Artwork by Casebeer

TEMPE Transportation Master Plan

January 2015

CITY OF TEMPE ARIZONA

TRANSPORTATION MASTER PLAN

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INTRODUCTION

The goal of the City of Tempe *Transportation Master Plan* (TMP) is to provide a multi-modal transportation guide for the City that includes short term (2020) and long term (2040) recommendations and supports the *General Plan 2040*. Goals and policies for the TMP are derived from the Circulation Chapter of the *General Plan 2040*, which was approved by Tempe voters in May 2014.

The TMP sets a new level of mobility for Tempe and emphasizes the following:

- Transportation linkages that emphasize mobility over capacity
- Connections between activity centers
- Priority corridors (roadway, transit, and bicycle/pedestrian)
- Multi-modal connections and transportation nodes
- Neighborhood vitality
- Optimization of existing transportation network
- Transportation recommendations grouped by corridors

The TMP includes a list of possible projects as funding (Capital Improvement Projects funding, local and federal grants, etc.) becomes available. The 2020 TMP project list consists of projects including costs that may be built by 2020, subject to funding opportunities. The 2040 TMP project list consists of projects that may be built between 2020 and 2040, pending funding opportunities. The TMP goes above and beyond requirements in the state statute with regards to expanding on the Transportation Element of the Circulation Chapter within the *General Plan 2040*.

General Plan 2040

The TMP was prepared in accord with the City of Tempe *General Plan 2040*, in particular the Circulation Chapter. The following pages summarize circulation goals and objectives and other information pertinent to the TMP.

General Plan 2040

The purpose of Tempe's Circulation Chapter is to guide the further development of a citywide multi-modal transportation system integrated with the City's land use plans. The Circulation Chapter highlights the ability to provide a more direct link between transportation and quality of life. Important themes of the Chapter include:

- enhancing connections for pedestrian, bike and transit to produce a "20-minute city";
- creating safe and comfortable pedestrian and bike connections to schools, parks and multi-generational centers, as well as with local-serving transit routes to hubs; and
- enhancing pedestrian and bike use with shaded streets and shelters, as well as connecting parks, plazas and open spaces as rest stops for that 20-minute walk or bike ride.

The Circulation Chapter contains five elements: Pedestrian and Bikeways, Transit, Travelways, Parking and Access Management, and Aviation. The goals and objectives for the first three elements are shown on the next page. For more information on the last two, refer to the *General Plan 2040*. The circulation system-wide goal for all travel modes is shown below.

Circulation System-wide Goal

Develop an effective multi-modal transportation system integrated with sound land use planning, thereby creating safe, efficient, and accessible mobility for persons, goods, and commerce within the city and region.
Develop a functional relationship between the diverse land uses in Tempe and the transportation system that serves them.
Accommodate regional travel demands with transit and other modes, as alternatives to street widening, to address capacity needs.

Seeking the 20-minute city

A 20-minute city is characterized by a vibrant mix of commercial and residential establishments within a ***1-mile walking distance****,* ***4-mile bike ride*** *or* ***20-minute transit ride****.*

The 20-minute city premise is at the core of planning for traditional neighborhood design, transit-oriented development and complete streets. A few of the many benefits of the 20-minute city are reduced transportation costs, reduced greenhouse gas emissions, improved public health and improved access to residents' daily needs.

Pedestrian Network Goal

Develop safe, comfortable walking environments and pedestrian connections to encourage pedestrian travel.

- Increase awareness that pedestrians are a priority in Tempe, and that pedestrian travel is an important part of the overall transportation system.
- Provide convenient and safe pedestrian access to destinations to promote neighborhood sustainability.
- Ensure pedestrian accessibility for all.
- Increase pedestrian accessibility and enhance the pedestrian environment with engaging and interesting experiences for pedestrians.

Bikeways Goal

Expand and enhance bicycle travel within the city.

- Provide safe and convenient access between neighborhoods and schools, parks, shopping, transit, employment and other destinations.
- Ensure that the circulation network and facilities will accommodate all types and levels of bicyclists.
- Facilitate regional bikeway planning efforts to ensure that Tempe's bikeways connect with those of neighboring communities and that Tempe's system is an integral part of the overall region-wide system.
- Improve the bikeways network.

Transit Goal

Coordinate and produce efficient, safe, convenient and interconnected transit options to increase ridership.

- Increase transit modes and services that support ridership increases and an expanded transit mode share.
- Facilitate connections among transportation modes.

Support transit that facilitates regional and interregional commute patterns.

- Expand transit availability to regional and interregional systems.

Travelways Goal

Encourage redevelopment of the street network that balances the needs of various types of travelers and more fully serves all modes of transportation safely and efficiently.

- Retain existing traffic capacity while reducing reliance on the automobile.
- Ensure the system integrity is conserved through maintenance and preservation.
- Establish guidelines that enhance the land use and transportation connection.
- Facilitate safe and efficient movement of arterial and collector streets.

Encourage transportation interconnections between street, highway and rail networks that balance and more fully serve all modes of transportation safely and efficiently.

- Avoid widening highways as the only solution to traffic congestion.
- Plan and encourage beneficial rail uses.

Note: Refer to the *General Plan 2040* for the strategies that accompany each objective.

Public Involvement Summary

The City of Tempe values public input and believes that community members should be engaged early on in decisions that affect them. The purpose of the Public Involvement Program (PIP) is to create an open and transparent process to guide the Transportation Master Plan in a shared community vision.

Previous public meetings about the TMP were held in November/December 2012. All comments from those meetings were incorporated into the 2014 TMP public input process. In addition, all transportation-related comments from the Character Area public meetings were also included in development of the TMP.

The first round of public meetings occurred in May 2014 to inform the public about the project and gather input from residents, businesses and organizations related to:

- TMP Overview
- Existing Conditions (demographics, roadway, transit and bicycle/pedestrian)
- Transportation Supportive Policies
- Development of Performance Measures
- Proposed arterial roadway corridors
- Active transportation corridors
- Proposed bike corridors, i.e., bike boulevards and off-street bike network
- Proposed pedestrian corridors
- Proposed transit priority corridors
- Changes to Tempe's street cross-sections
- Potential candidates for traffic calming and/or streetscape improvement

The second round of public meetings occurred in August 2014 and covered topics related to:

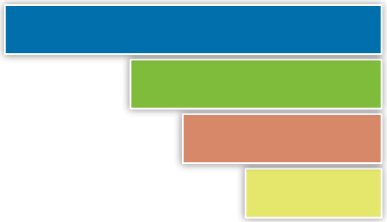
- Background report, proposed plan and project recommendations from Tempe residents, and as identified in the results of the gap analysis
- Proposed arterial roadway, bike, pedestrian and transit priority corridors
- Proposed street cross-sections and node improvements
- Proposed short and long-term future street, bicycle (proposed bike corridors, i.e., bike boulevards and off-street bike network) and pedestrian networks
- Proposed short and long-term future transit service and facilities plan
- Resident-identified neighborhood corridors, neighborhood destinations and character area circulation needs
- Proposed areas for traffic calming and/or streetscape improvements
- Neighborhood corridors and character area circulation needs
- ITS and roadway improvements

There were two sets of public meetings during the planning process at which comments were solicited:

- May 29 and 31, 2014, Tempe Historical Museum and Tempe Transportation Center, respectively
- August 4 and 9, 2014, Tempe Historical Museum and Tempe Transportation Center, respectively

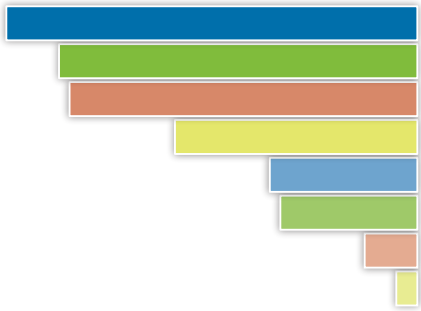
Comments were also accepted online at the city's Web page from May 29 to June 15, 2014, and August 4 to 21, 2014. Some of the comments are highlighted on the next page.

Which street should receive **bicycle improvements** first?



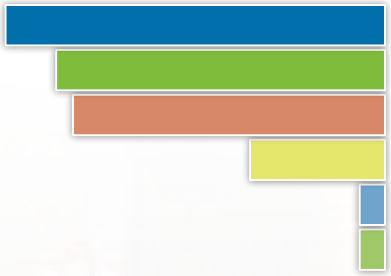
- Broadway Road (Priest Drive to Mill Avenue, and Rural Road to Tempe Canal)
- Southern Avenue (48th Street to Tempe Canal)
- McClintock Drive (US 60 to Rio Salado Parkway)
- None of these are a priority for me

Of the following 2020 **recommended projects**, which are priorities for you?



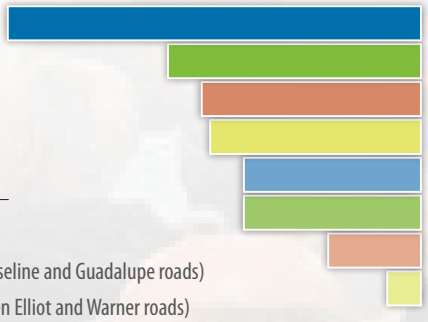
- North/South Rail Spur Multi-use Path
- McClintock Drive and Rio Salado Multi-use Path Underpass
- Upstream Dam at Tempe Town Lake Pedestrian/Bicycle Bridge
- Western Canal Multi-use and Baseline Road/Kyrene Road Path Crossing Treatment
- Pedestrian/Bicycle Bridge over Loop 101 (at Alameda Drive/Balboa Drive)
- Pedestrian/Bicycle Bridge over I-10 freeway (at Alameda Drive)
- Other
- None of these are a priority for me

Which **bicycle boulevards** are priority?



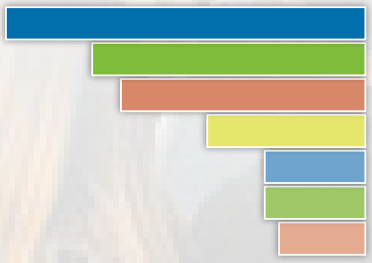
- Lakeshore Drive, Southshore Drive, College Avenue (to downtown Tempe/ASU)
- Alameda Drive (48th Street/Phoenix border to Tempe Canal/Mesa border)
- Western Canal, Hardy Drive (Loop 101 Freeway/Chandler border to Tempe Town Lake/Van Buren Street)
- Country Club Way/Smith Road/Martin Lane (Rio Salado Southbank Path to Knox Road/Chandler border)
- Other
- None of these are a priority for me

Which **transit corridors** should have increased bus service?



- Rural Road
- McClintock Drive
- Broadway Road
- Priest Drive
- Southern Avenue
- None of these are a priority for me
- Baseline Road
- Other

Which **midblock crossings** are a priority?



- Kyrene Road (between Baseline and Guadalupe roads)
- McClintock Drive (between Elliot and Warner roads)
- Kyrene Road (between Elliot and Warner roads)
- Warner Road (between Rural Road and McClintock Drive)
- Warner Road (between Kyrene and Rural roads)
- Kyrene Road (between Warner and Ray roads)
- Other

Character Area Plans

Character Area plans are being prepared for specific areas in Tempe as encouraged by the *General Plan 2040*. Character Areas recognize areas or groups of neighborhoods that contain common design, land use and commercial characteristics distinct from neighboring areas. Similarly, Character Areas are areas of the community that have achieved a distinctive, recognizable character that is different from neighboring areas. Styles of architecture, patterns of development, building materials, land use or street patterns, lot size, landscaping, landmarks, social magnets, and/or physical barriers form some of the recognizable differences. Character Area plans include circulation plans that support the unique characteristics including the transportation requirements of the designated employment cores.

The TMP will incorporate the Character Area plans and when possible incorporate the transportation strategies identified in a specific character area. Applicable segments of the circulation section of the character area plans will be integrated as updates to the TMP.

Art in Transportation

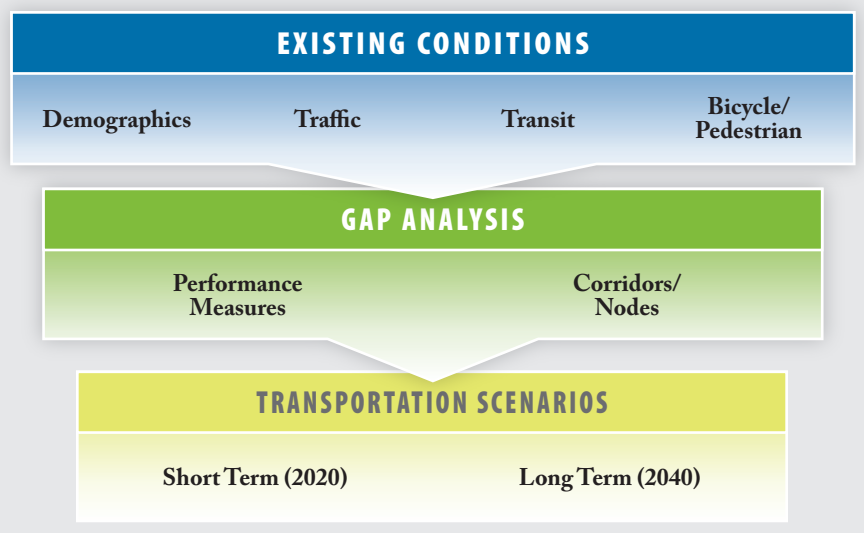
Transportation public art projects provide bicyclists, pedestrians and transit passengers with an enhanced traveling experience. Public art will continue to be an integral part of the Tempe transportation system. The TMP and Tempe in Motion promote and support public art in the transportation program and incorporation of public art into all Capital Improvement Projects when feasible. Tempe public art collaboration with transportation includes the construction of unique bus shelters, BIKEiT branding, art at multi-use paths and bridges, and streetscape projects.

EXISTING CONDITIONS

Documenting existing conditions was the first step in the TMP process, as shown in Figure 1. Existing conditions are separated into four categories:

- Demographics
- Roadway
- Transit
- Bicycle/Pedestrian

Figure 1: Transportation Master Plan Process



THE GOAL...

...develop a multi-modal transportation plan for the City of Tempe that provides short term (2020) and long term (2040) recommendations and supports the General Plan 2040.

Demographics

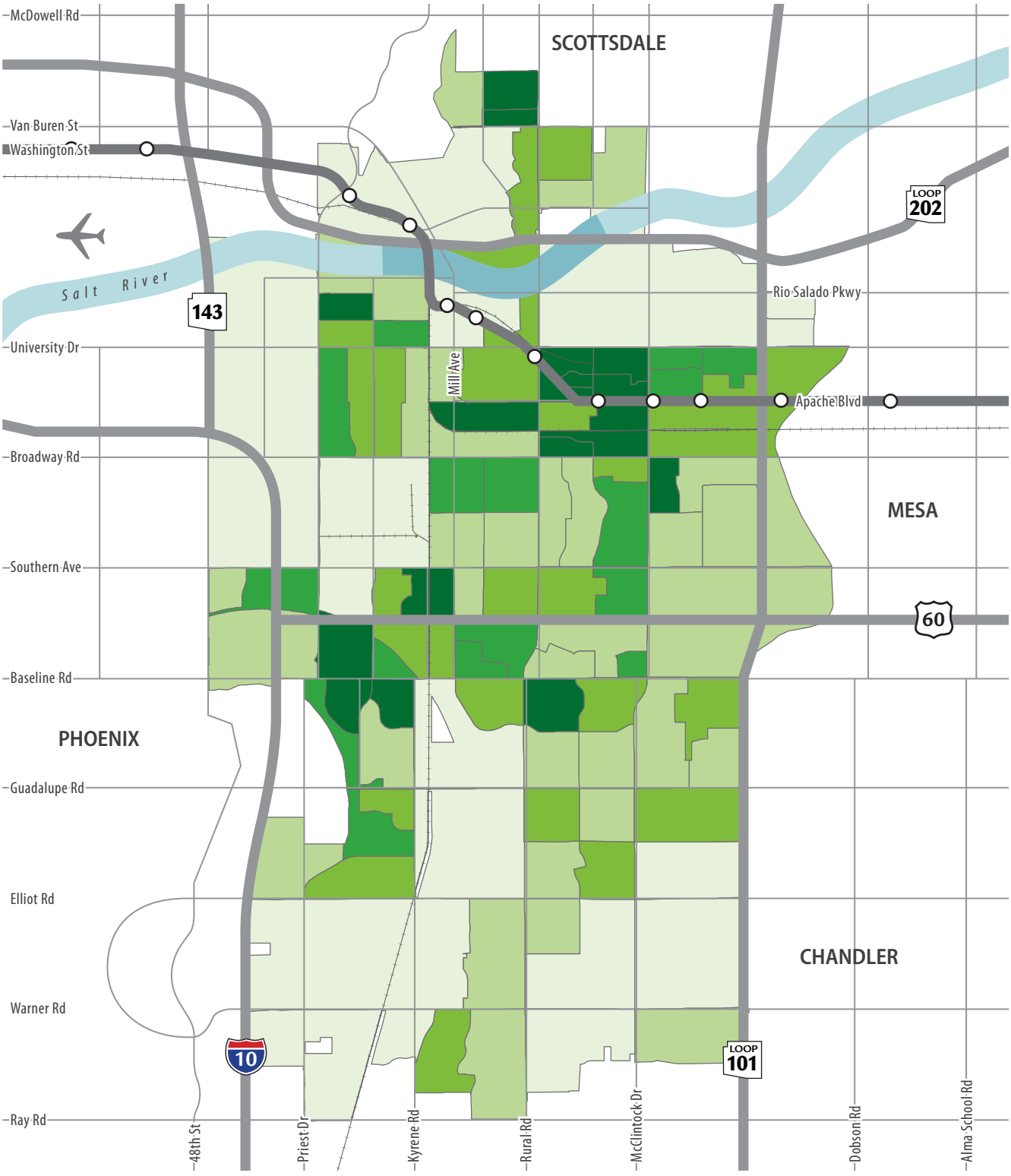
The recent demographic changes in Tempe are well documented. Tempe is landlocked and therefore it continues to transform into a more urbanized city that includes multi-modal transportation connections and defined character areas. The *General Plan 2040* identifies changes in land use and transportation that take on a more urban arrangement and preference.

Existing demographics in Tempe are documented using Census and American Community Survey data. This information is shown using density, which is a better indicator for transportation analysis.

Figures 2 through 12 show current demographic information in Tempe for the following categories:

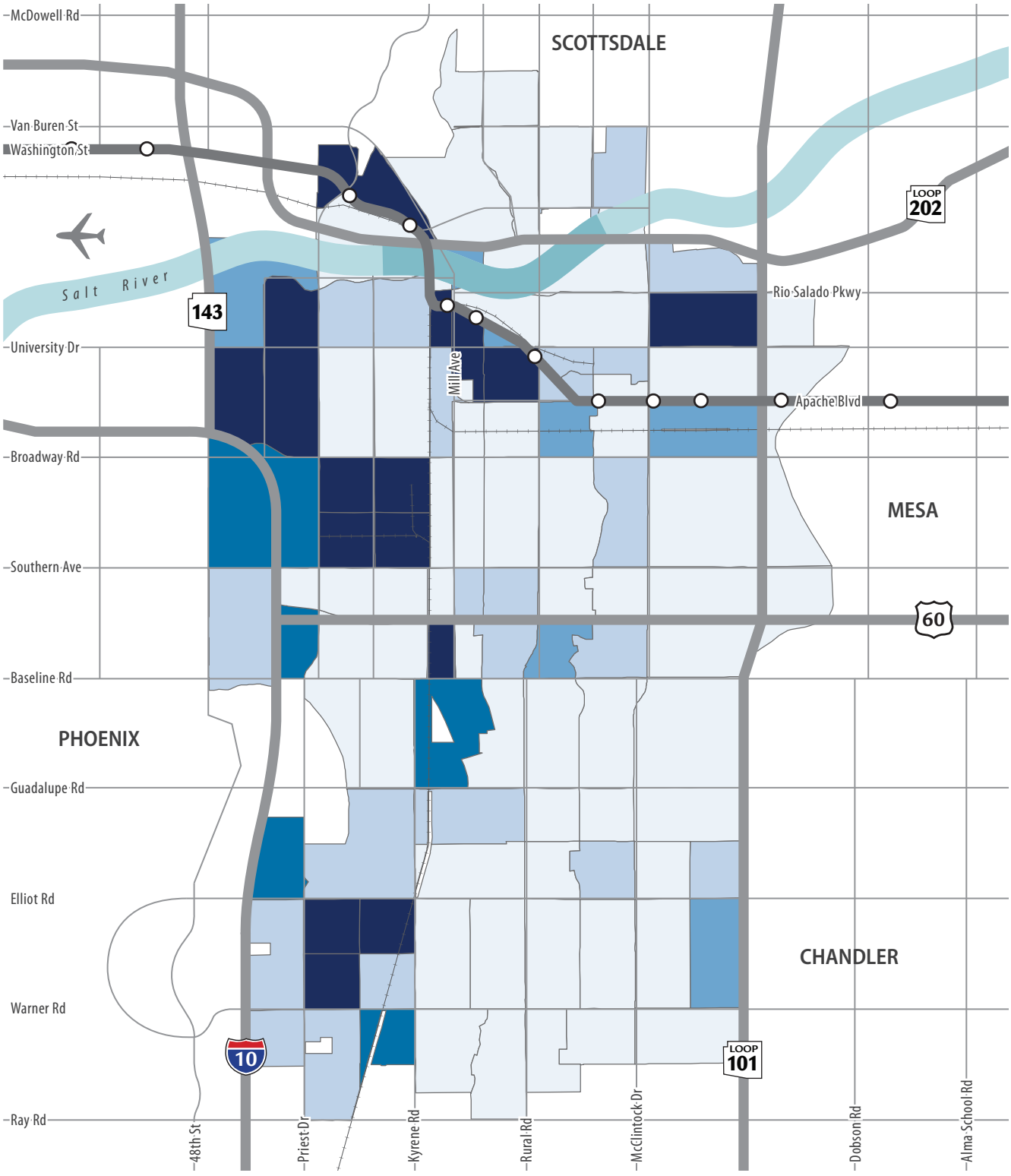
- Population Density
- Employment Density
- Minority Population Density
- Hispanic Population Density
- Housing Units
- Zero-car Household Density
- Household Density
- Low Income Household Density
- Persons with Disabilities Density
- Population Under 18 Density
- Population Over 65 Density

Figure 2: Population Density



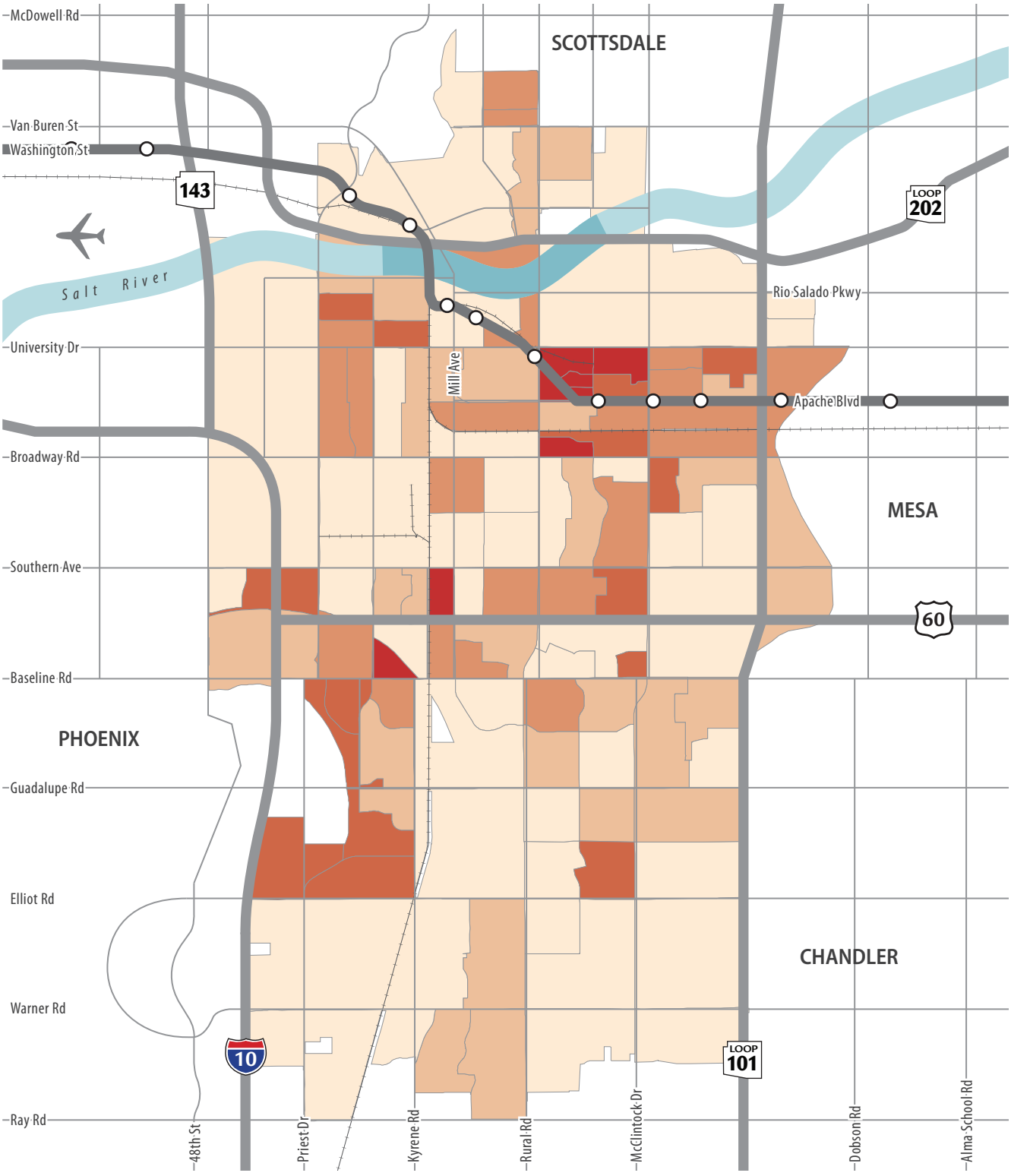
Source: U.S. Census Bureau, American Community Survey, 2008-2012

Figure 3: Employment Density



Source: MAG, 2010

Figure 4: Minority Population Density



Freeway
Light rail
Street
River

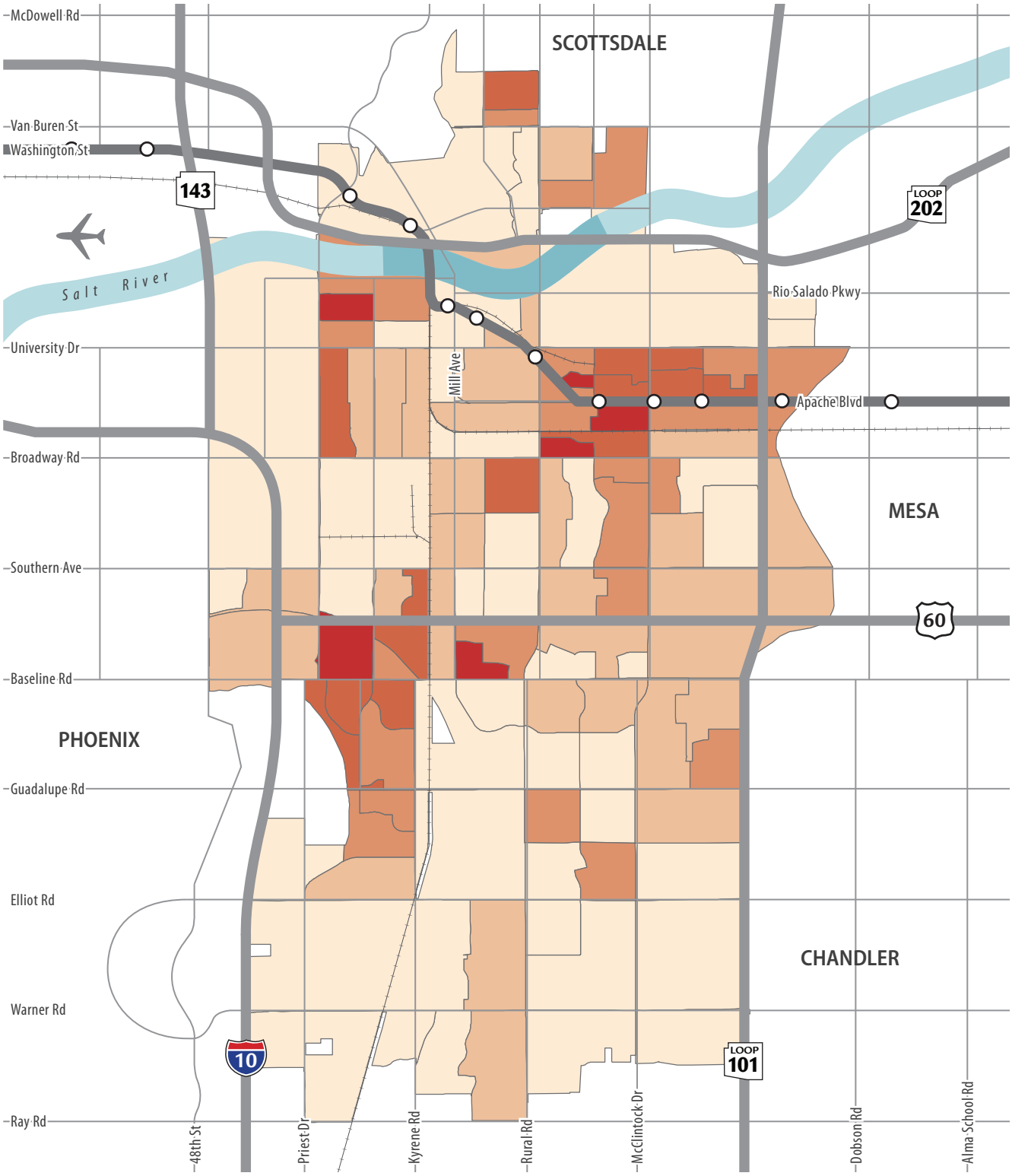
Minority persons per square mile

- < 600
- 600 - 1,400
- 1,401 - 2,500
- 2,501 - 4,000
- > 4,000

north

Source: U.S. Census Bureau, American Community Survey, 2008-2012

Figure 5: Hispanic Population Density



Freeway
Light rail
Street
River

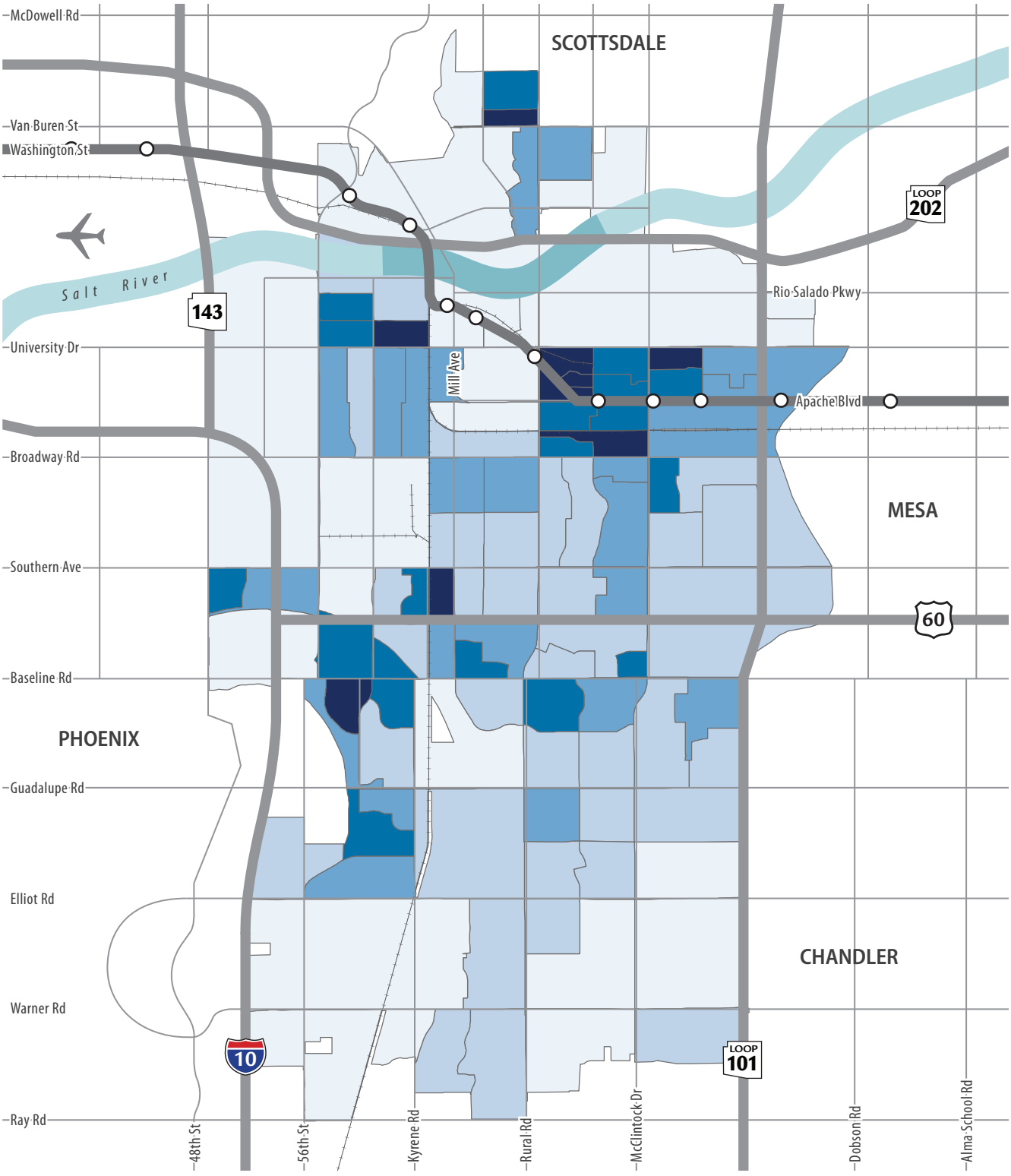
Hispanic persons per square mile

- < 600
- 600 - 1,400
- 1,401 - 2,500
- 2,501 - 4,000
- > 4,000

north

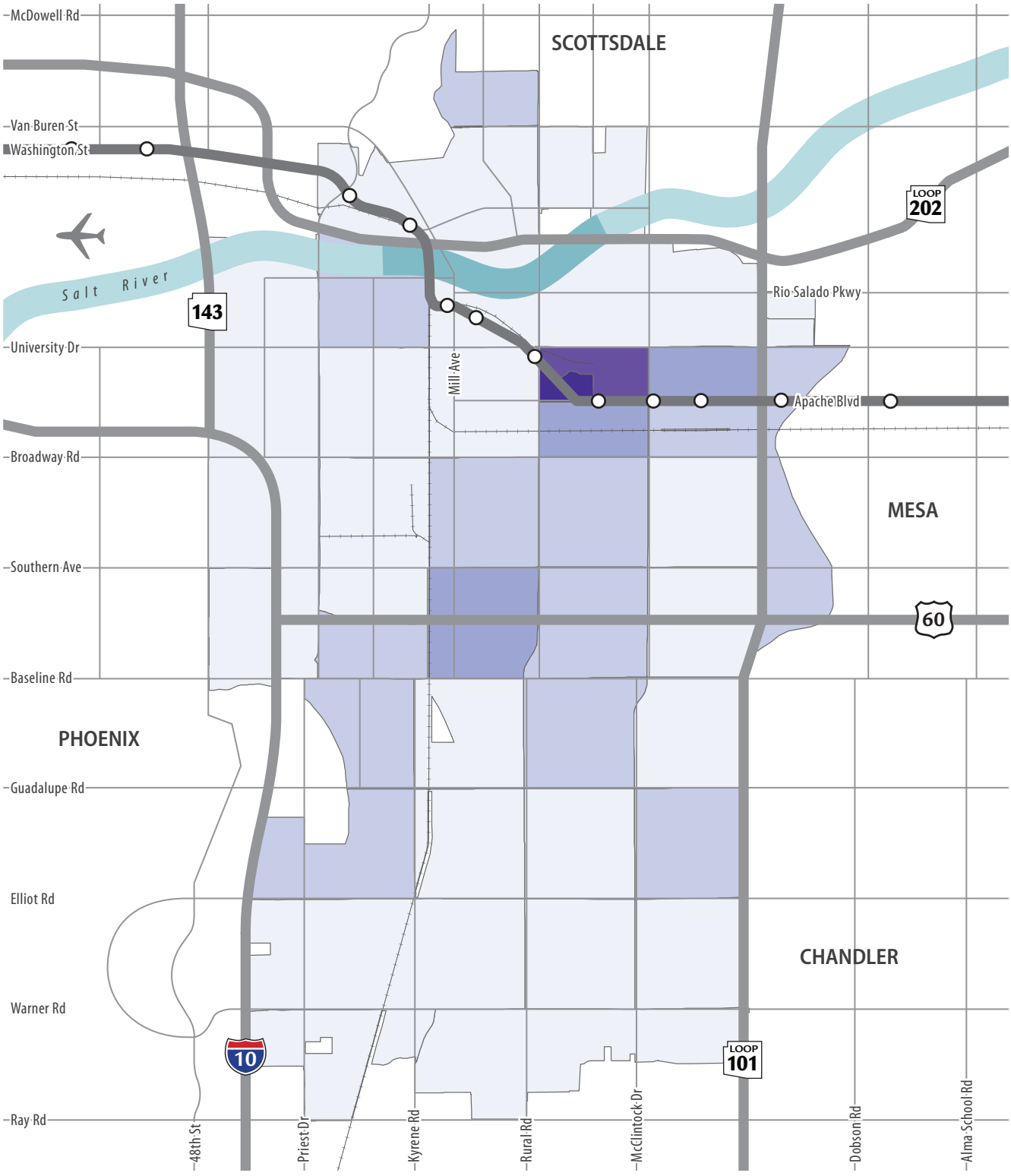
Source: U.S. Census Bureau, American Community Survey, 2008-2012

Figure 6: Housing Unit Density



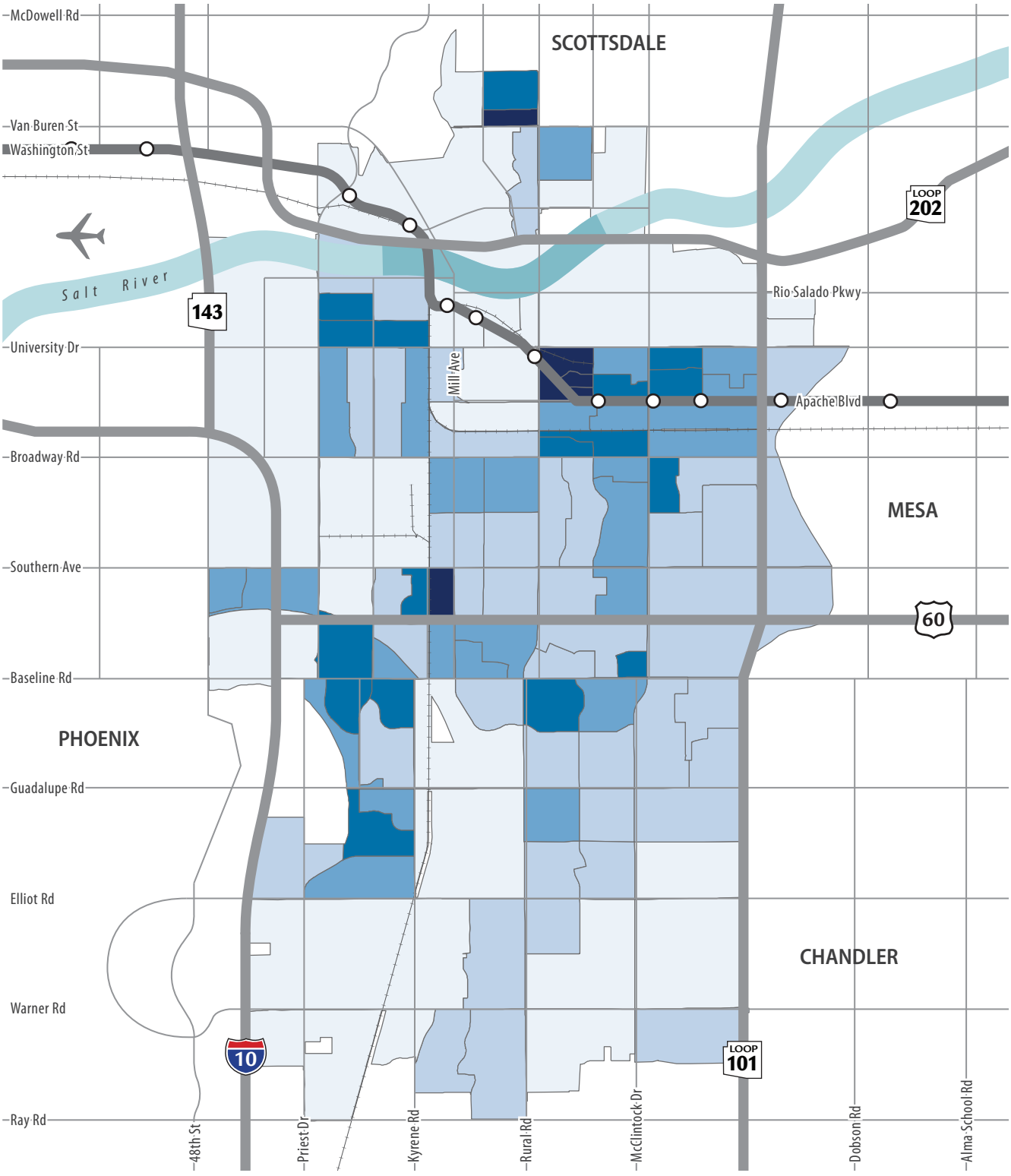
Source: U.S. Census Bureau, American Community Survey, 2008-2012

Figure 7: Zero-car Household Density



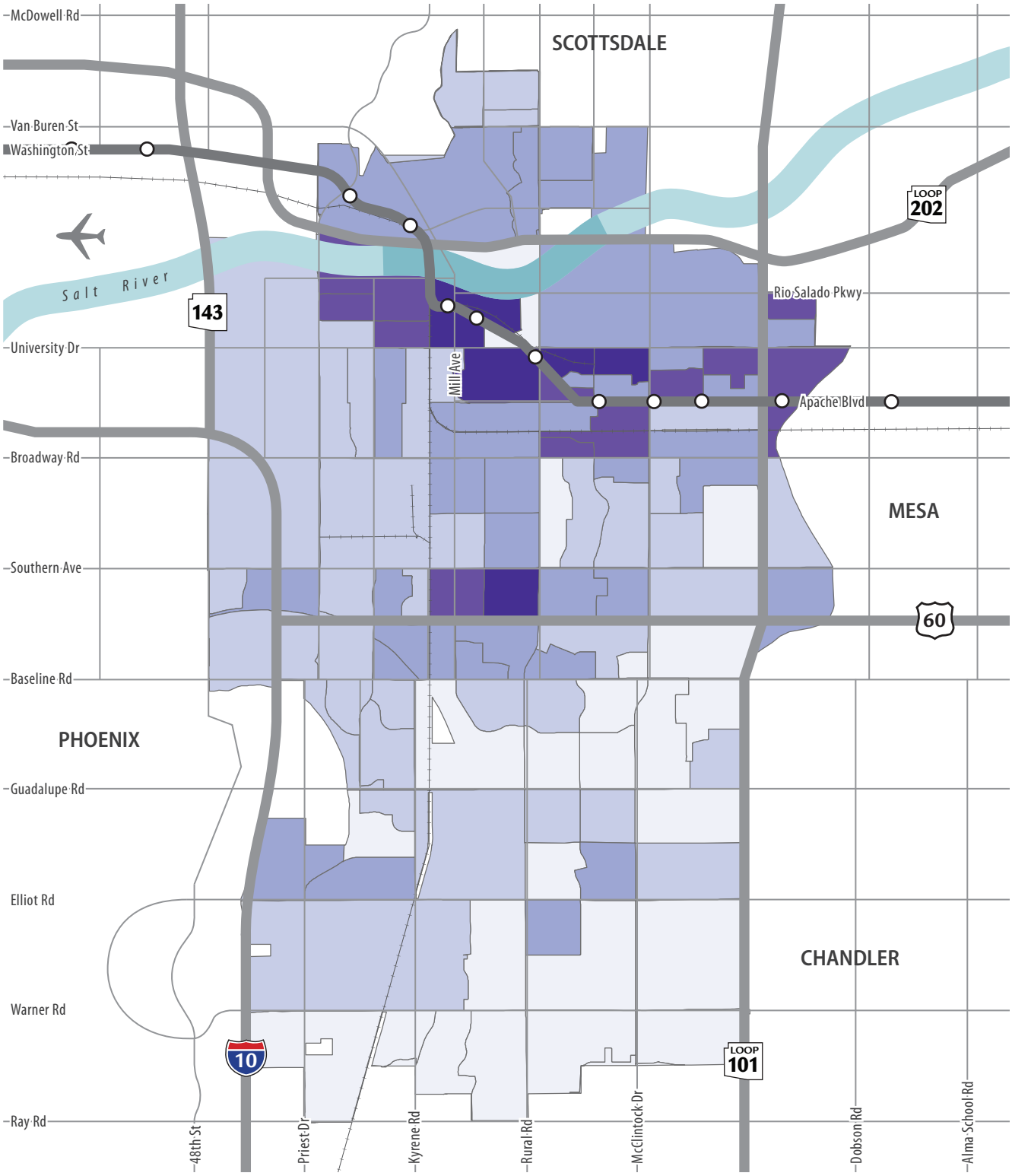
Source: U.S. Census Bureau, American Community Survey, 2008-2012

Figure 8: Household Density



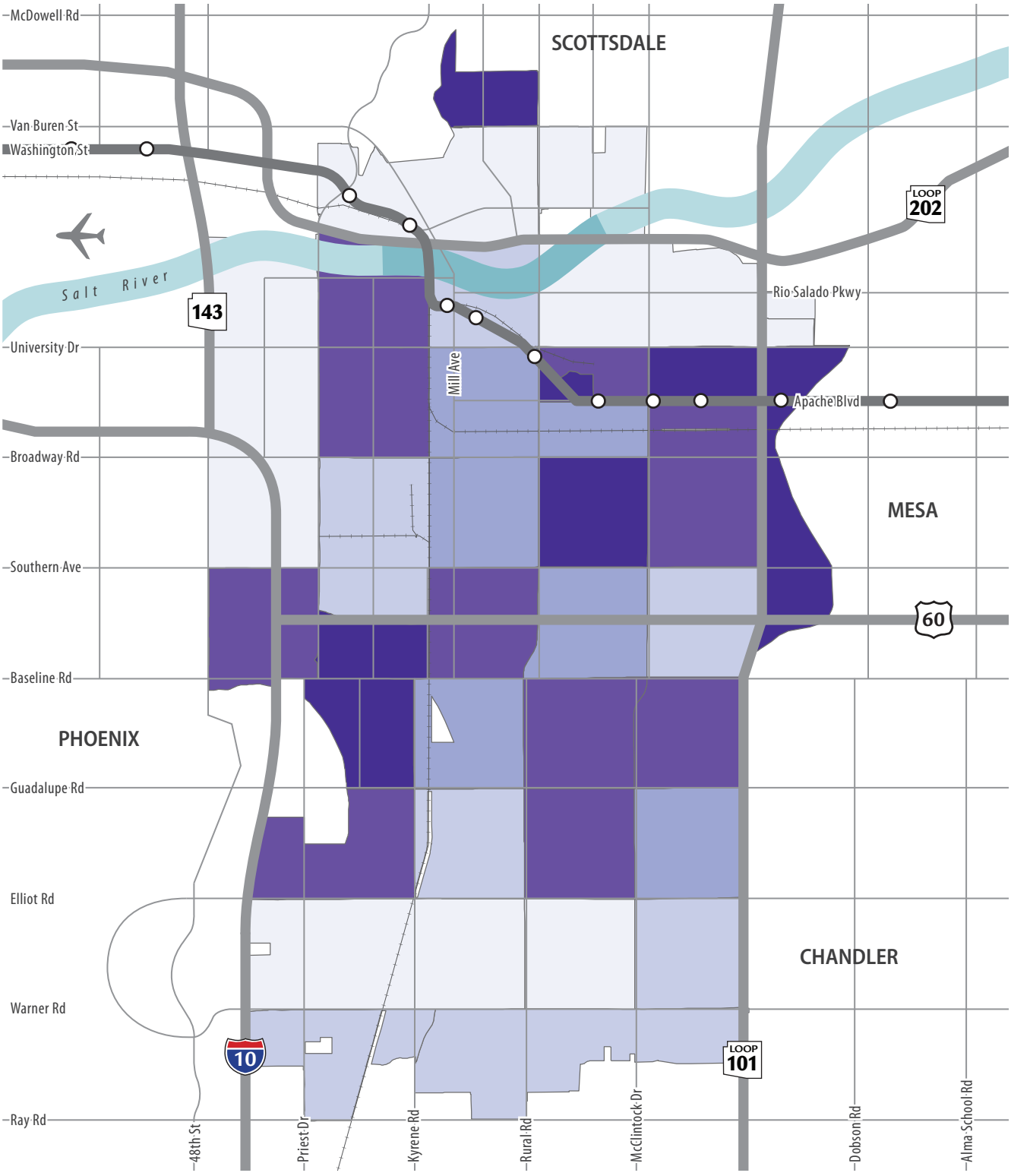
Source: U.S. Census Bureau, American Community Survey, 2008-2012

Figure 9: Low Income Household Density



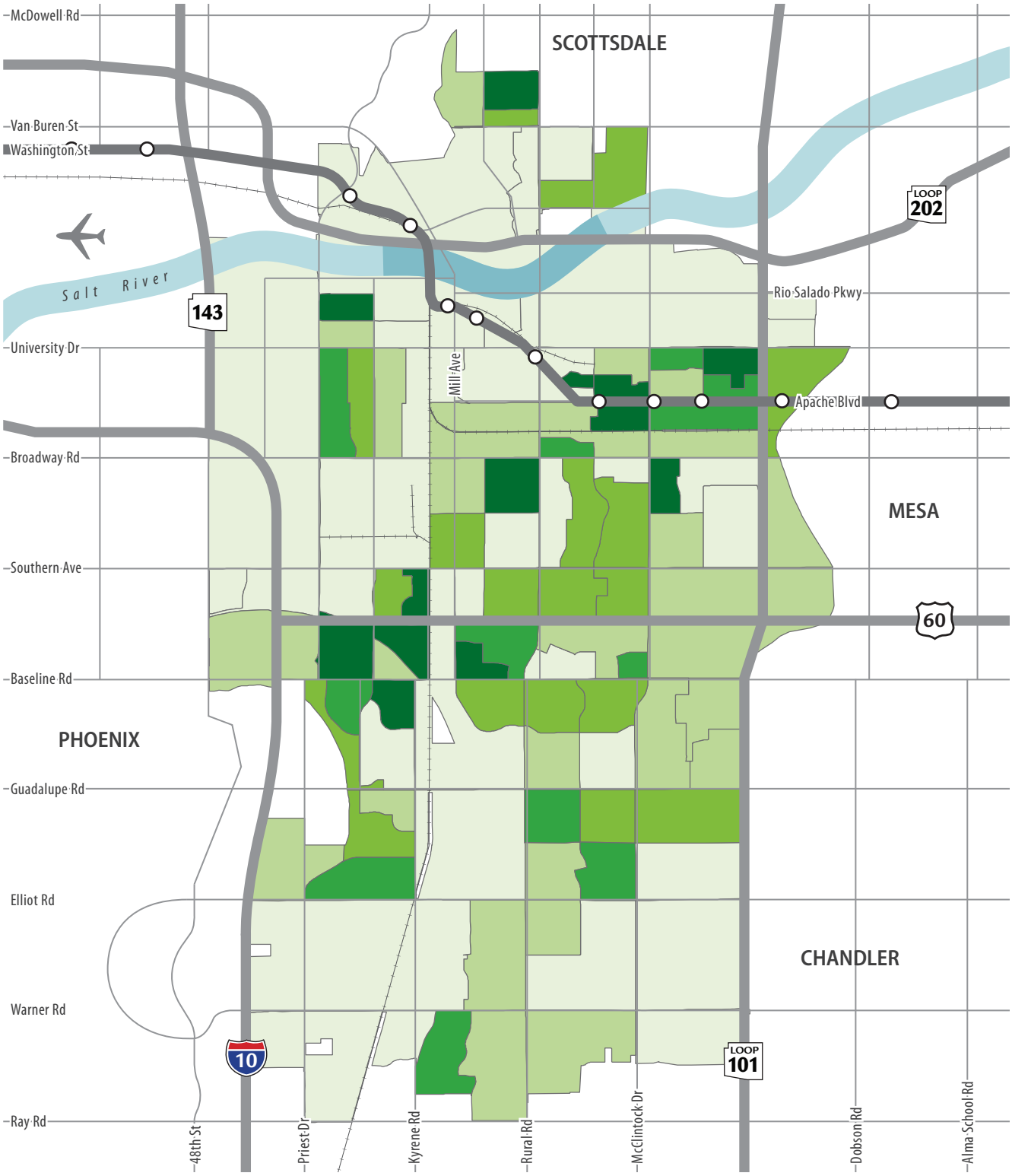
Source: U.S. Census Bureau, 2010

Figure 10: Persons with Disabilities Density



Source: U.S. Census Bureau, American Community Survey, 2008-2012

Figure 11: Population Under 18 Years Old Density



Freeway
Light rail
Street
River

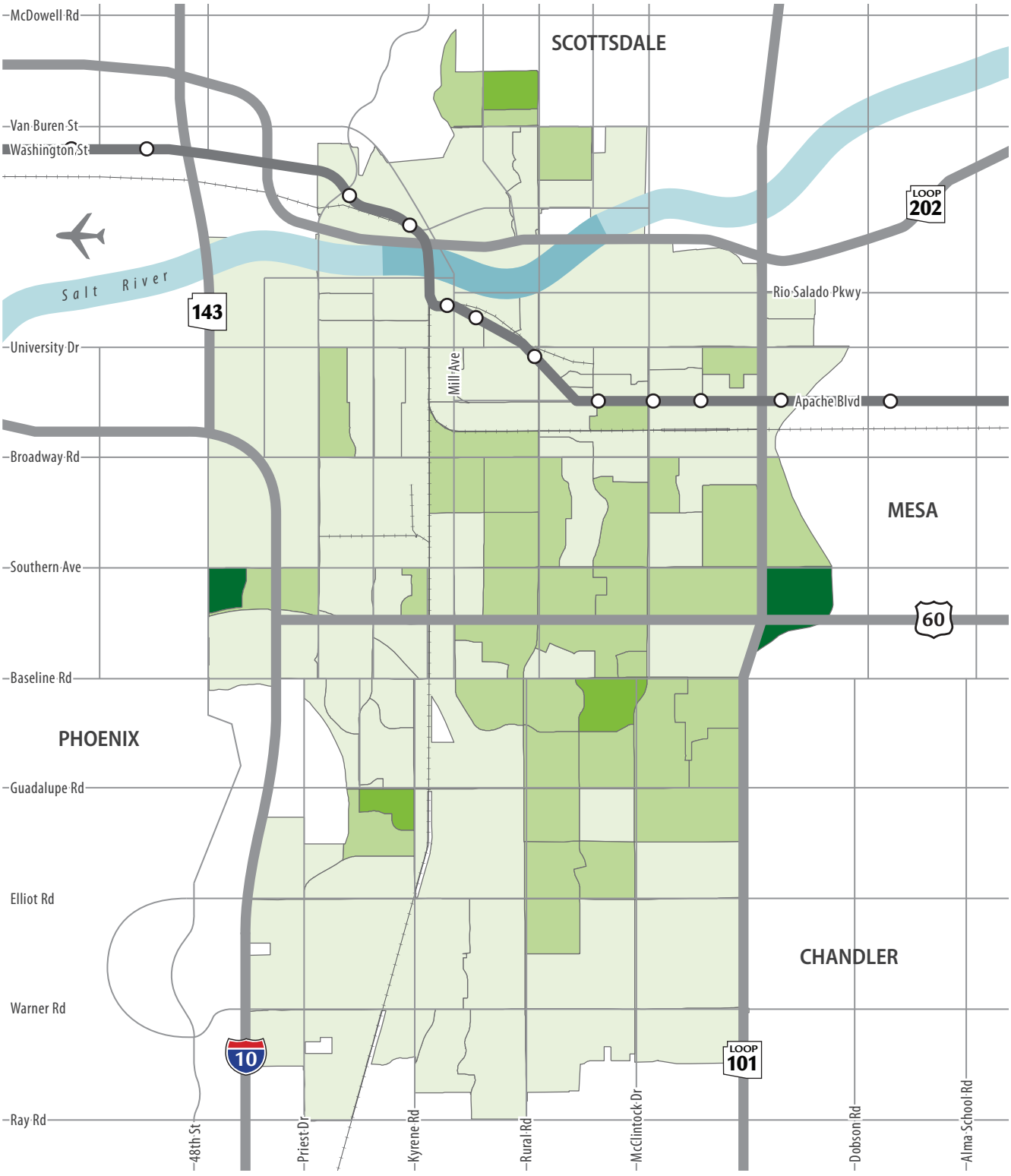
Persons under 18 years of age per square mile

< 500
501 - 1,000
1,001 - 1,500
1,501 - 2,000
> 2,000

north

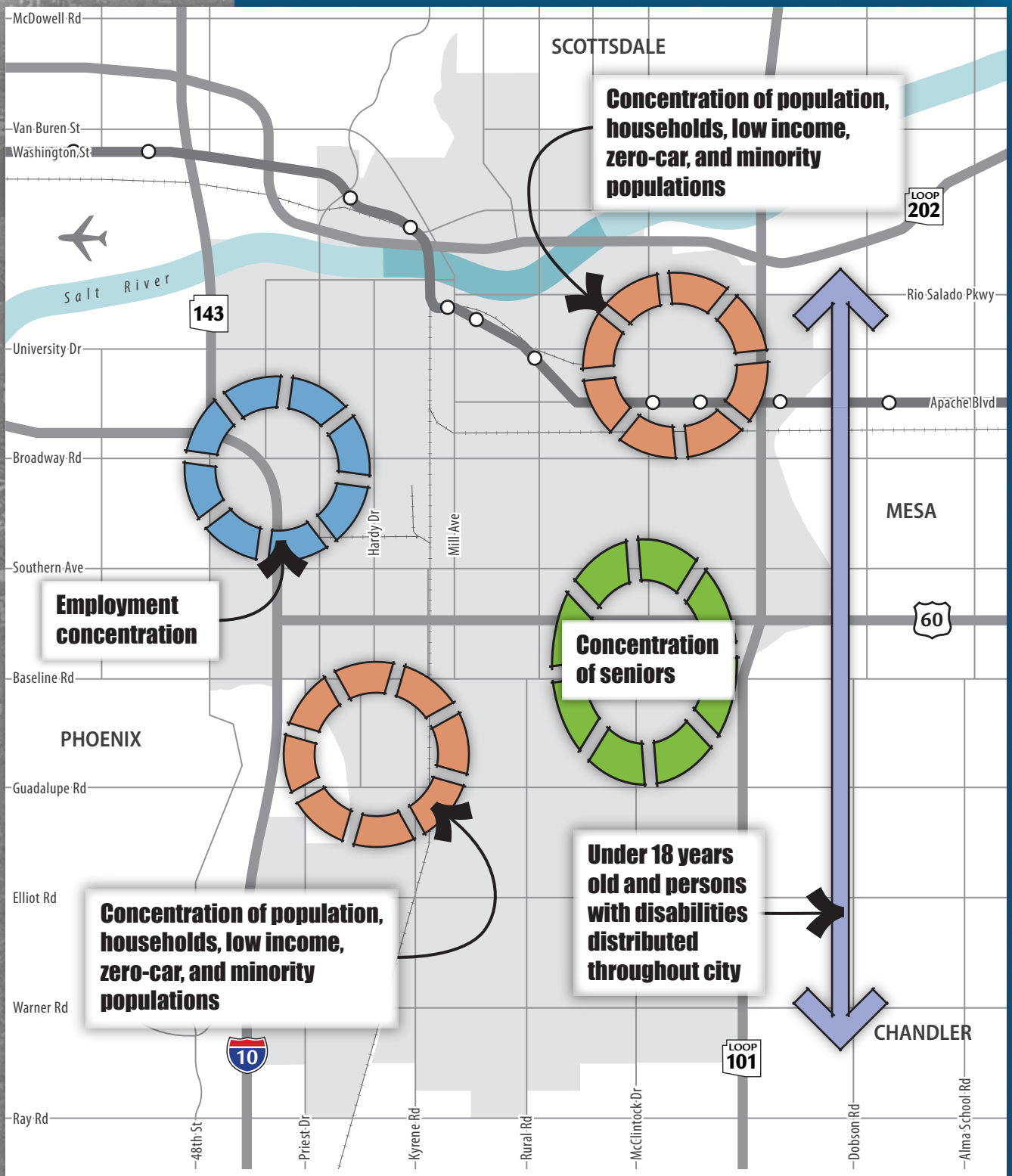
Source: U.S. Census Bureau, American Community Survey, 2008-2012

Figure 12: Population Over 65 Years Old Density



Source: U.S. Census Bureau, American Community Survey, 2008-2012

Demographic Trends



Roadway

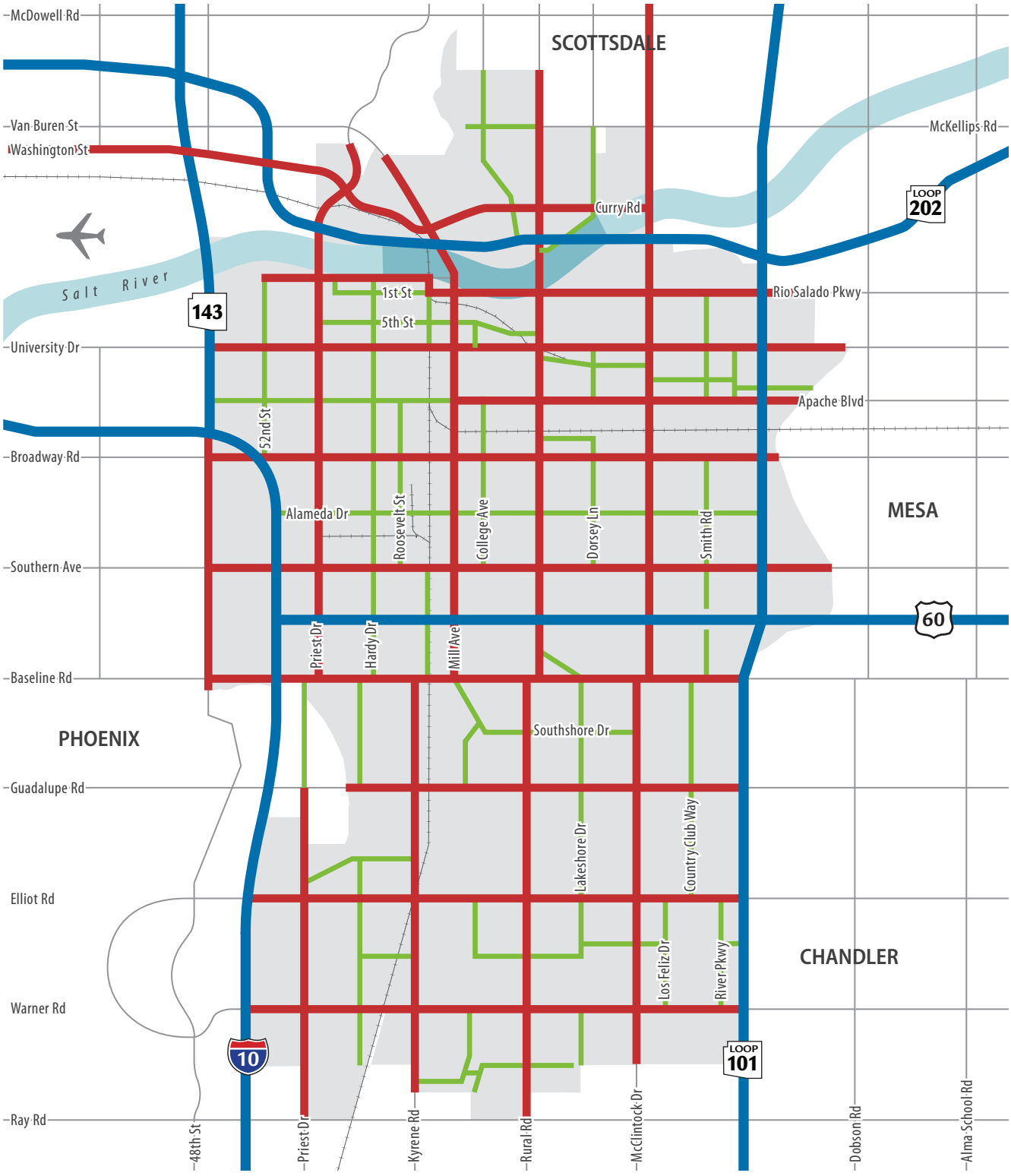
Vehicles provide the primary mode of travel for residents of Tempe. The roads within Tempe are almost entirely built to their ultimate functional use.

Roadway Facilities

The roadway network in Tempe is made up of a system of freeways, arterials, collectors and local roads, as shown in Figure 13.

- Freeways, which are operated and maintained by the Arizona Department of Transportation, provide regional connections. Within Tempe, they include Interstate 10, US 60 (Superstition Freeway), Loop 101 (Price Freeway), Loop 202 (Red Mountain Freeway) and State Route 143.
- Arterial streets, which provide regional and local connections, are primarily aligned on an east-west and north-south grid spaced at one-mile increments.
- Collector streets are primarily located at the half-mile spacing between arterial streets and provide local connections.
- Local roads are those within neighborhoods and only provide local connections.

Figure 13: Existing Functional Classification

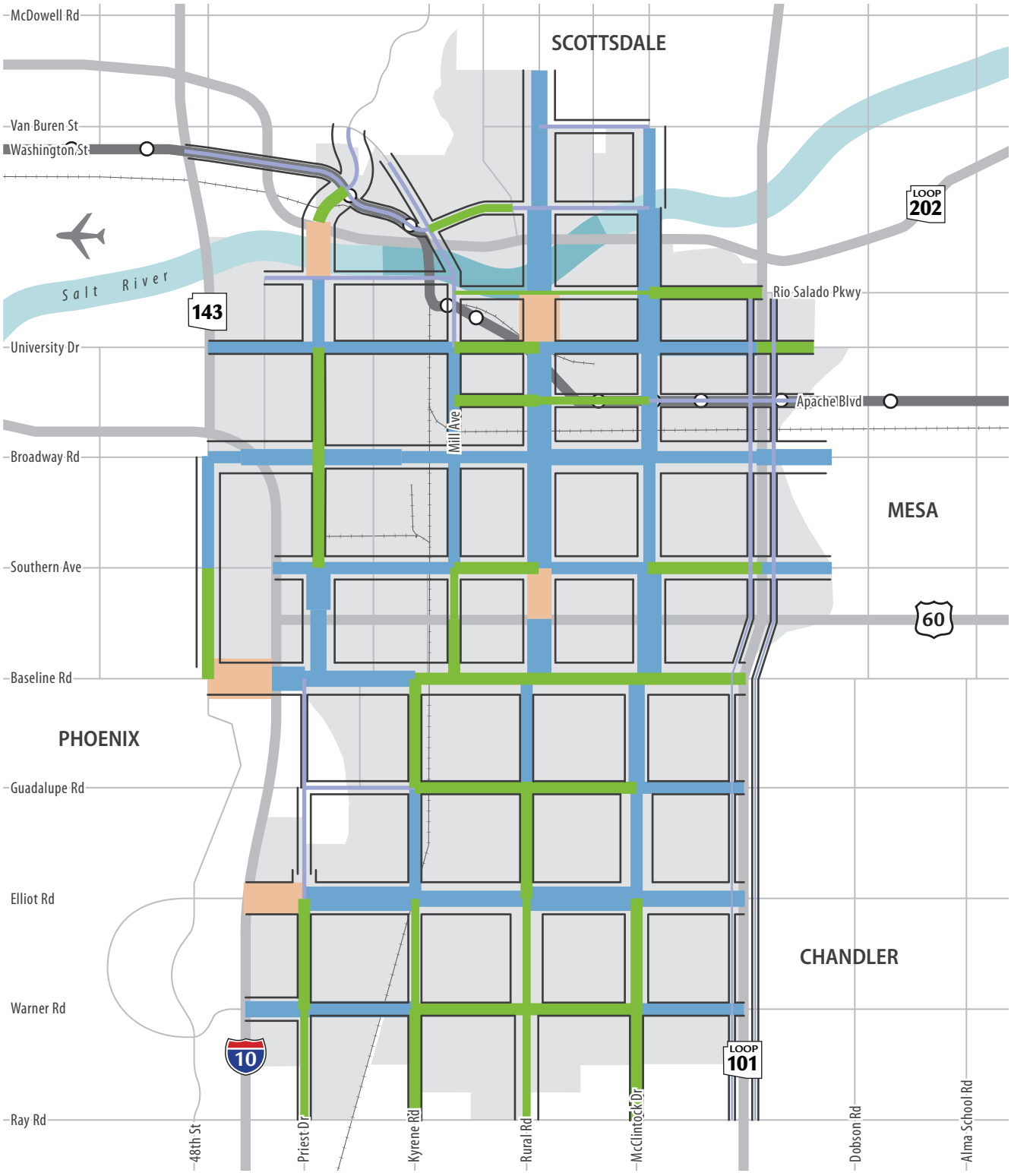


Source: City of Tempe General Plan

Roadway Performance

The assessment of roadway performance included inventorying existing traffic counts, analyzing intersection level of service and identifying high crash intersections. The City of Tempe regularly collects vehicular traffic counts along its arterial and collector streets. This information is plotted on Figures 14 and 15 for arterials and collectors, respectively. These maps compare the individual roadway traffic volumes to capacity, based on number of through lanes.

Figure 14: Arterial Segment Traffic Volumes and Capacity



Freeway
Light rail
Street
River

Capacity (1000s)*
20 (~2 lanes)
40 (~4 lanes)
50 (~5 lanes)
60 (~6 or 7 lanes)

Traffic count (1000s)**
0 - 10
10 - 25
25 - 40
40 - 55

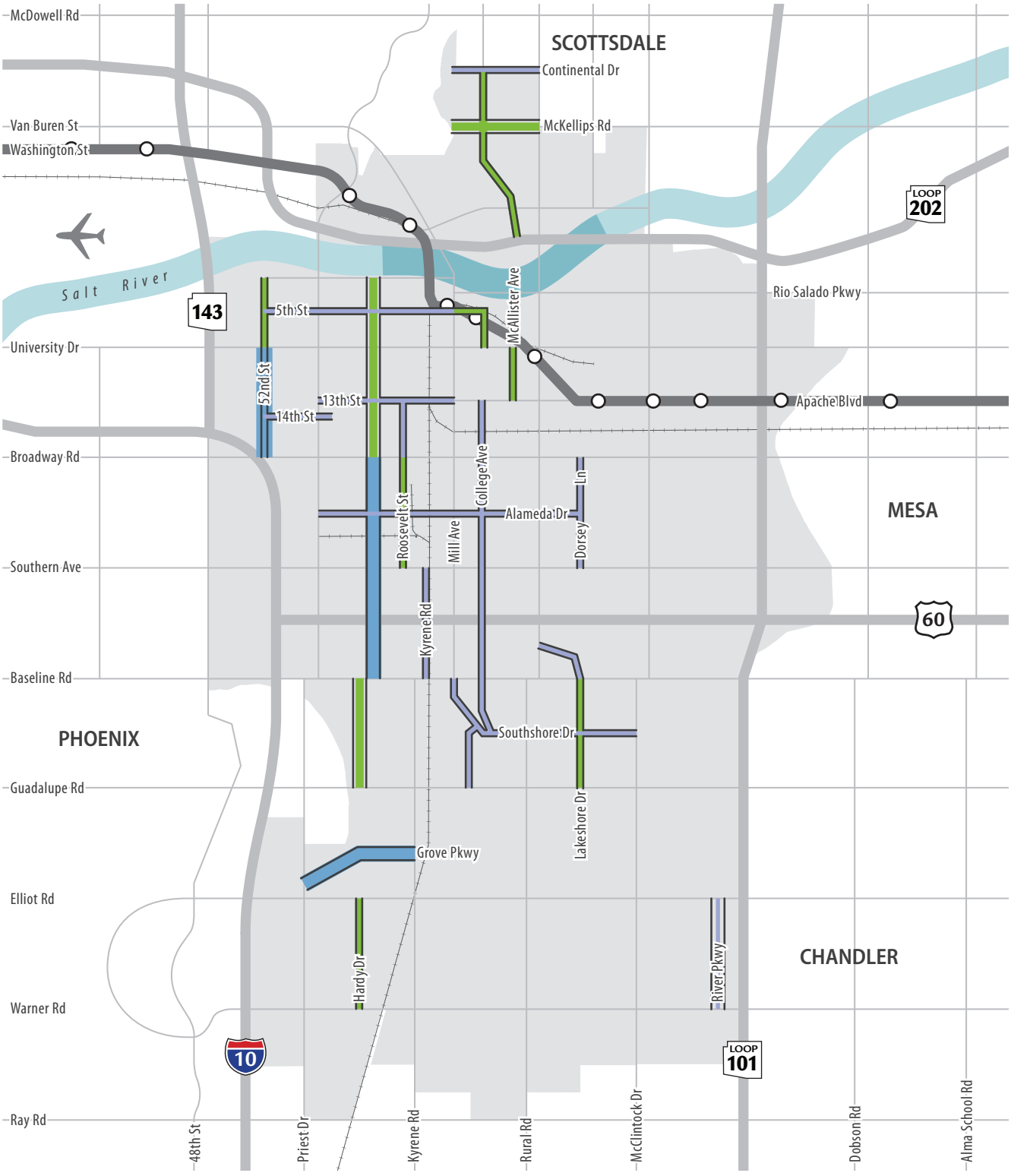
* Excess capacity is expressed by space between the color shading and black bar. Roads that are over capacity have color shading outside the black bars.

** Line width represents approximate volume of average daily traffic, both directions.

north

Source: City of Tempe Traffic Counts Map, 2010-2012

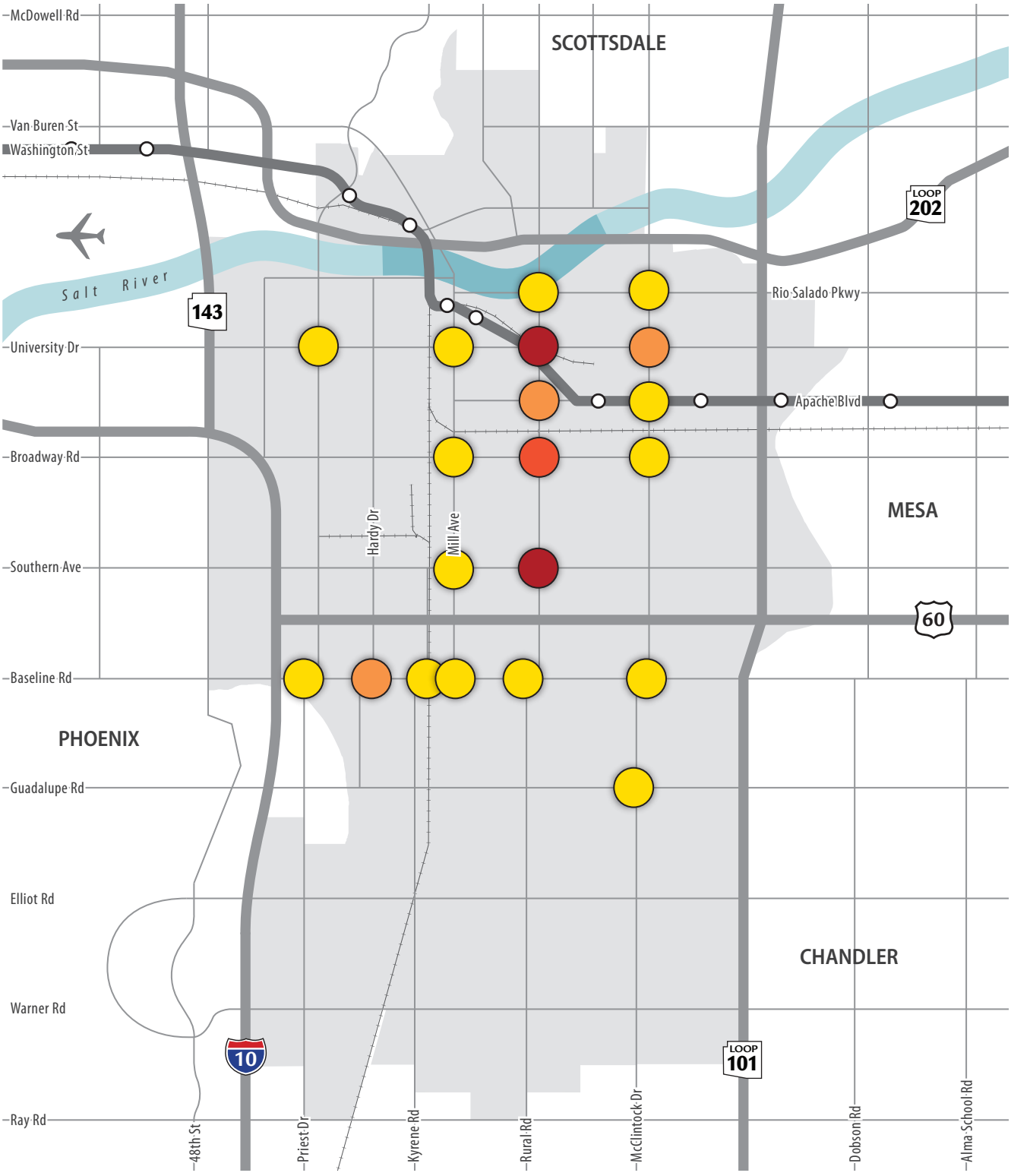
Figure 15: Collector Segment Traffic Volumes and Capacity



Source: City of Tempe Traffic Counts Map, 2010-2012

In January, 2014, the City of Tempe published the *2012 Annual Traffic Safety Report,* which included an evaluation of reported collisions involving vehicles, pedestrians and bicyclists. The report focused on intersection collisions because a high percentage of injuries and fatalities are caused by crashes at intersections. Figure 16 presents the 20 intersections with lowest safety scores. The safety score is a weighted metric that considers crash frequency (number of crashes), crash severity (fatality, injury, etc.), crash type (sideswipe, rear-end, head-on, etc.) and crash rate (crashes per vehicle entering the intersection).

Figure 16: Vehicular Crashes (intersections with lowest safety score)



Freeway
Light rail
Street
River

Intersection safety score*

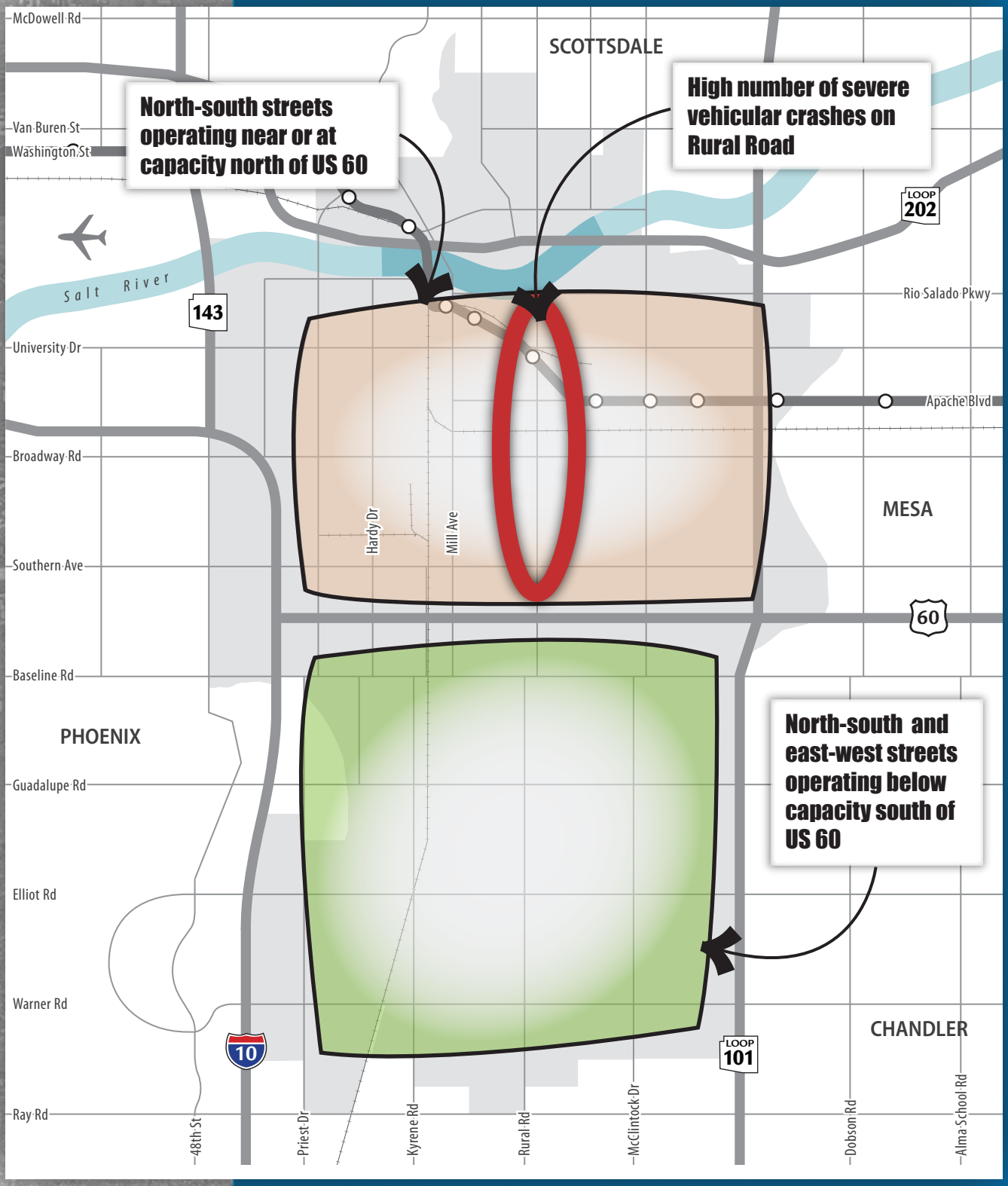
0.97 - 0.98
0.78 - 0.85
0.60 - 0.72
0.47 - 0.59

*Intersection safety score is a weighted score that considers crash frequency, crash severity, crash type and crash rate.

north

Source: City of Tempe 2012 Annual Traffic Safety Report

Traffic Trends



Transit

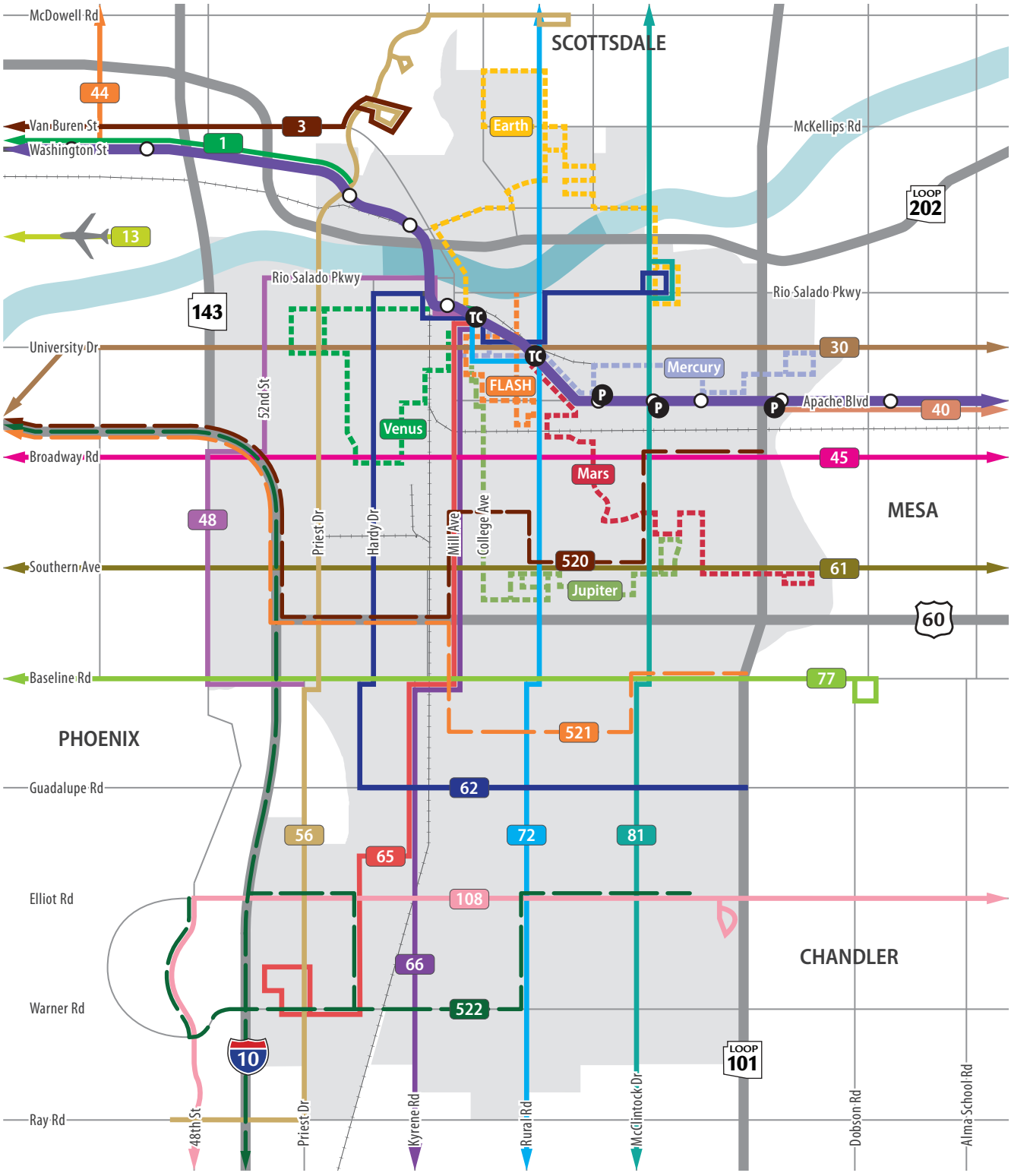
Existing transit service in Tempe includes light rail transit, local and express bus service, neighborhood circulators and paratransit. Transit service in Tempe has changed dramatically in the last six years with the implementation of light rail in 2008.

Transit Service and Facilities

Existing transit service in Tempe is shown in Figure 17, while a list of transit routes, including service hours and frequency, is provided in Table 1. Figure 18 shows a map of the frequent transit service in Tempe. Frequent transit service is defined as routes that provide 20-minute frequency or better during the peak period. Peak period is defined as 7 to 9 a.m. and 4 to 6 p.m., but peak hour transit service can extend beyond these time frames.

Frequent transit service provides 20-minute frequency or better during peak periods.

Figure 17: Existing Transit Service



Freeway
Street
River

Route type

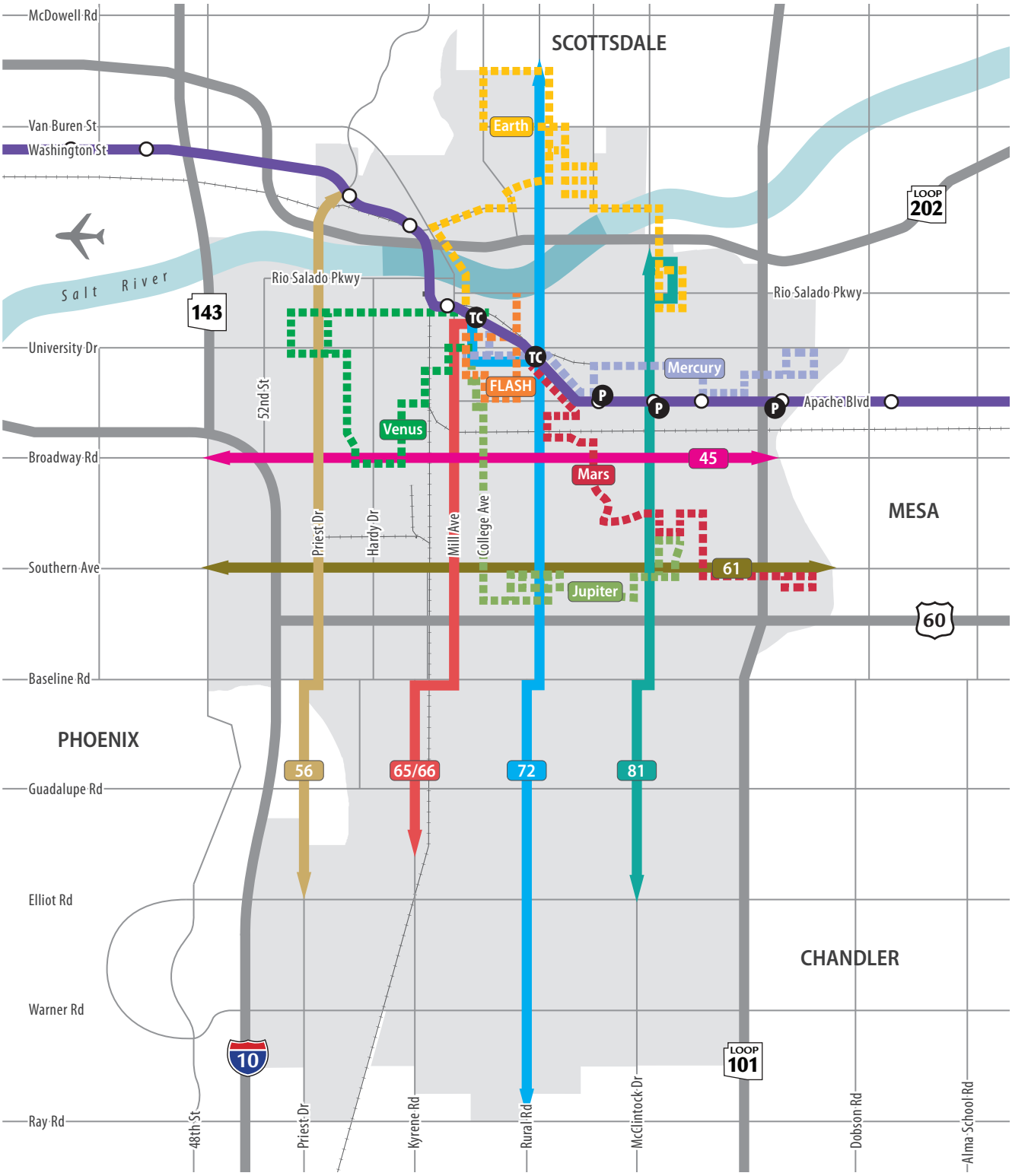
Light rail
Express route
Local bus
Circulator

Transit Center
Light Rail Park-and-Ride

north

Source: Valley Metro 2014

Figure 18: Frequent Transit Service (20-minute service or better during peak)



Source: Valley Metro 2014

Light Rail

The 20-mile light rail line operates in Phoenix, Tempe and Mesa. The segment in Tempe serves downtown Tempe, the ASU Tempe Campus, Tempe Town Lake and Apache Boulevard. There are three light rail stations in Tempe.

Local Bus

There are fifteen local bus routes in Tempe. Local bus service hours and frequency vary by route, with service provided 5 a.m. to 12:30 a.m.

Express Bus

There are three express bus routes in Tempe, all of which provide service to and from downtown Phoenix.

Neighborhood Circulators

Tempe has five Orbit routes that primarily serve residential neighborhoods and two FLASH routes that serve the ASU Tempe campus.

All transit services in Tempe are ADA accessible and all buses have room for two wheelchairs.

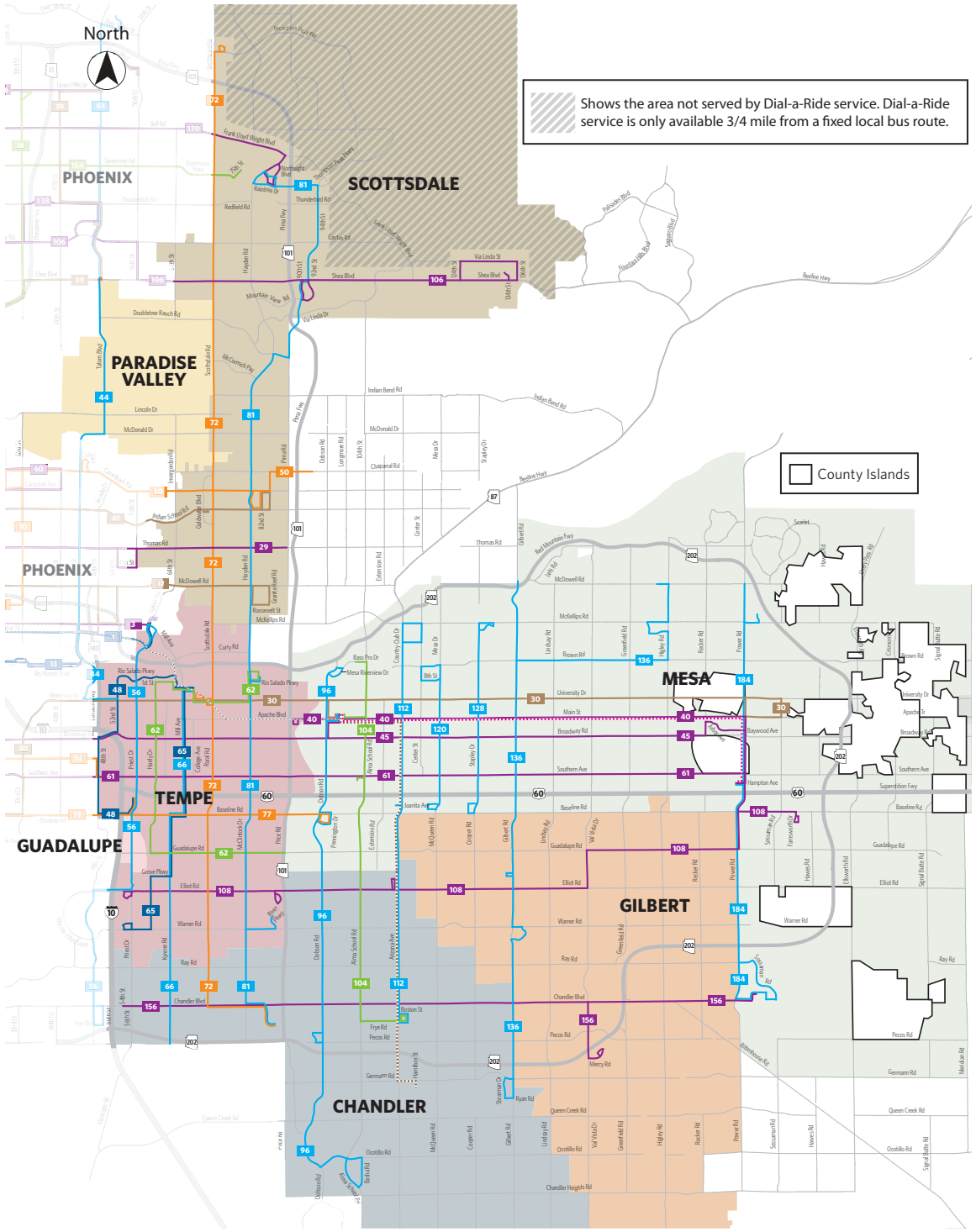
Table 1: Transit Service Hours and Frequency

	Weekday				Saturday			Sunday		
Route Name	Hours	Peak	Off-peak	Night	House	Day	Night	Hours	Day	Night
Light Rail										
Light Rail	4:15 am - 12:30 am	12	12	20	4:30 am - 3:30 am	15	20	4:30 am - 12:30 am	20	20
Local Bus										
1 - Washington	5:30 am - 9: 00 pm	30	30	45	6:45 am - 9:00 pm	60	60	6:45 am - 9:00 pm	60	60
3 - Van Buren	5:00 am - 10:00 pm	30	30	60	5:00 am - 9:30 pm	60	60	6:30 am - 9:30 pm	60	60
30 - University	5:00 am - 12: 45 am	30	30	30	5:00 am - 12:45 am	30	30	6:00 am - 10:00 pm	60	60
40 - Main	5:30 am - 10:00 pm	30	30	30	6:00 am - 10:00 pm	30	30	6:00 am - 10:00 pm	30	30
45 - Broadway	4:45 am - 12:30 am	15	30	30	5:15 am - 10:00 pm	30	30	5:15 am - 10:00 pm	30	30
48 - 48th St/Rio Salado	5:30 am - 12:30 am	30	30	30	5:15 am - 12:30 am	30	30	4:45 am - 10:30 pm	30	30
56 - Priest	4:45 am - 1:00 am	15	30	30	5:15 am - 12:45 am	30	30	5:30 am - 10:30 pm	30	30
61 - Southern	5:00 am - 12:30 am	15	30	30	5:00 am - 12:30 am	30	30	5:30 am - 10:30 pm	30	30
62 - Hardy /Guadalupe	5:00 am - 1:00 am	30	30	30	5:00 am - 1:00 am	30	30	5:15 am - 11:00 pm	30	30
65 - Mill/Kyrene	5:00 am - 1:00 am	30	30	60	5:00 am - 1:00 am	60	60	5:00 am - 9:00 pm	60	60
66 - Mill/Kyrene	5:00 am - 12:30 am	30	30	60	5:00 am - 12:30 am	60	60	5:00 am - 10:30 pm	60	60
72 - Scottsdale/Rural	5:00 am - 1:00 am	20	20	30	5:00 am - 1:00 am	30	30	5:00 am - 10:30 pm	30	30
77 - Baseline	5:00 am - 12:30 am	30	30	30	5:30 am - 12:30 am	30	30	5:00 am - 10:30 pm	30	30
81 - Hayden/McClintock	5:00 am - 12:30 pm	15	30	30	5:00 am - 1:00 am	30	30	5:00 am - 10:30 pm	30	30
108 - Elliot	5:00 am - 12:30 pm	30	30	30	5:30 am - 12:00 am	60	60	5:30 am - 10:00 pm	60	60
Express										
520 - Tempe Express	2 trips AM peak, 2 trips PM peak				No service			No service		
521 - Tempe Express	4 trips AM peak, 4 trips PM peak				No service			No service		
522 -Tempe Express	4 trips AM peak, 4 trips PM peak				No service			No service		
Circulator										
Orbit Earth	6:00 am - 11:00 pm	15	15	15	8:00 am - 11:00 pm	15	15	8:00 am - 7:00 pm	30	30
Orbit Jupiter	6:00 am - 10:00 pm	15	15	15	8:00 am - 10:00 pm	15	15	8:00 am - 7:00 pm	30	30
Orbit Mars	6:00 am - 10:00 pm	15	15	15	8:00 am - 10:00 pm	15	15	8:00 am - 7:00 pm	30	30
Orbit Mercury	6:00 am - 10:00 pm	10	10	15	8:00 am - 10:00 pm	15	15	8:00 am - 7:00 pm	30	30
Orbit Venus	6:00 am - 10:00 pm	15	15	15	8:00 am - 10:00 pm	15	15	8:00 am - 7:00 pm	30	30
Flash	7:00 am - 1:00 am	10	10	15	No service			No service		
Flash McAllister	6:00 am - 10:00 pm	30	30	30	No service			No service		

Paratransit

Paratransit service in Tempe is provided by East Valley Dial-a-Ride (EVDAR), and can be used by passengers who are certified by the American with Disabilities Act (ADA). ADA requires that complementary paratransit service be provided in all areas within three-fourths of a mile of fixed route transit service. The EVDAR service area is shown in Figure 19. In addition to EVDAR, service to persons with disabilities and seniors is provided through the East Valley RideChoice Program, which is a cab connection service.

Figure 19: East Valley Dial-a-Ride Service Area



Note: Refer to www.valleymetro.org/images/uploads/maps_valleymetro/2012_VM_EVDAR_Service_Area_Map.pdf *for most recent routes.*

Source: Valley Metro 2014

Transit Centers

There are two transit centers in Tempe. The Tempe Transportation Center (TTC) is located adjacent to the light rail station at Veterans Way and College Avenue. The TTC includes a fare outlet, public restrooms, and bicycle shop. There is also a transit center adjacent to the University Drive and Rural Road light rail station, but it does not provide any additional services. Both transit centers provide connections between light rail, local bus routes and neighborhood circulators.

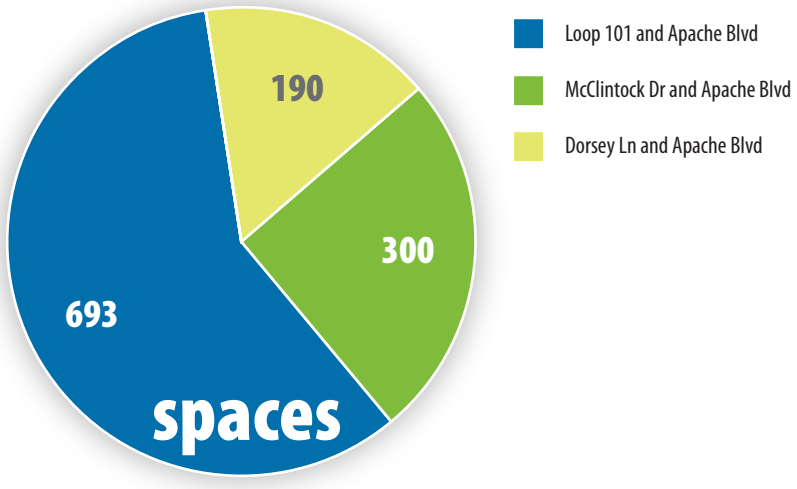
Light Rail Park-and-Rides

There are three park-and-rides in Tempe served by light rail. Table 2 and Figure 20 provide further detail on park-and-rides in Tempe.

Table 2: Light Rail Park-and-Rides

Facility	Routes Served	Parking Spaces		Bicycle Storage
		Total	Covered	
Dorsey Ln and Apache Blvd	Light Rail	190	0	16
McClintock Dr and Apache Blvd	Light Rail Route 81 (Hayden/McClintock)	300	300	78
Loop 101 and Apache Blvd	Light Rail Route 40 (Main)	693	0	12
TOTAL		**1,183**	**300**	**106**

Figure 20: Light Rail Park-and-Ride Capacity



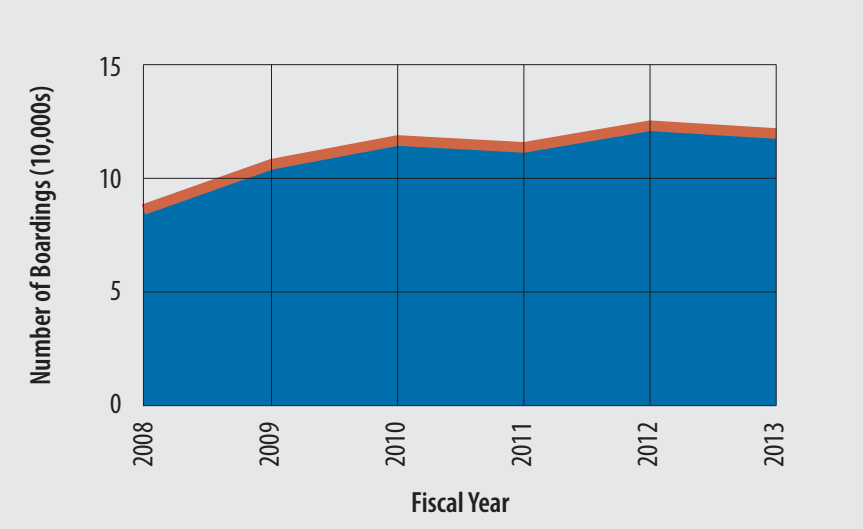
Transit Performance

Ridership

Existing transit ridership in Tempe represents almost 17 percent of all transit ridership in the Valley.

Ridership data for existing transit service in Tempe is provided by Valley Metro. Transit ridership continues to grow throughout the region, with existing transit ridership in Tempe representing almost 17 percent of all transit ridership in the Valley. Figure 21 shows the annual transit ridership increase in Tempe since 2008.

Figure 21: Annual Transit Ridership



Source: Valley Metro, FY 2013 Annual Ridership Report

The highest performing transit routes in Tempe are Light Rail, Route 61 (Southern) and Route 72 (Rural).

For the purpose of evaluating transit performance in Tempe, the April 2014 ridership is being used because it best represents average system-wide ridership conditions. Average weekday boardings, total monthly boardings, daily revenue miles and boardings per mile by route are included in Table 3. For those routes that operate in multiple jurisdictions, the ridership data for both the segment that operates in Tempe and the total route is included.

Average daily boardings and boardings per mile are two common metrics used to evaluate ridership performance by Valley Metro. Figure 22 shows average daily boardings in Tempe, while Figure 23 shows boardings per mile. Figures 24 and 25 show light rail boardings by station and bus boardings by stop. Figures 26 and 27 show average daily boardings and boardings per mile in bar chart format.

ROUTE 72
RURAL ROAD

- **Highest ridership** *bus route in Tempe*
- **Top 15 ridership** *for all bus routes in the region*
- **Over 500** *more average daily boardings than the next highest local bus route in Tempe*
- **Connects** *Scottsdale, Tempe and Chandler*

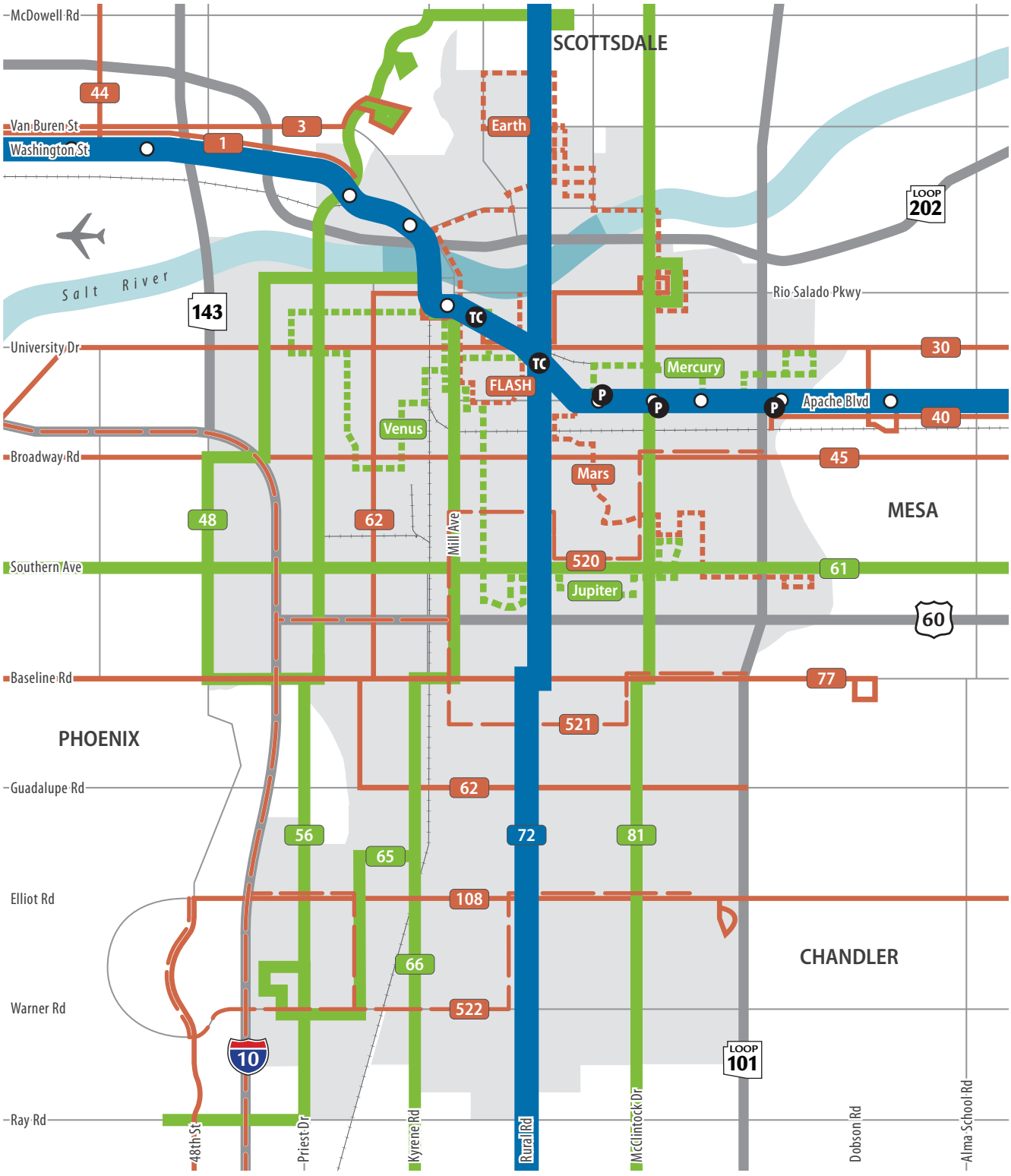
Table 3: Transit Performance

Route Name	Average Daily Boardings		Monthly Boardings		Daily Revenue Miles		Boardings per Mile	
	Tempe	Route Total	Tempe	Route Total	Tempe	Route Total	Tempe	Route Total
Light Rail								
Light Rail	13,518	47,021	297,389	1,034,459	2,070.2	7,385.7	6.5	6.4
Local Bus								
30 - University	875	3,158	19,247	69,429	444.9	1,941.5	2.0	1.6
40 - Apache/Main	166	1,797	3,630	39,510	33.2	955.8	5.0	1.9
45 - Broadway	1,407	4,471	30,941	98,364	521.0	2,273.2	2.7	2.0
48 - 48th St/Rio Salado	1,572	1,572	34,571	34,571	700.5	700.5	2.2	2.2
56 - Priest	1,798	2,235	39,555	49,156	763.0	1,049.0	2.4	2.1
61 - Southern	1,653	6,908	36,360	151,945	575.9	2,743.9	2.9	2.5
62 - Hardy/Guadalupe	1,225	1,225	26,954	26,954	939.4	939.4	1.3	1.3
65 - Mill/Kyrene	1,307	1,307	28,716	28,716	587.1	587.1	2.2	2.2
66 - Mill/Kyrene	664	880	14,601	19,354	508.7	688.6	1.3	1.3
72 - Scottsdale/Rural	2,546	4,905	56,020	107,931	1,108.5	2,966.3	2.3	1.7
77 - Baseline	1,111	3,612	24,431	79,461	465.2	1,472.3	2.4	2.5
81 - Hayden/McClintock	1,969	3,155	43,298	69,383	923.3	2,142.4	2.1	1.5
108 - Elliot/48th St	406	1,372	8,941	30,199	388.6	1,678.0	1.0	0.8
Express								
520 - Tempe Express	28	49	622	1,071	35.5	77.8	0.8	0.6
521 - Tempe Express	62	117	1,384	2,585	59.4	143.9	1.0	0.8
522 - Tempe Express	50	112	1,095	2,459	58.8	161.6	0.9	0.7
Circulator								
Earth	1,431	1,431	31,478	31,478	1,058.1	1,058.1	1.4	1.4
Flash*	1,264	1,264	27,815	27,815	553.3	553.3	2.3	2.3
Jupiter	1,745	1,745	38,399	38,399	740.9	740.9	2.4	2.4
Mars	1,247	1,247	27,442	27,442	822.3	822.3	1.5	1.5
Mercury	2,170	2,170	47,743	47,743	808.4	808.4	2.7	2.7
Venus	1,609	1,609	35,399	35,399	731.3	731.3	2.2	2.2

** Flash includes Flash McAllister*

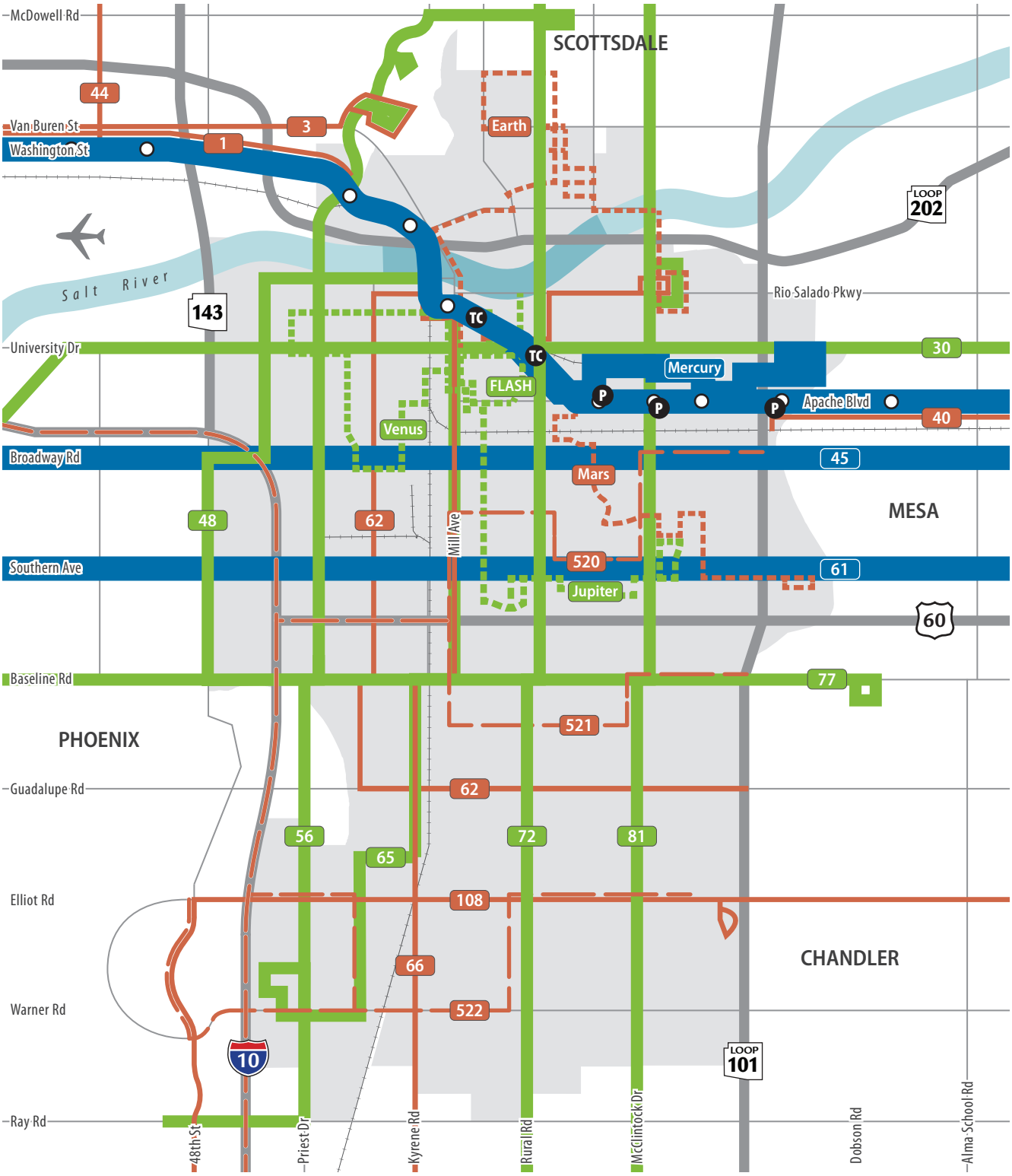
Source: Valley Metro, April 2014 Monthly Ridership Report

Figure 22: Transit Performance (Average Daily Boardings)



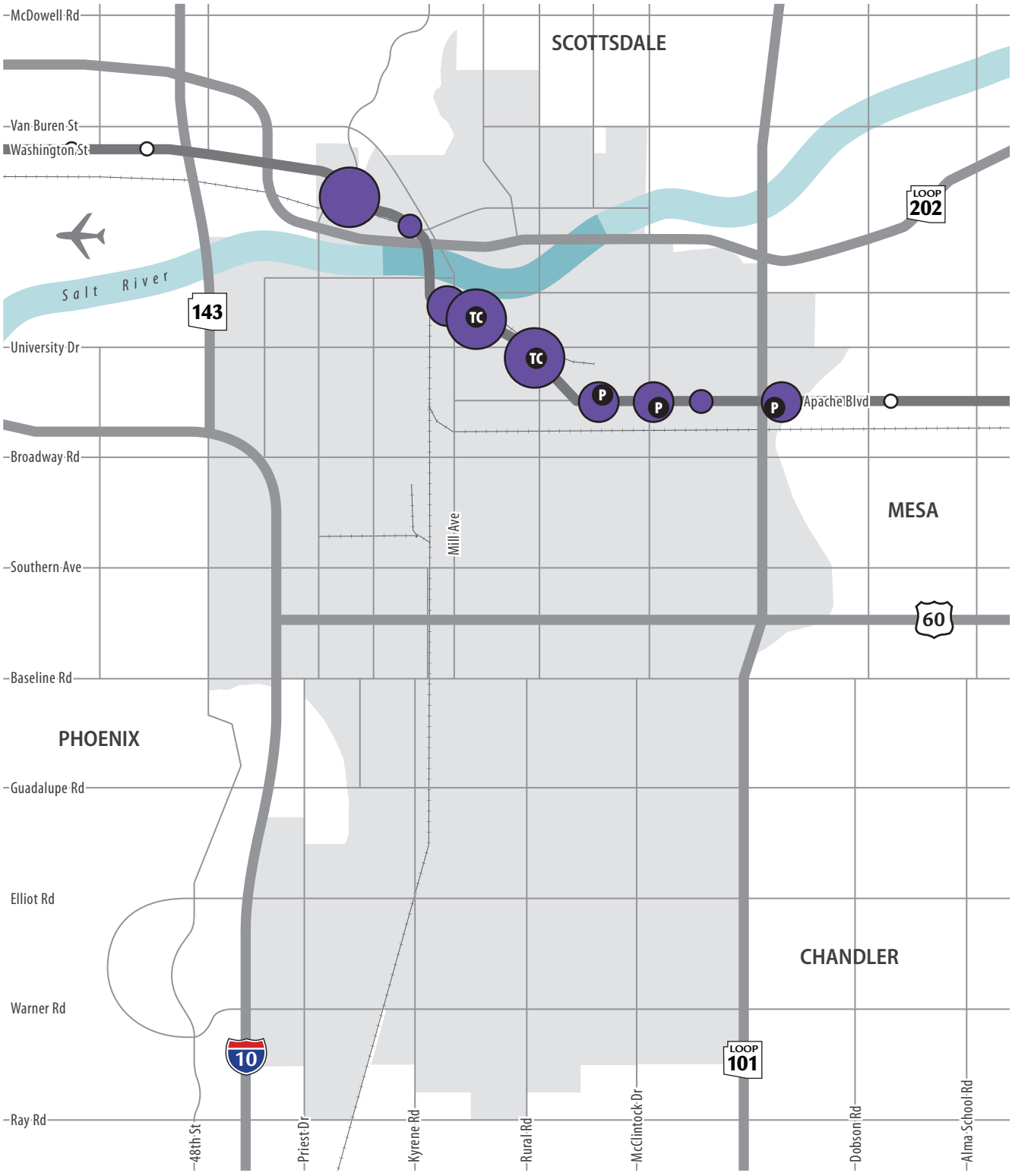
Source: Valley Metro, March 2014

Figure 23: Transit Performance (Boardings Per Mile)



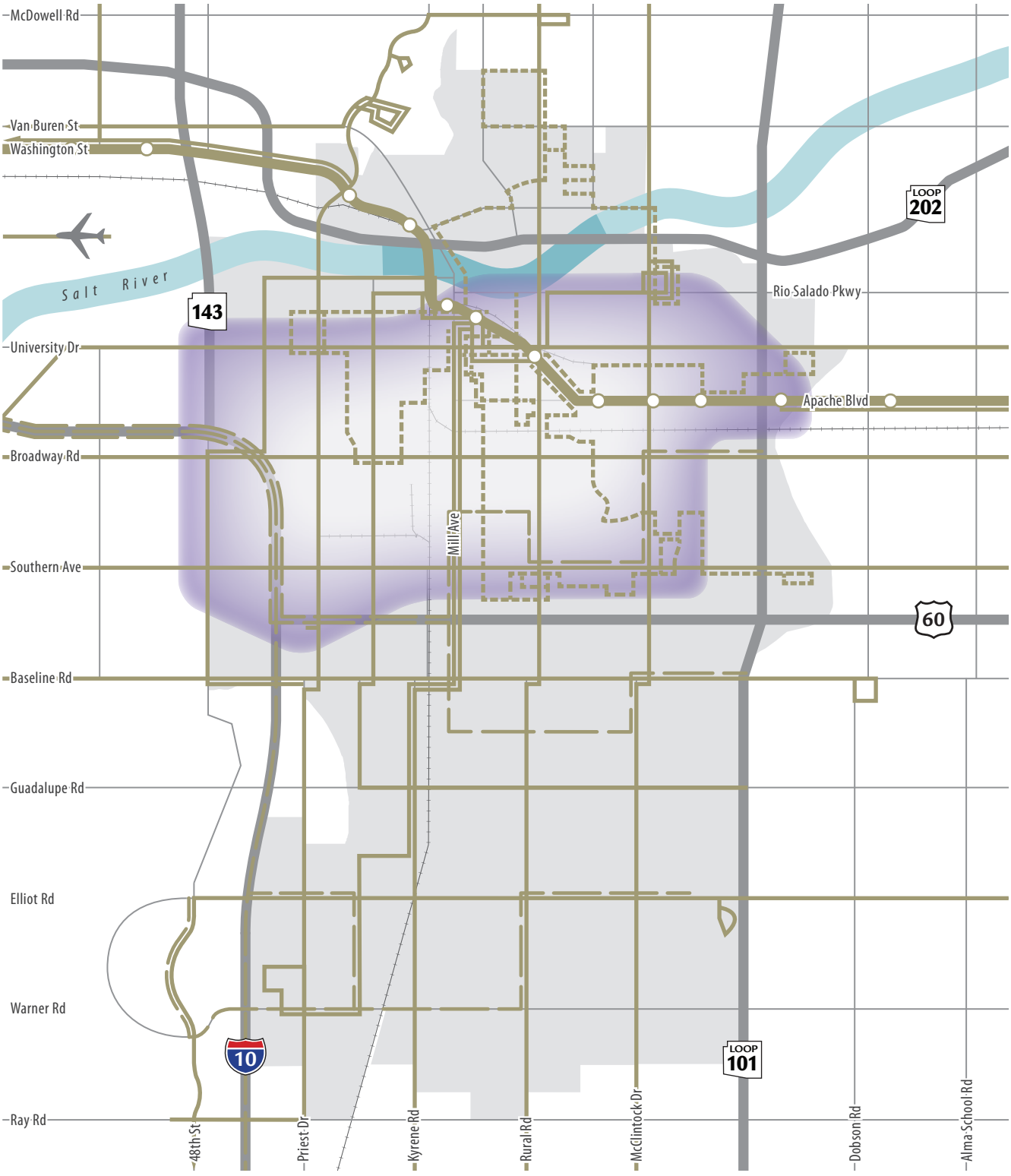
Source: Valley Metro, March 2014

Figure 24: Light Rail Boardings by Station



Source: Valley Metro 2014

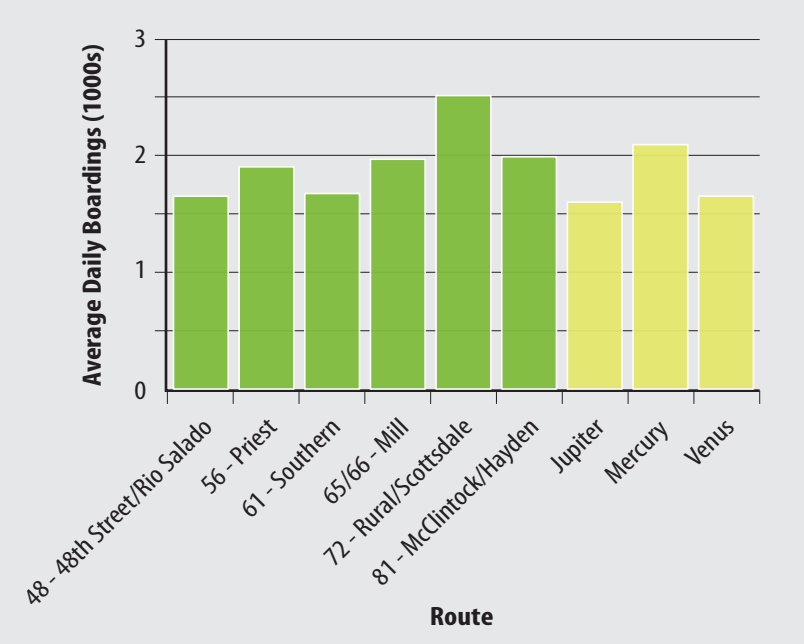
Figure 25: Bus Boardings by Stop



Source: Valley Metro, October 2013

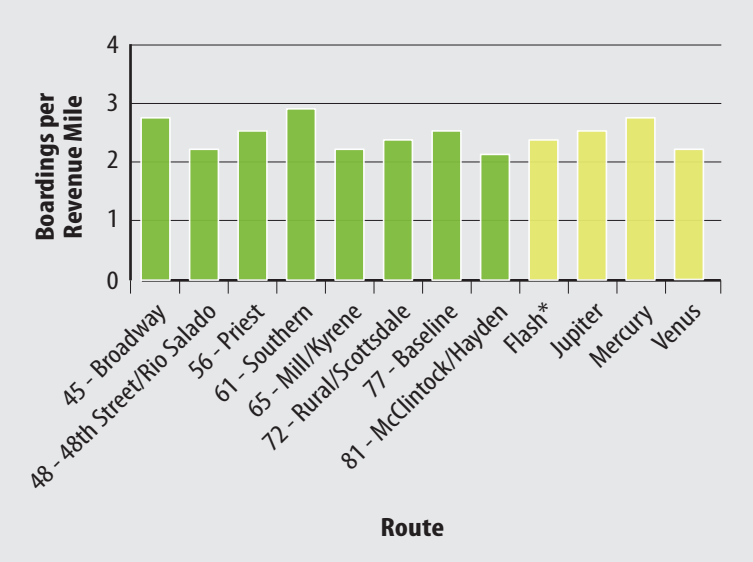
Average daily boardings for light rail are 13,404.

Figure 26: Transit Performance (Routes >1,500 Average Daily Boardings)



Source: Valley Metro, April 2014 Monthly Ridership Report

Figure 27: Transit Performance (Routes >2.0 Boardings per Mile)



** Flash includes Flash McAllister*

Source: Valley Metro, April 2014 Monthly Ridership Report

Light Rail Park-and-Ride Use

Valley Metro completed a survey of regional park-and-ride facilities in 2013. This survey documented the total number of parking spaces at each park-and-ride and the number of occupied parking spaces on an average weekday.

According to the survey, the average park-and-ride occupancy is approximately 50 percent throughout the region, with approximately 54 percent of parking spaces covered. Park-and-ride use in Tempe is approximately 52 percent, but only 25 percent of parking spaces are covered. Table 4 and Figure 28 show park-and-ride use in Tempe.

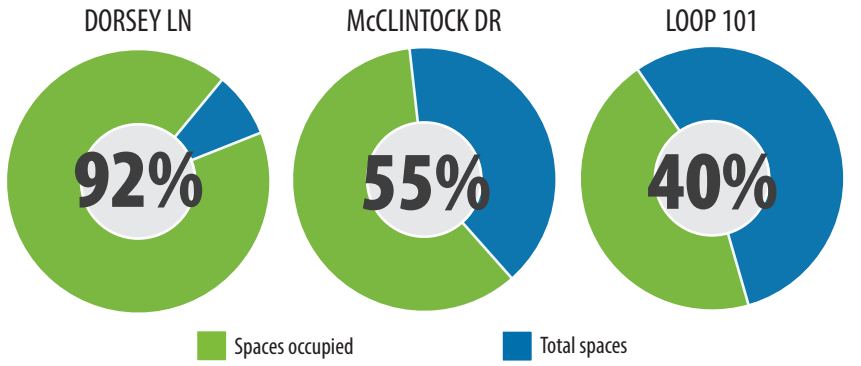
The average park-and-ride occupancy is approximately 50 percent throughout the region.

Table 4: Light Rail Park-and-Rides Use

Facility	Total Spaces	Use	Percent Use (%)
Dorsey Ln and Apache Blvd	190	175	92
McClintock Dr and Apache Blvd	300	165	55
Loop 101 and Apache Blvd	693	277	40
TOTAL	**1,183**	**617**	**52**

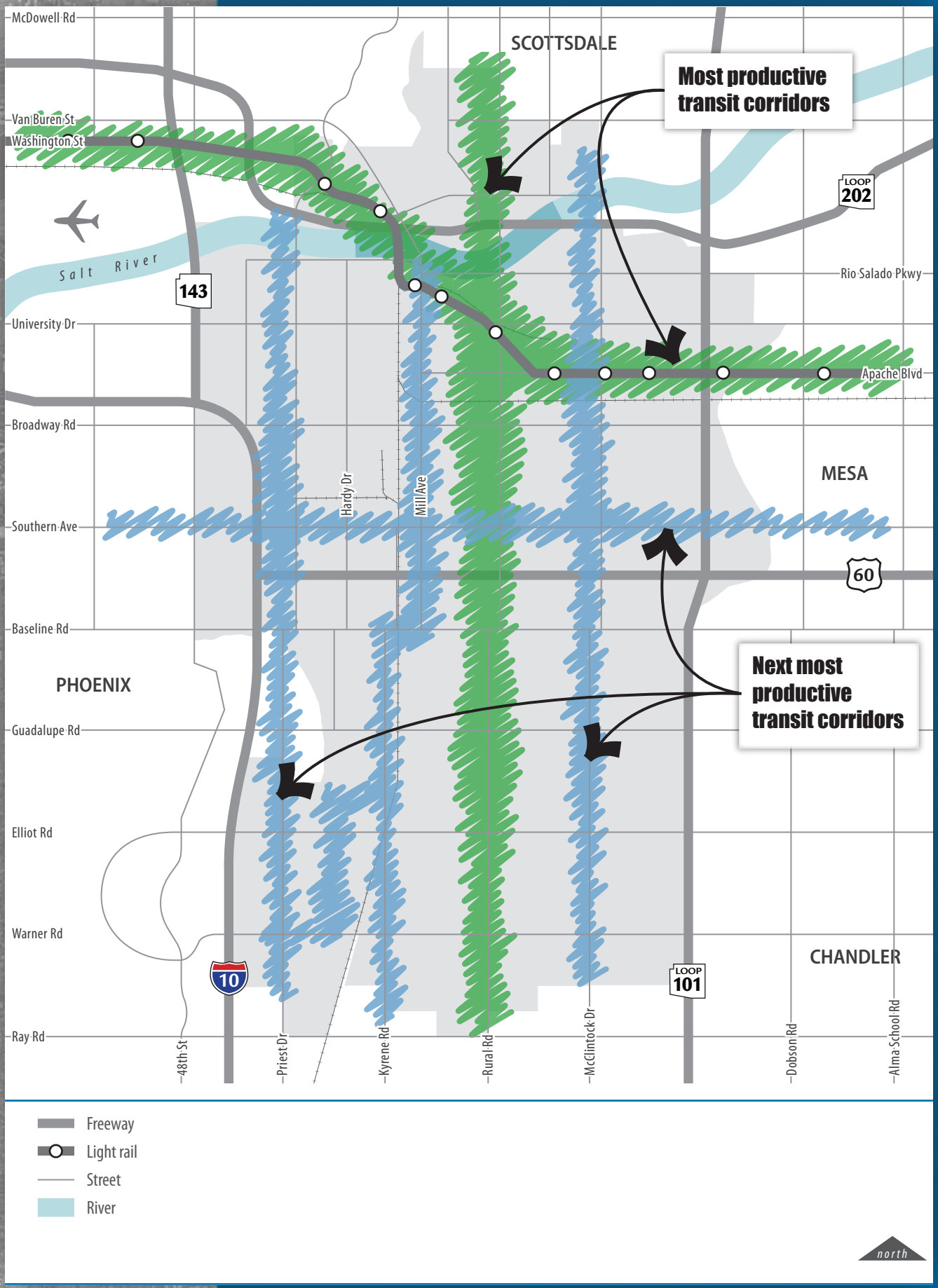
Source: Valley Metro Park-and-Ride Survey, 2013

Figure 28: Light Rail Park-and-Ride Spaces Occupied



Source: Valley Metro Park-and-Ride Survey, 2013

Transit Trends



Bicycle and Pedestrian

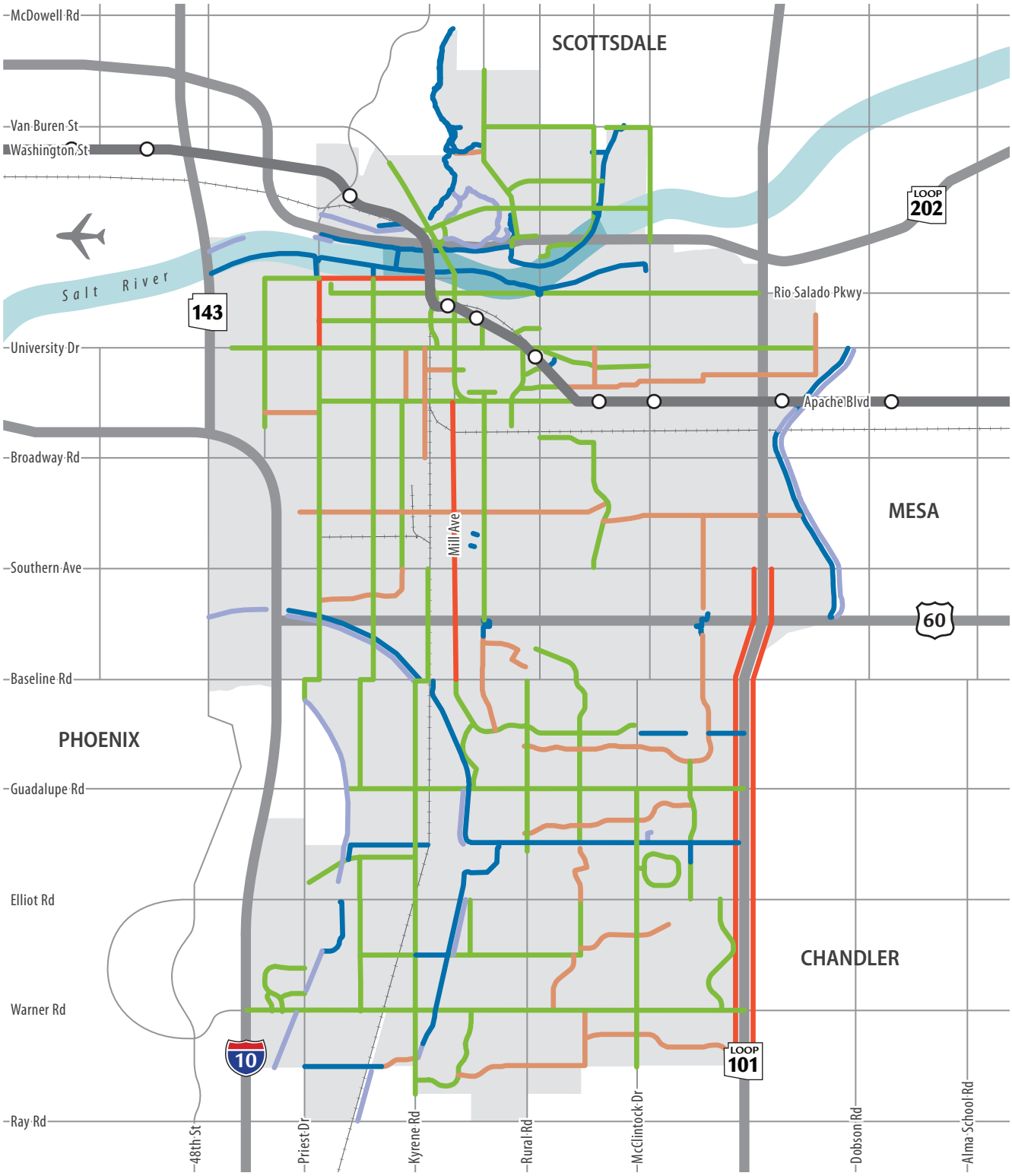
The City of Tempe has a long-standing commitment to encouraging bicycle and pedestrian travel through the provision of a comprehensive network of safe and efficient facilities. As a result, Tempe has a greater share of residents commuting by these modes than other cities in the Valley. According to American Community Survey 2012 data, 4.2 percent and 3.7 percent of Tempe residents bike and walk to work, respectively, far higher than the Maricopa County averages for these modes, at 0.8 percent and 1.6 percent.

In Tempe, 4.2 percent and 3.7 percent of residents bike and walk to work, respectively, far higher than the Maricopa County averages for these modes, at 0.8 percent and 1.6 percent.

Bicycle Facilities

Tempe boasts more than 175 miles of bicycle facilities, which are generally divided into the following five categories: bicycle lanes, bicycle routes, paved multi-use paths, unpaved multi-use paths and paved shoulders. Each of these facility types is described briefly on page 47. Figure 29 shows the existing bicycle network in Tempe.

Figure 29: Bicycle Network



Source: MAG 2014

Bicycle Lanes
A bicycle lane is defined as a portion of a roadway that has been designated by striping, signage and pavement markings for the preferential or exclusive use of bicycles. Bicycle lanes are a minimum of 4 feet wide. These facilities currently account for 52 percent of Tempe's bicycle network.

Bicycle Routes
A bicycle route is a segment of a system of bikeways designated by signage only and typically on residential streets only. These facilities currently account for 15 percent of Tempe's bicycle network.

Paved Multi-use Paths
A paved multi-use path is a facility completely separate from the roadway and motorized traffic that is designated for nonmotorized, mixed use. Paved multi-use paths are a minimum of 10 feet wide. These facilities currently account for 17 percent of Tempe's bicycle network. Tempe's multi-use paths are also accessible to people with disabilities.

Unpaved Multi-use Paths
An unpaved multi-use path is a facility completely separate from the roadway and motorized traffic that is designated for nonmotorized, mixed use. Unpaved multi-use paths are a minimum of 10 feet wide. These facilities currently account for 10 percent of Tempe's bicycle network.

Paved Shoulders
A paved shoulder is defined as an additional pavement width of at least 4 feet adjacent to a roadway that can help accommodate bicycles more safely. These facilities currently account for 6 percent of Tempe's bicycle network.

Pedestrian Facilities
The City of Tempe's pedestrian network, which is comprised of sidewalks, walkways and multi-use paths, has been developed to encourage walking as a viable mode of transportation and includes ADA-accessible amenities.

Pedestrian enhancements included with streetscape projects are: shade from vegetation, awnings, and canopies; paving or widening sidewalks; meeting or exceeding requirements from American with Disabilities Act; and pedestrian safety improvements. Examples of completed streetscape projects include 5th Street, 13th Street, and College Avenue. Hardy Drive and Broadway Road streetscape projects include trees as pedestrian shade component and bus shelters for transit passengers.

Tempe's bicycle network:

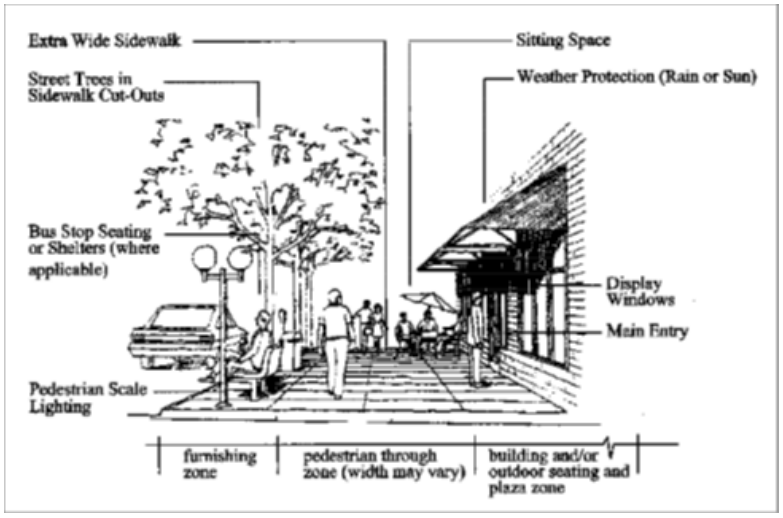
- *52% bicycle lanes*
- *15% bicycle routes*
- *17% paved multi-use paths*
- *10% unpaved multi-use paths*
- *6% paved shoulders*

The City of Tempe's Public Works Department *Engineering Design Criteria Manual* outlines several design specifications aimed at facilitating and encouraging safe pedestrian travel.

- Sidewalks are required adjacent to both sides of all city streets and must be 8 feet wide along arterial streets, 5 feet 6 inches wide on local streets, and 6 feet wide for all other streets.
- Pedestrian walkways shall be designed to provide a direct connection between the main building entrance to public sidewalks and transit stops. Landscaping plans shall be designed to provide shading to the pedestrian walkways.
- Pedestrian and transit user access to buildings is encouraged by locating buildings at the minimum setback at arterial-to-arterial intersections and arterial-to-collector intersections, or where transit service is provided or planned (all arterial and collector streets).

The City of Tempe *Zoning and Development Code* allows the city to stipulate pedestrian shade requirements for development projects.

> "The city may require the placement of pedestrian amenities along sidewalks and pathways to support defensible space, crime prevention, pedestrian comfort and accessibility."

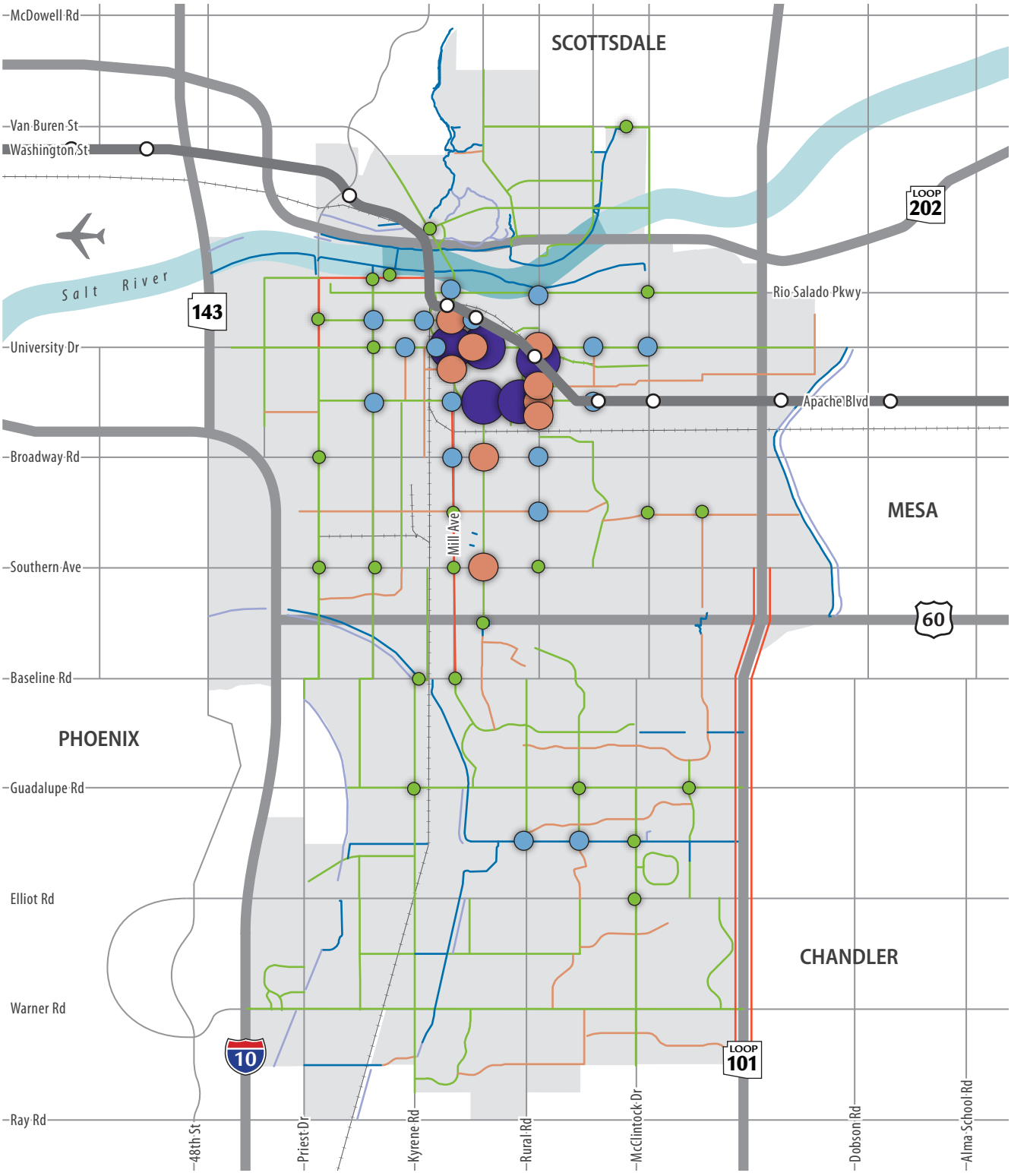


Bicycle and Pedestrian Performance

Bicycle Counts

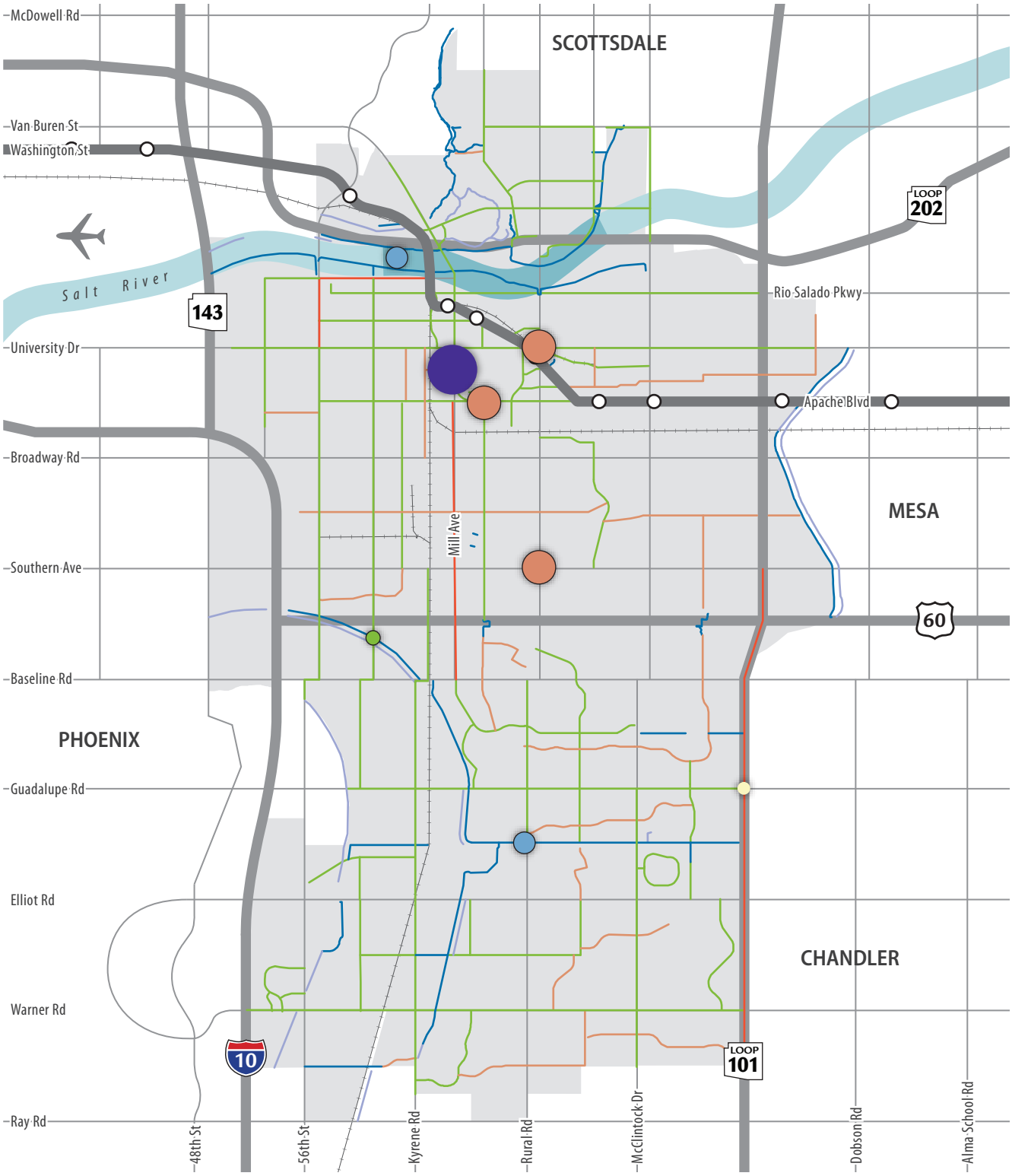
Since 2011, the Tempe Bicycle Action Group (TBAG) has conducted annual counts to determine bicycle volumes at select locations throughout the city. The data collected helps determine bicycle travel patterns and areas where demand may warrant future improvements. The results of the 2013 TBAG bicycle counts are illustrated in Figure 30. Additionally, the Maricopa Association of Governments (MAG) recently completed a Valley-wide bicycle count study with several count locations in Tempe. The 2013 MAG bicycle counts are illustrated in Figure 31.

Figure 30: Bicycle Counts (TBAG)



Source: TBAG 2013

Figure 31: Bicycle Counts (MAG)

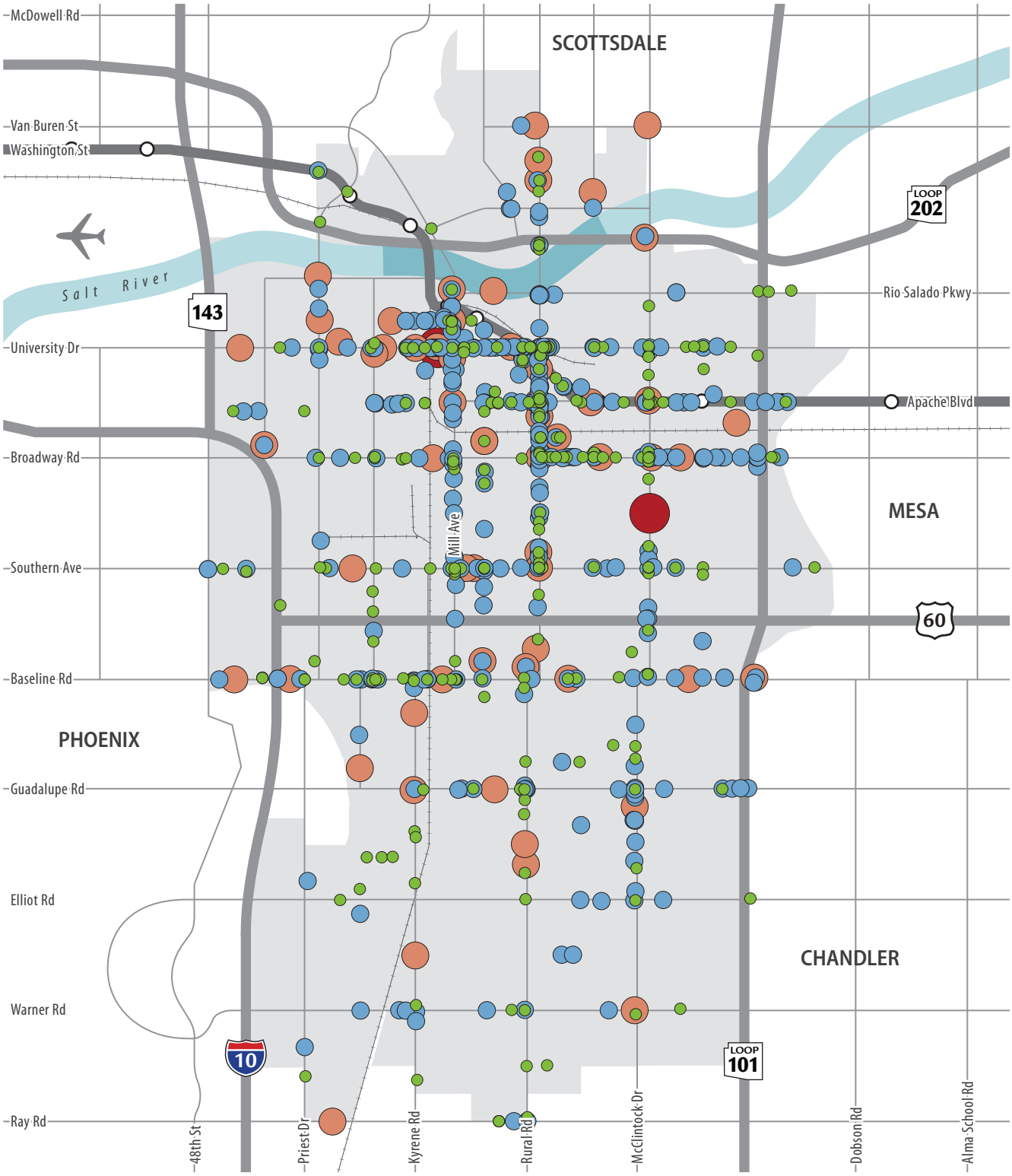


Source: MAG 2013

Bicycle-Vehicle Crashes

In the four year period from 2009 to 2012, just over 850 bicycle-vehicle crashes were reported in Tempe. As depicted in Figure 32, a high number of crashes are clustered along the major arterial roads in the downtown Tempe and ASU Tempe Campus areas. The bicycle crash data was further analyzed to determine potential trends or patterns based on several criteria. Table 5 summarizes bicycle crashes by injury severity and includes the year-over-year change for each category. Figure 33 illustrates the distribution of bicycle crashes throughout hourly periods of the day and indicates that the greatest share of crashes occurs during the afternoon peak period (4 to 6 p.m.). Figure 34 illustrates bicycle crashes by month and indicates that crashes peak in the spring and fall, and drop in the summer and winter.

Figure 32: Bicycle-Vehicle Crashes



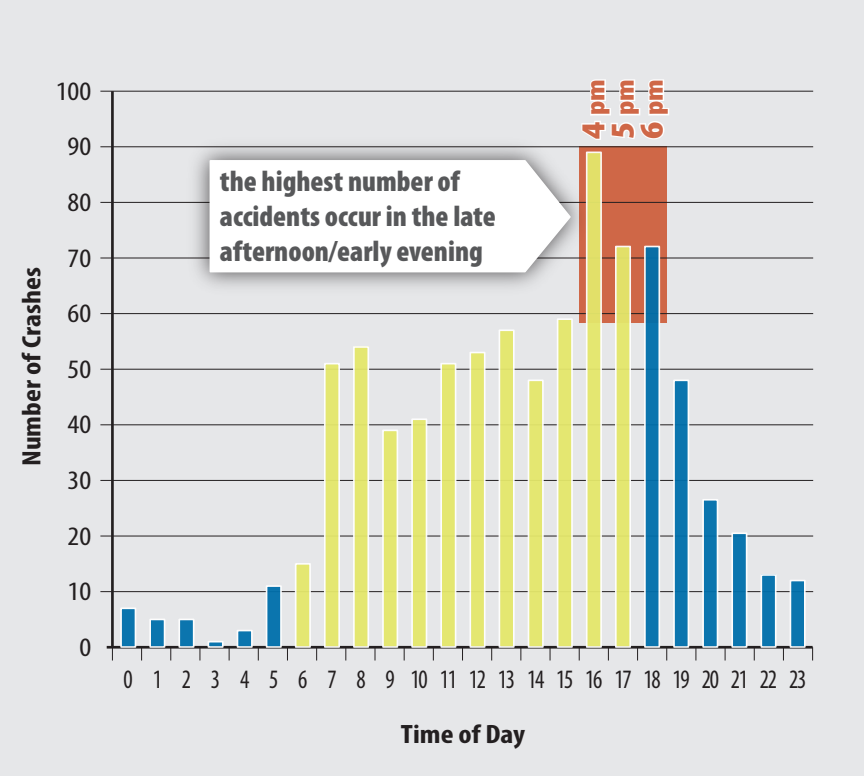
Source: ADOT

Table 5: Bicycle-Vehicle Crashes by Injury Severity

Injury Severity	2009	2010	Percent Change (%) 2009-2010	2011	Percent Change (%) 2010-2011	2012	Percent Change (%) 2011-2012
No Injury	31	45	45	42	-7	61	45
Possible Injury	54	55	2	72	31	76	6
Non-Incapacitating Injury	84	84	0	90	7	97	8
Incapacitating Injury	24	11	-54	15	36	10	-33
Fatal	0	2	—	0	-100	0	—
TOTAL	**193**	**197**	**2**	**219**	**11**	**244**	**11**

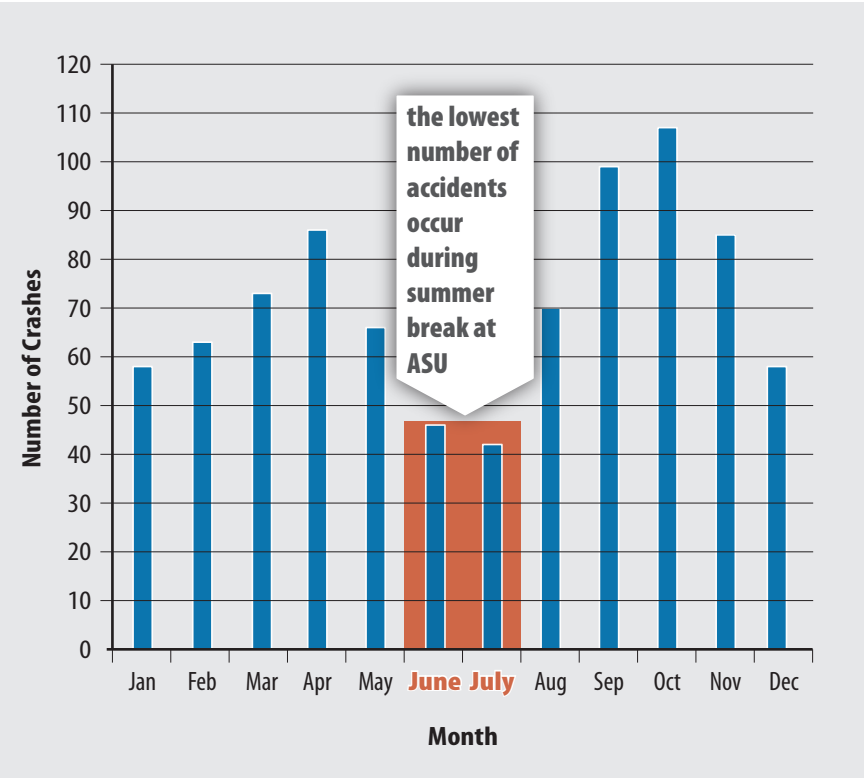
Source: Arizona Department of Transportation, 2009-2012

Figure 33: Bicycle-Vehicle Crashes by Time of Day



Source: Arizona Department of Transportation, 2009-2012

Figure 34: Bicycle-Vehicle Crashes by Month: 2009-2012

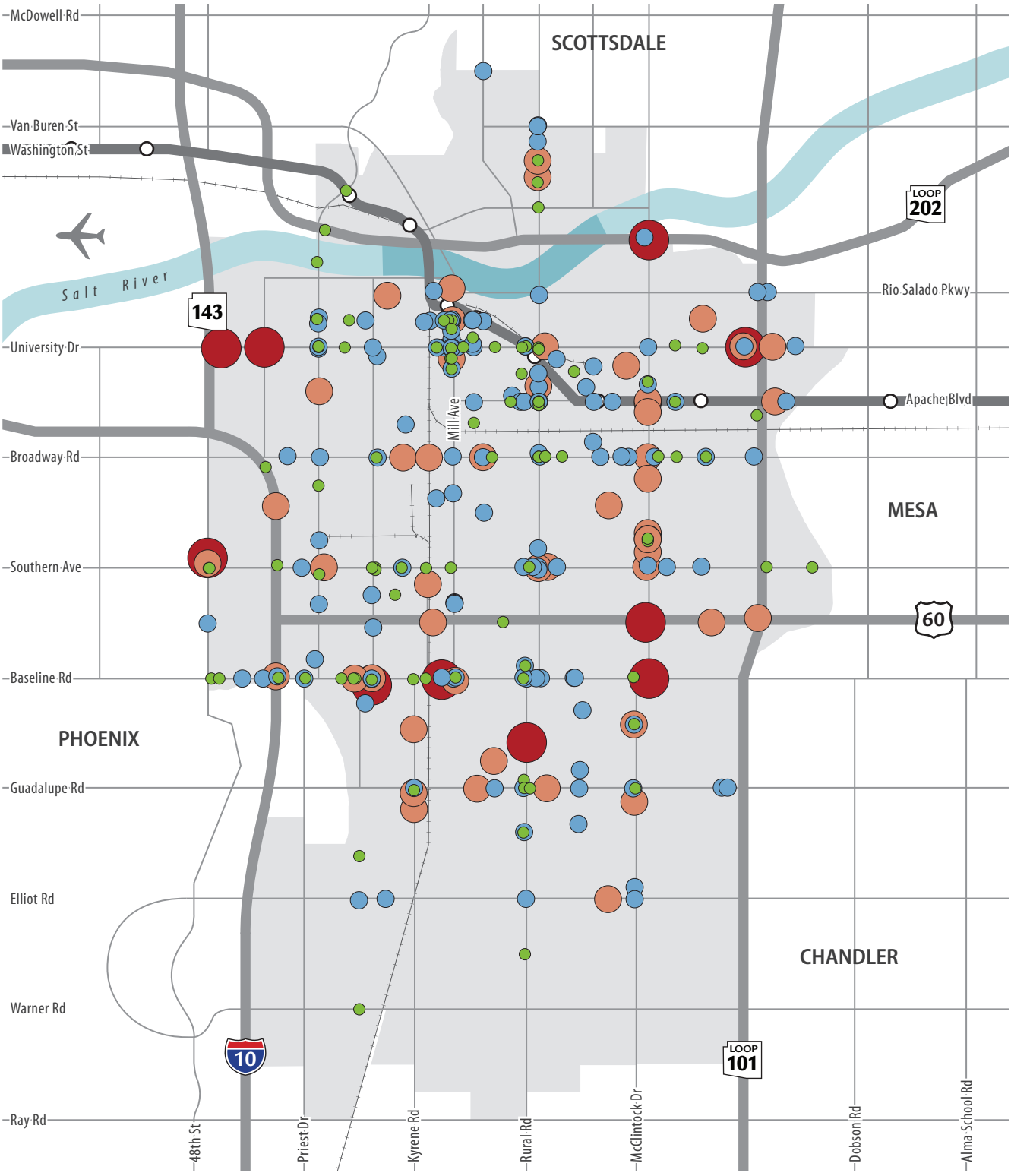


Source: Arizona Department of Transportation, 2009-2012

Pedestrian-Vehicle Crashes

In the four-year period from 2009-2012, Tempe reported 327 pedestrian-vehicle crashes in the city. The location of these crashes is depicted in Figure 35. The pedestrian crash data was further analyzed to determine potential trends or patterns based on several criteria. Table 6 summarizes pedestrian crashes by severity and includes the year-over-year change for each category. Figure 36 depicts the distribution of pedestrian crashes throughout hourly periods of the day and indicates that the greatest share of crashes occurs between 3 and 6 p.m. Lastly, Figure 37 depicts pedestrian crashes by month and indicates a relatively steady occurrence of crashes throughout the year.

Figure 35: Pedestrian-Vehicle Crashes



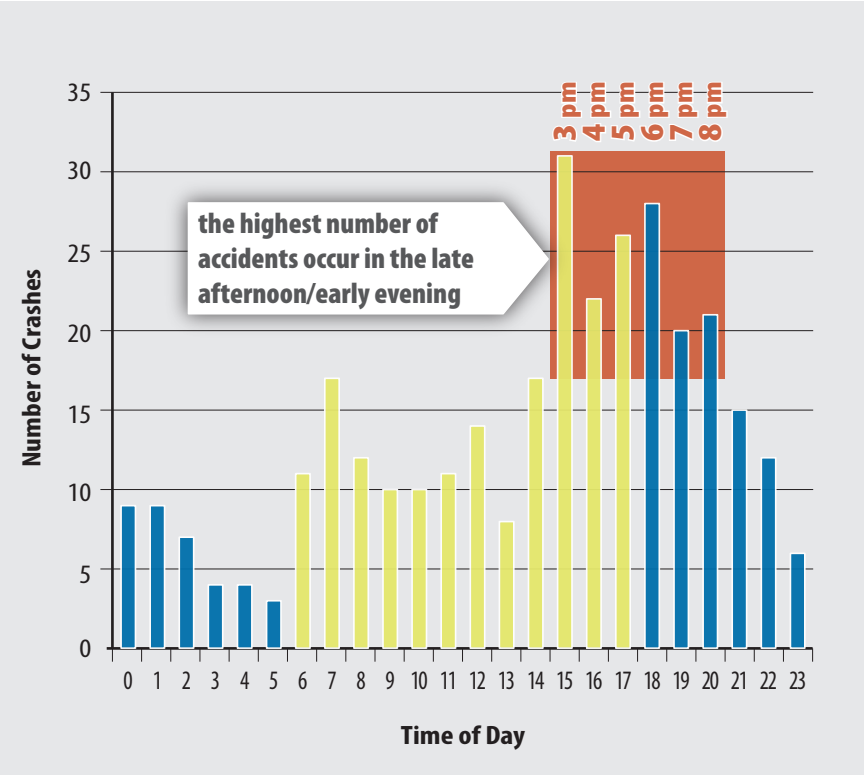
Source: ADOT

Table 6: Pedestrian-Vehicle Crashes by Injury Severity

Injury Severity	2009	2010	Percent Change (%) 2009-2010	2011	Percent Change (%) 2010-2011	2012	Percent Change (%) 2011-2012
No Injury	11	8	-27	12	50	8	-33
Possible Injury	24	20	-17	26	30	24	-8
Non-Incapacitating Injury	24	35	46	38	9	36	-5
Incapacitating Injury	15	10	-33	12	20	14	17
Fatal	4	2	-50	4	100	0	-100
TOTAL	**78**	**75**	**-4**	**92**	**23**	**82**	**-11**

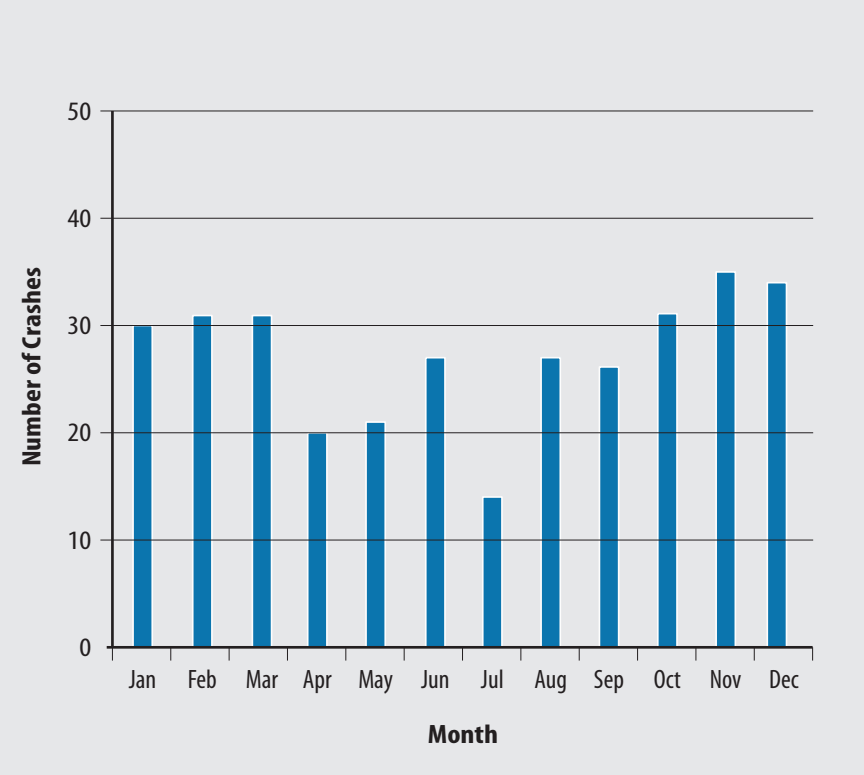
Source: Arizona Department of Transportation, 2009-2012

Figure 36: Pedestrian-Vehicle Crashes by Time of Day



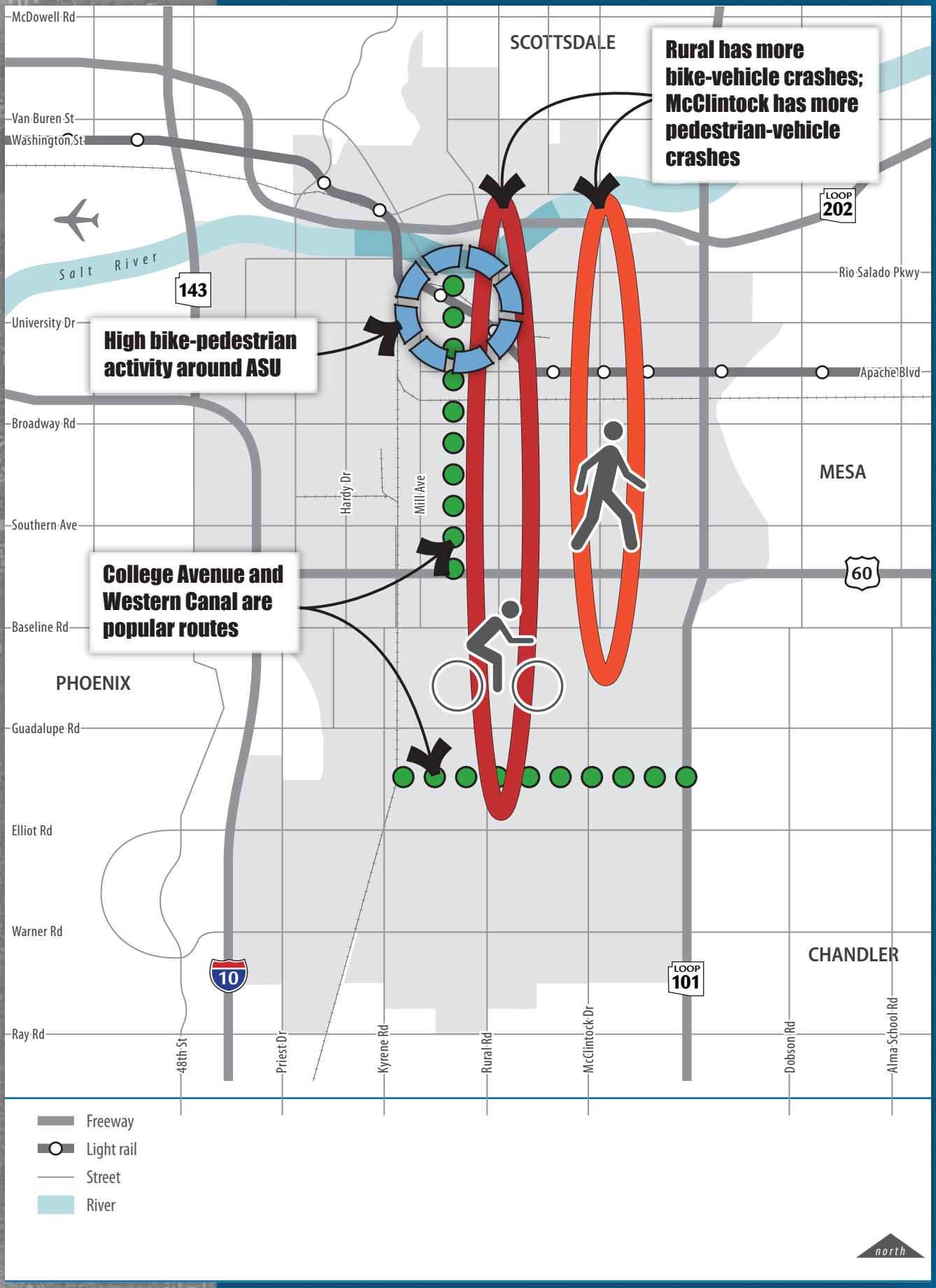
Source: Arizona Department of Transportation, 2009-2012

Figure 37: Pedestrian-Vehicle Crashes by Month: 2009-2012



Source: Arizona Department of Transportation, 2009-2012

Bicycle and Pedestrian Trends



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TRANSPORTATION SCENARIOS

The TMP includes short term (2020) and long term (2040) transportation scenarios, the latter of which correlates to the *General Plan 2040*.

The transportation scenarios are based on the results of a gap analysis performed using the existing conditions data. The purpose of the gap analysis is as follows:

- Analyze all modes together and identify gaps in the multi-modal transportation network
- Analyze the transportation network from the perspective of the user or passenger
- Use the results of this gap analysis to develop the transportation scenarios

The short term (2020) transportation scenario is focused on near term transportation improvements and optimizes the existing transportation network. The long term (2040) transportation scenario is focused on long term transportation improvements and serves as the build-out scenario that correlates to the *General Plan 2040*. Table 7 highlights the differences between the transportation scenarios.

Table 7: Transportation Scenarios

Short Term (2020)	Long Term (2040)
Focuses on near term transportation improvements	Focuses on long term transportation improvements
Optimizes existing transportation network	Correlates to *General Plan 2040*
Builds upon existing, planned, and programmed projects	Serves as build-out scenario
Identifies project list	Identifies project list
Includes project cost estimates	Does not include project cost estimates

The short term (2020) and long term (2040) transportation scenarios identify project lists, which are grouped into the following transportation categories:

- Roadway
- Transit
- Bicycle/pedestrian

Roadway

This section includes the roadway projects for the short term (2020) and long term (2040) transportation scenarios. The types of roadway improvements include modifications to roadways and intersections, such as:

- Capacity increases
- Lane reductions
- Safety improvements
- Bike lanes
- Streetscape improvements

Roadway (2020)

The recommended roadway improvements for the short term (2020) transportation scenario are shown in Figure 38 and Table 8. Highlights of the recommended roadway improvements include the following:

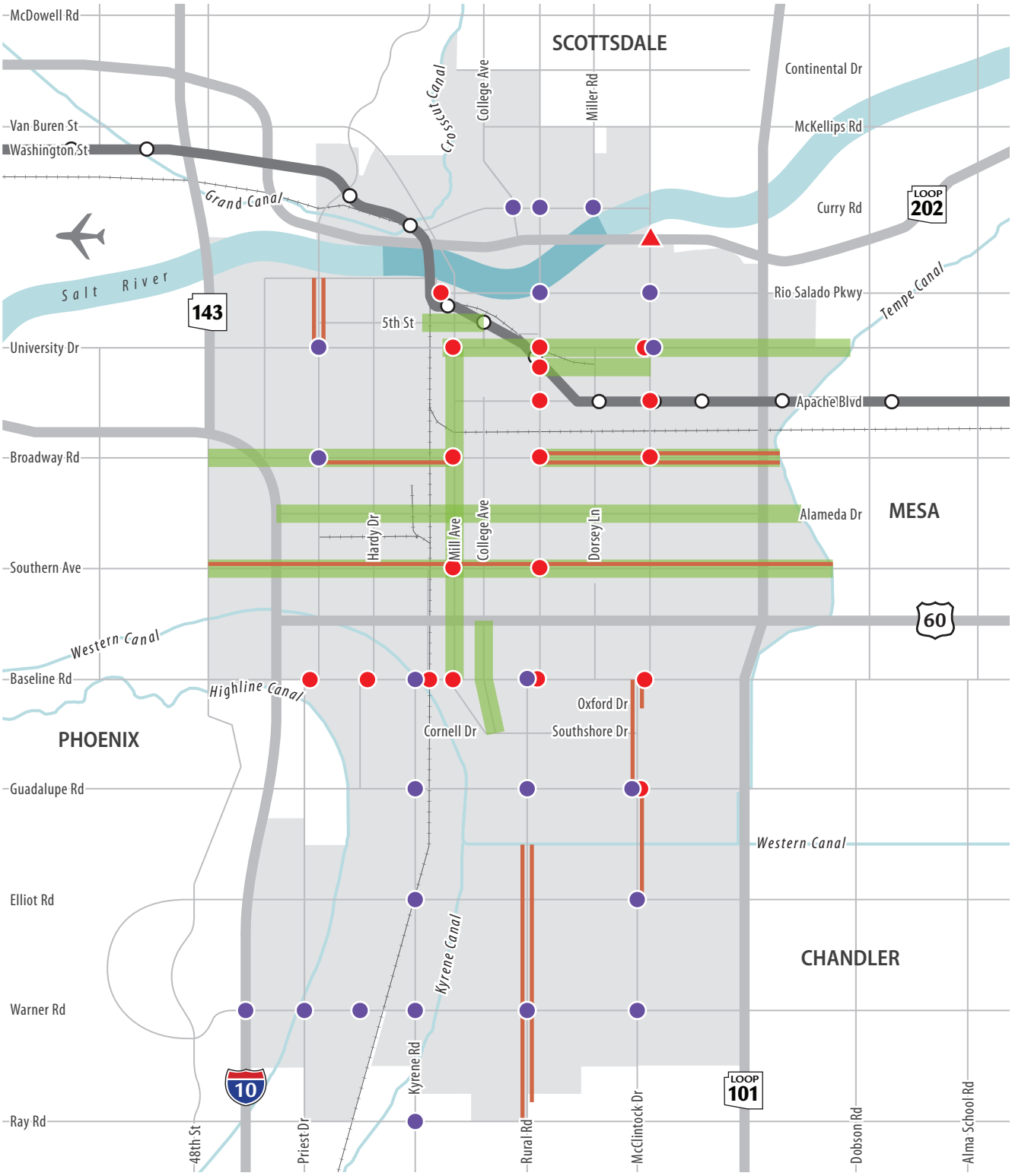
- Lane reductions on segments of Priest Drive, Broadway Road, Southern Avenue and McClintock Drive
- Streetscape improvements on segments of University Drive, Broadway Road, Alameda Drive, Southern Avenue and Mill Avenue
- Intersection safety improvements at high crash locations
- Completion of bike lane gaps at intersections throughout Tempe

Roadway (2040)

The recommended roadway improvements for the long term (2040) transportation scenario are shown in Figure 39 and Table 9. Highlights of the recommended roadway improvements include the following:

- Lane reduction on segments of Baseline and Rural roads
- Streetscape improvements on segments of Rural Road, McClintock Drive and Curry Road
- I-10 HOV direct access connections

Figure 38: Recommended Roadway Improvements 2020



Source: City of Tempe, HDR 2014

Table 8: Recommended Roadway Improvements 2020

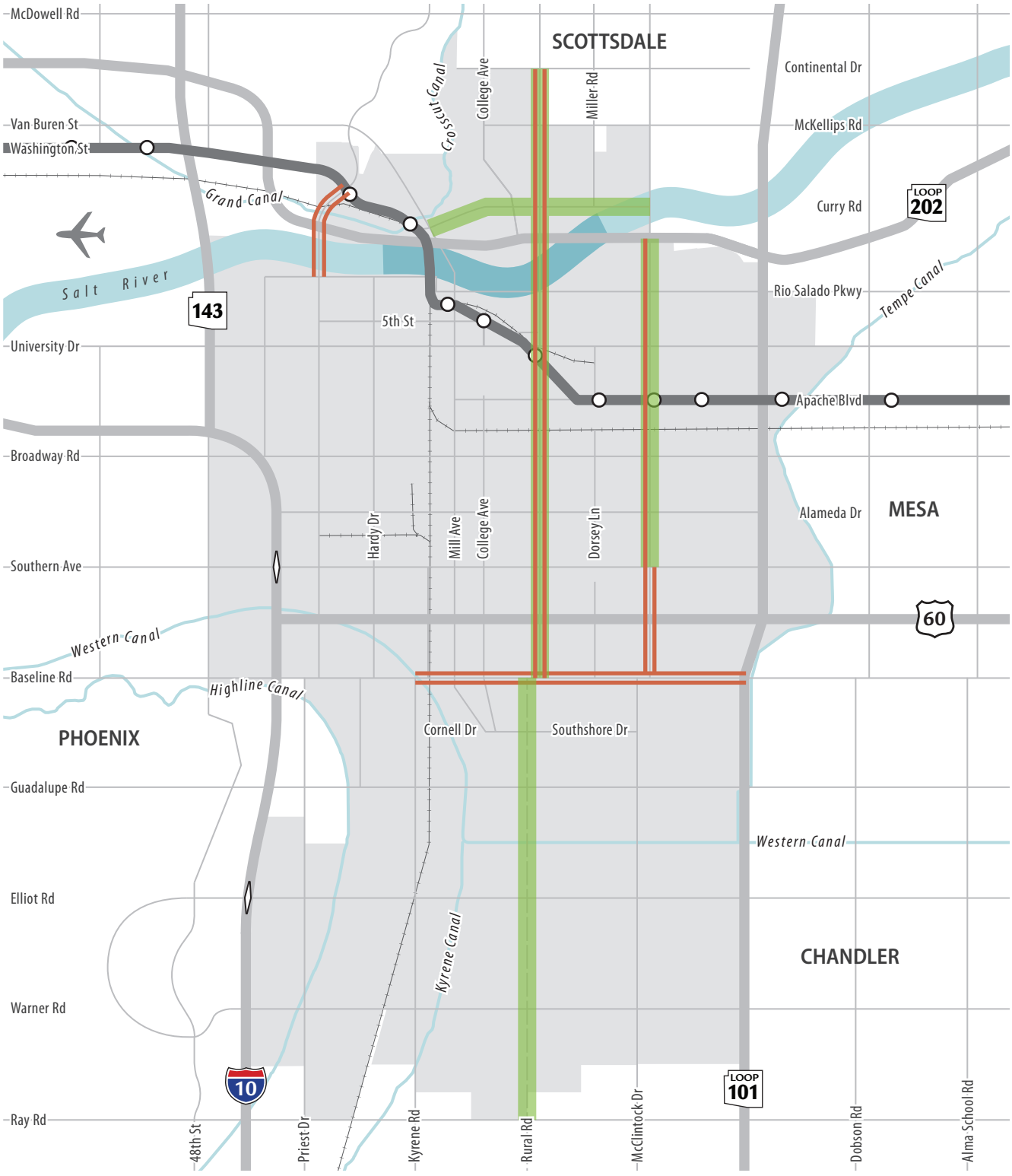
PROJECT		TYPE	DESCRIPTION	COST ($1,000)
Roadway Segment				
Curry	Mill – College	Bicycle	Add buffered bicycle lanes or protected bicycle lane	56
	Miller – McClintock	Bicycle	Add bicycle lanes	25
5th St	Farmer – College/Veterans Way	Streetscape	Streetscape (pedestrian, bicycle, transit, landscape, parking)	550 -2,750
University	Ash – McClintock	Streetscape	Streetscape (pedestrian, bicycle, transit, landscape)	2,000-10,000
	McClintock – Tempe Canal	Streetscape	Streetscape (pedestrian, bicycle, transit, landscape)	1,750-8,750
8th Street	Rural – McClintock	Streetscape	Streetscape (pedestrian, bicycle, transit, landscape)	1,600-8,500
Broadway	Priest – Mill	Lane reduction	Lane reduction (eliminate one EB lane)	*
	Priest – Mill	Bicycle	Add bicycle lanes	*
	48th St – Mill	Streetscape	Streetscape (pedestrian, bicycle, transit, landscape)	1,250-6,250
	Rural – Tempe Canal	Lane reduction	Lane reduction (eliminate one EB lane and WB lane)	*
	Rural – Tempe Canal	Bicycle	Add buffered bicycle lanes or protected bicycle lane	220
	Rural – Tempe Canal	Streetscape	Streetscape (pedestrian, bicycle, transit, landscape)	2,200-11,000
Alameda	I-10 – Tempe Canal	Streetscape	Streetscape (pedestrian, bicycle, transit, landscape)	5,000-25,000
Southern	48th St – Tempe Canal	Lane reduction	Lane reduction (eliminate one WB lane)	*
	48th St – Tempe Canal	Bicycle	Add buffered bicycle lanes or protected bicycle lane	375
	48th St – Tempe Canal	Streetscape	Streetscape (pedestrian, bicycle, transit, landscape)	5,000-25,000
Priest	Rio Salado – University	Lane reduction	Lane reduction (eliminate one NB and SB lane)	38
	Rio Salado – University	Bicycle	Add buffered bicycle lanes or protected bicycle lane	38
Mill	University – Baseline	Bicycle	Add bicycle lanes	*
	University – Baseline	Streetscape	Streetscape (pedestrian, bicycle, transit, landscape)	3,000-15,000
College	US 60 – Cornell	Streetscape	Streetscape (pedestrian, bicycle, transit, landscape)	1,000-5,000
Rural	Western Canal – Ray	Lane reduction	Lane reduction (eliminate one NB lane and SB lane)	250
McClintock	Loop 202 – Southern	Bicycle	Add bicycle lanes	300
	Baseline – Oxford	Lane reduction	Lane reduction (eliminate one NB lane and SB lane)	25
	Oxford – Guadalupe	Lane reduction	Lane reduction (eliminate one SB lane)	37
	Guadalupe – Elliot	Lane reduction	Lane reduction (eliminate one NB lane)	50

** in streetscape*

PROJECT	TYPE	DESCRIPTION	COST ($1,000)
Intersection			
Rio Salado/Ash	Safety	Safety improvements	100
Rural/University	Safety	Safety improvements	100
Rural/Terrace	Safety	Safety improvements	100
Rural/Apache	Safety	Safety improvements	100
Rural/Broadway	Safety	Safety improvements	100
Rural/Southern	Safety	Safety improvements	100
McClintock/University	Safety	Safety improvements	100
McClintock/Apache	Safety	Safety improvements	100
McClintock/Broadway	Safety	Safety improvements	100
McClintock/Guadalupe	Safety	Safety improvements	100
Mill/University	Safety	Safety improvements	100
Mill/Broadway	Safety	Safety improvements	100
Mill/Southern	Safety	Safety improvements	100
Baseline/Priest	Safety	Safety improvements	100
Baseline/Hardy	Safety	Safety improvements	100
Baseline/Kyrene	Safety	Safety improvements	100
Baseline/Mill	Safety	Safety improvements	100
Baseline/Rural	Safety	Safety improvements	100
Baseline/McClintock	Safety	Safety improvements	100
McClintock/Loop 202	Capacity increase	Add second NB left turn lane	25
Curry/Rural	Bicycle	Complete bicycle lane	25
Curry/Miller	Bicycle	Complete bicycle lane	25

PROJECT	TYPE	DESCRIPTION	COST ($1,000)
Intersection			
Rio Salado/Rural	Bicycle	Complete bicycle lane	25
Rio Salado/McClintock	Bicycle	Complete bicycle lane	25
University/McClintock	Bicycle	Complete bicycle lane	25
Guadalupe/Kyrene	Bicycle	Complete bicycle lane	25
Guadalupe/Rural	Bicycle	Complete bicycle lane	25
Guadalupe/McClintock	Bicycle	Complete bicycle lane	25
Warner/I-10	Bicycle	Complete bicycle lane	25
Warner/Priest	Bicycle	Complete bicycle lane	25
Warner/Hardy	Bicycle	Complete bicycle lane	25
Warner/Kyrene	Bicycle	Complete bicycle lane	25
Warner/Rural	Bicycle	Complete bicycle lane	25
Warner/McClintock	Bicycle	Complete bicycle lane	25
Priest/University	Bicycle	Complete bicycle lane	25
Priest/Broadway	Bicycle	Complete bicycle lane	25
College/Curry	Bicycle	Complete bicycle lane	25
Kyrene/Baseline	Bicycle	Complete bicycle lane	25
Kyrene/Elliot	Bicycle	Complete bicycle lane	25
Kyrene/Ray	Bicycle	Complete bicycle lane	25
Rural/Baseline	Bicycle	Complete bicycle lane	25
McClintock/Elliot	Bicycle	Complete bicycle lane	25

Figure 39: Recommended Roadway Improvements 2040



Source: City of Tempe, HDR 2014

Table 9: Recommended Roadway Improvements 2040			
PROJECT		**TYPE**	**DESCRIPTION**
Roadway Segment			
Curry	Mill – McClintock	Streetscape	Streetscape (pedestrian, bicycle, transit, landscape)
Baseline	Kyrene – Loop 101	Lane reduction	Lane reduction (eliminate one EB and WB lane)
	Kyrene – Loop 101	Bicycle	Add buffered bicycle lanes or protected bicycle lane
Scottsdale	Continental – Tempe Town Lake	Lane reduction	Lane reduction (eliminate one NB and SB lane)
	Continental – Tempe Town Lake	Bicycle	Add bicycle lanes
	Continental – Tempe Town Lake	Streetscape	Streetscape (pedestrian, bicycle, transit, landscape)
Rural	Tempe Town Lake – Baseline	Lane reduction	Lane reduction (eliminate one NB and SB lane)
	Tempe Town Lake – University	Bicycle	Add bicycle lanes
	Tempe Town Lake – Ray	Streetscape	Streetscape (pedestrian, bicycle, transit, landscape)
	University – Baseline	Bicycle	Add bicycle lanes
	Baseline – Ray	Bicycle	Add bicycle lanes
McClintock	Loop 202 – Southern	Streetscape	Streetscape (pedestrian, bicycle, transit, landscape)
	Loop 202 – Southern	Roadway	Lane reduction (eliminate one SB lane)
	Southern-Baseline	Roadway	Lane reduction (eliminate one NB and SB lane)
Priest	Washington – Rio Salado	Lane reduction	Lane reduction (eliminate one NB and SB lane)
	Washington – Rio Salado	Bicycle	Add buffered bicycle lanes or protected bicycle lane
Loop 101 Frontage Roads	Loop 202 – US 60	Bicycle	Add protected bicycle lane
UPRR	@ Rural	Grade-separated crossing	Rural grade separated
I-10	Ray – 44th Street	HOV direct access	HOV direct access from reconfigured I-10

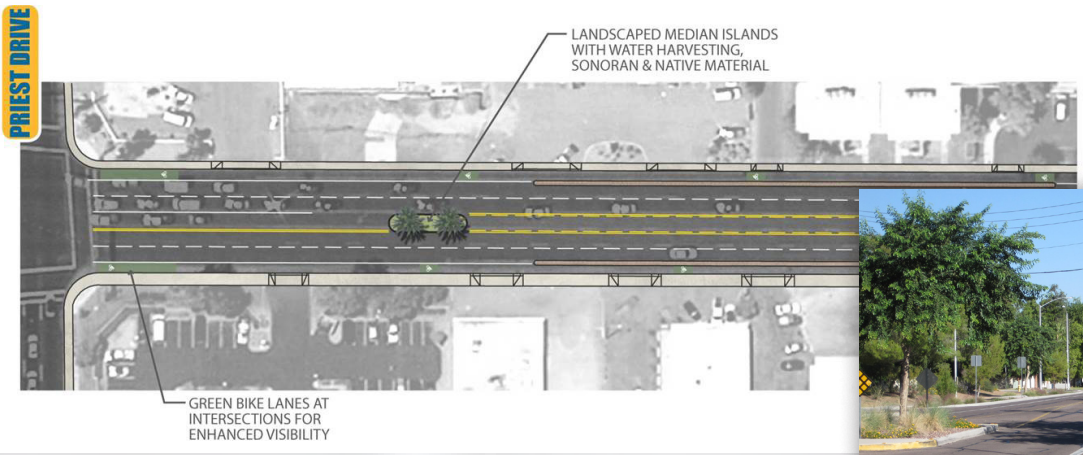
Streetscape

The term streetscape can encompass many types of facilities for all modes of travel. The range of improvements could include any of the following:

- reconfiguring street striping and vehicle lanes to include traditional and buffered bike lanes, where feasible
- moving the curbs inward to narrow the street cross section, freeing up room for wider sidewalks or wider planting areas
- improving sidewalks
- improving bicycle lanes
- improving planting areas

Broadway Road (for example)

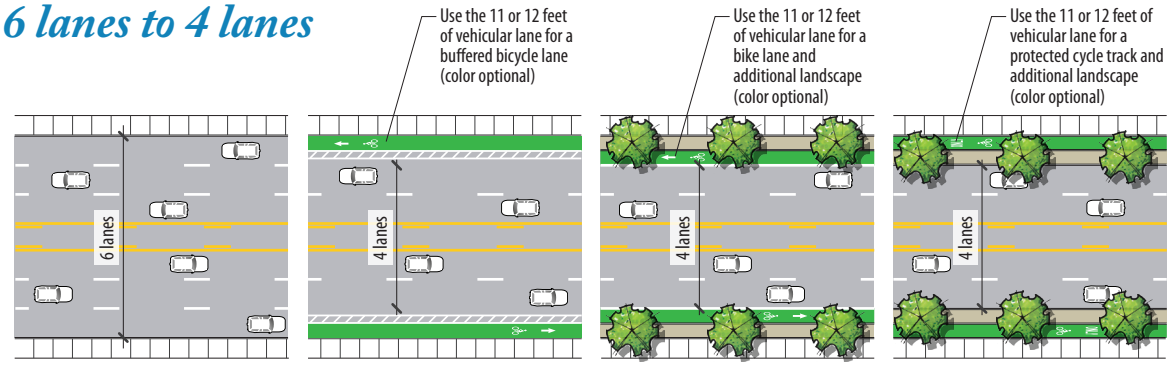
Source: City of Tempe, Parsons Brinckerhoff

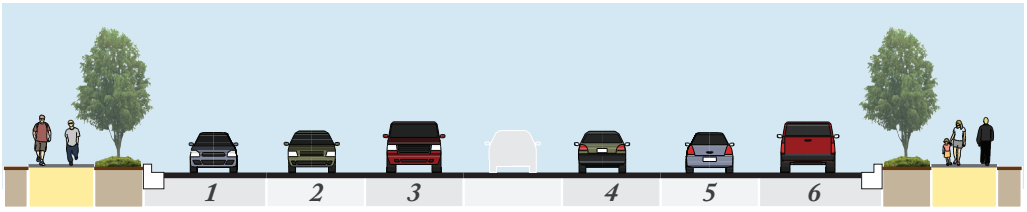


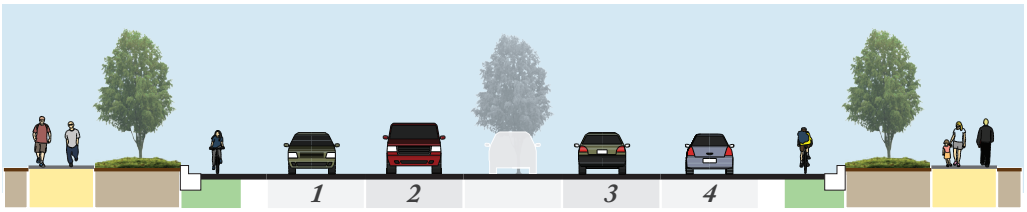
Source: City of Tempe, Kimley-Horn

College Avenue

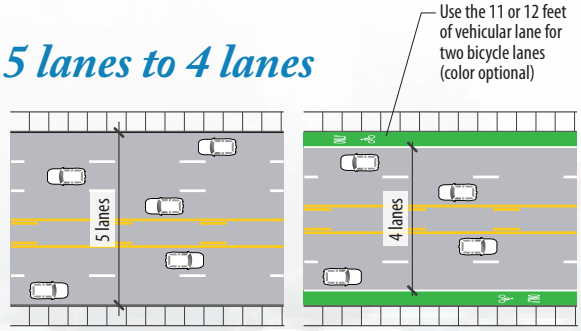
6 lanes to 4 lanes

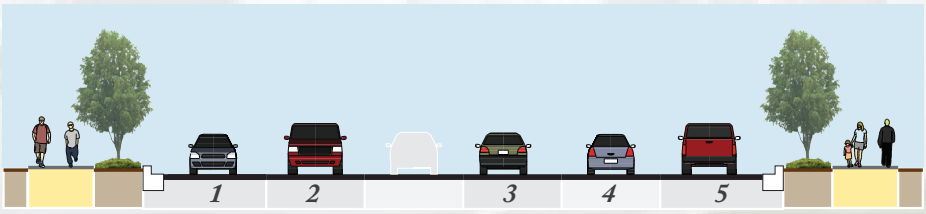


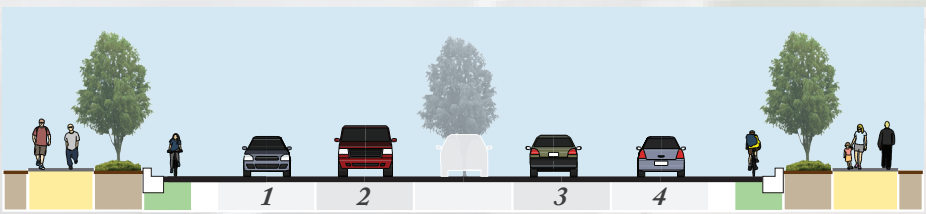




5 lanes to 4 lanes



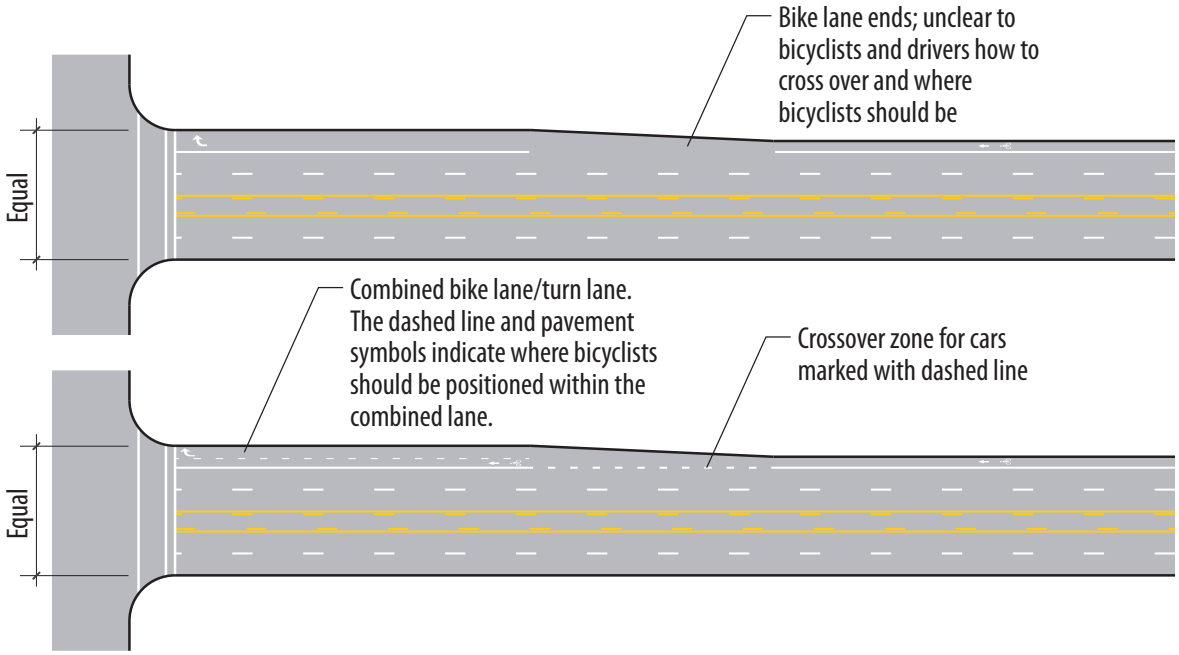




Repurposed Vehicular Lanes

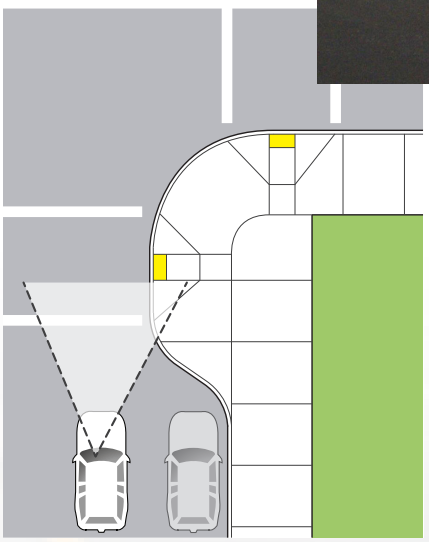
Where traffic level of service will not be significantly impacted by removing a vehicular lane, the area used by that lane or lanes can be used instead for bicycle lanes, increased planting areas, wider sidewalks, ADA improvements, or other desired nonmotorized facilities and amenities.

Safety Improvements



Bicycle Lane Improvements

Several intersections in the city have bicycle lanes approaching from two or four directions but the bike lanes drop just short of the intersection, leaving some bicyclists and motorists unsure of how to proceed and who has the right of way. In some cases, this situation can be corrected with simple remarking of the pavement to include a combined bike lane/turn lane with a crossover zone.



Curb Extensions

Curb extensions can be added to small and large intersections. They visually and physically narrow the roadway to create shorter crossings for pedestrians. In most cases, they also increase the available space for street furniture and landscape.

Universal Mobility

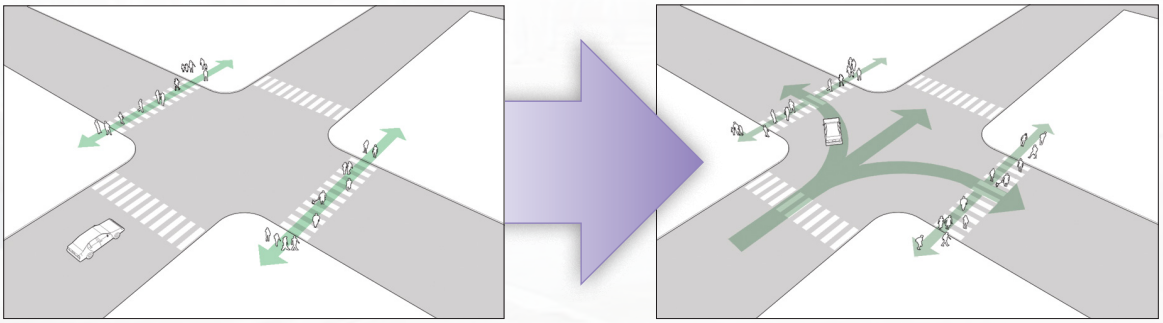
As intersections and streetscapes are improved, all current best practices for aiding the physically challenged should be considered for inclusion. New technologies and equipment are being developed and made available for installation. Improvements that aid the physically challenged almost always assist other users.

The list of possible improvements include:

- audible signals
- push button locator tones
- tactile intersection maps (see below)
- Braille signs
- extended button press
- directional ramps with tactile domes
- improved wheelchair accessibility at bus stops
- curb extensions to reduce crossing distance
- median refuge areas
- leading pedestrian interval signalization (see below)

Leading Pedestrian Interval Signalization

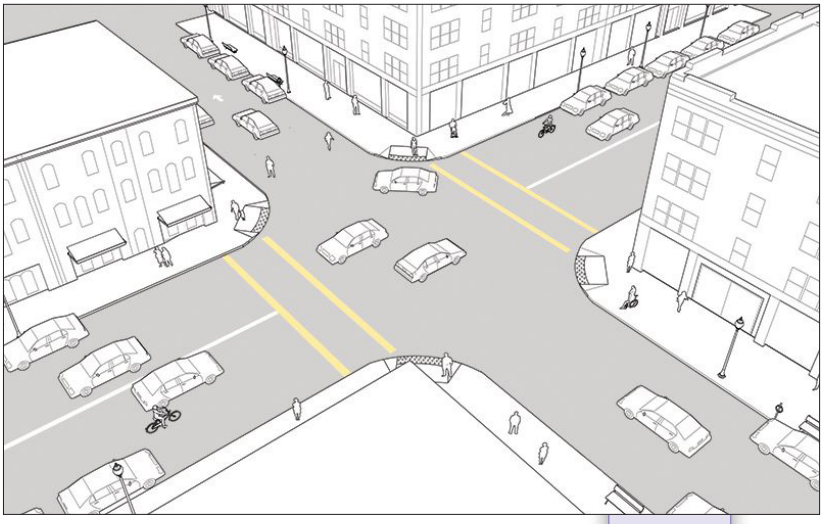
Leading pedestrian interval signals are used at intersections that have both high pedestrian volumes and high vehicular turning volumes. The signalization displays a WALK symbol for pedestrians for three to seven seconds or more before the signal turns green for traffic. This provides time for pedestrians to either clear the crossing or enhance their visibility to turning vehicles.



Source: NACTO

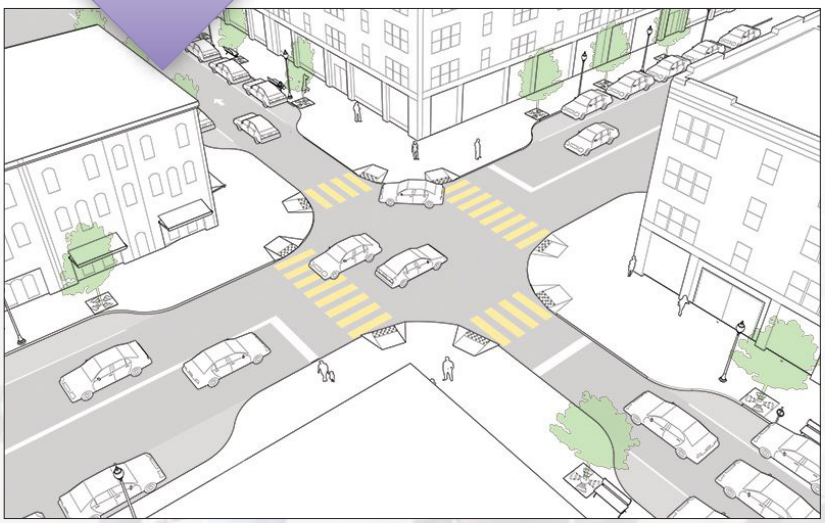
Tactile Intersection Map

Tactile intersection maps are raised schematic maps that show what pedestrians will encounter as they negotiate the crosswalk controlled by that push button.



Intersection Improvements

The intersection improvements diagrammed in these figures from National Association of City Transportation Officials (NACTO) include curb extensions to reduce crossing distance, directional ramps with tactile domes, high visibility crosswalk markings, and vehicular stop bars set back from the crosswalk.



Source: NACTO

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Transit

This section includes the transit projects for the short term (2020) and long term (2040) transportation scenarios. The types of transit improvements include the following:

- High capacity transit
- Local and express bus service
- Circulators
- Transit facilities
- Streetscape improvements

Transit (2020)

The recommended transit improvements for the short term (2020) transportation scenario are shown in Figure 40 and Table 10. Highlights of the recommended transit improvements include the following:

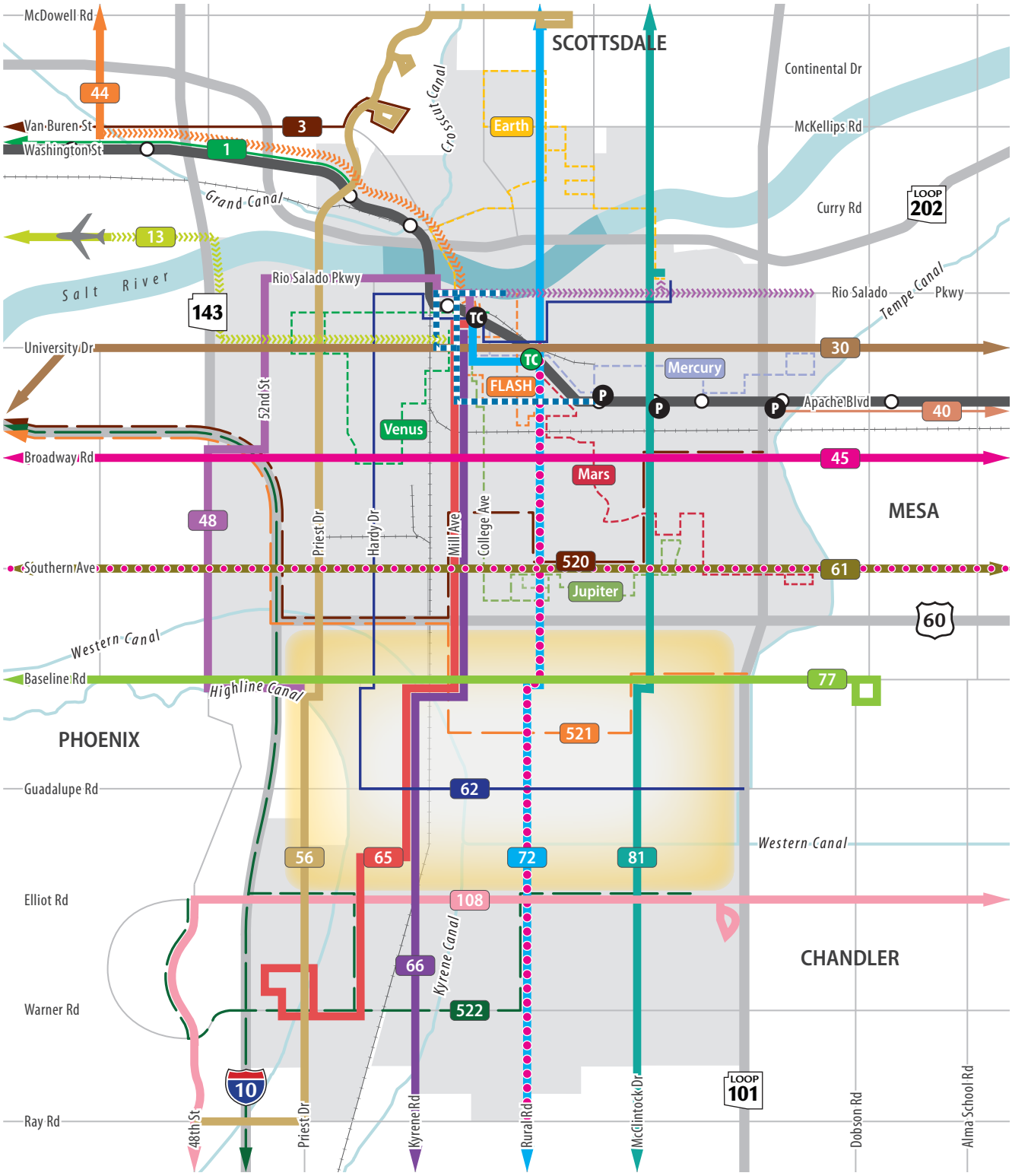
- Premium bus service on Rural Road and Southern Avenue
- Tempe Streetcar starter line
- Weekday bus service increases on Routes 45 (Broadway), 48 (48th Street/Rio Salado), 56 (Priest), 61 (Southern), 72 (Rural) and 77 (Baseline)
- Orbit Saturn circulator in South Tempe
- Improvements to Rural/University Transit Center

Transit (2040)

The recommended transit improvements for the long term (2040) transportation scenario are shown in Figure 41 and Table 11. Highlights of the recommended transit improvements include the following:

- High capacity transit on Rural Road between the Scottsdale border and Baseline Road
- Tempe Streetcar system
- Second Orbit circulator in South Tempe
- All bus routes meet Tempe and/or Valley Metro service standards
- New transit facility in South Tempe

Figure 40: Recommended Transit Improvements 2020

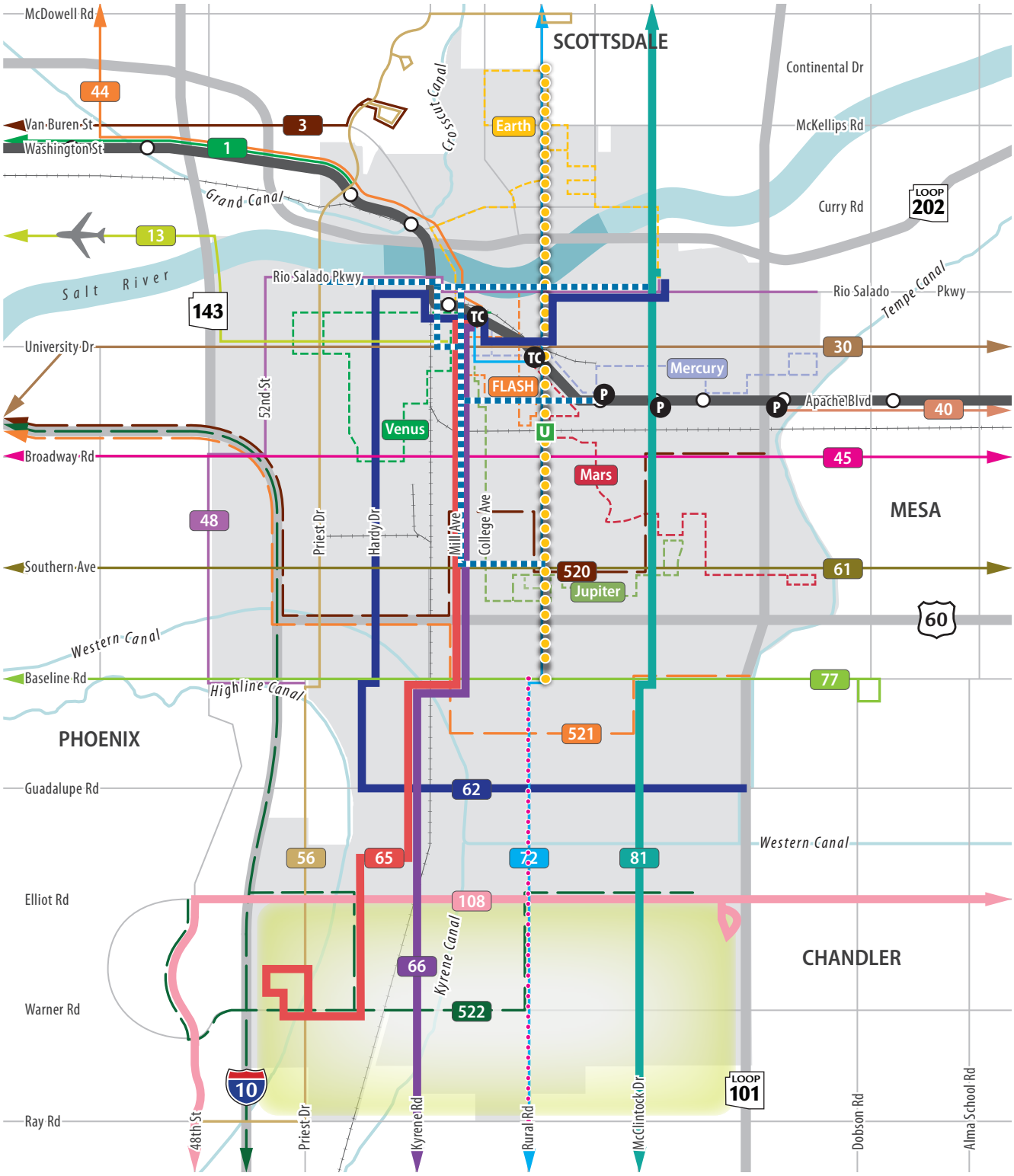


Source: City of Tempe, HDR 2014

Table 10: Recommended Transit Improvements 2020

PROJECT		TYPE	DESCRIPTION	COST ($1,000)
High Capacity Transit				
Tempe Streetcar Starter		Streetcar	Rio Salado, Mill/Ash, and Apache (adopted LPA)	3,100 - 4,000
Rural		Premium Bus	University/Rural TC to Tempe/Chandler border	803
Southern		Premium Bus	Tempe/Phoenix border to Tempe/Mesa border	510
Local Bus				
30	University	Increase frequency	30 min Sun	70
45	Broadway	Increase frequency	10 min weekday peak	235
48	48th St/Rio Salado	Increase frequency	15 min weekday peak	421
	48th St/ Rio Salado	Extend route	Connect with Route 96	247
56	Priest	Increase frequency	10 min weekday peak	459
61	Southern	Increase frequency	10 min weekday peak	255
65	Mill/Kyrene	Increase frequency	30 min Sat/Sun	456
66	Mill/Kyrene	Increase frequency	30 min Sat/Sun	504
72	Scottsdale/Rural	Increase frequency	10 min weekday peak/day	1,090
	Scottsdale/Rural	Increase frequency	20 min Sat/Sun	188
77	Baseline	Increase frequency	15 min weekday peak	255
81	Hayden/McClintock	Increase frequency	30 min Sat/Sun	408
108	Elliot	Increase frequency	30 min Sat/Sun	216
Circulator				
Orbit	Saturn	Circulator	To be determined	1,200
Transit Facility				
Transit Center	Rural and University	—	Upgrade facility	3,000 - 5,000

Figure 41: Recommended Transit Improvements 2040



Source: City of Tempe, HDR 2014

Table 11: Recommended Transit Improvements 2040			
PROJECT		**TYPE**	**DESCRIPTION**
High Capacity Transit			
Tempe Streetcar System		Streetcar	System Plan
High Capacity Transit	Rural	High Capacity Transit	University/Rural TC to Baseline Road
	Rural/Scottsdale	High Capacity Transit	University/Rural TC to Tempe/Scottsdale border
Local Bus			
62	Hardy/Guadalupe	Increase frequency	15 min weekday peak
65	Mill/Kyrene	Increase frequency	20 min weekday peak
66	Mill/Kyrene	Increase frequency	20 min weekday peak
81	Hayden/McClintock	Increase frequency	10 min weekday peak
108	Elliot	Increase frequency	15 min weekday peak
Circulator			
Orbit	South Tempe 2	Circulator	To be determined
Transit Facility			
Transit Center	South Tempe (or P&R)	New facility	To be determined

Tempe Streetcar

Tempe Streetcar Route and Stop Locations

Source: City of Tempe, Valley Metro Rail

Tempe Streetcar Vision (Future Phases)

Source: City of Tempe, Valley Metro Rail

Bicycle/Pedestrian

This section includes the bicycle/pedestrian projects for the short term (2020) and long term (2040) transportation scenarios. The types of bicycle/pedestrian improvements include the following:

- Streetscape
- Bike lanes
- Buffered or protected bike lanes
- Bicycle boulevards
- Bicycle/pedestrian crossings
- Multi-use paths

Bicycle/Pedestrian (2020)

The recommended bicycle/pedestrian improvements for the short term (2020) transportation scenario are shown in Figure 42 and Table 12. Highlights of the recommended bicycle/pedestrian improvements include the following:

- Streetscape improvements including shade strategies for pedestrians and ADA improvements along 8th Street, Alameda Drive, Southern Avenue, Mill Avenue, Broadway Road, McClintock Drive, College Avenue, University Drive and Rural Road
- Bike lanes on segments of Rural Road, McClintock Drive and Mill Avenue
- Buffered or protected bike lanes on segments of Curry Road, Broadway Road, Southern Avenue and Priest Drive
- Bicycle boulevards
- Crossings (at-grade and grade separated)
- Completion of bike lane gaps at intersections throughout Tempe
- Multi-use paths on canals, adjacent to railroads, and along Rio Salado
- BIKEiT wayfinding program
- Character Area Plan and employment core pedestrian improvements

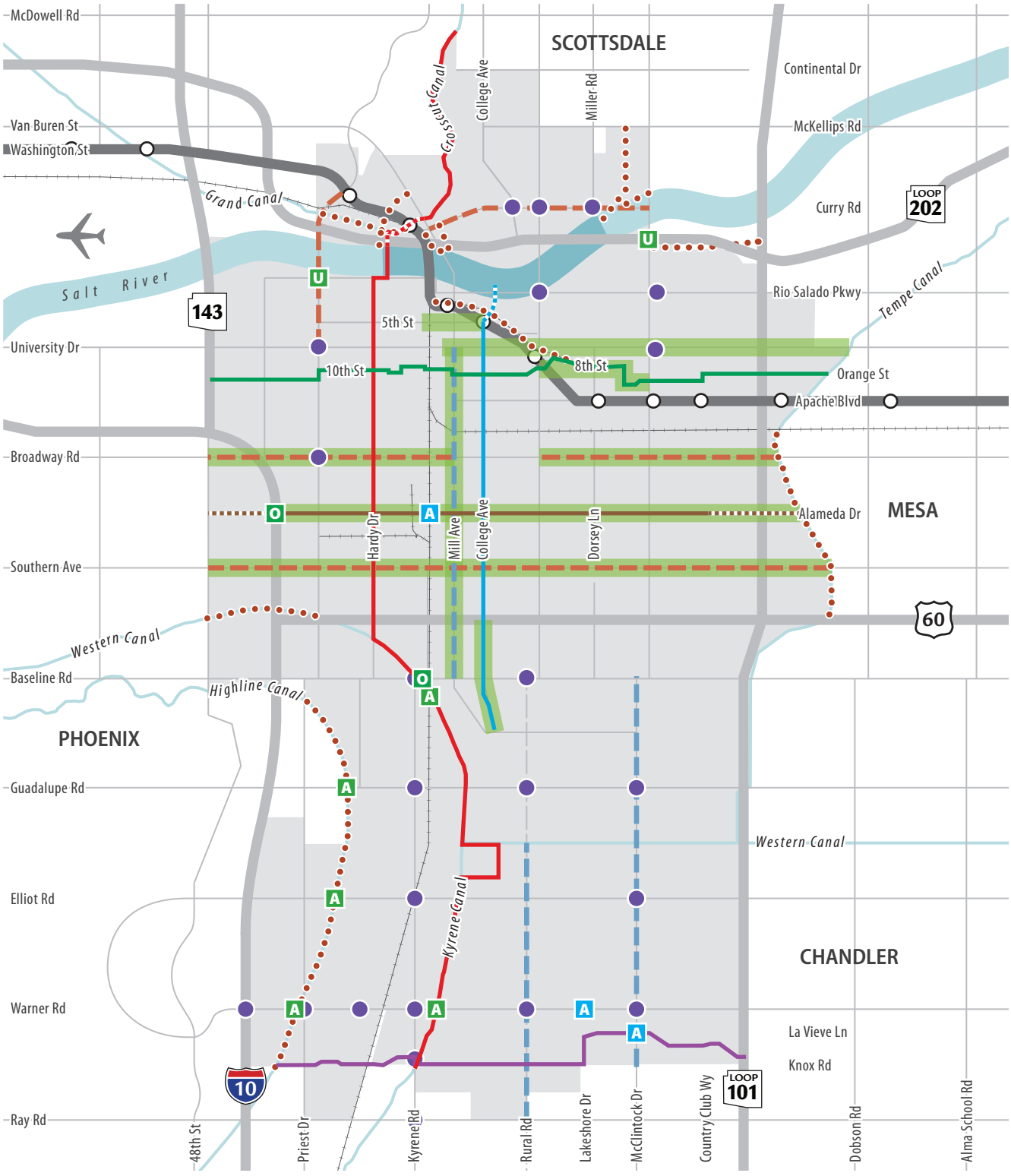
Bicycle/Pedestrian (2040)

The recommended bicycle/pedestrian improvements for the long term (2040) transportation scenario are shown in Figure 43 and Table 13. Highlights of the recommended bicycle/pedestrian improvements include the following:

- Bike lanes on segments of Rural Road and McClintock Drive
- Buffered or protected bike lanes on segments of Baseline Road and Price Road
- Crossings (at-grade and grade separated)
- Completion of multi-use path system

Figure 44 illustrates the future nonmotorized improvements in relation to Tempe's public schools. Figure 45 illustrates the BIKEiT routes.

Figure 42: Recommended Bicycle/Pedestrian Improvements 2020



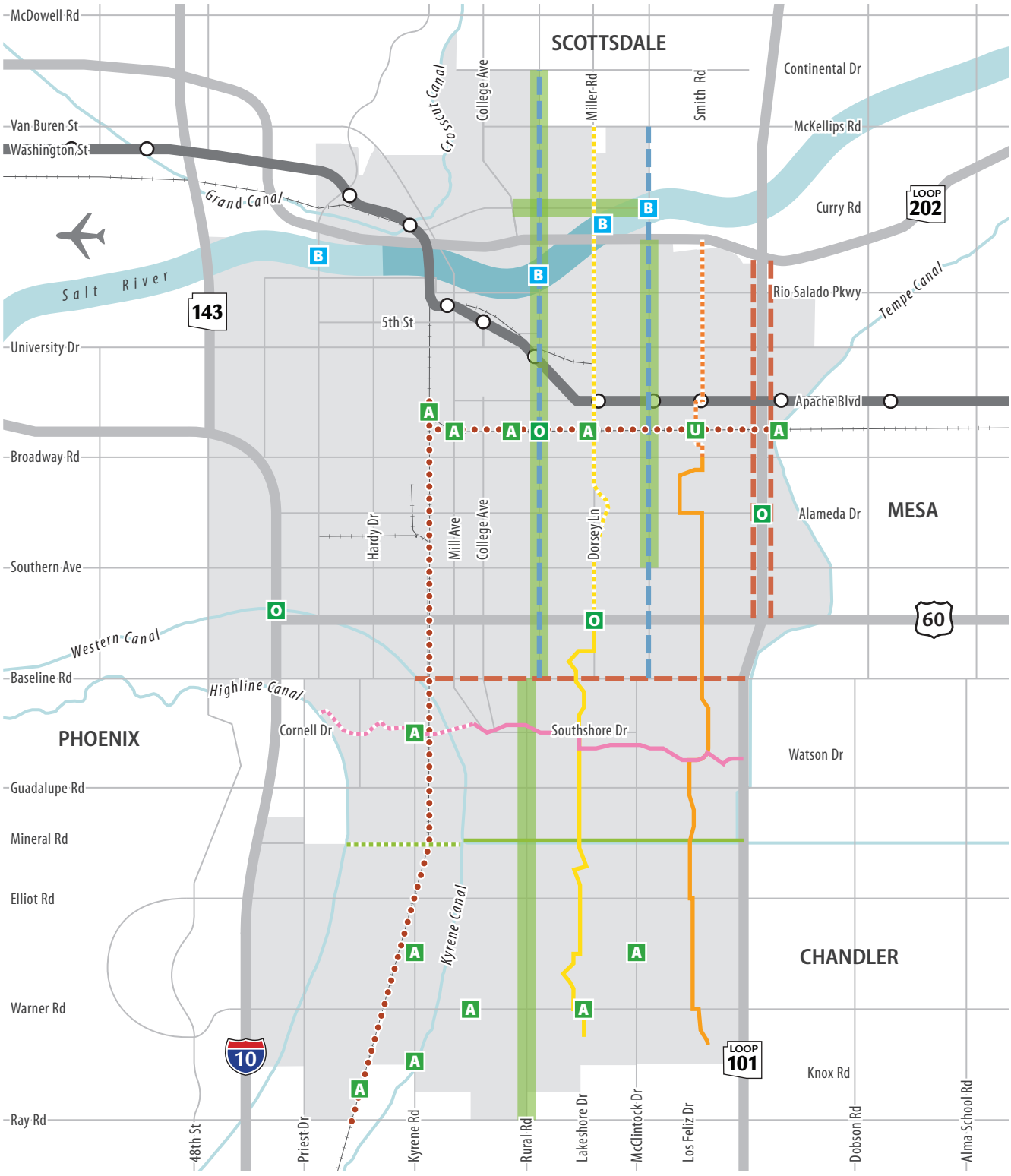
Source: City of Tempe, HDR 2014

Table 12: Recommended Bicycle Pedestrian Improvements 2020

PROJECT	TYPE	DESCRIPTION	COST ($1,000)
Bicycle Boulevard			
Sprocket (8th St/Orange)	BIKEiT bicycle boulevard	Pavement markings, signage, traffic management, crossings, landscaping, branding	688
Wheel (Alameda)	BIKEiT bicycle boulevard	Pavement markings, signage, traffic management, crossings, landscaping, branding	1,250
Handlebars (Hardy Kyrene Canal)	BIKEiT bicycle boulevard	Pavement markings, signage, traffic management, crossings, landscaping, branding	2,000
Pedal (College)	BIKEiT bicycle boulevard	Pavement markings, signage, traffic management, crossings, landscaping, branding	1,625
Seat (Knox)	BIKEiT bicycle boulevard	Pavement markings, signage, traffic management, crossings, landscaping, branding	1,250

PROJECT		TYPE	DESCRIPTION	COST ($1,000)
Bicycle/Pedestrian Crossing				
UPRR	@ Alameda	Improved crossing	At-grade	500
	@ Western Canal	New crossing	At-grade	500
Highline Canal	@ Guadalupe	New crossing	Mid-block	175
	@ Elliot	New crossing	Mid-block	175
	@ Warner	New crossing	Mid-block	175
Kyrene Canal	@ Warner	New crossing	Mid-block/HAWK	175
Rio Salado (South)	@ Priest	New crossing	Underpass	3,000
	@ McClintock	New crossing	Underpass	3,000
Alameda	@ I-10	New crossing	Overpass	7,000-10,000
Baseline	@ Western Canal	New crossing	Overpass or underpass	4,000
Warner	@ Lakeshore	Improved crossing	At-grade	500
McClintock	@ La Vieve	Improved crossing	At-grade	500
Multi-use Path				
Grand Canal	Center/Priest – Tempe/Phoenix border	Canal	0.75 mile multi-use path	1,125
Tempe Canal	UPRR – US 60	Canal	1.5 mile multi-use path	2,250
Highline Canal	Knox – Baseline	Canal	4 mile multi-use path	6,000
Western Canal	I-10 – 48th	Canal	0.5 mile multi-use path	750
Rio Salado (South)	Tempe – Mesa – ADOT	Rio Salado	2 mile multi-use path	3,000
Rio Salado (North)	Indian Bend Wash – McClintock	Rio Salado	0.5 mile multi-use path	750
8th St and Creamery Branch RR		Railroad	Multi-use path and streetscape	1,000
Center Parkway	Van Buren – Rio Salado (N)	Roadway/Rio Salado	Roadway/bicycle lanes/multi-use path	750
Lakeview	Curry – Washington	Rio Salado	Sidewalks	375
Bike Lanes/Buffered Bike Lanes				
McClintock	Baseline – Knox	Bike lanes		88
Mill	University – Baseline	Bike lanes		75
Curry	Mill – McClintock	Buffered bike lanes		63
Broadway	Phoenix border – Mill	Buffered bike lanes		113
Broadway	Rural – Mesa border	Buffered bike lanes		113
Priest	Washington – University	Buffered bike lanes		100
Southern	Phoenix border – Mesa border	Buffered bike lanes		275
Rural	Western Canal – Ray	Bike lanes		125

Figure 43: Recommended Bicycle Pedestrian Improvements 2040



Freeway
Light rail
Street
River
Canal

Improvement

Bike lane
Buffered or protected bike lane
Multi-use path
Bike boulevard (see Figure 45 for more detail)

B Improved bridge crossing
A New at-grade crossing
U New underpass
O New overpass

north

Source: City of Tempe, HDR 2014

Table 13: Recommended Bicycle Pedestrian Improvements 2040

PROJECT		TYPE	DESCRIPTION
Bicycle Boulevard			
Chain (Dorsey/Lakeshore)		BIKEiT bicycle boulevard	Pavement markings, signage, traffic management, crossings, landscaping, branding
Reflector (Country Club Way)		BIKEiT bicycle boulevard	Pavement markings, signage, traffic management, crossings, landscaping, branding
Spoke (Southshore)		BIKEiT bicycle boulevard	Pavement markings, signage, traffic management, crossings, landscaping, branding
Brake (Western Canal)		BIKEiT bicycle boulevard	Pavement markings, signage, traffic management, crossings, landscaping, branding
PROJECT		**TYPE**	**DESCRIPTION**
Bicycle/Pedestrian Crossing			
Rio Salado Upstream Dam		Grade-separated crossing	Bridge structure
UPRR	@ Mill	New crossing	At-grade
	@ McAllister	New crossing	At-grade
	@ Knox	New crossing	At-grade
	@ Bonarden	New crossing	At-grade
	@ Kenneth	New crossing	At-grade
	@ Country Club Way	New crossing	Underpass
	@ Tempe Canal	New crossing	At-grade
	@ Rural	Grade-separated crossing	Rural grade separation as part of Rural high capacity transit
Alameda/Balboa	@ Loop 101	New crossing	Overpass
US 60	@ Dorsey	New crossing	Overpass
Western Canal	@ I-10	New crossing	Overpass
Priest	@ Salt River	Improved crossing	Modified bridge structure
Rural	@ Tempe Town Lake	Improved crossing	Modified bridge structure
McClintock	@ Tempe Town Lake	Improved crossing	Modified bridge structure
Warner	Kyrene – Rural	New crossing	Mid-block
	Rural – McClintock	New crossing	Mid-block
Kyrene	Baseline – Guadalupe	New crossing	Mid-block
	Elliot – Warner	New crossing	Mid-block
	Warner – Ray	New crossing	Mid-block
McClintock	Elliot – Warner	New crossing	Mid-block
Multi-use Path			
UPRR	Mainline right-of-way	Railroad	Multi-use path
	North/south right-of-way	Railroad	Multi-use path
Bike Lanes/Buffered Bike Lanes			
Rural	Continental – Baseline	Bike lanes	
McClintock	McKellips – Baseline	Bike lanes	
Baseline	Kyrene – Loop 101	Buffered bike lanes	
Price	Loop 202 – US 60	Buffered bike lanes	

Getting to School Safely

Over the years, because of an increased perception that walking or biking to school is dangerous, many parents have resorted to driving their children to school every day; some schools require it.

The two most common concerns cited by parents are distance to school and traffic-related danger. Finding ways to improve these conditions so children will walk or bike will help increase physical activity during the school day, improve air quality by decreasing vehicular trips, and decrease the very congestion that causes parental concern.

The concept of Safe Routes to School began in Denmark in the 1970s and quickly expanded to Europe, Australia, Canada, and the United States. In 2005, Congress created a federal funding source for the program that continued until recent cuts in the transportation budget. While federal funding may be sporadic or nonexistent in the future, there are still many solutions that can be implemented with minimal funding.

Every school setting is unique, so any safety program must be tailored by those who know the area and circumstances best. Action can begin at any level or with any group of people; it does not need to be initiated by a school or municipality. A successful program will include parents, children, school personnel, law enforcement officers, and transportation and health professionals.

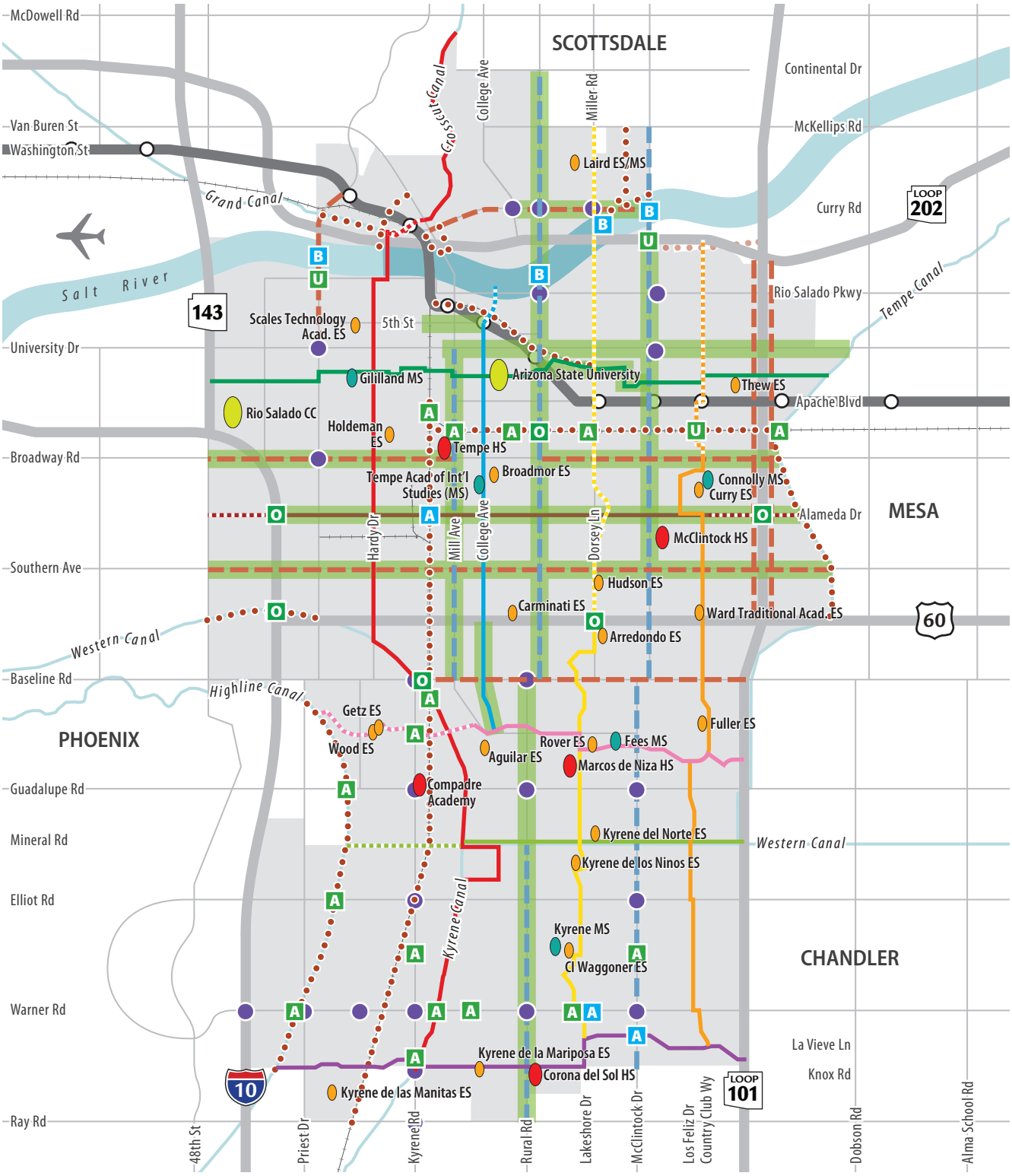
There are numerous resources available on the Web with examples, solutions and lessons learned, beginning with *saferoutesinfo.org*. Most program guidelines use the following basic steps:

1. Enlist the right group of people
2. Hold a kick-off meeting
3. Gather information and identify issues
4. Identify solutions
5. Develop a plan
6. Get everyone started
7. Over time, readjust as needed

The successful programs also have in common that they develop solutions in each of the following categories: Encouragement, Engineering, Enforcement and Education.

Figure 44 on page 85 illustrates future nonmotorized improvements in relation to Tempe's public schools.

Figure 44: Public Schools Relative to Nonmotorized Improvements



Freeway
Light rail
Street
River
Canal

School Type
Adult
High school
Middle school
Elementary school

Improvement
Bike lane
Buffered or protected bike lane
Bike boulevard
Multi-use path
Streetscape
Bike lane improvement at intersection
A Improved at-grade crossing
B Improved bridge crossing
A New at-grade crossing
U New underpass
O New overpass

north

Source: City of Tempe, HDR 2014

BIKEiT

Tempe has more than 175 miles of bikeways. As the system expanded, discussions occurred regarding the idea of naming the Tempe bicycle system and creating a wayfinding system for Tempe that further promotes the system and the ability to connect to desired destinations.

Naming the bicycle system included creating recognizable symbols for Tempe's preferred bicycle routes. These preferred bicycle routes are commonly referred to as bicycle boulevards. Bike boulevards are typically low-car-volume, low-speed streets with specialized bike treatments like bridges, striping, green paint, priority signal treatments, landscape and protected bike lanes. They are meant to connect bicyclists to all major parts of the community. This is similar to how the Orbit system connects to local bus routes and specific Tempe destinations. In the same way there are freeways, arterials and local streets, the bike system in Tempe has a variety of routes that have varying conditions. The bicycle boulevard concept does not replace current bike routes around Tempe; instead it simply provides another layer of facilities that are considered easier to use, even preferred to use. The Transportation Master Plan proposes to include bicycle boulevards into the long range plan for transportation in Tempe. Figure 45 on page 87 illustrates the BIKEiT locations.

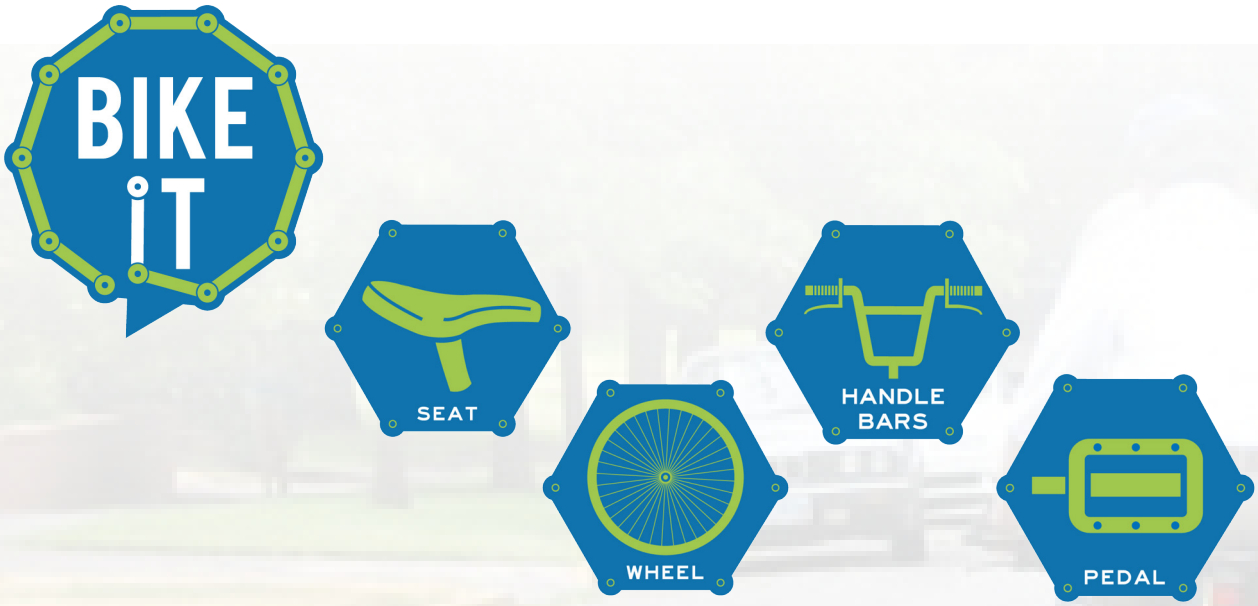
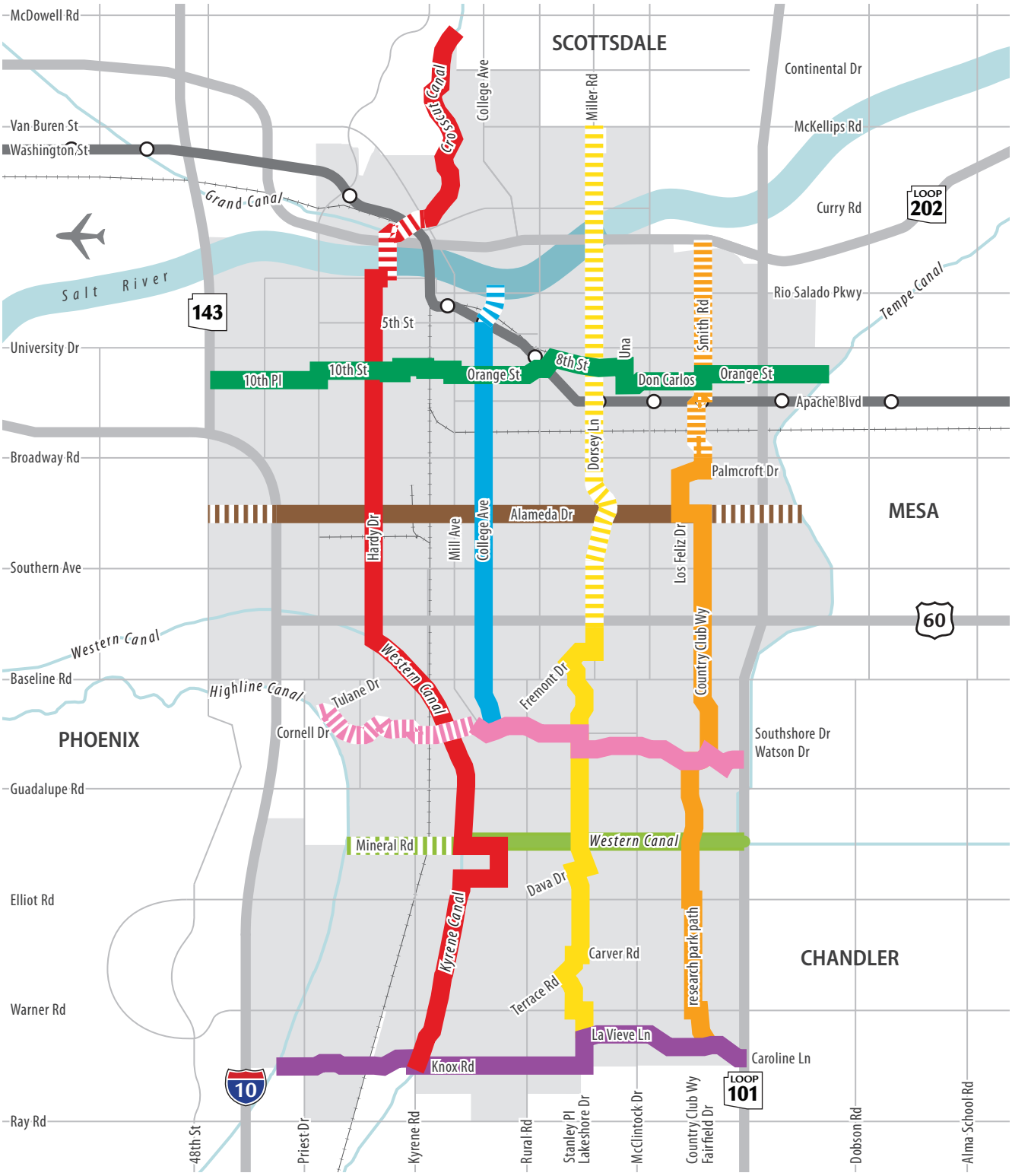
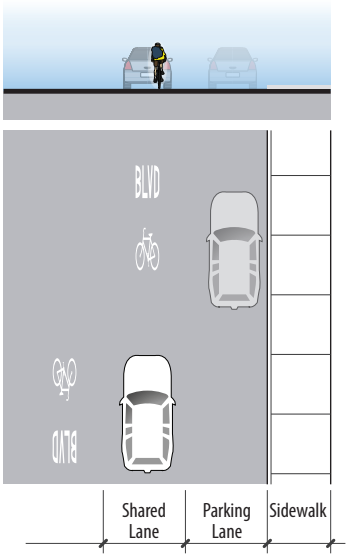


Figure 45: BIKEiT Routes



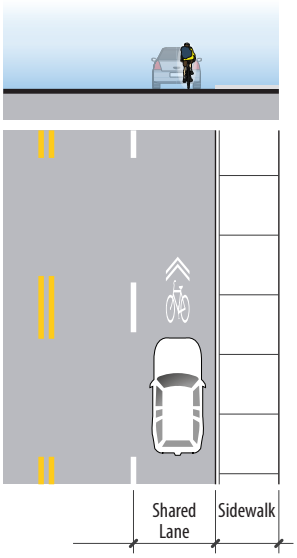
Source: City of Tempe, HDR 2014

Bicycle Facilities



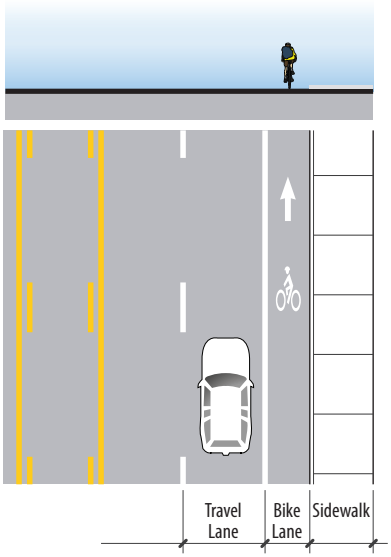
Bicycle Boulevard

Bike boulevards are streets optimized for bike traffic. They are typically low-volume, low-speed local streets with traffic calming enhancements such as speed humps, traffic circles, curb extensions or bicyclist-activated traffic signals at major street crossings. Vehicles may use the street but, because of the bicycle enhancements, travel at the same speed as the bicycles.



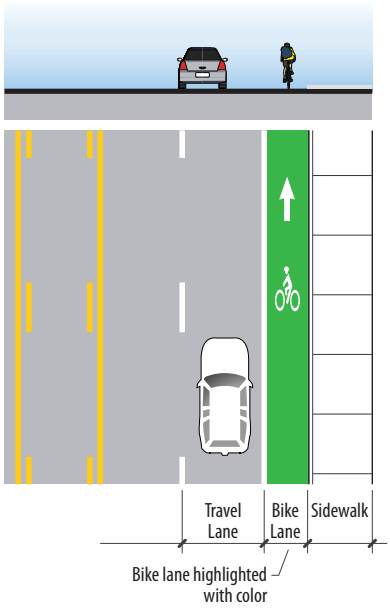
Shared Lane

Shared lanes, or sharrows, are used where low traffic speeds and volumes do not necessitate a separate bike lane. They should never be used to replace bike lanes on high-speed or high-volume streets. Vehicles travel behind bicycles until it is safe to pass.



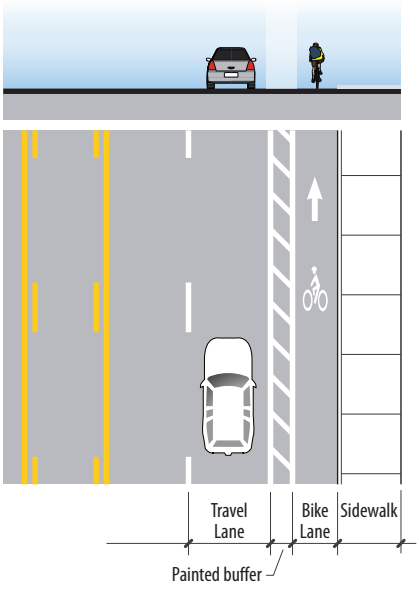
Bike Lane

Bike lanes are striped and signed lanes for bicycle traffic, and are typically used on arterial and collector streets. They provide a dedicated space on the street, marked by a solid white line and pavement symbols, for bicycles. These lanes are restricted to bicycles only except when vehicles need to cross over them to make a turn or access on-street parking, where the latter exists. However, bicyclists are not required by law to ride only in the bike lane; they may use other lanes.



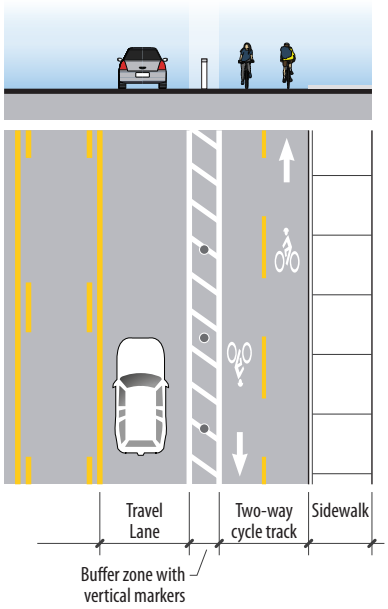
Colored Bike Lane

Colored bike lanes are used to highlight either the entire bike lane or locations where vehicles merge or turn across the bike lane. The color most often used is green.



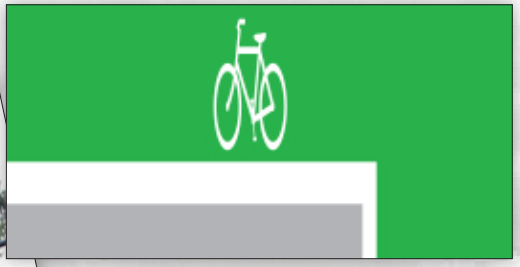
Buffered Bike Lane

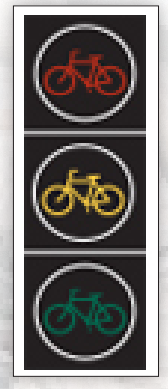
Buffered bike lanes, also typically used on arterial and collector streets, increase the space between the bike lane and travel lane. The buffer is typically 2 to 3 feet wide with diagonal hatches or chevrons.



Protected Cycle Track

A protected cycle track is a bike lane separated from the travel lane by a raised curb, median or parking lane. Cycle tracks provide a dedicated space for cyclists.





There are additional bicycle facility roadway options to those shown here, including two-way cycle tracks, multi-use off-street paths and contraflow bike lanes. Wayfinding signs, bicycle boxes, special bicycle settings for traffic signals and bicycle intersection markings can also improve bicyclists' experience and safety.

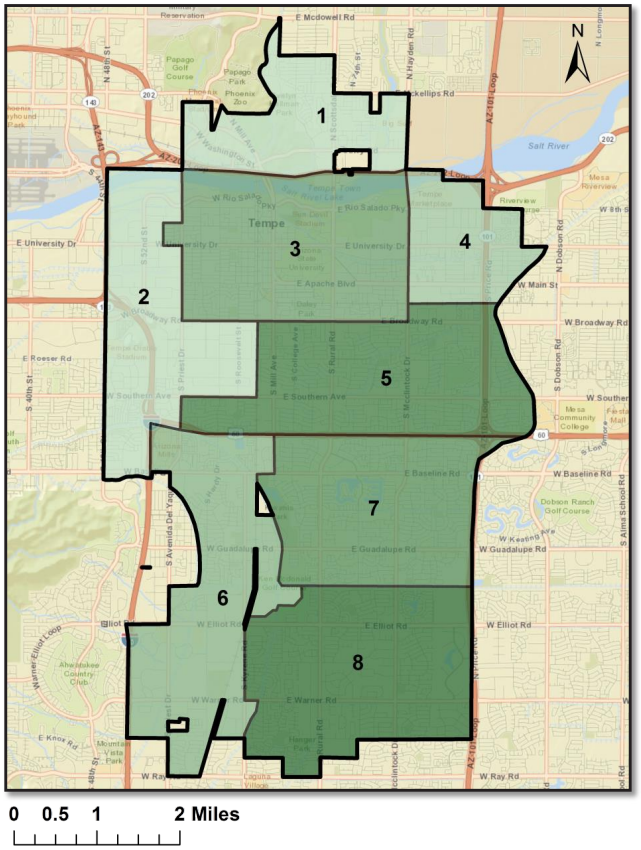
Pedestrian Facilities

Walking is a fundamental human activity. Most trips people make begin or end with walking, or are entirely a walking endeavor. Improving the pedestrian environment can lead to increased numbers of walking trips or longer trips. The pedestrian environment can be improved through the use of one or a combination of design considerations. A few of them are listed here.

- A path width that accommodates the anticipated volume of pedestrian traffic.
- A preferred 5-foot pedestrian zone clear of obstruction and intrusions that can be hazardous to persons with vision impairments. The clear pedestrian route should never be less than 36 inches which is the minimum for an accessible route.
- A firm, stable, and relatively smooth pavement surface.
- Good lighting.

Tree Canopy Cover in Tempe per Character Area

	Character Areas	canopy cover [%]	canopy cover [acres]
1	Papago/North Tempe	8.5	176
2	Diablo/Double Butte	8.5	262
3	Rio Salado/Downtown/ASU	12.1	461
4	Escalante/Marketplace	9.2	137
5	Central City/Shalimar	15.9	611
6	AZ Mills/Emerald Center	11.2	413
7	Kiwanis/The Lakes	15.4	531
8	Corona/South Tempe	20.5	827

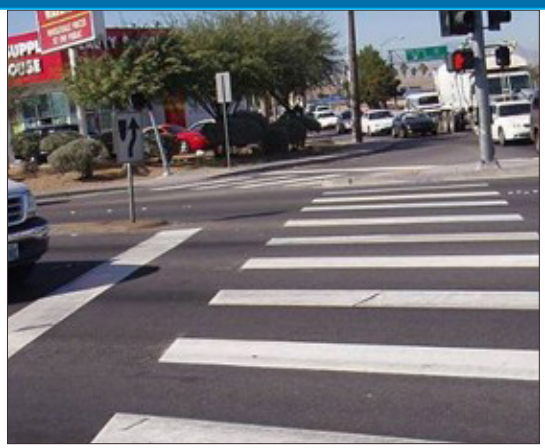


Percent Canopy Cover

1	2	4	6	3	7	5	8
8.5	8.5	9.2	11.2	12.1	15.4	15.9	20.5

The percent of tree canopy coverage is higher in southeast Tempe.

- A path that is shaded, either by trees or shade structures, particularly during summer afternoons.
- A buffer between high-volume and/or high-speed vehicular traffic and the path. The buffer can be a bike lane, parking, or landscape strip.
- Shortened roadway crossing distances at intersections and mid-block crossings.
- The addition of traffic calming features such as chicanes, bulb-outs, and speed tables.
- High-visibility crosswalks with a ladder or continental design painted with an epoxy material embedded with reflective glass beads.
- Amenities such as shaded benches or seatwalls, trash and ash receptacles, and wayfinding signs and kiosks.



High-visibilty crosswalks painted with reflective paint help motorists to see and yield sooner to people in the crosswalk.

A sidewalk buffered with a landscape strip and a bike lane.

Provide plenty of shade, especially on summer afternoons. Trees are good but built shade structures or awnings can also be used.

forms-surfaces.com

Ample site furnishings provide function and vitality to a space.

Tempe Transportation Master Plan

January 2015