

COMMUNITY ANALYSIS

Understanding the context into which a bike share program would be introduced is important in determining whether such a program is feasible. The project team undertook a GIS-based heat mapping analysis to understand where bike share might be most successful in Tucson and conducted a review of how some of the physical, demographic, and cultural characteristics of Tucson might impact the potential demand for bike share.



Figure 1: Downtown Tucson and the University of Arizona.

The heat mapping process included spatially analyzing several variables believed to influence bike share demand including:

- Physical conditions and topography;
- Population density and housing;
- Employment density;
- Colleges and student populations;
- Visitors and tourism;
- Transportation, including transit, car share, and regional transportation; and
- Bicycling infrastructure.

Each of these variables were mapped and scored with weightings based on the project team's experience with usage and uptake rates in other cities with bike share systems. These scores were then compiled to develop a "heat map" that shows the areas of the community most likely to embrace bike share. The spatial analysis of each variable and the resulting heat mapping process are described below.

Physical Conditions

Tucson is located in Pima County in south-central Arizona. It is situated on the banks of the Santa Cruz River at the intersection of Interstates 10 and 19 approximately 60 miles north of the U.S. – Mexico border. It is the second largest city in Arizona (behind Phoenix) with a city population of over 500,000 people and a metropolitan area population of approximately 1 million people.

The city covers a large area of approximately 227 square miles. Downtown Tucson is located on the central west side of town and includes a high proportion of the region’s employment and governmental services and is home to numerous cultural, entertainment, and visitor attractions. Downtown Tucson also includes several historic, residential, and commercial neighborhoods and is defined as the area shown on **Figure 2** extending north to Speedway Boulevard, east to Campbell Avenue, south to 22nd Street, and west of I-10. It is built primarily on a grid street network interrupted by the interstate, rail corridors, and other physical features.

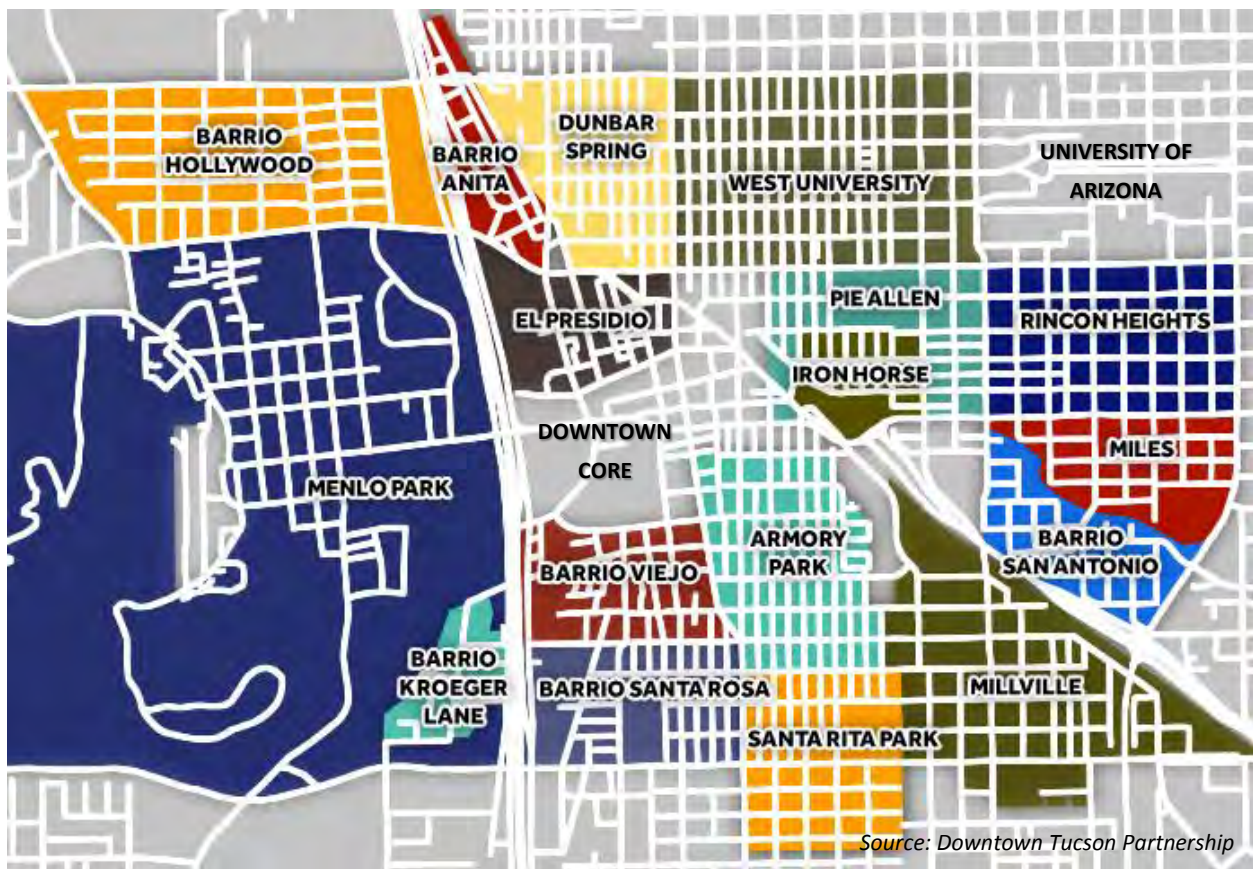


Figure 2: Downtown Tucson Neighborhoods.

The city is home to the University of Arizona, a 40,000 student campus located approximately 1 mile northeast of Downtown Tucson. Outside of the downtown core, suburban growth has extended the city to the north and east with significant single family residential development. However, there are pockets of higher densities and several large commercial, educational, health, and employment centers including



Pima Community College, several hospital campuses, and the technology and aerospace industries around the Tucson Airport and the Davis-Monthan Airforce Base.

Tucson is situated in the Sonoran Desert and although the city is surrounded by mountain ranges it is generally flat within the city limits with some hills in the northeast parts of the region in the Catalina Foothills. A topography map is shown on **Figure 3**.

Tucson has very hot and dry summers with average temperatures exceeding 90 F between May and September. Temperatures are milder between October and April and with average highs ranging from 65 F to 85 F. There is very little rainfall with an annual average of 12 inches of rain, although occasional, intense thunderstorms can occur in the summertime. The mild temperatures and low rainfall encourage spring, fall, and winter bicycling.¹

Challenges:

- Outside of Downtown Tucson, land use tends to be fairly low density and follows the major arterials and highways; and
- Extremely hot weather during the summer could have an impact on ridership and will likely result in lower demands on extremely hot days.

Opportunities:

- Downtown Tucson and the immediately surrounding area offer a variety of high density land uses with a generally well-connected, grid-like street pattern that encourages bicycling;
- Mild winter temperatures and very little precipitation will encourage year-round operation; and
- The majority of the city is generally flat.

Demographics

Bike share ridership is influenced by the density and mix of land uses, or in other words, bike share works best where many people live, work, play and take transit. Certain populations have been shown to be early adopters of bike share in other cities. Deploying a system in areas of Tucson with these characteristics will help to maximize early success.

Tucson is home to approximately 500,000 people living in the city and approximately 1 million people living in the metropolitan area. The City of Tucson represents a population density of approximately 2,300 people per square mile, which is within the range of the peer cities shown in **Table 1**.

Figure 4 shows the distribution of population density in Tucson. The highest population densities are in the areas around the University of Arizona and along the corridors north and south of Downtown. There are also pockets of higher density in the east and northeast of the city. There are also many areas of the city where population density is very low and may be more challenging for bike share.

¹ <http://www.usclimatedata.com/climate/tucson/arizona/united-states/usaz0247> Accessed on December 1, 2014.

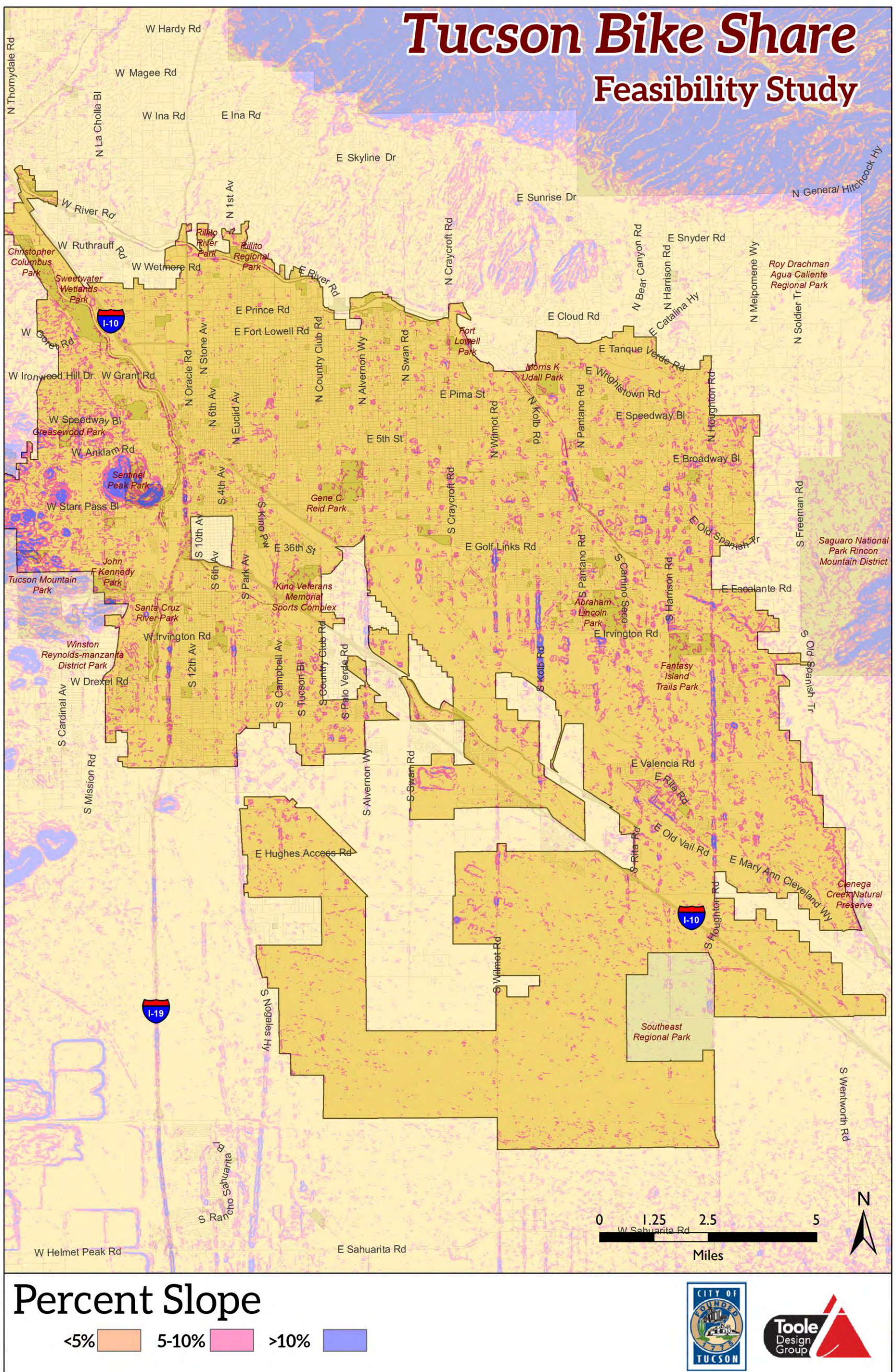


Figure 3: Topography Map of Tucson.

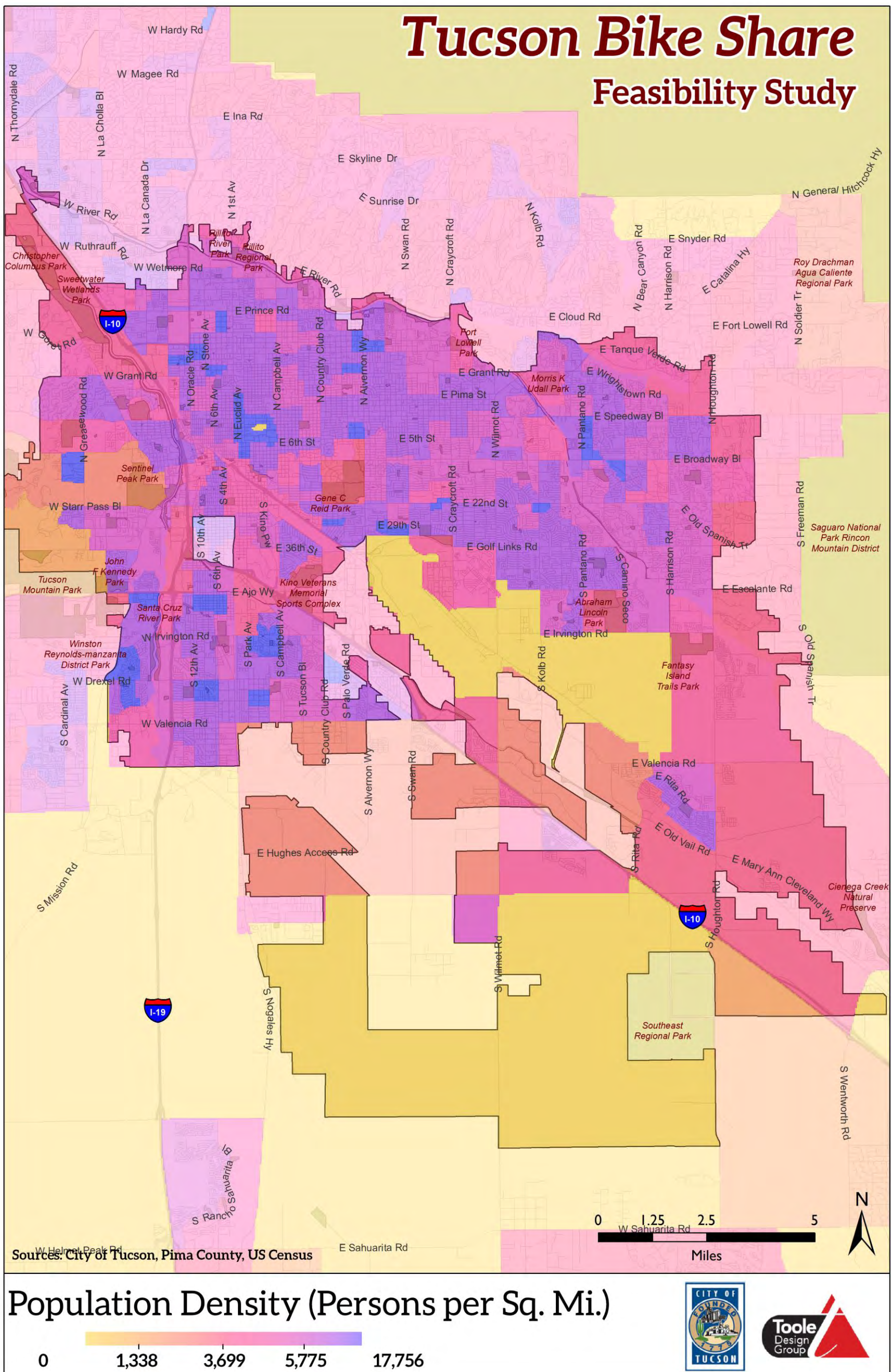


Figure 4: Tucson Population Density Map



Table 1: Population Density of Peer Cities

	Area (sq.mi.)	Population	Density (pop./sq. mi.)
Minneapolis/St. Paul	106	670,000	6,321
Denver	153	600,000	3,922
San Antonio	461	1,330,000	2,885
Phoenix	517	1,450,000	2,805
Charlotte	298	731,000	2,457
Tucson	227	520,000	2,291
Indianapolis	361	820,000	2,270
Fort Worth	340	741,000	2,181
Salt Lake City	111	185,000	1,667

Exploring the demographics of the population in Tucson, the 2012 American Community Survey² shows that:

- The median age is 33 and a large proportion of the population (around 44 percent) is between the ages of 20 and 50 as shown on **Figure 5**;
- The median household income is just over \$37,032 (lower than at the state average of \$49,774);
- Approximately 24-percent of the population has a bachelor’s degree or higher; and
- The demographic composition of the City, shown on **Figure 6**, includes approximately 48-percent Caucasian, 42-percent Hispanic/Latino, 5-percent African American, 3-percent Asian and 3-percent of Native Hawaiian, American Indian or other background.³

The above factors are important, as experience in other cities shows that early adopters tend to be younger, well educated, and more affluent riders⁴. The University, with its population of young, educated students will likely be an early adopter of the system as will more affluent communities. **Figure 7** maps concentrations of these populations by

² US Census Bureau. 2008-2012 American Community Survey 5-Year Estimates. DP03 Selected Economic Characteristics

³ US Census Bureau. 2008-2012 American Community Survey 5-Year Estimates. DP05 Demographic and Housing Characteristics.

⁴ Surveys of annual members of Capital Bikeshare in 2012 showed that 95% of annual members had a bachelor’s degree (compared to 51% of the entire Washington D.C. population), that the median salary of annual members was between \$75,000 and \$100,000 per year (compared to the city-wide median salary of \$64,267 per year), and that approximately 63% of annual members were between the ages of 18 and 35 (compared to 17% of the regional employee population). Based on a survey conducted by LDA Consulting: *2013 Capital Bikeshare Member Survey Report*. Accessed online at <http://capitalbikeshare.com/assets/pdf/CABI-2013SurveyReport.pdf> on January 6, 2014.

Tucson Snapshot

(Based on 2010 U.S. Census)

526,116

Population (2013)

24%

Bachelor’s degree or higher

\$37,032

Median household income

2,291

Persons per square mile

28%

Aged 20 – 35 years old



selecting census blocks where at least two of the following criteria were met:

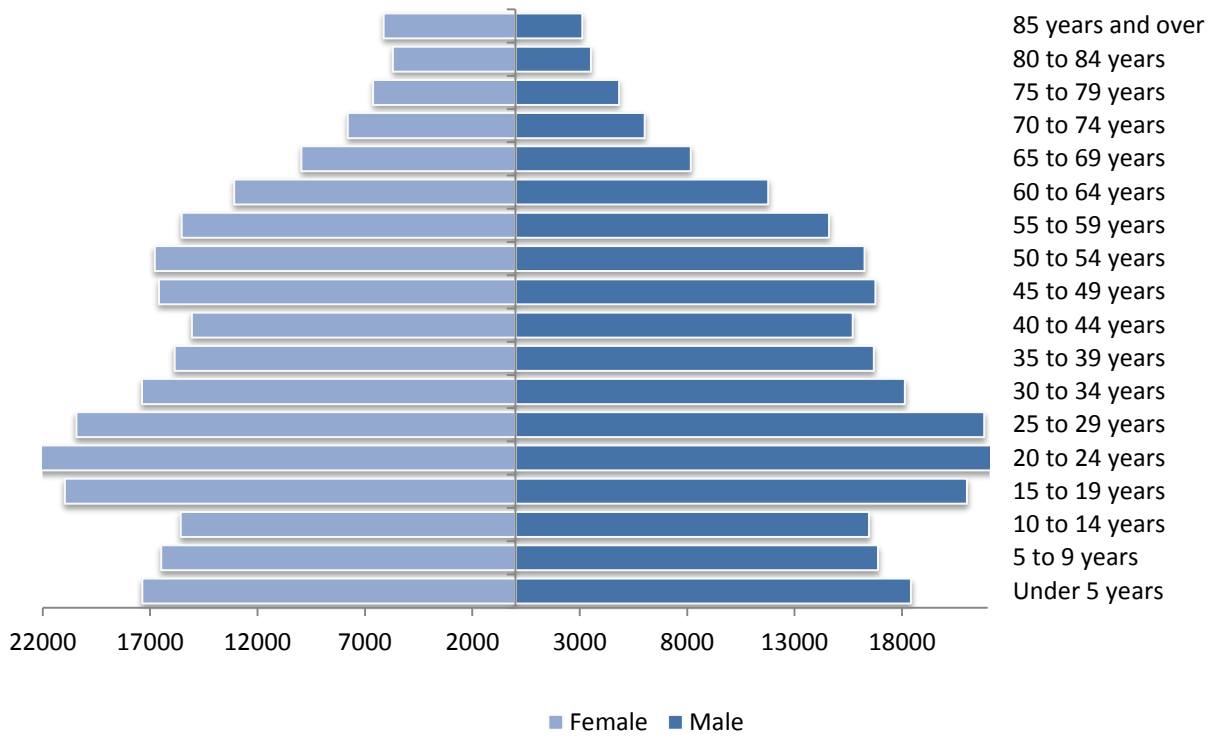


Figure 5 - Population by Age and Sex.

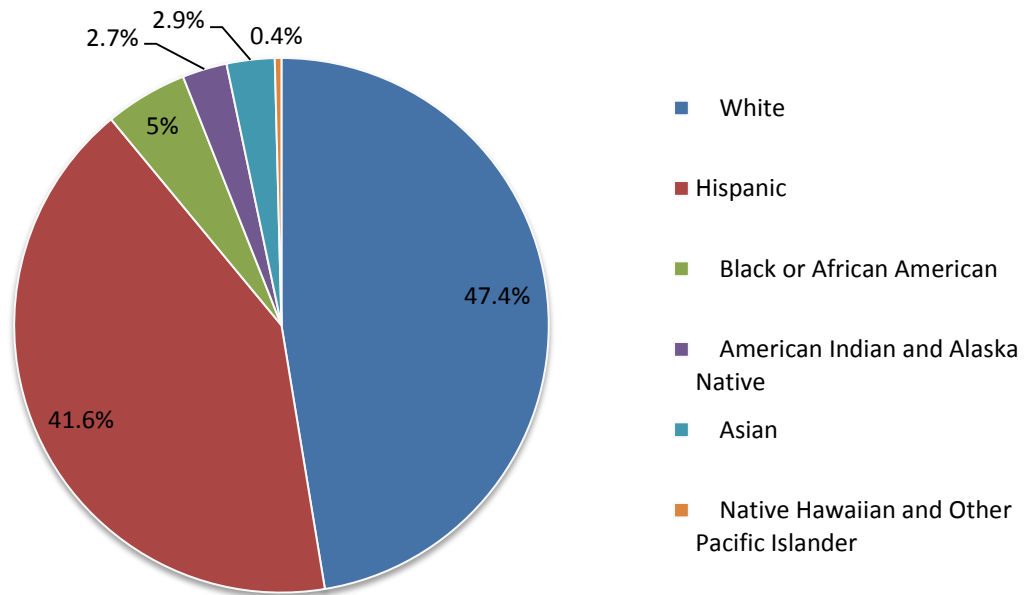


Figure 6 – Demographic Composition.

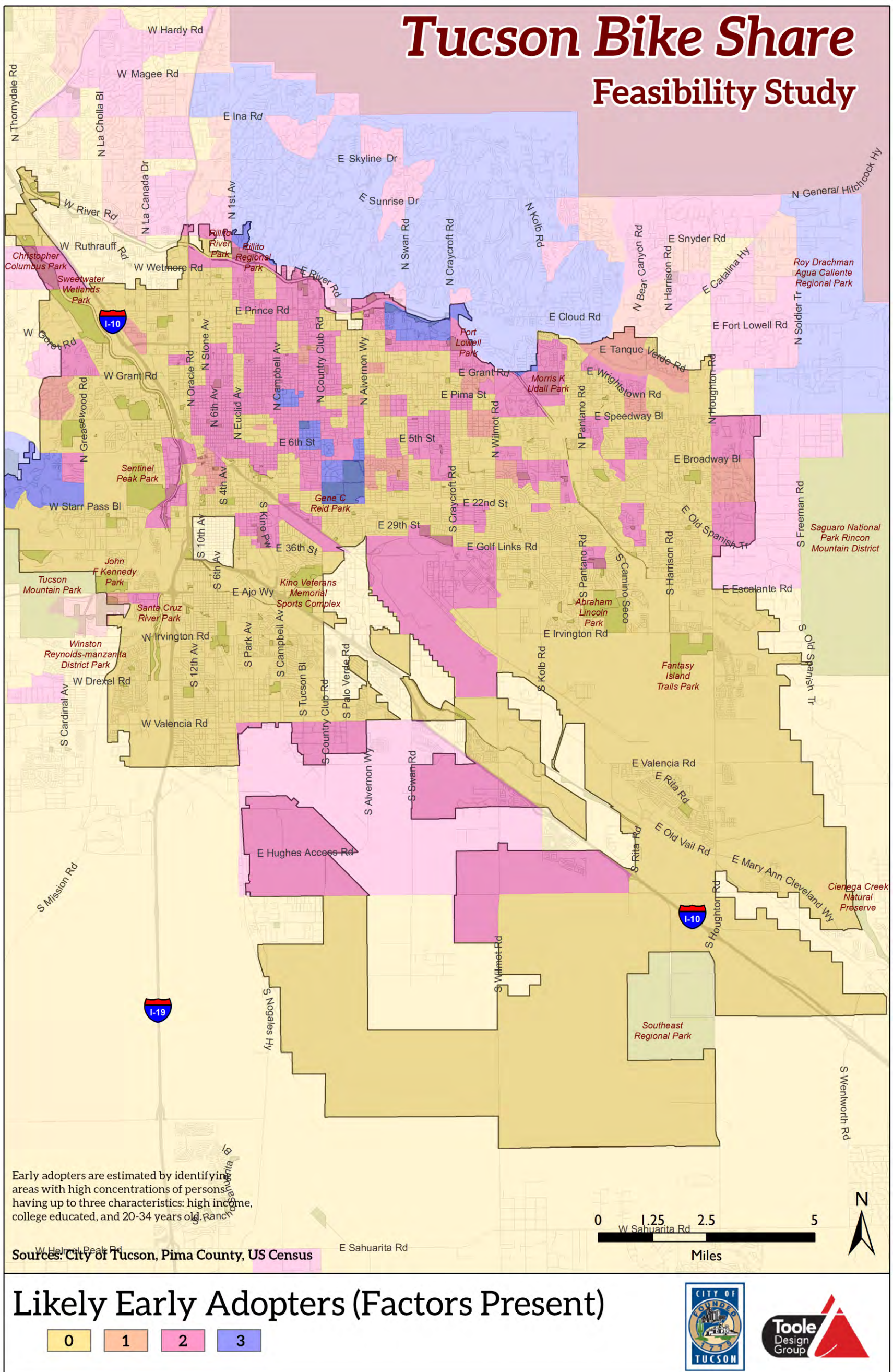


Figure 7 - Potential Early Adopters of Tucson Bike Share.



1. The percentage of the population with a bachelor's degrees or higher, or that are currently enrolled as a college student, is at least 25-percent higher than the city median (i.e., census blocks with greater than 30-percent);
2. The percentage of the population aged between 20 and 35 is higher than the city median (i.e., greater than 31-percent); and
3. The average salary is at least 25-percent higher than the city median (i.e., greater than \$46,290).

Figure 7 shows that the area around the University campus and to the southeast near Reid Park, as well as areas to the north of the city and in the Foothills have high concentrations of potential early adopters. It is noted that Figure 7 was constructed using 2012 data and that since that time, the Modern Streetcar has student housing and other development and is likely to also include a significant number of potential early adopters.

Challenges:

- Population densities are low in many parts of Tucson. Bike share will need to be more strategically located in these areas and focused around specific attractions or activity centers.

Opportunities:

- There are relatively high population densities in Downtown Tucson and around the University of Arizona;
- There are several areas with high proportions of young, middle-class, and well-educated populations, who tend to be early adopters of bike share; and
- There are areas of Tucson with high proportions of low income and ethnically diverse populations. Bike share could be an opportunity to improve these populations' access to transportation, jobs, and other services but will require strategic site planning and marketing of the system.

Employment

Just as population density has a strong influence over bike share success, so does the number of jobs and density of day-time activity. Bike share programs expand transit options for local commuters and offer a convenient way to get around during the day.

Tucson's economic environment has attracted a number of technology and aerospace firms in the south of the city around the Tucson Airport and the Davis-Monthan Air Force Base, as well as a significant health care sector located on campuses throughout the city. In addition, the University of Arizona is a significant employer and Downtown Tucson serves as an administrative hub with the City of Tucson, Pima County, and other state and federal offices employing approximately 8,000 people in Downtown Tucson with many public employees based at the City-County complex at Presidio Park. A further 4,000



private sector office employees work downtown with the largest concentrations on Congress Street and Stone Avenue.⁵

Figure 8 uses a probability density function created from employment density point data to show the areas of the city with the highest density of employment. It shows that the highest employment densities are: in the downtown core and around the University of Arizona campus; in eastern areas of the city around the Tucson Medical Center, the Park Place Mall, and commercial districts along Broadway Boulevard and Speedway Boulevard; in southern areas of the city around the University of Arizona Medical Center and Pima County Health Center and at Raytheon and the Tucson International Airport; and to the north at the Tucson Mall and associated commercial district.

The 15 largest employers in Tucson are listed in **Table 2**. Although some of these may not be obvious candidates for bike share in the immediate term (e.g., Raytheon Missile Systems), there may be unexpected opportunities for sponsorship, future opportunities to bring bike share to their campuses or to connect them to nearby destinations. In Salt Lake City, Kennecott Utah Copper and Rio Tinto are major sponsors of the GREENbike bike share program, although bike share is not provided at the mine.

Table 2: Largest Employers in Tucson⁶

Employer	Estimated Employees
Raytheon Missile Systems	12,140
University of Arizona	10,363
State of Arizona	8,708
Davis Monthan Airforce Base	7,755
Tucson Unified School District	7,684
Wal-Mart Stores, Inc.	7,192
Pima County	6,767
U.S. Army Intelligence Center	6,236
City of Tucson	5,399
Phelps Dodge Mining Company	4,900
Carondelet Health Network	3,746
TMC HealthCare	3,135
University Medical Center Corp	2,918
CheckMate Professional Employer	2,033
University Physicians, Inc.	1,460

For other large employers, bike share could provide an immediate term opportunity to connect them to local destinations and to provide bike share membership to their employees as part of their employee wellness or travel demand management programs. For example, St. Mary’s (Carondelet) is located just over a mile from the Convento-Congress Street streetcar station and bike share could be a means of connecting the campus to the streetcar.

⁵ Downtown Tucson Partnership (2010). *Revitalizing Downtown Tucson: Building the New Pueblo*.

⁶ <http://www.visittucson.org/about/facts/> Accessed on December 1, 2014.

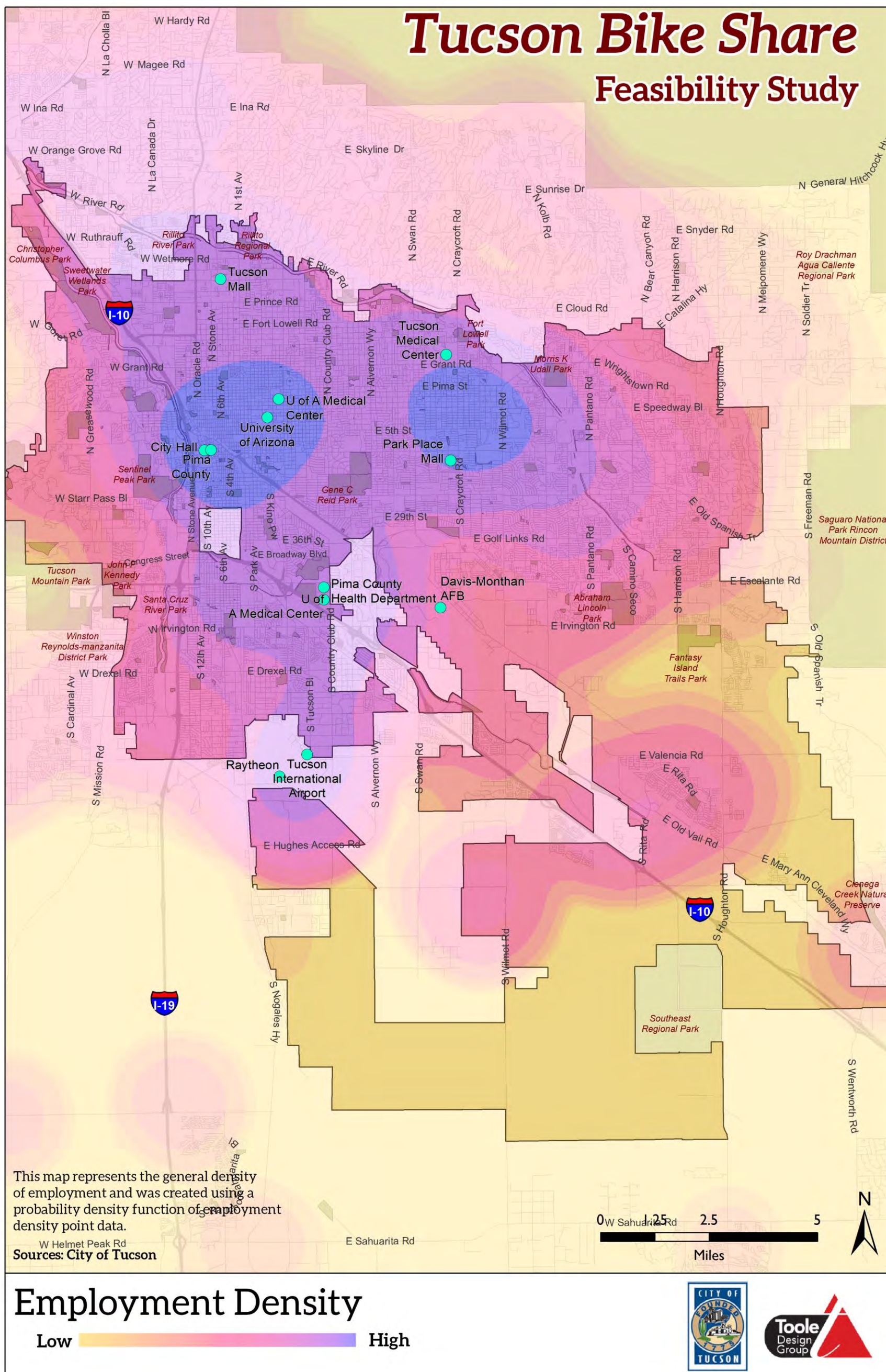


Figure 8: Tucson Employment Density Map



Challenges:

- Although there are some major employment campuses, employment densities are generally lower in areas outside of the downtown core and may present a challenge for implementing bike share in these areas.

Opportunities:

- There are high concentrations of employment in Downtown Tucson and around the University of Arizona. As well, the large student populations at the University of Arizona and Pima Community College are potential early adopters of the system.
- Significant public sector employment in Downtown Tucson could provide group membership opportunities. Other large employers, such as those in the health care sector, could be interested in sponsorship and could provide bike share membership as a wellness benefit for employees or as part of their transportation demand management program.
- There are several other pockets of high employment density in the City. These include the hospital and health campuses in the east of the city and a number of major employers in the southern part of Tucson focused around the technology and aerospace industry. These employers could provide a focus for future phases of the program to connect these jobs to local attractions and neighborhoods.

Education

Tucson includes a large student population from the University of Arizona, Pima Community College, and other college campuses that represent a large pool of potential early adopters.

The University of Arizona is a 3-square-mile campus located approximately 1 mile northeast of Downtown and has an enrollment of over 40,000 students and over 12,000 full-time equivalent faculty and staff.⁷ Bike share systems in cities with universities have been well-utilized by students. A bike share system in Tucson could similarly help students move around within the campus, connect (particularly the northern part of campus) to the streetcar, and connect the educational, sporting, and cultural attractions of the campus to downtown, commercial districts such as the 4th Avenue Business District, and to student housing.

The University of Arizona is one of the busiest bicycling areas in the City of Tucson. The University's bicycle program is run by Parking and Transportation Services, which operates a number of bicycle-related programs including free, optional bicycle registration, a bike valet program, service and repair stations, and their own bike share program. Cat Wheels allows students and employees with a valid ID card to check out one of 55 bicycles for free for up to 24-hours from one of nine staffed parking garages or other locations. The bicycle must be returned to the station where it was checked out. Approximately 3,800 bicycles were checked out in the 2011-2012 fiscal year.

⁷ <http://factbook.arizona.edu/2013-14> Accessed on December 1, 2014.



In several cities bike share stations have been located on university property. Site selection should be sensitive to areas with heavy pedestrian traffic and any locations where bicycling is not permitted. In addition, communication of on-campus bicycling rules can be emphasized when designing the posters on the bike share stations.

Pima Community College is one of the largest community colleges in the United States with an enrollment of over 50,000 students annually and over 1,300 full time faculty and staff.⁸ The main campus is located approximately 3 miles west of Downtown and there are several smaller campuses in other parts of the city including in Downtown.

There are several significant student housing developments that may be good locations for bike share stations to connect students to campus and to broader community amenities. Developments such as the District on 5th, the Hub, and Main Gate Village as well as new student housing developments in the downtown area such as Cadence and Junction would be good candidates for bike share stations.

Opportunities:

- The large student, faculty, and staff populations at the University of Arizona and Pima Community College are potential early adopters of the system; and
- Major student housing developments could be well used bike share locations to connect students to campus and to other community amenities.

Visitors and Tourism

Tourists, visitors, and other casual users provide an important revenue stream representing approximately two-thirds (2/3) of user-generated revenues in peer cities. This may be because tourists and visitors are less cost-sensitive and are willing to pay higher fees to keep the bicycle out longer.

According to Tourism Arizona, the Tucson and Southern Arizona region attracted approximately 6.4 million visitors in 2013.⁹ In addition, over 2.5 million people visit Tucson from Mexico each year with the primary trip purposes being shopping, visiting family and friends, and work.¹⁰

There are over 10,000 hotel rooms in Tucson with several major clusters. Downtown Tucson includes only two hotels; however there are several hotels just south of Downtown on the west side of I-10 and several others north of Downtown along Main Avenue and Stone Avenue. There are a number of large hotel chains located along Broadway and in other areas east of Downtown and there is a large cluster of hotels on the northeast side of the Tucson International Airport.

The most popular visitor attractions in Tucson are shown in **Table 3**. Several of Tucson's smaller visitor attractions such as its museums and theaters are located in or within a short ride of Downtown. As well, the Reid Park Zoo is approximately a 3 mile ride east of Downtown and is the city's third largest visitor

⁸ <https://www.pima.edu/campuses-centers/quick-facts/index.html> Accessed on December 1, 2014.

⁹ https://tourism.az.gov/sites/default/files/documents/files/GCOT%20Slides%20071514FINAL_1.pdf Accessed on December 2, 2014.

¹⁰ Visit Tucson website: <http://www.visittucson.org/media/research-facts/visitor-stats/> Accessed on December 2, 2014.



attraction. A significant number of visitors are drawn by the University and to the sports, arts, and cultural venues on the campus. The annual Tucson Gem, Mineral, and Fossil Showcase is the city’s largest event and attracts 50,000 people over two weeks in early February to the Convention Center and a variety of other locations across the city.

Several other attractions such as the Pima Air & Space Museum and the Tohono Chul Park are a ten mile ride from Downtown and many of the larger attractions such as the Saguaro National Park, the Arizona-Sonora Desert Museum, the Old Tucson Studios theme park, and several State Parks are located outside of the City limits. Although access to these sites may not be provided directly by bike share, it is important to connect visitors from their accommodations to entertainment venues, commercial districts, restaurants, and to transportation that can take them to further afield attractions.

Table 3: Top 10 Visitor Attractions in Tucson¹¹

Attractions	Annual Attendance (2005 – 2006)	Description
Saguaro National Park	740,000	Saguaro cacti, Upper Sonoran Desert biota, hiking trails, visitor center
Arizona-Sonora Desert Museum	470,000	Zoological park, geological museum, botanical garden
Reid Park Zoo	445,000	17-acre zoo, animals in natural settings, gift shop
Pima Air & Space Museum	300,000	Operate Pima Air & Space Museum & Titan Missile Museum
Pima County Fairgrounds	250,000	County fair, exhibits, 4-H, concerts, carnival rides
Patagonia Lake State Park	200,000	Camping, boating and fishing
Kartchner Caverns State Park	200,000	Guided cave tours, gift shop, campground
Old Tucson Studios	195,000	Family theme park, movie location, live entertainment
Mt. Lemmon Ski Valley	190,000	Restaurant, shops, hiking, skiing, lifts
Tohono Chul Park	175,000	Sonoran desert plants, culture, lectures, nature trails, nursery, bird watching, shops, tearoom

Connecting business travelers from their hotels to meeting spaces, the Convention Center, restaurants, entertainment venues, and recreational facilities such as some of the regions’ multi-use pathway system may also provide a potential market segment for the bike share system. Conference and event planners could purchase bulk casual memberships to offer multi-day bike share membership as part of their attendees’ welcome packets.

Tucson also has a number of unique commercial districts offering a variety of retail, restaurants, and entertainment venues. Major commercial districts that may be attractive to bike share include Congress Street in Downtown, the 4th Avenue commercial district and Main Gate Square between Downtown and the University of Arizona, the Lost Barrio east of Downtown, and (perhaps as part of a future phase) the upscale La Encantada in the Catalina Foothills.

¹¹ City of Tucson – Housing and Community Development website: <http://hcd.tucsonaz.gov/hcd/tucson-update-tourism>
Accessed on December 2, 2014.



In addition to visitor attractions, there are a number of local services, amenities, and attractions such as community centers, libraries, parks, etc. that will draw potential bike share users. **Figure 9** shows the location of some of the area's major visitor attractions, hotel clusters, commercial districts, and community amenities.

Challenges:

- There are only two hotels in Tucson's Downtown Core;
- Many of Tucson's major visitor attractions are outside the range of the bike share system; and
- Marketing to tourists and visitors tends to be more expensive as it requires additional outreach beyond standard digital marketing.

Opportunities:

- The City has a significant tourist and visitor market. Tapping into this demographic will help boost user-generated revenues. Bike share could provide a means for hotel guests to move about the city without needing an automobile;
- Bike share will increase the connection for visitors to the University of Arizona's cultural attractions, sporting events, and academic tours.
- Conventions and special events may increase usage and can be tied with special membership deals or short-term passes to introduce people to the system; and
- Bike share can serve day visitors looking to experience Tucson's multi-use trails and will strengthen Tucson's reputation as a bike friendly city and destination for bicycling and the outdoors.

Transportation

Tucson offers a variety of transportation options that includes private automobile, regular bus service, a new streetcar line, miles of dedicated bikeways, car share, and regional rail, bus, and air services.

The road network is generally laid out in a traditional grid pattern in the downtown and in older parts of the city and is conducive to bicycling. Further from Downtown, development patterns generally follow the arterial roads with less connectivity provided by the lower order street system. However, Tucson and Pima County have made significant investments in a regional trail system that connects many neighborhoods as well as provides an almost complete loop around the city.

Tucson is still a predominately auto-oriented city – single occupancy vehicle use represents approximately 74-percent of all commuting trips (See **Figure 10**).¹² The supply and low cost of parking has traditionally encouraged vehicle travel. Metered parking prices range from \$0.50 to \$1.00 per hour for on-street spaces and there are over 15,000 parking spaces in the downtown alone including approximately 1,000 metered on-street spaces.¹³

¹² US Census Bureau. 2008-2012 American Community Survey 5-Year Estimates File B08101 Means of Transportation To Work By Age.

¹³ <http://www.downtowntucson.org/get-around/parking/> Accessed on December 2, 2014

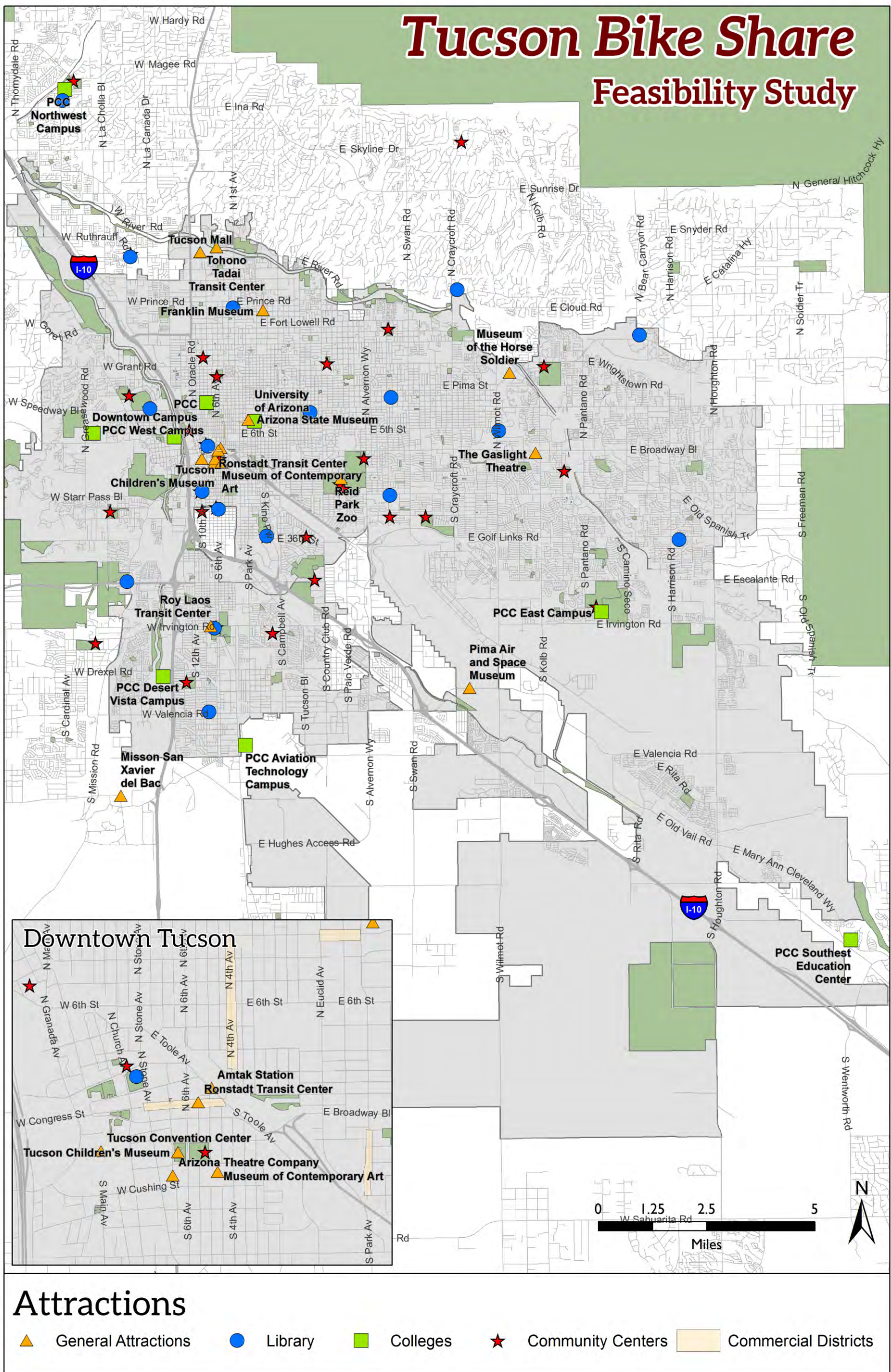


Figure 9: Tucson Visitor and Community Attractions Map.



Bike share provides an opportunity to replace some motor vehicle trips with bike share trips. In other cities of similar size, between 20- and 40-percent of bike share trips replace automobile trips. It would also provide an option for commuters that did not drive to move about during the day. Approximately 21-percent of people bicycled, walked, took public transportation, or carpooled to work.

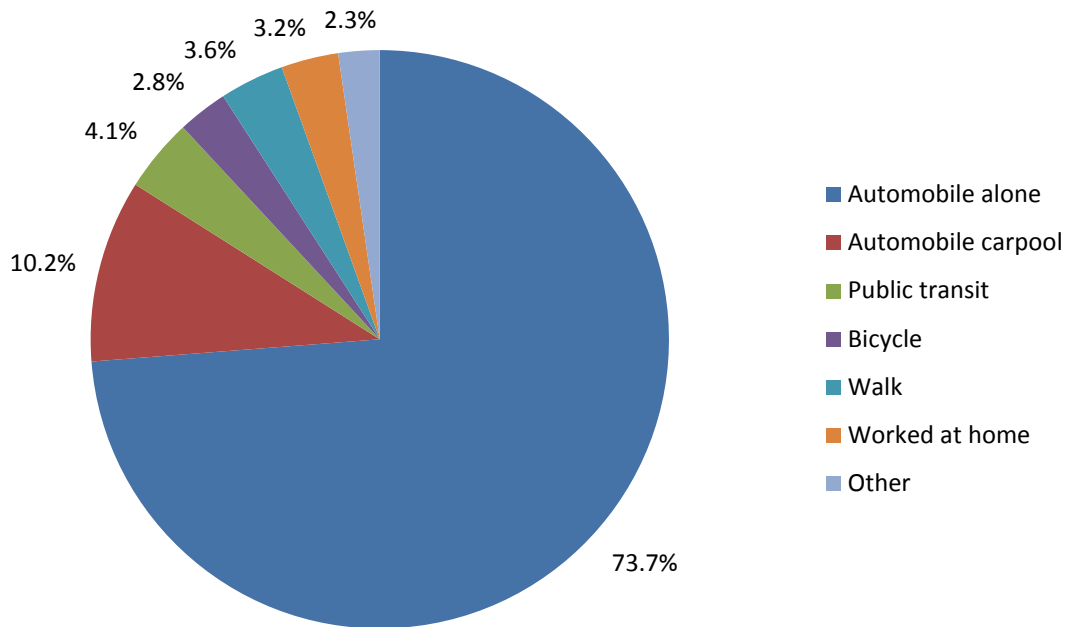


Figure 10 - Journey to Work Mode Share in Tucson

Local transit service in Tucson is provided by Sun Tran, which is overseen by the Transit Services Division of the City and operated by private sector companies. Transit service includes Sun Tran (regular bus service), Sun Express (express bus service), Sun Shuttle (neighborhood transit service), and Sun Link (modern streetcar). Sun Tran serves approximately 20 million passenger trips annually and the bus system includes over 250 buses, 40 fixed routes, and more than 2,200 bus stops. The network includes three major transit centers: the Ronstadt Transit Center in Downtown Tucson; the Tohono Tadaí Transit Center in north Tucson and the Ray Laos Transit Center in the southern part of Tucson.

The Ronstadt Transit Center is a logical location for a bike share station in the initial phase of the system. Although the initial system may not reach the other two transit centers, they could form part of a future phase of the system that would include bike share stations to connect people from the surrounding neighborhoods to the Tohono Tadaí and Ray Laos Transit Centers where they could make transit connections to Downtown Tucson and other locations. Bike share would be available at both ends of their trip.

Transit fares in Tucson are \$1.50 per ride and can be paid in cash or using a SunGO smart card that provides a single payment option and allows riders to transfer on Sun Tran, Sun Express, Sun Shuttle, and the Sun Link modern streetcar. One day and 30-day passes are also available and University of



Arizona and other college students are eligible for the U-Pass or other fare discounts. In 2013, Sun Tran operated with a farebox recovery of 22.7% and at a cost of \$2.71 per passenger.¹⁴

The Sun Link modern streetcar is a 3.9 mile streetcar route that connects the University of Arizona, the University Main Gate Business District, the 4th Avenue Business District, Downtown Tucson, and the Mercado District (see **Figure 11**). It was constructed using a combination of federal and local funding sources.¹⁵ Since the project began, it has seen significant development along the route with over 50 new restaurants, bars, and cafes, 1,500 new student housing apartments, and 50 new retail businesses developed in the space of two years.¹⁶ The service operates at the following headways:

Monday - Wednesday

- 7 am - 9 am every 15 minutes
- 9 am - 6 pm every 10 minutes
- 6 pm - 10 pm* every 15 minutes

Thursday - Friday

- 7 am - 9 am every 15 minutes
- 9 am - 6 pm every 10 minutes
- 6 pm - 12 am every 15 minutes
- 12 am - 2 am* every 30 minutes

Saturday

- 8 am - 10 am every 30 minutes
- 10 am - 12 am every 15 minutes
- 12 am - 2 am every 30 minutes

Sunday

- 8 am - 10 am every 30 minutes
- 10 am - 6 pm every 20 minutes
- 6 pm - 8 pm every 30 minutes

¹⁴ Sun Tran Factsheet: http://suntran.com/pdf/fact_sheets/Fact%20Sheet%20-%20System%20Overview%20Sun%20Tran.pdf
Accessed on December 2, 2014. These figures do not include the Sun Link modern streetcar.

¹⁵ <http://www.sunlinkstreetcar.com/index.php?pg=5> Accessed on December 2, 2014.

¹⁶ <http://www.sunlinkstreetcar.com/index.php?pg=13> Accessed on December 2, 2014.



Figure 11: Sun Link Streetcar Route Map.

Bike share provides a way to extend the reach of transit services by providing a fleet of bicycles available at major transit and streetcar stations that can be used to complete trips to nearby destinations.

Until recently, the City of Tucson operated a free Downtown Loop shuttle van service that served the stops shown on **Figure 12**. The discontinued Downtown Loop was replaced with changes to Route 22, which provides additional access to the community services on Bonita Avenue throughout the day and evening. As with the Downtown Loop, the Bonita Avenue leg of the Route 22 will only be run on weekdays. Bike share can provide access on weekends when traditional transit service does not service Bonita Avenue.

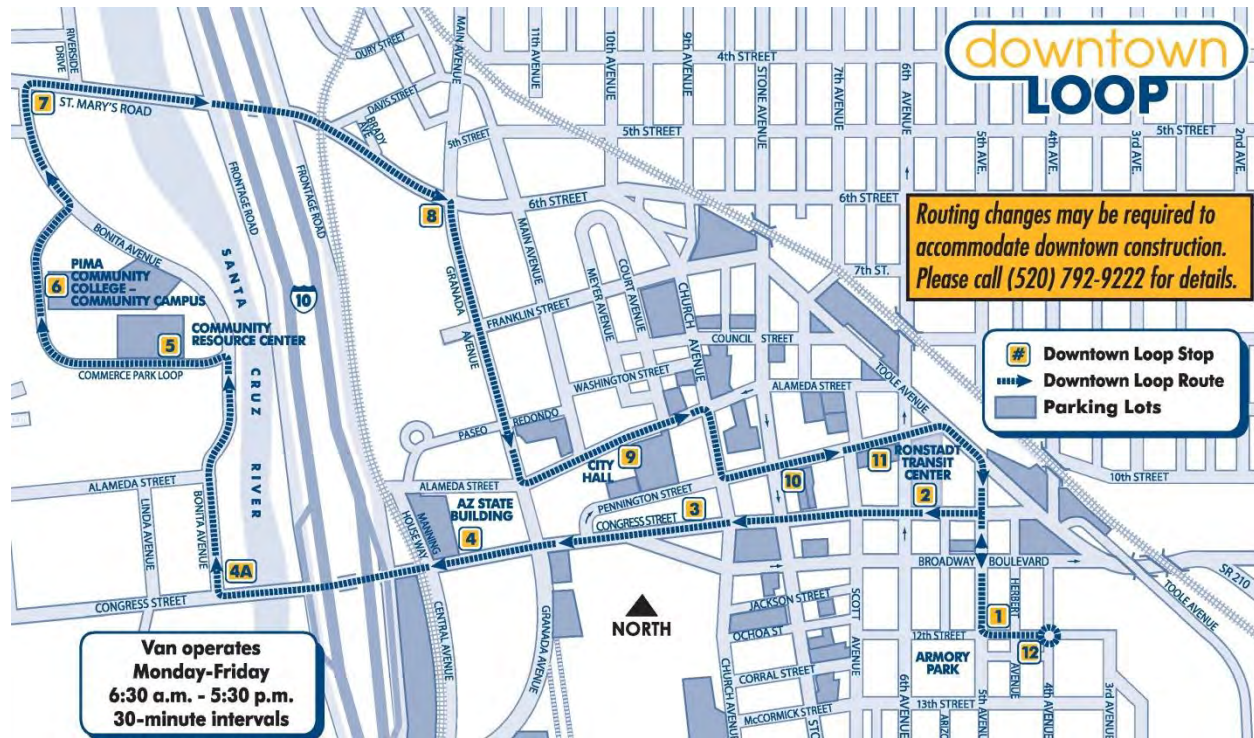


Figure 12: Downtown Loop Shuttle Van Map.¹⁷

Figure 13 shows a map of transit ridership density. It was constructed using a probability density function created from boarding and alighting data collected at bus stops in Tucson on four separate days in 2013. Note that this does not include Streetcar ridership. As expected, it shows that the busiest locations are in downtown and near the University of Arizona and in the adjacent neighborhoods. Streetcar stations with high ridership will also be good candidates for initial bike share station placements to extend and enhance transit services from these locations.

Other transportation options with synergies to bike share in Tucson include:

- Car share services offered by Zipcar on the University of Arizona campus. Car share could be combined with bike share to provide a complete set of alternatives to motor vehicle ownership. Bike share could be used to access car share locations.
- Regional rail and bus service: the Sunset Limited Amtrak line runs three days a week between Los Angeles and New Orleans with service to Downtown Tucson. There is also a Greyhound bus station in Downtown Tucson. Bike share could provide a last mile extension for incoming visitors.

¹⁷ <http://tdot.tucsonaz.gov/park-tucson/downtown-loop> Accessed on December 2, 2014.

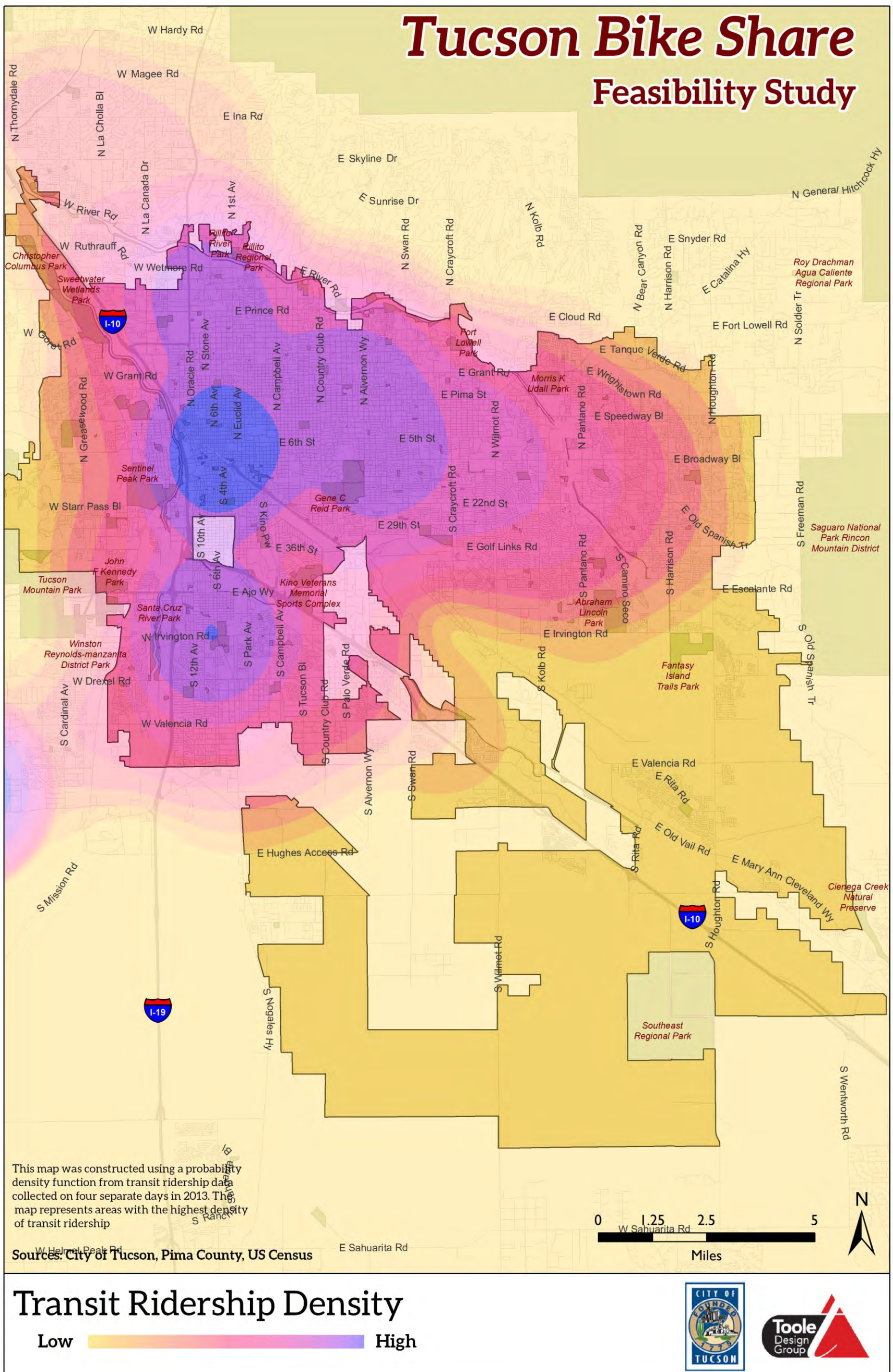


Figure 13 - Transit Ridership Map

Challenges:

- Single occupant motor vehicle travel is still a high portion of trip-making in the region. Parking is generally low cost and encourages driving.

Opportunities:

- Bike share offers a first- and last-mile connection to and from transit and in particular should be provided as an option at major transit centers and streetcar stations; and
- Linked with regional travel options and car share services, bike share completes a realistic set of transportation options that will allow residents and visitors to move around the city without the need for a private automobile.

Bicycling

Bicycling is a popular and effective way to get around town. In 2014, 3.4% of workers 16 years and older commuted to work by bicycle. Tucson has been recognized by the League of American Bicyclists as a Gold Level Bicycle Friendly Community and in its feedback to the 2012 application, the League recommended that Tucson consider a bike share system as a “convenient, cost effective, and healthy way of encouraging locals and visitors to make short trips by bike”.¹⁸

The city has approximately 514 miles of bikeways¹⁹ including:

- 102 miles of shared use paths;
- 82 miles of on-street bike routes;
- 313 miles of on-street bike routes with striped shoulders;
- 9 miles of bus/bike lanes; and
- 8 miles of bicycle boulevards.

Pima County has also invested heavily in bicycling infrastructure in the region and is close to completing the Loop, which when complete will total over 130 miles of multi-use trail circling the city. The City has completed or is planning to construct a number of other multi-use trails throughout the city as well as continuing to expand its on-street bikeway network. A map of bicycle facilities in Tucson is included on **Figure 14**.

While there has been little academic research regarding the link between the provision of bicycle facilities and bikeshare ridership, there is a significant volume of research that shows a positive relationship between facilities and private bicycling levels.^{20,21,22,23} For example, Buehler and Pucher

¹⁸ <http://www.pagnet.org/documents/2012LABfeedback.pdf>

¹⁹ City of Tucson

²⁰ Buehler, R. & Pucher J. (2012). *Cycling to Work in 90 Large American Cities; New Evidence on the Role of Bike Paths and Lanes*.

²¹ Dill, J. & Carr, T. (2003). *Bicycle Commuting and Facilities in Major U.S. Cities: If You Build Them, Commuters Will Use Them*.



found that cities that made a 10-percent increase in bike facilities saw a 2- to 3-percent increase in bicycle commuting compared to cities with no change. This relationship may be especially strong among minority and low income individuals. Fifty-nine percent of minorities²⁴ and 60-percent of low income persons responding to a 2012 survey conducted by the League of American Bicyclists stated that the provision of more bicycle facilities would encourage them to ride more often²⁵.

In addition several bikeshare systems collect survey information from their annual members and the general public. In 2013, Capital Bikeshare surveyed the general public about their feelings on the bike share system. Fifty-six percent of respondents who were not currently members of the program (both previous members who had canceled membership and those who had never been members) stated that a lack of dedicated bicycle lanes or paths was a barrier to using Capital Bikeshare²⁶. Continued investment in bicycling facilities by the City of Tucson and Pima County will have a positive influence on bikeshare ridership, especially for inexperienced riders and visitors.

Challenges:

- There are still many streets in Tucson that are less comfortable for new and inexperienced bicyclists.

Opportunities:

- Tucson has a growing bicycling culture, particularly around the University campus, and an extensive bikeway network that can be utilized to provide bike share users with a comfortable and safe way to move between stations. Tucson has a proven record of investment in bicycle infrastructure, which will help encourage greater levels of bike share ridership, especially among less experienced riders and tourists.

Bike Share Suitability Analysis

A suitability analysis (or “heat mapping” analysis) was performed using GIS data provided by the City of Tucson, the University of Arizona, and from publicly available sources. Bike share works best where there is a variety and density of different land uses and as such the bike share suitability analysis was created by aggregating various data including: population density; employment density; college enrollment; community and visitor attractions (e.g., libraries, community centers, sports venues, etc.); transit and regional transportation; and topography.

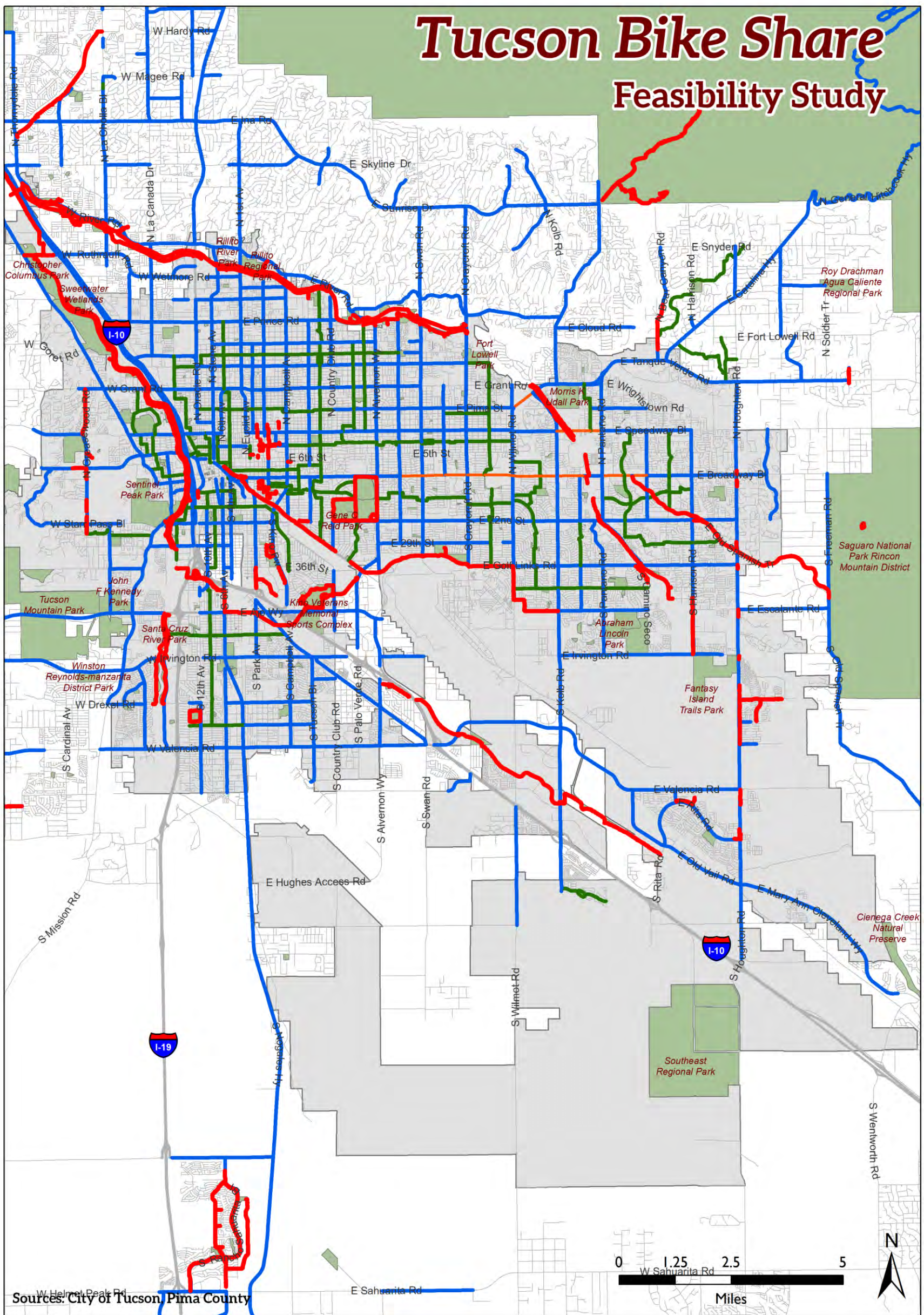
²² Hunt, J. & Abraham, J. (2007). *Influences on Bicycle Use*. Transportation, 34, 453–470.

²³ Parkin, J., Wardman, M. & Page, M. (2008). *Estimation of the Determinants of Bicycle Mode Share for the Journey to Work Using Census*.

²⁴ Minorities defined as Hispanics, African Americans, Asians, Native Americans, mixed, or other race.

²⁵ http://bikeleague.org/sites/default/files/equity_report.pdf

²⁶ <http://www.capitalbikeshare.com/assets/pdf/CABI-2013SurveyReport.pdf>



Bicycle Facilities

- Bike Route
- Bike Route with Striped Shoulder
- Bus/Bike Lane
- Shared-use Path



Figure 14: Tucson Bicycle Network



The methodology includes a point-scoring system where points are allocated for an area based on its performance in each of the above categories. These are then summed to give a total “suitability” score. The weighting and methodology used for each variable is described in **Table 4**.

Table 4: Heat Mapping Scoring and Methodology

Variable	Points	Methodology
Population Density	20	Census blocks grouped into quartiles based on their population density. Census blocks assigned scores based on which quartile they fall, e.g. top quartile = 20/20, bottom quartile = 5/20.
Employment Density	20	Census blocks grouped into quartiles based on their employment density. Census blocks assigned scores based on which quartile they fall, e.g. top quartile = 20/20, bottom quartile = 5/20.
College Enrollment	10	College campuses were assigned points to the entire campus area.
Community and Tourist Attractions	20	Point locations based on information from the City of Tucson, and publicly available maps. These locations include: <ul style="list-style-type: none"> • Libraries • Community centers • Major arts, culture, and sporting venues • Tourist attractions Areas identified as community attractions were assigned points.
Transit	30	Transit stops grouped into quartiles based on ridership data. Stops assigned scores based on which quartile they fall, e.g. top quartile = 30/30, bottom quartile = 7.5/30. Scores graduated from the maximum score within a ¼ mile radius from the point location and decreasing out to ½ mile radius from the point location.
TOTAL	100	Combined total of above scores

The results of the heat map are shown in **Figure 15**. As expected, the major concentrations of activity are around Downtown Tucson and the University of Arizona campus with isolated pockets of activity along some of the commercial corridors and at particular attractions and destinations. These outputs will be combined with public and stakeholder input to define a bike share service area and develop a phasing plan as part of a future phase of this project.

Summary of Community Analysis

Based on the community analysis, bike share is feasible in Tucson. The area including Downtown Tucson and the University of Arizona displays many of the characteristics considered important for a successful bike share system. There are other parts of Tucson that may support future phases of the system including southeast along the Arroyo-Chico trail to Reid Park, east along Broadway extending to the medical campuses and hotels in that area; corridors north and south of downtown, parts of southern Tucson focused on connecting people to jobs in the technology and aerospace industry around the



International Airport and Air Force Base; and in north Tucson along the Loop Trail to connect users to the Tohono Tadaí Transit Center, nearby commercial and office land uses, and recreational uses.

Some of the potential users of bike share in Tucson include:

- Residents living in the service area using the system to access local services, destinations, restaurants, and entertainment venues.
- Commuters travelling to the service area making first and final mile connections to and from streetcar or other transit and those that drive into Downtown and want a way to move about throughout the day.
- Students, staff and faculty of the University of Arizona or other colleges making first and final mile connections to and from streetcar or other transit, to access nearby commercial districts, restaurants, and entertainment venues, and to connect between campus and student housing.
- Visitors to Tucson connecting from their hotels to visitor attractions, commercial districts, recreational opportunities, and transportation to take them to further afield attractions.
- Visitors to sporting events, campus visits and tours, or arts and cultural attractions on the University of Arizona campus.
- Business travelers connecting from their hotels to meeting spaces, the Convention Center, restaurants and entertainment venues, and recreational opportunities.

The primary challenges of establishing a bike share system in Tucson include:

- Low population and employment densities in areas outside of the downtown core may present a challenge for implementing bike share in these areas and stations will need to be more strategically located in these areas and focused around specific attractions or activity centers.
- Many of Tucson's major visitor attractions and hotels are outside the range of the bike share system and marketing to tourists and visitors tends to be more expensive as it requires additional outreach beyond standard digital marketing.
- Single occupant motor vehicle travel is still a high portion of trip-making in the region. Parking is generally low cost and encourages driving, although parking prices are increasing in the downtown area and meters will be introduced on 4th Avenue.
- There are still many streets in Tucson that are less comfortable for new and inexperienced bicyclists. The City of Tucson and Pima County continue to expand bicycling infrastructure and the initial system can be planned around existing bicycling facilities.
- Extremely hot weather during the summer could have an impact on ridership and will likely result in lower demands on extremely hot days.
- Steep topography in areas such as the Catalina Foothills.

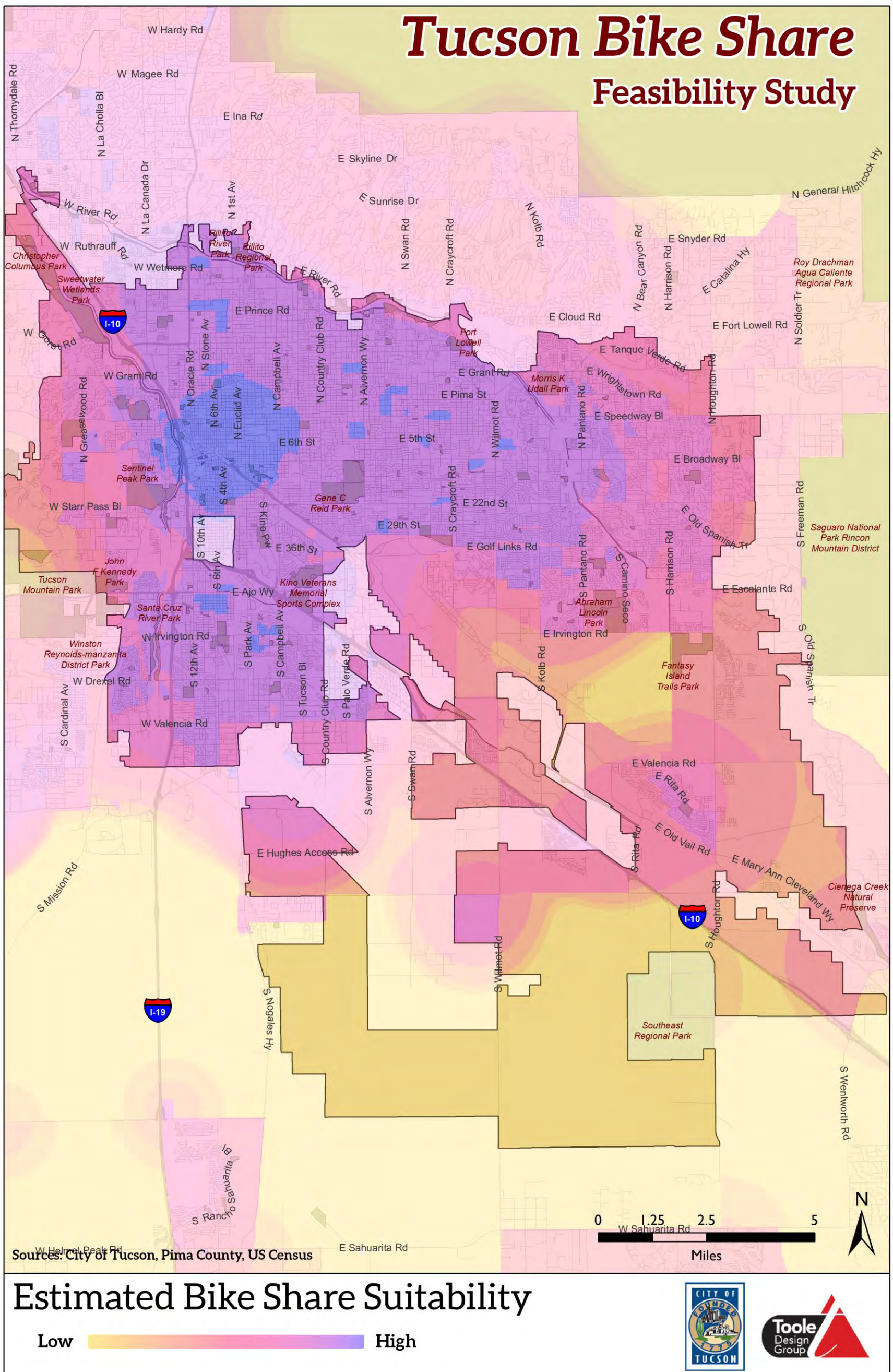


Figure 15: Tucson Bike Share Suitability Analysis

