TUCSON BIKE SHARE

Feasibility Study Report

July 2015

Toole Design Group

PAG Pima Association of Governments

CITY OF TUCSON FOUNDED 1775

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1. INTRODUCTION

The City of Tucson (City) engaged Toole Design Group (TDG) to investigate and determine the feasibility of a bike share system in Tucson, Arizona. TDG was also tasked with identifying an appropriate scale and operational model to implement an effective system that complements the existing transit network, including the recent investment in Modern Streetcar, and Tucson's increasing investment in on-street and off-street bicycling infrastructure.

The intent of this study is to provide a comprehensive planning effort to investigate what a bike share system would look like in Tucson and to develop a guiding document that can be used as an implementation blueprint for the City and partner agencies to attract funding and support for the system.

> *"The intent of this study is to develop a guiding document that can be used as an implementation blueprint for the City and its partner agencies to attract funding and support for the program."*

This feasibility study follows the process outlined in **Figure 1**. It includes phases for information gathering, goal setting, community analysis, evaluation of feasibility, system development, and implementation considerations. The completion of each phase resulted in the chapters described below.

Figure 1: Feasibility Study Process

Chapter 2 introduces the concept of bike share and examines several peer cities that have implemented bike share programs. It also explores potential benefits and risks in terms of mobility and transportation, economic and financial performance, health, environment, and safety.

Chapter 3 outlines the system goals identified by the project team, local stakeholders, and the Technical Advisory Committee. These are important as they set the parameters for how the system will be set up and what will constitute success.

Chapter 4 presents the results of a community analysis that explores the preparedness of the region for bike share and these results are combined with feedback obtained through the public and stakeholder engagement process summarized in Chapter 5 to develop a preliminary system plan and phasing strategy that is outlined in Chapter 6.

Implementation is considered in in several chapters. Chapter 7 includes a summary of local policies and

ordinances to determine how bike share fits into these and what changes may be needed.

Chapter 8 explores how bike share could be integrated with transit and transit payment structures in Tucson. Chapter 9 includes an implementation flow chart and summary of the steps required to move towards integration including descriptions of the required procurement process, public and stakeholder outreach, marketing needs, operational considerations, and evaluation metrics.

2. BIKE SHARE SYSTEM REVIEW

This section provides an overview of modern bike share in the United States and summarizes the experience of other cities implementing bike share and recent trends in the industry to understand what is required to implement a successful bike share program and the potential benefits and risks associated with implementing a program in Tucson.

What is Bike Share?

Bike share is a mobility option that allows users to access bicycles located at a network of self-service stations. It is typically made available through a subscription fee that usually ranges from a few dollars for one-day access to $80 to $100 for annual access.

Figure 2: Divvy is the name of the bike share system in Chicago (Credit: People for Bikes).

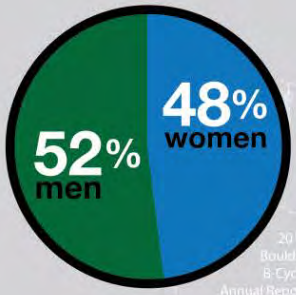
Bike share has become an effective mode of transportation for short point-to-point trips allowing subscribers to make spontaneous or planned trips for very little cost. Most trips in existing U.S. bike share systems are between 15 to 35 minutes duration and around one-to-three miles long.[1]

Bike share is different from bicycle rental in that it encourages short trips and high turnover by using a fee structure that charges higher rates the longer a bicycle is kept out. In this way, renting a bicycle is generally more cost effective for longer time periods.

[1] Bike Sharing in the United States: State of the Practice and Guide to Implementation. Federal Highway Administration. United States Department of Transportation. September 2012.

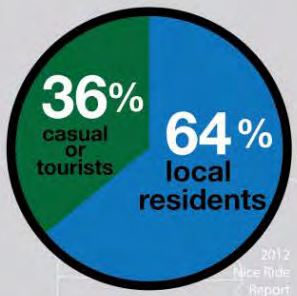
What is Bike Share?

Gender



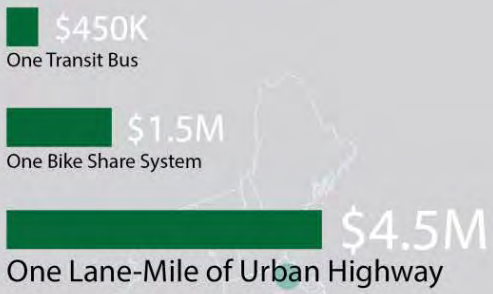
2012 Boulder B-Cycle Annual Report

Ridership



2012 Nice Ride Report

Cost



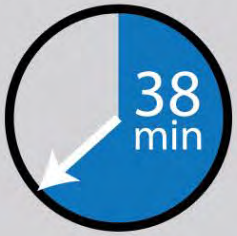
Bike Share is a station-based system of automated, self-service bicycle rentals. Bike share systems typically offer membership-based and pay-per use bicycle rental options for short one-way or round-trip journeys. Stations are located within convenient distances from popular origins and destinations including transit stops, jobs, shopping, and residences.

Existing Bike Share Systems in the United States

Average Trip Duration

Annual Members

Tourists & Casual Riders

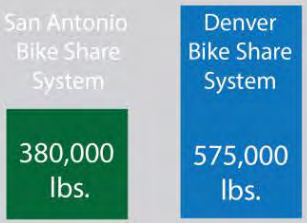


2012 Madison B-Cycle Annual Report

Average Trip Length

2012 Capital Bikeshare Arlington Annual Report

Carbon Offset (CO_2)



Bike Share Systems in North America

Elements of Bike Share

Most existing U.S. bike share programs are automated and do not require on-site staff. To provide easy access and increased accountability, systems utilize credit cards and radio frequency identification (RFID) technology in the stations and bicycles. The system is intended to be easy to use, from signing up for membership, to getting a bicycle, to feeling comfortable and safe when riding a bicycle.

There are two bike share technologies currently being utilized in the United States: station-based or "smart dock" systems and bicycle-based or "smart bike" systems. These are summarized on **Figure 3** and **Figure 4**, respectively. Both utilize RFID, credit card and GPS technologies. However they differ in where the technology is housed. The majority of systems in the U.S. are smart dock systems; however, many cities are scheduled to launch smart bike systems within the next two years. Phoenix launched Grid Bike Share in November 2014 with a smart bike system.

In smart dock systems, users interact at a separate terminal or kiosk and the locking mechanism for the bicycle is located at the dock. With smart bike systems, all of the technology is housed on the bicycle itself including the lock.

While smart-bike technologies tend to be a lower capital cost per bike, they remain relatively untested in large city-wide applications and as such operating costs and other parameters are still largely unknown.

Peer Programs

There are over 40 operating bike share programs in the United States and at least 15 more programs in various stages of planning. This section draws from experience around the country to provide a complete account of different technologies, business models, partner roles, operating costs, pricing structures, ridership and membership rates, success factors, and risks.

Detailed summaries are provided for five bike share programs operating in peer cities that were selected based on similarities in geographic and population size, transit infrastructure, presence of a college campus and other factors. These include:

- Phoenix: local example, private ownership model, smart-bike technology.
- Denver: comparable population size, non-profit ownership model, light rail integration.
- San Antonio: south-west city, agency-owned / non-profit operated model, regional pathway system.
- Minneapolis: multiple cities, major university campus, light rail integration, non-profit ownership model.
- Salt Lake City: south-west region, quasi-agency ownership model, very successful mid-sized city sponsorship and ridership model, light rail integration.

Detailed profiles are included below for each of these cities and their key characteristics and performance metrics are summarized in **Table 1**.

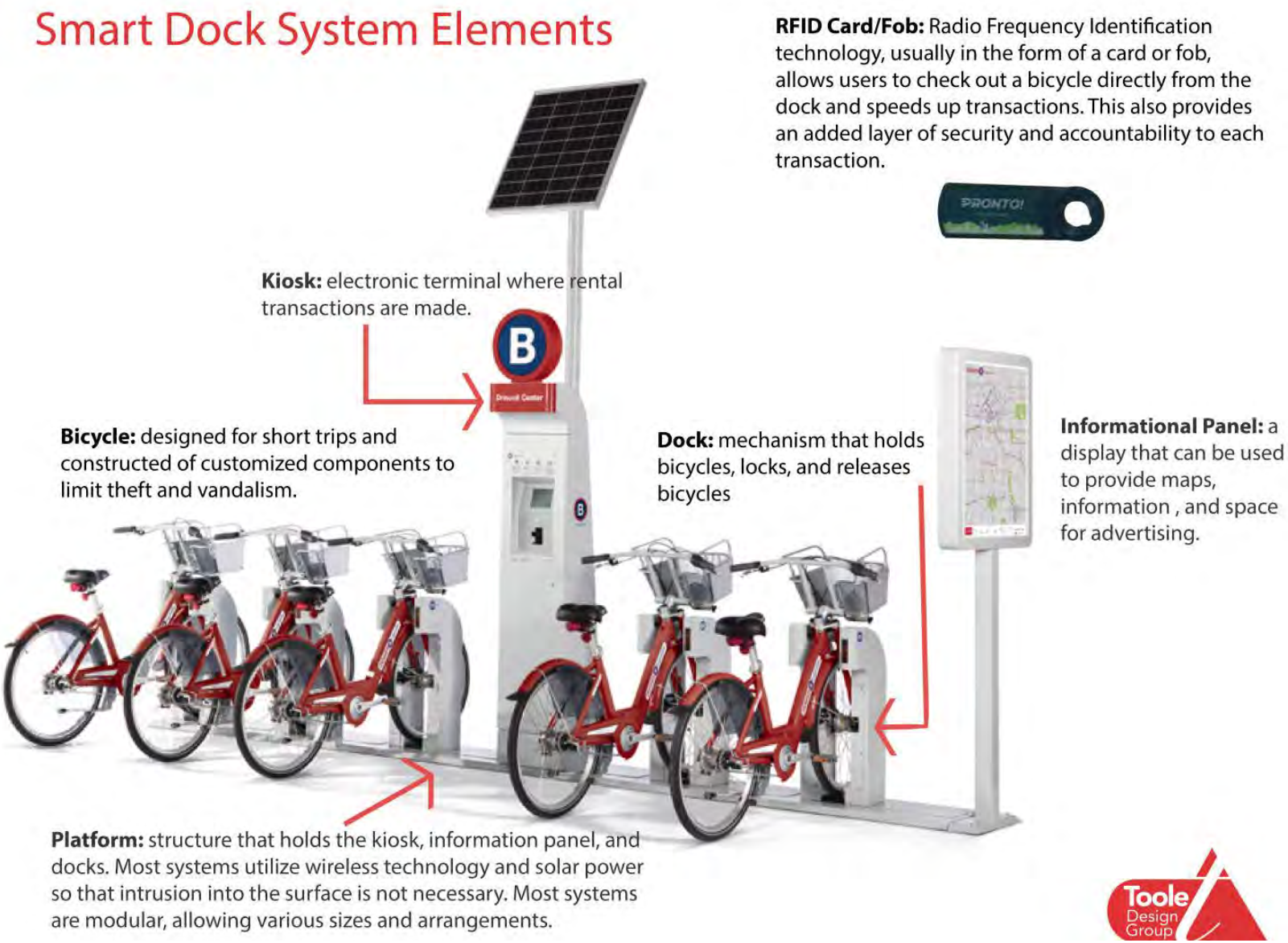


Figure 3 - Smart Dock System Elements

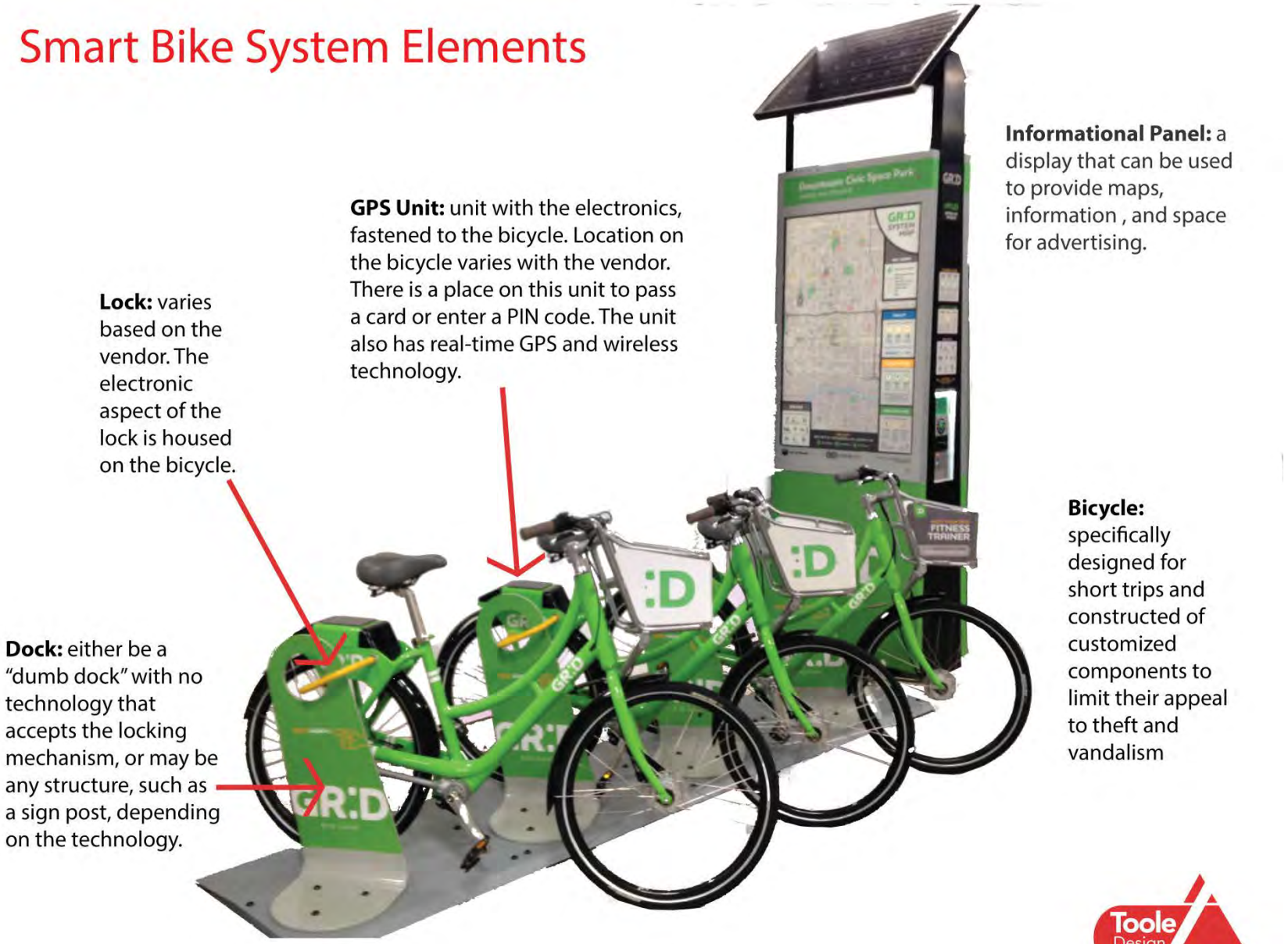


Figure 4: Smart Bike System Elements

Table 1: Comparison of Peer City Bike Share Programs.

	Phoenix, AZ	Denver, CO	San Antonio, TX	Minneapolis, MN	Salt Lake City, UT
System Name	Grid Bike Share	Denver B-cycle	San Antonio B-cycle	Nice Ride Minnesota	Green Bikes
Start Date	November 2014	April 2010	March 2011	June 2010	April 2013
Technology	Smart Bike	Smart Dock	Smart Dock	Smart Dock	Smart Dock
SYSTEM STATISTICS					
Number of Bikes	500	709	450	1,328	65
Number of Stations	50	82	53	146	11
Bikes per station	10.0	8.6	8.5	9.1	5.9
Service Area (sq. mi.)*	11.2	12.8	13.2	34	2
Station Density (stations per sq. mi.)**	4.5	6.4	4.0	4.3	5.5
MEMBERSHIP					
Cost of Annual Membership	$79	$80	$80	$65	$75
Cost of 24-Hour Membership	$5 / hour	$8	$10	$6	$5
Usage Fees	**Annual** members: 60 minutes free per day; $5 per additional hour; $25 daily maximum **Casual** members: pay as you go - $5 per hour **Other**: $2 "out of hub" parking fee	**All**: First 30 minutes free; $1 (31 -60 minutes); $4 (per additional 30 minutes)	**Annual** members: first 60 minutes free **Casual** users: first 30 minutes free **Usage fees**: Additional 30 minute increments: $2 **Daily maximum**: $35	**Annual** members: first 60 minutes free; $3 (60 – 90 minutes); $6 (additional half hours) **Casual** users: first 30 minutes free; $1.50 (30-60 minutes); $4.50 (60-90 minutes); $6 (additional half hours) **Daily maximum**: $65	**Annual** members: first 60 minutes free **Casual** users: first 30 minutes free **Usage fees**: Additional 60 minute increments: $3 **Daily maximum**: $72
Casual Members	n/a	51,153	26,031	54,451	9,689
Annual Members	n/a	4,023	1,824	3,500	308
RIDERSHIP					
Total Annual Trips	n/a	263,110	65,560	274,047	25,968
Annual Member Trips	n/a	63%	n/a	62%	n/a
Annual Casual Trips	n/a	37%	n/a	38%	n/a
Trips per Bike per Day	n/a	1.02	0.4	0.8	1.6

Table 2 (cont.): Comparison of Peer City Bike Share Programs.

	Phoenix, AZ	Denver, CO	San Antonio, TX	Minneapolis, MN	Salt Lake City, UT
FINANCIAL					
Capital Funding	Private sources	DNC Legacy Fund, federal and state grants	Federal and state grants	Federal, state, county, and city grants; title sponsorship; contributions	Title sponsorship
Operating Funding	System revenues, sponsorship, and private sources	System revenues, sponsorship, and contributions	System revenues and sponsorship	System revenues, sponsorship, and contributions	System revenues and sponsorship
Operating Cost per Dock per Month	n/a	$114.13	$70.86	$30.77	$238.54
Farebox Recovery	n/a	64%	48%	62%	32%
BUSINESS MODEL					
Equipment Owner	Privately Owned	Non-Profit Owned	Agency Owned	Non-Profit Owned	Non-Profit Owned
Business Model	Privately Managed	Non-Profit Managed	Non-Profit Managed	Non-Profit Managed	Non-Profit Managed
Impetus Driven By	Mayor's Office and City staff	DNC Organizing Committee and Mayor's Office	City staff	Mayor's Office	City and Chamber of Commerce
City Role	Selected vendor / operator; planning assistance	Represented on Board; staff support	Office of Sustainability oversees the operating contract and seeks capital funding	Mayor serves as a Board member; funding partner	Founding partner; Mayor serves as a Board member, funding partner
Role of Others	Entirely privately owned and operated system	Variety of public / private Board members representing different sectors and skill sets	Non-profit Board consists of mainly private sector, but has a variety of skill sets.	Variety of public / private Board members representing different sectors and skill sets	System operated by Downtown Alliance; Other Board members include Chamber of Commerce, Tour of Utah, Visit Salt Lake, transit agency, and others

* Service area refers to the area of the city in which bike share stations are located.

** Number of stations per square mile within the service area.

DENVER B-cycle

Bike Share Case Study
Year End 2013

Denver, CO

Description
Denver B-Cycle is owned and operated by Denver Bike Sharing, a 501(c)(3) non-profit organization. It was implemented in 2010 with 50 stations and 500 bicycles and has expanded to a system of 82 stations and 709 bikes as of the end of 2013.

denver.bcycle.com

System Characteristics

Equipment:	B-Cycle
Equipment Type:	Solar/modular
Equipment Ownership:	Non-profit owned
Operator:	Denver Bike Sharing
Operations:	Year-round (365 days)

System Size[1]

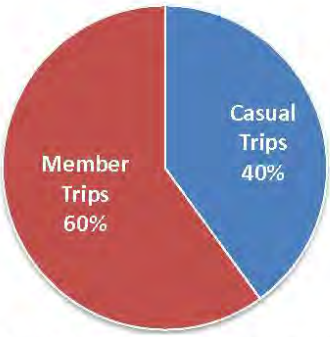
Bikes:	709
Stations:	82
Docks[2]:	1,260
Days in Operation (2013):	365
Service Area:	12.8 sq. mi.
Station Density:	6.4 stations / sq. mi.

Demographics

City Population[3]:	649,495 (2013)
Metro Area Population[4]:	2,897,298 (2014)
Estimated Annual Tourists[5]:	13,600,000 (2012)
City Population Density[3]:	7,000 people / sq. mi.

Membership and Ridership (2013)[1]

Casual Subscriptions:	51,153
Annual Members:	4,023
Casual Subscriber Rides:	97,213
Annual Member Rides:	165,897
Total Rides:	263,110
Rides per annual membership:	41.2
Rides per casual subscription:	1.9
Population per bike:	916
Annual members per bike per 100,000 pop.:	0.87
Casual subscriptions per station:	624
Tourists per casual subscription:	233



Total: **1.02** rides per bike per day

DENVER B-cycle

Bike Share Case Study
Year End 2013

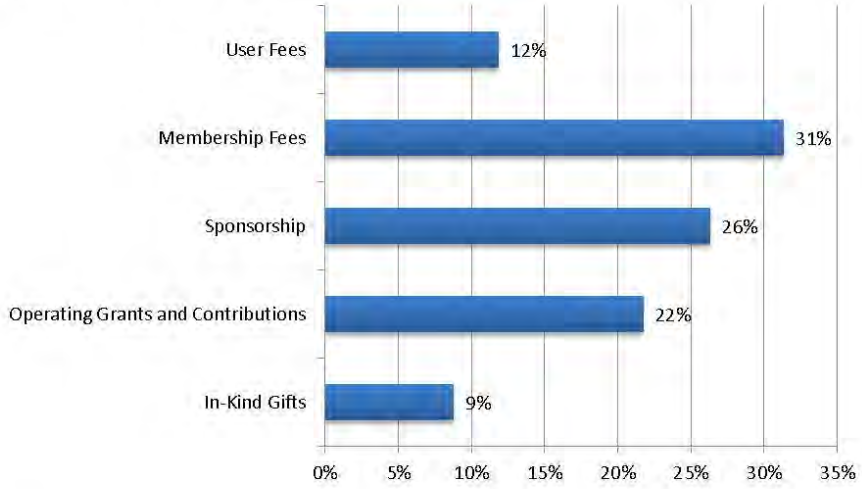
Denver, CO

Business Model

The system was born out of a pilot program of 1,000 bicycles provided for the 2008 Democratic National Convention (DNC). The host committee chose bike share as one of the legacy programs to award $1 million from the DNC surplus. Community leaders and the City formed the Denver Bikesharing non-profit to own and manage the system. Operating revenues are generated from fundraising, sponsorship, membership and usage fees.

Membership Fees[6]		**Usage Fees**
Annual:	$80	First 30 minutes free
Monthly:	$30	Additional 30 minute increments:
Weekly:	$20	+ $1 (31 – 60 mins)
24 Hours:	$8	+ $4 (per additional 30 mins)

Breakdown of Operations Revenue



Operating Costs

Operating expense per bike per year:	$1,897.63
Operating expense per dock per month:	$114.13
Operating expense per ride:	$5.11
Fare box recovery[7]:	64%

[1] Denver Bike Sharing Annual Report, 2013.

[2] Bike Share Map - Oliver O'Brien. http://bikes.oobrien.com/denver/November 2014

[3] United States Census Bureau. http://quickfacts.census.gov/qfd/states/08/0820000.html. 2014.

[4] http://www.metrodenver.org/do-business/demographics/population/ October 2014

[5] Visit Denver, http://www.denver.org/about-visit-denver/

[6] Denver B-Cycle Website, Rates. https://denver.bcycle.com/pricing.aspx. 2014

[7] Fare box recovery is the percent operating costs recovered from annual memberships, casual subscriptions, and usage fees.

Nice Ride — Bike Share Case Study — Minneapolis, MN

Year End 2012

Description

Minneapolis Nice Ride launched in June 2010 in the City of Minneapolis and was expanded into Saint Paul the following year. To date, there have been no reported thefts and two crashes.

www.niceridemn.org

System Characteristics

Equipment:	PBSC Urban Solutions (Bixi)
Equipment Type:	Solar/modular
Equipment Ownership:	Non-profit owned
Operator:	Nice Ride MN
Operations:	Seasonally April through October

System Size

Bikes (Reported[1] | Active)	1,328 | N/A
Stations:	146
Docks[2]:	2,656
Service Area[3]:	34 sq. mi
Station Density:	4.3 stations/sq. mi

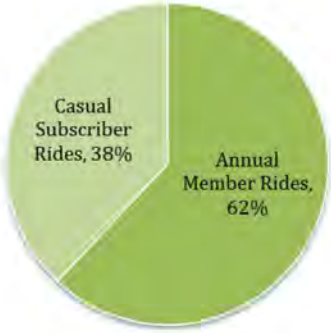
Demographics

System Population[4]:	683,650 (2012)
Metro Area Population[5]:	3,459,146 (2013)
Estimated Annual Tourists[6]:	17,900,000
System Population Density[7]:	6,559 people / sq. mi.

Membership and Ridership (2012) [1]

Casual Subscriptions:	54,541
Annual Members:	3,500
Casual Subscriber Rides:	103,850
Annual Member Rides:	170,197
Total Rides:	274,047

Rides per annual membership:	48.6
Rides per casual subscription:	1.9
Population per bike:	515
Annual members per bike per 100,000 pop.:	0.37
Casual subscriptions per station:	373
Tourists per casual subscription:	329



0.8 rides per bike per day

Nice Ride — Bike Share Case Study — Minneapolis, MN

Year End 2012

Funding Sources[1]

Expansion Funds *(through 2013)*

Public Funding	$5,063,000
Presenting Sponsorship	$2,675,000
Total Capital	$7,738,000

Business Model

The Nice Ride non-profit was established to own and manage the system with revenues generated from fundraising, sponsorship, membership, and usage fees. The system received considerable support from the City and in particular the Mayor's Office during the establishment of the system.

Membership Fees

Annual:	$65
Annual Student:	$55
30 Day	$15
24 Hours:	$6

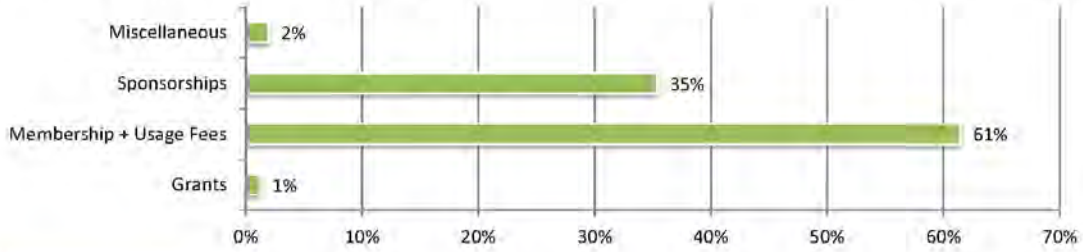
Usage Fees

Annual members: first 60 minutes free; $3 (60 – 90 minutes); $6 (per additional 30 minutes)

Casual members: first 30 minutes free; $1.50 (30 – 60 minutes); $4.50 (60 - 90 minutes); $6 (per additional 30 minutes)

Daily maximum: $65 per day

Breakdown of Operations Revenue (2012)[1]



Operating Costs[1]

Operating expense per dock per month:	$30.77
Operating expense per ride:	$3.58
Fare box recovery[8]:	62%

Equity Strategy

Target sponsored 600 free memberships for low-income residents. In addition, Nice Ride hired a staff person to sell discounted $20 memberships. The outreach resulted in a few partnerships and events but almost no subscriptions.[9]

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[1] Nice Ride Annual Report 2012, 2013 Mid-Season Update. Per dock per month cost calculated over 12 months, although system is not operational November through April.
[2] Bike Share Map – Oliver O'Brien. http://bikes.oobrien.com/global.php. 2012.
[3] Service area is calculated as the area encompassing every station plus a ¼ mile buffer around each station.
[4] The System population is calculated as the sum of the populations in Minneapolis and St. Paul. Population sources: United States Census Bureau. 2012. January 2014.
[5] US Census. http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=bkmk. 2014.
[6] Meet Minneapolis, http://www.minneapolis.org/sites/default/files/u7/pdfs/MediaKit_Meet.pdf
[7] The average system population density calculated as the average of the population densities in Minneapolis and St. Paul. Population and land area taken from US Census Quick Facts. January, 2014.
[8] Fare box recovery is the percent operating costs recovered from annual memberships, casual subscriptions, and usage fees.
[9] Bringing Bike Share to a Low-Income Community: Lessons Learned Through Community Engagement, Minneapolis, Minnesota, 2011, http://www.cdc.gov/pcd/issues/2013/12_0274.htm.

GREENbike

Bike Share Case Study
Year End 2013

Salt Lake City, UT

Description

GREENbike in Salt Lake City is a relatively new bike share system that opened in April 2013. It is primarily located downtown with 65 bikes at 11 stations. The operating model is unique in that GREENbike, SLC Bike Share is a 501(c)3 non-profit organization that is a public / private partnership between Salt Lake City, the Salt Lake Chamber of Commerce and the Salt Lake City Downtown Alliance. The system is operated by the Downtown Alliance. Local public funding and significant sponsorship was used to launch and operate the system.

www.greenbikeslc.org

System Characteristics

Equipment:	B-Cycle
Equipment Type:	Solar/modular
Equipment Ownership:	Non-profit
Operator:	Downtown Alliance
Operations:	24 hours, 7 days / week Closed for winter

System Size[1]

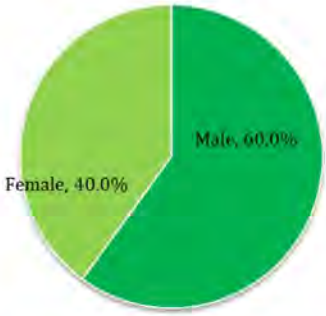
Bikes:	65
Stations:	11
Docks:	165
Days in Operation (2013):	251
Service Area (Mi²):	2
Station Density (Stations/Mi²)	5.5

Demographics[2]

City Population:	189,000 (2012)
Metro Area Population (approx.):	1,100,000 (2012)
Estimated Annual Tourists:	N/A
Average System Population Density:	1,678 people / sq. mi.

Membership and Ridership (2013)[3]

Casual Subscriptions:	9,689
Annual Members:	308
Casual Subscriber Rides:	-
Annual Member Rides:	-
Total Rides:	25,968
Population per bike:	2,910
Annual members per bike per 100,000 pop.:	2.5
Casual subscriptions per station:	880
Tourists per casual subscription:	-



Total 1.6 rides per bike per day

GREENbike

Bike Share Case Study
Year End 2013

Salt Lake City, UT

Funding Sources[3]

Initial System (65 Bikes, 11 Stations)

Capital

Title sponsors – Select Health

Operations

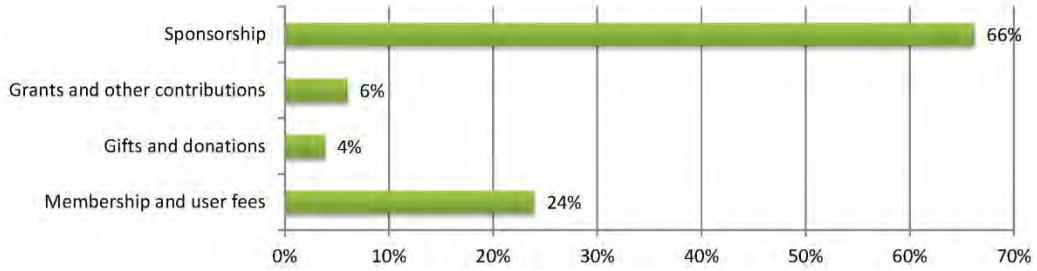
Basket sponsor – Rio Tinto
Nine station sponsors - various
Membership card and helmet sponsors

Business Model

The impetus for a bike share system was driven from the Mayor's Office. However, the City did not have the funds to launch the system and so asked the Downtown Alliance if they would take on responsibility for developing a business model and seeking funds for the system. The Downtown Alliance secured a title sponsor and other sponsors sufficient to launch and maintain operations for an 11 station system in 2013.

Membership Fees[4]		**Usage Fees[4]**
Annual:	$75	Annual members: first 60 minutes free
Annual Discounted:	$56	Casual members: first 30 minutes free
4-Day Pass:	$15	Usage fees:
24 Hour Pass:	$5	$3 (additional hours); (max $72/day)

Breakdown of Operations Revenue[1]



Operating Costs[1]

Operating expense per bike:	$4,844
Operating expense per dock per month:	$238.54
Operating expense per ride:	$12.13
Fare box recovery:	32%

[1] Information provided by GREENbikes on October 15, 2014.

[2] United States Census Bureau (2012). July 2014.

[3] Information provided by GREENbikes on October 15, 2014 and http://utahpolicy.com/index.php/features/featured-articles/2344-live-work-play-bike. Accessed July 2014.

[4] Rates taken from GREENbikes website: https://www.greenbikeslc.org/pricing.aspx Accessed on November 24, 2014.

SAN ANTONIO B-cycle

Bike Share Case Study

July 2012 - June 2013 Operating Year

San Antonio, TX

Description

San Antonio B-Cycle launched in March 2011 as a 14 station/140 bike system in the downtown core. The system has since expanded several times to now be 53 stations and 450 bikes, increasing the density of stations downtown and extending the system north to Brackenridge Park and south along the San Antonio Mission Trail. The City of San Antonio owns the equipment and the system is managed and operated by San Antonio Bike Share, a specially formed non-profit organization.

www.sanantonio.bcycle.com

System Characteristics

Equipment:	B-Cycle
Equipment Type:	Solar/Wired modular
Equipment Ownership:	City of San Antonio
Operator:	San Antonio Bike Share
Operations:	Year-round (365 days)

System Size[1]

Bikes:	450
Stations:	53
Docks[2]:	824
Days in Operation:	365
Service Area[3]:	13.2 sq. mi
Station Density:	4.0 stations per sq. mi

Demographics

City Population:[4]	1,382,951 (2012)
Estimated Annual Tourists[5]:	30,000,000
City Population Density:	2,880 people / sq. mi

Membership and Ridership[6]

Casual Subscriptions:	26,031
Annual Members:	1,824
Casual Subscriber Rides:	-
Annual Member Rides:	-
Total Rides:	65,560
Population per bike:	3,073
Annual members per bike per 100,000 pop.:	0.29
Casual subscriptions per station:	491
Tourists per casual subscription:	1,152

Total 0.40 rides per bike per day

SAN ANTONIO Bcycle

Bike Share Case Study

July 2012 - June 2013 Operating Year

San Antonio, TX

Capital Funding Sources

Current System *(450 Bikes, 53 Stations)*

$841,579	American Recovery & Reinvestment Act (ARRA)
$403,522	Department of Energy
$42,645	Communities Putting Prevention to Work
$619,774	U.S. Department of Transportation Sarbanes Grant
$1,050,000	ARRA Energy Efficiency and Conservation Block Grant
$1,000,000	TxDOT

Business Model

The City of San Antonio initially issued a Request for Proposals for the system to be privately owned and operated but because of the type of funding secured for capital revised the business model so that the system's assets are owned by the City (the funds being administered by the Office of Sustainability) and the program is operated by a specially-formed non-profit.

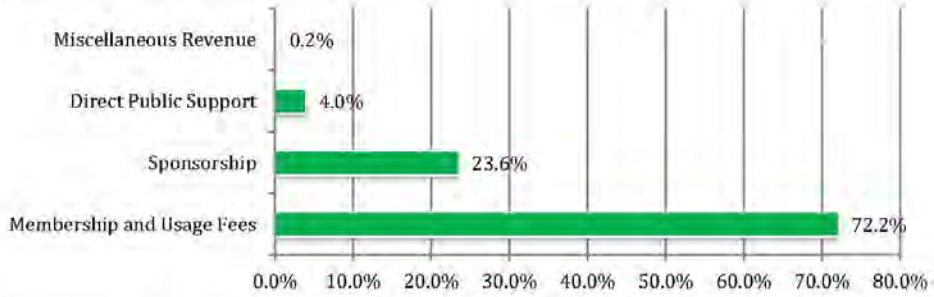
Membership Fees

Annual:	$80
7 days:	$24
24 hours:	$10

Usage Fees

Annual: First 60 minutes: no usage fee
Casual: First 30 minutes: no usage fee
Additional 30 minute increments:
$2 (each additional half hour)(max $35/day)

Breakdown of Operations Revenue[7]



Operating Costs

Operating expense per bike per year:	$1,933
Operating expense per dock per month:	$70.86
Operating expense per ride:	$6.91
Fare box recovery:	48%

[1] As of April 2014
[2] Bike Share Map – Oliver O'Brien. http://bikes.oobrien.com/global.php
[3] Calculated as a best fit polygon with a ¼ mile buffer around existing stations
[4] 2012 US Census Estimates. State & County QuickFacts.
[5] www.visitsanantonio.com/nttw accessed on April 28, 2014.
[6] San Antonio Bike Share Annual Report, July 2012 – June 2013. At that time, the fleet consisted of 42 stations and 354 bikes.
[7] San Antonio Bike Share Annual Report, July 2012 – June 2013.

Pricing structures are similar in most peer city systems offering annual membership for between $65 - $80 and 24-hour passes for $5 to $10. Many of these systems offer annual members a 60-minute free ride period and casual users a 30 minute free ride period. Phoenix, along with a number of systems, are using a different fee structure to try and increase system revenues from annual members who currently make the majority of trips in the system but pay the least. Grid Bike Share will offer annual membership that allows members 60 minutes of free time per day (rather than per ride). Casual memberships will be replaced with a $5 per hour pay-as-you-go rental option.

Although the peer city systems vary in size (from 11 to 146 stations), all of these systems provide stations at densities between 4.0 to 6.5 stations per square mile. Peer cities have observed differing levels of success in terms of membership and ridership but in all systems, these statistics have increased each year, e.g., Minneapolis has seen a 40% increase in total trips since its first full year of operation in 2011 and Denver B-cycle has experienced a nearly 30% increase in the same time period. Ridership rates varied between 0.4 to 1.6 trips per bike per day in different systems. It is uncertain all of the factors that influence ridership rates, but in the case of the peer cities the lowest density systems also experienced the lowest ridership.

The case studies show that there is no single "right" way to form, implement, or operate a bike share system in a medium sized community. In all cases, cities have built on the momentum created by those championing the idea. In some instances this is a community group (such as in Boulder and Aspen[2]), a business improvement association (such as in Salt Lake City), or through the local transit agency (in the case of Fort Worth). However, most systems receive their impetus from city government, and, in particular, programs have tended to be most successful (especially in obtaining capital and sponsorship dollars) when there has been early and visible mayoral support for the program.

There is also no one "right" business model. There are advantages and disadvantages to each of the different business models. Although the case study cities show that a popular model for mid-sized communities is to include a non-profit (given their ability to receive funding from a variety of sources, generally community-minded mission, and ability to reduce operating costs through in-kind services), there are several new models being considered in other cities, e.g., the privately owned and operated business model in Phoenix (it will be the first mid-sized city to operate under this model – which was previously found only in large tourist markets such as New York City and Miami Beach) and a city-operated system in Boise, ID (which will be the first time an agency has taken on operations).

Capital and operating costs generally come from a variety of sources, with the most prevalent capital sources being use of federal or state grants with a local match. Operating revenues generally come from a combination of system revenues (membership and usage fees) and sponsorship / advertising. In mid-sized communities, system revenues generally cover only a portion of the operating cost (ranging from 32% in Salt Lake City to 64% in Denver). In mid-sized communities there is some potential to attract a system-wide sponsor as well as numerous smaller sponsors. This can take significant time and effort to identify, commit, and retain sufficient sponsorship to make the system financially sustainable.

Phoenix launched a smart-bike system named Grid Bike Share in November 2014. The early impetus for bike share came from Mayor Stanton, who saw the creation of a bike share system as an early initiative

[2] The WE-Cycle system in Aspen, Colorado was also established through the grass-roots efforts of local champions of the concept.

of his downtown sustainability platform. The City of Phoenix had applied for capital funding through CMAQ in a joint application with the City of Tempe. However, the Mayor's interest in launching bike share sooner than the federal funding would allow, led Phoenix to issue a Request for Proposal with no public funds seeking a company to purchase, implement, operate, and maintain a bike share system in the City of Phoenix. The RFP received two respondents and the City selected CycleHop to own and operate the system using smart-bike technology provided by Social Bicycles. The system was scheduled to be the first large scale deployment of smart bikes and was initially scheduled to launch in December 2013 however was delayed several times because of equipment development and supply issues.

The Cities of Mesa and Tempe are not part of the initial system launch, but could join through an add-on clause in the contract that would allow any community in Arizona, including Tucson, to add onto the contract without having to go through separate procurement.

Potential Benefits and Risks

From the experience of other U.S. bike share programs, this section summarizes some of the potential benefits and risks associated with a bike share program in Tucson and focuses on the areas of mobility and transportation, economic and financial performance, health, environment, and safety.

It is important that both the potential benefits and the potential risks be considered so that an informed decision can be made on the feasibility of bike share in Tucson.

Mobility and Transportation

Mobility and Transportation Benefits

Bike share trips tend to be short – between one to three miles in length and about 20 minutes in duration. As a result, they provide an option for trips too far to walk but inconvenient or too short to wait for transit.

Many bike share users combine their membership with transit, car share, walking, and other transportation options to reduce their dependency on automobile travel. In some places, this has resulted in a fundamental shift in trip-making and household vehicle ownership. In addition, cities have found that bike share contributes positively to people's perception and enjoyment of the city.

One of the biggest opportunities in Tucson is the chance to use bike share to augment the city's recent investment in Streetcar. Bike share offers a first and last mile transportation option that could extend the reach of existing fixed route services, simplify connections between routes, and relieve over-capacity transit services delaying the need for costly increases in bus service frequency or additional fleet capacity.

The connection to transit is highlighted in other communities. For example, the most popular stations in each of the five communities in which Bay Area bike share operates are at the Caltrain Stations. In Washington D.C. over half (54%) of respondents to Capital Bikeshare's member survey stated that at least one of their bike share trips in the previous month had started or ended at a Metrorail station[3]. A study by the University of Maryland[4] found that 6 of the 7 busiest stations in the Capital Bikeshare system were located at Metrorail Stations and that bike share ridership is associated with higher transit ridership. Seventy-eight percent of Boulder B-cycle annual members also have a transit pass and 34-percent use the system to connect to transit[5].

Recognizing that transit agencies are important partners in bike share programs, the Federal Transit Administration (FTA) has funded several different systems including in Boston and Chattanooga. To be eligible for FTA funding stations must be within a 3 mile radius of transit and funds can be used towards

[3] LDA Consulting (2013). *2013 Capital Bikeshare Member Survey Report.* Accessed online at http://capitalbikeshare.com/assets/pdf/CABI-2013SurveyReport.pdf on December 13, 2013.

[4] *Bicycle Sharing and Transit: Does Capital Bikeshare affect Metrorail Ridership in Washington, D.C.?* Ma, Ting et. Al. Accessed online at: http://smartgrowth.umd.edu/assets/bikeshare_transit_for_parisws_v1.pdf on November 20, 2014

[5] Boulder B-cycle *2013 Annual Report.* Accessed online at: https://boulder.bcycle.com/LinkClick.aspx?fileticket=AyhiVuJAAfI%3D&tabid=1104 on November 24, 2014.

bike share docks, equipment and other capital costs (the cost of the bikes and operating costs are not eligible)[6].

Bike share has also been effectively used to quickly and affordably introduce new riders to bicycling. It reduces many of the common barriers to entry as new bicyclists do not need to own a bicycle, store or maintain a bicycle, or have the concern that the bike will be stolen when it is parked. A survey of Hubway members in Boston found that 12-percent bicycled less than once per year prior to joining Hubway and a further 16-percent bicycled less than once per month prior to joining[7].

Tucson is already recognized as a gold-level bicycling friendly city by the League of American Bicyclists[8]. The addition of more bicyclists could provide the impetus for further investment in bicycling facilities and make a push towards platinum status. **Figure 5** shows an example of how the City of Boston increased its on-street bikeways in conjunction with the implementation and launch of bike share.

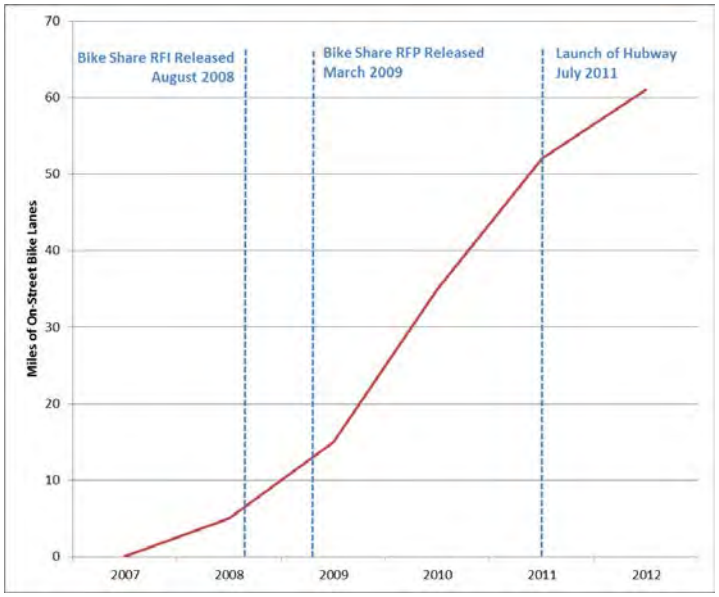


Figure 5: Increase in On-Street Bikeways in Boston with the Launch of Bike Share.

Mobility and Transportation Risks

Although 20- to 40-percent of bike share trips replace single occupancy vehicle trips,[9,10] the remainder of trips are entirely new trips, augment public transit trips, or may actually replace public transit or walking trips. A full, holistic analysis of the impact of bike share on public transit and active transportation has not been undertaken. However, some bike share trips may detract from other public transit or active transportation trips.

Economic and Financial Performance

Economic and Financial Benefits

There are a number of economic benefits that bike share offers at a community, business, and individual level.

[6] Federal Transit Administration's *Frequently Asked Questions and Answers Concerning Bike Sharing Relative to the United States Department of Transportation.* Accessed online at http://www.fta.dot.gov/documents/Informal_Q_and_As_Final_6-14-12.pdf on December 26, 2013.
[7] Presentation titled The Hubway Influence on New Riders given by Nicole Freedman, 2013. Accessed online at: http://baystateroads.eot.state.ma.us/movingtogether/docs/Freedman-Moving%20Together%202013.ppt.pdf.
[8] http://bikeleague.org/community
[9] National League of Cities (2011) Integrating Bike Share Programs into a Sustainable Transportation System.
[10] Nice Ride Minnesota (October 2011) Presentation about Nice Ride Minnesota.

At a community level, bike share is recognized as a means for attracting or retaining residents, students, and workforce talent. Many communities use it as a tool in their (re)vitalization and redevelopment efforts and to promote their image as a forward thinking, bicycle friendly community. Bike share embraces new technology, social media, and is part of the new sharing economy, which are attractive characteristics to younger demographics and professionals.

Bike share also serves visitors and is a unique way for tourists to see a city, helping attract their spending power. The amount of national and international press coverage generated by a bike share system would serve to emphasize the city to visitors, businesses, and employers. For example, the launch of Charlotte B-cycle in North Carolina received exposure in 18 newspapers including the New York Times[11].

There have been several studies into whether businesses located near bike share stations have seen an economic benefit. A recent study of annual members of the Nice Ride system in Minneapolis / St. Paul found that annual members made a number of commercial trips that they would otherwise not have made because of bike share. Based on the average amount that respondents' spent for these trip types, the researchers calculated that Nice Ride annual members created an additional $150,000 in economic activity at local businesses over the course of one bike share season[12].

A study of five Capital Bikeshare stations in 2013 also suggests a positive economic impact on surrounding commercial areas[13]. A majority of riders travelling to these stations spent money within a four block area and planned to return to the neighborhood on a regular basis. Further, approximately 20-percent of riders to these stations would not have made the trip if not for bike share, suggesting that bike share generated new spending trips to these commercial areas. A survey of businesses around these stations showed that 70-percent believe that Capital Bikeshare has had a positive impact on their neighborhood and approximately 60-percent would like to see more stations.

For employers and local businesses, bike share may be an addition to a company's health and wellness program or become part of their travel demand management program. Many bike share programs offer corporate membership packages with memberships sold at a discounted rate.[14]

Most bike share systems rely on sponsorship to generate operating revenues. This may be an opportunity for local businesses to get exposure in a particular market or location.

A bike share system creates a small number of local jobs operating and maintaining the system.

For individuals, the economic benefits come in the form of reduced household expenditure on transportation and health care, which combined make up over 22-percent of annual average household expenditure in the United States[15]. Compared to the cost of operating an automobile, bike share membership is relatively inexpensive with most programs costing between $50 and $100 per year. In

[11] From the Sponsor's Perspective (2013). Accessed online at www.bikeshare.com on December 12, 2013.

[12] Schoner, J.E., Harrison, A. and Wang, X. (2012). Sharing to Grow: Economic Activity Associated with Nice Ride Bike Share Stations. Humphrey School of Public Affairs, University of Minnesota.

[13] *Economic Impact & Opperational Efficiency for Bikeshare Systems. Anderson, Ryan et al,. Accessed online at: http://ralphbu.files.wordpress.com/2014/01/virginia-tech-capital-bikeshare-studio-report-2013-final.pdf on ovember 19, 2014.*

[14] Hubway Corporate / University Accounts, accessed online at http://www.thehubway.com/corporate on December 27, 2013.

[15] U.S. Department of Labor, Bureau of Labor Statistics, Consumer Expenditure Survey, 2010.

comparison, the median cost of annual car ownership is approximately $9,100[16]. Annual members of Capital Bikeshare in Washington D.C. saved an average of $800 per year on personal transportation costs[17].

Economic Risks

Most bike share systems are not economically self-sustaining, i.e. operating costs are greater than system revenues. Therefore, the organization responsible (public agency, non-profit, or private company) must ensure that the requisite funding is available to support capital purchases, expansion, and ongoing operations.

Based on stakeholder conversations, there are likely only few potential large sponsors for a bike share system in Tucson. It is likely that the system owner will need to employ a multi-pronged strategy towards sponsorship, which includes title and/or presenting sponsorship as well as station, bike and other types of smaller sponsorships.

Although there are several examples in North America where the initial business model was not initially successful (e.g., Montreal, Ottawa, Toronto, New York), all systems to date have identified a new business and/or ownership model. Should such an occurrence happen, or if a system doesn't garner high ridership or membership, it can reflect negatively on a city's image.

There has been a fear in many communities that bike share will threaten local bike rental businesses. Some actions have been taken to reduce this risk including developing a price structure to deter long term rental of the bike share bikes and identifying bike rental and retail locations on the station maps. The impact is expected to be limited as the bike rental shops in Tucson rent out high-end road bicycles.

Health

Health Benefits

The health benefits of bicycling are well known in helping to address preventable diseases such as obesity, heart disease, and diabetes[18,19]. As such, bike share can have a positive impact on both physical and mental health.

Nearly a quarter of the adult population in Pima County is obese[20] and bike share is a means for people to incorporate active transportation into their daily lives and lower medical and health care costs.

[16] For comparison, the median annual cost of car ownership is approximately $9,100 based on information from www.consumerreports.org accessed on December 12, 2013.
[17] 2013 Capital Bike Share Annual Member Report. Page vii. accessed online at http://www.capitalbikeshare.com/assets on November 18, 2014.
[18] British Medical Association (1992). Cycling Towards Health and Safety. Oxford University Press.
[19] Lindström, J. et al. The Finnish Diabetes Prevention Study: Lifestyle intervention and 3-year results on diet and physical activity. Diabetes Care, December 2002, vol. 26 no. 12 3230-3236. Accessed online at http://care.diabetesjournals.org/content/26/12/3230.full on December 13, 2013.
[20] Pima County Health Department (2014). State of the County's Health. Accessed online at http://webcms.pima.gov/UserFiles/Servers/Server_6/File/Health/Health%20Data,%20Statistics%20and%20Reports/State%20of%20the%20County%2001-29-2014%20[Compatibility%20Mode].pdfl on October 13, 2014.

Additionally, businesses in the health care industry may be interested in sponsoring part of a bike share system as part of a public health and prevention strategy.

A study of the Bicing bike share system in Barcelona, Spain published in the British Medical Journal in 2011 compared the benefits of increased physical activity to the additional risks introduced from increased inhalation of air pollutants and increased exposure to traffic crashes. The study found that over 10 deaths were avoided each year due to increased physical activity, offsetting any smaller increases in expected deaths from air pollutant inhalation and traffic crash exposure[21].

The health benefits of bike share are recognized by the health care industry. The federal government, through the Center for Disease Control (CDC), has funded several different systems including in Boston and Nashville. The private sector is also represented with many bike share systems in the United States supported by health care providers such as Blue Cross Blue Shield (Nice Ride Minnesota) and Kaiser Permanente (Denver B-cycle) through partnerships and sponsorships[11].

Health Risks

Safety is a large concern for bike share users; however, thus far the safety record for bike share systems has been impressive. This risk is described more in the Safety Risks section below.

Environmental

Environmental Benefits

Bike share can reduce greenhouse gas emissions by replacing trips taken previously by automobile. These impacts can be multiplied when bike share is used in combination with transit and other modes to reduce dependence on automobile use and change travel patterns.

In communities where bike share is a transportation option, surveys have shown that approximately 20- to 40-percent of annual member bike share trips replace what would have been an automobile trip[9,10]. A survey of Capital Bikeshare members in Washington D.C. in 2011 showed that bike share trips had replaced approximately 4.4 million vehicle miles[17], representing a 4-percent decrease in the city's annual driving mileage[22].

For individuals, most bike share systems offer member logins where people can track the amount of greenhouse gas emissions avoided through their bike share trips. Employers can also use these statistics to help track the organization's greenhouse gas emission reductions and foster competition among employees to see who can ride the most or the farthest.

Environmental Risks

[21] Rojas-Rueda, D. et. al. (2011). The Health Risks and Benefits of Cycling in Urban Environments Compared with Car Use: Health Impact Assessment Study. British Medical Journal 2011; 343:d4521. Accessed online at: http://www.bmj.com/content/343/bmj.d4521 on January 2, 2014. Statistics reported are based on the sensitivity analysis that assumes 10% of Bicing trips replace car trips.

[22] Federal Highway Administration, Highway Statistics 2011: Urbanized Areas – 2010 Miles and Daily Vehicle – Miles Traveled. Accessed online at http://www.fhwa.dot.gov/policyinformation/statistics/2011/hm71.cfm on December 27, 2013.

A major part of bike share operations is rebalancing the system – that is, moving bikes around from full stations to empty stations to ensure the availability of bicycles and empty docking points. Typically, this operation is undertaken by vans. Because of the relatively high cost and low availability of non-GHG options, there are few operations that utilize electric or other environmentally friendly vehicles. There have been no studies on the emissions of such vehicles, or other aspects of operations, on the overall environmental impact of a bike share system. However, this negative impact should be noted.

An important issue raised by local stakeholders is the impact of extreme heat both on ridership and on the comfort and performance of the equipment[23]. Other cities have observed dips in ridership on hotter days. In terms of equipment protection, none of the bike share equipment vendors in the United States currently offer covered stations. However, a Japanese company has constructed a solar charging station for a fleet of electric bikes that it makes available for community use[24] and there are American companies that manufacture solar-powered, covered stations for electric car and electric bicycle recharging (see **Figure 6**)[25]. Covering bike share stations would add significant cost and make station placements more permanent. These impacts will need to be considered in planning the system.

Figure 6: Illustration of a Solar eBike Charging Station in Portland, Oregon.

Safety

Safety Benefits

Safety has been a concern to all cities that have implemented bike share. However, although still relatively new, bike share has an extremely impressive safety record. To date, no system in the United States has recorded a fatality and the rates of injury crashes are typically lower than for private bicycling, as shown on **Figure 7**[26].

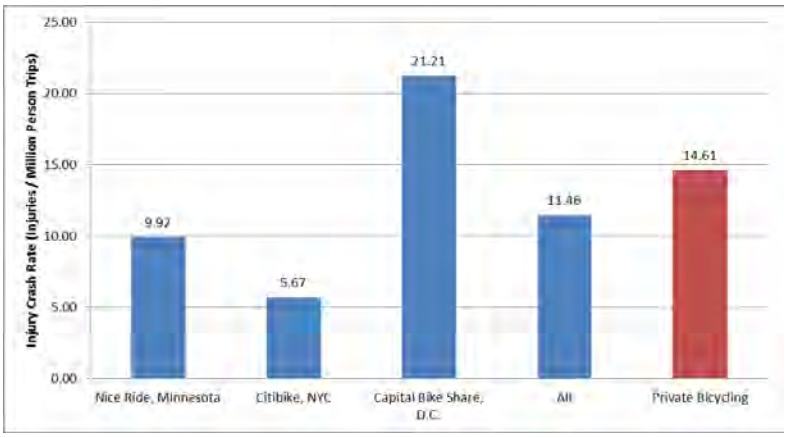


Figure 7: Comparison of Injury Rates for Bike Share and Private Bicycling.[26]

[23] City staff identified several issues with solar powered ticket vending machines at Streetcar stations malfunctioning due to the heat of the sun melting certain components.
[24] http://inhabitat.com/sanyo-installs-solar-parking-lots-in-japan-for-electric-hybrid-bicycles/ Accessed on November 24, 2014
[25] http://breakfastonbikes.blogspot.com/2010/07/omsi-first-out-with-sanyo-solar-ebike.html Accessed on November 24, 2014
[26] Only Capital Bikeshare has a higher injury crash rate than private bicycling. It is uncertain why the injury crash rate is higher in Capital Bikeshare than in other systems and higher than the private bicycling rate.

Introducing more riders to a community has a "safety in numbers" effect. Millions of bike share trips were taken in almost 30 U.S. cities in 2013 significantly increasing the number of bicycling trips in these cities. For example, in New York, there were an additional 40,000 bike trips per day due to Citi Bike and bike share trips made up approximately 29% of the 113,000 daily bicycle trips made within the bike share service area.

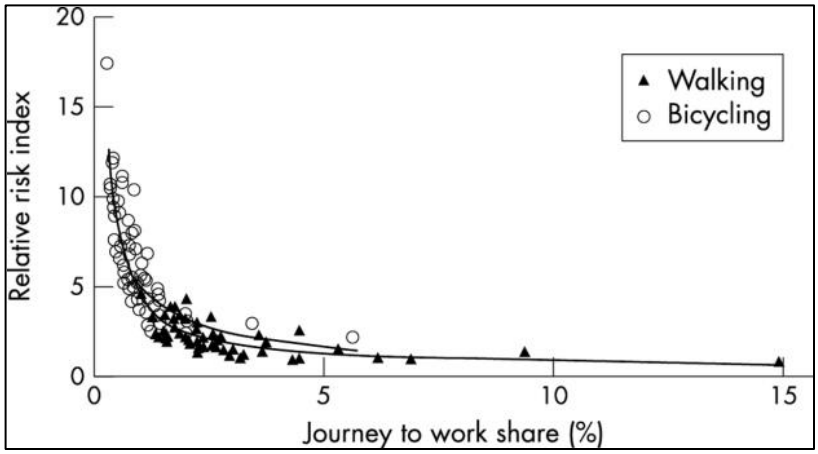


Figure 8: Walking and Bicycling Injury Rate (Relative Risk) in 68 California Cities in 2000. [24]

Along with the high visibility of stations, the high volume of riders results in greater awareness of bicyclists by drivers. In fact, the "safety in numbers effect" is well established. A study published in Injury Prevention in 2003 showed that the "likelihood of a person walking or bicycling being struck by a motorist varies inversely with the amount of walking and bicycling"[27].

Bike share provides a unique opportunity to communicate with riders about road rules and regulations and safety hints through safety messaging at bike share stations, on the program website, through social media, and on the bicycle itself. Messaging may include:

- Don't ride on sidewalks.
- Ride with the flow of traffic.
- Watch out for car doors.
- Encouragement of helmets and communication about where to purchase a helmet.
- Watch out for right-turning vehicles.

The strong safety record of bike share is also impacted by the introduction of bikes with many built in safety features. The features of the bicycle are shown on **Figure 9** and include:

- Built-in front and back lights, brakes, and reflectors.
- An upright position for the rider.
- A heavy bike (typically 40-45 lbs) with wide handlebars where riders generally keep slow speeds and do not weave in traffic.

In addition, the operator undertakes regular maintenance of the bike fleet to ensure safety.

[27] Jacobsen, P.L. (2003). Safety in Numbers: More Walkers and Bicyclists, Safer Walking and Bicycling. Injury Prevention 2003;9:205-209. Note that the injury rate (referred to as the "relative risk index") reduces exponentially with the number of bicyclists using the road system (in this case using journey to work mode share as a proxy for the overall amount of bicycling).

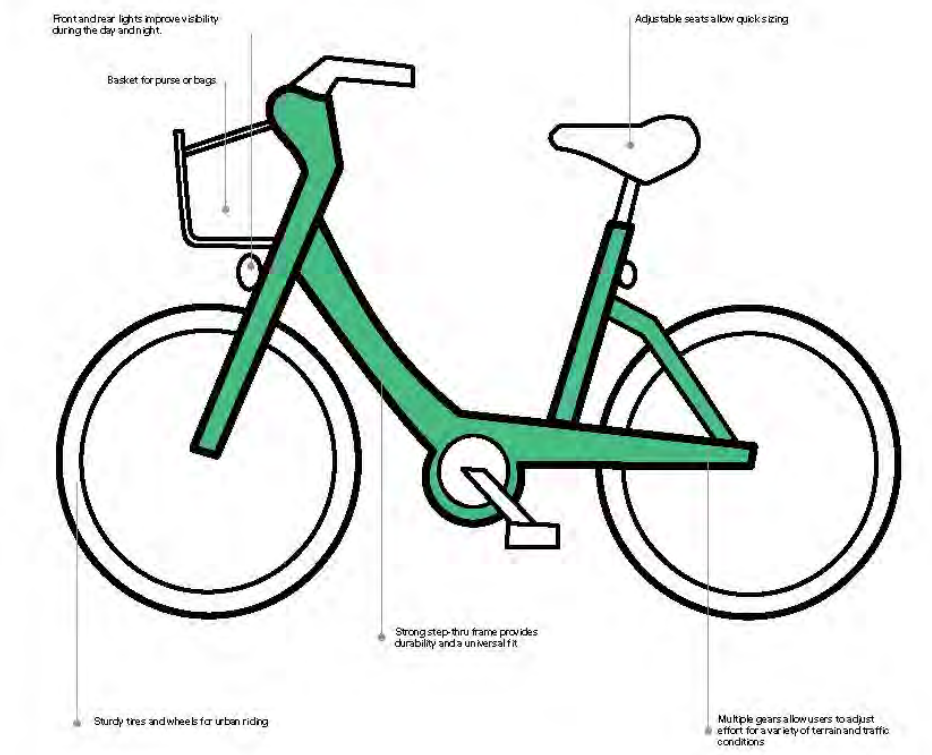


Figure 9: Safety Features of the Bike Share Bicycle. [28]

Safety Risks

Many communities have had strong concerns about safety prior to implementation, including:

- Lack of bicycle infrastructure for safe cycling (see the Mobility and Transportation section).
- Introducing inexperienced riders to the streets.
- Low helmet usage rate among bike share users (a study of bike share trips in Boston and Washington D.C. showed that less than 20-percent of bike share riders wore a helmet[29]).
- Pedestrian concerns of riders breaking rules such as riding on the sidewalk or against traffic (particularly among elderly pedestrians).

Although the safety risks are real and should be mitigated, none of these considerations have proven to be a significant deterrent for any existing systems. This is evidenced by the strong safety record of bike share in almost all communities that it has been introduced.

[28] Atlanta Bicycle Coalition (2013). Atlanta – Decatur Bike Share Feasibility Study. Accessed online at: http://issuu.com/atlantabike/docs/atl-dec_bikeshare_book_lowres# on January 2, 2014.

[29] Fischer, C.M. et al. (2012). Prevalence of Bicycle Helmet Use by Users of Public Bikeshare Programs. Published in the Annals of Emergency Medicine, Vol. 60, Issue 2, pp. 228-231.

One of the major concerns in Tucson is the interaction of bike share bicycles with the Streetcar tracks. In general, cities with streetcar or light rail tracks often see an increase in bicycle crashes related to bicycle tires getting caught in the streetcar tracks.

The Living Streets Alliance conducted an 18-month study of bicycle crashes resulting from the interaction with Streetcar tracks in Tucson. Crashes were reported online using a self-reporting tool established for the study. A total of 86 crashes were reported between August 2012 and April 2014[30]. The majority of crashes were reported as no injury or only minor injuries (including minor cuts, scrapes, or bruises), however 30-percent of crashes were reported as major cuts, broken bones, or a visit to the hospital. The major reported crash causes included:

- Approximately 43-percent were attributed to the bicyclist crossing at a bad angle or otherwise getting their tire stuck in the tracks.
- Approximately 40-percent were attributed to the bicyclist having to take some evasive action to avoid vehicles, obstacles or other incidents occurring in the bike lane.
- Approximately 14-percent were attributed to the physical environment, i.e., the bicyclist having to maneuver around some sort of roadway design feature.
- Approximately 3-percent were attributed to the tracks being wet or obscured following rain.

Although crashes were reported along the entire Streetcar route, there were clusters of crashes at the Main Gate area, thought to be the result of double-parked cars, taxis, loading, and large numbers of pedestrians requiring bicyclists to swerve into the streetcar tracks. Other large clusters were reported at the 4th Avenue intersections with Toole Avenue and University Avenue.

Nevertheless, a survey of six cities that have both streetcar or light rail and an operating bike share system including Charlotte, Denver, Kansas City, Minneapolis, San Francisco, and Seattle reported only one streetcar-related bicycle crash where a rider fell on the Muni tracks in San Francisco. Some of the reasons for the better safety record of bike share bicycles around streetcar tracks are the wider tires of the bicycles (that do not fit all the way into the track) and the generally more cautious behavior of bike share riders.

Summary of Benefits and Risks

Bike share provides a multitude of mobility, transportation, community-building, economic, health, environmental, and safety benefits. However, there are also risks associated with launching a bike share program.

Some of the major benefits that bike share could bring to Tucson include:

- Providing an additional transportation option that by itself or combined with other options presents an opportunity to reduce dependence on automobile transportation.

[30] http://www.livingstreetsalliance.org/our-work/projects/streetcar-crash-data/. This may not include all bicycle crashes resulting from interaction with the streetcar tracks as some bicyclists may not have known about the self-reporting tool. Note that there were no reports of crashes involving the bicyclist being struck by other vehicles, streetcars, or pedestrians.

- Expanding and enhancing existing transit service by providing a new first- and last-mile option, in particular, to augment the City's recent investment in Streetcar.
- Introducing new riders to the benefits of bicycling by reducing some of the common barriers to entry.
- Providing an impetus for further investment in bicycling facilities.
- Building on the City's reputation as a forward-thinking, bicycle-friendly community, and using bike share to promote the city to potential employers, residents, and visitors.
- Providing an economic benefit to local businesses.
- Reducing household transportation expenditures.
- Improving physical and mental health and reducing health care costs.
- Reducing greenhouse gas emissions.
- Providing safely designed and well maintained bicycles in order improve comfort through the safety in numbers effect.
- Introducing new opportunities to promote safety messaging to all road users.

The major risks include:

- The possibility that some bike share trips may detract from other public transit or active transportation trips.
- The need to ensure that sufficient funding is available to support capital, expansion, and ongoing operations. Most bike share systems are not economically self-sustaining from membership and usage fees alone.
- Concerns that bike share may threaten the local bike rental and retail markets.
- Ensuring that rebalancing efforts do not offset the greenhouse gas emission benefits of the system.
- Introducing new riders onto some streets that do not have significant bicycle infrastructure.
- Exposing a larger number of riders to the possible risks associated with interacting with the Streetcar tracks. However, other cities with bike share and streetcar or light rail have reported very few bike share crashes as a result of the tracks.
- The timeliness of obtaining political support, fundraising, and implementing a bike share program and the public image risk of implementation delays.
- The changing landscape of the industry means there are very few vendors with a strong track record on the market.

3. GOALS AND OBJECTIVES

An important component in determining the feasibility of a bike share program is to understand the program's role in the community, decide what benefits are considered most valuable, and determine what will be considered a successful program. To this end, a set of system goals and objectives were developed based on meetings with key regional stakeholders and initial feedback from the public.

Two types of goals were defined for the system: Policy Goals and Financial Goals. The Policy Goals are the reasons why the system will exist – the fundamental drivers. These should match the desires of the community.

However, the primary need of any program is to maintain financial viability. This does not mean that revenues generated by the program must cover the full cost of operating the program – in fact few systems do. Nevertheless, the program needs to maintain financial viability to continue to operate.

The Financial Goals will need to support the Policy Goals for the program. Some Policy Goals will complement financial viability and others will compete with this interest. For example, promoting high membership and ridership and considering market value pricing structures will encourage financial viability, whereas maintaining a high functioning program with high operating standards will add cost to the program and reduce financial viability. The ultimate funding plan should identify funding targets that the program must meet either by reducing operating costs or generating more revenue.

Performance measures are also included in order to be able to evaluate success of the program in relation to the defined goals and objectives.

Table 3: Proposed Goals and Objectives for a Potential Tucson Regional Bike Share Program

Policy Goal	Objectives	Performance Measures
Mobility: **Offer additional transportation options for residents, students, employees, and visitors to Tucson**	• Increase the reach of other transportation modes using bicycle trips as the first mile / last mile solution and to increase overall use of public transportation. • Connect key origins and destinations in and around downtown Tucson with one another, including between downtown and the University of Arizona. • Increase the accessibility of neighborhoods that are not currently served with efficient transit options, as well as connections between neighborhoods that currently do not have efficient transit connections. • Provide a low cost transportation option for all socio-economic groups.	• Percentage of bike share stations within 1/4 mile of a public transit stop or station. • Number of trips origins and destinations at stations with direct proximity to transit stations and bus stops, as well as trips between stations that are >1/4 mile from the closest transit stop. • Percentage of rides coupled with public transit as reported through survey. • Success of co-promotions with transit or integrated transit solutions, such as a single payment card. • Number of new trips that would not have been made without bike share, as reported through survey. • Number of residents and students who are bike share members. • Annual member demographics and income levels. • Percentage of annual members from lower socio-economic zip codes.
Economic: **Increase the attractiveness of Tucson as a place to live, work, visit and do business**	• Provide a system that promotes economic development including increased local business productivity and real estate values. • Provide an alternative means of transportation for visitors to Tucson, including conference attendees, families of students, partial year residents and tourists to the area. • Provide a program that is customer-service focused and well-maintained to standards that will attract and maintain program sponsors, and be a visual and economic asset to the local setting. • Create co-promotions with employers to offer discounted bike share membership as a part of a group membership. • Create a program that promotes quality of life and will both attract visitors and retain residents in and around Downtown Tucson and its surrounding neighborhoods.	• Population and employment within a quarter mile of a bike share station. • Number of employer / corporate partnership memberships. • Number of active corporate memberships. • Proportion of surveyed bike share users who are visiting the city for leisure or business. • Number of casual users. • Usage reports of stations located near high tourist destinations, including casual and member usage. • Number of media reports about Tucson bike share. • Number of social media posts related to Tucson bike share. • Increase in sales revenue nearby bike share stations. • Change in real estate values nearby bike share stations.

	• Create a program that will attract national attention to Tucson as a city that is technology-oriented, fun, attractive, safe and comfortable to both live and visit.	
Bicycling: **Increase the amount of bicycling in Tucson**	• Provide alternatives to single occupancy vehicle trips including bicycling to foster an active lifestyle and environmental sustainability. • Build off the bike friendliness that the region is known for and increase the presence of and visibility of bicyclists to improve overall bike safety. • Increase the mode share for bicycle-related trips in Tucson, whether for transportation or recreation. • Encourage businesses to embrace bicycle friendly status.	• Number of annual memberships. • Number of casual memberships. • Number of rides per annual member. • Annual member rides from each station. • Casual member rides from each station. • Bicycle and transit mode share measured through survey. • Percentage of bike share trips that avoided single occupancy vehicle trips, as reported through survey. • Number of reported bike share crashes per 1,000 bike share trips. • Total calories burned per year. • Greenhouse gas emissions avoided. • Number of bike friendly businesses.
Financial: **Create a public-private program that is financially viable and can meet the Policy Goals.**	• Seek a public-private partnership to maximize private sector funding for a bike share system that will meet the stated Policy Goals. • Utilize a combination of user revenues, sponsorship, other revenues, and, if necessary, some local public assistance to fund ongoing operations. • Create and maintain a contract structure whereby the program owner and operator (if applicable) are both incentivized for a financially sustainable program. • Plan for and ensure sustainable capital and operational funding for program growth and ongoing equipment replacement. • Seek grant funding or other large, one-time funding sources for capital investment. • Clearly communicate program performance and effectiveness to stakeholders and the public. • Seek cost saving opportunities to promote bike share through partnerships with like-minded organizations.	• Sponsorship funding acquired. • Grant and other type of funding acquired. • Total system revenue (broken down by annual membership, casual membership, and usage fees for each). • System revenue per bike and for each station per year. • Membership and ridership performance measures included in operator contract. • Farebox recovery. • Annual reporting of the state of bike share that details to members and public the progress of the system. • Number of cross-promotions annually.

4. EXISTING CONDITIONS AND DEMAND 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 might impact the potential demand for bike share.

Figure 10: Downtown Tucson and the University of Arizona.

The heat mapping process included spatially analyzing several variables 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 11** 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.

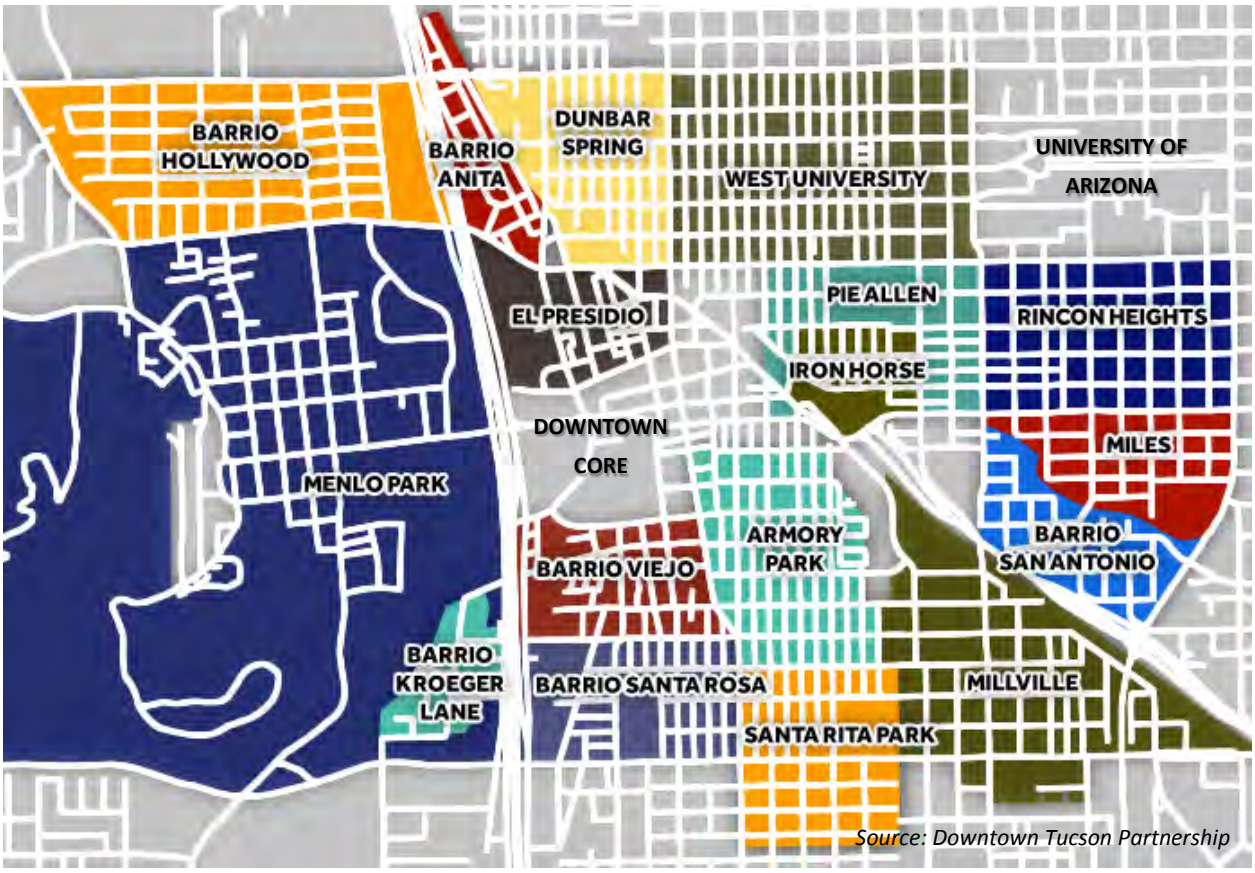


Figure 11: Downtown Tucson Neighborhoods.

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 Air Force 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 12**.

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.[31]

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 3**.

Figure 13 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.

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

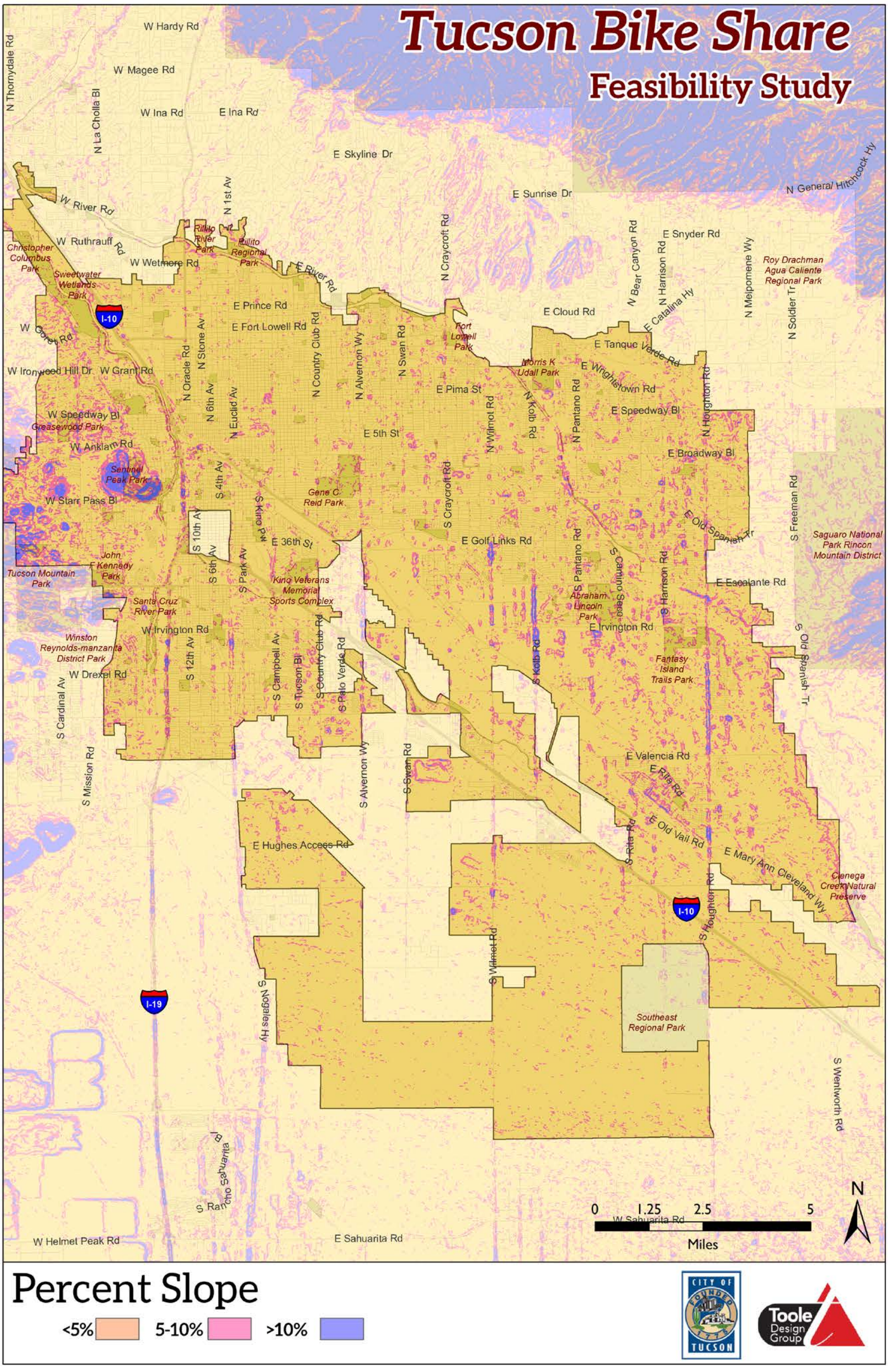


Figure 12: Topography Map of Tucson.

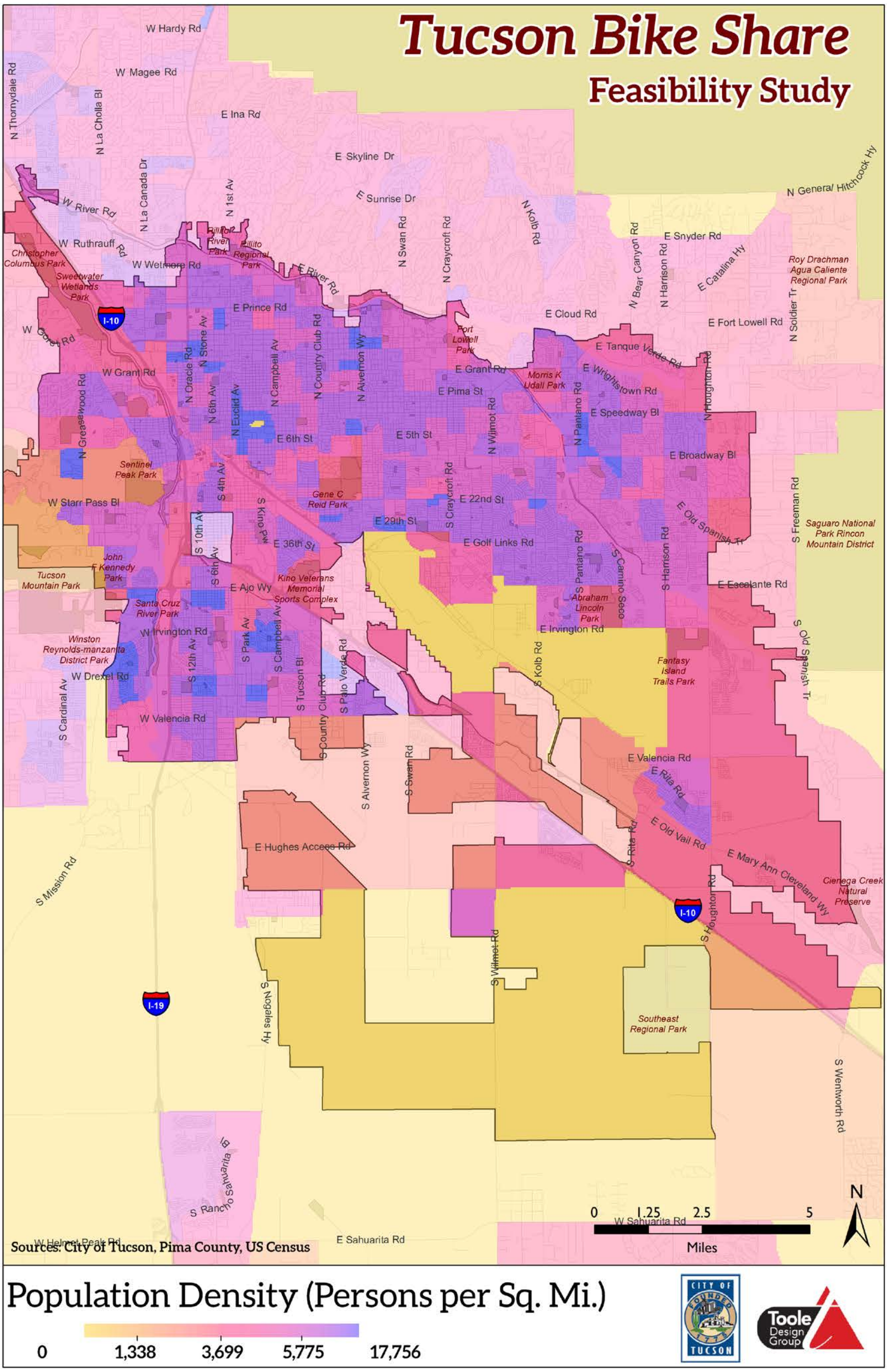


Figure 13: Tucson Population Density Map

Table 4: 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 Survey[32] 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 14**;
- 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 15**, 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.[33]

The above factors are important, as experience in other cities shows that early adopters tend to be younger, well educated, and more affluent riders[34]. The University, with its population of young, educated students will likely be an early adopter of the system as will more affluent communities. **Figure 16** maps concentrations of these populations by selecting census blocks where at least two of the following criteria were met:

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

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

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

[34] 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.

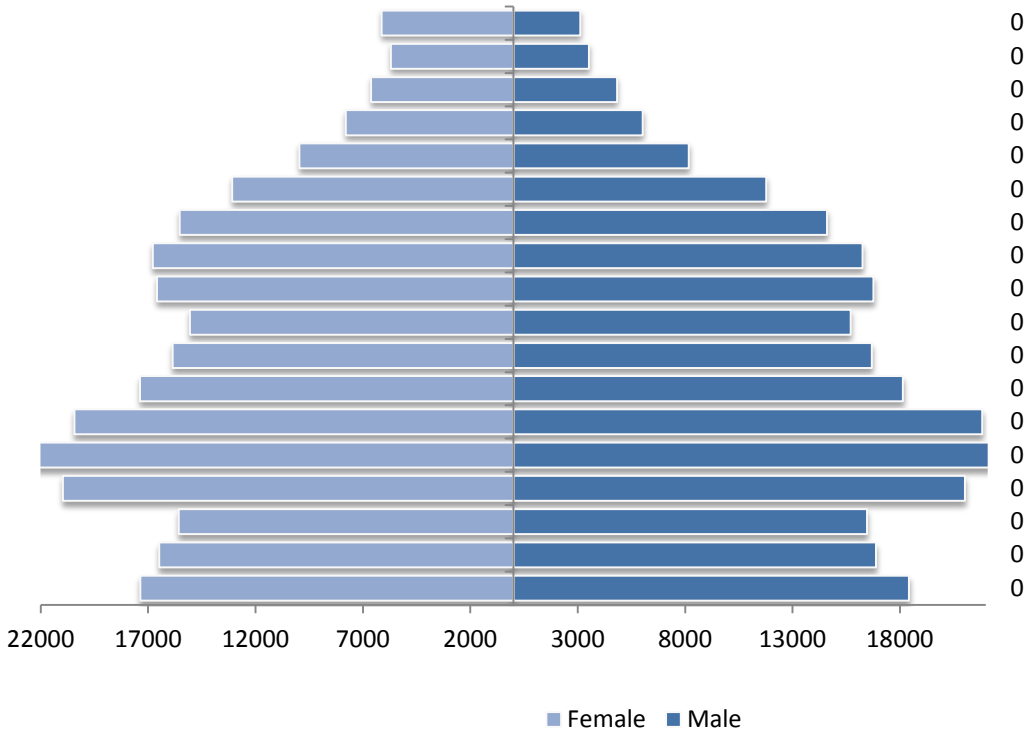


Figure 14: Population by Age and Sex

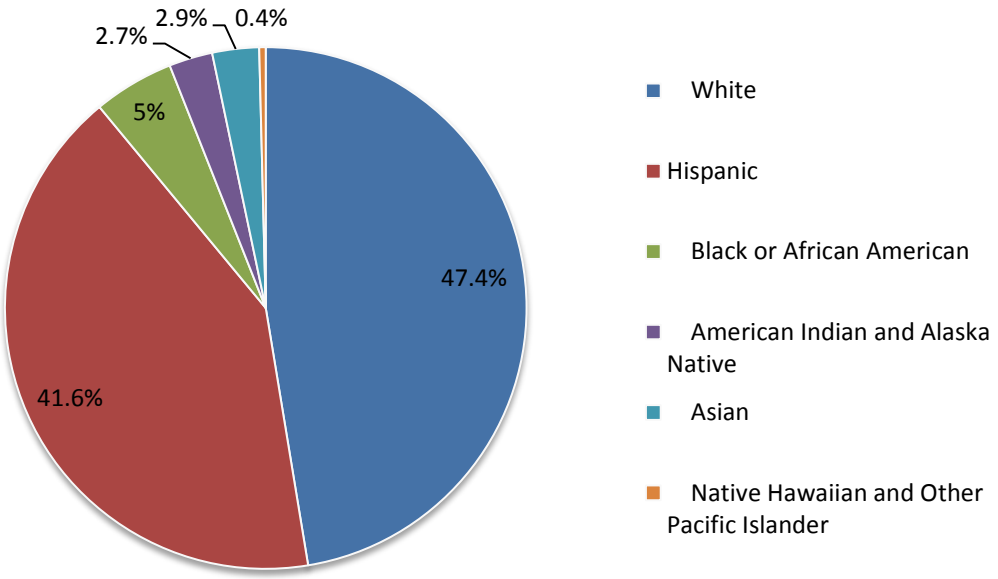


Figure 15: Demographic Composition.

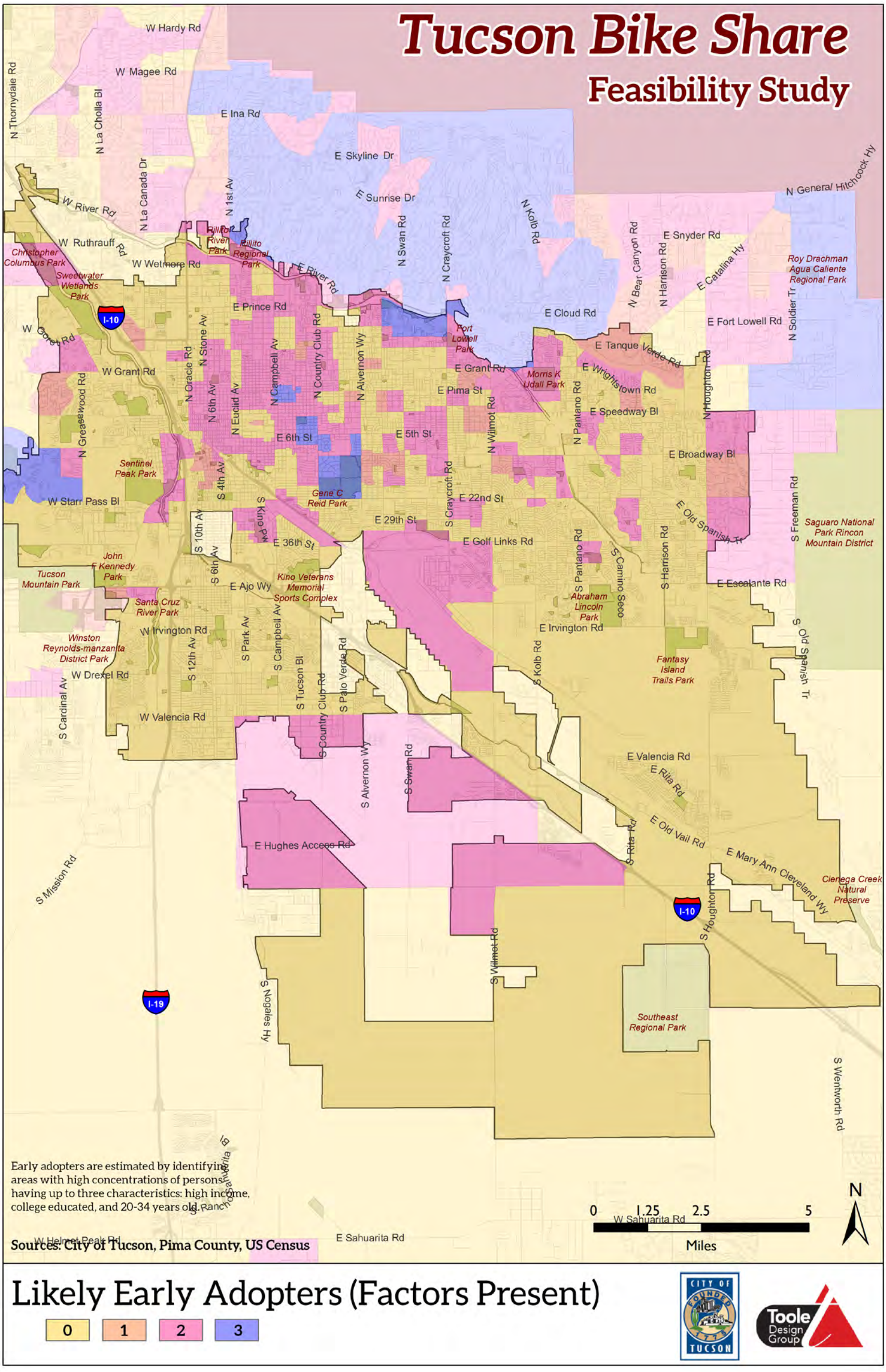


Figure 16: Potential Early Adopters of Tucson Bike Share.

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 16 shows that the areas 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 16 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.[35]

[35] Downtown Tucson Partnership (2010). *Revitalizing Downtown Tucson: Building the New Pueblo.*

Figure 17 shows the areas of the city with the highest density of employment**.** The highest densities are located 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 4**. 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 and future opportunities to bring bike share to these 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 5: Largest Employers in Tucson[36]

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
Carondolet 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.

[36] http://www.visittucson.org/about/facts/ Accessed on December 1, 2014.

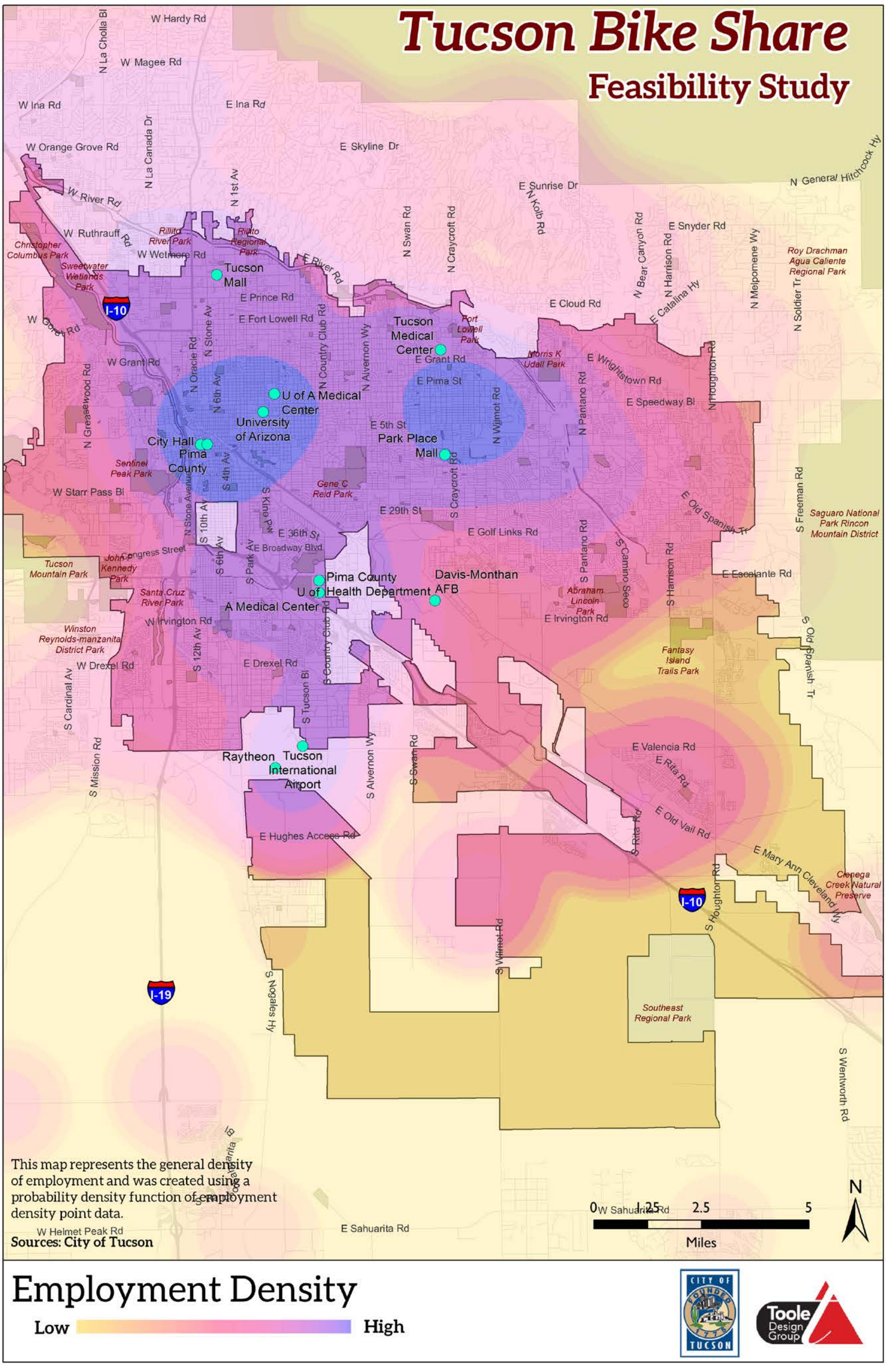


Figure 17: Tucson Employment Density Map

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.[37] 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.

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

[37] http://factbook.arizona.edu/2013-14 Accessed on December 1, 2014.

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.[38] 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.[39] 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.[40]

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 5**. 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 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.

[38] https://www.pima.edu/campuses-centers/quick-facts/index.html Accessed on December 1, 2014.
[39] https://tourism.az.gov/sites/default/files/documents/files/GCOT%20Slides%20071514FINAL_1.pdf Accessed on December 2, 2014.
[40] Visit Tucson website: http://www.visittucson.org/media/research-facts/visitor-stats/ Accessed on December 2, 2014.

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 6: Top 10 Visitor Attractions in Tucson[41]

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 that may be attractive to bike share users including 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.

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 18** shows the location of some of the area's major visitor attractions, hotel clusters, commercial districts, and community amenities.

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

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 19**).[42] The supply and low cost of parking has traditionally encouraged vehicle travel. The majority of metered parking costs $1.00 per hour for on-street spaces in the downtown and in the 4th Avenue area and there are over 15,000 parking spaces in the downtown alone including approximately 1,000 metered on-street spaces.[43]

[42] US Census Bureau. 2008-2012 American Community Survey 5-Year Estimates File B08101 Means of Transportation To Work By Age.
[43] http://www.downtowntucson.org/get-around/parking/ Accessed on December 2, 2014

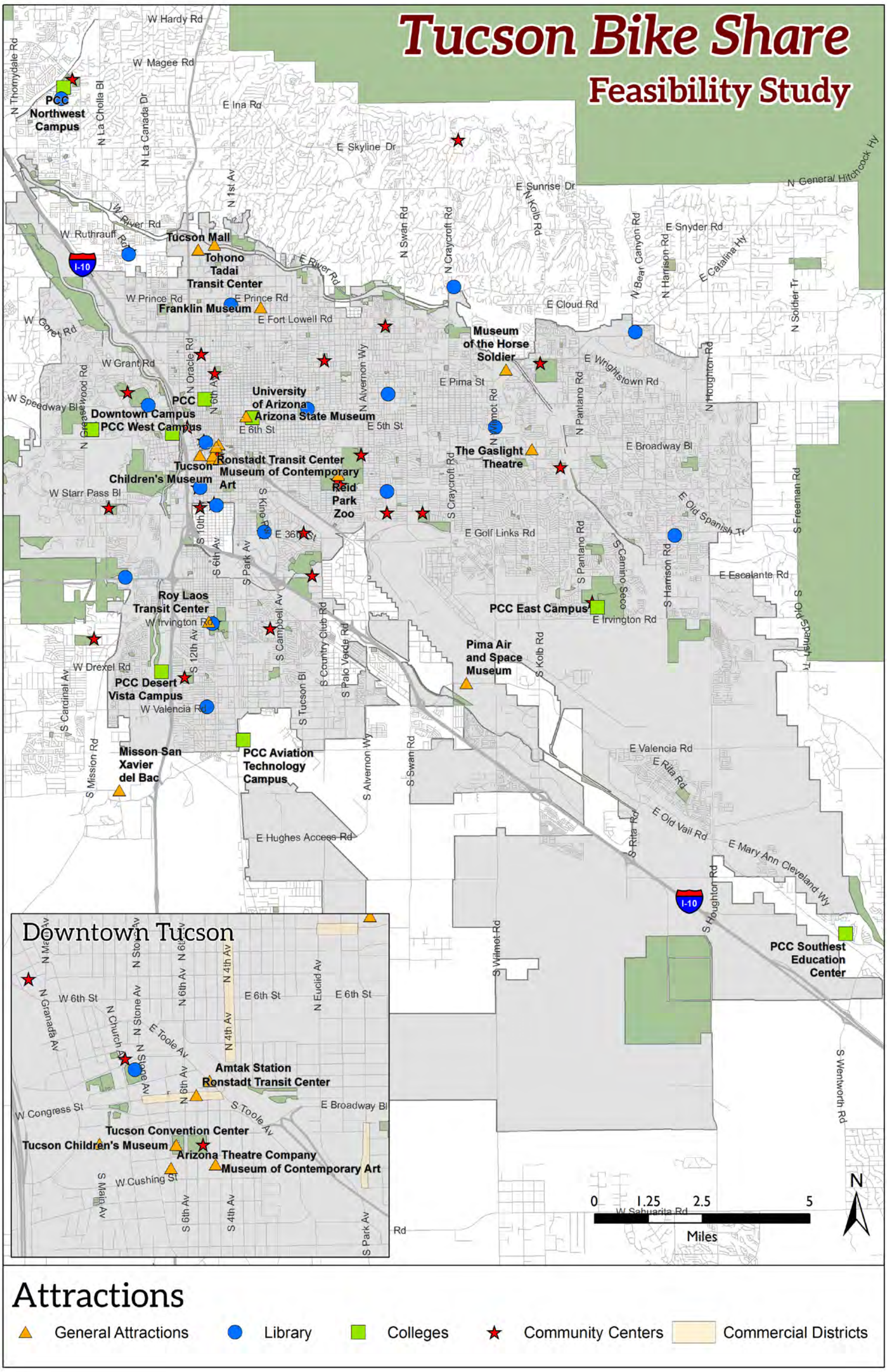


Figure 18: Tucson Visitor and Community Attractions Map.

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 bicycle, walk, take public transportation, or carpool to work.

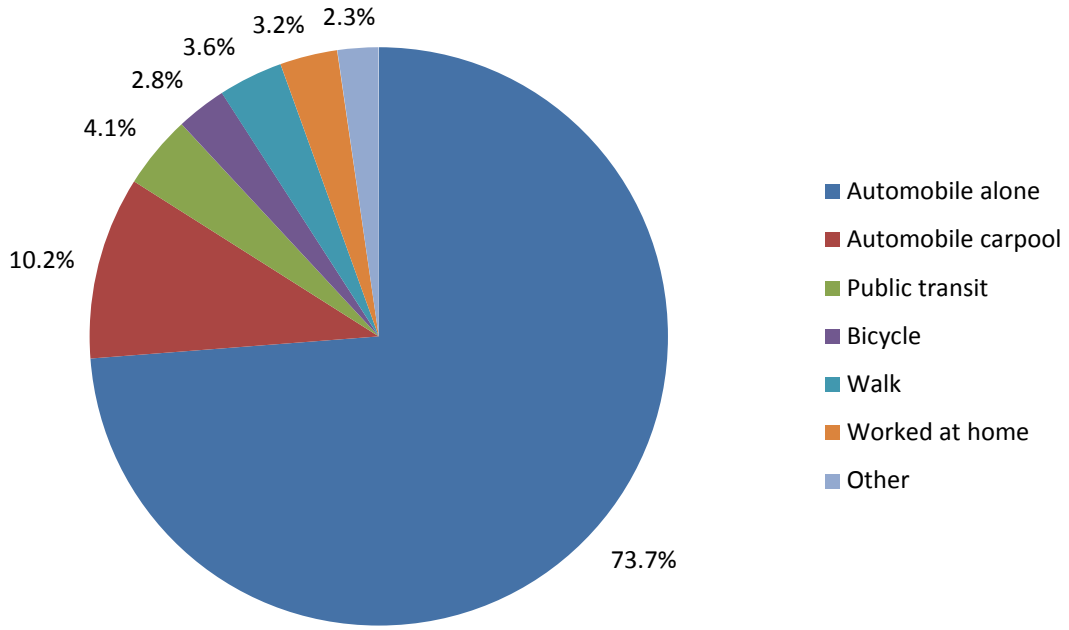


Figure 19: Journey to Work Mode Share in Tucson

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 Tadai 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 the hub of future phases of the system with bike share connecting people from the surrounding neighborhoods. 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.[44]

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 20**). It was constructed using a combination of federal and local funding sources.[45] 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.[46] 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

[44] 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.
[45] http://www.sunlinkstreetcar.com/index.php?pg=5 Accessed on December 2, 2014.
[46] http://www.sunlinkstreetcar.com/index.php?pg=13 Accessed on December 2, 2014.

Figure 20: Sun Link Streetcar Route Map.

Bike share provides a way to extend the reach of transit services by providing a fleet of bicycles 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 21**. 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.

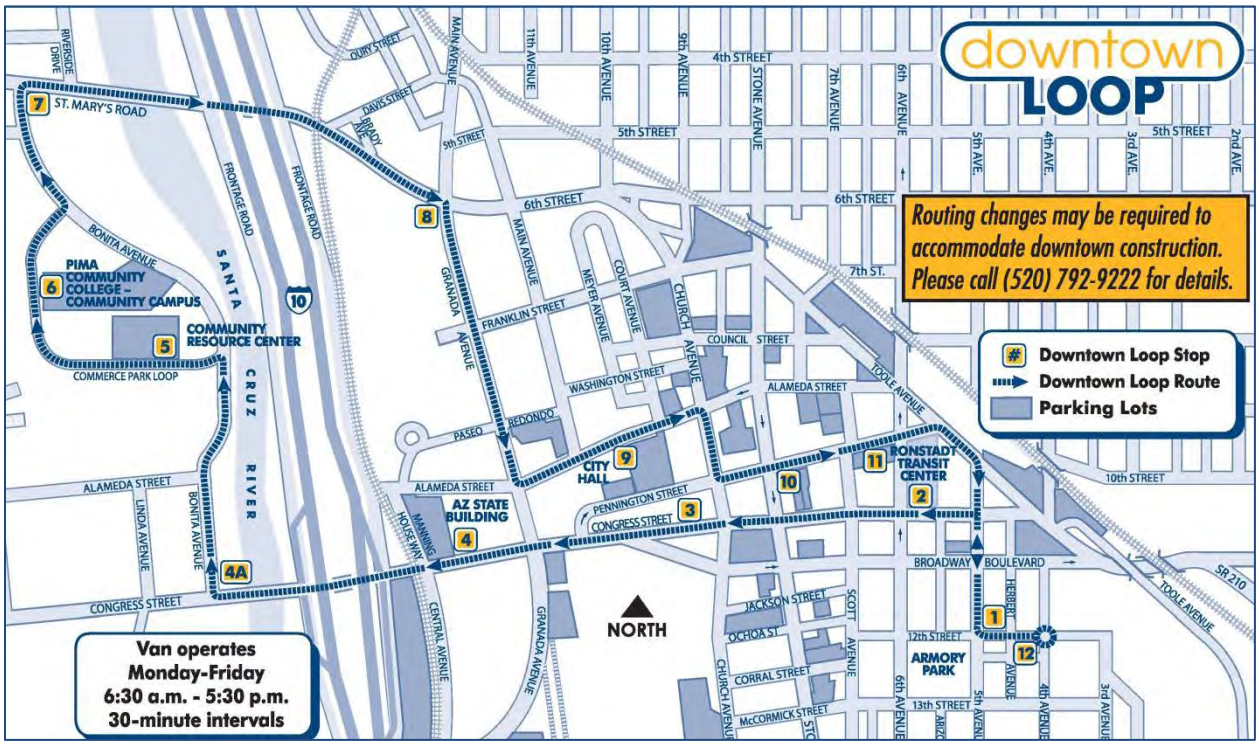


Figure 21: Downtown Loop Shuttle Van Map.[47]

Figure 22 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.

[47] http://tdot.tucsonaz.gov/park-tucson/downtown-loop Accessed on December 2, 2014.

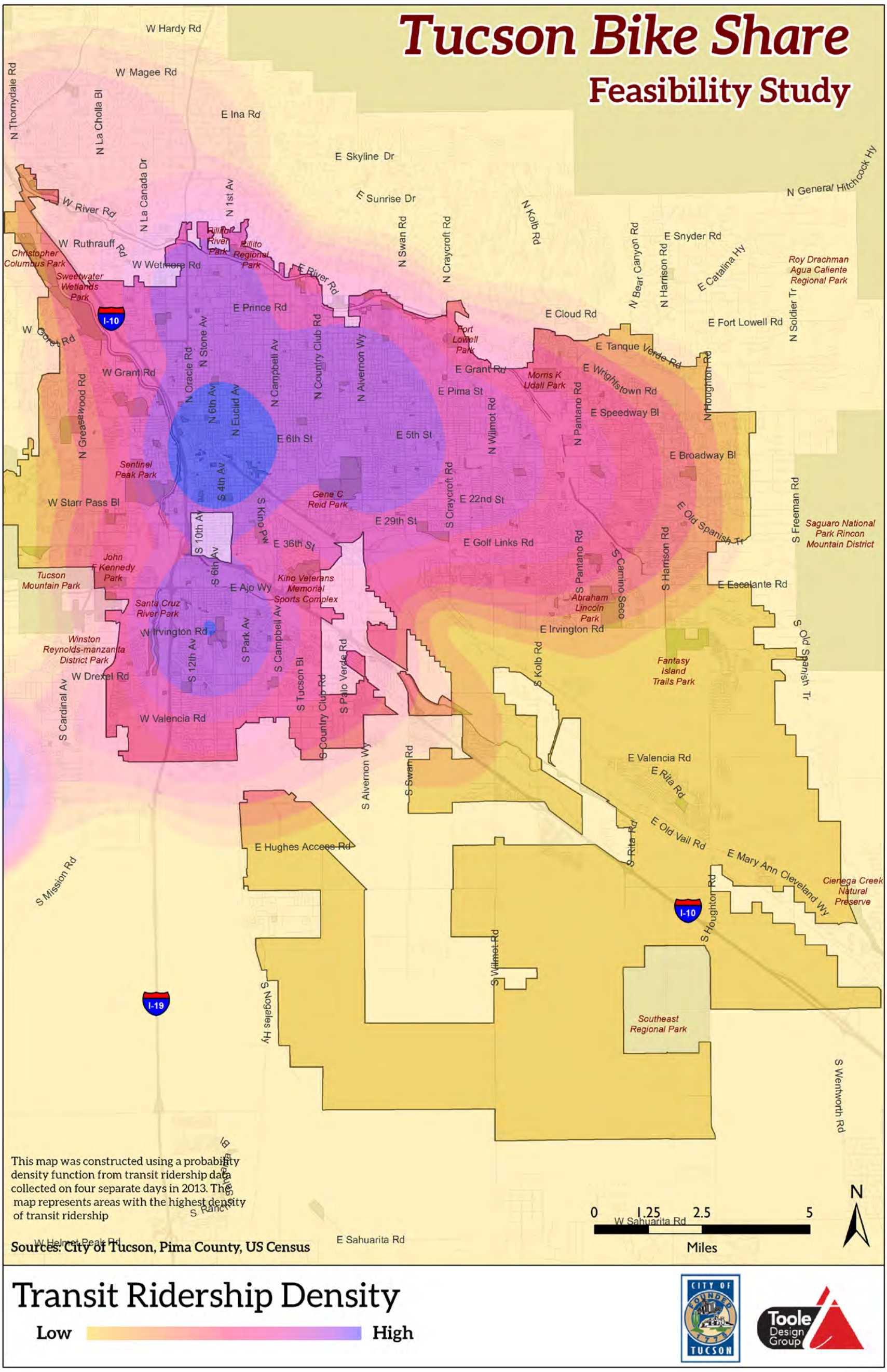


Figure 22: Transit Ridership Map

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-percent 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".[48]

The city has approximately 514 miles of bikeways[49] 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 23**.

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.[50,51,52,53] For example, Buehler and Pucher found that cities that made a 10-pecent increase in bike facilities saw a 2- to 3-pecent increase in bicycle commuting compared to cities with no change. This relationship may be especially strong among

[48] http://www.pagnet.org/documents/2012LABfeedback.pdf
[49] City of Tucson
[50] Buehler, R. & Pucher J. (2012). *Cycling to Work in 90 Large American Cities; New Evidence on the Role of Bike Paths and Lanes*.
[51] Dill, J. & Carr, T. (2003). *Bicycle Commuting and Facilities in Major U.S. Cities: If You Build Them, Commuters Will Use Them*.
[52] Hunt, J. & Abraham, J. (2007). *Influences on Bicycle Use*. Transportation, 34, 453–470.
[53] Parkin, J., Wardman, M. &Page, M. (2008). *Estimation of the Determinants of Bicycle Mode Share for the Journey to Work Using Census.*

minority and low income individuals. Fifty-nine percent of minorities[54] 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 often[55].

In addition, several bike share 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 Bikeshare[56]. Continued investment in bicycling facilities by the City of Tucson and Pima County will have a positive influence on bike share 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.

[54] Minorities defined as Hispanics, African Americans, Asians, Native Americans, mixed, or other race.
[55] http://bikeleague.org/sites/default/files/equity_report.pdf
[56] http://www.capitalbikeshare.com/assets/pdf/CABI-2013SurveyReport.pdf

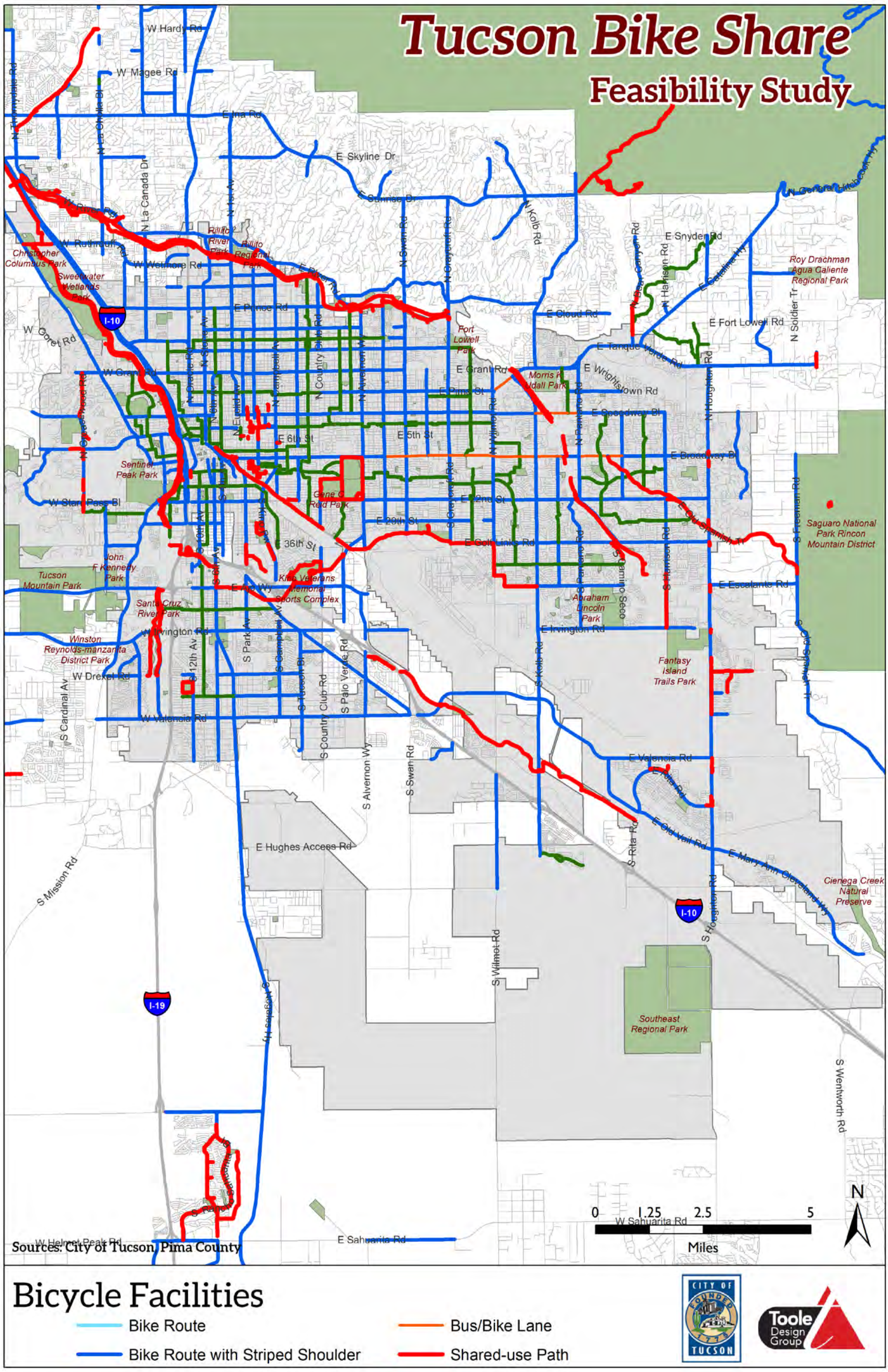


Figure 23: Tucson Bicycle Network

The methodology includes a point-scoring system where points are allocated to 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 6**.

Table 7: 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: • 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 24**. 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 Tadai 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.

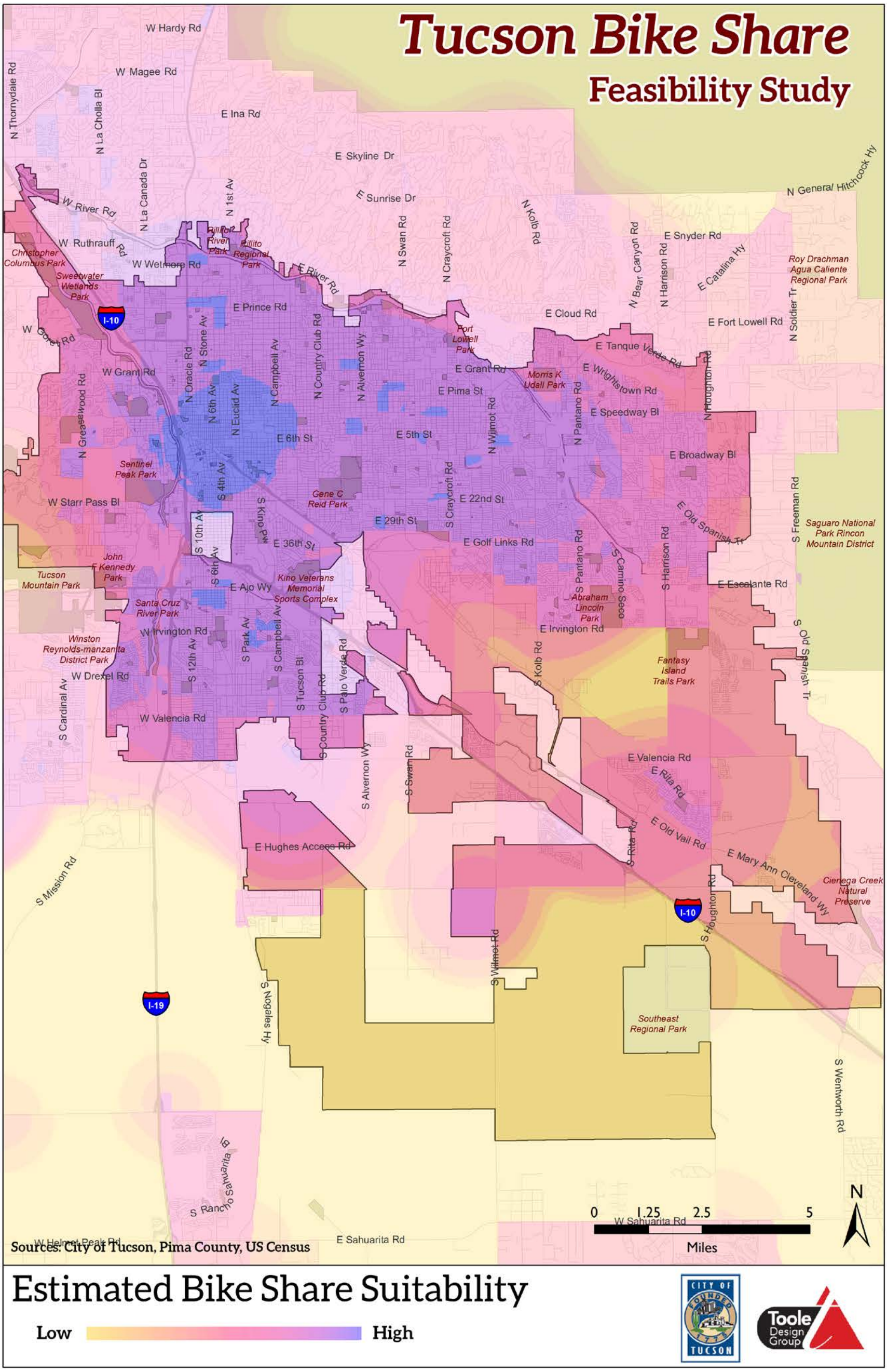


Figure 24: Tucson Bike Share Suitability Analysis

5. COMMUNITY ENGAGEMENT AND SYSTEM PLANNING

Public and Stakeholder Engagement

The project team conducted outreach to the general public and engaged local stakeholders to gather input from the local community about the potential for bike share in Tucson. Outreach to the general public included an online survey, crowdsourcing map, and a public information session. Stakeholders, who represent individuals, organizations, and community groups that could play a role as supporters, sponsors, or participants of a bike share system, were identified and invited to a series of stakeholder workshops.

The overall theme of the input was that there is significant support for bike share in Tucson, however there will be challenges to overcome including finding sustainable funding sources to maintain long term operations. Details of the public and stakeholder outreach effort are described below.

Online Survey and Crowdsourcing Map

A webpage was created for the project and linked to the City's Bicycle and Pedestrian Program website (http://bikes.tucsonaz.gov/bicycle/tucson-bike-share). It was updated throughout the project with information about the project and key milestones. For the public outreach process, an online survey and crowdsourcing map were created and linked to the bike share webpage.

Online Survey

An online survey was made available between October 1 and December 31, 2014 and promoted through a variety of media including links from the project webpage, student media at the University of Arizona, press releases, local publications, an announcement at the public information session, and through social media. The survey included 22 questions asking for respondents' demographic and employment information; current bicycling habits; and opinions on bike share implementation. A copy of the survey is included in **Appendix A**.

A total of 271 responses were received and the results are summarized below.[57]

Demographic and Employment Information

Survey participants were asked to provide demographic and employment information. Table 7 compares the demographics of respondents with the citywide population and shows that respondents tended to over-represent individuals enrolled in college as well as older, white, and higher income populations.

The survey also asked respondents to provide the zip code of their current residence, place of employment, and school (if currently enrolled). **Figure 25** shows the distribution of survey responses – the majority of respondents (96%) live in the City of Tucson.

[57] It is noted that there are some limitations to this survey, e.g., many of the respondents are self-selecting individuals who either strongly support or oppose bike share and may be more inclined to complete the survey rather than a randomly chosen sample.

Table 8: Comparison of Survey Respondent and Citywide Demographics

Demographic	Survey Respondents	Tucson Population	Representation
Age (median)	39	33	Survey over-represents older populations
Gender (% female)	52.3%	50.5%	Survey represents gender split
Ethnicity (% white)	78.1%	47.4%	Survey over-represents white populations
Annual Household Income (median)	$60,000	$37,032	Survey over-represents higher income households
College Enrollment (% enrolled)	20%	7.5%	Survey over-represents individuals enrolled in college

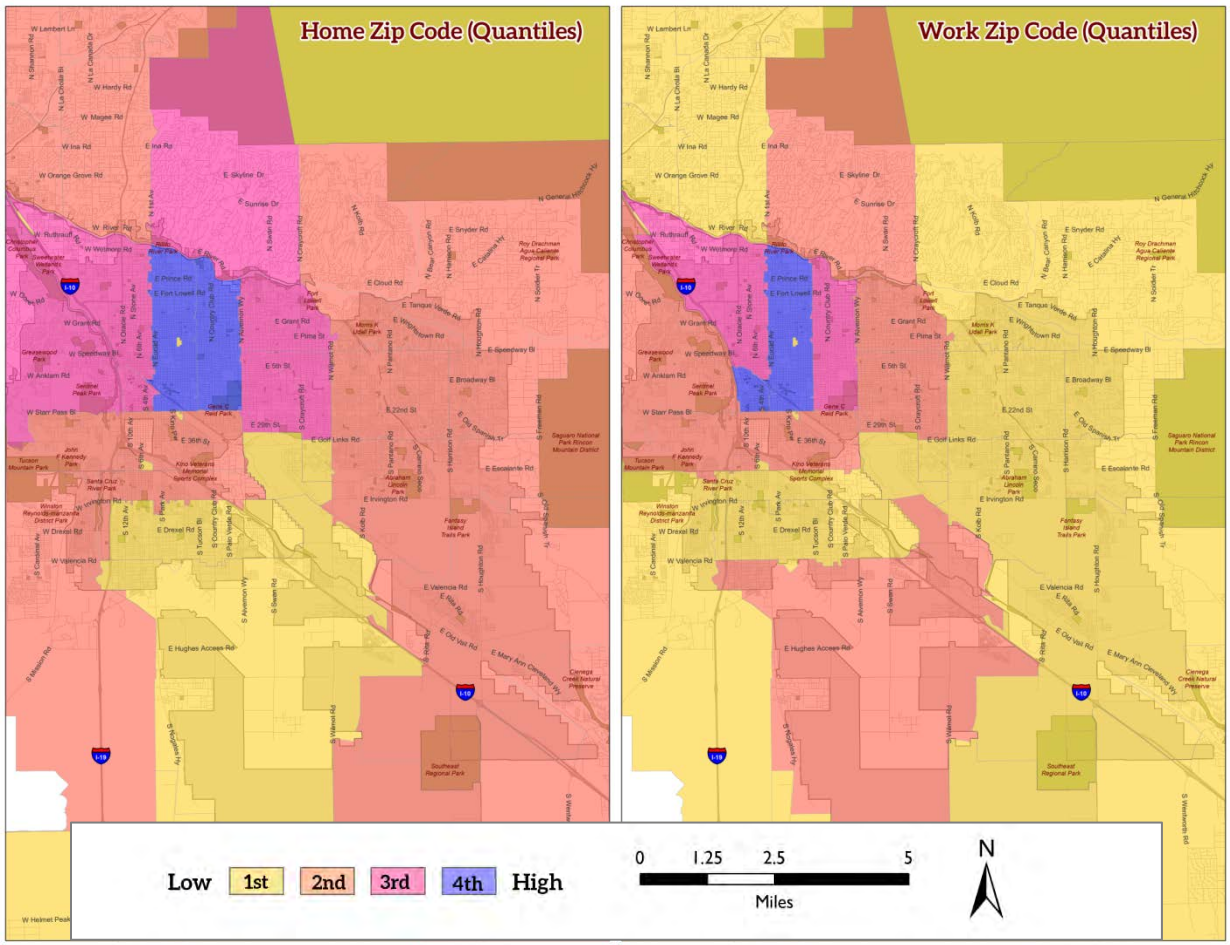


Figure 25: Distribution of Survey Responses by Zip Code.

Current Bicycle Usage

Generally, survey respondents represented active cyclists with a significant percentage of respondents (82%) having access to a working bicycle and two-thirds (66%) stating that they ride daily or multiple times per week.

Just over one-third of respondents (37%) indicated that they had previously used a bike share system, with Capital Bikeshare (Washington, D.C.), Denver B-cycle (Denver, CO) and Citi Bike (New York, NY) being the most common. A summary of bicycling usage amongst survey respondents is included on **Figure 26**.

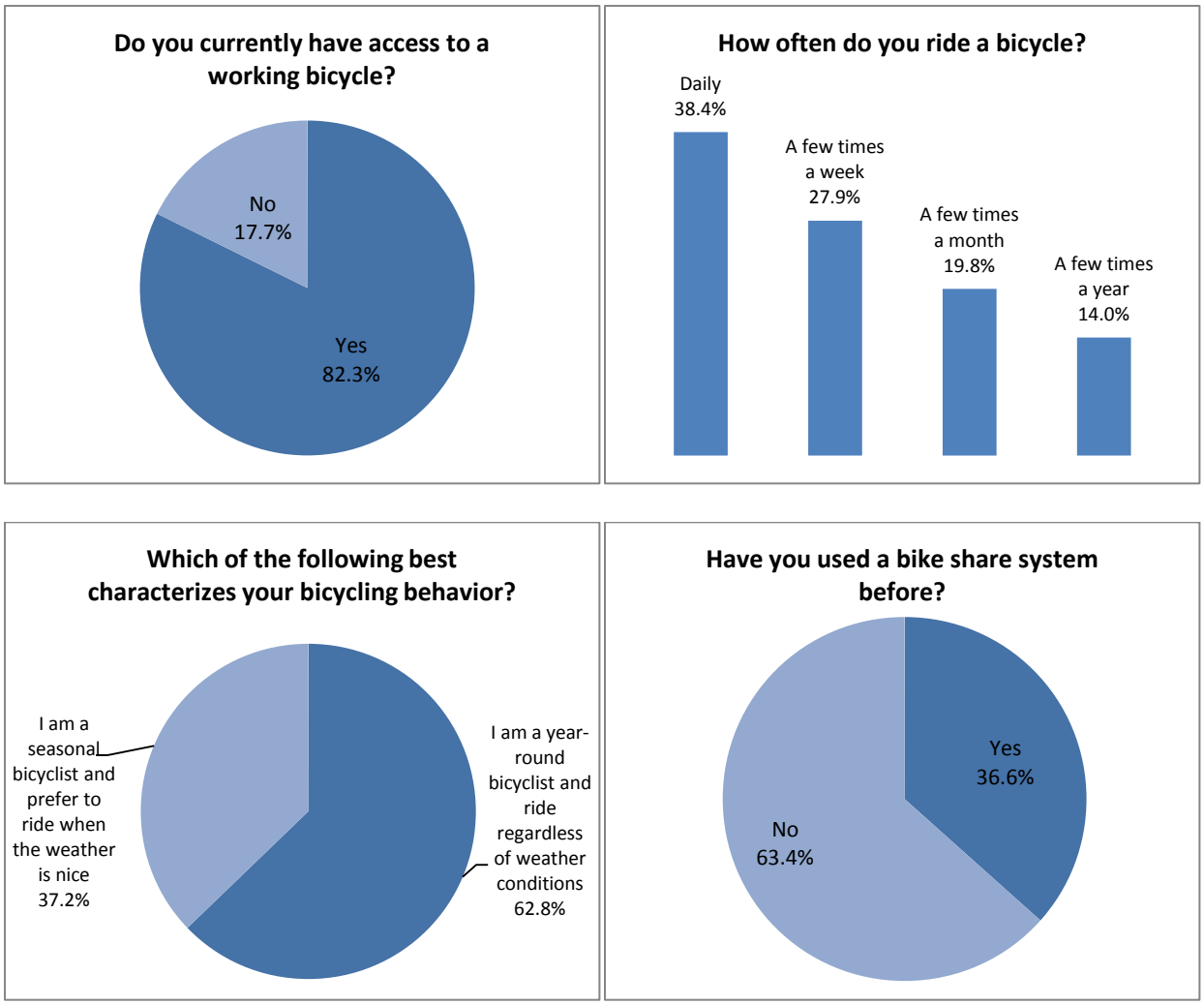


Figure 26: Bicycling Usage Trends among Survey Respondents.

Opinions on Bike Share and its Feasibility in Tucson

A majority of survey respondents (75%) were of the opinion that a bike share system is a good idea for Tucson, approximately 12% were not sure, and approximately 13% did not think it was a good idea.

When asked why bike share was a good idea, respondents included as reasons:

- It provides all community members with access to a cheap and efficient form of transportation;
- It can increase connectivity to transit;
- It can help reduce traffic and increase transit options;
- It can promote health, tourism and local businesses; and
- It would provide additional connections between Downtown Tucson and the University of Arizona.

Respondents who indicated they didn't think bike share was a good idea for Tucson cited the following reasons:

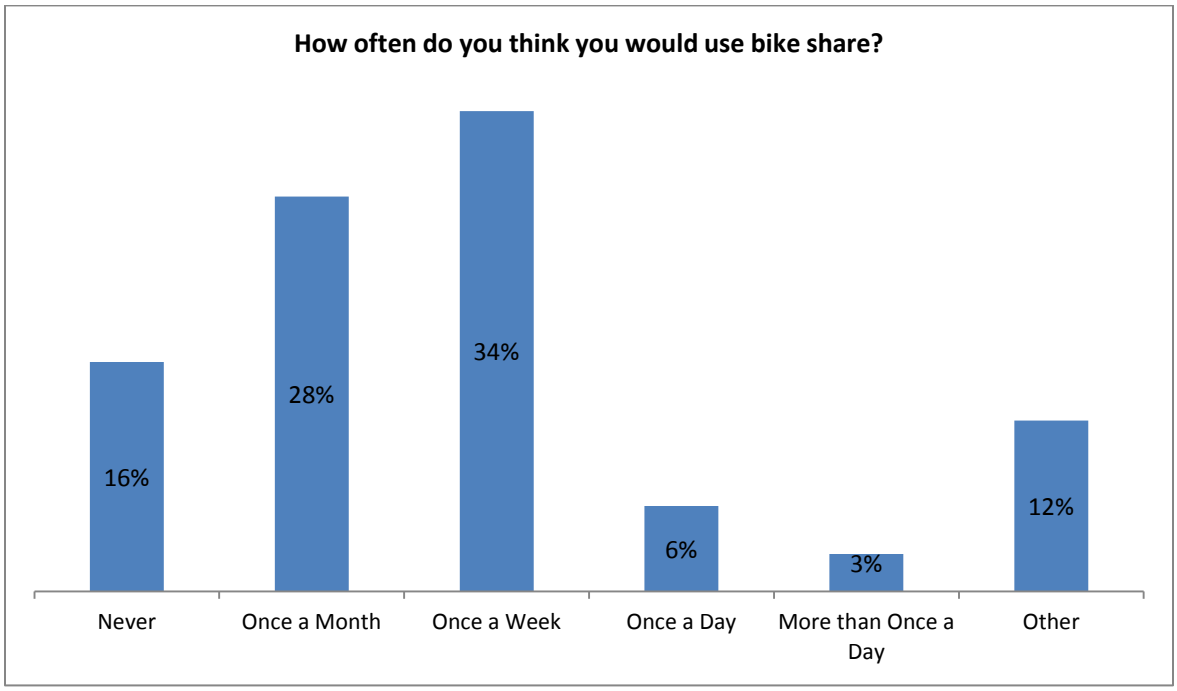
- Concern regarding the cost of implementation and maintenance;
- Opportunity cost, i.e., other bicycling investments may have larger returns;
- Barriers to entry (e.g., many people who may want to participate don't have credit cards); and
- Safety concerns related to using bike share near the streetcar tracks and on streets that aren't bicycle friendly.

Forty-three percent (43%) of survey respondents stated that they would utilize a bike share system at least once a week, while an additional 28% stated they would use it at least once a month. Sixteen percent (16%) stated that they would never use the system and 12% were unsure.

Respondents stated that the most likely trips that they would use bike share for included: running errands; going to or from transit stops; recreation or exercise; and transportation during the day while at work or school. A full break down of anticipated trip types is included on **Figure 27**.

Respondents stated that they would pay an average of $100 for annual membership, $32 for weekly membership, and $6 for daily membership. These responses are at the high end of the price range of other programs in the United States.

$100	Annual membership
$32	Weekly membership
$6	24-hour access



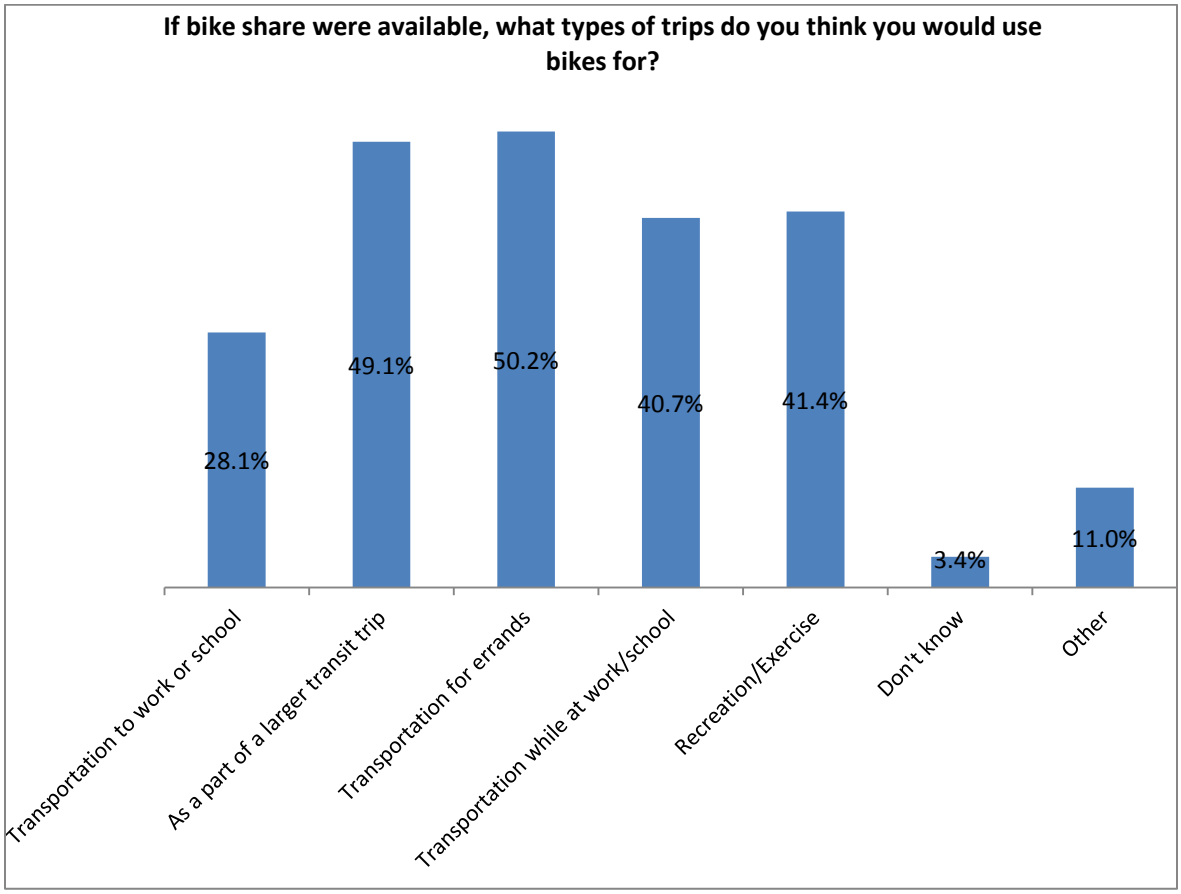


Figure 27: Stated Frequency and Trip Purpose for Bike Share Trips in Tucson.

Other Results

Further analysis of the survey responses found that:

- Of those people who do not currently have access to a working bicycle (18% of respondents), 42-percent stated that they would use bike share about once a week and 24-percent stated that they would use it at least once a month. Similarly, of those people who bicycle only a few times per year (14% of respondents), 58-percent stated that they would use a bike share at least monthly.
- Typically under-represented bicycling population groups provided the following responses:
  - Female respondents (52%) identified that they would use bike share primarily for running errands, exercise, and riding to transit.
  - About 22-percent of respondents self-selected as non-white and most (72%) stated they would use bike share at least once a month.
  - Lower income individuals (i.e., those people earning less than the median income in Tucson) represented 32-percent of respondents and of these, 72-percent stated that they would use bike share at least once a month. These individuals reported that if bike share were available they would use bicycles for running errands, exercising, and meeting family and friends most often.
- Of the 37-percent of respondents that had previously used bike share, 75-percent supported a bike share system in Tucson.
- Of the 20-percent of respondents that reported being students, 51-percent stated they would use bike share at least once a day.

Crowdsourcing Map

The project website provided a link to an interactive map where the public could suggest possible bike share station locations. A total of 292 station suggestions were made between October 1 and December 31, 2014 with many of these locations being “liked” by multiple users. A map of suggested locations is shown on **Figure 28** with each location weighted by the number of “likes”.

The map shows that the highest concentration of suggested locations is in Downtown Tucson and at the University of Arizona campus, however there is strong support for stations along corridors to the north and east of campus that would connect to student housing and student services in these areas. As well, there are pockets of support in the Mercado neighborhood west of I-10 and around Reid Park, which could be connected to the Downtown network via the Arroyo-Chico Greenway. There was also support for stations along the Rillito River corridor including at the Tucson Mall, Rillito River Park, and along the Loop Trail. Although this area would be disconnected from the rest of the system, a “mini-system” along this section of the Loop could serve both recreational trips and could extend the reach of transit services by connecting residents to the Tohono Tadai Transit Center. These results were used along with the community analysis to plan the bike share system.

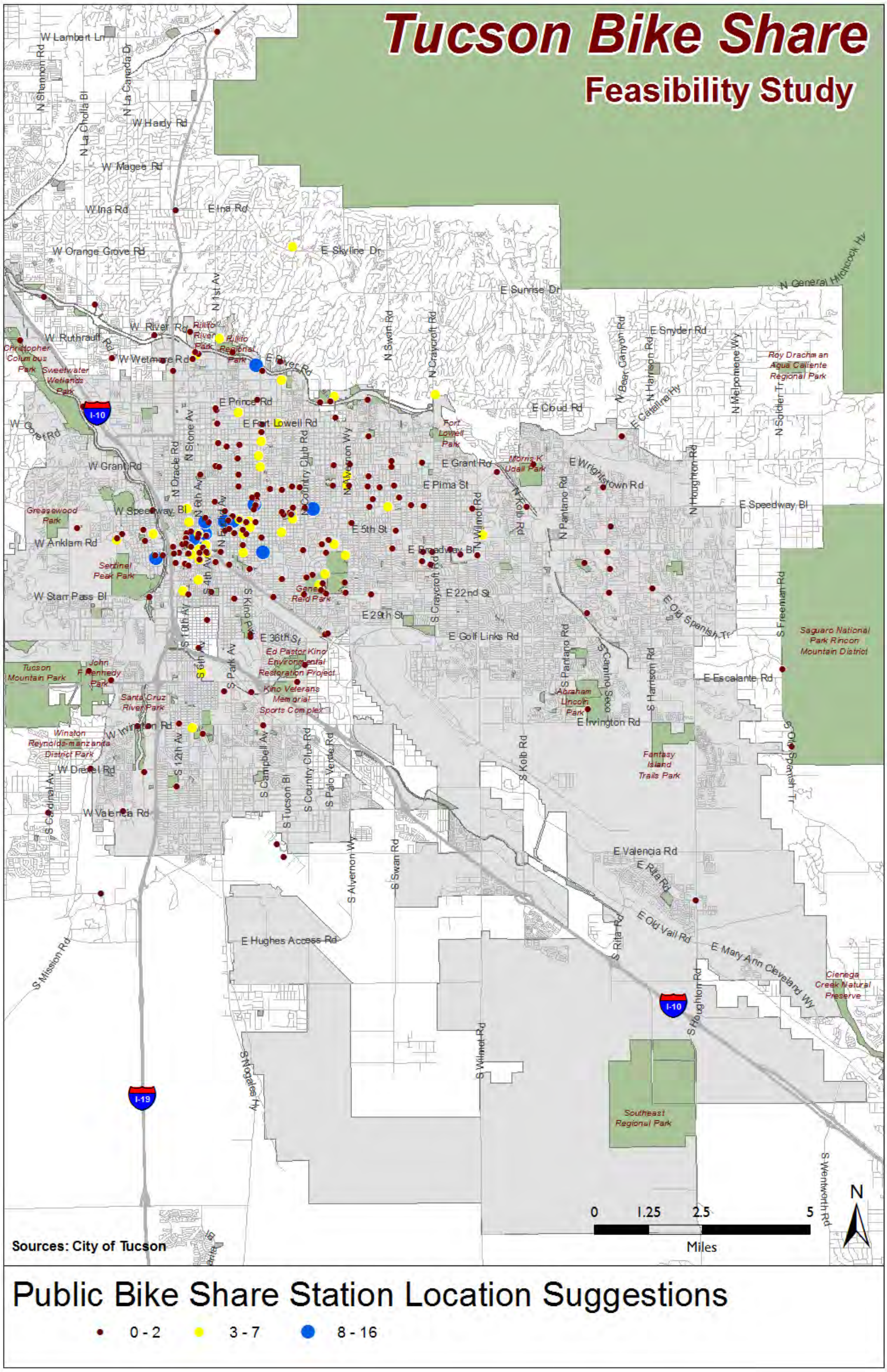


Figure 28: Suggested Bike Share Station Locations.

Stakeholder Engagement

Stakeholder outreach was conducted through a series of workshops held in Tucson between October 6 and October 8, 2014 with individuals, organizations, and community groups that could play a role as supporters, sponsors, or participants of a bike share system. Overall, the project team gathered information from over 30 organizations including:

- Mayor Jonathan Rothschild and the Mayor's Office;
- City Council Member Offices;
- City of Tucson staff (including representatives from the Department of Transportation, the City Manager's Office, the Office of Integrated Planning, the Development Services Department, Parks and Recreation, and the Finance department);
- Pima County;
- Pima Association of Governments;
- City of South Tucson;
- Regional Transportation Authority;
- University of Arizona staff (including representatives from Parking and Transportation Services, Planning Design and Construction Services, and the Sustainability Department);
- Pima County Public Health;
- University of Arizona Public Health;
- Tucson Medical Center;
- Downtown Tucson Partnership;
- Downtown Neighborhoods and Residents Council;
- Visit Tucson; and
- Tucson Bicycle Advisory Committee.

In addition, a public information session was held at the Main Library in Downtown Tucson on Monday October 6, 2014.

Each meeting asked participants to identify how bike share might be relevant to them or their organization and to identify any opportunities and challenges they saw to implementing a bike share system. Depending on the group, the project team also worked with participants to identify the level of support for program sponsorship.

The majority of organizations were supportive of a bike share system in Tucson. In particular, organizations believed that bike share could help Tucson enhance its reputation as a livable and bikeable city to attract and retain younger workforce talent; and to provide first and last mile connections to transit and in particular leverage the City's recent investment in streetcar.

Other opportunities and challenges identified by stakeholders and the public included:

- Creating a sustainable business model to operate the system on an ongoing basis. In particular utilizing innovative funding mechanisms given that the pool of potential large corporate sponsors is limited in Tucson.
- Needing to better understand the regulations and limitations around advertising and sponsorship at the stations and on the bicycles. In particular, investigating whether sponsorship

would be allowed on the University campus and whether sponsorship could be added to the City's existing advertising contracts.

- Integrating the system with the existing transit fare payment system so that transition between modes is seamless and ensuring the safety of bicyclists around streetcar tracks.
- Ensuring standards are in place to design the system with enough additional docks and to maintain the system in good condition.
- Using the system as an economic development tool – not only to attract and retain workforce talent but to attract visitors and tourists to Tucson, and to use the system to connect these people to their destinations. There may be an opportunity to create "themed rides" to encourage use of the system and encourage business at local shops and restaurants.
- Engaging a variety of stakeholders to support and promote the system and create local opportunities for sponsorship where possible.
- Siting stations in visible locations to encourage ridership and reduce opportunities for theft and vandalism. Locating stations in place of on-street parking could be challenging in some areas.
- Ensuring that the system is affordable and engages lower-income communities. This could include locating stations in low income communities, reducing barriers to access (such as the need for a credit card), and engaging targeted marketing towards low income populations.

6. PRELIMINARY SYSTEM PLAN

This chapter summarizes recommendations for the service area, size, and phasing of a potential bike share system in the City of Tucson. The recommendations consider the areas expected to have the highest demands for bike share (as shown on the heat map included in Chapter 3 and supported by crowdsourcing input collected as part of the public engagement process - see Chapter 4) and system planning principles developed from industry best practice and experience in the peer cities. These are described below.

Density and Breadth of Coverage

A key decision is to determine the balance between breadth of coverage and station density. Some cities have chosen to launch their initial system with a high density of stations in a smaller area (e.g., Chattanooga, Salt Lake City, etc.), whereas others have chosen to spread out their stations at lower densities and cover a larger area (e.g., Minneapolis-St. Paul, Madison, etc.). There are a number of aspects to consider in making this decision:

- Providing stations at high densities maximizes the visibility and utility of the system by providing users with a reasonable expectation that there will be a station within walking distance from anywhere in the system area. It also provides redundancy so that if a station is empty or full, a user can go to a nearby station and find an available bicycle or an empty dock.
- If stations are provided at high densities but the coverage area is too small, then the system may not serve a sufficient range of destinations and may not be an effective alternative to walking. For more dispersed systems or for stations at the edges of the system, it is important to make sure that there is additional capacity available (i.e., more docking points) so that users are not faced with empty or full stations.

In peer cities, station densities average approximately 5.5 stations per square mile and in most cities, station densities are higher in downtown and inner-city areas and get progressively lower as the system moves away from these areas. Please see **Table 8** below for peer city station densities and comparisons to the Tucson system proposed below.

System Size and Layout

A system that provides too few stations will be limited in the number of destinations it serves and therefore be less attractive to potential users. However, cities generally must take a measured approach due to funding and other constraints and may not initially launch with the full system.

Most systems are generally contiguous. Providing a contiguous system offers a larger number of connections between stations than if the same resources were split into several smaller (disconnected) systems. Please see **Figure 29** for the layout of several peer cities, showing how they can vary from dense to sparse, from clustered to linear.

Table 9: Peer City System Statistics

City	Program Name	Stations	Area (sq.mi.)	Station Density (stations / sq.mi.)	Bikes	Docks	Dock-to-Bike Ratio	Population Density (per/sq.mi.)
Denver	Denver B-Cycle	84	13.2	6.4	709	1,228	1.7	4,193
Minneapolis / St. Paul	Nice Ride Minnesota	170	46.4	3.7	1,550	3,010	1.9	6,559
Phoenix	Grid Bike Share	39	9.2	4.2	290	n/a	n/a	2,798
Salt Lake City	GREENbike	12	1.5	8.0	65	165	2.5	1,720
San Antonio	San Antonio B-Cycle	53	10.1	5.2	450	830	1.8	3,057
Tucson (proposed)	**Phase 1**	**30**	**6.3**	**4.8**	**300**	**510**	**1.7**	**2,294**
	Phases 1 & 2	**60**	**9.9**	**6.1**	**600**	**1,020**	**1.7**	

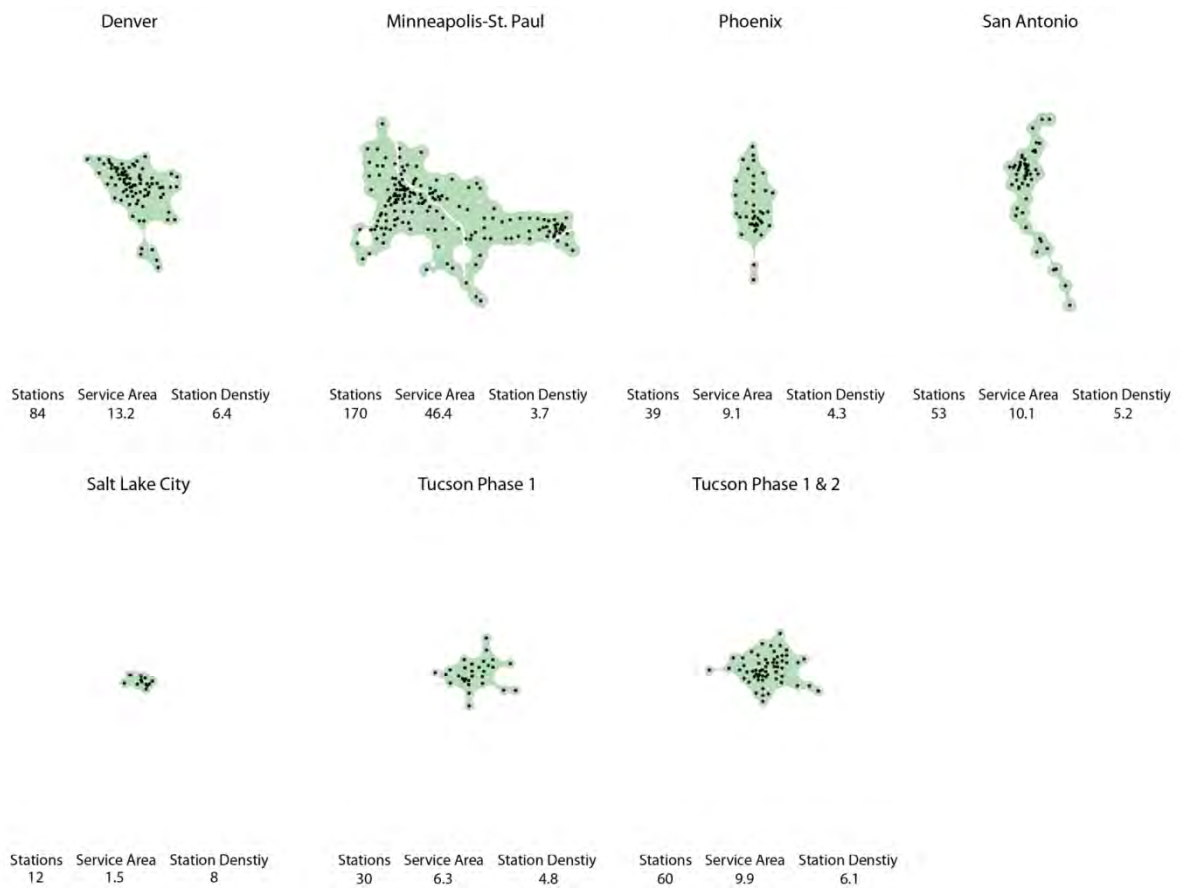


Figure 29: Comparison of System Size, Coverage Area, and Station Density for Peer U.S. Bike Share Cities.

Dock-to-Bike Ratios

For smart dock systems, other cities have adopted dock-to-bike ratios ranging from 1.5 to over 2.0 docks per bike. This ratio is important as higher ratios reduce rebalancing needs and therefore operating costs, but must consider the higher upfront capital cost. A ratio of 1.7 docks-per-bike has been assumed for Tucson to balance these factors. Smart bike systems have different technologies depending on the vendor with different requirements for a docking mechanism. For a system like Phoenix that doesn't require specialized docking points, this ratio is not as relevant, as bikes can be locked up outside of a docking point. Please note that when we discuss numbers of docks below, this is referring to systems that require a specific docking point only.

System Phasing Plan

A phasing plan was developed to show the potential build out of a bike share system in Tucson. The phasing plan is shown on **Figure 30** and summarized in **Table 9**.

The first two phases of the program include the highest demand areas of Downtown and the University of Arizona campus and extend the reach of the streetcar system further into neighborhoods north of Downtown and the University, into the Mercado neighborhood and areas west of I-10, extend south of Downtown including into South Tucson, and cover key neighborhoods around the University campus.

Phase 1 represents approximately 30 stations, 300 bikes, and 510 docks, and includes key locations in Downtown, on the University campus, and at key streetcar station and extend into neighborhoods currently beyond the reach of the streetcar system. The average station size is 10 bikes and 17 docks.

A second phase of approximately 30 stations, 300 bikes, and 510 docks would be added later to fill in more destinations in Downtown and on the University campus and extend the system further into nearby neighborhoods.

A third phase would be added to include approximately 20 stations, 200 bikes, and 340 docks and extend coverage along the Broadway corridor and into neighborhoods northeast of the University campus.

Future phases could include the following areas:

- A mini- system along the Rillito River using the Loop Trail to connect neighborhoods to recreational bicycling opportunities, Rillito River Park, the Tucson Mall, and the Tohono Tadai Transit Center, which provides frequent transit service into Downtown. This mini-system would be connected with a certain number of stations to the rest of the system. Approximately 25 stations, 250 bikes, and 425 docks.
- A satellite system that connects the health campuses, neighborhoods, retail attractions, and hotels in the north-east part of the City. Approximately 15 stations, 150 bikes, and 255 docks.
- Extension of the service area into the neighborhoods to the south and south-east of Downtown along the Aviation Bikeway and other bikeways to connect to the Kino Sports Complex and the University of Arizona Medical Center's south campus. Approximately 20 stations, 200 bikes, and 340 docks.

- Other phases could include employer-based programs to help employees and visitors move around or between large campuses such as the Airport or the Davis-Monthon Airforce Base.

The phasing plan does not preclude future expansion into other areas or accelerated expansion into areas identified in later phases. Expansion should be considered after an initial operating period of six to twelve months when operation of the system is better understood and funding commitments for expansion are in place.

Table 10: Proposed Phasing Plan

Phase	Description	Stations	Area (sq.mi.)	Station Density (stations / sq.mi.)	Bikes	Docks
1	Downtown, University, and inner-city neighborhoods	30	6.3	4.8	300	510
2	Infill and extension into inner-city neighborhoods	30	3.3	9.1	300	510
3	Broadway Corridor	20	3.3	6.1	200	340
Potential Future Phases:						
	The Loop / Rillito River	25	5.9	4.3	250	425
	NE Medical District	15	3.5	4.3	150	255
	S/SE Expansion	20	4.3	4.7	200	340
TOTAL		**140**	**26.6**	**5.3**	**1,400**	**2,380**

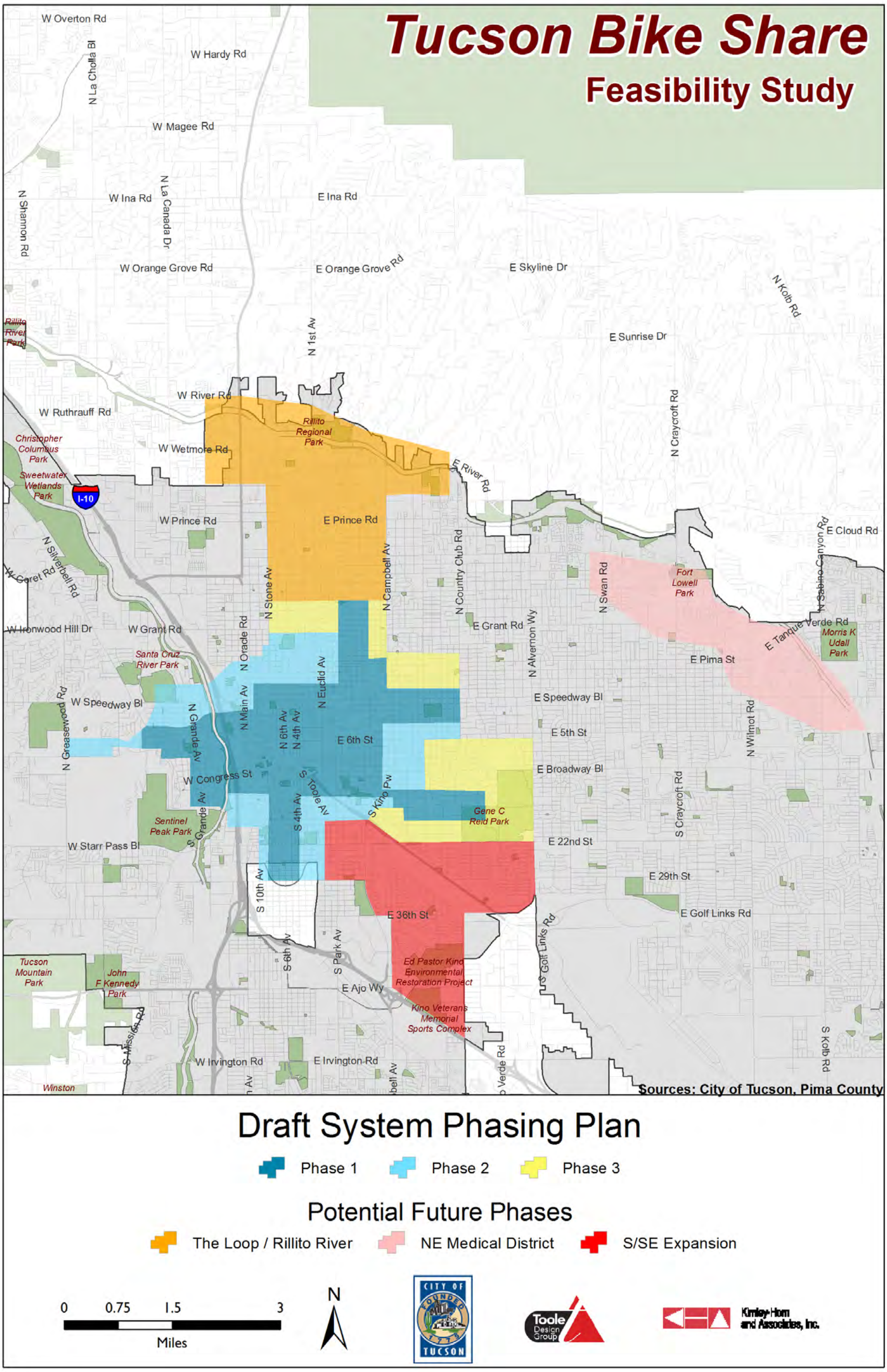


Figure 30: Proposed Phasing Plan for Bike Share in Tucson.

Initial System

Potential station locations were identified for the first two phases of the system and are shown on **Figure 31** and listed in **Table 10**. These are general locations only and will require additional public outreach and field work to confirm the availability of space, identify right-of-way and property ownership, meet the specific needs of the equipment vendor (such as solar exposure requirements), react to potential sponsorship agreements, and identify the interest of the adjacent property and business owners to finalize station locations.

Under this plan, Phase 1 would include 30 stations, 300 bikes, and 510 docks at a station density of approximately 4.8 stations per square mile. The addition of Phase 2 would increase the system to 60 stations, 600 bikes, and 1,020 docks and a station density of approximately 6.1 stations per square mile. These station densities are within the range of station densities in peer city systems.

Table 11: List of Preliminary Station Locations

Number	Station Name	Number	Station Name
	Phase 1		**Phase 2**
101	Warren Avenue – Helen Street Station	201	Banner University Medical Center
102	Park Avenue Garage	202	Highland Garage
103	Student Union / 2nd Street Garage	203	Centennial Hall
104	University Transit Hub	204	1st Street & Tyndall Avenue
105	Main Gate Village	205	5th Street & Tyndall Avenue
106	ENR Building	206	University Rec Center
107	Mountain Avenue & Copper Street	207	Linden Street & 1st Avenue
108	Mountain Avenue & Linden Street	208	Adams Street & Tyndall Avenue
109	8th Street & Park Avenue	209	Broadway & Highland Avenue
110	Himmel Park	210	3rd Street & Norton Avenue
111	Pima Community College	211	Mansfield Park
112	Catalina Park	212	Main Street & Adams Avenue
113	University Blvd & Stone Avenue	213	University Blvd & 3rd Street
114	4th Avenue & 5th Street	214	7th Street & 6th Avenue
115	4th Avenue & 8th Street	215	Aviation Bikeway at 3rd Avenue
116	Lost Barrio	216	14th Street & Highland Avenue
117	Rincon Vista Sports Complex	217	Reid Park Zoo
118	Reid Park	218	Congress & 6th Avenue
119	Broadway & 4th Avenue	219	Convention Center
120	Armory Park	220	Toole Street & 7th Avenue
121	Church Avenue Streetcar	221	Franklin & Court
122	Stone & Pennington	222	Congress & Granada
123	Presidio Park	223	The Loop at Granada Avenue
124	Granada & Franklin	224	Bonita Avenue
125	Mercado	225	Pima Community College (West Campus)
126	Menlo Park	226	The Loop at Speedway Boulevard
127	The Loop at St. Mary's Road	227	El Rio
128	St. Mary's Hospital	228	Santa Rosa
129	Five Points	229	Santa Rita Park
130	South Tucson	230	22nd Street & 6th Avenue

* Phase 2 station locations may move into Phase 1 if there are private entities willing to fund the station.

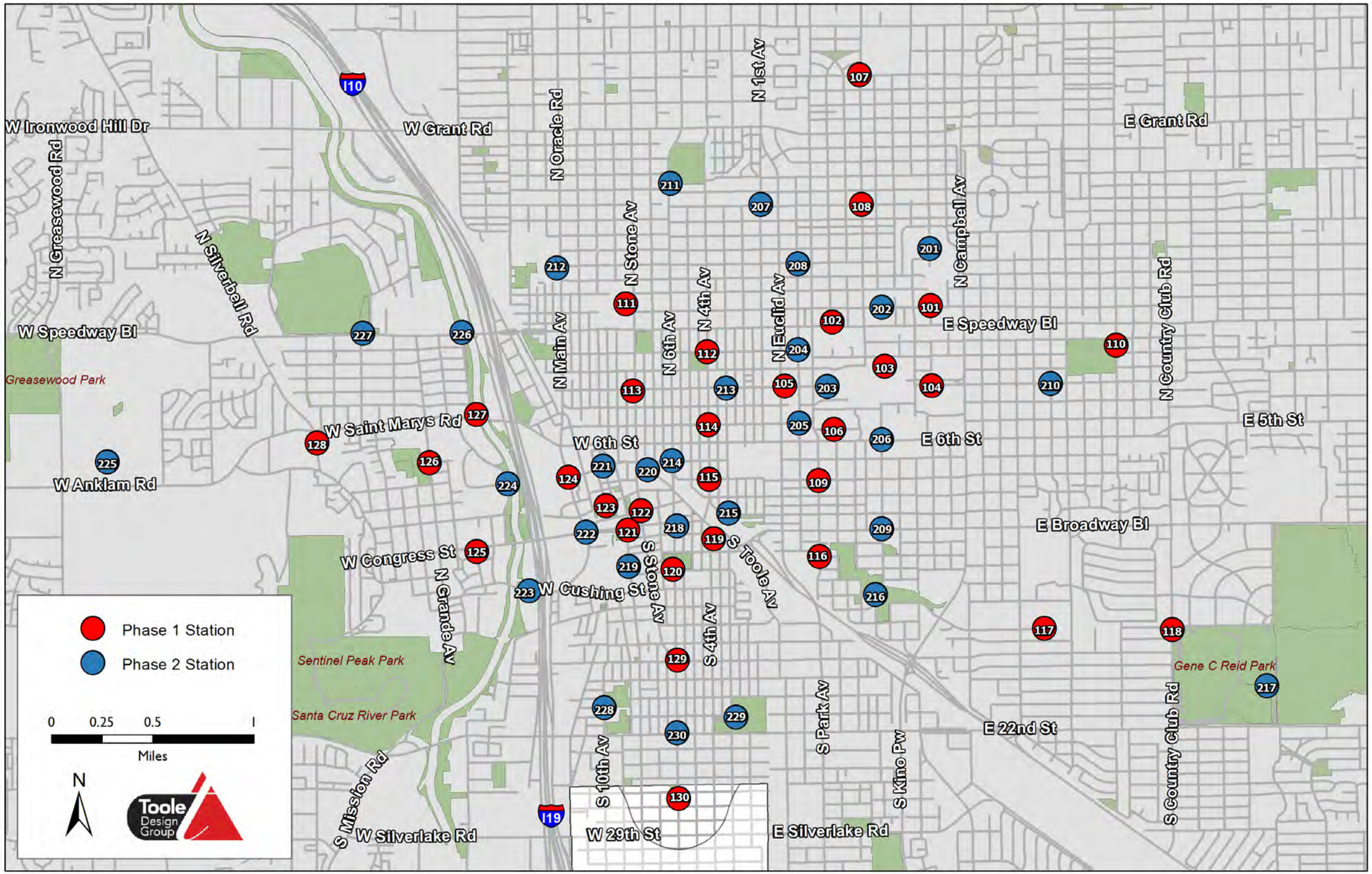


Figure 31: Potential Station Locations in the Initial Service Area.

Station Siting Guidelines

Stations should generally be placed in safe, convenient, and visible locations and can include installations in-street, on sidewalks, in parks and other public lands, or on private property through the use of a License Agreement with the property owner. In all instances stations should be available at all times to the public and to the operator for the purposes of maintenance and bicycle redistribution.

Bike share stations should be placed on a hard, level, paved surface and must meet the solar exposure and cellular signal requirements specified by the equipment vendor. In cases where stations do not meet solar or connectivity requirements, hard wiring may be necessary.

The footprint of the station will depend on the proposed number of docks. Actual station dimensions will need to be confirmed once an equipment vendor is selected. However, approximate station sizes are shown in **Table 11**. For example, a 15 dock, single sided station is approximately 40 feet long and 6 feet deep.

Table 12: Approximate Station Dimensions

Characteristic	Approximate Dimension
Height	
Dock height	2’-8”
Kiosk / map panel height	7’-0”
Height to top of solar panel	11’-6”
Depth	
Base plate with dock	<3’-0”
Station with bicycle	<6’-0”
Length	
11 docks + kiosk	30’-0”
12 docks + kiosk	32’-6”
13 docks + kiosk	35’-0”
14 docks + kiosk	37’-6”
15 docks + kiosk	40’-0”
16 docks + kiosk	42’-6”
Additional docks	2’-6”

The stations identified above will need to be verified in the field prior to deployment and may need to be relocated depending on right-of-way availability and ownership, physical space availability away from utilities and other obstacles, operating requirements such as solar and wireless communication access, and consultation with adjacent land owners.

The implementation team will need to work with staff at the City of Tucson, the University of Arizona, and other agencies and property owners to understand the permitting process and to develop a set of site guidelines. It is recommended that if possible, a streamlined or bulk permitting process be

established to expedite implementation. The following provides some of the key considerations for each station type.

Sidewalk Site Requirements

Sidewalk sites should not interfere with existing pedestrian travel patterns and must maintain sufficient clearance to fixed objects and utilities. A photo rendering of a potential sidewalk bike share station in Tucson is shown on **Figure 32**.

Figure 32: Example of a Potential Sidewalk Bike Share Station.

On-Street Site Requirements

On-street sites typically make use of converted parking spaces; however restricted parking areas may also be considered where these sites do not impact sight lines. It is preferred that on-street sites first consider conversion of non-metered parking and that any metered parking conversion be reviewed by the City's Parking Department.

Generally, on-street stations should first consider low traffic volume streets. However, higher traffic volume streets can be considered where there is sufficient width for a user to pull a bike from the

station without encroaching into the traffic lane, or where there is a buffer provided between the station and moving traffic, e.g., a bike lane or painted buffer.

Standard safety treatments should be developed for on-street stations in consultation with the City's Engineering Department and may include street markings, flexible delineators, or other safety equipment. A photo rendering of a potential on-street bike share station in Tucson is shown on **Figure 33**.

Figure 33: Example of a Potential On-Street Bike Share Station.

Parks and Other Public Property

Sites may be placed on Parks Department or other City property at the discretion of the relevant agency. In general, sidewalk siting guidelines apply to these sites. A photo rendering of a potential station on the University of Arizona campus is shown on **Figure 34**.

Figure 34: Example of a Potential Bike Share Station on the University of Arizona Campus.

Private Property

Sites may be placed on private property at the discretion of the owner. The operator must secure a License Agreement to establish the terms of use, to transfer liability, and to ensure the site is accessible to the public at all times. Generally, sidewalk siting guidelines apply to these sites.

7. PLANNING, LIABILITY, ORDINANCE, AND POLICY REVIEW

The study team reviewed the following policies, ordinances, and regulations that may influence bike share implementation and operation in the City of Tucson:

- *Tucson City Code, Chapter 3 - Sign Code*
- *Tucson City Code, Chapter 25 - Streets and Sidewalks*
- *City of Tucson Transit Advertising Policies*
- *City of Tucson/Pima County Outdoor Lighting Code*
- *Unified Development Code, Administrative Manual & Technical Standards Manual*
- *Downtown Urban Design Reference Manual*
- *Tucson, Arizona Charter and General Ordinances*

In general, the review attempted to answer the following questions:

1. What is allowed in terms of sponsorship and/or advertising on the bike share system infrastructure?
2. What is allowable for site planning (i.e., are there any restrictions or guidelines for the placement of stations on sidewalks, in-street, and other public rights-of-way)?
3. Are there other ordinances or policies that could impact bike share users (e.g., helmet laws, riding restrictions, etc.)?

Street Furniture Sponsorship and Advertising

In most cities, sponsorship or advertising on the bike share bicycle is generally accepted. However, the stations, being a more permanent fixture, are generally considered street furniture and may be subject to the City's rules on advertising.

The City of Tucson allows advertising at transit stations as long as it is in compliance with the *City of Tucson Transit Advertising Policies*. Given the intention that bike share will be an extension of the transit system, it is anticipated that these policies will also extend to the bike share system. The subject matter suitable for display at a transit station must propose a commercial transaction or provide transit information and the City retains strict control over the nature of the advertisements.

Chapter 25 – Streets and Sidewalks of the *Tucson City Code* describes policies pertaining to newspaper vending machines that may also be applicable to bike share stations. Advertising signage and structures must not block utility, fire department, or emergency access; installation procedures must be submitted to and approved by the City engineer prior to installation; and public liability insurance is required. The City must be notified of the removal of any licensed machine and the licensee is liable for any damage to the right-of-way surface caused by the removal of the vending machine.

The *Tucson City Code, Chapter 3 - Sign Code* also carries implications for the inclusion of advertising and signage at a bike share station. Per the *Sign Code*, signs on or over public right-of-way are permitted only under special license by Mayor and Council and may be displayed for up to sixty (60) days. However, specially licensed signs, such as signage on bus benches (and by extension, potentially the bike share stations), may be exempt from the provisions of the *Tucson Sign Code*. If the signs are not

specially licensed (i.e., they are on private property), then a permit must be obtained from development services prior to installation and other guidelines such as the maximum number of sign faces, the maximum area per sign face, minimum setback distances, and maximum sign heights apply based on the zoning of the proposed site.

Per the *City of Tucson/Pima County Outdoor Lighting Code*, outdoor internally illuminated signs need to be turned off at 12:00 am (or 11:00 pm if within a residential zone). This may impact some stations depending on whether the selected equipment vendor offers backlit displays. Bottom mounted sign lighting is not permitted.

Site Planning

The *Tucson City Code, Chapter 25 - Streets and Sidewalks* permits improvements within the public right-of-way that are implemented for the convenience of city residents and visitors as long as a right-of-way permit is obtained from the City. This would include bike share infrastructure. Improvements made within the public right-of-way by a private agency must be maintained by the private agency, which may also be held liable for accidents occurring within the right-of-way. Stations placed on private property must have a License Agreement with the owner prior to installation.

Many cities expedite the permitting process by considering bike share stations a form of bicycle parking. The City of Tucson has established guidelines for the installation of bicycle parking in the *Unified Development Code*. Included in these, for sidewalk stations, bicycle parking must not impede pedestrian access and a clearance of at least four feet must be provided. For on-street stations, bicycle parking is permitted in vehicular use areas provided the parking area is separated from vehicular areas by a barrier or is located a sufficient distance to prevent damage to the parked bicycles. Examples of acceptable barriers include curbs, bollards, concrete planters, and landscape buffers. As well, striping in combination with other barrier devices is also permitted.

The *Unified Development Code* may also be applicable to bike share stations, however, is more focused on bicycle parking related to a specific development. For short-term bicycle parking, the code requires parking to be located within 50 feet of a public entrance to a building and long-term bicycle parking to be located on-site or within 300 feet of a public entrance to a building. Long-term bicycle parking must be covered to provide weather protection. The cover must be permanent and be at least seven feet above the floor or ground. Signage must be provided instructing a cyclist how to access long-term bicycle parking.

Outdoor bicycle parking areas (both short and long-term) must be lighted so that they are thoroughly illuminated and visible from adjacent sidewalks, parking lots, or buildings during hours of use. The *City of Tucson/Pima County Outdoor Lighting Code* includes additional provisions for site lighting. A permit is required for the installation of outdoor lighting.

Other Considerations

The *Tucson, Arizona Charter and General Ordinances* require that a bicycle used at nighttime have a lamp on the front that emits a white light visible from a distance of at least five hundred feet to the

front and a red reflector on the rear. Most bike share equipment providers offer this standard with pedal-activated front and rear lights.

Riders aged 18 or younger are required to wear a helmet. Some bike share operators have started developing strategies around promoting helmet use, but these are typically not provided standard with a bike check-out. To adhere to this requirement, it is recommended that bike share riders be limited to those over 18 years of age.

It is unlawful to ride a bicycle on any public sidewalk or through an underpass unless there are signs specifically permitting bicycling. This will need to be considered where a bike share station is located within a sidewalk that is not immediately adjacent to an acceptable bikeway and can be addressed as part of safety messaging, signage, and education campaigns. Similarly, it is unlawful to ride against the flow of traffic. In both cases, design of the station should encourage compliance with these laws.

The *Downtown Urban Design Reference Manual* provides design recommendations for bicycle facilities in the Downtown area. Bike share system signage could incorporate, or be incorporated into existing wayfinding signage and the kiosks should be fitted with maps showing the bike route network. The manual also recommends a standard platinum grey color for conventional bicycle racks within the Downtown area.

8. TRANSIT INTEGRATION

A bike share system represents a unique opportunity for the City of Tucson to increase the use of bicycles for short trips and to complement investments the region has made in the Sun Link Streetcar and the regional transit system. Bike share implementation has the potential to increase the percentage of trips made by non-automobile modes in the region.

Bike share systems and transit are naturally complementary. Bike share systems can expand the catchment area served by a transit stop beyond walking distance and can be used as complementary modes of transportation (see Chapter 2 for a description of the transit benefits of bike share). Several systems have utilized Federal Transit Administration grants (e.g., Chattanooga, TN and Boston, MA) and others are utilizing new federal grant funding rules to place bike share stations within a three-mile radius of transit stops[58]. Transit agencies are also starting to show interest in owning and operating bike share programs with agencies in Boise, ID and Topeka, KS preparing to implement systems under this model.

Current Management Structure of Tucson Transit Services

Transit in Tucson and the surrounding region are managed by either the City of Tucson for services within Tucson (Sun Tran [bus], Sun Van [paratransit] and Sun Link [streetcar]) or the Regional Transportation Authority (RTA) for services that span beyond the boundaries of Tucson (Sun Shuttle and Sun Shuttle Dial-A-Ride [regional bus]).

For the City services, the City contracts with two different private transportation management companies, which manage operations of the services and undertake union negotiations if necessary. The actual operations are undertaken by three separate companies called Sun Tran, Sun Van and Sun Link, respectively. City leaders determine policy and pricing and pay for private operations. This complex structure is required by Arizona legislation which mandates that a public agency cannot directly undertake union negotiations. For the regional services, a private company owns and operates the services for a fee from RTA.

Fare Payment Technology

The SunGO card provides a means to pay a fare and transfer throughout the region on Sun Tran, Sun Shuttle and Sun Link. It resembles a credit card in size and shape and utilizes a Radio-Frequency Identification (RFID) chip instead of a magnetic strip found on typical credit cards. SunGO cards can be used to pay fares on the region's transit system including: Sun Tran, Sun Express, Sun Shuttle and the Sun Link modern streetcar. Passengers "tap" the card on the farebox reader.

The SunGO Card can be purchased at various sales outlets including: online at the Sun Tran website (http:///www.suntran.com/sungo), ticket vending machines, certain retail sales outlets, or at Sun Tran's administrative office (including phone or mail purchases).

The SunGO Card can be registered for balance protection and users can activate an Auto Buy feature that sets up the account to automatically add a specified amount of cash value through a secure funds

[58] Frequently asked Questions concerning Bike–Sharing Relative to the United States Department of Transportation, http://www.fta.dot.gov/documents/Informal_Q_and_As_Final_6-14-12.pdf, accessed February 25, 2014.

transfer from a credit or debit card on a regular basis or when the balance falls below a certain amount. Product choices available with the SunGO Card include a regular or reduced 30-day pass, a 1-day pass, or a cash value up to $200. Adding cash value allows the payment system to automatically deduct the appropriate fare from the card for each ride.

Transit users can also purchase SunGO tickets. However, only 30-Day and 1-Day passes are available on SunGO tickets; additional pass products and stored value are not available and are only offered on SunGO cards. They are intended for short-term use unlike the SunGO card which is valid for up to 4 years.

Potential Transit Integration with Bike Share

Based on discussions with the City's transit administration and other regional transit stakeholders, integration of transit and bike share could occur on a spectrum representing five different levels of integration. These include:

- Level 1 – Geographic Integration: stations are placed at or near transit stops (e.g., at transit centers, street car stops, and at bus stops).
- Level 2 – Station Branding and Bike Share Marketing Integration: bike share and transit is co-branded and co-marketed.
- Level 3 – Semi-Integrated Fare Payment: a separate bike share payment chip is placed on the transit fare payment card to allow a single card to be used for bike share and for transit fare payment. However, the back-end financial processing systems are separate and users would need to maintain two separate accounts.
- Level 4 – Fully Integrated Fare Payment: transit fare and bike share payment systems are fully integrated into one account with a single card that can be used to pay for bike share or for transit fare.
- Level 5 – Operations, Maintenance, and Oversight Integration: this full-integration scenario would see the bike share system be owned and operated similar to existing transit services in the region.

Each of these integration levels is further described below. Please note that in the US, there are two bike share systems that have proceeded beyond Level 1, Boise ID and Topeka KS, and they have both just launched in spring 2015. These systems include Level 1 and Level 5, but not Levels 2, 3 and 4 in between. The descriptions of Levels 3, 4 and 5 are based on conversations with bike share vendors who have begun to explore backend integration. Undoubtedly, there are significant technical and contractual issues that will have to be overcome to make this a reality. This section is meant as an overview based only on current market information and conjecture.

Level 1 – Geographic Integration

Locating Bike Share Stations near Transit Stops

Placement of bike share stations at or near the major transit centers, at streetcar stops, and at major bus stops is an important consideration. Placing stations so that they are visible to transit users can

encourage use of the bike share program and expand the reach of the transit service. Station placement should consider:

- Working with Sun Tran and Sun Link to provide secure bike share station locations, preferably with shade.
- Appropriately locate stations and provide safety messaging to encourage riders to use caution when riding near the streetcar tracks.
- Incorporate bike share stations into transit service maps and vice versa.

Level 2 – Station Branding and Bike Share Marketing Integration

Co-Marketing, Co-Branding and Pricing with Transit Services

Many transit services in the region have undertaken coordinated naming and branding – Sun Tran, Sun Link and others as discussed above. Bike share can be identified as part of the transit infrastructure by having similar branding and undertaking other co-marketing opportunities. Please note in the section below, Sun Tran and Sun Link are highlighted because these are the predominant services in or near downtown Tucson, which is the initial location for a bike share system in Tucson. These opportunities include:

- Developing a brand and name for the bike share system that reflects the region's transit system (e.g., naming the Sun Bike or Sun Bikeshare).
- Creating promotional materials that are consistent with Sun Tran route maps and other existing transit materials.
- Selecting a color and iconography for bike share bicycles and stations that is consistent with the branding of other regional transit services, e.g., Sun Tran and Sun Link have similar color schemes, fonts, etc.
- Selecting a pricing structure for bike share that mirrors the types of fares provided by Sun Tran and Sun Link.
- Making the following additions to the Sun Tran website (www.suntran.com):
  - A link to the bike share website.
  - A map of bike share locations in the *Bike & Ride* section of the *How to Ride* section.
  - Incentives for College students to use the Bike Share system in the College Programs section of the website.
  - A section on the Bike Share program in the Regional Transit section of the website.
  - Bike share locations on the detailed maps of nearby stops in the Live Bus Tracking section of the website.
- Make the following additions to the Sun Link assets:
  - A link to the bike share website in the Links section of the website (www.sunlinkstreetcar.com).
  - Map and information about the Bike Share program in the printed Sun Tran Ride Guide.
  - Bike share stations on the map in the How to Ride section of the website.
  - Section on the bike share program in the Be Street Smart section of the website.
- Coordinate with third party app developers to include bike share locations in transit app development. A link to some existing transit apps in Tucson is included on the following webpage: http://www.suntran.com/developers_showcase.php.

- Advertise the Bike Share system on the City of Tucson, University of Arizona, and Pima Association of Governments websites.
- Include bike share advertising, if possible, at Sun Tran and Sun Link stops and on the streetcars and buses themselves.

Level 3 – Semi-Integrated Fare Payment

Common Fare Payment Card but Separate Accounts for Transit and for Bike Share

Level 3 integration involves creating a common fare payment card, but maintaining distinct and separate fare payment user accounts (i.e., users would need to register for and maintain a transit fare account and a bike share membership account). Level 3 integration would create a new transit + bike share card which includes two RFID chips on a single card. This type of card would be available only to those with a SunGO account that is attached to an individual, not an anonymous guest.

SunGO/Bike Share Payment Card Integration

A Level 3 semi-integrated fare payment system would require a new card that includes two RFID chips, one for bike share and one for SunGO. This would only be available for registered SunGO cards which are linked to an individual (to provide a secure link back to the user in the event of theft or damage to the bikes). The first chip would be used to pay for transit fare, while the second chip on the same SunGO card would allow access to the bike share system and payment of any overage fees.

Level 3 integration would provide the user the convenience of a single card (SunGO) to transfer from one mode of public transportation to the other, however, would require the user to establish and maintain two separate accounts. Back-end processing is separate for each account.

SunGO and bike share Level 3 integration will require the selected bike share vendor to test the compatibility of the SunGO chip with its card reader. Based on conversations with bike share equipment vendors, this is easily done by providing a card to the bike share vendor for testing. If compatible, the bike share vendor configures the bike share card reader to read the SunGO RFID frequency.

Similar to the current process for purchasing SunGO passes or adding cash value to the SunGO card, a bike share user would be able to purchase the various plans offered by the bike share operator.

The process for ordering a bike share + transit card, linking the two accounts to the one card, producing the cards, sending out the card, replacing lost cards and financial agreements for production and administrative support would need to be worked between the technical and administrative staff of the bike share operator and transit companies. In this model, however, except for card costs, revenue systems would be completely separate and therefore there is no need for regular reconciliation and reimbursement of any system revenues.

Accountability is ensured by the user of the bike share system as detailed account information is associated with the SunGO card. Most bike share systems require the use of credit cards to ensure accountability, which introduces equity concerns. However, Philadelphia has just piloted a means for people to pay for bike share memberships with cash. The SunGO card offers the opportunity for users to

pay with cash, so such a system could potentially be extended to bike share memberships. Sun Tran services don't require registration with a credit card as other types of passes can be purchased.

Level 4 – Fully-Integrated Fare Payment

Common Fare Payment Card and Combined Accounts for Sun Tran and Bike Share

Level 4 integration is achieved when bike share payments and transit fare payments are fully integrated into a single card and payment processing system.

Cash "loaded" onto the SunGO card would be used to pay for either bike share or transit fare from a single account. Level 4 integration would also enable bike share fees to be directly included in the purchase of a transit pass.

Level 4 integration is more complicated and involved for a full back-end integration and will introduce technical and administrative challenges, such as linking software systems, separating memberships and user fees for each service, and managing agreements for the distribution of funds from bundled membership fee programs.

The cost of implementing the system is likely higher than Level 3 integration. But once operational, could be lower costs in operations because of absence of repetitive membership and database administration.

Interviews with bike share vendors indicated that Level 4 integration is most advantageous with large bike share systems, and where multiple transit agencies may be involved. In Tucson, with the transit companies managed by a single entity, the City, a fully integrated fare payment and processing system is not critical to the success of the bike share system.

Level 5 – Operations and Maintenance Integration

Bike shared operated and maintained with transit services under a single company

The highest level of transit and bike share integration would be a bike share system that is operated and maintained by a single company. Common administration and operations would facilitate a unified fare payment system and could have significant savings in operations by utilizing existing administrative capabilities, vehicles, on-street employees and facilities to manage the bike share system. Several transit agencies have launched bike share systems in 2015 which they own and operate bike share systems. These include Boise, ID, Dayton, OH and Topeka, KS.

As described above, though, transit services in Tucson are managed by two different private companies with three separate companies actually undertaking operations. To integrate administration and/or operations, the City could undertake a contract amendment to add the responsibility of bike share management under the same contract. It is possible that the City could realize cost savings through the integration of services. It should be noted, however, that there are no companies that operate both transit and bike share in the United States, so finding the right private vendor could be difficult.

9. IMPLEMENTATION CONSIDERATIONS AND FRAMEWORK

This section addresses some of the common considerations that will need to be determined prior to and during implementation of the bike share system.

Procurement

Considering the business model recommendation that the system should be city-owned and privately managed, the City should undertake an analysis of its procurement options for a bike share system, which include:

- Attaching onto the Phoenix system and utilizing the same technology as in Phoenix without undertaking a competitive procurement process;
- Utilizing current transit contracts to include operations (and potentially equipment) to the existing transit contracts; and
- Undertaking a new competitive procurement process for equipment and operations.

The limitations, advantages, and disadvantages of the first two options listed above should be researched by the City. The third option has been undertaken by dozens of communities, and typically includes one procurement process for both equipment and operations (as opposed to separating out each item). The City can consider including sponsorship acquisition in this RFP or separating it out in a different contract (or undertaking it directly).

Other items that should be considered during the procurement process are:

- Scope of work and performance requirements for operator and equipment provider.
- Contract structure for bike share equipment and operations.
- Cost and revenue sharing arrangement which maximizes the alignment of incentives between the City, the operator and equipment provider.
- Technical specifications for an equipment provider, ensuring inclusion of both smart bike and smart dock options.
- Financial bid structure to allow for easy comparison between bids.

Public and Stakeholder Outreach

During the course of this Feasibility Study, a basis for public and stakeholder outreach around bike share was established through online outreach, public meetings and many stakeholder meetings, as detailed in Chapter 5. This open communication should be continued throughout planning and implementation, but the conversation should be advanced, not replicated.

The bulk of the outreach will be focused around specific site locations. It should include aspects of the following:

- Online: Creation of a web-based map with the hot spot location where public input can be given on specific station locations (not just crowdsourcing, which was done as part of this study).

- Surrounding location outreach: When specific sites are identified, reaching out to businesses and property owners in the immediate area around those sites to educate and receive input about the specific proposed location.
- Stakeholder outreach: Continued work with stakeholders engaged as part of this project to continue project updates and education, input on station locations when relevant, and enlist support for media, partnerships, and financial contributions. Stakeholders should include businesses, institutions, and any relevant departments in the City of Tucson.
- Elected officials briefing: The City should make sure to brief elected officials in the City, County and State about the bike share launch. Briefing should include a one-page summary sheet of "what is bike share", where and when it will be implemented in Tucson, talking points as to the way bike share will benefit Tucson, and enlist these officials to publicize and support bike share in any way possible, both prior to and after launch.
- Media outreach: To the extent possible, the media should be leveraged to increase public awareness and input prior to system installation. Such general awareness will reduce the possibility of negative feedback and surprise responses to bike share in general, as well as specific locations.

Marketing

This section addresses some of the key issues that go into promoting and marketing a bike share system and draws on examples from other cities in the United States to understand some of the strategies and limitations to existing bike share marketing strategies.

Branding

Branding is the creation of an identity that users and the general public can attach to, recognize, and associate with the bike share program. Branding is also the use of consistent messaging that is representative of the core values of the program. The key branding decisions include coming up with the system name, logo, and color. These are described in detail below.

Some cities have hired outside marketing consultants to develop branding, e.g., New York City and Chicago, while others have developed branding in house either as a public agency (e.g., Capital Bikeshare in Washington D.C. or CoGo in Columbus), non-profit organization (e.g., Nice Ride Minneapolis), or as a private company (e.g., Miami DecoBike).

Name

Naming the system is probably the most critical decision and needs to take in a number of factors including:

- Representing the core values of the system, e.g., Bixi in Montreal is a shortening of the words "bicycle" and "taxi" to represent personal, independent, spontaneous mobility by bicycle; or Greenbikes in Salt Lake City that uses the word "green" to represent environmental consciousness.

- Geographic representation: e.g., Capital Bikeshare in Washington D.C. representing the capital region; CoGo in Columbus; and Bay Area Bike Share (BABS) to represent an area with multiple cities.
- Sponsor representation: e.g., Citi Bike in New York City; and Santander Cycles (formerly Barclay's Cycle Hire) in London.
- Common brand / vendor: e.g., Boulder BCycle and San Antonio BCycle; or Miami Decobike and San Diego Decobike.
- Other considerations may include:
  - Integrating a play on words: e.g., Nice Ride Minnesota in Minneapolis and St. Paul is a play on the phrase "Minnesota nice" and the popular parlance for a comfortable bicycle.
  - Use of the name as a noun or a verb: e.g., Hubway in the Boston area – "I'm going to hubway to Cambridge on a Hubway".
  - Naming competitions can be a good way to connect people to the system and generate early interest, e.g., Columbus issued a contest to come up with the name CoGo.

As discussed in Chapter 4, considering many of Tucson's transit assets already have the same color and naming scheme (Sun Tran, Sun Van, Sun Link), Sun Bike or Sun Bikeshare is a viable name possibility. Should a title sponsor be secured, incorporation of the Sun branding with the sponsor branding will have to be discussed and negotiated.

Logo

The system logo is the visual equivalent of the name and will become synonymous with the system being branded on all infrastructure, system elements, online media, and merchandise. Most cities include the following features in some form in their logo:

- A bicycling element or reference: e.g., the Nice Ride logo incorporates a bicycle; the Hubway logo uses a gear sprocket; Divvy uses the arrow elements of a sharrow roadway marking.
- Core values: e.g., the Hubway gear sprocket invokes forward movement and connection.

Color

Color is important not only from a branding perspective but also from a safety and urban aesthetic perspective. The decision on color may factor in:

- Cost: most vendors offer basic colors at the standard price with other color options costing more per unit.
- City or campus colors: e.g., Capital Bikeshare adopted the color of Washington DC's Circulator Bus system.
- Visibility / eye-catching: e.g., the vibrant green color of the Nice Ride bicycles.
- Reiterate a theme: e.g., Greenbikes promoting environmental consciousness.
- Aesthetics: e.g., powder blue in the Bay Area – this is also a "neutral" color as the system represents multiple cities.
- Sponsor: e.g., the color of the Citi Bike system is a shade of Citi's corporate colors.

Again, the Sun branding may be a strong option for system logo and branding, depending on the procurement and negotiation of a title sponsor.

Marketing Package

Sponsorships are a critical component to raising the necessary funds to launch and operate Tucson's bike share system. Sponsorships extend beyond a large scale title sponsor, and many systems employ a mix of local sponsors along with a title sponsor; companies can sponsor stations to gain more local visibility or provide additional amenities to their employees; universities may fund stations to enhance the mobility of the student population; and non-profits could sponsor stations to extend the reach of the system to target populations. In seeking sponsorship, the needs of the target audience must be considered in preparing an appropriate sponsorship ask.

An example of a sponsorship deck put together by Miami Beach's DecoBike, which relies on sponsorship to fund the program, can be found online at www.slideshare.net/decobike/decobike-6906631#. The deck is a graphics-heavy document that includes:

- Content that captures the opportunity. DecoBike highlight the exclusivity and unique form of street advertising provided by bike share through a full page quote stating, "You can brand an entire city!"
- Key themes that make connections with potential advertisers. DecoBike promote the opportunity to combine advertising exposure with environmental consciousness, e.g., "Going green and gaining exposure has never been easier!"
- An introduction to bike share and why it's a good idea for Miami Beach.
- An outline of the proposed bike share system – how it works and where it will be located.
- Quantification of the system's assets and their expected exposure rates.
- Statistics and demographics of the target market / audience.
- Contact information.

Marketing Plan

Marketing and promotions are an essential part of the success of a bike share program and marketing activities need to start prior to the first stations being placed on the street and continue all the way through operations. Success relies on creating "buzz" for the system. Traditionally, bike share has relied very little on traditional media with buzz generated by the stations and bikes themselves and marketing campaigns focused on low-cost opportunities such as social media, self-advertising, and generating attention through targeted activities and stunts. Many existing systems have not invested sufficiently in marketing and promotions and it is important that appropriate incentives be put in place to encourage appropriate spending on marketing efforts.

Timing of Marketing Efforts

There are several stages to the marketing campaign:

1. Prior to the first stations being placed on the ground ("preparation"): marketing budgets should be focused on the development and launch of the website and preparation of promotional materials.
2. When the first stations are deployed on the street ("visibility"): marketing efforts should build on the excitement generated by station deployments and the lead up to launch with activities

focused on providing program information, directing people to the website, and signing members.

3. Program launch ("excitement"): the buzz and attention created by the launch of the program brings forth numerous opportunities for free and widespread press coverage.
4. Ongoing operations ("momentum"): once the program is launched, marketing efforts are focused on maintaining interest and excitement in the program, typically through social media networks, strategic events, stunts, and other activities.

Potential Marketing Activities

Various strategies for creating a buzz about bike share have been undertaken through a combination of earned media, community events, digital media (i.e. social media and blogs), and other activities. Existing programs have found creative ways to increase the significance of free PR (i.e. newspaper stories, TV stories, press releases, etc.), which have made it possible for the program to create buzz without utilizing traditional paid advertising such as television and radio commercials, newspaper advertising, billboards, etc. To this end, a high percentage of the marketing budgets for existing programs are spent on creating earned media. Some potential marketing activities are included in **Table 12**.

Table 13: Potential Marketing and Promotional Activities for a Bike Share System in Tucson

Activity	Description
Website	The website should serve as the all-encompassing place for information about sign up, benefits, and overall program information. All marketing and "buzz" should advertise and drive people to the website where, even prior to the first stations being deployed, people can register for the program.
Website Launch Stunt	It is important to gain members prior to launch so that people are there to ride the system on day one. An affordable way to drive free PR at this important time is to coordinate a "stunt" to garner social media attention and free PR. For example, at the launch of the Boston website, "Freedom Riders" rode Hubway bikes around the city. Press and blog outlets covered the story announcing the website launch, and dozens of pictures were posted on the Hubway Facebook page and Twitter feed, and the system was able to garner approximately 1,000 new members in the short two week timeframe prior to system launch.[59] Philadelphia's Indego undertook a station demonstration at a major Center City location timed with the website launch to gain earned media, garner memberships and create social media buzz.

[59] Hubway riders in Boston. Retrieved from http://transportationnation.org/2011/09/06/tn-moving-stories-boston-bike-share-booming-and-a-look-at-the-new-dc-metro-map/samsung/on April 10, 2013.

Activity	Description
Earned Media	Earned media (i.e. newspaper stories, TV stories, press releases, etc.) should be used wherever possible to focus attention on the deployment and impending system launch (prior to program launch) and to promote the success of the system (following launch).
Partnerships and Co-Promotions	Creating partnerships and/or co-promotions with established organizations and institutions is a critical way to promote the new bike share service. Announcements of partnerships with different organizations by leaders in the city can bring positive associations from different groups. Examples include: • A partnership for discounted memberships with the Denver Housing Authority (DHA) was used to begin signing up DHA residents. • Co-promotions with local sports teams such as Boston Hubway's 2013 season opening coordinated with the Red Sox opening day and Hubway discount passes were distributed with Red Sox tickets. In Tucson, this may tie in with college sports at the University of Arizona. • Other companies, institutions or organizations, such as universities, hospitals, or car-sharing companies. These partnerships may offer incentives to these large and influential organizations to associate themselves with bike share and promote the bike share brand, at no cost to the system.
Station Posters	Depending on the contractual agreement with the sponsor(s), one or both sides of a poster on the bike share station can be used to promote the system. In Washington, D.C., Capital Bikeshare has a map on one side of the poster and advertising for the system on the other. In New York City, as stations were deployed, the included messages of the impending system launch (e.g., "Coming Soon").
Outdoor and Digital Paid Advertising	Paid advertising has been used in a very limited fashion throughout existing U.S. systems because of small budgets and little need to date. One method of existing advertising is from the District Department of Transportation (DDOT) in Washington DC which has used some of its own advertising assets to place outdoor signs for Capital Bikeshare.[60] In Philadelphia, the title sponsor, Independence Blue Cross, gave significant outdoor advertising space to the bike share system around the system launch, including bus wraps, train wraps, bus shelters, transit advertisements and highway billboards.
Targeted Events	Targeted events can create free advertising in the neighborhoods. Ribbon-cutting events for particular stations with local politicians are great ways to imbue ownership of the system on a very local level. Attendance at neighborhood events such as street fairs and farmers markets can also create local interest and stories in local media.
Social Media	Growth of social networks like Facebook, Twitter can help augment the word-of-mouth "buzz" about bike share. Other systems have shown large and committed social media followings which have helped promote the system. Social media can also help promote new discounts, contests and events. In addition to the use of social media, creating and maintaining positive relationships with influential writers, columnists, bloggers and local media outlets is crucial to creating the right kind of buzz for bike share.

[60] Through its advertising contracts with Clear Channel, DDOT has been able to promote the Capital Bikeshare brand throughout some of the existing advertising panels in various parts of the city.

Activity	Description
Contests	Contests run by bike share systems garner both buzz on social media and free PR. For example, Capital Bikeshare ran a Winter Weather Warrior contest. The contest helped promote and increase use of the system through the winter months (when ridership tends to be lower), while garnering coverage in the Washington Post and blogs, which consequentially helped increase the number of members and bike share use.
City PR Department	No matter how good the contractor, sponsors and/or implementation team, the media is strongly attracted to actions and announcements by the City, far more than any private company. To this end, it is recommended that the City leverages existing PR assets throughout its different departments to help promote the program.
Sponsor Network and Marketing	There are significant opportunities for major sponsors to help spread the word about the program but the level of support depends on its means for communicating to its stakeholders and the resources it is willing to give. Sponsors can bring the sophistication of a large company to a small business. The Citi sponsorship of New York City's bike share program has provided the bike share program a means to gain the marketing support of a large company and Citi an opportunity to augment the Citi brand. Citi has contributed the following marketing to the Citi Bike program: • Using the 2-feet x 4-feet advertising panels on each bike share station that they received as part of the sponsorship package to advertise the Citi Bike program. • Discounts to certain cardholders on bike share memberships. • Placement of Citi Bike branding at the bottom of credit card statements and on ATMs. • Distributing Citi Bike brochures at branches and internally communicating with branch employees about the program. Independence Blue Cross, the Philadelphia sponsor, has given branding and design expertise, as well as significant advertising assets to the system.
Integration with Transit	Bike share will complement the existing Sun Tran and Sun Link network in Tucson and bike share should be promoted as a tool that extends the reach and flexibility of transit. Close cooperation with transit administration and utilizing their existing promotional and marketing channels will be important.
Visitor Market	Visitor and tourist usage is very important for the financial sustainability of bike share, however advertising to this market has not yet been undertaken in a consistent manner in other systems due to the increasingly higher costs to reach out to this market. Many short-term users become aware of the program simply by walking past a station. Strategies to reach this sector are generally focused around co-promotions with: • Hotels: have brochures and educate their concierge desks about bike share and how the program works. • Visitor and Convention Service Organizations: work with XX and other visitor service organizations to have promotional information on-hand regarding bike share. • Universities and Hospitals: provide promotional materials to universities and hospitals that could be distributed to families and campus visitors. • Other institutions: work with other visitor attractions to ensure they have the appropriate information and education about bike share.

Budget

Each system has a different structure and level of resources for marketing and advertising. In Washington D.C.'s Capital Bikeshare, the public agencies (DDOT, Arlington County, and the City of Alexandria) provide the marketing resources. In Boston, the contractor undertakes marketing for the system. In Denver, it is up to the non-profit to promote the program leveraging its partnerships with funders, community organizations, and city government. The major lessons learned are related to the marketing and advertising budget and the structure of contracting and incentives.

Some existing bike share programs have launched on too small a marketing budget that have not taken into account the necessary personnel and other resources required to promote the system as effectively as possible. As the region considers implementing a bike share program, it should ensure that the organization charged with managing the system prepare a budget that includes at least one full-time employee, as well as several part-time seasonal employees for event staffing. In addition, there should be enough funding to provide for system collateral, such as t-shirts, brochures, key chains, events and giveaways, and budgets for events, such as vehicles, fuel, tents, signage and permits. A second dedicated person could also be included in the budget to cover social media, partnerships, coupons and/or any other education or outreach needed for the system. Targeted, paid digital advertising through Facebook and Google should also be considered, as they are low spend, high impact strategies.

Contract Structure and Incentives

If marketing and operations are to be contracted to a third party, it is important that the contract be structured to incentivize the contractor to spend appropriately on marketing in line with the goals of the program. For example, if the contract calls for a flat fee to be paid to the contractor for operations with a marketing budget included, they are likely to spend as little as possible because their incentive is to operate efficiently, not to increase ridership.

A possible contract structure that should be considered is to propose a base budget for operations that includes a base level of marketing. Augmenting the base budget would help incentivize the potential contractor to promote high membership and ridership, and would also penalize it for low membership or ridership. The contract should also align incentives for increasing membership and ridership of minority and low-income users to create this program as a positive aspect, not just a cost, to the contractor.

Operational Considerations

Equipment Maintenance, Warranty and Recapitalization

As the City will most likely be the equipment owner, it is important that there is budget to provide for equipment maintenance to ensure it lasts through its useful life. The budget should include the operator undertaking the following:

- Spare parts purchasing each year for both bikes and stations.
- Monthly bike checking of every bicycle.
- Annual bike overhaul.

- Regular station cleaning.
- Station and bike vandalism response.
- Following manufacturer's recommendation for care of stations and bicycles.
- Using proprietary spare parts or other specified spare parts as per manufacturer's recommendations.
- Prompt response to repair damaged bicycles or stations so issues do not worsen.

Should the operator follow the manufacturer's recommendation, most equipment vendors offer some sort of warranty on bikes and stations, which can vary between 1 and 5 years. Typically, a 1-year warranty covers all performance and design issues, whereas a 5-year warranty may be more limited in the range of items it covers.

Bike share systems in North America are mostly less than five years old and have not yet had to account for significant maintenance and replacement costs. Minneapolis, Denver, and Washington D.C. are in their sixth season, and have not had to replace bikes or stations because of age, beyond replacement of consumables. However, bike share systems need to take into account the future costs of maintaining and replacing equipment when planning for growth. It is recommended that as soon as the City reaches a comfortable system size, establishes financial reserves, and understands the steady state financial performance of the bike share system, it should start planning for eventual recapitalization to ensure long-term sustainability.

Theft and Vandalism

Theft and vandalism to date in bike share has been minimal. For example, Minneapolis has reported losing only a handful of bicycles over the four years of operation of the Nice Ride system (it had originally projected a 10 percent loss rate). However, it should be noted that most systems have been "tested" in a home environment before rolling out in a new city (for example, Bixi launched in Montreal first and worked on its system security at that point). Therefore, it is recommended that the City select a technology that has received a good amount of field testing and has been proven successful in other cities.

Rebalancing

Whether a smart bike or smart dock system is chosen by the City, the fleet inventory must be maintained to keep the system balanced and to have bikes and docks available throughout the system, not all of the bikes in one area of the system and empty spaces in another part of the system. Therefore, a large part of the system operations is to keep the system balanced, predominantly by dispatching a van with a 30-40 bike capacity throughout the system to move bikes from one area of the system to another. Typically, it may take the operator a few months to recognize regular flows in the system, and the flows will vary in morning and evening commute times, as well as on the weekend, when the system is used more recreationally. The operator can use several different tools to track system inventory, as all technology-based systems have a public feed of bike and station locations that the operator can use to see when stations are full or empty.

Ideally, bicycle redistribution should occur primarily before and during the weekday rush hours of 6-10 AM, 3-6 PM, and at night before any non-holiday weekday. A higher station density, we will minimize the need for heavy redistribution.

Over the first few months, usage patterns will be observed, after which time, stations will be "pre-balanced" or "staged" late at night, and in the pre-rush hours, to maximize bicycle availability from high-demand stations. Redistribution crew utility is typically vastly diminished during peak rush hours due to competing traffic, which is why the focus should be on "staging" the system. Many operators have explored using non-motorized means for redistribution, such as electric bikes, regular bikes, or electric trucks. These have shown to be either extremely expensive or inefficient. Customer-driven rebalancing through incentives has also not been extremely successful to date.

On weekends, holidays, and during non-rush hours on weekdays, redistribution can occur on an as-needed basis or as user patterns require, and vehicle resources can be reallocated for station maintenance, broken bike collection, cleaning, and other system needs.

Implementation Timeline

The steps involved for implementation of a bike share system in Tucson are identified on **Figure 35**.

These steps are generally categorized into:

- Procurement
- Funding
- Branding and Marketing
- Site Planning and Permitting
- Deployment
- Operations
- Launch

Funding is likely to be the critical path through the project with the timeliness of capital funding largely unknown and sponsorship needing to be obtained, often pieced together from various sources that require the attention of a dedicated staff resource.

It is estimated that a system could be launched in approximately 16 months from beginning this process.

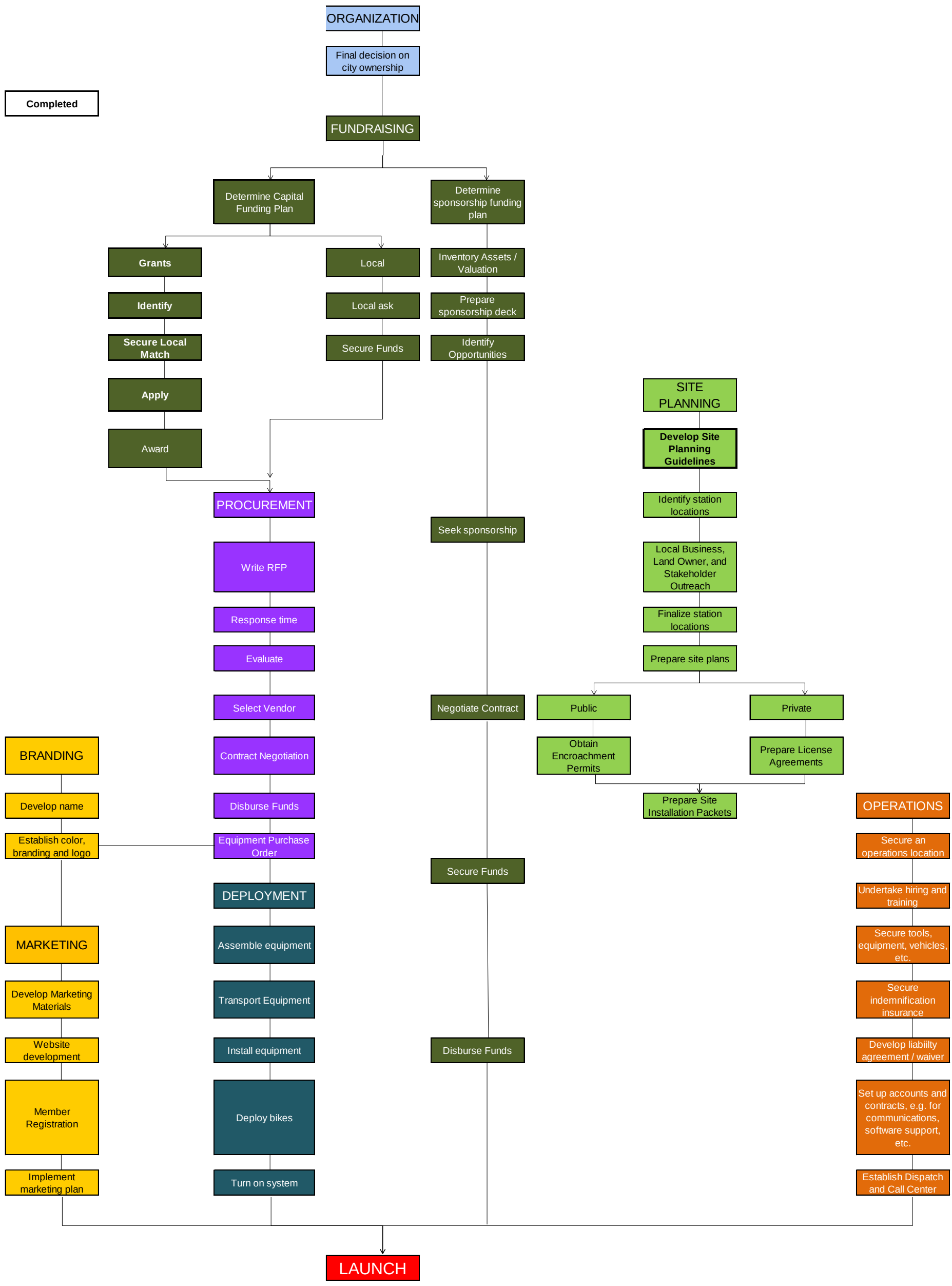


Figure 35: Implementation Steps

Evaluation Methods

Effective performance measurements must be detailed enough to give meaningful indicators about system performance, yet be simple enough to collect and report on a regular basis. The measurements proposed for Tucson can be developed using three different input sources: automatically generated system data, a proposed annual user survey, and figures that the program administrative and marketing staff can track internally over time. If any of the proposed performance measurements fall under the responsibility of an outside vendor, the vendor should be contractually required to track these measurements. While many of these figures can be tracked in real-time, the full set of performance measurements should generally be reported on an annual basis by the managing agency. The measures, and means to measure performance on these, are listed below.

To achieve operational excellence, performance standards should be specified in a contract with an operator, and could even be included in an agreement with a non-profit. However, the more stringent the performance standards, the more expensive contracted operations will cost. Therefore, the City must strike the right balance of operational excellence and affordability. These standards should include, but not be limited to, the following:

- System launch:
  - Delivery timeline.
  - Site planning timeline.
- System operations:
  - Bike redistribution metrics.
  - Fleet size on street.
  - On-street bike maintenance.
  - Station cleaning (standard and graffiti).
  - Station technical maintenance.
  - Station and docking point functionality.
  - Customer service.
  - System accuracy (station inventory, financial and ride reporting).
  - System and website functionality.
- System marketing:
  - Membership.
  - Ridership.
  - Equity achievement.

Basic performance levels for each set of metrics should be defined, and the contract should include incentives to surpass the basic level, as well as liquidated damages for failing to meet that level.

Reporting and evaluation will also be important. Each year, a summary report should be prepared that includes program highlights, operational performance metrics, and other system statistics including:

- System size
- Membership and ridership statistics
- Station performance
- Health impacts
- Economic impacts for users
- Economic benefit for the City
- Safety
- Operational efficiency
- Financial performance
- Emissions Reductions
- Shifts in transportation modes

An annual survey of members should also be undertaken. This should include annual and casual members and if possible, non-members to understand why they don't join the program. The intention of the report is to evaluate system performance and make decisions about its future direction and emphases, e.g., the individual station performance statistics can be used to make decisions on expanding, reducing, or relocating stations to fine tune the performance of the system.

Additional performance metrics specifically aligned with the system Goals and Objectives are included in Chapter 3.

APPENDIX A

Online Survey Form

Bicycling Preferences

1. Do you currently have access to a working bicycle?

a. Yes

b. No

2. How often do you ride a bicycle?

a. A few times a year

b. A few times a month

c. A few times a week

d. Daily

3. Which of the following best characterizes your bicycling behavior?

a/ I am a seasonal bicyclist and prefer to ride when the weather is nice

b. I am a year-round bicyclist and ride regardless of weather conditions

Attitude Toward Bike Share

4. Have you used a bike share system before?

a. Yes

b. **No**

5. What system did you use? (Please Name the system or the city, for example, "Capital Bikeshare" or "Washington, DC)

6. Do you think a bike share program is a good idea for Tucson?

a. Yes

b. No

c. I don't know

7. Please tell us why you think bike share is a good idea for Tucson.

8. Please tell us why you think bike share is a not good idea for Tucson.

9. If bike share were available, what types of trips do you think you would use the bikes for?

a. Transportation to work or school

b. As a part of a larger transit trip (eg, to get to or from bus, streetcar)

c. Transportation for errands/other non-work

d. Transportation during the day while at work/school

e. Recreation/Exercise

f. Wouldn't use it

g. Don't know

h. Other

10. About how often do you think you would use bike share?

a. Never

b. Once a month

c. Once a week

d. Once a day

e. More than once a day

f. Other

11. What price would make you likely to subscribe to a single ride or daily bike share pass in Tucson?

a. Single 30-minute pass? Range from $0 to $20

b. Daily pass with unlimited 30-minute rides? Range from $0 to $20

12. What price would make you likely to subscribe to an monthly or annual bike share pass in Tucson?

a. Monthly pass with unlimited 30 minute rides? Range from $0 to $200

b. Annual pass with unlimited 30 minute rides? Range from $0 to $200

About You

13. Age

14. Sex

a. Male

b. Female

c. No Response

15. Ethnicity

a. Asian or Pacific Islander

b. Black or African American

c. Hispanic or Latino

d. Native American Indian

e. White or Caucasian

f. Other

16. What is your annual household income?

a. Less than $20,000

b. $20,001 to $40,000

c. $40,001 to $60,000

d. $60,001 to $80,000

e. $80,001 to $100,000

f. $100,001 to $120,000

17. 5-digit zip code for your home address

18. Are you currently employed?

a. Yes

b. No

19. What is the zip code of your place of employment?

20. Are you currently enrolled in school?

a. Yes

b. No

21. What is the zip code of the school you attend?

Stay Informed

22. Would you like to stay informed about the Bike Share Feasibility Study?

a. Yes

b. No

Please enter your email address below. Please note that all email addresses and responses will be kept confidential.