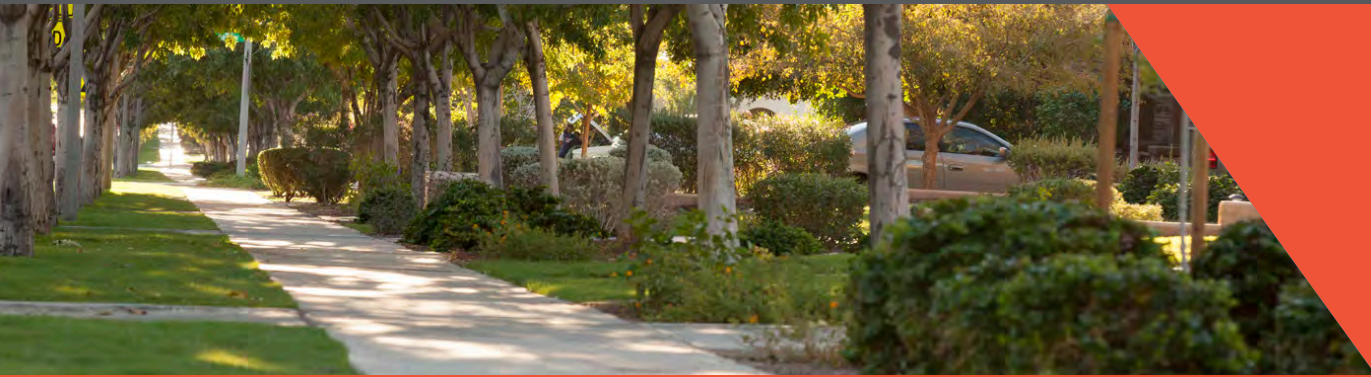




BICYCLE & PEDESTRIAN MASTER PLAN



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Buckeye Bicycle and Pedestrian Master Plan

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Please see the next page.



1. Plan Development

Introduction

A safe, convenient, and connected bicycle and pedestrian network to serve Buckeye as it grows was identified by elected officials and residents as a primary community goal in the Imagine Buckeye 2040 General Plan. The Buckeye Bicycle and Pedestrian Master Plan (BPMP) establishes a vision, strategies and an implementation plan to provide for a connected, convenient, and efficient network of bicycle and pedestrian facilities for use and enjoyment by residents of all ages and abilities. The BPMP establishes design criteria and programs with the broad goal of increasing residents' choice to walk or bike throughout Buckeye into the future.

Nationally, studies have demonstrated an increase in use of bicycle and pedestrian facilities by residents when the facilities are designed in a manner to improve connectivity and improve the perception of safety^{1and 2}. Simply put, the safer a walker, runner, or bicyclist feels, the more inclined they will be to use bicycle and pedestrian facilities regularly for recreation and/or transportation purposes. Likewise, numerous studies have confirmed a positive relationship between walking and biking and improvements to public health. Increased walking or bicycling also reduces automobile dependence and vehicular infrastructure demand, which contributes to the quality of life for the community.

The BPMP is intended to provide the city with the tools and strategies to guide development of a connected and convenient bicycle and pedestrian network to serve residents as Buckeye grows into the future. The study area for the BPMP is the Buckeye Municipal Planning Area, depicted on **Figure 1-1**.

¹ Mekuri, Firth and Nixon, Low Stress Bicycling and Network Connectivity, Mineta Transportation Institute 2012. San Jose University College of Business Publication, San Jose, CA.

² Dill, J., McNeil, N. Four Types of Cyclists? Testing a Typology to Better Understand Bicycling Behavior and Potential. 2012. Portland State University, Portland, OR.

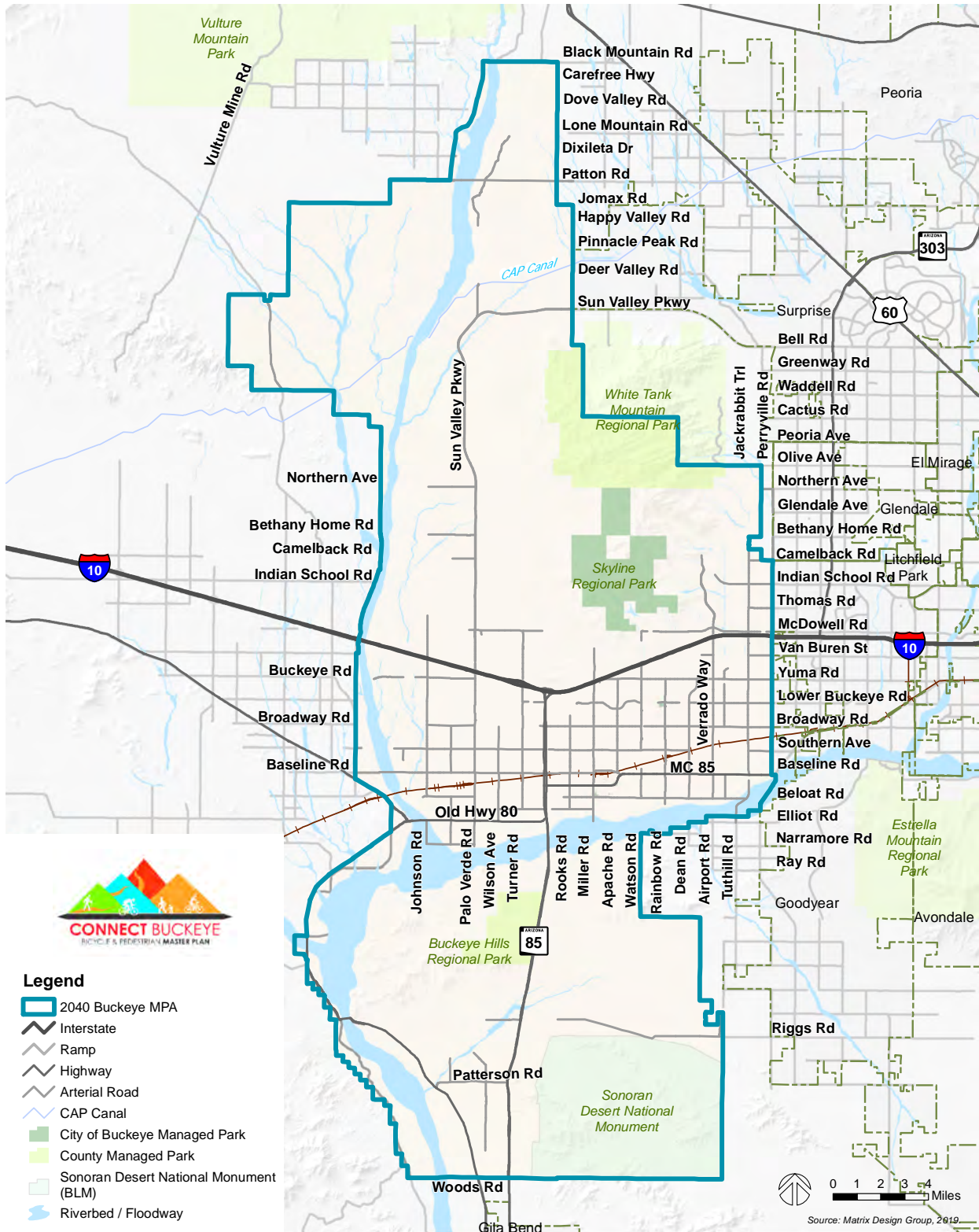


Figure 1-1

Buckeye BPMP Study Area

Chapter 1: Plan Development

Plan Overview

The Bicycle and Pedestrian Master Plan (BPMP) is organized into the five chapters described as follows:

- CHAPTER 1: PLAN DEVELOPMENT** Chapter 1 outlines the planning process, which guided the formation and development of the BPMP, the vision and goals, and the public engagement process employed to garner meaningful community input.
- CHAPTER 2: FACTS, TRENDS, AND BENEFITS** Chapter 2 identifies facts and benefits associated with riding a bicycle or walking and outlines different types of bicyclists within the general population. This Chapter also summarizes academic research on traffic stress and strategies to reduce stress in the bicycle and pedestrian network.
- CHAPTER 3: PLAN INFLUENCES** Chapter 3 identifies relevant plans and studies used in the formation of the BPMP, existing and planned development, the existing bicycle and pedestrian network, corridor opportunities, and trip generators (origins and destinations).
- CHAPTER 4: THE PLAN** Chapter 4 establishes the on- and off-street bicycle and pedestrian networks, descriptions and cross-sections of facility types, support facilities, and strategies to be employed to reduce stress and improve the function of the bicycle and pedestrian networks.
- CHAPTER 5: PLAN IMPLEMENTATION** Chapter 5 provides the implementation plan for the BPMP, including improvement schedules, funding sources and partners, and community programs.

Planning Process

The BPMP was developed and completed in four distinct phases:

PHASE I PROJECT KICK-OFF AND INFORMATION ANALYSIS (OCTOBER – DECEMBER 2018)

This beginning phase involved data collection and analysis of relevant transportation plans and other studies, such as land use, corridors, crash data, and mapping. This phase also involved the identification and mapping of existing conditions and uses and destinations for the planned network including parks, recreation corridors, planned primary commercial, employment and residential areas, activity centers, and transit nodes.

PHASE 2 COMMUNITY ENGAGEMENT (THROUGHOUT)

The initial community engagement began in January and February 2019 with Council Workshops, public workshops, stakeholder interviews, and meetings with developers. Community engagement was continued throughout the BPMP formation and the development process to ensure meaningful public input.



PHASE 3 PLAN DEVELOPMENT (DECEMBER 2018-MAY 2019)

Based on the results of the data and mapping analysis, the vision and goals, and public input received, the draft network for on- and off-street bicycle and pedestrian facilities was developed. This phase also involved the formation of the programs, strategies, and implementation plan.

PHASE 4 DOCUMENT FINALIZATION (JUNE-AUGUST 2019)

This phase involved public review and input on the BPMP through public workshops, Council Workshops, and stakeholder interviews. During this phase, the document was finalized and prepared for City Council adoption in September 2019.

Vision and Goals

The vision and goals of the BPMP were developed based on goals, policies, and broad public input received during the Imagine Buckeye 2040 General Plan and further refined through the public engagement process. The vision and goals served as the foundation of, and informed the development, direction and recommendations of the BPMP.

Buckeye Bicycle and Pedestrian Master Plan Vision

“The City of Buckeye is a community where walking or riding a bike is a comfortable and convenient transportation choice for residents and visitors of all ages and abilities”

Goals and Guiding Principles

The intent and purpose of this Plan is to guide the development of a convenient and connected network that links bicyclists and walkers with key destinations throughout Buckeye. The following Goals and Guiding Principles were developed based on this foundational intent and purpose of the BPMP.

- ▶ **Goal 1 Improve Safety** of bicyclists and pedestrians through infrastructure improvements and safety programs.
- ▶ **Goal 2 Improve Connectivity** within the community by linking residents and visitors with activity centers, employment areas, recreational facilities, corridors and opportunities for transit.
- ▶ **Goal 3 Improve Convenience** of the bicycle and pedestrian network to connect people with transit corridor hubs and stops.
- ▶ **Goal 4 Improve Awareness and Use** of the bicycle and pedestrian network through awareness programs, events and other public engagement activities.
- ▶ **Goal 5 Improve Maintenance** to enhance use of the network through the use of low maintenance materials and design considerations with the objective of reducing overall maintenance costs.

Project Management and Public Engagement

An important component of the planning process is public input and engagement. Through the adoption of the Imagine Buckeye 2040 General Plan, residents provided significant public input relative to the overarching goal to foster development of a safe and connected bicycle and pedestrian network to serve the community. To build on this input, a detailed public engagement plan was implemented in conjunction with the development and formation of the BPMP. This section outlines the approach to project management and methods employed to gather meaningful public input.

Project Management

The project was managed by a Technical Advisory Committee (TAC) comprised of staff members from the City of Buckeye Engineering, Planning, and Community Services Departments. The TAC met regularly to discuss project administration, coordination of public engagement, and technical comments relative to the BPMP.

Public Engagement

This Plan is the result of significant input received throughout the process at public workshops, Council Workshops, stakeholder interviews, and through the project website. The public engagement strategies and approach resulted in meaningful input which shaped the BPMP.

Public Workshops

Public Workshops were held throughout the duration of the Bicycle and Pedestrian Master Plan process to ensure that the community had the opportunity to view the progress of the Plan and provide meaningful feedback. Input was collected through a series of interactive exercises including key pad surveys, visual preference surveys, and an issues and opportunity exercise.

Summaries of the public workshops and their respective survey results are provided below:

Public Workshop 1

The first set of public workshops were held on January 23rd and 24th, 2019 in the central and northern portions of the City (Coyote Branch Library and Sun City Festival). The purpose of these public workshops was to receive resident input on issues and opportunities related to the bicycle and pedestrian network in Buckeye and determine the community's preferences on bicycle and pedestrian facility cross-sections.

The key pad, or 'clicker', surveys consisted of a series of questions, presented to the audience by the meeting's moderator, then using individual hand-held devices,





the audience anonymously responded to each question. Once the audience responded, the data was shown in real time. Discussion was encouraged and resulted in valuable insights that might not otherwise be obtained. The results for each question have been included in this chapter.

To encourage further discussion on the topic of bicycle and pedestrian facilities planning, a series of sample cross-sections were created and supplemented with a detailed collection of visual preference image boards. Meeting attendees were asked to place stickers on the various cross-sections and images to help guide the discussion towards preferred elements (green dots) and away from less-desirable elements (red dots). Upon completion, a relatively clear set of preferences was presented for consideration in the BPMP.

Lastly, the project team guided meeting attendees through a guided issues and opportunities exercise. In this exercise, participants were asked to write issues on red index cards and opportunities on green index cards. The issues and opportunities were then sorted into one of six categories (Maintenance, Surface Type, Amenities, Access, Connections, and Safety) and posted on a board for viewing and discussion.

Each series of public workshops was followed by a period of data collection and sorting where the project team looked for recurring themes, consistencies among citizen responses, and gaps where additional information might still be needed from City staff, stakeholders, or future public workshops.



What We Heard at Workshop 1

- ▶ Top 3 Overall Priorities: Bicyclist safety, pedestrian safety, and traffic separation
- ▶ Top 3 Pedestrian Priorities: Safety, intersection and crossing treatments, and connectivity
- ▶ Top 3 Bicycle Priorities: Safety, connectivity, and crossing treatments
- ▶ Top 3 Most Important Facilities: Recreation paths, sidewalks, and bike routes/bike lanes
- ▶ Top 3 Destinations: Parks/open space, neighborhoods, and dining/shops
- ▶ Top 2 Purposes of Travel: Recreational use and exercise
- ▶ What's Lacking: Maintenance of existing pedestrian facilities and the quality of bicycle facilities
- ▶ Most Preferred Bicycle Facility: Bicycle lanes and routes

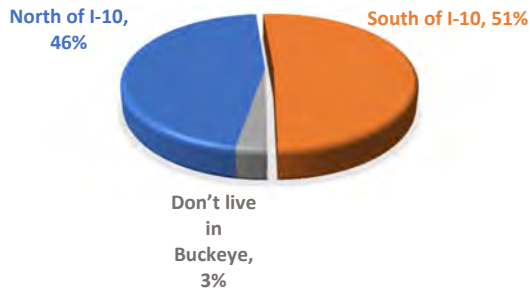
Chapter 1: Plan Development

- ▶ Most Used Pedestrian Facility: Sidewalks and recreation trails
- ▶ Lowest Bicyclist Priorities: Shade and amenities such as showers and lockers
- ▶ Top Opportunities
 - Connect existing paths and trails
 - Provide paths and trails along power corridors and canals
 - Provide different surface types to accommodate different users
- ▶ Top Issues
 - Lack of bicycle lanes
 - Disconnected trails and discontinuous north/south access
 - Maintenance of paths
 - Lack of lighting
 - Concerns with uneven surface materials
 - Lack of buffer from vehicular traffic
 - Facilities not wide enough to feel safe
- ▶ Bicycle and Pedestrian preferences
 - Separation of bicycle and pedestrian traffic from vehicular traffic with landscape buffer
 - Facilities where pedestrian and bicycle facilities are clearly separated from one another
 - On-street facilities that provide painted buffer or vertical element
 - Completely separated multi-use paths
 - Different surfaces for bicyclist and pedestrian users
 - Primary facilities should accommodate both bicycles and pedestrians, as well as equestrians where appropriate

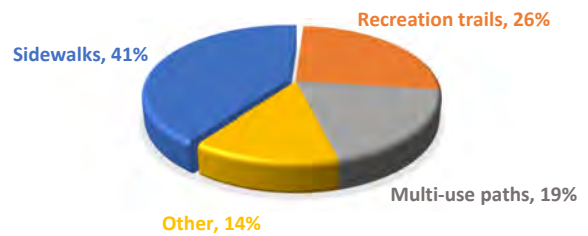


The following is a visualization of the key pad survey questions and the collective responses:

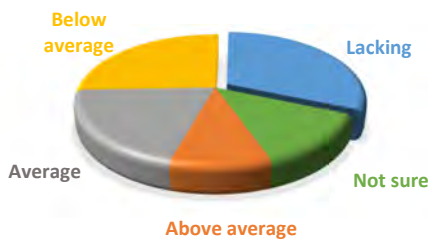
Q1. Where do you live?



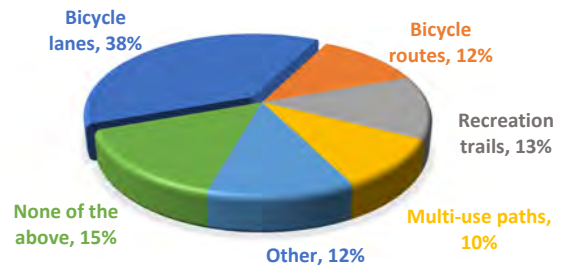
Q2. What pedestrian facilities do you currently use?



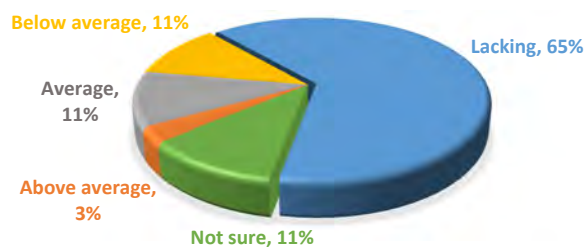
Q3. How would you rate the quality of pedestrian facilities in Buckeye?



Q4. What bicycle facilities do you currently use?



Q5. How would you rate the quality of bicycle facilities in Buckeye?

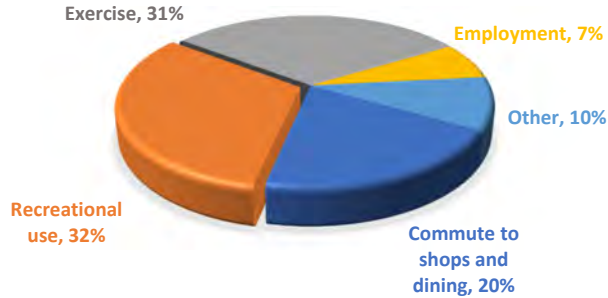


Q6. What are the top 3 facilities most important to you?



Chapter 1: Plan Development

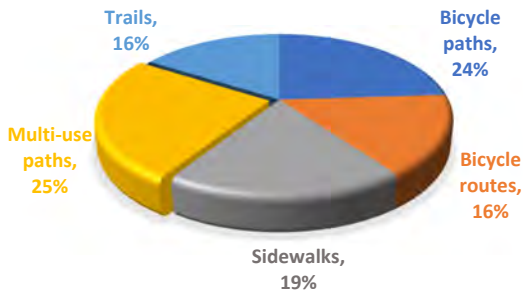
Q7. What is the purpose for your use/future use of the bicycle and pedestrian network?



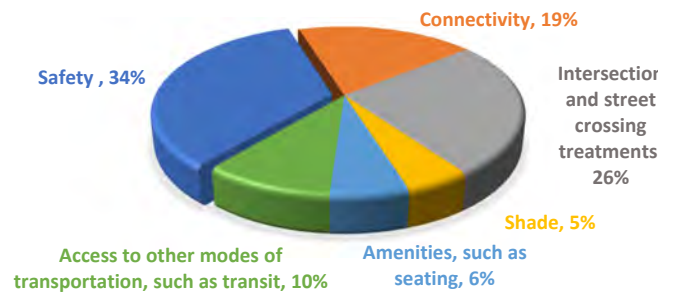
Q8. Which facility would you likely use?



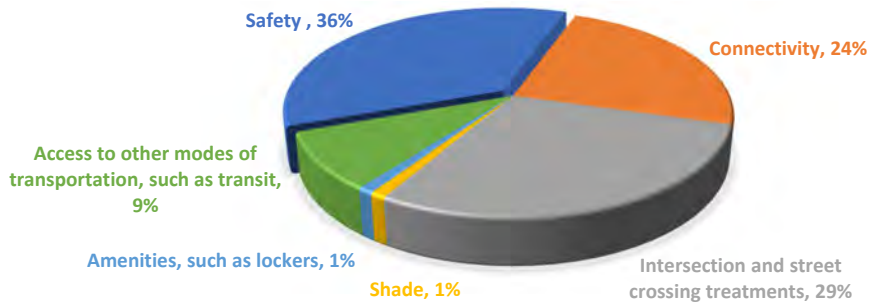
Q9. Which of the following does Buckeye need more of?



Q10. What are the top 3 priorities for the pedestrian network in Buckeye?

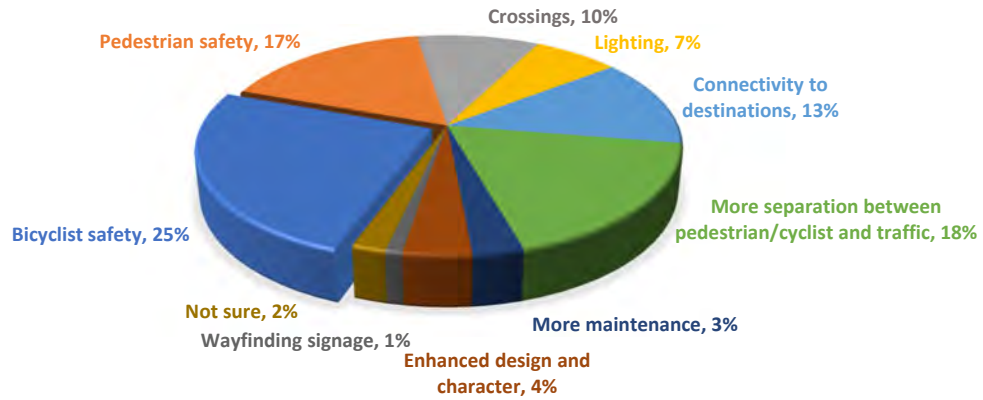


Q11. What are the top 3 priorities for the bicycle network in Buckeye?

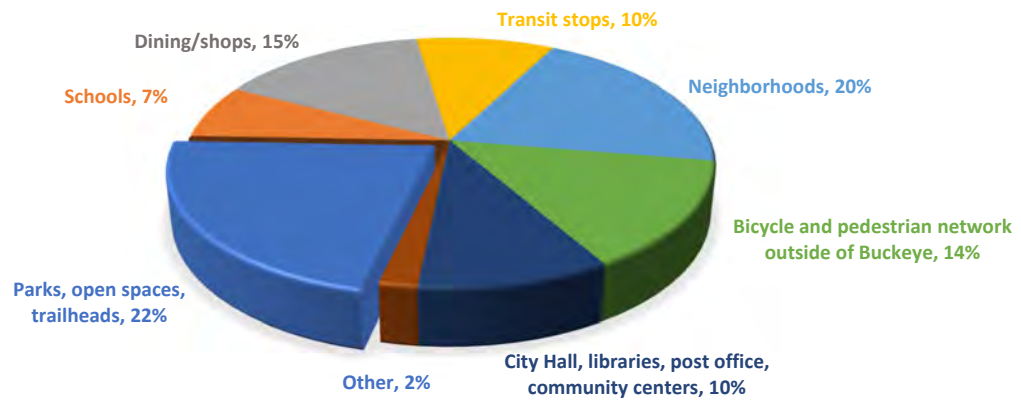




Q12. What are the top 3 improvements needed related to the bicycle and pedestrian network in Buckeye?

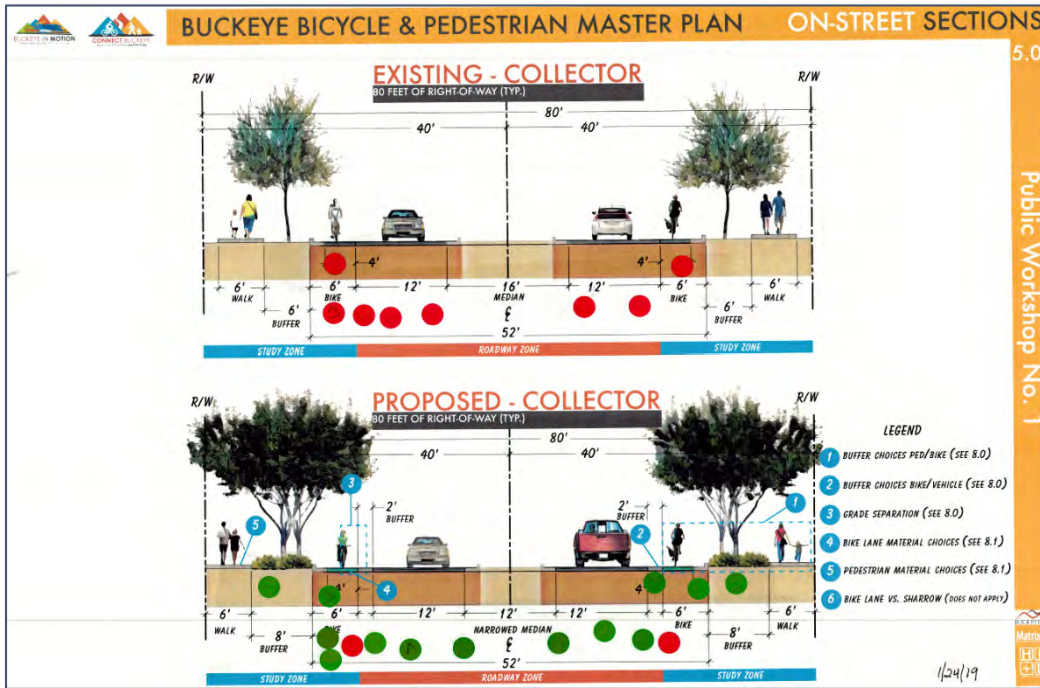


Q13. What destinations should bicycle and pedestrian facilities connect to?



Chapter 1: Plan Development

The following images are samples of the visual preference boards and the respective public opinion. Green dots signify a positive preference. Red dots signify a negative preference.





The following is a sample of the feedback received on the four topic areas associated with the 'blue wall' exercise:

As described in the public workshop section, the issues and opportunities exercise was intended to focus on a defined set of categories and, under each category, residents were encouraged to provide real or perceived issues and opportunities. Because this was an open-ended exercise without multiple choice answers, the input received often addressed a much wider variety of topics, some of which could be difficult to align with a pre-defined category. Nonetheless, the input was important and established a line of thinking as the project and associated concepts continued to evolve.

| Maintenance | | Surface Type | | Amenities | |
|---|--|---|---|--|--|
| Opportunities | Issues | Opportunities | Issues | Opportunities | Issues |
| Repaved Sun Valley Parkway from I-10 at SVP to Bell into Surprise, AZ | Keep holes, rocks, etc. off paths | Side by side path/trails with hard surface and soft surface to accommodate multiple user groups | Pavers at intersections instead of continuous asphalt/concrete | Opportunity to integrate with informal trail system through north section of White Tanks from Sun Valley Parkway | Provide bathrooms along trails and pathways, especially in mountain and hilly areas far from services |
| More trails with clear paths | Trash/litter accumulation on Yuma between Dean and Rainbow | Use existing canals for bicycle use but have paved portions for 'road bikes' | Paved for connecting. Road bikes don't go on gravel. Gravel mountain bikes can go on pavement | Provide paths/trails near mountains | Need bathrooms on trails - paths - whatever. Check out Folsom -> Sacramento Bikeway |
| Access | | Connections | | Safety | |
| Opportunities | Issues | Opportunities | Issues | Opportunities | Issues |
| Opportunity to create a pathway along canal area | Do not reduce lanes downtown. Keep 2 lanes both ways so firetrucks can negotiate in emergency or turn at intersections | Take advantage of the large unimproved areas to "do it right" (as you are doing) | Lack of sidewalks north of I-10 (Sun Valley Parkway) | | Connecting streets in SCF area narrow and busy. Most have existing sidewalks. Change sidewalks to multi-use paths to get bikes off of narrow busy street |
| Use all the power lines that Buckeye has to put paved paths below them for miles of biking access | Providing bike lanes to connect subdivisions and other recreation destinations | Opportunity to connect to Grand Ave northwest of 303 | Ways to get from park to park | | Multi-use trails. Bicyclists and horses don't mix. We use a strobe headlight which can frighten a horse |

Chapter 1: Plan Development

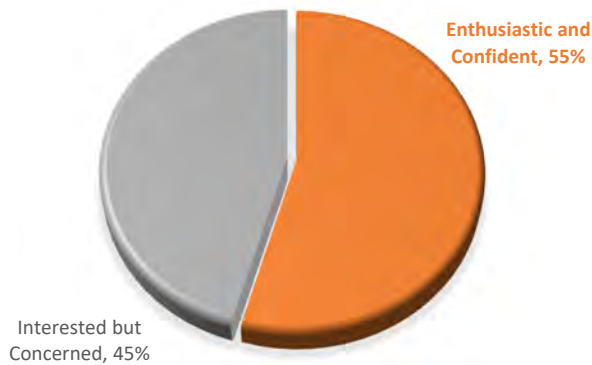
Public Workshop 2

The second set of public workshops were held on April 3rd and 4th, 2019 in the central and northern portions of the community (Coyote Branch Library and Sun City Festival). The purpose of these workshops was to provide an overview of the Bicycle and Pedestrian Master Plan for any new attendees and to introduce a number of research concepts regarding stresses associated with the built environment and how the environment, through proper design, can influence pedestrians and cyclists depending on their self-assessed commuter personality.

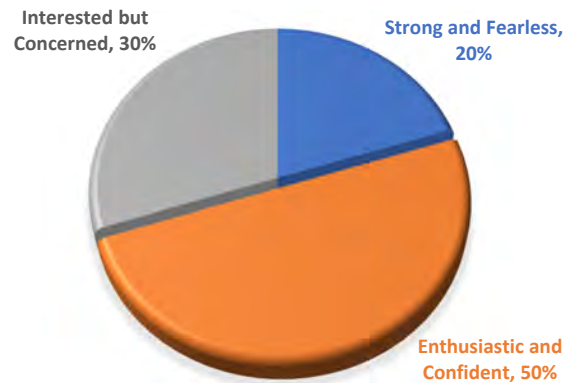
As part of this workshop, participants were asked a series of questions regarding their perception of the bicycle and pedestrian network in Buckeye. The results of this survey provided a baseline understanding of the types of bicycle and pedestrian network users that should be planned for and the types of facilities that would encourage these users to continue or increase their utilization of the network.

The following is a visualization of the key pad survey questions and the collective responses:

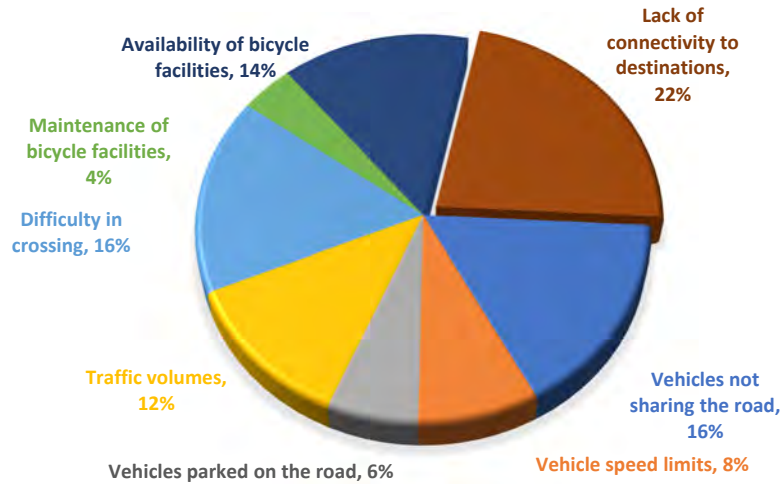
Q1. Which best describes your confidence level as a bicyclist?



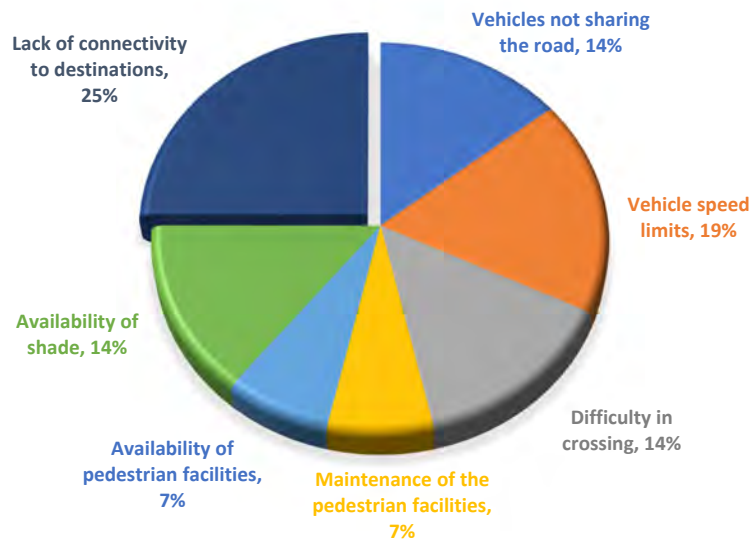
Q2. Which best describes your confidence level as a pedestrian?



Q3. What's keeping you from bicycling in Buckeye?

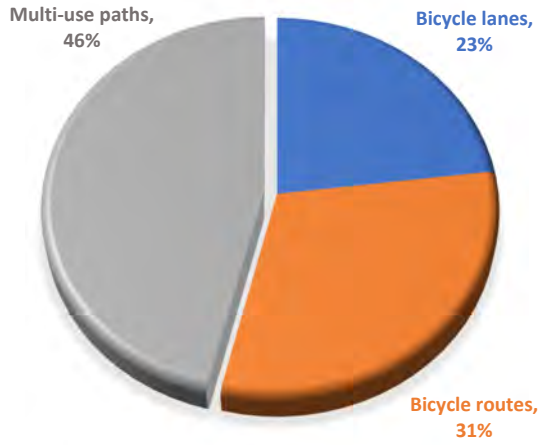


Q4. What's keeping you from walking in Buckeye?

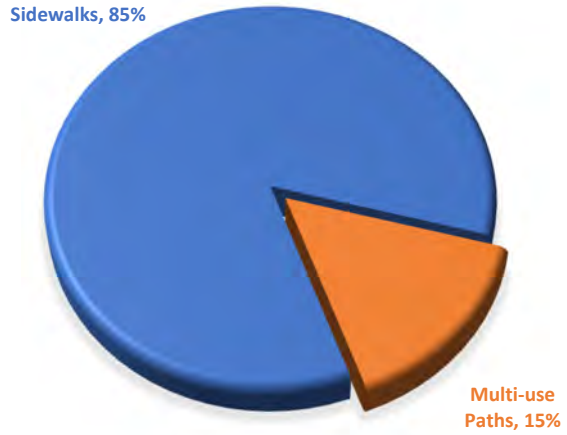


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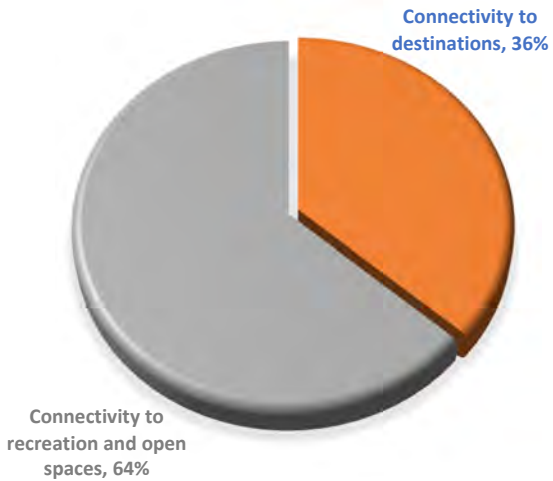
Q5. Which facility type would you prefer to bicycle on while commuting in Buckeye?



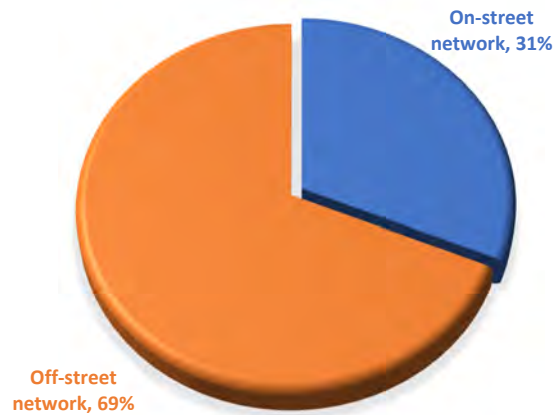
Q6. Which facility type would you prefer to walk on while commuting in Buckeye?



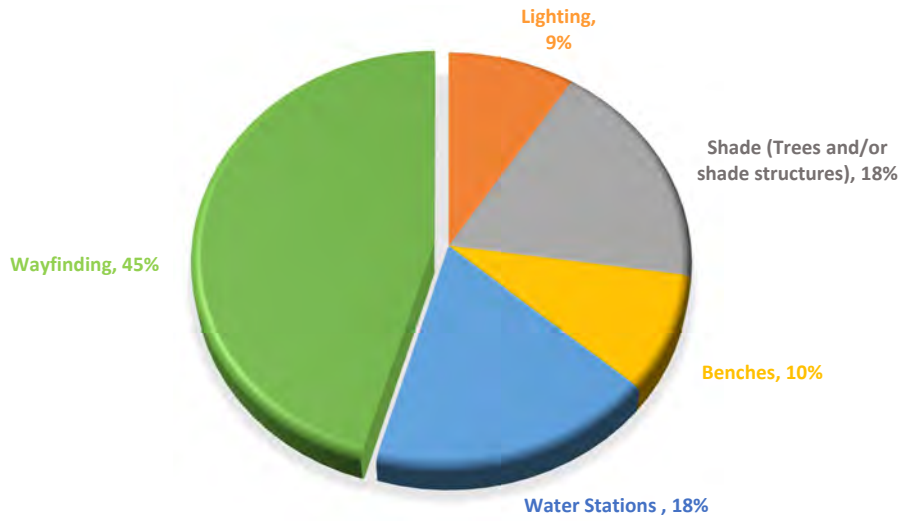
Q7. What kind of connectivity should be prioritized?



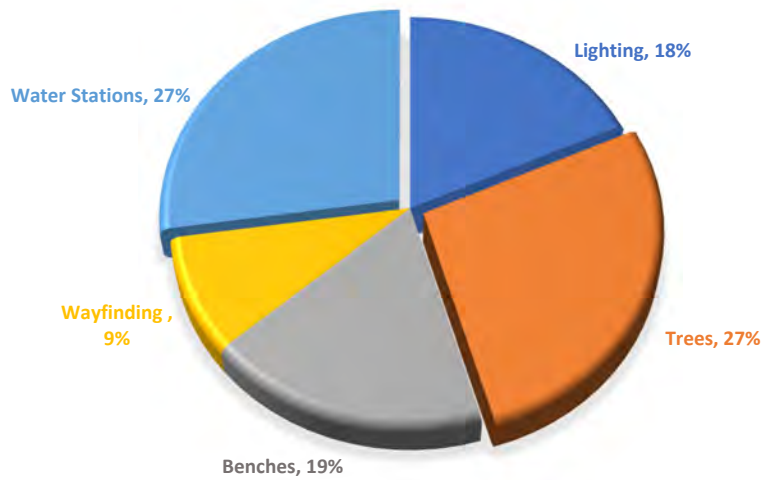
Q8. What bicycle and pedestrian facilities should be prioritized?



Q9. What are your preferences for bicycle amenities?



Q10. What are your preferences for pedestrian amenities?



Chapter 1: Plan Development

Public Workshop 3

The third public workshop was held on June 17 and 19, 2019 in the central and northern portions of the city (Buckeye Coyote Library and the Sun City Festival Fire Station). The purpose of this workshop was to show the community different components of the draft Bicycle and Pedestrian Master Plan. The workshop was an open house format in which participants were able to view and discuss map boards and cross-section boards. Comment cards were made available for participants to provide comments on the maps and cross-sections.

Council Work Sessions

Three Council Work Sessions were held during the formation of the Bicycle and Pedestrian Master Plan. These Work Sessions were held in January, April, and August 2019 to provide a project overview and status update to City Council and receive input on the draft BPMP. The Transportation Master Plan was discussed in tandem with the Bicycle and Pedestrian Master Plan to ensure coordination between the two documents.

Developer Partners Focus Group

The Developer Partners Focus Group is a quarterly meeting between the City of Buckeye and representatives from the development community including residential and non-residential developers and builders to discuss issues related to development. Two Development Partner Group meetings were held to introduce the BPMP and later to present an update of the BPMP for the purposes of obtaining input from the development community. The first meeting was held in March, 2019. The second meeting was held in August, 2019. Input from these meetings were incorporated into the development of this BPMP.

Stakeholder/MAG Interviews

Stakeholder Interviews were held during the development of the Plan and included representatives from various community members and leaders. Interviews were conducted on a one-on-one basis through phone calls. MAG interviews were conducted with MAG staff to discuss funding resources for bicycle and pedestrian facility improvements. The interviews were treated as conversational discussions focused on the views that the stakeholders have on the current bicycle and pedestrian network in Buckeye and future visions for the network.

The following is a list of agencies that were interviewed in May 2019:

- ▶ Saddle Mountain Unified School District
- ▶ Buckeye Elementary School District
- ▶ Sun City Festival Hiking Club
- ▶ Arizona Alliance for Livable Communities
- ▶ City of Goodyear - Transportation Department

A summary of key input received during the stakeholder interviews includes:

- ▶ Bicycle and pedestrian opportunities are tied to healthy communities
- ▶ Sidewalks should be wide and connected



- ▶ Bicycle facilities should be supportive and prioritize safety and include an education component
- ▶ Design the pedestrian environment for senior citizens and moms with strollers
- ▶ The bike environment should be planned for recreational riders and kids
- ▶ Vision Zero – policy for zero traffic-related deaths
- ▶ Consider Impact Fee Credits to fund bicycle and pedestrian facilities
- ▶ Ensure that there is access to schools as there are high parent pick-up/drop-off rates
- ▶ Community Master Plans have smaller schools, which makes them more walkable
- ▶ At Tartesso, there are student, pedestrian tunnels and no at-grade crossings
- ▶ Lots of bicycle and pedestrian interest in Goodyear
- ▶ Buffered bike lanes needed
- ▶ Federal funding will be main funding source for bicycle and pedestrian facilities
- ▶ There are no bike lanes in Sun City Festival so many residents ride on the street, which lots of residents are not happy about
- ▶ Lack of sidewalks are detrimental to students' ability to walk to school

Stakeholder Interviews were held during the development of the BPMP and included representatives from school districts, hiking clubs, trail advocates, medical facilities, and conservancy groups. Interviews were also held with transportation staff from adjacent municipalities, Arizona Game and Fish Department, Maricopa County Department of Transportation, Maricopa Association of Governments, and the Central Arizona Project (CAP).

Website

The Bicycle and Pedestrian Master Plan was available on the Buckeye's Engineering Department website during development of the BPMP. The website included background information on the project and notices for upcoming and past public input opportunities.

Key Themes and Public Input Summary

Several key themes emerged during the public engagement process from the City, the public, the development community and stakeholders. These key themes were integrated into the development of the proposed network as well as the design of bicycle and pedestrian facilities and supporting uses. In summary, the common themes expressed throughout the process included the following preferences:

- ▶ Separation of bicycle and pedestrian traffic from vehicular traffic
- ▶ Facilities that accommodate both bicyclists and pedestrians
- ▶ Separation of bicycle facilities from pedestrian facilities

Chapter 1: Plan Development

- ▶ Multi-use paths along power corridors and canals
- ▶ Different surfaces to accommodate bicyclists and pedestrians
- ▶ Bicycle and pedestrian safety



Please see the next page.



2. Facts, Trends, and Benefits

The Chapter identifies facts, trends, and benefits associated with riding a bike or walking and outlines different types of bicyclists and pedestrians within the general population. This Chapter also summarizes academic research on traffic stress and strategies and improvements to reduce stress in the bicycle and pedestrian network.

Benefits of Bicycle and Pedestrian Travel

A well-utilized bicycle and pedestrian network provides significant community benefits that improve the overall quality of life for residents. These include health and safety, accessibility, recreation, transportation, environmental, economic, and quality of life benefits.

Health and Safety. Regular physical activity has been shown to have reduced risks of heart disease, stress, obesity and other chronic diseases. As such, biking and walking on a regular basis improves the overall health of residents.

Accessibility. A convenient and connected bicycle and pedestrian network provides access to destinations for people without access to a vehicle, including older residents, youth, and persons with disabilities. A well-connected bicycle and pedestrian network increase public access to parks, libraries, schools, recreation areas, activity centers, and city facilities and services. The provision of sidewalks, paths, trails, and bicycle facilities enhances residents' ability to reach Buckeye's many recreation facilities and natural open space areas.

Transportation. Riding a bicycle or walking reduces traffic volume and traffic congestion on streets. Benefits of reduced traffic congestion include increased travel efficiency, more reliable travel times, reduced traffic delays due to accidents, and an overall reduction in transportation costs to the city.

Environmental. With a more appealing biking and walking environment, a larger number of local trips can be safely made on foot or by bicycle to destinations, such as shops, restaurants, school, and recreation, thereby reducing the number of cars on the road. This change in transportation choice has a positive cumulative impact on improving air quality and reducing vehicular congestion.



Economic. Bicycle and pedestrian facilities have a positive impact on local businesses, business sales, and economic development within the community. People walking or riding a bicycle tend to spend money locally, instead of spending money for products and services further away. Additionally, bike and walking paths have been shown to have a positive impact on home values as people seek out areas for active and passive recreation opportunities.

Quality of Life. A robust bicycle and pedestrian network provides opportunities for social interaction and recreation for residents and contributes to an overall increase in quality of life within a community. Providing opportunities for social interaction reinforces and enhances the sense of community for residents. A sense of community contributes to the overall quality of life.

Perception of Safety

People’s willingness to walk or ride a bike is directly influenced by their perception of safety. People differ in their level of comfort for riding or walking in areas where they do not perceive they are safe – some people (very few) feel comfortable riding a bicycle with the speed of traffic on a busy road, wherein most people avoid placing themselves in or very close to fast moving trucks and vehicles.

Traffic stress is the perceived sense of danger associated with using the bicycle and pedestrian network adjacent to vehicular traffic. Transportation systems throughout the United States are designed with the overarching goal of decreasing the perception of danger. This concept is relevant and important to bicycle and pedestrian system planning as many people avoid riding a bicycle due to lack of perceived safe routes. There are two common methods for classifying cyclists relative to bicycling facilities – one is skilled-based and the other is based on rider typologies.

Skill-Based

American Association of State Highway and Transportation Officials (AASHTO)¹ and the Federal Highway Administration (FHWA)² classify cyclists based on skill as follows:

- ▶ **Class A.** Advanced cyclists whose greater skill enables them to share roads with motor traffic. Moreover, they are unwilling to sacrifice speed for separation from traffic stress.
- ▶ **Class B.** Basic adult cyclists who lack the “skill” to confidently integrate with fast or heavy traffic.
- ▶ **Class C.** Children cyclists, less capable than Class B at negotiating traffic and are more prone to irrational and sudden movements.

(1) American Association of State Highway and Transportation Official (AASHTO). Guide for the Development of Bicycle Facilities, 1999, Washington, DC: AASHTO

(2) W.C. Wilkinson, A Clarke, B. Epperson and R. Knoblauch. Selecting Roadway Design Treatments to accommodate Bicycles, US Department of Transportation, Publication No. FHWA-RD-92-073, 1994.

Chapter 2: Facts, Trends, and Benefits

Four Types of Cyclists

A second method of classification is based on a rider's tolerance of stress versus skill. Tolerance of stress was explored through community surveys and documented by City of Portland Bicycle Coordinator Roger Geller in a publication titled "Four Types of Cyclists"³. The numerous community surveys established four broad categories of people relative to their views on bicycling as provided in **Table 2-1**.

Table 2-1. Four Types of Cyclists

| | |
|-----------------------------------|--|
| Strong and Fearless | This small group of the population is willing to ride a bicycle on any roadway condition. The Strong and Fearless rider is comfortable taking the lane and riding in a vehicular manner on major streets without designated bicycle facilities. |
| Enthusiastic and Confident | This group of riders is comfortable riding in most roadway situations but prefer to have a designated bicycle facility. They are comfortable riding on major streets with a bike lane. |
| Interested But Concerned | This type of rider has an inclination toward biking, but ultimately chooses not to based on concern over sharing the road with vehicles. These riders are not very comfortable on major streets, even with a striped bike lane, and prefer separated pathways or low traffic neighborhood streets. |
| No Way, No How | This type of cyclist is not interested at all in bicycling, may be physically unable to, or do not know how to ride a bicycle. This group is unlikely to adopt bicycling in any way. |

Source: Roger Geller, City of Portland Bureau of Transportation, *Four Types of Cyclists*.

These original typologies have been incorporated into academic research^{4 5} and utilized nationally by numerous cities in generally assessing residents' attitudes toward bicycle riding. The results of the Portland surveys established a generalized distribution of the population relative to their attitudes towards riding a bicycle as a mode of transportation. Overall, a small percentage (1%) of the population self-classify themselves as "Strong and Fearless" and another 7% of the population self-classify themselves as "Enthusiastic and Confident". The Strong and Fearless and Enthusiastic and Confident types represent the percentage of the population that generally will ride a bicycle for transportation.

The majority of the population classify themselves as Interested and Concerned (60%) and approximately 33% of the population will not ride a bicycle for any reason. While the percentages range from region to region,

"Riding a bicycle should not require bravery. Yet all too often, that is the perception among cyclists and non-cyclists alike."

Roger Geller, Bicycle Coordinator, Portland Office of Transportation

³ Geller, Roger. Four Types of Cyclists. Portland, OR: City of Portland Office of Transportation, 2009, <https://www.portlandoregon.gov/transportation/article/237507>. Accessed May 22, 2019.

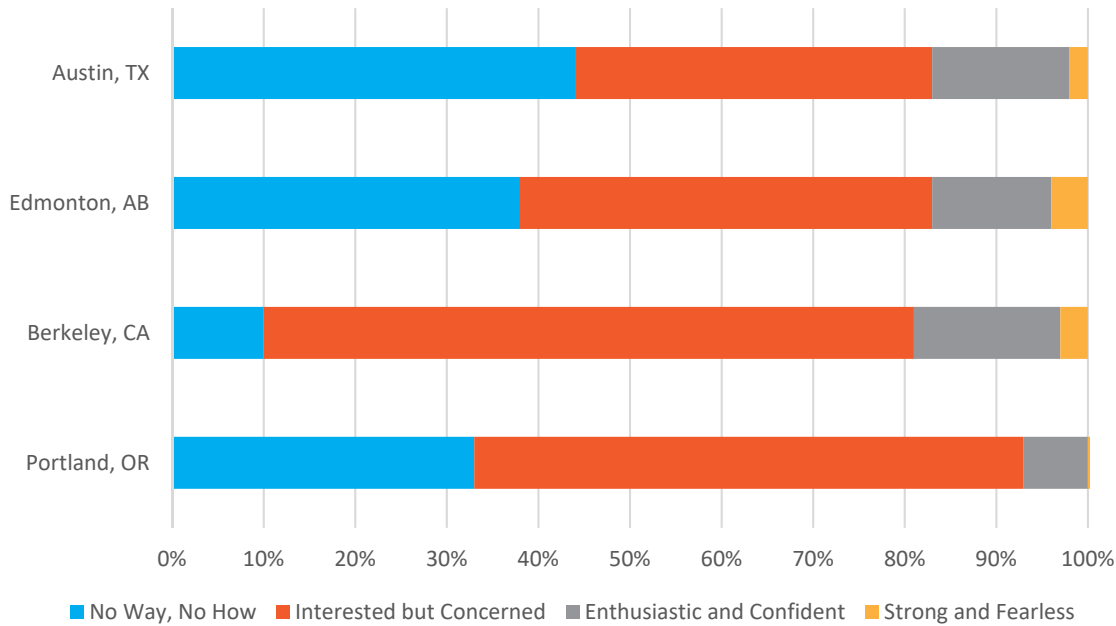
⁴ Mekuri, Firth and Nixon, Low Stress Bicycling and Network Connectivity, Mineta Transportation Institute 2012.

⁵ Dill, J., McNeil, N. Four Types of Cyclists? Testing a Typology to Better Understand Bicycling Behavior and Potential. 2012.



people broadly relate to the four typologies to describe their concerns with bicycling relative to the perception of safety. A comparison of the survey results from four large U.S. and Canadian cities is shown in **Figure 2-1**.

Figure 2-1: Four Types of Transportation Cyclists



Source: Roger Geller, City of Portland Bureau of Transportation, *Four Types of Cyclists*.

These typologies were incorporated into the public outreach process with Buckeye residents and have been integrated into the BPMP for consistency with national best practices.

Level of Traffic Stress

The Geller classification scheme has been adopted and applied through academic research to quantify the level of traffic stress into a rating system. Levels of Traffic Stress (LTS) is a rating indicating the traffic stress created on bicyclists from a segment of a street or street crossing. LTS criteria, first published in 2012 in a report by Mekuri, Firth and Nixon through the Mineta Transportation Institute, classify levels of traffic stress on a four-level rating system from low to most stressful as provided in **Table 2-2**.

Chapter 2: Facts, Trends, and Benefits

Table 2-2. Levels of Traffic Stress

| | |
|----------------------------------|---|
| Level Of Traffic Stress 1 | Presenting little traffic stress and demanding little attention from cyclists and attractive enough for a relaxing bike ride. Suitable for almost all cyclists, including children trained to safely cross intersections. On links, cyclists are either physically separated from traffic, or are in an exclusive bicycling zone next to a slow traffic stream with no more than one lane in either direction or are on a shared road where they interact with only occasional motor vehicles (as opposed to a stream of traffic) with a low speed differential. Where cyclists ride alongside a parking lane, they have operating space outside the zone into which car doors are opened. Intersections are easy to approach and cross. |
| Level Of Traffic Stress 2 | Presenting little traffic stress and therefore suitable for most adult cyclists but demanding more attention than might be expected from children. On links, cyclists are either physically separated from traffic, or are in an exclusive bicycling zone next to a well-confined traffic stream with adequate clearance from a parking lane, or are on a shared road where they interact with only occasional motor vehicles (as opposed to a steam of traffic) with a low speed differential. Where a bike lane lies between a through lane and a right-turn lane, it is configured to give cyclists unambiguous priority where cars cross the bike lane and to keep car speed in the right-turn lane comparable to bicycling speed. Crossings are not difficult for most adults. |
| Level Of Traffic Stress 3 | More traffic stress than LTS 2, yet markedly less than the stress of integrating with multi-lane traffic, and therefore welcome to many people currently riding bikes in American cities. Offering cyclists either an exclusive riding zone (lane) next to moderate-speed traffic or shared lanes on streets that are not multi-lane and have moderately low speed. Crossings may be longer or across higher-speed roads than allowed by LTS 2, but are still considered acceptably safe to most adult pedestrians. |
| Level Of Traffic Stress 4 | Most stressful. A level of stress beyond LTS 3 |

Source: Mekuri, Firth and Nixon, *Mineta Transportation Institute* 2012.

The Mineta Study indicates that identifying tolerance for stress (such as Geller’s Four Typologies), rather than skill (such as AASHTO and FHWA), has more utility in bicycle network planning. This method is consistent with studies that show people’s increasing affinity for low-stress bicycling environments and indicate that perceived traffic danger is the chief impediment to bicycling.

To illustrate the application of the rating system, **Table 2-3** from the Mineta Transportation Institute study shows the increase level of stress that is felt by a bicyclist in crossing varying widths of streets at varying traffic speeds.



Table 2-3. LTS Criteria for Mixed Traffic (Bike and Vehicle)

| Speed Limit | Street Width | | |
|--------------|--------------|-----------|----------|
| | 2-3 Lanes | 4-5 Lanes | 6+ Lanes |
| Up to 25 mph | LTS 1 | LTS 3 | LTS 4 |
| 30 mph | LTS 2 | LTS 4 | LTS 4 |
| 35+ mph | LTS 4 | LTS 4 | LTS 4 |

Source: Mekuri, Firth and Nixon, Mineta Transportation Institute 2012.

In application, the Mineta study established that design and infrastructure improvements can reduce the level of traffic stress in a particular location, such as a street crossing. The comparison in **Table 2-4**, which was published in the research, is an example demonstrating that the addition of a crossing island has a significant reduction on the level of traffic stress for speeds of traffic less than 30 mph.

Table 2-4. LTS For Unsignalized Road Crossing With and Without Crossing Island

| Speed Limit | Without Crossing Island | | | With Crossing Island | | |
|--------------|-------------------------|-----------|----------|----------------------|-----------|----------|
| | Up to 3 Lanes | 4-5 lanes | 6+ lanes | Up to 3 Lanes | 4-5 lanes | 6+ lanes |
| Up to 25 mph | LTS 1 | LTS 2 | LTS 4 | LTS 1 | LTS 1 | LTS 2 |
| 30 mph | LTS 1 | LTS 2 | LTS 4 | LTS 1 | LTS 2 | LTS 3 |
| 35+ mph | LTS 2 | LTS 3 | LTS 4 | LTS 2 | LTS 3 | LTS 4 |
| 40+ | LTS 3 | LTS 4 | LTS 4 | LTS 3 | LTS 4 | LTS 4 |

Source: Mekuri, Firth and Nixon, Mineta Transportation Institute 2012.

The conclusion of the Mineta study was that people have varying levels of tolerance for traffic stress, which is comprised of perceived level of safety and other stress impacts such as pavement quality, vehicle noise, vehicle exhaust, crime, etc. Although there is small segment of the population willing to share a busy arterial street with large trucks, buses, fast speeds and heavy traffic volume, many people are “traffic intolerant” and are only willing to tolerate a small degree of traffic stress.

Reducing the perceived level of danger felt by bicyclists and walkers and encouraging more people to walk or bike in Buckeye is the foundational goal of the BPMP. The BPMP provides for separate facilities on parkway and arterial streets and identifies improvements that can increase the perception of safety such as bike boxes, striped buffers, median crossing refuge areas, and street bulb-outs which is further discussed in Chapter 4 of this BPMP. The best practices referenced herein were incorporated into the bicycle and pedestrian network and design standards to support the broad vision and goals of the BPMP.



3. Plan Influences

Buckeye’s future bicycle and pedestrian network is influenced by existing plans and conditions in the city. This Chapter addresses elements that influenced the development of the BPMP including relevant studies, existing/planned development, the existing bicycle and pedestrian network, corridor opportunities, and trip generators (origin and destinations).

Relevant Plans and Studies

Buckeye has adopted plans and studies that describe the general framework related to the future bicycle and pedestrian network. Additionally, regional agencies and surrounding jurisdictions have also adopted plans that influence the Buckeye network.

Imagine Buckeye 2040 General Plan

The vision of a safe and connected bicycle and pedestrian network in Buckeye has its origin in the Imagine Buckeye 2040 General Plan, ratified by voters in 2018. The goals, policies, and strategies of the Imagine Buckeye 2040 General Plan established a course of action resulting in the development of this Bicycle and Pedestrian Master Plan.

Buckeye Transportation Master Plan

The Buckeye Transportation Master Plan (TMP) provides long-term guidance for the planning of roadway, transit, rail, freight, aviation, intelligent transportation systems and non-motorized transportation projects through the buildout of the City’s Municipal Planning Area (MPA). The TMP was developed in concert with Imagine Buckeye 2040 General Plan allowing for a seamless link between land use and transportation infrastructure decisions for the City.

The TMP includes a chapter on active transportation in Buckeye addressing non-motorized methods of transportation, including walking and bicycling. Chapter 4, Active Transportation, of the TMP recommends the creation of a Bicycle and Pedestrian Master Plan. The following points were listed for the basis of a Bicycle and Pedestrian Master Plan:

- ▶ The Bicycle and Pedestrian Master Plan should provide best practice guidance for long-term implementation including identifying where on-street facilities are needed in the arterial and collector network, identifying the

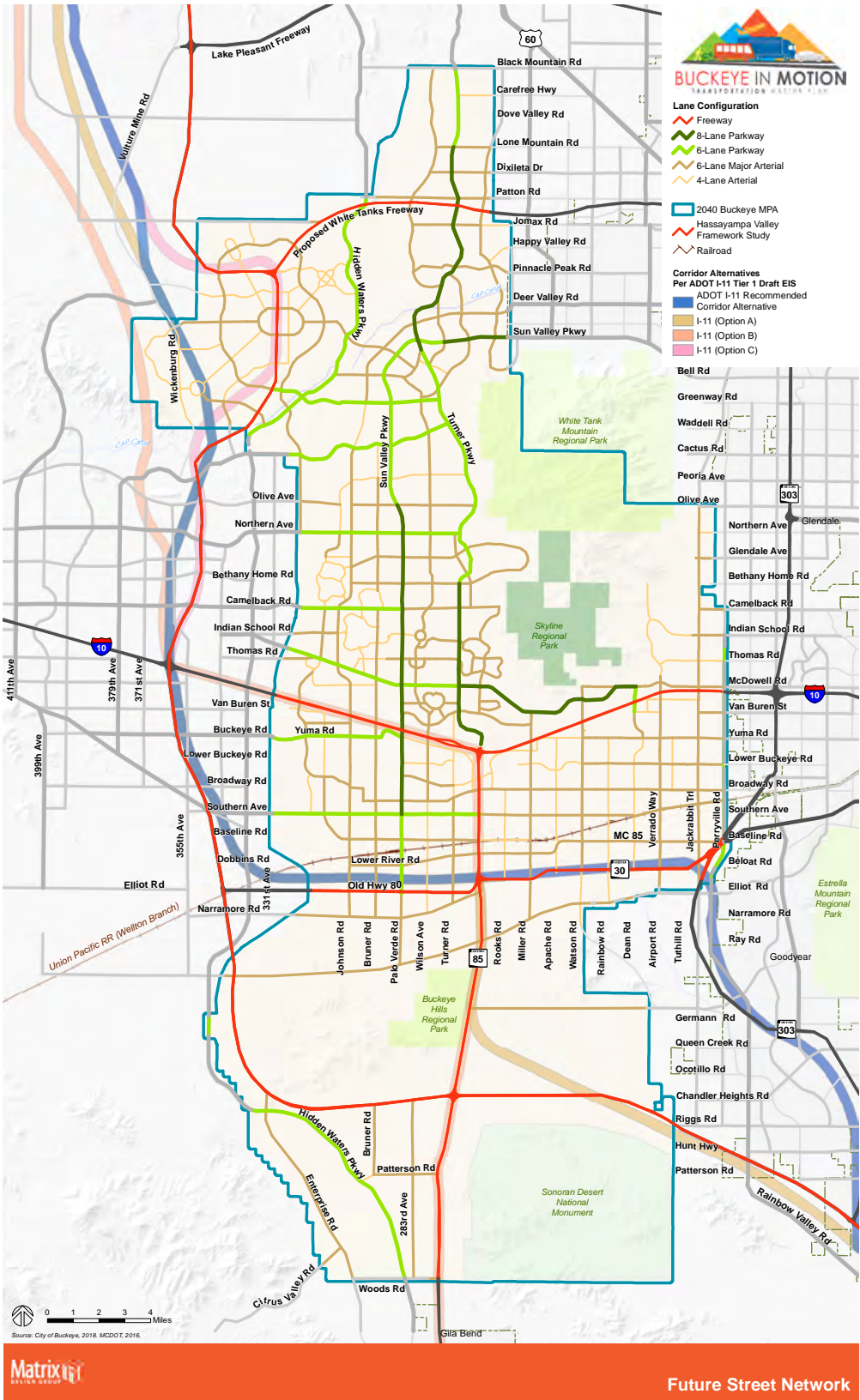


type of facility recommended, and identifying a variety of cross-sections to be implemented throughout the changing landscape of Buckeye.

- ▶ In the Bicycle and Pedestrian Master Plan, locations of planned off-street facilities should be identified to determine which off-street facilities are already planned for the future. In areas where off-street facilities are not planned, Wildlife Linkages, powerline corridors, irrigation corridors, washes, channel, and the Buckeye Parks and Recreation Master Plan should provide best practice guidance including typical cross-sections and safe roadway crossing designs.
- ▶ The TMP noted that the Bicycle and Pedestrian Master Plan should identify the following:
 - Targeted improvements in areas where the City should pursue additional funds to execute design improvements.
 - Best practices in roadway crossings as well as transit accessibility improvements to support a truly multimodal network and address safety concerns at locations with pedestrian- and bicycle-involved crashes that resulted in serious injuries or fatalities.
 - A signage program to be implemented in phases or over time as areas of Buckeye are developed.

The framework for the bicycle/pedestrian network in the BPMP is based on the recommended street network shown in the Buckeye Transportation Master Plan (TMP) and is shown on **Figure 3-1**.

Figure 3-1: Future Street Network





City of Buckeye Parks and Recreation Master Plan

The City of Buckeye adopted the Parks and Recreation Master Plan in 2016, which established a framework for parks, paths, trails, and open spaces in Buckeye. The plan established a robust network of planned trail and path facilities along washes, rivers, canals, utility corridors, and open space areas. This network was used as the framework for the off-street bicycle and pedestrian network in the Imagine Buckeye 2040 General Plan. The 2016 Parks and Recreation Master Plan established path and trail classifications, which were integrated into the formation of this BPMP. Table 3-1 provides the path and trail facility types, widths, and surface characteristics.

Table 3-1. Parks and Recreation Master Plan, Pathways & Trails Classifications and Guidelines

| Areas | Path / Trail Name | Path Width | Surface | Parallel Trail Width | Parallel Surface | Recommended Easement Width |
|--|--------------------|------------|---------------------------------------|----------------------|---------------------------------------|--|
| Paths/Trails in Urban/Suburban Areas | Primary Path | 12' | Concrete | 4' | Stable & Compacted Decomposed Granite | 35' – 50' |
| | Secondary Path | 10' | Concrete or Asphalt | | None required | 25' – 40' |
| | Accessible Trail | 8' | Stable & Compacted Decomposed Granite | | None Required | 20' |
| Trails in Areas with Topographic Constraints or Regional Parks & Preserves | Primary Trail | 5' | Natural Surface | | None Required | Archeological Surveys Should Be Conducted 25' off both sides of flagged trail centerlines in areas not previously surveyed, if applicable. |
| | Frontcountry Trail | 4' | Natural Surface | | None Required | |
| | Backcountry Trail | 32'' | Natural Surface | | None Required | |
| | Summit Trail | 28'' | Natural Surface | | None Required | |

Source: City of Buckeye Parks and Recreation Master Plan, 2016.

Chapter 3: Plan Influences

Pathways and Trailheads

The Parks and Recreation Master Plan indicated areas for locations of pathways and trailheads. Pathways and trails should be established adjacent to the following natural and manmade linear corridors whenever possible with partnerships:

- ▶ Gila River (El Rio)
- ▶ Hassayampa River
- ▶ Significant Washes, such as Waterman Wash, Rainbow Wash
- ▶ Utility Corridors including power lines and gas lines
- ▶ Buckeye Irrigation District Canal (BWCCD)
- ▶ Roosevelt Irrigation District Canal (RID)
- ▶ BWCCD South Extension Canal
- ▶ Arlington Canal
- ▶ Beardsley Canal
- ▶ Central Arizona Project Canal (CAP)
- ▶ Flood Control Structures

For certain linear features, such as rivers, washes and power line corridors, pathways and trails may be required along both sides of the feature if wider than 150 feet from top of bank to top of bank, or from edges of easements.

Buckeye Street Planning and Design Criteria (Engineering Design Standards)

This provides design guidance on street classifications, design criteria, intersection design, street geometry, and final plans preparation. This document outlines the following street planning and design guidelines that apply to bicycle and pedestrian transportation modes:

- ▶ Street Planning Design Criteria
- ▶ Street Classifications
- ▶ Sidewalks

MCDOT Active Transportation Plan

The Maricopa County Department of Transportation (MCDOT) updated its Active Transportation Plan (ATP) in 2018, which replaces the 1999 Bicycle Transportation System Plan. The MCDOT Active Transportation Plan identifies both pedestrian and bicycle facility needs throughout the county, including the unincorporated areas in Buckeye, which were outlined in the Buckeye Transportation Master Plan and contributed to the active transportation recommendations in the TMP. These bicycle and pedestrian facility needs will need to be incorporated into the larger Buckeye bicycle and pedestrian network.

MAG Active Transportation Plan

MAG is currently in the process of creating an Active Transportation Plan, which will be a regional plan that will guide a regional bicycle and pedestrian network. The Plan will identify potential new routes and investments for bicycle and pedestrian connections. The MAG Active Transportation Plan recommendations are anticipated in 2019.



Adjacent Jurisdictions Bicycle and Pedestrian Plans

The City of Buckeye is a large landmass that borders several jurisdictions such as Surprise, Glendale, Gila Bend, and Goodyear. Rapid population growth and complex spatial relationships require thorough analysis to develop a successful Bicycle and Pedestrian Master Plan. Understanding plans for bicycle and pedestrian networks in surrounding jurisdictions is important to continue connectivity through Buckeye.

Presently, the City of Surprise is in the process of drafting an Active Transportation Plan, which will include planning for the bicycle and pedestrian network in the city. The Surprise Active Transportation Plan is scheduled to be completed in 2019. The City of Glendale is also in the process of developing an Active Transportation Plan, which is slated for completion in 2019.

The City of Goodyear does not have a standalone bicycle and pedestrian master plan; however, in 2014, the City adopted a Transportation Master Plan and a Parks, Recreation, Trails and Open Space Master Plan, which include planning for pedestrian and bicycle facilities. The Parks, Recreation, Trails and Open Space Master Plan includes proposed trails and paths, some of which directly abut Buckeye. These paths and trails were also incorporated into the 2014 Transportation Master Plan, which included additional on-street facilities.

The Town of Gila Bend also does not have a plan specifically for a bicycle and pedestrian network; however, bicycle and pedestrian facility policies are included in the 2017 General Plan. There are trails that are planned to extend north into Buckeye, along the Gila River and the Sonoran Desert National Monument.

Planned Land Uses

Planned land uses outline the areas where there will be future development. This will help guide where the bicycle and pedestrian network will be needed to provide connections. Land uses in Buckeye are planned through the Imagine Buckeye 2040 General Plan and through community master plans (CMP's).

Imagine Buckeye 2040 General Plan

The Imagine Buckeye 2040 General Plan identifies future land uses (**Figure 3-2**) that will guide future growth and development throughout the Buckeye Municipal Planning Area (MPA). The policies in Imagine Buckeye 2040 General Plan support active transportation as compatible with various land uses in Buckeye, one of which is Open Space. There are many policies in the Imagine Buckeye 2040 General Plan that promote the use of paths and trails to provide links to different open spaces in the city. There is also a need expressed in the Imagine Buckeye 2040 General Plan to provide connectivity between neighborhoods and neighborhood destinations, such as commercial areas. This makes both Residential and Business Commerce land uses compatible with active transportation. Additionally, the Imagine Buckeye 2040 General Plan identifies Activity Centers, where mixed land uses would be appropriate, as centers that should be connected. These Activity Centers should also have bicycle and pedestrian connectivity where appropriate.

Figure 3-2: Imagine Buckeye 2040 General Plan, Future Land Use

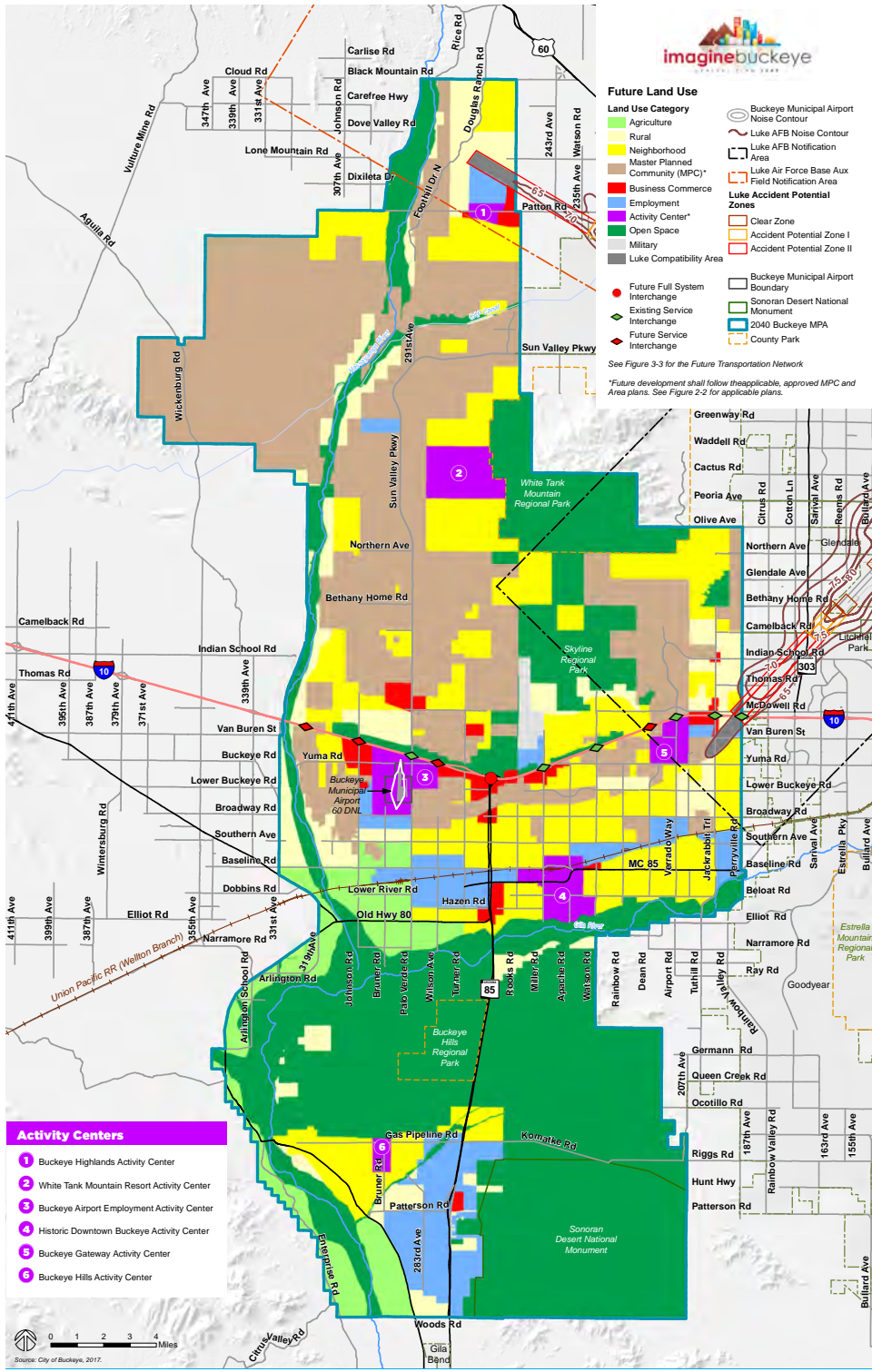


Figure 2-3

Future Land Use



Community Master Plans

Buckeye has a total of 26 community master plans (CMPs), comprising 45% of the land zoned. The CMPs are shown on **Figure 3-3**. The ten largest CMPs in terms of acreage are listed on **Table 3-2**. These communities have not all been fully developed; however, the zoning for these CMPs indicate where significant growth will occur. Understanding where development will occur and the intensity of future development is important in projecting where the future bicycle and pedestrian network is needed. For example, any of the CMPs planning for open space areas and public schools are creating destinations where the bicycle and pedestrian network should connect.

In addition to land use, the street network for each CMP will also influence the bicycle and pedestrian network. The bicycle and pedestrian network is most suitable for collector streets, making it important to understand where collector roads are planned within CMPs to ensure that there is adequate connectivity throughout the city. Additionally, many communities have trails and pathways planned for their community to serve those residents.

Table 3-2. Top Ten Community Master Plans in Buckeye

| Development | Total Acres |
|------------------|-------------|
| Douglas Ranch | 33,810 |
| Sun Valley | 16,266 |
| Sun Valley South | 11,193 |
| Festival Ranch | 10,105 |
| Verrado | 8,800 |
| Tartesso West | 5,560 |
| Elianto | 3,931 |
| Tartesso | 3,186 |
| Trillium West | 3,042 |
| Spurlock Ranch | 2,840 |

Source: City of Buckeye, 2016.

Chapter 3: Plan Influences

Figure 3-3: Imagine Buckeye 2040 General Plan, Approved Master Planned Communities and Area Plans

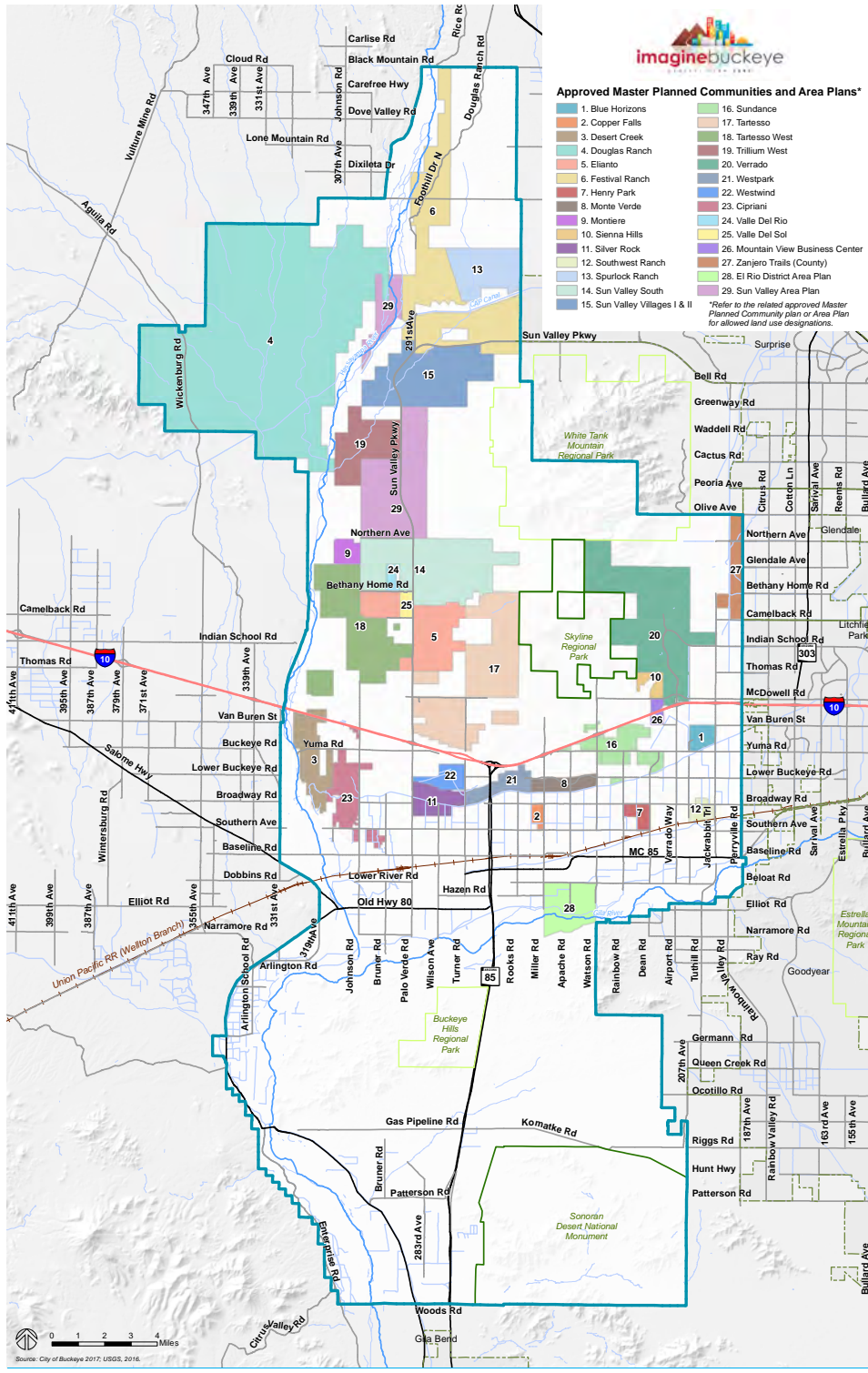


Figure 2-2 Approved Master Planned Communities and Area Plans

Buckeye Demographic Profile

In 2017, the population was 62,090, and as noted in the Imagine Buckeye 2040 General Plan, the population is expected to grow to 310,800 by 2040. This increase in population will contribute to population density, making it necessary to plan for a bicycle and pedestrian network that serves the recreational and commuting needs of the population.

As Buckeye plans for growth, it is also important to know the age groups that are represented in Buckeye. Age distribution is important as different age groups may have different needs for the bicycle and pedestrian network. In 2017, it was estimated that the median age was 33.5. **Figure 3-4** shows the distribution of residents within age ranges. As shown on the chart, the 25-34 and 35-44 age range has the greatest representation in Buckeye. There is also a high distribution of residents that are under the age of 20 and between the ages of 65-74.

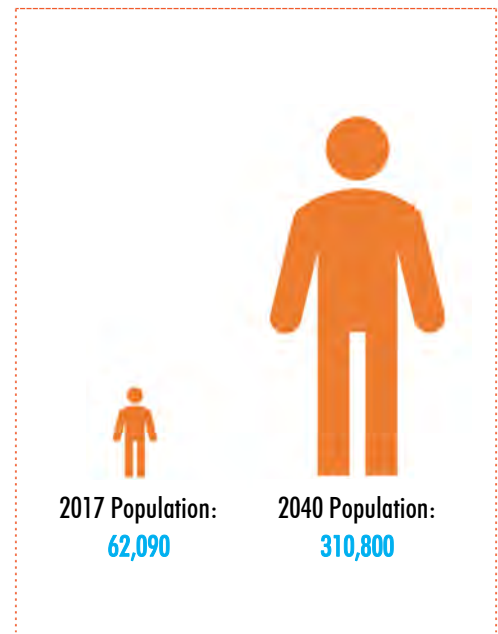
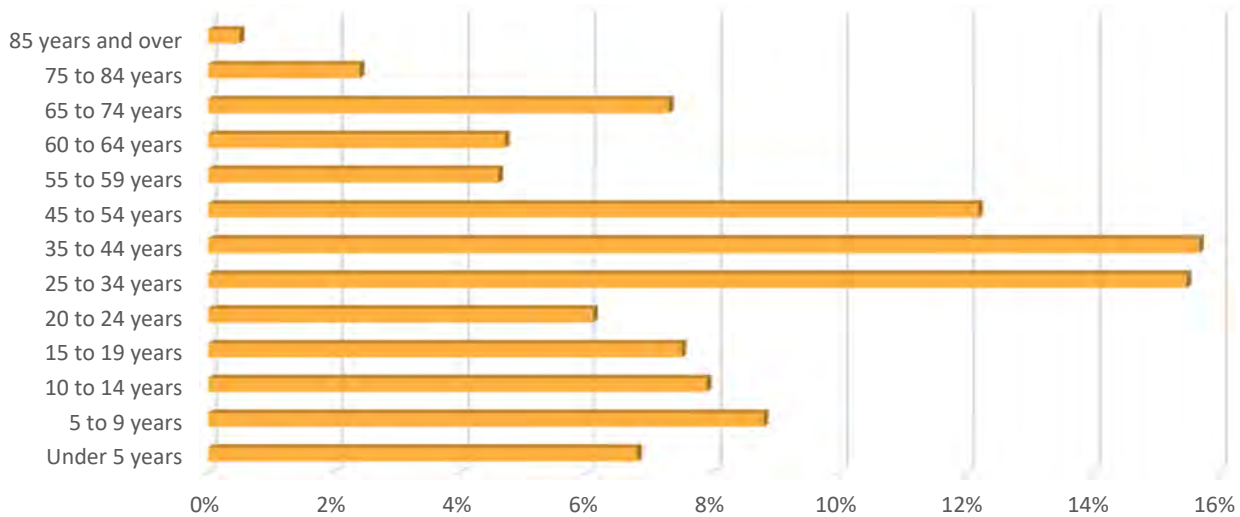


Figure 3-4: Buckeye Age Distribution, 2017



Source: American Community Survey, 2017.

Corridor Opportunities

A number of natural and man-made features provide a significant opportunity for path and trail development throughout Buckeye. These corridor opportunities are linear elements that traverse the community such as a powerline corridor, canal, or wash corridor. Path and trail development in these man-made or natural corridors also must accommodate dual-use of the corridor to provide for maintenance access to the facility. This section identifies the primary corridor opportunities which were evaluated and incorporated into the BPMP.

White Tanks Mountains

The White Tanks Mountains is comprised of two parks; Maricopa County's White Tank Mountain Regional Park in the north half of the mountain range and containing 30 miles of shared-use trails and 2.5 miles of pedestrian-only trails. In the south half of the mountain range is the Skyline Regional Park, operated by the City of Buckeye and containing 22 miles of shared-use trails.

River Corridors

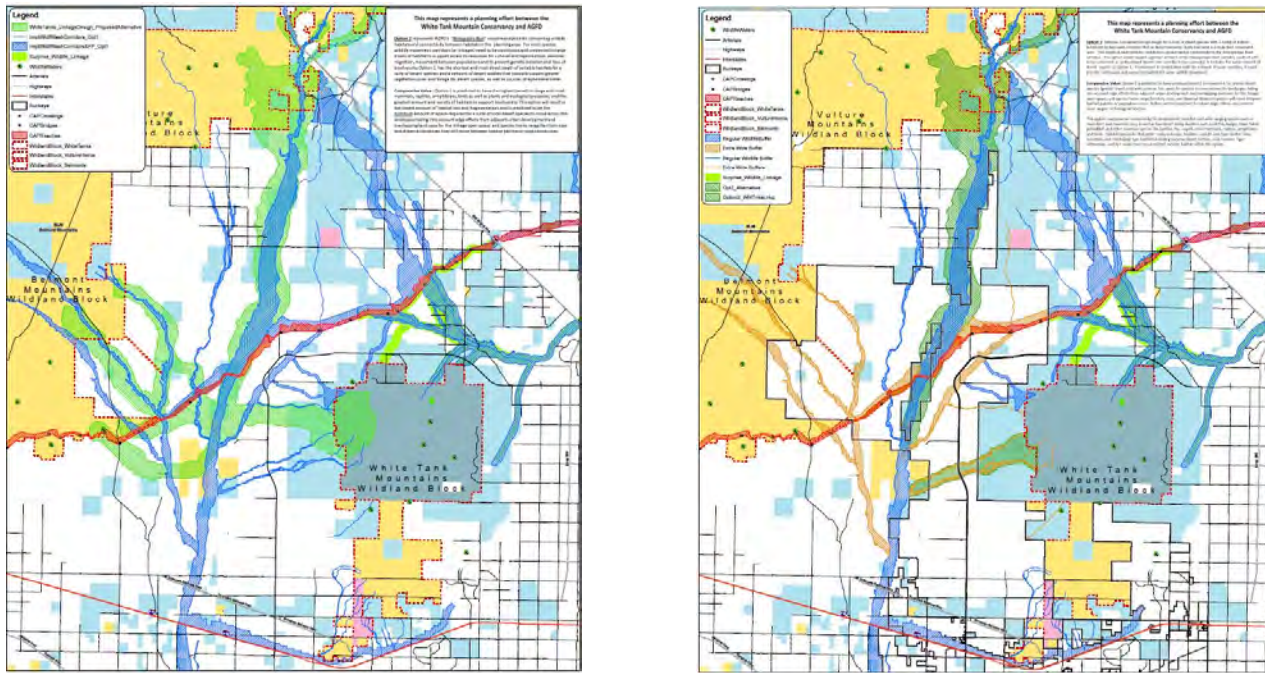
Buckeye is traversed by two primary watercourses; the Hassayampa River and the Gila River. The Gila River runs east west through the south-central portion of Buckeye. The Hassayampa River runs north south along the western-most portion of Buckeye.

Wildlife Corridors

In addition to trails throughout Buckeye, there are corridors that provide connectivity for wildlife habitats. The Arizona Game and Fish Department and the White Tank Mountains Conservancy created two Wildlife Linkage options for connecting wildlife habitats and supporting the movement of wildlife between the White Tank Mountains, the Hassayampa River, and the Gila River. The focus of the linkage options is to overlap and utilize important wash corridors. One option recommends conserving wildlife habitats and connectivity between habitats to support species survival and reproduction, migration, movement between populations, and biodiversity. The second option provides upland habitat connectivity to the Hassayampa River corridor. Both options are shown on **Figure 3-5**.

These wildlife corridors should be considered during planning and construction of bicycle and/or pedestrian facilities in proximity to these mapped wildlife corridors to ensure that habitat connectivity is accommodated practically; furthermore, the potential for recreational non-motorized trails along these corridors provide for passive recreational use while conserving critical habitats.

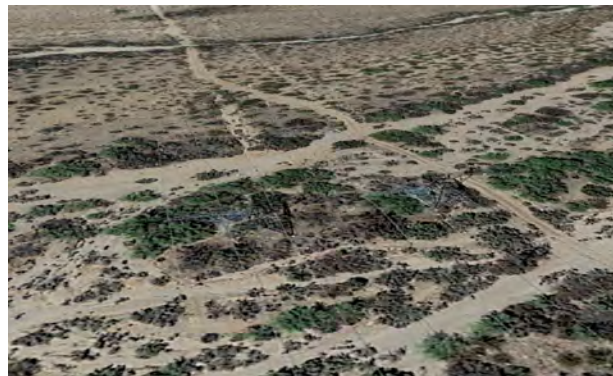
Figure 3-5: Wildlife Linkage Option 1 & Option 2



Source: Arizona Game and Fish Department, 2015.

Powerline Corridors

The 2016 Buckeye Parks and Recreation Master Plan identified powerline corridors as appropriate places for the construction of Accessible Trails, which are made from stabilized decomposed granite. Powerline corridors are generally compatible with Accessible Trails due to limitations that utility companies have on the development that can occur below the powerlines. Powerline Wash is an example of an existing 230 kilowatts (kV) powerlines in Buckeye where powerlines cross wash corridors.



Powerline Wash

Central Arizona Project

Canals are existing corridors that can serve as corridors for trails and pathways due to their linear nature. The Central Arizona Project Canal (CAP) traverses throughout the valley. CAP has an ongoing program for a trail corridor plan along the canal. The trail is characterized as long distance, non-motorized, and being multi-use. The trail is planned to be constructed along the entirety of the CAP canal, which is 336 miles long. The CAP trail is built in partnership with municipal, county, and tribal agencies, all which sponsor the portion of the trail that runs through the respective jurisdiction. Currently, the portion of the CAP canal that has trail already constructed is between Scottsdale and Phoenix; however, Buckeye has the opportunity to construct the segment of the CAP canal that falls within the Buckeye MPA. This portion of the canal would run in a general east/west orientation through the northern end of the city, north of Sun Valley Parkway.

Irrigation Canals

Irrigation canals, in Buckeye are owned and operated by private irrigation districts. There are many existing canals existing in Buckeye, including:

- ▶ Buckeye Water Conservation & Drainage District (BWCCD)
- ▶ Roosevelt Irrigation District Canal (RID)
- ▶ BWCCD South Extension Canal
- ▶ Arlington Canal
- ▶ Beardsley Canal

These canals run in a generally linear orientation, making them opportune for trails and pathways if coordinated with the irrigation districts. If the City of Buckeye is unsuccessful in developing an inter-governmental agreement with the respective entity, paths and trails will be located adjacent to the canal on private property with public access trail easements. Developers would be responsible for constructing their applicable portion. Paths and trails along irrigation canals can serve as a dual purpose providing for trail and facility maintenance access.

Washes

There are many washes and channels that run through Buckeye. While these washes do not contain water year-round, the intermittent water supply creates riparian and ecological resources. Because washes create their own natural corridor, there is an opportunity to establish trails to follow the wash corridors in a way that is least disruptive to the wildlife that utilize the washes. The following are washes in Buckeye:

- ▶ Wagner Wash
- ▶ Powerline Wash
- ▶ Jackrabbit Wash
- ▶ Skyline Wash
- ▶ Rainbow Wash
- ▶ Sun Valley Area Drainage
- ▶ Buckeye Area Drainage



Trip Generators

Origin and destination information help to determine where trips are generated and where trips need to reach.

Understanding areas within Buckeye that have the highest opportunity for active transportation trips is important for developing the network. These locations are shown on **Figure 3-6** mapped and utilized in the creation of the bicycle and pedestrian network in the BPMP and include the following:

Areas of Planned Growth

Planned land uses as provided on the Future Land Use Map of the Imagine Buckeye 2040 General Plan were mapped to identify higher density residential, higher intensity non-residential areas, and planned mixed-use areas that would generate trips to the bicycle and pedestrian network. Adopted Community Master Plans were also mapped and reflected in the development and refinement of the planned bicycle and pedestrian network.

Planned Employment Centers

The locations of major future employment centers, as established on the Future Land Use Map of the Imagine Buckeye 2040 General Plan, were integrated into the planned bicycle and pedestrian network as potential destinations for bicycle and pedestrian trips.

Activity Centers

The Imagine Buckeye 2040 General Plan establishes six Activity Centers, which denote live, work and play areas that are vibrant mixed-use areas providing destination locations. These community areas include entertainment, research and development, employment, accommodations and other community focal areas. These six Activity Centers include Buckeye Highlands, White Tank Mountain Resort, Buckeye Airport Employment, Buckeye Gateway, Historic Downtown Buckeye and Buckeye Hills.

Schools

Bicycling or walking to school can be an option for students. There are currently four charter schools, 16 elementary schools, one middle school, and four high schools within the Buckeye MPA, which were integrated into the future bicycle and pedestrian network as trip generators for school aged residents. As of 2016, there were over 16,000 students that attended these schools.

Community Facilities

Community facilities include libraries, the community center and recreation center, and government services where community members are likely to visit. Currently, community facilities are located south of I-10 and east of SR 85. These facilities should have bicycle and pedestrian connectivity between each facility as well as with the surrounding neighborhoods to ensure that residents have optimal access to city services.

Parks

Parks in Buckeye include regional and local parks. Local parks, such as pocket or neighborhood parks are generally located within neighborhoods, while community parks such as Sundance Park are conveniently accessible from multiple neighborhoods and located along arterial or collector streets. Regional parks are within open space areas, such as Skyline Regional Park, White Tanks Mountain Regional Park, and Buckeye Hills. The variety of park types provide

a multitude of recreational amenities and should be connected to each other to create an integrated park network. These parks should also be connected to neighborhoods to provide residents access to recreation.

Transit Nodes

Existing and proposed transit stops were considered for the development of the future bicycle and pedestrian network to provide connectivity for last-mile trips. The first-last-mile describes the gap in the public transportation system where the user must travel further to their ultimate destination after they have arrived at their public transportation stopping point. This makes it necessary to provide sidewalks and paths from bus stops and transit hubs that connect to regional and local destinations as well as neighborhoods. Future transit centers and park-n-rides are proposed for areas of high activity, such as activity centers, business commerce areas, and employment areas.

Trailheads

The BPMP was designed to ensure connection of planned trailheads to trip generating uses such as parks and schools (Figure 3-6). Future bicycle and pedestrian facilities should include connections to trailheads, accounting for the primary origins and destinations identified in Table 3-3.

Table 3-3. Active Travel Origin and Destination Locations

| Origins | Destinations |
|---|---|
| ■ Population Density | ■ Schools |
| ■ Employment Density | ■ Transit Stops |
| ■ Low- and Moderate-Income Block Groups | ■ Civic Facilities (post office, library, government buildings) |
| ■ Percent who Walk, Bike, or Use Transit to Commute to Work | ■ Commercial Land Use |
| ■ Percent of Zero-Vehicle Households | ■ Parks and Open Space |
| ■ Density of Children (16 and under) | ■ Activity Centers |
| ■ Density of Seniors (65 and older) | |
| ■ Density of People with Disability | |

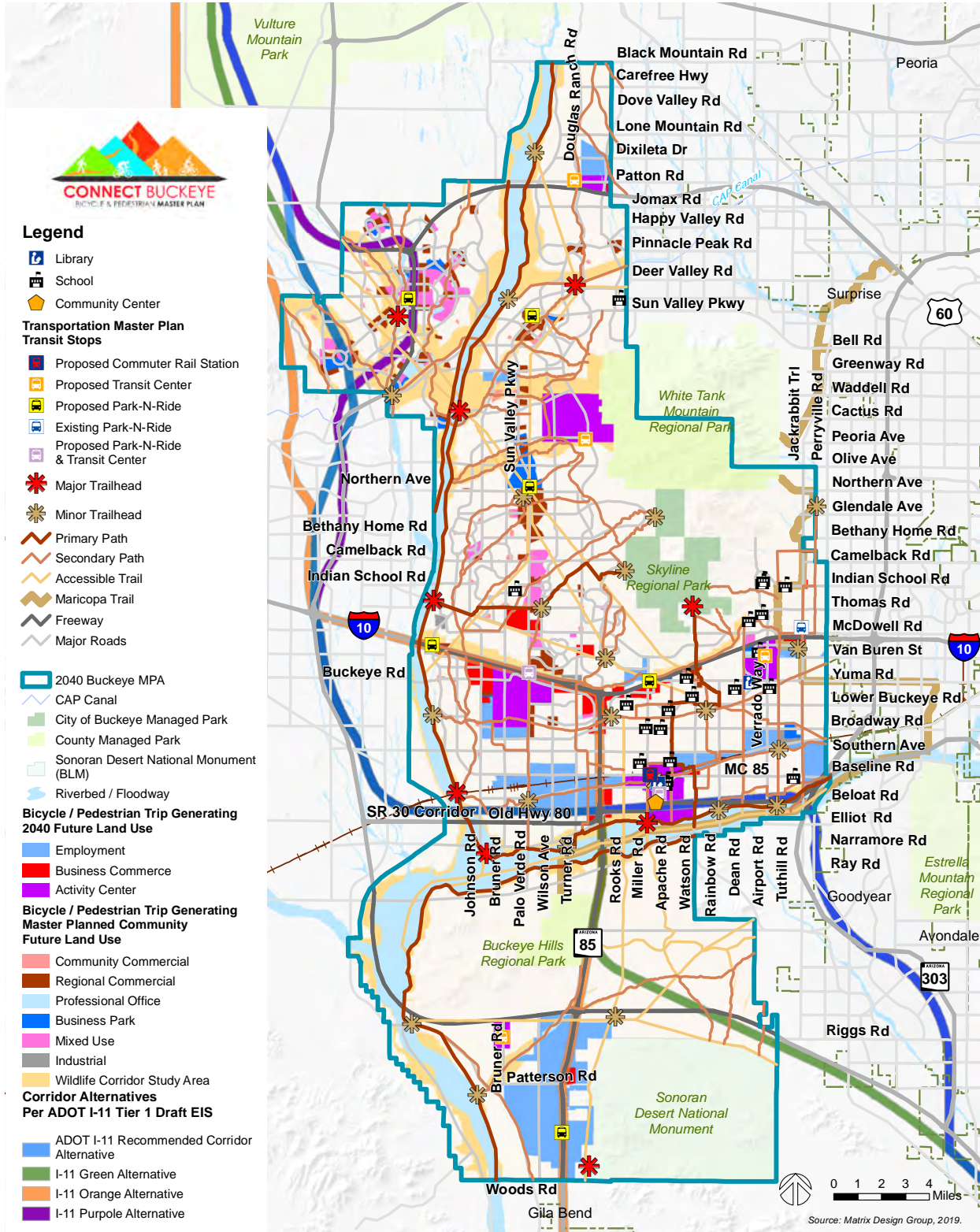


Figure 3-6

Bicycle and Pedestrian Trip Generators

Existing Bicycle and Pedestrian Network

Buckeye’s current active transportation network consists of a combination of on-street bicycle facilities, sidewalks, paths, and trails that are owned and maintained by various entities including the City of Buckeye, Maricopa County, and local homeowner’s associations (HOAs). Existing active transportation facility types in Buckeye include on-street facilities, off-street facilities, and sidewalks. **Table 3-4** lists the total miles of each facility type present in Buckeye. **Figure 3-7**, a figure from the Buckeye Transportation Master Plan, depicts this information graphically.

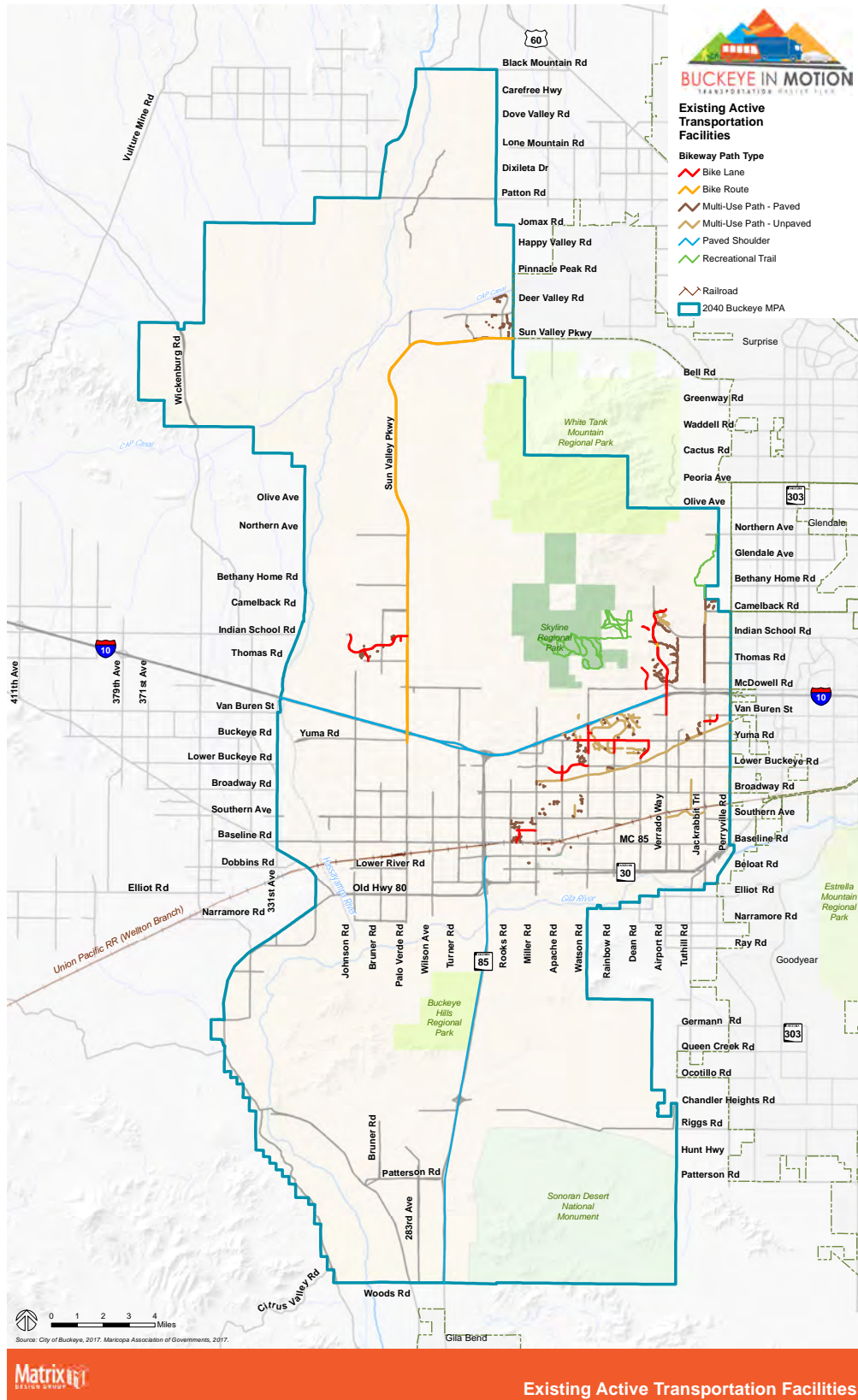
Table 3-4. Miles of Bicycle and Pedestrian Facilities

| Facility Type | Miles |
|--------------------------|-------|
| Bike Lane | 21 |
| Bike Route | 40 |
| Paved Shoulder | 50 |
| Multi-Use Path - Unpaved | 27 |
| Multi-Use Path - Paved | 24 |
| Recreational Trail | 28 |

* Sidewalks not included in table

Source: City of Buckeye, 2017.

Figure 3-7: Existing Bicycle and Pedestrian Network



Existing Trail Network

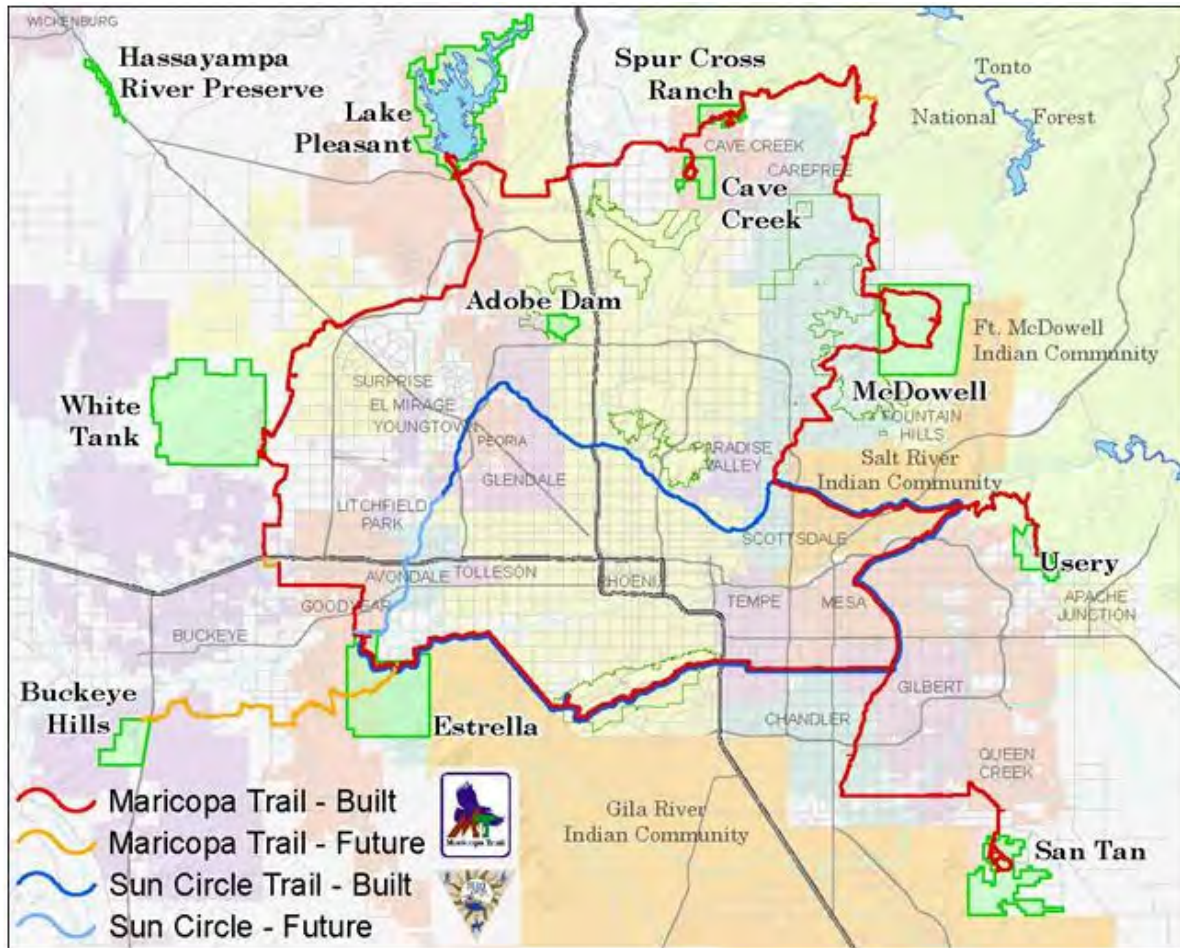
Trails are a recreational facility that have an unpaved surface treatment (i.e. crushed gravel or dirt). Trails are typically designed for recreational riders or walkers and do not serve local trip options. Trail users can include non-experienced and experienced walkers and riders (i.e. mountain bike riders and equestrians). City-owned trail facilities are limited to those in Skyline Regional Park, Sundance Park, and Earl Edgar Recreational Facility. While city-owned paths and trails are somewhat limited, several of the community master plans in Buckeye have paths or trails that connect parks and greenbelts. Additionally, Maricopa County and other regional and state entities own and maintain trails within Buckeye. In summary, trails in Buckeye can be found at:

- ▶ Skyline Regional Park
- ▶ Buckeye Hills Regional Park
- ▶ White Tank Mountain Regional Park
- ▶ Sonoran Desert National Monument

The existing trail network also includes the Maricopa Trail (**Figure 3-8**), which is a non-motorized trail, connecting all of the Maricopa County regional parks to one another. The portion of the trail in Buckeye connects the White Tank Mountains with the Estrella Mountains to the south and Lake Pleasant to the North. There is a future segment planned to connect the Estrella Mountains with Buckeye Hills.

Other existing recreational trails in Buckeye are within regional parks, such as Skyline Regional Park and the White Tank Mountain Regional Park. Unpaved multiuse paths are mainly located south of I-10 and east of SR 85 within Sundance, along the Roosevelt Irrigation District Canal, and along some portions of the Buckeye Canal. There are some unpaved pathways in Verrado as well. Most of the unpaved multiuse pathways are not connected to one another.

Figure 3-8: Maricopa Trail



Source: <https://www.maricopacountyparks.net/things-to-do/activity/maps/>

Crash Locations

As part of the development of the BPMP, bicycle and pedestrian crash data was analyzed to identify the number of pedestrian and bicycle crashes reported with an effort to determine the volume and types of crashes present in the City. The data was also analyzed to better understand the nature of the crashes, any known conditions that might have contributed to each crash, and, in the spirit of continued improvement, determine if opportunities exist for specific infrastructure improvements that could be associated with future crash reduction. The bicycle and pedestrian crash data were reviewed and there does not appear to be any trends in crash type or volume. Additionally, the crash rate appears to be consistent with other similar communities in the Southwestern United States.

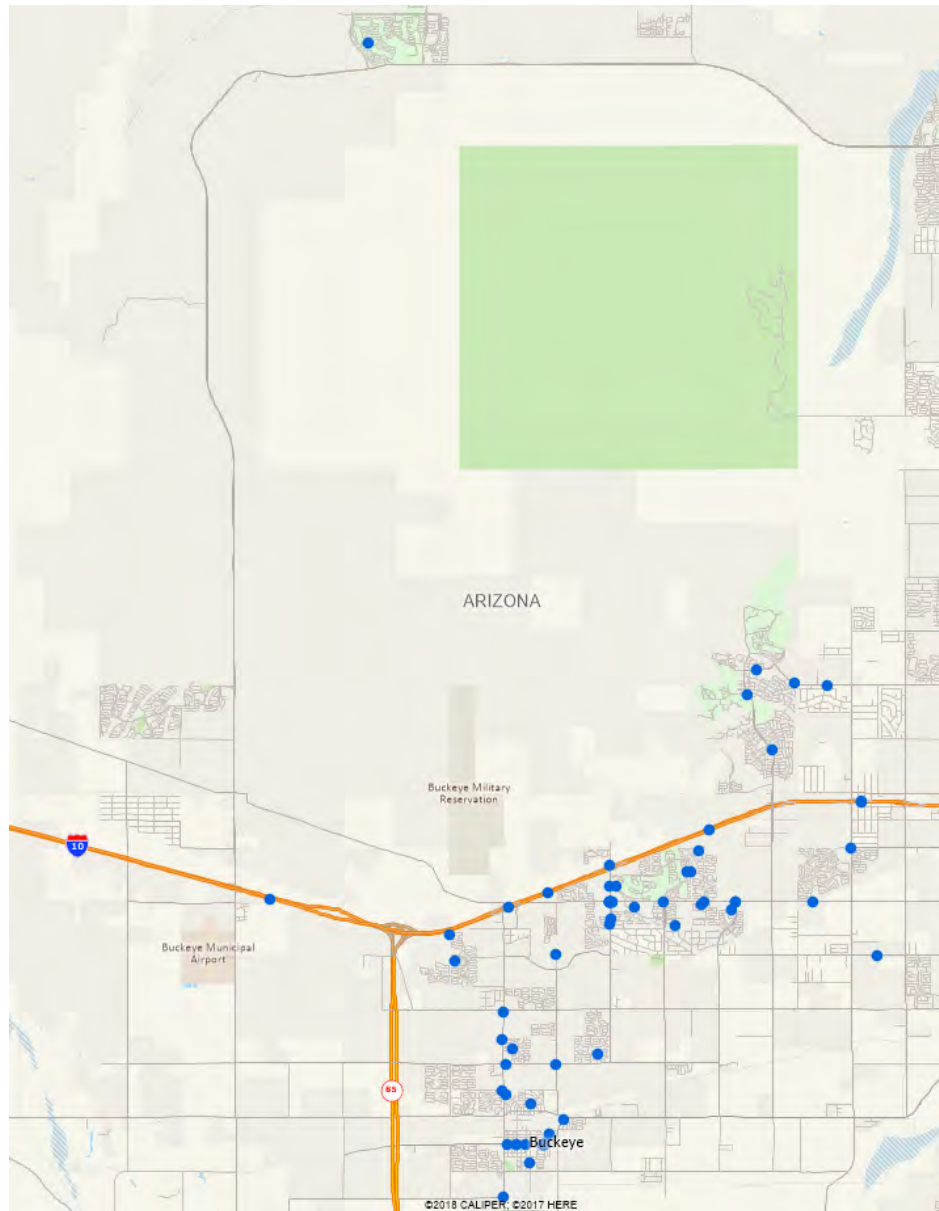
This analysis found that pedestrian and bicycle crashes were distributed throughout the City primarily along arterials with seven of the crashes occurring on Interstate 10. According to the data analyzed over the 6.6 years, 61 percent of the crashes occurred at intersections and 39 percent occurred on roadway segments (not intersection-related).

While the majority of crashes appear to be at random locations, six intersections were identified as potential locations for further study, which were further evaluated in the BPMP. Based on the analysis of reported pedestrian and bicycle crashes, these six intersections were evaluated to determine if predominate crash factors could be identified. The intersections were selected based upon multiple crashes at a same location and crash manner. Severity was reviewed as part of the selection process; however, the fatal crashes appear to be isolated incidents. **Table 3-5** presents the selected locations ranked according to highest pedestrian and bicycle crash volume. Improvements are included in Chapter 5 Implementation related to these six intersections. Appendix A provides the complete crash data analysis performed as part of the BPMP development.

Table 3-5. Selected Intersections for Further Analysis

| Intersection | Number of Crashes in Study Period |
|--------------------------------------|-----------------------------------|
| Watson Road/Yuma Road | 8 |
| Monroe Avenue/9 th Street | 3 |
| Monroe Avenue/4 th Street | 2 |
| Dean Road/Yuma Road | 2 |
| Yuma Road/Jackrabbit Trail Corridor | 1 |
| Southern Avenue/Miller Road Corridor | 1 |

Figure 3-9: Pedestrian and Bicycle Crash Sites in the City of Buckeye – January 2012 through July 2018





4. The Plan

This Chapter establishes the bicycle and pedestrian network, which is comprised of the On-Street and Off-Street networks. This chapter provides descriptions, cross sections, and a toolbox of strategies for support facilities to reduce stress and improve the function of the bicycle and pedestrian networks. The resulting Bicycle and Pedestrian Master Plan (BPMP) defines a comprehensive and integrated system of the on- and off-street bicycle and pedestrian networks, as well as the supporting facilities that enhance the user experience. Together, these systems and supporting facilities create a convenient and safe bicycle and pedestrian network suitable for all ages and abilities.

On-Street Arterial and Collector Networks

The On-Street network defines the bicycle and pedestrian network that is located within a street right-of-way on Arterial Streets (including Parkways) **Figure 4-1**, and Collector Streets **Figure 4-2**.

Arterial Street Network

The Arterial Street Network is based on the adopted Buckeye Transportation Master Plan (TMP) Future Street Plan. This plan reflects the Freeway, Parkway and Arterial Street network to serve the build out condition established by the Imagine Buckeye 2040 General Plan. The Arterial Street Network for the BPMP is shown on **Figure 4-1**.

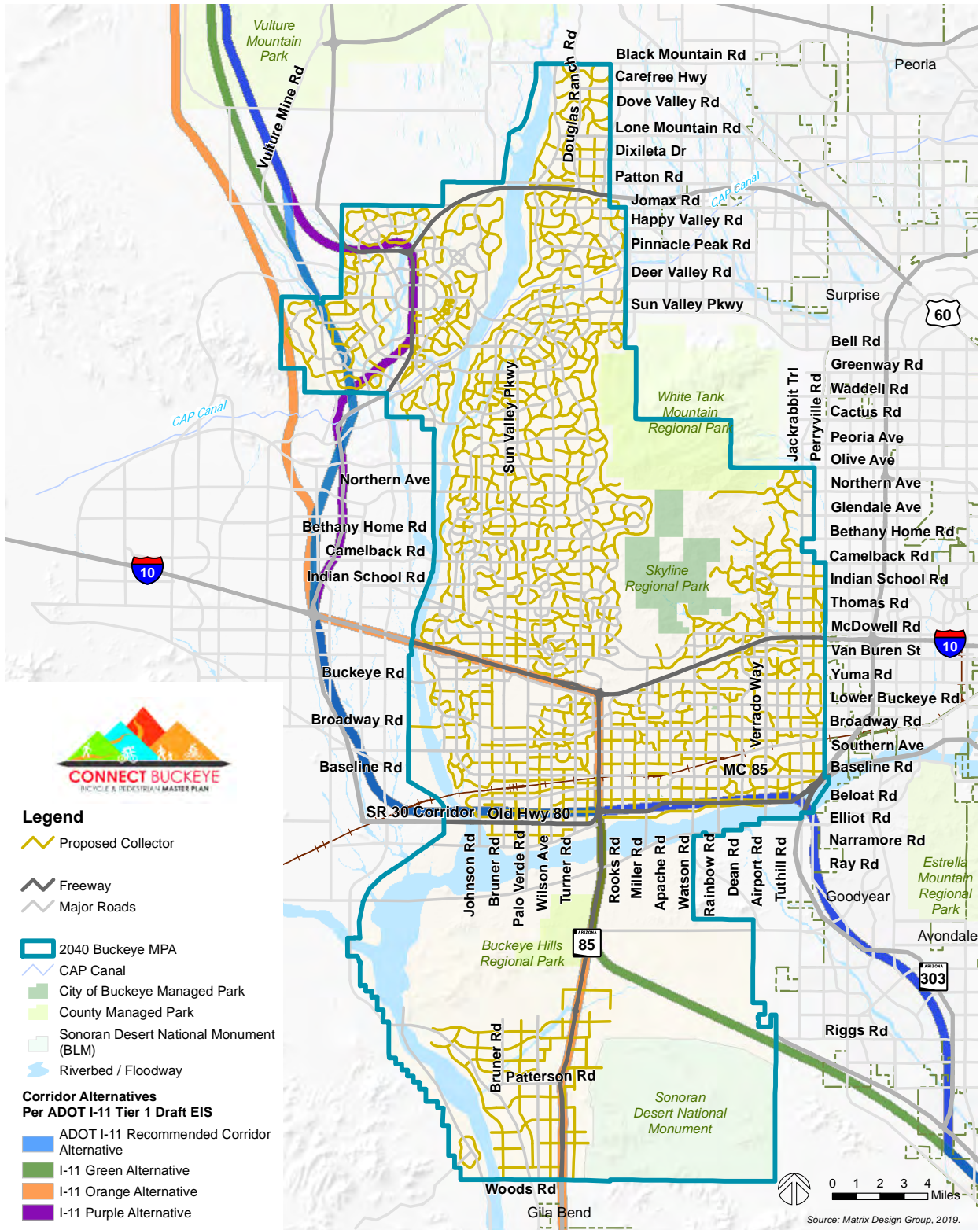
Collector Street Network

The future Collector Street network **Figure 4-2** reflects the planned Collector Streets in approved community master plans and the Imagine Buckeye 2040 General Plan. Collector Streets are shown in concept only and the specific alignment is intended to be established following review and approval a specific plan of development by the City.



Figure 4-1

On-Street - Arterial Network



Source: Matrix Design Group, 2019.



Figure 4-2
On-Street - Collector Network

On-Street Cross Sections

The On-Street bicycle and pedestrian facility types are described based on different roadway types and are depicted in the following illustrative cross sections. Specific dimensions and construction related details for these facility types are established in the Engineering Design Standards maintained and available from the City of Buckeye Engineering Department.

Parkways

Parkways provide regional connectivity and are designed for high volumes at high-speeds with limited access to accommodate the enhanced flow of vehicular traffic, typically with posted speed limits of 55 miles per hour or greater. Given the high speed and volume of traffic on Parkways, bicycle and pedestrian facilities should be separated from the roadway by a landscape buffer to reduce the level of stress and increase the perception of safety. This is consistent with public input regarding providing a buffer from high speed traffic. Pedestrians are accommodated on a separate walkway and bicyclists are provided a two-way bike path separated from both the pedestrian walkway and the Parkway. The cross section for Parkways is shown on **Figure 4-3**.

Figure 4-3: Parkway Cross Section



Arterial Streets

Similar to Parkways, Arterial Streets are intended for high volumes of traffic at high-speeds, creating a high level of stress for bicyclists. Although Arterial Streets contain high stress levels for bicyclists, there are instances where Arterials provide the best route to a destination. This may be the case where gaps exist between facilities and where direct connectivity to destinations in the community is needed. To foster a comfortable environment and reduce stress levels, bicycle facilities are separated from pedestrian facilities with a landscape buffer. A landscaped buffer between the roadway zone and pedestrian zone should also be provided to further separate pedestrians from high-speed vehicular traffic, consistent with public input received during the development of the BPMP. Two alternative cross sections are provided for Arterial Streets **Figure 4-4 and 4-5**, which will be employed dependent on-site specific conditions in different locations.

Figure 4-4: Arterial Street Cross Section (140 feet ROW)

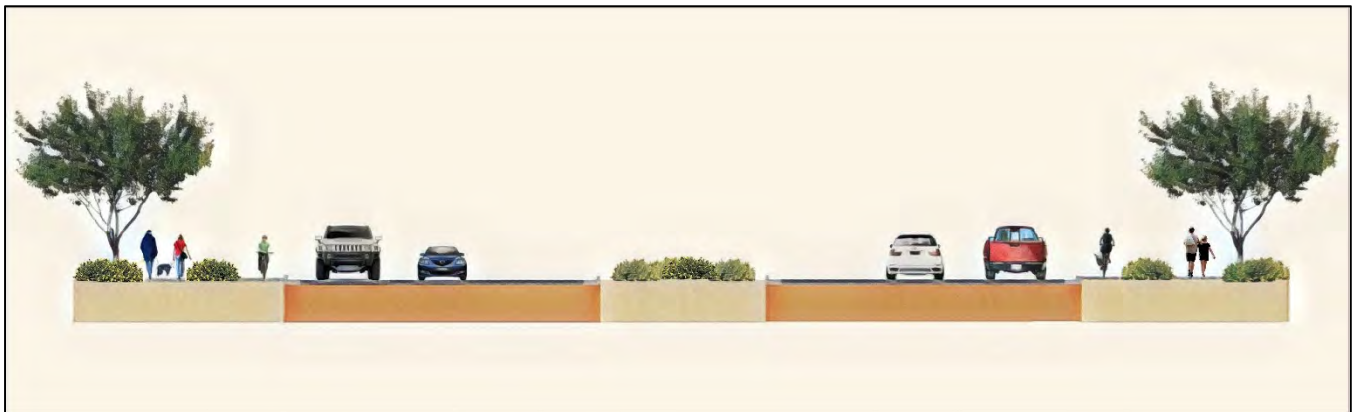
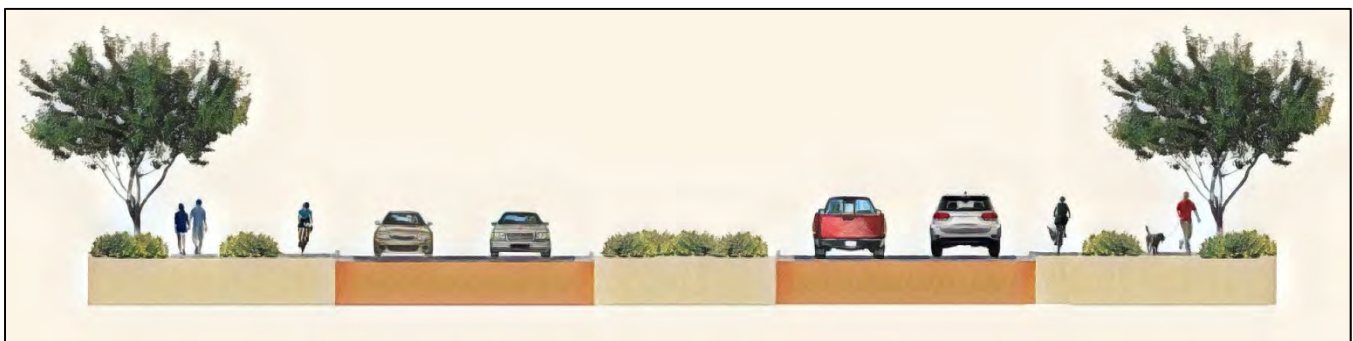


Figure 4-5: Arterial Street Cross Section (120 foot ROW)



Collector Streets

Collector Streets are intended for neighborhood connectivity and funneling traffic from residential areas to Arterial Streets and vice versa. Thus, these streets generate less traffic and at slower speeds than Arterial Streets and Parkways, making Collector Streets safer and more suitable for bike facilities. Since Collector Streets contain less traffic at slower speeds, striped bike lanes are suitable within the roadway. The Collector Street cross sections, shown on **Figures 4-6** and **4-7** provides a bike lane with a striped buffer to provide separation between vehicles and bicyclists. Pedestrians are accommodated on a detached sidewalk with a landscaped buffer from the roadway.

Figure 4-6: Collector Street Cross Section

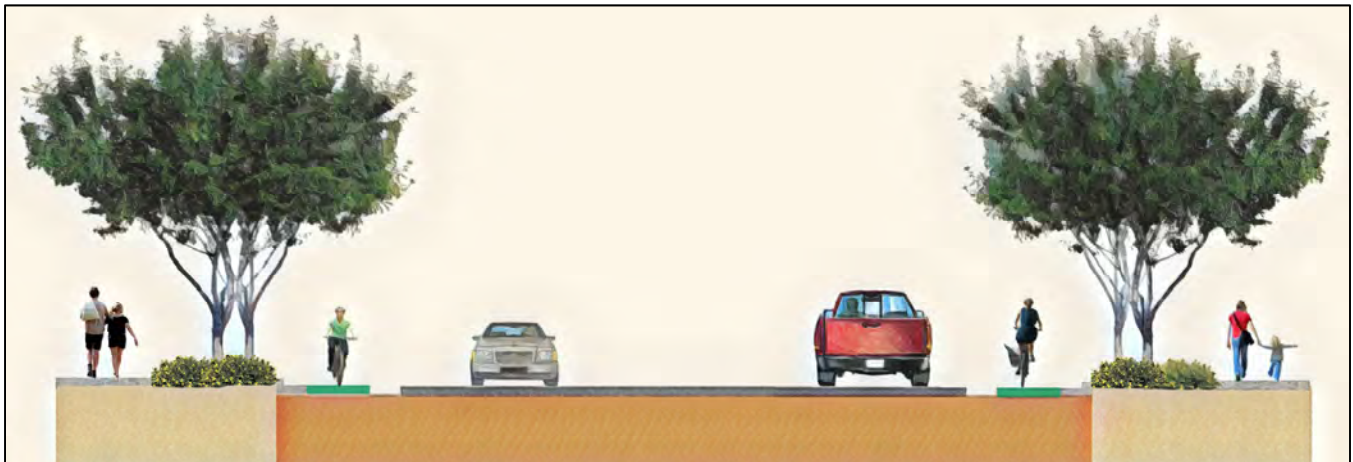
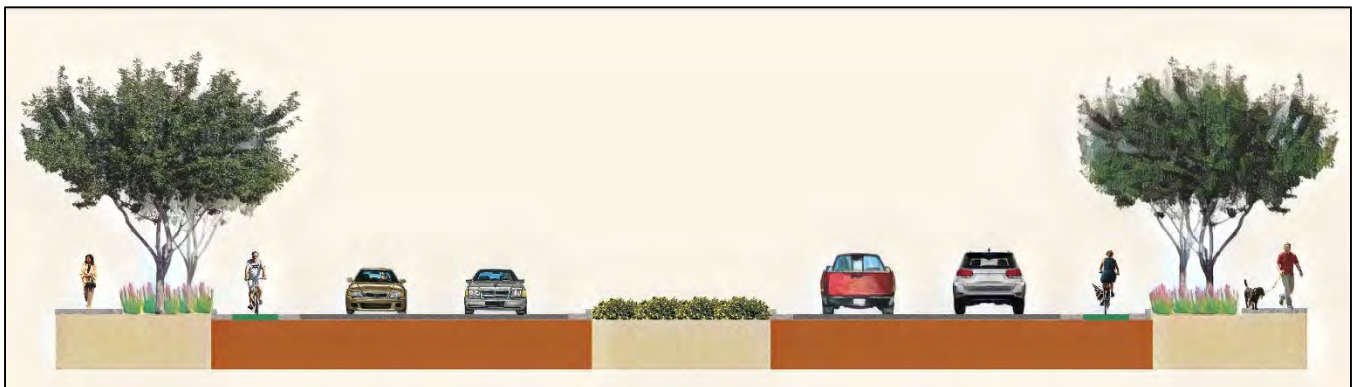


Figure 4-7: Major Collector Street Cross Section



Local Streets

Local Streets are intended to provide direct access to abutting land uses, typically residential uses, and connect to the Collector Street network. These streets generate the least amount of traffic at the lowest speeds, which is suitable for bicycle routes mixed with vehicular traffic. Local Streets are not mapped as part of the BPMP. The cross section for Local Streets is shown on **Figure 4-8**.

Figure 4-8: Local Street Cross Section



On-Street Bicycle Facilities

On-Street bicycle facilities in Buckeye consist of Bike Routes, Bike Lanes, and Paved Shoulders. While the design of the roadways should consider the speeds that are associated with the types of street classification, the use of roadways for bicycle use shall also be done in accordance with Arizona Revised Statutes (ARS) 28-815, which sets regulations for bicycling on roadways. Each of the on-street bicycle facility types are described below.

Bike Routes

Bike Routes are designed to connect trip generating uses such as school, residential areas, shopping centers, and recreational areas. Bike routes are designated with signage and striping in accordance with the Manual on Uniform Traffic Control Devices (MUTCD) published by the Federal Highway Administration. Bike Routes serve either to provide continuity with other bicycle facilities (usually bike lanes) or to designate preferred routes through high-demand corridors. Potential Bike Routes are identified on **Figure 4-9**. The potential routes follow the existing and planned fixed route bus routes established by the Buckeye Transportation Master Plan (TMP).



Bike Lanes

Bike Lanes delineate separate travel lanes for cyclists and drivers. Bike Lanes can be relatively inexpensive bicycle treatments that can go a long way in helping to decrease stress for bicyclists. Given roadway conditions, particularly geometry, roadway width, traffic volume, and number of travel lanes, bike lanes can be installed economically. Bike lanes are intended to be provided on Arterial and Collector streets as depicted on the above cross-sections.

Paved Shoulders

Paved Shoulders are often used to accommodate bicyclists and pedestrians on rural roads where volumes of traffic are relatively low. If a roadway shoulder is frequently used by cyclists, it is recommended that supplemental bicycle signage be added, and regular street sweeping be conducted to clear debris from the road shoulders. Paved Shoulders are intended to be provided on future rural streets within Buckeye.

Chapter 4: The Plan

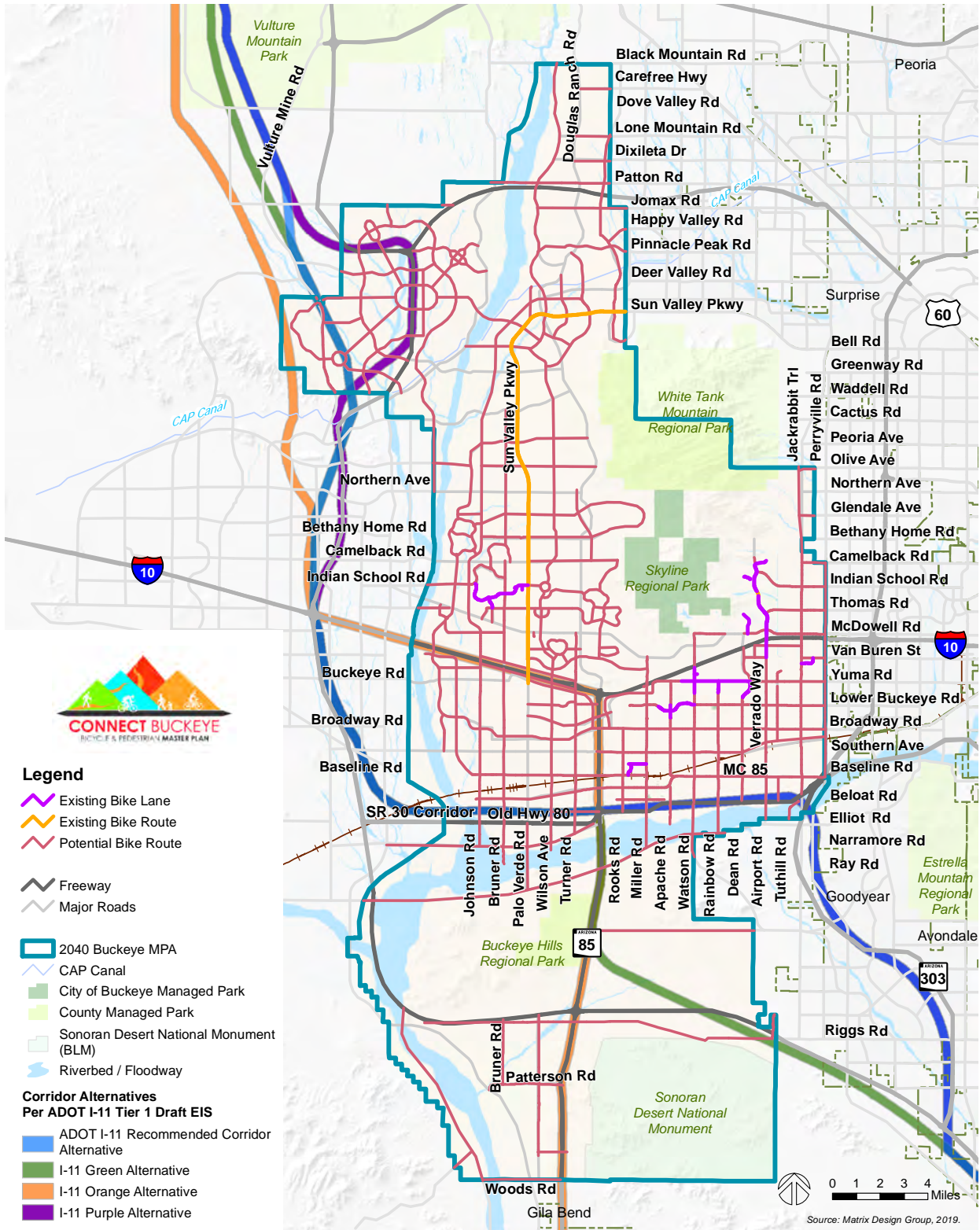


Figure 4-9

Existing and Potential Bike Routes

Off-Street Paths and Trails Network

The Off-Street network consists of paths and trails that provide low-stress and recreational routes for a bicycle and pedestrian network. The Off-Street paths and trails in Buckeye are Primary Paths, Secondary Paths, Canal Paths, and Multiuse Paths. Off-Street paths and trails in Buckeye have multiple uses, such as hiking, walking, mountain biking, and equestrian use. Recreational hiking trails are provided in the Buckeye Parks and Recreation Master Plan and are not addressed as part of this Plan. The Off-Street Network is shown on **Figure 4-11**.

Off-Street Path Cross Sections

The Off-Street facility types are described in the following sections and depicted with illustrative cross sections. Specific dimensions and construction related details for these facility types are established in the Engineering Design Standards maintained and available from the City of Buckeye Engineering Department.

Primary Paths

Primary Paths are off-street facilities reserved for the use of pedestrians and bicyclists exclusively and typically consist of a paved surface treatment. These facilities are designed for both recreation and transportation. In appropriate areas, equestrians can be accommodated with different surface treatments appropriate to horses. Primary Paths should be Americans with Disabilities Act (ADA) accessible with grades less than five percent. Primary Paths are currently located along the Hassayampa River, the Gila River, and within the central portion of Buckeye. The cross section for Primary Paths is shown on **Figure 4-10**.

Figure 4-10: Primary Path Cross Section



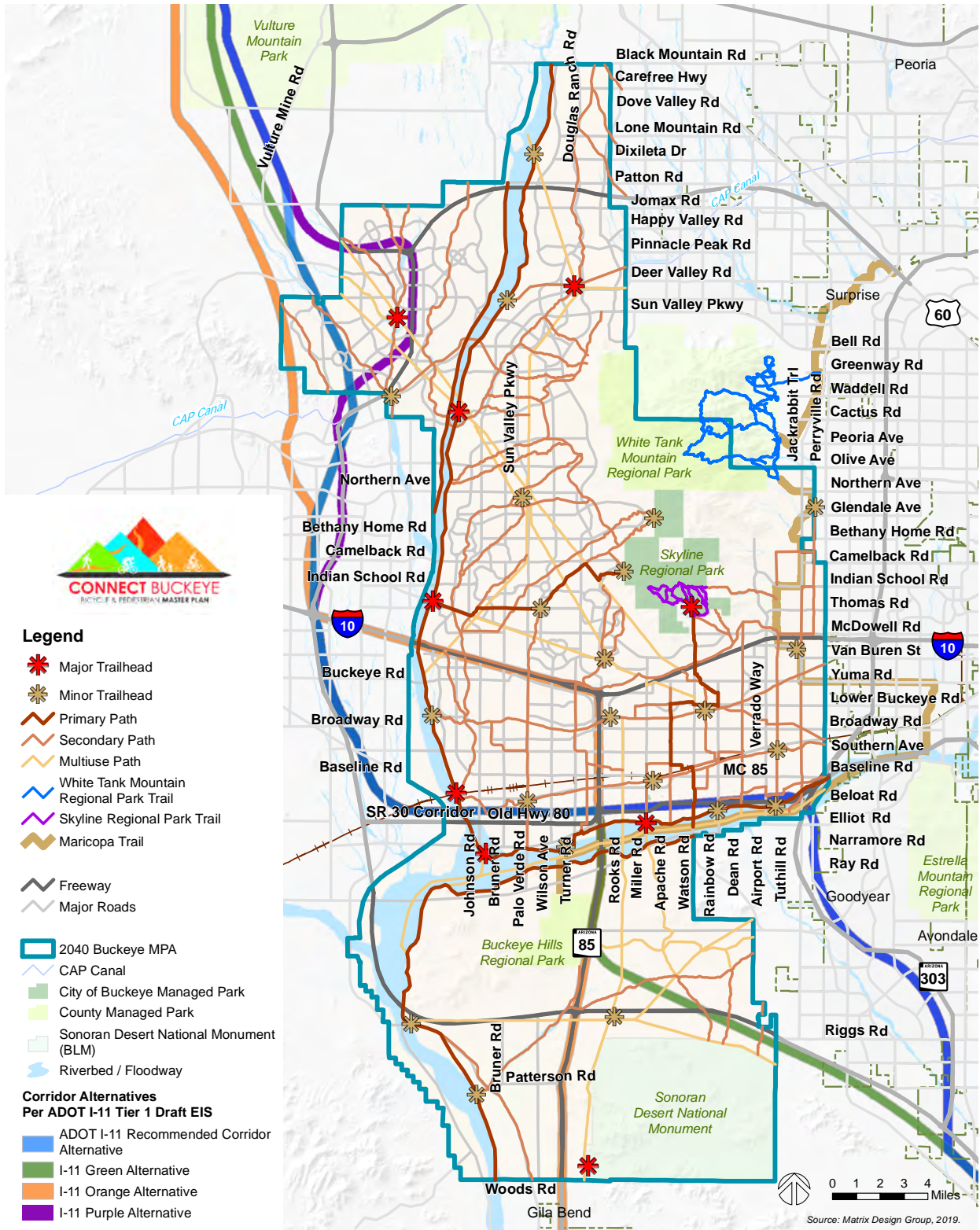


Figure 4-11

Off-Street - Paths and Trails

Secondary Paths

Secondary Paths provide for recreation and transportation and connect neighborhoods with Activity Centers, parks, and other destinations in Buckeye. Secondary Paths include a shared use path, with a safety clear zone required on either side of the path. The cross section for Secondary Paths is shown on **Figure 4-12**.

Figure 4-12: Secondary Path Cross Section



Multiuse Paths

Multiuse Paths have a surface of compacted and stabilized decomposed granite, providing a more natural walking or riding experience. These trails are located predominately along power line corridors. Utility companies have limitations on the types of improvements that can be located below the powerlines and for this reason, typical improvements, such as lighting, and landscaping is not permitted due to maintenance concerns. Multiuse Paths provide for vehicular access for the maintenance of the shared facility. The cross section for Multiuse Paths is shown on **Figure 4-13**.

Figure 4-13: Multiuse Path Cross Section



Canal Paths

Canal Paths are multiuse paths and are planned along the primary irrigation canals in Buckeye. In some cases, the irrigation district owning the facility may not permit construction of a bike or pedestrian facility in the canal right-of-way due to safety or based on maintenance access needs. In these instances, the path will be provided at time of development adjacent to the canal on private property within a public access trail easement. Where feasible, Canal Paths should be provided in accordance with the cross section shown on **Figure 4-14**.

Figure 4-14: Canal Path Cross Section



Trailheads

The Off-Street network also includes trailheads for accessibility to paths and trails. Trailheads are classified as either major or minor trailheads. Major trailheads are usually placed along Primary Paths, while minor trailheads are generally located along Secondary Paths or Multiuse Paths. The amenities differ between the two types of trailheads, providing different levels of parking, lighting, ramadas, and restrooms. Major and Minor Trailhead examples are shown on **Figures 4-15** and **4-16**.

Figure 4-15: Major Trailhead Example



Figure 4-16: Minor Trailhead Example





Path Surfaces

Select paths may include different surface materials. Some network segments can offer both a hard surface material and a soft surface material. Hard materials such as asphalt or concrete are best suited for wheeled traffic and for a low maintenance ADA complainant surface. Hard materials have longer life cycles, but high initial development costs. Hard materials can be decorative with enhanced colors or textures. Soft materials such as ¾" minus compacted decomposed granite (DG) are best suited for equestrian use or for a flexible running surface. Soft materials offer lower initial costs but require more attention for maintenance. Soft materials can be more context sensitive for natural or rural character environments. The choices for surface materials and the design options will be determined on a case by case basis and may be influenced by the path function and adjacent visual character.

Support Facilities Strategy Toolbox

This section provides a toolbox of best practice strategies to be employed by the City to reduce stress and enhance the bicycle and pedestrian network through support facilities. These improvements allow for rebalancing the use of streets so that walking and cycling are as comfortable as vehicular travel. Strategies include providing rest areas for recreational users, storage for commuters, lighting for night users, designated crossings to warn vehicular traffic, as well as shade to keep comfortable in warm weather. Descriptions of different types of support facilities are provided in the following sections and are incorporated into the recommendations of the BPMP. The specific type and application of these strategies shall be determined by the City during the development review process and/or infrastructure plan development process.

Crosswalks and Enhanced Features

Crosswalks are marked locations for pedestrians, as well as some bicyclists, to cross a street. Crosswalks are primarily located at intersections. At intersections, crosswalks are aligned with the sidewalks and should be accompanied by a walk signal.

The standard treatment for marked crosswalks at intersection locations consists of two 12-inch-wide white retro-reflective thermoplastic stripes that delineate the sides of the pedestrian walking area.

High-Visibility Crosswalks

High-visibility ladder, zebra, and continental crosswalk markings are preferable to standard parallel or dashed pavement markings. These are more visible to approaching vehicles and have been shown to improve yielding behavior. Due to the low approach angle at which pavement markings are viewed by drivers in vehicles, the use of longitudinal stripes in addition to or in place of the standard transverse markings can significantly increase the visibility of a crosswalk to oncoming traffic.



Crosswalk: Standard parallel markings



Crosswalk: High visibility markings

Artistic Crosswalks

These crosswalks may be marked in a variety of ways to signify vehicular traffic to yield. Many of the common markings are a ladder design, but sometimes may incorporate an artistic design. Although these artistic crosswalks are costlier due to maintenance requirements and may not be feasible at every intersection. Artistic crosswalks may be appropriate at specific intersections for added emphasis, to serve as a gateway into an area and to enhance the character of an area. Artistic Crosswalks:

- ▶ Can have high-impact in functionality rather than being fully aesthetic; and
- ▶ Can be a solution for complex intersections in order to promote a truly multimodal network.



Functional Artistic Crosswalk



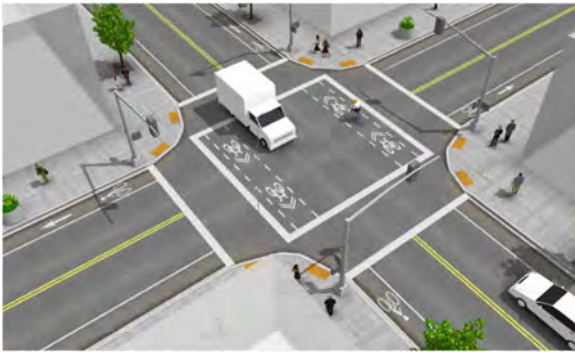
Functional Artistic Crosswalk

Bicycle Pavement Markings

Intersection Markings

Intersection crossing markings for bicyclists provide clarity on the intended path for bicyclists at intersections. They provide guidance to bicyclists on a direct path through intersections, driveways, and ramps. These markings distinguish the boundary between the paths of through bicyclists and motor vehicles in the adjacent lane. Intersection markings:

- ▶ Raise awareness for both bicyclists and motorists to potential conflict areas;
- ▶ Make bicycle movements more predictable; and
- ▶ Reduce bicyclist stress by delineating the bicycling zone.



Bicycle Markings at Intersection



Bicycle Markings at Intersection

Advance Stop Bar and Bicycle Box

Advances stop bars are used to indicate the point at which vehicles must stop for a pedestrian crossing. Bicycle boxes can be used in addition to the advance stop bar. Advanced stop bars:

- ▶ Should be located eight feet in advance of the crosswalk;
- ▶ Improve visibility of crossing pedestrians; and
- ▶ Reduce vehicles from blocking pedestrian crossing.

A bike box is a designated area that uses pavement markings to delineate a space for bicycles at signalized intersections. This space is located at the head of a traffic lane and provides bicyclists with a visible way to get ahead of traffic during the red signal phase. Bike boxes:

- ▶ Help prevent 'right-hook' conflicts with turning vehicles at the start of the green indication; and
- ▶ Reduce signal delay for bicyclists.



Bike Box

Protected Bike Lane

A protected bike lane is an exclusive bike facility that is physically separated from the road and distinct from the sidewalk. The physical separation can be an elevated grade change, vegetated buffer, pavement marking buffer, or vertical delineators. Typically, protected bike lanes are installed along high-volume high-speed roads. Protected bike lanes:

- ▶ Dedicate and protect space for bicyclists in order to improve perceived comfort and safety;
- ▶ Reduce risk and fear of collisions with over-taking vehicles;
- ▶ Reduce risk of 'dooring' compared to a bike lane and eliminates the risk of a doored bicyclist being run over by a motor vehicle. Dooring occurs when bike lanes parallel a parking area;
- ▶ Prevent double-parking, unlike a bike lane; and
- ▶ Include physical separation, which makes bicycling attractive and inclusive for all levels and ages.



Protected bike lane with elevated lane



Protected bike lane with pavement marking buffer and vertical delineators

Midblock Crossings Options and Features

Midblock crossings help reduce the distance pedestrians and bicyclists must travel to cross a street, and generally serve popular destinations, such as parks, plazas, schools, transit stops, and entertainment districts. Ideally, midblock crossings should be located where the distance between two intersections is greater than 300 feet. Midblock crossings should be accompanied with a variety of safety features to warn motorists pedestrians or bicyclists are crossing.

Not all safety features are required, nor are appropriate for all streets. Rather, the type of street, speed of traffic, and volume of traffic generally determine the necessary safety features that should be incorporated. **Table 4-1** identifies safety features that should be incorporated into midblock crossings by street type. Midblock crossings are only permitted by the City Engineer, following completion of required traffic study.

Table 4-1. Midblock Crossing – Safety Features

| Safety Features | Local | Collector | Arterial |
|----------------------------|-------|-----------|----------|
| Yield to Pedestrian Stands | ■ | ■ | |
| Pedestrian Crossing Signs | ■ | ■ | ■ |
| Bulb-outs/Curb Extension | ■ | ■ | |
| HAWK Beacons | | ■ | ■ |
| Pedestrian Islands | | | ■ |

Bulb-out/Curb Extension

A bulb-out, or curb extension, is typically located along streets that contain on-street parking and extend the curb into the parking lane. Bulb-outs may also be located where traffic lanes are wider than necessary and can be reduced, narrowing the width of the traffic lane. This reduces the distance pedestrians must travel to cross the street and helps slow traffic down as the lane narrows. Bulb-outs and curb extensions:

- ▶ Can be located midblock and at intersections;
- ▶ Decrease the overall width of the roadway and can serve as a visual cue to drivers that they are entering a neighborhood street or area;
- ▶ Increase the overall visibility of pedestrians by aligning them with the inside of the parking lane;
- ▶ Reduce the crossing distance for pedestrians;
- ▶ Increase the available space for street furniture, benches, plantings, and street trees; and
- ▶ Can be implemented using low-cost, interim materials. In such cases, curb extensions should be demarcated from the existing road-bed using temporary curbs, bollards, planters, or striping.



Bulb-out/Curb Extension with stormwater infiltration



Bulb-out/Curb Extension with stormwater infiltration

Pedestrian Island

Pedestrian islands are located in the center of the street where medians exist. This allows pedestrians to cross less traffic lanes at one time, spending less time in the roadway.

High Intensity Activated Crosswalk (HAWK) Beacon

A HAWK beacon is an overhead traffic light for motorists, signaling a pedestrian is crossing the road and has the right-of-way. Vehicles must stop for the pedestrian at the crosswalk when the light turns red and wait for the user to cross.

“Pedestrian Crossing” Sign

A Pedestrian Crossing sign is a roadway sign that warns motorists they are approaching a pedestrian crossing.

Grade-Separated Crossings

Overpasses and Underpasses

Pedestrian and bicycle overpasses and underpasses allow for the uninterrupted flow of pedestrian/bicycle movement separate from vehicle traffic. These types of crossings are needed where barriers, such as highways, railroads, and natural environmental conditions, create a mobile disruption that requires a more complex crossing intervention.

Overpasses and underpasses:

- ▶ Should have lighting, drainage, and anti-graffiti design considerations;
- ▶ Should be designed for open and accessible environments;
- ▶ Must have entrances and exits that are clearly visible and at least eight feet wide per American Association of State Highway and Transportation Officials;
- ▶ Should be used sparingly as pedestrians/bicyclists will use the direct route if available; and
- ▶ Are appropriate for high-volume, high-speed roadways, railroad tracks, and natural barriers.



Pedestrian Island



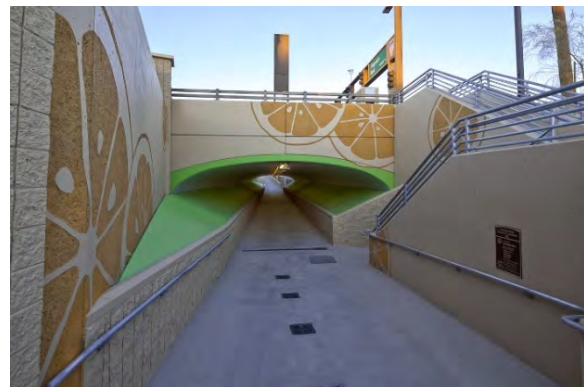
HAWK Beacon



“Pedestrian Crossing” Sign



Enhanced visibility is critical to the design



Example of an underpass

Shade – Mechanical and Natural

Shade is essential to create a comfortable experience within a hot, arid desert climate. The summers in Buckeye regularly reach triple digits, which requires shade to encourage users to continue walking and biking year-round. Shade can be provided through mechanical and natural features.

Mechanical Shade

Mechanical shade comes from physical features, such as buildings and other independent structures. If designed properly, some buildings can provide shade over the sidewalk. Buildings that are built up to, or close to, the sidewalk can project shade over the street, depending on the time of day and orientation. Locating buildings along sidewalks also provides a barrier between the sidewalk and asphalt parking lot. This contributes to comfort as asphalt parking lots retain and radiate heat from the sun, making the surrounding area hotter, known as the Heat Island Effect. Separating and buffering sidewalks from parking lots adds another element of comfort for users.

Building may also incorporate shade structures, such as awnings, galleries, or arcades to protect pedestrians from the sun. These shade structures may also be located along a pedestrian pathway independent of a building, but are typically more costly.

Benefits of Mechanical Shade

- ▶ Reduced maintenance costs compared to trees; however, lacks the ability to provide valuable ecosystem services offered by trees.



Buildings producing shade



Buildings producing shade

Natural Shade

One of the best forms of providing shade along bicycle and pedestrian pathways is from landscaping, more specifically, trees. Trees and other landscaping features not only reduce the amount of heat reflection, but also add to the overall aesthetic and attractiveness of the area. Adding trees back into the urban environments provides significant benefits, including improving public health, providing economic opportunities and advantages, as well as supporting a healthy environment.

Benefits of Natural Shade

- ▶ Evapotranspiration and shade that trees provide help to cool down buildings and reduce the need for air conditioning, which then decreases energy consumption;
- ▶ Trees improve air quality by intercepting particulate matter and absorbing gaseous pollutants;
- ▶ Trees provide significant storm water retention benefits by intercepting and absorbing rainfall and by increasing the ability of soil to store water;
- ▶ Large scale vegetated areas can be as much as 9°F cooler than non-green city centers;
- ▶ Low Biogenic Volatile Organic Compound (BVOC)-emitting trees can provide positive ecological services and benefits – contributing to better air quality and community health. Low BVOC-emitting trees for the low desert include: Acacia, Ash, Evergreen Elm, Desert Willow, Ironwood, Pistache, Palo Verde; and
- ▶ A tree canopy and green features can improve transit experience for waiting riders, increasing comfort and reducing perceived wait time. The use of natural shade involves additional operation and maintenance costs for irrigation, pruning, and cleaning up leaves.



Single tree canopy with dense shade



Double tree canopy



Trees are part of the urban fabric

Signage

Signage along paths and bike routes helps guide users to their destinations. This type of signage is often referred to as wayfinding, and can feature pole-mounted signs, kiosks, and pavement markings. Pole-mounted signs typically identify bike routes, destinations, and the distance to destinations. Kiosks are typically located at important pedestrian nodes in entertainment districts and activity centers and provide more detailed information about specific destinations.

Wayfinding

Wayfinding is a type of signage that translates navigational information to pedestrians and bicyclists along their journey. Maricopa Association of Governments Valley Path Brand and Wayfinding Signage Guidelines (2015) provides guidance for designing wayfinding signs as does the most up to date version of the Manual on Uniform Traffic Control Devices (MUTCD). Both these references provide information for locations, sizes, and vertical placement of signage. While this resource provides options for wayfinding design, it is limited in its context sensitivity for the City of Buckeye. The City of Buckeye could develop a wayfinding signage guide that is culturally and environmentally sensitive to Buckeye.

Wayfinding can be explored in other design strategies beside physical signage. Paving materials and site furnishings can be embedded with information to serve as wayfinding solutions. As technology evolves, digital information infrastructure has the potential to be embedded into wayfinding strategies. Consideration should be taken to evaluate possible emerging digital information technologies.



Wayfinding elements



Wayfinding elements



Wayfinding elements

Educational

Signage along pedestrian paths and bike routes can be an educational tool for enhancing a recreational user’s experience. Educational information can include historical, cultural, or environmental descriptions of the area. These types of signs are often found along natural trails, such as the trails through the White Tank Mountain range, but could also be applicable in Downtown Buckeye or along the Gila and Hassayampa Rivers, and canals.

To enhance the overall experience throughout the network, some communities have created unique, custom wayfinding signage that reflects the character of the area. One example of unique wayfinding signage can be found in Downtown Buckeye.



Educational Signage



Signage for Activity Centers



Pedestrian Lighting

Roadway lighting has often focused on the needs of the motorist and not necessarily the needs of the pedestrian; however, it is important to consider lighting that illuminates pedestrian crosswalks and reduces glare to motorists.

Pedestrian lighting:

- ▶ Increases the perception of safety;
- ▶ Creates a stronger edge along the sidewalk, reinforcing the sidewalk itself as an exterior habitable space when lighting elements are more closely spaced;
- ▶ Should consider the human users of the street and sidewalk; and
- ▶ Assists in making wayfinding elements visible at night.



Pedestrian-scale lighting



Pedestrian-scale lighting

Drinking Fountains/Bottle Filling Stations

The availability and access of public water fountains can improve urban health and encourage multimodal activities. In the context of the arid southwest desert, availability of water during an activity is a necessity for maintaining healthy hydration states during travel. Water stations:

- ▶ Should be located in strategic locations, such as pedestrian corridors or bike trails, near schools or libraries, or within plazas or other public gathering spaces;
- ▶ May be freestanding, wall-mounted, pump-style, and/or have individual spigots for pets and filling water bottles;
- ▶ Will be code and ADA compliant;
- ▶ Offer an opportunity for placemaking and artist involvement;
- ▶ Should be integrated into buildings/spaces by the private sector; and
- ▶ Could include advertising on fountains to assist with maintenance costs.

Installation of water stations should take into consideration maintenance costs and nuisance issues, such as vandalism, bug attraction and hygiene.



Example of a drinking fountain



Example of a bottle filling station

Green Infrastructure along Pedestrian and Bike Routes

Incorporating green infrastructure into the bicycle and pedestrian system design can improve water quality from polluted stormwater through biofiltration, help manage stormwater flows, reduce the volume of stormwater runoff, and provide relieve to overloaded municipal water treatment systems.

Green infrastructure can complement the bicycle and pedestrian network by calming traffic, enhancing comfort and reducing air temperature while commuting, and creating opportunities for pedestrian crossing and curb extensions.

Green infrastructure:

- ▶ Could be integrated into sidewalks, medians, curbs, and other features, including bioswales, flow-through planters, or pervious strips;
- ▶ Helps restore the natural hydrological cycle;
- ▶ Complements gray infrastructure and may extend the life of capital street projects; and
- ▶ Reduce prevalence of flooding.

Should be designed with maintenance requirements in mind. All of these types of integrated green spaces require significant maintenance due to trash accumulation, weed growth, irrigation and other landscaping attention.



Example of bioinfiltration planter: Stormwater entering and infiltrating



Example of bioinfiltration planter



Green street: Vegetated bulb-outs that receive stormwater

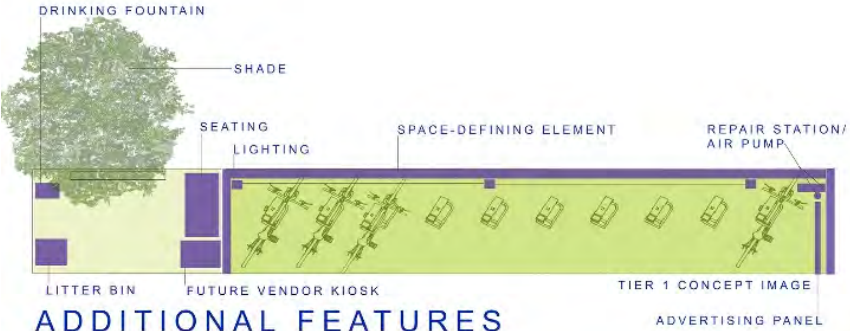
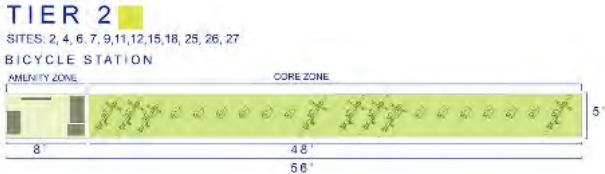
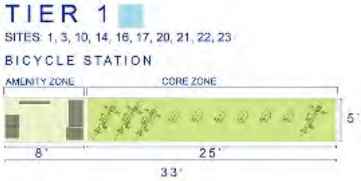
Enhanced Bicycle Station

Enhanced bicycle stations can increase ridership by including improved features and design elements. These elements may include seating, space-defining elements, lighting, litter bins, shade, vendor kiosks, advertising panels, drinking fountains, and repair stations with air pumps.

An enhanced Bicycle Station can be designed for different scales and is composed of three zones: Core Zone, Amenity Zone, and Expansion Zone.

- ▶ The Core Zone describes the area where a bicycle rack is mounted to a stable surface for bicycle parking.
- ▶ The Amenity Zone is a separate area adjacent to the bicycles, serving as a node for social activity, rest, and wayfinding.
- ▶ The Expansion Zone is an additional area of parking for larger tricycles, bicycle carriages, and scooters.

Each tier includes specific design elements that respond to the existing site.



ADDITIONAL FEATURES

| Feature | SITES 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 |
|-------------------------|---------|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| SEATING | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SPACE-DEFINING ELEMENT | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| LIGHTING | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| LITTER BIN | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SHADE | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| FUTURE VENDOR KIOSK | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ADVERTISING PANEL | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| DRINKING FOUNTAIN | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| REPAIR STATION/AIR PUMP | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Plan views: Enhanced bicycle station



Please see the next page.



5. Plan Implementation

This chapter provides the implementation plan, including potential funding sources and partners, opportunities for cooperative planning, and community programs that can be initiated to promote the bicycle and pedestrian network.

Funding Sources and Partners

Funding

Funding for active transportation can come from a variety of sources including City funds, private funds (philanthropic or developer-paid), and federal and state funds passed through the Maricopa Association of Governments (MAG). Maintenance funding for all these features will need to be funded through local city sources such as the Highway User Revenue Fund (HURF) allocation received by the City, or its general fund for non-HURF eligible applications. Traditional government funding opportunities are summarized below.

Federal Funds

Several federal funding sources can be used to fund active transportation infrastructure. For Buckeye, these funds would be applied for through the MAG Transportation Improvement Program (TIP). These federal funding sources include the Congestion Mitigation and Air Quality (CMAQ) Program and the Surface Transportation Block Grant (STBG) Program, which includes the Transportation Alternative (TA) Set-Aside and the Recreation Trails Program (RTP).

CMAQ provides a flexible funding source to State and local governments for transportation projects and programs to help meet the requirements of the Clean Air Act. Funding is available to reduce congestion and improve air quality for areas that do not meet the National Ambient Air Quality Standards (NAAQS) for ozone, carbon monoxide, or particulate matter (nonattainment areas) and for former nonattainment areas that are now in compliance (maintenance areas). As of February 2017, Maricopa County is in nonattainment for ozone and particulate matter. Funds in the CMAQ program can be used for an active transportation project or program that has the potential to contribute to the attainment or maintenance of a NAAQS. The project in the CMAQ program should be effective in reducing air pollution and should be included in MAG's current transportation plan and TIP.

STBG funds include two set-aside programs: Transportation Alternatives and Recreational Trails Program. The TA set-aside funds are authorized for transportation alternatives, including:



- ▶ On- and off-street pedestrian and bicycle facilities;
- ▶ Infrastructure projects for improving non-driver access to public transportation and enhanced mobility;
- ▶ Community improvement activities such as historic preservation and vegetation management, and environmental mitigation related to stormwater and habitat connectivity;
- ▶ Recreational trail projects;
- ▶ Safe routes to school projects; and
- ▶ Projects for planning, designing, or constructing boulevards and other roadways largely in the right-of-way of former divided highways.

The Recreational Trails Program (RTP) provides funds to develop and maintain recreational motorized and nonmotorized trails and trail-related facilities, including facilities for hiking, bicycling, equestrian use, off-road motorcycling, all-terrain vehicle riding, four-wheel driving, and other off-road motor vehicles.

Regional Funds

In addition to CMAQ and STBG funds, MAG has three funding programs that can be utilized for active transportation projects. These funding sources include the Safe Routes to School (SRTS) Program, the Bicycle and Pedestrian Design Assistance Program, and the Bicycle and Pedestrian Master Plans and First Time Updates Program. Each of these programs are summarized below.

The SRTS Program provides resources for schools and municipalities to administer Safe Routes to School (SRTS) initiatives and activities such as:

- ▶ Crossing Guard training workshops;
- ▶ Programming of Transportation Alternative SRTS federal aid funding; and
- ▶ Administration of SRTS Studies Projects.

The MAG region receives an annual allocation of federal aid for transportation alternatives from the Arizona Department of Transportation (ADOT). MAG member agencies are eligible to submit applications on behalf of a requesting school district to utilize these funds for projects that will help schools and communities promote the health and safety of students. MAG allocations fund qualifying SRTS non-infrastructure projects.

The Bicycle and Pedestrian Design Assistance Program involves an application process where local governments compete for funding. Project applications are evaluated by the MAG Active Transportation Committee via an objective scoring process. The highest scoring projects receive funding to complete a scoping study, project assessment, or preliminary engineering for bicycle or pedestrian infrastructure projects. Eligible projects include regional shared-use paths or canal paths, bicycle and pedestrian access to transit, and bicycle and pedestrian facilities.

Short-, Mid-, and Long-Term Improvements

This section identifies short-, mid-, and long-term improvements for On-Street Parkway, Arterial and Collector Streets. The Off-Street network will be implemented through the development process with segments of the network being built as development occurs and as the City of Buckeye programs improvements to address gaps in the Off-Street network. The City's focus in regard to the Off-Street network will be on paths on the Hassayampa and Gila Rivers, and connecting those paths to the trail system in the mountain ranges

The improvement schedule for the On-Street network is intended to mirror the improvement schedule of Parkway and Arterial street improvements identified in the Buckeye Transportation Master Plan (TMP), with the addition of the six intersection improvements identified within Chapter 3 Plan Influences. Adjustments to the schedules herein will be implemented by the City of Buckeye through adoption of the annual Capital Improvement Program (CIP). Short-term recommendations include improvements identified in the BPMP, City Capital Improvements Program, MCDOT Transportation Improvement Program (TIP), and the MAG Regional Transportation Plan (RTP) and include projects in the first five years in accordance with the TMP. Mid-term recommendations include improvements anticipated to be needed by 2040, that have resulted from the travel demand modeling efforts described in the TMP. Long-term recommendations include improvements anticipated to be needed after 2040.

Table 5-1 includes implementation action associated with the BPMP recommended improvements including responsible parties and potential funding source (s). It is intended that the respective on-street bicycle and pedestrian facility will be constructed in conjunction with the road type of the applicable project. These recommended improvements will require the City of Buckeye to plan for the respective maintenance costs. These costs can be significant but are essential in order to sustain successful plan implementation.

Short-term Improvements

Recommendations for the short-term planning horizon cover Fiscal Year (FY) 2020-2024, the first five years following adoption of the BPMP. The recommendations provided include projects identified in the City of Buckeye CIP, projects identified for the next five years in the MAG Regional Transportation Plan, projects identified in the near-term from referenced previous planning documents, projects intended to address updated needs in the bicycle and pedestrian network, and any other project identified by the City as a short-term critical action item.

Mid-term Improvements

Recommendations for the mid-term planning horizon cover the years FY 2025-2040. These improvements are currently not programmed in the CIP but identified as needed by the TMP.

Long-term Improvements

Recommendations for the long-term planning horizon cover the years 2040-Buildout. These improvements are currently not programmed and are either not identified as short-term or mid-term needs through the 2040 travel demand model results or as directed by the City during formation of the TMP.



Table 5-1. On-Street Short-Term, Mid-Term and Long-Term Improvement Schedule

| Project Name | Responsible Party, Partners | Recommendation Source |
|---|-----------------------------|------------------------------------|
| Short-term | | |
| Watson Road and Yuma Road Traffic Interchange | City | BPMP |
| Monroe Avenue and 9th Street Traffic Interchange | City | BPMP |
| Monroe Avenue and 4th Street Traffic Interchange | City | BPMP |
| Dean Road and Yuma Road Traffic Interchange | City | BPMP |
| Yuma Road/Jackrabbit Trail Corridor | City | BPMP |
| Southern Avenue/Miller Road Corridor | City | BPMP |
| Apache Road and Southern Avenue Traffic Signal | City | CIP FY 18/19 – FY 23/24 |
| Apache Road: Lower Buckeye Road to SRP/WAPA powerlines | City, MAG | MAG 2035 RTP |
| Apache Road: Pine Road to Yuma Road | City, MAG | MAG 2035 RTP |
| Apache Road: RID Canal to Lower Buckeye Road | City, MAG | MAG 2035 RTP |
| Apache Road: WAPA power lines to Pine Road | City, MAG | MAG 2035 RTP |
| Dean Road: Southern Avenue to 0.5 mi north of RID Canal | City, MAG | MAG 2035 RTP |
| Durango St from Miller Road to Yuma Road | City | CIP FY 18/19 – FY 23/24 |
| Indian School Road from Jackrabbit Trail to Loop 303 | City, MCDOT | City Prop 500 List, MCDOT 2035 TSP |
| Indian School Road: Sunrise Lane to Verrado Way | Developer, MAG | MAG 2035 RTP |
| Jackrabbit Road Traffic Interchange at I-10 | ADOT | Buildout Network Map |
| McDowell Road: Dean Road (alignment) to Verrado Way | City, MAG | MAG 2035 RTP |
| McDowell Road: Verrado Way to 202nd Avenue | Developer | MAG 2035 RTP |
| Miller Road & Maricopa Ultimate Traffic Signal | City | CIP FY 18/19 – FY 23/24 |
| Miller Road and Baseline Road Traffic Signal | City | CIP FY 18/19 – FY 23/24 |
| Miller Road and Broadway Road Traffic Signal | City | CIP FY 18/19 – FY 23/24 |

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Table 5-1. On-Street Short-Term, Mid-Term and Long-Term Improvement Schedule (continued)

| Project Name | Responsible Party, Partners | Recommendation Source |
|--|-----------------------------|-------------------------|
| Miller Road and Southern Road Traffic Signal | City | CIP FY 18/19 – FY 23/24 |
| Miller Road: ADOT ROW line south of I-10 to Narramore Avenue | City, MAG | MAG 2035 RTP |
| Miller Road: Narramore Avenue to Hazen Road | City, MAG | MAG 2035 RTP |
| Perryville Road: McDowell Road to Roosevelt Street | City, MAG | MAG 2035 RTP |
| Rainbow Road: Durango Street to RID Canal | City, MAG | MAG 2035 RTP |
| Rooks Road: Baseline Road to MC-85 | City, MAG | MAG 2035 RTP |
| Southern Avenue: 231st Avenue (alignment) to Watson Road | City, MAG | MAG 2035 RTP |
| Southern Avenue: Apache Road to Miller Road | City, MAG | MAG 2035 RTP |
| Thomas Road: 199th Avenue to Tuthill Road - Arroyo Seco Road | Developer, MCDOT | MAG 2035 RTP |
| Thomas Road: Acacia Way to Tuthill Road (alignment) | Developer, City, MAG | MAG 2035 RTP |
| Thomas Road: Jackrabbit Trail to 199th Avenue | Developer | MAG 2035 RTP |
| Turner Parkway: Baseline Road to 0.5 miles north | City, MAG | MAG 2035 RTP |
| Verrado Way and Yuma Road Intersection Improvements | City | CIP FY 18/19 – FY 23/24 |
| Warner Street Bridge Approaches | City, ADOT | CIP FY 18/19 – FY 23/24 |
| Watson Rd and Broadway Road Traffic Signal | City | CIP FY 18/19 – FY 23/24 |
| Watson Road: Durango Street to Lower Buckeye Road | City, MAG | MAG 2035 RTP |
| Watson Road: Extension from Southern Avenue to MC-85 | City, MAG | MAG 2035 RTP |
| Watson Road: Lower Buckeye Road to Broadway Road | City, MAG | MAG 2035 RTP |
| Westpark Loop Road: Rooks Road (South) to Rooks Road (North) | Developer | MAG 2035 RTP |
| Yuma Road: Dean Road to 0.15 miles east of Dean Road | MCDOT, City | MCDOT 2035 TSP |



Table 5-1. On-Street Short-Term, Mid-Term and Long-Term Improvement Schedule (continued)

| Project Name | Responsible Party, Partners | Recommendation Source |
|---|-----------------------------|---------------------------------|
| Yuma Road: Tuthill Road to 199th Avenue, south half of the road, (Mountain View South) | Developer | MAG 2035 RTP |
| Mid-term | | |
| 287th Avenue from Pinnacle Peak Road to Dove Valley Road | City | MAG 2040 Lane Configuration Map |
| 315th Avenue from Glendale Avenue to Peoria Avenue/Johnson Road | City | MAG 2040 Lane Configuration Map |
| 315th Avenue from Southern Avenue to Yuma Road | City | MAG 2040 Lane Configuration Map |
| 319th Avenue from Broadway Road to I-10 | City | MAG 2040 Lane Configuration Map |
| 319th Avenue from I-10 to 1/4 mile north of Camelback Road | City | MAG 2040 Lane Configuration Map |
| 323rd Avenue from Wintersburg Parkway, loop around Douglas Ranch development, terminate at Greenway Parkway | City | MAG 2040 Lane Configuration Map |
| 331st Avenue from Broadway Road to Van Buren Street | MCDOT | MAG 2040 Lane Configuration Map |
| Airport Road/Verrado Way from Beloat Road to Roosevelt Street | MCDOT, City | MAG 2040 Lane Configuration Map |
| Apache Road from Baseline Road to the RID canal | City | MAG 2040 Lane Configuration Map |
| Apache Road from Beloat Road to MC-85 | City | MAG 2040 Lane Configuration Map |
| Baseline Road from Apache Road to 315th Avenue | MCDOT, City | MAG 2040 Lane Configuration Map |
| Beardsley Parkway from Desert Oasis Boulevard to Johnson Road | City | MAG 2040 Lane Configuration Map |
| Bell Road from Hidden Waters Parkway to Turner Parkway | City | MAG 2040 Lane Configuration Map |
| Beloat Road: 0.25 miles east of Apache Road to Watson Road | MCDOT, City | MCDOT 2035 TSP |
| Beloat Road: Rainbow Road to Dean Road | MCDOT, City | MCDOT 2035 TSP |
| Beloat Road: Tuthill Road/Jackrabbit Trail to Verrado Way | MCDOT, City | MCDOT 2035 TSP |
| Broadway Road from 223rd Avenue to Miller Road | City | MAG 2040 Lane Configuration Map |

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Table 5-1. On-Street Short-Term, Mid-Term and Long-Term Improvement Schedule (continued)

| Project Name | Responsible Party, Partners | Recommendation Source |
|---|-----------------------------|--|
| Broadway Road from Dean Road to 223rd Avenue | City | MAG 2040 Lane Configuration Map |
| Broadway Road from Johnson Road to 319th Avenue | City | MAG 2040 Lane Configuration Map |
| Broadway Road from Perryville Road to Jackrabbit Trail | MCDOT, City | MAG 2040 Lane Configuration Map |
| Bruner Road from Old US-80 to Wintersburg Parkway | City | MAG 2040 Lane Configuration Map |
| Camelback Road from 1/2 mi east of Sun Valley Parkway to 339th Avenue | City | MAG 2040 Lane Configuration Map |
| Camelback Road from Perryville Road to Tuthill Road | MCDOT, City | MAG 2040 Lane Configuration Map |
| Canyon Springs Boulevard from Hayden-Rhodes Viaduct to Cloud Road | City | MAG 2040 Lane Configuration Map |
| Dean Road from Beloat Road to Southern Avenue | City | MAG 2040 Lane Configuration Map |
| Dean Road Traffic Interchange at I-10 | ADOT | City Prop 500 List, Buildout Network Map |
| Dove Valley Road from Canyon Springs Boulevard to Hidden Waters Parkway | City | MAG 2040 Lane Configuration Map |
| Glendale Avenue from Perryville Road to Jackrabbit Trail | City | MAG 2040 Lane Configuration Map |
| Glendale Avenue from Sun Valley Parkway to 310th Avenue alignment | City | MAG 2040 Lane Configuration Map |
| Greenway Parkway from Turner Parkway to Sun Valley Parkway | City | MAG 2040 Lane Configuration Map |
| Hazen Road: SR-85 to Miller Road | MCDOT | MCDOT 2035 TSP |
| Hidden Waters Parkway from Greenway Parkway to Bell Road | City | MAG 2040 Lane Configuration Map |
| Indian School Road from 195th Avenue to Sunrise Lane | City | MAG 2040 Lane Configuration Map |
| Indian School Road from Tartesso Parkway to 319th Avenue | City | MAG 2040 Lane Configuration Map |
| Jackrabbit Trail from MC-85 to Durango Street | MCDOT | MAG 2040 Lane Configuration Map |
| Jackrabbit Trail from McDowell Road to Olive Avenue | MCDOT | MAG 2040 Lane Configuration Map |



Table 5-1. On-Street Short-Term, Mid-Term and Long-Term Improvement Schedule (continued)

| Project Name | Responsible Party, Partners | Recommendation Source |
|---|-----------------------------|---------------------------------|
| Jackrabbit Trail from Yuma Road to Van Buren Street | MCDOT | MAG 2040 Lane Configuration Map |
| Johnson Road from 315th Avenue/Peoria Avenue to Greenway Parkway | MCDOT | MAG 2040 Lane Configuration Map |
| Johnson Road from Old US-80 to I-10 | MCDOT | MAG 2040 Lane Configuration Map |
| Johnson Road Traffic Interchange at I-10 | ADOT | City Prop 500 List |
| Lower Buckeye Road from Dean Road to RID canal | MCDOT | MAG 2040 Lane Configuration Map |
| Lower Buckeye Road from the RID canal to Watson Road | City | MAG 2040 Lane Configuration Map |
| Lower Buckeye Road from Watson Road to 255th Avenue | City | Buildout Network Map |
| Lower Buckeye Road from Wilson Road to Palo Verde Road | City | MAG 2040 Lane Configuration Map |
| MC-85 from Southern Avenue to Watson Road | MCDOT | MAG 2040 Lane Configuration Map |
| MC-85 from SR-85 to Turner Parkway | MCDOT | MAG 2040 Lane Configuration Map |
| MC-85 from Watson Road to Miller Road | City | MAG 2040 Lane Configuration Map |
| McDowell Parkway from Loop 303 to Sun Valley Parkway | City | City Prop 500 List |
| McDowell Parkway from Sun Valley Parkway to the MPA Boundary | City | MAG 2040 Lane Configuration Map |
| McDowell Road from 202nd Avenue to Verrado Way | MCDOT | MAG 2040 Lane Configuration Map |
| Narramore Road from Rainbow Valley Road to Airport Road/Verrado Way | MCDOT | MAG 2040 Lane Configuration Map |
| Northern Avenue from Perryville Road to Jackrabbit Trail | City | MAG 2040 Lane Configuration Map |
| Northern Avenue from Turner Parkway to Hidden Waters Parkway | City | MAG 2040 Lane Configuration Map |
| OLD US-80 from SR-85 to Salome Highway | MCDOT | MAG 2040 Lane Configuration Map |

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Table 5-1. On-Street Short-Term, Mid-Term and Long-Term Improvement Schedule (continued)

| Project Name | Responsible Party, Partners | Recommendation Source |
|---|-----------------------------|---------------------------------|
| Olive Avenue from 183rd Avenue (Cortessa Parkway) to White Tank Mountain Road | City | MAG 2040 Lane Configuration Map |
| Olive Avenue from Turner Parkway to Hidden Waters Parkway | City | MAG 2040 Lane Configuration Map |
| Palo Verde Road from Old US-80 to I-10 | MCDOT | MAG 2040 Lane Configuration Map |
| Patton Road from 253rd Avenue to Hidden Waters Parkway | MCDOT | MAG 2040 Lane Configuration Map |
| Perryville Road from MC-85 to Roosevelt Street | MCDOT | MAG 2040 Lane Configuration Map |
| Perryville Road from McDowell Road to Camelback Road | City | MAG 2040 Lane Configuration Map |
| Perryville Road from Orangewood Avenue to Mountain View Avenue | MCDOT | MAG 2040 Lane Configuration Map |
| Pinnacle Peak Road from 259th Avenue (alignment) to 287th Avenue | City, MAG | MAG 2035 RTP |
| Rainbow Road from Beloit Road to the RID canal | City | MAG 2040 Lane Configuration Map |
| Rooks Road from Baseline Road to Broadway Road | City | MAG 2040 Lane Configuration Map |
| Rooks Road from Beloit Road to MC-85 | City | MAG 2040 Lane Configuration Map |
| Salome Highway from Old US-80 to 339th Avenue | MCDOT | MAG 2040 Lane Configuration Map |
| Southern Avenue from Johnson to 319th Avenue | MCDOT | MAG 2040 Lane Configuration Map |
| Southern Avenue from SR-85 to Johnson Road | MCDOT | MAG 2040 Lane Configuration Map |
| Southern Avenue SR-85 to Loop 303 | City | City Prop 500 List |
| Tartesso Parkway from Bruner Road to Indian School Road | City | MAG 2040 Lane Configuration Map |
| Thomas Road between Perryville Road and Jackrabbit Trail | MCDOT | MAG 2040 Lane Configuration Map |
| Thomas Road from 1/2 mile east of Sun Valley Parkway to Sun Valley Parkway | City | MAG 2040 Lane Configuration Map |
| Thomas Road from Sun Valley Parkway to Bruner Road | City | MAG 2040 Lane Configuration Map |



Table 5-1. On-Street Short-Term, Mid-Term and Long-Term Improvement Schedule (continued)

| Project Name | Responsible Party, Partners | Recommendation Source |
|--|-----------------------------|---------------------------------|
| Turner Parkway from Desert Oasis Boulevard to Cloud Road | MCDOT | MAG 2040 Lane Configuration Map |
| Turner Parkway from I-10 to Desert Oasis Boulevard | City | MAG 2040 Lane Configuration Map |
| Turner Road from Old US-80 to 1/2 mile south of Hazen Road | City | MAG 2040 Lane Configuration Map |
| Van Buren Street from 183rd Avenue to Jackrabbit Trail | MCDOT | MAG 2040 Lane Configuration Map |
| Van Buren Street from 331st Avenue to 339th Avenue | MCDOT | MAG 2040 Lane Configuration Map |
| Watson Road from Beloat Road to MC-85 | City | MAG 2040 Lane Configuration Map |
| Wickenburg Road from Waddell Road alignment to Beardsley Road alignment | MCDOT | MAG 2040 Lane Configuration Map |
| Wilson Avenue from Old US-80 to Southern Avenue | City | MAG 2040 Lane Configuration Map |
| Wintersburg Parkway from Turner Parkway to Hidden Waters Parkway | City, MCDOT | MAG 2040 Lane Configuration Map |
| Yuma Road from 1/4 mi east of Palo Verde Road to Johnson Road | City | MAG 2040 Lane Configuration Map |
| Yuma Road from 239th Avenue to 247th Avenue | City, MCDOT | MAG 2040 Lane Configuration Map |
| Yuma Road from Johnson Road to 319th Avenue | City | MAG 2040 Lane Configuration Map |
| Yuma Road from Perryville Road to Jackrabbit Trail | MCDOT | MAG 2040 Lane Configuration Map |
| Yuma Road from Tuthill Road to Dean Road | MCDOT | MAG 2040 Lane Configuration Map |
| Yuma Road from W Connector Road/Lower Buckeye to 1/4 mi east of Palo Verde Road | City | MAG 2040 Lane Configuration Map |
| Long-term | | |
| 283rd Avenue from Woods Road to I-11 | City | Buildout Network Map |
| 287th Avenue from Dove Valley to Cloud Road | City | Buildout Network Map |
| 287th Avenue from Pinnacle Peak to Dove Valley | City | Buildout Network Map |
| 315th Avenue curve between Baseline Road/309th Avenue and Southern Avenue/315th Avenue | City | Buildout Network Map |

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Table 5-1. On-Street Short-Term, Mid-Term and Long-Term Improvement Schedule (continued)

| Project Name | Responsible Party, Partners | Recommendation Source |
|--|-----------------------------|-----------------------|
| 315th Avenue from Yuma Parkway north to Van Buren Street, then west along Van Buren Street (alignment) to 319th Avenue | City | Buildout Network Map |
| 319th Avenue between Southern Avenue and Broadway Road | City | Buildout Network Map |
| 323rd Avenue from Northern Parkway to Wintersburg Parkway | City | Buildout Network Map |
| Beardsley Road from 323rd Avenue Loop east to Douglas Ranch Loop | City | Buildout Network Map |
| Beardsley Road from Douglas Ranch Loop to Wickenburg Road | City | Buildout Network Map |
| Bethany Home Road from Johnson Road to Bethany Home Road-Glendale Avenue loop | City | Buildout Network Map |
| Bethany Home Road-Glendale Avenue Loop between Bethany Home Road and Glendale Avenue | City | Buildout Network Map |
| Broadway Road from 231st Avenue to Apache Road | City | Buildout Network Map |
| Bruner Road from Narramore Road to SR-30 | MCDOT | Buildout Network Map |
| Bruner Road from Old US-80 to Wintersburg Parkway | MCDOT | Buildout Network Map |
| Bruner Road from Patterson Road to I-11 | MCDOT | Buildout Network Map |
| Camelback Road from 263rd Avenue (alignment) to Sun Valley Parkway | City | Buildout Network Map |
| Canyon Springs Boulevard at Sun Valley Parkway | City | Buildout Network Map |
| Canyon Springs Boulevard from Sun Valley Parkway to Cloud Road | City | Buildout Network Map |
| Carefree Highway from 253rd Avenue to Turner Parkway | City | Buildout Network Map |
| Citrus Valley Road from Enterprise Parkway to MPA boundary | City | Buildout Network Map |
| Cloud Road from 267th Avenue (alignment) to 291st Avenue (alignment) | City | Buildout Network Map |
| Desert Creek Traffic Interchange at I-10 | ADOT | City Prop 500 List |
| Dixileta Drive from 253rd Avenue to 287th Avenue | City | Buildout Network Map |
| Durango Road from 257th Avenue to 263rd Avenue | City | Buildout Network Map |
| Durango Road from Miller Road to 257th Avenue | City | Buildout Network Map |



Table 5-1. On-Street Short-Term, Mid-Term and Long-Term Improvement Schedule (continued)

| Project Name | Responsible Party, Partners | Recommendation Source |
|---|-----------------------------|-----------------------|
| Elliot Road from Airport Road to I-11 | MCDOT | Buildout Network Map |
| Enterprise Road from I-11 to southernmost MPA boundary | City | Buildout Network Map |
| Glendale Avenue from Sun Valley Parkway to Bethany Home Road-Glendale Avenue loop | City | Buildout Network Map |
| Greenway Parkway from Sun Valley Parkway to Hidden Waters Parkway | City | Buildout Network Map |
| Hidden Waters Parkway along 351st Avenue alignment adjacent to Old US-80 | City | Buildout Network Map |
| Hidden Waters Parkway from Bell Road to White Tanks Freeway | City | Buildout Network Map |
| Hidden Waters Parkway from Wintersburg Parkway to Greenway Parkway | City | Buildout Network Map |
| Hidden Waters Parkway from Woods Road to SR-30 | MCDOT | Buildout Network Map |
| Indian School Road from Jackrabbit Trail to Verrado Way | City | Buildout Network Map |
| Indian School Road from Johnson Road to Hidden Waters Parkway | City | Buildout Network Map |
| Johnson Road from McDowell Road to Peoria Avenue | City | Buildout Network Map |
| Johnson Road from Narramore Road to SR-30 | MCDOT | Buildout Network Map |
| Jomax Road from Canyon Springs Boulevard to 287th Avenue | City | Buildout Network Map |
| Jomax Road from White Tanks Freeway to I-11 | MCDOT | Buildout Network Map |
| Lone Mountain Road from Canyon Springs Boulevard to 287th Avenue | City | Buildout Network Map |
| Lower Buckeye Road from Turner Parkway to Wilson Avenue | City | Buildout Network Map |
| MC-85 from Miller Road to SR-85 | MCDOT | Buildout Network Map |
| MC-85 from Turner Parkway to Johnson Road | MCDOT | Buildout Network Map |
| McDowell Parkway from Dean Road to Turner Parkway | City | Buildout Network Map |
| McDowell Road from Bruner Road to 319th Avenue | City | Buildout Network Map |
| McDowell Road from McDowell Parkway to Watson Road | City | Buildout Network Map |

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Table 5-1. On-Street Short-Term, Mid-Term and Long-Term Improvement Schedule (continued)

| Project Name | Responsible Party, Partners | Recommendation Source |
|---|-----------------------------|-----------------------|
| Miller Road from Elliot Road to SR-30 | MCDOT | Buildout Network Map |
| Narramore Road from Palo Verde Road to Old US-80 | MCDOT | Buildout Network Map |
| Narramore Road from SR-30, curve west to Palo Verde Road | MCDOT | Buildout Network Map |
| Old US-80 from SR-85 to I-11 | ADOT | Buildout Network Map |
| Olive Avenue from Turner Parkway to Hidden Waters Parkway | City | Buildout Network Map |
| Palo Verde Road from Elliot Road to SR-30 | MCDOT | Buildout Network Map |
| Patterson Road from Bruner Road to Hidden Waters Parkway | MCDOT | Buildout Network Map |
| Patterson Road from SR-85 to Bruner Road | City | Buildout Network Map |
| Patton Road from 253rd Avenue to Hidden Waters Parkway | MCDOT | Buildout Network Map |
| Pecos Road (Alignment) from SR-303 to SR-85 | MCDOT | Buildout Network Map |
| Peoria Avenue from Turner Parkway to Johnson Road /315th Avenue | City | Buildout Network Map |
| Rainbow Road from Elliot Road to SR-30 | MCDOT | Buildout Network Map |
| Roosevelt Street from Jackrabbit Trail to 211th Avenue | City | Buildout Network Map |
| Southern Avenue from SR-85 to I-11 | MCDOT | Buildout Network Map |
| Sun Valley Parkway from I-10 to Loop 303 | MCDOT | City Prop 500 List |
| Sun Valley Parkway from Broadway Road to Olive Avenue | MCDOT | Buildout Network Map |
| Sun Valley Parkway from MPA boundary to 271st Avenue | MCDOT | Buildout Network Map |
| Tartesso Parkway throughout Tartesso development | City | Buildout Network Map |
| Thomas Road from Bruner Road to McDowell Parkway | MCDOT | Buildout Network Map |
| Thomas Road from McDowell Parkway to Hidden Waters Parkway | MCDOT | Buildout Network Map |
| Thomas Road from Turner Parkway to Sun Valley Parkway | City | Buildout Network Map |



Table 5-1. On-Street Short-Term, Mid-Term and Long-Term Improvement Schedule (continued)

| Project Name | Responsible Party, Partners | Recommendation Source |
|---|-----------------------------|-----------------------|
| Turner Parkway from I-10 to intersection of SR-30 | City | City Prop 500 List |
| Turner Parkway from 271st Avenue to Pinnacle Peak Road | City | Buildout Network Map |
| Turner Parkway from I-10 to Bethany Home Road | City | Buildout Network Map |
| Turner Parkway from Jomax Road to Lone Mountain Road | MCDOT | Buildout Network Map |
| Turner Road from Narramore Road to SR-30 | City | Buildout Network Map |
| Van Buren Street from Airport Road (Verrado Way) to Dean Road | City | Buildout Network Map |
| Van Buren Street from Turner Parkway to Sun Valley Parkway | City | Buildout Network Map |
| Watson Road from Elliot Road to SR-30 | City | Buildout Network Map |
| Watson Road from McDowell Parkway to McDowell Road | City | Buildout Network Map |
| White Tanks Freeway from 251st Avenue to system interchange at I-11 | ADOT | Buildout Network Map |
| Wilson Avenue from Broadway Road to Bell Road | City | Buildout Network Map |
| Wilson Avenue from Narramore Road to SR-30 | MCDOT | Buildout Network Map |
| Woods Road from SR-85 to Johnson Road | MCDOT | Buildout Network Map |
| Yuma Road from 319th Avenue to 331st Avenue | City | Buildout Network Map |
| Yuma Road from 339th Avenue to I-11 | City | Buildout Network Map |
| Yuma Road from Palo Verde Road to I-11 | City | Buildout Network Map |

Opportunities for Cooperative Planning

Within Buckeye, there are opportunities for cooperative planning amongst Maricopa County and other area jurisdictions. Buckeye shares natural features and borders with these jurisdictions, creating an opportunity to plan for future bicycle and pedestrian network connectivity and future discussions between planning, transportation and parks officials from area agencies to explore cooperative planning issues. Coordination should focus on developing methods to ensure future information sharing, possible joint funding opportunities and coordination of capital improvements. Opportunities for cooperative planning are listed in the following sections and are illustrated on **Figure 5-1**.

Sun Valley Parkway

Sun Valley Parkway is the primary north-south roadway in the City of Buckeye. This roadway turns to the east and continues through the City of Surprise as the primary roadway. Opportunities exist for future coordination between Buckeye, Surprise, and MCDOT on bicycle and pedestrian improvements and support facilities within this important roadway corridor to both communities.

White Tanks Mountain Regional Park

The White Tanks Regional Parks is a regional park operated by Maricopa County. The park is generally located in the northeast quadrant of Buckeye and also spans into the City of Surprise. There are approximately 30 miles of trails at the park. Coordination of trail and trailhead improvements planned by Maricopa County, Surprise, and Buckeye are key focal points for future planning coordination.

Buckeye – Surprise Common Borders

The City of Buckeye and the City of Surprise share approximately 15 miles of common borders. This area is vacant and undeveloped in both communities. Development of the bicycle and pedestrian network in both the BPMP and the City of Surprise Active Transportation Plan were coordinated to ensure consistency, non-duplicated improvements and primary corridor connections aligned.

Hassayampa River

The Hassayampa River runs through both Buckeye and Surprise. Low impact design and sensitive path and trail development relative to hillsides, floodplain boundaries, wildlife corridors and other impacts to sensitive environmental resources in this important river corridor should be considered within both jurisdictions.

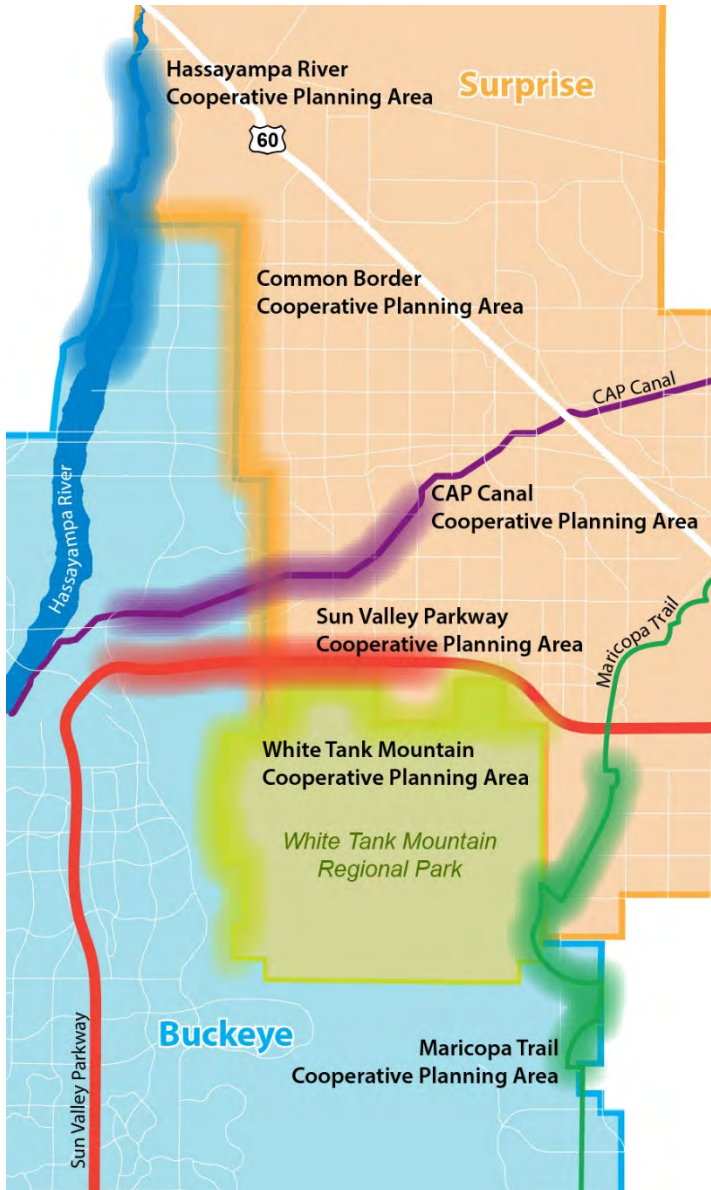
Maricopa Trail

The Maricopa Trail is a non-motorized trail, connecting all of the Maricopa County regional parks to one another. The portion of the trail in Buckeye connects the White Tank Mountains with the Estrella Mountains to the south and Lake Pleasant to the north. There is a future segment planned to connect the Estrella Mountains with Buckeye Hills. There is potential for future cooperative planning between Buckeye, Surprise, Maricopa County and other area jurisdictions for future segments of the trail. In 2017, the City and Maricopa County signed an intergovernmental agreement (IGA) for the Maricopa Trail in Buckeye's municipal planning area, which formalized the partnership between the City of Buckeye and Maricopa County.

Central Arizona Project Canal

The Central Arizona Project (CAP) canal provides the opportunity for a long distance, non-motorized multi-use recreational rail corridor. Approximately 90 miles of trails have been improved and opportunities exist with partner agencies to develop and build portions of the trail through their jurisdiction. The canal runs through both Surprise and Buckeye, presenting an opportunity for a future project along the CAP canal corridor.

Figure 5-1: Opportunities for Cooperative Bicycle and Pedestrian Planning



The above list is not intended to identify all future opportunities for cooperative planning. Additional opportunities could be pursued by the City of Buckeye with adjacent jurisdictions and other agencies with common objectives. One such example is along the Gila River corridor and shared boundary with the City of Goodyear.

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Six E's

The 6 E's are core elements that are used to plan bicycle and pedestrian networks and programs. Often, such as in the Safer Routes to Schools Program and the Bike and Walk Friendly Communities Program, six criteria must be addressed in the project design in order to receive funding. These criteria are: education, engineering, encouragement, enforcement, equity, and evaluation¹. They are described as follows:



Education: Providing the community with the skills to walk and bicycle with care, educating them about benefits of walking and bicycling, and teaching them about the broad range of transportation choices.



Engineering: Providing a well-connected bicycle and pedestrian network, consisting of quiet neighborhood streets, conventional and protected bike lanes, shared use trails, and policies to ensure connectivity and maintenance of these facilities.



Encouragement: Generating enthusiasm and increased walking and bicycling for students through events, activities, and programs.



Enforcement: Deterring risky traffic behaviors and encouraging careful walking and bicycling habits.



Equity: Ensuring that bicycle and pedestrian programs are benefiting all demographic groups.



Evaluation: Developing a seamless network that emphasizes short trip distances, multi-modal trips and is complemented by encouragement, education and enforcement programs to increase usage.

Programs

Several programs have been established to encourage environmental design for walking and biking. The following are examples of such programs that the City of Buckeye could employ in future endeavors to promote the bicycle and pedestrian network and educate the community on the bicycle and pedestrian network.

Safe Routes to School

Safe Routes to School (SRTS) is a national initiative to promote and encourage students to walk and bike to school. This initiative seeks to improve students' health and safety by increasing physical activity and providing a safe route for school children to use to get to and from school². The Safe Routes to School National Partnership is a non-profit that aims to advance policy and support for active communities.

¹ <https://www.saferoutespartnership.org/safe-routes-school/101/6-Es>

² <https://www.saferoutespartnership.org/safe-routes-school/101>



The National Partnership provides resources for communities to use to improve the active transportation network to encourage safe routes to school. SRTS funding requires that school initiate the project request; however, the city must sponsor the project. As a result, close coordination with the respective school is essential and early planning is vital.

Eligible activities for funding included infrastructure and non-infrastructure activities. Infrastructure funds may be used for the planning, design and construction of projects that will improve the ability of students to walk and bicycle to school while non-infrastructure funds may be used to encourage walking and bicycling to school, through awareness campaigns, outreach and, traffic education³.

Bicycle Friendly Communities

The Bicycle Friendly Communities (BFC) program was established in 1995 by the League of American Bicyclists. The BFC program provides a roadmap for improving bicycling conditions within a community and provides recognition to communities that are BFCs. The two main characteristics of a BFC is a safety and convenience⁴.

Walk Friendly Communities

The Walk Friendly Communities (WFC) program is operated through UNC Highway Safety Research Center, sponsored by FedEx, and supported by the Pedestrian and Bicycle Information Center (PBIC). The WFC program encourages communities to establish a high priority for safe walking environments and recognizes communities that are improving conditions related to walking, including access and comfort⁵.

Bike Education Classes

Educational programs or classes can be an effective strategy to encourage bicyclists to follow traffic rules and provide an awareness for motorists to look for bicyclists on the road. Additionally, providing educational programs in schools can support a Safe Routes to Schools Program by teaching children about bicycling principles, as well as getting school-aged children interested in riding safely in the long term. The following are examples of bike education classes from other municipalities.

- ▶ **Boston Youth Cycling Program.** The Boston Youth Cycling Program teaches bicycle safety lessons to young students between 2nd and 12th grades. Boston Public Schools may apply for this program through the City's Transportation Department. Once accepted, the City provides bikes, helmets, and instructors to the school for a one- to two-week period. These lessons are typically held during gym or physical education classes.
- ▶ **City of Mesa Bike Education Classes.** The City of Mesa, Arizona offers bicycle education classes for both adults and kids. Both classes cover road safety and protective gear to encourage safe bicycling habits throughout Mesa's 578-miles of bike lanes. As a bonus, each participant receives free safety gear, including a helmet.

Bike Events

Bike events typically consist of temporarily closing select streets and permitting bicyclists to safely occupy the streets for that period of time. This provides an opportunity to bring together bicycle enthusiasts from the community and

³ <https://www.saferoutespartnership.org/safe-routes-school/101>

⁴ <https://www.bikeleague.org/bfa/toolkit>

⁵ <http://walkfriendly.org/about/>

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region together to socialize, collaborate, and encourage others to participate in bicycling through city streets. Additionally, these events provide opportunities to hold bicycle awareness education for inexperienced riders. The following are examples of bike events that other municipalities.

- ▶ **Brownsville CycloBia.** Each year, the City of Brownsville, Texas temporarily closes select downtown streets to cars for their CycloBia event. These closed streets permit recreational activities, such as bicycling, without worrying about vehicular traffic interfering.
- ▶ **CycloMesa.** CycloMesa is an annual event in Mesa, Arizona held at the downtown Convention Center. This event consists of several activities that promote bicycling and other forms of recreation, including a bicycle scavenger hunt throughout downtown Mesa, a BMX freestyle show, a historic bike tour, and the El Tour de Mesa, in combination with other bicycle vendors and kid-friendly festivities.

Bike to Work Week

Bike to Work Week programs encourage employers and their employees to compete against one another as the most bike-friendly work place. The League of American Bicyclists sponsors an annual nationwide Bike to Work Week each May. Similarly, Valley Metro holds an annual Bike Month in April, which includes a series of events throughout the region. These programs are catalysts for converting first-time bike commuters into regular bike commuters. The City of Buckeye also participates in the Maricopa County Trip Reduction Program, a program to encourage and document bike commuting.

Bicycle Friendly Business Program

The Bicycle Friendly Business Program is an award system through the League of American Bicyclists. This award system is based on four of the six E's: Engineering, Education, Encouragement, and Evaluation. Businesses that are designated as a Bicycle Friendly Business are recognized through the League of American Bicyclists, and receive feedback on how to become more bike-friendly for both employees and customers. Nationally, there are 1,314 businesses recognized through the Bicycle Friendly Business Program, including 17 in Arizona.



Please see the next page.



Buckeye Bicycle and Pedestrian Master Plan

Appendix A

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Supporting Facilities: Intersection Improvements

Based on the analysis of reported pedestrian and bicycle crashes, four intersections were selected to determine if predominate crash factors could be identified. The intersections were selected based upon multiple crashes at a same location and crash manner. Severity was reviewed as part of the selection process; however, the fatal crashes appear to be isolated incidents. **Table A-1** presents the selected locations ranked according to highest pedestrian and bicycle crash volume.

Table A-1. Selected Intersections for Further Analysis

| Number | Intersection | Number of Crashes in Study Period |
|--------|--------------------------------------|-----------------------------------|
| 1 | Watson Road/Yuma Road | 8 |
| 2 | Monroe Avenue/9 th Street | 3 |
| 3 | Monroe Avenue/4 th Street | 2 |
| 4 | Dean Road/Yuma Road | 2 |
| 5 | Jackrabbit Trail Corridor/Yuma Road | 1 |
| 6 | Southern Avenue/Miller Road Corridor | 1 |

Intersection 1 – Watson Road and Yuma Road

The intersection of Watson Road and Yuma Road operates as a signalized intersection with permissive/protective turn phasing in all approaches. The northbound approach consists of an exclusive left-turn lane, two through lanes, a shared through/right turn lane and a bike lane. The southbound approach consists of an exclusive left-turn lane, three through lanes, a bike lane and a dedicated right-turn lane. The eastbound and westbound approaches consist of an exclusive left-turn lane, two through lanes, a bike lane and a dedicated right turn lane. The posted speed limits on Watson Road and Yuma Road are 45mph through the intersection. **Table A-2** summarizes the crashes at the Yuma Road and Watson Road intersection.



Table A-2. Crash Summary for the Intersection of Yuma Road and Watson Road

| Incident No. | Date | Pedestrian/Bicycle | Injury/Fatality | Intersection/Location | Daylight Condition | Description | Intersection Related | Note |
|--------------|------------|--------------------|-----------------|-----------------------|--------------------|---|----------------------|------|
| 2585637 | 1/19/2012 | B | I | Watson Rd/Yuma Rd | Dawn | WB bicycle disregarded traffic signal and was struck by SB vehicle going straight ahead. | ✓ | |
| 2665030 | 10/25/2012 | B | | Yuma Rd/Watson Rd | Dark-Lighted | SB bicycle disregarded traffic signal and was struck by EB vehicle making right turn. | ✓ | |
| 2701214 | 12/21/2012 | P | F | Yuma Rd/Watson Rd | Daylight | NB pedestrian did not use the crosswalk and was struck by EB vehicle making right turn. | ✓ | |
| 2701645 | 2/27/2013 | B | I | Watson Rd/Yuma Rd | Daylight | SB bicycle failed to keep in proper lane and struck/was struck by SB vehicle making right turn. | ✓ | |
| 2804690 | 1/23/2014 | P | I | Watson Rd/Yuma Rd | Dark-Lighted | WB pedestrian disregarded traffic signal and was struck by SB vehicle going straight ahead. | ✓ | |
| 2934981 | 2/22/2015 | B | I | Yuma Rd/Watson Rd | Daylight | SB bicycle disregarded traffic signal and was struck by SB vehicle turning left that failed to keep in proper lane. | ✓ | |
| 2935527 | 2/25/2015 | P | I | Watson Rd/Yuma Rd | Dark-Lighted | NB pedestrian disregarded traffic signal crossing the road and was struck by vehicle making left turn. | ✓ | |
| 2998699 | 9/23/2015 | B | I | Yuma Rd/Watson Rd | Daylight | SB vehicle failed to yield to right-of-way making right turn and struck EB bicycle. | ✓ | |

Of the eight recorded pedestrian/bicycle crashes at the intersection of Yuma Road and Watson Road over the 6.6-year crash history, seven reports noted that the person violation was the pedestrian or the bicyclist: 5 – disregarded the traffic signal, 1 – did not use the crosswalk, and 1 – failed to keep in their proper lane. Of the motorists, three were noted with person violations: 1 – made improper turn, 1 – failed to keep in proper lane and 1 – failed to yield right of way. It should be noted that multiple person violations (both driver and pedestrian/bicyclist) can be recorded for one crash.

The countermeasures for this intersection were identified due to the majority crash factor – bicyclist/pedestrian disregarded traffic signal.

Countermeasures:

- ▶ Examine traffic and pedestrian signal bulbs for brightness. Replace as necessary to ensure optimum visibility.
- ▶ Review signal and pedestrian clearance timing. Walk/flash/solid times should be considered at 3 feet per second from the push button to the far side of the travel way. The Manual on Uniform Traffic Control Devices should be used as the guide in reviewing and modifying signal and pedestrian clearance times.
- ▶ Consider a leading pedestrian interval that gives pedestrians a “head start” over cars going in the same direction or turning across the pedestrians’ path.
- ▶ Review lateral positioning of signal faces and need for near side signals on Watson Road.
- ▶ Perform a routine speed study and supplement the study with the Federal Highway Administration’s USLIMITS2 (web-based design tool) to verify that the 45 mph posted speed limit is reasonable through the intersection of Yuma Road and Watson Road as the area continues to develop.
- ▶ Use backplates with retroreflective borders around traffic and pedestrian signals to improve the visibility of the illuminated faces of the signals.
- ▶ Perform an engineering study to determine if high visibility crosswalks may lower pedestrian and bicycle crashes at the intersection.



Looking south from northwest corner of intersection 1.



Looking east from northwest corner of intersection 1.

Intersection 2 – Monroe Avenue and 9th Street

The intersection of Monroe Avenue and 9th Street operates as an unsignalized intersection with stop control in the northbound and southbound approaches. The northbound and southbound approaches consist of a shared left/through/right lane. The eastbound and westbound approaches consist of a shared left/through lane and shared through/right lane. The posted speed limit on Monroe Avenue is 30 mph and 9th Street is 25 mph through the intersection. **Table A-3** summarizes the crashes at the Monroe Avenue and 9th Street intersection.

Table A-3. Crash Summary for the Intersection of Monroe Avenue and 9th Street

| Incident No. | Date | Pedestrian/Bicycle | Injury/Fatality | Intersection/Location | Daylight Condition | Description | Intersection Related | Note |
|--------------|-----------|--------------------|-----------------|-------------------------------|--------------------|---|----------------------|-------------------|
| 2578529 | 1/8/2012 | P | I | Monroe Ave/9 th St | Dark-Lighted | EB vehicle failed to yield to right-of-way and struck SB pedestrian. | ✓ | |
| 2656077 | 6/28/2012 | P | I | Monroe Ave/9 th St | Daylight | NB pedestrian failed to yield to right-of-way crossing the road and was struck by WB vehicle. | ✓ | |
| 2951590 | 4/27/2015 | P | I | Monroe Ave/9 th St | Daylight | WB vehicle struck NB pedestrian. | ✓ | Report incomplete |

Of the three recorded pedestrian/bicycle crashes at the intersection of Monroe Avenue and 9th Street over the 6.6 year crash history, one report noted that the person violation was the pedestrian: 1 – failed to yield right of way. Of the motorists, one was noted with a person violation: 1 – failed to yield right of way. The third crash record was incomplete, but showed that the driver made no improper action.

Countermeasures:

- ▶ Perform a photometrics study to ensure the street lighting near the intersection is uniform and within compliance.
- ▶ Collect pedestrian volumes and prepare an engineering study at the intersection to determine if a high visibility crosswalk or HAWK may reduce pedestrian crashes.
- ▶ Repaint the crosswalks and stop bars at the intersection. See photos.
- ▶ Add W11-2 pedestrian warning signs near the crosswalk in both directions on Monroe Avenue. LED lighting could be added to enhance visibility.



- ▶ Consider the installation of speed feedback signs or trailers to notify drivers of their speed within the downtown area.
- ▶ Review the sight visibility on 9th Street at Monroe Avenue to ensure adequate sight distance of departing vehicles and pedestrians.
- ▶ Consider the installation of a pedestrian crossing island to separate crossing pedestrians from motor vehicles and allow pedestrians to cross one direction of traffic at a time.
- ▶ Consider roadway reconfiguration on Monroe Avenue from the existing four lane undivided roadway to a three-lane roadway consisting of two through lanes and a center two way left turn lane.



Looking west from southeast corner of intersection 2.



Looking northwest from southeast corner of intersection 2.



Looking north from southeast corner of intersection 2.



Looking west from southeast corner of intersection 2.



Looking east from southeast corner of intersection 2.

Intersection 3 – Monroe Avenue and 4th Street

The intersection of Monroe Avenue and 4th Street operates as a signalized intersection with permissive turn phasing in all approaches. The northbound and southbound approaches consist of a shared left/through/right lane with angled parking on both sides. The eastbound and westbound approaches consist of a shared left/through lane and shared through/right lane. The posted speed limit on Monroe Avenue is 30 mph and 4th Street is 25 mph through the intersection. **Table A-4** summarizes the crashes at the Monroe Avenue and 4th Street intersection.

Table A-4. Crash Summary for the Intersection of Monroe Avenue and 4th Street

| Incident No. | Date | Pedestrian/Bicycle | Injury/Fatality | Intersection/Location | Daylight Condition | Description | Intersection Related | Note |
|--------------|-----------|--------------------|-----------------|-------------------------------|--------------------|---|----------------------|------|
| 3054812 | 2/5/2016 | P | I | Monroe Ave/4 th St | Dark-Lighted | SB vehicle making left turn failed to yield to right-of-way and struck NB pedestrian. | ✓ | |
| 3202719 | 2/17/2017 | P | I | Monroe Ave/4 th St | Daylight | WB vehicle making left turn failed to yield to right-of-way and struck SB pedestrian. | ✓ | |

Of the two recorded pedestrian/bicycle crashes at the intersection of Monroe Avenue and 4th Street over the 6.6 year crash history, both reports noted that the person violation was the motorist where they failed to yield right of way.

Countermeasures:

- ▶ Perform a photometrics study to ensure the street lighting near the intersection is uniform and within compliance.
- ▶ Review signal and pedestrian clearance timing. Walk/flash/solid times should be considered at 3 feet per second from the push button to the far side of the travel way. The Manual on Uniform Traffic Control Devices should be used as the guide in reviewing and modifying signal and pedestrian clearance times.
- ▶ Consider a leading pedestrian interval that gives pedestrians a “head start” over cars going in the same direction or turning across the pedestrians’ path.
- ▶ Consider roadway reconfiguration on Monroe Avenue from the existing four lane undivided roadway to a three lane roadway consisting of two through lanes and a center two way left turn lane.



Looking north from southeast corner of intersection 3.



Looking southeast from northwest corner of intersection 3.



Looking south from northeast corner of intersection 3.



Intersection 4 – Dean Road and Yuma Road

The intersection of Dean Road and Yuma Road operates as a signalized T-intersection with permissive/protective turn phasing on the westbound approach. The northbound approach consists of an exclusive left-turn lane and a dedicated right turn lane. The eastbound approach consists of a through lane and a dedicated right turn lane. The westbound approach consists of an exclusive left-turn lane and a through lane. The posted speed limits on Dean Road and Yuma Road are 45mph through the intersection. **Table A-5** summarizes the crashes at the Dean Road and Yuma Road intersection.

Table A-5. Crash Summary for the Intersection of Dean Road and Yuma Road

| Incident No. | Date | Pedestrian/Bicycle | Injury/Fatality | Intersection/Location | Daylight Condition | Description | Intersection Related | Note |
|--------------|-----------|--------------------|-----------------|-----------------------|--------------------|--|----------------------|-------------------------------|
| 2801922 | 1/6/2014 | B | | Dean Rd/Yuma Rd | Daylight | Inattentive/distracted WB bicyclist was struck by NB vehicle | ✓ | Stop control at time of crash |
| 3206494 | 3/18/2017 | B | I | Dean Rd/Yuma Rd | Daylight | SB vehicle made improper left turn and struck SB bicycle. | ✓ | |

Of the two recorded pedestrian/bicycle crashes at the intersection of Dean Road and Yuma Road over the 6.6 year crash history, both reports noted that the motorist was traveling to or from the north side of the T-intersection.

During the site visit, three parked vehicles were noted north of the T-intersection of Dean Road and Yuma Road.

Countermeasures:

- ▶ Barricade north side of intersection to discourage parking on north side of Yuma Road at the Dean Road T-intersection.



Looking west from southeast corner of intersection 4.



Looking north from southeast corner of intersection 4.



Google Earth image 4/5/2018 of vehicles parked on north side of Dean Road and Yuma Road intersection.

Intersection 5 – Jackrabbit Trail and Yuma Road

The intersection of Jackrabbit Trail and Yuma Road operates as a unsignalized intersection with stop control in the northbound, southbound, eastbound and westbound approaches. The northbound and southbound approaches consist of a shared left/through/right lane. The eastbound and westbound approaches consist of a shared left/through/right lane. The posted speed limit on Yuma Road is 50 mph and Jackrabbit Trail is 45 mph through the intersection.

This area of Buckeye remains undeveloped land and farm area with minimal roadway improvements. However, there are sporadic residential properties, a subdivision, and a school in the vicinity. The corridor lacks roadway lighting as well as pedestrian lighting and the road shoulders are unimproved asphalt interfacing with gravel. Irrigation ditches and headwalls add to the obstructions pedestrians and bicyclists would encounter. The combination of high speed roadways and minimal signaling, signage, lighting, or other visual cues of multi-modal use may be contributing to the lack of awareness for caution for drivers, bicyclists, and pedestrians. Although there is one bicycle accident shown on the crash summary, there are 2 other bike/pedestrian incidents in the vicinity under similar conditions, which demonstrates a potential need for future countermeasures. **Table A-6** summarizes the crash at the Jackrabbit Trail and Yuma Road intersection.

Table A-6. Crash Summary for the Intersection of Jackrabbit Trail and Yuma Road

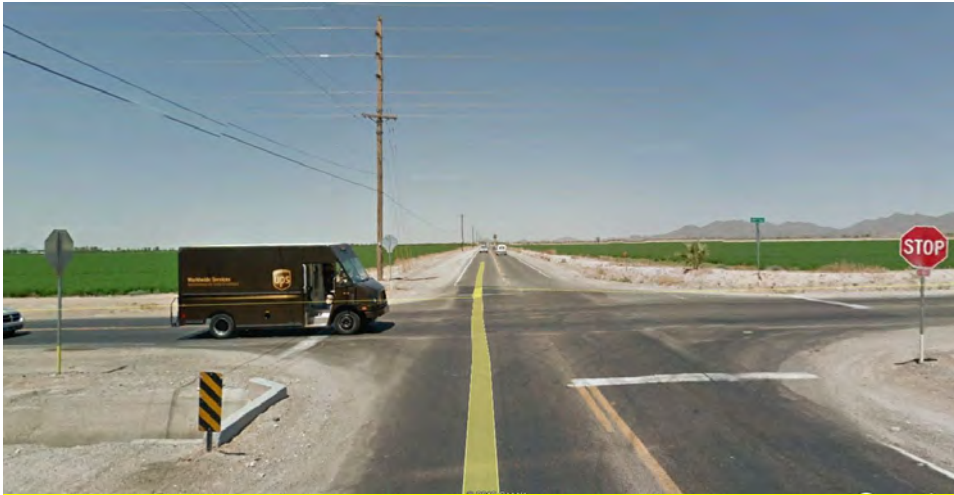
| Incident No. | Date | Pedestrian/Bicycle | Injury/Fatality | Intersection/Location | Daylight Condition | Description | Intersection Related | Note |
|--------------|-----------|--------------------|-----------------|------------------------|--------------------|-------------|----------------------|------|
| 3189900 | 11/2/2016 | B | F | Jackrabbit Trl/Yuma Rd | Dusk | No data. | | |

Countermeasures

- ▶ Add pedestrian scale lighting to illuminate and call attention to the pedestrian paths at night. The difference in streetscape lighting and pedestrian lighting would signal to the traffic that they are in a pedestrian zone.
- ▶ Add signage, especially in more undeveloped parts the city, to alert drivers to pedestrian routes in the area. Reflective and high visibility colors would enhance safety during non-daylight hours. In developed areas of higher traffic, they would be an additional measure in a driver’s environment as a reminder to be aware of others.
- ▶ Similar to pedestrian conditions, add smaller scale non-vehicular street lighting to enhance safety in non-daylight hours and call attention to the bike routes in the roadway.
- ▶ Add roadway “Share the Road” warning signs or signs denoting “bike route” to problem areas. The existing bike route signage is the standard small rectangular black and white sign. Upgrading to high visibility colored signs, larger signs, or signs and more frequent intervals would be helpful to keep drivers aware of other modes



of transportation sharing the roadway. In addition, bike route theme signage would also be a way of encouraging bike use, enhancing dedicated routes to various city amenities and facilities.



Looking east from west of Yuma Road.

Intersection 6 – Southern Avenue and Miller Road

The intersection of Southern Ave and Miller road operates as a unsignalized intersection with stop control in the northbound, southbound, eastbound and westbound approaches. The northbound and southbound approaches consist of an exclusive left-turn lane and a shared through/right turn lane. The eastbound approaches consist of an exclusive left-turn lane and a shared through/right turn lane. The westbound approaches consist of a shared left/through/right lane. The posted speed limit on Southern Ave is 45 mph and Miller road is 45 mph through the intersection.

This corridor includes a mix of developed and undeveloped roadway shoulders with some sides of the streets having roadway lighting and curb/gutter/sidewalk improvements where the other side may not. Some intersections in the corridor are signaled whereas others aren't. In addition, roads widen at intersections, or narrow, depending on the development on each corner. The inconsistent conditions may play a part in driver awareness as there are more roadway changes to process. There was one bike incident at this intersection, however there were 5 bike incidents along the Miller Rd. corridor. There is no marked or delineated bike route along Miller Rd. although from the crash summary it appears this may be a higher use bike route for the area. **Table A-7** summarizes the crash at the Southern Avenue and Miller Road intersection.

Table A-7. Crash Summary for the Intersection of Southern Avenue and Miller Road

| Incident No. | Date | Pedestrian/Bicycle | Injury/Fatality | Intersection/Location | Daylight Condition | Description | Intersection Related | Note |
|--------------|-----------|--------------------|-----------------|------------------------|--------------------|---|----------------------|------|
| 2866895 | 7/31/2014 | B | I | Southern Ave/Miller Rd | Daylight | NBN bicycle was struck by WB vehicle making right turn. | | |

Countermeasures

- ▶ Add pedestrian scale lighting would help to illuminate and call attention to the pedestrian paths at night. The difference in streetscape lighting and pedestrian lighting would signal to the traffic that they are in a pedestrian zone.
- ▶ Add multi-modal signage, especially in more undeveloped parts the city, to alert drivers to pedestrian routes in the area. Reflective and high visibility colors would enhance safety during non-daylight hours. In developed areas of higher traffic, they would be an additional measure in a driver's environment as a reminder to be aware of others.
- ▶ Add smaller scale non-vehicular street lighting to enhance safety in non-daylight hours and call attention to the bike routes in the roadway.
- ▶ Buffer bike lanes, such as reflectors along the dividing stripe or flexible delineators with reflectors as an added buffer to delineate the bike lane in high traffic areas.



- ▶ Enhance bike lane markings with green painted demarcation method being adopted in many bike-friendly cities for higher visibility and encourage the mode of transportation to reduce traffic.
- ▶ Add “Share the Road” warning signs or signs denoting “bike route” to problem areas. High visibility colored signs, larger signs, or signs and more frequent intervals would be helpful to keep drivers aware of other modes of transportation sharing the roadway. In addition, bike route theme signage would also be a way of encouraging bike use, enhancing dedicated routes to various city amenities and facilities.



Looking north from south of Miller Road.





BUCKEYE, AZ

