oversight: U of A staff and researchers from a number of University departments will assist with the implementation and analysis of a number of project elements. Details provided below.
• Advanced Traffic and Logistics Algorithms and Systems (ATLAS)	Memorandum of Understanding (MOU)		UA researcher Dr. Larry Head will develop the Connected Vehicle Reference Implementation Architecture (CVRIA) and will support the essential services of data capture and distribution, and Connected Vehicle (CV) Map Management.
• INSITE: Center for Business Intelligence and Analytics	Memorandum of Understanding (MOU)		INSITE will develop scalable techniques to analyze big data sets that arise from a variety of sources including social media, sensors, mobile applications and web based platforms directly and indirectly related to the Tucson Smart City Challenge project.
• CyVerse (formerly known as iPlant)	Memorandum of Understanding (MOU)		Formerly known as iPlant, CyVerse is a powerful open-data infrastructure that provides the foundation on which to analyze big data sets. CyVerse was developed through $100 million in funding by the National Science Foundation. U of A researcher Parker Antin serves as the Principal Investigator and Project Director, and Dr. Nirav Merchant serves as the Co-Principal Investigator.
Pima Association of Governments (PAG)(multiple programs described below)	Intergovernmental Agreement (IGA)	See below	Programmatic Guidance: As the regional metropolitan planning agency, PAG is uniquely positioned to provide guidance on the implementation of infrastructure related to electric vehicles, intelligent transportation systems (ITS), and bike and pedestrian facilities. The specific programs are described below. It is anticipated that a single Intergovernmental Agreement (IGA) would establish the respective roles in the Smart City demonstration period.

B. Governance Processes (continued)

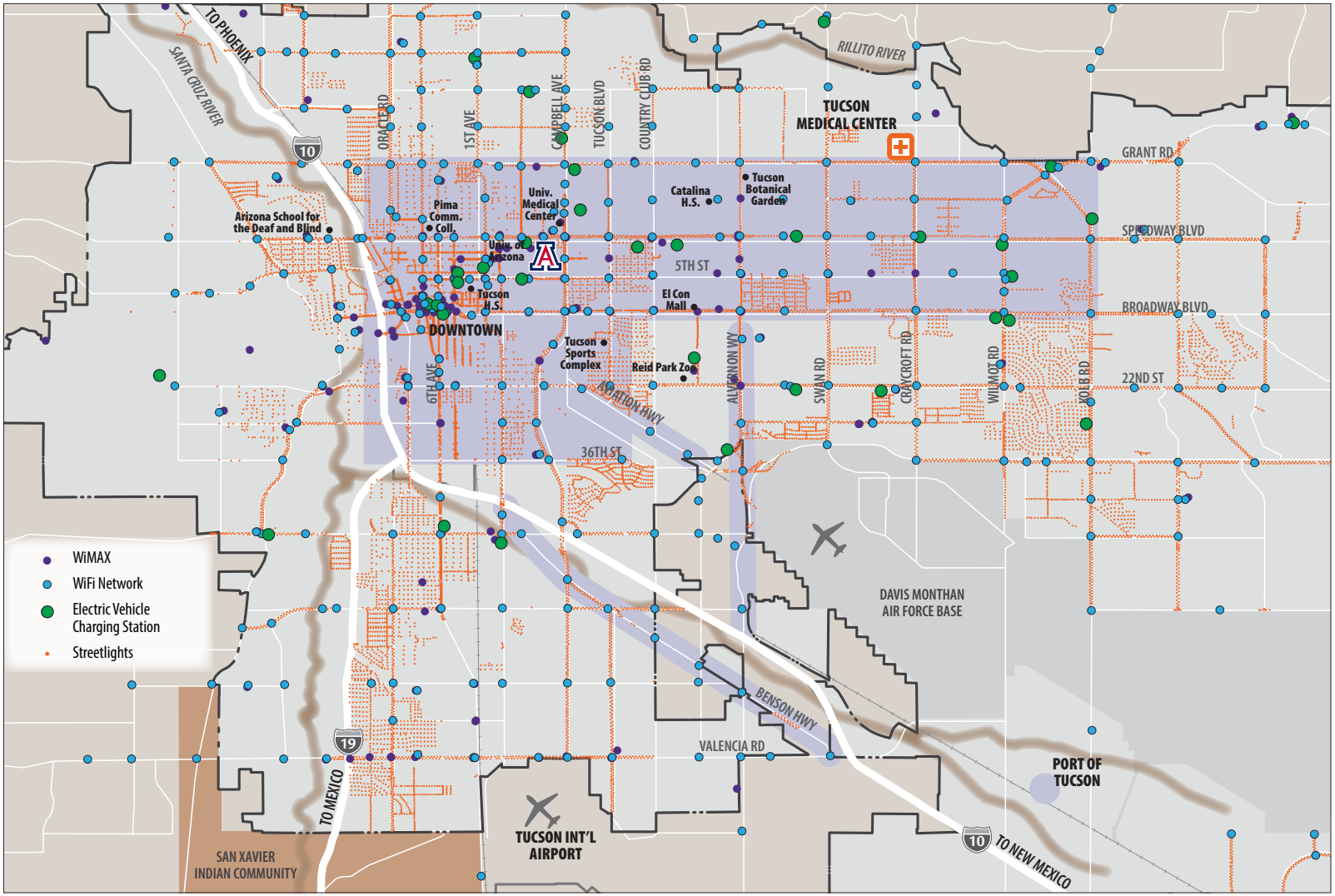
Tucson Smart City Partner	Governance Structure	Vision Element	Demonstration Project Role
• Clean Cities Program	—		The Clean Cities Coalition will promote the use of clean fuels and clean-fuel vehicles in partnership with the U.S. Department of Energy's Clean Cities Program. The coalition will coordinate with member jurisdictions to develop clean-fueling infrastructure, advance the understanding of the benefits of clean-fuel vehicles, and work to develop Clean Corridors on interstate highways and trade routes
• ITS Program	—		PAG's ITS program will coordinate regional activities, meet federal requirements and recommend ITS infrastructure investments in the region
• Bicycle and Pedestrian Program; Living Streets Alliance	—		The Tucson/Eastern Pima County Region is designated a Gold Level Bicycle Friendly Community by the League of American Bicyclists
Arizona Department of Transportation	Intergovernmental Agreement (IGA)		ADOT will partner with the City of Tucson on providing a demonstration corridor within the Tucson region
State of Arizona	Not Applicable		The State of Arizona has provided a policy for autonomous vehicle testing

C. Existing and Potential Public Private Partnerships

Supporting Group	Smart Cities Role	Individuals Submitting Letters of Support of Tucson Smart Cities Proposal		
City, Regional, and State Political Support	To provide programmatic and policy guidance To facilitate public-private partnerships To provide suitable Smart City technology infrastructure	Arizona State Governor Doug Ducey Arizona Department of Transportation Director John Halikowski City of Tucson Mayor Jonathan Rothschild Pima County Administrator Chuck Huckelberry United States Representative Raul Grijalva United States Representative Ann Kirkpatrick	United States Representative Martha McSally Arizona State Senator, Senate Transportation Committee Chair Bob Worsley Arizona State Representative, House Transportation Committee Chair Rick Gray Arizona State Representative Bruce Wheeler	
Project Partners	To provide technical expertise in the development, deployment, and operation of Tucson's Smart Cities Proposed Project	PAG Executive Director Farhad Moghimi PAG Regional Council Expressed Support of Tucson Smart Cities Proposal University of Arizona Dr. Kimberly Andrews Espy, Senior Vice President for Research University of Arizona Science and Technology Park		
Potential Private Sector and Non-Profit Project Partners	To support the implementation of Tucson's Smart City Project	1776 Acuity AirMeteo / Civic Resources Group Apollo Robotics Aqua Pure Hydration Arzon Solar ASDB ATLAS BYD Cisco Community Food Bank Darling Environmental Earth Knowledge Econolite EOITech Ford GOe3 Gtechna	HDR Engineering HERE IdleAir Intelight Living Streets Alliance Local First Arizona Lockheed-Martin Metropia Nanotechnology Cluster New West Technologies OnAnyMoto Passport PATH Program Peloton Port of Tucson Primavera Foundation PTV Qualcomm	Raytheon RN Patient Advocates/MedKey SAAVI Sanborn Savari Sharing Tribes SiriusXM SpireWirk Start Up Tucson Swift Systems Tucson Electric Power Total Transit Transportation for America Trapeze TSI Transit Solutions Urban Insights UTC – Berkeley Verizon

8 Existing Transportation Infrastructure and Features

- Arterial miles: 385
- Total centerline miles: 1934+ lane miles
- Freeway miles
  - I-10: 45 regional miles
  - I-19: 28 miles
- Transit services
  - Sun Link: modern streetcar service
  - Sun Tran: 4 routes, 252 buses
  - Sun Van
  - Cat Tran: U of A campus shuttles
- Shared-use mobility services
  - Bike share
  - Uber
  - Lyft
  - Taxis
  - Zipcar
  - Connect by Hertz car sharing
  - Entourage



9 Data Collection, Use, and Policies

A. Data Currently Collected by the City of Tucson

DATA COLLECTED
TRANSPORTATION NETWORK & INFRASTRUCTURE & MOBILITY
• City-wide 2015 orthophotography and aerial LIDAR and Mobile LiDAR datasets • ARAN pavement condition metrics (IRI, rutting and cracking with ROW and LCMS images) • Real time wireless transportation communications systems locations and (RTDN) • Stop and yield sign locations • Road Side Units installed
• LED Smart Streetlights – **NEW DATA** • Lighting and dimming data   • Energy use and costs

• Central traffic signal real time performance data– **NEW DATA**
  • signal status (preemption/priority)
  • phase
  • push button crossing activation

• Open HD base map for autonomous and connected vehicles – **NEW DATA**
  • from existing orthophotos, airborne and mobile LiDAR
  • updates from autonomous vehicles

• System performance data of the technology components of a smart city– **NEW DATA**
  • availability
  • reliability
  • maintainability

• Barricades and cones with sensors– **NEW DATA** • Real-time traffic closures
• Assessment of calibration and enhancement of PAG travel demand forecasting models– **NEW DATA**
REAL TIME, CONTINUOUS INTERSECTION DATA– NEW DATA
• Intersection video based volume and turning movement counts by mode • Intersection real time congestion measurements • Intersection delays and congestions

DATA COLLECTED
BIKE / PEDESTRIAN
• Annual pedestrian and bicycle counts • Location of crossings • WalkScore • Inventory of sidewalks • Mayor's Challenge Safer People, Safer Streets • Number of improvements implemented

• Bike Share– **NEW DATA**
  • Number of stations
  • Bike locations; station repopulating

• Traveler counts (all modes)– **NEW DATA**
• BikeScore for geographic locations– **NEW DATA**
TRANSIT
• SunTran, SunLink and SunVan General Transit Feed Specifications (GTFS) • SunCard transactions • Boardings / Alightings • User surveys • Bus Stop locations and amenities; photos • Manual reports on incidents

• Transit / pedestrian and cyclist (Mobileye data)– **NEW DATA**
  • Location and number of vehicle alerts / near misses
  • Identification of hot spots (aggregate # of conflicts over time)
  • Real time mapping

• Social Media Data Mining– **NEW DATA** • User satisfaction • Quality of facilities and vehicles • Origin / Destination
FREIGHT

A. Data Currently Collected by the City of Tucson (continued)

DATA COLLECTED

- Freight values
- Freight tonnage
- Commercial vehicle volumes

- Truck Stop electrification use **– NEW DATA**
- Freight spoilage **– NEW DATA**
- Social media mining **– NEW DATA**
  - Travel delay within city limits

PARKING

- Real time parking meter availability **– NEW DATA**
- Parking garage space occupancy **– NEW DATA**
- Smarter parking garage lighting – cost reductions; energy usage
- Revenues paid, by method

  - Real time parking spot availability
  - Car share parking spots reserved / utilized

PARTNER PROGRAMS

- Travel Reduction Program
  - RideShare / Carpool participation
  - Travel Surveys
  - Car Share program usage**– NEW DATA**

- Clean Cities Program
  - Alternate fuel availability (mapping)
  - Number of fleets converting

- Aggregate Purchasing Opportunities
  - Number of vehicles purchased, by type
  - Number of assistive devices purchased by type

PUBLIC SAFETY

- Tucson Police Department incident reporting
- Arrests
- Calls for Service
- Officer-Involved Shootings
- Aggravated Assaults Against Police Officers

DATA COLLECTED

WATER & STORMWATER

- Smart Water meters usage data
- Storm water flow accumulation lines
- Storm flow barricading (manual reporting)
- Customer usage, billing, and payments

- Real time mapping: **– NEW DATA**
  - storm water flow
  - barricaded areas (streets, washes, other)
  - work zones

- Payments by smartphone app

WASTE

- Smart trash compactor bins fill levels
- Sensor-based pickup request
- Customer billing and payments

- Payments by smartphone app

CITY OF TUCSON CUSTOMER SERVICE & BILLING – NEW DATA

- Transit

- Parking

- Utility (water, sewer, garbage, recycling) billing and payments

- Integrated payment smartphone app

BUSINESS DATA

- Quarterly cumulative and Weekly business licenses

- Data mining using social media to identify **– NEW DATA**
  - Common "Hubs" / Public Spaces
  - Retail and business location opportunities
  - What Tucsonans want, are lacking, are happy with

WEATHER & AIR QUALITY & SOLAR

- Flooding events
- Heat
- Solar

A. Data Currently Collected by the City of Tucson (continued)

DATA COLLECTED

FLEET OPERATIONS & MAINTENANCE

- New fleet vehicles
  - Number of alternatively-fueled vehicles
  - Reductions in gas costs
  - Alternative fuels and energy costs
- Vehicle locations by GPS trace (Tucson Water, Garbage trucks, public safety)
- Route optimization **– NEW DATA**
- Scheduling fleet trucks **– NEW DATA**
- Network flow of connected vehicle fleet ASD (V2I) **– NEW DATA**
  - Performance observation by mode
  - Traffic signal performance by mode by movement
  - Travel time, travel time variability

OTHER DATA

- Using Social Media to Mine Data
  - Geofencing areas identified as "Commons"
  - Traveler satisfaction
  - Trends and events

DATA COLLECTED

- Tucson Smart City Program Partnerships and Rewards
  - Number of new organizational partners
  - Number of new users of smartphone apps
  - New developers using data
  - Number of travelers using Smart City technologies
- Food System
  - Mapping local and regional foodshed, distributions centers, retailers, and food sharing programs
  - Partnerships linking local farmers and consumers and encouraging sustainable delivery
- Smarter Land Use
  - Mapping and analyzing characteristics of local vibrant Commons in corridors (National Trust for Historic Preservation Green Lab Phase 2 Study)
    - Urban design features (building age, size, use)
    - Roadway design features (lanes, roadway facility widths, travel demand and modes)
    - Number of jobs and job types
    - Property investments over time
- Scenario Targets

B. How Data Will Be Used and Integrated Across Departments to Address City's Challenges

Using the data collected as represented in the table above, we expect to further address our city challenges in the following ways:

MOBILITY

- Prioritize uses on the road network for freight, transit and cyclists – resulting in a Complete Streets Network.
- Ensure access to a variety of affordable, safe transportation options that address vulnerable populations' needs, such as getting to doctor's visits, food retailers/markets/distribution sites, family and childcare services, education, and social commons.
- Optimize travel through the network, reducing traffic congestion and vehicle idling.
- Cyclists and pedestrians will experience traffic signals that can hold a green light to let them get through – this will be through the signals sensing the bikes or pedestrians as the cross.
- Provide better routing of public and fleet services.Provide citizens with real time data about travel mode choices and optimal routes.
- Better estimate and reduce infrastructure costs for freight travel by reducing pavement degradation.
- The public will be informed of real time location and arrival of transit vehicles.

B. How Data Will Be Used and Integrated Across Departments to Address City's Challenges (continued)

SAFETY

- Implement infrastructure improvements that both identify and correct deficiencies and hot spots for incidents and near misses.
- Deploy barricades and cones with sensors for providing real time traffic closures, work zone information, and wash closures to travelers.
- Autonomous and connected vehicles that travel safely on arterial roadways and recognize other cars, pedestrians and cyclists.
- Emergency service vehicles travel safely through the transportation network and provide real-time warnings to users in the corridor ahead
- Roadside alerts provide real-time information about safety incidents in your corridor of travel.

ENVIRONMENTAL

- Increased number and visibility of available electric vehicle charging stations will allow drivers of electric vehicle drivers to travel through the city without fear of their car losing power. Inductive charging stations will also reduce anxiety for electric vehicle users. Inductive charging also reduces peak charging. This will also be addressed with workplace charging stations.
- The increase in EV charging infrastructure and tracking of EV car purchases will enable the estimation of reduction in greenhouse gas emissions.
- Data collected on our weather, including heat, storms and haboobs (severe dust storms), will enable alerts to be broadcasted, and travelers may make informed decisions.
- The city will use social media data to develop a better understanding of user satisfaction.
- Through use of the payment apps, the City will be able to administer more reliable revenue collection and tracking of services.
- Sensors in the City's smart trash compactors will allow waste management trucks to be dispatched when the bin is full and requests a pick up .
- Real-time user data will allow transit routes and stops to better reflect traveler behaviors and needs.
- Food spoilage and waste will be reduced through use of the truck stop electrification. Truck stop electrification allows a portable, electric power source for commercial trucks carrying consumables that will preserve their load better and also reduce greenhouse emissions produced as a result of the vehicle idling.
- Platooning of commercial freight vehicles allow faster movement through connected corridors, reduced idling and efficient fuel use.
- Another result of truck stop electrification is that farmers and food distributors receive fresher produce.
- Urban design and policy as well as transportation road design will be informed by measures characteristics of vibrant economic corridors/districts where people congregate.

C. Existing Policies Applicable to Data Collected

The City of Tucson Open Government Initiative Ordinance adopted on October 16, 2012 established the City's commitment to providing open data. Staff within the City identify the data sets made available, following national privacy and open data standards. The Tucson Smart City proposal team will be involved in the decisions regarding the new data sets that will be made available as open data. This team includes representatives from the City of Tucson, Pima Association of Governments, and the University of Arizona, as well as private partners who are key to the implementation of the Tucson Smart City. This team will coordinate with other established committees, such as the City's Capital Improvement Projects (CIP) Committee, Pima Association of Governments' Smart Transportation Committee and the Regional Data Committee (including regional DOTs, private and public utilities, and university representatives), and the Arizona Governor's Self-Driving Vehicle Oversight Committee.

9d Data Collection, Management, and Sharing

The Tucson Smart City proposal involves cross-cutting partnerships that support innovation and commercial deployment of smart city technologies. Entities such as the University of Arizona Science and Technology Park, Startup Tucson, and 1776 provide support, capacity, and funding/financing for technology companies.

The University of Arizona Science and Technology Park is a 1,345 acre campus with 2 million square feet of space for offices, research and development, and laboratory facilities. It is directed by Tech Parks Arizona, which also houses the Arizona Center for Innovation which provides facilities, services and expertise to grow developing technology companies.

The environment at the UA Tech Park supports and promotes research and education, technology innovation and commercialization, and business development and attraction in alignment with the mission of the University of Arizona.

UA Tech Park provides an exceptional environment for the testing, independent evaluation and demonstration of new technologies in autonomous vehicles and intelligent transportation systems in accordance with the conditions outlined by Executive Order 2015-09 issued by Arizona Governor Doug Ducey in August 2015.

Tech Parks Arizona maintains a close relationship with University of Arizona researchers active in the development of new technologies in the transportation sector, and has a strong track record of success with commercializing technologies developed at the University.

Tech Parks Arizona has developed a regional partnership through its Autonomous Vehicles and Intelligent Transportation Systems initiative with the Pima Association of Governments, Pima Community College, the Southern Arizona Raceway and other community stakeholders that collectively creates a technology innovation ecosystem for education and testing/evaluation/demonstration of autonomous vehicles and intelligent transportation network technologies.

Startup Tucson is a local tech incubator working to grow a strong, vibrant startup ecosystem of companies, entrepreneurs, and talent in Tucson. Startup Tucson's "Idea to Impact" pipeline program was cited by Entrepreneur Magazine as a key reason for naming Tucson one of five emerging hubs for entrepreneurship. A strong community partnerships including with the University of Arizona and the City of Tucson helped Startup Tucson to be one of 7 cities to be awarded a ScaleUp America contract from U.S. Small Business Administration.

By launching the digital news organization Startup Tucson News, they are committed to covering the local scene and providing strong support for the efforts of partner organizations like the Arizona Center for Innovation, Desert Angels (the 3rd most active investor group in the nation), Gangplank Tucson, Spoke6, Connect, Xerocraft, The Hive, UA's Tech Launch Arizona, Idea Funding, Tucson Young Professionals, and many others.

The State of Arizona and City of Tucson provide incentives and financing to technology innovators, as described in Question 13.

E. How Data from Outside Organizations and Interests will be Collected, Managed, and Shared Across Sectors or With the Public

The Tucson Smart City proposal takes advantage of existing resources and expertise available through our key partners, including the NSF-funded iPlant Collaborative, now known as CyVerse, and the Eller College INSITE program for data analytics, machine learning, and data integration. Security and privacy of the data will be maintained through agreements established that include terms and conditions. The University of Arizona Advanced Traffic and Logistics Algorithms and Systems (ATLAS) Center will provide a unified regional implementation of the Connected Vehicle Reference Implementation Architecture (CVRIA) Core Services.

F. Terms and Conditions

Agreements will be necessary for all data systems and data sets that will ensure compliance with national, state, and local standards and policies. Elements of the agreements will address terms and conditions, such as:

- acceptable use of data and systems
- user rights and privacy
- data management
  - data storage limits and dataset size limitations
- security and privacy
- data collection and privacy rights that address what data will be used, for what, and by whom:
  - Personal Identifying Information
  - Information made available for public use by providing document APIs, for example Sun Tran transit data is made available using the GTFS common core public data format.
  - Information made available for private use, which might include data mined from algorithms or derived from urban analytics provided be researchers and partners.
- intellectual property rights
- service level agreements
- use of open source software, such as the USDOT OSADP, and
- cost recovery

The City of Tucson will draw from the various agreements already in place with its partners, and those of our key partnering agencies, to ensure the security, integrity, and accuracy of all data collected and shared. These existing partnerships for activities included in this Smart City Proposal and beyond the award period include relevant terms and conditions from those examples listed above:

- Formal agreements in the forms of Intergovernmental Agreements and Memorandums of Understanding between the partnering public agencies that relate to Pima Association of Governments, departments of the Arizona State government, and units of the University of Arizona
- Contracts and service level agreements with vendors, such as Metropia for their smartphone app providing user/traveler movement data, and Passport for their GoTucson smartphone app allowing payments for off-board transit fares and parking fees and fines, as well as find available parking spots.
- Developer agreements for use of the open data, such as the online agreements established through online registration for the GTFS data, and
- User agreements with community partners/ citizens for use of the apps or other accounts established with the City of Tucson.

10 Approach for Use of Existing Standards, Architecture, and Certification Processes

The City of Tucson's approach to using existing standards, architectures, and certification processes for ITS and Connected Vehicle based technologies is based on a solid foundation of systems engineering. The systems engineering process ensures that the stakeholder needs are properly considered through the development of the Concept of Operations which considers several critical views of the system including functional, physical, enterprise, operational, and maintenance. The Concept of Operations forms the basis for identification of the System Requirements, which drive the system design, development, verification, and validation processes.

The system engineering process is enabled by the existing ITS Architecture that is based on the Computer Aides Systems Engineering (CASE) model. The ITS Architecture will be used to identify standards for communications, such as NTCIP and TCIP standards for traffic and transit management.

PAG, in close cooperation with its regional partners, has developed and maintains a Regional ITS Architecture which provides a framework to accommodate development and growth of ITS.

The PAG Regional ITS Architecture documents logical, physical, and institutional components of the regional ITS program with concentration on an ITS that is truly integrated. PAG's planning efforts included identifying and prioritizing ITS-related needs and transportation services as well as identifying existing and developing standards related to ITS functions. The needs and priorities identified were matched with the ITS User Services identified in the National ITS Architecture to determine which ones best addressed regional needs. User Services address what stakeholders consider to be the most important prioritized needs to which the ITS network should be responsive. They serve to illustrate the transportation services that the PAG ITS network can provide to satisfy the user's needs.

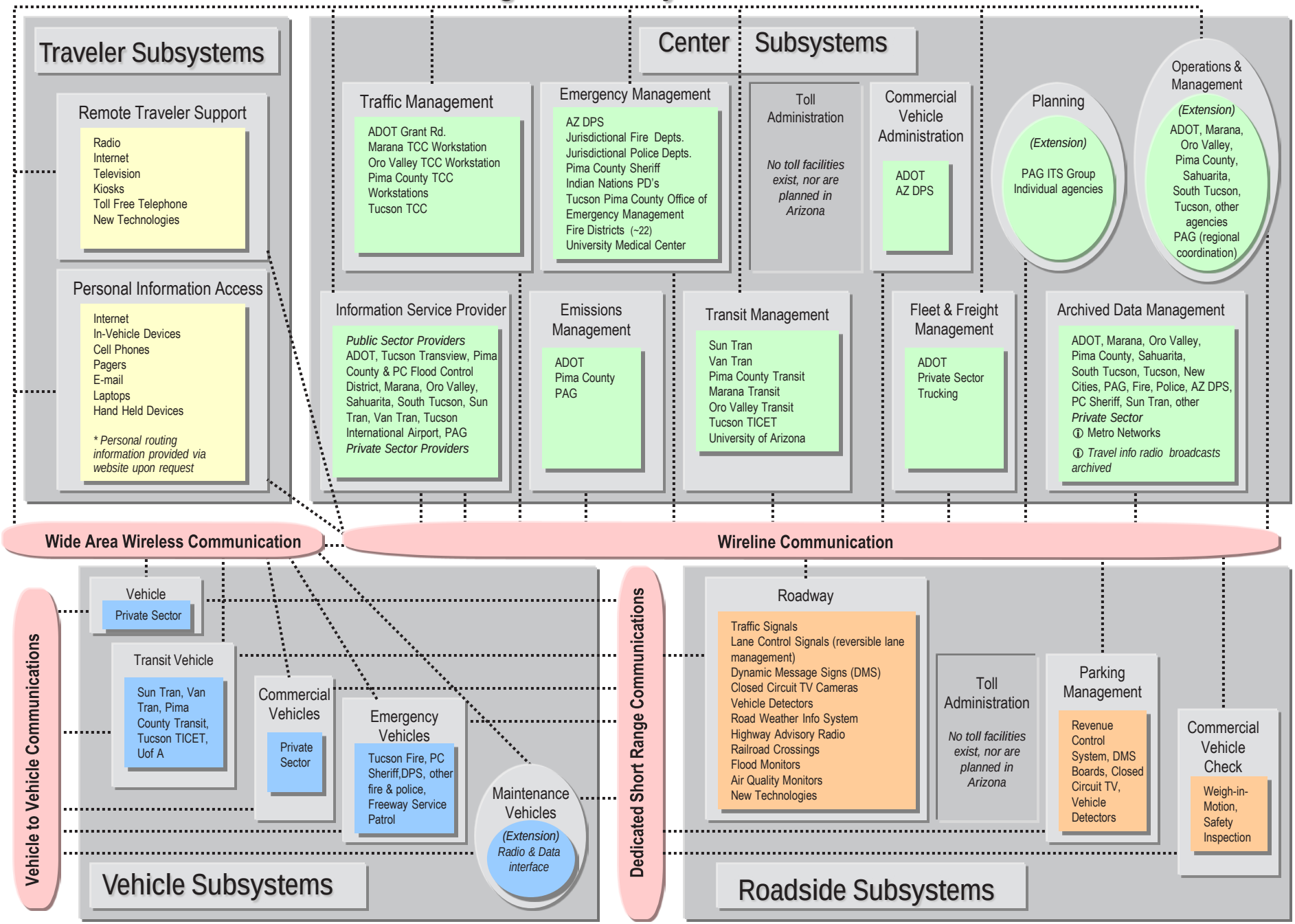
In the connected vehicle components, the Connected Vehicle Reference Implementation Architecture (CVRIA) will be used, including the SET-IT software tool, to leverage the rich architecture development for deployment of applications. The CVRIA will be used to identify the appropriate standards and messages (such as the SAE J2735, as well as to identify the performance specifications, such as SAE J2945/1 and other emerging standards. In the Connected Vehicle applications, the Institute of Electrical and Electronics Engineers (IEEE) 1609 suite of standards will be used to define both the messaging and security (IEEE 1609.2) including the use of the USDOT developed Security Certificate Management System (SCMS).

Dr. Larry Head, Director of ATLAS Transportation Research Center, sits on the national SAE DSRC Technical Committee an dworks on the DSRC standards (J2735,J2945/x). He is also the co-chair of NRCIP 1211. (Signal Control and Prioritization.)

Data collected will be shared with the USDOT Research Data Exchange (RDE) and source code developed under sponsorship of the Smart City project will be shared through the Open Source Application Development Portal (OSADP). Providing these data are an important part of being the USDOT Smart City.

The Tucson Smart City Team appreciates the national efforts to develop standards (ITS, SAE, NTCIP, IEEE), but also recognizes that there will be interfaces/messages/data that aren't currently part of an existing standard. The Team will work with the appropriate standards organizations to identify the needs and to prototype candidate solutions to help in the standards development process. The knowledge gained and lessons learned will be shared with other cities as they begin the journey towards becoming a Smart City.

Future PAG Region ITS Physical Architecture



11 Smart City Goals, Objectives, and Performance Measures

CHALLENGES	GOALS	PERFORMANCE MEASURES
MOBILITY	Signal Priority for First Responders, Transit and Freight	▲ Monitor network corridor congestion ▲ Monitor response times for emergency vehicles ▲ Monitor on time performance for transit vehicles
	Track Emergency Vehicle Accidents for vehicles using signal priority	▲ Monitor locations and frequency of accidents with first responder vehicles related to emergency calls
	Deploy after market devices in local fleets and up to 15,000 vehicles in Tucson	▲ Monitor after market devices activation and use ▲ Utilize video detection at intersections to assess penetration of ASD
	Deploy construction barricade sensors in construction zones	▲ Monitor after market devices activation and use ▲ Utilize video detection at intersections to assess penetration of ASD
	Monitor the number of private apps developed through partnerships	▲ Maintain a database of private apps developed with smart information captured through sensor data
	Monitor Transit On-Time Performance when using signal priority	▲ Using transit priority, track on-time transit performance
SAFETY	Track pedestrian and bicycle related crashes utilizing Mobileye fleet	▲ Monitor Mobileye data regarding vehicle alerts for near misses with bikes/peds ▲ Monitor potential apps that will be developed by private companies
	Install smart LED street lights	▲ Monitor smart LED street lights for function and providing real time data
	Deploy app related to safe roadway crossing with vulnerable populations	▲ Create apps to assist our visual and hearing impaired community in awareness of electric vehicles and for crossing streets safely
	Develop a standard for base specification and file exchange format for Autonomous Vehicle HD basemap development	▲ Propose standards to American Society for Photogrammetry and Remote Sensing (ASPRS) Map Accuracy Standards Working Group
	Develop solutions to address policy hurdles for broad deployment of autonomous vehicles	▲ Work with private partners to develop consistent standards that can be used on a national basis
ENVIRONMENTAL	Monitor new fleet acquisitions	▲ Utilize National Association of Regional Councils alternative fuel vehicle purchase agreement
	Monitor mobility enhancements and congestion reduction efforts	▲ Track fuel savings and emissions reduction ▲ Track travel times savings for the region
	Monitor truck stop electrification program	▲ Track fuel savings and emissions reduction
	Monitor new electric vehicle charging stations	▲ Report on the capacity expansion ▲ Work with private developer on real time tracking of available charging stations for public use

12 Tucson has the Capacity, Commitment, and Capability to be the Smart City Challenge Winner

The City of Tucson (COT) has a long history of envisioning, designing, and constructing large-scale projects of significant magnitude. The COT operates on an annual budget of approximately $1.1 billion of which $120 million is allocated to the Tucson Department of Transportation (the third largest operating budget in the city). Additionally, the City's annual capital budget is approximately $289 million of which $180 million is allocated to the Tucson Department of Transportation (the highest allocation of capital budget for any City department and 62% of the City's total capital budget). The Tucson Department of Transportation (TDOT) has an outstanding track record of managing projects which are on-budget and on-time including the major, clean electric operating Sun Link Modern Streetcar project, which was a four year, $196 million project using federal TIGER I grant money ($63 million for design, construction, rail activation, etc). Finally, beginning this year, the Tucson Department of Transportation will retrofit approximately 18,400 street lights citywide with smart LED technology, which will reduce energy consumption, reduce maintenance costs, increase vehicle, bicycle, and pedestrian visibility, and have remote capabilities for light illuminance levels; this project is estimated to cost approximately $16.5 million.

As we embark on the Smart City Challenge, the COT has received tremendous executive commitment from its local leaders, state leaders, and federal congressional leaders. This incredible commitment shows that we are ready and willing to embrace and implement the innovation and technology to make Tucson a demonstrable, connected, world-class Smart City.

Team members from the COT, The University of Arizona (U of A), the Pima Association of Governments (PAG – metropolitan planning organization), and contracted consultants are prepared to address all facets of the Smart City Challenge. Our multidisciplinary team is comprised of people with skill sets in program and project administration/management, technical management, engineering, planning and land use, research, database administration/management, GIS, procurement process, public policy and law, risk management, and public outreach.

The City, with support from the U of A and the PAG, is poised to house, handle, and report on anticipated (and current) data and performance management capabilities. The COT already has experience in data management through its Open Data Portal, and TDOT staff that has created and deployed public GIS mapping of transportation assets. TDOT works closely with research staff at the U of A, particularly through its Civil Engineering & Engineering Mechanics Department and Systems & Industrial Engineering Department, to deliver traffic engineering-related solutions using real-time data. Data, such as corridor traffic control signal timing, congestion/delay, travel time, queuing, and turning movements, is collected from existing infrastructure available on city roadways, housed on servers at the U of A, and evaluated and managed to create base transportation performance measures and achievable, optimized solutions.

Degree of infrastructure readiness:

Leverage	Item	In Place	Y1 (7/16)	Y2 (7/17)	Y3 (7/18)	Y4 (7/19)
X	Smart LED street lights retrofit project (citywide)	X	X			
X	Regional Transportation Data Network (regional mesh WiFi/ WiMax network)	X				
X	Traffic Operations Management Network	X				
X	NTCIP traffic signal controllers	X				
X	Signalized intersection optical detection	X				
X	Bluetooth roadside units	X				
X	Smart parking meters	X				
X	Smart parking garage revenue collection	X				
	Smart parking garage lights		X	X		
X	Smart parking garage count sensors	X				
X	Transit GPS tracking	X				
X	Test beds/data management centers for/at The University of Arizona	X				
X	INSITE					
X	iPlant/CyVerse	X				

13 Tucson will Leverage Existing and Extensive Federal Resources and U of A Research Programs

The City of Tucson will leverage Federal resources by building on existing/planned regional technological investments, research/knowledge developed at the University of Arizona, developing public private partnerships and cooperative agreements, and providing economic development incentives for startup and expansion.

The following is a list of Regional Existing projects.

Regional Transportation Data Network (RTDN)

The RTDN is a regionally coordinated central traffic signal system and a municipally owned communications network for transportation. The network includes a region wide fiber optic backbone driving a WiFi/WiMax mesh network. The network is includes connectivity to all traffic signals and all jurisdictions. Traffic signals include NTCIP controllers, and optical detection.

Smart LED Street Lighting retrofit project

This project includes the installation of 18,400 new, smart LED street lights citywide, which will reduce energy consumption, reduce maintenance costs, increase vehicle, bicycle, and pedestrian visibility, and have remote capabilities for light luminance levels; and have the ability to accommodate additional sensors. This project is estimated to cost approximately $16.5 million.

Smart Parking Infrastructure

Park Tucson, the City of Tucson's Parking Manager has over 1500 solar powered smart parking meters that allow for electronic payment via the Go Tucson Parking and Transit payment smart phone app. The system is being upgraded for in 2016 to provide occupancy data. Additionally Park Tucson operates 5 smart garages that have smart LED lighting and will also be equipped to provide occupancy data in 2016.

Tucson Clean Cities

PAG manages the Tucson Clean Cities a program of the U.S. Department of Energy which includes the Tucson Regional Clean Cities Coalition with nearly 100 members. Tucson Clean Cities has one of the most robust electric vehicle infrastructures in the nation with more than 100 of the first Level2 stations and a growing number of DC fast-charging stations. The Tucson Regional Clean Cities Coalition includes a wide array of vehicle fleets that will be incorporated into the activation of a Tucson Smart City.

Regional Mapping Data

PAG manages a regional mapping database and since 1988 PAG has obtained orthophotos for eastern Pima County with periodic updates. Most recently PAG has enhanced it mapping database with the acquisition of over 60 TB of mobile LiDAR data delivering better than 5cm accuracy and a resolution of up to 1cm.

Regional Transit Systems

The Tucson has a robust regional transit system with the following components

Sun Tran – City of Tucson's bus systems that operates 40 fixed routes, and the award-winning system remains on the cutting edge of technology as it has since the beginning. with a fleet of 252.

Sun Van – regional Paratransit service in Tucson, Tohono O'Odham Nation, Paqua Yaqui Tribe, South Tucson and parts of Pima County.

Sun Express – A weekday rush hour service in Tucson, Marana, Oro Valley, Rita Ranch and parts of Pima County.

Sun Link – The Sun Link streetcar serves the University of Arizona, Main Gate Square, 4th Avenue, downtown Tucson and the Mercado districts.

Sun Shuttle – A neighborhood transit service in Marana, Oro Valley, Catalina, Sahuarita and Green Valley, Tucson Estates, San Xavier, Rita Ranch, southwest Tucson and Ajo. Dial-a-Ride service is also available in Oro Valley, Sahuarita and Green Valley.

Ajo Community Circulator Service – Transportation option to easily travel around Ajo or connect to other regional transit systems in Tucson.

Pima Find a Ride – Need a ride anywhere in the Tucson region? PimaFINDaRIDE.org is a search engine that connects you with the best transportation for your needs.

Sun RideShare – Carpooling and vanpooling options for commuters.

Neighbors Care Alliance – A volunteer program through the Pima Council on Aging that provides transportation services for seniors and younger disabled individuals.

CyVerse (formerly iPlant Collaborative)

Developed at the University of Arizona's for the National Science Foundation's iPlant tool (now CyVerse). This tool that provides scientists with powerful computational infrastructure to handle huge datasets and complex analyses, thus enabling data-driven discovery. Our powerful extensible platforms provide data storage, bioinformatics tools, image analyses, cloud services, APIs, and more.

Arizona Connected Vehicle Test Bed

Lead by Dr. Larry Head, this project is collaboration with Maricopa County Department of Transportation and the Arizona Department of Transportation to create an Arizona Vehicle Test Bed which is one of the Nationally Affiliated Connected Vehicle Test Beds. The University of Arizona developed the Multi Modal Intelligent Traffic Signal Systems (MMITSS) Dynamic Mobility Prototype that is installed in the Arizona Connected Vehicle Test Bed and has been evaluated by FHWA.

Metropia

University of Arizona Professor Dr. Yi-Chang Chiu has created the successful start up Metropia which is currently providing user-based mobility information to travelers in originally in Tucson, and since expanded to Austin and New York City. Metropia is based on the research of Dr. Chiu who has created an innovative approach to travel demand management that has potential to expand into helping both travelers and logistics providers to find new modes and travel options. Metropia provides value to both the travelers and to the infrastructure providers through data sharing and traveler options.

Smart City Research Project

The University of Arizona's INSITE center for Business Intelligence and Analytics and Dr. Sudha Ram is working on an international collaboration with the City of Fortaleza and the University of Fortaleza. The project developing smart city analytics mining different databases including social media using artificial intelligence to help the transit providers better understand the needs of the travelers and to design transit service that is smart and efficient.

The City will also leverage the local entrepreneurial environment to work with existing and new business partners to develop and adapt Smart City Technologies. The thriving entrepreneurial ecosystem, which features StartUp Tucson, the only organization west of the Mississippi to receive a $1.44 million SBA grant to help high-potential, high-growth companies reach the next level, and The Desert Angels, Arizona 's largest and oldest network of angel investors. Additionally the following economic incentives are available to attract and develop business, they are as follows:

- Downtown Financial Incentive
- Government Property Lease Excise Tax (GPLET)
- Infill Incentive District
- Global Economic Development District (GEDD)
- Arizona Commerce Authority NEW TECHNOLOGIES
  - R&D Grant
  - Arizona Competes Fund
  - Arizona Innovation Challenge for startups for the commercialization of new technologies
  - Arizona Fast Grant - $5,000-$20,000 for early stage technology companies providing training and ta to entrepreneurs
  - Arizona Innovation Accelerator Fund
- Arizona Commerce Authority
  - Qualified Facilities Incentive – tax credits
  - Quality Jobs Incentive – tax credits
- Industrial Development Authority
  - Private Activity Bonds to provide working capital

> ***"...we look forward to the opportunity to partner with Tucson..."***
>
> **—Brad Simmons**
> Director, Government and Stakehold Relations,
> Ford Motor Company