City of Phoenix
STREET TRANSPORTATION DEPARTMENT

COMPREHENSIVE BICYCLE MASTER PLAN

bikePHX

Final Report

November 2014

MAKING CONNECTIONS

PREPARED BY LEE ENGINEERING

IN ASSOCIATION WITH TooleDesignGroup Charlier Associates, Inc.

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Wylie Bearup ..... City of Phoenix - Street Transportation
Ray Dovalina ..... City of Phoenix - Street Transportation
Tom Godbee ..... City of Phoenix - Street Transportation - Traffic Services
Scott Logan ..... City of Phoenix - Street Transportation - Traffic Services
Marcus Hunter ..... City of Phoenix - Street Transportation - Traffic Services
Kerry Wilcoxon ..... City of Phoenix - Street Transportation - Safety & Neighborhood Traffic
Joseph Perez ..... City of Phoenix - Street Transportation - Safety & Neighborhood Traffic
Matthew Heil ..... City of Phoenix - Street Transportation - Public Information Office
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Katherine Coles ..... City of Phoenix - Planning & Development Services
Lysistrata Hall ..... City of Phoenix - Neighborhood Services Department
Amanda Luecker ..... Valley Metro Regional Public Transit Authority
Abigail Williams ..... Arizona Department of Administration (ADOA)
David Oihus ..... Arizona Department of Administration (ADOA)
Mike Sanders ..... Arizona Department of Transportation (ADOT)
Maureen DeCindis ..... Maricopa Association of Governments (MAG)
Jude Nelson ..... Arizona State University (ASU)

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PEDESTRIAN AND BIKING AD HOC TASK FORCE

Suzanne Day	District 1 representative
Bob Pane	District 2 representative
Leslie Dornfeld	District 3 representative
Lisa Parks	District 4 representative
Haley Ritter	District 5 representative
Susan Bookspan	District 6 representative
Libby Coyner	District 7 representative
Gene Holmerud	District 8 representative
Bob Boschee	At-Large Member
Erika Keenan	At-Large Member
Edward Jensen	At-Large Member
Feliciano Vera	Chair, At-Large Member

CONSULTANT TEAM

Jim C. Lee, PhD, PE, PTOE	Lee Engineering
Michael J. Cynecki, PE	Lee Engineering
Yung Koprowski, PE, PTOE	Lee Engineering
RJ Eldridge	Toole Design Group
Jim Elliott, AICP	Toole Design Group
Terri Musser	Charlier Associates

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Benefits of a Bicycle Friendly Community

Throughout urban centers in the United States, bicycles have become a visible part of the landscape. Borrowing from European commuters in cities such as Copenhagen and Amsterdam, Americans are increasingly choosing bicycles as a mode of transportation and recreation. Bicycles provide environmentally-friendly, economical, fun, and healthy transportation, and do so at a low impact to roadways. Younger generations are emerging from high school and into the world, and are choosing more car-free and/or multimodal lifestyles based on higher density areas. Companies are recognizing that, in order to attract young talent, they are wise to build and invest in bicycle-friendly facilities. Businesses are learning that bicycles are good for business.

Phoenix, Arizona has the potential to be a world-class city for bicycling. With nearly year-round beautiful weather, wide streets, lack of hills, and grid layout, Phoenix should have one of the highest rates of ridership in the nation. However, Phoenix's history of automobile dependency, limited bicycle infrastructure, and narrow traffic lanes has deterred many prospective bicyclists from riding. Some of the primary obstacles in Phoenix that have resulted in low ridership include expansive distances, wide streets, and high speeds.

Phoenix currently struggles under the staggering costs for maintaining a vast roadway system and doing so with ever-dwindling sources of funding. In an effort to creatively address funding shortages, the city has already demonstrated a commitment to bicycle infrastructure as part of a larger vision for promoting multimodal and alternative transportation. This document identifies ways that the City of Phoenix can aim to achieve excellence in the five essential elements of bicycle-friendly communities, or "the Five Es". By focusing on these five areas, the City of Phoenix has the potential to become a League of American Bicyclists Platinum Bicycle-Friendly Community.

The 5 E's for Bicycle Friendly Communities

ENGINEERING
Creating safe and convenient places to ride and park.

EDUCATION
Giving people of all ages and abilities the skills and confidence to ride.

ENCOURAGEMENT
Creating a strong bike culture that welcomes and celebrates bicycling.

ENFORCEMENT
Ensuring safe roads for all users.

EVALUATION AND PLANNING
Planning for bicycling as a safe and viable transportation.

What is the Bicycle Master Plan?

This planning document will set the course for the next 20 years for the development, growth and connectivity of bicycle facilities in Phoenix. This plan is intended to provide a framework for decision-making to greatly expand and improve bicycling facilities within Phoenix. These facilities are to make it safer and easier for bicyclists to travel throughout the city and make connections to adjacent communities as a part of the regional bicycle transportation network. The intent of the plan is to identify specific actions for Phoenix to take, along with an implementation schedule, and provide quantifiable outcomes to measure the success in meeting the goals of the plan.

The Phoenix Bicycle Master Plan is a comprehensive and collaborative effort that had considerable input from numerous city departments. While this plan was developed under the direction of the Street Transportation Department and the Phoenix Bicycle Coordinator, considerable input was also provided by the Police, Planning and Development Services, Parks and Recreation, and Transit Departments. The lead consultant for this project is Lee Engineering, LLC, along with substantial guidance and support from subconsultants Charlier Associates, Inc. and Toole Design Group.

Even though this is a 20-year plan, it is fully recognized that this plan may be updated periodically during the 20-year planning horizon to reflect changes in the community.

Why is the Bicycle Master Plan Important?

Bicycling promotes a healthy lifestyle, has an extremely small carbon footprint, and requires much less infrastructure or space for travel and parking compared to motor vehicle transportation. Currently, Phoenix lacks a comprehensive bicycle network that is fully connected with the community and other transportation networks (transit, airports). While over 700 miles of bicycle facilities exist within Phoenix along with 42 bicycle and pedestrian bridges/tunnels, the 596 on-street bicycle facility miles represents only a small fraction of the nearly 5,000 miles of street network in the city. Many of the bike facilities are not connected with other bicycle facilities or important destinations such as schools, universities, employment centers, shopping centers, transportation centers, or recreation facilities within Phoenix or in adjacent communities.

A comprehensive and connected bicycle network will promote a healthier community and healthy transportation alternative for residents and visitors. This network and innovations such as bike share programs can greatly expand the number of bicyclists while helping to eliminate the demand for vehicle travel.

The Bicycle Master Plan is intended to make Phoenix a part of the regional bicycle network throughout the metropolitan area. Bicycle facilities should not end at the city limits and instead should connect to facilities in adjacent cities to provide access to destinations in adjacent communities for Phoenix residents and visitors. Furthermore, residents of adjacent communities should have good access to a multitude of destinations or recreational routes within Phoenix.

The Bicycle Master Plan provides new policies for bicycle facility design as well as a framework for implementation of those facilities. These policies include the design of facilities, traffic control practices and proposals for facilities at destinations, such as parking or shower facilities.

The adoption of a comprehensive bicycle master plan will allow Phoenix to better compete for funding either through the Federal Government, when funding opportunities become available, or through the Maricopa Association of Governments (MAG). Since much of the transportation infrastructure is built by private developers, this plan will help to ensure bicycle facilities are constructed at the time parcels or site plans are developed.

In short, a comprehensive bicycle master plan will help make Phoenix an even better place to live, work and play.

Bicycle Master Plan Vision

The Bicycle Master Plan is guided by the following Vision, developed by the Technical Advisory Committee and Ad Hoc Task Force and informed by community ideas.

In the next 20 years, Phoenix will be a Platinum-level Bicycle Friendly Community. It will be safe and easy to bike anywhere in the city. A well-connected infrastructure network will link people and places, making bicycling a preferred option for daily transportation, recreation, and healthy lifestyles.

This plan establishes direction to transform the City of Phoenix into a bicycle-friendly community over the next 20 years. The goal is to systematically improve levels of bicycle friendliness, as defined by the League of American Bicyclists' Bicycle Friendly Communities program.

Areas of Excellence

To achieve the Vision, seven areas of excellence necessary to a Platinum-level Bicycle Friendly Community were established. Each Area of Excellence is a focus of this plan and organized into Chapters 5 through 11. To help the City succeed in each of these areas, this plan includes a specific goal for each Area of Excellence and recommends strategies, actions, and objectives at the end of each chapter.

Policies & Perceptions

Policies and Perceptions focus on the level of consideration given by the City in planning for bicycles and providing a safe, comfortable and accessible cycling environment in Phoenix.

GOAL:

- A strong bike culture will be the norm, not the exception, as reflected in government organization, community, and individual actions. Public policy will be connected with the desire to have more people riding bikes more often. Bicycling will be easy, safe, convenient, fun, and an accepted mode of transportation and recreation.

STRATEGIES:

- Review and update of City policies, procedures, codes, ordinances, guidelines, and standards to promote bicycle safety and facilities.
- Achieve Platinum-level Bicycle Friendly Community Status from the League of American Bicyclists.
- Broaden the responsibility for creating a bicycle-friendly community among engaged and impacted City Departments.
- Strengthen regional transportation planning coordination with state and regional governmental agencies and public services providers.

Opportunities & Investments

As part of this planning process, bike corridors were prioritized based on a variety of factors. From this list, a series of bicycle facility improvements were recommended. This Area of Excellence identifies implementation and funding strategies for these facilities.

GOAL:

- Investments made for bicycling will be smart, focused, and equitable. The city will leverage existing assets and create partnerships with local, county, and state agencies to build out the bicycle infrastructure network.

STRATEGIES:

- Successfully complete top priority projects on ranked project list.
- Increase amount of funding dedicated to the bicycle program including infrastructure, amenities, education, encouragement and enforcement.
- Seek State and Federal funding through the Maricopa Association of Governments (MAG) to assist with implementation of large and difficult projects.

Equity & Efficiency

This Area of Excellence ensures that the City and its neighborhoods are accessible by bicycle, and that bicycle facilities are safe, fun, and convenient throughout Phoenix.

GOAL:

- The City's bicycle network will connect neighborhoods with each other and into downtown Phoenix. Bicycling will be a safe, fun, and convenient transportation option to access schools, parks, shopping, work, and community centers in all parts of the City.

STRATEGIES:

- Account for social equity when identifying and prioritizing bicycle infrastructure improvement projects
- Provide continuous transportation facilities for bicycling along corridors.

Safety

Safety is a paramount consideration for implementing bicycle facilities in the City of Phoenix. It is also a criteria for federal funding of transportation programs, which require performance-based and data-driven processes for developing and implementing projects. This Area of Excellence provides a five-year review of bicycle crashes in the City and discusses how Complete Streets increase safety for all road users.

GOAL:

- Bicycling will be a safe transportation and recreation option. Streets will be designed and retrofitted to safely accommodate all modes.
- People on bikes will understand bicycling rules of the road through proper facility design and safety education, Bicycling will be safer by promoting accountability and responsible attitudes of all road users.

STRATEGIES:

- Update the City of Phoenix Website
- Provide Training for Transportation Professionals and Police Officers
- Enhance Driver Education
- Enhance Bicyclist Education
- Promote Bicycle Events
- Evaluate Bicyclist Safety and Education Regularly
- Significantly Reduce Bicycle-Related Crashes

Design & Connectivity

Because they are an important mode of transportation to provide connectivity, bicycle routes are located along existing arterial and collector streets and included in plans for new streets. This Area of Excellence focuses on ensuring the bicycle network is continuous so that it functions as a viable transportation mode. This section also includes a discussion of bicycle facility design, ensuring that the right facility is used in the appropriate location.

GOAL:

- People on bikes will be able to share transportation facilities with motor vehicles and easily cross roadways. Missing gaps in the bicycle network will be completed.

STRATEGIES:

- Retrofit arterial and collector streets to meet commuting needs and utilize signalized intersections, while minimizing the need to ride on the most heavily-trafficked major arterial routes.
- Provide wayfinding for bicyclists throughout the City
- Update City of Phoenix guidelines addressing bicycle facility design and traffic control
- Incorporate NACTO Urban Bikeway Design Guide

Connections & Collaborations

This section recognizes off-street and recreational routes as an integral piece of the regional bicycle system. Phoenix residents work and recreate throughout the region; and residents from outside Phoenix come to the City for the same reasons. This Area of Excellence discusses the opportunities for collaboration and partnerships with other agencies and adjoining cities to enhance regional bicycle connectivity and access.

GOAL:

- The City of Phoenix will be connected to bikeways, shared use paths, and trails within Phoenix and in adjoining communities to provide longer-distance recreation and commuting opportunities. This mix of facility types will provide a variety of comfortable travel options for all ages, abilities, and travel purposes through the promotion of loops and links.

STRATEGIES:

- Use the off-street network to complement and supplement the on-street network
- Enhance the safety of off-street corridors at their intersections with streets and other motorized facilities such as railroads and freeways
- Enhance the functionality of the Phoenix bicycle system by connecting to bicycle facilities that provide regional access

Bikes & Transit

Every transit user is a pedestrian or bicyclist at some point on their trip. Public transit operates as a key part of the region's multimodal transportation system while working in tandem with walking, bicycling, and driving modes to provide commuters with multiple transportation choices. This Area of Excellence highlights multimodal initiatives and opportunities for bike-transit integration.

GOAL:

- Commuting by public transportation will be a seamless and efficient choice for cyclists. Completing the first and last 2.5 miles of a transit trip will be easy to accomplish on a bike as modes will be fully integrated.

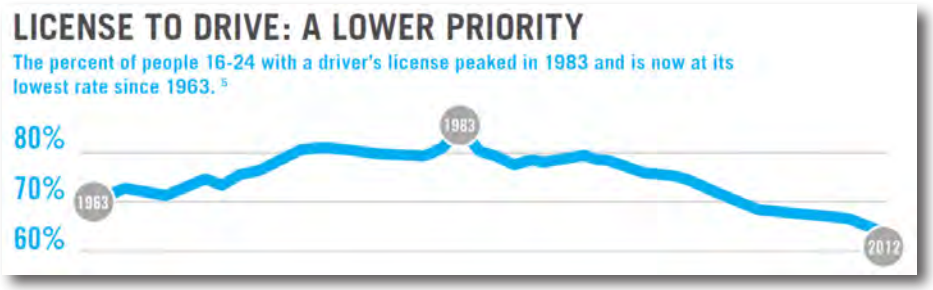
STRATEGY:

- Encourage bike integration with the overall transit system.

Benefits of a Bicycle Friendly Community

As cities across the country build better biking systems, it's becoming clear to more businesses and politicians that, when used right, these networks are part of the path to prosperity.

Throughout urban centers in the United States, bicycles have become a visible part of the landscape. Borrowing from European commuters in cities such as Copenhagen and Amsterdam, Americans are increasingly choosing bicycles as a mode of transportation and recreation. Bicycles provide environmentally-friendly, economical, fun, and healthy transportation, and do so at a low impact to roadways. Younger generations are emerging from high school and into the world, and are choosing more car-free and/or multimodal lifestyles based on higher density areas[1]. Companies are recognizing that, in order to attract young talent, they are wise to build and invest in bicycle-friendly facilities[2]. And businesses are learning that bicycles are good for business[3].



Phoenix, Arizona has the potential to be a world-class city for bicycling. With nearly year-round beautiful weather, wide streets, lack of hills, and grid layout, Phoenix should have one of the highest rates of ridership in the nation. However, Phoenix's history of automobile dependency, limited bicycle infrastructure, and narrow traffic lanes has deterred many prospective bicyclists from riding. Some of the primary obstacles in Phoenix that have resulted in low ridership include expansive distances, wide streets, and high speeds. Additionally, Phoenix possesses an automobile-focused culture that is often not pedestrian or bicycle-friendly.

Phoenix currently struggles under the staggering costs for maintaining a vast roadway system and doing so with ever-dwindling sources of funding. In an effort to creatively address funding shortages, the city has already demonstrated a commitment to bicycle infrastructure as part of a larger vision for promoting multimodal

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and alternative transportation. This document identifies ways that the City of Phoenix can aim to achieve excellence in the five essential elements of bicycle-friendly communities, or "the Five Es": Engineering (Creating safe and convenient places to ride and park); Education (Giving people of all ages and abilities the skills and confidence to ride); Encouragement (Creating a strong bike culture that welcomes and celebrates bicycling); Enforcement (Ensuring safe roads for all users); and Evaluation & Planning (Planning for bicycling as a safe and viable transportation option). By focusing on these five areas, the City of Phoenix has the potential to become a League of American Bicyclists Platinum Bicycle-Friendly Community.

Reduced Travel Costs

In a bibliography of statistics and studies, members of bicycle advocacy nonprofit PeopleforBikes identify that the costs for driving add up significantly: the average cost for owning and operating a car totals approximately three month's salary, and automobile owners spend more on this expense than any other except housing[4]. American Automobile Association (AAA) estimates that the average cost of owning, insuring, maintaining, and driving a car increased to approximately $9000 per year[5], versus the average $308 for bicycles[6].

A Cleaner Environment

More people opting to bicycle instead of driving has the benefit of not only reducing the number of cars on the road, but reducing congestion during peak hours of traffic and effectively diminishing the number of cars idling on the road. This adds up to decreased consumption of fossil fuels, and a reduction in carbon emissions. Recent studies have estimated fossil fuel consumption to be approximately 136 billion gallons of gasoline, and emissions to fall around 1.2 billion tons of CO_2[7]. However, bicycling can assist in reducing these numbers if people opt to make short trips by bicycle (accounting for 75% of all trips or by commuting by bicycle (easing congestion during peak hours). These factors add up to cleaner air – a win for the environment, as well as a win for public health.

Improved Community Health

Bicycling improves personal and public health in a variety of ways. On a personal level, it improves cardiovascular health and promotes weight loss – in fact, the average person loses an average of 13 pounds in the first year of cycling[8].

How 21st Century Transportation Networks Help New Urban Economies Boom

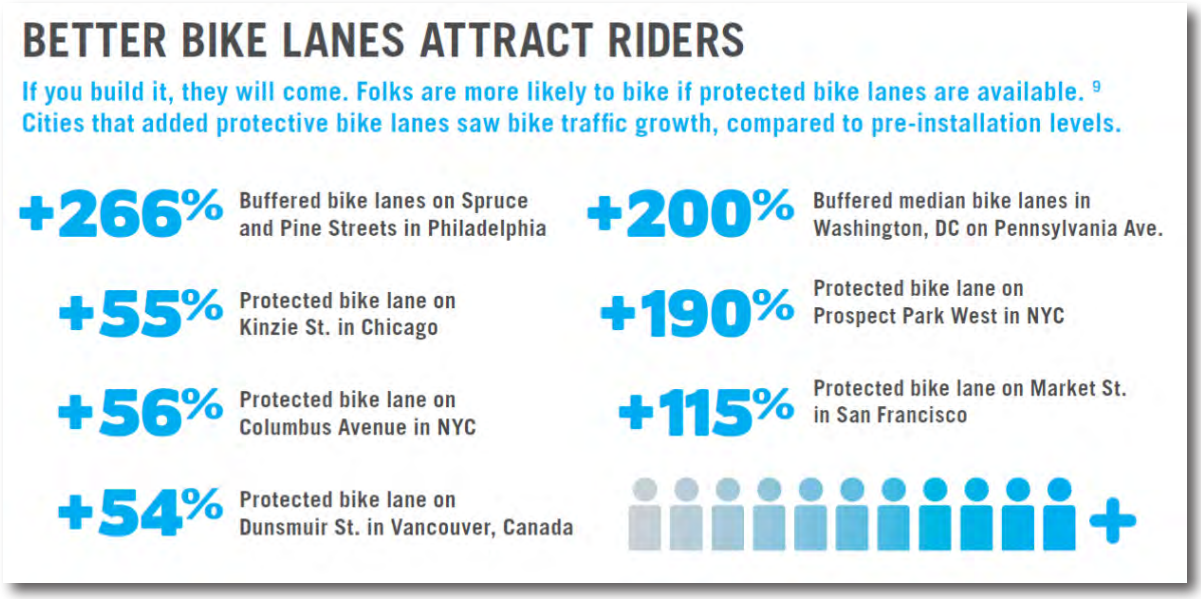
The 2014 report on "How 21st Century Transportation Networks Help New Urban Economies Boom" from PeopleForBikes and Alliance for Biking & Walking summarizes the case for investment in bicycle infrastructure to boost economic growth. As the American economy slowly recovers, U.S. businesses are weighing their opportunities to make the most of that returning energy with new jobs, products and services. Business leaders from coast to coast are seeing four related mega-trends reshaping American urban economies.

Fueling Redevelopment to Boost Real Estate Value

New roads are rarely an option in mature cities. Bicycle infrastructure, such as bike lanes, bring order and predictability to streets and provide transportation choices while helping to build neighborhoods where everyone enjoys spending time. By extending the geographic range of travel, bike lanes help neighborhoods redevelop without waiting years for new transit service to debut.

The Great Urban Rebound

After 40 years of being synonymous with decay, inner cities have come alive and are booming with new development and residents. Twenty years of falling crime rates have helped make urban life desirable again, especially for young adults. As successful city centers fill with people, city leaders find that building high-quality bicycle networks is an efficient and appealing way to move more people in the same amount of space.



The Battle for Human Capital

White-collar workers, from software developers to graphic designers to management consultants, are redefining the "service sector" — creating a digital workforce armed with technical skill and a generational preference for urban living. Companies and cities are scrambling to attract the most talented Millennials and Generation X-ers, who increasingly prefer downtown jobs and nearby homes.

Helping Companies Score Talented Workers

Because bike lanes and other bicycle facility treatments make biking more comfortable and popular, they help companies locate downtown without breaking the bank on auto parking space, and allow workers to reach their desk the way they increasingly prefer: under their own power.

Rising Health Care Costs

Desk-bound jobs and sedentary travel modes are contributing to spiking health care costs and alarming obesity rates. It's getting more and more costly for employers and insurers to finance health coverage for working families — and more cost-effective for cities and companies to lower their costs by incentivizing healthier living.

Making Workers Healthier and More Productive

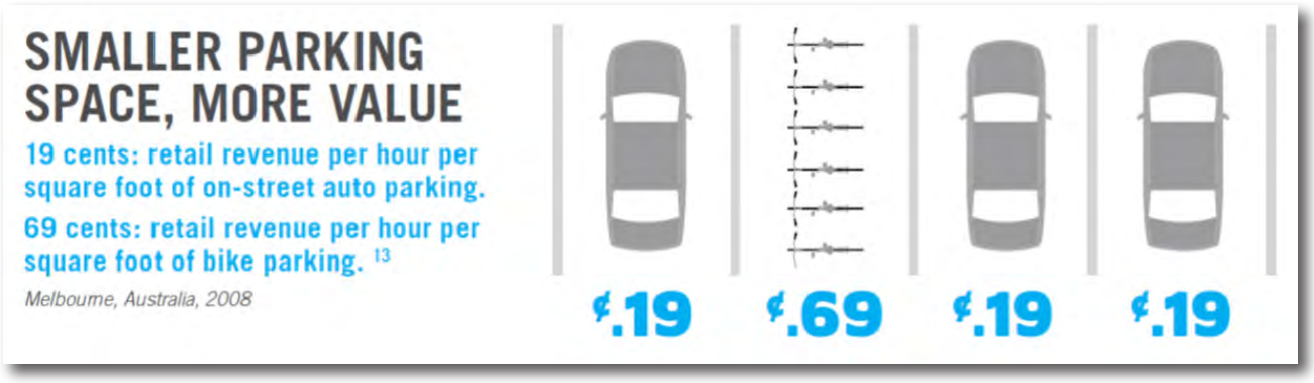
From DC to Chicago to Portland, the story is the same: people go out of their way to use low stress bicycle facilities, such as protected bike lanes. Connected, barrier-free bicycle infrastructure will get more people in the saddle — burning calories, clearing minds, and strengthening hearts and lungs. As companies scramble to lower health care costs, employees who benefit from the gentle exercise of pedaling to work help boost overall hourly productivity and cut bills.

Planning for Wealth, Not Traffic

After 50 years of framing their work around the automobile, retail analysts in both the private and public sectors are shifting to a new consensus: cars don't spend money — people do. By closely studying the ways people move and do business in the urban environment, proponents of local business are boosting sales in retail districts by looking for optimal ways to use public street space.

Increasing Retail Visibility and Sales Volume

In growing urban communities, connected bicycle facility networks encourage more people to ride bikes for everyday trips. And when people use bikes for errands, they're the ideal kind of retail customers: regulars. They stop by often and spend as much or more per month as people who arrive in cars. Plus, ten to fifteen customers who arrive by bike fit in the parking space of a customer who arrives in one car.



1 - Darren Ross, "Millenials Don't Care About Owning Cars, and Car Makers Can't Figure Out Why," Fast Coexist, Online: http://www.fastcoexist.com/3027876/millennials-dont-care-about-owning-cars-and-car-makers-cant-figure-out-why (Accessed 21 May 2014)

2 - Simultaneously, companies also recognize that investing in bicycle infrastructure is significantly cheaper than investing in parking lots. Cascade Bicycle Club, "Building Bike-Friendly," Online: http://www.cascade.org/2013/07/building-bike-friendly (Accessed 21 May 2014). See also Sanjah Bhatt, "Amazon Gives a Push to Biking Downtown," Seattle Times, Online: http://seattletimes.com/html/localnews/2021622545_amazoncycletracksxml.html (Accessed 21 May 2014).

3 - Mary Lauran Hall, "NYC Study Finds Protected Bicycle Lanes Boost Local Business," America Bikes Blog, Online: http://www.americabikes.org/nyc_study_finds_protected_bicycle_lanes_boost_local_business (Accessed 21 May 2014). See also Carolyn Szczepanski, "How Bicycles Bring Business," Momentum Magazine (29 April 2013), Online: http://momentummag.com/features/how-bicycles-bring-business/ (Accessed 21 May 2014).

4 - People for Bikes, "Statistics Library/Economic Statistics," Online: http://www.peopleforbikes.org/statistics/category/economic-statistics.

5 - Bikes Belong and Rails-to-Trails Conservancy, "Active Transportation for America," Online: http://www.railstotrails.org/resources/documents/whatwedo/atfa/atfa_20081020.pdf (Accessed 1 June 2014).

6 - Mandi Woodruff, "13 Reasons You Should Start Biking to Work," Business Insider, Online: http://www.businessinsider.com/13-reasons-you-should-bike-to-work-2012-10 (Accessed 1 June 2014).

7 - Bikes Belong and Rails-to-Trails Conservancy, "Active Transportation for America," Online: http://www.railstotrails.org/resources/documents/whatwedo/atfa/atfa_20081020.pdf (Accessed 1 June 2014).

8 - Mandi Woodruff, "13 Reasons You Should Start Biking to Work," Business Insider, Online: http://www.businessinsider.com/13-reasons-you-should-bike-to-work-2012-10 (Accessed 1 June 2014).

How to Use this Plan

What is the Bicycle Master Plan?

This planning document is developed to set the course for the next 20 years for the development, growth and connectivity of bicycle facilities in Phoenix. This plan is intended to provide a framework and projects for decision-making to greatly expand and improve bicycling facilities within Phoenix. These facilities will make it safer and easier for bicyclists to travel throughout the city and make connections to adjacent communities as a part of the regional bicycle transportation network. The intent of the plan is to identify specific actions for Phoenix to take, along with an implementation schedule, and provide quantifiable outcomes to measure the success in meeting the goals of the plan.

A goal in developing this plan is to make it compatible with other efforts currently underway such as the development of a Complete Streets Ordinance, the Downtown Phoenix Transportation Study, and the Reinvent Phoenix planning efforts. As such, there was considerable coordination between the development of this master plan and the other ongoing studies and nonmotorized enhancements. Further coordination will require greater cooperation between city departments.

The Phoenix Bicycle Master Plan is a comprehensive and collaborative effort that had considerable input from numerous city departments. While this plan was developed under the direction of the Street Transportation Department and the Phoenix Bicycle Coordinator, considerable input was also provided by the Police, Planning and Development Services, Parks and Recreation, and Transit Departments. These departments are a crucial part of the success of this plan. The lead consultant for this project is Lee Engineering, LLC, along with substantial guidance and support from subconsultants Charlier Associates, Inc. and Toole Design Group.

Even though this is a 20-year plan, it is fully recognized that this plan may be updated periodically during the 20-year planning horizon. Updates are needed to reflect changes in the community including growth, changes in population density or employment centers, and new developments; and to reflect updates in the AASHTO and NACTO bicycle facility design guides, ADOT or MAG policies, practices or guidelines, changes in laws, improvements in technology, and revisions to the Manual on Uniform Traffic Control Devices (MUTCD) and Arizona supplement.

This plan is intended to be flexible to allow the city to respond to changes in budget, development and other funding opportunities as they arise.

On his 100th day in office, Mayor Greg Stanton remarked, "we cannot be a great city without a great transportation system, and our current needs to grow. As your Mayor, I will support public transit whole heartedly including expansion of rail, bus, and multimodal forms of transportation - especially walkability and bikeability."

Why is the Bicycle Master Plan Important?

Bicycling promotes a healthy lifestyle, has an extremely small carbon footprint, and requires much less infrastructure or space for travel and parking compared to motor vehicle transportation. Currently, Phoenix lacks a comprehensive bicycle network that is fully connected with the community and other transportation networks (transit, airports). While over 700 miles of bicycle facilities exist within Phoenix along with 42 bicycle and pedestrian bridges/tunnels, the 596 on-street bicycle facility miles represents only a small fraction of the nearly 5,000 miles of street network in the city. Many of the bike facilities are not connected with other bicycle facilities or important destinations such as schools, universities, employment centers, shopping centers, transportation centers, or recreation facilities within Phoenix or in adjacent communities. Many bicycle facilities were built by developers as part of their off-site improvements and exist in segments along an arterial or collector street. At times, on-street bike lanes end several hundred feet in advance of a signalized intersection and reappear several hundred feet downstream from the traffic signal. This is not representative of a continuous connected bicycle facility, and is intimidating to inexperienced bicyclists.

A comprehensive and connected bicycle network will promote a healthier community and healthy transportation alternative for residents and visitors. This network and innovations such as bike share programs can greatly expand the number of bicyclists while helping to eliminate the demand for vehicle travel.

The Bicycle Master Plan is important to identify barriers to bicycling and provide solutions to eliminate those barriers. At times the barrier may be a missing bicycle facility or a gap in an existing bike facility. Other times the barrier may be an arterial street that is difficult to cross or a freeway or canal without a crossing. The lack of access to Sky Harbor Airport or other transportation centers is a barrier to bicycling for residents, airport employees and visitors to Phoenix. Other barriers may include the lack of safe and convenient parking facilities or the lack of shower facilities at employment centers.

TAC member Mark Melnychenko participates in exercise to establish a Vision for the Phoenix Bicycle Master Plan.

The inability for a bicyclist to put in a call at a traffic signal without having to get off their bicycle to use a pedestrian push button is another obstacle to a good bicycle system. Not only have numerous types and locations to barriers been identified, but numerous improvements have been recommended to overcome the barriers.

The Bicycle Master Plan is intended to make Phoenix a part of the regional bicycle network throughout the metropolitan area. Bicycle facilities should not end at the city limits and instead should connect to facilities in adjacent cities to provide access to destinations in adjacent communities for Phoenix residents and visitors. Furthermore, residents of adjacent communities should have good access to a multitude of destinations or recreational routes within Phoenix.

The Bicycle Master Plan provides new policies for bicycle facility design as well as a framework for implementation of those facilities. These policies include the design of facilities, traffic control practices and proposals for facilities at destinations, such as parking or shower facilities.

The adoption of a comprehensive bicycle master plan enables Phoenix to better compete for funding either through the Federal Government, when funding opportunities become available, or through the Maricopa Association of Governments (MAG). Since much of the transportation infrastructure is built by private developers, this plan will help to ensure bicycle facilities are constructed at the time parcels or site plans are developed. The plan enables city leaders to better plan for development of future support for funding proposals. Having a comprehensive bicycle master plan in place enables the public to understand what the funding request will provide and how the proposed facilities will fit into the overall bicycle network.

In short, a comprehensive bicycle master plan will help make Phoenix an even better place to live, work and play.

Technical Advisory Committee

A Technical Advisory Committee (TAC) was established to provide oversight from the various Phoenix departments who would provide input into the planning, design, operation and enforcement of bicycle facilities and users. In addition, agencies outside of Phoenix government that play a role in bicycle transportation or facilities within the city or in the regional bicycle network were also invited to participate on the TAC. These agencies consisted of:

- Valley Metro
- Cities of Tempe and Mesa
- Arizona State University (ASU)
- Downtown Phoenix Partnership
- Arizona Department of Transportation (ADOT)
- Maricopa Association of Governments (MAG)

The initial TAC meeting occurred on August 29, 2013, and subsequent meetings were held on November 4, 2013, November 20, 2013, March 20, 2014, and April 24, 2014. In addition to providing overall technical input and oversight to the master plan process, this committee participated in a workshop to establish a 20-year Vision for the Phoenix Bike Plan, and develop Goals for the bicycle system. The Vision and the Goals created from the TAC visioning workshop were later refined by the Ad Hoc Task Force.

Ad Hoc Task Force Meeting

Phoenix residents identify barriers and desired routes on a map at a community meeting.

Pedestrian and Biking Ad Hoc Task Force

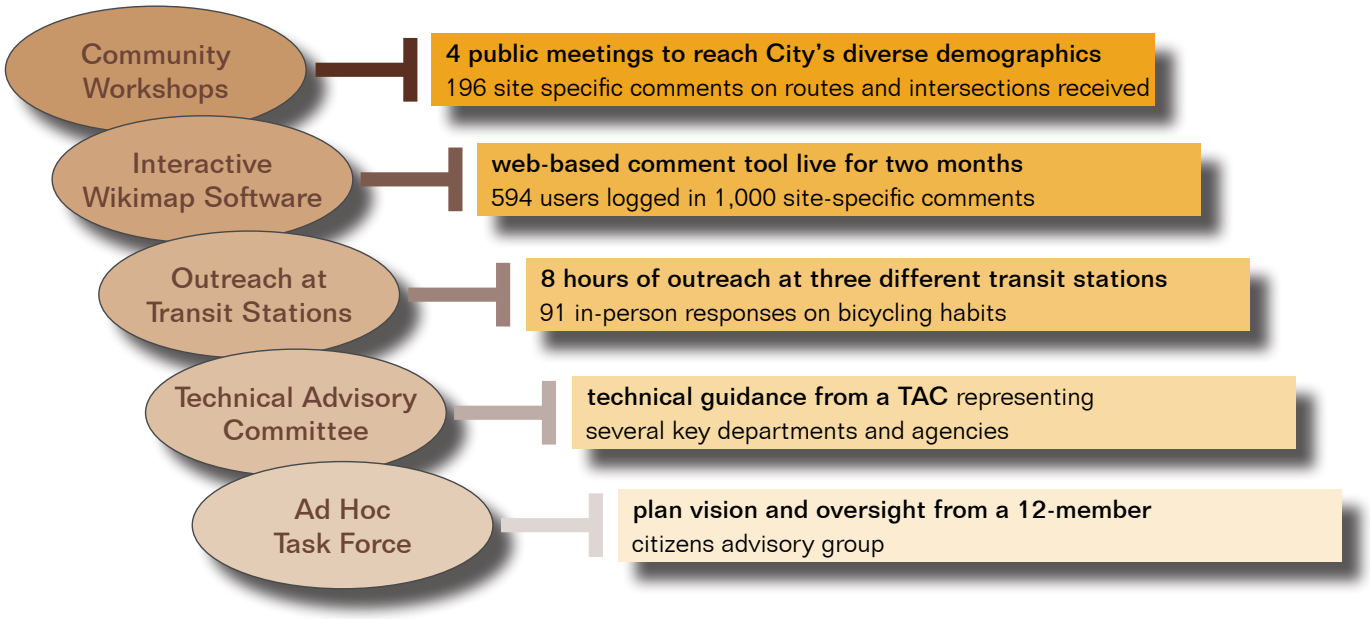
The success of this plan was enhanced by the input and guidance and of the city's residents and many bicycle advocates. Their expertise, experience, and creativity are invaluable in planning and developing improvements for our current and future bikeway system. As a means of incorporating these individuals into a cohesive group to help shape the future of our bikeway system, the Phoenix Office of the Mayor established a Pedestrian and Biking Ad Hoc Task Force that was charged with the following tasks:

1. Review past reports, data, maps and bike-related information provided by City staff
2. Help prepare the overall Vision for the 20-Year Master Bike Plan
3. Provide feedback and guidance to City staff and its Consultant on best methods for enhancing the Phoenix bikeway system including, but not limited to, improving infrastructure and facilities, policies and bike safety education
4. Assist the Consultant in the analysis of the bike-related community feedback
5. Attend project meetings to stay engaged on the development of the Plan
6. Provide feedback and oversight into the Bike Share program station locations and operation
7. Serve in an advisory capacity to City Council on proposed City initiatives and policies that enhance pedestrian and bicycling mobility, such as Complete Streets
8. Advise City staff and Council on methods and actions to improve pedestrian safety citywide

The Pedestrian and Biking Ad Hoc Task Force met the first and third week of every month beginning on December 5, 2013 and sunset after the June 5, 2014 meeting where the Bicycle Master Plan projects were approved.

Community Input

The bicycling vision for Phoenix was developed through a comprehensive process undertaken from July 2013 - June 2014. Extensive public and City staff input guided the development of the plan approach and content, which led to the overall theme of Making Connections. Highlights of the community outreach process included:



The community outreach strategy was to reach the City's diverse demographics, including transit-dependent groups, to engage bicyclists of all ages and abilities, as well as local Bicycle Advocacy groups. A detailed summary of the community outreach is provided in Appendix A.

Organization of Chapters

The remaining part of the Bicycle Master Plan is organized into nine chapters. Chapter 3-Plan Vision & Areas of Excellence presents the Vision developed for bicycling in Phoenix over the next 20 years. This chapter also describes the seven Areas of Excellence necessary to achieve the vision of a platinum-level bicycling community as defined by the League of American Bicyclists. Chapter 4-Past & Present describes a brief history of the bicycle system in Phoenix as well as the current status of the bicycle network.

Chapters 5 through 11 are structured around specific goals to achieve each Area of Excellence relating to the bicycle transportation system in Phoenix. Each goal has one or more specific and measurable objectives to monitor the progress of the system implementation. Each chapter is organized in the following manner:

- Background of Area of Excellence
- What Phoenix wants to accomplish
- How Phoenix will accomplish each goal

"What Phoenix wants to accomplish" is the goal and measurable objectives for each of the identified Area of Excellence. "How Phoenix will accomplish each goal" entails the implementation plan for each Area of Excellence. These Areas of Excellence are organized into the following chapters:

5. Policies & Perceptions
6. Opportunities & Investments
7. Equity & Efficiency
8. Safety
9. Design & Connectivity
10. Connections & Collaboration
11. Bikes & Transit

Plan Vision & Areas of Excellence

The Bicycle Master Plan is guided by the following Vision, developed by the Technical Advisory Committee and Ad Hoc Task Force and informed by community ideas.

In the next 20 years, Phoenix will be a Platinum-level Bicycle Friendly Community. It will be safe and easy to bike anywhere in the city. A well-connected infrastructure network will link people and places, making bicycling a preferred option for daily transportation, recreation, and healthy lifestyles.

This plan establishes direction to transform the City of Phoenix into a bicycle-friendly community over the next 20 years. The goal is to systematically improve levels of bicycle friendliness, as defined by the League of American Bicyclists' Bicycle Friendly Communities program. Phoenix received an Honorable Mention in 2011; the next goal is a Bronze Award, progressing up to the Platinum level as additional recommendations of the Bicycle Master Plan are implemented over time.

To achieve this vision, seven Areas of Excellence are necessary to a Platinum-level Bicycle Friendly Community were established. Each Area of Excellence is a focus of this plan. To help the City succeed in each of these areas, this plan includes specific goals, strategies, actions, and objectives. These Areas of Excellence will be incorporated into the five E's of the League of American Bicyclists.

GOAL: A desired, ultimate condition.

STRATEGY: Provides a framework for decision-making and actions to achieve a goal.

ACTION: A specific activity to achieve a goal.

OBJECTIVE: A measurable outcome occurring as a result of an action.

Areas of Excellence

Policies and Perceptions

Policies and Perceptions focus on the level of consideration given by the City in planning for bicycles and providing a safe, comfortable and accessible cycling environment in Phoenix.

Opportunities and Investments

As part of this planning process, bike corridors were prioritized based on a variety of factors. From this list, a series of bicycle facility improvements were recommended. This Area of Excellence identifies implementation and funding strategies for these facilities.

Equity and Efficiency

This Area of Excellence ensures that the City and its neighborhoods are accessible by bicycle, and that bicycle facilities are safe, fun, and convenient throughout Phoenix.

Safety

Safety is a primary consideration for implementing bicycle facilities in the City of Phoenix. It is also an important criteria for federal funding of transportation programs, which require performance-based and data-driven processes for developing and implementing projects. This Area of Excellence provides a five-year review of bicycle crashes in the City and discusses how Complete Streets increase safety for all road users.

Design and Connectivity

Because they are an important mode of transportation to provide connectivity, bicycle routes are located along existing arterial and collector streets and included in plans for new streets. This Area of Excellence focuses on ensuring the bicycle network is continuous so that it functions as a viable transportation mode. This section also includes a discussion of bicycle facility design, ensuring that the right facility is used in the appropriate location.

Connections and Collaboration

This section recognizes off-street and recreational routes as an integral piece of the regional bicycle system. Phoenix residents work and recreate throughout the region; and residents from outside Phoenix come to the City for the same reasons. This Area of Excellence discusses the opportunities for collaboration and partnerships with other agencies and adjoining cities to enhance regional bicycle connectivity and access.

Bikes and Transit

Every transit user is a pedestrian or bicyclist at some point on their trip. Public transit operates as a key part of the region's multimodal transportation system, working in tandem with walking, bicycling, and driving modes to provide commuters with multiple transportation choices. This Area of Excellence highlights multimodal initiatives and opportunities for bike-transit integration.

THE BUILDING BLOCKS OF A BICYCLE FRIENDLY COMMUNITY

SETTING THE STANDARD | MAKING PROGRESS | GETTING STARTED

produced by
THE LEAGUE OF AMERICAN BICYCLISTS
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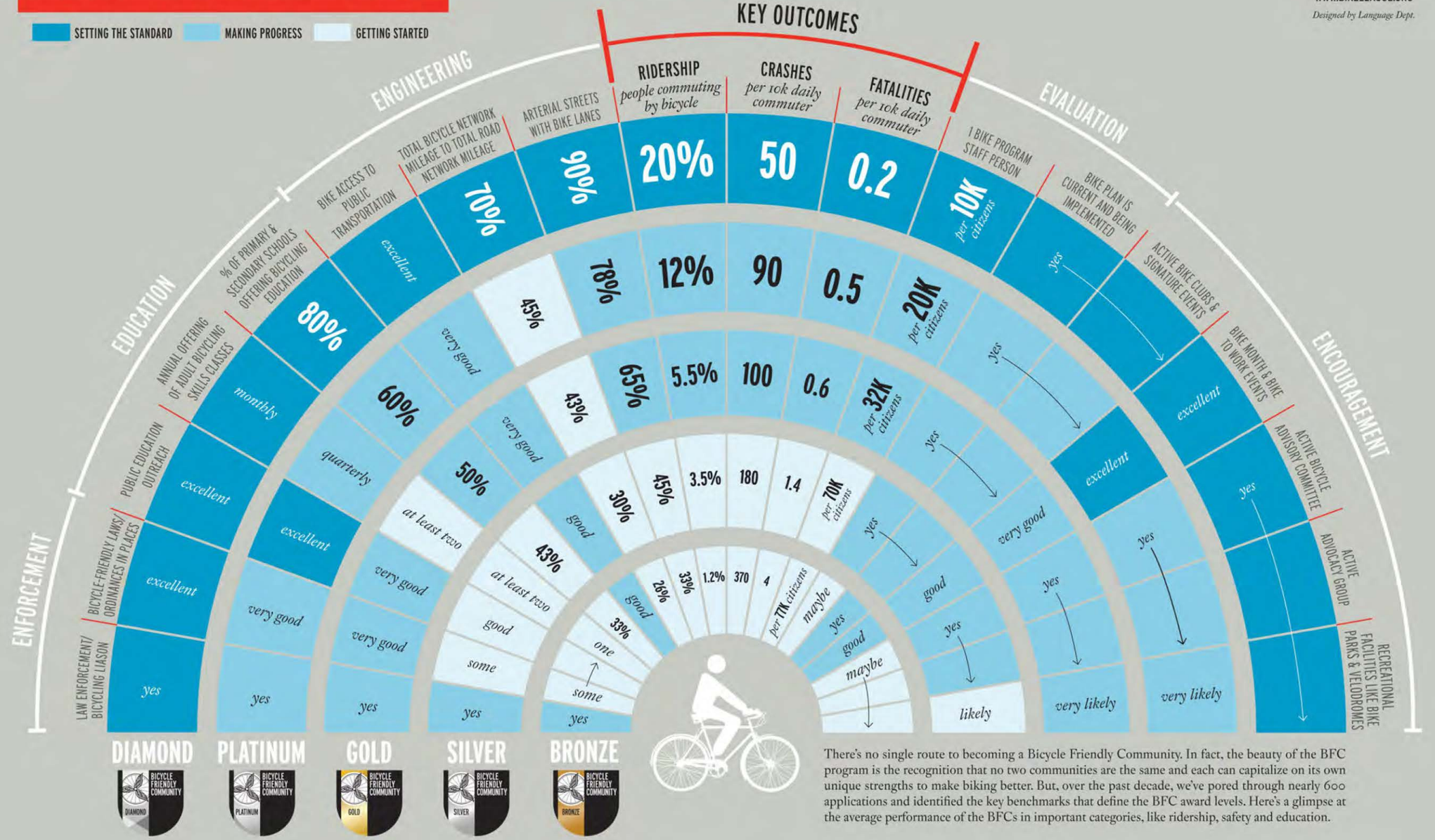

There's no single route to becoming a Bicycle Friendly Community. In fact, the beauty of the BFC program is the recognition that no two communities are the same and each can capitalize on its own unique strengths to make biking better. But, over the past decade, we've pored through nearly 600 applications and identified the key benchmarks that define the BFC award levels. Here's a glimpse at the average performance of the BFCs in important categories, like ridership, safety and education.

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Past & Present

Major Milestones

Phoenix first recognized the need to plan for bicycles almost 30 years ago. Accomplishments of the City to date include:

1985 Bicycle Task Force appointed

1987 Council approves initial 700-mile Phoenix bike system

1988 Bond program provides $2.9M for plan implementation over five years

1993 Built system reaches 360 miles

1995 Bicycling magazine ranked Phoenix as the 9th Best City in North America for bicyling

2002 Phoenix General Plan includes Bicycle Element

2009 City adopts bicycle standards as part of Street Planning & Design Guidelines

Environmental Quality Commission establishes a Bicycle Initiative Subcommittee to begin meeting monthly

2010 Re-established Bike Coordinator Position

2011 City receives an Honorable Mention award in the national Bicycle Friendly Communities program

2013 Reinvent PHX initiative looks at bicycling as sustainable transportation option within transit oriented development districts

2014 Comprehensive Bicycle Master Plan Developed

Building on the Past

The first step in developing this Comprehensive Bicycle Master Plan was to assess existing government policies and programs that support and impact bicycling as a mode of transportation. Eleven planning and policy documents were reviewed that directly relate to bicycling, six departmental interviews were conducted, and 14 regional and neighboring community bicycle plans were consulted.

Five basic types of bikeways are currently provided within the City of Phoenix:

- bicycle lanes
- bicycle boulevards
- shared use paths
- bicycle routes
- bikeable streets

Deputy City Manager Rick Naimark has served the City of Phoenix for more than 27 years. In early 2014, he volunteered as a tester for the pre-launch of the GR:D Bike Share program and logged the most miles and rides!

Phoenix Bikeways

BICYCLE LANES: Bikeways created by designating a portion of street (using pavement markings and signs) for exclusive use by bicyclists.

BICYCLE BOULEVARDS: Shared roadways that create an attractive, convenient, and comfortable cycling environment that is welcoming to cyclists of all ages and skill levels. Bicycle boulevards are low-volume, low-speed streets that have been optimized for bicycle travel through treatments such as traffic calming, traffic reduction, signage, pavement markings, and intersection crossing treatments. These treatments enable through movements for cyclists while discouraging similar through trips by non-local motorized traffic. One such treatment is shared-lane markings, among others.

SHARED-USE PATHS: Bikeways physically separated from motorized traffic and designed for shared use by bicycles, pedestrians, joggers, in-line skates, and other non-motorized modes of transportation. Paths may be along the highway right-of-way or within an entirely independent right-of-way (i.e., canal banks or through park land).

BICYCLE ROUTES: Bikeways designated by guide signing to indicate a trailblazed route, which is a shared facility either on-street (shared with cars) or on the sidewalk (shared with pedestrians).

BIKEABLE STREETS: Streets which connect with higher level bikeway facilities and can be acceptable for bicycle travel and are designated on a bikeable street map for bicyclist convenience. Bikeable streets are intended only as a guide and are generally local and collector streets which connect bike lanes or signed bike paths/routes.

Bicycle facilities fall into two functional categories: **recreational paths** within city parks, desert preserves, which are generally implemented and maintained by the Parks and Recreation Department; and **commuter/transportation-related facilities** located within street corridors under the jurisdiction of the Street Transportation Department and along canals under the jurisdiction of Salt River Project (SRP).

The Parks and Recreation Department is primarily responsible for planning and implementing recreational bikeways, and periodically publishing brochures showing recreational bikeways. Regional bike facility maps are normally available through the Maricopa Association of Governments (MAG) based on information provided by Phoenix. The Parks and Recreation Department is responsible for monitoring and maintaining recreational bikeways in city parks and off-road alignments. When the Parks and Recreation Department is unable to provide maintenance, they may refer signing deficiencies to the Traffic Services Division or surface problems to the Street Maintenance Division for repair. On-street routes (such as Third Avenue/Fifth Avenue one-way pair, 23rd Avenue, etc.) are monitored, maintained and operated by the Street Transportation Department.

Level terrain and good weather conditions for a majority of the year provide an ideal environment for bicyclists. Experienced bicyclists prefer to ride in the roadway with motor vehicles, and are normally equipped to do so. They ride at higher speeds and for longer distances, and by riding in the street, are governed by the laws for any other vehicle operator (where relevant). Experienced bicyclists typically do not ride on sidewalks along the street.

Bicycle Boulevard

Children or inexperienced bicyclists typically do not have the confidence or equipment to share arterial streets with higher speed motorized traffic. From a safety standpoint, it is advisable that these less experienced riders use sidewalks, local streets, collector streets, or separate bicycle paths instead of arterial streets. To encourage more experienced cyclists to use the street instead of sidewalks, city officials should design, install and maintain a system of continuous bicycle facilities throughout the city.

Snapshot of the Present

Levels of bicycle accommodation in Phoenix today may be summarized by examining the current status of the City's physical bicycle infrastructure and bicyclist ridership data.

Existing Programs, Activities, and Organizations

The following list highlights current programs, activities and organizations that support bicycling in Phoenix.

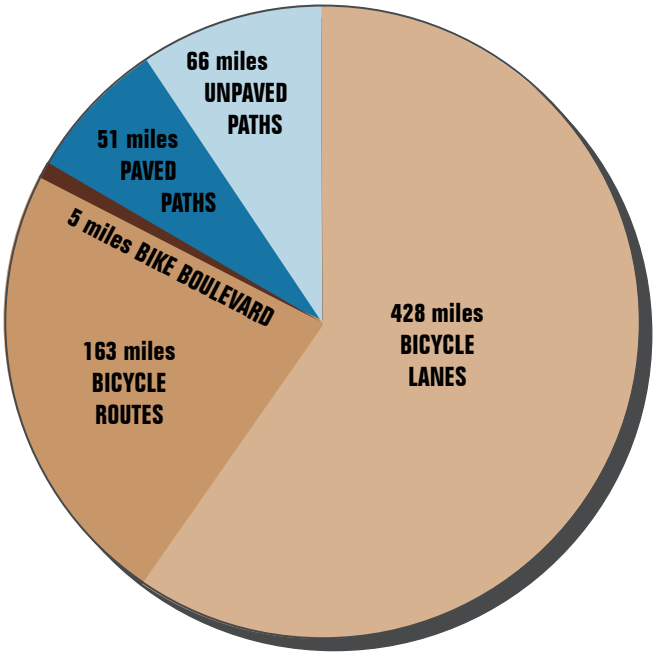
- City of Phoenix Bicycle Program web page
- City of Phoenix Bicycle Safety web page
- Phoenix Police Department Bicycle Safety web page
- Phoenix Police Department bicycle rodeos
- Valley Metro bike on bus and bike on LRT programs
- Phoenix Safe Routes to School program--The Phoenix Street Transportation Department Safe Routes to School (SRTS) Coordinator coordinates SRTS at the city-wide level. Duties include organizing bicycle rodeos and walk and bike to school days. 30-40 schools within the city participate every year.
- Maricopa Association of Governments (MAG) Safe Routes to School Program

Miles of Bikeways

As of January 2014, Phoenix has **713 total bikeway miles** comprised of:

- **596 miles** of on-street facilities
- **117 miles** of off-street paths
- includes 22 bike bridges and 20 bike tunnels

The City of Phoenix currently provides 0.48 miles of bicycle facilities per 1,000 residents, ranking 20th of 29 MAG member communities. A map of existing bicycle facilities is provided in Figures 4-1 and 4-2: Existing Bikeway Inventory.



Number of Cyclists

Limited tools are currently available to determine levels of bicycling in Phoenix. Three sources that can help track numbers of cyclists reveal the following:

- There are over 4,900 estimated bicycle commuters in Phoenix, representing 0.76% of all commuters, according to the U.S. Census 2011 American Community Survey. This number is up from the 2006 Census rate of 0.62% percent bicycle commuting.
- Work commute rates reported by the 2013 Maricopa County Trip Reduction Program Survey are slightly higher. Bicycling is used by 1.12% of commuters surveyed (1.47% of students; 1.04% of employees), with the <25 year old group most likely to bicycle, and men more likely to bike to work than women by a 3:1 ratio.
- More than 100 bicyclists per day were counted at 29% of locations on weekdays and 25% locations on weekends when the City of Phoenix conducted bicycle counts in the fall of 2013. The highest weekday count exceeded 270 bicyclists per day.
- Valley Metro Ridership data shows 897,000 bicyclists boarded buses in FY 2010/11 in Phoenix, which is about 2.7% of the total ridership in Phoenix.

FIG 4-1: Existing Bikeway Inventory (inset)

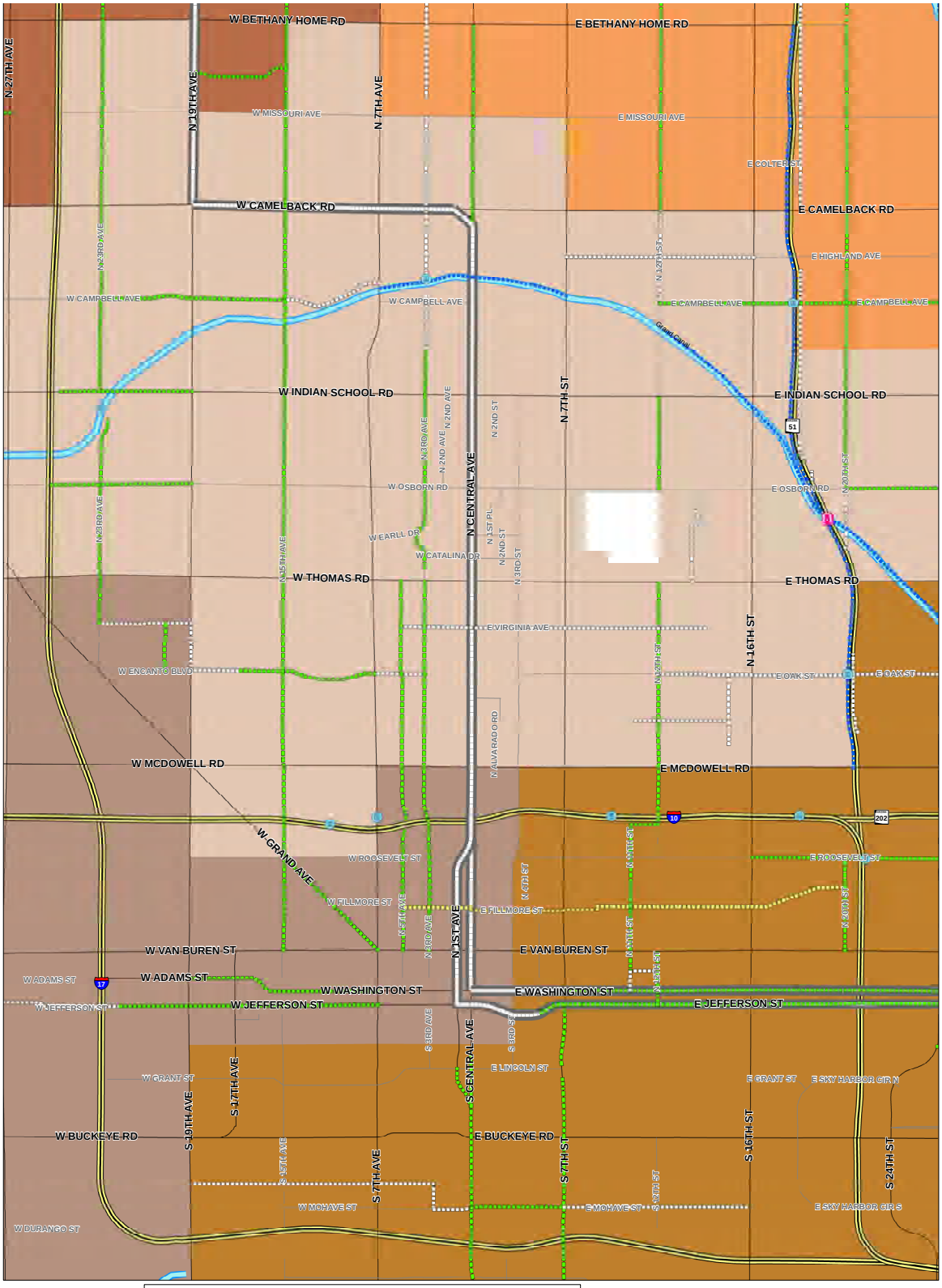
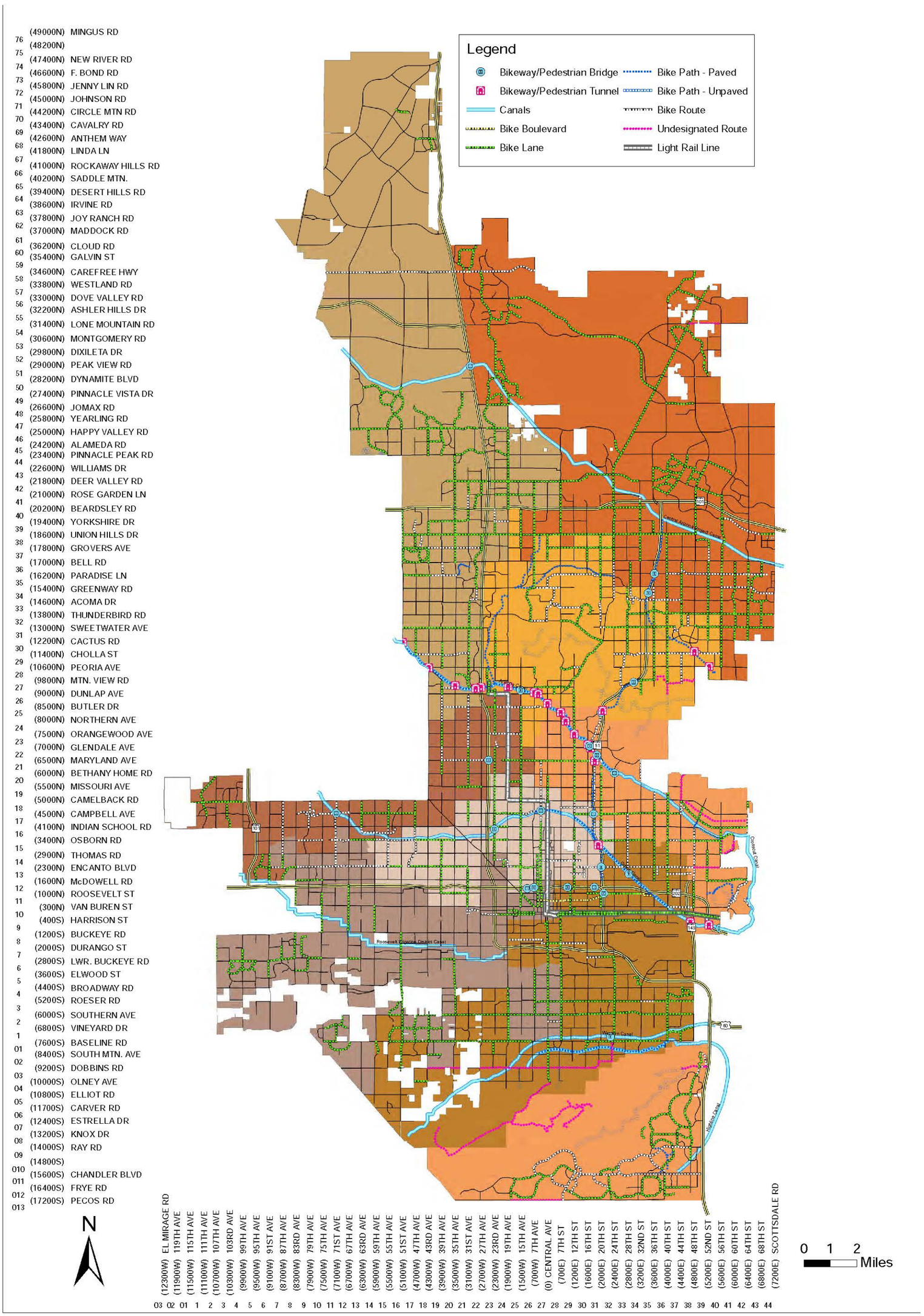


FIG 4-2: Existing Bikeway Inventory



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Bicycle lane usage (bicyclists/hour) at strategically selected locations throughout the city was counted by the City of Phoenix and MAG as part of their concurrent bicycle count project in the Fall of 2013. Appendix B: Bicycle Counts includes data collected by the City of Phoenix using pneumatic tubes, MAG Bicycle Count station location and technologies, and MAG Bicycle Count data for City of Phoenix sites. Additionally, maps of all bicycle count site locations are provided. Valley Metro counts of bikes on buses is discussed in Chapter 11-Bikes & Transit.

Historically, Phoenix has not counted bicycle traffic. These bicycle counts collected by MAG and by Phoenix in the Fall of 2013 represent baseline values to measure changes in the level of bicycling throughout the community in subsequent years. The Phoenix counts were all accomplished along streets with on-street bicycle lanes, and the locations were selected to supplement the MAG contractor counts and avoid duplication. The Phoenix counts were collected using pneumatic tubes stretched only across the bike lane to count all bicycles traveling in the bicycle lanes. In some cases, the count hoses also had to be placed across the sidewalk when the sidewalk was built adjacent to the curb. In these cases, bicyclists using the sidewalk are included in the on-street bike lane counts. There is no indication in the city database when the count hoses included counts of sidewalk bicycle traffic, and at times the sidewalk counts may be in only one direction. Since future bicycle studies at these locations will be accomplished in the same manner, this should not create an issue when comparing trend data.

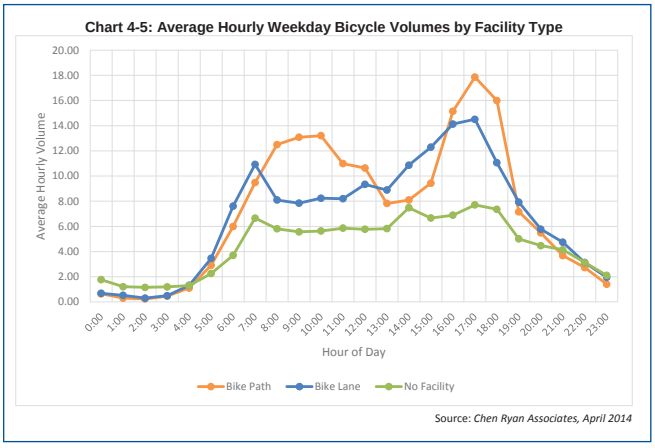


FIG 4-3: Average Hourly Weekend Bicycle Volumes by Facility Type in Maricopa County

The Phoenix count hoses were placed for a period of five consecutive days that included both weekend days. These counts were accomplished on days that avoided state or city holidays. Phoenix bicycle counts in the Appendix are summarized by average weekday and weekend numbers (per day), and the counts are available by direction of travel. While the weekend counts are more typically representative of recreational bicycling, several may be commute trips as well as other utility trips.

Fifty locations were selected for counting by Phoenix, and valid weekday counts were obtained for 49 locations for weekday and 48 weekend count locations (some locations were recounted in early 2014 to obtain valid numbers). Fourteen locations exceeded a bidirectional weekday count of 100 bicycles per day (29% of the locations studied), with the highest average weekday count on 23rd Avenue north of Townley Avenue of 272 bicycles per day. Fifteenth Avenue south of Fairmount Avenue resulted in an average count of 180 bicycles per weekday, while an average of 174 bicycles were counted on Osborn Road west of 30th Street per weekday. The highest weekday count along an arterial street was Union Hills Drive east of 45th Avenue (averaging 148 bicycle per day), and Southern Avenue east of 25th Lane (averaging 144 bicycle per day).

Average weekend bicycle counts are also shown in the table in Appendix B. Half of the 48 count locations experienced higher or virtually the same average count on the weekends as during weekdays. Twelve of the locations had counts exceeding 100 bicycles per day on the weekend. The highest weekend count was on Lafayette Boulevard west of 54th Place, with an average of 240 bicycles per day (averaging Saturday and Sunday). Chandler Boulevard (an arterial street) west of 14th Street experienced 197 bicyclists per day on the weekend.

These bicycle counts should be repeated biannually at these locations to track future bicycling levels and trends. In addition, the Phoenix video trailers may be used to conduct counts as well as long-term observations of bicyclist behavior, such as helmet use on a periodic basis at these locations or along off-road trails, such as the canal or park trails.

Automated bicycle counter installed on 44th Street, north of Thomas Road.

Maricopa County Trip Reduction Program

Community input reported that many routes are too stressful for most people due to lack of facilities, not enough space on roadways, and high traffic speeds. Public investment in bike-friendly infrastructure and more vibrant, people-oriented urban development will serve as catalysts in getting more people on bikes more often. However, focused efforts need to be made to reach out to those who currently do not consider themselves cyclists. The Maricopa County FY2013 Trip Reduction Program Annual Report indicates that men are more likely to bicycle than women by a 3:1 ratio, and people under age 25 are most likely to bike. Thus the goal is to make bicycling fun, safe, and effortless to increase usage by women, families, and others who have yet to enjoy daily health, social, and economic benefits of bicycling.

The Maricopa County Air Quality Department furnishes aggregate bicycling data by zip code to the Maricopa Association of Governments. FY2012 data was provided to Charlier Associates regarding commuters who ride bikes one or more days per week, and for people who are willing to make a change to their daily commute and switch to the bicycle option. This last data set has been mapped to examine areas of latent demand for use in project prioritization. The maps, listed below and discussed in the following paragraphs are provided in Appendix C:

- 1a - Commute Trip Origins
- 1b - Major Employment Destinations
- 2a - Latent Demand Commuting – Within A Zip Code
- 2b - Latent Demand Commuting – Between Zip Codes
- 2c - Latent Demand Commuting – To/From Adjacent Communities

Two maps have been generated using MAG FY2012 data to compare potential bicycling origins and destinations within the City of Phoenix. Map 1A shows zip codes with high demand (>200 residents interested in bike commuting). Map 1B shows location of major employment site destinations by zip code. Per the Trip Reduction Program survey responses, desired access is very high (>1000 expressions of interest) for people wishing to reach school/employment destinations located in zip codes 85027, 85021, 80534, and 85040. These geographically represent the village planning areas within the Deer Valley, North Mountain, Central City, and South Mountain villages.

The FY2012 data set was also analyzed to determine where new bicycle work/school trips are most desired. Of 1,482 TRP survey respondents expressing an interest in commuter bicycling, responses have been mapped to show where more than 50 people, and more than 100 people, desire to make a bicycle trip. Map 2A depicts short-distance trips internal to a zip code. Map 2B depicts longer trips desired to be made between zip codes. Most of these trips are likely less than 5 miles in length and within easy riding distance if bicycle facilities are provided. In addition, Map 2C depicts the locations of commute trips between Phoenix zip codes and surrounding communities that are desired to be accomplished on bike.

In summary, the latent demand map series demonstrates that a long-distance north/south bicycle commuter corridor(s) is highly desired on the eastern side of Phoenix from, generally, the South Mountain Park open space lands, around the Sky Harbor International Airport, continuing north to the Camelback East Village area. A second major area of need is within the Deer Valley Village area. Regional connections that may be prioritized according to highest latent demand include bikeways connecting the City of Phoenix with the adjacent communities of Glendale and Tempe.

Identify Bicycle System Obstacles and Gaps

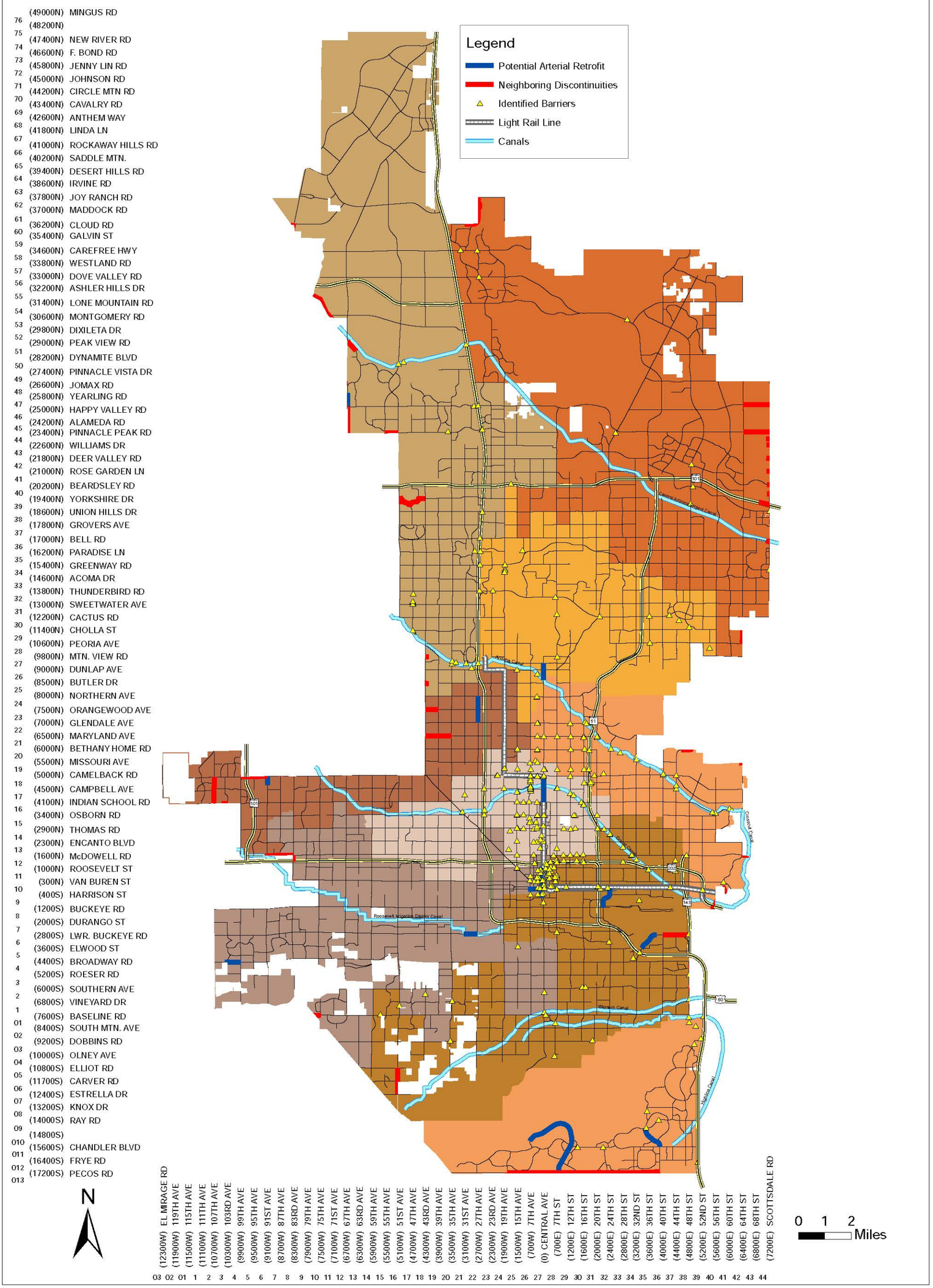
Lee Engineering reviewed existing bicycle facilities using city-provided bike data to identify bicycle system obstacles and gaps including:

- Barriers to bicycling as identified by the public
- Missing links from Phoenix to/from bicycle facilities in neighboring cities and towns
- Arterial street segments with potential to retrofit bicycle lanes within the existing cross-section

The maps that follow show locations identified as barriers to bicycling. The map also depicts where bicycle facilities are not continuous with adjacent agencies, lack of bicycle facilities on the arterial street network, and locations with potential for retrofit.

The City of Phoenix incorporates bicycle facilities on the street network by designing new roadways with bicycle facilities, restriping existing street right-of-way to accommodate bicycle lanes, and implementing road diets.

FIG 4-3: Key Gaps in Bike Network



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RECOMMENDATIONS

STRATEGY:

- Measure changes in the level of bicycling throughout the community.

ACTION:

- Conduct biannual bicycle counts.
- Analyze Maricopa County Trip Reduction Survey data annually and suggest adding survey questions to enhance bike to work data.

OBJECTIVE:

- Seek funding to add bike facilities and improve connections with Glendale and Tempe based on this data.

STRATEGY:

- Continue monitoring condition and extent of bike facilities throughout the City.

ACTION:

- Develop interactive smart phone application for bicycle facility inventory and reporting.

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Policies & Perceptions

GOAL:

A strong bike culture will be the norm, not the exception, as reflected in government organization, community, and individual actions.

Public policy will be connected with the desire to have more people riding bikes, more often. Bicycling will be easy, safe convenient, fun, and an accepted mode of transportation and recreation.

The past decades have seen a ultural shift on how bicycling is perceived. It is a goal that bicycling in Phoenix will be:

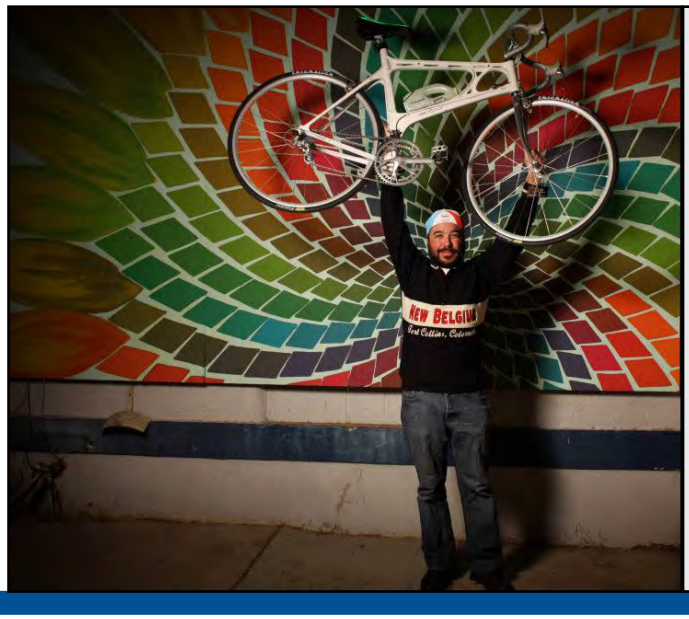
- a viable mode of transportation for those who cannot or choose not to drive;
- recognized as the norm
- an integral component of an accessible public transit system; and
- viewed as a means to enhance the quality of life and accessibility of a community.

This chapter discusses opportunities and constraints as reflected in government actions to institutionalize bicycle friendly practices into the city's transportation planning processes.

Current Conditions

There are several City departments and regional and statewide agencies engaged in bicycle planning and/or directly impacted by implementation of bicycle friendly policies. Additionally, bicycle paths on regional transportation routes such as State highways and some regionally important roadways must be coordinated with relevant agencies and entities. It is important that these agencies support Phoenix's vision to be a Platinum Level Bicycle Friendly community by 2034. To date, many of the agencies and entities that are engaged in bicycle planning throughout Phoenix and the region have developed specific plans and policies that provide them with guidance to support the development of bicycle facilities. These plans and policies are listed in Table 5-1: Existing Bicycle Plans and Policies.

In 2008, the City of Phoenix Street Transportation Department identified $19 million in unfunded bicycle of transportation program needs. Identified projects included bike structures, shared use paths, safety projects, major and street improvement projects to accommodate bicycles, bike lane retrofit projects, and bike program operations. To date, some of these needs are still unfunded with an additional $52.7 million identified to complete the priority corridor projects of this Master Plan.



City Bicycle Coordinator Joseph Perez is a bicycle enthusiast and works to make sure that new infrastructure is implemented to make riding safer. Joe subscribes to the Gil Penalosa philosophy that bike infrastructure should make bicycling inviting for everyone aged 8 to 80. He says, "I also fell in love with bicycling because it's efficient and powerful and you can do it by yourself or with other people. I love riding in groups because you feel very connected with the people around you, and you notice things that you wouldn't notice in a car. I feel a strong and deep sense of community and togetherness."

TABLE 5-1: Existing Bicycle Plans and Policies

Plan/Policy/ Standard	Enforcing Entity	Summary
MUTCD	Federal Highway Administration (FHWA)	Provides legal requirements and options for traffic control devices for bicycle facilities and operations.
AASHTO Guide for Design of Bicycle Facilities	American Association of State Transportation Agencies (AASHTO)	Provides design guidance for bicycle transportation facilities as adopted by state agencies.
NACTO Urban Street Design Guide	National Association of City Transportation officials	Charts the design principles and strategies that cities are adopting to confront 21st Century demands on their streets.
NACTO Urban Bikeway Design Guide	National Association of City Transportation officials	Provides design guidance and options for bicycle transportation facilities as adopted by an organization of cities.
City of Phoenix (2002). Phoenix General Plan – Bicycling Element.	City of Phoenix	The Bicycling element sets forth goals, policies, and recommended programs that will help enhance bicycle facilities within the City of Phoenix. The three goals are- Bicycle access: increase bicycle access to destinations in Phoenix and maximize bike route connections to other cities; Ridership: increase bicycle ridership by removing barriers, improving facilities and providing more information; Safety: improve bicycling safety through more education, better signage and installation of more safety features. Includes the Planned Bikeway System Approved 1987 consisting of approximately 588 miles of bike facilities.
City of Phoenix (2009). City of Phoenix Street Planning and Design Guidelines. Chapter 10– Bikeways.	City of Phoenix	These standards are for planning and designing both on- and off-street types of bikeways within the City of Phoenix. It contains detailed information on the location of bikeways and the signs and markings for each type. Guidance for bikeways affected by construction and a list of maintenance responsibilities is provided. National, regional, and local design standards to be used in conjunction with this document are listed.
2012 City of Phoenix Supplement to 2012 MAG Uniform Standard Specifications	City of Phoenix	These Specifications are developed for public works construction within the City of Phoenix and include construction of improvements that will be owned and/or maintained by the City of Phoenix. These Specifications are not intended to supersede the City of Phoenix Construction Code, or any other applicable law, or ordinance. Multi-Use Trails shall allow bicycle use with tread and surface conditions that allow side-by-side travel and ease of passing by bicycles.
City of Phoenix (2011). Traffic Operations Handbook. Chapter 5 – Pedestrians and Bicyclists	City of Phoenix	The purpose of this chapter is to provide guidelines on the design and operation of bike facilities. The definition of bicycles and requirements on bicycle equipment and usage, by law, is provided. Four types of bikeways and two functional types are defined. The procedure for installing bicycle racks is detailed. Several portions of this handbook chapter are pending in draft form.

Plan/Policy/ Standard	Enforcing Entity	Summary
City of Phoenix (additions and revisions in 1997 and 2003). City of Phoenix Zoning Code(Canal Design Guidelines).	City of Phoenix	These Canal Bank Design Guidelines applies to all development in the City of Phoenix on both public and private land adjacent to Highline, Grand, Arizona, and Western canals which is subject to development review. It states that canal banks be a primary component of pedestrian, bicycle, and equestrian pathways. There is mention of cyclists in regards to safety where canals cross arterials and adjacent to power easements.
Perez, J. (2012). Bicycle Minimum Green Times at Signalized Intersections.		This internal memorandum provides a methodology for calculating minimum green times based on street width, speed limits, yellow and red time to accommodate bicyclists stopped at a signal. Bicycle minimum green times can be as low as 4.9 seconds to cross a 40 foot road and as high as 9.7 seconds to cross a 132 foot road. It is recommended that a bicyclist be present to test any changes to signal timing, especially at wider intersections. Look-up tables are included.
Perez, J. (2012). Bicycle Acceleration at Signalized Intersections.		This paper reviews the FHWA publication Characteristics of Emerging Road Users and Their Safety, which analyzes performance characteristics of human powered objects, including bicycles. The FHWA report provides a table of distance versus observed times for various user types. An important observation is that hand cyclists, entitled to use bike lanes, do not meet the lowest bicycle acceleration rate suggested for use in AASHTO guidelines. The City of Phoenix allows engineering judgment to determine whether to use the AASHTO equation (with the recommendation of using a bicycle acceleration rate of 1.5 ft/s^2) or the FHWA table for hand cyclists to calculate minimum green time.
Perez, J. (2013). Bicycle Detection at Traffic Signals. Perez, J. (2011). Bicycle Detection at Traffic Signals.		These papers discuss different technologies for bicycle detection at intersections for the City of Phoenix and neighboring cities. Information regarding the Bicycle Detector Pavement Marking and Bicycle Signal Actuation Sign (R10-22) is provided. Information regarding Bicycle Push Buttons, Bicycle Signal Heads, Bicycle Boulevard Intersection needs, Bicycle Detector Pavement Markings and Bicycle Signal Actuation Signs are provided. References are listed.
City of Phoenix (2007). Traffic Barricade Manual.	City of Phoenix	This 2007 edition of the Traffic Barricade Manual was developed based on the field experience of the city's most experienced traffic control inspectors and professional traffic engineers. The primary goal of the TBM is to provide guidance for implementing the most effective temporary traffic control in our urban public streets and complement the Arizona Manual on Uniform Traffic Control Devices, and includes guidance for bicycles in temporary traffic control zones.
Phoenix Code. Chapter 36 Vehicles and Traffic. Article IX. Bicycles	City of Phoenix	Chapter 36 Vehicles and Traffic, Article IX, includes legal requirements for bicycle licensing, operating a bicycle, bicycle parking, and the disposition of abandoned bicycles.

Development of the Phoenix Bicycle Master Plan included reviewing and assessing existing Phoenix policies, practices, and procedures for traffic control and bicycle facility design with respect to the standards and guidelines published by AASHTO, MUTCD, and NACTO.

Recommendations were developed based the review and assessment described above. General recommendations addressing the City of Phoenix's bicycle facility design and traffic control guidance is provided in the objectives of this Area of Excellence. These should be taken into account when the City updates the documents listed Table 5-1 or develops new guidelines addressing bicycle facility design or traffic control. A detailed assessment of each of the documents reviewed is provided in Appendix D.

Design options, organized into the following categories, are provided in Chapter 9-Design & Connectivity:

- Design options for roadway segments
- Design options for intersections
- Off-street design options
- Design options for bicycle parking
- Wayfinding

Roles and Responsibilities of Other Agencies and Private Sector

It is largely the responsibility of various city departments to plan, design and operate the bicycle network in Phoenix. Phoenix will also be involved in enforcement and education activities. While much of the funding for the construction and operations may come from city government, through the proper application of zoning ordinances a large part of the infrastructure may be provided through developer improvements. Additionally, there is a need for public/private involvement and coordination with the State and regional agencies for planning and implement of regional bicycle facilities.

- **Phoenix Street Transportation Department:** Plan, design, build, operate and maintain bicycle facilities in the public rights-of-way. The Street Transportation is also involved in education and encouragement activities (promoting bike to school and bike to work events, and promoting helmet use and educating young cyclists). Explore bicycle facility funding opportunities through grants.
- **Planning and Development Services Department:** Plan and provide design guidelines for bicycle facilities. Ensure developers provide the facilities required through ordinances or as indicated in the bike master plan.
- **Phoenix Bicycling Initiative Subcommittee:** Established to get more people on bikes more often and works to improve resource efficiency, air quality, public health, safety and welfare.
- **Police Department:** Enforce traffic laws and ordinances for the rules of the road for motorists and bicyclists, and assists in providing education to drivers and bicyclists. Assists in major bike events and bicycle rodeos in Phoenix. Completes Arizona crashes for all motor vehicle collisions involving bicycles.
- **Parks and Recreation Department:** Plan, design, operate and maintain bicycle facilities within the phoenix parks system.
- **Phoenix Council/Mayor's Office:** Promote bicycling and bicycle facility development and help to coordinate information outreach to their constituents.
- **Downtown Phoenix Partnership, Inc. (DDP:** A nonprofit organization funded by an assessment on property owners within the 90-square-block area of the Downtown Phoenix Business Improvement District. The boundaries for this district are Seventh Street on the east to Third Avenue on the west, and Fillmore Street on the north to the Union Pacific tracks (south of Jackson Street) on the south. Some of their activities include: streetscape and urban design, transportation and parking coordination, branding, public relations, and Public Policy Facilitation for their district.
- **ADOT:** Prepares statewide bicycle plan. Coordinates bicycling design guidelines and standards throughout the state. Provides AHUR funding and oversees HSIP and other Federal grant programs that may be used for bicycle infrastructure improvements and safety projects.
- **MAG Bicycle and Pedestrian Committee:** Consists of regional member agencies as well as the development, architecture, landscape architecture communities, Valley Metro and the Coalition of Arizona Bicyclists. Earlier versions of the committee developed a Regional Bicycle Plan, the Regional Off-Street System Plan, and the Regional Bikeways Map. The committee encourages the implementation of these plans by recommending pedestrian and bicycle-related projects for funding from federal and other sources as well as activities to inform the region about the benefits of biking and walking.
- **MAG Transportation Safety Committee:** Provides school crossing guard training and oversees Safe Route to School grant applications in the MAG planning area.

- **Valley Metro:** The Regional Public Transportation Authority (RPTA) operates the regional bus system and light rail transit (LRT) system. They accommodate bicycle travel by providing bike racks on all buses and allow bicycles to board light rail trains to extend the range of bicycling across the valley. Provides education on how to use the bus bike racks. Bicycle parking storage is provided at a number of transit centers and some major stations.
- **Arizona Governor's Office of Highway Safety (GOHS):** Provides funding to agencies throughout Arizona to promote bicycle safety, including funds to purchase bike helmets for low income school children in support of Bike to School events and Bike rodeos
- **Salt River Project (SRP):** Through an IGA, allows the maintenance roads along the SRP irrigation canals to be used for walking and bicycling.
- **Coalition of Arizona Bicyclists (CAB):** Promotes efforts that improve bicycling usage and safety within the state of Arizona by addressing law enforcement and transportation engineering issues through education, outreach and advocacy programs thereby enhancing the role of bicycling in local, county and statewide transportation plans.
- **Phoenix Spokes People:** A community of urban bicyclists dedicated to making the downtown Phoenix area a friendlier, more welcoming place to ride a bike regardless of age, gender, race, income or bicycling ability, with a mission of inspiring cycling as a transportation option for Phoenix.
- **Private Developers/Homeowner Associations:** Provide bicycle infrastructure in the right of way or on private property within their development (as required by the zoning ordinance, general plan or desire to provide a bicycle-friendly environment for their community) and operate and maintain the bicycle facilities on their private property
- **ASU:** Operates two major campuses in Phoenix; Downtown campus and the West campus that are major generators of bicycle transportation. Provides bicycle parking at various locations on their campuses.
- **Other Universities, Colleges and Schools within Phoenix:** Generate bicycle traffic and must provide a safe route to enter their facilities and bicycle storage for their faculty and students.

RECOMMENDATIONS

GOAL:

- A strong bike culture will be the norm, not the exception, as reflected in government organization, community, and individual actions. Public policy will be connected with the desire to have more people riding bikes more often. Bicycling will be easy, safe, convenient, fun, and an accepted mode of transportation and recreation.

STRATEGY:

- Review and update of City policies, procedures, codes, ordinances, guidelines, and standards to promote bicycle safety and facilities.

ACTION:

- By 2015, review and update 100% of documents, and then biannually thereafter Guidance on bicycle facility design and traffic control should be consistent across all City of Phoenix guidance documents.

OBJECTIVE:

- Guidance on bicycle facility design and traffic control should reference the most up-to-date standards and guidance provided by the MUTCD with the Arizona Supplement and guidance provided by AASHTO and NACTO.
- Guidance on bicycle facility design should allow for flexibility in design, sensitivity to roadway context, and the application of engineering judgment.
- Guidance on bicycle facility design and traffic control should allow for innovative bicycle facilities.
- Guidance on bicycle facility design should recommend separated facilities like cycle tracks and buffered bicycle lanes that accommodate users of all ages and abilities, where feasible.
- Guidance on bicycle facility design and traffic control should address bicycle accommodation and bicycle facilities at intersections.
- Guidance on bicycle facility design should include cross sections with typical widths for bicycle and pedestrian facilities and travel lanes.

STRATEGY:

- Achieve Platinum-level Bicycle Friendly Community Status from the League of American Bicyclists .

OBJECTIVE:

- By 2019, receive Bronze Bicycle Friendly Community award
- By 2024, receive Silver Bicycle Friendly Community award
- By 2029, receive Gold Bicycle Friendly Community award
- By 2034, receive Platinum Bicycle Friendly Community award.

STRATEGY:

- Broaden the responsibility for creating a bicycle -friendly community among engaged and impacted City Departments.

ACTION:

- Create an interdepartmental bicycle Task Force to plan for, fund, manage and maintain bicycle facilities.
- Establish and promote City of Phoenix as a bicycle friendly community.
- Promote federal tax incentives for "bike to work."
- Pursue federal grants through the National Endowment for the Arts that could be applied for "Functional Art" - art that can be used as shade structures. ADOT, MAG, Street Transportation Department, along with trained members of the Police bike patrol should assist in educating other police officers on bicycle laws, ordinances and operating characteristics, especially motor officers and those involved in filling out crash reports. The League of American Bicyclists or FHWA can provide training expertise in this effort .
- The Police department should partner with the Street Transportation Department on reporting deficiencies within the street network that may have an adverse effect on bicycling, such as pot holes, missing or damaged signs, worn pavement markings, landscaping blocking visibility or encroaching into a bike lanes, and streetlight outages along city streets. Routine requests can be reported via Intradepartmental Service Requests (SSRs), or be reported via email or by phone to a Street Transportation dispatcher.
- The Street Transportation Department should partner with the Planning and Development Services Department on future bicycle facility infrastructure and implementation involving individual site plans as well as master plan developments. The Street Transportation Department should partner with the Aviation and Transit Departments and Valley Metro on improved means for bicycle access and bicycle parking facilities at the airports and at various transit centers.
- The Street Transportation Department should partner with the Transit Department and Valley Metro to count how many patrons with bikes cannot be accommodated on buses (along with the number who currently ride on buses).
- The various divisions within the Street Transportation Department should coordinate with the Phoenix Bike Coordinator on bicycle facility design and operation practices and guidelines, the street overlay program, striping changes, the CIP, and other issues within the department that would affect the bicycle system or program.
- The Street Transportation Department should continue to partner with the Police and City Council offices, GOHS, local health agencies/ bike advocates and schools to sponsor bicycle rodeos and promote bike to school day events to encourage bicycling at a young age and to educate the young bicyclists.
- The Street Transportation Department should partner with the Parks and Recreation Department to identify opportunities to provide improved connections between on-street bicycle facilities with off-street trails/paths and to explore trailblazing and other guide signing for off-road trails.
- The Phoenix Street Transportation Department should partner with the Downtown Phoenix Partnership and representatives of the ASU Downtown campus and Valley Metro to explore improvements in the bicycle network, bicycle connections and parking facilities in the downtown area, and identify optimal Bike Share station locations. These same agencies should partner to promote and educate new users when the Bike Share becomes available to the public.
- The Street Transportation Department and Police should partner with Channel 11 and other media outlets (such as radio traffic alerts) to provide bicycle safety PSAs and other educational outreach to motorists and bicyclists

- The Street Transportation, Planning and Development Services, Police, and Law Departments should partner to review the zoning and traffic ordinances to make them more Bicycle Friendly and promote the addition of improved/additional bicycle facilities with new development or redevelopment.

STRATEGY:

- Strengthen regional transportation planning coordination with state and regional governmental agencies and public services providers.

ACTION:

- ADOT, MAG, RPTA, SRP, Maricopa County, adjoining cities The City of Phoenix Street Transportation Department and Police Department should partner with bicycle advocacy organizations and health organizations for improved bicycle education.
- The Street Transportation Department should continue to partner with ADOT to apply for HSIP or other grants that may be used to provide bicycle safety improvements.
- The Street Transportation Department should partner with MAG and local advocacy groups to conduct regular Cyclovia events.
- The Street Transportation Department should continue to participate on the MAG Bicycle and Pedestrian Committee and the Transportation Safety Committee to coordinate implementation of regional bicycle facilities and to explore the possibility of obtaining MAG Design Assistance funds for bicycle enhancements and improved regional facility connectivity. A partnership should continue with MAG to provide future bicycle ridership count studies in future years to monitor ridership.
- The Street Transportation Department should partner with SRP to provide paved canal paths along all of the SRP irrigation canals and provide more canal crossing opportunities.
- The Street Transportation Department should partner with bicycle organizations, businesses, schools, HOAs and members of the community to create an "Adopt-A Bike-Route" program to clean (trash removal) and better monitor bicycle facilities, especially for off-street routes.
- The Street Transportation Department should partner with ADOT to explore additional opportunities to provide bicycle crossings across the freeways in Phoenix, both at-grade crossings and with bicycle/pedestrian bridges such as along the Grand Canal path and at other locations.
- The Parks and Recreation and Street Transportation Departments should partner with ADOT to assure the addition of a bicycle path along the proposed SR202 Loop South Mountain freeway.

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CHAPTER 6

Opportunities & Investments

GOAL:

Investments made for bicycling will be smart, focused, and equitable.

The City of Phoenix will leverage existing assets and create partnerships with local, county, and state agencies to build out the bicycle infrastructure network.

Why Focus on Smart, Focused, and Equitable Investments

Many communities – Phoenix included – began bikeway implementation in areas where pilot projects could be built at low to moderate costs, with community backing and support, as opportunities arose. Other bike facilities were built as developer offsite improvements or with individual major street improvement projects. The result is a collection of individual bikeway segments that do not provide the network connectivity desired by cyclists who wish to ride for transportation or longer-distance recreational pursuits. Second generation bicycle plans therefore often look at how to overcome travel barriers and complete missing gaps in a community's bicycle network. The challenge is determining where to start when many diverse and worthy projects combine to form the long-range bicycling vision of a community.

Bikeway Prioritization Process

With limited resources to commit, the City identified and prioritized 39 corridors to focus future bicycle infrastructure investments. The roster of prioritized corridors is provided in the following pages. A variety of on-street and off-road bicycle projects were identified to complete gaps and make connections within these corridors. These projects have been prioritized using a methodology that reflects community values, builds upon best practices in bikeway planning, and takes advantage of the latest national research on safety and other issues. The outcome is a three-tiered approach to implement projects over short, medium, and long-term planning horizons.

FIG 6-1: Iterative Approach to Using the Bicycle Corridor/Project Prioritization Methodology

The City of Phoenix Bicycle Master Plan served as a national pilot methodology for evaluating corridors and selecting bicycle improvement projects. Figure 6-1 summarizes the iterative approach of this methodology. Appendix E: Prioritization Methodology details the methodology used. Factors such as demand, connectivity, stakeholder input, safety, existing conditions, constraints, and equity were weighted and used to develop a ranked list of prioritized projects. The initial phase of recommendations will be implemented as part of the five-year Capital Improvement Program (CIP); projects associated with Tier II and Tier III corridors will be addressed in future years of bike plan implementation. Implementation of all priority corridor projects will result in 351 miles of seamlessly connected bikeways focused in areas with high bicycling demand to equitably serve the citizens of Phoenix. The planning level unit cost estimates established for the various types of bicycle facility improvement projects are provided in Appendix F. In total, the City of Phoenix will seek $52.7 million in funding for these projects.

The prioritized roster of Tier I, Tier II, and Tier III projects are provided in Appendix G, Appendix H, and Appendix I, respectively. Bike projects range from extending the bike lane to the intersection to providing on-street bike lanes, or shared lane markings to a bicycle bridge over I-17. Each has their own unique cost, and the costs developed for the Phoenix Bike Master Plan are considered "planning level costs" that may vary based on individual characteristics at a site. Except for the proposed bicycle bridge over I-17 and the paving of the SRP or CAP canal paths, all bike lane projects are proposed to be built within existing right-of-way.

Tier I Corridors

Completion of Tier I corridor projects will add 32 miles of bikeways and improve bicycle safety and mobility through 50 intersections. The planning level in-house cost estimate to implement these projects is $4,031,000. The highest priority corridors for implementation include the following, in order ranked:

1. **3rd Street**
   from Indian School Road to Buckeye Road
2. **24th Street**
   from Van Buren Street to Baseline Road
3. **Central Avenue**
   from Mountain View Road to South Mountain Park
4. **20th Street**
   from Grand Canal Trail to Glendale Avenue
5. **Osborn Road**
   from I-17 to 40th Street
6. **12th Street**
   from Mountain View Road to Washington Street
7. **15th Avenue**
   from Dunlap Avenue to Jefferson Street
8. **Washington/Jefferson Streets**
   one-way pair from 27th Avenue to 56th Street
9. **Reinvent Phoenix Gateway Bicycle Infrastructure and Intersection Projects**
10. **Reinvent Phoenix Eastlake Bicycle Infrastructure and Intersection Projects**

Tier II Corridors

Completion of Tier II corridor projects will add 33 miles of bikeways, make an important connection across the I-17 freeway, and improve bicycle safety and mobility through 108 intersections. The planning level in-house cost estimate to implement these projects is $14,008,000. An additional $9,320,000 would be invested to pave the Grand Canal Trail. The Tier II corridors for implementation include the following, in order ranked:

11. **Maryland Avenue**
    from 43rd Avenue to 20th Street
12. **3rd/5th Avenues (one-way pair)**
    from Arizona Canal to Jefferson Street
13. **Encanto Boulevard/Oak Street**
    from 19th Avenue to 52nd Street

14 **7th Avenue**
from Coral Gables Drive to Deer Valley Road

15 **Grand Canal**
from 75th Avenue to East City Limits (SR202)

16 **Ray Road**
from Chandler Boulevard to I-10

17 **Missouri Avenue**
from 43rd Avenue to 24th Street

18 **48th Street**
from Baseline Road to Pecos Park

19 **Indian Bend Wash**
from SR51 to East City Limits (Mountain View Road)

20 **40th Street**
from Shea Boulevard to Union Hills Drive

21 **Union Hills Drive**
from 51st Avenue to Tatum Boulevard

22 **19th Avenue**
from Jomax Road to Thunderbird Road

23 **Sweetwater Avenue**
from 20th Street to Scottsdale Road

Tier III Corridors

Completion of Tier III corridor projects will add 55 miles of bikeways and improve bicycle safety and mobility through 125 intersections. The planning level in-house cost estimate to implement these projects is $10,798,000. An additional $14,550,000 would be invested to pave the Arizona, Highline, Western, and CAP Canal Trails. The Tier III corridors for implementation include the following, in order ranked:

24 **32nd Street**
from Rose Garden (CAP Canal) to Puget Avenue

25 **Cave Creek Wash**
from Arizona Canal to 7th Street

26 **Roeser Road**
from 19th Avenue to 48th Street

27 **Baseline Road**
from 75th Avenue to 48th Street

28 **Arizona Canal**
from 51st Avenue to East City Limits (60th Street)

29 **Highline Canal**
from Dobbins Road to Arizona Grand Parkway

30 **Southern Avenue**
from 75th Avenue to 48th Street

31 **Chandler Boulevard**
from 19th Avenue to I-10

32 **Dobbins Road**
from 51st Avenue to 20th Street

33 **Western Canal**
from 27th Avenue to 48th Street

34 **Cave Creek Road**
from 7th Street/Dunlap Road to Carefree Highway

35 **Broadway Road**
from 99th Avenue to 48th Street

36 **Deer Valley Road**
from 35th Avenue to 56th Street

37 **Encanto Boulevard**
from 95th Avenue to 31st Avenue

38 **44th Street**
from Sky Harbor Airport East Economy Lot to University Drive

39 **CAP Canal**
from West City Limits (6700 W) to Scottsdale Road

Highlighted Corridors

The Ad Hoc Task Force members expressed a desire to highlight a select number of bicycle corridors within Phoenix to briefly describe why the route is important for cyclists, to highlight the important features and destinations along the corridor, and to indicate the needs along these corridors. The corridors were selected to represent a cross-section of Phoenix Council Districts as well as a cross-section of the Tiered Corridors (priorities) and include a diversity of recreation, commuter and school corridors within Phoenix to highlight their benefits. Consensus from the Ad Hoc Task Force is that Central Avenue should be the primary focus of the profile corridors because of the statement it makes in Phoenix and in the Comprehensive Bicycle Master Plan. The other selected corridors include 3rd Street, Osborn Road, Deer Valley Road, Dobbins Road, Arizona Canal, 47th Avenue, and 19th Avenue. Brief narratives and photos are provided to highlight each corridor.

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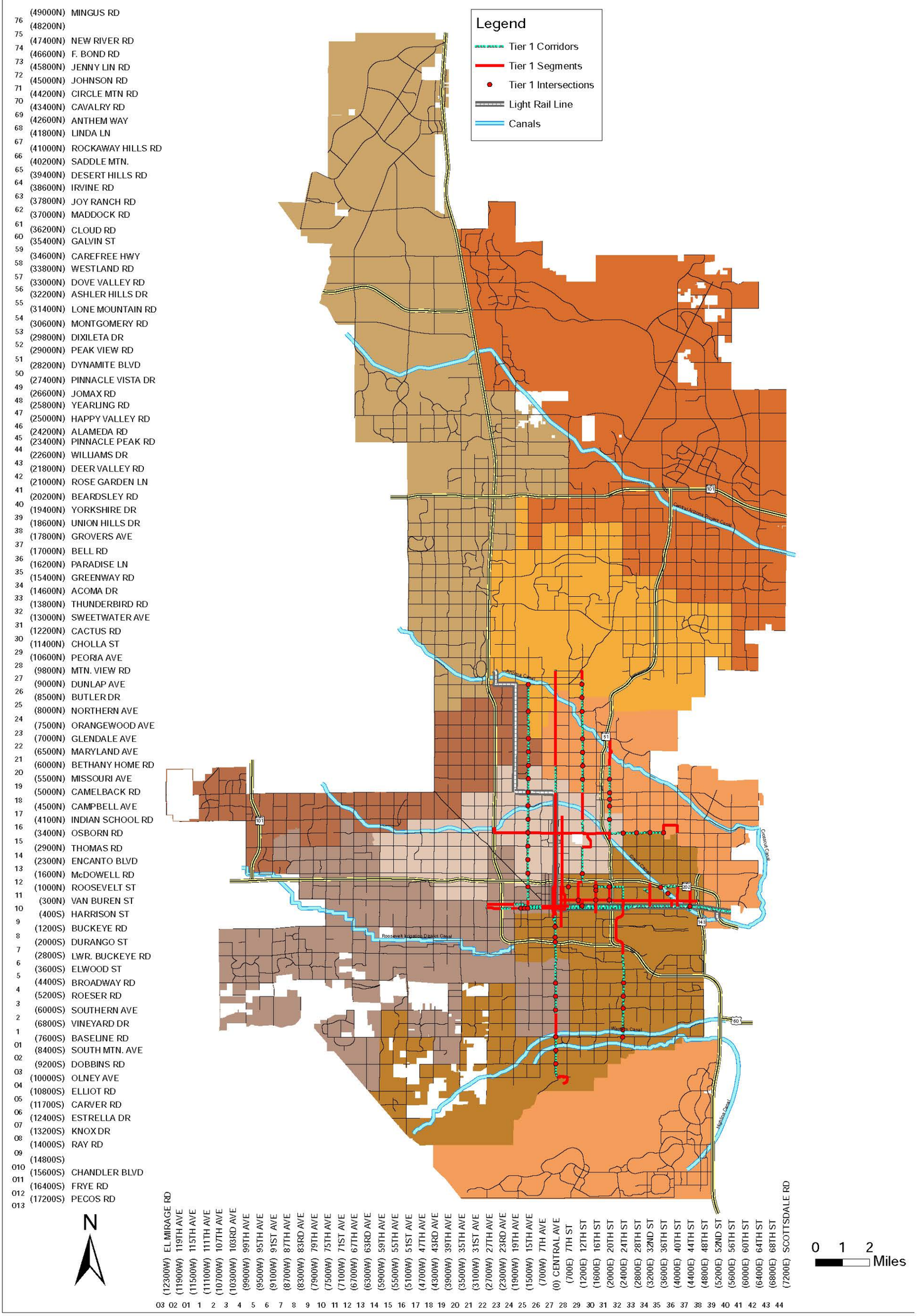
Tier 1 Corridors



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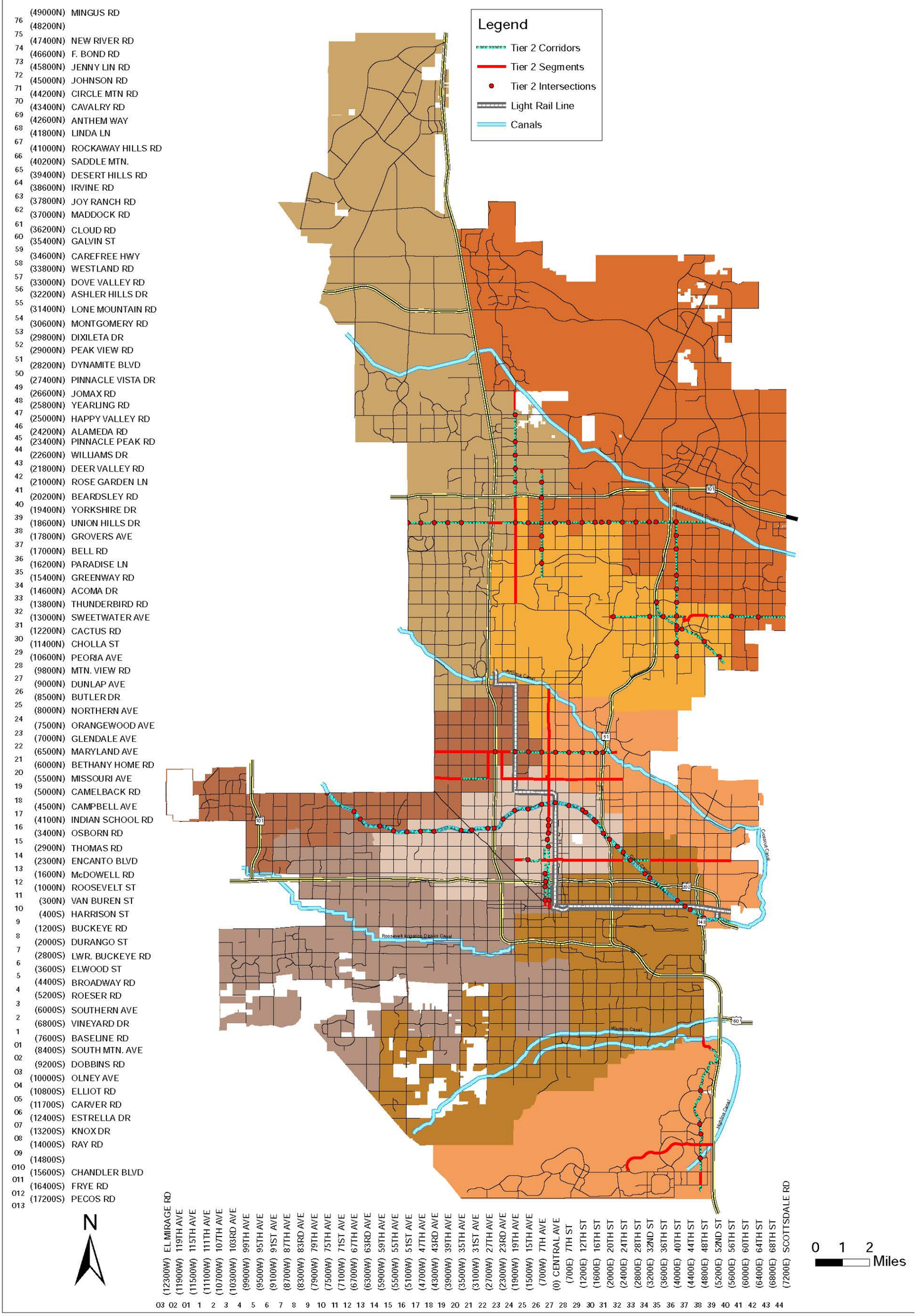
Tier II Corridors



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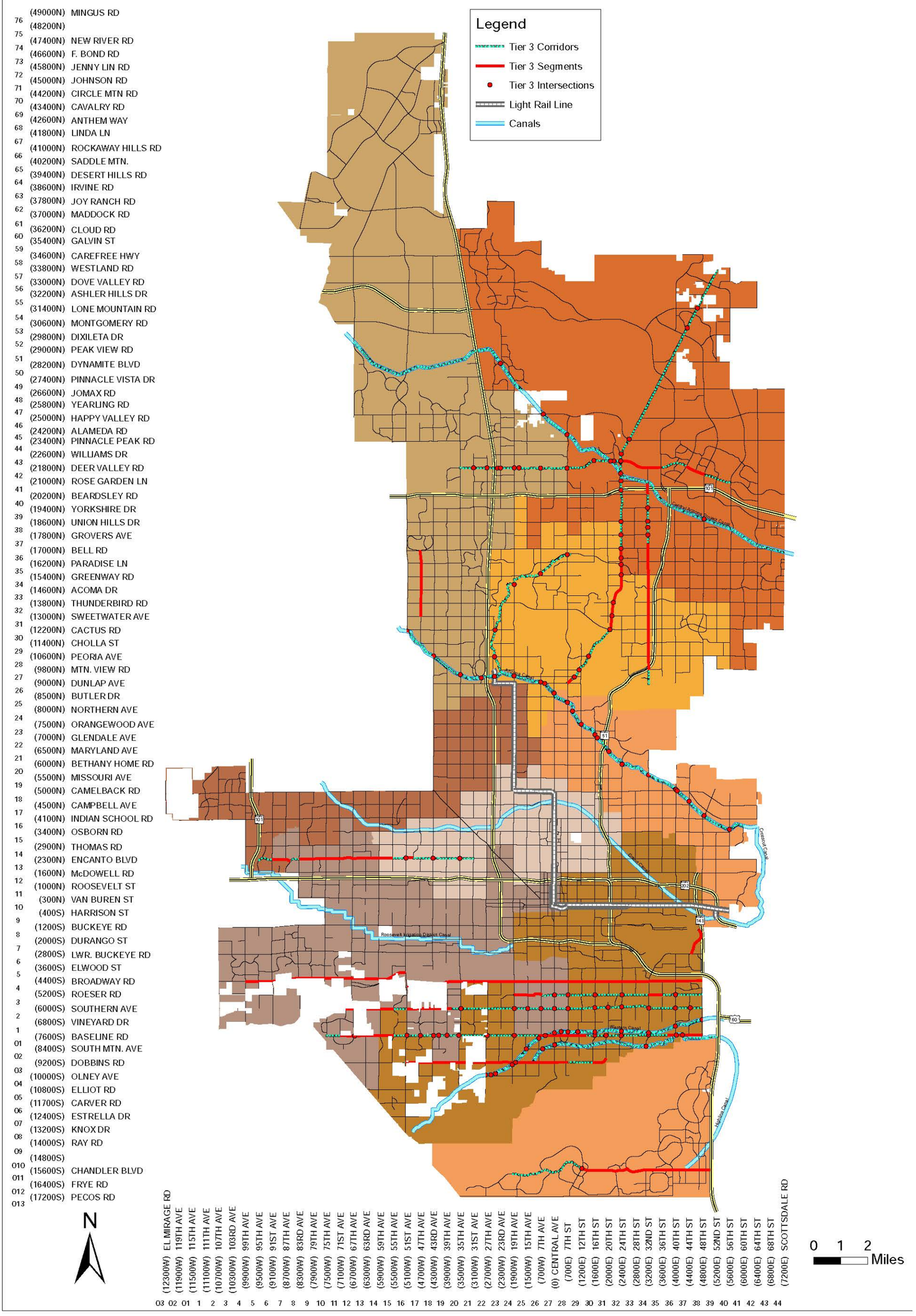
Tier III Corridors



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Tier 1 - 3rd Street

Why We Currently Ride 3rd Street

A citizens' backed 3rd Street Promenade initiative has the potential to transform 3rd Street through midtown and downtown to a corridor for multimodal, human-powered transportation. In downtown, the evolving Biomedical Campus is bordered by 3rd and 5th Streets. This is the highest ranked corridor in the Comprehensive Bike Master Plan and provides an important north/south connection into the central core for commuting, college students, and for recreational uses.

3rd Street south of Roosevelt
One Way section (looking south)

3rd Street at the Taylor Street Pedestrian Mall (looking south)

Why It Is Important to Complete This Corridor

The 3rd Street Corridor provides connectivity from the Steele Indian School Park/Arizona Veteran Home/VA Medical Center through the ASU Downtown Campus and Biomedical Center, past Chase Field and connecting into Buckeye Road where ASU is considering expanding classrooms. There is a direct connection to the Washington/Jefferson Street bike routes and light rail. Some of the significant destinations along the 3rd Street corridor include Phoenix Center for the Arts and Margaret T Hance Park, UofA Medical School, Herberger Theater Center, Symphony Hall, Arizona Center, Phoenix Convention Center, US Airways Center, Heritage Square and the Phoenix Sheraton which is the largest hotel in Phoenix. For route continuity and clarity, the 3rd Street bicycle corridor should exist along 3rd Street as a two-way route.

The Good About This Corridor

- Lower speeds and moderate traffic volumes
- Connectivity to the ASU downtown campus and large student populations
- Connectivity to Osborn Road and the Washington/Jefferson Street corridors through downtown Phoenix
- Connection to LRT
- Connection to major sports venues in downtown Phoenix (Arizona Diamondbacks and Phoenix Suns)
- Good crossing over I-10

What Is Bad About This Corridor

- High on-street parking demand from Fillmore Street to Jefferson Street
- Lack of space dedicated to bicycling in the downtown corridor
- May need to remove some parking to accommodate bicycle facilities
- Railroad crossing south of Jackson Street
- One-way operation between Fillmore and Roosevelt Street

Tier 1 - Central Avenue

Why We Currently Ride Central Avenue

Central Avenue is the heart of midtown Phoenix and the connector from north Phoenix to this country's largest municipal park, South Mountain Park. Central Avenue carries METRO light rail from Camelback Road to Jefferson Street with further extensions south planned. As Phoenix's main street, it has the potential to be our Champs-Élysées with density and diversity of people, places, and things. Recently repaved with the construction of METRO, it is one of the smoothest streets to ride in Central Phoenix.

Why It Is Important to Complete This Corridor

This route provides a connection from the Sunnyslope area to downtown Central Business District to South Mountain Park. It supports a diversity of commuter, recreational and school trip purposes. This central

corridor provide access to several important east west bicycle corridors including the Arizona Canal multipurpose trail, Maryland Avenue, Missouri Avenue, Grand Canal, Osborn Road, Encanto Blvd/Oak Street, Washington/Jefferson Streets, Southern Avenue, Roeser Road, Western Canal, Baseline Road, Highline Canal and Dobbins Road. The corridor also provides connectivity to the ASU Downtown campus, the world famous Heard Museum, Phoenix Art Museum, the Burton Barr Central Library, Margaret T. Hance Park, Steele Indian School Park, the downtown city and county governmental office complexes, US Airways Center, and multiple high schools. The corridor is in close proximity to the Phoenix Convention Center and Chase Field, as well as the UofA Medical School.

Central Avenue approaching Margaret T. Hance Park (looking southbound

Central Avenue bike lane approaching the CBD (looking north)

The Good About This Corridor

- Length
- Connectivity to bus service and LRT
- Buffered bike lanes between Central Ave and Bethany Home Road
- Bike lanes exist for much of the corridor south of I-17
- Excellent crossing over the Salt River

The Bad About this Corridor

- Lack of bike lanes along a portion of the corridor south of Southern Avenue, between I-17 and Camelback Road, and north of Bethany Home Road
- High traffic volumes in the central corridor
- Lack of bike facilities crossing I-17

Tier I - Osborn Road

by Susan Bookspan

Why We Ride This Corridor

Osborn Avenue has a 35 MPH speed limit on most segments and 25 MPH on some segments. The entire corridor parallels Indian School Road on the north and Thomas Road on the south. It is a convenient route that connects to many north/south roads that are conducive to bike riding.

Why It's Important to Complete This Corridor Connection

Osborn Road is a "neighborhood street throughout most of its length with both homes and apartments in close proximity. It connects to stores, restaurants and businesses. It is home to many schools and in some areas is close to mass transit. Having bike lanes on the Osborn Road corridor would encourage bike riders to use this a part of their daily commute to work or school, to run errands or to ride with family members. Adding bicycle facilities would encourage the addition of facilities on corridor cross streets. It has signalized intersections and in most segments sidewalks. More use by bicycle riders might encourage business to install end use facilities such as showers, lockers and secure parking.

The Good About This Corridor

- Length
- Motorized vehicle speed limit
- Low number of vehicles per day
- Connectivity to other bicycling corridors
- Proximity to schools and businesses

What Is Bad About This Corridor

- No bicycle facilities in certain segments
- Corridor usually has two vehicle lanes in each direction with no center turn lane. Sections that have one lane in both directions also do not have bicycle facilities.
- Although this corridor has many attributes, bicyclists do not choose to ride it in significant numbers.

Bike lanes do not exist in this area and would require a road diet (looking east on Osborn Road at 2nd Avenue)

Looking west on Osborn Road approaching SR-51

Tier II - 19th Avenue

Why We Currently Ride 19th Avenue

19th Avenue is one of the few mountain pass routes east of I-17 from the North Valley area into Central Phoenix, and it connects to vibrant north/south bus service (Route 19) and a LRT connection into the downtown area. The corridor crosses SR-101 and provides access to shopping, business and schools in the community and is heavily used by bicyclists.

Why It Is Important to Complete This Corridor

This route will provide a connection to north of the CAP and into the Deem Hills and Anthem communities north of Phoenix, and provides a connection to USAA as well as the CAP and Deer Valley routes and the Deer Valley Airport and business park. Currently only two miles along the corridor has bike facilities (SR-101 to Happy Valley Road), and the bike lanes need to be extended further south where there can be better connection to transit to complete the rest of the trip to the central Phoenix area and the Light Rail stations. Connections along the Skunk Creek Wash to Greenway Parkway will provide direct access to the Arizona Canal trail. Rose Mofford Sports Complex, and a crossing under I-17 to Metro Center Mall.

Bike lanes exist between SR-101 and Happy Valley Road (looking northbound)

Bike lanes do not exist between SR-101 and Thunderbird Road (looking north approaching Thunderbird High School)

The Good About This Corridor

- Length
- Connectivity to bus service along 19th Ave to Central Phoenix and LRT
- Connectivity to other major bicycle corridors (CAP, Deer Valley, Skunk Creek Wash)
- Crosses SR-101 and CAP
- Proximity to Deer Valley Airport, USAA, Turf Paradise, Deer Valley Park and Community Center, schools, shopping and other business along 19th Avenue
- Provides a connection to the communities north of Carefree Highway as well as Pioneer Living History Museum

The Bad About this Corridor

- Lack of bike lanes south of SR-101 and through the SR-101 interchange
- High traffic volume and speeds
- Lack of full road improvements between Happy Valley Road and Jomax Road
- Lack of bike lanes through the mountain pass south of Thunderbird Road

Tier II - Missouri Avenue

by Susan Bookspan

Why We Ride This Corridor

Missouri Avenue has a 35 MPH speed limit, begins at 24th Street traverses Phoenix and continues through Glendale. The entire corridor parallels Camelback Road, so it is a convenient route that connects to many north/south roads that are conducive to bike riding.

Why It's Important to Complete This Corridor Connection

Missouri is a "neighborhood" street throughout most of its length. It connects to stores, restaurants, businesses and schools and is close to mass transit. Having bike lanes on the Missouri corridor would encourage bike riders to use this a part of their daily commute to work or school, to run errands or to ride with family members. Adding bicycle facilities would allow this corridor to be indicated on bicycle maps. Missouri has signalized intersections and in most segments sidewalks. More use by bicycle riders might encourage business to install end use facilities such as showers, lockers and secure parking.

The Good About This Corridor

- Length
- Motorized vehicle speed limit
- Low number of vehicles per day
- Connectivity to other bicycling corridors
- Proximity to schools and businesses

What Is Bad About This Corridor

- Few bike facilities
- Not usually indicated on bicycle maps
- Corridor has two vehicle lanes in each directions which is not bicycle friendly
- Although this corridor has many attributes, bicyclists do not choose to ride this corridor with its lack of bicycle lanes.

Missouri Avenue near 31st Avenue along the north side of Grand Canyon University (looking west)

Bike lanes do not exist between SR-101 and Thunderbird Road (looking north approaching Thunderbird High School)

Tier III - Deer Valley Road

by Bob Pane

Why We Ride This Corridor

Deer Valley Road is one of the few continuous routes that connects the west valley to the east valley north of the 101 freeway, from 35th Avenue to 56th Street. The Reach 11 Sports Complex is situated along the route east of Cave Creek Road.

Looking West out of Reach 11

Looking East out of Reach 11
(no bike lanes and a narrow shoulder)

Why It Is Important to Complete This Corridor

Deer Valley is a major thoroughfare across the northern portion of the City. It connects to stores, restaurants, businesses, schools, airports and is one of only a handful of bike lanes that cross I-17. Reach 11 Sports Complex is located along the route which is a focal point for numerous sporting events and major cycling events. It connects with Cave Creek Road another major bike corridor that has access to the Sonoran Desert Drive. At its farthest eastern extent it connects to 56th street which provides access to the south into the east Phoenix area and also bike lanes that tie into Scottsdale. Pinnacle High School is just south of Deer Valley and east of that are two major shopping destinations, Desert Ridge and City North.

The Good About This Corridor

- Length
- Travelled by cyclists seeking long distance routes
- Connectivity to other bicycling corridors
- Proximity to schools and businesses including Deer Valley Airport and Deer Valley Rock Art Center
- One of a small number of bike routes crossing I-17

What Is Bad About This Corridor

- High traffic volume and speeds
- No bike lanes east of Reach 11 towards Pinnacle High School
- No bike lanes between 40th Street and Tatum Boulevard where Desert Ridge Mall is located
- No bike lane crossing the I-17 interchange in the westbound direction
- Few bike facilities

Tier III - Dobbins Road

by Erika Keenan

Dobbins Road is currently a two-lane, uncurbed, undivided east west roadway. The current posted speed limit is 40 mph between Central Avenue and 27th Avenue, 50 mph west of 27th Avenue and 40 mph at the old Laveen Elementary School.

Major intersections along the Dobbins Road corridor include: Central Avenue, 7th Avenue, 19th Avenue, 27th Avenue, 35th Avenue, 43rd Avenue, 51st Avenue and 59th Avenue. The Dobbins Road corridor currently has at least 9 public/charter schools located on or within a ¼ - ½ mile distance off these major intersections. Safe routes to schools for both child pedestrians and cyclists make this corridor a priority for District 7 and District 8. Because of the density and zoning criteria for South Phoenix and Laveen, homes/schools aren't quite as close as in downtown Phoenix and hence, a distance of 1 mile commute to a school is more typical.

Inventory of Schools/Children Activity at each Major Intersection Crossing:

- Central Avenue
- 7th Avenue
  - Southwest Elementary School (physically located on Dobbins Road)
  - Nina Pullman Center for Compassion Arizona Human Society
  - City of Phoenix Fire Station
  - Valley View School (.5 miles north of Dobbins on 7th Ave)
- 19th Avenue
- 27th Avenue
  - Eagle College Prep Elementary School (.4 miles from Dobbins to South Mountain Avenue)
- 35th Avenue
  - Cesar Chavez Park (.5 mile from Dobbins)
  - Major bus stop at 35th Avenue and Baseline Road (.8 mile from Dobbins)
- 43rd Avenue (there should be a cross walk at this intersection due to all the schools)
  - Laveen Elementary School (. 3 mile South of Dobbins)
  - Legacy Traditional School (.7 mile North of Dobbins)
  - Vista del Sur Elementary School (.4 miles to turn onto South Mountain Avenue)
  - Cesar Chavez High School (1 mile from Dobbins Road)
  - Heritage High School (1 mile from Dobbins Road)
- 51st Avenue
  - City of Phoenix Fire Station
  - Old Laveen Elementary School, while owned by the Laveen Elementary School District, rents space to: South Mountain Community College, the Laveen Art League, which holds community events.
  - Laveen Elementary School District Offices, and the well-used community baseball fields owned by the Laveen District office.
  - Old Laveen Baptist Church
- 55th Avenue
  - Betty Fairfax High School (.6 mile from Dobbins Road)

There are various SRP irrigation canals and nationally registered or eligible historic places existing on or near either side of Dobbins Road from Central Avenue to 67th Avenue. For this reason, it is important to preserve the historic and rural charter of Dobbins Road and the canals. The canal between 19th Avenue and 23rd Avenue has been determined to be eligible for Nation Historic Registry listing. The Western Canal from 17th Avenue to 23rd Avenue has been recommended by the Federal Government as a historic canal. Due to this categorization, funding may be available to improve this road through both Federal and State resources[1].

1 - Dobbins Road Design Concept Report (Central Ave to 67th Ave), produced by Kirkham Michael Consulting Engineers for the City of Phoenix October, 2003.

Individually Listed on the National Register

- Laveen School Auditorium (5001 West Dobbins Road)
- Ralph H. Stoughton Estate (805 West South Mountain Avenue)
- Determined Eligible for National Register
- Western Canal and lateral ditch to 23rd Avenue
- Del Monte Market – Established in 1908 (2659 W. Dobbins Road)

When Dobbins Road was analyzed by City of Phoenix consultants Kirkham Michael Consulting Engineers in October 2003, it was recommended that the segment from Central Avenue to 51st Avenue be a three-lane section with continuous two-way left turn lane with traffic signals at the major cross streets. Six-foot bicycle lanes, five-foot sidewalks, and 10-foot multipurpose trails were recommended throughout the proposal. A joint agreement will be needed with SRP for the multipurpose trail located along the south side of the historic canal between 19th and 23rd Avenues. From January-October 2003, The City of Phoenix hosted a series of public meetings in conjunction with the Laveen and South Mountain Village Planning Committees. Even as far back as 2003, the public voiced their desire for bike lanes, pedestrian safety, and vehicular accidents. Since that time, Laveen, in particular, doubled in size jumping from 20K population to currently 50K+ residents as recorded by Census[2] and the American Community Survey data, with over 40% of Households having school age children under the age of 17. And the public, via Wikimaps, still identified Dobbins corridor as a priority for the area for bike/pedestrian improvements.

Tier III - Arizona Canal

by Suzanne Day

This canal path is an important route between Peoria and Glendale to the northwest and Scottsdale with connections to Tempe to the southeast. Providing a quiet, scenic, cross-town route through Phoenix City Council districts 1, 3, and 6, the Arizona canal is one of Phoenix's hidden gems.

Why We Ride This Corridor

The biggest advantage of this off-street corridor is the ease of crossings at major arterials (including the behemoth that is I-17) thanks to dedicated bicycle and pedestrian underpasses. Another big advantage is the quiet serenity of pedaling along the canal and seeing birds, fish and community members enjoying the outdoors. Third, the corridor connects to well-established bike trails and paths in Glendale, Surprise, Scottsdale, and – via the Galvan Parkway and Tempe Town Lake bike and pedestrian bridge in Tempe.

2 - 2010 Census; 2012 ACS

Why We Ride This

Why It's Important to Complete This Corridor Connection

The Valley Metro light rail expansion to 19th Avenue and Dunlap will open in 2016, and is within a half-mile of this corridor. From there, it's less than a 6-mile ride to ASU West Campus, and under 8 miles to the Thunderbird School of Global Management. This corridor will become even more valuable when the Valley Metro light rail northwest extension Phase 11 reaches Metrocenter in the early 2020s.

An important feature of this segment will be addressing a large berm on the alignment of 47th Avenue, between Sweetwater and ASU West. Currently the berm is too steep to ride up or down, it's necessary to dismount and walk at both ends of the berm. The 47th Avenue bike route leads directly to the Arizona Canal trail; the berm is a major impediment to an easy bike commute for ASU West students.

47th Avenue and Sweetwater Avenue berm - north end

47th Avenue and Sweetwater Avenue berm - south end

Another important enhancement to this corridor will be wayfinding signage. Below are two examples of locations where signage is critical – a wrong turn results in leaving the trail for an unsigned neighborhood street.

Signage is needed here (south of 47th Avenue and Cholla). Proceeding south across the bridge leads to Phoenix, Scottsdale, and Tempe. Riding the paved path straight ahead goes nowhere – it empties into the neighborhood after about 200 yards.

Signage is needed here (south of 47th Avenue and Cholla). It's easy to miss the turn off the trail onto 47th Avenue, which leads to ASU West.

Funding Strategies

Arizona Highway User Revenue Funds (AHUR or HURF)

In 2008, the Phoenix Street Transportation Department released an Infrastructure Needs report which identified $43 million in needs for the Bikeway Program. Many of these projects are now already built, under construction or will be constructed with the Five-Year Capital Improvement Program (CIP). The report also documented $19 million in unfunded bike program needs but the projected shortfall in AHUR (Arizona Highway User Revenue Funds) revenues jeopardizes the City's ability to complete these projects.

The State of Arizona taxes motor fuels and collects a variety of fees and charges relating to the registration and operation of motor vehicles on the public highways of the state. These collections include gasoline and use fuel taxes, motor carrier taxes, vehicle license taxes, motor vehicle registration fees, and other miscellaneous fees. These revenues are deposited in the Arizona Highway User Revenue Fund and are then distributed to the cities, towns and counties and to the State Highway Fund. These taxes represent a primary source of revenues available to the state for highway construction, improvements and other related expenses[3].

Figure 6-4 provides a history of AHUR funding provided to Phoenix from FY 04-05 through FY 11-12.

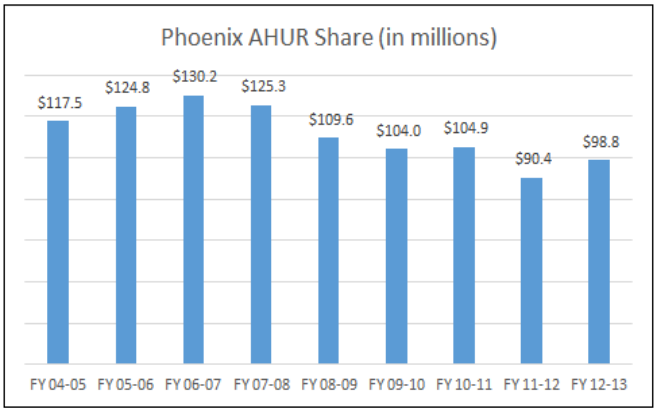


FIG 6-4 - City of Phoenix's Share of AHUR Revenue from FY 06-07 to FY 11-12

3 - http://www.azdot.gov/about/FinancialManagementServices/transportation-funding/highway-user-revenue-fund

Developer Improvements

Much of the public roadway infrastructure is built by developers and dedicated to the public. Amenities such as sidewalks and landscaping in the right-of-way adjacent to their development are often required to be maintained by the property owners or Homeowners Associations after construction. In the same way, developers can provide portions of the bicycle infrastructure on or adjacent to their development or provide funding for eventual bikeway improvements at the time of their development. Developer-required on-site or off-site improvements, in response to master plans or stipulations on their development, occur as a result of site-plan review by the Planning and Development Services Department. Zoning ordinances need to provide the ability for plan reviewers to stipulate these amenities or improvements, and the plan reviewers should be trained to look for opportunities for developer bicycle facility improvements.

Bond Program to Fund Improvements

Another efficient way to fund bicycle infrastructure improvements in the right-of-way is though the sale of general obligation bonds, which much be approved by the voters. The sustained growth of Phoenix has contributed to the City's use of bonds as a major source of financing for its capital improvement programs. The Bike Master Plan can be used to identify specific corridors and improvements within those corridors for a bond program to target so the voters have a clear understanding on what they are approving. Bond funds are the most flexible and lowest cost dollars for Phoenix to use and result in the most capital improvements per dollar spent. Furthermore, once bond funds are obligated for a specific improvement that has been approved by the Citizen's Bond Committee, they cannot be diverted to another use.

MAP-21

The first draft of the Alliance for Biking and Walking's 2014 Benchmarking Report on Bicycling and Walking in the United States report is the source of the following text as contributed by Darren Flusche of the League of American Bicyclists.

On October 1, 2012, the recently passed federal transportation law, Moving Ahead for Progress in the 21st Century (MAP-21), went into effect. MAP-21 maintained broad eligibility for bicycling and walking projects across transportation funding programs and put more decision-making power in the hands of regional governments for active transportation projects, but it also consolidated bicycling- and walking-friendly programs while reducing total funding for them. It also made it easier for states to divert these funds to other purposes.

Program Consolidation

Prior to MAP-21, three of the most common sources of federal funds for bicycling and walking projects were the Transportation Enhancements Program (TE), Safe Routes to Schools (SRTS), and the Recreational Trails Program (Rec Trails or RTP). Under MAP-21 these have been consolidated into one program called the Transportation Alternatives Program (TAP). Unfortunately, the funding for the TAP program is 26 percent less in fiscal year 2014 than the combined FY2012 funding for the three programs it replaced. You can find specific funding levels for your state and region at www.AdvocacyAdvance.org/MAP21.

There have been some changes in eligible activities. For example, states and regions can still use TAP funds for pedestrian and bicycling improvements, but they cannot use TAP to pay for adult bicycle education classes. There is a new activity called Safe Routes for Non-Drivers, which is meant to improve access and accommodations for older adults, children, and individuals with disabilities and may lend itself to creative projects. Another new use of TAP funds is that the right-of-way of former Interstate routes can be converted into walkable, low-speed thoroughfare in urban environments.

Any activity that was eligible under the Safe Routes to School Program, including educational safety programs for K-8 students, is eligible under TAP. Some states are using a portion of TAP funds to maintain an independent SRTS project selection process, others are incorporating SRTS activities in their overall TAP process. Some states, like Washington, are using additional safety funds from the Highway Safety Improvement Program to cover SRTS activities to make up for reduction in funds.

Every year, each state decides if it wants to maintain the Rec Trails program as it had been, with the same agency administration and rules, or "opt-out". If the state maintains the program, the funds equal to the FY2009 amount are taken off the top of TAP. If the state opts out, the Rec Trails funds get absorbed into TAP. In 2013, only Florida and Kansas opted out of the Rec Trails.

Local Control

TAP funds are distributed within states in two ways. Half of the funds are controlled by the state DOT to be spent anywhere in the state. The other half is allocated to rural areas, small cities, and large cities based on the proportion of the population in those geographies.

In many places, local governments are more responsive to walking and bicycling needs than states are. In response, bicycling advocates fought to increase the amount of control regional planning agencies – Metropolitan Planning Organizations (MPOs) – have over federal transportation dollars. The result of these efforts is that MPOs with a population of over 200,000 are now sub-allocated funds to run their own TAP application process and select the projects they think are most important.

Flexibility

Transferability and Opt-outs of TAP Funds One of the goals of MAP-21 was to increase "flexibility" for how states spend their federal dollars. One of the things this means is that states can transfer their anywhere-in-the-state funds to other transportation programs – for uses other than biking and walking projects. Additionally, if funds are unspent ("unobligated") after the first full year, funds may be flexed to the Congestion Mitigation and Air Quality Improvement Program (CMAQ).

Broad Eligibility

Looking Where the Big Money Is TAP is a very small part of MAP-21 and it is just a small source for walking and biking projects within the law. Bicycling and walking projects are broadly eligible in the vast majority of federal-aid funding programs. CMAQ funds projects that provide alternatives to car travel, including several bikeshare systems. The Highway Safety Improvement Program (HSIP) funds pedestrian and bicycle safety infrastructure. Section 402 State and Community Highway Safety Grants funds non-infrastructure programs, like adult bicycle education classes and pedestrian safety trainings. And the Surface Transportation Program (STP) funds bicycle and pedestrian transportation projects and now can be used for TAP-type projects and Rec Trails-type projects.

TIGER Discretionary Grant Program

The Transportation Investment Generating Economic Recovery, or TIGER Discretionary Grant program, provides a unique opportunity for the DOT to invest in road, rail, transit and port projects that promise to achieve critical national objectives. Since 2009, Congress has dedicated more than $4.1 billion for six rounds to fund projects that have a significant impact on the Nation, a region or a metropolitan area.

The TIGER program enables DOT to examine a broad array of projects on their merits, to help ensure that taxpayers are getting the highest value for every dollar invested. In each round of TIGER, DOT receives many applications to build and repair critical pieces of our freight and passenger transportation networks. Applicants must detail the benefits their project would deliver for five long-term outcomes: safety, economic competitiveness, state of good repair, livability and environmental sustainability.

There are $600 million that has been appropriated for the FY 2014 TIGER program. The FY 2013 TIGER program, the fifth round of federal TIGER grants, awarded $474 million to 52 projects. Although highly competitive, past rounds of TIGER have funded several stand along bicycling and walking projects and a large number of successful projects that include bicycling and walking components.

Current Investments

The following table summarizes some of the recently completed (RC), ongoing (O), and committed (C) bike program expenditures:

TABLE 6-1: City of Phoenix Bicycle Program Expenditures

(Source: City Council Report, May 7, 2013)

Project	Funding	Status	Cost
Bike Structures ($12,189,726)			
Arizona Canal Bike Tunnel under 7th Ave.	AHUR, stimulus	RC	$2,877,165
South Mt. Comm. College Ped. and Bike Crossing	AHUR, fed aid	RC	$790,518
Royal Palm (15th Ave/Dunlap) AZ Canal Bike Bridge	AHUR, fed aid	RC	$1,261,698
Nevitt Park at Western Canal Bike Bridge	AHUR, fed aid	O	$1,168,600
7th St. Science Center Bike and Ped. Bridge	'06 bond	C	$6,091,745
Bike Trails and Paths ($15,401,201)			
Indian School/16th St. Multi-Use Trail	AHUR, fed aid	O	$1,882,885
19th Ave./Cave Creek Wash Bike Trail (Revised project scope)	'06 bond	C	$794,306
Rio Salado/Salt River; 24th ST. to I-10 Path	AHUR, fed aid	RC	$3,552,487
Arcadia Portal Multi-Use Trail	AHUR, fed aid	RC	$651,137
Grand Canal Bike Crossings	AHUR	O	$14,434
Grand Canal Major St. Safety Improvements	'06 bond	O	$25,000
Sonoran Boulevard. Paseo Bike Trail	PPI (Parks)	RC	$3,800,000
Rio Salado/Salt River; 32nd St. – 40th St. Path	AHUR, fed aid	C	$1,122,642
Rio Salado/Salt River; 40th St. – SR 143 Path	AHUR, fed aid	C	$2,058,310
107th Avenue; ISR to Camelback Shared Use Path	AHUR, fed aid	C	$1,500,000
Special Projects ($86,572)			
Bike Racks and Corrals Citywide	AHUR	O	$26,822
Bike Detection at Traffic Signals	AHUR	O	$22,250
Bike Storage Corrals for Schools	CCF	O	$7,500
Bike Parking Rings for Parking Meters	AHUR	O	$5,000
Bike Safety Education	GOHS	O	$9,000
Bike Helmets for Children	GOHS	O	$6,000
Bike Share ($1,914,500)			
Regional Bike Share Project with City of Tempe	CMAQ, Fed Aid	O	$1,414,500
Bike Share Infrastructure Improvements	AHUR	O	$500,000
Major Street Improvement Project Bike Lanes ($18,279,900)			
Baseline; 51st Ave. – 59th Ave. Bike Lanes	AHUR	C	$725,000
43rd Avenue; Baseline – Southern	AHUR	C	$725,000
Southern Avenue; 19th Avenue/ - 31st Avenue/	AHUR	RC	$725,000
Pinnacle Peak Road; 35th Ave. – 55th Ave.	AHUR	O	$1,450,000

Project	Funding	Status	Cost
Sonoran Boulevard; North Valley Pkwy. - Cave Creek Rd.	AHUR, IF, CCF	RC	$2,175,000
Avenida Rio Salado	AHUR, fed aid	O	$272,400
Centennial Way (Washington St. near State Capitol)	ADOT, fed aid	RC	$5,000
7th Avenue; Southern – Salt River	AHUR	C	$1,087,500
43rd Avenue; Lower Buckeye – Buckeye Rd.	AHUR	C	$725,000
32nd Street; Southern – Broadway	AHUR, '01 bond	O	$725,000
35th Avenue; Baseline – Southern Ave.	AHUR	C	$725,000
75th Avenue; Lower Buckeye – Buckeye	AHUR	C	$725,000
Buckeye Road; 67th Ave. – 59th Ave.	AHUR, IF	C	$725,000
Lower Buckeye; 51st Ave. – 43rd Ave.	AHUR, '06 bond	C	$725,000
32nd Street; Washington St. – McDowell Rd.	Fed aid, '06 bond	C	$725,000
56th Street; Deer Valley Rd. – Pinnacle Peak Rd.	AHUR, IF	C	$725,000
35th Avenue; Dobbins – Baseline	AHUR	C	$725,000
27th Avenue; Lower Buckeye – Buckeye	AHUR	C	$725,000
27th Avenue; L-101 – Deer Valley	AHUR	C	$725,000
64th Street; Utopia – Mayo	AHUR, IF	C	$1,450,000
Buckeye Road; 7th St. – 16th St.	AHUR	C	$725,000
Baseline Road; 59th Ave. – 51st Ave.	AHUR	C	$725,000
Roosevelt; Central Ave. – 4th St.	AHUR, fed aid	O	$240,000
Bike Lane Retrofit Projects ($2,781,136)			
Central Avenue; Camelback – Bethany Home Rd.	AHUR	RC	$41,754
Chris-Town Gateway Bicycle Boulevard	AHUR	RC	$58,613
11th St Pedestrian and Bike Improvements	FTA	RC	$10,000
Indian School; 19th Ave. – I-17	AHUR	C	$100,000
Overlay Projects (2 miles, various projects)	AHUR	RC	$10,000
32nd Street SR 51 – Reach 11	AHUR, fed aid	O	$445,568
Shea Boulevard; 32nd St. – SR 51	AHUR, fed aid	C	$364,941
Roosevelt Row Bike Lanes	AHUR, fed aid	O	$750,260
Discretionary Project Funding for Bike Lanes	AHUR	C	$1,000,000
Bike Program Operations/Administration ($419,968)			
Staffing (1 Full-Time Equivalent position)	AHUR	O	$110,000
Citywide Specialty Bike Marking and Signing	AHUR	O	$59,968
Discretionary Small Project Funding (FY13-17)	AHUR	O	$250,000
TOTAL EXPENDITURES/COMMITTED BIKE FUNDING			**$51,073,003**

FTA – Federal Transit Authority
PPI – Parks and Preserve Initiative
GOHS – Governor's Office of Highway Safety
CMAQ – Congestion Management & Air Quality
CCF – Capital Construction Funds
IF – Impact Fees
AHUR – Arizona Highway User Revenue

Bike Program Expenditures

1. **BIKE STRUCTURE:** New bridges and tunnels to accommodate the flow of bicyclists over or under canals or roadways ($1 million - $6 million per structure)

2. **BIKE TRAILS / PATHS:** Off-roadway bicycle or multi-use paths to fully separate the flow of pedestrians and bicyclists from motorized traffic ($800,000 - $8 million per mile), including ROW acquisition, asphalt, etc.

3. **SPECIAL PROJECTS:** Smaller specialty projects to support education, safety and improved operation for bicyclists ($2,000 - $30,000 per project)

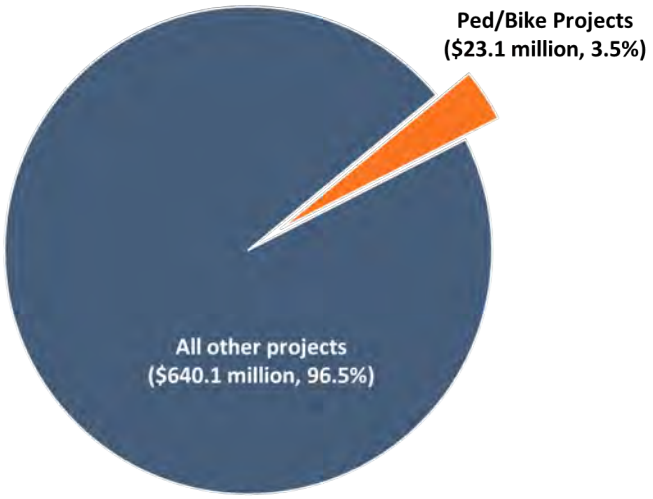
4. **BIKE SHARE:** Program for residents and visitors to rent bicycles at stations throughout the city ($1.5 million in approved funding including regional Congestion Mitigation Air Quality funding in partnership with the City of Tempe)

5. **MAJOR STREET IMPROVEMENT PROJECTS:** New bike infrastructure added in conjunction with new roadway or roadway widening projects ($600,000 - $1.1 million per mile, estimated at $725,000 per mile on average)

6. **BIKE LANE RETROFIT PROJECTS:** New bike lanes added to existing streets without widening, e.g., new bike lanes added with overlay projects or through road diets ($5,000 - $75,000 per mile)

7. **BIKE PROGRAM OPERATIONS:** Operating budget to manage program, including staff, materials and related expenses ($160,000 - $210,000 per year)

Existing Ped and Bike Projects in 5-Year CIP (2014-19)



RECOMMENDATIONS

GOAL:

- Investments made for bicycling will be smart, focused, and equitable. The city will leverage existing assets and create partnerships with local, county, and state agencies to build out the bicycle infrastructure network.

STRATEGY:

- Successfully complete top priority projects on ranked project list.

ACTION:

- Program bicycle facility needs into the City's Capital Improvement Program (CIP).
- Consolidate projects to eliminate gaps and barriers on individual priority corridors when possible or to take advantage of economies of scale.

OBJECTIVE:

- By 2019, complete 80% of Tier I projects
- By 2024, complete 100% of Tier I projects and 50% of Tier II and Tier III projects
- By 2029, complete 75% of Tier II and Tier III projects
- By 2034, complete 100% of Tier II and Tier III projects
- Complete other identified bicycle infrastructure projects as opportunities and resources become available.

STRATEGY:

- Increase amount of funding dedicated to the bicycle program including infrastructure, amenities, and education.

OBJECTIVE:

- By 2019, allocate a minimum of 1% of the Street Transportation CIP budget for bicycle infrastructure improvements
- Annually report the amount of funding (5-year rolling dollar value and % of total CIP) dedicated to the bicycle program

STRATEGY:

- Seek State and Federal funding through the Maricopa Association of Governments (MAG) to assist with implementation of large and difficult projects.

ACTION:

- Identify best qualified projects and apply for State or Federal Aid.

CHAPTER

7

Equity & Efficiency

The Need to Address Transportation Equity

During its post-war boom, the City of Phoenix planned its transportation and land use policies and investments around the assumption that the automobile was the primary modal choice for existing and new residents. Those prior planning efforts and public investment decisions provided a template for deployment of private sector capital and resources in a manner that supported, and continues to support, a reliance on automobiles as the primary form of day to day transportation for the majority of adult-age Phoenix residents.

Dedicated funding for the initial Valley Metro light rail line and expanded bus and paratransit services was made possible with voter approval of Transit 2000. Prior to this time, a disproportionate amount of transportation funding was focused on motor vehicles, primarily private automobiles. The new transportation services provided by Transit 2000 funds began to meaningfully expand the Phoenix transportation options to address the needs of those citizens utilizing active and public transit modes. The Bike Master Plan, along with the Reinvent PHX and the Complete Streets Ordinance, recognizes that a full range of choices provided by the City's transportation system, utilizing all modes, is required for the entire community to have full access to jobs and public life. This is especially true for those who rely on active transportation and public transportation system in their daily life. Bicycles are a vital and underutilized tool in the City's transportation system, and for many, they are the only means to access work, school, shopping, recreation, or other daily needs.

The Bike Master Plan regards equity in transportation investment as a constitutive element of a healthy, sustainable local economy. By providing for the broadest possible access to bicycles and other forms of active transport, the City also enhances the ability of its residents to seek employment, education, business, and personal opportunities while ensuring that every resident has the dignity of choice in their transportation mode.

GOAL:

The City's bicycle network will connect neighborhoods with each other and into downtown Phoenix.

Bicycling will be a safe, fun, and convenient transportation option to access schools, parks, shopping, work, and community centers in all parts of the City.

Social Equity

The Bike Master Plan addresses social equity by working to provide bicycle transportation for all socioeconomic groups and all portions of the community. Several variables were used to account for social equity in the master plan process when identifying corridors, ranking the corridors and ranking projects along the targeted corridors. Corridor identification and selection utilized a variety of social equity measures, including: percentage of households in poverty; percentage of population under 18; and percentage of households with no vehicles, as well as population density. The process of corridor prioritization included the same measures to account for social equity as well as land use.

Equity in stakeholder input was accomplished by holding the public meetings in the community centers of low income communities. Personal interviews were conducted at Phoenix Transit centers to obtain input from individuals with limited English proficiency and from those who may not have access to a computer.

Modal Equity

The Plan seeks to achieve modal equity by providing facilities to access public transportation modes, including provision of bicycle parking facilities at destinations. The master plan seeks to further achieve modal equity by providing continuous transportation facilities bicycle travel along the corridors, and establishes a philosophy that if a bicycle facility is provided a long a two-way motor vehicle facility, the bicycle facility should also provide two-way bicycle services. Bicyclists should not be diverted to a different route if a motor vehicle route is provided, and the bicycle facility should be continuous. Furthermore, opportunities should be explored to provide additional bicycle facilities throughout Phoenix so that bicyclists have modal equity throughout the entire community and travel to every destination that a motor vehicle can access.

Additionally bicyclists should have equal access to public transit (buses and light rail) that is offered to pedestrians. While Phoenix was the first major city to equip all buses with bike racks with the ability to carry two bicycles, there are times when bicyclists cannot be accommodated because the racks are full. All new buses are being purchased with racks that are able to accommodate three bicyclists, and the conversion to 3-bike bus racks should continue.

Finally, the Plan recognizes that equity in investment among active, public, and motorized transportation is vital to the interests of the City in fostering a globally competitive economy capable of attracting and retaining capital and talent, and will further enhance our ability to diversify our City's economy in a sustainable manner.

RECOMMENDATIONS

GOAL:

- The City's bicycle network will connect neighborhoods with each other and into downtown Phoenix. Bicycling will be a safe, fun, and convenient transportation option to access schools, parks, shopping, work, and community centers in all parts of the City.

STRATEGY:

- Account for social equity when identifying and prioritization bicycle infrastructure improvement projects

ACTION:

- Continue to utilize a prioritization methodology that utilize a variety of social equity measures, including: % of households in poverty; % of population under 18; % of households with no vehicles; and population density.

STRATEGY:

- Provide continuous transportation facilities for all modes along corridors.

ACTION:

- Provide continuous bicycle facilities
- Provide two-way bicycle facilities on two-way motor vehicle facilities
- Provide bicyclists equal access to public transit (buses and light rail) that is offered to pedestrians

photo provided by Charlier and Associates

CHAPTER

8

Safety

GOAL:

Bicycling will be a safe transportation and recreation option. Streets will be designed and retrofitted to safely accommodate bicyclists.

People on bikes will understand bicycling rules of the road through proper facility design and safety education, Bicycling will be safer by promoting accountability and responsible attitudes of all road users.

One of the goals of the Bicycling Element in the 2002 Phoenix General Plan is to improve bicycle safety through more education, better traffic signs and pavement markings, and installation of more safety features for bicyclists. This master plan continues that goal and expands it to focus on redesigning major streets and intersections to be safe for all bicyclists.

Why Does Phoenix Need Complete Streets?

The City of Phoenix Street Transportation Department, in collaboration with a group of community stakeholders, developed a Complete Streets Policy. The stated intent of this policy, adopted by City Council on July 2, 2014, is that –

> "Complete Streets will make Phoenix more walkable and bikeable, support investments in transit, foster social engagement and community pride, boost the local economy and property values, and improve the livability and long-term sustainability of our region. Phoenix will be a better place to be, realizing long-term savings from improved public health and safety, environmental stewardship, social mobility and transportation equity."

Phoenix Police Officer Walter Olsen providing bicycle safety training at a bike rodeo event.

Safety Statistics

A review of reported motor vehicle crashes involving bicyclists in Phoenix over the past five years highlights the need to focus on the redesign of arterial streets and intersections to better accommodate cyclists.

This chapter of the Bicycle Master Plan presents a five-year summary of bicyclist crash data from 2008 through 2012. In summary, future facility planning and education programs should strive to address the following:

Numbers

- 25% of all the reported bicyclist crashes involving a motor vehicle in the State of Arizona occur in Phoenix (Fig 8-1).
- 495 crashes were reported annually, resulting in approximately 62 serious injuries and 8 fatalities per year.
- In the past two years, total bicyclist crashes have increased by more than 8% each year. The number of serious injury and fatal bicycle crashes have not followed the same trend.

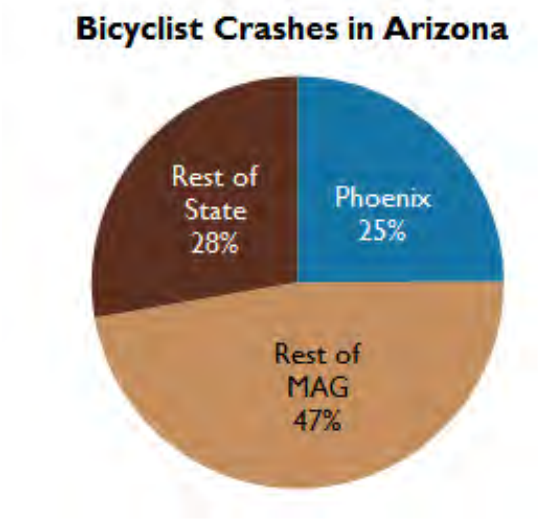


FIG 8-1: 2008-2012 Bicyclist Crash Comparison of City Phoenix of Phoenix to MAG Planning Area and the State

Locations

- 96.3% of bicyclist crashes occur on arterial and local roads.
- 53.3% of all bicycle crashes are intersection related.
- Serious injury crashes frequently occur along major arterial streets that serve transit.

Demographics

- Children and teenagers age 10-19 were involved in the highest number of bicycle crashes.
- The number of bicycle crashes were highest in October, November and March, and on weekdays from 7-8 am and 3-6 pm – corresponding to high volume bike travel months and bicycle commuter patterns.

Bicycle Safety

The information provided in this section is intended to supplement the Phoenix Traffic Collision Summary and Phoenix Bicycle Collision Summary reports. Both are compiled by the Street Transportation Department; the former on an annual basis and the latter as staff resources permits.

To gain insight into crash occurrence involving bicyclists in the City of Phoenix, an analysis of crash data was performed for the years 2008 through 2012. The results of this analysis, as shown in Figures 2 through 9, provide an overview of bicycle transportation safety in the City of Phoenix. Fatal crashes (K) and serious injury crashes (A) are a prime focus of this analysis to reflect national performance measures.

The analysis was performed using the Regional Transportation Safety Information Management System (RTSIMS) software. RTSIMS Version 1.0 serves as a key analytical tool at the Maricopa Association of Governments (MAG) for performing transportation safety analysis that is required for safety planning functions at the regional level. The primary source of this crash data is the ALISS crash database maintained by the Arizona Department of Transportation (ADOT). Crashes involving bicyclists are defined as crashes involving a "pedalcylist" traffic unit. Data for this analysis was filtered for crashes with Phoenix as the law enforcement agency having jurisdiction of the crash scene. Note that to get in the ALISS crash database at least one motor vehicle must be involved.

The Arizona Motor Vehicle Crash Facts, compiled annually by ADOT, is the source of State crash data presented in this section. Twenty-five percent of the State's bicyclist crashes occur in the City of Phoenix. Based on the 2010 US population census, 22.6% of the State's population reside in the City of Phoenix.

As shown in Figure 8-2, most reported bicyclist crashes result in an injury (89.4%). Since 2010, total bicyclist crashes have increased by more than 8% each year. The number of serious injury and fatal crashes has not followed the same trend.

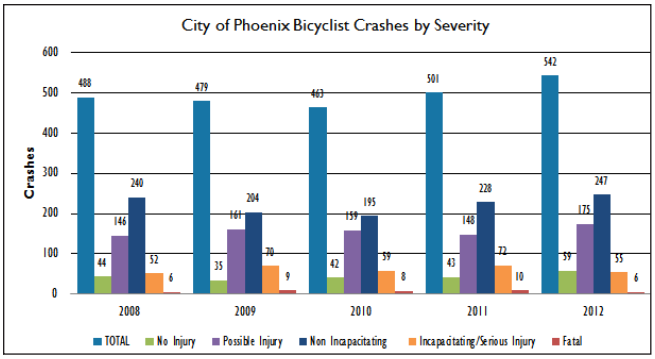


FIG 8-2: Crashes involving Bicyclists in the City of Phoenix by Severity

Crashes involving bicyclists are highest in the month of October, followed by November and March (Figure 8-3), which is largely consistent to those times when it is most comfortable to ride Phoenix with respect to temperature.

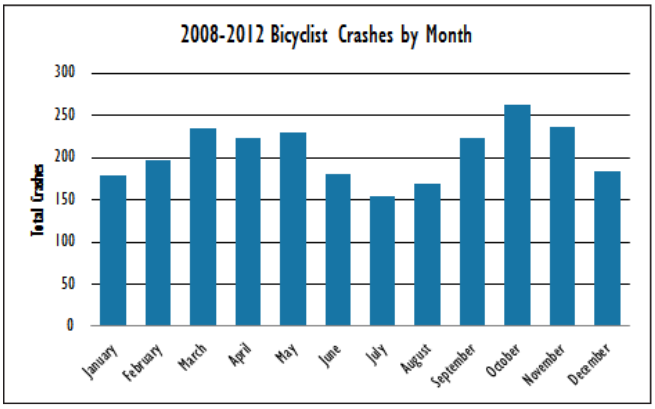


FIG 8-3: 2008-2012 Crashes involving Bicyclists in the City of Phoenix by Month

Bicyclist crashes occur most frequently on weekdays; particularly Thursdays and Tuesdays (Figure 8-4). Bicyclist volume data that is being collected and analyzed by MAG and Phoenix will provide further insight into ridership by day of week.

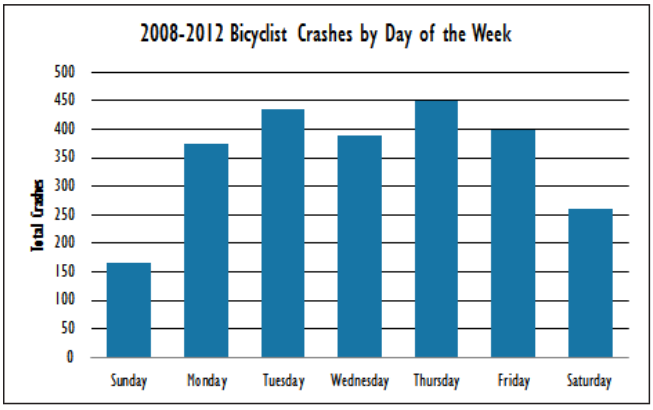


FIG 8-4: 2008-2012 Crashes involving Bicyclists in the City of Phoenix by Day of the Week

Bicyclist crashes are highest in the afternoon hours of 3 pm to 6 pm and the morning hour of 7 am to 8 am. This data suggests that bicyclist crashes are more likely to occur at times of high motor vehicle volumes. The total number of bicyclists may also be higher at these times.

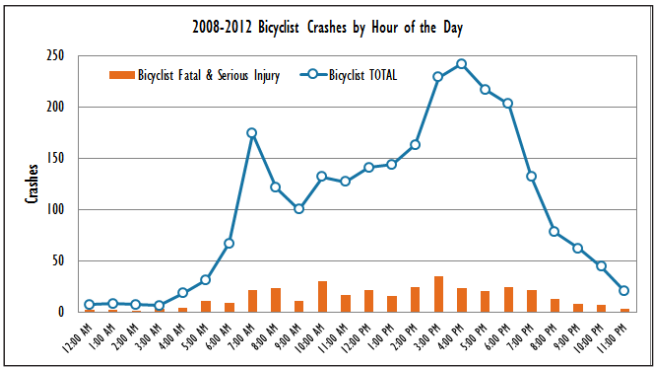


FIG 8-5: 2008-2012 Crashes involving Bicyclists in the City of Phoenix by Hour of the Day

Children and teenagers between the ages of 10 and 19 are involved in the highest number of bicyclist crashes (Figure 8-6). For those under the age of 16, this group may rely on bicycling as a primary mode of transportation because they are not old enough to obtain a driver's license and those from 16 to 19 may not be able to afford the expense of owning and driving a motor vehicle. Bicyclists between the ages of 40 to 54 also experience a higher number of bicycle crashes. The bicyclists within this age range (40-54 years old) are most likely to sustain serious injuries or die in a crash.

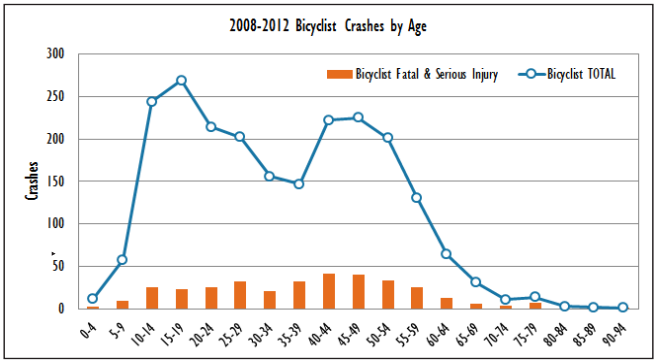


FIG 8-6: 2008-2012 Crashes involving Bicyclists in the City of Phoenix by Age

A crash tree of fatal and serious injury bicyclist crashes in Phoenix for 2008-2012 is presented in Figure 8-7. Crash trees are a tool to help identify and select the facility types and roadway and traffic characteristics of the locations where target crash types occur most frequently. Bicyclist-involved K (fatal) and A (serious injury) crashes in the City rarely occur at freeway interchanges with 96.3% occurring on arterial, collector, and local roads. Approximately half of these crashes occur at intersections. Of the intersection-related

crashes, there is nearly an even split between bicyclist-involved fatal and serious injury (K and A) crashes at signalized versus unsignalized intersections. Angle crashes (38%) are most common at intersections. Angle crashes (24%) are also common elsewhere which is likely due to potential conflict between bicyclists and motor vehicles at driveways or bicyclists riding on sidewalks and crossing streets.

The current crash report form and police officer reporting may not provide enough detail to accurately describe bicyclist crashes. Upon review of fatal and serious injury (K and A) crashes involving bicyclists by manner of collision, approximately 50% are coded under "other" or "single vehicle." This may indicate a greater need for police officer training on how to accurately fill out crash reports that involve bicyclists. It would also be desirable to include more types of bicycle-involved crashes in the ALISS crash database to better monitor the safety of the road network for bicyclists. This would require a change in the ADOT reporting procedures.

A spatial analysis of fatal and serious injury bicyclist crashes within the City of Phoenix was performed and provided in Figure 8-8 on the next page. The METRO Light Rail line and Valley Metro transit centers are shown on the map. There appears to be a pattern of serious injury crashes along some of the arterial streets that transit serves such as Bell Road, Camelback Road, and Indian School Road. Indian School Road has the most fatal bicyclist-involved crashes.

There are limited safety countermeasures the City can implement on Indian School Road. The City has partnered with MAG to perform a corridor safety assessment on Indian School Road between 27th and 51st Avenues in 2015. Some of the recommendations from that report may be applicable elsewhere. Previously, the City has upgraded to larger diameter signal heads and added higher visibility street name signs along the entire length of Indian School as part of a federal grant. A recent City overlay project on Indian School Road from 19th Avenue to I-17 reconfigured the roadway to add bike lanes. The City will continue to evaluate roadways at the time of pavement overlays to add bike lanes.

Bicycle Safety Education

In addition to making engineering improvements to the city's infrastructure, education programs are also being recommended. Model programs from Boston, Chicago, Davis, Minneapolis, Portland, and other cities may be adapted to address safety needs in Phoenix.

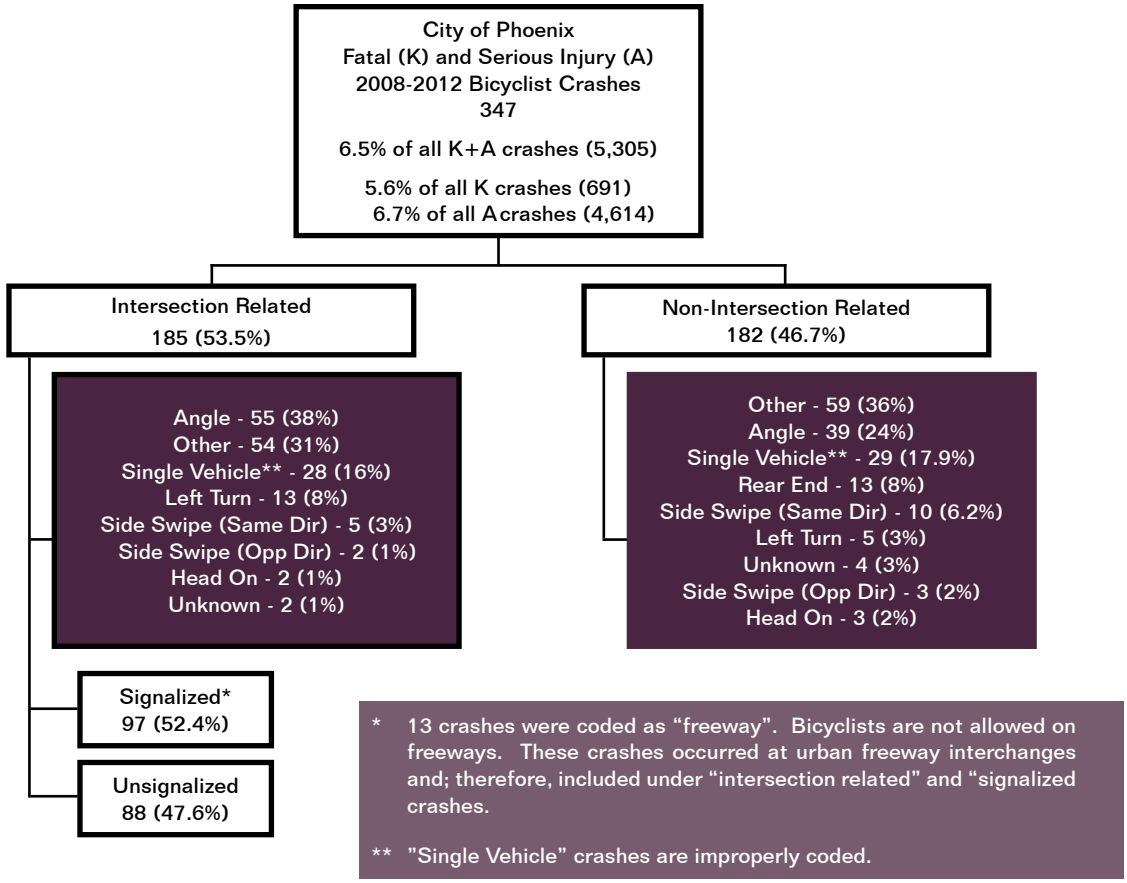


FIG 8-7 - Crash Tree of Fatal and Serious Injury Bicyclist Crashes in the City of Phoenix for 2008-2012

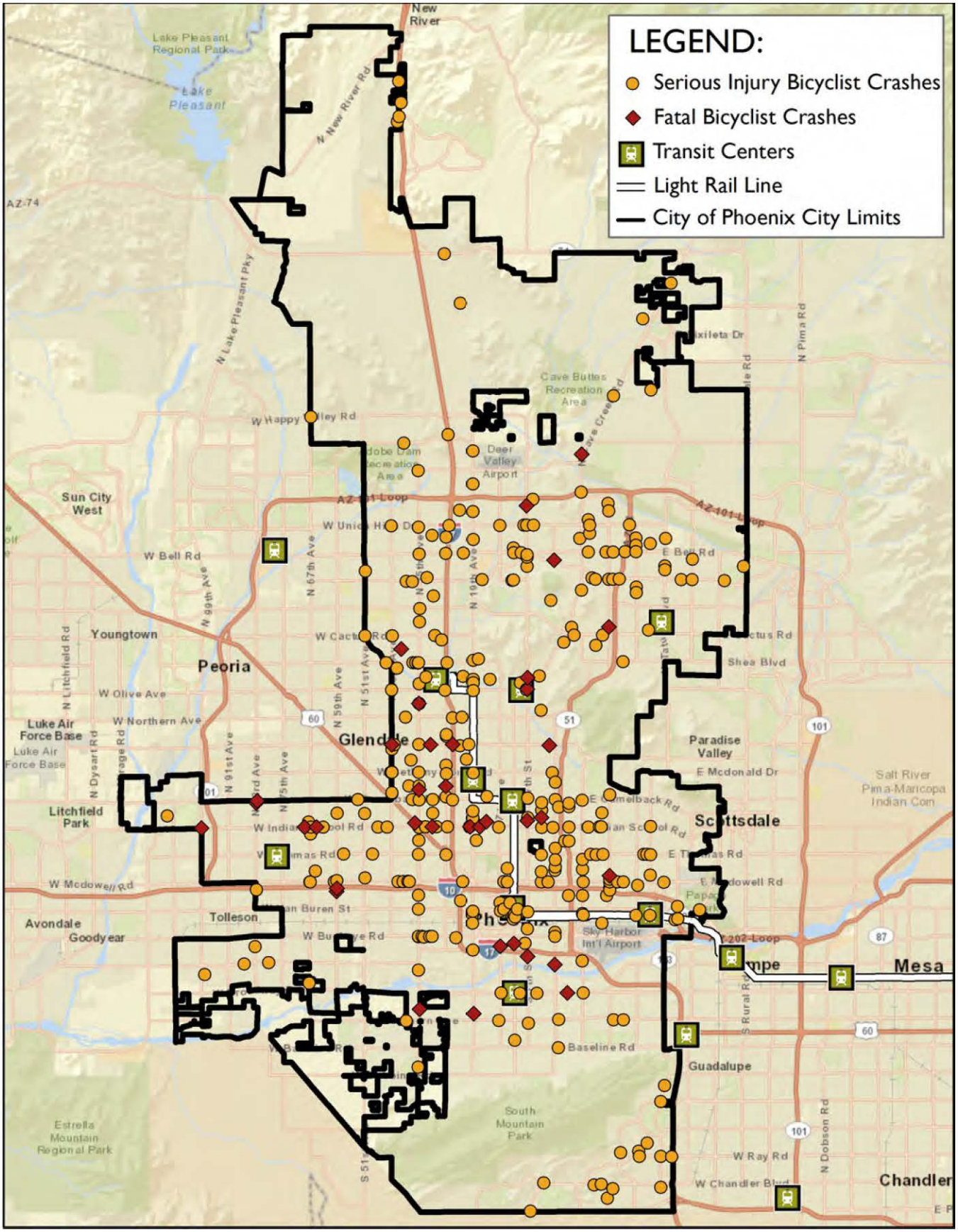


FIG 8-8 - Spatial Analysis of Fatal and Serious Injury Bicyclist Crashes in the City of Phoenix for 2008-2012

How Can Complete Streets Help?

One of the commonly cited problems with bicycling on many streets in Phoenix today is the speed of automobile traffic. With few provisions for on-street parking, bicycle facilities, or other urban traffic calming features, many arterial roadway corridors have traffic moving at very high speeds, which can result in serious injury or death if a cyclist is involved in a crash with a motor vehicle.

"Complete Streets" projects address this problem by re-examining the allocation of roadway space, making transportation improvements to promote active transportation and public health, and adding to the value of businesses, offices, and schools along the roadway. The goal is to make streets safe and inviting for people, whether walking, shopping, biking, parking, or driving in an urban context.

It is important to note that there is no single design treatment that makes a given street a complete street. A typical Complete Streets policy include adding street and sidewalk lighting; pedestrian and bicycle safety improvements; access improvements including compliance with the Americans with Disabilities Act; public transit facilities accommodation including, but not limited to, pedestrian and bicycle access improvements to transit stops and stations; landscaping; drainage; and street amenities. Chapter 9 of this plan further addresses specific design options to make Phoenix streets more bicycle friendly.

Complete Streets Initiative

Over the past 40 years, Phoenix-area population, housing, and employment experienced some of the fastest growth in the nation by over 500 percent. The population in the United States as a whole grew by approximately 70 percent during the same time period.

"Complete Streets" projects work to reallocate roadway space so that all modes are safely and efficiently accommodated. This typically results in improvements that promote active transportation which works to improve public health. Active transportation options also promote the viability of businesses, offices and schools along the roadway. The goal is to make streets safe and inviting for people whether walking, biking, using public transit or driving.

Complete Streets provide numerous benefits including:

- Increases safety
- Encourages walking and bicycling
- Spurs economic development
- Fosters sustainable growth
- Strengthens environment
- Provides more transportation choices and accessibility
- Lowers transportation costs
- Strengthen federal funding applications

The City of Phoenix Complete Streets Policy proposes the following vision:

Phoenix streets are designed and maintained to be safe, accessible, convenient and comfortable for all ages and abilities at all times.

FIG 8-9 - Keys to the Success of Complete Streets

From October 27 to 29, 2013 the City hosted the Regional National Association of City Transportation Officials (NACTO) Designing Cities Conference. The conference brought together national and local leaders in transportation planning and design to discuss pressing issues in the development of Complete Streets and how this reinvestment will improve mobility, safety and economic development.

To demonstrate Complete Streets principles, the Street Transportation Department installed the Greening Lower Grand Avenue and First Street improvements prior to the NACTO Conference. These pilot projects serve as initial phases in the development of livable streets in the downtown area and will be evaluated as components of the ongoing Downtown Phoenix Comprehensive Transportation Study. The study team will also investigate and analyze potential roadway, transit, bicycle, pedestrian, and parking improvements in the downtown area. Using the Central Phoenix Transportation Framework Study sponsored by MAG, the study will develop transportation scenarios using a host of strategies to improve the movement of people.

State Law and City Code

Arizona Revised Statutes ARS 28-101 and City Code Section 36-97 define bicycles as devices propelled by human power, having two tandem wheels greater than 16 inches in diameter or having three wheels in contact with the ground with at least one greater than 16 inches. Anyone riding a bike with wheels greater than 16 inches is a bicyclist and can ride on the sidewalk or in the street regardless of age, experience, or ability. State law imposes requirements on bicycle equipment and usage, prohibiting carrying more than one rider (unless designed to do so), and carrying bulky articles that take both hands from the handle bars. ARS 28-817 requires an "adequate" front lamp to be seen at 500 feet, rear red reflector for nighttime use, and requires equipment to enable proper braking.

City Code Section 36-98 requires bicycles operating on streets, alleys or public highways to be licensed by the Police Department. However, the police have not issued licenses in several years. Additionally, ARS 28-812 requires bicyclists riding in the road (or on the shoulder) to obey "Rules of the Road" as any other vehicle operator (where appropriate). Traffic laws apply to all cyclists when riding in the roadway. Bicyclists are required to ride as far as practicable on the right side of the road, travel in the same direction as traffic, stop at STOP signs or red traffic signals and yield the right-of-way to pedestrians in crosswalks.

Bicyclists may ride on sidewalks, but clearly sidewalks are designed to give preferential use to pedestrians. For example, City Code Section 36-113 requires bicyclists on sidewalks to yield right-of-way to pedestrians. City Code Section 36-110 also requires bicyclists emerging from an alley, driveway or building to yield right-of-way to pedestrians on sidewalks, and yield right-of-way to all vehicles on the road. Furthermore Section 36-108 requires bicyclists to ride at a speed reasonable and prudent under existing conditions, which with pedestrians and street furniture, often requires a readiness to come to a complete stop. A combination of narrow sidewalks, conflicts with pedestrians and at driveways, and "wrong way" riding on sidewalks often results in sidewalks being a poor place for bicyclists to ride.

Communities that combine infrastructure development, and education and encouragement programs are the most successful at increasing levels of participation in bicycling. Education and encouragement programs are a good opportunity for partnerships between government agencies, community groups and the non-profit sector.

RECOMMENDATIONS

GOAL:

- Bicycling will be a safe transportation and recreation option. Streets will be designed and retrofitted to safely accommodate all modes.
- People on bikes will understand bicycling rules of the road through proper facility design and safety education, Bicycling will be safer by promoting accountability and responsible attitudes of all road users.

STRATEGY:

- Update the City of Phoenix Website

OBJECTIVE:

- Consolidate bicycle information on the City of Phoenix website into one bicycling portal with an intuitive URL that is easy for people to remember and include this URL on printed materials.
- Add the Street Maintenance Division's problem reporting telephone number and Online Street Maintenance/ADA Problem Reporting Form link to the bicycle safety website. Modify this form, so cyclists can report problems with storm drains, debris in roadway, bicycle detection not working, and other bicycle-specific issues.

STRATEGY:

- Provide Training for Transportation Professionals and Police Officers.

OBJECTIVE:

- Provide training to City of Phoenix transportation engineers, as well as consultants who regularly work with Phoenix regarding the City's complete streets policy (when finalized), City bicycle facility standards and guidelines, and bicycle facility planning and design best practices.
- Establish a program to train police officers on laws impacting bicyclists and bicycle safety, and filling out the Police crash reports for bicycle crashes.
- Partner with Valley Metro to provide training to bus drivers on sharing the road with bicyclists.

STRATEGY:

- Enhance driver education.

OBJECTIVE:

- Expand automobile driver education about bicycle laws, behavior, and rights.
- Launch a "share the road" campaign to educate motorists and bicyclists to promote safe and respectful behavior from all road users.
- Launch anti-distracted driving campaign to remind drivers of the dangers of distracted driving.

STRATEGY:

- Enhance Bicyclist Education

OBJECTIVE:

- Continue City-wide coordination of Safe Routes to School (SRTS) activities, including bicycle rodeos and Bike to School Day safety assemblies and group rides.
- Establish a Phoenix Bicycle Ambassadors Program to provide outreach and education on bicycling. Potentially partner with Phoenix Metro Bicycle Club or other local or regional advocacy organization to institute and sustain the program.
- Establish a bicycle education program targeting seniors, e.g., by allowing seniors to try comfortable and stable three-wheeled bicycles and encouraging empowerment in transportation and health decisions.
- Establish an active living partnership that includes agencies, businesses and institutions involved in promoting health and wellness to implement programs promoting bicycling for health.

STRATEGY:

- Promote Bicycle Events

ACTION:

- To promote bicycle helmet use, especially amongst children and novice bicyclists.

OBJECTIVE:

- Continue promotion of Citywide Bike to School Day and Bike to Work Day.
- Establish a regular Cyclovia in downtown Phoenix, where streets are closed to motorized vehicles and opened up to non-motorized users. One such event was held in Council District 5 in conjunction with John F. Long Elementary School on March 8, 2014.

STRATEGY:

- Evaluate bicyclist safety and education regularly

OBJECTIVE:

- Create an implementation performance dashboard to track progress on implementing various aspects of the bicycle plan and document the impact on rates of bicycling, bicycle crashes and demographics (e.g. increases in female or minority riders).
- Conduct observations around schools where bike helmets have been distributed to students and safety assemblies and rodeos were conducted to monitor the change in student behavior and helmet use.

STRATEGY:

- Significantly reduce bicycle-related crashes

OBJECTIVE:

- Add language to City ordinances that places responsibility on the motor vehicle drivers to yield to bicyclists travelling lawfully on sidewalks.

CHAPTER

9

Design & Connectivity

GOAL:

People on bikes will be able to share transportation facilities with motor vehicles and easily cross roadways.

Missing gaps in the bicycle network will be completed.

This chapter covers several design details that are needed to successfully retrofit and build street corridors to help reach the targeted Platinum level Bicycle Friendly Community designation by 2035. These include addressing traffic speeds, roadway space, intersection design, and innovative bikeway facility treatments along arterial and collector streets.

The Backbone of a Connected Bicycle System

Phoenix has the benefit of being physically laid out on a grid street network, which provides multiple routes of travel for all modes. However, the functional street classification system – and corresponding design standards and speeds of vehicular travel – create major roadway corridors that often become barriers to bicycling. Interstate highways require grade-separated crossings; multi-lane arterials must be crossed at signalized intersections; local and collector streets offer little connectivity outside of neighborhoods.

To overcome these barriers, the backbone of the Phoenix bicycle system will be comprised of retrofitted arterial and collector streets that meet commuting needs and utilize signalized intersections, while minimizing the need to ride on the most heavily-trafficked major arterial routes.

BikeHAWK
Tucson, AZ

New and Existing Streets to Accommodate Bicycle Facilities/Restriping

The Street Planning and Design Guidelines (2009) as adopted by the City of Phoenix recognize eleven street cross-sections for new arterial and collector streets. These cross-sections are required to be used for new roadway design. Some of the cross-sections include bicycle lanes as presented below (Figures 9-1 through 9-4).

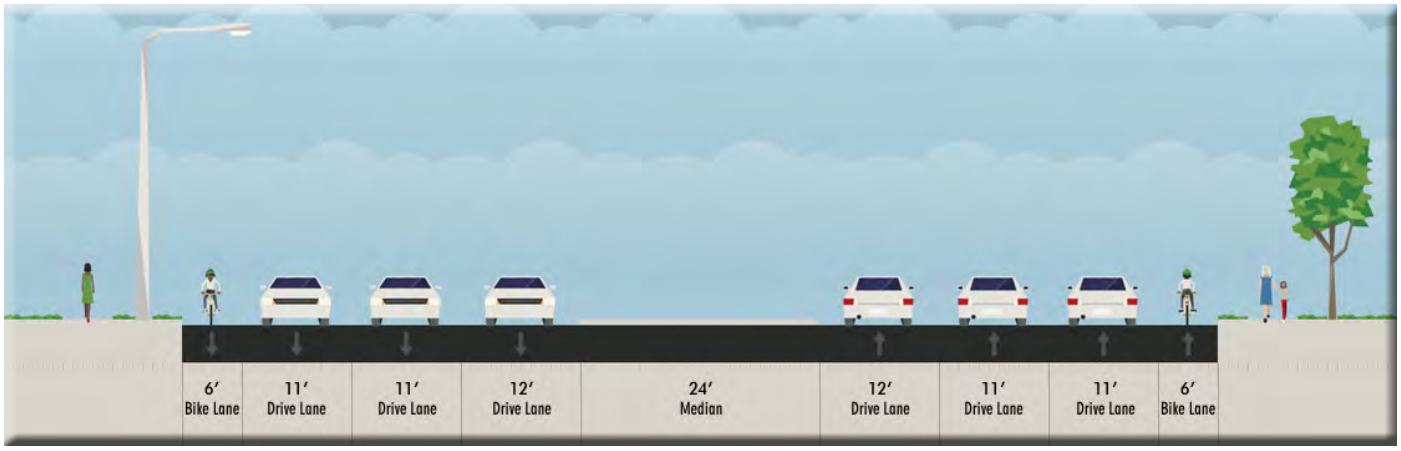


FIG 9-1: Cross-section "A" – Major Arterial/140 ft. ROW/104 ft. FOC/with Bike Lane

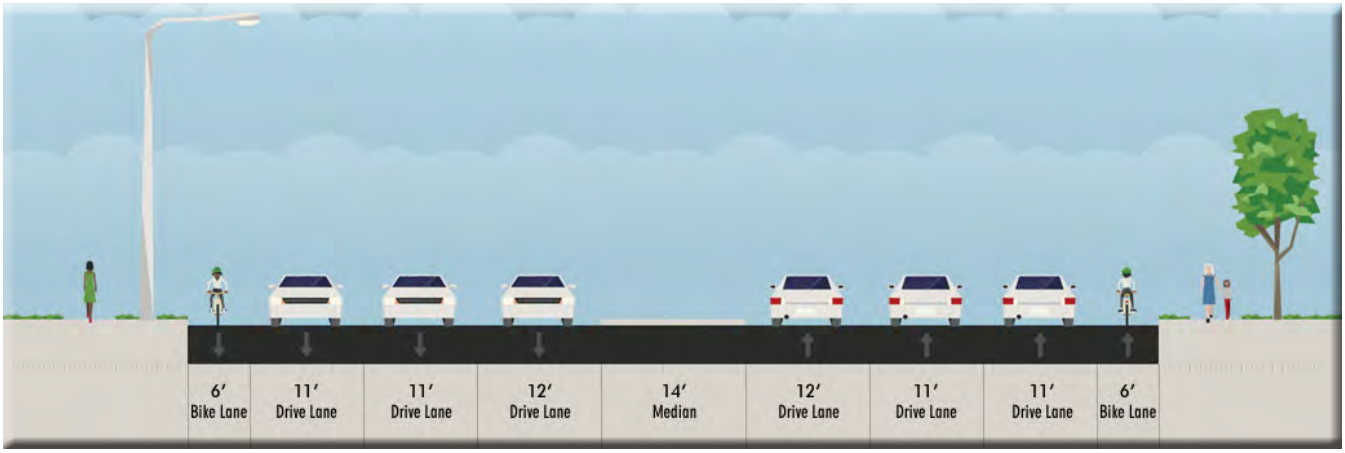


FIG 9-2: Cross-section "B" – Major Arterial and Arterial/130 ft. ROW/94 ft. FOC/with Bike Lane

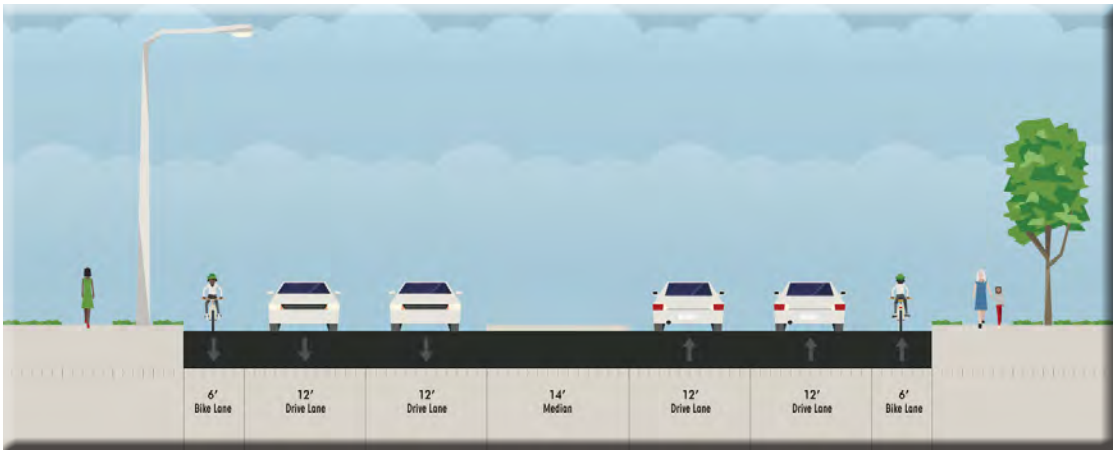


FIG 9-3: Cross-section "C" – Major Arterial and Arterial/110 ft. ROW/74 ft. FOC/with Bike Lane

Cross-sections A, B, and C designs include bicycle lanes; however, streets that were designed before 2009 when the latest City of Phoenix Street Planning and Design Guidelines was approved, may not necessarily have bicycle lanes. In such cases, restriping existing street rights-of-ways to accommodate bicycle lanes should be considered. Roadway restriping,

as referred to in this document, does not require a change to the existing number of motor vehicle lanes (as opposed to road diet). Instead it as is a term used to describe the situation where lane width can be narrowed to accommodate new or buffered bicycle lanes in the roadway between the existing curbs. The City of Phoenix cross-section "D" is presented below as an example of road retrofit to accommodate bicycle lanes (Figures 9-5 and 9-6). The City should discontinue use of Cross-section D without bike lanes.

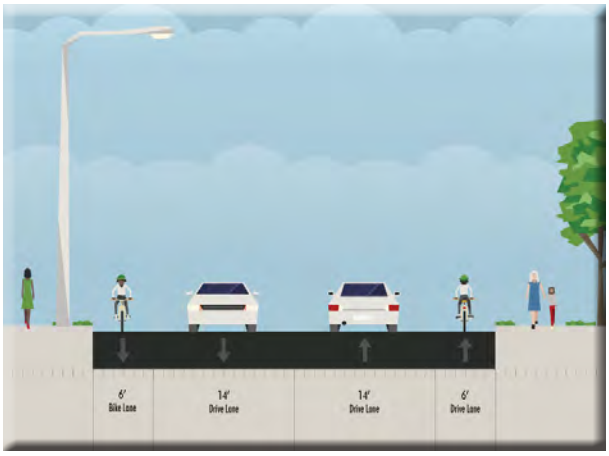


FIG 9-4: Cross-section "F" – Minor (Residential) Collector/60 ft. ROW/40 ft. FOC/with Bike Lanes

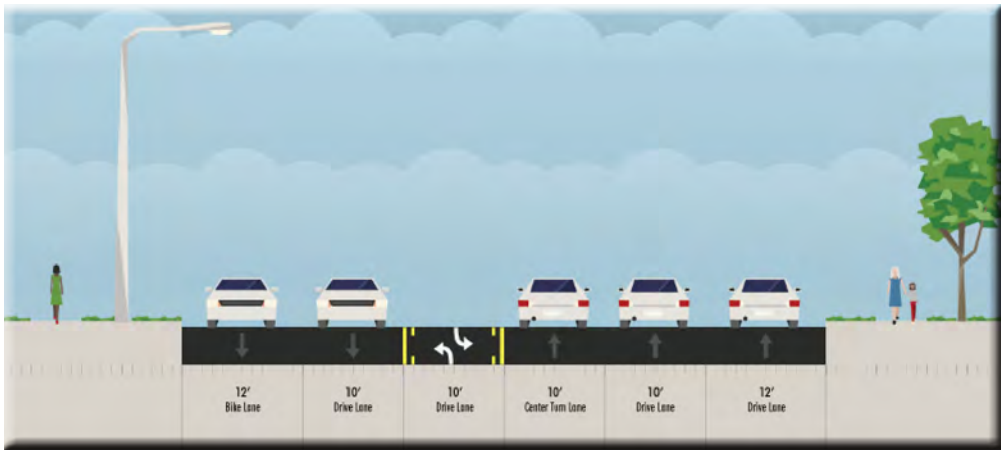


FIG 9-5: Cross-section "D" – Arterial/100 ft, ROW/64 ft, FOC/no Bike Lanes

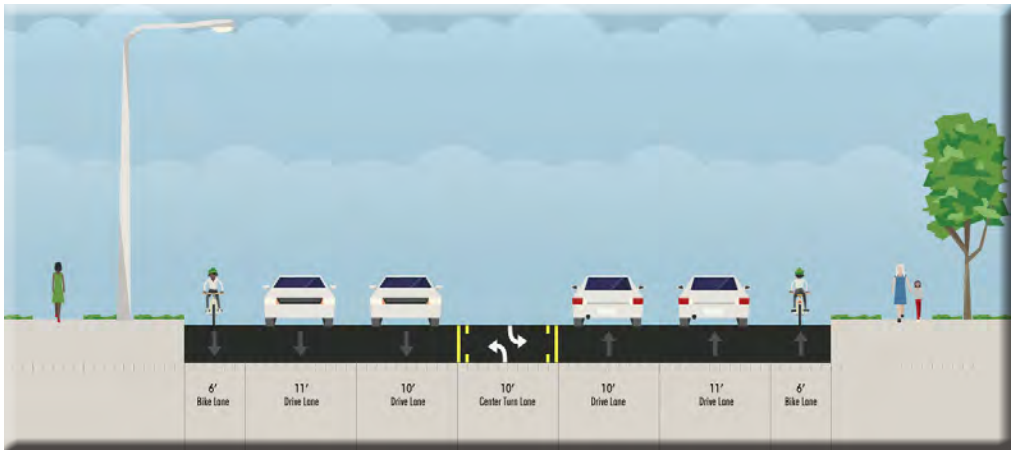


FIG 9-6: Cross-section "D" – Arterial and Major Collector/100 ft. ROW/64 ft. FOC/with Bike Lanes

Another example of roadway restriping is adding buffer space to provide additional separation between bicyclists and vehicular traffic. The "before" condition for this treatment is shown in Figure 9-7. The "after" condition is shown in Figure 9-8. If physical vertical barriers are added to the buffer space, this would be referred to as a protected bike lane or one-way protected cycle track.

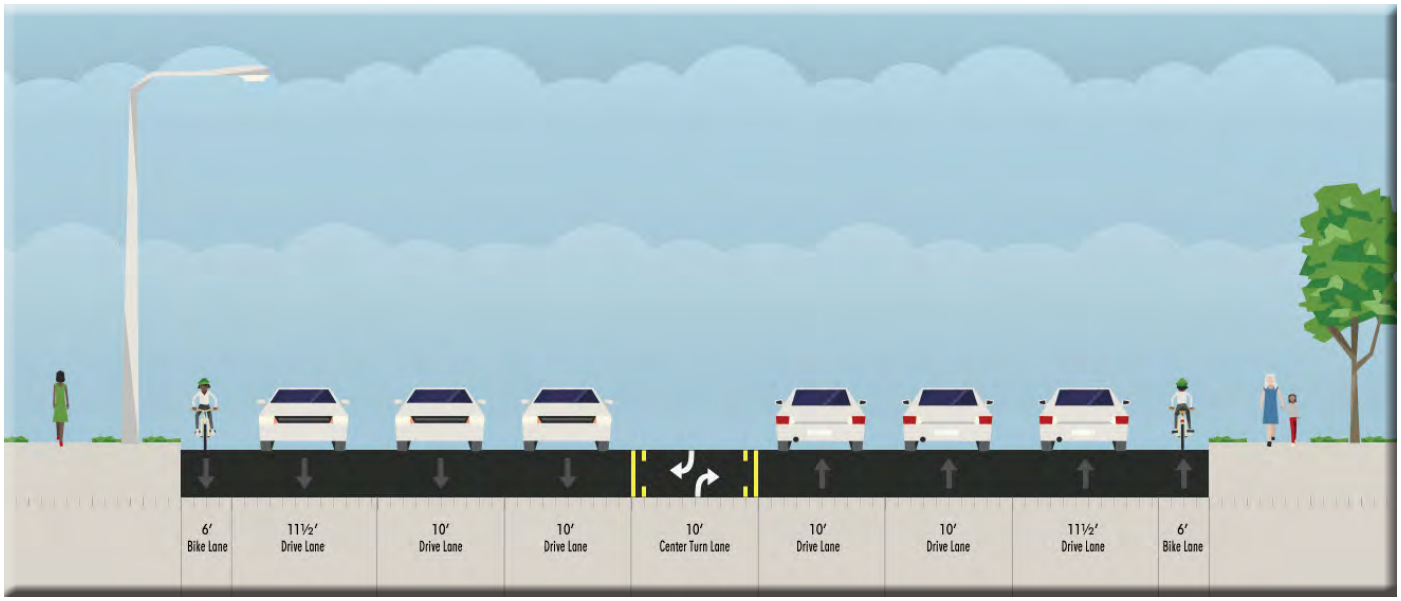


FIG 9-7: – Cross-section with bike lanes/no buffer space/81 ft. FOC

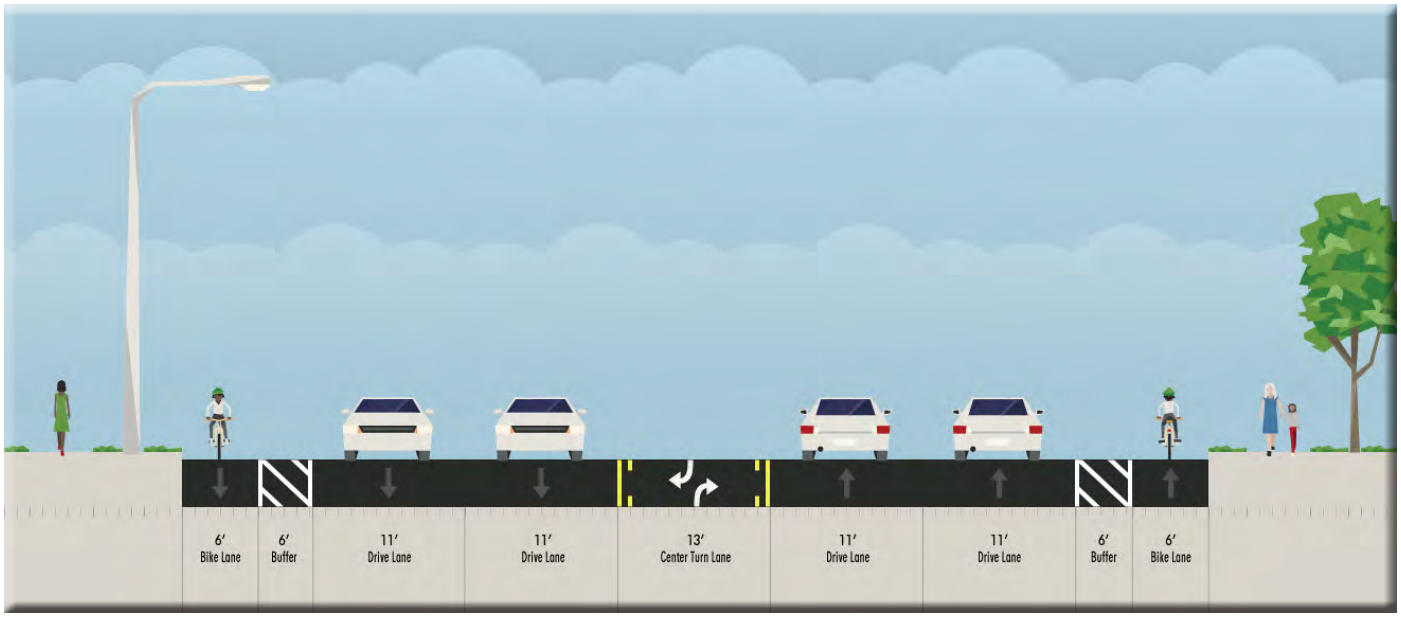


FIG 9-8: – Cross-section with bike lanes and buffer space/81 ft. FOC

Additional separation between bicyclists and vehicular traffic can be achieved by adding raised cycle tracks. This retrofitting requires significant right-of-way to accommodate both pedestrians and bicyclists outside of the paved roadway, but it provides even more separation between bicyclists and vehicular traffic than a buffer space (Figure 9-9 and Figure 9-10). This and other innovation bicycle facilities are included in the NACTO Urban Bikeway Design Guide.

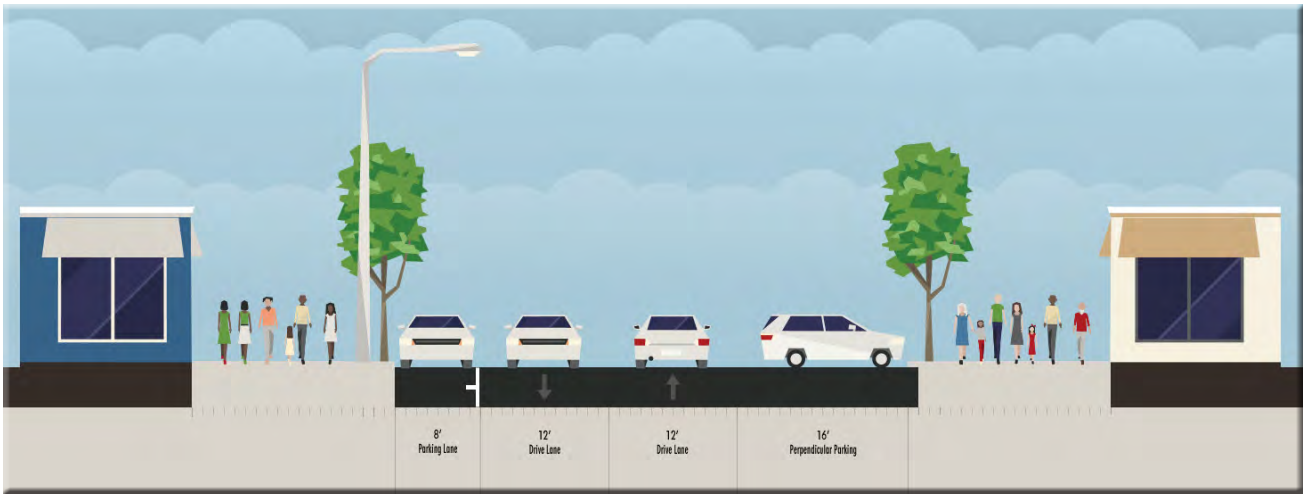


FIG 9-9: – Cross-section without cycle track[1]

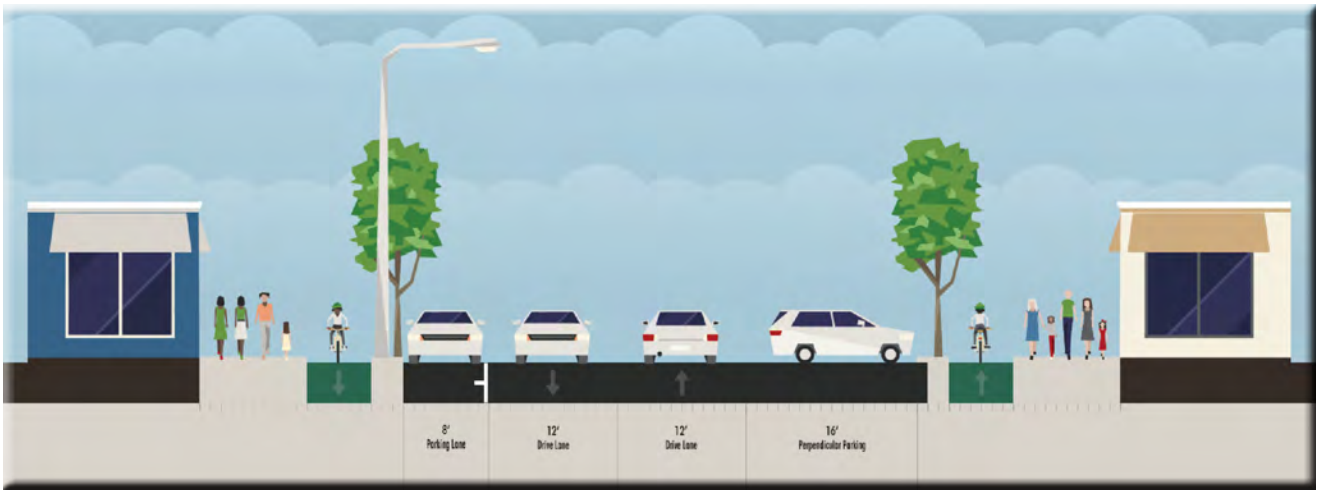


FIG 9-10 - Cross-section with raised cycle track[2]

Road Diets

Road diets are based on reallocation of road space through a reduction in the number of vehicular traffic lanes. Typical roadway reconfiguration on a 40 feet wide collector street involves converting an undivided four lane roadway into three lanes made up of two through lanes and a center two-way left turn lane plus bike lanes. A typical four-lane roadway before a road diet is depicted in Figure 9-13. The roadway after road diet implementation is depicted in Figure 9-14. The remaining space of 10 feet can be utilized as bike lanes (5 feet in each direction), pedestrian crossing islands or parking spaces. The advantages of road diets include, but are not limited to, crash reduction, improved overall safety and accessibility for non-motorized users, reduced traffic speed, and improved access management.

Many roads are suitable for a road diet. According to Federal Highway Administration[3] four-lane roadways with Average Daily Traffic (ADT) of 20,000 or less may be good candidates for road reconfiguration. Road diets can be applied to four-lane roadways with motor vehicle capacity from around 5,000 up to 24,000 vehicles per day, or up to around 1,500 to 1,750 vehicles during the peak hour[4]. In the City of Phoenix, a road diet on 15th Avenue showed ADTs above approximately 20,000 vehicles. On a road diet section, there is an increased likelihood of traffic congestion that may divert traffic to nearby parallel roads or neighborhood streets.

1 - All dimensions are approximate
2 - All dimensions are approximate
3 - FHWA Proven Safety Countermeasures "Road Diet" (Roadway Reconfiguration)
4 - Libby, T. *Road Diet Conversions: A Synthesis of Safety Research*. DTFH61-11-H-00024, May 2013

Several feasibility factors should be considered before implementing a road diet: roadway function and environment, overall traffic volume, turning volumes and patterns, frequent-stop and slow-moving vehicles, speeds, and queues, crash type and pattern, pedestrian and bicycle activity, right-of way availability, as well as other contextual considerations. None of these factors have specific threshold assigned to consider road diet; rather, multiple factors need to be taken into account when evaluating road diet option.

"All roads, streets, and highways, except those where bicyclists are legally prohibited, should be designed and constructed under the assumption that they will be used by bicyclists."

2012 AASHTO Guide for the Design of Bicycle Facilities Design Imperative

Table 9-2: Road Diet Examples for High Volume Locations

Location	Approx. ADT	Safety	Operations
Montana: Helena - US12	18,000	Improved	No Notable Decrease*
Minnesota: Duluth - 21st Avenue East Ramsey County - Rice Street	17,000 18,700 Before 16,400 After	Improved* 28 percent total crash reduction (3 years of data)	No Notable Decrease* N/A
California: Oakland - High Street San Leandro - East 14th Street	22,000-24,000 16,000-19,300 Before 14,000-19,300 After	17 percent in total crash reduction (1 year of data) 52 percent in total crash reduction (2 years of data)	No notable change in vehicle speed Maximum of 3 to 4 MPH spot speed reduction
Washington: Seattle - Nine Locations	9,400-19,400 Before 9,800-20,300 After	34 percent average total crash reduction (1 year of data)	N/A
Florida: Orlando - Edgewater Drive.	N/A	increase in safety: crash rate dropped by 34%, injury rate dropped by 68%	drop in speed between approximately 1% to 7% increase in on-street parking utilization by approximately 12% overall increase in bicyclist use by approximately 30%

*Summarized results based on anecdotal information.

The FHWA Highway Safety Information System (HSIS) Summary Report discussed the Evaluation of Lane Reduction "Road Diet" Measures and Their Effects on Crashes and Injuries[5]. This report includes road-diet before and after study using 10 groups, with 11 road diets and 24 comparison sites. The analysis included examination of crash frequency, crash rate, crash severity and crash type on selected locations. The results of this study are depicted in Figure 9-11.

5 - http://www.fhwa.dot.gov/publications/research/safety/humanfac/04082/04082.pdf (last visited 12/5/2012)

ANALYSIS CATEGORY	COMPARISON			
	Road Diets Before vs. After	Comparison Sites Before vs. After	Before Period Road Diets vs. Comparison Sites	After Period Road Diets vs. Comparison Sites
Crash Frequency	Reduction In After Period	No Change	No Difference	Road Diets Lower
Crash Rates	No Change	No Change	Road Diets Lower	Road Diets Lower
Crash Severity	No Change	No Change	No Difference	No Difference
Crash Type	No Change	No Change	Difference: 1. Road diets had a higher percentage of angle crashes 2. Road diets had a lower percentage of rear-end crashes	Difference: 1. Road diets had angle crashes. 2. Road diets had a lower percentage of rear-end crashes.

FIG 9-11: – Depicting HSIS Study: Results[6]

The need for bicycle lanes in urban/suburban setting was evaluated by the Oregon Department of Transportation (ODOT) study[7]. The City of Phoenix should use this chart to help practitioners determine the appropriateness for bicycle lanes (Figure 9-12). If a bicycle lane cannot be retrofitted on a major arterial, the City should identify a continuous parallel bicycle route or consider a shared lane and implement intersection bicycle design treatments for crossing the major arterial.

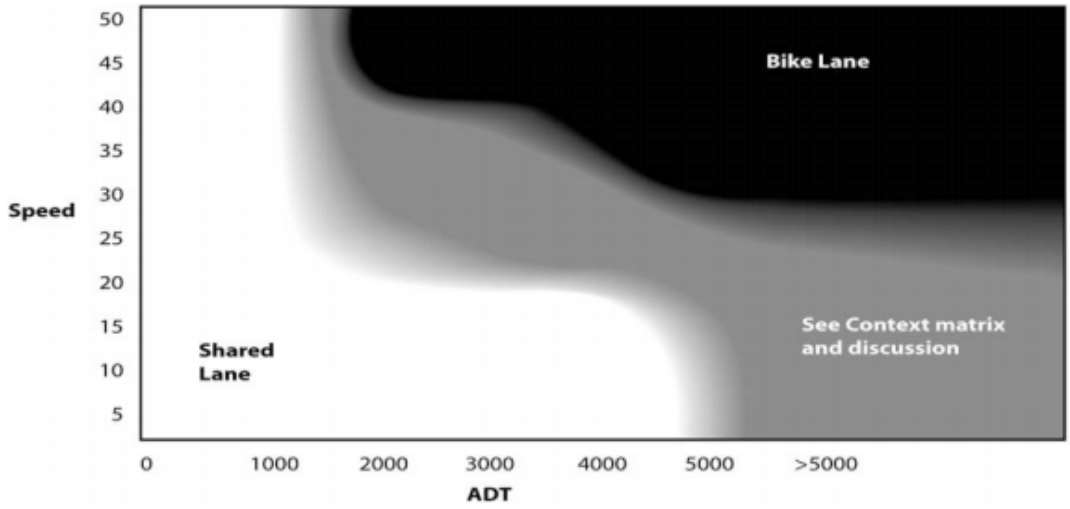


FIG 9-12: – Oregon Department of Transportation Chart

6 - http://www.fhwa.dot.gov/publications/research/safety/humanfac/04082/04082.pdf (last visited 12/5/2012)
7 - http://www.oregon.gov/ODOT/HWY/BIKEPED/docs/bike_lane_matrix.pdf

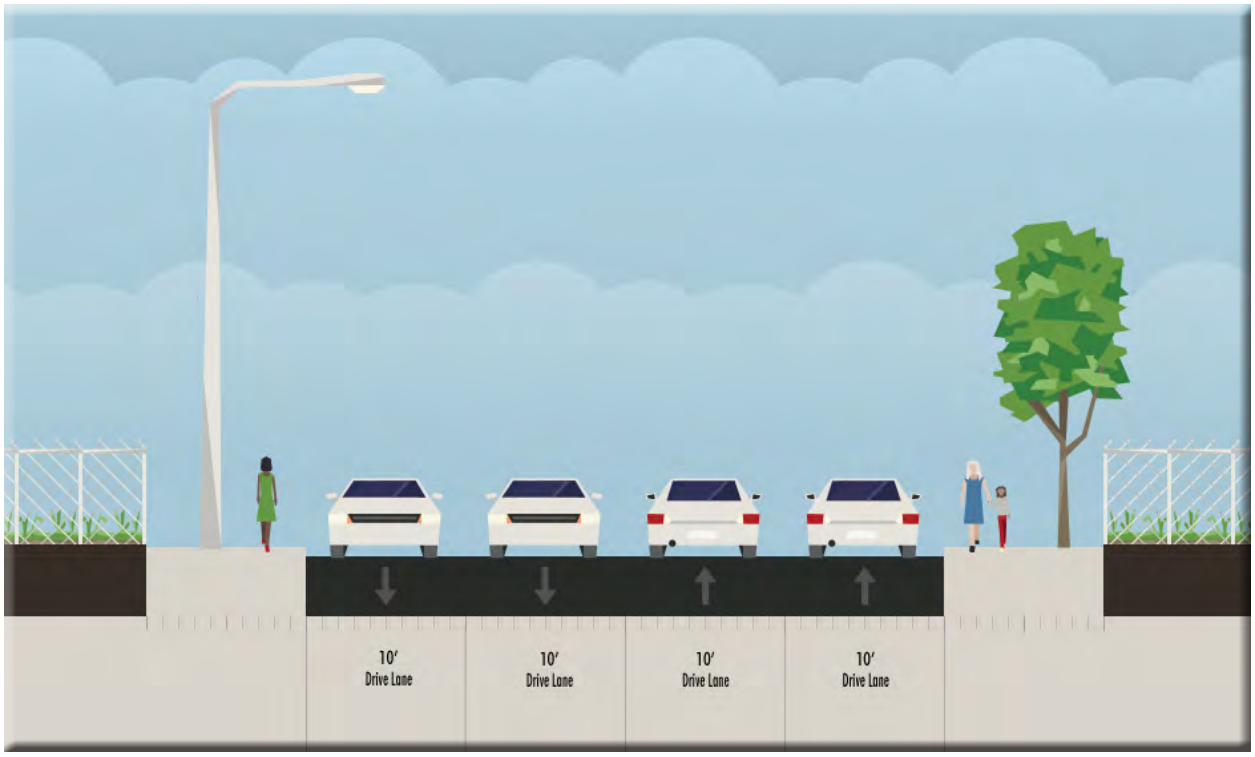


FIG 9-13: – Typical four-lane roadway before road diet

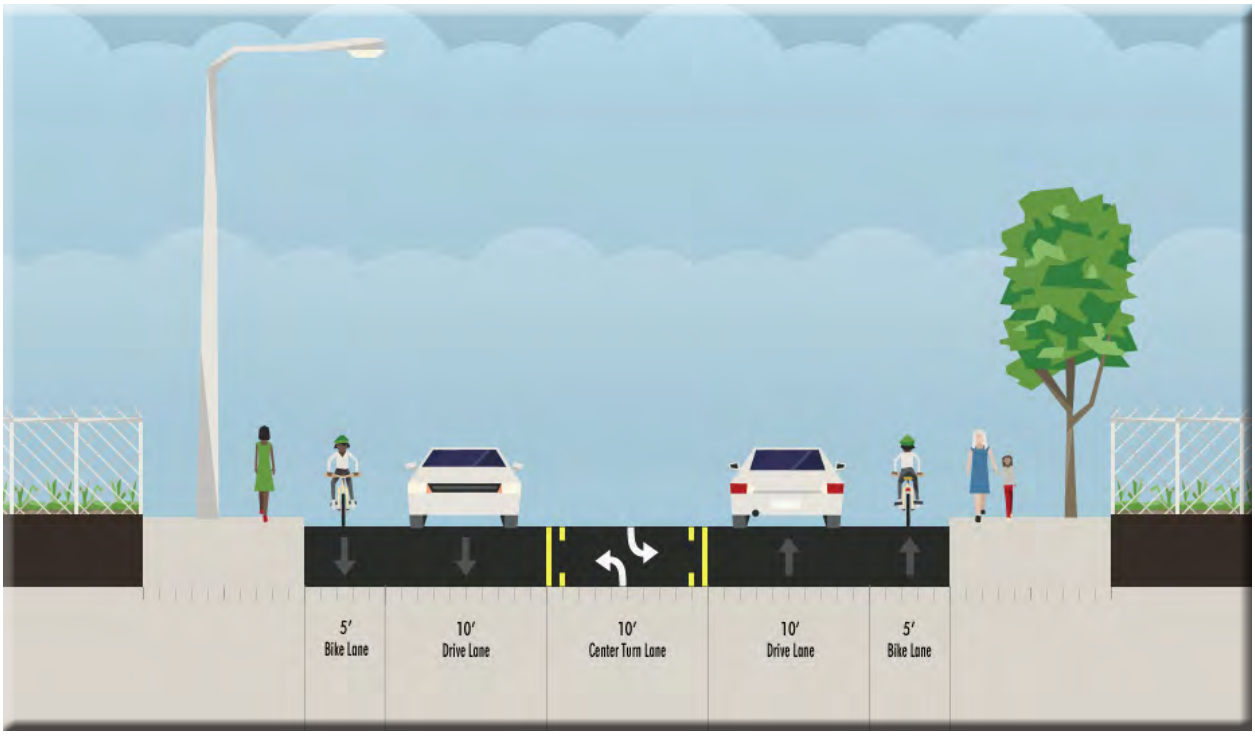


FIG 9-14: – Typical four-lane roadway after road diet

The City of Phoenix has implemented road diets over the last 15 years and should continue this practice as underutilized roadways without bike lanes are identified. Examples of road diet projects the City of Phoenix has implemented include:

- 12th Street between Osborn Road and Indian School Road
- 12th Street between Camelback Road and Mountain View Road
- 15th Avenue between Van Buren Street and Bethany Home Road
- Central Avenue between Camelback Road and Bethany Home Road
- 23rd Avenue between Dunlap Avenue and Peoria Avenue
- 40th Street between McDowell Road and Camelback Road
- Grand Avenue between 7th Avenue and 15th Avenue
- 1st Street from Van Buren Street to Moreland Street

In particular, the City of Phoenix implemented a road diet on 40th Street between McDowell Road and Indian School Road as part of a traffic calming project. Prior to the road diet implementation, 40th Street was four-lane roadway without bike lanes, and had approximately 18,000 vehicles per day. After the road diet was implemented 40th street was converted into a two-lane roadway with a center turn lane and bike lanes. However, all 40th Street approaches were designed to have one left, one through and one right turn lane at the collector street intersections. The signalized intersections along 40th Street remained unchanged. A one-year before and after study concluded that the collision rate between the arterial street intersections decreased by 43 percent. Collision rates at the signalized intersections remained approximately constant during this same time period[8].

Designs to Encourage Increased Levels of Bicycling

Many engineering advancements have been made in recent years to make bicycling a more prominent daily activity for short-distance trips within cities. Most notably, the National Association of City Transportation Officials (NACTO) has developed two new guidance documents that are being enthusiastically embraced by metropolitan areas across the country. The NACTO Urban Street Design Guide and Urban Bikeway Design Guide will be used by Phoenix to supplement current local, state, and national transportation standards.

In a memorandum dated August 20, 2013, the Federal Highway Administration expressed support for taking a flexible approach to bicycle and pedestrian facility design, particularly in urban areas. The AASHTO Guide for the Development of Bicycle Facilities is the primary national resource for planning, designing, and operation of bicycle facilities. The NACTO Urban Bikeway Design Guide builds upon the flexibilities provided in the AASHTO guide, which can help communities plan and design safe and convenient facilities for bicyclists. The City of Phoenix Street Transportation Department has demonstrated national leadership by adopting the NACTO Design Guides for Streets and Bicycle Facilities in 2013. The table presented on the FHWA's bicycle and pedestrian design guidance web page is regularly updated (http://1.usa.gov/1qoNCov) and explains what bicycle facilities, signs, and markings are allowed in accordance with the MUTCD. Elements of the NACTO Guide's new and revised provisions will be considered in the rulemaking cycle for the next edition of the MUTCD. Non-compliant traffic control devices may be piloted through the MUTCD experimentation process. That process is described in Section 1A.10 of the MUTCD.

This section of the report documents an extensive review of the state of the art and practice in variety of design options. These design options represent the most innovative technologies and practices implemented worldwide by cities leading in bicycle friendly design. The design options were selected to accommodate preferences of a variety of bicyclists (e.g. preferring to use on and/or off-street bicycle facilities).

The design options presented in this section were chosen as infrastructure tools that can be used to improve bicycling in Phoenix and are consistent with guidance provided by the National Association of City Transportation Officials (NACTO), Manual on Uniform Traffic Control Devices (MUTCD), and the American Association of State Highway and Transportation Officials (AASHTO).

8 - Lee Engineering, LLC 40th Street Traffic Study, 2003

The City's existing plans, standards, and guidelines should be updated to specifically address intersection treatments. Additionally, existing plans, standards, and guidelines do not reference innovative facilities, such as cycle tracks. Below is a list of recommended innovative facilities from the NACTO guide that should be included in the City of Phoenix Street Planning and Design Guidelines. These as well as other design options are presented with greater detail in the next section of this report.

Innovative Facilities for Roadway Segments

- Buffered Bike Lane
- Contra-Flow Bike Lane
- Colored Bike Lane
- One-Way Cycle Track (protected bike lane)
- Two-Way Cycle Track
- Raised Cycle Track
- Bicycle Boulevard
- Shared Lane Marking

Innovative Facilities for Intersections

- Bike Box
- Intersection Crossing Marking
- Two-Stage Turn Queue Box
- Median Refuge Island
- Through Bike Lane
- Combined Bike Lane/Turn Lane
- Cycle Track Intersection Approach
- Active Warning Beacon for Bike Route at Unsignalized Intersection
- Bicycle Signals
- Hybrid Beacon for Bike Route Crossing of Major Street (BikeHAWK)

DESIGN OPTIONS FOR ROADWAY SEGMENTS

Bicycle Lanes

Definition and Purpose:

- Provides exclusive space for bicyclists through the use of bicycle lane striping, signs, and pavement markings.

Application:

- On roadways with 3,000 or more motor vehicle trips per day where there is potential or existing bicycle demand.
- Any street with excessive curb to curb space where bike lanes could help reduce vehicle lane widths.

Advantages:

- Improves bicyclist comfort on busy roads.
- Improves bicyclist visibility to motor vehicle drivers by encouraging bicyclists to ride on the road rather than on the sidewalk.
- Allows bicyclists to ride at their preferred speed.

- When created by narrowing motor vehicle lanes, can reduce motor vehicle speeds.
- Allows for bicycle access on major through streets.
- Distinguishes lane usage between motorists and cyclists.

Considerations:

- Bike lanes should provide a width of 5 ft. to 8 ft. of rideable surface; however, in constrained situations a minimum width of 4' ride-able surface is allowable based on engineering judgment. Bicycle lanes over 8 ft. wide are discourage to limit confusion as to whether the bike lane is a vehicle lane.
- Space for bicycle lanes can be created by reallocating existing roadway space, e.g., by narrowing other travel lanes, removing travel lanes, and/or reconfiguring parking lanes.

Buffered Bicycle Lane

Definition and Purpose:

- Provides buffer space on one or both sides of bicycle lane to create greater separation between bicyclists and passing motorists as well as on-street parking.

Application:

- The buffer is typically installed on the parking side where parking turnover is high and traffic speeds low, and on the travel lane side where parking turnover is low and traffic speeds high.
- Streets where high motor vehicle volumes and speeds where cycle track is not feasible

Advantages:

- Provides additional space to separate bicyclists from vehicular traffic
- Provides space for bicyclists to pass one another without encroaching into the adjacent motor vehicle travel lane
- Encourages bicyclists to ride outside of the door zone when the buffer is between parked cars and the bike lane
- Provides more space for bicycling without making the bike lane appear so wide that it might be mistaken for a travel lane or a parking lane

Consideration:

- Space for buffered bicycle lanes can be created by reallocating existing roadway space, e.g., by narrowing other travel lanes, removing travel lanes, and/or reconfiguring parking lanes.

Contra-Flow Bicycle Lane

photo provided by Toole Design Group

Definition and Purpose:

- Provides a bicycle lane for bicyclist to travel in both directions while vehicular traffic remains one-way.

Application:

- One-way traffic streets
- Narrow streets where on-street parking and bicycle accessibility are given priority over traffic accessibility

Advantages:

- Provide direct access for bicycles traveling in both directions
- Influence motorist choice of routes without limiting bicycle traffic
- Cyclists do not have to make detours as a results of one-way traffic

Considerations:

- Space can be created by reallocating existing roadway space, e.g., by narrowing other travel lanes, removing travel lanes, and/or reconfiguring parking lanes.
- Limited parking on side with contraflow lane
- Illegal parking within the contraflow lane
- Traffic control signs/signals must exist for contra-flow bicyclist traffic
- Design of contra-flow lane termini and its connection to the receiving roadway
- A bicycle lane or other marked bicycle facility should be provided for bicyclists traveling in the same direction as motor vehicles to discourage wrong way riding in the contra-flow lane

Colored Bicycle Lane

Definition and Purpose:

- Bicycle lanes that are painted green to provide the visual perception of a narrow roadway for motorists and give the bicyclist a psychological perception of separation from traffic.

Application:

- Use for existing bicycle lanes at locations of potential conflict points, i.e., heavily utilized driveway crossings, within bicycle crosswalks, at uncontrolled intersections, railroad track crossings, etc.

Advantages:

- Provides visual separation
- Provides warning of possible conflict from crossing paths

Considerations:

- Maintenance
- Cost
- Use materials that provide a slip resistant surface
- Typically requires approval from FHWA to implement on an experimental basis.

One-Way Cycle Track

Definition and Purpose:

- Exclusive one-way bicycle facilities that are physically separated from motor vehicle travel lanes and sidewalks. Separation can be achieved through a variety of treatments, including: a) parking lanes with pavement marking buffers inclusive of flexposts or bollards; b) curbs or concrete medians; or c) planters with landscaping. Can be implemented at street level, raised to the level of the adjacent sidewalk, or raised at a vertical offset between the street and the sidewalk. The latter can utilize a mountable curb to allow for entry and exit of the roadway.

Application:

- Arterial roadways with higher motor vehicle speeds and volumes
- Roadways with high parking turnover
- Roadways with fewer cross-streets and longer blocks

Advantages:

- Provides physically protected, exclusive space for bicyclists separate from motor vehicles and pedestrians
- Suitable for, and more attractive to, bicyclists of all ages and abilities
- Prevents vehicles from driving and parking in facility
- Reduces or eliminates chance of "dooring"
- Can provide traffic calming by visually narrowing the street's allowable travel way.

Considerations:

- Cycle tracks should be designed to allow bicyclists to pass one another.
- Space for one-way cycle track can be created by reallocating existing roadway space, e.g., by narrowing other travel lanes, removing travel lanes, and/or reconfiguring parking lanes
- Design to meet minimum sight distance requirements for motorists and cycle track users at intersections and driveway crossings
- Pedestrian accessibility and conflict points at intersections and transit stops
- Presence of drainage and utility structures along the curb may reduce the effective width of the cycle track
- Maintenance

Two-Way Cycle Track

Definition and Purpose:

- Exclusive two-way bicycle facilities that are physically separated from motor vehicle travel lanes and sidewalks. Can be implemented at street level, raised to the level of the adjacent sidewalk, or at a vertical offset between the street and the sidewalk.

Application:

- Arterial roadways with higher motor vehicle speeds and volumes
- Streets where two one-way cycle tracks will not fit within the usable width of the right-of-way
- Streets with fewer conflict points at driveways or minor cross streets on one side of the street
- One-way streets where contra-flow bicycle travel is desired for connectivity purposes
- Streets where more destinations are on one side of the street, thereby reducing the need to cross the street
- Streets that intersect with another bicycle facility, such as a cycle track or multi-use trail/ sidepath

Advantages:

- Same benefits as one-way cycle track
- Allows bicyclists to travel in both directions on a one-way street, potentially minimizing a more circuitous existing route.

Considerations:

- Same considerations as one-way cycle track
- Additional warning signs for motorists and pedestrians at conflict points where the contra-flow movement of a bicyclist is unexpected
- Signal timing coordination (if installed on a one-way street) to minimize contra-flow bicyclists needing to stop more frequently due to progression against the optimized green for vehicular traffic
- Protected bicycle phasing/bicycle signals are desired due to potential the potential for conflicts with left-turning motor vehicles.
- Two one-way cycle tracks are preferred over a two-way cycle track if there is sufficient space within the right-of-way.

Shared Lane Markings

Definition and Purpose:

- Pavement markings that emphasize to motorists that a travel lane should be shared with bicyclists or that bicyclists have priority in the travel lane. They also help bicyclists position themselves outside of the door zone.

Application:

- Streets with moderate traffic volumes where bike lanes are precluded by constrained right-of-way
- Short gaps between bike lanes
- Streets without space for bike lanes in both directions.
- Low-traffic shared roadways to indicate presence of bikeway
- To designate through-movement of bicycles through shared turn lane
- Streets with speed limits of 35 mph or less

Advantages:

- Increase visibility of bicyclists
- Guide proper roadway positioning of bicyclists on streets

Considerations:

- Maintenance costs
- Markings must be spaced 250 ft. or less
- Installation of appropriate MUTCD signage to indicate when a bicyclist and motorist should share the available lane width or when the bicyclist “may use full lane.”

Bike-Bus Lane

Definition and Purpose

- Shared on-road facility designated only for bus and bicycle use. Sometimes painted in red. Provide on-road travel lanes designated exclusively for bus and bicycle use, along with right turns at intersections and driveways

Application:

- Arterial streets where there is not enough space for a bike lane
- Arterial streets with high bus and bike volumes

Advantage:

- Provides dedicated lane for buses and bicyclists

Considerations:

- May be uncomfortable for some bicyclists due to sharing lane with large vehicles and mixing with motor vehicle traffic at intersections.
- Issues with right turn motorists entering the lane on the approach to driveways and intersections.
- Important to educate bus drivers

Bicycle Boulevard

Definition and Purpose:

- Local street routes that are optimized for bicycle and pedestrian travel. Design elements may include: diverters, reconfiguration of stop signs to favor the bike boulevard, traffic calming and shared lane markings, and crossing improvements at high traffic crossings

Application:

- Any residential street or minor collectors

Advantages:

- Improves connectivity for non-motorized modes
- Improves bicycle comfort
- Improves bicycle safety
- Provides comfortable and attractive places for people of all ages to bike, run, skate, and walk
- Lowers vehicular volume
- Maintenance costs

Bicycle Friendly Traffic Calming

Definition and Purpose:

- Traffic calming measures designed to accommodate bicyclists. Examples include curb extensions, speed tables, chicanes, storm water plantings, cut-throughs, and diverters.

Application:

- Local or collector streets

Advantages:

- Calms traffic
- Reduces traffic speeds and volumes
- Reduces cut-through traffic

Considerations:

- Maintenance (issues such as street sweeping) and landscape trimming/watering
- Affects parking

Road Diet

BEFORE

AFTER

Definition and Purpose:

- Reallocating roadway space by reducing the number of general purpose travel lanes and using the balance for other purposes, such as to support bicycle and pedestrian access.

Application:

- Four-lane undivided streets, which may be converted to a three-lane cross section (one lane in each direction with a center turn lane or median)
- Multi-lane streets with extra capacity where one or more lanes can be removed

Advantages:

- Can create space for bicycle lanes, cycle tracks, refuge islands, and other bicycle and pedestrian improvements
- Reduces exposure of crossing bicyclists and pedestrians to motor vehicle traffic
- Can reduce motor vehicle crashes and improve speed limit compliance

Considerations:

- A capacity analysis is often necessary to evaluate the impacts of the proposed design on the operations of the roadway and adjacent road network.
- Maintain continuity of pavement markings from blocks with road diet to blocks in the existing condition.
- Advantageous to add width to the parking lane or the bicycle lane in areas of high parking turnover to reduce the likelihood of dooring

Lane Diet

photo provided by Toole Design Group

Definition and Purpose

- Reducing the width of general purpose travel lanes to the minimal lane widths allowed within the jurisdiction to encourage slower vehicular speeds and/or provide space for bicycle and pedestrian improvements.

Application:

- Streets with lanes that are wider than the minimum requirement

Advantages:

- Can create space for bicycle lanes, cycle tracks, refuge islands, and other bicycle and pedestrian improvements
- Can reduce motor vehicle speeds

Considerations:

- Heavy vehicles, transit vehicles, and emergency vehicles and the width of roadway considered to be a minimum for these vehicles' routes
- Potential impacts on the adjacent road network

Design Option for Intersections

Bicycle Box

Definition and Purpose:

- Provides a dedicated space for bicyclists to wait ahead of traffic during the red light at signalized intersections. A typical bicycle box is designated by two pavement markings called stop bars, approximately 12 to 16 feet apart with painted bicycle symbol. Bicycle boxes maybe painted with bright colors (green).

Application:

Signalized intersection with:

- High number of queuing bicyclists
- High automobile and bicycle volume
- Frequent bicycle left turns or motor vehicle right turns
- History of frequent turning conflicts
- No right turn bay

Advantages:

- Improves visibility of bicyclists stopped at signalized intersection
- Reduces bicycle/motor vehicle crashes
- Gives bicyclist priority when signal has a short green phase
- Allows left turn bicyclist to position themselves ahead of traffic
- Shorter crossing distance for bicyclists
- Lessens nuisance from vehicle exhaust

Considerations:

- Post "No Turn on Red" signs for motorists
- Vehicle encroachment into bike boxes
- Initial and maintenance costs of colored surface

Two-Stage Turn Queue Box

photo from NACTO Urban Bikeway Design Guide

Definition and Purpose:

- Offer bicyclists a safe way to make left turns at multi-lane signalized intersections from a right side cycle track or bike lane, or to make right turns from a left side cycle track or bike lane. The configuration of two-stage turn queue boxes is typically dictated by the geometric layout of the intersection. For example, the queue box can utilize area in front of a setback crosswalk, area in line with a cycle track's buffer space and far side parking lane or, if right-of-way constraints allow at a T-Intersection, an area within a carved out "jughandle" sidewalk configuration.

Application:

- Signalized, multi-lane intersections with high motor vehicle volumes or speed where a significant number of bicyclists turn left from a right side facility
- Unsignalized intersections in conjunction with connections to other facilities such as bicycle boulevards
- To assist bicyclists in navigating safely across streetcar tracks

Advantages:

- Improves the ability of the bicyclist to make safe and comfortable left-turning movements
- Provides a dedicated queuing space for bicyclists making a two-stage turn
- Reduces turning conflicts between bicyclists and motor vehicles
- Prevents conflicts arising from bicyclists queuing in a bike lane or crosswalk

Considerations:

- Typically results in higher average delay for bicyclists, due to the need to receive two separate green signal indications (one for the through street, followed by one for the cross street) before proceeding with the turn; at unsignalized intersections, the two-stage turning movement can cause delay as bicyclists need to wait for appropriate gaps in traffic to cross
- In cities that permit right turns on red signal indications, a "No Turn on Red" sign should be installed to prevent vehicles from entering the queue area (MUTCD Section 2B.54)

Intersection Crossing Markings

Definition and Purpose:

- Pavement markings in the intersection that indicate where bicyclists should cross. Pavement marking treatments can include dashed white lines. symbols (e.g., chevrons, bicycle symbols), and green paint.

Application:

- Limited visibility for side street traffic
- On-street parking
- Curved road through intersection

Advantages:

- Provides greater visibility for bicyclists at intersections.
- Informs all roadway users of where bicyclists should cross.
- Separates modes to reduce conflicts.

Considerations:

- Maintenance
- Potential confusion or clutter with additional pavement markings

Through-Bike Lane

Definition and Purpose:

- As bicyclists approach intersections in a standard bicycle facility, the presence of vehicular turning lanes can pose a significant challenge for bicyclists to correctly position themselves to make a through movement across the intersection. A standard bike lane, also referred to as a 'bicycle pocket' is placed to the left of a right-turn-only lane at an intersection to enable bicyclists and right-turning motorists to position themselves in advance of the intersection, avoiding last-second conflicts in the "weaving area." A through bike lane is designed so that the through bicyclists are given priority within the weaving area and signs and markings are installed to indicate that motorists turning right should yield to bicyclists going straight through the intersection in the bike lane. Dashed lines and colored pavement are used to increase the visibility of the conflict area.

Application:

- Streets with right-side bike lanes and right-turn only lanes at intersections
- Streets with bike lanes where the right or left travel lane terminates in a turn lane
- Streets with bike lanes and a parking lane that transitions into a turn lane at intersections

Advantages:

- Enables bicyclists to correctly position themselves to the left of right turn lanes
- Reduces conflicts between turning motorists and bicycle through traffic
- Provides bicyclists with guidance to follow the preferred travel path
- Leads to more predictable bicyclist and motorist travel movements
- Alerts motorists to expect and yield to merging bicycle traffic

Considerations:

- Designs should encourage turning motorists to yield to bicyclists through installation of MUTCD regulatory signs
- Important to consider safety implications for all allowed movements for each travel mode (motor vehicle, transit vehicles, bicyclists, pedestrians)
- Consider restricting movements to reduce potential conflicts and increase protection for bicyclists and pedestrians
- Merging or weaving areas should be located prior to the intersection

Combined Bike Lane/Turn Lane

Definition and Purpose:

- A combined bicycle lane/motor vehicle turn lane with a designated space for through-moving bicyclists. Typically, a dashed line indicates the end of a bicycle facility adjacent to the curb and the start of the space for bicyclist and motorists to merge into a shared lane, the combined bike lane/turn lane. The intended path for bicyclists is indicated by a dashed bicycle lane, or shared lane markings, placed towards the inside portion of the turn lane. This treatment includes signs to advise motorists and bicyclists of proper positioning within the lane.

Application:

- Streets where there is a right turn lane but not enough space to maintain a standard-width bicycle lane at the intersection
- Streets where there is no dedicated right turn lane, but on which high volumes of right turning traffic may cause conflicts between motorists and bicyclists
- Cycle track corridors where there is a dedicated turn lane on the side of the street with the cycle track, but where a separate bike signal phase is not appropriate or feasible

Advantages:

- Preserves positive guidance for bicyclists in a situation where the bicycle lane would otherwise be dropped prior to an intersection
- Maintains bicyclist comfort and priority in the absence of a dedicated bicycle through lane.
- Reduces the risk of "right hook" collisions at intersections

Considerations:

- May not be appropriate at intersections with very high peak automobile right turn demand

Median Refuge Island

photo provided by Toole Design Group

Definition and Purpose:

- Raised median or island that provides refuge along the route of a bicycle or pedestrian crossing.

Application:

- Controlled/uncontrolled crossings with high motor vehicle volumes or speeds
- Controlled/uncontrolled crossings with high bicycle or pedestrian volumes
- Crossings where it is difficult for bicyclists and pedestrians to find gaps in motor vehicle traffic sufficient to cross all roadway lanes in one stage

Advantages:

- Reduces bicyclist and pedestrian exposure to motor vehicle traffic
- Enables bicyclists and pedestrians to cross the roadway in two stages by providing a protected space to wait for an acceptable gap in traffic
- Provides a motor vehicle traffic calming measure for a street's cross section

Considerations:

- May require reallocation of roadway space

Bicycle Over/Under Pass

Definition and Purpose:

- Provide safe and efficient bicycle movement for bicyclists traveling over or under a major railway or roadway.

Application:

- Major roadway or railway where no crossing is provided.

Advantages:

- No interaction with vehicular traffic

Considerations:

- Cost
- "footprint" required for bridge ramps
- Security for underpasses
- Vandalism for underpasses

Bicycle Signal Head

photo provided by City of Tucson

Definition and Purpose:

- Use a bicycle symbol lens at signalized intersections to indicate when bicycles may travel through the intersection.

Application:

- Signalized intersection with high bicycle volume

Advantages:

- Minimize conflicts between bicyclists and other modes of transportation.
- Reduced bicycle delay during periods of high vehicle traffic
- Provide bicyclist priority over other users (leading bicycle interval)
- Help to simplify bicycle movements through complex intersections

Considerations:

- Maintenance costs
- Increase stops and delay for automobile traffic
- Increase delay for bicyclist during periods when the major street traffic is low
- Not yet in MUTCD (under consideration for next revision)
- Motorist may confuse bicycle signal for vehicle signal in some applications

Bicycle Signal Detection

photo provided by City of Tucson

Definition and Purpose:

- Provides detection for bicyclists at signalized intersections using pavement sensors/loops, video detection, or other technologies. Designs should include markings to indicate to bicyclists where to position themselves to actuate the signal.

Application:

- Signalized intersection where signal change is unlikely without detection (activated signal approaches)

Advantages:

- Provide a way for a bicyclist to call the signal

Considerations:

- Installation and maintenance costs
- Sensitivity and adjustment

Rectangular Rapid Flashing Beacon (RRFB)

photo provided by City of Scottsdale

Definition and Purpose:

- A warning beacon consisting of yellow LED lights in two rectangular clusters, or beacons, that employ a stutter-flash pattern similar to that used on emergency vehicles. Used at uncontrolled intersections and mid-block crossings to warn drivers of crossing bicyclists and pedestrians.

Application:

- Uncontrolled intersections/crossings with high motor vehicle volumes or speeds
- Uncontrolled intersections/crossings with high bicycle or pedestrian volumes, or a high number of vulnerable pedestrians (e.g. near schools, senior centers)
- Shared-use path crossings

Advantages:

- Increases driver yielding
- Costs less than traffic signals or hybrid signals and can be used with solar power panels to eliminate the need for a power source

Considerations:

- RRFB's should be limited to locations with critical safety concerns and should not be installed in locations with sight distance constraints that limit the driver's ability to view pedestrians on the approach to the crosswalk.
- RRFB's should be used in conjunction with advance yield pavement lines and signs.

Hybrid Beacon for Bike Route Crossing of Major Street

photo provided by City of Tucson

Definition and Purpose:

- A push-button-activated pedestrian and bicycle signal that increases pedestrian and bicycle safety at crossings while stopping vehicle traffic only as needed. This type of signal is also commonly referred to as the High intensity Activated crosswalk, or HAWK, signal. This signal consists of two red lenses above a single yellow lens. Once activated by the push-button, the hybrid beacon will briefly flash yellow intervals until displaying a steady red indication to drivers and a "WALK" indication to pedestrians and bicyclists. While pedestrians finish crossing, the hybrid beacon displays alternating flashing red lights to the motorist until it goes dark signaling that motorists may proceed.

Application:

- Mid-block crossings (including off-street path crossings)
- Crossings where high traffic volumes and speeds make it difficult for pedestrians and bicyclists to cross the street, and where 'warrants' for a conventional signal are not met

Advantages:

- Provide a protected crossing while allowing vehicles to proceed through a pedestrian/bicycle crossing as soon as it is clear, thus minimizing vehicle delay
- May also provide audible information for visually impaired pedestrians

Considerations:

- Hybrid beacons should only be installed at marked crosswalks and if gaps in traffic are not deemed adequate to permit pedestrians and bicyclists to cross safely.

Off Street Design Options

Shared-Use Path

Definition and Purpose:

- A shared bicycle and pedestrian facility that is physically separated from motor vehicle traffic by an open space or barrier and either within the highway right-of-way or within an independent right-of-way. Most shared use paths are designed for two-way travel and are at least 8' wide.

Application:

- Corridors not well served by the on-street bikeway network
- Washes, canals, river banks

Advantage:

- Separates bicyclist from vehicular traffic
- Provides more direct/shorter routes to access destinations

Considerations:

- Stops at street crossings unless underpasses and overpasses are built

Design Options for Bicycle Parking

Short-Term Bicycle Parking

photo provided by City of Tucson

Definition and Purpose:

- Bicycle parking intended for short-term use, such as a brief shopping trip. May consist of individual or multiple bike racks placed within the furniture or building frontage zones on a sidewalk or high-capacity corrals placed within the parking lane.

Application:

- Within close proximity of major entrances to businesses, parks, libraries and other community facilities.

Advantages:

- Promotes bicyclist traffic to variety of destinations
- Provides secure located to store bicycles

Considerations:

- In-street corrals may require removal of on-street parking space

Long Term Bicycle Parking

photo provided by Toole Design Group

Definition and Purpose:

- Long-term bicycle parking should be secure and protected from the elements. Potential facilities include bike lockers, bike lids, bike cages, and bike stations.

Application:

- Close to places of employment, transit centers, educational facilities, airports, and train stations (long-term).

Advantages:

- Promotes bicyclist traffic to variety of destinations
- Provides secure located to store bicycles

Considerations:

- For private property applications, must be provided by property owners
- Additional amenities may be provided, including showers, lockers, and maintenance stations

Wayfinding

Definitions and Purpose:

- Signs to provide distance and direction to points of interest or destinations along a route. In the context of this plan, wayfinding also includes guides signs to provide connectivity and continuation of an existing bike route, connection to another bicycle route, and street name signs at trail crossings of arterial streets.

Application:

- Multi-use trail crossings at arterial streets, or along any on-street or off-street route which provide connections to major attractors or points of interest or alternate routes.
- Guidance for complex routes where the primary path may be unclear

Advantages:

- Provides useful guidance to bicyclists
- Promotes tourism
- Encourages and promotes bicycling by providing improved directions and distances

Considerations:

- Requires custom signs and sign monitoring
- MAG is currently conducting a study to develop standardized Wayfinidng sign design guidelines and branding for the off-street trail system. Phoenix should provide input into the development of the sign design and usage guidelines and adopt the guidelines and branding that are developed for the MAG region. This same practices can be used for the on-street bicycle routes where appropriate.

RECOMMENDATIONS

Goal:

- People on bikes will be able to share transportation facilities with motor vehicles and easily cross roadways. Missing gaps in the bicycle network will be completed.

Strategy:

- Retrofit arterial and collector streets to meet commuting needs and utilize signalized intersections, while minimizing the need to ride on the most heavily-trafficked major arterial routes.

Action:

- Continue to implement road diets as underutilized roadways without bike lanes are identified.
- Evaluate roadways at the time of pavement overlays to add bike lanes
- Implement innovative bicycle facilities as described in Chapter 9 of the Bicycle Master Plan

Strategy:

- Provide wayfinding for bicyclists throughout the City

Action:

- Install guide signs for connections to the continuation of the existing bike route
- Install guide signs for connections to other bicycle routes
- Install wayfinding signs that provide guidance as well as distance and/or time to nearby destinations or points of interest
- Provide street name signs for trail crossings of arterial and collector streets where none currently exists.
- Provide input into the development of the MAG wayfinding sign design and usage guidelines
- Adopt the wayfinding guidelines that are developed for the MAG region

Strategy:

- Update City of Phoenix guidelines addressing bicycle facility design and traffic control

Action:

- Take a flexible approach to bicycle and pedestrian facility design, particularly in urban areas, through the use of AASHTO and NACTO national resource guides.
- Guidance on bike lane design should recommend a width of 5' to 7'of ride-able surface; however, in constrained situations a minimum width of 4' ride-able surface is allowable based on engineering judgment. Guidance should discourage bicycle lanes over 7' wide to limit confusion as to whether the bike lane is on-street parking or a travel lane. If surplus pavement exists, a striped buffer between the vehicle travel lane and the bicycle lane may be provided.
- Guidance on bike lane design should specify that bike lane symbols should be installed at intervals of 500 ft. to 1000 ft. based on engineering judment, and that bike lane markings should generally be provided after intersections and signalized driveways. Pavement symbols on the approach to intersections where separate right turn lanes exist should be encouraged.
- The Traffic Operations Handbook allows consideration to be given to declaring a bike lane in effect only during commute periods (7:00 a.m. – 6 p.m.). This language should be modified to specify that such consideration should include roadway classification, cross section, traffic speeds and volumes, and adjacent land uses.
- Guidance on shared use path design should recommend two-way shared-use path widths of 10 ft. - 14 ft. or more (per AASHTO), with reductions to 8' under certain circumstances based on engineering judgment.
- Guidance on shared use path design should promote the use of materials other than decomposed granite for multi-use trails, such as asphalt or concrete.
- Guidance on canal pathway design should promote the inclusion of bicycle accommodations on bridges across canals.
- Guidance on canal pathway design should include guidelines for bicycle access to the pathway, short- and long-term bicycle parking, and bicycle wayfinding.
- Guidance on bike routes should include additional detail on the use and placement of BIKE ROUTE signs per AASHTO and MUTCD.
- Guidance on bicycle detection at traffic signals should encourage testing of new bicycle detection technologies.

- Guidance on bike rack placement and minimum clearances should be updated based on the most recent AASHTO and APBP guidelines.
- Guidance on bike parking should address long-term bicycle parking, such as bike lockers at transit hubs.
- The Street Transportation Department should review and potentially expand the existing rack request program.
- The City should partner with business improvement districts such as the Downtown Phoenix Partnership to provide bicycle racks in commercial areas.
- Funding should be prioritized for bicycle rack installation along Tier 1 corridors during the initial phase of bicycle plan implementation, Tier II corridors during the second phase of bicycle plan implementation, and Tier III corridors during the third phase of bicycle plan implementation.
- The City should consider initiating an interagency program to evaluate, replace and add bike parking at all City-owned public facilities.
- The City should consider amending zoning and subdivision codes to require redevelopment and new development to provide appropriate types, quantities and locations of bicycle parking as part of development approval. See Sample Bicycle Parking Guidelines in Appendix K: Bicycle Parking.
- The City of Phoenix bicycle program web page should provide a map of bicycle parking locations in downtown Phoenix, a way for bicyclists to indicate where bicycle parking is needed, and information on how to request a bicycle rack.
- If the Street Transportation Department converts single-space parking meters to pay-stations, old parking meter posts should be modified to function as bicycle racks where feasible and appropriate.
- The Planning and Development Services Department should establish a process to evaluate locations and facility types for long-term bicycle parking, and develop branding.
- The bicycle parking standards provided in the Phoenix Traffic Operations Handbook should be updated. See recommended updates in Appendix K: Bicycle Parking.
- Guidance on work zones should address bicycle safety and accommodation.
- Guidance on work zones should include temporary detour signing and striping recommendations for bicycles, as well as “Share the Road” and “May use Full Lane” signs as provided for in the MUTCD.

CHAPTER

10

Connections & Collaborations

Opportunities for Connections & Collaboration

The city of Phoenix is one of 32 jurisdictions in Maricopa County (including the County Government and Indian Reservations). Within the city, bicycle facilities can be found on- and off-street. Most of these off-street facilities are managed by the City of Phoenix Parks and Recreation Department. Like the on-street network, the off street network fulfills a mobility and recreation role. For bicycle facilities within Phoenix to be fully functional, it is imperative that the on- and off- street networks be seamlessly integrated. This chapter discusses opportunities to ensure bicycle facilities are connected within the city and within the region.

Current Conditions

Connectivity Within Phoenix

Within Phoenix, a total of 51 miles of off-street paved paths and 66 miles of unpaved trails are managed by the Phoenix Parks and Recreation Department, Salt River Project, and the Flood Control District of Maricopa County. These facilities are used by a wide variety of cyclists described in Table 10-1: Types of Cyclists.

GOAL:

The City of Phoenix will be connected to bikeways, shared use paths, and trails with Phoenix and in adjoining communities to provide longer-distance recreation and commuting opportunities.

This mix of facility types will provide a variety of comfortable travel options for all ages, abilities, and travel purposes through the promotion of loops and links.

TABLE 10-1: Types of Cyclists

Type of Cyclists	Characteristics
Type A: Child Bicyclists	• Pre-teen riders whose bicycle use is initially monitored by parents • Do not like to ride in traffic and/or are not allowed to ride on most streets • Desire access to key destinations surrounding residential area • Will seek out multi-use pathways as safe, recreational places to ride.
Type B: Basic Bicyclists	• Casual adult and teenage riders who are less confident operating in traffic • Are often intimidated by motor vehicles, tend to make short trips close to home and prefer designated bicycle facilities • Some will develop greater skills and progress to the advanced level, but basic bicyclists will always make up the largest percentage of cyclists.
Type C: Sport Cyclists	• Riders preferring adventure cycling requiring high levels of technical expertise • Includes recreational road cyclists focusing on distance and speed • Includes off-road cyclists focusing on terrain, speed and distance.
Type D: Advanced Bicyclists	• Experienced riders who can operate under most traffic conditions. • Includes road cyclists comfortable riding in traffic who will ride with or without bicycle facilities present, often bike long distances, and prefer direct routes for utilitarian trips.

Most of the paved and unpaved shared use facilities are along canals or washes, and in parks, mountain parks, and preserves. Of these facilities, the canals and washes are preferred by all types of cyclists. These facilities provide important non-motorized connections because they are generally level surfaces and connected to the street grid. These off-street facilities include the shared use corridors along the Indian Bend and Cave Creek Washes, and shared use corridors along the Grand, Arizona, Highline, Western, and Central Arizona Project (CAP) canals. Other facilities, preferred by Types A through C cyclists are located in parks, mountain parks and preserves are primarily loops not connected to the street grid and used for recreational and sport bicyclists. This plan is focused on enhancing the network of bicycle facilities that provide recreational and commuter, shopping or other mobility options. For these reasons, this plan focused on providing opportunities associated with bicycle facilities along canals.

Canals

Salt River Project (SRP) operates a system of canals throughout the metropolitan area for the purposes of transmission and distribution of water. As shown in Figure 10-1, the banks of SRP-operated canals have become popular recreation areas. Some corridors offer developed shared use trails; others corridors are not developed and users share access provided primarily for SRP maintenance vehicles. All canals are required by Federal law to be accessible to the public.

Grand Canal (18.69 miles within Phoenix)

The most significant off-street bicycle facility is the partially completed 18.69 mile shared-use path and trail corridor along the Grand Canal. Completing this corridor is the top ranked off-road bikeway project recommended in this plan. This project is recommended as part of the Tier II improvement projects.

The Grand Canal trail is a major SRP corridor that links the communities of Peoria, Glendale, Phoenix, and Tempe. The Grand Canal represents a substantially under-utilized asset. In addition to providing a recreational venue, it also contributes to the transportation network as a major bike trajectory connecting neighborhoods along its route and linking with two Metro Light Rail stations at Sky Harbor International Airport and Campbell/Central Avenue.

Within the City of Phoenix, the Grand Canal connects between and within neighborhoods east and west of I-17. These include the westside urban villages of Maryvale and the eastside urban Villages of Alhambra, Encanto, Camelback East, and Central City. The Grand Canal Trail does not traverse I-17. As a result, the urban village of Maryvale is not connected by the canal to other urban villages east of I-17. One of the projects identified as a part of this plan is a bridge over I-17 at the Grand Canal.

The Grand Canal Trail is also important as an intra-village facility connecting destinations within the Encanto and Camelback East Villages. As part of the ReinventPHX initiative, detailed plans have been developed for trail development and major street crossing improvements at ten intersections located between 7th Avenue and 44th Street. These plans include installing 12-foot wide paved multi-use trails along the canal, using a combination of highly visible crosswalk markings, colored pavements,

median refuge islands, and bicycle hybrid beacons (BikeHAWKs) to enhance intersection crossings; and celebrating the canal by creating a community gateway using an urban roundabout, public art, and amenities at the intersection of the Grand Canal with Van Buren and 40th Street. Other concepts put forward by ReinventPHX include activating the canal with buildings that front onto it, improving access by adding new pedestrian bridge crossings, and the creating new civic spaces at select nodes.

Indian Bend Wash (3.78 miles within Phoenix)

The Indian Bend Wash within Phoenix extends from Scottsdale Road to the Piestewa Peak Parkway (SR-51). This corridor extends the existing city of Scottsdale Indian Bend Wash shared use facility into Phoenix. The Indian Bend Wash terminates at the Salt River and Rio Salado Development in Tempe.

Cave Creek Wash (6.64 miles within Phoenix)

The Cave Creek Wash is a significant open space corridor that extends from the Tonto National Forest through the Cave Buttes Recreation Area to the Arizona Canal. Within Phoenix, a paved, shared-use path extends from Union Hills Road to the Arizona Canal. A portion of the path, between Greenway Parkway and the Cave Creek Golf Course access road is incomplete but should be built soon. This portion includes a mid-block crossing across 19th Avenue.

Arizona Canal (16.72 miles within Phoenix)

The Arizona Canal Corridor includes a paved shared use path between the Skunk Creek Wash and East 24th Street in Phoenix. The Arizona Canal is also the northern link of the Maricopa County Sun Circle Trail. At 24th Street, the corridor includes a decomposed granite trail through the Arizona Biltmore and proceeds east along the canal bank into Scottsdale. This corridor includes the Arizona Falls, which was restored by SRP as a visitor destination.

Highline Canal (13.41 miles within Phoenix)

The Highline Canal is located between the Western Canal and South Mountain. A paved, shared use path is located along this canal corridor between Central Avenue and 46th Street. At 46th Street, the Highline Canal proceeds south into Tempe and Guadalupe, and wraps back across I-10 into Phoenix. The unpaved path is discontinuous between Ray Road, across I-10, and Chandler Boulevard. The portion of the Canal within Phoenix is one of two east-west non-motorized facilities serving the area between the Gila River and South Mountain.

Western Canal (13.27 miles within Phoenix)

The Western Canal is part of the Maricopa County Sun Circle and Maricopa Trails. This important corridor extends from 35th Avenue within Phoenix into Tempe, where is proceeds south to approximately Chandler Boulevard.

Central Arizona Project (20.40 miles within Phoenix)

The CAP corridor is a regional facility that extends from the Salt River Pima Indian Community throughout the county. Within Phoenix, a portion of the corridor from 19th to 67 Avenues is a designated, shared use unpaved trail. While other portions of the CAP are designated as shared use facilities, they are discontinuous along the canal.

Sport and Recreational Cycling

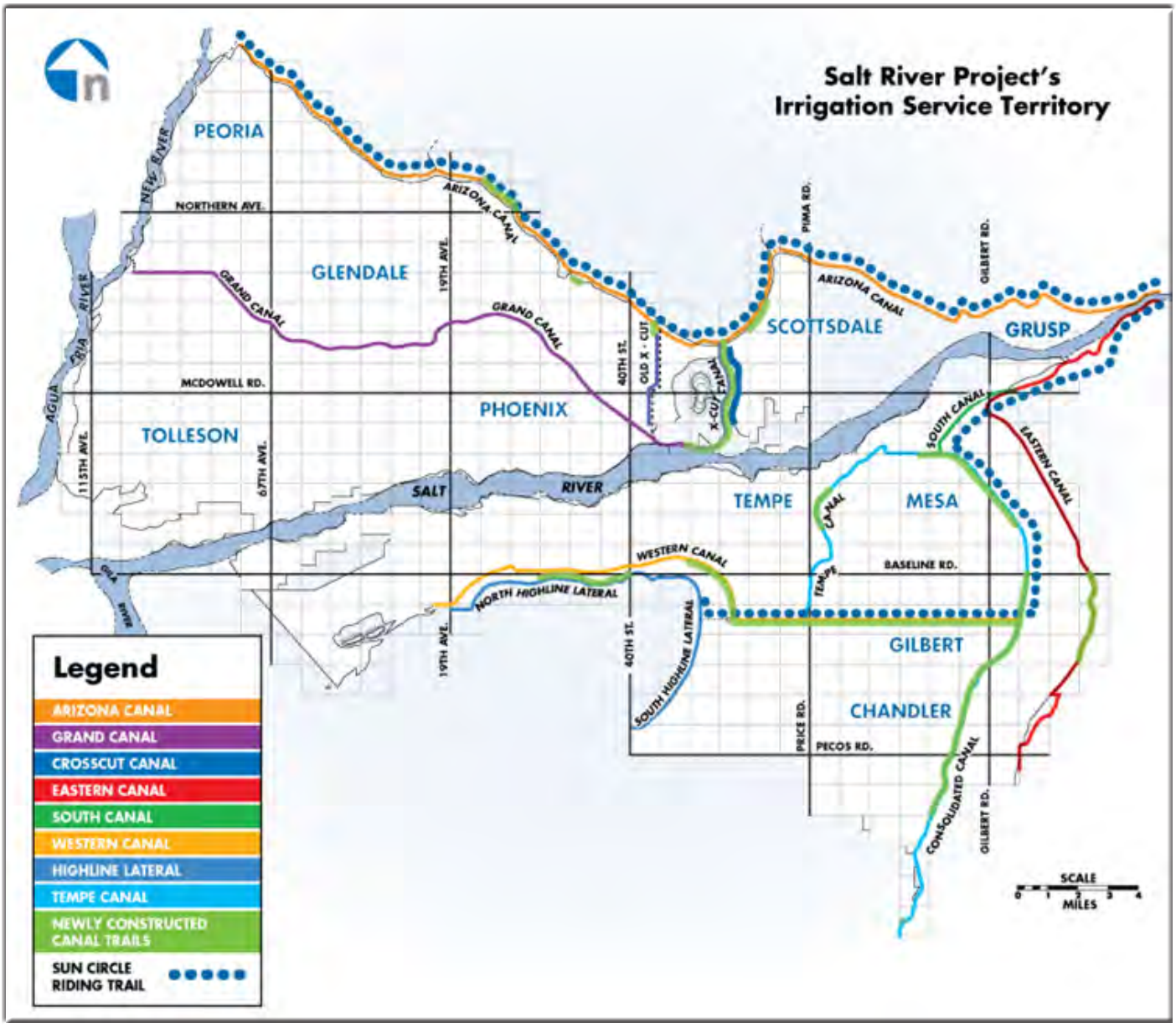
Sport and Recreational Cyclists have frequent rides in excess of 50 miles per day that cross through many jurisdictions. They desire large loops that utilize connectors that feed into larger main corridor routes. These loops can be built on/connected with larger loops to support rides from 35 to more than 60 miles. These loop routes would also provide access to cultural features such as the Musical Instrument Museum, Reach 11, or the canal system and other family oriented routes. Within Phoenix priority corridors that support these larger loops are:

- Deer Valley from 35th Avenue to 56th Street
- Central Avenue to South Mountain Park and the route around South Mountain
- Cave Creek Road

Additional corridors that would support these larger loops are:

- Greenway Road from 51st avenue to the Greenway/Hayden Loop. This would tie Phoenix into Scottsdale's system.
- Mayo Boulevard from the Musical Instrument Museum (Tatum Boulevard) to Scottsdale Road. This would also tie north Scottsdale to the Phoenix system.

FIG 10-2: Canals Managed by SRP



Connectivity with Adjacent Communities

Officials from adjacent communities were contacted to obtain information about connectivity to and from Phoenix into their community. A summary of this information is provided in the following sections.

City of Glendale

Glendale borders Phoenix to the northwest. Important opportunities for bicycle facilities exist along the Grand Canal and Skunk Creek Trails as well as along on-street routes:

On Street Routes

- To connect the ASU West campus (located south of Thunderbird Road from 51st Avenue to 43rd Avenue) to the main campus of Glendale Community College (located north of Olive Avenue to Mountain View Avenue, between 59th Avenue and 63rd Avenue.) through the provision of an on-street path from the ASU West campus along 47th Avenue in Phoenix south to Mountain View Road and west to the Glendale Community College main campus.

Skunk Creek Wash

- Along the Skunk Creek Wash from the Glendale/Phoenix border at 51st Avenue (north of Union Hills Drive) that extends to Rio Vista Park in the City of Peoria west of 83rd Avenue and north of Thunderbird Road where the wash connects with the New River Bike Trail (see Figure 17).
- Along the Arizona Canal Diversion Channel multi-purpose trail (Thunderbird Paseo trail) from Phoenix through Glendale and into Peoria linking with the Skunk Creek Trail. This connection also provides access into the Rio Vista Park and the New River Trail that runs north/south through Peoria and Glendale (Figure 17).

Grand Canal

- Glendale plans to extend the Grand Canal trail west from SR-101 along approximately the Bethany Home Road alignment to connect with the New River Trail at about 107th Avenue. There are bike facilities that provide access to Midwestern University medical campus located between 57th Avenue and 59th Avenue and south of the Outer Loop Freeway (SR-101). There is also potential for on-street bike lanes along Greenway Rod between Phoenix and Glendale that would provide access to the International School of Global Management located on the southeast corner of 59th Avenue and Greenway Road.
- Along the Grand Canal trail as it crosses Camelback Road at 75th Avenue at the Phoenix/Glendale border. This would provide improved bicycle access to the University of Phoenix stadium where the 2015 Super Bowl game will be held. In addition a number of additional major sporting and other types of events are held both the University of Phoenix football stadium and Jobing.com Hockey Arena complex immediately to the north of the football stadium.
- Along the Grand Canal off-road path to the Camelback Ranch sports complex (spring training facility) located west of 107th Avenue and south of Bethany Home Road. This link could also provide connectivity to the New River off-road trail. The cities of Peoria and Glendale have plans to extend the New River off-road trail south from Olive Avenue to Bethany Home Road.

City of Peoria

Peoria now allows 10-foot wide vehicle lanes on streets, which has resulted in opportunities to re-stripe many arterial streets with bicycle lanes. Opportunities for facility connectivity with Peoria include:

- Extending Happy Valley Road on-street bike lanes west of 67th Avenue into Peoria and connecting to the Phoenix on-street bike lanes to the east.
- Connecting Jomax Road west of 67th Avenue (This will be resolved when future development along Jomax Road occurs)
- Providing access into the Sonoran Mountain Ranch development in Peoria along Pyramid Peak Road north of Brookhart Way .

City of Avondale

The primary connecting routes between Avondale and Phoenix are along 17th Ave at Indian School Road, 14th Drive/Westwind Park at Indian School Road, 111th Avenue at Indian School Road and 107th Avenue from Lower Buckeye to MC-85. Avondale is also planning a multi-use trail along Van Buren from 113th Avenue to 99th Avenue that will have an opportunity to link into Phoenix.

- The primary bicycle destinations in Avondale include Estrella Mountain Community college,

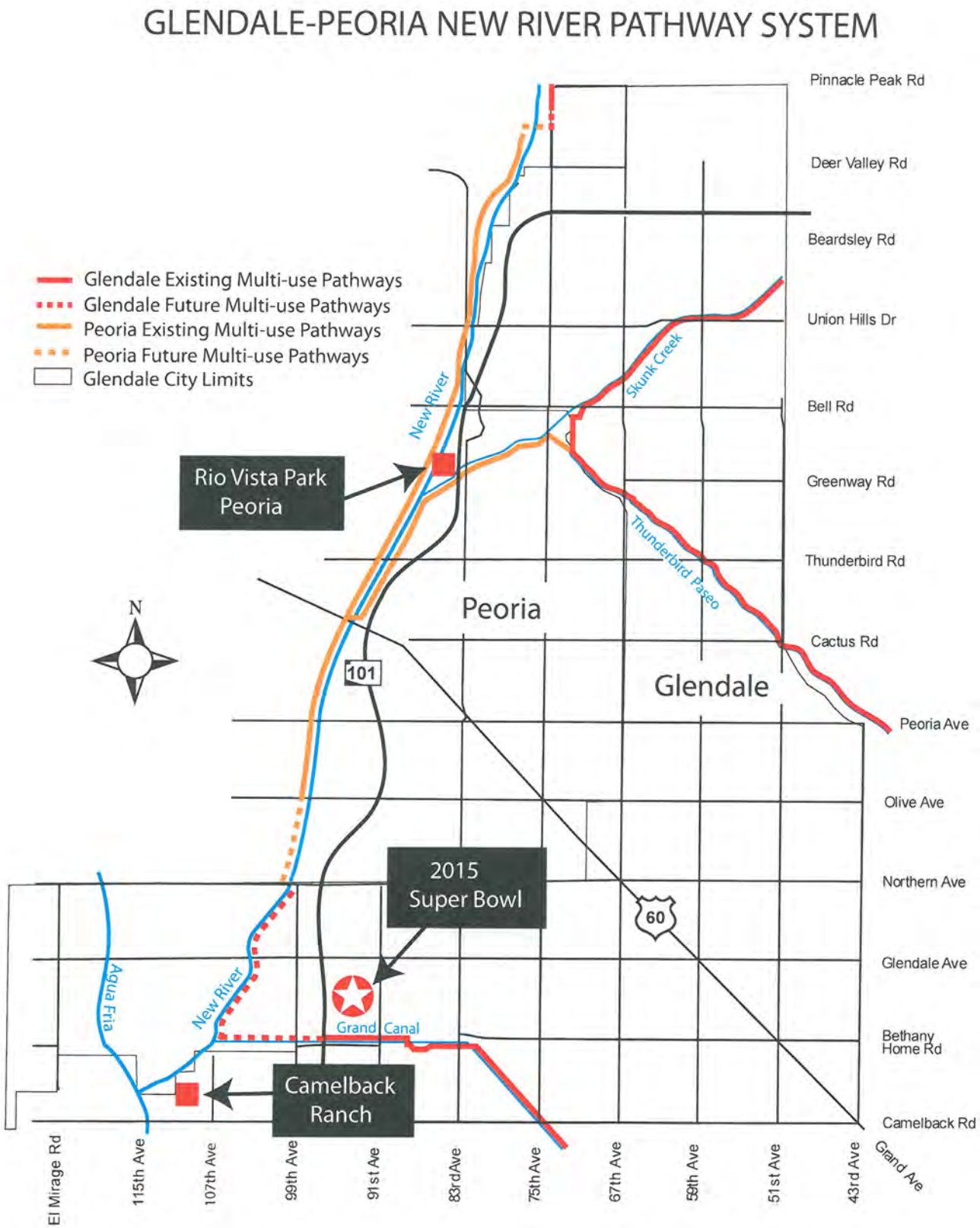


FIG 10-3 - Bike System Connectivity with the cities of Glendale and Peoria

Westview High School, La Joya Community High School, Agua Fria High School and the Avondale Transit centers.

- The primary destinations that Phoenix residents may want to access within the city include Estrella Mountain Community College, Avondale Transit Center and Gila River recreation area.
- Avondale residents would most likely want to access the following destinations within Phoenix: Ak-Chin Pavilion (with Loop 101 being a barrier to bicycle access), and future light rail transit stations along I-10 when they are built.
- Current barriers to bicycle travel in Avondale include the lack of adequate bicycle accessways, inability to cross the freeways and the lack of paved pathways along the Gila River.
- Avondale reports that currently all commercial/industrial developments are required to provide on bike parking space per 50 parking spaces. There is no information provided on requirements for bike parking at residential developments. As with most cities, the Avondale traffic department monitors the on-road system and the off-road system is monitored by their Parks Department.

Towns of Cave Creek and Carefree

Missing links exist along the Cave Creek Road bicycle facility from Carefree Highway to Pima Road. These connections will improve bicycle access from Phoenix to the downtowns of Cave Creek and Carefree. Construction of the missing bike facility is scheduled to begin in May 2015.

City of Scottsdale

Scottsdale borders Phoenix to the east and shares on-street and off street bicycle facilities. Major bicycle trails currently in Scottsdale include the Crosscut Canal Path, Arizona Canal Path, Indian Bend Wash Path, Pima Path, Oak Street, Indian School Road, Miller road, Lincoln Drive, McDonald Drive, Scottsdale Road, Pima Road, Sweetwater, Cholla and Roosevelt Street. Key planning considerations include:

- Scottsdale on-street bike lanes end at 60th Street (the border with Phoenix).
- An off-road paved path along the south side of the Arizona Canal (north of Indian school Road) also ends at the City Limits (60th Street alignment) and should extended west into Phoenix.
- Scottsdale has plans to provide on-street bike lanes along McDowell Road and Thomas Road east of the Phoenix city limits. While there are no city of Phoenix bike lanes planned on Thomas Road, there are on-street bike lanes along McDowell Road through Papago Park from 52nd Street to Galvin Parkway within Phoenix that could connect into Scottsdale. These on-street bike lanes provide access to the Galvin Parkway bike trail and on-street bike lanes and the path along the west side of the Crosscut canal.
- There is no paved path along the Arizona Canal and no bike lanes on Indian School Road from Phoenix that will allow a connection to downtown Scottsdale, a popular destination for cyclists.
- Scottsdale residents could also more easily access downtown Phoenix using bicycle facilities that could be located along Oak Street, Earll Drive and Osborn Road, but there are barriers in some of the neighborhoods west of the Crosscut Canal that prevent a continuous route into downtown Phoenix.

City of Tempe

Tempe borders the southeastern portion of Phoenix. The city plans to launch Bikeshare in the spring of 2014. The major bicycle corridors in Tempe include College Avenue, Crosscut Canal, and Tempe Town Lake/Rio Salado trails. Major destinations include downtown Tempe, Town Lake, ASU main campus, Kiwanis Park and a number of other schools and parks. The primary bicycle routes connecting into Tempe include Washington Street on-street bike lanes, University Drive bike lanes, the Western Canal Multi-user Path near I-10, Town Lake/Rio Salado Multi-use Path near the Grand Canal in Phoenix, and the bike lanes on Warner Road.

Planned routes that will provide connectivity from Tempe to Phoenix include:

- A 10-foot wide Rio Salado West multi-use path adjacent to the Rio Salado (Salt River) between Priest Drive and the City of Tempe boundary with Phoenix just east of SR-143.
- A bike/pedestrian bridge over I-10 at Alameda. This bridge is unfunded at this time.

Planning considerations for enhanced connectivity between Phoenix and Tempe include:

- Access to Tempe Town Lake via the Grand Canal (the Grand Canal is not a multi-use, lit path), Western Canal path (I-10 freeway is currently a barrier) and Alameda Drive (I-10 is a barrier).
- Access to Sky Harbor Airport via the Grand Canal (this would provide an additional option to the Washington bike lanes to the Sky train at 44th Street).
- Access to downtown Phoenix and the restaurants along the Grand Canal path via the Grand Canal.

City of Chandler

Chandler shares a 2.5 mile border with Phoenix from approximately the Knox Road alignment to the Pecos Road alignment. There are two major arterials in Chandler that extend into Phoenix; Ray Road and Chandler Boulevard. Both of these have on-street bike lanes in the city of Chandler. The Ray Road bike lanes extend to the ADOT right of way, but do not cross I-10 and there are no bike lanes on the Phoenix (west) side of the freeway. Bike lanes on Chandler Boulevard terminate at 54th Street, ¼ miles east of I-10. The bike lanes do not extend all the way to the ADOT ROW and there are no on-street bike lanes in Phoenix west of I-10.

Arizona Department of Transportation (ADOT)

ADOT manages and maintains Interstates 10 and 17 and the existing and planned Loop 101, 202 and 303 freeways. Portions of the ADOT system were constructed prior to a time when bicycle facilities were considered, and as a result, some ADOT facilities create barriers to bicycle connectivity. In later years, ADOT included bicycle crossings on some of its facilities such as the Maryland bridge over I-17, and bicycle/pedestrian bridges over SR-51 at Grovers Avenue, Nisbet Road, Paradise Lane, Oak Street, Campbell Avenue and at the Mercury Mine School (approximately 29th Street alignment); and underpasses along the Arizona Canal at I-17 and under SR-51 at Thunderbird Road, Maryland Avenue, Arizona Canal, and the Grand Canal to name a few. However, funding constraints continue to prevent crossings at some key locations.

Planning Considerations:

- The planned Southwest portion of SR 101 west of I-10 around South Mountain will be constructed along the existing Pecos Road corridor. This corridor is heavily used by bicyclists and accommodates a major bicycle sporting event. Currently, ADOT has no plans to build a bike facility in conjunction with this freeway unless it is requested by Phoenix and Phoenix is willing to pay for the added cost of a bike facility. At this time, the city has not requested a bicycle facility along SR 101 Pecos Road alignment.
- Bicycle crossings on many of the ADOT interchanges throughout Phoenix are needed. These include Happy Valley Road at I-17 and as Deer Valley and Pinnacle Peak Road at I-17.

MAG Bikeways Map

The Maricopa Association of Governments facilitates planning and construction of bicycle facilities throughout the region through Transportation Alternatives Funds, and other programs offered through the Bicycle and Pedestrian Working Group. The Maricopa Association of Governments (MAG) hosts a regional bikeways map that shows existing, locally-designated bicycle facilities at http://geo.azmag.gov/maps/bikemap/. This map was produced under the direction of the MAG Regional Bicycle Task Force with funding provided by the Federal Highway Administration.

RECOMMENDATIONS

GOAL:

- The City of Phoenix will be connected to bikeways, shared use paths, and trails within Phoenix and in adjoining communities to provide longer-distance recreation and commuting opportunities. This mix of facility types will provide a variety of comfortable travel options for all ages, abilities, and travel purposes through the promotion of loops and links.

STRATEGY:

- Use the off street network to complement and supplement the on-street network.

ACTION:

- Implement projects listed in Appendices G-I: Off Road Priority Projects along the following off-street corridors within Tier I – III projects.
    - Grand Canal
    - Indian Bend Wash
    - Cave Creek Wash
    - Arizona Canal
    - Highline Canal
    - Western Canal
    - CAP Canal
- Work with ADOT to ensure there is a bicycle path along the SR 202 Loop along the Pecos Road alignment.

STRATEGY:

Enhance the safety of off-street corridors at their intersections with streets and other motorized facilities such as railroads and freeways.

ACTION:

- Give first priority to street crossing enhancement projects.
- Work with ADOT to enhance bicycle facility crossings of freeways and state roads. In particular, focus include Happy Valley Road at I-17 and Deer Valley and Pinnacle Peak Road at I-17 as priority projects.

STRATEGY:

- Enhance the functionality of the Phoenix bicycle system by connecting to bicycle facilities that provide regional access.

ACTION:

- Work with the City of Tempe to provide access along the Grand Canal to:
    - Tempe Town Lake (also using Alameda Drive)
    - Sky Harbor Airport
    - Downtown Phoenix
    - Planned developments along the Grand Canal
- Work with the City of Scottsdale to provide continuous bicycle facilities that link Phoenix with bicycle facilities within City of Scottsdale that terminate at the city of Phoenix border including:
    - On-street bike lanes at the borders at the Phoenix at 60th street alignment;
    - An off-road paved path along the south side of the Arizona Canal (north of Indian school Road at 60th Street alignment).
    - Planned on-street bike lanes along McDowell Road.
    - Along the Arizona Canal and on Indian School Road from Phoenix that provide a connection to downtown Scottsdale.
    - Along Oak Street, Earll Drive and Osborn Road providing a continuous route into downtown Phoenix.
- Work with the City of Peoria to provide continuous bicycle facilities that link Phoenix with bicycle facilities within City of Peoria including:
    - Extend Happy Valley Road on-street bike lanes west of 67th Avenue into Peoria and connecting to the Phoenix on-street bike lanes to the east.
    - Connect Jomax Road west of 67th Avenue (This will be resolved when future development along Jomax Road occurs)
    - Providing access into the Sonoran Mountain Ranch development in Peoria along Pyramid Peak Road north of Brookhart Way .
- On Street Routes:
    - To connect the ASU West campus (located south of Thunderbird Road from 51st Avenue to 43rd Avenue) to the main campus of Glendale Community College (located north of Olive Avenue to Mountain View Avenue, between 59th Avenue and 63rd Avenue.) through the provision of an on-street path from the ASU West campus along 47th Avenue in Phoenix south to Mountain View Road and west to the Glendale Community College main campus.
- Work with the City of Glendale to provide continuous bicycle facilities that link Phoenix with bicycle facilities within City of Glendale including:

    Skunk Creek Wash

    - Along the Skunk Creek Wash from the Glendale/Phoenix border at 51st Avenue (north of Union Hills Drive) extending to Rio Vista Park in the City of Peoria west of 83rd Avenue and north of Thunderbird Road where the wash connects with the New River Bike Trail (see Figure 17).
    - Along the Arizona Canal Diversion Channel multi-purpose trail (Thunderbird Paseo trail) from Phoenix through Glendale and into Peoria linking with the Skunk Creek Trail. This connection also provides access into the Rio Vista Park and the New River Trail that runs north/south through Peoria and Glendale (Figure 17).
    - Along Greenway Road between Phoenix and Glendale to provide access to the International School of Global Management located on the southeast corner of 59th Avenue and Greenway Road.
    - Along the Grand Canal trail as it crosses Camelback Road at 75th Avenue at the Phoenix/Glendale border.
    - Along the Grand Canal off-road path to the Camelback Ranch sports complex (spring training facility) located west of 107th Avenue and south of Bethany Home Road.

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CHAPTER

11

Bikes & Transit

GOAL:

Commuting by public transportation will be a seamless and efficient choice for cyclists. Completing the first and last 2.5 miles of a transit trip will be easy to accomplish on a bike as modes will be fully integrated.

Valley Metro provides eco-friendly public transit options to residents of greater Phoenix and Maricopa County including the planning and operations of a regional bus system and the development and operations of light rail. In Fiscal Year 2013, total ridership for the system was 73.4 million passengers, which set a new record for bus and light rail boardings. The first 20 miles of light rail opened December 2008. Seven light rail extensions are planned or are under construction that will create a 60-mile system by 2034.

Valley Metro recognizes that public transit is a key part of the region's multimodal transportation system, working in tandem with walking, bicycling, and driving modes to provide commuters with multiple, equally easy transportation choices.

Why Address the "Last Mile" of Transit Trips?

Valley Metro recognizes that public transit is a key part of the region's multimodal transportation system. Transit works in tandem with walking, bicycling, and automobile use to provide commuters with multiple convenient transportation choices throughout the city and region.

Bike-Transit Integration

Valley Metro offers several programs to promote bicycling, and the agency is working with the City of Phoenix to enhance last-mile access for cyclists, as described in detail in this chapter. Highlights of these multimodal initiatives include:

BIKES ON BUSES: All Valley Metro buses are equipped with a two-bike or three-bike rack located on the front of the bus. Racks are available on a first-come, first-serve basis. Valley Metro bike ridership for FY2011-12 showed that 13 bus routes had more than 20,000 bike boardings, and bike boardings on 14 routes represented more than 3% of total passengers.

BIKES ON TRAINS: Bike-transit integration is an important contributor to ridership along light rail. On-board storage hangers for 4 bikes are located in the center section of each vehicle. Standing with a bicycle is also allowed as long as train aisles and doorways are not blocked. Allowing bikes on trains is so popular that is it starting to create capacity and vehicle circulation constraints during peak hours and special events. Of Metro riders surveyed in 2011, over 9% combined their transit trips with bicycling, with 72% of cyclists biking both to and from light rail.

BICYCLE PARKING: Most transit centers and light rail stations have open air bike stands (bike racks) and/or enclosed bicycle lockers. Bike racks are provided at Valley Metro rail park-and-rides, rail station platforms, and several bus stops. Bicycle lockers are provided at Central Station in Downtown Phoenix, and at the Phoenix Skytrain Station at 44th and Washington. Existing capacity at station areas along the Central Phoenix/East Valley light rail alignment currently provides parking for 536 bicycles.

BICYCLE PROMOTION: Valley Metro actively encourages bicycling to transit through a variety of programs including Valley Bike Month, Bike to Work and School Day, Bike to the Ballpark, a Portable Bike Rack Loan Program for special events, Bicycle Commuting 101 classes, and distribution of educational materials on bike safety and sharing the road.

BIKE SHARE: A new bike share program will be launched in 2014. Named "Grid Bikes" after Phoenix's well-known street grid system, the program will be implemented and operated by CycleHop. Valley Metro and the City of Phoenix are working with CycleHop to finalize locations for bicycle hubs, where bikes may be rented by the hour. Each Grid Bike will be equipped with a solar-powered, GPS-enabled locking mechanism and be remotely monitored. Plans are to have 500 bikes in the downtown Phoenix area by early 2015.

Transit Amenities and Ridership

Of the 15 transit centers in Maricopa County, there are nine in the City of Phoenix. A transit center is a facility where transit vehicles converge, enabling passengers to transfer among routes and services. Some transit centers also have Park-and-Ride facilities. Transit centers are generally located off the street and provide passengers with a shaded or enclosed waiting area, seats, drinking fountains and transit information. Transit centers in the City of Phoenix with bike racks[1] include Central Station, Desert Sky, Ed Pastor, Metro Center, Paradise Valley Mall, and Sunnyslope. The number of bicycle parking spaces available at transit centers and park-and-rides is not currently available. There are 22 bicycle lockers available at Central Station that are available for use between 5 am and 10 pm seven days a week. Increased misuse of bike lockers for storage or personal use is leading to consideration of alternatives such as bike lids.

1 - As listed under amenities at http://www.valleymetro.org/getting_on_board/transit_centers; accessed on October 1, 2013

The Phoenix Sky Train station at 44th Street and Washington Street provides bike racks and bike lockers. The high usage at this location prompted the Aviation Department to relocate more bike lockers to this location since opening on April 8, 2013. Airport employees can use these amenities[2], and they are also able to bring their bikes on the Sky Train into the airport.

Light Rail vehicles have bicycle symbols on train windows to indicate the doors nearest the bicycle racks. Racks are available on a first-come, first-served. If the bicycle rack on the train is full or individuals are unable to load their bicycle into the rack, they may stand with the bicycle as long as they do not block the aisle or doorway. If the train is crowded, bicyclists may choose to wait for a less-crowded train before boarding with their bike, however, some bicyclists may not have the ability to board if the train is overly crowded.

Bicycles may not be secured to the Light Rail station structure, railings or fences. Warning notices will be placed on bicycles secured to unauthorized locations. After 24 hours, the lock will be cut and the bicycle will be removed and taken to Lost and Found at Central Station, located at Van Buren and Central Avenue in downtown Phoenix. Bicycle racks are provided at Valley Metro Rail Park-and-Rides along the light rail and the Center Parkway/Washington station in Phoenix.

Valley Metro has a "Rack 'n Roll" program to educate the public on how to take bicycles on the bus. As part of Valley Metro Notes[3] (a series of short animated music videos that demonstrate all the ins and out of riding transit), there is an educational video called "Take Your Bike for a Ride" on the Valley Metro website. All Valley Metro buses are equipped with bike racks. Racks are available on a first-come, first-serve basis. If the bike rack is full, bicyclists will need to wait for the next bus. Children under the age of 12 must be accompanied by an adult. Folding bikes are allowed on all buses at all times. Adjacent sidewalk/bus stop bike racks are located at the following located at many stations through Phoenix.

2 - September 13, 2013 interview with Anne E. Kurtenbach, PHX Sky Train Program Manager, Phoenix Aviation Department

3 - http://www.valleymetro.org/notes/

Valley Metro 2012 Bike Transit Integration White Paper Conclusions

Widening the catchment area by increasing bike-transit integration will not only improve accessibility and ridership, but also decrease auto-dependence, fossil-fuel consumption, harmful emissions contributing to global warming, and negative impacts on public health. (Rojas-Rueda, et al., 2011) By increasing bike integration with the overall transit system, METRO can provide an exemplary level of service that promotes environmental stewardship and physical activity. Bike-transit integration propagates a healthy living standard for Phoenix residents. Developers and residents will be more likely to embrace mixed-use and transit-oriented developments located along the METRO light rail corridor that allow residents freedom from expensive automobiles. These are hopeful improvements for a region inundated with sprawl.

Bicycle parking improvements of all types - indoor bike facilities, bike corrals, BikeLids, and bike lockers - benefit all riders. Riders who use mobility devices, such as wheelchairs and crutches, on-board the light rail often come into conflict with bicyclists. According to the 2012 METRO Mobility Device User Survey, 8% of respondents have difficulty interfacing with bicycles on the train. When this occurs, bicycles create an impediment to these individuals securing ADA seating, especially during peak hour and special event times when vehicles are crowded. Efforts toward alleviating capacity constraints for bicycles in the system benefits not only cyclists, but also improves conditions for mobility device users.

The installation of park-and-rides at METRO stations was a successful capital investment in encouraging METRO light rail ridership. It required commitment and coordination by the regional transit agency Valley Metro, METRO light rail, and member cities to solve end-of-line catchment issues. The existing level of bicycle/pedestrian-transit integration needs improvement and requires a feasible capital investment. METRO recognizes that accommodating the needs of riders, both that use bicycles and those who do not, is paramount to encouraging additional ridership. The current infrastructure that exists in station areas offers insufficient levels comfort, security, safety, and connectivity. The results of this research highlight short and long-term strategies for METRO to better accommodate current bicyclist demand. The research also provides guidance on how to encourage bike trips by new riders traveling to light rail, including those willing to switch from motorized modes to the bike/transit mode. With these actions, METRO will effectively grow into a more complete and accessible system by allocating active transportation as an integral part of Valley Metro's total transit network.

An overview of recommendations from the Valley Metro 2012 Bike Transit Integration White Paper Recommendations is provided in Table 11-1.

Valley Metro Bike Ridership (FY2011-2012)

Bus routes were reviewed with more than 20,000 bike boardings or where bike boardings represented more than 3% of total passenger boardings. Table 11-2 summarizes the ridership data for these 24 routes. The general cross section of the roadway and the existence of bike lanes for these routes are provided. Except for the Union Hills Drive, 40th Street, Southern Avenue, and south Central Avenue routes, bike lane facilities do not exist for long distances on these routes.

TABLE 11-1: Valley Metro 2012 Bike Transit Integration White Paper Recommendations

Goal	Solution
Short Term: Alleviate the overcrowding of bikes on light rail vehicles	• Add secure bike parking facilities (i.e. BikeLids and bike lockers) to stations with the highest levels of bike access. • Vehicle modification to increase on-board bicycle capacity • Create bike-use policies, rules of conduct, & rider-guide. • Station info posters sharing bike policies, best practices, & bike amenities. • Larger bicycle decals on vehicles and station platform signage instructing bikers where to board. • Vehicle signage placed on the outside of vehicle wraps. • Bike compartment viewing portal (visible through vehicle wrap)
Long Term: Encourage additional bike ridership	• Provide secure bike parking at all stations. • Offer bike-sharing near popular bicyclist destinations along the light rail corridor • Improve station connectivity to bikeways • Improve bike infrastructure in and around stations • Increase security presence (personnel, cameras, lighting) at stations/park-and-rides. • Educate riders traveling to Park-and-rides about the health, environmental, and cost benefits of biking to stations and destinations. • At major transit stations, put practice bicycle racks for riders to practice, in a low-stress setting, putting bicycles onto bus racks or light rail racks • New light rail and bus rolling stock should have minimum bicycle position requirements

RECOMMENDATIONS

GOAL:

- Commuting by public transportation will be a seamless and efficient choice for cyclists. Completing the first and last 2.5 miles of a transit trip will be easy to accomplish on a bike as modes will be fully integrated.

STRATEGY:

- Encourage bike integration with the overall transit system.

ACTION:

- Encourage Valley Metro to provide at least 3 or 4 capacity bike racks on all buses
- Encourage Valley Metro to provide more than 4 bike spaces on LRT cars (increase as new rolling stock is purchased and through retrofit)
- Encourage Valley Metro to provide practice racks for busses/LRT
- Identify and build bike facilities that support and connect to transit. Bicyclists should have equal access to public transit that is offered to pedestrians.
- Partner with Valley Metro to provide repair stations at critical light rail stations.
- Provide bike parking and repair stations in City -owned parking garages.

TABLE 11-2: FY2011-2012 Valley Metro Bike Ridership and Roadway Features Summary

Route Name	Passengers (all days)	Bikes (all days)	% (all days)	ADT	Bike Lane Coverages
19th Ave	2,562,634	69,244	2.70%	21,583	Few Bike Lanes, existing only on southernmost portion of route
Indian School	2,512,145	54,346	2.16%	39,843	No Bike Lanes (except 23rd Ave to 19th Ave)
35th Ave	1,948,950	52,202	2.68%	26,163	Few Bike Lanes, existing north of Bell Road
Thomas Road	2,756,478	47,675	1.73%	31,665	No Bike Lanes
McDowell	2,102,721	45,890	2.18%	28,491	Few Bike Lanes
Glendale - 24th Street	1,694,495	40,116	2.37%	32,064	No Bike Lanes
16th Street	1,429,856	38,565	2.70%	33,427	Few Bike Lanes
Central	1,482,845	38,165	2.57%	22,486	Few bike lanes north of downtown, south of I-17 bike lanes are present except from Southern to Baseline
Van Buren	1,518,478	37,723	2.48%	20,826	No Bike Lanes
7th Street	1,371,182	36,823	2.69%	33,997	Existing on south 1/3 of route
44th Street	698,117	23,986	3.44%	34,644	Few Bike Lanes
Bell	632,610	21,295	3.37%	34,040	No Bike Lanes
Union Hills	485,886	20,096	4.14%	22,496	Bike lanes along almost entire route in Phoenix
Southern	614,650	18,647	3.03%	27,947	Bike lanes along almost entire route in Phoenix
Broadway	482,292	15,038	3.12%	24,347	No Bike Lanes
Thunderbird	347,738	12,216	3.51%	29,853	Few Bike Lanes
Buckeye	341,161	11,290	3.31%	32,368	No Bike Lanes
Greenway	311,853	11,142	3.57%	28,690	Some bike lanes
40th Street	188,715	6,632	3.51%	11,847	Bike lanes along entire route
University	126,716	5,183	4.09%	16,887	No Bike Lanes
Priest Drive	116,688	4,752	4.07%	12,147	No Bike Lanes
Cactus - 39th Ave	54,362	1,841	3.39%	30,754	No Bike Lanes
RAPID	19,098	732	3.83%	181,370	No Bike Lanes
RAPID	2,539	208	8.19%	-	No Bike Lanes

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Glossary of Terms and Acronyms

AASHTO – American Association of State Highway Transportation Officials

Arterial Street – A street that provides for moderately long distance traffic movement within Phoenix or between Phoenix and adjacent cities. Moderate service is provided to abutting land. Access is controlled through frontage roads, raised medians and the spacing and location of driveways and intersections. Opposing traffic flows are separated by a raised median or a continuous left turn lane.

ADOT – Arizona Department of Transportation

ADT - Average Daily Traffic – The average 24 hour volume of traffic, being the total volume during a stated period divided by the number of days in that period. Normally this would be periodic daily traffic volumes over several days, not adjusted for days of the week or seasons of the year. For two-way streets, the ADT includes both directions of travel

ARS – Arizona Revised Statutes (State law)

Bicycle – A device, including a racing wheelchair, that is propelled by human power and on which a person may ride and that has either: (a) Two tandem wheels, either of which is more than sixteen inches in diameter. (b) Three wheels in contact with the ground, any of which is more than sixteen inches in diameter (ARS 28-101.6)

Bicycle Boulevard – A street segment or series of contiguous street segments, that has been modified to accommodate through bicycle traffic and minimize through motor vehicle traffic

Bicycle Detector – A device used for determining the presence or passage of bicyclists

Bicycle Facilities – A general term denoting improvements and provisions that accommodate or encourage bicycling, including parking and storage facilities, and shared roadways not specifically defined for bicycle use.

Bicycle Lane – A portion of a roadway that has been designated for preferential or exclusive use by bicyclist by pavement markings and, if used, signs. In Phoenix BIKE LANE signs will always be used to designate bike lanes

Bicycle Locker– A secure, lockable container used for individual bike storage

Bicycle Network – A system of bikeways designate by the jurisdiction having authority. This system may include bike lanes, bicycle routes, shared use paths, and other identifiable bicycle facilities.

Bikeway – A generic term for any road, street, path or way that in some manner is specifically designated for bicycle travel, regardless of whether such facilities are designated for the exclusive use of bicycles or are to be shared with other transportation modes.

Bike HAWK – A pedestrian hybrid beacon (PHB) that has been modified to accommodate bicycle traffic along with pedestrians

Buffer-Separated Lane – A preferential lane or other special purpose lane that is separated from the adjacent general-purpose lanes(s) by a pattern of standard longitudinal pavement markings that is wider than a normal or wide lane marking. The buffer area might include rumble strips, textured pavement or channelized devices such as tubular markers or transversable curbs, but does not include a physical barrier.

Bicycle Route – A roadway that is officially designated and signed as a BIKE ROUTE, but which is open to motor vehicle travel and upon which no bicycle lane is designated (see Shared Roadway)

Collector Street – A street that provides for short distance (less than 3 miles) traffic movement; primarily functions to collect and distribute traffic between local streets or high volume traffic generators and arterial streets. Provides direct access to abutting land. Some access may be controlled by raised medians and the spacing and location of intersections and driveways.

Complete Streets – Streets that are designed and operated to enable safe access for all users. People of all ages and abilities are able to safely move along and across streets in a community, regardless of how they are traveling. Complete Streets make it easy to cross the street, walk to shops, and bicycle to work. They allow buses to run on time and make it safe for people to walk to and from train stations. (Source: National Complete Streets Coalition)

Cycle Track – A form of protected bicycle lane

FHWA – Federal Highway Administration, a division of the USDOT

Fixed-Time Operation (Pre-timed Operation) – A type of traffic signal operation in which all signal phases are pre-timed and where no detection is required for any mode.

Full Actuated Operation – A type of traffic signal operation in which all signal phases function on the basis of actuation or detection.

Highway - "Highway" or "Street" is the entire width between the boundary lines of every way if a part of the way is open to the use of the public for purposes of vehicular travel (ARS 28-101.52)

ITE – Institute of Transportation Engineers

LAB – League of American Bicyclists

Local Street – A street that provides for direct access to residential, commercial, industrial or other abutting land, and for local traffic movements and connects to collector and/or major streets.

LRT – Light Rail Transit

MAG – Maricopa Association of Governments

MAP-21 – Moving America Ahead for Progress in the 21st Century; the Federal highway bill that was signed into law on July 6, 2012 and became effective October 1, 2012

Major Arterial Street - A street that provides for long distance traffic movement within Phoenix and between Phoenix and other cities. Service to abutting land is limited. Access is controlled through frontage roads, raised medians, and the spacing and location of driveways and intersections. Opposing traffic flows are often separated by a raised median.

Minor Collector Street - A street that provides for short distance (less than 3 miles) traffic movement; primarily functions to collect and distribute traffic between local streets and arterial streets. Provides direct access to abutting land. Some access may be controlled and the spacing and location of intersections.

Modal Equity - Providing adequate transportation facilities for all modes (motor vehicle, pedestrian and bicycles), including parking facilities at destinations.

MPH or mph – miles per hour

MUTCD – Manual on Uniform Traffic Control Devices for Streets and Highways, 2009 edition, which was adopted by the State of Arizona with an Arizona Supplement on January 13, 2012.

NACTO – National Organization of City Transportation Officials

NHTSA – National Highway Traffic Safety Administration

Pedestrian Hybrid Beacon (PHB or HAWK) – A special type of hybrid beacon used to warn and control traffic at an unsignalized location to assist pedestrians in crossing a street or highway at a marked crosswalk

Recumbent Bicycle – A bicycle with pedals at roughly the same level as the seat where the operator is seated in a reclined position with their back supported

Right-of-way – A general term denoting land, property or interest therein, usually in a strip, acquired for or devoted to transportation purposes.

Right-of-Way (Assignment) – The permitting of vehicles and/or pedestrians to proceed in a lawful manner in preference to other vehicles or pedestrians by the display of a sign or signal indications. Per ARS 28-101.46, "Right-of-way" when used within the context of the regulation of the movement of traffic on a highway means the privilege of the immediate use of the highway.

Road User – A vehicle operator, bicyclist or pedestrian, including persons with disabilities, within the highway or on a private road open to the public travel.

Roadway – That portion of the highway that is improved, designed or ordinarily used for vehicular travel, exclusive of the berm or shoulder. If a highway includes two or more separate roadways, roadway refers to any such roadway separately but not to all such roadways collectively (ARS 28-601.22)

Roundabout – A type of circular intersection that provides yield control to all entering vehicles and features channelized approaches and geometry to encourage reduced travel speeds through the circular roadway.

RPTA – Regional Public Transit Authority

Shared-Lane Marking – A pavement marking symbol that indicates an appropriate bicycle positioning in a shared lane

Shared Roadway – A roadway that is officially designated and signed as a BIKE ROUTE, but which is open to motor vehicle travel and upon which no bicycle lane is designated (see Bicycle Route)

Shared-Use Path – Bikeways physically separated from motorized traffic and designed for shared use by bicycles, pedestrians, joggers, in-line skates, and other non-motorized modes of transportation. Paths may be along the highway right-of-way or within an entirely independent right-of-way (i.e., canal banks or through park land).

Shoulder – the portion of the roadway contiguous with the traveled way that accommodates stopped vehicles, emergency use, and lateral support of subbase, base and surface courses. Shoulders, where paved, are often used by bicyclists.

Sidewalk – That portion of a street that is between the curb lines or the lateral lines of a roadway and the adjacent property lines and that is intended for the use of pedestrians (ARS 28-601.24)

Sidepath – A shared-use path located immediately adjacent and parallel to a roadway.

Social Equity - The effort to provide bicycle transportation facilities for all socioeconomic groups and all portions of the community

SRP – Salt River Project, the utility company that owns and operates the irrigation canals in Phoenix, often used by bicyclists and pedestrians, and provides electric power to a portion of the Phoenix metropolitan area.

Traffic – Pedestrians, ridden or herded animals, vehicles and other conveyances either singly or together while using a highway for purposes of travel (ARS 28-601.28)

Traveled Way – The portion of the roadway for the movement of vehicles, exclusive of the shoulders, berms, sidewalks and parking lanes.

Unpaved Path – Path not surfaced with a hard, durable surface such as asphalt or Portland cement concrete.

USDOT – United States Department of Transportation

Vehicle – A device in, on, or by which a person or property is or may be transported or drawn on a public highway, excluding devices moved by human power or used exclusively on stationary rails or tracks (ARS 28-101.57)

Valley Metro – The regional transit agency in the Valley that began on March 1, 2012, consisting of two distinct transit systems: Regional Public Transportation Authority (RPTA) and Valley Metro Rail.

VPH or vph – vehicles per hour

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Appendix A

Community Outreach

Community Meetings

The City of Phoenix and Lee Engineering conducted four public meetings related to the Phoenix Comprehensive Bicycle Master Plan. The community outreach strategy was to reach the City's diverse demographics, including transit-dependent groups, to engage bicyclists of all ages and abilities, as well as local Bicycle Advocacy groups.

The purpose of the public meetings was to:

- Provide introductory information about the City's current efforts to prepare its Bicycle Plan;
- Obtain input on bicycle-related transportation issues and priorities; and
- Obtain input on biking areas that may benefit from street or other infrastructure improvements.

Meeting Notification and Attendance

A water bill notice and meeting notification flyer were prepared as well as a media press release. Additionally, the meetings were posted on the City website and tweeted through the City of Phoenix Street Transportation Department (see Figure 1). Additional outreach methods included posting meeting information at bikearizona.com and direct outreach to bicycle clubs, advocacy groups, and businesses.

Figure 1 City of Phoenix Street Transportation Department Tweet

Notifications were facilitated as follows:

Media Press Release was sent to…

- Technical Advisory Committee (32 members)
- MAG Pedestrian/Bicycle Committee (23 members)

Media Press Release was sent to the following Village Planning Committees:

- Alhambra
- Central City
- Deer Valley
- Desert View
- Encanto
- Maryvale
- North Gateway
- North Mountain
- Paradise Valley
- Rio Vista
- South Mountain
- Ahwatukee Foothills
- Camelback East
- Estrella
- Laveen

Flyer notices were e-mailed or otherwise electronically distributed to:

- Technical Advisory Committee (32 members)
- Valley Metro
- MAG Pedestrian/Bicycle Committee (23 members)
- Bicycle Clubs and Advocacy Groups
    - Arizona Bicycle Club
    - Coalition of Arizona Bicyclists
    - Phoenix Metro Bike Club
    - Phoenix Spokes People
- Bicycle Shops and Businesses within the Cities of Phoenix, Glendale, Peoria, Cave Creek, Scottsdale, Tempe, Chandler, and Town of Guadalupe
    - AirPark Bicycles
    - Arizona Outback Adventures
    - Bicycle Cellar
    - Bicycle Depot of Arizona
    - Bicycle Exchange
    - Bicycle Haus
    - Bicycle Ranch
    - Bicycle Vibe
    - Bicycles of Phoenix
    - Bicycles of Scottsdale

- Bike Barn
- Bike Emporium
- Bike Zone
- Bob's Bike Shop
- Bob's Lock & Cycle
- Build-A-Bike
- Cactus Adventures
- Cactus Bike
- Curbside Cyclery
- DNA Cycles
- Domenics 2 Wheelers
- E-Tour Bikes
- Exhale Bikes Inc
- Faster
- Flat Tire Bike Shop
- Garage Bike Shop
- Global Bikes
- Golden Spoke Cyclery
- Gordy's Bicycles
- HoodRide Bicycles
- Hybikes
- Industry Bikes
- Javelina Cycles
- Kore Bike Industries
- Landis Cyclery
- Performance Bicycle
- Phoenix Bicycle Shop
- Phx Bikes
- Portapedal Bike
- Rage Cycles
- Roadrunner Bike Center
- Slippery Pig Bicycles
- SouthWest Bicycles
- Sun Cyclery Inc
- Sunday Cycles Bike Shop
- Tempe Bicycle
- Thrill Bikes
- Trailhead Bike Café
- Triple Sports
- Try Me Bicycle Shop

Flyer notices were distributed to the following community centers for posting:

- Goelet A. Beuf Community Center, 3435 W. Pinnacle Peak Road
- Devonshire Senior Center, 2802 E. Devonshire Avenue
- Desert West Community Center, 6501 W. Virginia Avenue
- Eastlake Park, 1549 E. Jefferson Street

Information Provided

The community meetings included a Prezi presentation about the background and purpose of the study, over arching goals, and next steps in the study, namely, to compile community input on the City's bicycle network, identifying gaps in the existing/current conditions, and developing alternatives for the future. As of November 13, 2013, the presentation was viewed more than 100 times.

Group discussion followed the presentation, giving participants a chance to provide general comments, ask questions, and discuss network qualities and concerns. Participants were asked to complete a survey and write down their comments on provided Comment cards. Information cards were also provide for participants to take home with contact information for the project team and URLs for the City, project Wikimap, and community meeting presentation.

Participants were then given time to look at maps of the city, highlight routes that need to be addressed, and identify existing barriers within the network. They also identified missing links. These maps provided input for the study network for data collection. Maps that depicted existing bicycle facility conditions and data for the 15 villages were available at each meeting. Participants at the four community meetings identified 196 unique routes and intersections on these maps.

October 22, 2013 – Districts 1 & 2

On October 22, 2013, the City of Phoenix and Lee Engineering conducted the first public meeting related to the Phoenix Comprehensive Bicycle Master Plan. The public meeting took place from 6 – 8 pm at the Goelet A C Beuf Community Center at 3435 West Pinnacle Peak Road, Phoenix, AZ 85027.

Input Received

During the meeting, City of Phoenix staff and other members of the project team were available to talk with attendees, listen to comments and concerns, and answer any questions. Through those discussions, comments and concerns included the following:

- Lack of parking at health care providers
- Lack of space for bicycles on transit
- Safety should be paramount
- Importance of bicycles having headlights, taillights or reflectors when ridden between dusk and dawn
- Operators or motorized vehicles cannot easily see bicycle riders, especially when the rider wears dark colored clothing
- Desire for CAP (Central Arizona Project) to be involved in Bicycle Master Plan and for adjacent property owhers to clear fences built on 10 feet of right-of-way to allow use by bicyclists.
- Importance of coordination with neighboring cities
- Compliment of green bike lanes on Grand Avenue
- Desire for bicycle push buttons at signalized intersections
- Desire for continuously paved canal paths
- Desire to retrofit all arterial streets with bike lanes during resurfacing
- Compliment of bike lane retrofit on Indian School Road
- Desire for bike lanes on 7th Street and 7th Avenue
- Request for HAWK at 21st Avenue and Camelback Road
- Request review and revision of contradicting laws and ordinances related to bicyclists
- There needs to be a traffic ordinance that all new tar overlays on every major arterial road shall or must include bicycle lanes (painted, buffered, etc…) in their implementation/construction.
- It is important to ensure that there is continuity of bike routes between Phoenix and adjacent cities.
- There be some planning focused on bike routes within two to three miles of public schools – K through 12 – so that children (ages 5 – 19) can ride and walk to school safely.
- Part of bike and pedestrian safety has to do with keeping pathways clear of branches – a job for city landscapers/arborists (tree pruning).
- Require bicycles that are ridden between dusk and dawn, to have headlights, taillights, and reflectors. Enforce a City ordinance by confiscating bikes, without lights, that are ridden after dark, until such time as the owner provides lights and reflectors and installs them on the bike.
- Recommend the "strobe light" type of headlight and tail light since a flashing light is more easily seen than a constant beam.

October 24, 2013 – Districts 3 & 4

On October 24, 2013, the City of Phoenix and Lee Engineering conducted the second public meeting related to the Phoenix Comprehensive Bicycle Master Plan. The public meeting took place from 6 – 8 pm at the Devonshire Senior Center at 2802 East Devonshire Avenue, Phoenix, AZ 85016.

Input Received

During the meeting, City of Phoenix staff and other members of the project team were available to talk with attendees, listen to comments and concerns, and answer any questions. Through those discussions, comments and concerns included the following:

- Educate drivers, police, and engineers
- Improve access to bike lanes, protected bike lanes, and canals

- Develop new funding mechanisms
- Require bike parking and showers at work places or partner with fitness centers
- De-silo City Hall to foster inter-departmental collaboration on planning and funding infrastructure
- Include transit department and fund and fill a position at Valley metro to focus on bike/ped interconnectivity
- Promote bike commuter tax incentives and workplace health and fitness campaigns
- Put road diet on Indian School Road from I-17 to Scottsdale Road
- Cyclists want to connect to destinations on major arterials safely
- Increase staff dedicated to bike/ped planning and add urban designers to streets department
- Develop and apply a "speed management plan"
- Develop an app to report information (crowd sourcing)
- Valley Metro should encourage bicyclists on buses and LRT.
- Install bike HAWK on 19th Avenue at Cave Creek Golf Course (South of Greenway Rd).
- Osborn's bike path needs to be extended to cross Central Avenue
- More and larger signs that state "Share the Road 3 Feet Minimum Distance is the Law"
- Discourage driving to encourage bicycling by having more bike paths that restrict traffic
- 3rd Street would be an excellent candidate for a bike path
- Canal paths are great but they need better crossings at the larger intersections

October 29, 2013 – Districts 5 & 7

On October 29, 2013, the City of Phoenix and Lee Engineering conducted the third public meeting related to the Phoenix Comprehensive Bicycle Master Plan. The public meeting took place from 6 – 8 pm at the Desert West Community Center at 6501 West Virginia Avenue, Phoenix, AZ 85035.

Input Received

During the meeting, City of Phoenix staff and other members of the project team were available to talk with attendees, listen to comments and concerns, and answer any questions.

Citizen input was largely gained from Mark Juetten who is not only an avid bicyclist (relies solely on transit and bicycle transportation), but has also been driving a bus in Phoenix for Veolia Transportation for about seven years. Mark drives different routes and as a result has a much wider perspective than most other bus drivers. Highlights of the conversation are as follows:

- Bicycle racks on buses are more likely to be more full in the summer months than in the winter due to the heat.
- Bike racks tend to be more full in the evening hours than during the daytime when visibility conditions are better for bicyclists.
- Newer buses have a three-bike rack. With a three-bike rack, operators rarely have to turn away bicyclists because the racks are full.
- It is up to the discretion of the individual bus operators on allowing transit patrons with bicycles to board the bus with their bikes when the racks are full.
- Mark reported that from his experience bike theft from the bus racks is rare. In his seven years of driving, he is aware of only two bicycles that were stolen from his bus. He urges bicyclists to lock the wheel to the frame when loading a bike onto the rack to minimize the chance for theft, and not to the rack. If locked to the bike rack and the lock will not open, the bus has to leave with the bike attached to it.
- Bus operators only count the bikes that are loaded onto a bus, and they do not count those bicyclists that are not able to be loaded onto a bus due to lack of space. We could contact Valley metro to see if the

operators can be asked to count those bikes that cannot board the bus due to lack of space to measure latent demand.

- There are occasionally data collectors on the bus who collect various pieces of information along the route including boardings and disembarkations. We should contact Valley Metro to see if these data collectors can log the number of bicyclists that are turned away at bus stops due to the lack of space, as well as identify the location *where* they are turned away to get a better measure of latent bicycle demand.
- LRT bike hooks cannot fit the 29 inch wheels and 29 CC wheels also are difficult to fit into the racks. The hook is reportedly designed to be too close to the tire. He would like to recommend these hooks to be changed.

October 30, 2013 – Districts 6 & 8

On October 30, 2013, the City of Phoenix and Lee Engineering conducted the fourth public meeting related to the Phoenix Comprehensive Bicycle Master Plan. The public meeting took place from 6 – 8 pm at the Eastlake Park Community Center at 1549 East Jefferson Street, Phoenix, AZ 85034.

Input Received

During the meeting, City of Phoenix staff and other members of the project team were available to talk with attendees, listen to comments and concerns, and answer any questions. Through those discussions, comments and concerns included the following:

- Drastically increase bike infrastructure
- Promote denser residential development
- For bridges over canals, use steel that will be sturdy and last for years
- Use a universal color scheme
- Connecting communities to schools and parks is most important.
- Safety for families is important.
- Completely separate bikes and cars.
- Provide kids with a park for biking (bmx).
- Safety is a big concern.
- Color would be helpful.
- Improve connections and safety at intersections
- Encourage: show local business benefit with cycling community. Key into local business, markets, and supporting community.
- Reach out to females, schools and (untapped resource) healthy communities.
- While bike lanes can be better than nothing, a bike lane on a street engineered for 60 MPH traffic is not a complete street.
- Implement city-wide greenways project aimed at slowing traffic on key through streets like 15th Ave, Campbell, etc…
- Complete the paved canal network and create safe crossings. The worst is 32nd St & Grand Canal, but that entire canal path needs signals.
- Enhance facilities with a cycle track on 44th Street between Salt River and LRT, bike/bus only lanes on Central/1st Ave through downtown.
- Work with streets department to significantly slow arterial traffic on most arterials
- For safety, do not allow right turn on red for vehicles.
- Move the stop line at each intersection with traffic signals back 1 ½ car lengths (establish bike boxes).
- Close down Central Avenue on Sundays to encourage families to ride.
- Buffered bike lanes.

- Make sure the language of the plan looks ahead and is extremely comprehensive.
- Bicycling and proper bicycling infrastructure is beneficial for the health of people – especially those who are low income and at risk for chronic disease. We must consider how this plan can reach not only avid bicyclists in good neighborhoods but also those in low income areas that cycle in order to survive everyday.
- More bicycle friendly paths and along major boulevards.
- Make it safe so there are minimal bicycle related injuries and accidents.
- Encourage more bicycling through incentives like register your bike (with police in case of theft) and receive Valley Metro pass discounts, etc…
- Add bike lanes on Osborn Road between 19th Avenue and 20th Street and also 3rd Street as an additional north/south corridor for cycling safely.
- The best way to get more people on their bikes is to make the streets friendlier to bikes and pedestrians, as in lanes and crossings.
- Build a BMX bike park in the City of Phoenix. Desert West Community Center is a desired location.

WikiMaps

In addition to the community meetings, the City used crowd-sourcing to gather comments about where people currently bike and dangerous or difficult spots. Toole Design Group developed and managed the interactive, web-based map (i.e. Wikimap) that allowed the public to provide input on specific locations and routes, and for this information to be directly integrated into a GIS database.

The Google base map showed the City of Phoenix jurisdictional boundary and existing bikeways. To learn where people currently bike, and places they would bike if the street or bikeway were improved, Wikimap users were able to add points and lines to identify problem intersections and routes, routes they currently ride, and places they go. Users could mark as many areas as they like, comment on others' routes and points, and upload photos to map points.

The Wikimap was open for input at http://wikimapping.net/wikimap/Phoenix-Bicycle-Master-Plan.html for two months from September 9, 2013 to November 10, 2013. The ability to upload photos to map points was enabled on October 4, 2013.

In total, 594 users input approximately 1,000 features to the Wikimap. Additionally, project team members added more than 200 problem intersections and routes identified at the community meetings and via email to City of Phoenix Street Transportation staff.

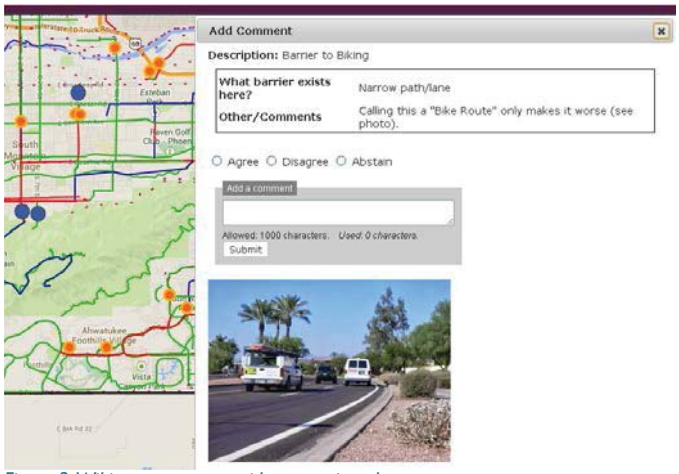


Figure 2 Wikimap comment with supporting photo

Overview of Comments

The main (most often cited) concerns for each category are provided below.

Route I'd Like to Ride

- Pave canal path
- Add bike lanes
- Make connections between off-road paths
- Make connections for bicyclists and pedestrians when there is a gap in street network
- Poor pavement conditions
- Add signalized crossing
- Provide physically separated bike lane
- Make connections to light rail

Figure 3 - Photo uploaded by Wikimap user with a request to add wayfinding signs

High Stress Routes

- Poor surface conditions
- Lack of paving along canals
- Heavy traffic
- Poor bike connectivity (gaps)
- Trail ends with no outlet
- Rude motorists
- No bike lane
- High speed traffic
- Canal crossings at arterials
- Lack of sidewalks
- Narrow sidewalks
- Paved path wet from sprinklers
- Narrow bike lanes
- Debris on roadway
- Conflicts with turning vehicles, particularly at dual rights
- Not enough space on road for motor vehicles to pass cyclists
- Lack of connection across freeways
- Intersection without traffic control
- Lack of striping on multiuse paths for exclusive bicycle use

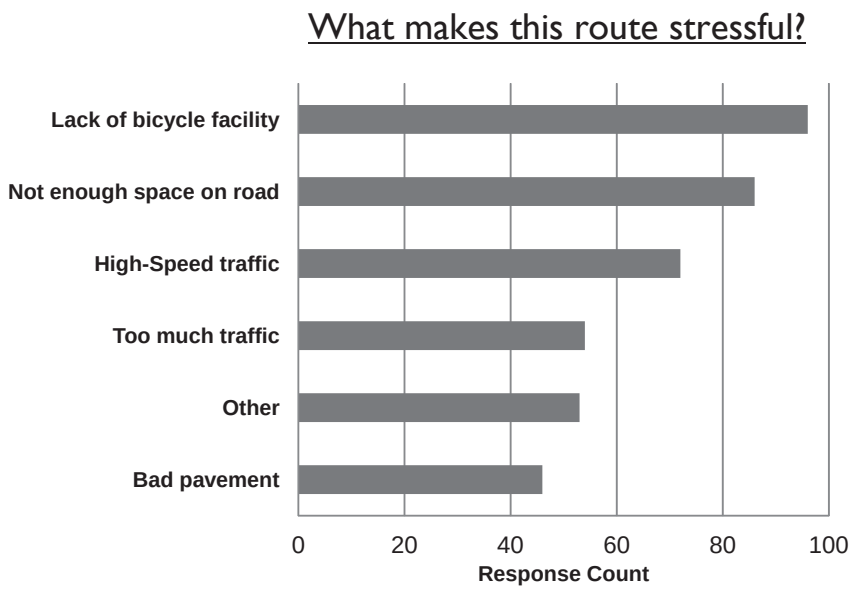


Figure 4 Wikimap user responses to "What makes this route stressful?"

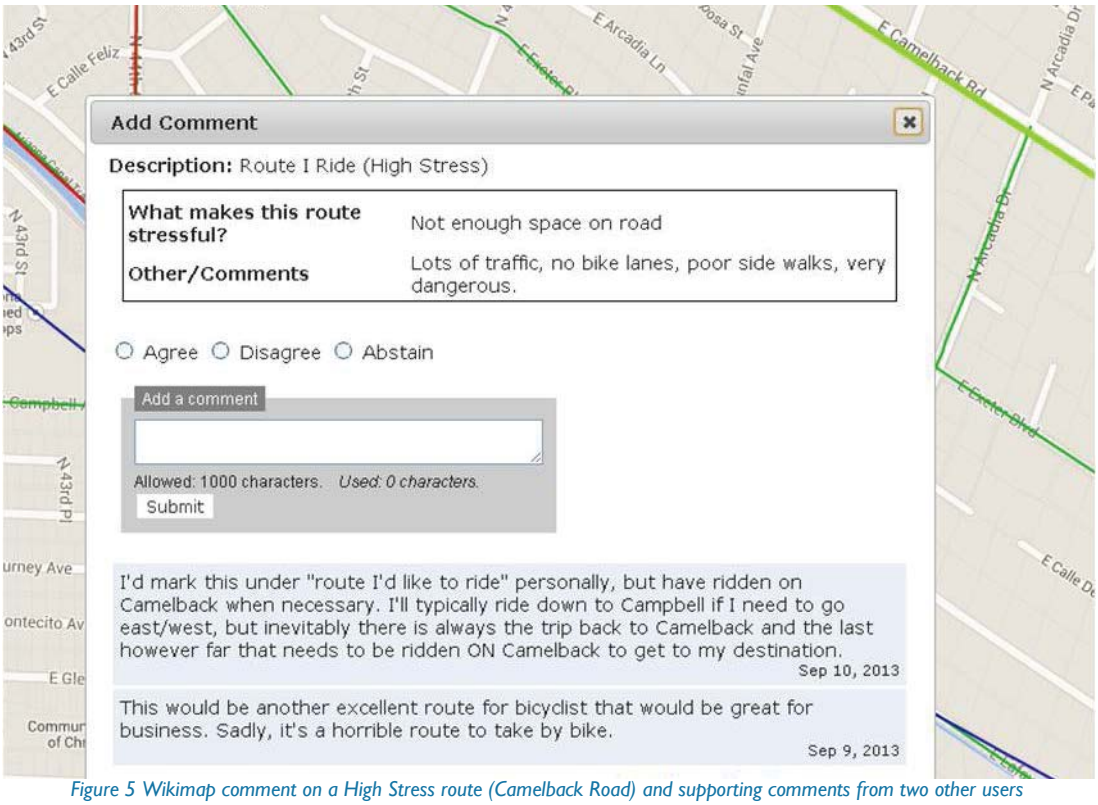


Figure 5 Wikimap comment on a High Stress route (Camelback Road) and supporting comments from two other users

Barriers

- Berm south of ASU West
- Freeways
- Canal crossings at arterials
- Intersection without traffic control
- Lack of bicycle detection
- Bike lanes do not continue through signalized intersections
- Crosswalk paint is thick and makes riding across very bumpy
- Poor lighting at night
- High speed, busy traffic
- Abandoned streets
- Gates on canal paths
- Trail ends
- Lack of signs to direct bicyclists (wayfinding)

What barrier exists here?

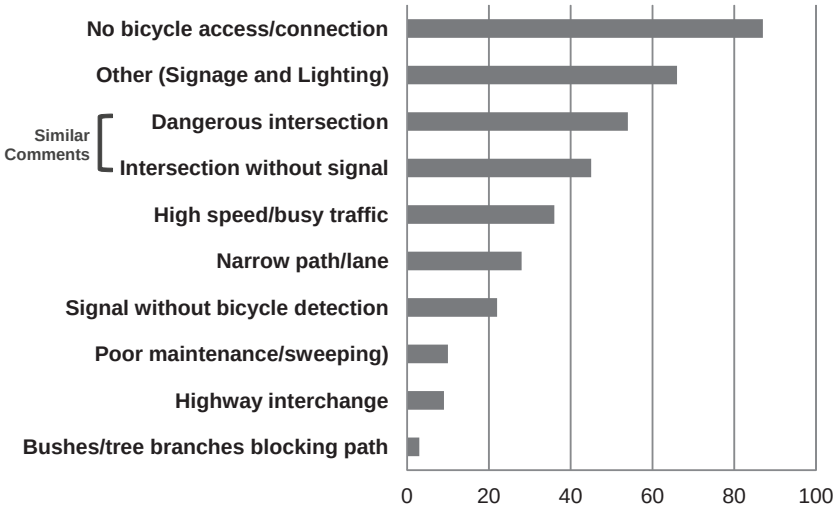


Figure 6 Wikimap user responses to "What barrier exists here?"

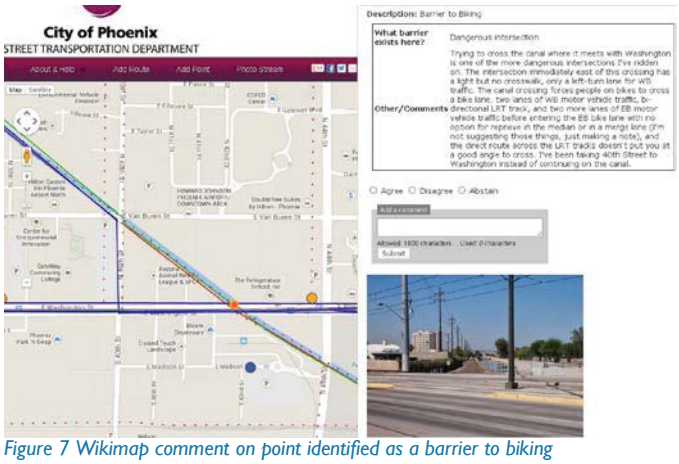


Figure 7 Wikimap comment on point identified as a barrier to biking

Low Stress Routes

- Canal paths
- Bike lanes
- Respectful motorists
- Close to light rail
- Separation from traffic
- Bike lanes through intersections
- Paved
- Low traffic volumes
- Grade separated crossings (bridges)
- Buffered bike lane

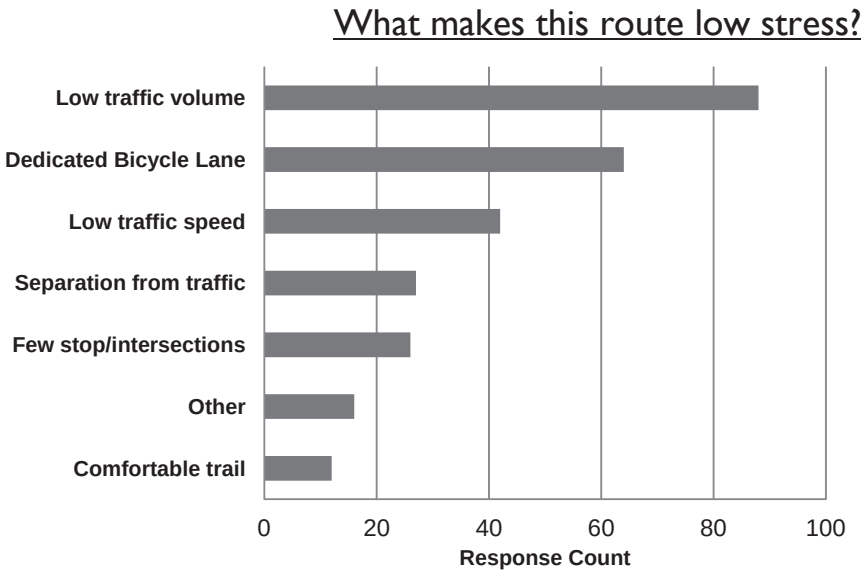


Figure 8 Wikimap user responses to "What makes this route low stress?"

Destinations

- Tempe Town Lake
- Grocery stores
- Dining
- Libraries
- Recreation centers
- Gyms
- Schools
- Light rail stations
- Sky Harbor Airport
- Entertainment
- Canals

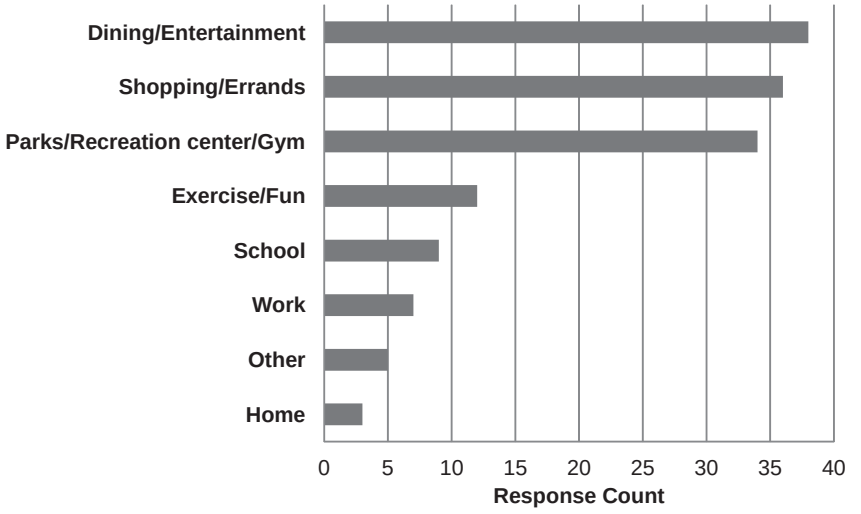


Figure 9 Wikimap user responses to "What destination is located here?"

Community Outreach Results

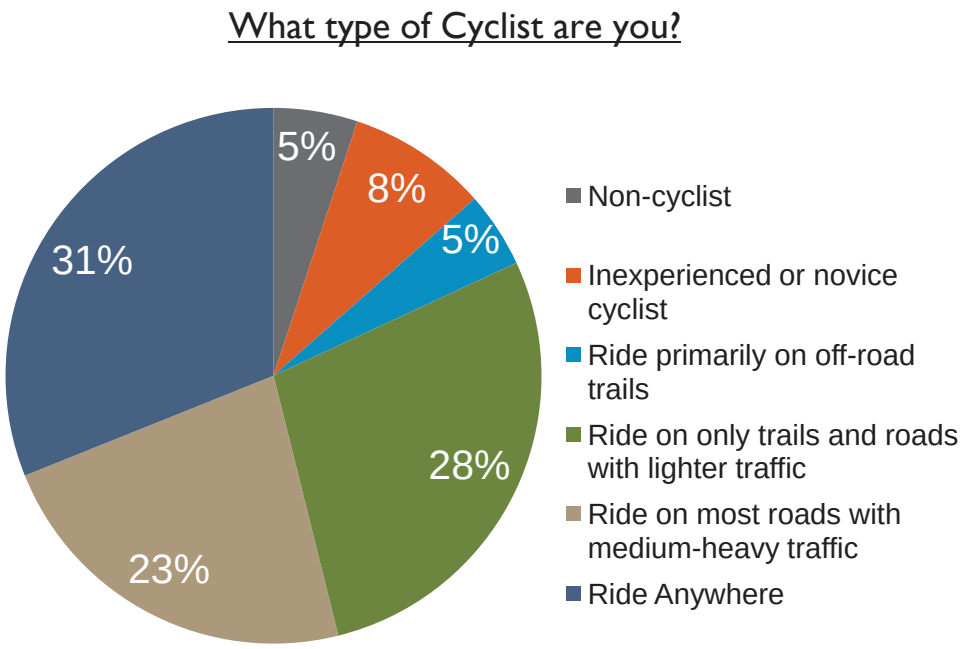


Figure 10 Survey Results - What type of Cyclist are you?

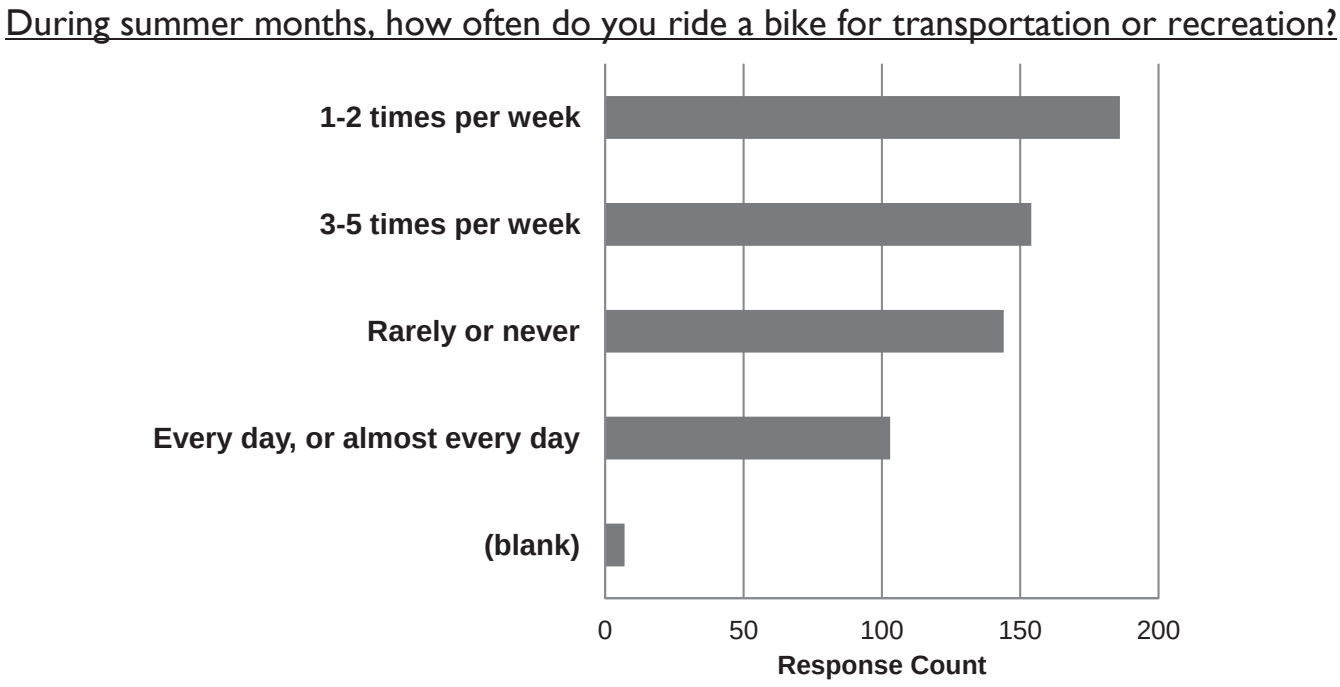


Figure 11 Survey Results - During summer months, how often do you ride a bike for transportation or recreation?

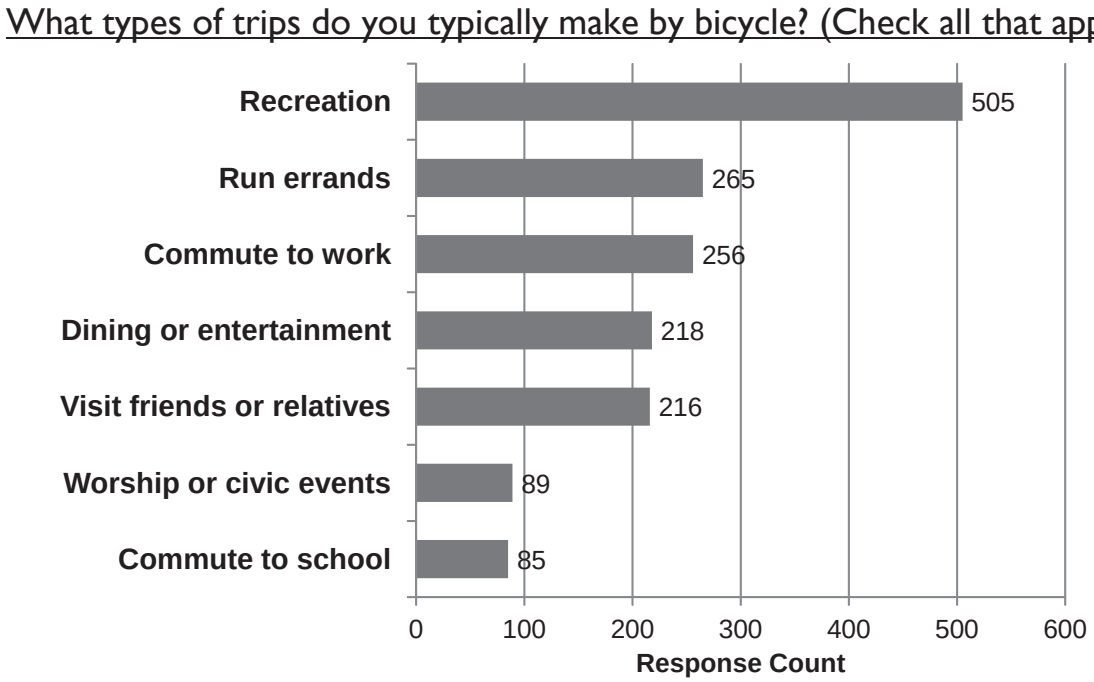


Figure 12 Survey Results - What types of trips do you typically make by bicycle? (Check all that apply.)

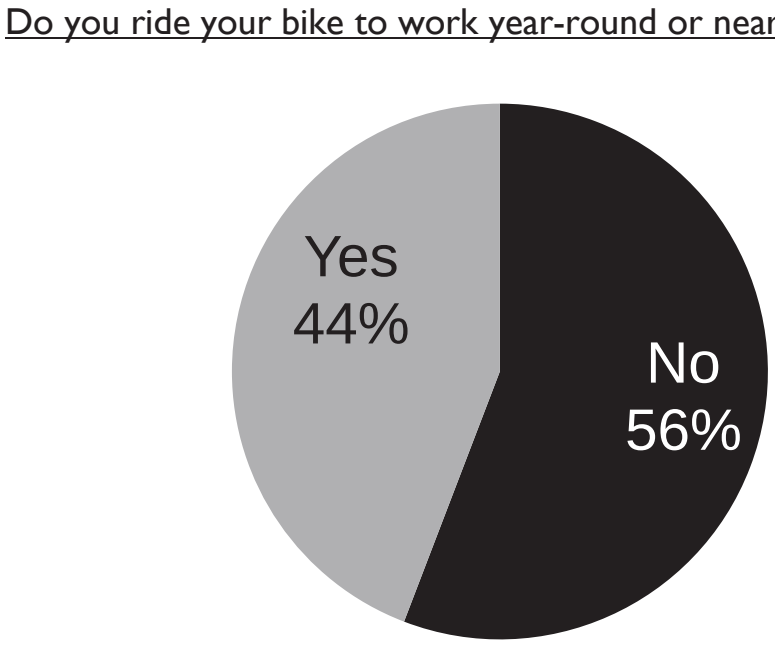


Figure 13 Survey Results - Do you ride your bike to work year-round or nearly year-round?

What is your home zip code?

Council District	Number of Responses
1	20
2	32
3	43
4	75
5	12
6	59
7	49
8	89

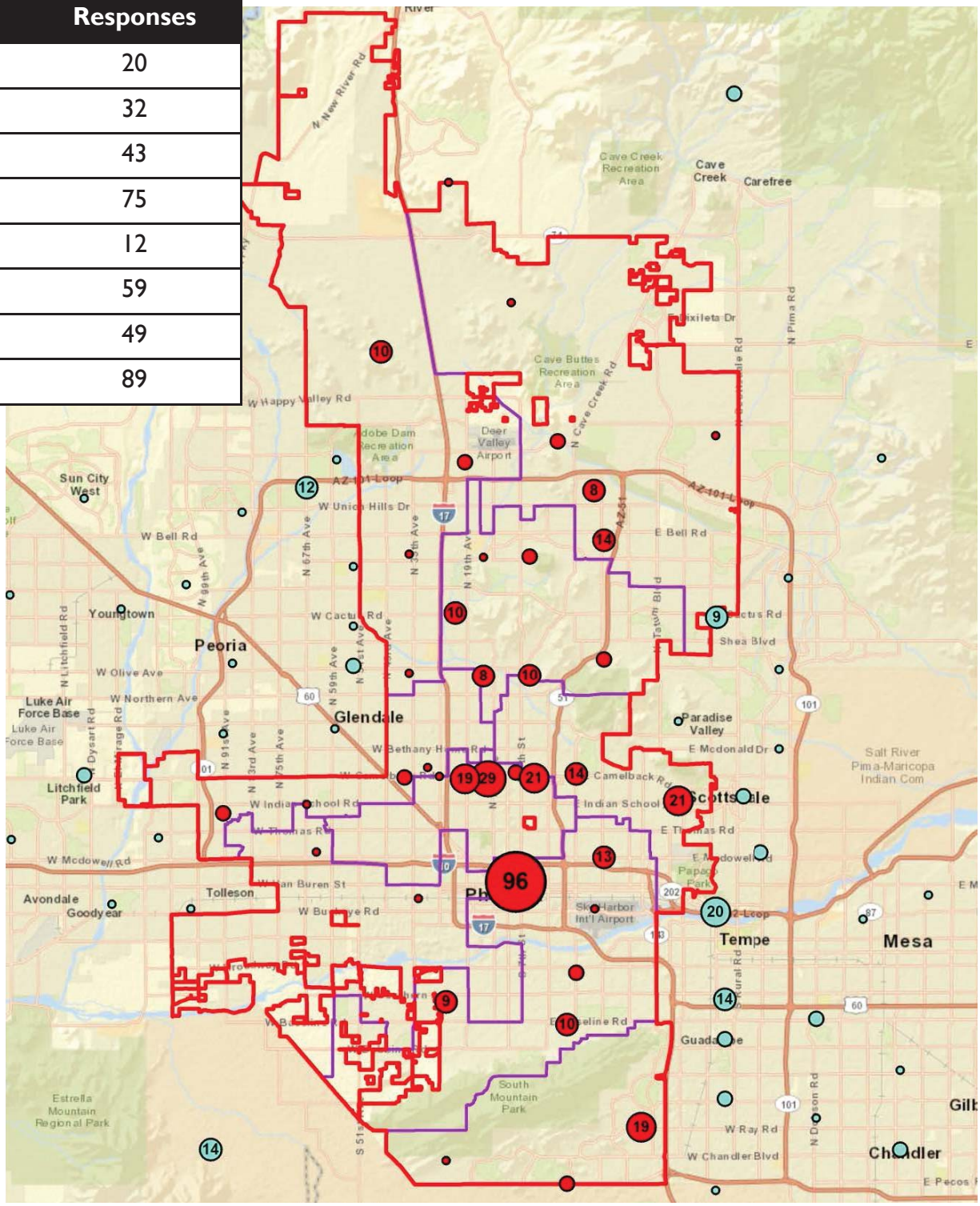


Figure 14 Survey Results - What is your home zip code?

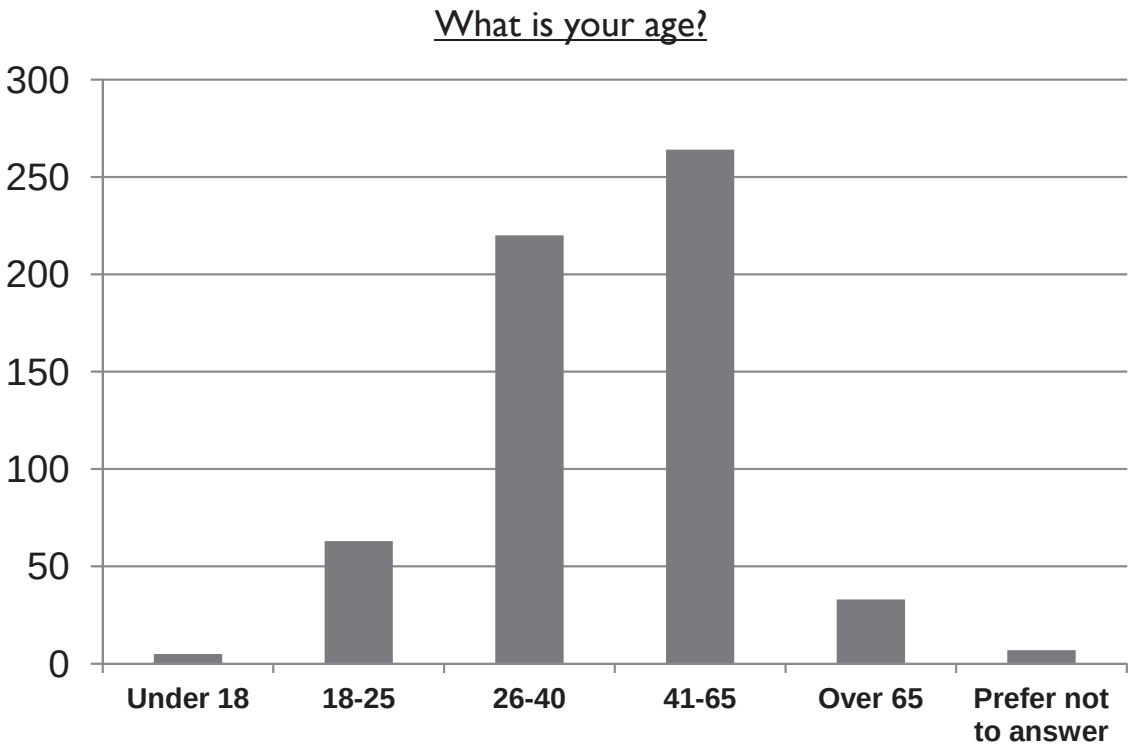


Figure 15 Survey Results - What is your age?

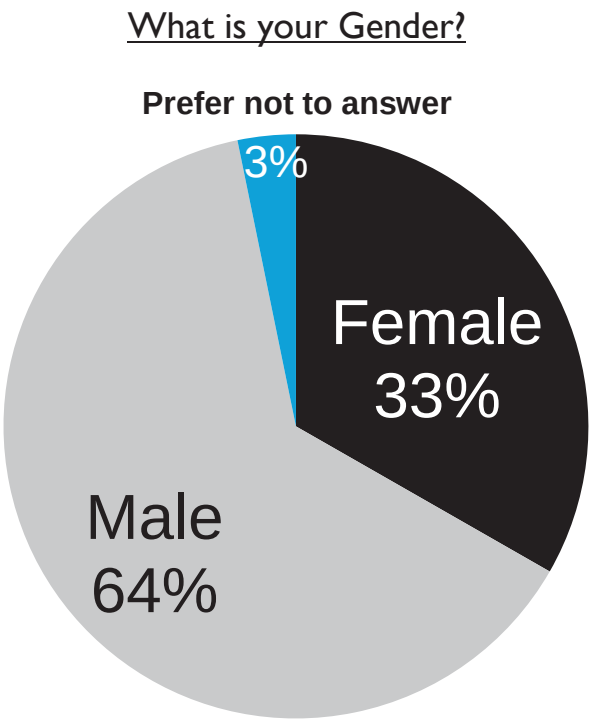
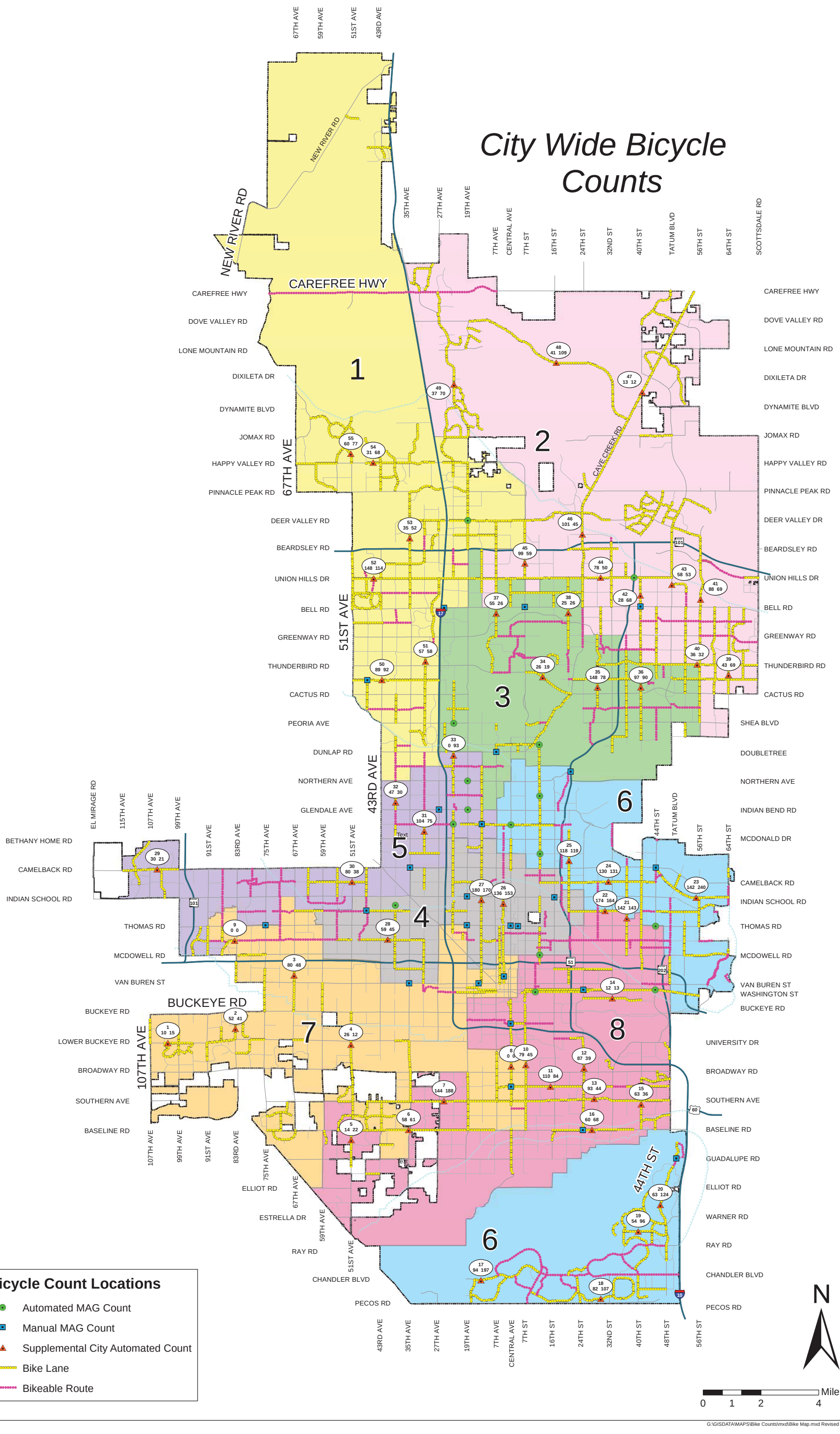


Figure 16 Survey Results - What is your gender?

Appendix B

Bicycle Counts

City Wide Bicycle Counts



G:\GISDATA\MAPS\Bike Counts\mxd\Bike Map.mxd Revised 12/26/2013

City of Phoenix Bicycle Counts

					Bike Count					
					Eastbound or Northbound		Westbound or Southbound		Total (Both Directions)	
#	District	Street	Location	Direction	Wkday Avg	Wkend Avg	Wkday Avg	Wkend Avg	Wkday Avg	Wkend Avg
1	7	Lower Buckeye Road	East of 102nd Avenue	East/West	4	8	6	7	10	15
2	7	83rd Avenue	North of Hilton Avenue	North/South	11	14	41	27	52	41
3	7	67th Avenue	North of Filmore Street	North/South	40	24	133	128	173	152
4	7	51st Avenue	North of S.Williams Street	North/South	Recount		13	6		
5	7	51st Avenue	North of Ian Drive	North/South	Recount		7	11		
6	7	Baseline Road	West of S.35th Drive	East/West	30	18	28	43	58	61
7	7	Southern Avenue	East of 25th Lane	East/West	40	25	104	63	144	88
8	7	Central Avenue	South of Southgate Avenue	East/West	Recount		148	109		
9	7	Encanto Blvd	West of 83rd Drive	East/West	225	191	127	135	352	326
10	7 & 8	7th Street	North of Jones Street	North/South	52	27	27	18	79	45
11	8	Roeser Road	West of S.14th Way	East/West	77	57	33	27	110	84
12	8	S.24th Street	North of Wood Street	North/South	53	14	34	25	87	39
13	8	Southern Avenue	West of S.27th Street	East/West	39	18	54	26	93	44
14	8	Air Lane	East of S.32nd Street	East/West	7	7	5	6	12	13
15	8	S.40th Street	South of E. Nancy Lane	North/South	30	14	33	22	63	36
16	8	Baseline Road	West of S.27th Street	East/West	30	44	30	24	60	68
17	6	Chandler Blvd	West of S.14th Avenue	East/West	51	122	43	75	94	197
18	6	E. Liberty Lane	East of S.29th Way	East/West	39	61	43	46	82	107
19	6	E.Knox Road	West of S.40th Street	East/West	24	35	30	61	54	96
20	6	S.48th Street	North of Kiowa Street	North/South	29	56	34	68	63	124
21	6 & 8	N.36th Street	South of Earl Drive	North/South						
22	6 & 8	E. Osborne Road	West of 30th Street	East/West	76	69	98	95	174	164
23	6	E. Lafayette Blvd	West of 54th Place	East/West	75	136	67	104	142	240
24	6	E. Cambell Avenue	East of 31st Place	East/West	84	70	46	61	130	131
25	6	N.20th Street	South of Colter Street	North/South	54	62	64	57	118	119
26	4	N. 3rd Avenue	South of Clarendon Avenue	North/South	54	65	82	88	136	153
27	4	N. 15th Avenue	South of Fairmount Avenue	North/South	82	88	98	82	180	170
28	4	W. Encanto Blvd	West of 41st Avenue	East/West	34	31	25	14	59	45

					Bike Count					
					Eastbound or Northbound		Westbound or Southbound		Total (Both Directions)	
#	District	Street	Location	Direction	Wkday Avg	Wkend Avg	Wkday Avg	Wkend Avg	Wkday Avg	Wkend Avg
29	5	Camelback Road	West of 105th Avenue	East/West	20	12	10	9	30	21
30	5	W. Campbell Avenue	West of 51st Avenue	East/West	53	26	27	12	80	38
31	5	N. 31st Avenue	South of W. Rose Lane	East/West	21	19	83	56	104	75
32	5	N. 39th Avenue	South of Myrtle Avenue	North/South	20	17	27	13	47	30
33	5	N. 23rd Avenue	North of Townley Avenue	North/South	110	23	162	70	272	93
34	3	E. Thunderbird Road	West of N.Pointe Golf Club Drive	East/West	10	7	16	12	26	19
35	3	N. 28th Street	South of E. Corrine Drive	North/South	40	26	108	52	148	78
36	3	N. 40th Street	North of E. Charter Oak Road	North/South	71	60	26	30	97	90
37	3	N. 7th Avenue	North of W. Aire Libre Avenue	North/South	25	14	30	12	55	26
38	3	N. 20th Street	South of W. Aire Libre Avenue	North/South	15	15	10	11	25	26
39	2	N. 64th Street	North of E. Eugie Terrace	North/South	17	33	26	36	43	69
40	2 & 3	E. Thunderbird Road	East of N.55th Street	East/West	14	14	22	18	36	32
41	2	N. 56th Street	North of Campo Bello Drive	North/South	63	43	25	26	88	69
42	2	N. 40th Street	South of Helena Drive	North/South	14	40	14	28	28	68
43	2	N. Tatum Blvd	North of Robert E. Lee Street	North/South	15	23	43	30	58	53
44	2	N. Union Hills Drive	East of N.29th Street	East/West	43	27	35	23	78	50
45	2	N. 7th Street	North of E. Utopia Road	North/South	53	31	46	28	99	59
46	2	N. Cave Creek	North of E. Rose Garden Lane	North/South	78	29	23	16	101	45
47	2	Cave Creek Road	South of E. Peak View Road	North/South	9	9	4	3	13	12
48	2	E. Sonoran Desert Drive/Dove Valley Road	E. 1600 Blk Sonoran Desert Drive/Dove Valley Road	East/West						
49	2	North Valley Parkway	South of W. Morning Vista Lane	North/South						
50	1	W. Sweetwater Avenue	East of W. 43rd Avenue	East/West	21	28	68	64	89	92
51	1	N. 31st Avenue	South of Dailey Street	North/South	21	26	36	32	57	58
52	1	W. Union Hills Drive	East of N.45th Avenue	East/West	Recount		74	57		

					Bike Count					
					Eastbound or Northbound		Westbound or Southbound		Total (Both Directions)	
#	District	Street	Location	Direction	Wkday Avg	Wkend Avg	Wkday Avg	Wkend Avg	Wkday Avg	Wkend Avg
53	1	N. 35th Avenue	North of W. Irma Lane	North/South	10	19	25	33	35	52
54	1	W. Happy Valley Road	East of N.45th Avenue	East/West						
55	1	N. Stetson Valley Pkwy/ N. 51st Avenue	North of W. Range Mule Drive	North/South						

*** Notes**

1. Bike Counts must be performed in a marked bike lane

2. GPS coordinates shall be given

3. Bike Counts must be performed on both sides of the street

4. Bike Counts must be 5 day counts

5. Bike Count period must extend over the weekend

Bicycle Count Data Summary
Working Paper #4
Excerpt: 4.0 Bicycle Count Summaries

MAG Bicycles Count Project

Draft Report

April 23, 2014

Prepared for:

Maricopa Association of Governments
302 North 1st Avenue, Suite 300
Phoenix, AZ 85003

Prepared by:

CHEN RYAN
239 Laurel Street,
Suite 203
San Diego, CA 92101

In association with:

WILSON & COMPANY ENGINEERS & ARCHITECTS

COFFMAN STUDIO PLLC
Landscape Architecture & Planning

4.0 Bicycle Count Summaries

This section presents bicycle count data summaries after completion of the steps outlined in the preceding sections. Key data summaries include bicycle volumes by day of week and by hour of day. Daily and hourly bicycle counts are also summarized by facility type. The daily and hourly patterns inform trip purposes, in particular, utilitarian versus recreational cycling.

4.1 Bicycle Volumes by Day of Week

4.1.1 Automated Count Stations

Table 4-1 displays average daily weekday and weekend bicycle volumes for the automated count stations. The daily bicycle volumes are displayed for each direction of travel (east-west or north-south) and a sum of counts for both travel directions is provided.

The lowest average weekday bicycle volume was associated with Site ID 39 along Gavilan Peak Parkway south of Pioneer Road in the unincorporated Maricopa County, with an average weekday daily bicycle volume of 28 cyclists. The maximum weekday volume was recorded at Site ID 1 along 107th Avenue south of Thomas Road in the City of Avondale, with approximately 488 average daily weekday cyclists.

The lowest average weekend daily volume was found at Site ID 35 along Camelback Road east of Litchfield Road in the City of Litchfield Park, with an average weekend daily volume of 19 cyclists. The highest average daily weekend volume was recorded at Site ID 119, along the Rio Salado Downstream Dam Bridget in the City of Tempe, with 859 average weekend daily cyclists.

The count station with the greatest difference between average daily weekday and weekend cyclists was found at Site ID 119, where on average, 379 more cyclists were recorded on weekends than weekdays. Conversely, the count station with the smallest difference between average daily weekday and weekend cyclists was Site ID 113 along the Western Canal Bike Path, west of Hardy Drive in the City of Tempe, with an average of only two more daily weekend cyclists than weekday cyclists.

Table 4-1: Average Daily Bicycle Volumes Collected from the Automated Count Stations

Automated Count Station ID	Facility Type	Direction of Travel	Average Daily Bicycle Volume (Weekday)			Average Daily Bicycle Volume (Weekend)		
			NB / WB	SB / EB	Total	NB / WB	SB / EB	Total
1	Bike Lane	North-South	198	290	488	170	188	358
10	Bike Lane	North-South	80	55	136	73	72	145
13	Bike Path	East -West	94	86	179	148	153	301
16	No Facility	North-South	20	42	62	26	47	73
18	Bike Lane	East -West	35	78	113	40	124	165
24	No Facility	East -West	26	45	71	15	24	38
25	Bike Path	North-South	39	36	75	54	48	102
26	Bike Path	East -West	15	15	29	18	18	36
35	Bike Lane	East -West	12	24	36	6	13	19
39	Bike Lane	North-South	17	11	28	34	13	47
40	Bike Lane	North-South	161	82	242	90	57	147
41	Bike Lane	East -West	92	47	139	51	40	91
42	Bike Lane	East -West	41	135	176	26	71	97
43	Bike Lane	East -West	268	75	342	288	43	331
46	Bike Lane	North-South	71	84	155	47	77	124
54	Bike Lane	North-South	184	125	309	104	141	245
55	No Facility	East -West	56	22	78	11	16	27
58	Bike Path	North-South	112	115	227	96	106	203
59	No Facility	East -West	44	70	115	46	84	129
61	No Facility	East -West	n/a	40	40	n/a	29	29
63	Bike Lane	East -West	54	61	115	58	70	128
64	Bike Path	North-South	21	18	39	37	33	70
65	Bike Lane	North-South	20	29	50	11	15	26
66	Bike Lane	North-South	84	90	174	61	78	139
67	Bike Lane	North-South	56	62	117	52	54	106
68	Bike Path	East -West	21	19	40	13	8	21
69	Bike Path	East -West	64	41	105	66	32	99
73	No Facility	East -West	113	106	219	96	96	192
74	No Facility	East -West	124	147	271	110	131	241
98	Bike Lane	North-South	60	56	116	56	56	112
100	Bike Path	North-South	17	14	31	28	25	53
102	Bike Path	North-South	169	152	321	337	291	628
104	Bike Lane	East -West	84	62	146	105	66	170
113	Bike Path	East -West	44	43	87	43	45	89
115	Bike Path	East -West	151	171	323	260	258	518
119	Bike Path	North-South	223	257	480	422	437	859

Source: *Chen Ryan Associates, April 2014*

Table 4-2 summarizes average daily weekday and weekend automated count bicycle volumes by facility type. Categories of bicycle facility type include Bike Path, Bike Lane, or No Facility.

Table 4-2: Summary of Average Daily Weekday and Weekend Bicycle Volumes for Automated Count Sites by Facility Type

Site ID	Facility Type	Average Daily Weekday Volume	Average Daily Weekend Volume
13	Bike Path	179	301
25		75	102
26		29	36
58		227	203
64		39	70
68		40	21
69		105	99
100		31	53
102		321	628
113		87	89
115		323	518
119		480	859
1	Bike Lane	488	358
10		136	145
18		113	165
35		36	19
39		28	47
40		242	147
41		139	91
42		176	97
43		342	331
46		155	124
54		309	245
63		115	128
65		50	26
66		174	139
67		117	106
98		116	112
104		146	170
16	No Bike Facility	62	73
24		71	38
55		78	27
59		115	129
61		40	29
73		219	192
74		271	241

Source: *Chen Ryan Associates, 2014*

The lowest average daily weekday bicycle volume recorded along Bike Paths was 29 cyclists at Site ID 26 (along the Thunderbird Paseo Canal Path, east of 51st Avenue in the City of Glendale), while the highest volume was 480 cyclists at Site ID 119, along the Rio Salado Downstream dam Bridge in the City of Tempe.

The lowest average daily weekend volume along Bike Paths was 21 cyclists at Site ID 68 along the Grand Canal Bike Path east of 39th Avenue in the City of Phoenix. The highest average daily weekend bicycle volume was at Site ID 119, along the Rio Salado Downstream Dam Bridge in the City of Tempe, with 859 average daily weekend cyclists.

The minimum average daily weekday volume along Bike Lanes was 28 cyclists at Site ID 39, along Gavilan Peak Parkway south of Pioneer Road in the unincorporated Maricopa County. The maximum average daily weekday bicycle volume was 488 cyclists at Site ID 1 (along 10th avenue south of Thomas Road in the City of Avondale). The minimum average daily weekend bicycle volume along Bike Lanes was 19 cyclists at Site ID 35, along Camelback Road east of Litchfield Road in the City of Litchfield Park.

Automated count sites without bicycle facilities ranged from a minimum average daily weekday bicycle volume of 40 cyclists at Site ID 61 (along Jefferson Street west of 11th Avenue in the City of Phoenix), to a maximum of 271 cyclists at Site ID 74 (along Glendale Avenue west of 19th Avenue in the City of Phoenix).

Average daily weekend bicycle volumes at sites without bicycle facility varied from a minimum of 27 cyclists at Site ID 55 (along Happy Valley Parkway west of Agua Fria River in the City of Peoria), to a maximum of 241 cyclists at Site ID 74 (along Camelback Road east of Litchfield Road in the City of Litchfield Park).

Figure 4-1 displays the average daily weekday bicycle volumes, while **Figure 4-2** displays the average daily weekend bicycle volumes for both automated and manual count sites.

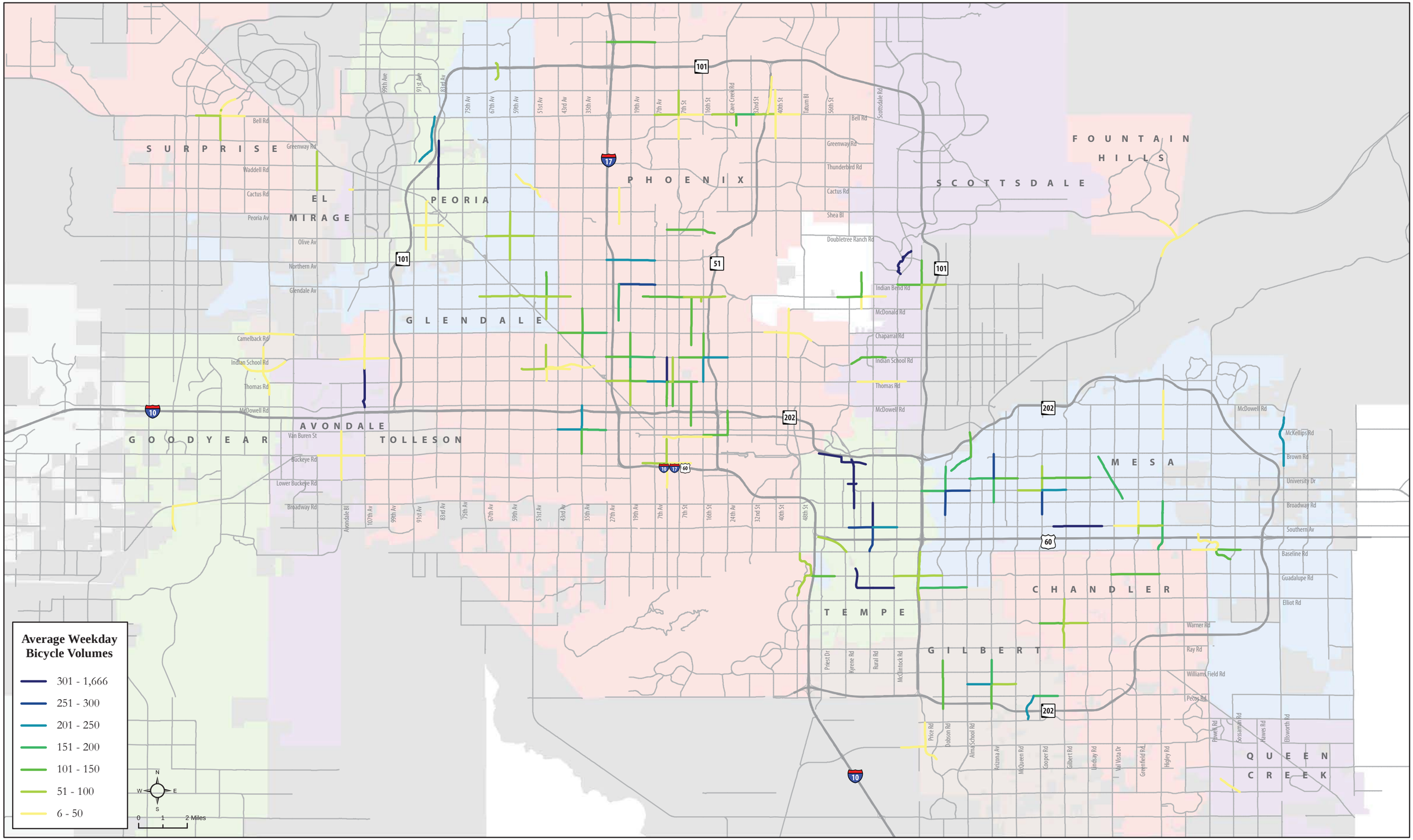


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Figure 4-1
Average Daily Weekday Bicycle Volumes for Automated and Manual Count Sites

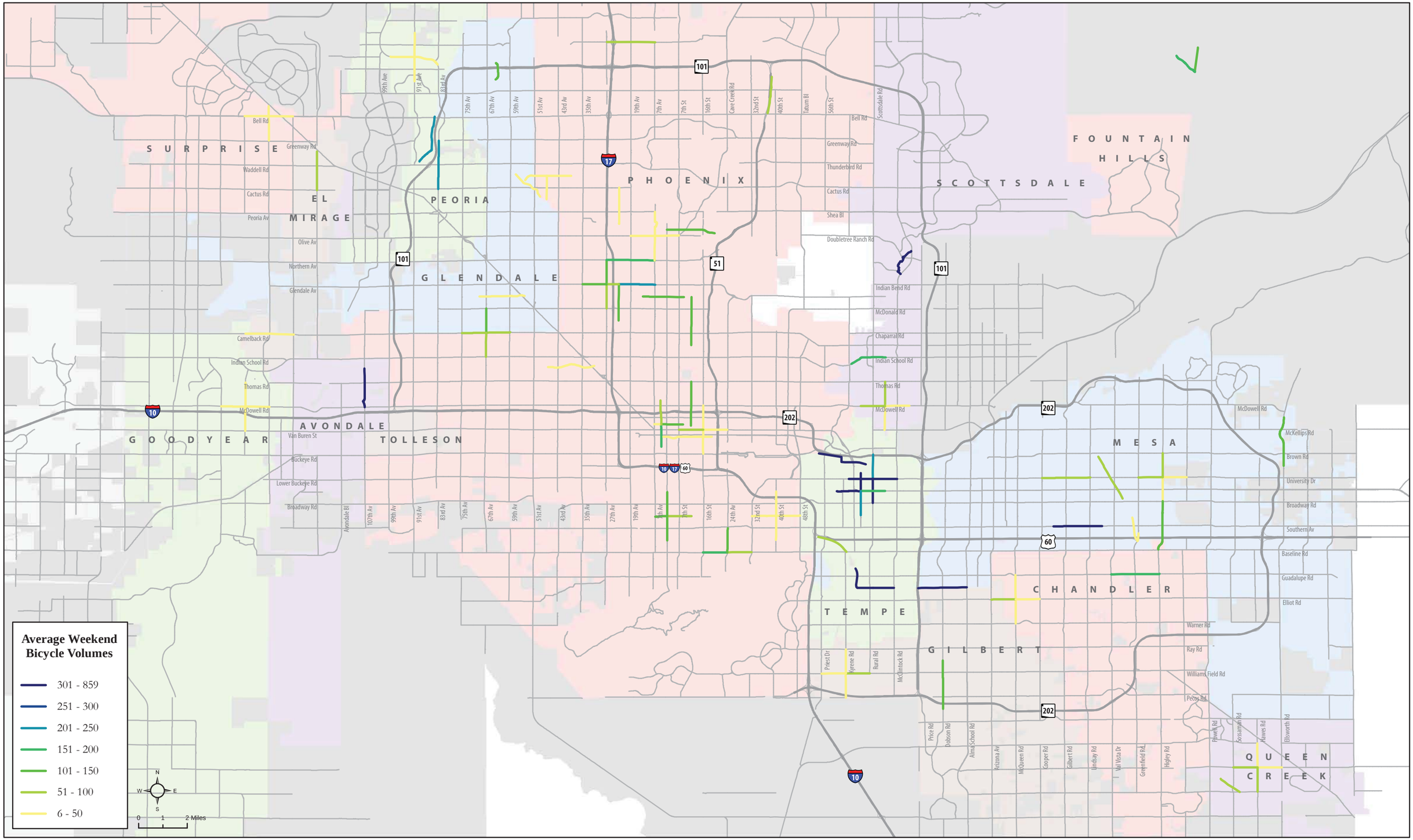

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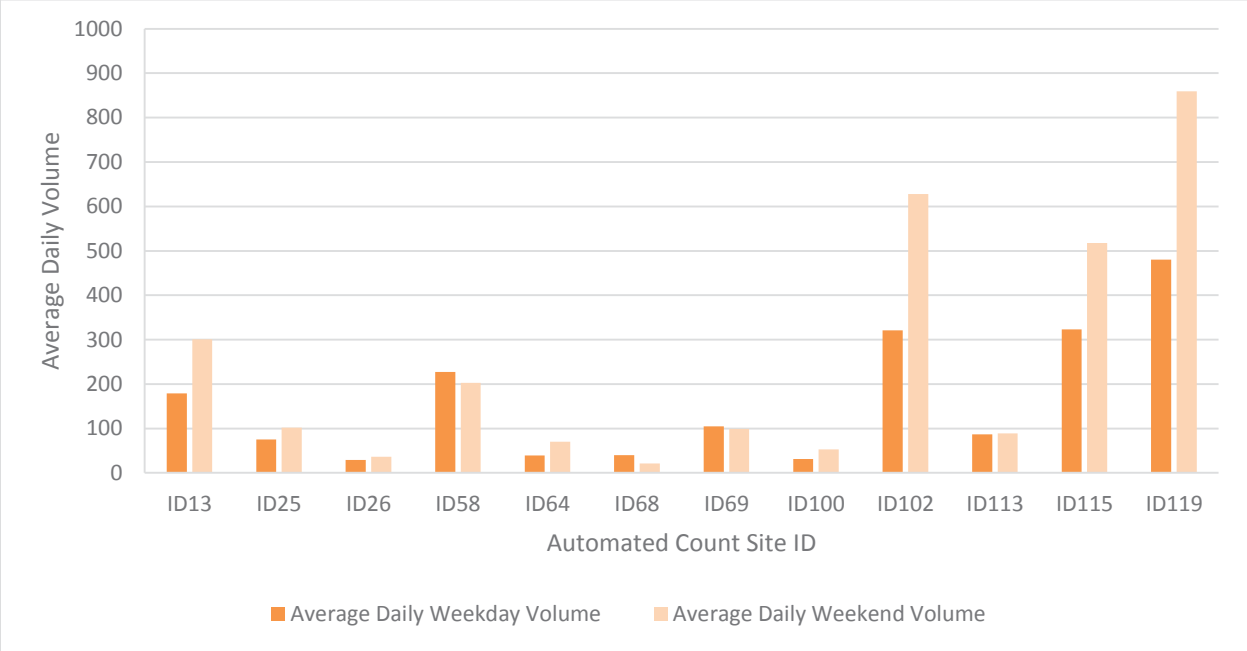
Figure 4-2
Average Daily Weekend Bicycle Volumes for Automated and Manual Count Sites

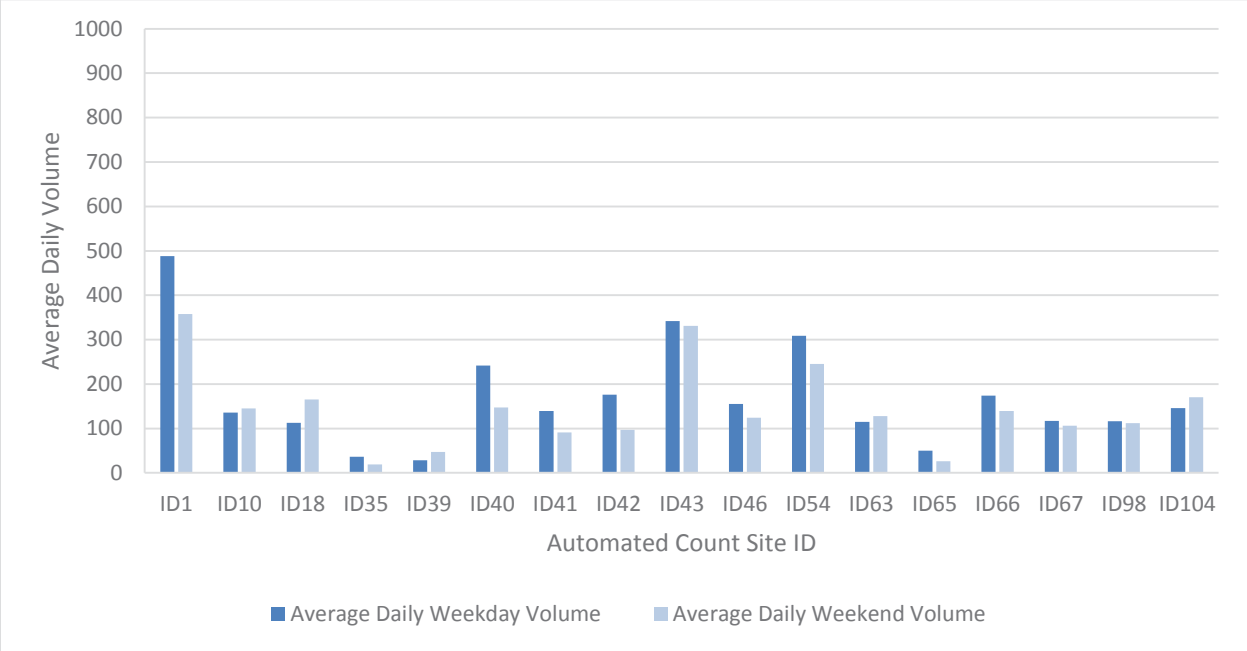
Charts 4-1 through **4-3** display average daily weekday and weekend bicycle volumes collected from the automated count stations by facility type for Bike Path, Bike Lane and No Facility sites, respectively.

Chart 4-1: Average Daily Bicycle Volumes for Weekdays & Weekends by Automated Count Sites along Bike Paths



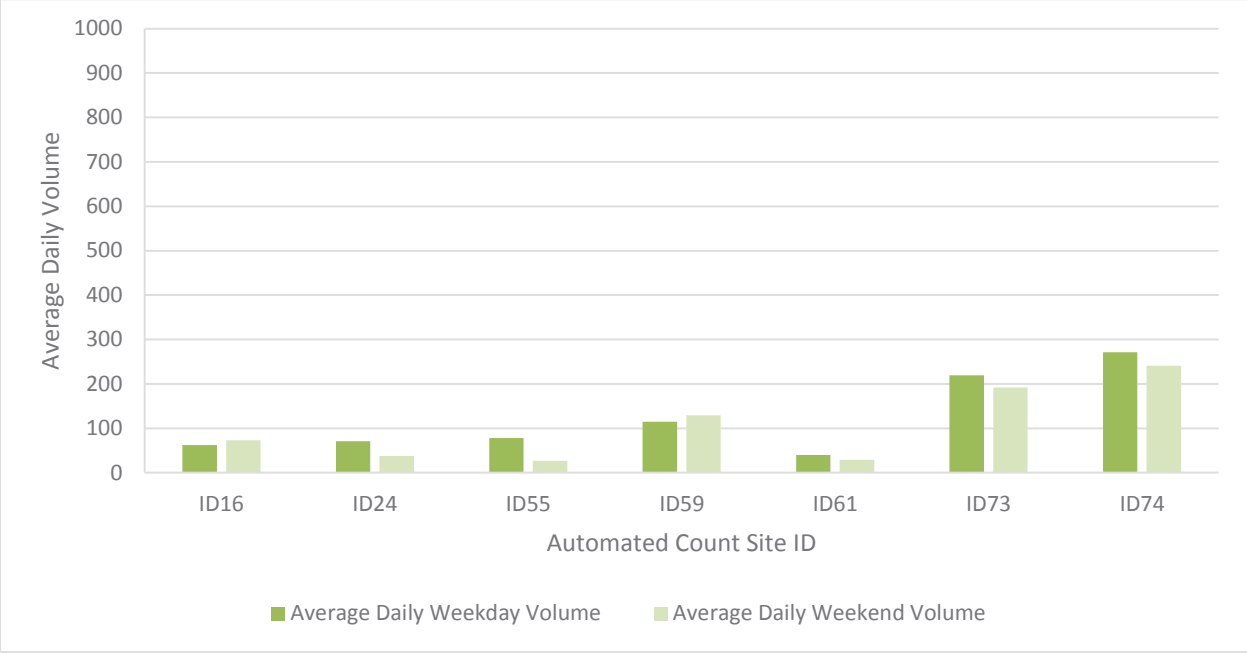
Source: *Chen Ryan Associates, April 2014*

Chart 4-2: Average Daily Bicycle Volumes for Weekdays & Weekends by Automated Count Sites along Bike Lanes



Source: *Chen Ryan Associates, April 2014*

Chart 4-3: Average Daily Bicycle Volumes for Weekdays & Weekends by Automated Count Sites without Bicycle Facility



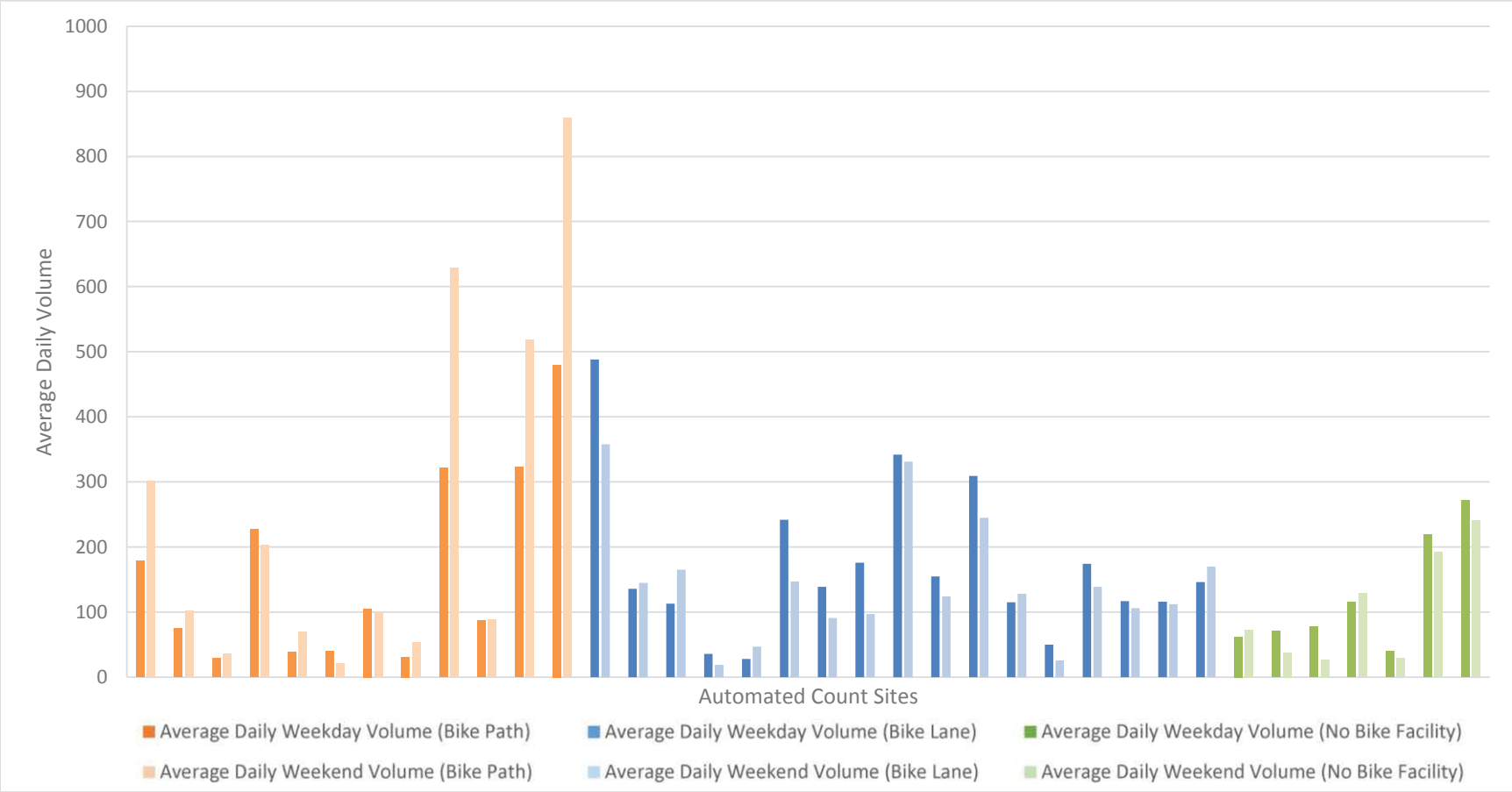
Source: *Chen Ryan Associates, April 2014*

As shown in Chart 4-1, in about eight of twelve total sites where counts were collected along bike paths, average daily *weekend* bicycle volumes were higher than average daily *weekday* bicycle volumes. Conversely, twelve of seventeen locations where automated counts were collected along bike lanes showed higher *weekday* versus *weekend* average daily bicycle volumes. For count stations with no facility locations, five of seven sites showed higher *weekday* versus *weekend* average daily bicycle volumes.

These findings reflect the fact that bike paths are used more frequently overall; and that for recreational cyclists, bike paths are the facility of choice since they offer a more comfortable environment for cycling. The findings also might indicate that utilitarian bicycle trips are more constrained in terms of facility type the cyclist uses, therefore bike lanes and roadways without facilities have higher rates of cycling on weekday, when the destination and route choice is less flexible.

Chart 4-4 provides a side-by-side comparison of average daily bicycle volumes for weekdays and weekends by facility type. Bike path volumes tend to be higher overall, followed by bicycle volumes on bike lanes, followed by roadways with no facility.

Chart 4-4: Average Daily Bicycle Volumes for Weekdays & Weekends by Facility Type



Source: *Chen Ryan Associates, April 2014*

4.1.2 Manual Counts

Table 4-3 displays estimated daily weekday bicycle volumes at manual count stations. These estimates were developed using the daily factors developed from the automated count data, as described in Section 3.2. **Table 4-4** displays estimated daily bicycle volumes at manual count stations for weekends.

As shown, estimated volumes are shown for each leg of the intersection. The volumes on each leg of the intersection were obtained by summing the two directions of travel along each intersection leg, or the approach/departure along each intersection leg. The total sum in the last column reflects the summation of all approaches/departures divided by two, to avoid counting double counting cyclists entering and exiting the intersection.

The estimated daily weekday volumes range from a minimum of 6 cyclists, observed at Site ID 34 (at the Cotton Lane & MC 85 intersection in the City of Goodyear), to a maximum of 2,244 cyclists at Site ID 114 (at the Mill Avenue and 10th Street intersection in the City of Tempe).

Estimated daily weekend volumes range from a minimum of 17 cyclists at site ID 90 (at the 40th Street and Roeser Road intersection in the City of Phoenix) to a maximum of 719 cyclists at Site ID 112 (at the College Avenue and Apache Boulevard intersection in the City of Tempe).

Table 4-3: Daily Weekday Bicycle Volume Estimates at Manual Count Stations

Manual Count Station ID	North Intersection Leg	South Intersection Leg	East Intersection Leg	West Intersection Leg	Total Daily Estimated Bicycle Volume at the Intersection
2	36	30	24	18	54
3	42	18	12	36	54
11	173	113	95	250	316
12	0	232	167	0	200
14	30	12	0	18	30
20	90	96	66	125	189
28	78	84	78	90	165
29	119	78	54	96	174
32	24	24	30	30	54
34	0	6	6	0	6
36	6	12	6	0	12
37	6	84	89	0	90
44	286	184	148	178	398
45	96	274	214	90	337
48	143	0	0	155	149
49	166	256	274	190	443
50	36	84	96	48	132
53	36	6	0	30	36
57	18	18	6	24	33
71	90	42	36	72	120
72	60	36	6	30	66
75	0	148	172	60	190
77	125	119	160	131	268
78	107	214	220	137	339
81	250	143	160	238	396
82	36	36	24	42	69
83	84	30	42	72	114
86	78	36	12	54	90
87	108	155	178	107	274
88	90	119	131	78	209
89	119	72	108	84	192
91	316	142	184	238	440
93	42	48	48	54	96
96	84	54	54	95	144
97	54	90	107	0	126
99	143	0	0	131	137
105	131	66	72	137	203
110	36	89	36	90	126
114	608	1666	1500	714	2244
117	310	285	250	274	560
118	54	54	66	54	114
120	0	0	18	12	15
123	12	0	6	6	12
124	149	6	12	149	158
126	18	0	0	12	15
127	0	6	6	0	6

Source: *Chen Ryan Associates, April 2014*

Table 4-4: Daily Weekend Bicycle Volume Estimates at Manual Count Stations

Manual Count Station ID	North Intersection Leg	South Intersection Leg	East Intersection Leg	West Intersection Leg	Total Daily Estimated Bicycle Volume at the Intersection
4	23	39	22	6	45
15	28	39	51	50	84
21	50	33	39	56	89
27	101	73	90	61	163
33	39	11	11	39	50
38	129	0	23	151	152
47	22	113	112	22	135
51	22	0	0	45	34
52	62	17	39	84	101
56	12	23	17	6	29
76	73	158	129	17	189
79	124	118	61	157	230
80	130	101	73	101	203
84	101	79	67	101	174
85	34	28	12	17	46
90	12	6	6	12	18
92	34	40	45	56	88
94	0	34	34	22	45
101	45	56	23	56	90
107	73	17	17	62	85
109	17	23	23	17	40
112	438	247	185	567	719
116	248	416	421	304	695
121	6	39	56	34	68
128	28	0	0	28	28

Source: *Chen Ryan Associates, April 2014*

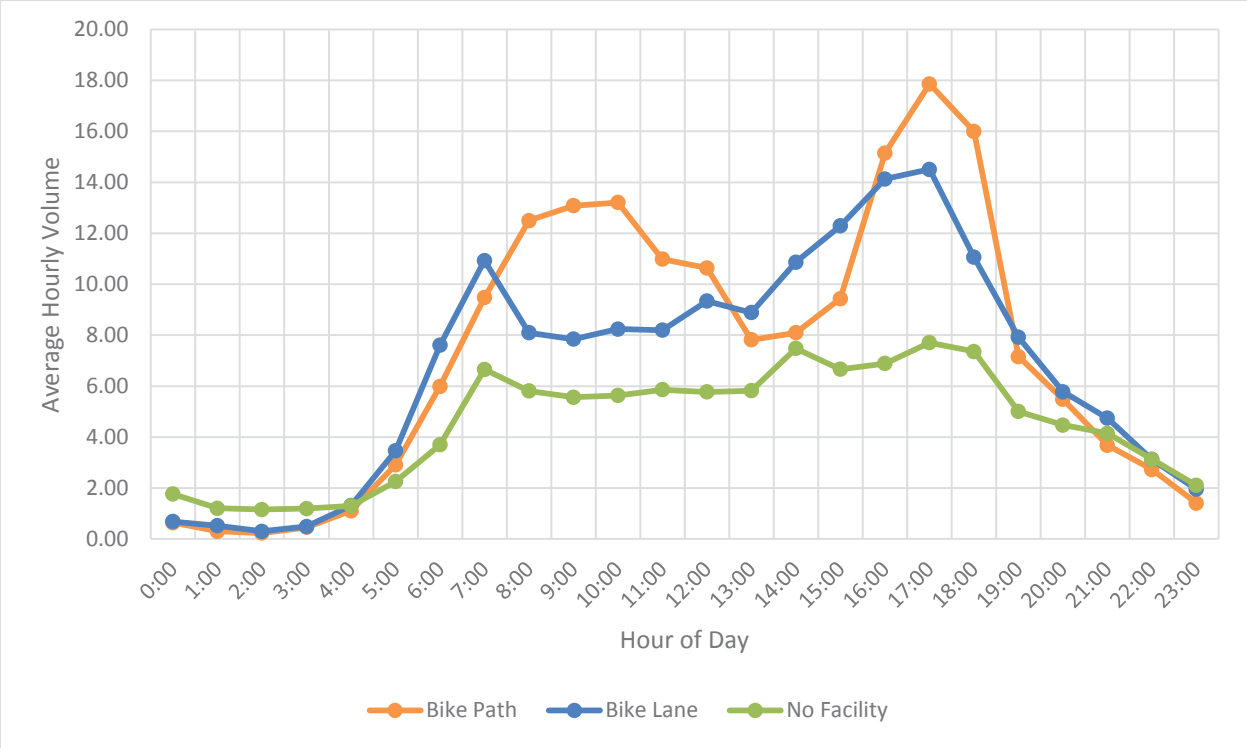
4.2 Using Temporal Patterns to Understand Bicycle Trip Purpose

Analyses of bicycle travel patterns by hour of day and day of week were performed to inform bicycle trip purpose. A broadly accepted concept underlying this analysis is that bicycle trips occurring during the AM and PM peak periods on weekdays are trips being made primarily for utilitarian purposes, such as work or school commute trips. Bicycle volumes observed on the weekends are more commonly associated with recreational trips.

4.2.1 Hour of Day Bicycle Travel

Chart 4-5 displays the average hourly weekday bicycle volumes by facility type for Bike Path, Bike Lane and No Facility as collected at automated count stations. Both morning and evening peaks are visible for each facility type. The two peaks are more prominent at count stations along Bike Paths and Bike Lanes as compared to roadways without bicycle facility, however peaking is still noticeable. Across each of the three facility types the highest average hourly weekday bicycle volume occurred between 5:00PM and 6PM, with 18 cyclists per hour.

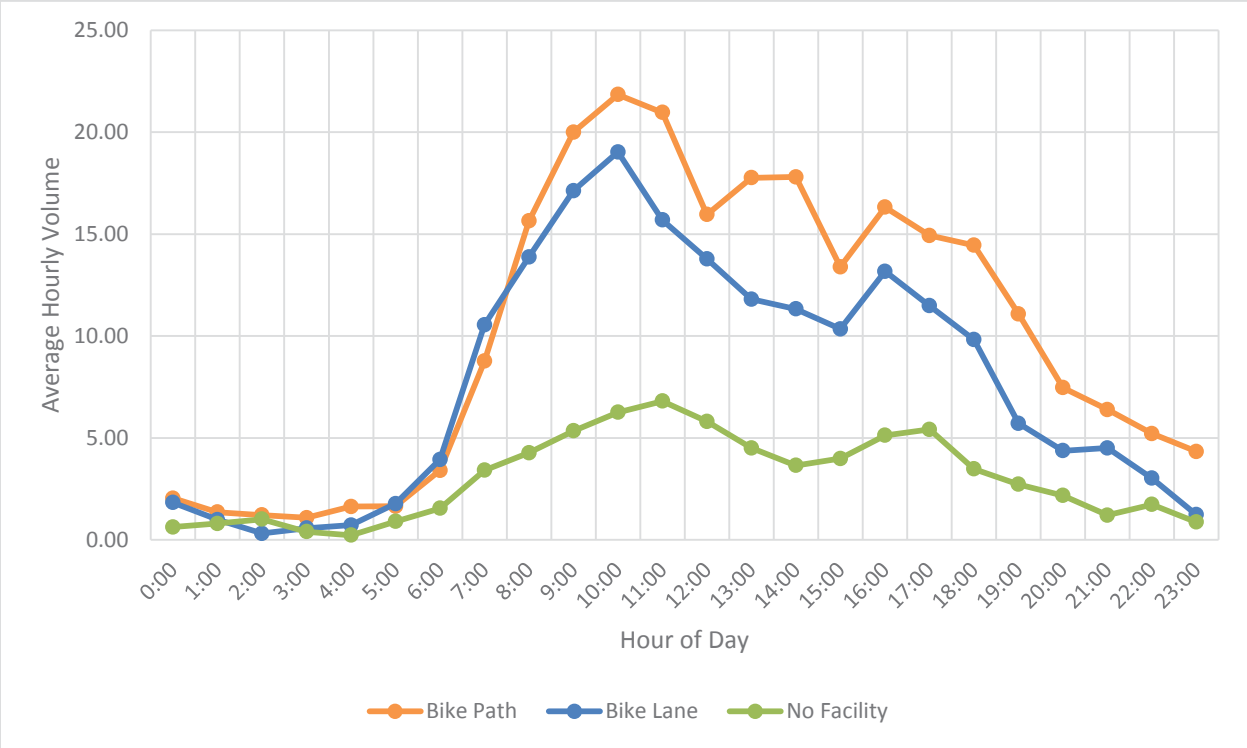
Chart 4-5: Average Hourly Weekday Bicycle Volumes by Facility Type



Source: *Chen Ryan Associates, April 2014*

Chart 4-6 displays the average hourly weekend bicycle volumes by facility type. A 10:00AM peak is visible for both Bike Paths and Bike Lanes, while roadways without bicycle facility experienced an 11:00AM weekend peak. An additional weekend peak also appears to occur along each of the three facility types around 4:00PM or 5:00PM.

Chart 4-6: Average Hourly Weekend Bicycle Volumes by Facility Type



Source: *Chen Ryan Associates, April 2014*

Appendix C contains charts displaying the average hourly weekend and weekday volumes for each individual automated count station.

4.2.2 Day of Week Bicycle Travel

Table 4-5 presents daily bicycle volumes for each day of the week for the automated count stations. The average daily bicycle volume by day of week ranged from a low of 155 on Wednesday to a high of 180 on Saturday.

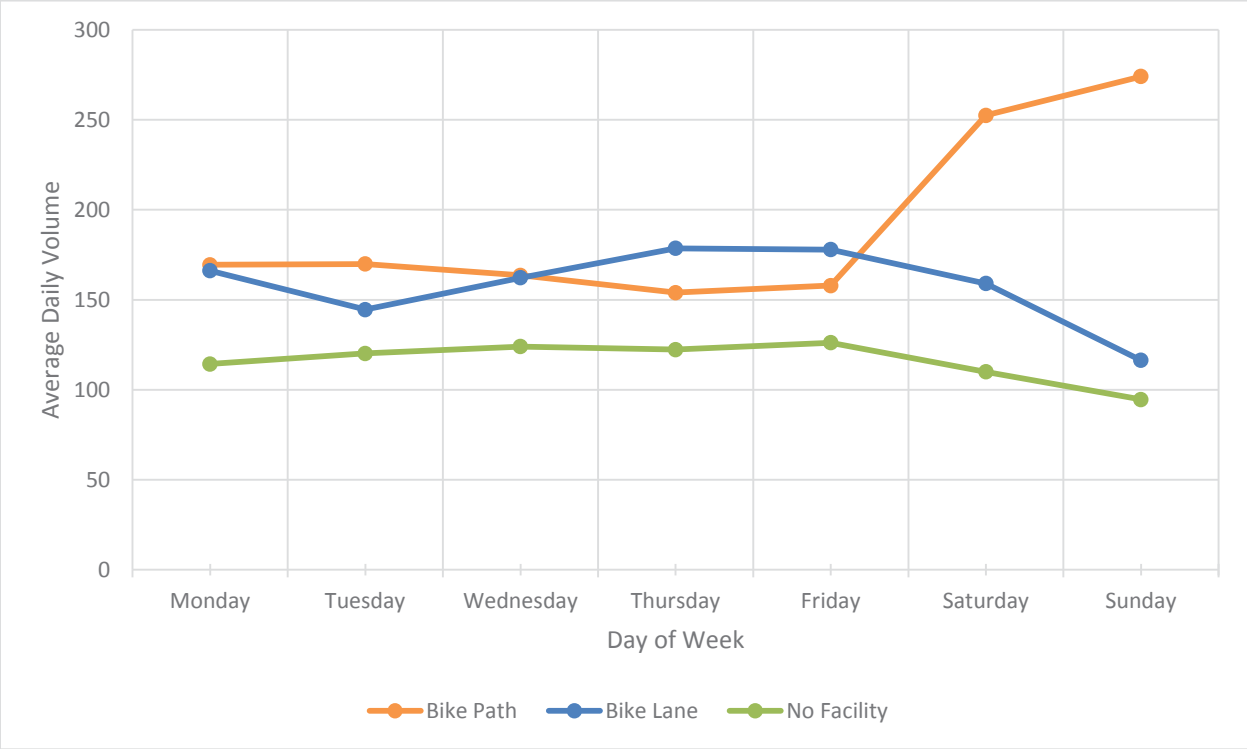
Chart 4-7 summarizes the automated count volumes by day of week by facility type to better understand trends in travel patterns along Bike Paths, Bike Lanes and roadways without bicycle facility. As shown, the highest activity day of the week for Bike Paths is Sunday, with over 274 average daily cyclists. The highest activity day of the week along Bike Lanes is Thursday, with 179 average daily cyclists (followed closely by Fridays at 178 average daily cyclists). For roadways without facilities, Fridays show the highest average daily cyclists, with 126 cyclists.

Table 4-5: Average Daily Bicycle Volumes by Day of Week (Automated Count Stations)

Phase	Site ID	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Phase 1 Sites	59	72	123	119	125	113	141	107
	39	29	39	19	28	24	49	43
	62	117	91	119	119	141	234	251
	63	108	136	110	98	117	117	148
	64	36	44	28	37	50	79	54
	65	42	55	51	44	52	32	15
	66	169	185	191	182	139	141	134
	69	225	69	90	92	110	98	100
	73	214	208	212	199	258	211	156
	74	236	264	264	285	287	242	239
	98	73	124	119	121	120	130	74
Phase 2 Sites	10	157	79	115	178	158	146	143
	61	37	41	39	34	46	29	30
	67	112	95	122	138	117	123	73
	102	331	329	301	318	332	615	655
	104	143	66	127	200	192	174	164
	113	72	103	98	67	84	94	79
	119	505	522	486	425	476	855	867
Phase 3 Sites	13	187	202	154	186	172	265	375
	18	159	87	105	112	124	142	209
	40	159	254	295	231	229	192	58
	41	114	123	159	167	117	110	54
	42	141	183	186	176	179	105	81
	43	376	255	365	391	341	357	277
	46	144	170	162	137	155	150	73
	100	54	30	27	24	32	54	52
	115	283	340	355	313	304	491	573
Phase 4 Sites	1	482	329	325	535	767	511	206
	16	73	44	86	66	48	72	74
	24	87	75	71	60	69	43	34
	25	92	80	85	81	48	104	99
	26	40	15	40	25	16	35	38
	35	40	31	33	50	30	25	13
	54	317	321	346	334	230	261	230
	55	81	86	77	87	62	32	22
	58	278	234	231	209	209	185	220
	68	38	48	39	43	30	18	25
Average		**157**	**148**	**155**	**160**	**161**	**180**	**163**

Source: *Chen Ryan Associates, April 2014*

Chart 4-7: Average Daily Bicycle Volumes by Day of Week and Facility Type



Source: *Chen Ryan Associates, April 2014*

4.2.3 Utilitarian and Recreational Trips

Based on the analyses throughout this section, there appears to be consistent use of all three facility categories, Bike Path, Bike Lanes, and roadways with No Facility, for both utilitarian and recreational trips. Each category displayed noticeable peaks in volumes during weekday mornings and evenings, potentially due to bicycle commuters going to and from work or school. Additionally, the 10:00AM weekend peak experienced by all sites is indicative of increased recreational bicycle trip making.

Generally, Bike Paths experienced greater average hourly volumes during weekdays and weekends than Bike Lanes or roadways without bike facility. This finding is potentially indicative of a general preference for Bike Paths for both utilitarian and recreational uses.

4.3 Sidewalk Cycling

Sidewalk cycling rates are a potential indicator of cyclist comfort or perception of cycling safety along a roadway. **Table 4-6** identifies the levels of sidewalk cycling observed at manual count stations for each individual intersection leg and an overall rate for the intersection. Manual count sites that that were located on separated bicycle facilities such as a Bike Path, or on a roadway without a sidewalk were not included in the table.

Table 4-6: Sidewalk Cycling Rates at Manual Count Stations by Intersection Leg and Intersection Total

Station ID	North Intersection Leg			South Intersection Leg			East Intersection Leg			West Intersection Leg			Total Intersection Sidewalk Cycling Rate
	Sidewalk Cyclists	Total Cyclists	Sidewalk %	Sidewalk Cyclists	Total Cyclists	Sidewalk %	Sidewalk Cyclists	Total Cyclists	Sidewalk %	Sidewalk Cyclists	Total Cyclists	Sidewalk %	
2	6	6	100%	3	3	100%	5	5	100%	4	4	100%	100%
3	1	7	14%	5	6	83%	3	3	100%	2	2	100%	61%
4	1	4	25%	1	1	100%	3	7	43%	3	4	75%	50%
11	24	29	83%	39	42	93%	16	19	84%	10	16	63%	84%
12							26	39	67%	15	28	54%	61%
14	1	5	20%	0	3	0%	1	2	50%	0	0	0%	20%
15	3	5	60%	6	9	67%	3	7	43%	4	9	44%	53%
20	14	15	93%	18	21	86%	11	16	69%	7	11	64%	79%
21	1	9	11%	3	10	30%	2	6	33%	3	7	43%	28%
27	18	18	100%	11	11	100%	13	13	100%	16	16	100%	100%
28	13	13	100%	15	15	100%	14	14	100%	13	13	100%	100%
29	11	20	55%	6	16	38%	8	13	62%	5	9	56%	52%
32	4	4	100%	5	5	100%	4	4	100%	5	5	100%	100%
33	1	7	14%	3	7	43%	0	2	0%	0	2	0%	22%
34	0	0	0%	0	0	0%	0	1	0%	0	1	0%	0%
36	0	1	0%	0	0	0%	0	2	0%	0	1	0%	0%
37	1	1	100%	0	0	0%	14	14	100%	15	15	100%	100%
38	6	23	26%	6	27	22%	0	0		0	4	0%	22%
44	37	48	77%	20	30	67%	17	31	55%	14	25	56%	66%
45	8	16	50%	12	15	80%	30	46	65%	21	36	58%	63%
47	2	4	50%	3	4	75%	4	20	20%	4	20	20%	27%
48	14	24	58%	7	26	27%	0	0		0	0		42%
49	22	28	79%	28	32	88%	32	43	74%	29	46	63%	74%
50	2	6	33%	4	8	50%	3	14	21%	6	16	38%	34%
51	1	4	25%	4	8	50%	0	0		0	0		42%
52	0	11	0%	2	15	13%	2	3	67%	4	7	57%	22%
53	0	6	0%	0	5	0%	0	1	0%				0%
56	2	2	100%	1	1	100%	4	4	100%	3	3	100%	100%
57	3	3	100%	4	4	100%	0	3	0%	0	1	0%	64%
71	15	15	100%	9	12	75%	7	7	100%	6	6	100%	93%
72	9	10	90%	5	5	100%	6	6	100%	1	1	100%	95%

Table 4-6: Sidewalk Cycling Rates at Manual Count Stations by Intersection Leg and Intersection Total

Station ID	North Intersection Leg			South Intersection Leg			East Intersection Leg			West Intersection Leg			Total Intersection Sidewalk Cycling Rate
	Sidewalk Cyclists	Total Cyclists	Sidewalk %	Sidewalk Cyclists	Total Cyclists	Sidewalk %	Sidewalk Cyclists	Total Cyclists	Sidewalk %	Sidewalk Cyclists	Total Cyclists	Sidewalk %	
75	0	0	0%	10	10	100%	25	25	100%	29	29	100%	100%
76	12	13	92%	3	3	100%	21	28	75%	19	23	83%	82%
77	19	21	90%	21	22	95%	20	20	100%	26	27	96%	96%
78	18	18	100%	23	23	100%	35	36	97%	36	37	97%	98%
79	10	22	45%	4	28	14%	7	21	33%	4	11	36%	30%
80	12	23	52%	10	18	56%	10	18	56%	10	13	77%	58%
81	42	42	100%	37	40	93%	24	24	100%	27	27	100%	98%
82	6	6	100%	7	7	100%	6	6	100%	4	4	100%	100%
83	14	14	100%	12	12	100%	5	5	100%	7	7	100%	100%
84	18	18	100%	18	18	100%	12	14	86%	9	12	75%	92%
85	6	6	100%	3	3	100%	5	5	100%	2	2	100%	100%
86	13	13	100%	9	9	100%	6	6	100%	2	2	100%	100%
87	18	18	100%	18	18	100%	26	26	100%	30	30	100%	100%
88	14	15	93%	12	13	92%	19	20	95%	21	22	95%	94%
89	19	20	95%	12	14	86%	11	12	92%	17	18	94%	92%
90	1	2	50%	1	2	50%	0	1	0%	1	1	100%	50%
91	53	53	100%	38	40	95%	23	24	96%	30	31	97%	97%
92	5	6	83%	10	10	100%	7	7	100%	6	8	75%	90%
93	5	7	71%	7	9	78%	8	8	100%	8	8	100%	88%
94				1	4	25%	3	6	50%	4	6	67%	50%
96	7	14	50%	11	16	69%	1	9	11%	2	9	22%	44%
97	3	9	33%				5	15	33%	6	18	33%	33%
99	23	24	96%	21	22	95%	0	0		0	0		96%
101	2	8	25%	5	10	50%	4	10	40%	0	4	0%	34%
105	20	22	91%	23	23	100%	11	11	100%	10	12	83%	94%
107	4	13	31%	5	11	45%	2	3	67%	2	3	67%	43%
109	3	3	100%	3	3	100%	4	4	100%	4	4	100%	100%
110	6	6	100%	14	15	93%	15	15	100%	5	6	83%	95%
112	19	78	24%	19	101	19%	17	44	39%	8	33	24%	25%
114	53	102	52%	69	120	58%	51	280	18%	24	252	10%	26%
116	42	44	95%	49	54	91%	70	74	95%	52	75	69%	86%

Table 4-6: Sidewalk Cycling Rates at Manual Count Stations by Intersection Leg and Intersection Total

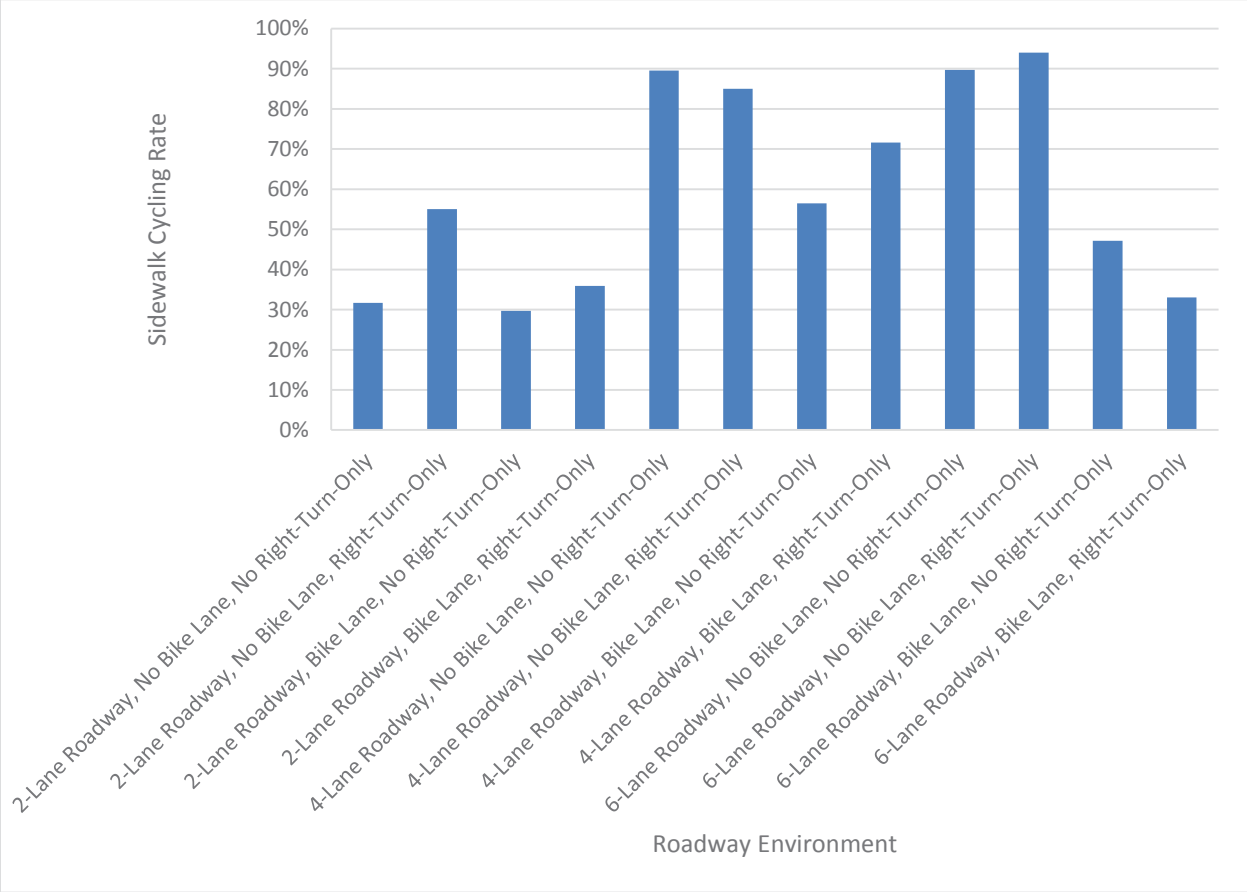
Station ID	North Intersection Leg			South Intersection Leg			East Intersection Leg			West Intersection Leg			Total Intersection Sidewalk Cycling Rate
	Sidewalk Cyclists	Total Cyclists	Sidewalk %	Sidewalk Cyclists	Total Cyclists	Sidewalk %	Sidewalk Cyclists	Total Cyclists	Sidewalk %	Sidewalk Cyclists	Total Cyclists	Sidewalk %	
117	52	52	100%	46	46	100%	41	48	85%	38	42	90%	94%
118	5	9	56%	4	9	44%	6	9	67%	9	11	82%	63%
120	0	0		2	2	100%	0	0	0%	2	3	67%	80%
121	0	1	0%	0	6	0%	1	7	14%	4	10	40%	21%
123	0	2	0%	0	1	0%	0	0		0	1	0%	0%
124	1	25	4%	2	25	8%	0	1	0%	0	2	0%	6%
126	3	3	100%	2	2	100%	0	0	0%	0	0	0%	100%
127	0	0	0%	0	0	0%	1	1	100%	1	1	100%	100%
128	4	5	80%	5	5	100%	0	0		0	0		90%

Source: *Chen Ryan Associates, April 2014*

Chart 4-8 displays the rates of sidewalk cycling associated with the twelve roadway types, as described in Section 2.3, which distinguishes intersection approaches by number of lanes, presence of a bike lane, and presence of a right-turn-only lane. The roadway environment showing the highest rate of sidewalk cycling (94.0%) was found along a 6-lane roadway without bike lanes and with a right-turn-only lane. Conversely, the lowest sidewalk cycling rate (29.7%) was found along a 2-lane roadway, with bike lanes and no right-turn-only lane.

As stated in Section 2.3, the results from the sidewalk cycling analysis support the expectation that a large portion of cyclists will choose to ride along the sidewalk when traveling in an environment characterized by high speed/high volume traffic and no supporting bicycle infrastructure.

Chart 4-8: Rates of Sidewalk Cycling by Roadway Environment



Source: *Chen Ryan Associates, April 2014*

4.4 Comparing Cycling in Maricopa County with other Regions

This section presents a brief comparison of cycling levels in Maricopa County with other cities or counties across the nation, including the City of Portland, the City of San Francisco, the City of Minneapolis and the County of San Diego. The intention of this section is to provide an order of magnitude understanding of how Maricopa County compares to other regions, some of which are considered cycling-prominent cities such as Portland and San Fransisco.

Table 4.7 displays population density information and cycling level summaries for the five cities/counties. Total population, land area, population density, the three highest average daily cycling volumes cited in various cycling count reports, and the three lowest cycling volumes reported.

As shown, San Francisco has the highest population density at 25.74 persons per squares mile, and Maricopa County has the lowest population density, at 0.65 persons per square mile. Minneapolis reports the highest average daily bicycle volume (7,370 cyclists), followed by Portland (4,105 cyclists), followed by Maricopa County (2,244 cyclists), then followed by San Francisco and San Diego at 1,365 cyclists and 754 cyclists, respectively.

These findings reflect the fact that Maricopa County, especially considering its population density, has noteworthy cycling levels that fall within the general order of magnitude of other major regions across the country.

Table 4-7: Comparing Maricopa County Average Daily Bicycle Volumes to Other US Regions

	Maricopa County	Minneapolis[1]	Portland[2]	San Diego[3]	San Francisco[4]
Population of Region or City[5]	3,817,117	382,578	583,776	3,095,313	805,235
Land Area of Region or City (sq. miles)	9,200.14	53.97	133.43	4,206.63	48.87
Population Density (persons/acre)	0.65	11.07	6.83	1.15	25.74
Three Highest Average Daily Bicycle Volumes	**2,244** (Mill Ave & 10th St)	**7,370** (Washington Ave SE Bridge)	**4,105** (N Vancouver & Russell)	**754** (Harbor Drive Bike Path)	**1,365** (Market & Valencia)
	560 (Rural Rd & Southern Ave)	**4,330** (15th Ave, north of University)	**3,995** (Interstate/ Lloyd/ Oregon)	**599** (Coronado Bayshore Bkwy)	**1,337** (17th & Valencia)
	488 (107th Ave & Thomas Rd)	**4,110** (Midtown Greenway, west of Cedar Ave)	**3,600** (SE Harrison & Ladd)	**447** (Chula Vista Bayshore Bkwy)	**1,267** (5th & Market)
Three Lowest Average Daily Volumes	**6** (Cotton Lane & MC 85)	**170** (7th St N over I-94)	**45** (SW Hamilton & 45th)	**29** (Palm Ave, west of Sea Coast Dr)	**11** (San Bruno and Paul)
	6 (SR-85 & Martin Ave)	**260** (E 42nd St east of Minnehaha Ave)	**45** (N Willis & Woolsey)	**46** (Vista Village Dr, east of Indiana)	**12** (Ortega and 24th Ave)
	12 (7th St & Carefree Highway)	**260** (Glenwood Ave N west of Royalston)	**50** (SW Arnold & 35th)	**48** (30th Street, north of Upas St)	**30** (Sloat and 34th Ave)

Source: Chen Ryan Associates, April 2014

[1] Data obtained from the *2013 Minneapolis Bicyclists & Pedestrian Count Report*
[2] Data obtained from *2011 Portland Bicycle Counts Report*
[3] Data obtained from San Diego State University's Active Transportation Research (April, 2014)
[4] Data obtained from the *2013 SFMTA Bicycle Count Report*
[5] Data representative of 2010 U.S. Census

2014 MAG Bicycles Count Project **Counter Installation Locations**

Count ID	Jurisdiction	Count Location	Count Direction	Installation Instructions	Tubing	Installation Date	Download Data & Uninstall	Setting Rational
62	Phoenix	12th St & Arizona Canal Bike Path	Canal	North side of Canal Bike Path, West of 12th	Mini	9/30/2013	10/13/2013	off-street
74N	Phoenix	19th Ave & Glendale	EW	On Glendale, west of 19th (minis on sidewalks, no street)	2 X Mini	9/30/2013	10/13/2013	off-street
74S						9/30/2013	10/13/2013	off-street
73N	Phoenix	19th Ave & Northern Rd	EW	On Northern, west of 19th (minis on sidewalks, no street)	2 X Mini	9/30/2013	10/13/2013	off-street
73S						9/30/2013	10/13/2013	off-street
64	Phoenix	Bike Path parallel to SR-51 & Union Hills Dr	NS	Northwest leg of bridge	Mini	9/30/2013	10/13/2013	off-street
59N	Phoenix	12th St & Hatcher Rd	EW	On Hatcher, west of 12th	2 X 20'	9/30/2013	10/13/2013	older counter
59S	Phoenix					9/30/2013	10/13/2013	older counter
98E	Phoenix	12th St & Missouri Ave	NS	On 12th, south of Missouri	2 X 20'	9/30/2013	10/13/2013	older counter
98W	Phoenix					9/30/2013	10/13/2013	older counter
69N	Phoenix	19th Ave & Deer Valley Rd	EW	On Deer Valley, west of 19th	2 X 20'	9/30/2013	10/13/2013	older counter
69S	Phoenix					9/30/2013	10/13/2013	older counter
66E	Phoenix	23rd Ave & Maryland Ave	NS	On 23rd, south of Maryland	2 X 20'	9/30/2013	10/13/2013	older counter
66W	Phoenix					9/30/2013	10/13/2013	older counter
65E	Phoenix	23rd Ave & Peoria Rd	NS	On 23rd, north of Peoria	2 X 20'	9/30/2013	10/13/2013	older counter
65W	Phoenix					9/30/2013	10/13/2013	older counter
63N	Phoenix	Central Ave & Maryland Ave	EW	On Maryland, west of Central	2 X 20'	9/30/2013	10/13/2013	older counter
63S	Phoenix					9/30/2013	10/13/2013	new counter
61	Phoenix	11th St & Jefferson St (o/w)	EW	On Jefferson, west of 11th (one counter in bikelane on northside of Jefferson)	1 X 20'	10/14/2013	10/26/2013	older counter
67E	Phoenix	12th St and McDowell Rd	NS	On 12th, north of McDowell	2 X 20'	10/14/2013	10/26/2013	older counter
67W	Phoenix					10/14/2013	10/26/2013	older counter
60E	Phoenix	44th St & Thomas Rd	NS	On 44th, north of Thomas	2 X 20'	10/14/2013	10/26/2013	older counter
60W	Phoenix					10/14/2013	10/26/2013	older counter
70N	Phoenix	44th St & Washington St	EW	On Washington, east of 44th	2 X 20'	10/14/2013	10/26/2013	older counter
70S	Phoenix					10/14/2013	10/26/2013	older counter
9N	Chandler	Price Rd & W Ray Rd	EW	On Ray, east of Price	2 X 20'	10/14/2013	10/26/2013	new counter
9S	Chandler					10/14/2013	10/26/2013	new counter
68	Phoenix	39th Ave & Grand Canal Bike Path	Canal	On south side of canal, east of 39th	Mini	11/11/2013	11/24/2013	off-street

2014 MAG Bicycles Count Project **Manual Count Locations**

Count ID	Jurisdiction	Count Location	Method	Count Direction
71	Phoenix	47th Ave & Osborn Rd	Manual	
72	Phoenix	75th Ave & Thomas Rd	Manual	
75	Phoenix	27th Ave & Bell Rd	Manual	
76	Phoenix	3rd Ave & Fillmore St	Manual	
77	Phoenix	35th Ave & Camelback Rd	Manual	
78	Phoenix	16th St and Indian School Rd	Manual	
79	Phoenix	24th St & Baseline Rd	Manual	
80	Phoenix	Central Ave & Roeser Rd	Manual	
81	Phoenix	35th Ave and Van Buren St	Manual	
82	Phoenix	44th St & Camelback Rd	Manual	
83	Phoenix	7th St & Bell Rd	Manual	
84	Phoenix	27th Ave & Glendale Ave	Manual	
85	Phoenix	7th Ave & Dunlap Ave	Manual	
86	Phoenix	Central Ave & Mohave St	Manual	
87	Phoenix	19th Ave & Indian School Rd	Manual	
88	Phoenix	3rd Street and Thomas Rd	Manual	
89	Phoenix	19th Ave and Thomas Rd	Manual	
90	Phoenix	40th St & Roeser Rd	Manual	
91	Phoenix	Central Ave & Thomas Rd	Manual	
92	Phoenix	16th St and Van Buren St	Manual	
93	Phoenix	40th St & Bell Rd	Manual	
94	Phoenix	47th Ave & Sweetwater Ave	Manual	
95	Phoenix	Northern Ave & Bike Path south of SR-51	Manual	
96	Phoenix	15th Ave & Maryland Ave	Manual	
97	Phoenix	48th St and Guadalupe Rd	Manual	EW
99	Phoenix	24th St & Washington St	Manual	

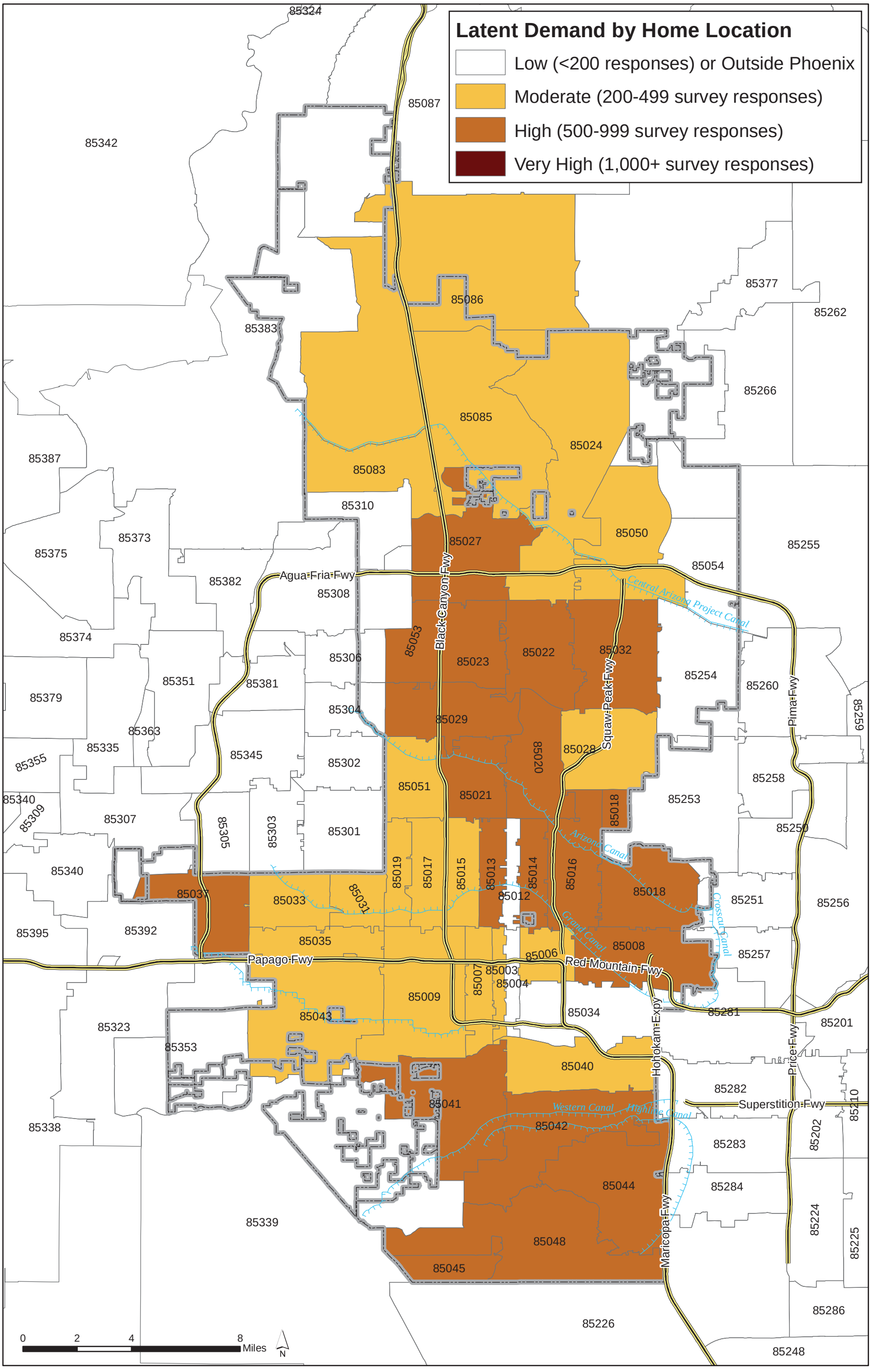
Appendix C

Maricopa County Trip Reduction

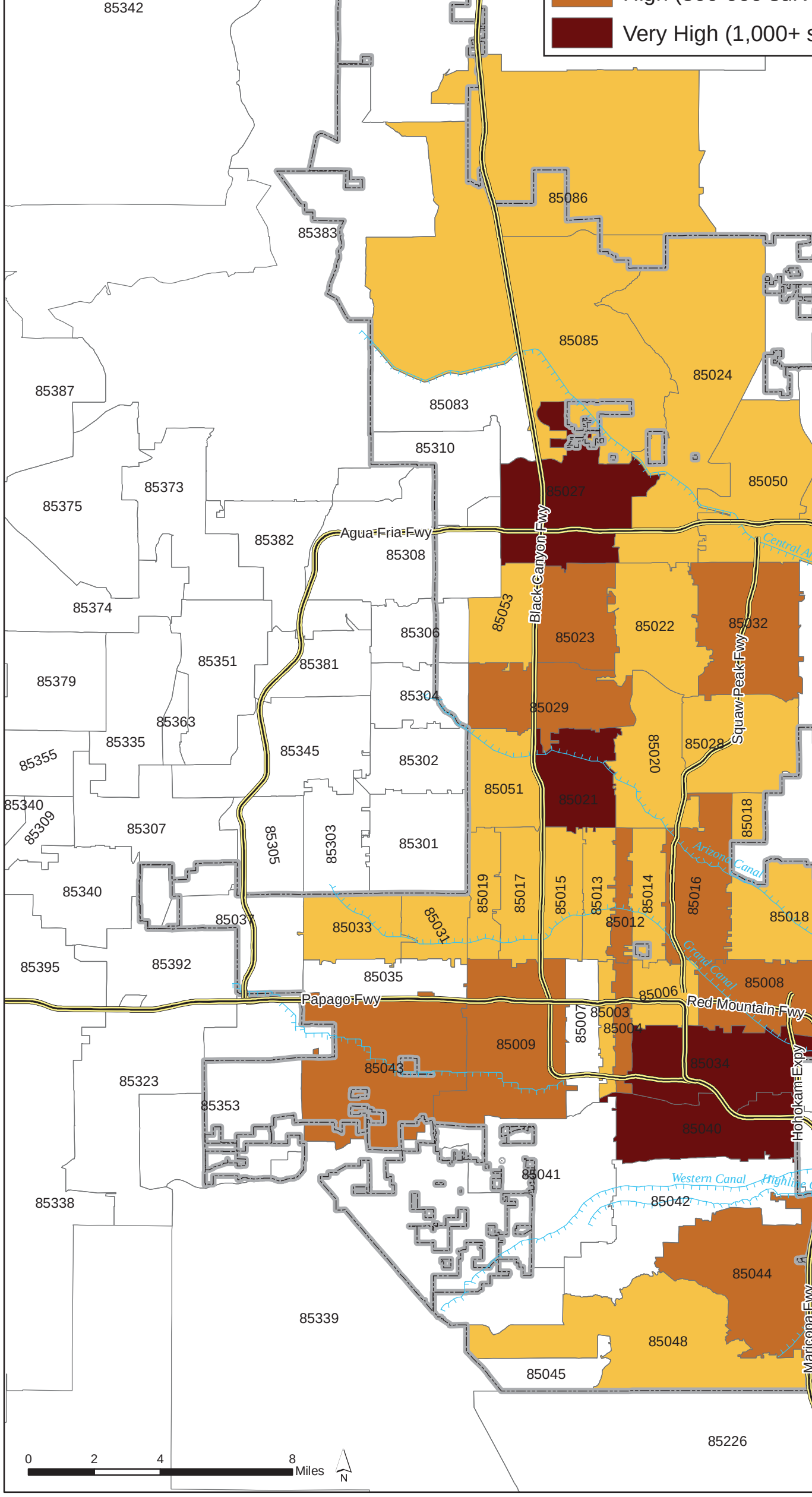
Latent Demand Maps

1a - Commute Trip Origins
Latent Demand by Home ZIP Code

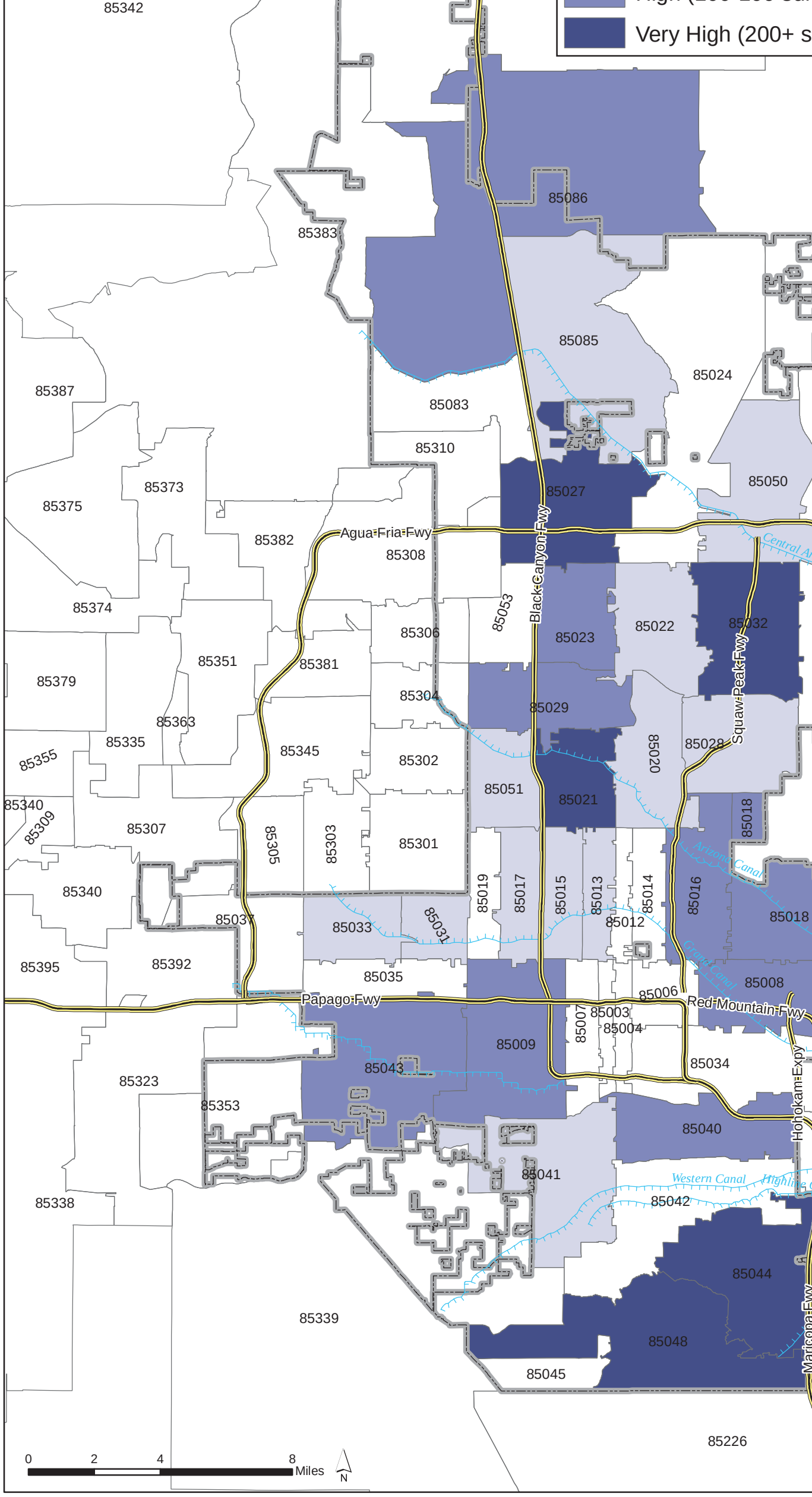
Data shows the number of employees by home ZIP Code who do not bicycle to work but are interested in bicycling to work.



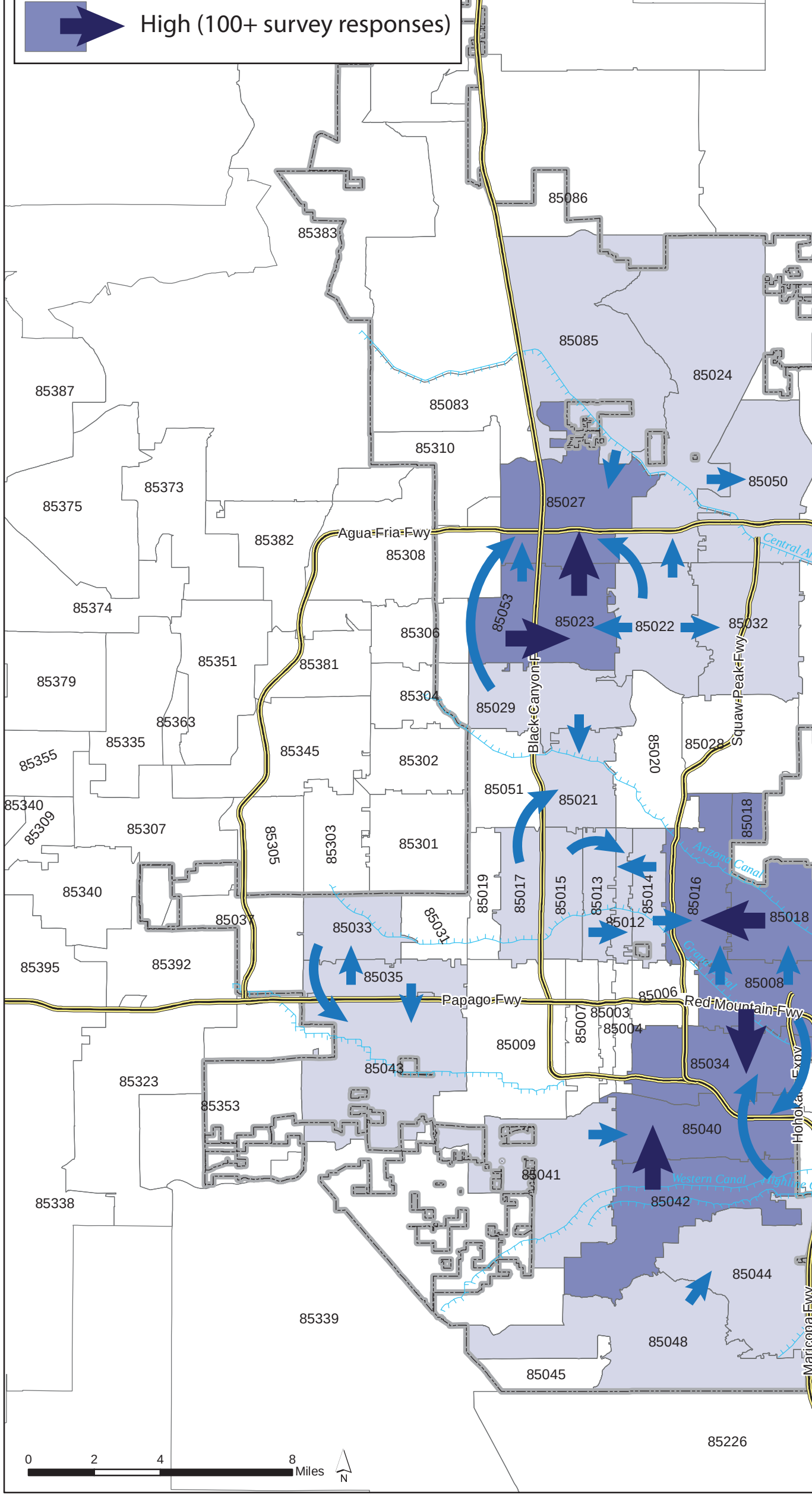
Source: The Maricopa County Air Quality Department Trip Reduction Program (TRP) 2012 Survey.
Note: Only businesses in Maricopa County with 50 or more employees were surveyed.



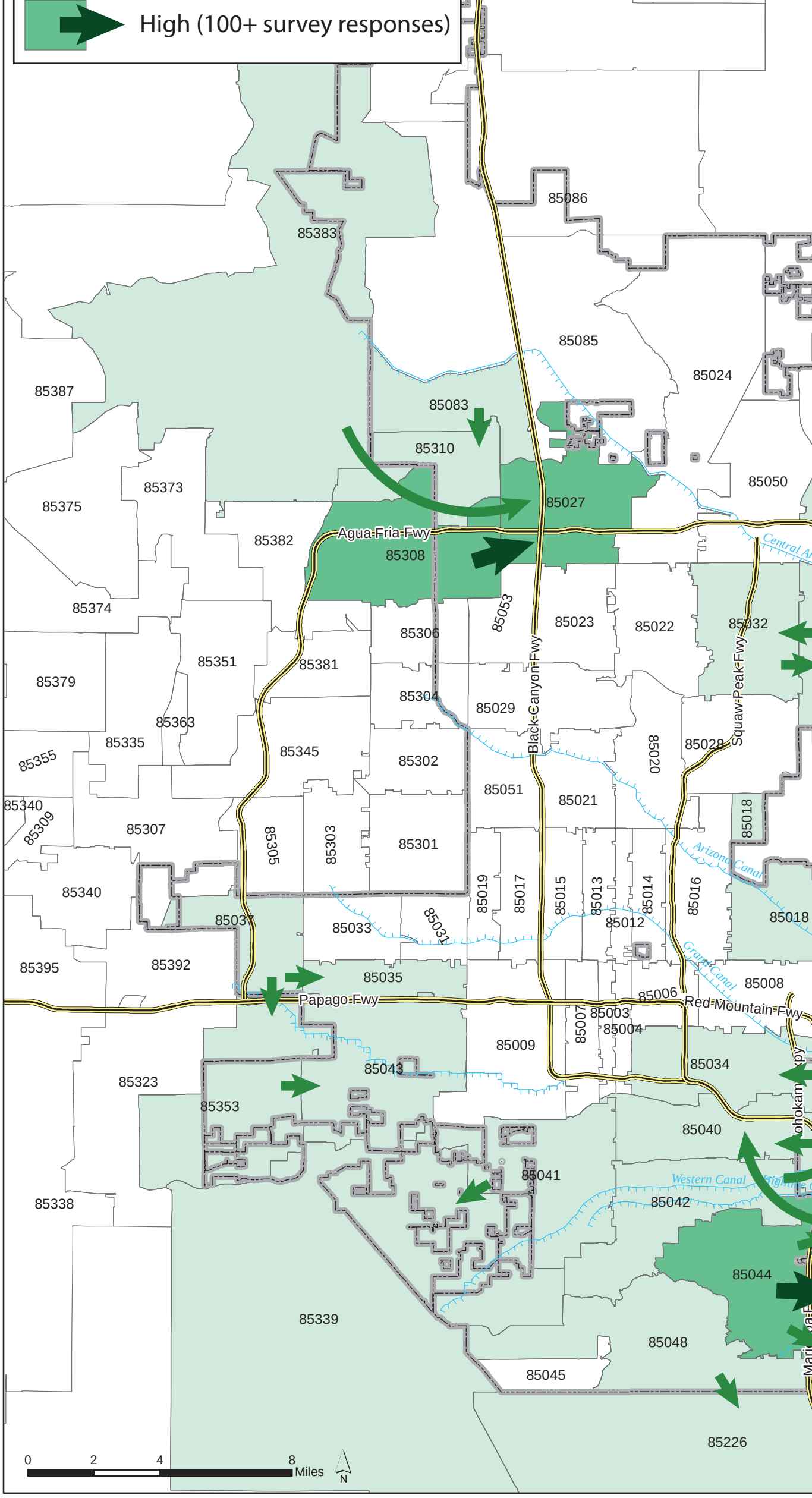
Source: The Maricopa County Air Quality Department Trip Reduction Program (TRP) 2012 Surve
Note: Only businesses in Maricopa County with 50 or more employees were surveyed.



Source: The Maricopa County Air Quality Department Trip Reduction Program (TRP) 2012 Surve
Note: Only businesses in Maricopa County with 50 or more employees were surveyed.



Source: The Maricopa County Air Quality Department Trip Reduction Program (TRP) 2012 Surve
Note: Only businesses in Maricopa County with 50 or more employees were surveyed.



Source: The Maricopa County Air Quality Department Trip Reduction Program (TRP) 2012 Surve
Note: Only businesses in Maricopa County with 50 or more employees were surveyed.

Appendix D

Detailed Assessment of Existing Policies, Practices and Procedures for Traffic Control and Bicycle Facility Design

Appendix D: Detailed Assessment of Existing Policies, Practices and Procedures for Traffic Control and Bicycle Facility Design

Introduction

The following tables provide a detailed assessment of existing Phoenix policies, practices, and procedures for traffic control and bicycle facility design with respect to the standards and guidelines published by AASHTO, MUTCD, and NACTO. The tables below reference relevant sections for each document reviewed, including specific existing text and headings, and provide a related assessment in the "Comment" column.

City of Phoenix (2002). Phoenix General Plan – Bicycling Element

Section	**Existing Text or Heading**	**Comment**
Goal 1: Policy 1-J	*Design and construct all bicycle paths and lanes in accordance with American Association of State Highway and Transportation Officials (AASHTO) guidelines.*	Consider adding additional resources and softening language to allow for flexibility in design and engineering judgment. Bicycle facilities designs should reference guidance from AASHTO, MUTCD, NACTO, and allow for flexibility in design to test new innovations based on engineering judgment.

City of Phoenix (2009). City of Phoenix Street Planning and Design Guidelines. Chapter 10 – Bikeways

Section	Existing Text or Heading	Comment
10.1.1. Philosophy	Introduction	Add the following to the bulleted list: • Reinforce that bicycling is an equitable and viable form of transportation • Provide opportunities for active transportation to improve health and quality of life
10.1.2 Components	N/A	GENERAL COMMENT--Define each facility type in a bulleted list.
	On-street bike lanes are always one-way.	Consideration should be given to two-way cycle tracks and contra-flow bicycle facilities.
	Bike routes may include shared streets, bike lanes, shared-use paths or multiuse trails, in any combination.	Add cycle tracks, bicycle boulevards, etc. Should allow for flexibility in design.
	Bike routes may include shared streets, bike lanes, shared-use paths or multiuse trails, in any combination. Routes may be designated by signing or by placement on a map. Bikeways can be any combination of shared-streets, bike lanes, bike routes, shared-use paths or multi-use trails, and can be designated by signing, mapping, or consistent public use.	Same sentence twice.
	Multi-use trails are made from stabilized, decomposed granite.	Include other materials that may be used for multi-use trails, such as asphalt or concrete.
10.1.3 Documents and References	N/A	GENERAL COMMENT--Include general discussion about flexibility in design and engineering judgment. Add references to NACTO, bike plans from neighboring jurisdictions, state bike and pedestrian plan, and PROWAG. Update references from 1999 AASHTO to 2012 AASHTO throughout.
10.2.1 Location	*Providing facilities for both on- and off-street types of bikeways is not always practical but is to be encouraged, as that will accommodate the widest possible range of users, purposes, and trip destinations.*	Adjust language to reflect a more context sensitive approach, e.g., bicycle facilities should always be investigated for feasibility and appropriate facility types for the context and condition of the roadway…
10.2.2 Facility Selection: On-Street	*Bike Lanes are the most desirable facility for any street with a classification of minor collector or higher.*	Consider adjusting language to indicate preference for protected or separated bicycle facilities, such as shared-use paths, buffered bicycle lanes, and cycle tracks.

Section	Existing Text or Heading	Comment
	Parkways, major arterials, minor arterials, major collectors, minor collectors, and certain special neighborhood and rural streets have standard cross-sections that include bicycle lanes. Bike lanes would, therefore, be included on these streets whenever they are built or reconstructed as long as parking along single family homes can be accommodated along collector or neighborhood streets. These cross sections are given in the City of Phoenix Supplement to MAG Uniform Standard Specifications.	Cross sections in the City of Phoenix Supplement to the MAG Uniform Standard Specifications do not provide typical widths. Provide reference to the document where the typical widths are provided.
	For streets that are needed to provide a connection for local or regional bikeway systems, but where a full cross-section with bicycle lanes cannot be accommodated, the following measures should be considered: (Listed starting with the most desirable.) • *Edge line stripe with bike route signs* • *Bike route signs with no edge stripe*	Recommended shoulder width for an edge line striping should be a minimum 4 ft to accommodate bicyclists; however 5 ft is the typical operating space of a bicyclist. Including shared lane markings as a possible measure to consider where bike lanes cannot be provided
10.2.3 Facility Selection: Off-street	• *Ten (10) or twelve (12} foot path/trail, well separated from streets, and in a natural setting* • *Ten (10) or twelve (12) foot path/trail, set off from the street by at least eight (8) feet of landscaping for arterials and five (5) feet for collectors* • *Ten (10) or twelve (12) foot path/trail protected from the street*	Width of two-way: 8 ft min (typically 10 ft to 14 ft+) Separation from road: For high speed facility, preferred width > 5 ft; If greater separation cannot be provided, a crashworthy barrier should be considered. For lower speed facility, 5 ft min. separation or provide a physical barrier (does not need to be crashworthy) for < 5 ft.
10.3.3 On-Street Bike Lanes	*Streets such as arterials, collectors, and certain neighborhood streets have cross-sections that include bicycle lanes. These cross-sections are in the City of Phoenix Supplement to MAG Uniform Standard Specifications.*	Cross sections in the City of Phoenix Supplement to the MAG Uniform Standard Specifications do not provide typical widths. Provide reference to the document where the typical widths are provided.
	In rural areas, a paved shoulder can serve the function of a bike lane, in which case it should have a minimum of five (5) feet of paving.	Where a bypass lane is provided, the minimum width of a shoulder that may serve as a bike lane can be decreased to 4 ft.
	A bicycle lane can also be delineated with striping between an area for parallel parking and a traffic lane. In this case, the bicycle lane should be at least five (5) feet. Parking should not be allowed in marked bicycle lanes. Raised pavement markers or curbing should not be used to delineate bike lanes.	Add a note that wider bike lanes should be considered in areas of on-street parking with high parking turnover.
10.3.4 Shared-Use Paths/Multi-Use Trails	N/A	GENERAL COMMENT--Update shared-use path recommendations to include guidance from 2012 AASHTO Bike Guide with an emphasis on engineering judgment and flexibility in design.

Section	Existing Text or Heading	Comment
	City of Phoenix Standard Details for shared-use paths/multi-use trails are found in City of Phoenix Supplement to MAG Uniform Standard Specifications, section 429 and details P1130 and P1131	Details show 10 ft cross section with 2 ft shoulders on either side. Consider providing additional information from 2012 AASHTO Bike guide and lowering the minimum to 8 ft based on engineering judgment.
	Minimum design speed of 20 mph.	Design speeds should be determined based on engineering judgment. Typical design speeds are 18 mph for relatively flat trails.
	Width of eight (8) feet where paths can be paired so each can have one-way travel.	Clarify meaning.
	Where needed, fences or railings for paths or bikeways should be 54 inches in height and be flared at the ends.	Add minimum and preferred rail heights. Per 2012 AASHTO Bike Guide, the minimum safety rail height is 42 inches (pg. 5-7), but there may be some locations where a 48 inch rail should be considered to prevent a bicyclist from falling over the railing during a crash (pg. 5-27). Rub rail height of 36 inches high (6 to 8 inches wide) recommended (pg. 5-27)
1 0.4.1 Signs and Markings	*In urban areas, pavement markings will be placed at about 1/4 mile intervals.*	Update spacing recommendations to include engineering judgment, context and character of roadway; ranges between 100' - 1000'. Should provide pavement symbols immediately after intersections. Pavement symbols should be placed in bike lanes to the left of right turn lanes on the intersection approach.
	Where a bike lane continues past the left side of a right-turn-only lane, bike symbols should be placed in that continuation. On leaving an intersection, the lane stripe should start at the crosswalk or where the crosswalk would be. Approaching an intersection the stripe should be dropped about 50 feet before the intersection, unless the elimination of the bike lane will allow for a second approach lane where it will be dropped about 200 feet in advance.	Needs clarification. Update based on 2012 AASHTO Bike guide and MUTCD. Change the word “past” to “on” in the first sentence for clarification. If no separate right turn lane exists, bike lanes should be extended to the intersection radius point, stop line or marked crosswalk (if one exists) on the intersection approach.

City of Phoenix (2011). Traffic Operations Handbook. Chapter 5 – Pedestrians and Bicyclists

Section	Existing Text or Heading	Comment
Bicycle Facilities Background	*Anyone riding a bike with wheels greater than 16 inches is a bicyclist and can ride on the sidewalk or in the street regardless of age, experience, or ability.*	Consider adding emphasis that bicyclists are not required to ride in the street.
Bicycle Facilities Discussion	*Level terrain and local weather provide an ideal environment for bikers. Bicycle operator capabilities vary widely, ranging from young children riding to school, to recreational riders, ranging up to experienced adult riders properly equipped (mirrors, lights, helmets, special clothing) to ride with traffic. Recent estimates indicate nearly one-half million adults own likes in the Valley, with 23 percent riding bikes regularly. Experienced bicyclists prefer to ride in the street with vehicles, and are normally equipped to do so. They ride at higher speeds and for longer distances, and by riding in the street, are accepting responsibility for remaining prepared to react to vehicular traffic. They are not well suited to sidewalks, particularly where numerous driveways and significant numbers of pedestrians exist. The majority of bicyclists are children or recreational bicyclists who typically do not have the experience or equipment to share arterial streets with higher speed motorized traffic. From a safety standpoint, it is advisable that these less experienced riders use sidewalks, local streets or separate bicycle paths instead of arterial streets. To encourage more experienced cyclists to use the street instead of sidewalks, traffic officials should design, install and maintain contiguous bicycle facilities as part of their regular operations.*	Add a discussion about how to encourage more diverse types of people to ride bicycles; in general bicycle facilities should be designed for riders of all ages and abilities. Separated, protected bicycle facilities on higher volume and speed roadways should be provided where feasible. Bicycle boulevards, shared-use paths, buffered bicycle lanes, and cycle tracks are some facility types that can help encourage higher bicycle use by more types of people.
	There are four types of facilities (bikeways) for bikers, each with different designs and characteristics:	Consider opening this up for more flexibility. Shared lane markings, bicycle boulevards, and cycle tracks could be incorporated into this language.
	2. On-street Bicycle Lanes: Bikeways created by designating a portion of street (using pavement markings and signs) for preferential or exclusive use by bicyclists. Per the 2009 MUTCD, bike lane signs are optional.	Add that bike lane signs should be considered and used based on engineering judgment.

Section	Existing Text or Heading	Comment
	Bicycle Routes: Bikeways designated by guide signing only which merely indicates a trailblazed route, which is a shared facility either on-street (shared with cars) or on the sidewalk (shared with pedestrians). Per the 2009 MUTCD, shared lane markings should be used in areas between marked bike lanes to maintain connectivity and	Incomplete statement (word missing at the end of description)? This section is confusing. It says "by guide signs only" then mentions shared lane markings. A street with a bicycle lane can also be considered a bicycle route. This description needs to be rephrased.
	4. Bikeable Streets: Streets which connect with higher level bikeway facilities and have proven to be acceptable for bicycle travel and are designated on a bikeable street map for biker convenience. Bikeable streets are intended only as a guide and are gnerally low volume local and collector streets which connect bike lanes or signed bike paths/routes.	Spelling error. This designation could include bicycle boulevards with pavement markings and signs.
<u>Bicycle Facilities</u> Procedure: Bike Lanes	*Bike lanes are the highest category of bicycle facility, where bicyclists are the preferred, and usually exclusive, user.*	Consider rephrasing. Protected, separated facilities like cycle tracks and buffered bicycle lanes are the highest form of bicycle accommodations for users of all ages and abilities.
	On-street bike lanes may be used where a minimum of 3 feet width (excluding gutter) can be obtained. Where practical, it is desirable to provide 6.0 feet (including gutter).	Typical rideable surface not including the gutter pan should be 5 ft as a desirable minimum. Engineering judgment should be used to allow for 4' in constrained situations.
	This lane will normally be marked with an 8 inch white line with white bicycle stencils placed at two to four per mile per direction.	Replace "two to four per mile per direction" with "based on engineering judgment." A more in depth discussion of symbol spacing should be based on the 2012 AASHTO Bike Guide and MUTCD recommendations.
	Bike lanes are normally signed with the black and white R3-17 BIKE LANE sign two per mile per direction. The R3-17bP BIKE LANE ENDS sign is normally used where the painted lane terminates or where the lane does not reappear for more than a ½ mile. Per the 2009 MUTCD, the use of bike lane signs is optional, but City of Phoenix shall install the signs to provide clear guidance to motorists and bicyclists	Revise to include more details from 2012 AASHTO Bike Guide and MUTCD on spacing and placement.
	Per ARS 28-815, establishment of a bike lane automatically prohibits parking or even stopping in the lane by motorized vehicles. However, to be sensitive to the needs of residents along commuter routes on collector/local streets, consideration may be given to declaring the bike lane in effect for only part of the day and imposing parking restrictions only during commute periods (7:00 a.m. - 6:00 p.m. Monday thru Friday).	There needs to be consideration for the available space for parking and the type of roadways (not limited to the collector/local classifications). Depending on the cross section, speeds, contexts and adjacent land uses, this may be feasible based on engineering judgment.

Section	Existing Text or Heading	Comment
	Experience has shown that even when a 5.5-feet wide bike lane is not available on-street, wide outside lanes (12' - 14') help bikers.	Not consistent. Revise with a consistent minimum width and express emphasis on engineering judgment. A 12-foot lane is not comfortable for bicyclists to share with motorists. A 14 ft lane can typically be shared. Change "bikers" to "bicyclists".
Bicycle Facilities Procedure: Bike Routes	*Designated bike routes are shared facilities. Designated bike routes are signed using the D11-1 BIKE ROUTE guide sign. They are normally placed within 100 to 300 feet beyond a major street intersection and are spaced at intervals of two to four per mile (per direction). Additional guide signs with directional arrows may be helpful when the route changes direction.*	Replace "two to four per mile per direction" with "based on engineering judgment." A more in depth discussion of spacing should be based on the 2012 AASHTO Bike Guide and MUTCD recommendations.
Bicycle Facilities Procedure: Share-use Paths	*Paved path widths of 8 to 10-feet are normally desirable, with one-way routes being 5 to 6-feet wide. Paths greater than 10-feet are acceptable where high volumes or unusual geometries exist, but may have the undesirable effect of encouraging use by motorized traffic.*	Width of two-way: 8 ft min (typically 10 ft to 14 ft+ widths are desirable for new facilities) Separation from road: For high speed facilities, preferred separation width > 5'; If greater separation cannot be provided, use of a crashworthy barrier should be considered. For lower speeds, 5' min. separation or provide a physical barrier (does not need to be crashworthy) for < 5'
	When separate off street "shared-use" paths are designated specifically to allow use by bicyclists, BIKE ROUTE (D11-1) signs should be sparingly used.	Revise based on 2012 AASHTO Bike Guide and MUTCD spacing recommendations.
Bicycle Racks	N/A	GENERAL COMMENT--Include long term parking recommendations such as bike lockers at transit hubs.
	10. Minimum required clearance from the curb face to the bike rack should be two and a half (2.5) feet except for bike racks attached to parking meters.	Revise per best practice. See 2012 AASHTO Bike Guide and APBP Bike Parking Guide, or Boston bicycle parking guidelines from Boston Bikes and in the Complete Streets design guidelines.
	11. Minimum unobstructed pedestrian clearance is required on all city streets. The unobstructed pedestrian clearance should be at least three (3) feet. The unobstructed distance shall be measured from the bike rack in a 360-degree arc around the rack.	Is this for every rack? Need to clarify.
	12. Minimum clearance from a pedestrian curb ramp should be twenty (20) feet from the near side of the crosswalk to the bike rack.	Revise per best practice. See 2012 AASHTO Bike Guide and APBP Bike Parking Guidelines.

Section	Existing Text or Heading	Comment
	13. Minimum clearance from street furniture to the edge of the bike rack envelope should be five (5) feet. Street furniture shall include, but not be limited to, benches, trash receptacles, mailboxes, permanent outdoor seating areas, etc.	
	14. Minimum clearance from bus shelters, fire hydrants, and signal control cabinets should be fifteen (15) feet.	
	15. Minimum clearance from utility vaults, manholes, power poles, permanent planters, etc. shall be five (5) feet.	

City of Phoenix (additions and revisions in 1997 and 2003). *City of Phoenix Zoning Code (Canal Design Guidelines).*

Section	Existing Text or Heading	Comment
All	N/A	GENERAL COMMENT--Consider adding bicyclists, including families bicycling, to the graphics throughout the guidelines.
2.1. Physical Access	*2.1.a.5 Where canal access points exist (cul-de-sac, alleys, streets, and utility rights-of-way), adjacent development should provide landscaping on the development's property. (see Figure 3) (P) +8 *14 2.1.a.6 Public pedestrian bridges across the canal are encouraged to link neighborhoods, commercial, recreational, and public uses. (C) +8*	Revise to indicate that bridges are for use by bicyclists and pedestrians.
2.7. Urban Area/Canalscape Treatment - Design Continuity.	*Rationale (3.7.1-3.7.6): An urban area is an area which generates high levels of activity and has a strong pedestrian emphasis. Urban area land uses along the canal banks would include retail, restaurants, offices, resort/hotel, cultural facilities, and high density residential. The canal right-of-way should take on the characteristics of a highly developed urban paseo. Building design should help accommodate outdoor spaces for the pedestrian adjacent to the canals in an urban area. One of the goals in urban areas is to line the canal with activities that are of interest to the canal bunk users. +8 *14*	Consider discussing bicycle access including path systems, short and long term parking, wayfinding, etc.
2.8. Suburban Area/Canalscape Treatment – Design Continuity.	N/A	GENERAL COMMENT--Consider discussing bicycle access including path systems, short and long term parking, wayfinding, etc.

Perez, J. (2012). Bicycle Minimum Green Times at Signalized Intersections.

Section	Existing Text or Heading	Comment
N/A	N/A	Formulas and methodology comply with the 2012 AASHTO Bike Guide. The statement "*Because a bicyclist rarely travels over 25 mph, I recommend that only the 25 mph lines be used*" is confusing. Bicyclists can and do ride on roads with speed limits over 25 miles per hour; therefore calculations for conditions with motor vehicle speeds over 25 mph are relevant. The memo does not include information on clearance and extension times based on Rolling Bicycle Crossing Time or on bicycle detection. These are the two remaining signal considerations (in addition to bicycle minimum green time using standing bicycle crossing time) to provide accommodation for bicyclists.

Perez, J. (2012). Bicycle Acceleration at Signalized Intersections.

Section	Existing Text or Heading	Comment
N/A	N/A	GENERAL COMMENT--Update to reference 2012 AASHTO Bike Guide.

Perez, J. (2013). Bicycle Detection at Traffic Signals, Perez, J. (2011). Bicycle Detection at Traffic Signals.

Section	Existing Text or Heading	Comment
N/A	N/A	GENERAL COMMENT--Update to reference information on bicycle detection methods from the 2012 AASHTO Bike Guide.
Introduction; last sentence	*Other technologies are in-ground pucks, and the standard push button.*	Consider adding flexibility to explore other technologies such as magnometers and radar detection. As technology progresses and innovations are being developed, consideration should be given to piloting and testing new detection methods for all modes of transportation.

City of Phoenix (2007). Traffic Barricade Manual.

Section	Existing Text or Heading	Comment
N/A	N/A	GENERAL COMMENT--Similar to the chapter and section, "Accommodating Pedestrians and Worker Safety" and "Pedestrian safety and service considerations", consider adding to or creating a similar chapter or section on accommodating bicycles and bicycle safety and service considerations.
N/A	N/A	GENERAL COMMENT--Include temporary signing and striping recommendations for bicycles including "SHARE THE ROAD" and "MAY USE FULL LANE" MUTCD Signs.

Appendix E

Prioritization Methodology

Prioritization Methodology

The Phoenix Bicycle Master Plan includes a prioritized list of over 375 projects. The prioritization methodology used for the Plan is based on the *10-Step Method for Prioritizing Pedestrian and Bicycle Improvement Locations Along Existing Roads* developed through Project 07-17 of the National Cooperative Highway Research Program (NCHRP) of the Transportation Research Board (TRB). The City of Phoenix served as pilot agency for the *10-Step Method*, which is based on findings from a national survey, literature review, and agency interviews.

The adopted methodology was designed to reflect the Vision and Goals established for the Plan and was accomplished in three iterations (Figure 1):

- Iteration 1 Develop map of relative demand for bicycling across the City and use the map as a basis for identifying bicycle corridors.
- Iteration 2: Prioritize bicycle corridors based on demand and connectivity; separate corridors into three tiers.
- Iteration 3: Identify specific improvement projects and then prioritize these improvements along the bicycle corridors, focusing on the highest tier corridors.

Figure 1: Iterative Approach to Using the Bicycle Corridor/Project Prioritization Methodology

Additional details regarding each iteration are provided below, including selected *factors* and *variables*. Factors are categories used in the prioritization process to express community/agency values and group variables with similar characteristics. Variables are characteristics of roadways, households, neighborhood areas, and other features that can be measured.

Iteration 1 – Demand Heat Map

For Iteration 1, a *heat map* was developed using a Geographic Information System (GIS) to show relative levels of existing and potential bicycle demand across the City (See Appendix A for map). Members of the Technical Advisory Committee then used this map to identify corridors connecting locations with the highest existing and potential demand. This process supports the Plan vision, which calls for "a well-connected infrastructure network [that] will link people and places" within 20 years.

The heat map was created using one factor, Demand. The Demand factor included variables affecting existing and potential demand, including locations, such as schools and parks, that have the potential to attract bicycle riders if safe and comfortable bicycling conditions are provided. The Demand factor also included input from members of the public collected through an online interactive map, or *Wikimap*, regarding where they currently ride or would like to ride. Wikimap input was included under Demand in Iteration 1, because locations where members of the public said they rode or would like to ride were regarded as indicative of demand.

A complete list of factors, variables, and data sources used in Iteration 1 is provided in Table 1.

Table 1. Iteration 1 Factors and Variables

Factor	Variable	Source
Demand	Schools	City of Phoenix
	Bus Stops	City of Phoenix
	City Facilities (e.g. libraries, municipal offices, etc.)	City of Phoenix
	Community Centers	City of Phoenix
	Light Rail Stops	Valley Metro
	Park and Rides	Valley Metro
	Parks	City of Phoenix
	Existing Bikeways	City of Phoenix
	Wikimap Routes	Wikimap
	Wikimap Destinations	Wikimap
	% of Households in Poverty	U.S. Census Bureau
	% of Population under 18	U.S. Census Bureau
	% Households with No Vehicle	U.S. Census Bureau
	Population Density	City of Phoenix

Iteration 2 - Corridor Prioritization

Based on the heat map created in Iteration I, the Technical Advisory Committee and Ad Hoc Task Force identified 37 corridors connecting locations with the highest existing and potential bicycle demand in the City. In Iteration 2, these corridors were ranked and divided into three tiers—Tier I, Tier II, and Tier III. A table showing the rank and tier of each corridor is provided in Appendix B.

The corridors were ranked using three factors, Stakeholder Input, Connectivity, and Demand.

- **Stakeholder Input** included data collected through the online Wikimap and input from the Ad Hoc Task force and Technical Advisory Committee.
- **Connectivity** included variables meant to capture the degree to which improvements along a given corridor might enhance the connectivity of Phoenix's bicycle network by connecting to existing bicycle facilities or other identified corridors.
- **Demand** included variables representing existing or potential bicycle demand along each corridor, including all of the Demand variables used in Iteration 1 (except the Wikimap variables which were incorporated as Stakeholder Input) and one additional variable, Bicycle Trip Origin and Destination Zip Codes, from the Maricopa County Trip Reduction Survey. For Iteration 2, locations with the potential to attract bicycle demand (Attractors) were consolidated into two classes, Tier I and Tier II. Tier 1 Attractors were counted for each corridor if they were within 1 mile of the corridor. Tier 2 Attractors were counted for each corridor if they were within ¼ mile of the corridor or, in the case of bus stops, on the corridor itself.

The final corridor ranking was influenced by the weights assigned to each factor by the Ad Hoc Task Force. Weights are numbers used to indicate the relative importance of factors. A complete list of factors, factor weights, variables, and data sources used in Iteration 2 is provided in Table 2.

Table 2. Iteration 2 Factors and Variables

Factor	Factor Weight	Variable	Source
Connectivity	10	Number of times corridor intersects other corridors	N/A
		Number times corridor intersects bicycle facilities	N/A
		Presence of existing bicycle facilities	City of Phoenix
Demand	7	Tier 1 attractors (light rail stops, colleges/universities) within 1 mile of the corridor	Valley Metro Google Maps
		Tier II attractors (schools, city facilities, community centers, park and rides, parks) within ¼ mile of the corridor. Also includes bus stops directly on the corridor	City of Phoenix Valley Metro
		Land Use (commercial and high-density housing)	City of Phoenix
		Population Density	City of Phoenix
		% Households in Poverty	U.S. Census Bureau
		% Households with No Vehicle	U.S. Census Bureau
		% of Population under 18	U.S. Census Bureau
		Bicycle Trip Origin and Destination Zip Codes from the Maricopa County Trip Reduction Survey	MAG
Stakeholder Input	3	Wikimap Destinations (included public meeting input and transit center surveys)	Wikimap
		Wikimap Routes (included public meeting input)	Wikimap
		Ad Hoc Task Force input	Ad Hoc Task Force
		Technical Advisory Committee input	TAC

Iteration 3 - Project Prioritization

Discrete projects to eliminate bicycle network gaps and barriers were identified along each of the identified corridors. Projects were identified by driving each corridor or using other data to establish the desired bikeway facilities and connections along the corridors. In Iteration 3, these projects were ranked within each of the corridor tiers.

The project rankings were developed based on six factors—Connectivity, Safety, Existing Conditions, Constraints, Demand, and Equity.

- **Connectivity** included variables to represent whether the proposed projects might address an identified bicycle network barrier or connect to an existing bikeway.
- **Safety** included bicycle crashes within 300 feet of the proposed project as a way of assessing whether the project location might have the potential to improve safety. At the request of the Ad Hoc Task Force, this factor also included the percent of population under 18 to include the importance of children.
- **Existing Conditions** included variables to represent the posted speed limit and street classification of the road where each of the proposed projects is located.
- **Constraints** included variables for the order of magnitude cost for each project and whether or not it could be done within available right-of-way.
- **Demand** included variables meant to represent existing or potential bicycle demand near each project location. As in Iteration 2, attractors were classified in two tiers. Each tier was handled the same way as in Iteration 2, except that bike share stations were added as a Tier II location (these locations were not

available during Iteration 1), and schools were reclassified as Tier 1 based on a request from the Ad Hoc Task Force.

- **Equity** included variables to represent degree to which a proposed project might benefit lower income communities. These variables were included under the Demand factor in Iteration 2, where they were intended to represent potential bicycle demand along a corridor.

After consideration by the Ad Hoc Task Force, the factors used in Iteration 3 were not weighted, meaning each factor had equal influence over the final ranking. A complete list of the factors, variables, and data sources used in Iteration 3 is provided in Table 3.

Table 3. Iteration 3 Factors and Variables

Factor	Variable	Source
Connectivity	Bicycling Barriers	Wikimap
	Existing Bikeways	City of Phoenix
Safety	Bicycle Crashes	MAG
	% of Population under 18	U.S. Census Bureau
Existing Conditions	Posted Speed Limit	City of Phoenix
	Street Classification	City of Phoenix
Constraints	Order of Magnitude Cost	Lee Engineering
	Available Rights of Way	City of Phoenix
Demand	Tier 1 Attractors (light rail stops, colleges/universities, schools)	Valley Metro Google Maps
	Tier II Attractors (bus stops, bikeshare stations, city facilities, community centers, park-and-rides, parks)	City of Phoenix Valley Metro
	Population Density	City of Phoenix
	Land Use (commercial and high-density housing)	Maricopa County
Equity	% Households in Poverty	U.S. Census Bureau
	% Households with No Vehicle	U.S. Census Bureau

Conclusion

The result of Iteration 3 was three lists of ranked projects organized by tier (I, II, and III). The Tier 1 list will be used to identify and prioritize projects for inclusion in the Capital Improvement Program (CIP). The prioritized list of Tier I projects is provided in Appendix G. These projects will also be designated in the Phoenix Bicycle Master Plan as part of the initial phase of implementation. Projects associated with Tier II and Tier III corridors will be addressed in phases 2 and 3 of Plan implementation, although projects may be implemented earlier based on opportunity or other circumstances. The prioritized roster of Tier II projects is provided in Appendix H. The prioritized roster of Tier III projects is provided in Appendix I.

Appendix F

Planning Level Unit Cost Estimates

PLANNING LEVEL COST ESTIMATES

6-lane Road Diet (3-1-2 to 2-1-2 with bike lanes)/mile	$200,000/mile (rounded) = $184,800 + $15,000 Layout cost
4-lane Road Diet (2-2 to 2-1-2 with bike lanes)/mile	$121,000/mile (rounded) = $110,880 + $10,000 Layout costs
Bike Lanes (retrofit w/ obliteration and restripe)/mile	$10,000 per mile + 70 cents per liner foot (water blasting), $7 per linear foot (microseal)
Lane Line Obliteration (microseal)	$7/ft
Lane Line Obliteration (water blasting)	$0.70/ft
New Bike Lanes (no existing pavement markings)/mile	$10,000
Extend Bike lanes to intersection at signal & reduce one add/drop lane	$15,000
Extend bike lanes to intersection at signal & reduce both add/drop lanes	$10,000
10' Multi-use path ($10 per sq ft at 10 ft wide)/mile	$528,000
PHB / Bike HAWK	$85,000
Convert PHB (HAWK) to Bike HAWK	$5,000
Bicycle Detection at traffic signal (2 approaches)	$5,000
RRFB at refuge island (4 RRFB units)	$22,000
RRFB w/o refuge island (2 RRFB units)	$12,000
Center Refuge Island for Bicyclists	$50,000
Crosswalk with TRAIL CROSSING signs	$5,000
Ped / Bike Bridge over I-17 at Grand Canal	$8,000,000
Extend bike lane lines to signalized intersection	$500
Shoulder paving for bike lanes ($5 per Sq Ft, and 4 ft min width) (per mile)	$105,600
Reconstruct median (per mile)	$350,000
Green Bike Lanes with SLMs (per mile)	$120,000
SLM & BIKE ROUTE signs (20 signs per mile)	$5,500
Wayfinding signs at crossings	$1,000

Appendix G

Tier I Corridor Projects

City of Phoenix Comprehensive Bicycle Master Plan
Tier I Corridor Projects

TIER I	*SHORT TERM (5 YEARS)*
82.88	TOTAL CORRIDOR MILES (NOT INCLUDING WASHES/CANALS)
39%	OF EXISTING TOTAL CORRIDOR MILES THAT DO NOT HAVE BIKE FACILITIES
31.96	PROJECT MILES (TO COMPLETE BIKE FACILITY GAPS)
29	SEGMENT PROJECTS (INCLUDING INTERSECTIONS WITHIN OR AT SEGMENT TERMINUS)
50	INTERSECTION IMPROVEMENT PROJECTS (WHERE BIKE LANES EXIST)
$4,031,050	DOLLARS TO MAKE THE CONNECTIONS (PLANNING LEVEL IN-HOUSE COST ESTIMATE)
$126,114	AVERAGE DOLLARS PER MILE
$4,031,050	**SUBTOTAL**

1. 3rd Street from Steele Indian School Park (Indian School Road) to Buckeye Road

Segments

Road 1	Road 2	Existing	Proposed	Comments	Cost Estimate
Steele Indian School Park	Roosevelt St	None	Bike Lanes	Road Diet & add Bicycle Detection at Indian School Rd	$320,000
Roosevelt St	Fillmore St	None	Bike Facilities	Road Diet	$50,000
Fillmore St	Washington St	None	Bike Facilities	Road Diet	$100,000
Washington St	Lincoln St	None	Bike Facilities	Road Diet	$100,000
Lincoln St	Buckeye Rd	None	Shared Lane Markings		$2,000

Signalized Intersections with Existing Bike Lanes

Intersection	Existing	Proposed	Cost Estimate
None	-	-	-

2. 24th Street from Van Buren Street to Baseline Road

Segments

Road 1	Road 2	Existing	Proposed	Comments	Cost Estimate
Van Buren St	Sky Harbor Cir	None	Bike Lanes	Road Diet north of Madison / Median narrowing south of Madison / RR Crossing improvement	$338,000
Sky Harbor Cir	I -10	None	Bike Lanes	Reconstruct or remove a portion of median / Crosses ADOT ROW	$350,000
I-10	Magnolia St	None	Bike Lanes	Remove median / Crosses ADOT ROW	$112,000
Magnolia St	Baseline Rd	Bike Lanes	None		$0

Signalized Intersections with Existing Bike Lanes

Intersection	Existing	Proposed	Cost Estimate
Broadway Rd	No Bike Lanes for SB	Extend Bike Lanes to intersection	$500
Roeser Rd	Bike Lanes	Extend Bike Lanes to intersection	$500
Southern Ave	Bike Lanes	Extend Bike Lanes to intersection	$500
Fremont Rd	No Bike Lanes NB	Extend NB Bike Lanes to intersection and add dashed line markings for SB right turn	$500
Baseline Rd	No Bike Lanes	Extend Bike Lanes to intersection	$500

3. Central Ave from Mountain View Road to South Mountain Park

Segments

Road 1	Road 2	Existing	Proposed	Comments	Cost Estimate
Mountain View Rd	Ruth Ave	None	Bike Route & SLMs		$5,000
Ruth Ave	Bethany Home Rd	None	Bike Route & SLMs		$15,000
Bethany Home Rd	Camelback Rd	Bike Lanes	None		$0
Camelback Rd	Buchanan St	None	Shared Lane Markings and Green Bike Lane	Supplemental signs - Includes NB 1st Ave from Portland to Buchanan St	$710,400
Buchanan St	Lynne Ln	Bike Lanes	None	Includes NB 1st Ave from Buchanan St to Hadley St. Crosses I-17 (ADOT ROW)	$0
Lynne Ln	Western Canal	None	Bike Lanes	Road Diet (2-1-2 to 2-1-1)	$123,000
Western Canal	Mineral Rd	Bike Lanes	None		$0
Mineral Rd	Phoenix South Mountain Park	None	Shared Lane Markings, Wayfinding Signs, Paved Trail	Park access via Mineral Rd, 2nd Pl, Summerside Rd, 5th St, Mineral Rd to 7th St	$170,000

Signalized Intersections with Existing Bike Lanes

Intersection	Existing	Proposed	Cost Estimate
Lincoln St	Bike Lane	None	$0
Buckeye Rd	No bike lane	Extend Bike Lanes to intersection	$500
Mohave St	No bike lane	Extend Bike Lanes to intersection	$500
I-17	No bike lane	Extend Bike Lanes to intersection (ADOT Signal / ROW)	$500
Broadway Rd	No bike lane	Extend Bike Lanes to intersection	$500
Roeser Rd	No bike lane	Extend Bike Lanes to intersection	$500
Southern Ave	No bike lane	Extend Bike Lanes to intersection	$500
Baseline Rd	No bike lane	Extend Bike Lanes to intersection	$500
South Mountain Ave	No bike lane	Extend Bike Lanes to intersection	$500
Dobbins Rd	No bike lane	Extend Bike Lanes to intersection	$500

4. 20th Street from Grand Canal Trail to Glendale Avenue

Segments

Road 1	Road 2	Existing	Proposed	Comments	Cost Estimate
Grand Canal Trail	Mitchell Dr	None	Bike Lanes	Accommodate on-street parking	$3,000
Mitchell Dr	Bethany Home Rd	Bike Lanes	None		$0
Bethany Home Rd	Glendale Ave	None	Shared Lane Markings / Bike Lanes	Improve diverter at Bethany Home Rd. On-street route with SLMs from Bethany Home to Claremont. Paved trail from Claremont to Maryland. Use Maryland to cross Arizona Canal. Signed bike route with SLMs for 20th St / Maryland to Glendale.	$70,000

Signalized Intersections with Existing Bike Lanes

Intersection	Existing	Proposed	Cost Estimate
Indian School	No Bike Lanes	Extend Bike Lanes to intersection by eliminating one add/drop lane at signal & add Bicycle Detection	$20,000
Campbell Ave	No Bike Lanes	Extend Bike Lanes to intersection by eliminating both add/drop lanes at signal	$10,000
Highland Ave	No Bike Lanes NB	Extend NB Bike Lane to intersection and add dashed line for SB right turn lane	$500
Camelback Rd	No Bike Lanes	Extend SB Bike Lane to intersection by eliminating one add/drop lane at signal and provide through NB bike lane	$15,000
Missouri Ave	No Bike Lanes	Extend SB Bike Lane to intersection and provide one NB right turn lane with combined bike lane	$1,000

5. Osborn Road from I-17 to 40th Street

Segments

Road 1	Road 2	Existing	Proposed	Comments	Cost Estimate
I-17	19th Ave	Bike Lanes	Detour to/from proposed Grand Canal Overpass over I-17 (Grand Canal project) using I-17 frontage	I-17 frontage road needs shared use path (sidewalk) and/or bike lane improvements. Provide 8 ft sidewalk along east side of I-17 frontage road	$62,000
19th Ave	20th St	None	Bike Lanes	Road Diet (19th Ave to 7th Ave & 7th St to 20th St 2-2 to 1-1-1, 7th Ave to 7th St 2-1-2 to 2-1-1) & add Bicycle Detecton at Central Ave	$470,000
20th St	36th St	Bike Lanes	None		$0
36th St	40th St	None	Bike Route with SLMs		$6,000

Signalized Intersections with Existing Bike Lanes

Intersection	Existing	Proposed	Cost Estimate
24th St	No Bike Lanes	Extend Bike Lanes to intersection by eliminating one add/drop lane at signal	$15,000
28th St	No Bike Lanes	Extend Bike Lanes to intersection	$500
32nd St	No Bike Lanes	Extend Bike Lanes to intersection by eliminating one add/drop lane at signal & add Bicycle Detection	$20,000
36th St	No Bike Lanes	Extend Bike Lanes to intersection & add EB Bicycle Detection	$3,000

6. 12th Street from Cave Creek Road to Washington Street

Segments

Road 1	Road 2	Existing	Proposed	Comments	Cost Estimate
Cave Creek Rd	12th St	None	Bike Lanes	Connect 12th St to Cave Creek via Mountain View Rd	$1,000
Mountain View Rd	Sunnyslope Ln	None	Bike Lanes		$3,000
Sunnyslope Ln	Camelback Rd	Bike Lanes	None		$0
Camelback Rd	Indian School Rd	None	Bike Lanes	Road Diet (2-1-2 to 1-1-2) Camelback to Campbell and 2-2- to 111 from Campbell to Indian School Rd & Wayfinding to Grand Canal trail	$140,000
Indian School Rd	Osborn Road	Bike Lanes	None		$0
Osborn Road	Thomas Rd	None	Bike Lanes & Signed Route with SLMs	Sidewalk improvements on Thomas to Bike HAWK at Thomas/Evergreen. Signed bike route with SLMs on Evergreen St and Randolph Rd to bike lanes on Osborn Rd	$135,600
Thomas Rd	Moreland St	Bike Lanes	None		$0
Moreland St	Monroe	None	Bike Lanes	Detour utilizing 11th St between Moreland and Monroe (Recently completed project)	$0
Monroe	Washington Street	None	Bike Lanes	Recently completed project	$0

6. 12th Street from Cave Creek Road to Washington Street

Signalized Intersections with Existing Bike Lanes

Intersection	Existing	Proposed	Cost Estimate
Dunlap Ave	No Bike Lanes	Extend Bike Lanes to intersection by eliminating one add/drop lane at signal	$15,000
Butler Dr	No Bike Lanes	Extend Bike Lanes to intersection by eliminating both add/drop lanes at signal	$10,000
Northern Ave	No Bike Lanes	Extend Bike Lanes to intersection by eliminating one add/drop lane & add Bicycle Detection, Wayfinding to Arizona Canal	$21,000
Glendale Ave	No Bike Lanes	Extend Bike Lanes to intersection by eliminating one add/drop lane at signal, Wayfinding to Arizona Canal	$16,000
Maryland Ave	No Bike Lanes	Extend Bike Lanes to intersection by eliminating both add/drop lanes at signal	$10,000
Bethany Home Rd	No Bike Lanes	Extend Bike Lanes to intersection by eliminating one add/drop lane at signal	$15,000
Missouri Ave	No Bike Lanes	Extend Bike Lanes to intersection by eliminating both add/drop lanes at signal	$10,000
McDowell Rd	No Bike Lanes	Extend SB Bike Lane to intersection and provide NB right turn lane with combined Bike Lane	$500
Washington St	Bike Lanes	Add Bicycle Detection	$5,000

7. 15th Ave from Dunlap Avenue to Jefferson Street

Segments

Road 1	Road 2	Existing	Proposed	Comments	Cost Estimate
Dunlap Ave	Lawrence Ln	Bike Lanes	None		$0
Lawrence Ln	Butler Dr	Shared Lane Markings & Green Bike Lane	None	Recently installed	$0
Butler Dr	Van Buren St	Bike Lanes	None		$0
Van Buren St	Jefferson St	None	Bike Lanes	Road Diet: Convert from 2-2 into 1-1-1	$36,300

7. 15th Ave from Dunlap Avenue to Jefferson Street

Signalized Intersections with Existing Bike Lanes

Intersection	Existing	Proposed	Cost Estimate
Dunlap Ave	No Bike Lanes	Extend SB Bike Lane to signal & provide NB Bicycle Detection and trail connection	$8,500
Northern Ave	No Bike Lanes	Extend Bike Lanes to intersection & add Bicycle Detection	$5,500
Glendale Ave	No Bike Lanes	Extend Bike Lanes to intersection & add Bicycle Detection	$5,500
Maryland Ave	No Bike Lanes	Extend Bike Lanes to intersection	$500
Bethany Home Rd	No Bike Lanes	Extend Bike Lanes to intersection by eliminating one add/drop lane at signal & add Bicycle Detection	$20,000
Missouri Ave	No Bike Lanes	Extend Bike Lanes to intersection by eliminating both add/drop lanes at signal	$10,000
Camelback Rd	No Bike Lanes	Extend Bike Lanes to intersection by eliminating one add/drop lane at signal & add Bicycle Detection	$20,000
Campbell Ave	No Bike Lanes	Extend Bike Lanes to intersection by eliminating both add/drop lanes at signal	$10,000
Indian School Rd	No Bike Lanes	Extend Bike Lanes to intersection by eliminating one add/drop lane at signal & add Bicycle Detection	$20,000
Osborn Rd	No Bike Lanes	Extend Bike Lanes to intersection by eliminating both add/drop lanes at signal	$10,000
Thomas Rd	No Bike Lanes	Extend Bike Lanes to intersection by eliminating one add/drop lane at signal & add Bicycle Detection	$20,000
Encanto Blvd	No Bike Lanes	Extend Bike Lanes to intersection by eliminating both add/drop lanes at signal	$10,000
McDowell Rd	No Bike Lanes	Extend Bike Lanes to intersection by eliminating one add/drop lane at signal & add Bicycle Detection	$20,000
Roosevelt St	No Bike Lanes	Extend Bike Lanes to intersection by eliminating both add/drop lanes at signal	$10,000

8a. Washington Street from 27th Avenue to 56th Street

Segments

Road 1	Road 2	Existing	Proposed	Comments	Cost Estimate
27th Ave	19th Ave	None	Bike Lane	Adams St alignment, crosses I-17, Road Diet (4 to 3 lanes)	$121,000
19th Ave	7th Ave	Bike Lane	None	Adams St alignment west of 15th Avenue	$0
7th Ave	7th St	None	Bike Lane	Road Diet / Green Line &Shared Lane Markings from 1st St to 1st Ave; bike box at 7th St intersection	$110,000
7th St	56th St	Bike Lane	None		$0

Signalized Intersections with Existing Bike Lanes

Intersection	Existing	Proposed	Cost Estimate
44th Street	No bike lanes	Extend bike lanes to intersection	$500

8b. Jefferson Street from 27th Avenue to 26th Street

Segments

Road 1	Road 2	Existing	Proposed	Comments	Cost Estimate
27th Ave	22nd Ave	Bike Route	Bike Lane	Accommodate on-street parking; Road Diet across I-17 (remove 1 lane for 900 feet)	$6,000
22nd Ave	20th Ave	Bike Lane	None		$0
20th Ave	19th Ave	None	Bike Lane	Reconstruction or Road Diet	$50,000
19th Ave	18th Ave	None	Bike Lane	Stripe Bike Lane	$11,000
18th Ave	7th Ave	Bike Lane	None		$0
7th Ave	5th St	None	Bike Lane with door zone buffer at on-street parking areas. Green Line with SLM's from 1st Ave to 1st St	Road Diet	$45,000
5th St	26th St	Bike Lane	None		$0

Signalized Intersections with Existing Bike Lanes

Intersection	Existing	Proposed	Cost Estimate
17th Ave	No Bike Lane	Extend Bike Lane to intersection	$250
16th Ave	No Bike Lane	Extend Bike Lane to intersection	$250
15th Ave	No Bike Lane	Extend Bike Lane to intersection	$250

9. ReInventPHX Gateway Bicycle Infrastructure and Intersection Projects

Segments

Roadway	End Point 1	End Point 2	Proposed	Comments	Cost Estimate
24th St	Van Buren St	Washington St	Cycle Track		
32nd St	SR 202	Washington St	Bike Lanes		
38th St	Van Buren St	Washington St	Bike Lanes	38th St in this area does not currently exist	
40th St	SR 202	Washington St	Bike Lanes		
44th St	SR 202	Washington St	Bike Lanes		
Van Buren St	I 10	SR 143	Bike Lanes		

Signalized Intersections with Existing Bike Lanes

Intersection	Existing	Proposed	Cost Estimate
None	-	-	-

10. ReInventPHX Eastlake Bicycle Infrastructure and Intersection Projects

Segments

Roadway	End Point 1	End Point 2	Proposed	Comments	Cost Estimate
3rd St / 5th St	I 10	Jefferson St	Bike Lanes		
11th St	Moreland St	Van Buren St	Bike Lanes	Completed with recent project	$0
12th St	Van Buren St	Jefferson St	Bike Lanes		
16th St	I 10	Jacob St	Bike Lanes or Cycle Track	2-1-2 with bike lanes	
20th St	Roosevelt St	Van Buren St	Bike Lanes		
Van Buren St	3rd St	I 10	Bike Lanes	1-1 with bike lanes and on-street parking on both sides	

Bike Priority - Intersection Improvements

Road 1	Road 2	Proposed	Cost Estimate
7th St	Roosevelt St		
11th St	Van Buren St		
16th St	Roosevelt St	WB Bike Box; green lane to indicate the restart of bike lanes on the NB and SB far sides of intersection; EB SLMs; SB green dashed bike lane striping at right turn lane conflict area	
16th St	McKinley St		
16th St	Van Buren St	EB and WB Bike Boxes; green lane to indicate the restart of the bike lanes on the NB and SB far sides of intersection	
20th St	Roosevelt St		
20th St	Van Buren St		

Appendix H

Tier II Corridor Projects

City of Phoenix Comprehensive Bicycle Master Plan
Tier II Corridor Projects

TIER II	*MEDIUM TERM*
76.84	TOTAL CORRIDOR MILES (NOT INCLUDING WASHES/CANALS)
43%	OF EXISTING TOTAL CORRIDOR MILES THAT DO NOT HAVE BIKE FACILITIES
33.42	PROJECT MILES (TO COMPLETE BIKE FACILITY GAPS)
29	SEGMENT PROJECTS (INCLUDING INTERSECTIONS WITHIN OR AT SEGMENT TERMINUS)
69	INTERSECTION IMPROVEMENT PROJECTS (WHERE BIKE LANES EXIST)
$4,692,500	DOLLARS TO MAKE THE CONNECTIONS (PLANNING LEVEL IN-HOUSE COST ESTIMATE)
$140,413	AVERAGE DOLLARS PER MILE
21.43	MILES OF WASHES/CANALS
39	IMPROVEMENT PROJECTS AT WASH/CANAL CROSSINGS
$9,315,250	DOLLARS TO OVERCOME BARRIERS* (PLANNING LEVEL IN-HOUSE COST ESTIMATE)
	**Includes $8,000,000 estimate to construct bridge over I-17 at the Grand Canal*
$9,320,000	DOLLARS TO PAVE GRAND CANAL TRAIL
$23,327,750	**SUBTOTAL**

11. Maryland Ave from 43th Avenue to 22nd Street

Segments

Road 1	Road 2	Existing	Proposed	Comments	Cost Estimate
43rd Ave	I 17	None	Bike Lanes	Street retrofit, accommodate on-street parking / add Bcycle Detection at 47th Ave, 35th Ave & 27th Ave	$105,000
I 17	23rd Ave	None	Bike Lanes	Accommodate on-street parking	$2,300
23rd Ave	21st Ave	None	Multi-use Path	Provide paved concrete path through Washington Park	$164,000
21st Ave	18th St / SR 51	Bike Lanes	None		$0
18th Pl / SR 51	20th St	Bike Lanes	None		$0
20th St	22nd St	None	Signed Route with SLMs		$1,100

Signalized Intersections with Existing Bike Lanes

Intersection	Existing	Proposed	Cost Estimate
I 17	Pedestrian/Bike Bridge	Wayfinding Signs	$1,000
19th Ave	No Bike Lanes	Extend Bike Lanes to intersection & add Bicycle Detection	$5,500
15th Ave	No Bike Lanes	Extend Bike Lanes to intersection	$500
7th Ave	No Bike Lanes	Extend Bike Lanes to intersection & add Bicycle Detection	$5,500
Central Ave	No Bike Lanes	Extend Bike Lanes to intersection & add Bicycle Detection	$5,500
7th St	No Bike Lanes	Extend Bike Lanes to intersection & add Bicycle Detection	$5,500
12th St	No Bike Lanes	Extend Bike Lanes to intersection	$500
16th St	No Bike Lanes	Extend Bike Lanes to intersection & add Bicycle Detection	$5,500
SR 51	Underpass	Wayfinding Signs	$1,000

12a. 3rd Avenue from Arizona Canal to Jefferson Street

Segments

Road 1	Road 2	Existing	Proposed	Comments	Cost Estimate
Arizona Canal	Roma Ave	None	Shared Lane Markings / Paved Trail	Detour at Missouri using 4th Ave and Marshall Ave. Bike HAWKs at Northern Ave, Glendale Ave, and Bethany Home Rd.	$350,000
Roma Ave	Thomas Rd	Bike Lane	Sidewalk Trail Along North Side of Thomas Road	SB Detour to 5th Avenue via Thomas Rd sidewalk	$27,500
Thomas Rd	Van Buren St	Bike Lane	None	One-Way NB	$0
Van Buren St	Jefferson St	None	Bike Lanes	One-Way NB, accommodate on-street parking/loading. Remove one travel lane or parking lane	$36,300

Signalized Intersections with Existing Bike Lanes

Intersection	Existing	Proposed	Cost Estimate
Indian School Rd	No Bike Lane	Extend Bike Lanes to intersection & add Bicycle Detection	$5,500
Clarendon Ave	No Bike Lane	Extend Bike Lanes to intersection	$500
Osborn Rd	No Bike Lane	Eliminate N/S right turn lanes and add bike lanes	$4,000
Earll Dr	No Bike Lane	Extend Bike Lanes to intersection	$500
Thomas Rd	No Bike Lane SB	Extend Bike Lane to intersection & add NB Bicycle Detection	$2,750
Van Buren St	No Bike Lane	Extend Bike Lanes to intersection & add Bicycle Detection	$3,000

12b. 5th Avenue from Thomas Road to Washington Street

Segments

Road 1	Road 2	Existing	Proposed	Comments	Cost Estimate
Thomas Rd	Van Buren St	Bike Lane	None	One-Way SB	$0
Van Buren St	Washington St	None	Bike Lanes	One-Way SB. Road Diet to remove 1 travel lane or parking lane	$27,000

Signalized Intersections with Existing Bike Lanes

Intersection	Existing	Proposed	Cost Estimate
McDowell Rd	No Bike Lane	Extend bike lane to intersection / Eliminate right turn only lane / add SB Bicycle Detection	$4,500
I-10	No Bike Lane	Shared right turn lane and bike lane	$1,000
Roosevelt St	No Bike Lane	Convert SB right turn lane into bike lane	$1,000
Van Buren St	No Bike Lane	Extend Bike Lane to intersection / Shift SB travel lanes /add SB Bicycle Detection	$7,500

13. Encanto Boulevard / Oak Street from 19th Avenue to 52nd Street

Segments

Road 1	Road 2	Existing	Proposed	Comments	Cost Estimate
19th Ave	17th Ave	None	Bike Lanes	Encanto Blvd Road Diet & add Bicycle Detection at 19th Ave	$51,400
17th Ave	7th Ave	Bike Lanes	None	Encanto Blvd	$0
7th Ave	Central Ave	None	Shared Lane Markings	Encanto Blvd; Improve crossing through 1st Ave diverter & add Bicycle Detecton at Central Ave	$13,000
Central Ave	3rd St	Discontinuous	Shared Lane Markings via Hoover Ave	RRFB at 3rd St & Oak	$14,000
3rd St	16th St	None	Shared Lane Markings	Modify 7th St HAWK to Bike HAWK	$12,000
16th St	24th St	Bike Route	Bike Lanes	Accommodate on-street parking & Wayfinding signs at SR 51 bridge & add Bicycle Detection at 16th St and 24th St	$58,000
24th St	32nd St	Bike Lanes	None		$0
32nd St	47th Pl / Cross-cut Canal	Bike Route	Bike Lanes	Accommodate on-street parking & add Bicycle Detection at 32nd St, 36th St, 40th & 44th St	$113,000
48th St	52nd St	None	Bike Lanes		$23,000
52nd St	56th St	None	Bike Lanes	Paved Shoulders & add bicycle detection at 52nd St	$71,000

Signalized Intersections with Existing Bike Lanes

Intersection	Existing	Proposed	Cost Estimate
15th Ave	No Bike Lanes	Extend bike lanes to intersections & add Bicycle Detection	$5,500

14. 7th Avenue from Coral Gables Drive to Deer Valley Road

Segments

Road 1	Road 2	Existing	Proposed	Comments	Cost Estimate
Coral Gables Dr	Melinda Ln	Bike Lanes	None		$0
Melinda Ln	Deer Valley Rd	None	Bike Lanes	Ad Bicycle Detection at Deer Valley Dr	$6,400

Signalized Intersections with Existing Bike Lanes

Intersection	Existing	Proposed	Cost Estimate
Greenway Pkwy	No Bike Lanes	Extend Bike Lanes to intersection / Road Diet to remove SB right turn lane & add Bicycle Detection	$7,000
Bell Rd	No Bike Lanes	Extend Bike Lanes to intersection & add Bicycle Detection	$5,500
Grovers Ave	No Bike Lanes	Extend Bike Lanes to intersection	$500
Union Hills Dr	No Bike Lanes	Extend Bike Lanes to intersection	$500
Beardsley Rd (SR 101)	No Bike Lanes	Extend Bike Lanes to intersection & add Bicycle Detection	$10,500
Rose Garden Ln	No Bike Lanes	Extend Bike Lanes to intersection	$500

15. Grand Canal from 75th Avenue to East City Limits (SR 202)

Intersections

Cross Street	Existing Crossing	Proposed	Comments	Cost Estimate
Grand Canal Trail	*Not Paved*	*10' Concrete Shared Use Path*	*75th Avenue to Center Parkway*	$9,320,000
75th Ave	Signalized Intersection	Utilize existing signal for crossing	Enhance Crosswalk markings, Improve Intersection Corners	$11,750
67th Ave	None	Hybrid Beacon / Bike HAWK		$85,000
Indian School Rd (6400 W)	None	Hybrid Beacon / Bike HAWK		$85,000
59th Ave	None	Route bicyclists to existing Hybrid Beacon at 59th Ave/Clarendon Ave	Widen west sidewalk / convert to Bike HAWK / Wayfinding signs	$10,500
55th Ave	None	Install ladder crosswalk and TRAIL CROSSING signs		$5,000
51st Ave	None	Route bicyclists south to signalized intersection of 51st Ave/Osborn Rd	widen sidewalks on both sides of 51st Ave & Wayfinding	$11,000
47th Ave	None	Install ladder crosswalk and TRAIL CROSSING signs		$5,000
43rd Ave	None	Hybrid Beacon / Bike HAWK		$85,000
35th Ave	None	Hybrid Beacon / Bike HAWK		$85,000
Grand Avenue	None	Hybrid Beacon / Bike HAWK or Signal	BNSF railroad crossing, upgrade surface treatment	$100,000
27th Ave	None	Hybrid Beacon / Bike HAWK		$85,000
I 17	None	Overpass	Complete connections to Osborn Rd when overpass is constructed	$8,000,000
Indian School Rd (2250 W)	None	Re-route bicyclists north and east to signalized intersection of 23rd Ave/Indian School Rd (or Hybrid Beacon / Bike HAWK)	Enhance crosswalk markings, widen sidewalks, provide wayfinding signs	$26,500
19th Ave	None	Hybrid Beacon / Bike HAWK		$85,000
15th Ave	None	Rectangular Rapid Flashing Beacon (RRFB)		$12,000
7th Ave	None	Hybrid Beacon / Bike HAWK		$85,000

15. Grand Canal from 75th Avenue to East City Limits (SR 202)

Intersections

Cross Street	Existing Crossing	Proposed	Comments	Cost Estimate
Central Ave	Signalized Intersection	None	Wayfinding signs / LRT Crossing	$1,000
7th St	None	Route bicyclists to signalized intersection of 7th St/Central High School	Widen sidewalks, provide wayfinding signs, provide north leg crosswalk at signal and PPB's	$14,000
12th St	None	Rectangular Rapid Flashing Beacon (RRFB)		$12,000
Longview Ave	None	Install ladder crosswalk and TRAIL CROSSING signs		$5,000
Indian School Rd (1550 E)	None	Hybrid Beacon / Bike HAWK	Option: Route bicyclist east to signalized intersection of 16th St/Indian School, widen sidewalks, provide wayfinding signs	$85,000
16th St	None	Hybrid Beacon / Bike HAWK	Option: Route bicyclist north to signalized intersection of 16th St/Indian School, widen sidewalks, provide wayfinding signs	$85,000
Osborn Rd	None	Rectangular Rapid Flashing Beacon (RRFB)		$12,000
20th St	None	Rectangular Rapid Flashing Beacon (RRFB)		$12,000
Thomas Rd	None	Route bicyclists west to signalized intersection of 22nd St/Thomas Rd	Enhance crosswalk markings, widen sidewalks, provide wayfinding signs	$13,500
24th St	None	Hybrid Beacon / Bike HAWK		$85,000
Oak St	None	Install ladder crosswalk and TRAIL CROSSING signs		$5,000
McDowell Rd	None	Hybrid Beacon / Bike HAWK		$85,000
32nd St	None	Hybrid Beacon / Bike HAWK	Resurface 32nd St bridge deck at crossing	$95,000
Van Buren St	Signalized Intersection	None	Wayfinding signs	$1,000
Washington St	None	Route bicyclists east to signalized crosswalk at 4250 E	Upgrade crosswalk to ladder type, provide wayfinding signs. LRT Crossing	$5,000

15. Grand Canal from 75th Avenue to East City Limits (SR 202)

Intersections

Cross Street	Existing Crossing	Proposed	Comments	Cost Estimate
44th St	Refuge Island	Rectangular Rapid Flashing Beacon (RRFB)		$12,000
SR 143	Underpass	None	Railroad track crossing west of SR 143 (2 tracks)	$0
48th St	None	Install ladder crosswalk and TRAIL CROSSING signs		$5,000
SR 202	Underpass	None		$0

16. Ray Road from Chandler Boulevard to I-10

Segments

Road 1	Road 2	Existing	Proposed	Comments	Cost Estimate
Chandler Blvd	Ranch Cir S	Edge Line Stripe & Bike Route signs	Bike Lanes	Reconstruction to narrow median	$900,000
Ranch Cir S	I 10	None	Bike Lanes	Reconstruction to narrow median	$400,000

Signalized Intersections with Existing Bike Lanes

Intersection	Existing	Proposed	Cost Estimate
None	-	-	-

17. Missouri Ave from 43rd Avenue to 24th Street

Segments

Road 1	Road 2	Existing	Proposed	Comments	Cost Estimate
43rd Ave	35th Ave	None	Bike Lanes	Accommodate on-street parking & add Bicycle Detection at 35th Ave	$34,500
35th Ave	27th Ave	Bike Lanes	None	Bicycle Detection at 27th Ave	$5,000
27th Ave	23rd Ave	Detour	Bike Lanes	Detour to bridge at I 17/Maryland via 23rd Ave and 27th Ave. Road Diet and bike lanes required on 27th Ave between Maryland and Missouri / Wayfinding signs.	$202,000
23rd Ave	19th Ave	None	Bike Lanes		$23,500
19th Ave	24th St	None	Bike Lanes	Road Diet (2-2 to 1-1-1 with bike Lanes) + Bicycle Detection at 19th Ave	$490,000

Signalized Intersections with Existing Bike Lanes

Intersection	Existing	Proposed	Cost Estimate
none	-	-	-

18. 48th Street from Baseline Road to Pecos Park

Segments

Road 1	Road 2	Existing	Proposed	Comments	Cost Estimate
Baseline Rd	Arizona Grand Pkwy / Pointe Pkwy	None	Bike Route	Private Road	$0
Arizona Grand Pkwy / Pointe Pkwy	Pointe Pkwy	Bike Lanes	None	Private Road	$0
Pointe Pkwy	Piedmont Rd	Shared Lane Markings	None	SLMs Recently installed	$0
Piedmont Rd	Chandler Blvd	Bike Lanes	None		$0
Chandler Blvd	50th St	None	Bike Lanes	Road Retrofit & add Bicycle Detection at Chandler Blvd	$85,000
50th St	Pecos Park	Bike Lanes	None		$0

Signalized Intersections with Existing Bike Lanes

Intersection	Existing	Proposed	Cost Estimate
Elliot Rd	No Bike Lanes	Extend Bike Lanes to intersection	$500
Warner Rd	No Bike Lanes	Extend Bike Lanes to intersection	$500
Knox Rd	No Bike Lanes	Extend Bike Lanes to intersection	$500
Thistle Landing Dr	No Bike Lanes	Extend Bike Lanes to intersection	$500

19. Indian Bend Wash from SR 51 to East City Limits (Mountain View Rd)

Intersections

Cross Streets	Existing Crossing	Proposed	Comments	Cost Estimate
Thunderbird Rd	Underpass	Wayfinding Signs		$1,000
36th St	Crosswalk	Wayfinding Signs		$1,000
40th St	Underpass	Wayfinding Signs		$1,000
Cactus Rd	Underpass	Wayfinding Signs		$1,000
Tatum Blvd	Underpass	Wayfinding Signs		$1,000
Shea Blvd	Underpass	Wayfinding Signs		$1,000

20. 40th Street from Shea Boulevard to Union Hills Drive

Segments

Road 1	Road 2	Existing	Proposed	Comments	Cost Estimate
Shea Blvd	Union Hills Dr	Bike Lanes	None		$0

Signalized Intersections with Existing Bike Lanes

Intersection	Existing	Proposed	Cost Estimate
Shea Blvd	No Bike Lanes	Extend Bike Lanes to intersection, eliminate dual SB right and have combined bike lane and SB through lane	$10,000
Cholla St	No Bike Lanes	Extend Bike Lanes to intersection	$500
Cactus Rd	No Bike Lanes	Extend Bike Lanes to intersection	$500
Sweetwater Ave	No Bike Lanes	Extend Bike Lanes to intersection	$500
Thunderbird Rd	No Bike Lanes	Provide missing NB segment of bike lane S of Thunderbird Rd	$1,000
Acoma Dr	No Bike Lanes	Extend Bike Lanes to intersection	$500
Greenway Rd	Bike Lanes NB only	Convert SB right turn lane to bike lane	$3,000
Bell Rd	No Bike Lanes	Extend Bike Lanes to intersection & add Bicycle Detection	$5,500
Grovers Ave	No Bike Lanes	Extend Bike Lanes to intersection	$500
Union Hills Dr	No Bike Lanes	Extend Bike Lanes to intersection & add Bicycle Detection	$5,500

21. Union Hills Drive from 51st Avenue to Tatum Boulevard

Segments

Road 1	Road 2	Existing	Proposed	Comments	L
51st Ave	27th Ave	Bike Lanes	None		$0
27th Ave	23rd Ave	None	Bike Lanes	I-17 Interchange, explore alternatives with ADOT	$500,000
23rd Ave	Tatum Blvd	Bike Lanes	None		$0

Signalized Intersections with Existing Bike Lanes

Intersection	Existing	Proposed	
51st Ave	No Bike Lanes	Extend WB Bike Lanes to intersection	$250
47th Ave	No Bike Lanes	Extend Bike Lanes to intersection	$500
43rd Ave	No Bike Lanes	Convert EB Right Turn Lane to Bike Lane and extend WB Bike Lanes to intersection	$1,000
39th Ave	No Bike Lanes	Extend Bike Lanes to intersection	$500
35th Ave	No Bike Lanes	Extend Bike Lanes to intersection	$500
19th Ave	No Bike Lane WB	Extend WB Bike Lane to intersection; extend EB Bike Lane to 100' of right turn pocket and add dashed lines	$500
15th Ave	No Bike Lanes	Extend Bike Lanes to intersection	$500
7th Ave	No Bike Lanes	Extend Bike Lanes to intersection	$500
Central Ave	No Bike Lanes	Extend Bike Lanes to intersection	$500
7th St	No Bike Lane EB	Extend EB Bike Lane to intersection	$250
12th St	No Bike Lanes	Extend Bike Lanes to intersection	$500
16th St	No Bike Lanes	Extend Bike Lanes to intersection	$500
North CanyoHigh School / 1	No Bike Lane EB	Extend EB Bike Lane to intersection	$250
20th St	No Bike Lanes	Extend Bike Lanes to intersection	$500
Cave Creek Rd	No Bike Lanes	Extend Bike Lanes to intersection	$500
28th St	No Bike Lanes	Extend Bike Lanes to intersection	$500
32nd St	No Bike Lane EB	Extend EB bike lane to intersection / extend WB Bike Lane to 100' of right turn pocket and add dashed lines	$750
34th St	No Bike Lanes	Extend Bike Lanes to intersection	$500
40th St	No Bike Lanes	Extend Bike Lanes to intersection	$500
Tatum Blvd	No Bike Lanes	No recommended improvements	$0

22. 19th Avenue from Jomax Road to Thunderbird Road

Segments

Road 1	Road 2	Existing	Proposed	Comments	Cost Estimate
Jomax Rd / North Valley Pkwy	Desert Hollow Dr	None	Utilize multi-use path for interim	Future developer widening will provide on-street bike lanes	$0
Desert Hollow Dr	Beardsley Rd / SR 101	Bike Lanes	None		$0
Beardsley Rd / SR 101	Thunderbird Rd	None	Bike Lane	Road Diet Thunderbird to Grandview 2-1-3 to 2-1-2, Grandview to 700 ft N of Bell Rd, and 2-1-3 to 2-1-2 to 400 feet south of Union Hills, and 3-1-3 to 2-1-3 to SR-101	$800,000

Signalized Intersections with Existing Bike Lanes

Intersection	Existing	Proposed	Cost Estimate
Rose Garden Ln	No Bike Lanes	Extend Bike Lanes to intersection	$500
Deer Valley Rd	No Bike Lanes	Extend Bike Lanes to intersection	$500
Williams Dr	No Bike Lane NB	Extend NB Bike Lane to intersection	$250
Pinnacle Peak Rd	No Bike Lanes	Extend Bike Lanes to intersection	$500
Happy Valley Rd	Bike Lanes	Provide dashed Bike Lane lines for SB right turn	$500

23. Sweetwater Avenue from 20th Street to Scottsdale Road

Segments

Road 1	Road 2	Existing	Proposed	Comments	Cost Estimate
20th St	Cave Creek Rd	Bike Route	Bike Lanes		$1,500
Cave Creek Rd	42nd St	Bike Lanes	None		$0
42nd St	Paradise Village Pkwy	None	Shared Lane Markings	42nd St to Windrose to Paradise Village Pkwy West/North/East along north side of mall to Sweetwater Ave & add Bicycle Detection at Windrose Dr & Tatum Blvd	$16,500
Paradise Village Pkwy	Scottsdale Rd	Bike Lanes	None		$0

Signalized Intersections with Existing Bike Lanes

Intersection	Existing	Proposed	Cost Estimate
Cave Creek Rd	No Bike Lanes	Extend Bike Lanes to intersection & add Bicycle Detection	$5,500
32nd St	No Bike Lanes	Extend Bike Lanes to intersection & add Bicycle Detection	$5,500
40th St	No Bike Lanes	Extend Bike Lanes to intersection & add Bicycle Detection	$5,500
56th St	No Bike Lanes	Extend Bike Lanes to intersection & add Bicycle Detection	$5,500
64th St	No Bike Lanes	Extend Bike Lanes to intersection & add Bicycle Detection	$5,500

Appendix I

Tier III Corridor Projects

City of Phoenix Comprehensive Bicycle Master Plan
Tier III Corridor Projects

TIER III	*LONG TERM*
111.74	TOTAL CORRIDOR MILES (NOT INCLUDING WASHES/CANALS)
49%	OF EXISTING TOTAL CORRIDOR MILES THAT DO NOT HAVE BIKE FACILITIES
54.84	PROJECT MILES (TO COMPLETE BIKE FACILITY GAPS)
39	SEGMENT PROJECTS (INCLUDING INTERSECTIONS WITHIN OR AT SEGMENT TERMINUS)
69	INTERSECTION IMPROVEMENT PROJECTS (WHERE BIKE LANES EXIST)
$9,198,101	DOLLARS TO MAKE THE CONNECTIONS (PLANNING LEVEL IN-HOUSE COST ESTIMATE)
$167,714	AVERAGE DOLLARS PER MILE
58.37	MILES OF WASHES/CANALS
56	IMPROVEMENT PROJECTS AT WASH/CANAL CROSSINGS
$1,600,000	DOLLARS TO OVERCOME BARRIERS (PLANNING LEVEL IN-HOUSE COST ESTIMATE)
$14,550,000	DOLLARS TO PAVE ARIZONA, HIGHLINE, WESTERN, AND CAP CANAL TRAILS
$25,348,101	**SUBTOTAL**

24. 32nd Street from Rose Garden Lane (CAP Canal) to Puget Avenue

Segments

Road 1	Road 2	Existing	Proposed	Comments	Cost Estimate
Rose Garden Ln (CAP Canal)	Beardsley Rd	None	Bike Lanes	Roadway Retrofit	$72,500
Beardsley Rd	Hartford Ave	Bike Lanes	None		$0
Hartford Ave	Mountain View	None	Bike Lanes	Road Diet (Current Project)	$0
Mountain View	Puget Ave	Bikes Lanes	None		$0

Signalized Intersections with Existing Bike Lanes

Intersection	Existing	Proposed	
Grovers Ave	No Bike Lane SB	Extend SB Bike Lane to intersection	$250
Michigan Ave	No Bike Lane SB	Extend SB Bike Lane to intersection	$250
Union Hills Dr	No Bike Lane SB	Extend SB Bike Lane to intersection	$250
Utopia Rd	No Bike Lanes	Extend Bike Lanes to intersection	$500

25. Cave Creek Wash from Arizona Canal to 7th St

$91,000

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Intersections				
Cross Streets	Existing Crossing	Proposed	Comments	Cost Estimate
Peoria Ave	Underpass	Wayfinding Signs		$1,000
Cactus Rd	Underpass	Wayfinding Signs		$1,000
Thunderbird Rd	Underpass	Wayfinding Signs		$1,000
19th Ave	None	Hybrid Beacon / Bike HAWK	650 ft south of Greenway Rd + Wayfinding signs	$86,000
7th Ave	Underpass	Wayfinding Signs		$1,000
7th St	Underpass	Wayfinding Signs		$1,000

26. Roeser Road from 19th Avenue to 48th Street

Segments

Road 1	Road 2	Existing	Proposed	Comments	Cost Estimate
19th Ave	11th Ave	Bike Route	Bike Lanes / Shared Lane Markings	19th Ave to 17th Ave bike lanes with on-street parking; 17th Ave to 11th Ave SLMs	$155,000
11th Ave	7th Ave	None	Shared Lane Markings	Detour to Atlanta Ave; 7th Ave from Atlanta Ave to Roeser Rd two-way cycle track on west side on street. Includes 40 ft trail connection at Roeser and 11th Ave.	$11,100
7th Ave	32nd St	Bike Lanes	None		$0
32nd St	36th St	Bike Route	Bike Lanes	Half-street Improvements along 0.5 miles of Esteban Park	$245,000
36th St	48th St	Bike Lanes	None		$0

Signalized Intersections with Existing Bike Lanes

Intersection	Existing	Proposed	Cost Estimate
Central Ave	No Bike Lanes	Extend Bike Lanes to intersection & add Bicycle Detection	$5,500
7th St	No Bike Lanes	Extend Bike Lanes to intersection & add Bicycle Detection	$5,500
16th St	No Bike Lanes	Extend Bike Lanes to intersection & add Bicycle Detection	$5,500
24th St	No Bike Lanes	Extend Bike Lanes to intersection & add Bicycle Detection	$5,500
40th St	No Bike Lane EB	Extend Bike Lane to intersection & add Bicycle Detection	$5,250

27. Baseline Road from 75th Avenue to 48th Street

Segments

Road 1	Road 2	Existing	Proposed	Comments	Cost Estimate
75th Ave	71st Ave	Bike Lanes	None		$0
71st Ave	63rd Ave	EB Bike Lane and WB Shoulder	Add WB Bike Lane	Roadway Retrofit / utilize shoulder for bike lane (portions not in Phoenix)	$73,200
63rd Ave	55th Ave	None	Bike Lanes	Pave Shoulder or wait for developer widening (Portions may not be in Phoenix)	$71,250
55th Ave	7th Ave	Bike Lanes	None		$0
7th Ave	14th St	None	Bike Lanes	Roadway Retrofit (7th Av to 7th St), Reconstruct to narrow median (7th St to 14th St)	$463,500
14th St	38th Pl	Bike Lanes	None		$0
38th Pl	48th St	None	Bike Lanes	Roadway Reconstruction to remove/narrow median or Road Diet to remove WB lane	$450,000

Signalized Intersections with Existing Bike Lanes

Intersection	Existing	Proposed	Cost Estimate
67th Ave	No Bike Lanes	Extend Bike Lanes to intersection	$500
51st Ave	No Bike Lane WB	Extend WB Bike Lane to intersection	$250
47th Avenue	No Bike Lanes	Extend Bike Lanes to intersection	$500
43rd Ave	No Bike Lanes	Extend Bike Lanes to intersection	$500
41st Ave	Bike Lanes	Provide dashed bike lines for right turn EB	$250
39th Ave	No Bike Lane WB	Extend WB Bike Lane to intersection	$250
35th Ave	No Bike Lane WB	Extend WB Bike Lane to intersection	$250
27th Ave	No Bike Lane WB	Extend WB Bike Lane to intersection	$250
19th Ave	No Bike Lanes	Extend Bike Lanes to intersection	$500
16th St	No Bike Lanes	Extend Bike Lanes to intersection	$500
20th St	No Bike Lane EB	Extend WB Bike Lane to intersection	$250
24th St	No Bike Lanes	Extend Bike Lanes to intersection	$500
32nd St	No Bike Lanes	Extend Bike Lanes to intersection	$500

28. Arizona Canal from 51st Avenue to east city limits (60th St)

Intersections

Cross Streets	Existing Crossing	Proposed	Comments	Cost Estimate
Ari ona Canal Trail	*Not Paved*	*10' Concrete Shared Use Path*	*th Street to 0th Street*	*50 000*
51st Ave	Underpass	Wayfinding Signs	borders City of Glendale	$1,000
43rd Ave	Underpass	Wayfinding Signs		$1,000
35th Ave	Underpass	Wayfinding Signs		$1,000
29th Ave	Underpass	Wayfinding Signs		$1,000
I 17	Underpass	None		$0
25th Ave	Ladder Crosswalk	Wayfinding Signs		$1,000
19th Ave	Underpass	Wayfinding Signs		$1,000
7th Ave	Underpass	Wayfinding Signs		$1,000
Dunlap Ave	Underpass	Wayfinding Signs		$1,000
Central Ave	Underpass	Wayfinding Signs		$1,000
7th St	Underpass	Wayfinding Signs		$1,000
Northern Ave	Underpass	Wayfinding Signs		$1,000
12th St	Underpass	Wayfinding Signs		$1,000
16th St	Underpass	Wayfinding Signs		$1,000
Glendale Ave	Underpass	Wayfinding Signs		$1,000
SR 51	Underpass	None		$0
Maryland Ave	None	Install ladder crosswalk TRAIL CROSSING and wayfinding signs		$5,000
24th St	Underpass	Wayfinding Signs		$1,000
32nd St	Signalized Intersection	Wayfinding Signs		$1,000
40th St	None	Route bicyclists south to signalized intersection of 40th St / Camelback Rd	Widen sidewalk, provide wayfinding signs	$10,000
Camelback Rd	None	Route bicyclists west to signalized intersection of 40th St / Camelback Rd	Widen sidewalk, provide wayfinding signs	$10,000
44th St	None	Hybrid Beacon / Bike HAWK	Wayfinding signs	$86,000
48th St/Arcadia Drive	None	Install ladder crosswalk, TRAIL CROSSING and wayfinding signs		$5,000
56th St	Signalized Intersection	Wayfinding signs		$1,000

29. Highline Canal from Dobbins Road to Arizona Grand Parkway

Intersections

Cross Streets	Existing Crossing	Proposed	Comments	Cost Estimate
i hline Canal Trail	*Paved As halt*	*10' Concrete Shared Use Path*	*o ins oad to Chandler oulevard*	*700 000*
South Mountain Ave (500 W)	None	Provide on-street bike lanes along South Mountain Ave to 7th Ave and south on 7th Ave to Dobbins Road	Provide for on-street parking. Use SLMs as alternate	$25,000
Central Ave	ladder crosswalk	Install Refuge Island and RRFB	Include RRFB in mdian island	$72,000
7th St	ladder crosswalk	None		$0
16th St	ladder crosswalk	None		$0
20th St	ladder crosswalk	None		$0
24th St	ladder crosswalk	None		$0
32nd St	None	Install ladder crosswalk and TRAIL CROSSING SIGNS		$5,000
Baseline Rd (4300 E)	No Crossing	Provide multi-use trail along S side of Baseline Rd	Provide Wayfinding signs (west half of trail)	$65,000
Baseline Rd (4100E)	No Crossing	Provide multi-use trail along S side of Baseline Rd	Provide Wayfinding signs (east half of trail)	$65,000
46th St	None (3-way STOP)	N/A	Private Street	N/A
48th St	None (4-way STOP)	N/A	Private Street	N/A
Arizona Grand Pkwy	None	N/A	Private Street	N/A

30. Southern Avenue from 75th Avenue to 48th Street

Segments

Road 1	Road 2	Existing	Proposed	Comments	Cost Estimate
75th Ave	55th Ave	None	Bike Lanes	Portions not in Phoenix	$420,000
55th Ave	51st Ave	Bike Lanes	None		$0
51st Ave	47th Ave	None	Bike Lanes	Stripe existing shoulder	$60,000
47th Ave	43rd Ave	Bike Lane EB	Bike Lane WB	Roadway retrofie, portions not in Phoenix	$42,000
43rd Ave	37th Ln	None	Bike Lanes	Reconstruction, portions not in Phoenix	$71,500
37th Ln	48th St	Bike Lanes	None		$0

30. Southern Avenue from 75th Avenue to 48th Street

Signalized Intersections with Existing Bike Lanes

Intersection	Existing	Proposed	Cost Estimate
35th Ave	No Bike Lanes	Extend Bike Lanes to intersection	$500
19th Ave	No Bike Lanes	Extend Bike Lanes to intersection	$500
15th Ave	No Bike Lanes	Extend Bike Lanes to intersection	$500
7th Ave	No Bike Lanes	Extend Bike Lanes to intersection	$500
Central Ave	No Bike Lanes	Extend Bike Lanes to intersection	$500
7th St	No Bike Lanes	Extend Bike Lanes to intersection	$500
16th St	No Bike Lanes	Extend Bike Lanes to intersection	$500
20th St	No Bike Lanes	Extend Bike Lanes to intersection	$500
24th St	No Bike Lanes	Extend Bike Lanes to intersection	$500
32nd St	No Bike Lanes	Extend Bike Lanes to intersection	$500
40th St	No Bike Lanes	Extend Bike Lanes to intersection	$500
44th St	No EB Bike Lane	Extend EB Bike Lane to intersection	$250

31. Chandler Boulevard from 19th Avenue to I-10

Segments

Road 1	Road 2	Existing	Proposed	Comments	Cost Estimate
19th Ave	18th Ave	None	None	Residential	$0
18th Ave	Desert Foothills Pkwy	Bike Lanes	None		$0
Desert Foothills Pkwy	26th St	Bike Route with edge line stripe	Bike Lanes	Reconstruct to narrow median	$553,000
26th St	I-10	None	Bike Lanes	Reconstruct to narrow median	$1,145,000

Signalized Intersections with Existing Bike Lanes

Intersection	Existing	Proposed	Cost Estimate
Desert Foothills Pkwy	No Bike Lanes	Extend Bike Lanes to intersection	$500

32. Dobbins Road from 51st Avenue to 20th Street

Segments

Road 1	Road 2	Existing	Proposed	Comments	Cost Estimate
51st Ave	43rd Ave	None	Bike Lanes	Utilize available shoulder for Bike Lanes / Roadway Retrofit (portions not in Phoenix)	$79,000
43rd Ave	40th dr	Bike Lane WB only	Add EB Bike Lane	Utilize existing shoulder to retrofit EB Bike Lane	$44,000
40th Dr	35th Glen	None	Bike Lanes	Provide 6 ft wide full depth asphalt for bike lane	$115,000
35th Glen	33rd Ave	Bike Lane EB	Bike Lane WB	Roadway Retrofit	$43,000
33rd Ave	Central Ave	None	Bike Lanes	Utilize available shoulder for Bike Lanes	$760,000
Central Ave	8th Street	None	Bike Lanes	Roadway retrofit to add bike lanes	$62,000
8th Street	16th Street	Bike Lanes	None		$0
16th Street	19th Street	None	Bike Lanes	Add Pavement for bike lanes	$67,500
19th Street	20th Street	Bike Lane WB only	Bike Lane EB	Add Pavement for bike lanes (south and east sides only)	$48,000

Signalized Intersections with Existing Bike Lanes

Intersection	Existing	Proposed	Cost Estimate
None	-	-	-

33. Western Canal from 27th Avenue to 48th Street

Intersections

Cross Streets	Existing Crossing	Proposed	Comments	Cost Estimate
estern Canal Trail	*Not Paved*	*10' Concrete Shared Use Path*	*51st Avenue to ast City i its*	*10 000*
27th Ave	None	Install ladder crosswalk and TRAIL CROSSING signs		$5,000
25th Ave	None	Install ladder crosswalk and TRAIL CROSSING signs		$5,000
24th Ave	None	Install ladder crosswalk and TRAIL CROSSING signs		$5,000
19th Ave	None	Install ladder crosswalk and TRAIL CROSSING signs		$5,000
Dobbins Rd	None	Install ladder crosswalk and TRAIL CROSSING signs		$5,000
South Mountain Ave	None	Install ladder crosswalk and TRAIL CROSSING signs		$5,000
7th Ave	None	Install ladder crosswalk and TRAIL CROSSING signs		$5,000
Baseline Rd (400 W)	None	Install Hybrid Beacon / Bike HAWK		$85,000
Central Ave	None	Install Hybrid Beacon / Bike HAWK		$85,000
Jesse OwenPkwy	None	Install ladder crosswalk and TRAIL CROSSING signs		$5,000
7th St	None	Install Hybrid Beacon / Bike HAWK		$85,000
10th St	None	Install ladder crosswalk and TRAIL CROSSING signs		$5,000
16th St	None	Install Hybrid Beacon / Bike HAWK		$85,000
24th St	None	Install Hybrid Beacon / Bike HAWK		$85,000
32nd St	None	Install RRFB (two double-sided units)		$12,000
40th St	None	Install Hybrid Beacon / Bike HAWK		$85,000
48th St	None	Install Hybrid Beacon / Bike HAWK		$85,000

34. Cave Creek Road from 7th Street / Dunlap Road to Carefree Highway

Segments

Road 1	Road 2	Existing	Proposed	Comments	Cost Estimate
7th St / Dunlap Rd	8th St	None	None	Detour route to use Hatcher Rd WB	$1,000
8th St	Cactus Rd	Bike Lanes	None		$0
Cactus Rd	Bell Rd	Bike Lanes	Buffered Bike Lanes	Road Diet	$622,000
Bell Rd	Carefree Hwy	Bike Lanes	None	northernmost half mile is not in Phoenix city limits	$0

Signalized Intersections with Existing Bike Lanes

Intersection	Existing	Proposed	Cost Estimate
Hatcher Rd	No Bike Lanes	Extend Bike Lanes to intersection	$500
Mountain View Rd	No Bike Lanes	Extend Bike Lanes to intersection	$500
Peoria Ave	No Bike Lanes	Extend Bike Lanes to intersection	$500
Cactus Rd / Thunderbird Rd	No Bike Lanes	Provide one right turn lane with combined Bike Lane (NB) / Road Diet (SB)	$1,000
Sweetwater Ave	No Bike Lanes	Extend Bike Lanes to intersection	$500
Sharon Dr	No Bike Lanes	Extend Bike Lanes to intersection	$500
Greenway Rd	No SB Bike Lane	Extend SB Bike Lane to intersection	$250
Greenway Pkwy	No Bike Lanes	Extend Bike Lanes to intersection	$500
Grandview Rd	No Bike Lanes	Extend Bike Lanes to intersection	$500
Bell Rd	No Bike Lanes	Extend Bike Lanes to intersection (SB) / Provide Bike Lane to left of NB right turn lane	$1,000
Grovers Ave	No Bike Lanes	Extend Bike Lanes to intersection	$500
Union Hills Dr	No Bike Lanes	Extend Bike Lanes to intersection	$500
Beardsley Rd	No Bike Lanes	Extend Bike Lanes to intersection	$500
Rose Garden Ln	No Bike Lanes	Extend Bike Lanes to intersection	$500
Deer Valley Rd	No SB Bike Lane	Road Retrofit (SB) / Provide SB Bike Lane	$250
Mountain Gate Pass	No Bike Lanes	Extend Bike Lanes to intersection	$500
Desert Peak Pkwy	No SB Bike Lane	Extend SB Bike Lane to intersection	$250
Desert Willow E / W Pkwy	No Bike Lanes	Extend Bike Lanes to intersection	$500
Lone Mountain Rd	No Bike Lane NB	Convert NB right turn lane to Bike Lane	$1,000

35. Broadway Road from 99th Avenue to 48th Street

Segments

Road 1	Road 2	Existing	Proposed	Comments	Cost Estimate
99th Ave	75th Ave	None	Bike Lanes	Roadway retrofit for 1 miles, add asphalt for new shoulders for 2 miles. Portions outside of city limits	$650,000
75th Ave	69th Dr	Striped Shoulders	Bike Lanes	Some street retrofit required. Portions outside of city limits	$48,000
69th Dr	63rd Ave	None	Bike Lanes	Roadway retrofit / add shoulder for Bike Lanes & provide Bicycle Detection at 67th Ave. Portions outside of city limits	$220,000
63rd Ave	59th Ave	None	Bike Lanes	Road Diet, portions outside of city limits	$62,000
59th Ave	51st Ave	None	Bike Lanes	Roadway retrofit / Utilize available shoulder for Bike Lanes / Add pavement for shoulder east of 59th Ave	$147,000
51st Ave	19th Ave	None	Bike Lanes	Reconstruction (Current Project will include bike lanes)	$0
19th Ave	7th St	None	Bike Lanes	Reconstruction (Current Reconstruction Project will not include bike lanes, roadway retrofit to provide bike lanes)	$404,000
7th St	48th St	None	Bike Lanes	Road Diet	$1,000,000

Signalized Intersections with Existing Bike Lanes

Intersection	Existing	Proposed	Cost Estimate
None	-	-	-

36. Deer Valley Road from 35th Avenue to 56th Street

Segments

Road 1	Road 2	Existing	Proposed	Comments	Cost Estimate
35th Ave	Sport Complex (2500 E)	Bike Lanes	None		$0
Cave Creek Sport Complex (2500 E. Deer Valley)	Black Mountain Pkwy	None	Bike Lanes	Pave shoulder or wait for future development. Provide Bicycle Detection at Black Mountain Pkwy	$410,000
Black Mountain Pkwy	40th St	Bike Lanes	None		$0
40th St	Tatum Blvd	None	Bike Lanes	Pave south shoulder or wait for future development. Eliminate dual EB right turn lanes at Tatum Blvd.	$170,000
Tatum Blvd	56th Street	Bike Lanes	None		$0

Signalized Intersections with Existing Bike Lanes

Intersection	Existing	Proposed	Cost Estimate
31st Ave	No Bike Lanes	Extend Bike Lanes to intersection	$500
27th Ave	No Bike Lanes	Extend Bike Lanes to intersection	$500
I 17	No WB Bike Lanes	Stripe WB Bike Lane through interchange (ADOT)	$5,000
23rd Ave	No Bike Lanes	Extend Bike Lanes to intersection	$500
19th Ave	No Bike Lanes	Extend Bike Lanes to intersection	$500
18th Ave	No EB Bike Lanes	Extend EB Bike Lane to intersection	$250
7th Ave	No Bike Lanes	Extend Bike Lanes to intersection	$500
7th St	No Bike Lanes	Extend Bike Lanes to intersection	$500
16th St	No Bike Lanes	Extend Bike Lanes to intersection	$500
22nd St	No Bike Lanes	Extend Bike Lanes to intersection	$500
Cave Creek Rd	No Bike Lanes	Roadway retrofit, remove dual EB right turn lanes, extend WB bike lane to intersection	$2,000

37. Encanto Boulevard from 95th Avenue to 31st Avenue

Segments

Road 1	Road 2	Existing	Proposed	Comments	Cost Estimate
95th Ave	91st Ave	Bike Lanes	None		$0
91st Ave	87th Ave	None	Bike Lanes	Provide on-street parking & add Bicycle Detection at 91st Ave	$26,000
87th Ave	86th Dr	None	Bike Lanes	Roadway Retrofit	$11,300
86th Dr	83rd Ave	Bike Lanes	None		$0
83rd Ave	75th Ave	None	Bike Lanes	Road Diet (2-1-2 to 2-1-1) & add Bicyle Detection at 83rd Ave	$165,000
75th Ave	55th Ave	None	Bike Lanes	Roadway Retrofit, accommodate on-street parking. Add Bicycle Detection at 75th, 67th Ave & 59th Aves	$131,500
55th Ave	51st Ave	Bike Lanes	None		$0
51st Ave	49th Ave	None	Shared Lane Markings	Detour via Vernon Ave. Add EB Bicycle Detection at 51st Ave	$1,500
49th Ave	31st Ave	Bike Lanes	None		$0

Signalized Intersections with Existing Bike Lanes

Intersection	Existing	Proposed	Cost Estimate
51st Ave	No Bike Lanes EB	Roadway Retrofit / add sidewalk on E side of 51st Ave to Vernon. Add EB Bicycle Detection at 51st Ave	$4,500
43th Ave	No Bike Lanes	Roadway Retrofit / extend bike lanes to intersection. Add EB Bicycle Detection at 51st Ave	$6,000
35th Ave	No Bike Lanes	Extend Bike Lanes to intersection & add Bicycle Detection	$5,500

38. 44th Street from Sky Harbor Airport East Economy Lot to University Drive

Segments

Road 1	Road 2	Existing	Proposed	Cost Estimate
East Economy Lot, Sky Harbor Airport	University Dr	None	Two-way cycle track along west side of 44th street utilizing existing 44th Street bridge over the Salt River. Two-way cycle track will need to be constructed on west side of 44th street north of University for 2,100 feet. Pedestrian and bicycle crosswalk improvements at 44th Street / University. New bike entrance will be needed from cycle track into East Economy Parking Lot with access to Sky Train. Provide secure bike parking at East Economy Parking Lot.	$350,000

39. CAP Canal from west City limits (6700 W) to Scottsdale Road

Intersections

Cross Streets	Existing Crossing	Proposed	Comments	Cost Estimate
CAP Canal Trail	Not Paved	10' Concrete Shared Use Path	West City Limits to East City Limits	*0 000*
I-17	Overpass (south side)	None		$0
Norterra Pkwy	None	Install Refuge Island and RRFB & Wayfinding Signs		$62,000
North Valley Pkwy	Underpass (south side)	None		$0
Happy Valley Rd	None	Install Hybrid Beacon / Bike HAWK	Wayfinding signs	$86,000
7th St	None	Install Hybrid Beacon / Bike HAWK	Wayfinding signs	$86,000
Deer Valley Rd	None	Install Hybrid Beacon / Bike HAWK	Wayfinding signs. Explore grade separated crossing	$86,000
Cave Creek Rd	None	Install Hybrid Beacon / Bike HAWK	Wayfinding signs. Explore grade separated crossing with future bridge over the CAP	$86,000
SR 101	Underpass	None	ADOT	$0
SR 51	Underpass	None	ADOT	$0
Tatum Blvd	None	Install Hybrid Beacon / Bike HAWK	Wayfinding signs	$86,000
56th St	Underpass	None		$0
Scottsdale Rd	Signalized Intersection	None	City of Scottsdale	$0

Appendix J

Draft City Ordinance to Preclude Bicyclists from Riding Against Traffic On Sidewalks

City of Phoenix

To: Gary Clovis, Sergeant
Traffic Bureau Headquarters

Date: January 24, 2012

From: Walter Olsen, 4479
Traffic Bureau Headquarters

Subject: AMEND CITY ORDINANCES DEALING WITH THE OPERATION OF BICYCLES

PURPOSE:

The purpose of this memorandum is to suggest a committee be formed to draft a city ordinance that would preclude bicyclists from riding against traffic on sidewalks inside the city of Phoenix. I believe if this ordinance were to pass, we could thru media campaigns, warnings by officers and later enforcement significantly reduce bicycle related crashes in the city of Phoenix.

DISCUSSION:

In the course of doing enforcement and investigating traffic collisions, we have identified a significant problem as it relates to the operation of bicycles within our community. A common bicycle related collision we encounter is a cyclist riding against traffic on the sidewalk and colliding with a motor vehicle exiting a private drive or making a right turn from a collector street.

Drivers of motor vehicles are looking in the direction of on-coming traffic as they exit a driveway or turn right from an intersecting street. Bicyclists traveling against the flow of traffic often believe the driver has seen them. The bicyclist will pull out in front of the right turning vehicle and thus they collide.

Currently Arizona traffic laws only govern the movement of bicycles when they are riding in the street. There are no state statutes or city ordinances that prohibit bicyclists from riding the wrong way on sidewalks. There are laws that require bicycles riding in the street do so with the normal flow and direction of traffic.

Our neighboring city of Tempe (a college town) has for many years dealt with a high volume of bicyclists. In order to reduce bicycle related crashes they passed an ordinance that prohibits bicyclists from riding the wrong way on sidewalks. As a resident of Tempe (and as a driver) I have some expectation that bicycle riders are far less likely to be riding against traffic.

Bicycle enthusiasts and bike groups have an obvious interest in bicycle safety; they want cars and bicycles to share the road safely. Bicycle safety advocates strongly recommend bicyclists ride with traffic. We have heard from bicycle groups they would not oppose an ordinance prohibiting bicycle riders from riding the wrong way on sidewalks.

According to Phoenix Street Transportation Engineer and Safety Specialist Kerry Wilcoxon the problem of "wrong way cyclists" is either the first or second leading cause of bicycle collisions in our community. He indicated the timing for such an ordinance may be now as the City is working hard to find solutions to reduce bicycle crashes.

I believe it would be in the Community's best interest to prohibit wrong way bicycle riding on sidewalks that are adjacent to streets with speed limits above 25 mph. If this ordinance were to pass, we would be regulating bicycles generally outside of residential areas, on main arterial roadways.

RECOMMENDATION:

I recommend a committee be formed with members from Street Transportation, Police (Traffic) and the City's Legal Department in hopes of establishing an ordinance to preclude wrong way bicycling on city sidewalks. If the committee drafts a proposed ordinance it could then be presented to the City's Public Safety, Veterans, Transparency and Ethics Subcommittee.

I am also suggesting this group discuss adding language to the City ordinances that places responsibility on the drivers of motor vehicles to yield to *bicyclists travelling lawfully on sidewalks*.

See attachment "A" for a suggested first draft of this ordinance. Please forward this memo through the chain-of-command for consideration.

Attachment A

Phoenix City Ordinance Sec 36-111
Speed limit and direction of travel on a sidewalk

A. No person shall ride, operate or use a wheeled conveyance, to include but not limited to bicycle, unicycle, skateboard, cart, wagon, wheelchair, or mobility device whether human, gas or electric powered on a sidewalk in a willful or wanton disregard for the safety of persons or property or at speed greater than 15 mph.

B. [On or adjacent to any street or highway with a speed limit greater than 25 mph,] no person shall ride or operate a bicycle or wheeled conveyance in any direction except that permitted by vehicular traffic on the same side of the roadway where the sidewalk or bicycle lane exists; provided, that bicycles or wheeled conveyance may proceed either way where signs or pavement markings on the sidewalk, bikeway or bicycle lane appear designating two-way traffic.

Phoenix City Ordinance Sec. 36-110
Yielding right-of-way

A. The operator of a bicycle emerging from an alley, driveway, or building shall, upon approaching a sidewalk or the sidewalk area extending across such alley, driveway, or building exit, yield the right-of-way to all pedestrians approaching on said sidewalk or sidewalk area, and upon entering the roadway shall yield the right-of-way to all vehicles approaching on said roadway

B. No person shall drive a vehicle upon or across a sidewalk except to enter or leave the roadway and only after giving the right-of-way to all bicycles or pedestrians lawfully upon the sidewalk.

Italics indicates suggested language to add to the City Ordinances

Appendix K

Bicycle Parking

Bicycle Parking at Destinations

Bicycle parking is an important component of a multi-modal transportation system. More people are likely to bicycle if they are confident they will find convenient, secure, and weather-protected parking areas at their destination. Convenient, well-designed bicycle parking enables bicyclists to secure their bicycles and discourages locking bicycles to trees, fences, and other undesignated locations. Adding bicycle parking is also an opportunity to integrate public art into streetscapes, develop a brand for the Phoenix bicycling program, and engage the business community in bicycling.

General Guidelines

- Bicycle parking should be located to prevent encroachment into the pedestrian traveled way and prevent damage to vegetation and street furniture.
- Bicycle parking should be conveniently placed within close proximity of entrances to businesses, transit stops, multi-family dwellings, parks, schools, libraries and other community facilities.
- Unless located at a transit station or other high demand destination, generally one or two racks at multiple locations along a block face is preferred to grouping all bike racks at one location.
- Bicycle racks should be covered wherever possible to prevent damage from the sun and rain, and to prevent bicycle seats from deteriorating (from ultra violet rays) or getting too hot. This can often be achieved through strategic placement, such as placing racks under an existing storefront awning or eave.
- Bicycle parking should be designed to accommodate the full range of bicycle types, including cargo bikes, bikes with trailers, bikes with a trailer bike, bikes with built-in child or cargo holders, tandems, and adult and child tricycles.
- In areas with high bicycle parking demand, limited space behind the curb, and limited private bike parking, in-street corrals or other high capacity bike rack designs should be considered.

Recommended Facilities

Bicycle parking may be provided in a variety of forms depending on whether it is for short-term or long-term use (e.g., a brief shopping stop or an all-day event).

Short Term Parking

Bicycle racks are an inexpensive and effective way to provide short-term bicycle parking. The preferred bicycle rack design is the Inverted-U, due to its versatility, level of security and small footprint. Inverted U racks can be installed individually or as part of a series. Hitch style racks may also be appropriate in locations where there is insufficient space for inverted U-racks.

Covered or uncovered bicycle racks are appropriate for short term parking needs at retail stores, restaurants, recreation centers, parks, libraries and similar locations. Covered bicycle racks are recommended at transit stations, universities, colleges, and elementary, middle and high schools, because students, teachers and staff often stay for longer periods of time. At all locations it is important to plan for both employee and visitor bicycle parking.

Long-Term Parking

On-demand lockers, standard rental lockers or bike-lids are recommended at locations where long-term bicycle parking is needed in lightly supervised locations such as park-and-ride lots, commuter rail stations, office complexes, and industrial parks. Bike lids are covered racks that provide protection from the weather, but are easier to install and move if needed.

Secure indoor parking is needed in apartment buildings and other multi-family, residential housing types, including senior housing and retirement centers. Garden apartments and campus-style complexes that have limited public access can meet residents' needs by providing covered medium security bike parking in convenient locations for regular use, and indoor storage areas for long-term storage.

Showers, changing rooms, and secure storage facilities

People choose to travel by bike because it is fun and a good source of exercise. To make their trips more comfortable, bicyclists often choose to wear athletic clothing and work up a sweat, while their plain clothes are stowed in a backpack, basket or pannier. If their final destination does not have a place where they can clean up and change, they may opt to drive instead. One method employers use to encourage bicycle commuting is installing showers and locker rooms in their buildings. Some establishments have partnered with nearby gyms to allow their employees and customers access to the showering facilities, at a reduced or subsidized cost. Phoenix can show its support by installing showers and changing rooms in their civic buildings for employees to use.

Bicyclists often have additional gear that needs to be stored safely when they arrive at their destination. This can include helmets, lights, bells, baskets/panniers, etc. Usually these items are vulnerable to theft or damage even if the bike is secured to a rack. To ease the concerns of the bicyclist, it can be helpful to offer lockers or other secure locations for bicyclists to store their gear. One low-cost alternative is allowing customers to store their gear behind a store counter, or with a coat check. If bicyclists know that their gear is safe, it makes the choice to bike an easier one.

Recommendations

- The City of Phoenix should review and potentially expand the existing rack request program operated by the Street Transportation Department.
- The City of Phoenix should partner with business improvement districts such as the Downtown Phoenix Partnership to provide bicycle racks in commercial areas.
- The City of Phoenix should prioritize funding for bicycle rack installation along Tier I corridors during the initial phase of bicycle plan implementation, Tier II corridors during the second phase of bicycle plan implementation, and Tier III corridors during the third phase of bicycle plan implementation.
- The City of Phoenix should consider initiating an interagency program to evaluate, replace and add bike parking at all City-owned public facilities.
- The City of Phoenix should consider amending zoning and subdivision codes to require redevelopment and new development to provide appropriate types, quantities and locations of bicycle parking as part of development approval. See Sample Bicycle Parking Guidelines below.
- The City of Phoenix bicycle program web page should provide a map of bicycle parking locations in downtown Phoenix, a way for bicyclists to indicate where bicycle parking is needed, and information on how to request a bicycle rack.
- If the City of Phoenix Street Transportation Department converts single-space parking meters to pay-stations, old parking meter posts should be modified to function as bicycle racks where feasible and appropriate.
- The City of Phoenix should establish a process to evaluate locations and facility types for long-term bicycle parking, and develop branding.
- The bicycle parking standards provided in the Phoenix Traffic Operations Handbook should be updated to:
    - Accommodate cargo bikes, bikes with trailers, bikes with a trailer bike, bikes with built-in child or cargo holders, tandems, and adult and child tricycles.
    - Provide specifications for in-street bicycle corrals and long-term bicycle parking, such as bike lockers.
    - Specify that, with the exception of racks attached to parking meters, racks located perpendicular to the curb should be a minimum 3-feet from the back of the curb and racks located parallel to the curb should be a minimum of 2 feet from the back to the curb per AASHTO. Professional judgment should be exercised in areas where the sidewalk is narrow.
    - Specify that the minimum clearance between a crosswalk and a bike rack is 5 feet.
    - Specify that the minimum clearance between a bike rack and street furniture is 3 feet.
    - Specify that the minimum clearance between utility vaults, manholes, power poles, permanent planters, etc. shall be 3 feet.
    - Specify that the minimum clearance between bus shelters, fire hydrants, and signal control cabinets should be 5 feet.
    - Specify desirable spacing between racks.

- Specify spacing between bicycle racks and walls per the 2012 AASHTO Bicycle Design Guide. For U-racks placed perpendicular to a wall, AASHTO recommends a minimum of 4 feet, assuming access is needed from both sides. For U racks placed parallel to a wall, AASHTO recommends a minimum of 3 feet between the wall and the rack.

Sample Bicycle Parking Guidelines

The following sample guidelines provide guidance and direction for new regulations in the City of Phoenix zoning and subdivision codes that govern new development, redevelopment or major renovations. These sample guidelines are intended to facilitate adequate and secure short and long-term bicycle parking for residents, workers in office and commercial buildings and students and staff in institutional buildings. They can also serve as a template for those building owners who would like to retrofit existing residential or commercial properties with new or added bike parking facilities.

The proposed guidelines presented below are provided as a model for the City of Phoenix. Sections include: Why Bike Parking, Definitions, Requirements, Equipment and Installation Design.

Why Bike Parking?

The provision of parking facilities directly encourages people to use their bicycles as a means of transportation. More people are likely to bicycle if they are confident that they will find convenient, secure, and weather-protected parking areas at their destination. The following Bicycle Parking Requirements are applicable for accommodating bicycles in all buildings and development types in Phoenix.

These requirements also set standards for bicycle parking at public facilities, bike-share stations and shower and changing facilities.

Definitions

Secure/Covered Facilities: Bicycle parking areas that protect the entire bicycle, its components and accessories against theft and against inclement weather, including wind-driven rain. Examples include but are not limited to: indoor bike room, indoor storage area, bike lockers, indoor or outdoor bike valet parking with weather protective cover and siding, areas with security camera linked to live viewers, and/or key access-covered cages with weather-protective siding.

Outdoor/Covered Facilities: Bicycle parking areas that provide some protection against inclement weather and may have added theft security. Covers include but are not limited to a building projection, an awning or tented roof. Siding is not required. Racks associated with covers will allow the user to lock the bicycle frame and one wheel while the bicycle is supported in a stable position.

Outdoor/Open facilities: Bicycle parking areas that permit the locking of the bicycle frame and one wheel to a bicycle rack and which supports the bicycle in a stable position without damage to wheels, frame or components. Cover and/or security enhancements are not provided.

Bicycle parking space: The number of bicycles that can be accommodated by the bicycle racks or facility, as defined by the user's manual for the rack or facility referenced. For the remainder of this document, guidelines refer to spaces, or number of bicycles for which the facility is designed to accommodate.

Requirements

The following are minimum requirements according to building type. Exceeding these minimum requirements is encouraged but not required.

Three-Five Unit Residential Buildings:

- One Secure/Covered bicycle parking space per unit located in an easily accessed basement storage area or adjacent / attached garage or shed.
- Shower / changing facilities as included in each residential unit.

Appendix K – Bicycle Parking

Multi-Unit Residential (6 or more units) Buildings:

- One Secure/Covered bicycle parking space per unit located in an easily accessed dedicated storage area.
- One Outdoor/Covered or Outdoor/Open parking space per five units with a minimum of 2 Outdoor/Covered or Outdoor/Open spaces per building.
- Shower / changing facilities as included in each residential unit.

Office, Commercial and Industrial Buildings:

- One Secure/Covered parking space per worker for 10% of the planned part- and full-time worker occupancy (or 0.3 parking spaces per 1,000 square feet of development), but no fewer than 4 Secure/Covered parking spaces per building.
- One Outdoor/Covered or Outdoor/Open parking space for patrons and visitors for 2.5% of estimated daily building users but no fewer than 4 Outdoor/Covered or Outdoor/Open spaces per building.
- Provide at least one shower / changing facility for any building with 100 or more planned part- and full-time workers (or over 40,000 square feet of development) and one additional shower / changing facility per every 200 planned workers (or 80,000 square feet of development), thereafter. Shower / changing facility requirements may be met by providing the equivalent of free access to on-site health club shower facilities where the health club can be accessed without going outside.

Retail Buildings:

- One Secure/Covered bike parking space per worker for 10% of the planned part- and full-time worker occupancy (or 0.3 spaces for 1,000 square feet of development) but no fewer than 2 Secure/Covered parking spaces per building.
- One Outdoor/Covered or Outdoor/Open parking space for patrons and visitors per 5,000 square feet, but no less than 2 Outdoor/Covered or Outdoor/Open spaces per building.
- Provide at least one shower / changing facility for any development with 100 or more planned part- and full-time workers (or over 40,000 square feet of development) and one additional shower / changing facility per every 200 planned workers (or 80,000 square feet of development), thereafter. Shower / changing facility requirements may be met by providing the equivalent of free access to on-site health club shower facilities where the health club can be accessed without going outside of buildings.

Institutional Building and Campus Dormitory Buildings:

- One Secure/Covered parking space per student and staff for 15% of the planned part- and full-time campus wide occupancy (or 0.5 parking spaces per 1,000 square feet of development), but no fewer than 4 Secure/Covered parking spaces per building.
- One Outdoor/Covered or Outdoor/Open parking space for patrons and visitors for 5% of estimated daily building users but no fewer than 4 Outdoor/Covered or Outdoor/Open spaces per building.
- Provide at least one shower / changing facility for any campus building with 100 or more planned part- and full-time students and staff (or over 40,000 square feet of development) and one additional shower / changing facility per every 200 planned students and staff (or 80,000 square feet of development), thereafter. Shower / changing facility requirements may be met by providing the equivalent of free access to on-site health club or gym shower facilities where the health club or gym can be accessed without going outside.
- One Secure/Covered parking space per every two beds in a Dormitory building where such parking spaces may not be counted in the campus wide total.

Mixed- Use Buildings:

- Provide parking and shower facilities proportional to the mix of uses using the above requirements.
- Shared facilities may be provided for non-residential uses mixed within a single building or for non-residential uses within a single development that is under 50,000 square feet. Specific requirements for unique uses such as senior or assisted living facilities, movie theaters, sports arenas or conference venues will be determined on a case-by-case basis. Special provisions such as bicycle valet parking for single events such as concerts should be encouraged.

Bike Parking Equipment and Installation Design

1. Acceptable bike rack designs must have a two point support system for easy access and locking of frame and wheels. The designs must present no sharp edges to pedestrians or bicyclists.
2. Developers are encouraged, but not required to use either an inverted-U style rack or an artistic style rack to match City of Phoenix preferred designs.
3. All racks and other fixtures must be securely affixed to the ground or a building.
4. Areas used for bicycle parking should be secure, well-maintained, well-lighted and easily accessible to bicycle riders.
5. No bicycle parking areas should impede sidewalk or pedestrian traffic. Designs that do not provide two-point supports for bicycles may create unfit sidewalk conditions. Poor rack designs may allow bicycles to fall over easily and become damaged, or encroach into the pedestrian right-of-way. Older "school" or "dish" racks are not functional and do not provide full support. Single post designs with sharp edges can also be problematic to pedestrians, especially those with visual disabilities. Racks with one point of contact, like hitch racks need to be in-ground mounted. Examples of recommended racks include: inverted U, hitch rack, upside down U rack, and multiple bike racks.
6. Retail establishments shall have Outdoor/Covered or Outdoor/Open facilities within 50 feet of the primary entrance(s).
7. Racks must be 4-5 feet away from hydrants and other street furniture.
8. No bicycle parking shall be located farther from the entrance of a building than the closest automobile parking space (including accessible parking spaces).
9. Prominently placed signs should be within 50 feet of parking and immediately visible. Signs must direct users to all secure/covered or outdoor/covered facilities that are not immediately visible from the street.
10. All bicycle parking shall be separated by a physical barrier/parallel to curb or sufficient distance from car parking and vehicular traffic to protect parked bicycles from damage.
11. Accessible, Indoor and Secure Accessible bike parking encourages daily use with well-maintained and well-lit easy access for riders.
12. Converting on-street car parking to in-street bike corrals can accommodate up to eight bicycles, and encourage people to use their bikes for shopping and running errands-not just commuting.