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Memorandum

Date: Fall 2020

To: Andrew Bemis and Patrick Hartley, City of Tucson

From: Alta Planning + Design

Re: **Tucson Mobility Master Plan- Existing Conditions: Section A**

Introduction

The following memo presents the results of the Move Tucson existing conditions analysis. This assessment documents how people travel in Tucson today and what the existing conditions are for people traveling by foot, bike, bus, and car. The document is divided into two primary sections. **Section A** outlines the general process for completing the existing conditions analysis, including data sources, selected methodology, and key considerations. **Section B** presents the key findings of the analysis, including supporting statistics, maps, and charts. The Findings section is intended to inform the final Existing Conditions Report and recommendations developed as part of the Move Tucson plan process.

Section A: Analysis Process

The existing conditions analysis considers the variety of ways Tucsonans travel today. Not only does this include current patterns of travel, but it also addresses the condition and quality of the existing networks. A variety of analyses consider challenges and opportunities for walking, bicycling, driving, and taking transit in Tucson utilizing spatial data, demographic data, employment statistics, current use patterns, and site observations. Each mode is considered based on its unique characteristics and is also evaluated in conjunction with demographic, safety, and demand patterns.

The assessment uses data provided by the City of Tucson and Pima Association of Government; or sourced from the United States Census Bureau Longitudinal Employer-Household Dynamics (LEHD) and American Community Survey (ACS) programs. The specific process for each mode is explored below, including an overview of data limitations.

Demographics

Demographic data includes trends in population, employment, student, and visitor growth as well as characteristics of these groups to understand where certain populations are most highly concentrated, where employment opportunities are located, and seasonal variations in trends.

The Demographic Analysis first considers current population trends. As the City grows, a greater number of people will rely on the transportation network to get to where they need to go. Increasing economic

opportunities, a growing university population, and a flourishing tourism market further increase the demand on Tucson's existing network. A future vision for mobility in Tucson will need to consider this growth and how to increase options for traveling that can help reduce congestion on the city's streets.

However, not all Tucson residents have the same quality of access, resulting in disparities affecting travel to work, school, and other destinations. Studies from across the country routinely find that certain demographic groups typically face greater barriers than others in getting to the places they need to go, especially in communities designed primarily for motor vehicles.

These demographic groups include: people who identify as black, indigenous and people of color; youth; older adults; people with low incomes; people without a high school diploma; people with limited English proficiency; people without access to a motor vehicle; and people with disabilities.[1,2,3] Some barriers faced by these groups relate to historic patterns of injustice that have shaped the physical environment and negatively affected people's ability to reach jobs, services, and education, among other destinations. For example, highways and high-stress roadways have often been built through communities of color and through low-income communities, displacing residents and cutting people off from jobs and services. People in these demographic groups may also face barriers directly related to their age, disability, income, education level, and more.

Improving transportation options is critical to overcoming these barriers and responding to the needs of all Tucson residents. Transportation options, including traveling by car, public transportation, walking, or biking, provide connections to opportunity, allowing people to access jobs, services, education, and recreation.

The data informing the demographic analysis include the items outlined in Table 1 below.

Table 1: Data Sources for Demographic Data

Data	Description	Source	Assumptions/Limitations
Equity Indicators	Equity indicators, including race, age, income, educational attainment, access to a motor vehicle, limited English proficiency, and disability.	2017 ACS 5-year estimates	N/A
Population and Employment	Population and employment counts and projections	Pima Association of Governments	Note: Demand analysis and related measures utilize ACS data for spatial analysis purposes
University of Arizona Enrollment	10-year enrollment numbers for the University of Arizona	University of Arizona	N/A

[1] Dannenberg A, Frumkin H, Jackson R. *Making Healthy Places*. 1st ed. Washington D.C.: Island Press; 2011.

[2] International City/County Management Association. *Active Living for Older Adults: Management Strategies for Healthy & Livable Communities.*; 2003. http://www.ca-ilg.org/sites/main/files/file-attachments/resources_Active_Living.pdf. Accessed February 22, 2020.

[3] Mckenzie B. Modes Less Traveled—Bicycling and Walking to Work in the United States: 2008–2012. *Am Community Surv Reports*. 2014.

Data	Description	Source	Assumptions/Limitations
Airport Passengers	The number of passengers by month at the Tucson Airport	Tucson Airport Authority	N/A
Hotel Occupancy	Percent of Occupied Hotel Rooms	Visit Tucson	N/A

Transportation: Travel Patterns

This section provides an overview of current commute mode share, commute travel patterns, and comparisons to other peer cities. Commute travel pattern data includes average trip length, direction of travel, and in-flow and out-flow for employment opportunities.

Table 2: Data Sources for Travel Patterns

Data	Description	Source	Assumptions/Limitations
In-Flow/Out-Flow	This data describes the relationship Tucson residents and employees based on home and job location, including those who travel to Tucson for work, those who live and work in Tucson, and those who leave Tucson for work	U.S Census Longitudinal Employer-Household Dynamics, 2017	Data is provided by LEHD at the summary level and does not allow for further breakdown.
Direction of Travel	This data describes generally the distance and direction that Tucsonans are traveling for work.	U.S Census Longitudinal Employer-Household Dynamics, 2017	Data is provided by LEHD at the summary level and does not allow for further breakdown.
Commute Mode	This data describes the mode people use to travel to work most often.	2017 ACS 5-year estimates	This data does not capture non-work trips nor does it capture multi-modal trips.

To better understand this data and opportunities for improvement, commute patterns are compared to four peer cities. These cities, listed in Table 3 below, represent cities of similar population and/or geographic area[4], offer similar levels of public transportation service, and are located in the Sunbelt. These cities were also considered in the public transportation analysis below.

[4] Data for the cities listed in Table 2 were sourced from the US Census Bureau.

Table 3: Peer Cities

City	Population (2018 est.)	Area (Square Miles)
Tucson, Arizona	545,987	239
Austin, Texas	964,243	320
El Paso, Texas	686,686	257
Fresno, California	530,073	114
Albuquerque, New Mexico	560,234	187

Transportation: Safety

The safety analysis for the City of Tucson considers data from 2014 through 2018. This data documents locations and severity of crashes involving drivers (of motor vehicles and motorcycles), bicyclists, and pedestrians. The results of the safety analysis identify locations with high frequencies of crashes, where serious injury and/or fatal collisions occur most often, and reveal other patterns in the crashes occurring in the city, such as time of day. Table 4 below outlines the data used in this analysis:

Table 4: Data Sources for Safety Analysis

Data	Description	Source	Assumptions/Limitations
Crash Locations	Crash locations of all reported crashes in Tucson from 2014 to 2018, including mode and severity	Pima Association of Governments	Pedestrian- and bicycle-involved collisions were determined through use of field *Dsc_FirstHarm = PEDESTRIAN or PEDALCYCLE.* Intersection-related collisions were determined based on field *Dsc_JunctRel.*
Roadway Centerline	Location of roadways, including number of travel lanes and posted speed limit. This data support understanding of roadway characteristics where collisions occurred	City of Tucson; Pima Association of Governments	Speed, number of lanes and volume are maintained for major roadways only. Assumptions for local roadways were provided by the City of Tucson. Where lane miles are referenced, length of roadway is multiplied by provided or assumed lanes.

In this process, crashes were considered separately by mode as well as in combination to understand overall patterns, frequency, and location characteristics. It is important to note that this assessment includes only reported collisions. Bicycle and pedestrian crashes are often underreported, especially when they are of lesser severity; further the City of Tucson does not complete full reporting for property damage only collisions. For this reason, the data analysis may not fully portray the experience of these groups on the roadway.

Crashes located in close proximity (100 feet or less) were aggregated for display and analysis purposes, depicting areas with higher frequencies of crashes. Locations where serious injury or fatal collisions occurred are highlighted separately from all crash types to understand where improvements may be most needed to improve safety.

Transportation: Bicycling

The bicycle network in Tucson includes striped bike lanes, trails, greenways, signed routes, bicycle boulevards, and cycle tracks. Over 1,100 miles of designated bikeways of all types and comfort levels are currently present in the city; funding through Proposition 407 will fund implementation of an additional 100 miles of low-stress bikeways across the City.

To understand the relative comfort of the existing network, a Bicycle Level of Traffic Stress (BLTS) analysis was completed. Not only does this analysis demonstrate how stressful it is to travel along a roadway, it also reveals the impact that major roadway crossings have on connectivity. Building on methodology defined by the Mineta Institute[5] and further developed by Peter Furth[6], the BLTS examines the relative comfort of traveling along and across roadways.

This analysis considers the following elements:

- Motor Vehicle Speed
- Number of Travel Lanes
- Motor Vehicle Volumes
- Bicycle Facility Presence and Width
- Signal Location

When considered together, these factors score roadways on a four-point scale. An LTS 1 represents the lowest stress pathway and is typically considered appropriate for all ages and abilities. An LTS 4 designates roadways that are highest stress and typically not comfortable for a bicyclist of any level. Bicycle boulevards and trails are most often considered BLTS 1 (lowest stress), while arterials and other high speed, high volume roadways are considered BLTS 4 (highest stress).

BLTS results are one tool to identify where and what types of improvements can increase connectivity and comfort of a bicycle network. For example, lowering roadway speeds, increasing separation of the bicyclist from motor vehicles, and designating crossings can all improve overall comfort of the bicycle network. Table 5 below outlines the data used in this analysis, along with limitations and assumptions.

Table 5: Data Sources for Bicycle Analysis

Data Element	Description	Source	Assumptions/Limitations
Roadway Centerline	Location of roadways, including number of travel lanes, volume, and posted speed limit	City of Tucson; Pima Association of Governments	Speed, number of lanes and volume are maintained for major roadways only. Assumptions for local roadways were provided by the City of Tucson

[5] *Low-Stress Bicycling and Network Connectivity.* Mineta Transportation Institute. 2012. https://transweb.sjsu.edu/sites/default/files/1005-low-stress-bicycling-network-connectivity.pdf

[6] Furth, Peter. *Level of Traffic Stress Criteria for Road Segments, Version 2.0.* 2017. http://www.northeastern.edu/peter.furth/wp-content/uploads/2014/05/LTS-Tables-v2-June-1.pdf

Data Element	Description	Source	Assumptions/Limitations
Existing Bike Facilities	Location of bike routes, bike lanes, trails, bicycle boulevards, and cycle tracks.	Pima Association of Governments	Data does not include facility width; assumption of 5 feet is used for bicycle lanes. Benefit is provided only when bike lanes measure 6 feet wide or greater and have posted speed of 30mph or less.
Signal Locations	Location of standard traffic signals and bicycle/pedestrian signals	City of Tucson	N/A
Bicycle User Counts	Manual user counts at various locations conducted annually between 2015 and 2019. Counts are collected for bicycle and pedestrian activity.	Pima Association of Governments	Data displayed in report is for most recent year, weekday counts. Historical data may be taken into account in the network development process. This data is not integrated into the BLTS analysis.

Additional Data Limitations

The methodology utilized in this analysis includes options for a more robust understanding of roadway configuration and its impacts on bicycle travel. Specifically, data delineating right turn lane locations, turn lane length, and interaction with bicycle lanes can illuminate additional challenges for a complete, connected bicycle network. Right turn lane data is not available for the City of Tucson, and this assessment was not included. Future data collection efforts should consider documenting these locations for a more robust analysis of the bicycle network.

Transportation: Walking

Tucson's current pedestrian network is comprised of sidewalks, gravel and dirt pathways, and trails. Some areas around the city have relatively complete sidewalks, and some areas feature wide sidewalks and well-shaded pathways. In many locations, however, sidewalks may not be continuous or connected; when present, they may be narrow, in need of repair, or located immediately adjacent to high speed roadways.

To better understand the relative quality of the existing sidewalk network, an assessment of the relative safety and comfort of the pedestrian network was completed. This analysis, similar to the BLTS noted above, provides insight into where improved facilities may better support pedestrian travel. It evaluates relative comfort along roadways based on motor vehicle speed, volume, and provision of dedicated pedestrian space. Roadways that include bike lanes are also considered, as they provide additional separation between motor vehicles and pedestrians.

In general, higher speed roadways with higher volumes of motor vehicles and limited sidewalks are least comfortable. Low-speed, low-volume roadways with complete sidewalks will be most comfortable and typically suitable for people walking of all ages. It should be noted that this assessment is not intended to evaluate ADA compliance. Understanding access for people of all abilities requires additional data and analysis. The following table outlines the data used in this analysis, including any required assumptions.

Table 6: Data Sources for Pedestrian Analysis

Data	Description	Source	Assumptions/Limitations
Roadway Centerline	Location of roadways, including number of travel lanes and posted speed limit	City of Tucson; Pima Association of Governments	Speed and number of lanes are maintained for major roadways only. Assumptions for local roadways were provided by the City of Tucson
Sidewalks	Location of sidewalks along roadways based on sidewalk centerline. Data includes width and surface type	Pima Association of Governments	Sidewalk data at this level of detail is only available for major roadways. Only sidewalks 4 feet wide or greater and with surface types of asphalt or concrete were included.
Pedestrian User Counts	Manual user counts at various locations conducted annually between 2015 and 2019. Counts are collected for bicycle and pedestrian activity.	Pima Association of Governments	Data displayed in report is for most recent year, weekday counts. Historical data may be taken into account in the network development process. This data is not integrated in the PLTS analysis.

Additional Data Limitations

Details regarding sidewalk width and surface type are available for limited number of roadways—specifically major roadways, some local roadways, and frontage roads. The PLTS analysis considers only those areas where sidewalk data with this level of specificity was available. Data was manually coded to the roadway centerline where sidewalk lines meeting the standards noted in Table 6 above were present along the entire length of the roadway segment. Percentages of roadway with sidewalk present are based on roadway centerline mileage.

Transportation: Public Transportation

Sun Tran provides nearly 80 million miles of service annually, reaching residents across the greater Tucson region with local bus, express bus, streetcar, shuttle, paratransit and on-demand service. The range of public transportation options include support for weekday late-night service while reaching a significant number of households and jobs in the region. The *Regional Long-Range Transit Plan*, completed in early 2020, identifies opportunities to improve trip times, increase the number of residents with easy access to frequent routes, and improve weekend service.

Building on this information, the existing conditions analysis also considers current bus stop quality, ridership demographics, and areas of highest demand to provide greater understanding of how the public transportation network can best integrate with other modes of travel. The data used in this analysis include the items outlined in Table 7.

Table 7: Data Sources for Public Transportation Analysis

Data	Description	Source	Assumptions/Limitations
Public Transportation Routes	Route information, including frequency, for bus, shuttle, paratransit, and street car service, as applicable	City of Tucson	N/A
Public Transportation Stops	Stop locations for bus and street car service; includes details on amenities of each stop	City of Tucson	N/A
Ridership Data	Boarding information for stops and routes within the SunTran network	City of Tucson	N/A
Transit Agency Profiles and Data	Data regarding status and performance of peer city agencies and City of Tucson	Federal Transit Authority National Transit Database	N/A
Population and Employment	2017 estimates for population and employment in Tucson	U.S. Census Bureau LEHD and ACS	N/A

Transportation: Driving

A complete transportation network will support a variety of ways to get around and provide choices to all residents. Driving can support longer trip distances, access to further reaching destinations not served well by transit, or trips taken in non-traditional hours. When considered in conjunction with walking, biking, and public transportation, a system that provides options can be more efficient, safer, and more useful for all.

The assessment of the driving-focused network considers vehicle volumes, roadway capacity, and surface conditions. Utilizing data from PAG on existing volumes and capacity as well as 2045 projected volumes (no build scenario), the analysis focuses on identifying pinch points in the network and opportunities to better utilize the existing investment in roadways. Table 8 outlines these data sources.

Table 8: Data Sources for Driving Analysis

Data Type	Description	Source	Assumptions/Limitations
Roadway Centerline	Location of roadways, including number of travel lanes, posted speed limit, and surface quality measures.	City of Tucson; Pima Association of Governments	Speed and number of lanes are maintained for major roadways only. Assumptions for local roadways were provided by the City of Tucson
Traffic Volume	Existing and projected volumes as determined by the Regional Travel Demand Model	Pima Association of Governments	N/A

Transportation: Shared Mobility

TUGO Bikeshare and the e-scooter pilot program have introduced shared mobility options for Tucsonans, particularly within the central city. While these modes travel along the same networks as bikes and motor vehicles, they provide additional options for residents and visitors. Shared mobility options can help alleviate the need for a motor vehicle for shorter trips, encourage more active trips, and help connect people to a broader range of destinations. As part of the Move Tucson planning process, shared mobility options should be considered as part of Tucson's mobility future. For the purposes of the Existing Conditions Analysis, locations, trip patterns, and overall ridership were considered to better understand current demand.

Table 9 outlines the data sources support this analysis.

Table 9: Data Sources for Shared Mobility

Data Element	Description	Source	Assumptions/Limitations
TUGO Station Locations	Locations of TUGO stations, including number of docking locations	City of Tucson	N/A
e-Scooter Pilot Trip Data	Data regarding e-Scooter Pilot ridership, trip locations, and fleet for both Razor and BIRD	City of Tucson; Populus Data Manager	Ridership and fleet numbers were calculated as of February 20, 2020

Transportation: Demand

The above focus areas for analysis provide insight into demographic and modal patterns as well as safety concerns across the transportation network. These analyses describe the current systems but do not specifically consider to where people travel today or would like to travel. Where people live, work, play, access transit, go to school, and shop can help inform common origins and destinations across the city. Areas where these destinations are located in close proximity are considered areas of high demand and may have greater potential for active, shared, or public transportation-based trips. Clusters of destinations can indicate opportunities for developing more walkable communities through pedestrian improvements.

The data sources informing this analysis are outlined in Table 10 on the next page.

Table 10: Data Sources for Demand Analysis

Data	Description	Source	Assumptions/Limitations
Population and Employment	Population and Employment densities by block group	2017 ACS and LEHD	N/A
Schools	School locations, including universities and K-12 schools	City of Tucson	Schools are weighted based on level and potential for shorter, active trips; elementary schools and colleges are weighted higher
Trails	Trail locations as a recreational destination	City of Tucson	N/A
Parks	Park locations, including neighborhood and regional parks	City of Tucson	N/A
Public Transportation and Bike Share	Bus stops, street car stops, and bike share stations	City of Tucson	Bike share station were included in this measure. High frequency buses were weighted higher than standard service.
Shop	Density of commercial locations, as determined by retail employment codes	LEHD	N/A

Special Topics: Stormwater and Green Infrastructure

With minimal stormwater infrastructure, many of Tucson's roadways provide stormwater conveyance in major storm events. The presence of rain water along the roadway impacts not only travel along that route by bicycles, pedestrians, and motor vehicles; it also affects roadway quality and maintenance needs. Storm events often result in debris in shoulders and bike lanes, and flowing water can further deteriorate the roadway surface.

Research and investment into Green Stormwater Infrastructure (GSI) have helped divert stormwater in some locations, while supporting an increase in tree canopies. The City of Tucson and its partners have recently identified funding sources for increasing GSI throughout the City, particularly in coordination with other capital projects. The data listed in Table 10 below was considered as part of this preliminary assessment.

Table 10: Data Sources for Special Topic Analysis

Data Type	Description	Source	Assumptions/Limitations
Roadway Centerline	Location of roadways	City of Tucson	N/A
Flood Plain	Areas within the 100-year flood plain, as identified by FEMA	FEMA	N/A
Tree Canopy	Approximate canopy coverage by census blocks	PAG	N/A
Washes	Wash locations with flow rate	City of Tucson	N/A

Section B: Results

The attached results report outlines key findings from the analyses listed Section A. This information is intended to highlight current conditions in Tucson, and when combined with results from public engagement and scenario development, will help inform project and program recommendations.

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Existing Conditions

FALL 2020

Executive Summary

The following document evaluates Tucson's existing transportation network, considering who uses it, the quality of the networks, and opportunities for improvement. This analysis is informed by spatial data, site observations, previous planning efforts, and economic and demographic data. The results of this analysis will inform project recommendations, in coordination with public and stakeholder engagement.

The results of the existing condition report suggest significant opportunity for improving transportation options across Tucson. The findings indicate a need to increase mobility options in areas that are underserved by the current system, reduce rates of serious injuries and fatalities across all modes, leverage existing investments through maintenance, repair, and closing network gaps; and mitigate future congestion through providing additional transportation choices, making operational improvements to the system, and investing in key mobility corridors. Tucson benefits from a roadway network with limited congestion and excess capacity, a vast network of minor roads that can support multimodal connections, lower drive-alone commute rates than some peer communities, a high percentage of residents living and/or working within a 10 minute walk of frequent public transportation, and relatively short commute distances for a large portion of the daytime population.

Move Tucson project recommendations will carefully consider both the data presented here as well as the needs of the public expressed through public engagement activities to create a transportation system that reflects Tucson's values and vision for the future.

Growth in Jobs, Population, Students, and Visitors

While the Tucson region is not growing as quickly as once projected, Tucson continues to see a steady increase in both population and jobs. Current projections anticipate an 11% increase in population and 32% increase in jobs over the next 25 years. Combined with a growing student population and tourism industry, the City of Tucson and nearby communities will witness increased demand on the transportation network. Move Tucson will seek to meet growing demand by increasing the efficiency of Tucson's transportation system through modernizing the street network and improving opportunities to walk, bike, and take public transportation.

Travel Patterns and Travel Options

Today, most of Tucson's workforce drives alone to work, over 60% of whom travel less than 10 miles. The average commute time for Tucson workers across all modes is 22.4 minutes, comparable to similar sized peer cities. A significant number of workers also travel into Tucson each day from nearby communities, resulting in a 25% increase in Tucson's daytime population. This means that each work day, Tucson experiences a significant uptick in traffic, with more cars traveling through the city to reach economic opportunities; however, shorter-distance trips may be an opportunity to increase the use of more efficient and sustainable modes and reduce strain on Tucson's streets. Today, only 2% report bicycling to work, while 3% walk and 3% take transit, which likely reflects a legacy of auto-centric development patterns and a low level of investment in pedestrian, bicycle, and public transportation networks compared to motor vehicle investments.

Safety

Transportation safety is a significant concern in Tucson. Between 2014 and 2018, there were more than 29,000 reported crashes on Tucson's streets, resulting in more than 270 deaths. While the rate of serious injuries and fatalities for drivers and passengers has declined, the rate of severe injury and fatal collisions have increased for bicyclists and pedestrians. In 2019 alone, 39 pedestrians were killed on Tucson's roadways, representing over 50% of all traffic fatalities. This is despite only being involved in less than 4% of all crashes.

Community Characteristics: Destination Density Analysis

Not all transportation options will be equally effective throughout the city. Tucson includes a range of land use contexts, from more dense urban development to lower-density rural development. This land use context, including consideration for where people are traveling from and to, will impact the potential success of different transportation solutions. For example, high quality bicycle and pedestrian networks can provide more travel options for shorter trips. This report analyzes the potential demand for biking and walking trips by evaluating the density and proximity of where people live, work, learn, shop, play, and access transit. The highest areas of demand, when coupled with high-quality infrastructure, have the potential to support the greatest diversity of mobility options to get to daily destinations.

Community Characteristics: Equity

Using demographic data, this report assessed Census block groups with higher concentrations of historically disadvantaged and vulnerable populations. More than 20% of Tucson's population is located in areas identified as higher need. Households in these communities tend to have lower access to private automobiles, therefore relying more on public transportation, walking, and biking for daily trips; experiencing longer commute times; and facing longer distances to reach safe crossing opportunities.

As the City of Tucson seeks to support increased transportation options and improve safety of its streets, it is also important to consider how Tucson's mobility future can best meet the needs of all residents. Historic and systemic inequities have limited access to economic opportunity, influenced where investment occurs, and have been reinforced through development patterns over time, making it more difficult for people living in high need areas to get around.

Transportation System Assessment

Tucson's transportation system is comprised of roadways, including multimodal travel lanes and freight routes; bicycle infrastructure, including shared use paths, protected bike lanes, bike lanes, bicycle boulevards, and signed routes; sidewalks and unpaved paths for pedestrians; and public transportation options including local bus routes, express bus routes, and the streetcar. The quality and reach of each of these systems varies by mode and location:



Bicycle and Pedestrian

Over half of major roadways in Tucson lack complete sidewalks, and 41% of major streets are considered to be high stress for pedestrians due to limited sidewalks, high travel speeds, and large volumes of motor vehicles. Similarly, nearly 70% of major streets are also considered high stress for people who bicycle. Neighborhood streets provide opportunities for low-stress travel for people walking and biking when safe crossings are provided at major roadways. Opportunities for improvement include closing gaps in network infrastructure while also prioritizing a complete, connected network of high-quality bicycle and pedestrian facilities.



Public Transportation

Public transportation options are available across most of the city. The transit system serves more than 56,000 daily riders, outperforming many peer cities. Highest ridership routes include Routes 8, 11, 16, 4, and 18. Currently, 11 routes in the City of Tucson operate on frequencies of 15 minutes or less between 6:00 a.m. and 6:00 p.m., comprising the frequent transit network. However, many areas of the city are not currently served by frequent routes, and weekend and evening service is limited. Further it's important to consider the ease and comfort of accessing local bus stops. Limited benches, shelter, and lighting in addition to limited crossings opportunities and poor quality or incomplete sidewalks can discourage those who may choose to use public transportation and increases the stress and difficulty for those who rely on this mode.

Motor Vehicles

This analysis looked at current and future projected traffic volumes and congestion on major corridors, which revealed that there is and will continue to be excess road capacity in many areas. In 2019, only 9% of the road network was congested during the busiest hour. Without any capacity investments this is projected to increase to 21% by 2045. Congestion is not distributed uniformly across the network. Areas of high current and future congestion will be evaluated for opportunities to minimize travel delay. Where there is excess capacity, there is an opportunity to re-envision how some major streets are used to support improved opportunities for all modes.

Freight

In addition to commutes or trips to reach services and other destinations, it's important to also consider the other roles that Tucson's roadways have. For example, Tucson's roads support local and regional freight, as do the railway running through the city. While most regional freight travels along Interstate 10, local deliveries and goods from the region's mining and related industries also rely on major roadway in the city. Proposed transportation networks will consider opportunities to both improve safety for other road users as well as reduce opportunities for conflict and delay of freight traffic.

Special Topics

Tucson's roadways are in significant need of repair, with 68% of local roadways and 15% of major roadways in very poor or worse condition. Tucson's roadways also play an important role for stormwater management. Particularly in the summer monsoons, major and local roadways carry and store stormwater. During large storm events, flooding of roadways impacts route options, and the presence of stormwater also negatively affects roadway quality. Ongoing regional efforts to improve green stormwater infrastructure should be considered as part of this plan to identify opportunities for all weather networks.

Growth in Jobs, Population, Students, and Visitors

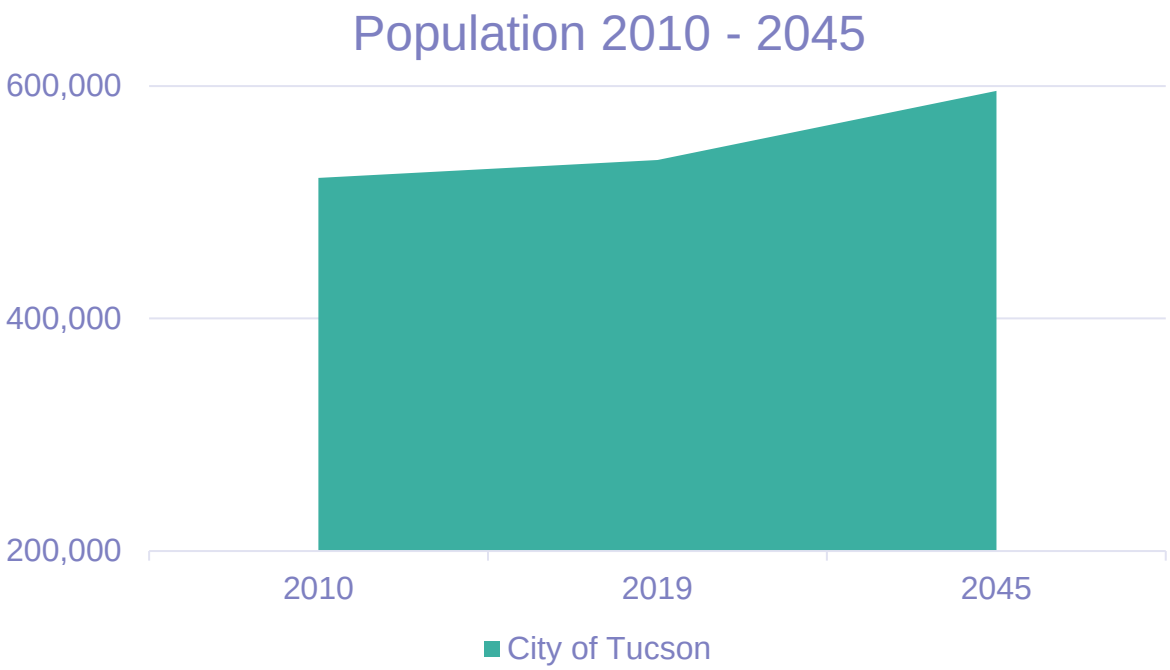
The City of Tucson and the larger region are continuing to grow. Increasing job opportunities, a growing University of Arizona enrollment, and a flourishing tourism market are resulting in increased demand on the City's transportation network. Although the rate of growth has slowed from past projections, the region's population is anticipated to grow by 17% and jobs by nearly 30%. While the growing population is more dispersed across the region, nearly 75% of all new jobs are expected to be in Tucson.

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GROWTH IN POPULATION

3%

increase in population over past 10 years



11%*

increase in Tucson's population over next 25 years; the region will grow by 17%.

1,528

new residents every year over past 10 years

2,380

new Tucson residents every year over next 25 years

**This data represents economic growth projects prior to the COVID-19 pandemic.*

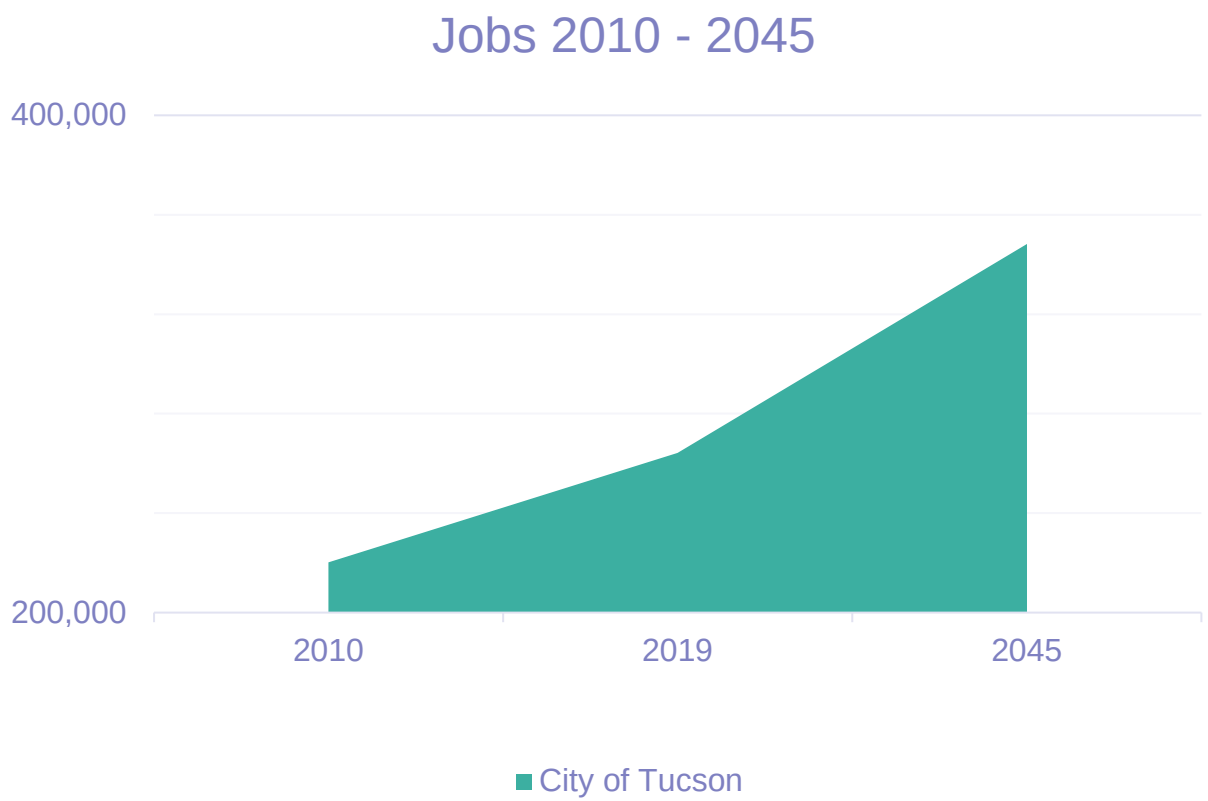
GROWTH IN JOBS

20%

increase in jobs over past 10 years

4,401

new jobs every year over past 10 years



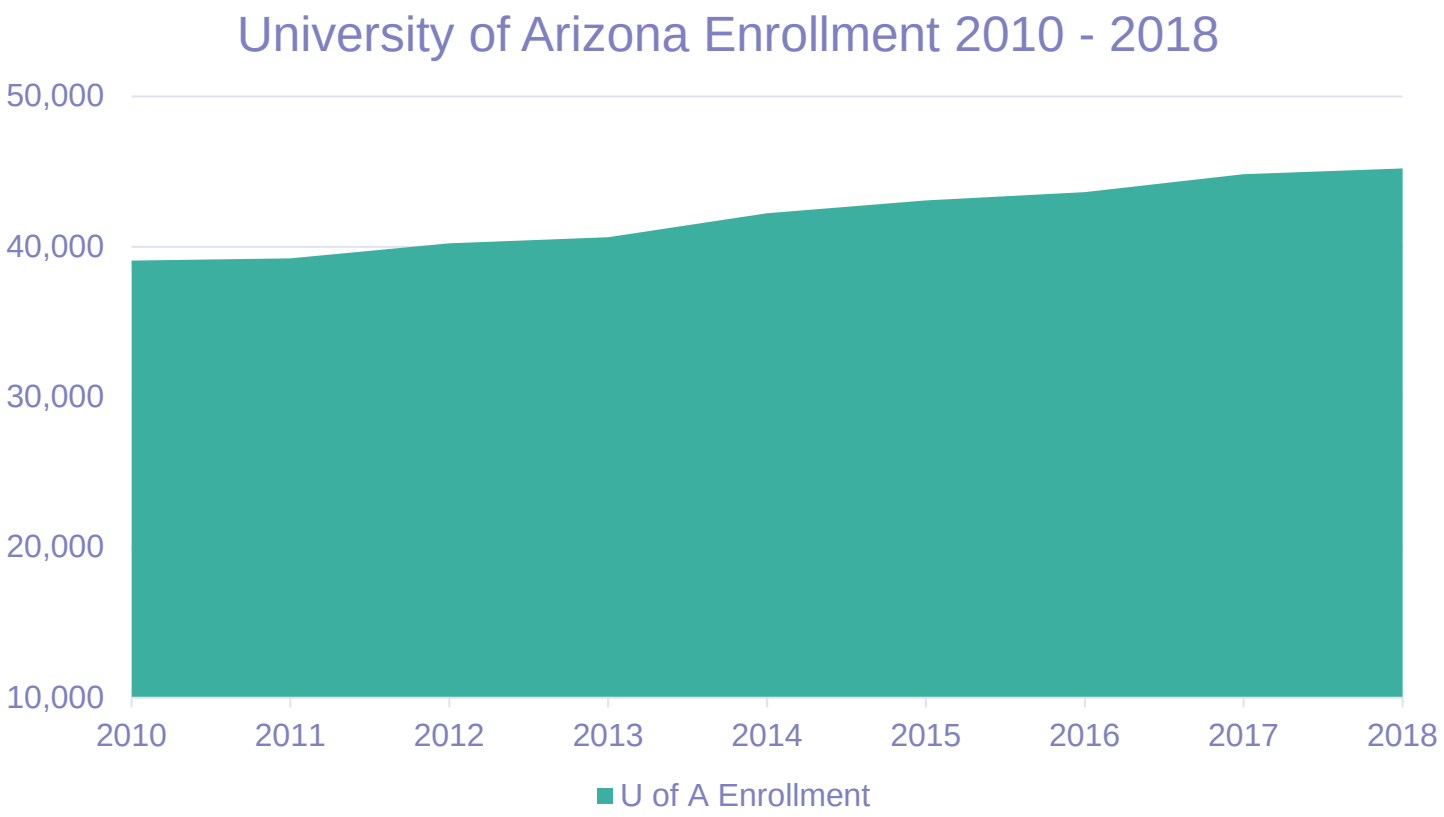
32%

increase in jobs over next 25 years. This represents nearly 75% of all new jobs in the region.

3,360

new jobs every year over next 25 years

GROWTH IN STUDENTS



17%

increase in enrollment over past 10 years

4%

increase in City population over past 10 years

GROWTH IN VISITORS

Visitors to the region are increasing. Hotel occupancy rates and Tucson Airport Passengers continue to grow, with cooler months of the year seeing the largest number of visitors.

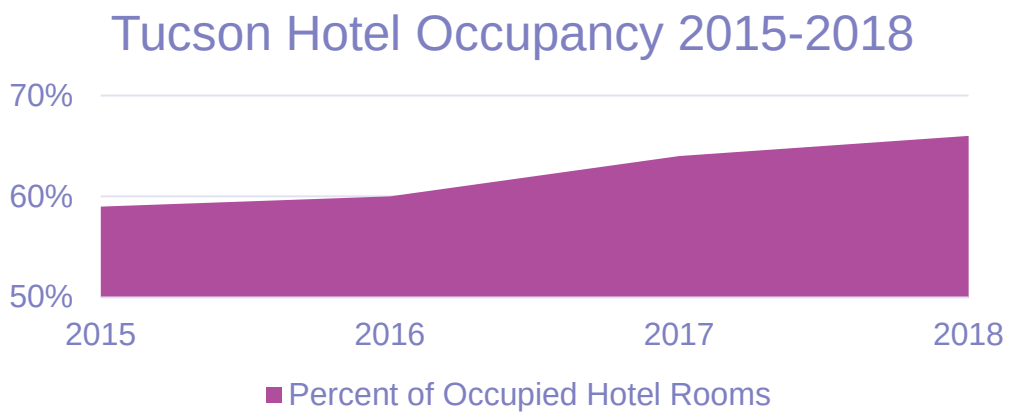
While reasons to visit Tucson vary, the City also hosts several large events that bring people from across the world to the Southwest, including the Gem Show, El Tour de Tucson, and the Tucson Festival of Books.

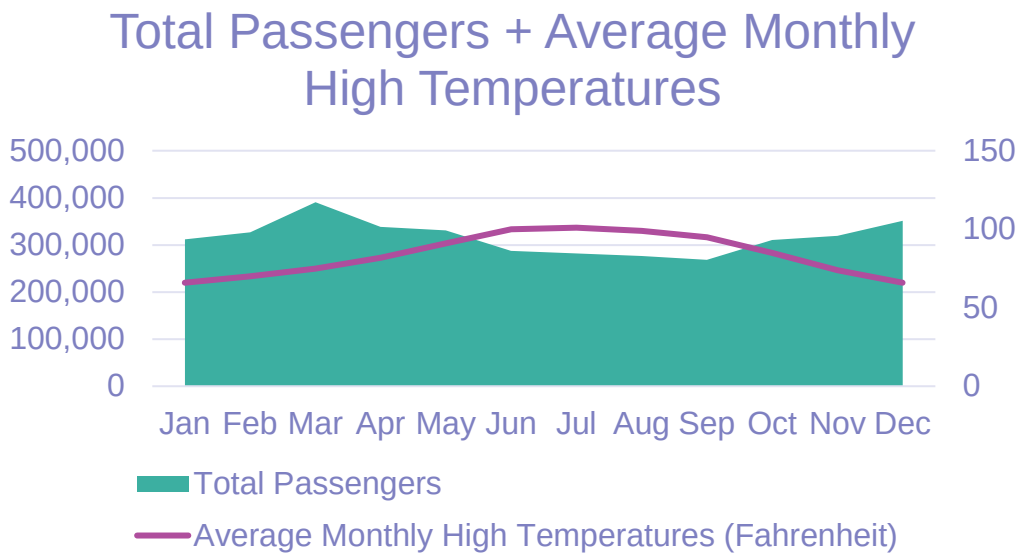
7%

increase in hotel occupancies in past 4 years

24%

increase in peak season passengers at Tucson Airport over past 5 years





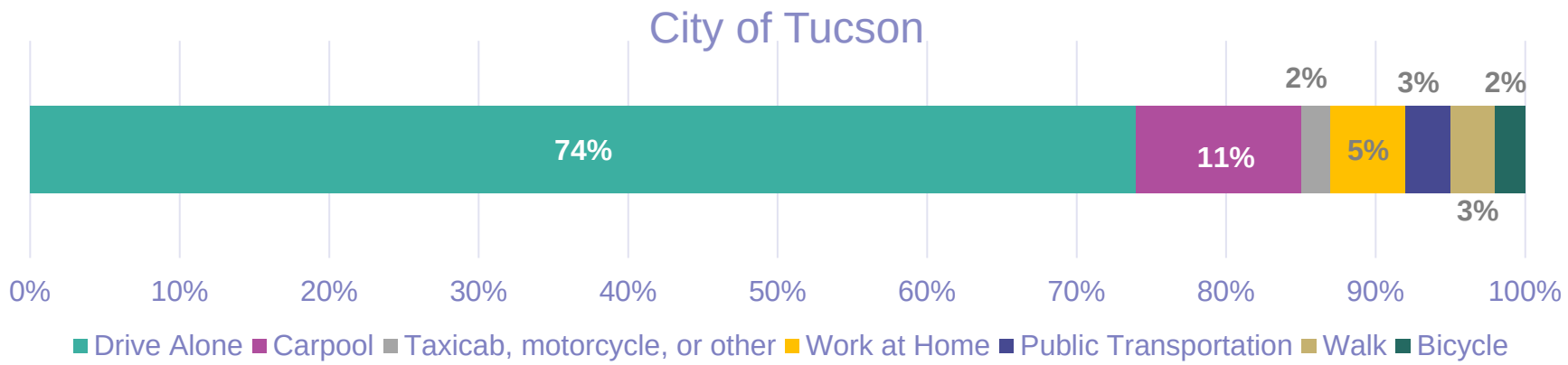
Travel Patterns and Travel Options

Economic opportunities are dispersed across the region, resulting in varied trip lengths and modes. Each day, Tucson's population increases nearly 25% as residents from outside Tucson travel into the city for work. Although the majority of commute trip distances are relatively short (under 10 miles), nearly a quarter of those working in Tucson travel at least 50 miles to reach their place of employment.

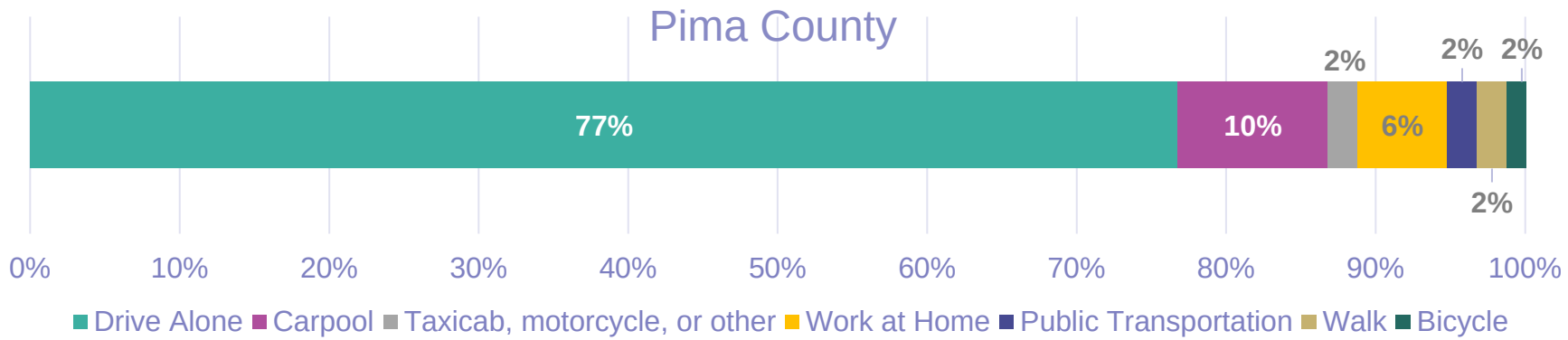
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DELIVERING MOBILITY CHOICES

REGIONAL COMMUTE MODE SHARE

The majority of Tucson workers drive alone to work.

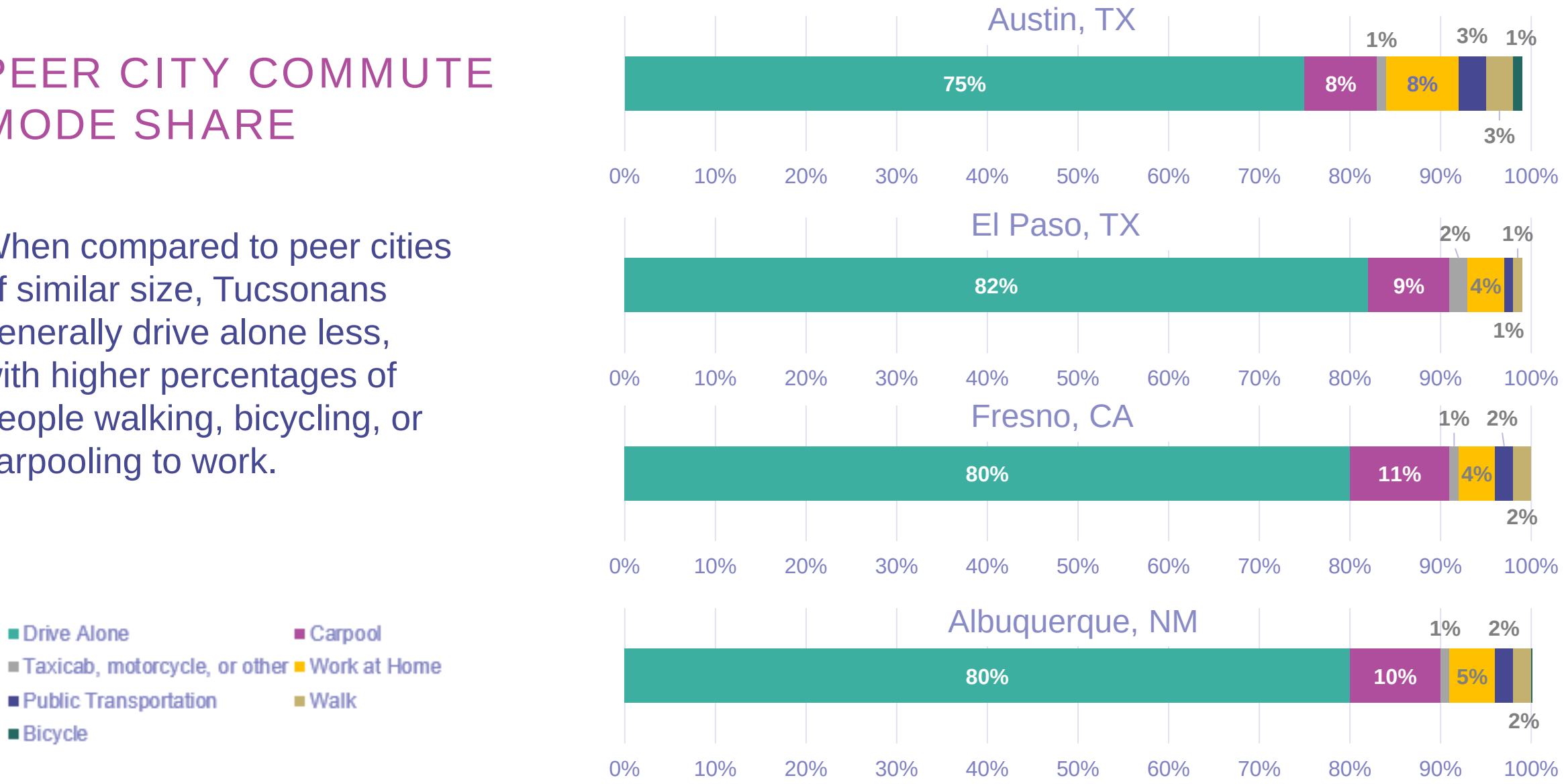


This is similar to commute rates across Pima County as a whole.



PEER CITY COMMUTE MODE SHARE

When compared to peer cities of similar size, Tucsonans generally drive alone less, with higher percentages of people walking, bicycling, or carpooling to work.



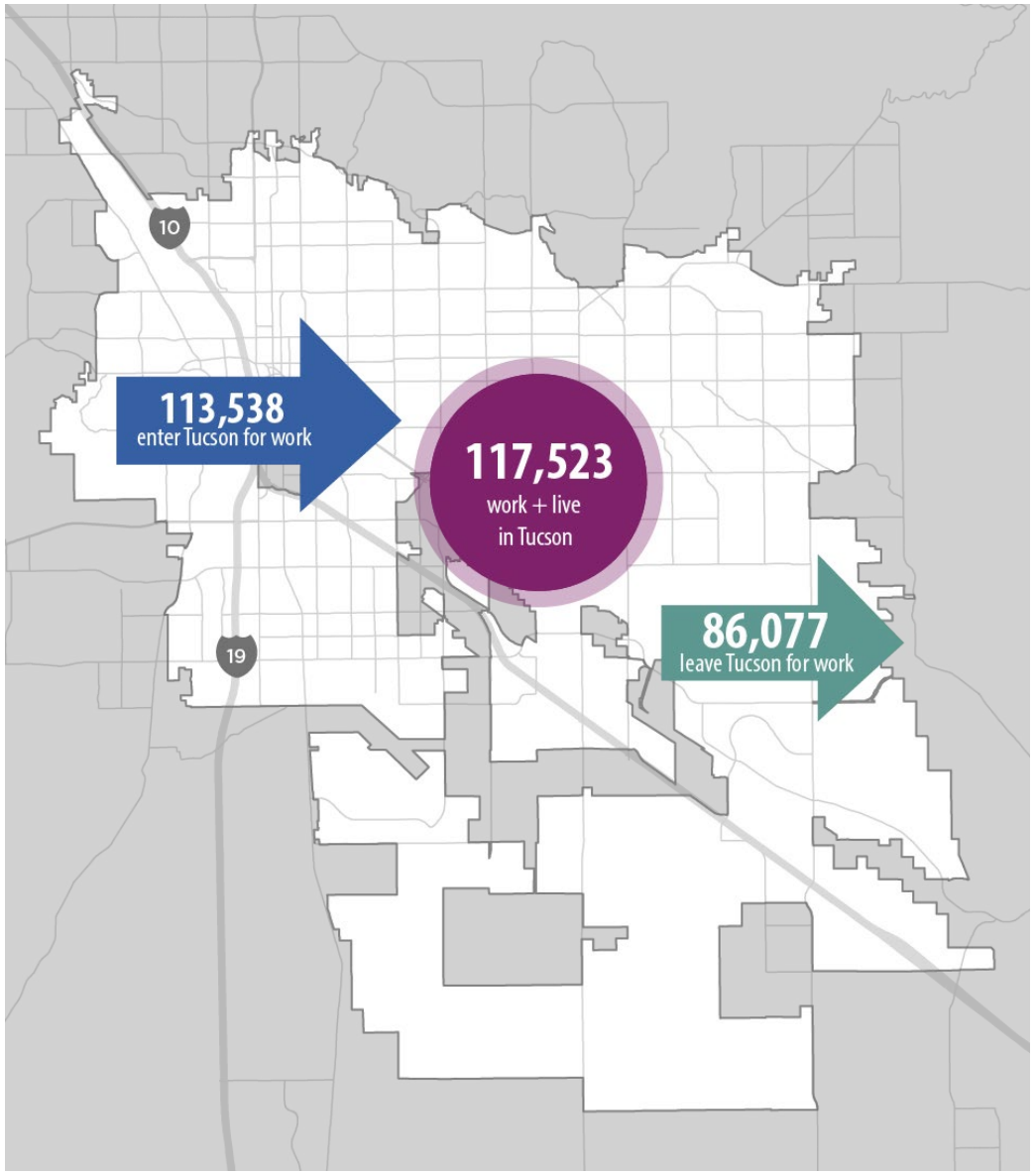
DAYTIME POPULATION INCREASE

While many people live and work within Tucson, over 85,000 workers travel outside of Tucson to reach their place of employment.

However, nearly 114,000 people travel into the city each work day, resulting in an overall increase in the city's daytime population and a significant number of people relying on Tucson's streets to access economic opportunities.

25%

increase in City's daytime population



COMMUTE TIMES

Workers living in Tucson have shorter average commute times, while those living further away have longer commute times.

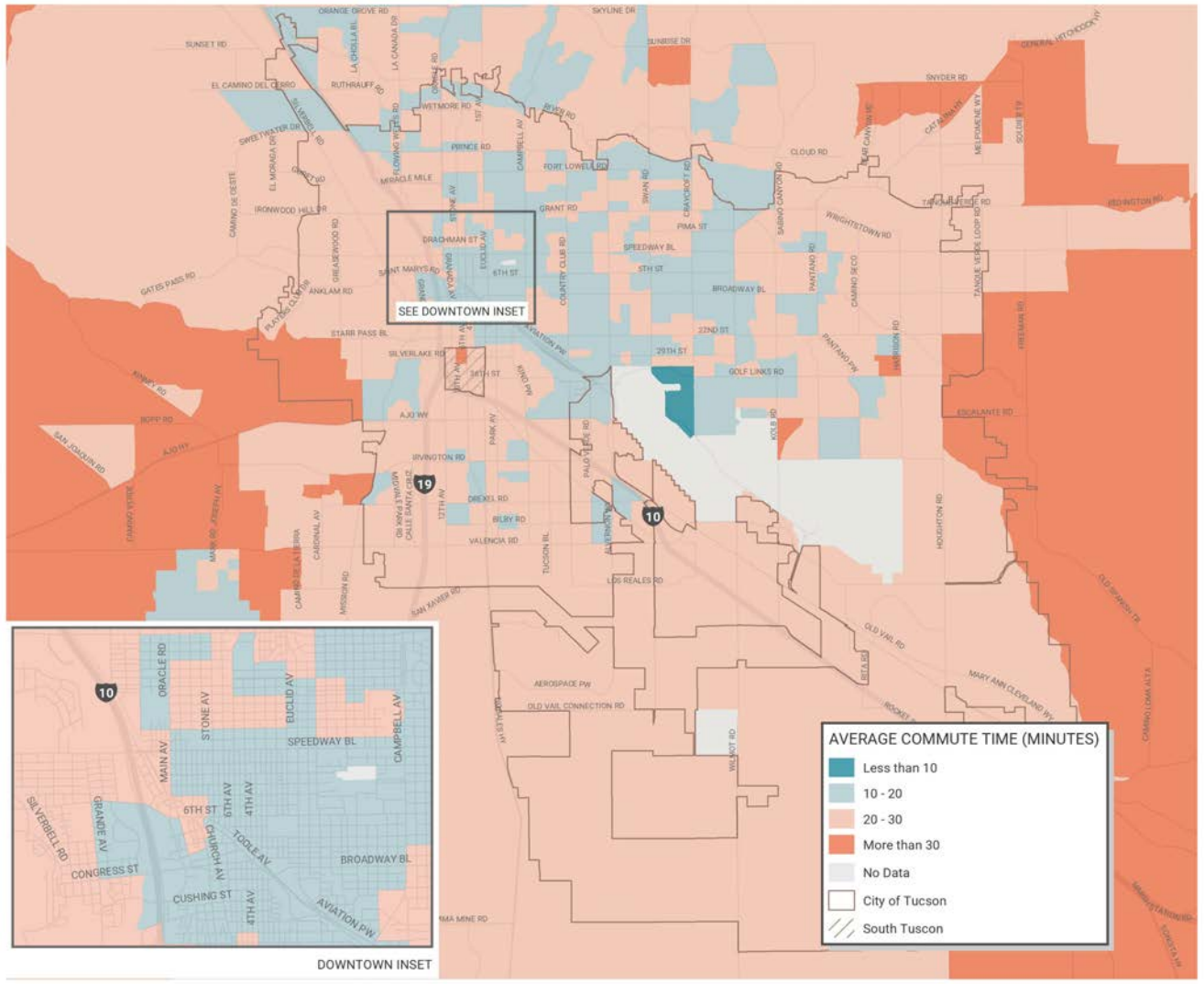
The average commute time for Tucsonans is

22.4

minutes

48%

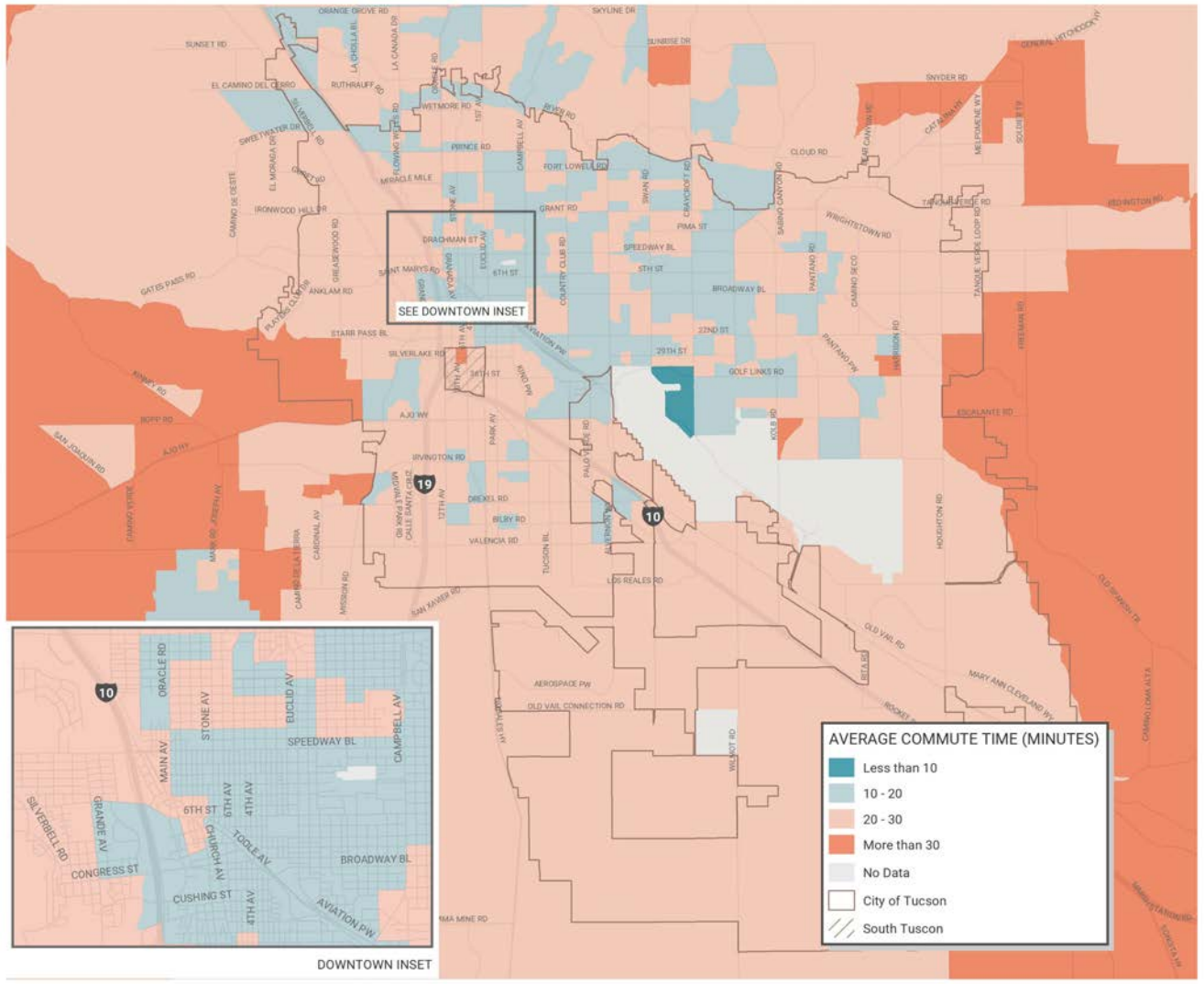
of people working in Tucson have a commute time of less than 20 minutes



COMMUTE TIMES

Tucson's average commute time is comparable to peer cities of similar size:

- **Austin, TX:** 24.3 minutes
- **El Paso, TX**: 22.8 minutes
- **Fresno, CA:** 21.8 minutes
- **Albuquerque, NM:** 21.6 minutes
- **Phoenix, AZ:** 25.7 minutes



Community Development Patterns and Characteristics

Understanding where people live, work, play, access transit, go to school, and shop can help shape a transportation system that gets people where they need to and want to go efficiently. Further, understanding areas where disadvantaged or vulnerable populations live and work can guide investments to where they may provide the greatest benefit. The maps that follow assess these centers of relative demand and identify areas most supportive of expanding mobility choices.

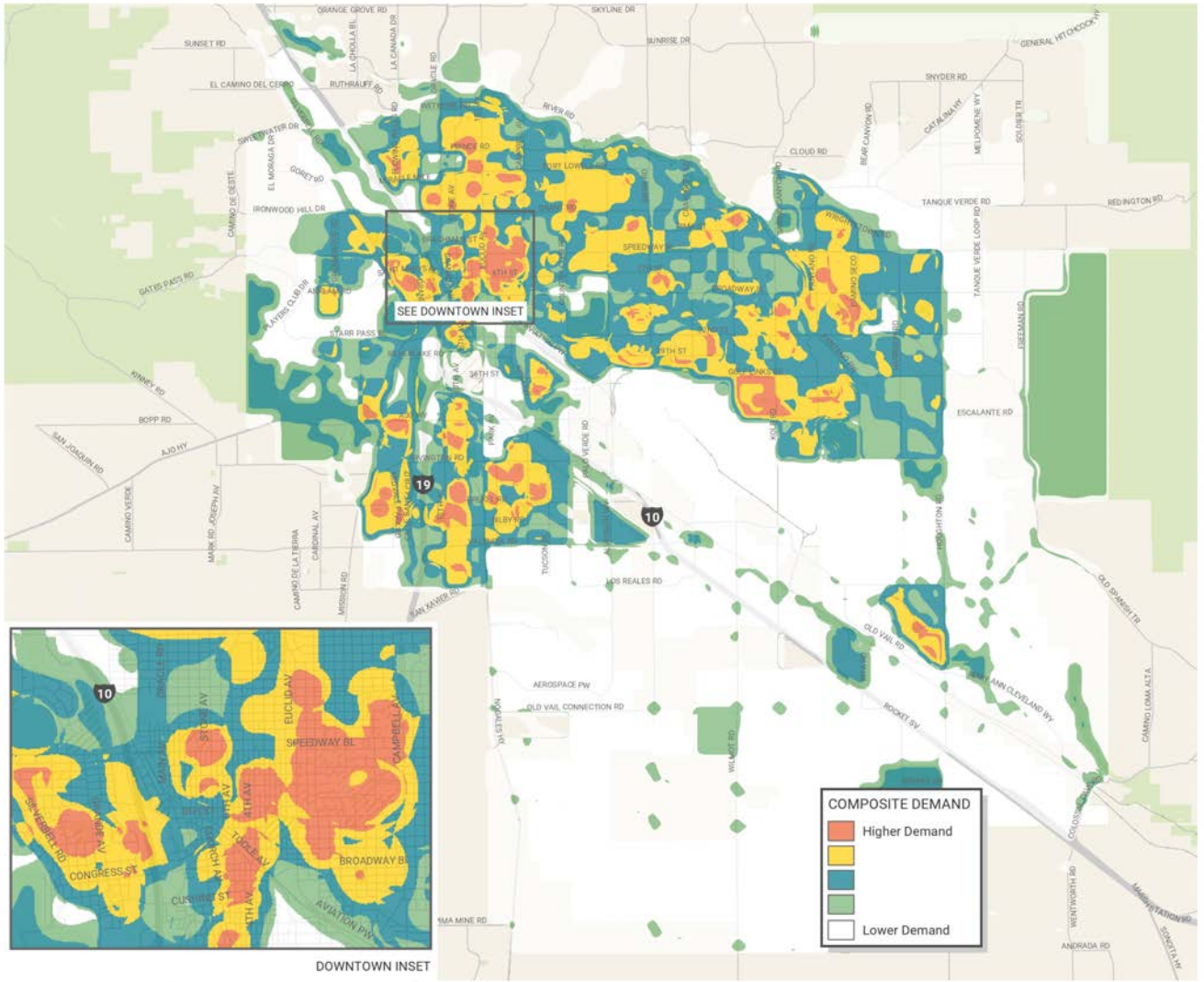
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DELIVERING MOBILITY CHOICES

DESTINATION DENSITY ANALYSIS

Areas of high demand are located where there are greater densities of origins (where people live) and destinations (where people are going).

Demand considers:

- Employment Density
- Population Density
- Retail Density
- Parks + Trails
- Public Transportation + Bikeshare
- Schools



DESTINATION DENSITY ANALYSIS

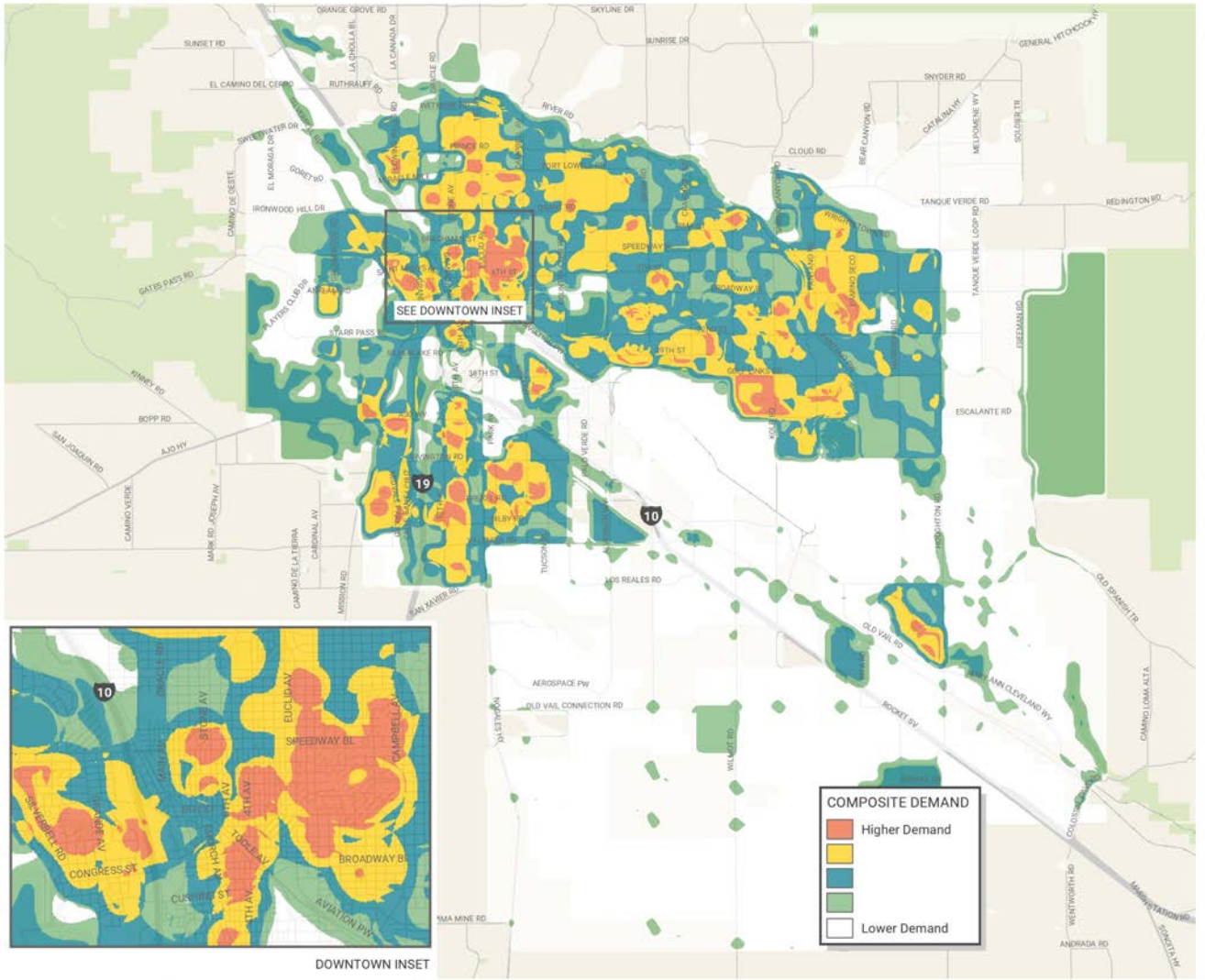
Areas of highest demand are shown in orange and yellow. These areas, when combined with high quality infrastructure, have the potential to shift shorter trips away from personal vehicles and to walking and biking, including connections to public transportation.

68%

of people working in Tucson work within areas with high potential for walking and biking.

77%

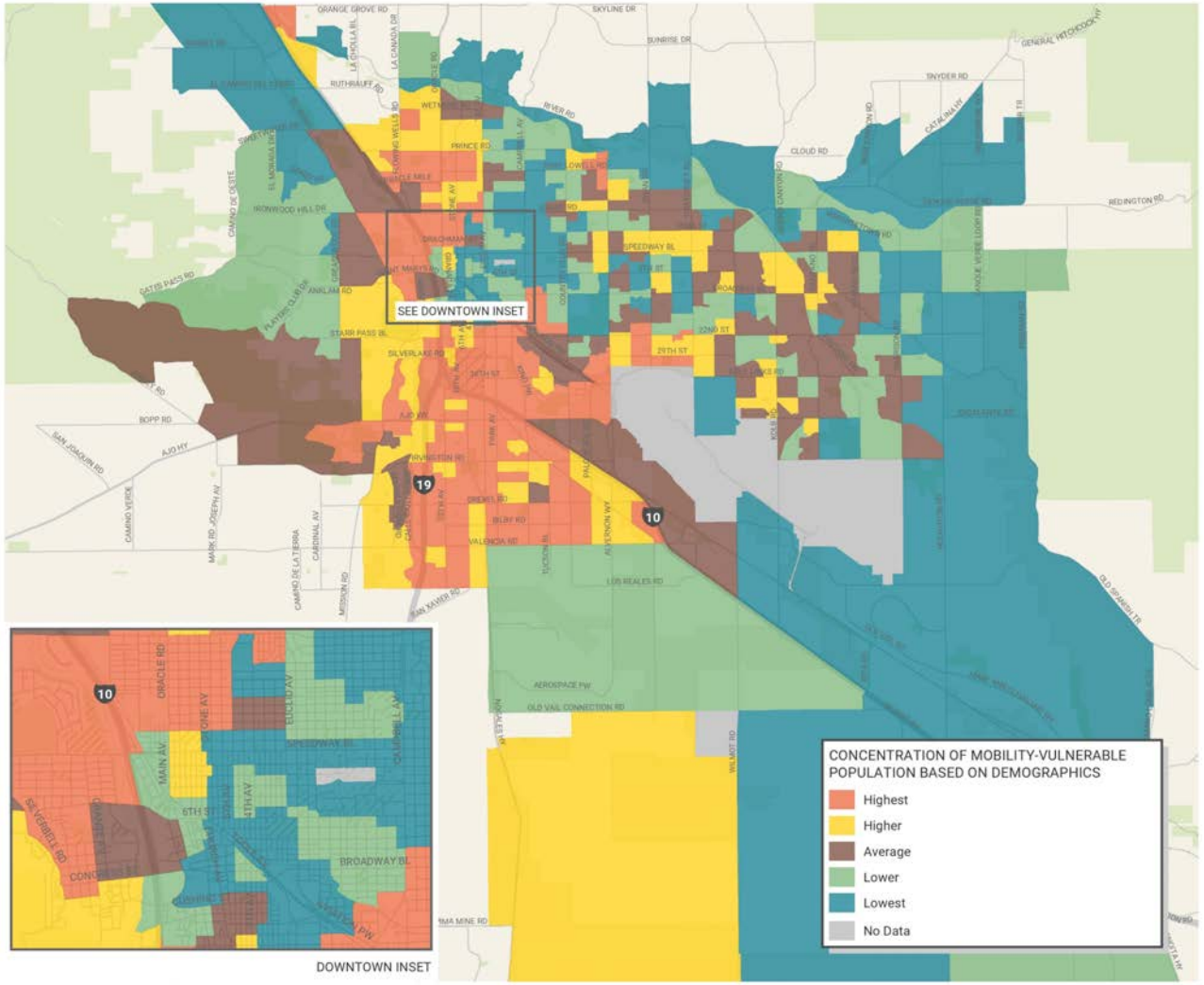
of Tucson residents live within areas with high potential for walking and biking



EQUITY – WHERE PEOPLE LIVE AND WORK

Historic and systemic inequities have limited access to economic opportunity, influenced where investment occurs, and have been reinforced through development patterns over time, resulting in fewer ways to get around and a greater reliance on motor vehicles.

In addition, our youngest and oldest populations are more vulnerable to conflicts with motor vehicles and are more likely to rely on other ways to get around than driving.



EQUITY – WHERE PEOPLE LIVE AND WORK

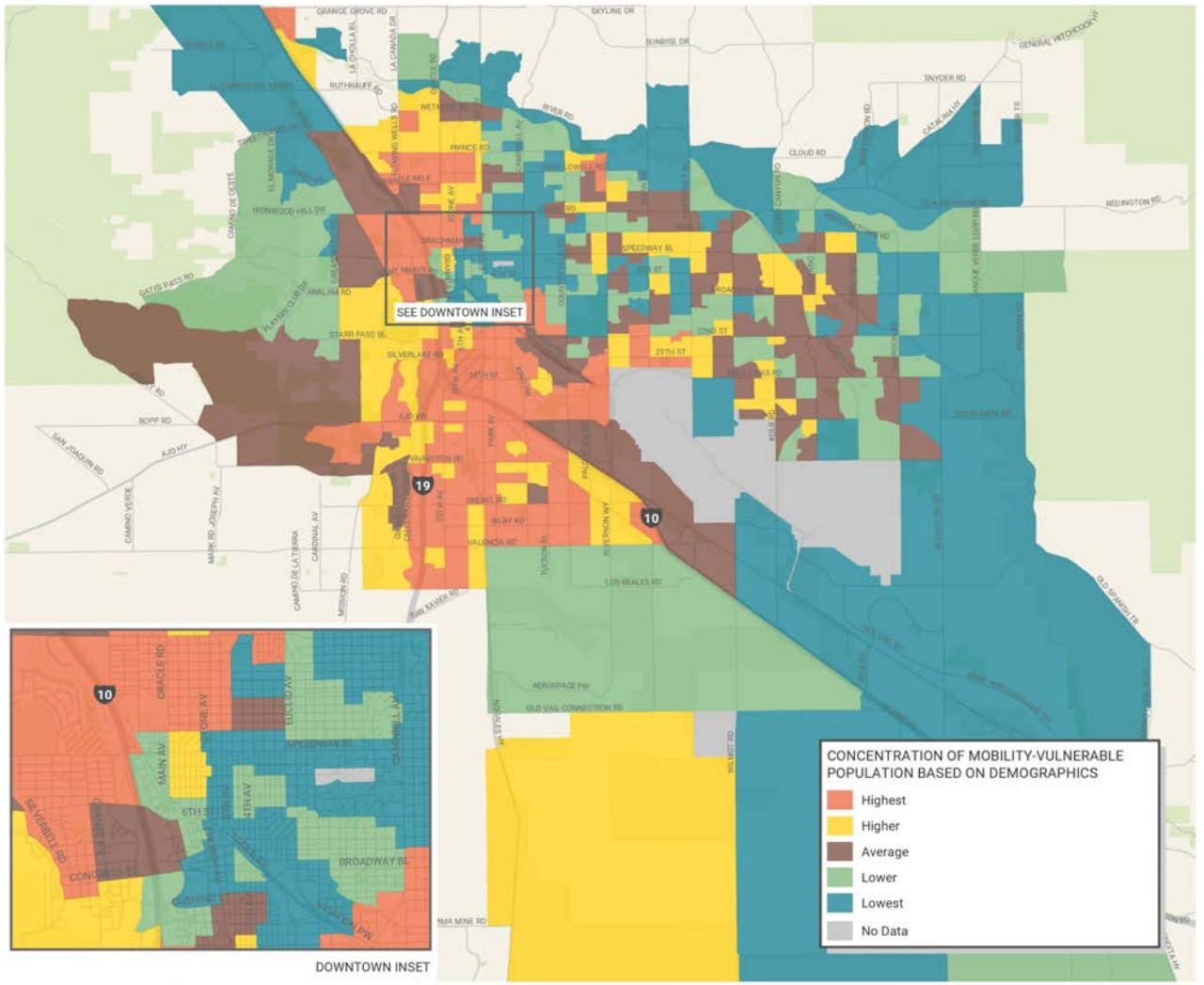
21%

of residents live within the highest equity areas

18%

of people working in Tucson work in the highest equity areas

The equity analysis maps concentrations of factors known to indicate social and economic inequity. The results show areas of Tucson where underinvestment in infrastructure and services is likely, where residents experience unique barriers to transportation, and where improved access to economic and educational opportunities is most needed. The results also indicate that these areas make up a significant portion of Tucson.



Safety Assessment

More than 1,700 people were seriously injured or killed on Tucson's roadways between the years of 2014 and 2018. Pedestrian deaths in particular increased significantly in 2018 and again in 2019, with over 60 pedestrians killed in these two years alone. Improving safety on Tucson's roadways is critical for supporting a transportation system that works for all, no matter how you choose to get around. By understanding where crashes are occurring most often, we can better address common challenges to needed safety improvements.

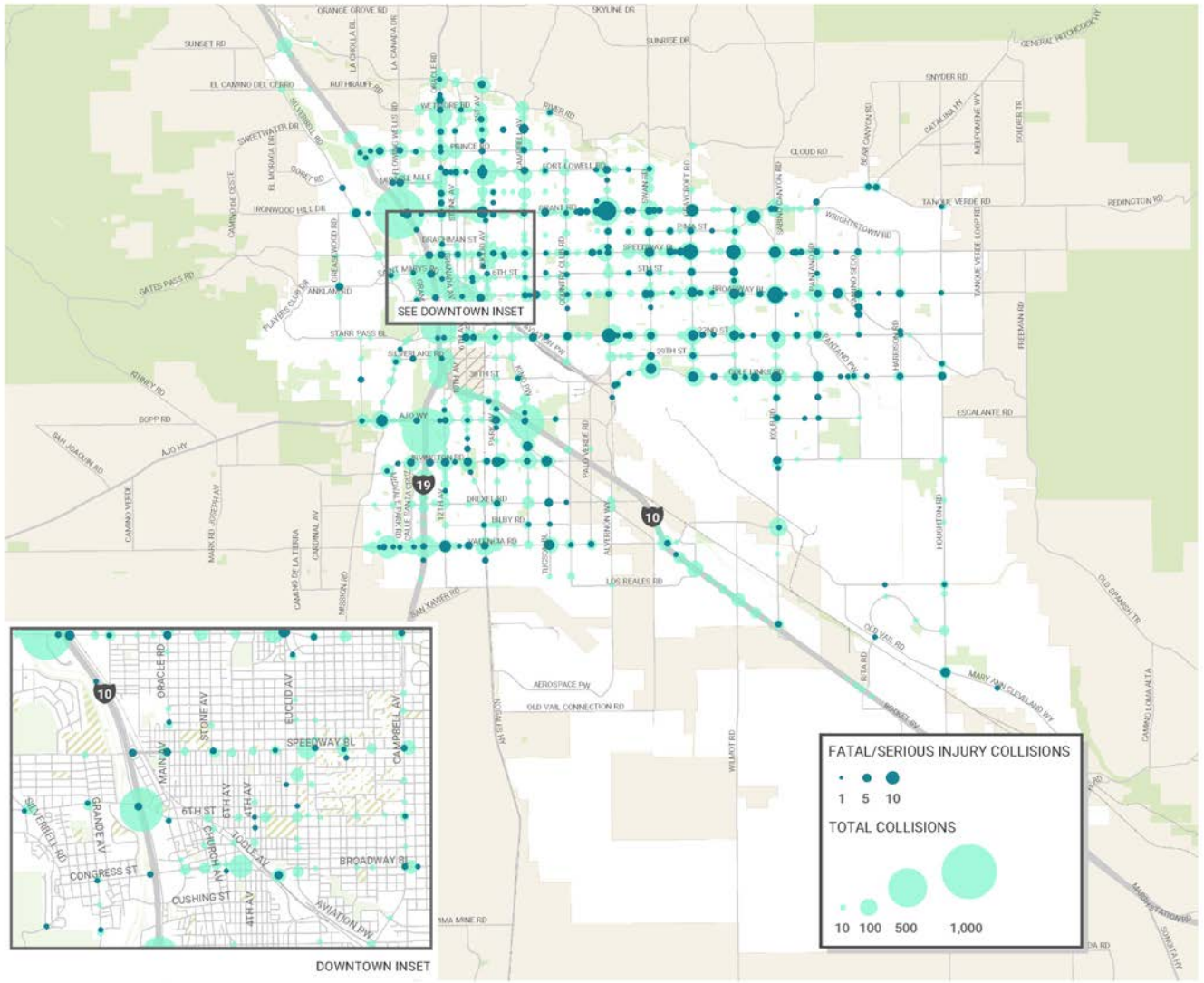
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DELIVERING MOBILITY CHOICES

CITY OF TUCSON SAFETY

- From 2014 to 2018, more than **29,000 crashes** were reported on Tucson-area streets. This is an average of **16 crashes every day.**

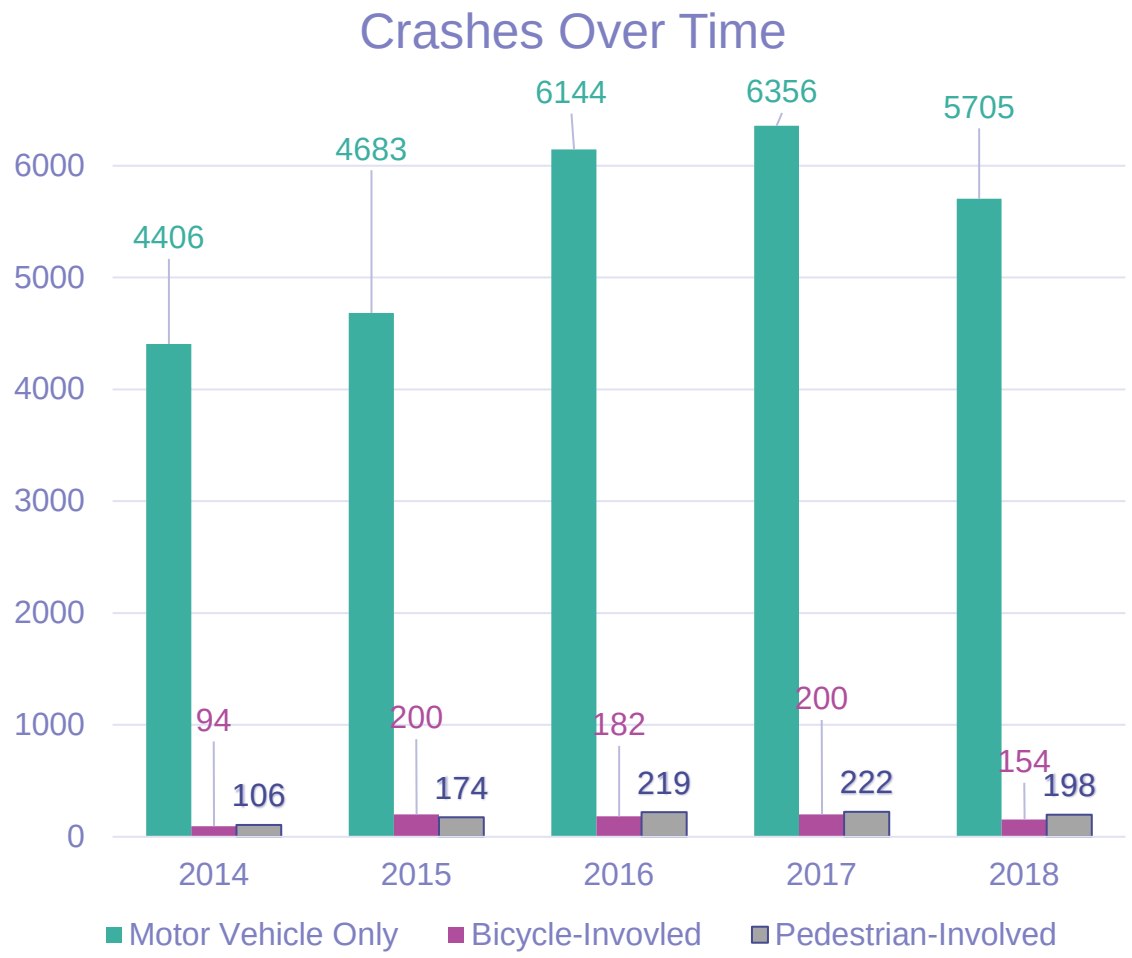
- Crashes of all severities are most common along major roadways.

- Fatal and serious injury crashes most frequently occurred along major roadways. A greater density of these crashes occurred in the eastern areas of the city.



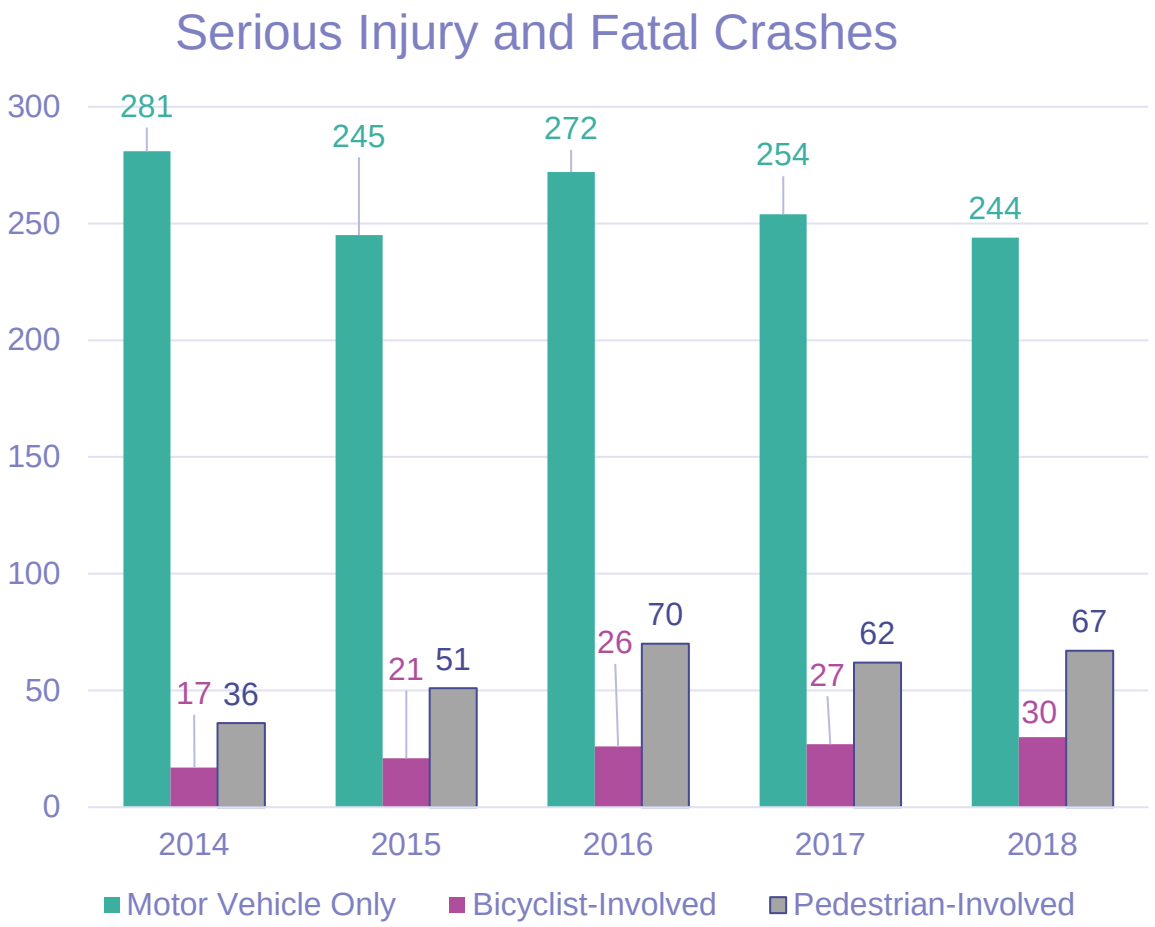
CRASH TRENDS BY MODE

- Total reported crashes have risen over the past 5 years.
- City reporting practices may not fully capture property-damage only crashes, resulting in fewer crashes reported in these statistics.
- Further, bicyclist- and pedestrian-involved crashes are often under-reported.



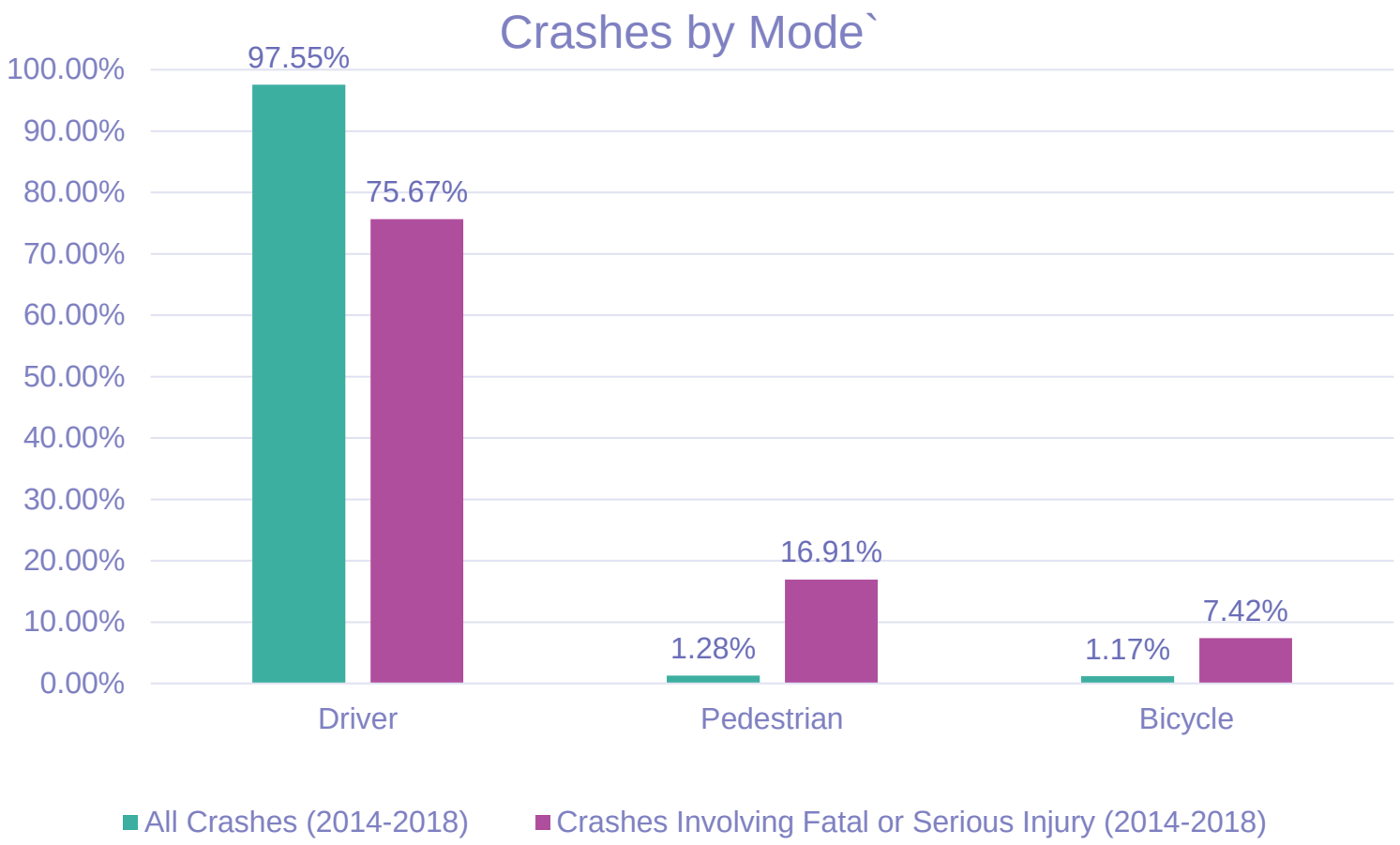
CRASH TRENDS BY MODE

- Serious injury and fatal crashes have decreased for drivers; however, they have increased significantly for active modes.
- Pedestrian-involved serious injury and fatal crashes **increased by nearly 90%** between 2014 and 2018.
- It is becoming more dangerous to walk and bike in Tucson.



CRASHES BY MODE

- Pedestrian- and bicycle-involved crashes make up a relatively small percentage of total collisions
- However, serious injury or fatal crashes are disproportionately represented by these modes



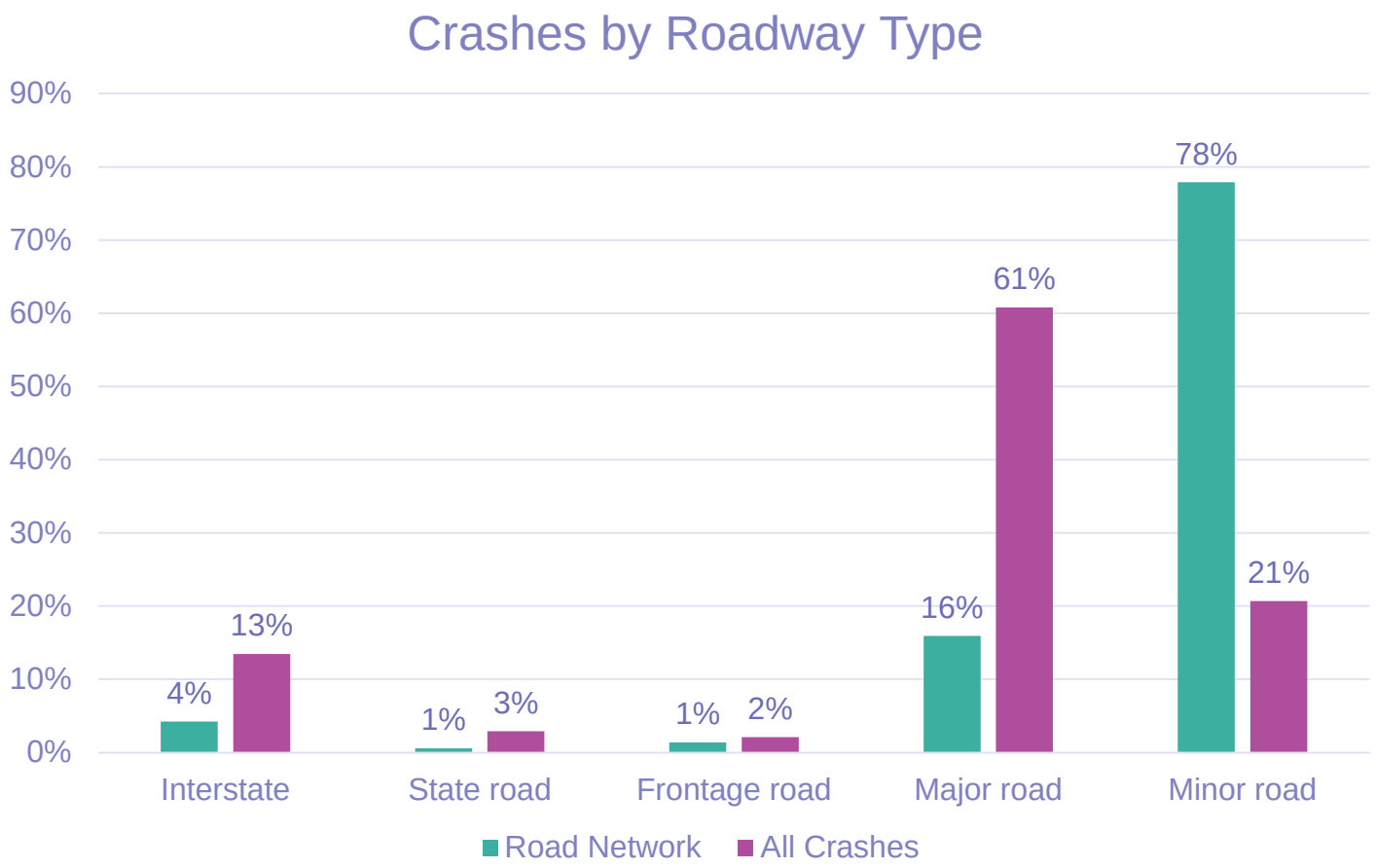
CRASHES BY STREET TYPE

16%

of Tucson's roadways are arterials or collectors. These roadways are typically high-speed with many travel lanes.

61%

of all crashes occur on these roadways.

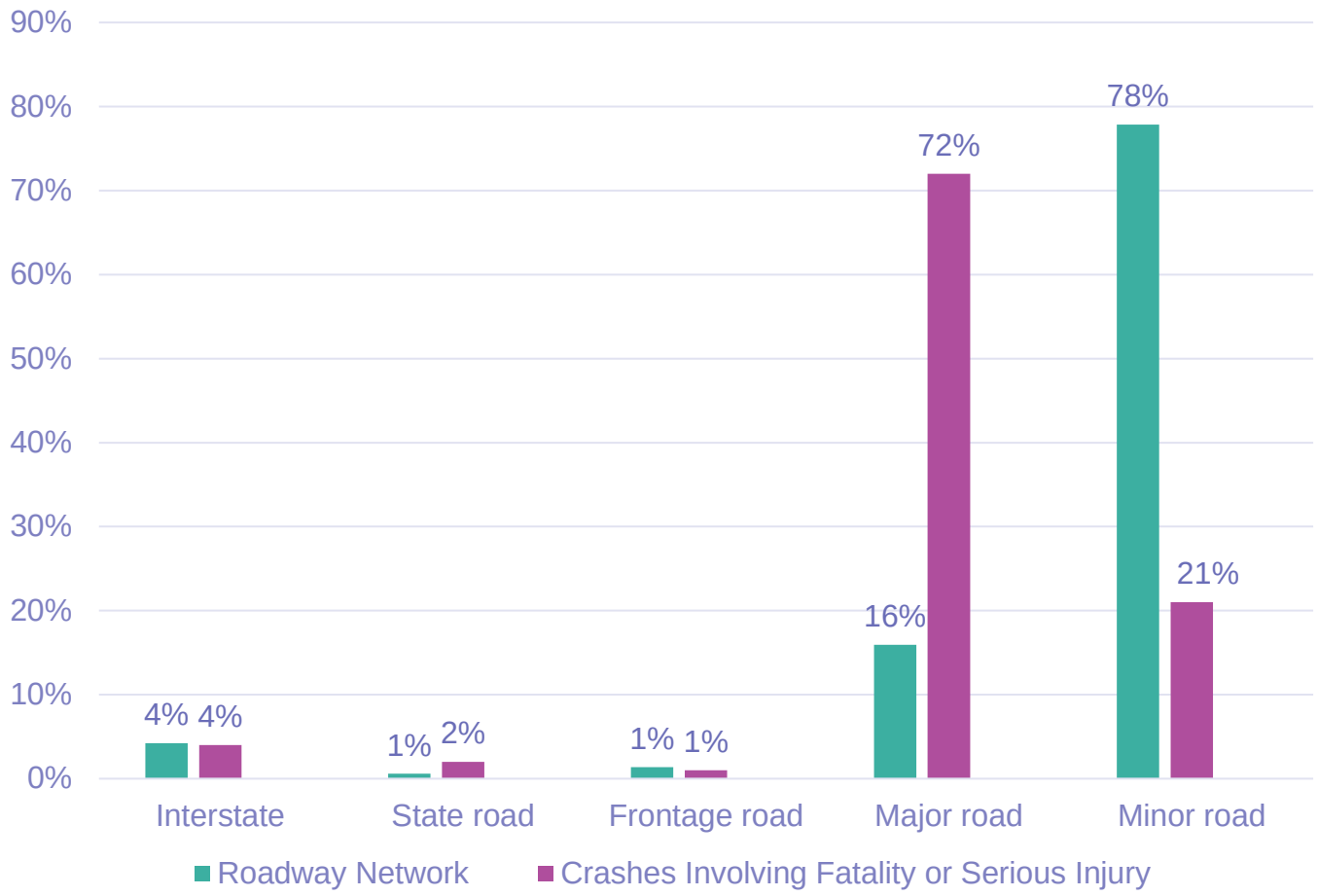


CRASHES BY STREET TYPE

- Serious injury or fatal crashes are disproportionately occurring on major roadways.
- Major roadways have higher posted speeds and greater volumes of vehicles, increasing safety concerns for all roadway users, particularly those traveling by foot or by bike.

72%

of serious injury or fatal crashes occur on major roadways.



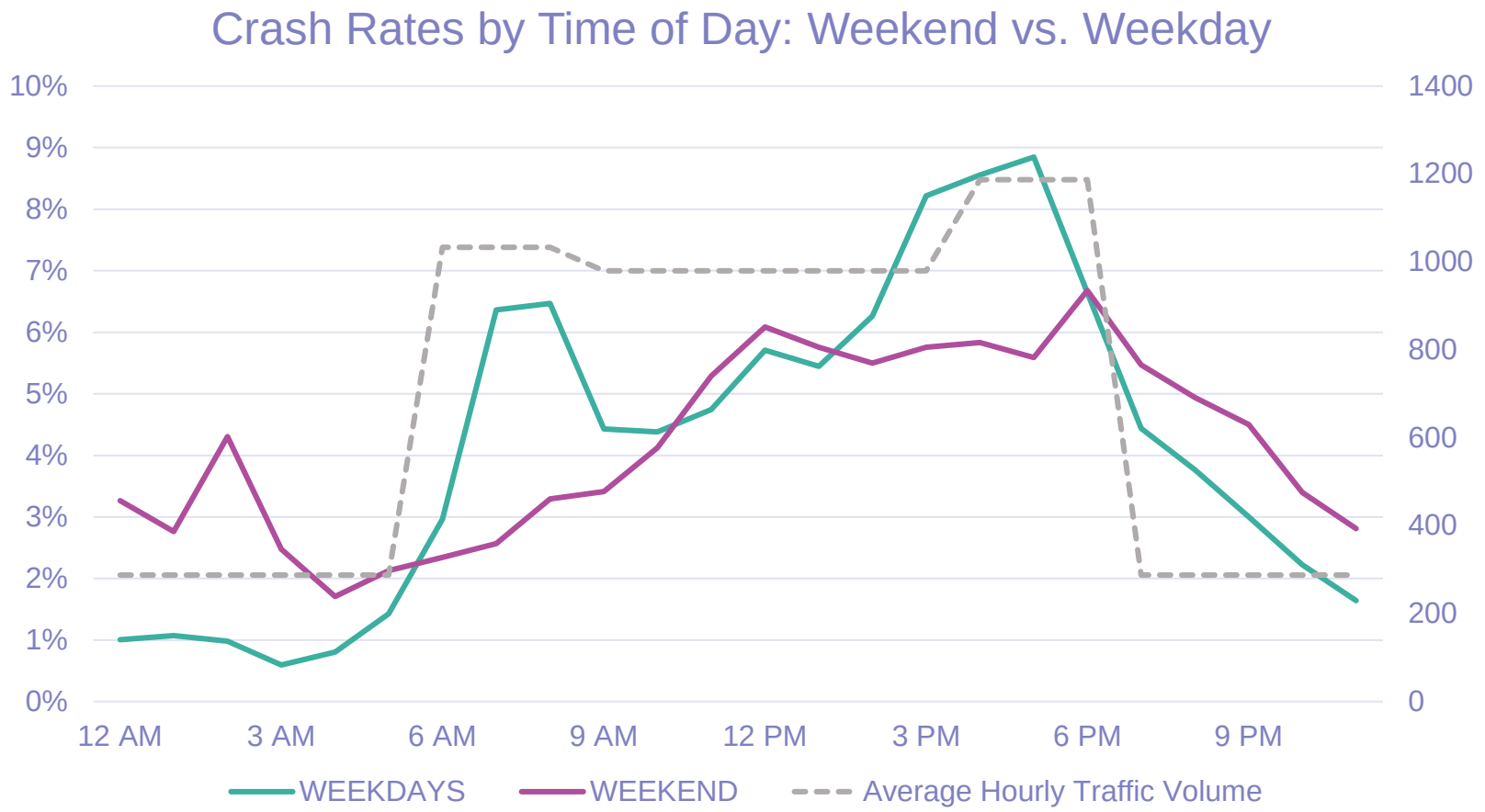
CRASHES BY TIME OF DAY

Crash rates correspond with peak travel time when traffic volumes are highest.

Reducing crashes during commute hours can reduce travel times and increase system reliability for all modes of travel.

54%

of all weekday crashes occur during peak morning and afternoon travel times.

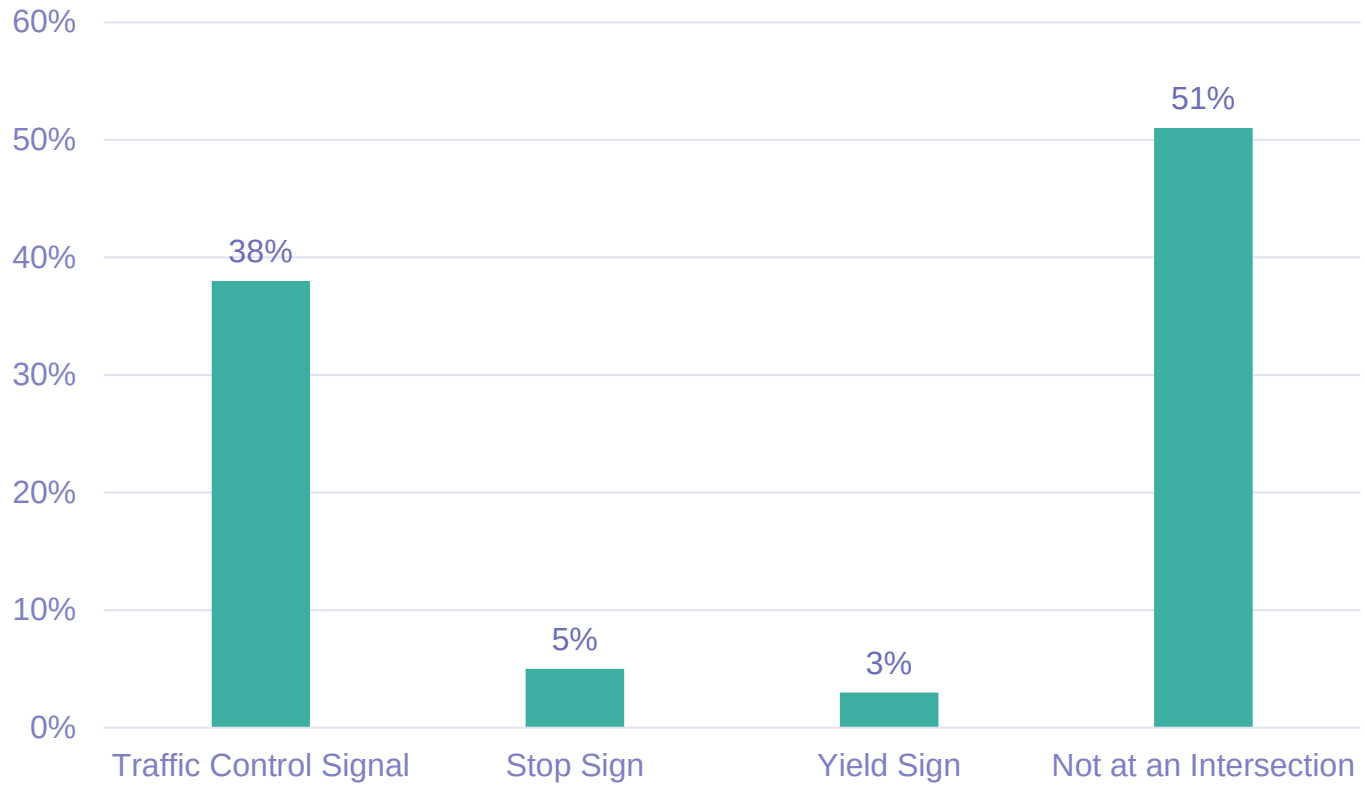


CRASH LOCATION TYPE

49%

of all crashes occurred at an intersection

- Nearly 40% of fatal or serious injury crashes occurred at an intersection
- 7% of intersection-related crashes involved a person walking or biking



EQUITY + TRAVEL SAFETY

More than

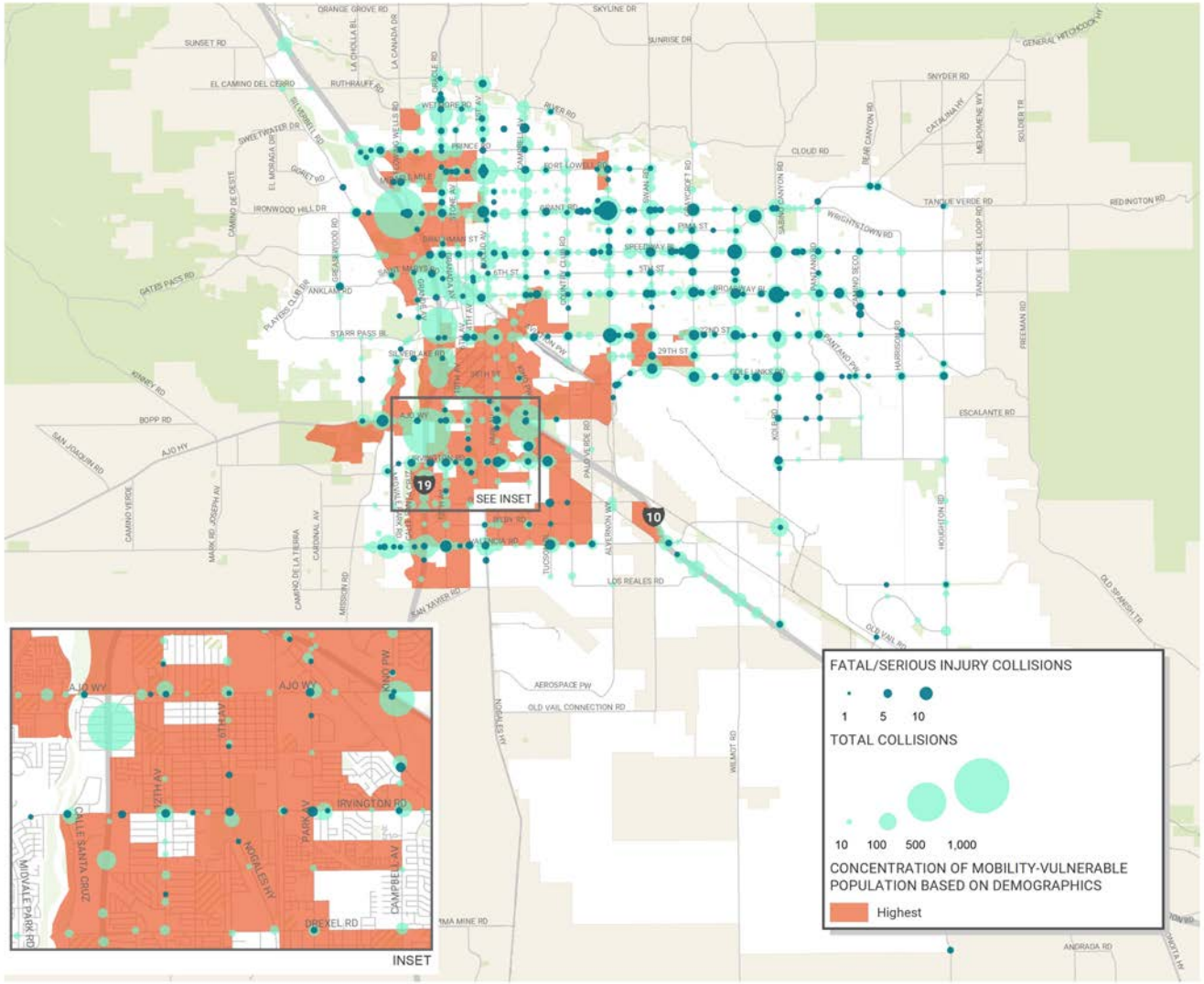
1 in 4

crashes in the city occur in the highest scoring equity areas.

23%

of bicycle- or pedestrian-involved serious injury or fatal collisions occur in these areas

Because residents in the highest scoring equity areas rely more on public transportation than residents elsewhere in the city, improved crossings, more frequent bus routes, and high quality bike and pedestrian networks can improve the experience in terms of both real and perceived safety.



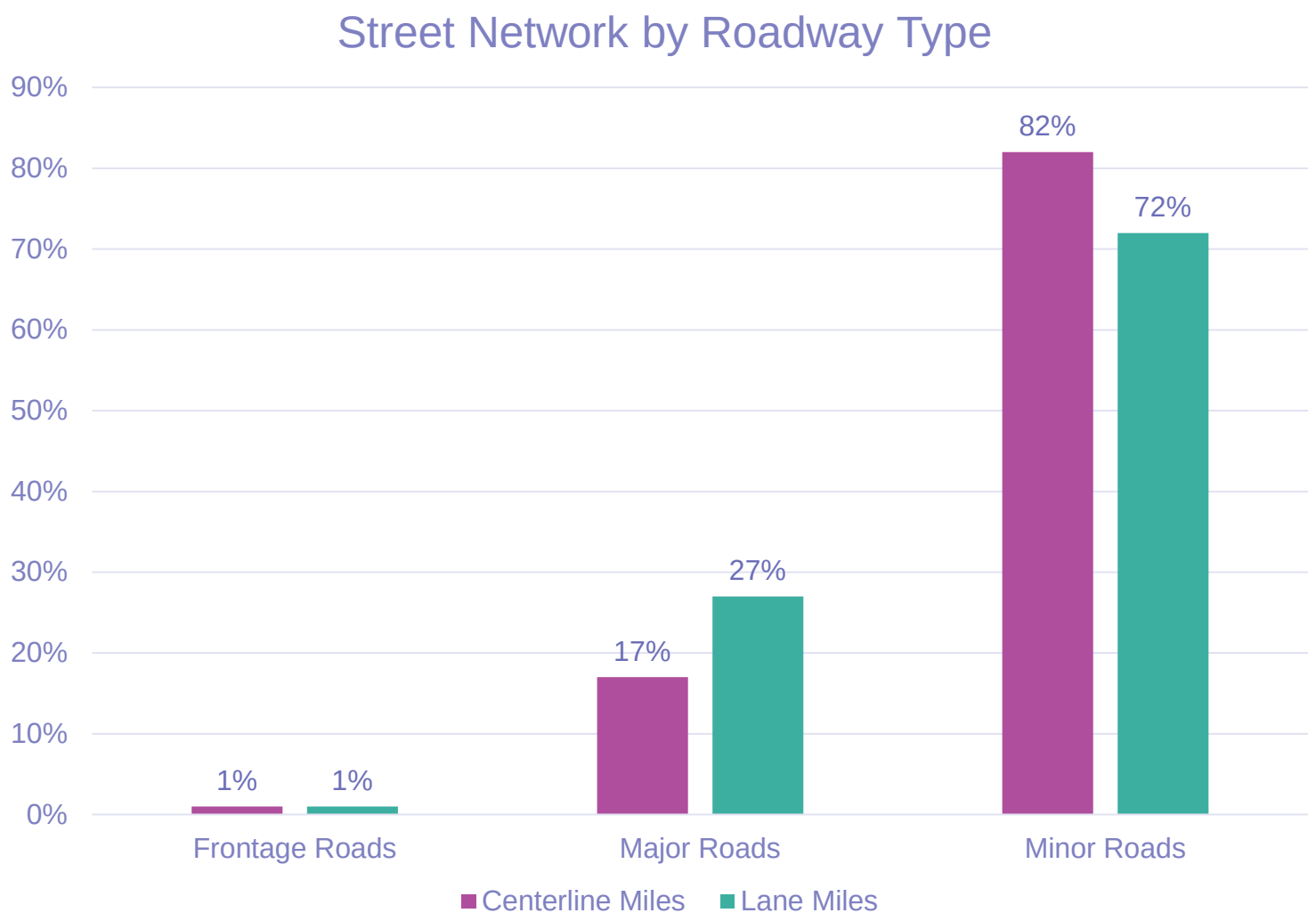
Transportation System Assessment

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DELIVERING MOBILITY CHOICES

STREET NETWORK

The City of Tucson has an extensive grid of streets, providing many route options and opportunities to distribute traffic volumes across major and local roadways.

The majority of streets in Tucson are local roadways and neighborhood streets, comprising over 1,700 miles of roadway centerline miles

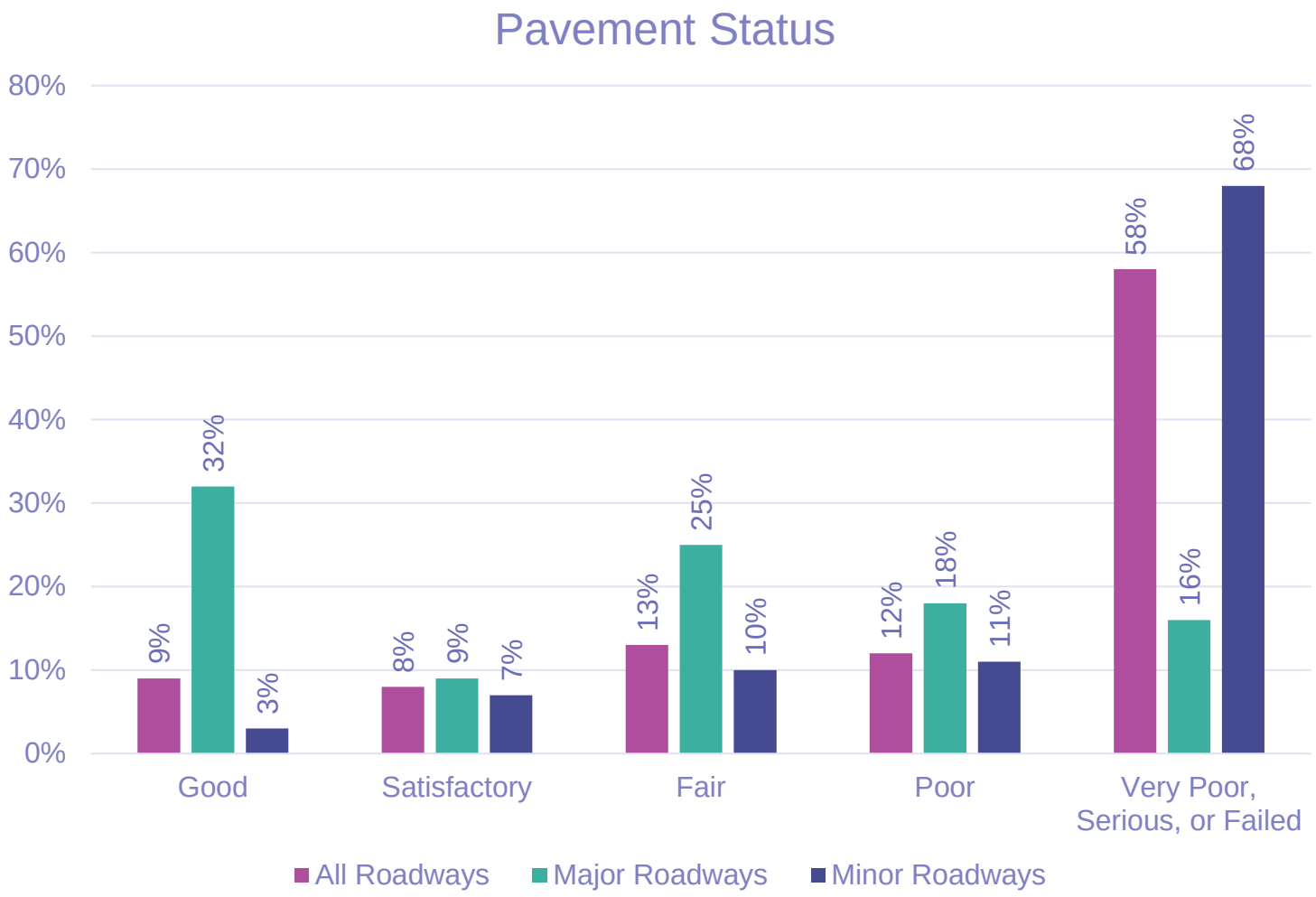


STATE OF GOOD REPAIR

The majority of roadways are in need of repair. Poor road quality increases the need for maintenance investments, impacts wear and tear on personal vehicles, and can create unsafe conditions that can lead to crashes and property damage.

68%

of Tucson's local roadways are in Very Poor condition or worse, compared to only 15% of major roadways.



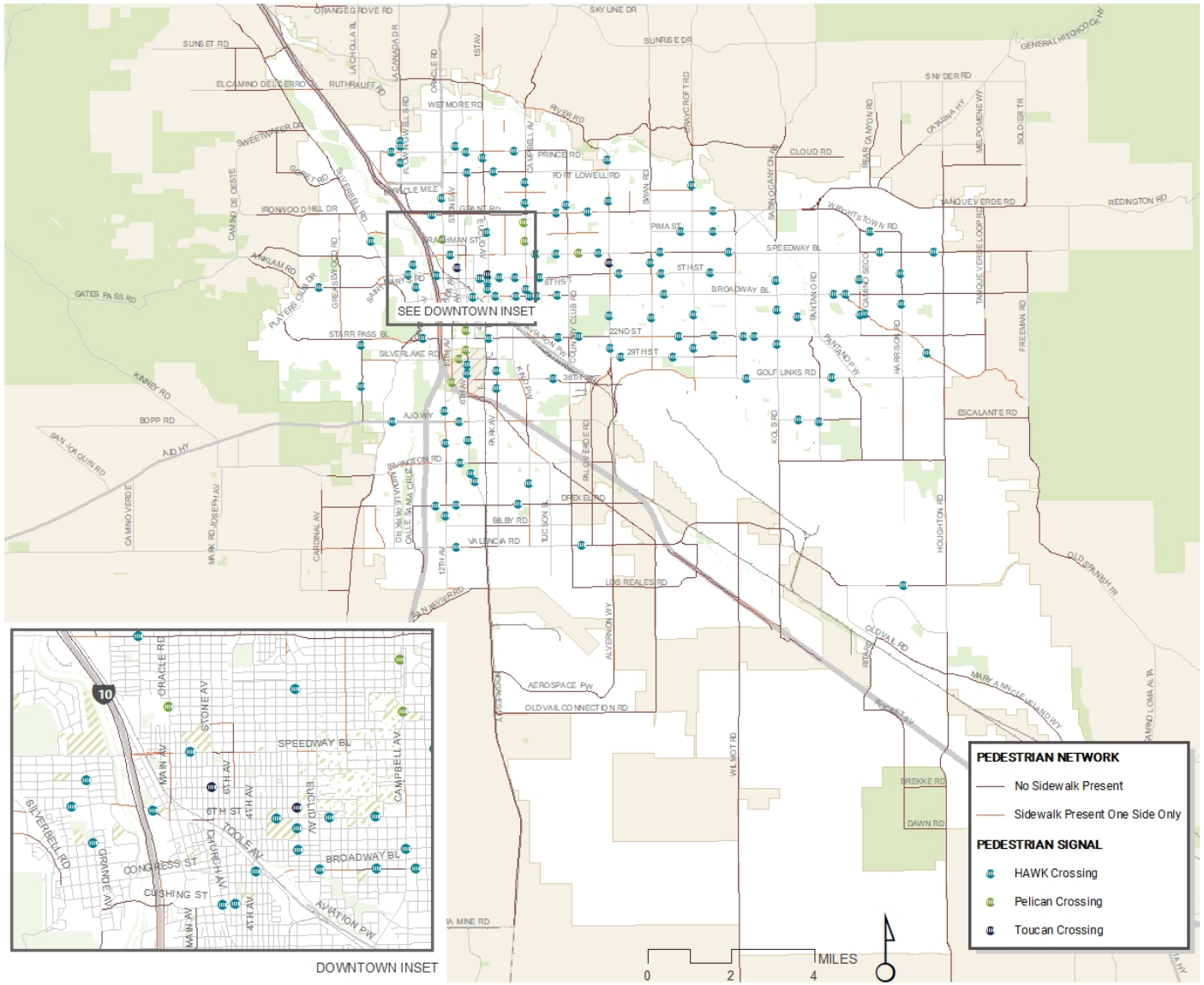
WALKING

Walk Commute Rates

- 3% City of Tucson
- 3% Pima County

45%

of major roadways are missing sidewalks on one or both sides of the street.



WALKING ANALYSIS

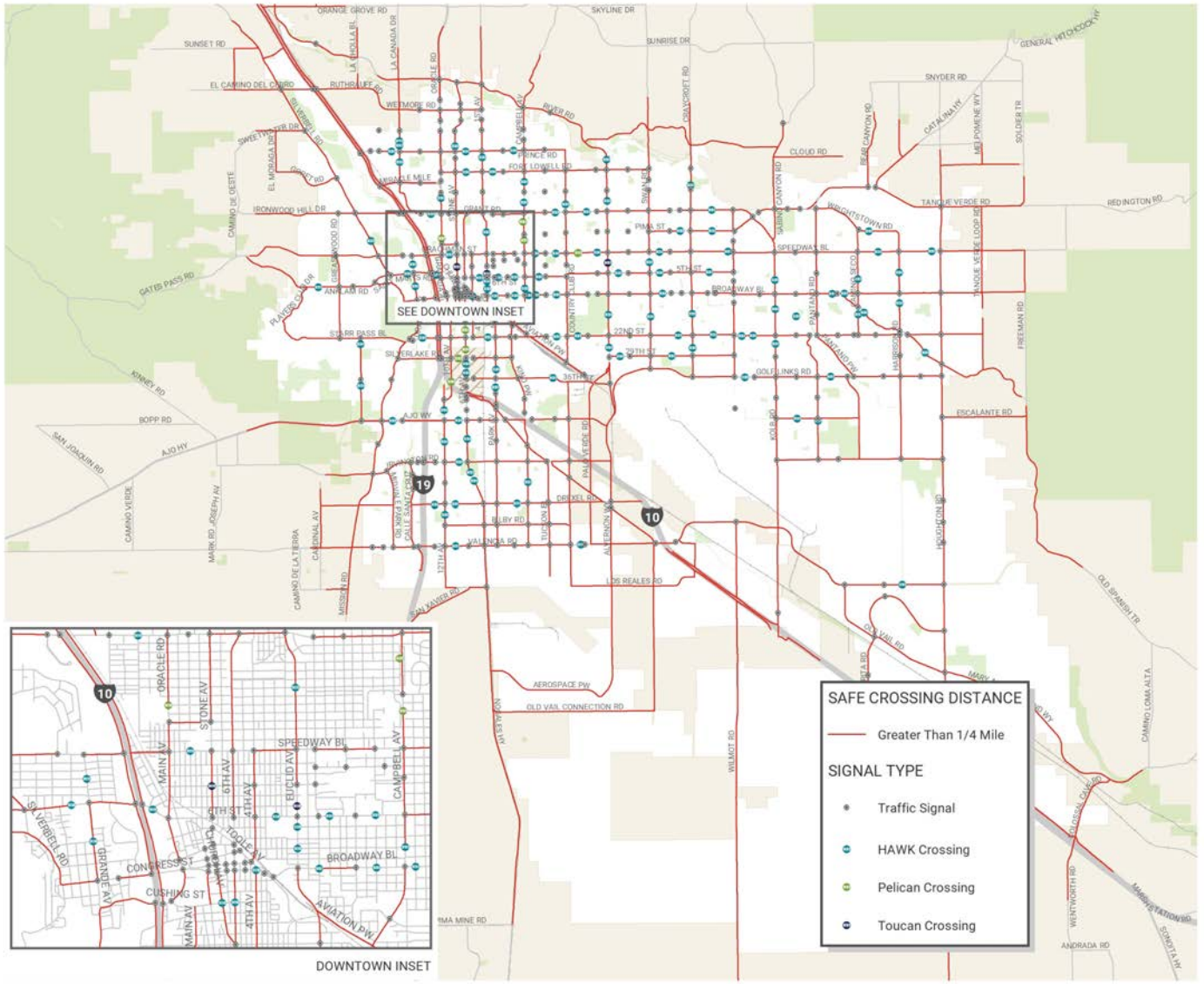
Traffic signals and crossing signals support safe pedestrian crossings throughout Tucson. Despite over 120 HAWK, Pelican, and Toucan crossing signals in place today, distances between protected crossings are insufficient to meet pedestrian travel needs on Tucson's major streets.

92%

of Tucson's major roadways have greater than ¼ mile between safer crossing opportunities

71%

of Tucson's major roadways have greater than ½ mile between safer crossing opportunities.



Pedestrian Volumes

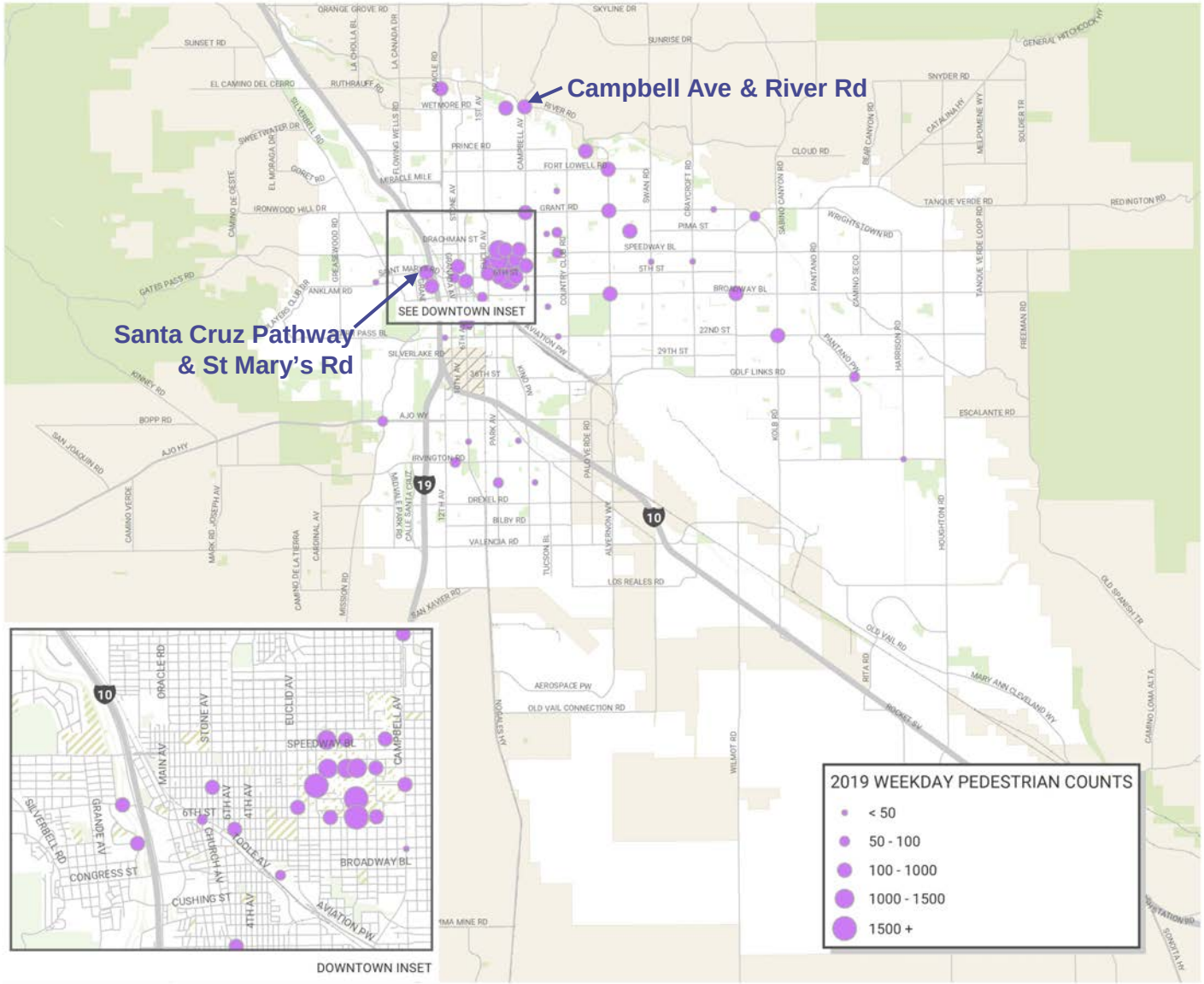
Annual volunteer-conducted manual counts provide insight into areas with increasing pedestrian activity. 2019 weekday counts are shown here, with the majority of count locations in the vicinity of downtown.

Count locations with the highest number of pedestrians in 2019:

- 2nd St and Highland Ave
- 6th St and Highland Ave
- Park Ave and University Blvd

Count locations with the greatest increase in pedestrians (2015-2019):

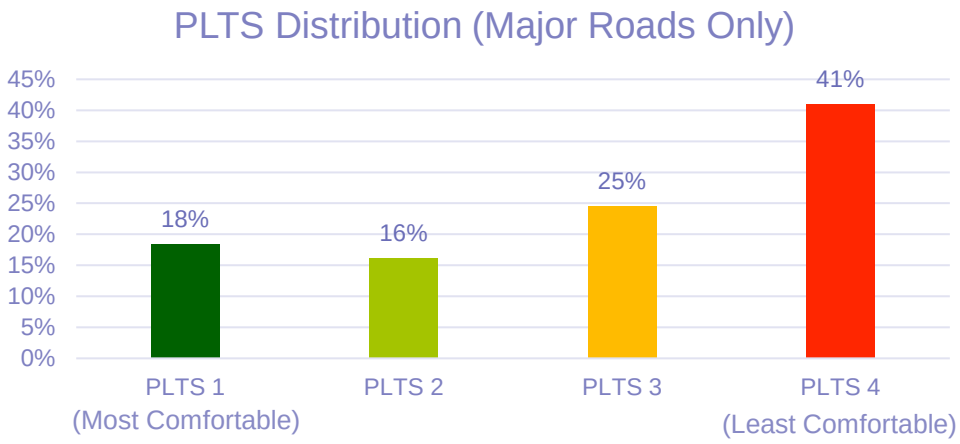
- Campbell Ave and River Rd
- Santa Cruz Pathway and St Mary's Rd

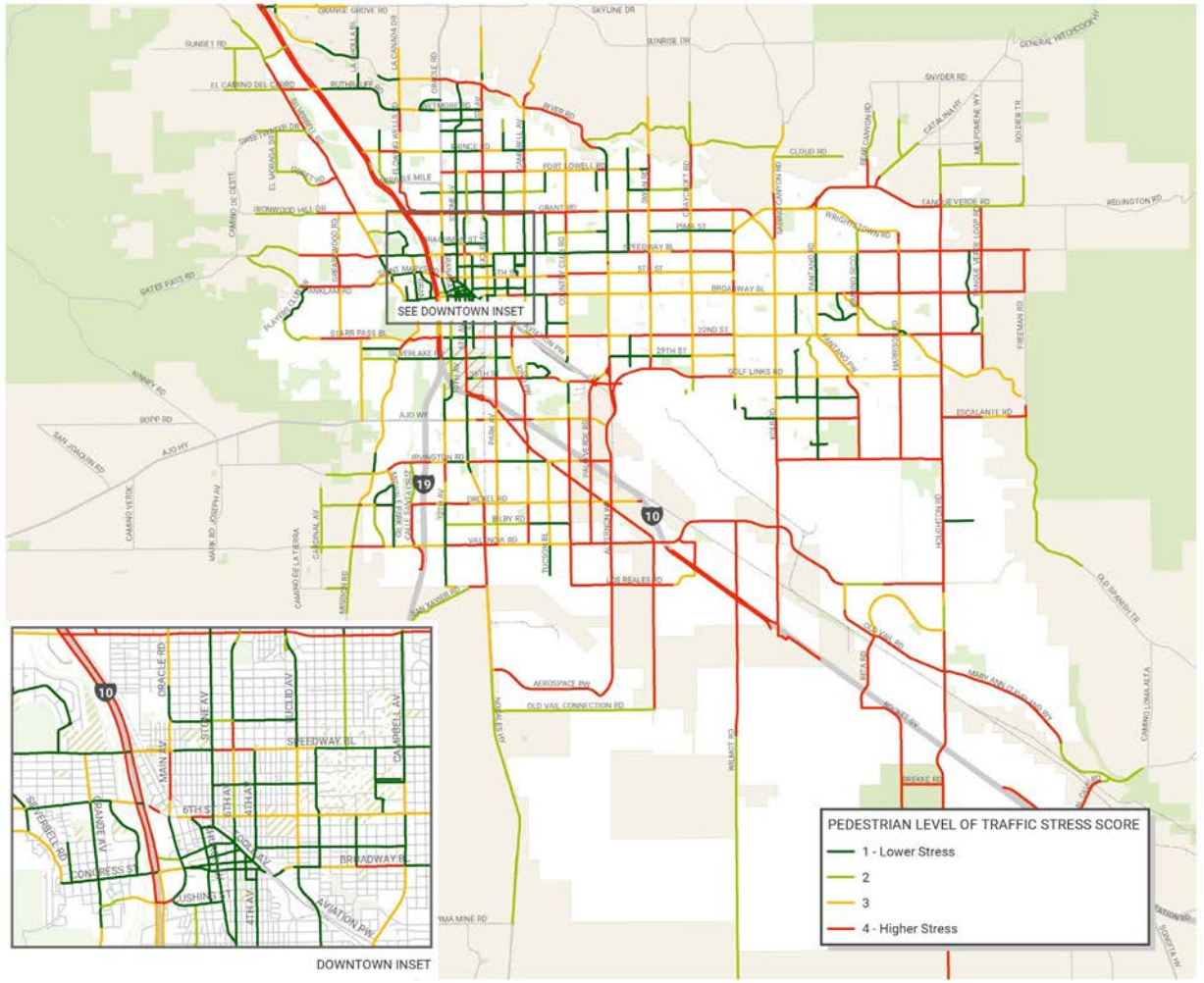


WALKING ANALYSIS

Low-stress roadways are roadways with lower traffic speeds, complete sidewalks, and buffer space providing separation from motor vehicles

Approximately half of major streets have complete sidewalks. However, many of these sidewalks are not wide enough or do not have sufficient buffer space to make them comfortable to use. In many cases, existing sidewalks are not fully ADA compliant.





WALKING

Needs and Opportunities

- Many neighborhoods have limited or narrow sidewalks, reducing connectivity across the network.
- Distances between protected crossing opportunities are often significant, particularly in areas with poor sidewalk quality and limited shade.
- Many sidewalks are immediately adjacent to the curb, have an uneven surface, and experience frequent driveway crossings, reducing real and perceived safety for those walking, as well as limited access for persons with disabilities.
- Increasing vegetation, shade, and distance from the roadway could significantly improve overall pedestrian comfort.









BIKING

Bike Commute Rates

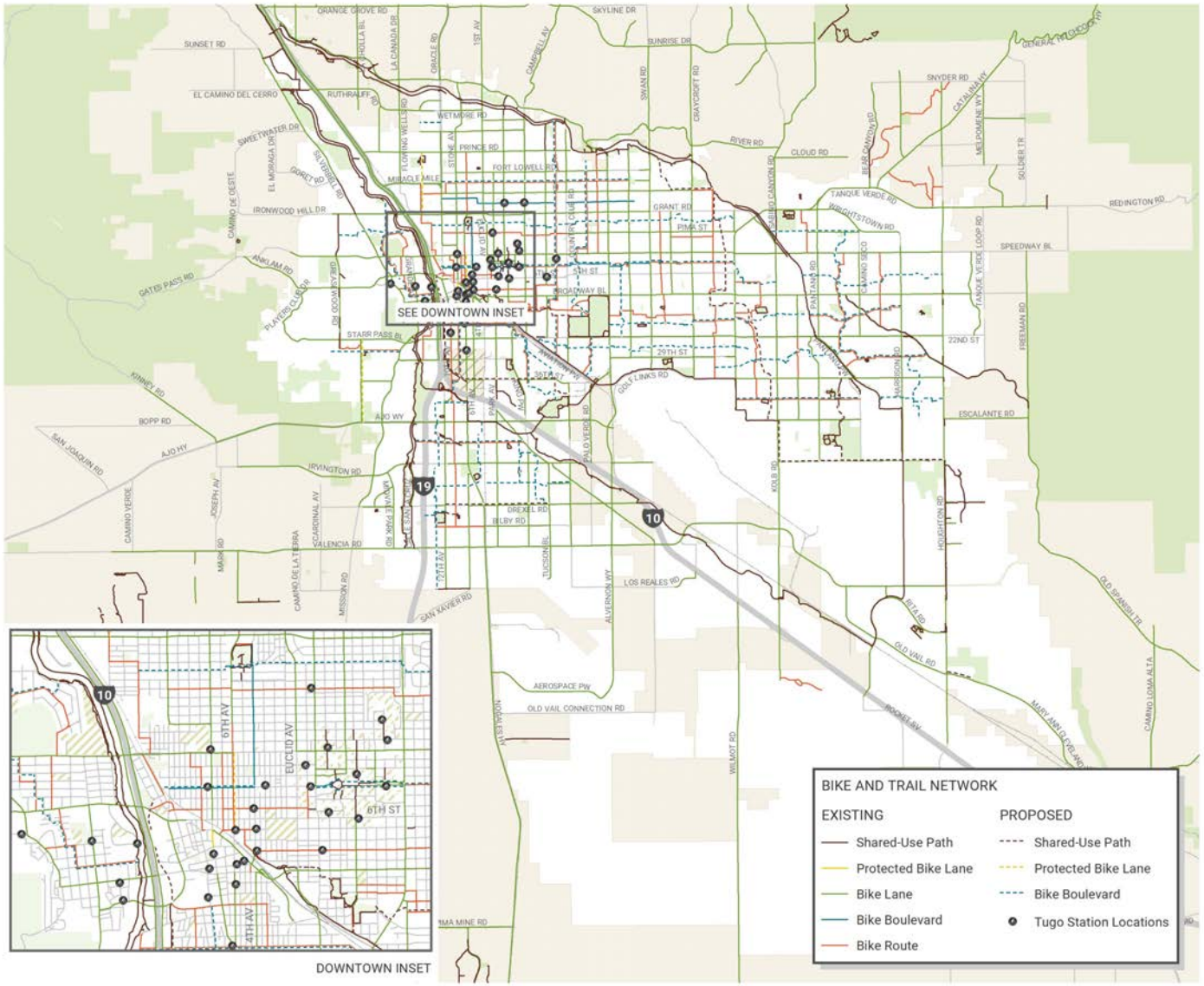
- 3% City of Tucson
- 2% Pima County

39%

of the on-street network has a designated bikeway

1,155

miles of bikeways in Tucson, including off-street shared-use paths



BIKE COUNTS

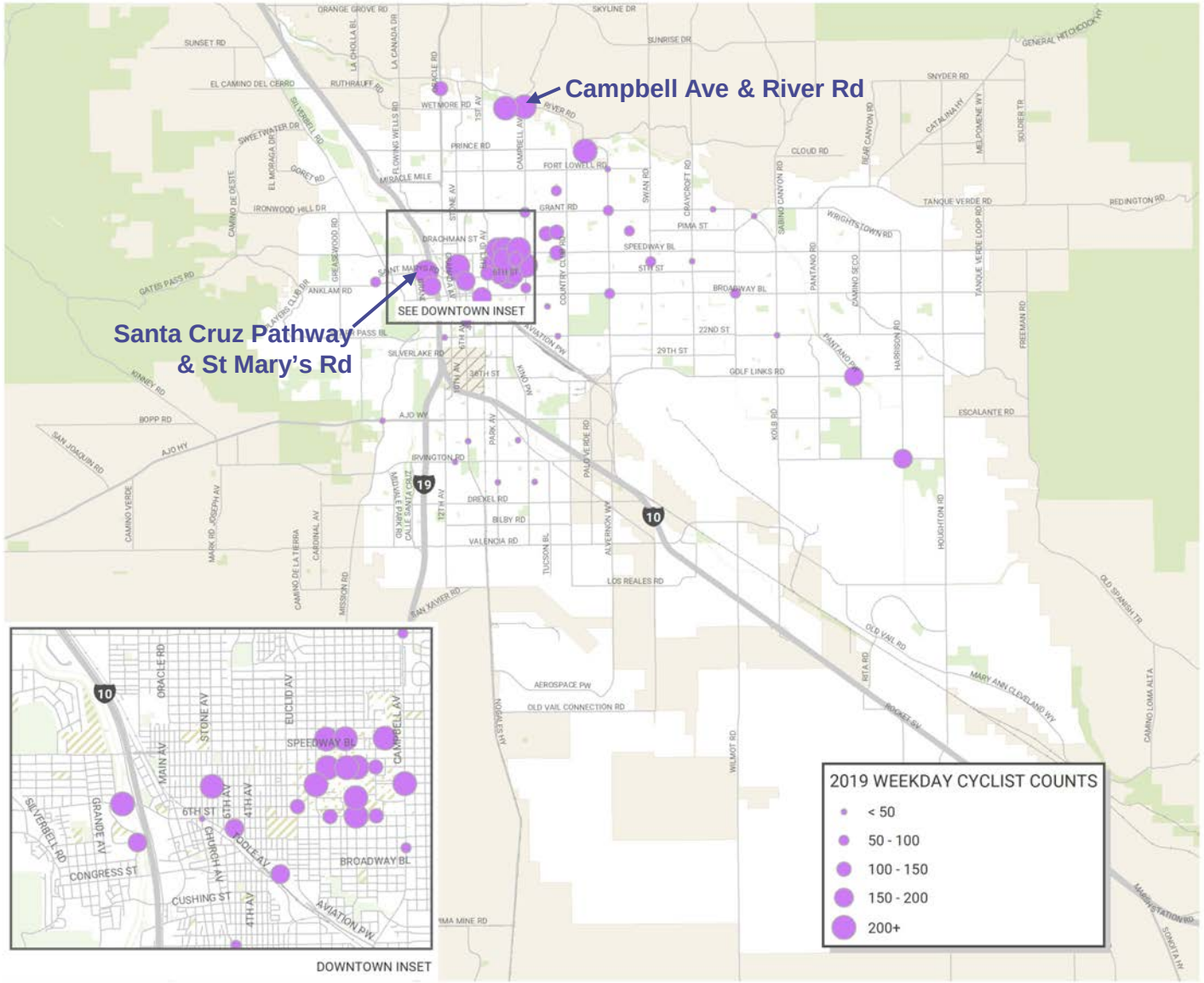
Annual volunteer-conducted manual counts provide insight into areas with increasing bicycle activity. 2019 weekday counts are shown here, with the majority of count locations in the vicinity of downtown.

Count locations with the highest rates of cyclists in 2019:

- 2nd St and Highland Ave
- 3rd St and Campbell Ave
- Park Ave and University Blvd

Count locations with the greatest increase in cyclists (2015-2019):

- Campbell Ave and River Rd
- Santa Cruz Pathway and St Mary's Rd

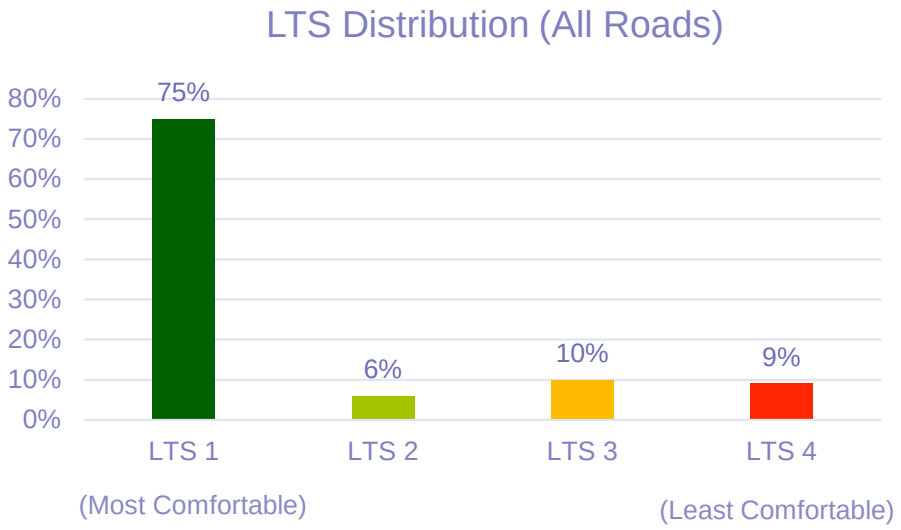


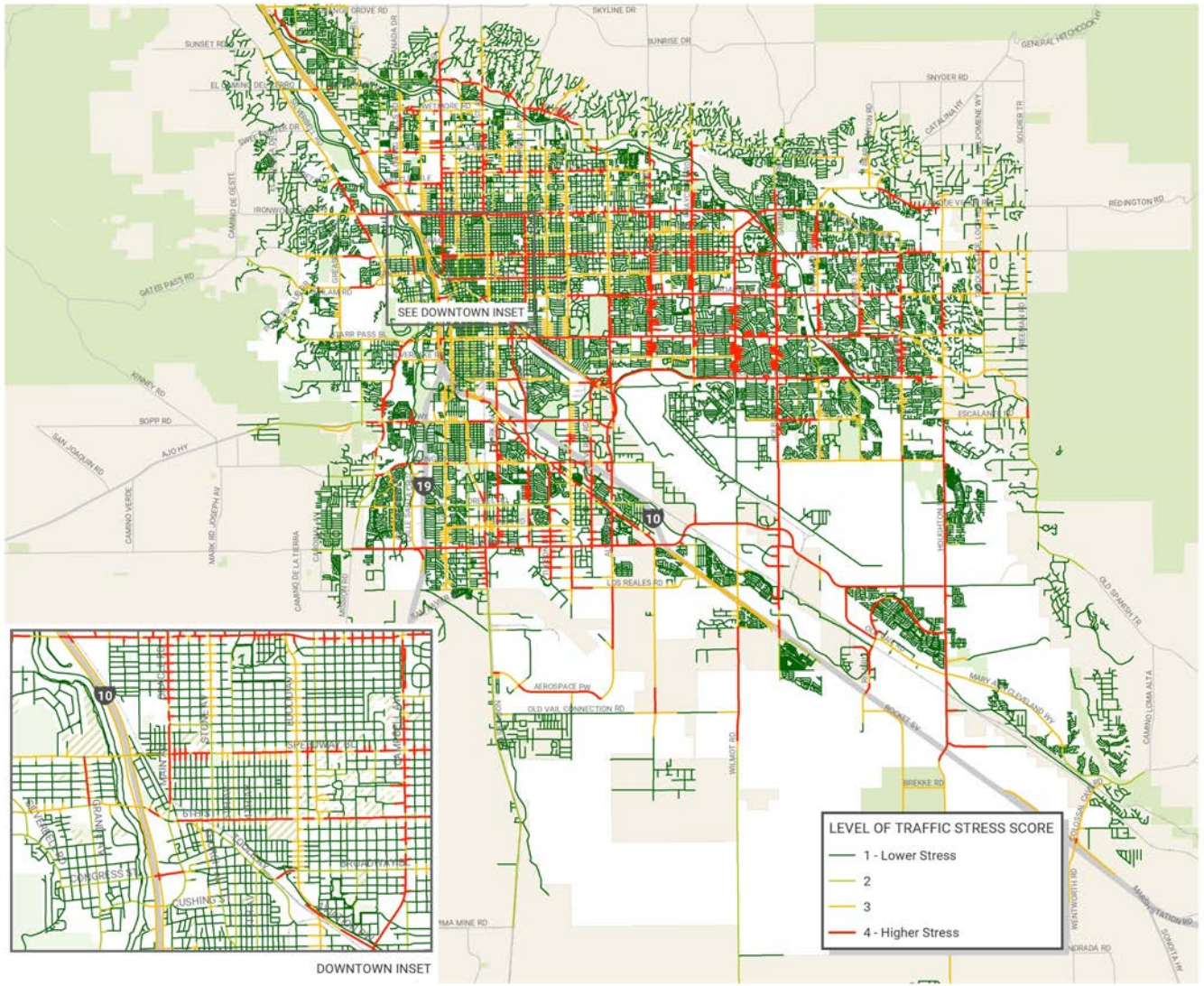
BIKING ANALYSIS

Key Observations

- 75% of Tucson's roadways are considered All Ages and Abilities (LTS 1); most (92%) LTS 1 routes are neighborhood roadways

- Only 12% of All Ages and Abilities routes have designated bicycle facilities



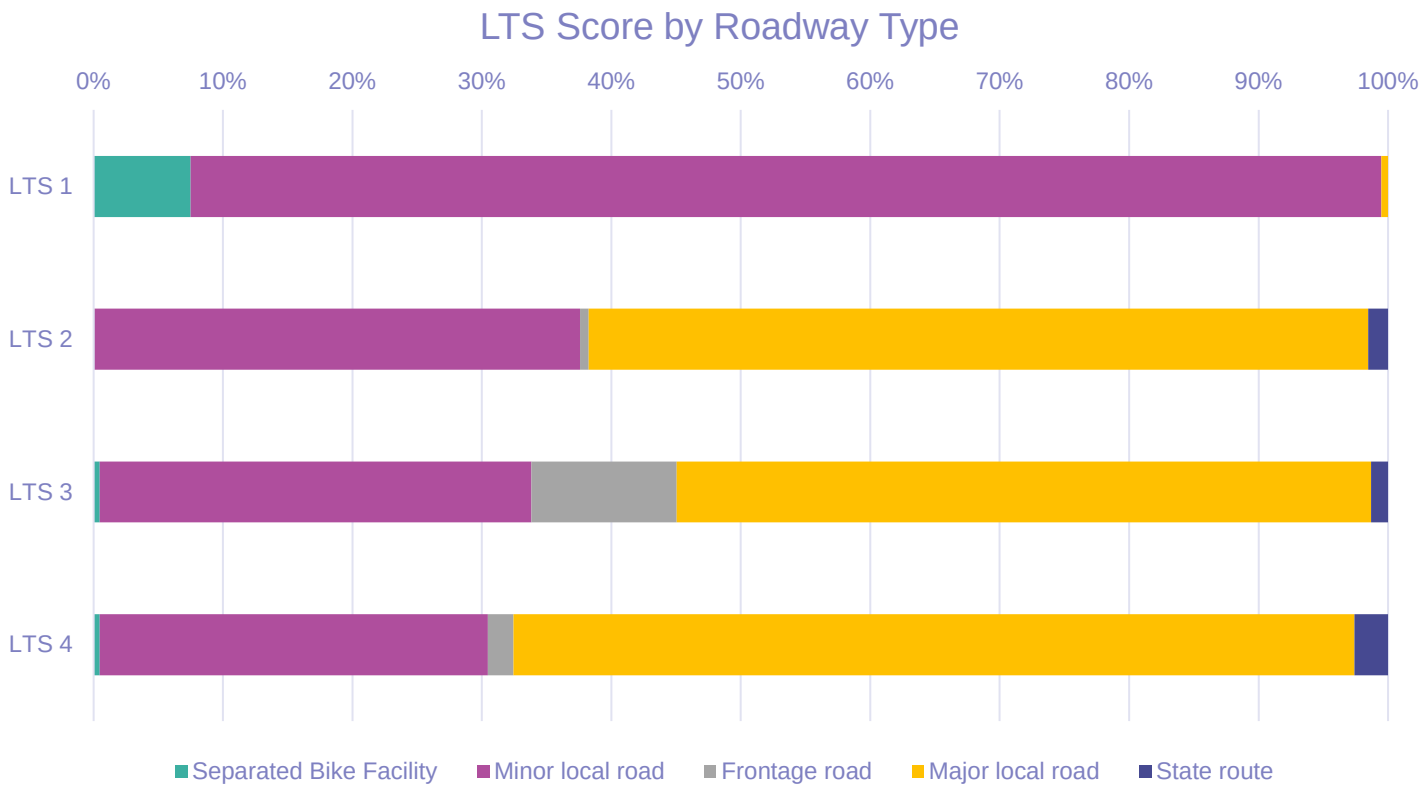


BIKING ANALYSIS

Low-stress roadways providing all ages and abilities route options are primarily separated facilities or neighborhood roadways

Key Observations

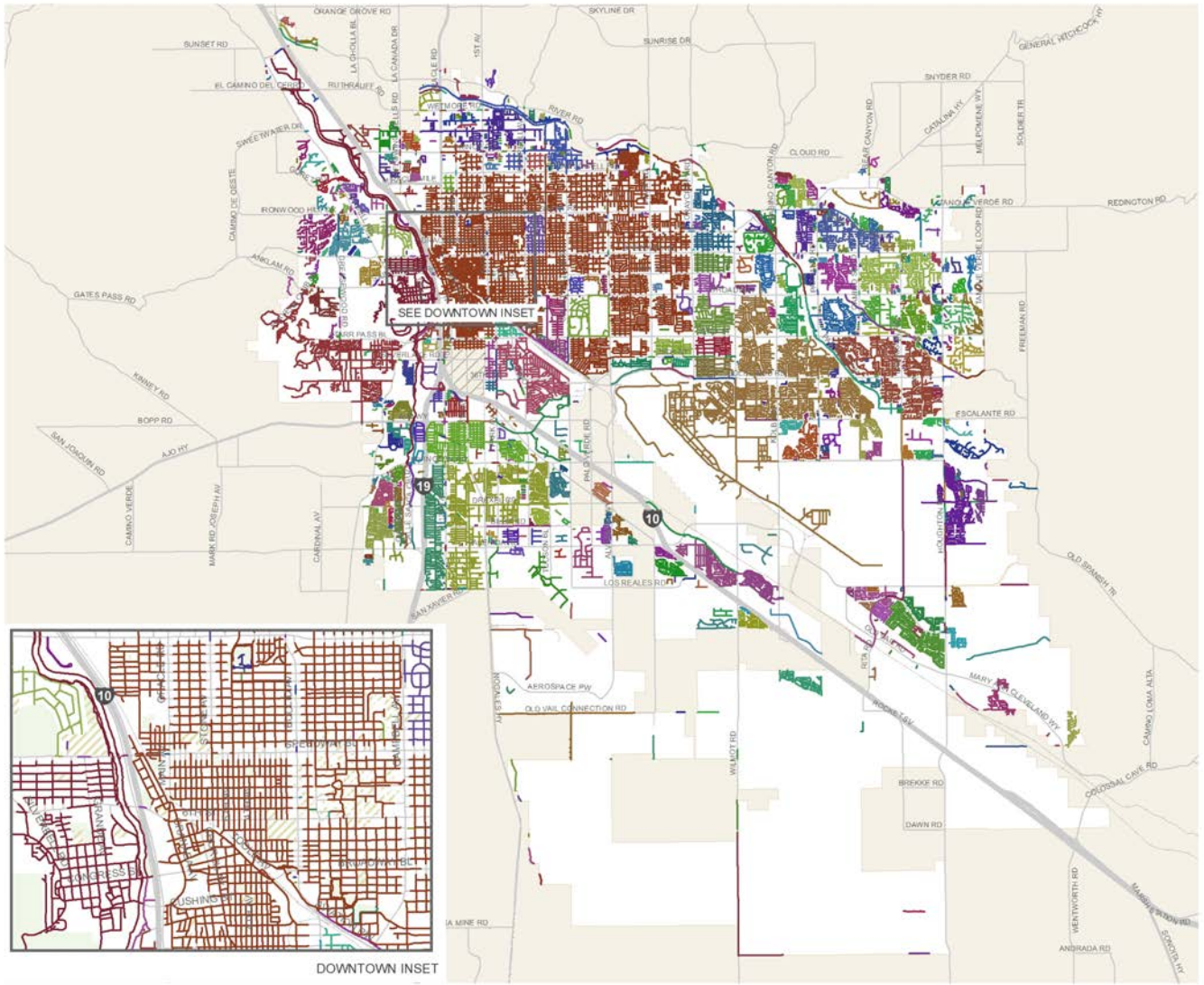
- Although some major roadways offer low-stress routes suitable for an average adult, most major roadways are considered high stress and create barriers for continuous travel along routes.



BIKING ANALYSIS

Low-stress travel (LTS 1 or LTS 2) along a roadway requires that all elements are low-stress, including intersections. Unsignalized major roadway crossings affect the ability to travel safely and comfortable along a route. Areas shown in the same color in the map to the right are locations connected by a continuous low-stress network.

However, it is important to note that while some areas appear highly connected, there may be significant out-of-direction travel required to cross a major roadway. Further, as many destinations are located along major roadways, it may not be possible to complete a trip along only low-stress routes.



BIKING

Needs and Opportunities

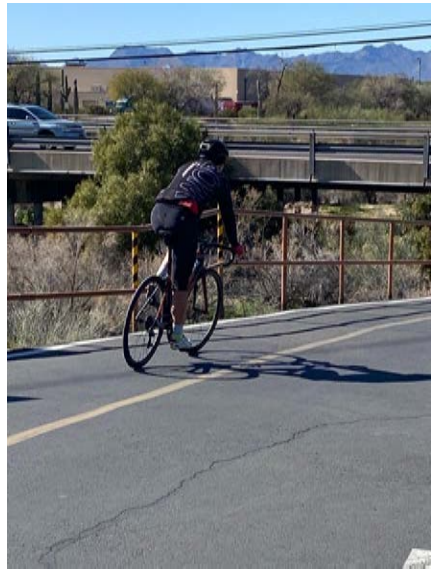
- Low-stress bikeway networks often end at the edge of neighborhoods, where major roads have high stress conditions and often lack dedicated space to bike.

- Many destinations are located along major roadways and at major intersections; a complete, connected bikeway system should connect bicyclists to these locations.

- Improvements should aim to create more low-stress pathways that connect major destinations and existing low-stress routes, including the Loop and the growing bicycle boulevard network.









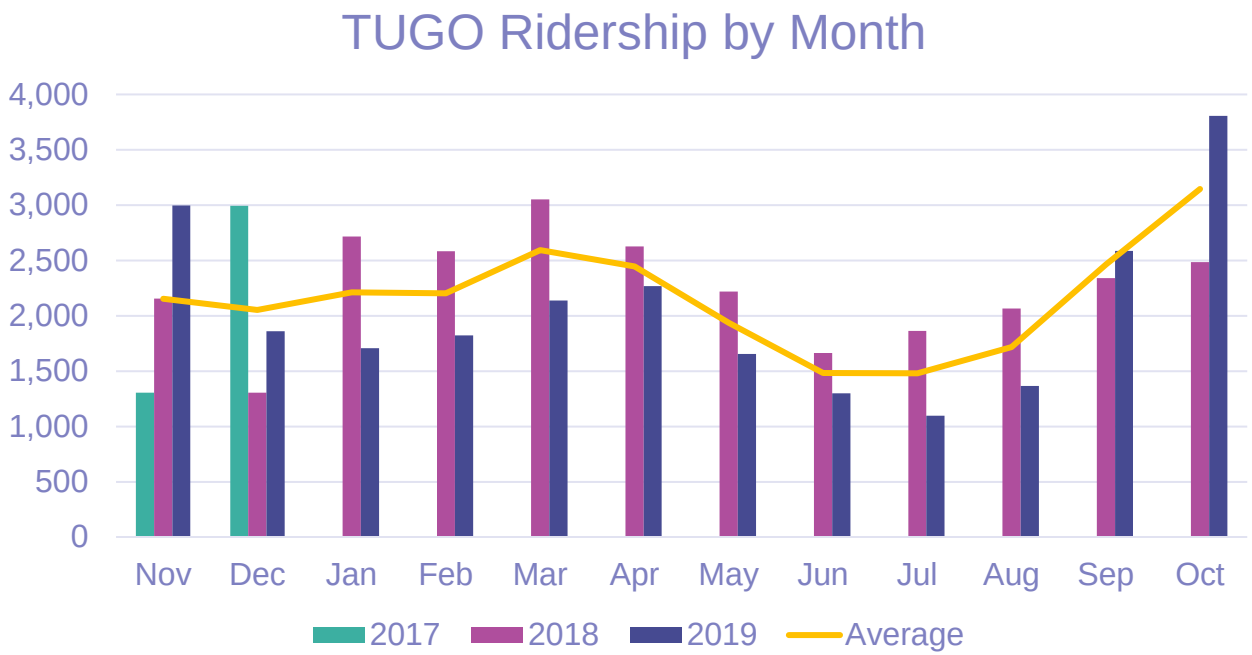
TUGO + SCOOTER SHARE

Since launching in 2017, TUGO bike share has grown to 40 stations. The system hosted over 24,600 trips in 2019 alone. Since system launch, the TUGO program has averaged 70 trips per day.

The E-Scooter launched in September 2019 added more options for how people get around Downtown Tucson and the surrounding neighborhoods. The initial pilot period last 6 months and logged nearly 200,000 trips during this time. There were an average of 1,130 trips per day, generally lasting less than 10 minutes and traveling about 1 mile. The scooter pilot was extended in Spring 2020, although the COVID-19 pandemic has significantly reduced the size of the e-scooter fleet and service area.



TUGO + SCOOTER SHARE



TUGO bike share ridership is generally higher during peak travel times in fall and spring. The e-scooter pilot reflected similar trends.



PUBLIC TRANSPORTATION

Public Transportation Commute Rates

- 3.6% City of Tucson
- 2% Pima County

Key Observations

- SunTran Bus Service and SunLink Street car service provide 56,000 weekday trips.

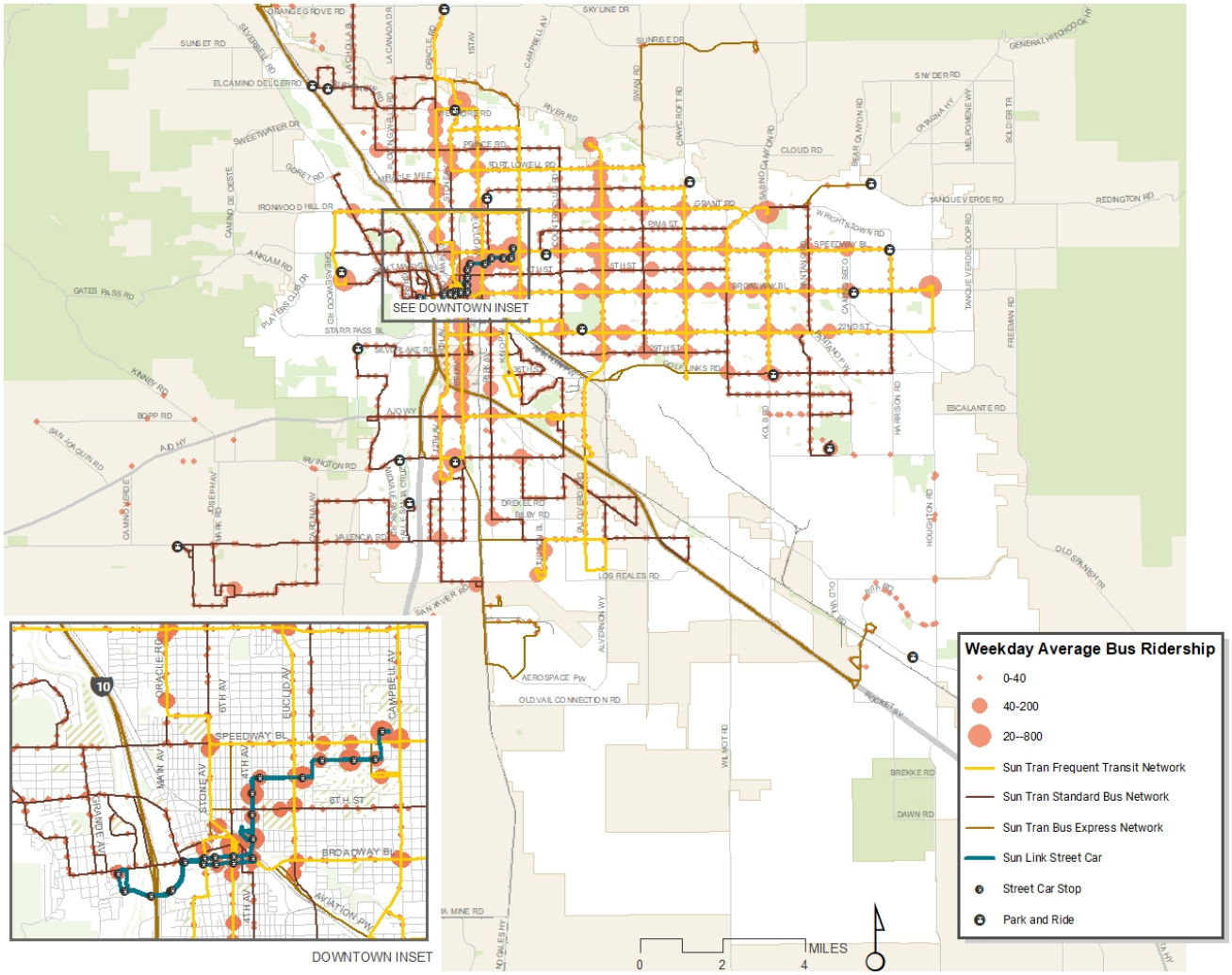
- The system includes 29 regular service routes, 11 of which are frequent transit network routes, and 12 express routes serving over 2,200 stops.

46%

of Tucsonans live within a 10-minute walk of a frequent transit stop.

72%

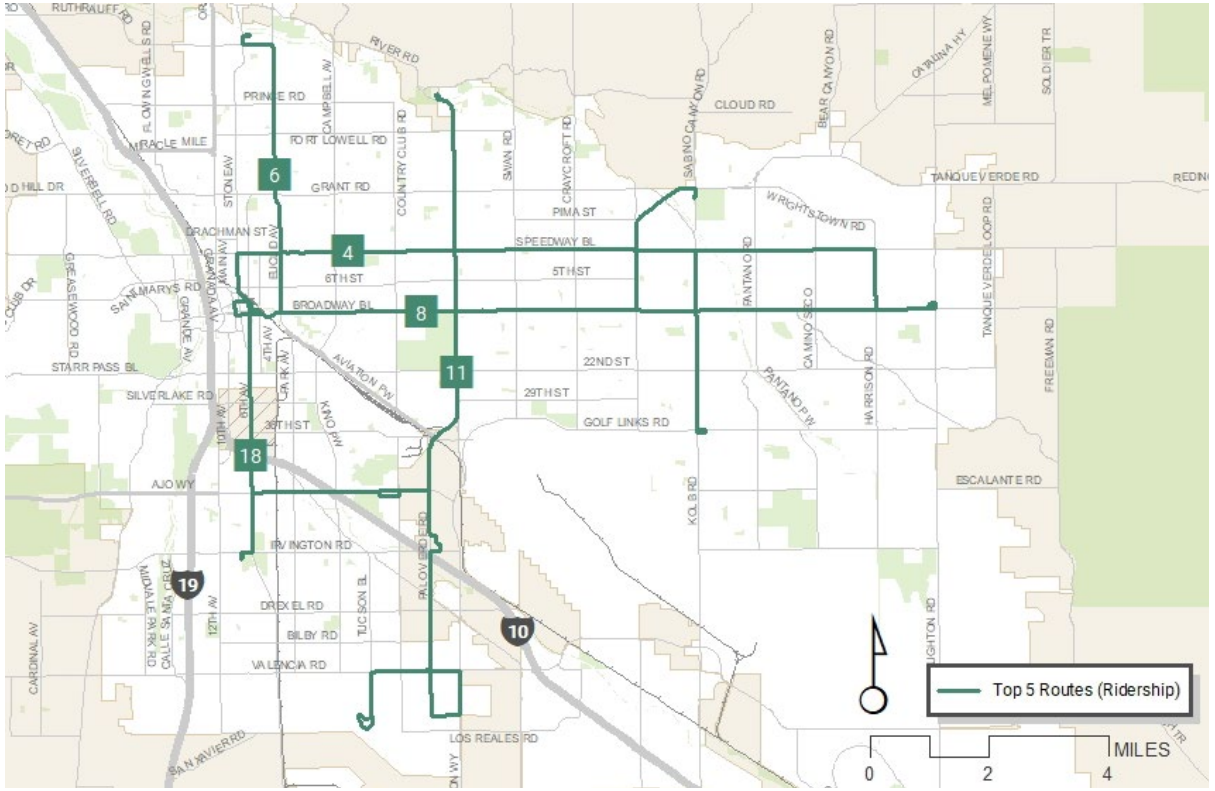
of Tucsonans work within a 10-minute walk of a frequent transit stop.



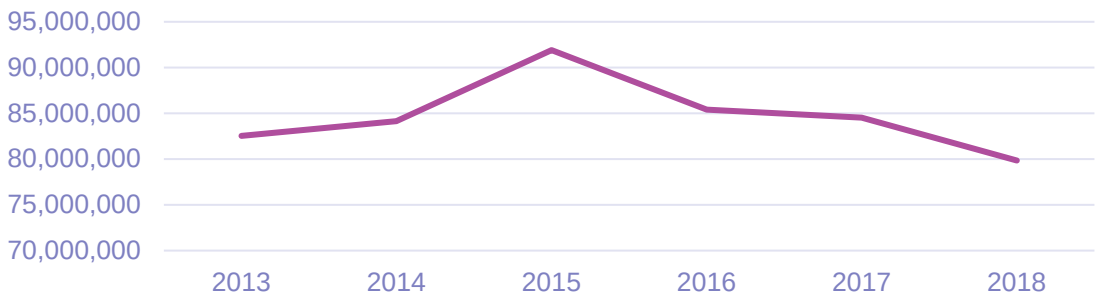
PUBLIC TRANSPORTATION

Key Observations

- Ridership has declined in recent years, similar to national ridership trends.
- SunTran outperforms peer cities of similar size and service on a number of ridership, service, and cost metrics. These cities include El Paso, Albuquerque, Austin, and Fresno.
- Boardings are highest at transit centers and the University of Arizona, with routes along along South 6th Avenue, Alvernon Way, and Oracle having high levels of ridership.
- Sun Shuttle, Sun Van, and Dial-a-Ride provide **557,000 annual passenger trips** for passengers connection to core Sun Tran Service or for passengers with disabilities.



Annual Passenger Miles



PUBLIC TRANSPORTATION

Needs and Opportunities

- Opportunities to improve route travel time may have the largest impact on improving ridership numbers, specifically through implementation of a frequent transit network.

- The 2018 *Long-Range Regional Transit Plan* recommends improving service through implementation of a frequent transit network to support more reliable trip times, longer service periods, and expanded route coverage.

- Nearly half of all transit stops have a shelter, but fewer than **20% have lighting**, and only **33% have a bench**. 33% of all stops lack both a shelter and a bench.

- Improving connectivity to stops by foot and by bike can help support multi-modal trips and increase the reach of existing public transportation service.









DRIVING

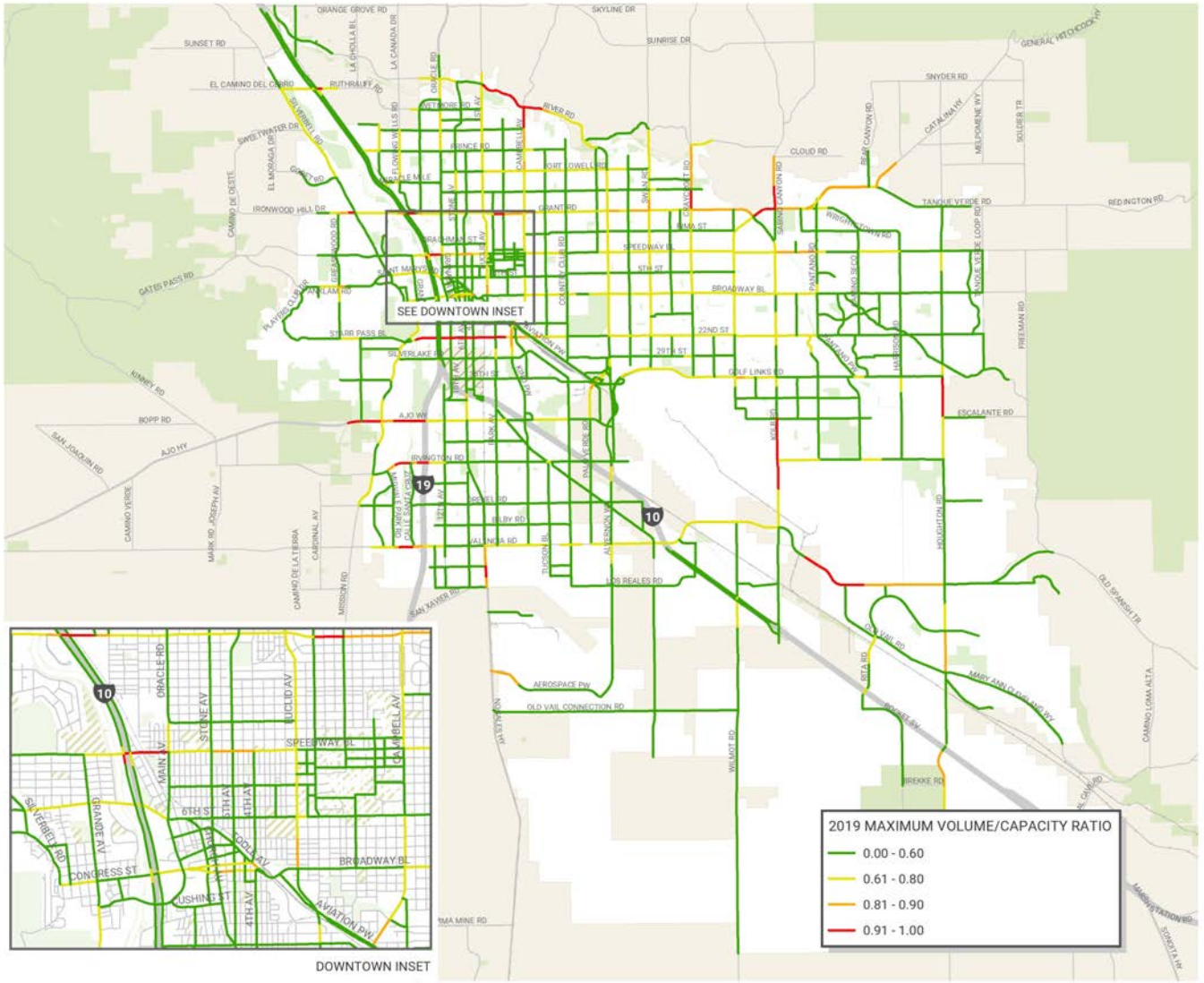
Commute Rates

- 74% City of Tucson
- 77% Pima County

Key Observations

- There is excess capacity on many of Tucson's roadways, with only 9% of major roadways reaching the area threshold for heavy congestion at the busiest time of day.[1]
- Intersection operations may further affect roadway congestion

9% of roadway network congested in 2019



[1] Pima Association of Governments defines heavy congestion levels as greater than 0.8 volume-to-capacity ratio.

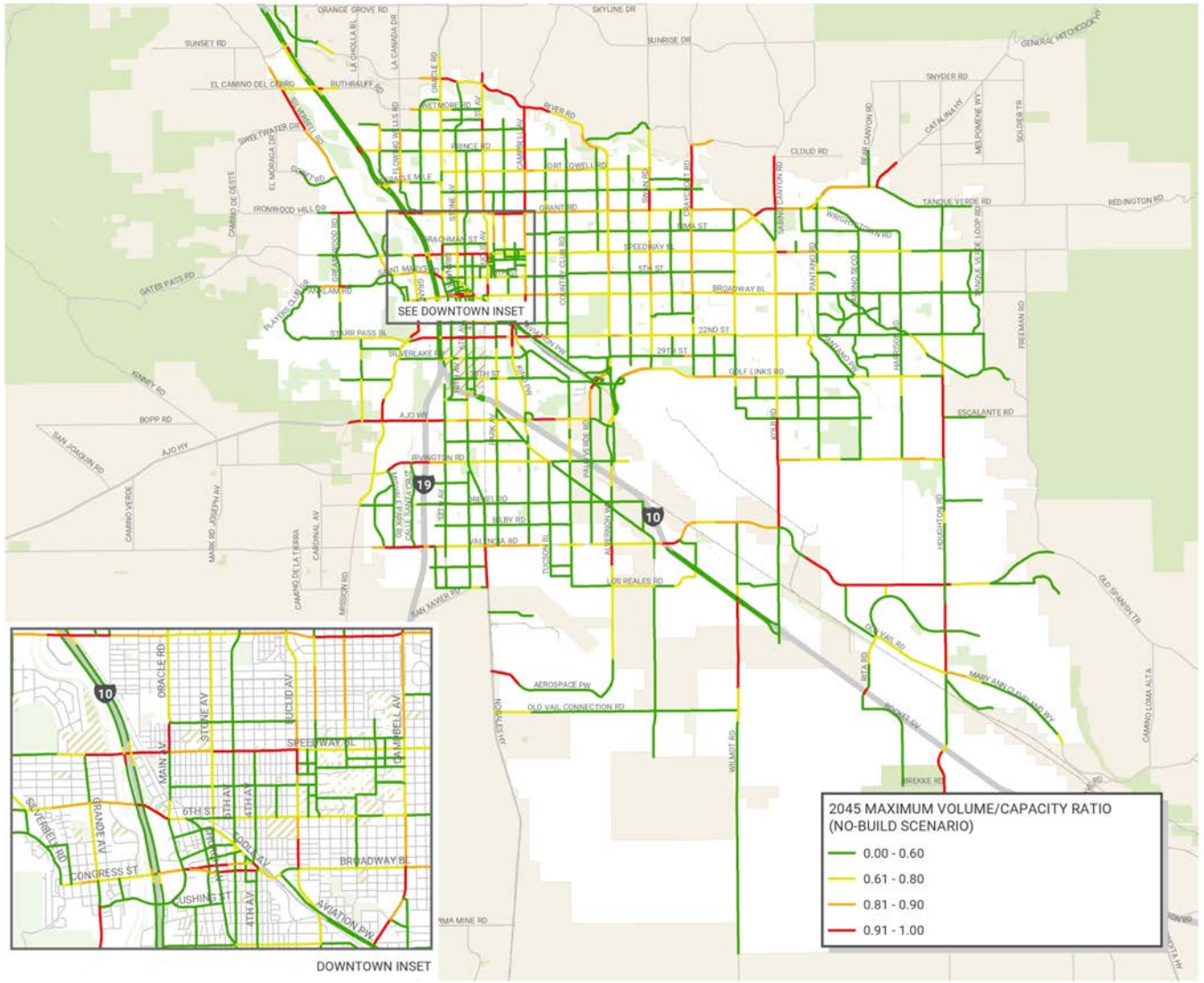
DRIVING ANALYSIS

Key Observations

- Future congestion of Tucson's roadways is expected to increase, with 21% of major roadways meeting the threshold for heavy congestion in 2045 without any operational or roadway capacity improvements.

- Strategies for addressing congestion may vary by location based on land use context and density of population and employment, but may include: upgrading traffic signal operations, improving intersections, and, in some cases, adding travel lanes.

- Expanding and improving mobility options through active and shared modes offer opportunities for improving roadway performance.



DRIVING

Traffic operations are significantly affected when more than 80% of roadway capacity is used. Additionally, there are certain corridors and directions of travel that may see higher or lower travel volumes across the network.

Less than

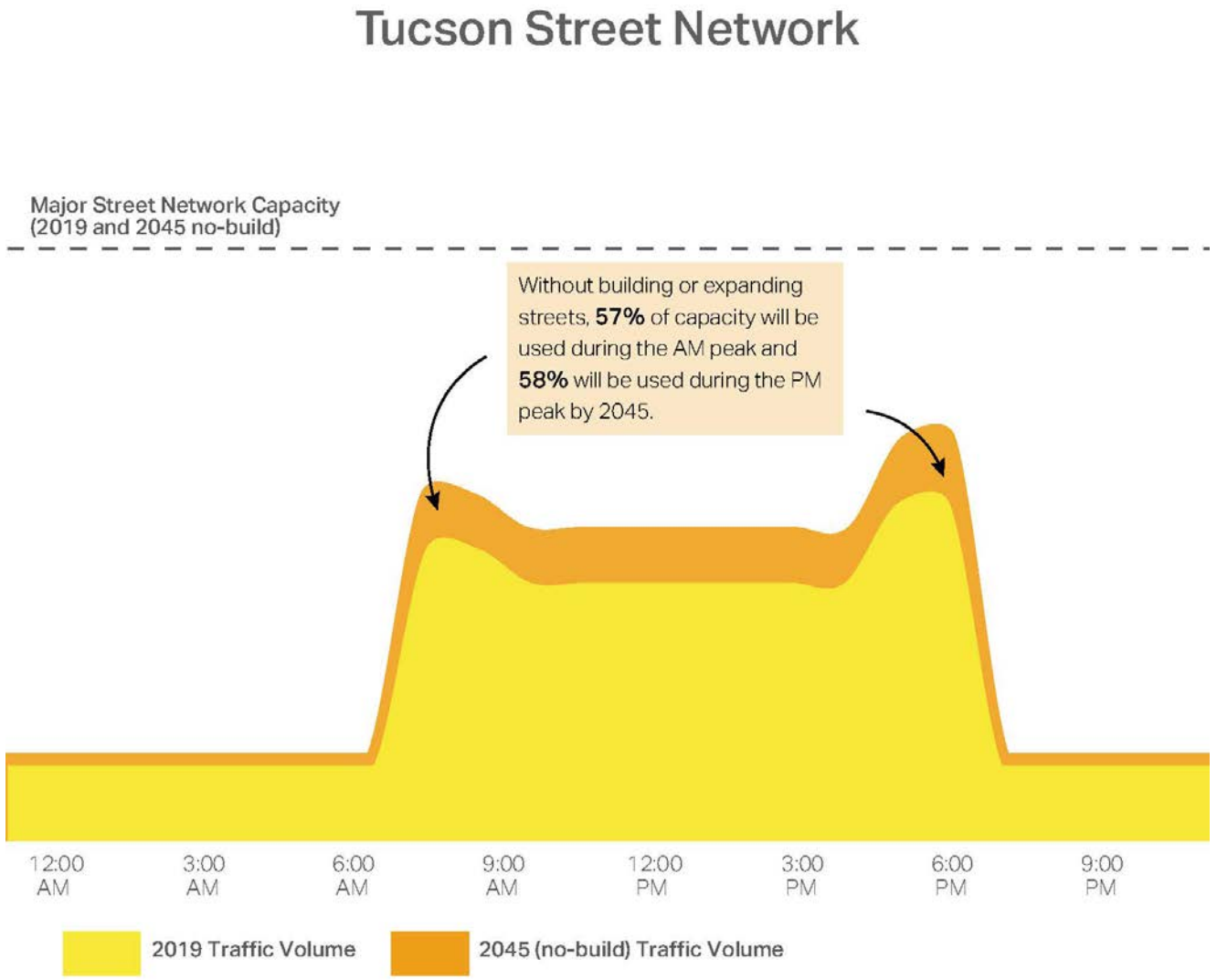
50%

of the major street network's capacity is used during peak travel times today

Without building new roadways, this only increases to

58%

by 2045



DRIVING

Needs and Opportunities

- Development patterns reflect an expectation that people will travel to and from destinations by car.
- Driving-inducing development patterns result in an expansive roadway network that is often in need of maintenance, does not efficiently distribute traffic at peak times, and results in traffic patterns that pose safety concerns for all users.
- Signals along major corridors are outdated and investments in new signal technology could help with traffic operations and improve travel times.
- High travel speeds, wide roadways, and limited lighting increase safety concerns along these roadways.





FREIGHT

Tucson's transportation system also supports a significant amount of freight traffic, with over $195 billion in good traveling on regional roadways in 2013, the majority of which passes through the region along I-10 and the Union Pacific Sunset Route.

Increased volume of freight and passenger vehicles have impacts on both the efficiency of freight activity and the safety of Tucson's roadways.

13%

of all traffic on I-10 are freight vehicles

50

trains travel through Tucson each day

Figure 3.11 16-week truck volumes in eastern Pima County, without interstates (2016)

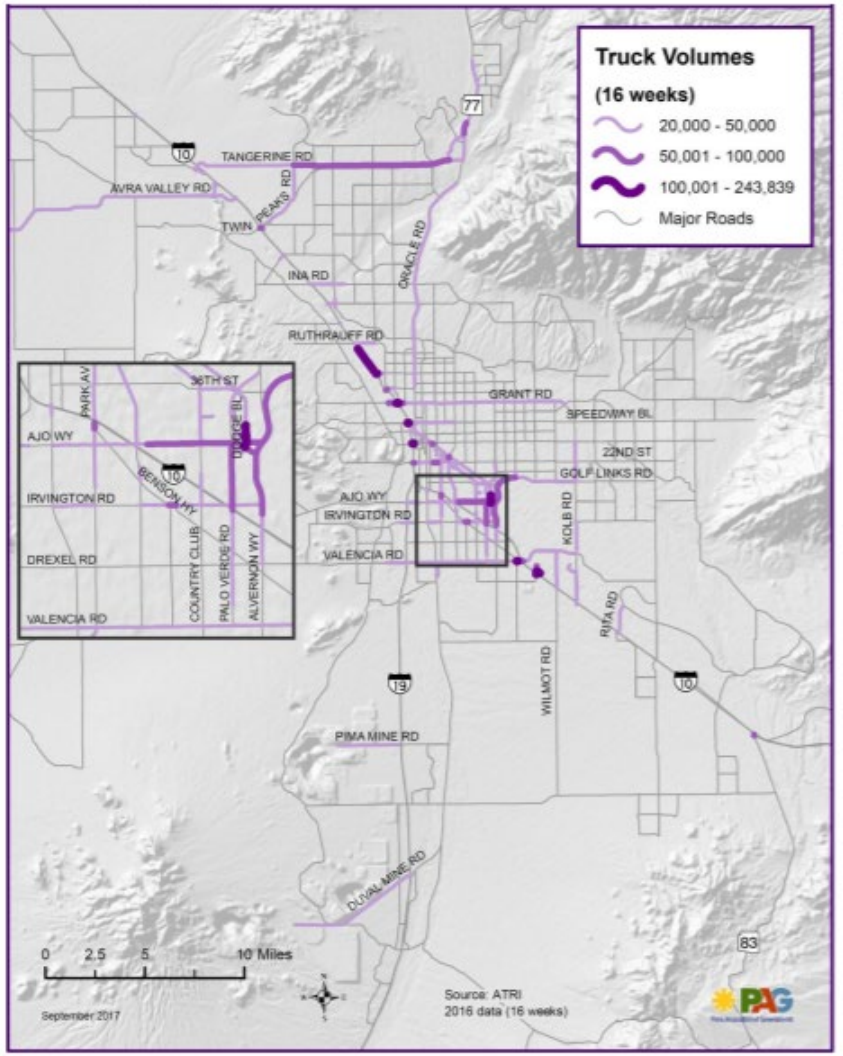


Image Source: 2018 PAG Freight Plan

FREIGHT

Key Observations

- Freight vehicles rely on I-10, Oracle Road, Grant Road, 22nd Street, Ajo Way, and Kino Parkway to travel in and around Tucson
- These roadways also support commercial activity, with personal vehicles traveling along the same corridors
- Mining and other industrial activities contribute to freight activity in the region
- At-grade rail crossings result in traffic delays on affected roadways and can impact safety along roadways and at crossings for all roadway users

Figure 4 shows which locations within the PAG region generate the highest value of freight.

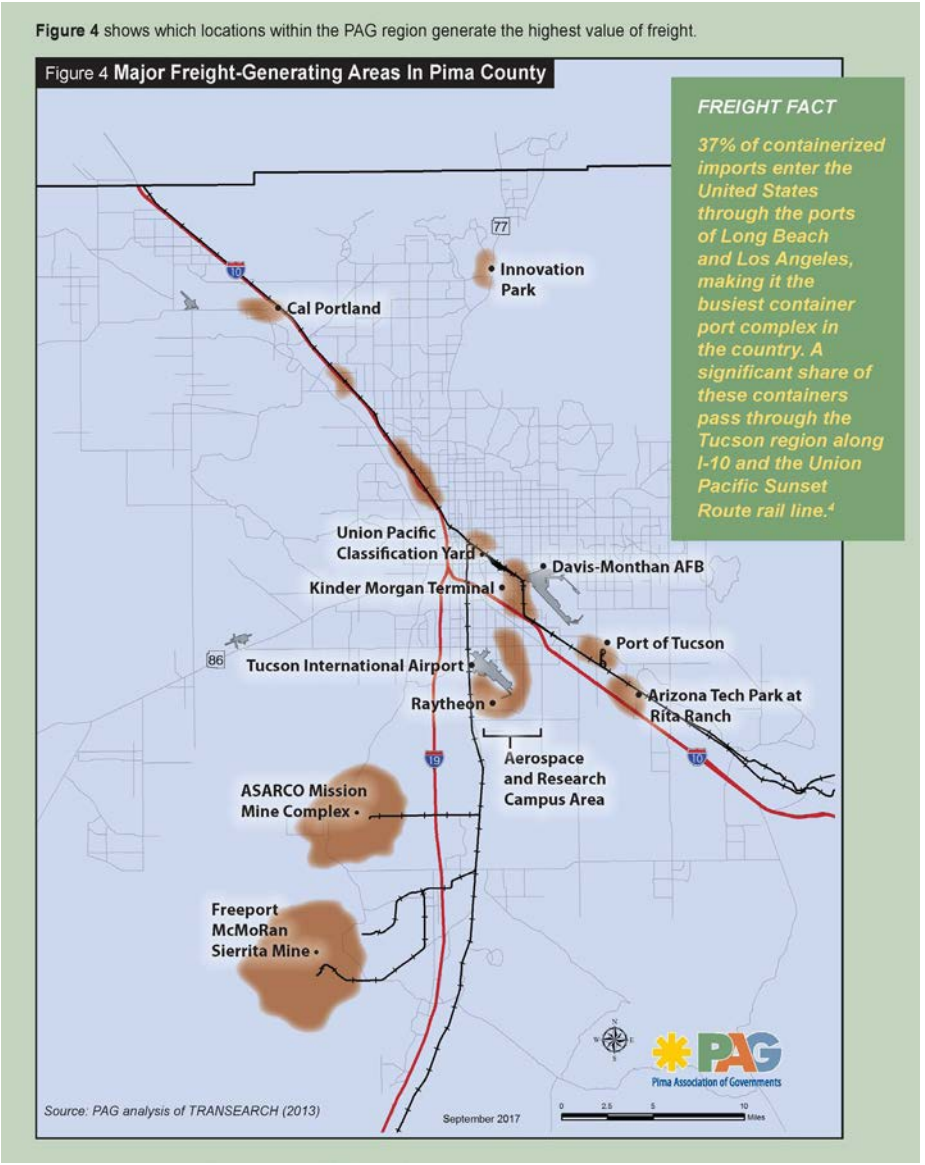


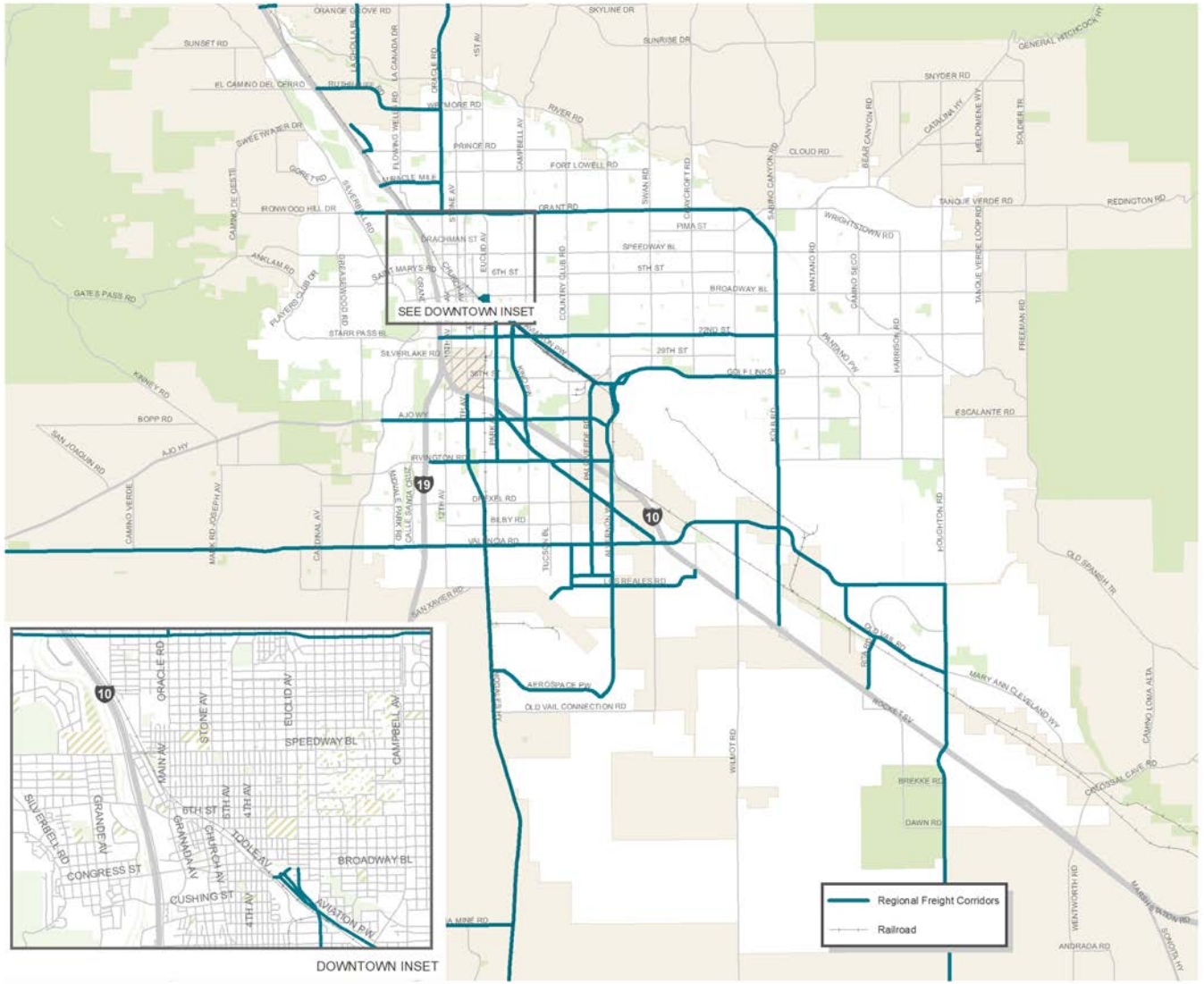
Image Source 2018 PAG Freight Plan

FREIGHT

Needs and Opportunities

- Supporting freight movement on identified corridors provides benefit to the area's economic activity; however, the mix of competing uses on major corridors can cause conflicts among the different user groups and lead to safety and mobility challenges for all travelers

- Particular attention should be given to how these routes interact with more vulnerable road users to increase safety for all. At grade railroad crossings and intersections along roads with a high volume of freight activity are key locations of concern.



Special Topics

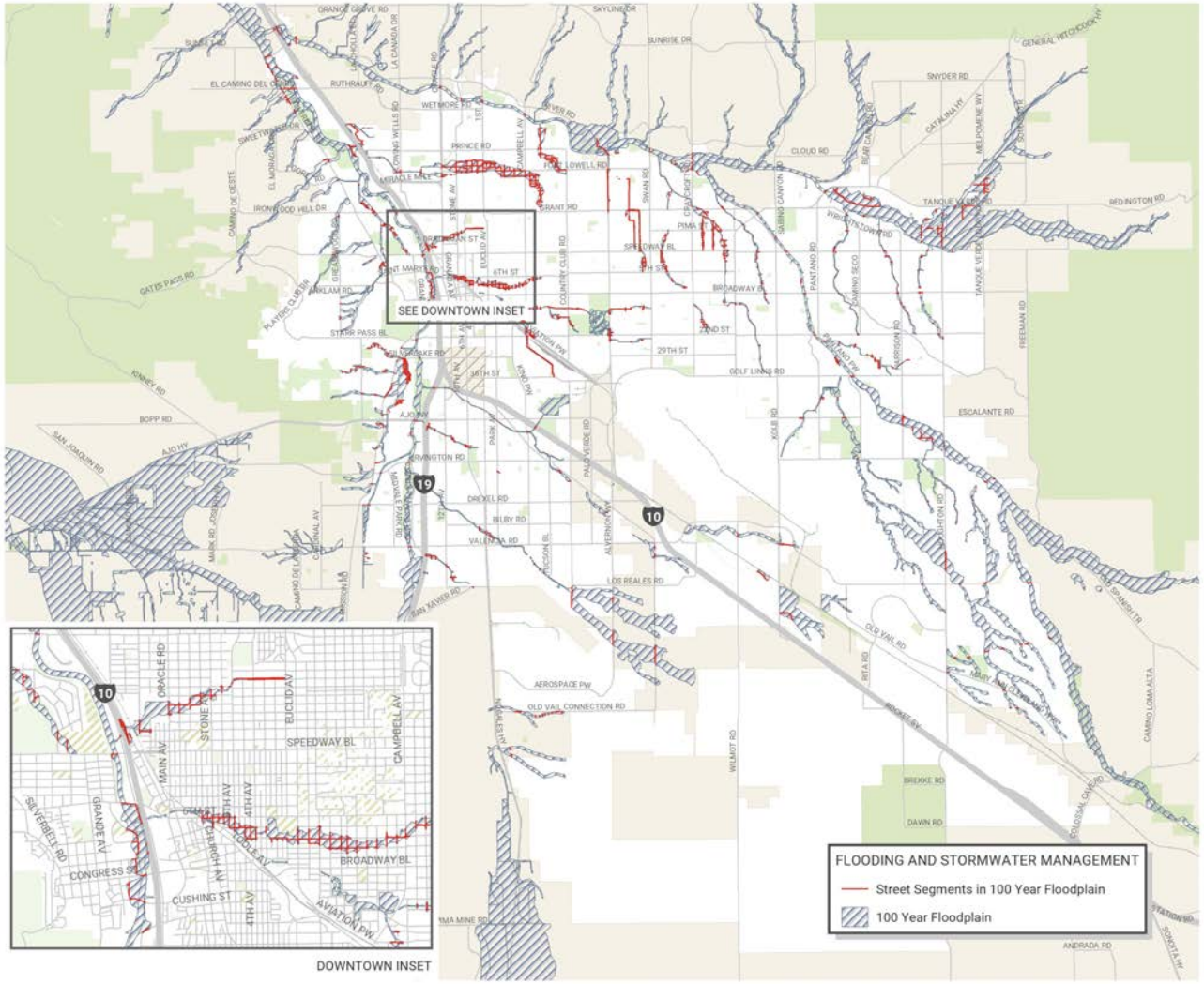
move tucson
DELIVERING MOBILITY CHOICES

FLOODING AND STORMWATER MANAGEMENT

Although a small segment of Tucson's roadways are within a floodplain, major storm events can quickly impede travel along many roadways.

3.2%

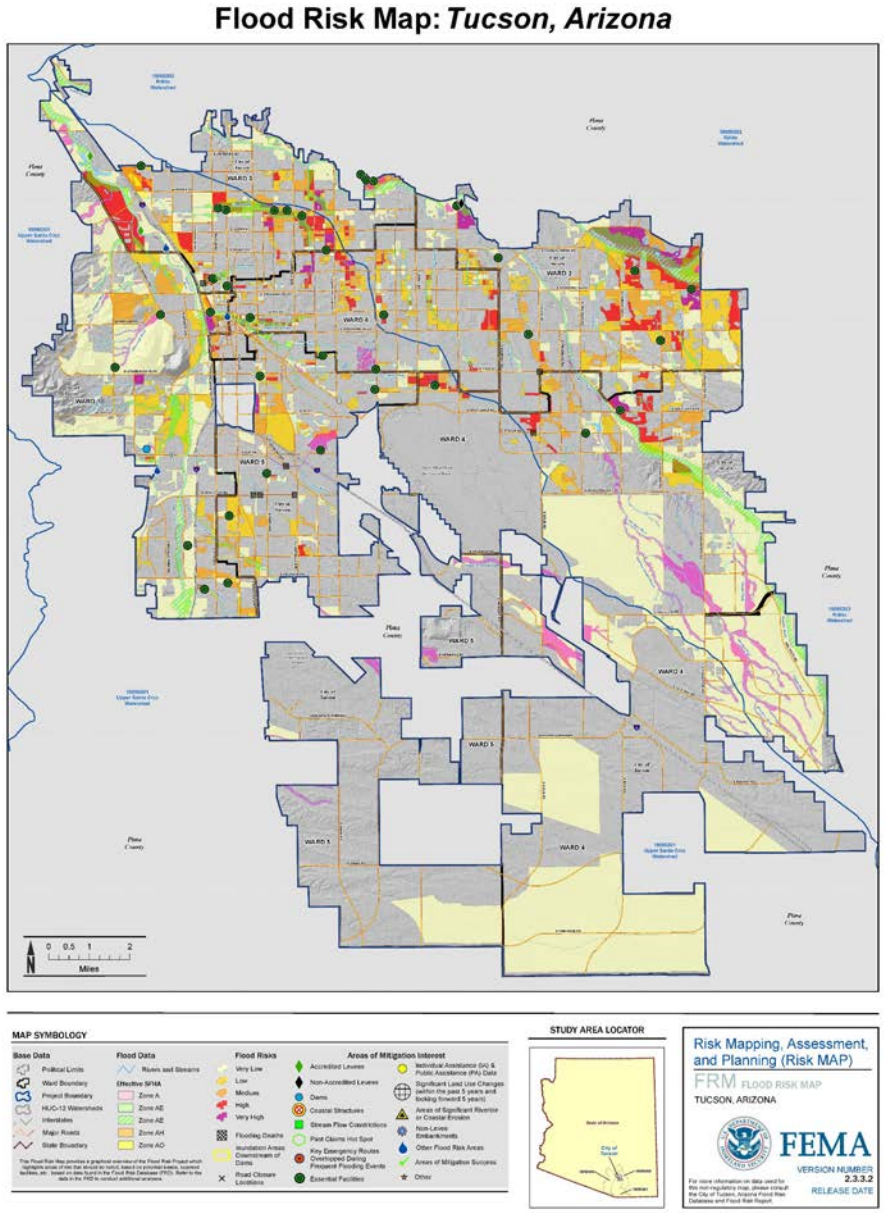
of roadway network is within the 100-year flood plain



FLOODING AND STORMWATER MANAGEMENT

The limited stormwater system relies primarily on roadways for water conveyance, resulting in additional wear and creating barriers for all modes when flooding occurs.

High percentages of impervious surfaces and limited tree canopy further limit opportunities for infiltration and stormwater management.



GREEN STORMWATER INFRASTRUCTURE (GSI)

To help divert stormwater and improve tree canopy the City and partners have implemented GSI in locations across the City and identified high priority areas for new GSI investment.

High priority areas, as identified by PAG, include locations with lower than average tree canopy and higher than average heat events.

The recently-approved Green Stormwater Infrastructure Fund will support implementation of over 86 new projects in the next 15 years and offer opportunities to coordinate with projects funded through other initiatives, such as Proposition 407.

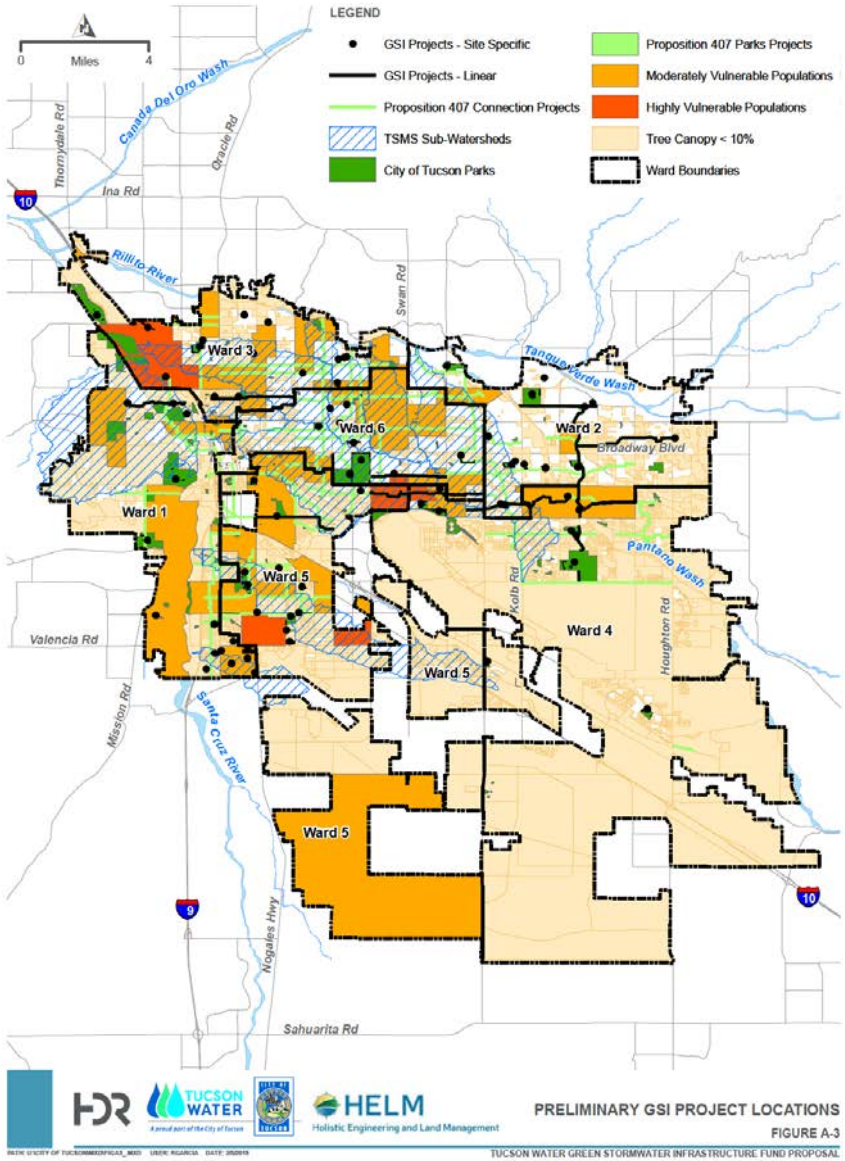


Image Source: City of Tucson GSI Report

LAND USE AND TRANSPORTATION

Walkable Neighborhoods Index

How far people have to travel influences travel choices. The Walkable Neighborhoods Index identifies areas in the City where destinations are close and where there is the greatest opportunity to expand travel options beyond driving. These areas are distributed throughout the City and present opportunities to align growth in jobs and homes with transportation investments that create more opportunities to walk, bike, and take transit.

77%

of people living in Tucson work within areas with high potential for walking and biking.

98%

of schools are within areas with high potential for walking and biking

68%

of people working in Tucson work within areas with high potential for walking and biking.

90%

of parks are connected to areas with high potential for walking and biking

