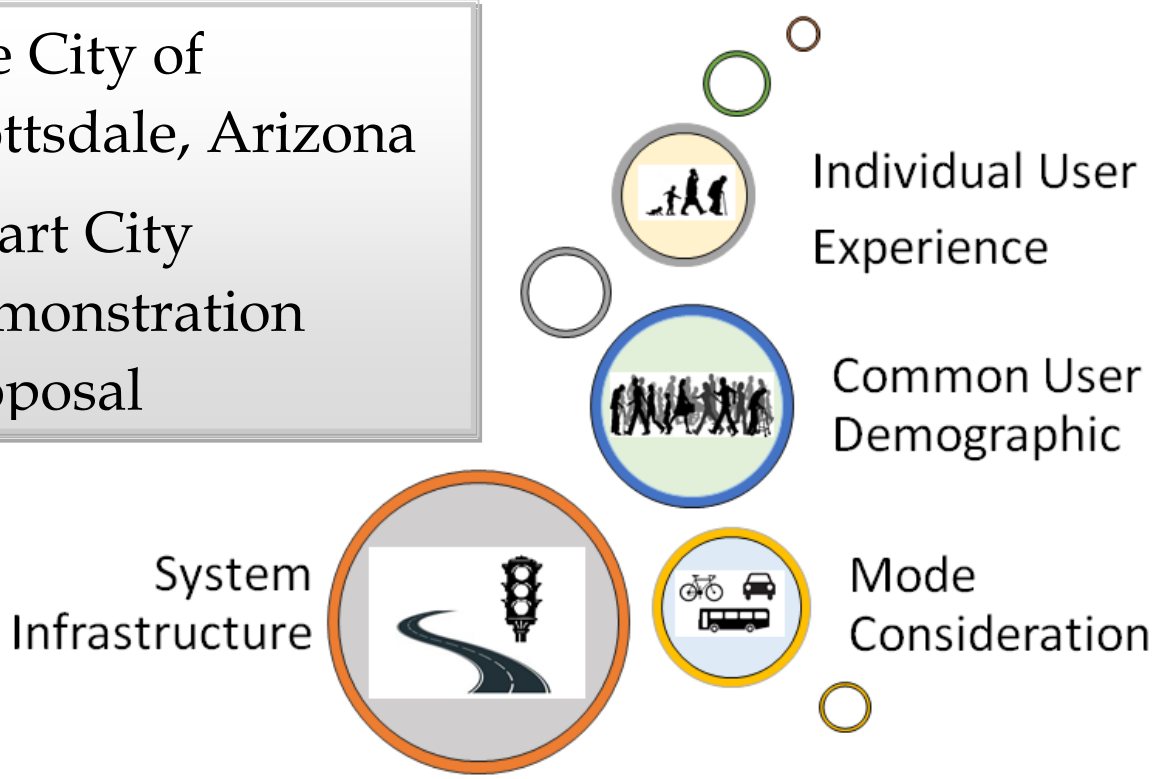
The City of Scottsdale, Arizona

Smart City Demonstration Proposal



Federal Agency Name:	U.S. Department of Transportation (USDOT) Federal Highway Administration (FHWA) Office of Acquisition and Grants Management 1200 New Jersey Avenue, SE Mail Drop: E62-204 Washington DC 20590 Attn: Sarah Tarpgaard, HCFA-32
Funding Opportunity Title:	Beyond Traffic: The Smart City Challenge
Funding Opportunity Number:	DTFH6116RA00002
CFD Number:	20.200 Highway Research & Development

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Summary

The U.S. Department of Transportation (USDOT) has developed a challenge to address "how emerging transportation data, technologies, and applications can be integrated with existing systems in a city to address transportation challenges. The USDOT is looking for bold and innovative ideas to fund demonstration projects that would test, evaluate, and demonstrate the significant benefits of smart city concepts."[i]

According to the challenge Notice of Funding Opportunity, the submitted proposals should "demonstrate how advanced data and intelligent transportation systems (ITS) technologies and applications can be used to reduce congestion, keep travelers safe, protect the environment, respond to climate change, connect underserved communities, and support economic vitality."

This proposal from the City of Scottsdale, Arizona (further referred to as the 'City') illustrates the high-level vision and goals the City has for a 21st century smart, connected, and complete transportation system and what a demonstration project would look like for the City. The proposal will provide a framework relative to the prioritization of the Vision Elements and the eight (8) potential major project demonstration test areas. The City has already instituted, over the last twenty-four (24) months, a dynamic and open discussion on recognizing the role transportation plays in preserving livable neighborhoods, promoting economic vitality, responding to 21st century safety, efficiency, and mode choice needs to ensure Scottsdale, Arizona remains a world class destination for residents and visitors alike.

This challenge will be a fantastic addition to an already forward moving effort that has involved participants such as residents, the Mayor, City Council, City staff, City Transportation Commission, and business leaders working together on complex transportation problems faced by the City. This partnering will become even more evident as a City of Scottsdale Transportation Summit is scheduled for early summer.

Thoughtful disruption is underway nationwide, especially as it relates to technology adoption and the role technology plays in the evolution of smart transportation. The idea of accelerating emerging technologies that have the potential to transform the City's transportation system is captivating. The last few years have seen the City already trending toward a smart government and transportation operations approach. The City transportation department in particular has been adopting progressive approaches to collecting and analyzing data, communication and the use of social media and mobile platforms, and discussing how connected, semi-autonomous, and autonomous vehicle technologies will affect the City in the near future. The City of Scottsdale, Arizona wants this opportunity in order to further transportation opportunities for our citizens and visitors and participate as a national thought leader on these evolving topics.

PART I – VISION NARRATIVE

Introduction

Scottsdale, Arizona is known for its exceptional Sonoran Desert experience and is a premier southwestern United States tourist destination. The City's neighborhoods have a long history of fostering outstanding livability through healthy and sustainable communities.

Paramount to continuing this tradition is developing a smart, connected, complete surface transportation system that addresses all-modes and, all contributing infrastructure, across all demographics, for all users. The deeper success of these efforts is further measured by how that system incorporates those with limited mobility options which includes, but is not limited to people without vehicles, students, people with disabilities and seniors.

The City is bordered by the Arizona Department of Transportation (ADOT) State Route (SR) 101 to the east and north (currently undergoing a $100 million general purpose lane addition for a maximum 25% capacity increase); ADOT's SR 202, Arizona State University, Valley Metro Light Rail to the south; and Phoenix, Arizona - the sixth largest city in the nation - 1,488,750 people to the west.[ii] The City's transportation system contains 324 street segments and 203 street intersections (System Map – see last page). A recent City survey concluded over 70% of those living in Scottsdale work elsewhere, over 80% of people working in Scottsdale reside elsewhere, and almost 20% live and work in the City.[iii]

As smart public sector initiatives advance across the nation the private sector is also doubling down on technology that can transform entire industries. These technology provider companies have now identified transportation as an environment ripe for transformation. These transformative technologies: cloud and mobile computing, connected devices, the Internet of Things (IoT), virtual reality, big data and machine learning, advanced robotics and drones are the center piece of what's now possible in extracting transportation system performance.

Comparably, thoughtful disruption is also underway inside transportation operations in connection with asset management planning, sustainable transportation program implementation, resilience design engineering, climate change data downscaling, Level of Service needs-based budgeting; transportation system management and operations (TSMO), and a whole host of growing connected vehicle systems and architectures, and advanced transportation and congestion management technologies. Scottsdale, itself, has been adopting and shifting to a smart transportation/smart government framework for more than two years. Utilizing a mix of innovative policies, proactive energy, and transformative reform – especially in the transportation division – the ultimate goal has been to achieve a transparent, engaged, data-driven environment to deliver transportation services people actually need, and quite honestly expect.

Specific to the City's transportation evolution and the notion of smart, connected, complete systems, a lot of work exists in orchestrating the complex interplay of data, cameras, sensors, devises, applications and the system users. With the growth of IoT, these dynamic interactions are growing in possibility. With the addition of this dynamic interplay of multiple nodes and multiple applications, the information can now be harnessed into user friendly decision making tools. While advances such as software-defined networking (SDN), open application programming interfaces (APIs), and 5G LTE wireless are progressing, it is big data analytics and cloud storage that looks to lead the transportation systems build out. This type of opportunity to disseminate large amounts of data unveils the possibility to truly blend user interactions, capacity and trip segment solutions, and modal choice efficiency into a progressive 21st century multimodal system. Specific to the City, this would be an environment where all data from all modes operating within the system can be gathered, transmitted, processed, and subsequently determinations and commands sent back. This return interaction reaching both the City operations staff, the system itself, and to the intelligent devices of the user, all in real or near real time, really turns the transportation system into a digital nervous system - constantly scanning for efficiencies and user feedback.

To further add to the mix, the City of Scottsdale, Arizona sits at the nexus of this disruptive transformation in transportation. The City could hardly be identified as suffering from 21st century ills. But, therein lies the problem. This has presented a serious number of transportation issues to solve stemming from the hyper-growth Maricopa County has experienced in the last two decades, the City's own development, and the transportation system infrastructure life-cycle deterioration rates. As a result, the downtown area parking has reached capacity; numerous streets segments are at or over capacity; changing user and demographic expectations; and connectivity demands to the wider Maricopa County system have expanded. These issues will not be solved by traditional plan, design, build, operate and maintain approaches. In addition, the citizens, visitors, business owners, conventioneers, seniors, urban youth, and those with disabilities are no longer willing to accept a transportation system that is overrun by cars with limits on complete streets, multimodal solutions, and technological advancements.

The reality is the City's transportation system that has been in place for much of the last forty years is reaching maximum utilization using currently available industry standards. The build-your-way out approach is no longer viable. More importantly, the City has a long history of bold action when it comes to solving problems. However, today's financially constrained transportation environment, economic development pressures, and resident and visitor expectations have raised the problem solving complexity. The 2015 *Scottsdale, AZ: Elevating Excellence, Promoting Prosperity* report – adopted by the Mayor and City Council under Resolution 9750 was a wakeup call.[iv] It highlighted the complex nature running today's city governments.

Looking back further, in May 2013, the Scottsdale City Council was already initiating an organizational strategic planning process that builds on the legacy of previous work and studies to drive and align the City Government's activities and investments toward key priorities. The Organizational Strategic Plan was formally approved in December 2013, and affirmed the following strategic goals for the City Government:[v]

- Value Scottsdale's Unique Lifestyle and Character
- Support Economic Vitality
- Enhance Neighborhoods
- Preserve Meaningful Open Space
- Seek Sustainability
- Advance Transportation

The 2015 report reiterated the need to act on the 2013 strategic goals. It stated "the prospects for the City's future economic development competitiveness and stature are unparalleled. But just as all that Scottsdale is today is reflective of generations of hard work by its elected officials, public management, citizens, and business and civic leaders, all that Scottsdale can and will become requires even greater strategic vision and more arduous work because the proven methods of what worked in the past are dramatically different than those that drive economic growth and prosperity in today's globalized world."

The 2015 report references transportation eight times over sixty-pages. Those eight references are mentioned in the following context: as a strategic goal, as an economic development priority, as an opportunity, as a threat (what a lack of action could do), as an employment source under two categories, and as a strategic component to the two million square feet of commercial space in use at the Scottsdale Airpark. The Airpark in particular is identified as creating $3 billion per year in economic spinoff activity.

Thus began a new chapter in the City's transportation system and a call to action from the people passionate about the City's transportation needs. The *Scottsdale, AZ: Elevating Excellence, Promoting Prosperity* report in particular spurred the Scottsdale Transportation Commission (TC) into action to seriously overhaul its charter, contributing use, and ultimate driver in reinventing how the City's transportation system would work into this century. The TC started with a cross-platform thinking approach with a progressive transportation movement centered on three pillars: Service, Leadership, and Community Engagement. See update to City Council P.13 http://www.scottsdaleaz.gov/Asset58082.aspx.

It is important to note that the movement of technology in relation to shifting modal choice and user interface does not exist in a vacuum. The simultaneous shift in technology in the auto industry is driving change in how people and cities interact with the automobile, and for all

intents and purposes, this shift will be with us as part of the multimodal landscape for years to come. New technologies - electric vehicles, advanced propulsion, autos linked to the Internet, advanced safety systems - are arriving in cities and are fundamentally changing the way we drive and forcing cities to react and adapt.

To sum all this up, you have to consider all aspects of technology, government, citizens, and the auto legacy into reinventing a transportation system. For the City, this was simply further opportunity for thoughtful disruption, using a cross-platform approach, and an agreement that without all participants no matter what their views, this evolution would not happen.

To be awarded round one funding is very timely and will give the City the rare opportunity to leverage five very specific actions;

- The City is well underway to finalizing the next City General Plan
- The City is nearing completion of the next Transportation Master Plan
- The City community leaders, after a long dormant period in discussing transportation, have joined the tidal wave of progressive transportation change
- A complete redevelopment and utilization assessment of the City's fixed route transit, free trolley system, and adoption of a high capacity transit vision is all being undertaken.
- Most important, the citizens, visitors, business owners, conventioneers, seniors, urban youth, and those with disabilities have all voiced a desire to participate in developing that next vision.

The City of Scottsdale, Arizona is an ideal site due to its continuity of committed leadership, authority, and capacity to carry out the demonstration project throughout the period of performance and continue operation after the period of performance is over. The City is a separate and independent city, has a central business district, maintains existing, robust, and advanced transportation infrastructure that includes ITS equipment, an existing traffic operations center (TOC), and shared use transportation options.

Smart City Demonstration Proposal Team

City of Scottsdale, Arizona Director of Transportation Paul Basha Pbasha@scottsdaleaz.gov

City of Scottsdale, Arizona Transportation Commission Chair Steven Olmsted

Arizona Department of Transportation Sustainable Transportation Project Manager Emily Lester

Smart City Demonstration Project Implementation Team (see Org Charts Part 2)

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Supporting Individuals (letters attached)

City

City of Scottsdale, Arizona Mayor Jim Lane

City of Scottsdale, Arizona Director of Transportation Paul Basha

City of Scottsdale, Arizona Director of Public Works Randy Ghezzi

City of Scottsdale, Arizona City Council Member Linda Milhaven

City of Scottsdale, Arizona City Council Member Virginia Korte

City of Scottsdale, Arizona Transportation Commission Chair Steven Olmsted

Outside Partners

Arizona Department of Transportation Director John Halikowski

Maricopa County Department of Transportation Director Jennifer Toth

Arizona Department of Transportation Sustainable Transportation Project Manager Emily Lester

Street Light Data Chief Executive Officer Laura Schewel

City of Scottsdale's Smart City Demonstration Proposal Specifics

Goal
The City aims to define the involvement of smart, connected, and complete transportation system ideals in the aspects of expanding modal options, advancing technological integration and further evolving the behaviors associated with the system and user interaction.

Project Focus
Smart data developed and provided to City staff; who uses that smart data to find efficiencies and tweak the system; in order to provide a better user experience; where the user of the system is then continuously analyzed to improve the system – continuous loop of data and determination.

Big Data
Extraction of data across four areas: system infrastructure, modes, users, demographics

Eight (8) Major Project Demonstration Test Areas to identify, determine, support, assess smart city system ideas and contribute to the national conversation through;

- Ultra Smart Corridors – Two smart corridor test circuits that would include the City's most congested highway/major-arterial/collector segments and City work centers; in order to assess auto, electric vehicle, semi-autonomous auto, autonomous auto, transit, bike, pedestrian dynamics. This could include, but limited to, – transitioning traffic interchanges from static to communication enabled; connecting intelligent infrastructure to the internet in order to develop multi-source, contextual data, and programmable two-way functionality; intelligent, light-emitting diode, microprocessor-enabled raised pavement markers; road sensors for reading volumes, load leveling, alert drifting; charge electric vehicles through pavement technology; autonomous communication with TOCs; on-road electric vehicle vehicle-to-grid deployment strategies; Maricopa County DOT SMART*drive* Program and Arizona DOT Multi-Modal Intelligent Traffic Signal System linkages. Two smart corridors are proposed;

  No. 1 - State Route 101/Scottsdale Road/Frank Lloyd Wright Boulevard/Shea Boulevard.
  No. 2 – State Route 101/McDowell Road (E-W unlabeled)/Scottsdale and Hayden Roads

Eight (8) Major Project Demonstration Test Areas continued

- Smart infrastructure/vehicle to vehicle (V2V)/vehicle to infrastructure (V2V)/mobile Big Data analytics leveraging current all modes static technology – through a near term smart technology data development effort, with a particular focus on a mobile data analytics effort to develop a real time/near real time digital nervous system. A particular focus on the three Vs of big data – volumes of data, variety of data, and velocity of data.

- Disadvantaged multi-modal test case - Vista del Camino Community Center and Granite Reef Senior Center. The potential to review mode to mode interaction between the two sites will aid in the development/improvement of efficiencies or lack thereof associated with public transit in the area. Understanding individual user and demographic behavior relative to transportation will be invaluable to the system as a whole.

- System user interface and change driver behavior through navigation tools and socially responsible gamification. "Incentivizing user engagement by appealing to a sense of fun and competition" and crowdsourcing to "assess the practice of obtaining needed services, ideas, or content"[vi] Providing an interactive platform in which the user in real time may utilize to determine more socially responsible preferred routes, ultimately elevating system stressors.

- Signal preemption impacts and how smart data and infrastructure could be deployed and managed through the TOC. A special interest in the idea of satellite bus availability that could be deployed in real time due to system interruptions to the transit user and the City's 203 transportation intersections

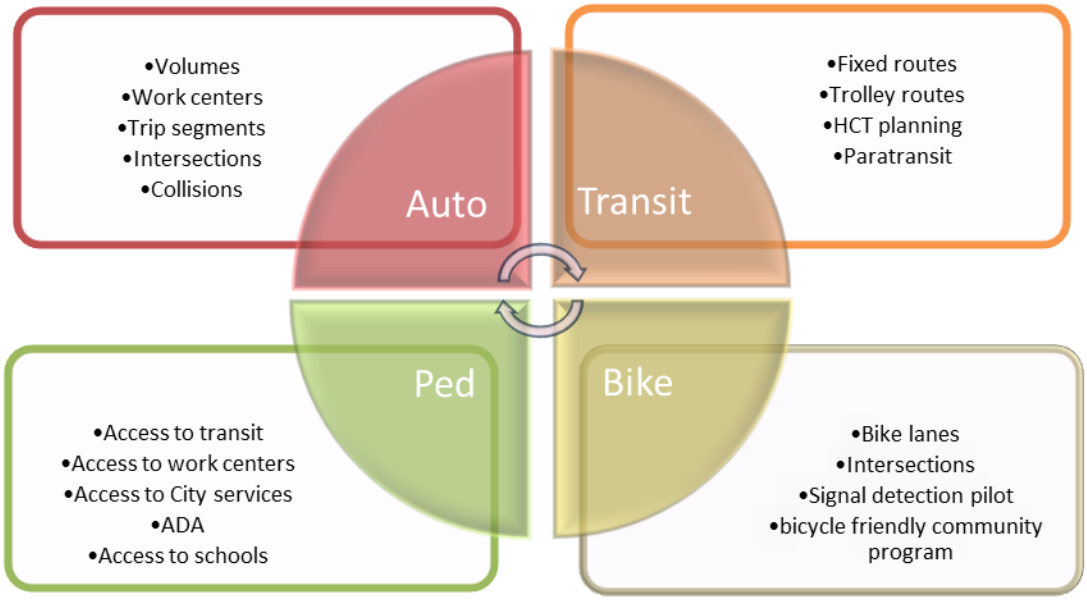
- Further exploit the interplay of bike/ped technology and user interface in relation to the entire system and all modes connectivity with a particular focus on data analytics of the in-development City bike share program.

- Paratransit, fixed transit, and trolley routing creating enhanced mobility for aging populations.

- Further evaluate system constraints through traditional auto system load leveling and signal prioritization utilizing data extracted at all 203 street intersection and V2V and V2I.

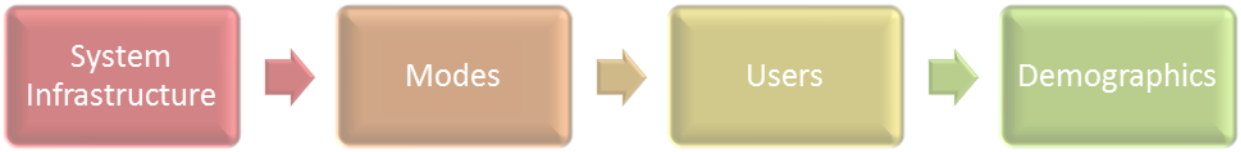
A flow diagram showing a framework approach to using all twelve Vision Elements and how the City would prioritize those Elements in relation to the eight test areas follows.

Conduct Vision Element #4: Urban Analytics



Element #4 will utilize current, previoiusly synthesized data and analyics to formulate where information gaps are present. Then, the goal will be to develop new Big Data sets to complement the existing data sets and gaps.

The team with also explore and test the data sets across the four areas:



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

Element #3 would require the team to inventory the relevant City infrastructure that may be a candidate for Smart technology adaptation (smaller transistors, faster processors, more economically responsible sensors). This would allow for better precision when collecting and reporting real-time data which is used to inform day to day transportation-related operations, performance, and system trends.

Conduct Vision Element #11: Low-Cost, Efficient, Secure, and Resilient ICT

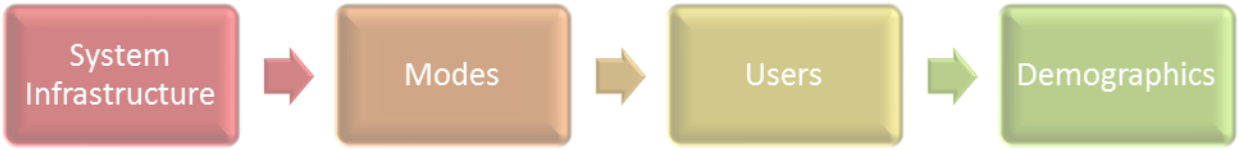
Element #11 will aid in identification of reasonable telecommunications platforms, software, storage, and visualization systems that may transfer voluminous data sets furthering the understanding of the area's characteristics. Identification would contribute to:

- Developing one common operating platform
- Informing the system user
- Informing transportation staff
- Ultimately, informing city government decision-making

Conduct Vision Element #4: Urban Analytics – Second Phase accounting for the identified SMART technologies and ICTs in order to understand the potential benefits of deployed solutions against the system infrastructure from Element #3

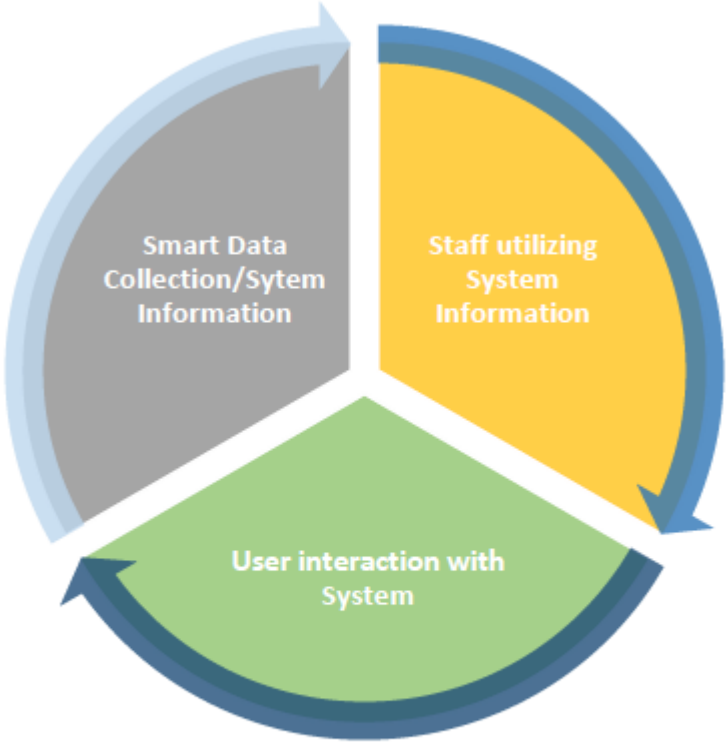
Element #4 process has 6 (six) outcomes:

1) Complex urban challenges, such as personal safety and mobility, network efficiency, environmental sustainability, will be identified. This may possibly provide a measure to assess the transportation network performance.
2) Strategies to resolve those challenges would lead to all-mode system user solutions.
3) City staff would further benefit from what was static data, generally limited in scalability to auto-to-auto, transit-to-transit, bike-to-bike, ped-to-ped, decision making, to now see each mode more deeply analyzed, inter-mode comparability, relational analysis of each mode as it impacts the system, and how all these are additionally impacted/or impact the four data set areas previously mentioned –



4) The newly collected data would allow city operators to visualize how the operation of facilities, systems, services, and information generated for the public may be enhanced.
5) These four aforementioned activities may create a continuous smart, connected, complete loop of data which will ultimately need to be identified.

6) Once the system infrastructure, smart technologies, and big data sets are identified and normalized, a continuous loop of information will be established.



The development of the continual loop process then allow the four more system specific, road-user interface, physical construction, application oriented Vision Elements to be blended with a specific focus on the Ultra Smart Corridor implementation:

Conduct Vision Element #9: Connected, Involved Citizens	**Conduct Vision Element #1: Urban Automation**
Conduct Vision Element #5: User-Focused Mobility Services and Choices	**Conduct Vision Element #2: Connected Vehicles**

Vision Elements #1, #2, #5, and #9 implementation allows for: lessons learned, re-run and further refinement of data sets, opportunities to conduct additional user outreach, and

continuous loop practice. The project would contribute to the City, county, state and the overall national topic relative to the practice. Maturity of the models and technologies would allow the final set of Vision Elements to be conducted:

Conduct Vision Element #10: Architecture and Standards	Conduct Vision Element #6: Urban Delivery and Logistics	Conduct Vision Element #12: Smart Land Use

Vision Element #7 has already been underway at the City of Scottsdale since mid-2014. Goal has been to develop an open and dynamic format in order to recognize the role transportation plays in preserving livable neighborhoods, promoting economic vitality, responding to 21st century safety, efficiency and mode choice needs. This, in an essence, will ensure Scottsdale remains a world class destination for residents and visitors alike.

City of Scottsdale, Arizona by the Numbers

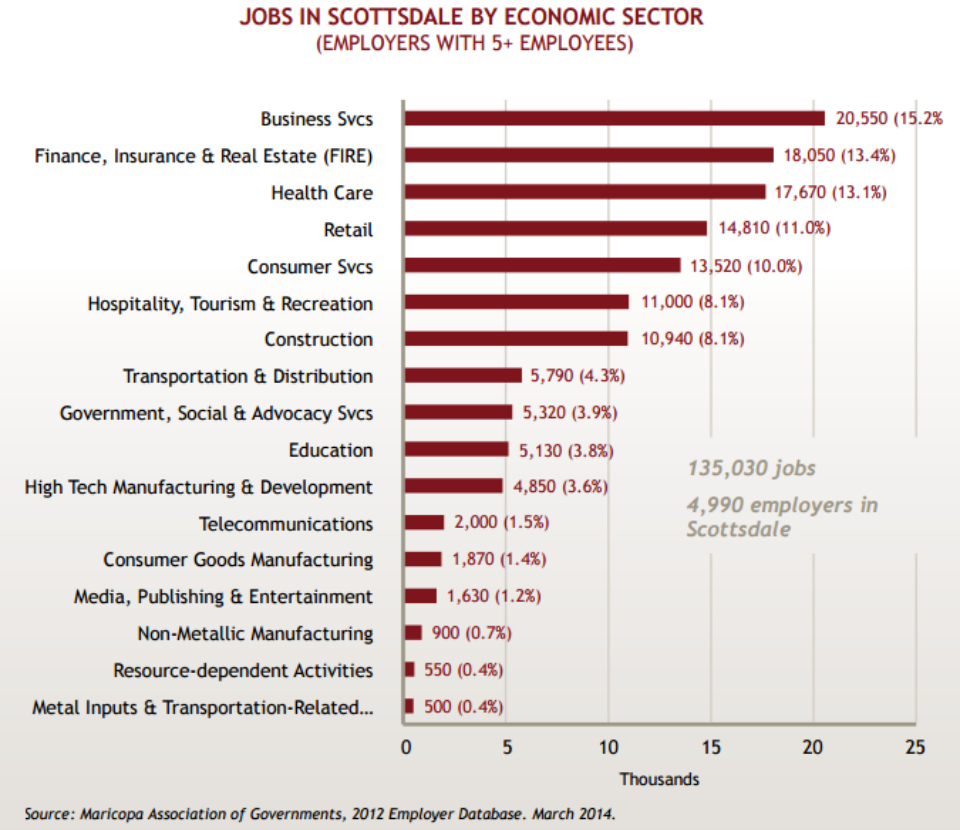
Scottsdale's key demographic factors reflect the quality and affluence of a community that enjoys a high standard of living and high educational attainment.

A SNAPSHOT OF SCOTTSDALE, AZ - 2014	
Median Age	46
Population	219,741
Median Household Income	$76,124 (Arizona: $50,256)
Average Household Income	$96,048
Per Capita Income	$44,967
Average Household Size	2.13
Owner Occupied Households	68.1%
Median Disposable Income by Household	$62,031
Average Disposable Income by Household	$81,704
Median Home Value	$261,652
Total Businesses	24,422
Total Employees in Scottsdale Businesses	143,515

Source: ESRI Business Analytics, January 2014.

As represented in the following table from the Maricopa Association of Governments, Scottsdale's employment base is diverse, reflecting particular strengths in the Business Services (15.2 percent); , Finance, Insurance and Real Estate (13.4 percent); Healthcare (13.1 percent); Retail 11 percent), Hospitality, Tourism and Recreation (8.1 percent), and Construction (8.1 percent) sectors.

The 2014 Scottsdale, Arizona, population was 219,867. There are 1,195 people per square mile (population density).



City of Scottsdale, Arizona Transportation by the Numbers

<u>System Size</u>

825 Lane-Miles of major streets

300 Signalized Intersections

500 Miles of paths, trails, bicycle lanes, bicycle routes

15 bus routes with 7,000 daily riders

87,200 annual trips for elderly and disabled residents

2035 Traffic Volume Projections

2014: 3,900,000 Daily Vehicle-Miles

2035: 4,500,000 Daily Vehicle-Miles

15% Anticipated daily traffic volume increase expected in 20 years

2014 Daily Traffic Volumes

Arterials

Over or Near Capacity	25%
Between 50% and 80% of Capacity	45%
Less than 50% of Capacity	30%

Collectors

Over or Near Capacity	8%
Between 50% and 80% of Capacity	18%
Less than 50% of Capacity	74%

Highest Volume-to-Capacity Streets in Scottsdale

Street Segment		Capacity
1.	Shea, SR-101 to 90th	128%
2.	Chaparral, Miller to 78th	122%
3.	Indian School, Miller to Hayden	116%
4.	Scottsdale, Williams to Pinnacle Peak	115%
5.	Indian School, Drinkwater to Miller	113%
6.	Shea, 90th to 92nd	113%
7.	Indian School, Hayden to Granite Reef	113%
8.	Indian School, Granite Reef to Pima	109%
9.	Scottsdale, SR-101 to Thompson Peak	107%
10.	Cactus, 84th to SR-101	106%

Highest Volume-to-Capacity Streets in Scottsdale (continued)

Street Segment		Capacity
11.	Pima, Pinnacle Peak to Happy Valley	105%
12.	Scottsdale, Thompson Peak to Grayhawk	103%
13.	Scottsdale, Deer Valley to Williams	102%
14.	Cactus, Hayden to 84th	102%
15.	Scottsdale, Grayhawk to Deer Valley	101%
16.	Shea, 92nd to 96th	100%
17.	Cactus, Scottsdale to Hayden	98%
18.	Raintree, Northsight to SR-101	97%
19.	Camelback, 68th to Goldwater	96%
20.	Frank Lloyd Wright, Hayden to SR-101	95%

Lastly, a best in class Traffic Volume and Collision Rate Data Report has been published for even numbered years since 1988. This 200-page document, the exhaustive data collection, and subsequent analysis are an incredible launching point for a smart city demonstration project. It would seamlessly link to an initial big data collection effort and the consequential Vision Elements implementation.

See also Transportation Master Plan link http://www.scottsdaleaz.gov/Asset62223.aspx

City of Scottsdale Current Progressive Transportation Programs/Actions

2016 Smart/Connected/Complete Transportation Speaker Series

A speaker series was developed to allow citizens and decision makers to attend a wide array of presentations that influence what transportation looks like and how it will influence the City over the next 20 years. Initiated to address a host of digital, technological, and modal shifts in the industry, the first presentation was from the Arizona State University Technology Center Skysong and focused on transportation, commercial land use and urban commuter modal choice. This Smart City proposal was addressed at the December 2015 City Transportation Commission monthly meeting, a Mayoral meeting in early January 2016, and presented as an entire presentation at the February 18, 2016 Transportation Commission meeting.

Best in class Paratransit Programs for Senior Citizens

The following discussion includes the City's transportation programs for Senior Citizens (65+), introduce the Greater Phoenix Age-Friendly Network, and explain the community's involvement in Age Friendly programs. The City provides an interconnected network of transportation services for senior citizens (and disabled individuals) with three programs: 1) East Valley Dial-a-Ride; 2) Cab Connection; and 3) Scottsdale Trolley. In addition, all seniors are eligible for reduced-fare on Valley Metro bus routes and light rail. Every Scottsdale senior, whether or not they are disabled, is eligible for all three of these programs.

East Valley Dial-a-Ride Service

Provision of paratransit service to individuals living within ¾ mile of any fixed route transit service is a Federal requirement. The majority of jurisdictions nationwide provide Dial-a-Ride service to comply with the Federal law. By 1995, several East Valley Cities either did not provide paratransit service, or found it extremely expensive to do so. In 1999 the East Valley Dial-a-Ride program was started as a partnership with the City of Scottsdale and the cities of Tempe, Mesa, Gilbert and Chandler to comply with the Federal requirement. The program today provides door-to-door paratransit service, during the same days and hours as a regular fixed route bus service. Participants can qualify to use paratransit service through a Valley Metro certification process (called "ADA" Trips); or, if they are age 65 or older certain cities within the program will provide "non-ADA" Trips without requiring a certification process (the City of Scottsdale provides both "ADA" and "non-ADA" trips). The non-ADA service is not federally required.

All trips are scheduled through a call center. Various types of vehicles, other than taxis, are used to fit each participant's need. In the beginning of Fiscal Year 2012-13 the service delivery method changed from a collector/distributor system using large vehicles, to a taxi-based smaller vehicle system. Under the old system large vehicles picked-up multiple participants and delivered them to their destination all along a single route (routes were designed daily by the stops scheduled). This system kept participants on bouncy vehicles for a long time, sometimes for up to an hour and a half. By scheduling a taxi trip for one or two individuals, the trip time for riders was shortened and the vehicles used were much more comfortable. The majority of taxi trips are now taken with more fuel efficient electric hybrid vehicles (like the Toyota Prius), while larger lift equipped vehicles are also used when needed. In line with the City's growing population, and the nation's aging population trend, the number of Dial-a-Ride trips steadily increased over the years until the recent recession when the number of trips declined.

Three years later as the recession ended, a more convenient and comfortable taxi based system was implemented; ridership and program costs began to grow again. The ridership trend (number of annual trips provided) is shown in Figure 1 below. The use of more fuel efficient vehicles has resulted in contract cost savings, even though fewer individuals are transported

per trip. The dramatic cost savings to the City between Fiscal Years 2012-13 and 2013-14 can be seen in Figure 2 below both in terms of cost per trip type, as well as total cost.

Figure 1. East Valley Dial-a-Ride Annual Trips Provided FYs 2009-10 to Estimated 2014-15

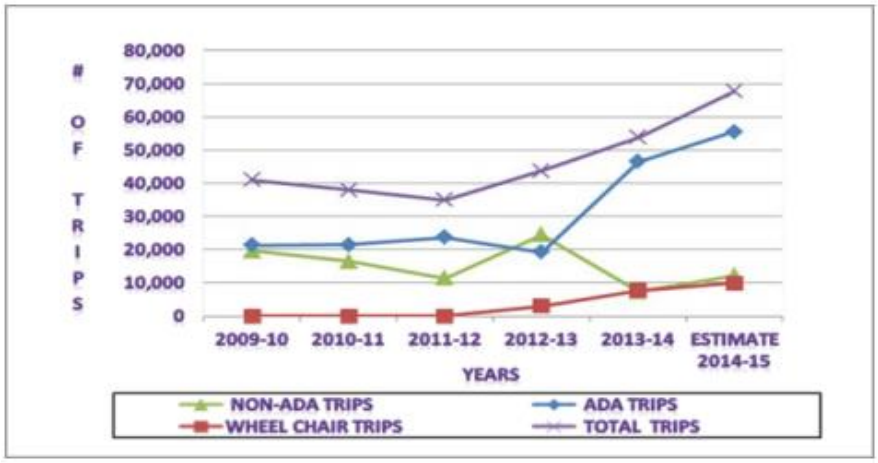
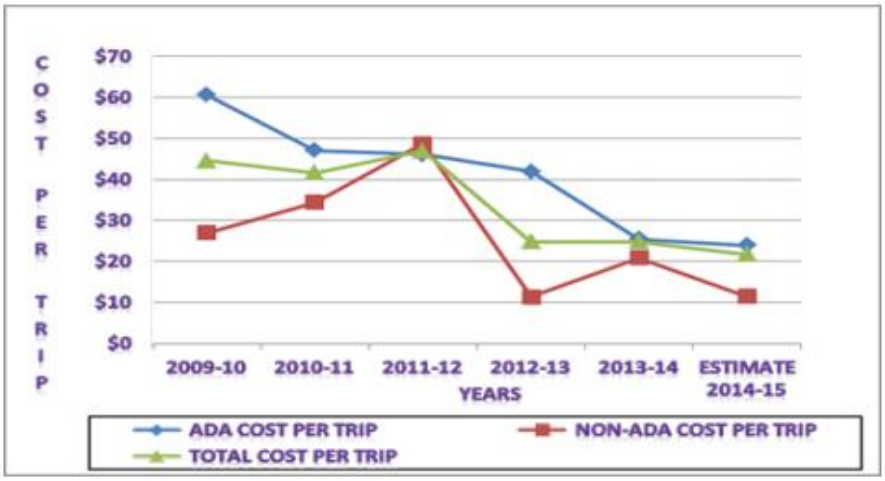


Figure 2. East Valley Dial-a-Ride, Total Cost per Trip (ADA vs. Non-ADA) FYs 2009-10 to 2014-15



Cab Connection Taxi Voucher Program

The City's taxi service program for seniors started in the late 1950's as an informal program. In 2001 the service became more formalized and was named Cab Connection. It now provides over 45,000 taxi rides per year, primarily to senior residents. Cab Connection has four subprograms:

1. Regular vouchers: a. For those 65+ or certified disabled. b. Each participant receives up to 16 monthly vouchers (1 voucher = 1 one-way trip). c. Each voucher pays for 80 percent of the trip cost, up to $10.00. d. Approximate miles traveled per voucher are 2.92. e. The average fare paid per participant per voucher is $3.51.

2. Dialysis vouchers: a. Each participant receives 26 dialysis vouchers per month in addition to 16 regular vouchers. b. The voucher covers 100 percent of the trip cost and also pays a 15 percent driver tip.

3. Wheels to Meals vouchers: Each participant receives between 38 – 46 vouchers per month depending on city business days.

4. City Volunteer Worker vouchers: Senior or disabled volunteers enrolled in a qualified work skills program with the City receive vouchers for transport to volunteer stations as needed. The most recently implemented program, Wheels to Meals, was developed by Transportation and Human Services staff. The Wheels to Meals program provides free transport for low income seniors from their home to the Granite Reef Senior Center for a nutritious lunch each day. This noon meal is the primary, and sometimes the only, daily meal for these seniors.

Participants are qualified based on income by the Human Services staff, and receive vouchers for up to 5 round trips per week to the Senior Center. Wheels to Meals started as a pilot program in 2013 with 15 individuals and due to its success has now become a permanent program with 21 current participants. As expected, just as our community's population ages, the number of participants served in the Cab Connection program increases every year, as does the program cost. A study of voucher use in Fiscal Year 2008-09 indicated that the majority of participants used an average of only 16 vouchers. To curb costs the number of vouchers was decreased from 20 to 16 for all participants.

Maricopa County Area Government Proposition 400 funding was used to fund trips provided for ADA certified individuals. Currently, 50 percent of the program cost is covered by Proposition 400 funding. While the current level of Proposition 400 ADA funding will remain available, future program cost increases will need to be funded directly from the Transportation budget. The number of trips provided and the program costs are depicted in Figure 3 below. The figure illustrates the increase in participants served and vouchers used. The cost per trip compares well to the East Valley Dial-a-Ride trip cost.

Once the Dial-a-Ride non-ADA fare was increased to $4.00, the City staff expected to see an exodus from East Valley Dial-a-Ride to the Cab Connection as the average fare for participants on Cab Connection was less than $3.00. Unfortunately that shift did not occur. There are still non-ADA participants taking short trips (less than 5 miles) using the more expensive East Valley Dial-a-Ride program instead of using the City's less expensive Cab Connection vouchers. A program goal this year is to bring the shorter trip non-ADA Dial-a-Ride users over to Cab Connection.

Figure 3. Cab Connection Annual Trips Provided Fiscal Years 2009-10 to Estimated FY 2014-15

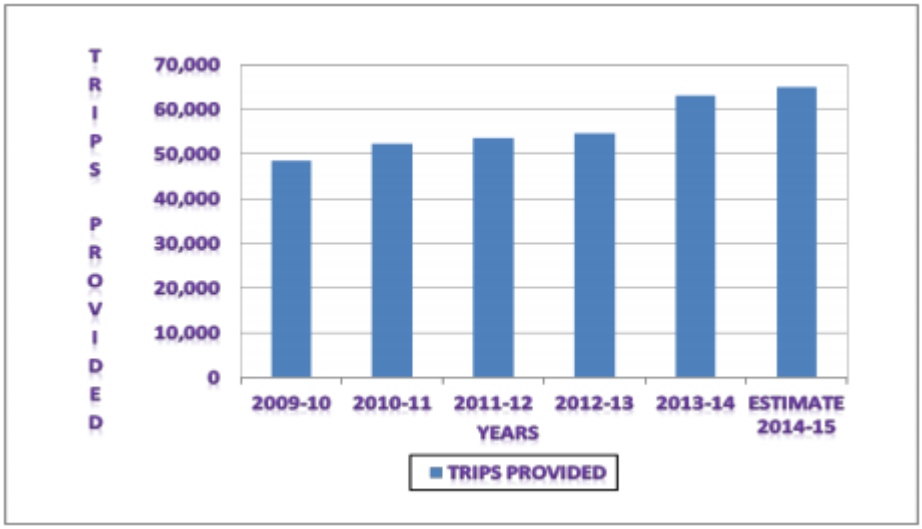
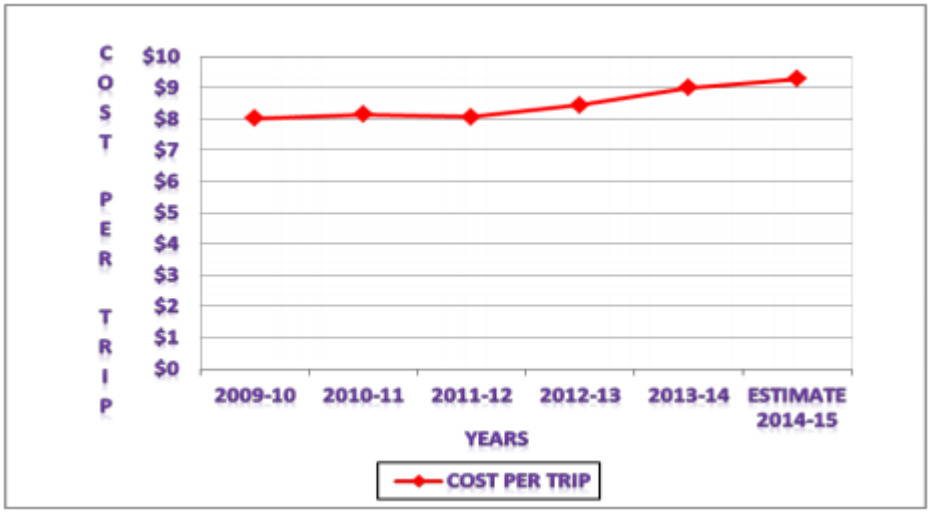


Figure 4. Cab Connection Annual Budget Fiscal Years 2009-10 to Estimated FY 2014-15



Scottsdale Trolley System

Scottsdale's trolley system is well known throughout the valley, and not just for using old-fashioned Trolley replica vehicles. Two of the three routes (Miller Road and Neighborhood) have higher average daily ridership than many of the Valley Metro fixed routes. These two routes primarily serve neighborhoods in the southern portions of Scottsdale with the highest senior populations. The routes pick up seniors from near their homes and take them to local activity centers. By serving at the neighborhood level, senior citizens have a shorter walk to a transit vehicle. A third Downtown Route provides service primarily for tourists. The route provides a tour of the City for visitors in a nostalgic vintage looking trolley replica vehicle, introducing them to key attractions such as the Districts, Scottsdale Fashion Square, and many

of the City's public art sculptures. Transfers are accommodated between all three Trolley routes. In addition, the three trolley routes provide access to all Valley Metro bus routes, the light rail system, and the city of Tempe Orbit system. The annual ridership of the system over the last five years has increased as shown in Figure 5. The increase in boardings shown in Fiscal Year 2011-12 is the result of the addition of Valley Metro Route 76 to the City's Trolley system (Miller Road Trolley). Upon the changeover to a farefree system, the route ridership doubled per month and continues to rise every year. Miller Road Trolley provides access throughout to a large number of senior housing units along Miller Road. The System's annual cost is shown in Figure 6. The slight increase estimated in Fiscal Year 2014-15 is the result of the new contract rate that went into effect October 1, 2014.

Figure 5. Scottsdale Trolley Boardings Fiscal Years 2009-10 to Estimated 2014-15

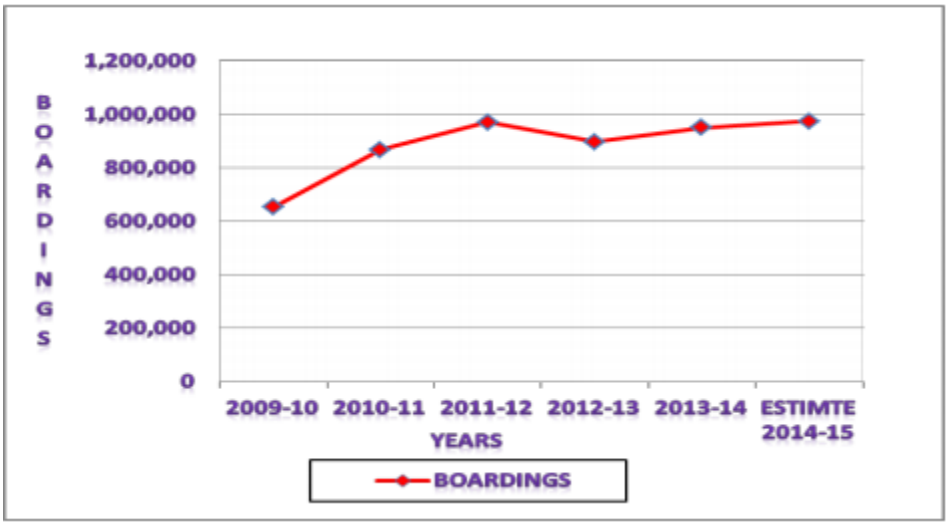


Figure 6. Scottsdale Trolley System Annual Budget Fiscal Years 2009-10 to Estimated 2014-15

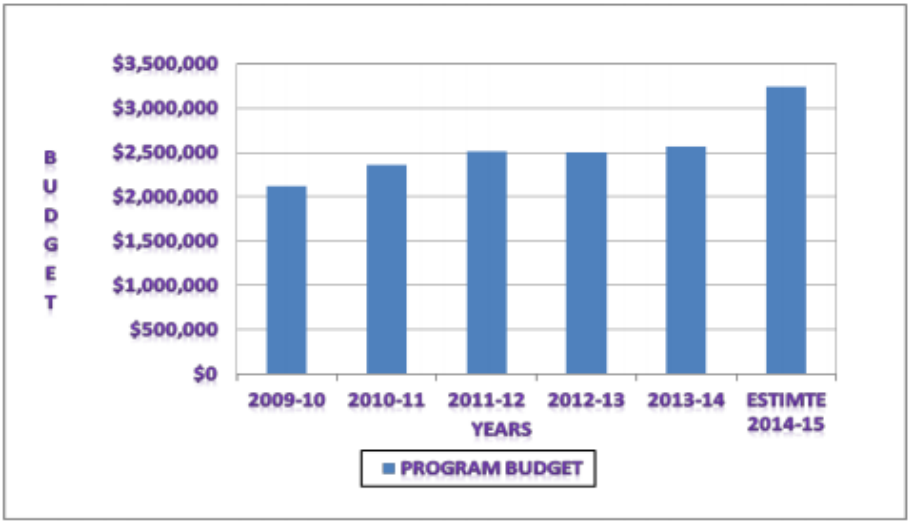
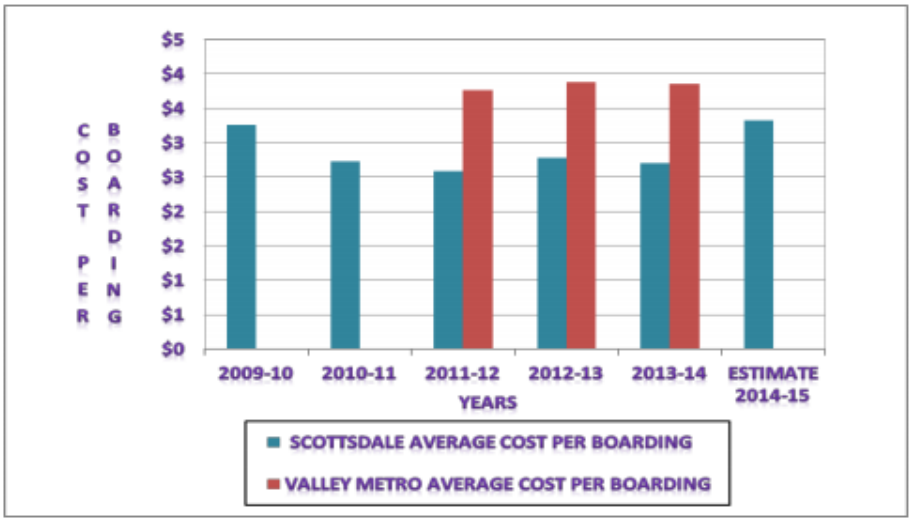


Figure 7 below compares the average cost per boarding to Valley Metro's average cost per boarding per year. The City's system cost is lower despite the fact that the system is not dependent on collecting a fare. The City's annual system cost fluctuates slightly each year depending on the number of days service is provided each month. The most important benefits for seniors is the fact that the service is provided free (no fare), and every vehicle is equipped with a wheelchair boarding ramp or lift. Thirteen of the 21 vehicles have a low floor (loads at almost curb height) and a ramp making boarding for seniors as easy as walking on. By 2016, all vehicles will be low-floor with a curb-height loading ramp.

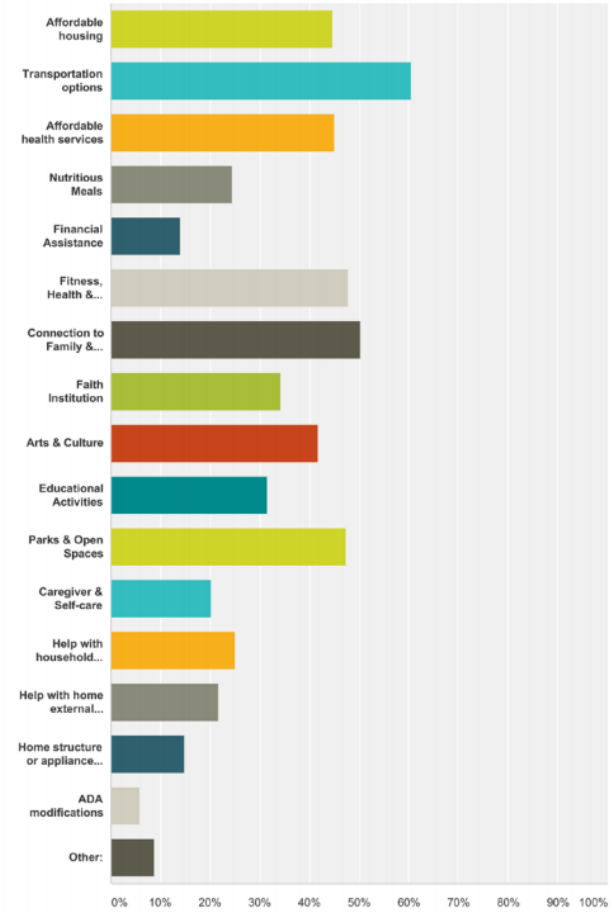
Figure 7. Scottsdale Trolley vs. Valley Metro, Average Cost per Boarding Fiscal Years 2009-10 to Estimated 2014-15



Greater Phoenix Age-Friendly Network

The City's Age Friendly Group's role in the age friendly program linked to the city of Phoenix program and is through our own Age Friendly Planning Committee. The City's program is attended by approximately 15 community individuals who have an interest in transportation, shared housing and home modifications, health advocacy and care transitions, time banks, and villages. In February 2014, a survey was taken by participants in programs of Duet, the Senior Expo, and Cab Connection program. There were 1,257 survey respondents total. In several questions relating to maintaining lifestyle, transportation was a high ranking response, compared to other responses such as health, nutrition, finance, etc. In one particular question: "What do you most value about your community and/or most value to assist you to live independently?" Over 60 percent of the 1,157 respondents that answered the question indicated Transportation was the most valued community asset (see the Report's Figure 11 next).

Figure 11. Age Community Survey, 2014, Question #8 Responses
Answered: 1,257 Skipped: 100



Best in Class Traffic Volume and Collision Rate Data Report [vii]

The above report has been published for even numbered years since 1988, it is a collaborative effort with the Traffic Engineering Department and contains traffic volume and collision data for 324 street segments and 203 street intersections. Traffic Engineering conducts a top 20 analysis of approximately 20 intersections that experience a high collision rate, analyze collision trends and conducts field visits at these locations. Mitigation measures are then recommended. These may include signing and striping changes to capital improvement projects.

Data collected for the Collision Manual comes from the collision database maintained by Traffic Engineering. Traffic volume data is collected by Traffic Engineering technicians over the two-year period with two counters placed at each intersection approach. Data is seasonally adjusted based on historical data. Volumes reported in the manual consist of the sum of all approaches to an intersection. The following is example information extracted from the recent report;

- The Collision Manual is broken into segment data and intersection data

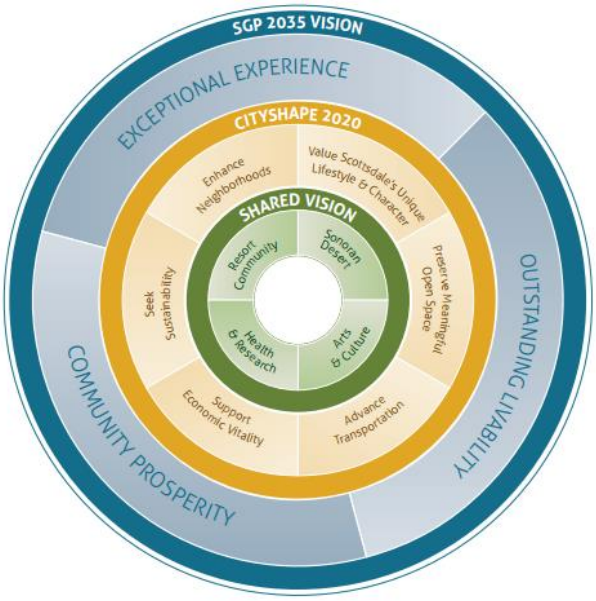
- Segment data are divided into collision data and volume data. Segment collision rates and volume data are sorted by location and descending criteria as well as historical comparisons
- New to the 2014 manual, volume to capacity ratios are also included
- Intersection collision rate and volume data is sorted by intersection location with historical comparison
- The collision rate is defined as the collision experience related to traffic exposure
- For segments, it is defined as collisions per million vehicle miles traveled, calculated using the annual number of collisions on the segment, the daily traffic volume and the segment length. The city-wide average segment collision rate in 2014 was 1.35 collisions per million vehicle miles traveled, representing an increase from the 2012 average rate of 1.31
- Intersection collision rates are defined as collisions per million vehicles entering the intersection. The 2014 average City-wide collision rate is 0.57 collisions per million vehicles entering the intersection, representing an increase for 2014 of 0.52
- For segments, the highest collision rate of 9.59 and a total of seven collisions was experienced on Camelback Road between Hayden Road and Granite Reef Road. Camelback Road between Scottsdale Road and Miller Road had a total collision rate of 7.69 and 31 collisions, due to a higher volume of traffic in this segment
- When sorted by highest frequency, the segment collision experience, Frank Lloyd Wright between Greenway Hayden and Hayden Road had the greatest number of collisions at 53. Shea Boulevard between Scottsdale Road and Hayden Road had 37
- For 2014 volume to capacity ratios, the highest ratio of 1.28 is experienced on Shea Boulevard between Loop 101 and 90th Street, followed by Chaparral Road between Miller Road and 78th Street, with a ratio of 1.22
- For intersection data, the highest collision rate experienced is 1.66 at the Loop 101 and Frank Lloyd Wright interchange, followed by the Hayden Road and Thomas Road intersection, with a rate of 1.61, the Loop 101 and Raintree Road interchange at 1.56 and the two Scottsdale Road intersections at 1.45
- When intersections are sorted by highest frequency of collisions, the highest rate is experienced at the Loop 101 and Frank Lloyd Wright Blvd interchange at 51 collisions.
- The Collision Manual is useful in analyzing city-wide trends, based on metrics such as population, daily vehicle miles traveled, city-wide number of collisions, time of day, month of collision, manner of collision and violation by driver.

- Between 2006 and 2012, there was a sharp decrease in collision rate, however this trend is reversing somewhat since 2014, with an increase in the rate.
- Annual vehicle miles traveled show an increase from 1994 through 2006 with this rate stable since that time. The number of collisions sharply fell after 2006, but has increased since 2012.

2016 General Plan Working Draft
See also General Plan link http://www.scottsdaleaz.gov/Asset62223.aspx

The General Plan is the primary tool for guiding the future of the City. It contains the community's goals and policies on character and design, land use, open space and the natural environment, business and economics, community services, neighborhood vitality, transportation, and growth. It shapes the physical form of the City, yet it also addresses other aspects, such as human services, protection of desert and mountain lands, arts and culture, community health, and the character of neighborhoods. The General Plan provides a guide for day-to-day, as well as short- and long-term decision-making. The City's General Plan has three interrelated roles: it is an expression of community vision, aspirations, values, and goals; it is a decision-making guide; and it fulfills State and City Charter legal requirements.

The goals and policies in the General Plan are implemented through ordinances, regulations, ongoing procedures, recommendations from City boards and commissions, and decisions made by the City Council.



2016 General Plan Working Draft 20135 Vision [viii]

General Plan draft Chapter 5[ix] – Connectivity is where the largest discussion of transportation resides, although you will find the importance of transportation throughout the other seven

chapters. The chapter defines the City's transportation system as the backbone of the City, supporting the economy and serving and influencing land use patterns. The automobile historically has been, and will continue to be, the predominant mode of transportation in the City of Scottsdale. However, to match the character, needs, and lifestyle of different areas, the City will need to diversify its transportation choices. A variety of mobility choices will provide greater accessibility and connectivity; alleviate pollution and congestion; and foster community well-being and quality of life.

It recognizes the primary role of the automobile, but also fully integrates other modes, such as public transit, air travel, bicycling, and walking. The plan also recognizes the interrelationships among transportation, land use, neighborhoods, and growth and activity areas. Different areas within the City may have unique mobility needs requiring specific-area solutions. However, transportation systems and their impacts do not stop at the City's boundary. Therefore, this element stresses the efficient use of Scottsdale's existing transportation systems and strong inter-jurisdictional coordination.

When it comes to mobility the City strives for cost-effective, diverse, affordable, adaptable, and innovative local and regional mobility options that serve all its residents, commuters and visitors. The City's Shared Vision is a path into the next century. It does not presume to 'know' the future. Rather it sets forth the clear magnetism of our special character and purpose.

2016 Transportation Master Plan Update

See also Transportation Master Plan link http://www.scottsdaleaz.gov/Asset62223.aspx

History

The current Transportation Master Plan is a 400-page, 11-chapter document that was unanimously adopted by the City Council on 8 January 2008. The implementation plan was adopted by the City Council on 13 January 2009. This was the first comprehensive Transportation Master Plan for Scottsdale. The Scottsdale City Council appointed a General Plan Task Force that began meeting in January 2013. The Transportation Department monitored the General Plan development. In spring of 2014, the City Council elected to delay the General Plan vote until 2016. The General Plan Task Force continued their efforts and completed their recommended draft in November 2014. The recommended General Plan is being presented to the Scottsdale Boards and Commissions and the general public throughout 2016.

The citywide voter election is currently anticipated for November 2016. The Transportation Department resumed revision of the Transportation Master Plan utilizing the current draft General Plan as its basis. Three of the most innovative aspects of the 2008 Transportation Master Plan are;

- The adoption of “Complete Streets” as the basis of planning, design, and construction of all streets in the City
- The investigation of three different types of High Capacity Transit on Scottsdale Road from Chaparral Road to the City of Tempe
- The reduction of the planned right-of-way and street width for 32 separate street segments

The 2016 Transportation Master Plan Characteristics and Process

The process to develop the new Transportation Master Plan began in April 2015 at a regularly scheduled Transportation Commission meeting. The intention was to provide generalized system guidance rather than meticulous specifics. Also, to provide separate public hearings at designated Transportation Commission meetings to present each of the following four sections: Streets, Transit, Bicycle, and Pedestrian. The Bicycle and Pedestrian Elements were also discussed at regular or designated Paths & Trails Subcommittee meetings.

Purpose

The Transportation Master Plan is tentatively scheduled for a recommendation by the Transportation Commission to the City Council on 4 February 2016. This document is similar to the General Plan. It is not intended to list specific projects. Specific project lists are the function of the City Council annually adopted Capital Improvement Plan. An exception to this intent is multi-use path and trail priorities. Pages 34 through 52 indicate in both maps and tables; high, medium, and low for multi-use path and trail priorities. The multiuse path projects are primarily those included in the 2008 Transportation Master Plan, as supplemented with additional projects identified in the past year of deliberations. The trails priorities are those determined by 2004 Scottsdale Trails Master Plan and the 2009 Ad Hoc Citizens Trails Task Force. These multi-use path and trail priorities are provided as numerous improvements and connections are necessary to complete our multi-use and trail system.

League of American Bicyclists (LAB) Bike Friendly America Program

Background

The League of American Bicyclists (LAB) offers the Bicycle Friendly America program for communities, states, universities, and businesses as a tool to make bicycling available for transportation and recreation. The Bicycle Friendly Community Program (BFC) provides incentives, hands-on assistance and award recognition for communities that actively support bicycling. These communities welcome cyclists by providing safe accommodations for cycling and encouraging people to bike. Increasing the safety and comfort of bicycling improves a community’s public health, environment, quality of life, and contributes to economic development. The City was awarded Silver level in 2005 and was notably the first community without a university or college to reach this level in the national program. Scottsdale was

awarded Silver again in 2007. In 2011, Scottsdale was awarded Gold, which was a goal of the 2008 Transportation Master Plan.

Transportation staff provided an update to the Path & Trails Subcommittee on 7 July 2015 and the Transportation Commission on 16 July 2015. Discussion included the recent public meetings, feedback, and portions of the application. Staff finalized and submitted the Bicycle Friendly Communities application on 11 August 2015. The League of American Bicyclists announced the results of the Bicycle Friendly Communities applications on 16 November 2015. Scottsdale's Gold designation was renewed for the next four years.

Bicycle Signal Detection Technology Implementation

Background

Bicyclists that use on the on-road bike lane system in the City of Scottsdale currently rely on vehicles or signal phasing to actuate a green light to cross signalized intersections. Bicycle detection only exists at three intersections in the City. Bicycle detection is used at signalized intersections to alert the signal system of bicycle crossing demand at a particular approach. It is much like the existing vehicle detection systems at many City intersections. The goal of this program is to implement a consistent reliable technology that will accurately detect bicycles and provide clear guidance to bicyclists on how to actuate detection. In April 2013, staff began investigating bicycle detection technologies availability and visited local jurisdictions using various technologies. In July 2013, staff gave a presentation to the Transportation Commission on various bicycle signal detection technologies such as manual push buttons and automated devices (e.g., inductive loops, video cameras, infrared, microwave, and magnetometers). Through research and discussions with other jurisdictions, staff found that inductive loops and video cameras are the most widely used automated bicycle detection technologies due to their versatility and reliability.

Recommended Technology

Based on the research, video camera detection is the best technology to use in the city of Scottsdale. Staff proposed a pilot project to install bicycle video detection at two intersections. If the pilot project is successful, other intersections will be added to the system.

- **End of the City of Scottsdale Current Progressive Transportation Programs/Actions Section -**

Sustainable Transportation Implementation

The City has been partnering with ADOT's Sustainable Transportation Program for the last two years. As one of two cities in Arizona to begin adopting a comprehensive sustainable transportation approach to planning, design, construction, maintenance, and operations via participation in ADOT's local public agency outreach program, the City is scheduled to issue its first annual sustainable transportation annual report in the fall of 2016. The City appeared as part of ADOT's first ever annual report in 2015.[x] A greenhouse gas emissions City framework is envisioned, is a natural extension for the City to the December 2015 *U.S. Mayors Report on a Decade of Global Climate Leadership*,[xi] and would be accelerated under a this opportunity.

Resilience

The major wash, Indian Bend Wash, runs north to south through the heart of the City. Low water crossings are also prevalent throughout many of the northern sections of road. The City has spent extensive resources addressing extreme weather and how it affects the traveling public. The City's emergency, operations, and maintenance have a mature process for handling storm damage and any smart infrastructure implementation would be additionally assessed for weather risk.

Conclusion

Scottsdale, Arizona respectfully requests to be seriously considered for the Smart City demonstration funding. The City is motivated and capable of handling such an opportunity and hopes the package submitted reflects the requirements to meet this challenge. Please contact The Mayor's Office or the Director of Transportation, Paul Basha, with any questions.

Partnering beyond all participating City individuals

Arizona Department of Transportation (see support letter from this partner)
Arizona is a great state for testing transportation technologies. In addition to the strong support from Arizona Department of Transportation (ADOT) and our Governor's office, climates that range from the extreme hot desert to the extreme cold with snow, ice, etc. We have large metropolitan areas and rural roadways, including freeways (heavy truck usage), transit, etc. The Arizona Department of Transportation, Maricopa County Department of Transportation, and the University of Arizona have developed the Arizona Connected Vehicle Test Bed in Anthem, Arizona to support the development and testing of advanced traffic management strategies based on vehicle-to-infrastructure communications. This Test Bed includes 11 fully equipped intersections that operate 24-7 with our Multi-Modal Intelligent Traffic Signal System (MMITSS) and have plans to expand to the I-17 freeway segment. The applications comprised of intelligent traffic signal control, priority signal control for emergency vehicles, transit buses, and freight trucks, ramp metering control, and a pedestrian application to enable access to pedestrians. The infrastructure based systems use SAE DSRC standards for communicating with

vehicles and include additional vehicle-to-vehicle capabilities such as issuing roadside alerts for first responders and work zones and emergency vehicle alerts for emergency vehicles. Furthermore, Arizona Department of Transportation, Maricopa County Department of Transportation, City of Scottsdale, Arizona Department of Public Safety, Scottsdale Police Department/Fire Department, and Salt River Pima-Maricopa Indian Community developed freeway-arterial Integrated Corridor Management system (ICM) on L-101, which is the first ICM in the state and planning to advance to fully automated system in the future as well expanding the concept further to other routes in the region.

Maricopa County Department of Transportation (see support letter from this partner)
The Arizona Connected Vehicle Team (MCDOT, ADOT and University of Arizona) has a deep and hands-on understanding of connected vehicle systems and architectures, including the CVRIA, SAE DSRC standards (J2735 Messages, J2945 Performance Requirements), as well as existing traffic operations including development and deployment of advanced connected vehicle enabled transportation management systems (adaptive control, transit priority, freeway, arterial), transit systems, emergency management (ALERT, REACT), and Stakeholder engagement. The team has deployed Connected Vehicle technology in Anthem, Arizona on Daisy Mountain Drive complemented by a USDOT Multi-model Intelligent Traffic Signal System (MMITSS) and has demonstrated the proven systems engineering methodology for successful design, deployment, and testing along the 'live' corridor. Maricopa County is one of the most advanced county transportation departments in the country.

Street Light Data (see support letter for more information on this partner)
The mission is to transform the way information about transportation and mobility behavior is used across urban planning, transportation infrastructure design, business, and research. The company strives to make it easy, affordable and intuitive to incorporate transportation and mobility behavior into decision making throughout the world.

Through the pioneering approach to the use of location data, StreetLightData will:

- Help reduce greenhouse gas emissions and petroleum use in vehicles, especially by reducing miles driven.
- Improve transportation access and equity.
- Improve quantity and quality of in-store commerce for retail clients.
- Equip small and medium businesses with analytic tools that are affordable and easy to use.
- Create a new source of knowledge about how people use cities and make that knowledge available to researchers.

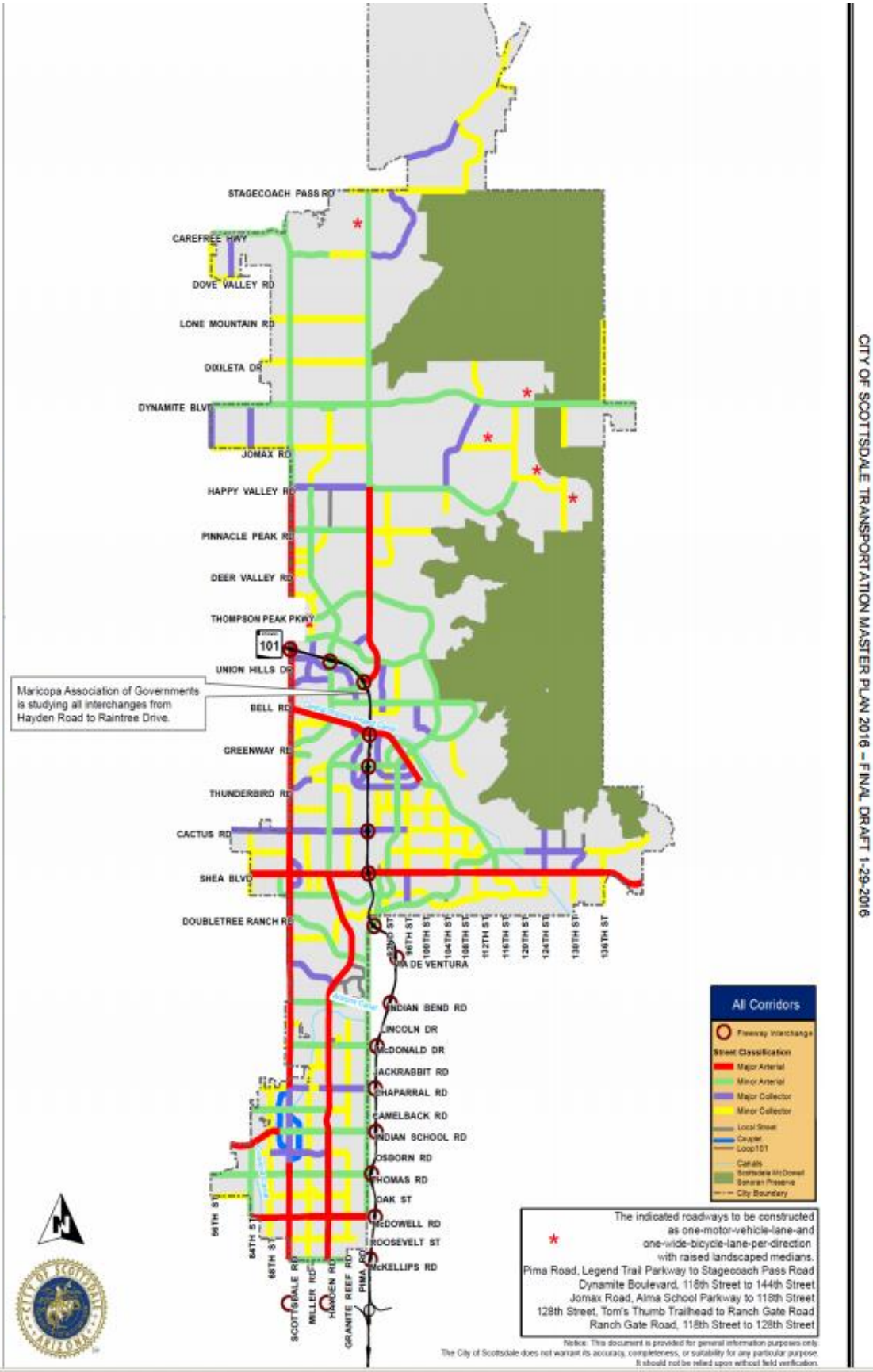


Figure 6: All Street Classifications – Entire City

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